



Update on the spectrum regulatory framework for Lunar PNT

Session: Lunar PNT Spectrum

UNOOSA - Workshop on Cislunar PNT

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Cathy Sham: ITU-R WP 7B Chair
Space Frequency Coordination Group, Lunar Martian Spectrum Group Chair
NASA Lunar and Human Spaceflight Spectrum Manager
catherine.c.sham@nasa.gov

International Spectrum Regulators are Studying Lunar Spectrum

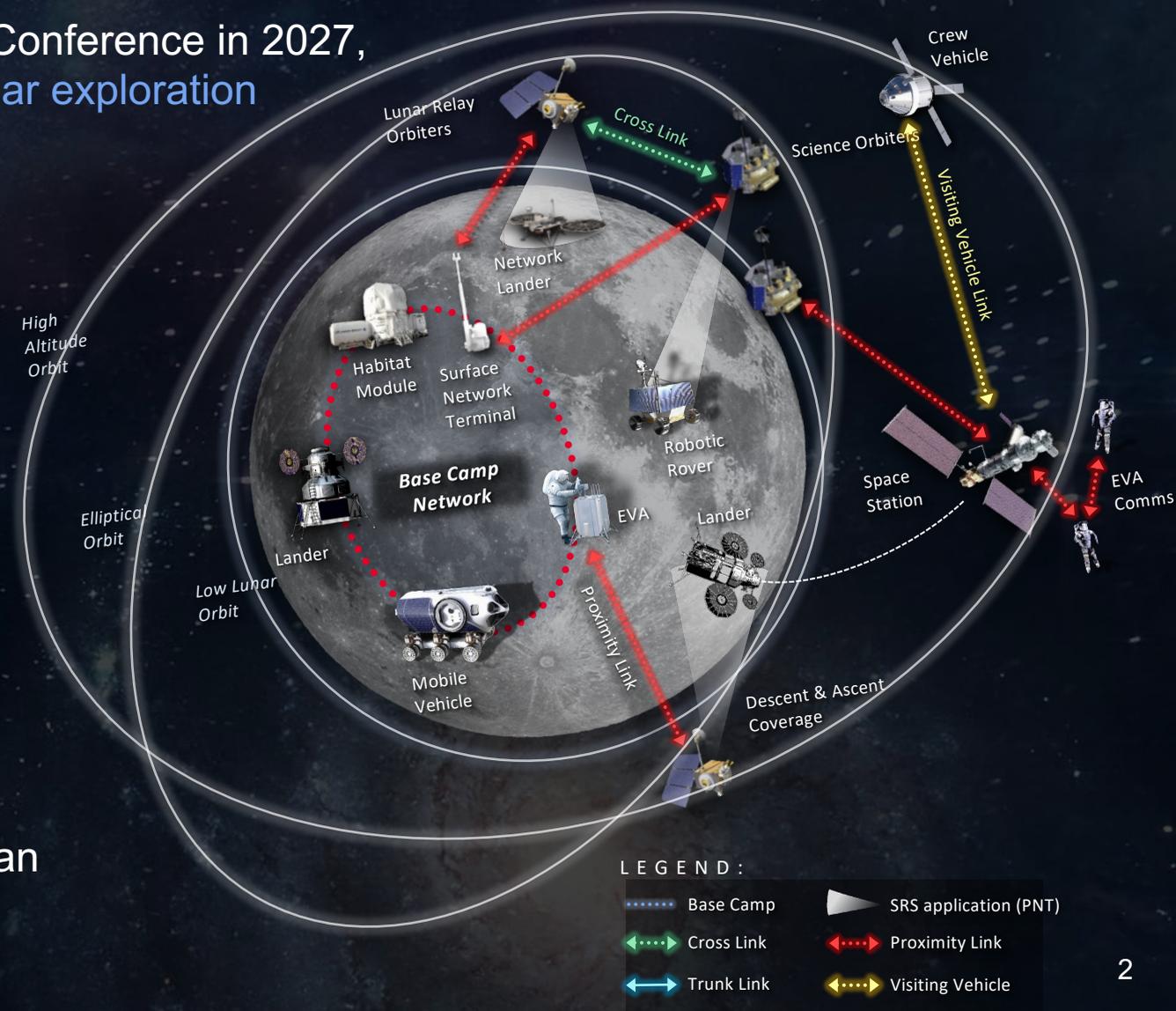


Studies in preparation for World Radiocommunication Conference in 2027, for possible decisions to enable near-term scientific lunar exploration

- Frequency ranges under study for possible new or modified *Space Research Service* (SRS) allocations include:
 - 390-406.1 MHz, 420-430 MHz, 440-450 MHz (outside the Shielded Zone of the Moon)
 - 2 400-2 690 MHz, 3 500-3 800 MHz, 5 150-5 570 MHz, 5 570-5 725 MHz, 5 775-5 925 MHz, 7 190-7 235 MHz, 8 450-8 500 MHz and 25.25-28.35 GHz

Studies informed by multilateral planning efforts (Space Frequency Coordination Group Recommendations, LunaNet Interoperability Specification)

- Frequency architecture *assumes sharing*
- Position, Navigation and Timing capabilities are an application of *Space Research Service*



Status of Technical Studies: 2483.5 – 2500 MHz

Services identified for sharing studies with lunar communications (2 400-2 690 MHz)

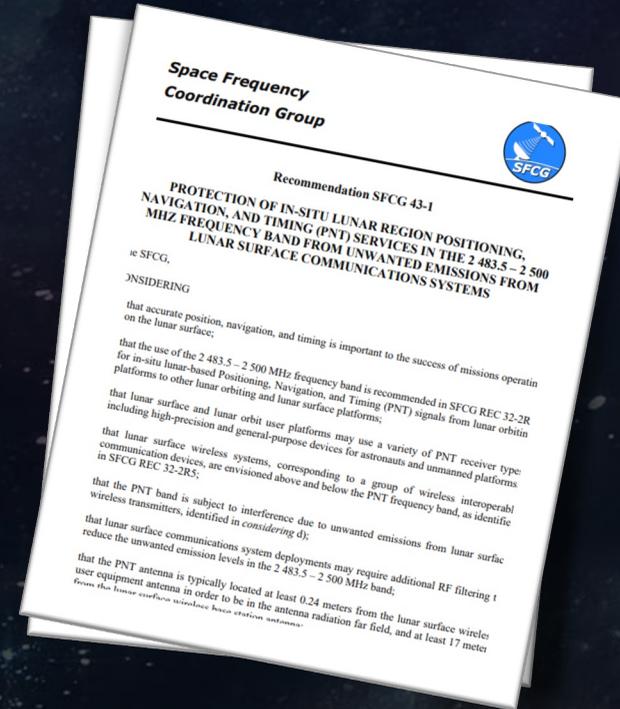
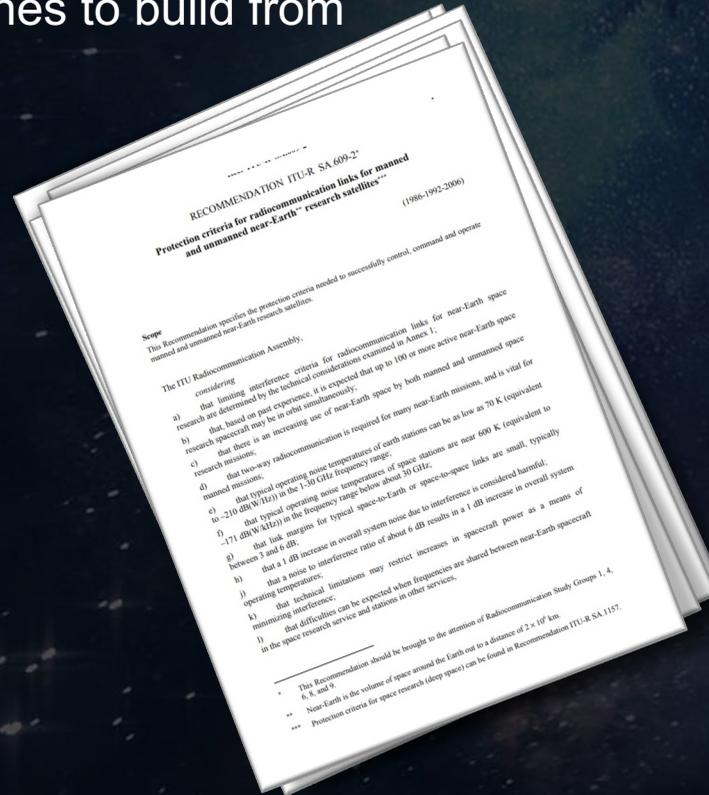
Service	Frequencies	Footnotes
FIXED	2 400-2 690 MHz	
MOBILE	2 400-2500 MHz	
RADIOLOCATION	2 450-2 500 MHz	
RADIODETERMINATION-SATELLITE (space-to-Earth)	2 483.5-2 500 MHz	5.398, 5.399 (Region 1), 5.401 (Regions 1&3), 5.402
MOBILE-SATELLITE (space-to-Earth)	2 483.5-2 500 MHz	5.351A, 5.401 (Regions 1&3), 5.402
	2 500-2 520 MHz	

- WRC-27 AI 1.15 includes 2483.5-2500 MHz band for in-situ PNT as an application of space research service
- ITU studies to demonstrate sharing between proposed new application and existing allocations in the same band are compulsory, based on the technical and operation characteristics and protection criteria of the existing allocations.
- Sharing studies to-date showed the proposed in-situ PNT can share with existing services in this band.
- Proposed draft regulatory solutions is expected in March 2026 meeting of WP 7B.

2 483.5-2 500 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.351A RADIODETERMINATION-SATELLITE (space-to-Earth) 5.398 <u>SPACE RESEARCH (space-to-space) 5.A115-1B</u> Radiolocation 5.398A 5.150 5.368 5.372A 5.399 5.401 5.402	2 483.5-2 500 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.351A RADIOLOCATION RADIODETERMINATION-SATELLITE (space-to-Earth) 5.398 <u>SPACE RESEARCH (space-to-space) 5.A115-1B</u> 5.150 5.368 5.372A 5.402	2 483.5-2 500 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.351A RADIOLOCATION RADIODETERMINATION-SATELLITE (space-to-Earth) 5.398 <u>SPACE RESEARCH (space-to-space) 5.A115-1B</u> 5.150 5.368 5.372A 5.401 5.402
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Protections in Space Research Bands

Baselines to build from



- ITU-R Recommendation SA.609-2, “Protection criteria for radiocommunication links for manned and unmanned near-Earth research satellites”: Defines a required ratio of interference spectral density to system noise spectral density (I_0/N_0) of -6 dB for 0.1% of time (unmanned missions) or 0.001% of time (crewed missions), for systems operating within Space Research Service allocations (excluding deep space links).

- SFCG REC 43-1, “Protection of In-situ Lunar Region Positioning, Navigation, and Timing (PNT) Services in the 2483.5-2500 MHz Frequency Band from Unwanted Emissions from Lunar Surface Communications Systems”: Recommends emitter and receiver design considerations to protect lunar PNT signals from in-situ lunar S-band links.

SFCG Recommendation 43-1

- SFCG REC 43-1 recommends that the maximum aggregate unwanted emissions into the 2483.5-2500 MHz band from lunar surface wireless systems be limited to -121 dB(W/m²/MHz) as measured at the input to the PNT receive antenna
 - This PFD level is derived from the characteristics and protection criterion for L-band (1559-1610 MHz) RNSS receivers given in Recommendation ITU-R M.1903
- SFCG Rec 43-1 provides a maximum aggregate unwanted emissions PFD level into the S-band PNT receive antenna from adjacent frequency bands
- This approach provides system designers flexibility on how to meet this PFD level.
 - Some possible options are:
 - Reduce the transmitter's unwanted emissions level into the PNT band
 - Increase the distance between the transmitter and the PNT receive antenna
 - Increase RF shielding between transmitter and the PNT receive antenna
 - Increase frequency separation between transmitter and PNT receive band
- SFCG Rec 43-1 does not recommend a particular option to be used, since this depends on the specific system design and is beyond the scope of the SFCG
- SFCG Rec 43-1 also recommends that the lunar PNT receiver provide sufficient filtering of signals in adjacent bands to avoid receiver saturation
 - Similar to above, there are a number of different options to avoid receiver saturation and the SFCG recommendation allows flexibility depending on the specific system design
 - From Rec ITU-R M.1903, the receiver input saturation level for the high precision RNSS receiver is -120 dBW