ITU Kaleidoscope 2014

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Spectrum occupation and perspectives millimeter band utilization for 5G networks

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The aim of selection of frequency bands for 5G

The implementation of 5G technologies is aimed at increasing the efficiency of radio spectrum utilization in comparison with 4G mobile technologies (LTE Advanced). Considering the need of large frequency resources for a single channel 5G, exceeding 100 MHz, one of the most likely options for the development of a new generation of mobile communications will be the employment of higher frequency ranges between 6 - 95 GHz.

The criteria for selection of 5G suitable frequency bands

- Frequency bands are allocated on a primary basis for the categories of mobile/fixed radio services, or sharing utilization of a frequency band on a primary basis;
- Bandwidth: continuous frequency range of several hundred megahertz in the bands below 40,5 GHz and at least one gigahertz above 40,5 GHz;
- Candidate bands for the 5G should be conducted for both paired and unpaired spectrum;
- Availability of the regulatory basis for the frequency bands selected for the development of 5G is considered as an additional advantage.

Prioritization of frequency bands in the range 27,5–40,5 GHz

Frequency band, GHz	Bandwidth, GHz	Priority
27,5-29,5	2,0	Medium
31,0-31,3	0,3	Medium
31,8-33,4	1,6	High
36,0-37,0	1,0	Low

Source: METIS

Prioritization of frequency bands in the range 40,5-95,0 GHz

Frequency band, GHz	Bandwidth, GHz	Priority
40,5 – 42,5	2	Medium
42,5 – 43,5	1	High
43,5 – 45,5	2	Low
45,5 – 47,0	1.5	High
47,2 – 50,2	3	High
50,4 – 52,6	2.2	Medium-low
55,78 – 57,0	1.22	High
57 - 66	7	High
66 - 71	5	High
71 - 76	5	High
81 - 86	5	High

Source: METIS

Russian regulatory permits for using millimeter band

SRFC decision	Frequency band, GHz	Types of RES
№ 07-21-01-001 of 25.06.2007	27,5 - 29,5	RES of BFWA (27,8285 - 28,4445 GHz and 28,8365 - 29,4525 GHz)
№ 09-03-04-2 of 28.04.2009	27,5 - 29,5	Line of sight RRL
№ 05-10-01-001 of 28.11.2005	40,5 - 43,5	RES of BFWA
№ 08-23-04-001 of 26.02.2008	40,5 - 43,5	RES of BFWA (42,5 - 43,5 GHz)
№ 11-13-06-1 of 20.12.2011	58,25 - 63,25	RES of BFWA
№ 10-06-03-2 of 19.02.2010	63,0 - 64,0	RES of intelligent transport systems (ITS)
№ 10-07-04-1 of 15.07.2010	71,0 - 76,0 81,0 - 86,0	Line of sight RRL
№ 10-07-04-2 of 15.07.2010	92,0 - 94,0 94,1 - 95,0	Line of sight RRL

Spectrum release and redeployment aspects

Utilization of 27,5 - 95 GHz frequency band for development 5G will require two procedures:

- spectrum release and redeployment of civil RESs;
- spectrum conversion and spectrum release of military bands.

Currently spectrum rescheduling and release issues are resolved by interested carriers without public funds, while the conversion procedure is possible only with public funds, because the law provides the purchase of arms and military equipment only from the state budget for the armed forces and release of the frequency bands used for military purposes.

Economic costs of search and release of spectrum in the millimeter wave range

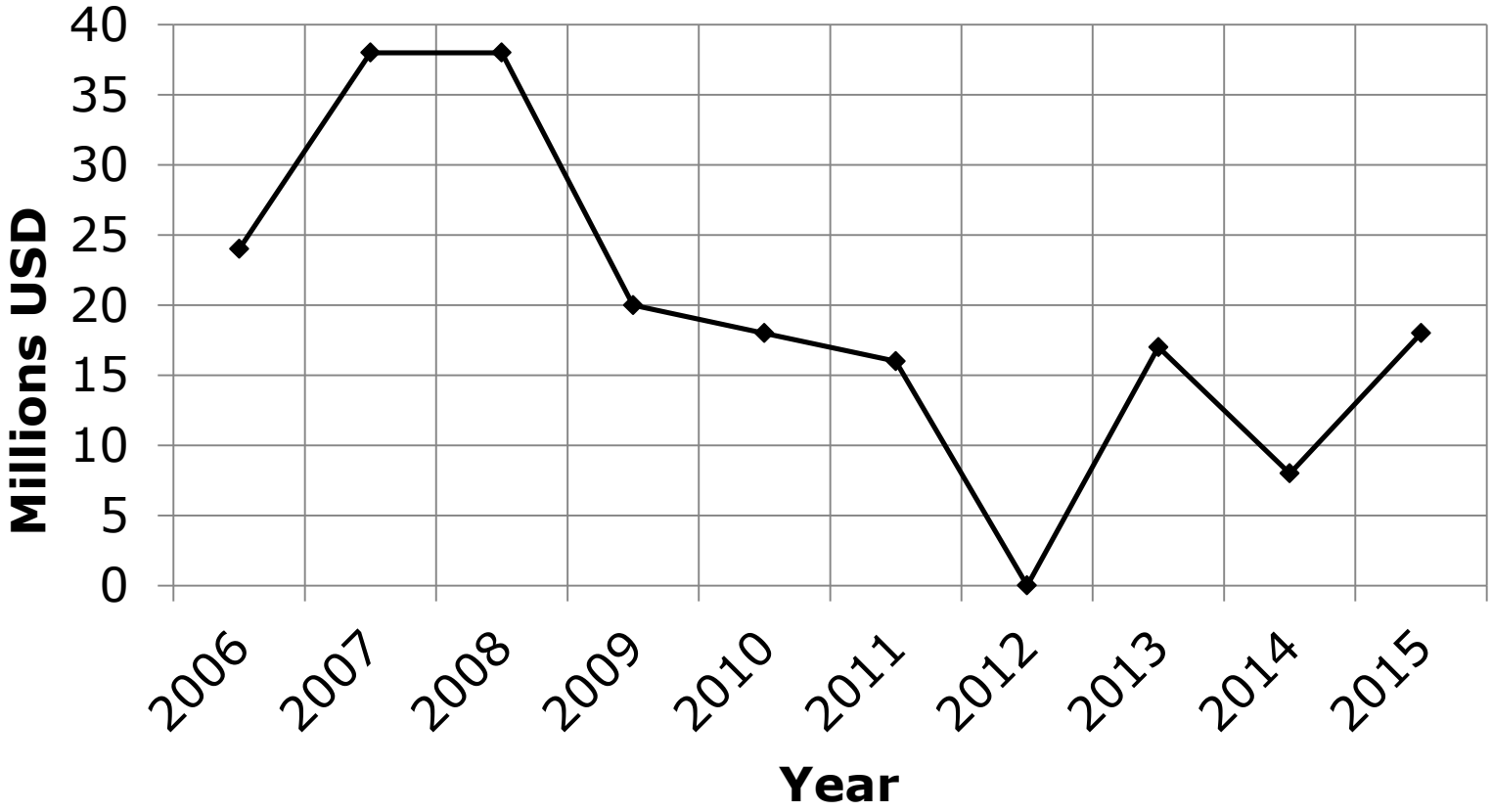
- The cost of conducting research on each considered frequency band;
- The cost of removing and replacing spans RRL and base stations of BFWA;
- The cost of work on the organizational and technical measures in the frequency bands used by military RESs;
- The cost of spectrum conversion, including the transition to new types of military equipment and transfer of military RESs in other frequency bands.

Number of RES working in millimeter band in Russia

Frequency band, GHz	Number of RES of fixed service	Number of RES of other services
27,5 - 29,5	312 - BFWA	25 - fixed-satellite
31 - 31,3	20 -RRL	not used
40,5 - 42,5	262 - BFWA	not used
42,5 - 43,5	84 - BFWA	not used
57,2 - 58,2	558 - RRL	not used
58,2 - 63,25	unlicensed band	no data
71 – 76	> 9000 RRL (TDD)	no data
	> 1000 RRL (FDD)	no data
81 - 86	> 1000 RRL (FDD)	no data

The release of the band 27,5 - 29,5 GHz from the RES of wireless access networks Local Multipoint Distribution Service (LMDS) technology may require from 10 to 50 million USD. A similar level of costs may be required for the release of the bands 40,5-42,5 GHz and 42,5-43,5 GHz.

State budget costs on spectrum conversion and redeployment



Conclusion

- Future implementation of 5G mobile networks in Russia may require the release of the millimeter band from RES, the number of which currently estimated at more than 1000 RESs of BFWA and over 11000 RESs of RRL.

- Millimeter band release activity by 2020 requires planning the costs in the state budget, which can reach 100 million USD annually, that significantly exceeds the previous annual budget spending.