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| **Radiocommunication Study Groups** |  |
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| Received: 12 February 2020 | **Document 5D/129-E** |
| **13 February 2020** |
| **English only  TECHNOLOGY ASPECTS** |
| Director, Radiocommunication Bureau[[1]](#footnote-1) | |
| CIRATEG final evaluation report on  nufront submission (IMT-2020/18) | |
|  | |

# 1 **Introduction**

This final evaluation report describes the evaluation results and activities from Chinese Industry and Research Alliance of Telecommunications Evaluation Group for IMT-2020 candidate technology submissions in Document IMT-2020/18.

# 2 Administrative aspects of the Independent Evaluation Group:

## 2.1 Name of the Independent Evaluation Group;

Chinese Industry and Research Alliance of Telecommunications Evaluation Group (CIRATEG).

## 2.2 Background of the Independent Evaluation Group;

The Chinese Industry and Research Alliance of Telecommunications Evaluation Group (CIRAT EG) cooperates with each other in all members.

The major task of CIRAT EG includes: participate in ITU independent evaluation activity for formal results submission.

CIRAT EG members participating in the Group's evaluation activities are as follows:

– Huawei Technologies Co. Ltd.

– ZTE Corporation

– China Unicom Network Technology Research Institute

– vivo Mobile Communication Co. Ltd.

– Beijing OPPO Telecommunications Co. Ltd.

– Beijing Jiaotong University

– Beijing Unisoc Communication Technology Co. Ltd.

CIRAT EG follows the guidelines of the IMT-2020 process, to work on evaluation of the candidate technology, such as in Docs. IMT-2020/18.

## 2.3 Method of Work

The assessments reported are performed using all the three methods, i.e., inspection, analysis and simulation which are suggested in Report ITU-R [M.2412](https://www.itu.int/pub/R-REP-M.2412). For each evaluation, one of the three methods will be chosen in accordance with methods summarised of M.2412. Some additions, which are provided by the proponent of the evaluated technology, are also applied.

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# 3 Technical aspects of the work of the Independent Evaluation Group

## What candidate technologies or portions of the candidate technologies this IEG is or might anticipate evaluating?

This contribution is the final evaluation report on portions of the EUHT technology in  
 Docs. IMT-2020/18

## Confirmation of utilization of the ITU-R evaluation guidelines in Report ITU‑R M.2412;

CIRAT EG confirms that the evaluation reported in this contribution is performed in accordance with Report ITU‑R M.2412. The evaluation methodologies and configurations used for each minimum requirement are chosen according to Table 8-2 in Report ITU-R M.2412.

Other parameter details used in this contribution are in accordance with Docs. IMT-2020/18.

## Verification as per Report ITU-R M.2411 of the compliance templates and the self-evaluation for each candidate technology as indicated in A).

CIRATEG identifies that the technology submission in Docs. IMT-2020/18, including complete compliance templates for service and technical performance as specified in Chapter 4.2.4 of Report ITU-R M.2411

## Assessment as per Reports ITU-R [M.2410](https://www.itu.int/pub/R-REP-M.2410), ITU-R [M.2411](https://www.itu.int/pub/R-REP-M.2411) and ITU-R [M.2412](https://www.itu.int/pub/R-REP-M.2412) for each candidate technology as indicated in A).

## D.1 Final assessment and evaluation results on EUHT RIT

#### D.1.1 Compliance template for services

|  |  |  |
| --- | --- | --- |
|  | Service capability requirements | CIRATEG’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) | The assessment of service requirement follows the evaluation method as defined in Section 7.3.3 in Report ITU-R M.2412.  As provided in Annex 1, the candidate EUHT cannot support usage scenarios of eMBB and URLLC. |
| (1) Refer to the process requirements in IMT-2020/2. | | |

#### D.1.2 Compliance template for technical performance

Detailed results, configurations and specific assumptions can be found in the Annex 1.

| 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? | CIRATEG’s Comments |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Usage scenario | Test environment | Downlink or  uplink |
| **5.2.4.3.1** Peak data rate (Gbit/s) *(4.1)* | eMBB | Not applicable | Downlink | 20 | 1.83~15.20 | No | Carrier aggregation is not supported by the EUHT specification, based on the analysis in *CIRATEG Final evaluation results on EUHT.docx* |
| Uplink | 10 | 0.72~9.33 | No |
| **5.2.4.3.2** Peak spectral efficiency (bit/s/Hz) *(4.2)* | eMBB | Not applicable | Downlink | 30 | 32.02 ~47.50 | Yes |  |
| Uplink | 15 | 32.62 ~47.52 | Yes |
| **5.2.4.3.3** User experienced data rate (Mbit/s) *(4.3)* | eMBB | Dense Urban – eMBB | Downlink | 100 | 14.67~17.9 | No | For evaluation configuration A (4 GHz), Channel model A.  Carrier aggregation is not supported by the EUHT specification, based on the analysis in *CIRATEG Final evaluation results on EUHT.docx* |
| Uplink | 50 | 2.67~3.08 | No |
| **5.2.4.3.4** 5th percentile user spectral efficiency (bit/s/Hz) *(4.4)* | eMBB | Indoor Hotspot – eMBB | Downlink | 0.3 | 0.03~0.236 | No | For evaluation configuration A (4 GHz), Channel model A/B, with 12 TRxP and 36 TRxP. |
| Uplink | 0.21 | 0.08~0.18 | No |
| Downlink | 0.3 | 0.01~0.06 | No | For evaluation configuration B (30 GHz), Channel model A/B, with 12 TRxP and 36 TRxP. |
| Uplink | 0.21 | 0.05~0.10 | No |
| eMBB | Dense Urban – eMBB | Downlink | 0.225 | 0.22~0.269 | No | For evaluation configuration A (4 GHz), Channel model A/B. |
| Uplink | 0.15 | 0.08~0.093 | No |
| Downlink | 0.225 | 0.001 | No | For evaluation configuration B (30 GHz), Channel model A/B. |
| Uplink | 0.15 | 0 | No |
| eMBB | Rural – eMBB | Downlink | 0.12 |  |  | No assessment |
| Uplink | 0.045 |  |  |
| **5.2.4.3.5** Average spectral efficiency (bit/s/Hz/ TRxP) *(4.5)* | eMBB | Indoor Hotspot – eMBB | Downlink | 9 | 4.93~7.35 | No | For evaluation configuration A (4 GHz), Channel model A/B, with 12 TRxP and 36 TRxP. |
| Uplink | 6.75 | 2.71~4.02 | No |
| Downlink | 9 | 4.77~5.42 | No | For evaluation configuration B (30 GHz), Channel model A/B, with 12 TRxP and 36 TRxP. |
| Uplink | 6.75 | 2.48~3.61 | No |
| eMBB | Dense Urban – eMBB | Downlink | 7.8 | 7.505~7.74 | No | For evaluation configuration B (4 GHz), Channel model A/B. |
| Uplink | 5.4 | 3.607~3.71 | No |
| Downlink | 7.8 | 5.53 | No | For evaluation configuration B (30 GHz), Channel model A/B. |
| Uplink | 5.4 | 1.7 | No |
| eMBB | Rural – eMBB | Downlink | 3.3 |  |  | No assessment |
| Uplink | 1.6 |  |  |
| **5.2.4.3.6** Area traffic capacity (Mbit/s/m2) *(4.6)* | eMBB | Indoor-Hotspot – eMBB | Downlink | 10 | 0.98~2.0 | No | For evaluation configuration B (30 GHz), Channel model A/B, with 12 TRxP and 36 TRxP. |
| Downlink | 10 | 2.89~7.63 | No | For evaluation configuration B (30 GHz), Channel model A/B, with 12 TRxP and 36 TRxP. |
| **5.2.4.3.7** User plane latency (ms) *(4.7.1)* | eMBB | Not applicable | Downlink | 4 |  |  | No assessment |
| Uplink | 4 |  |  |
| URLLC | Not applicable | Downlink | 1 |  |  |
| Uplink | 1 |  |  |
| **5.2.4.3.8** Control plane latency (ms) *(4.7.2)* | eMBB | Not applicable | Not applicable | 20 |  |  | No assessment |
| URLLC | Not applicable | Not applicable | 20 |  |  |
| **5.2.4.3.9** Connection density (devices/km2) *(4.8)* | mMTC | Urban Macro – mMTC | Uplink | 1 000 000 |  |  | No assessment |
| Uplink | 1 000 000 |  |  | No assessment |
| **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 | Lack of essential function for sleep.  Data transmission in a loaded case is not efficient. | No | Network side.  Detailed analysis is in *CIRATEG Final evaluation results on EUHT.docx*. |
| No | Device side.  Detailed analysis is in *CIRATEG Final evaluation results on EUHT.docx*. |
| **5.2.4.3.11** Reliability *(4.10)* | URLLC | Urban Macro –URLLC | 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 | 99.54% | No | For evaluation configuration A (4 GHz), Channel model A. |
| Uplink | 92.37% | No |
| **5.2.4.3.12** Mobility classes *(4.11)* | eMBB | Indoor Hotspot – eMBB | Uplink | Stationary, Pedestrian |  |  | No assessment |
| eMBB | Dense Urban – eMBB | Uplink | Stationary, Pedestrian,  Vehicular (up to 30 km/h) |  |  | No assessment |
| eMBB | Rural – eMBB | Uplink | Pedestrian, Vehicular, High speed vehicular |  |  | No assessment |
| **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) |  |  | No assessment |
| eMBB | Dense Urban – eMBB | Uplink | 1.12 (30 km/h) |  |  | No assessment |
| eMBB | Rural – eMBB | Uplink | 0.8 (120 km/h) |  |  | No assessment |
| 0.45 (500 km/h) |  |  |
| 0.8 (120 km/h) |  |  | No assessment |
| 0.45 (500 km/h) |  |  |
| **5.2.4.3.14** Mobility interruption time (ms)  *(4.12)* | eMBB and URLLC | Not applicable | Not applicable | 0 | >0 | No | See analysis in *CIRATEG Final evaluation results on EUHT.docx*. |
| **5.2.4.3.15** Bandwidth and Scalability *(4.13)* | Not applicable | Not applicable | Not applicable | At least 100 MHz |  |  | No assessment |
| Up to 1 GHz |  |
| Support of multiple different bandwidth values(4) |  |  |
| (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. | | | | | | | |

## Questions and feedback to WP 5D and/or the proponents or other IEGs

CIRAT EG will discuss with the proponent and other IEGs in ITU-R WP 5D#34.

## Next steps towards to WP 5D for the February 2020 meeting.

CIRAT EG will sent final Evaluation report in ITU-R WP 5D#34. Moreover, CIRATEG will exchange evaluation related information with the proponent and other IEGs during this period.

# 4 Conclusion

## 4.1 Use of information in Report ITU-R M.2412

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

🗹 Yes 🞎 No

## 4.2 Provision of compliance templates

Provision of compliance template for services (section 5.2.4.1 of Report ITU-R M.2411)

🗹 Yes 🞎 No

Provision of compliance template for technical performance (section 5.2.4.3 of Report ITU-R M.2411)

🗹 Yes 🞎 No

## 4.3 Summary of conclusions of the evaluation report

Does the Evaluation Report indicate that the candidate technology meet minimum service and spectrum requirements?

Service requirements: 🞎 Yes 🗹No

Which test environments have been considered in the 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 |
| 🗹 Dense Urban – eMBB | 🞎 Yes 🗹 No |
| 🗹 Rural – eMBB | 🞎 Yes 🞎 No (CIRAT EG does not evaluate the test environment) |
| 🗹 User experienced data rate– eMBB | 🞎 Yes 🗹 No |
| 🗹 Area traffic capacity– eMBB | 🞎 Yes 🗹 No |
| 🗹 Mobility interruption time– eMBB | 🞎 Yes 🗹 No |
| 🗹 Energy efficiency– eMBB | 🞎 Yes 🗹 No |
| 🞎 Urban Macro – mMTC | 🞎 Yes 🞎 No (CIRAT EG does not evaluate the test environment) |
| 🗹 Urban Macro – URLLC | 🞎 Yes 🗹 No |
| 🗹 Mobility interruption time– URLLC | 🞎 Yes 🗹 No |

## 4.4 Additional evaluation methodologies and assumptions

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

🞎 Yes 🗹 No

# 5 References

1. ITU-R: Minimum requirements related to technical performance for IMT-2020 radio interface(s). Report ITU-R M.2410-0, (11/2017).
2. ITU-R: Requirements, evaluation criteria and submission templates for the development of IMT-2020. Report ITU-R M.2411-0, (11/2017).
3. ITU-R: Guidelines for evaluation of radio interface technologies for IMT-2020. Report ITU-R M.2412-0, (10/2017).
4. ITU-R WP5D: Acknowledgement of Candidate RIT Submission from Nufront Proponent under Step 3 of the IMT-2020 Process. Document IMT-2020/18-(Rev.1)E, 23 December 2019.
5. ITU-R WP 5D: Information of the evaluation for the terrestrial components of the radio interface(s) for IMT-2020. Liaison statement to registered Independent Evaluation Groups. Document 5D/TEMP/769(Rev 1), 16 July 2019.
6. Nufront: Updated submission of candidate IMT-2020 Radio Interface Technology (EUHT), Contribution 5D/1300, Geneva, December 2019.

# Annex 1: Final Evaluation report from CIRATEG

*CIRATEG evaluation results on EUHT.docx*

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1. Submitted on behalf of the Chinese Industry and Research Alliance of Telecommunications Evaluation Group (CIRATEG). [↑](#footnote-ref-1)