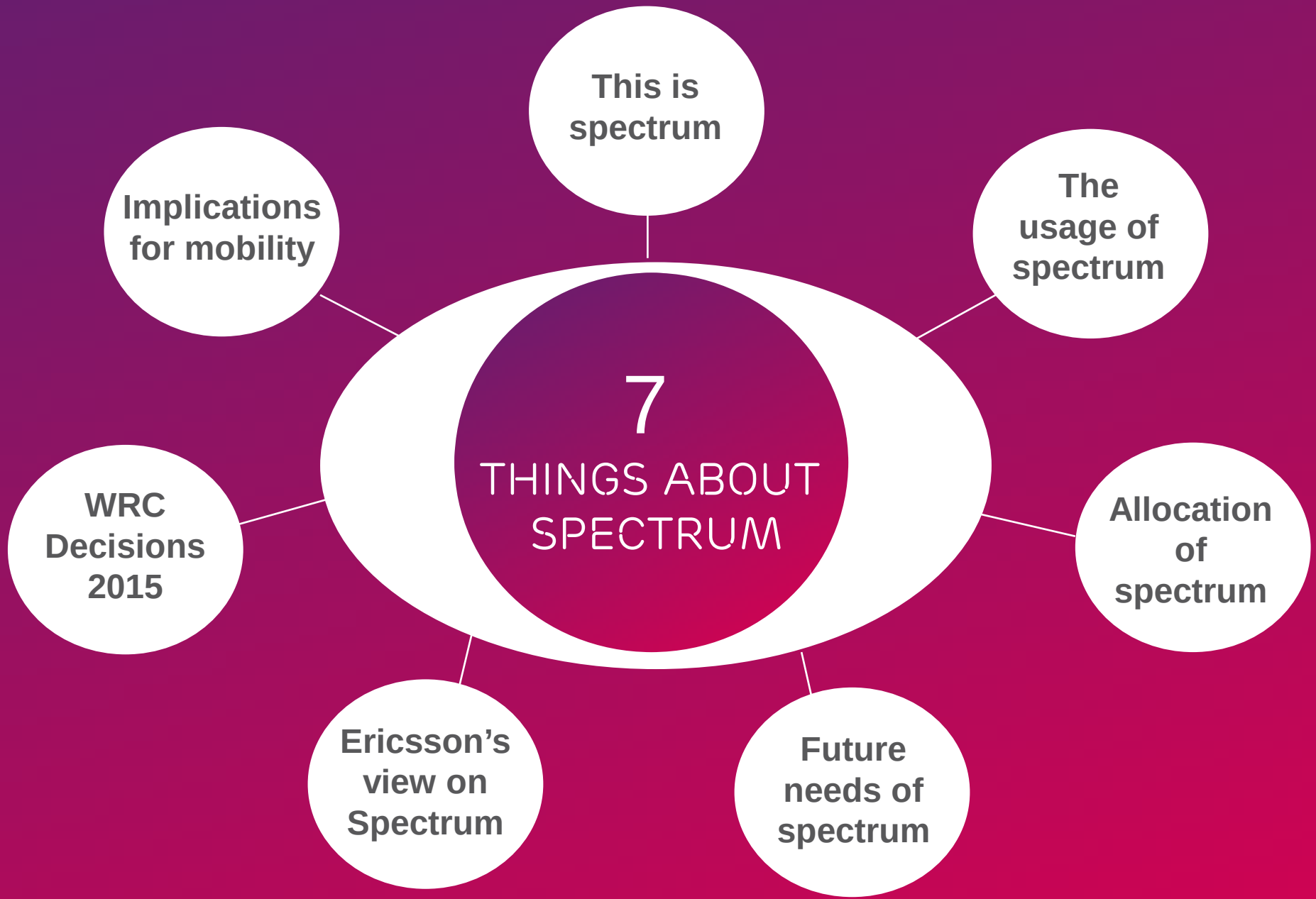
7 THINGS ABOUT RADIO FREQUENCY SPECTRUM

ERICSSON


This is spectrum
The usage of spectrum
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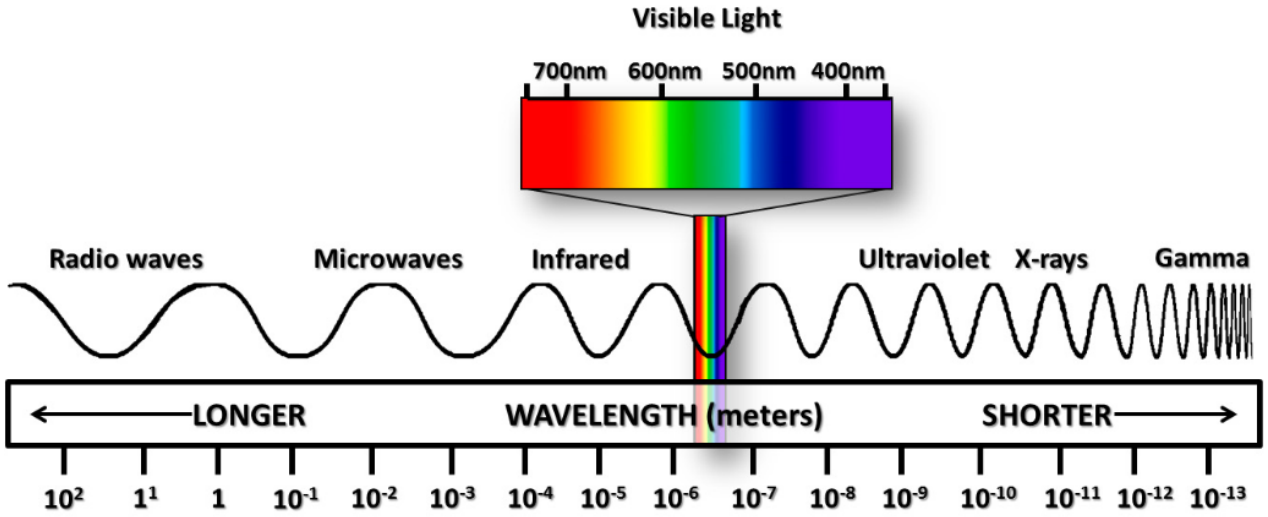
THINGS ABOUT SPECTRUM

1 THIS IS SPECTRUM

Spectrum is the continuum of frequencies that characterizes radio signals.

Frequencies are measured in the number of cycles per second, Hertz, e.g., 700 MHz (700 million cycles), and spectrum is often administratively discussed in terms of bands as defined in the ITU Radio Regulation, Table of Allocations (e.g. 698 – 806 MHz).

Radio signals can travel far and different nearby radio signals can interfere with each other, so it is necessary to manage the usage of frequencies and spectrum. The international Radio Regulations, and related regional and national instruments, today provide governance for the range between 9 kHz up to 300 GHz.



Source: http://www.ces.fau.edu/nasa/module-2/radiation-sun.php

2 THE USAGE OF SPECTRUM

A very large number of services use radio spectrum

Radio frequency spectrum, the part of the electromagnetic spectrum from 1Hz to 3,000GHz, is essential to almost all forms of modern communications. Different parts of the spectrum allocated to different radio technologies and applications like:

Mobile communications systems, TV broadcasting, satellite communication systems, weather radars, military radars, aeronautical navigation and control, missile tracking systems, road toll systems, Wi-Fi, intelligent transport systems, baby alarms, AM- and FM-radios, walkie-talkies, vehicle radars, radiation therapy, wireless industrial automation, Bluetooth, radio navigation (GPS and others), radio astronomy/space research, medical implants (pace makers, hearing aids), maritime communications, drones, alarms and much more.

3 ALLOCATION OF SPECTRUM

Mobile communication systems today have access to about 500 MHz in total bandwidth of dedicated spectrum.

Mobile communication systems today have access to about 400 – 1000 MHz total bandwidth of dedicated spectrum. There are large variations between countries. Essentially all spectrum that could be feasible for mobile radiocommunication today is already allocated to other radiocommunication services. The airwaves are indeed very crowded.

The allocated spectrum is distributed over frequencies from around 450 MHz up to 3.6 GHz. Additionally there is about 500 MHz of shared spectrum available for unlicensed or licensed exempt short range use for e.g remote controls, home video streaming and Wi-Fi.

4 FUTURE NEEDS OF SPECTRUM

A Networked Society is emerging and mobility will be key in peoples lives, in digital enterprises and for connected machines.

A new mobile broadband subscription is activated every second and spectrum is an essential resource in meeting this tremendous growth in mobile traffic. Connected devices by 2021 – more than 15 billion will be Machine-to-Machine (M2M) and consumer electronic devices.

From 2020, additional spectrum will also be required to support mobile media distribution as well as a wide range of 5G use cases, such as smart infrastructure with connected transports, live-TV at scale and anywhere, remote control of heavy machines or drones, remote surgery or human interaction with IoT like surveillance or tactile Internet.

HOW WILL THINGS LOOK IN 2021?

11x

growth in smartphone traffic

70%

of all mobile data traffic will be from video

9.1B

mobile subscriptions

90%

of mobile data traffic will be from smartphones

150M

5G subscriptions by end of 2021

28B

By 2021 – more than 15 billion Machine-to-Machine (M2M) and consumer electronic devices

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ERICSSON FAVORS EFFICIENT USE OF SPECTRUM

Ericsson favors an efficient use of spectrum. This means licensed and unlicensed as well as multimedia distribution spectrum. Ericsson wants to see enough spectrum secured to meet the consumer driven growth of mobile broadband usage for 4G and for next generation 5G networks, alongside the needs of other spectrum users like the broadcast industry. However, there will be large regional variations.

All radio-based services are indeed important. However, society is continuously changing, and the success of mobile broadband has proven to be unmatched in terms of consumer demand and penetration. The terrestrial cellular services are also clearly empowering people and enriching their lives, stimulating progress for citizens in villages and cities in all countries of the world.

Ericsson believes that the TV UHF band could be released to give future digital dividends when terrestrial TV no longer needs all this spectrum, and the excellent coverage characteristic should be utilized to its best by macro cellular networks in a licensed regime to ensure efficient spectrum usage. Our view is that deployment of unlicensed low-power niche-solutions now in this band would block more appropriate use in the future.

Ericsson believes this is about satisfying the coverage needs in both under-served and metropolitan areas, as well as bridging the digital divides between regions and people. There are many benefits to be gained from finding solutions to the issues faced with regard to radio spectrum – for both individuals and society at large.

Access to sufficient spectrum is of paramount importance in terms of providing affordable mobile broadband and meeting the tremendous growth in mobile data traffic. Ericsson feel confident in our journey towards 5G and with right allocated efficient spectrum usage we will soon experience a fully developed Networked Society.

6 RESULTS FROM WRC 2015

World radio communication conferences (WRC) are held every three to four years. It is the job of WRC to review, and, if necessary, revise the Radio Regulations, the international treaty governing the use of the radio-frequency spectrum and the geostationary-satellite and non-geostationary-satellite orbits. Revisions are made on the basis of an agenda determined by the ITU Council, which takes into account recommendations made by previous world radio communication conferences. The outcome of WRC 2015 in short:

- Agreement was reached to make a number of frequency bands available for IMT in various parts of the world:
  - 470 – 694/698 MHz (600 MHz) – primarily for some countries in Americas and APAC
  - 694 – 790 MHz (700 MHz, Region 1) – for Region 1 (EMEA) as a result out of WRC-12, effectuated at WRC-15
  - 1427 – 1518 MHz (L-band) - global band
  - 3300 – 3400 MHz – for some countries in all three ITU Regions
  - 3400 – 3600 MHz (C-band) – additional country support making this a global band
  - 3600 – 3700 MHz (C-band) – for some countries globally
  - 4800 – 4990 MHz – for some few countries in APAC and one in Americas.
- WRC-15 approved an agenda item for WRC-19 to study bands above 24GHz for 5G mobile services. The frequency bands/ranges to study are 24.25-27.5 GHz, 31.8-33.4 GHz, 37-43.5 GHz, 45.5-50.2 GHz, 50.4-52.6 GHz, 66-76 GHz and 81-86 GHz.

7 IMPLICATIONS OF DECISIONS AT WRC-15

Global alignment of the following frequencies:

For the first time in history the mobile telecom industry now has global bands which will enable a good growth and expansion of LTE.

- UHF 700 MHz, Global band*
- 1427 – 1518 MHz, (L-band) Global band *
- 3300-3400, Emerging band for countries in all ITU Regions
- 3400 – 3600 MHz (C-band) Global band*
- 3600-3700 MHz (C-band) Emerging band starting in Europe and Americas

Low spectrum, e.g. 700 MHz spectrum, is efficient to improve the network in rural areas. High spectrum, e.g. C-Band, is efficient to improve the network in urban areas.

World Radio Conference 2019

Spectrum at higher frequencies in the range from 24.25 GHz up to 86 GHz will be subject to study work for 5G or IMT-2020 usage in ITU, which lays the foundation for future 5G services.

*) global band is, or expected to be, available in countries represented in all three Regions (according to ITU) of the world.

Regional allocations:

Region 1: EMEA

Africa gained the L-band as well as 3.3 GHz to 3.4 GHz and 3.4 GHz to 3.6 GHz identified for IMT use. This will support an increased mobile broadband usage and help push down device prices.

Middle East gained the 700 MHz band with will enable the expansion of LTE. They C-band will enable the Middle East to continue to lead the smart city initiatives, which is dependent on good coverage and capacity in urban areas.

Europe was allocated the 700 MHz band that now is a global band. This will primarily enable network growth and improvements in rural areas.

Region 2: Americas

In addition to the global alignments, Americas also gained 600 MHz band and 4800-4990 MHz (some countries). The lower UHF band, 470 – 694/698 MHz, will enable new market opportunities that is expected to open up 2017.

Region 3: APAC

In addition to the global alignments, APAC gained 600 MHz band and 4800-4990 MHz (some countries) that will enable growth and expansion in LTE.

SUMMARY

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- For the Networked Society, there is indeed a need for new spectrum resources
- Fortunately new spectrum was allocated to the mobile industry by the WRC-15
- Ericsson’s products are clearly designed to use spectrum in an ever-efficient way