EISCAT Scientific Association
Enquiry for
The EISCAT 3D Antenna Unit Installation

Closing date for offers:	**2022-08-01**
The offer should be valid at least until:	2022-10-01

2022-06-15: This enquiry has been updated to add flexibility once the contract is running to allow for changes in manpower needs and resources based on experience from first units installation. The mechanism will be the cost-breakdown calculation that would be the basis for changes to the installation cost. We have also revisited the wording relating to possible price changes due to inflation and extended the enquiry dates.

The updated sections are marked in green.

TABLE OF CONTENT

1 INTRODUCTION

This is the top-level document for this enquiry and describes the scope and requirements for the EISCAT 3D Antenna Unit installations.

1.1 Applicable documents

The following applicable documents are appendixes to this enquiry:

APP1	ALOS 05
APP2	Requirements Answer template
APP3	EISCAT_3D AU Installation Scheme (2022-04)
APP4	Handling of TUs

Note: The appendix document APP3 (EISCAT_3D AU Installation Scheme (2022-04)) is produced by the Chinese Antenna Unit manufacturer. Their installation procedure is based on their access to vehicles and manpower which may not comply to what another contractor has and should therefore be regarded as a guideline rather than a procedure. APP3 provides a good understanding of the required operations and requirements, but which may be achieved by other means/tools/vehicles and procedures.

EISCAT is open to deviations from APP3 if the requirements are fulfilled. Also, the APP3 description of the site conditions may not be completely correct. For any discrepancies, the site descriptions in this document supersedes what is said in APP3.

2 EISCAT AND EISCAT 3D

The EISCAT Scientific Association, "EISCAT" throughout this document, conducts research on the lower, middle, and upper atmosphere and ionosphere using the incoherent scatter radar technique. EISCAT is implementing a project called EISCAT 3D where the final product is a new scientific radar system which will be a next generation incoherent scatter radar capable of providing a 3-dimensional monitoring of the atmosphere and ionosphere. Please visit our homepage for more information, https://www.eiscat.se/.

The EISCAT 3D radar system is designed to investigate how the Earth's atmosphere is coupled to space, but it will also be suitable for a wide range of other scientific targets for e.g space weather forecasts and detecting space debris.

The EISCAT 3D system will consist of three phased-array antenna sites located in the northernmost areas of Finland, Norway and Sweden. The largest site in Norway will consist of 10,000 crossed dipole antenna elements distributed over 109 hexagon shaped Antenna Units (AU) arranged in a honeycomb-structure. The Swedish and Finnish sites are smaller, having 55 and 54 Antenna Units respectively.

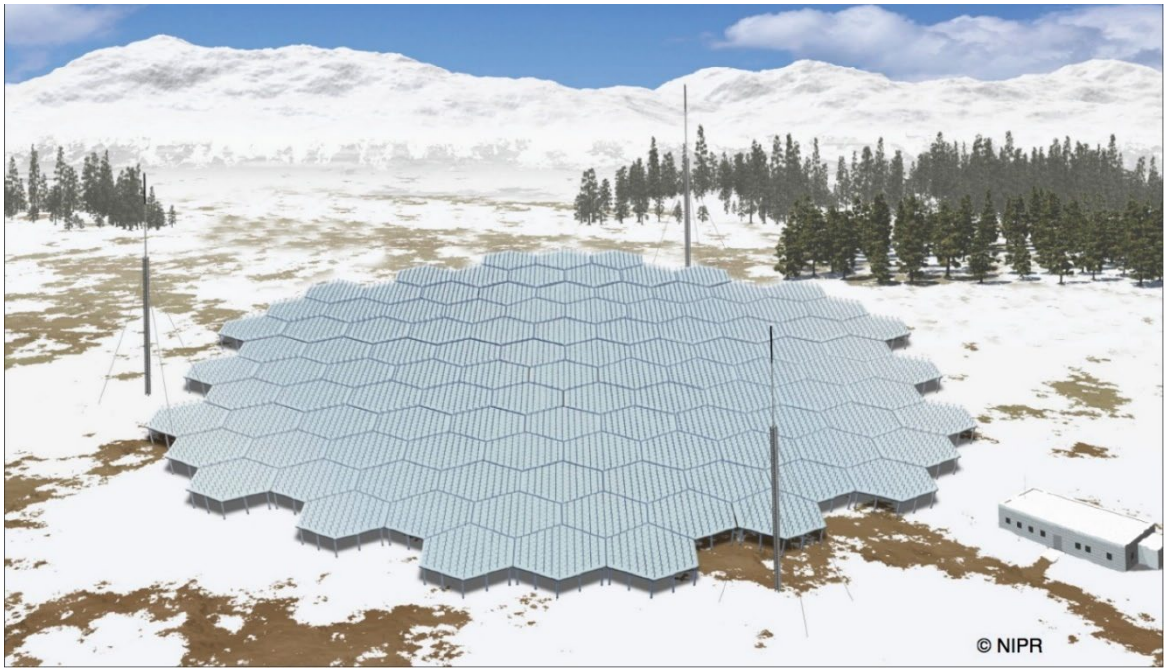

Figure 1. An illustration of the Skibotn EISCAT 3D site having 109 Antenna Units mounted together.

2.1 The EISCAT 3D sites

Once completed, each site mainly consists of a number of Antenna Units (AU), three 30m heigh masts for calibrations and lightning protection, a site building and a garage, as illustrated in Figure 1.

- None of the sites will have the masts installed during the Antenna Unit installations, but the mast foundations are there, as part of the ground preparations.
- All sites will have construction power available.
- Road access to all sites.
- None of the sites have facilities for accommodation, catering, toilets, restrooms etc.

The sites are:

Location	Coordinates (Lat-Long)	Nb. Of AUs	Note	Nearest recycling center
Skibotn, Norway	69.339934° 20.314406° https://goo.gl/maps/RZ4yMyNRJLzHu3cn9	109 + 10	109 AUs in the core, 10 AUs distributed in the close vicinity of the core	1km
Karesuvanto, Finland	68.480567° 22.524091° https://goo.gl/maps/M4HhVZ3KVpbVMM1CA	54	54 AUs in the core	3km
Kaiseniemi, Sweden	68.267101° 19.448069° https://goo.gl/maps/7NZkXtjU7JFeuMg66	55	55 AUs in the core	65km

Table 1. Key details of the EISCAT 3D sites

2.1.1 Skibotn, Norway

The Norwegian site in Skibotn is the main site and the largest in terms of number of Antenna Units. The core consists of 109 Antenna Units and there are 10 single Antenna Units (outriggers) spread out in the close vicinity from the core. All outrigger positions have a road access (dirt roads). See Figure 4 that shows the Outrigger positions relative to the core. Figure 3 shows a drawing of the Skibotn site and how the Antenna Units are arranged in the core. The 55 Antenna Units marked in yellow are the ones that have transmitting capability, the others are receive-only Antenna Units. The transmitting Antenna Units differs slightly from the others in how they are prepared inside the container and needs to be grouped together as

illustrated. This is not a problem from installation point of view but has a logistic impact as one must keep track of those.

TU Storage: Most of the Skibotn Transportable Units will be stored at the staging area, and possibly some in the lower-right corner of the site area if the staging area is not large enough. The Container TUs will be stacked two layers high. This is also where the Outrigger Antenna Unit items will be stored. All stored TUs will require some intermediate handling (lifting and relocation).

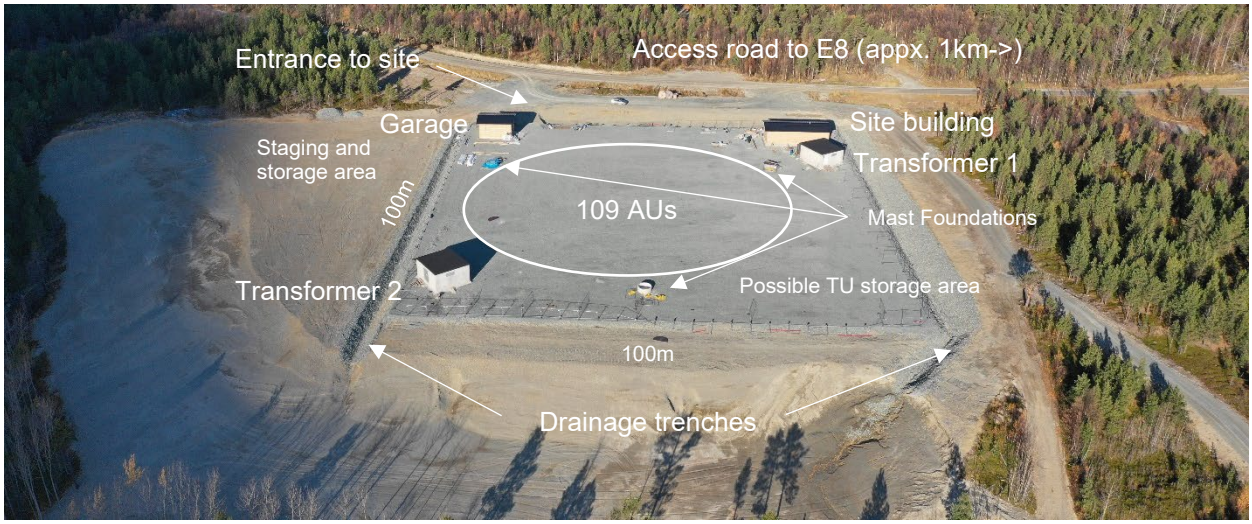

Figure 2. The Norwegian site in Skibotn

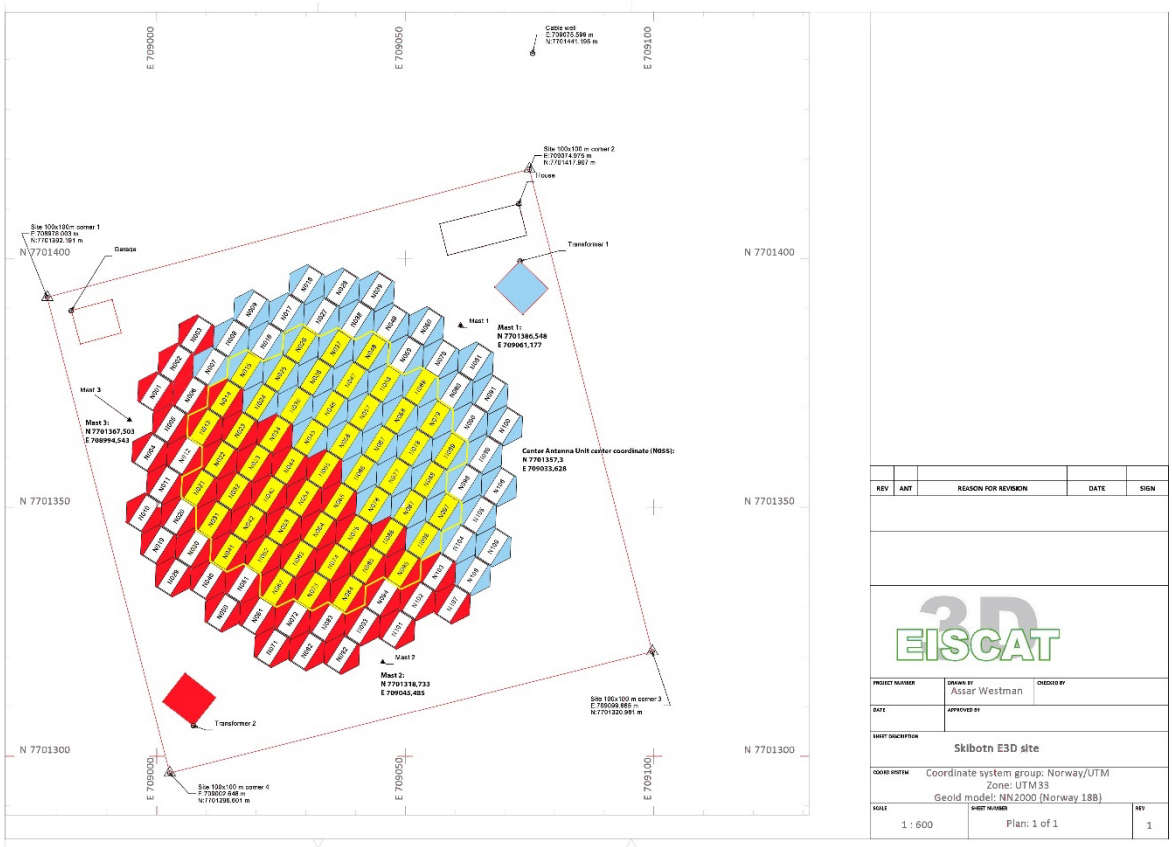

Figure 3. Drawing of the Norwegian site

Figure 4. All Outrigger positions (white circles) relative to the core (red circle)

2.1.2 Karesuvanto, Finland

Due to funding limitations, the number of Antenna Units at the Finnish site in Karesuvanto is limited to 54. This site however is prepared for 109 Antenna Units and are as large as the Norwegian site (100x100m). Figure 6 shows a site drawing with the 54 Antenna Units orientation.

TU Storage: Most of the Karesuvanto Transportable Units will be stored at the staging area, and possibly some in the corners of the site area if the staging area is not large enough. The Container TUs will be stacked two layers high. All stored TUs will require some intermediate handling (lifting and relocation).

Figure 5. The Finnish site in Karesuvanto

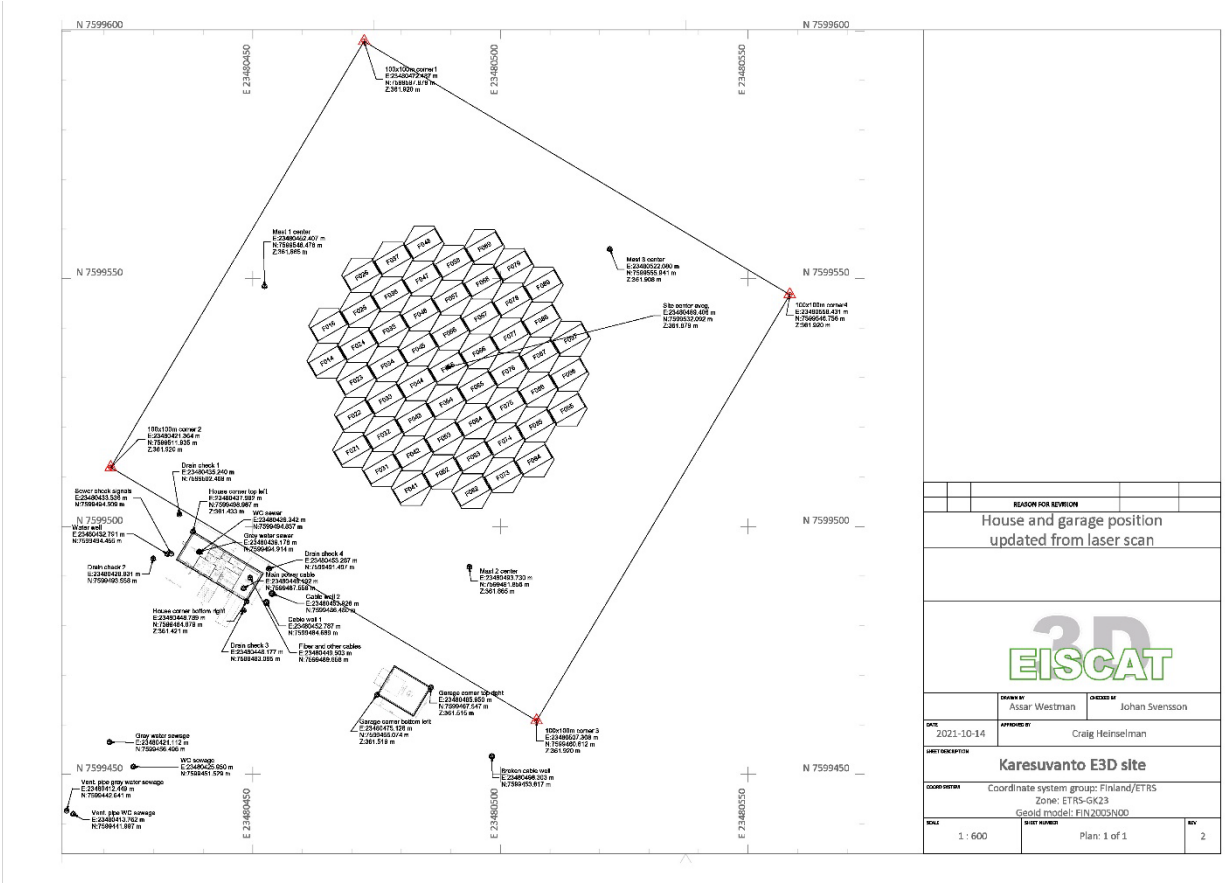

Figure 6. Drawing of the Finnish site

2.1.3 Kaiseniemi, Sweden

Due to funding limitations, the number of Antenna Units at the Swedish site in Kaiseniemi is limited to 55. The site is not fully prepared at the time for this enquiry but will be ready at the time for the Antenna Units installation. The Swedish site design is the same as for the other two, but is slightly smaller, 100 x 90m. Figure 7 shows the site drawing with the 55 Antenna Units orientation.

TU Storage: All the Kaiseniemi Transportable Units will be stored along the edges of the site area (no staging area is available). The Container TUs will be stacked two layers high. All stored TUs will require some intermediate handling (lifting and relocation).

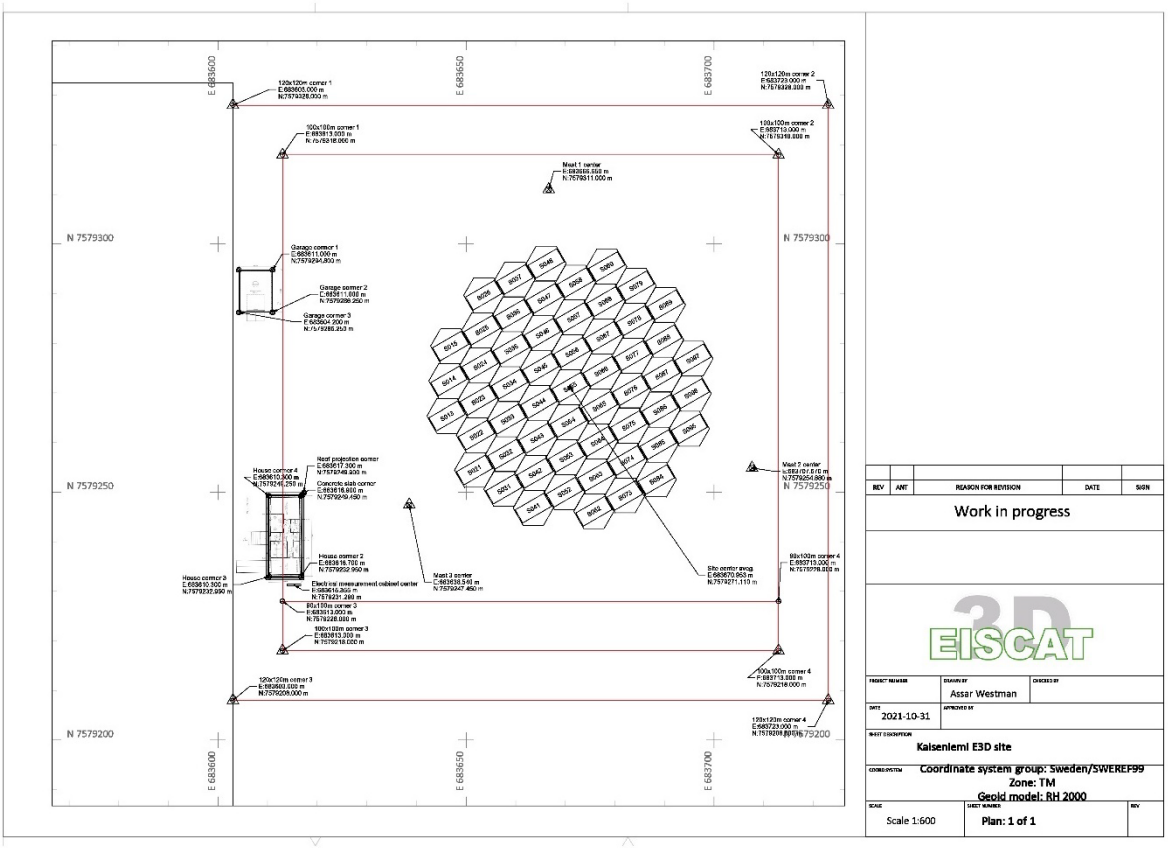

Figure 7. Drawing of the Swedish site

3 THE ANTENNA UNIT (THE AU)

The Antenna Unit is one of the main components in the EISCAT 3D radar system and the subject for this installation enquiry. It is designed and manufactured by a Chinese company (East China Research Institute of and Electronic Engineering - ECRIEE).

The Antenna Unit mainly consists of a 20-foot container, an antenna frame structure and 91 dipole antenna elements.

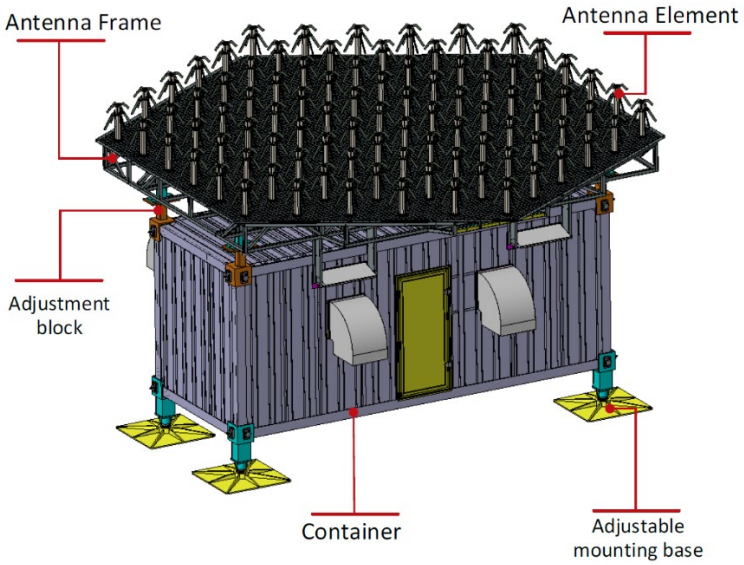

Figure 8. The Antenna Unit

Unit	Dimensions (mm)	Qty	Weight/pc [kg]
Antenna frame	8105×7010×462	1	3000
Antenna element	552×462×462	91	2,5
Adjustment block	500×500×200	4	60
Container	6058×2438×2591	1	4730
Adjustable mounting base	900×900×822	4	100
Array RF Cable		182	1
		Total	**8800 kg**

Table 2. Antenna Unit key properties

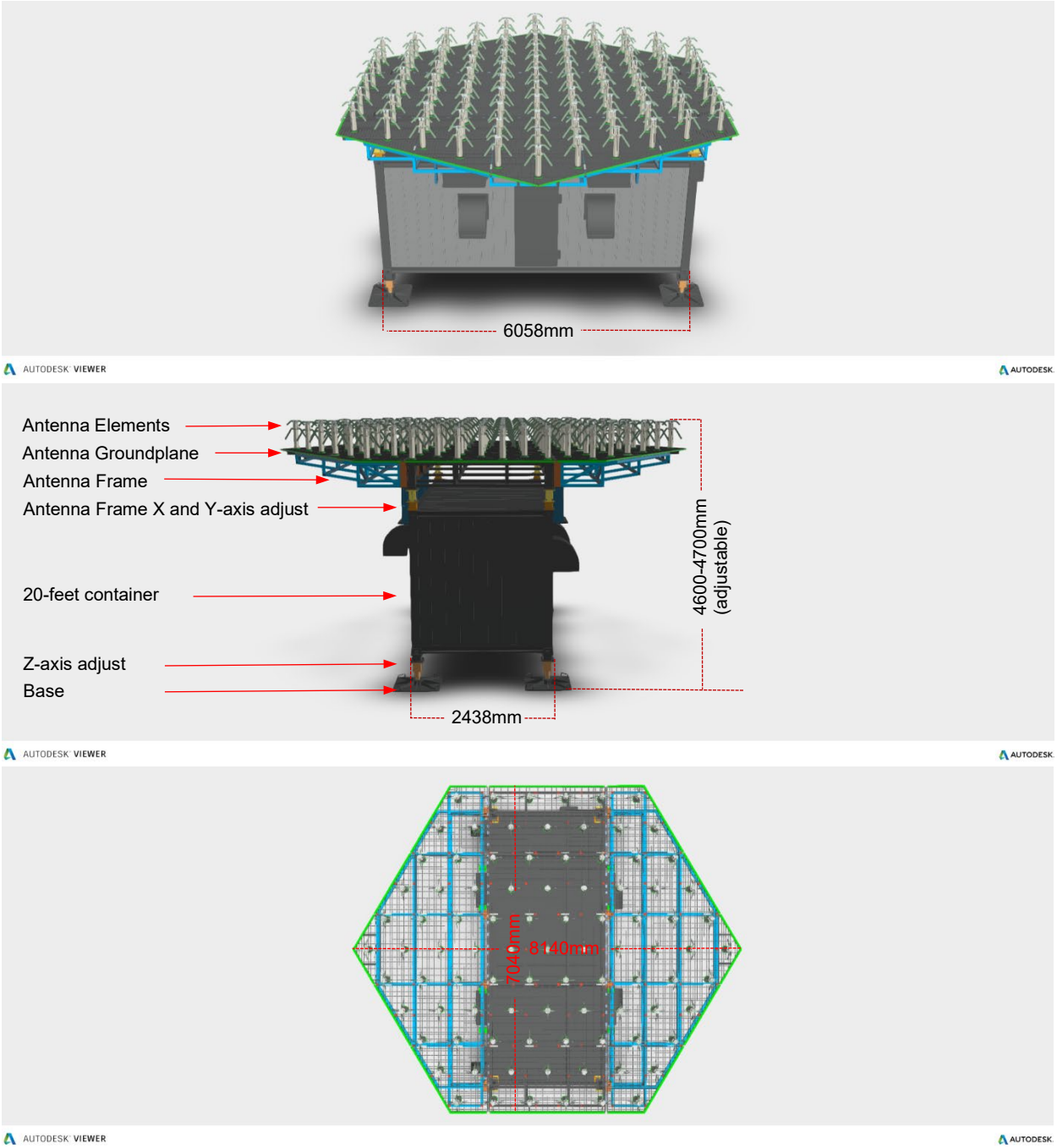

Figure 9. Antenna Unit key dimensions

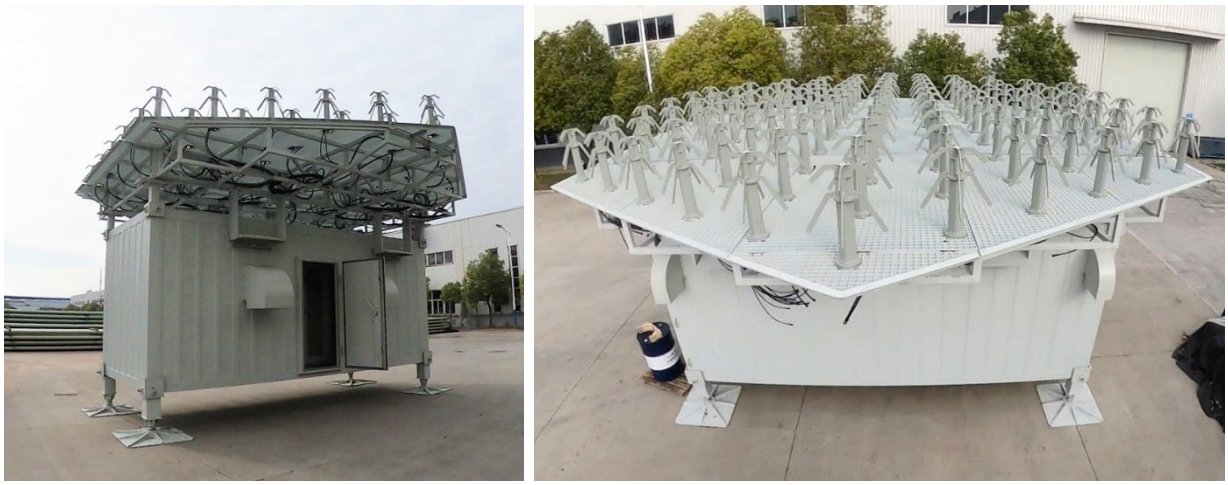

Figure 10. One completed Antenna Unit

3.1 The Container

The container is not a standard 20-foot transport container but can be handled as one. It allows for top- and front lifting with e.g. a reach stacker or can be lifted in slings by a crane (see APP4 for details).

The Container serves as the electronics room for each Antenna Unit and is equipped with an environmental control system and seven computer racks inside (those are empty during the installation). Once installed, the Container will be connected to electrical power and an optical fiber network (by another contractor).

There are a few hoods and casings that needs to be installed once the Container is in place, those are: Two air inlet hoods, two air outlet hoods, one power and fiber casing and four RF-cable interconnection board eaves. These items are stored inside the containers during transport.

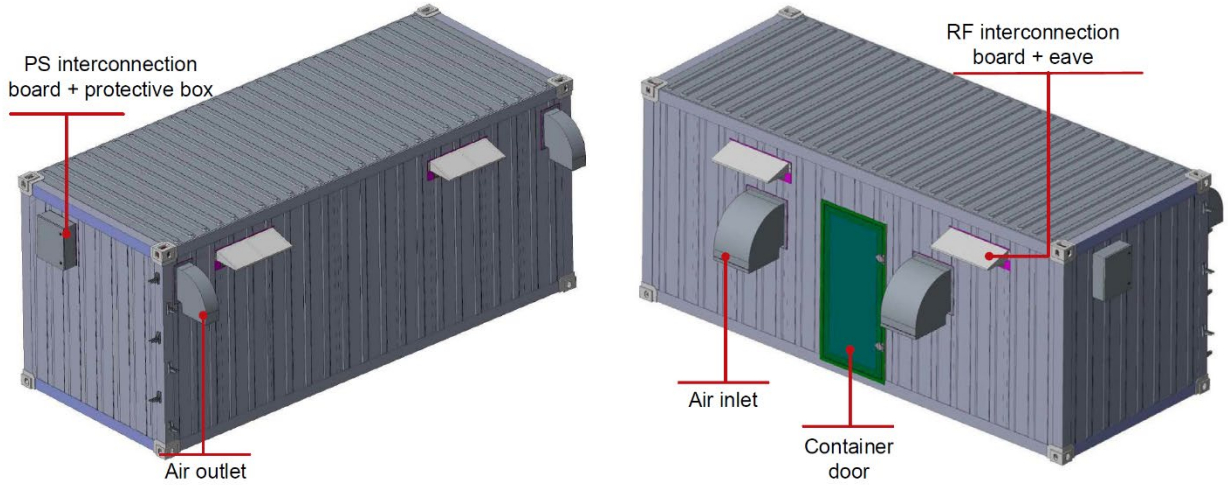

Figure 11. External layout of Container

Figure 12. One Container prepared for shipment (sealed openings etc.)

3.2 The Antenna Frame

The Antenna Frame is a structure that serves as the platform for the 91 Antenna Elements and as the Antenna Groundplane (the grid structure that is the electrical reference for the Antenna Elements, see Figure 9). For the shipping, it is divided into five sub-frames which needs to be bolted together before it is mounted on top of a Container. Each sub-frame is prepared with bundles of two RF coaxial cables from each of the 91 Antenna Element positions. Those 182 cables in total needs to be routed and bundled in four groups - one group for each RF interconnection board on the Container (see Figure 11). The five sub-frames are tailored to one Antenna Frame, but a completed Antenna Frame can be mounted onto any Container. Hence, one cannot use e.g. one random middle sub-frame for any Antenna Frame, it will only fit with the other sub-frames for that particular Antenna Frame.

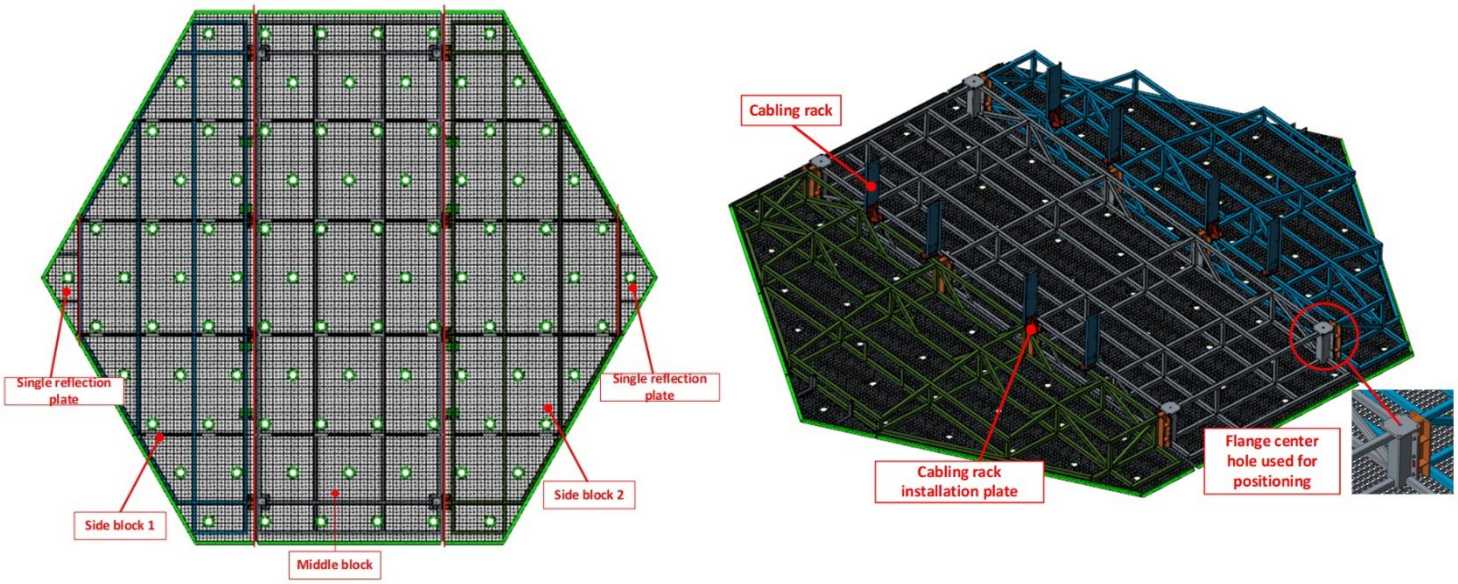

Figure 13. Structural composition of the Antenna Frame

The five sub-frames need to be bolted together for the completeness of the Antenna Frame. Once assembled, it is prepared for the 91 Antenna Elements installation. The installation of those can either be done before or after the Antenna Frame is mounted onto a Container.

Figure 14. Illustrations of how the Antenna Frame sections are bolted together

3.3 The Antenna Element

The Antenna Element is a dipole antenna (it has two polarizations, pol. A and B). As shown in the pictures below, it is approximately 53cm high and has eight rods that sticks out from the body. The rods are the active parts of the Antenna Element and are sensitive to forces and stress from e.g. bending. The Antenna Element has two coaxial connectors in the bottom, which needs to be connected to its dedicated and marked coaxial cables available on each Antenna Element position. It is essential that the polarization gets right for all Antenna Elements, so that all Antenna Element polarization A points towards the same direction - and the same for polarization B.

The Antenna Element is mounted on the Antenna Frame by four bolts. The mounting can either be done directly once the Antenna Frame is assembled but still on ground, or when the Antenna Frames are mounted onto the Containers. The latter may help as space are needed for doing the AU-to-AU electrical connection (done by riveted steel nets that covers the gap in between AUs).

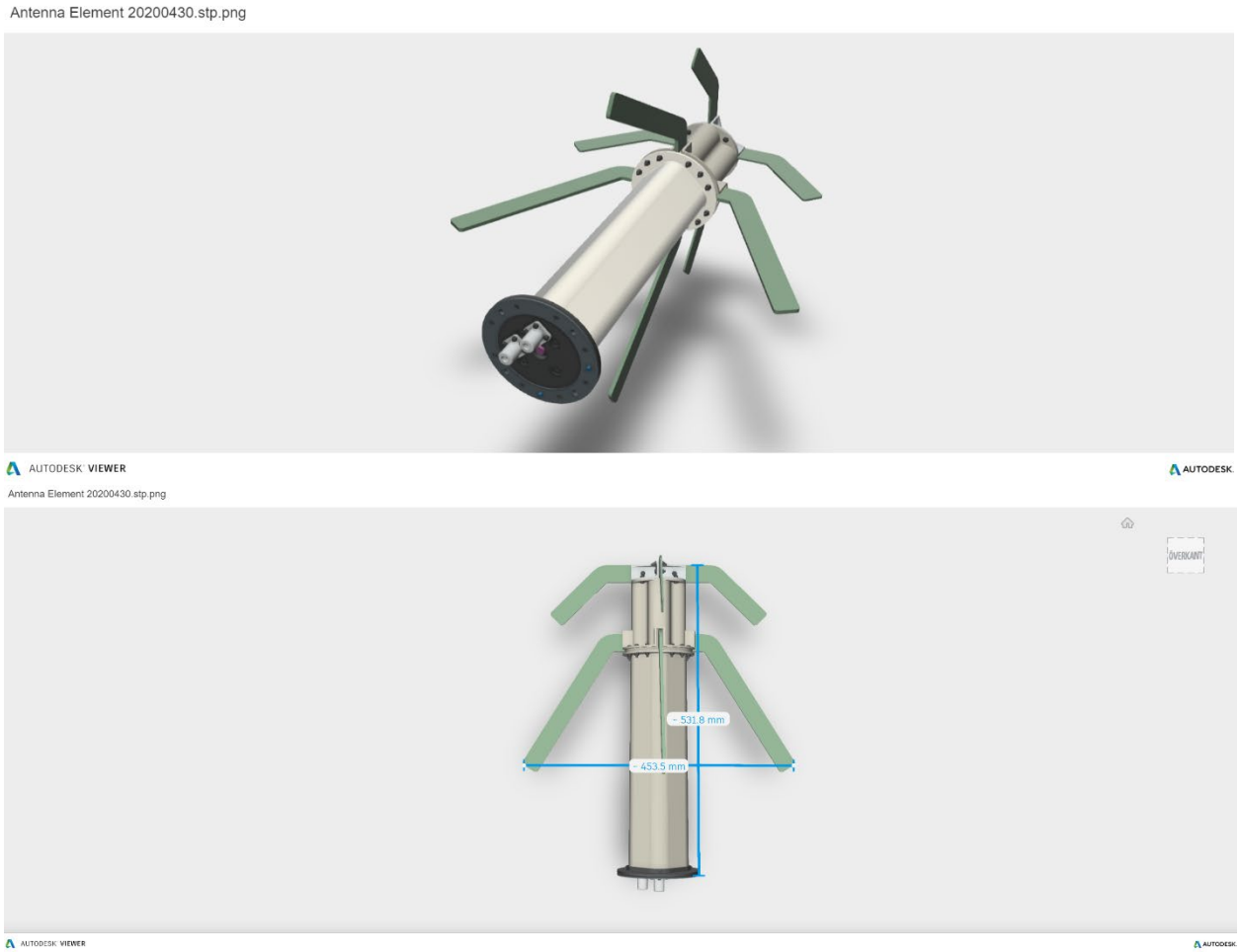

Figure 15. Antenna Element physical properties

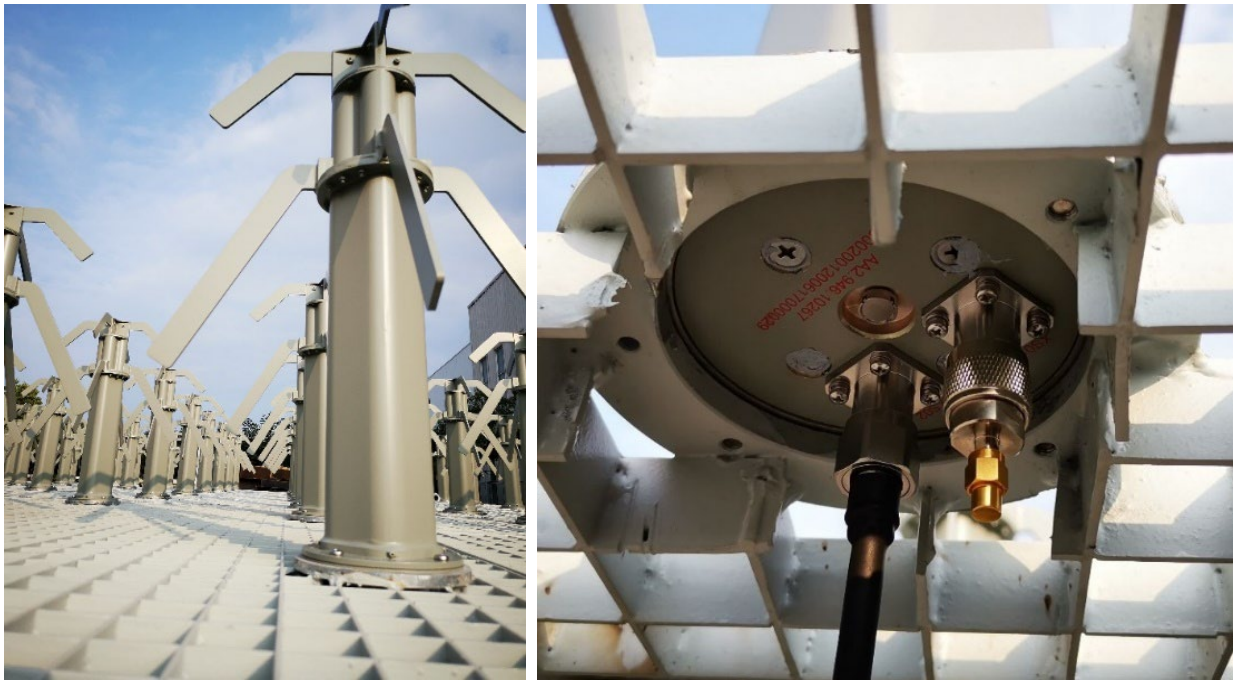

Figure 16. Images of the Antenna Element with one of the two cables connected

4 TRANSPORTABLE UNITS

All Antenna Unit elements are shipped in some few variants of Transportable Units (TU), the general TUs are:

			Dimensions [m]			Weight [Metric tons]
Site	**TU Name**	**Qty**	**L**	**W**	**H**	**Per unit**
Skibotn, Norway						
1	Container TU	119	6,06	2,59	2,44	4,00
2	Antenna Frame TU	90	7,01	2,40	2,60	3,73
3	Mounting Base I TU	14	2,64	0,94	1,29	4,00
4	Measuring Tooling TU	1	3,60	2,24	1,33	3,80
5	Assembling Tooling TU	1	4,30	1,62	0,44	0,40
Subtotal		**225**				
Kaiseniemi, Sweden						
1	Container TU	55	6,06	2,59	2,44	4,00
2	Antenna Frame TU	42	7,01	2,40	2,60	3,73
3	Mounting Base I TU	7	2,64	0,94	1,29	4,00
4	Measuring Tooling TU	1	4,10	2,24	1,33	4,00
5	Assembling Tooling TU	1	4,30	1,62	0,44	0,40
Subtotal		**106**				
Karesuvanto, Finland						
1	Container TU	54	6,06	2,59	2,44	4,00
2	Antenna Frame TU	41	7,01	2,40	2,60	3,73
3	Mounting Base I TU	6	2,64	0,94	1,29	4,00
4	Measuring Tooling TU	1	4,10	2,24	1,33	4,00
5	Assembling Tooling TU	1	4,30	1,62	0,44	0,40
Subtotal		**103**				

Table 3. List of general Transportable Units and key properties

There are a few variants of TUs that requires attention during the installation, but the handling of those is the same. The reason for the TU variants is for optimizing the shipment due the different number of Antenna Units at the three sites. What is important for this enquiry is to describe the number of TUs that requires handling (lifting) and the properties of those, see Table 3 and APP4 for details.

Figure 17. Container TU

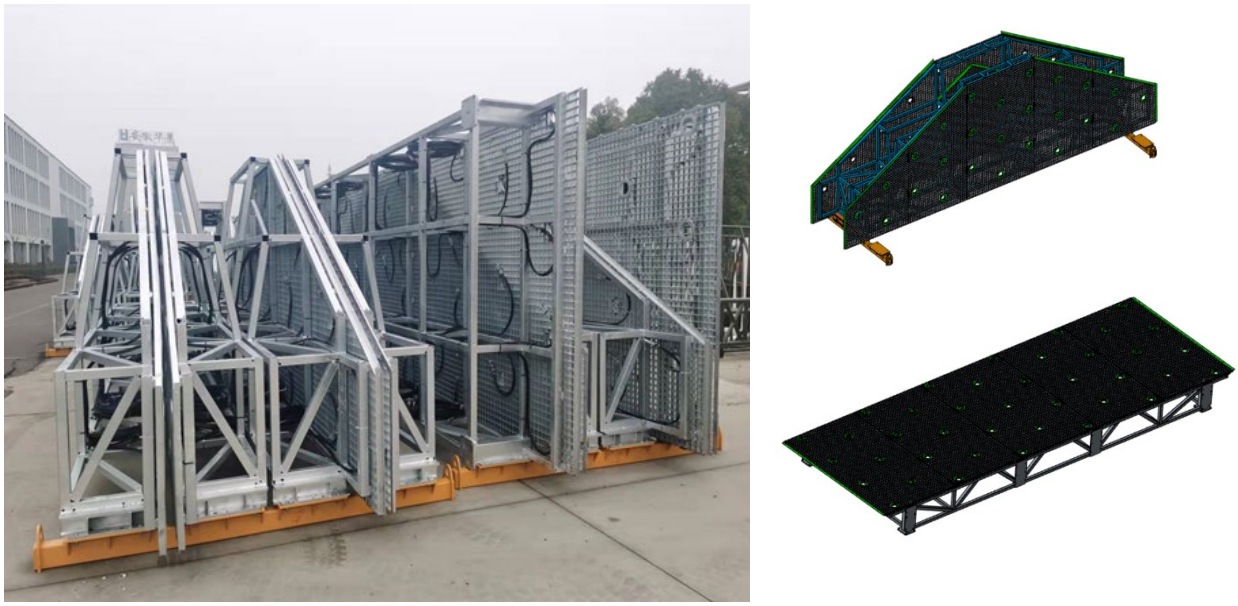

Figure 18. The two main versions of the Antenna Frame TU. Both have very similar properties and are lifted using slings. There are two smaller variants of the Antenna Frame TU (right)

Figure 19. Mounting Base I TU. There are two smaller variants of Mounting Bases (right).

Figure 20. Left image: Measuring Tooling TU. Right image: Assembling tooling TU

5 INSTALLATION

5.1 Scope of work

All three installation sites are in somewhat remote places without direct access to infrastructures like sheds, WC, restrooms, accommodation etc. The scope of the installation work at each site can be described as:

Site establishment:	Have all the necessary equipment and support systems installed (e.g. sheds, WC etc).
Site survey:	Establish a site model and determine the locations of the key coordinates (e.g. AU feet coordinates).
AU installation:	There are several steps involved in the AU installation (see APP3 for details). Some items such as the Antenna Frames needs to be assembled e.g. at the staging areas before they can be installed on a Container. The correctness of the Installation Requirements must be verified throughout the full installation.
Waste material:	The handling of waste packing material is part of the installation. The waste material must be sorted and transported to the nearest recycling center (see Table 1).
Project Reviews:	Fulfil the requirements attached to the project Reviews.
Site evacuation:	Empty the site after the completion of the Final Inspection and Acceptance review.

5.2 Installation Requirements

There are three important parameters applicable to the Antenna Unit installation:
The interrelation between Antenna Elements, the groundplane flatness, and the positioning of the Antenna Units such that the core (all 109 Antenna Units combined) fits within the three masts.

Req. 1 The offset from the ideal position* of the antenna elements in the full core array: ±10mm
Req. 2 Ground plane flatness of the full 109 Antenna Unit core: 15mm (rms)
Req. 3 Core positioning within the three masts, as illustrated in Figure 21 and Figure 22.

There are different ways to control those parameters throughout the installation. The means are dependent on what experiences and tools the contractor has. EISCAT expect to address this in detail in the contract phase. EISCAT has the tools and knowledge to verify these parameters in case the contractor wants assistance and/or guidance. In such case how and to what extent would then be agreed during the start of the contract phase. The final accuracy of the installation will though always be with the contractor.

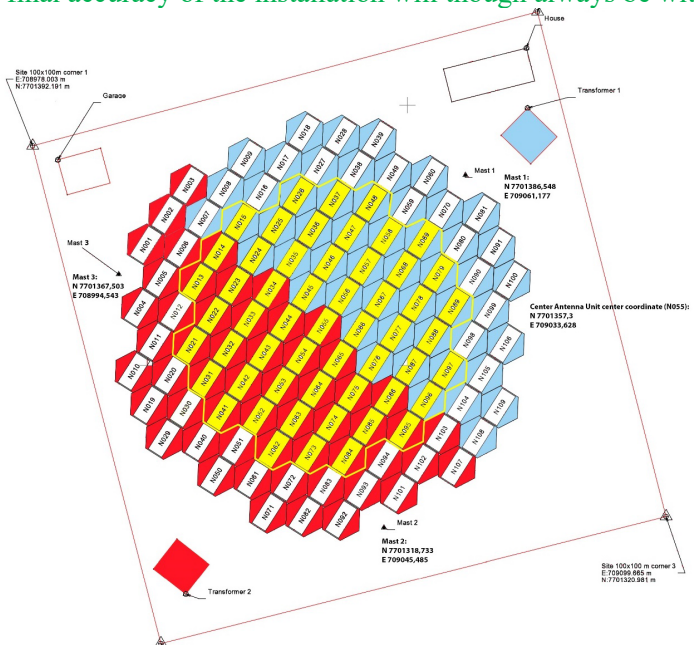

Figure 21. Core orientation with respect to the three calibration masts.

*Precalculated coordinates of the Antenna Element center positions.

Figure 22. Illustration of how the Skibotn core needs to be fitted within the three mast foundations

5.3 Procedures

The Antenna Unit manufacturer has suggested a tested and verified method as described in the attached document APP3. EISCAT is open to changes and modifications to the manufacturers procedure, to suit the contractors experiences, tools and operation methods.

5.4 Schedule

The installations in priority order are:

1. Skibotn, Norway (119 Antenna Units. 109 in the core and 10 Outriggers)
2. Karesuvanto, Finland (54 Antenna Units, all in the core)
3. Kaiseniemi, Sweden (55 Antenna Units, all in the core)

The site installations can start directly once the delivery of the Antenna Units is completed to each site. The delivery of the full set of Antenna Units and related hardware will be done by sea in one ship to the harbor of Tönsvik (Tromsö, Norway). The harbor-to-sites trucking will be done as fast as a number of trucks allow for it (assumed some few weeks). The Skibotn site will be prioritized, and that installation can start in parallel with the trucking to the other sites is still in progress.

Installation start date: The anticipated arrival to the Tromsö harbor of the Antenna Units is on August 25, which is when the site establishment for the installation could start.

6 TENDERING INFORMATION

6.1 General instructions

EISCAT would like to emphasize the importance of that potential bidders monitor the specific tendering area in the EISCAT web-site (https://eiscat.se/procurements/) on a regular basis in order to get access to possible changes and/or clarifications of the procurement, cancellations, questions & answers and all other information related to this enquiry.

EISCAT responsibility for the correctness and accuracy of the documentation for this enquiry is limited to the documentation published on the EISCAT web site and/or sent out by e-mail.

In order to qualify as Tenderer and have tenders evaluated, a Tenderer must reply to and/or comment on all the requirements stipulated in this enquiry, including all requirements stipulated in appendices APP1 and APP2. The tender must be received by EISCAT, at the latest, at the closing date, be confirmed by an authorised representative and include an affirmation that the submitted tender is valid until the expiration of the validity period as stated on the frontpage of this document.

6.2 Form of contract

6.2.1 Options

A tender and contract should be split in options, where the related cost and schedule are described per option. A tender can cover all or some of the options. Tenders including two or three options will be ranked higher in the selection process.

Option 1 – NO Skibotn
Option 2 – FI Karesuvanto
Option 3 – SE Kaiseniemi

6.2.2 Price

Since this enquiry relate to on-site installations only, we limit the currencies that can be used when making the offer to the currencies in use in the various countries, e. g. NOK, EUR or SEK. Contractors bidding for more than one option can chose to either just use one currency or divide the offer in different currencies. All prices should be exclusive of VAT.

The nature and scope of the enquiry makes it hard to estimate the time required to complete the installation. Therefore, EISCAT will agree to adjust the contracted prices in case the needed manpower and/or resources differ from the assumptions the contractor had when submitting the offer. The basis for such adjustments would be the cost breakdown table provided with the bid. The cost breakdown should preferably include estimate manpower needs, and cost, for the various stages. An elaborated cost breakdown will simplify such change. The cost should be on-site costs including e.g. hourly rates of machinery and include professional categories if any, travel costs, accommodation, salaries etc. See Table 4.

Category, Skibotn	Qty	Unit	Price	Sum
Establishment at the site (sheds, WC etc - specify)				
Vehicles (cranes, trucks etc - specify)				
Manpower (number of people)				
Staff accommodation				
Anticipated hours per Antenna Frame				
Supervision				
Management				
Site survey				
Hourly cost for additional work				
Other …..				
Total				

Table 4. Cost breakdown example

6.2.3 Price adjustments

The quoted prices shall be firm and valid with estimated September 2022 as start date. If the installation date is delayed the prices can be adjusted based on an open cost increase index with September 2022 as start month.

6.2.4 Envisaged payment schedule

The payment schedule needs to be related to an option. In example:

Milestone	Payment	Description	% of option total	Note
M1	1	Contract award	10	% of total bid
M2	2	Site establishment	20	
M3	3	½ site readiness	30	
M4	4	¾ site readiness	25	% of e.g. each option
M5	5	Final Inspection and Acceptance	25	
Option *n* payment			100	

6.2.5 Advance payment

Any advance payments by EISCAT shall be covered by Tenderer advance payment guarantees issued by bank or a corporate entity.

6.3 Verification of qualification of Tenderers

EISCAT's requirements for Tenderers are stipulated below. EISCAT will examine if the Tenderer fulfils these requirements before a tender is further evaluated.

6.3.1 Exclusion of Tenderer

Candidates or tenderers are excluded from participation in procurement procedures if:

- The candidate is bankrupt or are having their affairs administered by a court, have entered into an arrangement with creditors, have suspended business activities, are subject to proceedings concerning those matters, or are in any analogous situation arising from a similar procedure provided for in national legislations or regulations.
- The candidate has been convicted of an offence concerning applicable laws and regulations of the environment, human rights, working conditions, anti-corruption, gender equality and diversity.
- The candidate is banned or restricted from doing business in Norway, Finland or Sweden.

6.3.2 Requirement for registration

The company's registration from the Register of companies, commercial enterprises, or associations, whichever is applicable, shall be attached to the reply (verified by a registration certificate or special certificate from a competent authority). If there is no such official register as referred to above in the country where the Tenderer is established, the Tenderer shall provide a certificate containing corresponding details signed by an authority or an authorised accountant or equivalent. The above certificates shall not be more than six months old. It is preferred if the Tenderer's main business, or a subsidiary entity, is already registered in the country related to the offered installation works.

6.3.3 Requirement for technical and professional capacity

The qualification criteria related to technical and professional capacity are designed to show if the Tenderer has the capacity needed to perform the contract. The following qualifications are required, and evidence must be included in the reply:

- A list of the principal customers in the past three years with the sums involved and whether they are public or private customers.
- Short description of two completed reference projects (with relevant need for technical and professional capacity as this enquiry) for two different customers.

6.4 Submission of the enquiry

6.4.1 Language

All documentation in this procurement including all correspondence shall be in English, Norwegian, or Swedish.

6.4.2 Disposition

The reply must be based on what is stipulated in this enquiry. The disposition of the Requirements Answer Template shall be followed. The reply shall contain comments on all requirements and any award criteria stipulated. If no comment is made in respect of a stipulated requirement, it will be regarded as not accepted by the Tenderer.

6.4.3 Tenderer data

The reply shall show the Tenderer's:
Name
Address
Registration number
Telephone number
E-mail address

6.4.4 Subcontractors

The Tenderer shall in its tender state to what extent parts of the Contract and/or which parts of the Contract it intends to subcontract to third parties and which subcontractors are proposed. The main contractor shall always be responsible for any subcontractor in all aspects.

6.4.5 Submission

Tenders are accepted both as originals and via email (PDF format). The reply shall be (electronically/scanned) signed by the Tenderer and marked with "ENQUIRY, E3DS1 AU Installation" and the stipulated closing date for submission.

The enquiry shall be addressed to the following postal address:
EISCAT Scientific Association
Bengt Hultqvists väg 1
SE-981 92 Kiruna
Sweden

Tenders submitted by email shall be sent to the following email addresses:
Craig.Heinselman@eiscat.se and registrar@eiscat.se

EISCAT must receive the enquiry, at the latest, by 18.00 Central European Time (CET) on the closing date.

6.5 Information regarding the enquiry

Questions regarding this tender shall be submitted in writing and may be addressed to:
Harri.Hellgren@eiscat.se with a copy to Johan@eiscat.se.

Relevant questions and answers will be published on EISCAT's web site (at https://eiscat.se/procurements). Updates will be published regularly, however not after five days before the closing date.

6.6 Tenders received too late or being incomplete

A tender received after the closing date ~~cannot~~ will not be considered. Submissions lacking requested supporting material, and/or not provided using the requirements answer template without a reasonable justification, will not be considered.

6.7 Applicable law

Swedish law applies for this enquiry. National laws and regulations apply for the installations.

6.8 Invoice instructions

EISCAT has entities in all the three Nordic countries and the invoices must be addressed to those respectively:

EISCAT Norway:
EISCAT Scientific Association
Ramfjordmoen
N-9127 Ramfjordbotn
Norskt organisasjonsnummer: 971 400 536

EISCAT Finland:
EISCAT Scientific Association
Tähteläntie 54B
FIN-99600 Sodankylä
FO-nummer: 3103178-2

EISCAT Sweden:
EISCAT Scientific Association
Bengt Hultqvists väg 1
SE-981 92 Kiruna
Organisationsnummer: 897300-2549

Invoices addressed to the different EISCAT entities will be handled by the EISCAT central administration in Kiruna and should always be sent electronically to faktura@eiscat.se.

6.9 Award of contract

EISCAT will accept the tender that meets the requirements or has given reasonable justifications for the requirements that are not met and is the most economically and technically advantageous. Tenders including two or three options will be ranked higher.

7 CONTRACT IMPLEMENTATION AND MANAGEMENT

This section covers the envisaged management for the AU Installations contract.

7.1 Compliance

The contractor is required to have all permits and follow all national and local regulations at the work sites.

7.2 Project Milestones and Reviews

EISCAT monitors the progress of the Contractor through project monitoring and formal reviews for payment milestones. The Contractor needs to relate to Project Phases, e.g. as suggested in Table 5 and the related Project Reviews. Each accepted Milestone or Project Review allows for progress to the next project phase. EISCAT shall be invited to participate in the Project Reviews.

Milestone	Payment	Description	Action
M1	1	Contract award	Signing of contract
xM2	2	Site establishment and survey	Agree on the site survey
xM3	none	10 AU installation assessment of manpower and other resources needed for remaining installations	Potential contract change
xM4	3	½ site readiness	Review
xM5	4	¾ site readiness	Review
xM6	5	Final Inspection and Acceptance	Inspection at the site

x = NO, FI or SE

Table 5. Project phases and related milestones

7.3 Documentation delivery

The following requirements shall be met during the delivery of documentation:

Req. 4 The Contractor shall agree to adopt a daily progress journal (images and notes) and to share that with EISCAT on a weekly basis without any additional costs for EISCAT.

Req. 5 EISCAT will be responsible for all Review meeting minutes, and the contractor is responsible for reviewing and act for a common acceptance of those.

Req. 6 The Contractor shall agree that all necessary updates detected at reviews shall be carried out without additional costs for EISCAT, unless they are caused by EISCAT.

7.4 Management

Req. 7 Status and progress meetings: Part from the project phases and reviews, the contractor shall agree to support regular progress meetings as the need for those arise.

Req. 8 The Contractor shall agree that all documentation produced for the Antenna Unit installations can be used by EISCAT without restrictions.