Viasat Perspective on Development of NTNs

Presentation to the UKSPF workshop:
"Landscape of NTN's and Spectrum Management"

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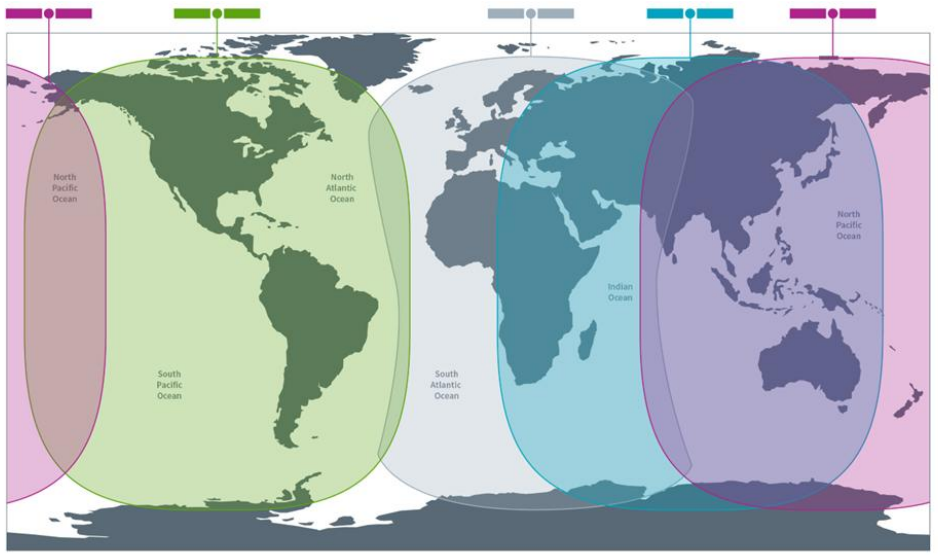
21 November 2024

Viasat

Traditional Viasat MSS service

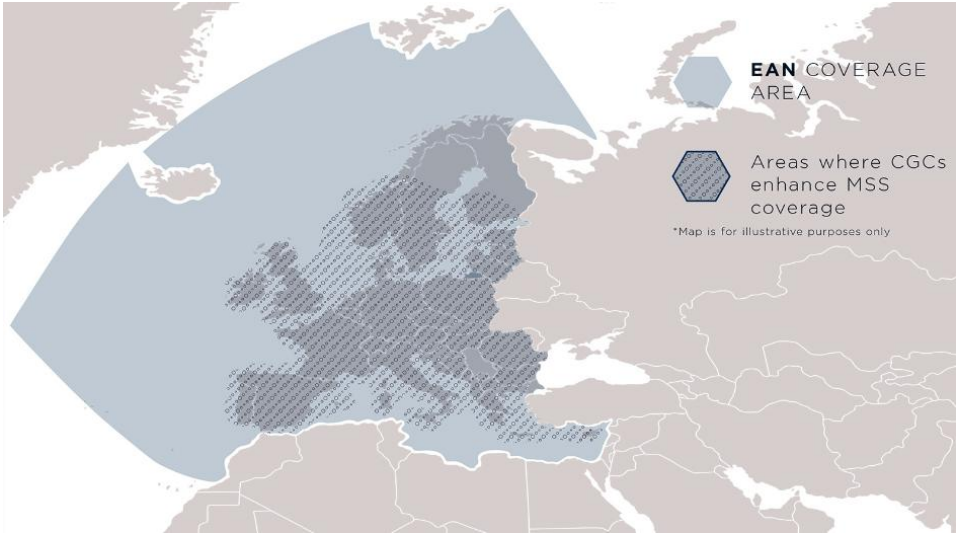
- Utilises allocated MSS spectrum
- Utilises Inmarsat GSO satellites, with multi-spot beam satellite antenna.
- End user segments: maritime, aeronautical and land
- Land terminals include handheld phone (*ISatphone*) and small/low power IoT devices (*ISatData Pro).*
- BGAN (used in L-band and S-band) was world-first 3G UMTS network
- Network backend is 3GPP compliant

L-band MSS coverage



For illustrative purposes only. Coverage is approximate and subject to change. Not representative of any single product or service.

S-band MSS coverage (European Aviation Network)



Developments in 3GPP and NTN

- 3GPP Standard **Release 17** added MSS L-band (n255/255) and MSS S-band (n256/256) for:
  - NR NTN
  - NB NTN (NB-IoT, eMTC)
- Other bands were introduced in **Release 18**, and new bands are currently being specified in **Release 19**
- NTN benefits:
  - User terminal availability, in particular incorporation of satellite capability into regular mobile phones (Direct-to-Device or “D2D”)
  - Narrowband supported, with roadmap to broadband
  - Roaming between satellite and terrestrial operators
  - Inbound/outbound roaming
  - Legal intercept
  - Location services
  - Broadcast/multicast
  - Ease of billing

NR NTN Band	Uplink (UL)	Downlink (DL)	Duplex
n256	**1980 – 2010 MHz**	**2170 – 2200 MHz**	**FDD**
n255	**1626.5 – 1660.5 MHz**	**1525 – 1559 MHz**	**FDD**
n254	1610 – 1626.5 MHz	2483.5 – 2500 MHz	FDD
n253	1668 – 1675 MHz	1518 – 1525 MHz	FDD
n252	2000 – 2020 MHz	2180 – 2200 MHz	FDD
n251	1626.5 – 1660.5 MHz	1518 – 1559 MHz	FDD
n250	1668 – 1675MHz	1518 – 1559 MHz	FDD

NOTE: Satellite bands are numbered in descending order from n256.

NB NTN Band	Uplink (UL)	Downlink (DL)	Duplex
256	**1980 – 2010 MHz**	**2170 – 2200 MHz**	**FDD**
255	**1626.5 – 1660.5 MHz**	**1525 – 1559 MHz**	**FDD**
254	1610 – 1626.5 MHz	2483.5 – 2500 MHz	FDD
253	1668 – 1675 MHz	1518 – 1525 MHz	FDD
252	2000 – 2020 MHz	2180 – 2200 MHz	FDD

NOTE 1: Satellite bands are numbered in descending order from 256.

NOTE 2: UE assigned to channels and allocated frequency resources in the lower portion of Band 253 may experience blocking or harmful interference from terrestrial networks in adjacent or nearby frequencies when operating in the proximity with terrestrial base stations.

Viasat

Offering commercial service today

In partnership with Skylo and Ligado Networks, Viasat is deploying the first global NTN D2D network, based on Rel-17+ NB-IoT and existing geostationary space assets.

Viasat + skylo ligado NETWORKS

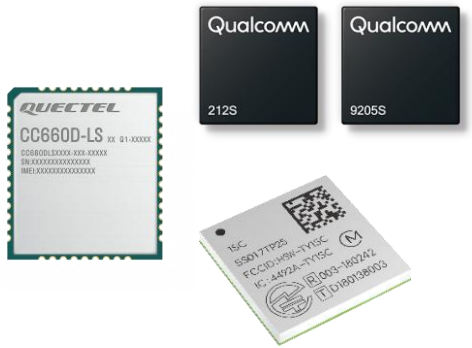
Some example devices with NTN support

CAT S75

Google Pixel 9

Vivo X90 Pro+

Motorola Defy Satellite Link



Chipsets and Modules from multiple manufacturers

MSSA

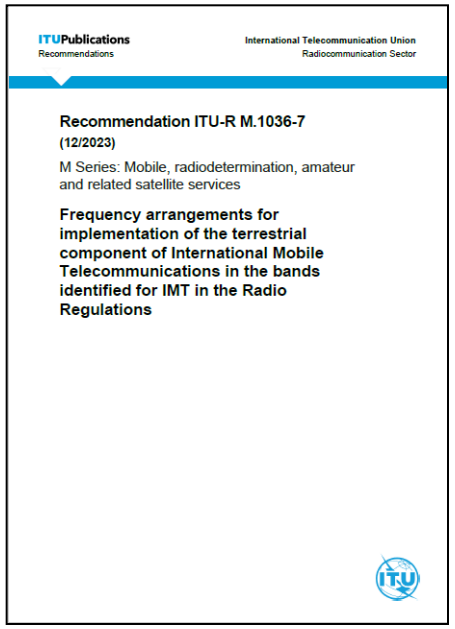
- **Mobile Satellite Services Association** established 2024 (www.mss-association.org).
- MSSA aims to promote the adoption of D2D and enhance seamless global roaming between terrestrial and multi-orbit satellite networks.
- MSSA is a forum facilitating adoption of open, interoperable architectures and standards for use in multi-orbit satellite systems, ground infrastructure, and end user equipment.
- Use of existing MSS bands means that D2D can operate in the existing regulatory framework.

MSSA
Mobile Satellite Services Association

Viasat
yahsat
ligado NETWORKS
omnispace
Terrestar
APEX
ERICSSON
FOCUSPOINT
TERRAN ORBITAL
DigitalLocations
Druid
eSAT GLOBAL
ULAK

MS-D2D

- Alternative approach to NTN, is use of the TN air interface for the UE to satellite links, using terrestrial IMT frequency bands (“D2D-IMT” or “MS-D2D”).
- Currently, only option for satellite links in terrestrial IMT bands is operation under **RR No. 4.4** (non-compliant with the Radio Regulations).
- **WRC-27 agenda item AI 1.13** seeks to develop new regulations for D2D in terrestrial IMT bands (i.e. for “D2D-IMT” or “MS-D2D”).
- New national regulations required, partially addressed for a sub-set of bands in some national proceedings, including USA (FCC Report and Order) and some in-progress proceedings (Canada, UK).



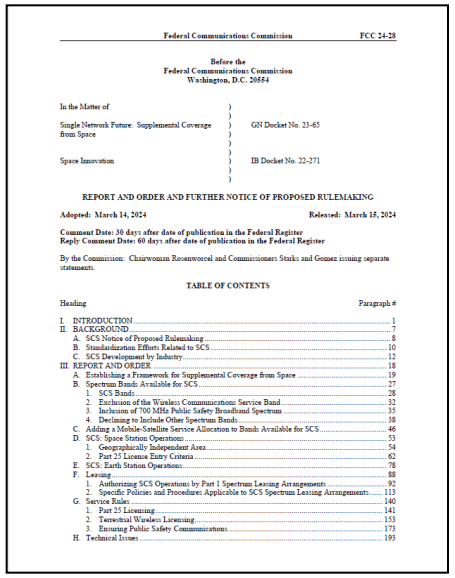
ITUPublications
Recommendations

International Telecommunication Union
Radiocommunication Sector

Recommendation ITU-R M.1036-7
(12/2023)

M Series: Mobile, radiodetermination, amateur and related satellite services

Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications in the bands identified for IMT in the Radio Regulations



Federal Communications Commission FCC 24-28

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of)
)
Single Network Future: Supplemental Coverage from Space) GN Docket No. 23-65
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Space Innovation) IB Docket No. 22-271
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REPORT AND ORDER AND FURTHER NOTICE OF PROPOSED RULEMAKING

Adopted: March 14, 2024 Released: March 15, 2024

Comment Date: 30 days after date of publication in the Federal Register
Reply Comment Date: 60 days after date of publication in the Federal Register

By the Commission: Chairwoman Rosenworcel and Commissioners Starks and Gomez issuing separate statements.

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Heading Paragraph #

Viasat

WRC-27 agenda item 1.13

- Long list of bands to be studied (see Table 1).
- Using IMT spectrum raises complex coexistence issues, in the same country and between countries, including potentially severe interference from in-band, out-of-band and spurious emissions to:
  - Terrestrial IMT systems
  - UHF DTV receivers
  - Passive services, including Radio Astronomy
  - Aviation systems, including DME and ADS-B
  - MSS user terminals in L-band (including safety systems) and S-band European Aviation Network
  - MSS satellites, from D2D satellites (space-to-space interference, in the same and adjacent bands)
  - Others...
- Will be challenging to address all the co-existence issues.

TABLE 1

List of the possible IMT frequency arrangements for MSS direct communication with IMT UE

Directionality	
Uplink (MHz)	**Downlink (MHz)**
807-849	852-894
880-915	925-960
832-862	791-821
698-716 776-798	716-746 746-768
698-748	753-803
1 427-1 470	1 475-1 518
1 920-1 980	2 110-2 170
1 710-1 785	1 805-1 880
1 850-1 920	1 930-2 000
1 710-1 780	2 110-2 180
2 000-2 020	2 180-2 200
2 010-2 025	1 880-1 920
2 305-2 320	2 345-2 360
2 500-2 570	2 620-2 690