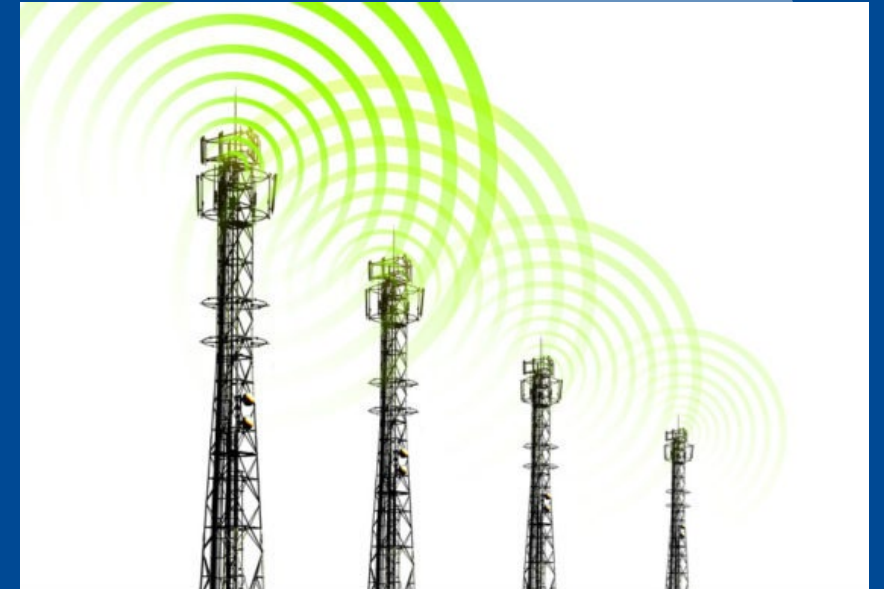


Technics and applications of 5G

ICOH meets ISSA
ISSA meets ICOH

Sabine Glückmann (BG ETEM)

Christian Werner (IFA)



What is 5G?

- 5th generation of mobile radio standard
- use of higher frequency ranges
- data rates up to 20 Gbit/s
- increased data rates
- latencies from under 1ms up to a few milliseconds

Differences between the generations

properties	2G (GSM)	3G (UMTS)	4G (LTE)	5G	6G
latency	400 - 500ms	80 - 400ms	60 - 80ms	1 – 10ms	tbd
transmission rate	Up to 0,25Mbits/s	Up to 40Mbits/s	Up to 500Mbits/s	Up to 2Gbits/s (20Gbits/s)	Up to 400Gbits/s
Year of launch	1992	2000	2010	2019	2030




~every 10 years a new standard is launched

Perspective 6G



[ENGLISH](#) [BEKANNTMACHUNGEN](#) [PRESSE](#) [DATENSCHUTZ](#)  [GEBÄRDENSPRACHE](#)  [LEICHTE SPRACHE](#)   

[Bildung](#) [Forschung](#) [Europa und die Welt](#) [Über uns](#) [Service](#)  

 | [Aktuelles](#)  | [Presse](#)  | [Pressemitteilungen](#)

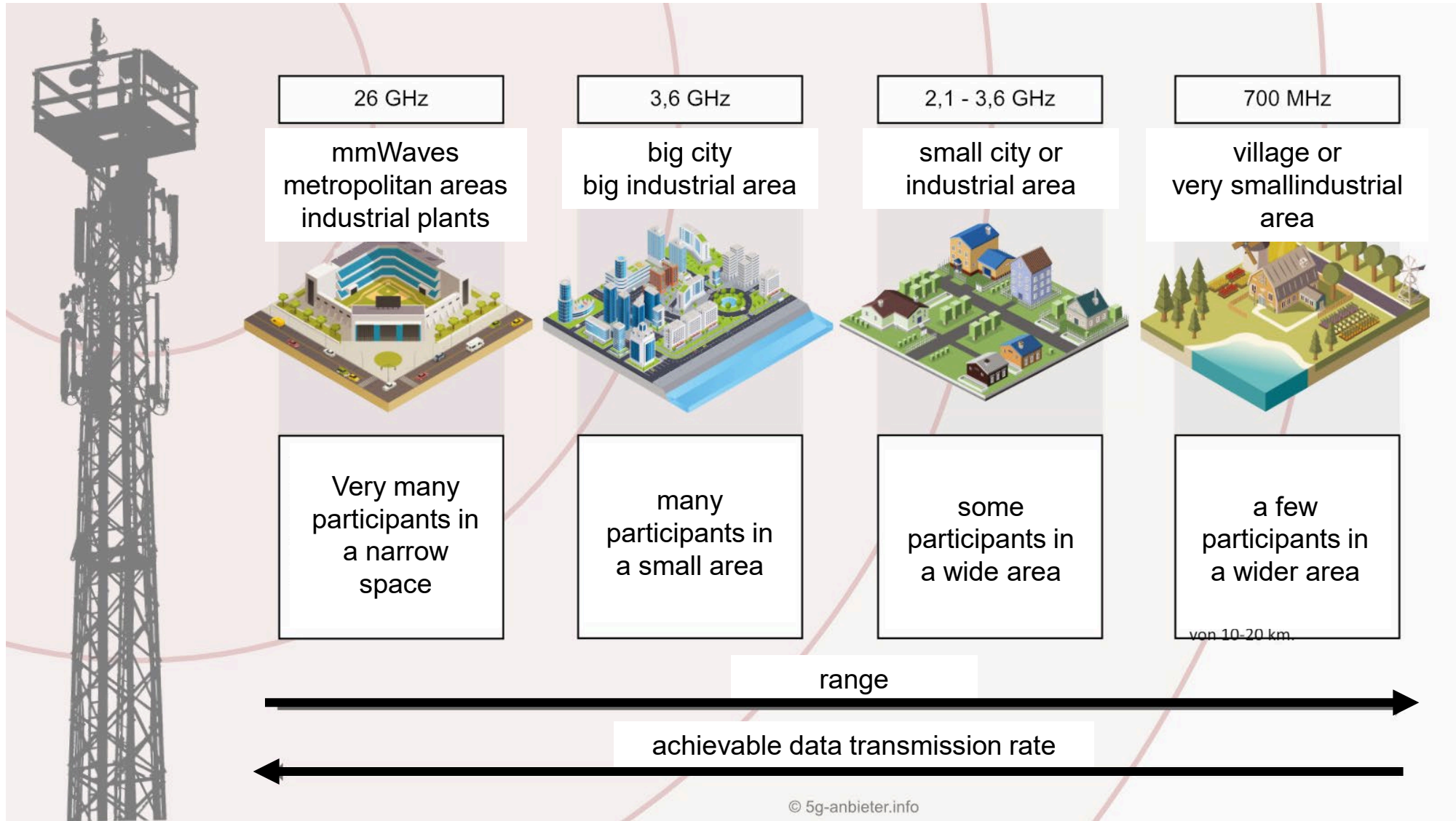
12.04.2021 | [PRESSEMITTEILUNG: 072/2021](#)

6G will revolutionise our future - around 700 million euros for the networking technology of the day after tomorrow

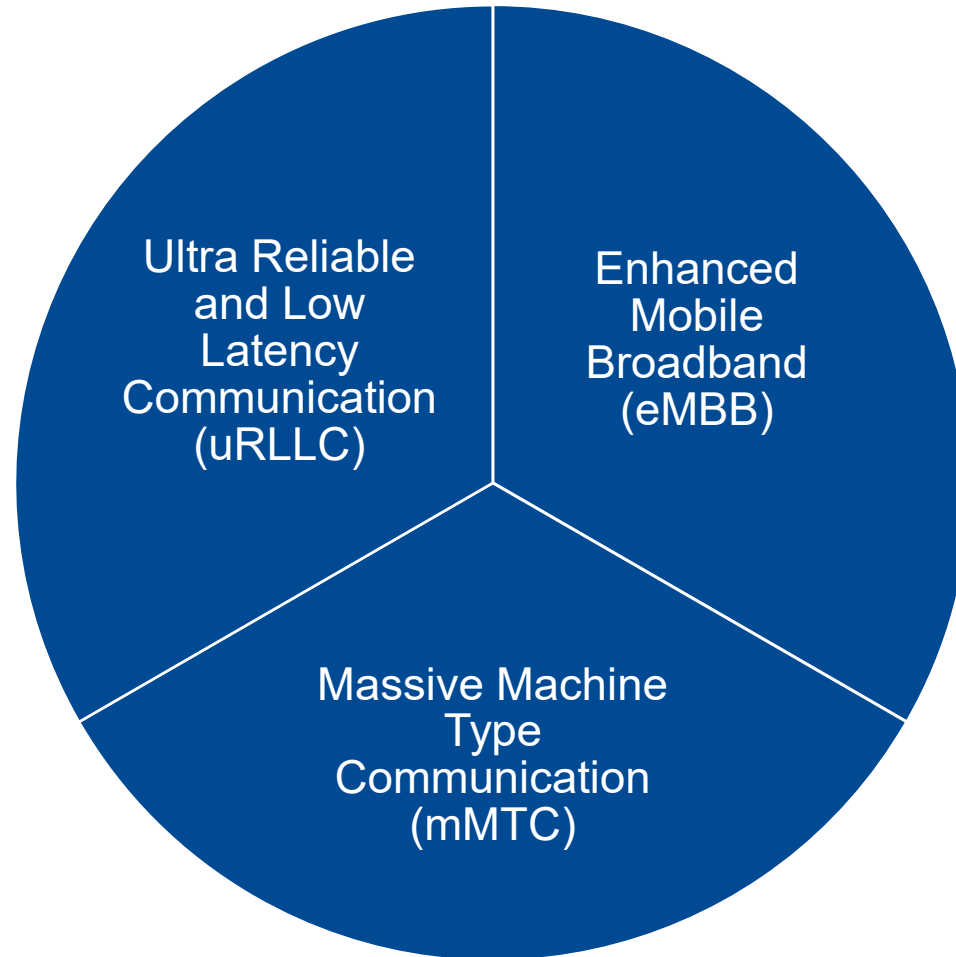
BMBWF supports 6G communication technology with funds from the Federal Government's Future Package

Frequency assignment for Germany and Austria (mobile radio)

frequency [GHz]	usage
0,7	4G, 5G
0,8	4G
0,9	2G, 4G
1,5	4G
1,8	4G, 5G (2G expiring)
2,1	4G, 5G (3G expiring)
2,6	4G
3,4 - 3,7	5G
24,25 - 27,5	5G



5G application profiles



Requirements & use cases

- high reliability
- high transmission rates
- low latency
- low error and packet loss rate
- high availability

Ultra Reliable
and Low
Latency
Communication
(uRLLC)

- autonomous driving
- remote control
- imaging methods
(medical engineering)

Requirements & use cases

- Small data sizes
- large number of participants
- large spatial distribution
- good energy efficiency

- networking of devices
- machine to machine (M2M)
- industrial sites



Massive Machine
Type
Communication
(mMTC)

Requirements & use cases

- high transmission rates
- precise transmission
- rather short transmission distances

Enhanced
Mobile
Broadband
(eMBB)

Applications with high data rates:

- VR/AR
- mobile working



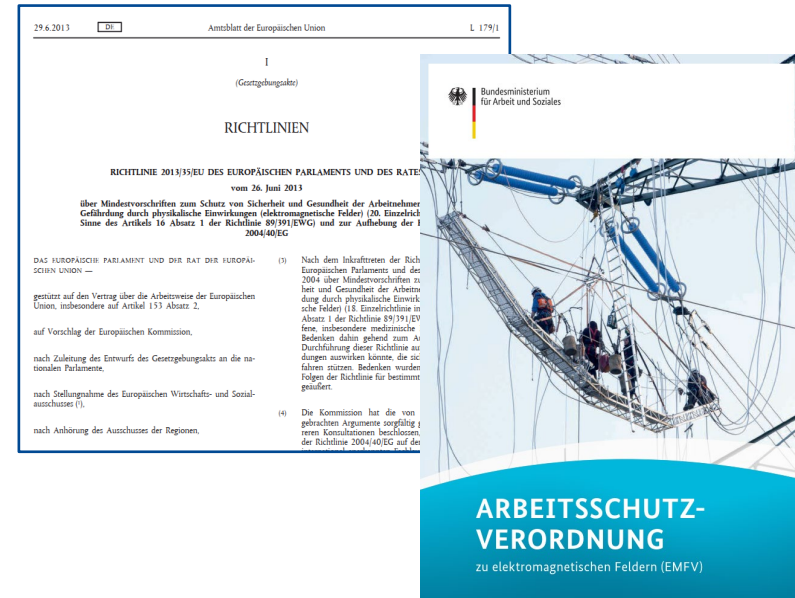
Erst vernetzen, dann steuern: An der TU Dresden untersuchen Forscher, wie man ein stabiles Netz aufbaut, um schweres Gerät auf der Baustelle fernzusteuern. Foto: Continental

Kräne, Raupen und Bagger aus der Ferne steuern







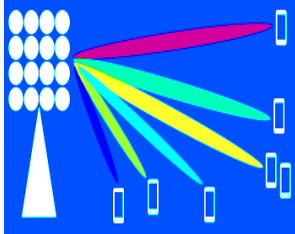
BAU: In Hoyerswerda arbeiten Forscher an einer IT-Infrastruktur, um Baumaschinen künftig fernsteuern zu können. Der Weg ist aber noch weit.

Legal Requirements for Use of 5G

- standards for security and robustness
 - required certification
 - radio licences
 - occupational health and safety
- ❖ Directive 2013/35/EU of European parliament
 - ❖ Ordinance of occupational safety to electromagnetic fields



Overview 5G Technology and Occupational Health and Safety

up to 2 W EIRP		100 mW EIRP – 10 W EIRP			10 W EIRP and above	
IoT	near the body	Home Small Cells	In-building Small Cells	Street Small Cells	Macro Cells	Massive MIMO
						
e.g. sensors	e.g. smart phone	e.g. router	e.g. distribution units	e.g. street lamps	e.g. tower or rooftop sites	e.g. tower or rooftop sites
<ul style="list-style-type: none"> • Intrinsic safety (SAR) • PSI not always possible 	<ul style="list-style-type: none"> • Intrinsic safety (SAR) • PSI (AIMD) 	<ul style="list-style-type: none"> • Safety distance • PSI (AIMD) 	<ul style="list-style-type: none"> • Intrinsic safety (SAR) • PSI not always poss. 	<ul style="list-style-type: none"> • Intrinsic safety (SAR) • PSI not always poss. 	<ul style="list-style-type: none"> • Site certificate • Controlled access 	<ul style="list-style-type: none"> • Site certificate • Controlled access
Protection: Safe installation	Protection: Product Safety Information (PSI) for user		Protection: correct and safe installation to protect from direct effects and interference with AIMD			