

5G-IA Pre-Standardization WG

# Summary of 3GPP TSG RAN Rel-18 Workshop

3GPP Rel-18: First release of "5G-Advanced"  
(28 June - 2 July 2021)

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# 3GPP TSG RAN Rel-18 Workshop - Relevance

## ◆ From 28 June through 2 July, 3GPP RAN held a major Workshop on "**Release 18**"

### ■ Release 18 (Rel-18) will be the first release for **5G-Advanced**

- Some companies have started to refer to 5G-Advanced as "5.5G", similarly to previously:
  - "2.5G" (GPRS)
  - "3.5G" (HSPA)
  - "4.5G" (LTE-Advanced)

### ■ This was the **first time** 3GPP TSG RAN (Radio Access Network) officially discussed Rel-18

- 3GPP TSG SA WG1 (Services) has been working on Rel-18 for some time and is scheduled to complete its work 80% by September and fully by December
- 3GPP TSG SA (Service and System Aspects) is planning a Workshop on Rel-18 on 9-10 September
- 3GPP TSG RAN, CT and SA are planning to have a joint discussion on Rel-18 during the September #93 plenaries

## ◆ Materials:

- [https://www.3gpp.org/ftp/tsg\\_ran/TSG\\_RAN/TSGR\\_AHs/2021\\_06\\_RAN\\_Rel18\\_WS/](https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_AHs/2021_06_RAN_Rel18_WS/)

Or

- [ftp://ftp.3gpp.org/tsg\\_ran/TSG\\_RAN/TSGR\\_AHs/2021\\_06\\_RAN\\_Rel18\\_WS/](ftp://ftp.3gpp.org/tsg_ran/TSG_RAN/TSGR_AHs/2021_06_RAN_Rel18_WS/)

- This presentation is intended as a **navigation help** through the materials

# 3GPP MRP "Verticals" Workshop prior to RAN Rel-18 Workshop

- ◆ 3GPP Market Representation Partners (MRP) Workshop on **"Industry Verticals"**
  - 3-hour Workshop on 23 June in preparation of the RAN Rel-18 Workshop
  - Focus on **requirements of "vertical" industries** regarding 3GPP RAN standardization

Automotive (5GAA, GW Consulting)	Satellite (ESOA, Thales)
Railways (UIC, Swiss Railways)	Industrial (5G-ACIA, Siemens)
Public safety (TCCA, Finnish govt.)	Utilities (EUTC, Samsung)
Maritime (IALA, Synctechno)	Broadcast/media (5GMAG, BBC)

# 3GPP RAN Rel-18 Workshop - Registrations

Organization Category	#Organizations	#Registrations
<b>Vendor groups</b> <ul style="list-style-type: none"> <li>Terminal/Chipset/Antenna</li> <li>Network</li> <li>Test equipment</li> </ul>	<b>51</b> 33 13 5	<b>739</b> 506 222 11
<b>Operators</b>	<b>39</b>	<b>199</b>
<b>Research organizations</b>	<b>31</b>	<b>161</b>
<b>Government representatives/Regulators</b>	<b>11</b>	<b>13</b>
<b>Verticals (some organizations belong to multiple categories)</b> <ul style="list-style-type: none"> <li>Aerospace/Satellite</li> <li>Broadcasting and Media</li> <li>Automotive</li> <li>Public Safety</li> <li>Industry</li> <li>Utilities</li> <li>Health</li> <li>Railways</li> <li>Other</li> </ul>	<b>60</b> 14(14) 10(10) 7(7) 9(10) 5(7) 3(4) 2(3) 3(3) 7(7)	<b>115</b> 35 20 15 14 9 4 4 3 11
<b>3GPP Organizational Partners (OPs)</b>		<b>24</b>
<b>Total</b>	<b>192</b>	<b>1251</b>

# 3GPP RAN Rel-18 Workshop - Contributions

- ◆ Companies submitted **over 500 original contributions**
  - **Only 45** original contributions were allowed to be presented, see next pages
  - The presentations were judged by the Chair to be '**representative**' of the topics, and were not presented because of company positions, but to allow discussion on those topics
  - In the meeting report on the server, you will find the **discussions** that took place on each of those topics reported under these 45 documents only, while other documents were officially marked as 'not treated'
  - However, in this particular Workshop, the status of each document ('noted', 'not treated') is **not important** because even 'not treated' documents were taken into account (e.g. in the decision on the Rel-18 initial timeline)
  - The agenda was split into three parts, namely **eMBB** topics, **non-eMBB** topics and **cross-functionality** topics
    - This split was a **one-time split** and is not intended to be used again in future
    - Companies did not always choose the same agenda item for the same topic, leading to some confusion

# 3GPP RAN Rel-18 Workshop - Presented Contributions

Order	Topics	Tdoc#	Title	Company
1	General	RWS-210122	Orange views on Rel18 objectives for RAN	Orange
2	General	RWS-210212	Views on eMBB-driven Functional Evolution for Rel-18	AT&T
3	MIMO	RWS-210307	Discussion on Release 18 MIMO enhancements	Ericsson
4	UL enhancements	RWS-210459	Uplink Radio Capacity, Coverage & Speed Improvement	VODAFONE
5	UL enhancements	RWS-210199	Uplink Enhancements	Rakuten Mobile, Inc
6	Mobility enhancements	RWS-210105	[x-area] Mobility Enhancements	MediaTek Inc.
7	UE power saving	RWS-210168	Motivation for new study item on almost-zero-power wake up signal in Rel-18	vivo, Spreadtrum communications, Guangdong Genius
8	Above 52.6GHz	RWS-210366	Rel-18 NR above 52.6 GHz	Intel Corporation
9	NR-U	RWS-210503	On unlicensed band enhancement	Apple
10	MR-MC	RWS-210143	Multi Radio Multi Connectivity for Rel-18	China Telecom
11	Flexible spectrum fusing	RWS-210210	Improved Utilization of Fragmented Spectrum Holdings	Charter Communications, Inc
12	IAB	RWS-210489	IAB enhancements for Rel. 18	CEWiT, Indian Institute of Tech (M), Reliance Jio, Saankhya Labs
13	Smart repeaters, RIS	RWS-210300	NR repeaters and Reconfigurable Intelligent Surface	KDDI Corporation
14	In-device co-ex	RWS-210114	Work Item on enhanced in-device coexistence for NR	Xiaomi Communications
15	MDT/SON	RWS-210263	Considerations on SON related enhancements in Rel-18	Lenovo, Motorola Mobility

# 3GPP RAN Rel-18 Workshop - Presented Contributions

Order	Topics	Tdoc#	Title	Company
16	General	RWS-210034	5G-SOLUTIONS: Verticals' requirements to 3GPP RAN Rel18	TELECOM ITALIA S.p.A.
17	General	RWS-210492	TCCA input for 3GPP Rel18 RAN workshop	TCCA
18	General	RWS-210215	5G-Advanced RAN Enhancements for Verticals	ROBERT BOSCH GmbH
19	Public safety	RWS-210498	Public Safety Requirements for Release 18	FirstNet
20	5GAA/V2X	RWS-210360	5GAA input to 3GPP Rel.18 Workshop	5GAA
21	V2X	RWS-210290	Views on Rel-18 Sidelink	Fujitsu
22	Positioning	RWS-210414	On further positioning enhancements in Rel-18	CATT
23	XR	RWS-210428	XR Enhancements for Rel-18	InterDigital, Inc.
24	Broadcast/MBS	RWS-210205	5G-MAG Proposals for 3GPP RAN Rel-18	5G Media Action Group (5G-MAG)
25	eRedCap	RWS-210050	Discussion on Redcap enhancement	OPPO
26	Dedicated band <5MHz	RWS-210035	NR Support for FDD Bandwidths less than 5 MHz	Anterix
27	Personal IoT	RWS-210060	R18 Personal IoT network considerations	Spreadtrum communications
28	NTN	RWS-210074	NTN in Rel-18	THALES
29	NTN	RWS-210421	5G satellite network solutions - operators' perspectives	Hughes/EchoStar
30	HAPS/UAV	RWS-210278	Views on Rel-18 HAPS and UAV	SoftBank Corp.

# 3GPP RAN Rel-18 Workshop - Presented Contributions

Order	Topics	Tdoc#	Title	Company
31	General	RWS-210363	KT's view on Cross functionalities for Release-18	KT Corp.
32	General	RWS-210032	Views on 3GPP RAN Rel-18 focus & content	DT T-Mobile USA
33	General	RWS-210160	Commercial Drivers for Release 18	Telstra Corporation Limited
34	IIoT/URLLC	RWS-210071	Further enhancements for IIoT/URLLC in Release 18	Nokia, Nokia Shanghai Bell
35	Evolution of duplex operation	RWS-210180	XDD (cross-division duplex) for enhanced duplexing operation in 5G Advanced	Samsung
36	AI/ML	RWS-210024	On Machine Learning over the NR Air Interface	QUALCOMM
37	AI/ML	RWS-210235	Views on AI based Physical layer enhancements	CAICT
38	Network energy saving	RWS-210447	Network energy saving and green operation for NR	Huawei, HiSilicon
39	Inter-gNB coordination	RWS-210327	Motivation of Study on Inter-gNB Coordination	NTT DOCOMO Inc., etc.
40	MUSIM	RWS-210127	Discussion on further MUSIM enhancement	NEC, Rakuten Mobile Inc.
41	QoE enhancement	RWS-210386	Motivation of NR QoE enhancement in R18	China Unicom
42	UE aggregation	RWS-210355	Motivation of study for UE Aggregation	CMCC
43	Network slicing	RWS-210230	Enhancement for RAN slicing	LG Electronic Inc.
44	Security enhancement	RWS-210379	Rel-18 Upper Layers Misc. Features: AS Security Enh, NPN Enh, Inter UE coordination	Sony Europe B.V.
45	Network coding	RWS-210484	Discussion on Network Coding for 5G Advanced	ZTE, Sanechips



# 3GPP RAN Rel-18 Workshop - Q&A/Comment Sessions

- ◆ Each company was asked to lead a Q&A/Comment session on their contributions, and to **publish the results of discussion**
  - Therefore, for each company there are 1-3 so-called 'Summary' documents, one each for:
    - All contributions of that company under the eMBB agenda item
    - All contributions of that company under the non-eMBB agenda item
    - All contributions of that company under the cross-functionality agenda item
  - The company 'Summary' documents are numbered from [RWS-210512](#) through [RWS-210650](#)
  
- ◆ Yet another Q&A/Comment session was held for **all topics per agenda item**
  - Three documents collect the Q&A/Comments on these topics, in:
    - [RWS-210654](#) Email discussion 'summary' for [RAN-R18-WS-eMBB-Overall]
    - [RWS-210655](#) Email discussion 'summary' for [RAN-R18-WS-non-eMBB-Overall]
    - [RWS-210656](#) Email discussion 'summary' for [RAN-R18-WS-crossFunc-Overall]
  - The next pages give a **breakdown of the documents per topic** as covered by the 'Summaries'
  
- ◆ Most of these are **not real summaries but a collection of Q&A/Comments**

# 3GPP RAN Rel-18 Workshop - eMBB Topics

◆ See discussion in [RWS-210654](#)

■ The numbers below are only the last 3 numbers, i.e. xxx stands for RWS-210xxx

Section	Title	Related contributions
1	Evolution for DL MIMO	003, 036, 042, 053, 075, 093, 122, 123, 162, 181, 203, 212, 240, 264, 268, 275, 276, 303, 307, 319, 361, 370, 396, 424, 437, 438, 440, 499
2	UL enhancements	003, 033, 036, 042, 053, 056, 075, 076, 122, 149, 160, 162, 181, 192, 199, 203, 212, 220, 240, 268, 275, 276, 277, 289, 296, 307, 361, 362, 370, 396, 403, 424, 436, 440, 459, 479, 507
3	Mobility Enhancements	003, 055, 078, 105, 137, 151, 161, 181, 196, 202, 212, 227, 234, 275, 283, 307, 317, 369, 384, 400, 438, 449, 457, 464, 481, 493
4	Additional topological improvements (IAB and smart repeaters)	019, 020, 099, 166, 212, 213, 228, 248, 255, 275, 281, 300, 320, 339, 361, 365, 475, 489, 492, 498, 509, 032
5	Misc. RAN1/2/3 improvements: set 1	
5.1	UE power savings	004, 064, 122, 168, 276, 312
5.2	Extending up to 114 GHz	027, 042, 119, 271, 366, 395, 425
5.3	CA/DC enhancements	004, 079, 094, 138, 140, 143, 165, 183, 192, 227, 234, 258, 276, 401, 457, 464
5.4	Flexible spectrum fusing	147, 210, 334, 402, 441
5.5	RIS	247, 300, 306, 390, 361, 465
5.6	Others	209, 003, 212, 503, 080, 231, 467, 004, 114, 246, 305, 212, 308, 361, 084, 182, 405, 226, 237, 386, 450, 494, 030

# 3GPP RAN Rel-18 Workshop - Non-eMBB Topics

◆ See discussion in [RWS-210655](#)

■ The numbers below are only the last 3 numbers, i.e. xxx stands for RWS-210xxx

Section	Title	Related contributions
1	Enhancements for XR	010, 036, 037, 042, 058, 070, 095, 122, 164, 191, 201, 213, 256, 272, 282, 324, 364, 374, 381, 411, 428, 439, 469, 500
2	Sidelink enhancements (excluding positioning)	005, 006, 008, 009, 037, 039, 046, 048, 059, 072, 073, 088, 097, 098, 122, 124, 125, 173, 187, 215, 216, 217, 218, 222, 244, 257, 261, 266, 287, 290, 316, 365, 323, 325, 347, 360, 362, 371, 407, 410, 426, 427, 431, 432, 433, 434, 444, 445, 470, 472, 491, 492, 495, 496, 503, 498, 509
3	RedCap evolution	007, 037, 050, 057, 085, 109, 122, 223, 262, 267, 269, 296, 302, 313, 324, 362, 378, 409, 444, 476, 504, 116
4	NTN evolution (NR & IoT)	011, 012, 037, 062, 074, 100, 101, 102, 120, 158, 159, 186, 194, 200, 207, 221, 232, 284, 302, 321, 363, 365, 394, 408, 421, 423, 468, 498, 511
5	Evolution for Broadcast and MBS services	013, 015, 066, 077, 096, 126, 132, 133, 195, 205, 282, 292, 330, 333, 365, 374, 406, 446, 473, 492, 653
6	Expanded and improved Positioning (incl. SL and RedCap Positioning)	009, 021, 032, 037, 046, 048, 059, 065, 072, 073, 097, 098, 107, 117, 122, 124, 125, 173, 074, 187, 188, 215, 216, 217, 222, 224, 244, 245, 257, 261, 266, 287, 081, 285, 290, 301, 315, 316, 365, 322, 323, 325, 347, 360, 362, 367, 071, 407, 410, 414, 418, 426, 427, 429, 431, 432, 433, 434, 443, 445, 471, 476, 491, 492, 495, 496, 503, 498, 509
7	Misc. RAN1/2/3 improvements: set 2	
7.1	UAV	014, 069, 122, 190, 213, 254, 278, 293, 362, 474
7.2	IIoT/URLLC	016, 067, 071, 108, 167, 193, 204, 277, 304, 328, 380, 377, 417, 442, 115, 218
7.3	Narrowband in Dedicated Spectrum	017, 035, 121, 122, 280, 492
7.4	Network Slicing Enhancements	022, 034, 082, 122, 139, 230, 349, 482, 492, 509
7.5	Other IoT Enhancements	060, 172, 251, 294, 324, 453, 508, 509, 467
7.6	HAPS	270, 278, 391
7.7	Others	061, 154, 229, 346, 454, 277, 350, 360, 288, 345, 156

# 3GPP RAN Rel-18 Workshop - Cross-Functionality topics

◆ See discussion in [RWS-210656](#)

■ The numbers below are only the last 3 numbers, i.e. xxx stands for RWS-210xxx

Section	Title	Related contributions
1	Evolution of duplex operation	026, 032, 036, 042, 054, 081, 122, 175, 180, 197, 199, 212, 219, 241, 242, 274, 275, 286, 295, 326, 353, 363, 388, 397, 416, 488, 145
2	AI/ML	024, 032, 038, 051, 052, 063, 083, 103, 104, 122, 128, 129, 160, 170, 177, 185, 198, 214, 225, 233, 243, 235, 236, 253, 260, 265, 273, 282, 291, 296, 357, 359, 363, 373, 383, 510, 412, 413, 430, 448, 478, 483, 505
3	Network energy savings	025, 032, 033, 106, 118, 122, 153, 160, 281, 310, 358, 363, 398, 415, 438, 447, 462, 486
4	Inter-gNB coordination	140, 327
5	Misc. RAN1/2/3 improvements: set 3	
5.1	Network Coding	028, 213, 368, 484
5.2	MUSIM	004, 127, 176, 208, 296, 299
5.3	UE aggregation	199, 355, 451, 479
5.4	Security Enhancements	090, 184, 362, 379, 509
5.5	SON/MDT	237, 263, 275, 336, 404, 466
5.6	Others	506, 213, 279, 363, 460, 461, 490, 040, 086, 135, 171, 452, 480, 485, 487, 379
6	Potential RAN4 improvements	032, 163, 340, 033, 375, 419, 456, 458, 029, 249, 393, 455, 457, 337, 477, 276

# 3GPP RAN Rel-18 Workshop - Official Outcome (1): Endorsed Timeline

## ◆ Initial **timeline** for Rel-18

- The initial timeline for Rel-18 is **18 months for each RAN WG**
  - A large majority (14 out of 17 companies with input on the timeline) consider 18 months the ideal duration for Rel-18
- The exact start time has not been confirmed yet, but is expected in Q1 or Q2 2022
- Many companies warn that 18 months is only feasible if 3GPP returns to F2F meetings for (almost) the entire duration of the release

# 3GPP RAN Rel-18 Workshop - Official Outcome (2): Endorsed Topic List

## ◆ Endorsed **list of topics for further discussion** ([RWS-210659](#))

- The official output of this workshop was 'just' an endorsed initial timeline (see above) and an endorsed list of topics for email discussion in the week of 30 August to 3 September.
- Note that it is allowed to bring additional topics (i.e. topics for which there were no inputs in this workshop) for discussion to RAN#93e, but not to the email discussion.
- The following list are the topics for discussion in the email discussion in August:
  - 1. Evolution for downlink MIMO, with the following example areas:**
    - *Further enhancements for CSI (e.g., mobility, overhead, etc.)*
    - *Evolved handling of multi-TRP (Transmission Reception Points) and multi-beam*
    - *CPE (customer premises equipment)-specific considerations*
  - 2. Uplink enhancements, with the following example areas:**
    - *>4Tx operation*
    - *Enhanced multi-panel/multi-TRP uplink operation*
    - *Frequency-selective precoding*
    - *Further coverage enhancements*

# 3GPP RAN Rel-18 Workshop - Official Outcome (2): Endorsed Topic List

## ◆ Endorsed list of topics for further discussion ([RWS-210659](#))

■ The following list are the topics for discussion in the email discussion in August:

### **3. Mobility Enhancements, with the following example areas:**

- *Layer 1/Layer 2 based inter cell mobility*
- *DAPS (Dual Active Protocol Stack)/CHO (Conditional HandOver) related improvements*
- *FR2 (frequency range 2)-specific enhancements*

### **4. Additional topological improvements (IAB and smart repeaters), with the following example areas:**

- *Mobile IAB (Integrated Access Backhaul)/Vehicle mounted relay (VMR)*
- *Smart repeater with side control information*

### **5. Enhancements for XR (eXtended Reality), with the following example areas:**

- *KPIs/QoS, application awareness operation, and aspects related to power consumption, coverage, capacity, and mobility*
- *Note: only power consumption/coverage/mobility aspects specific to XR*

### **6. Sidelink enhancements (excluding positioning), with the following example areas:**

- *SL enhancements (e.g., unlicensed, power saving enhancements, efficiency enhancements, etc.)*
- *SL relay enhancements*
- *Co-existence of LTE V2X & NR V2X*

# 3GPP RAN Rel-18 Workshop - Official Outcome (2): Endorsed Topic List

## ◆ Endorsed list of topics for further discussion ([RWS-210659](#))

■ The following list are the topics for discussion in the email discussion in August:

### **7. RedCap evolution (excluding positioning), with the following example areas:**

- *New use cases and new UE bandwidths (5MHz?)*
- *Power saving enhancements*

### **8. NTN (Non-Terrestrial Networks) evolution**

- *Including both NR & IoT (Internet of Things) aspects*

### **9. Evolution for broadcast and multicast services**

- *Including both LTE based 5G broadcast and NR MBS (Multicast Broadcast Services)*

### **10. Expanded and improved Positioning, with the following example areas:**

- *Sidelink positioning/ranging*
- *Improved accuracy, integrity, and power efficiency*
- *RedCap positioning*

### **11. Evolution of duplex operation, with the following example areas:**

- *Deployment scenarios, including duplex mode (TDD only?)*
- *Interference management*



# 3GPP RAN Rel-18 Workshop - Official Outcome (2): Endorsed Topic List

## ◆ Endorsed list of topics for further discussion ([RWS-210659](#))

■ The following list are the topics for discussion in the email discussion in August:

### **12. AI (Artificial Intelligence)/ML (Machine Learning), with the following example areas:**

- *Air interface (e.g., Use cases to focus, KPIs and Evaluation methodology, network and UE involvement, etc.)*
- *NG-RAN*

### **13. Network energy savings, with the following example areas:**

- *KPIs and evaluation methodology, focus areas and potential solutions*

#### **14. Additional RAN1/2/3 candidate topics, Set 1:**

- *UE power savings*
- *Enhancing and extending the support beyond 52.6GHz*
- *CA (Carrier Aggregation)/DC (Dual-Connectivity) enhancements (e.g., MR-MC (Multi-Radio/Multi-Connectivity), etc.)*
- *Flexible spectrum integration*
- *RIS (Reconfigurable Intelligent Surfaces)*
- *Others (RAN1-led)*

#### **15. Additional RAN1/2/3 candidate topics, Set 2:**

- *UAV (Unmanned Aerial Vehicle)*
- *IIoT (Industrial Internet of Things)/URLLC (Ultra-Reliable Low-Latency Communication)*
- *<5MHz in dedicated spectrum*
- *Other IoT enhancements/types*
- *HAPS (High Altitude Platform System)*
- *Network coding*

# 3GPP RAN Rel-18 Workshop - Official Outcome (2): Endorsed Topic List

## ◆ Endorsed list of topics for further discussion ([RWS-210659](#))

■ The following list are the topics for discussion in the email discussion in August:

### **16. Additional RAN1/2/3 candidate topics, Set 3:**

- *Inter-gNB coordination, with the following example areas:*
- *Inter-gNB/gNB-DU multi-carrier operation*
- *Inter-gNB/gNB-DU multi-TRP operation*
- *Enhancement for resiliency of gNB-CU*
- *Network slicing enhancements*
- *MUSIM (Multiple Universal Subscriber Identity Modules)*
- *UE aggregation*
- *Security enhancements*
- *SON (Self-Organizing Networks)/MDT (Minimization of Drive Test)*
- *Others (RAN2/3-led)*

### **17. Potential RAN4 enhancements**

# 3GPP RAN Rel-18 Workshop - What Next

- ◆ The RAN Rel-18 Workshop was the **first** official opportunity to make proposals for **Rel-18 RAN content** (and timeline), **but not the last one**
  - The topics on previous slides will be discussed in RAN by email, from 30 August to 3 September
  - New topics are still allowed, not in the email discussion but at RAN#93e (September)
- ◆ **RAN, CT and SA** will **jointly discuss Rel-18** (e.g. timeline and system aspects) during the September plenaries #93
- ◆ **RAN** will continue to discuss **Rel-18 'core' content** by email and during plenary meetings until and including December (two-week RAN#94 meeting)
  - RAN will dedicate the 1st week of RAN#94 to create a (mostly) RAN1/RAN2/RAN3 work package
  - During the 2nd week of RAN#94, the work package will be finalized and approved
- ◆ **Rel-18 RAN4 content** will be discussed by email and a RAN4 package is planned to be approved in March 2022 (RAN#95 meeting)

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