ITU/SbPU seminar for CIS and Europe “Development of the modern radiocommunication ecosystem”

6-8 June 2018, St. Petersburg

ERICSSON

5G MOBILE BROADBAND

Contact: jose.costa@ericsson.com

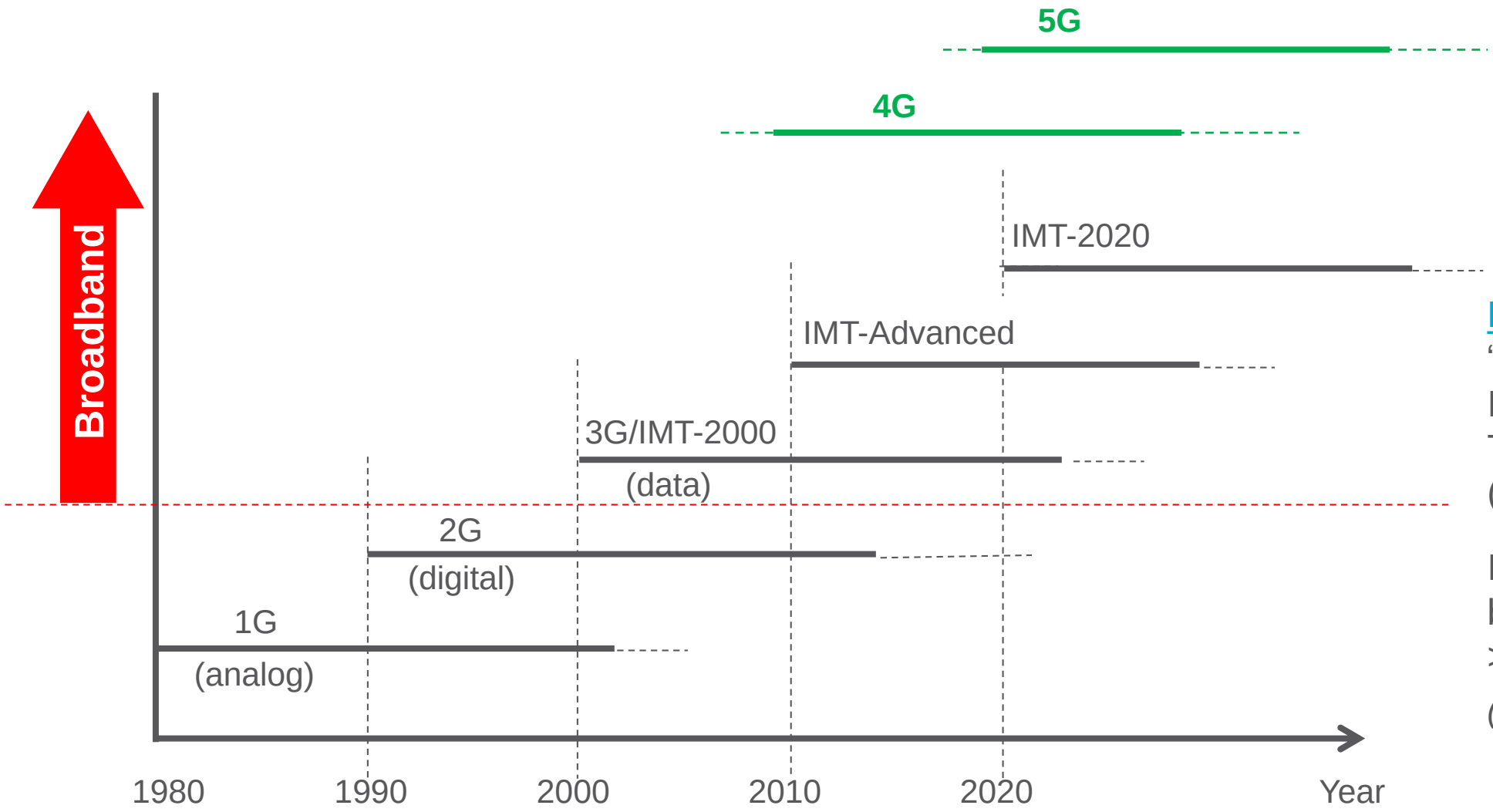
OUTLINE

- 5G capabilities and business value
- IMT-2020 standardization process
- Bands identified for IMT in the ITU Radio Regulations and further bands to be considered at WRC-19

Glossary:

5G	5th Generation
IMT	International Mobile Telecommunications
WRC	World Radiocommunication Conference

GENERATIONS OF MOBILE WIRELESS ACCESS SYSTEMS

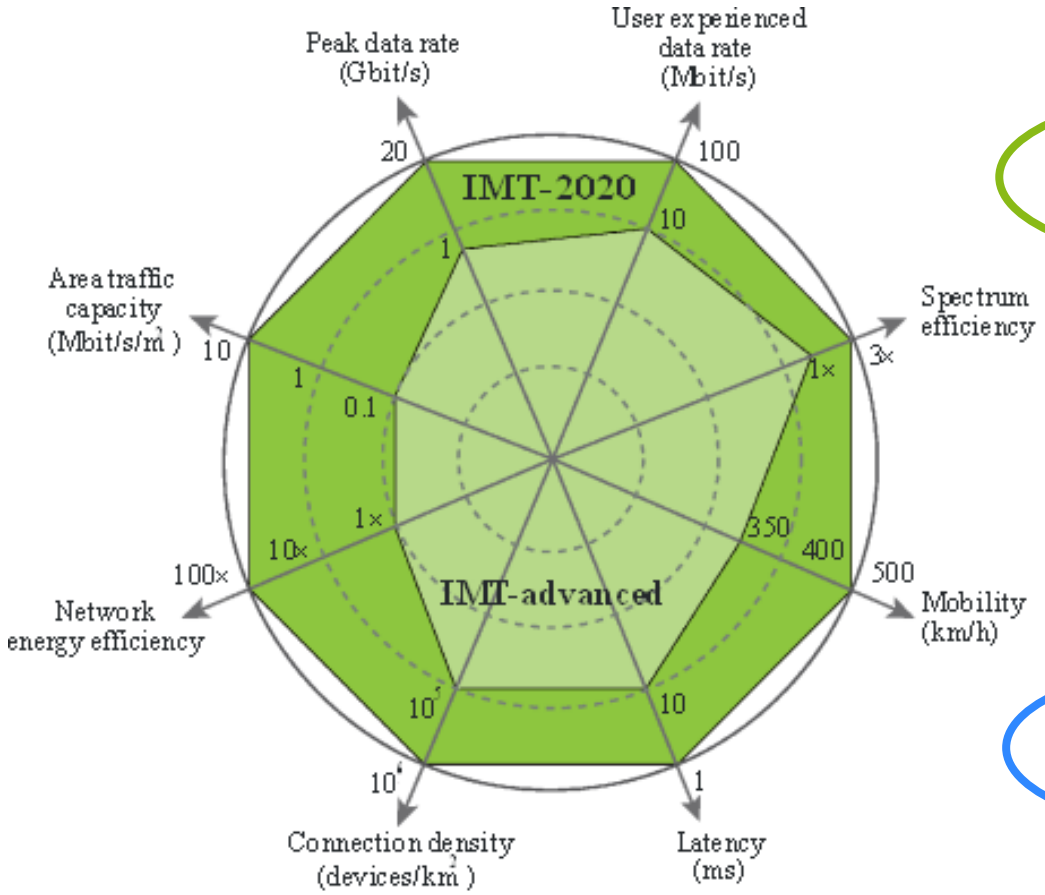


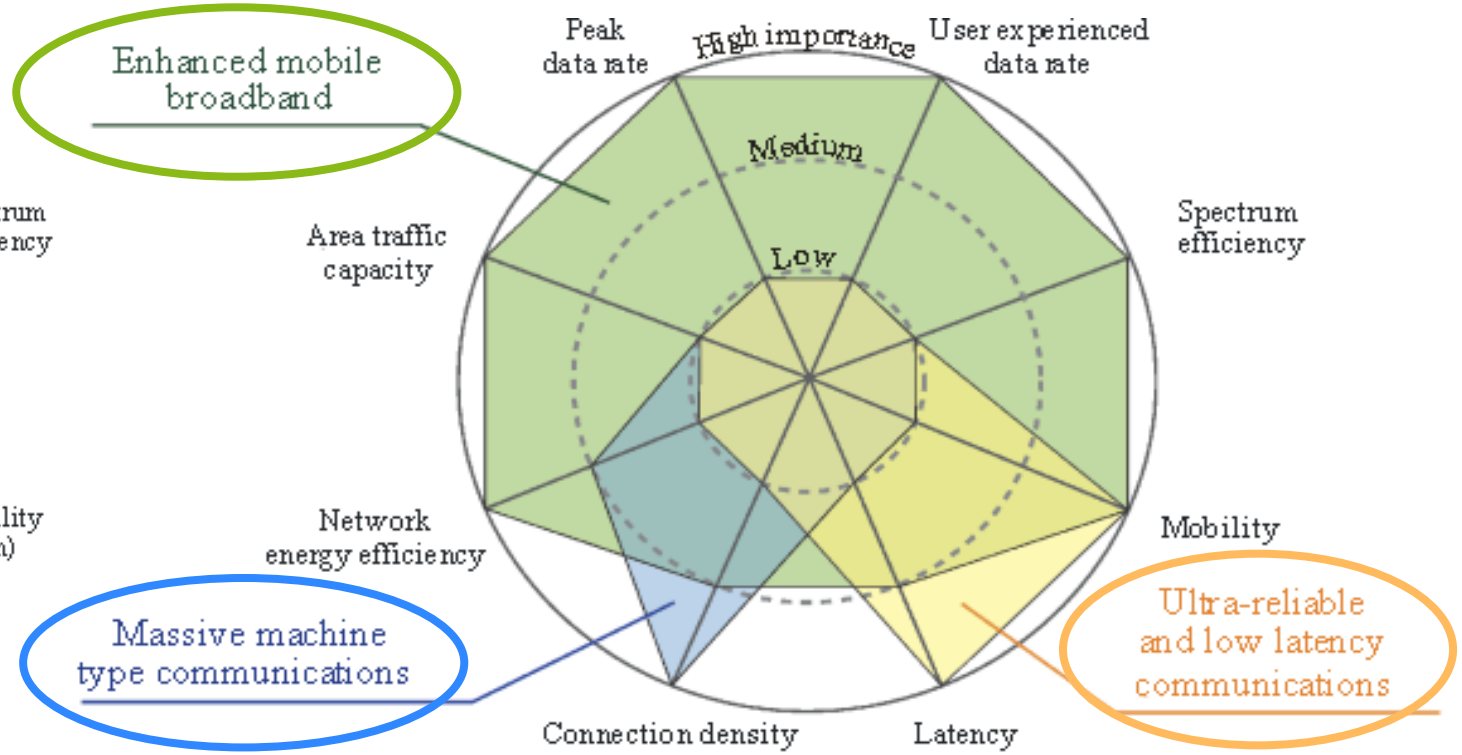
Resolution ITU-R 56
"Naming for International Mobile Telecommunications (IMT)

ITU definition of broadband access:
> 2 Mbit/s

(Ref. Doc. 5D/426)

KEY CAPABILITIES ENHANCEMENTS

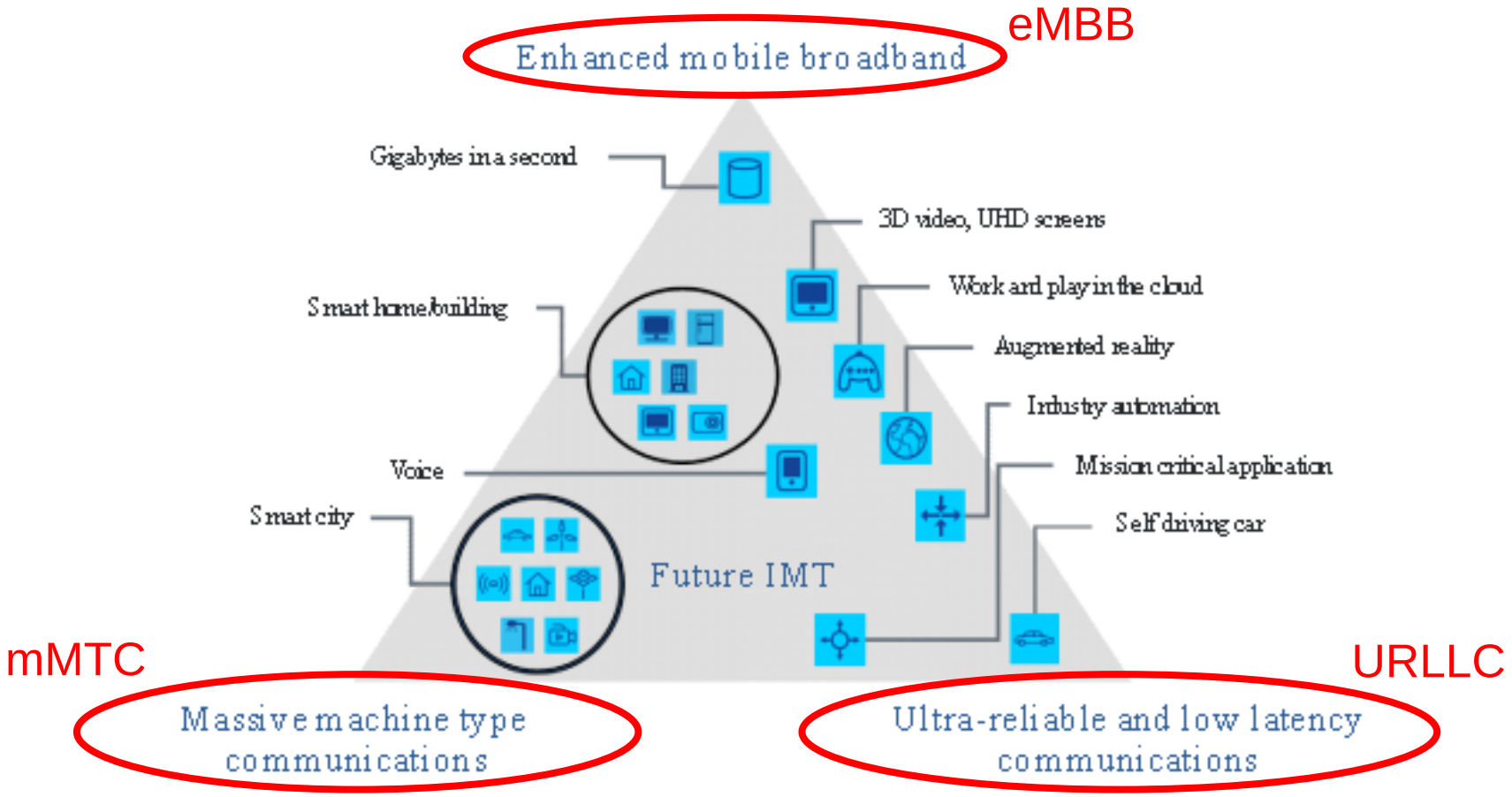




Reference: [Recommendation ITU-R M.2083](#) "IMT Vision – Framework and overall objectives of the future development of IMT for 2020 and beyond"

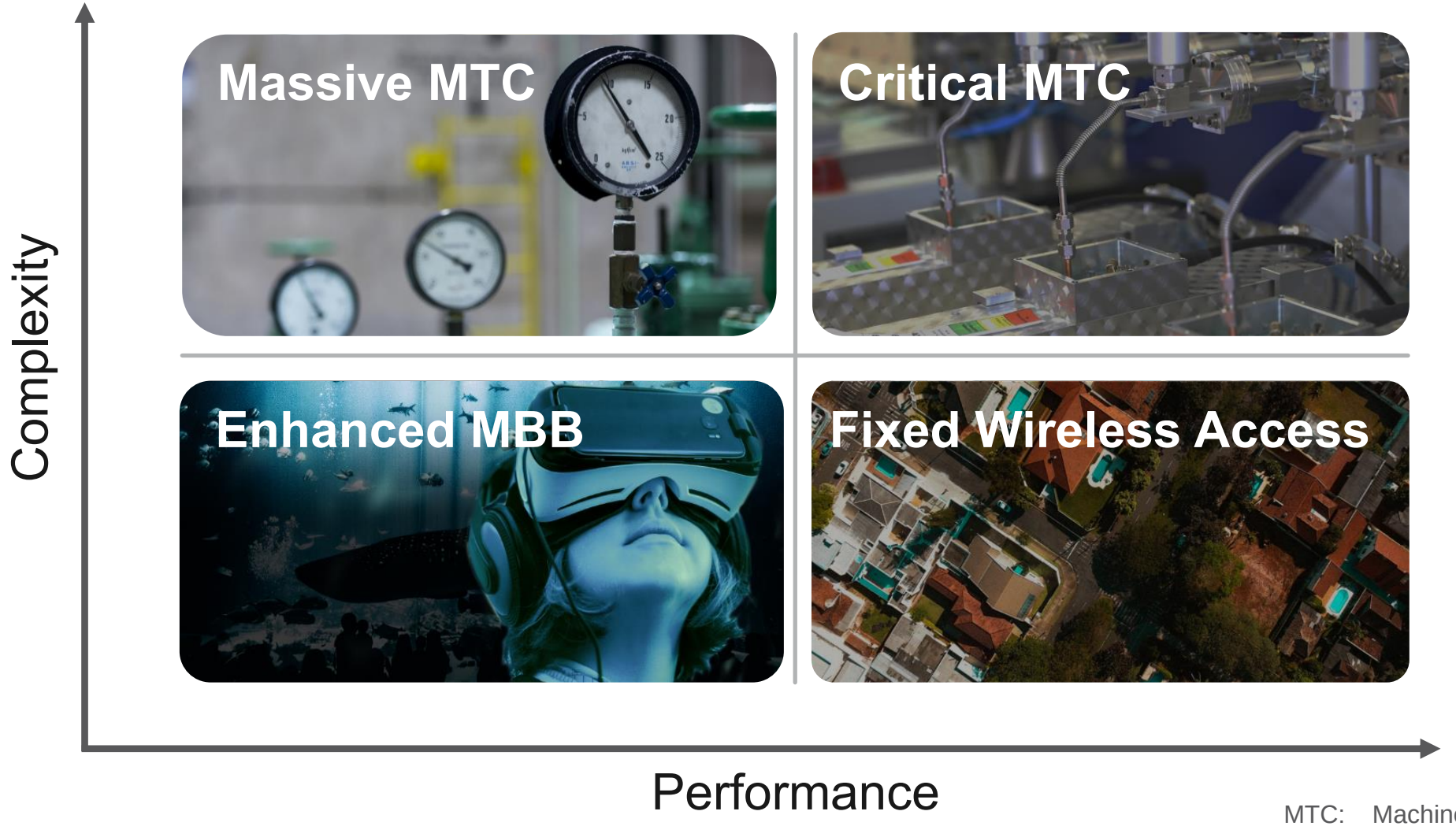
MINIMUM TECHNICAL PERFORMANCE REQUIREMENTS

User environments:



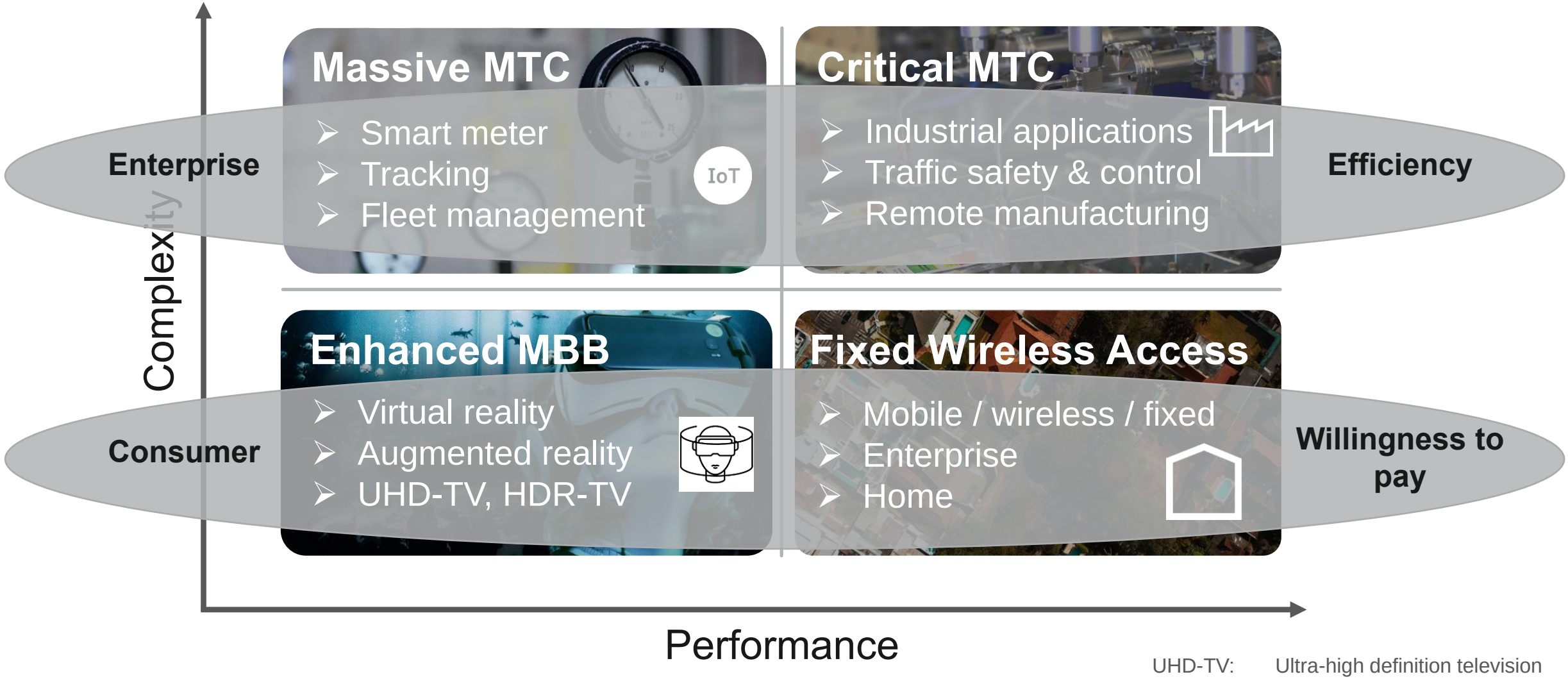
Reference: [Recommendation ITU-R M.2083](#) "IMT Vision – Framework and overall objectives of the future development of IMT for 2020 and beyond" and [Report ITU-R M.2410](#) "Minimum requirements related to technical performance for IMT-2020 radio interface(s)"

5G use cases by segment



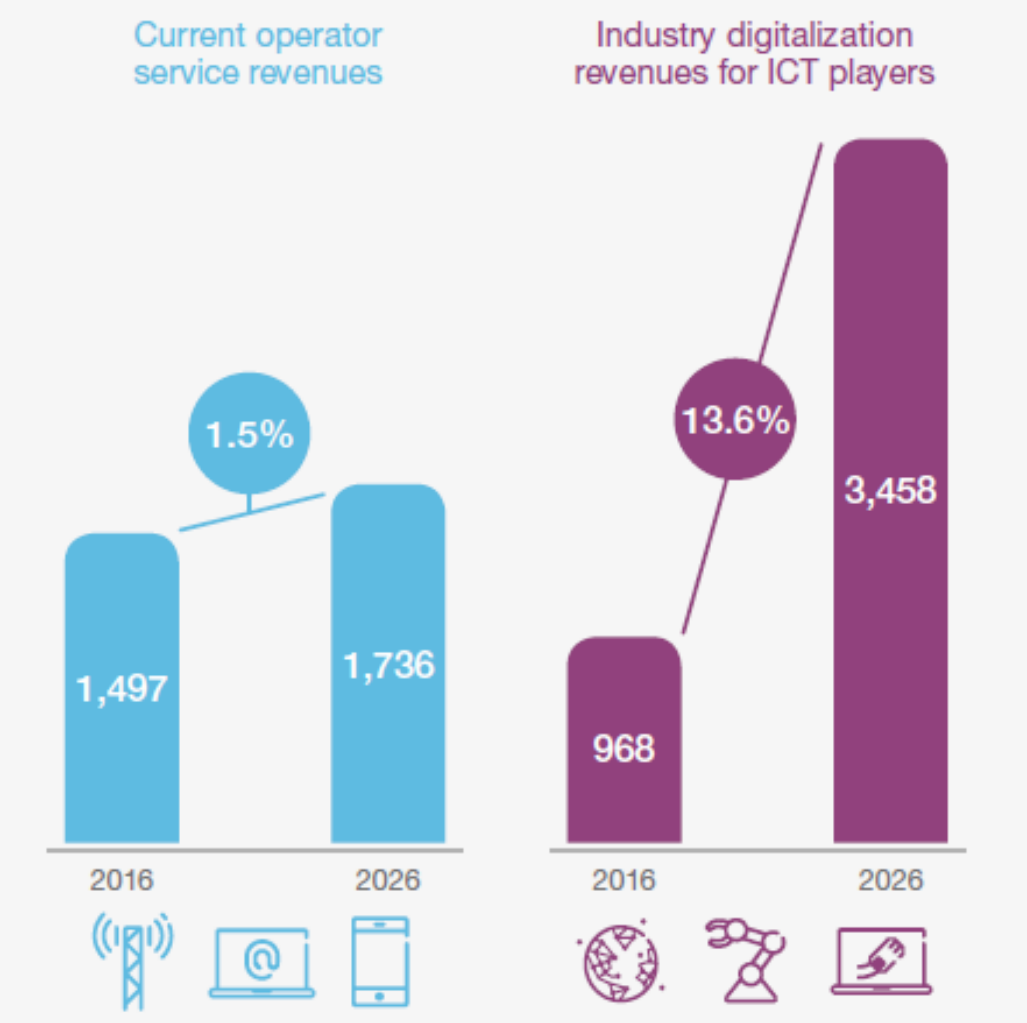
MTC: Machine type communications
MBB: Mobile Broadband

5G use cases by segment



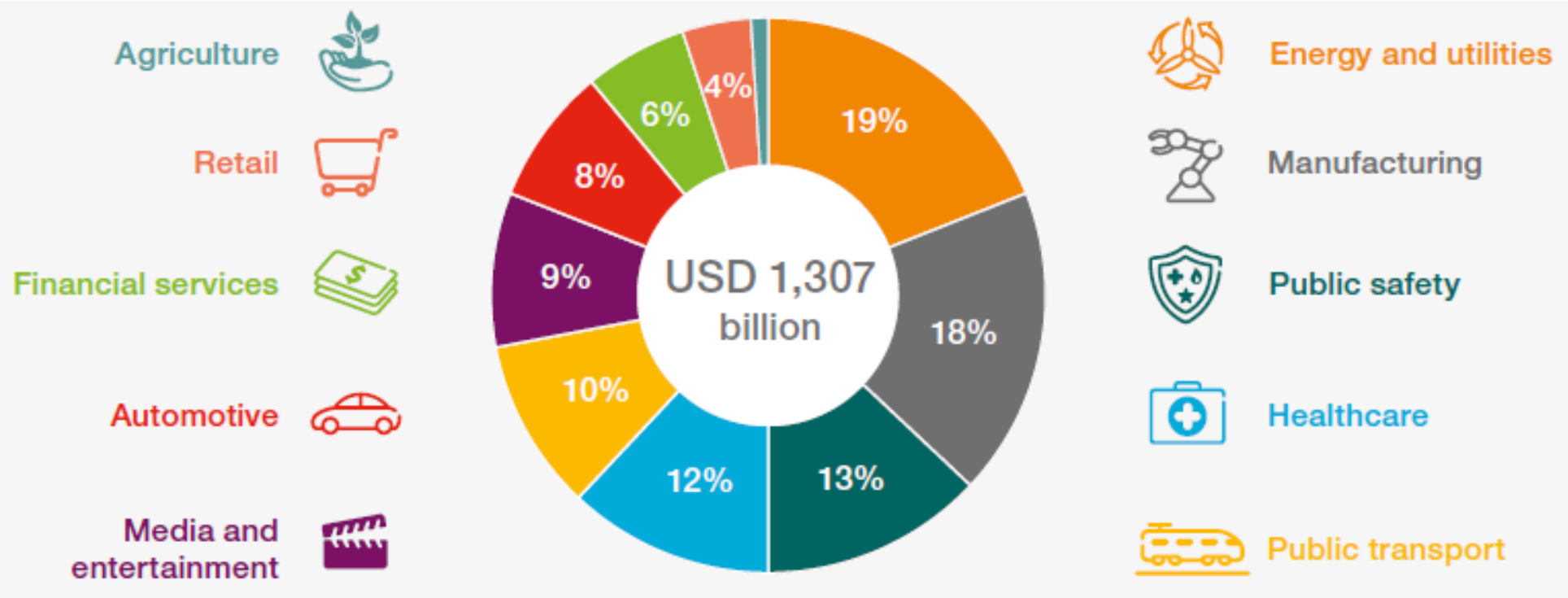
UHD-TV: Ultra-high definition television
HDR-TV: High dynamic range television

5G MARKET REVENUE FORECAST



- Compound annual growth rate (CAGR) 2016–2026, USD billion.
- Industries included: manufacturing, media and entertainment, financial services, public safety, energy and utilities, healthcare, retail, agriculture, automotive, public transport.
- *Source:* Ericsson and Arthur D. Little, Figure 1 in "**The 5G business potential**", Second edition, October 2017. Available: https://www.ericsson.com/en/events/archive/mwcs-2017/5g-business-potential

5G-ENABLED REVENUES FOR ICT PLAYERS, 2026



› Industry digitalization revenues for ICT players come from adopting or integrating digital technologies into a specific industry (not including revenue from the sale of smart objects such as devices, cars, forklifts, or hospital beds).

CASE STUDY EXAMPLE: BLISKS

- Introducing 5G mobile communications into industrial manufacturing processes, such as the manufacture of bladed disks (BLISKs).
- The rework rate of BLISKs today is approximately 25 percent, meaning that 1 in every 4 BLISKs needs to be reworked, and with automation it can be decreased from 25 to 15 percent.
- The 5G-enabled BLISK case study alone could **create annual savings of approximately EUR 27 million for one single factory, and up to EUR 360 million globally**.
- While the BLISK case is an extreme example, similar challenges exist within the manufacturing industry as a whole; vibration and "chatter" during milling is a very common problem.
- There are approximately 5 million industrial sites in Europe alone, compared with a total of 4 million mobile base stations in the world (https://rod.eionet.europa.eu/obligations/721): equipping each industrial site with mobile communications opens up large opportunities for operators to expand their business.

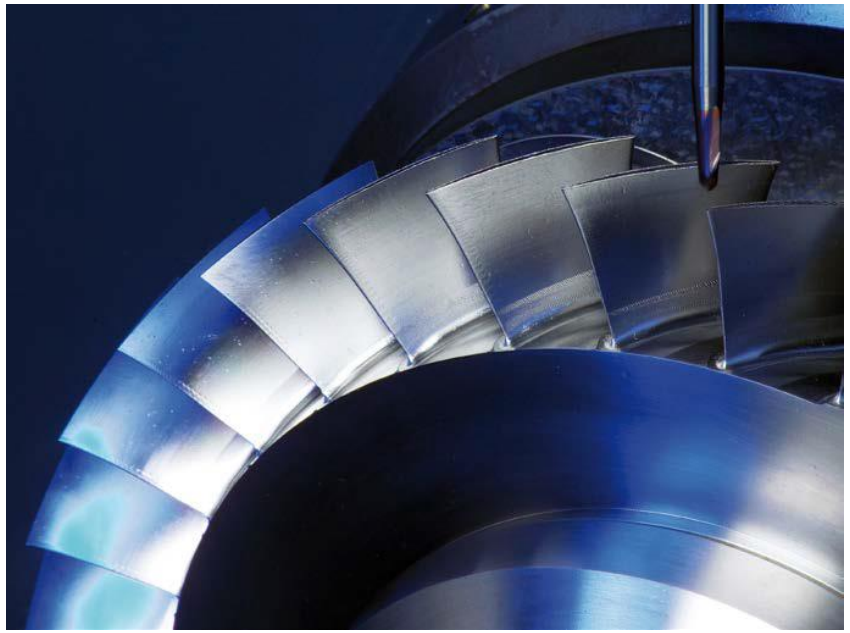


Image source: Fraunhofer IPT in "**Bringing 5G business value to industry**", An Ericsson Consumer & IndustryLab Insight Report April 2018. Available: https://www.ericsson.com/en/trends-and-insights/consumerlab/consumer-insights/reports/5g-business-value-to-industry-blisk

OPERATOR OPPORTUNITIES

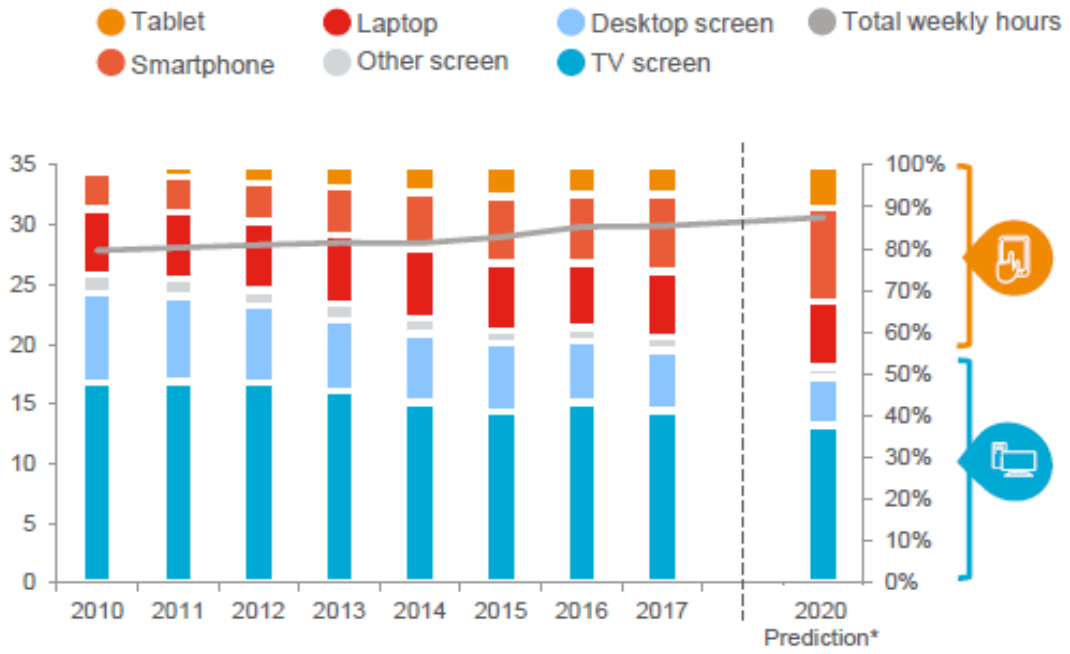
- Mobile operators can now create a new business model based on Service Level Agreements (SLAs) rather than subscriptions. However, to do so will require adapting the operators' go-to-market and delivery strategies by considering 3 areas:
  1. **Package an easy-to-buy, off-the-shelf commercial solution**: Work together with major factory ecosystem suppliers to help establish one unified form of communication technology. Based around high-value use cases, this would make it easy for a customer to choose a private enterprise cellular connectivity solution. Being early in offering a unified solution could build momentum in an expanding market, and would also accelerate mobile communications' progress into the selection of available options.
  2. **Build a delivery organization that responds to very strict SLAs**: Build trust in operating core processes with high performance requirements, ensure processes are in place to deliver at that level and be resilient in restoring and proactively preventing disturbances.
  3. **Sales and marketing** - Gain market awareness of the deployment challenges and ecosystem properties affecting customers: Build awareness and demonstrate a credible understanding of customer needs through, for example, demonstrating capability to actively engage with partners and drive the market.

IMT BY INDUSTRIES: ITU STUDY

- Machine-Type Communication (MTC)
- Broadband public protection and disaster relief (PPDR)
- Transportation: ITS, railway, public transportation & logistics
- Utilities: smart grid, water management
- Industrial automation: factory automation, process automation
- Remote control: mining, construction sites, harbours, surveying and inspection, oil and gas, remote surgery
- Healthcare: mobile health applications, sustainability/environmental
- Enhanced multi-media: augmented reality, gaming, media and entertainment, broadcast content distribution and production
- Other: education, smart city, wearables, smart homes, agriculture

Reference: Working document towards a preliminary draft new Report ITU-R M.[IMT.BY.INDUSTRIES] "The use of terrestrial component of International Mobile Telecommunication (IMT) by industry sectors" (Attachment 3.13 to Doc. 5D/875)

IMT AUDIO VIDEO DISTRIBUTION



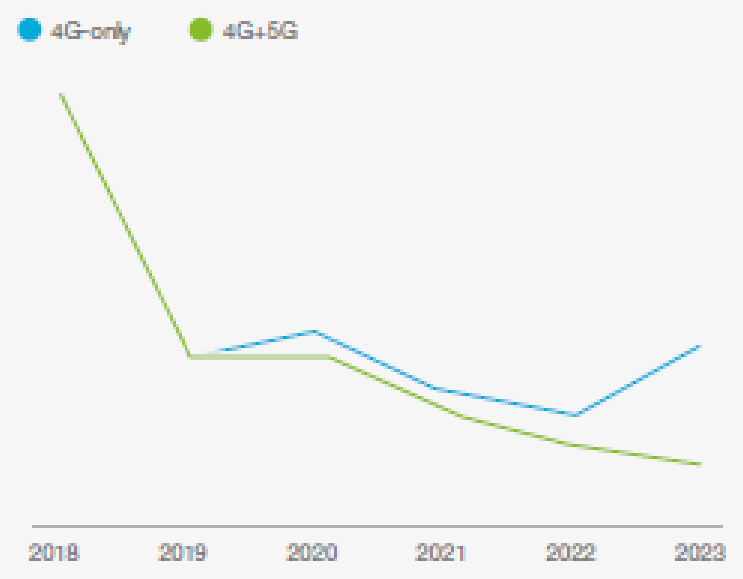
- User requirements and trends for audio-visual services and applications
- Key characteristics of terrestrial IMT that enable audio-visual services and applications
- Detailed description of LTE eMBMS features

***eMBMS**: evolved Multimedia broadcast / multicast services*

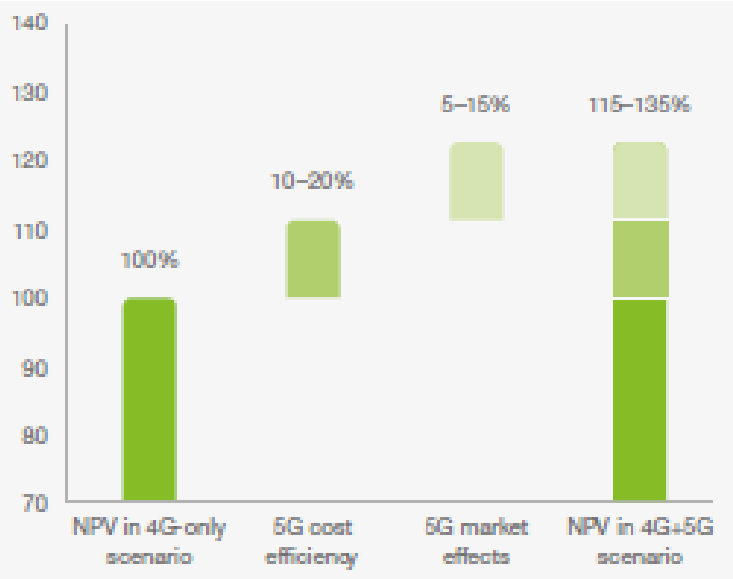
Source: Working document towards a draft revision of Report ITU-R M.2373-0 – "Audio-visual capabilities and applications supported by terrestrial IMT systems" (Attachment 3.6 to ITU-R Doc. 5D/875).

VALUE IMPACT OF 5G

Network cost (capex and opex) per gigabyte



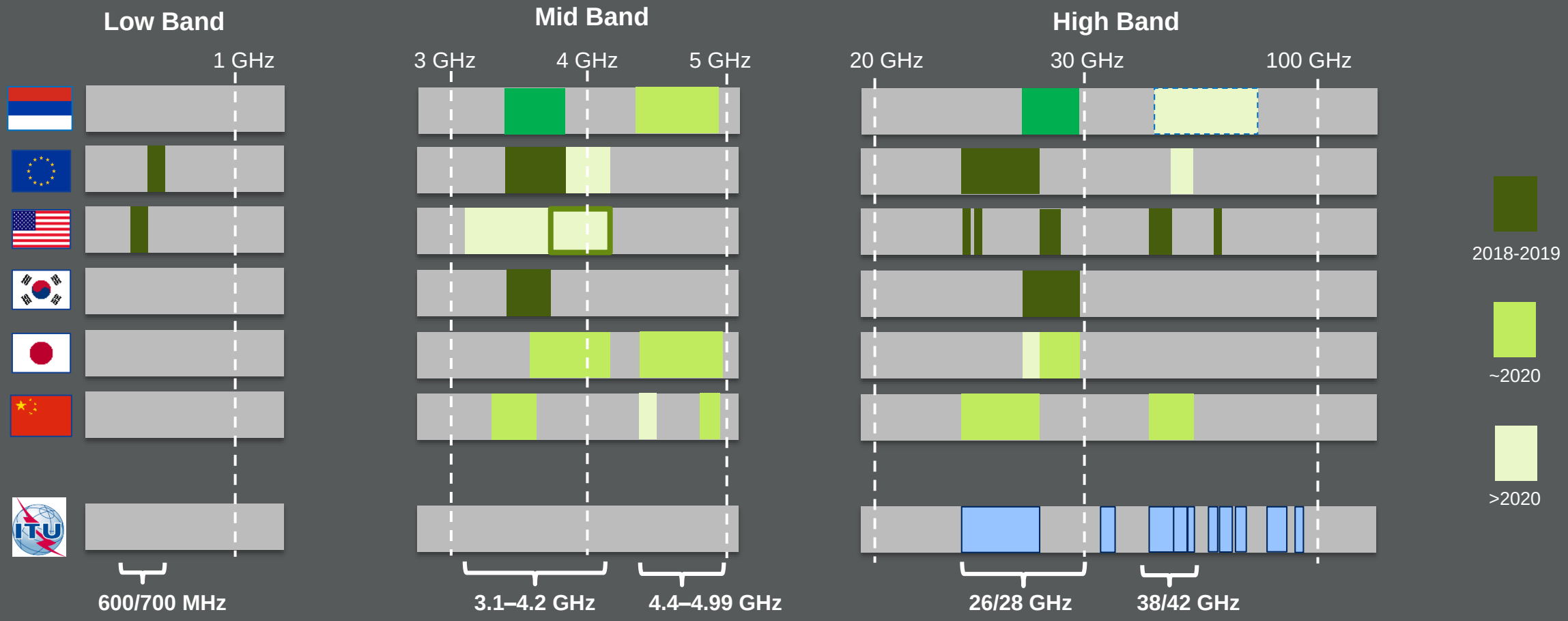
NPV impact of 5G (percent)



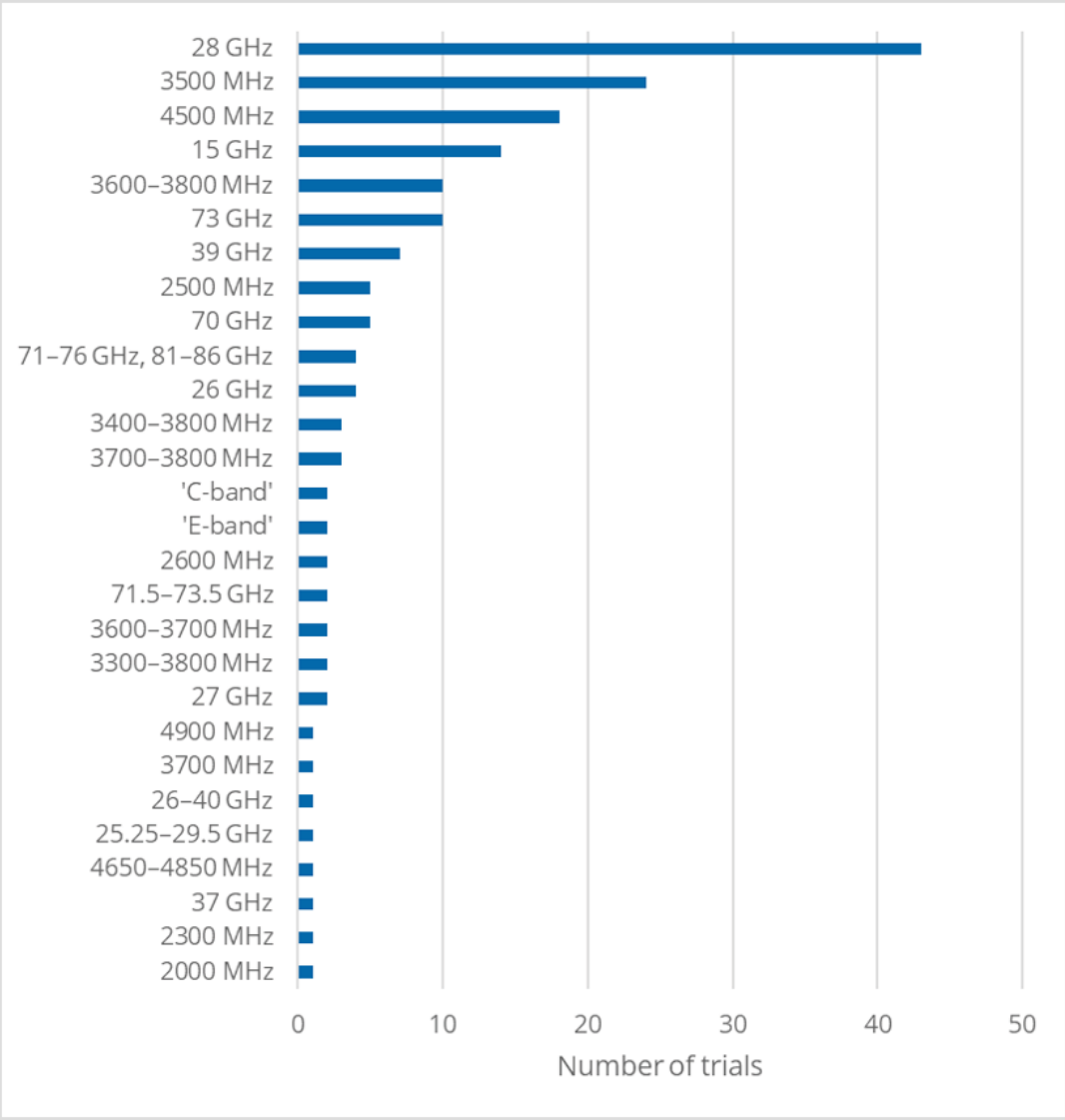
- A site fully evolved with 4G and 5G capacity will deliver mobile data 10 times more cost efficiently than a basic 4G site.
- The cost efficiencies enabled in the 4G+5G deployment scenario improved the Net Present Value (NPV) of the modeled operator by 10 to 20 percent over a 5-year period.

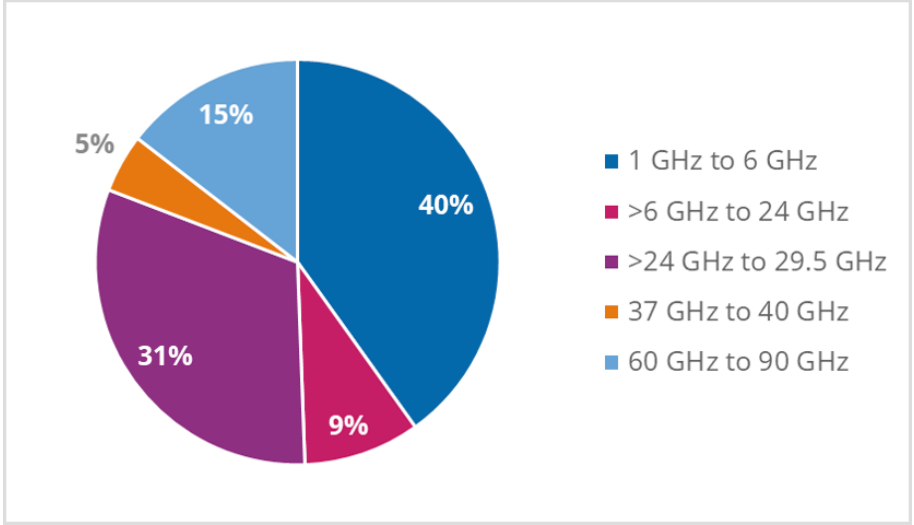
Source: Ericsson, "**The 5G consumer business case**", 2018. Available: https://www.ericsson.com/en/networks/trending/insights-and-reports/the-5g-business-case-for-enhanced-mobile-broadband

5G: POSSIBLE FREQUENCY BANDS AND TIMING



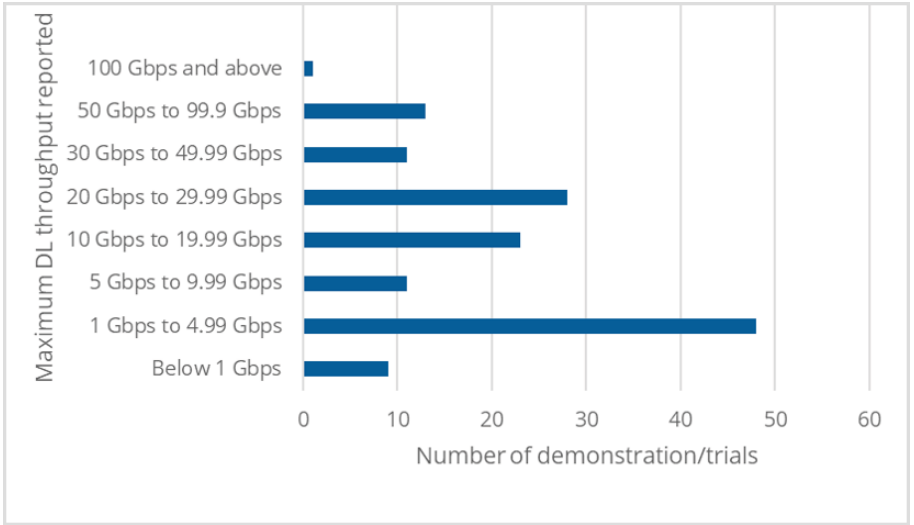
5G DEMONSTRATIONS AND TRIALS





Spectrum bands reported
Base: 172 demos/trials

Maximum download throughput reported:



Throughput reported
Base: 44 demos/trials

Source: GSA, April 2018
https://gsacom.com

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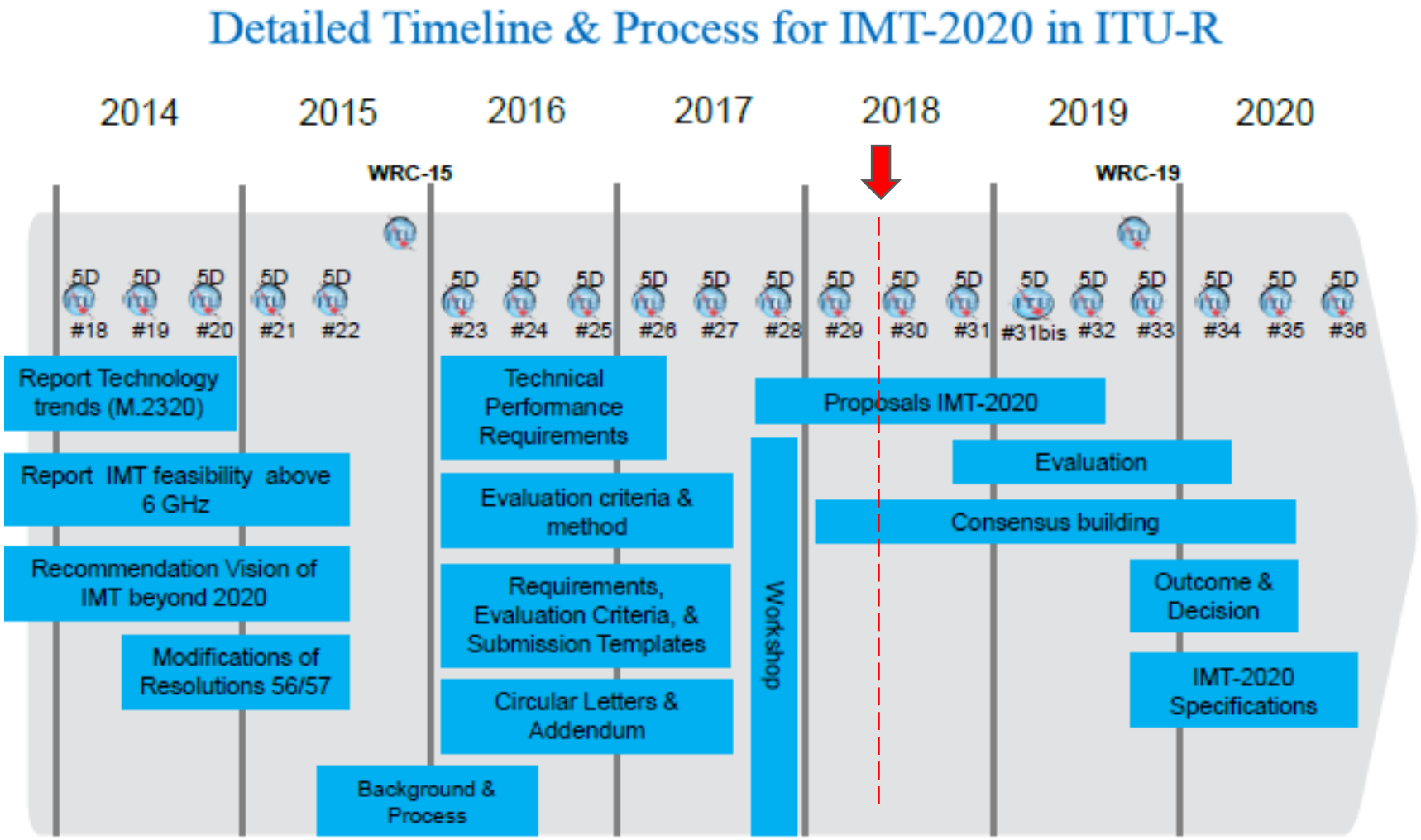
IMT-2020 STANDARDIZATION



Note: Meeting #31bis – if needed focus meeting towards WRC-19 (non-Technology), Meeting #33 – focus meeting on Evaluation (Technology)

Note: While not expected to change, details may be adjusted if warranted.

MINIMUM TECHNICAL PERFORMANCE REQUIREMENTS

- To ensure that IMT-2020 technologies are able to fulfil the objectives of IMT-2020 and to set a specific level of performance that each proposed RIT/SRIT needs to achieve in order to be considered by ITU-R for IMT-2020.
- These requirements are not intended to restrict the full range of capabilities or performance that candidate RITs/SRITs for IMT-2020 might achieve, nor are they intended to describe how the RITs/SRITs might perform in actual deployments.
- Requirements are to be evaluated according to the criteria defined in Report ITU-R M.2410 and Report ITU-R M.2411 for the development of IMT-2020.
- RIT/SRIT example requirement: 100 MHz to 1 GHz scalable bandwidth.

RIT: radio interface technology
SRIT: set of radio interface technologies

References:

Report ITU-R M.2410 “Minimum requirements related to technical performance for IMT-2020 radio interface(s)” and
Report ITU-R M.2411 “Requirements, evaluation criteria and submission templates for the development of IMT-2020”

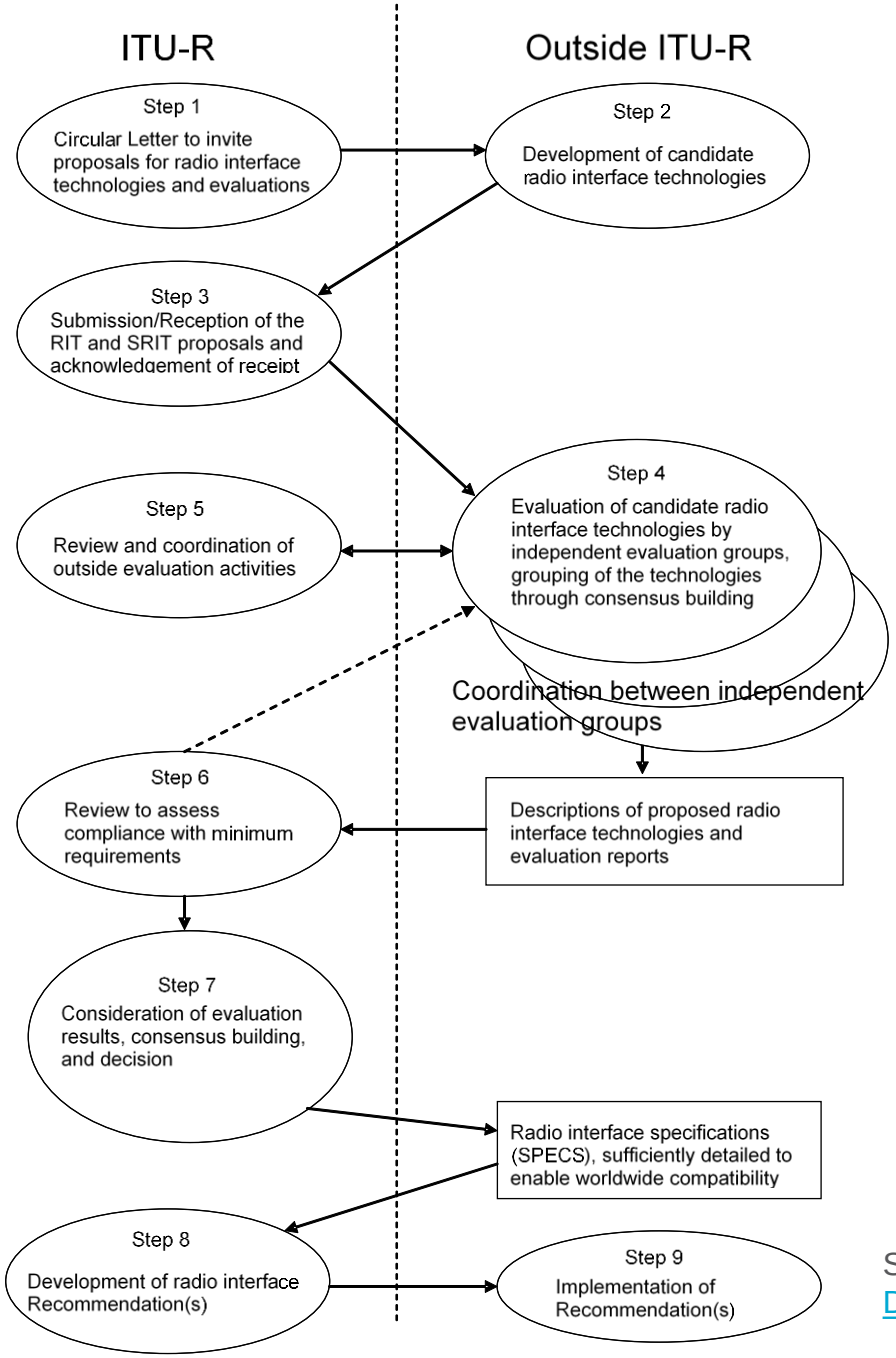
IMT-2020 PROCESS

References:

- ITU towards "IMT for 2020 and beyond"
- Circular Letter 5/LCCE/59: Invitation for submission of proposals
- Web page for the IMT-2020 submission and evaluation process
- IMT-2020 documents (Doc. IMT-2020/...)

Evaluation Groups (as of 25 January 2018)

- Evaluation Group registration form
- 5G Infrastructure Association - 5G PPP web site
- ATIS WTSC IMT-2020 Evaluation Group - WTSC web site
- ChEG ChineseEvaluation Group - ChEG web site
- Canadian Evaluation Group - CEG web site
- Wireless World Research Forum - WWRF web site
- Telecom Centres of Excellence, India - TCOE web site
- The Fifth Generation Mobile Communications Promotion Forum, Japan - 5GMF web site
- TTA 5G Technology Evaluation Special Project Group - TTA SPG33 web site
- Trans-Pacific Evaluation Group - TPCEG web site
- ETSI Evaluation Group - ETSI web site
- Egyptian Evaluation Group



Source: Doc. IMT-2020/2(Rev.1)

IMT-2020 2-02

PRELIMINARY SUBMISSIONS

- ITU-R WP 5D, Workshop on IMT-2020 terrestrial radio interfaces (Wednesday 4 October 2017, 9:00-17:00, Munich, Germany)
- ITU-R WP 5D, 31 January – 7 February 2018 (Seoul, Korea (Republic of))
  - Preliminary submissions to WP 5D (Doc. 5D/…):

Number	Source	Title
[867]	Alliance for Telecommunications Industry Solutions [ATIS]	3GPP initial technology submission of 3GPP 5G solution for IMT-2020
[863]	Director, BR [TTA]	3GPP initial technology submission of 3GPP 5G2 solution for IMT-2020 (TTA)
[847]	Association of Radio Industries and Businesses [ARIB]	3GPP initial technology submission of 3GPP 5G solution for IMT-2020
[838]	China (People's Republic of)	Initial submission of candidate technology for IMT-2020 radio interface
[819]	Korea (Republic of)	Submission of a candidate technology of IMT-2020
[818]	Director, BR [TTC]	3GPP initial technology submission of 3GPP 5G solution for IMT-2020 (TTC)
[817]	Apple Inc.... [3GPP TSG RAN]	Initial description template of 3GPP 5G candidate for inclusion in IMT-2020
[796]	TSDSI, India	Response to the Liaison Statement from ITU-R on "Availability of Addendum 3 to Circular Letter 5/LCCE/59 related to proposals for candidate radio interface technologies for the terrestrial components of the radio interface(s) for IMT-2020 and their subsequent evaluation"

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IMT IDENTIFICATIONS IN THE RR

Frequency bands with IMT identifications in the table of frequency allocations

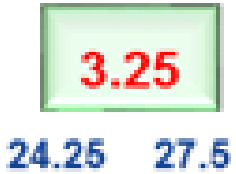
Band (MHz)	Footnotes identifying the band for IMT		
	Region 1 or parts thereof	Region 2 or parts thereof	Region 3 or parts thereof
450-470	5.286AA		
470-698	-	5.295, 5.308A	5.296A
694/698-960	5.317A	5.317A	5.313A, 5.317A
1 427-1 518	5.341A, 5.346	5.341B	5.341C, 5.346A
1 710-2 025	5.384A, 5.388		
2 110-2 200	5.388		
2 300-2 400	5.384A		
2 500-2 690	5.384A		
3 300-3 400	5.429B	5.429D	5.429F
3 400-3 600	5.430A	5.431B	5.432A, 5.432B, 5.433A
3 600-3 700	-	5.434	-
4 800-4 990	-	5.441A	5.441B

RR = ITU Radio Regulations

Source: Draft rev. Rec. ITU-R M.1036-5 (WP 5D), Table 1 in Att. 4.2 to Doc. 5D/875

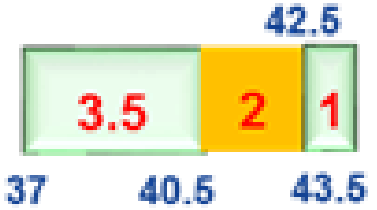
WRC-19 AGENDA ITEM 1.13 BANDS

1) 24.25 - 27.5 GHz

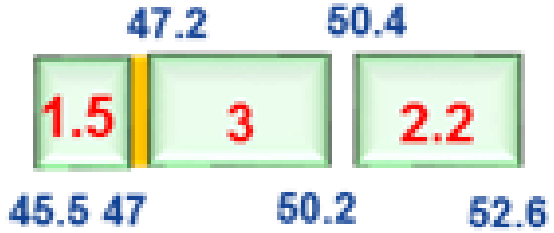


2) 31.8 - 33.4* GHz

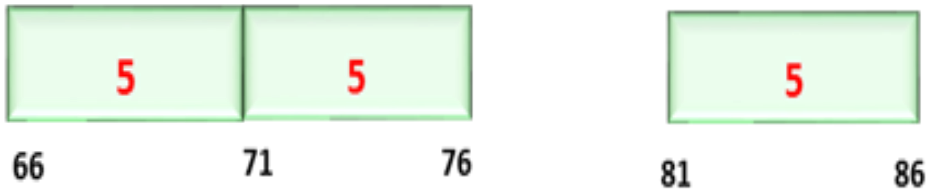
3) 37 - 40.5 GHz, 40.5 - 42.5* GHz, 42.5 - 43.5 GHz



4) 45.5 - 47 GHz, 47 - 47.2* GHz, 47.2 - 50.2 GHz, 50.4 - 52.6 GHz



5) 66 - 76 GHz, 81 - 86 GHz



* needs MS allocation

SUMMARY

- Have discussed the capabilities of 5G mobile broadband and its value to users, operators and society and general.
- Have discussed examples of 5G business cases and trials.
- Have described the IMT-2020 standardization process.
- Have discussed the need for frequency spectrum, in particular the bands being considered under WRC-19 agenda item 1.13.

ERICSSON