



International Telecommunication Union

ITU REGIONAL SEMINAR
5G IMPLEMENTATION IN EUROPE AND CIS
Budapest 3-5 July 2018

**ETSI & 3GPP 5G standardization toward IMT-
2020**

Radio spectrum and interface

Mr. Srđan Mihaljević
ITU Expert



International Telecommunication Union

European Telecommunication Standardization Institute



ETSI is a standards developing organization with European roots and global outreach recognized by EU and most of the CEPT countries.

As such it supports industry and EU regulation through development of specification and testing methodologies as well as interoperability testing.



3rd Generation Partnership Project



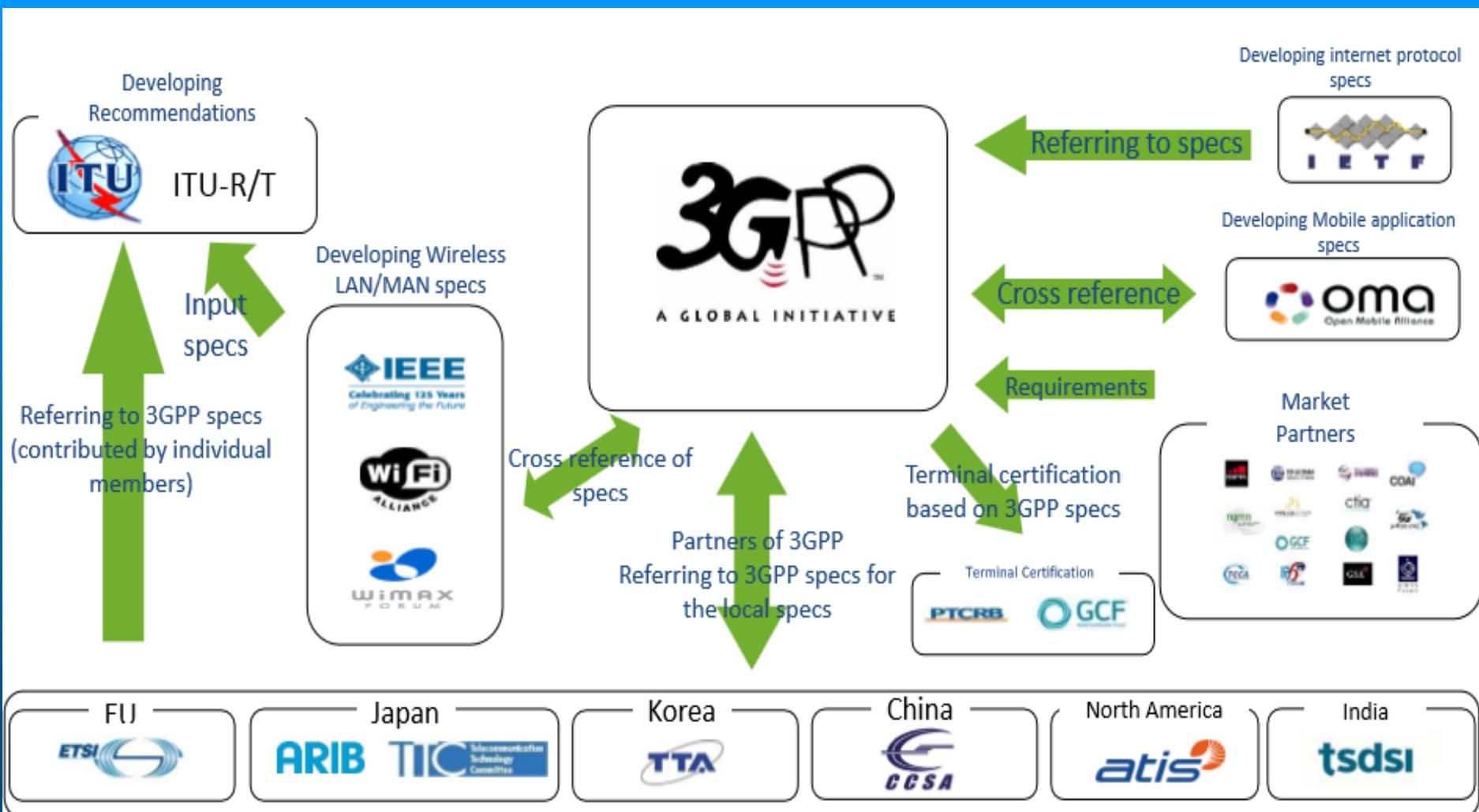
The 3rd Generation Partnership Project (3GPP) unites 7 telecommunications standard development organizations and provides their members with a stable environment to produce the Reports and Specifications that define 3GPP technologies.





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3GPP ecosystem





3GPP Technical Specification Groups



TSG RAN Radio Access Network
RAN WG1 Radio Layer 1 spec
RAN WG2 Radio Layer 2 spec Radio Layer 3 RR spec
RAN WG3 Iub spec, Iur spec, Iu spec UTRAN O&M requirements
RAN WG4 Radio Performance Protocol aspects
RAN WG5 Mobile Terminal Conformance Testing
RAN WG6 GSM/EDGE radio and protocol aspects

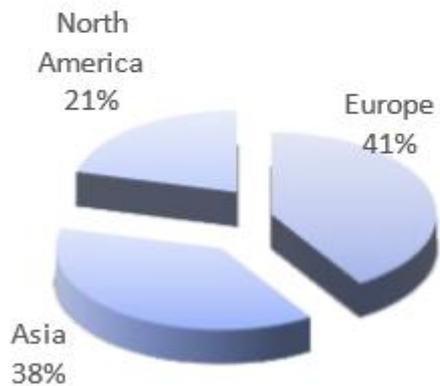
TSG CT Core Network & Terminals
CT WG1 MM/CC/SM (Iu)
CT WG3 Interworking with external networks
CT WG4 MAP/GTP/BCH/SS
CT WG6 Smart Card Application Aspects

TSG SA Service & Systems Aspects
SA WG1 Services
SA WG2 Architecture
SA WG3 Security
SA WG4 Codec
SA WG5 Telecom Management
SA WG6 Mission-critical applications

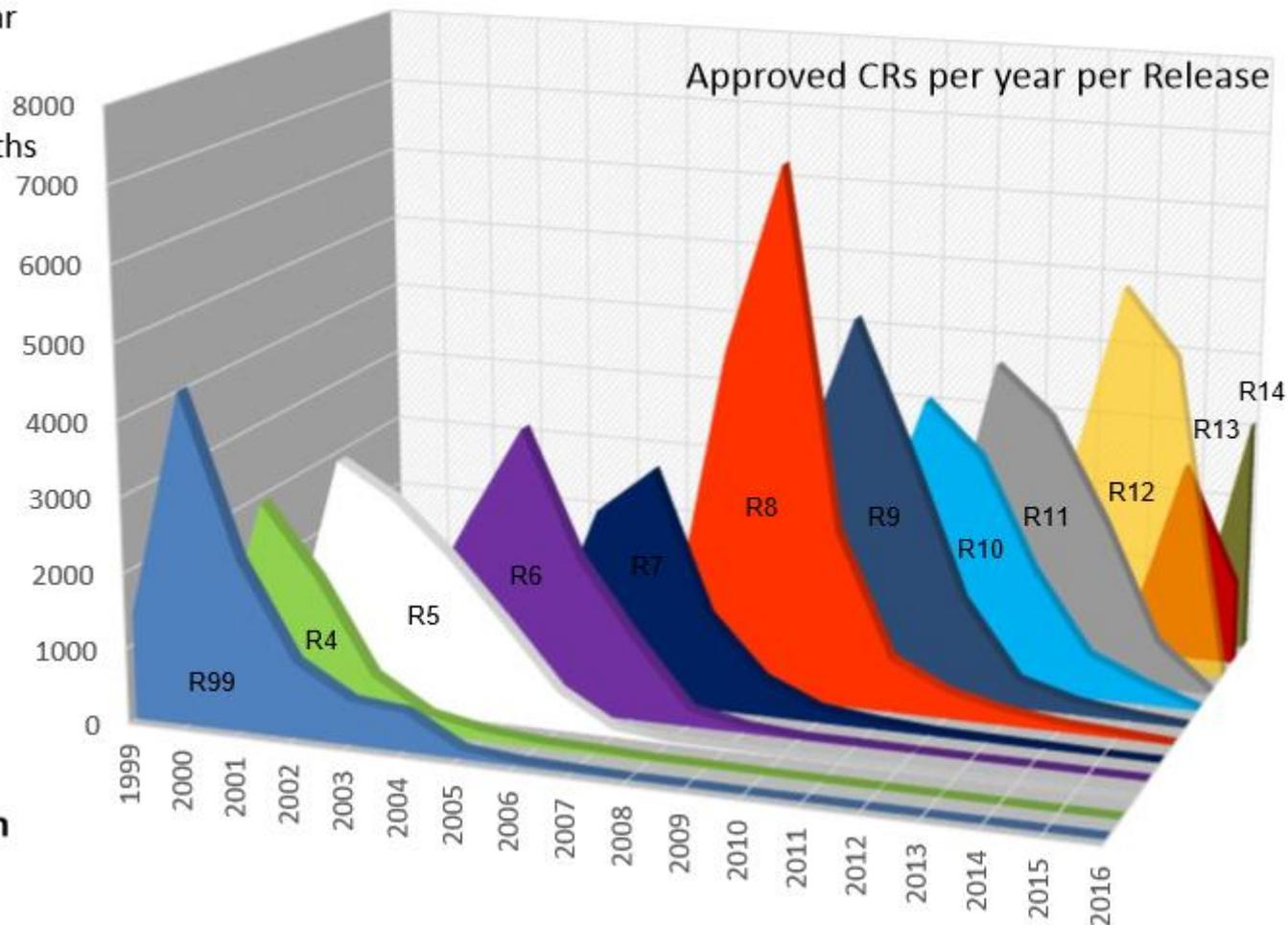


3GPP Figures

- ~400 Companies from 39 Countries
- 50.000 delegate days per year
- 40.000 documents per year
- 1.200 specs per Release
- New Release every ~18 months



Participation by Region



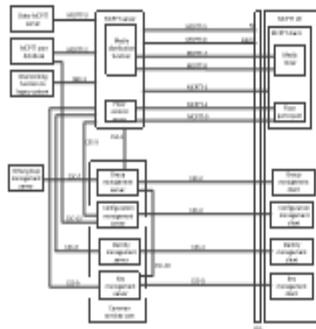


3GPP Process

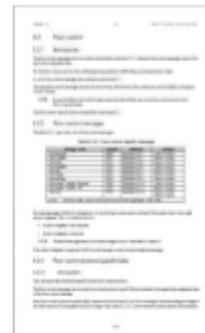
Stage 1: Requirements



Stage 2: Architecture



Stage 3: Protocols



Work is completed in Releases of typically 15 – 18 months

New specifications issued at the completion of each release

Change requests then make corrections as needed

Working groups involved in Mission Critical standardisation:

SA1

- Requirements normally come from operators (MNOs)
- High public safety presence from Europe and USA for Mission Critical applications

SA6

- Mission Critical application architecture

SA3

- Security architecture and protocols

SA2

- Overall LTE (2G, 3G etc) system architecture

CT1

- Core protocols

CT4

- Database aspects

SA3

- Security protocols

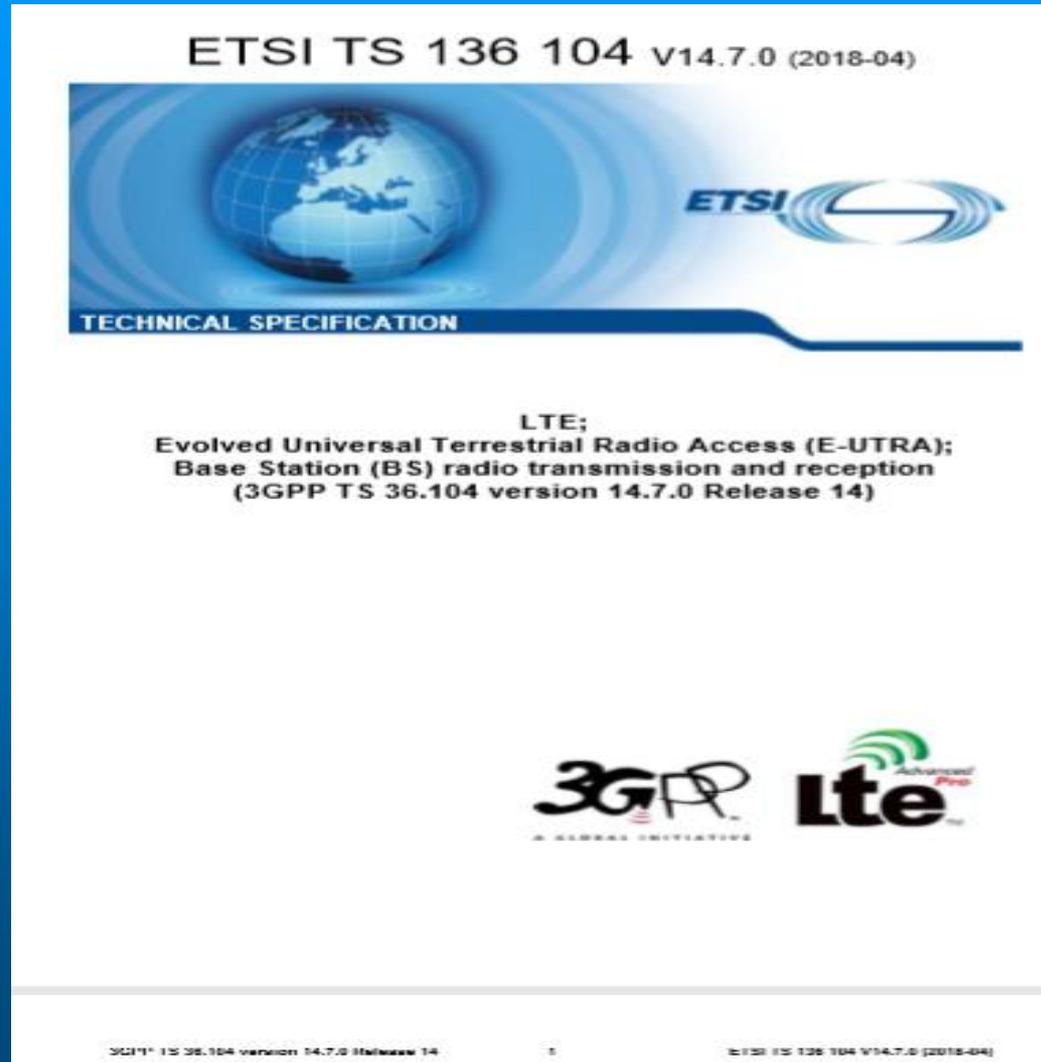
SA4

- Codec and multicast aspects

+ RAN groups for radio specifications



An example of approved specification





5G LIST OF SPECIFICATIONS





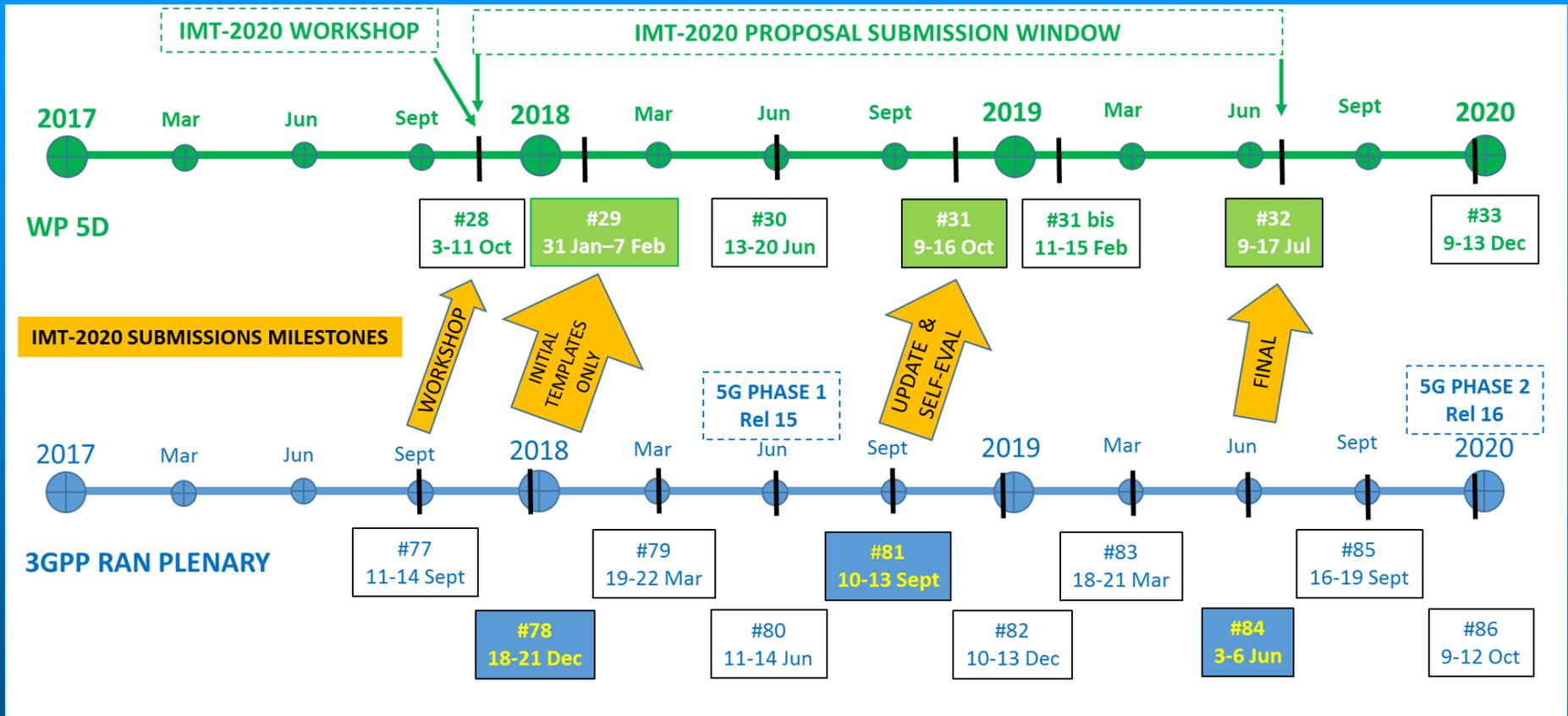
<p>TS 38.101-1 TS 38.101-2 TS 38.101-3 TS 38.101-4 TS 38.101 TS 38.111 TS 38.112 TS 38.113 TS 38.114-1 TS 38.114-2 TS 38.115 TS 38.116 TS 38.117 TS 38.118 TS 38.119 TS 38.120 TS 38.121 TS 38.122 TS 38.123 TS 38.124 TS 38.125 TS 38.126 TS 38.127 TS 38.128 TS 38.129 TS 38.130 TS 38.131 TS 38.132 TS 38.133 TS 38.134 TS 38.135 TS 38.136 TS 38.137 TS 38.138 TS 38.139 TS 38.140 TS 38.141 TS 38.142 TS 38.143 TS 38.144 TS 38.145 TS 38.146 TS 38.147 TS 38.148 TS 38.149 TS 38.150 TS 38.151 TS 38.152 TS 38.153 TS 38.154 TS 38.155 TS 38.156 TS 38.157 TS 38.158 TS 38.159 TS 38.160</p>	<p>NR User Equipment (UE) radio transmission and reception; Part 1: 5G-Range 1 (5G NR) NR User Equipment (UE) radio transmission and reception; Part 2: 5G-Range 2 (5G NR) NR User Equipment (UE) radio transmission and reception; Part 3: 5G-Range 1 and 5G-Range 2 (5G NR) NR User Equipment (UE) radio transmission and reception; Part 4: Performance requirements NR User Equipment (UE) radio transmission and reception NR User Equipment (UE) Radio Resource Management (RRM) NR: Electromagnetic compatibility (EMC) requirements for mobile terminals and installing equipment NR: Requirements for support of radio resource management NR: Base Station (BS) conformance testing; Part 1: Core network conformance testing NR: Base Station (BS) conformance testing; Part 2: 5G-Baseband conformance testing NR: Physical layer: general description NR: Services provided by the physical layer NR: Physical channels and modulation NR: Multiplexing and channel coding NR: Physical layer protocols and procedures NR: Physical layer measurements NR: Coverage: exceptions, 5G-Range 2 NR: User Equipment (UE) procedures in idle mode and in RRC inactive state NR: Radio Access Network (RAN) Stage 2 functional specification of 5G-Range 1 and 5G-Range 2 (5G NR) NR: User Equipment (UE) radio access capabilities NR: Requirements on User Equipment (UE) supporting a primary or secondary frequency band NR: Media Access Control (MAC) protocol specifications NR: Radio Link Control (RLC) protocol specifications NR: Medium Access Control (MAC) and Physical Layer (PHY) specifications NR: Radio Resource Control (RRC) Protocol specifications NR: RAN Architecture description NR: RAN: NG general aspects and principles NR: RAN: NG-1 NR: RAN: NG signaling transport NR: RAN: NG Application Protocol (NGAP) NR: RAN: NG data transport NG-RAN Core Network NR: RAN: NG-2 NR: RAN: NG-3 NR: RAN: NG-4 NR: RAN: NG-5 NR: RAN: NG-6 NR: RAN: NG-7 NR: RAN: NG-8 NR: RAN: NG-9 NR: RAN: NG-10 NR: RAN: NG-11 NR: RAN: NG-12 NR: RAN: NG-13 NR: RAN: NG-14 NR: RAN: NG-15 NR: RAN: NG-16 NR: RAN: NG-17 NR: RAN: NG-18 NR: RAN: NG-19 NR: RAN: NG-20 NR: RAN: NG-21 NR: RAN: NG-22 NR: RAN: NG-23 NR: RAN: NG-24 NR: RAN: NG-25 NR: RAN: NG-26 NR: RAN: NG-27 NR: RAN: NG-28 NR: RAN: NG-29 NR: RAN: NG-30 NR: RAN: NG-31 NR: RAN: NG-32 NR: RAN: NG-33 NR: RAN: NG-34 NR: RAN: NG-35 NR: RAN: NG-36 NR: RAN: NG-37 NR: RAN: NG-38 NR: RAN: NG-39 NR: RAN: NG-40 NR: RAN: NG-41 NR: RAN: NG-42 NR: RAN: NG-43 NR: RAN: NG-44 NR: RAN: NG-45 NR: RAN: NG-46 NR: RAN: NG-47 NR: RAN: NG-48 NR: RAN: NG-49 NR: RAN: NG-50 NR: RAN: NG-51 NR: RAN: NG-52 NR: RAN: NG-53 NR: RAN: NG-54 NR: RAN: NG-55 NR: RAN: NG-56 NR: RAN: NG-57 NR: RAN: NG-58 NR: RAN: NG-59 NR: RAN: NG-60 NR: RAN: NG-61 NR: RAN: NG-62 NR: RAN: NG-63 NR: RAN: NG-64 NR: RAN: NG-65 NR: RAN: NG-66 NR: RAN: NG-67 NR: RAN: NG-68 NR: RAN: NG-69 NR: RAN: NG-70 NR: RAN: NG-71 NR: RAN: NG-72 NR: RAN: NG-73 NR: RAN: NG-74 NR: RAN: NG-75 NR: RAN: NG-76 NR: RAN: NG-77 NR: RAN: NG-78 NR: RAN: NG-79 NR: RAN: NG-80 NR: RAN: NG-81 NR: RAN: NG-82 NR: RAN: NG-83 NR: RAN: NG-84 NR: RAN: NG-85 NR: RAN: NG-86 NR: RAN: NG-87 NR: RAN: NG-88 NR: RAN: NG-89 NR: RAN: NG-90 NR: RAN: NG-91 NR: RAN: NG-92 NR: RAN: NG-93 NR: RAN: NG-94 NR: RAN: NG-95 NR: RAN: NG-96 NR: RAN: NG-97 NR: RAN: NG-98 NR: RAN: NG-99 NR: RAN: NG-100</p>	<p>TS 38.200-1 TS 38.200-2 TS 38.200-3 TS 38.200-4 TS 38.200-5 TS 38.200-6 TS 38.200-7 TS 38.200-8 TS 38.200-9 TS 38.200-10 TS 38.200-11 TS 38.200-12 TS 38.200-13 TS 38.200-14 TS 38.200-15 TS 38.200-16 TS 38.200-17 TS 38.200-18 TS 38.200-19 TS 38.200-20 TS 38.200-21 TS 38.200-22 TS 38.200-23 TS 38.200-24 TS 38.200-25 TS 38.200-26 TS 38.200-27 TS 38.200-28 TS 38.200-29 TS 38.200-30 TS 38.200-31 TS 38.200-32 TS 38.200-33 TS 38.200-34 TS 38.200-35 TS 38.200-36 TS 38.200-37 TS 38.200-38 TS 38.200-39 TS 38.200-40 TS 38.200-41 TS 38.200-42 TS 38.200-43 TS 38.200-44 TS 38.200-45 TS 38.200-46 TS 38.200-47 TS 38.200-48 TS 38.200-49 TS 38.200-50 TS 38.200-51 TS 38.200-52 TS 38.200-53 TS 38.200-54 TS 38.200-55 TS 38.200-56 TS 38.200-57 TS 38.200-58 TS 38.200-59 TS 38.200-60 TS 38.200-61 TS 38.200-62 TS 38.200-63 TS 38.200-64 TS 38.200-65 TS 38.200-66 TS 38.200-67 TS 38.200-68 TS 38.200-69 TS 38.200-70 TS 38.200-71 TS 38.200-72 TS 38.200-73 TS 38.200-74 TS 38.200-75 TS 38.200-76 TS 38.200-77 TS 38.200-78 TS 38.200-79 TS 38.200-80 TS 38.200-81 TS 38.200-82 TS 38.200-83 TS 38.200-84 TS 38.200-85 TS 38.200-86 TS 38.200-87 TS 38.200-88 TS 38.200-89 TS 38.200-90 TS 38.200-91 TS 38.200-92 TS 38.200-93 TS 38.200-94 TS 38.200-95 TS 38.200-96 TS 38.200-97 TS 38.200-98 TS 38.200-99 TS 38.200-100</p>
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5G NR Studies completed:

- TS 38.101-1 Study on non-terrestrial access technology: Earth-orbiting non-terrestrial access (NTN)
- TS 38.101-2 Study on non-terrestrial access technology: Physical layer aspects
- TS 38.101-3 Study on non-terrestrial access technology: Radio resource management aspects
- TS 38.101-4 Study on non-terrestrial access technology: Radio interface protocol aspects
- TS 38.101-5 Study on non-terrestrial access technology: NR RAN architecture
- TS 38.101-6 Study of support for NR in 5G-Range 1 (5G NR) and 5G-Range 2 (5G NR)
- TS 38.101-7 Study on NR in support of non-terrestrial networks
- TS 38.101-8 Study on Non-Terrestrial Multiple Access (NTN-Multi-Access)
- TS 38.101-9 New frequency range for NR (5.3-4.2 GHz)
- TS 38.101-10 New frequency range for NR (4.4-5.8 GHz)
- TS 38.101-11 New frequency range for NR (6.425-7.1 GHz)
- TS 38.101-12 Study on 5G-Range 1 and 5G-Range 2 (5G NR)
- TS 38.101-13 General aspects for 5G-Range 1 and 5G-Range 2 (5G NR)
- TS 38.101-14 General aspects for 5G-Range 1 and 5G-Range 2 (5G NR)
- TS 38.101-15 Study on integrated access and backhaul (IAB)
- TS 38.101-16 Study on IAB in support of 5G-Range 1 and 5G-Range 2 (5G NR)
- TS 38.101-17 Study on channel model for frequency spectrum above 6 GHz
- TS 38.101-18 Study on channel model for frequency spectrum below 6 GHz
- TS 38.101-19 Characteristics of test scenarios for 5G-Range 1 and 5G-Range 2 (5G NR) radio resource management tests
- TS 38.101-20 IAB: Evaluation of test models for radio transmission and reception test scenarios for IAB
- TS 38.101-21 Study on non-terrestrial access technology
- TS 38.101-22 Study on non-terrestrial access technology: test scenarios



An IMT2020 status – 5G 3GPP

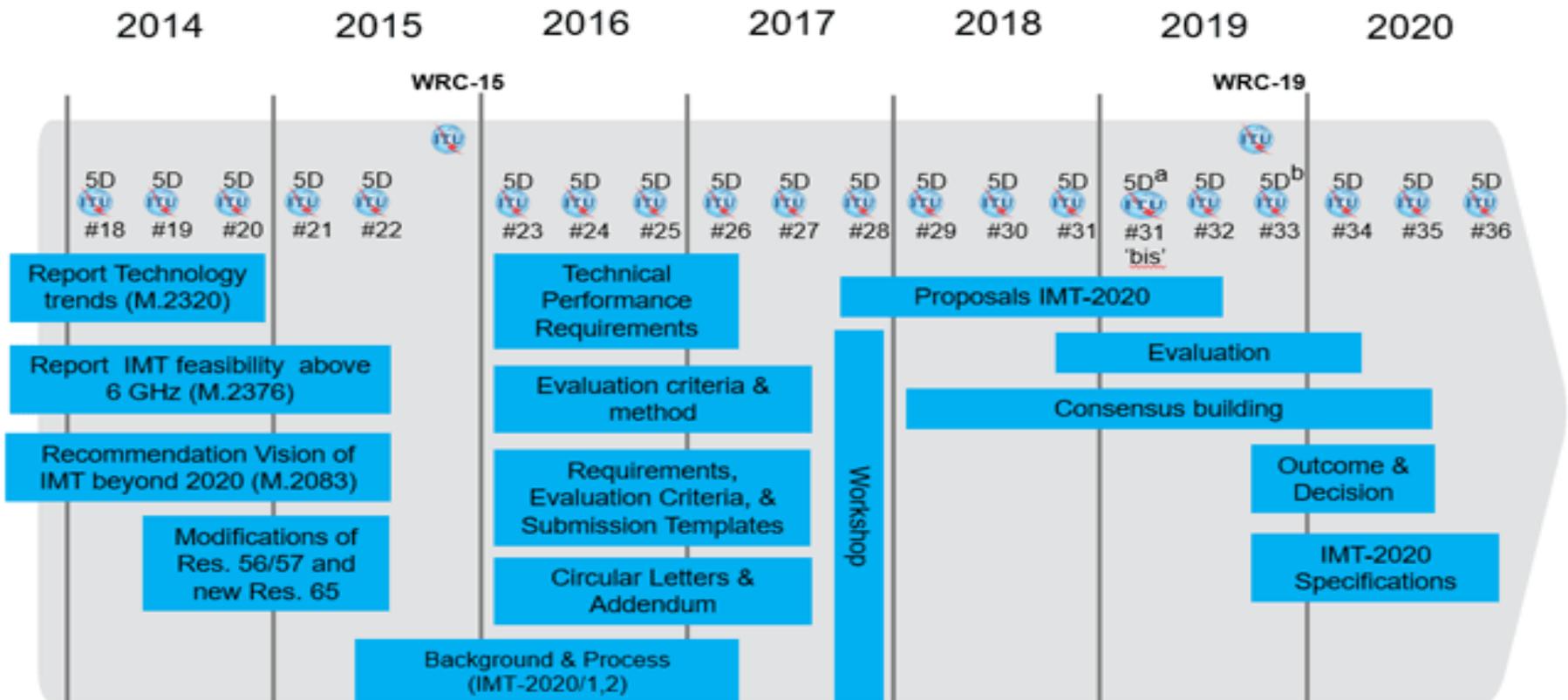


3GPP has submitted to the ITU initial “Description template of 3GPP 5G Candidate for inclusion in IMT2020”. The final one will be July 2019.



An IMT2020 status – ITU

Detailed Timeline & Process For IMT-2020 in ITU-R



(a) – five day meeting, (b) – focus meeting on Evaluation (Technology)



SUBMISSION TO ITU WP 5D



Naming

- Name : 5G
- Footnote: Developed by 3GPP as 5G, Release 15 and beyond

Submission 1

SRIT

Component RIT: NR
Component RIT: E-UTRA/LTE

Submission 2

NR RIT

SRIT – Standalone radio interface template
NR RIT – New radio interface template



3GPP Spectrum – 38.104 & 38.101

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Definition of frequency ranges

Frequency range designation	Corresponding frequency range
FR1	450 MHz – 6000 MHz
FR2	24250 MHz – 52600 MHz



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Operating bands in FR1

NR operating band	Uplink (UL) operating band BS receive / UE transmit $F_{UL_low} - F_{UL_high}$	Downlink (DL) operating band BS transmit / UE receive $F_{DL_low} - F_{DL_high}$	Duplex Mode
n1	1920 MHz – 1980 MHz	2110 MHz – 2170 MHz	FDD
n2	1850 MHz – 1910 MHz	1930 MHz – 1990 MHz	FDD
n3	1710 MHz – 1785 MHz	1805 MHz – 1880 MHz	FDD
n5	824 MHz – 849 MHz	869 MHz – 894 MHz	FDD
n7	2500 MHz – 2570 MHz	2620 MHz – 2690 MHz	FDD
n8	880 MHz – 915 MHz	925 MHz – 960 MHz	FDD
n20	832 MHz – 862 MHz	791 MHz – 821 MHz	FDD
n28	703 MHz – 748 MHz	758 MHz – 803 MHz	FDD
n38	2570 MHz – 2620 MHz	2570 MHz – 2620 MHz	TDD
n41	2496 MHz – 2690 MHz	2496 MHz – 2690 MHz	TDD
n50	1432 MHz – 1517 MHz	1432 MHz – 1517 MHz	TDD
n51	1427 MHz – 1432 MHz	1427 MHz – 1432 MHz	TDD
n66	1710 MHz – 1780 MHz	2110 MHz – 2200 MHz	FDD
n70	1695 MHz – 1710 MHz	1995 MHz – 2020 MHz	FDD
n71	663 MHz – 698 MHz	617 MHz – 652 MHz	FDD
n74	1427 MHz – 1470 MHz	1475 MHz – 1518 MHz	FDD
n75	N/A	1432 MHz – 1517 MHz	SDL
n76	N/A	1427 MHz – 1432 MHz	SDL
n77	3300 MHz – 4200 MHz	3300 MHz – 4200 MHz	TDD
n78	3300 MHz – 3800 MHz	3300 MHz – 3800 MHz	TDD
n79	4400 MHz – 5000 MHz	4400 MHz – 5000 MHz	TDD
n80	1710 MHz – 1785 MHz	N/A	SUL
n81	880 MHz – 915 MHz	N/A	SUL
n82	832 MHz – 862 MHz	N/A	SUL
n83	703 MHz – 748 MHz	N/A	SUL
n84	1920 MHz – 1980 MHz	N/A	SUL



Operating bands in FR2

NR operating band	Uplink (UL) and Downlink (DL) operating band BS transmit/receive UE transmit/receive $F_{UL_low} - F_{UL_high}$ $F_{DL_low} - F_{DL_high}$	Duplex Mode
n257	26500 MHz – 29500 MHz	TDD
n258	24250 MHz – 27500 MHz	TDD
n260	37000 MHz – 40000 MHz	TDD



Maximum transmission bandwidth configuration

SCS kHz	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	70 MHz	80 MHz	90 MHz	100 MHz
15	242.5	312.5	382.5	452.5	522.5	[592.5]	552.5	692.5	N.A	N.A	N.A	N.A	N.A
30	505	665	645	805	785	[945]	905	1045	825	[965]	925	[885]	845
60	N.A	1010	990	1330	1310	[1290]	1610	1570	1530	[1490]	1450	[1410]	1370

SCS [kHz]	50MHz	100MHz	200MHz	400 MHz
60	1210	2450	4930	N.A
120	1900	2420	4900	9860



Channel bandwidth per operating band

NR band / SCS / BS channel bandwidth														
NR Band	SCS kHz	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	70 MHz	80 MHz	90 MHz	100 MHz
n41	15		Yes	Yes	Yes			Yes	Yes					
	30		Yes	Yes	Yes			Yes	Yes	Yes		Yes		Yes
	60		Yes	Yes	Yes			Yes	Yes	Yes		Yes		Yes
n50	15	Yes	Yes	Yes	Yes			Yes	Yes					
	30		Yes	Yes	Yes			Yes	Yes	Yes		Yes		
	60		Yes	Yes	Yes									
n77	15		Yes		Yes		Yes	Yes	Yes					
	30		Yes		Yes		Yes							
	60		Yes		Yes		Yes							
n78	15		Yes		Yes		Yes	Yes	Yes					
	30		Yes		Yes		Yes							
	60		Yes		Yes		Yes							
n79	15							Yes	Yes					
	30							Yes	Yes	Yes		Yes		Yes
	60							Yes	Yes	Yes		Yes		Yes

NR band / SCS / BS Channel bandwidth					
NR Band	SCS kHz	50 MHz	100 MHz	200 MHz	400 MHz
n257	60	Yes	Yes	Yes	Yes
	120	Yes	Yes	Yes	Yes
n258	60	Yes	Yes	Yes	Yes
	120	Yes	Yes	Yes	Yes
n260	60	Yes	Yes	Yes	Yes
	120	Yes	Yes	Yes	Yes



THANK YOU

**Mr. Srđan Mihaljević
ITU Expert**

srdjanITU@gmail.com

http://www.itu.int/ITU-D/tech/spectrum_management/