



TRANSCÉLESTIAL

CENTAURI

Site Survey Tool & Site Selection Guide



WELCOME!

Thank you for choosing the CENTAURI Wireless Laser Communication device from Transcelestial Technologies Pte. Ltd.

This guide provides important information you need to properly select and prepare an installation site for CENTAURI 1G and 10G devices. It is important that you follow the instructions included in this guide carefully.

Following this guide when operating Transcelestial products will ensure that you get the most benefit from CENTAURI's technical capabilities.

All statements regarding safety of operation and CENTAURI performance contained in this guide only apply when the Site Survey Tool and CENTAURI is operated correctly.

If you have any questions or need further assistance, please contact us at <https://support.transcelestial.com>.



IMPORTANT NOTICES

MINIMUM OPERATING DISTANCE

CENTAURI is specifically calibrated to support point-to-point communication links between two devices positioned a minimum of 200 meters from each other.

DO NOT ATTEMPT TO DEPLOY LINKS OVER DISTANCES OF LESS THAN 200 METERS

Operation of CENTAURI at distances under 200 meters may cause damage to the optical components inside the device and/or void the product warranty.

If your deployment is intended to cover a distance of less than 200 meters, please [contact Transcelestial](#), immediately, for further guidance and assistance.

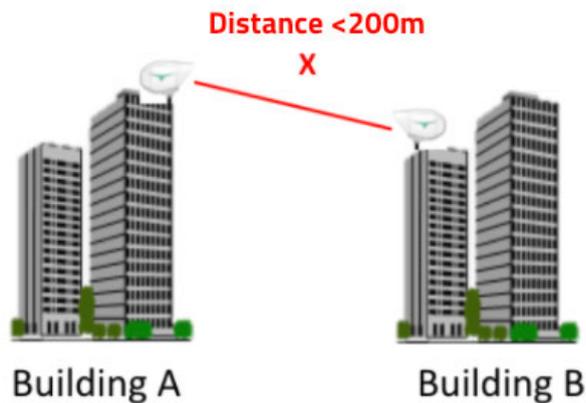


Figure 1: Minimum Link Distance



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ABOUT CENTAURI

CENTAURI is the next-generation wireless laser communications solution for ground-based last-mile connectivity.

Enclosed in its sleek, shoebox-sized shell, CENTAURI houses a sophisticated wireless laser communications mechanism which delivers up to either 1 Gbps or 10 Gbps in data throughput (full duplex) over a point-to-point, line of sight link.

When properly installed, CENTAURI can maintain alignment across a wide variety of environmental and weather conditions, with much higher reliability and availability performance than past generations of Free Space Optics devices.

Furthermore, CENTAURI can maintain its high data rates in conditions that challenge RF and mmWave devices, with a much higher ceiling for future performance gains and data rates of up to 100 Gbps or more.

Not only that, but CENTAURI can be installed more quickly and easily than many RF/mmWAVE solutions.

WHY SITE SELECTION AND PROPER INSTALLATION MATTERS

CENTAURI is a high performance communications solution. Therefore, it needs to be installed correctly, according to specific guidelines, to deliver maximum performance.

CENTAURI has been tested in a variety of environments, and we collect a great deal of data related to device performance. This information has given us critical insights about what it takes to install the product successfully.

In fact, poor site selection and sub-optimal installation are the biggest reasons why CENTAURI typically doesn't live up to our customers' (and our) expectations.

This guide is intended to help explain not only what we have learned, but how you can apply it and use Transcelestial's Site Survey Tool ("SST") to help make deployments faster, easier and ultimately successful.

DO I REALLY NEED TO USE THE SITE SURVEY TOOL?

There are many situations where we can be reasonably certain that CENTAURI will perform well, based upon visual inspection of the site or past experience has proven a specific type of mounting environment has yielded good results. Transcelestial is also constantly working to improve CENTAURI's pointing and tracking performance to allow it to compensate for a broader range of vibration and sway events.

Our aim is to qualify 80% of installation sites for CENTAURI installation without the need to deploy the Site Survey Tool and perform a full site survey analysis. In situations where we recommend testing a site before deploying CENTAURI, there is usually some concern about the intended deployment location, the type of pole or



mount being proposed, or there is an extra layer of assurance being sought to confirm CENTAURI is likely to perform as required to meet customer requirements.

SITE SURVEY TOOL OVERVIEW

In situations where the decision to assess site readiness before going through the time and expense of deploying CENTAURI directly, Transcelestial designed the Site Survey Tool (SST).

The SST is an electronic device that can be installed on a standard CENTAURI mounting bracket at any site where CENTAURI might be deployed.

Once installed, the SST collects a range of data, used to analyse the vibration and motion characteristics of the intended mounting structure. The analysis determines whether or not a given site is suitable for installation of the Transcelestial CENTAURI telecommunications device, with a high degree of accuracy.



Figure 2: The SST installed

SITE SURVEY TOOL: WHAT'S IN THE BOX?

The SST package contains the following components:

Site Survey Tools placed inside a waterproof enclosure	SD card reader	SST charging cable (USB-C)
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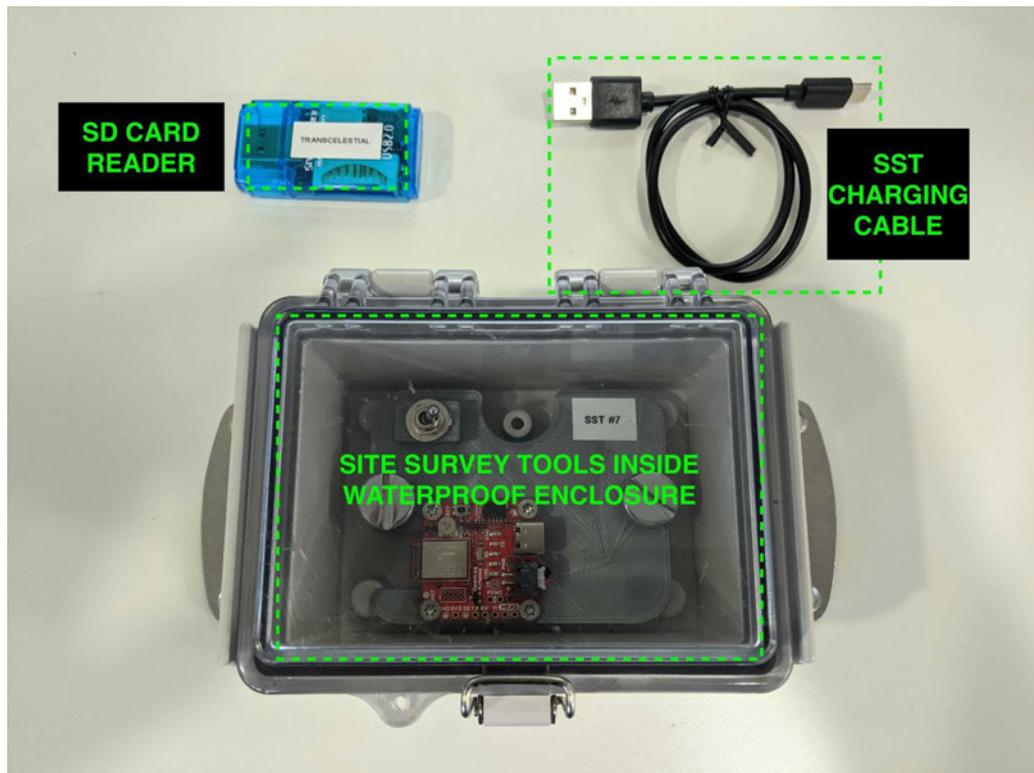


Figure 3: SST and Accessories

SST COMPONENTS

The electronics board (from inside the waterproof enclosure) contains the following parts and features:

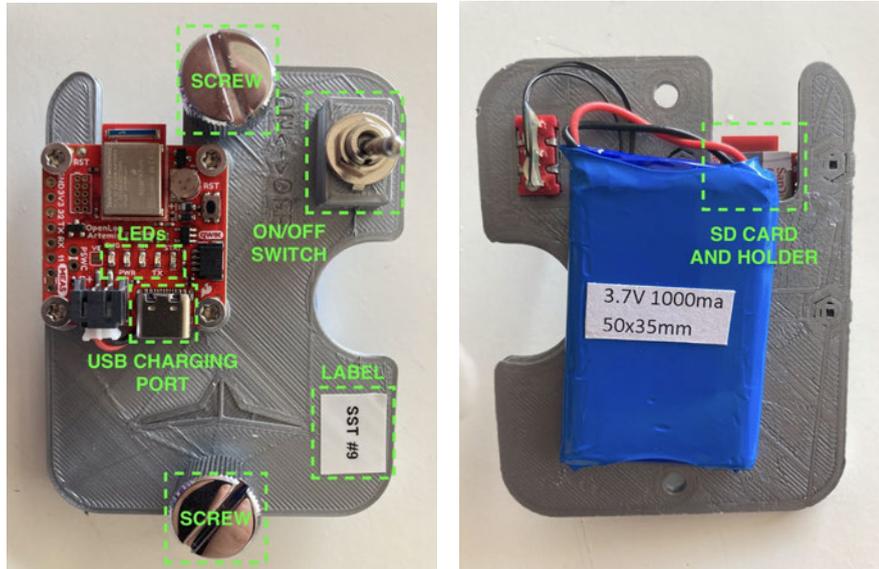


Figure 4: The Site Survey Tool as seen from the front (left) and the back (right) with labeled components.

Component	Function/Specification
ON/OFF Switch	Main SST switch
LEDs	Device states: <ul style="list-style-type: none"> • <u>Blue LED</u>: device is recording data • <u>Orange LED</u>: battery is charging • <u>Red LED</u>: device is switched ON
USB Charging Port	USB-C, 400mA+
Metal Screws	Used to access the back side of the SST
SD Card and Holder	Located on the back side of the SST



SST INSTALLATION SITE REQUIREMENTS

The following items pertain to the deployment of CENTAURI as well as the installation of the SST.

It's important to highlight these points in order to ensure that the intended installation location is suitable.

1. Line of Sight Between Intended Installation Points

- a. For CENTAURI to work properly, the most important requirement is that there is **CLEAR LINE OF SIGHT** between the locations of both CENTAURI devices being linked to each other.
- b. This is something that cannot be tested with the SST, but no matter how suitable a site is from the perspective of vibration and tower sway, if there is no line of site between the two CENTAURI devices, the installation will fail.
- c. Before going through the process of testing a site for suitability with the SST, you must first ensure that there are no obstructions (permanent or temporary) that could intervene and block the connection between the two points where CENTAURI will be mounted. For example, avoid installing CENTAURI (and the SST):
 - i. Where any large plants or trees might grow to block the line of sight between devices or which could become obstacles as they move and sway during heavy winds.
 - ii. In front of, or even nearby any object that might reflect significant sunlight or generate excessive heat, such as kitchen exhaust vents, or sources of steam, smoke and other particulate matter like chimneys or HVAC system outlets.
 - iii. Where the device is low to the ground, or has a potentially partially obstructed view over a window sill or building roof retaining wall, especially one with steel, aluminium or other cladding that might reflect light from other sources into CENTAURI's optical window
 - iv. Where CENTAURI will be more than 1 meter from the base of whatever pole it is mounted on, or mounted on a pole with many other devices (RF/mmWave Antennas, Transmitters, etc).

2. Proper Mounting Support

CENTAURI and the SST are built to function optimally when installed on poles meeting certain specifications. The SST helps test intended installation points

and will either “pass” or “fail” locations, depending on how much tower sway or vibration is present on the site during the time it collects data.

Ideally, CENTAURI will be installed on its own pole, which has the following specifications:

Single Pole Installation

- a. Single vertical cylindrical mounting pole with an outer diameter measuring from 7.6 cm (3.0”) to 10.2 cm (4.0”).
- b. Accepted tilt relative to vertical alignment of < 3.0 degrees.

The image below shows a “good” installation for CENTAURI vs. a “bad” one. The pole on the left is too tall, while the pole on the right allows CENTAURI to site < 1 m from the closed attachment point for the pole to the wall, and the pole is < 1.5m in height, overall.

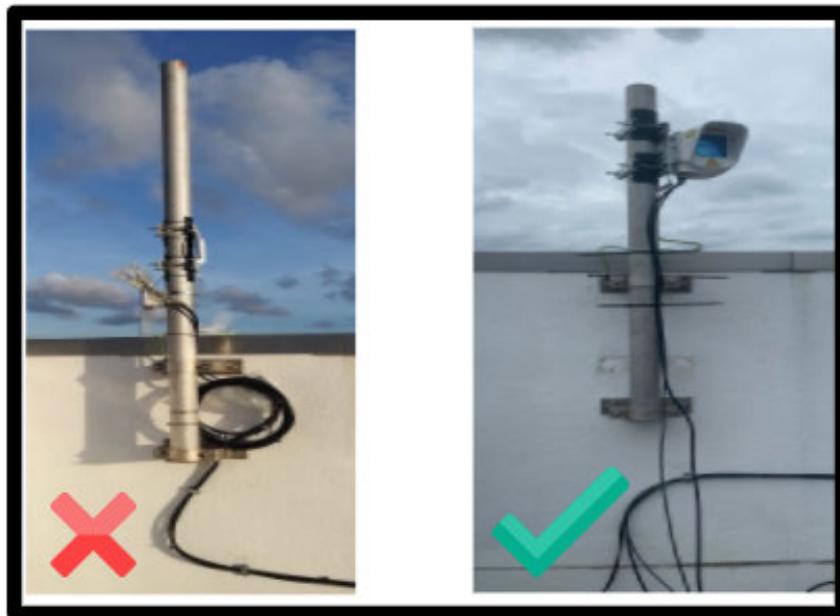


Figure 5: “Bad” pole (Left) vs. “Good” pole

The figures below provide more specific information on ideal mounting poles.

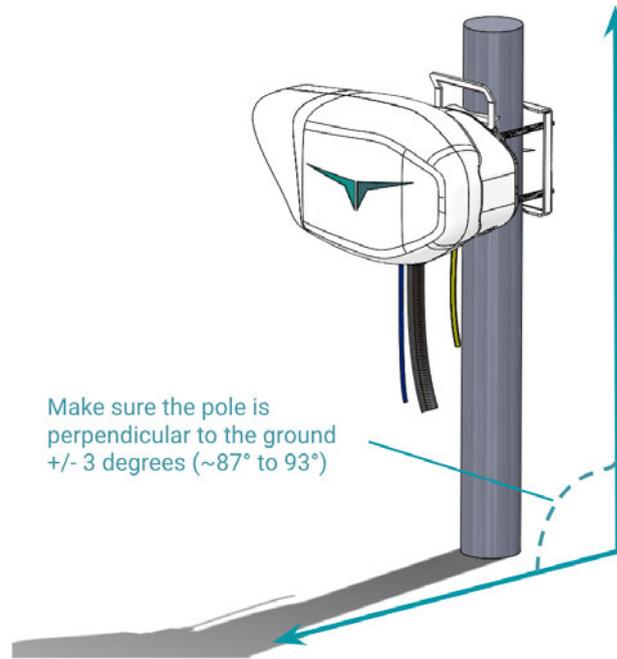


Figure 6: Pole should be as close to vertical as possible.

Below, the installation point is less than 1 meter from one of the pole's fixed attachment points. This helps minimise the impact of pole vibration and sway to CENTAURI's performance.

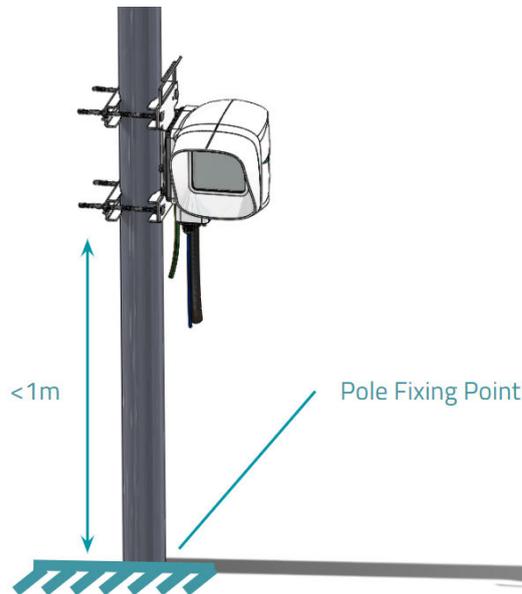


Figure 7: Maximum mounting height

Telecommunications Tower Installation

CENTAURI may be installed on a telecommunications tower similar to those pictured below:



Figure 8: Telecom tower examples

When installed on telecommunications towers, the following requirements apply:

1. CENTAURI should be mounted as closely as possible to one of the guy-wire points on the tower.
2. The tower must be a wide and stable structure (> 100cm in width at the point of installation)
3. The tower must be properly seated on a heavy foundation
4. There should be no other equipment mounted on the same boom or bracket on which CENTAURI is mounted

The graphic below illustrates proper installation to meet these requirements:

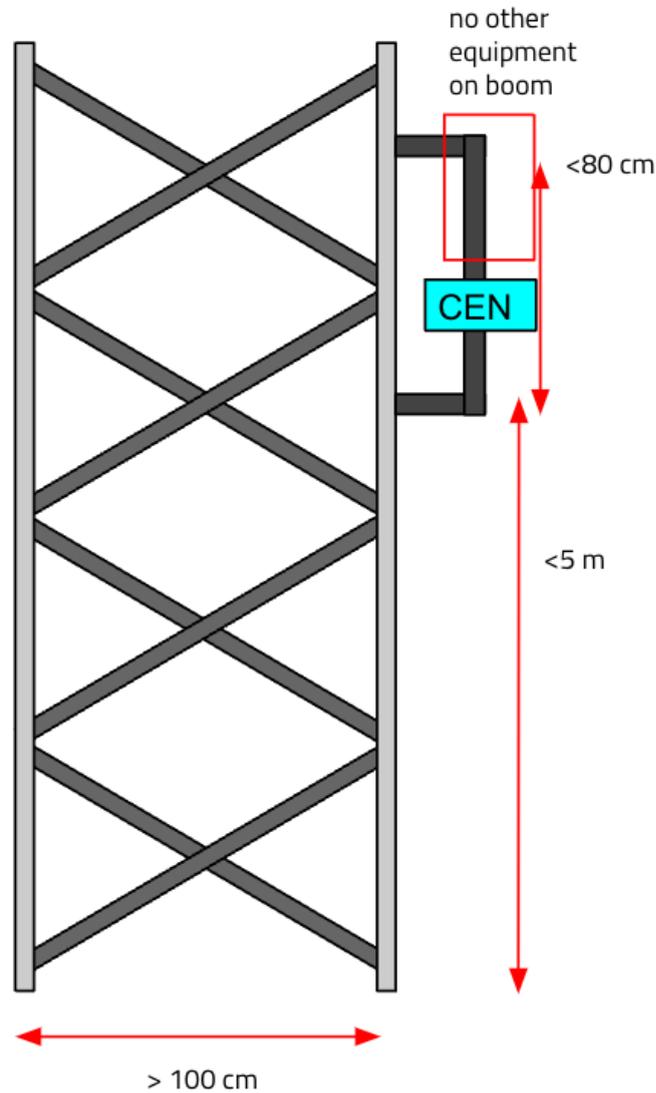


Figure 9: Installation on a Telecommunications Tower

Telecommunications Freestanding Pole

CENTAURI may also be installed on a freestanding telecommunications pole, subject to the following requirements:

1. CENTAURI should be installed at a distance no more than 200cm from the base of the pole
2. CENTAURI should be installed within 50cm of the legs or supports of the pole
3. There should be no more than 80cm of excess pole above the point where CENTAURI is installed
4. The pole must be mounted on a heavy base or otherwise securely mounted to prevent excess motion.

5. There should be no other machinery or equipment in the vicinity of the pole

The graphic below illustrates proper installation and adherence to the requirements above:

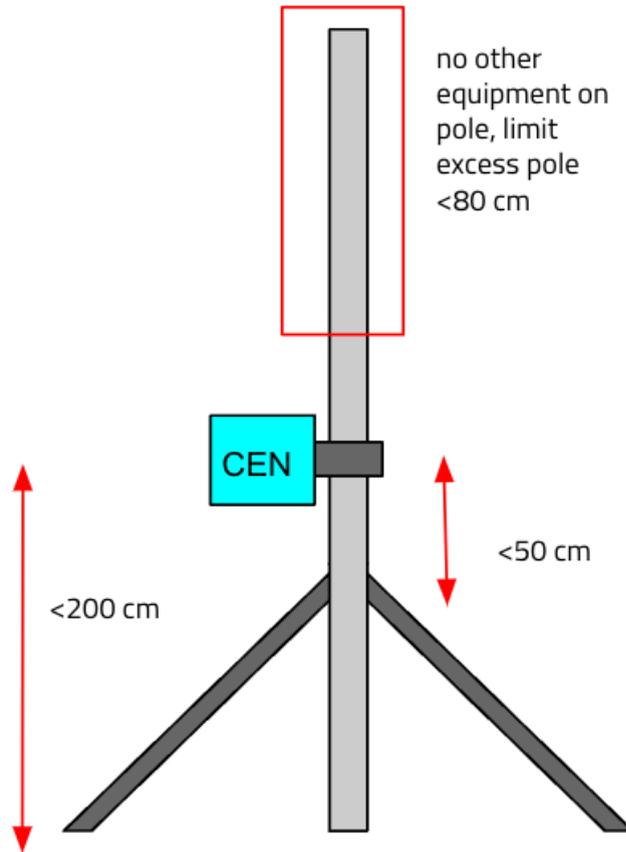


Figure 10: Telecommunications Freestanding Pole Installation

Tripod Mounting (Temporary Deployment)

It is possible to install CENTAURI on industrial tripods such as the one in the photo below and to achieve satisfactory performance results.

The requirements for successful installation on a tripod are:

1. The tripod legs should be adjusted so that the mounting base at the top of the tripod is level.
2. The feet of the tripod should be anchored firmly to whatever surface the tripod sits on.
3. A proper mounting adapter should be installed on the tripod, to support a cylindrical short pole measuring 3" to 4" in diameter, with sufficient height to install CENTAURI on its regular mounting bracket but with as little excess height above CENTAURI as possible.
4. Proceed with mounting and installation of CENTAURI following the instructions in the CENTAURI Product Manual.

Below is a photo of a CENTAURI installed on a tripod mount.



Figure 11: CENTAURI mounted on a tripod

3. Tools Required for SST Installation

- a. 13mm Wrench (pole mounting tool)
- b. TORX T20 Screwdriver (pre-assembly tool)

SST PREPARATION

The SST needs to be fully charged before every use.



Figure 12: The electronics board plugged into a power source via the charging wire. The 'orange LED' shows that the charging has started.

1. Set the 'ON/OFF switch' to the OFF position.
2. Open the SST's waterproof enclosure and remove the gray plastic electronics board using the two metal screws.
3. Plug the charging cable into the USB port on the electronics board and a power source (recommended USB charging power adapter or laptop).
 - a. The 'orange LED' will indicate that the charging has started (see Fig 3).
 - b. The 'orange LED' will turn off when the charging is finished. A full charge will take approximately 2.5 hours.
4. Remove the charging cable and insert the electronics board back into the waterproof enclosure using the two metal screws.

INSTALLING THE SST

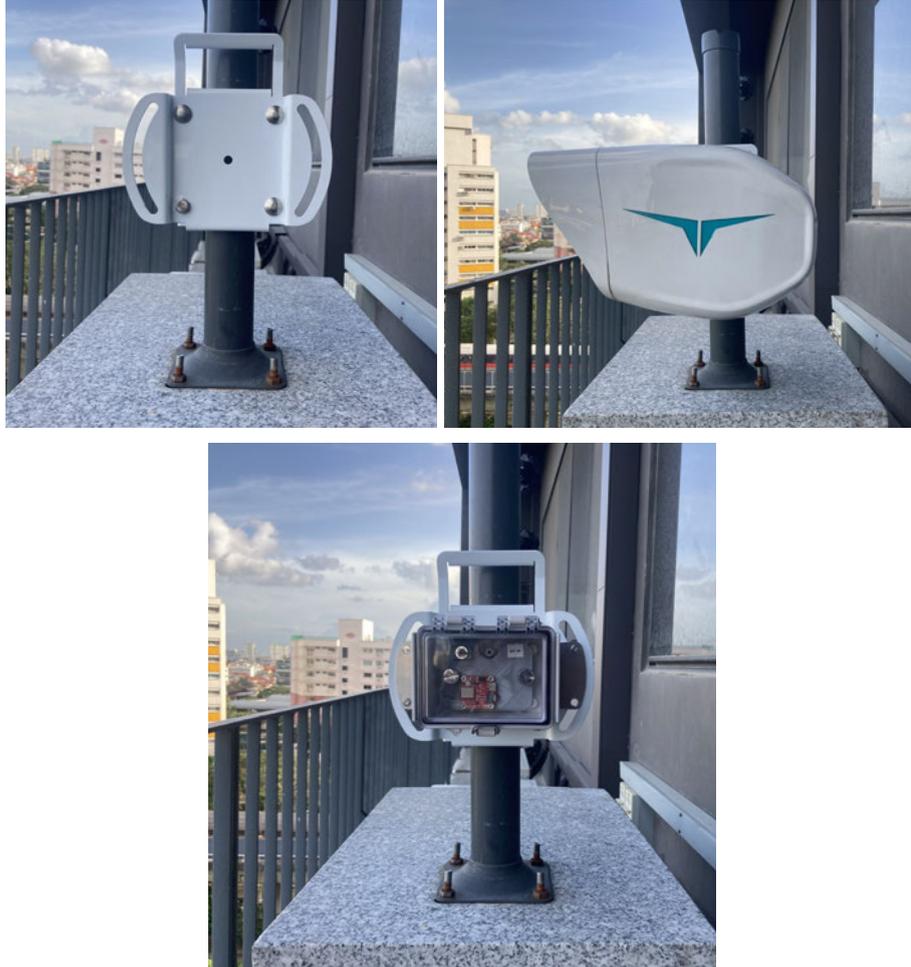


Figure 13: The Site Survey Tool installation orientation (right) relative to the empty mounting pole (left) and the positioning of the CENTAURI device (centre).

1. The SST should be attached to a CENTAURI mounting bracket at the installation location, and affixed to a suitable mounting pole.
2. Position the SST as shown above..
 - a. The mounting pole should be located less than 1 meter from one of the pole's fixing points to minimize pole vibration.
 - b. Secure the mount using the provided long M8 screws.
3. The waterproof enclosure has a 'Line of Sight' label with an arrow. The arrow on this label should point in the **direction that CENTAURI will point** (Fig 5).

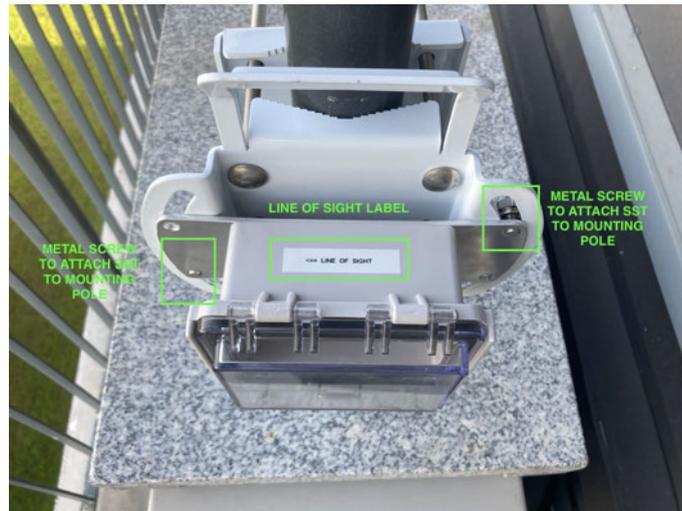


Figure 14: Mounted SST illustrating positioning of metal screws at opposite corners and the device's 'Line of Sight' label.

4. Using two metal screws provided by the mount, securely and tightly attach the SST to the mounting pole (Fig 5). Each screw should be used at opposite corners to do so (e.g. top right and bottom left).
5. Set the 'ON/OFF Switch' located on the gray electronics board to the ON position.
6. **The blue LED should start rapidly blinking**, indicating that the SST has started recording data.
7. Securely close the waterproof enclosure, making sure that the transparent lid is properly seated and clamped tightly shut.
8. The SST is now collecting data from your site.
9. Take pictures of the fully installed SST. An example is shown below.
10. Make one last check to ensure that the SST is attached securely and can't be easily moved/shaken.

IMPORTANT!

Be sure to take note of the date and time that the SST was turned on.

The SST should be allowed to collect data for at least 48 hours before removing the SST and retrieving the data.



Figure 15: SST Installation Example

RETRIEVING SST DATA

The SST should be allowed to run and collect data for at least 48 hours after installation. To retrieve the data and prepare it for analysis, please follow these steps:

1. At the installation site, take a photo of the SST device and the mounting pole.
2. Open the SST enclosure, and set the 'ON/OFF Switch' located on the gray electronics board to OFF.
3. Remove the SST from the mount and pole.
4. Next, open the waterproof enclosure and remove the two metal screws located inside. Remove the gray plastic board from within.
5. Access the back of this plastic board and remove the SD card from the device (see below).
6. Using theConnect the SD card to a laptop using the SD card reader in order to obtain the recorded data.
7. The SD card will contain a large amount of LOG_x.TXT files (2 files per hour of recording). Copy all files to your computer. Then, compress the files into a single ZIP archive.

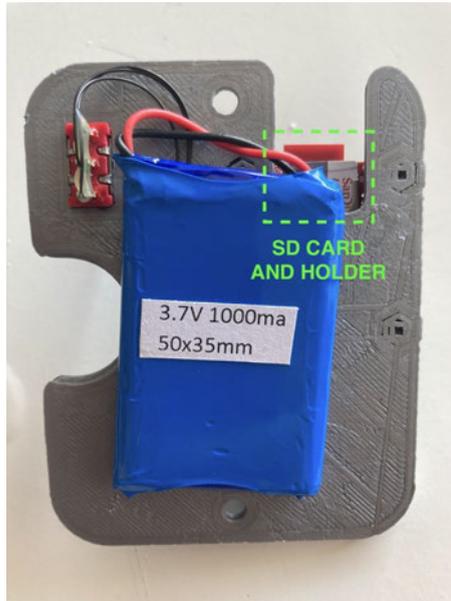


Figure 16: Location of SD Card on SST

SENDING SST DATA TO TRANSCESTIAL

Once the data retrieval process is complete and you have obtained the SST data, you must send the following information back to Transcelestial Technologies at the following email address: [sst@transcelestial.com](mailto:ssat@transcelestial.com).

What to Send	Important Details
Compressed ZIP File of SST data	This will be approx 120Mb for a 48 hour measurement cycle. You may use a file sharing service for data storage and retrieval, if needed. For example, Google Drive, DropBox, https://wetransfer.com/ , or others.
Pictures and Video of SST Installation	The procedure is outlined in the Installing the SST and Retrieving SST Data sections of this guide.
Timeframe of Data Recorded	Take note of the date and time the SST was turned OFF. Send the information about both the start date/time and end date/time of the recording to Transcelestial.
Location of Mounting Structure	GPS coordinates; Specific address;



Upon confirmation that Transcelestial has received the data, you may delete all files from the SD card and prepare the SST for another test, as required.

SST RESULTS

Once Transcelestial receives the .zip archive and the SST data, it will be analysed and a “link availability score” will be calculated.

The result of the analysis will be a “pass/fail” grade.

Results will be returned to customers by email along with an explanation.

If the chosen site achieves a SST score of 99.9% “link availability” or higher, the site and mounting location are given a “pass”.

Passing sites can proceed with deployment of CENTAURI.

If the SST result score is lower than 99.9%, Transcelestial will suggest specific improvements or changes that can be made to remediate the installation site, or recommend that the installation point be moved to a more suitable location.

SST TECHNICAL SPECIFICATIONS

Parameter	Specification
Battery life	1Ah - 48+ hours on full charge
Battery charging time	2.5 hours with a 500mA supply
Data storage capacity	500+ hours
Environment protection	IP66

SITE INSTALLATION EXAMPLES

Over the last two years or so, we've had the opportunity to visit and see a variety of different installation sites.

The good news is that CENTAURI has performed better, in many ways, than we ever could have hoped, across a wide range of different quality sites.

The bad news is that there are definitely some kinds of sites and installations where it is unlikely any amount of modification or magic could have helped CENTAURI perform successfully.

This section of the guide is where we share some pictures of a few installations that we could reliably predict would be unsuitable from the start.

GOOD SITE SELECTION EXAMPLES

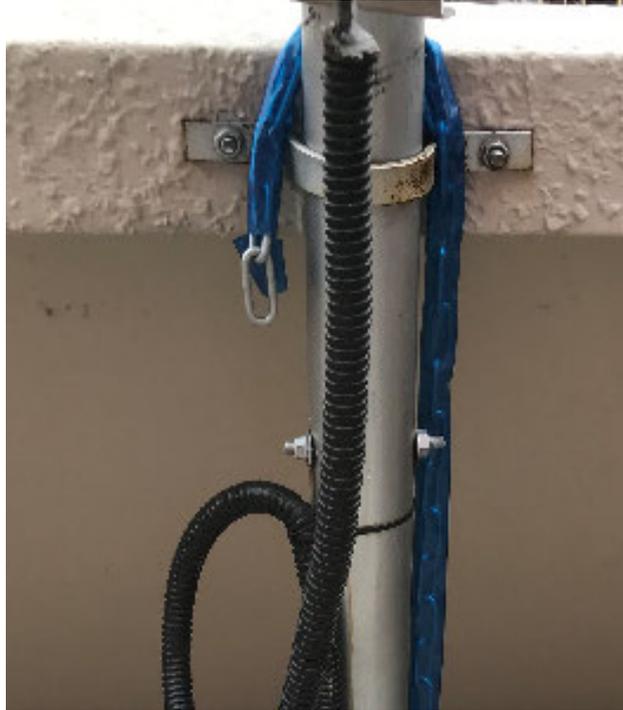
GOOD SETUP

Pole mounted on a concrete base. Mounting can be reinforced with metal structures (shown on the right picture)



GOOD SETUP

Pole mounted firmly with strong attachment to retaining wall.



GOOD SETUP

Pole mounted on the rooftop ledge



GOOD SETUP

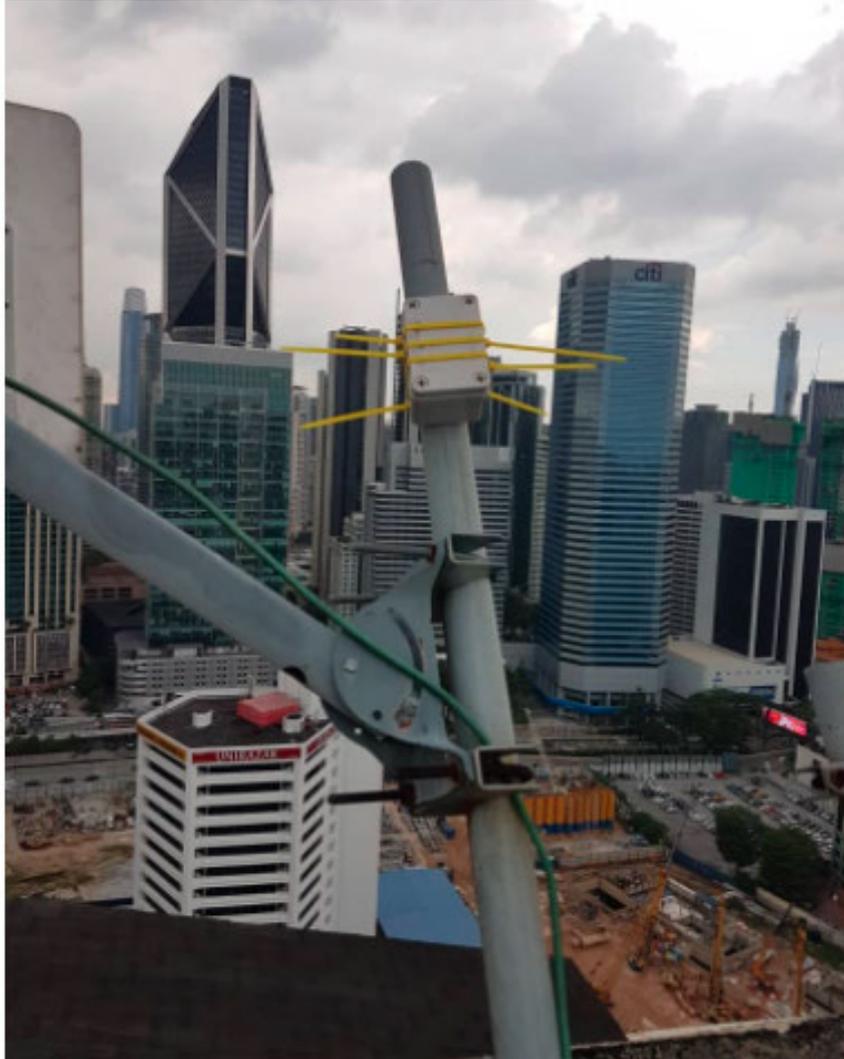
Pole mounted on a telecom tower with >2 fixation points to the main structure and no heavy/large equipment mounted on the same pole.



POOR SITE SELECTION AND POLE EXAMPLES

WHAT'S WRONG?

The pole on which CENTAURI is mounted is not within ± 3 degrees of vertical, as required for optimum performance.



WHAT'S WRONG?

CENTAURI mounted very low on a pole and too close to the railing on this wall, which could result in reflections and degraded performance.



WHAT'S WRONG?

The mounting pole is coupled with another pole to which heavy/large equipment is mounted.



WHAT'S WRONG?

The device is mounted directly on a tall monopole and too far away from the stable points where guy wires are attached. With all the other equipment sitting on this pole, the likelihood is high that this pole will shake and sway in even light winds. At the very least, this is an example where testing the site with the SST prior to installation may be recommended.



WHAT'S WRONG?

The mounting location (low height and center of the rooftop) is such that the field of view is crowded with other equipment. As a result, there is no clear line of sight between this location and the location of the other device in the link. Mounting the device this close to the roof, even when there is clear line of sight to the other end of the link, may also subject the link to more reflections and scintillation due to it being so close to the surface of the roof.



WHAT'S WRONG?

CENTAURI is mounted on the correct type of pole. This is clearly a temporary installation. However, the base supporting the pole is not properly weighted down (we would recommend using a concrete plinth). The second problem is that CENTAURI is installed too far from the ground, given that there are no other support struts between it and the base of the pole.



WHAT'S WRONG?

CENTAURI may be mounted on a tripod like the one shown in this photo. However, even for a temporary deployment where the use of a tripod may be warranted, this is a poor way to install CENTAURI.



When using a tripod to install CENTAURI, a proper mounting adapter should be affixed to the top of the tripod, supporting a suitable circular pole 3" to 4" in diameter. The CENTAURI mounting bracket should be used to affix CENTAURI to the pole. As shown earlier in this document, the photo below illustrates a fairly good tripod installation.

An early version of the SST is also mounted on the same tripod (behind CENTAURI, facing camera). This particular installation has been in place for over a year and is used for operational testing. You can also see another pole in the background, onto which multiple CENTAURIs may be mounted for testing.





GET IN TOUCH!

If you have any questions or need help understanding or applying the guidance provided in this document, please [contact us](#).

And, if you have photos of great installations or new contestants for the deployment “Hall of Shame” you can send them to us anytime via our [Support Portal](#).



DOCUMENT REVISION HISTORY

Date	Version	Author
December 2021	1.0	Chip Wilcox