

ITU-R activities on 5G

ITU overview

193 Member States
>700 Sector Members,
Associates and Academia

ITU

Helping the World Communicate

ITU-T

Telecommunication
standardization
- network and
service aspects



ITU-R

Radiocommunication
standardization and
global radio spectrum
management

ITU-D

Assisting
implementation and
operation of
telecommunications in
developing countries

IMT standardization



- With the approval of Recommendation ITU-R M.1457, ITU established the detailed specifications for **IMT-2000** and the first “3G” deployments commenced around the year 2000
 - In January 2012, ITU defined the next big leap forward in wireless cellular technology – **IMT-Advanced** – as detailed in Recommendation ITU-R M.2012
 - LTE-Advanced and WirelessMAN-Advanced were the two technologies assessed as being able to meet the stringent performance requirements specified by ITU
 - All 3G and 4G mobile broadband systems are based on the ITU's International Mobile Telecommunications (IMT) standards.
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IMT for 2020 and beyond



- With IMT-Advanced systems now starting to be deployed, attention in the industry is now on the “5G” future steps in mobile communications.
 - The detailed investigation of the key elements of “IMT-2020” are already well underway, 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.
 - We are now working together with these partners in the same open process to establish the criteria for “IMT-2020”.
 - The workplan and timeline for the future development of IMT have been defined and all interested parties are warmly invited to participate in this activity.
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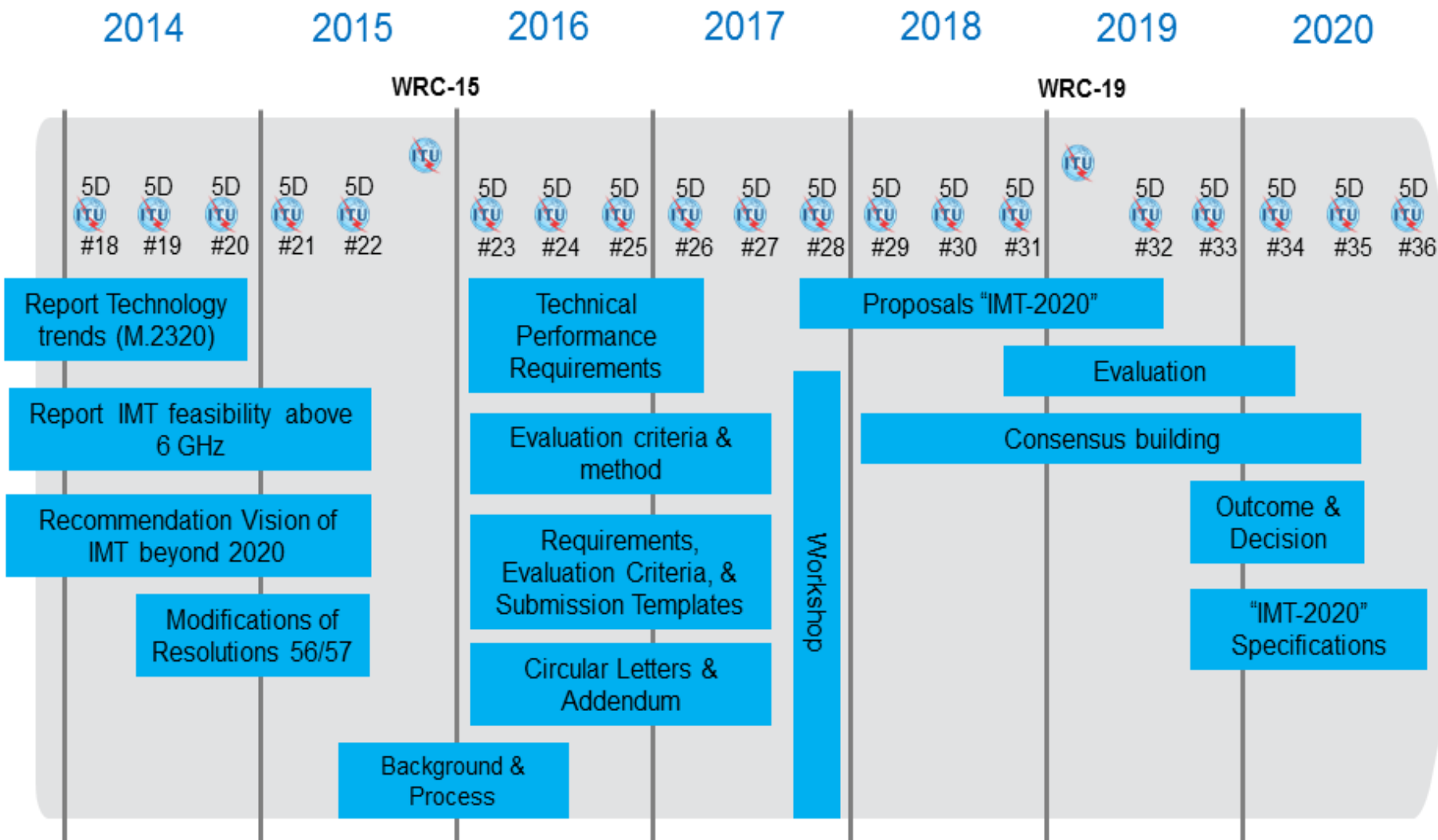
Coordination with activities in external entities engaged in 5G developments



Liaisons dispatched from WP 5D in February 2015 to the following entities provided the detailed time plan and requesting certain information:

- 3GPP,
 - 3GPP2,
 - 4G Americas,
 - 5G Infrastructure Public Private Partnership (Europe),
 - 5G Innovation Centre,
 - APT Wireless Group,
 - Fifth Generation Mobile Communications Promotion Forum (Japan),
 - ARIB, ATIS,
 - CCSA,
 - CDG,
 - ETSI, EU METIS Project,
 - GSMA,
 - IEEE,
 - IMT-2020 Promotion Group (China),
 - ITRI,
 - NGMN,
 - NYU Wireless,
 - Telecommunications Standards Development Society (India),
 - TIA,
 - TTA,
 - TTC,
 - UMTS Forum,
 - WiMax Forum, Wireless
 - World Research Forum
 - *We welcome any other interested partner*
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Detailed Timeline & Process for “IMT-2020” in ITU-R



Spectrum management



- Radio frequencies are the life blood of all the radio systems that we now sometimes take for granted - mobile phones and WiFi, sound and television broadcasting, radionavigation systems, terrestrial and satellite links, emergency communications on land, sea and air and all of the science services operating on Earth and in space.
- ITU provides the international framework to manage the spectrum of radio frequencies and to minimise the potential for interference between these various uses.
- At the national level, each administration is responsible for the use and management of radio frequencies within their country.

Spectrum for IMT



- We are witnessing a very rapid increase in the volume of mobile data traffic, spurred on by the introduction of a growing array of advanced multimedia devices and applications.
 - The substantially increased spectrum efficiency provided by IMT-Advanced will go some way towards meeting this demand, but this alone will not be sufficient – additional radio frequency spectrum will be required.
 - The issue of additional spectrum for IMT and mobile broadband will be addressed at the World Radiocommunication Conference scheduled to be held on 2-27 November 2015.
 - In the longer term we may also need to consider the use of higher frequency bands (above 6 GHz) to support 5G systems.
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Thank you!



Additional information

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5G Related Aspects in ITU-R Working Party 5D

(Responsible group for terrestrial IMT in ITU-R)



- WP 5D initiated detailed work in 2012 towards the next generation IMT for the year 2020 and beyond (i.e., "5G"). We have:
 - Agreed on a workplan through year 2020 to address constituent parts of "5G" as parts of "IMT for 2020".
 - Foundation work now such as technology perspectives and future vision and the more detailed defining information in near future.
 - Supported the need for additional spectrum for the future success of IMT.
 - **Released a detailed time line and action plan for IMT for 2020 to energize and focus the industry "5G" activities through year 2020.**
- The detailed investigation of the key elements of "5G" are well underway in ITU-R
 - The remaining documents in the foundation set of deliverables will complete in 2015.
- The work on the next phases will ramp up in 2016 and early aspects have already been initiated towards the radio interface technology or sets of radio interface technologies
 - The Report on the Technical Performance Requirements expected of a technology to satisfy "IMT-2020"
 - The Report on Evaluation Criteria and Evaluation Methods for "IMT-2020" technologies
 - The Report on Specific Requirements of the candidate technology related to submissions, the evaluation criteria and submission templates
 - For efficiency, the process and deliverable formats effectively utilized for IMT-Advanced will be leveraged.
- **WP 5D will continue to utilize the highly successful partnership ITU-R has with the mobile broadband industry and the wide range of stakeholders in the "5G" community and *the development work is jointly proceeding.***
- **WP 5D also addressed for WRC-15 the future spectrum needs (per the terms of reference of WRC-15 for AI 1.1 & 1.2).**
 - Development of Reports on future market for mobile *broadband*
 - Development of anticipated spectrum requirements
 - Suggested potential frequency ranges for future use
 - Perspectives on future technology trends aimed at 2020 and beyond to assist national and regional preparations

Key Current Deliverable

Milestones



- A key deliverable, the new [Report ITU-R M.2320](#) "*Future technology trends of terrestrial IMT systems*" was completed in by WP 5D at end of 2014 and subsequently approved by ITU-R, and is now published.
 - This Report provides a broad view of future technical aspects of terrestrial IMT systems considering the time frame 2015-2020 and beyond. It includes information on technical and operational characteristics of IMT systems, including the evolution of IMT through advances in technology and spectrally-efficient techniques, and their deployment.
- Draft New Recommendation ITU-R M.[IMT-Vision] "*Framework and overall objectives of the future development of IMT for 2020 and beyond*" will be completed by WP 5D in mid-June 2015 and forwarded to ITU-R Study Group 5 for the final steps of approval.
 - This Recommendation defines the framework and overall objectives of the future development of IMT for 2020 and beyond in light of the roles that IMT could play to better serve the needs of the networked society in the future.
 - In this Recommendation, the framework of the future development of IMT for 2020 and beyond, including a broad variety of capabilities associated with envisaged usage scenarios, are described in detail.
 - Furthermore, this Recommendation addresses objectives of the future development of IMT for 2020 and beyond, which includes further enhancement of existing IMT and development of "IMT-2020".
 - It should be noted that this Recommendation is defined considering the development of IMT to date based on Recommendation ITU-R M.1645.
- Draft New Report Report ITU-R M.[IMT.ABOVE 6 GHz] "*The technical feasibility of IMT in the bands above 6 GHz*" will be completed by WP 5D in mid-June 2015 and forwarded to ITU-R Study Group 5 for the final steps of approval.
 - This Report is to study and provide information on the technical feasibility of IMT in the bands between 6 GHz and 100 GHz.
 - Technical feasibility includes information on how current IMT systems, their evolution, and/or potentially new IMT radio interface technologies and system approaches could be appropriate for operation in the bands between 6 GHz and 100 GHz, taking into account the impact of the propagation characteristics related to the possible future operation of IMT in those bands.
 - Technology enablers such as developments in active and passive components, antenna techniques, deployment architectures, and the results of simulations and performance tests are considered

Key Timing Milestones



- Through the leading role of Working Party 5D, ITU-R released in July 2014 its *high level view* of a defined actionable timeline towards “IMT-2020” – which has established for the industry the target dates for the first release of “5G” to become reality in 2020.
 - *A detailed timeline picture* for “IMT-2020” was widely released by WP 5D in February 2015 which includes information on specific work actions over time by WP 5D and the external organizations through year 2020.
 - *A detailed deliverable table* was also widely released by WP 5D in February 2015 which includes further information on the specific work and the planned deliverables for “IMT-2020” for each meeting of WP 5D through year 2020.
 - *WP 5D will be developing Circular Letters and Liaisons to define the specific interactions with all relevant industry partners outside ITU-R through the year 2020 and relevant timing milestones for each step of the interactive process.*
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Timeline & Plan for “IMT-2020” Focused on the Terrestrial Radio Interface Technologies and Systems

Note:

- WP 5D is currently using “IMT-2020” as an interim terminology to refer to these systems and has under discussion the specific nomenclature to be adopted for the future development of IMT.
- The use of the term “IMT-2020” is a placeholder terminology and the specific nomenclature to be adopted for the future development of IMT is expected to be proposed by WP 5D in June 2015 and subsequently finalized at the Radiocommunication Assembly 2015.

Key Themes on the Timeline & Plan for “IMT-2020”

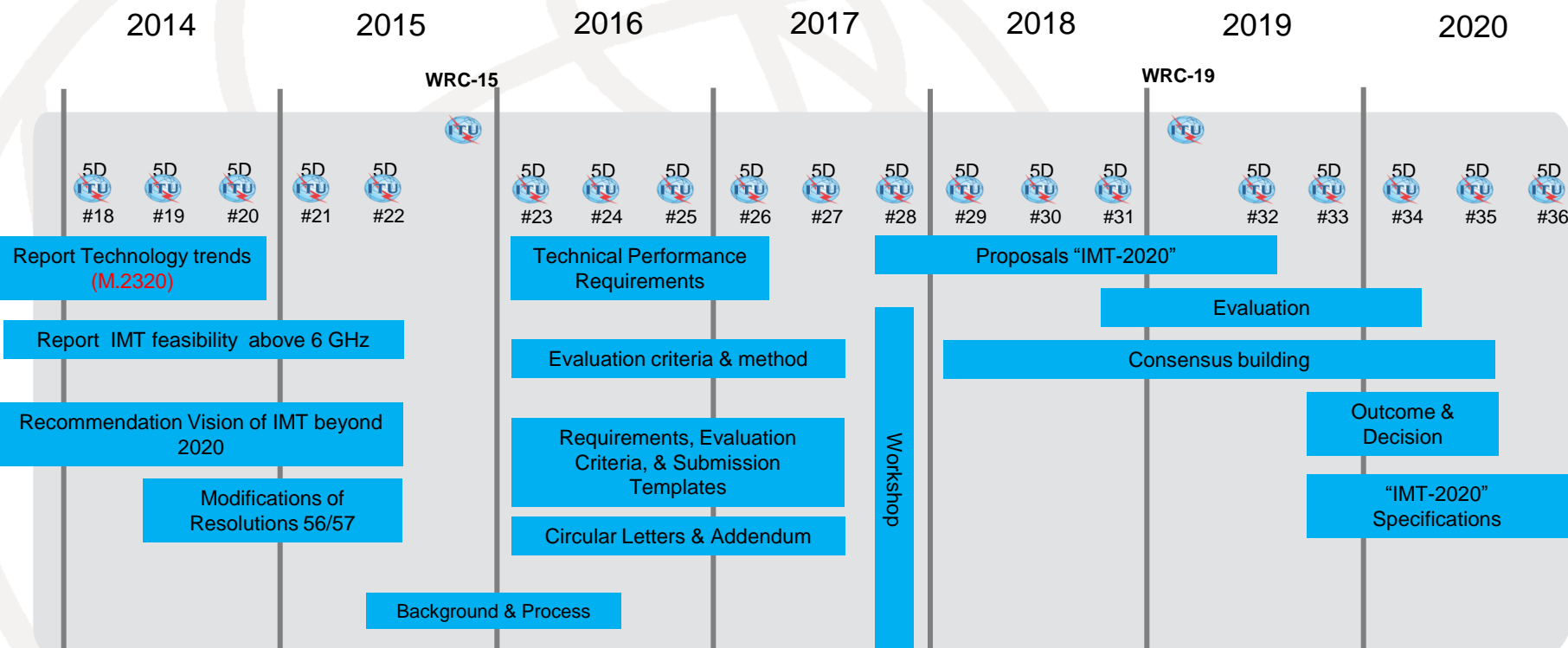


- Working Party 5D will essentially use the same process and deliverable formats successfully utilized in the development of IMT-Advanced.
- *In the next phase, in the 2016-2017 time-frame, WP 5D will define in detail the performance requirements and evaluation criteria and methodology for the assessment of new IMT terrestrial radio interface.*
- It is anticipated that the timeframe for proposals will be focused in 2018. (window spans late 2017 to mid-2019)
- In 2018-2020 the evaluation by independent external evaluation groups and definition of the new radio interfaces to be included in “IMT-2020” will take place.
- Working Party 5D also plans to hold a workshop in late 2017 that will allow for an explanation and discussion on performance requirements and evaluation criteria and methodology for candidate technologies for “IMT-2020” that has been developed by WP 5D, as well as to provide an opportunity for presentations by potential proponents for “IMT-2020” in an informal setting.
- The whole process for the initial release of “IMT-2020” is planned to be completed in 2020 when a draft new ITU-R Recommendation with detailed specifications for the new terrestrial radio interfaces of “IMT-2020” will be submitted for approval within ITU-R.
- Enhancement and additional capabilities for “IMT-2020” are expected to start in 2021 and be on-going.



Published WP 5D Timeline for "IMT-2020" Related to the Terrestrial Radio Interface Technology and Systems

Source 5D/929 Att 2.12, Figure 1, Meeting #22 (27 Jan – 4 Feb 2015)



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

Important “Technology Proponent Organizations” Milestones on “IMT-2020”



- Workshop: WP 5D Meeting #28 ~ Oct 2017
 - Proposals: WP 5D Meeting #28 - #32 ~ Oct 2017 – Jun 2019
 - Specifications: WP 5D Meeting #33 - #36 ~ Oct 2019 – Oct 2020
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- Note:
 - Is expected that the final specifications for the “global core specification” from the external organizations (the technology proponents) towards the work on Draft new Recommendation ITU-R M.[IMT-2020.SPECS] “*Detailed specifications of the terrestrial radio interfaces of “IMT-2020”*” would be received into WP 5D Meeting #34 (February 2020) at the latest.
 - Transposed specifications (from the individual regional or national transposing organizations) would be received at WP 5D Meeting #35 (June 2020) at the latest.
 - The finalization of the complete Draft new Recommendation ITU-R M.[IMT-2020.SPECS] for the initial release of “IMT-2020” would be at WP 5D Meeting #36.
 - Details of specific requests for material from the external organizations and relevant timings of the process steps will be communicated through ITU-R Circular Letters and liaisons and is expected to be similar to the process in Docs ITU-R [IMT- ADV/24 Rev 2](#).

WP 5D Deliverables Initiated in 2015 to Complete in 2016



Item	Proposed “IMT-2020” Related Deliverable	Aspect to be Addressed in Proposed Deliverable	Potential Work Start Timing	Potential Document Completion in WP 5D	IMT-Advanced Model Document
1	Doc. “IMT-2020”/AAA “IMT-2020” Background	Background on “IMT-2020”	Meeting #22 (June 2015)	Meeting #24 (June 2016)	Document IMT-ADV/1 <i>“Background on IMT-Advanced”</i>
2	Doc. “IMT-2020”/BBB “IMT-2020” Process	The Submission and evaluation process and consensus building for “IMT-2020” as well as the “timeline” for “IMT-2020”	Meeting #22 (June 2015)	Meeting #24 (June 2016)	Document IMT-ADV/2 <i>“Submission and evaluation process and consensus building”</i>

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

WP 5D Deliverables Initiated in 2016 to Complete in 2017



Item	Proposed “IMT-2020” Related Deliverable	Aspect to be Addressed in Proposed Deliverable	Potential Work Start Timing	Potential Document Completion in WP 5D	IMT-Advanced Model Document
3	Draft new Report ITU-R M.[IMT-2020. TECH PERF REQ]	General Technical Performance Requirements expected of a technology to satisfy “IMT-2020”	Meeting #23 (February 2016)	Meeting #26 (February 2017)	Report ITU-R M.2134 <i>“Requirements related to technical performance for IMT-Advanced radio interface(s)”</i>
4	Draft new Report ITU-R M.[IMT-2020. EVAL]	Evaluation Criteria and Evaluation Methods for “IMT-2020” technologies	Meeting #23 (February 2016)	Meeting #27 (June 2017)	Report ITU-R M.2135 <i>“Guidelines for evaluation of radio interface technologies for IMT-Advanced”</i>
5	Draft new Report ITU-R M.[IMT-2020. SUBMISSION]	Specific Requirements of the candidate technology related to submissions, the evaluation criteria and submission templates	Meeting #23 (February 2016)	Meeting #27 (June 2017)	Report ITU-R M.2133 <i>“Requirements, evaluation criteria and submission templates for the development of IMT-Advanced”</i>
6	Circular Letter “IMT-2020”	The official ITU-R announcement of the “IMT-2020” process and the invitation for candidate technology submissions	Meeting #23 (February 2016)	Meeting #27 (June 2017)	Circular Letter 5/LCCE/2 and Addenda <i>“Invitation for submission of proposals for candidate radio interface technologies for the terrestrial components of the radio interface(s) for IMT-Advanced and invitation to participate in their subsequent evaluation”</i>

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

WP 5D Deliverables Initiated in 2017 to Complete in 2019



Item	Proposed “IMT-2020” Related Deliverable	Aspect to be Addressed in Proposed Deliverable	Potential Work Start Timing	Potential Document Completion in WP 5D	IMT-Advanced Model Document
7	Doc. “IMT-2020”/YYY Input Submissions Summary	Capturing in ITU-R documentation the inputs documents and the initial view of suitability as a valid submission	Meeting #28 (October 2017)	Meeting #32 (June 2019)	For example, Documents IMT-ADV/4 thru IMT-ADV/9 <i>“Acknowledgement of candidate submission fromunder step 3 of the IMT-Advanced process (..... technology)”</i>

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

WP 5D Deliverables Initiated in 2018 to Complete in 2020



Item	Proposed “IMT-2020” Related Deliverable	Aspect to be Addressed in Proposed Deliverable	Potential Work Start Timing	Potential Document Completion in WP 5D	IMT-Advanced Model Document
8	Doc. “IMT-2020”/ZZZ Evaluation Reports Summary	As the evaluation of each candidate technology proceeds the results of each evaluation of each technology by the different evaluation groups must be documented and analyzed by WP 5D towards the final evaluation assessment	Meeting #31 (October 2018)	Meeting #34 (February 2020)	For example, Documents IMT-ADV/10 thru IMT-ADV/23 “ <i>Evaluation IMT-Advanced candidate technology submissions in documents IMT-ADV/xyz by XYZ Evaluation Group</i> ”

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

WP 5D Deliverables Initiated in 2019 to Complete in 2020



Item	Proposed “IMT-2020” Related Deliverable	Aspect to be Addressed in Proposed Deliverable	Potential Work Start Timing	Potential Document Completion in WP 5D	IMT-Advanced Model Document
9	Draft new Report ITU-R M.[IMT-2020. OUTCOME]	The outcome of the evaluation and assessment and the statement on those candidate technologies suitable to move to the specification phase in ITU-R	Meeting #33 (October 2019)	Meeting #35 (June 2020)	Report ITU-R M.2198 <i>“The outcome of the evaluation, consensus building and decision of the IMT-Advanced process (Steps 4 to 7), including characteristics of IMT-Advanced radio interface”</i>
10	Draft new Recommendation ITU-R M.[IMT-2020.SPECS]	The detailed specification of each of “IMT-2020” technology	Meeting #33 (October 2019)	Meeting #36 (October 2020)	Recommendation ITU-R M.2012 <i>“Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-Advanced (IMT-Advanced)”</i>

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Coordination With Activities in External Entities Engaged in 5G Developments



Liaisons dispatched from WP 5D in February 2015 to the following entities provided the detailed time plan and requesting certain information:

- 3GPP,
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- UMTS Forum,
- WiMax Forum, Wireless
- World Research Forum
- *We welcome any other interested partner*

Liaison To External Organizations And Research Entities Engaged In "5G" Development Requesting an Update on IMT activities



Request for Information (providing a focal point for the global activities)

- In early 2014, Working Party 5D held a workshop on "*Research Views on IMT Beyond 2020*" and at that time had the opportunity to hear the perspectives of various organizations and entities engaged in the developmental activities on future systems commonly referred as "5G".
- Recognizing that progress on the development of "5G" has occurred since then, Working Party 5D has requested information to our June 2015 meeting on:
 - the current status of the work and conclusions that may have been reached on "5G"
 - and on the respective planned work programs for the remainder of 2015 and into 2016 (if available).
 - **Of particular interest to WP 5D are updates that might relate to "the general technical performance requirements of a radio interface technology or set of technologies for 5G".**

Initiating the Work in WP 5D of the Detailed Technical Performance Requirements Deliverable (setting the stage in June 2015)

- **The information will be utilized by WP 5D in organizing the detailed work that is scheduled to begin at WP 5D Meeting #23 in early 2016**
- The updates will assist WP 5D in understanding how WP 5D might further appropriately engage with the recipients of the liaison as the work on "IMT-2020" continues to unfold.
- Additional liaisons are anticipated as the detailed work on "IMT for 2020" in WP 5D begins to address other 2016/2017 deliverables such as the evaluation criteria and methods.

WP 5D Deliverables



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2015 Deliverables to be completed and forwarded to Study Group 5 for consideration in the 20-21 July 2015 meeting



<p>27 January – 4 February 2015</p>	<p>WP 5D #21 Auckland, New Zealand</p>	<ul style="list-style-type: none"> • Handbook on "Global trends in IMT" (approved and will be published in April 2015)
<p>10-18 June 2015</p>	<p>WP 5D #22 San Diego, California</p>	<ul style="list-style-type: none"> • Finalize revision of Recommendation ITU-R M.2012-1 • Finalize revision of Recommendation M.1036-4 • Finalize draft new Recommendation ITU-R M.[IMT VISION] • Finalize draft new Report ITU-R M.[IMT.SMALL CELL] • Finalize draft new Report ITU-R M.[IMT.ABOVE 6 GHz] • Finalize draft new Report ITU-R M.[IMT.ARCH] • Finalize draft new Report ITU-R M.[IMT.BEYOND 2020 TRAFFIC] • Finalize draft new Report ITU-R M.[IMT.AV] • Finalize draft new Report ITU-R M.[TDD.COEXISTENCE] • Finalize draft new or draft revisions of relevant Questions & Resolutions

2014 Deliverables completed and approved in ITU-R



- *Recommendation ITU-R M.2070* - Generic unwanted emission characteristics of base stations using the terrestrial radio interfaces of IMT-Advanced.
 - *Recommendation ITU-R M.2071* - Generic unwanted emission characteristics of mobile stations using the terrestrial radio interfaces of IMT-Advanced.
 - *Recommendation ITU-R M.1579-2* - Global circulation of IMT terrestrial terminals - Question ITU-R 229-3/5.
 - *Recommendation ITU-R M.1457-12* - Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-2000 (IMT-2000).
 - *Report ITU-R M.2039-3* - Characteristics of terrestrial IMT-2000 systems for frequency sharing/interference analyses.
 - *New Report ITU-R M.2320* - Future technology trends of terrestrial IMT systems.
 - *New Report ITU-R M.2334* - Passive and active antenna systems for base stations of IMT systems.

 - *Note: Published versions of the above documents anticipated to be available by mid-March 2015.*
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2013 Deliverables completed and approved that support WRC-15

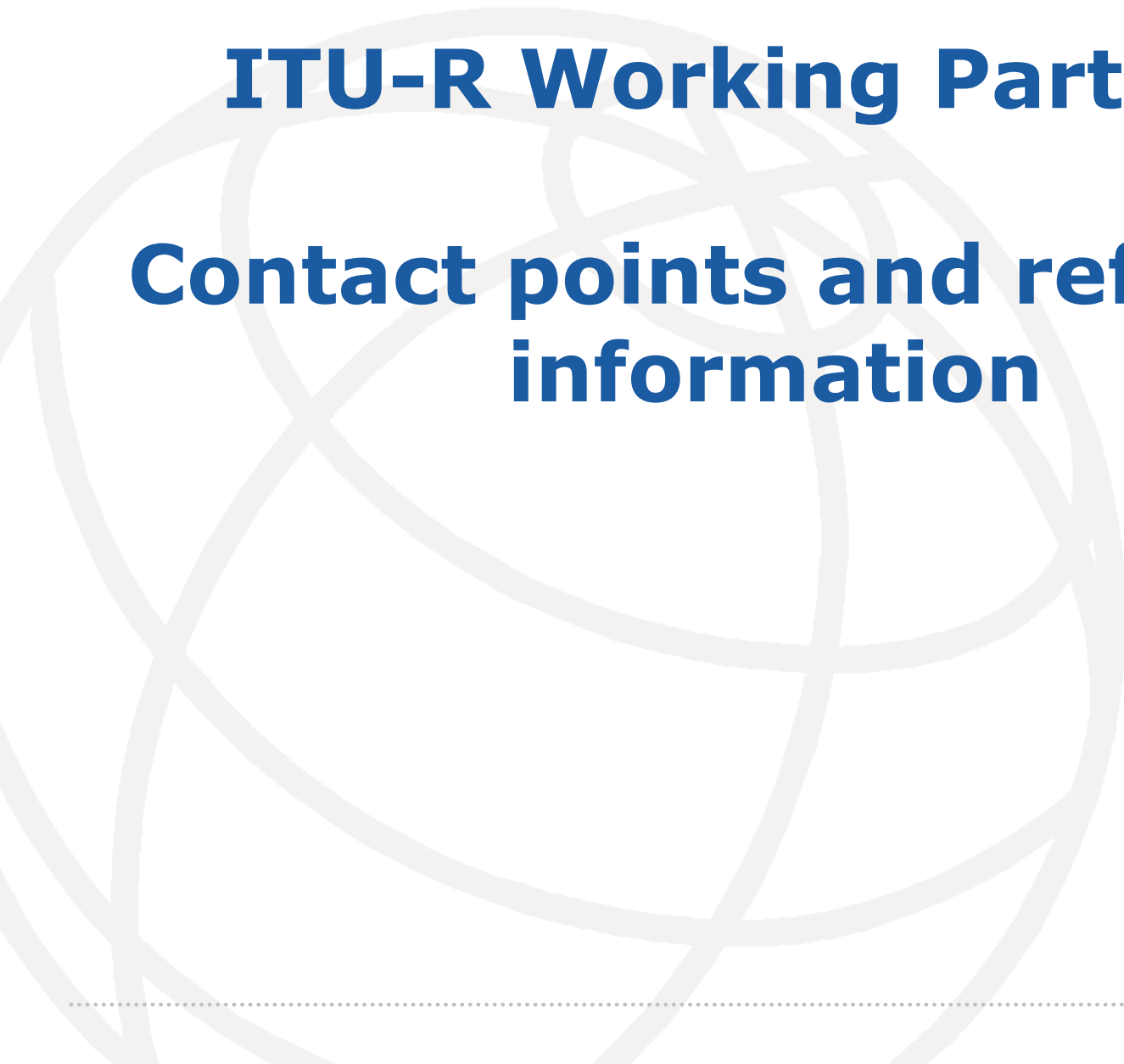


- [Recommendation ITU R M.1768-1](#) - Methodology for calculation of spectrum requirements for the terrestrial component of International Mobile Telecommunications
 - [Report ITU-R M.2289](#) - Future radio aspect parameters for use with the terrestrial IMT spectrum estimate methodology of Recommendation ITU-R M.1768-1
 - [Report ITU-R M.2290](#) - Future spectrum requirements estimate for terrestrial IMT
 - [Report ITU-R M.2292](#) - Characteristics of terrestrial IMT-Advanced systems for frequency sharing/interference analyses
 - [Report ITU-R M.2291](#) - The use of International Mobile Telecommunications (IMT) for broadband public protection and disaster relief (PPDR) applications
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ITU-R Working Party 5D

Contact points and reference information



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SWG PPDR	Mr. Bharat BHATIA
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SWG RADIO ASPECTS	Mr. Marc GRANT
SWG OUT OF BAND EMISSIONS (OOBE)	Mr. Uwe LÖWENSTEIN
AH WORK PLAN	Dr. Hakan OHLSSEN

- **Reference Links:**

- [WP 5D Home Page](#)
- [WP 5D "IMT-2020" Page](#)
- [Report of WP 5D Meeting #21](#) (requires ITU TIES Account)

- **ITU-R Key 2015 Meeting Schedule**

- **WP 5D Meeting #21:** 27 January–4 February 2015 (Auckland, New Zealand)
- **CPM 15-2:** 23 March–2 April 2015 (Geneva)
- **WP 5D Meeting #22** 10–18 June 2015 (San Diego)
- **Study Group 5:** 20–21 July 2015 (Geneva)
- **RA-15:** 26–30 October 2015 (Geneva)
- **WRC-15:** 2–27 November 2015 (Geneva)