General Principles

For

Earth Station

Operators

General Principles for Earth Station Operators

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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

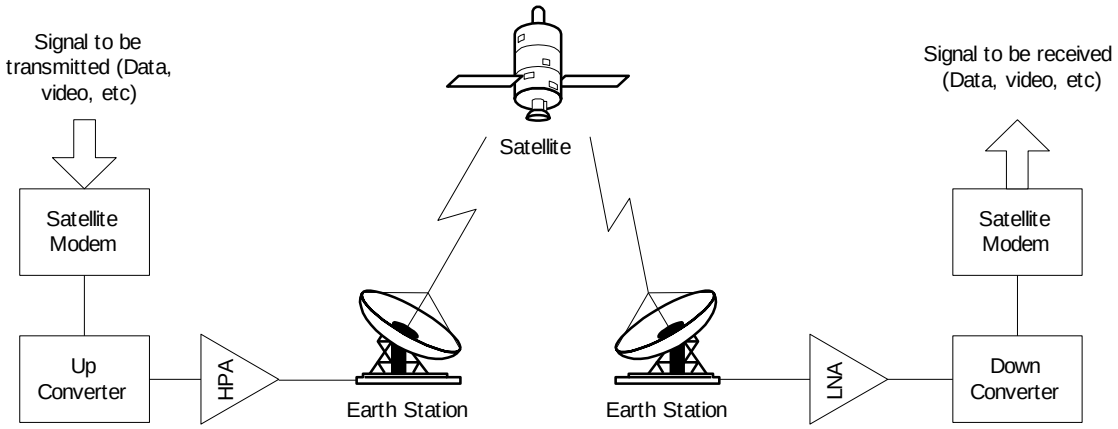
4. Natural Satellite Related Outages

- 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 side lobe patterns

  Side-lobe masks (ITU)
- Polarisation Discrimination *(Linear polarisation)*
- Voltage Axial Ratio (VAR) *(Circular polarisation)*

5.2. Earth Station Antenna Mounts

- Elevation/Azimuth
- X/Y

5.3. Feed horns

- Cross-polarised feed
- Co-polarised feed

5.4. Tracking systems

- Step; Programme; Manual

5.5. Uplink Power Control

- Set-up procedure
- Dangers of operating Uplink Power Control (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

Eb/No; 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
- Inclinometer + Compass

6.10. Regulatory

- Licensing
- Planning applications
- Orbital Locations

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