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Direction du Transport Spatial Sous Direction Sol Architectures Stations **NEW ZEALAND SITE SURVEY** **Diffusion Limitée**	Réf : DTS/SDS/AS-2025.0006045 Date : 12/05/2025 Edition : 1, Révision : 0 Page : 1/32

NEW ZEALAND SITE SURVEY

	Nom et sigle	Date et signature
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DIFFUSION INTERNE/EXTERNE			
Sigle/Société	**Nom (+ adresse email si externe)**	**Observation pour**	
		Action	**Information**
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Documents applicables

Référence		Titre du document
DXX		

Termes, définitions et abréviations

Sigle / abréviation	Définition
AWA	Awarua
DO	Pointing Designation

SOMMAIRE

1 CONTEXT

In order to dispose of the telemetry for the Kuiper launches, the Awarua SpaceOps NZ site has been chosen by CNES to deploy a telemetry kit dedicated for this launches. This site was indeed compliant with the 3 trajectories that will be used for these 18 launches

SpaceOps NZ was already solicited in 2006 to help to deploy a South African mobile telemetry antenna (OTR) for the ATV mission. The Awarua site has since then grown and is now equipped with more than 20 telemetry antennas, involving several international partners.

The CNES site survey occurred on May 2025 during one week, in order to qualify the interfaces requirement between the CNES telemetry kit and the SpaceOps NZ facilities. A visit of the SpaceOps NZ Warkworth center was also made at this occasion.

This document will list the interfaces existing or to be made, and definie the actions required for SpaceOps NZ and CNES in order to be compliant with every interface requirement before the arrival of the telemetry kit.

2 SPACEOPS NZ AVAILABLE MEANS

2.1 AWARUA AWA4

2.1.1 INTERFACE ANALYSIS

The following table state the interface analysis (see annex for details):

Interface	Solution	Comments
Between the Telemetry Kit and the site		
Facility	**New Building**	A new building is under construction, supposed to be ready to receive the telemetry kit in August 2025 A room dedicated for customers will be used for the installation of the TM cabinets and for the KVM Desk (2 screens + keyboard/mouse). Storage of spares part will be possible in the new building (empty cranes can be sent somewhere else)
Power Supply	**New Building**	The power supply will be available from 2 different breakers for the 2 PDU (Different phase, 16A breaker in 230V 50Hz). The generator and 20kW UPS already in place will be wired to the new building for the first launch. A new UPS and generator dedicated to the new building will be available for the following launches.
Telecom	**New Building**	An 96F optical fiber is already in place and will be wired to the new building for the first launch. A microwave backup is available (100 Mbps). A second 96F optical fiber will be wired to the new building (around august) for following launches.
GPS	By TM kit antenna	No IRIG-B will be available on site, the GPS antenna of the TM kit will be installed on the roof of the new building
Between the Telemetry Kit and the antenna		
DO (Pointing Designation)	**Interface to be develop**	The actual AWA4 S band antenna is not fitted to work with real time DO acquisition. The SpaceOps NZ team has been provided a DO laptop and simulation tools in order to be able to implement and test an interface solution between the DO laptop and the ACU, threw their antenna Server. DO will be implemented threw an IP connection (not serial) to be able to send DO through long distances
TM Downlink	Threw optical fiber	Both LHCP and RHCP S band telemetry is converted inside AWA4 into 2 optical fiber (allowing the availability of the telemetry anywhere on site). An Optical to S band converter will then provide AWA4 LHCP and RHCP telemetry signal on N connectors close to the telemetry kit.
TM Test Uplink (option)	*To be develop*	*If possible to dispose of a long loop, SpaceOps NZ team will analyse the best solution to dispose of a long loop test in order to qualify the telemetry downlink with simulated data replayed (test horn, couplers, other). LPA solution (Log Periodic Array, calibrated antenna) might suit.*
Calibration Tower	*To be develop*	*If possible to dispose of a generator and cal tower (carrier) to have a RF reference between launch*
G/T	*To be develop*	*This measurement is considered to be done every week on AWA4. When last measured, G/T was 15.2 dB/K in S-Band.*

2.1.2 NEXT STEPS

⇨ ***1st week of July 2025 : progress point***

- *SPACEOPS NZ: On-going building construction status*
- *SPACEOPS NZ: DO compatibility status*
- *CNES: ATA carnet needed (implies a fee on the kit if it stays more than a year), lay on with a NZ customs broker (NJ CRISP with Jonathan in Invercargill,* Jonathan Crisp jon@njcrisp.co.nz *). 15% payment for GST (Good and Services Tax) will be needed upfront for equipment that will stays permenantly.*

⇨ ***September: Installation mission***

- *Installation of the telemetry kit by a technical staff (2/3 CNES + 1 TPZ)*
- *Qualification of interfaces with AWA station (power supply, telecom, GPS)*
- *Qualification of interfaces with AWA4 antenna (telemetry, DO)*
- *Training of AWA staff*

⇨ ***November: 1st KUIPER mission (inclinaison 52°)***

- *Support of 1 TPZ agent*

2.1.3 BACKUP SCENARIOS

These scenarios have to be considered, as backup solutions in case any hazard occurs before the first mission

- 1st Scénario: Building not ready in time

Backup facilites : Building 4 for the cabinet (close to Lockheed Martin antennas), or Builder's hut (can be move anywhere on SpaceOps NZ Awarua site)

⇨ All services will need to be available in this backup site if used is confirmed : Energy, Air con, telecom & telemetry (optical fiber), DO access (IP)

- 2nd Scénario: DO (Pointing Designation) not compatible of AWA antennas

Need for CNES to send a transportable antenna to Awarua

⇨ For AGATA antenna: 4x4m concrete/tar location needed to deploy the antenna in AWA

⇨ For AGATA antenna: warning on the wind (antenna to be unmounted if wind above 100km/h)

2.2 WARKWORTH

A visit of the Warkworth facility was made to get informations regarding this second SpaceOps NZ site, witch is more in the north (closed to Auckland) and therefore less optimized for Kuiper mission.

Nevertheless, informations are given in annex regarding both antennas available on site:

- A 12m S+X+C band antenna (WAR12)
- A 30m S+X+C band antenna (WAR30)

3 TABLE OF ACTIONS

Hereunder are the actions listed for both parties:

Action	Bearer	Action	Due Date	Comments
A1	**SpaceOps NZ**	**Completion of the building dedicated to welcome the CNES telemetry kit**	**August 2025**	*If not ready, see A2 to A3*
A2	SpaceOps NZ	Installation of required interfaces into Building 4		*If A1 not available* *Interfaces = power supply, telemetry, telecom, DO link, GPS*
A3	SpaceOps NZ	Installation of required interfaces into technical hut		*If A1 and A2 not available* *Interfaces = power supply, aircon, telemetry, telecom, DO link, GPS*
B1	**SpaceOps NZ**	**Completion of the real time CNES DO compatibility**	**July 2025**	*If not ready, see B2 to B3*
B2	CNES	Analysis of AGATA transportation		*If B1 not available* *Depends on the repair of the antenna*
B2	SpaceOps NZ	Completion of infrastructure to welcome AGATA Antenna		*If B1 not available* *4x4 meter concrete plateform, power supply, S band to optical fiber converter (5 links)*
B3	CNES	Analysis of a Safran Antenna transportation		*If B1 and B2 not available* *Depends on the compatible product available at that time in SAFRAN*
B3	SpaceOps NZ	Completion of infrastructure to welcome SAFRAN Antenna		*If B1 and B2 not available* *Depends of the SAFRAN antenna architecture*
B4	CNES	Analysis of an OTR transportation		*If B1, B2 and B3 not available* *To be checked if antenna still available*
B4	SpaceOps NZ	Completion of infrastructure to welcome OTR Antenna		
C1	**CNES**	**ATA carnet completion**	**August 2025**	*To be organized with NZ customs broker (NJ CRISP)*

4 ANNEX

4.1 AWARUA

4.1.1 ANTENNA DESCRIPTION

4.1.1.1 AWA4 ANTENNA

Long : 168.38034°
Lat : -46.52845°
Alt : 11.4m

Model : Cossor C.R.353D Frame

Tracking : DO only

Telemetry : LHCP & RHCP
S Band

Diameter: 3.7m
3dB beam: 2.7°
G/T: 13.5 dB/K

Deflection : AZ = -180° to +540°
EL = 0° to +180°

Max speed : AZ = 20 °/s
EL = 5 °/s

AWA4 Antenna in Awarua SpaceOps NZ facilities

The AWA4 antenna is made with a pedestal of 1962 that was initialy a S band meteorological radar (Cossor CR 353) used for windfinding by tracking passive corner reflectors attached to ballons, or for direct weather observation by the fitting of a suitable display unit. It can support very strong winds (up to 200km/h).

All the servo drive and servo control unit has been changed in 2023 into Beckhoff equipments (ax5000). SpaceOps NZ has made the programmation of the servo drive and the control unit, so is totally autonomous in software optimization of the servo drives parameters and in the configuration of the antenna control unit.

- ⇨ The upgrade of the ACU to implementant the real time antenna pointing (DO) provided by the CNES DO laptop, will be done by SpaceOps NZ Team. A CNES DO laptop and DO simulators were left to SpaceOps NZ during this mission, in order for SpaceOps NZ to be autonomous to implemeant ant test the real time DO solution.

The 3.7m reflector has also been changed in 2023, and is optimsed for S band telemetry

- ⇨ G/T of AWA4 is 13.5dBK while G/T of AWA1 antenna is 12dBK due to a reflector designed for S+X band.

4.1.1.2 AWA1 ANTENNE

Long :	**168.38121°**
Lat :	**-46.52867°**
Alt :	**11.4m**
Model :	**Cossor C.R.353D Frame**
Tracking :	**DO only**
Telemetry :	**LHCP & RHCP** **S Band, X Band**
Diameter:	**3.7m**
3dB beam:	**2.7°**
G/T:	**12 dB/K**
Deflection :	**AZ = -180° to +540°** **EL = 4° to +176°**
Max speed :	**AZ = 20 °/s** **EL = 5 °/s**

AWA1 Antenna in Awarua SpaceOps NZ facilities

Another similar S band antenna is available on site in case of an AWA4 failure. It does have the same pedestal than AWA4, only the following limitations has to be noticed :

1) Reflector is less optimsed for S band, due to its use dedicated for S and X band (G/T of 12dB/K for AWA1, instead of 13.5dB/K for AWA4).
2) Antenna cannot go under 4° elevation, due to its square support that avoid the reflector to go under this limitation (AWA4 has a circular support that do allow elevation to go lower and reach 0°)

Because of this limitation in elevation, AWA1 cannot be considered to be AWA4 backup in case of failure for the expected Kuiper missions, every events that needs to be checked being under 4° elevation (see Kuiper analysis at the end of the document).

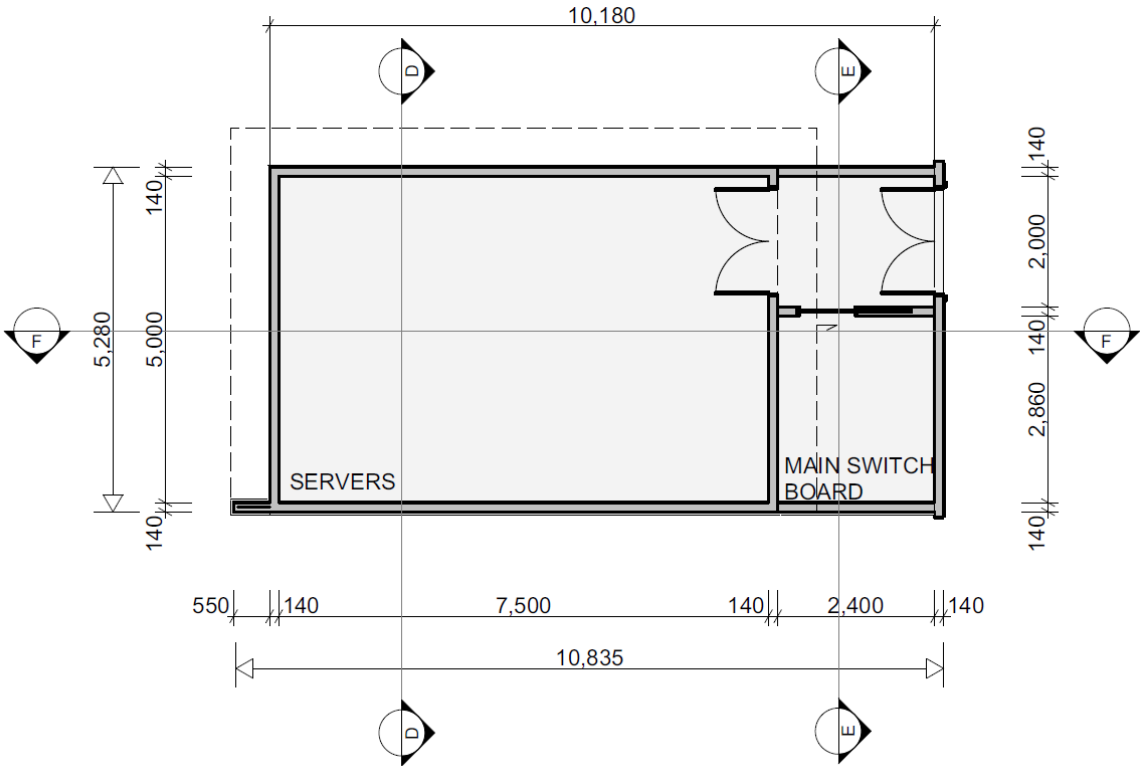
SpaceOps NZ is investigating the possibility of rebuilding the antenna mount so that it can accommodate elevations to 0°. This would unlikely to be ready before mid-2026.

4.1.2 FACILITIES

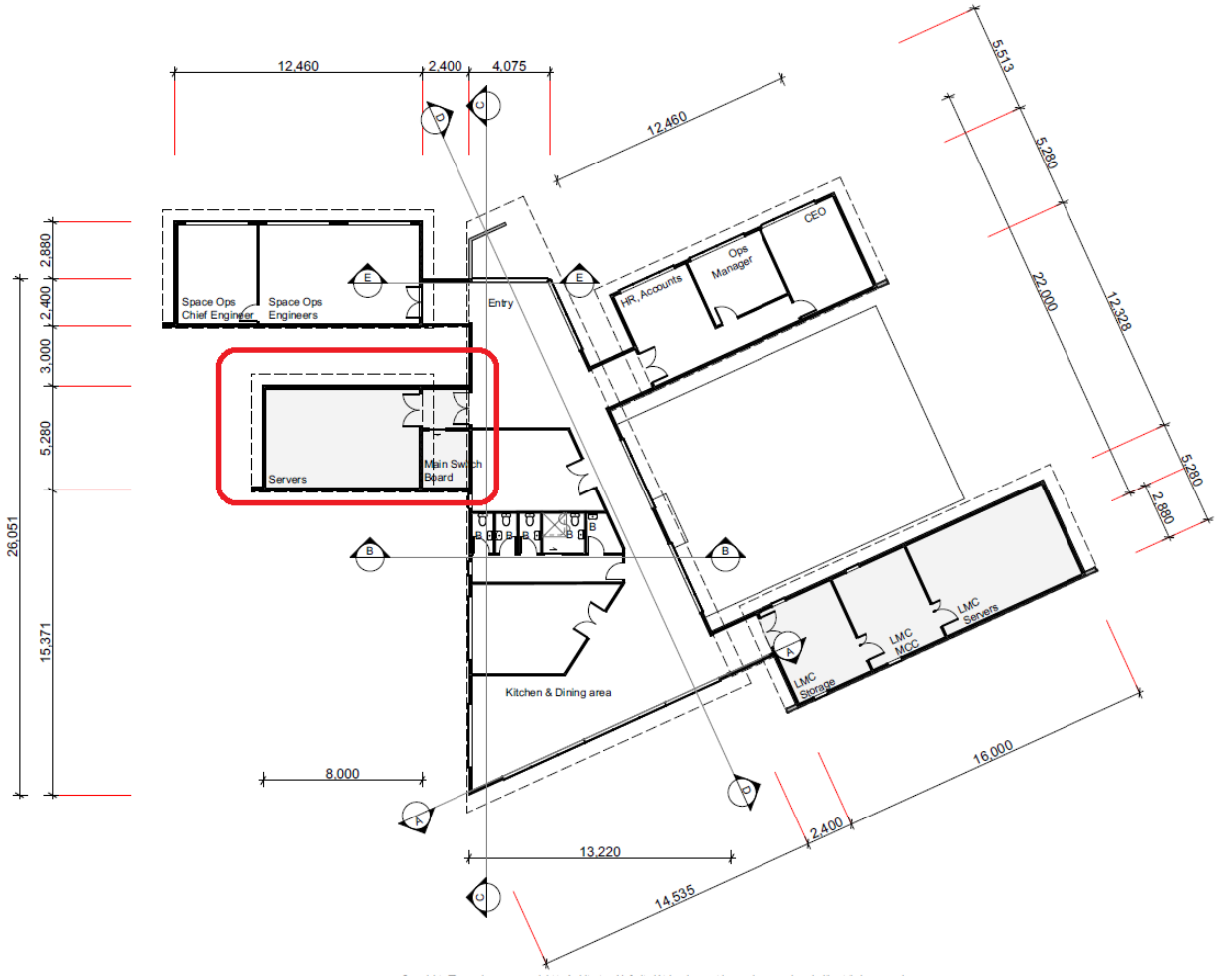
4.1.2.1 TECHNICAL FACILITIES

The new SpaceOps NZ building expected to welcome the telemetry kit is still under construction at the date of the survey (may 2025). It is scheduled to be deliver by August 2025.

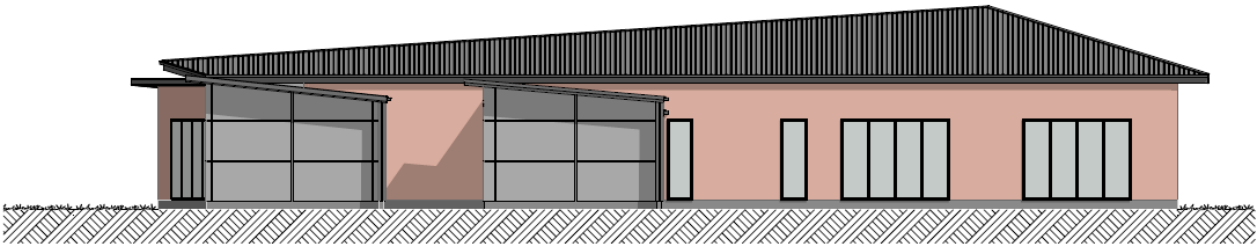
Construction site of the new SpaceOps NZ Building (May 2025)



Room dedicated to customers equipments, where the telemetry kit should be deployed in September 2025 (scale in mm). A garage will be available for cranes and spare equipments.



Position of the server room in the new Building



West view of the building

In the event the main building would not be ready in September to welcome the telemetry kit, 2 backups solutions had been identified on site:

- 1st backup: a technical mobile hut, that can be moved any where on the SpaceOps NZ site

- Pros : CNES dedicated space, one side with desk for Setters local supervision, other side for telemetry racks, double door (86cm to 176cm) to ease the installation of the racks.
- Cons: Servitudes and interfaces needs to be implemented by SpaceOps NZ (energy, air con, optical fiber for telecom and telemetry, Ethernet for DO)

- 2nd backup: a technical fixed container, close to Lockheed Martin facilities (Bat 4)

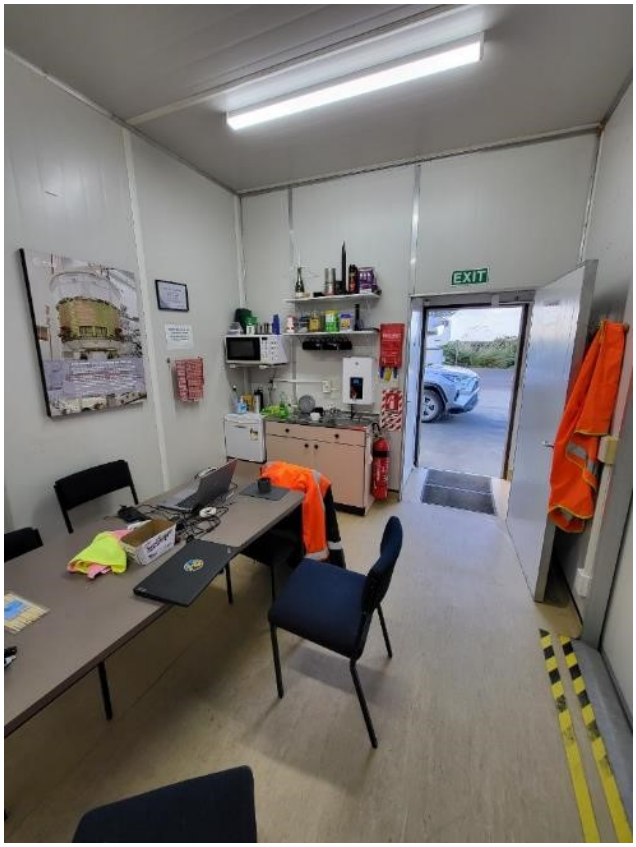
Empty rack, available for spare equipments

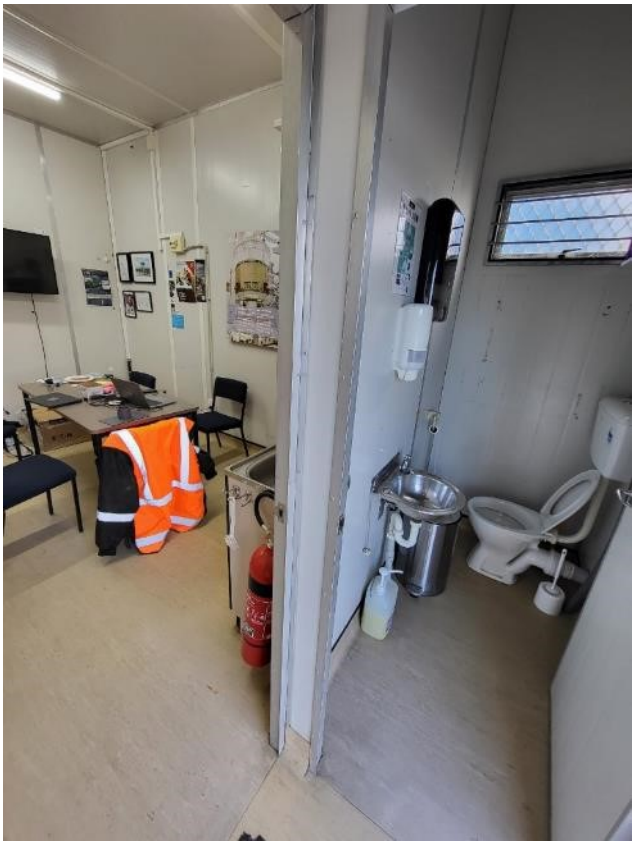
2 empty cabinets, to be removed

- Pros : Servitudes already installed (energy, air con)
- Cons: Interfaces needs to be implemented by SpaceOps NZ (optical fiber for telecom and telemetry, Ethernet for DO), shared space, little place for the Setters local supervision desk, simple door (86cm)

4.1.2.2 REST FACILITIES

The new building will provide facilities for installation team (rest rooms & toilets).
If not ready, the actuel main building (Bat 1) is equipped with a toilet and a equipped rest room (microwave/fridge/sink).



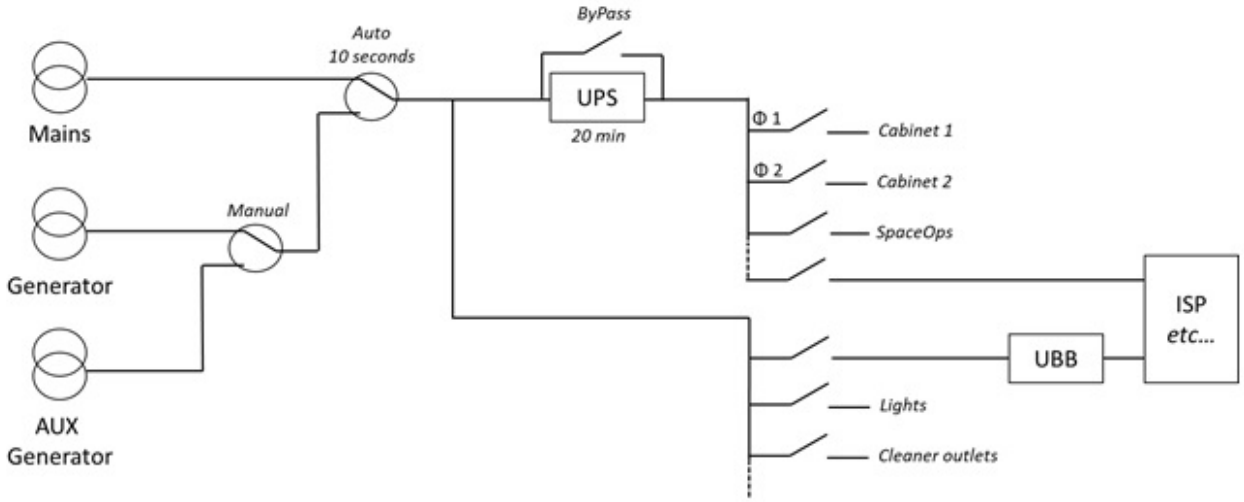


4.1.3 POWER SUPPLY

The power supply in New Zealand is similar to the one in France (230V per phase, 50Hz). Only the outlets are differents (I type).

Type I outlet available in New Zealand

The actual backup power supply on Awarua site is ensure by a UPS able to provide 20 minutes of power for the whole site in case of an energy failure. The site is also equipped with a generator that turns on 10 seconds after the energy failure.



For the first launch, the actual configuration will be used, until a new generator and UPS dedicated to the new building should be implemented.

The distribution in the new building for the CNES telemetry cabinets should be wired as described hereunder:

- One of the 3 phases UPS power supply will be connected to the CNES main chain PDU, threw a dedicated 16A breaker
- Another phase of the 3 phases UPS power supply will be connected to the CNES backup chain PDU, threw a dedicated 16A breaker

All the wiring will be done threw ladder racks, located above the cabinets.

2 outlets will be available close to the CNES cabinet

SpaceOps NZ will provide 2 I type plugs, to be wired by CNES to both PDU power cable.

4.1.4 TELEMETRY

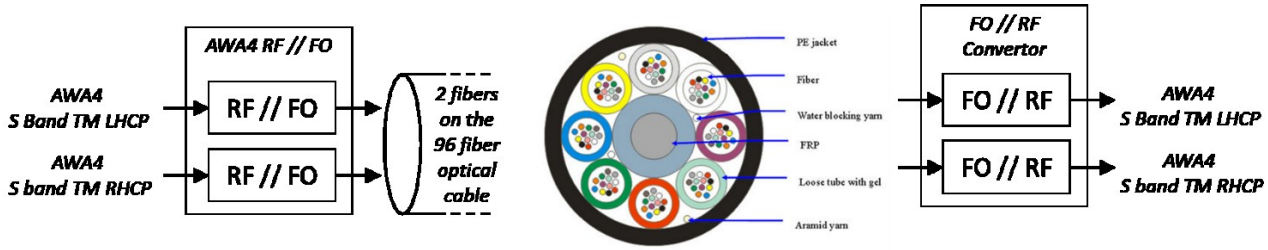
4.1.4.1 DOWNLINK

A S band to optical fiber converter is located inside the AWA4 pedestal, allowing to dispose of LHCP and RHCP telemetry anywhere on Awarua SpaceOps NZ site threw an optical cable.

The 96 fiber optical cable, already available on site, will have 2 of its fibers dedicated for AWA4 LHCP and RHCP telemetry.

This configuration allows the CNES telemetry kit to be located anywhere on site, and still dispose of the telemetry without any degradation of the RF performances.

An optical to S band converter will be installed by SpaceOps NZ close to the telemetry kit. Two S band cables will be wired by SpaceOps NZ, to provide the LHCP and RHCP S band signal on N connectors located near the telemetry kit (ready to be wired to the CNES interface panel).



4.1.4.2 UPLINK

No long loop is actually available for AWA4. SpaceOps NZ will study if a solution would be possible to implement (option not mandatory).

- A solution using couplers on telemetry downlinks close to the feed has been considered, but involve a wiring intervention to configure either a long loop or an emission configuration
- Another solution would be to use a test horn
- A collimation tower that could emit RF coming from the telemetry kit (threw optical fiber) would also fit (no boresight actually deployed)

4.1.5 TELECOM LINKS

As for the telemetry, one fiber of the 96F optical cable already available on site, will be dedicated to the nominal telecom link. A second fibre cable using a diverse route is expected to be commissioned in the next few months. At present, a microwave link provides route diversity, with speeds of up to 100 Mbps.

For the first launch, another fiber of the same cable will be used for the backup telecom link if the second fibre route has not been commissioned.

⇨ In case of a failure on the FO, the telecom link will switch to a microwave backup (100 Mbps).

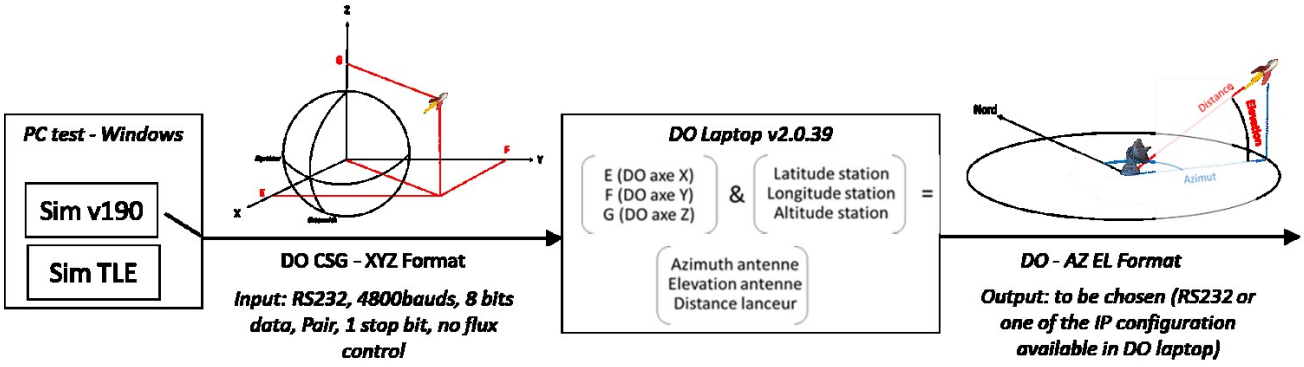
4.1.6 POINTING DESIGNATION

During the site survey, a DO laptop v2.0.39 was brought in order to check the DO compatibility of Awarua Antenna.

The Awarua AWA4 antenna is actually not equipped to treat pointing designation in real time (only TLE or local command mode are available).

An implementation of the AWA4 server is therefor needed, in order the AWA4 antenna to be compliant with real time pointing designation (DO).

The DO laptop was therefor left to SpaceOps NZ team, with 2 simulators (DO from flight v190 + DO simulator from TLE), and were shown how to use simulators and DO laptop.



Because the serial output of the DO laptop may not be used, due to the position of the DO laptop regarding the AWA4 server (RS232 protocol not compatible with long distances), the existing IP protocol available in the DO laptop will be analyse by SpaceOps NZ, in order to identify an existing protocol that will be used (documentation regarding the differents IP protocol of the DO laptop was given by CNES to SpaceOps NZ).

Important: No tracking mode is available on AWA4 nor AWA1 (DO only)

A tracking by conical scan may be implemented by SpaceOps NZ, but should only fit geostationary pointing requirement (not suited for moving target).

4.1.7 AWA4 LOG REQUIREMENT

In order to dispose of the real AWA4 position in AZ and EL, regarding the DO position in AZ and EL, the following requirement has been made in order to dispose of an antenna log after each launch with the same format

If a record of the acquired signal on both TMO frequencies could be made in adition (optional) this could help for some launch analysis.

A 100ms time resolution for the antenna log would be sufficient.

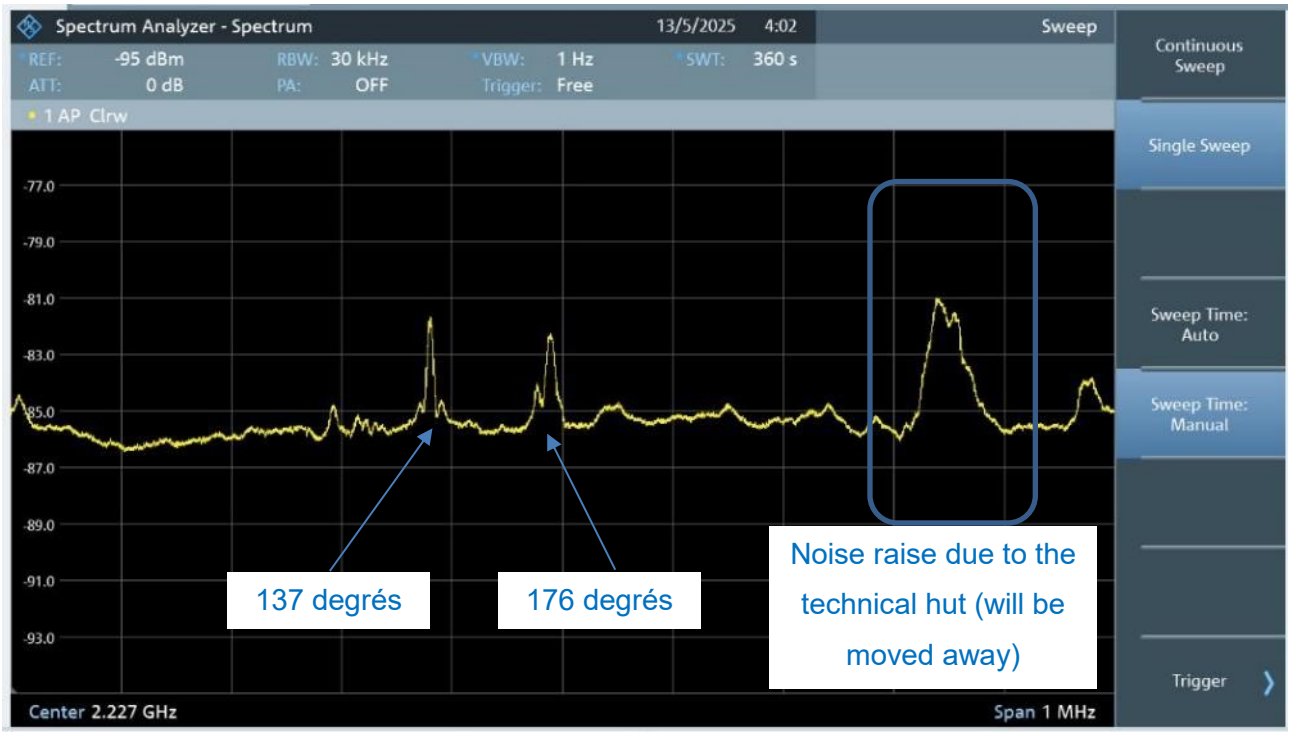
TU (HH.MM.SS.000)	DO AZ (°)	DO EL (°)	DA AZ (°)	DA EL (°)	F1 Level (CAG or dBm)	F2 Level (CAG or dBm)
21:50:23.128	127.45	23.65	127.45	23.62	-45.6	-23.4
21:50:23.228	127.45	23.68	127.45	23.65	-45.4	-23.7
21:50:23.328	127.46	23.71	127.45	23.68	-45.4	-24.1
…	…	…	…	…		

4.1.8 RF HORIZON MEASUREMENT

2 measurement (TMO F1=2218MHz and TMO F2=2227MHz) were made with AWA4 antenna, on LHCP telemetry downlink, at 0° elevation while moving antenna from 0° to 360° in azimuth.

2 signal could be noticed at 137° and 176°, so with no impact on the 3 Kuiper trajectories.

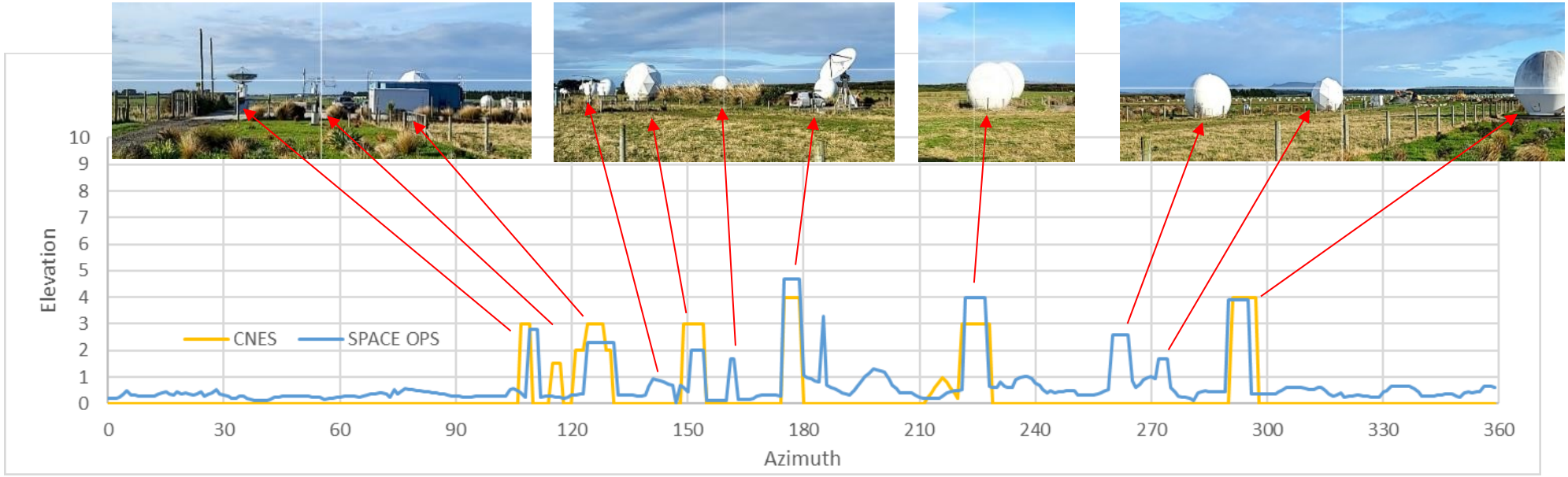
TMO F1 LHCP Measurement



TMO F2 LHCP Measurement

4.1.9 CONFIRMATION OF PROVIDED MASK

The mask was quickly checked during this mission, in order to confirm the main elements of mask provided by SpaceOps NZ and available in the CNES station catalog v1.13:



⇨ *All the element given last year are considered to be still accurate*

4.2 WARKWORTH

4.2.1 WARK12 ANTENNA

4.2.1.1 ANTENNA DESCRIPTION

Long :	**174.663194°**
Lat :	**-36.434844°**
Alt :	**82m**
Model :	
Tracking :	**DO only**
Telemetry :	**LHCP & RHCP** **S Band, X Band**
Diameter:	**12m**
3dB beam:	**0.8°**
G/T:	**>25.0 dB/K**
Deflection :	**AZ = -180° to +540°** **EL = 4° to +90°**
Max speed :	**AZ = 10 °/s** **EL = 10 °/s**

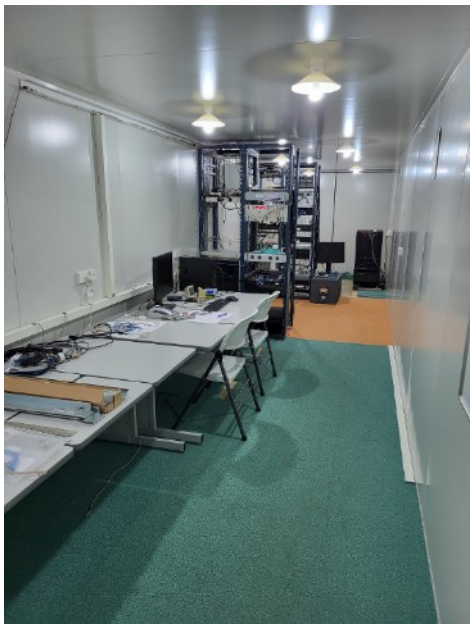
Warkworth-12m antenna in Warkworth SpaceOps NZ facilities

The WARK12 antenna is a Cobham-Patriot S/X band 12m antenna from 2008. It was build from a Patriot missile launcher that was converted into a telemetry antenna.

The specific architecture of the antenna remains of a geostationary antenna, however the pedestal is capable of high speed on both axis (Azimuth 10°/s, Elevation 10°/s)

SpaceOps NZ bought this antenna 2 years ago and has since taken in charge the programmation of the servo drives and the antenna control unit (Emerson), so is once again totally autonomous in software optimization of the servo drives parameters and in the configuration of the antenna control unit.

4.2.1.2 FACILITIES



A 40 feet technical container is located near the antenna to welcome telemetry equipment. The telemetry link between the antenna and the container is in S band (a S band to optical fiber convertor is then located inside the container).

Aircon and power supply are available. A generator is close to the container, dedicated to the 12m facilitie backup power supply.

A hydrogen clock (10^{-14}s at T=10s accuracy) is inside the container, and IRIG-B signal is provided.

A specific development would be needed in order for the antenna to be able to treat DO pointing positions coming from the CNES DO laptop. Because SpaceOps NZ is in charge of the ACU and servo drive programming, they should be autonomous to do so in case the CNES would require the use of this antenna.

4.2.2 WARK30 ANTENNA

4.2.2.1 ANTENNA DESCRIPTION

Long :	**174.66293°**
Lat :	**-36.433277°**
Alt :	**69m**
Model :	
Tracking :	**DO only**
Telemetry :	**LHCP & RHCP** **S Band, C Band, X Band**
Diameter:	**30m**
3dB beam:	**0.3°**
G/T:	**30 dB/K**
Deflection :	**AZ = -180° to +540°** **EL = 4° to +90°**
Max speed :	**AZ = 10 °/s** **EL = 10 °/s**

Warkworth-30m antenna in Warkworth SpaceOps NZ facilities

Another S band antenna is available on site, a 30 meter 3 bands antenna (S, X and L) built in 1984. SpaceOps NZ bought it 2 years ago, and had since change the whole feed structure in order to make it compliant with their required frequencies, and also to optimize the RF performances.

The antenna dispose of 2 motors per axis in order to improve the pointing accuracy by canceling the gear incertainty.

SpaceOps NZ has taken in charge the programmation of servo drives and antenna control unit (Emerson), so is once again autonomous in software optimization of the servo drives parameters and in the configuration of the antenna control unit.

4.2.2.2 FACILITIES

A technical room is located under the antenna to welcome telemetry equipment. An S band to optical fiber convertor is located directly under the antenna.

Aircon and power supply are available.

ACU and servo drive are similar to the ones of the 12m antenna, allowing SpaceOps NZ to dispose of some common elements between both antenna. Once again SpaceOps NZ is autonomous in configuring the servo drives and ACU regarding their requirements.

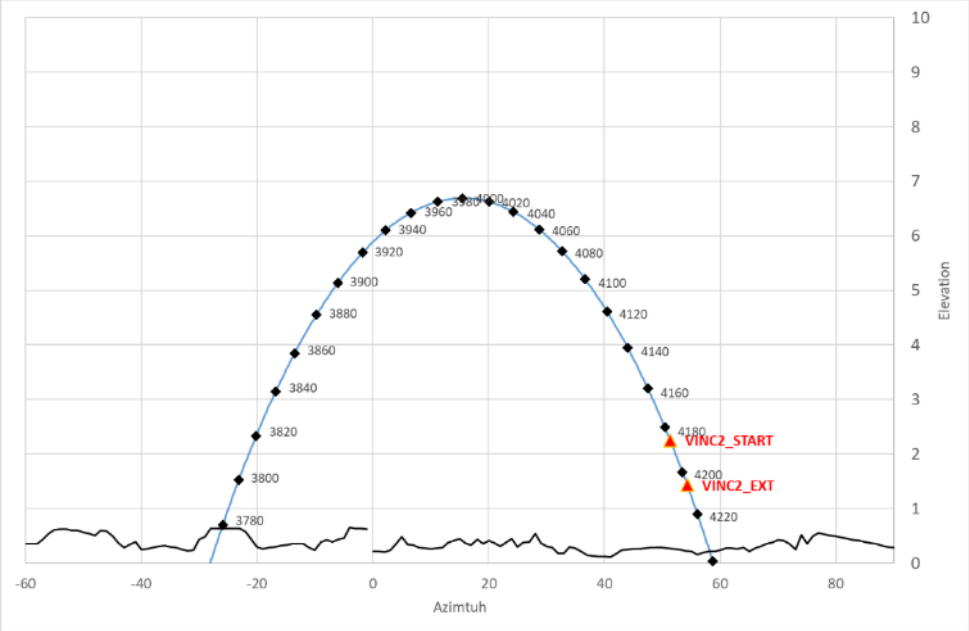
4.3 KUIPPER VISIBILITIES

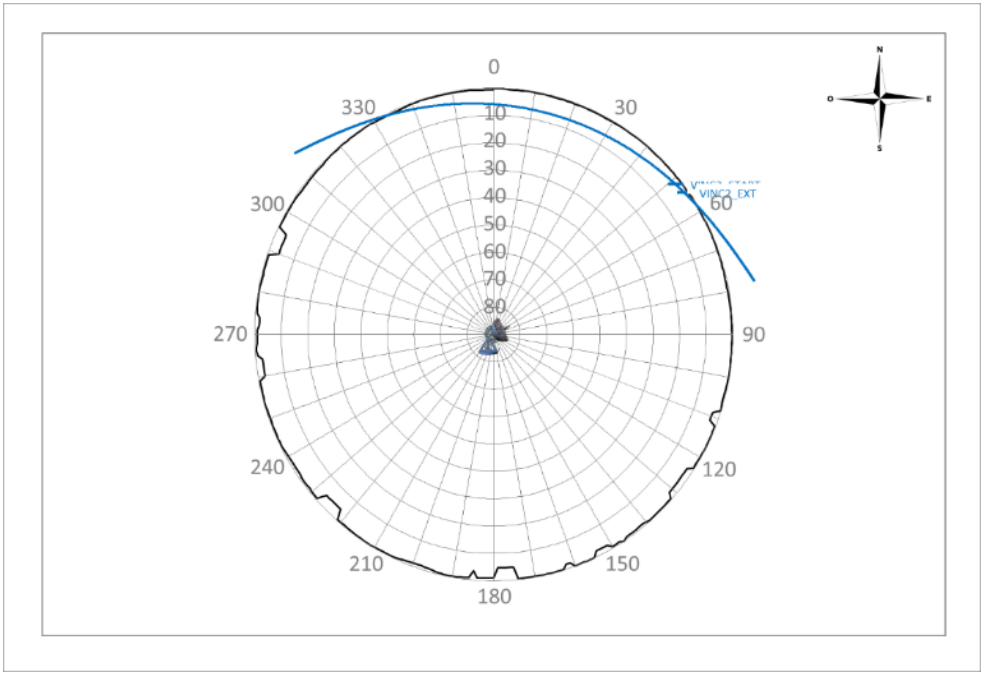
4.3.1 AWARUA (AWA4)

4.3.1.1 AWA4 - INCLINAISON 33° (FICHIER : HLEO_I33_AES)

TD (s)	EVT	EL (°)	AZ (°)	Distance (km)
3763	EL > 0°	0	-28.3	2432.6
3779	AOS GEO	0.6	-26.2	2363.0
4000	EL MAX	6.7	15.2	1840.2
4186.2	**VINC2_START**	**2.3**	51.3	2251.3
4207.4	**VINC2_EXT**	**1.5**	54.2	2332.4
4237	LOS GEO	0.2	58.1	2463.9
4241	EL < 0°	0	58.6	2482.2

Max speed :
AZ = 0.22 °
EL = 0.04°

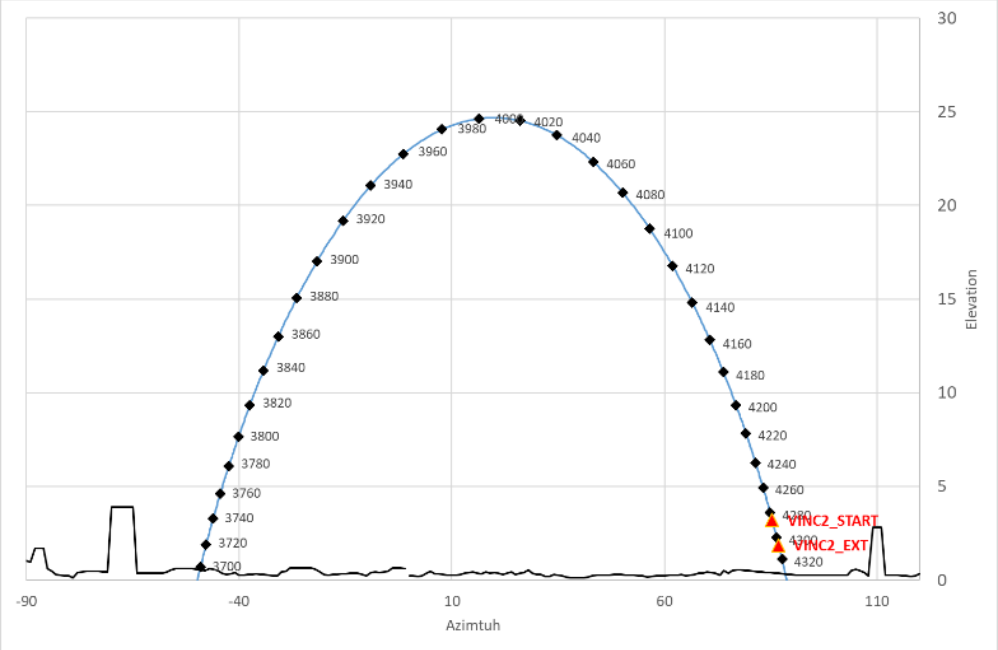


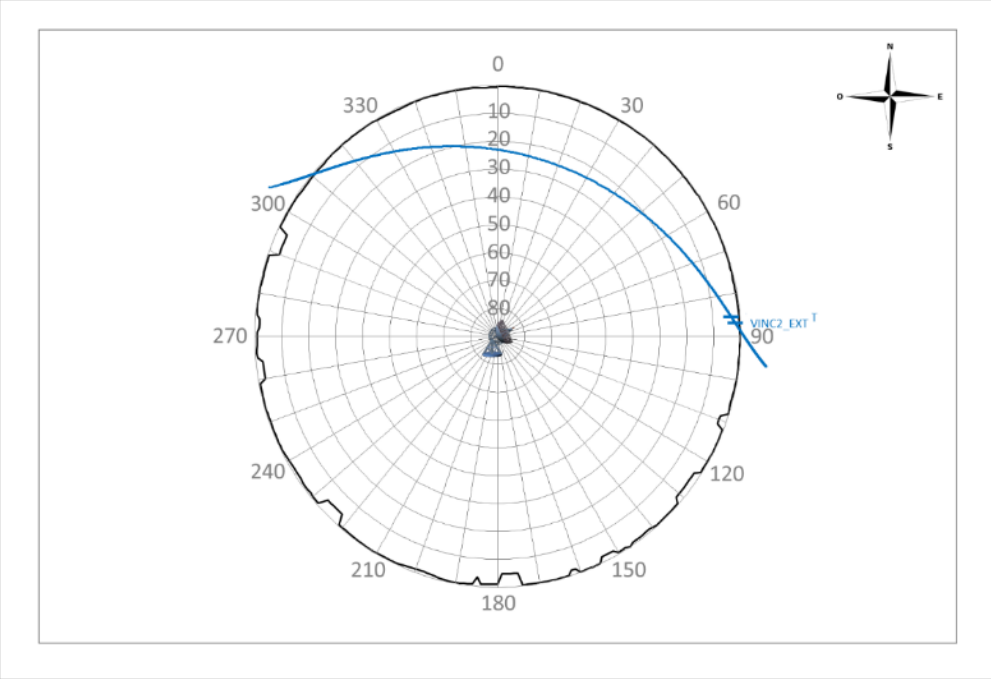


4.3.1.2 AWA4 - INCLINAISON 42° (FICHIER : HLEO_I42_AES)

TD (s)	EVT	EL (°)	AZ (°)	Distance (km)
3689	EL > 0°	0	-49.9	2400.0
3699	AOS GEO	0.5	-49.2	2337.3
4007	EL MAX	24.7	19.2	972.0
4286.5	**VINC2_START**	**3.3**	85.3	2165.6
4307.5	**VINC2_EXT**	**1.9**	86.8	2301.8
4334	LOS GEO	0.3	88.4	2465.9
4339	EL < 0°	0	88.7	2497.6

Max speed :
AZ = 0.47 °
EL = 0.10°

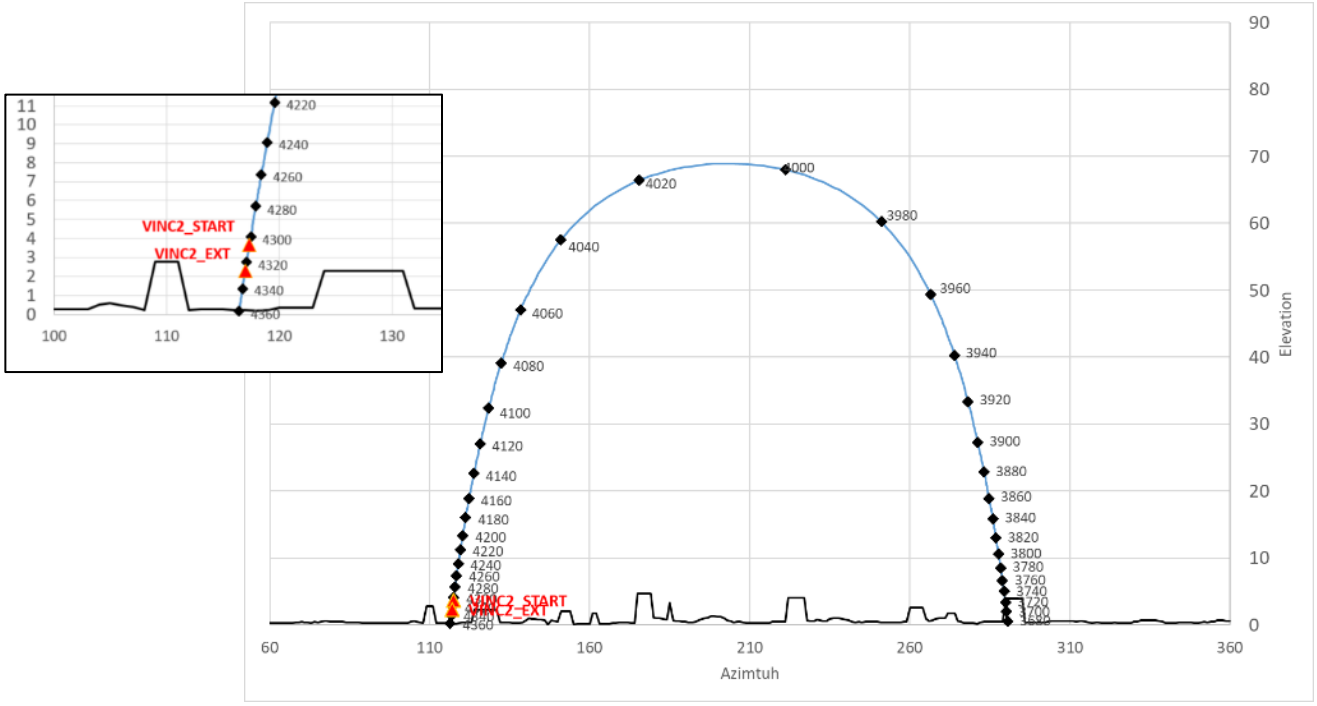


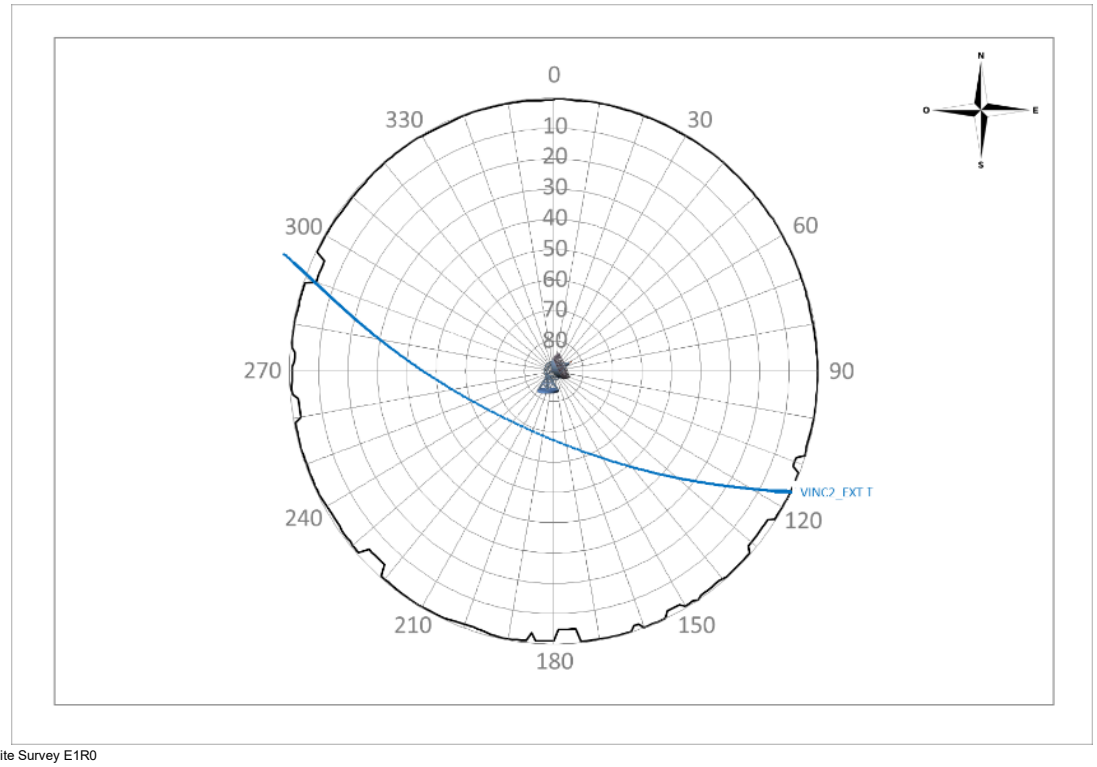


4.3.1.3 AWA4 - INCLINAISON 51.9° (FICHIER : HLEO_I51-9_AES)

TD (s)	EVT	EL (°)	AZ (°)	Distance (km)
3671	EL > 0°	0	-69.2	2397.1
3714	AOS GEO	2.9	-70.0	2107.3
4008	EL MAX	68.9	-154.6	497.4
4307.1	**VINC2_START**	**3.7**	117.3	2140.5
4327.6	**VINC2_EXT**	**2.4**	117.0	2268.2
4359	LOS GEO	0.3	116.5	2484.9
4362	EL < 0°	0	116.4	2505.2

Max speed :
AZ = 2.32 °
EL = 0.53°



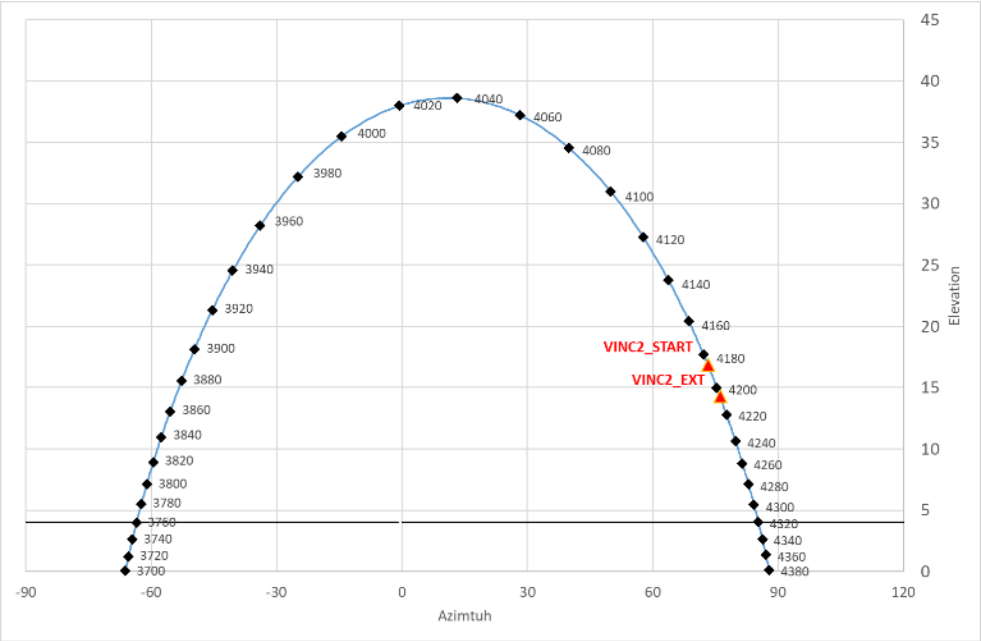


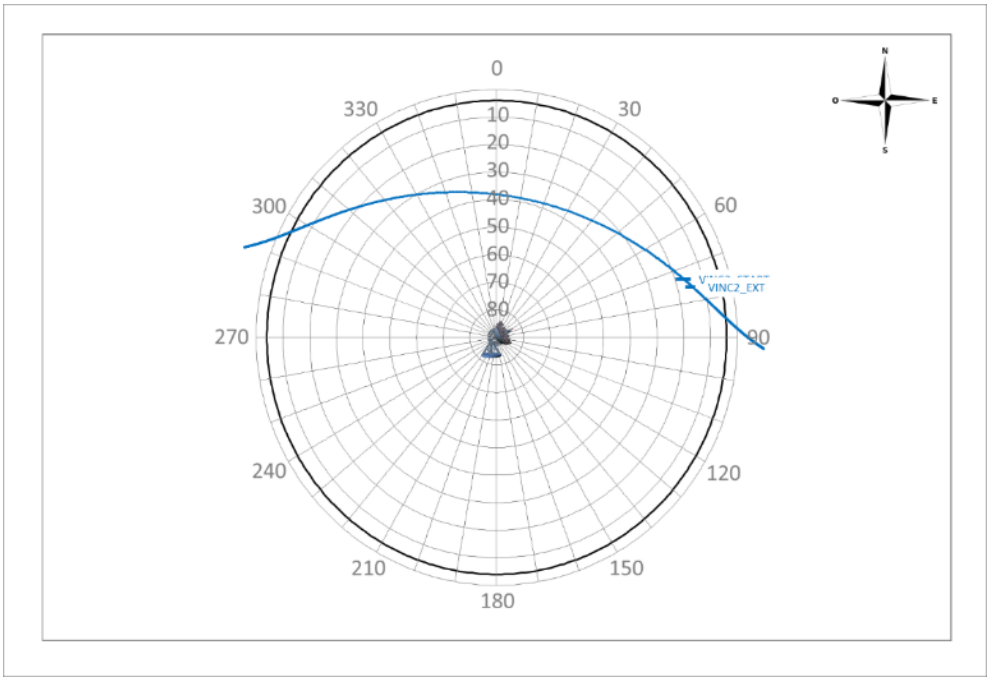
4.3.2 WARKWORTH (WAR12)

4.3.2.1 WAR12 - INCLINAISON 33° (FICHIER : HLEO_I33_AES)

TD (s)	EVT	EL (°)	AZ (°)	Distance (km)
3700	EL > 0°	-0.1	-66.3	2420.8
3761	AOS GEO	4.0	-63.6	2026.6
4037	EL MAX	38.6	10.3	708.9
4186.2	**VINC2_START**	**16.9**	73.1	1251.7
4207.4	**VINC2_EXT**	**14.4**	76.0	1367.6
4321	LOS GEO	4.0	85.3	2082.2
4382	EL < 0°	0.1	87.8	2480.5

Max speed :
AZ = 0.74 °
EL = 0.19°

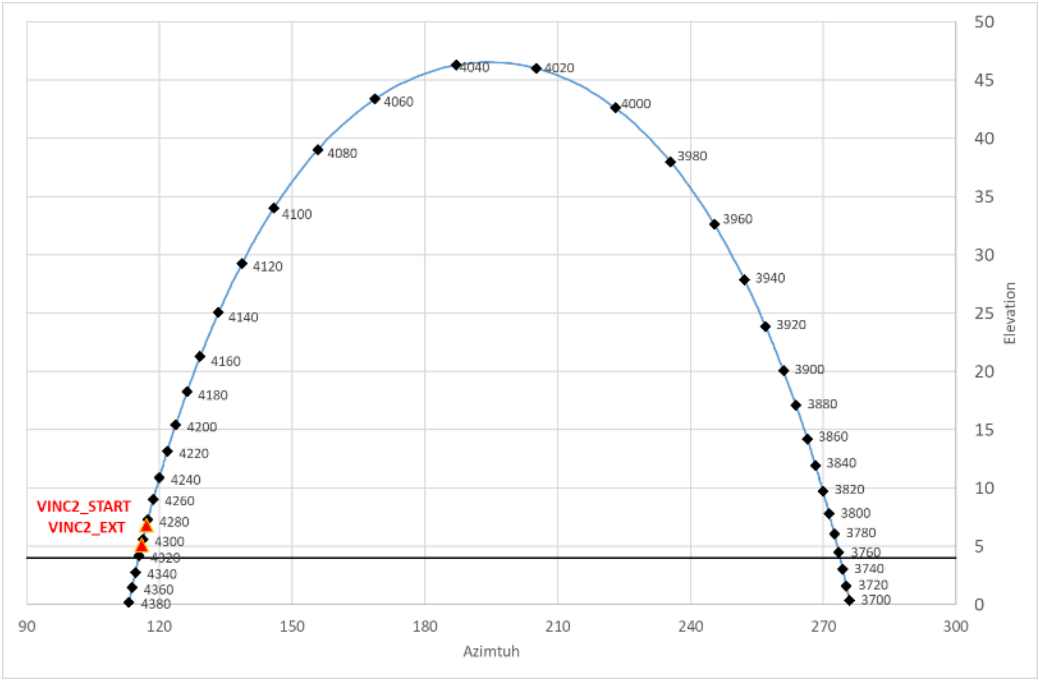


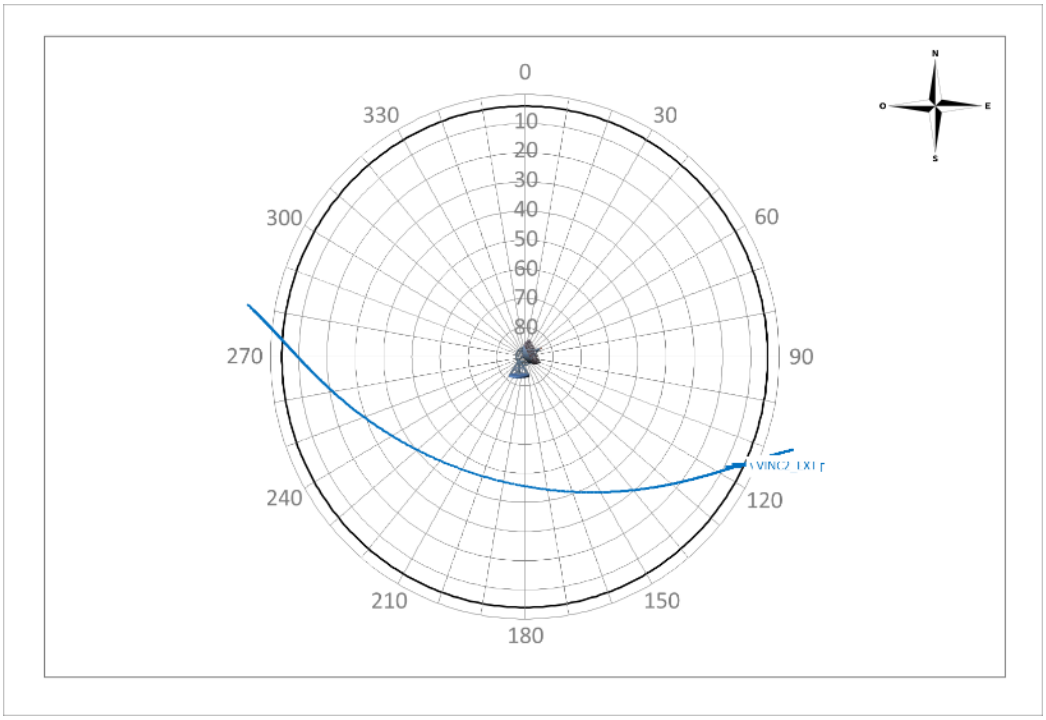


4.3.2.2 WAR12 - INCLINAISON 42° (FICHIER : HLEO_I42_AES)

TD (s)	EVT	EL (°)	AZ (°)	Distance (km)
3695	EL > 0°	-0.1	-83.9	2403.3
3754	AOS GEO	3.9	-86.2	2016.1
4032	EL MAX	46.5	-164.3	621.8
4286.5	**VINC2_START**	**6.9**	117.1	1852.3
4307.5	**VINC2_EXT**	**5.1**	116.0	1994.9
4323	LOS GEO	4.0	115.3	2093.4
4383	EL < 0°	0.1	113.1	2489.9

Max speed :
AZ = 0.96 °
EL = 0.26°

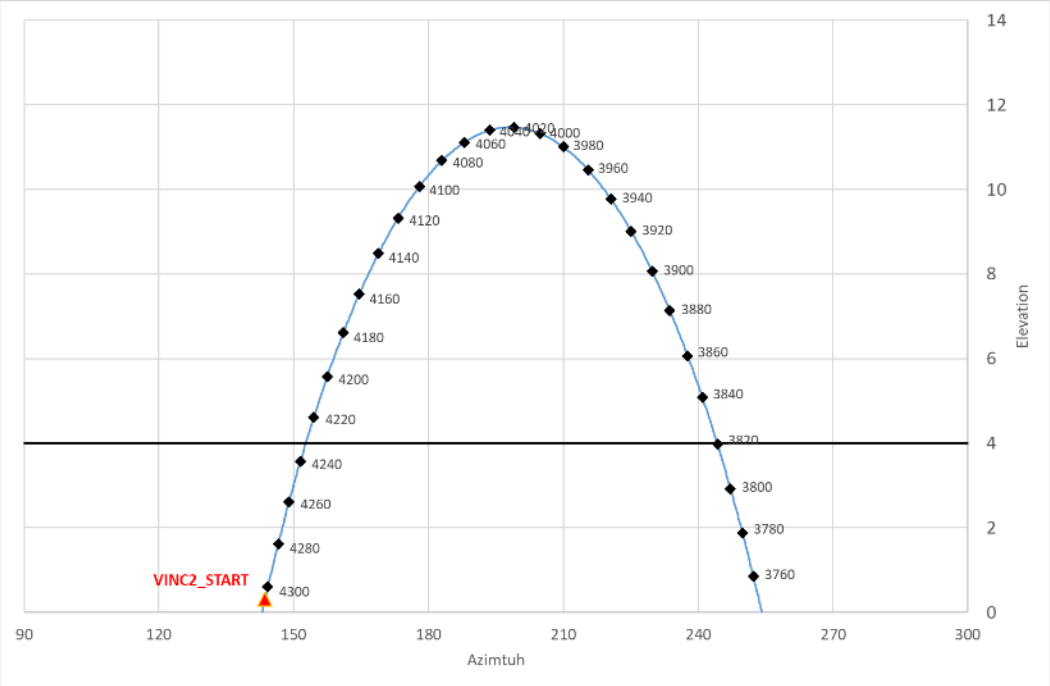


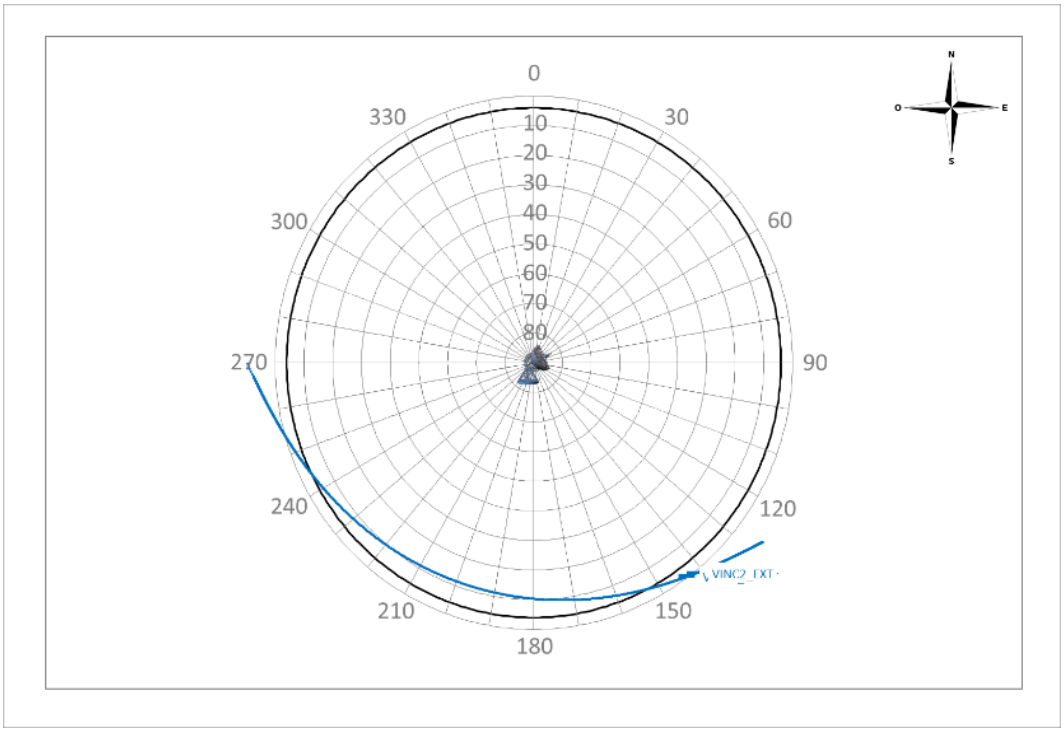


4.3.2.3 WAR12 - INCLINAISON 51.9° (FICHIER : HLEO_I51-9_AES)

TD (s)	EVT	EL (°)	AZ (°)	Distance (km)
3743	EL > 0°	-0.1	-105.7	2421.3
3821	AOS GEO	4.0	-115.7	2036.6
4024	EL MAX	11.5	-161.6	1522.5
4233	LOS GEO	4.0	152.7	2103.9
4307.1	**VINC2_START**	**0.3**	143.6	2480.1
4313	EL < 0°	0.1	143.1	2506.8
4327.6	**VINC2_EXT**	**-0.6**	141.7	2582.5

Max speed :
AZ = 0.28 °
EL = 0.05°





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