



INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

EMF Standards for 5G technologies

**Human exposure compliance assessment procedures for
mobile device and network equipment operating from 6-100 GHz**



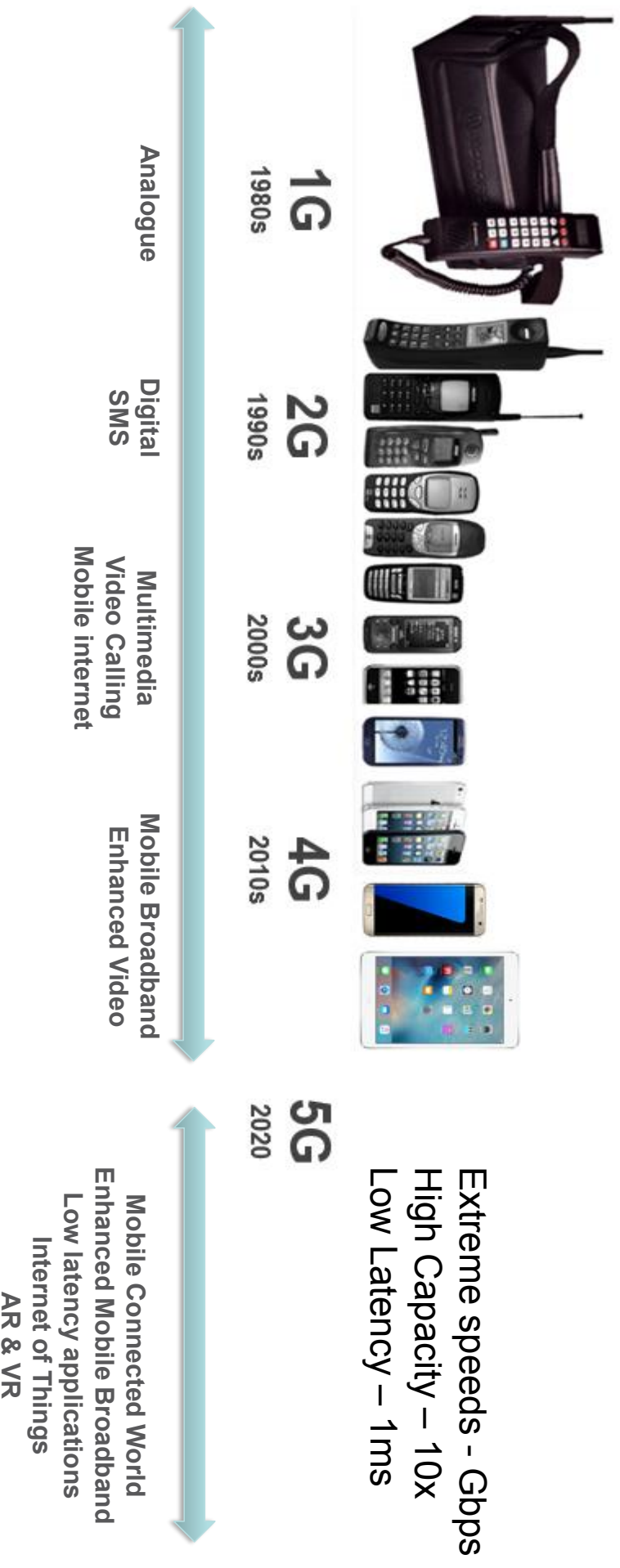
Mike Wood
Chairman IEC TC106

MWF 5G Workshop – Portoroz, Slovenia

24 June 2018

What is 5G?

5G is the 5th generation of mobile networks





5G Timeline



Fixed wireless access for homes and enhanced mobile broadband services are likely to be the first applications using new 5G wireless access modems and hot spots.

Mobile handsets with 3G, 4G and 5G connectivity expected in the 2019 – 2021 timeframe
Low latency and widespread machine to machine applications using 5G in similar timeframe

5G – Implications for EMF Assessment



EMF Assessment Considerations

<u>New Spectrum</u>	mmWave
<u>Macro Cells, Small Cells</u>	near & far field
<u>MIMO Beam Steering</u>	power averaging
<u>5G and 4G together</u>	multiple technologies
<u>Many devices</u>	complex assessments

5G and 4G working together, with central and local servers providing faster content to users and low latency applications

Challenges for 5G & EMF Standards

- Globally harmonised EMF exposure limits
- Revised ICNIRP, IEEE, FCC exposure guidelines are critical especially for 5G devices >6/10GHz
- Development and implementation of new network and device testing procedures to meet 5G technology evolution

Devices

- mmWave
- Complex devices
- Far field – E or H is measured
- Near field - E&H field, Phase, field reconstruction
- Multiple tx, beam steering & varied shapes
- Advanced modelling techniques

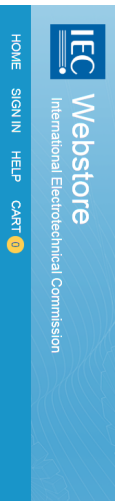
Networks

- mmWave
- Complex antennas
- Near field and far field
- MIMO & beam steering
- Power averaging for true EMF level
- Advanced modelling techniques

Challenge – IEC TC106 has responsibility to develop assessment standards for 5G devices and networks to 100GHz (by 2018)

New 5G Exposure Assessment Standards from the IEC

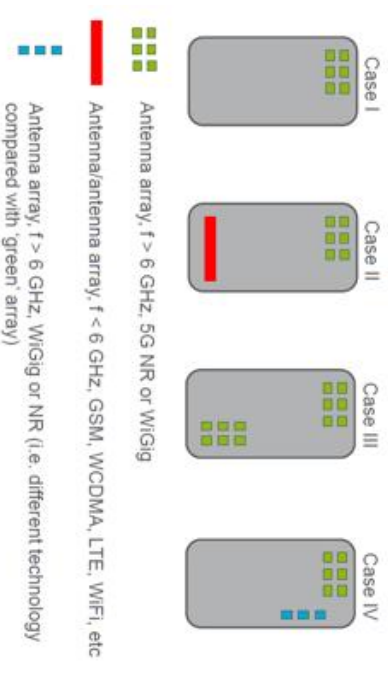
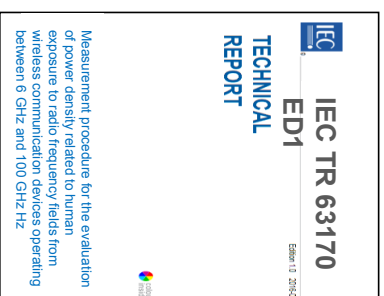
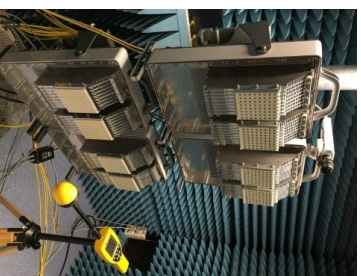
- IEC Strategic Business Plan has been to prepare for 5G
- **Ensure Standards and Technical Reports are developed**
 - Trials & early deployments in 2018 – 2019, Commercial Launch 2019 - 2020



IEC 62232:2017

Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure

TC 106 | Additional Information



5G Networks

- IEC 62232 ED2 110 MHz to 100GHz 2017
- IEC TR 62669 – case studies inc 5G 2018

5G Devices

- IEC TR 63170 Technical Report 6 to 100GHz July 2018
- IEC / IEEE International Std 6 to 300 GHz Dec 2020

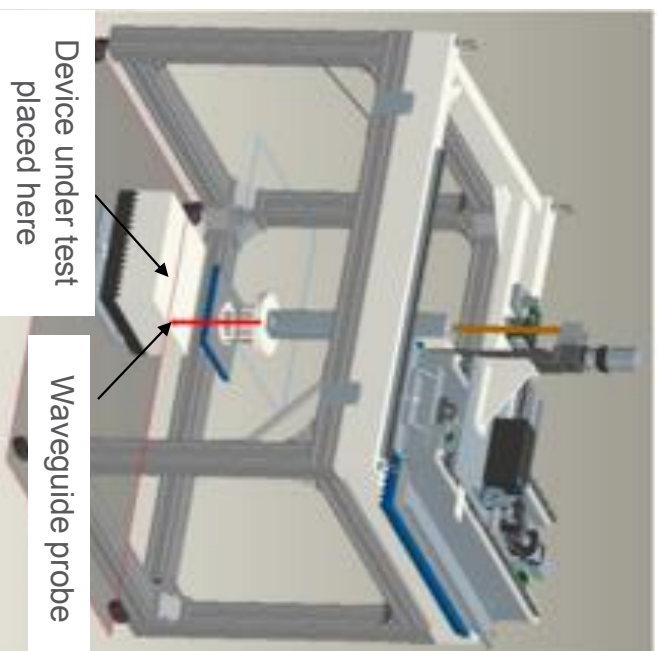


5G Device Test systems – power density measurements

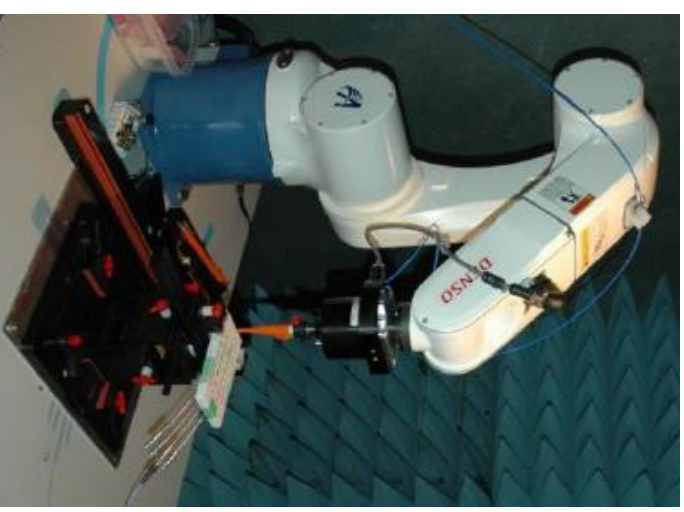
During development of the IEC 5G Technical Report in 2017, test laboratories initiated development of 5G mmWave device test systems



[IT'IS EUMmW Poynting vector probe](#)



[Art-FI mmWave guide probe development](#)

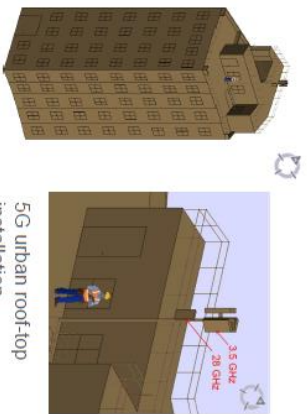


[APREL mmWave probe development](#)



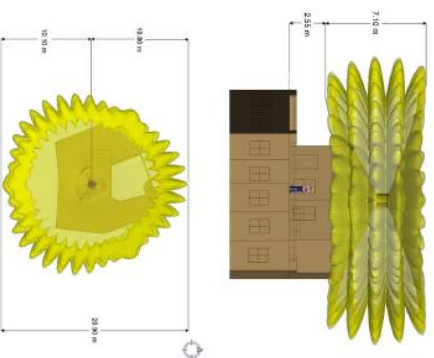
5G Macro Cell Assessment using IEC 62232

Example: 5G site with massive MIMO 3.5 GHz and 28 GHz, actual maximum power



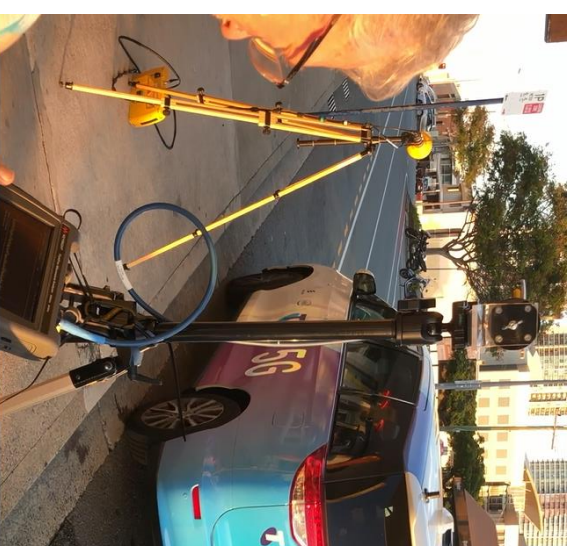
5G urban roof-top installation

Actual maximum power = 25% of theoretical maximum RF-EMF exposure below ICNIRP limits in public areas
Case study to be included in IEC TR 62669 (2018) and ITU-T Supplement on 5G EMF compliance



Exclusion zone
10 W/m²
ICNIRP general public limit

Modelling actual power due to beam steering



Measurements of 5G in Australia using IEC 62232
Locating beam and observing level variation **8**



Summary



IEC and IEEE have formed a Joint Working Group to ensure 5G assessment standards are globally harmonised and meet the 5G release timeframes

THANK YOU

