

IAFI - SPACE POLICY CONFERENCE (ISPC 25)

DIRECT TO DEVICE SATELLITE COMMUNICATIONS

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WHAT TO EXPECT:

- ❖ Introduction of Direct-to-Device Technology (D2D)
- ❖ Spectrum Issues for D2D and MSS
- ❖ WRC 27 agenda items 1.11, 1.12, 1.13 and 1.14
 - ❖ India's Preliminary views
- ❖ D2D Technology, Regulations and Standards
- ❖ D2D Market Opportunities



INTRODUCTION OF DIRECT-TO-DEVICE TECHNOLOGY (D2D):



- Innovation to address connectivity challenges, particularly remote or underserved or unserved areas, including maritime, aeronautical, desert, mountainous regions etc.
- Direct interaction between satellites and end-user devices such as smartphones by utilizing frequency spectrum allocated to:
 - Mobile-satellite service (MSS)
 - Land mobile service (LMS)
- GEO spacecrafts in D2D – Viasat (utilizing MSS spectrum), Skylo (narrowband IoT)
- LEO/MEO constellations in D2D – Starlink (in partnership with T-Mobile), Lynk Global (Sat2Phone), AST SpaceMobile (partnership with MNOs like AT&T and Vodafone), Globalstar (iPhone SoS services)



➤ **D2D in MSS frequency bands:**

- Utilize MSS frequency spectrum, such as L and S bands – supports smartphones, IoT devices etc.
- Utilize established standards for seamless integration of satellite and terrestrial networks
- Offer high-quality voice, data, and IoT communication without requiring additional regulatory frameworks in many countries.
- Ensure minimal interference due to well-defined spectrum allocations

➤ **D2D in LMS frequency bands:**

- Uses LMS frequency spectrum to complement terrestrial mobile networks,
- Address connectivity gaps (where terrestrial infrastructure is unavailable)
- Requires partnerships between satellite operators and MNOs for spectrum sharing
- Updated regulatory frameworks must address interference management and power limitations



WRC 27 AGENDA ITEMS RELATED TO D2D



- ✓ Agenda item 1.13 - **MSS in IMT** (Resolution 253) - Possible new allocations to MSS for direct connectivity between space stations and IMT user equipment to complement terrestrial IMT network coverage.
 - 694/698 MHz and 2.7 GHz taking into account IMT frequency arrangements addressed in ITU-R M.1036
 - *ITU context as “DC-MSS-IMT”*
- ✓ Agenda item 1.11 - **MSS sat-sat link** (Resolution 249) - Space-to-space link between NSGOs and GSOs.
- ✓ Agenda item 1.12 - **Low-data-rate MSS** (Resolution 252) - Possible allocations to MSS and possible regulatory actions in certain frequency bands for LDR-MSS systems.
- ✓ Agenda item 1.14 - **MSS in 2 GHz** (Resolution 254) - Additional allocations to MSS



INDIA'S PRELIMINARY VIEW:

- ✓ **Agenda item 1.13** - India supports ongoing ITU-R studies on new allocations for MSS to enable direct connectivity with IMT in the 694/698 MHz to 2690 MHz range. Any new allocation must not cause interference to, claim protection from, or impose extra constraints on existing and future operation of incumbent services. Sharing and compatibility studies must ensure protection of services operating in adjacent bands.
- ✓ **Agenda item 1.11** - India supports ongoing ITU-R studies regarding use of identified frequency bands for Space-to-Space links among NGSO and GSO satellites and operated in conjunction with coordinated MSS (E-s and s-E) networks in these bands; ensure protection of existing and future operation of incumbent services in these and adjacent frequency bands.
- ✓ **Agenda item 1.12**: These bands and their adjacent frequencies, are already heavily used by existing services. Any new narrowband NGSO MSS requirements should be accommodated in existing MSS bands or other potential new bands considered in this AI & AI 1.14.
- ✓ **Agenda item 1.14** - Extensive deployment of terrestrial IMT networks and other critical services in this band and adjacent to 2160-2170 MHz and 2120-2160 MHz and therefore NOC (No change) for these frequency bands. For the frequency band 2010-2025 MHz, India supports ongoing sharing and compatibility studies within ITU-R.

D2D technology refers to two main concepts:

- ✓ **Satellite-based connectivity** - allows standard smartphones to connect directly to satellites (GSO or NGSO satellites), enabling communication in remote areas or situations where cellular networks are unavailable.

Ex. BSNL D2D services - enabling phone calls, messages and UPI payments via satellites.

- ✓ **Device-to-device communication within cellular networks** - within cellular networks, devices communicate directly with each other, bypassing the base station, which can improve network efficiency and offer proximity-based services.

Ex. 5G and future 6G technologies to enable efficient D2D communication



Regulatory frameworks already implemented or under consideration in various countries; close to 10 countries have either amended their regulations or launched public consultations aimed at integrating D2D services into their national frameworks.

- **USA:** FCC adopted comprehensive framework for integrating satellite-based connectivity with terrestrial mobile networks;
 - issued “Supplemental Coverage from Space” (SCS) order designated specific freq. band to expand coverage for communication and emergency services - including 600 MHz, 700 MHz, 800 MHz, Broadband PCS, and AWS-H Block;
 - Identified new frequency bands for MSS allocations to support D2D services that do not rely on IMT spectrum.



- **Brazil:** National Telecommunications Agency (ANATEL) introduced a regulatory sandbox to facilitate D2D trials;
 - Operators and MNOs to test D2D services in the 800 MHz band;
 - supports innovation and efficiency while addressing key challenges such as interference and interoperability.
- **Australia:** Australian Communications and Media Authority (ACMA) published a regulatory guide for D2D services following public consultations;
 - identifies the 700 MHz, 800 MHz, 850/900 MHz, and 2.5 GHz bands as suitable for IMT-based D2D services;
 - emphasize need for coexistence and addressing interference issues.

REGULATIONS:



- **Canada:** Canada's Innovation, Science, and Economic Development (ISED) completed a consultation on a policy, licensing, and technical framework;
 - Identifies frequency bands - 600 MHz, 700 MHz, 800 MHz cellular, AWS-1, AWS-3, and PCS bands, for potential D2D applications;
 - ISED announced the Decision fostering investment and competition
- **Saudi Arabia:** Communications, Space, and Technology Commission (CST) addressed satellite connectivity in its 2024-2027 Spectrum Outlook.
- **Zambia:** Information and Communications Technology Authority (ZICTA) launched a public consultation for use of IMT spectrum between 694 MHz and 2.7 GHz in underserved/unserved areas.

STANDARDS:



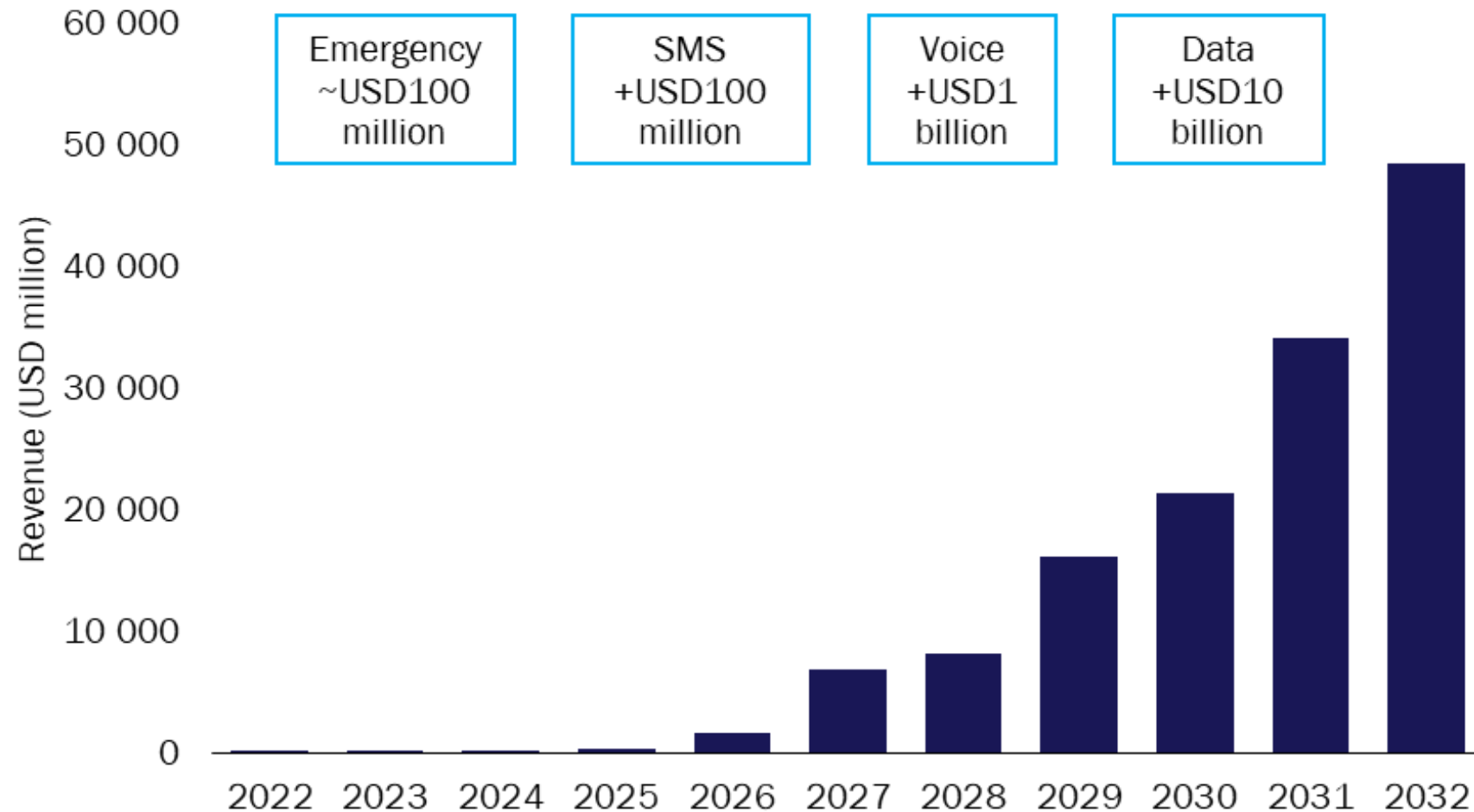
3rd Generation Partnership Project Release 17 (3GPP Rel-17) standard

- **Enable full integration of satellites** within 3GPP ecosystem to supports future sat. networks
- **Compatibility between NTNs and terrestrial systems** - allowing D2D providers to use frequency spectrum in bands defined as n255 (UL: 1 626.5-1 660.5 MHz / DL: 1 525-1 559 MHz) and as n256 (UL: 1 980-2 010 MHz/ DL: 2 170-2 200 MHz)
- **No specialized hardware** in end-user compatible devices, facilitating cost-effective and widespread adoption
- **Advantages:** Seamless global connectivity across NTNs and Terrestrial Nks; improve network resilience; reachability & service continuity in unserved/underserved areas; Fosters interoperability, minimize interference risks, accelerate the deployment of integrated satellite-terrestrial ecosystems.



MARKET OPPORTUNITIES:

D2D connectivity market is expected to rapidly expand over the next years, as below.



Source: NSR

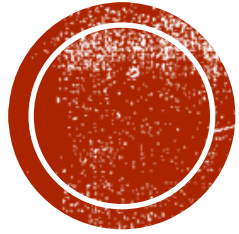


MARKET OPPORTUNITIES:



- Global Coverage would address direct connections between satellites and mobile devices, primarily in remote, underserved or unserved areas;
- Critical application of disaster response and emergency communications;
- Various Applications like:
 - environmental monitoring,
 - asset tracking in water and on land in remote location,
 - precision agriculture,
 - IoT Connectivity etc...





**THANK YOU FOR
YOUR KIND
ATTENTION !!!**

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