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(71) Applicant: **Intracom S.A. Hellenic Telecommunications & Electronics Industry**
19002 Peania, Athens (GR)

(72) Inventors:
- **Patsoulas, Constantinos, Intracom S.A.**
19002 Peania, Athens (GR)
- **Tsabieris, Nicolaos, Intracom S.A.**
19002 Peania, Athens (GR)

(74) Representative: **Papataxiarchis, Panagiotis**
Intracom S.A.,
Markopoulo Avenue 19, 5KM
19002 Peania - Athens (GR)

(54) Secure, autonomous, transportable VSAT terminal

(57) The present invention concerns a secure, autonomous, transportable satellite terminal of VSAT type (Very Small Aperture Terminal), for the secure support - through encryption - of telecommunication needs of mobile units, headquarters as well as other special telecommunication needs. The system is placed inside a protected shelter that has the capability of being transportable while it distinguishes for its enhanced mechanical properties. Furthermore, the system supports many analogue and digital interface protocols for communication with terrestrial networks and has the capability of interfacing with a EUROCOM tactical network. Pursuant this invention, the transportable satellite ground terminal comprises a complete telecommunication protected shelter, a parabolic antenna, a transceiver, a modem, a multiplexer, a cryptographic device, a GPS receiver, a power supply system, a UPS system, a generator and an air conditioning device.

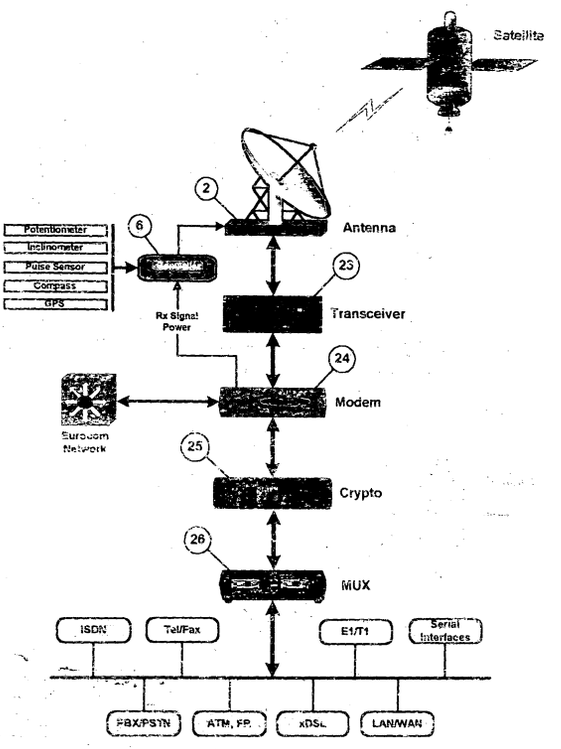

Figure 2. Functional Configuration of the VSAT terminal

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Description

BACKGROUND OF THE INVENTION

[0001] The present invention pertains to the field of modem telecommunication systems and networks, and in particular to satellite communications systems. It specifically concerns a secure, autonomous, transportable satellite terminal of VSAT type (Very Small Aperture Terminal), for the support of telecommunication needs of mobile units, headquarters as well as other special telecommunication needs.

[0002] VSAT satellite terminals refer to land satellite stations for signal transmission and reception, which communicate either with one another or with some central node through satellite. VSAT systems are equipped with a satellite antenna, usually of 0.6 to 3.8m diameter.

[0003] VSAT networks offer powerful, cost-effective and reliable solutions for both private and public telecommunication networks. Furthermore, they offer added value to services and applications such as Internet, data transmission, LANs, voice and facsimile communications etc.

[0004] Some examples of the fields where applications for the said systems have been developed are:

- E-mail and Internet applications
- E-commerce
- Teleconferences
- Telemetry
- Telemedicine

[0005] Compared to terrestrial communication networks, satellite networks can be installed and operate in a short period of time, mainly because they are free from the time-consuming procedure of cabling. Geographically also they are more adaptable and relatively easily installed and connect distance places. Furthermore, operating frequencies for VSAT systems (usually Ku, C, Ka bands) have the advantage of greater bandwidth, attaining faster and easier data transmissions of high quality and therefore increased efficiency.

SUMMARY OF THE INVENTION

[0006] The present invention refers to a secure, autonomous, transportable satellite terminal of VSAT type, for the support of telecommunication needs of mobile units. Information exchange through the satellite is made securely, by data encryption with the use of a special cryptographic device. Furthermore, the satellite terminal offers full operational autonomy at communication interface level and also at the level of the required power supply. As for the communication interface level, autonomy is assured both by an automatically orientated antenna and by the system independence from terrestrial telecommunication networks. At power supply level on the other hand, besides its supply possibility from urban power networks, the system is also equipped with a generator and a UPS.

[0007] The satellite terminal is transportable, protected and housed in a shelter, which can be transported by a vehicle and may be automatically fixed and stabilized on the ground, through its electro-hydraulic system. The protected shelter has also high mechanical properties such as vibration resistance, wide operational temperature range etc., which ensure that both operators and terminal equipment work under the most adverse external conditions.

[0008] As far as terrestrial communications are concerned, the satellite terminal supports a great many analogue and digital interfaces:

- Analogue and digital voice and facsimile services
- Data transmission through E1/T1 lines
- Data transmission through serial protocols
- Connection with EUROCOM tactical networks
- Connection with ISDN network
- Connection with ATM, Shelter Relay networks
- Connection with LAN
- Connection with WAN
- Connection with PSTN network
- Connection with xDSL network

[0009] In brief, the secure, autonomous, transportable satellite terminal of VSAT type presents the following detailed mechanical and operational features:

- Mechanical / Electrical properties
  - Installation of all equipment in a transportable protected shelter
  - Ergonomical design of the interior of the protected shelter
  - Special design and structure for wind pressure resistance of the protected shelter and the unfolded satellite antenna
  - Normal system operation even under adverse environmental conditions of temperature and mechanical strain
  - Anti-vibrating protection of all installed devices within the protected shelter
  - Autonomous electro-hydraulic system of the protected shelter for fixing and stabilization on the ground, in a short period of time
  - Vigorous and high resistant in all mechanical fixing arrangements
  - Fast system loading / unloading, unfolding and putting into operation
  - Autonomous operation through generator and UPS
  - Reliability of electrical installation
- Telecommunication properties
  - Interface with satellite communication network

- Voice, facsimile and data information exchange, with the use of different communication protocols with terrestrial networks
- Connection with EUROCOM network, for the support of tactical communications
- Communication security through a special cryptographic device for secure satellite communications
- Folding satellite antenna, which, when in operation, is automatically orientated to the selected satellite

[0010] A comparative example of an application based on satellite communication networks, is the one referred to patent numbered 5,280,625 (United States Patent). In this example, transaction terminals communicate with a central computer system through the satellite network with no telephone network involved. Furthermore, in this patent, there is no means of data encryption, no operational autonomy and the system is not placed in a protected shelter for transportation purposes. Besides, this patent is solely limited to information exchange between transaction terminals.

[0011] One more comparative example is patent numbered 5,912,883 (United States Patent), which describes a LAN remote control and access system, with no telephony network involved here as well. In this patent, no data encryption method is described, while operational autonomy is not provided, neither is the system placed in a protected shelter for transportation purposes. Besides, communication is solely limited to LAN remote control and access.

[0012] Another application of this type is presented in patent numbered WO 99/52240 (Patent Cooperation Treaty - PCT) where, a satellite terminal is used for data exchange and forwarding between distant portable radio units. In detail, the said patent describes a method, on the basis of which, portable radio units from one geographical place may communicate with other distant radio units, by a satellite link through the terminal. Encryption is used here, however no system operational autonomy or transportation possibility is offered, as it is not equipped with the necessary elements such as, folding antenna installation inside a protected shelter etc.

BRIEF DESCRITPION OF THE DRAWINGS

[0013] For the best understanding of the functional configuration of the equipment that the secure, autonomous, transportable, satellite terminal consists of, detailed diagrams are attached hereto, properly numbered, for convenience purposes.

[0014] Figure 1 illustrates the mechanical arrangement of the invention. In particular, it shows the protected shelter, the satellite antenna placement, and the internal arrangement within the protected shelter as well as the secondary support equipment.

[0015] Figure 2 illustrates the telecommunication block diagram of the satellite terminal and depicts the system interfaces at the device level.

DETAILED DESCRIPTION OF THE DRAWINGS

[0016] The present invention is detailed hereunder, using examples and references to attached Figures 1 and 2.

[0017] According to this invention, the ground satellite terminal illustrated in Figures 1 and 2 comprises the following operational units:

- Complete telecommunication protected shelter (1)
- Folding parabolic antenna (2)
- Antenna Controller (6)
- Transceiver (23)
- Modem (24)
- Cryptographic device (25)
- Multiplexer (26)
- GPS receiver
- Power supply (7) and UPS system (9)
- Generator (5)
- Air conditioning device (3) (4)

[0018] Figure 1 shows the system mechanical arrangement. The first basic element of the satellite terminal is the protected shelter (1), which is made of hollow beam profiles soldered together to secure load strength and vibration strain during vehicle movement.

[0019] Inner and outer sides are covered by aluminum plates for full corrosion protection of the system when operating under adverse environmental conditions. At points where load is concentrated, e.g. on the antenna base, on the telecommunication equipment base or on the suspension points, there is an appropriate arrangement by steel plates, which transfers loads to a larger surface.

[0020] Furthermore, between inner and outer layers, there is an appropriate polyurethane insulation for thermal protection of the protected shelter and for the proper operation of the air conditioning system.

[0021] Lifting and loading / unloading of the system is achieved through an electro-hydraulic system (13), comprising an electro-hydraulic unit, hydraulic adjustable feet and control device.

[0022] Inside the protected shelter, there are two racks (7), (8) for the batteries and the devices, which offer higher vibration protection. They are arranged in a way to facilitate access to the devices front panels, the replacement of devices and access to their rear side for any repair or connection work. Finally, there is some secondary equipment offered such as, operator seats (11), operator table (16), fire-extinguishers (19), (20), tool boxes (12), ladder (21) for access to the top, lighting sets (14), medicine-box (17) and fuel container (22).

[0023] The folding satellite antenna (2) with a diameter up to 2.4m is designed for data transmission and reception for Ku and C frequency bands. Its reflector is

entirely made of aluminum, for maximum precision and strength under all operation environments. The feed and the sub-reflector are designed to cooperate with the reflector in a way to provide cross-polarization isolation and exemplary behavior of side lobes. The antenna (2) is equipped with rotation mechanisms to support automatic orientation and automatic folding and unfolding.

[0024] The controller (6) that works together with the satellite antenna (2) automatically calculates azimuth and elevation angles and precisely orientates the antenna, activating the respective rotation mechanisms. The controller (6) gets different outer signals from sensors placed on the antenna (potentiometers, inclinometers, pulse sensors etc.) and processes them to calculate orientation position. Orientation procedure is further supported by a GPS receiver and the level assessment of a DC voltage, relative to the power of the received signal by the satellite modem (24).

[0025] The transceiver (23) interfaces the ground station with the satellite communication network. Output power combined with other technical features of the device, forms the basis for an unhindered operation under any operational environment. Its installation is performed with all required functions integrated in one external unit of small dimensions and high integration level. Transmission and reception paths are completely independent from one another.

[0026] The satellite modem (24) modulates digital data, to make them suitable for transmission to the satellite network. On the other hand, during reception, it receives the radio frequency signal from the satellite and demodulates it to a base band digital signal. Modulations supported by the modem (24) are BPSK, QPSK, OQPSK and 8PSK, with the possibility of additional modulation techniques. Furthermore, FEC algorithms are applied, to achieve the maximum reliability of transmitted information. The data rate is of Mbps level, whereas as far as terrestrial communications are concerned, the device supports different interfaces, such as RS-232, RS-422, V.35, E1/G.703 among others. Also the modem supports communication with a EUROCOM network.

[0027] The cryptographic device (25) has been designed in compliance with military standards and offers specialized features to meet operational needs of Armed Forces. Simultaneous multi-channel encryption / decryption at high speeds secures maximum possible support of security needs for transmitted data in telephone network connections and digital communication systems in general. This device is connected between the modem (24) and the multiplexer (26), achieving encryption of all transmitted information.

[0028] Data rates reach 44.5 Mbits/sec, whereas protocols such as E1/T1, EUROCOM, E3/T3 and ITU-T V. XX (V.10, V11, V24, V35, V36) are supported. The device functions in two ways, either as a Bulk Encryption Device, encrypting any information received or encrypting specific channels of information flow. Furthermore, for the encryption, a certified non-linear algorithm is used to offer maximum security during data transmission, while cryptographic keys are conveniently and easily available to manage.

[0029] The multiplexer (26) consists of a unit where different cards may be inserted having multiple interfaces of independent operation. Cards vary depending on application, they operate independently from one another and they may be placed in any available position of the multiplexer. The unit concentrates and handles in one single point voice and data services and it may support LAN and WAN network topologies. The multiplexer device supports the following applications:

- Analogue and digital voice and facsimile services
- Data transmission through E1 /T1 lines
- Data transmission through serial protocols
- Connection with ISDN network
- Connection with ATM, Frame Relay network
- Connection with LAN network
- Connection with WAN network
- Connection with PSTN network
- Connection with xDSL network

[0030] The GPS device is small, light and portable, offering measurements of longitude, latitude, altitude, time, velocity and direction. Besides its standard operation method, the device may precisely calculate positioning through its PPS operation (Precision Positioning System).

[0031] The terminal is supplied with urban power, whereas inside the protected shelter there is a board of power distribution (10) made of a firm metal construction with a locking metal opening. The board (10) has a switch capacity at 120% of the one required. There is an antivibration base and operation readings on the front. Cables pass through metal stuffing boxes. AC/LINE, AC/HZ, AC/UPS lines from and to loads pass through metal tubes (15) fixed on the protected shelter.

[0032] The supply system (7) consists of a line of accumulators, placed inside a metal cabinet, which is connected in parallel with the integrated UPS line of accumulators (9) and can support the required load. The entire arrangement is placed on a platform on the shelter floor, under the operators' table without hindering their work.

[0033] UPS (9) is firmly constructed, small in dimensions, with modern technology circuits. It operates with a microprocessor, which makes it possible to control all components and to locate deficiencies through self-diagnostic tools. It gives a sound signal indication for any deficiency and it may be connected with a PC or computer network for remote operation, monitoring and maintenance. It has an internal line of closed lead acid accumulators, with no maintenance requirements. It comprises a rectifier / charger, a converter, an automatic switch and protection and control circuits to secure unhindered functioning in case of input changes or voltage variations in the power distribution network.

[0034] In case of failure or interruption of urban power supply, there is a generator (5) supplying power to the terminal. The generator (5) can supply more power than the one required by the unit and it is placed on the same outer base of the protected shelter. It is protected by a metal cabinet made of galvanized steel plates.

[0035] The air conditioning device (3), (4) is firmly constructed on the protected shelter, vibration resistant, supplying hot and cool air, of split unit type for the protection of the equipment installed inside the protected shelter. Having elaborated the system and taking into consideration existing insulations combined with the heat produced by the devices inside the protected shelter, the device ensures ideal inside temperature conditions from 18°C to 23°C, when outside temperatures vary from -20°C to +45°C. Furthermore, there is a ventilating unit (18) for proper ventilation inside the protected shelter.

Claims

1. Secure, autonomous, transportable satellite terminal with a small aperture antenna of VSAT type, for the secure support - through encryption - of telecommunication needs of mobile units, headquarters as well as other special telecommunication needs, including: a) secure satellite communications b) protected shelter c) folding parabolic satellite antenna d) interface of the terminal with a satellite communication network e) digital data modulation f) multiplexer to support analogue and digital voice, facsimile and data services g) a multi-channel cryptographic device for fast encryption-decryption h) interface with a tactical EUROCOM network i) antenna orientation through controller and sensors j) power supply k) generator l) UPS device m) air conditioning device n) GPS receiver system.

2. Secure, autonomous, transportable satellite terminal according to claim 1, where said voice, facsimile and data transmissions are performed in a secure way, through encryption of information by a special cryptographic device of military standards.

3. Secure, autonomous, transportable satellite terminal according to claims 1 and 2, said system is installed inside a protected shelter made of hollow beam profiles soldered together to ensure load resistance, said system offers full corrosion protection to allow operation under adverse environmental conditions.

4. Secure, autonomous, transportable satellite terminal installed inside a protected shelter according to claims 1, 2 and 3, said system is capable of being transportable on a special vehicle.

5. Secure, autonomous, transportable satellite terminal installed inside a protected shelter according to claims 1 to 4, said system is equipped with an electro-hydraulic apparatus for easy and fast lifting, loading / unloading, fixing and stabilizing of the shelter on the ground.

6. Secure, autonomous, transportable satellite terminal according to claims 1 to 5, which said system includes a satellite antenna on the top of the protected shelter for data transmission and reception in various frequency bands, said systems is equipped with special rotation mechanism along the three axes, for the attainment of fast and precise orientation to the selected satellite and a controller for the calculation of the appropriate orientation and the control of antenna rotation mechanism.

7. Secure, autonomous, transportable satellite terminal according to claims 1 to 6, which said system includes a transmitter / receiver interfaced with the satellite antenna and a modem for the appropriate signal modulation and demodulation.

8. Secure, autonomous, transportable satellite terminal according to claims 1 to 7, which said system includes a multiplexer having the capability of accepting multiple cards of independent operation, aiming at the multiplexing and demultiplexing of the signals directed to and from the modem.

9. Secure, autonomous, transportable satellite terminal according to claims 1 to 8, which said system supports the connection of telephone devices, facsimile devices, LANs, WANs, serial interfaces, ATM networks, Frame Relay, ISDN networks, PSTN networks, xDSL networks, E1/T1 channels and other digital / analogue communication protocols.

10. Secure, autonomous, transportable satellite terminal according to claims 1 to 9, which said system supports interface with a said EUROCOM tactical communication network.

11. Secure, autonomous, transportable satellite terminal according to claims 1 to 10, which said system includes a GPS providing measurements of longitude, latitude, altitude, time, said system offers a significant feature for the accurate positioning through a Precision Positioning System (PPS).

12. Secure, autonomous, transportable satellite terminal according to claims 1 to 11, which said system is supplied by an urban power supply, a UPS system and alternatively by a generator.

13. Secure, autonomous, transportable satellite terminal according to claims 1 to 12, of which said system

the inner and outer sides of the protected shelter are covered by aluminum plates for full corrosion protection of the system and appropriate polyurethane insulation for thermal protection of interior of the shelter, said system together with the air conditioning device ensures inside temperatures from 18°C to 23°C (with outside temperatures from -20°C to +45°C).

14. Secure, autonomous, transportable satellite terminal, which includes a variety of systems from any of the claims 1 to 13.

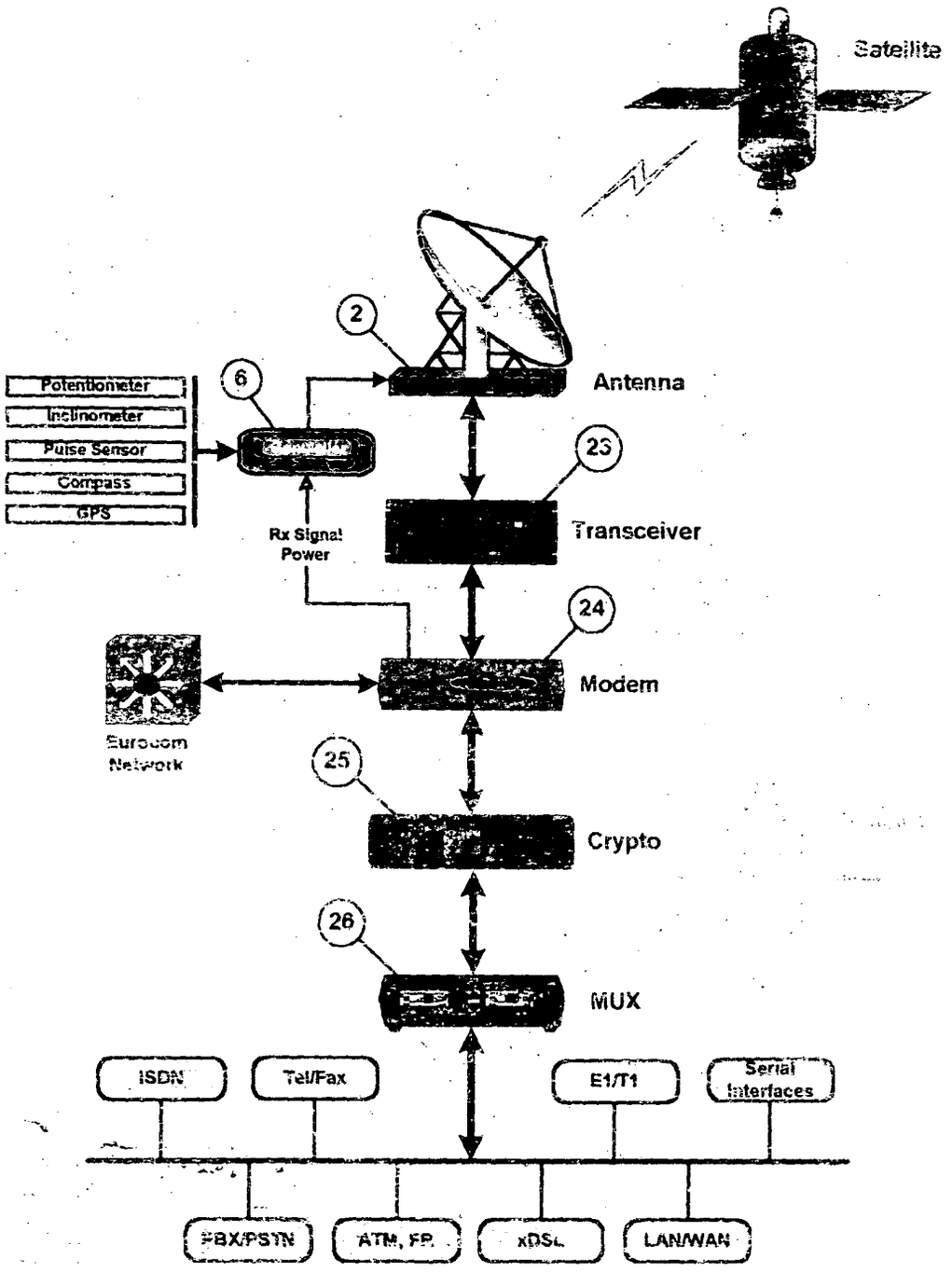

Figure 2. Functional Configuration of the VSAT terminal

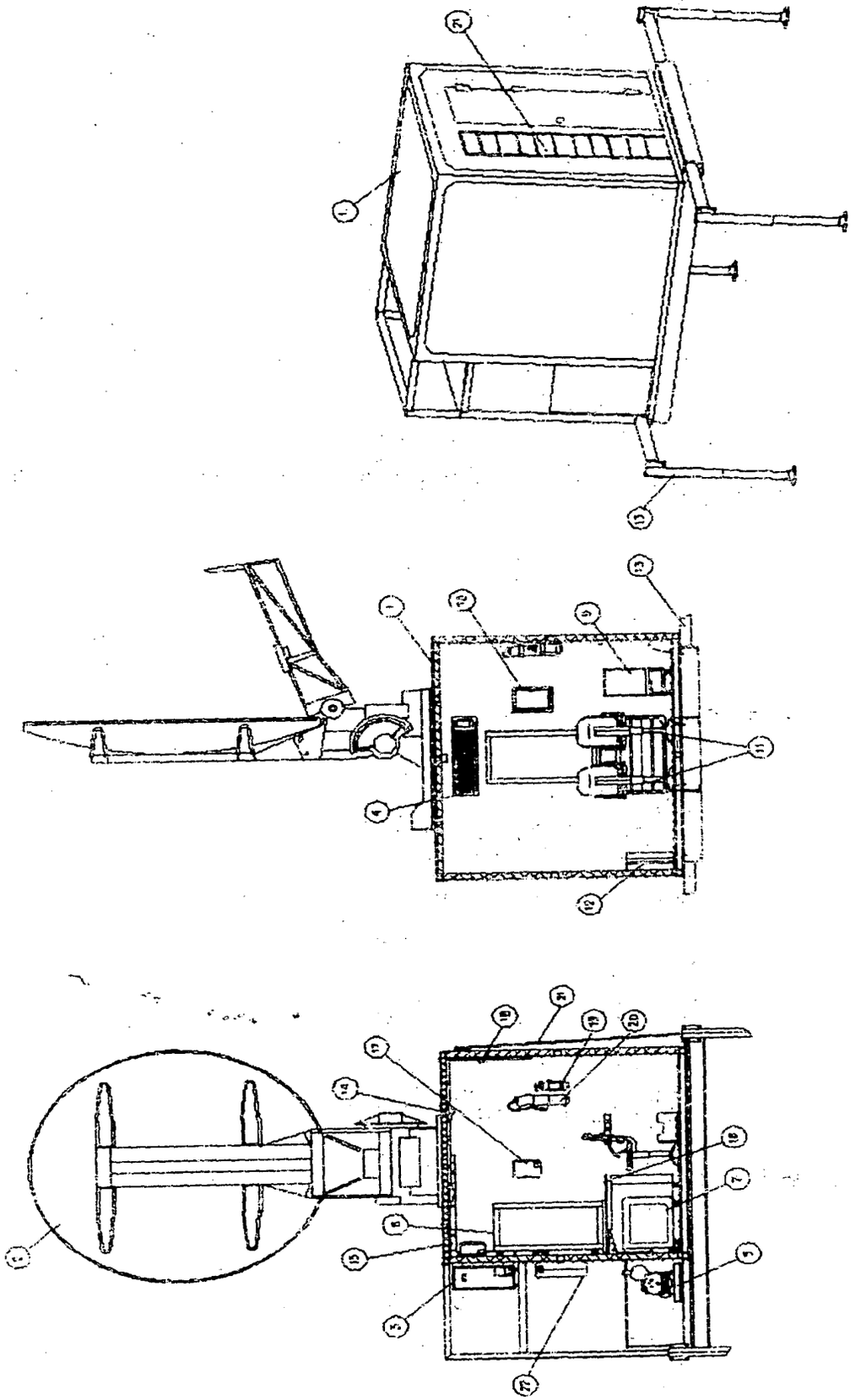

Figure 1. Mechanical Arrangement of the VSAT terminal.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 38 6022

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	15 September 2004	Sorrentino, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 03 38 6022

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