Answers to the Technical Queries at the SWG

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#### 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*

1. 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.
2. 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 |