

Impact of 5G technology on human exposure

Expert Meeting: Electromagnetic Field Level and 5G Roll-out
2-3 November 2017, Rome, Italy

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Introduction - 5G mobile systems

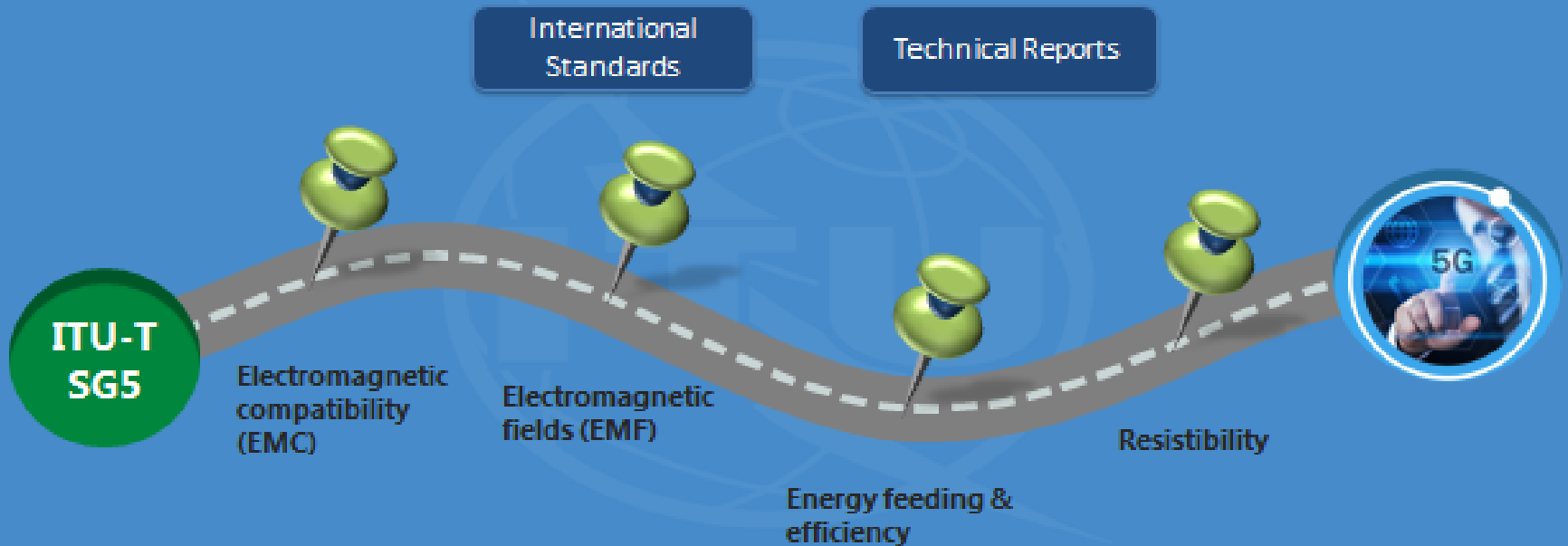


ITU-T SG5 “Environment, Climate Change and Circular Economy” Vision



Introduction - 5G mobile systems

Setting Environmental Requirements for 5G



1st Technical Report published in June 2017

ITU-T LSTR.5GEE - Technical Report on Methods and metrics to evaluate energy efficiency for future 5G systems



Introduction - 5G mobile systems

Technical Report on Methods and metrics to evaluate energy efficiency for future 5G systems



This Technical Paper analyses the energy efficiency issues for future 5G systems.



Introduction - 5G mobile systems

ITU – ETSI Workshop on Towards Setting Environmental Requirements for 5G

Get an up-to-date analysis of environmental requirements related to 5G and help us to identify possible future activities in this field!

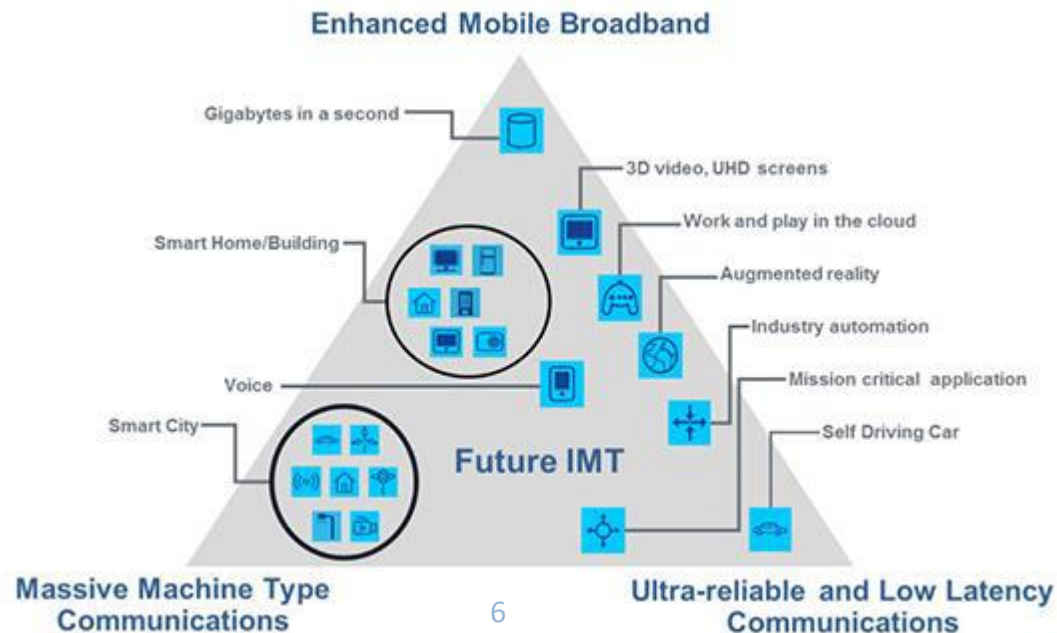
Date: 23 November 2017

Venue: ETSI Headquarters, Sophia Antipolis, France

Visit: <http://itu.int/go/tsg05>

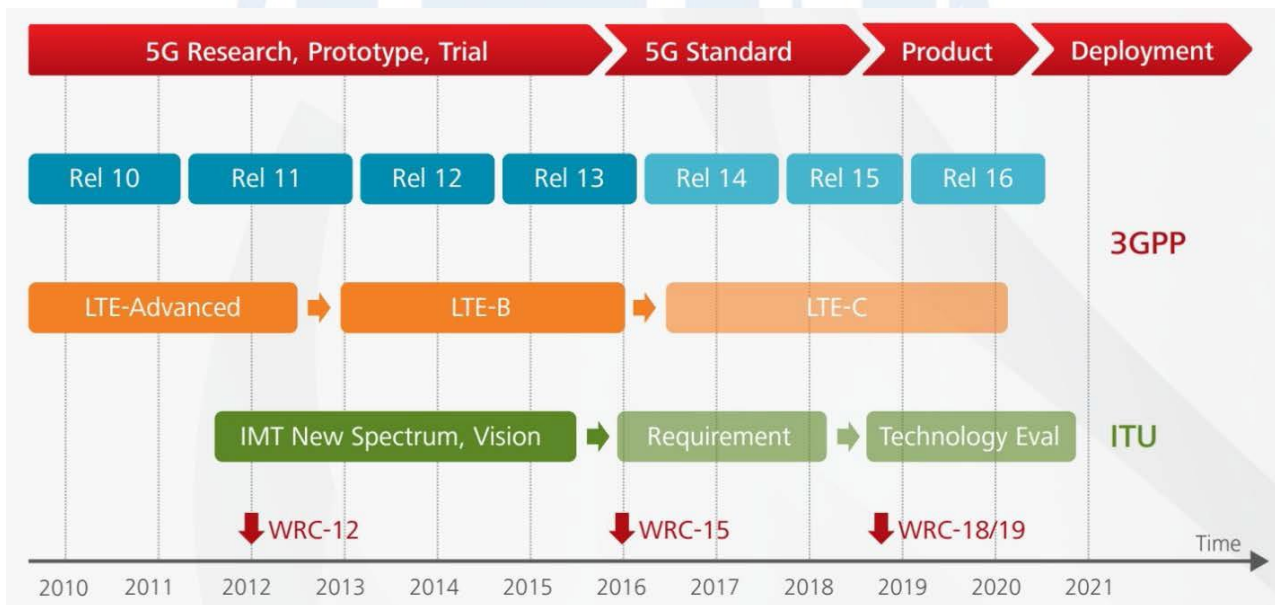
Introduction - 5G mobile systems

- Heterogeneous network – much more base stations including small cells
- Much shorter distance to the users
- Much more wireless devices (IoT)
- New much higher (microwave) frequencies
- Smart antennas – antenna beam following the user location
- Massive MIMO antennas



5G NR Time Table

- 5G New Radio (NR) standard is still under development – expected to be finished in 2020
- All current implementations represent some form of the implementation of chosen features of 5G NR system only
- 5G NR system will use frequencies currently used by mobile communication and will operate with older systems in parallel



Source: Commerce Spectrum Management Advisory Committee (CSMAC), 5G Subcommittee, Final Report, August 1, 2016

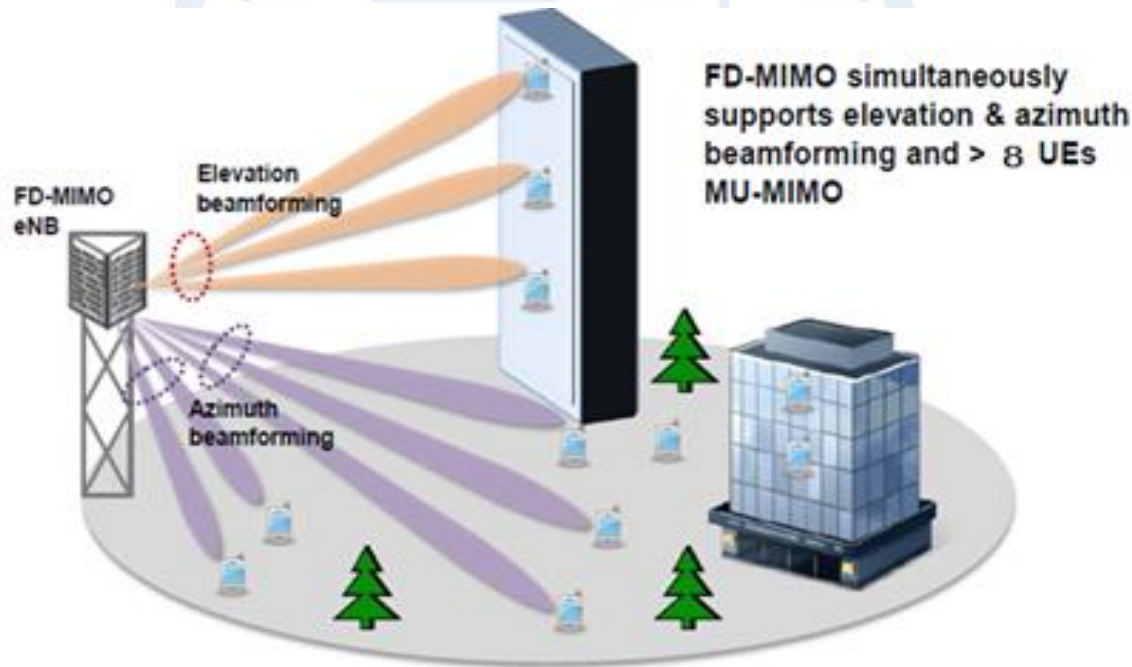
Review of the exposure limits

- The exposure limits in most countries are that recommended by WHO and based on ICNIRP or IEEE guideline
- In some countries exposure limits are much more restrictive
- Because of increasing number of radiating sources and operating frequencies it may be expected that the compliance with exposure limits will be more difficult to achieve
- Smart antennas with narrow beams may decrease the exposure level in the environment

Frequency band	ICNIRP limit (UE etc.)	IEEE limit C.95.1-2005	Example of more restrictive limits
Basic restrictions			
10MHz<f<3GHz	0.08 W/kg	0,08 W/kg	-
3GHz<f<10GHz	0,08 W/kg	10 W/m ²	-
10GHz<f<300GHz	10 W/m ²	10 W/m ²	-
Reference levels			
400MHz<f<2GHz	2W/m ² -10W/m ² (28 V/m-61V/m)	2W/m ² -10W/m ² (27.5 V/m-61V/m)	0,1 W/m ² (7V/m)
f>2GHz	10 W/m ² (61 V/m)	10 W/m ² (61 V/m)	0,1 W/m ² (7V/m)

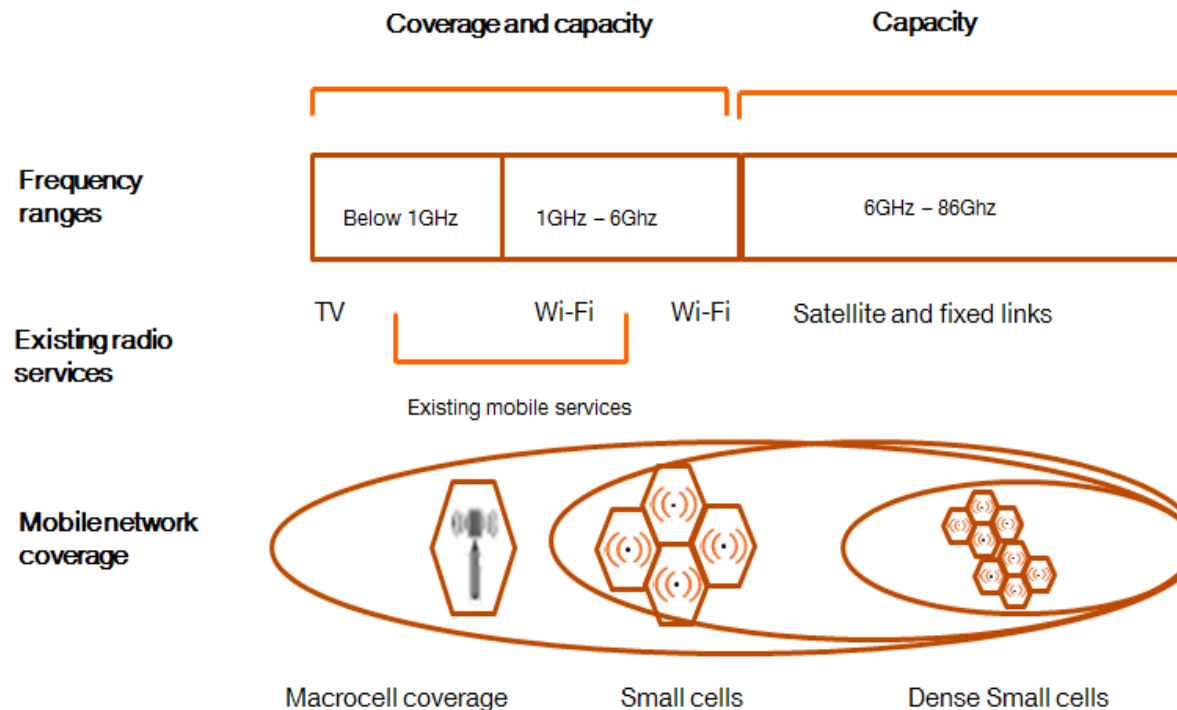
Smart antennas

- Current mobile systems: 2G, 3G and 4G apply base stations that are covering the whole intended area
- Smart antennas, that are planned for use in 5G will have narrow antenna beam (or beams) directed directly to the user (or users)
- This will allow to substantially reduce exposure in the environment



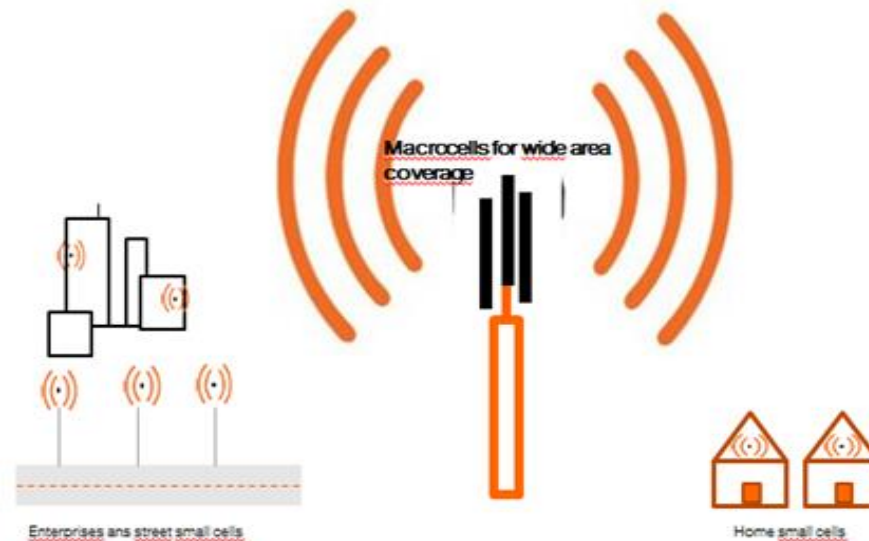
5G NR heterogeneous networks

- 5G NR radio access network will combine all types of cells: macro, micro, small and piko/femto
- Band aggregation and site sharing will increase the total radiated power from many base stations – especially macro base stations



5G NR small cells

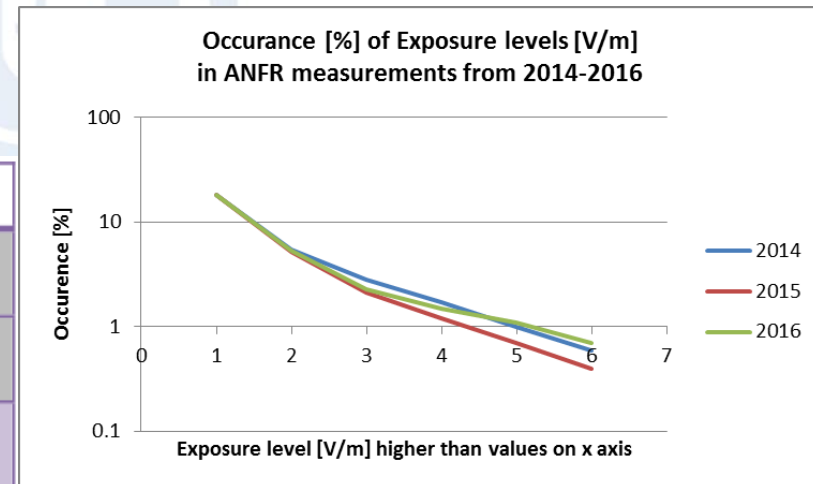
- Small cells will be much widely used especially for the high speed transmission that require very broadband (high frequency) transmission
- Small cells and use of the high frequencies means lower coverages – base stations will be located close to the user, but the power used will be also small
- Current experience shows that the use of small cells (indoor and outdoor) reduce overall exposure level



Current exposure levels

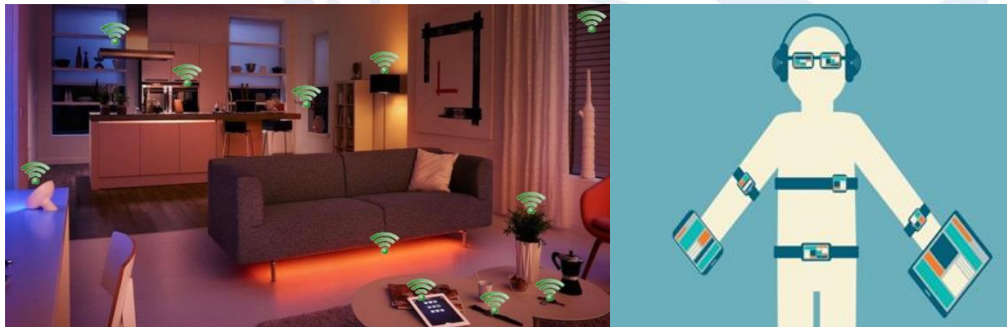
- In Table below there is presented results of measurements of the electric field strength in about 3000 measurement points made by Franch Agency ANFR in 2014-2016 (Etude de l'exposition du public aux ondes radioélectriques, ANFR, October 2017)
- In more than 80% of locations the exposure level is lower than 1 V/m
- In less than 1% of locations the exposure level is higher than 6 V/m

Année	E (V/m)	≥ 1 V/m	≥ 2 V/m	≥ 3 V/m	≥ 4 V/m	≥ 5 V/m	≥ 6 V/m
2014	Occurrence (%)	18,3 %	5,5 %	2,8 %	1,7 %	1 %	0,6 %
2015	Occurrence (%)	18,4 %	5,2 %	2,1 %	1,2 %	0,7 %	0,4 %
2016	Occurrence (%)	18,4 %	5,3 %	2,3 %	1,5 %	1,1 %	0,7 %



Internet of things (IoT), M2M

- It is expected that many devices will be connected to the internet using radiowaves because it allows for many new improvements of our life
- It means that the number of radiating sources will increase dramatically
- But almost all such devices will be very low power and short range and will communicate on the event-based, periodic and automatic communication modes
- It means that the exposure level from such devices will be very low



Conclusions

- 5G NR system will have many differences in comparison with current mobile systems
- As a new system it will apply many new features that increase its efficiency and flexibility
- The reduction of the impact on EMF is one of the most important issues taken into account in 5G NR system development
- It may be assumed that 5G NR system will not increase the exposure level in human environment
- In the first stage of 5G implementation it has to operate in parallel with current mobile system and in this time the exposure level may slightly increase

Thank you

Questions ?

