

## 3G Yagi Antenna - Installation Instructions

### SAFETY

Telco Antennas advocates a Zero Harm approach to installation works. The telecommunications industry is particularly exposed to certain hazards including, but not limited to; live electrical plant and equipment, fall from heights, wildlife attack, operation of power tools, loose asbestos, etc.

Contractors installing equipment on behalf of Telco Antennas must conduct a Job Safety Analysis (JSA), Safe Work Method Statement (SWMS), and/or Take-5 risk assessment before beginning work. Specifically the following sections must be addressed:

- *Document the activity:* Assemble those involved in the activity and then, using the JSA worksheet, write down the tasks that make up the activity, step by step.
- *Identify the hazards:* Next to each task, identify what part of the task may cause injury to those doing the work or to anyone else nearby.
- *Document the control measures:* For each identified hazard, list the measures that need to be put in place to eliminate or minimise any likely risk of injury to those involved.
- *Identify who is responsible:* Document the name of the person responsible for implementing the control measure.
- *Monitor and review:* Make sure the activity is supervised to ensure the documented process is being followed.

#### *Mandatory Control Measures*

Contractors operating on behalf of Telco Antennas must wear a full complement of Personal Protective Equipment (PPE), including, but not limited to; protective eyewear, enclosed footwear, long pants, long sleeved shirt, and high visibility vest. Works undertaken in commercial and industrial sites may also require gloves, hearing protection, hard hat, and steel capped boots.

In compliance with Workplace Health & Safety requirements, any works conducted above 2 metres for commercial premises, or above 3 metres for residential premises must operate a fall arrest system, such as a PFAS. Contractors must hold valid and current Working Safely at Heights qualifications, and harnesses pass annual checks as required by legislation. When working from an Elevated Work Platform (EWP) contractors must also hold appropriate qualifications.

#### *Optional Control Measures*

Following Zero Harm methodologies, Telco advocates a minimum team size of two personnel at all times. A team size of two assists to minimise risk from hazards arising from simple activities such as visiting a site - hazards such as snake bites, dehydration, fatigue, heavy lifting, etc.

Teams conducting field activities should elect a First Aid Officer who should hold a current First Aid certificate. While not mandatory, it's highly recommended that all contractors operating on behalf of Telco Antennas hold First Aid certificates and complete CPR refresher courses annually.

## INSTALLATION

### WARNING - POWERLINES & LIGHTNING

Never conduct installation of antenna equipment during storm activity. There is no safe location outdoors during a storm event. If you can hear lightning you are in danger of being struck - most casualties arise immediately before and after a storm event when danger does not appear obvious.



Look up and live. Accessing a roof may put you in close proximity to live power lines. Antennas by their nature conduct electricity very well - you may be killed if the equipment comes in contact with power lines. Always think ahead and plan your task in advance.

### PRE-INSTALLATION INSTRUCTIONS

Upon unpacking your antenna please ensure all components described in product documentation are present and that there is no physical damage. Contact your supplier or Telco Antennas directly if equipment is missing/damaged.

Check that the supplied connector on your antenna mates with the connector on your coaxial cable or arrester.

Verify that the antenna's electrical and environmental operating specifications are suited to the environment and user equipment.

### INSTALLATION INSTRUCTIONS

In most situations a mobile antenna will benefit from being installed in an elevated position to minimise signal attenuation due to trees and nearby buildings, and to minimise the impact of terrain.

This antenna can be safely attached to a TV antenna or UHF radio mast if available. If a suitable mast is not available you will need to contact your supplier to arrange a mount that suits your intended application. The type of mast and mount will be determined by the required installation height and roof mounting surface (such as tile, Colorbond, Klip-Lok, etc). Please make note to find the highest and safest point on your roof, and install the mast in a vertical position by using the correct fasteners and tools, if unsure your nearest hardware store will be able to point you in the right direction.

Once the mast has been installed, mount your yagi antenna on the highest possible point on the mast.

Uncoil your roll of LMR400 (or other supplied cable) carefully to avoid "kinks" and "twists" which in turn will reduce cable loss and help you feed it smoothly into your wall space and or conduit. Connect the N-Male connector to the antenna (hand tighten only) and seal with self-amalgamating tape. Measure an appropriate length of 20-25mm telecommunications conduit from the desired roof entry point to the start of the antenna cable. Ideally leave a small bend in the conduit to serve as a drip-loop just above roof entry point to minimise potential water ingress.

Drill a hole in the roof to suit the FME end of the cable approx. 13mm wide or gain access through a tile by sliding the tile upwards mount as close as possible to the mounting pole to eliminate the need to run the cable across the roof, or run through an existing hole either where a TV antenna or satellite cable (if any) runs through. Ensure once finished, you either use a gland or silicon up the area to reduce the risk of water penetration. Once in the cavity of the roof, feed one end in until all exposed cable is inside the roof cavity. If using LMR-400 cable it is important not to bend the cable tighter than 60mm radius as this may increase cable loss and/or VSWR.

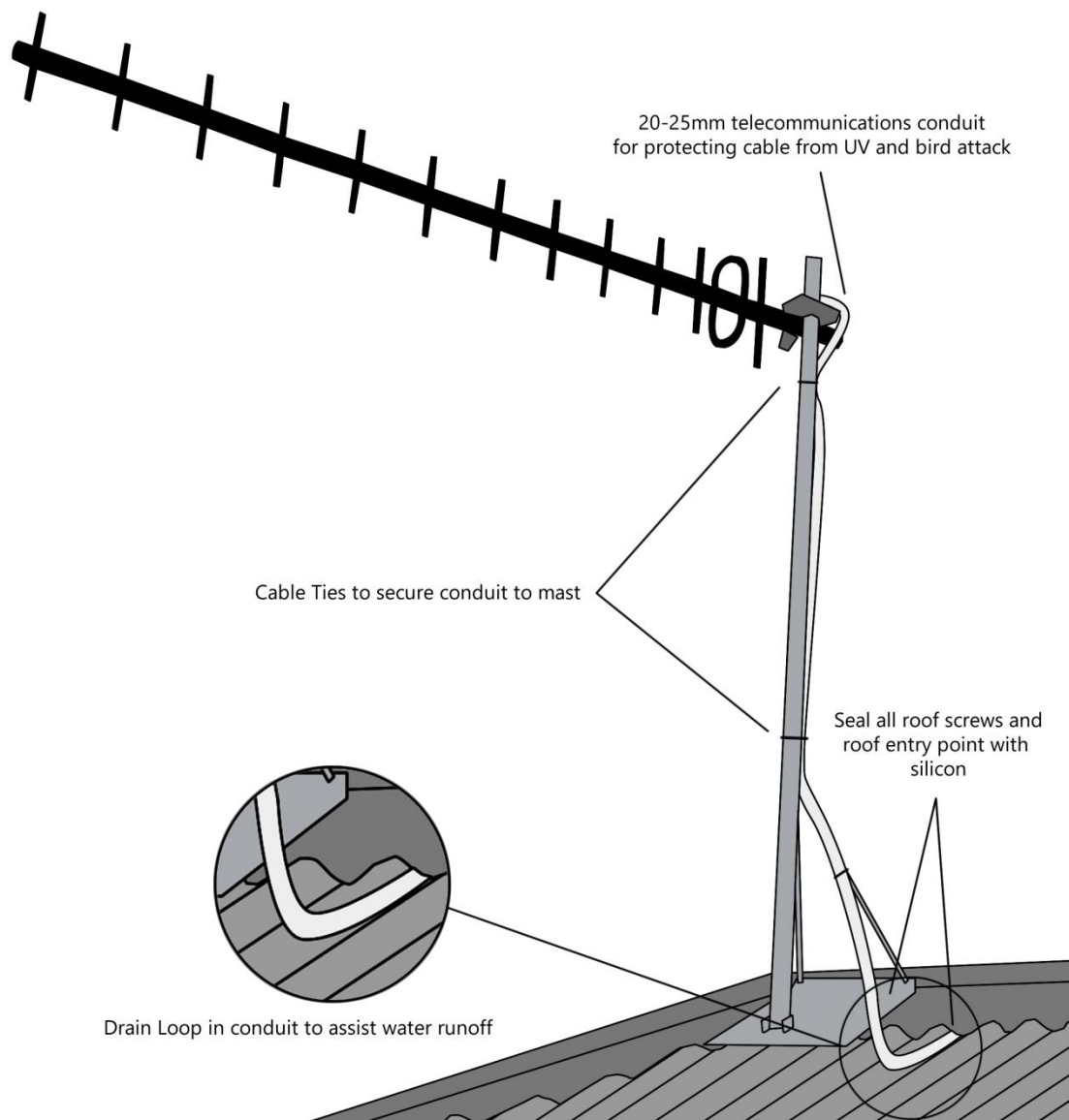
Find an area inside the building where you want the cable to exit, either wall mount or conduit. Once you have your cable terminated, with your existing cable in the roof cavity try and limit the amount touching each other or coiled up by running the cable back and forth across the roof space.

If installing antenna on a demountable structure (or 'donga'), run conduit vertically down external of structure and back up through floor.

Now that you have everything in place you may close up your roof access and perform additional weatherproofing if required.

#### POST-INSTALLATION INSTRUCTIONS

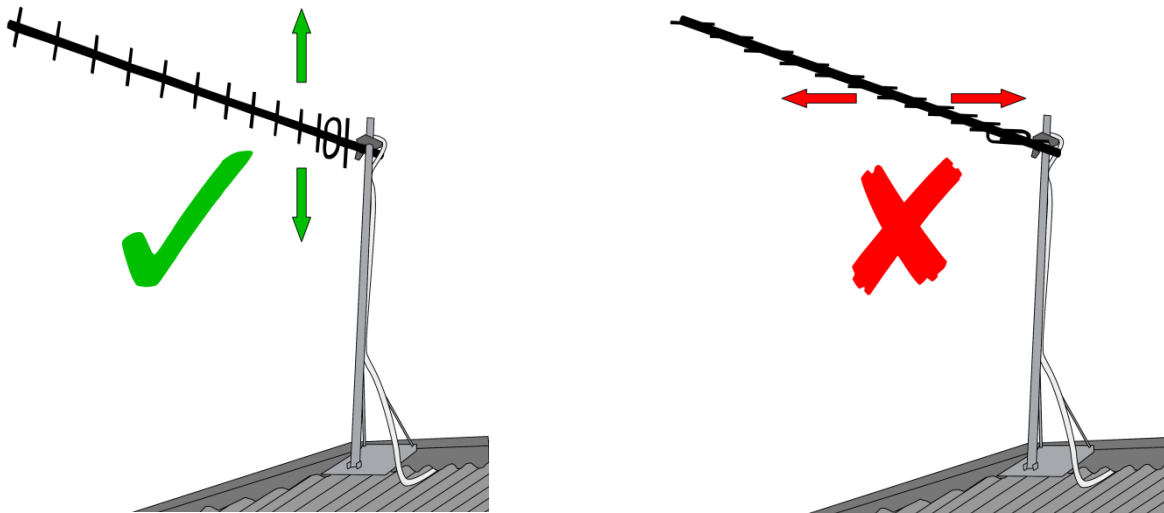
- Check the VWSR as measured at the antenna and record this measurement for future reference.
- If not already connected, connect the transmission cable to the antenna (hand tightening is sufficient). Make sure the connection is firm, but do not apply heavy force with pliers.
- Carefully weather proof all connections with rubberized amalgam tape, covering all cracks and the outer jacket of the cable. Failure to waterproof the connection could result in damage to both the cable or antenna.
- Secure the cable to the mounting pole in the best position to avoid damage to the cable using cable ties.
- After the antenna and cable have been installed, a careful visual check should be made to ensure that:
  - > All mechanical connections have been securely made and the antenna is mounted with sufficient physical clearance.
  - > The antenna is mounted with the yagi antenna must be oriented with the antenna elements facing to the 'sky and ground'.
  - > All connections have been carefully wrapped to prevent moisture problems.



## GENERAL TIPS

### ORIENTATION

3G cellular mobile antennas are vertically polarised, meaning that during installation a yagi antenna must be oriented with the antenna elements facing to the 'sky and ground'. Some UMTS base stations will transmit separate channels on 45 and 135 degree polarities (using cross-polarised antennas), however as there is no guarantee which channel you will be allocated by the base station the safest installation practice is to always install the antenna in vertical polarisation.



### COLLOCATION & METAL OBJECTS

Installing your antenna near other antennas or metal objects can cause interference. Even if the collocated equipment is of a vastly different design or frequency, any transmitter can cause out of band interference by the generation of wideband noise, harmonics, and spurious emissions. To protect against coupling antennas must be physically separated by distance. The following are some simple guidelines to maximising antenna isolation.

- Antennas of opposing polarity will provide maximum isolation - horizontally polarised TV antennas can be safely collocated with vertically polarised mobile antennas. Physical separation is of course still necessary.
- Isolating vertically polarised antennas vertically is best - if installing multiple mobile antennas, or collocating mobile with UHF land radio antennas, stacking antennas vertically on a vertical mast or tower will provide better isolation than horizontal separation.
- Do not install antennas within the main beam/lobe/aperture of directional antennas.
- Do not install antennas where metal objects would intersect the main beam/lobe/aperture
- For horizontal separation, as an extremely general rule of thumb distance should approximate 2.5 wavelengths of your network's carrier (for example 850MHz for Telstra Next-G results in a separation calculation  $0.341\text{m} \times 2.5 \approx 0.85\text{m}$ ) - note that these calculations are to protect the mobile antenna from impacting other more critical systems.
- For vertical separation, a general rule of thumb is 1.5 wavelengths to minimise impact on other systems (0.5m for Telstra Next-G). As with horizontal separation if the mobile antenna represents the more critical system, use the wavelength of the interferer when calculating separation distance.

### SURGE PROTECTION

Antenna cables are electrically conductive and must be grounded to ensure equipment damage potential is minimised. Most Yagi antennas are constructed DC Ground to reduce current flow down the coaxial cable, however damaging levels of current will still flow through the coax. Upon assessing surrounding terrain and structures if the installation is deemed high risk surge protection should be used. As a minimum, a coaxial surge arrester should be installed either between the antenna and feeder cable (if grounding point exists on the roof), or cable entry point (ideal but not always practical). If the antenna is installed on a tower or tall mast, further arresters should be installed mid-span and at cable entry positions, particularly if cable length exceeds 20m vertically (to protect against parasitic coupling).