



Prepared for:	Shire of Dandaragan
Attention:	<u>CEO:</u> Brent Bailey <u>Executive Manager Development Services:</u> Louis Fouché By email: dsr@dandaragan.wa.gov.au
Date:	7 October 2026
Site Location:	<u>Site reference:</u> RCP3-012-H (Near Badgingarra site) <u>Address:</u> 504 (Lot 3788) North West Road, Badgingarra WA

Commercial in Confidence

Vision Statement

To be the first choice for broadband internet in regional Western Australia by providing first-class infrastructure with a consistent focus on excellent customer service and ongoing regional community consultation to ensure our program meets the needs of country WA.

Background

CRISP Wireless is a Network owner/operator licensee for Fixed Wireless Broadband and NBN services in Western Australia.

We provide a unique telecommunications solution that utilises Point-to-Point secured wireless connectivity between sites as well as community wireless services and subscriber broadband.

Quality Information

Prepared for:

Near Badgingarra site (RCP3-012-H)

Prepared by:

CRISP Wireless Pty Ltd

Address: PO Box 1004, Narrogin WA 6312

Email: lballard@crispwireless.com.au

Document number:

Revision	Revision Date	Details	Authorisation		
			Prepared By	Reviewed By	Authorised By
A	07/10/2026	Proposal	Heidi Cowcher	Leigh Ballard	Leigh Ballard
B	07/10/2026	Final Document collation	Heidi Cowcher	Leigh Ballard	Leigh Ballard



Proposal

CRISP Wireless is continuing the expansion of our fixed wireless network across the Wheatbelt. It is proposed that a 50-metre communications tower be built at 504 (Lot 3788) North West Road, Badgingarra in the Shire of Dandaragan. This proposed tower is part of a wider network across the region that is being established to improve telecommunications connectivity for Wheatbelt-based residents.

An agreement has been entered into with the landowner for the installation of this telecommunications infrastructure to be located on the subject land in the form of a 50m telecommunications tower, together with a container to house the communication equipment with solar panels on top for power provision.

The development application is made in accordance with the *Planning and Development Act 2005* for assessment under the Shire of Dandaragan Town Planning Scheme 7. The subject land is in the 'Rural' Zone.

The Rural Zone's objectives are *'to provide for a range of rural activities such as broadacre and diversified farming so as to retain the rural character and amenity of the locality, in such a way as to prevent land degradation and further loss of biodiversity.'* The proposed use is amenable to such an objective and will not detract from the rural character and amenity of the locality; nor will it cause any land degradation or further loss of biodiversity.

The proposed work shall be referred to as *Telecommunications Infrastructure* for the purposes of this development application. The site proposed will not affect, nor adversely impact, current farming practices.

Under the TPS, the Zoning tables specify the uses permitted in various zones. The permissibility of any use is determined by considering the zoning table and cross-referencing it with the proposed works. The definition of telecommunications infrastructure is described in the Scheme but is not included in the zoning table as a specified use.

A summary of the subject land is provided in the table below:

Address of subject land	504 North West Road, Badgingarra
Real Property Description	Lot 3788 on DP209087
Area of Subject Land	1706.9185ha
Existing buildings on Subject Land	General farming related infrastructure
Road Frontages	North West Road / McNamara Road / Brand Hwy
Zone	Rural Zone
Overlays	Bushfire-Prone Area, Native Vegetation
Landowners	Gary Alexander Park and Anne Marie Park as Joint tenants
Easements/Encumbrances	Numerous – listed on COT attached

The site is highlighted on the following maps:



Fig 1: Shire of Dandaragan Town Planning Scheme 7 (Map 2 – Dandaragan NE)
Source: Shire of Dandaragan

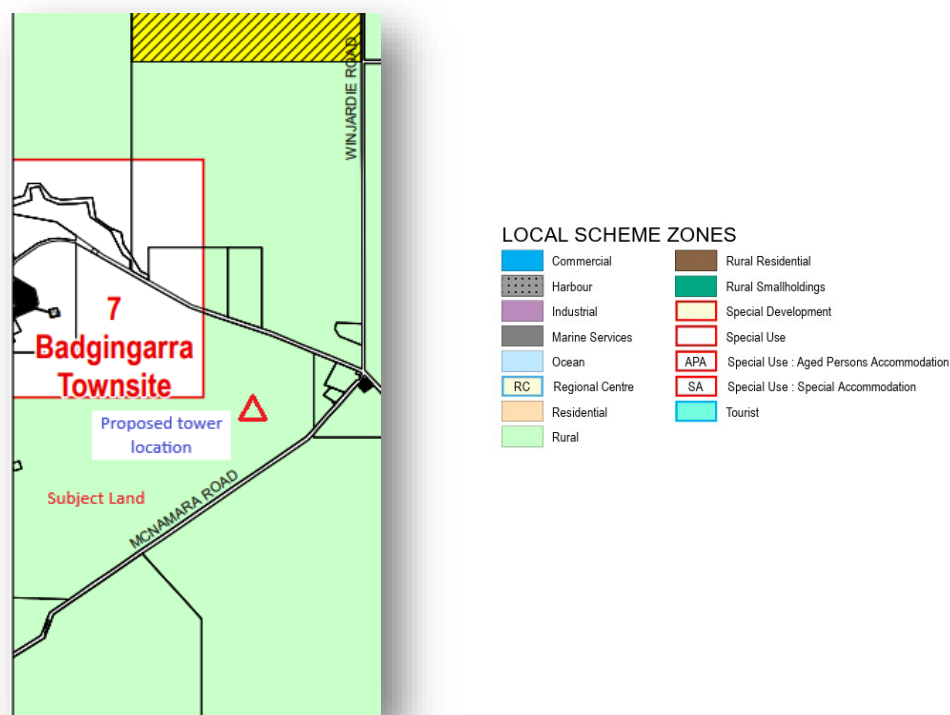


Figure 2: Map of Bushfire Prone Area (Source: Landgate SLIP)





Figure 3: Native Vegetation Extent (Source: DPIRD WA Remnant Vegetation Mapping)

The telecommunications infrastructure will consist of the following:

- A 50m steel tower, as shown in **Attachment 5**.
- A combination of Dual Pole Parabolic Antennas (Dishes) and Sector Antennas as shown in **Attachment 6**.
- A sea container housing the communications equipment; and
- Solar panels to power the system on the roof of the sea container.

The tower is proposed to be built in the north-east corner of the lot, with an estimated setback of 982m from the eastern boundary and 1285m from the northern boundary. The boundary setback is shown in the Site Plan in **Attachment 4**. The TPS prescribes that the local government will determine the setback requirements as it is not specified within the scheme.

The subject land is not located within the mapped remnant vegetation (as highlighted in Figure 3 above); and further, no vegetation clearing is required for the construction of the tower. It is always preferential to locate the infrastructure in an area that is already cleared to minimise any environmental impacts. All construction will endeavour to manage the existing vegetation on the lot and site the tower and container in an already cleared area.

Access to the site will be via North West Road, via existing farm crossover/gateway/laneway/tracks. No special construction is required as the property is reasonably accessible as it is. Access to the site during construction will amount to one semi-trailer accessing the site on one occasion (total of two 'movements' – one in and one out); followed by one six-wheeler Hiab accessing the site on one occasion (total of two 'movements' – one in and one out); and then lastly one commercial ute on two occasions (total of four 'movements' – two in and two out) – with construction anticipated to take two days.



At the completion of construction, it is highly unlikely that the applicant will be required to access the site for ongoing maintenance as much can be undertaken via the remote access software by our experienced and qualified technicians. However, if a need arises, it will be by a light vehicle (commercial ute) and would be on one occasion (total of two 'movements' – one in and one out). It is not proposed to establish formalised parking given the very infrequent nature of the access required to the tower once construction is complete and the tower is 'live'.



Please refer to the attached Site Plan in **Attachment 4** showing the location of the proposed tower and associated infrastructure, the proposed access location and the access pathway.

As the proposed tower is for wireless broadband only and does not transmit electromagnetic waves/fields to mobile phones, it does not emit electromagnetic radiation and does not require an Environmental EME (Electromagnetic Energy) Report to be prepared or provided to support the development application.

Figure 5: Photo of Tower and Communication Hut
(Source: CRISP Wireless)

Planning Scheme and other Legislation

The Planning Scheme

The proposed use will be assessed against the Shire of Dandaragan Town Planning Scheme 7 (*the Planning Scheme*).

The TPS provides a definition for the proposed use as follows:

“telecommunications infrastructure: means premises used to accommodate the infrastructure used by or in connection with a telecommunications network including any line, equipment, apparatus, tower, antenna, tunnel, duct, hole, pit or other structure related to the network.”

The proposed telecommunications tower and associated infrastructure are consistent with the abovementioned definition. The subject land is located in the Rural Zone, however, the Zoning Table in the Planning Scheme does not include Telecommunications Infrastructure as a use, therefore it is difficult to ascertain whether it is a permissible use in that zone.

Clause 3.4.2 of the Scheme states the following in relation to a use not being specifically mentioned in the Zoning table and how this should be considered:

If a person proposes to carry out on land any use that is not specifically mentioned in the Zoning Table and cannot reasonably be determined as falling within the type, class or genus of activity of any other use category the local government may-

- (a) *Determine that the use is consistent with the objectives of the particular zone and therefore be permitted.*



- (b) *Determine that the use may be consistent with the objectives of the particular zone and thereafter follow the advertising procedures of clause 64 of the deemed provisions in considering an application for development approval; or*
- (c) *Determine that the use is not consistent with the objectives of the particular zone and is therefore not permitted.*

Rural Zone Objectives

The TPS describes the following objective in relation to the Rural Zone:

To provide for a range of rural activities such as broadacre and diversified farming so as to retain the rural character and amenity of the locality, in such a way as to prevent land degradation and further loss of biodiversity.

The proposed construction of the telecommunications infrastructure ensures that agricultural pursuits can be preserved, will not adversely impact the viability of agricultural land, will not adversely impact the rural character and amenity of the area, and does not propose the clearing of any vegetation. In direct correlation, the proposed telecommunications infrastructure, as a non-rural land use, has evidenced significant benefits for the district with improvements in connectivity and access to a reliable, fast internet service.

Section 64 of Schedule 2 Deemed provisions for local planning schemes of the Planning and Development (Local Planning Schemes) Regulation 2015 requires the advertising of complex applications for development approval.

It may be, therefore, that Council will consider that the prescribed use (telecommunications infrastructure) is consistent with the objectives of the zone and advertise the proposed development as per Clause 64 of the Deemed Provisions. If no objections are received, then Council may consider approving the proposed development.

State Planning Policy 5.2 – Telecommunications Infrastructure

The intent of State Planning Policy 5.2 – Telecommunications Infrastructure is to “*balance the need for effective telecommunications services and effective roll-out of networks, with the community interest in protecting the visual character of local areas*”.

As stated in the Policy, adequate and reliable telecommunications are essential for all aspects of contemporary community life, from supporting the State's economy to creating and maintaining connected and cohesive social networks. Contact between emergency services and the community increasingly relies on telecommunications networks. The importance of telecommunications services in Western Australia is recognised in the Western Australian Planning Commission's (WAPC's) State Planning Strategy 2050 (2014), which advocates for the provision of an effective state-wide telecommunications network. This network includes both above and below-ground infrastructure to support both fixed-line and wireless telecommunications.

The proposed development provides a wireless broadband network through line-of-site towers and complies with the intent of the Policy. Sites for telecommunications facilities are chosen for elevation, distance to other towers and ease of access. In this case, the facility is set well away from roads and sensitive receptors and is unlikely to affect visual amenities.

The Policy further states the following about the Visual Impacts of any proposed Telecommunications infrastructure:



Visual impacts

For telecommunications infrastructure to be effective, structures are generally located prominently, at high points in the landscape or on top of buildings where they are more likely to be visible to the public. The benefits of improved telecommunications services should be balanced with the visual impact on the surrounding area:

1. *Assessment of the visual impact should be made on a case-by-case basis - **assessment to be undertaken as part of the DA. The proposed CRISP tower is a wireless point-to-point tower providing internet connectivity. Given the location of the proposed tower, it is not anticipated that there would be any negative visual impact that would be detrimental to the surrounding land.***
2. *Telecommunications infrastructure should be sited and designed to minimise visual impact and*
 - a. *Be located where it will not be prominently visible from significant viewing locations (eg: scenic lookouts) - **met***
 - b. *Be located to detract from areas of significant importance (eg: heritage sites) - **met***
 - c. *Not located on sites where environmental, cultural heritage, social and visual landscape values may be compromised - **met***
 - d. *Include design features that are sympathetic to the surrounding landscape - **towers are black (blends in) with white radios; containers are generally beige or white in colour with solar panels on top. Commitment is to be sympathetic to surrounding land uses (farming) and ensure that it does not impact the day-to-day farming enterprises.***
3. *Not applicable to this project*
4. *Telecommunications infrastructure should be located where it will facilitate continuous network coverage and/or improved telecommunications services to the community - **sites are chosen to provide significant coverage improvements in the region. All our towers are 'line of site' technology up to 30km from an existing tower within our network. The area that is the subject of this Development Application is an area in need of significant internet connectivity upgrades, and the coverage that will be provided, should the tower be approved, will have a marked improvement for all in the area.***
5. *Telecommunications infrastructure should be co-located and wherever possible*
 - a. *Cables and lines should be located in existing underground conduits/ducts - **not applicable***
 - b. *Overhead lines and towers should be co-located with existing infrastructure corridors and/or mounted on existing or proposed buildings- **noted & not applicable.***

It is important to note that whilst co-location is generally a recommendation under the State Planning Policy, it is not always feasible for this to be achieved in reality. The tower that is the subject of this planning application is part of a broader project that will see the construction of 11 towers across the Wheatbelt region from Dowerin to Jurien. The network connectivity improvements that will be offered will have significant and far-reaching benefits to the businesses and communities in these areas with accessibility to a fast, reliable and locally managed internet service designed by a regionally based business for regional businesses.

The selected location for individual towers is based on evidence of need, location, line-of-sight to existing towers in the network, known 'black-spot' areas and ability to provide a service that will meet the needs of the community.

Co-location, whilst an option, is not always a viable alternative for consideration.

Financial implications are a considerable factor in determining the location of a tower. The construction



of a purpose-built tower that is owned, operated and managed by CRISP Wireless is a financially responsible outcome for the business. Additionally, when we build our own towers, we have full access as and when needed, which is especially important in times of an out-of-hours network or tower outage that requires our technicians to access the tower.

If we were to consider a co-location option, the time taken to negotiate an agreement with a third party may be considerable, and this would impact the timeline of delivery of the project. The timeline that we have has been set by the funding partners and the deliverables that need to be met in that time.

We have negotiated with the landowners of the proposed site and have approval for the infrastructure to be built on their land. They do not have any concerns with the visual impact of the infrastructure. This delivery method has been successfully implemented for the last 7 years that we have been building this comprehensive network across the Wheatbelt region.

Therefore, it is our opinion that the proposal is generally consistent with the principles set out in the Policy and can be balanced with the need for effective telecommunications services. Connectivity is considered a basic need, as without it, we can be left behind in an increasingly digital economy. Reliable internet connectivity promotes economic growth and connections to markets; drives productivity through access to information; fosters innovation and knowledge sharing; and is crucial for emergency communications, with reliable, robust telecommunications infrastructure allowing timely response to natural disasters.

State Planning Policy 3.7 – Planning in Bushfire Prone Areas

Part of the subject land has been identified in the SLIP mapping as within a Bushfire Prone Area, as shown in Figure 2 above. The actual tower site proposed is within this Bushfire Prone Area.

The intent of the SPP is “to implement effective, risk-based land use planning and development to preserve life and reduce the impact of bushfire on property and infrastructure”.

Sites for telecommunications facilities are chosen for elevation, distance to other towers and ease of access.

Recognising that whilst the proposed facility is within the identified bushfire-prone area, the fact that the development does not result in an increase of residents or employees, it does not increase the bushfire threat. CRISP employees have a duty of care to ensure that any access to landowners’ properties is undertaken in a manner so as to not cause a bushfire risk. As a business, we ensure that we remain up to date at all times of bushfire risks, harvest and vehicle movement bans in the areas where we are working, and any other restrictions imposed at a local or state level, and will always adhere strictly to these as imposed, especially during the peak fire season.

Accordingly, a bushfire assessment has not been carried out given the above as it is not required for this project proposal.



Conclusion

The proposed development of a telecommunications facility will provide a much-needed service to the local community. The location of the proposed tower is set well back from the road and will not impact the privacy or visual amenities of the local residents.

The subject land is suitable for a telecommunications tower for the following reasons:

- ✓ The site has a direct line of site to other constructed and proposed towers in the region and across the network.
- ✓ The site has safe access, and the development will not create a nuisance to current traffic volumes and usage.
- ✓ The subject land is not flood prone.
- ✓ The development will not increase the threat of bushfires or put lives in danger.
- ✓ The proposed location has not been identified as containing native vegetation or Aboriginal artefacts.
- ✓ The proposed facility will not interfere with agricultural land; and
- ✓ Potential impacts are low.

Therefore, the Council can be confident in approving the telecommunications facility as it will satisfy an essential community need.

Attachments

Attachment 1	Application for Local Government Development Approval
Attachment 2	Landowner's Consent
Attachment 3	Certificate of Title
Attachment 4	Site Plan
Attachment 5	Example Tower Technical Drawings (50m tower design)
Attachment 6	Antenna Infrastructure



Attachment 1: Application for Local Government Development Approval

 SHIRE OF DANDARAGAN LOCAL PLANNING SCHEME NO.7 DISTRICT ZONING SCHEME APPLICATION FOR DEVELOPMENT APPROVAL	<u>Office Use Only</u>	
	Application no:	Date of payment:
	Date received:	Amount Paid:
	Officer initials:	Receipt number:

Property Details		
Street number and /or Lot Number: 504	Street Name: North West Road	Area/Suburb: Badgingarra
Title encumbrances (e.g. easements, restrictive covenants): As per attached COT		
Nearest street intersection North West Road / McNamara Road		
Owner details		
Name: Gary Alexander Park and Anne Marie Park	ABN (if applicable):	
Address: PO Box 35, Badgingarra		Postcode: 6521
Phone number: 0438 529 285	Email and Fax (if available): hamika6521@gmail.com	
Contact person for correspondence: Gary Park		
Signature: Please refer to the attached landowner consent	Date: As per attached	
Signature: Please refer to the attached landowner consent	Date: As per attached	
<i>The signature of the owner(s) is required on all applications. This application will not proceed without that signature. For the purposes of signing this application an owner includes the persons referred to in the Planning and Development (Local Planning Schemes) Regulations 2015 Schedule 2 Clause 62(2)</i>		
Applicant details (if different from owner)		
Name: CRISP Wireless Pty Ltd		
Address: 4/2 Williams Road, Narrogin WA		Postcode: 6312
Phone number: 08 6809 2100	Email and Fax (if available): lballard@crispwireless.com.au	
Contact person for correspondence: Leigh Ballard, CEO		
Do you agree that the information and plans provided with this application may be made available by the local government for public viewing in connection with the application. x Yes ☐ No (If no, please specify why)		
Signature: 		Date: 07/10/2026
Proposed Development		
Nature of development: x Use and work ☐ Use ☐ Work	Description of proposed works and/or land use: Telecommunications infrastructure - communication repeater point - wireless broadband and communications hut	

Is an exemption from development claimed for part of the development?	☐ Works ☐ Use ☐ Works and Use
No	
Approximate cost of proposed developments:	\$50,000
Estimate time of completion:	4-6 weeks after all approvals secured

Development Application Checklist

To reduce potential time delays associated with incomplete applications, applicants are advised to carefully read and consider all relevant requirements prior to lodgement of an application. **This Checklist is to accompany ALL Development Applications.** Applicants are required to verify the application against the following checklist (using the tick boxes supplied ☐) and sign to confirm that the requested information has been provided. **Please note that incomplete applications may not be processed and may be returned to the applicant until such time as all details are provided.**

Please be aware that this is NOT an application for a Building Licence

<u>ALL</u> APPLICATIONS TO BE ACCOMPANIED BY	Shire Use
☐ Application for Development Approval completed and signed by all landowners.	☐
☐ Development Application fee paid (refer to Schedule of Fees and Charges – Planning Services).	☐
☐ Bushfire Management Plan (Bushfire Prone Areas) if applicable.	☐
☐ Written details of the proposal including justification for any item not complying with applicable standards.	☐
☐ A copy of the Certificate of Title.	☐
SITE PLAN/S (Scale 1:200 or nearest appropriate) – 2 copies required	
☐ Street name(s), street and lot number/s.	☐
☐ North Point.	☐
☐ Lot boundaries.	☐
☐ Existing and proposed buildings/ structure/ earthworks.	☐
☐ The structures, vegetation and environmental features that are proposed to be removed.	☐
☐ Contours and final floor levels.	☐
☐ Car parking, manoeuvring areas, points of access and egress etc.	☐
☐ Dimensions of lot and buildings.	☐
☐ Landscaping proposed for the site.	☐
☐ Distances from boundaries to structures (setbacks).	☐
☐ Details of any fencing.	☐
☐ Position of septic tanks, leach drains and soak wells.	☐
☐ Position of any development envelopes, easements, reciprocal access etc.	☐
☐ Infrastructure i.e. crossover, street trees, power poles, gas pipelines etc.	☐
☐ Earthworks cross section (including cut, fill, retaining walls and rock pitching).	☐
☐ Natural water courses/bodies.	☐
☐ Nearby structures on adjoining properties	☐

BUILDING PLANS (Scale 1:100 or 1:200) – 2 copies required	Shire Use
☐ The plans of any building proposed to be erected or altered and of any building that is intended to be retained	☐
FLOOR PLAN (Scale 1:100 or 1:200) – 2 copies required	
☐ A plan of every storey with floor levels	☐
☐ Internal layout showing doors/windows etc. with dimensions and room names	☐
☐ Total floor area in square metres	☐
ELEVATIONS (Scale not less than 1:100) – 2 copies required	
☐ All elevations are to be submitted with description / heading of each elevation (ie. north, south, east, west)	☐
☐ Natural ground levels and proposed ground levels and finish floor levels relative to nominated datum point or AHD (where applicable).	☐
☐ Height of walls and roof pitch from natural ground level	☐
☐ Details of external construction materials and colours proposed	☐
Note: Elevations are not required for a change of use application where there are no alterations or additions proposed to the external elevation.	
THE FOLLOWING INFORMATION MAY ALSO BE REQUIRED	
REPORTS, STUDIES	
☐ A report on any specialist studies in respect of the development that the local government requires the applicant to undertake such as site surveys or traffic, heritage, environmental, engineering etc.	☐
ONSITE SEWERAGE DISPOSAL	
☐ Site and soil evaluation where reticulated sewerage is not available for commercial, industrial and large residential developments.	☐
CHANGE OF USE	
☐ Nature of use/activity.	☐
☐ Proposed hours and days of operation.	☐
☐ Number of expected visitors and employees.	☐
☐ Details of any equipment to be used i.e. machines, amplifiers etc.	☐
☐ Proposed car parking / provision for car parking.	☐
ADVERTISING / SIGNAGE Please refer to the Shires Local Planning Policy no 5	
☐ Site plan clearly indicating the sign location and distances to boundaries	☐
Structural plan of the sign to scale 1:200 (2 copies required) including:	
☐ Elevation drawings	☐
☐ Materials	☐
☐ Footing and connection details	☐
☐ Dimensions i.e. height, width, depth, clearance to ground level	☐
☐ Artwork Plan in colour to scale 1:200 including the Graphic content of the sign	☐
☐ Colours and typography style to be used in the sign including the height of the typography	☐
☐ Superimposed images of the artwork plan where the sign will be located i.e. the façade of a building	☐
DEVELOPMENT ENVELOPE MODIFICATIONS	
☐ Site plan as detailed above, indicating the location of both the proposed and existing envelopes including dimensions and distances to the boundaries. This should include building and effluent disposal footprints	☐
☐ Justification of the proposed modification in writing	☐
☐ Contour Plan (Where Development Envelope is proposed to be relocated)	☐
NOTE: Where a Development Application for a Single House, Outbuilding etc. proposes a Development Envelope Modification this can be included on the same application	☐

BUSHFIRE MANAGEMENT PLAN (BUSHFIRE PRONE AREAS)	Shire Use
☐ A Bushfire Management Plan addressing Section 6.5 of State Planning Policy 3.7 – ‘Planning in Bushfire Prone Areas’ and the related guidelines (inclusive of a Bushfire Attack Level (BAL) assessment by an accredited Bushfire Planning Practitioner);	☐
☐ Emergency Evacuation Plan	☐

FURTHER ADVICE TO APPLICANT

Additional Information

Following initial assessment of your application, the Shire may request other information, or plans may need to be revised to assist in determination of the application.

Building Permit

In most instances where structures are proposed, a Building Permit will also need to be obtained.

Heritage Matters

With regard to applications placed or entered into the Municipal Heritage Inventory, please note that the Shire may require elevations and a schedule of materials and colours for the subject lot, and the lots immediately adjoining it.

Electronic versions of the application

The Council reserves the right to request an electronic version of the application to make a complete assessment of the development application.

Refunds

No refunds will be provided by the Shire once an application has been lodged and allocated.

I declare and acknowledge the information provided above is accurate and complete. I also acknowledge and accept that when lodging this checklist and application form, that the Shire may advertise, display, copy and/or reproduce any supporting plans and documentation submitted as part of this application.

Applicant Name: Leigh Ballard

Applicants Signature: 

Date Submitted: 07/10/2026

Please email your application to DSR@dandaragan.wa.gov.au

OR mail it to: Shire of Dandaragan, PO Box 676, Jurien Bay WA 6516

ATTACHMENT 2: LANDOWNER CONSENT

We, GARY ALEXANDER PARK and ANNE MARIE PARK, being the registered landowners of the property, Melbourne Location 3788 , located at 504RRN North West Road, Badgingarra, 6521, AS JOINT TENANTS, consent to the submission of an application for Development Approval by CRISP Wireless Pty Ltd on the property described above for the purpose of a Telecommunications Tower and associated infrastructure.

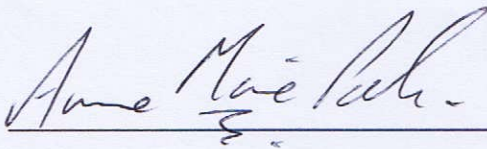
SIGNED



Gary Alexander Park

Date 1/10/2026

SIGNED



Anne Marie Park

Date 1/10/2026

Attachment 3: Certificate of Title

WESTERN



AUSTRALIA

TITLE NUMBER

Volume

Folio

1814

489

RECORD OF CERTIFICATE OF TITLE

UNDER THE TRANSFER OF LAND ACT 1893

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

BGRoberts
REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 3788 ON DEPOSITED PLAN 209087

REGISTERED PROPRIETOR: (FIRST SCHEDULE)

GARY ALEXANDER PARK
ANNE MARIE PARK
BOTH OF PO BOX 35 BADGINGARRA WA 6521
AS JOINT TENANTS

(T D924148) REGISTERED 3/11/1988

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS: (SECOND SCHEDULE)

1. THE LAND THE SUBJECT OF THIS CERTIFICATE OF TITLE EXCLUDES ALL PORTIONS OF THE LOT DESCRIBED ABOVE EXCEPT THAT PORTION SHOWN IN THE SKETCH OF THE SUPERSEDED PAPER VERSION OF THIS TITLE.
2. D203264 EASEMENT TO THE STATE ENERGY COMMISSION OF WESTERN AUSTRALIA. SEE INSTRUMENT D203264. REGISTERED 21/2/1986.
H599674 SUNDRY. THE GRANTEE OF TRANSFER D203264 IS NOW THE DBNGP LAND ACCESS MINISTER PURSUANT TO THE DAMPIER TO BUNBURY PIPELINE ACT 1997. REGISTERED 17/11/2000.
3. D203265 EASEMENT TO THE STATE ENERGY COMMISSION OF WESTERN AUSTRALIA. SEE INSTRUMENT D203265. REGISTERED 21/2/1986.
H599674 SUNDRY. THE GRANTEE OF TRANSFER D203265 IS NOW THE DBNGP LAND ACCESS MINISTER PURSUANT TO THE DAMPIER TO BUNBURY PIPELINE ACT 1997. REGISTERED 17/11/2000.
4. D203266 EASEMENT TO THE STATE ENERGY COMMISSION OF WESTERN AUSTRALIA. SEE INSTRUMENT D203266. REGISTERED 21/2/1986.
H599674 SUNDRY. THE GRANTEE OF TRANSFER D203266 IS NOW THE DBNGP LAND ACCESS MINISTER PURSUANT TO THE DAMPIER TO BUNBURY PIPELINE ACT 1997. REGISTERED 17/11/2000.
5. H599674 SUNDRY. PORTION OF THE LAND HEREIN IS WITHIN THE DBNGP CORRIDOR PURSUANT TO THE DAMPIER TO BUNBURY PIPELINE ACT 1997. SEE LAND ADMINISTRATION PLAN 15549. REGISTERED 17/11/2000.
6. H599674 SUNDRY. PORTION OF THE LAND HEREIN IS WITHIN THE DBNGP CORRIDOR PURSUANT TO

END OF PAGE 1 - CONTINUED OVER

RECORD OF CERTIFICATE OF TITLE

REGISTER NUMBER: 3788/DP209087

VOLUME/FOLIO: 1814-489

PAGE 2

- THE DAMPIER TO BUNBURY PIPELINE ACT 1997. SEE LAND ADMINISTRATION PLAN 15550. REGISTERED 17/11/2000.
7. H599674 SUNDRY. PORTION OF THE LAND HEREIN IS WITHIN THE DBNGP CORRIDOR PURSUANT TO THE DAMPIER TO BUNBURY PIPELINE ACT 1997. SEE OFFICE OF TITLES PLAN 14221. REGISTERED 17/11/2000.
8. I209691 SUNDRY. PORTION OF THE LAND HEREIN IS WITHIN THE DBNGP CORRIDOR PURSUANT TO THE DAMPIER TO BUNBURY PIPELINE ACT 1997. SEE DEPOSITED PLAN 29332. REGISTERED 20/8/2002.
9. I209692 TAKING ORDER. THE DESIGNATED PURPOSE OF THE INTEREST TAKEN IS STATE CORRIDOR RIGHTS TO THE DBNGP LAND ACCESS MINISTER UNDER THE PROVISIONS OF THE DAMPIER TO BUNBURY PIPELINE ACT 1997. AS TO THE PORTIONS OF THE WITHIN LAND SHOWN ON DEPOSITED PLANS 29332, 215549 AND 215550 ONLY. REGISTERED 20/8/2002.
10. P121421 LEASE TO OPTUS MOBILE PTY LIMITED OF 1 LYONPARK ROAD MACQUARIE PARK NSW 2113 EXPIRES: SEE LEASE. REGISTERED 22/4/2022.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
Lot as described in the land description may be a lot or location.

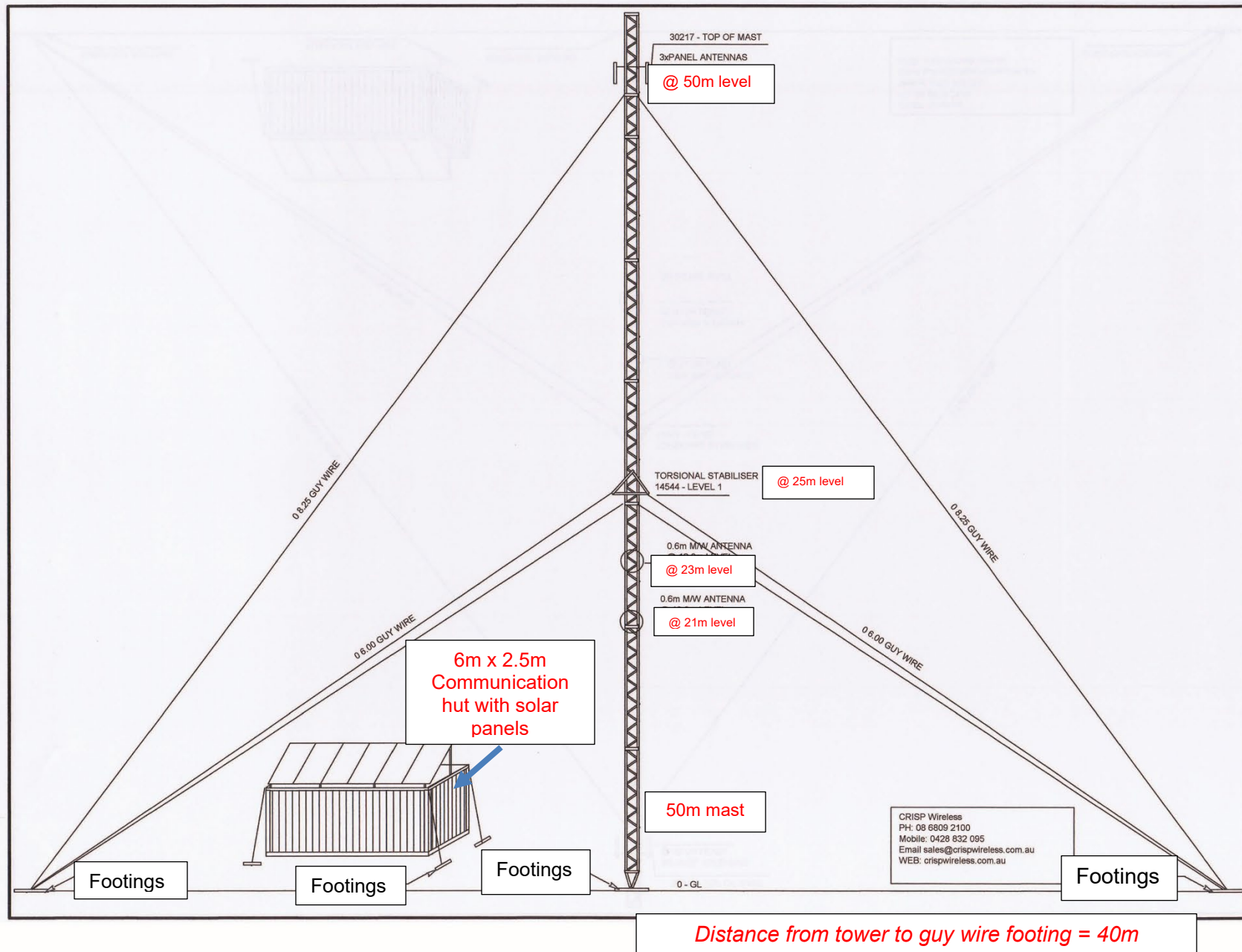
-----END OF CERTIFICATE OF TITLE-----

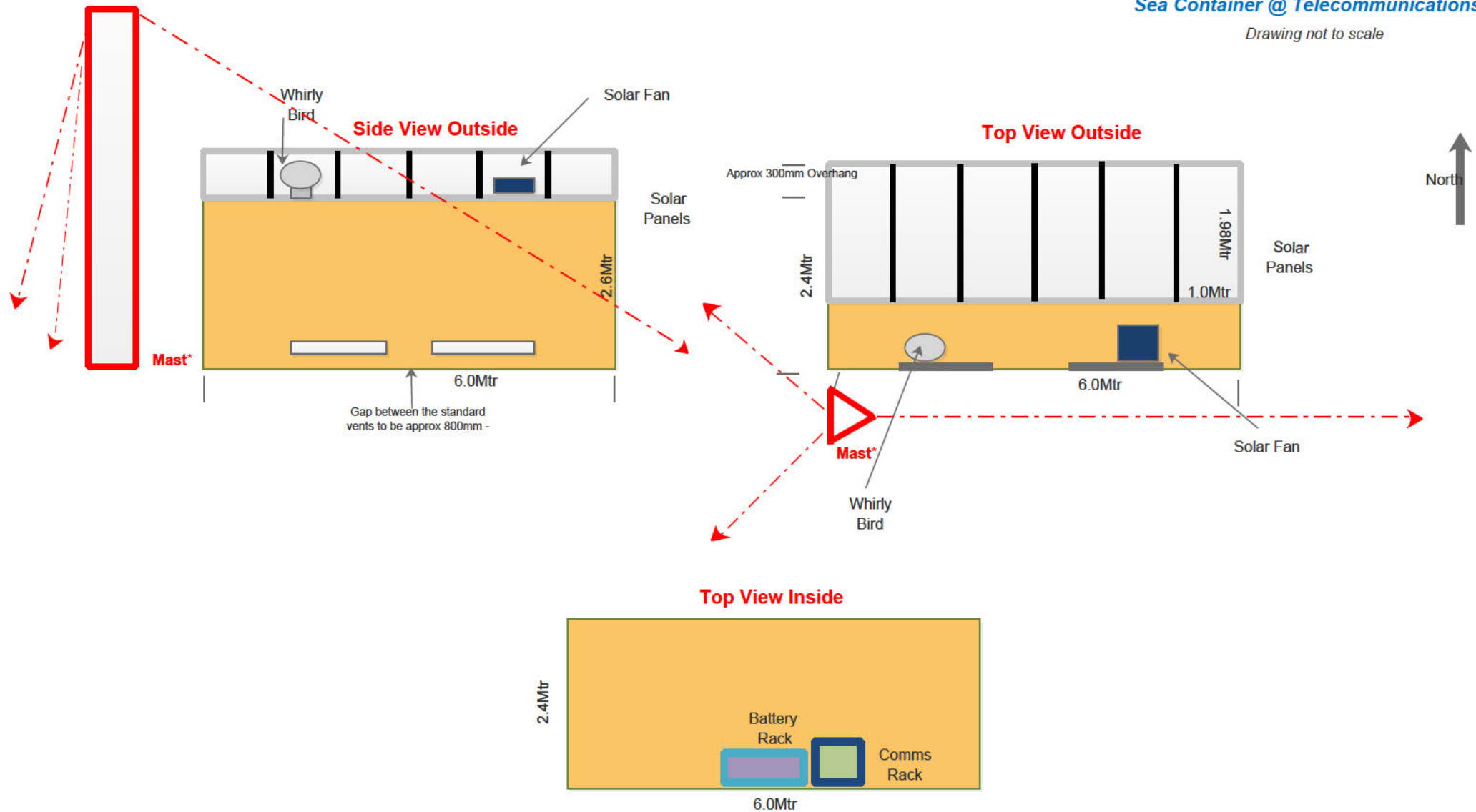
STATEMENTS:

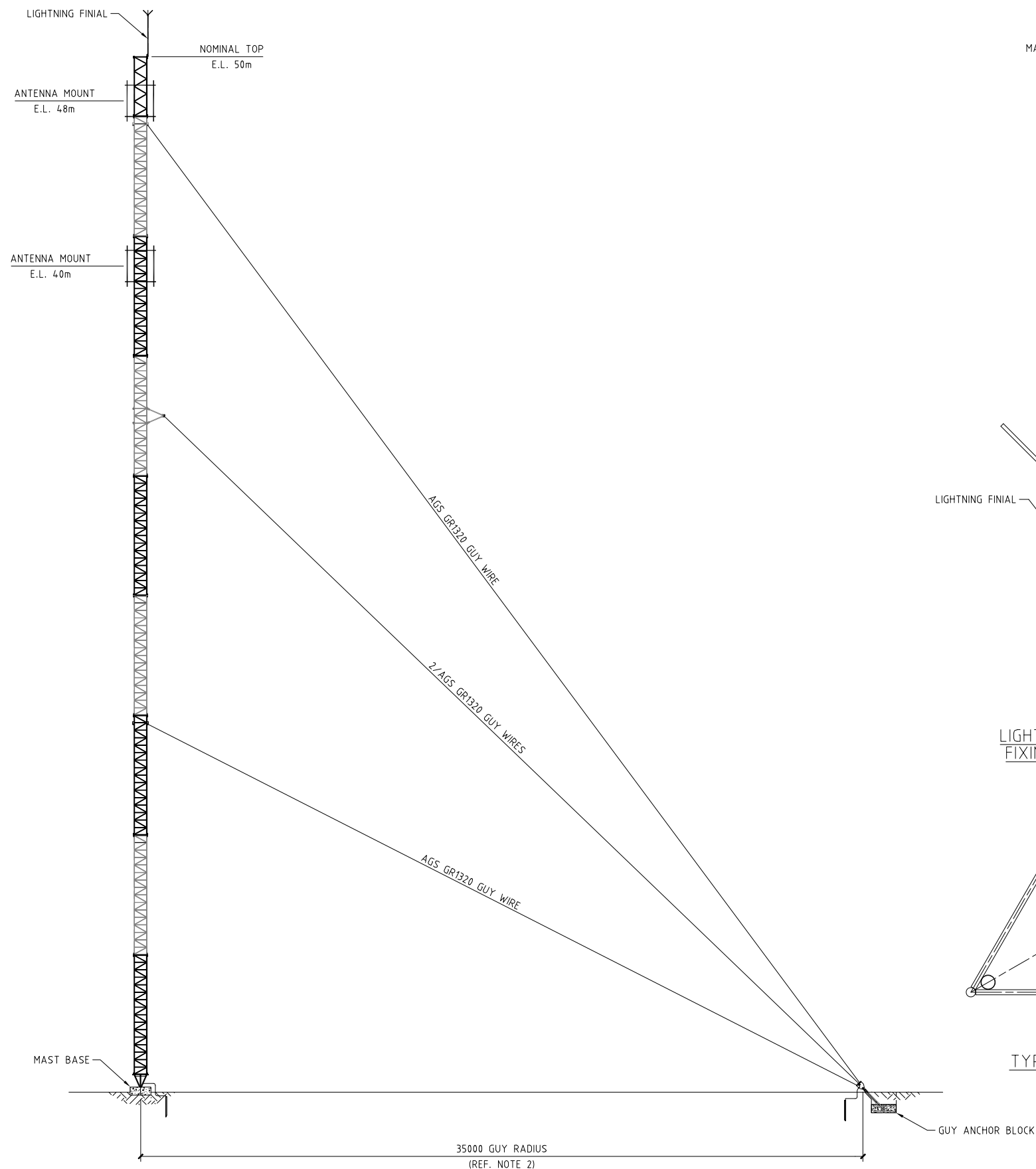
The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: 1814-489 (3788/DP209087)
PREVIOUS TITLE: 1652-189
PROPERTY STREET ADDRESS: 504 NORTH WEST RD, BADGINGARRA.
LOCAL GOVERNMENT AUTHORITY: SHIRE OF DANDARAGAN

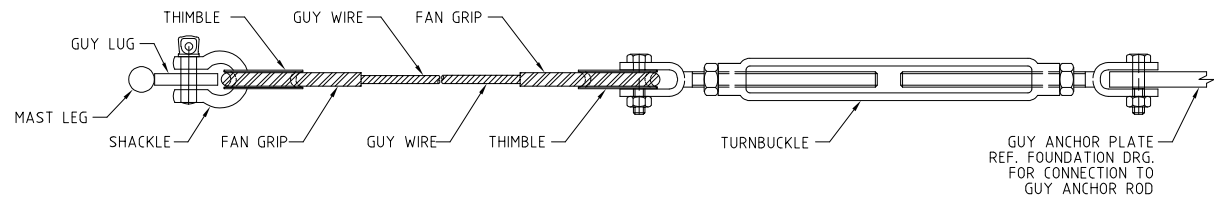
Attachment 5: Example Tower Technical Drawings



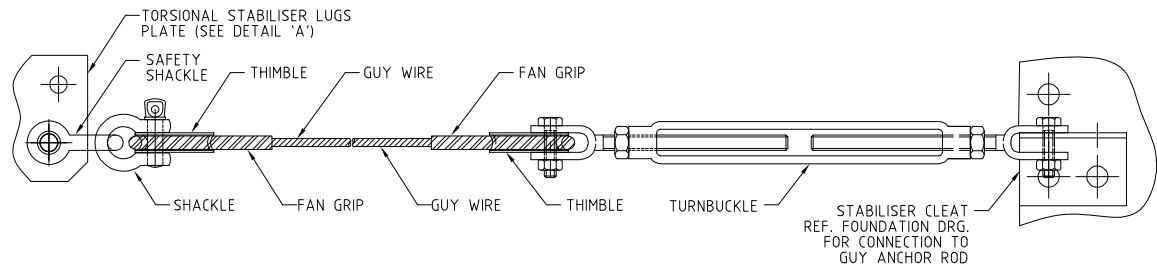




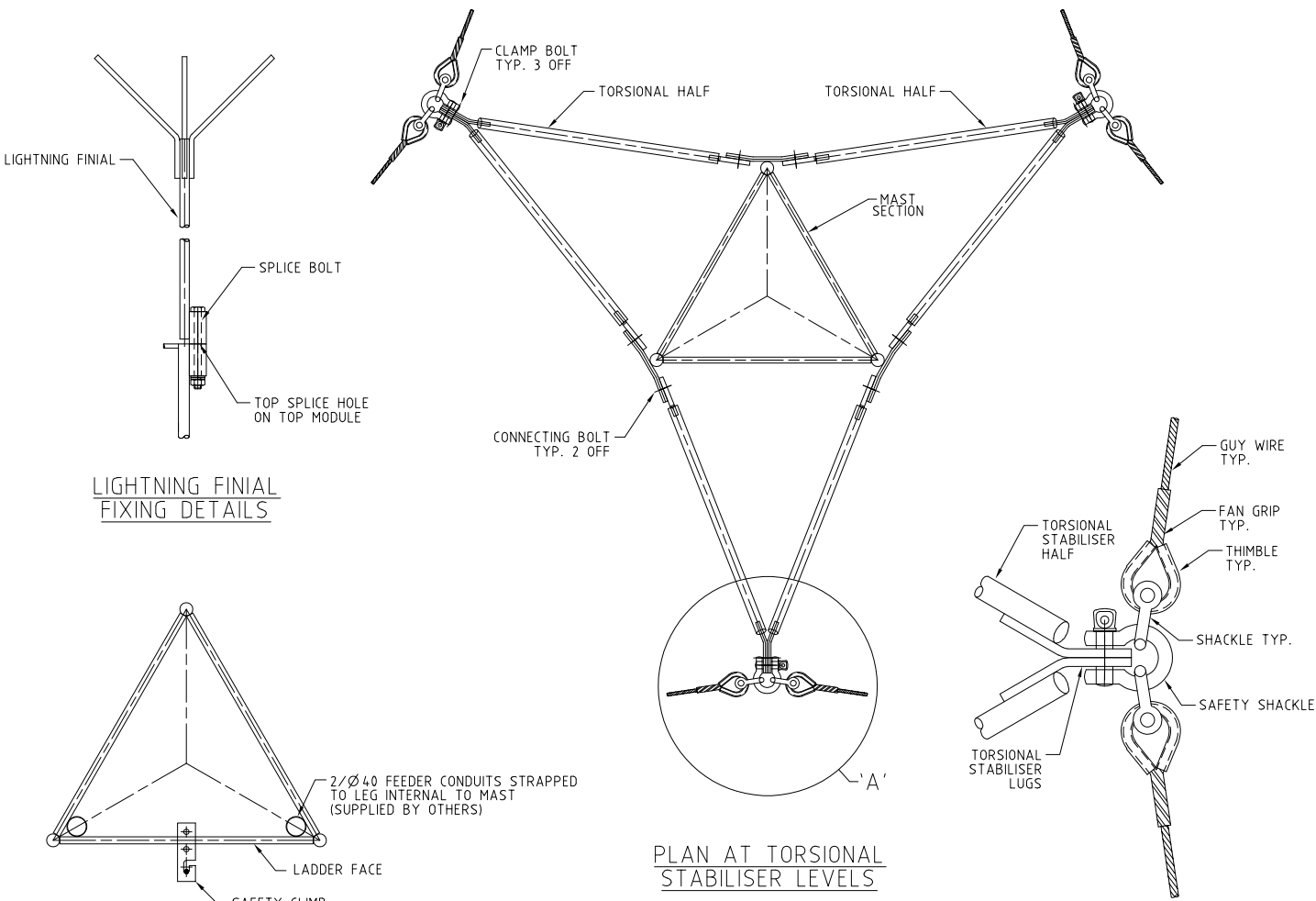
MAST ELEVATION



TYPICAL GUY ASSEMBLY



TYPICAL TORSIONAL STABILISER GUY ASSEMBLY



LIGHTNING FINIAL
FIXING DETAILS

TYPICAL PLAN

PLAN AT TORSIONAL
STABILISER LEVELS

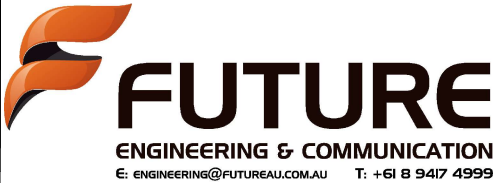
DETAIL 'A'

INFORMATION ONLY
NOT TO BE USED
FOR CONSTRUCTION

GENERAL NOTES

1. REFER TO FEC STANDARD NOTES F1/1/SN.
2. GUY RADII GIVEN ARE BASED ON LEVEL GROUND.

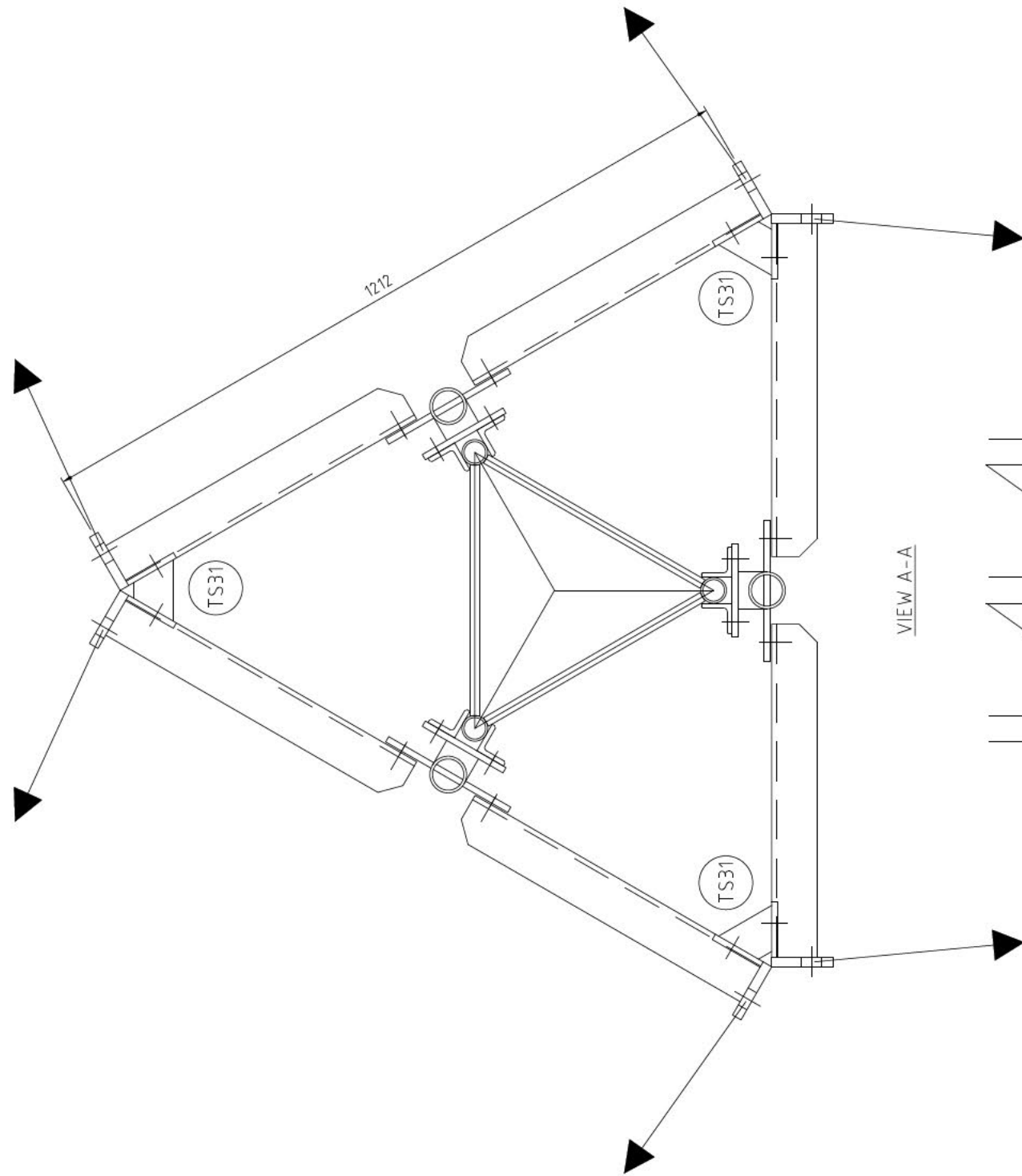
F1/1/SN	FEC STANDARD NOTES								
DRAWING No.	DESCRIPTION	DRAWING No.	DESCRIPTION	DRAWING No.	DESCRIPTION	REF	DESCRIPTION	DATE	APPV.
REFERENCE DRAWINGS						REVISIONS			



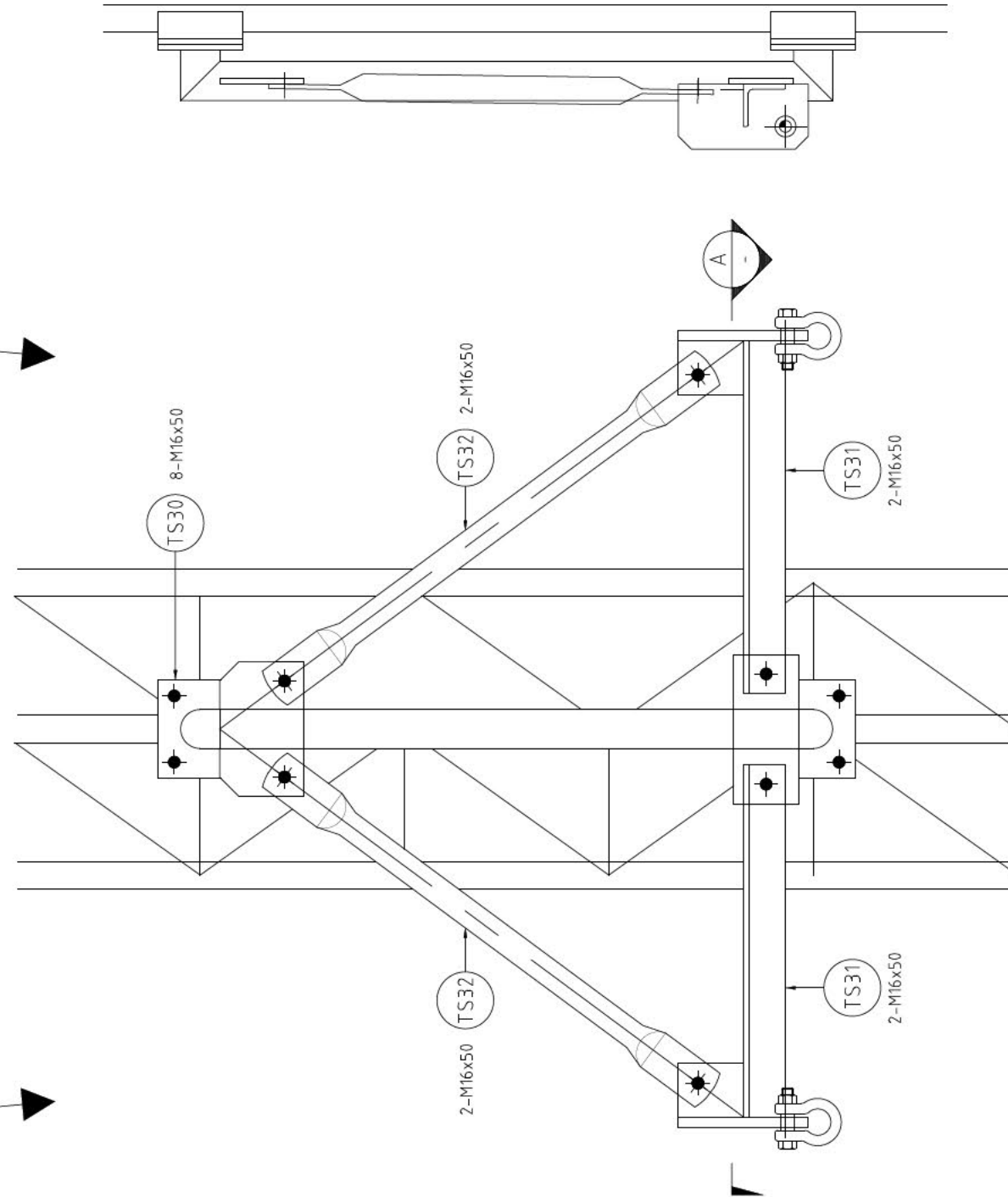
This design or drawing is not sold but lent. It remains the property of this company and is subject to recall. Its contents must not be communicated to any person whatsoever without the written consent of FEC.

DRAWN: TW	ENG.:	CRISP WIRELESS 50m GUYED MAST GENERAL ARRANGEMENT							
CHECKED:	APPV.:								
DATE: 03-06-26	SHEET: A1	SCALE: NTS	DWG No.:	J4531/1/3	REV:				

HARDWARE SCHEDULE			
SIZE	QTY	DESCRIPTION	GRADE/FINISH SUPPLIED BY
M16x50	42	HEX HEAD BOLT + NUT & FLAT WASHER	GRADE 8.8 GALV ROAM

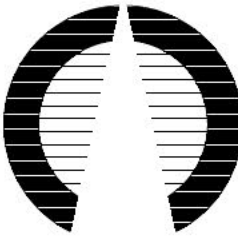


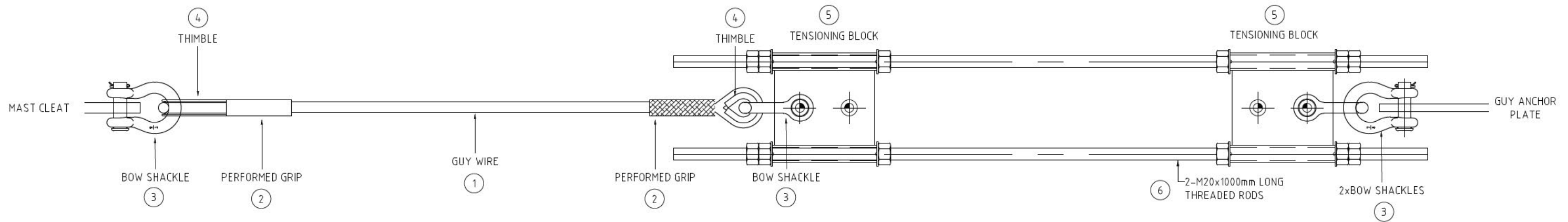
VIEW A-A



ELEVATION

DRG	COMPONENT	QTY	DESCRIPTION	LENGTH	MATERIAL	GRADE
RM450	TS32	6	STABILISER STRUT	839		
RM450	TS31	3	STABILISER HORIZONTAL	559		
RM450	TS30	3	STABILISER MOUNT	1075		
TOTAL QTY = 12		COMPONENT SCHEDULE				

REFERENCE DRAWINGS		REF	REVISION	BY	DATE	 ROAM PTY LTD 8 Meka Street Malaga W.A. 6090 Australia Tel (618) 9248 4950 Fax (618) 9248 4951 This drawing produced by roam is not sold but lent. its contents must not be copied, traced or communicated to any person whatsoever without written consent of roam pty. ltd.	ERECTION DRAWING			
		B	ISSUED FOR CONSTRUCTION	C.J.C	16-12-20		DESCRIPTION: TORSIONAL STABILISER			
		A	ISSUED FOR REVIEW	D.T	16-12-20		REF:	APPR: C.J.C	DATE: 16-12-20	TOWER TYPE: RM450
						SCALE: (A3) NTS	DRAWN: D.T	DATE: 16-12-20	DRG.No. RJ12748-2-TS1	REV B



QUANTITIES PER ASSEMBLY REQUIRED																
GUY-WIRE LEVEL	①				②		③		④		⑤		⑥		INITIAL TENSION (kN)	TOTAL No. OF ASSEMBLIES
	GRADE	CONSTRUCTION	GUY LENGTH	SUPPLIED LENGTH	φ (GRADE)	QTY	GRADE 'S' (WLL)	QTY	SIZE	QTY	TYPE	QTY	SIZE	QTY		
2	1320	7/2.75 (φ8.25)	35m	40m	8.25 (1320)	2	13mm (2.0t WLL)	4	10mm	2	TB8	2	M20x1000mm	2	5.2	3
1	1320	7/2.00 (φ6.00)	25m	30m	6.00 (1320)	2	13mm (2.0t WLL)	4	10mm	2	TB8	2	M20x1000mm	2	2.7	6

NOTES:

- Guy lengths in table are based upon a flat level site. Adjust cut guy lengths to compensate for any on-site anchor radius adjustments.
- All shackles pins to be wired to body on assembly.
- Check and adjust all guy wires to match initial tensions in table. Tension values based on still wind conditions

M20x1000mm	18	M20 THREADED ROD	GRADE 8.8 GALV.	ROAM
M20 NUT	108	M20 NUT	CLASS 8 GALV.	ROAM
M20 WASHER	72	M20 FLAT WASHER	GRADE 8.8 GALV	ROAM
10mm THIMBLE	18	10mm THIMBLE	GALV.	ROAM
13mm SHACKLE	36	13mm (2.0t WLL) BOW SHACKLE	GRADE S - GALV.	ROAM
6.00 GRIP	12	PREFORMED GRIP SUIT φ6.00 WIRE	GALV.	ROAM
8.25 GRIP	6	PREFORMED GRIP SUIT φ8.25 WIRE	GALV.	ROAM
7/2.00 (φ6.00)	180m	GUY WIRE	GRADE 1320 - GALV.	ROAM
7/2.75 (φ8.25)	120m	GUY WIRE	GRADE 1320 - GALV.	ROAM
SIZE	QTY	DESCRIPTION	GRADE/FINISH	SUPPLIED BY

HARDWARE SCHEDULE

RA07	TB8 revB	18	GUY-TENSIONING BLOCK	158		
DRG	COMPONENT	QTY	DESCRIPTION	LENGTH	MATERIAL	GRADE
TOTAL QTY = 18			COMPONENT SCHEDULE			

REFERENCE DRAWINGS	REF	C B A	TURNBUCKLES REPLACED WITH TENSIONING BLOCKS ISSUED FOR CONSTRUCTION ISSUED FOR REVIEW	C.J.C C.J.C D.T	22-01-21 16-12-20 15-12-20		ROAM PTY LTD 8 Meka Street Malaga W.A. 6090 Australia Tel (618) 9248 4950 Fax (618) 9248 4951 This drawing produced by roam is not sold but lent. its contents must not be copied, traced or communicated to any person whatsoever without written consent of roam pty. ltd.	ERECTION DRAWING							
								DESCRIPTION: GUY WIRE ASSEMBLY							
								REF: -	APPR: C.J.C	DATE: 16-12-20	TOWER TYPE: -	MODULE: -			
								SCALE: (A3) NTS	DRAWN: D.T	DATE: 15-12-20	DRG.No. RJ12748-2-GW1	VER: -	REV: C		

MAST ERECTION METHOD OF PROCEDURE

IMPORTANT:

Roam structures are only to be erected by experienced qualified rigging personnel working in accordance with a safety plan that has been prepared in conjunction with a competent erection supervisor. The safety plan is expected to include a comprehensive job hazard analysis covering an assessment of lifts by cranes, winches ginpoles and juries, safe lifting of partly assembled modules and temporary lifting points. The Safety Plan for construction works should incorporate design hazards, design control measures and notes to the Constructor identified in the Safety in Design drawing.

MAST ERECTION PROCESS

1. Check shipping lists to ensure all materials have been delivered. Check materials for any damage. Any small areas of damaged galvanising should be repaired with zinc rich paint. Touch-up any paint damage.
2. When erecting the mast, the intention should be to have each mast span (guy level to guy level) fully assembled with all ancillaries (ladders, cable brackets, antenna mounts, torsional stabiliser, fall-arrest) installed, and guys attached, before mobilising a crane to site for lifting. Guy tensioning equipment and theodolites should also be set-up in advance.
3. Assemble mast sections, on the ground, into the spans that comprise the mast. The mast shall not be lifted in a single 30m span. Ensure that bolts are fully tightened before lifting the mast.
4. Mast sections typically have a top and bottom. Ensure sections are orientated to achieve a continuous bracing pattern and equal cable bracket spacing.
5. Refer to the guy-wire assembly drawing. The drawing specifies the expected final guy lengths based upon the surveyed positions on the mast foundations. The "supplied length" specified on the drawing typically allows for extra 3m for each individual guy. The guys for each mast should be cut to the "supplied length" dimension and attached to the guy lugs at the top of each corresponding mast span.
6. Set-up 2 x theodolites at approximate 90° apart and at a distance that enables the theodolites to view the bottom of the mast and the top of the mast when fully erected.
7. Lift the bottom mast section into position, ensuring that the cable ladder and climbing ladder faces are orientated to best suit the site layout. Whilst the mast span is supported by the crane, pull the guys to the anchors, using turfs as required, and connect to the lowest anchor plate hole. Note that there is typically a spare hole at the top of the anchor plates for temporarily attaching turfs and tensioning equipment.
8. Tension the lower set of guys until they are taut and support the mast without the aid of the crane. At this point the mast can be safely climbed with appropriate climbing gear to detach the crane hook.
9. Align the vertical crosshairs of the theodolites with one of the mast legs at the lowest point possible. Adjust guy tensions to align the bottom mast section until it is vertical within the precision of the theodolite. Achieve verticality of 1:200 or better.
10. Repeat the process for the remaining mast spans.
11. Once the entire mast has been erected, attach and tension the fall-arrest cable, to the bottom tensioning bracket. The crane hook can be detached once all guys have been nominally tensioned maintaining mast verticality.

GUY TENSIONING PROCEDURE

1. Refer to the guy-wire assembly drawing. The values of initial tension have been calculated to achieve a vertical mast for the surveyed anchor positions. Initial tensions shall be achieved to within 10% of the specified value whilst maintaining mast verticality. Guy tension values are based upon still wind conditions.
2. Tensioning guys can be done with a guy-tension measuring instrument (such as a Piab RMT 20D) or with a load-cells. In either case, calibration records shall be maintained.
Guys can be tensioned one-at-a-time but they would need to be checked and adjusted twice to correct for the impact of tensioning upon previously tensioned guys.

TENSIONING GUYS USING IN-LINE GAUGE

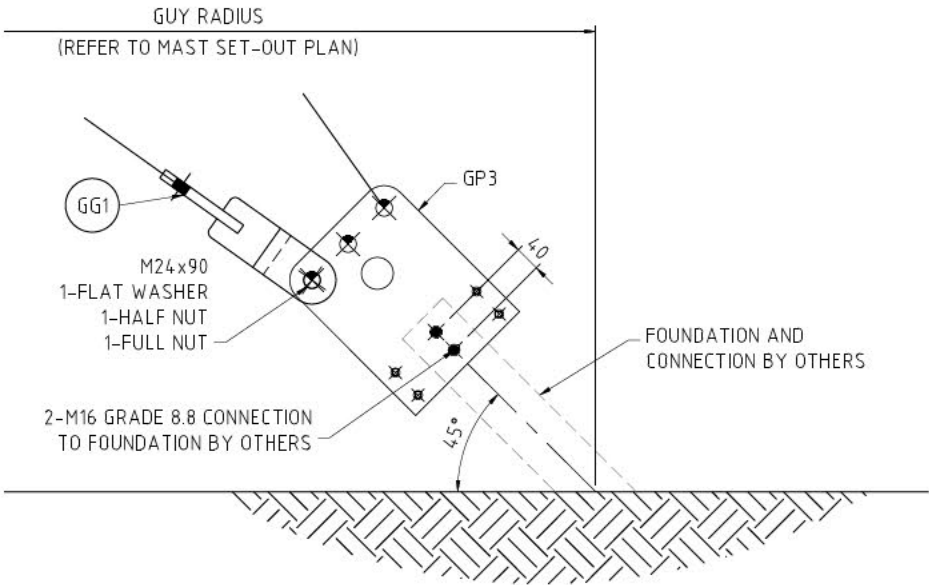
1. Connect load-cell to either side of the guy-tension-device (turnbuckle)
2. Tension the load-cell until the specified initial tension value is reached (+/- 10%)
3. Tension the guy-tension-device until the load-cell reading just reduces back to zero.
4. Release and remove the load-cell without adjusting the guy-tension-device.

BEFORE DEMOBILISING FROM SITE

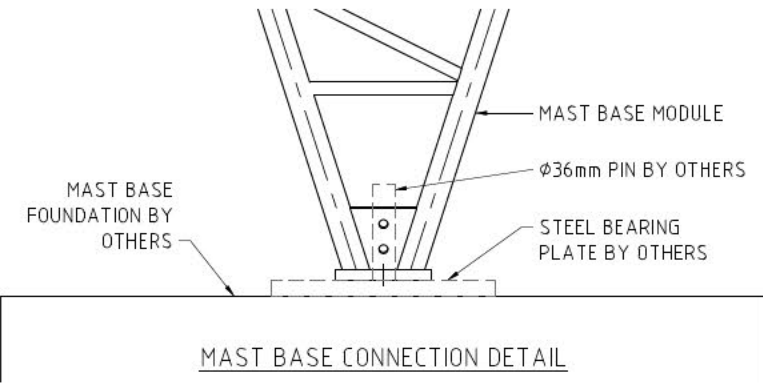
1. Once guys have been tensioned, re-tension the fall arrest cable and check that all mast splice bolts are properly tightened and have not loosened during the erection process.
2. Complete the mast inspection form supplied with the mast drawings.
3. On completion of all works, mark up the erection drawings and material lists;
 - i. Sign off drawings as as-built and records on the drawings any changes
 - ii. Fabrication mistakes
 - iii. Drawing mistakes
 - iv. Problems encountered during erection
 - v. Suggested design improvements
 - vi. Under-supply or over-supply of materials
 - vii. Appearance of structure.
4. Take photographs including one shot showing the entire structure.
5. Scan all drawings, lists and checklists and email these documents along with photographs and any other documentation to roam@roameng.com.au

							ROAM PTY LTD 437 VICTORIA ROAD MALAGA W.A. 6090 AUSTRALIA TEL (618) 9248 4950 FAX (618) 9248 4951 THIS DRAWING PRODUCED BY ROAM IS NOT SOLD BUT LENT. ITS CONTENTS MUST NOT BE COPIED, TRACED OR COMMUNICATED TO ANY PERSON WHATSOEVER WITHOUT WRITTEN CONSENT OF ROAM PTY. LTD.	DESIGN: C.J.C	DATE: 15-12-20	ROAM PTY LTD STANDARD GUYED-MAST ERECTION NOTES (SHEET 1 OF 1)			
								APPR: C.J.C	DATE: 16-12-20				
		B A	ISSUED FOR CONSTRUCTION ISSUED FOR REVIEW	C.J.C D.T	16-12-20 15-12-20				DRAWN: D.T	DATE: 15-12-20	SCALE: (A3) N.T.S	DWG. No. RJ12748-2-GM1	VER. 07
REFERENCE DRAWINGS		REF	REVISION		BY	DATE							

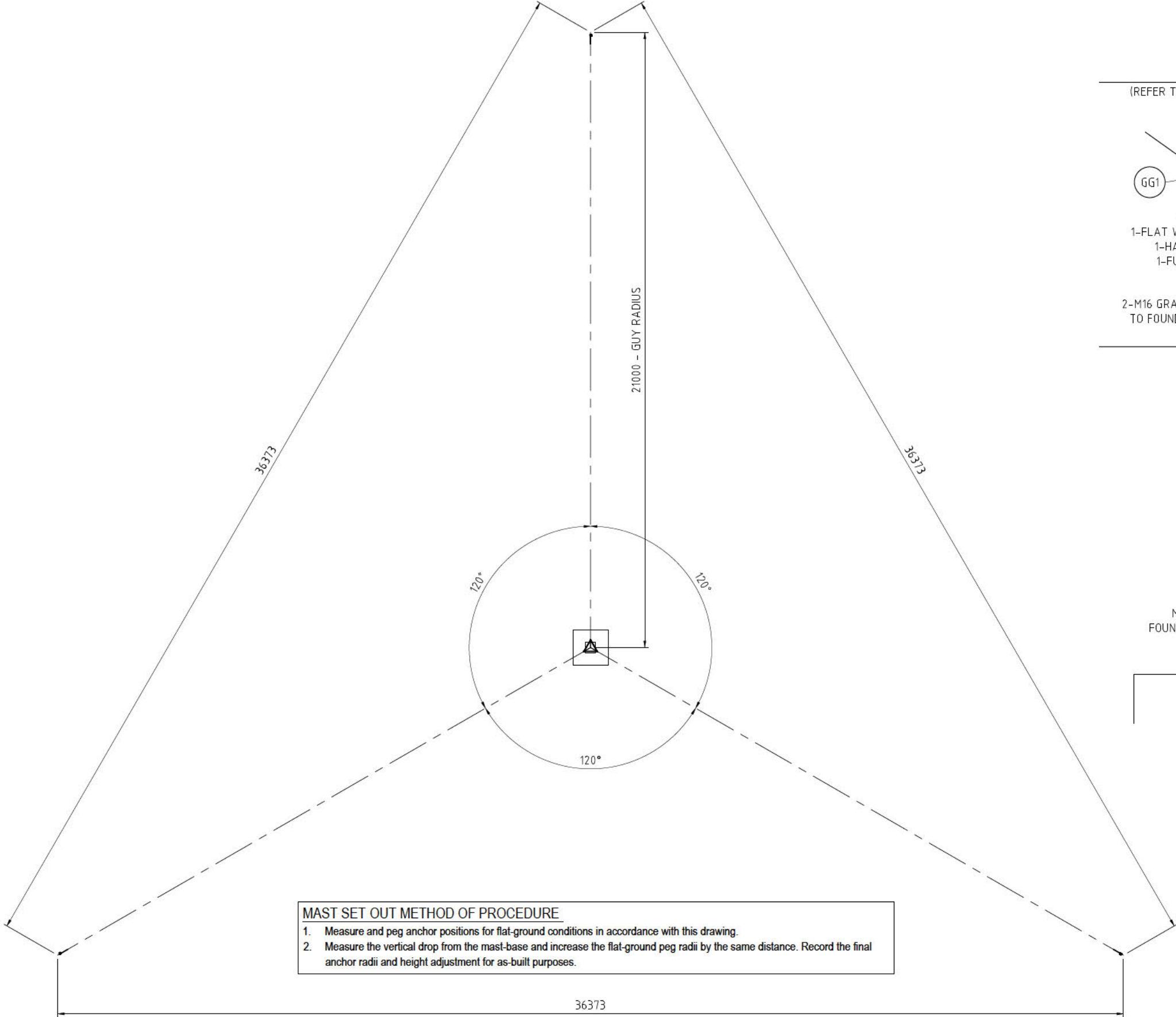
HARDWARE SCHEDULE				
SIZE	QTY	DESCRIPTION	GRADE/FINISH	SUPPLIED BY
M24x90	3	HEX. HD. BOLT c/w NUT & FLAT WASHER	GRADE 8.8 GALV	ROAM
M24	3	HALF NUT (LOCK NUT)	GRADE 8.8 GALV	ROAM



GUY ANCHOR PLATE DETAIL



MAST BASE CONNECTION DETAIL



- MAST SET OUT METHOD OF PROCEDURE**
1. Measure and peg anchor positions for flat-ground conditions in accordance with this drawing.
 2. Measure the vertical drop from the mast-base and increase the flat-ground peg radii by the same distance. Record the final anchor radii and height adjustment for as-built purposes.

FLAT GROUND MAST SET-UP PLAN

RM01	GG1	3	SPLITTER PLATE	325		
RM01	GP3	3	ANCHOR PLATE	300		
DRG	COMPONENT	QTY	DESCRIPTION	LENGTH	MATERIAL	GRADE
TOTAL QTY = 6			COMPONENT SCHEDULE			

							ROAM PTY LTD 8 MEKA STREET MALAGA W.A. 6090 AUSTRALIA TEL (618) 9248 4950 FAX (618) 9248 4951 THIS DRAWING PRODUCED BY ROAM IS NOT SOLD BUT LENT. ITS CONTENTS MUST NOT BE COPIED, TRACED OR COMMUNICATED TO ANY PERSON WHATSOEVER WITHOUT WRITTEN CONSENT OF ROAM PTY. LTD.	DESIGN: C.J.C	DATE: 15-12-20	CRISP WIRELESS 30m RM450 GUYED MAST – TOWER D NN MAST SET-OUT			
								APPR: C.J.C	DATE: 16-12-20				
REFERENCE DRAWINGS	REF	B A	ISSUED FOR CONSTRUCTION ISSUED FOR REVIEW	C.J.C D.T	16-12-20 15-12-20					DRAWN: D.T	DATE: 15-12-20	SCALE: (A3) N.T.S	DWG. No. RJ12748-3-1

			Hazard assessment table						Risk Rank	Probability			Consequence			
				1	2	3	4		E - EXTREME	A –Likely	“common or repeating occurrence”		1 – fatality or permanent disability			
			A	E	H	S	M		H - HIGH	B – Occasionally	“happens every now and then”		2 – lost time injury or serious illness			
			B	E	H	S	M		S - SUBSTANTIAL	C – Unlikely	“has been known to happen”		3 – medical treatment			
			C	H	S	M	L		M - MODERATE	D – Very Unlikely “possible but probably never will”			4 – possible first-aid treatment			
			D	S	M	L	L		L - LOW							

Attachment 6: General Antenna Information

ePMP™ 3000 Sector Antenna



Cambium Networks has deployed more than five million radios around the world achieving unparalleled degrees of scalability. Continuing the tradition of designing and manufacturing industry leading antenna solutions, the ePMP 3000 4X4 sector antenna encompasses all the key differentiations of the Cambium Antenna line and adds 4X4 Multi User MIMO Capability. Designed to work in 5 GHz spectrum and 90 degree coverage, the antenna is an integral part of the ePMP 3000 Access Point and allows for Multi User MIMO Operation.

KEY DEPLOYMENT ADVANTAGES

- **Frequency Re-use:** Designed for ABAB channel re-use (two channels covering four sectors), the sector antenna has a minimum 30 dB front to back ratio over a wide rear facing aperture.
- **Channel Flexibility:** Consistent gain from 4.9 to 6.0 GHz allows the operator to select a channel anywhere in the band and achieve the expected performance.
- **Consistent Coverage:** Excellent null fill capabilities of the antenna allow for broad geographical coverage within a sector even near the base of the tower and the edges of the sector.
- **Designed for the Installer:** Small, compact design, integrated ePMP radio mount and GPS antenna integration.
- **Predictable Performance:** The sector antenna is integrated into Cambium Networks LINKPlanner. The 3D model shows coverage at all elevations and across the azimuth.

KEY SPECIFICATIONS:

- 17 dBi gain
- 4.9 to 5.97 GHz spectrum
- 30 dBi front to back ratio
- IP 65 ruggedization

SPECIFICATIONS

ePMP 3000 SECTOR ANTENNA

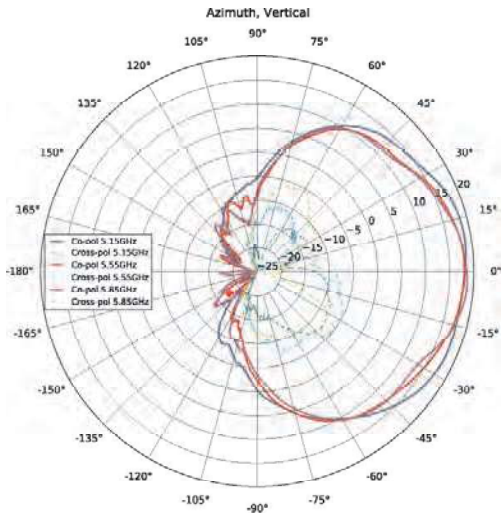
Model Number	C050910D301A
Frequency Range	4.9 GHz to 5.97 GHz
Gain	17 dBi
3 dB Beamwidth - Azimuth	70 degrees
3 dB Beamwidth - Elevation	6 degrees
Electrical Downtilt	-2 degrees
Polarization	2X Horizontal, 2X Vertical

SPECIFICATIONS

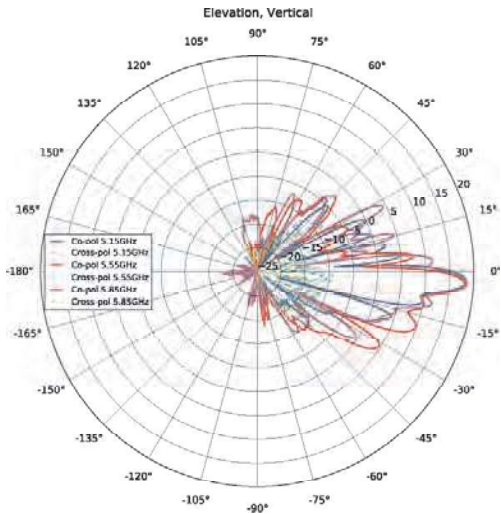
ePMP 3000 SECTOR ANTENNA	
Model Number	C050910D301A
Port-to-Port Isolation	> 20 dB
Front-to-Back Ratio	30 dB
Maximum Input Power	5 W
Input Impedance	50 ohms
Mounting Connectors	4 x RP SMA
Mounting Hardware	Included for mounting to mast diameters 2" to 4" (5 cm to 10 cm) -10 to +5 degree tilt Hardware included to connect ePMP access point to back of antenna body
Physical Dimensions	Antenna Body: 23.4" (H) x 9.6" (W) x 3.25" (D) (594 mm x 157 mm x 110 mm)
Weight	Antenna Body: 8.0 lbs, 3.7 kg w/ ePMP 3000 Access Point and Mounting Brackets: 13.8 lbs, 6.3 kg
Environmental	IP65
Radome Material	UV Protected ABS
Operating Temp	-40°C to 60°C (-40°F to 140°F)

ANTENNA PATTERNS

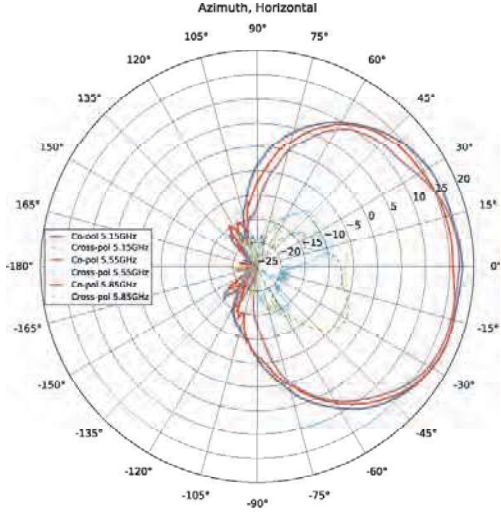
Channel 0 Vertical Polarization Azimuth



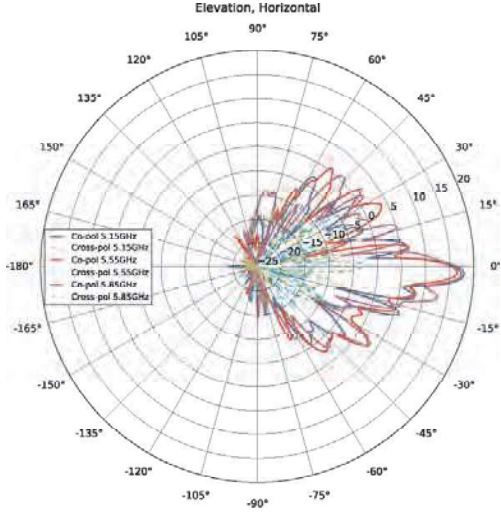
Channel 0 Vertical Polarization Elevation



Channel 1 Vertical Polarization Azimuth

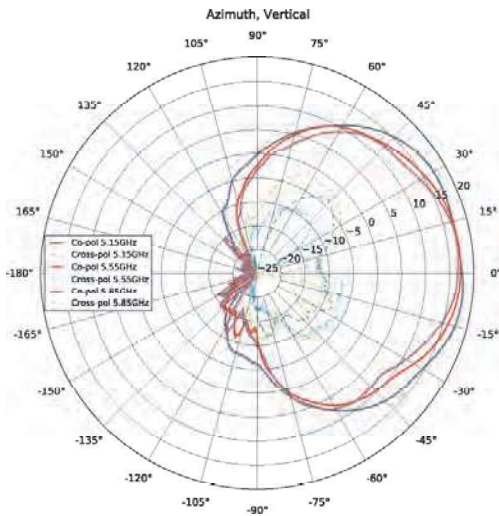


Channel 1 Vertical Polarization Elevation

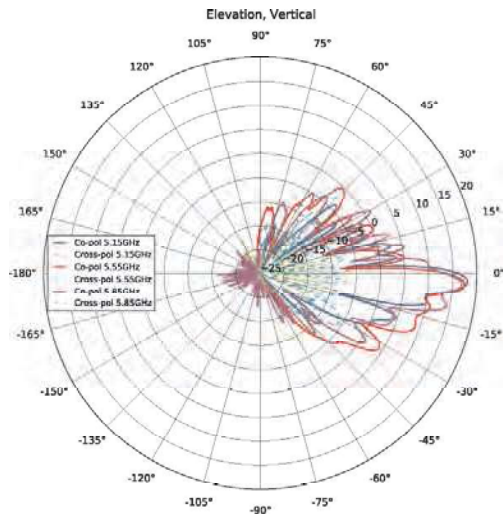


ANTENNA PATTERNS

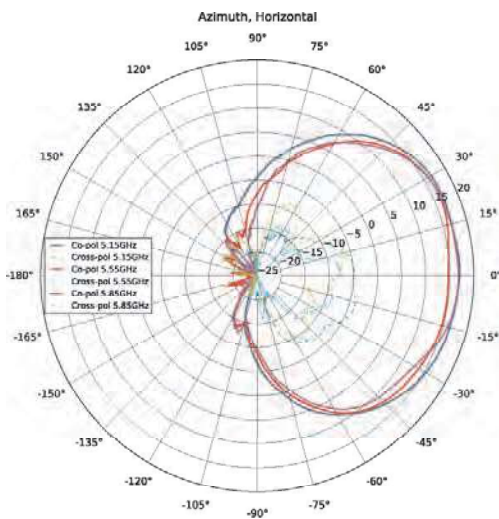
Channel 2 Vertical Polarization Azimuth



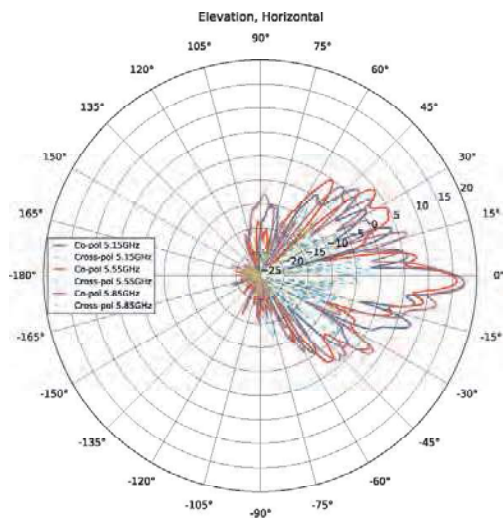
Channel 2 Vertical Polarization Elevation



Channel 3 Vertical Polarization Azimuth



Channel 3 Vertical Polarization Elevation





5.25 - 5.85 GHz High Performance Dual Pole Parabolic Reflector Antenna

High Performance Dual Pole Parabolic Reflector Antennas from Cambium Networks are well-suited for deployment with any of the sub-6 GHz PTP products. They are engineered to provide ETSI class 2/3 radiation pattern performance as well as excellent gain. Field-proven preassembled antennas and robust pole mounts ensure “set and forget” installation with minimal post installation maintenance. The included radome ensures robust and reliable performance under the most challenging conditions.

FEATURES AND BENEFITS:

- High Performance ETSI Class 2/3* Parabolic Antennas – Excellent performance for a wide range of applications
- Fully Preassembled at the Factory – Simplifies installation on site and guarantees “factory tested” quality
- Industry leading 7year warranty
- Suitable for deployment with PTP 650, PTP 670, PTP 700 and PTP 450i connectorized radios.
- Fully supported in LINKPlanner™ providing accurate predictions of PTP link performance and availability. LINKPlanner™ is available at no charge from the support website at cambiumnetworks.com.

**ETSI Class depends on frequency band*

SPECIFICATIONS

GENERAL

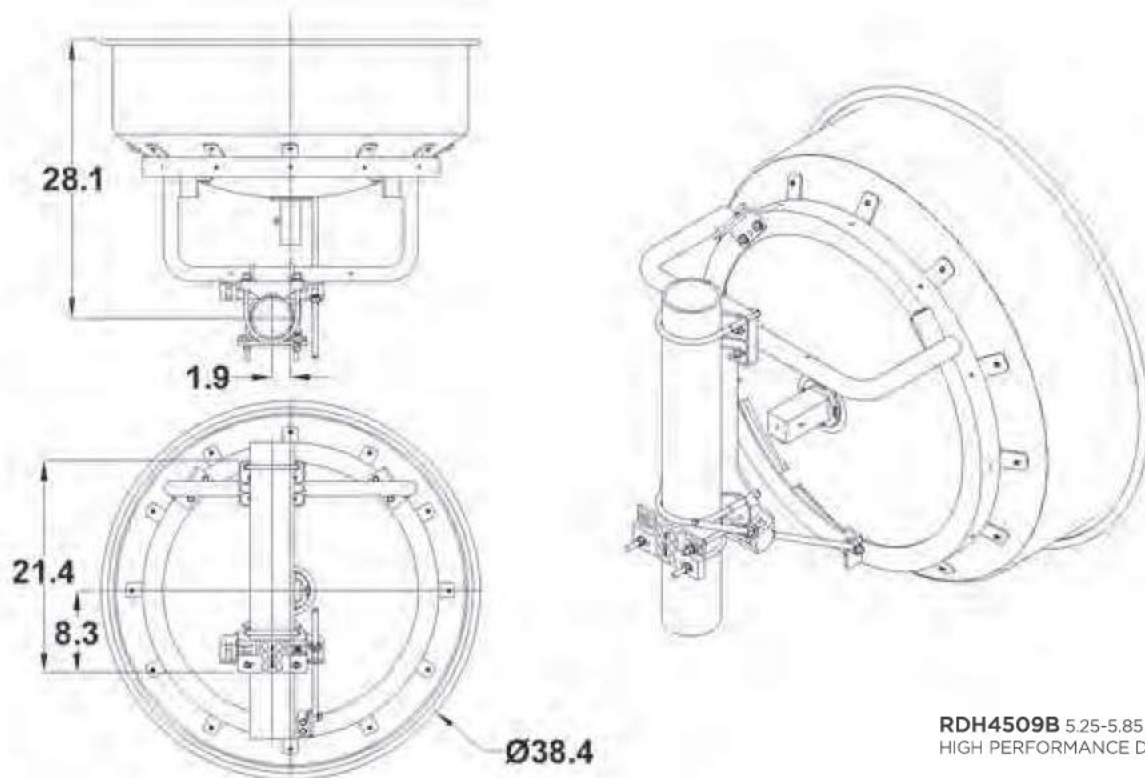
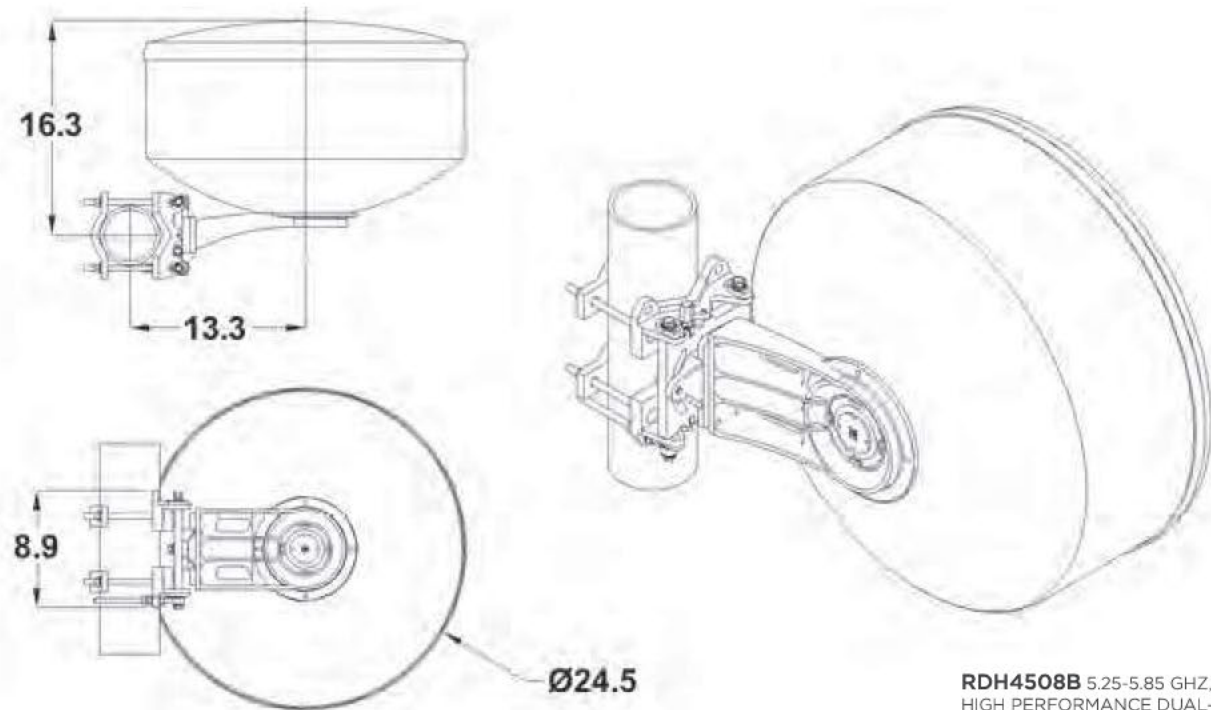
Antenna Type	High Performance Parabolic Reflector Antenna
Size, nominal	2 ft (0.6 m); 3 ft (0.9 m); 4 ft (1.2 m)
Polarization	Dual
Standard RF Connector Type	N-Female



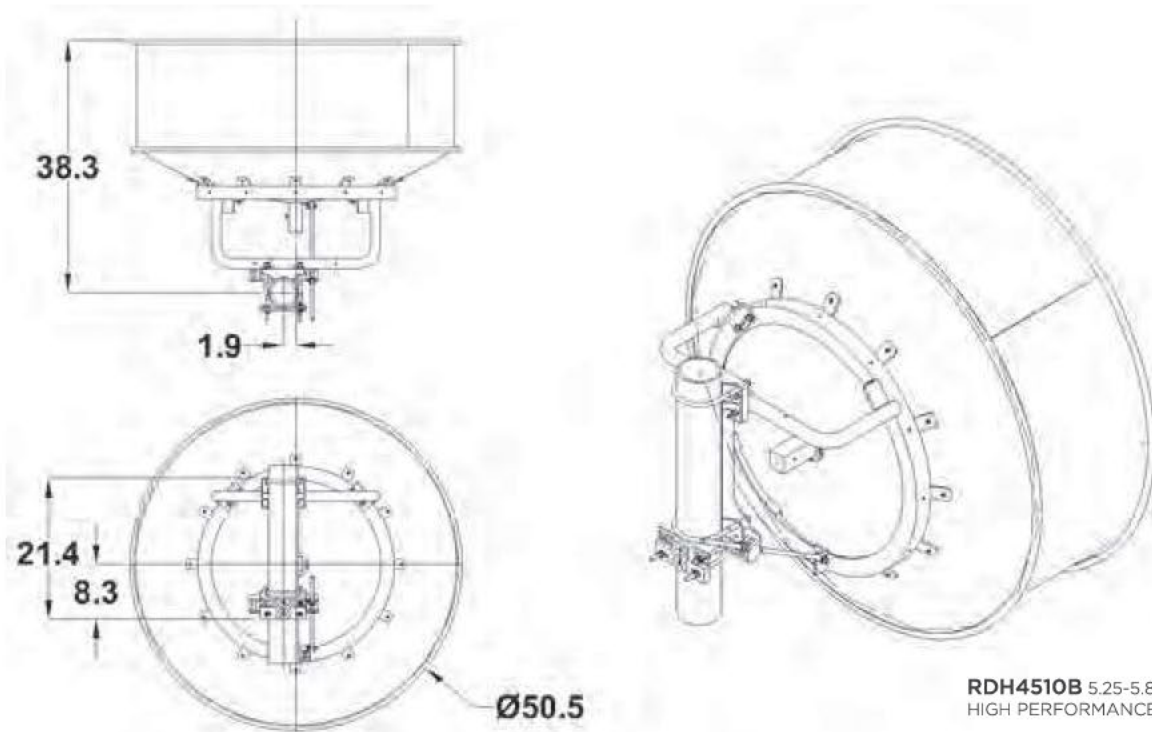
SPECIFICATIONS

ELECTRICAL	2 FT (0.6 M)	3 FT (0.9 M)	4 FT (1.2 M)
Model Number	RDH4508B	RDH4509B	RDH4510B
Description	5.25-5.85 GHZ, 2-FT (0.6M), HIGH PERFORMANCE DUAL-POL	5.25-5.85 GHZ, 3-FT (0.9M), HIGH PERFORMANCE DUAL-POL	5.25-5.85 GHZ, 4-FT (1.2M), HIGH PERFORMANCE DUAL-POL
Operating Frequency Band	5.25 - 5.85 GHz	5.25 - 5.85 GHz	5.25 - 5.85 GHz
Half Power Beamwidth, Horizontal	6.1 degrees	4.2 degrees	3 degrees
Half Power Beamwidth, Vertical	6.1 degrees	4.2 degrees	3 degrees
Cross-Polarization Discrimination	28 dB	30 dB	30 dB
Front to Back Ratio (F/B)	44 dB	46 dB	49 dB
Gain, Low Frequency	28.3 dB	31.8 dB	34.2 dBi
Gain, Mid Frequency	28.8 dB	32.3 dBi	34.7 dBi
Gain, High Frequency	29.3 dB	32.8 dBi	34.7 dBi
VSWR	1.5:1	1.5:1	1.5:1
Return Loss	-14 dB	-14 dB	-14 dB
MECHANICAL	2 FT (0.6 M)	3 FT (0.9 M)	4 FT (1.2 M)
Model Number	RDH4508B	RDH4509B	RDH4510B
Description	5.25-5.85 GHZ, 2-FT (0.6M), HIGH PERFORMANCE DUAL-POL	5.25-5.85 GHZ, 3-FT (0.9M), HIGH PERFORMANCE DUAL-POL	5.25-5.85 GHZ, 4-FT (1.2M), HIGH PERFORMANCE DUAL-POL
Fine Azimuth Adjustment	+/- 10 degrees	+/- 10 degrees	+/- 10 degrees
Fine Elevation Adjustment	+/- 30 degrees	+/- 25 degrees	+/- 25 degrees
Mounting Pipe Diameter, Min	2 inch 5.08 cm	4.5 inch 11.4 cm	4.5 inch 11.4 cm
Mounting Pipe Diameter, Max	4.5 inch 11.4 cm	4.5 inch 11.4 cm	4.5 inch 11.4 cm
Net Weight	27 lbs 12.3 kg	50 lbs 12.3 kg	85 lbs 38.3 kg
Wind Velocity Operational	90 mph 145 km/h	90 mph 145 km/h	90 mph 145 km/h
Wind Velocity Survival Rating	125 mph 201 km/h	125 mph 201 km/h	125 mph 201 km/h
Axial Force (FA)	202 lbs 899 N	403 lbs 1972 N	737 lbs 3278 N
Side Force (FS)	100 lbs 445 N	200 lbs 890 N	365 lbs 1623 N
Twisting Moment (MT)	194 ft-lbs 263 Nm	344 ft-lbs 466 Nm	784 ft-lbs 1063 Nm
Operating Temperature Range	-40 to +60 C	-40 to +60 C	-40 to +60 C
Max Pressure, PSIG, (if waveguide interface)	5	5	5
REGULATORY COMPLIANCE			
RoHS-compliant	Yes	Yes	Yes
SHIPPING INFORMATION	2 FT (0.6 M)	3 FT (0.9 M)	4 FT (1.2 M)
Model Number	RDH4508B	RDH4509B	RDH4510B
Description	5.25-5.85 GHZ, 2-FT (0.6M), HIGH PERFORMANCE DUAL-POL	5.25-5.85 GHZ, 3-FT (0.9M), HIGH PERFORMANCE DUAL-POL	5.25-5.85 GHZ, 4-FT (1.2M), HIGH PERFORMANCE DUAL-POL
Package Type	Cardboard	Wood Crate	Wood Crate
Gross Weight	48 lbs 28.7 kg	143 lbs 69.8 kg	196 lbs 88.9 kg
Dimensions, L x W x H	31 x 31 x 25in 79 x 79 x 64 cm	47 x 28 x 48in 119 x 71 x 122 cm	59 x 35 x 60in 180 x 89 x 152 cm
Shipping Volume	13.9 cu ft 0.39 cu m	36.56 cu ft 1.04 cu m	71.7 cu ft 2.03 cu m

TECHNICAL DRAWINGS



TECHNICAL DRAWINGS



RDH4510B 5.25-5.85 GHZ, 4-FT (1.2M),
HIGH PERFORMANCE DUAL-POL

TECHNICAL SPECIFICATIONS

	PTP 820S	PTP 820C + PTP 820C HP	PTP 820G	PTP 820F	PTP 820E	PTP 850E
Supported frequency	6-38 GHz	6-38 GHz	6-38 GHz	6-38 GHz, 10-46 GHz	7-46 GHz, 10-46 GHz	7-46 GHz, 10-46 GHz
Use in the Network	Compact all outdoor multi-carrier	Compact all outdoor w/ multi-carrier	Sub-mount or all-indoor, multi-carrier options	Sub-mount or all-indoor, multi-carrier options	Sub-mount or all-indoor, multi-carrier options	Sub-mount or all-indoor, multi-carrier options
Transport Technology	All packet	All packet	Hybrid and/or all packet	Hybrid and/or all packet	All packet	All packet
DMA Interface	None	None	IS-63T1	IS-63T1	None	None
Modulation	QPSK to 2048 QAM w/ACM	QPSK to 2048 QAM w/ACM	QPSK to 2048 QAM w/ACM	QPSK to 4096 QAM w/ACM	QPSK to 1024 QAM w/ACM	QPSK to 32 QAM w/ACM
Channel Size	3.5 to 80 MHz	3.5 to 80 MHz	3.5 to 60 MHz	3.5 to 60 MHz	62.5-500 MHz	250 MHz to 2 GHz
Capacity (Layer 2)	679 Mbps	1.26 Gbps	S27 Mbps, 125 Gbps	542 Mbps, 126 Gbps	24 Gbps	10 Gbps
Capacity with Multi-Layer Compression	833 Mbps	1.67 Gbps	833 Mbps (1-1)	1.67 Gbps (1-1)	24 Gbps (1-1)	10 Gbps (1-1)
Configuration	1x0, 1x1 HSB, 2x0	1x0, 1x1 HSB, 2x0 EFW, 2x0 VPC, 2x0 H-Mode	1x0, 1x1 HSB, 2x0 EFW, 2x0 VPC, 2x0 H-Mode	1x0, 1x1 HSB, 2x0 EFW, 2x0 VPC, 2x0 H-Mode	1x0, 2x0	1x0, 2x0 (H-Mode)
LOS MIMO	No	Yes, 4x4 or 2x2	No	No	No	No
MIMO	No	Yes	Yes	Yes	No	Yes
Ethernet Interface	1 x 10/100/1000Base-T and 2x 1000Base-T or 10/100/1000Base-T	1 x 10/100/1000Base-T and 2x 1000Base-T or 10/100/1000Base-T	4 x 10/100/1000Base-T and 2x 1000Base-T	4x1 Gbe (B-L45/SFP) to 2.5 Gbps SFP	1x10/100/1000Base-T PoE	1x10/100/1000Base-T PoE
Management Interface	1 x 10/100 Base-T	1 x 10/100 Base-T	1 x 10/100 Base-T	1 x 10/100 Base-T	1x10/100/1000Base-T for management	1x10/100/1000Base-T for management
External Alarm	None	None	1x0-28V	1x0-28V	None	None
Dimensions (HxWxD-mm)	230 x 235 x 98	PTP 820C: 230x235x98 PTP 820C HP: 315x284x107	10U 444x206x80 10U 444x206x80 10U 444x206x80	10U 444x206x80 10U 444x206x80 10U 444x206x80	220x190x75 43.48" integrated antenna: 285x285x107 43.48" integrated antenna: 341x270x103	322x227x86 43.48" integrated antenna: 341x270x103
Environmental	-35°C to +55°C (+45°C to +60°C extended)	-35°C to +55°C (+45°C to +60°C extended)	-35°C to +55°C (+45°C to +60°C extended)	-35°C to +55°C (+45°C to +60°C extended)	-35°C to +55°C (+45°C to +60°C extended)	-35°C to +55°C (+45°C to +60°C extended)
Power Input	-48 VDC	-48 VDC	-48 VDC	-48 VDC	-48 VDC	-48 VDC
Power Output	-48 VDC or +24 VDC	-48 VDC or +24 VDC	-48 VDC	-48 VDC	-48 VDC or +24 VDC	-48 VDC or +24 VDC
Maximum Power Consumption	641 GHz: 40W 1x48 GHz: 50W	Multi-Carrier Operation: PTP 820C: 6 GHz: 65W 7 GHz: 70W 11 GHz: 80W, 1x45 GHz: 80W 15 GHz: 80W 20 GHz: 80W 25 GHz: 80W 30 GHz: 80W 35 GHz: 80W 40 GHz: 80W 45 GHz: 80W 50 GHz: 80W 55 GHz: 80W 60 GHz: 80W 65 GHz: 80W 70 GHz: 80W 75 GHz: 80W 80 GHz: 80W 85 GHz: 80W 90 GHz: 80W 95 GHz: 80W 100 GHz: 80W 105 GHz: 80W 110 GHz: 80W 115 GHz: 80W 120 GHz: 80W 125 GHz: 80W 130 GHz: 80W 135 GHz: 80W 140 GHz: 80W 145 GHz: 80W 150 GHz: 80W 155 GHz: 80W 160 GHz: 80W 165 GHz: 80W 170 GHz: 80W 175 GHz: 80W 180 GHz: 80W 185 GHz: 80W 190 GHz: 80W 195 GHz: 80W 200 GHz: 80W 205 GHz: 80W 210 GHz: 80W 215 GHz: 80W 220 GHz: 80W 225 GHz: 80W 230 GHz: 80W 235 GHz: 80W 240 GHz: 80W 245 GHz: 80W 250 GHz: 80W 255 GHz: 80W 260 GHz: 80W 265 GHz: 80W 270 GHz: 80W 275 GHz: 80W 280 GHz: 80W 285 GHz: 80W 290 GHz: 80W 295 GHz: 80W 300 GHz: 80W 305 GHz: 80W 310 GHz: 80W 315 GHz: 80W 320 GHz: 80W 325 GHz: 80W 330 GHz: 80W 335 GHz: 80W 340 GHz: 80W 345 GHz: 80W 350 GHz: 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80W 740 GHz: 80W 745 GHz: 80W 750 GHz: 80W 755 GHz: 80W 760 GHz: 80W 765 GHz: 80W 770 GHz: 80W 775 GHz: 80W 780 GHz: 80W 785 GHz: 80W 790 GHz: 80W 795 GHz: 80W 800 GHz: 80W 805 GHz: 80W 810 GHz: 80W 815 GHz: 80W 820 GHz: 80W 825 GHz: 80W 830 GHz: 80W 835 GHz: 80W 840 GHz: 80W 845 GHz: 80W 850 GHz: 80W 855 GHz: 80W 860 GHz: 80W 865 GHz: 80W 870 GHz: 80W 875 GHz: 80W 880 GHz: 80W 885 GHz: 80W 890 GHz: 80W 895 GHz: 80W 900 GHz: 80W 905 GHz: 80W 910 GHz: 80W 915 GHz: 80W 920 GHz: 80W 925 GHz: 80W 930 GHz: 80W 935 GHz: 80W 940 GHz: 80W 945 GHz: 80W 950 GHz: 80W 955 GHz: 80W 960 GHz: 80W 965 GHz: 80W 970 GHz: 80W 975 GHz: 80W 980 GHz: 80W 985 GHz: 80W 990 GHz: 80W 995 GHz: 80W 1000 GHz: 80W	Multi-Carrier Operation: PTP 820C: 6 GHz: 65W 7 GHz: 70W 11 GHz: 80W, 1x45 GHz: 80W 15 GHz: 80W 20 GHz: 80W 25 GHz: 80W 30 GHz: 80W 35 GHz: 80W 40 GHz: 80W 45 GHz: 80W 50 GHz: 80W 55 GHz: 80W 60 GHz: 80W 65 GHz: 80W 70 GHz: 80W 75 GHz: 80W 80 GHz: 80W 85 GHz: 80W 90 GHz: 80W 95 GHz: 80W 100 GHz: 80W 105 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PTP 820/850

LICENSED ETHERNET MICROWAVE FOR MULTI-SERVICE NETWORKS

Cambium PTP 820/850



A single platform serving all radio transport requirements.

PTP 820/850 is a point-to-point licensed microwave backhaul platform that integrates leading networking functionality with the industry's most advanced microwave technologies, creating a superior microwave transport solution.

Supporting licensed frequency bands ranging from 6 to 86 GHz, the PTP 820/850 series delivers a wide range of configurations to offer a tailored solution for any deployment scenario.

Composed of high-density multi-technology nodes and integrated radio units, the PTP 820/850 series offers flexibility in choosing all-indoor, split-mount, and all-outdoor configuration options. Exploiting unique Line of Sight (LOS) Multiple Input Multiple Output (MIMO) technology, modulation up to 4096 QAM and wider channel bandwidths ensures industry-leading throughput and spectral efficiency.

The PTP 820E/850E operate in E-Band radio providing throughput up to 20Gbps, this eliminates the need for future forklift upgrades, or major system overhaul by the network operator to deliver multi-gigabit-plus capacity.

PTP 820/850 also offers both Synchronous Ethernet (SyncE) and IEEEv2 synchronization protocols required for large ISP and MPLS networks.

Operations, Administration and Maintenance (OA&M) tools coupled with a full suite of network and element management systems (NMS and EMS) simplify network provisioning and monitoring, reducing operators' total cost of ownership and enabling them to meet the most stringent service level agreements.

Combining technologies, equipment and services, PTP 820/850 enables network operators to meet accelerating demand for capacity cost-effectively under rapidly evolving conditions.

PTP 820/850 Product Series Highlights

- Licensed frequency bands 6-86 GHz
- Up to 4096 QAM, with 12-step hitless and errorless Adaptive Coding & Modulation (ACM) for high reliability
- Up to 20 Gbps bandwidth supported
- Multi-gigabit radio capacity with high spectral efficiency
- TDM and/or packet supporting legacy services and evolution to all-packet
- Integrated Ethernet Switch, MEF Carrier Ethernet 2.0 compliant, MPLS-TP-ready
- Header de-duplication for additional capacity boost
- Intelligent service-centric management utilizing QoS and advanced OA&M capabilities
- Carrier-grade service resiliency (G.8032, MSTP)
- ITU-T Y.1731 Performance Management – MEF 35
- Integrated synchronization solution: Native/SyncE/IEEE 1588v2
- Lowest power consumption with adaptive green mode
- Low latency with unique frame cut through for latency sensitive services
- Industry-leading system gain

NOTES: The highlight feature may not apply to all PTP 820/850 platform.



PUBLIC SAFETY



ENTERPRISE



WIRELESS CARRIER



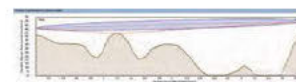
WIRELESS INTERNET
SERVICE PROVIDER

LINKPlanner

LINKPlanner is a free, easy-to-use link design tool that allows network operators to easily and quickly design networks. Microsoft® Windows® and Intel®-based Mac® versions of LINKPlanner can be downloaded from Cambium Networks' support pages.

Key LINKPlanner features:

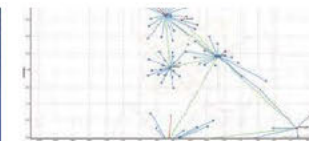
- Design a five-nines-reliable wireless link
- Plan and optimize a single link or multiple links simultaneously
- Perform calculations for both licensed and unlicensed products
- Automatically load path terrain profiles and environmental factors such as rain fade
- Display a comprehensive overview of your entire point-to-point wireless network via Google™ Earth
- Generate reports that validate projected performance and serve as time-saving deployment guidelines
- Create bills of material for point-to-multipoint and point-to-point networks including accessories



PATH PROFILE WITH OBSTRUCTIONS



GOOGLE EARTH NETWORK VIEW



MAP OF THE SITES AND LINKS
IN THE PROJECT

About Cambium Networks

Cambium Networks is a leading global provider of wireless connectivity solutions that strengthen connections between people, places and things. Specializing in providing an end-to-end wireless fabric of reliable, scalable, secure, cloud-managed platforms that perform under demanding conditions, Cambium Networks empowers service providers and enterprise, industrial and government network operators to build intelligent edge connectivity. Cambium Networks' commitment to continuous innovation in wireless access is demonstrated in the millions of radios deployed in thousands of networks that benefit communities around the world. Team members also contribute to social responsibility activities to serve the communities in which they live. Headquartered outside Chicago and with R&D centers in the U.S., U.K. and India, Cambium Networks sells through a range of trusted global distributors.

www.cambiumnetworks.com

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