بسم الله الرحمن الرحيم

SATELLITE COMMUNICATIONS - SERVICES AND APPLICATIONS

LECTURER : Dr. Lotfi Laadhar

I INTRODUCTION

II SATCOM - PRINCIPLE

III TVSAT & VSAT

IV LINK DESIGN – SatMaster Pro

SATELLITE COMMUNICATION SYSTEMS

[1] - DENIS RODDY SATELLITE COMMUNICATIONS 1996

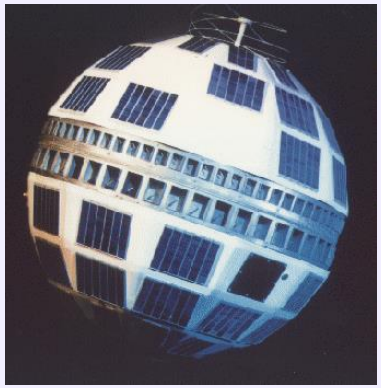
[2] – DONALD C. MEAD DIRECT BROADCAST SATELLITE COMMUNCATIONS 2000

[3] - TRI T. HA DIGITAL SATELLITE COMMUNICATIONS 1990

HISTORY

1957 – LAUNCH THE FIRST SATELLITE SPUTNIC1

1961 – AT&T HAD LAUNCHED TELSTAR



1964 August 20 - International Telecommunications Satellite Organization (INTELSAT).

HISTORY CON't

1976 – ARABSAT organization was created

1977- EUTELSAT was created

1979 - The International Maritime Organization sponsored the establishment of the International Maritime Satellite Organization INMARSAT

HISTORY CON't

1984–1985-1988 French satellites TELECOM had launched (I generation)

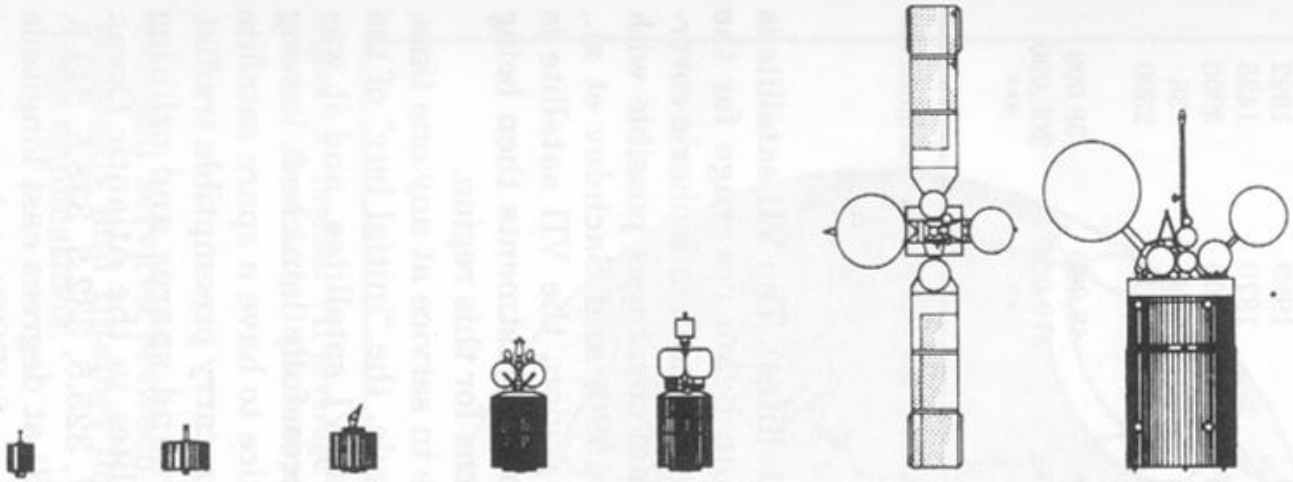
1995 – HOTBIRD I had lunched

1996 - II generation of ARABSAT was launched

1999 -Launching BADR-3 to the orbit of 26° East, the same orbit of Arabsat 2A.

Feb.28 2006 - Proton rocket fails in ARABSAT 4A launch

INTELSAT FLEET



Designation: Intelsat	I	II	III	IV	IV A	V	V A/V B	VI
Year of first launch	1965	1966	1968	1971	1975	1980	1984/85	1986/87
Prime contractor	Hughes	Hughes	TRW	Hughes	Hughes	Ford Aerospace	Ford Aerospace	Hughes
Width (m)	0.7	1.4	1.4	2.4	2.4	2.0	2.0	3.6
Height (m)	0.6	0.7	1.0	5.3	6.8	6.4	6.4	6.4
Launch vehicles		Thor Delta		Atlas-Centaur		Atlas-Centaur and Ariane	Atlas-Centaur and Ariane	STS and Ariane
Spacecraft mass in transfer orbit (kg)	68	182	293	1385	1489	1946	2140	12,100/3720
Communications payload mass (kg)	13	36	56	185	190	235	280	800
End-of-life (EOL) power of equinox (W)	40	75	134	480	800	1270	1270	2200
Design lifetime (years)	1.5	3	5	7	7	7	7	10
Capacity (number of voice channels)	480	480	2400	8000	12,000	25,000	30,000	80,000
Bandwidth (MHz)	50	130	300	500	800	2137	2480	3520

EUTELSAT FLEET

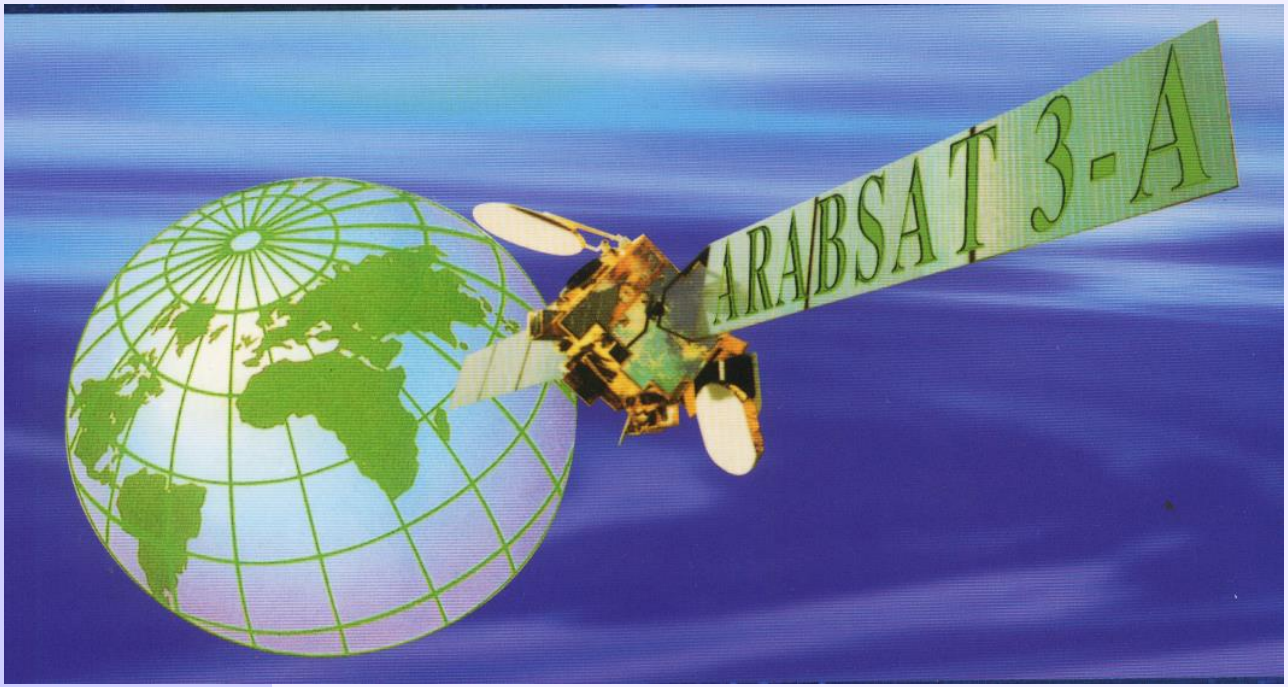
Satellite	Date	Duration
Eutelsat-1 F1,F2,F3,F4,F5	1981-1988	7 years
Eutelsat-2 F1,F2,F3,F4,F5	1990-1994	10 years
Hotbird1	1995	10 years
Hotbird 2, 3, 4, 5	1996-1998	12 years
Eutelsat W2, W3, W4, W5 (W1)	1998-2002	12 years
Eutelsat-W1R	2000	12 years
Atlantic Bird2	2001	12 years
Eurobirdt-1(W1R)	2001	12 years
Atlantic Bird1	2002	15years
Hotbird 6	2002	12 years
Atlantic Bird3 (Stellat 5)	2002	15years
Hotbird7	2002	12 years
Eutelsat-W 3A	2002	12 years
e-Bird	2003	10 years
HOTBIRD 8	2006	15 years

ARABSAT FLEET

ARABSAT 1A, 1B, 1C, 1D and 1E

ARABSAT 2A, 2B, 2C, 2D (BADR 2)

ARABSAT 3A (BADR3)



Arabsat 4-A (BADR1)

will carry 24 active channels in C-band
16 active Ku-band channels

Arabsat 4A was deorbited
on 24.03.2006 over the pacific

Arabsat 4-B (BADR4)

June’2006

Arabsat 4-C (BADR6)

2008

NILESAT FLEET

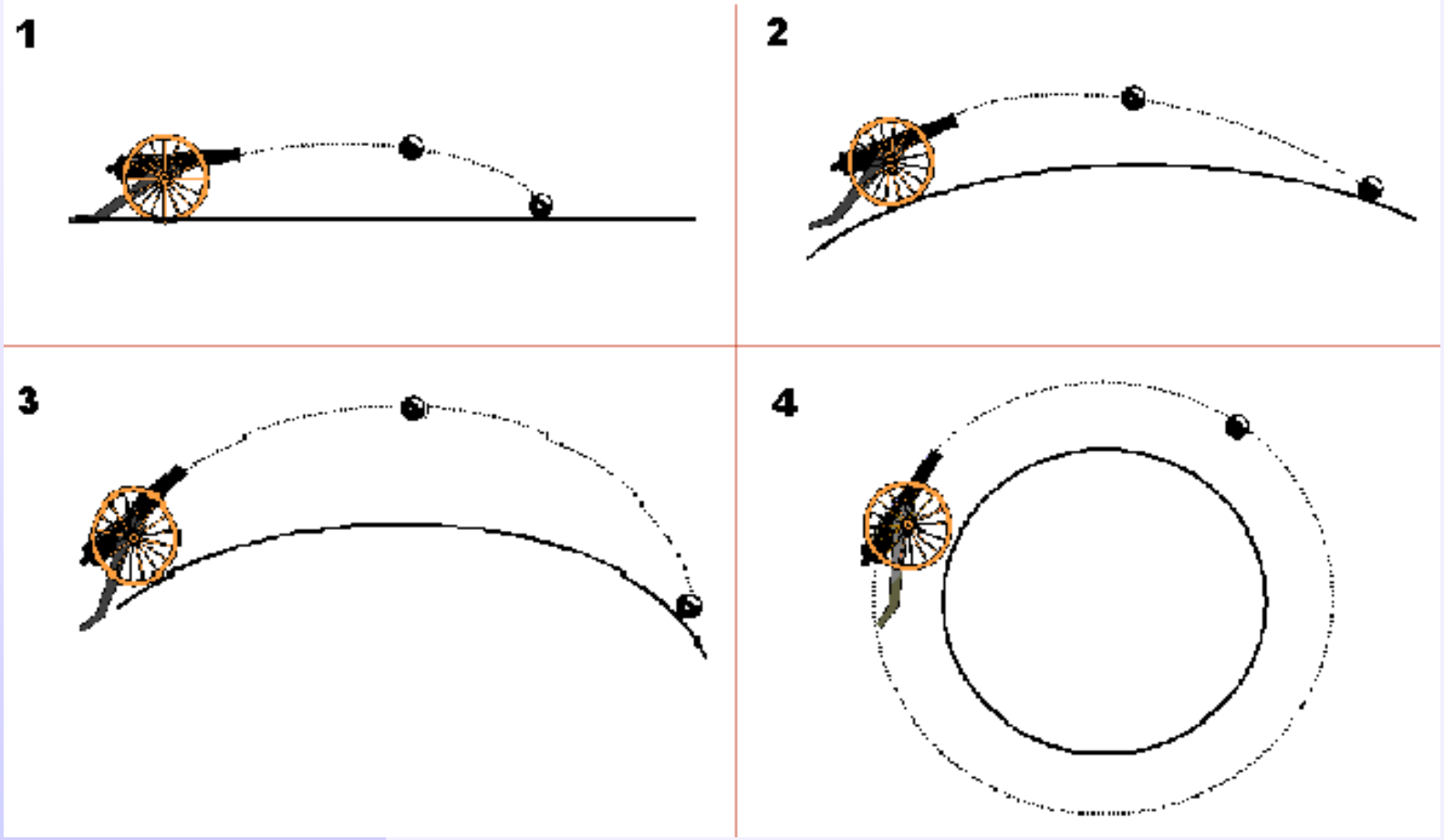
	NILESAT 101	NILESAT 102
Launch Information		
Launch Date	28 April 1998	17 August 2000
Launch Vehicle	Arian 4	
Launch Mass	1840 Kg	1827 Kg
Orbital Information		
Satellite Manufacturer	MATRA MARCONI SPACE	ASTRIUM
Orbital Position	7° West	
Stabilization System	3-Axis	
System Power Consumption (Max)	3.02 kW	3.06 kW
Expected Life Time	15 Years	

NILESAT FLEET

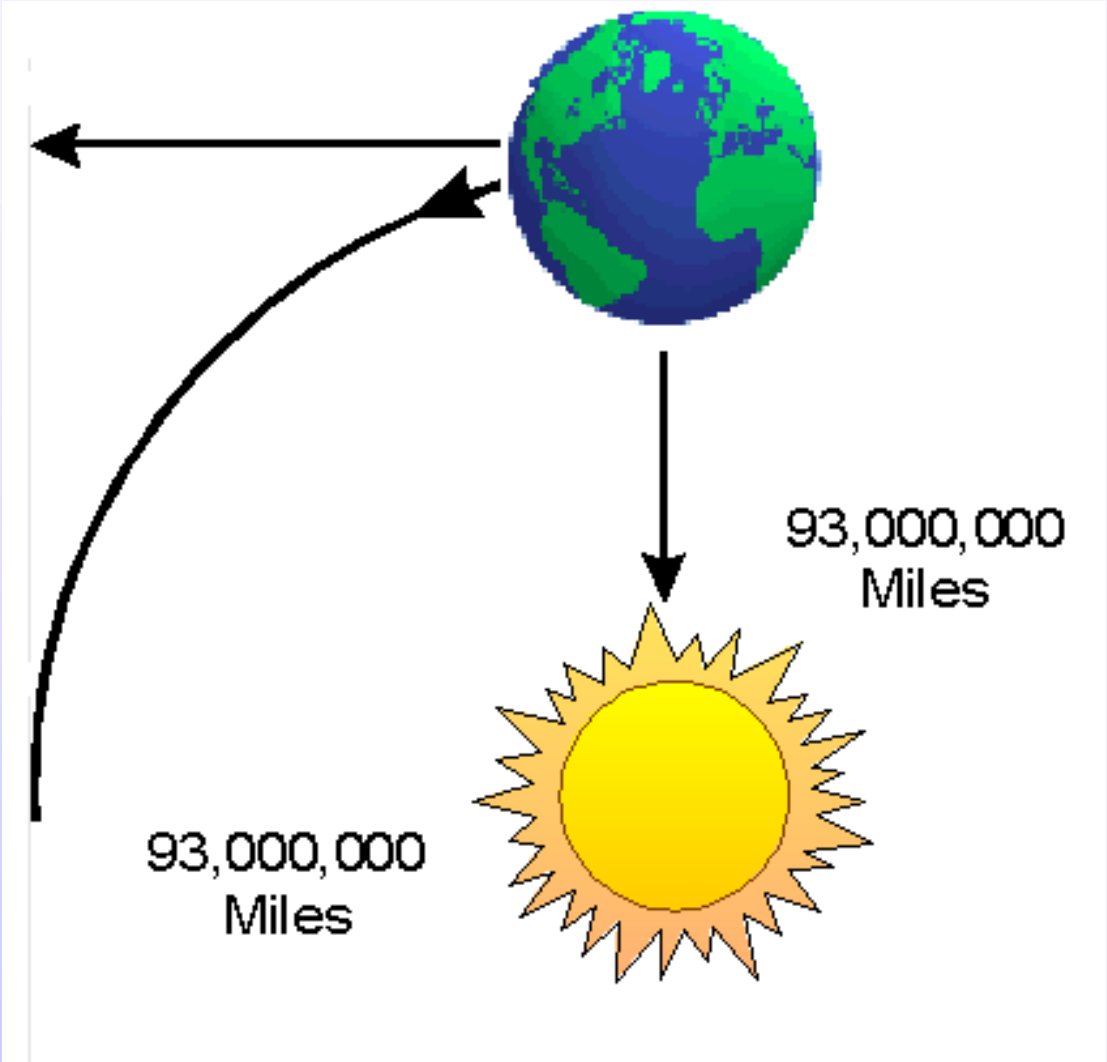
	NILESAT 101	NILESAT 102
Payload Information		
EIRP (Max.)	50.1 dBW	
G/T (Max.)	1.5 dB/K	
Downlink Frequency Band (KU)	11.7 - 12.1 GHz	11.8 – 12.3 GHz
Uplink Frequency Band (KU)	17.3 - 17.7 GHz	17.4 – 17.9 GHz
No. of Transponders	12	
Transponder Bandwidth	33 MHz	
Transponder Output Power	100 W	
TWTA Redundancy	16 for 12 in each satellite	
Polarization	Linear	
Saturation Flux Density (FGM) * london Horn	-76 to -96 dBW/m^2	-76 to –94 dBW/m^2 -72.5 to –90.5 dBW/m^2
Operation Information		
Receiving Dish Diameter	50 cm to 75 cm within the coverage area.	
Operation Start Date	31 May 1998	12 September 2000

ORBITS AND LAUNCHING METHODS

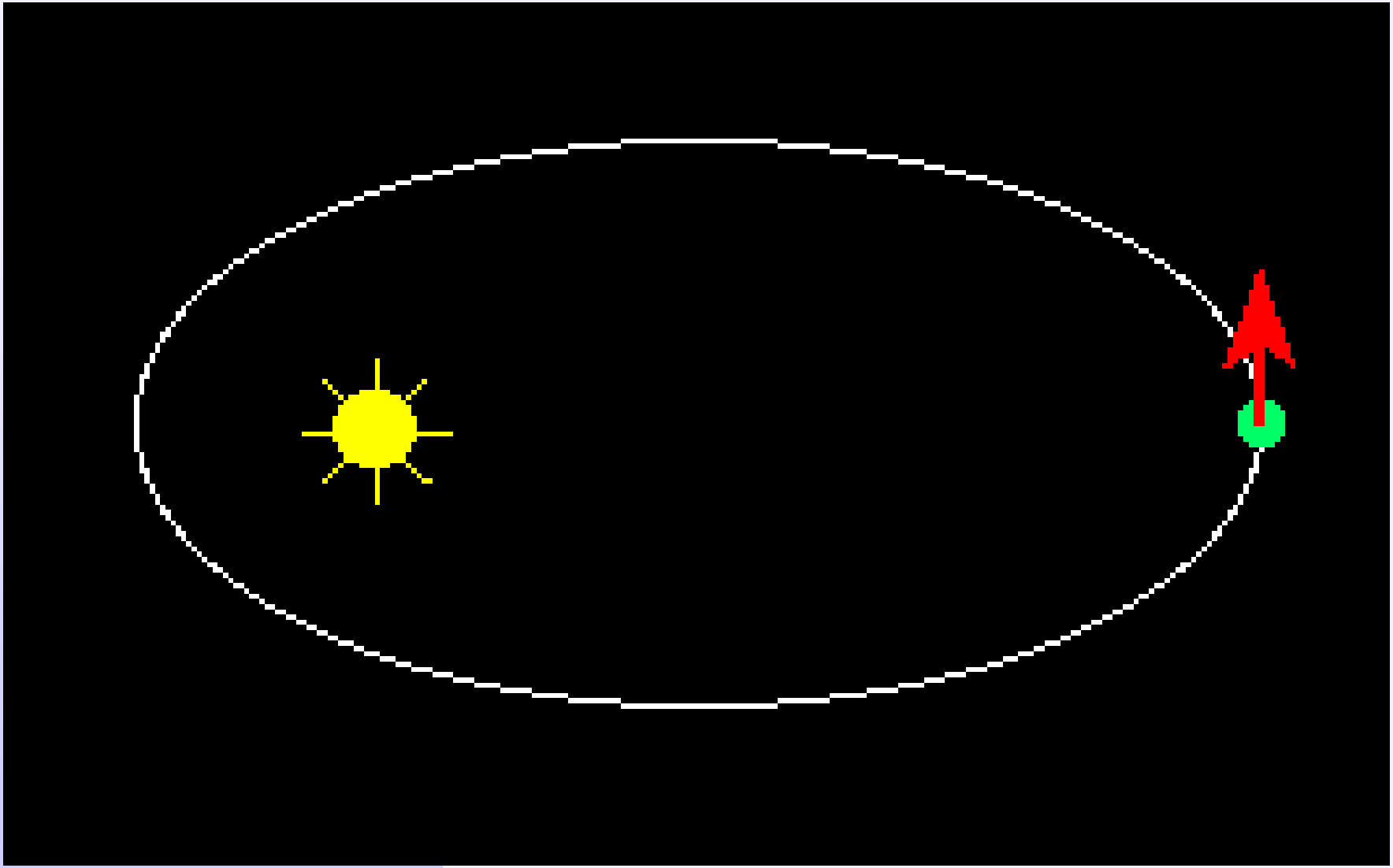
LUNCHING AN ARTIFICIAL SATELLITE



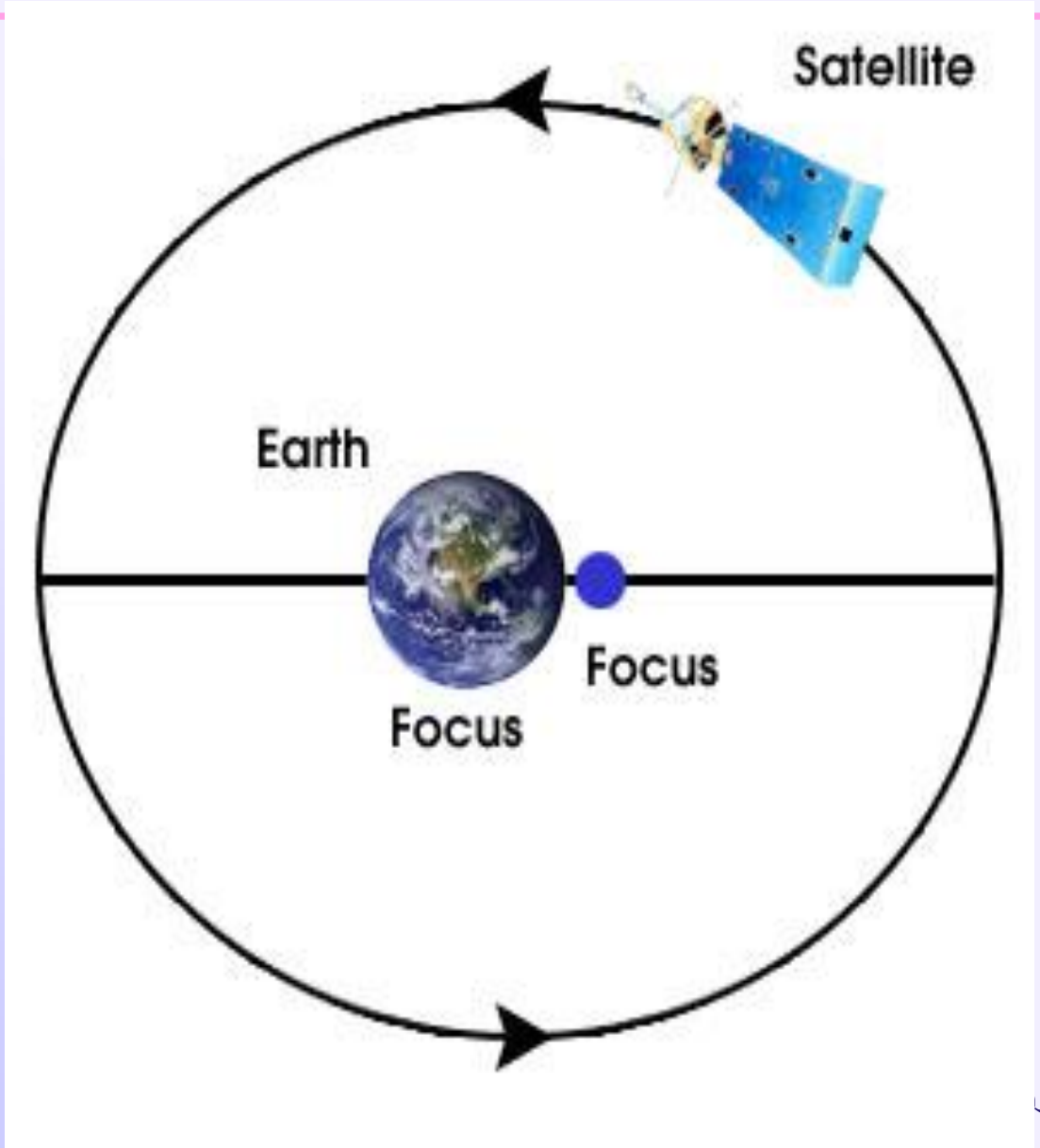
Earth orbits the sun



The Earth orbits the sun



KEPLER'S LAW



$$F_2 = \frac{4\pi^2 M_S D}{T^2}$$

$$F_1 = \frac{G M_S M_E}{D^2}$$

$$F_1 = \frac{G M_S M_E}{D^2} = F_2 = \frac{4\pi^2 M_S D}{T^2}$$

G= $6.67.10^{-11}$ Nm^2/Kg

Universal Gravitation

$M_E = 6.10^{24}$ Kg– Earth mass

M_S – Satellite mass

D=(6378 + h) Km

KEPLER'S LAW

$$F_1 = \frac{G M_S M_E}{D^2} = F_2 = \frac{4\pi^2 M_S D}{T^2}$$

$$D = \sqrt[3]{\frac{T^2 . G . M_E}{4 . \pi^2}}$$

DIFFERENT KINDS OF ORBITS

1 – LOW EARTH ORBIT L E O

IRIDIUM

SPONSORED BY MOTOROLLA

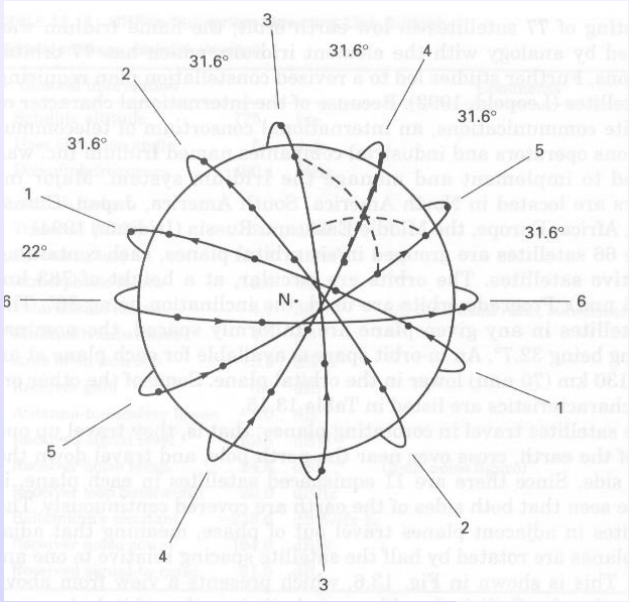
ALTITUDE 640 KM

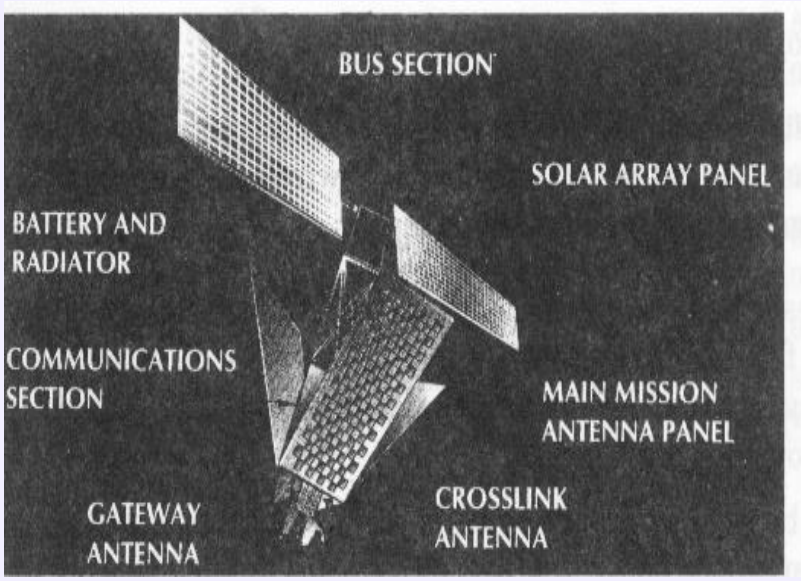
6 ORBITAL PLANS

11 SATELLITES PER PLAN

TOTAL 66 SATELLITES

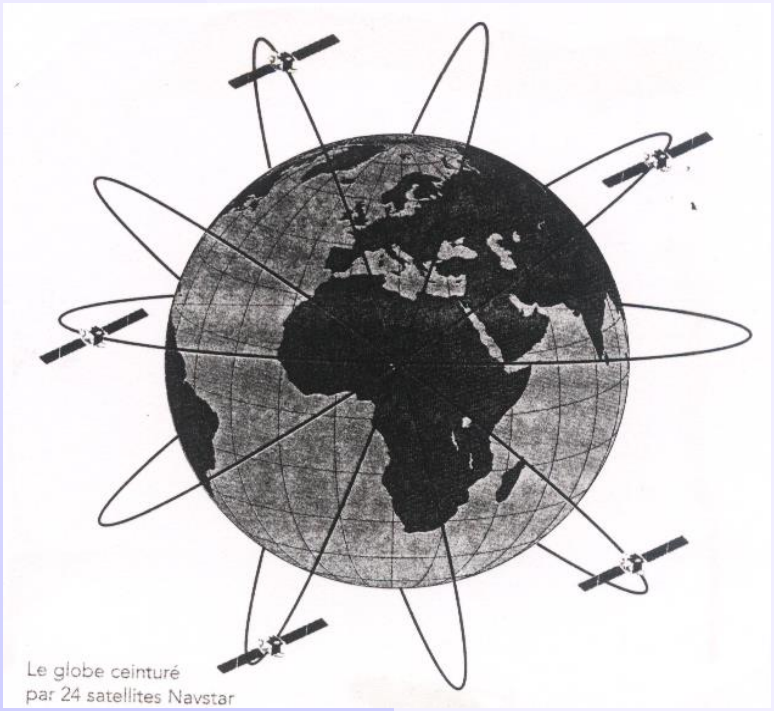
IRIDIUM


3
31.6°
31.6°
4
2
31.6°
5
31.6°
1
22°
31.6°
N
6
6
1
5
2
4
3


BUS SECTION
SOLAR ARRAY PANEL
BATTERY AND
RADIATOR
COMMUNICATIONS
SECTION
MAIN MISSION
ANTENNA PANEL
GATEWAY
ANTENNA
CROSSLINK
ANTENNA

2 – MEDIUM EARTH ORBIT M E O

GLOBALSTAR


Le globe ceinturé
par 24 satellites Navstar

ALTITUDE 1440 KM

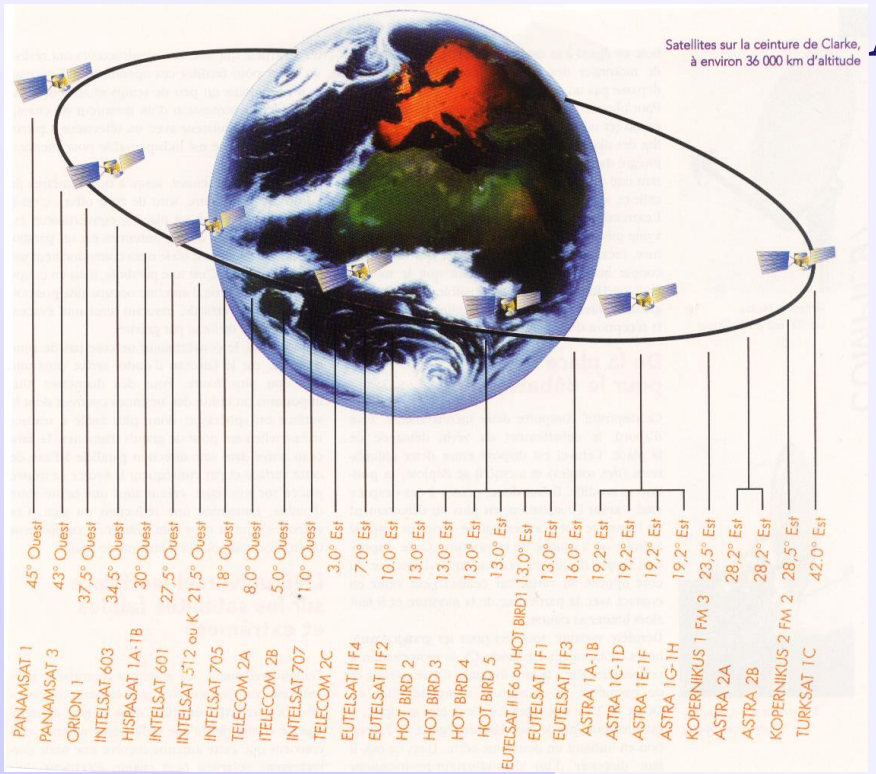
8 ORBITAL PLANS

6 SATELLITES PER PLAN

TOTAL 48 SATELLITES

3 – GEOSYCHRONOUS EARTH ORBIT

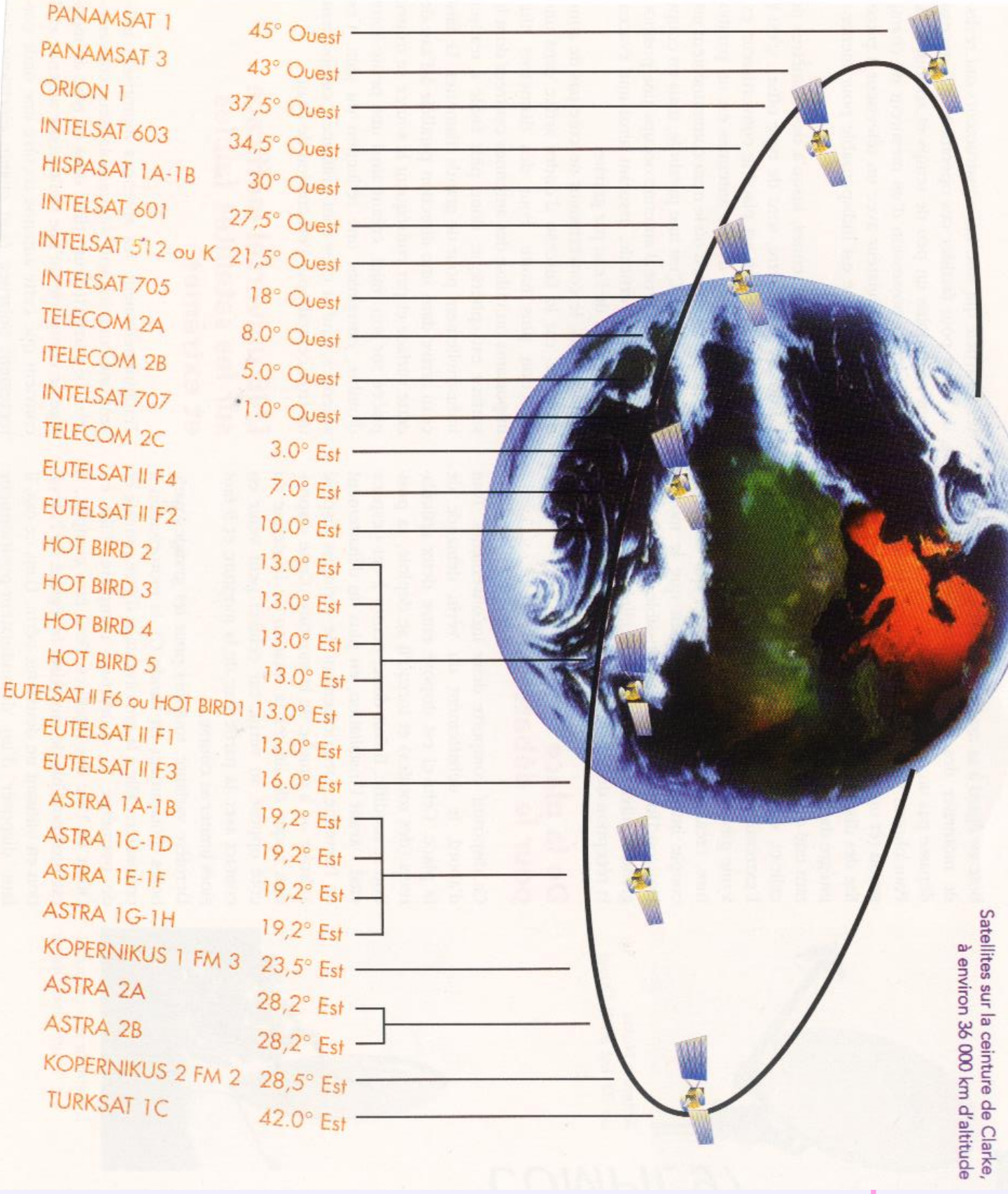
G E O



ALTITUDE 36000 KM

≈ 1000 SATELLITES

30 % ACTIVE

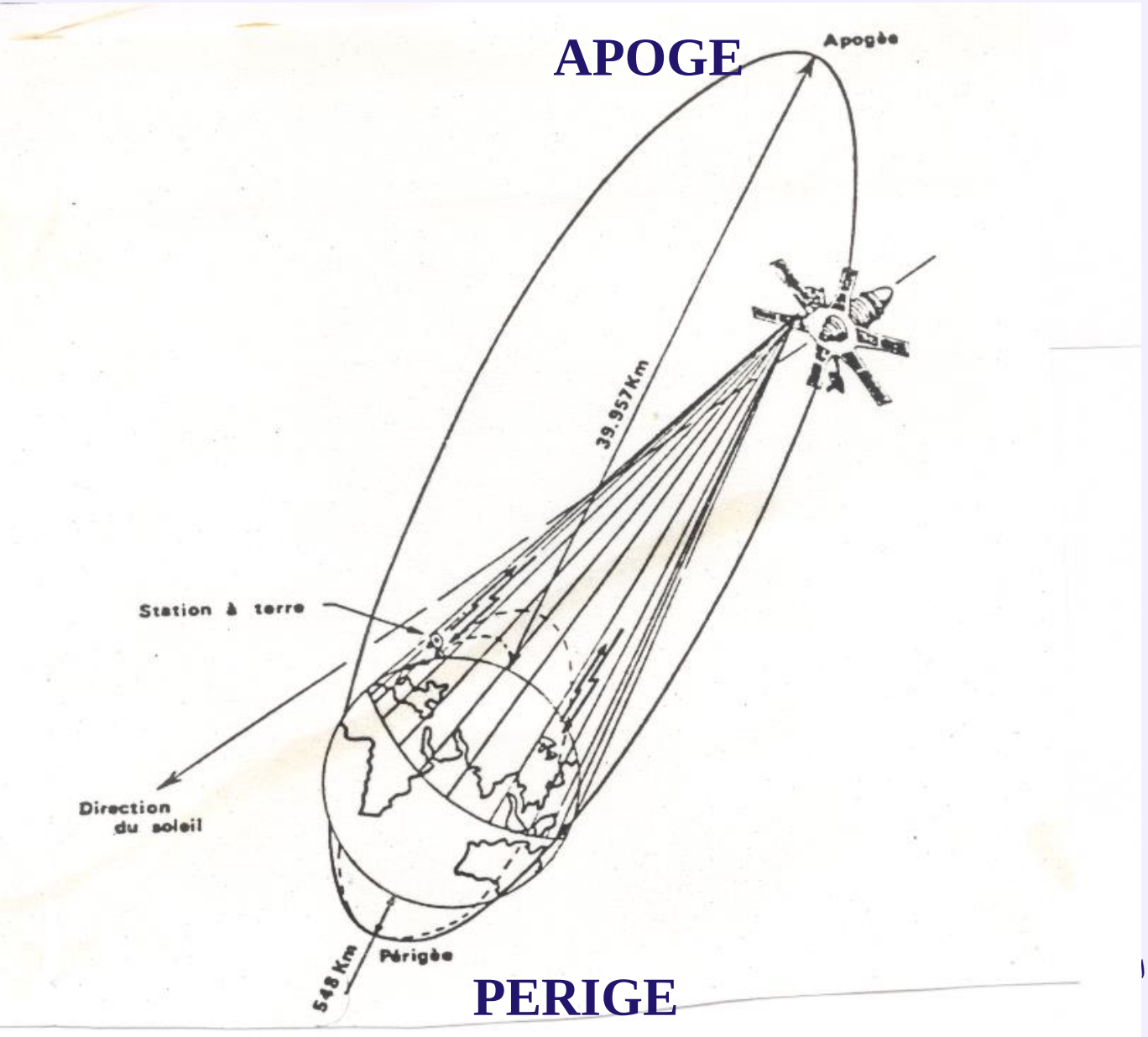


Satellites sur la ceinture de Clarke, à environ 36 000 km d'altitude

Features of different satellite constellations

Type	LEO	MEO	GEO
Description	Low Earth Orbit	Medium Earth Orbit	Geostationary Earth Orbit
Height	00-1000 miles	6000-12000 miles	36000 KM
Time in LOS	15 min	2-4 hrs	24 hrs
Merits	1) Lower launch costs. 2) Short round trip signal delay. 3) Small path loss.	1) Moderate launch cost. 2) Small round trip delays.	1) Covers as much as 42.2% of the earth's surface. Ease of tracking. 2) No problems due to doppler.
Demerits	1) Shorter life, 5-8 years. 2) Encounters radiation belts.	1) Larger delays. 2) Greater path loss than LEO's.	1) Very large round trip delays. 2) Expensive Earth Stations due to weak signals.

ELIPTIC ORBIT



TELSTAR

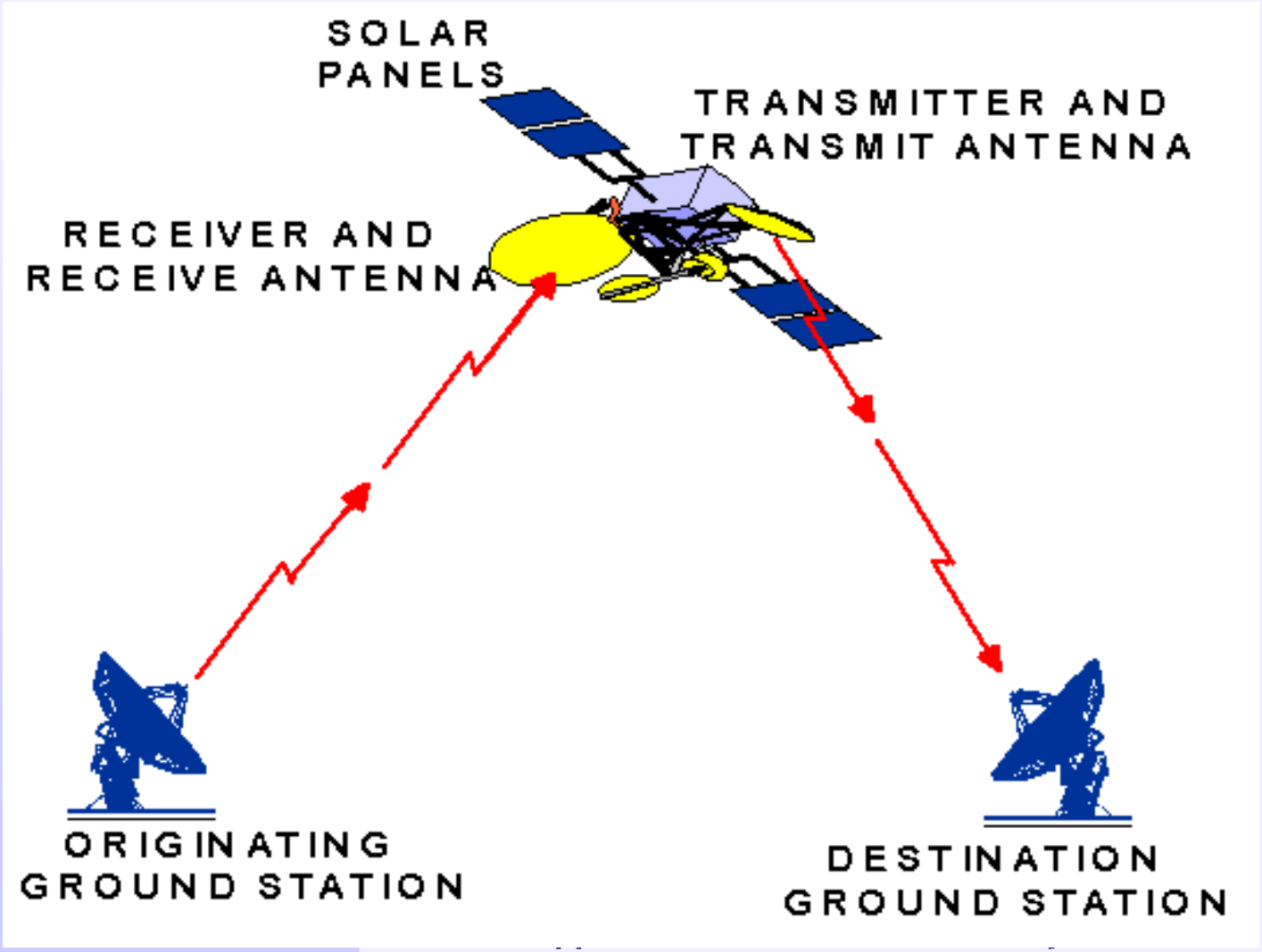
RELAY

MOLNYA

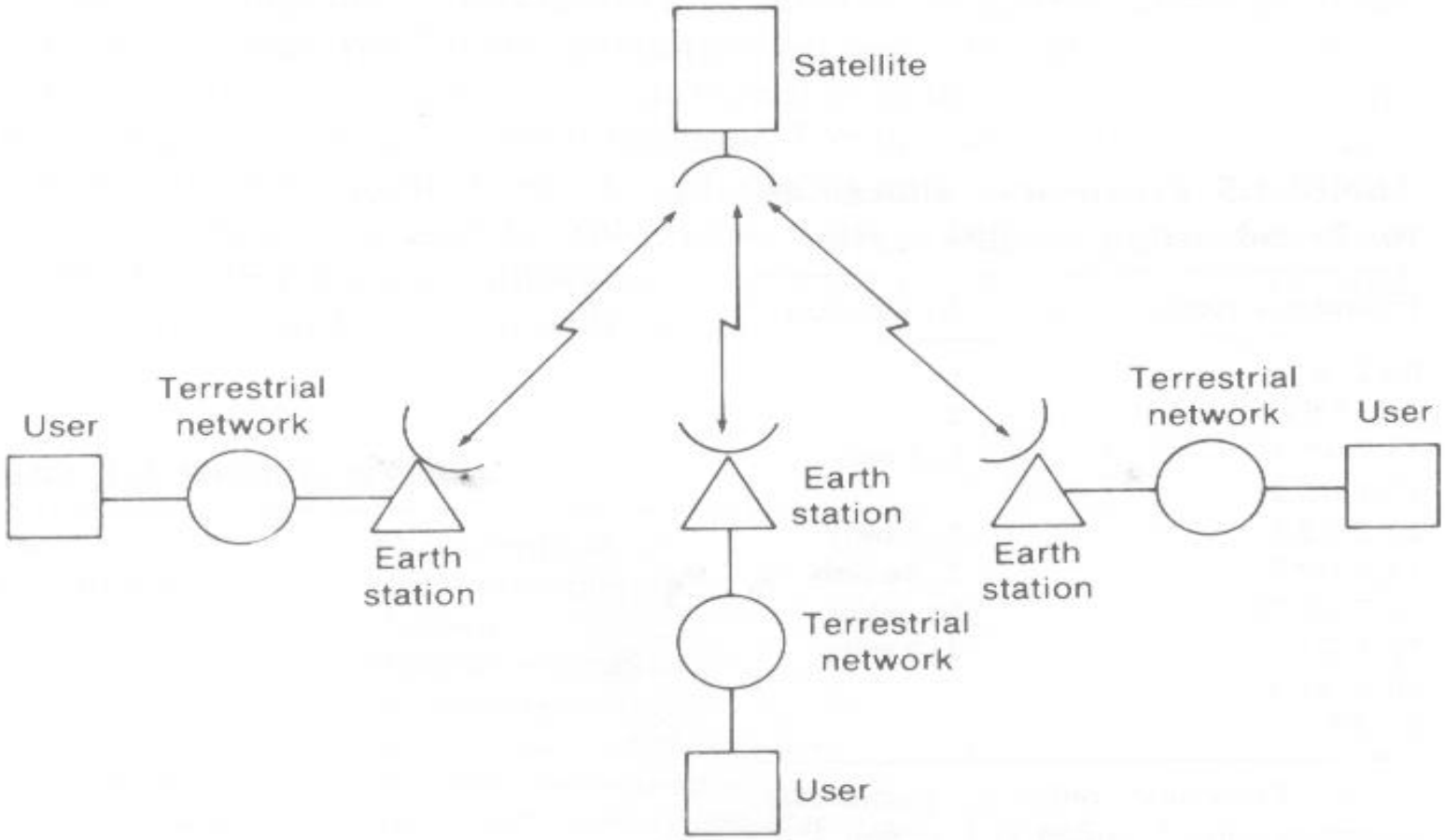
دورة لمنسوبي ا

I SATELLITE COMMUNICATION PRINCIPLE

(POINT TO POINT)



POINT TO MULTIPOINT (BROADCASTING)



III FREQUENCY AND POLARIZATION

1) FREQUENCY

FIXED SATELLITE SERVICE (FSS)

BROADCAST SATELLITE SERVICE (BSS)

MOBILE SATELLITE SERVICES

NAVIGATION SATELLITE SERVICES

METEROLOGICAL SATELLITE SERVICES

TIME OUT!

KILO = $x\ 10^3$

MEGA = $x\ 10^6$

GIGA = $x\ 10^9$

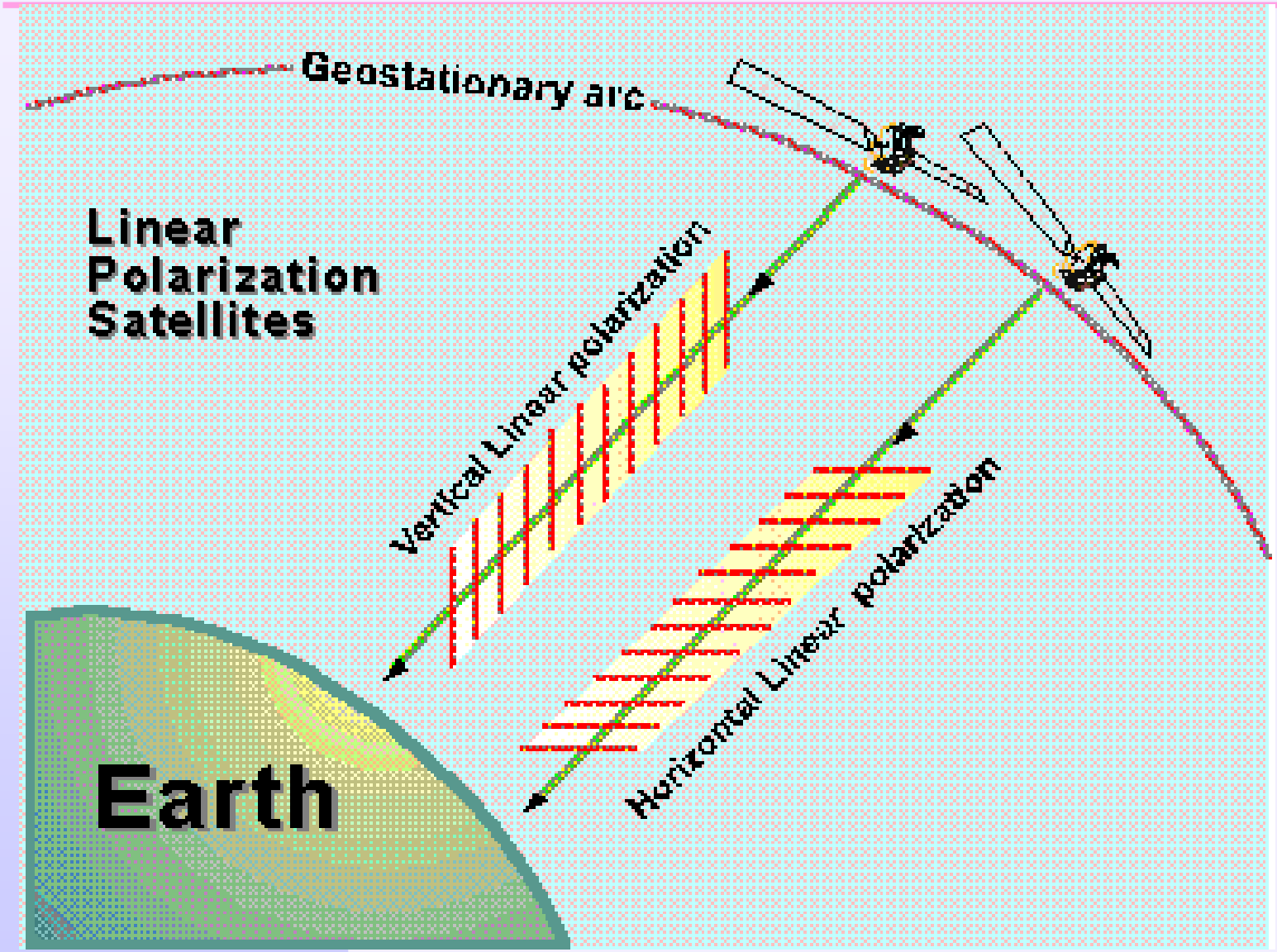
BAND DESIGNATION	UP-LINK GHz	DOWN-LINK GHz
S	4	2
C	6	4
X	8	7
Ku	14	11/12
K	24	18
Ka	40	24

POLARIZATION

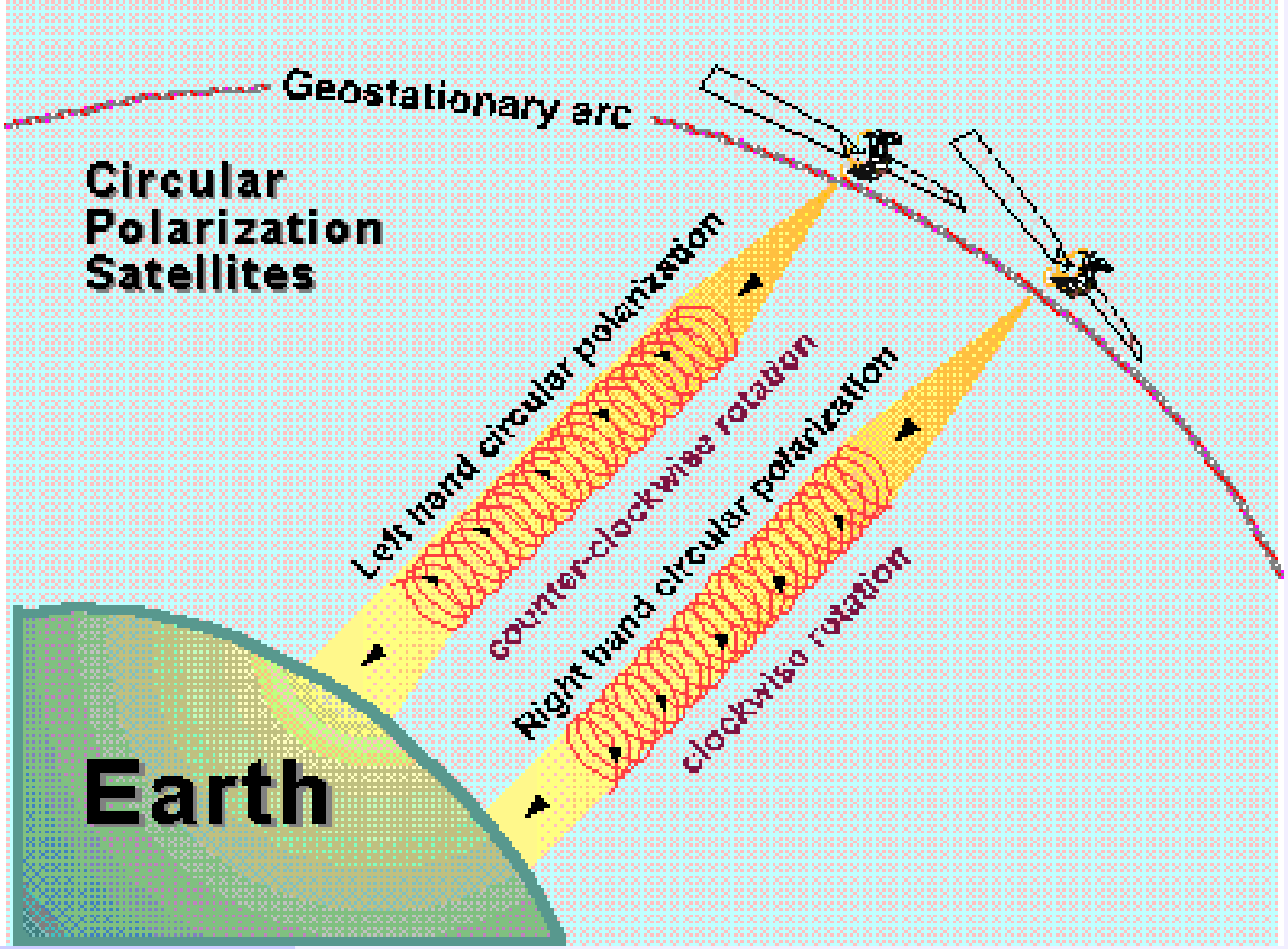
a) V/H POLARIZATION

b) RHC/LHC POLARIZATION (CIRCULAR)

a) V/H POLARIZATION



b) RHC/LHC POLARIZATION

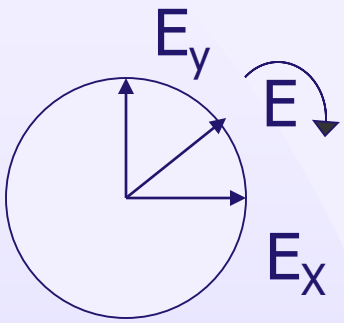


a) V/H POLARIZATION

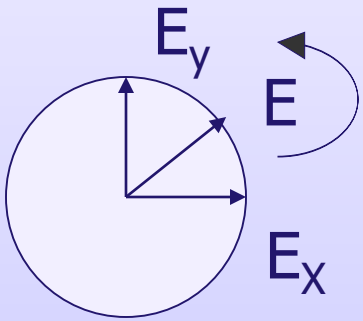
VERTICAL POLARIZATION

HORIZONTAL POLARIZATION

b) RHC/LHC POLARIZATION



Right-Hand Circular
RHC



Left-Hand Circular
LHC

SPACE SEGMENT

THE PAYLOAD

It refers to the equipment used to provide the service for which the satellite has been lunched

THE BUS

Refers to the various subsystems which provide the power, attitude control, orbital control, thermal control, command and telemetry functions required to the service payload.

TRANSPONDER

Refers to the equipment which provide the connecting link between the satellite transmit and receive antennas

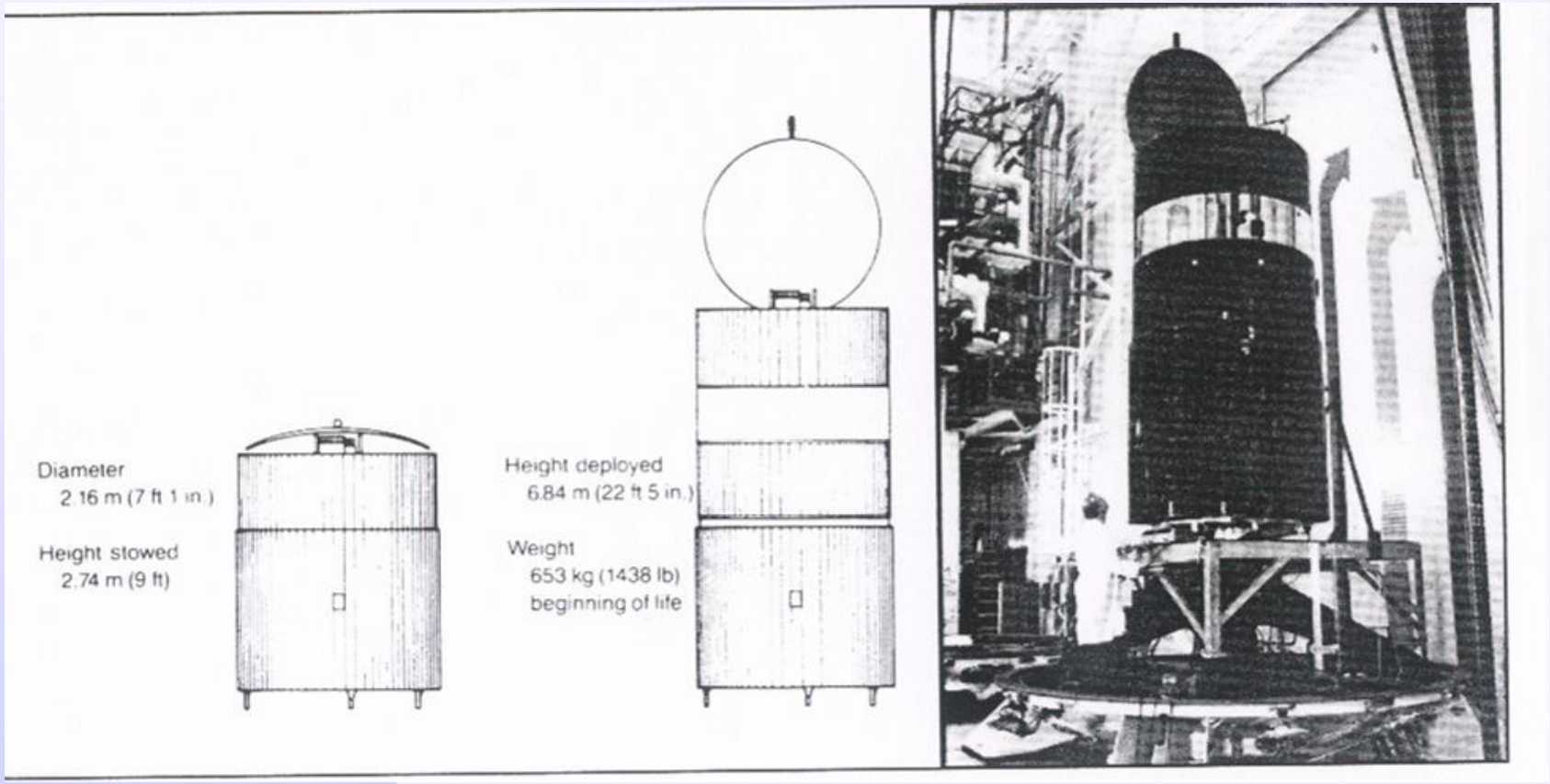
THE ATTITUDE CONTROL

THE ATTITUDE CONTROL DEPENDS ON SATELLITE TYPE

 **SPIN STABILZATION**

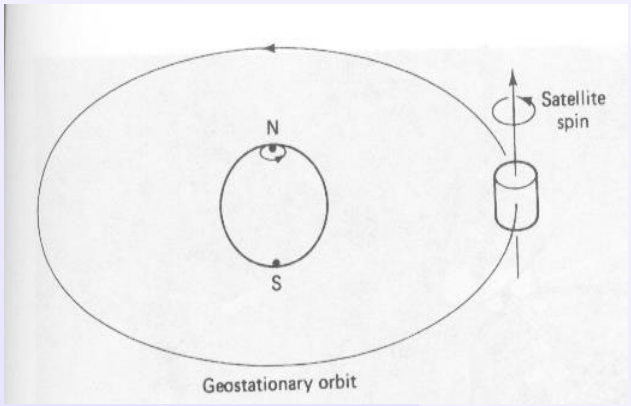
- **3-AXIS STABILIZATION OR BODY STABILIZATION**

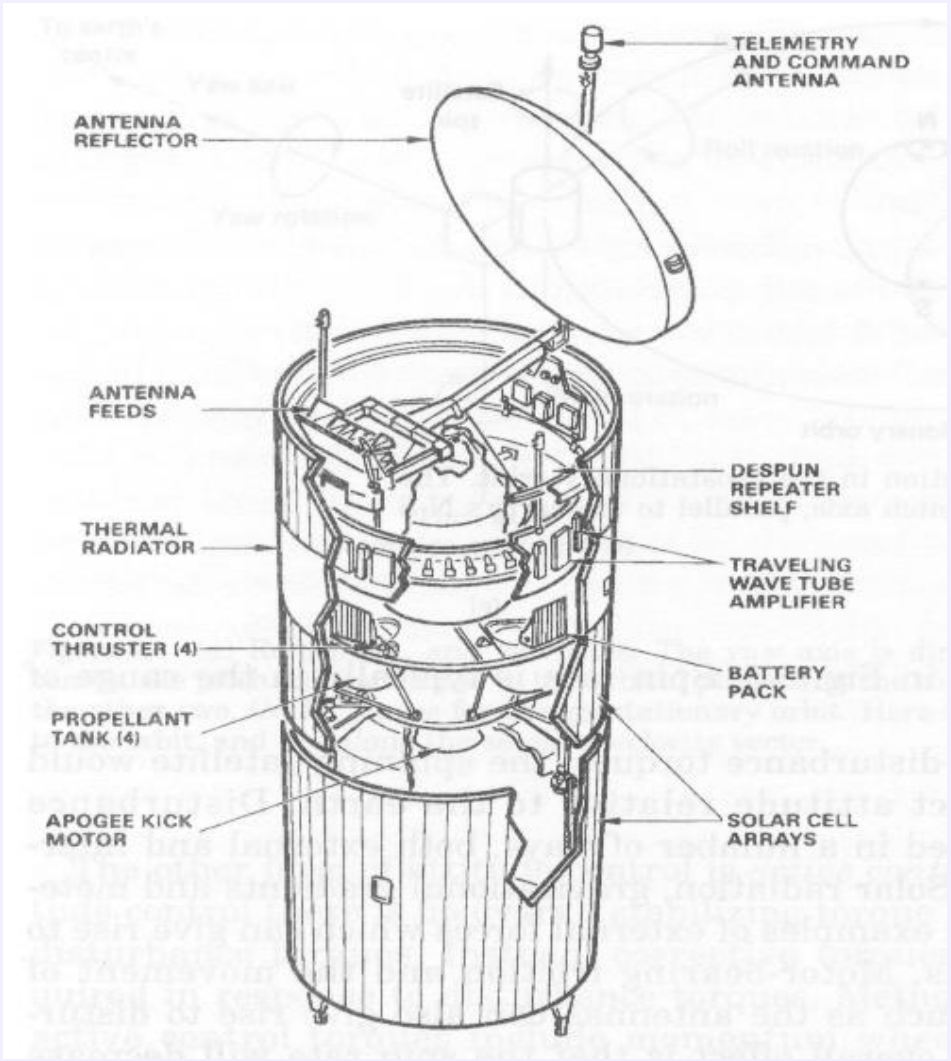
SPIN STABILIZATION



- **SPIN RATE IS TYPICALLY IN THE RANGE OF 50 ÷ 100 REV/min**

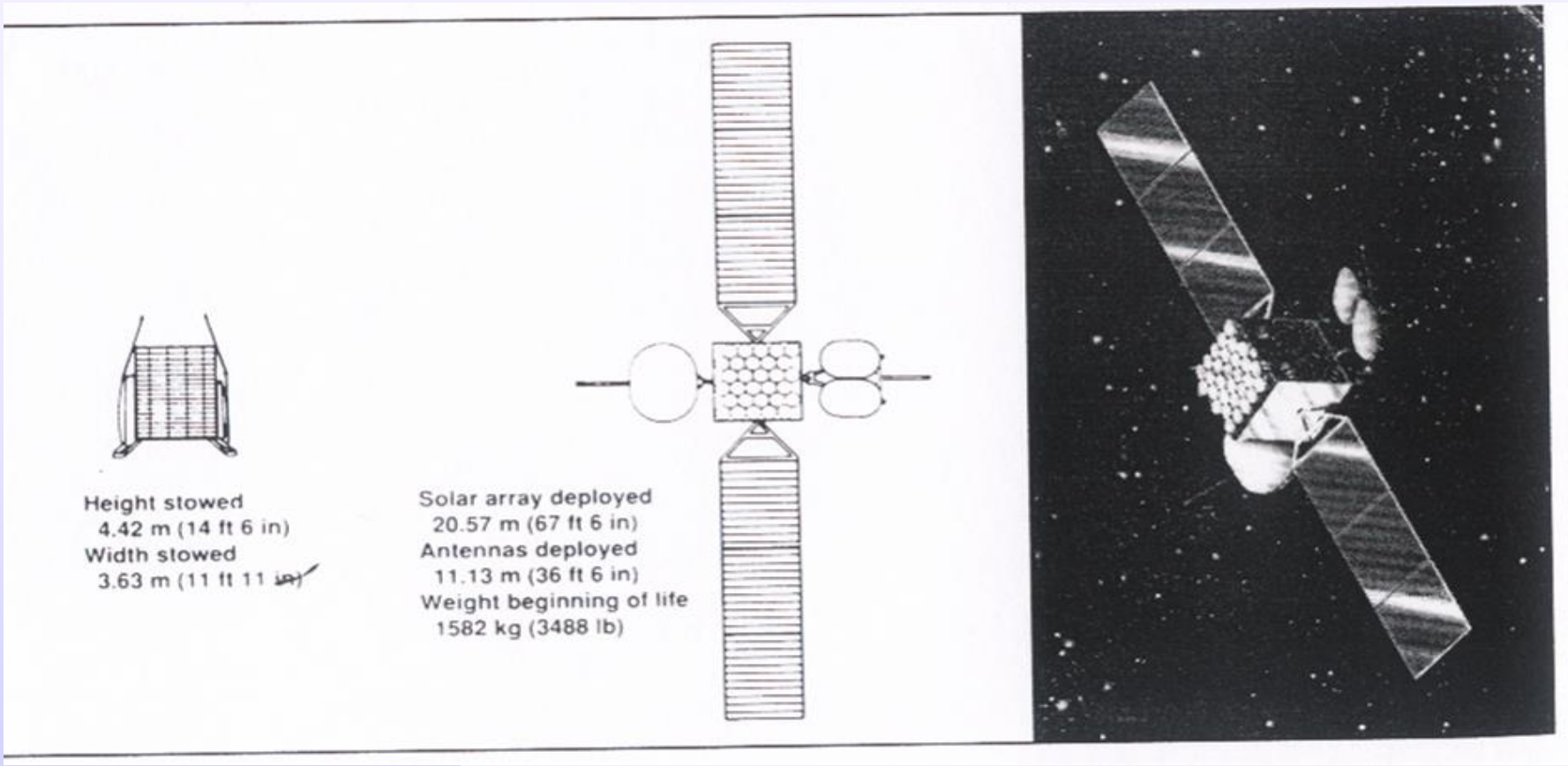
SPIN AXIS





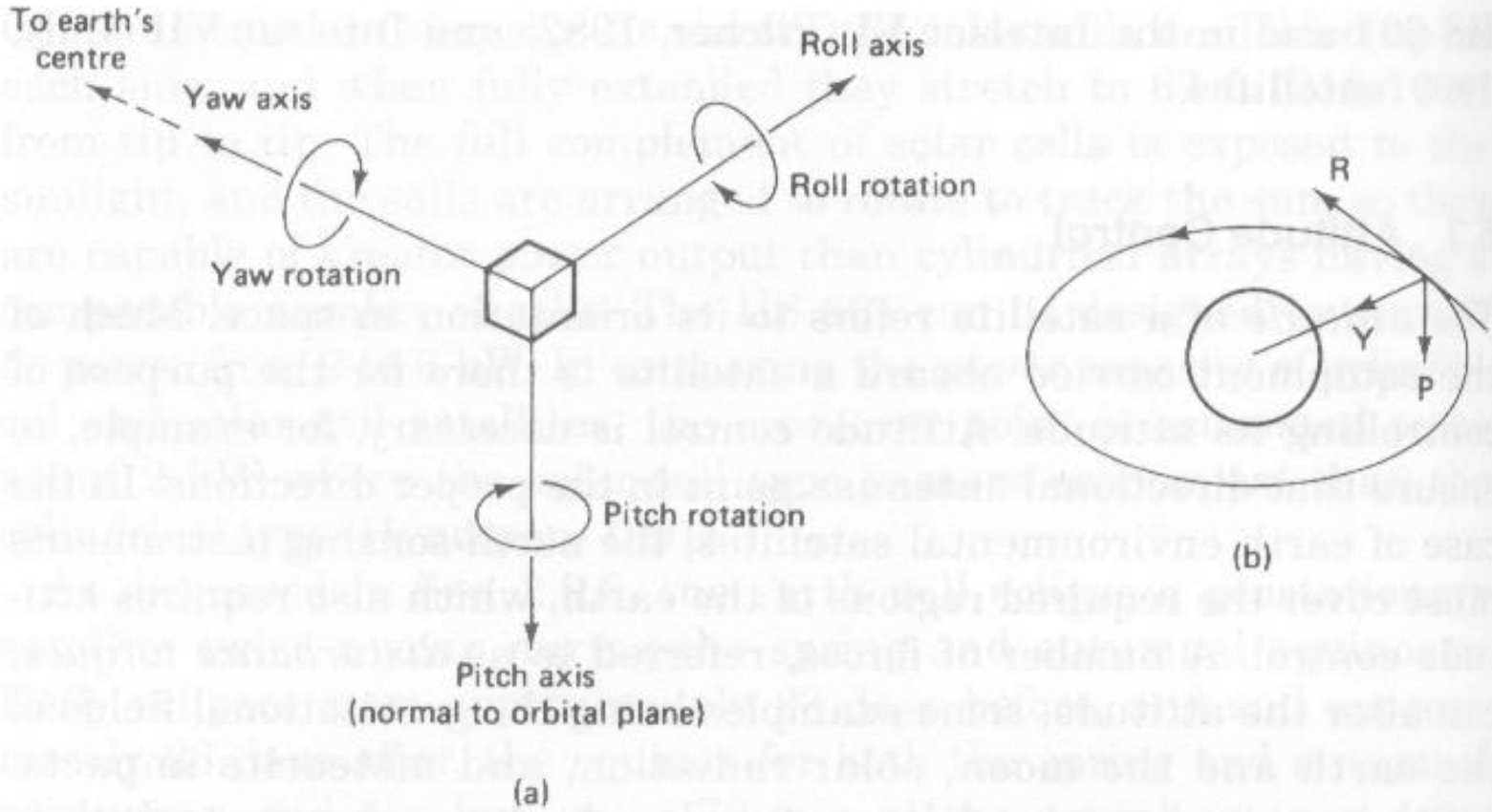
- **THE SPIN AXIS IS ADJUSTED TO BE PARALLEL TO N-S AXIS OF THE EARTH**

3-AXIS STABILIZATION



- **BECAUSE THE BODY REMAIN FIXED RELATIVE TO THE EARTH, 3-AXIS SATBILIZATION IS ALSO KNOWN AS BODY STABILIZATION**

ROLL PITCH and YAW AXIS



- **THE THREE AXIS ARE ROLL, PITCH AND YAW**

3-AXIS STABILIZATION

!

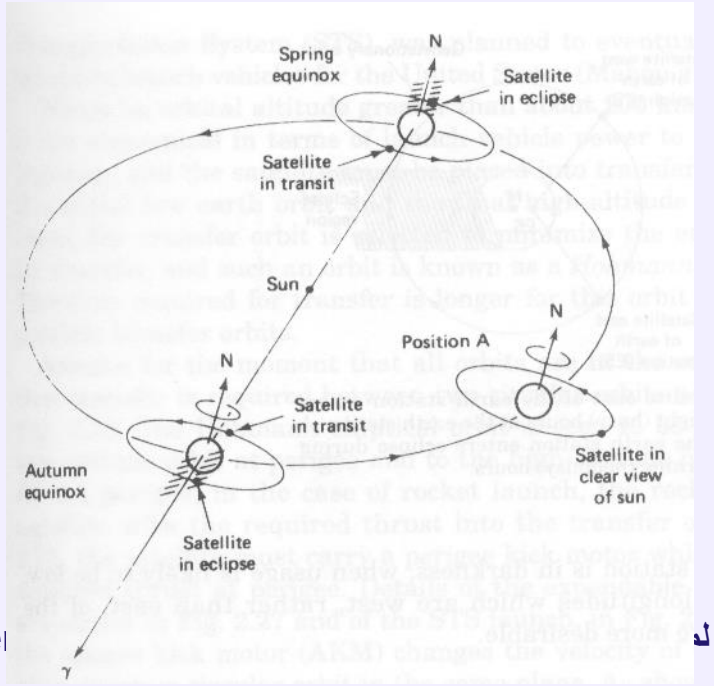
FOR COMMUNICATION SATELLITE, 3-AXIS STABILIZATION IS OFTEN USED

THE POWER SUPPLY

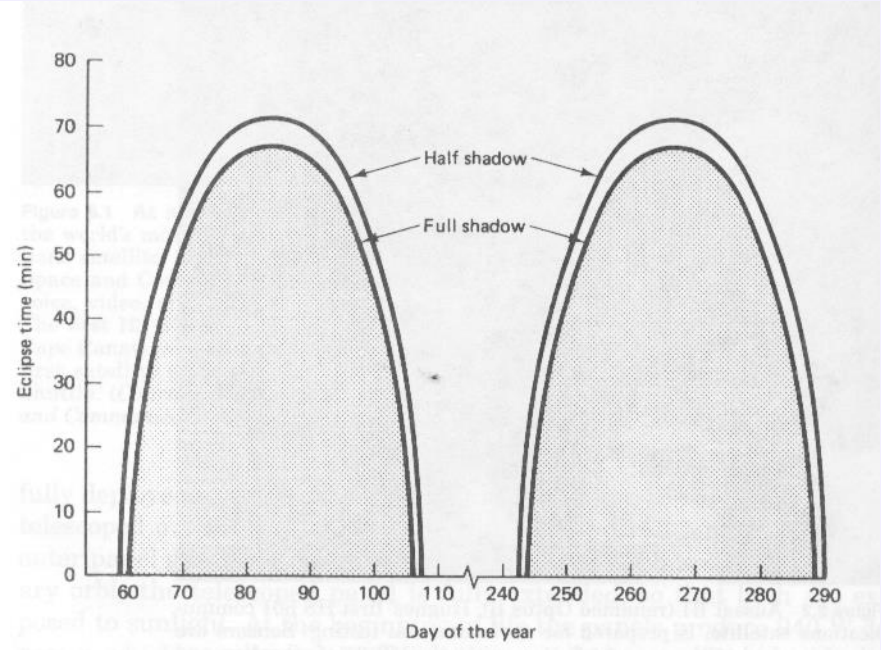
Primary Electrical Power supply provide from SOLAR CELLS

ARRAYS of cells in series-parallel connection are required so that have high power

The daily eclipse start approximately 23 days before EQUINOX And end approximately 23 days after.



EQUINOX

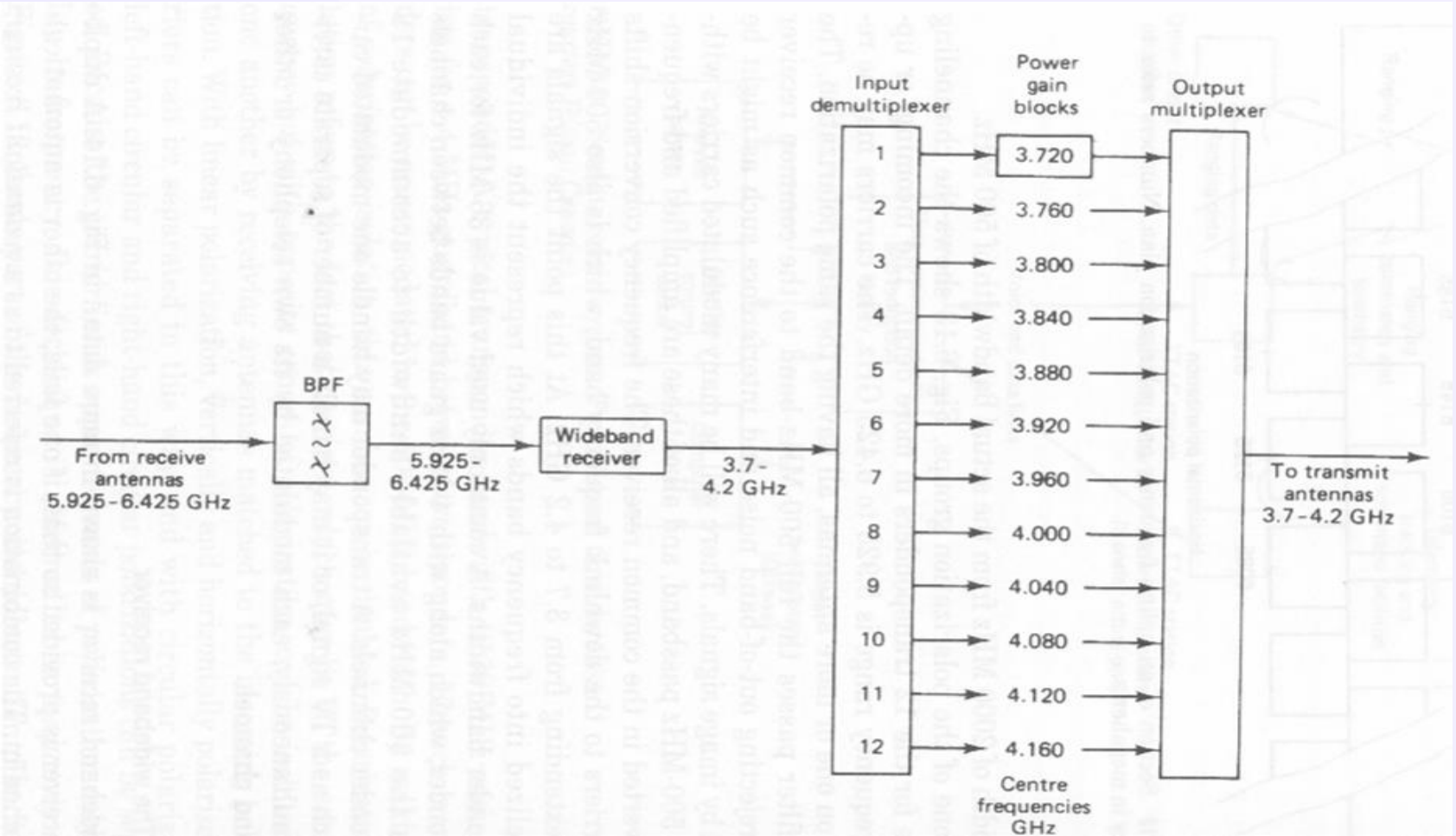


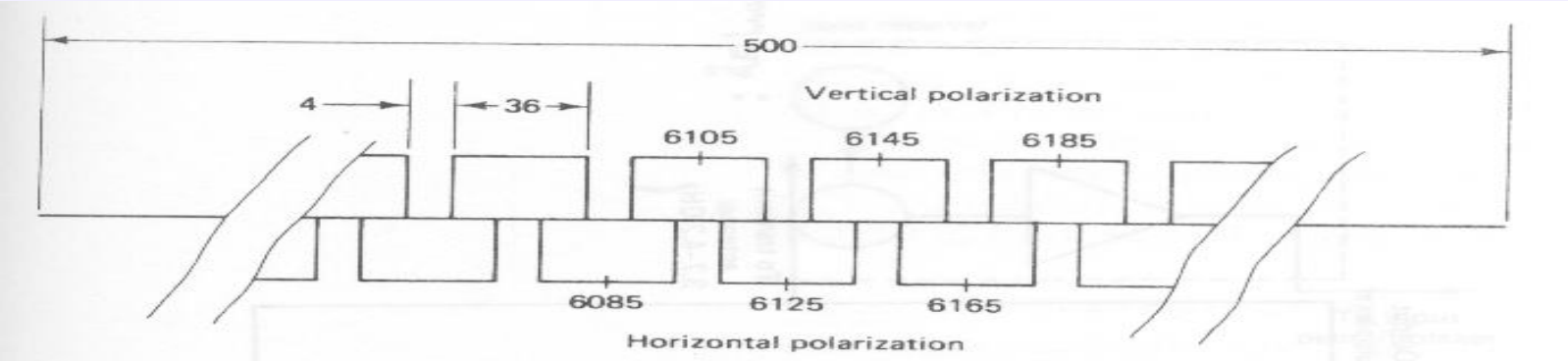
The EQUINOX for both the SPRING and AUTOMN can last Up to 72 min at the actual EQUINOX day.

During ECLIPSE power is provided by a NICKEL-CADMIUM Ni-Cd or NICKEL-HYDROGEN (Ni-H_2)Long life batteries.

TRANSPONDER

TRANSPONDER – SERIES OF INTERCONNECTED UNITS WHICH FORMS A SINGLE COMMUNICATIONS CHANNEL BETWEEN THE RECEIVE AND TRANSMIT ANTENNAS IN A COMMUNICATION SATELLITE.





THE BANDWIDTH ALLOCATED FOR THE C-BAND SERVICE IS 500 MHz, THIS IS DEVIDED INTO SUBANDS ONE FOR EACH **TRANSPONDER**

BY MAKING USE OF POLARIZATION ISOLATION, THIS NUMBER CAN BE DOUBLED

LINEAR POLARIZATION V AND H
CIRCULAR POLARIZATION LHC AND RHC

SATELLITE ACCESS

I INTRODUCTION

FDMA

Frequency Division Multiple Access

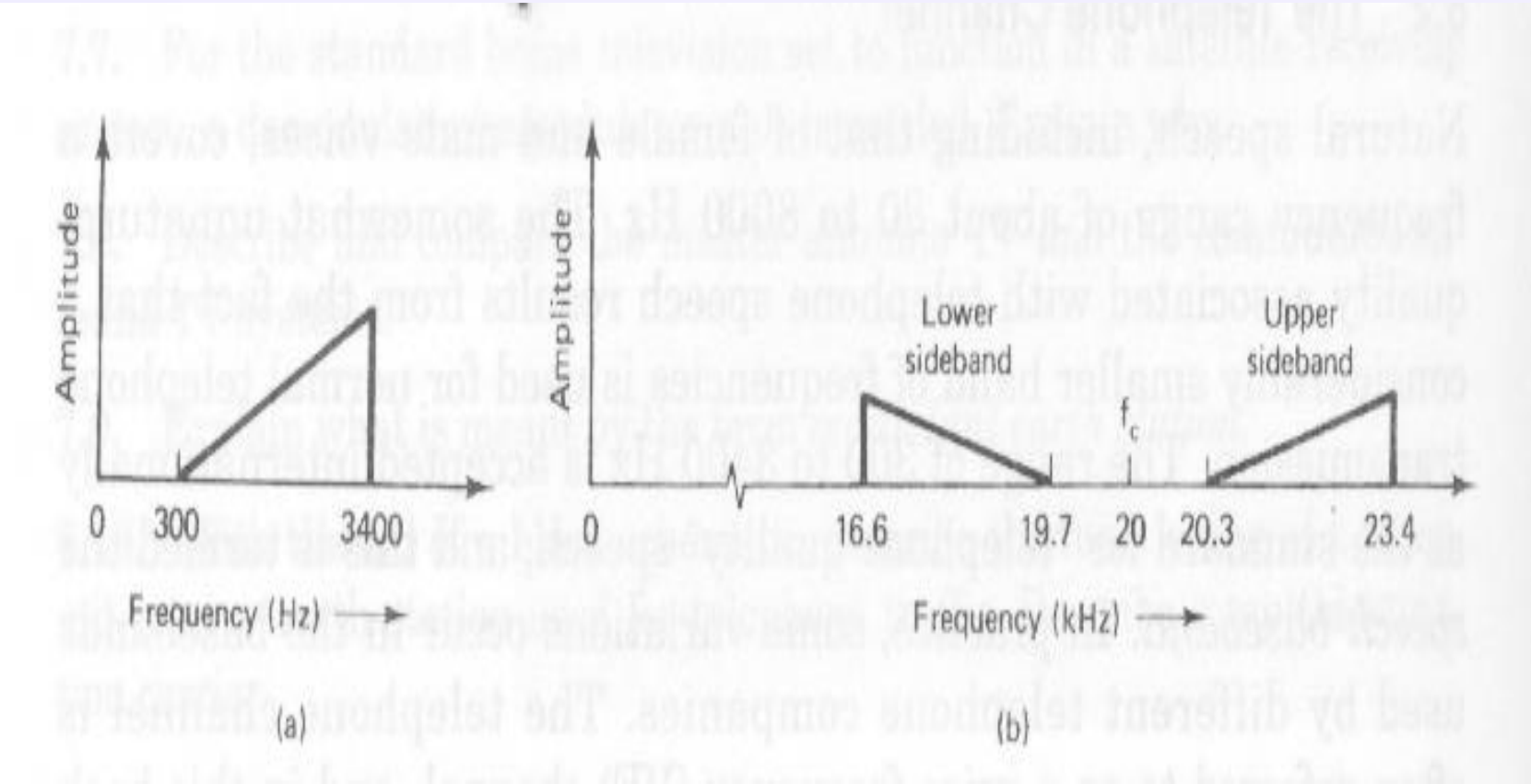
TDMA

Time Division Multiple Access

CDMA

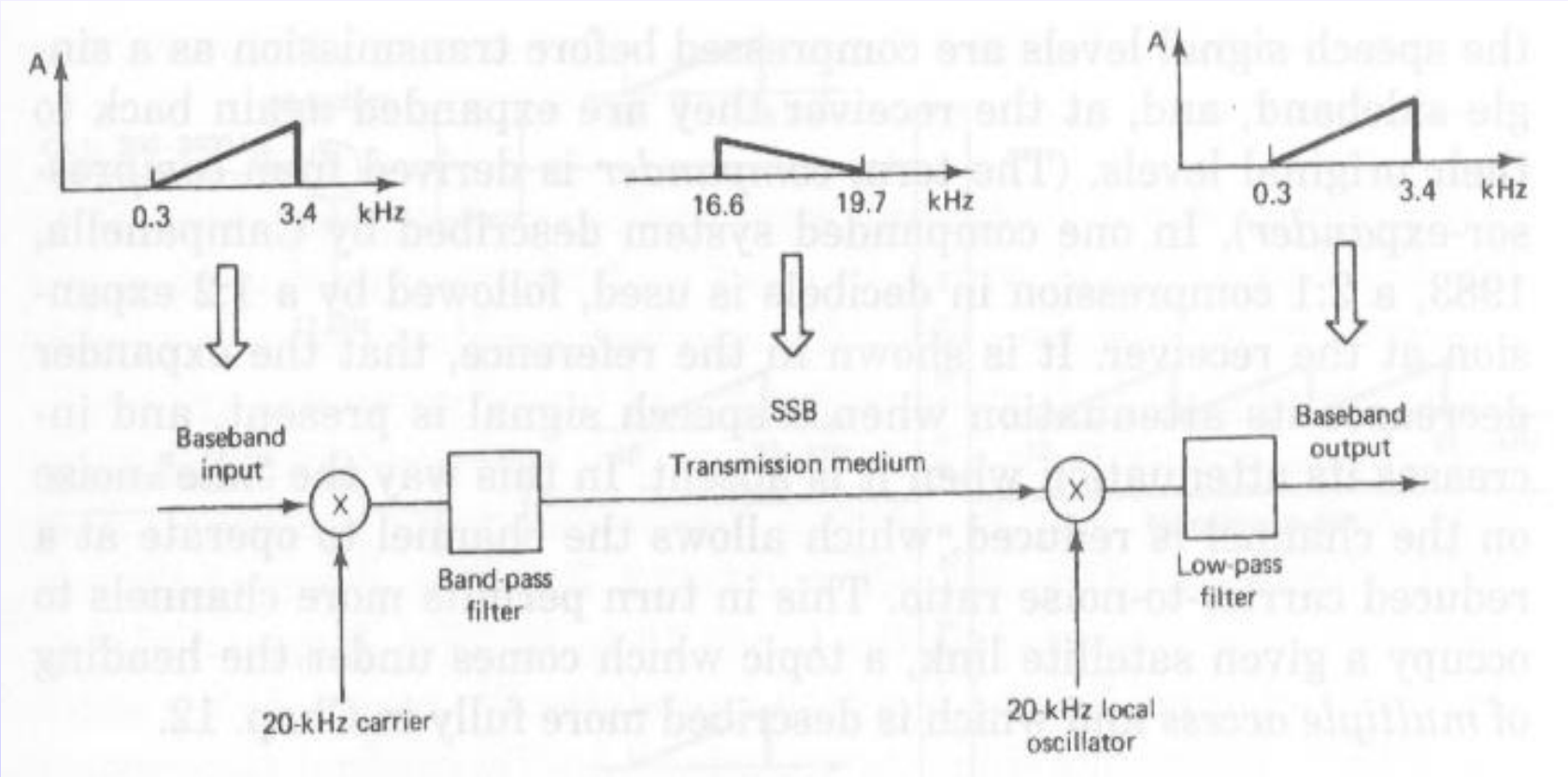
Code Division Multiple Access

2.1 FREQUENCY DOMAIN PRESENTATION (Analog signal)

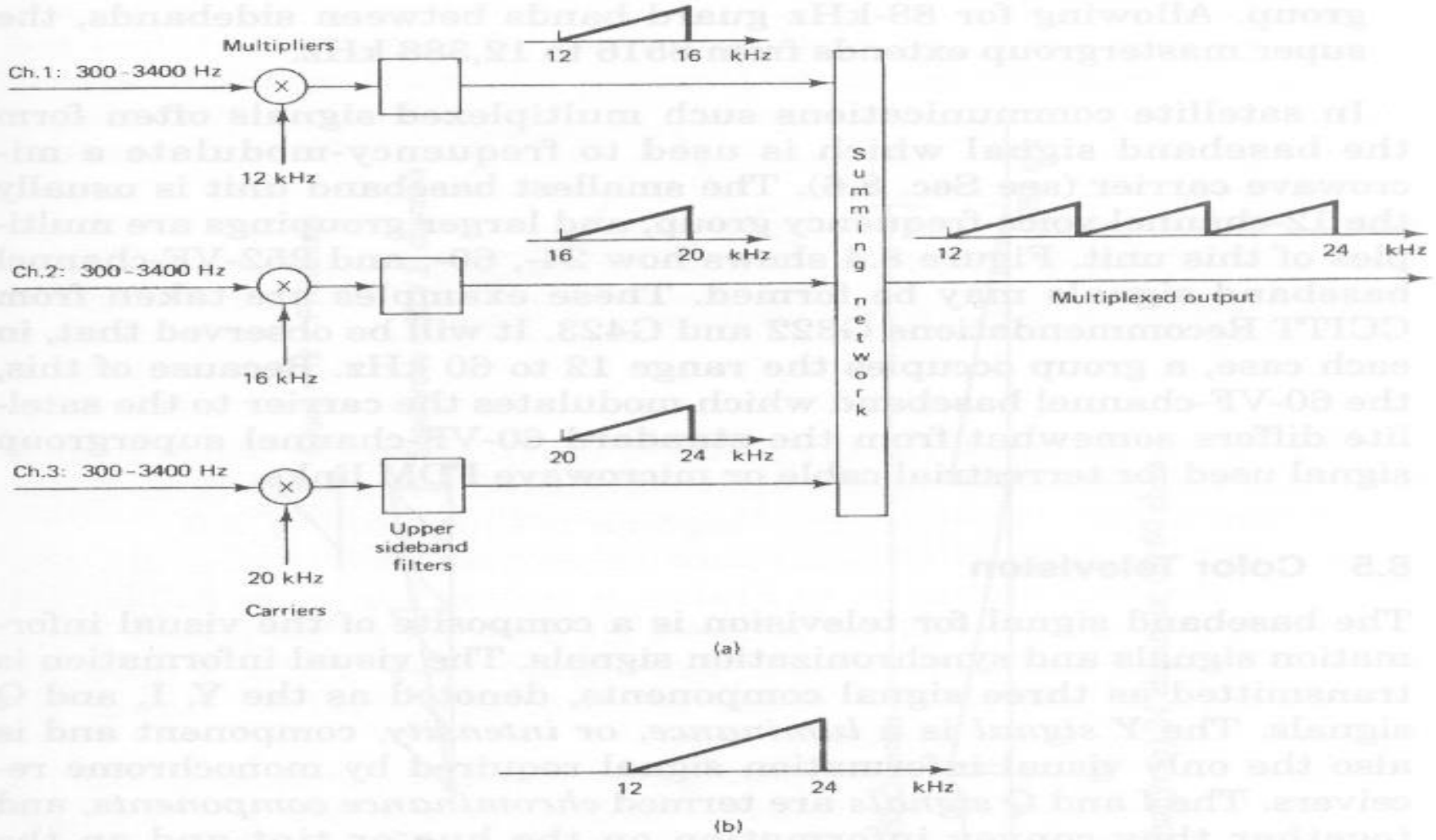


- a) A telephone baseband signal b) The double-sideband suppressed carrier (DSBSC)

SSB TRANSMISSION SCHEME

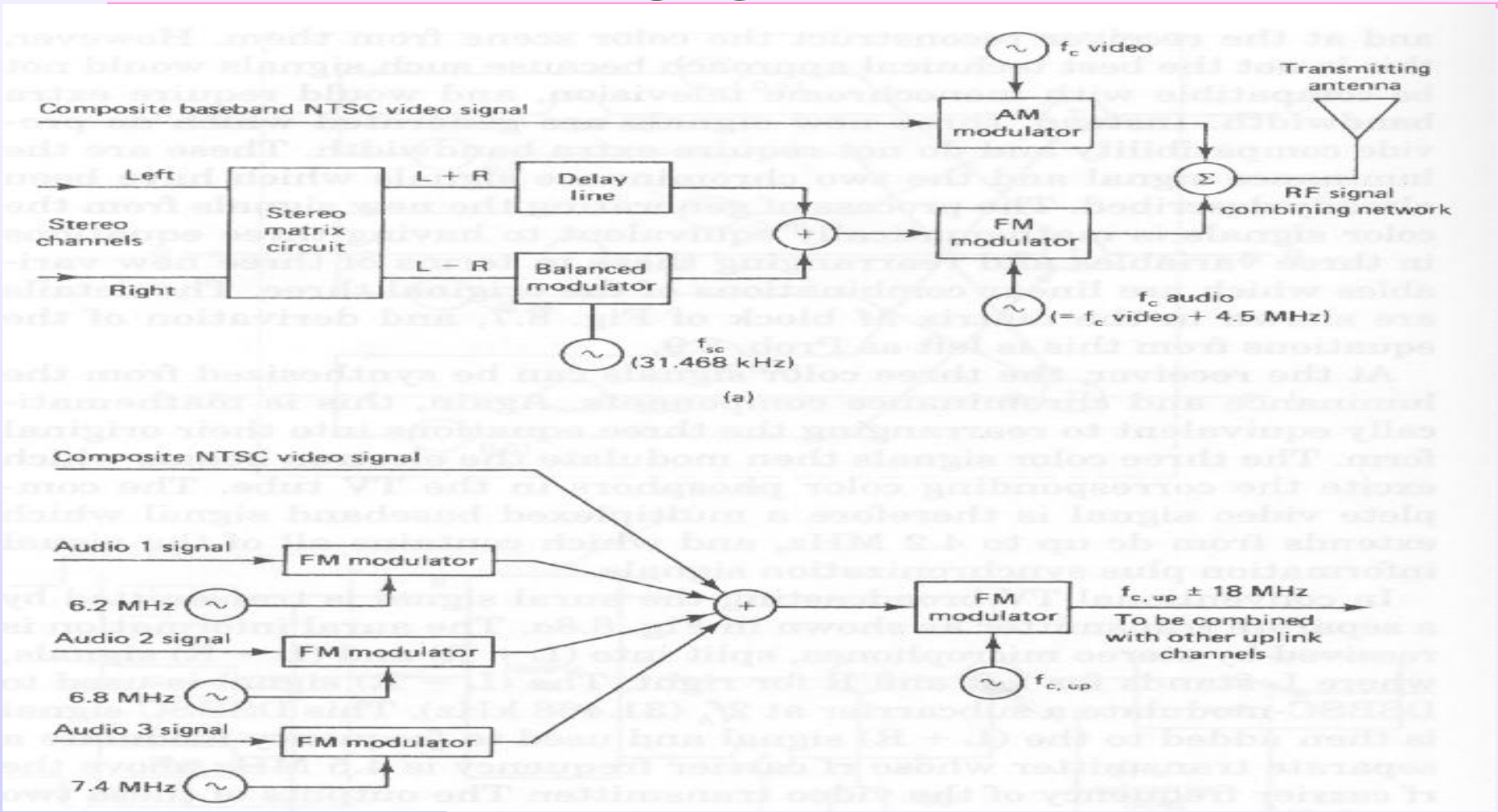


FDM-Frequency Division Multiplex (TELEPHONY)



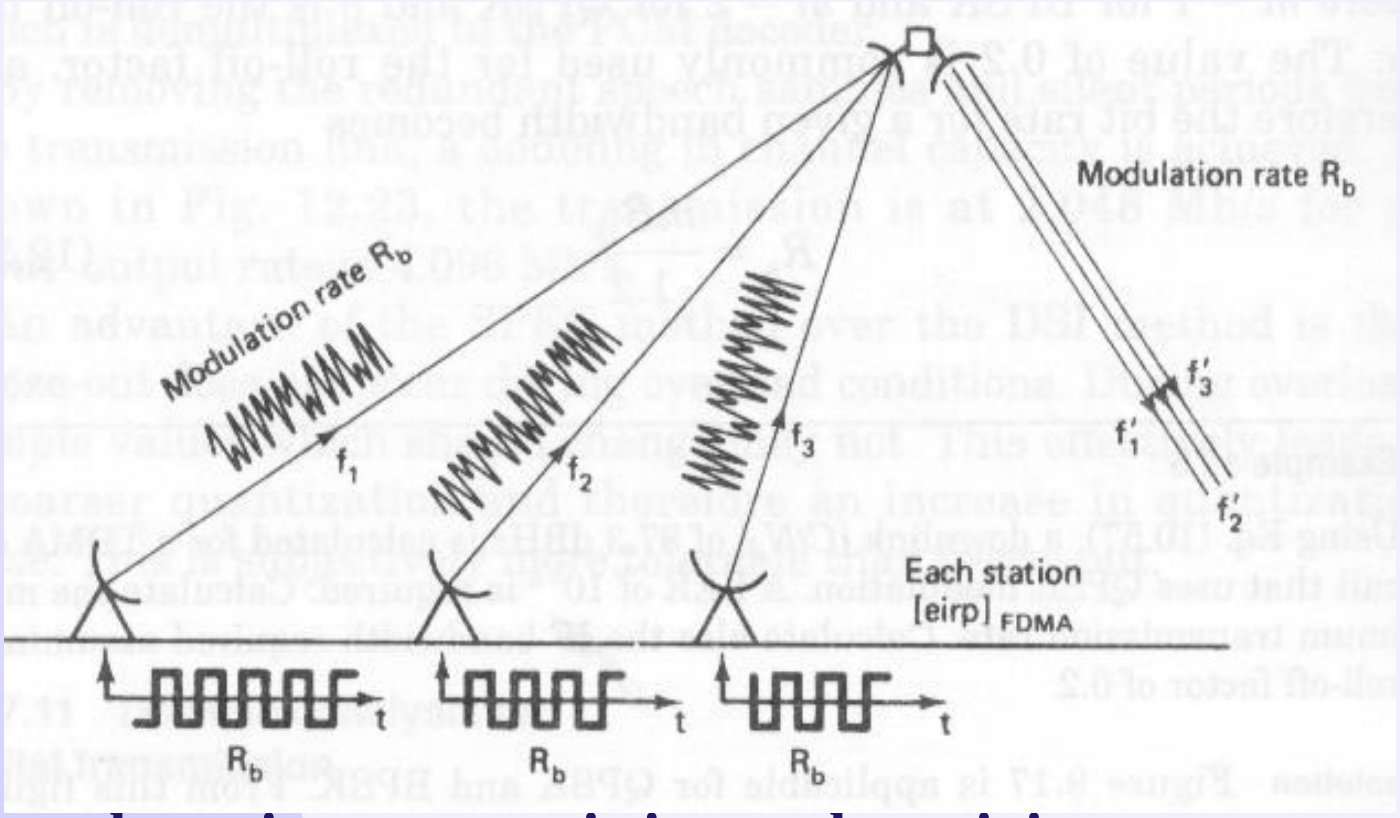
- **Three-channel frequency-division multiplex scheme**

SATELLITE TV AND AUDIO SIGNAL



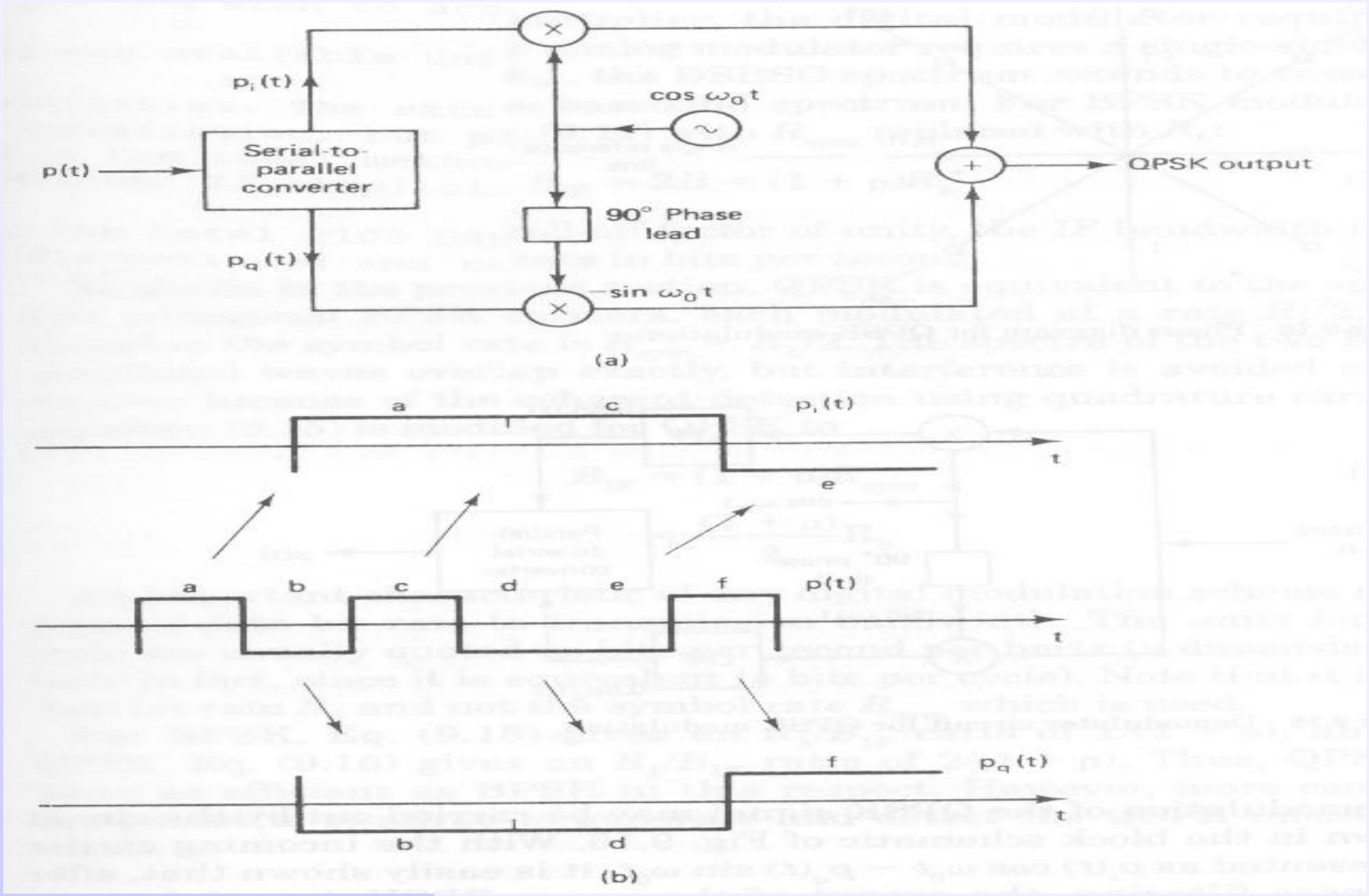
- a) Conventional TV broadcasting of the video and audio signals
- b) Generation of TV channel satellite uplink signal

FDMA- Frequency Division Multiple Access



- **Three earth stations transmitting and receiving simultaneously through the same satellite using FDMA**

QPSK- Quadrature Phase Shift Keying



DIGITAL SIGNAL

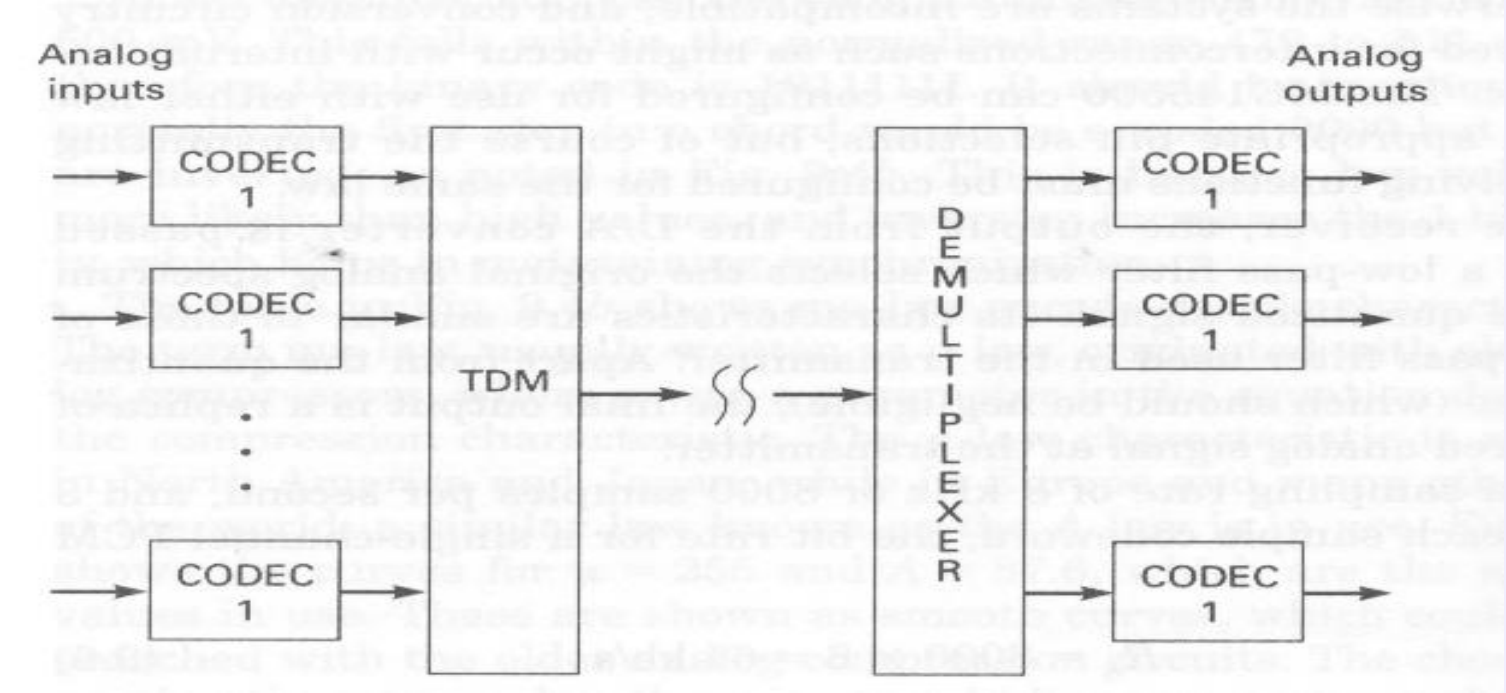
The bit rate refers to the number of digit per period and given by :

$$R_b = \frac{1}{T_b}$$

With a sampling rate of 8 KHz or 8000 samples per second, and 8 bit For each samples codeword, the bit rate for a single channel PCM Signal is

$$R_b = 8000 \times 8 = 64 \text{ kb/s}$$

TDM – Time Division Multiplexing



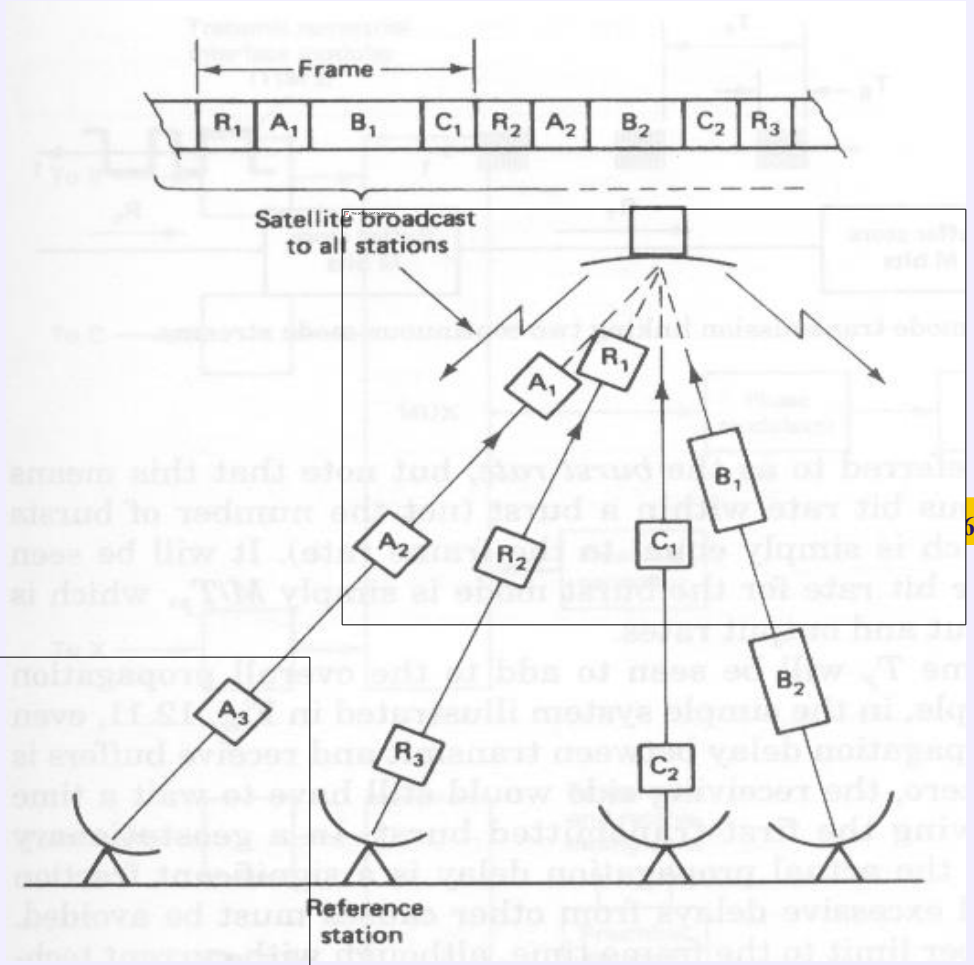
A basic TDM system

TDMA – Time Division Multiple Access

$$M = R_b . T_F$$

M - CAPACITY

T_F – FRAME TIME



A TDMA using a reference station for burst synchronization

One carrier uses the transponder at any one time and therefore intermodulation products are absent

END OF THE SECOND CHAPTER

SATELLITE SERVICES

INTRODUCTION

DBS – DIRECT BROADCAST SATELLITE SYSTEM (TVSAT)

DBS REFFERS TO THE TV AND RADIO BROADCAST THROUG SATELLITE

VSAT & USAT

VERY **S**MALL **A**PERTURE **T**ERMINAL & **U**LTRA **S**MALL **A**PERTURE **T**ERMINAL

MSAT

MOBILE **SAT**ELLITE SYSTEM

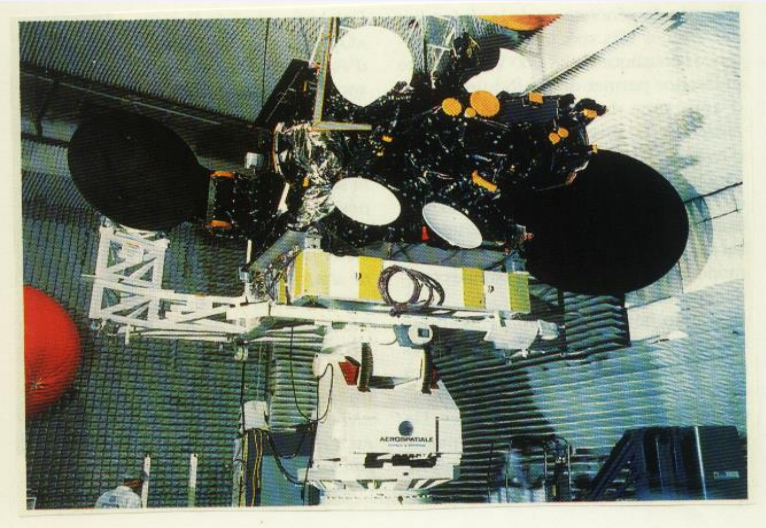
RADARSAT

RESOURCE MANAGEMENT AND MARITIME SAFETY

GPS

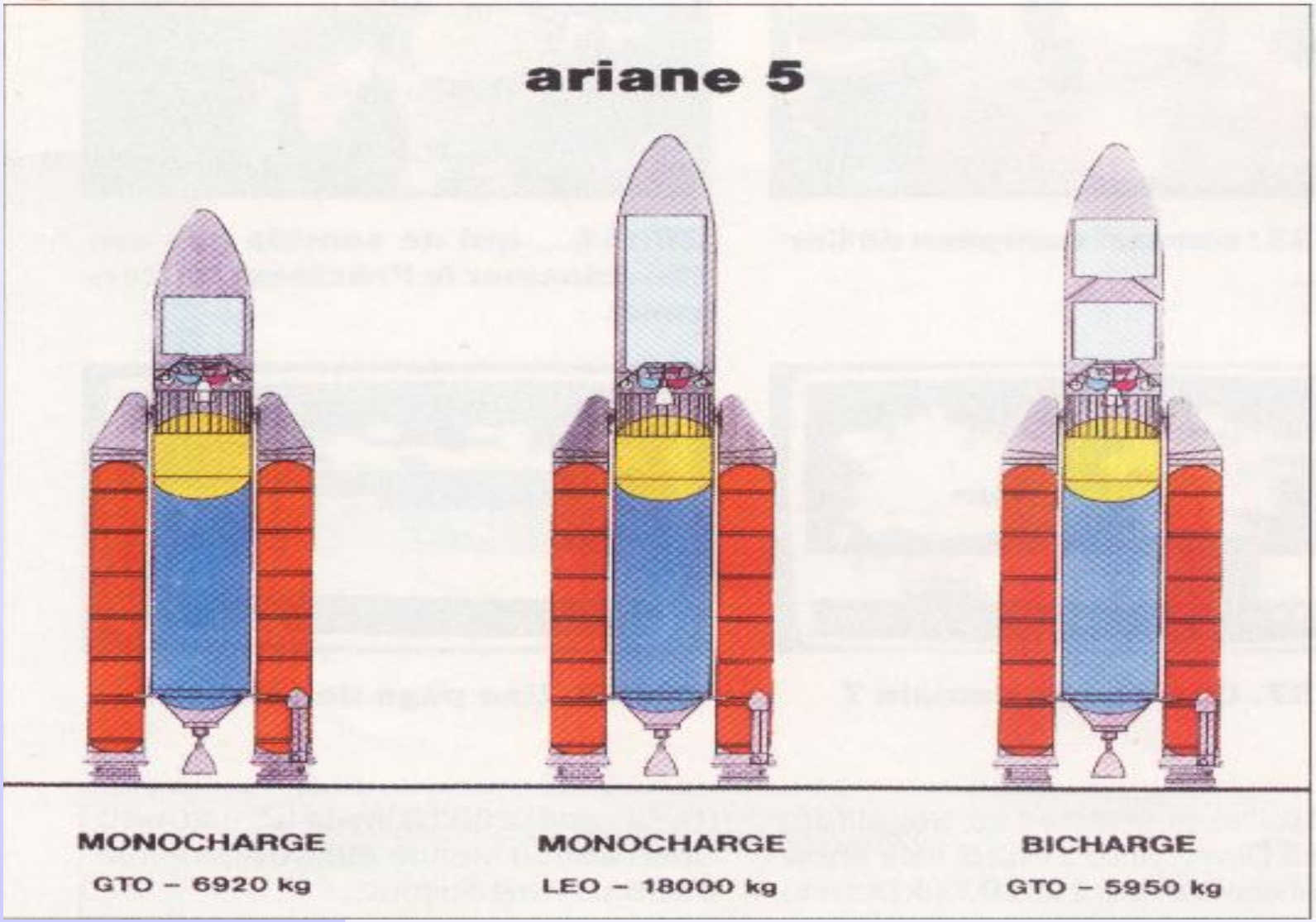
GLOBAL **P**OSITIONNING **S**ATELLITE SYSTEM

THE DBS (DIRECT BROADCAST SATELLITE SERVICE)

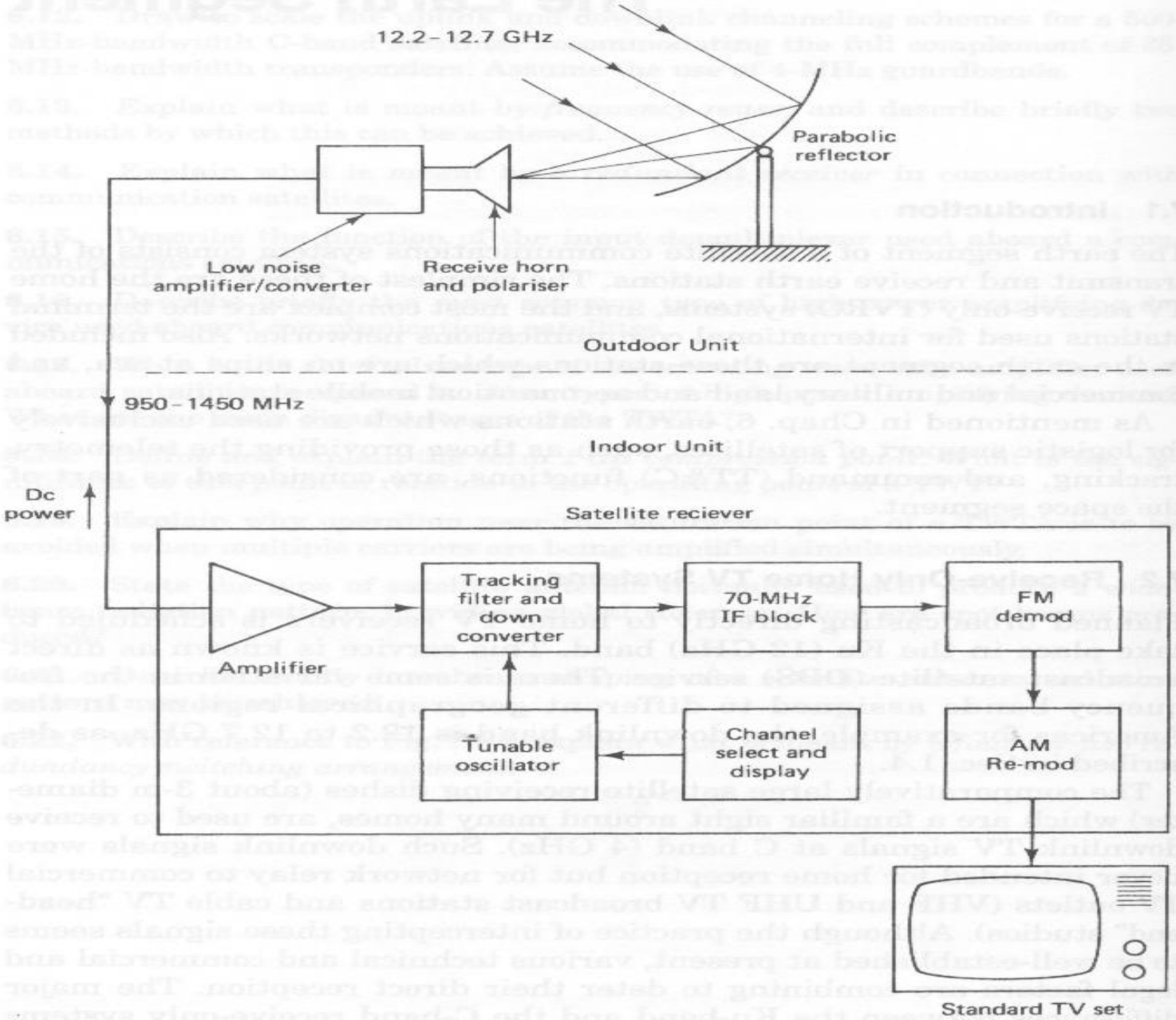


- **UPLINK FREQUENCY,GHz 17.3-17.8 14-14.5 5.925-6.425**
- **BAND Ku Ku C**
- **DOWNLINK FREQUENCY,GHz 12.2-12.7 11.7-12.2 3.7-4.2**
- **TERRESTRIAL INTERFERENCE POSSIBLE NO NO YES**
- **SATELLITE EIRP RANGE ,DBW 51-60 40-48 33-37**

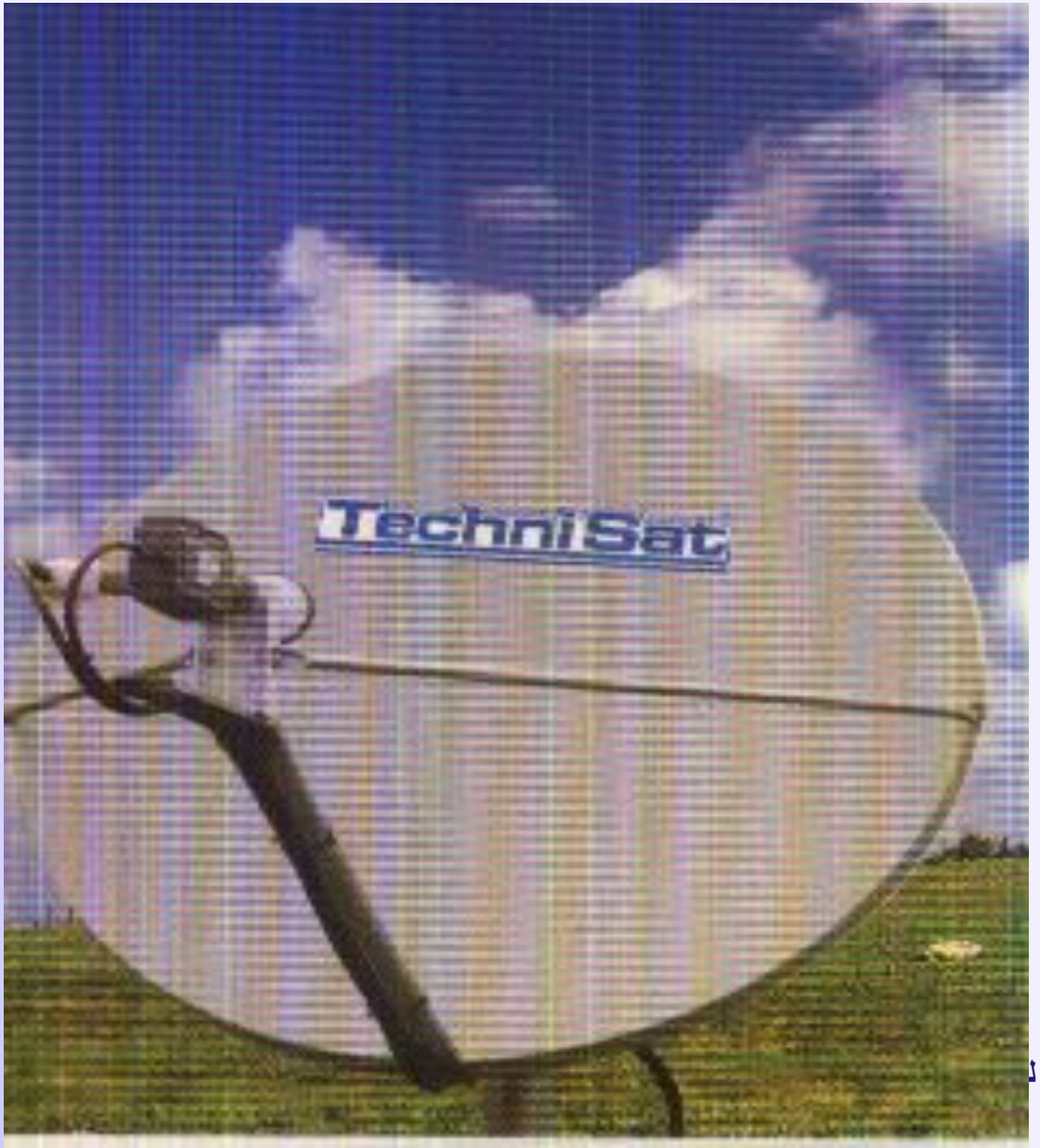
The lunching Rocket ARIANE 5



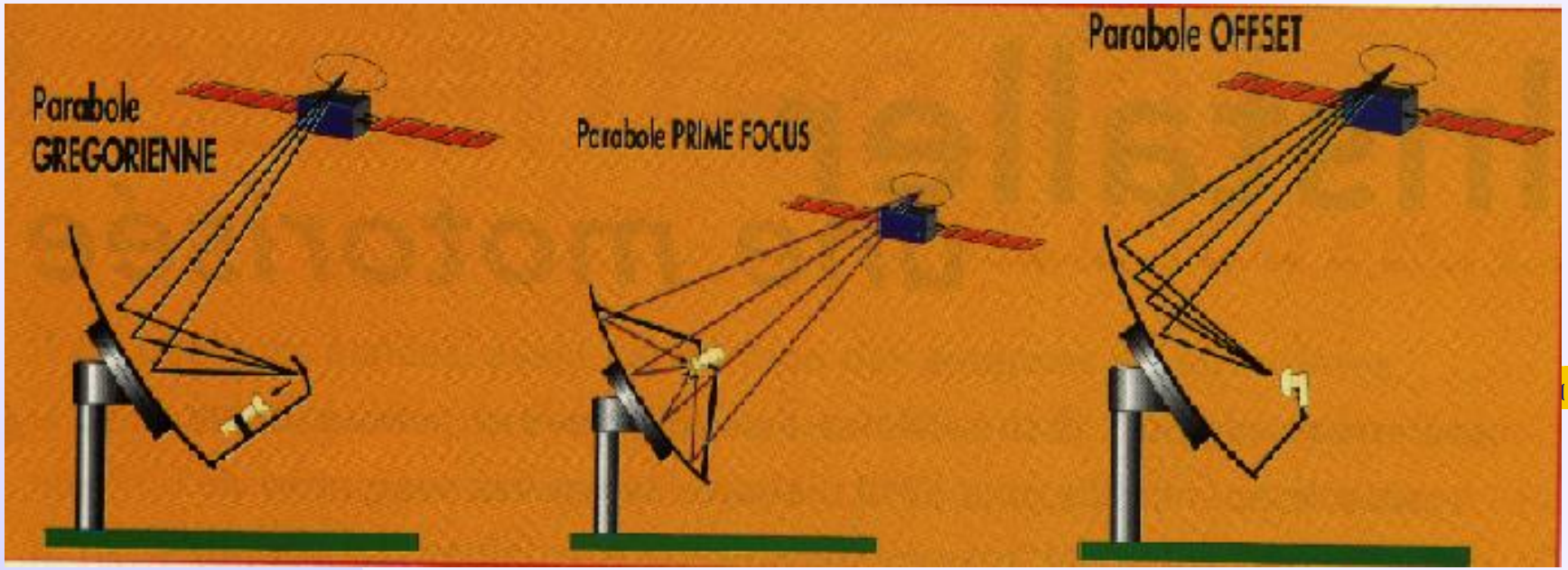
HOME TERMINAL



ANTENNA (DISH)

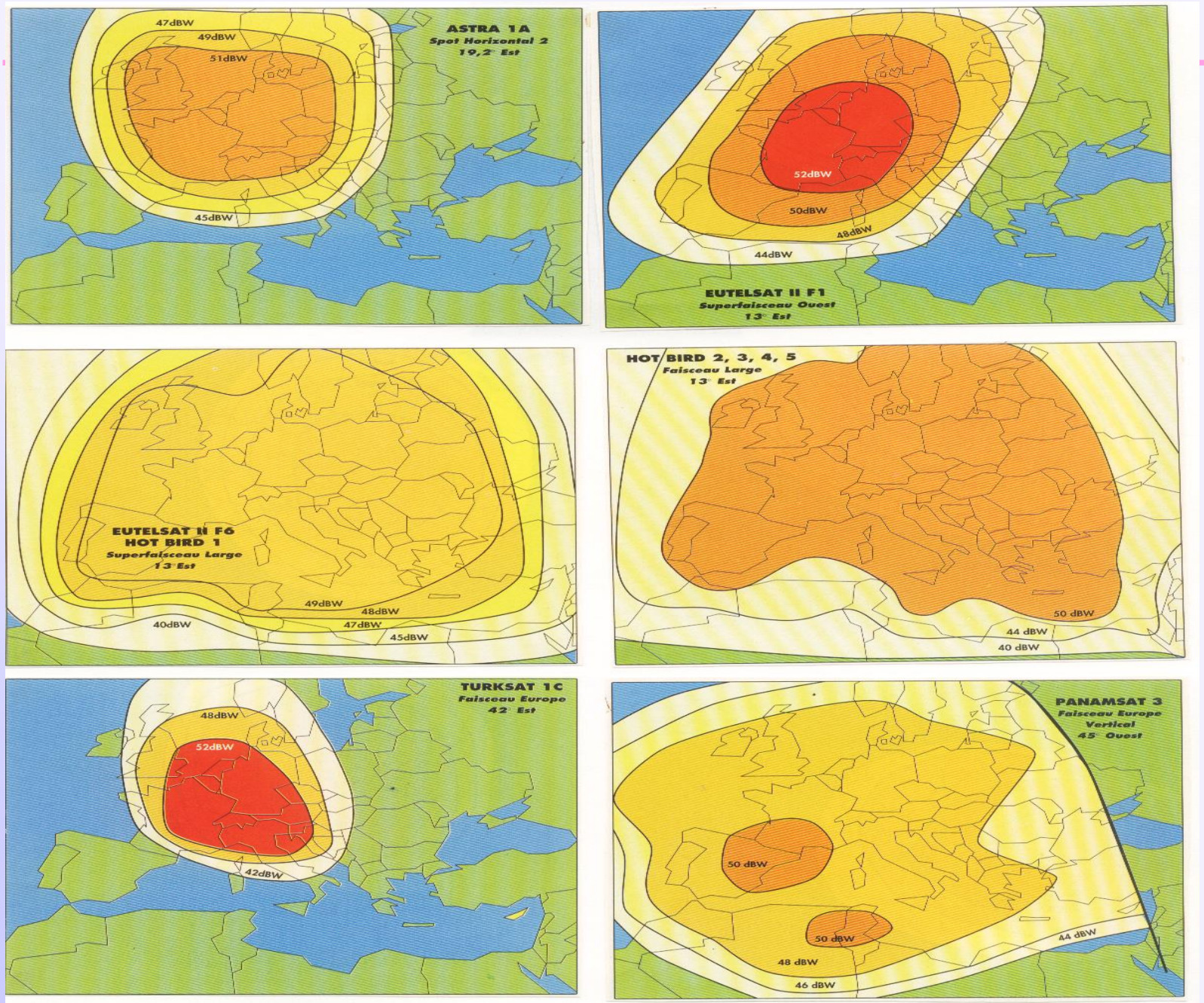


DIFFERENT DISHES

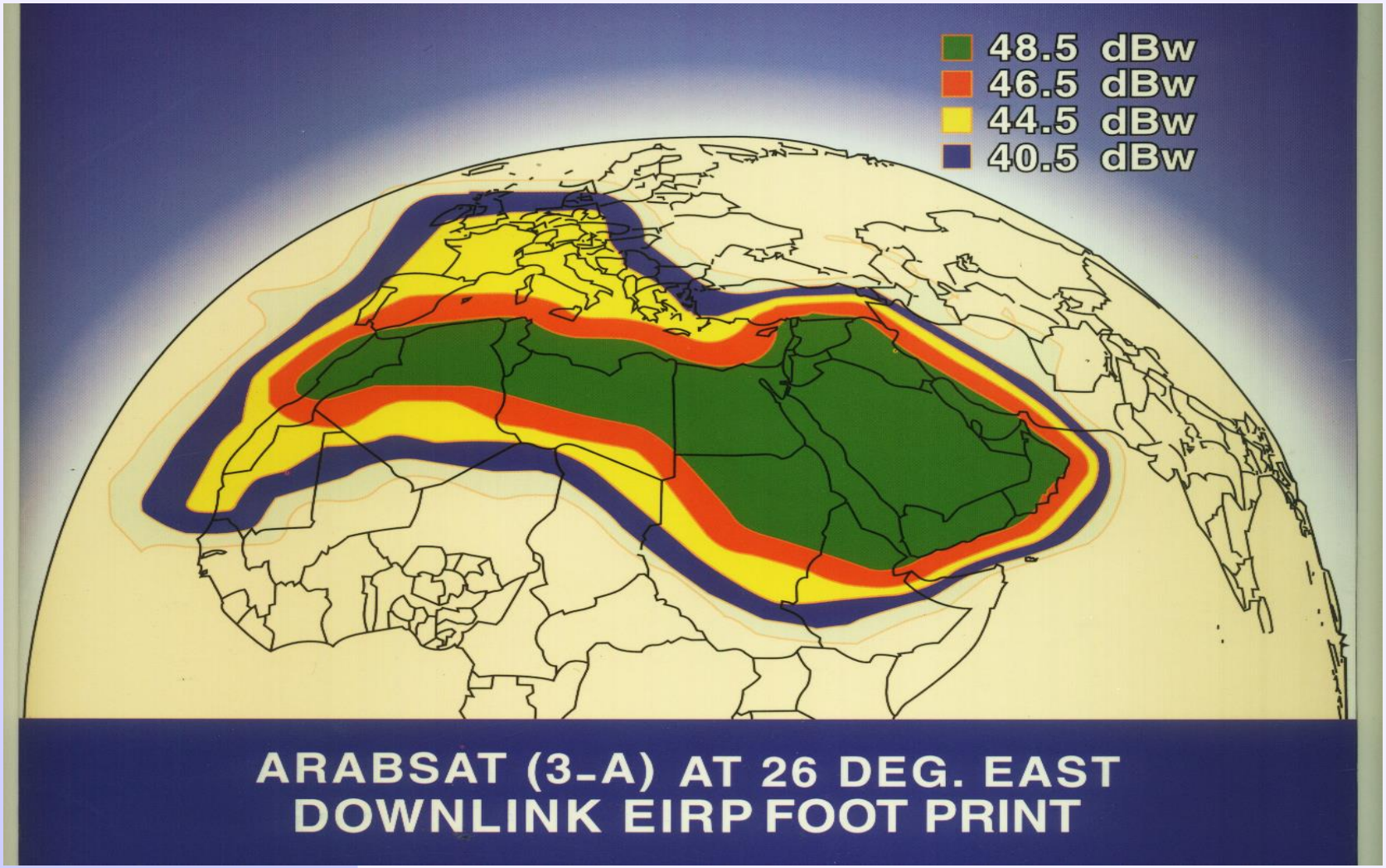


GREGORIENNE PRIME FOCUS OFFSET

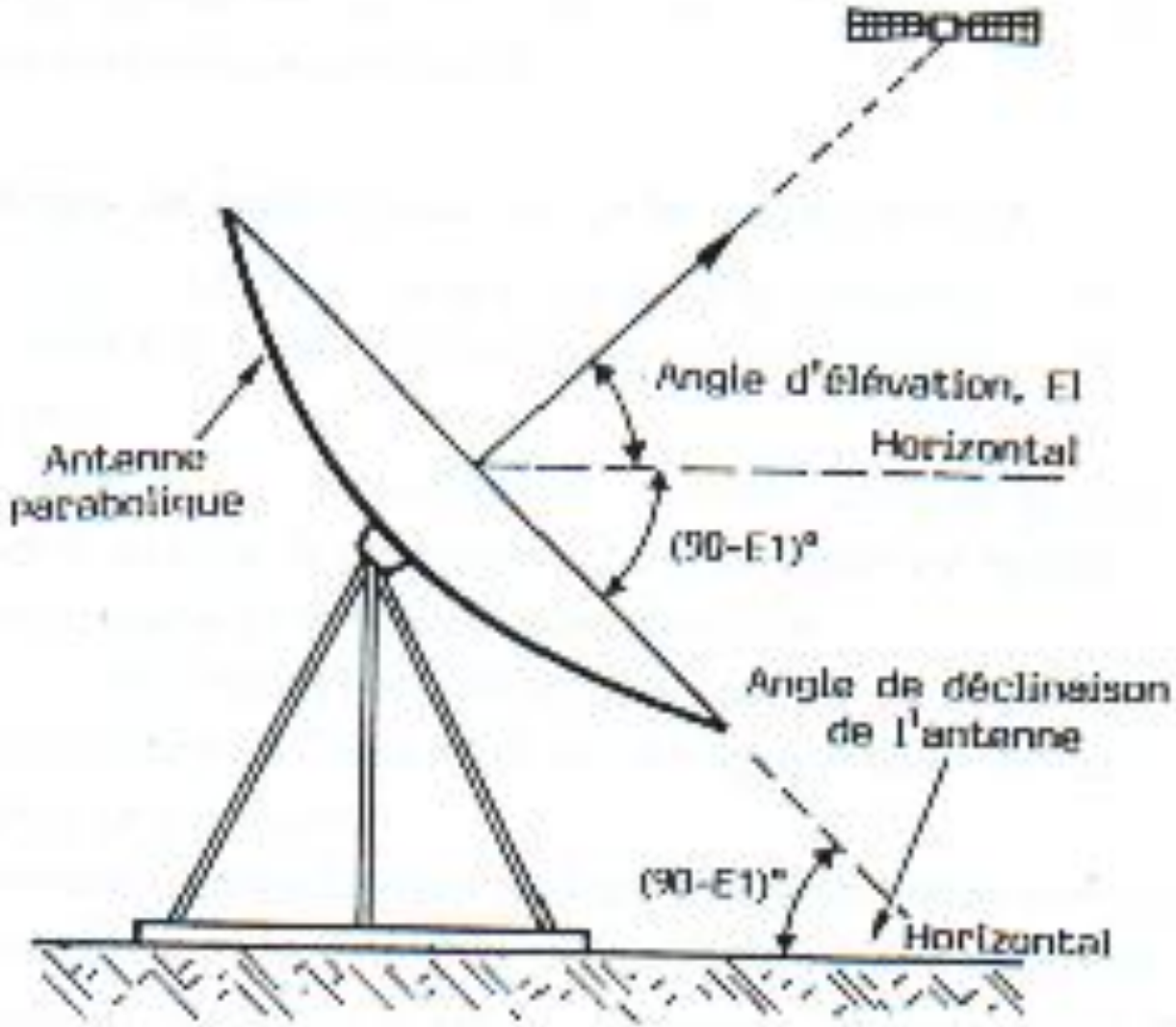
FOOTPRINT

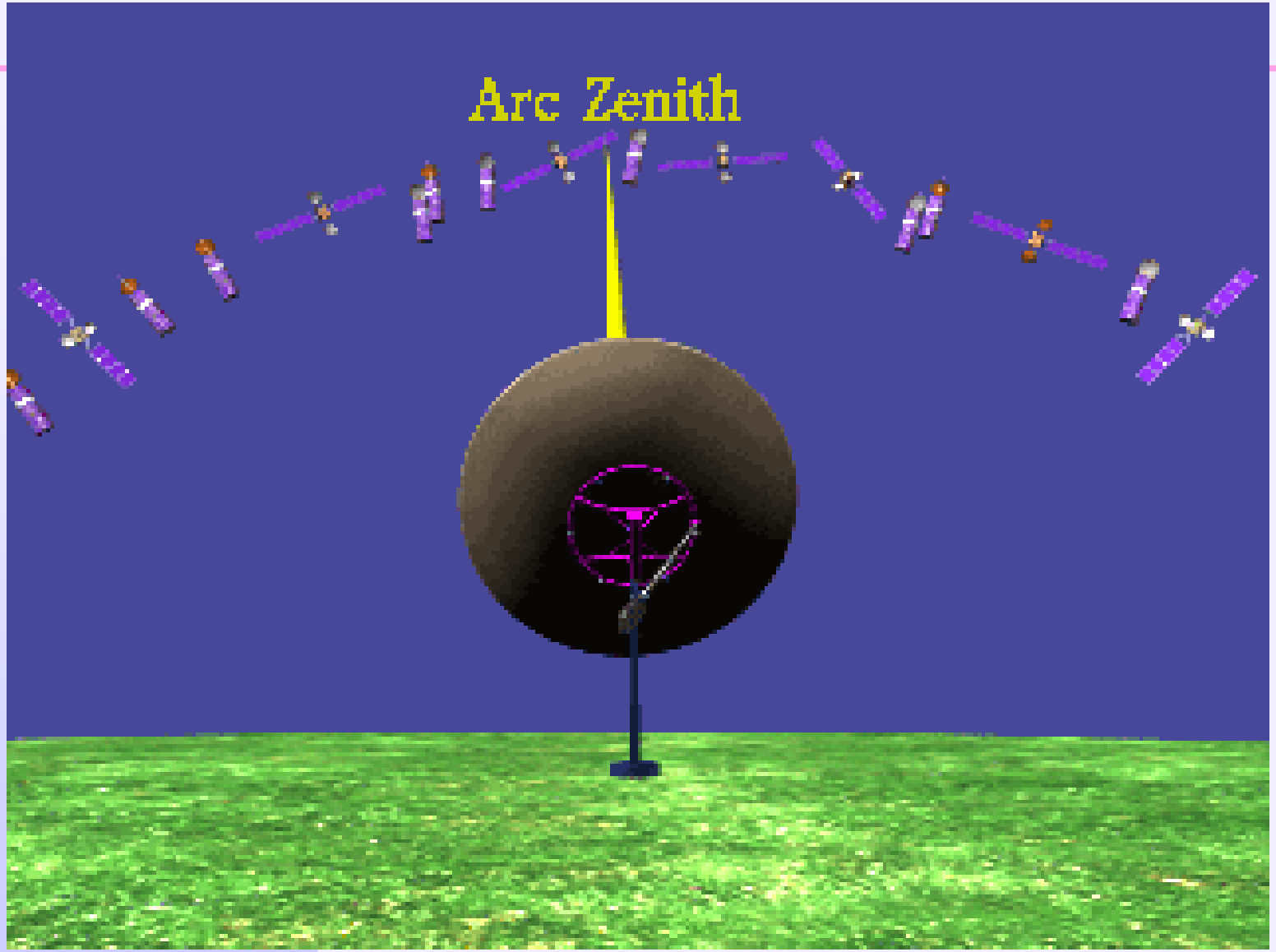

47dBW
49dBW
51dBW
45dBW
ASTRA 1A
Spot Horizontal 2
19,2° Est
52dBW
50dBW
48dBW
44dBW
EUTELSAT II F1
Superfaisceau Ouest
13° Est
EUTELSAT II F6
HOT BIRD 1
Superfaisceau Large
13° Est
49dBW
48dBW
40dBW
47dBW
45dBW
HOT BIRD 2, 3, 4, 5
Faisceau Large
13° Est
50 dBW
44 dBW
40 dBW
TURKSAT 1C
Faisceau Europe
42° Est
48dBW
52dBW
42dBW
PANAMSAT 3
Faisceau Europe
Vertical
45° Ouest
50 dBW
50 dBW
44 dBW
48 dBW
46 dBW

ARABSAT-3A FOOTPRINT



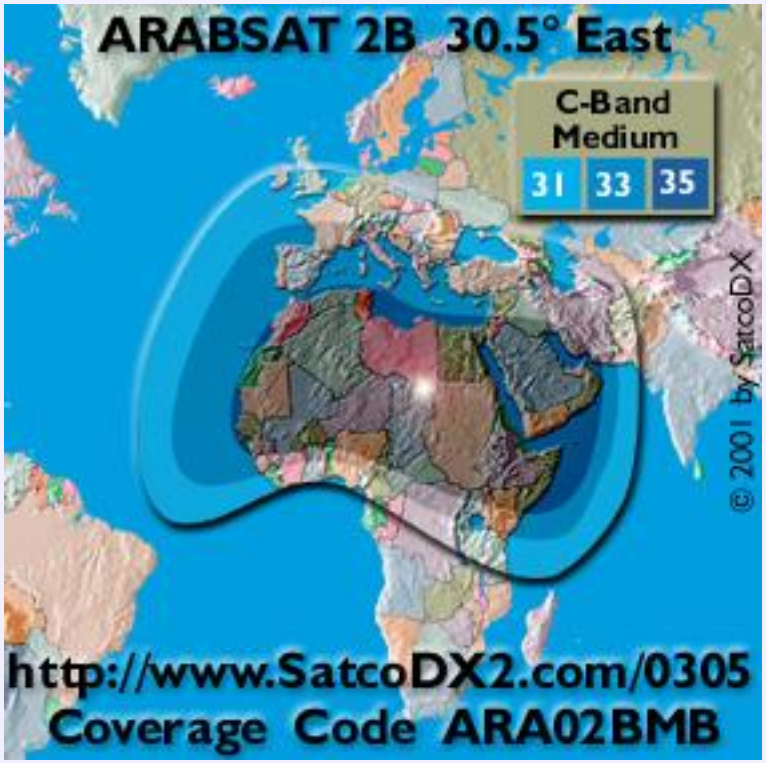
DISH SET UP


Antenne parabolique
Angle d'élévation, El
Horizontal
(90-E1)°
Angle de déclinaison de l'antenne
(90-E1)°
Horizontal


Arc Zenith

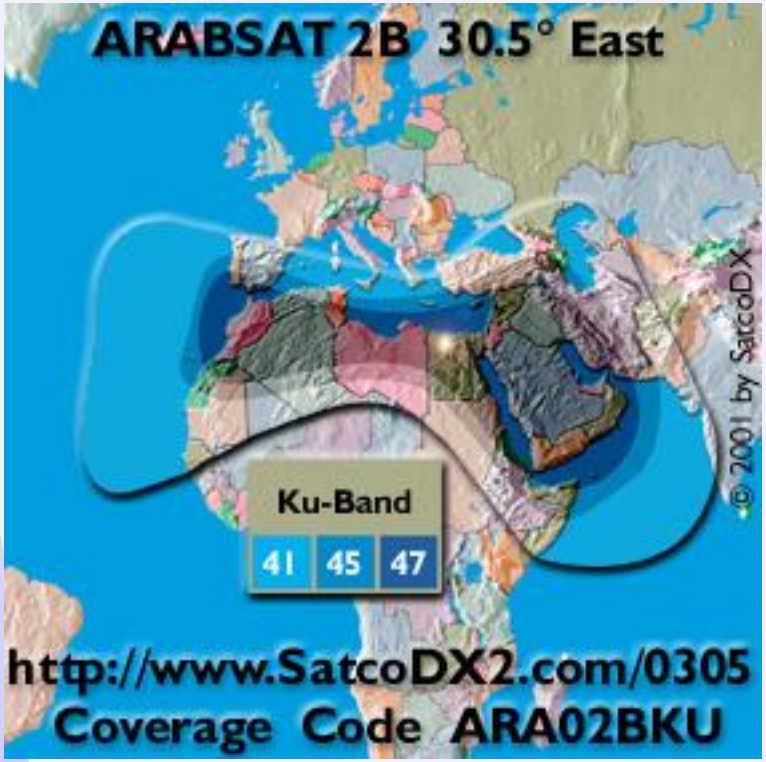
EIRP COLLECTION & FOOTPRINTS

www.satcodx.com

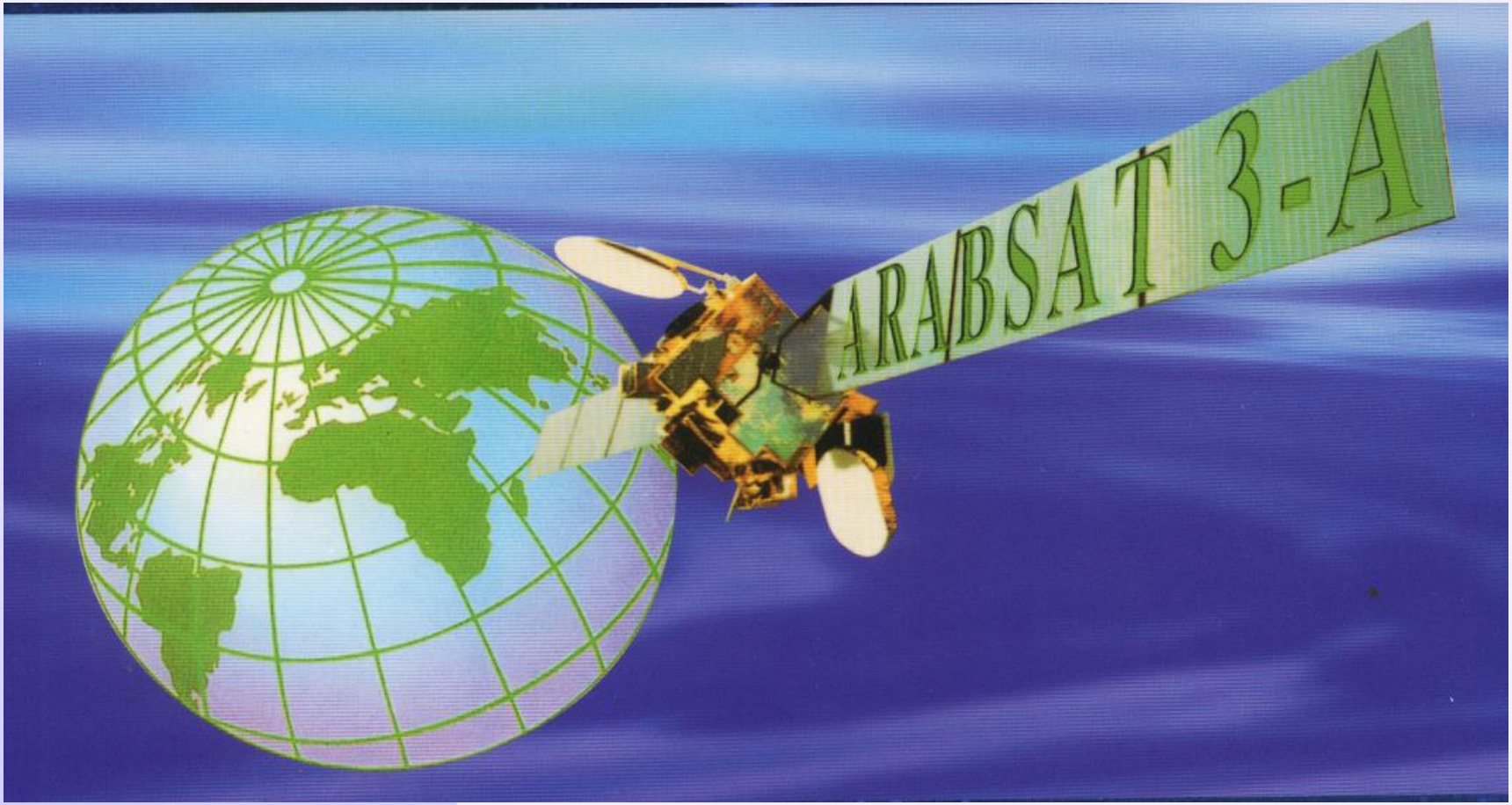


ARABSAT 2B Ku Band Footptint

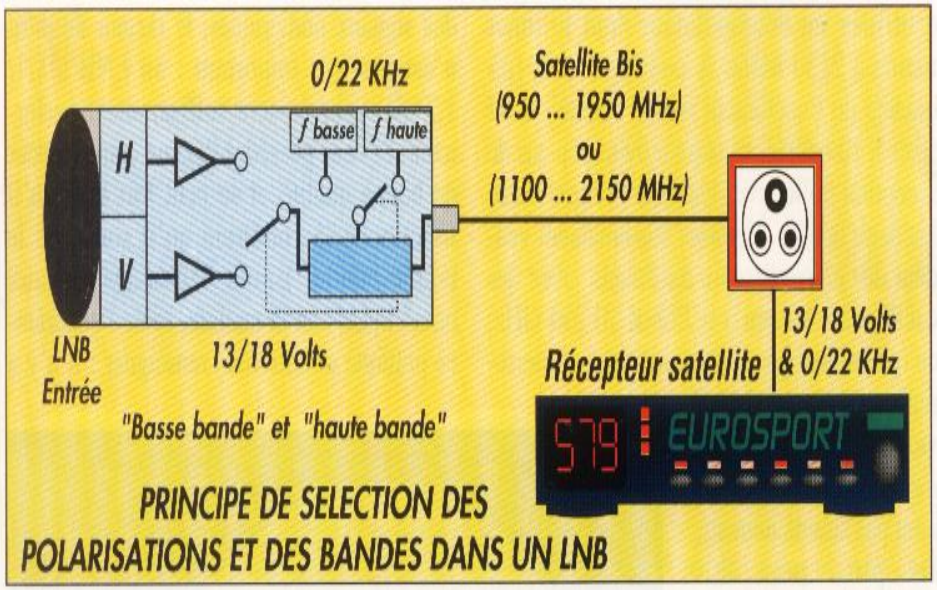
www.satcodx.com



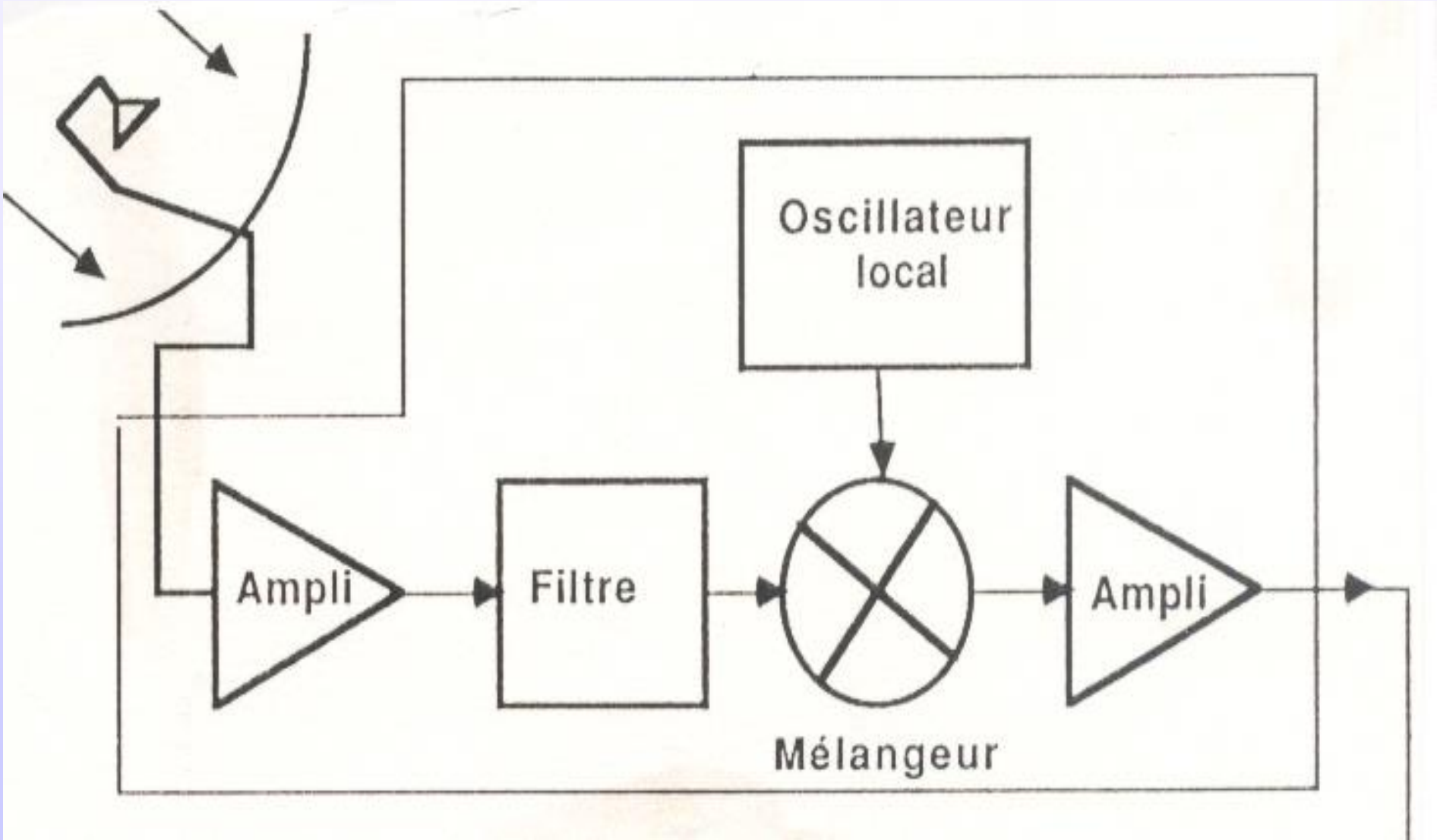
ARABSAT 3A



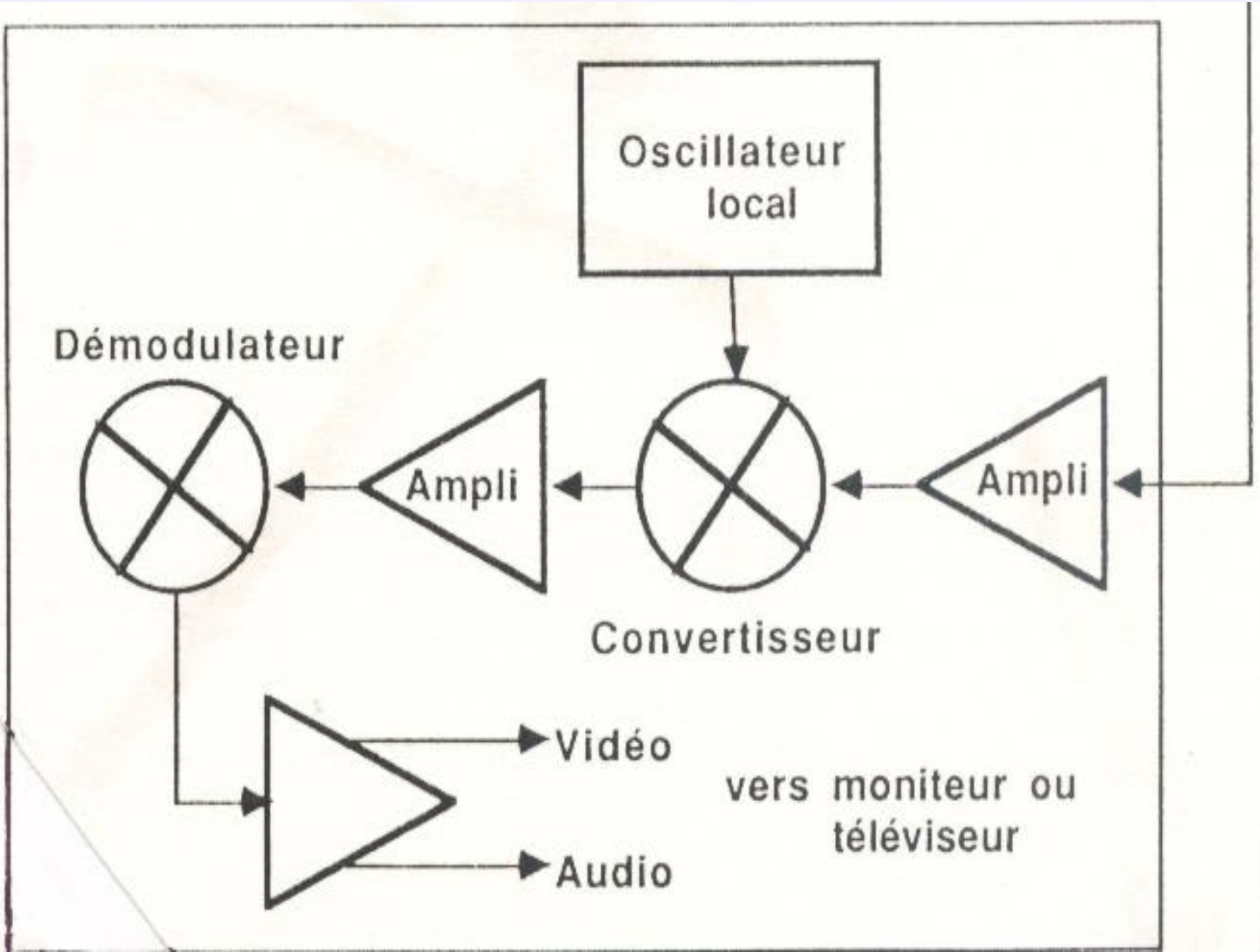
DEMODULATOR-RECEIVER



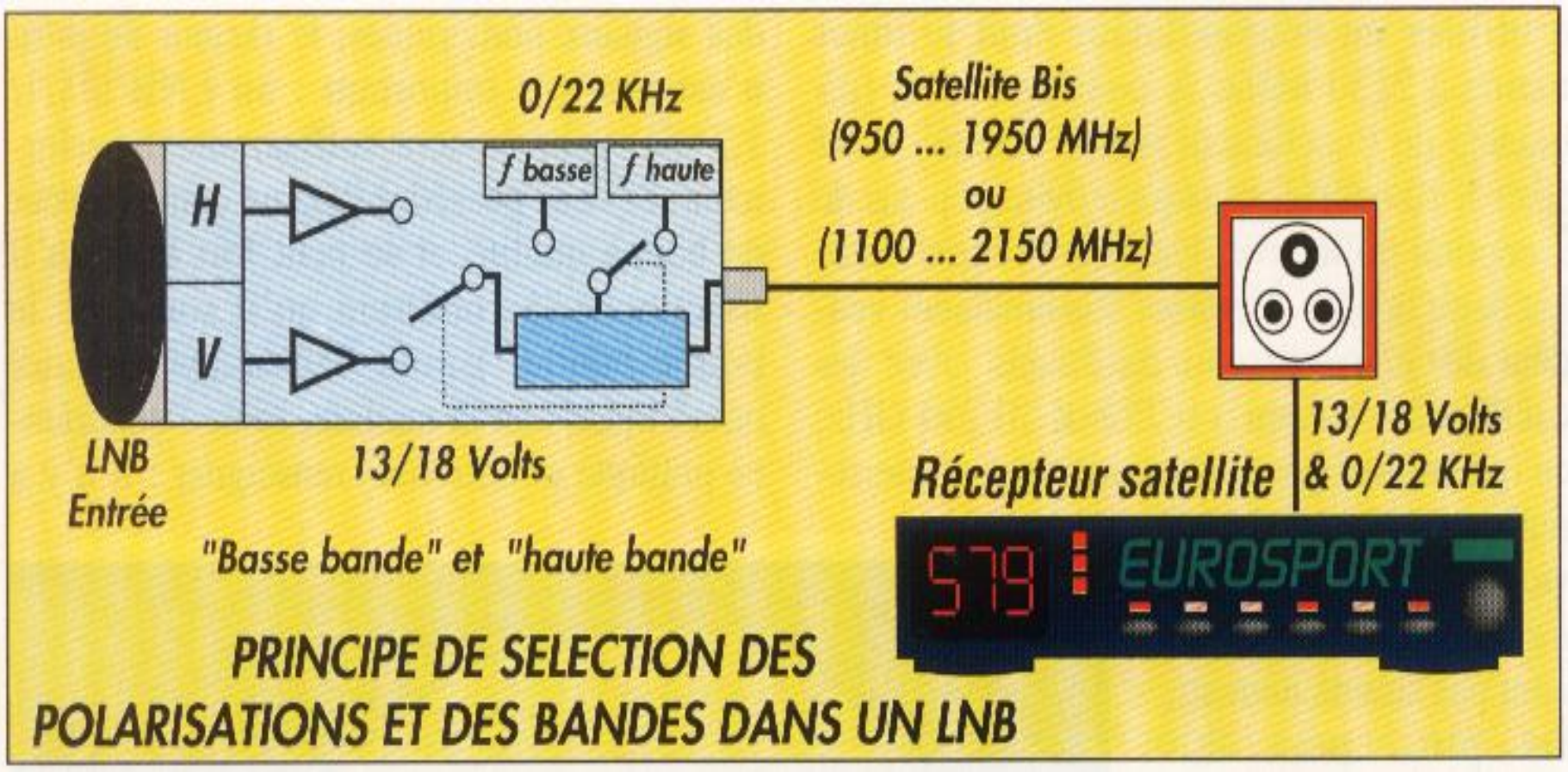
L N B – LOW NOISE BLOCK =
L N A – LOW NOISE AMPLIFIER +
L N C – LOW NOISE CONVERTER



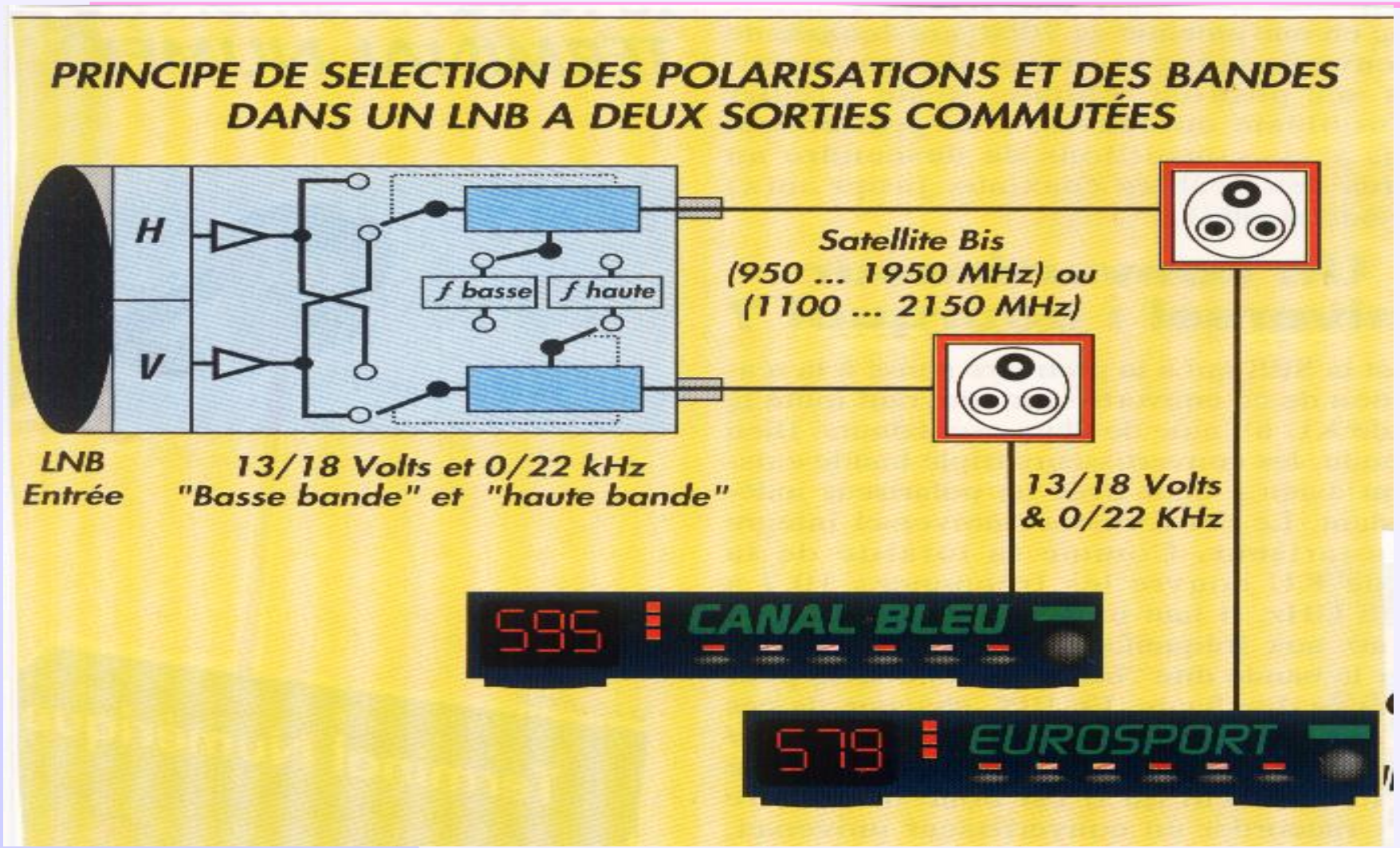
DEMODULATOR



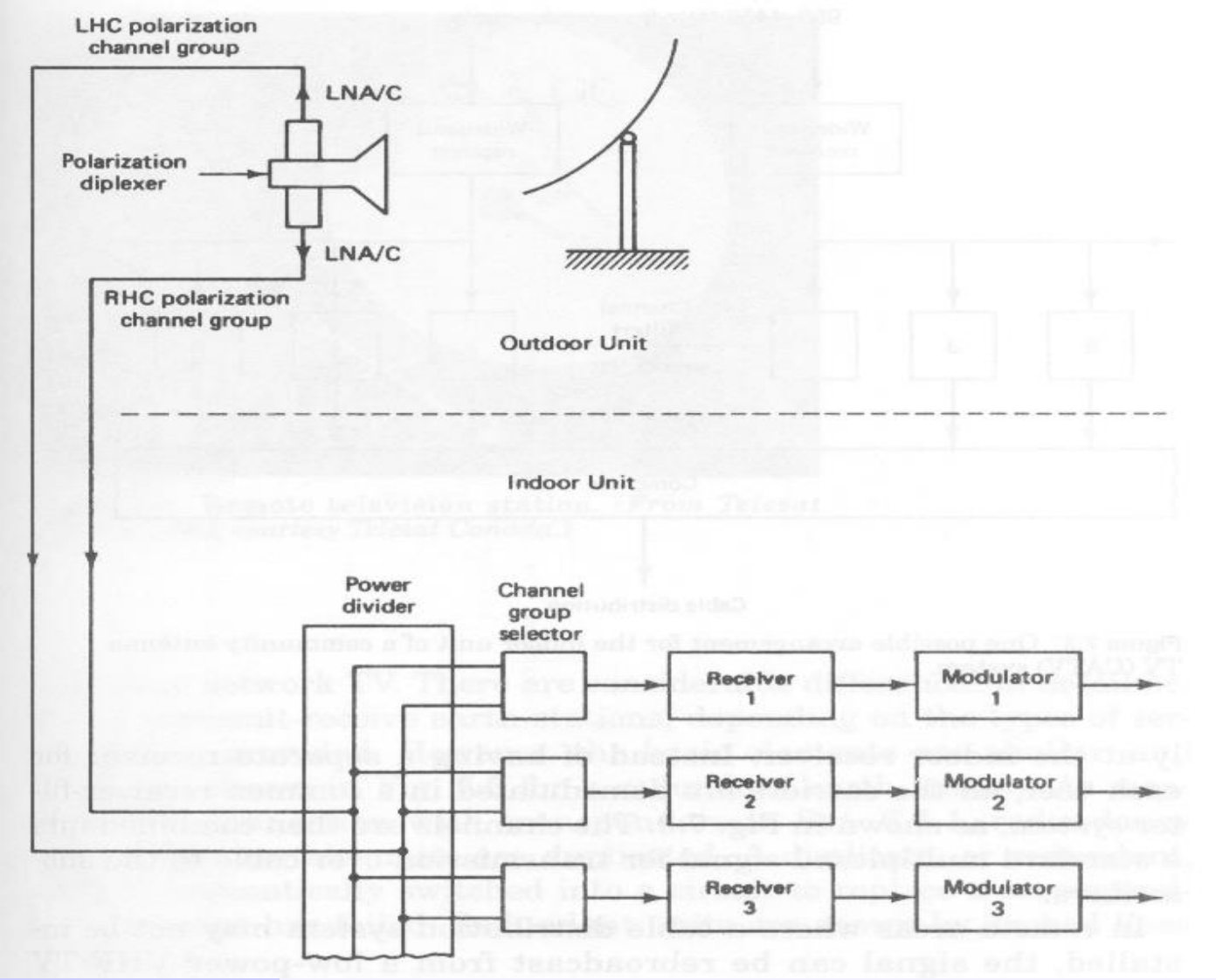
LNB – LOW NOISE BLOCK UNIVERSAL



TWIN UNIVERSAL LNB

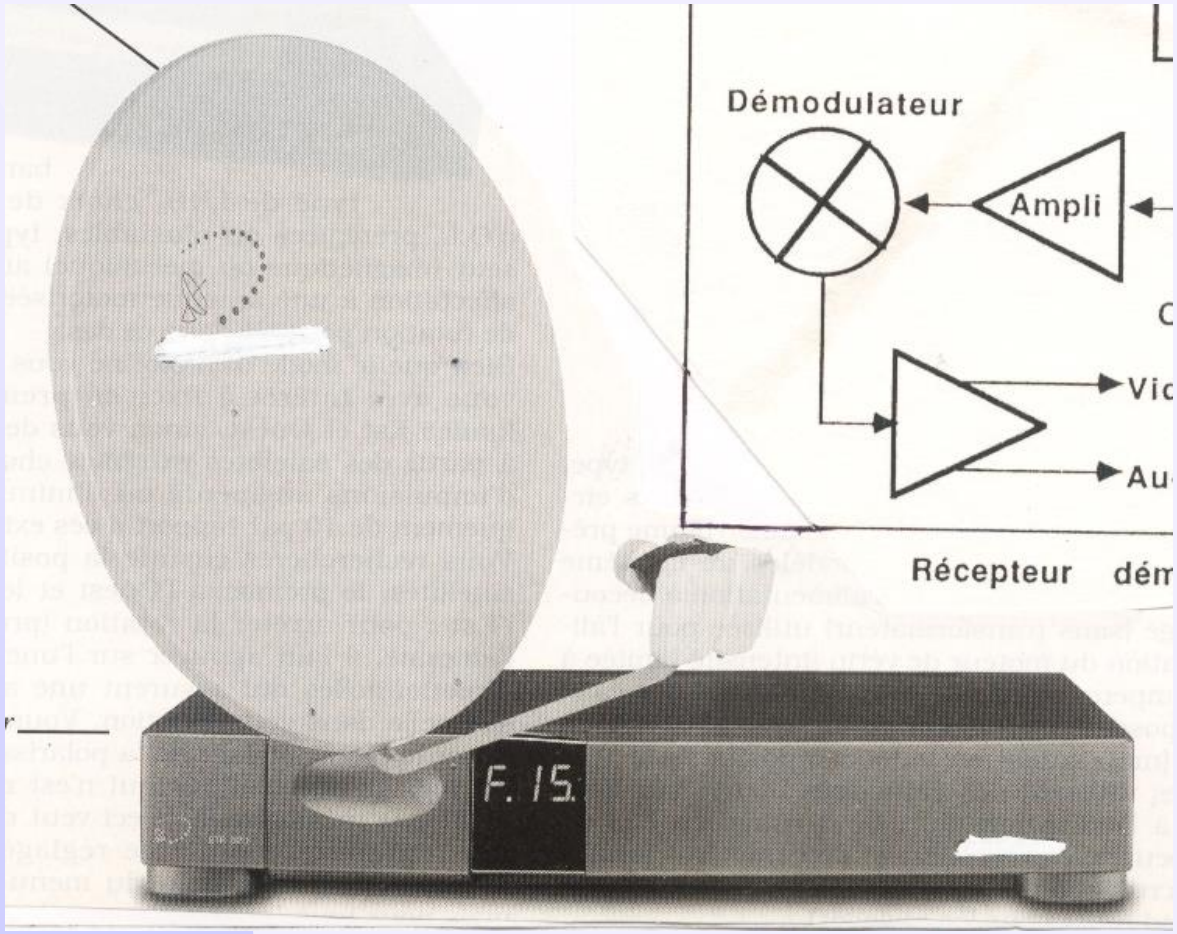


COMMUNITY RECEPTION



TVSAT (DIRECT TV)

BLOCK DIAGRAM OF TVSAT STATION



TVSAT : PROS & CONS

PROS : - COVER A BIG TERROTERY

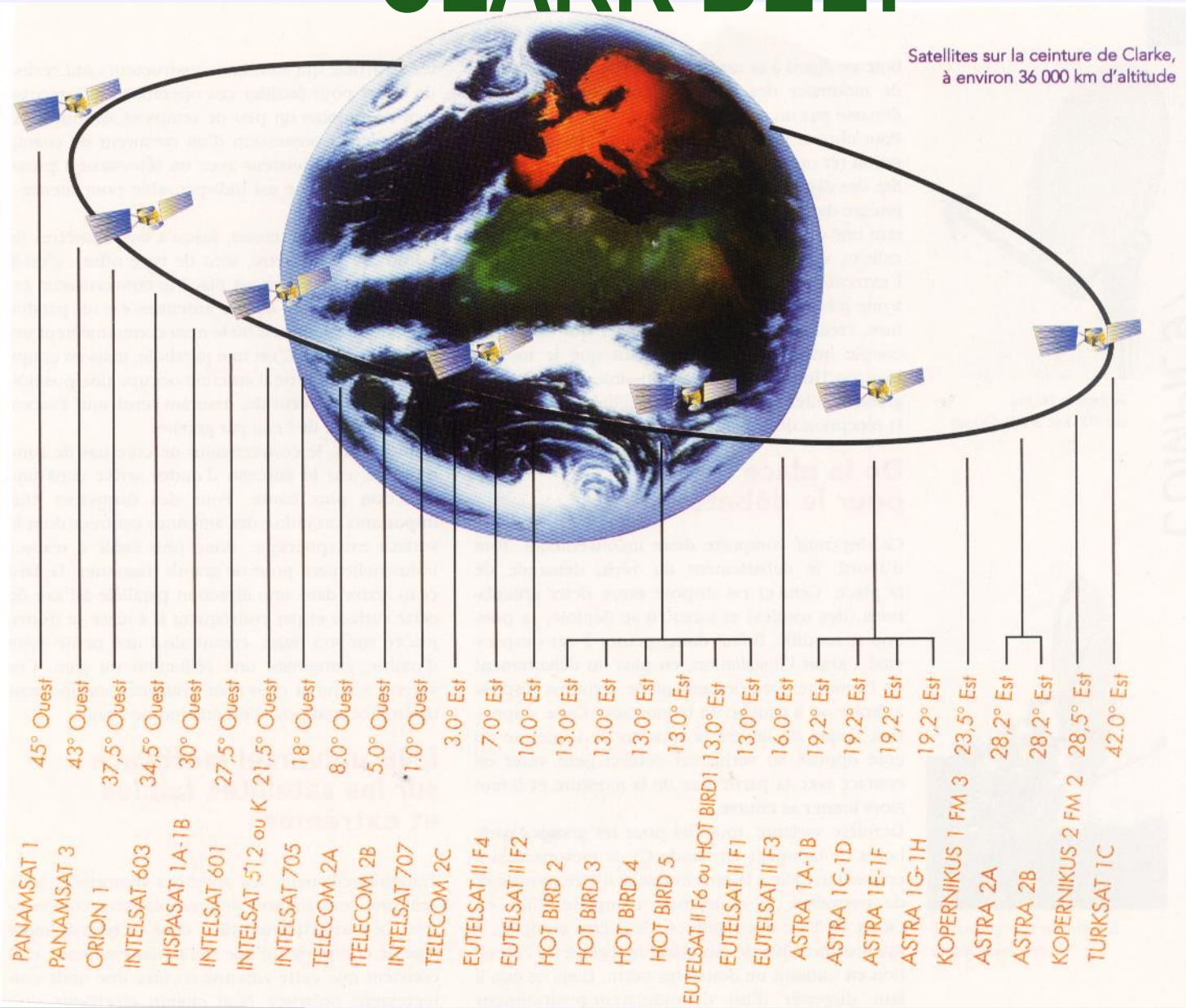
- SMALLER DISH

- SIMPLER AND SHIP ELECTRONICS

- GOOD RECEPTION QUALITY ESPECIALLY USING THE DIGITAL TECHNIQUES (MCPC)

CONS : VERY SENSITIVE IN TERMS OF THE INTEMPERY (Rain, Snow, Fog , etc..)

CLARK BELT

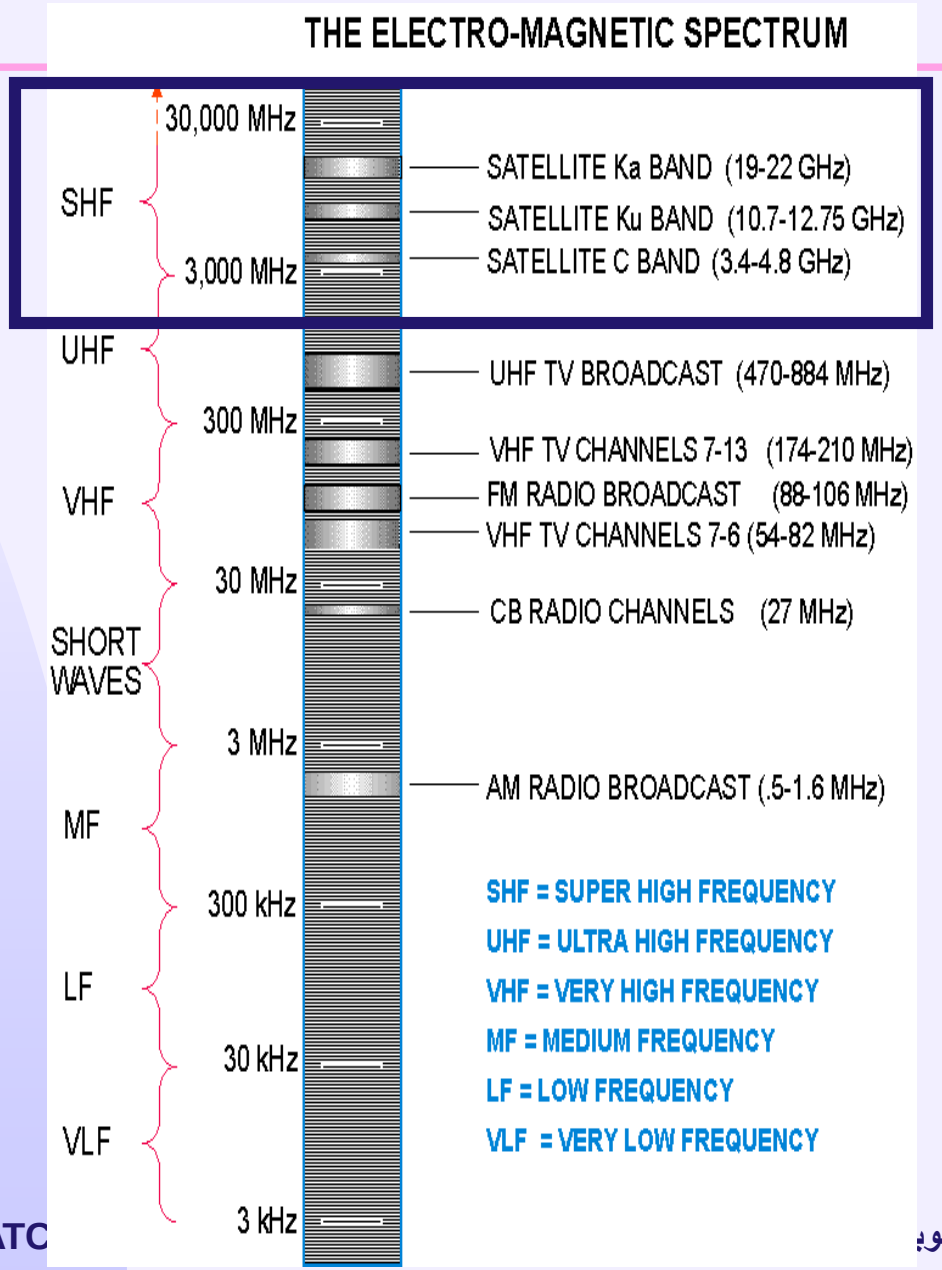

Satellites sur la ceinture de Clarke,
à environ 36 000 km d'altitude
PANAMSAT 1 45° Ouest
PANAMSAT 3 43° Ouest
ORION 1 37,5° Ouest
INTELSAT 603 34,5° Ouest
HISPASAT 1A-1B 30° Ouest
INTELSAT 601 27,5° Ouest
INTELSAT 512 ou K 21,5° Ouest
INTELSAT 705 18° Ouest
TELECOM 2A 8.0° Ouest
ITELECOM 2B 5.0° Ouest
INTELSAT 707 1.0° Ouest
TELECOM 2C 3.0° Est
EUTELSAT II F4 7.0° Est
EUTELSAT II F2 10.0° Est
HOT BIRD 2 13.0° Est
HOT BIRD 3 13.0° Est
HOT BIRD 4 13.0° Est
HOT BIRD 5 13.0° Est
EUTELSAT II F6 ou HOT BIRD1 13.0° Est
EUTELSAT II F1 13.0° Est
EUTELSAT II F3 16.0° Est
ASTRA 1A-1B 19,2° Est
ASTRA 1C-1D 19,2° Est
ASTRA 1E-1F 19,2° Est
ASTRA 1G-1H 19,2° Est
KOPERNIKUS 1 FM 3 23,5° Est
ASTRA 2A 28,2° Est
ASTRA 2B 28,2° Est
KOPERNIKUS 2 FM 2 28,5° Est
TURKSAT 1C 42.0° Est

INSTALLATION STEPS

1. Site Surveys and Terrestrial Interference
2. Finding the Satellite Arc
3. Azimuth & Elevation Coordinates
4. Large Dish Installations: Pouring the Pad
5. Assembling the Dish

6. Mounting the LNB
7. Running the Cable; Coaxial Cable & Connectors;
8. Wiring the Feedhorn & Wiring the Actuator.
9. Dish Alignment and Tracking Procedures using a Spectrum Analyzer
10. Satellite Receivers setup

RADIO FREQUENCY SPECTRUM



FREQUENCIES ALLOWED FOR THE VSAT

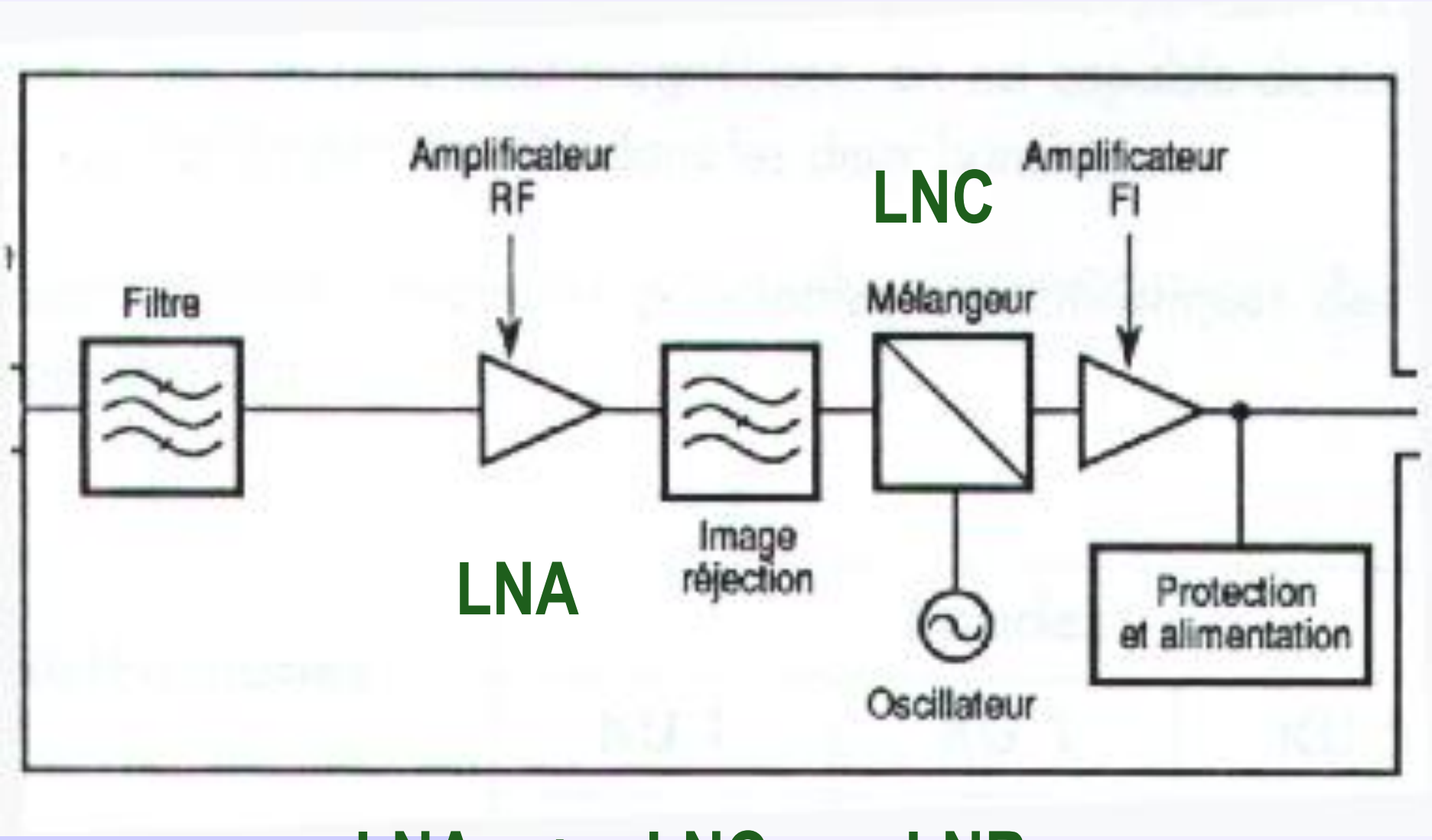
	Ka	Ku	C
• BAND			
• DOWNLINK FREQUENCY,GHz	12.2-12.7	11.7-12.2	3.7-4.2
• TERRESTRIAL INTERFERENCE POSSIBLE	NO	NO	YES
• SATELLITE EIRP RANGE ,DBW	51-60	40-48	33-37

LNB (Low Noise Block)

Ku BAND LNB

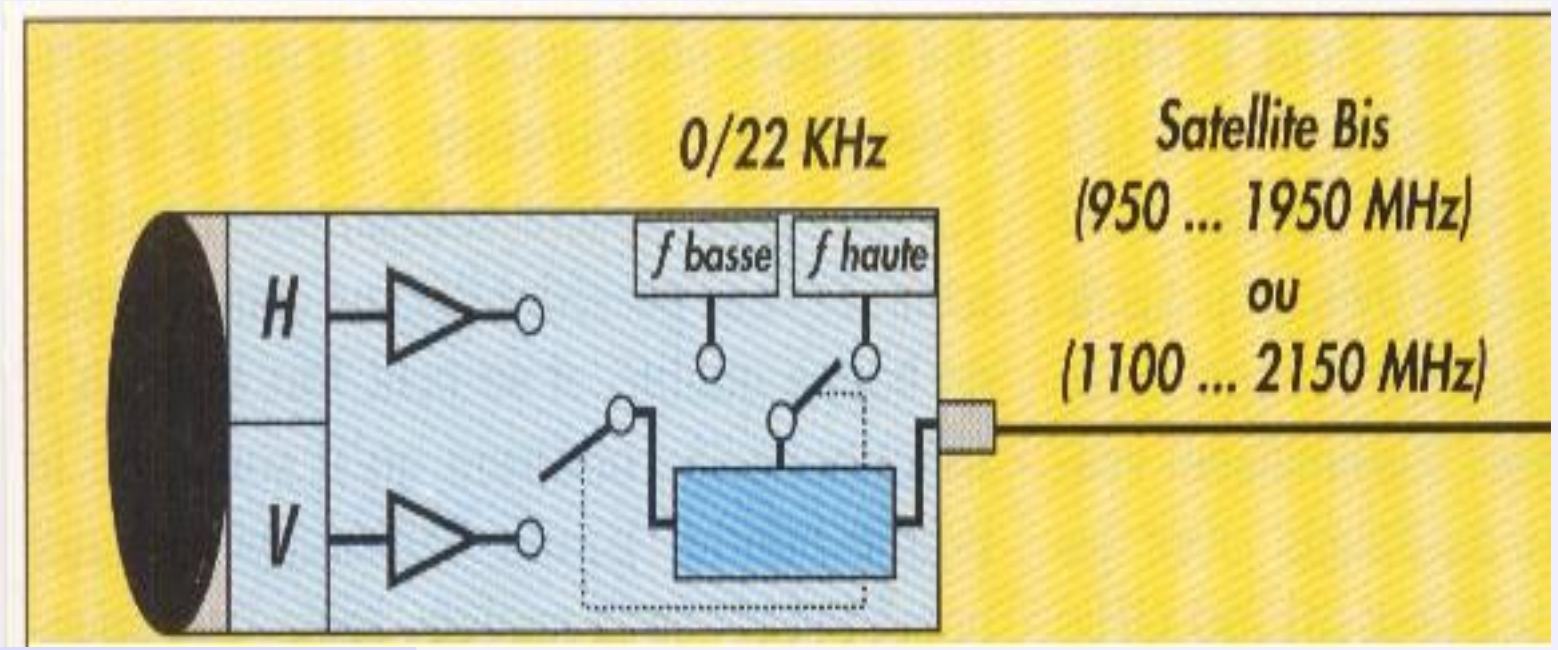
C & Ku BAND LNB

LNB (Low Noise Block)

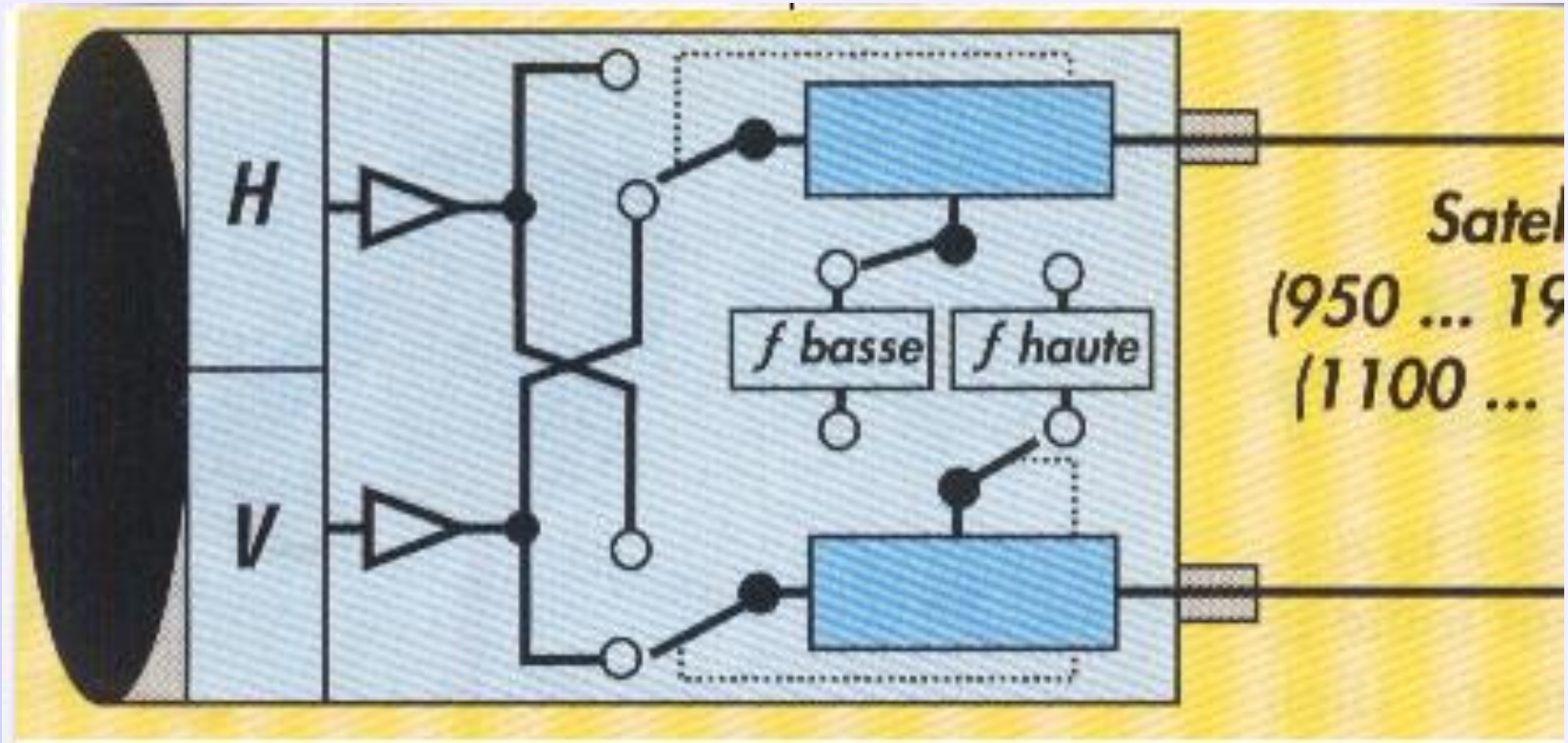


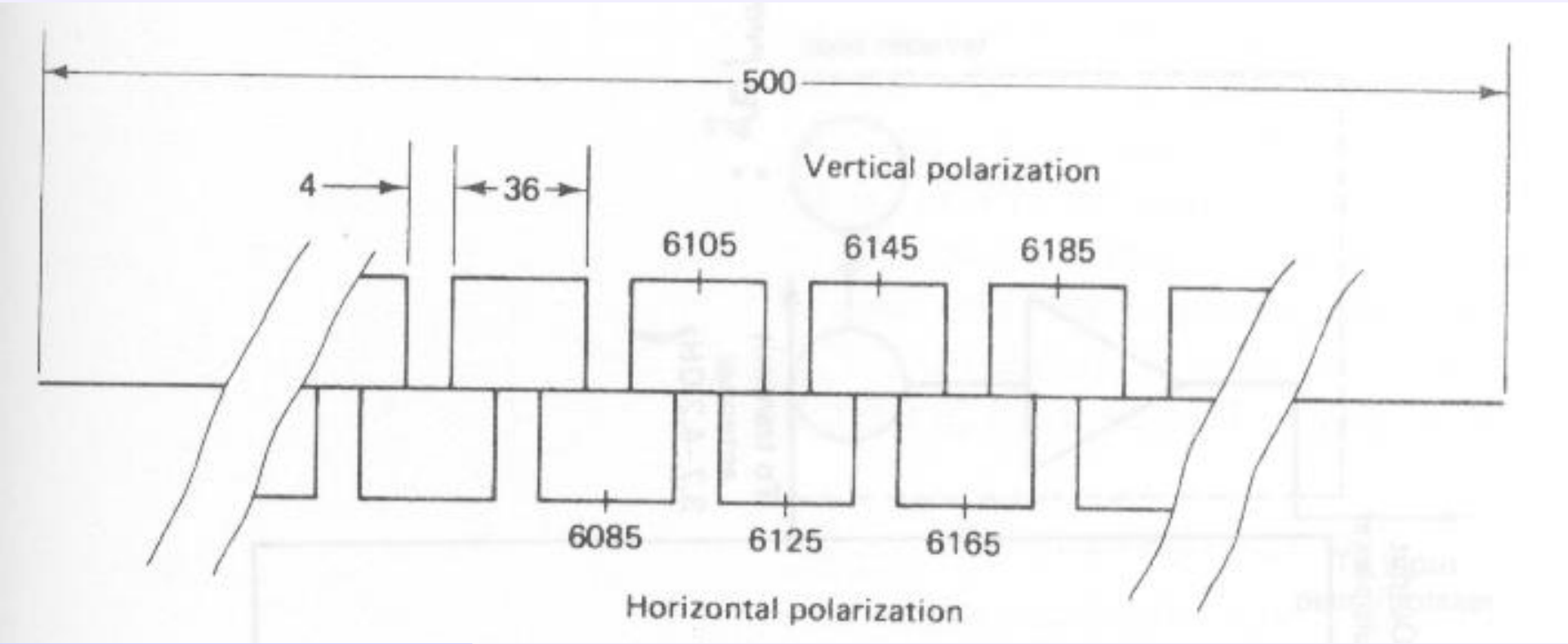
LNA + LNC = LNB

SINGLE L N B

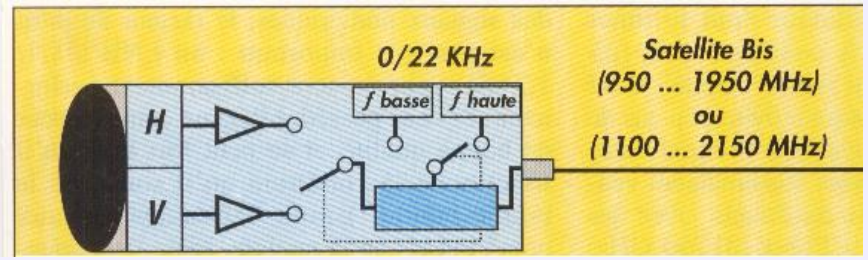

0/22 KHz
Satellite Bis
(950 ... 1950 MHz)
ou
(1100 ... 2150 MHz)
f basse
f haute
H
V

TWIN L N B



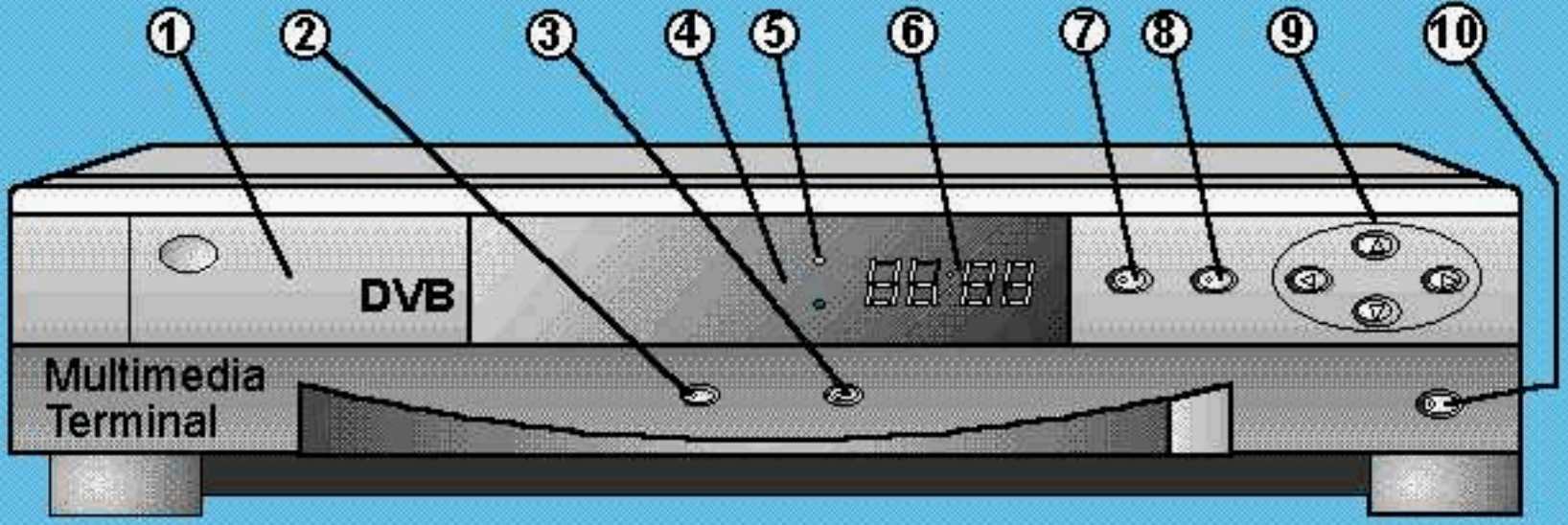

500
4
36
Vertical polarization
6105
6145
6185
6085
6125
6165
Horizontal polarization

WHAT DO YOU NEED



UNIVERSAL LNB

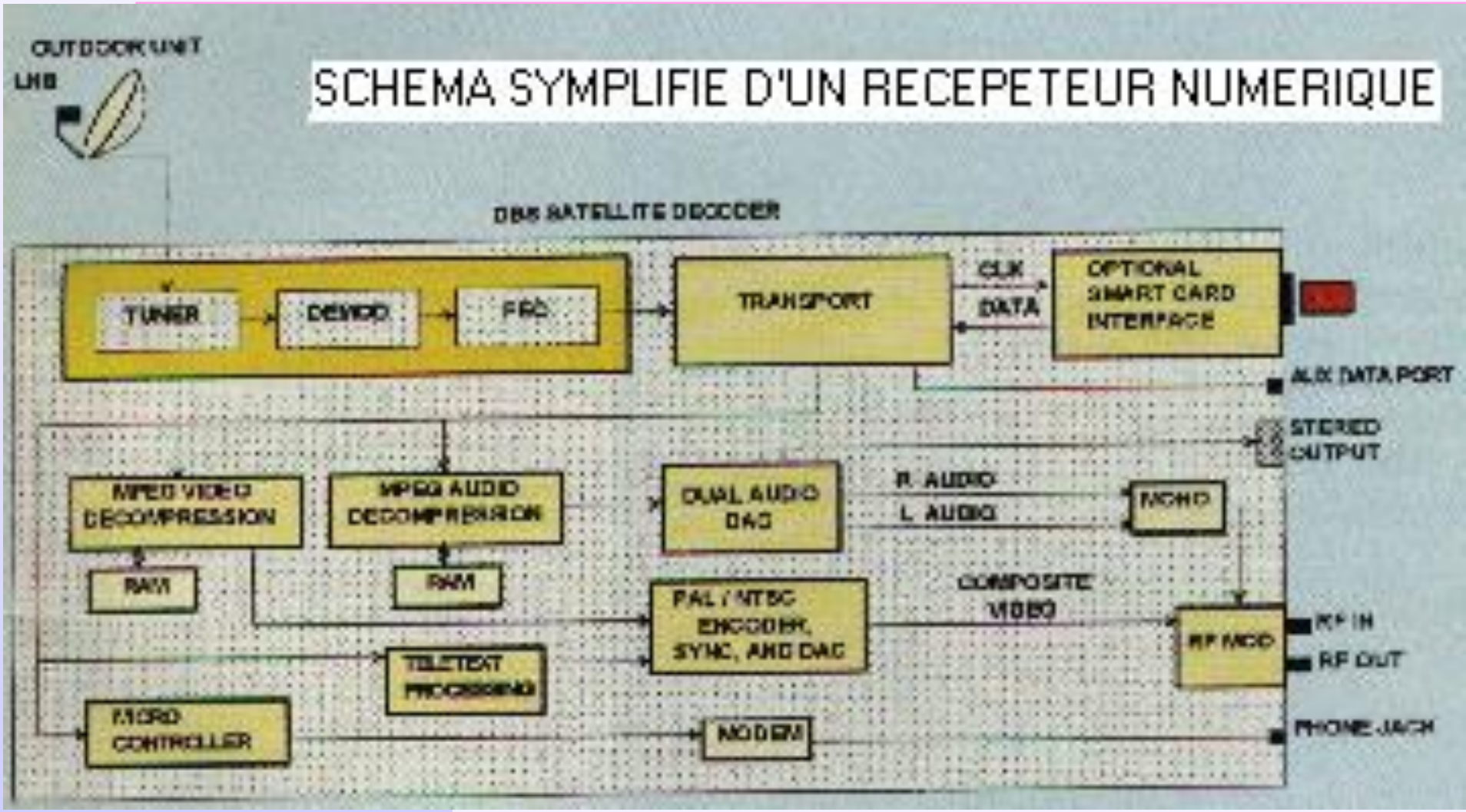
DIGITAL IRD FRONT PANEL

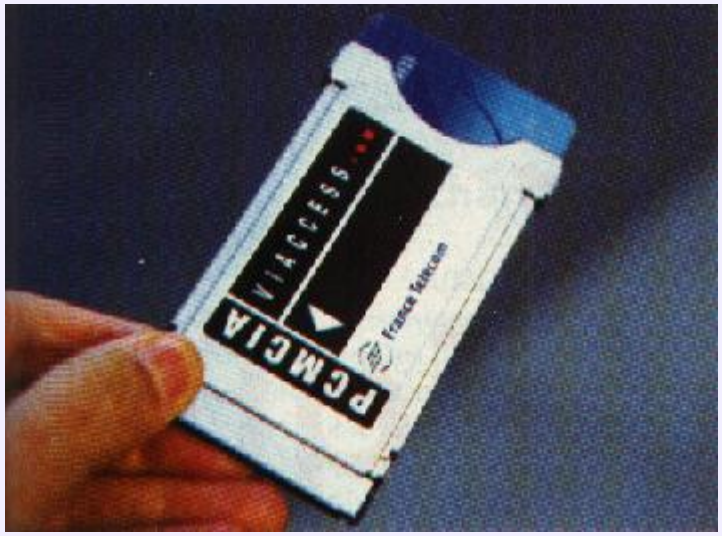


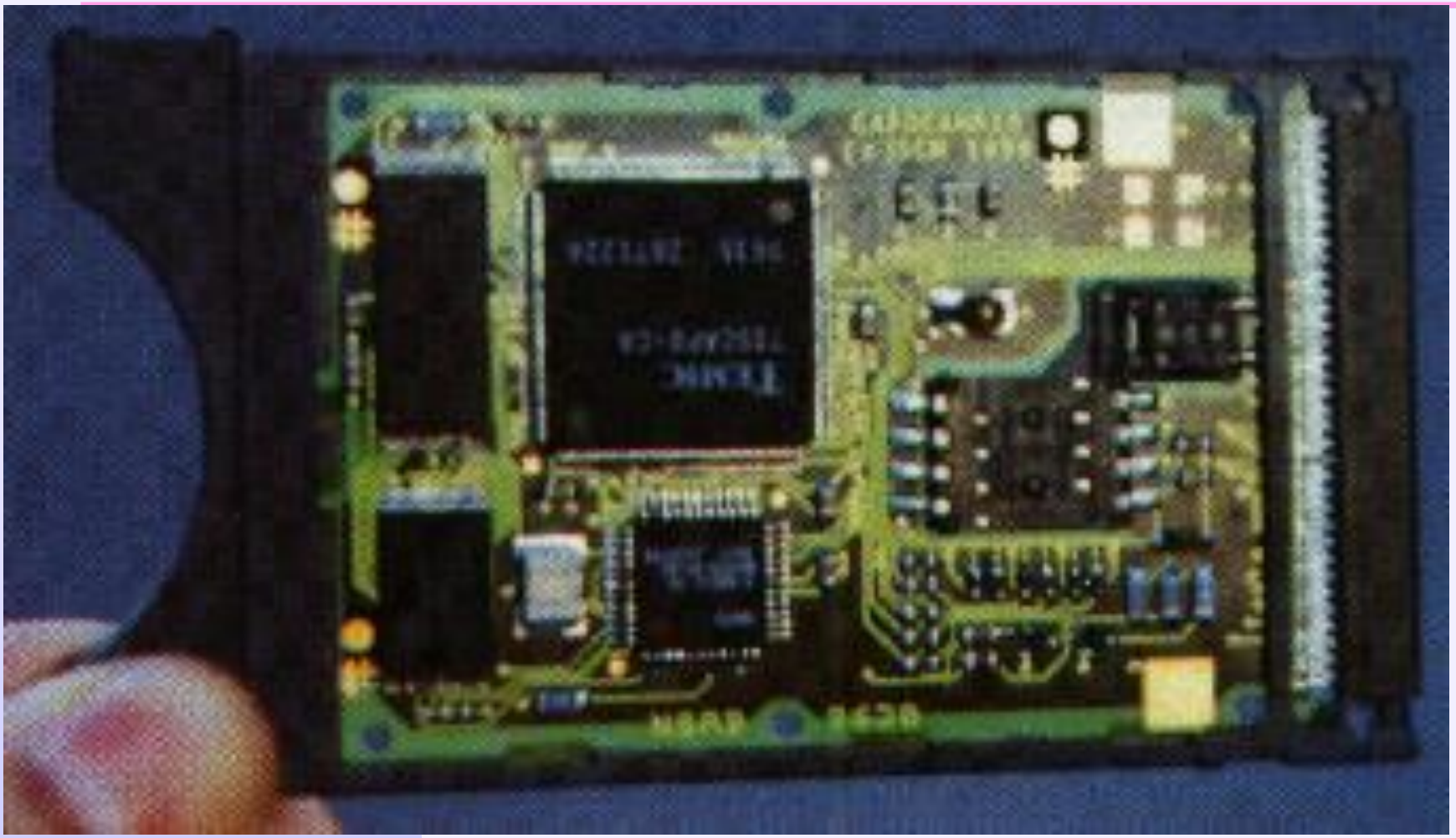
1. Smart-card slot door
2. Information button
3. Guide button
4. Green LED warning light (E-mail,remote control unit, signal reception)
5. Yellow LED warning light(smart card)
6. Four-digit front-panel LED display
7. Menu button
8. OK button
9. Directional arrow button
10. Stand-by button

PCI CARD

INDOOR UNIT (RECEIVER)


SCHEMA SYMPLIFIE D'UN RECEPETEUR NUMERIQUE
OUTDOOR UNIT
LNB
DBS SATELLITE DECODER
TUNER
DEMOD
FEC
TRANSPORT
CLK
DATA
OPTIONAL
SMART CARD
INTERFACE
AUX DATA PORT
STEREO
OUTPUT
MPEG VIDEO
DECOMPRESSION
MPEG AUDIO
DECOMPRESSION
DUAL AUDIO
DAC
R AUDIO
L AUDIO
MONO
RAM
RAM
PAL / NTSC
ENCODER,
SYNC, AND DAC
COMPOSITE
VIDEO
RF MOD
RF IN
RF OUT
TELETEXT
PROCESSING
MICRO
CONTROLLER
MODEM
PHONE JACK


PCMCIA
VIACCESS



Troubleshooting in the TVSAT installation

Bad or "Snowy" Picture on All or Several Channels

The Picture and Audio Does Not Match

No picture

Distorted picture

No sound

Poor Picture Quality or Scrambled Picture

Bad or "Snowy" Picture on All or Several Channels

- Check that the TV channel selector is set on the proper channel for your converter box .
- Check your equipment to make sure everything is hooked up properly and that all cables are connected securely.
- Remove any extra equipment, such as a VCR, DVD or game, and plug the TV directly into the cable jack in the wall.
- If this eliminates the bad picture, the problem may be related to one of the equipment you removed.
- If the problem still occurs, you may need to open a repair

The Picture and Audio Does Not Match

- Check your equipment to make sure everything is hooked up properly and that all cables are connected securely.

- Consult your owner's manual to change the audio receiver format or Audio Frequency.

No Picture

- Check to make sure that the TV and/or Cable box have not been unplugged.
- Make sure all connections are secure.
- If the channel number isn't displayed on the receiver front pannel, press POWER.
- Check to see if your TV, VCR, and the receiver are plugged into an electrical outlet that is controlled by a wall switch. If it is, make sure the switch is turned on.
- Verify that all cables are properly connected. You may want to walk through your connection steps again.
- If the problem continues, or you get a blue screen, turn off your VCR.

No sound

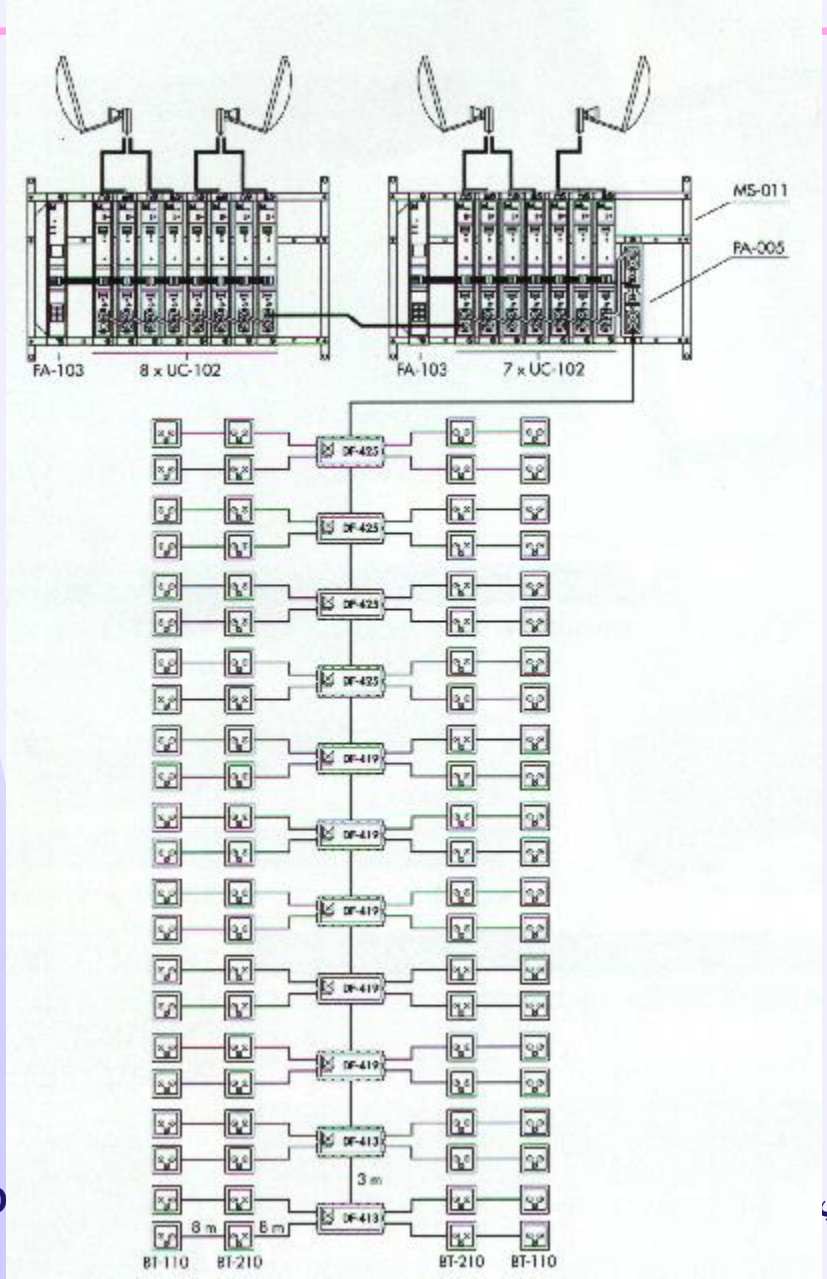
- Press the volume up button.
- Review all suggestions from no picture.

Poor Picture Quality or Scrambled Picture

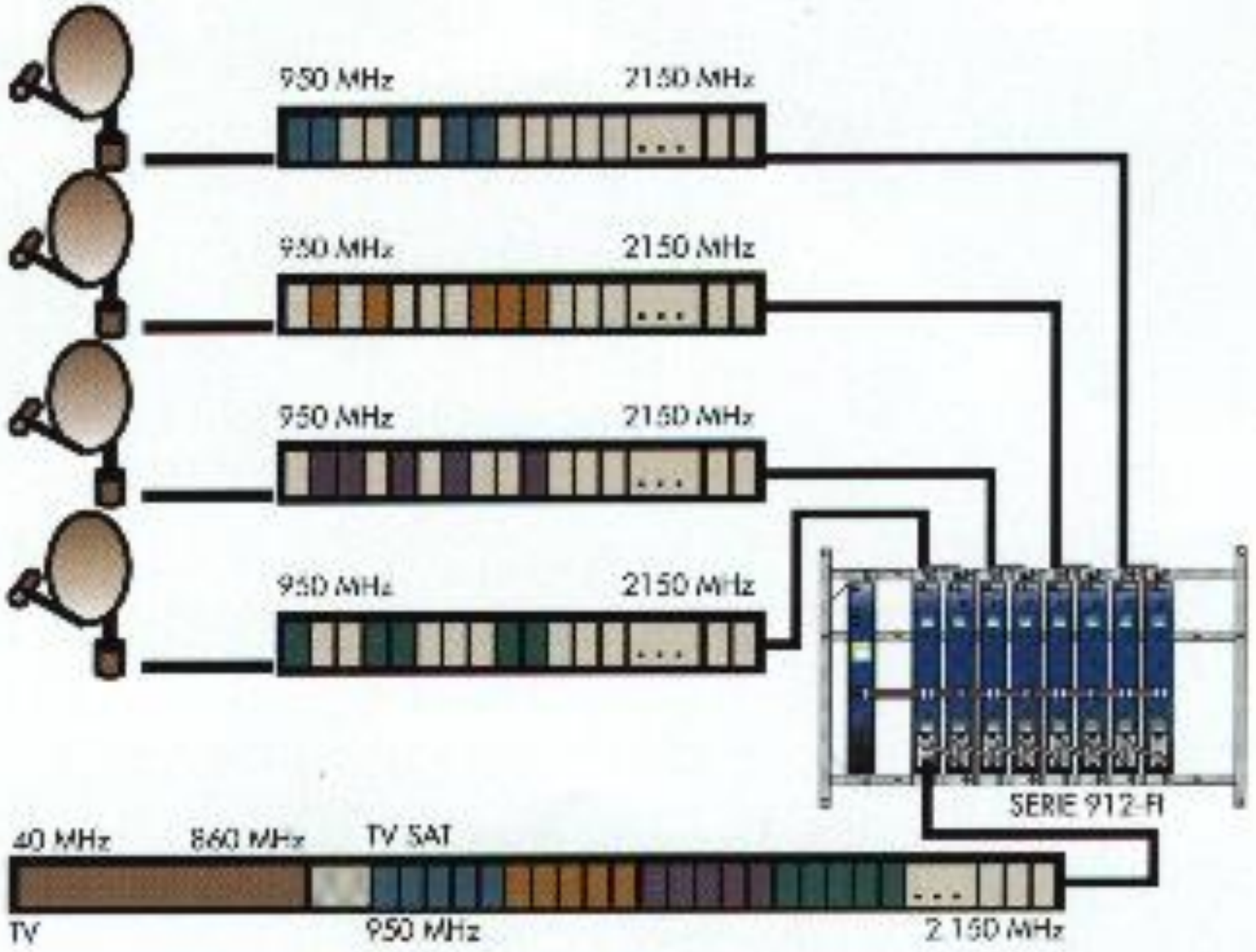
- Verify that you are authorized to view the selected channel.
- Check horizontal and vertical holds, brightness and contrast.
- Check VCR and converter box connections.

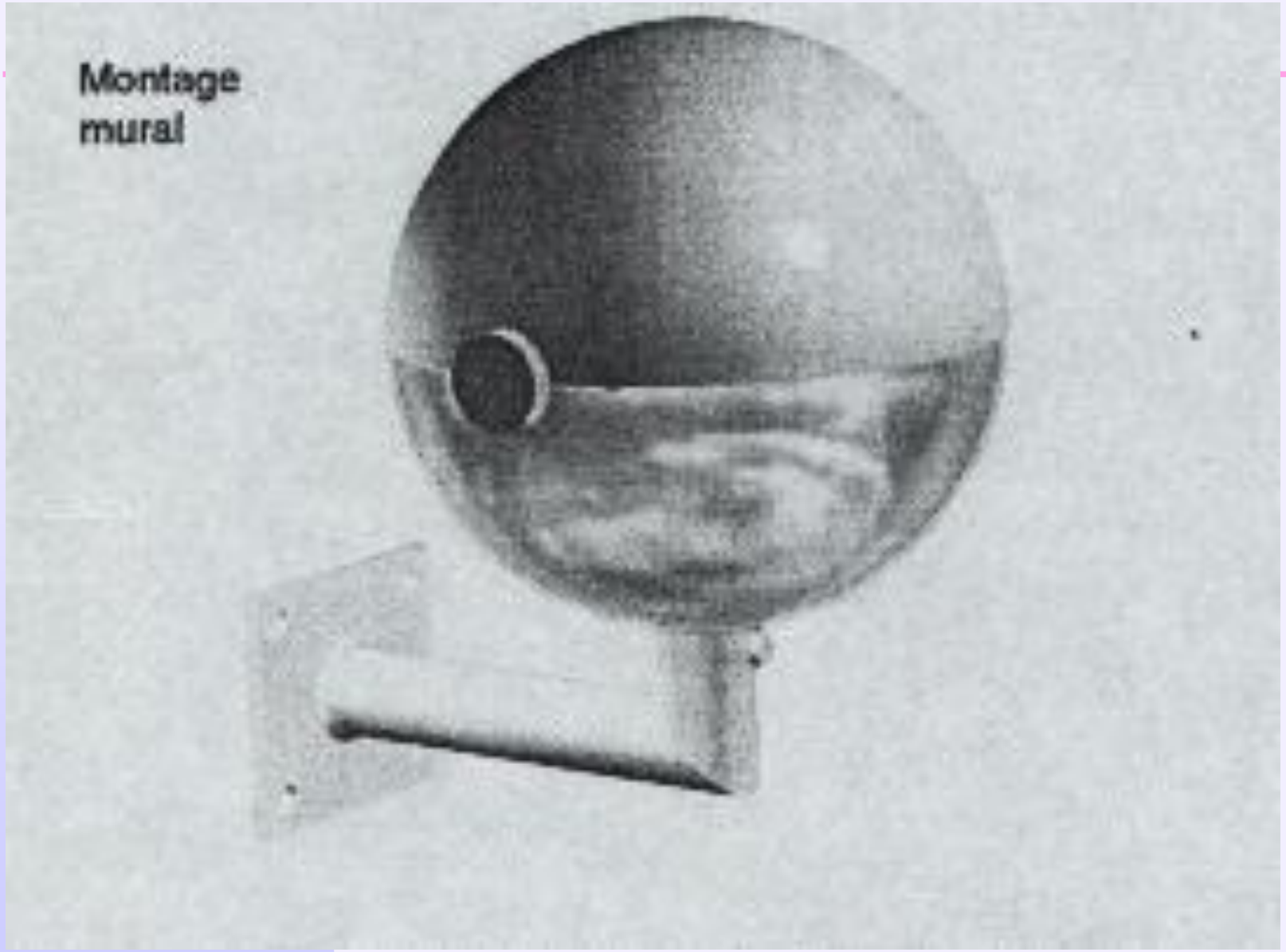

CABLE DE LIAISON POUR FLASHAGE DU RECEPTEUR

UHF distribution



IF distribution




Montage
mural

VSAT (USAT) SERVICE

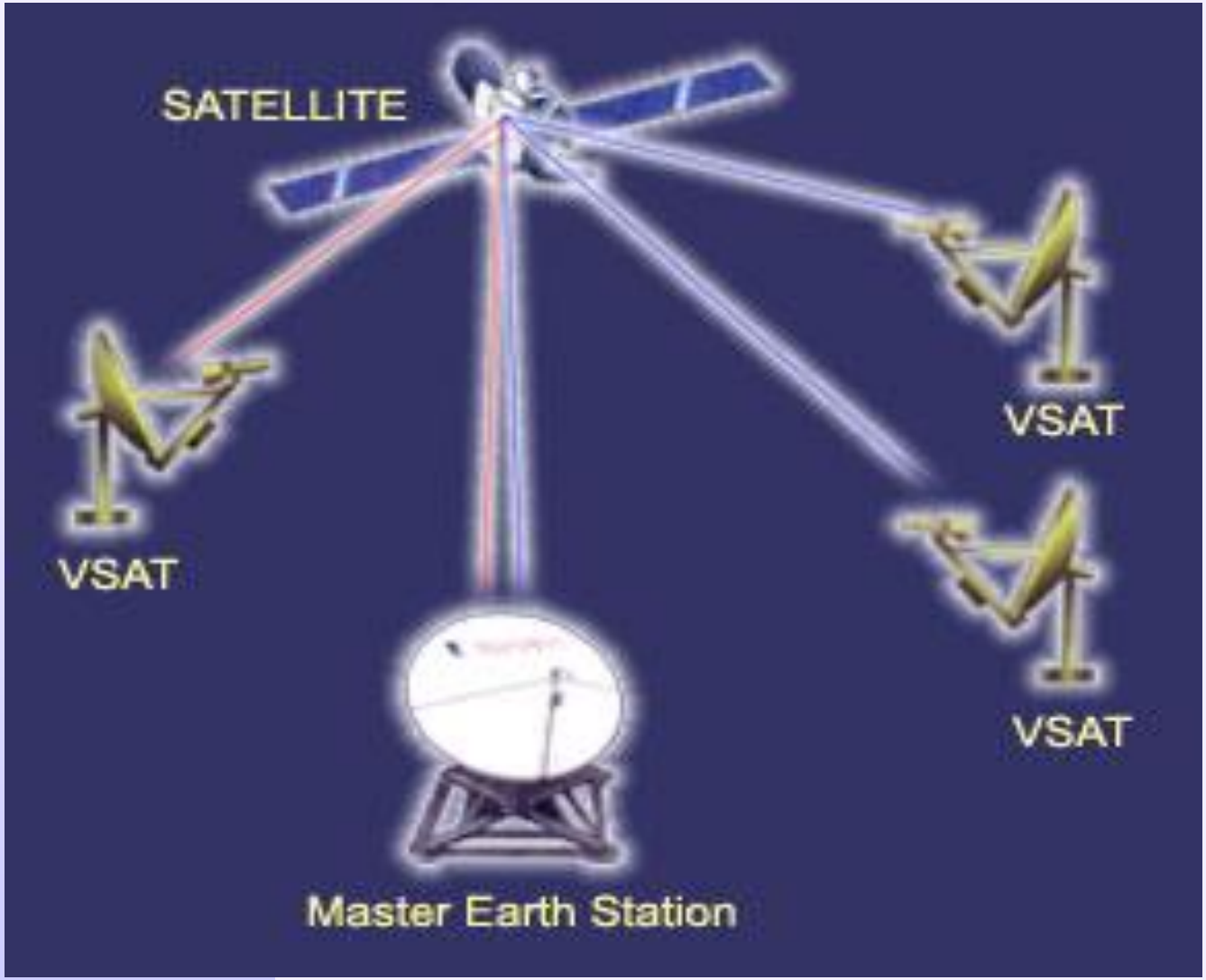
Very (Ultra)

Small

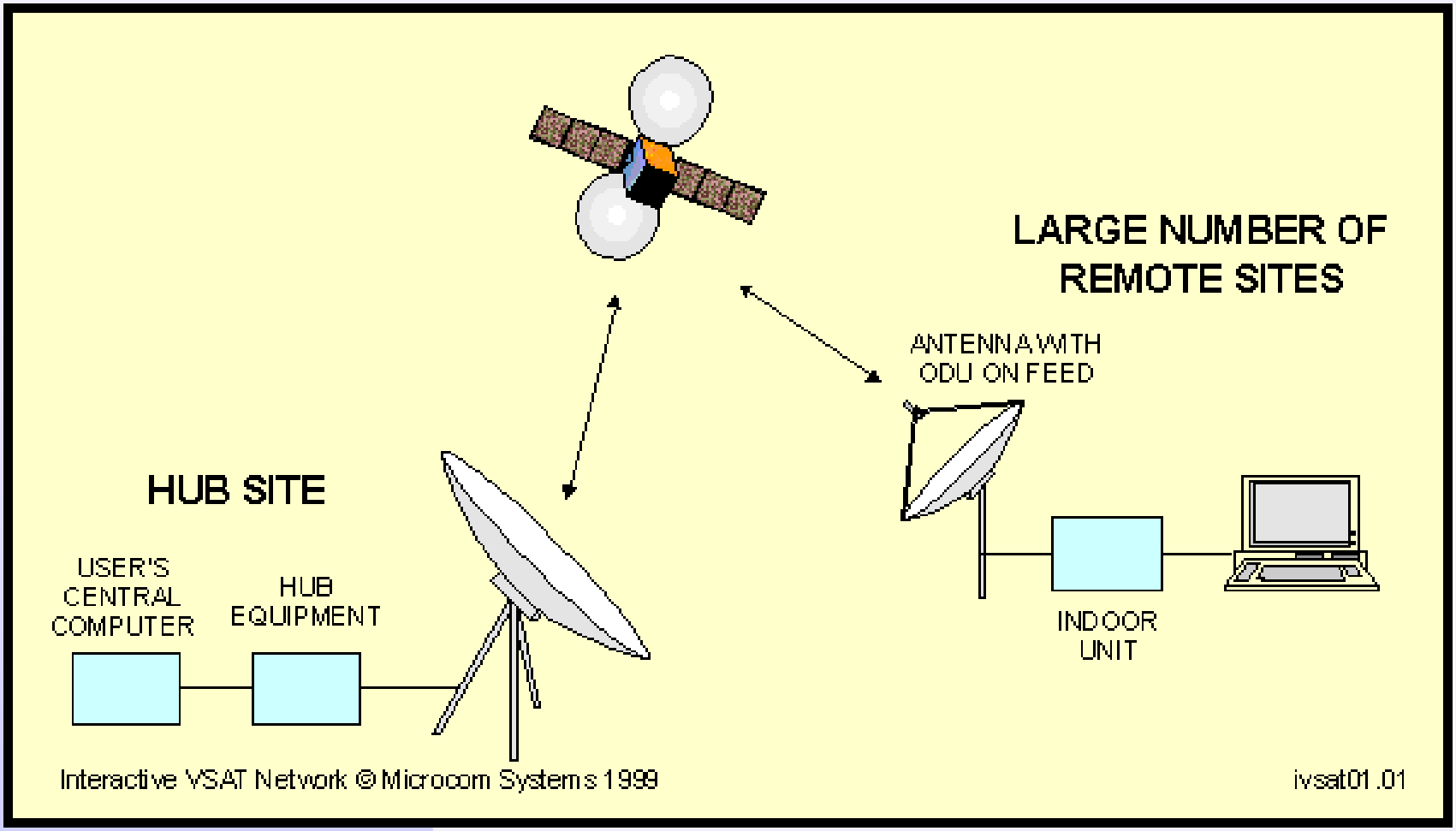
Aperture

Terminal

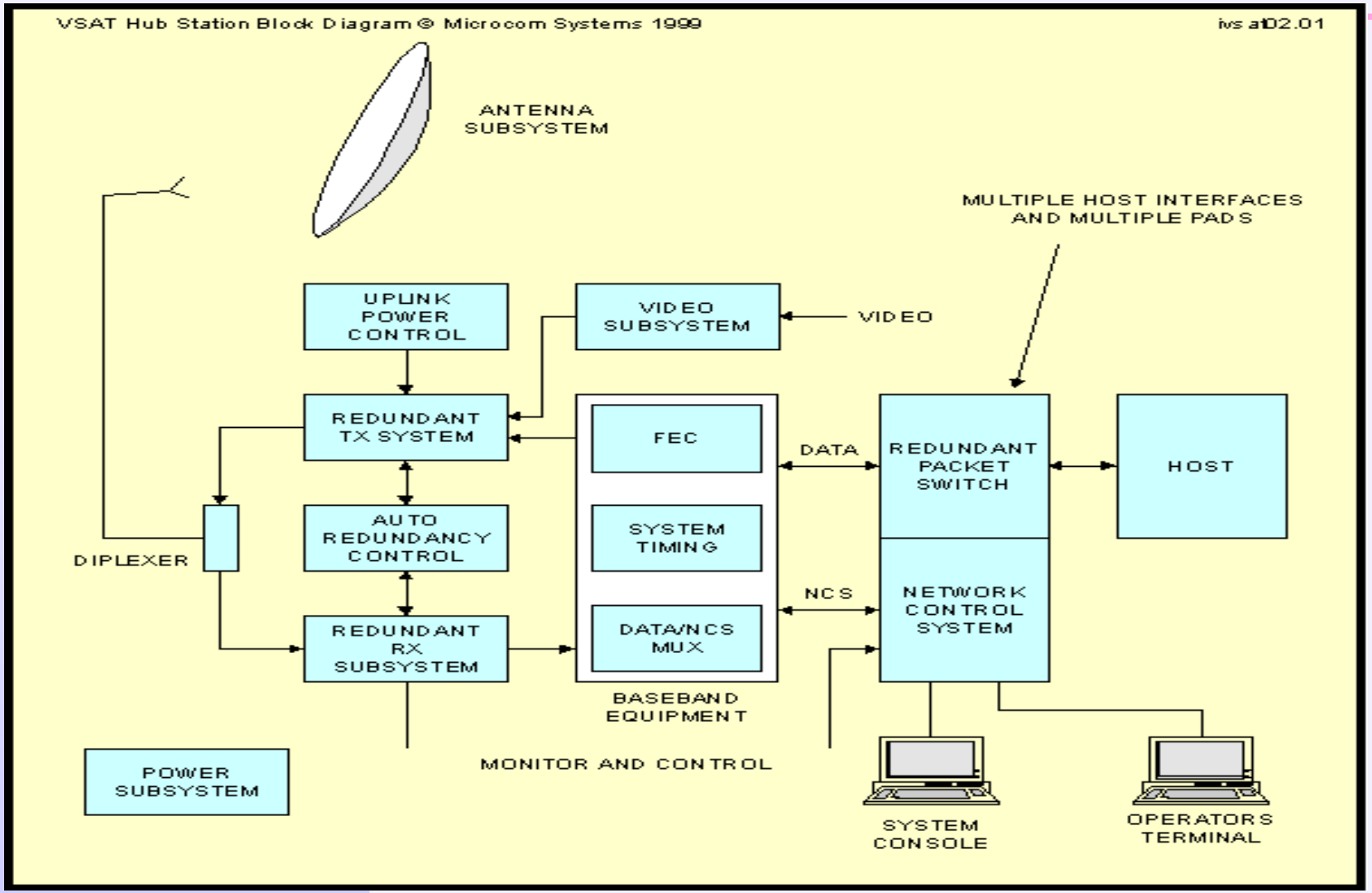
VSAT (USAT) SERVICE



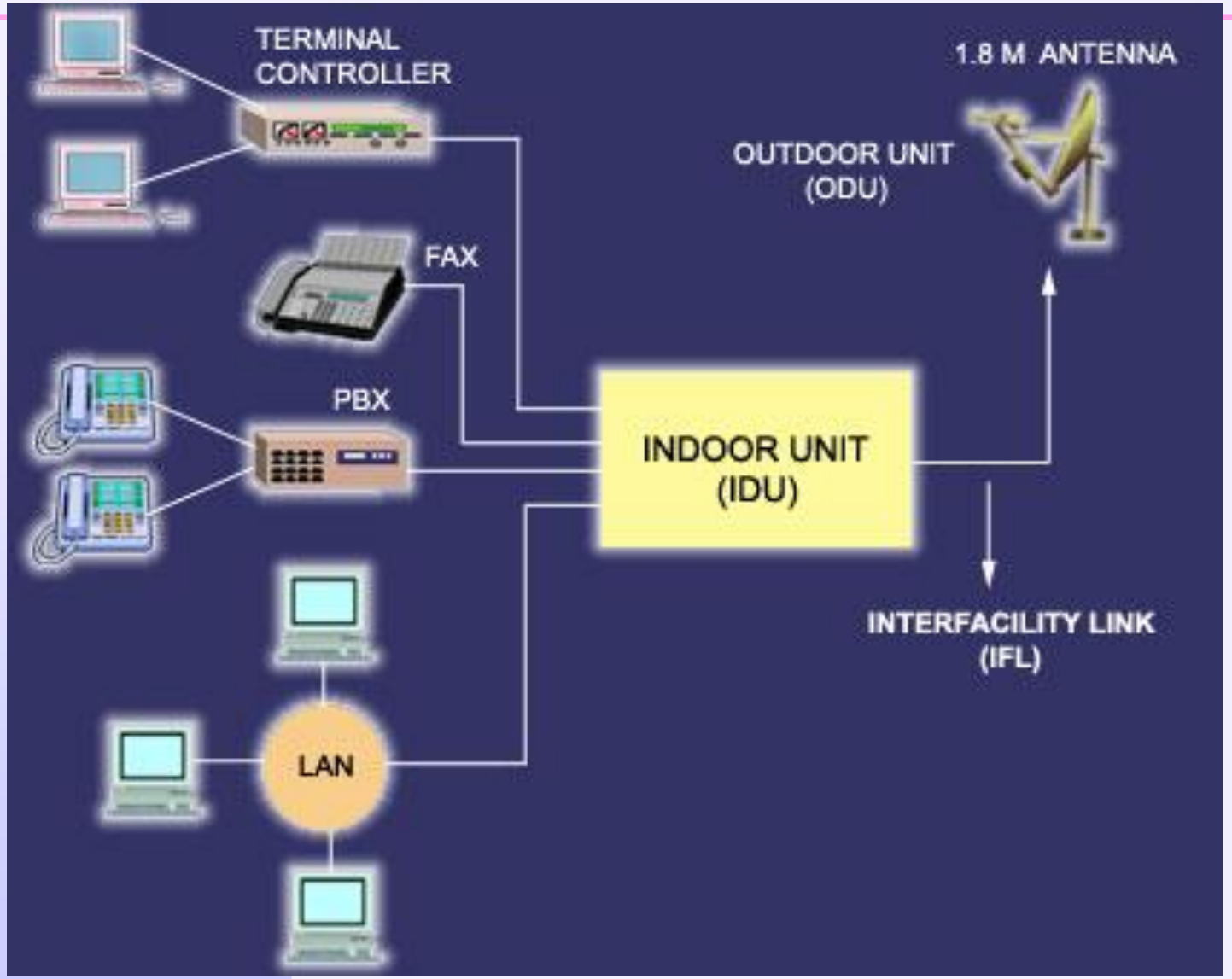
HUB AND REMOTE SITE



VSAT HUB STATION

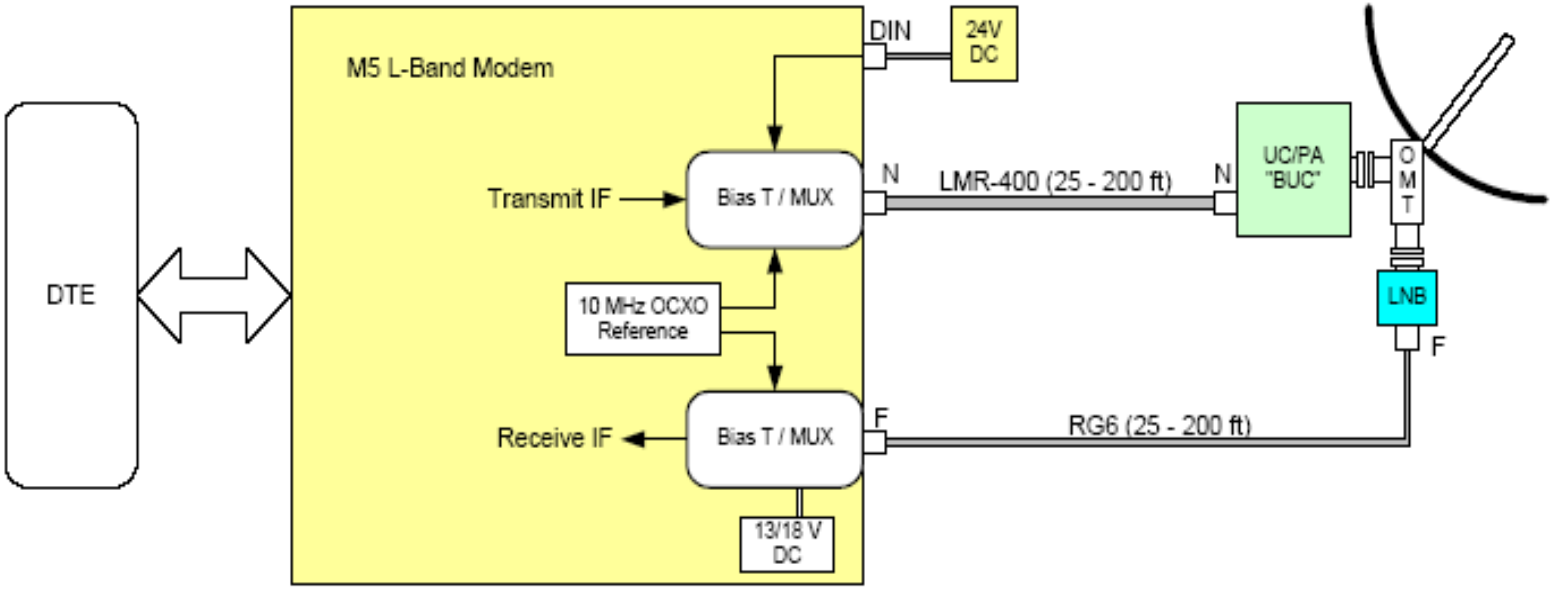


REMOTE SITE



- INDOOR UNIT
- OUTDOOR UNIT

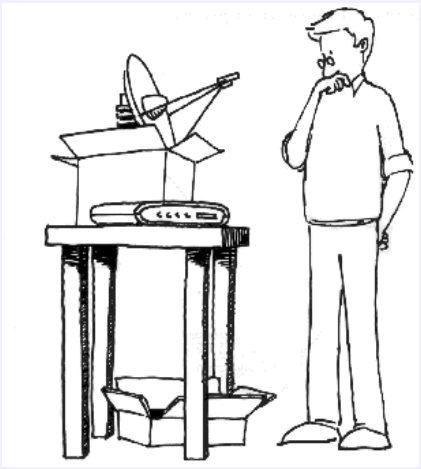
BLOCK DIAGRAM OF VSAT STATION



HARDWARE & SOFTWARE

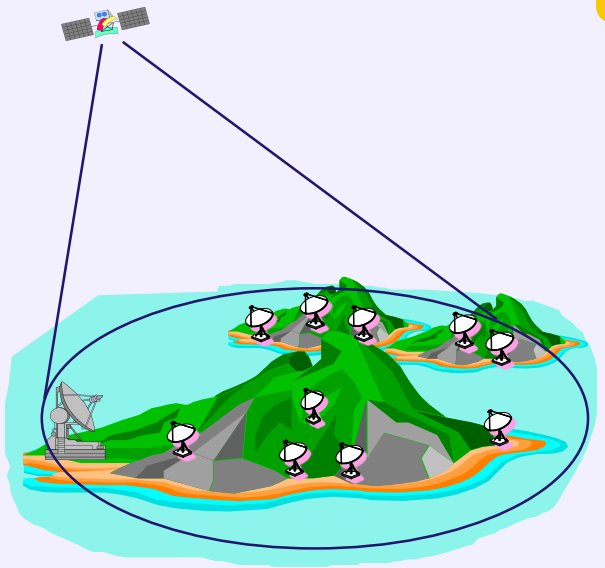
what's this VSAT anyway?

- Very Small Aperture Terminal
- fixed antenna (dish / aperture)
- 0.65m to 2.4m diameter antenna
- VSAT network includes a hub
- Hub has a large dish ~6m +
- All communications to and from VSAT back to hub (no meshing)
- Suits asymmetric networks - more traffic from hub, less from VSAT
- Data, video, audio



GEO- a renewed interest in VSAT

- distance & geography independent
- good for broadcast, multicast
- IP friendly
- DTH or Community distribution
- rapid deployment
- min expansion costs
- high reliability
- data, video, audio



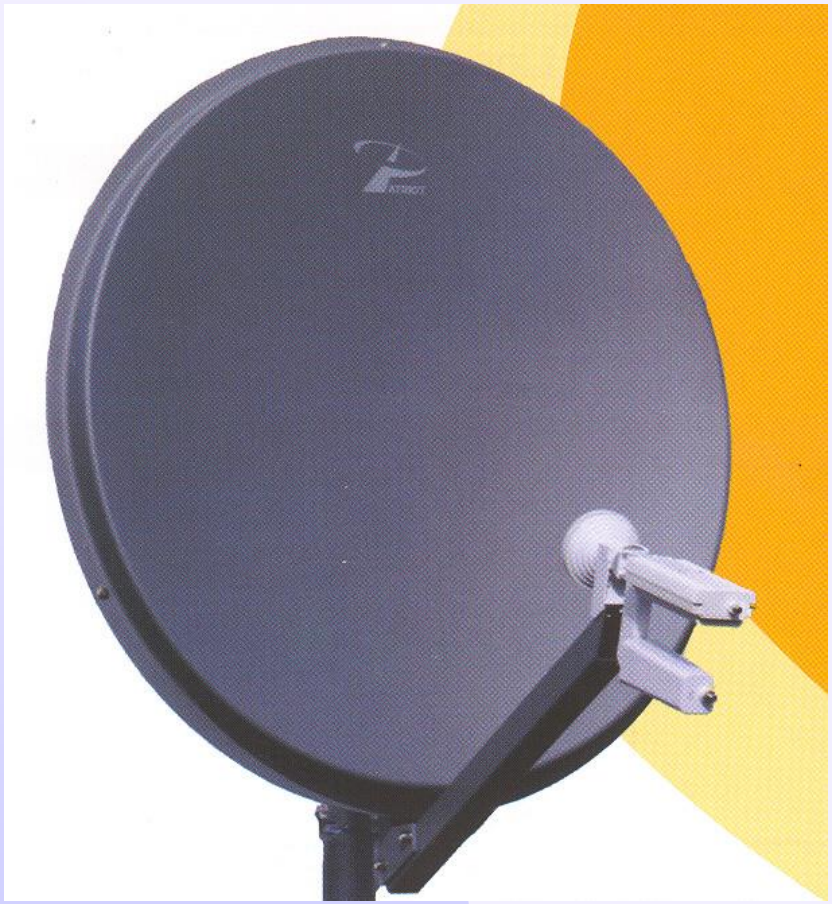
INDOOR UNIT

FRONT PANEL

REAR PANEL

INDOOR UNIT

OUTDOOR UNIT



TRANSMITTER (BUC) & RECEIVER (LNB)

LNB (Low Noise Block)

Ku BAND LNB

C & Ku BAND LNB

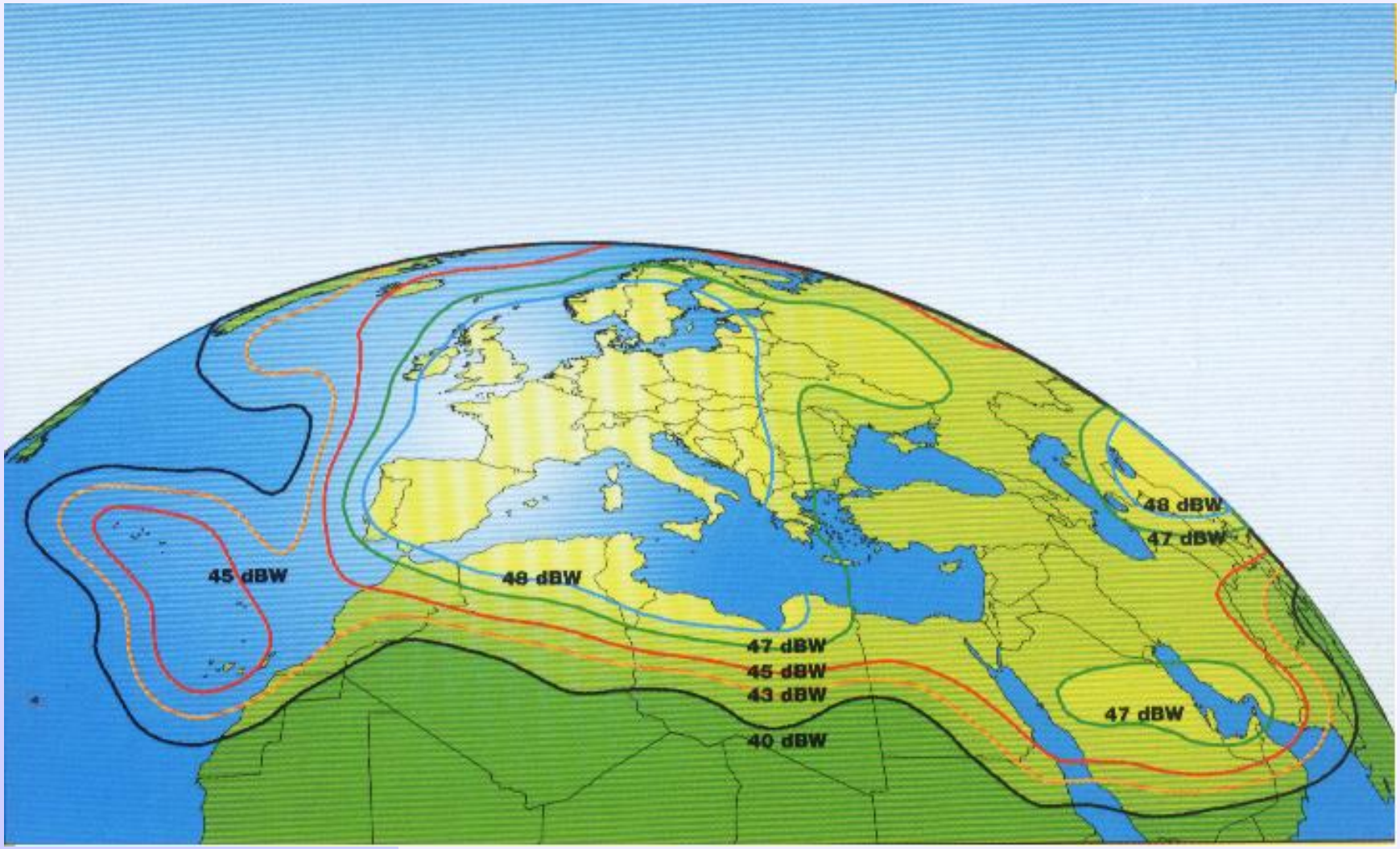
BUC (Block Up Converter)

C & Ku BAND BUC

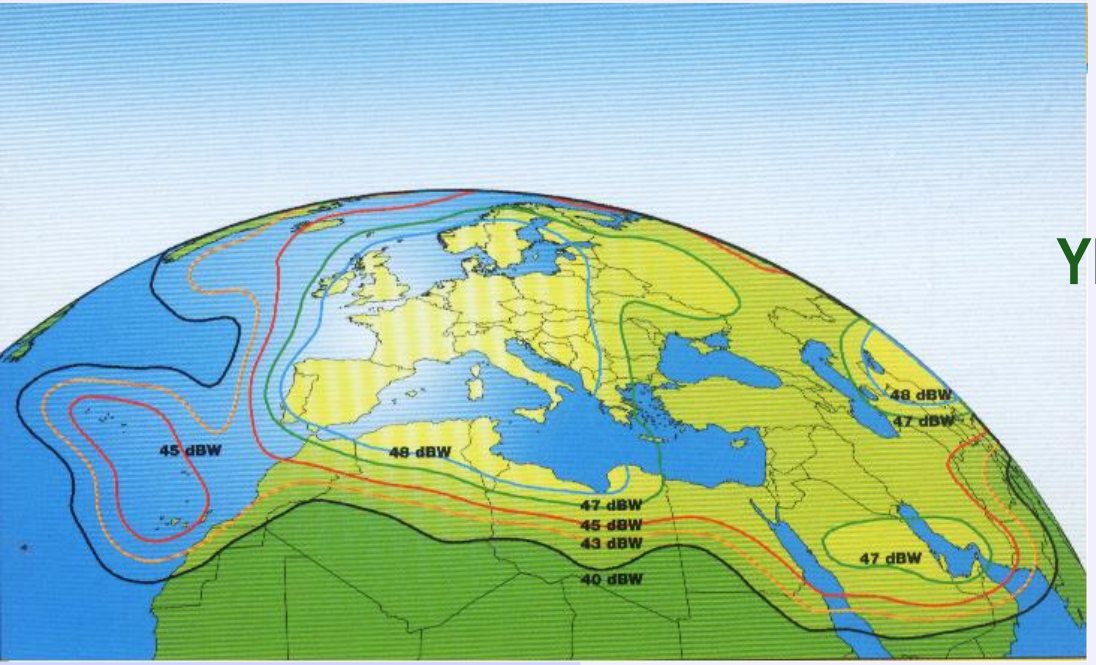
Ku BAND BUC

ANTENNAS (DISH)

W3 (EUTELSAT) @ 7° EAST



W3 (EUTELSAT) @ 7° EAST

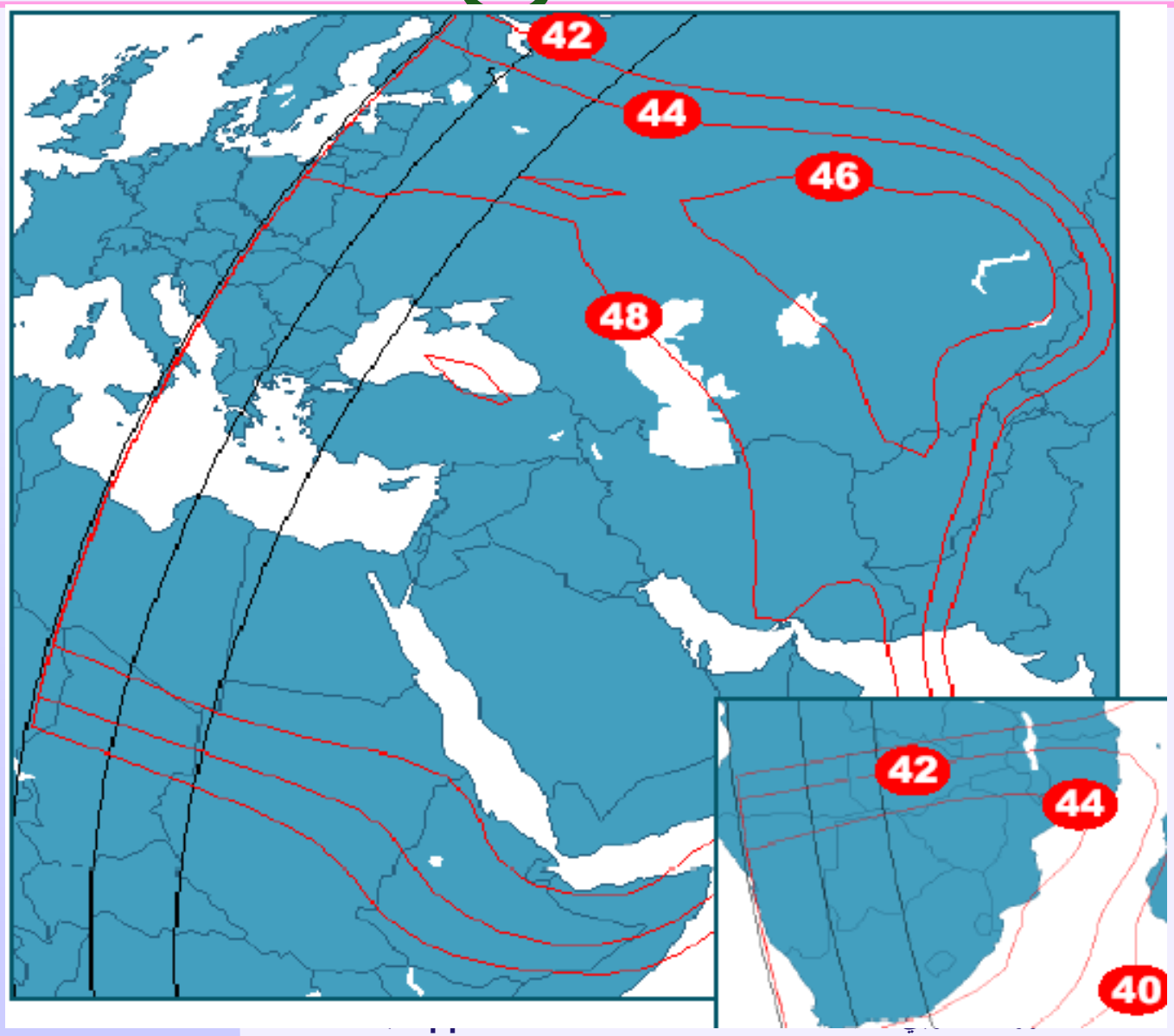


RED area with 0.96 m antenna

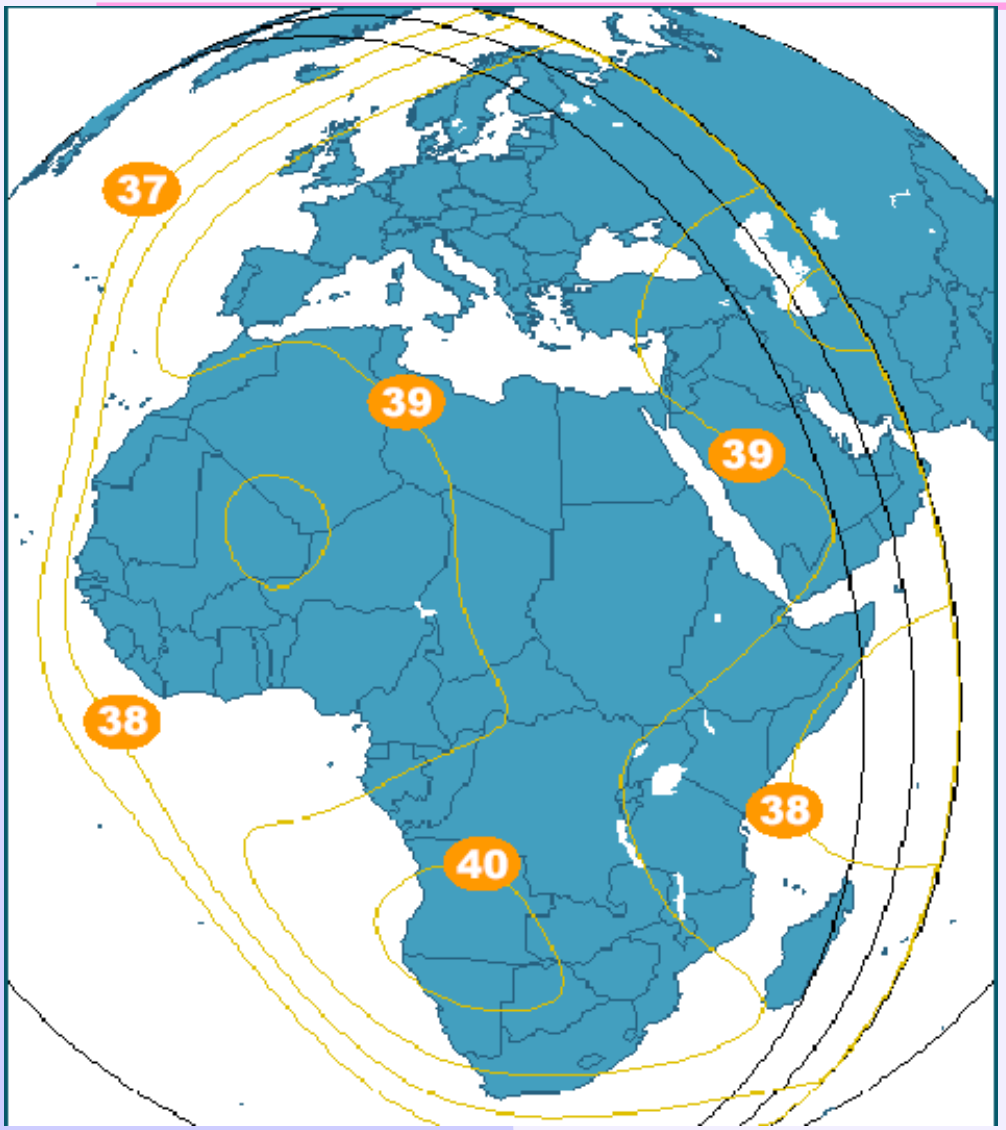
YELOW area with 1.20 m antenna

BLACK area with 1.80 m antenna

NSS 6 @ 95° EAST



NSS 7 @ 338.5° EAST

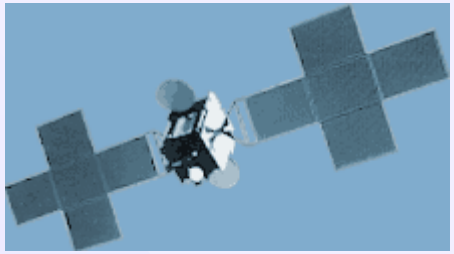


Ku AND C-BAND SATELLITE

REPLACE NSS-803 AND NSS`-K

dbW

EUROPE*STAR1 @ 45° EAST



MIDDLE EAST : DOWNLINK

EIRP at 12,75 GHz [dbW]

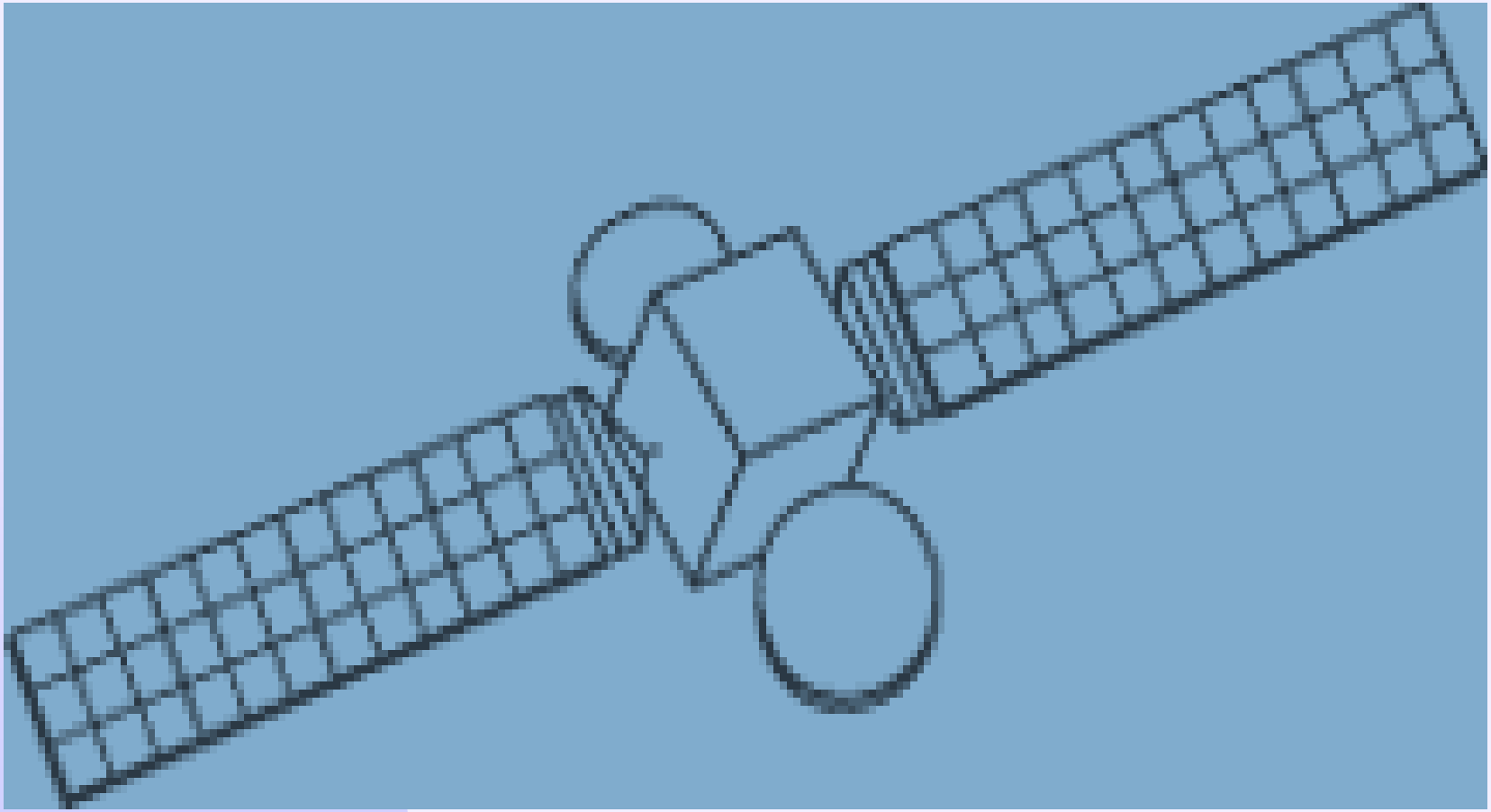
EIRP = P_T + G_T [dbW]

EUROPE*STAR1 @ 45° EAST

MIDDLE EAST : UPLINK

G/T at 14,25 GHz [db/°K]

EUROPE*STAR B @ 47,5° EAST



FREQUENCIES ALLOWED FOR THE VSAT

• UPLINK FREQUENCY,GHz	17.3-17.8	14-14.5	5.925-6.425
• BAND	Ku	Ku	C
• DOWNLINK FREQUENCY,GHz	12.2-12.7	11.7-12.2	3.7-4.2
• TERRESTRIAL INTERFERENCE POSSIBLE	NO	NO	YES
• SATELLITE EIRP RANGE ,DBW	51-60	40-48	33-37

V/H POLARIZATION

General Services and Applications

- PAY AND FREE TV AND RADIO PROADCASTING
- IP CONNECTIVITY
- VIDEO CONFERENCING
- VoIP (Voice over IP)
- MOBILE COMMUNICATION SYSTEM
- DATA, VOICE AND VIDEO CONNECTIVITY
- DISTANCE EDUCATION

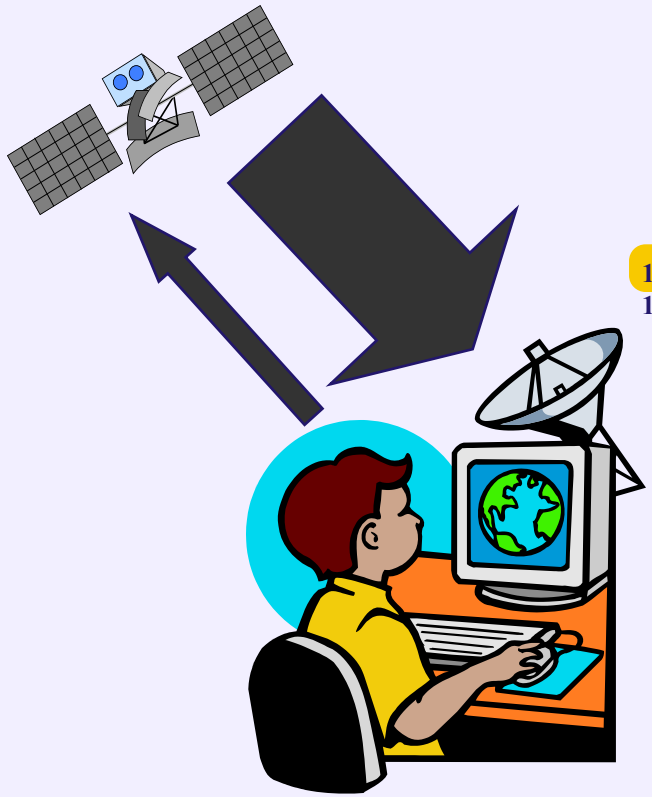
General Services and Applications

CON'T

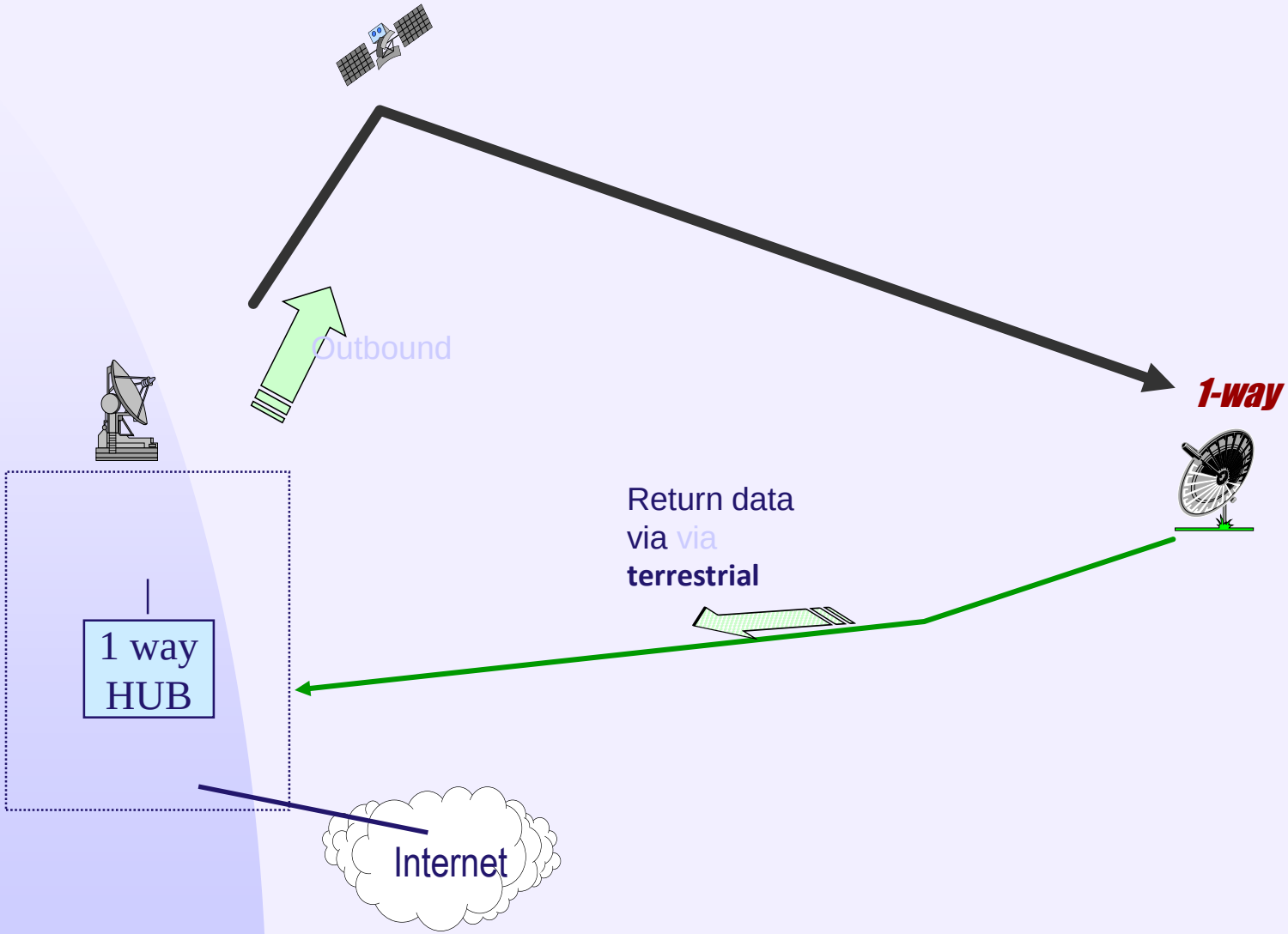
- INTERNET ACCESS
  - RECEIVE ONLY WITH TERRESTRIAL UPLINK (ONE-WAY)
  - SEND RECEIVE (TWO-WAY)
  - DEDICATED SCPC SERVICE

INTERNET VIA SATELLITE

- One way Broadcast / Multicast
  - Smaller dish RO (TVRO)
  - Simpler elechronics
  - IP based
- 2-way packet data
  - Larger dishes
  - More sophisticated
  - IP based



ONE WAY (RECEIVE ONLY)



WHAT DO YOU NEED

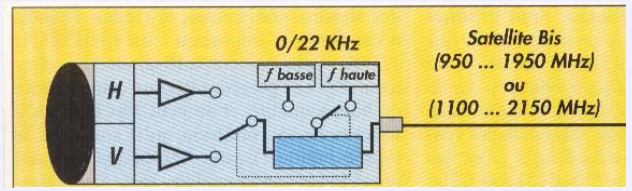
HARDWARE & SOFTWARE

small dish

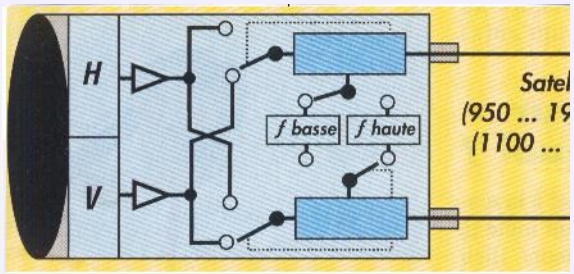
PCI card

ONE WAY HARDWARE

OUTDOR UNIT



UNIVERSAL LNB



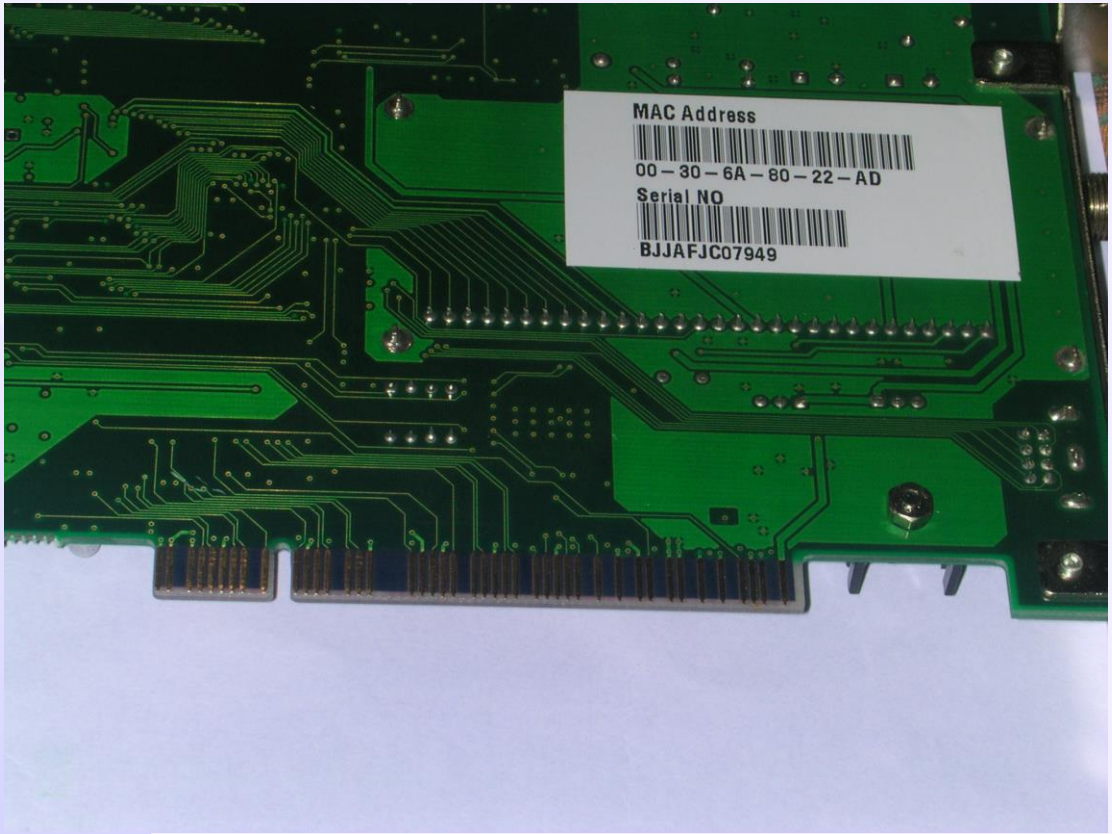
TWIN LNB

ONE WAY HARDWARE

INDOOR UNIT

PCI CARD

MAC ADDRESS



00-30-6A 80-22-AD

ONE WAY HARDWARE

INDOOR UNIT

USB BOX

USB BOX

REAR PANNEL

BIT RATE

MAXIMUM TRANSFER RATE

1000 Kbit/sec

AVERAGE TRANSFER RATE

500 Kbit/sec

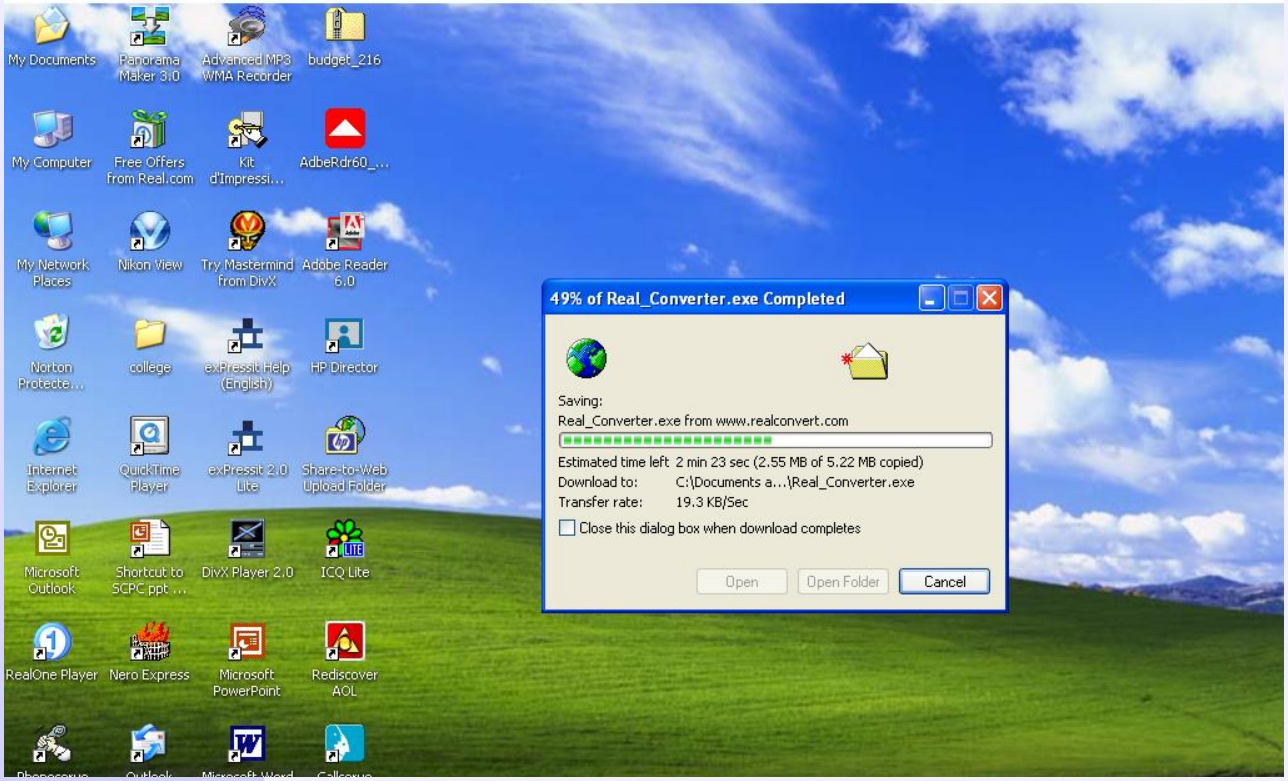
BIT RATE (SPEED)

Kbps (kilo bit per second) kbit/s

kB/Sec (kilo Byte per second)

1 BYTE = 8 BITS

TRANSFER RATE



19,3 kB/Sec

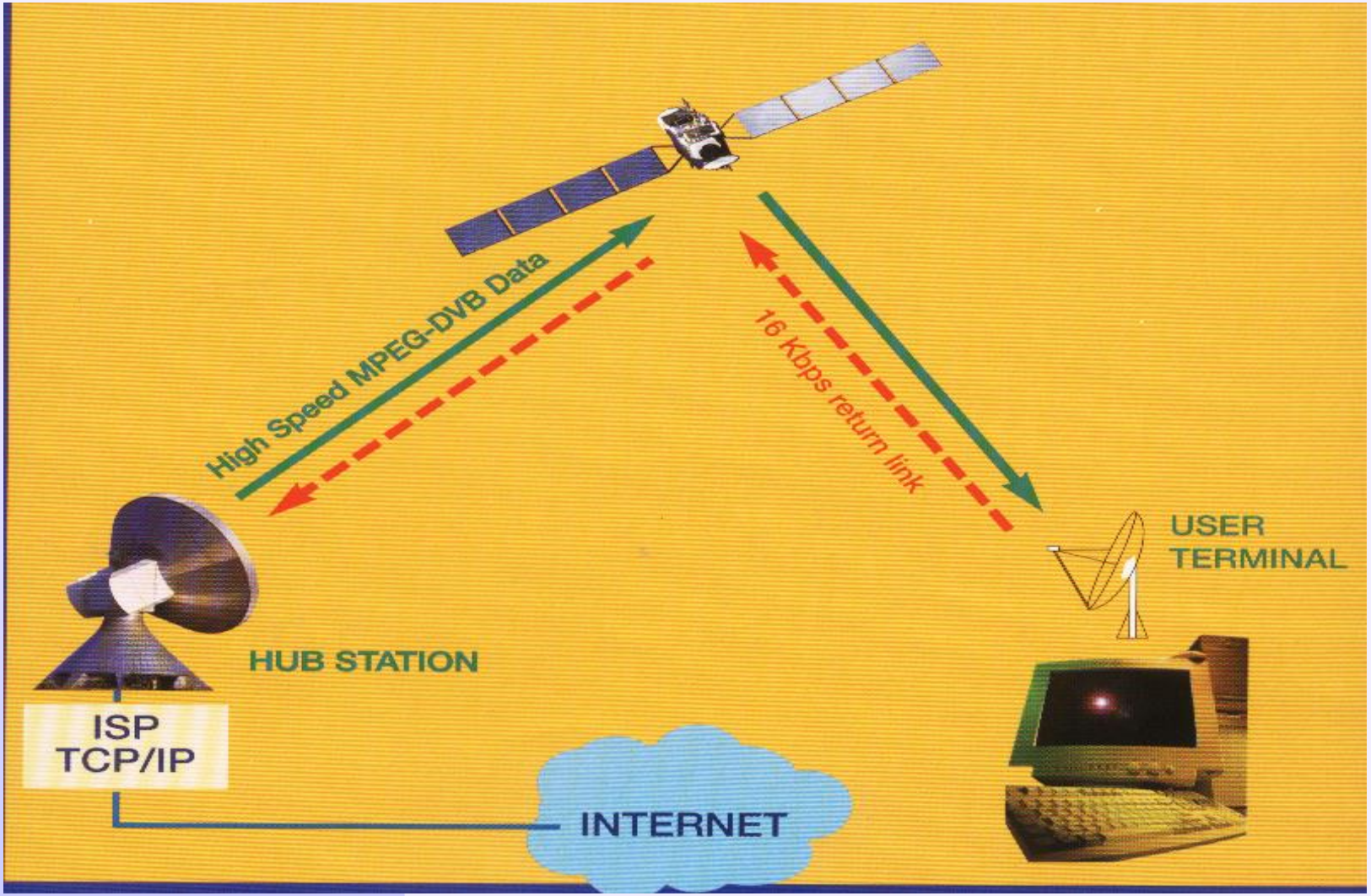
INTERNET PACKAGE

UNLIMITED USE

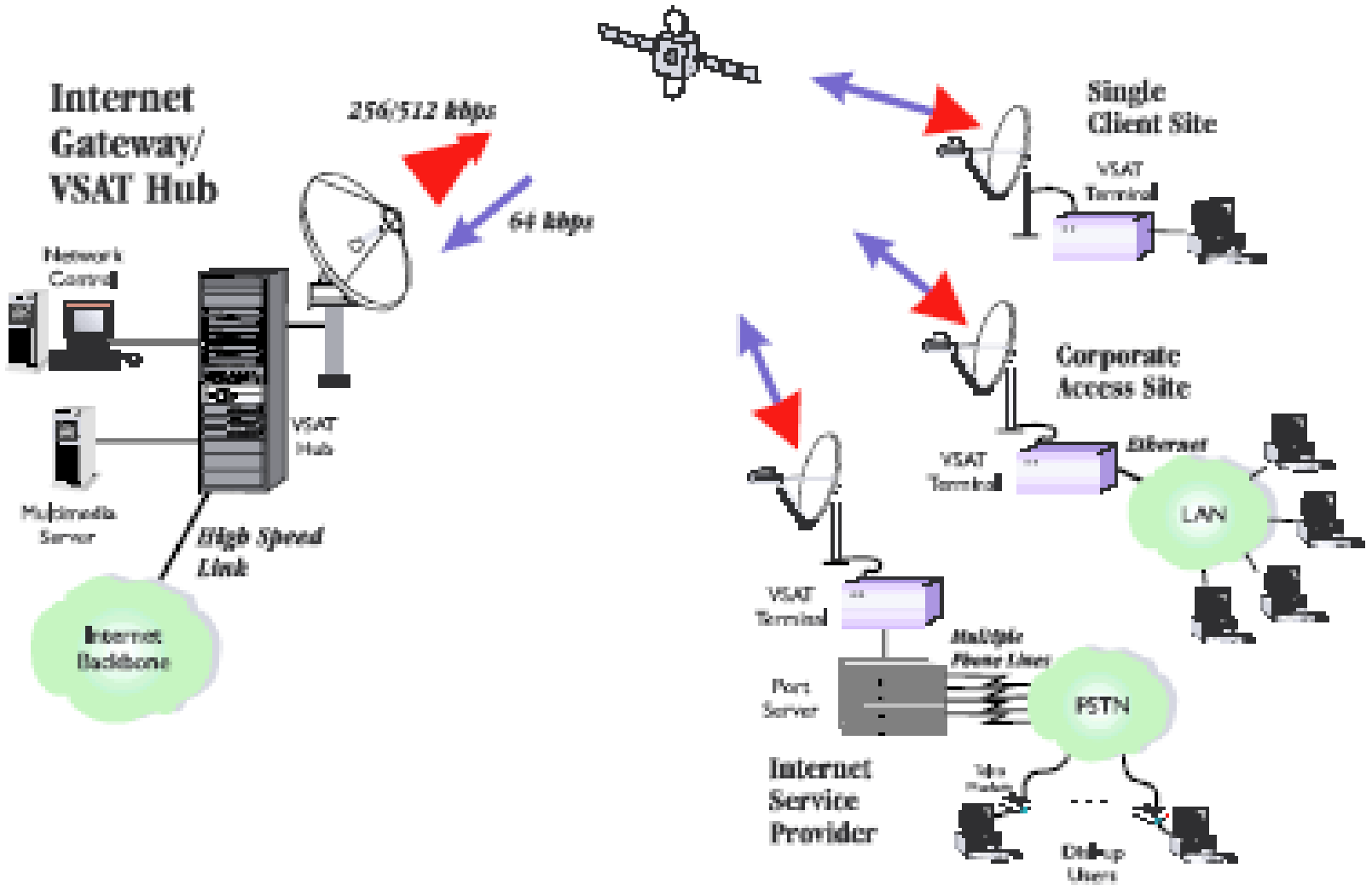
LIMITED USE = X MBYTES

= X GBYTES

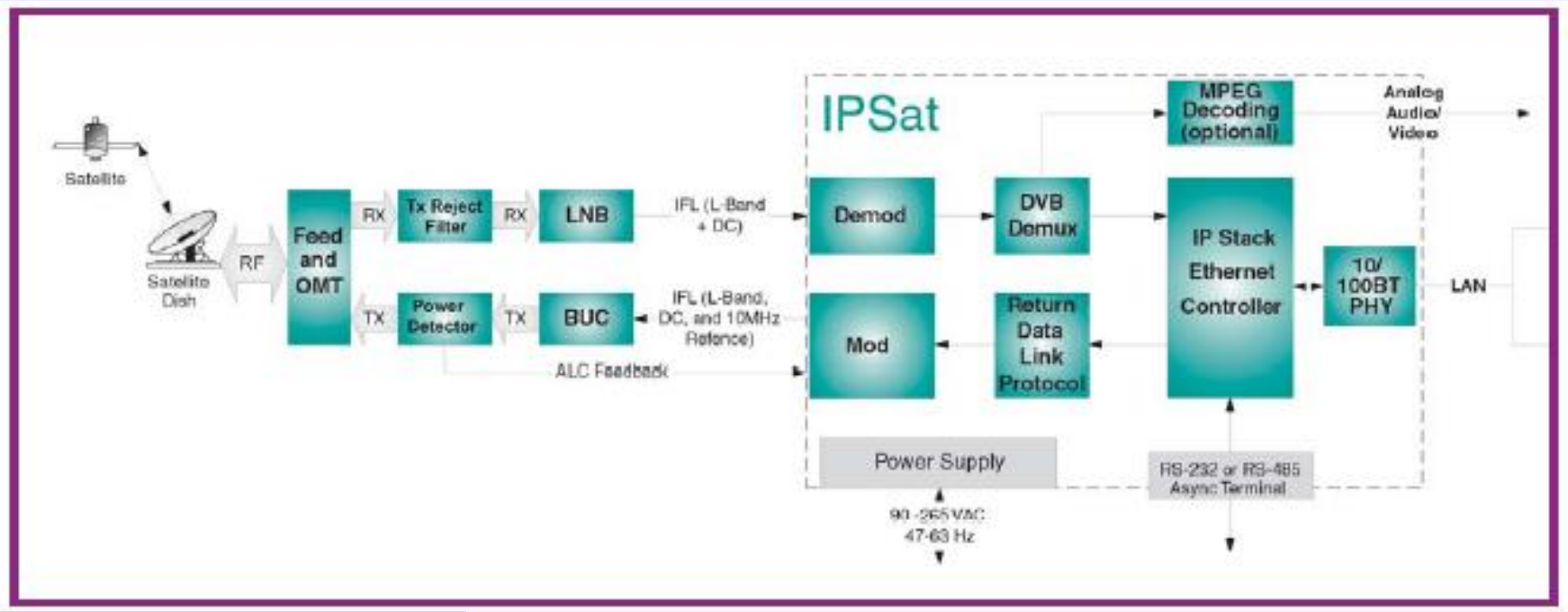
2-WAY INTERNET (SEND RECEIVE)



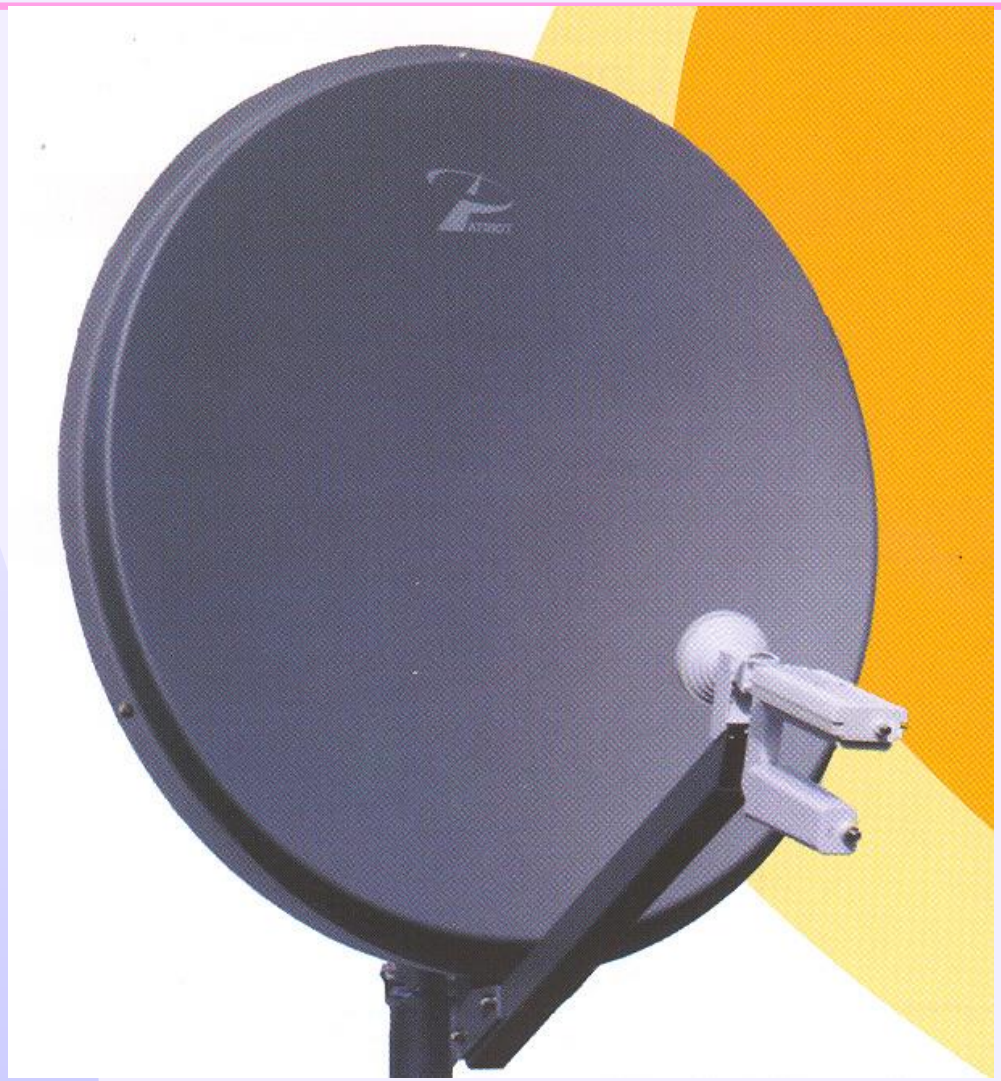
TDMA


Internet
Gateway/
VSAT Hub
256/512 kbps
64 kbps
Network
Control
VSAT
Hub
Multimedia
Server
High Speed
Link
Internet
Backbone
Single
Client Site
VSAT
Terminal
Corporate
Access Site
VSAT
Terminal
Ethernet
LAN
VSAT
Terminal
Multiple
Phone Lines
Port
Server
PSTN
Internet
Service
Provider
Dialup
Users

BLOCK DIAGRAMM OF INTERNET 2-WAY SYSTEM



OUTDOOR UNIT



BUC (Block Up Converter)

RETURN CHANEL SATELLITE TERMINAL (RCST)

2-WAY INTERNET MODEM (RCST)

REAR PANNEL

INTERFACE STANDART 10/100BaseT

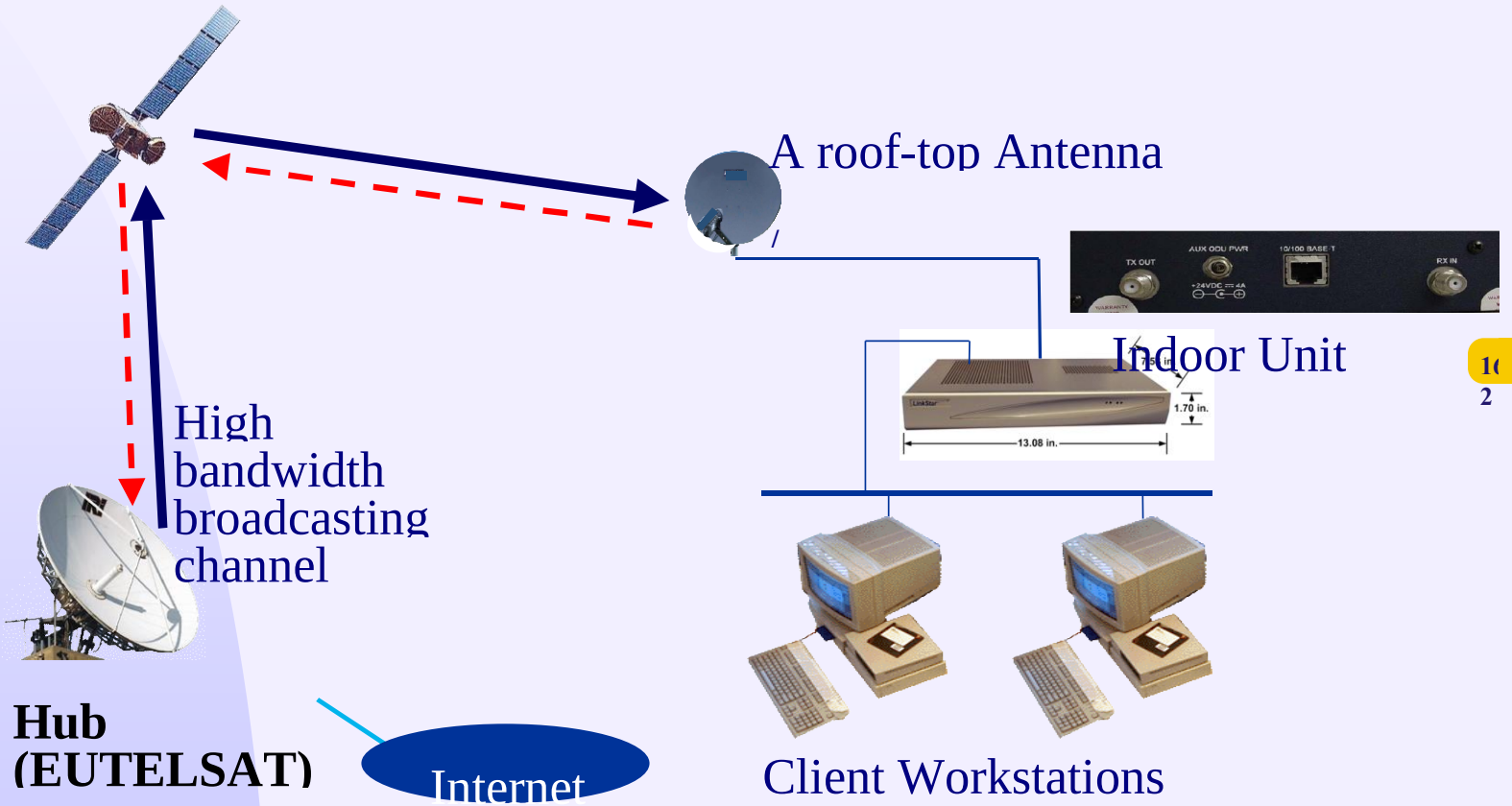
AVAILABLE SERVICES

IP ACCESS (INTERNET SERVICE)

IP CONNECT (CONNECT 2 OR MORE PC's)

IP SCPC (DEDICATED CONNECTION)

IP ACCESS (INTERNET SERVICE)



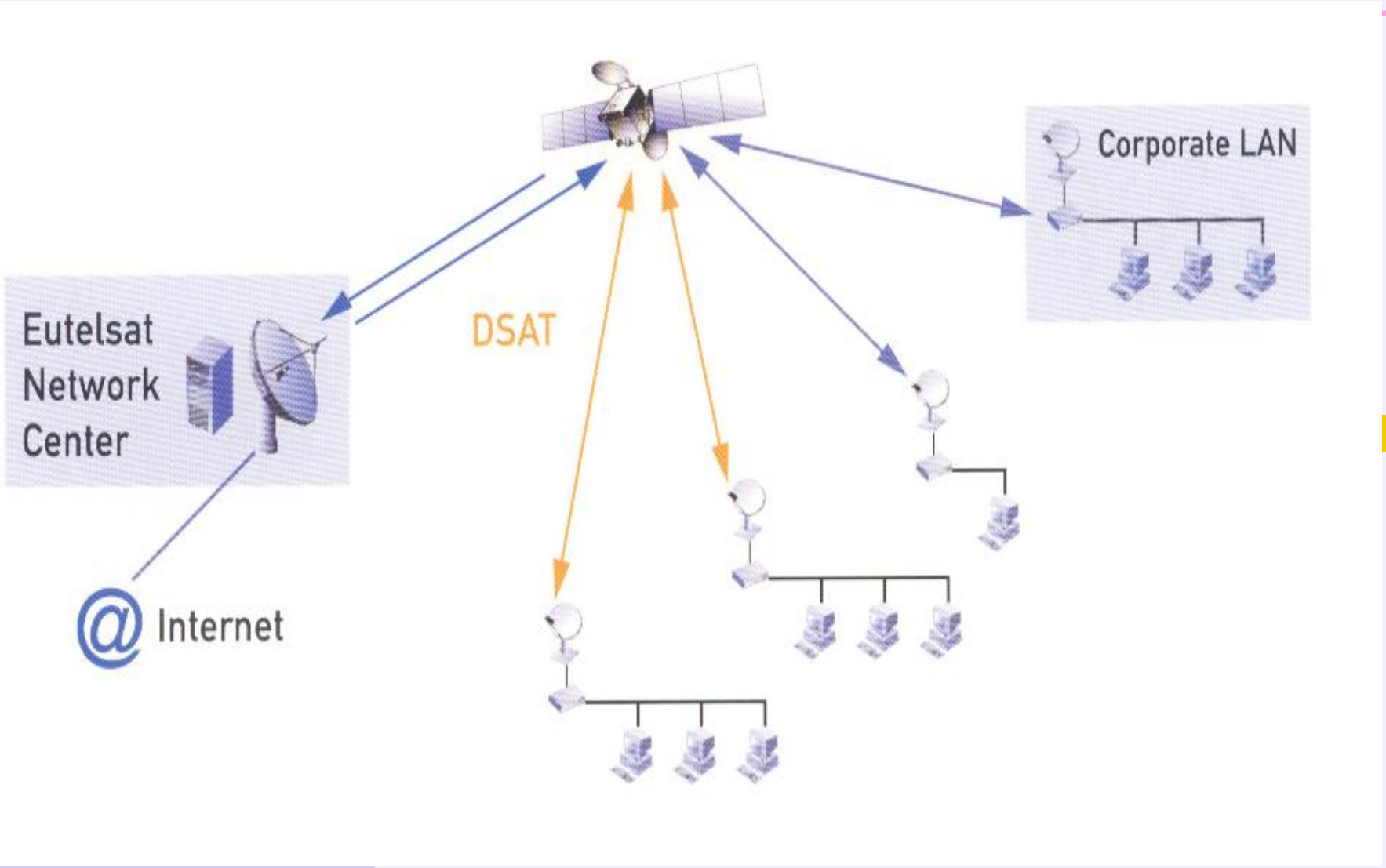
GRADES OF SERVICE

HUB → RCST OUTBOUND - **DOWNSTREAM** - FORWAR CHANNEL

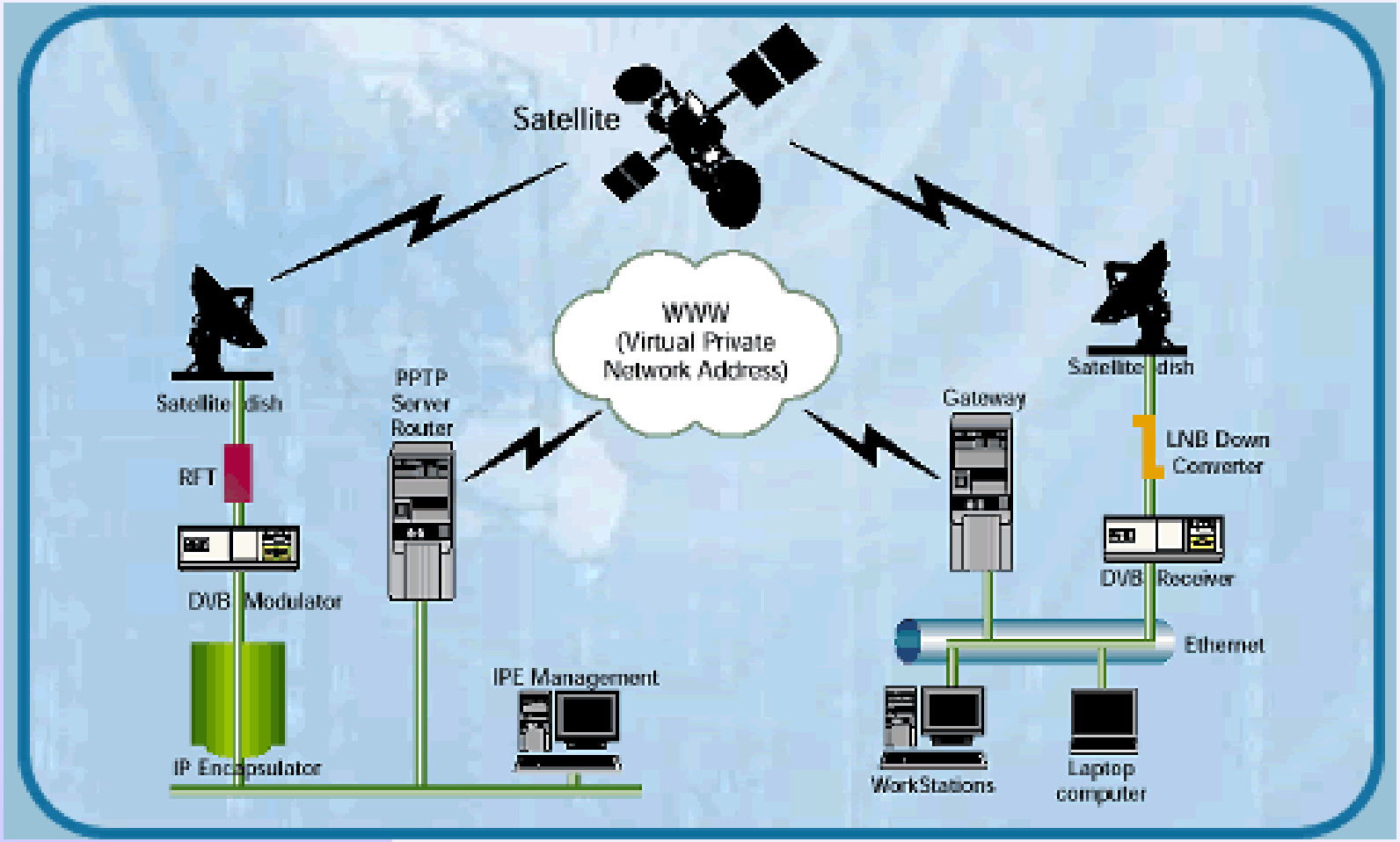
RCST → HUB INBOUND - **UPSTREAM** - RETURN CHANNEL

DOWNLOAD SPEED	UPLOAD SPEED
256 kbps	64 kbps
512 kbps	128 kbps
1024 kbps	256 kbps

INDIVUDUAL AND CORPORATE USE



IP ADDRESSING



IP ADDRESS

IP ADDRESS CONSITS OF 4 OCTETS (1 OCTET = 8 BITS)

EACH OCTET RANGES FROM 0 TO 255

00001010. 00000001. 00001010. 00001010

10

6

10.1. 23 . 19

IP ADDRESS CLASSES

TO DETERMINE THE CLASS OF IP ADDRESS LOOK AT THE FIRST OCTET

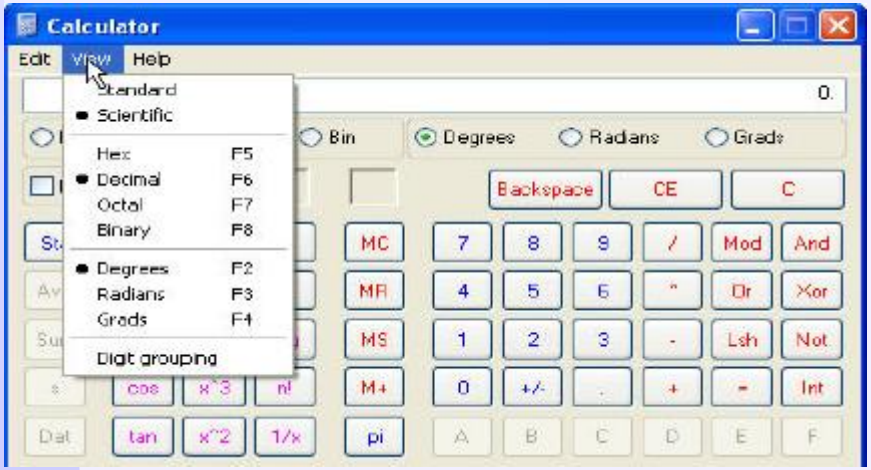
1 - 126	CLASS A
128 - 191	CLASS B
192 - 223	CLASS C
.....	CLASS D
.....	CLASS E

10.1. 23 . 19

IP ADDRESS

PRIVATE IP ADDRESS ALLOCATED FOR TERNINAL

10.1. ? . ?



MAC ADDRESS

8A – 76 - 1B - C7- 71- 3B

HEXADECIMAL → DECIMAL

71 – 3B → 113 . 59

10.88. ? . ?

10.88. ? . ?

FROM DESKTOP RIGHT CLIC ON “ NETWORK NIGHBORHOD “

LEFT CLIC ON PROPERTIES

LEFT CLIC ON PROTOCOL flag

HIGHLIGHT TCP/IP

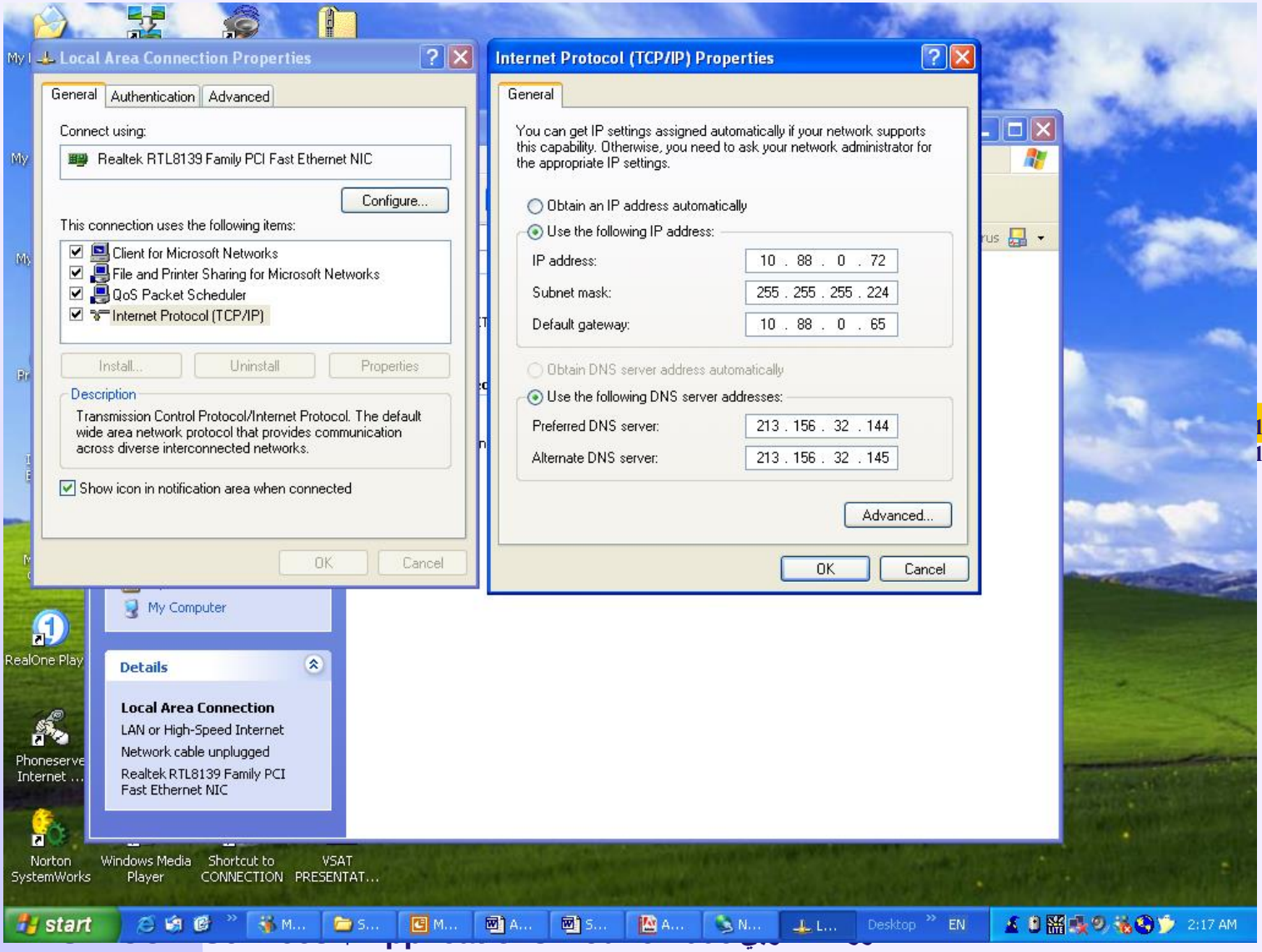
LEFT CLIC ON PROPERTIES

LEFT CLIC ON Specify an IP address for pc

IP - 10.88. ? . ?

SUBNET MASK - 255.255.255.0

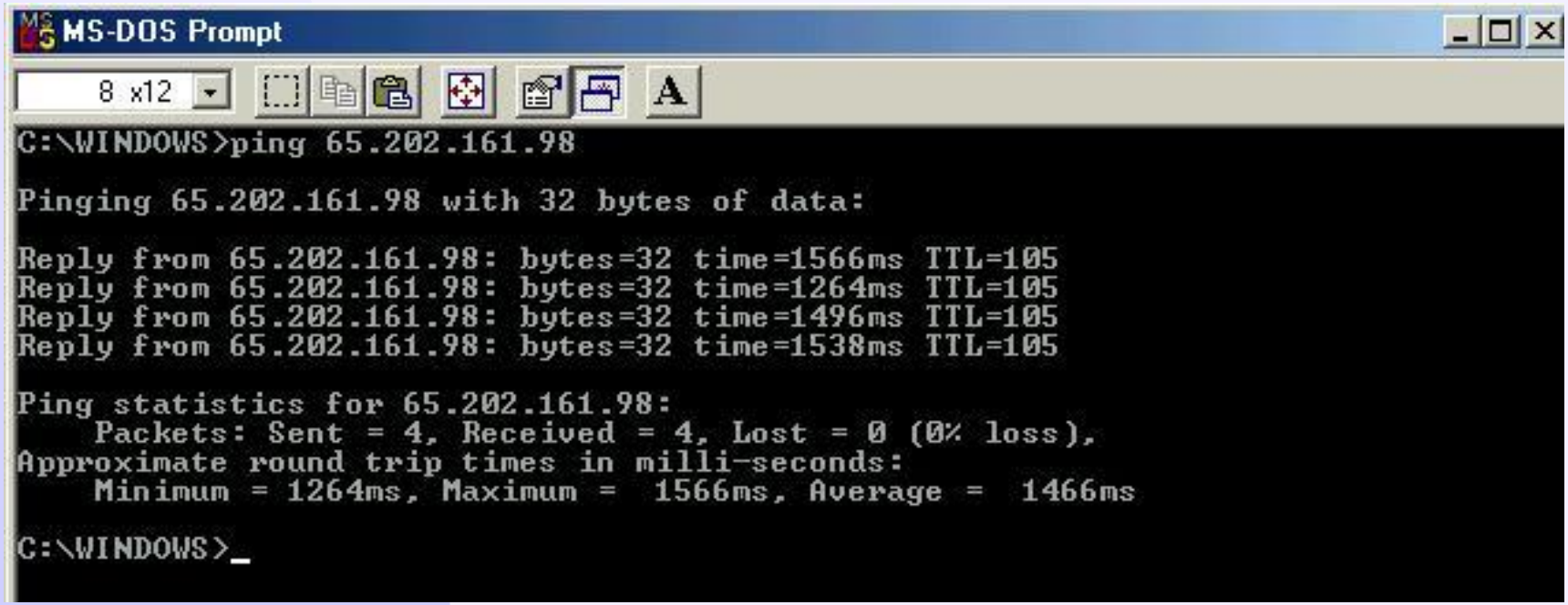
10.88. ? . ?


Local Area Connection Properties
General
Authentication
Advanced
Connect using:
Realtek RTL8139 Family PCI Fast Ethernet NIC
Configure...
This connection uses the following items:
Client for Microsoft Networks
File and Printer Sharing for Microsoft Networks
QoS Packet Scheduler
Internet Protocol (TCP/IP)
Install...
Uninstall
Properties
Description
Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.
Show icon in notification area when connected
OK
Cancel
Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address: 10 . 88 . 0 . 72
Subnet mask: 255 . 255 . 255 . 224
Default gateway: 10 . 88 . 0 . 65
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server: 213 . 156 . 32 . 144
Alternate DNS server: 213 . 156 . 32 . 145
Advanced...
OK
Cancel
My Computer
Details
Local Area Connection
LAN or High-Speed Internet
Network cable unplugged
Realtek RTL8139 Family PCI Fast Ethernet NIC
RealOne Play
Phoneserve Internet ...
Norton SystemWorks
Windows Media Player
Shortcut to CONNECTION
VSAT PRESENTAT...
start
Desktop
EN
2:17 AM

الكلية

TIME DELAY (PINGING)

THE TIME DELAY CAN REACH 250-300 ms IN ONE WAY



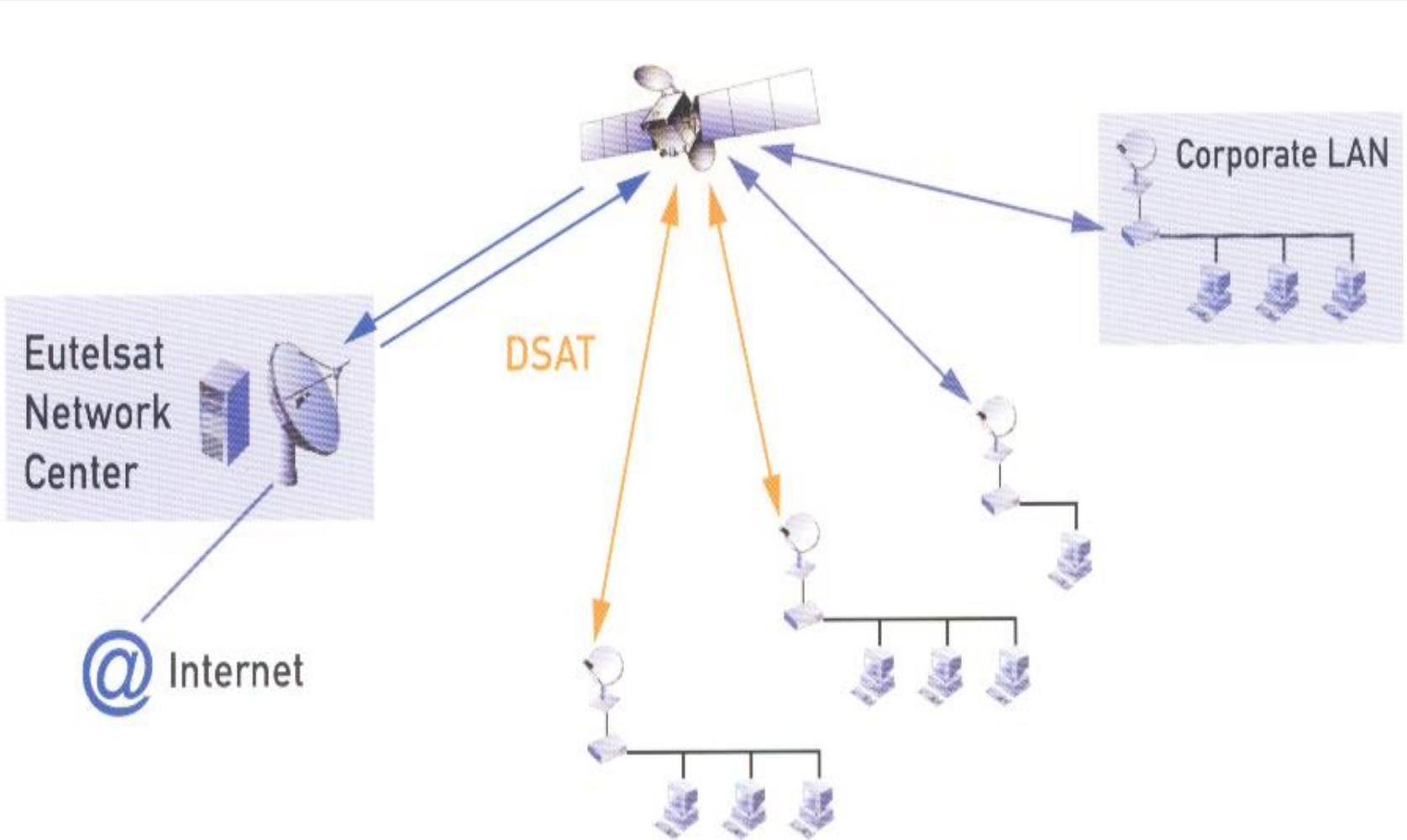
IP CONNECT

The IP Connect Service

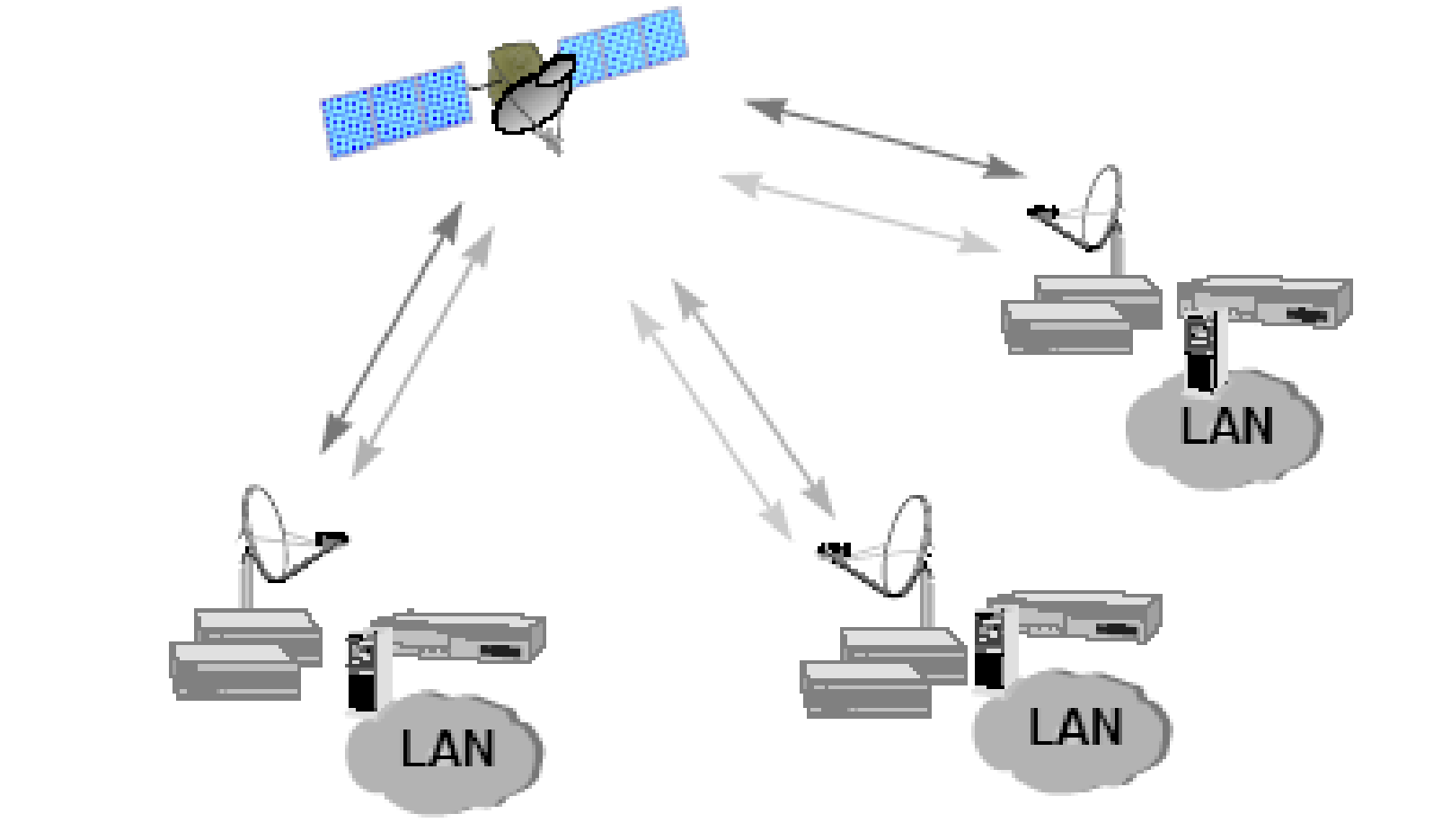
IP bandwidth

Two-way satellite terminals (known as Return Channel Satellite Terminal - RCST)

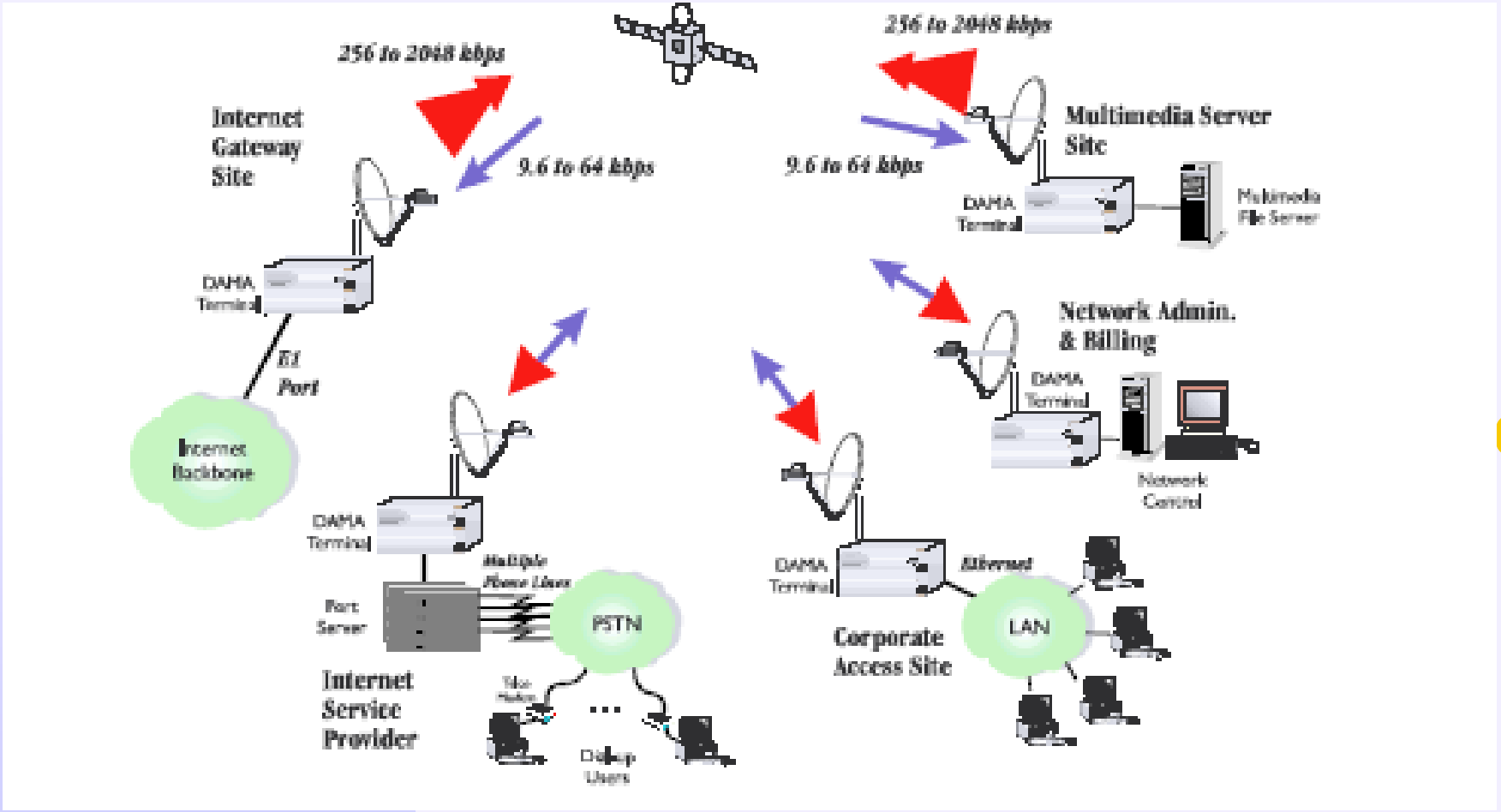
CONNECT USERS EACH OTHER



DEDICATED SCPC LINK



SCPC DAMA BASED MULTIMEDIA NETWORK



DAMA – Demand Assignment Multiple Access

SCPC HARDWARE

- High speed access to IP networks
- Credit authorizations
- Replacement of terrestrial circuits
- PABX extensions
- Backup circuits for redundancy or diversity
- Inventory management
- Supports true multimedia capabilities--voice, data, fax and e-mail
- Access to remote locations where high-speed terrestrial digital connectivity is not available
- Policy and account management
- Method to bypass PTT's or local infrastructure
- WAN connectivity

SOURCE OF INFO

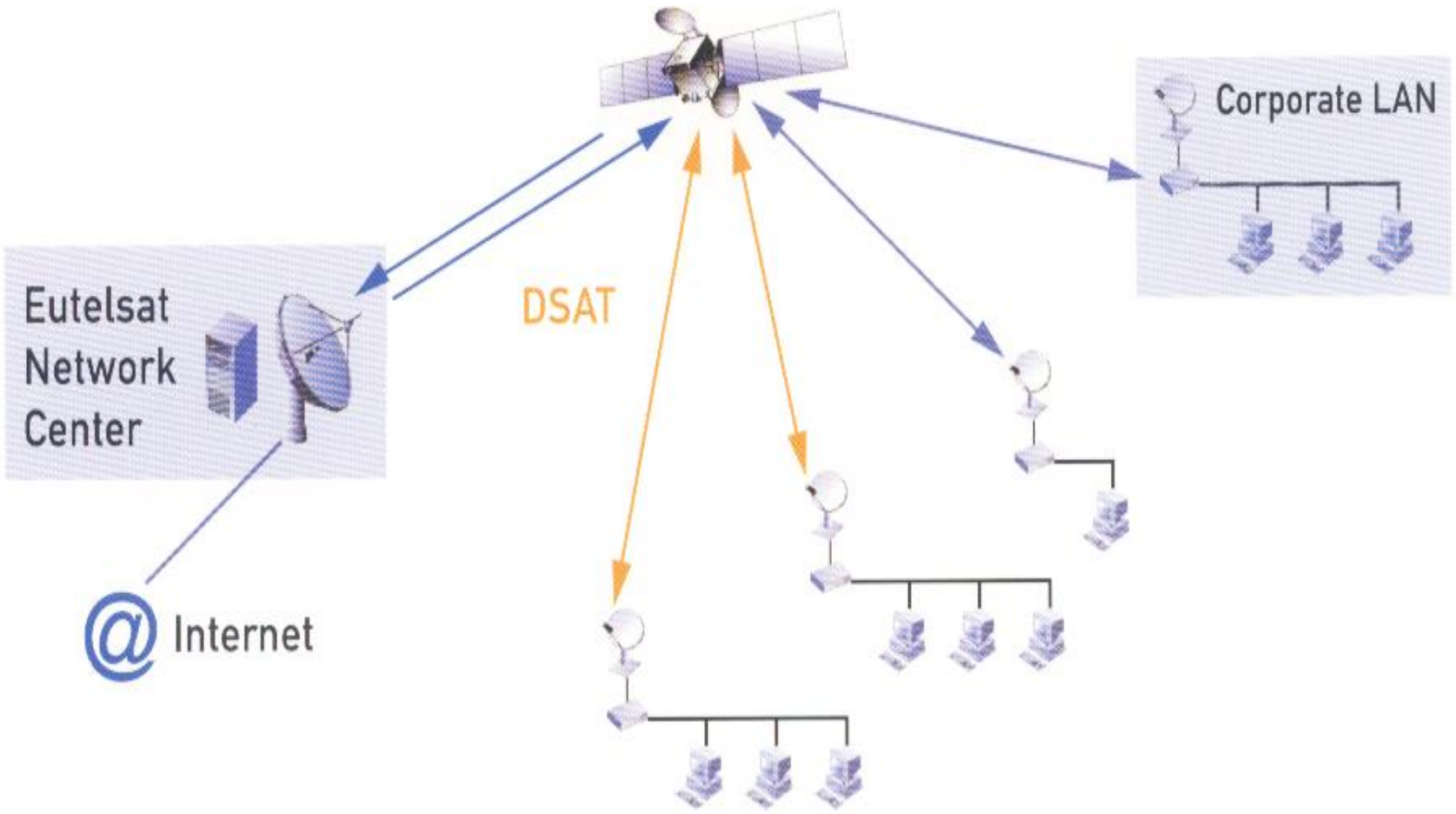
www.eutelsat.net

www.donegal-holdings.com

www.telnet.org

www.viasat.com

VSAT - PRINCIPLE



installed dish (1.8m)

TYPICAL WORKSTATION

END OF THE III PART

Questions

THE KNOWLEDGE IS THE POWER

Satmaster Pro MK6 SOFTWARE

Satmaster Pro, is a tool for digital point-to-point or point to multi-point link budgets.

- Look Angle Calculations
- Digital link budgets for Satellite TV and FM link budgets.
- Dish sizing.
- Polar mount alignment.
- EIRP, SFD and G/T map viewer.
- Rain attenuation model (ITU-R P.618-8 or Crane)
- Calculates atmospheric absorption and tropospheric scintillation losses.
- Generates numerous graphs and tables

Overview

SatMaster Pro is designed for manufacturers, broadcasters , SNV operatives, system installers, link budget analysis and solar outage prediction

Installation

Insert CD into drive and log into it.

The “autorun” feature is deliberately unsupported

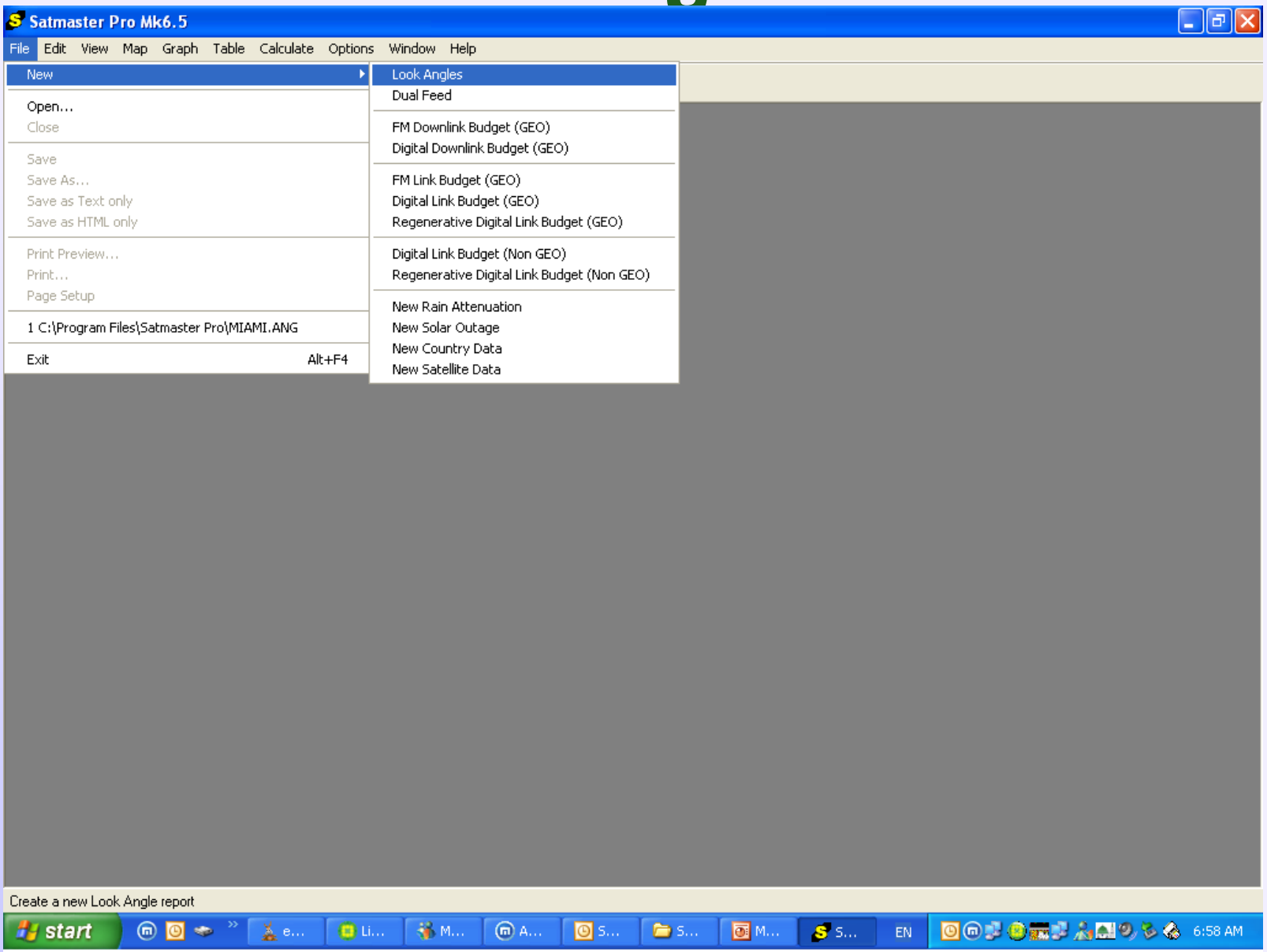
From Windows run the program “setup.exe”

and follow the 0n-screen instructions

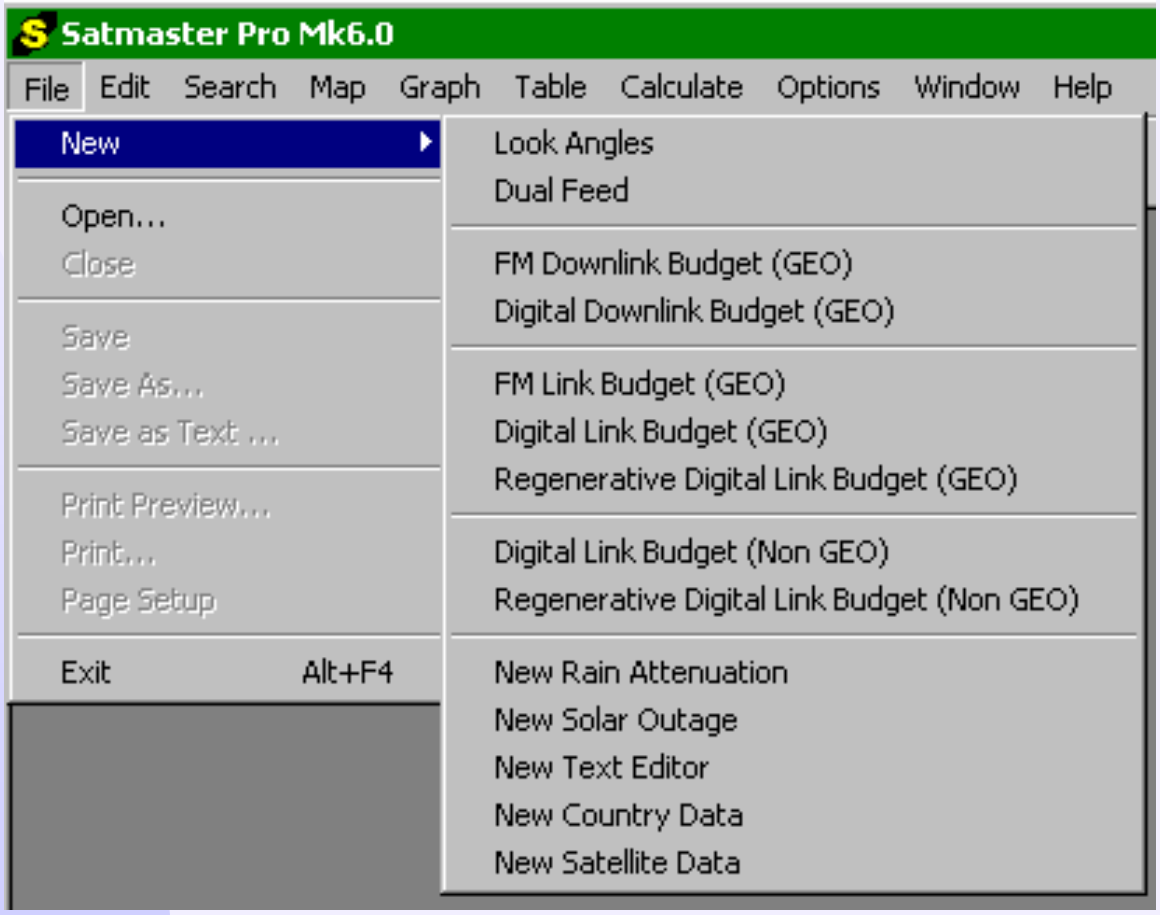
Run Satmaster Pro

By clicking the desktop shortcut shown below

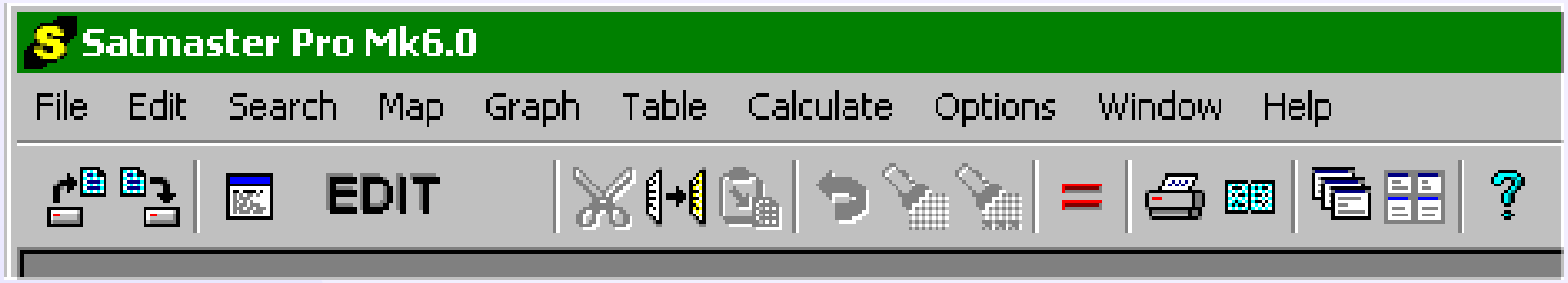
Getting Started



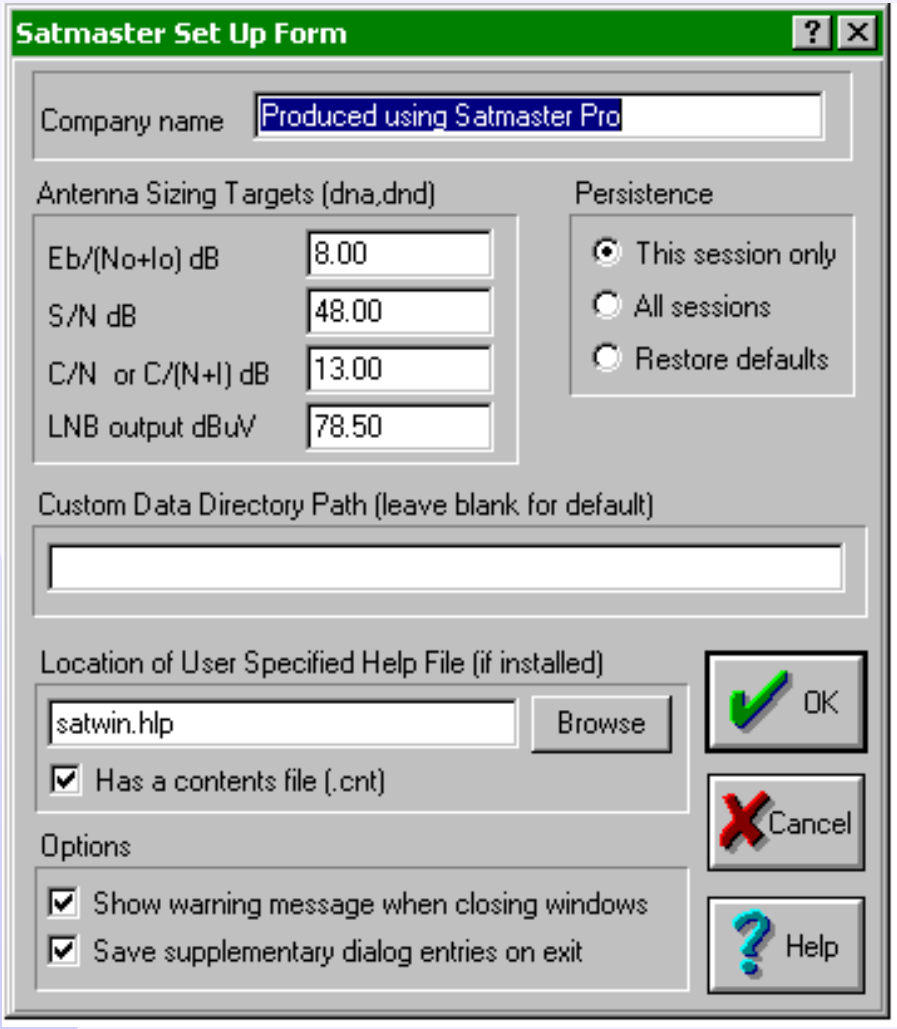
Opening new file



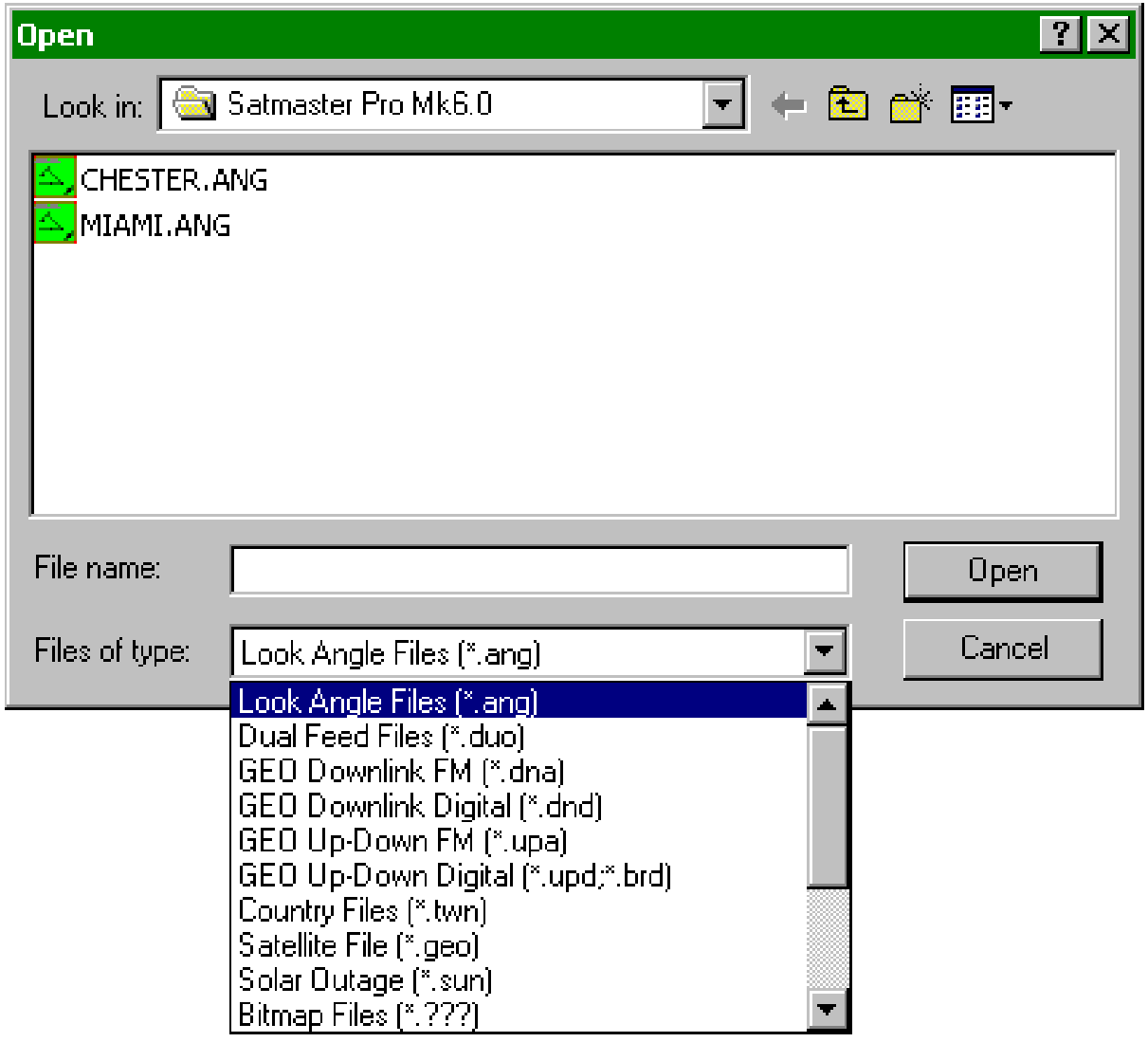
Toolbar


Satmaster Pro Mk6.0
File Edit Search Map Graph Table Calculate Options Window Help
EDIT

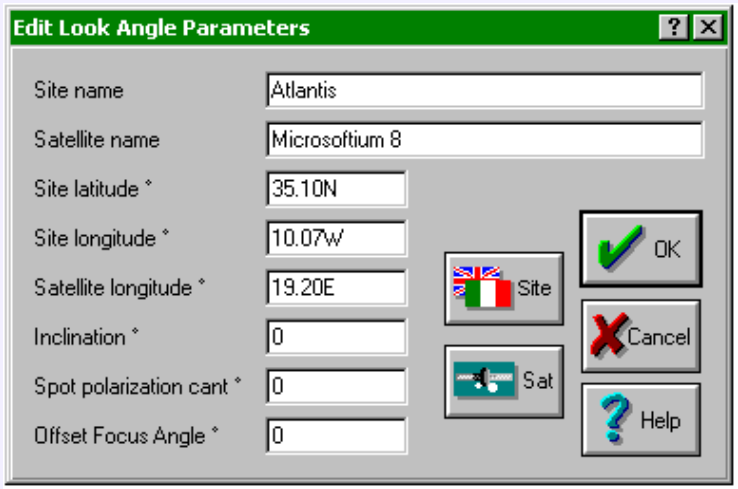
Options Menu

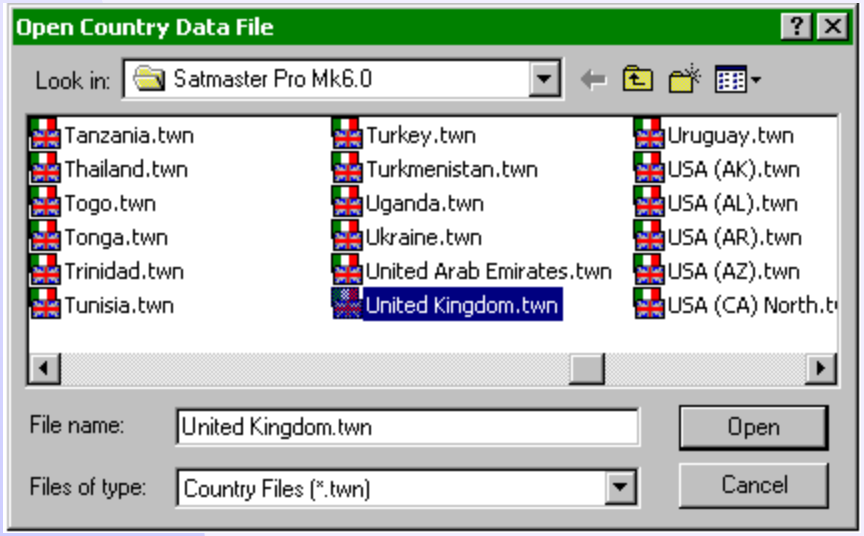


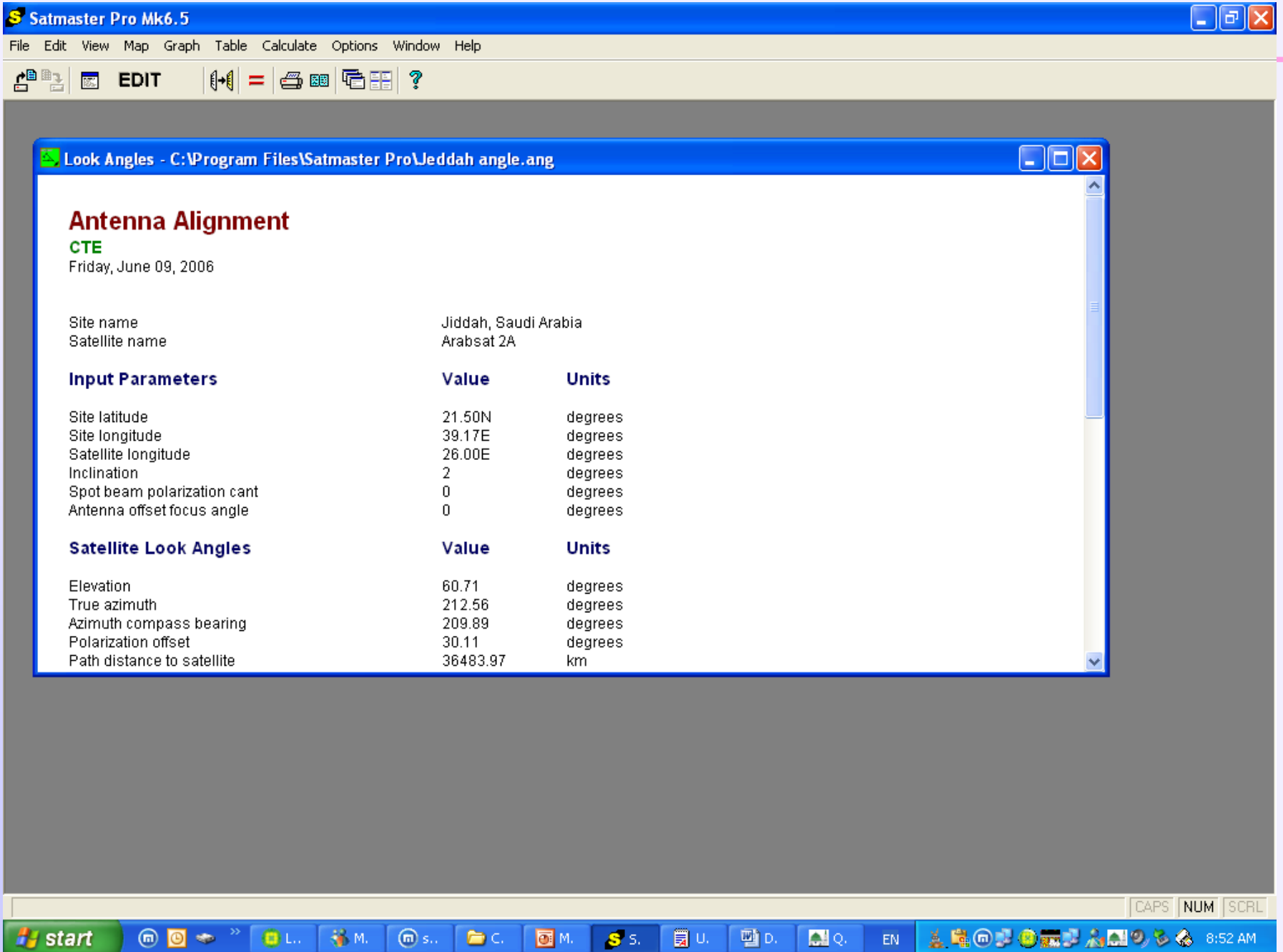
File Menu


Open
Look in:
Satmaster Pro Mk6.0
CHESTER.ANG
MIAMI.ANG
File name:
Open
Files of type:
Look Angle Files (*.ang)
Cancel
Look Angle Files (*.ang)
Dual Feed Files (*.duo)
GEO Downlink FM (*.dna)
GEO Downlink Digital (*.dnd)
GEO Up-Down FM (*.upa)
GEO Up-Down Digital (*.upd;*.brd)
Country Files (*.twn)
Satellite File (*.geo)
Solar Outage (*.sun)
Bitmap Files (*.???)

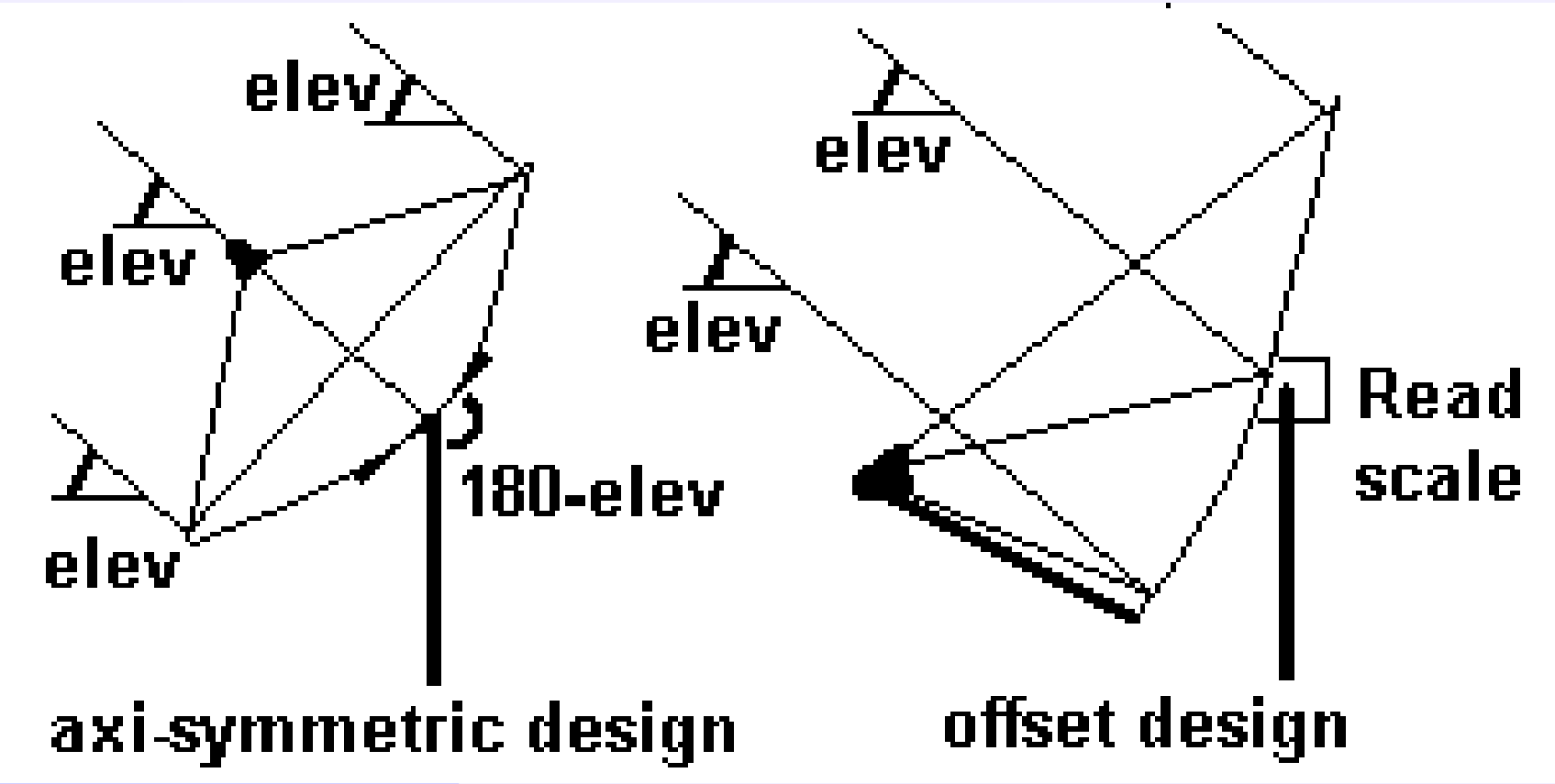
Look Angle File *.ang



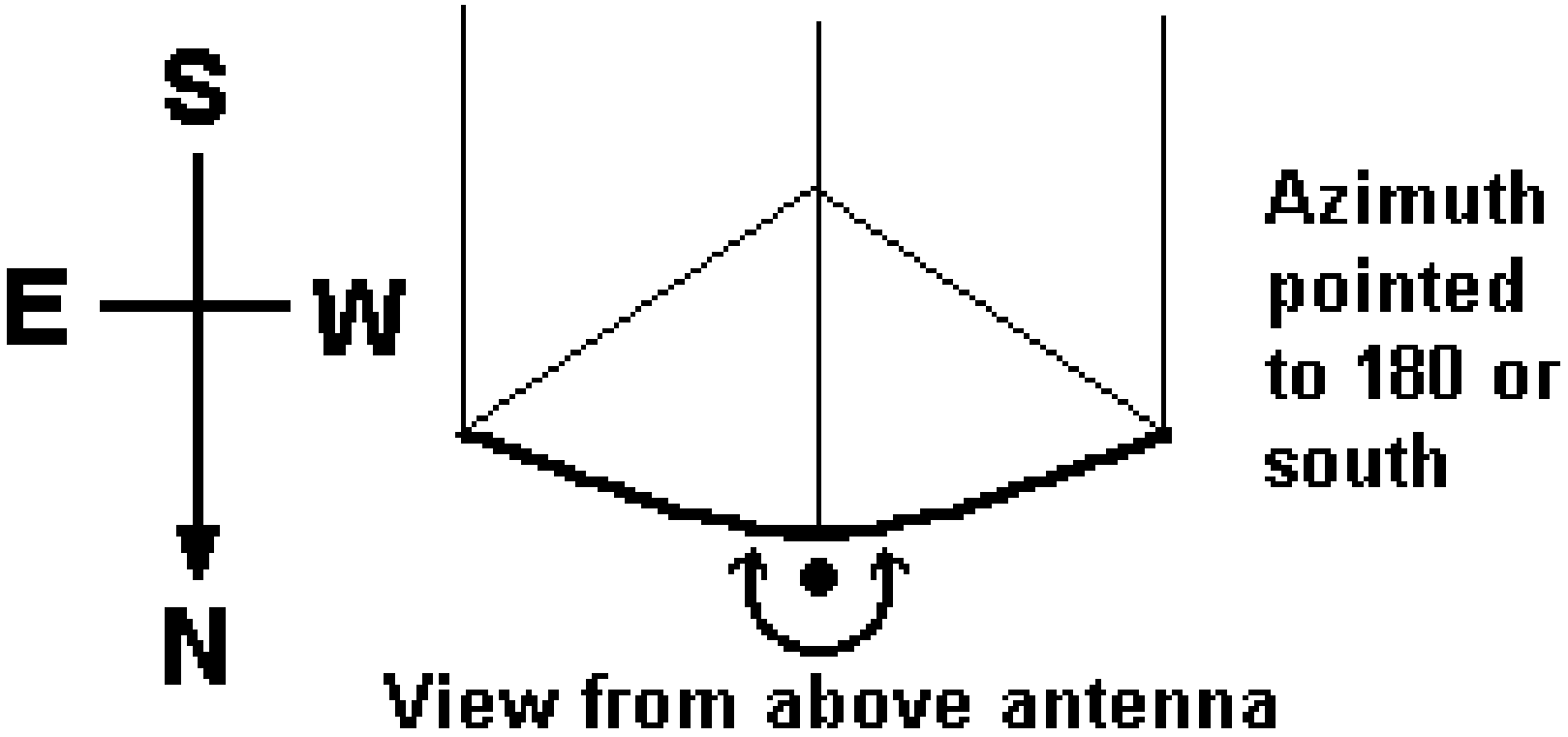



Satmaster Pro Mk6.5
File Edit View Map Graph Table Calculate Options Window Help
EDIT
Look Angles - C:\Program Files\Satmaster Pro\Jeddah angle.ang
Antenna Alignment
CTE
Friday, June 09, 2006
Site name Jiddah, Saudi Arabia
Satellite name Arabsat 2A
Input Parameters Value Units
Site latitude 21.50N degrees
Site longitude 39.17E degrees
Satellite longitude 26.00E degrees
Inclination 2 degrees
Spot beam polarization cant 0 degrees
Antenna offset focus angle 0 degrees
Satellite Look Angles Value Units
Elevation 60.71 degrees
True azimuth 212.56 degrees
Azimuth compass bearing 209.89 degrees
Polarization offset 30.11 degrees
Path distance to satellite 36483.97 km
CAPS NUM SCRL
start
8:52 AM

ELEVATION ANGLE



AZIMUTH ANGLE



USEFULL INFORMATIONS

RS – Symbol Rate

SR- The symbol rate is the speed at which the data on the transponder is transmitted, in thousands of symbols per second (ksym/sec).
The symbol rate is sometimes expressed as Megasymbols per second (Msym/sec, also referred to as MBaud/sec).
A symbol rate of 27500 ksym/sec is equal to 27.5 Msym/sec.

FEC – Forward Error Correction

The FEC (Forward Error Correction) indicates how many Bytes are used for the actual signal, and how many for correction of errors. A FEC of ½ means that 1 Byte out of 2 is used for error correction, while a ratio of 7/8 means 7 Bytes are used for the actual signal, and only one for error correction.

FEC = 0.1 - 1.0

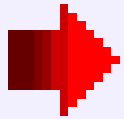
CHANNEL INFORMATIONS

Satellite : ARABSAT2B

AIMAJD TV f= 12703 MHz V

FEC = 0.1 - 1.0

RS



Show footprint

Digital Downlink (1m Antenna)

CTE

Friday, June 09, 2006

Site name	Jiddah, Saudi Arabia
Satellite name	Arabsat 2B

Input Parameters	Value	Units
Site latitude	21.50N	degrees
Site longitude	39.17E	degrees
Site altitude	4	km
Spot beam polarization cant	30	degrees
Frequency	11.640	GHz
Antenna aperture	1	metres
Antenna efficiency / gain	35	% (+ prefix dBi)
Antenna noise	290	K
LNB noise figure / temp	1.0	dB (+ prefix K)
Coupling loss (waveguides, polarizers)	1	dB
Antenna loss (aging, pointing, polarization)	1	dB
LNB gain	3	dB
LNB load impedance	75	Ohms
Co-channel interference C/I	3	dB
Adjacent satellite interference C/I	2	dB
Signal availability (average year)	99	%
Rain Model	ITU (18.0)	(mm/h or zone)
Water vapour density	2	g/m3
Surface temperature	40	degrees C
Polarization	Horizontal	-
Satellite longitude	30.50E	degrees
EIRP	48	dBW
Symbol rate	750	Mbaud
FEC code rate	0.75	-
RS Code (n/k)	204/188	-
(1 + Rolloff Factor)	1.2	-
Threshold IRD Eb/No	8	dB
Modulation	4-PSK	-

Satellite Look Angles	Value	Units

Clear / Degraded Sky Results	Clear	Rain	Units
Path distance to satellite	36381.82	36381.82	km
Free space path loss	204.98	204.98	dB
Spreading loss	162.21	162.21	dB/m2
Atmospheric gaseous absorption	0.04	0.04	dB
Tropospheric scintillation fading	0.07	0.07	dB
Total atmospheric losses	0.11	0.11	dB
Effective area of antenna	-5.61	-5.61	dB/m2
Antenna gain	37.17	37.17	dBi
LNB noise temperature	75.09	75.09	K
Signal availability (worst month)	100.000	97.150	%
Attenuation due to precipitation	0.00	0.04	dB
Noise increase due to precipitation	0.00	0.03	dB
System noise temperature	365.09	367.24	K
Downlink degradation (DND)	0.00	0.06	dB
Power flux density (PFD)	-114.32	-114.36	dBW/m2
Carrier power at LNB output	-118.92	-118.96	dBW
Carrier level at LNB output (75 Ohm)	19.83	19.79	dBuV
Carrier level at LNB output (75 Ohm)	-40.17	-40.21	dBmV
Figure of merit (G/T)	9.54	9.52	dB/K
C/No thermal	81.05	80.99	dB.Hz
C/Io co-channel interference	92.54	92.54	dB.Hz
C/Io adjacent satellite interference	91.54	91.54	dB.Hz
C/(No+Io)	80.41	80.35	dB.Hz
C/(N+I)	-9.14	-9.19	dB
Eb/(No+Io)	-9.75	-9.81	dB
Threshold IRD Eb/No	8	8	dB

Additional Data	Value	Units
Symbol rate	750.0000	Mbaud
Transmit rate	1500.0000	Mbps
Information rate	1036.7647	Mbps
Occupied bandwidth	900.0000	MHz

THANK YOU

- Questions?

THE KNOWLEDGE IS THE POWER