

# CEPT Workshop on 5G Mobile Communications



2- 4 November 2016

Mainz, Germany

## *Update on ITU-R Working Party 5D on IMT-2020 for 5G*

Hakan Ohlsen

Vice-Chairman, ITU-R Working Party 5D

Stephen M. Blust

Chairman, ITU-R Working Party 5D

# ITU

## Committed to connecting the world

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**673** Sector Members  
**168** Associates  
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Telecommunication  
standardization  
- network and service  
aspects



### ITU-D

Promote and assist the  
extension of ICTs to all the  
world's inhabitants - narrowing  
the digital divide

### ITU-R

Global radio spectrum  
management and  
radiocommunication  
standardization

# THE STORY OF IMT

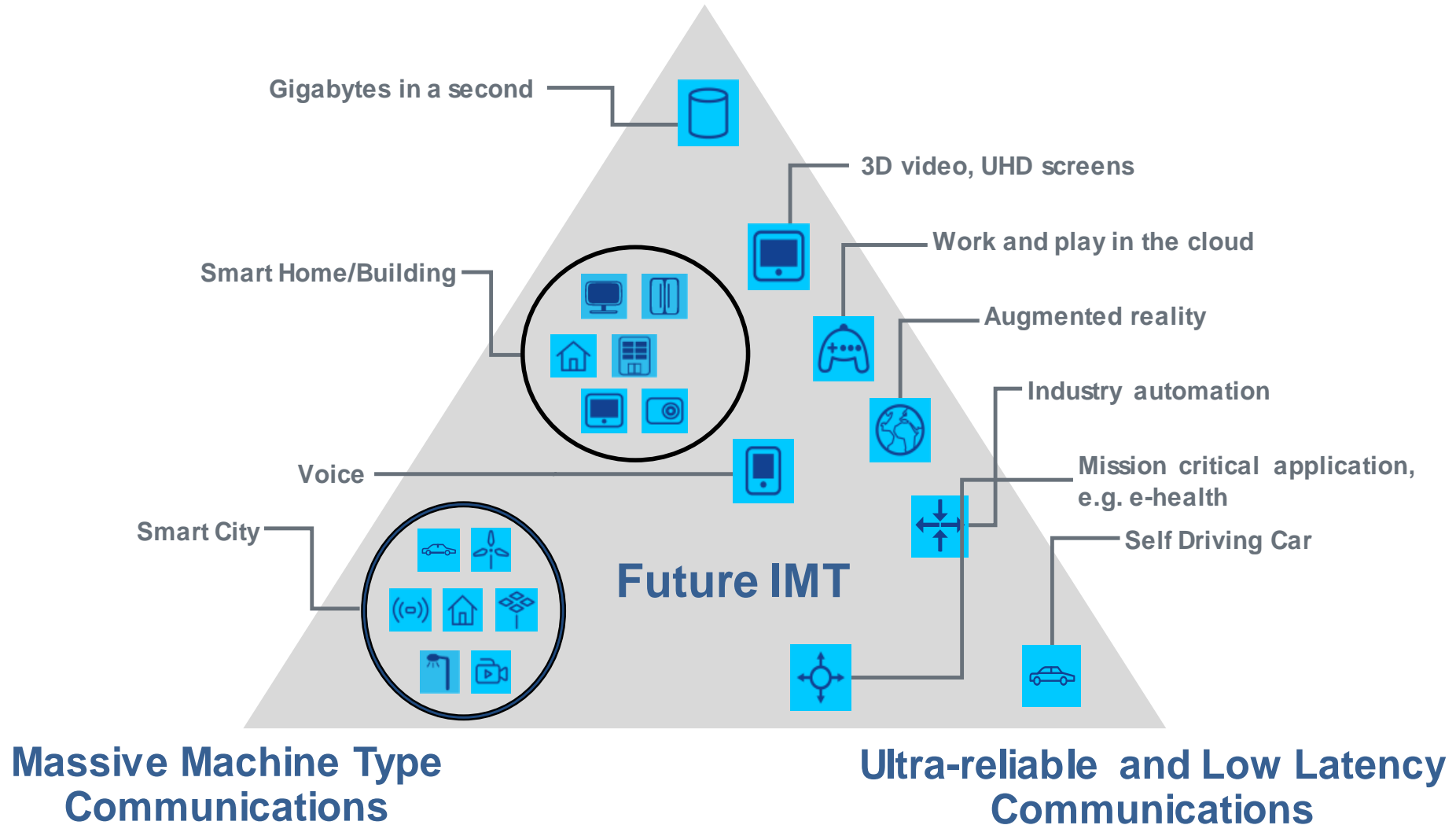


- All of today's 3G and 4G mobile broadband systems are based on standards contained in ITU Recommendations on IMT.
- ITU established the detailed specifications for **IMT-2000** and the first 3G deployments commenced around the year 2000.
  - Work started mid-80's and concluded end 1999 = around 15 years
- In January 2012, ITU defined the next big leap forward with 4G wireless cellular technology – **IMT-Advanced** – and this is now being progressively deployed worldwide.
  - Work started in 2000 and concluded 2012 = around 12 years
- The detailed investigation of the key elements of **IMT-2020** in support of 5G is already well underway with significant progress achieved in 2016, once again using the highly successful partnership ITU-R has with the mobile broadband industry and the wide range of stakeholders in the 5G community.
  - Work started 2013 and will conclude 2020 = 7 years!
- IMT provides the global platform on which to build the next generations of mobile broadband connectivity

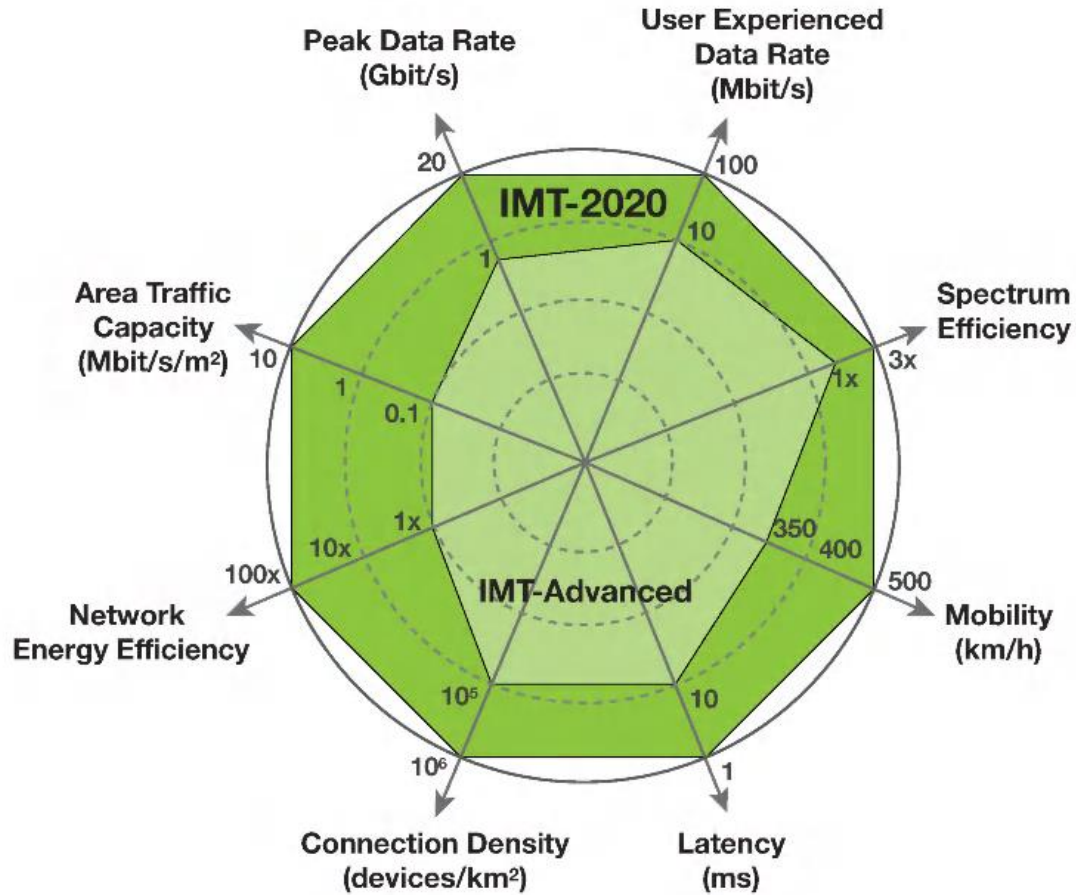


# 5G Usage Scenarios from the ITU-R IMT-2020 Vision Recommendation

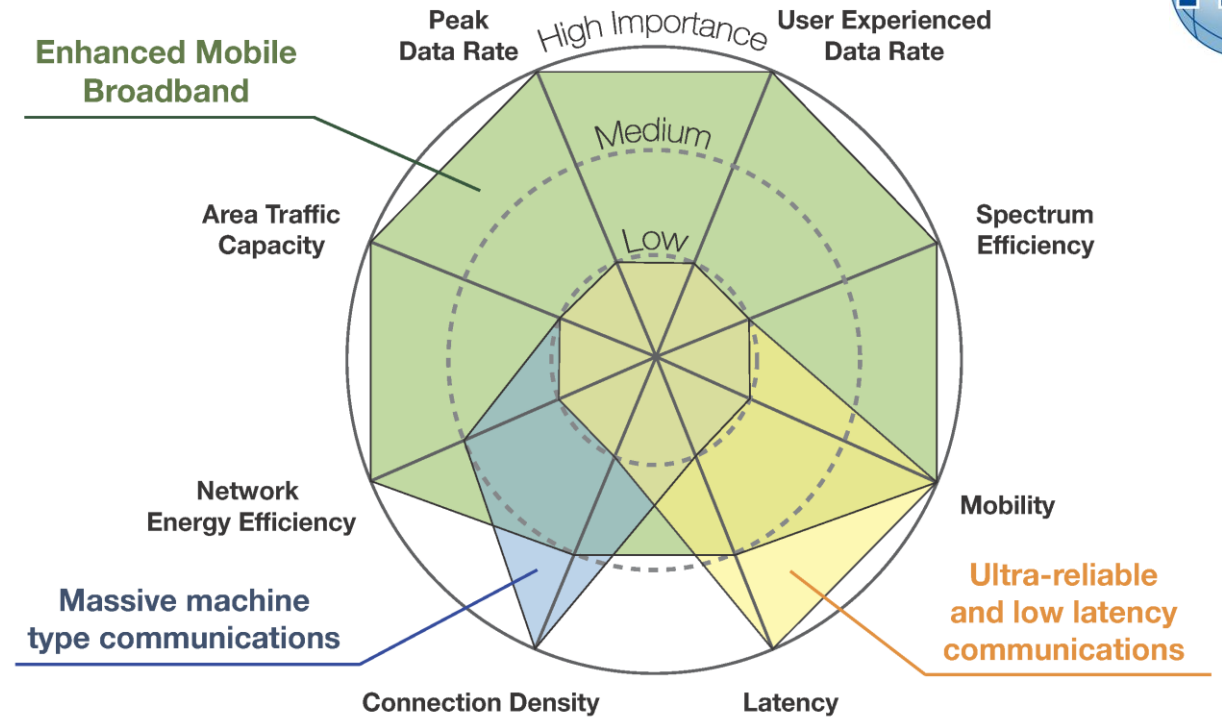
## Enhanced Mobile Broadband



# 5G Capability Perspectives from the ITU-R IMT-2020 Vision Recommendation



**Enhancement of key capabilities from IMT-Advanced to IMT-2020**



**The importance of key capabilities in different usage scenarios**

The values in the figures above are targets for research and investigation for IMT-2020 and may be revised in the light of future studies. Further information is available in the IMT-2020 Vision Recommendation (Recommendation ITU-R M.2083)

# IMT-2020 Standardization Process – Where we are and what is ahead

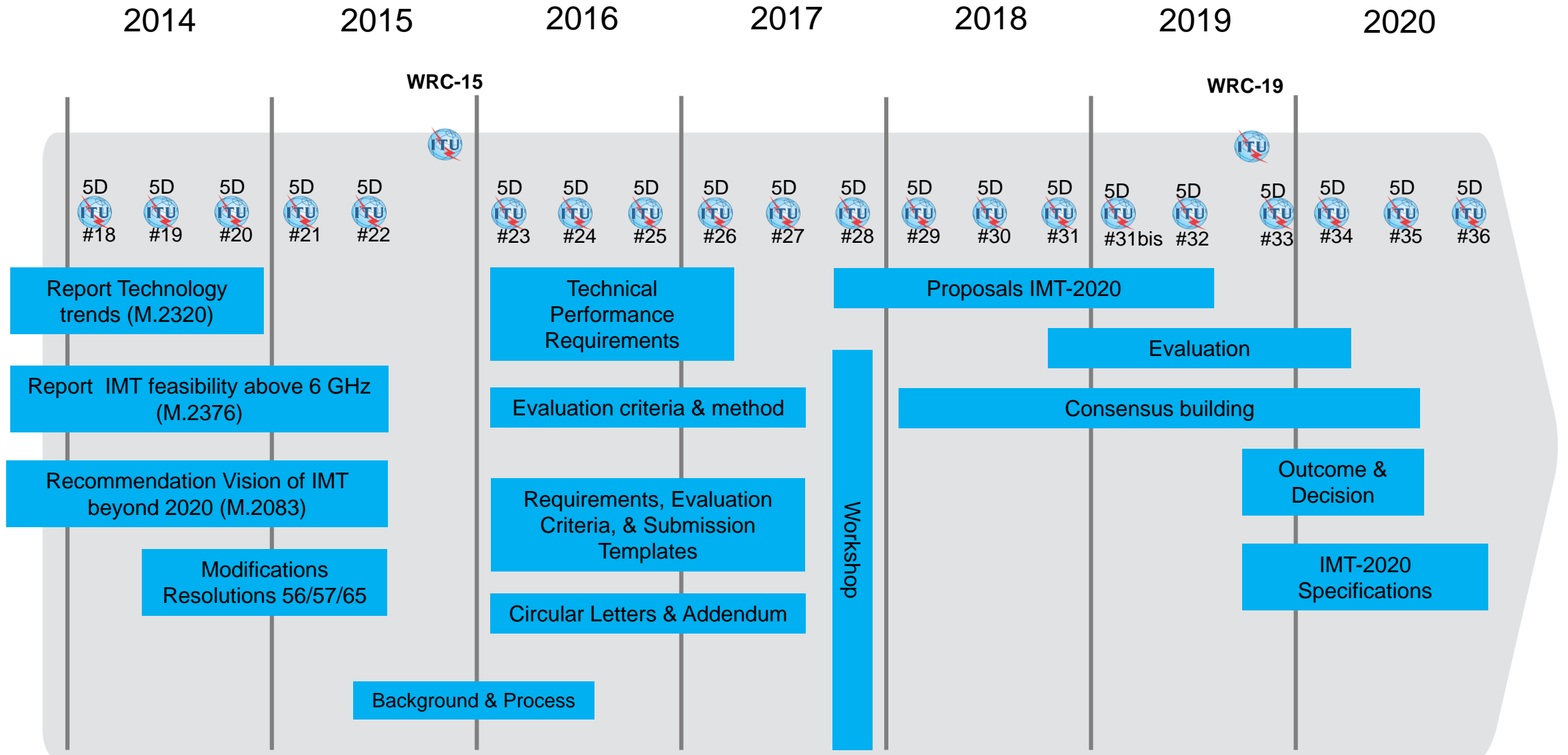


Setting the stage for the future:  
vision, spectrum, and  
technology views

Defining the  
technologies



# Detailed timeline & process for IMT-2020 in ITU-R



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

# WP 5D Updated Meeting Schedule (as of October 2016)



The following table shows the proposed meeting dates for Working Party 5D. Some adjustment of these dates might be required to accommodate availability of facilities at specific venues. Every effort will be made to keep these dates as listed. Please check the ITU website in case meeting details have changed (<http://www.itu.int/events/monthlyagenda.asp?lang=en> ).

GROUP	No.	FROM	TO	PLACE	COMMENTS
WP 5D	23	23 February 16	2 March 16	China	7 working day meeting
WP 5D	24	14 June 16	22 June 16	Geneva	7 working day meeting
WP 5D	25	5 October 16	13 October 16	Geneva	7 working day meeting
WP 5D	26	14 February 17	22 February 17	Geneva	7 working day meeting
WP 5D	27	13 June 17	21 June 17	[Canada]	7 working day meeting
WP 5D	28	3 October 17	11 October 17	[Germany]	7 working day meeting, including a one-day workshop
WP 5D	29	31 January 18	7 February 18	[Korea]	
WP 5D	30	13 June 18	20 June 18	[TBD]	
WP 5D	31	3 October 18	10 October 18	[TBD]	Proposed to shift to 10-17 October
WP 5D Expert meeting	31bis	[11 February 19]	[15 February 19]	[TBD]	If needed. Focus of meeting towards RA-19 and WRC-19
CPM19-2	-	18 February 19	28 February 19	Geneva	
WP 5D	32	9 July 19	17 July 19	[TBD]	7 working day meeting
RA-19	-	21 October 19	25 October 19	Geneva	
WRC-19	-	28 October 19	22 November 19	Geneva	
WP 5D	33	[9 December] 19	[13 December] 19	[TBD]	Focus meeting on evaluation (WG Technology Aspects)
WP 5D	34	19 February 20	26 February 20	[TBD]	
WP 5D	35	24 June 20	1 July 20	[TBD]	
WP 5D	36	7 October 20	14 October 20	[TBD]	

# Work on Certain WRC-19 Agenda Items (WP 5D)

See this file  5D/374 Att 2.11

Agenda item/ Issue	Topic	Resolution	WP 5A	WP 5B	WP 5C	WP 5D	TG 5/1
1.3	MetSatS, ESSS in 460-470 MHz	<b>766 [COM6/8] (WRC-15)</b>	C		C	C	
1.5	Use of 17.7-19.7 & 27.5-29.5 GHz in FSS	<b>158 [COM6/17] (WRC-15)</b>	C		C	I	
1.6	Non-GSO FSS in 37.5-39.5, 39.5-42.5, 47.2-50.2, and 50.4-51.4 GHz	<b>159 [COM6/18] (WRC-15)</b>	C	C	C	C	
1.10	Introduction and use of GADSS	<b>426 [COM6/11] (WRC-15)</b>	C	<b>R</b>	C	C	
1.11	Railway radiocommunication systems	<b>236 [COM6/12] (WRC-15)</b>	<b>R</b>	C	C	C	
1.12	Intelligent Transport Systems (ITS)	<b>237 [COM6/13] (WRC-15)</b>	<b>R</b>	C	C	C	
1.13	Future development of IMT	<b>238 [COM6/20] (WRC-15)</b>	C	C	C	C	<b>R</b>
1.14	HAPS in FS	<b>160 [COM6/21] (WRC-15)</b>	C		<b>R</b>	C	
1.15	LMS and FS in 275-450 GHz	<b>767 [COM6/14] (WRC-15)</b>	C		C <sup>1</sup>	I	
1.16	WAS/RLAN between 5 150 & 5 925 MHz	<b>239 [COM6/22] (WRC-15)</b>	<b>R</b>	C	C	I	
/9.1.1	IMT in 1 885-2 025 & 2 110-2 200 MHz	<b>212 (Rev.WRC-15)</b>				<b>R</b>	
/9.1.2	Compatibility of IMT and BSS (sound) in 1 452-1 492 MHz in Regions 1 and 3	<b>761 [COM4/7] (WRC-15)</b>				<b>R</b>	
/9.1.8	Machine-type communications	<b>958 [COM6/15] (WRC-15)</b>	C			<b>R</b>	
/9.1.9	FSS in 51.4-52.4 GHz	<b>162 [COM6/24] (WRC-15)</b>	C		C	C	

*Legend:* **R** = Responsible group; **C** = Contributing group; **I** = Interested group.

(2)WP 4C and WP 5D are jointly responsible. WP 5D is responsible for the studies requested in the invites ITU-R with respect to the terrestrial component of IMT, taking into account the technical and operational characteristics provided by WP 4C.

(3)WP 4A and WP 5D are jointly responsible. WP 5D is responsible for the studies requested in the resolves to invites ITU-R with respect to the IMT, taking into account the technical and operational characteristics provided by WP 4A.



# GENERAL ASPECTS: New Work in WP 5D



- In WG General Aspects the “SWG Usage” has been established to address certain items of the WP 5D work within the Study Period. It has the following Terms of Reference:
  - a) Development of deliverable(s) to complement of Recommendation ITU-R M.2083 for IMT usage in various vertical industry sectors.
  - b) WP 5D Work towards WRC Resolution 958 (WRC-15), Annex 3 & WRC-19 agenda item 9.1, issue 9.1.8 (MTC).
- The SWG is progressing work on the development of a new report addressing the use of terrestrial IMT by other industry sectors. Working document towards PDN Report ITU-R M.[IMT BY OTHER INDUSTRIES] is now available. The SWG also agreed that if a substantial amount of material was developed for any individual use case, a standalone Report on that use case could be developed
- A Working Document Towards Draft CPM Text for WRC-19 Issue 9.1.8 (MTC) was put into play along with a detail workplan towards completion of this WRC-19 deliverable.



- Scope of WP 5D work:
  - Annex 9 of CA/226 decides “that Working Party 5D is to conduct and complete the studies as indicated in resolves to invite ITU-R 1 of Resolution 238 [COM6/20] (WRC-15), with regards to spectrum needs, technical and operational characteristics including protection criteria, and deployment scenarios for the terrestrial component of IMT by 31 March 2017 and report the results of these studies to TG 5/1
- In order to determine the spectrum needs for the terrestrial component of IMT in the frequency range between 24.25 GHz and 86 GHz, WP 5D considered several approaches and decided to consider two of them: application-based and technical performance-based approaches.
- In response to the requirement for the technical and operational characteristics, including protection criteria, WP 5D developed “Characteristics of terrestrial IMT systems for frequency sharing/interference analyses in the frequency range between 24.25 GHz and 86 GHz”
- The major work focus at the recent October meeting of WP 5D was on the two working documents on IMT parameters and spectrum needs for inclusion in a liaison statement to TG 5/1 that is to be finalised at the 26th meeting of WP 5D in February 2017:
  - Spectrum needs for the terrestrial component of IMT in the frequency range between 24.25 GHz & 86 GHz
  - Characteristics of terrestrial IMT systems for frequency sharing/interference analyses in the frequency range between 24.25 GHz and 86 GHz

# New spectrum: bands under study for WRC-19


















Existing mobile allocation	No global mobile allocation
24.25 GHz – 27.5 GHz	31.8 – 33.4 GHz
37 – 40.5 GHz	40.5 – 42.5 GHz
42.5 – 43.5 GHz	
45.5 – 47 GHz	47 – 47.2 GHz
47.2 – 50.2 GHz	
50.4 – 52.6 GHz	
66 – 76 GHz	
81 – 86 GHz	

# Studies related to spectrum aspects under WRC-19 agenda items

	2015 WRC-15	2016	2017	2018	2019 WRC-19	2020
	ITU #21 ITU #22	ITU #23 ITU #24 ITU #25	ITU #26 ITU #27 ITU #28	ITU #29 ITU #30 ITU #31	ITU #31bis ITU #32 ITU #33	ITU #34 ITU #35 ITU #36
<b>IMT identification</b> <b>WRC-19 agenda item 1.13</b>	SWG TG5/1	Sharing Parameters Spectrum need	LS to TG5/1 Provide results of studies to TG5/1 by March 2017			
		Sharing studies and draft CPM texts @ TG5/1				
<b>Terrestrial/Satellite IMT</b> <b>WRC-19 agenda item 9.1 (issue 9.1.1)</b>	SWG Sharing studies	Sharing studies		Draft CPM text to CPM19-2	WP5D: Responsible for terrestrial IMT WP4C: Responsible for satellite IMT Draft CPM text shall be agreed by both WPs	
<b>IMT/BSS(sound)</b> <b>WRC-19 agenda item 9.1 (issue 9.1.2)</b>	SWG Sharing studies	Sharing studies		Draft CPM text to CPM19-2	WP5D: Responsible for terrestrial IMT WP4A: Responsible for BSS(sound) Draft CPM text shall be agreed by both WPs	
<b>Machine-type communication</b> <b>WRC-19 agenda item 9.1 (issue 9.1.8)</b>	SWG Usage*	Draft CPM text		Draft CPM text to CPM19-2		
		*It may be necessary to study spectrum related issue under WG Spectrum aspects				
<b>Other items</b> <b>Concerned/interested WRC-19 agenda items</b>	SWG T.B.D.	LS to responsible WPs, if necessary Technical studies				

The deadline for finalizing draft CPM text is assumed middle of 2018 in this figure.

# Studies related to spectrum aspects except those under WRC-19 agenda items

	2015 WRC-15  	2016   	2017   	2018   	2019 WRC-19   	2020   
<p><b>Sharing studies invited in WRC Resolution(s)</b></p> <p>e.g. L-band 3.3-3.4GHz 4.8-4.99GHz</p>	<p>SWG Sharing studies</p>	<p>Sharing studies</p>				
<p><b>Frequency arrangements for the band identified at WRC-15</b></p>	<p>SWG Frequency arrangement</p>	<p>Frequency arrangements</p>			<p>Draft revision of Rec. ITU-R M.1036</p>	
<p><b>Other items</b></p> <p>SWG Sharing studies</p> <p>SWG T.B.D.</p>	<p>Modelling &amp; Simulation for Sharing Study</p>		<p>Draft ITU-R Recommendation</p>			
	<p>Any other studies related to spectrum aspects</p>					

# *SPECTRUM: Joint Experts Meeting*

## *WP 5D with WPs 3J, 3K, 3L (Radiowave Propagation)*



*Taking advantage of concurrent meetings in Geneva of WP 5D and WPs 3J, 3K and 3M a special Joint Experts Meeting (JEM) was held on 20 June 2016.*

The focus for the meeting was the reply liaison statement from WP 5D to the Chairmen of SG 3, Working Parties 3J, 3K, and 3M (Copied for information to Task Group 5/1) – “Propagation advice in support of agenda item 1.13: Input requested from WP 5D”.

The JEM was deemed a success as it helped in clarifying issues related to determining appropriate propagation models for use in sharing studies under WRC-19 agenda item 1.13. This is information that TG 5/1 has requested SG 3 and its working parties to provide by 31 March 2017

# SPECTRUM: Joint Experts Meeting

## WP 5D with WP 4A (Efficient orbit/spectrum utilization for the (FSS) and (BSS))



- *Taking advantage of concurrent meetings in Geneva of WP 5D and WP 4A, a special Joint Experts Meeting (JEM) on the following topics was held on 5 October 2016:*
- Key Topics
  - **WRC-19 agenda item 9.1, Issue 9.1.2** concerning compatibility between IMT and BSS(Sound) for which WP 4A and WP 5D are the joint responsibility groups (*refer to LS from 5D in Document [4A/92](#)*)
  - **WRC-19 agenda item 9.1, Issue 9.1.9** concerning sharing studies and the possible allocation to the FSS in the band 51.4-52.4 GHz.
  - **WRC-19 Agenda Item 1.6** concerning studies for non-geostationary fixed-satellite services satellite systems in frequency bands 37.5-39.5 GHz, 39.5-42.5 GHz, 47.2-50.2 GHz, and 50.4-51.4 GHz
  - **PDNR ITU-R S.[INTERF.AREA]** under development in WP 4A (*refer to LS from 5D in Document [4A/89](#)*)

The JEM was deemed a success as it helped in clarifying issues related to the above topics of mutual interest to the two Working Parties.

# TECHNOLOGY: Formal invitation to external organizations to propose IMT-2020 candidate radio interface technologies

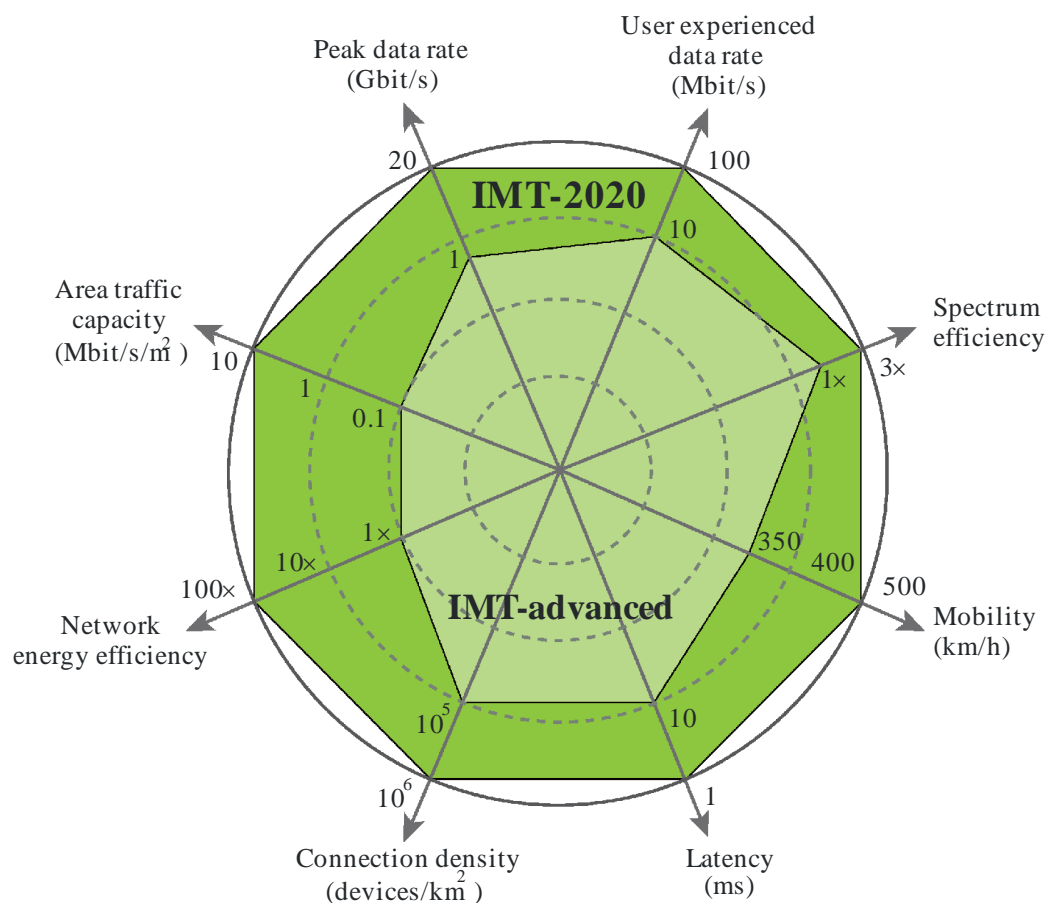


- A liaison statement to external organizations – “Invitation for submission of proposals for candidate radio interface technologies for the terrestrial components of the radio interface(s) for IMT-2020 and invitation to participate in their subsequent evaluation” was released.
- This continues the on-going the partnership approach on inviting ITU Members via the [Circular Letter 5/LCCE/59 and Addendum](#) and now a formal invitation to the external organizations via this liaison.
- Initial documents in support of the IMT-2020 process have been released
  - [Document IMT-2020/1](#) “IMT-2020 Background”
  - [Document IMT-2020/2](#) “SUBMISSION, EVALUATION PROCESS AND CONSENSUS BUILDING FOR IMT-2020”
- Further documents forthcoming in 2017
  - Draft new Report ITU-R M.[IMT-2020. TECH PERF REQ]
  - Draft new Report ITU-R M.[IMT-2020. EVAL]
  - Draft new Report ITU-R M.[IMT-2020. SUBMISSION]

# REQUIREMENTS FOR IMT-2020



There are 8 Key capabilities for IMT-2020 in ITU-R M.2083:



Technical Performance Requirements for IMT-2020 in ITU-R M.[TECH PERF REQ]:

- 8 requirements are based on the key capabilities in M-2083
- 5 additional requirements:
  - Peak spectral efficiency
  - 5<sup>th</sup> percentile spectral efficiency
  - Reliability
  - Mobility interruption time
  - Bandwidth



- The work of M.[IMT-2020 TECH PERF REQ] “*Minimum requirements related to technical performance for IMT-2020 radio interface(s)*” progressed well in the meetings in 2016 and has defined thirteen key requirements for IMT-2020.
- Texts were developed for the thirteen minimum technical performance requirements including requirement values, which are regarded as stable. For each requirement, the mapping to usage scenario and test environment is documented. Some requirement values in Chapter 4 remain in brackets or are marked as “TBD”; conclusion on these will be in the February WP 5D meeting.
- The Draft New Report will conclude at WP 5D #26 in February 2017 and then be forwarded to Study Group 5 for approval.

# Summary



- The scope of IMT-2020 is much broader than previous generations of mobile broadband communication systems – hence a much more complex set of interactions of radio communications, supporting ecosystems, spectrum resources and regulatory structures is envisioned to permit 5G to further empower global society in the coming decades .
- Use cases foreseen include enhancement of the traditional mobile broadband scenarios as well as ultra-reliable and low latency communications and massive machine-type communications.
- The ITU's work in developing the specifications for IMT-2020, in close collaboration with the whole gamut of 5G stakeholders, is now well underway, along with the associated spectrum management and spectrum identification aspects.
- IMT-2020 can be a cornerstone for all of the activities related to attaining the goals in the United Nations 2030 Agenda for Sustainable Development.