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Simultaneous TT&C of TerraSAR-X and TanDEM-X satellites with one Ground Station

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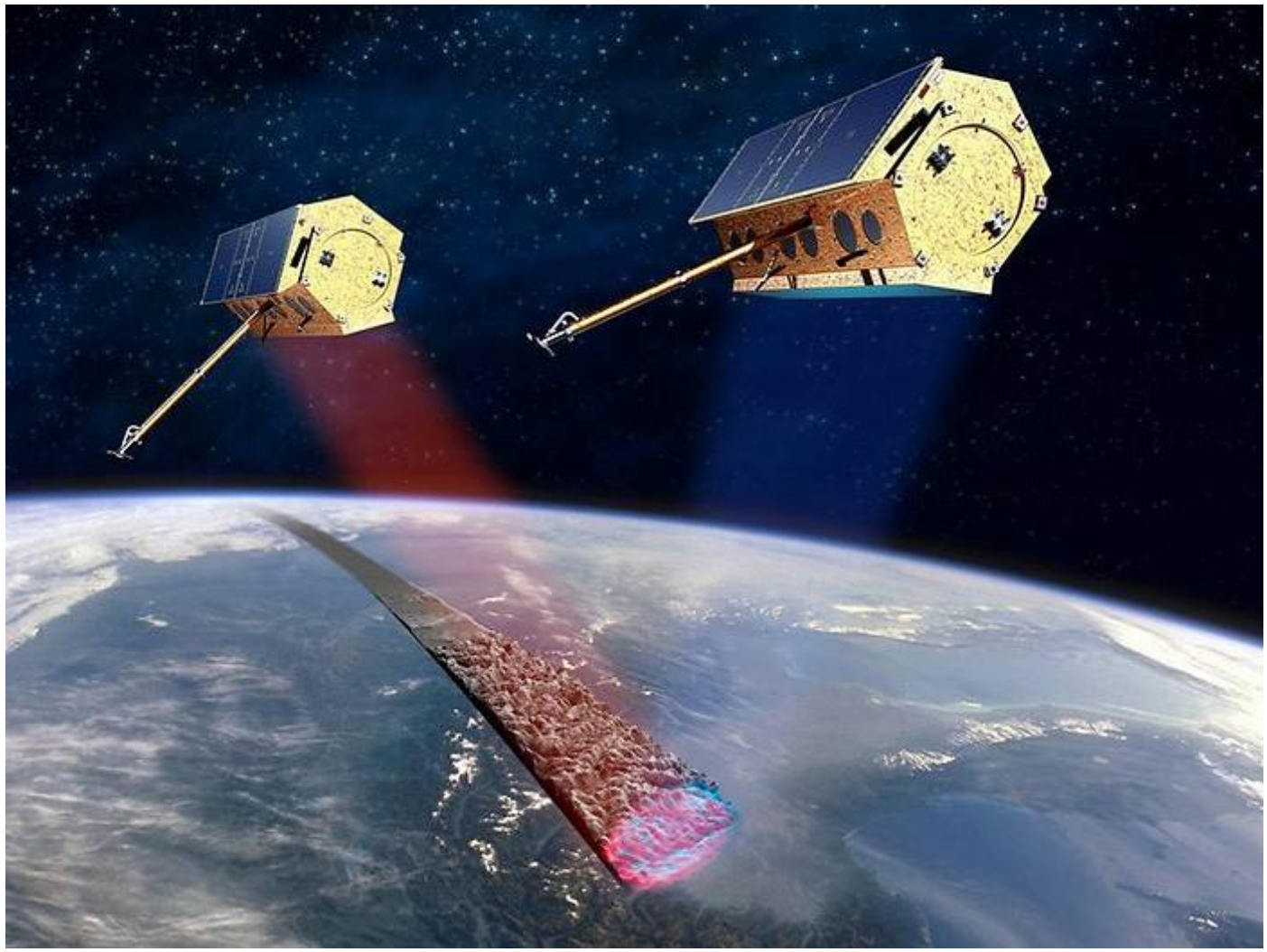
Introduction

- Simultaneous TT&C for few satellites with one ground station leads to efficient use of resources of ground station infrastructure
- Changes in ground antenna should be applied

TerraSAR-X and TanDEM-X

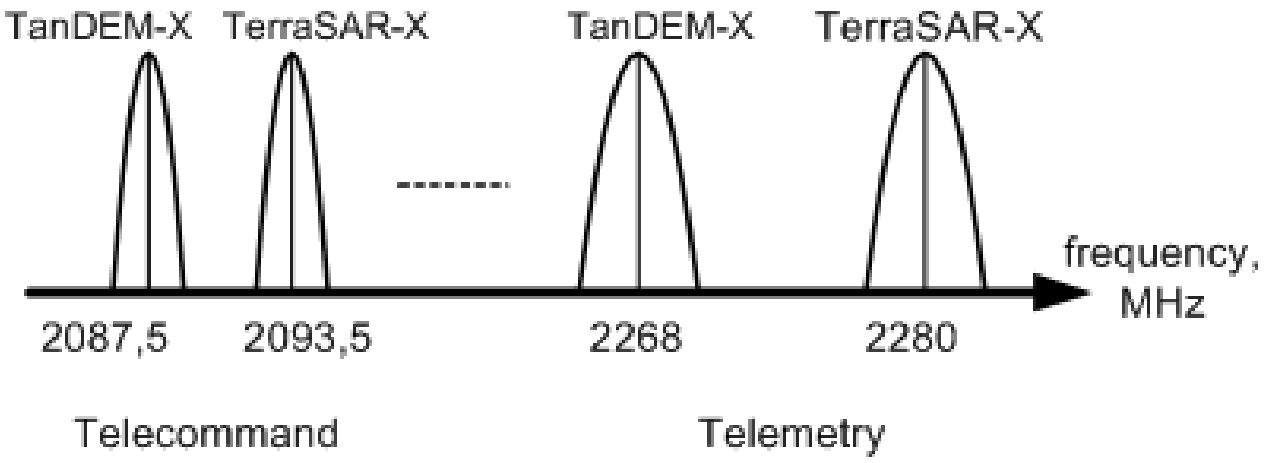


TerraSAR-X and TanDEM-X

- TerraSAR-X
  - **Terra** (lat.) means Earth
  - **SAR** – Synthetic Aperture Radar
  - **X** – frequency band of radar
- TanDEM-X
  - **T**erraSAR-X-**A**dd-o**n** for **D**igital **E**levation **M**easurements
  - A twin satellite of TerraSAR-X
  - Distance to TerraSAR-X is 500 meters
  - A second „eye“ for a 3D elevation model
- Both satellites are in LEO orbit (514 km)

RF Parameters

	TerraSAR-X	TanDEM-X
Uplink (TC)	2093,5 MHz	2087,5 MHz
Carrier frequency		
Downlink (TM)	2280 MHz	2268 MHz
Carrier frequency		



15 Meter S-Band Antenna

15 Meter S-Band Antenna

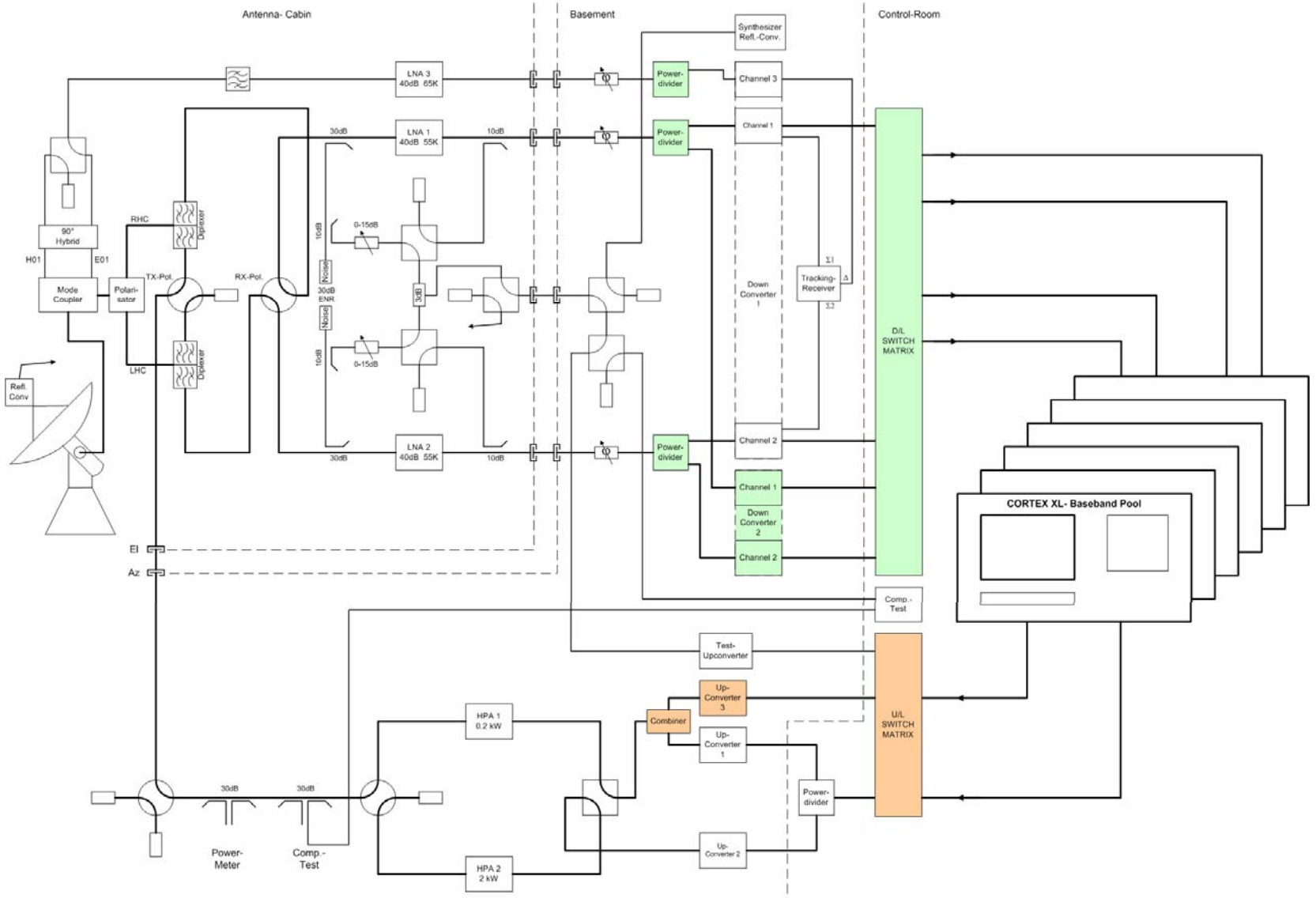
- Antenna is used for telemetry reception, telecommand transmission and orbital measurements
- System is capable of autotrack operation
- Receive system

Frequency range	**2200—2300 MHz**
Polarization	**RHC and LHC**
Antenna gain	**48,3 dBi @ 2250 MHz**
3dB-beamwidth	**0,62°**

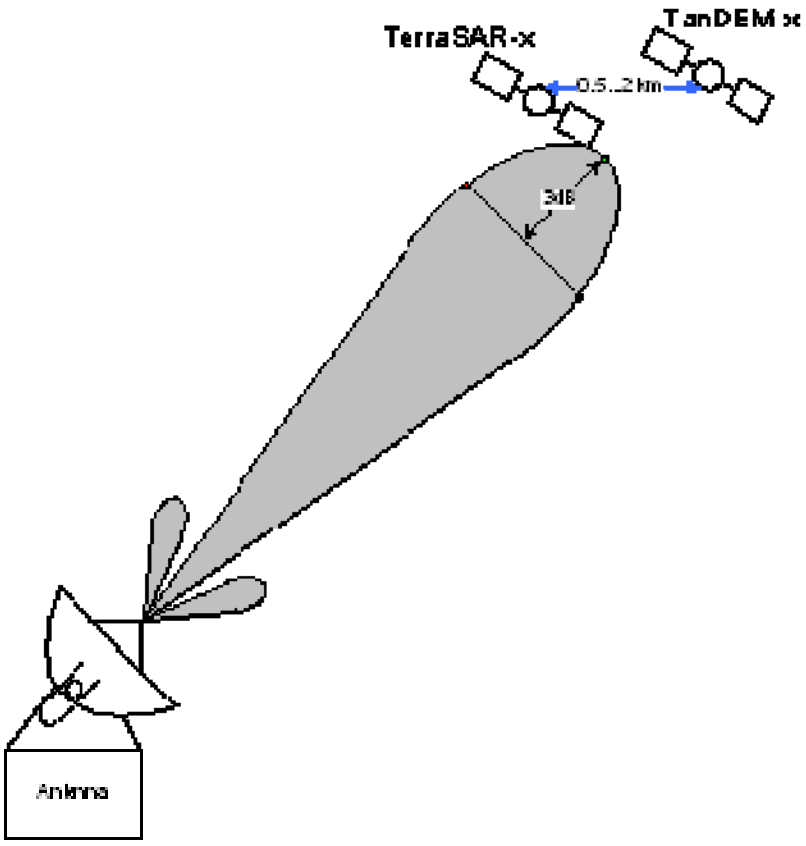
- Transmit system

Frequency range	**2025—2120 MHz**
polarization	**RHC or LHC**
EIRP	**59—79 dBW @ 2075 MHz**
3dB-beamwidth	**0,66°**

New Block Diagram



Calculations



Cosine Law:

$$c^2 = a^2 + b^2 - 2ab\cos(\gamma)$$

$\gamma \approx 0.0557°$ in zenith

Conclusion

- Few satellites can be simultaneously operated by one ground antenna. More efficient utilization of ground station resources

\+ Simple method to apply

\- Spectrally inefficient

Future Work

- A new concepts should be searched:
  - Spread spectrum technique is spectral efficient, which is based on CDMA and requires more complicated solutions for ground station and satelites

Thank you for your attention!

Any questions...??

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