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| **Radiocommunication Study Groups** |  |
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| **02 July 2019** |
| **English only** |
| **5G India Forum Evaluation Group (5GIF)** | |
| Partial Evaluation Report from 5GIF on the 3GPP NR candidate proposal on IMT-2020 | |
|  | |

This document describes the initial evaluation results and activities identified for IMT-2020 candidate technology submissions in Documents [IMT-2020/3 (Rev. 3)](https://www.itu.int/md/R15-IMT.2020-C-0003/en) from the 5GIF Evaluation Group.

**1 Background**

The 5G India Forum (5GIF) is a collaborative body under the aegis of the Cellular Operators Association of India (COAI). This forum aims to become the leading force in the development of next generation communications and will enable synergizing national efforts and will play a significant role in shaping the strategic, commercial and regulatory development of the 5G ecosystem in India.

The 5GIF Evaluation Group was formed as an independent Evaluation Group to evaluate the IMT2020 candidates with a perspective from the Indian network deployments. This is a group of operators, OEM’s, universities and individual experts participating in a collaborative manner to evaluate the IMT2020 candidate technologies. This is a contribution driven body, with decisions made through a consensus seeking approach.

**2 Contact details**

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### 3 Evaluation details

The 5GIF Evaluation Group has started receiving members inputs to the activity. We had prioritized on the Inspection and analytical aspects of the evaluation. This will be followed up with detailed analysis in subsequent meetings. Moreover, in this contribution, the preliminary results are provided only for the 3GPP NR RIT candidate. We have an ongoing simulation study in evaluating the remaining aspects on the evaluation. Currently we are calibrating the simulators within the group and look forward engaging with other IEGs. We will strive to provide a detailed report to the WP5D#33 meeting in Dec 2019.

**3.1 Use of information in Report ITU-R M.2412**

*Working Party 5D has defined evaluation guidelines for IMT-2020 candidate technology evaluation in the Report ITU-R M.2412. The latest version of this document is Report ITU-R M.2412-0.*

*Independent Evaluation Groups are requested to indicate in their inputs to Working Party 5D that they applied Report ITU-R M.2412-0 in their evaluation.*

Does Independent Evaluation Group confirm use of Report ITU-R M.2412-0 in their work?

🗹 Yes 🞎 No

#### Section below is reproduced from M.2411 ###

### 5.2.4 RIT/SRIT compliance templates

This section provides templates for the responses that are needed to assess the compliance of a candidate RIT or SRIT with the minimum requirements of IMT-2020.

The compliance templates are:

– Compliance template for services;

– Compliance template for spectrum; and,

– Compliance template for technical performance.

#### 5.2.4.1 Compliance template for services[[1]](#footnote-1)

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|  | Service capability requirements | Evaluator’s comments |
| **5.2.4.1.1** | **Support for wide range of services**  Is the proposal able to support a range of services across different usage scenarios (eMBB, URLLC, and mMTC)?: 🗹YES / NO  Specify which usage scenarios (eMBB, URLLC, and mMTC) the candidate RIT or candidate SRIT can support.(1) | *Based on the preliminary evaluation, the NR RIT supports all the three class of usage scenarios (eMBB, URLLC and mMTC)* |
| (1) Refer to the process requirements in IMT-2020/2. | | |

#### 5.2.4.2 Compliance template for spectrum3

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|  | Spectrum capability requirements |
| **5.2.4.2.1** | **Frequency bands identified for IMT**  Is the proposal able to utilize at least one frequency band identified for IMT in the ITU Radio Regulations?: 🗹 YES / NO  Specify in which band(s) the candidate RIT or candidate SRIT can be deployed.  *The proponent has identified support for the following bands in their submission.*   |  |  |  |  | | --- | --- | --- | --- | | NR *operating band* | Uplink (UL) *operating band* BS receive / UE transmit  FUL\_low – FUL\_high | Downlink (DL) *operating band* BS transmit / UE receive  FDL\_low – FDL\_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 | | n12 | 699 MHz – 716 MHz | 729 MHz – 746 MHz | FDD | | n20 | 832 MHz – 862 MHz | 791 MHz – 821 MHz | FDD | | n25 | 1850 MHz – 1915 MHz | 1930 MHz – 1995 MHz | FDD | | n28 | 703 MHz – 748 MHz | 758 MHz – 803 MHz | FDD | | n34 | 2010 MHz – 2025 MHz | 2010 MHz – 2025 MHz | TDD | | n38 | 2570 MHz – 2620 MHz | 2570 MHz – 2620 MHz | TDD | | n39 | 1880 MHz – 1920 MHz | 1880 MHz – 1920 MHz | TDD | | n40 | 2300 MHz – 2400 MHz | 2300 MHz – 2400 MHz | TDD | | n41 | 2496 MHz – 2690 MHz | 2496 MHz – 2690 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 | | 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 | | n86 | 1710 MHz – 1780 MHz | N/A | SUL |   *Inference: Thus, the proponents RIT has support for bands identified for IMT-2020.*  *Note 1: The evaluation group made use of 3GPP TS 38.104 for this inference*  *Note 2: Text highlighted in blue are possible candidate bands in India, and the 5GIF Evaluation will prioritize our studies on them* |
| **5.2.4.2.2** | **Higher Frequency range/band(s)**  Is the proposal able to utilize the higher frequency range/band(s) above 24.25 GHz?: 🗹YES / NO  Specify in which band(s) the candidate RIT or candidate SRIT can be deployed.  NOTE 1 – In the case of the candidate SRIT, at least one of the component RITs need to fulfil this requirement.  *The proponent has identified support for the following bands in their submission.*   |  |  |  | | --- | --- | --- | | NR *operating band* | Uplink (UL) and Downlink (DL) *operating band* BS transmit/receive UE transmit/receive  FUL\_low – FUL\_high  FDL\_low – FDL\_high | Duplex Mode | | n257 | 26500 MHz – 29500 MHz | TDD | | n258 | 24250 MHz – 27500 MHz | TDD | | n260 | 37000 MHz – 40000 MHz | TDD | | n261 | 27500 MHz – 28350 MHz | TDD |   *Thus, the proponents RIT has support for bands identified for IMT-2020.*  *Inference: Thus, the proponents RIT has support for bands identified for IMT-2020.*  *Note 1: The evaluation group made use of 3GPP TS 38.104 for this inference* |

#### 5.2.4.3 Compliance template for technical performance3

| Minimum technical performance requirements item (5.2.4.3.x), units, and Report ITU-R M.2410-0 section reference(1) | Category | | | Required value | Value(2) | Requirement met? | Comments (3) |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Usage scenario | Test environment | Downlink or uplink |  |  |  |  |
| **5.2.4.3.1** Peak data rate (Gbit/s) *(4.1)* | eMBB | Not applicable | Downlink | 20 | 20.68 | 🗹 Yes  No | Based on 10 Component Carrier of 40MHz each (FR1 , SCS=30KHz, FDD NR ) |
| Uplink | 10 | 10.34 | 🗹 Yes  No |
| **5.2.4.3.2** Peak spectral efficiency (bit/s/Hz) *(4.2)* | eMBB | Not applicable | Downlink | 30 | 43.68 | 🗹 Yes  No | Assumes overheard for 10MHz FDD NR System (SCS=30KHz, FR1) |
| Uplink | 15 | 23.77 | 🗹 Yes  No |
| **5.2.4.3.3** User experienced data rate (Mbit/s) *(4.3)* | eMBB | Dense Urban – eMBB | Downlink | 100 |  | Yes  No | ***TBD*** |
| Uplink | 50 |  | Yes  No |
| **5.2.4.3.4** 5th percentile user spectral efficiency (bit/s/Hz) *(4.4)* | eMBB | Indoor Hotspot – eMBB | Downlink | 0.3 |  | Yes  No | ***TBD*** |
| Uplink | 0.21 |  | Yes  No |
| eMBB | Dense Urban – eMBB | Downlink | 0.225 |  | Yes  No | ***TBD*** |
| Uplink | 0.15 |  | Yes  No |
| eMBB | Rural – eMBB | Downlink | 0.12 |  | Yes  No | ***TBD*** |
| Uplink | 0.045 |  | Yes  No |
| **5.2.4.3.5** Average spectral efficiency (bit/s/Hz/ TRxP) *(4.5)* | eMBB | Indoor Hotspot – eMBB | Downlink | 9 |  | Yes  No | ***TBD*** |
| Uplink | 6.75 |  | Yes  No |
| eMBB | Dense Urban – eMBB | Downlink | 7.8 |  | Yes  No | ***TBD*** |
| Uplink | 5.4 |  | Yes  No |
| eMBB | Rural – eMBB | Downlink | 3.3 |  | Yes  No | ***TBD*** |
|  | Yes  No | ***TBD*** |
| Uplink | 1.6 |  | Yes  No | ***TBD*** |
|  | Yes  No | ***TBD*** |
| **5.2.4.3.6** Area traffic capacity (Mbit/s/m2) *(4.6)* | eMBB | Indoor-Hotspot – eMBB | Downlink | 10 |  | Yes  No | ***TBD*** |
| **5.2.4.3.7** User plane latency (ms) *(4.7.1)* | eMBB | Not applicable | Uplink and Downlink | 4 |  | Yes  No | ***TBD*** |
| URLLC | Not applicable | Uplink and Downlink | 1 |  | Yes  No | ***TBD*** |
| **5.2.4.3.8** Control plane latency (ms) *(4.7.2)* | eMBB | Not applicable | Not applicable | 20 |  | Yes  No | ***TBD*** |
| URLLC | Not applicable | Not applicable | 20 |  | Yes  No | ***TBD*** |
| **5.2.4.3.9** Connection density (devices/km2) *(4.8)* | mMTC | Urban Macro – mMTC | Uplink | 1 000 000 |  | Yes  No | ***TBD*** |
| **5.2.4.3.10** Energy efficiency *(4.9)* | eMBB | Not applicable | Not applicable | Capability to support a high sleep ratio and long sleep duration |  | 🗹 Yes  No | Network side efficiency exceeding 98% and device side efficiency exceeding 95% (idle mode) and 92% (connected) mode were observed in our analysis |
| **5.2.4.3.11** Reliability *(4.10)* | URLLC | Urban Macro –URLLC | Uplink or Downlink | 1-10−5 success probability of transmitting a layer 2 PDU (protocol data unit) of size 32 bytes within 1 ms in channel quality of coverage edge |  | Yes  No | ***TBD*** |
| **5.2.4.3.12** Mobility classes *(4.11)* | eMBB | Indoor Hotspot – eMBB | Uplink | Stationary, Pedestrian |  | Yes  No | ***TBD*** |
| eMBB | Dense Urban – eMBB | Uplink | Stationary, Pedestrian,  Vehicular (up to 30 km/h) |  | Yes  No | ***TBD*** |
| eMBB | Rural – eMBB | Uplink | Pedestrian, Vehicular, High speed vehicular |  | Yes  No | ***TBD*** |
| **5.2.4.3.13**  Mobility Traffic channel link data rates (bit/s/Hz) *(4.11)* | eMBB | Indoor Hotspot – eMBB | Uplink | 1.5 (10 km/h) |  | Yes  No | ***TBD*** |
| eMBB | Dense Urban – eMBB | Uplink | 1.12 (30 km/h) |  | Yes  No | ***TBD*** |
| eMBB | Rural – eMBB | Uplink | 0.8 (120 km/h) |  | Yes  No | ***TBD*** |
| 0.45 (500 km/h) |  | Yes  No | ***TBD*** |
| **5.2.4.3.14** Mobility interruption time (ms)  *(4.12)* | eMBB and URLLC | Not applicable | Not applicable | 0 |  | Yes  No | ***TBD*** |
| **5.2.4.3.15** Bandwidth and Scalability *(4.13)* | Not applicable | Not applicable | Not applicable | At least 100 MHz |  | Yes  No | ***TBD*** |
| Up to 1 GHz |  | Yes  No | ***TBD*** |
| Support of multiple different bandwidth values(4) |  | Yes  No | ***TBD*** |
| (1) As defined in Report ITU-R M.2410-0.  (2) According to the evaluation methodology specified in Report ITU-R M.2412-0.  (3) Proponents should report their selected evaluation methodology of the Connection density, the channel model variant used, and evaluation configuration(s) with their exact values (e.g. antenna element number, bandwidth, etc.) per test environment, and could provide other relevant information as well. For details, refer to Report ITU-R M.2412-0, in particular, § 7.1.3 for the evaluation methodologies, § 8.4 for the evaluation configurations per each test environment, and Annex 1 on the channel model variants.  (4) Refer to § 7.3.1 of Report ITU-R M.2412-0. | | | | | | | |

#### Section above is reproduced from M.2411 ###

**3.2 Summary of the Initial Evaluation Report**

Which test environments have been considered in the Initial Evaluation Report? What is outcome of the evaluation?

|  |  |
| --- | --- |
| Test environment | Does the Evaluation Report indicate that the minimum technical performance requirements are met in the test environment? |
| 🗹 Indoor Hotspot-eMBB | 🞎 Yes 🞎 No 🗹 Partial evaluation |
| 🗹 Dense Urban-eMBB | 🞎 Yes 🞎 No 🗹 Partial evaluation |
| 🗹 Rural-eMBB | 🞎 Yes 🞎 No 🗹 Partial evaluation |
| 🞎 Urban Macro–mMTC | 🞎 Yes 🞎 No 🞎 Partial evaluation |
| 🞎 Urban Macro–URLLC | 🞎 Yes 🞎 No 🞎 Partial evaluation |

**3.3 Additional evaluation methodologies and assumptions**

Have any additional evaluation methodologies or assumptions that had not been included in the Report ITU-R M.2412-0 been used in evaluation?

🞎 Yes 🗹 No

**4 Conclusion**

This document provides an initial report on the partial evaluation of the 3GPP RIT candidate for IMT2020. We had prioritized the inspection and analytical aspects of the evaluation in this report. We are on the course to provide simulation-based results for the WP5D#33 meeting.

1. If a proponent determines that a specific question does not apply, the proponent should indicate that this is the case and provide a rationale for why it does not apply. [↑](#footnote-ref-1)