



General Principles for Earth Station Operators

(Guidelines for Training Programs)

General Principles for Earth Station Operators

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General Principles for Earth Station Operators

1. The Satellite

- ◆ Geostationary Orbits
- ◆ Non-inclined Orbit
- ◆ Inclined orbit

2. Satellite Frequency Bands

- ◆ Ku-band
- ◆ C-band
 - Circular Polarisation*
 - Linear Polarisation*
- ◆ Ka-Band

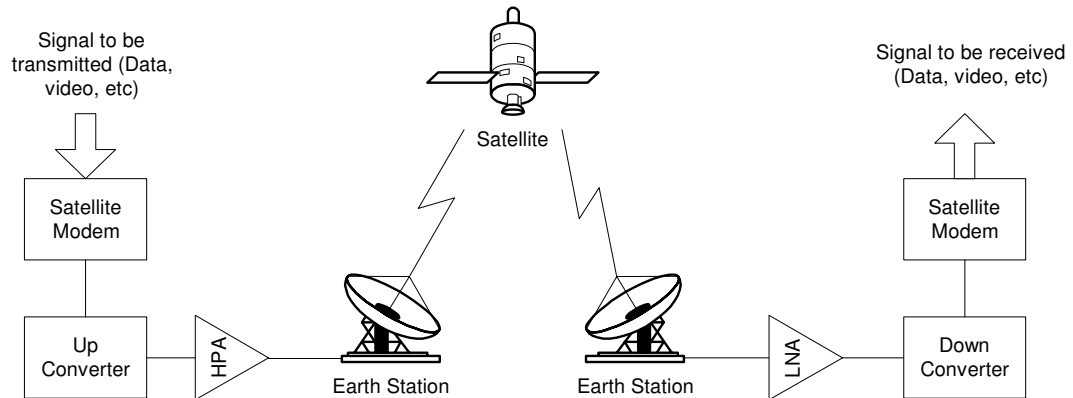
3. The Geo-Stationary Arc – “Clarke Belt”

- ◆ Satellite co-ordination
 - ITU*
 - Inter-satellite co-ordination*
- ◆ Identifying your satellite

4. Natural Satellite Related Outages

- ◆ Solar Eclipse
 - Sun Outages*
 - Preventative actions*

5. The Satellite Link



5.1. The Parabolic Satellite Antenna

- ◆ Focal length, F/D ratio
- ◆ Prime-focus; Off-set; Cassegrain; Gregorian
- ◆ Antenna Gain and Efficiency
 - 0.5dB + 3dB Beamwidth*
- ◆ Antenna Radiation Patterns
 - Transmit sidelobe patterns*
 - Side-lobe masks (New Skies, ITU)*
- ◆ Polarisation Discrimination (*Linear polarisation*)
- ◆ Voltage Axial Ratio (VAR) (*Circular polarisation*)

5.2. Earth Station Antenna Mounts

- ◆ Elevation/Azimuth
- ◆ X/Y

5.3. Feedhorns

- ◆ Cross-polarised feed
- ◆ Co-polarised feed

5.4. Tracking systems

- ◆ Step; Programme; Manual

5.5. Uplink Power Control

- ◆ Set-up procedure
- ◆ Dangers of operating UPC

5.6. Figure of Merit (G/T)

- ◆ Definition and derivation

5.7. Selecting the Uplink Site

- ◆ Site survey
- ◆ Satellite view; Power availability; Cable length
- ◆ Checking for Terrestrial Interference
 - Assessing impact of Local Interference*
 - Terrestrial Microwave links*
 - SHF Wireless networks*

5.8. MODEMS

- ◆ Modulation techniques
 - PSK; QAM; ASK; FSK*
 - Error Correction*
 - Filtering Techniques*
 - Roll-off factor*
- ◆ Performance indicators
 - E_b/N₀; C/N; C/No; BER*
- ◆ MCPC; SCPC
- ◆ DVB

5.9. Up & Down converters; BUC; BDC

- ◆ Function Description
Advantages / Disadvantages

5.10. LNA/LNB

- ◆ Function Description
Advantages / Disadvantages

5.11. HPA

- ◆ TWT; Klystron; SSPA
Basic Principles and characteristics
Methods of tuning and adjusting frequency
Advantages / Disadvantages

6. General Earth Station / VSAT Operations

6.1. RF Safety

- ◆ Basic reminders of RF hazards and HV risks

6.2. Antenna Pointing / Alignment

- ◆ Azimuth and Elevation
- ◆ Polarisation Angle (Linear Polarisation)

6.3. Configuring the Transmit chain

- ◆ Inter-facility link; Modem; Up-converter; HPA
Balancing the link from start to finish

6.4. Configuring the Receive chain

- ◆ LNA/B; Down-converter; Modem; Inter-facility link
Local Oscillator conversions

6.5. Universal Access Procedures

- ◆ Contacting the satellite operator
- ◆ Radiating a carrier under control of the satellite operator

6.6. Trouble Shooting the Transmit Chain

- ◆ Working through the various component blocks

6.7. Trouble Shooting the Receive Chain

- ◆ Working through the various component blocks

6.8. Routine Earth Station Maintenance

- ◆ Preventative maintenance
 - Cleaning Air filters*
 - Lubricating moving parts*
 - Recording power and signal levels at monitoring points*
 - General "Best Practice" activities*

6.9. Recommended Test Equipment

- ◆ Spectrum Analyser
- ◆ BER monitor
- ◆ Power meter + coupler
- ◆ Co-axial + wave-guide transitions/loads
- ◆ Various cables suitable for RF + IF
- ◆ Inclinator + Compass

7. Link Budget Calculations

7.1. *Earth Station Parameters*

- ◆ G/T
- ◆ HPA Size
- ◆ Antenna Gain
- ◆ Antenna Tracking

7.2. *Satellite Parameters*

- ◆ Satellite Antenna Patterns
- ◆ Satellite Saturated Flux Density (SFD)
- ◆ Satellite Effective Isotropic Radiated Power (EIRP)
- ◆ Satellite Orbital Inclination
- ◆ Satellite Transponder operating Modes
 - Automatic Level Control (ALC) Mode*
 - Fixed Gain Mode (FGM)*

7.3. *System Noise*

- ◆ Uplink Thermal Noise
- ◆ Transponder Intermodulation Noise
- ◆ Downlink Thermal Noise
- ◆ Overall Noise Performance

7.4. *System Interference*

- ◆ Adjacent Satellite Interference
- ◆ Adjacent Channel Interference
- ◆ Cross-Channel (cross-polarisation) Interference

7.5. *Atmospheric Effects*

- ◆ Rain Fade
- ◆ Depolarisation