|  |  |
| --- | --- |
| **Radiocommunication Study Groups** |  |
|  |  |
|  |  |
| Source : Document 5D/TEMP/14(Rev.1) | **Revision 1 to Document IMT-2020/28-E** |
| **16 December 2019** |
| **English only** |
| Working Party 5D | |
| Observations of SWG Evaluation (Proponent TSDSI) | |
| PART I (WP 5D Meeting #33) | |

IMT-2020 submission in Document 5D/1301 (Proponent TSDSI)

Working Party 5D (WP 5D) has identified at WP 5D meeting #33, in its review of the **Proponent** **TSDSI updated submission in** Document[5D/1301](https://www.itu.int/md/R15-WP5D-C-1301/en), the submission in Document 5D/1301 meets the completeness of Step 3.

Observations on the submitted self-evaluation

The criteria for the self-evaluation is found in the template for the document IMT-2020/YYY in Section 4.3 “Self-Evaluation”. See Document [5D/1110](https://www.itu.int/md/R15-WP5D-C-1110/en) Chapter 5, Attachment 5.9, Chairman’s Report of WP 5D #31 meeting, October 2018.

A summary of key findings is provided in Part I Attachment 1.

Part I Attachment 2 provides the guidance to understand the supplementary material.

Conclusion:

***4.3) Self-evaluation:*** *The entity that proposes a candidate RIT or SRIT to the ITU-R (the proponent) shall include with it either an self-evaluation or an evaluation submitted by another entity and endorsed by the proponent, and based on the compliance templates in § 5.2.4. (Report ITU-R M.2411 section 5.1 § 2).*

Self-evaluation supplied: X Yes  No

Comments (specify)

**These submissions by the TSDSI Proponent are determined to have satisfactorily fulfilled Section 4.3 for the self-evaluation.**

Evaluation type **X** provided by proponent (for the TSDSI RIT)

Comments (specify the entity)

SWG Evaluation requests that this compete document be included in the relevant IMT-2020/YYY document for the **Proponent** **TSDSI** submission.

part i

Attachment 1

Summary of discussions by SWG Evaluation for IMT-2020 submission   
in Document 5D/1301 (Proponent TSDSI)



part i

Attachment 2

Consideration of Supplementary Materials Provided per Report ITU-R M.2411 Section 5.2

For submission TSDSI incorporated in Document 5D/1301 it is noted that the provided supplementary material included with the submission as indicated below does not provide information that is directly relevant and pertinent to the IMT-2020 evaluation and does not align with the provision of Report ITU-R M.2411 Section 5.2 to “*provide further understanding of the submission*”.

WP 5D has observed that this supplementary information, in the parametric values or other assumptions and analysis utilized, does not align with that specified in Report ITU-R M.2412 for a specific scenario being assessed.

The supplementary material, in particular, in Document 5D/[1301](https://www.itu.int/md/R15-WP5D-C-1301/en) that this applies to is indicated below:

*Section 20: Coverage Enhancement with Pi/2 BPSK and Spectrum Shaping*

*…provide additional coverage results using power boost (26 dBm TX power with 50% duty cycle) feature as supplementary information. RIT introduces an LMLC waveform*

* *pi/2 BPSK with spectrum shaping feature using unfiltered DMRS*
* *When pi/2 BPSK is enabled, UE transmits up to 26 dBm max power compared to 23 dBm for QPSK*

Configuration/Assumptions (multi-cell system-level-simulation)

|  |  |
| --- | --- |
| **Parameter** | **Value** |
| **ISD** | **12 Km** |
| **Fc** | **3.5 GHz TDD** |
| Antenna (UE, BTS) | (1,2), (1,4) and 18 dB gain sectoral antenna |
| BS height | 35 m |
| UE height | 1.5 m |
| Bandwidth | 60 MHz |
| UE transmit power | 23 dBm (without pi/2 bpsk), 26 dBm (for pi/2 bpsk) |
| Pathloss Model | LMLC (ITU-R M.2412-0) |
| 10 UEs/sector | Available RBs are equally shared among the UEs |

In conjunction with the supplementary material noted above, and pertaining to Step 3 (for self-evaluation aspects) and/or Step 4 for this submission, it is noted that:

– WP 5D has not considered the indicated supplementary materials in the IMT-2020 evaluation as it is not directly relevant to the formal IMT-2020 evaluation.

– WP 5D therefore offers no endorsement of this supplementary information in the context of IMT-2020 suitability.

PART II  
(WP 5D Meeting #32)

IMT-2020 submission in Document 5D/1231 (Proponent TSDSI)

Working Party 5D (WP 5D) has so far identified at WP 5D #32 meeting, in its review of the **Proponent** **TSDSI submission in** Document[5D/1231](https://www.itu.int/md/R15-WP5D-C-1231/en),some submission deficiencies and clarification of technology issues which impact the submission and the ability of WP 5D to have the submission move forward in the IMT-2020 process. The proponent had been requested in the discussions in WP 5D meeting #32 to remedy the deficient information and it is noted that **TSDSI** did provide further information. This is a summary of the observations of SWG Evaluation.

Observations on the submitted self-evaluation

The criteria for the self-evaluation is found in the template for the document IMT-2020/YYY in Section 4.3 “Self-Evaluation”. See document [5D/1110](https://www.itu.int/md/R15-WP5D-C-1110/en) Chapter 5, Attachment 5.9, Chairman’s Report of WP 5D Meeting # 31, October 2018.

A summary of key findings is provided in Part II Attachment 1.

Part II Attachment 2 provides the further information supplied to WP 5D meeting #32 during the course of the meeting by the Proponent in response the request by SWG Evaluation for the Proponent to provide the information required by the process in such format as mandated by the process. Part II Attachment 2 should be considered, on a going forward basis in WP 5D as an official part of the submission provided in Document 5D/1231, i.e. as an Amendment.

Conclusion:

***4.3) Self-evaluation:*** *The entity that proposes a candidate RIT or SRIT to the ITU-R (the proponent) shall include with it either an self-evaluation or an evaluation submitted by another entity and endorsed by the proponent, and based on the compliance templates in § 5.2.4. (Report ITU-R M.2411 section 5.1 § 2).*

Self-evaluation supplied: X Yes  No

Comments (specify)

**This submission cannot, in its current form, be determined to have satisfactorily fulfilled Section 4.3 for the self-evaluation. The supplied self-evaluation and any amendments accepted during WP 5D meeting #32 *for TSDSI RIT* do not yet permit WP 5D to determine** **if a complete and satisfactory self-evaluation as required by the IMT-2020 process has been fully provided.**

**The Proponent should provide the full details requested in the process and in the specifically defined way to WP 5D, considering the comments raised in WP 5D meeting #32, in order for WP 5D to proceed further in the process with this submission.**

Evaluation type **X** provided by proponent (for the TSDSI RIT)

Comments (specify the entity)

SWG Evaluation requests that this compete document be included in the relevant IMT-2020/YYY document for the **Proponent** **TSDSI** Submission.

PART II

Attachment 1

Summary of discussions by SWG Evaluation for IMT-2020 submission   
in Document 5D/1231 (Proponent TSDSI)

Technique issue raised in this meeting:

− Some evaluation results applied by endorsed self-evaluation from another proponent (3GPP OPs) – any clarification from TSDSI

− Some highlights of the RIT are as follows (from Document 5D/1231), does those been evaluated by TSDSI:

• Pi/2 BPSK with 1+D spectrum shaping filter for higher coverage

– eMBB

– NB-IOT

• Improving spectral utilization by defining intelligent BWP configurations for resource block group (RBG) based scheduling.

• Reducing uplink channel state information (CSI) mismatch using low latency sounding reference signal (SRS) precoder update.

• Optimizing phase tracking reference signal (PTRS) density by defining intelligent PTRS threshold parameters.

– Observations from the third session of SWG Eval:

• The third session of SWG Evaluation discussed the issues raised from joint session and make some progress. Additional information from TSDSI will assist this discussion.

• Regarding self-evaluation, self –evaluation report is not complete, not clear, however clarification will be discussed

• Regarding delta part from 3GPP technologies evaluated: further clarification what difference between self-evaluations provided from TSDSI and 3GPP and whether they are valid are needed

− Any further technique issue?

• Question on spec. releases raised in the third session of SWG Evaluation.

The meeting received a clarification document from TSDSI to explain the concerns raised *for TSDIS RIT*

− “TSDSI\_RIT\_Technical\_response” is the clarifications document **(See Part II Attachment 2 below).**

• Any remaining issues?

– Self-evaluations of one technical performance requirements, connection density currently do not match the worksheet provided by the proponent

– There is an issue raised in the meeting that power class to some test environments was applied to self-evaluation does not follow Report ITU-R M.2412. There is not conclusion on that and it needs further offline discussions

− **Offline discussion to reach the common understanding for below two bullets:**

• Comments from the meeting: Self-evaluation results of one technical performance requirements, spectrum efficiency under Dense Urban-eMBB (configuration A), Rural-eMBB (configuration B and C) and of link budget of Rural-eMBB(configuration B and C) do not follow the power class defined in Report ITU-R M.2412.

• Clarification from TSDSI: with a TDD duty cycle of 50% or less, the effective transmit power is 23 dBm.

PART II

Attachment 2

Amendment 1 to IMT-2020 submission in Document 5D/1230

**(Proponent TSDSI)**

**Source:**



TSDSI response to the raised comments  
*for “TSDSI RIT”:*

#### 5.2.4.3 Compliance template for technical performance

|  | Category | | | Required value | Requirement met? | 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 |  Yes  No | Claims YES (same 3GPP results), but NO description in the self-evaluation report  Response: See Q5 Below |
| Uplink | 10 |  Yes  No |
| **5.2.4.3.2** Peak spectral efficiency (bit/s/Hz) *(4.2)* | eMBB | Not applicable | Downlink | 30 |  Yes  No | Claims YES (same 3GPP results), but NO description in the self-evaluation report  Response: See Q5 Below |
| Uplink | 15 |  Yes  No |
| **5.2.4.3.3** User experienced data rate (Mbit/s) *(4.3)* | eMBB | Dense Urban – eMBB | Downlink | 100 |  Yes  No | YES, endorsing PART of 3GPP self-eval/results (4GHz) |
| 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 | YES, endorsing 3GPP self-eval/results (4GHz) |
| Uplink | 0.21 |  Yes  No |
| eMBB | Dense Urban – eMBB | Downlink | 0.225 |  Yes  No | YES, based on their self-evaluation/results (4GHz) |
| Uplink | 0.15 |  Yes  No |
| eMBB | Rural – eMBB | Downlink | 0.12 |  Yes  No | YES, based on their self-evaluation/results (700MHz) |
| 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 | YES, endorsing 3GPP self-eval/results (4GHz) |
| Uplink | 6.75 |  Yes  No |
| eMBB | Dense Urban – eMBB | Downlink | 7.8 |  Yes  No | YES, based on their self-evaluation/results (4GHz) |
| Uplink | 5.4 |  Yes  No |
| eMBB | Rural – eMBB | Downlink | 3.3 |  Yes  No | YES, based on their self-evaluation/results (700MHz, and LMLC)  Note: LMLC link budget uses different assumptions than 3GPP/M.2412, e.g. max UE tx Pwr = 26dBm  Response: See Q4 Below |
|  Yes  No |
| Uplink | 1.6 |  Yes  No |
|  Yes  No |
| **5.2.4.3.6** Area traffic capacity (Mbit/s/m2) *(4.6)* | eMBB | Indoor-Hotspot – eMBB | Downlink | 10 |  Yes  No | YES, endorsing 3GPP self-eval/results (4GHz) |
| **5.2.4.3.7** User plane latency (ms) *(4.7.1)* | eMBB | Not applicable | Uplink and Downlink | 4 |  Yes  No | Claims YES (same 3GPP results), but NO description in the self-evaluation report  Response: See Q5 Below |
| URLLC | Not applicable | Uplink and Downlink | 1 |  Yes  No |
| **5.2.4.3.8** Control plane latency (ms) *(4.7.2)* | eMBB | Not applicable | Not applicable | 20 |  Yes  No |
| URLLC | Not applicable | Not applicable | 20 |  Yes  No |
| **5.2.4.3.9** Connection density (devices/km2) *(4.8)* | mMTC | Urban Macro – mMTC | Uplink | 1 000 000 |  Yes  No | Claims YES, endorsing PART of 3GPP self-eval/results.  Not clear, from self-eval report, if covering NR and NB-IOT, and whether NB-IOT baseline/assumptions are the same (spec release, deltas…)  Response: See Q3 Below |
| **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 | Claims YES (same 3GPP results), but NO description in the self-evaluation report  Response: See Q5 Below |
| **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 | YES, endorsing 3GPP self-eval/results (4GHz, and 700MHz) |
| **5.2.4.3.12** Mobility classes *(4.11)* | eMBB | Indoor Hotspot – eMBB | Uplink | Stationary, Pedestrian |  Yes  No | YES, endorsing 3GPP self-eval/results |
| eMBB | Dense Urban – eMBB | Uplink | Stationary, Pedestrian,  Vehicular (up to 30 km/h) |  Yes  No | YES, based on their self-evaluation/results |
| eMBB | Rural – eMBB | Uplink | Pedestrian, Vehicular, High speed vehicular |  Yes  No | YES, based on their self-evaluation/results |
| **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 | YES, endorsing 3GPP self-eval/results |
| eMBB | Dense Urban – eMBB | Uplink | 1.12 (30 km/h) |  Yes  No | YES, based on their self-evaluation/results |
| eMBB | Rural – eMBB | Uplink | 0.8 (120 km/h) |  Yes  No | YES, based on their self-evaluation/results |
| 0.45 (500 km/h) |  Yes  No |
| **5.2.4.3.14** Mobility interruption time (ms)  *(4.12)* | eMBB and URLLC | Not applicable | Not applicable | 0 |  Yes  No | Claims YES (same 3GPP results), but NO description in the self-evaluation report  Response: See Q5 Below |
| **5.2.4.3.15** Bandwidth and Scalability *(4.13)* | Not applicable | Not applicable | Not applicable | At least 100 MHz |  Yes  No | Claims YES (same 3GPP results), but NO description in the self-evaluation report  Response: See Q5 Below |
| Up to 1 GHz |  Yes  No |
| Support of multiple different bandwidth values(4) |  Yes  No |

A detailed mapping of the KPI and worksheets provided for self-evaluation is provided at the end of this document

*1) How is the performance of INH not effected by our changes (RIT)and how can we use the 3GPP results?*

Some feature of 3GPP RIT are part of TSDSI RIT. Therefore in some cases, TSDSI RIT has same performance as 3GPP RIT. INH evaluations use the common feature set between TSDSI RIT and 3GPP RIT. Pi/2 BPSK has the lowest MCS and will not get activated for small cell sizes, for example in scenarios like the InH. Also, the SRS enhancement does not get activated in the InH since there is no mobility. Hence, InH evaluations do not use the additional features present in TSDSI RIT and therefore performance is same as that of 3GPP RIT.

*2) What are the KPI that the current RIT effects?*

• Pi/2 BPSK affects the Rural eMBB, dense urban KPI because of the bigger cell size.

• The proposed signalling methods affect the KPI for test environments with large cells (LMLC), and with high speed mobility and have been evaluated

*3) Release issue of NB-IOT*

• Currently Release 14 is used.

• TSDSI RIT, and 3GPP RIT which is based in Rel. 15, both provide same performance results for NB-IoT, based on the IMT2020 evaluation methodology.

– As per simulation methodology of connection density, Rel.14 and Rel.15 of NB-IoT have similar performance.

*4) LMLC Link budget uses different assumptions than 3GPP/M.2412 e.g., Max UE tx Pwr=26 dBm*

• Pi/2 BPSK provides 3dB transmit power boost because of its lower PAPR, which implies a transmit power of 26 dBm. However, with a TDD duty cycle of 50% or less, the effective transmit power is 23 dBm.

• The LMLC link budget sheet is not mandatory and is included to provide additional information for the LMLC use case.

*5) Have all the KPIs been evaluated?*

• Yes.

• Some of the KPIs match the results in the 37.910. In particular, the proposed enhancements do not affect the KPIs that can be evaluated through analytical and inspection approaches, namely:

– Peak spectral efficiency

– Peak data rate

– Area traffic capacity

– Control plane latency

– User plane latency

– Mobility interruption time

– Bandwidth

– Energy efficiency

These KPIs depend only on the basic level physical layer parameters that have not been modified by the RIT proposal. Hence these results are the same as 3GPP and we have endorsed the same.

• The following KPIs based on simulations across different test environments have been provided in excel sheets.

– Average Spectral efficiency

– 5th percentile user spectral efficiency

– Connection density

– Mobility Traffic channel link data rates

– Reliability

– User experienced data rate is computed using analytical approach by multiplying the 5th percentile SE with the bandwidth.

The following table provides the mapping of the results to the KPI.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| KPI | Usage scenario | Test environment | Approach | Document |
| **5.2.4.3.1** Peak data rate (Gbit/s) *(4.1)* | eMBB | Not applicable | Analytical | 37.910 |
| **5.2.4.3.2** Peak spectral efficiency (bit/s/Hz) *(4.2)* | eMBB | Not applicable | Analytical | 37.910 |
| **5.2.4.3.3** User experienced data rate (Mbit/s) *(4.3)* | eMBB | Dense Urban – eMBB | Analytical | Follows from Worksheet “Spectral Efficiency-02 Dense Urban” and Compliance template |
| **5.2.4.3.4** 5th percentile user spectral efficiency (bit/s/Hz) *(4.4)* | eMBB | Indoor Hotspot – eMBB | Simulation | Worksheet “SpectralEfficiency-InH-eMBB” |
|  | eMBB | Dense Urban – eMBB |  | Worksheet “Spectral Efficiency-02 Dense Urban” |
|  | eMBB | Rural – eMBB |  | Worksheet “Rural eMBB” |
| **5.2.4.3.5** Average spectral efficiency (bit/s/Hz/ TRxP) *(4.5)* | eMBB | Indoor Hotspot – eMBB | Simulation | Worksheet “SpectralEfficiency-InH-eMBB” |
|  | eMBB | Dense Urban – eMBB |  | Worksheet “Spectral Efficiency-02 Dense Urban” |
|  | eMBB | Rural – eMBB |  | Worksheet “Rural eMBB” |
| **5.2.4.3.6** Area traffic capacity (Mbit/s/m2) *(4.6)* | eMBB | Indoor-Hotspot – eMBB | Analytical | 37.910 |
| **5.2.4.3.7** User plane latency (ms) *(4.7.1)* | eMBB | Not applicable | Analytical | 37.910 |
|  | URLLC | Not applicable |  | 37.910 |
| **5.2.4.3.8** Control plane latency (ms) *(4.7.2)* | eMBB | Not applicable | Analytical | 37.910 |
|  | URLLC | Not applicable |  | 37.910 |
| **5.2.4.3.9** Connection density (devices/km2) *(4.8)* | mMTC | Urban Macro – mMTC | Simulation | Worksheet “ConnectionDensity-UrbanMacro-mMTC” |
| **5.2.4.3.10** Energy efficiency *(4.9)* | eMBB | Not applicable | Inspection | 37.910 |
| **5.2.4.3.11** Reliability *(4.10)* | URLLC | Urban Macro –URLLC | Simulation | Worksheet “Reliability-URLLC” |
| **5.2.4.3.12** Mobility classes *(4.11)* | eMBB | Indoor Hotspot – eMBB |  | Follows from Worksheet “Mobility-IndoorHotspot-eMBB” |
|  | eMBB | Dense Urban – eMBB |  | Follows from Worksheet “Mobility- DenseUrban” |
|  | eMBB | Rural – eMBB |  | Follows from Worksheet “Mobility- Rural” |
| **5.2.4.3.13**  Mobility Traffic channel link data rates (bit/s/Hz) *(4.11)* | eMBB | Indoor Hotspot – eMBB | Simulation | Worksheet “Mobility-IndoorHotspot-eMBB” |
|  | eMBB | Dense Urban – eMBB |  | Worksheet “Mobility- DenseUrban” |
|  | eMBB | Rural – eMBB |  | Worksheet “Mobility- Rural” |
| **5.2.4.3.14** Mobility interruption time (ms)  *(4.12)* | eMBB and URLLC | Not applicable | Analytical | 37.910 |
| **5.2.4.3.15** Bandwidth and Scalability *(4.13)* | Not applicable | Not applicable | Inspection | 37.910 |

Note: Further material has been received.

Amendment 2  
  
to IMT-2020 submission in Document 5D/1230

**Source:**

**

NB-IOT

*Release issue of NB-IOT:* Currently Release 14 is used in the TSDSI RIT

Release 14 and Release 15 issue

Use the non-full Buffer case with RRC resume and not EDT. As per the discussion, Release 15 results without EDT will be used.

Results provided are in the worksheet of Non-Full Buffer.

|  |  |  |
| --- | --- | --- |
| 1732 M | Value | BW |
| Channel Model A | 10,18,000 | 2 700 kHz |
| Channel Model B | 10,34,385 | 1 980 kHz |

|  |  |  |
| --- | --- | --- |
| 500 M | Value | BW |
| Channel Model A | 12,33,000 | 180 kHz |
| Channel Model B | 12,25,000 | 180 kHz |

Current Compliance Template

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **5.2.4.3.9** Connection density (devices/km2) *(4.8)* | mMTC | Urban Macro – mMTC | Uplink | 1 000 000 | 35,083,000 / 180 kHz -  35,569,000 / 180 kHz | Yes | For evaluation configuration A (ISD = 500 m) with full buffer system level simulation followed by link level simulation; Channel model A/B. |
|  |  |  |  |  | 1,267,000 / 180 kHz -  1,530,000 / 180 kHz | Yes | For evaluation configuration B (ISD = 1 732 m) with full buffer system level simulation followed by link level simulation; Channel model A/B. |

Power Issue

*LMLC Link budget uses different assumptions than 3GPP/M.2412 e.g., Max UE TX Pwr=26 dBm.*

*New Question: Simulations for Rural and Dense Urban eMBB assume the same*

In the results provided in the worksheets for Rural-eMBB and Dense Urban-eMBB, for the simulations with TDD configuration (with a duty cycle of 50% or less) the UE power was boosted by 3dB in the simulations **only for Pi/2 BPSK MCS** mode. For FDD simulations, there is no change.

Justification of using the 26 dBM: Pi/2 BPSK provides 3 dB transmit power boost because of its lower PAPR. This implies a transmit power of 26 dBm. However, with a TDD duty cycle of 50% or less, the effective transmit power is 23 dBm.

What is UE power class? Not defined in Report ITU-R M.2412 (the reference document for IMT simulations).

As per 3GPP, 38.101-1, the power class definition is provided below:

### 6.2 Transmitter power

### 6.2.1 UE maximum output power

The following UE Power Classes define the maximum output power for any transmission bandwidth within the channel bandwidth of NR carrier unless otherwise stated. The period of measurement shall be at least one sub frame (1ms).

The notion of negative MPR (Maximum power reduction) has been introduced in 3GPP for pi/2 BPSK. This provides for an opportunity to transmit at a higher power than the power class based on the duty cycle.

MPR table. The entry for PI/2 BPSK in the below table should be read in conjunction with 6.2.4 provided below.



 

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_