Космическая связь
Федеральное государственное унитарное предприятие

# Development prospects of satellite communications and broadcasting services in the Russian Satellite Communications Company

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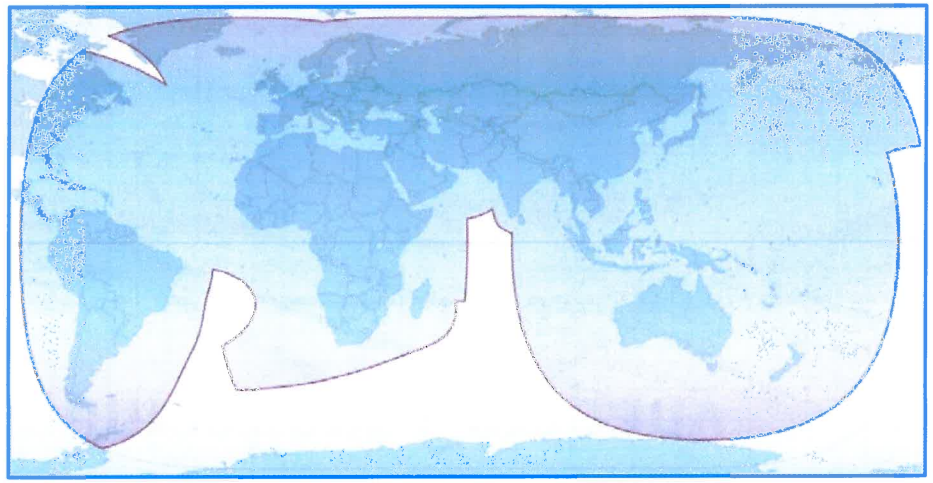
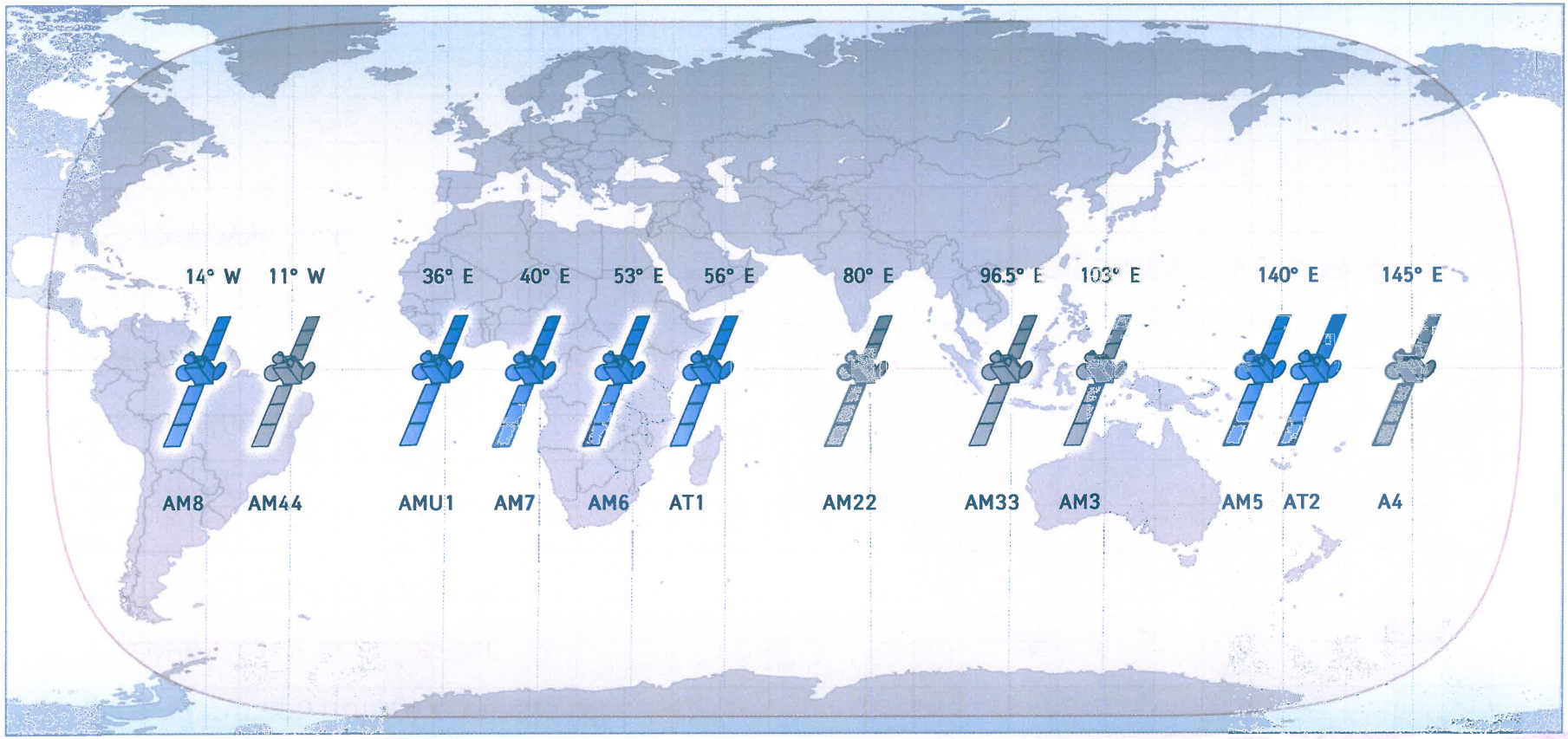
# Russian Satellite Communications Company (RSCC):

- Russian state satellite operator
- Number one satellite operator in Russia and the CIS
- Provides communications services for 52 countries worldwide
- Own satellite fleet of 12 communications and broadcasting satellites in the geostationary arc from 14° W to 145° E



Service area of RSCC satellites

# RSCC operational satellite fleet




Seven satellites were put into operation between 2014 and 2016.

# RSCC ground infrastructure

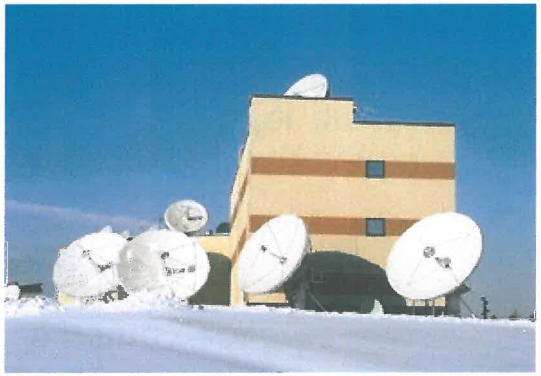
The ground infrastructure consists of:

- Shabolovka Technical Center
- five satellite communications centers:
  - Dubna SCC
  - Bear Lakes SCC
  - Skolkovo SCC
  - Zheleznogorks SCC
  - Khabarovsk SCC

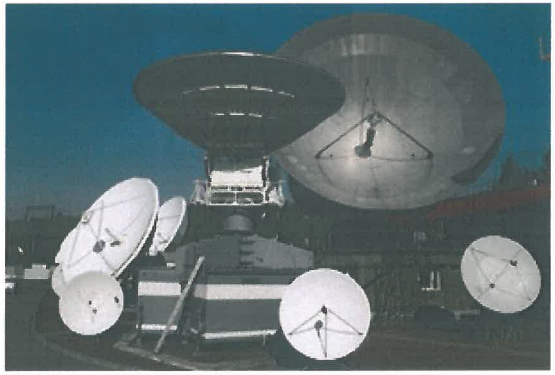

RSCC ground technical facilities

# RSCC ground infrastructure

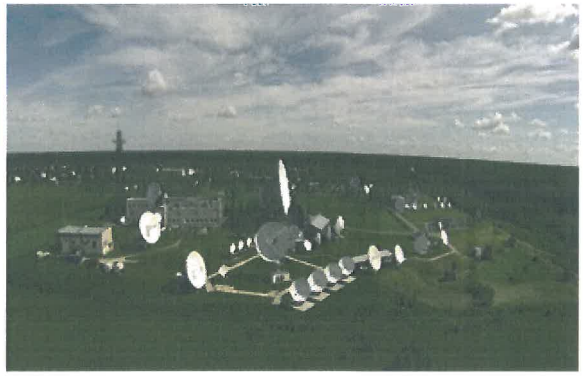
Shabolovka Technical Center



Skolkovo SCC



Bear Lakes SCC



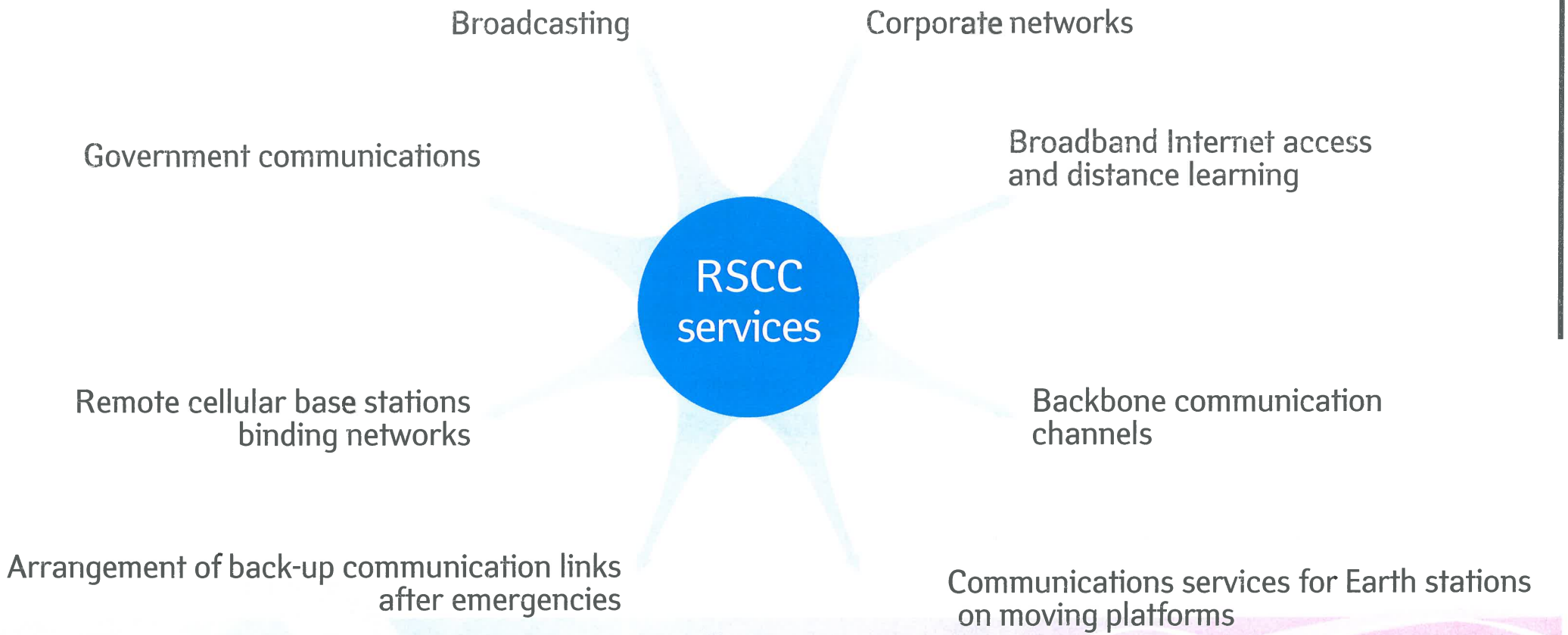
Dubna SCC

Vladimir SCS

Zheleznogorks SCC

Khabarovsk SCC

# RSCC key areas of activities



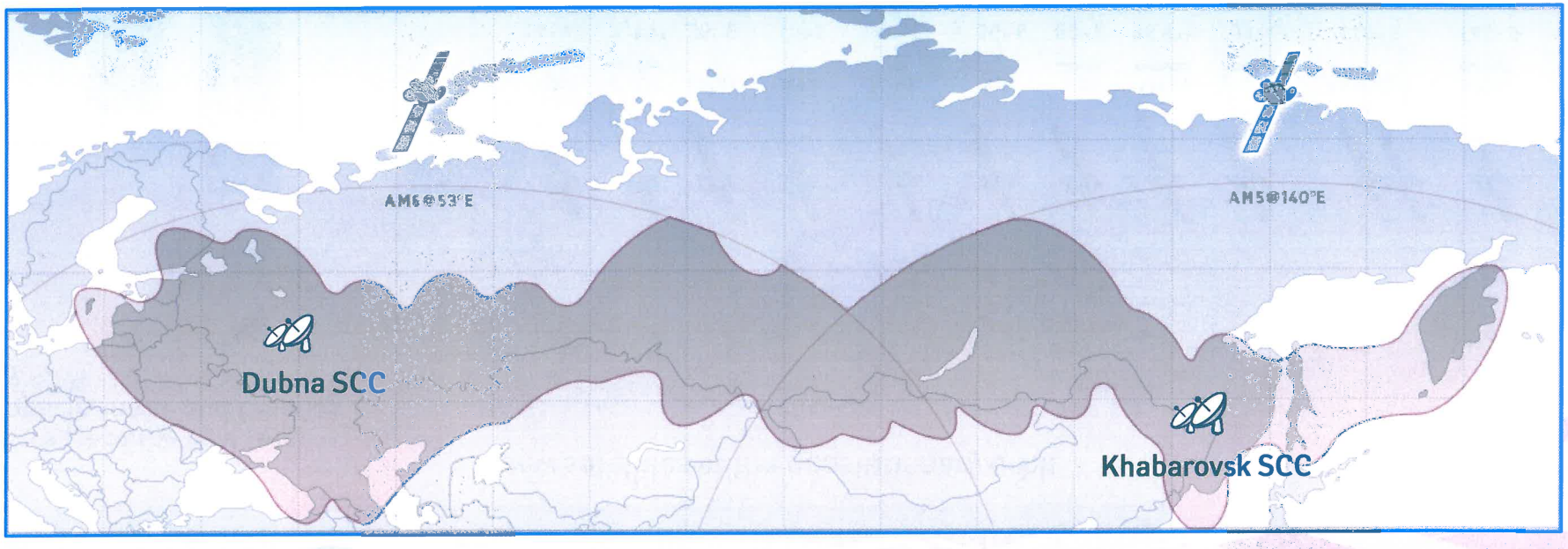
# Introduction of new services for satellite high-speed data transmission (Ka-band)

**In 2015, for the first time in Russia, satellite high-speed Internet access services were introduced in the Far East and Siberia by domestic RSCC satellites.**

In 2016 the service area was supplemented by the Central and South Ural regions.

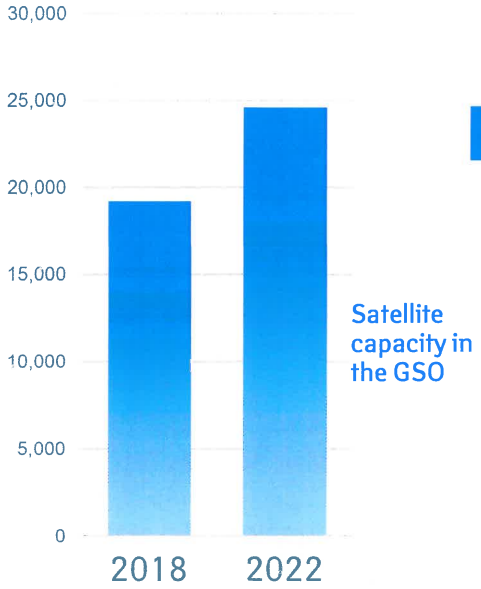
Satellite high-speed access network:

- Possibility to provide services for 200 thousand users
- Total system capacity of up to 12 Gbit/s
- Internet access speed of 6-10 Mbit/s
- Coverage of the territory where more than 80% of Russia's population lives
- Service area of 7 thousand km



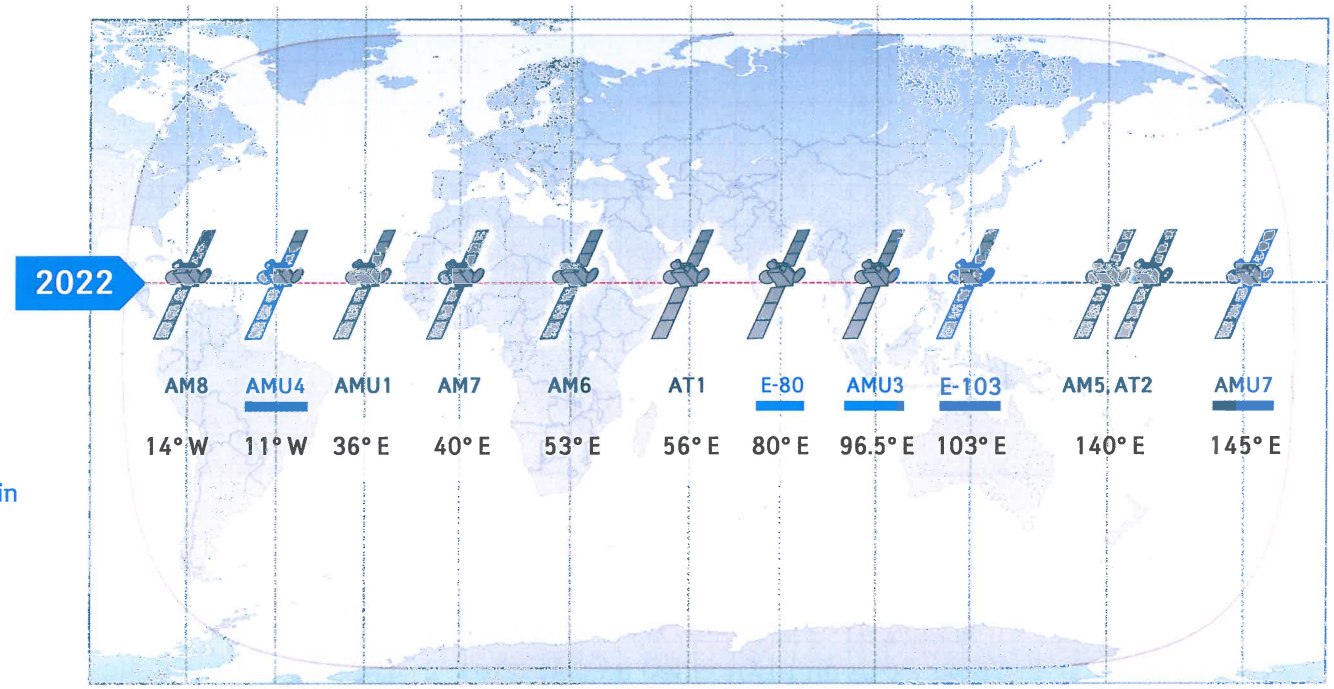
# Plans for extension of RSCC satellite fleet for the period up to 2022

**Increase of the fleet total capacity in Ku- and C-bands by 45%**




+ Ka-band throughput of 21 Gbit/s

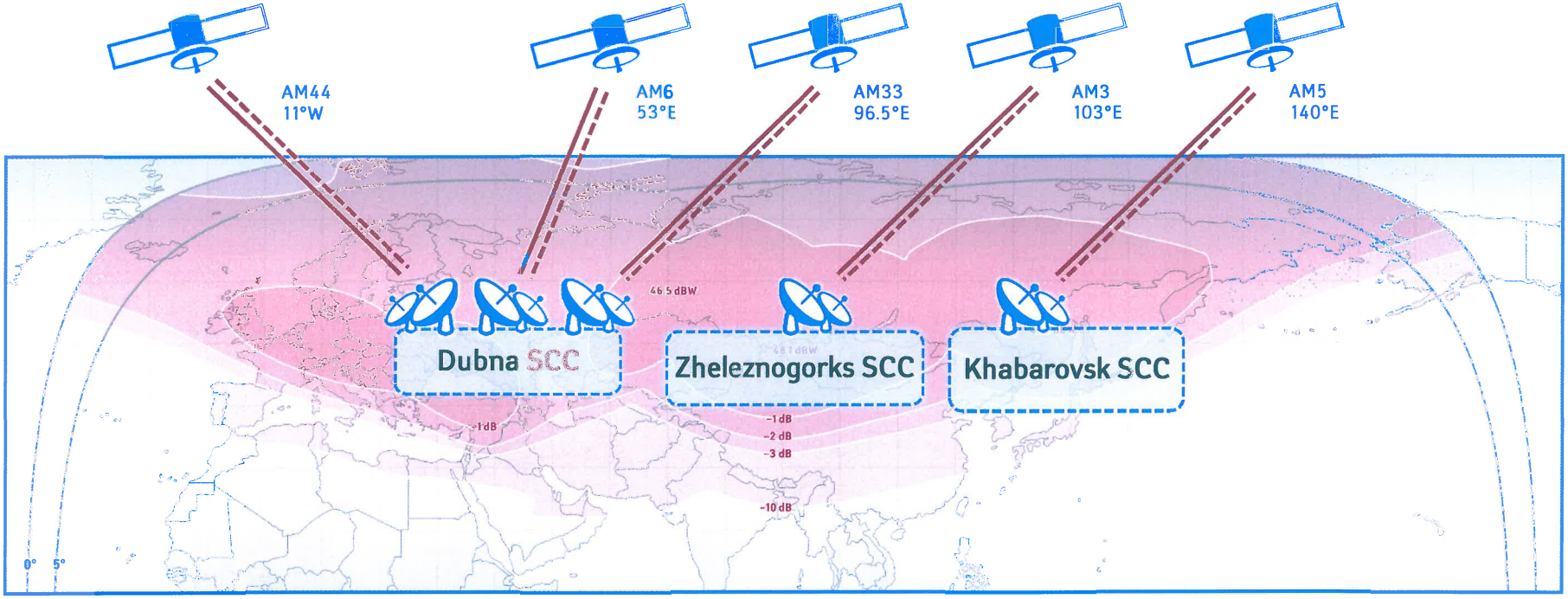
5 new satellites in the geostationary orbit




Satellites in the geostationary orbit

AMU New satellies to be launched

# RSCC VSAT network in Ku-band




RSCC VSAT networks in Ku-band are deployed based on iDirect and Hughes HN equipment. Central switching stations of VSAT iDirect network are located in Dubna, Zheleznogorsk and Khabarovsk satellite communications centers, VSAT Hughes HN networks - in Dubna and Khabarovsk satellite communications centers. The services are provided in Eurasia as well as in the adjacent waters of the Atlantic, Arctic and Pacific oceans.

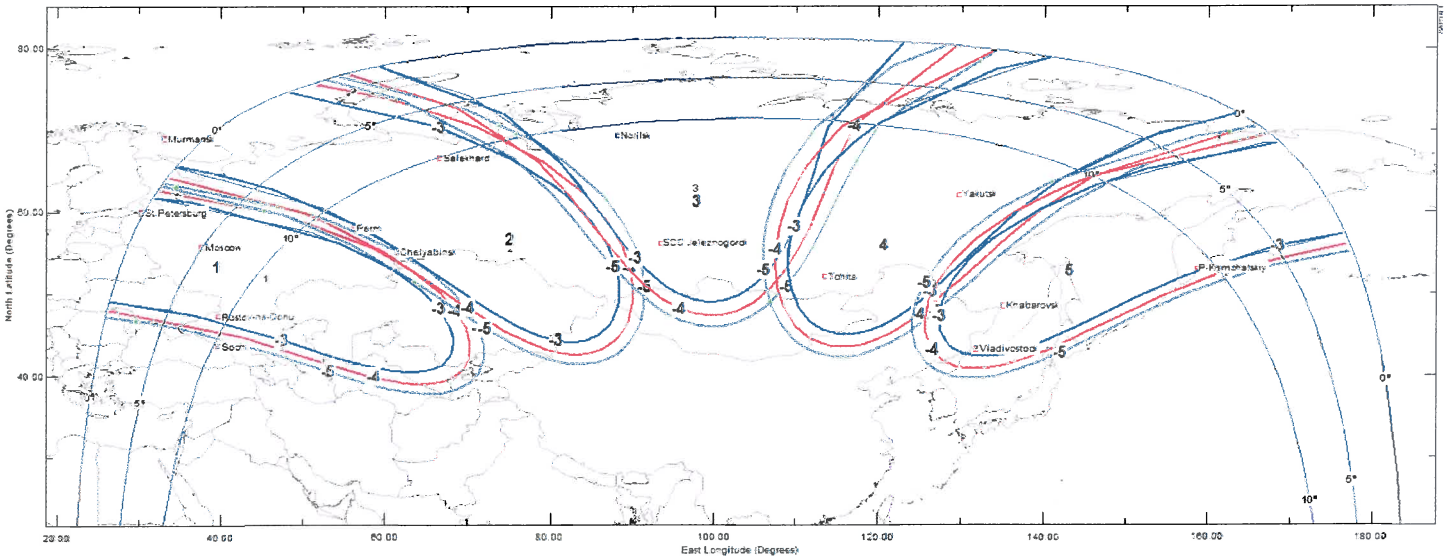
Networks based on iDirect Evolution series equipment are currently deployed using Express-AM44, Express-AM6, Express-AM33, Express-AM3 and Express-AM5 satellites.

A typical VSAT user station includes 1.2-1.8 m satellite antenna, 4-8 W transmitter and VSAT modem.

The total number of user stations operating in RSCC VSAT reaches 2000.

# Express-AMU3 multibeam service area in Ku-band

Express-AMU3 five-beam coverage area with 2° x 2° beams covers the entire territory of Russia and allows to increase the power of the link by 5-6 dB in order to use antennas with the diameter of no more than 1 m and transmitters with the power of no more than 2 W.

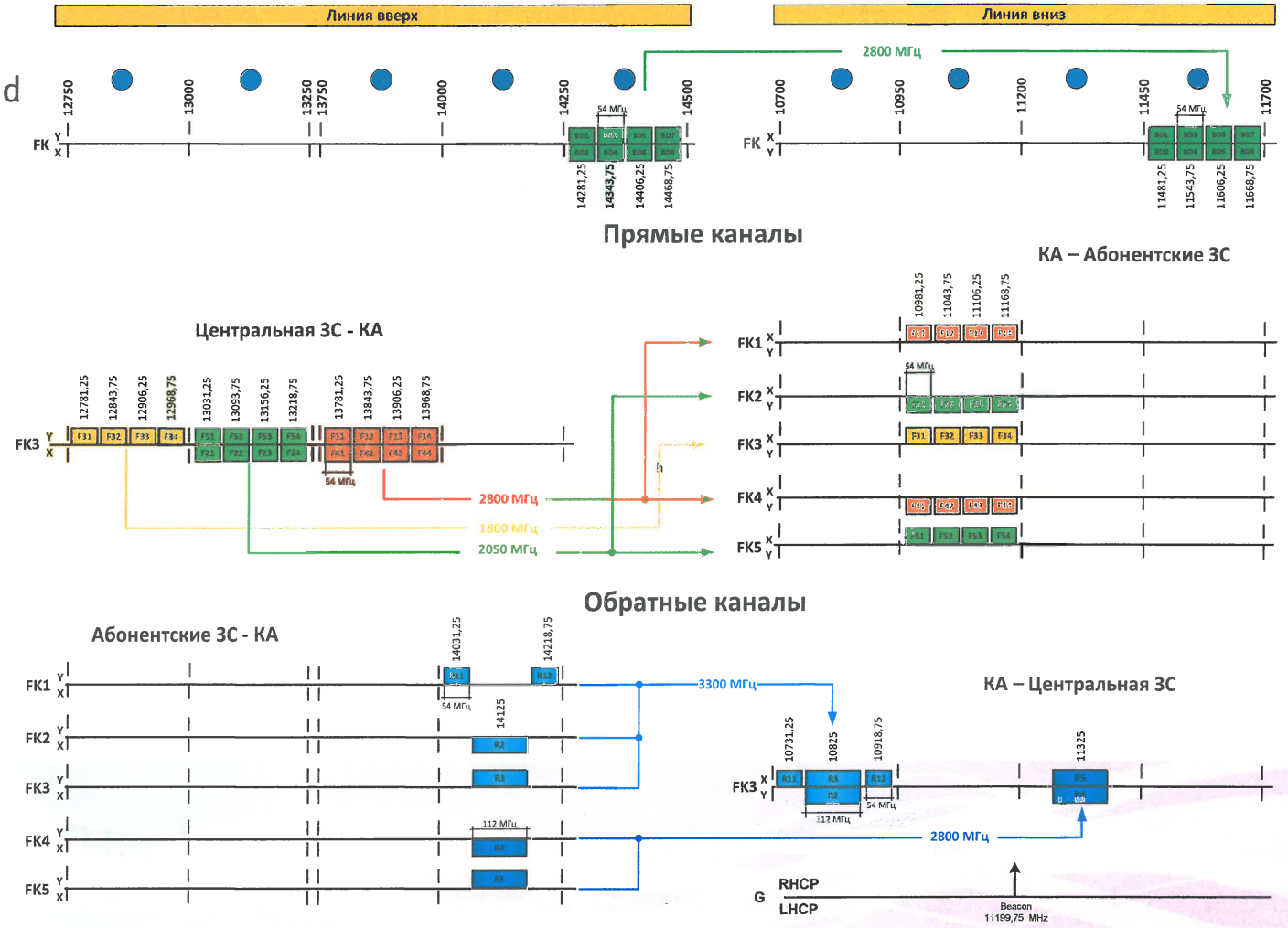


# Express-AMU3 frequency and polarization plan in Ku-band

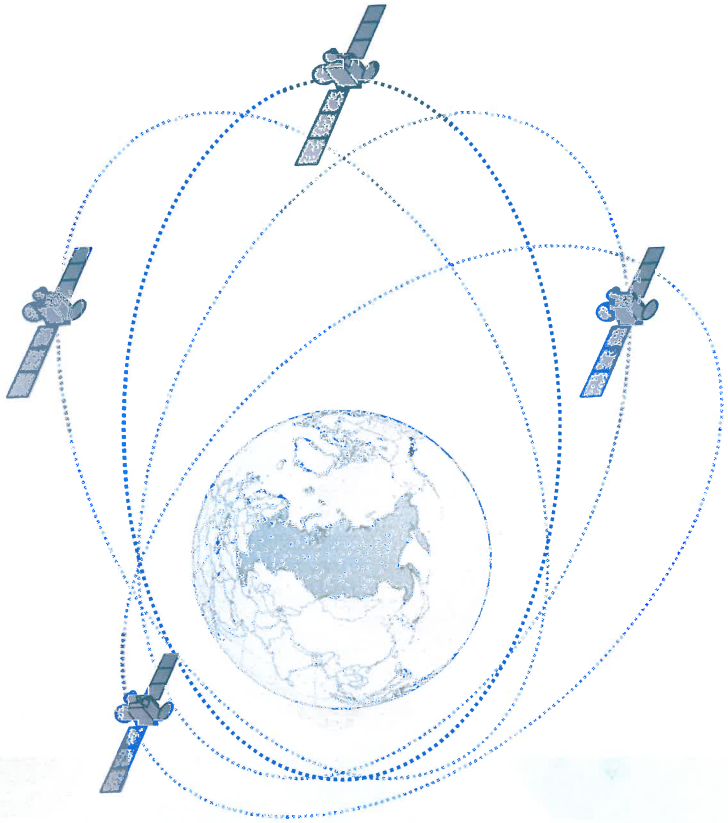
- 4 forward channels of 54 MHz and
- 1 return channel of 112 MHz are formed in each beam.

Expected parameters within the beam area:

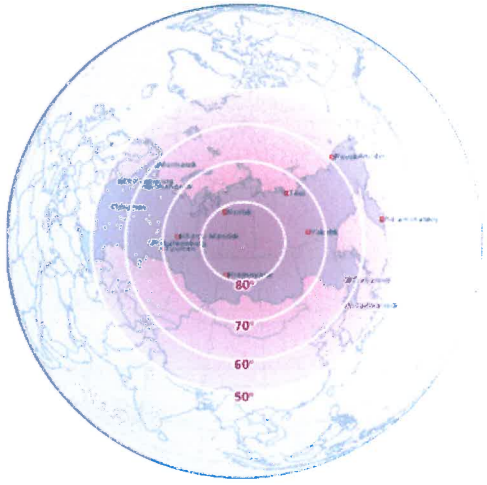
EIRP - 53-55 dBW
G/T - 8-10 dBK



# Advanced satellite communications and broadcasting system with satellites in highly elliptical orbits (HEO)



View of Russia from the geostationary orbit



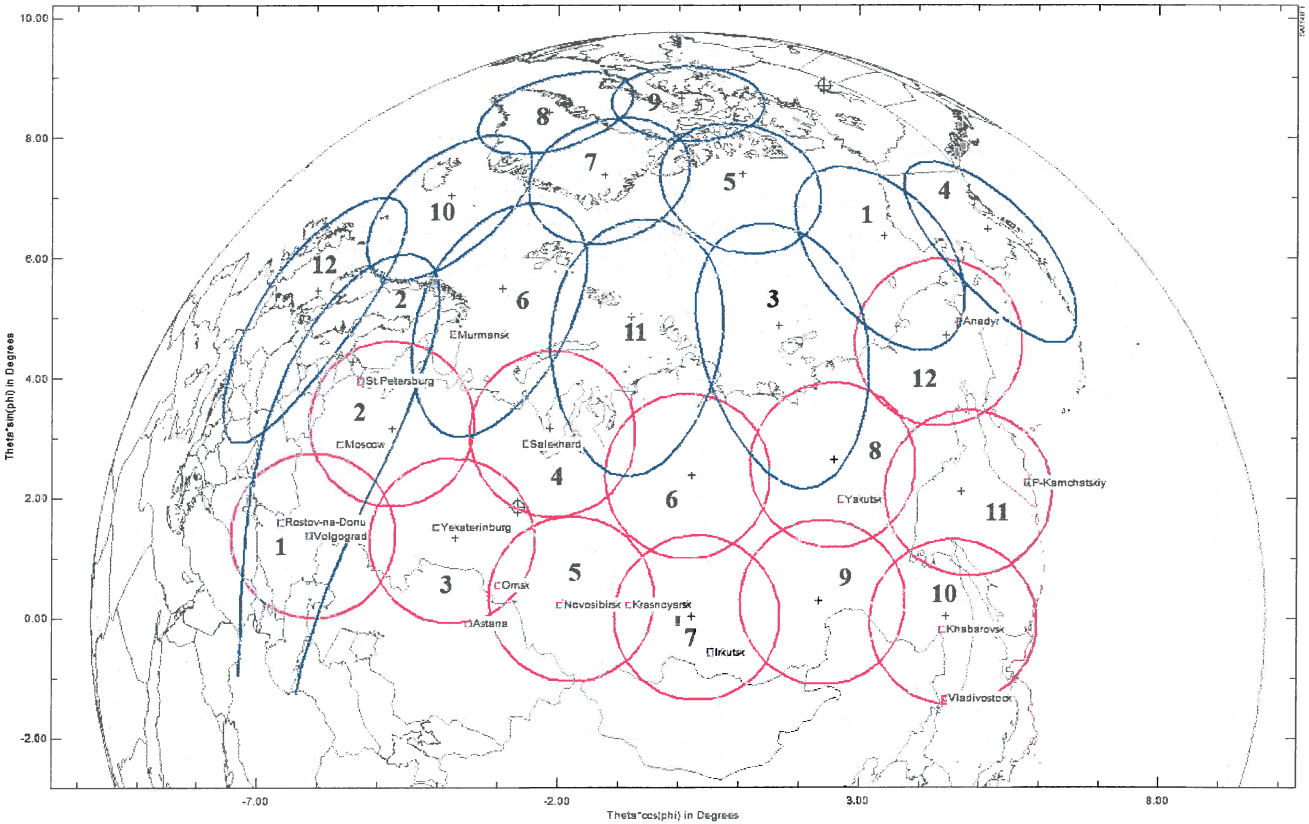

View of Russia from the highly elliptical orbit

**Service area of highly elliptical satellites covers the entire territory of the Russian Federation. Elevation angles of the ground stations range from 40° to 90°, thus providing reliable communications services for customers on moving platforms.**

# Express-RV multibeam service area

Molniya satellite makes 2 circuits in 24 hours, forming a coverage area in the Eastern Hemisphere on the primary circuit and in the Western Hemisphere on the conjugated circuit.

24 beams form the service area (12 from the primary circuit and 12 from the conjugated circuit) with the angular dimension of 2.75°x2.75°.




— coverage area on the primary circuit

— coverage area on the conjugated circuit

# Communications services in the Arctic region provided by Express-RV fleet

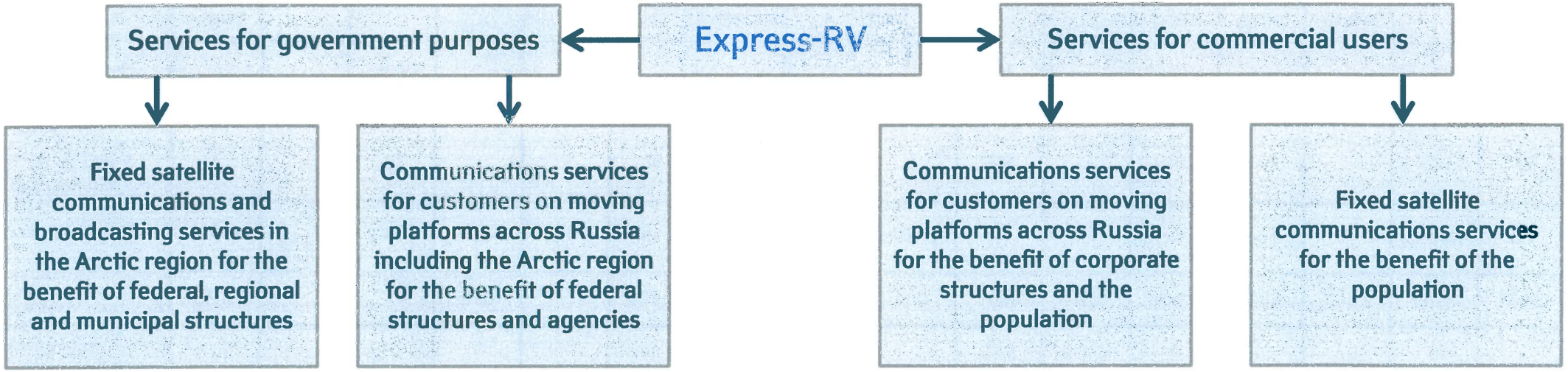
## System parameters:

- Fixed satellite services, including communications with customers on moving platforms, across the Russian Federation
- Total system throughput of up to 4.4 Gbit/s
- User terminals can operate with antennas of 60-70 cm in diameter and at a speed of 80 Mbit/sec for reception
- Potential for providing communications services to foreign users (Canada, the United States, Norway, Sweden, Finland, Iceland, Denmark)

## Communications performance:

- 18 forward channels in the direction to the users with 54 MHz bandwidth of each channel and minimum EIRP of 54 dBW.
- 18 return channels in the direction from the users with 36 MHz bandwidth of each channel.
- Receive system G/T for Ku-band return channels is not less than 6.5 dB/K

# Services provided by Express-RV communications system




**Implementatation of Express-RV project enables to:**

- provide satellite communications services for 100% of the Arctic region;
- provide fixed communications services for a wide range of users in the Arctic region, including users on moving platforms;
- solve the problem of forming a common information space across Russia including the Arctic region, applying combined solutions with geostationary and highly elliptical satellites;
- provide access to communications services in the Arctic areas of the USA, Canada, Denmark, Norway, Iceland, Sweden and Finland;

Express-RV project is planned to be implemented within the framework of public-private partnership using both goventment funding and off-budget investments.

# LEO and MEO satellite communication networks

| Program | OneWeb | OneWeb | SpaceX | SpaceX | Telesat LEO | LeoSat | Boeing | Kepler Comm. | Theia Holding | COMM-Stellat. | CAN-POL-2 | O3b | O3bN | O3bI | Laser Light | SKIF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Country | UK | | USA | | Canada | France | USA | Canada | USA | Canada | Canada | UK | | | - | Russia |
| Commissioning | 2019 | - | 2020 | - | 2019 | 2018 | - | - | - | 2018 | - | 2014 | - | - | 2018 | - |
| Number of satellites | 720 | 1280 | 4425 | 7518 | 117 | 84 | 60 | 140 | 112 | 84 | 45+2 | 12+8 | 24 | 16 | 8-12 | 6 |
| Orbit | LEO | | | | | | | | | | LEO/ HEO | MEO | | | | |
| Inclination | 87.9 | - | 53-81 | - | - | 90 | - | - | - | 99.5 | 37.4/90 | 0 | 0 | 70 | 0 | - |
| Altitude | 1200 | - | 1150-1300 | 340 | - | 1400 | - | 600 | 800 | 1000 | 1248 | 8063 | 8063 | 8062 | 8062 | 8062 |
| Frequency range | Ku,Ka | Ku,Ka, V | Ku,Ka | Ku,Ka,V | Ka | Ka | Ka | Ku | Ku,Ka,V | Ka | Ka | Ka | Ka,V | Ka | Optical | Ka |
| Capacity per satellite, Gbps; per satellite network, Tbps | 7<br>5 | -<br>- | 20<br>>80 | -<br>- | -<br>- | 20<br>- | -<br>- | -<br>- | -<br>- | 8.8<br>- | -<br>- | 16<br>0.192 | -<br>- | -<br>- | 6<br>- | 12<br>- |
| Useful lifetime | 7 | - | 5-7 | - | - | - | - | - | - | 10 | - | 10 | - | - | - | - |
| Manufacturer | Airbus | - | - | - | - | Thales | Boeing | - | - | - | - | Thales | Thales | Thales | - | - |
| CAPEX bln US dollars | 3.5 | - | 10-15 | - | - | - | - | - | - | - | - | - | - | - | - | - |

# WRC-19 preparations

## Para 1.4. of WRC-19 Agenda

*To consider the results of studies in accordance with Resolution 557 (WRC-15), and review, and revise if necessary, the limitations mentioned in Annex 7 to Appendix 30 (Rev.WRC-15), while ensuring the protection of, and without imposing additional constraints on, assignments in the Plan and the List and the future development of the broadcasting-satellite service within the Plan, and existing and planned fixed-satellite service networks;*

## Opinion of RSCC:

The removal or relaxation of the existing constraints for the broadcasting satellite service orbital positions in all three Regions in 11.7-12.7 GHz frequency bands will improve GSO frequency resource efficiency and enable a better use of the frequency bands assigned for the broadcasting satellite service.

## Para 1.5. of WRC-19 Agenda

*To consider the use of the frequency bands 17.7-19.7 GHz (space-to-Earth) and 27.5-29.5 GHz (Earth-to-space) by earth stations in motion communicating with geostationary space stations in the fixed-satellite service and take appropriate action, in accordance with Resolution 158 (WRC-15);*

## Opinion of RSCC:

According to the WRC-15 resolutions, the use of earth stations in motion is permissible in the fixed satellite service networks in the Ka-band frequencies allocated for FSS. The intensively developing Ka-band satellite systems call for enlargement of the possibilities to access the satellite resources for various satellite services, thus we are positive about the proposal of Ka-band expanding to be used for earth stations in motion.

## Para 7 of WRC-19 Agenda

*The use of a coordination arc in Ka-band to determine the necessity of coordination between FSS and other services.*

## Opinion of RSCC:

The use of a coordination arc criterion, which significantly reduces the number of affected networks and consequently the amount of coordination required, is a clear benefit to satellite operators.

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# Thank you for your attention!