



Experience of Earth Based Use of S Band and Spectrum Compatibility

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S Band: Navigation Spectrum Sharing

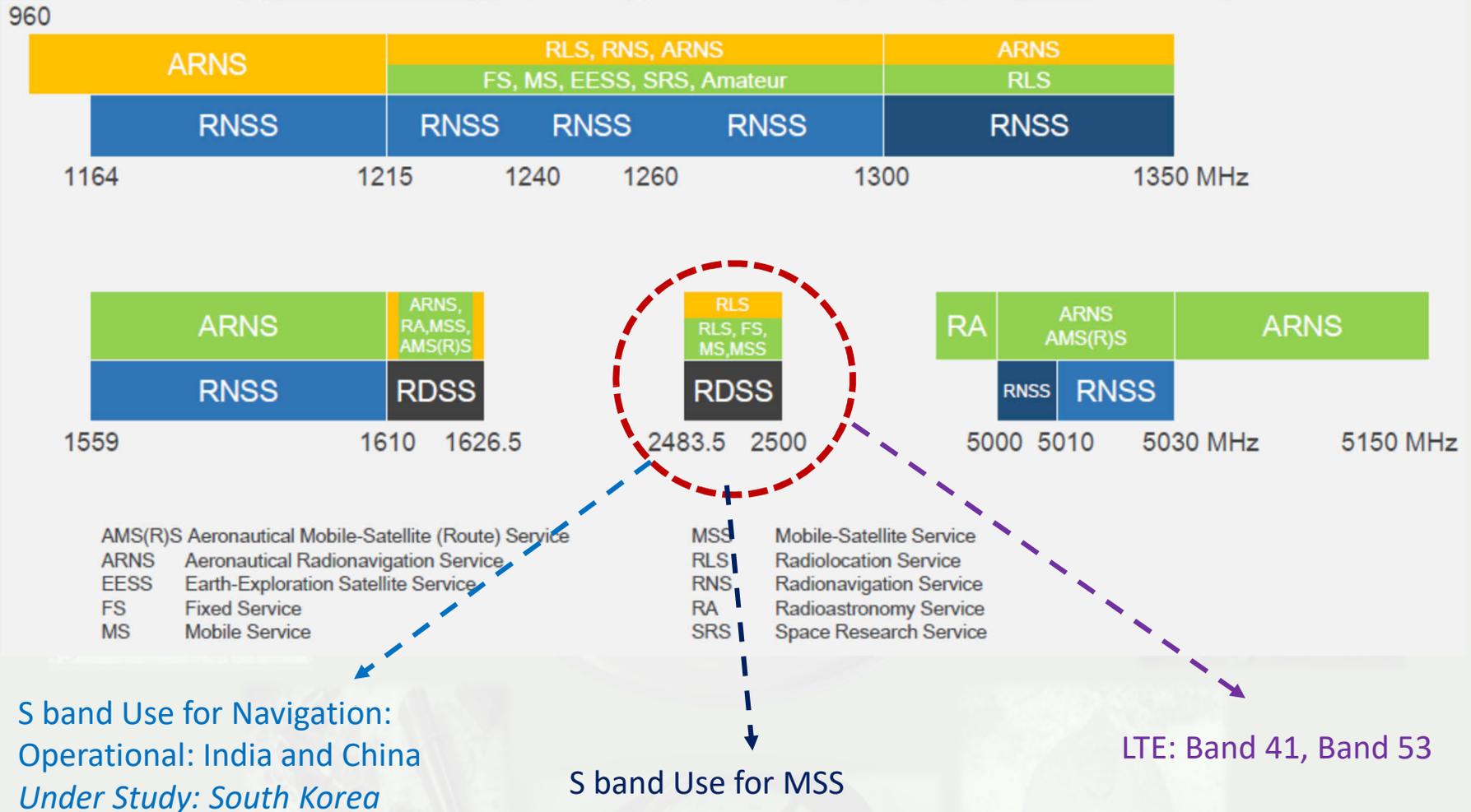
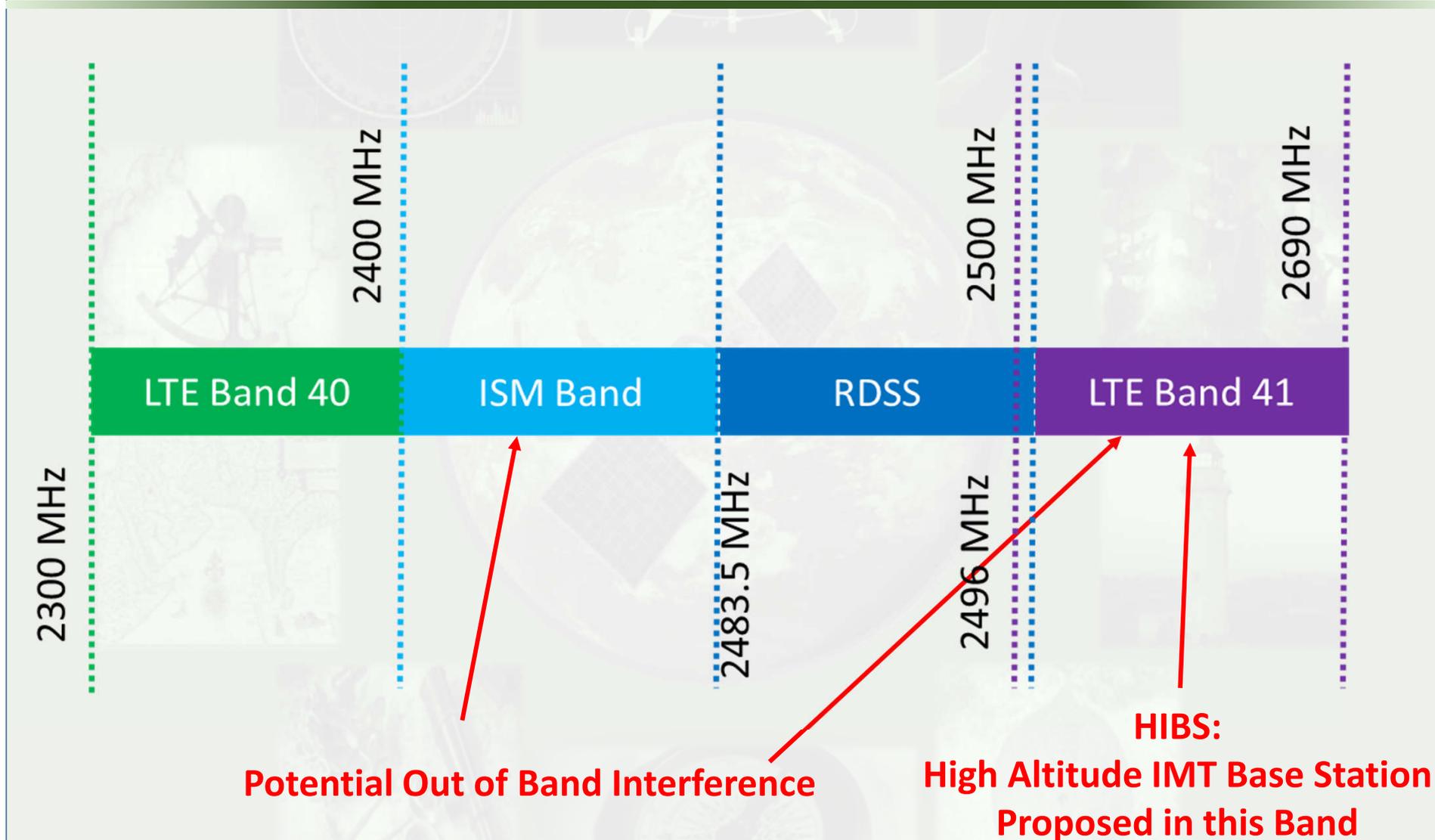


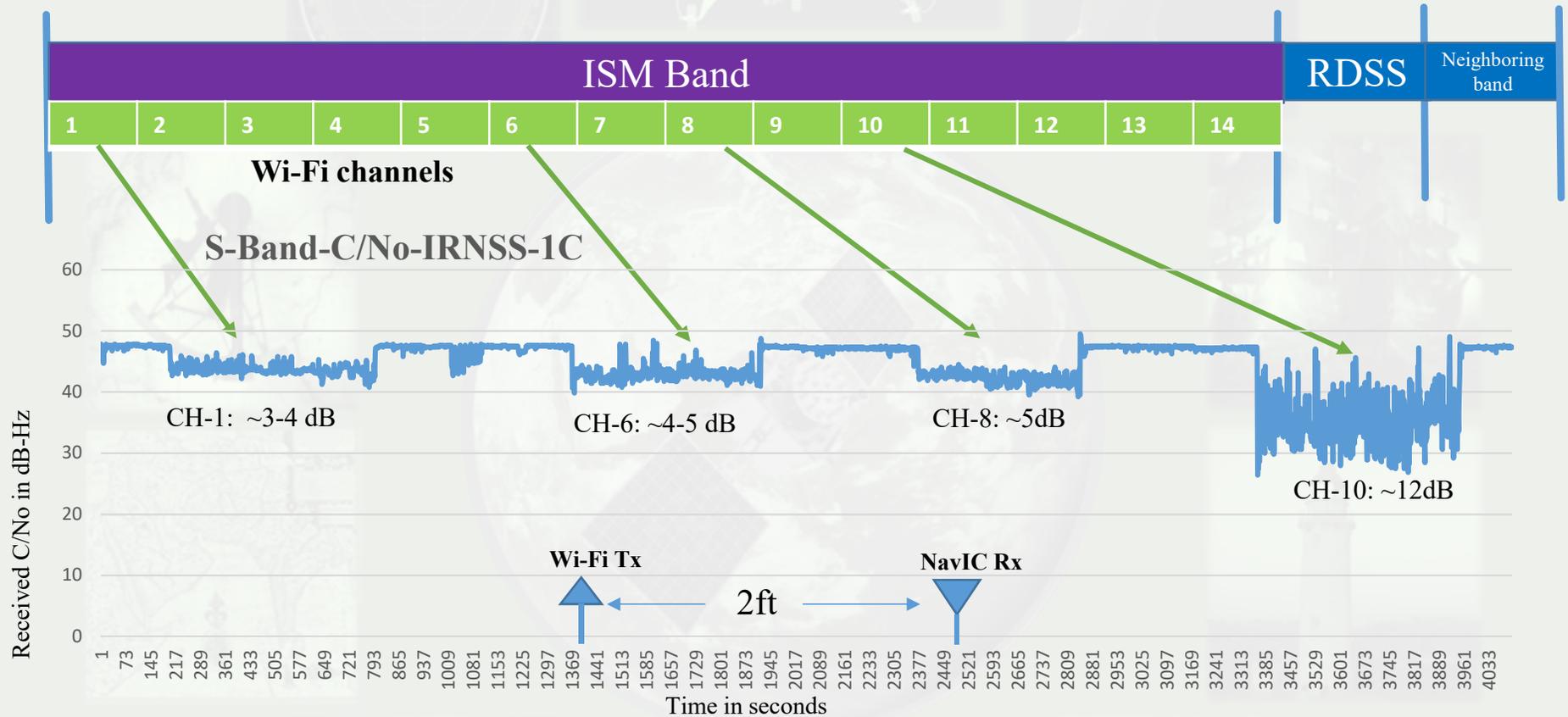
Figure From: Hon Fai Ng "ITU's role in GNSS" @ICG-13

S band: Adjacent Band Scenario



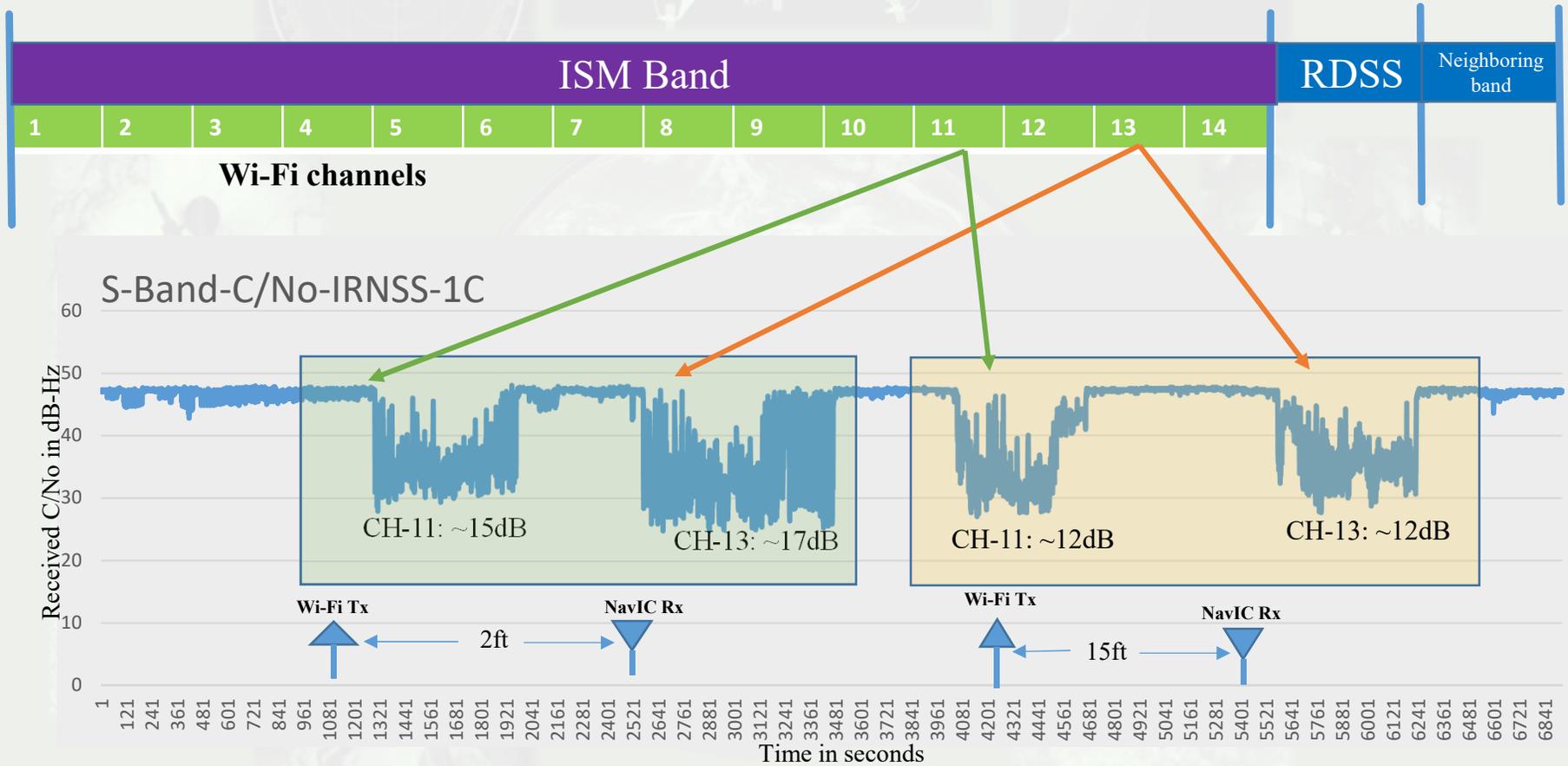
- NavIC has SPS (Standard Positioning Signal) and RS (Restricted Service) signals in S-band.
- Instances have been observed of adjacent band interference on NavIC S band signals.
- The interference manifest as:
 - Loss of Lock
 - Degraded Noise floor (reported as C/No degradation)

S band Interference



The Interference from Wi-Fi channels increases as it comes close to RDSS band.

S band Interference...



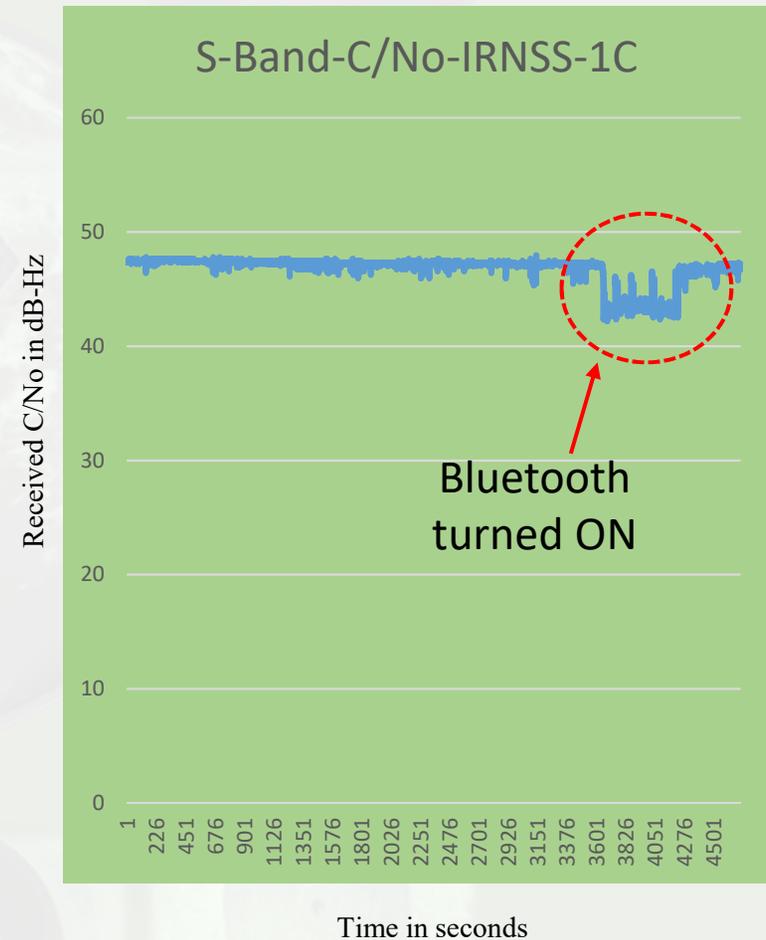
Wi-Fi Channel 13 has most severe impact

Interference due to Bluetooth

- Two mobile phones with Bluetooth 5.0 were paired and kept close to NavIC receiver (at 2 ft).



- The C/N0 degradation due to Bluetooth devices is around 3-4 dB.



S band for Lunar Comm & PNT

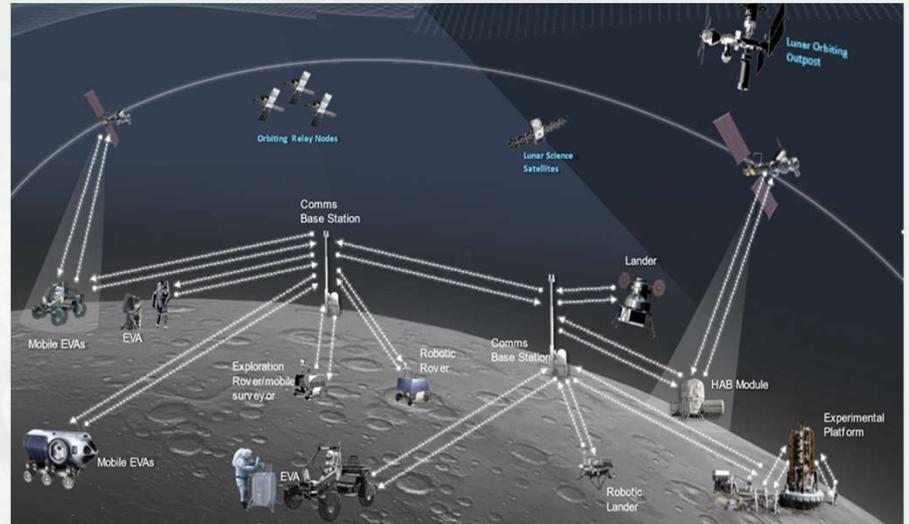
- To protect S band Lunar PNT signals, the Out of band emission from Lunar Communication devices in S band should be improved compared to earth based systems.
- Sufficient guard band should be implemented between proposed Lunar communication and navigation services in S band.

Agenda Item 1.15 Communication on Lunar Orbit and Surface

Proposed Candidate frequency bands:

- 390-406.1 MHz, 420-430 MHz and 440-450 MHz, limited to outside the SZM;
- 2400-2690 MHz, 3500-3800 MHz, 5150-5570 MHz, 5570-5725 MHz, 5775-5925 MHz, 7190-7235 MHz, 8450-8500 MHz and 25.25-28.35 GHz.

The proposed 2400-2690 MHz frequency band is overlapping with RDSS S-Band spectrum.



Envisioned Lunar Surface Communication Architecture

Service	Frequency Band	Lunar Surface to Lunar Surface	Lunar Orbit to Lunar Surface
Fixed, Mobile & Radiolocation	2400-2500 MHz	X	
RDSS & MSS	2483.5-2500 MHz		X
MSS & Fixed Satellite	2500-2690 MHz	X	X

India submitted the navigation user receiver parameters to ITU WP-4C for AI 1.15 study.

Reference: ITU WP-7B Document 7B/192-E, September 2025.

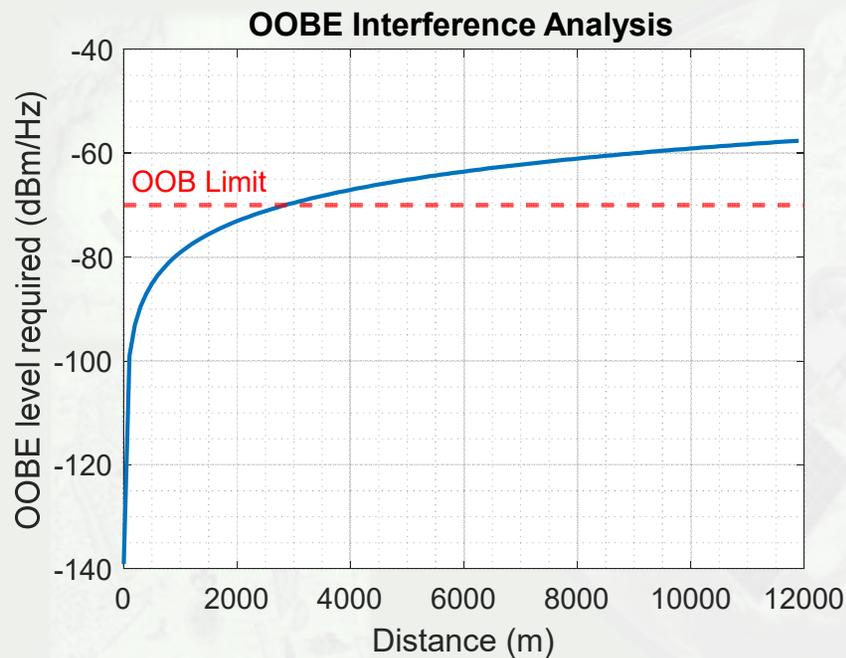
Additional Parameters of RDSS Receiver characteristics w.r.t MIFR	Values
RF filter 3 dB bandwidth	16.5/24/60/90 MHz
Pre-correlation filter 3 dB bandwidth	16.5 MHz
Receiver Noise Figure	2 dB
Receiver System Noise Temperature	270 K
Threshold power density level of aggregate wideband interference (incl. all non-RNSS interferences) at the passive antenna output	-150.3 dBW/MHz
Threshold power level of aggregate narrowband interference (incl. all non-RNSS interferences) at the passive antenna output	-160.3 dBW

Reference:

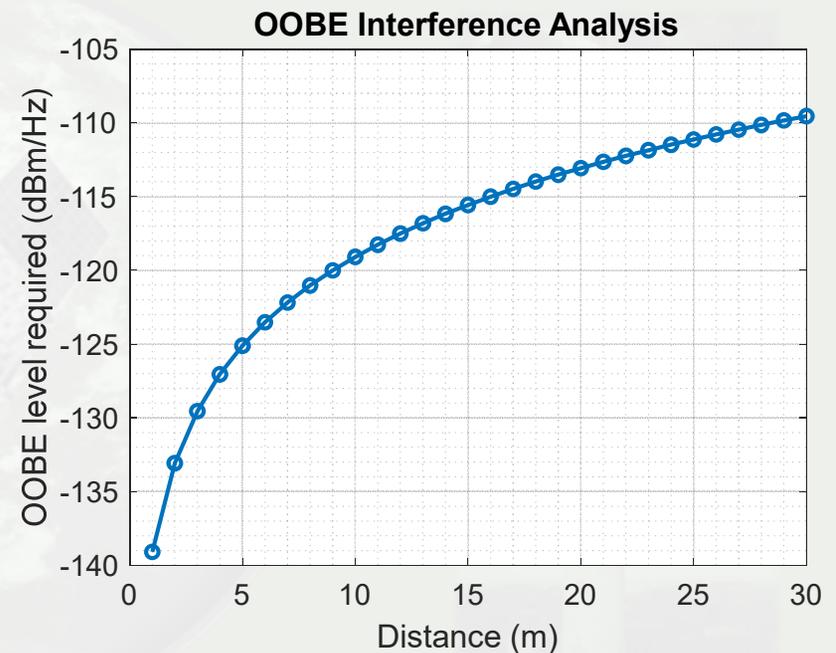
1. Inputs submitted to WP-4C/340-E 15 April 2025 document.
2. *These inputs will be submitted for WRC-27 agenda item 1.15 to ITU-R Working Party 7B (WP 7B) in March, 2026.*

WLAN Transmitter Parameters	Values	Ref
Transmit EIRP Density (OOBE)	-10 dBm/MHz	ETSI EN 300 328 v1.8.1 and ETSI EN 301 893 v1.7.1

OOBE Interference Analysis



Considering present OOB limits, minimum keep-out distance is ~ 2.7 kms.



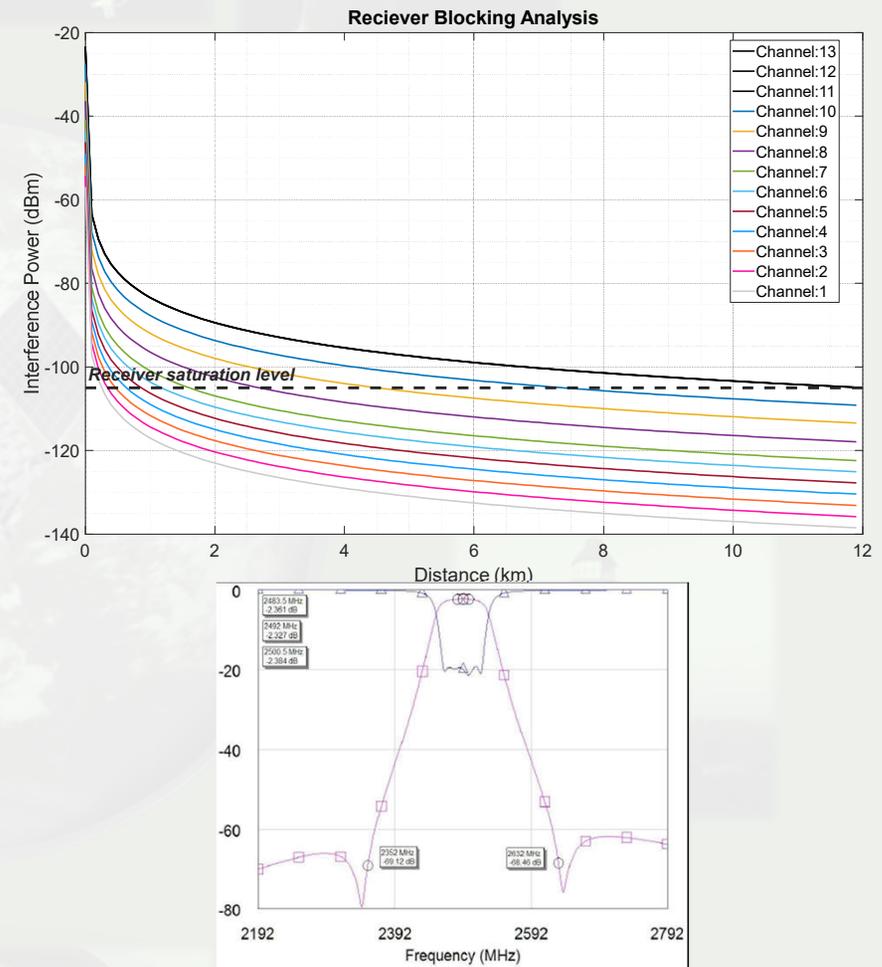
For coexistence at 5 m, OOB limit to updated as -125 dBm/Hz in place of existing -70 dBm/Hz (Reduction of ~55 dB).

Parameters

Parameters	Unit	Specifications	References
IMT WLAN Transmitter Signal Parameters (OOB)			
Transmit EIRP	dBm	20	ETSI
Interference Calculation			
Receiver Saturation Level	dBm	-105	Typical Value
WLAN Channels	#	7 to 13	ITUR-M.1903
Receive Filter BW	MHz	60	Calculation

Required Keep-out distance

Channel No.	Unit	Value
1	km	0.3
2		0.4
3		0.5
4		0.6
5		0.9
6		1.2
7		1.6
8		2.7
9		4.5
10		7.3
11 to 13		12

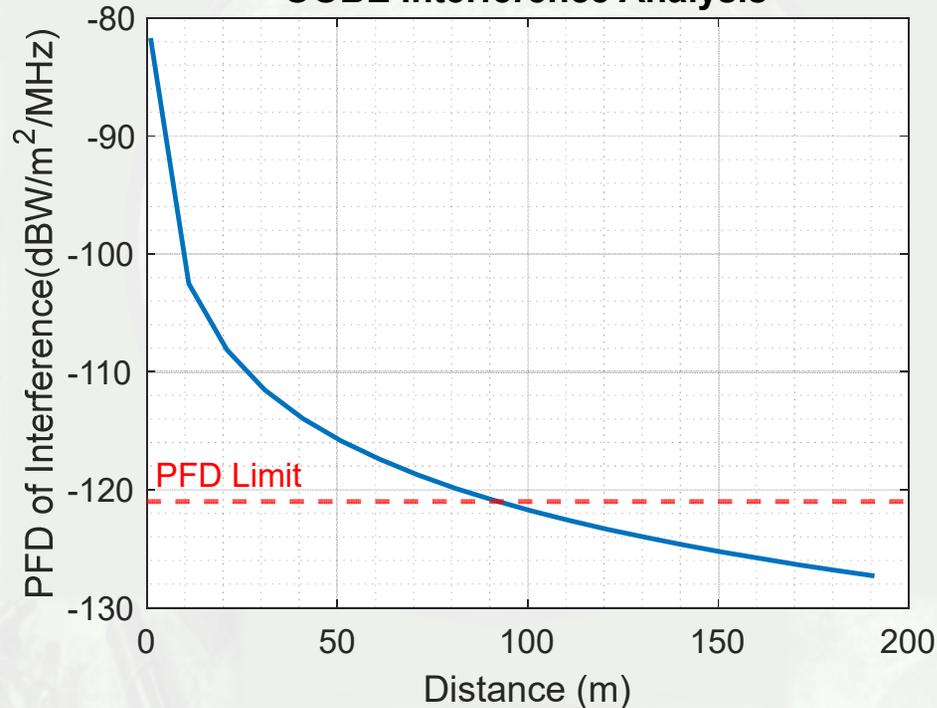


As a result of receiver saturation, minimum keep-out distance is ~300m between WLAN & S-band receiver.

PFD Analysis

Parameters	Unit	Specifications	References
Oobe Parameters			
PFD limit	dBW/m ² /MHz	-121	SFCG 43-1
Transmit EIRP Density (I0)	dBW/MHz	-40	ETSI

Oobe Interference Analysis



SFCG 43-1 criteria of PFD limit of -121 dBW/m²/MHz does not permit the coexistence within ~90m of keep-out distance



Thank You

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