Description of Makarios Teleport and its Capabilities
1. General Description of Makarios Teleport

Makarios Teleport has been in operation since 1980. The site has been growing consistently and today is a fully developed Teleport that can satisfy a wide range of customer requirements.

The site offers proximity to the island’s main towns, seaports and airports. Modern buildings house the earth station equipment and associated subsystems. Additional space is dedicated for service, monitoring, office space for personnel and for auxiliary support systems. The site is fully supported by all Public Utilities. Makarios Teleport is well connected with Cyta’s national and international fiber networks providing ample capacity and dedicated direct links with major international nodes.

The Teleport is manned on a 24 hour basis for 365 days per year by qualified personnel with the training and experience to support a diverse range of satellite communications systems and services. A manned security system ensures the safety of the operators and equipment at the site on a 24 hour basis.

![Fig. 1: The Makarios Teleport Site](image)

1.1 Geographic Location and Climate

The position of Cyprus in the eastern end of the Mediterranean Sea is a privileged location for Satellite Communications. Makarios Teleport offers full visibility of the geostationary arc, covering any satellite location between 33.5°W and 100.5°E with elevation angles greater than 10°. This arc provides visibility to a large number of satellites, which effectively allows access to any point on the globe.

The climate in Cyprus, with extensive sunshine, low rainfall and mild temperatures, is ideal for satellite operations. No de-icing is needed at the Teleport and the heating and air-conditioning loads are comparatively small. More importantly, reduced margins for rain attenuation make it possible to provide links with enhanced availability.

1.2 Qualifications and Experience of Personnel

Cyta considers the quality, qualifications and experience of its personnel as one of its most valuable assets and makes available at the Teleport competent personnel that is qualified for the provision of all required services. To this end, Cyta ensures that all personnel meets, and in most cases exceeds, the qualifications and experience required for the positions they hold. It is worth mentioning that most engineers hold at least a Masters Degree. All technicians hold a 3-year engineering diploma and a substantial number of them have additional professional qualifications. In addition, all personnel are fluent in English.
All personnel at Makarios Teleport have sufficient experience in satellite communications. Cyta has been involved in satellite communications since 1980 when it established MKR-1A, its first 32m Intelsat Earth Station. Since then, the number of major Earth Stations has gradually increased to more than twenty five, operating with a diverse collection of satellites from many operators. During these years, our personnel has undergone intensive training and acquired extensive experience in virtually all technical and management aspects involved with the planning and provision of services via satellite means, such as telephony, data, television, etc.

1.3 Quality of Equipment and Supporting Infrastructure

Makarios Teleport is fully developed and can readily provide the baseline utilities for the development of a wide range of satellite services. Cyta makes available at the site all the required facilities for the provision of the required customer services. Depending on the case, these will include the required earth station, RF, and associated baseband equipment, environmentally controlled space to host the indoors equipment, and all necessary infrastructure to support the facility and ensure optimum provision of service.

The satellite antennas and associated equipment at the Teleport have been supplied by reputable suppliers and companies with extensive experience in the provision and installation of Earth Station systems. The equipment is reliable and utilizes proven technology in order to warrant high quality of service. The Teleport is backed by Cyta’s telecommunications national and international infrastructure, which is among the most developed in the region.

1.4 Rainfall and Snow

Cyprus is located in the eastern corner of the Mediterranean Sea, a region with very mild climate and minimal rainfall. The Teleport lies at the edge of the ITU-R rain zone K with zone E and is very well suited for the provision of satellite communications.

The temperature at Makarios almost ever drops below zero and in such extremely rare occasions, the duration of the event is very short. Thus, there is no requirement for antenna de-icing at the site.

1.5 Frequency Co-ordination

Makarios Teleport is free of any restrictions related to the use of frequencies in the satellite or terrestrial bands. The utilization of these frequencies is uninhibited and not subject to any interference, or restriction by the Regulatory Authorities.

The site is conveniently located in a valley and so potential interference with terrestrial systems is avoided. Furthermore, the fact that Cyprus is an island ensures, complete isolation from any emissions from entities in other countries.

Detailed site surveys have shown that the Teleport is free of harmful interference. No satellite antenna operating at any satellite location has ever experienced degradation of performance because of interference from other satellite or terrestrial systems.

1.6 Permits and Licenses

Cyta has the responsibility to secure the required permits and licenses to carry our Teleport operations at the Site. The necessary licenses are the general permits for the construction of buildings and associate structures and the licenses that are specifically related to telecommunications services.

The license fees for telecommunications services are associated with the number of transmit carriers and their bandwidth. This licensing is a straightforward technical procedure that requires little time to complete as long as the relevant technical details are available.
2  Description of the Teleport General Facilities

Makarios Teleport has been in operation for a long time. Nevertheless, the Site continues to expand steadily and new equipment and infrastructure is regularly integrated to the existing facilities. The existing infrastructure and equipment are well maintained to ensure their reliable operation until the end of their useful life. Older facilities are gradually faced out and are replaced with modern equipment and systems to respond effectively to the needs of Cyta and its customers.

2.1  Buildings

Cyta provides environmentally controlled space at the Site to house the indoor equipment required for each service. Additional space is made available for hosting the equipment support systems, such as air-conditioning, UPS and backup generator systems. The site also includes office space for personnel and for dedicated monitoring and training areas. The buildings at the site cover an area of 2,000 m$^2$.

During normal operation, all equipment rooms are air-conditioned and the following conditions prevail:

(a) Temperature:  From 20$^\circ$C to 27$^\circ$C dry bulb
(b) Relative Humidity:  From 45% to 60%

2.2  Power Requirements

The primary power source of the Teleport is provided through the commercial power network in Cyprus. The network is well developed and provides secure and reliable power supply without disruptions. Cyta apportions the appropriate power capacity to feed the equipment required for each service. The power supply characteristics are:

(a) Voltage:  415/240V $\pm$ 6%
(b) Frequency:  50 Hz $\pm$ 2%

All communications and other critical equipment are powered through the four independent UPS systems which operate in a redundant configuration and provide instantaneous protection in case of a power cut. Furthermore, Cyta makes available at the Teleport a stand-by power source comprising a system of automatically starting diesel generator sets, in a 1+1 redundancy configuration. This system is rated at 650KVA and has sufficient capacity to cover the future power requirements of the site in case of outages of the primary source.

The auxiliary power systems are tested and maintained on a regular basis to ensure their availability in case they are needed.

2.3  Earthing System

A complete earthing system is provided for lightning protection, safety of personnel and suppression of radio frequency interference. Special emphasis is placed on protection of bearings, gears, rotating joints, etc., against electrostatic discharges.

Equipment earthing assures stable and controllable performance. Special care is taken to prevent transmission of interference due to DC devices, such as grid controlled rectifiers.
2.4 Communications Links

Makarios Teleport is well integrated with Cyta’s national and international networks, which offer resiliency and diversity with connectivity made available via protected fiber rings. There are broadband connections to the core IP/MPLS network, which provides links to various nodes in Cyprus and abroad. Ample capacity is made available with modern solutions, such as WDM technology, but dark fiber connections are also available. Protected IP connectivity to the Global Internet is also offered. Dedicated fiber connections to Cyta’s international switches are in place. The international fiber network is further protected with restoration plans which are regularly tested in association with other international operators.

Cyta makes available a wide range of telecommunications services to its customers at the Teleport. These can be delivered to the customer’s equipment to facilitate internal and external communications.

![Cyta's National Transmission Network with International Extensions](image)

**Fig. 3: Cyta’s National Transmission Network with International Extensions**

Being the incumbent and major Telecommunications Operator in Cyprus, Cyta is very well positioned to combine the capabilities of its fiber and satellite network into integrated products and services, which in turn, are made available to our customers in the international market.

2.5 Safety of Personnel and Protection of Equipment

Cyta makes all necessary arrangements to ensure that safety of personnel and equipment is assured at all times. Safety shields are placed over all moving parts in which personnel could become entangled, or caught. Ladders and stairways conform to usual safety standards.

The outside of all cabinets, racks and chassis, all external metal parts, etc, are earthed. Earthing devices are provided in all areas of equipment with voltages in excess of 300 V.

Cabinets, optical and RF interconnections and all RF enclosures are designed to protect personnel from radiation hazards. Particular precautions are taken to protect the equipment against dangerous high frequency return paths, over-voltage and over-current.

2.6 Site Security and Fire Protection

The site security arrangements ensure 24 hours a day, 365 days a year safety of the operators and equipment and comprise the following:

(a) Security system consisting of a number of security devices and equipment which are designed to monitor and control access to restricted areas, detect unauthorized entries or presence within specific buildings or areas and generate alarms in the event of a security breach.
Makarios Teleport is secured with general accepted industry standards. The site is manned on a 24-hour basis with security staff for monitoring the security system, controlling the entrance of the station and surveying all external areas. In addition to the local security system, the Teleport is connected to the Cyta's nationwide integrated security system, which offers remote monitoring capability of the site and comprehensive security management for coordination with internal security personnel and the Police. Access to the site and the equipment is restricted to authorized personnel only.

(b) Fire protection system consisting of smoke and/or heat detection devices, centralized alarm monitor and automatic or portable extinguishers as applicable. There are also outdoor fire station/points to protect the external Teleport equipment and buildings.

2.7 Site Access

The Teleport is readily accessible from airports in Larnaca and Paphos and seaports in Limassol and Larnaca. Driving to Makarios Teleport takes 20 minutes from Larnaca and 80 minutes from Paphos international airports. Cargo handling services at the two airports are similar to the ones offered at other international airports in Europe. The seaports of Limassol and Larnaca are used for international transport. Containers of typical size and weight can easily be transported on Cyprus roads. Cyta can provide assistance for customs clearance of all imported goods in a timely manner.

Customer personnel with citizenship from any European Union country can readily enter Cyprus without visas, or any other restrictions. For personnel from other countries, who may need entry visas for Cyprus, Cyta can readily provide all required information and assistance to ensure that a visa will be granted without delay.

Access at the Teleport is monitored at all times. Customers and their subcontractors need to coordinate their visits to the Teleport with Cyta's staff.
3 Description of the Teleport Operation and Maintenance Activities

The Teleport staff has the responsibility to ensure the continuous and uninterrupted provision of all services in accordance with the relevant service level agreements. In order to achieve this goal, they perform a series of tasks to maintain the healthy operation of the services and equipment needed to support them.

The responsibility for Installation, Testing, Operation and Maintenance activities is allocated to the respective engineer. The engineer is dealing with the organisational issues such as budgeting, spares inventory, preventive maintenance schedule and procedures, equipment corrective maintenance records, etc., also participating, in the troubleshooting of major faults to the extent required. Furthermore, the engineer has the responsibility to ensure that the personnel are adequately trained to perform the appropriate operation and maintenance functions.

3.1 Quality of Service and ISO Certification

Cyta is committed to provide quality services to its customers and in order to achieve this goal, it focuses on continuous performance improvement. To this end, the Teleport and Cyta as a whole are fully certified to the ISO 9001-2008 standard. Quality is part of the daily work and the Teleport personnel undertake the following activities towards achieving these goals:

(a) Set quality targets based on the relevant ITU recommendations, customer contracts or service level agreements, as appropriate.

(b) Take accurate measurements in accordance with a predetermined schedule and record the results in the database log-book.

(c) Carry out regular management revisions to ensure smooth operation and maintenance according to the quality criteria that have been set. Among other things, the following key performance indicators are reviewed during the meetings:

i. Time for fault investigations and corrections
ii. % of completed preventive maintenance

This process is facilitated by utilizing the necessary tools, such as the electronic data base log book and the appropriate instruments. Cyta’s staff has the training and experience to process the data and extract useful conclusions. The key performance indicators are re-evaluated every six months.

The Teleport operations are supported by an integrated RF Monitoring System. The Monitoring System is connected to more than 60 satellite antennas and provides direct visibility to the satellite carriers transmitted and received at the site. Detailed information on the relevant parameters, such as modulation details of wanted and interfering carriers can be readily extracted. The Teleport personnel are continuously aware about the status of every service we provide and in case of a problem can promptly take the necessary measures to ensure that the situation is addressed effectively.

Fig. 4: RF Monitoring System Operator Display

3.2 Installation of customer equipment

Usually, the customer equipment is installed on a turnkey basis under Cyta’s supervision. Some integration work is completed by Cyta’s personnel. During the installation phase, Cyta provides the necessary assistance for the implementation of the required service. This includes on-site support, activity coordination and planning, interface definition, site preparation, etc.
Competent personnel with extensive experience in the field, fulfil the staff requirements for the installation phase. These personnel include engineers, supervisors, and/or technicians, as appropriate.

3.3 Testing

Testing is necessary to verify that all equipment and facilities are in place to provide every required service. Cyta will support the appropriate testing of each service, including subsystem acceptance tests and ground station acceptance tests.

The Teleport personnel has extensive experience in satellite communications and they have the ability to analyze difficult problems and take the appropriate corrective actions. Sometimes manufacturers and integrators are not in a position to foresee all the potential problems that arise in the field. In such cases, the knowledge and experience of the Teleport personnel can enable them to solve difficult problems and help them remove the bottlenecks in order to meet the time schedule.

3.4 Preventive Maintenance

The preventive maintenance is performed according to the annual preventive maintenance schedule of the Makarios Teleport. Preventive maintenance is part of the ISO 9001-2002 quality system and is carried out on a weekly, monthly, six-monthly or yearly basis according to the relevant manufacturers’ manuals and relevant recommendations. All test data is recorded and compared to the original measurements at the provisional acceptance test period. All data is checked by the respective engineer and is stored electronically in the E/S records for future reference.

3.5 Corrective Maintenance

All means are available at the site to perform corrective maintenance down to board level. Corrective maintenance to component level is undertaken, by the Electronic Workshop at the Teleport, if technology permits. It also covers on-site interventions by the manufacturers if such a need arises. Spare parts are stored in shelves in air-conditioned storage areas. Consumable items are regularly reordered to maintain the recommended minimum quantities according to the MTBF of the relevant equipment.
Makarios Teleport hosts a large number of earth stations that provide links with numerous satellites, supporting Cyta’s extensive satellite telecommunications network. There are antennas operating in C-band with linear or circular polarization and antennas operating in standard or extended Ku-band frequencies.

The site provides visibility to a large section of the geostationary arc extending from the Atlantic to the Indian Ocean region and the numerous satellites in this arc are able to provide access practically to any point on the globe. The satellite network is fully integrated with the national and international fiber networks of Cyta thus making it possible to provide customized managed hybrid solutions.

The main antennas installed at the Makarios Teleport with details on size and frequencies of operation are shown in the figure below.

<table>
<thead>
<tr>
<th>Antenna</th>
<th>Diameter (m)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>MKR 1A</td>
<td>32</td>
<td>C-band</td>
</tr>
<tr>
<td>MKR 2B</td>
<td>11.8</td>
<td>C-band</td>
</tr>
<tr>
<td>MKR 3T</td>
<td>18</td>
<td>Ku-band</td>
</tr>
<tr>
<td>MKR 4A</td>
<td>15.5</td>
<td>C-band</td>
</tr>
<tr>
<td>MKR 5L</td>
<td>7</td>
<td>Ku-band</td>
</tr>
<tr>
<td>MKR 6L</td>
<td>9</td>
<td>Ku-band Rx only</td>
</tr>
<tr>
<td>MKR 7</td>
<td>4.8</td>
<td>Ku-band Rx only</td>
</tr>
<tr>
<td>MKR 8</td>
<td>7</td>
<td>C-band</td>
</tr>
<tr>
<td>MKR 9</td>
<td>7.2</td>
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</tr>
<tr>
<td>MKR 10</td>
<td>4.8</td>
<td>Ku-band</td>
</tr>
<tr>
<td>IRIS 1</td>
<td>11.1</td>
<td>C-band linear</td>
</tr>
<tr>
<td>IRIS 2</td>
<td>6.3</td>
<td>C-band</td>
</tr>
<tr>
<td>IRIS 3</td>
<td>4.8</td>
<td>Ku-band Rx only</td>
</tr>
<tr>
<td>IRIS 4</td>
<td>3.8</td>
<td>Ku-band</td>
</tr>
<tr>
<td>IRIS 5</td>
<td>6.1</td>
<td>C-band linear</td>
</tr>
</tbody>
</table>

Fig. 7: Major Antennas at Makarios Earth Station

The services provided include broadcasting and turnaround of digital television on permanent, periodic or occasional basis. Turnaround services for satellite-to-satellite links have been provided for a long time, but satellite-to-fiber links are becoming increasingly popular especially for satellite internet and VSAT applications.

Special care is provided to customers wishing to use the Teleport to provide their services in the international market. Hosting services to third parties include collocation, integration, and network
control. Monitoring services are also offered at the site. These include carrier and baseband monitoring and interference localization as required. Makarios Teleport also offers international telephony to various destinations and serves as a video head-end for Cyta’s multichannel television service, which is made available in Cyprus via ADSL.