MOBILECORP

5G DESKTOP SITE SURVEY
FOR
[ADD COMPANY NAME HERE]

Business Name:

Add company name

Document Reference

#

Site Address:

Add address

Survey Date:

Add date

Contact:

Jason Blayney

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0459 123 456

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Desktop Survey Summary

Carrier(s)	
Survey Type	5G
Site Address	
Site GPS Coordinates	
Project Description	Feasibility study of Voice & Data Services

Contents

1. Installation Recommendations

The Telstra service is available but may be poor indoor. To improve and optimise the indoor service at the site, the outdoor donor antenna for the signal repeater or modem should be installed correctly as shown in the table below.

	Primary Recommendation	Secondary Recommendation
Antenna location	-28.873111, 153.588056	-28.873111, 153.588056
Elevation	6 m	6 m
Target Base Station	Suvla Street BALLINA	BALLINA Telstra Exchange
Available Service	3G/4G	3G/4G
Minimal Height of Antenna	5 m	5 m
Azimuth of Antenna (^{0} TN)	4	272
Uptilt		
Predicted Received Signal	Moderate	Moderate
Service Availability	High	High

NOTE:
It is recommended to follow the Primary Recommendation unless the received service based on the Primary Recommendation is not suitable.

2. Equipment Recommendations

According to the required service, the corresponding equipment recommendations are shown in Table 1 and Table 2. The mast may vary if there is no roof available for the mast. It is advisedto confirm with us before purchasing the equipment.

Table 1 Equipment for Mobile Phone Service

Equipment	Qty	Link
Repeater Kit	1x	Telstra Repeater Kit for Hilly Areas – Indoor Coverage
Surge Arrester (Optional)	1x	Phaseblocker N Male to Female Lightning Arrester - up to 6GHz

Table 2 Equipment for Wireless Broadband Service

Equipment	Qty	Link
Antenna	1x	Telco XPOL MIMO Panel Antenna - 3G, 4G & 5G - 700-3800MHz
Surge Arrester (Optional)	2x	Phaseblocker N Male to Female Lightning Arrester - up to 6GHz
Cable	2x	LCU400 15m Coaxial Cable - N Male to SMA Male (shorter/longeravailable)
Patch Lead	2x	SMA Male to SMA Female Patch Lead - 15cm Cable

Table 3 Mast for Antennas

Equipment	Qty	Link
Mast	1x	Heavy Duty Galvanised Tin Roof Mount 50mm - Various Lengths

Table 4 Equipment for Wireless Broadband Router(If required)

Equipment	Qty	Link
Indoor Optional	1x	Teltonika RUT950 Industrial 3G+4G+4GX Modem Router
Outdoor Optional	1x	Telco T1 3G/4G/4GX/4G+ LTE Advanced Modem Router with Wifi
High Performance Router	1x	Teltonika LTE-A Cat6 Cellular IoT Router - RUTX09

Table 5 Optional Equipment for Increased Surge Protection

Equipment	Qty	Link
Cable Entry Surge Arrester	1x	Phaseblocker SMA Male to Female Surge Arrester - up to 6GHz
Cable Entry Fly Lead	1x	LCU195 1.5m Coaxial Cable - SMA Female to SMA Male
Ground Rod Kit	1x	Grounding Rod Kit - 1.4m

Note: the number of the cable entry surge arrests and fly leads is equal to the number of the tower-top surge arrester.

Table 6 Optional Equipment for the Installation

Equipment	Qty	Link
Wall plate for modem	1x	Dual SMA Wall Plate
Wall plate for Repeater	1x	SMA Wall Plate Kit
Fly Lead	1x	LCU195 1.5m Coaxial Cable - SMA Female to SMA Male
Conduit	1x	Conduit - 25mm Flexible Corrugated Conduit - 50m Roll

Note: the number of the Fly Lead is equal to the number of the connectors on the wall plate

3. Survey Results and Discussion

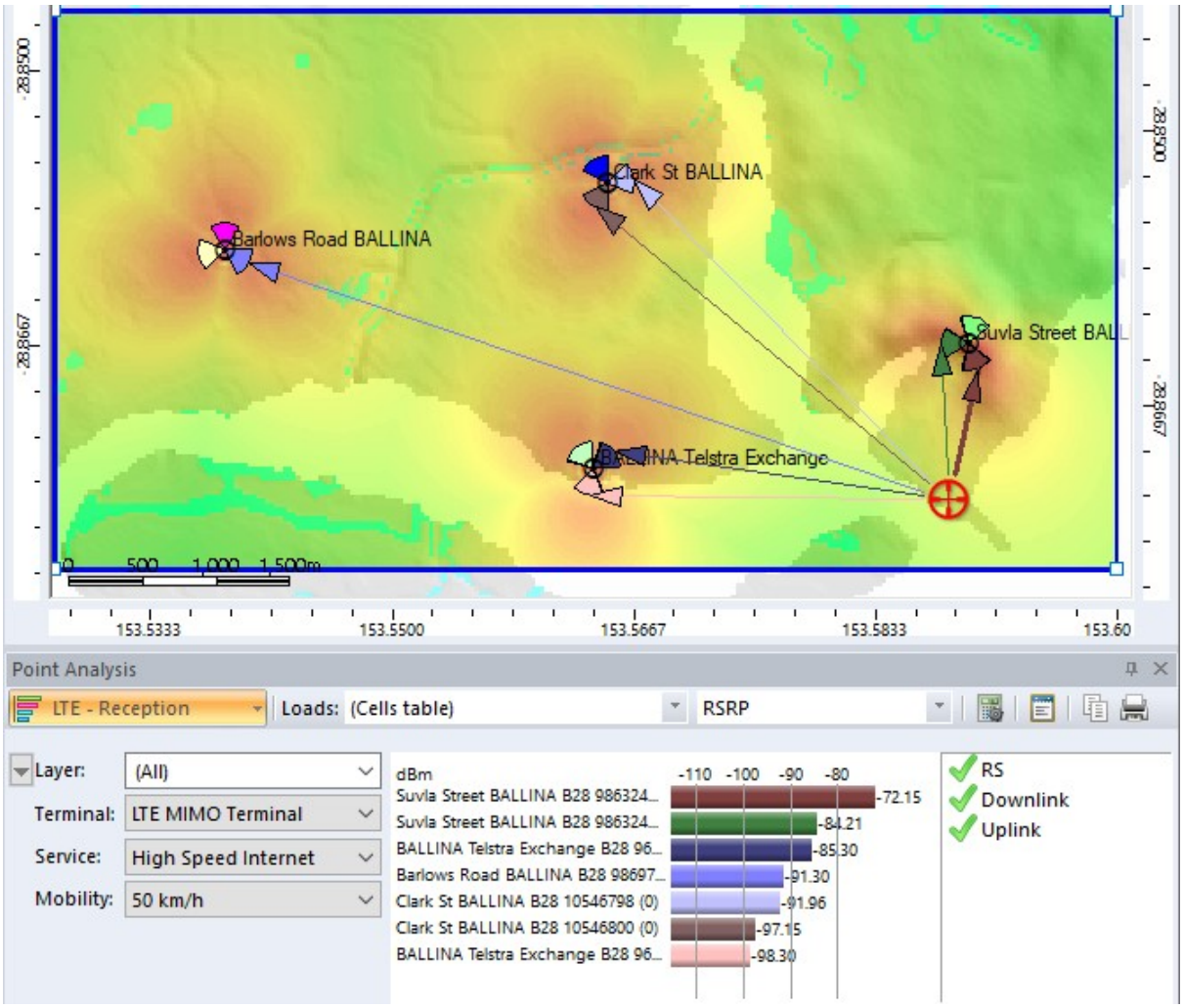
3.1 Location of Towers

This image shows the location of *Telstra base stations* around the site which provide *700MHzLTE service*.

The site is located in a *rural area*, and there are *several* basestations within 5 *km* of the site.

There should be several available signalsfor the site, however potential issues could include weak coverage due to line-of-sight barriers such as hills and trees; as well as poor data service caused by PCI confliction and congestion.

3.2 Signal Strength Prediction

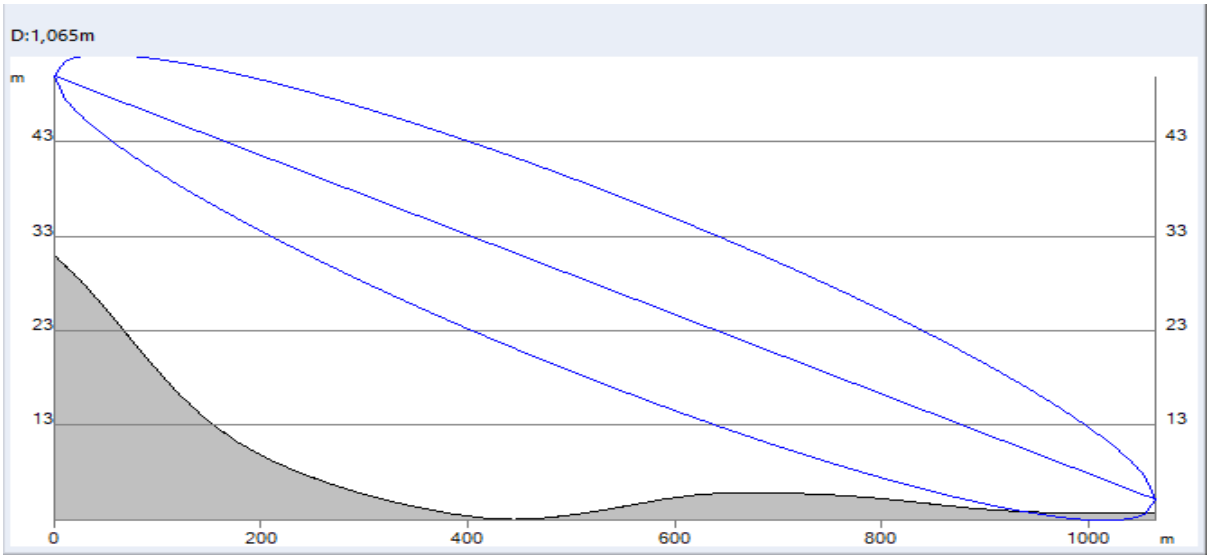


Based on the base station information from ACMA and SRTM geographic data, the image above shows the simulated heatmap of *Telstra 700MHz* signal coverage.

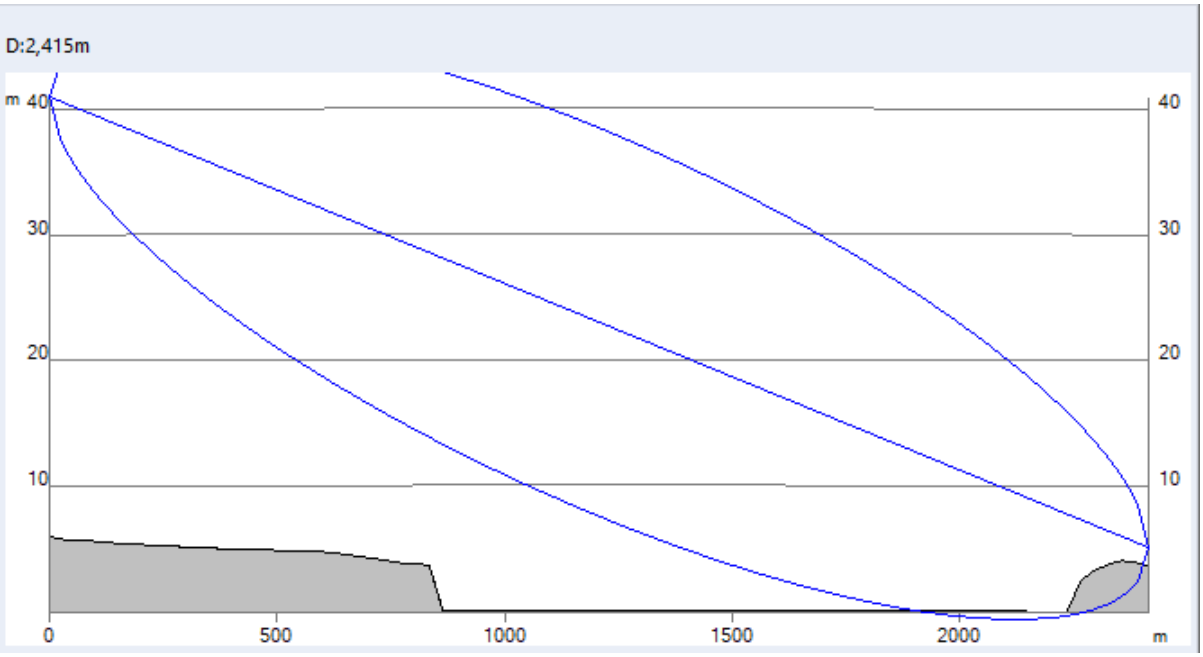
As can be seen from this image, the most suitable signal outdoor is from *Suvla Street BALLINA*, around *-72.15 dBm*. The signal strength is moderate. It should be the best option for the site, and requires *a moderate-gain receiving antenna*.

Excluding that base station, the second suitable signal is from *BALLINA Telstra Exchange*. The corresponding outdoor signal strength is predicted as -85.3 *dBm* which is regarded as moderate. Also, the LOS from the station to the site is still acceptable. This station is acceptable as an alternate.

3.3 Terrain Profile

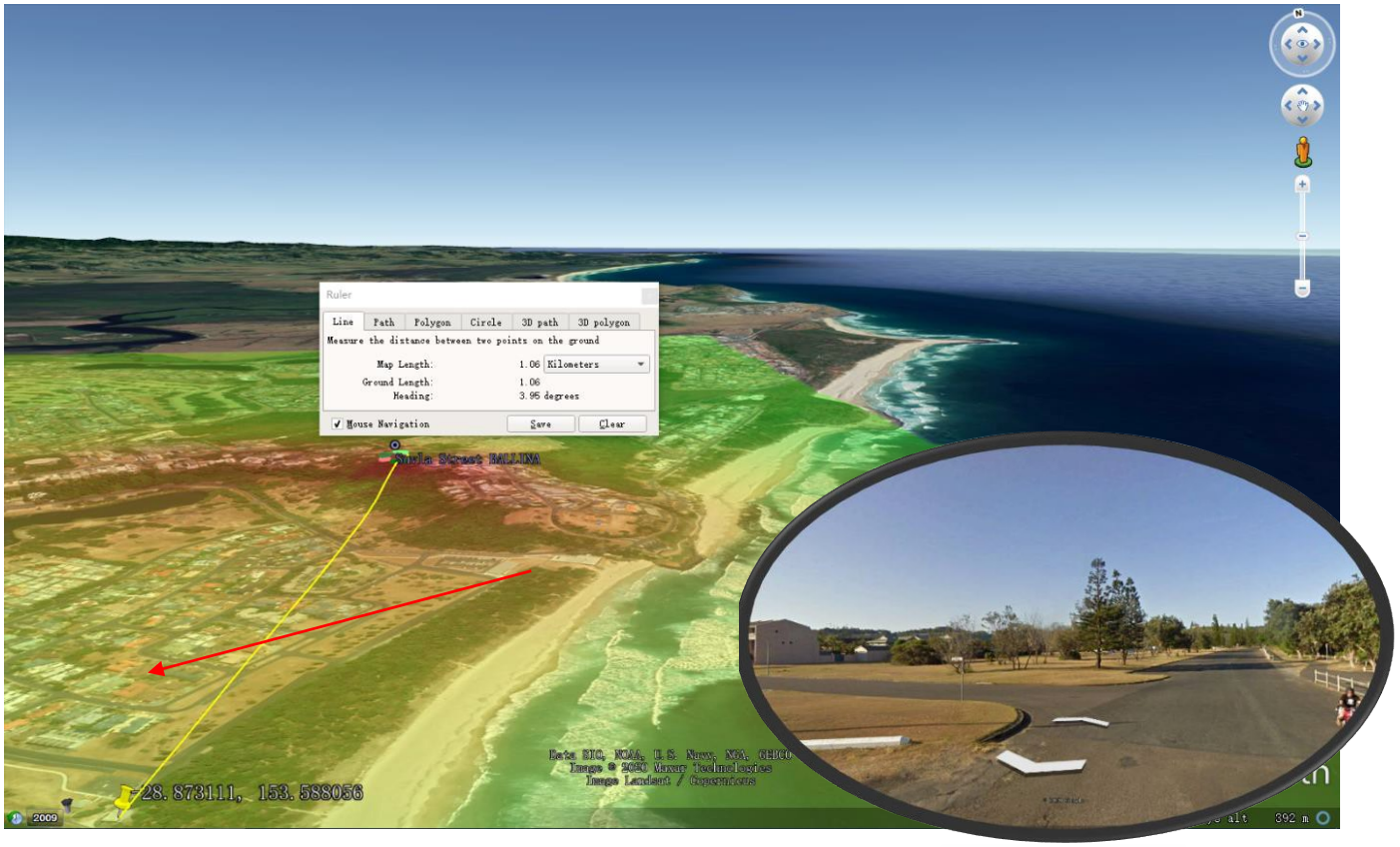


The image above shows the terrain profile from *Suvla Street BALLINA* to the site based on the SRTM digital elevation model. The distance between the two poits is *almost 1.06 km,* and *both* LOS and First Fresnel Zone are nearly clear. Therefore, service reliability from it should be *high*.

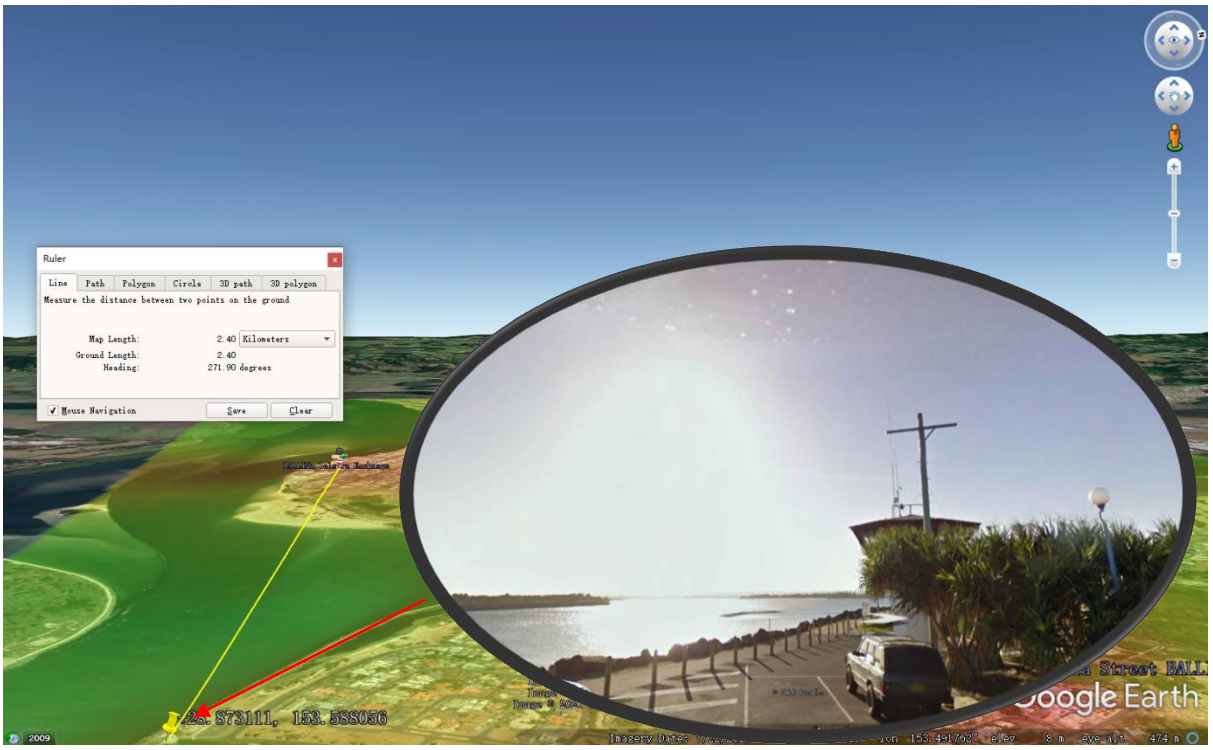


The image above shows the terrain profile from *BALLINA Telstra Exchange* to the site based on the SRTM digital elevation model. The distance between the two points is *nearly 2.4 km,*and *both* LOS and First Fresnel Zone are *nearly clear.* Therefore, service reliability from it should be *high*.

3.4 Land Cover



As can be seen from the image above, there are various buildings and trees between *Suvla Street BALLINA* and the site. As a result, there may be *a small variance* in the actual received signal strength from the estimated signal strength.



As can be seen from the image above, there are various buildings and trees between *BALLINA Telstra Exchange* and the site. As a result, they may be *a small variance* in the actual received signal strength from the estimated signal strength..

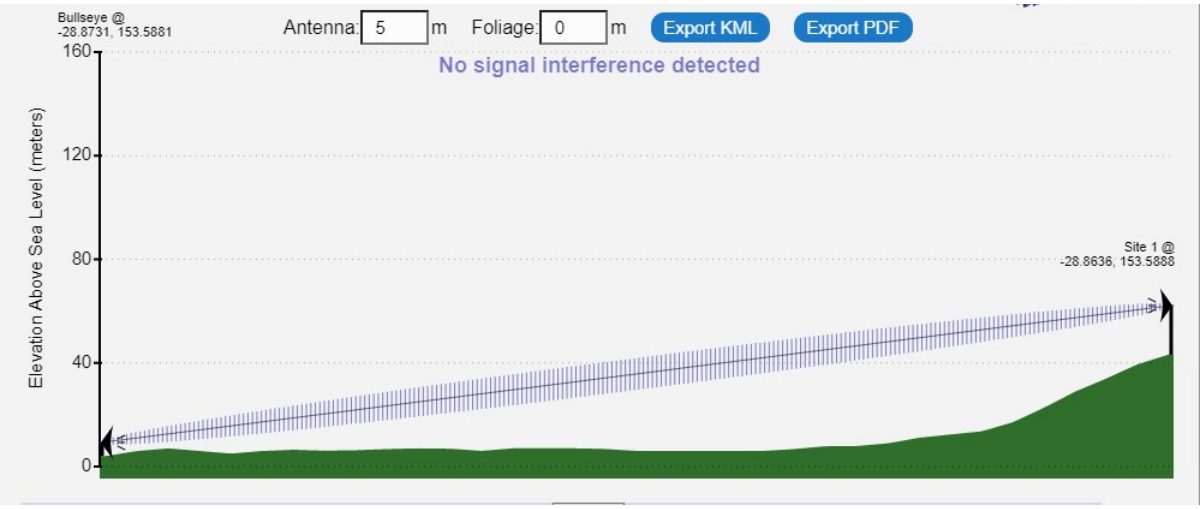
3.5 Base Station Information

Name	Suvla Street BALLINA	BALLINA Telstra Exchange
Coordinates	-28.8636, 153.5888	-28.8724, 153.5634
Tower Height	19 m	35 m
Distance to the Tower	1.06 km	2.4 km
Azimuth to the tower from Site(True North)	4	272
700MHZ (Band 28) 4G service installed	✔	✔
850MHz (Band 5) 4G service installed	✘	✘
900MHz (Band 8)4G service installed	✘	✘
1800MHZ (Band 3) 4G service installed	✔	✔
2100MHz (Band 1) 4G service installed	✔	✔
2300MHz (Band 40) 4G service installed	✘	✘
2600MHz (Band 7) 4G service installed	✘	✘
5G	✔	✔

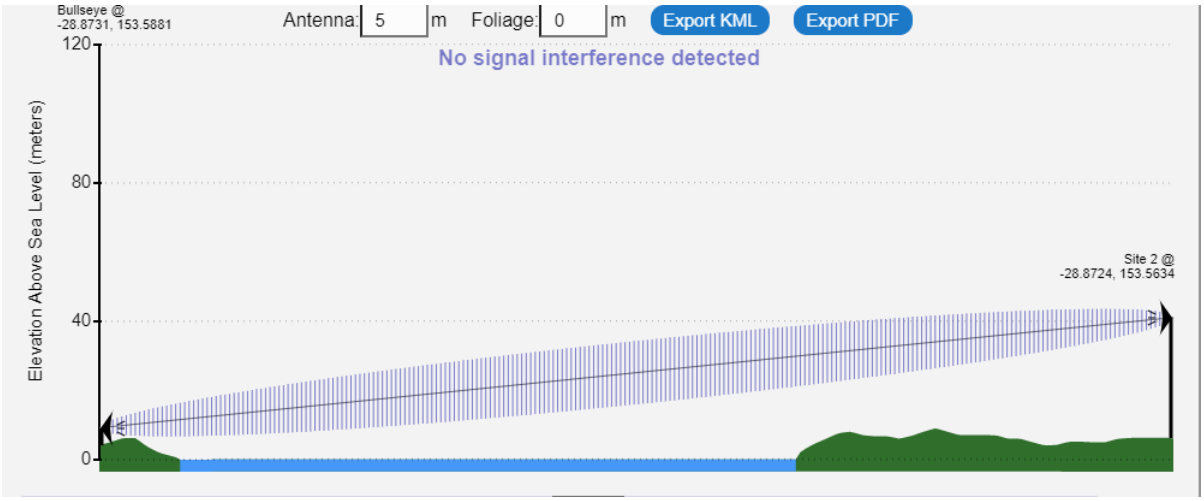
Note: the base station with multiple LTE services could provide a faster data speed and bigger capacity.

3.6 Antenna Height simulations

As a rule of thumb, when the base station is in service range, a clear LOS will guarantee a stable and available service, and a clear First Fresnel Zone (60% clear at least) is necessary to optimise the reception.



Assuming there is no non-terrain obstruction, and the predicted signal strength is close to the reality from station at *Suvla Street BALLINA,* the receiving antenna is recommended to be raisedto 5 m AGL in this setup to achieve *a clearer First Fresnel Zone*, and *then a better* connectioncan be attained.



Assuming there is no non-terrain obstruction, and the predicted signal strength is close to the reality from the station at *BALLINA Telstra Exchange*, the receiving antenna is recommended to be raised to 5 m AGL in this setup to achieve *a clearer First Fresnel Zone*, and then a *better* connection can be attained.

4. Conclusion

The desktop survey of the site at *add address,* finds that outdoor 5G *700MHz* coverage from *Telstra* is *moderate*.

The best servicing base stations are *Suvla Street BALLINA* and *BALLINA Telstra Exchange*.

Indoor coverage is anticipated to be *worse* and an antenna *is recommended*.

To improve the indoor reception, it is recommended to raise an *8dBi antenna* for a modem router or an *8dBi antenna* for a signal repeater to higher 5*m* AGL for receiving signals.

5. Next Steps

To discuss your survey results or arrange for an installation quote contact:.

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Address: S6.06. L6. 247 Coward Street, Mascot NSW 2020

Contact: Jason Blayney

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Mobile: 0459 972 675

6. Declaration

MobileCorp has chosen the FCC & ITU standard Okumura-Hata propagation model and Atoll software implementation as the basis of path-loss calculations. Sub-parameters include;

- Diffraction Loss – Yes
- The limitation to Free Space Loss – Yes
- Environmental Formula - Rural Quasi, Suburban, or Medium-Small City

The broadcast position is assumed to be clear of immediate non-terrain obstructions including,but not limited to; trees, man-made structures, vehicles, and earthwork deposits. This permits the use of the Rural (open area) environmental variable and is the best match given the intention of transmitting into clear space.

All heights in this report are given AGL, and all azimuth angles are given in reference to TrueNorth.

All coordinates in this report are in WGS84 geodetic datum. Digital Elevation Model data used in calculations are SRTM Level-1(1-second (30m) accuracy) - this is above industry standard requirements. LIDAR data is available, however, is extremely expensive and is not economically justifiable for this limited study.

All the information of base stations and the information of the antennas excluding the patterns is provided by Australian Communications and Media Authority (ACMA). Some errors between the simulation and practice may occur due to the difference between ACMA and the real situation.

Glossary

Antenna Gain: In a transmitting antenna, the gain describes how well the antenna converts input power into radio waves headed in a specified direction. In this report, low gain means less than 4dBi, medium gain means 5-12dBi, and high-gain means more than 12dBi.

Atoll: is a comprehensive radio planning and optimization platform that supports wirelessoperators throughout the network lifecycle, from initial design to densification and optimization. Atoll combines engineering and automation functions that enable operators to smoothly and gradually implement automated processes within their organisation.

Azimuth: is defined as a horizontal angle measured clockwise from a north base line or meridian the reference plane for an azimuth is typically true north, measured as a 0° azimuth, though other angular units (grad, mil) can be used. Moving clockwise on a 360 degrees circle,the east has azimuth 90°, south 180°, and west 270°.

Beamwidth: in a radio antenna pattern, the half power beam width is the angle between the half-power (-3 dB) points of the main lobe, when referenced to the peak effective radiated power of the main lobe.

dB & dBm: dB power gain of the unit is that a relative value. A calculation of the power whencompared to the large or small number of B dB, according to the formula 10*lg A / B calculation. dBm is an absolute value of said power unit, is calculated as 10*lg power value / 1mW.

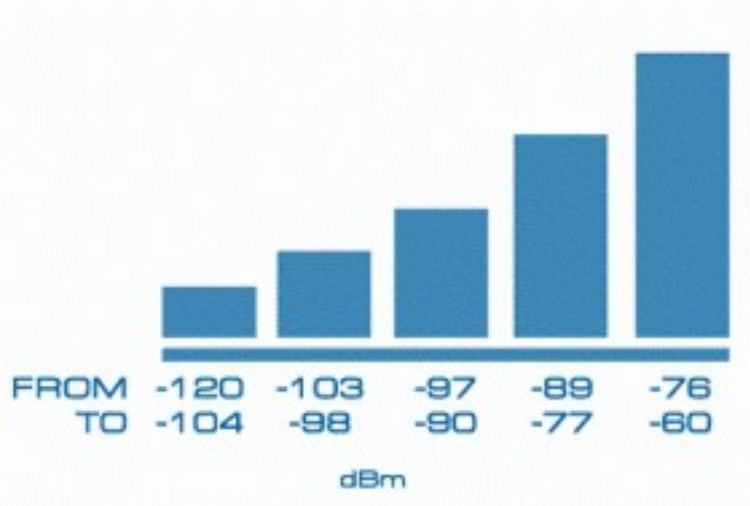
Fresnel Zone: the concept of Fresnel Zone clearance is used to analyse interference by obstacles near the path of a radio beam. Especially the First Fresnel Zone must be kept largelyfree from obstructions to avoid interfering with the radio reception.

Interference: is a phenomenon in which two waves superpose to form a resultant wave of greater, lower, or the same amplitude. In telecommunications, interference is anything which modifies or disrupts a signal as it travels along a channel between a source and a receiver. Common examples are Co-Channel Interference (CCI), Adjacent-Channel Interference (ACI), Inter-Symbol Interference (ISI), Inter-Carrier Interference (ICI), Common-Mode Interference (CMI). It may cause call drop, unavailable or bad internet services by cell overlap, and weak coverage.

Line-of-Sight (LOS): is a characteristic of electromagnetic radiation or acoustic wave propagation which means waves which travel in a direct path from the source to the receiver. The electromagnetic transmission includes light emissions travelling in a straight line. The raysor waves may be diffracted, refracted, reflected, or absorbed by the atmosphere and obstructions with material and generally cannot travel over the horizon or behind obstacles.

Path Loss: is the reduction in power density (attenuation) of an electromagnetic wave as it propagates through space. The Okumura-Hata Model is the most popular radio propagation model for predicting the path loss of cellular transmissions in exterior environments.

RSRP: is short for Reference Signal Received Power. In an LTE system, it is the average power of Resource Elements (RE) that carry cell-specific Reference Signals (RS) over the entire bandwidth. It is the main parameters of signal strength and its typical range is from about -75 dBm close into an LTE cell site to -120 dBm at the edge of LTE coverage. The picture below shows the general metrics of signal strength to bars on the phone.



Service Reliability: means how stable the service is in this report.

Signal Availability: means if the signal is available for normal devices with built-in antennas or small hinged antennas.

Appendix A

Installation Recommendation

The below are not specific to your particular site.

Antenna Alignment
When mounting a directional antenna, you will need to convert the provided true north azimuthto a magnetic north azimuth (or alternatively with a smartphone/digital compass set in true- north mode), or simply by rotating the antenna through that general direction until the signal isat its strongest. Be sure to shift the antenna 1-2 degrees at a time and pausing in between changes to allow your device's signal meter to update itself. When installing an antenna to improve data rates it's important to run a series of speed tests at www.speedtest.net.

Weatherproofing
All exposed coaxial connections (especially where the antenna joins to the cable) must be waterproofed by using coaxial sealant putty or electrical tape. Water in your connectors will decrease signal levels and cause dropouts. Coaxial cable is UV-resistant, however, for maximum lifespan, it's recommended any cable exposed to direct sunlight should be run in standards compliant telecommunications conduit.

Cabling & Connectors
On lower band networks such as Telstra Next-G and Telstra 3G 900MHz, low loss cabling likeLMR195 can be used up to a length of 10m. To minimize line attenuation cable runs exceeding10m should use LMR400 grade cable. 4G and higher band 3G networks (such as Telstra 2100MHz 3G) must use LMR400 grade cabling for lengths exceeding 5m. LMR400 has acceptable operating characteristics up to 50m on lower band networks and 30m on higher bands. For runs exceeding these distances, and for all feeder/riser cabling, higher grade cablingsuch as ½" LDF4-50A can be used out to 100m. Lengths exceeding 100m will require 7/8" LDF5-50A grade cables. N connectors are always preferred, but due to its large outer diameterFME or SMA connectors tend to be preferred to minimize installation impact.

Surge Protection

If installed in an exposed position inline coaxial surge protection should be installed where theantenna joins the cable. Most antennas rest at ground potential to minimize the impact of a surge, but lightning protection is always recommended. If cabling is run vertically for a lengthexceeding 5m (such as up a mast or tower) a surge protector is recommended to be installed atthe base of the coaxial feeder where the cabling enters the building to protect against parasiticcapacitive coupling from a nearby strike. Surge protectors can be grounded to any earthed metalsurface with low resistance earth wire (minimum Aust. Std. 2.5mm) or 25mm braided earth strap (preferred). Earth stakes are available for sites lacking a suitable grounding point. Pleasenote the following is listed as a guide only and may not be required.

Table 7 Components of Surge Arrester

Tower-top Surge Arrester	Link
Tower-top SurgeArrester	https://telcoantennas.com.au/site/phaseblocker-n-male-female- lightning-arrester-6ghz
Cable Entry SurgeArrester	https://telcoantennas.com.au/site/phaseblocker-n-female-lightning- arrester-6ghz
Grounding Rod Kit	https://telcoantennas.com.au/site/grounding-rod-kit
Sealant Tape	https://telcoantennas.com.au/site/coaxial-cable-sealant-tape- waterproof-uv-resistant

Appendix B

Legend of LTE Heatmap