Spectrum inefficiencies resulting from the claimed use of steerable beams, multiple beams or large coverage area beams for the Notification of Ku-band FSS satellite networks

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Immediate Problem

- **No usable Ku-band FSS spectrum / orbit resource is available for new satellite operators**

- **Current and planned satellites are not actually using, nor capable of using, all the available Ku-band FSS spectrum / orbit resource**

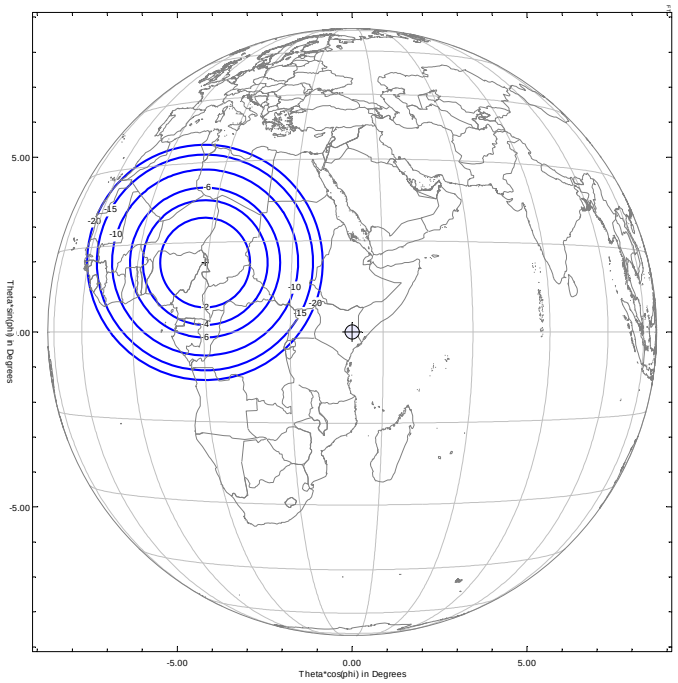
<u>Therefore</u>:

- **Some orbit / spectrum resource is being warehoused**

- **ITU procedures need to be improved to counter this trend**

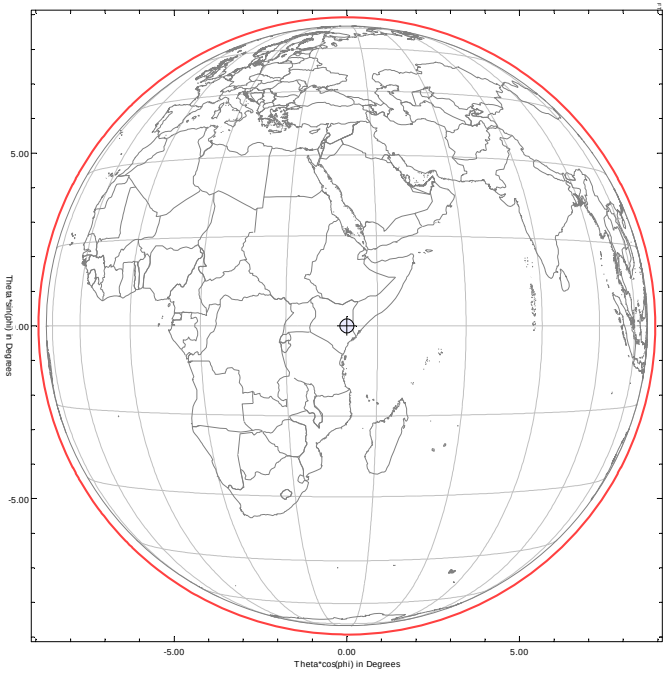
Beam Coverage / Service Area Discrepancy

Actual Satellite Beam Coverage



Example only

Claimed Service Area



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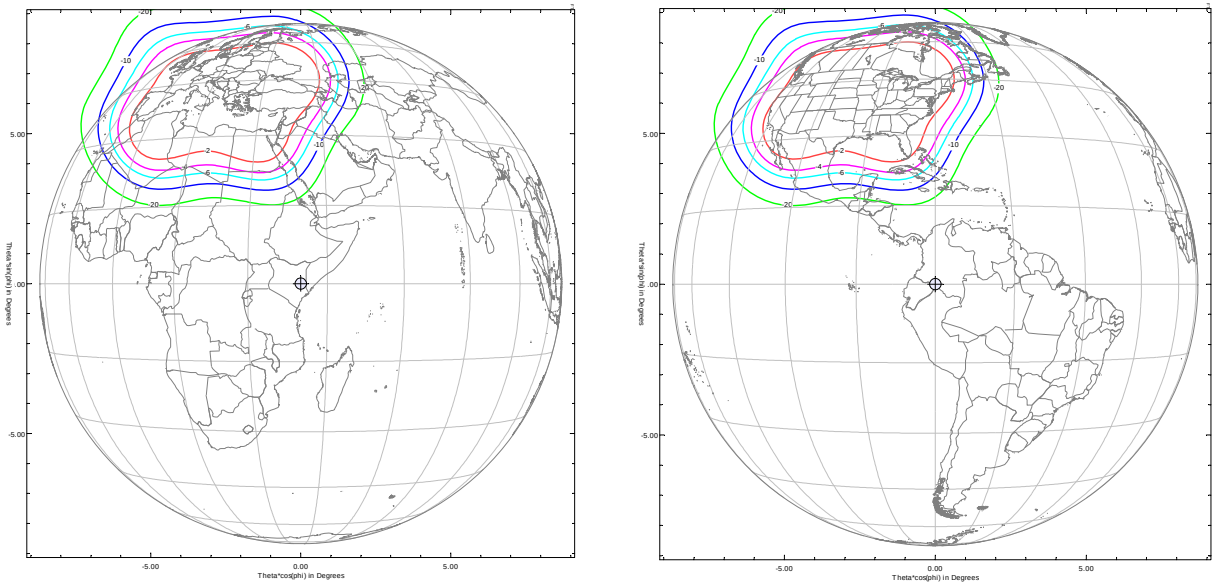
Actual Achievable Beam Coverage is Limited by Technology and Economics

- Service requirements dictate relatively high EIRP (>50 dBW)
- Limited satellite TWTA power capability (~150 Watts)
- Requires satellite antenna gain (at edge of coverage) of >30 dBi
  - Can only cover approximately 5% to 10% of the Earth's visible surface
- Example Ku-band beams:



Use of Steerable Beams

- Some Ku-band satellites have mechanically steerable antenna beams, but:
  - Antenna Pointing Mechanisms are heavy and expensive and reduce payload reliability
  - May degrade the antenna performance compared to a fixed antenna design
- Phased array satellite antennas are possible but unlikely to be used at Ku-band
  - Expensive and they introduce signal loss
- Spacecraft attitude bias can effectively steer the beam coverage, but
  - Very limited bias capability in the north-south direction
    - roll bias usually limited to ±0.5°, and pitch bias limited to ±3°).
  - All antennas steer together so not well suited to a multi-mission satellite

Efficiency Data for Sample 18° Arc

Satellite #	Notified Beam Coverage	Actual Beam Coverage Capability	Estimated % of Visible Land Area Served by Fixed Beam
1	Fixed & Steerable	**Fixed in 75% of used spectrum** Steerable in 25% of used spectrum	<5%
2	Fixed & Steerable	**Fixed**	<5%
3	Fixed & Steerable	**Fixed in ??% of used spectrum** Steerable in ??% of used spectrum	<10%
4	Fixed & Steerable	**Fixed**	<5%
5	Fixed & Steerable	**Fixed**	<5%
6	Fixed	Fixed	
7	Fixed & Steerable	**Fixed**	<5%
8	Fixed & Steerable	Fixed & Steerable in 100% of used spectrum	
9	Fixed	Fixed	
10	Fixed	Fixed	
11	Fixed & Steerable	**Fixed**	<10%
12	Fixed & Steerable	Steerable in 100% of used spectrum	

<u>Conclusion</u>: Average of approximately 50% of the world's land mass is being denied satellite service in the Ku-band !!!!!!

Next Steps?

- Introducing a regulatory procedure that discourages inaccurate claims of beam coverage is a natural next step for the ITU

- Analogous situation in 1997 when RR 11.44 was added
  - Ensures that only the actual frequency assignments that are brought into use within the permitted time period can become protected assignments in the MIFR
  - Prior to this **all** of the frequency assignments of a network were protected when **any one** of the assignments had been brought into use.

Long-term rights and flexibility for the satellite operators

Need for the ITU community to manage the limited spectrum/orbit resources fairly

What Type of Changes to the Radio Regulations?

- Appendix 4 already includes the necessary data items that quantify the degree of “steerability” of an antenna beam
  - Effective Boresight Area (B.3.b.1)

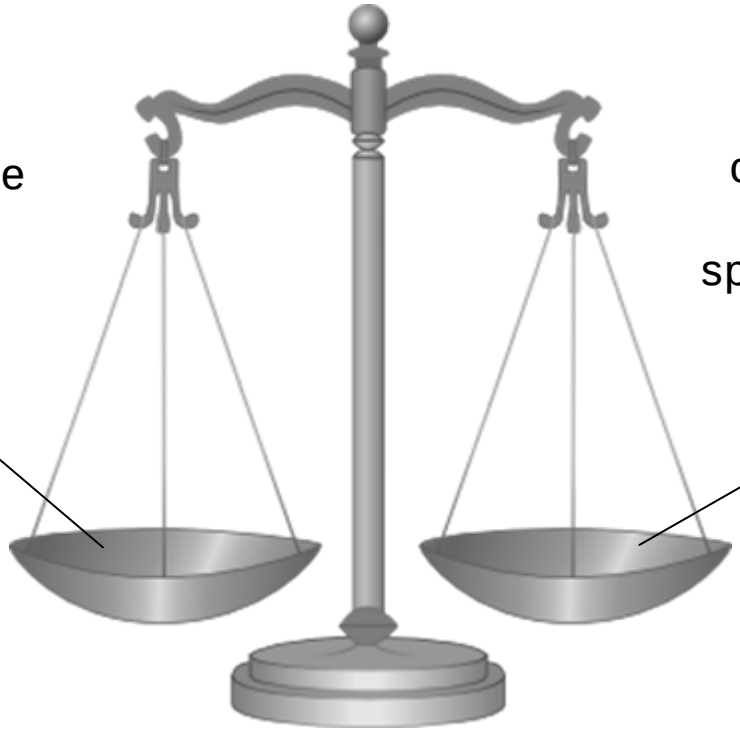
- New item needs to be added to the Part A data of Resolution 49 so that the exact steerability of the beam should be provided, together with the supporting technical rationale for this

- RR 13.6 should be applicable also in the event of noted and verifiable inconsistencies regarding actual vs claimed beam coverage

The Real Issue

Long-term rights and flexibility for the satellite operators

Need for the ITU community to manage the limited spectrum/orbit resources fairly



Consolidation in the satellite industry has lead to a small number of large satellite operators that "own" the Ku-band FSS orbit/spectrum resource

New entrants (new countries) have almost no possibility to become satellite operators in the Ku-band FSS