



Telecommunications
Standards Development
Society, India

TECH DEEP DIVE

TTDD 2025 CONFERENCE (8th EDITION)

STANDARDISING 6G:

ARCHITECTING INTELLIGENT, SECURE AND SUSTAINABLE NETWORKS & SERVICES

 **Date:** 15-18 July 2025

Media Partner

COMMUNICATIONS TODAY

Session #3 - Future path and challenges for integration of non-terrestrial (Satellite, HAPS and UAVs) & terrestrial networks for 6G communication

16 July 2025

Integration, Differentiation, and Harmonization -- Perspectives on NTN in 6G

by

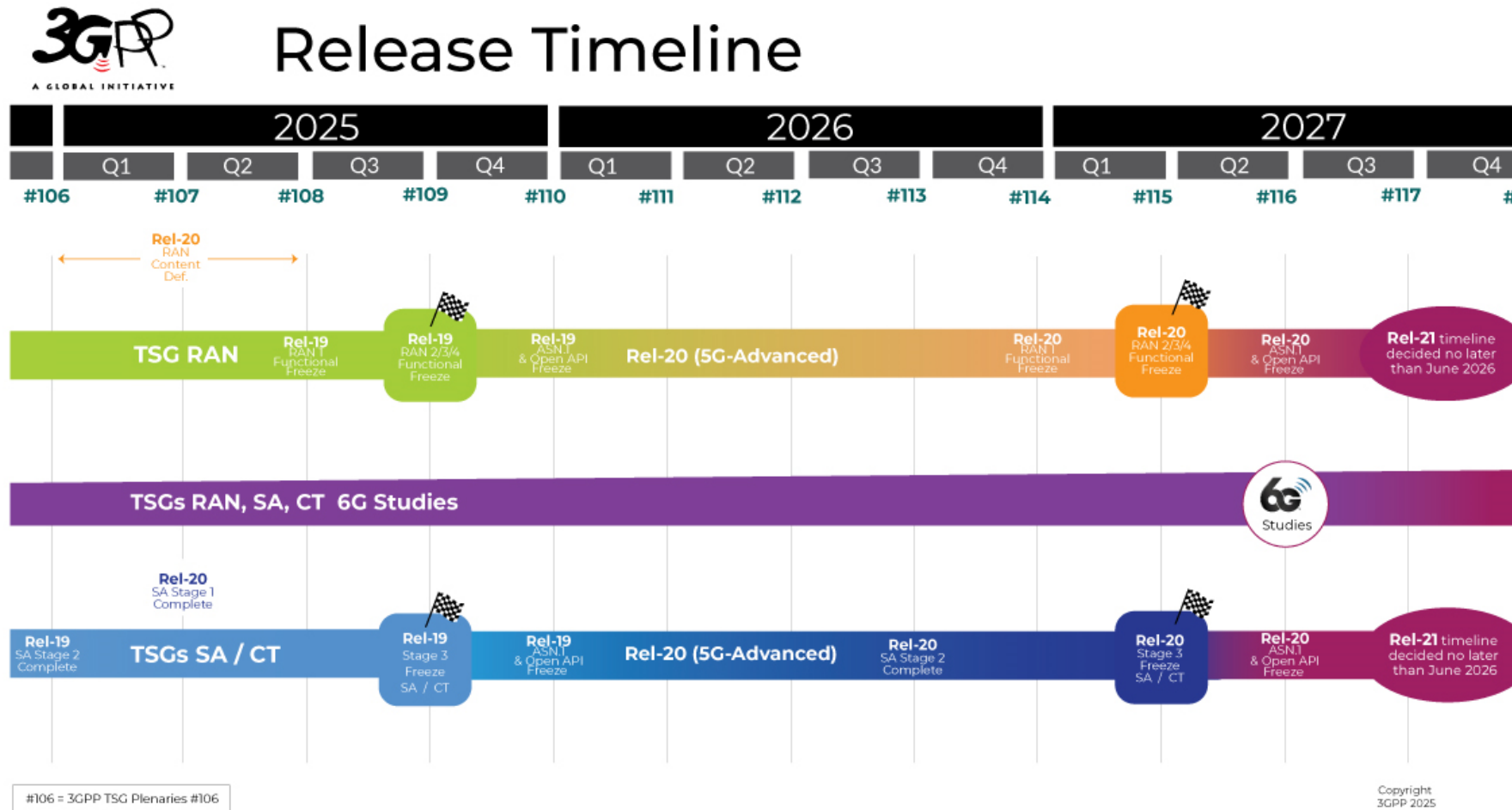
Dr. Nandan Das (Viasat)



What has a taxi ride got to do with 6G?



6G coming (not very) soon

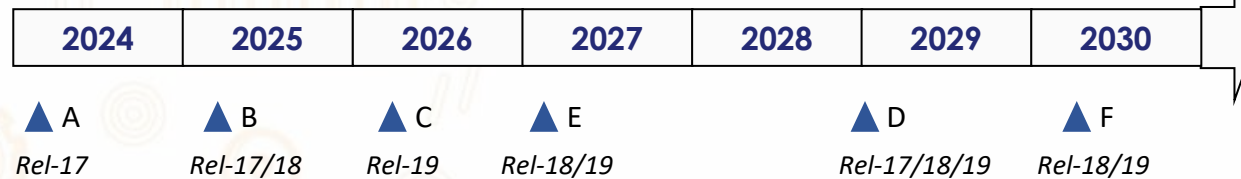


<https://www.3gpp.org/specifications-technologies/releases/release-20>

NTN coming sooner

Scenarios	A	B	C	D	E	F
Service	IoT-NTN, Messaging & voice			Broadband		
3GPP NTN RAT	IoT-NTN	IoT-NTN	IoT-NTN	NR-NTN	NR-NTN	NR-NTN
Orbit	GSO	NGSO	NGSO	NGSO	GSO	NGSO
Duplex mode	FDD	FDD	TDD	FDD	FDD	FDD
Payload	Transparent	Transparent/Regenerative			Transparent/Regenerative	Transparent/Regenerative
Bands	Below 7.125 GHz (e.g. L/S bands)			Above 10 GHz (e.g. Ku/Ka band)		
Targeted devices	IoT & Smartphones (D2D)			Smartphones	Fixed and Mobile VSAT	
Potential SNOs	EchoStar Viasat/Inmarsat Ligado TerreStar Solutions Thuraya Skylo	Sateliot EchoStar OmniSpace	Iridium	EchoStar, Viasat, Ligado, Thuraya	Eutelsat Group Hispasat Intelsat, Ovzon, SES, Intelsat, JSAT	SpaceRISE Eutelsat Group, Intelsat

Earliest service opening for each scenario (and related 3GPP releases)



Source: **RP-250302**
3GPP TSG RAN Meeting #107

Differentiated NTN

Differentiated by orbits and payload architecture

- GSO, NGSO, MEO, VLEO etc. Multi orbit
- Transparent, Regenerative, Semi Transparent

Differentiated by types of service

- NB vs NR
- Emergency/Safety, Consumer Entertainment

Differentiated by frequencies

- L/S, Ku, Ka
- Other bands for NR-NTN have been recently proposed for some regions

Differentiated by verticals and markets

- Consumer vs enterprise

Differentiated by UE types

Big Question: Can a “harmonized” PHY accommodate such a variety?

Integrated NTN

Integrate the fundamental NTN enablers (“hooks”) from the initial stages of 6G development

- Different approach than 5G

The satellite channel is just another radio channel

- PHY must be able to deal with delay and Doppler of satellite channel

6G radio interface/access should support diverse UE types

- Not all UEs have GNSS receivers
- Accurate and resilient positioning

NTN-TN Dual connectivity and mobility

- TN to NTN mobility (and vice versa) shall be seamless

Further Reading: **RP-250880**
3GPP TSG RAN#108 Meeting

Evolution for deployed 5GAdvanced NTN systems

- How does 6G NTN and 5GAdvanced NTN systems coexist
- Can we adopt a non-backwards compatible PHY

Path forward for NB-IoT-NTN

- 5GAdvanced will be improving it by adding voice
- From ePC to 6GC?
- How about HO between satellites in an NGSO constellation

Complex interference and co-existence issues

- Regulatory landscape is rapidly changing
- How does 3GPP address uplink/downlink interference in the same band
- Interference between different NTN systems

Sovereignty Issues are at the forefront

- Countries want to have confidence that their laws will be adhered to
- Interference issues are no longer limited to a country's border regions

Thank You
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