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Future & Current Demand for mmWave

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The global voice of the satellite industry to promote common interests at national, regional & global levels.

2002 - 2013 **Europe**

2014 - 2021 **EMEA**

2022 **Global**

GSOA Members

29 operators | Global and Regional | CEO-driven

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Licensing the 26 GHz Band:
Support for 5G -v- Protection of Existing Services

Satellite industry has supported 26 GHz band for 5G

⇒ Historically used for various applications - Inter-Satellite-Links / space science / feeder links for UL to BSS satellites

⇒ Basis for our support:

1. Ability to deploy new coordinated earth stations (today only 1 in UK using 26 GHz
2. Protecting satellite receivers from aggregate interference from 5G base stations

⇒ Request OFCOM to implement & enforce conditions and sharing measures foreseen by WRC-19 Res 242 & EU Decision 2019/784

A Balanced Approach will ensure a successful outcome

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Protecting Satellite in 26 GHz - 3 types of requirements

Technical Constraints on 5G base stations:

⇒ UK Licence conditions should reflect the constraints on the power/antenna characteristics of mobile base stations, deployment constraints, such as antenna pointing restrictions and limitation to land mobile use

Acceptable Density of Base Stations:

⇒ Res 242 & the EU Decision refer to an ongoing monitoring of IMT system deployment to ensure base station density does not cause interference to satellite uplinks. This requires UK mobile licences to include a reporting requirement to acquire/make available data on the number/location of base stations deployed & their characteristics

Potential for Future Sharing:

⇒ Res 242 & the EU Decision recognise the need to share some parts of the band with existing & new FSS earth stations. Operators may wish to deploy in the UK, in/near high or low density areas meaning some geographic separation would be required => UK licenses should foresee some conditions regarding sharing with earth stations

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Licensing the 40 GHz Band:
Support for 5G -v- Growth of New Satellite Services

Satellite industry supports conditional use of the 40 GHz band for 5G

⇒ Growth band for future higher capacity services - experimental use by multiple operators

⇒ Basis for our support:

1. Protection of satellite DL (40.5-42.5 GHz) with separation distances
2. Protection of satellite UL (42.5-43.5 GHz) - satellite receivers from aggregate interference from 5G base stations & need to protect 5G base stations from satellite interference
3. Ability to deploy new coordinated earth stations in future

⇒ Adjacent band 39.5-40.5 GHz - planned for ubiquitous satellite services

A Growth Band for both satellite & mobile

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UK Licensing & Authorisation Regime

Request OFCOM to implement & enforce conditions & sharing measures foreseen by WRC-19 Res 243 & Draft ECC Decision 22/06 (& future EU Decision)

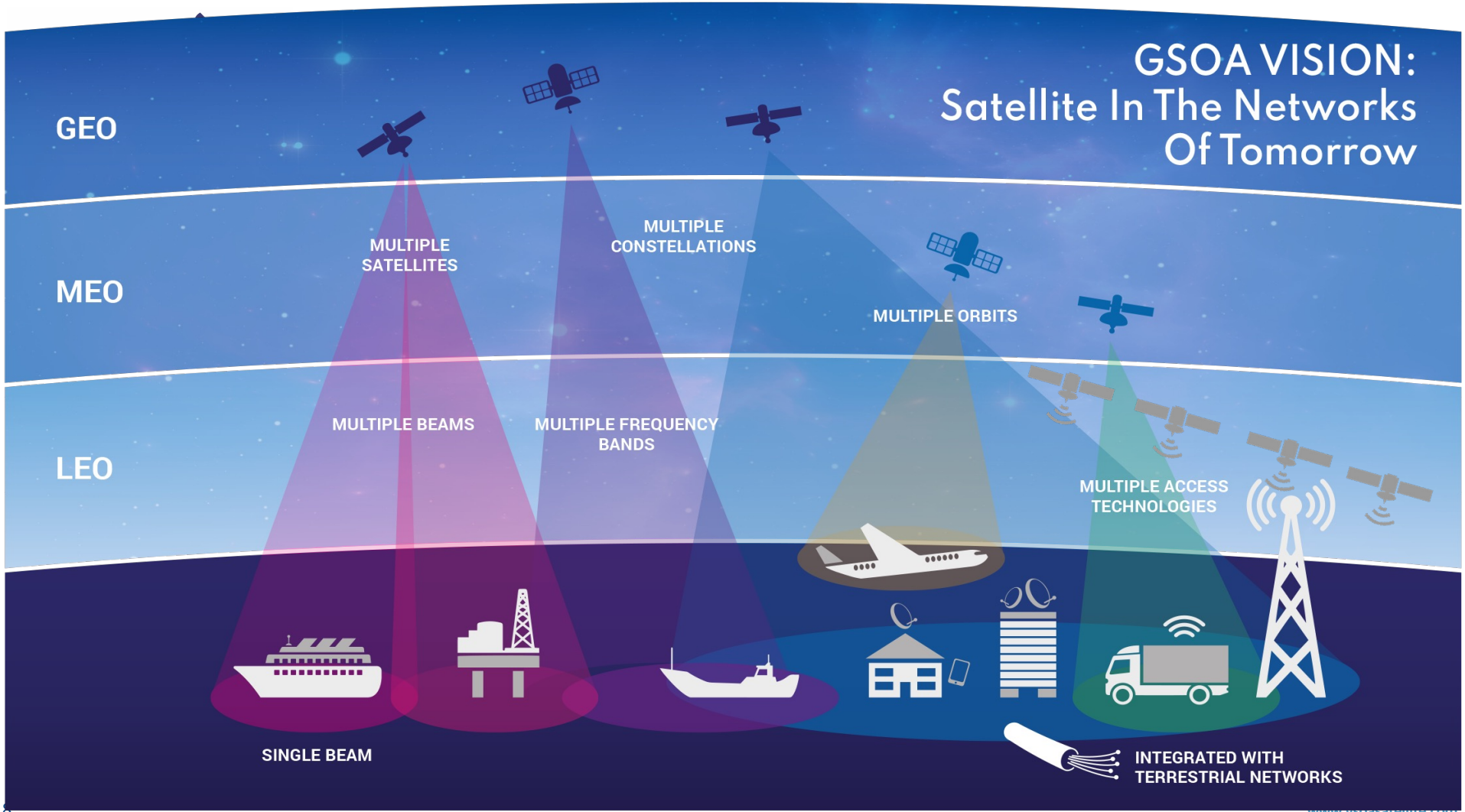
UK licence and authorisation regime for terrestrial mobile services in the 40 GHz band should include:

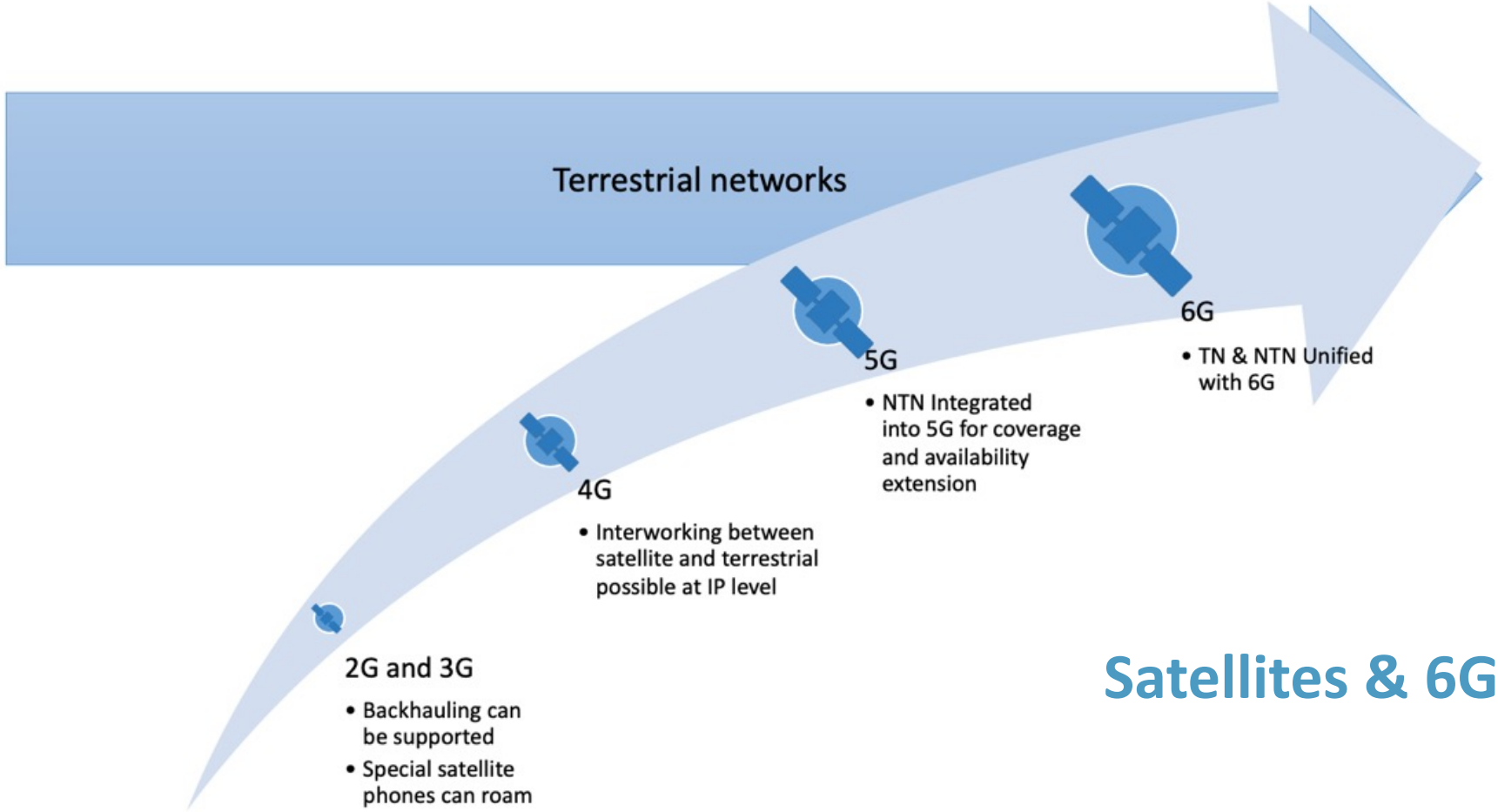
⇒ Technical limits and deployment constraints on base stations & their antennas

⇒ A reporting requirement for the number of base stations deployed

⇒ Licence conditions to enable sharing with FSS earth stations

GSOA Encourages OFCOM to address these issues in developing its licensing regime for the 26 & 40 GHz bands


GSOA VISION:
Satellite In The Networks Of Tomorrow
GEO
MEO
LEO
MULTIPLE SATELLITES
MULTIPLE CONSTELLATIONS
MULTIPLE ORBITS
MULTIPLE BEAMS
MULTIPLE FREQUENCY BANDS
MULTIPLE ACCESS TECHNOLOGIES
SINGLE BEAM
INTEGRATED WITH TERRESTRIAL NETWORKS



Satellites & 6G

Innovating & developing standards to support an evolving ecosystem

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Satellites & 5G/6G - 3GPP Release 18 & beyond

1. 3GPP's Release 17 was frozen in June 2022 including NR-NTN & NB-IoT NTN functions

2. Release 18 includes enhancements of 5G NR - NTN via GSO/NGSO above 10 GHz:

⇒ VSAT ESIM devices with directive antenna incl. on moving platforms **using 28 GHz as reference**
⇒ Dynamic conditions backhaul (bandwidth and latency)
⇒ NR-NTN in above 10GHz (targeting Ku/Ka bands)
⇒ Coverage and performance enhancements
⇒ TN to NTN and NTN to NTN mobility enhancements
⇒ Service continuity and discontinuous coverage enhancements
⇒ Network verified UE location, for regulated services

3. Targeted for Release 19

⇒ Regenerative payloads
⇒ Store and forward capabilities
⇒ UE without GNSS
⇒ Relay-based architecture for NTN
⇒ Broadcast over 5G NTN

⇒ Clear way forward for NTN
mmWave bands are crucial to future developments

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Lessons Learned: 28 GHz is a Satellite Band

The Need for Regulatory Certainty

Terrestrial vendors/some MNOs continue to push for 28 GHz for 5G/6G:

⇒ **Samsung's 6G Spectrum Vision**:
- considers mmWave band as '24-92 GHz' => will play a very important role in 6G
- notes that 28 GHz, the 5G frontier band, already commercially deployed in US, Korea, Japan

⇒ **South Korea's 5G Forum**: mmWave needs to be used to satisfy the extremely wide range of service requirements of 6G

⇒ **Korea**: 28 GHz for IMT in 2018 - frequencies not for "use" by satellite applications; 3 years later, less than 200 base stations => from a spectrum management perspective, they removed any flexibility of use by FSS without a certain 5G market

⇒ **Hong Kong**: MNO requirement of 2500 base stations by 2024 reduced to 500 by 2024, 1250 by 2025, remainder by 2026 despite 2900 MHz available/unassigned in 26 GHz => HK effectively precluded 5 years of potential satellite deployment in the 28 GHz band to get 500 base stations of mmWave 5G service by 2024!

Europe (& the UK) was right! 28 GHz maintained for satellite in the face of uncertain 5G demand

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Learning from the US

- ⇒ **Verizon**: 28 GHz important "for sporting venues and very high-density pedestrian locations”
- ⇒ **Device availability**: 2020 iPhone had mm wave but only in the US. Latest 2022 iPhone SE does not support mm wave band - costly to integrate: allows for less RAM/no room for microSD expansion *(despite AT&T & Verizon’s continued insistence otherwise)*
- ⇒ **2016: FCC Chair Tom Wheeler**: told the satellite industry to "get on the train or be run over by it” with respect to 28 GHz band
- ⇒ **2021: FCC Acting Chair Jessica Rosenworcel** “… the FCC made a ***mistake*** … when it focused … on spectrum called millimeter wave ... those airwaves are really high up - their ***signals don't travel very far***. … you have to have lots of ground based facilities … that's ***really costly*** ... if we just relied on millimeter wave spectrum ***we'd actually grow the digital divide with 5G***. … in the last year we’ve realized we need to pivot from mmWave to mid-band spectrum. That’s the sweet spot, that’s how we are going to deploy 5G across the country”

A measured approach is required in order to avoid creating uncertainty and stifling innovation & growth

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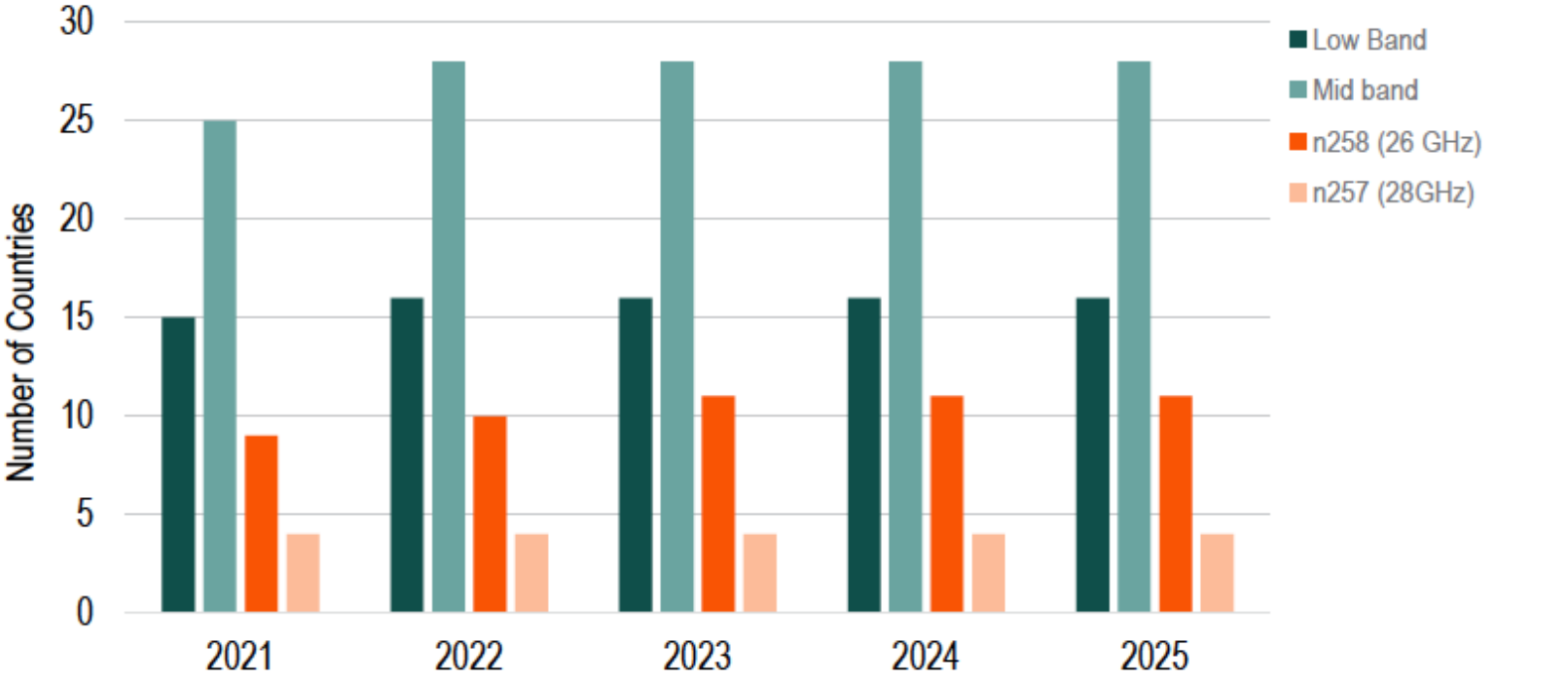
Current and expected spectrum allocation for terrestrial 5G in emerging markets, 2021-2025

(Source: ABI Research)



ABI Research: *Emerging Markets Broadband Objectives: Spectrum Requirements (2021)*
https://go.abiresearch.com/lp-emerging-markets-broadband-objectives-spectrum-requirements.

Some MNOs do need 28 GHz – for satellite!

British Telecom (BT) selected by UK government to provide the radio access network service for UK Emergency Services Network (ESN)

2 priorities: coverage for emergency services + network resiliency

- ⇒ VSAT terminals allow BT to back up fibre/microwave links with satellite: an effective way of significantly increasing uptime of network
- ⇒ Increasingly important as BT starts to deliver ever more reliable services: vital for BT to be able to decouple failures in terrestrial network infrastructure - a space-based component makes that easier

BT exploring investments into more satellite to support 5G applications requiring ultra high reliability