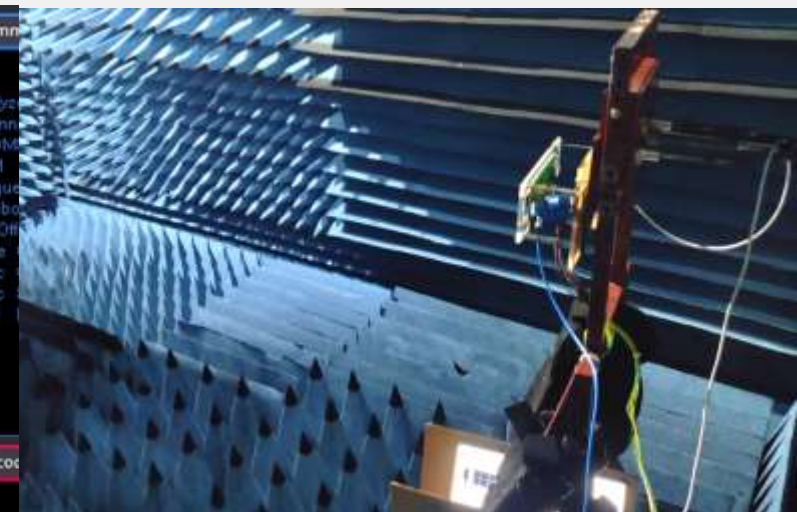
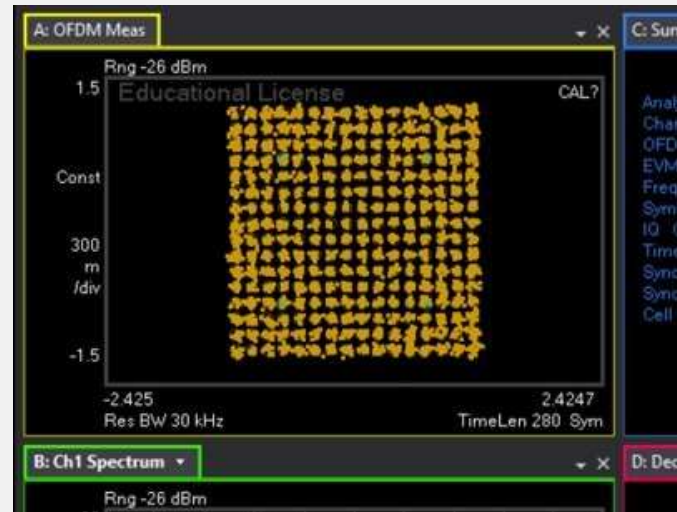
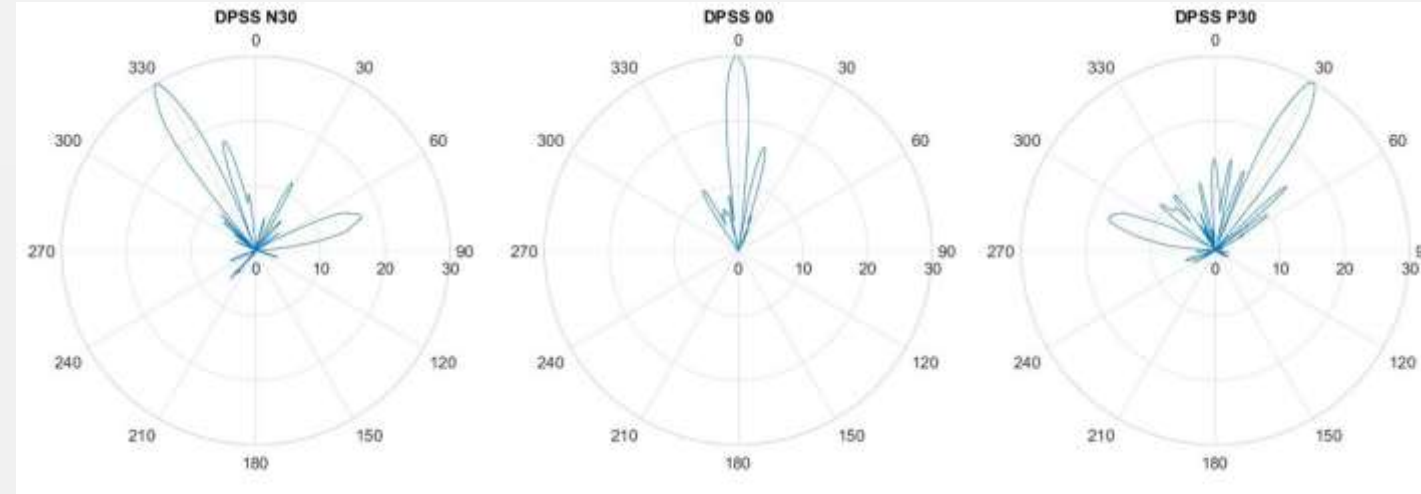


Perspectives on FR3

KJ Vinoy

INDIAN INSTITUTE OF SCIENCE

5G Experience: MMWave Phased Array



Phased array beam steering; Hybrid beam steering

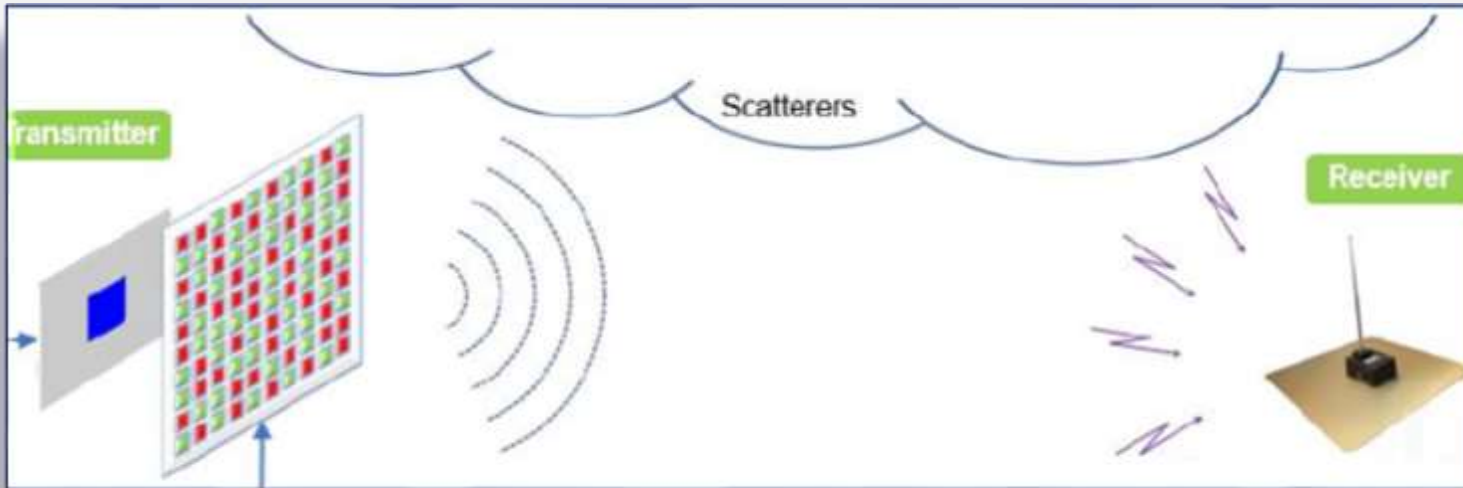
Baseband IF translated; Yet remain expensive; No large arrays

Our Learnings from FR2



- Wideband RF spectrum available.
 - Hardware readiness
 - Hardware complexity
 - Beam pointing
 - Beamwidth
 - Localization
- How much of the spectrum can be efficiently used by baseband?

Reconfigurable Metasurface with Antenna



Channel modulation scheme

The screen may consist of a planar array (of subwavelength) units.

Similar transmitter arrangements used under different nomenclature

Transmitarray Antennas

Direct Antenna Modulation

Reconfigurable Intelligent Surfaces

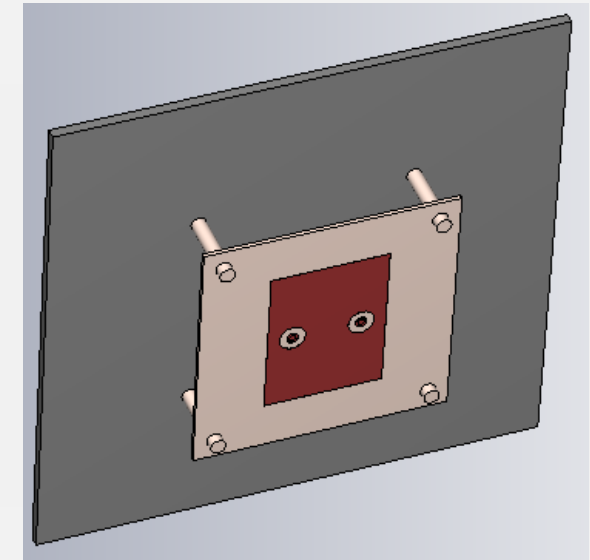
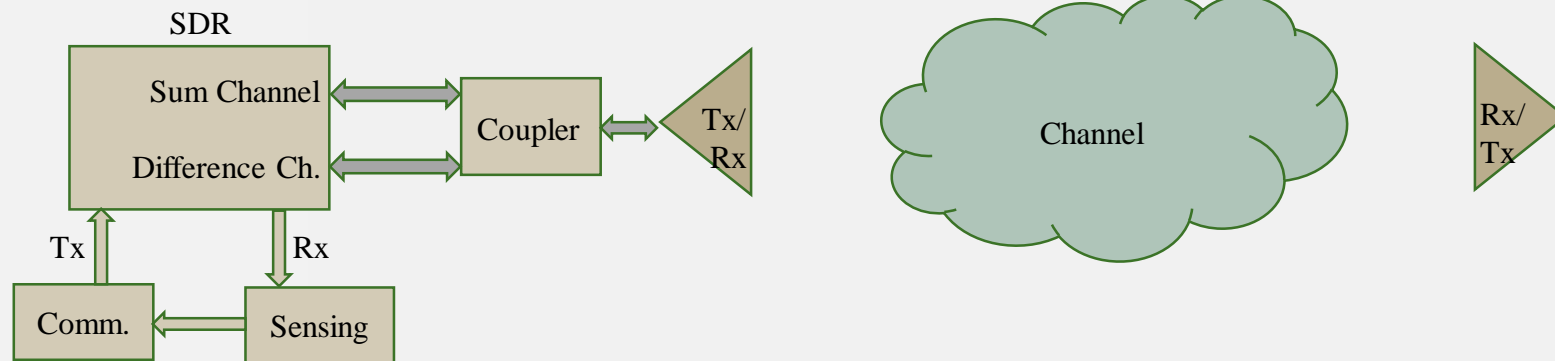
NLOS friendly

Communication under low SNR

Wideband Microwave Imaging

Directional Security

Ongoing Work: Dual-feed antennas



Monopulse radar is a simple techniques for DoA (IFF radars)

RF frontend provides sum and difference patterns for a single carrier → can be used for sensing DoA

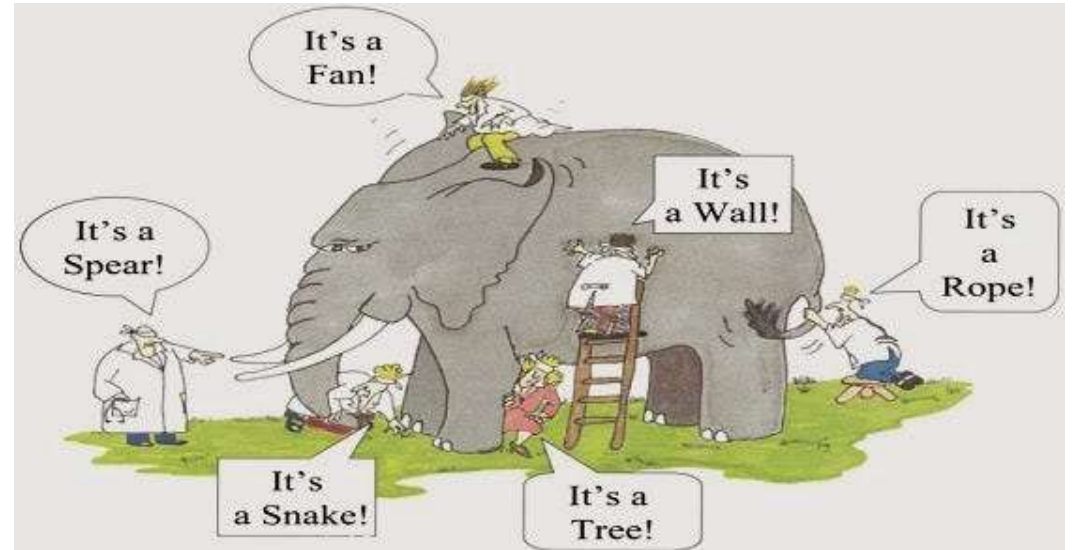
In multiantenna systems, beamforming can follow the sensing input to point the beam towards the moving receiver

In communication, sum & difference ports can provide 2 orthogonal signals → increase spectral efficiency

Possibility of user localization at RF (radar) and analog IQ signals using 2 port antennas

6G: Targeted Features

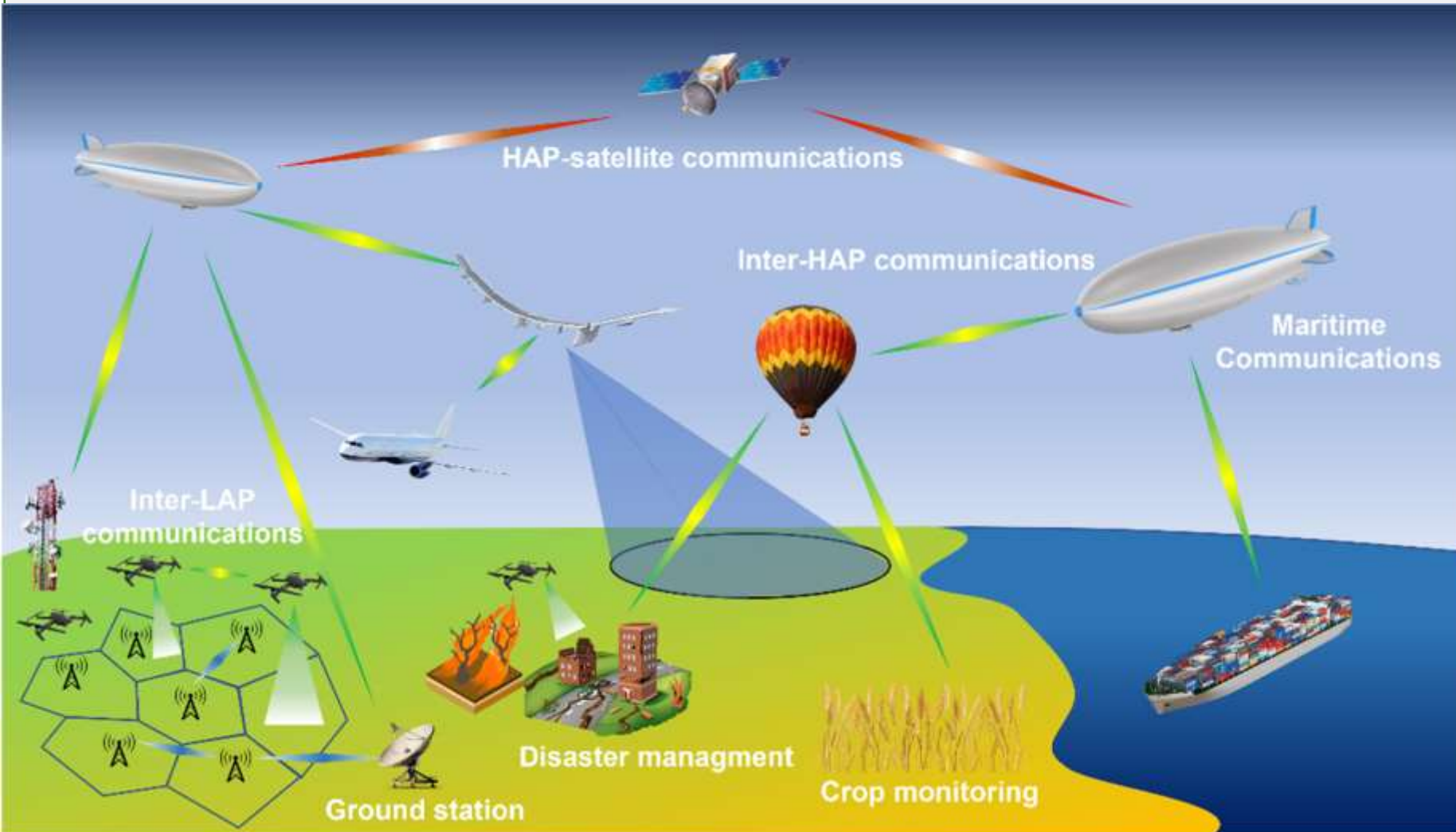
- Sensing/Radar with Communication (JRC/DFRC/??)
- Terrestrial/Non-terrestrial networks



Federal Communications Commission – Technological Advisory Council
Advanced Spectrum Sharing Working Group

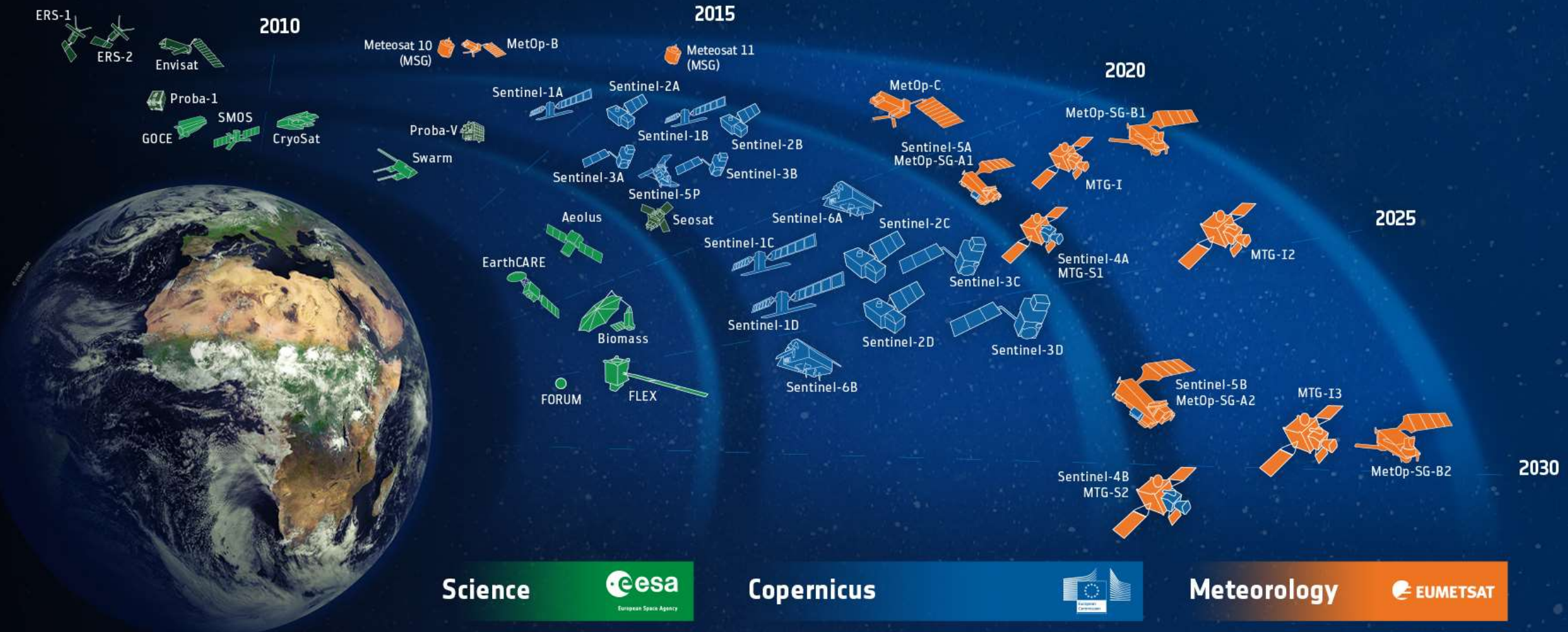
A Preliminary View of Spectrum Bands in the
7.125 - 24 GHz Range; and a Summary of
Spectrum Sharing Frameworks

6G Vision

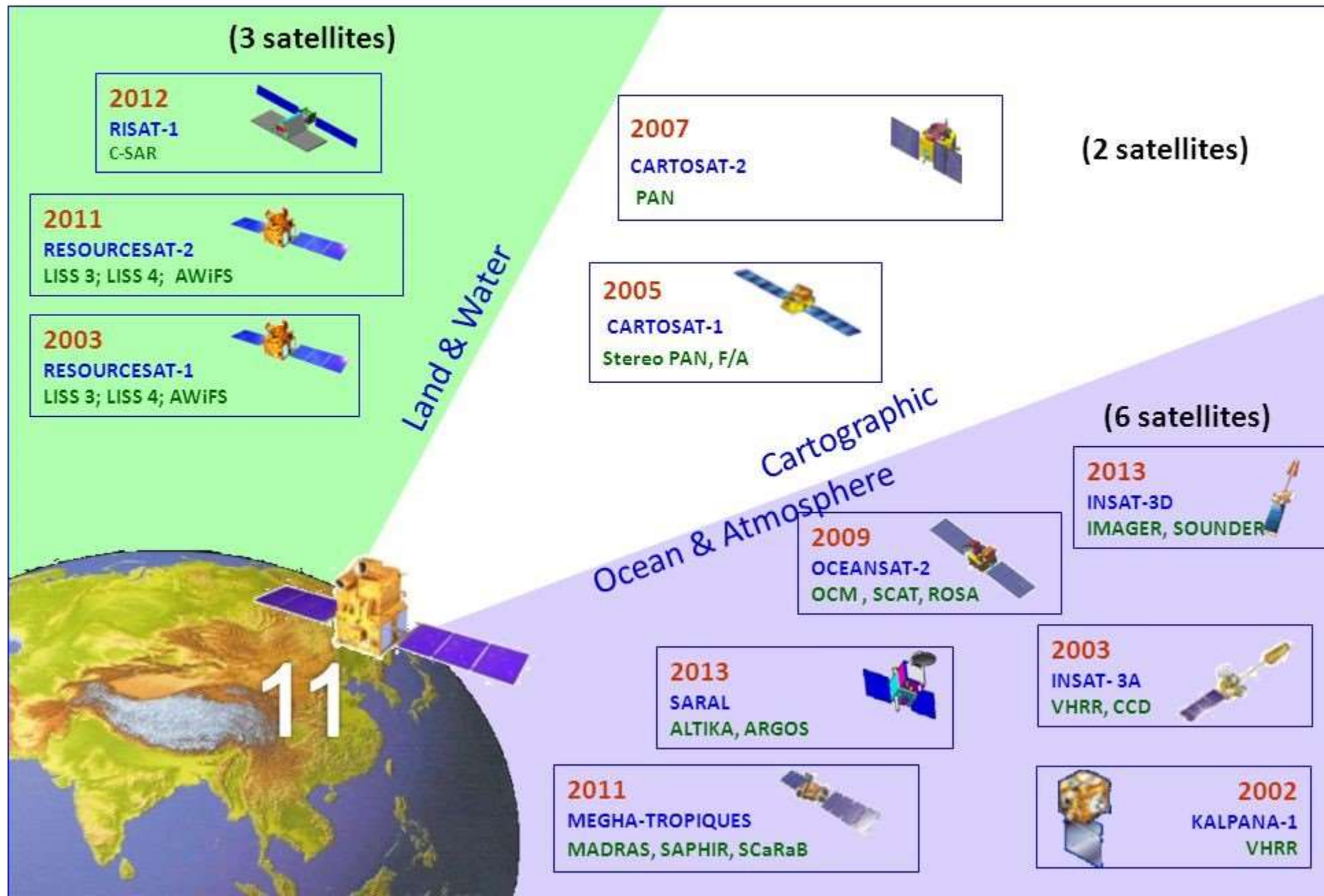


FA Dicandia et al. "Space-air-ground integrated 6G wireless communication networks: A review of antenna technologies and application scenarios." *Sensors* 22.9 (2022): 3136.

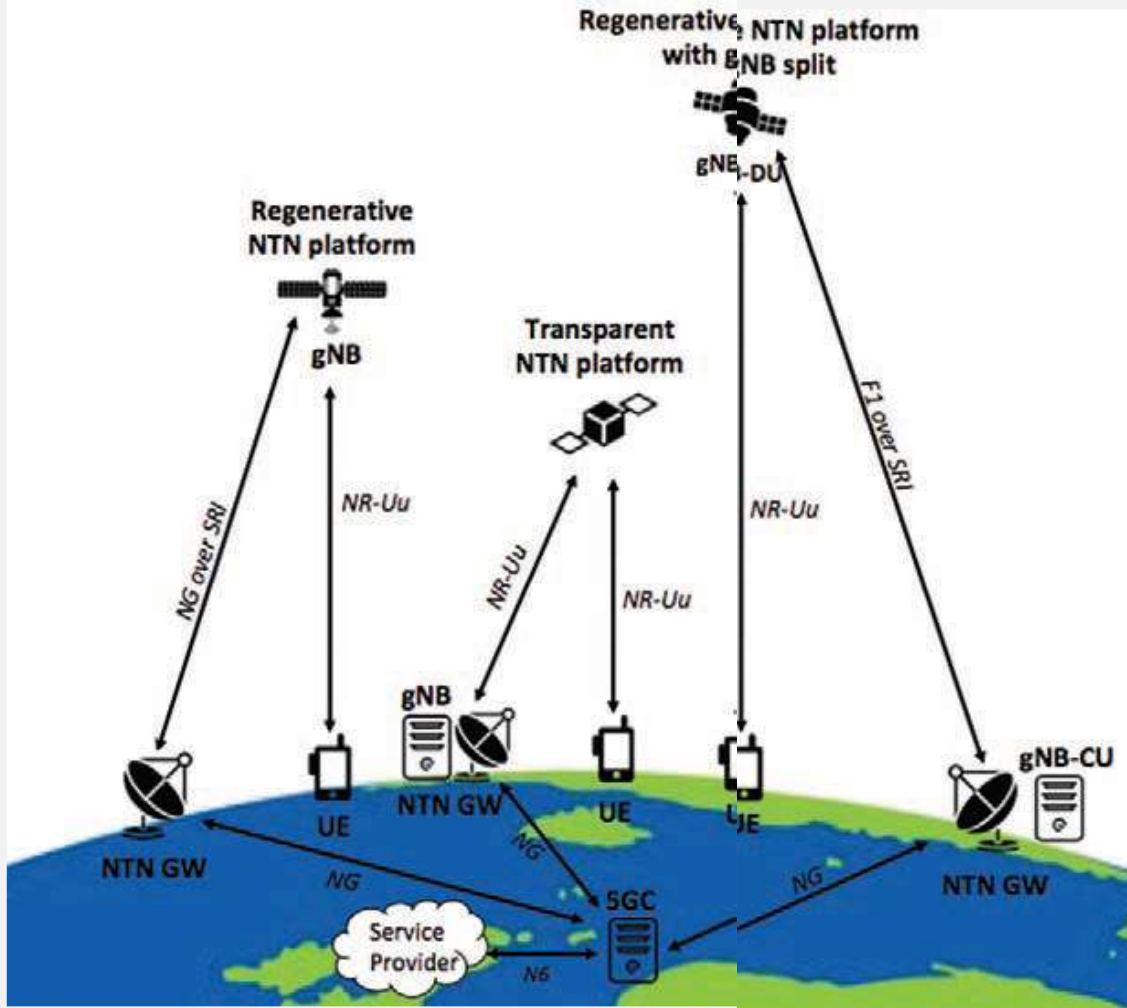
A lot of satellites up there!!



Indian Earth Observation (in-orbit satellites)



Different Modes for Comm.



- Can these different terrestrial and NTN networks coexist?
- Can these re-use the same frequency bands as existing space assets?
- Directional antennas likely. Can we manage spectrum resources better to multiplex use: space, orientation
- Can advanced AI/ML be employed for dynamic resource allocation/sharing?

Rely on Machines for Dynamic Spectrum Usage!!

