

# 5G EMISSIONS, PSD, AND OTHER CONCERNS

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# ONE NETWORK, MULTIPLE INDUSTRIES



› 5G will support a wide range of requirements.



Broadband experience everywhere anytime



Mass market personalized media and gaming



Meters, sensors, "Massive MTC"



Remote controlled machines



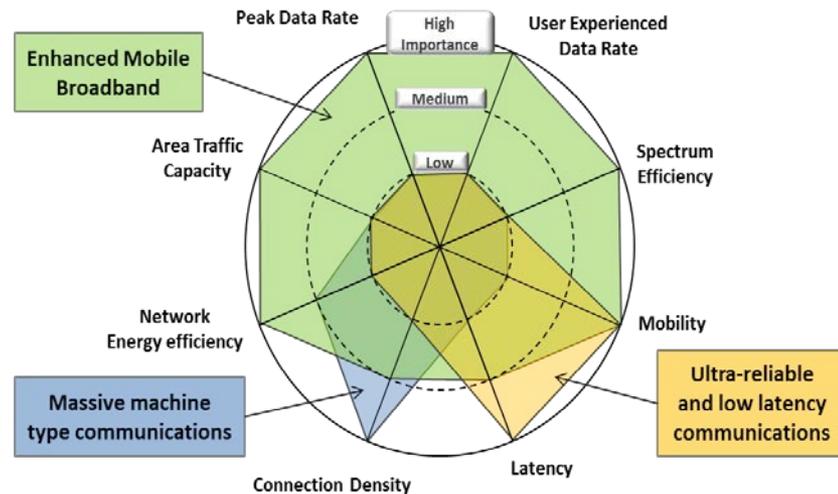
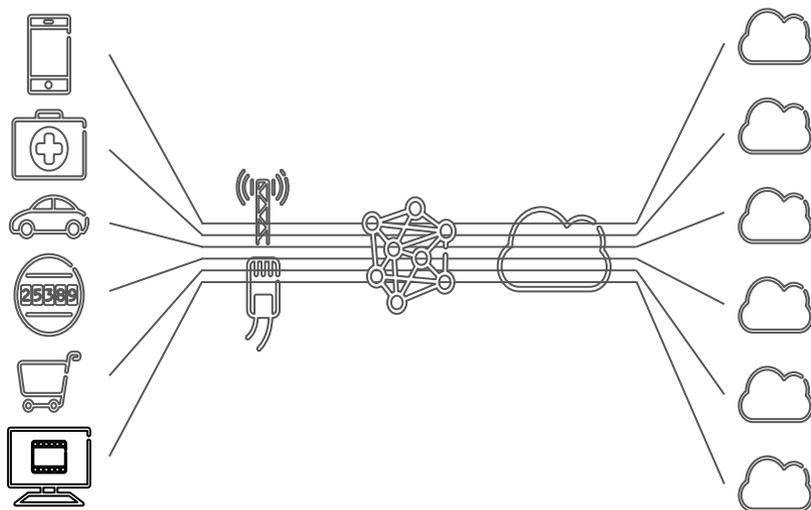
Smart Transport infrastructure and vehicles



Human / machines interaction



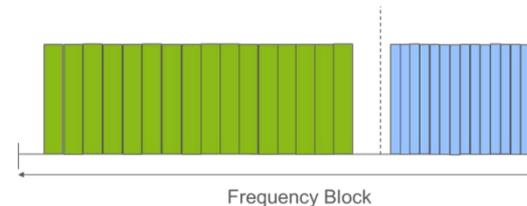
And much more beyond the crystal ball



# INTRODUCTION



- › Ongoing discussions to reach industry consensus as a 3GPP “Study Item” will start soon.
- › New access technologies in tight interworking with LTE evolution where the new access technology gradually would move to existing frequencies
- › Ericsson’s 5G access concept based on flexible OFDM parameterization:
  - Sub-carrier spacing ranging from a few kHz to several 100 kHz;
    - › spacing proportional to system bandwidths from sub-MHz to several GHz
    - › Large spacing also enables shortened sub-frames to reduce latency
  - Mixing of signal design possible.
- › Beam-forming essential part of system concept:
  - Suitable for higher frequency bands to improve antenna apertures;
  - Reduce interference in undesirable spatial regions;
  - Achieve improved bitrates in difficult situations, *e.g.*, at cell edge (“app coverage”).



# EMISSIONS REGULATIONS AND SPECTRUM ARRANGEMENTS

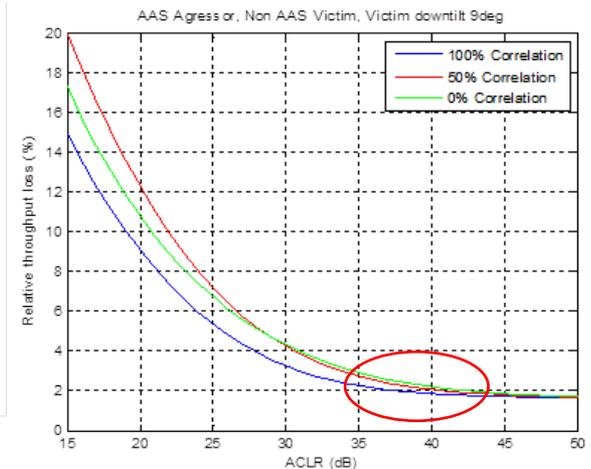
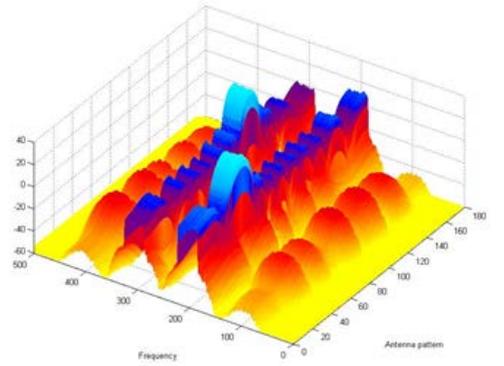
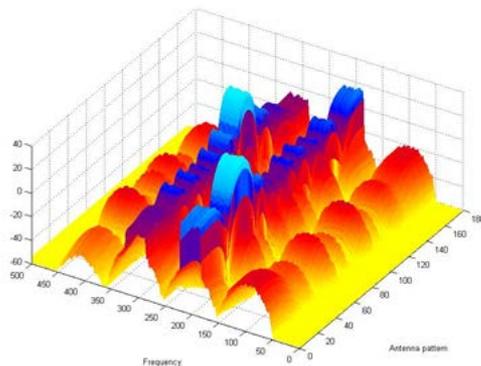


- › A given frequency block can carry various signals.
  - The concept of a “carrier” becomes obsolete.
  - Power Spectral Density (“PSD”) rises in significance as an additional parameter of choice.
    - › *E.g.*, combination of Enhanced-MBB and Massive Machine-to-Machine communication with improved coverage resulting in different PSD per signal realization.
- › Bandwidth-dependent emission requirements would punish broadband systems
  - Ericsson urges bandwidth-independent emission requirements; and
  - Reasonable levels considering massive MIMO with many radiating elements.

# UNWANTED EMISSIONS



- › Unwanted emission can have a slightly different spatial distribution compared to wanted signal but very little compatibility impact
  - Depends on correlation
  - Most probably not correlated outside the operating band due to filters group delay characteristics.
  - For AAS/Massive MIMO: much dynamic and statistics in reality
    - › Multiple user and time dynamics would average out the emissions



**Unwanted emissions can be defined  
as TRP (Total Radiated Power)**

# UNWANTED EMISSIONS



- › Highly integrated AAS/Massive MIMO products may not be designed with connectors to limit leakage and loss.
  - Conducted measurements would be impossible.
  - OTA measurement would be necessary.
  - Ericsson asks that the FCC continue to allow conducted measurements applying  $10 \log(n)$  as an option.
    - › Also allow for declaration of equivalence.
  
- › TRP measurements enough for emissions measurements
  - Avoid specifying emission limits in terms of EIRP for OTA measurements
    - › Excessive testing time when including spatial measurements

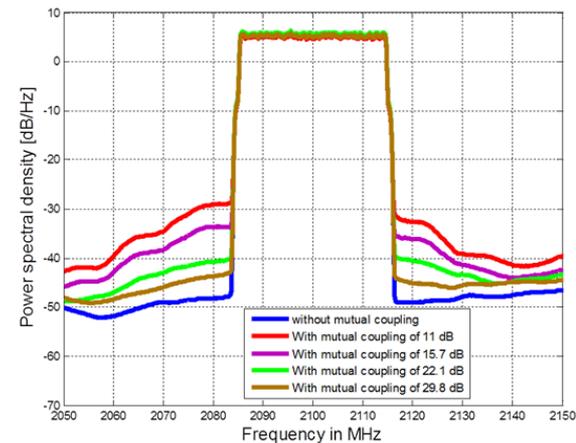
# UNWANTED EMISSIONS



- › Vary resolution bandwidth for measurements as frequency range increases.
  - Start with 1 MHz and progressively increase to 10 MHz and 100 MHz.
  - Otherwise, the frequency range for unwanted emissions /spurious emission would be extended to several hundred GHz increasing the number of measurements.

- › For in-band unwanted emission requirements, OTA measurements are important to capture the antenna cross-talk impact.

- TRP as measurement would still be representative

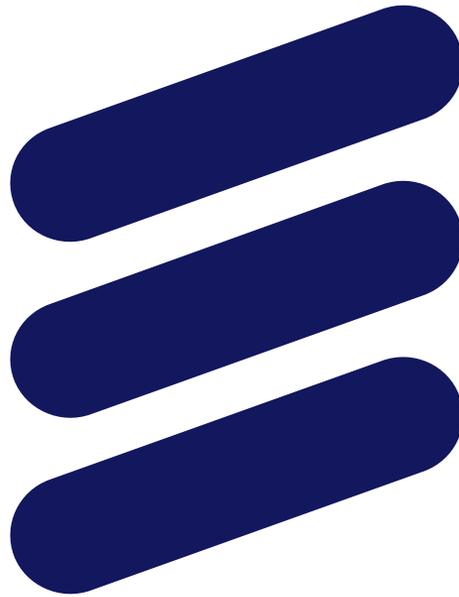


- › Having same requirement level for EIRP (if defined as EIRP) and conducted (scaled by  $10 \log(n)$ ) would pose significantly more stringent requirements on EIRP case and should be considered.

# ADDITIONAL THOUGHTS



- › A regulatory framework instead of determinations.
- › Important to retain the pre-testing possibilities.
- › Consider some restrictions for lower and higher frequency ranges.
  - Limit the lower frequencies as chambers become extremely large.
  - Allow for frequency converters, as instruments today have limitations in frequency range.



**ERICSSON**