

# LMR 600 coaxial cable installation at Liesbeek House for GPS station

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Organization: National Research Foundation (NRF) – South African Radio Astronomy Observatory (SARAO)

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This document describes the installation route for LMR-600 cable to be installed at Liesbeek house. The contract requests for RF co-axial cable installation at Liesbeek House based in Mowbray Cape Town. Figure 1 shows a photo of the NRF SARAO building. It is referred to as Liesbeek House. There are **three floors at Liesbeek House**. The cable must be routed from the rooftop to a laboratory on the ground floor. This means that the cable must be installed at the top of a three (3) story building that has an approximate height of **10metres**. This requires sufficient training to work at heights to perform the installation.

Position where Novatel GPS  
Antenna is to be installed

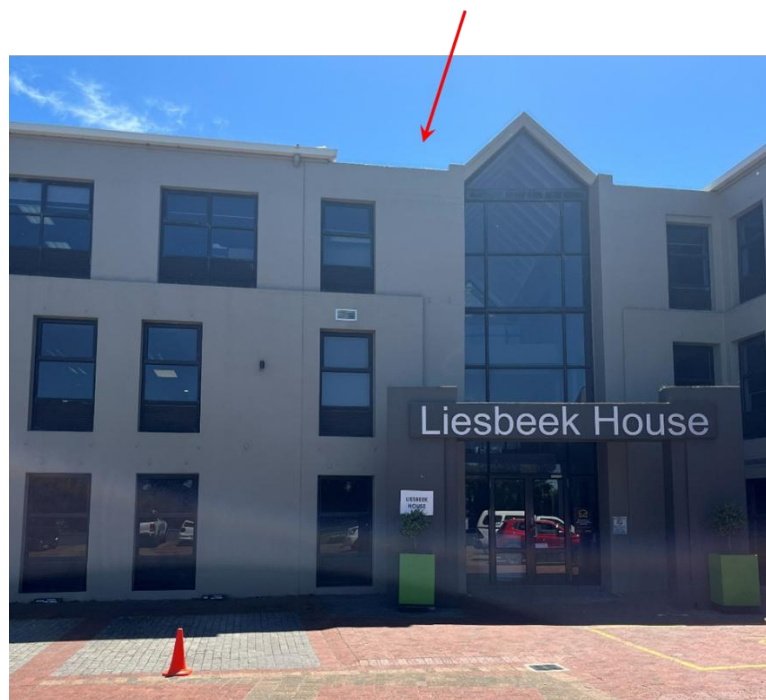


Figure 1: NRF SARAO building at Liesbeek House in Mowbray.

Installation of the coaxial cable is required to build a GPS station where a GPS antenna will be connected to a GPS receiver in the TFR laboratory. The following parts will be provided by NRF SARAO; 50m LMR-600 coaxial cable (see cable specification in the Appendix), N-type RF connectors fitted to ends of the coaxial cable, Novatel GPS antenna and high precision GNSS receiver. Permission has been granted by Liesbeek House building management for TFR's GPS installation at Liesbeek House.

The Time and Frequency Reference (TFR) laboratory requires GPS connectivity capable of detecting GPS L1 and L2 frequency bands from GPS satellites at Liesbeek House. Installation of the GPS antenna must be done on the Liesbeek House rooftop at the location indicated with a red cross as indicated in Figure 2. The rooftop may be accessed from the building's canteen located on the buildings West wing. Note that the rooftop is slanted at 30° angle. This will require that the technician anchor themselves to the anchor rail located at the parapet.



Figure 2. Proposed GPS antenna at Liesbeek House.

The antenna must be fastened to one of the available poles, preferably the highest pole to maximize visibility. The antenna will be bolted to an angled bracket that must be fastened to the pole with a hose clamp. SARAQ will provide the bracket and clamps required for the installation.

The antenna must be connected to a high precision global navigation satellite system (GNSS) receiver housed in the TFR laboratory via a N-type RF connector. SARAQ will provide the N-type connectors.

The starting end of the 50metre LMR 600 cable will have a N-type connector crimped to it. The LMR-600 cable will be connected to the Novatel antenna. LMR-600 cable must be routed from the Liesbeek House parapet to the Intellectual Property (IT) Networks and Cyber security offices as indicated in Figure 3. There is potentially a seal that must be broken to route the cable from the parapet to inside the building. The LMR 600 cable will be guided above the ceiling of the Networks office towards the IT Network storeroom shown by the red arrows in Figure 3.

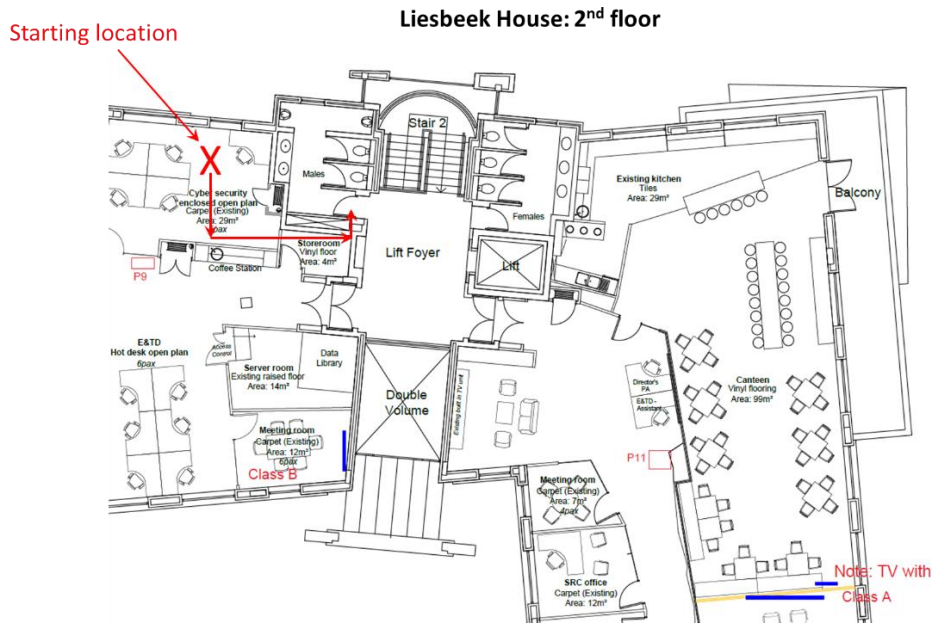


Figure 3: LMR-600 cable route from the rooftop along the second floor.



Figure 4: IT Network office and storeroom to the far right in view.

Figure 4 shows the outside of the Makeba office (Networks and Cyber security office) and the networks office to the far right of the photo. From the storeroom ceiling the cable will be guided via ducts located in the wall to a cabinet in the men’s toilet, shown in Figure 3. There is ducting in the toilet. The ducting is constructed in cabinets located in the men’s toilet, see Figure 7. Figure 5 shows the LMR 600 cable route from the IT Networks storeroom to the cabinet in the men’s toilet on the first floor. The cable must be guided to the bottom of the cabinet as indicated by the blue arrow in Figure 6.

Routed from IT Network storeroom to cabinet in the men's toilet on the second floor.

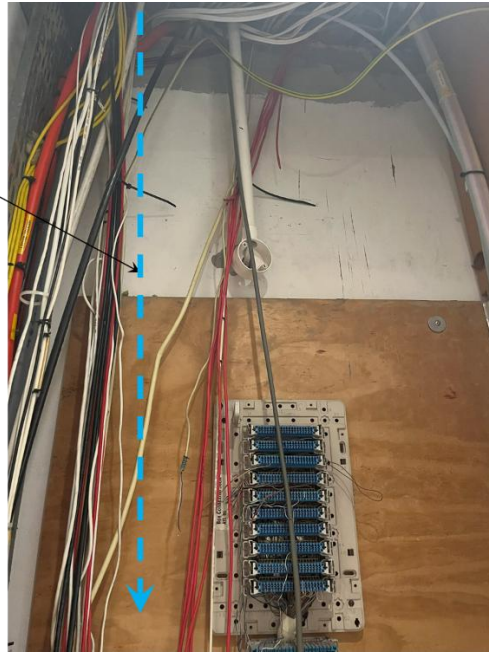
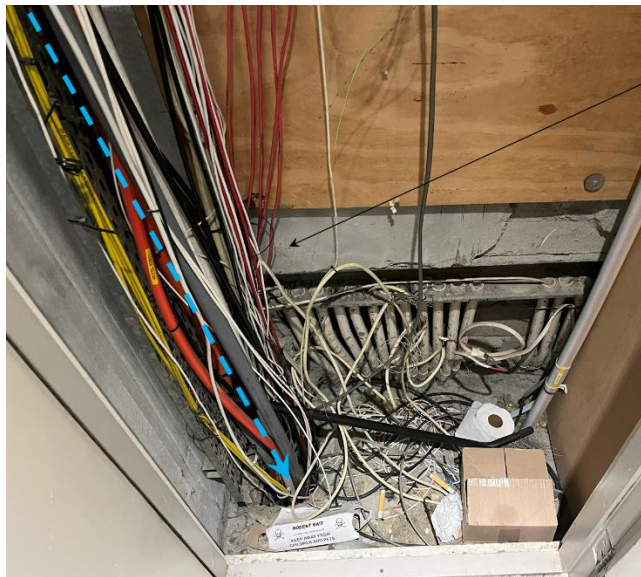


Figure 5: Cabinet through which cables are directed.



Guide LMR 600 through the cabinet to the next floor, i.e. from first to second floor.

Figure 6: Bottom of cabinet located on the second floor.

The cable must thereafter be routed through the cabinet on the first floor, see Figure 7, to the cabinet on the ground floor.

Guide LMR 600 cable through the cabinet in the men's toilet on the first floor to the ground floor.



Figure 7: Cabinet located on the first floor of Liesbeek house.

When the cable reaches the ground, it must be routed from the cabinet in the men's toilet to the communications cable tray located in the ground floor ceiling as shown in Figure 8.

Once the cable reaches the cabinet located in the ground floor, reroute the LMR 600 cable to towards the ceiling at the left foyer located on the ground floor.

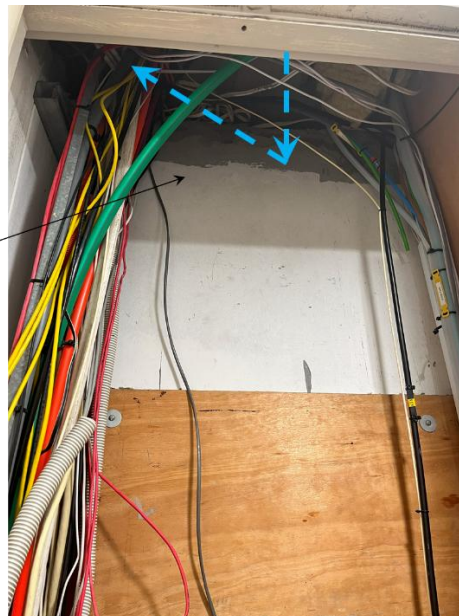


Figure 8: LMR 600 cable must be directed from the ground floor cabinet towards the communication cable tray located in the ground floor lift foyer.

The cable must then be directed towards a communications cable tray running from the lift foyer in the ground floor ceiling to the reception desk as shown in Figure 9. This cable tray is located above the ceiling. The communications cable tray will form a 90° angle that leads the cable tray to the TFR

laboratory. The cable must be guided to the TFR laboratory. A hole must be drilled in the TFR laboratory wall.

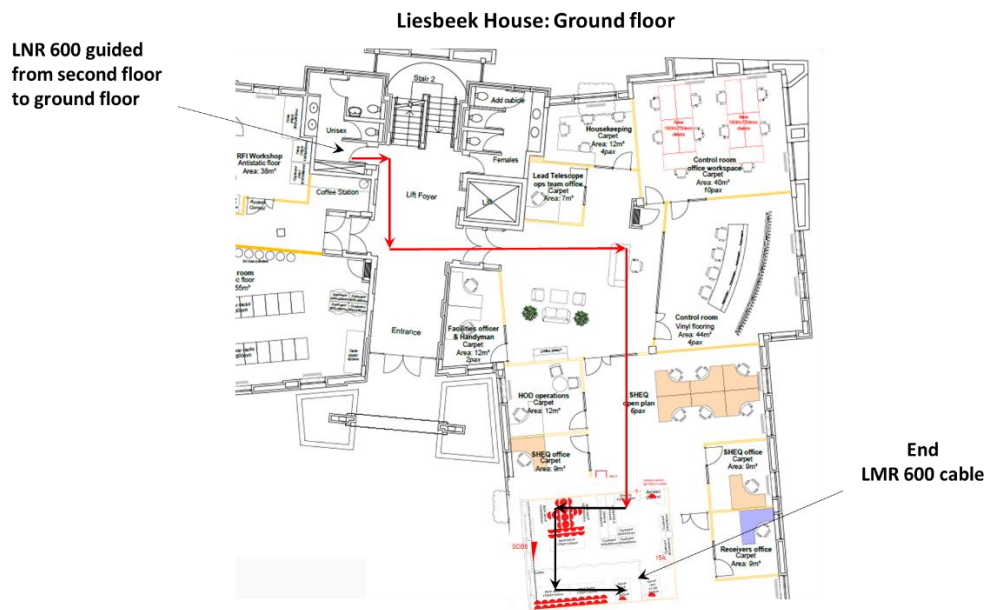


Figure 9: LMR-600 cable path from server room (ground floor) to the TFR laboratory.

Once the LMR 600 cable is in the TFR laboratory then it must be placed on an already installed cable tray. The cable will then be guided along the cable tray as shown in Figure 10. The TFR laboratory cable tray route is shown in Figure 9.



Figure 10: Cable tray located inside the TFR laboratory.

The communications cable tray in the TFR laboratory forms a U shape in the laboratory. It will guide the cable all the way to the opposite end of the TFR laboratory. The LMR 600 cable must be guided

along the cable tray to the server rack positioned at the far end of the laboratory. A high precision GNSS receiver will be installed in the server rack. After installation the LMR 600 cable will be terminated with a N-type connector.



**Figure 11: Tray near TFR laboratory Server Rack.**

The contractor's main responsibility is to install the LMR 600 cable from the Liesbeek House rooftop to the TFR laboratory along the route described in this document.

## Appendix

Note that the LMR-600 cable is an ultra-low loss coaxial cable. Its mechanical and construction specifications are shown below. It's outer jacket diameter is 15mm.

Part Description				Stock
Part Number	Application	Jacket Color	Color	Code
LMR-600	Outdoor	PE	Black	54003
LMR-600-DB	Outdoor/Watertight	PE	Black	54093
LMR-600-FR	Indoor/Outdoor Riser CMR	FRPE	Black	54032
LMR-600-FR-PVC	Indoor/Outdoor Riser CMR	FRPVC	Black	54074
LMR-600-PVC	General Purpose	PVC	Black	54219
LMR-600-PVC-W	General Purpose	PVC	White	54206

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BCCAI	0.176	(4.47)
Dielectric	Foam PE	0.455	(11.56)
Outer Conductor	Aluminum Tape	0.461	(11.71)
Overall Braid	Tinned Copper	0.490	(12.45)
Jacket	(see table)	0.590	(14.99)

Mechanical Specifications			
Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.50	(38.1)
Bend Radius: repeated	in. (mm)	6.0	(152.4)
Bending Moment	ft-lb (N-m)	2.75	(3.73)
Weight	lb/ft (kg/m)	0.131	(0.20)
Tensile Strength	lb (kg)	350	(158.9)
Flat Plate Crush	lb/in. (kg/mm)	60	(1.07)

Environmental Specifications		
Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

## Electrical Specifications