



GRUPPO TIM

ETSI Event "Towards Setting Environmental Requirements for 5G"

Sophia Antipolis, Nov 23, 2017

Assessment of energy efficiency of 5G

A view on the standards for EE and the evolution towards 5G

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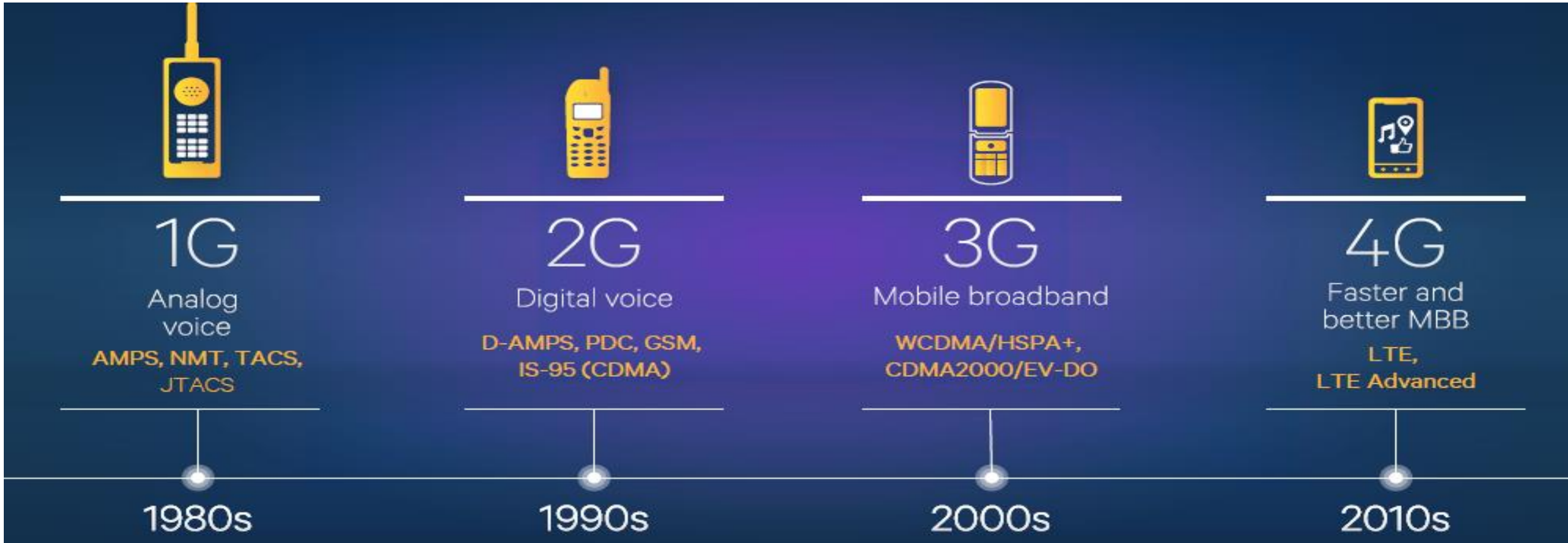
This presentation is about standards jointly developed in the latest years in ETSI EE- EEPS and ITU-T SG5

- ETSI TR 103 542, EE-EEPS, "Environmental Engineering (EE); Study on methods and metrics to evaluate energy efficiency for future 5G systems ", May 24, 2017
- ITU-T SG5, L.STP-5GEE, Series L, Technical Paper "Study on methods and metrics to evaluate energy efficiency for future 5G systems", May 24, 2017

Agenda

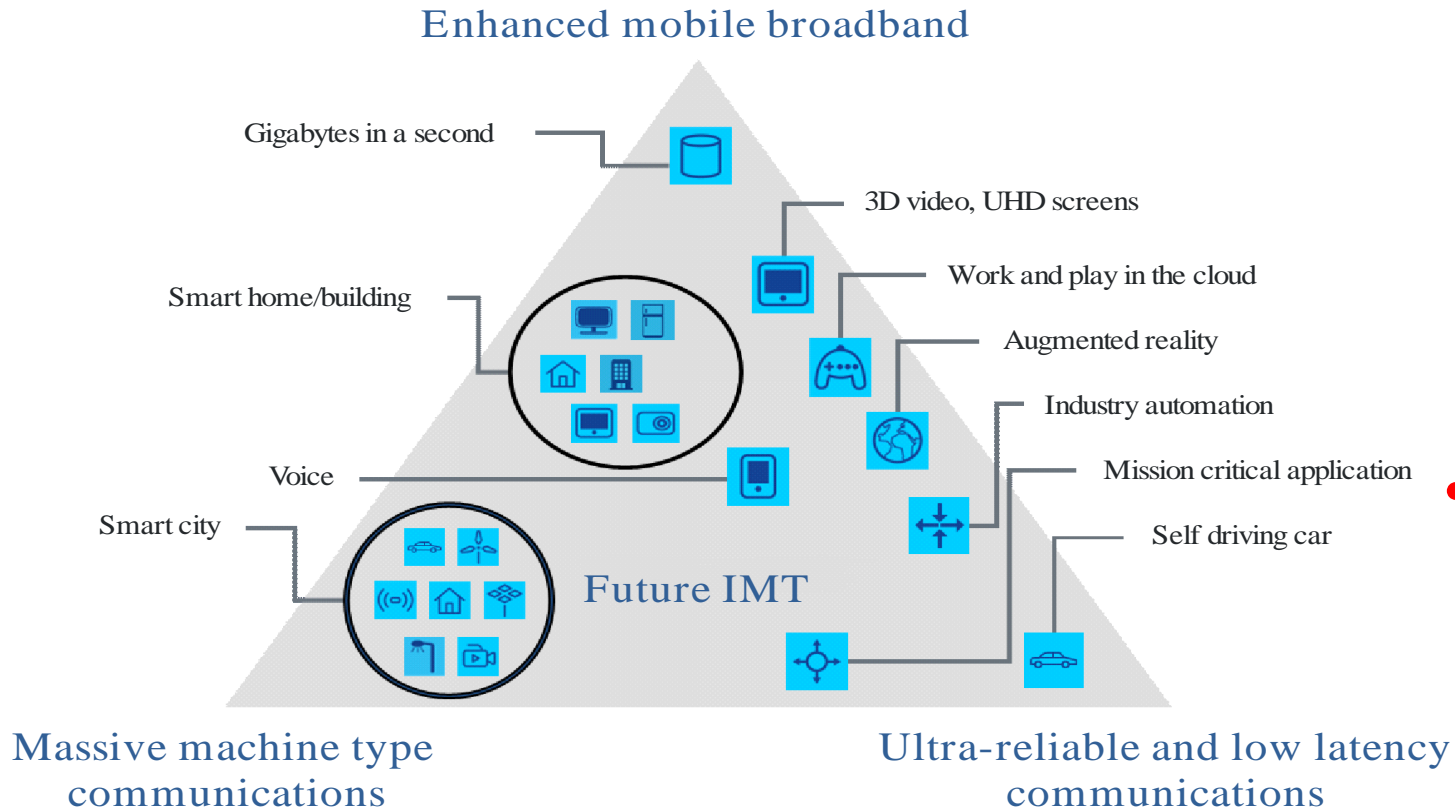
- Introduction of 5G systems
- Standardization of 5G systems
- Energy Efficiency and 5G
 - Aspects of 5G that could impact EE
 - Legacy EE specifications
 - State of The Art of 5G EE
 - Activities in ETSI and ITU for 5G EE

Today... we are here



Source : Qualcomm presentation @ 5G Tokyo Bay Summit (July 2015)

The 5G systems

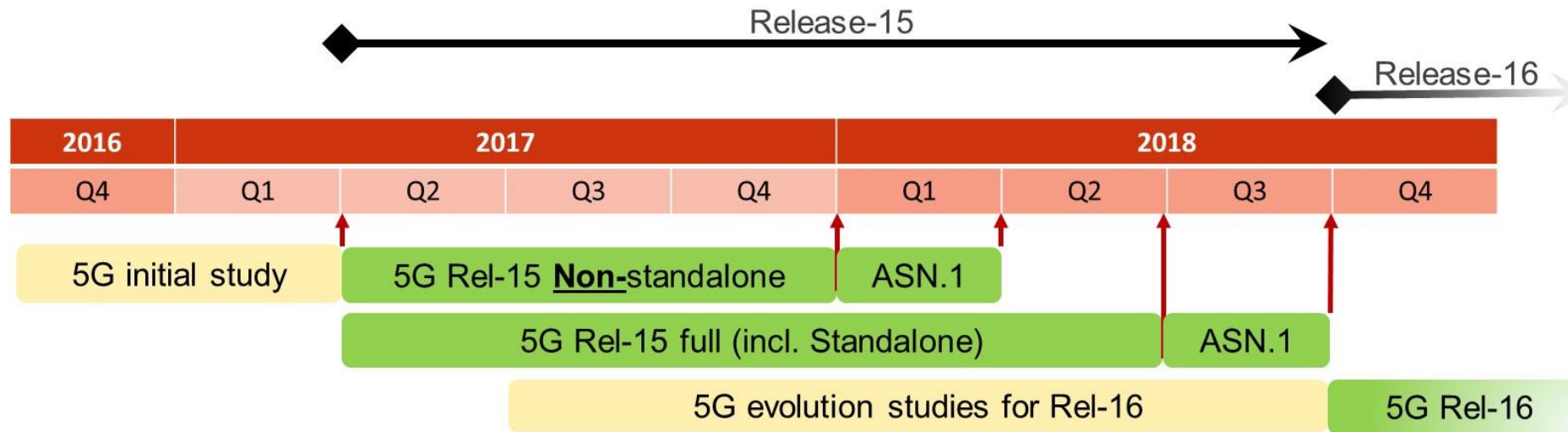


M.2083-02

[Source: Rec. ITU-R M.2083, "IMT Vision"]

- 5G is intended to serve three main services
 - eMBB as a direct evolution of legacy systems
 - URLLC as enablers for industry automation, self driving cars, mission critical applications, AR/VR
 - mMTC as enablers for smart cities, disaster recovery and so on
- The 5G system represents at the same time an **evolution** of the current legacy systems and a **revolution** to satisfy the new needs of the innovative services offered by the inclusion of new “vertical” areas in the telecommunications environment

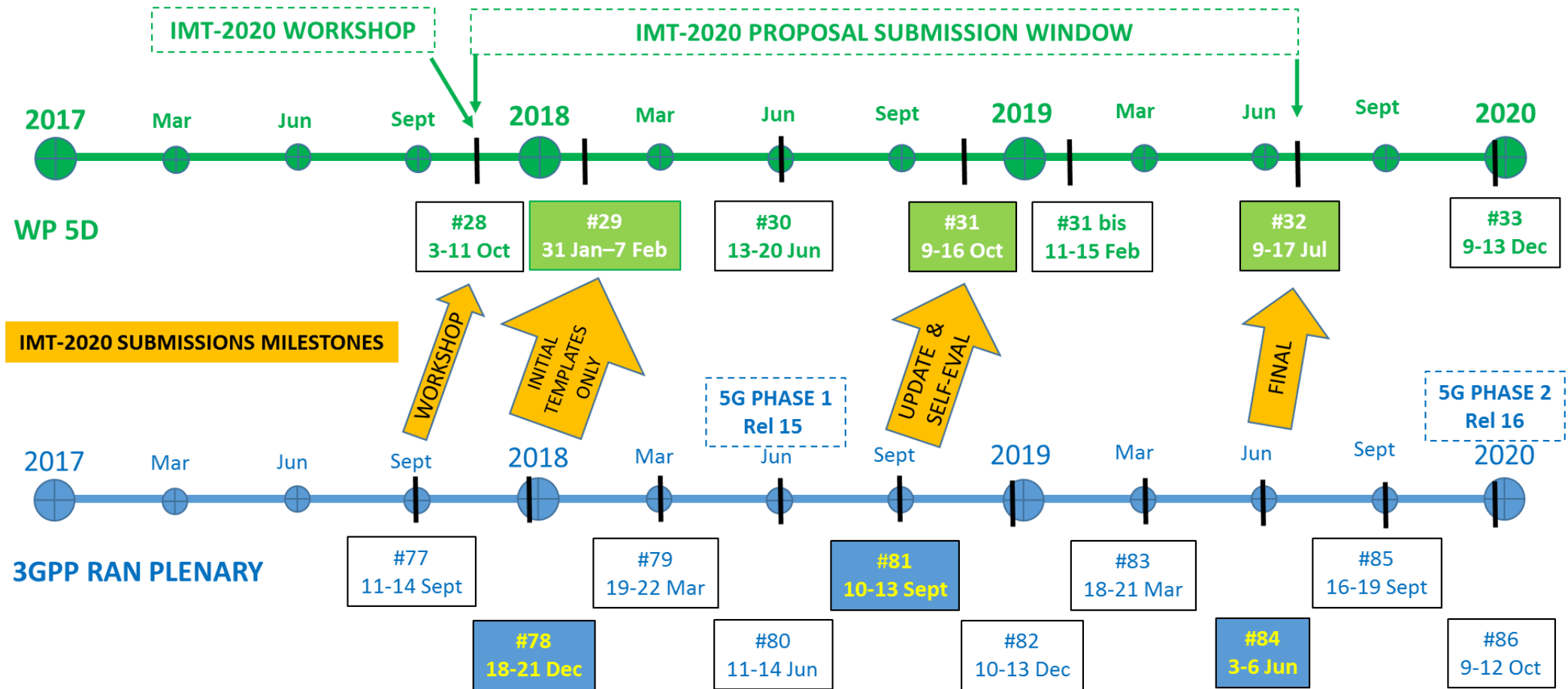
The 3GPP timeline



[Source: 3GPP RAN Plenary #75-77 (B.Balasz presentation)]

- This is the roadmap currently adopted in 3GPP RAN to standardize 5G
 - Release 15 with an Early Drop (NSA) End of 2017
 - Release 14 full (SA) 2Q18
 - Meanwhile SI/WIs on Release 16, that will be initiated in Q418

The ITU submission timeline



[Source: 3GPP RAN Plenary #75-77 (B.Balasz presentation)]

Aspects of 5G that could impact EE

- As stated, 5G is a system that will be evolutionary, and in this sense the previous EE specifications are still valid, and revolutionary, introducing new features that will require adaptation
- Currently, we envision in particular these features as possibly having impacts on 5G EE
 - **Higher data rates** (hence the usual metrics bit/joule could be biased)
 - **Lower latency** (at the expense of what?)
 - **IoT** and the related **low data rate services** (very different from a traditional base station)
 - **Carrier aggregation** and **multiple connectivity** (different models of transceivers)
 - **Massive MIMO** (and related usage of mmW)
 - Multilevel **sleep modes** (impacting EE directly)
 - Explicitly includes hooks to help **cloudification and virtualisation** (different network layout)
 - **Network slicing** for different applications (and different consumption models)



Existing «legacy» specifications for EE in mobile networks

- We are anyway not starting from the scratch (NGMN and European Projects started already years ago...)
- In ETSI EE/EEPS and in ITU-T SG5 in the last 5-10 years specifications about EE for radio networks have been developed and tested
- In particular the most significant are
 - ES 202 706
 - This is the specification, split into a version 1 for static EE evaluations, and a version 2 for dynamic, that deals with the EE of radio base stations for GSM, UMTS and LTE. Widely used e.g. for Code of Conduct by EC
 - ETSI ES 203 228/ITU-T L.1330 (03/15)/ITU-T L.1331 (04/17)
 - This is the specification/recommendation considered as a point of reference also by 3GPP (SA and RAN) that deals with the methods and metrics to evaluate EE for mobile radio access networks, encompassing GSM, UMTS and LTE
 - ITU-T L.1310
 - Recommendation related to the principles and concepts of energy efficiency metrics and measurement methods for telecommunication network equipment



State of The Art for EE in 5G

The ITU activities



- ITU-R IMT M2083 Vision
 - *The energy consumption for the radio access network of IMT-2020 should not be greater than IMT networks deployed today, while delivering the enhanced capabilities. The network energy efficiency should therefore be improved by a factor at least as great as the envisaged traffic capacity increase of IMT-2020 relative to IMT-Advanced for enhanced Mobile Broadband* ✓
- ITU-R IMT-2020.TECH PERF REQ Perf Req
 - *It is required that the 5G mobile networks have the capability to support a high sleep ratio and long sleep duration and other energy saving mechanisms for both network and device are encouraged* ✓



State of The Art for EE in 5G

The 3GPP activities



- RAN
 - TR 38.913 “Study on Scenarios and Requirements for Next Generation Access Technologies (Release 14)”
 - “Network energy efficiency shall be considered as a basic principle in the NR design”. Qualitative inspection is suggested, for Energy Efficiency, but also quantitative analysis ✓
- SA
 - TR 21.866 “Study on Energy Efficiency Aspects of 3GPP Standards (Release 14)”
 - Energy Efficiency KPI definitions
 - WI on FS_EE_5G “Study on system and functional aspects of Energy Efficiency in 5G networks”
 - Working on the TR 32.972 “Study on system and functional aspects of energy efficiency in 5G networks (Release 15)”
 - EE KPIs and metrics
 - Measurement methods
 - Potential solutions to improve Energy Efficiency ✓
 - Widely based on ETSI TC EE and ITU-T SG5 works



Proposed metrics for 5G EE

What will be done in ETSI EE and ITU-T SG5 in next months

- The metrics and methods described in ES 203 228/ITU-T L.STP 5GEE for the legacy networks are considered valid for 5G Phase 1 and an update will be issued once the 5G Phase 1 details will be standardized. It is worth noting that ES 203 228/ITU-T L.STP 5GEE already includes some remarks on virtualization
- The Phase 2 of 5G, that will come in next years, will impact heavily the specifications to measure energy efficiency and will require an extensive update of them, in tight cooperation with the standard bodies that will outline the new systems, especially 3GPP RAN and ITU-R. The objective is for example to leverage 3GPP SA5 work dealing with energy efficiency related analytics



Next steps

The future developments in ETSI EE and ITU-T SG5



- As a first step, it is proposed to:
 - New WI to complement ES 202706-1 with the following topics
 - antenna array systems used in mMIMO (in particular the definition of traffic models, the impact of number of beams and beam steering...)
 - improve specification of base band consumption testing including base band hostel use case
 - advanced sleep modes (informative annex)
 - New WI to complement ES 203 228/ITU 5GEE with the following topics
 - multi-techno networks (HetNet)
- As a second step, it is proposed to:
 - New WI to complement ES202706-1 with the following topics
 - advanced sleep modes
 - New WI to complement ES 203 228/ITU 5GEE with the following topics
 - develop energy KPIs/counters and energy efficiency analytics (liaison with SA5)
 - Cloud RAN

Activities to be approved in the Standard Groups (ETSI and ITU)



Grazie