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Source: Moderator (vivo)

Title: DRAFT TR section – Capacity evaluation

Agenda Item: 8.14.1

Document for: Discussion

# References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

1. 3GPP TR 21.905: "Vocabulary for 3GPP Specifications"
2. 3GPP RP-201145: "Revised SI on XR Evaluations for XR"
3. 3GPP R1-2104023: “LS on Status Update on XR Traffic”
4. 3GPP S4-210614: “FS\_XRTRaffic: Permanent document, v0.6.0”
5. 3GPP TR 23.501: “System architecture for the 5G System (5GS)”
6. 3GPP TR 38.840: “Study on User Equipment (UE) power saving in NR”
7. 3GPP R1-2101765, “LS on XR-Traffic Models”

*(Moderator’s note: In the text in this document, the source index and the corresponding component will be further updated as the following table. Note that in the final TR, the number could be revised to be consistent with other section if needed. )*



|  |  |
| --- | --- |
| Source 1 | Apple |
| Source 2 | AT&T |
| Source 3 | CATT |
| Source 4 | CEWiT |
| Source 5 | China Unicom |
| Source 6 | CMCC |
| Source 7 | Ericsson |
| Source 8 | FUTUREWEI |
| Source 9 | Huawei |
| Source 10 | Intel |
| Source 11 | InterDigital |
| Source 12 | ITRI |
| Source 13 | LG |
| Source 14 | MediaTek |
| Source 15 | Nokia |
| Source 16 | Qualcomm |
| Source 17 | OPPO |
| Source 18 | vivo |
| Source 19 | Xiaomi |
| Source 20 | ZTE |

================= (Unchanged part omitted) ==========================

# XR Capacity Evaluation

## Purpose of Study

In this section, we describe the KPI for capacity evaluations and provide evaluation results for capacity based on baseline parameters and optional parameters/modelling methods.

The purpose of capacity study is to understand the performance of NR systems for XR applications, and identify any issues and performance gaps, which could be useful for understanding the limitation of current NR systems in supporting XR applications and the potential directions for future necessary enhancements to better support XR.

## KPI

### UE Satisfaction

A UE is declared as a **satisfied UE** if **all** the considered streams meet their own PER and PDB requirements, i.e., more than a certain percentage of packets are successfully transmitted within a given air interface PDB. Specifically, we have followings depending on the evaluation directions considered.

* In DL-only evaluation, only DL streams are considered when identifying UE satisfaction**.**
* In UL-only evaluation, only UL streams are considered when identifying UE satisfaction**.**

### System Capacity

System capacity is identified as KPI for capacity study, which is defined as the maximum number of users per cell with at least Y % of UEs being satisfied.

* Y=90 (baseline) or 95 (optional)
* Other values of Y can also be evaluated optionally.

For details on how to evaluate capacity, see capacity evaluation section 14.

**=============== Start of Text update for TR section – Capacity Results in 8.3 =====================**

## Capacity Results

*(Moderator’s note: This section is to capture the evaluation results and the corresponding observations for capacity in the TR. The contents in this section are based on the summary (R1-2110682) of observations for capacity in RAN1 #106b-e, with some changes on the format to align with the TR and some updates based on the evaluation results in RAN1 #107e)*

### Capacity baseline performance

#### FR1 DL

This section captures the capacity baseline performance evaluation results of FR1 DL.

**Summary of FR1 DL capacity evaluation results for single-stream**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Scenario | App | PDB | Bit rate | Fps | MIMO | Capacity result | | Source | Note |
| mean | range |
| DU | AR/VR | 10ms | 60Mbps | 60 | MU | 0 | 0 | QC | Note 1, |
| 45Mbps | 60 | SU | 4.58 | 1.7~6 | Huawei, FUTUREWEI, MediaTek, Ericsson, Qualcomm, vivo, China Unicom | Note 1 |
| SU | 4.77 | 4.1~5 | OPPO, Xiaomi, Nokia | Note 2 |
| SU | 3.22 | 2.04~4.4 | OPPO, CEWiT | Note 2, 3 |
| MU | 7.07 | 5.3~8.4 | Huawei, FUTUREWEI, ZTE, vivo, Ericsson, Qualcomm | Note 1 |
| MU | 2.4 | 2.4 | Interdigital | Note 2 |
| 120 | SU | 8.03 | 8.03 | vivo | Note 1 |
| MU | 11.42 | 11.42 | vivo | Note 1 |
| 30 Mbps | 30 | SU | 6.3 | 6.3 | QC | Note 1 |
| 60 | SU | 8.46 | 5.1~10.6 | Huawei, FUTUREWEI, vivo, MediaTek, Intel, CATT, Ericsson, Qualcomm | Note 1 |
| SU | 6.98 | 6.54~7.4 | OPPO, Xiaomi, Nokia | Note 2 |
| SU | 6.23 | 4.05~8.4 | OPPO, CEWiT | Note 2,3 |
| MU | 11.41 | 7 ~ 13.59 | Huawei, FUTUREWEI, ZTE, vivo, Intel, Ericsson, Qualcomm, CMCC | Note 1 |
| MU | 3.9 | 3.9 | Interdigital | Note 2 |
| MU | 5.78 | 5.78 | CEWiT | Note 2, 3 |
| 120 | SU | 13.47 | 13.47 | vivo | Note 1 |
| MU | 20.78 | 20.78 | vivo | Note 1 |
| 7ms | 30 Mbps | 60 | MU | 7.35 | 6.3~ 8.4 | Huawei, FUTUREWEI | Note 1 |
| 13ms | 30 Mbps | 60 | MU | 14.65 | 14.6~14.7 | Huawei, FUTUREWEI | Note 1 |
| 15ms | 30 Mbps | 60 | SU | 10.3 | 10.2 | OPPO | Note 2 |
| SU | 10.2 | 10.2 | OPPO | Note2,3 |
| CG | 15 ms | 45 Mbps | 60 | SU | 6.3 | 6.3 | OPPO | Note 2 |
| SU | 6.3 | 6.3 | OPPO | Note2,3 |
| 30 Mbps | 60 | SU | 9.89 | 6.17~13 | Huawei, vivo, Xiaomi, MediaTek, Intel, CATT, Ericsson, Qualcomm, FUTUREWEI, CMCC, China Unicom, OPPO | Note 1 |
| SU | 8.25 | 8~8.5 | Xiaomi, Nokia | Note 2 |
| SU | 7.94 | 5.57~10.3 | OPPO, CEWiT | Note 2, 3 |
| MU | 15.06 | 10.1~19.65 | Huawei, ZTE, vivo, Intel, Ericsson, Qualcomm, FUTUREWEI, CMCC | Note 1 |
| MU | 5 | 5 | Interdigital | Note 2 |
| MU | >8 | >8 | CEWiT | Note 2, 3 |
| 8 Mbps | 60 | SU |  | >20~>36 | MTK, Ericsson, Qualcomm, China Unicom | Note 1 |
| MU |  | >36~56.6 | Ericsson, Qualcomm | Note 1 |
| InH | AR/VR | 10 ms | 60Mbps | 60 | MU | 2 | 0~4 | CATT, QC |  |
| 45 Mbps | 60 | SU | 4.44 | 3.27~5 | MediaTek, Nokia, Ericsson, Qualcomm, vivo, Xiaomi |  |
| MU | 6.07 | 3.5~8 | ZTE, vivo, Interdigital, Ericsson, Qualcomm, CATT |  |
| 120 | SU | 6.59 | 6.59 | vivo |  |
| MU | 9.22 | 9.22 | vivo |  |
| 30 Mbps | 60 | SU | 7.33 | 5.2~8.5 | vivo, Nokia, Qualcomm, MTK, Ericsson, Xiaomi |  |
| SU | 4.85 | 4.85 | ITRI | Note3 |
| MU | 9.21 | 5~12 | ZTE, vivo, CATT, Interdigital, Ericsson, Qualcomm, CMCC |  |
| 120 | SU | 11.63 | 11.63 | vivo |  |
| MU | 16.53 | 16.53 | vivo |  |
| 60 Mbps | 60 | MU | 4 | 4 | CATT |  |
| 7 ms | 30 Mbps | 60 | MU | 8 | 8 | CATT |  |
| CG | 15 ms | 30 Mbps | 60 | SU | 8.4 | 5.96~10.5 | vivo, Ericsson, Qualcomm, MTK, Nokia, CMCC, Xiaomi |  |
| SU | 9.4 | 9.4 | ITRI | Note3 |
| MU | 11.96 | 7.2~16.2 | ZTE, vivo, CATT, Interdigital, Ericsson, Qualcomm, CMCC |  |
| 8 Mbps | 60 | SU |  | >20~>38.7 | MTK, Ericsson, Qualcomm |  |
| MU |  | >38.7~44.1 | Qualcomm |  |
| UMa | AR/VR | 10 ms | 45 Mbps | 60 | SU | 3.62 | 1.8~4.7 | Huawei, FUTUREWEI, MediaTek, Ericsson, Qualcomm, vivo, China Unicom | Note 1 |
| SU | 1.85 | 1.85 | CEWiT | Note 2, 3 |
| MU | 4.51 | 2.9~6 | Huawei, FUTUREWEI, Ericsson, Qualcomm, vivo, ZTE | Note 1 |
| 120 | SU | 6.75 | 6.75 | vivo | Note 1 |
| MU | 8.12 | 8.12 | vivo | Note 1 |
| 30 Mbps | 60 | SU | 6.26 | 4.4~8 | Huawei, FUTUREWEI, Ericsson, Qualcomm, vivo, MTK, China Unicom | Note 1 |
| SU | 2.98 | 2.98 | CEWiT | Note 2,3 |
| MU | 8.29 | 5.2~10 | Huawei, FUTUREWEI, Ericsson, Qualcomm, vivo, ZTE | Note 1 |
| 120 | SU | 11.7 | 11.7 | vivo | Note 1 |
| MU | 14.59 | 14.59 | vivo | Note 1 |
| CG | 15 ms | 30 Mbps | 60 | SU | 8.36 | 5.4~10.33 | Huawei, vivo, MediaTek, Ericsson, Qualcomm, FUTUREWEI, China Unicom | Note 1 |
| SU | 4.08 | 4.08 | CEWiT | Note 2,3 |
| MU | 11.59 | 8~14.33 | Huawei, vivo, Ericsson, Qualcomm, ZTE, FUTUREWEI | Note 1 |
| 8 Mbps | 60 | SU |  | 17.5~32.9 | MTK, Ericsson, Qualcomm, China Unicom | Note 1 |
| MU |  | 23.8~>36 | Ericsson, Qualcomm | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2)  Note 3: zero packet arrival interval among UEs | | | | | | | | | |

**Summary of FR1 DL capacity evaluation results for multi-stream (I/P Frame Traffic Model)**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Scenario | Traffic model | App | Bit rate | Alpha | [PER\_I, PER\_P]  [PDB\_I, PDB\_P] | MIMO | Capacity result | | Source | Note |
|  | mean | range |
| DU | **GOP-Based I/P Frame** | VR/AR | 30Mbps | 1 | [1%, 1%]  [10ms, 10ms] | MU | 10 | 10 | Huawei | Note 1 |
| 1.5 | [1%, 1%]  [10ms, 10ms] | SU | 1.5 | 1.5 | China Unicom | Note 1 |
| MU | 7.62 | 6.74~8.5 | Huawei, vivo | Note 1 |
| 2 | [1%, 1%]  [10ms, 10ms] | SU | 6.05 | 6~6.1 | MTK, China Unicom | Note 1 |
| [1%, 1%]  [10ms, 10ms] | MU | 7.57 | 5.2~10.8 | Huawei, ZTE, vivo | Note 1 |
| 3 | [1%, 1%]  [10ms, 10ms] | MU | 3.11 | 2.21~4 | Huawei, vivo | Note 1 |
| 45 Mbps | 1.5 | [1%, 1%]  [10ms, 10ms] | SU | 2 | 2 | MTK | Note 1 |
| [1%, 1%]  [10ms, 10ms] | MU | 1.4 | 1.4 | Huawei | Note 1 |
| 3 | [1%, 1%]  [10ms, 10ms] | SU | - | <2 | MTK | Note 1 |
| **Slice-Based I/P Frame** | VR/AR | 30 Mbps | 1.5 | [1%, 1%]  [10ms, 10ms] | MU | 13.78 | 13.78 | vivo | Note 1 |
| 2 | [1%, 1%]  [10ms, 10ms] | MU | 13.76 | 12.7~14.9 | Huawei, ZTE, vivo | Note 1 |
| 3 | [1%, 1%]  [10ms, 10ms] | MU | 13.77 | 13.77 | vivo | Note 1 |
| Uma | **GOP-Based I/P Frame** | VR/AR | 30Mbps | 1.5 | [1%, 1%]  [10ms, 10ms] | SU | 4.2 | 4.2 | China Unicom | Note 1 |
| 2 | [1%, 1%]  [10ms, 10ms] | SU | 2.4 | 2.4 | China Unicom | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8) | | | | | | | | | | |

**Summary of FR1 DL capacity evaluation results for multi-stream (Video stream 30Mbps+Data/audio stream 1.12Mbps)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Scenario | App | PDB | Bit rate | MIMO | Capacity result | | Source | Note |
| mean | range |
| DU | VR/AR | 10ms for video stream; 30ms for audio stream | 30Mbps for video stream; 1.12Mbps for audio stream | SU | 6 | 6 | Apple | Note 1 |
| InH | VR/AR | 10ms for video stream; 30ms for audio stream | 30Mbps for video stream; 1.12Mbps for audio stream | SU | 4.1 | 4 | Apple |  |
| Note 1: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1,8,2) | | | | | | | | |

##### DU Scenario

###### VR/AR

Single-stream traffic model

**Observations**

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with SU-MIMO and 64 TxRU BS antenna, it is observedobserved from (Huawei, FUTUREWEI, vivo, MediaTek, Intel, CATT, Ericsson, Qualcomm) that mean capacity performances are 8.46 in the range of 5.1~10.6.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with SU-MIMO and 32 TxRU BS antenna, it is observed from (OPPO, Xiaomi, Nokia) that mean capacity performances are 6.98 in the range of 6.54~7.4.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with MU-MIMO and 64 TxRU BS antenna, it is observed from (Huawei, FUTUREWEI, ZTE, vivo, Intel, Ericsson, Qualcomm, CMCC) that mean capacity performances are are 11.41 in the range of 7 ~ 13.59.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with MU-MIMO and 32 TxRU BS antenna, it is observed from (Interdigital) that the capacity performances are 3.9.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with SU-MIMO and 64 TxRU BS antenna, it is observed from (Huawei, FUTUREWEI, MediaTek, Ericsson, Qualcomm, vivo, China Unicom) that the mean capacity performances are 4.58 in the range of 1.7~6.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with SU-MIMO and 32 TxRU BS antenna, it is observed from (OPPO, Xiaomi, Nokia) that the mean capacity performances are 4.77 in the range of 4.1~5.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with MU-MIMO and 64 TxRU BS antenna, it is observed from (Huawei, FUTUREWEI, ZTE, vivo, Ericsson, Qualcomm) that the mean capacity performances are 7.07 in the range of 5.3~8.4.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with MU-MIMO and 32 TxRU BS antenna, it is observed from (Interdigital) that the mean capacity performances are 2.4.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 60Mbps, 10ms PDB, 60 FPS, with 64 TxRU BS antenna and MU-MIMO, it is observed from (Qualcomm) that the mean capacity performances are 0.

Multi-stream traffic model

**Observations**

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR Slice-Based I/P Frame Traffic Model, 30Mbps, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [1%, 1%], with alpha = 1.5 and MU-MIMO, it is observed from (vivo) reported the capacity performances are 13.78.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR Slice-Based I/P Frame Traffic Model, 30Mbps, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [1%, 1%], with alpha = 2 and MU-MIMO, it is observed from (Huawei, ZTE, vivo) that the mean capacity performances are 13.76 in the range of 12.7~14.9.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR Slice-Based I/P Frame Traffic Model, 30Mbps, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [1%, 1%], with alpha = 3 and MU-MIMO, it is observed from (vivo) reported the capacity performances are 13.77.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR GOP-Based I/P Frame Traffic Model, 30Mbps, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [1%, 1%], with alpha = 1 and MU-MIMO, it is observed from (Huawei) that the capacity performances are 10.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR GOP-Based I/P Frame Traffic Model, 30Mbps, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [1%, 1%], with alpha = 1.5 and SU-MIMO, it is observed from (China Unicom) that the capacity performances are 1.5.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR GOP-Based I/P Frame Traffic Model, 30Mbps, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [1%, 1%], with alpha = 1.5 and MU-MIMO, it is observed from (Huawei, vivo) that the mean capacity performances are 7.62 in the range of 6.74~8.5.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR GOP-Based I/P Frame Traffic Model, 30Mbps, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [1%, 1%], with alpha = 2 and SU-MIMO, it is observed from (MediaTek, China Unicom) that the mean capacity performances are 6.05 in the range of 6~6.1.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR GOP-Based I/P Frame Traffic Model, 30Mbps, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [1%, 1%], with alpha = 2 and MU-MIMO, it is observed from (Huawei, ZTE, vivo) that the mean capacity performances are 7.57 in the range of 5.2~10.8.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR GOP-Based I/P Frame Traffic Model, 30Mbps, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [1%, 1%], with alpha = 3 and MU-MIMO, it is observed from (Huawei, vivo) that the mean capacity performances are 3.11 in the range of 2.21~4.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR GOP-Based I/P Frame Traffic Model, 45Mbps, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [1%, 1%], with alpha = 1.5 and MU-MIMO, it is observed from (Huawei) that the capacity performances are 1.4.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR GOP-Based I/P Frame Traffic Model, 45Mbps, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [1%, 1%], with alpha = 2 and SU-MIMO, it is observed from (MediaTek) that the capacity performances are 2

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR GOP-Based I/P Frame Traffic Model, 45Mbps, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [1%, 1%], with alpha = 3 and SU-MIMO, it is observed from (MediaTek) that the capacity performances are <2.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR mutli-stream traffic model with video stream 30Mbps+data/audio stream 1.12Mbps, [PDB\_video, PDB\_data/audio] = [10ms, 30ms], with SU-MIMO, it is observed from (Apple) that the capacity performances are 6.

###### CG

**Observations**

For FR1, Dense Urban, DL, with 100MHz bandwidth for CG traffic model, 8Mbps, 15ms PDB, 60 FPS, with SU-MIMO and 64TxRU BS antenna, it is observed from (MediaTek, Ericsson, Qualcomm, China Unicom) that the mean capacity performances are in the range of >20~>36.

For FR1, Dense Urban, DL, with 100MHz bandwidth for CG traffic model, 8Mbps, 15ms PDB, 60 FPS, with MU-MIMO and 64TxRU BS antenna, it is observed from (Ericsson, Qualcomm) that the mean capacity performances are in the range of >36~56.6.

For FR1, Dense Urban, DL, with 100MHz bandwidth for CG traffic model, 30Mbps, 15ms PDB, 60 FPS, with SU-MIMO and 64 TxRU BS antenna, it is observed from (Huawei, vivo, Xiaomi, MediaTek, Intel, CATT, Ericsson, Qualcomm, FUTUREWEI, CMCC, China Unicom, OPPO) that the mean capacity performances are 9.89 in the range of 6.17~13.

For FR1, Dense Urban, DL, with 100MHz bandwidth for CG traffic model, 30Mbps, 15ms PDB, 60 FPS, with SU-MIMO and 32 TxRU BS antenna, it is observed from (Xiaomi, Nokia) that the mean capacity performances are 8.25 in the range of 8~8.5.

For FR1, Dense Urban, DL, with 100MHz bandwidth for CG traffic model, 30Mbps, 15ms PDB, 60 FPS, with MU-MIMO and 64 TxRU BS antenna, it is observed from (Huawei, ZTE, vivo, Intel, Ericsson, Qualcomm, FUTUREWEI, CMCC) that the mean capacity performances are 15.06 in the range of 10.1~19.65.

For FR1, Dense Urban, DL, with 100MHz bandwidth for CG traffic model, 30Mbps, 15ms PDB, 60 FPS, with MU-MIMO and 64 TxRU BS antenna, with MU-MIMO and 32 TxRU BS antenna, it is observed from (Interdigital) that the mean capacity performances are 5.

##### InH Scenario

###### VR/AR

Single stream traffic model

**Observations**

For FR1, Indoor Hotspot, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with SU-MIMO, it is observed from (vivo, Nokia, Ericsson, Qualcomm, MediaTek, Xiaomi) that the mean capacity performances are 7.33 in the range of 5.2~8.5.

For FR1, Indoor Hotspot, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with MU-MIMO, it is observed from (ZTE, vivo, CATT, Interdigital, Ericsson, Qualcomm, CMCC) that the mean capacity performances are 9.21 in the range of 5~12.

For FR1, Indoor Hotspot, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with SU-MIMO, it is observed from (MediaTek, Nokia, Ericsson, Qualcomm, vivo, Xiaomi) that the mean capacity performances are 4.44 in the range of 3.27~5.

For FR1, Indoor Hotspot, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with MU-MIMO, it is observed from (ZTE, vivo, Interdigital, Ericsson, Qualcomm, CATT) that the mean capacity performances are 6.07 in the range of 3.5~8.

For FR1, Indoor Hotspot, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 60Mbps, 10ms PDB, 60 FPS, with MU-MIMO, it is observed from (Qualcomm, CATT) that the mean capacity performances are 2 in the range of 0~4.

Multi-stream traffic model

**Observations**

For FR1, Indoor Hotspot, DL, with 100MHz bandwidth for VR/AR mutli-stream traffic model with video stream 30Mbps+data/audio stream 1.12Mbps, PDB\_video, PDB\_data/audio = 10ms, 30ms, with SU-MIMO, it is observed from (Apple) that the capacity performances are 4.1.

###### CG

**Observations**

For FR1, Indoor Hotspot, DL, with 100MHz bandwidth for CG traffic model, 8Mbps, 15ms PDB, 60 FPS, with SU-MIMO, it is observed from (MediaTek, Ericsson, Qualcomm) that the mean capacity performances are in the range of >20~>38.7.

For FR1, Indoor Hotspot, DL, with 100MHz bandwidth for CG traffic model, 8Mbps, 15ms PDB, 60 FPS, with MU-MIMO, it is observed from (Ericsson, Qualcomm) that the mean capacity performances are in the range of >38.7~44.1.

For FR1, Indoor Hotspot, DL, with 100MHz bandwidth for CG traffic model, 30Mbps, with SU-MIMO, it is observed from (vivo, Ericsson, Qualcomm, MediaTek, Nokia, CMCC, Xiaomi) that the mean capacity performances are 8.4 in the range of 5.96~10.5.

For FR1, Indoor Hotspot, DL, with 100MHz bandwidth for CG traffic model, 30Mbps, with MU-MIMO, it is observed from (ZTE, vivo, CATT, Interdigital, Ericsson, Qualcomm, CMCC) that the mean capacity performances are 11.96 in the range of 7.2~16.2.

##### UMa Scenario

###### VR/AR

Single stream traffic model

**Observations**

For FR1, Urban Macro, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with SU-MIMO and 64 TxRU BS antenna, it is observed from (Huawei, FUTUREWEI, Ericsson, Qualcomm, vivo, MediaTek, China Unicom) that the mean capacity performances are 6.26 in the range of 4.4~8.

For FR1, Urban Macro, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with MU-MIMO and 64 TxRU BS antenna, it is observed from (Huawei, FUTUREWEI, Ericsson, Qualcomm, vivo, ZTE) that the mean capacity performances are 8.29 in the range of 5.2~10.

For FR1, Urban Macro, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with SU-MIMO and 64 TxRU BS antenna, it is observed from (Huawei, FUTUREWEI, MediaTek, Ericsson, Qualcomm, vivo, China Unicom) that the mean capacity performances are 3.62 in the range of 1.8~4.7.

For FR1, Urban Macro, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with MU-MIMO and 64 TxRU BS antenna, it is observed from (Huawei, FUTUREWEI, Ericsson, Qualcomm, vivo, ZTE) that the mean capacity performances are 4.51 in the range of 2.9~6.

Multi-stream traffic model

**Observations**

For FR1, Urban Macro, DL, with 100MHz bandwidth for VR/AR GOP-Based I/P Frame Traffic Model, 30Mbps, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [1%, 1%], with alpha = 1.5 and SU-MIMO, it is observed from (China Unicom) that the capacity performances are 4.2.

For FR1, Urban Macro, DL, with 100MHz bandwidth for VR/AR GOP-Based I/P Frame Traffic Model, 30Mbps, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [1%, 1%], with alpha = 2 and SU-MIMO, it is observed from (China Unicom) that the capacity performances are 2.4.

###### CG

**Observations**

For FR1, Urban Macro, DL, with 100MHz bandwidth for CG traffic model, 8Mbps, 15ms PDB, 60 FPS, with SU-MIMO and 64 TxRU BS antenna, it is observed from (MediaTek, Ericsson, Qualcomm, China Unicom) that the mean capacity performances are in the range of 17.5~32.9.

For FR1, Urban Macro, DL, with 100MHz bandwidth for CG traffic model, 8Mbps, 15ms PDB, 60 FPS, with MU-MIMO and 64 TxRU BS antenna, it is observed from (Ericsson, Qualcomm) that the mean capacity performances are in the range of 23.8, >36.

For FR1, Urban Macro, DL, with 100MHz bandwidth for CG traffic model, 30Mbps, 15ms PDB, 60 FPS, with SU-MIMO and 64 TxRU BS antenna, it is observed from (Huawei, vivo, MediaTek, Ericsson, Qualcomm, FUTUREWEI, China Unicom) that the mean capacity performances are 8.36 in the range of 5.4~10.33.

For FR1, Urban Macro, DL, with 100MHz bandwidth for CG traffic model, 30Mbps, 15ms PDB, 60 FPS, with MU-MIMO, it is observed from (Huawei, vivo, Ericsson, Qualcomm, ZTE, FUTUREWEI) that the mean capacity performances are 11.59 in the range of 8~14.33.

#### FR1 UL

This section captures the capacity baseline performance evaluation results of FR1 UL.

**Summary of UL capacity evaluation results in FR1**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Scenario | App | PDB (ms) | Bit rate (Mbps) | FPS | MIMO | Capacity result | | Source | Note |
| mean | range |
| DU | VR/CG (1 stream: Pose) | 10 | 0.2 | 250 | SU | - | 20 ~ 224.9 | vivo, MTK, Qualcomm, FUTUREWEI | Note 1 |
| SU | 39.9 | 39.9 | Ericsson | Note 1,4 |
| SU | 45.77 | 45.77 | Nokia | Note 2 |
| MU | - | >15 ~ >240 | Huawei, Qualcomm | Note 1 |
| AR (1 stream: Scene) | 30 | 10 | 60 | SU | 7.80 | 4.5 ~ 9.49 | vivo, MTK, Qualcomm, Intel | Note 1 |
| SU | 7.45 | 7.4~7.5 | Ericsson, FUTUREWEI | Note 1,4 |
| SU | 4.77 | 4.77 | Nokia | Note 2,3 |
| MU | 9.20 | 7.3~ 10.9 | Huawei, ZTE, Qualcomm, Intel | Note 1 |
| MU | 2.3 | 2.3 | Interdigital | Note 2,3 |
| 10 | MU | 0 | <1 | Huawei | Note 1 |
| 15 | MU | 5.4 | 5.4 | Huawei | Note 1 |
| 60 | MU | 8.3 | 8.3 | Huawei | Note 1 |
| 30 | 20 | 60 | MU | 3.4 | 3.4 | ZTE | Note 1 |
| AR (2 streams: Pose + Scene) | 10 (Pose),  30 (Scene) | 0.2 (Pose)  10 (Scene) | 250 (Pose)  60 (Scene) | SU | 4.37 | 2.6~ 7.43 | vivo, Ericsson, Qualcomm, Intel | Note 1 |
| MU | 3.96 | 1.5 ~ 5.8 | Huawei, Qualcomm, Intel | Note 1 |
| MU | 0 | 0 | Interdigital | Note 2 |
| AR (3 streams: Video +audio +Pose) | 10 (Pose),  30 (video),  10 (audio) | 0.2 (Pose)  10 (video)  1.12 (audio) | 250 (Pose)  60 (video)  100 (audio) | SU | 3.2 | 3 | Apple | Note 2 |
| AR (3 streams: Pose + I/P-stream) | 10 (Pose),  30 (I),  30 (P) | 0.2 (Pose)  10 (I+P) | 250 (Pose)  60 (I+P) | MU | 3.5 | 3.5 | Huawei | Note 1 |
| InH | VR/CG (1 stream: Pose) | 10 | 0.2 | 250 | SU | - | 20 ~ 198 | vivo, Nokia, MTK, Qualcomm |  |
| SU | - | >12~>40 | Ericsson, CATT | Note4 |
| MU | - | >40~>240 | ZTE, Qualcomm |  |
| AR (1 stream: Scene) | 30 | 10 | 60 | SU | 7.81 | 4.4 ~ 13.95 | vivo, MTK, Qualcomm |  |
| SU | 4.66 | 4.66 | Nokia | Note3 |
| SU | 6.05 | 6~6.1 | Ericsson, CATT | Note4 |
| MU | 9.3 | 7.1 ~ 11.5 | Interdigital, Qualcomm |  |
| 2 streams: Pose + Scene | 10 (Pose),  30 (Scene) | 0.2 (Pose)  10 (Scene) | 250 (Pose)  60 (Scene) | SU | 6.95 | 4.05 ~ 12.71 | vivo, Qualcomm, Nokia |  |
| SU | 5.8 | 5.8 | Ericsson | Note4 |
| MU | 7.3 | 7.2 ~ 7.4 | Interdigital, Qualcomm |  |
| 3 streams: Video + audio +Pose | 10 (Pose),  30 (video),  10 (audio) | 0.2 (Pose)  10 (video)  1.12 (audio) | 250 (Pose)  60 (video)  100 (audio) | SU | 4.1 | 4 | Apple |  |
| UMa | VR/CG (1 stream: Pose) | 10 | 0.2 | 250 | SU | - | 20 ~143 | vivo, MTK, Qualcomm, FUTUREWEI | Note 1 |
| SU | 17.4 | 17.4 | Ericsson | Note 1,4 |
| MU | - | >15 ~ >240 | Huawei, Qualcomm | Note 1 |
| AR (1 stream: Scene) | 30 | 10 | 60 | SU | - | 0 ~ 1.34 | vivo, MTK, Qualcomm, FUTUREWEI | Note 1 |
| SU | - | <1 | Ericsson | Note 1,4 |
| MU | 0 | 0 ~ <1 | Huawei, Qualcomm | Note 1 |
| AR (2 streams: pose + scene) | 10 (Pose),  30 (Scene) | 0.2 (Pose)  10 (Scene) | 250 (Pose)  60 (Scene) | SU | 0 | 0 | Qualcomm | Note 1 |
| SU | - | <1 | Ericsson | Note 1,4 |
| MU | 0 | 0 | Qualcomm | Note 1 |
| MU | - | <1 | Ericsson | Note 1,4 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2)  Note 3: With jitter  Note 4: DDDUU | | | | | | | | |  |

##### DU Scenario

###### VR/CG (Pose/control-stream)

**Observation:**

For FR1, Dense Urban, UL, with 100MHz bandwidth for VR/CG Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS, with SU-MIMO and 64 TxRU BS antenna, it is observed from (vivo, Qualcomm, MediaTek, FUTUREWEI) that capacity performances are in the range of 20~224.9.

For FR1, Dense Urban, UL, with 100MHz bandwidth for VR/CG Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS, with MU-MIMO and 64 TxRU BS antenna, it is observed from (Qualcomm, Huawei) that capacity performances are in the range of >15~>240.

For FR1, Dense Urban, UL, with 100MHz bandwidth for VR/CG Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS, with SU-MIMO and 32 TxRU BS antenna, it is observed from (Nokia) that capacity performances are 45.77.

For FR1, Dense Urban, UL, with 100MHz bandwidth for VR/CG Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS, with SU-MIMO, 64 TxRU BS antenna and DDDUU, it is observed from (Ericsson) that capacity performances are 39.9.

###### AR (1 stream: Scene/video/data/voice-stream)

For FR1, Dense Urban, UL, with 100MHz bandwidth for AR single-stream (Scene/video/data/ audio -stream, 10Mbps, 30ms PDB, 60FPS), with SU-MIMO and 64 TxRU BS antenna, it is observed from (vivo, Qualcomm, MediaTek, Intel) that the mean capacity performances are 7.80 in the range of 4.5~ 9.49.

For FR1, Dense Urban, UL, with 100MHz bandwidth for AR single-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS), with MU-MIMO and 64 TxRU BS antenna, it is observed from (ZTE, Qualcomm, Huawei, Intel) that the mean capacity performances are 9.20 in the range of 7.3~10.9.

For FR1, Dense Urban, UL, with 100MHz bandwidth for AR single-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS), with MU-MIMO, 64 TxRU BS antenna and DDDUU, it is observed from (Ericsson, Futurewei) that the mean capacity performances are 7.45 in the range of 7.4~7.5.

For FR1, Dense Urban, UL, with 100MHz bandwidth for AR single-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS), with SU-MIMO and 32 TxRU BS antenna, it is observed from (Nokia) that the capacity performances are 4.77.

For FR1, Dense Urban, UL, with 100MHz bandwidth for AR single-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS), with MU-MIMO and 32 TxRU BS antenna, it is observed from (Interdigital) that the capacity performances are 2.3.

For FR1, Dense Urban, UL, with 100MHz bandwidth for AR single-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS), with MU-MIMO and 64 TxRU BS antenna, it is observed from (Huawei) that the capacity performances are <1.

For FR1, Dense Urban, UL, with 100MHz bandwidth for AR single-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS), with MU-MIMO and 64 TxRU BS antenna, it is observed from (Huawei) that the capacity performances are 5.4.

For FR1, Dense Urban, UL, with 100MHz bandwidth for AR single-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS), with MU-MIMO and 64 TxRU BS antenna, it is observed from (Huawei) that the capacity performances are 8.3.

###### AR (2 streams: Pose/control-stream + scene/video/data/voice-stream)

For FR1, Dense Urban, UL, with 100MHz bandwidth for AR two-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS + Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS), with SU-MIMO and 64 TxRU BS antenna, it is observed from (vivo, Qualcomm, Ericsson, Intel) that the mean capacity performances are 4.37 in the range of 2.6~7.43.

For FR1, Dense Urban, UL, with 100MHz bandwidth for AR two-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS + Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS), with MU-MIMO and 64 TxRU BS antenna, it is observed from (Qualcomm, Huawei, Intel) that the mean capacity performances are 3.96 in the range of 1.5~5.8.

For FR1, Dense Urban, UL, with 100MHz bandwidth for AR two-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS + Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS), with MU-MIMO and 32 TxRU BS antenna, it is observed from (Interdigital) that the capacity performances are 0.

###### AR (3 streams: Video stream+Data/audio stream+Pose/control stream)

For FR1, Dense Urban, UL, with 100MHz bandwidth for AR three-stream (Video-stream, 10Mbps, 30ms PDB, 60FPS + Audio/data-stream, 1.12Mbps, 10ms PDB, 100FPS + Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS), with SU-MIMO and 32 TxRU BS antenna, it is observed from (Apple) that the capacity performances are 3.

###### AR (3 streams: Pose/control-stream + I/P-stream)

For FR1, Dense Urban, UL, with 100MHz bandwidth for AR three-stream (I/P-stream, 10Mbps, 30ms PDB, 60FPS + Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS), with MU-MIMO and 64 TxRU BS antenna, it is observed from (Huawei) that the capacity performances are 3.5.

##### InH Scenario

###### VR/CG (Pose/control-stream)

For FR1, Indoor Hotspot, UL, with 100MHz bandwidth for VR/CG Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS, with SU-MIMO, it is observed from (vivo, Qualcomm, Nokia, MediaTek) that capacity performances are in the range of 20~198.

For FR1, Indoor Hotspot, UL, with 100MHz bandwidth for VR/CG Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS, with MU-MIMO, it is observed from (Qualcomm, ZTE) that capacity performances are in the range of >40~>240.

For FR1, Indoor Hotspot, UL, with 100MHz bandwidth for VR/CG Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS, with SU-MIMO and DDDUU, it is observed from (Ericsson, CATT) that the capacity performances are in the range of >12~>40.

###### AR (1 stream: Scene/video/data/voice-stream)

For FR1, Indoor Hotspot, UL, with 100MHz bandwidth for AR single-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS), with SU-MIMO, it is observed from (vivo, Qualcomm, MediaTek) that the mean capacity performances are 7.81 in the range of 4.4~13.95.

For FR1, Indoor Hotspot, UL, with 100MHz bandwidth for AR single-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS), with MU-MIMO, it is observed from (Qualcomm, Interdigital) that the mean capacity performances are 9.3 in the range of 7.1~11.5.

For FR1, Indoor Hotspot, UL, with 100MHz bandwidth for AR single-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS), with SU-MIMO and DDDUU, it is observed from (Ericsson, CATT) that the mean capacity performances are 6.05 in the range of 6~6.1.

For FR1, Indoor Hotspot, UL, with 100MHz bandwidth for AR single-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS), with SU-MIMO and with jitter, it is observed from (Nokia) that the capacity performances are 4.66.

###### AR (2 streams: Pose/control-stream + scene/video/data/voice-stream)

For FR1, Indoor Hotspot, UL, with 100MHz bandwidth for AR two-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS + Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS), with SU-MIMO, it is observed from (vivo, Qualcomm, Nokia) that the mean capacity performances are 6.95 in the range of 4.05~12.71.

For FR1, Indoor Hotspot, UL, with 100MHz bandwidth for AR two-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS + Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS), with MU-MIMO, it is observed from (Qualcomm, Interdigital) that the mean capacity performances are 7.3 in the range of 7.2~7.4.

For FR1, Indoor Hotspot, UL, with 100MHz bandwidth for AR two-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS + Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS), with SU-MIMO and DDDUU, it is observed from (Ericsson) that the capacity performances are 5.8.

###### AR (3 streams: Video stream+Data/audio stream+Pose/control stream)

For FR1, Indoor Hotspot, UL, with 100MHz bandwidth for AR three-stream (Video-stream, 10Mbps, 30ms PDB, 60FPS + Audio/data-stream, 1.12Mbps, 10ms PDB, 100FPS + Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS), with SU-MIMO and 32 TxRU BS antenna, it is observed from (Apple) that the capacity performances are 4.

##### UMa Scenario

###### VR/CG (Pose/control-stream)

For FR1, Urban Macro, UL, with 100MHz bandwidth for VR/CG Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS, with SU-MIMO and 64 TxRU BS antenna, it is observed from (vivo, Qualcomm, MediaTek, FUTUREWEI) that capacity performances are in the range of 20~143.

For FR1, Urban Macro, UL, with 100MHz bandwidth for VR/CG Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS, with MU-MIMO and 64 TxRU BS antenna, it is observed from (Qualcomm, Huawei) that capacity performances are in the range of >15~>240.

For FR1, Urban Macro, UL, with 100MHz bandwidth for VR/CG Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS, with SU-MIMO, 64 TxRU BS antenna and DDDUU, it is observed from (Ericsson) that capacity performances are 17.4.

###### AR (1 stream: Scene/video/data/voice-stream)

For FR1, Urban Macro, UL, with 100MHz bandwidth for AR single-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS), with SU-MIMO and 64 TxRU BS antenna, it is observed from (vivo, Qualcomm, MediaTek, Futurewei, Ericsson) that the capacity performances are in the range of 0~1.34.

For FR1, Urban Macro, UL, with 100MHz bandwidth for AR single-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS), with MU-MIMO and 64 TxRU BS antenna, it is observed from (Qualcomm, Huawei) that the capacity performances are in the range of 0~<1.

###### AR (2 streams: Pose/control-stream + scene/video/data/voice-stream)

For FR1, Urban Macro, UL, with 100MHz bandwidth for AR two-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS + Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS), with SU-MIMO and 64 TxRU BS antenna, it is observed from (Qualcomm, Ericsson) that the capacity performances are in the range of 0~<1.

For FR1, Urban Macro, UL, with 100MHz bandwidth for AR two-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS + Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS), with MU-MIMO and 64 TxRU BS antenna, it is observed from (Qualcomm) that the capacity performances are 0.

#### FR2 DL

This section captures the capacity baseline performance evaluation results of FR2 DL.

**Summary of FR2 DL capacity evaluation results for single stream (100MHz bandwidth)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Scenario | App | PDB (ms) | Bit rate | Fps | MIMO | Capacity result | | Source | Note |
| mean | range |
| DU | AR/VR | 10 | 45 | 60 | SU | 5.71 | 3.94~8.2 | vivo, Qualcomm, Nokia | Note 1 |
| SU | 2.25 | 2~2.5 | Ericsson, Qualcomm | Note 1 3 |
| SU | 4.7 | 4.7 | MTK | Note 2 |
| 120 | SU | 10.32 | 10.32 | vivo | Note 1 |
| 30 | 60 | SU | 8.93 | 6.35~13.44 | vivo, Qualcomm, Nokia | Note 1 |
| SU | 4.85 | 4.2~5.5 | Ericsson, Qualcomm | Note 1,3 |
| SU | 10 | 10 | MTK | Note 2 |
| 120 | SU | 16.28 | 16.28 | vivo | Note 1 |
| CG | 15 | 30 | 60 | SU | 9.38 | 5.1~16.16 | vivo, Nokia, Ericsson, Qualcomm | Note 1 |
| SU | 11 | 11 | MTK | Note 2 |
| SU | 32.5 | 32.5 | Qualcomm | Note 1 |
| SU | >20 | >20 | MTK | Note 2 |
| InH | AR/VR | 10 | 45 | 60 | SU | 4.74 | 3.2~6.09 | vivo, Nokia, Ericsson, Qualcomm | Note 1 |
| SU | 2.5 | 2.5 | Qualcomm | Note 1, 3 |
| SU | 4.7 | 4.7 | MTK | Note 2 |
| 120 | SU | 6.03 | 6.03 | vivo | Note 1 |
| 30 | 60 | SU | 8.02 | 6.2~10.17 | vivo, Qualcomm, Ericsson, Nokia | Note 1 |
| SU | 5.5 | 5.5 | Qualcomm | Note 1, 3 |
| SU | 8.9 | 7.8~ 10 | ZTE, MTK | Note 2 |
| SU | 7.8 | 7.8 | ZTE, Sanechips | Note 2, 4 |
| 120 | SU | 10.23 | 10.23 | vivo |  |
| CG | 15 | 30 | 60 | SU | 8.94 | 6.9~11.45 | vivo, Ericsson, Qualcomm, Nokia | Note 1 |
| SU | 10.45 | 9.9~ 11 | ZTE, MTK | Note 2 |
| SU | 9.9 | 9.9 | ZTE, Sanechips | Note 2, 4 |
| 8 | 60 | SU | 29.5 | 28~31 | Ericsson, Qualcomm | Note 1 |
| SU | >20 | >20 | MTK | Note 2 |
| Note 1: UE Antenna parameters: Option 1: (M, N, P)=(1, 4, 2), 3 panels (left, right, top)  Note 2: UE Antenna parameters: Option 2: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2), (dH,dV) = (0.5, 0.5)λ  Note 3: DDDUU  Note 4: 64 QAM | | | | | | | | | |

**Summary of FR2 DL capacity evaluation results for single stream (400MHz bandwidth)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Scenario | App | PDB (ms) | Bit rate | Fps | MIMO | Capacity result | | Source | Note |
|  |  |  |  | mean | data |  |  |
| DU | AR/VR | 10 | 45 | 60 | SU | 33.20 | 22.5~43.89 | vivo, Qualcomm | Note 2 |
| SU | 16.5 | 16.5 | Qualcomm | Note 1, 2 |
| 30 | 60 | SU | 30 | 30 | Qualcomm | Note 2 |
| SU | 21.5 | 21.5 | Qualcomm | Note 1, 2 |
| CG | 15 | 30 | 60 | SU | 32.5 | 32.5 | Qualcomm | Note 2 |
| 8 | 60 | SU | >45 | >45 | Qualcomm | Note 2 |
| InH | AR/VR | 10 | 45 | 60 | SU | 19 | 19 | Qualcomm | Note 1, 2 |
| SU | 27 | 27 | Qualcomm | Note 2 |
| 30 | 60 | SU | 34 | 34 | Qualcomm | Note 2 |
| SU | 34 | 34 | Qualcomm | Note 2 |
| CG | 15 | 30 | 60 | SU | 32 | 32 | Qualcomm | Note 2 |
| 8 | 60 | SU | 44 | 44 | Qualcomm | Note 2 |
| Note 1: DDDUU  Note 2: UE Antenna parameters: Option 1: (M, N, P) = (1, 4, 2), 3 panels (left, right, top) | | | | | | | | | |

**Summary of FR2 DL capacity evaluation results for multi stream (Video + Audio/data)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Scenario | Video data rate | Video PDB (ms) | Audio data rate | Audio PDB  (ms) | MIMO | Capacity result | | Source | Note |
| mean | data |
| DU | 30 | 10 | 0.756 | 30 | SU | 6 | 6 | Qualcomm | Note1 |
| SU | 3.5 | 3.5 | Qualcomm | Note1,2 |
| InH | 30 | 10 | 0.756 | 30 | SU | 6 | 6 | Qualcomm | Note1 |
| SU | 4 | 4 | Qualcomm | Note1,2 |
| Note 2: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top)  Note 3: DDDUU | | | | | | | | | |

**Summary of FR2 DL capacity evaluation results for multi stream (I/P Frame Traffic Model)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Scenario | Traffic model | App | Bit rate | Alpha | MIMO | Capacity result | | Source | Note |
| mean | data |
| InH | **GOP-Based I/P Frame** | VR/AR | 30 Mbps | 1.5 | SU | 5.37 | 5.37 | vivo | Note 1 |
| 2 | SU | 3.53 | 3.53 | vivo | Note 1 |
| 3 | SU | 2.29 | 2.29 | vivo | Note 1 |
| **Slice-Based I/P Frame** | VR/AR | 30 Mbps | 1.5 | SU | 8.23 | 8.23 | vivo | Note 1 |
| 2 | SU | 8.24 | 8.24 | vivo | Note 1 |
| 3 | SU | 8.23 | 8.23 | vivo | Note 1 |
| Note 1: [PDB\_I, PDB\_P] = [10, 10]; [PER\_I, PER\_P] = [1%, 1%] | | | | | | | | | |

##### DU Scenario

###### VR/AR

Single stream traffic model

For FR2, Dense Urban DL, with 100MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO and Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), 30Mbps, 10ms PDB, 60 FPS, it is observed from (Nokia, vivo, Qualcomm) that mean capacity performances are 8.93 in the range of 6.35~13.44.

For FR2, Dense Urban DL, with 100MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO and Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), 30Mbps, DDDUU, 10ms PDB, 60 FPS, it is observed from (Nokia, vivo, Qualcomm) that mean capacity performances are 4.85 in the range of 4.2~5.5.

For FR2, Dense Urban DL, with 100MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO and Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), 45Mbps, 10ms PDB, 60 FPS, it is observed from (Nokia, vivo, Qualcomm) that mean capacity performances are 5.71 in the range of 3.94~8.2.

For FR2, Dense Urban DL, with 100MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO and Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), 45Mbps, DDDUU, 10ms PDB, 60 FPS, it is observed from (Ericsson, Qualcomm) that mean capacity performances are 2.25 in the range of 2~2.5.

For FR2, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO, 10ms PDB, 60 FPS, 30Mbps, Option 2 UE Antenna parameters: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2), (dH,dV) = (0.5, 0.5)λ, it is observed from (MediaTek), the capacity performance is 10.

For FR2, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO, 10ms PDB, 120 FPS, 30Mbps, Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), it is observed from (vivo), the capacity performance is 16.28.

For FR2, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO, 10ms PDB, 60 FPS, 45Mbps, Option 2 UE Antenna parameters: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2), (dH,dV) = (0.5, 0.5)λ, it is observed from (MediaTek), the capacity performance is 4.7.

For FR2, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO, 10ms PDB, 120 FPS, 45Mbps, Option 2 UE Antenna parameters: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2), (dH,dV) = (0.5, 0.5)λ, it is observed from (MediaTek), the capacity performance is 10.32.

For FR2, Dense Urban, DL, with 400MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO, 10ms PDB, 60 FPS, 30Mbps, Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), it is observed from (Qualcomm), the capacity performance is 30.

For FR2, Dense Urban, DL, with 400MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO, 10ms PDB, 60 FPS, 30Mbps, DDDUU, Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), it is observed from (Qualcomm), the capacity performance is 21.5.

For FR2, Dense Urban, DL, with 400MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO, 10ms PDB, 60 FPS, 45Mbps, Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), it is observed from (vivo, Qualcomm) that mean capacity performances are 33.20 in the range of 22.5~43.89.

For FR2, Dense Urban, DL, with 400MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO, 10ms PDB, 60 FPS, 45Mbps and DDDUU, Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), it is observed from (Qualcomm), the capacity performance is 16.5.（新增）

Multi-stream traffic model

For FR2, Dense Urban, DL, with 100MHz bandwidth for Video + Audio/data multi-stream traffic mode, with SU-MIMO, 10ms Video PDB,30ms Audio PDB, Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), it is observed from (Qualcomm), the capacity performance is 6.

For FR2, Dense Urban, DL, with 100MHz bandwidth for Video + Audio/data multi-stream traffic mode, with SU-MIMO, 10ms Video PDB,30ms Audio PDB and DDDUU, it is observed from (Qualcomm), the capacity performance is 3.5.

###### CG

For FR2, Dense Urban DL, with 100MHz bandwidth for CG single-stream traffic mode, with SU-MIMO and Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), 30Mbps, 15ms PDB, 60 FPS, it is observed from (Nokia, vivo, Ericsson, Qualcomm) that mean capacity performances are 9.38 in the range of 5.1~16.16.

For FR2, Dense Urban, DL, with 100MHz bandwidth for CG single-stream traffic mode, with SU-MIMO, 15ms PDB, 60 FPS, 30Mbps, Option 2 UE Antenna parameters: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2), (dH,dV) = (0.5, 0.5)λ, DDDSU, it is observed from (Qualcomm), the capacity performance is 11.

For FR2, Dense Urban, DL, with 100MHz bandwidth for CG single-stream traffic mode, with SU-MIMO, 15ms PDB, 60 FPS, 8Mbps, Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), it is observed from (Qualcomm), the capacity performance is 32.5.

For FR2, Dense Urban, DL, with 100MHz bandwidth for CG single-stream traffic mode, with SU-MIMO, 15ms PDB, 60 FPS, 8Mbps, Option 2 UE Antenna parameters: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2), (dH,dV) = (0.5, 0.5)λ, it is observed from (MediaTek), the capacity performance is >20.

For FR2, Dense Urban, DL, with 400MHz bandwidth for CG single-stream traffic mode, with SU-MIMO, 15ms PDB, 60 FPS, 30Mbps and Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), it is observed from (MediaTek), the capacity performance is 32.5.

For FR2, Dense Urban, DL, with 400MHz bandwidth for CG single-stream traffic mode, with SU-MIMO, 15ms PDB, 60 FPS, 8Mbps, Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), it is observed from (Qualcomm), the capacity performance is >45.

##### InH Scenario

###### VR/AR

Single-stream traffic model

For FR2, Indoor Hotspot DL, with 100MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO and Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), 45Mbps, 10ms PDB, 60 FPS, it is observed from (vivo, Nokia, Ericsson, Qualcomm) that mean capacity performances are 4.74 in the range of 3.2~6.09.

For FR2, Indoor Hotspot DL, with 100MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO and Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), 30Mbps, 10ms PDB, 60 FPS, it is observed from (vivo, Qualcomm, Ericsson, Nokia) that mean capacity performances are 8.02 in the range of 6.2~10.17.

For FR2, Indoor Hotspot DL, with 100MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO and Option 2 UE Antenna parameters: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2), (dH,dV) = (0.5, 0.5)λ, 30Mbps, 10ms PDB, 60 FPS, it is observed from (ZTE, MTK) that mean capacity performances are 8.9 in the range of 7.8~10.

For FR2, Indoor Hotspot DL, with 100MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO, 10ms PDB, 60 FPS, 30Mbps, DDDUU and Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), it is observed from (Qualcomm), the capacity performance is 5.5.

For FR2, Indoor Hotspot DL, with 100MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO, 10ms PDB, 60 FPS, 30Mbps, Option 2 UE Antenna parameters: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2), (dH,dV) = (0.5, 0.5)λ, it is observed from (Qualcomm), the capacity performance is 7.8.

For FR2, Indoor Hotspot DL, with 100MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO, 10ms PDB, 120 FPS, 30Mbps, Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), it is observed from (vivo), the capacity performance is 10.23.

For FR2, Indoor Hotspot DL, with 100MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO, 10ms PDB, 60 FPS, 45Mbps, DDDUU, Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), it is observed from (Qualcomm), the capacity performance is 2.5.

For FR2, Indoor Hotspot DL, with 100MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO, 10ms PDB, 60 FPS, 45Mbps, Option 2 UE Antenna parameters: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2), (dH,dV) = (0.5, 0.5)λ, it is observed from (MediaTek), the capacity performance is 4.7.

For FR2, Indoor Hotspot DL, with 100MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO, 10ms PDB, 120 FPS, 45Mbps, Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), it is observed from (MediaTek), the capacity performance is 6.03.

For FR2, Indoor Hotspot DL, with 400MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO, 10ms PDB, 60 FPS, 30Mbps, DDDUU, Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), it is observed from (Qualcomm), the capacity performance is 25.

For FR2, Indoor Hotspot DL, with 400MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO, 10ms PDB, 60 FPS, 30Mbps, Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), it is observed from (Qualcomm), the capacity performance is 34.

For FR2, Indoor Hotspot DL, with 400MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO, 10ms PDB, 60 FPS, 45Mbps, Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), it is observed from (Qualcomm), the capacity performance is 27.

For FR2, Indoor Hotspot DL, with 400MHz bandwidth for VR/AR single-stream traffic mode, with SU-MIMO, 10ms PDB, 60 FPS, 45Mbps, DDDUU, Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), it is observed from (Qualcomm), the capacity performance is 19.

Multi-stream traffic model

For FR2, Indoor Hotspot DL, with 100MHz bandwidth for GOP-Based I/P Frame Traffic Model, with SU-MIMO,30Mbps, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [1%, 1%], it is observed from (vivo), the capacity performance is 5.73 with alpha = 1.5.

For FR2, Indoor Hotspot DL, with 100MHz bandwidth for GOP-Based I/P Frame Traffic Model, with SU-MIMO,30Mbps, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [1%, 1%], it is observed from (vivo), the capacity performance is 3.53 with alpha = 2.

For FR2, Indoor Hotspot DL, with 100MHz bandwidth for GOP-Based I/P Frame Traffic Model, with SU-MIMO,30Mbps, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [1%, 1%], it is observed from (vivo), the capacity performance is 2.29 with alpha = 3.

For FR2, Indoor Hotspot DL, with 100MHz bandwidth for Slice-Based I/P Frame Traffic Model, with SU-MIMO,30Mbps, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [1%, 1%], it is observed from (vivo), the capacity performance is 8.23 with alpha = 1.5.

For FR2, Indoor Hotspot DL, with 100MHz bandwidth for Slice-Based I/P Frame Traffic Model, with SU-MIMO,30Mbps, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [1%, 1%], it is observed from (vivo), the capacity performance is 8.24 with alpha = 2.

For FR2, Indoor Hotspot DL, with 100MHz bandwidth for Slice-Based I/P Frame Traffic Model, with SU-MIMO,30Mbps, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [1%, 1%], it is observed from (vivo), the capacity performance is 8.23 with alpha = 3.

###### CG

For FR2, Indoor Hotspot DL, with 100MHz bandwidth for CG single-stream traffic mode, with SU-MIMO and Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), 30Mbps, 15ms PDB, 60 FPS, it is observed from (vivo, Ericsson, Qualcomm, Nokia) that mean capacity performances are 8.94 in the range of 6.9~11.45.

For FR2, Indoor Hotspot DL, with 100MHz bandwidth for CG single-stream traffic mode, with SU-MIMO and Option 2 UE Antenna parameters: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2), (dH,dV) = (0.5, 0.5)λ, 30Mbps, 15ms PDB, 60 FPS, it is observed from (vivo, Ericsson, Qualcomm, Nokia) that mean capacity performances are 10.45 in the range of 9.9~11.

For FR2, Indoor Hotspot DL, with 100MHz bandwidth for CG single-stream traffic mode, with SU-MIMO and Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), 8Mbps, 15ms PDB, 60 FPS, it is observed from (Ericsson, Qualcomm) that mean capacity performances are 29.5 in the range of 28~31.

For FR2, Indoor Hotspot DL, with 100MHz bandwidth for CG single-stream traffic mode, with SU-MIMO, 15ms PDB, 60 FPS, 30Mbps, Option 2 UE Antenna parameters: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2), (dH,dV) = (0.5, 0.5)λ, it is observed from (ZTE), the capacity performance is 9.9.

For FR2, Indoor Hotspot DL, with 100MHz bandwidth for CG single-stream traffic mode, with SU-MIMO, 15ms PDB, 60 FPS, 8 Mbps, Option 2 UE Antenna parameters: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2), (dH,dV) = (0.5, 0.5)λ, it is observed from (MediaTek), the capacity performance is >20.

For FR2, Indoor Hotspot DL, with 400MHz bandwidth for CG single-stream traffic mode, with SU-MIMO, 15ms PDB, 60 FPS, 30 Mbps, Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), it is observed from (Qualcomm), the capacity performance is 32.

For FR2, Indoor Hotspot DL, with 400MHz bandwidth for CG single-stream traffic mode, with SU-MIMO, 15ms PDB, 60 FPS, 8 Mbps, Option 1 UE Antenna parameters: (M, N, P) = (1, 4, 2), 3 panels (left, right, top), it is observed from (Qualcomm), the capacity performance is 44.

#### FR2 UL

This section captures the capacity baseline performance evaluation results of FR2 UL.

**Summary of UL capacity evaluation results in FR2**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Scenario | App | PDB (ms) | Bit rate (Mbps) | Fps | MIMO | Capacity result | | Source | Note |
| mean | range |
| DU | VR/CG (Pose/control-stream) | 10 | 0.2 | 250 | SU | 20 | 20 | Source 18, vivo | Note 1 |
| SU | 7.5 | 7.5 | Source 16, Qualcomm | Note 1,2,3 |
| SU | 18.5 | 18.5 | Source 16, Qualcomm | Note 1,2,4,6 |
| SU | >30 | >30 | Source 14, MediaTek | Note 5 |
| AR (1 stream: Scene/video/data/voice-stream) | 30 | 10 | 60 | SU | 8.3 | 8.3 | Source 18, vivo | Note 1 |
| SU | 1.29 | 1.29 | Source 14, MediaTek | Note 5 |
| SU | 9 | 9 | Source 16, Qualcomm | Note 1,6 |
| 15 | 20 | SU | 3.5 | 3.5 | Source 16, Qualcomm | Note 1,6 |
| 30 | SU | 5 | 5 | Source 16, Qualcomm | Note 1,6 |
| 60 | SU | 5 | 5 | Source 16, Qualcomm | Note 1,6 |
| AR (2 streams: Pose/control-stream + scene/video/data/voice-stream) | 10 (Pose),  30 (Scene) | 0.2 (Pose)  10 (Scene) | 250 (Pose)  60 (Scene) | SU | 1.5 | 1.5 | Source 16, Qualcomm | Note 1,6 |
| SU | 4.5 | 4.5 | Source 16, Qualcomm | Note 1 |
| 0.2 (Pose)  20 (Scene) | SU | 2 | 2 | Source 16, Qualcomm | Note 1,6 |
| InH | VR/CG (Pose/control-stream) | 10 | 0.2 | 250 | SU | 20 | 20 | Source 18, vivo | Note 1 |
| SU | 7 | 7 | Source 16, Qualcomm | Note 1,2,3 |
| SU | 19 | 19 | Source 16, Qualcomm | Note 1,2,4,6 |
| SU | 12.09 | 12.09 | Source 14, MediaTek | Note 5 |
| AR (1 stream: Scene/video/data/voice-stream) | 30 | 10 | 60 | SU | 8.59 | 8.59 | Source 18, vivo | Note 1 |
| 1 | 1 | Source 14, MediaTek | Note 5 |
| 10 | 10 | Source 16, Qualcomm | Note 1,6 |
| 15 | 20 | SU | 5 | 5 | Source 16, Qualcomm | Note 1,6 |
| 30 | SU | 6 | 6 | Source 16, Qualcomm | Note 1,6 |
| 60 | SU | 6 | 6 | Source 16, Qualcomm | Note 1,6 |
| AR (2 streams: Pose/control-stream + scene/video/data/voice-stream) | 10 (Pose),  30 (Scene) | 0.2 (Pose)  10 (Scene) | 250 (Pose)  60 (Scene) | SU | 5 | 5 | Source 16, Qualcomm | Note 1,6 |
| SU | 2.5 | 2.5 | Source 16, Qualcomm | Note 1 |
| 0.2 (Pose)  20 (Scene) | SU | 3.5 | 3.5 | Source 16, Qualcomm | Note 1,6 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top)  Note 2: Regular slot  Note 3: Full antena  Note 4: FDM/SDM  Note 5: UE antenna configuraiton: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2)  Note 6: DDDUU | | | | | | | | | |

##### DU Scenario

###### VR/CG (Pose/control-stream)

For FR2, Dense Urban, UL, for VR/CG (Pose/control-stream, 0.2Mbps data rate, 10ms PDB, 250 FPS),

* With Option 1 UE antenna configuration, TDD frame structure DDDSU, it is observed from (vivo), the capacity performance is 20.
* With Option 1 UE antenna configuration, TDD frame structure DDDSU, it is observed from (Qualcomm), the capacity performance is 7.5.
* With Option 1 UE antenna configuration, TDD frame structure DDDUU, it is observed from (Qualcomm), the capacity performance is 18.5.
* With Option 2 UE antenna configuration, TDD frame structure DDDSU, it is observed from (MediaTek), the capacity performance is >30.

###### AR (1 stream: Scene/video/data/voice-stream)

For FR2, Dense Urban, UL, for AR 1-stream (scene/video/data/voice-stream, 10Mbps data rate, 30ms PDB, 60FPS),

* With Option 1 UE antenna configuration, TDD frame structure DDDSU, it is observed from (vivo), the capacity performance is 8.3.
* With Option 1 UE antenna configuration, TDD frame structure DDDUU, it is observed from (Qualcomm), the capacity performance is 1.29.
* With Option 2 UE antenna configuration, TDD frame structure DDDSU, it is observed from (MediaTek), the capacity performance is 9.

For FR2, Dense Urban, UL, for AR 1-stream (scene/video/data/voice-stream, 20Mbps data rate, 30ms PDB, 60FPS),

* With Option 1 UE antenna configuration, TDD frame structure DDDUU, it is observed from (Qualcomm), the capacity performance is 5.

###### AR (2 streams: Pose/control-stream + scene/video/data/voice-stream)

For FR2, Dense Urban, UL, for AR 2-stream (Pose/control-stream with 0.2Mbps data rate, 10ms PDB, 250FPS and scene/video/ data/voice-stream with 10Mbps data rate, 30ms PDB, 60FPS),

* With TDD frame structure DDDSU, it is observed from (Qualcomm), the capacity performance is 1.5.
* With TDD frame structure DDDUU, it is observed from (Qualcomm), the capacity performance is 4.5.

For FR2, Dense Urban, UL, for AR 2-stream (Pose/control-stream with 0.2Mbps data rate, 10ms PDB, 250FPS and scene/video/ data/voice-stream with 20Mbps data rate, 30ms PDB, 60FPS),

* With TDD frame structure DDDUU, it is observed from (Qualcomm), the capacity performance is 2.

##### InH Scenario

###### VR/CG (Pose/control-stream)

For FR2, Indoor Hotspot, UL, for VR/CG (Pose/control-stream, 0.2Mbps data rate, 10ms PDB, 250 FPS),

* With Option 1 UE antenna configuration, TDD frame structure DDDSU, it is observed from (vivo), the capacity performance is 20.
* With Option 1 UE antenna configuration, TDD frame structure DDDSU, it is observed from (Qualcomm), the capacity performance is 7.
* With Option 1 UE antenna configuration, TDD frame structure DDDUU, it is observed from (Qualcomm), the capacity performance is 19.
* With Option 2 UE antenna configuration, TDD frame structure DDDSU, it is observed from (MediaTek), the capacity performance is 12.09.

###### AR (1 stream: Scene/video/data/voice-stream)

For FR2, Indoor Hotspot, UL, for AR 1-stream (scene/video/data/voice-stream, 10Mbps data rate, 30ms PDB, 60FPS),

* With Option 1 UE antenna configuration, TDD frame structure DDDSU, it is observed from (vivo), the capacity performance is 8.59.
* With Option 1 UE antenna configuration, TDD frame structure DDDUU, it is observed from (Qualcomm), the capacity performance is 1.
* With Option 2 UE antenna configuration, TDD frame structure DDDSU, it is observed from (MediaTek), the capacity performance is 10.

For FR2, Indoor Hotspot, UL, for AR 1-stream (scene/video/data/voice-stream, 20Mbps data rate, 30ms PDB, 60FPS),

* With Option 1 UE antenna configuration, TDD frame structure DDDUU, it is observed from (Qualcomm), the capacity performance is 6.

###### AR (2 streams: Pose/control-stream + scene/video/data/voice-stream)

For FR2, Indoor Hotspot, UL, for AR 2-stream (Pose/control-stream with 0.2Mbps data rate, 10ms PDB, 250FPS and scene/video/ data/voice-stream with 10Mbps data rate, 30ms PDB, 60FPS),

* With TDD frame structure DDDSU, it is observed from (Qualcomm), the capacity performance is 2.5.
* With TDD frame structure DDDUU, it is observed from (Qualcomm), the capacity performance is 5.

For FR2, Indoor Hotspot, UL, for AR 2-stream (Pose/control-stream with 0.2Mbps data rate, 10ms PDB, 250FPS and scene/video/ data/voice-stream with 20Mbps data rate, 30ms PDB, 60FPS),

* With TDD frame structure DDDUU, it is observed from (Qualcomm), the capacity performance is 3.5.

### Capacity Comparison for Different Parameters/Configurations

#### Capacity Comparison for Different Data-rate

This section captures the capacity performance comparison for different data-rate.

**AR/VR application capacity comparison for different data-rate**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Case | App | PDB | Fps | Scenario | MIMO | Capacity result (30Mbps) | | Capacity result (45Mbps) | | Note |
| mean | range | mean | range |
| FR1  DL | AR/VR | 10ms | 60 | DU | SU | 8.46 | 5.1~10.6 | 4.58 | 1.7~6 | Note 1 |
| SU | 6.98 | 6.54~7.4 | 4.77 | 4.1~5 | Note2 |
| MU | 11.41 | 7 ~ 13.59 | 7.07 | 5.3~8.4 | Note 1 |
| MU | 3.9 | 3.9 | 2.4 | 2.4 | Note 2 |
| InH | SU | 7.33 | 5.2~8.5 | 4.44 | 3.27~5 |  |
| MU | 9.21 | 5~12 | 6.74 | 3.5~12 |  |
| UMa | SU | 6.26 | 4.4~8 | 3.62 | 1.8~4.7 | Note 1 |
| MU | 8.29 | 5.2~10 | 4.51 | 2.9~6 | Note 1 |
| FR2  DL | 10ms | 60 | DU | SU | 8.43 | 5.5~13.44 | 4.71 | 2~8.2 | Note 3 |
| InH | SU | 8.13 | 5.5~10.17 | 4.54 | 3~6.09 | Note 3 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2)  Note 3: UE Antenna parameters: Option 1: (M, N, P) =(1, 4, 2), 3 panels (left, right, top) | | | | | | | | | | |

**CG application capacity comparison for different data-rate**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Case | App | PDB | Fps | Scenario | MIMO | Capacity result (8Mbps) | | Capacity result (30Mbps) | | Note |
| mean | range | mean | range |
| FR1  DL | CG | 15ms | 60 | DU | SU |  | >20~>36 | 9.89 | 6.17~13 |  |
| MU |  | >36~56.6 | 14.22 | 7.47~19.65 |  |
| InH | SU |  | >20~>38.7 | 8.4 | 5.96~10.5 |  |
| MU |  | >38.7~44.1 | 11.96 | 7.2~16.2 |  |
| UMa | SU |  | 17.5~32.9 | 8 | 5.4~10.33 |  |
| MU |  | 23.8~>36 | 11.59 | 8~14.33 |  |
| FR2  DL | 15ms | 60 | DU | SU |  | >20, 32.5 | 7.8 | 5.1~16.16 |  |
| InH | InH SU |  | >20, 31 | 8.725 | 6~11.45 |  |
|  | | | | | | | | | | |

**Observations:**

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 10ms PDB, 60 FPS, with SU-MIMO and 64 TxRU BS antenna, it is observed that the capacity performances are decreased from 5.1~10.6 with 30Mbps to 1.7~6 with 45Mbps, and the mean capacity performances are decreased from 8.46 with 30Mbps to 4.58 with 45Mbps by about 45.9%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 10ms PDB, 60 FPS, with SU-MIMO and 32 TxRU BS antenna, it is observed that the capacity performances are decreased from 6.54~7.4 with 30Mbps to 4.1~5 with 45Mbps, and the mean capacity performances are decreased from 6.98 with 30Mbps to 4.77 with 45Mbps by about 31.7%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 10ms PDB, 60 FPS, with MU-MIMO and 64 TxRU BS antenna, it is observed that the capacity performances are decreased from 7~13.59 with 30Mbps to 5.3~8.4 with 45Mbps, and the mean capacity performances are decreased from 11.41 with 30Mbps to 7.07 with 45Mbps by about 38.0%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 10ms PDB, 60 FPS, with MU-MIMO and 32 TxRU BS antenna, it is observed from (Interdigital) that the capacity performances are decreased from 3.9 with 30Mbps to 2.4 with 45Mbps by about 45.6%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for CG traffic model, 15ms PDB, 60 FPS, with SU-MIMO and 64 TxRU BS antenna, it is observed that the capacity performances are decreased from >20~>36 with 8Mbps to 6.17~13 with 30Mbps.

For FR1, Dense Urban, DL, with 100MHz bandwidth for CG traffic model, 15ms PDB, 60 FPS, with MU-MIMO and 64 TxRU BS antenna, it is observed that the capacity performances are decreased from >36~56.6 with 8Mbps to 7.47~19.65 with 30Mbps.

**Observations:**

For FR1, Indoor Hotspot, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 10ms PDB, 60 FPS, with SU-MIMO, it is observed that the capacity performances are decreased from 5.2~8.5 with 30Mbps to 3.27~5 with 45Mbps, and the mean capacity performances are decreased from 7.33 with 30Mbps to 4.44 with 45Mbps by about 39.4%.

For FR1, Indoor Hotspot, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 10ms PDB, 60 FPS, with SU-MIMO, it is observed that the capacity performances are decreased from 5~12 with 30Mbps to 3.5~12 with 45Mbps, and the mean capacity performances are decreased from 9.21 with 30Mbps to 6.74 with 45Mbps by about 43.8%.

For FR1, Indoor Hotspot, DL, with 100MHz bandwidth for CG traffic model, 15ms PDB, 60 FPS, with SU-MIMO, it is observed that the capacity performances are decreased from >20~>38.7 with 8Mbps to 5.96~10.5 with 30Mbps.

For FR1, Indoor Hotspot, DL, with 100MHz bandwidth for CG traffic model, 15ms PDB, 60 FPS, with MU-MIMO, it is observed that the capacity performances are decreased from >38.7~44.1 with 8Mbps to 7.2~16.2 with 30Mbps.

**Observations:**

For FR1, Urban Macro, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 10ms PDB, 60 FPS, with SU-MIMO, it is observed that the capacity performances are decreased from 4.4~8 with 30Mbps to 1.8~4.7 with 45Mbps, and the mean capacity performances are decreased from 6.26 with 30Mbps to 3.62 with 45Mbps by about 42.2%.

For FR1, Urban Macro, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 10ms PDB, 60 FPS, with SU-MIMO, it is observed that the capacity performances are decreased from 5.2~10 with 30Mbps to 2.9~6 with 45Mbps, and the mean capacity performances are decreased from 8.29 with 30Mbps to 4.51 with 45Mbps by about 45.6%.

For FR1, Urban Macro, DL, with 100MHz bandwidth for CG traffic model, 15ms PDB, 60 FPS, with SU-MIMO, it is observed that the capacity performances are decreased from 17.5~32.9 with 8Mbps to 5.4~10.33 with 30Mbps.

For FR1, Urban Macro, DL, with 100MHz bandwidth for CG traffic model, 15ms PDB, 60 FPS, with MU-MIMO, it is observed that the capacity performances are decreased from 23.8~>36 with 8Mbps to 8~14.33 with 30Mbps.

**Observations:**

For FR2, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 10ms PDB, 60 FPS, with SU-MIMO, it is observed that the capacity performances are decreased from 5.5~13.44 with 30Mbps to 2~8.2 with 45Mbps, and the mean capacity performances are decreased from 8.43 with 30Mbps to 4.71 with 45Mbps by about 44.13%.

For FR2, Dense Urban, DL, with 100MHz bandwidth for CG traffic model, 15ms PDB, 60 FPS, with SU-MIMO, it is observed that the capacity performances are decreased from >20, 32.5 with 8Mbps to 5.1~16.16 with 30Mbps.

For FR2, Dense Urban, DL, with 400MHz bandwidth for VR/AR single-stream traffic model, 10ms PDB, 60 FPS, with SU-MIMO, it is observed from (Qualcomm) that are decreased from 23.5 with 30Mbps to 19 with 45Mbps by about 19.1%.

For FR2, Dense Urban, DL, with 400MHz bandwidth for CG traffic model, 15ms PDB, 60 FPS, with SU-MIMO, it is observed from (Qualcomm) that are decreased from >30 with 8Mbps to 25 with 30Mbps.

**Observations:**

For FR2, Indoor Hotspot, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 10ms PDB, 60 FPS, with SU-MIMO, it is observed that the capacity performances are decreased from 5.5~10.17 with 30Mbps to 3~6.09 with 45Mbps, and the mean capacity performances are decreased from 8.13 with 30Mbps to 4.54 with 45Mbps by about 44.16%.

For FR2, Indoor Hotspot, DL, with 100MHz bandwidth for CG traffic model, 15ms PDB, 60 FPS, with SU-MIMO, it is observed that the capacity performances are decreased from >20, 31 with 8Mbps to 6~11.45 with 30Mbps.

For FR2, Indoor Hotspot, DL, with 400MHz bandwidth for VR/AR single-stream traffic model, 10ms PDB, 60 FPS, with SU-MIMO, it is observed from (Qualcomm) that are decreased from 26 with 30Mbps to 20.5 with 45Mbps by about 21.2%.

For FR2, Indoor Hotspot, DL, with 400MHz bandwidth for CG traffic model, 15ms PDB, 60 FPS, with SU-MIMO, it is observed from (Qualcomm) that are decreased from >30 with 8Mbps to 28 with 30Mbps.

**Observations:**

For FR2, Dense Urban, UL, with 100MHz bandwidth for AR 1-stream scene/video/data/voice-stream, it is observed from (Qualcomm) that the capacity performances are decreased from 9 with 10Mbps to 5 with 20Mbps by about 44.44%.

For FR2, Dense Urban, UL, with 100MHz bandwidth for AR 2-stream pose/control-stream and scene/video/ data/voice-stream, it is observed from (Qualcomm) that the capacity performances are decreased from 4.5 with video-stream 10Mbps to 2 with video-stream 20Mbps by about 55.56%.

**Observations:**

For FR2, Indoor Hotspot, UL, with 100MHz bandwidth for AR 1-stream scene/video/data/voice-stream, it is observed from (Qualcomm) that the capacity performances are decreased from 10 with 10Mbps to 6 with 20Mbps by about 40%.

For FR2, Indoor Hotspot, UL, with 100MHz bandwidth for AR 2-stream pose/control-stream and scene/video/ data/voice-stream, it is observed from (Qualcomm) that the capacity performances are decreased from 5 with video-stream 10Mbps to 3.5 with video-stream 20Mbps by about 30%.

#### Capacity Comparison for Different PDB/PER Values

This section captures the capacity performance comparison for different PDB/PER values. The definitions of PDB/PER refer to section 6.1.1.3 and 6.1.1.4.

**General single-stream capacity comparison for different PDB values**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Case | Data rate | Fps | Scenario | MIMO | Capacity result (10ms PDB) | | Capacity result (15ms PDB) | | Note |
| mean | range | mean | range |
| FR1  DL | 30Mbps | 60 | DU | SU | 7.72 | 4.05~10.6 | 9.34 | 5.57~13 |  |
| MU | 10.19 | 3.9~13.59 | 13.25 | 5~19.65 |  |
| InH | SU | 6.97 | 4.85~8.5 | 8.53 | 5.96~10.5 |  |
| MU | 9.21 | 5~12 | 11.96 | 7.2~16.2 |  |
| UMa | SU | 5.85 | 2.98~7.24 | 7.83 | 4.08~10.33 |  |
| MU | 8.40 | 5.2~10 | 11.59 | 8~14.33 |  |

**Source-specific single-stream capacity comparison for different PDB values**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Case | Data rate | Fps | Scenario | MIMO | Capacity result | | Capacity result | | Source | Note |
| PDB | capacity | PDB | capacity |
| FR1  DL | 30Mbps | 60 | DU | MU | 7ms | 6.3 | 10ms | 11.5 | Huawei |  |
| 7ms | 8.4 | 10ms | 12.3 | FUTUREWEI |  |
| 10ms | 11.5 | 13ms | 14.6 | Huawei |  |
| 10ms | 12.3 | 13ms | 14.7 | FUTUREWEI |  |
| InH | MU | 7ms | 8 | 10ms | 12 | CATT |  |
| 45Mbps | 60 | DU | SU | 10ms | 6.3~6.4 | 15ms | 6.3~6.4 | OPPO |  |
| FR2 DL | 30Mbps | 60 | DU | SU | 10ms | 13.44 | 15ms | 16.16 | vivo |  |
| 10ms | 10 | 15ms | 11 | MediaTek |  |
| 10ms | 6.35 | 15ms | 8.25 | Nokia |  |
| 10ms | 4.2 | 15ms | 5.1 | Ericsson |  |
| 10ms | 5.5 | 15ms | 6 | Qualcomm |  |
| 10ms | 23.5 | 15ms | 25 | Qualcomm | Note 1 |
| InH | SU | 10ms | 7.8 | 15ms | 9.9 | ZTE |  |
| 10ms | 8.72 | 15ms | 9.91 | vivo |  |
| 10ms | 10 | 15ms | 11 | MediaTek |  |
| 10ms | 10.17 | 15ms | 11.45 | Nokia |  |
| 10ms | 5.5 | 15ms | 6 | Qualcomm |  |
| 10ms | 26 | 15ms | 28 | Qualcomm | Note 1 |
| FR1 UL | 10Mbps | 60 | DU | MU | 10ms | <1 | 30ms | 8.1 | Huawei |  |
| 15ms | 5.4 | 30ms | 8.1 | Huawei |  |
| 30ms | 8.1 | 60ms | 8.3 | Huawei |  |
| FR2 UL | 20Mbps | 60 | DU | SU | 15 ms | 3.5 | 30ms | 5 | Qualcomm |  |
| InH | 15 ms | 5 | 30ms | 6 | Qualcomm |  |
| Note1: 400MHz bandwidth | | | | | | | | | | |

**Source-specific single-stream capacity comparison for different PER values**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Case | Data rate | PDB | Fps | Scenario | MIMO | Capacity result | | Capacity result | | Source | Note |
| PER | capacity | PER | capacity |
| FR1  DL | 30Mbps | 10ms | 60 | DU | MU | 0.5% | 9.9 | 1% | 11.5 | Huawei |  |
| 1% | 11.5 | 5% | 16.8 | Huawei |  |
| FR1 UL | 10Mbps | 30ms | 60 | DU | MU | 1% | 8.1 | 5% | 8.3 | Huawei |  |
| 1% | 8.1 | 10% | 8.4 | Huawei |  |
|  | | | | | | | | | | | |

##### Single-stream traffic model

**Observation:**

For FR1, Dense Urban, DL, with single stream traffic model, 30Mbps, 60FPS, with SU-MIMO, with PDB increase from 10ms to 15ms, it is observed from (Huawei, CEWiT, vivo, OPPO, Xiaomi, MediaTek, Nokia, Ericsson, Qualcomm, Intel, FUTUREWEI, CMCC, China Unicom) that capacity performances are increased from 4.05~10.6 to 5.57~13 and the mean capacity performances are increased from 7.72 to 9.34 by about 20.98%.

For FR1, Dense Urban, DL, with single stream traffic model, 30Mbps, 60FPS, with MU-MIMO, with PDB increase from 10ms to 15ms, it is observed from (Huawei, ZTE, vivo, CATT, Interdigital, Ericsson, Qualcomm, Intel, FUTUREWEI, CMCC, CEWiT) that capacity performances are increased from 3.9~13.59 to 5~19.65 and the mean capacity performances are increased from 10.19 to 13.25 by about 30.03 %.

For FR1, Indoor Hotspot, DL, with single stream traffic model, 30Mbps, 60FPS, with SU-MIMO, with PDB increase from 10ms to 15ms, it is observed from (vivo, Nokia, Ericsson, ITRI, Qualcomm, MediaTek, Xiaomi, CMCC) that capacity performances are increased from 4.85~8.5 to 5.96~10.5 and the mean capacity performances are increased from 6.97 to 8.53 by about 22.38%.

For FR1, Indoor Hotspot, DL, with single stream traffic model, 30Mbps, 60FPS, with MU-MIMO, with PDB increase from 10ms to 15ms, it is observed from (ZTE, vivo, CATT, Interdigital, Ericsson, Qualcomm, CMCC) that capacity performances are increased from 5~12 to 7.2~16.2 and the mean capacity performances are increased from 9.21 to 11.96 by about 29.86%.

For FR1, Urban Macro, DL, with single stream traffic model, 30Mbps, 60FPS, with SU-MIMO, with PDB increase from 10ms to 15ms, it is observed from (Huawei, CEWiT, vivo, Ericsson, Qualcomm, MediaTek, FUTUREWEI, China Unicom) that capacity performances are increased from 2.98~7.24 to 4.08~10.33 and the mean capacity performances are increased from 5.85 to 7.83 by about 33.85%.

For FR1, Urban Macro, DL, with single stream traffic model, 30Mbps, 60FPS, with MU-MIMO, with PDB increase from 10ms to 15ms, it is observed from (Huawei, vivo, Ericsson, Qualcomm, ZTE, FUTUREWEI) that capacity performances are increased from 5.2~10 to 8~14.33 and the mean capacity performances are increased from 8.40 to 11.59 by about 37.98%.

**Observations:**

For FR1, Dense Urban, DL, with single stream traffic model, 30Mbps, 60FPS, with MU-MIMO, with PDB decrease from 10ms to 7ms, it is observed from (Huawei, FUTUREWEI) that capacity performances are decreased from 11.5~12.3 to 6.3~8.4 and the mean capacity performances are decreased from 8.40 to 11.59 by about 38.2%.

For FR1, Dense Urban, DL, with single stream traffic model, 30Mbps, 60FPS, with MU-MIMO, with PDB increase from 10ms to 13ms, it is observed from (Huawei, FUTUREWEI) that capacity performances are decreased from 11.5~12.3 to 14.6~14.7 and the mean capacity performances are increased from 11.9 to 14.65 by about 23.1%.

For FR1, Dense Urban, DL, with single stream traffic model, 30Mbps, 60FPS, with MU-MIMO, with PER decrease from 1% to 0.5%, it is observed from (Huawei) that capacity performances are decreased from 11.5 to 9.9 by about 13.91%.

For FR1, Dense Urban, DL, with single stream traffic model, 30Mbps, 60FPS, with MU-MIMO, with PER increase from 1% to 5%, it is observed from (Huawei) that capacity performances are increased from 11.5 to 16.8 by about 46.09%.

For FR1, Dense Urban, DL, with single stream traffic model, 45Mbps, 60FPS, with SU-MIMO, with PDB increase from 10ms to 15ms, it is observed from (OPPO) that capacity performances are increased from 4.4~5.2 to 6.3~6.4 by about 16.67%~45.45%.

For FR1, Indoor Hotspot, DL, with single stream traffic model, 30Mbps, 60FPS, with MU-MIMO, with PDB decrease from 10ms to 7ms, it is observed from (CATT) that capacity performances are decreased from 12 to 8 by about 33.33%.

**Observations:**

For FR1, Dense Urban, UL, with AR single-stream (Scene/video/data/ audio -stream, 10Mbps, 60FPS), with PDB decrease from 30ms to 10ms, it is observed from (Huawei) that capacity performances are decreased from 8.1 to <1 by about 87.65%.

For FR1, Dense Urban, UL, with AR single-stream (Scene/video/data/ audio -stream, 10Mbps, 60FPS), with PDB decrease from 30ms to 15ms, it is observed from (Huawei) that capacity performances are decreased from 8.1 to 5.4 by about 33.33%.

For FR1, Dense Urban, UL, with AR single-stream (Scene/video/data/ audio -stream, 10Mbps, 60FPS), with PDB increase from 30ms to 60ms, it is observed from (Huawei) that capacity performances are increased from 8.1 to 8.3 by about 2.5%.

**Observations:**

For FR2, Dense Urban, DL, with single stream traffic model, 30Mbps, 60FPS, with PDB increase from 10ms to 15ms, it is observed from (vivo) that capacity performances are increased from 13.44 to 16.16 by about 20.2%.

For FR2, Dense Urban, DL, with single stream traffic model, 30Mbps, 60FPS, with PDB increase from 10ms to 15ms, it is observed from (MediaTek) that capacity performances are increased from 10 to 11 by about 10.0%.

For FR2, Dense Urban, DL, with single stream traffic model, 30Mbps, 60FPS, with PDB increase from 10ms to 15ms, it is observed from (Nokia) that capacity performances are increased from 6.35 to 8.25 by about 23.0%.

For FR2, Dense Urban, DL, with single stream traffic model, 30Mbps, 60FPS, with DDDUU TDD format, with PDB increase from 10ms to 15ms, it is observed from (Ericsson) that capacity performances are increased from 4.2 to 5.1 by about 21.4%.

For FR2, Dense Urban, DL, with single stream traffic model, 30Mbps, 60FPS, with 100MHz bandwidth, with PDB increase from 10ms to 15ms, it is observed from (Qualcomm) that capacity performances are increased from 5.5 to 6 by about 9.1%.

For FR2, Dense Urban, DL, with single stream traffic model, 30Mbps, 60FPS, with 400MHz bandwidth, with PDB increase from 10ms to 15ms, it is observed from (Qualcomm) that capacity performances are increased from 23.5 to 25 by about 6.4%.

**Observations:**

For FR2, Indoor Hotspot, DL, with single stream traffic model, 30Mbps, 60FPS, with PDB increase from 10ms to 15ms, it is observed from (vivo) that capacity performances are increased from 8.72 to 9.91 by about 13.7%.

For FR2, Indoor Hotspot, DL, with single stream traffic model, 30Mbps, 60FPS, with PDB increase from 10ms to 15ms, it is observed from (MediaTek) that capacity performances are increased from 10 to 11 by about 10.0%.

For FR2, Indoor Hotspot, DL, with single stream traffic model, 30Mbps, 60FPS, with PDB increase from 10ms to 15ms, it is observed from (Nokia) that capacity performances are increased from 10.17 to 11.45 by about 12.6%.

For FR2, Indoor Hotspot, DL, with single stream traffic model, 30Mbps, 60FPS, with PDB increase from 10ms to 15ms, it is observed from (ZTE) that capacity performances are increased from 7.8 to 9.9 by about 26.9%.

For FR2, Indoor Hotspot, DL, with single stream traffic model, 30Mbps, 60FPS, with 100MHz bandwidth, with PDB increase from 10ms to 15ms, it is observed from (Qualcomm) that capacity performances are increased from 5.5 to 6 by about 9.1%.

For FR2, Indoor Hotspot, DL, with single stream traffic model, 30Mbps, 60FPS, with 400MHz bandwidth, with PDB increase from 10ms to 15ms, it is observed from (Qualcomm) that capacity performances are increased from 26 to 28 by about 7.69%.

**Observations:**

For FR2, Dense Urban, UL, with AR single-stream (Scene/video/data/ audio -stream, 20Mbps, 60FPS), with PDB decrease from 30ms to 15ms, it is observed from (Qualcomm) that capacity performances are decreased from 5 to 3.5 by about 30%.

For FR2, Dense Urban, UL, with AR single-stream (Scene/video/data/ audio -stream, 20Mbps, 60FPS), with PDB increase from 30ms to 60ms, it is observed from (Qualcomm) that capacity performances are not affected.

For FR2, Indoor Hotspot, UL, with AR single-stream (Scene/video/data/ audio -stream, 20Mbps, 60FPS), with PDB decrease from 30ms to 15ms, it is observed from (Qualcomm) that capacity performances are decreased from 6 to 5 by about 16.67%.

For FR2, Indoor Hotspot, UL, with AR single-stream (Scene/video/data/ audio -stream, 20Mbps, 60FPS), with PDB increase from 30ms to 60ms, it is observed from (Qualcomm) that capacity performances are not affected.

##### Multi-stream traffic model

**Observation:**

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 1.5, with I\_PER = 1% and P\_PER = 1%, with P\_PDB = 10ms and I\_PDB increase from 10ms to 15ms, it is observed from (vivo) that capacity performances are increased from 6.74 to 12.58 by about 31.7%.

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PER = 1% and P\_PER = 1%, with P\_PDB = 10ms and I\_PDB increase from 10ms to 15ms, it is observed from (Huawei) that capacity performances are increased from 6.7 to 9.1 by about 35.82%.

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PER = 1% and P\_PER = 1%, with P\_PDB = 10ms and I\_PDB increase from 10ms to 15ms, it is observed from (vivo) that capacity performances are increased from 5.2 to 10.06 by about 93.46%.

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PER = 1% and P\_PER = 1%, with P\_PDB = 10ms and I\_PDB increase from 10ms to 15ms, it is observed from (MediaTek) that capacity performances are increased from 6 to 10 by about 66.67%.

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 3, with I\_PER = 1% and P\_PER = 1%, with P\_PDB = 10ms and I\_PDB increase from 10ms to 15ms, it is observed from (MediaTek) that capacity performances are increased from 2.21 to 5.73 by about 43.7%.

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 1.5, with I\_PER = 1% and P\_PER = 1%, with I\_PDB = 15ms and P\_PDB decrease from 10ms to 9ms, it is observed from (vivo) that capacity performances are decreased from 12.58 to 12.39 by about 2.3%.

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PER = 1% and P\_PER = 1%, with I\_PDB = 15ms and P\_PDB decrease from 10ms to 9ms, it is observed from (Huawei) that capacity performances are decreased from 9.1 to 8.8 by about 3.30%.

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PER = 1% and P\_PER = 1%, with I\_PDB = 15ms and P\_PDB decrease from 10ms to 9ms, it is observed from (vivo) that capacity performances are decreased from 10.06 to 9.19 by about 8.65%.

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 3, with I\_PER = 1% and P\_PER = 1%, with I\_PDB = 15ms and P\_PDB decrease from 10ms to 9ms, it is observed from (vivo) that capacity performances are decreased from 5.73 to 5.69 by about 2.3%.

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 1.5, with I\_PDB = 10ms and P\_PDB = 10ms, with I\_PER = 1% and P\_PER increase from 1% to 5%, it is observed from (vivo) that capacity performances are both 6.74.

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PDB = 10ms and P\_PDB = 10ms, with I\_PER = 1% and P\_PER increase from 1% to 5%, it is observed from (Huawei) that capacity performances are both 6.7.

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PDB = 10ms and P\_PDB = 10ms, with I\_PER = 1% and P\_PER increase from 1% to 5%, it is observed from (ZTE) that capacity performances are 10.8~10.9.

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PDB = 10ms and P\_PDB = 10ms, with I\_PER = 1% and P\_PER increase from 1% to 5%, it is observed from (vivo) that capacity performances are both 5.2.

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PDB = 10ms and P\_PDB = 10ms, with I\_PER = 1% and P\_PER increase from 1% to 5%, it is observed from (MediaTek) that capacity performances are both 6.

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 3, with I\_PDB = 10ms and P\_PDB = 10ms, with I\_PER = 1% and P\_PER increase from 1% to 5%, it is observed from (vivo) that capacity performances are both 2.21.

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 1.5, with I\_PDB = 10ms and P\_PDB = 10ms, with P\_PER = 5% and I\_PER decrease from 1% to 0.5%, it is observed from (vivo) that capacity performances are decreased from 6.74 to 6.39 by about 7.3%.

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PDB = 10ms and P\_PDB = 10ms, with P\_PER = 5% and I\_PER decrease from 1% to 0.5%, it is observed from (Huawei) that capacity performances are decreased from 6.7 to 6 by about 10.45%.

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PDB = 10ms and P\_PDB = 10ms, with P\_PER = 5% and I\_PER decrease from 1% to 0.5%, it is observed from (vivo) that capacity performances are decreased from 5.2 to 4.74 by about 8.85%.

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PDB = 10ms and P\_PDB = 10ms, with P\_PER = 5% and I\_PER decrease from 1% to 0.5%, it is observed from (MediaTek) that capacity performances are decreased from 6 to 2 by about 66.67%.

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 3, with I\_PDB = 10ms and P\_PDB = 10ms, with P\_PER = 5% and I\_PER decrease from 1% to 0.5%, it is observed from (vivo) that capacity performances are decreased from 2.21 to 2.09 by about 11.4%.

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PDB = 10ms and P\_PDB = 10ms, with P\_PER = 1% and I\_PER increase from 1% to 10%, it is observed from (ZTE) that capacity performances are increased from 10.8 to 12.2 by about 12.96%.

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 45Mbps, 60FPS, with alpha = 2, with I\_PER = 1% and P\_PER = 1%, with P\_PDB = 10ms and I\_PDB increase from 10ms to 15ms, it is observed from (MediaTek) that capacity performances are increased from 2 to 4 by about 100%.

For FR1, Dense Urban, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 45Mbps, 60FPS, with alpha = 2, with I\_PDB = 10ms and P\_PDB = 10ms, with I\_PER = 1% and P\_PER increase from 1% to 5%, it is observed from (MediaTek) that capacity performances are both 2.

**Observations:**

For FR1, Dense Urban, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 1.5, with I\_PER = 1% and P\_PER = 1%, with P\_PDB = 10ms and I\_PDB increase from 10ms to 15ms, it is observed from (vivo) that capacity performances are increased from 13.78 to 13.93 by about 1.09%.

For FR1, Dense Urban, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PER = 1% and P\_PER = 1%, with P\_PDB = 10ms and I\_PDB increase from 10ms to 15ms, it is observed from (vivo) that capacity performances are increased from 13.69 to 13.73 by about 0.29%.

For FR1, Dense Urban, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 3, with I\_PER = 1% and P\_PER = 1%, with P\_PDB = 10ms and I\_PDB increase from 10ms to 15ms, it is observed from (vivo) that capacity performances are increased from 13.77 to 13.84 by about 0.51%.

For FR1, Dense Urban, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 1.5, with I\_PER = 1% and P\_PER = 1%, with I\_PDB = 15ms and P\_PDB decrease from 10ms to 9ms, it is observed from (vivo) that capacity performances are increased from 13.93 to 13.27 by about 4.74%.

For FR1, Dense Urban, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PER = 1% and P\_PER = 1%, with I\_PDB = 15ms and P\_PDB decrease from 10ms to 9ms, it is observed from (vivo) that capacity performances are increased from 13.73 to 13.36 by about 2.69%.

For FR1, Dense Urban, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 3, with I\_PER = 1% and P\_PER = 1%, with I\_PDB = 15ms and P\_PDB decrease from 10ms to 9ms, it is observed from (vivo) that capacity performances are increased from 13.84 to 13.46 by about 2.75%.

For FR1, Dense Urban, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 1.5, with I\_PDB = 10ms and P\_PDB = 10ms, with I\_PER = 1% and P\_PER increase from 1% to 5%, it is observed from (vivo) that capacity performances are increased from 13.78 to 16.74 by about 21.48%.

For FR1, Dense Urban, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PDB = 10ms and P\_PDB = 10ms, with I\_PER = 1% and P\_PER increase from 1% to 5%, it is observed from (Huawei) that capacity performances are increased from 14.9 to 17.3 by about 16.11%.

For FR1, Dense Urban, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PDB = 10ms and P\_PDB = 10ms, with I\_PER = 1% and P\_PER increase from 1% to 5%, it is observed from (ZTE) that capacity performances are increased from 12.7 to 14.6 by about 14.96%.

For FR1, Dense Urban, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PDB = 10ms and P\_PDB = 10ms, with I\_PER = 1% and P\_PER increase from 1% to 5%, it is observed from (vivo) that capacity performances are increased from 13.69 to 16.84 by about 23.01%.

For FR1, Dense Urban, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 3, with I\_PDB = 10ms and P\_PDB = 10ms, with I\_PER = 1% and P\_PER increase from 1% to 5%, it is observed from (vivo) that capacity performances are increased from 13.77 to 16.89 by about 22.66%.

For FR1, Dense Urban, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 1.5, with I\_PDB = 10ms and P\_PDB = 10ms, with P\_PER = 5% and I\_PER decrease from 1% to 0.5%, it is observed from (vivo) that capacity performances are both 16.74.

For FR1, Dense Urban, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PDB = 10ms and P\_PDB = 10ms, with P\_PER = 5% and I\_PER decrease from 1% to 0.5%, it is observed from (Huawei) that capacity performances are decreased from 17.3 to 15.7 by about 9.25%.

For FR1, Dense Urban, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PDB = 10ms and P\_PDB = 10ms, with P\_PER = 5% and I\_PER decrease from 1% to 0.5%, it is observed from (vivo) that capacity performances are decreased from 16.84 to 16.59 by about 1.48%.

For FR1, Dense Urban, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 3, with I\_PDB = 10ms and P\_PDB = 10ms, with P\_PER = 5% and I\_PER decrease from 1% to 0.5%, it is observed from (vivo) that capacity performances are both 16.89.

**Observations:**

For FR2, Indoor Hotspot, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 1.5, with I\_PER = 1% and P\_PER = 1%, with P\_PDB = 10ms and I\_PDB increase from 10ms to 15ms, it is observed from (vivo) that capacity performances are increased from 5.37 to 7.07 by about 31.7%.

For FR2, Indoor Hotspot, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PER = 1% and P\_PER = 1%, with P\_PDB = 10ms and I\_PDB increase from 10ms to 15ms, it is observed from (vivo) that capacity performances are increased from 3.53 to 5.23 by about 48.2%.

For FR2, Indoor Hotspot, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 3, with I\_PER = 1% and P\_PER = 1%, with P\_PDB = 10ms and I\_PDB increase from 10ms to 15ms, it is observed from (vivo) that capacity performances are increased from 2.29 to 3.29 by about 43.7%.

For FR2, Indoor Hotspot, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 1.5, with I\_PER = 1% and P\_PER = 1%, with I\_PDB = 15ms and P\_PDB decrease from 10ms to 9ms, it is observed from (vivo) that capacity performances are decreased from 7.07 to 6.91 by about 2.3%.

For FR2, Indoor Hotspot, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PER = 1% and P\_PER = 1%, with I\_PDB = 15ms and P\_PDB decrease from 10ms to 9ms, it is observed from (vivo) that capacity performances are decreased from 5.23 to 4.99 by about 4.6%.

For FR2, Indoor Hotspot, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 3, with I\_PER = 1% and P\_PER = 1%, with I\_PDB = 15ms and P\_PDB decrease from 10ms to 9ms, it is observed from (vivo) that capacity performances are both 3.29.

For FR2, Indoor Hotspot, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 1.5, with I\_PDB = 10ms and P\_PDB = 10ms, with I\_PER = 1% and P\_PER increase from 1% to 5%, it is observed from (vivo) that capacity performances are increased from 5.37 to 5.43 by about 1.1%.

For FR2, Indoor Hotspot, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PDB = 10ms and P\_PDB = 10ms, with I\_PER = 1% and P\_PER increase from 1% to 5%, it is observed from (vivo) that capacity performances are increased from 3.53 to 3.87 by about 9.6%.

For FR2, Indoor Hotspot, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 3, with I\_PDB = 10ms and P\_PDB = 10ms, with I\_PER = 1% and P\_PER increase from 1% to 5%, it is observed from (vivo) that capacity performances are both 2.29.

For FR2, Indoor Hotspot, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 1.5, with I\_PDB = 10ms and P\_PDB = 10ms, with P\_PER = 5% and I\_PER decrease from 1% to 0.5%, it is observed from (vivo) that capacity performances are decreased from 5.37 to 4.98 by about 7.3%.

For FR2, Indoor Hotspot, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PDB = 10ms and P\_PDB = 10ms, with P\_PER = 5% and I\_PER decrease from 1% to 0.5%, it is observed from (vivo) that capacity performances are decreased from 3.53 to 2.73 by about 22.7%.

For FR2, Indoor Hotspot, DL, with VR/AR GOP-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 3, with I\_PDB = 10ms and P\_PDB = 10ms, with P\_PER = 5% and I\_PER decrease from 1% to 0.5%, it is observed from (vivo) that capacity performances are decreased from 2.29 to 2.03 by about 11.4%.

**Observations:**

For FR2, Indoor Hotspot, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 1.5, with I\_PER = 1% and P\_PER = 1%, with P\_PDB = 10ms and I\_PDB increase from 10ms to 15ms, it is observed from (vivo) that capacity performances are 8.23~8.24.

For FR2, Indoor Hotspot, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PER = 1% and P\_PER = 1%, with P\_PDB = 10ms and I\_PDB increase from 10ms to 15ms, it is observed from (vivo) that capacity performances are both 8.24.

For FR2, Indoor Hotspot, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 3, with I\_PER = 1% and P\_PER = 1%, with P\_PDB = 10ms and I\_PDB increase from 10ms to 15ms, it is observed from (vivo) that capacity performances are 8.23~8.28.

For FR2, Indoor Hotspot, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 1.5, with I\_PER = 1% and P\_PER = 1%, with I\_PDB = 15ms and P\_PDB decrease from 10ms to 9ms, it is observed from (vivo) that capacity performances are decreased from 8.24 to 8.14 by about 1.2%.

For FR2, Indoor Hotspot, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PER = 1% and P\_PER = 1%, with I\_PDB = 15ms and P\_PDB decrease from 10ms to 9ms, it is observed from (vivo) that capacity performances are decreased from 8.24 to 8.18 by about 0.7%.

For FR2, Indoor Hotspot, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 3, with I\_PER = 1% and P\_PER = 1%, with I\_PDB = 15ms and P\_PDB decrease from 10ms to 9ms, it is observed from (vivo) that capacity performances are decreased from 8.28 to 8.22 by about 0.7%.

For FR2, Indoor Hotspot, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 1.5, with I\_PDB = 10ms and P\_PDB = 10ms, with I\_PER = 1% and P\_PER increase from 1% to 5%, it is observed from (vivo) that capacity performances are increased from 8.23 to 10.61 by about 28.9%.

For FR2, Indoor Hotspot, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PDB = 10ms and P\_PDB = 10ms, with I\_PER = 1% and P\_PER increase from 1% to 5%, it is observed from (vivo) that capacity performances are increased from 8.24 to 10.73 by about 30.2%.

For FR2, Indoor Hotspot, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 3, with I\_PDB = 10ms and P\_PDB = 10ms, with I\_PER = 1% and P\_PER increase from 1% to 5%, it is observed from (vivo) that capacity performances are increased from 8.23 to 10.61 by about 28.9%.

For FR2, Indoor Hotspot, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 1.5, with I\_PDB = 10ms and P\_PDB = 10ms, with P\_PER = 5% and I\_PER decrease from 1% to 0.5%, it is observed from (vivo) that capacity performances are decreased from 10.61 to 10.46 by about 1.4%.

For FR2, Indoor Hotspot, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 2, with I\_PDB = 10ms and P\_PDB = 10ms, with P\_PER = 5% and I\_PER decrease from 1% to 0.5%, it is observed from (vivo) that capacity performances are decreased from 10.73 to 10.46 by about 2.5%.

For FR2, Indoor Hotspot, DL, with VR/AR Slice-Based I/P Frame multi-stream traffic model, 30Mbps, 60FPS, with alpha = 3, with I\_PDB = 10ms and P\_PDB = 10ms, with P\_PER = 5% and I\_PER decrease from 1% to 0.5%, it is observed from (vivo) that capacity performances are decreased from 10.61 to 10.38 by about 2.2%.

#### Impact of Jitter on Capacity

This section captures the capacity performance comparison for the impact of jitter on capacity, where jitter model is described as in 6.1.1.2.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Case | Scenario | App | PDB | Bit rate | Fps | MIMO | Capacity result | | Source | Note |
| w/ jitter | w/o jitter |
| FR1  DL | DU | AR/VR | 10ms | 45Mbps | 60 | SU | 5.2 | 5.4 | OPPO |  |
| 30Mbps | MU | 11.5, 7.15 | 11.6, 7.5 | Huawei, Intel |  |
| 30 | SU | 8.4 | 9 | OPPO |  |
| CG | 15 | 30Mbp | MU | 7.47 | 8.20 | Intel |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Case | Scenario | App | PDB | Bit rate | Fps | MIMO | Capacity result | | Source | Note |
| w/ jitter | w/o jitter |
| FR2  UL | DU | **AR (2 streams: pose + scene)** | 10 (Pose),  30 (Scene) | 0.2 (Pose)  10 (Scene) | 250 (Pose)  60 (Scene) | SU | 4.5 | 4.5 | Qualcomm |  |
| 0.2 (Pose)  20 (Scene) | 2 | 2 | Qualcomm |  |
| InH | 0.2 (Pose)  10 (Scene) | 5 | 5.5 | Qualcomm |  |
| 0.2 (Pose)  20 (Scene) | 3.5 | 3.5 | Qualcomm |  |

**Observation:**

For FR1, Dense Urban, DL, with 100MHz bandwidth for CG traffic model, 30Mbps, 15ms PDB, 60 FPS, with SU-MIMO, it is observed from (OPPO) that the capacity performances are increased from 10.2 with jitter to 10.5 without jitter by about 2.94%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for CG traffic model, 45Mbps, 15ms PDB, 60 FPS, with SU-MIMO, it is observed from (OPPO) that the capacity performances are increased from 6.3 with jitter to 6.7 without jitter by about 6.35%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for CG traffic model, 30Mbps, 15ms PDB, 60 FPS, with MU-MIMO, it is observed from (Intel) that the capacity performances are increased from 7.47 with jitter to 8.20 without jitter by about 9.8%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with SU-MIMO, it is observed from (OPPO) that the capacity performances are increased from 8.4 with jitter to 9 without jitter by about 7.1%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with SU-MIMO, it is observed from (OPPO) that the capacity performances are increased from 5.2 with jitter to 5.4 without jitter by about 3.85%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with MU-MIMO, it is observed from (Huawei, Intel) that the capacity performances are increased from 7.15~10.19 to 7.5~13.25 and the mean capacity performances are increased from 8.67 to 10.38 by about 19.67 %.

#### Impact of Dual-eye Buffers Staggering

This section captures the capacity performance comparison for the impact of dual-eye buffer, where dual-eve buffer model is described as in 6.1.1.5.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Case | Scenario | App | PDB | Bit rate | MIMO | Capacity result | | Source | Note |
| FPS 60 | FPS 120 |
| FR1  DL | DU | AR/VR | 10ms | 45Mbps | SU | 5.77 | 8.03 | Source 18, vivo |  |
| MU | 6.91 | 11.42 | Source 18, vivo |  |
| 30Mbps | SU | 9.49 | 13.47 | Source 18, vivo |  |
| MU | 13.59 | 20.78 | Source 18, vivo |  |
| InH |  |  | 45Mbps | SU | 4.65 | 6.59 | Source 18, vivo |  |
| MU | 5.91 | 9.22 | Source 18, vivo |  |
| 30Mbps | SU | 8.27 | 11.63 | Source 18, vivo |  |
| MU | 10.8 | 16.53 | Source 18, vivo |  |
| UMa |  |  | 45Mbp | SU | 4.17 | 6.75 | Source 18, vivo |  |
| MU | 4.68 | 8.12 | Source 18, vivo |  |
| 30Mbp | SU | 7.24 | 11.7 | Source 18, vivo |  |
| MU | 8.82 | 14.59 | Source 18, vivo |  |
| FR2 DL | DU |  |  | 30Mbps | SU | 13.44 | 16.28 | Source 18, vivo |  |
| InH |  |  | 30Mbps | SU | 8.72 | 10.23 | Source 18, vivo |  |

**Observation:**

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with SU-MIMO, it is observed from (vivo) that the capacity performances are increased from 9.49 with 60FPS to 13.47 with 120FPS by about 41.94%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with MU-MIMO, it is observed from (vivo) that the capacity performances are increased from 13.59 with 60FPS to 20.78 with 120FPS by about 52.91%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with SU-MIMO, it is observed from (vivo) that the capacity performances are increased from 5.77 with 60FPS to 8.03 with 120FPS by about 39.17%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with MU-MIMO, it is observed from (vivo) that the capacity performances are increased from 6.91 with 60FPS to 11.42 with 120FPS by about 65.27%.

For FR1, Indoor Hotspot, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with SU-MIMO, it is observed from (vivo) that the capacity performances are increased from 8.27 with 60FPS to 11.63 with 120FPS by about 40.63%.

For FR1, Indoor Hotspot, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with MU-MIMO, it is observed from (vivo) that the capacity performances are increased from 10.80 with 60FPS to 16.53 with 120FPS by about 53.06%.

For FR1, Indoor Hotspot, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with SU-MIMO, it is observed from (vivo) that the capacity performances are increased from 4.65 with 60FPS to 6.59 with 120FPS by about 41.72%.

For FR1, Indoor Hotspot, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with MU-MIMO, it is observed from (vivo) that the capacity performances are increased from 5.91 with 60FPS to 9.22 with 120FPS by about 56.01%.

For FR1, Urban Macro, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with SU-MIMO, it is observed from (vivo) that the capacity performances are increased from 7.24 with 60FPS to 11.7 with 120FPS by about 61.60%.

For FR1, Urban Macro, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with MU-MIMO, it is observed from (vivo) that the capacity performances are increased from 8.82 with 60FPS to 14.59 with 120FPS by about 65.42%.

For FR1, Urban Macro, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with SU-MIMO, it is observed from (vivo) that the capacity performances are increased from 4.17 with 60FPS to 6.75 with 120FPS by about 61.87%.

For FR1, Urban Macro, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with MU-MIMO, it is observed from (vivo) that the capacity performances are increased from 4.68 with 60FPS to 8.12 with 120FPS by about 73.50%.

**Observations:**

For FR2, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with SU-MIMO, it is observed from (vivo) that the capacity performances are increased from 13.44 with 60FPS to 16.28 with 120FPS by about 21.13%.

For FR2, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with SU-MIMO, it is observed from (vivo) that the capacity performances are increased from 8.20 with 60FPS to 10.32 with 120FPS by about 25.85%.

For FR2, Indoor Hotspot, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with SU-MIMO, it is observed from (vivo) that the capacity performances are increased from 8.72 with 60FPS to 10.23 with 120FPS by about 17.32%.

For FR2, Indoor Hotspot, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with SU-MIMO, it is observed from (vivo) that the capacity performances are increased from 4.67 with 60FPS to 6.03 with 120FPS by about 29.12%.

#### Impact of TDD Frame Format

This section captures the capacity performance comparison for the impact of TDD frame format.

**Summary for impact of TDD frame format**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Case | App | Data rate | PDB | Fps | Scenario | MIMO | Capacity result  (DDDSU TDD format) | Capacity result  (DDDUU TDD format) | Source | Note |
| FR1  DL | AR/VR | 30Mbps | 10ms | 60 | DU | SU | 9.7 | 7.6 | FUTUREWEI | Note 1 |
| MU | 12.3 | 8.7 | FUTUREWEI | Note 1 |
| UMa | SU | 7 | 5.4 | FUTUREWEI | Note 1 |
| MU | 7.7 | 6.1 | FUTUREWEI | Note 1 |
| FR2  DL | AR/VR | 30Mbps | 10ms | 60 | DU | SU | - | 4.2 | Ericson | Note 1,2 |
| 7 | 2.5 | Qualcomm | Note 1,2 |
| 30 | 21.5 | Qualcomm | Note 1,2,3 |
| InH | SU | - | 4.2 | Ericson | Note 1,2 |
| 5.5 | 3 | Qualcomm | Note 1,2 |
| 26 | 15.5 | Qualcomm | Note 1,2,3 |
| 45Mbps | 10ms | 60 | DU | SU | - | 2 | Ericson | Note 1,2 |
| 5 | 2.5 | Qualcomm | Note 1,2 |
| 22.5 | 16.5 | Qualcomm | Note 1,2,3 |
| InH | SU | 5 | 2.5 | Qualcomm | Note 1,2 |
| 27 | 19 | Qualcomm | Note 1,2,3 |
| VR/AR Video +Audio/data | 30Mbps | - | - | InH | SU | 4.5 | 2.5 | Qualcomm | Note 1,2 |
| DU | SU | 6 | 3.5 | Qualcomm | Note 1,2 |
| FR2  UL | Pose/control | 0.2Mbps | 10ms | 250 | DU | SU | 7.5 | 18.5 | Qualcomm | Note 1,2 |
| InH | SU | 7 | 19 | Qualcomm | Note 1,2 |
| AR (2 streams: pose + scene) | 10 (Pose),  30 (Scene) | 0.2 (Pose)  10 (Scene) | 250 (Pose)  60 (Scene) | DU | SU | 1.5 | 4.5 | Qualcomm | Note 1,2 |
| InH | SU | 2.5 | 5 | Qualcomm | Note 1,2 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: UE Antenna parameters: Option 1: (M, N, P) = (1, 4, 2), 3 panels (left, right, top)  Note 3: 400MHz bandwidth | | | | | | | | | | |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Case | App | Data rate | PDB | Fps | Scenario | MIMO | Capacity result  (DDDSU TDD format) | Capacity result  (Other TDD format) | Source | Note |
| FR1  DL | AR/VR | 45Mbps | 10ms | 60 | DU | SU | 6 | 0 with DDDDD DDDUU (2.6GHz) | MediaTek | Note 1 |
| 6 | 4.2 with DSUDD SUUDD (4.9GHz) TDD format | MediaTek | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8) | | | | | | | | | | |

**Observations:**

For FR1, Dense Urban DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with SU-MIMO, it is observed from (FUTUREWEI) that the capacity performances are decreased from 9.7 with DDDSU TDD format to 7.6 with DDDUU TDD format by about 21.64%.

For FR1, Dense Urban DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with MU-MIMO, it is observed from (FUTUREWEI) that the capacity performances are decreased from 12.3 with DDDSU TDD format to 8.7 with DDDUU TDD format by about 29.27%.

For FR1, Dense Urban DL, with 100MHz bandwidth for VR/AR (single-stream traffic mode, 45Mbps, 60FPS, 10ms PDB), with SU-MIMO, it is observed from (MediaTek) that the capacity performances are increased from 0 with DDDDD DDDUU (2.6GHz) TDD format to 4.2 with DSUDD SUUDD (4.9GHz) TDD format.

For FR1, Dense Urban DL, VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with SU-MIMO, it is observed from (FUTUREWEI) that the capacity performances are decreased from 7 with DDDSU TDD format to 5.4 with DDDUU TDD format by about 22.86%.

For FR1, Dense Urban DL, VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with MU-MIMO, it is observed from (FUTUREWEI) that the capacity performances are decreased from 7.7 with DDDSU TDD format to 6.1 with DDDUU TDD format by about 20.78%.

For FR2, Dense Urban DL, with 100MHz, VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with SU-MIMO, it is observed from (Qualcomm) that the capacity performances are decreased from 7 with DDDSU TDD format to 2.5 with DDDUU TDD format by about 64.29%.

**Observations:**

For FR2, Dense Urban DL, with 400MHz, VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with SU-MIMO, it is observed from (Qualcomm) that the capacity performances are decreased from 30 with DDDSU TDD format to 21.5 with DDDUU TDD format by about 28.33%.

For FR2, Dense Urban DL, with 100MHz, VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with SU-MIMO, it is observed from (Qualcomm) that the capacity performances are decreased from 5 with DDDSU TDD format to 2.5 with DDDUU TDD format by about 50%.

For FR2, Dense Urban DL, with 400MHz, VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with SU-MIMO, it is observed from (Qualcomm) that the capacity performances are decreased from 22.5 with DDDSU TDD format to 16.5 with DDDUU TDD format by about 26.67%.

For FR2, Dense Urban DL, with 100MHz, Video +Audio/data multi-stream traffic model, 30Mbps, 60 FPS, it is observed from (Qualcomm) that the capacity performances are decreased from 6 with DDDSU TDD format to 3.5 with DDDUU TDD format by about 41.67%.

For FR2 Indoor hotspot DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, it is observed from (Qualcomm) that the capacity performances are decreased from 5.5 with DDDSU TDD format to 3 with DDDUU TDD format by about 45.45%.

For FR2 Indoor hotspot DL, with 400MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, it is observed from (Qualcomm) that the capacity performances are decreased from 26 with DDDSU TDD format to 15.5 with DDDUU TDD format by about 40.38%.

For FR2 Indoor hotspot DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, it is observed from (Qualcomm) that the capacity performances are decreased from 5 with DDDSU TDD format to 2.5 with DDDUU TDD format by about 50%.

For FR2 Indoor hotspot DL, with 400MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, it is observed from (Qualcomm) that the capacity performances are decreased from 27 with DDDSU TDD format to 19 with DDDUU TDD format by about 29.63%.

For FR2 Indoor hotspot DL, with 100MHz bandwidth for Video +Audio/data multi-stream traffic model, 30Mbps, it is observed from (Qualcomm) that the capacity performances are decreased from 4.5 with DDDSU TDD format to 2.5 with DDDUU TDD format by about 44.44%.

**Observations:**

For FR2 Dense urban UL, with 100MHz bandwidth for VR/CG pose/control traffic model, 0.2Mbps, 250FPS, 10ms PDB, it is observed from (Qualcomm) that the capacity performances are increased from 7.5 with DDDSU TDD format to 18.5 with DDDUU TDD format by about 146.67%.

For FR2 Dense urban UL, with 100MHz bandwidth for AR 2-stream pose/control-stream with 0.2Mbps data rate and scene/video/ data/voice-stream with 10Mbps data rate, it is observed from (Qualcomm) that the capacity performances are increased from 1.5 with DDDSU TDD format to 4.5 with DDDUU TDD format by about 200%.

For FR2 Indoor Hotspot UL, with 100MHz bandwidth for VR/CG pose/control-stream, 0.2Mbps, 250FPS, 10ms PDB, it is observed from (Qualcomm) that the capacity performances are increased from 7 with DDDSU TDD format to 19 with DDDUU TDD format by about 171.14%.

For FR2 Indoor Hotspot UL, with 100MHz bandwidth for AR 2-stream pose/control-stream with 0.2Mbps data rate and scene/video/ data/voice-stream with 10Mbps data rate, it is observed from (Qualcomm) that the capacity performances are increased from 2.5 with DDDSU TDD format to 5 with DDDUU TDD format by about 100%.

#### Impact of Bandwidth

This section captures the capacity performance comparison for the impact of system bandwidth.

**Summary for impact of bandwidth**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Case | App | Data rate | PDB | Fps | Scenario | MIMO | Capacity result  (100MHz bandwidth) | Capacity result  (400MHz bandwidth) | Source | Note |
| FR2  DL | AR/VR | 30Mbps | 10ms | 60 | DU | SU | 7 | 30 | Qualcomm | Note 1 |
| SU | 5.5 | 21.5 | Qualcomm | Note 2 |
| InH | SU | 7 | 34 | Qualcomm | Note 1 |
| SU | 5.5 | 25 | Qualcomm | Note 2 |
| 45Mbps | 10ms | 60 | DU | SU | 5 | 22.5 | Qualcomm | Note 1 |
| SU | 2.5 | 16.5 | Qualcomm | Note 2 |
| InH | SU | 5 | 27 | Qualcomm | Note 1 |
| SU | 2.5 | 19 | Qualcomm | Note 2 |
| CG | 8Mbps | 15ms | 60 | DU | SU | 32.5 | >45 | Qualcomm | Note 1 |
| InH | SU | 31 | 44 | Qualcomm | Note 1 |
| 30Mbps | 15ms | 60 | DU | SU | 8 | 32.5 | Qualcomm | Note 1 |
| InH | SU | 7.5 | 32 | Qualcomm | Note 1 |
| FR2  UL | VR/CG pose/control-stream | 0.2Mbps | 10ms | 250 | DU | SU | 7.5 | 8.5 | Qualcomm |  |
| InH | SU | 7 | 7 | Qualcomm |  |
| AR 2-stream pose/control-stream | 0.2Mbps (Pose),  10Mbps (Scene) | 10ms (Pose),  30ms (Scene) | 250 (Pose),  60 (Scene) | DU | SU | 4.5 | 7 | Qualcomm |  |
| InH | SU | 5 | 7.5 | Qualcomm |  |
| Note1：DDDSU  Note2：DDDUU | | | | | | | | | | |

For FR2, Dense Urban, DL, for AR/VR (30 Mbps, 10ms PDB, 60FPS), DDDSU TDD format, when bandwidth is increased from 100MHz to 400MHz, it is observed from (Qualcomm), the capacity performance increases from 7 to 30 by about 300%.

For FR2, Dense Urban, DL, for AR/VR (30 Mbps, 10ms PDB, 60FPS), DDDUU TDD format, when bandwidth is increased from 100MHz to 400MHz, it is observed from (Qualcomm), the capacity performance increases from 5.5 to 21.5 by about 290.9%.

For FR2, Indoor Hotspot, DL, for AR/VR (30 Mbps, 10ms PDB, 60FPS), DDDSU TDD format, when bandwidth is increased from 100MHz to 400MHz, it is observed from (Qualcomm), the capacity performance increases from 7 to 34 by about 385.71%.

For FR2, Indoor Hotspot, DL, for AR/VR (30 Mbps, 10ms PDB, 60FPS), DDDUU TDD format, when bandwidth is increased from 100MHz to 400MHz, it is observed from (Qualcomm), the capacity performance increases from 5.5 to 25 by about 385.71%.

For FR2, Dense Urban, DL, for AR/VR (45 Mbps, 10ms PDB, 60FPS), DDDSU TDD format, when bandwidth is increased from 100MHz to 400MHz, it is observed from (Qualcomm), the capacity performance increases from 5 to 22.5 by about 350%.

For FR2, Dense Urban, DL, for AR/VR (45 Mbps, 10ms PDB, 60FPS), DDDUU TDD format, when bandwidth is increased from 100MHz to 400MHz, it is observed from (Qualcomm), the capacity performance increases from 2.5 to 16.5 by about 560%.

For FR2, Indoor Hotspot, DL, for AR/VR (45 Mbps, 10ms PDB, 60FPS), DDDSU TDD format, when bandwidth is increased from 100MHz to 400MHz, it is observed from (Qualcomm), the capacity performance increases from 5 to 27 by about 440%.

For FR2, Indoor Hotspot, DL, for AR/VR (45 Mbps, 10ms PDB, 60FPS), DDDUU TDD format, when bandwidth is increased from 100MHz to 400MHz, it is observed from (Qualcomm), the capacity performance increases from 2.5 to 19 by about 660%.

For FR2, Dense Urban, DL, for CG (8 Mbps, 15ms PDB, 60FPS), DDDSU TDD format, when bandwidth is increased from 100MHz to 400MHz, it is observed from (Qualcomm), the capacity performance increases from 32.5 to >45.

For FR2, Indoor Hotspot, DL, for CG (8 Mbps, 15ms PDB, 60FPS), DDDSU TDD format, when bandwidth is increased from 100MHz to 400MHz, it is observed from (Qualcomm), the capacity performance increases from 31 to 44 by about 41.94%.

For FR2, Dense Urban, DL, for CG (30 Mbps, 15ms PDB, 60FPS), DDDSU TDD format, when bandwidth is increased from 100MHz to 400MHz, it is observed from (Qualcomm), the capacity performance increases from 8 to 32.5 by about 306.25%.

For FR2, Indoor Hotspot, DL, for CG (30 Mbps, 15ms PDB, 60FPS), DDDSU TDD format, when bandwidth is increased from 100MHz to 400MHz, it is observed from (Qualcomm), the capacity performance increases from 7.5 to 32 by about 326.67%.

**Observations:**

For FR2, Dense Urban, UL, for VR/CG (Pose/control-stream, 0.2Mbps data rate, 10ms PDB, 250 FPS), when bandwidth is increased from 100MHz to 400MHz, it is observed from (Qualcomm), the capacity performance increases from 7.5 to 8.5 by about 13.33%.

For FR2, Indoor Hotspot, UL, for VR/CG (Pose/control-stream, 0.2Mbps data rate, 10ms PDB, 250 FPS), when bandwidth is increased from 100MHz to 400MHz, it is observed from (Qualcomm), the capacity performance is unchanged.

For FR2, Dense Urban, UL, for AR 2-stream (Pose/control-stream with 0.2Mbps data rate, 10ms PDB, 250FPS and scene/video/data/voice-stream with 10Mbps data rate, 30ms PDB, 60FPS), when bandwidth is increased from 100MHz to 400MHz, it is observed from (Qualcomm), the capacity performance increases from 4.5 to 7 by about 55.56%.

For FR2, Indoor Hotspot, UL, for AR 2-stream (Pose/control-stream with 0.2Mbps data rate, 10ms PDB, 250FPS and scene/video/data/voice-stream with 10Mbps data rate, 30ms PDB, 60FPS), when bandwidth is increased from 100MHz to 400MHz, it is observed from (Qualcomm), the capacity performance increases from 5 to 7.5 by about 50%.

#### Impact of FDM/SDM and mini-slot

This section captures the capacity performance comparison for the impact of FDM/SDM or mini-slot based transmission.

**Summary for impact of FDM/SDM and mini-slot**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Case | App | Data rate | PDB | Fps | Scenario | MIMO | Capacity result  (w/o FDM/SDM, w/ regular slot) | Capacity result  (w/ FDM/SDM or mini-slot) | Source | Note |
| FR2 UL | VR/CG pose/control-stream | 0.2Mbps | 10ms | 250 | DU | SU | 7.5 | 15 | Qualcomm | Note1 |
| 18.5 | Qualcomm | Note2 |
| 26.5 | Qualcomm | Note3 |
| InH | SU | 7 | 11.5 | Qualcomm | Note1 |
| 20 | Qualcomm | Note2 |
| 26 | Qualcomm | Note3 |
| Note 1: with FDM/SDM  Note 2: with mini-slot  Note 3: with combination of FDM/SDM and mini-slot | | | | | | | | | | |

For FR2, Dense Urban, UL, for VR/CG (Pose/control-stream, 0.2Mbps data rate, 10ms PDB, 250 FPS),

* Comparing between without and with FDM/SDM, it is observed from (Qualcomm), the capacity performance increases from 7.5 to 15 by about 100%.
* Comparing between without and with mini-slot, it is observed from (Qualcomm), the capacity performance increases from 7.5 to 18.5 by about 146.67%.
* Comparing between without and with FDM/SDM and mini-slot, it is observed from (Qualcomm), the capacity performance increases from 7.5 to 26.5 by about 253.33%.

For FR2, Indoor Hotspot, UL, for VR/CG (Pose/control-stream, 0.2Mbps data rate, 10ms PDB, 250 FPS),

* Comparing between without and with FDM/SDM, it is observed from (Qualcomm), the capacity performance increases from 7 to 11.5 by about 64.29%.
* Comparing between without and with mini-slot, it is observed from (Qualcomm), the capacity performance increases from 7 to 20 by about 185.71%.
* Comparing between without and with FDM/SDM and mini-slot, it is observed from (Qualcomm), the capacity performance increases from 7 to 26 by about 271.43%.

### Potential Capacity Enhancements

#### Staggering of packet arrivals at gNB among UEs

This section captures the capacity performance evaluation results of staggering packet arrival interval among Ues.

In this evaluation, following schemes of staggering packet arrival interval among Ues are evaluated and compared,

1. the arrival offsets are random across Ues.
2. the arrival offsets are equally staggered across connected Ues within one period
3. the arrival offsets are synchronized across Ues

Compared to the case when all the Ues are synchronized in terms of packet arrival offset (All Sync), the capacity improves when the arrival offsets are random across Ues (Random Staggering). The capacity could further improve when the arrival offsets are equally staggered across connected Ues within one period (Equal Staggering)

Table 1 FR1, DL, DU, VR/AR 30Mbps, SU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | All Sync | 10 | 7 | 7 | 90% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | Random | 10 | 8.8 | 8 | 97% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | Evenly Spaced | 10 | 9.1 | 9 | 93% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | All Sync | 10 | 3.1 | 3 | 92% | Note 1, 3 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | Random | 10 | 6.3 | 6 | 93% | Note 1, 3 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | Evenly Spaced | 10 | 8.3 | 8 | 93% | Note 1, 3 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | random | 10 | 8.4 | 8 | 95% | Note 2 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | evenly spaced | 10 | 9.2 | 9 | 91% | Note 2 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | same | 10 | 7.4 | 7 | 95% | Note 2 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2)  Note 3: stream packet generation rate (Fps or Hz): 30 | | | | | | | | | | |

Table 3 FR1, DL, DU, VR/AR 45Mbps, SU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 16, Qualcomm |  | DDDSU | SU-MIMO | reciprocity-based precoding | All Sync | 10 | 4.5 | 4 | 98% | Note 1 |
| Source 16, Qualcomm |  | DDDSU | SU-MIMO | reciprocity-based precoding | Random | 10 | 5.9 | 5 | 99% | Note 1 |
| Source 16, Qualcomm |  | DDDSU | SU-MIMO | reciprocity-based precoding | Evenly Spaced | 10 | 6.1 | 6 | 92% | Note 1 |
| Source 16, Qualcomm |  | DDDSU | SU-MIMO | reciprocity-based precoding | All Sync | 10 | 1.8 | 1 | 97% | Note 1,3 |
| Source 16, Qualcomm |  | DDDSU | SU-MIMO | reciprocity-based precoding | Random | 10 | 3.6 | 3 | 95% | Note 1,3 |
| Source 16, Qualcomm |  | DDDSU | SU-MIMO | reciprocity-based precoding | Evenly Spaced | 10 | 9 | 5 | 90% | Note 1,3 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | random | 10 | 5.2 | 5 | 94% | Note 2 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | evenly spaced | 10 | 5.4 | 5 | 97% | Note 2 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | same | 10 | 4.4 | 4 | 96% | Note 2 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2)  Note 3: stream packet generation rate (Fps or Hz): 30 | | | | | | | | | | |

Table 14 FR1, DL, DU, CG 30Mbps, SU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | random | 15 | 10.2 | 10 | 92% | Note 1 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | evenly spaced | 15 | 10.3 | 10 | 93% | Note 1 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | same | 15 | 10.3 | 10 | 94% | Note 1 |
| Note 1: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2) | | | | | | | | | | |

Table 16 FR1, DL, DU, CG 45Mbps, SU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | random | 15 | 6.3 | 6 | 94% | Note 1 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | evenly spaced | 15 | 6.3 | 6 | 94% | Note 1 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | same | 15 | 6.4 | 6 | 96% | Note 1 |
| Note 1: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2) | | | | | | | | | | |

Table 29 FR1, UL, DU, VR/CG 0.2Mbps, SU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | single layer transmission | evenly spaced | 10 | 178.4 | 178 | 90% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8) | | | | | | | | | | |

Table 30 FR1, UL, DU, VR/CG 0.2Mbps, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 11, InterDigital | R1-2111830 | DDDSU | MU-MIMO | 32-port CSI-RS Type I codebook | evenly spaced | 10 | 8 | 8 | 96.50% | Note 2 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2) | | | | | | | | | | |

Table 39 FR1, UL, InH, VR/CG 0.2Mbps, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 11, InterDigital | R1-2111830 | DDDSU | MU-MIMO | 32-port CSI-RS Type I codebook | evenly spaced | 10 | 20 | 20 | 100% | Note 2 |
| Note 1: 64QAM  Note 2: with jitter | | | | | | | | | | |

Table 45 FR1, UL, Uma, VR/CG 0.2Mbps, SU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | single layer transmission | evenly spaced | 10 | 142.4 | 142 | 95% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: downtilt: 12 | | | | | | | | | | |

**Observations**

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with SU-MIMO and 64TxRU, it is observed from (Qualcomm) that the capacity performances are increased from 7 with synchronized arrival offsets across Ues to 8.8 with random arrival offsets across Ues by about 25.71%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with SU-MIMO and 64TxRU, it is observed from (Qualcomm) that the capacity performances are increased from 7 with synchronized arrival offsets across Ues to 9.1 with arrival offsets equally staggered across connected Ues by about 30.00%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 30 FPS, with SU-MIMO and 64TxRU, it is observed from (Qualcomm) that the capacity performances are increased from 3.1 with synchronized arrival offsets across Ues to 6.3 with random arrival offsets across Ues by about 103.23%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 30 FPS, with SU-MIMO and 64TxRU, it is observed from (Qualcomm) that the capacity performances are increased from 3.1 with synchronized arrival offsets across Ues to 8.3 with arrival offsets equally staggered across connected Ues by about 167.74%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with SU-MIMO and 64TxRU, it is observed from (Qualcomm) that the capacity performances are increased from 4.5 with synchronized arrival offsets across Ues to 5.9 with random arrival offsets across Ues by about 31.11%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with SU-MIMO and 64TxRU, it is observed from (Qualcomm) that the capacity performances are increased from 4.5 with synchronized arrival offsets across Ues to 6.1 with arrival offsets equally staggered across connected Ues by about 35.56%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 30 FPS, with SU-MIMO and 64TxRU, it is observed from (Qualcomm) that the capacity performances are increased from 1.8 with synchronized arrival offsets across Ues to 3.6 with random arrival offsets across Ues by about 100.00%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 30 FPS, with SU-MIMO and 64TxRU, it is observed from (Qualcomm) that the capacity performances are increased from 1.8 with synchronized arrival offsets across Ues to 9 with arrival offsets equally staggered across connected Ues by about 400.00%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with SU-MIMO and 32TxRU, it is observed from (OPPO) that the capacity performances are increased from 7.4 with synchronized arrival offsets across Ues to 8.4 with random arrival offsets across Ues by about 13.51%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 30Mbps, 10ms PDB, 60 FPS, with SU-MIMO and 32TxRU, it is observed from (OPPO) that the capacity performances are increased from 7.4 with synchronized arrival offsets across Ues to 9.2 with arrival offsets equally staggered across connected Ues by about 24.32%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with SU-MIMO and 32TxRU, it is observed from (OPPO) that the capacity performances are increased from 4.4 with synchronized arrival offsets across Ues to 5.2 with random arrival offsets across Ues by about 18.18%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for VR/AR single-stream traffic model, 45Mbps, 10ms PDB, 60 FPS, with SU-MIMO and 32TxRU, it is observed from (OPPO) that the capacity performances are increased from 4.4 with synchronized arrival offsets across Ues to 5.4 with arrival offsets equally staggered across connected Ues by about 22.73%.

For FR1, Dense Urban, DL, with 100MHz bandwidth for CG traffic model, 30Mbps, 15ms PDB, 60 FPS, with SU-MIMO and 32TxRU, it is observed from (OPPO) that the capacity performances are 10.3 with synchronized arrival offsets across Ues, 10.2 with random arrival offsets across Ues, and 10.3 with arrival offsets equally staggered across connected Ues.

For FR1, Dense Urban, DL, with 100MHz bandwidth for CG traffic model, 45Mbps, 15ms PDB, 60 FPS, with SU-MIMO and 32TxRU, it is observed from (OPPO) that the capacity performances are 6.4 with synchronized arrival offsets across Ues, 6.3 with random arrival offsets across Ues, and 6.3 with arrival offsets equally staggered across connected Ues.

For FR1, Dense Urban, UL, with 100MHz bandwidth for VR/CG Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS, with SU-MIMO, 64 TxRU BS antenna, DDDUU and equal packet arrival interval among Ues, it is observed from (Futurewei) that capacity performances are 160.8.

For FR1, Dense Urban, UL, with 100MHz bandwidth for VR/CG Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS, with MU-MIMO and equal packet arrival interval among Ues, it is observed from (Interdigital) that capacity performances are 8.

For FR1, Indoor Hotspot, UL, with 100MHz bandwidth for VR/CG Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS, with MU-MIMO and equal packet arrival interval among Ues, it is observed from (Interdigital) that capacity performances are 20.

For FR1, Urban Macro, UL, with 100MHz bandwidth for VR/CG Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS, with SU-MIMO, 64 TxRU BS antenna, DDDUU and equal packet arrival interval among Ues, it is observed from (Futurewei) that capacity performances are 142.4.

#### Delay Aware/Frame Level Integrated Transmission Scheduler

This section describes the capacity performance with Delay Aware Scheduler or Frame Level Integrated Transmission (FLIT) Scheduler.

* Delay aware scheduler: during scheduling, gNB considers factors including: the size of the frame, the size of the already sent part of the frame, the remaining delivery time of the frame, etc.
* FLIT scheduler: during scheduling, gNB considers factors including: the size of the frame, the size of the already sent part of the frame, the remaining delivery time of the frame, etc.

**Observation:**

For FR1, Dense Urban, DL, with CG, 30Mbps, 60FPS, 15ms PDB, with SU-MIMO, it is observed from (vivo) that capacity performances are increased from 11.68 with PF scheduler to 13.58 with delay-aware scheduler by about 16.27%.

For FR1, Dense Urban, DL, with CG, 30Mbps, 60FPS, 15ms PDB, with MU-MIMO, it is observed from (vivo) that capacity performances are increased from 19.65 with PF scheduler to 19.75 with delay-aware scheduler by about 0.51%.

For FR1, Dense Urban, DL, with VR/AR, 30Mbps, 60FPS, 10ms PDB, with SU-MIMO, it is observed from (vivo) that capacity performances are increased from 9.49 with PF scheduler to 12.67 with delay-aware scheduler by about 33.51%.

For FR1, Dense Urban, DL, with VR/AR, 30Mbps, 60FPS, 10ms PDB, with MU-MIMO, it is observed from (vivo) that capacity performances are increased from 13.59 with PF scheduler to 14.40 with delay-aware scheduler by about 5.96%.

**Observation:**

For FR1, Dense Urban, DL, with VR/AR, 30Mbps, 60FPS, 10ms PDB, with SU-MIMO, it is observed from (Huawei) that capacity performances are increased from 5.1 with PF scheduler to 6.4 with Frame Level Integrated Transmission (FLIT) scheduler by about 25.49%.

For FR1, Dense Urban, DL, with VR/AR, 30Mbps, 60FPS, 10ms PDB, with MU-MIMO, it is observed from (Huawei) that capacity performances are increased from 11.5 with PF scheduler to 14 with Frame Level Integrated Transmission (FLIT) scheduler by about 21.74%.

For FR1, Dense Urban, DL, with VR/AR, 45Mbps, 60FPS, 10ms PDB, with SU-MIMO, it is observed from (Huawei) that capacity performances are increased from 2.1 with PF scheduler to 2.7 with Frame Level Integrated Transmission (FLIT) scheduler by about 28.579%.

For FR1, Dense Urban, DL, with VR/AR, 45Mbps, 60FPS, 10ms PDB, with MU-MIMO, it is observed from (Huawei) that capacity performances are increased from 5.3 with PF scheduler to 6.6 with Frame Level Integrated Transmission (FLIT) scheduler by about 24.53%.

**Observation:**

For FR1, Dense Urban, DL, with VR/AR I/P Frame Traffic Model, 30Mbps, 60FPS, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [1%, 1%], with alpha = 2 and SU-MIMO, it is observed from (MediaTek) that capacity performances are increased from 6 with PF scheduler to 8.7 with delay-aware scheduler by about 45%.

For FR1, Dense Urban, DL, with VR/AR I/P Frame Traffic Model, 30Mbps, 60FPS, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [0.5%, 0.5%], with alpha = 2 and SU-MIMO, it is observed from (MediaTek) that capacity performances are increased from 6 with PF scheduler to 8.7 with delay-aware scheduler by about 45%.

For FR1, Dense Urban, DL, with VR/AR I/P Frame Traffic Model, 30Mbps, 60FPS, [PDB\_I, PDB\_P] = [17ms, 9ms], [PER\_I, PER\_P] = [1%, 1%], with alpha = 2 and SU-MIMO, it is observed from (MediaTek) that capacity performances are increased from 9 with PF scheduler to 11 with delay-aware scheduler by about 22.2%.

For FR1, Dense Urban, DL, with VR/AR I/P Frame Traffic Model, 30Mbps, 60FPS, [PDB\_I, PDB\_P] = [10ms, 10ms], [PER\_I, PER\_P] = [1%, 5%], with alpha = 2 and SU-MIMO, it is observed from (MediaTek) that capacity performances are increased from 6.5 with PF scheduler to 9 with delay-aware scheduler by about 38.5%.

For FR1, Dense Urban, DL, with VR/AR I/P Frame Traffic Model, 30Mbps, 60FPS, [PDB\_I, PDB\_P] = [15ms, 10ms], [PER\_I, PER\_P] = [1%, 1%], with alpha = 2 and SU-MIMO, it is observed from (MediaTek) that capacity performances are increased from 10 with PF scheduler to 11.5 with delay-aware scheduler by about 15%.

For FR1, Dense Urban, DL, with VR/AR I/P Frame Traffic Model, 30Mbps, 60FPS, [PDB\_I, PDB\_P] = [15ms, 10ms], [PER\_I, PER\_P] = [1%, 5%], with alpha = 2 and SU-MIMO, it is observed from (MediaTek) that capacity performances are increased from 10.3 with PF scheduler to 11.7 with delay-aware scheduler by about 13.6%.

**Observation:**

For FR1, Indoor Hotspot, DL, with CG, 30Mbps, 60FPS, 15ms PDB, with SU-MIMO, it is observed from (vivo) that capacity performances are increased from 10.14 with PF scheduler to 11.43 with delay-aware scheduler by about 12.72%.

For FR1, Indoor Hotspot, DL, with CG, 30Mbps, 60FPS, 15ms PDB, with MU-MIMO, it is observed from (vivo) that capacity performances are increased from 16.20 with PF scheduler to 16.67 with delay-aware scheduler by about 2.90%.

For FR1, Indoor Hotspot, DL, with VR/AR, 30Mbps, 60FPS, 10ms PDB, with SU-MIMO, it is observed from (vivo) that capacity performances are increased from 8.27 with PF scheduler to 10.77 with delay-aware scheduler by about 30.23%.

For FR1, Indoor Hotspot, DL, with VR/AR, 30Mbps, 60FPS, 10ms PDB, with MU-MIMO, it is observed from (vivo) that capacity performances are increased from 10.80 with PF scheduler to 12.40 with delay-aware scheduler by about 14.81%.

For FR1, Urban Macro, DL, with CG, 30Mbps, 60FPS, 15ms PDB, with SU-MIMO, it is observed from (vivo) that capacity performances are increased from 10.33 with PF scheduler to 11.94 with delay-aware scheduler by about 15.59%.

For FR1, Urban Macro, DL, with CG, 30Mbps, 60FPS, 15ms PDB, with MU-MIMO, it is observed from (vivo) that capacity performances are increased from 14.33 with PF scheduler to 14.45 with delay-aware scheduler by about 0.84%.

For FR1, Urban Macro, DL, with VR/AR, 30Mbps, 60FPS, 10ms PDB, with SU-MIMO, it is observed from (vivo) that capacity performances are increased from 7.24 with PF scheduler to 8.56 with delay-aware scheduler by about 18.23%.

For FR1, Urban Macro, DL, with VR/AR, 30Mbps, 60FPS, 10ms PDB, with MU-MIMO, it is observed from (vivo) that capacity performances are increased from 8.82 with PF scheduler to 9.55 with delay-aware scheduler by about 8.28%.

For FR1, Dense Urban, UL, with AR two-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS + Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS), with MU-MIMO, it is observed from (Huawei) that capacity performances are increased from 1.5 with PF scheduler to 5.6 with aware-traffic scheduler by about 273.3%.

**Observation:**

For FR2, Dense Urban, DL, with VR/AR, 30Mbps, 10ms PDB, with SU-MIMO, it is observed from (vivo) that capacity performances are increased from 13.44 with PF scheduler to 14.16 with delay-aware scheduler by about 5.4%.

For FR2, Dense Urban, DL, with VR/AR, 45Mbps, 10ms PDB, with SU-MIMO, it is observed from (vivo) that capacity performances are increased from 8.2 with PF scheduler to 10.32 with delay-aware scheduler by about 25.9%.

For FR2, Dense Urban, DL, with CG, 30Mbps, 15ms PDB, with SU-MIMO, it is observed from (vivo) that capacity performances are increased from 16.16 with PF scheduler to 16.82 with delay-aware scheduler by about 4.1%.

For FR2, Dense Urban, DL, with VR/ARtwo-stream (video-stream 30Mbps + audio-stream 0.756Mbps), with SU-MIMO, it is observed from (Qualcomm) that capacity performances are increased from 6 with PF scheduler to 6.5 with delay-aware scheduler by about 8.33%.

For FR2, Indoor hotspot, DL, with VR/AR, 30Mbps, 10ms PDB, with SU-MIMO, it is observed from (vivo) that capacity performances are increased from 8.72 with PF scheduler to 8.83 with delay-aware scheduler by about 1.3%.

For FR2, Indoor hotspot, DL, with VR/AR, 45Mbps, 10ms PDB, with SU-MIMO, it is observed from (vivo) that capacity performances are increased from 4.67 with PF scheduler to 6.03 with delay-aware scheduler by about 29.1%.

For FR2, Indoor hotspot, DL, with CG, 30Mbps, 15ms PDB, with SU-MIMO, it is observed from (vivo) that capacity performances are increased from 9.13 with PF scheduler to 10.23 with delay-aware scheduler by about 12.0%.

For FR2, Indoor hotspot, DL, with VR/ARtwo-stream (video-stream 30Mbps + audio-stream 0.756Mbps), with SU-MIMO, it is observed from (Qualcomm) that capacity performances are increased from 4.5 with PF scheduler to 5.4 with delay-aware scheduler by about 20.0%.

For FR2, Indoor hotspot, UL, with ARtwo-stream (Scene/video/data/audio-stream, 10Mbps, 30ms PDB, 60FPS + Pose/control-stream, 0.2Mbps, 10ms PDB, 250 FPS), with SU-MIMO, it is observed from (Qualcomm) that capacity performances are increased from 5 with PF scheduler to 6.5 with delay-aware scheduler by about 30.0%.

#### Cooperative MIMO/Precoding

This section describes the capacity performance with Cooperative MIMO/Precoding. In the evaluations, following schemes of MIMO precoding are evaluated,

* 1. Zero forcing precoding
  2. bi-directional training (BiT) precoding.

This section captures the capacity evaluation results of bi-directional training (BiT) precoding relative to Zeroforcing precoding for XR applications.

Bi-directional Training (BiT) is a spatial-domain interference avoidance scheme in a TDD Cooperative MIMO system. In BiT, DL interference probing is performed on uplink sounding resources semi-statically coordinated among gNBs. On the sounding resources, each gNB triggers SRS transmissions with parameters associated with corresponding DL transmissions. Then DL interference mitigation in spatial domain is performed by each gNB for its DL transmissions based on the interference probing outcome.

Table 1 FR1, DL, DU, VR/AR 30Mbps, SU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | Zeroforcing | random | 10 | 7.6 | 7 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | cooperative MIMO/precoding | random | 10 | 9.4 | 9 | 93% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | SU-MIMO | Zeroforcing | random | 10 | 9.7 | 9 | 94% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | SU-MIMO | cooperative MIMO/precoding | random | 10 | 11.7 | 11 | 92% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8) | | | | | | | | | | |

Table 2 FR1, DL, DU, VR/AR 30Mbps, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | Zeroforcing | random | 10 | 8.9 | 8 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | cooperative MIMO/precoding | random | 10 | 16.4 | 16 | 93% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | Zeroforcing | random | 10 | 12.3 | 12 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | cooperative MIMO/precoding | random | 10 | 20.3 | 20 | 91% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | Zeroforcing | random | 7 | 6.4 | 6 | 91% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | cooperative MIMO/precoding | random | 7 | 12.7 | 12 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | Zeroforcing | random | 7 | 8.4 | 8 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | cooperative MIMO/precoding | random | 7 | 16.9 | 16 | 93% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | Zeroforcing | random | 13 | 11.4 | 11 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | cooperative MIMO/precoding | random | 13 | 18.6 | 18 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | Zeroforcing | random | 13 | 14.7 | 14 | 91% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | cooperative MIMO/precoding | random | 13 | 22.1 | 22 | 90% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8) | | | | | | | | | | |

Table 3 FR1, DL, DU, VR/AR 45Mbps, SU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | Zeroforcing | random | 10 | 4.0 | 4 | 90% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | cooperative MIMO/precoding | random | 10 | 4.7 | 4 | 93% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | SU-MIMO | Zeroforcing | random | 10 | 6 | 6 | 90% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | SU-MIMO | cooperative MIMO/precoding | random | 10 | 7 | 7 | 90% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8) | | | | | | | | | | |



Table 4 FR1, DL, DU, VR/AR 45Mbps, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | Zeroforcing | random | 10 | 5.2 | 5 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | cooperative MIMO/precoding | random | 10 | 10.6 | 10 | 95% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | Zeroforcing | random | 10 | 7.3 | 7 | 94% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | cooperative MIMO/precoding | random | 10 | 14.3 | 14 | 92% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8) | | | | | | | | | | |



Table 14 FR1, DL, DU, CG 30Mbps, SU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | Zeroforcing | random | 15 | 10.3 | 10 | 91% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | cooperative MIMO/precoding | random | 15 | 11.4 | 11 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | SU-MIMO | Zeroforcing | random | 15 | 12.4 | 12 | 91% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | SU-MIMO | cooperative MIMO/precoding | random | 15 | 14.9 | 14 | 92% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8) | | | | | | | | | | |

Table 15 FR1, DL, DU, CG 30Mbps, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | Zeroforcing | random | 15 | 12.3 | 12 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | cooperative MIMO/precoding | random | 15 | 19.7 | 19 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | Zeroforcing | random | 15 | 17.1 | 17 | 91% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | cooperative MIMO/precoding | random | 15 | 22.9 | 22 | 91% | Note1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8) | | | | | | | | | | |

Table 25 FR1, DL, Uma, VR/AR 30Mbps, SU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | Zeroforcing | random | 10 | 5.4 | 5 | 94% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | cooperative MIMO/precoding | random | 10 | 6.5 | 6 | 93% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | SU-MIMO | Zeroforcing | random | 10 | 7 | 7 | 90% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | SU-MIMO | cooperative MIMO/precoding | random | 10 | 8.8 | 8 | 92% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8) | | | | | | | | | | |

Table 26 FR1, DL, Uma, VR/AR 30Mbps, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | Zeroforcing | random | 10 | 6.3 | 6 | 91% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | cooperative MIMO/precoding | random | 10 | 9.5 | 9 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | Zeroforcing | random | 10 | 7.7 | 7 | 94% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | cooperative MIMO/precoding | random | 10 | 11.6 | 11 | 92% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8) | | | | | | | | | | |

Table 27 FR1, DL, Uma, VR/AR 45Mbps, SU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | Zeroforcing | random | 10 | 3.3 | 3 | 95% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | cooperative MIMO/precoding | random | 10 | 3.7 | 3 | 96% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | SU-MIMO | Zeroforcing | random | 10 | 4.4 | 4 | 93% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | SU-MIMO | cooperative MIMO/precoding | random | 10 | 5.4 | 5 | 93% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8) | | | | | | | | | | |

Table 28 FR1, DL, Uma, VR/AR 45Mbps, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | Zeroforcing | random | 10 | 3.6 | 3 | 96% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | cooperative MIMO/precoding | random | 10 | 5.5 | 5 | 94% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | Zeroforcing | random | 10 | 4.9 | 4 | 95% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | cooperative MIMO/precoding | random | 10 | 7.7 | 7 | 94% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8) | | | | | | | | | | |







FR1, DL, Uma, CG 30Mbps, SU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | Zeroforcing | random | 15 | 7.2 | 7 | 91% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | cooperative MIMO/precoding | random | 15 | 8.7 | 8 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | SU-MIMO | Zeroforcing | random | 15 | 9.7 | 9 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | SU-MIMO | cooperative MIMO/precoding | random | 15 | 11.4 | 11 | 91% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8) | | | | | | | | | | |

FR1, DL, Uma, CG 30Mbps, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | Zeroforcing | random | 15 | 8.4 | 8 | 91% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | cooperative MIMO/precoding | random | 15 | 12.4 | 12 | 91% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | Zeroforcing | random | 15 | 11.1 | 11 | 90% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | cooperative MIMO/precoding | random | 15 | 14.2 | 14 | 91% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8) | | | | | | | | | | |

**Observation:**

For FR1, Dense Urban, DL, for VR/AR, with single stream traffic model, DDDUU/DDDSU TDD format, with SU-MIMO, 30Mbps, 10ms PDB, 60 FPS, it is observed from (FUTUREWEI) that capacity performance is 9.4/11.7 with cooperative MIMO/precoding, compared to zero forcing precoding with 7.6/9.7, with performance increased by 23.7%/20.6%.

For FR1, Dense Urban, DL, for VR/AR, with single stream traffic model, DDDUU/DDDSU TDD format, with MU-MIMO, 30Mbps, 10ms PDB, 60 FPS, it is observed from (FUTUREWEI) that capacity performance is 16.4/20.3 with cooperative MIMO/precoding, compared to zero forcing precoding with 8.9/12.3 , with performance increased by 84.3%/65%.

For FR1, Dense Urban, DL, for VR/AR, with single stream traffic model, DDDUU/DDDSU TDD format, with MU-MIMO, 30Mbps, 7ms PDB, 60 FPS, it is observed from (FUTUREWEI) that capacity performance is 12.7/16.9 with cooperative MIMO/precoding, compared to zero forcing precoding with 6.4/8.4, with performance increased by 98%/101%.

For FR1, Dense Urban, DL, for VR/AR, with single stream traffic model, DDDUU/DDDSU TDD format, with MU-MIMO, 30Mbps, 13ms PDB, 60 FPS, it is observed from (FUTUREWEI) that capacity performance is 18.6/22.1 with cooperative MIMO/precoding, compared to zero forcing precoding with 11.4/14.7, with performance increased by 63%/50%.

For FR1, Dense Urban, DL, for CG, with single stream traffic model, DDDUU/DDDSU TDD format, with SU-MIMO, 30Mbps, 15ms PDB, 60 FPS, it is observed from (FUTUREWEI) that capacity performance is 11.4/14.9 with cooperative MIMO/precoding, compared to zero forcing precoding with 10.3/12.4, with performance increased by 10.7%/20.2%.

For FR1, Dense Urban, DL, for CG, with single stream traffic model, DDDUU/DDDSU TDD format, with MU-MIMO, 30Mbps, 15ms PDB, 60 FPS, it is observed from (FUTUREWEI) that capacity performance is 19.7/22.9 with cooperative MIMO/precoding, compared to zero forcing precoding with 12.3/17.1, with performance increased by 60.2%/33.9%.

For FR1, Dense Urban, DL, for VR/AR, with single stream traffic model, DDDUU/DDDSU TDD format, with SU-MIMO, 45Mbps, 10ms PDB, 60 FPS, it is observed from (FUTUREWEI) that capacity performance is 4.7/7 with cooperative MIMO/precoding, compared to zero forcing precoding with 4/6, with performance increased by 17.5%/16.7%.

For FR1, Dense Urban, DL, for VR/AR, with single stream traffic model, DDDUU/DDDSU TDD format, with MU-MIMO, 45Mbps, 10ms PDB, 60 FPS, it is observed from (FUTUREWEI) that capacity performance is 10.6/14.3 with cooperative MIMO/precoding, compared to zero forcing precoding with 5.2/7.3, with performance increased by 104%/95.9%.

For FR1, Uma, DL, for VR/AR, with single stream traffic model, DDDUU/DDDSU TDD format, with SU-MIMO, 30Mbps, 10ms PDB, 60 FPS, it is observed from (FUTUREWEI) that capacity performance is 6.5/8.8 with cooperative MIMO/precoding, compared to zero forcing precoding with 5.4/7, with performance increased by 20.4%/27%.

For FR1, Uma, DL, for VR/AR, with single stream traffic model, DDDUU/DDDSU TDD format, with MU-MIMO, 30Mbps, 10ms PDB, 60 FPS, it is observed from (FUTUREWEI) that capacity performance is 9.5/11.6 with cooperative MIMO/precoding, compared to zero forcing precoding with 6.3/7.7, with performance increased by 50.8%/50.6%.

For FR1, Uma, DL, for VR/AR, with single stream traffic model, DDDUU/DDDSU TDD format, with SU-MIMO, 45Mbps, 10ms PDB, 60 FPS, it is observed from (FUTUREWEI) that capacity performance is 3.7/5.4 with cooperative MIMO/precoding, compared to zero forcing precoding with 3.3/4.4, with performance increased by 2.1%/22.7%.

For FR1, Uma, DL, for VR/AR, with single stream traffic model, DDDUU/DDDSU TDD format, with MU-MIMO, 45Mbps, 10ms PDB, 60 FPS, it is observed from (FUTUREWEI) that capacity performance is 5.5/7.7 with cooperative MIMO/precoding, compared to zero forcing precoding with 3.6/4.9, with performance increased by 52.8%/57.1%.

For FR1, Uma, DL, for CG, with single stream traffic model, DDDUU/DDDSU TDD format, with SU-MIMO, 30Mbps, 15ms PDB, 60 FPS, it is observed from (FUTUREWEI) that capacity performance is 8.7/11.4 with cooperative MIMO/precoding, compared to zero forcing precoding with 7.2/9.7, with performance increased by 20.8%/17.5%.

For FR1, Uma, DL, for CG, with single stream traffic model, DDDUU/DDDSU TDD format, with MU-MIMO, 30Mbps, 15ms PDB, 60 FPS, it is observed from (FUTUREWEI) that capacity performance is 12.4/14.2 with cooperative MIMO/precoding, compared to zero forcing precoding with 8.4/11.1, with performance increased by 47.6%/27.9%.observedobservedobservedobservedobservedobservedobservedobservedobservedobservedobserved

#### Network Coding

This section captures the capacity evaluation results of network/outer coding for XR applications. In this evaluation, the baseline scheme is HARQ. In network/outer coding scheme provides additional redundancy reducing the overall latency of packet transmission by removing HARQ retransmission.

**Observation:**

For FR2, Dense urban, DL, for VR/AR, with single stream traffic model, DDDSU TDD format, with SU-MIMO, 30Mbps, 10ms PDB, network coding (50% redundancy), 2CC (30&39GHz) CA, no blocking, it is observed from (Qualcomm) that capacity performance is 8.5.

For FR2, Dense urban, DL, for VR/AR, with single stream traffic model, DDDSU TDD format, with SU-MIMO, 30Mbps, 10ms PDB, network coding (100% redundancy), 2CC (30&39GHz) CA, no blocking, it is observed from (Qualcomm) that capacity performance is 5.

For FR2, Dense urban, DL, for VR/AR, with single stream traffic model, DDDSU TDD format, with SU-MIMO, 30Mbps, 10ms PDB, network coding (20% redundancy), 4CC (30,30.4,39&39.4GHz) CA, no blocking, it is observed from (Qualcomm) that capacity performance is 15.

For FR2, Dense urban, DL, for VR/AR, with single stream traffic model, DDDSU TDD format, with SU-MIMO, 30Mbps, 10ms PDB, network coding (120% redundancy), 4CC (30,30.4,39&39.4GHz) CA, no blocking, it is observed from (Qualcomm) that capacity performance is 10.

For FR2, Dense urban, DL, for VR/AR, with single stream traffic model, DDDSU TDD format, with SU-MIMO, 45Mbps, 10ms PDB, network coding (50% redundancy), 2CC (30&39GHz) CA, no blocking, it is observed from (Qualcomm) that capacity performance is 5.

For FR2, Dense urban, DL, for VR/AR, with single stream traffic model, DDDSU TDD format, with SU-MIMO, 45Mbps, 10ms PDB, network coding (100% redundancy), 2CC (30&39GHz) CA, no blocking, it is observed from (Qualcomm) that capacity performance is 3.

For FR2, Dense urban, DL, for VR/AR, with single stream traffic model, DDDSU TDD format, with SU-MIMO, 45Mbps, 10ms PDB, network coding (20% redundancy), 4CC (30,30.4,39&39.4GHz) CA, no blocking, it is observed from (Qualcomm) that capacity performance is 10.

For FR2, Dense urban, DL, for VR/AR, with single stream traffic model, DDDSU TDD format, with SU-MIMO, 45Mbps, 10ms PDB, network coding (120% redundancy), 4CC (30,30.4,39&39.4GHz) CA, no blocking, it is observed from (Qualcomm) that capacity performance is 6.

For FR2, Dense urban, DL, for VR/AR, with single stream traffic model, DDDSU TDD format, with SU-MIMO, 45Mbps, 10ms PDB, network coding (100% redundancy), mTRP (2ms evaluation interval), it is observed from (Qualcomm) that capacity performance is 10.5.

For FR2, Dense urban, DL, for VR/AR, with single stream traffic model, DDDSU TDD format, with SU-MIMO, 45Mbps, 10ms PDB, network coding (100% redundancy), mTRP (10ms evaluation interval), it is observed from (Qualcomm) that capacity performance is 5.

#### gNB Scheduling Awareness UE Playout Buffer

This section captures the evaluation results of gNB Scheduling Awareness UE Playout Buffer. In the evaluation, the size of playout buffer is feedback from UE and known at gNB. Then, gNB can have additional PDB, which could give gNB more time to schedule UE within the delay budget requirements of the XR service and more likely to successfully transmit packets with link adaptation gain. gNB knowing the size of playout buffer can preferentially schedule UE with packet delay close to deadline and better channel conditions.

**Observation:**

For FR1, Indoor Hotspot, DL, for VR/AR, with single stream traffic model, DDDSU TDD format, with MU-MIMO, 30Mbps, 60FPS, 10ms PDB, codebook-based Type 2, it is observed from (CATT) that capacity performance is 12.

For FR1, Indoor Hotspot, DL, for VR/AR, with single stream traffic model, DDDSU TDD format, with MU-MIMO, 30Mbps, 60FPS, 10ms PDB, codebook-based Type 2, gNB scheduling awareness of 2 frames UE playout buffer, it is observed from (CATT) that capacity performance is 16.

For FR1, Indoor Hotspot, DL, for VR/AR, with single stream traffic model, DDDSU TDD format, with MU-MIMO, 30Mbps, 60FPS, 10ms PDB, codebook-based Type 2, gNB scheduling awareness of 3 frames UE playout buffer, it is observed from (CATT) that capacity performance is 20.

For FR1, Indoor Hotspot, DL, for VR/AR, with single stream traffic model, DDDSU TDD format, with MU-MIMO, 30Mbps, 60FPS, 10ms PDB, codebook-based Type 2, gNB scheduling awareness of 4 frames UE playout buffer, it is observed from (CATT) that capacity performance is 20.

#### Impact of Carrier Aggregation

This section describes the capacity performance with enhanced carrier aggregation, e.g. applying CA with enhancements to a two-carrier DL CA: DDDDD DDDUU (2.6GHz) + DSUDD SUUDD (4.9GHz).

The CA enhancement here includes “cross-carrier HARQ ACK feedback” and “cross-carrier DL retransmission”.

**Observation:**

For FR1, Dense Urban, DL, for VR/AR, with single stream traffic model, with SU-MIMO, 45Mbps, 10ms PDB, 60 FPS, it is observed from (MediaTek) that capacity performance is 10.3~12.3 with CA with enhancements DDDDD DDDUU (2.6GHz) + DSUDD SUUDD (4.9GHz), compared with capacity performance 4.2 with DSUDD SUUDD (4.9GHz) or capacity performance 0 with DSUDD SUUDD (4.9GHz).

#### Prioritizing important stream

This section describes the capacity performance with prioritizing important stream.

In the evaluation, the transmission of the more important stream, e.g. I-frame is prioritized.

**Observations**

For FR1, Dense urban, DL, with VR/AR GOP-based multi-stream traffic model, 30Mbps, 60FPS, 10ms PDB, with DDDSU, MU-MIMO, with PF scheduler, it is observed from (Source 9, Huawei) that the capacity performances are increased from 6 with no prioritization of streams to 7.4 with prioritizing the transmission of I frame by 23.3%.

For FR1, Dense urban, DL, with VR/AR GOP-based multi-stream traffic model, 30Mbps, 60FPS, 10ms PDB, with DDDSU, MU-MIMO, it is observed from (Source 9, Huawei) that the capacity performances are increased from 6 with PF scheduler with no prioritization of streams to 8.6 with with FLIT scheduler with prioritizing the transmission of I frame by 43.3%.

For FR1, Dense urban, DL, with VR/AR GOP-based multi-stream traffic model, with [PER\_I, PER\_P] = [1%, 1%]/[1%, 5%]/[0.5%, 5%], 30Mbps, 60FPS, 10ms PDB, with DDDSU, MU-MIMO, with PF scheduler, it is observed from (Source 18, vivo) that the capacity performances are increased from 5.2/5.2/4.74 with no prioritization of streams to 5.53/5.53/4.97 with prioritizing the transmission of I frame by 6.3%/6.3%/4.9%.

For FR1, Dense urban, DL, with VR/AR GOP-based multi-stream traffic model with [PER\_I, PER\_P] = [0.5%, 5%], 45Mbps, 60FPS, 10ms PDB, with DDDSU, MU-MIMO, with PF scheduler, it is observed from (Source 9, Huawei) that the capacity performances are increased from 1.4 with no prioritization of streams to 2.6 with prioritizing the transmission of I frame by 85.7%.

For FR1, Dense urban, DL, with VR/AR GOP-based multi-stream traffic model, 45Mbps, 60FPS, 10ms PDB, with DDDSU, MU-MIMO, it is observed from (Source 9, Huawei) that the capacity performances are increased from 1.4 with PF scheduler with no prioritization of streams to 3.2 with with FLIT scheduler with prioritizing the transmission of I frame by 128.6%.

For FR1, Dense urban, DL, with VR/AR Slice-based multi-stream traffic model, with [PER\_I, PER\_P] = [1%, 1%]/[1%, 5%]/[0.5%, 5%], 30Mbps, 60FPS, 10ms PDB, with DDDSU, MU-MIMO, with PF scheduler, it is observed from (Source 18, vivo) that the capacity performances are 13.54/16.23/16.17 with prioritizing the transmission of I frame.

For FR1, Indoor hotspot, DL, with coexistence between uRLLC service and XR service, with VR/AR single stream traffic model, 30Mbps, 60FPS, 10ms PDB, with DDDSU, MU-MIMO, it is observed from (Source 20, ZTE) that the capacity performances are increased from 8.5 with no preemption indication to 11.8 with Rel-15 Preemption by 38.8%.

For FR1, Indoor hotspot, DL, with coexistence between uRLLC service and XR service, with VR/AR single stream traffic model, 30Mbps, 60FPS, 10ms PDB, with DDDSU, MU-MIMO, it is observed from (Source 20, ZTE) that the capacity performances are increased from 8.5 with no preemption indication to 16.6 with enhanced Preemption by 95.3%.

For FR1, Indoor Hotspot, DL, with Audio/data + video multi stream traffic model, with [PER\_audio, PER\_video] = [0.1%, 1%], 1.12Mbps, 100FPS + 30Mbps, 60FPS, 10ms PDB, with DDDSU, MU-MIMO, with PF scheduler, it is observed from (Source 20, ZTE) that the capacity performances are increase from 5.7 with Rel-15 preemption to 8.4 with enhanced preemption by 47.37%.

For FR1, Indoor Hotspot, DL, with Audio/data + video multi stream traffic model, with [PER\_audio, PER\_video] = [0.1%, 1%], 1.12Mbps, 100FPS + 30Mbps, 60FPS, 10ms PDB, with DDDSU, MU-MIMO, with PF scheduler, it is observed from (Source 20, ZTE) that the capacity performances are increase from 4.9 without preemption to 8.4 with enhanced preemption by 71.43%.

For FR1, Indoor Hotspot, DL, with VR/AR slice-based multi stream traffic model, 30Mbps, 60FPS, 10ms PDB with [PER\_I, PER\_P] = [1%, 1%] and VR/AR single-stream traffic model, 30Mbps, 60FPS, 10ms, with DDDSU, MU-MIMO, with PF scheduler, it is observed from (Source 20, ZTE) that the capacity performances are increased from 7.1 without preemption to 10.2 with enhanced preemption by 43.66%.

For FR1, Indoor Hotspot, DL, with VR/AR slice-based multi stream traffic model, 30Mbps, 60FPS, 10ms PDB with [PER\_I, PER\_P] = [1%, 1%] and VR/AR single-stream traffic model, 30Mbps, 60FPS, 10ms, with DDDSU, MU-MIMO, with PF scheduler, it is observed from (Source 20, ZTE) that the capacity performances are increased from 4.5 without preemption to 10.2 with enhanced preemption by 126.67%.

Table FR1, DL, DU, GOP-based 30Mbps, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Traffic arrival offset among different Ues | Alpha | [I\_PDB, P\_PDB] (ms) | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 2 | [10,10] | 6 | 6 | 90.08% | Note 1,4 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 2 | [10,10] | 7.4 | 7 | 91.38% | Note 1,4,5 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 2 | [10,10] | 8.6 | 8 | 95.44% | Note 1,4,6 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 5.2 | 5 | 91.14% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 5.2 | 5 | 91.14% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 4.74 | 4 | 94.84% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 5.35 | 5 | 91.47% | Note 1,2,5 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 5.35 | 5 | 91.47% | Note 1,3,5 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 4.97 | 4 | 90.87% | Note 1,4,5 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: [PER\_I, PER\_P] = [1%, 1%]  Note 3: [PER\_I, PER\_P] = [1%, 5%]  Note 4: [PER\_I, PER\_P] = [0.5%, 5%]  Note 5: Based on PF, prioritize the transmission of I frame  Note 6: [PER\_I, PER\_P] = FLIT and prioritize the transmission of I frame  Note 7: [PER\_I, PER\_P] = [10%, 1%]  Note 8: [PER\_I, PER\_P] = [1%, 10%] | | | | | | | | | | |

Table 9 FR1, DL, DU, GOP-based 45Mbps, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Traffic arrival offset among different Ues | Alpha | [I\_PDB, P\_PDB] (ms) | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 1.5 | [10,10] | 1.4 | 1 | 97.14% | Note 1,2 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 1.5 | [10,10] | 2.6 | 2 | 92.83% | Note 1,2,3 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 1.5 | [10,10] | 3.2 | 3 | 90.79% | Note 1,2,4 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: [PER\_I, PER\_P] = [0.5%, 5%]  Note 3: Based on PF, prioritize the transmission of I frame  Note 4: [PER\_I, PER\_P] = FLIT and prioritize the transmission of I frame | | | | | | | | | | |

Table 10 FR1, DL, DU, Slice-based 30Mbps, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Traffic arrival offset among different Ues | Alpha | [I\_PDB, P\_PDB] (ms) | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 13.69 | 13 | 92.25% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 16.84 | 16 | 91.77% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 16.59 | 16 | 91.27% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 13.54 | 13 | 91.72% | Note 1,2,5 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 16.23 | 16 | 90.77% | Note 1,3,5 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 16.17 | 16 | 90.57% | Note 1,4,5 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: [PER\_I, PER\_P] = [1%, 1%]  Note 3: [PER\_I, PER\_P] = [1%, 5%]  Note 4: [PER\_I, PER\_P] = [0.5%, 5%]  Note 5: Based on PF, prioritize the transmission of I frame | | | | | | | | | | |

Table x FR1, DL, InH, VR/AR 30Mbps, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | 10 | 16.6 | 16 | 91% | Note 3, 10 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | 10 | 11.8 | 11 | 94% | Note 3, 11 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | 10 | 8.5 | 8 | 95% | Note 3, 12 |
| Note 3: 64QAM  Note 10: Enhanced Preemption (XR vs. uRLLC)  Note 11: Rel-15 Preemption (XR vs. uRLLC)  Note 12: No Preemption (XR vs. uRLLC) | | | | | | | | | | |

Table x FR1, DL, InH, audio/data + video multi stream traffic model, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | [PDB\_Audio, PDB\_video] (ms) | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | [10,10] | 8.4 | 8 | 92% | Note 3, 10-1 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | [10,10] | 5.7 | 5 | 95% | Note 3, 11-1 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | [10,10] | 4.9 | 4 | 92% | Note 3, 12-1 |
| Note 3: 64QAM  Note 10-1: Enhanced Preemption (Audio/data streams vs. Video streams)  Note 11-1: Rel-15 Preemption(Audio/data streams vs. Video streams)  Note 12-1: No Preemption (Audio/data streams vs. Video streams) | | | | | | | | | | |

Table x FR1, DL, InH, slice-based multi stream traffic model and single stream video traffic model, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | [I\_PDB, P\_PDB, PDB\_video] (ms) | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | [10,10, 10] | 10.2 | 10 | 90% | Note 3, 10-2 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | [10,10, 10] | 7.1 | 7 | 90% | Note 3, 11-2 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | [10,10, 10] | 4.5 | 4 | 93% | Note 3, 12-2 |
| Note 3: 64QAM  Note 10-2: Enhanced Preemption (I-slices vs. P-slices and video streams)  Note 11-2: Rel-15 Preemption(I-slices vs. P-slices and video streams)  Note 12-2: No Preemption(I-slices vs. P-slices and video streams) | | | | | | | | | | |

#### Adaptive Inter-UE/Intra-UE Multiplexing Techniques

This section describes the capacity performance with adaptive inter-UE/intra-UE multiplexing technique. In the evaluation, enhanced preemption mechanism with finer granularity preemption area indication is evaluated. For simulation of XR traffic and uRLLC traffic, uRLLC traffic and XR traffic are considered as the two types of traffic to be transmitted in the system, where uRLLC traffic has higher priority (HP) while XR traffic has a relatively low priority (LP). In simulation of audio/data + video multi stream traffic model, audio/data streams and video streams are also considered as the two types of streams to be transmitted in the system, where audio/data streams have higher priority while video streams have a relatively low priority. Besides, in simulation of sliced-based multi stream traffic model and single stream video traffic model, I-slices, P-slices and video streams are considered as the three types of streams to be transmitted in the system, where I-slices streams have higher priority while video streams and P-slices have a relatively low priority.

**Observations**

For FR1, Indoor hotspot, DL, with coexistence between uRLLC service and XR service, with VR/AR single-stream traffic model, 30Mbps, 60FPS, 10ms PDB, with DDDSU, MU-MIMO, it is observed from (Source 20, ZTE) that the capacity performances are increased from 8.5 with no preemption indication to 11.8 with Rel-15 Preemption by 38.8%.

For FR1, Indoor hotspot, DL, with coexistence between uRLLC service and XR service, with VR/AR single-stream traffic model, 30Mbps, 60FPS, 10ms PDB, with DDDSU, MU-MIMO, it is observed from (Source 20, ZTE) that the capacity performances are increased from 8.5 with no preemption indication to 16.6 with enhanced Preemption by 95.3%.

For FR1, Indoor Hotspot, DL, with Audio/data + video multi stream traffic model, with [PER\_audio, PER\_video] = [0.1%, 1%], 1.12Mbps, 100FPS + 30Mbps, 60FPS, 10ms PDB, with DDDSU, MU-MIMO, with PF scheduler, it is observed from (Source 20, ZTE) that the capacity performances are increase from 5.7 with Rel-15 preemption to 8.4 with enhanced preemption by 47.37%.

For FR1, Indoor Hotspot, DL, with Audio/data + video multi stream traffic model, with [PER\_audio, PER\_video] = [0.1%, 1%], 1.12Mbps, 100FPS + 30Mbps, 60FPS, 10ms PDB, with DDDSU, MU-MIMO, with PF scheduler, it is observed from (Source 20, ZTE) that the capacity performances are increase from 4.9 without preemption to 8.4 with enhanced preemption by 71.43%.

For FR1, Indoor Hotspot, DL, with VR/AR slice-based multi stream traffic model, 30Mbps, 60FPS, 10ms PDB with [PER\_I, PER\_P] = [1%, 1%] and VR/AR single-stream traffic model, 30Mbps, 60FPS, 10ms, with DDDSU, MU-MIMO, with PF scheduler, it is observed from (Source 20, ZTE) that the capacity performances are increased from 7.1 without preemption to 10.2 with enhanced preemption by 43.66%.

For FR1, Indoor Hotspot, DL, with VR/AR slice-based multi stream traffic model, 30Mbps, 60FPS, 10ms PDB with [PER\_I, PER\_P] = [1%, 1%] and VR/AR single-stream traffic model, 30Mbps, 60FPS, 10ms, with DDDSU, MU-MIMO, with PF scheduler, it is observed from (Source 20, ZTE) that the capacity performances are increased from 4.5 without preemption to 10.2 with enhanced preemption by 126.67%.

Table 18 FR1, DL, InH, VR/AR 30Mbps, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | 10 | 16.6 | 16 | 91% | Note 3, 10 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | 10 | 11.8 | 11 | 94% | Note 3, 11 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | 10 | 8.5 | 8 | 95% | Note 3, 12 |
| Note 3: 64QAM  Note 10: Enhanced Preemption (XR vs. uRLLC)  Note 11: Rel-15 Preemption (XR vs. uRLLC)  Note 12: No Preemption (XR vs. uRLLC) | | | | | | | | | | |

Table 22 FR1, DL, InH, audio/data + video multi-streams traffic model, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | [PDB\_Audio, PDB\_video] (ms) | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | [10,10] | 8.4 | 8 | 92% | Note 3, 10-1 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | [10,10] | 5.7 | 5 | 95% | Note 3, 11-1 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | [10,10] | 4.9 | 4 | 92% | Note 3, 12-1 |
| Note 3: 64QAM  Note 10-1: Enhanced Preemption (Audio/data streams vs. Video streams)  Note 11-1: Rel-15 Preemption(Audio/data streams vs. Video streams)  Note 12-1: No Preemption (Audio/data streams vs. Video streams) | | | | | | | | | | |

Table 23 FR1, DL, InH, slice-based multi-streams traffic model and single stream video traffic model, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | [I\_PDB, P\_PDB, PDB\_video] (ms) | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | [10,10, 10] | 10.2 | 10 | 90% | Note 3, 10-2 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | [10,10, 10] | 7.1 | 7 | 90% | Note 3, 11-2 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | [10,10, 10] | 4.5 | 4 | 93% | Note 3, 12-2 |
| Note 3: 64QAM  Note 10-2: Enhanced Preemption (I-slices vs. P-slices and video streams)  Note 11-2: Rel-15 Preemption(I-slices vs. P-slices and video streams)  Note 12-2: No Preemption(I-slices vs. P-slices and video streams) | | | | | | | | | | |

#### ADU awareness

This section describes the capacity performance with ADU awareness. An ADU is composed of several PKTs.

In the evaluation, the relatioship between AER and PER is investigated, focusing on how to map a target AER to an equivalent PER.

Acronyms:

|  |  |
| --- | --- |
| * PKT = IP Packet * PER = PKT Error Rate * PDB = PKT Delay Buget | * ADU = Application Data Unit * AER = ADU Error Rate * ADB = ADU Delay Buget * ACP = ADU Content Policy |

PKT errors have mainly two causes: PKT drops or PDB expiry. ADU errors are a consequence of losing some of the PKTs constiuting it. In order to correctly decode an ADU at least a given percentage of the PKTs need to be received. This percentage is defined by the ACP. For the purpose of current simulations an ACP = 100% is considerd (i.e. all PKTs must be received, otherwise the ADU is considered lost)

**Observations:**

For FR1, Dense Urban, DL, with VR/AR, single-stream traffic model, 30Mbps, 60FPS, with DDDSU, MU-MIMO, it is observed from (Source 16, Qualcomm) that the ADU capacity performances with ADU awareness, PDB=10/15/20/50ms are 11/15/16/17, and the PKT capacity performances with ADU awareness, PDB=10/15/20/50ms are 13/16/16/18

For FR1, Indoor hotspot, DL, with VR/AR, single-stream traffic model, 30Mbps, 60FPS, with DDDSU, MU-MIMO, it is observed from (Source 16, Qualcomm) that the ADU capacity performances with ADU awareness, PDB=10/15/20/50ms are 11/15/16/17, and the PKT capacity performances with ADU awareness, PDB=10/15/20/50ms are 10/12/12/13

For FR1, UMa, DL, with VR/AR, single-stream traffic model, 30Mbps, 60FPS, with DDDSU, MU-MIMO, it is observed from (Source 16, Qualcomm) that the ADU capacity performances with ADU awareness, PDB=10/15/20/50ms are 4/6/7/8 with 50ms packet discard time, capacity measured for AER target of 1%, and the ADU capacity performances with ADU awareness, PDB=10/15/20/50ms are 5/7/7/8 with 50ms packet discard time, capacity measured for PER target of 1%

Table 2 FR1, DL, DU, VR/AR 30Mbps, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 13.4 | 13 | 92% | Note 1 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 11 | 95% | Note 1. 12 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 15 | 91% | Note 1, 13 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 16 | 92% | Note 1, 14 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 17 | 94% | Note 1, 15 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 13 | 95% | Note 1, 16 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 16 | 92% | Note 1, 17 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 16 | 95% | Note 1, 18 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 18 | 90% | Note 1, 19 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 12: ADU awareness, PDB=10ms: ADU capacity  Note 13: ADU awareness, PDB=15ms: ADU capacity  Note 14: ADU awareness, PDB=20ms: ADU capacity  Note 15: ADU awareness, PDB=50ms: ADU capacity  Note 16: ADU awareness, PDB=10ms: PKT capacity  Note 17: ADU awareness, PDB=15ms: PKT capacity  Note 18: ADU awareness, PDB=20ms: PKT capacity  Note 19: ADU awareness, PDB=50ms: PKT capacity | | | | | | | | | | |

Table 18 FR1, DL, InH, VR/AR 30Mbps, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 10.3 | 10 | 93% |  |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 9 | 91% | Note 13 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 11 | 92% | Note 14 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 12 | 93% | Note 15 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 13 | 94% | Note 16 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 10 | 94% | Note 17 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 12 | 93% | Note 18 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 12 | 95% | Note 19 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 13 | 95% | Note 20 |
| Note 13: ADU awareness, PDB=10ms: ADU capacity  Note 14: ADU awareness, PDB=15ms: ADU capacity  Note 15: ADU awareness, PDB=20ms: ADU capacity  Note 16: ADU awareness, PDB=50ms: ADU capacity  Note 17: ADU awareness, PDB=10ms: PKT capacity  Note 18: ADU awareness, PDB=15ms: PKT capacity  Note 19: ADU awareness, PDB=20ms: PKT capacity  Note 20: ADU awareness, PDB=50ms: PKT capacity | | | | | | | | | | |

Table 26 FR1, DL, Uma, VR/AR 30Mbps, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 5.2 | 5 | 91% | Note 1 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 4 | 91% | Note 1, 5, 9 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 6 | 91% | Note 1, 6, 9 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 7 | 90% | Note 1, 7, 9 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 8 | 90% | Note 1, 8 ,9 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 5 | 91% | Note 1, 5, 10 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 7 | 90% | Note 1, 6, 10 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 7 | 92% | Note 1, 7, 10 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 8 | 91% | Note 1, 8 ,10 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 5: ADU awareness, PDB=10ms: ADU capacity  Note 6: ADU awareness, PDB=15ms: ADU capacity  Note 7: ADU awareness, PDB=20ms: ADU capacity  Note 8: ADU awareness, PDB=50ms: ADU capacity  Note 9: 50ms packet discard time, capacity measured for AER target of 1%  Note 10: 50ms packet discard time, capacity measured for PER target of 1% | | | | | | | | | | |

#### HARQ-ACK enhancement for DG scheduling

This section describes the capacity performance with HARQ-ACK enhancement for DG scheduling. In the evaluation, soft HARQ-ACK is used, where the UE provides enhanced HARQ-ACK feedback beyond the single bit ACK/NACK status in the form of a Delta MCS based on PDSCH decoding. By allowing the UE to provide additional information based on reception of a transport block, soft HARQ-ACK allows the gNodeB to adapt the scheduling of retransmissions and thereby allows the UE to decode the transport block without waiting for too many additional HARQ round trips.

**Observations:**

For FR1, Dense Urban, DL, with VR/AR, single-stream traffic model, 60Mbps, 60FPS, 10ms PDB, with DDDSU, MU-MIMO, it is observed from (Source 16, Qualcomm) that the capacity performances are increased from 0/0/0 Baseline HARQ-Ack with (gNodeB processing delay from HARQ feedback to retransmission = 4/6/8) to 4.6/2.8/2 with Soft HARQ-Ack with (gNodeB processing delay from HARQ feedback to retransmission = 4/6/8).

For FR1, Indoor hotspot, DL, with VR/AR, single-stream traffic model, 60Mbps, 60FPS, 10ms PDB, with DDDSU, MU-MIMO, it is observed from (Source 16, Qualcomm) that the capacity performances are increased from 0/0/0 Baseline HARQ-Ack with (gNodeB processing delay from HARQ feedback to retransmission = 4/6/8) to 2.93/2.1/1.17 with Soft HARQ-Ack with (gNodeB processing delay from HARQ feedback to retransmission = 4/6/8).

Table 5 FR1, DL, DU, VR/AR 60Mbps, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2112244 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 4.6 | 4 | 94.50% | Note 1,2 |
| Source 16, Qualcomm | R1-2112244 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 0 | 0 | N.A. | Note 1,3 |
| Source 16, Qualcomm | R1-2112244 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 2.8 | 2 | 92.90% | Note 1,4 |
| Source 16, Qualcomm | R1-2112244 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 0 | 0 | N.A. | Note 1,5 |
| Source 16, Qualcomm | R1-2112244 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 2 | 2 | 90.10% | Note 1,6 |
| Source 16, Qualcomm | R1-2112244 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 0 | 0 | N.A. | Note 1,7 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: Soft HARQ-Ack, k3 = 4  Note 3: Baseline HARQ-Ack, k3 = 4  Note 4: Soft HARQ-Ack, k3 = 6  Note 5: Baseline HARQ-Ack, k3 = 6  Note 6: Soft HARQ-Ack, k3 = 8  Note 7: Baseline HARQ-Ack, k3 = 8 | | | | | | | | | | |

Table 19 FR1, DL, InH, VR/AR 60Mbps, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 2.93 | 2 | 97.70% | Note 3 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 0 | 0 | N.A. | Note 4 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 2.1 | 2 | 91.25% | Note 5 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 0 | 0 | N.A. | Note 6 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 1.17 | 1 | 91.25% | Note 7 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 0 | 0 | N.A. | Note 8 |
| Note 1: 64QAM  Note 2: Jitter STD=2ms, Jitter range Min=0ms, Jitter range Max=8ms  Note3: Soft HARQ-Ack, k3 = 4  Note4: Baseline HARQ-Ack, k3 = 4  Note5: Soft HARQ-Ack, k3 = 6  Note6: Baseline HARQ-Ack, k3 = 6  Note7: Soft HARQ-Ack, k3 = 8  Note8: Baseline HARQ-Ack, k3 = 8 | | | | | | | | | | |

#### Enhanced buffer status reporting for UL transmission

This section describes the capacity performance with Enhanced buffer status reporting for UL transmission. In the evaluation, enhancements to BSR reporting could make the networks UE buffer estimation closer to the actual UE buffer value, which may improve the utilization efficiency of radio resource and transmitting the packets on time.

**Observations:**

For FR1, Dense Urban, UL, AR (1 stream: Scene/video/data/voice-stream), 10Mbps, 60FPS, 30ms PDB, with DDDSU, SU-MIMO, it is observed from (Source 7, Ericsson) that the capacity performances are increased from 7 with legacy BSR to 8.4 with enhanced BSR by 20%.

For FR1, Dense Urban, UL AR (1 stream: Scene/video/data/voice-stream), 10Mbps, 60FPS, 30ms PDB, with DDDSU, MU-MIMO, it is observed from (Source 20, ZTE that the capacity performances are increased from [9.5] with legacy BSR to 10.9 with enhanced BSR by 14.47%.

For FR1, Dense Urban, UL, AR (1 stream: Scene/video/data/voice-stream), 20Mbps, 60FPS, 30ms PDB, with DDDSU, SU-MIMO, it is observed from (Source 20, ZTE) that the capacity performances are increased from 3.4 with legacy BSR to 5.1 with enhanced BSR by 50%.

Table 31 FR1, UL, DU, AR (1 stream: Scene/video/data/voice-stream), 10Mbps, SU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 7, Ericsson | R1-2112551 | DDDUU | SU-MIMO | reciprocity-based precoding | random | 30 | 7.5 | 7 |  | Note 1 |
| Source 7, Ericsson | R1-2112551 | DDDUU | SU-MIMO | reciprocity-based precoding | random | 30 | 8.4 | 8 |  | Note 1, 4 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 4: Elastic BSR | | | | | | | | | | |

Table 32 FR1, UL, DU, AR (1 stream: Scene/video/data/voice-stream), 10Mbps, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | 30 | 9.5 | 9 | 95% | Note 1, 2, 3 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | 30 | 10.9 | 10 | 94% | Note 1, 2, 4 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: 64QAM  Note 3: legacy BSR  Note 4: Enhanced BSR | | | | | | | | | | |

Table 33 FR1, UL, DU, AR (1 stream: Scene/video/data/voice-stream), 20Mbps, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | 30 | 3.4 | 3 | 91% | Note 1, 2, 3 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | 30 | 5.1 | 5 | 90% | Note 1, 2, 4 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: 64QAM  Note 3: legacy BSR  Note 4: Enhanced BSR | | | | | | | | | | |

#### Application Data Unit (ADU) dropping

This section describes the capacity performance with Application Data Unit (ADU) dropping. In the evaluation, for ADU dropping all PDCP packets belonging to a single ADU frame are dropped after any of them have passed the PDB limit. The performance is compared with the legacy case where PDCP packet discarding is enabled, i.e. dropping PDCP packets after they have passed the PDB limit.

**Observation:**

For FR1, Dense Urban, DL, with VR/AR, single-stream traffic model, 30Mbps, 60FPS, 10ms PDB, with DDDSU, MU-MIMO, it is observed from (Source 7, Ericsson) that the capacity performances are increased from 11.2 without ADU dropping to 12.9 with ADU dropping by 15.2%.

Table 2 FR1, DL, DU, VR/AR 30Mbps, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 7, Ericsson | R1-2112551 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 11.2 | 11 |  | Note 1 |
| Source 7, Ericsson | R1-2112551 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 12.9 | 12 |  | Note 1, 11 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 11: ADU dropping | | | | | | | | | | |

**=============== End of Text update for TR section – Capacity Results in 8.3 =====================**

=================(Unchanged part omitted)==========================

# Annex <B> Source Specific Capacity Performance Evaluation Results

**============Start of Text update for TR section – Source Specific Capacity Performance Evaluation Results in Annex <B> =====================**

* 1. FR1 DL
     1. DU Scenario
        1. VR/AR
           1. Single stream traffic model

Table 1 FR1, DL, DU, VR/AR 30Mbps, 60FPS, SU-MIMO, 100Mbps badwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | SU-MIMO | Close loop rank adaptation | random | 10 | 5.1 | 5 | 91.43% | Note 1 |
| Source 9, Huawei | R1-2110811 | DDDSU | SU-MIMO | Close loop rank adaptation | random | 10 | 6.4 | 6 | 91.67% | Note 1, 3 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | Zeroforcing | random | 10 | 7.6 | 7 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | cooperative MIMO/precoding | random | 10 | 9.4 | 9 | 93% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | SU-MIMO | Zeroforcing | random | 10 | 9.7 | 9 | 94% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | SU-MIMO | cooperative MIMO/precoding | random | 10 | 11.7 | 11 | 92% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 9.49 | 9 | 94.18% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 12.67 | 12 | 95.12% | Note 1, 4 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 13.47 | 13 | 94.05% | Note 1, 5 |
| Source 3, CATT | R1-2111234 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 10 | 8 | 8 | 91% | Note1, 7, 8 |
| Source 4, CEWiT | R1-2108869 | DDDSU | SU-MIMO | reciprocity-based precoding | same | 10 | 4.05 | 4 | 90% | Note 2 |
| Source 6, CMCC | R1-2109307 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 1 | 1 | 95.24% | Note 1, 4 |
| Source 10, Intel | R1-2111521 | DDDSU | SU-MIMO |  | random | 10 | 5.45 | 5 | 94.19% | Note 1, 10, 11 |
| Source 10, Intel | R1-2111521 | DDDSU | SU-MIMO |  | random | 10 | 7.18 | 7 | 91.9% | Note 1, 11 |
| Source 10, Intel | R1-2111521 | DDDSU | SU-MIMO |  | random | 10 | 5.7 | 5 | 94.76% | Note 1, 10, 12 |
| Source 10, Intel | R1-2111521 | DDDSU | SU-MIMO |  | random | 10 | 7.31 | 7 | 93.19% | Note 1, 12 |
| Source 19, Xiaomi | R1-2112573 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 7 | 7 | 92.44% | Note 2 |
| Source 15, Nokia | R1-2111828 | DDDSU | SU-MIMO |  | random | 10 | 6.54 | 6 | 97% | Note 2 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 8.2 | 8 | 93% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | All Sync | 10 | 7 | 7 | 90% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | Random | 10 | 8.8 | 8 | 97% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | Evenly Spaced | 10 | 9.1 | 9 | 93% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | All Sync | 10 | 3.1 | 3 | 92% | Note 1, 6 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | Random | 10 | 6.3 | 6 | 93% | Note 1, 6 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | Evenly Spaced | 10 | 8.3 | 8 | 93% | Note 1, 6 |
| Source 5, China Unicom | R1- 2112079 | DDDSU | SU-MIMO |  |  | 10 | 6.3 | 6 |  | Note 1 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 10 | 10.6 | 10 | 94.30% | Note 1 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | random | 10 | 8.4 | 8 | 95% | Note 2 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | evenly spaced | 10 | 9.2 | 9 | 91% | Note 2 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | same | 10 | 7.4 | 7 | 95% | Note 2 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | random | 10 | 9 | 9 | 90% | Note 2, 9 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | evenly spaced | 10 | 10.5 | 10 | 94% | Note 2, 9 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | same | 10 | 7.1 | 7 | 92% | Note 2, 9 |
| Source 7, Ericsson | R1-2110144 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 9.3 |  |  | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2)  Note 3: DL scheduler for dynamic grant based PDSCH scheduling: Frame Level Integrated Transmission (FLIT)  Note 4: DL scheduler for dynamic grant based PDSCH scheduling: Delay aware (DA)  Note 5: stream packet generation rate (Fps or Hz): 120  Note 6: stream packet generation rate (Fps or Hz): 30  Note 7: 64QAM  Note 8: Jitter STD=2ms, Jitter range Min=0ms, Jitter range Max=8ms  Note 9: Without Jitter  Note 10: Target BLER: 1%  Note 11: Not discard packet not meeting PDB  Note 12: Discard packet not meeting PDB | | | | | | | | | | |

Table 2 FR1, DL, DU, VR/AR 30Mbps, 60FPS, MU-MIMO, 100Mbps badwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 10 | 11.5 | 11 | 92.99% | Note 1 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 10 | 9.9 | 9 | 94.36% | Note 1,4 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 10 | 11.5 | 11 | 92.99% | Note 1 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 10 | 16.8 | 16 | 91.96% | Note 1, 5 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 7 | 6.3 | 6 | 91.67% | Note 1 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 13 | 14.6 | 14 | 91.72% | Note 1 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 13 | 19.3 | 19 | 90.54% | Note 1, 5 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 10 | 11.6 | 11 | 93.42% | Note 1, 6 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 10 | 14 | 14 | 90.08% | Note 1, 3 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | Zeroforcing | random | 10 | 8.9 | 8 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | cooperative MIMO/precoding | random | 10 | 16.4 | 16 | 93% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | Zeroforcing | random | 10 | 12.3 | 12 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | cooperative MIMO/precoding | random | 10 | 20.3 | 20 | 91% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | Zeroforcing | random | 7 | 6.4 | 6 | 91% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | cooperative MIMO/precoding | random | 7 | 12.7 | 12 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | Zeroforcing | random | 7 | 8.4 | 8 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | cooperative MIMO/precoding | random | 7 | 16.9 | 16 | 93% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | Zeroforcing | random | 13 | 11.4 | 11 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | cooperative MIMO/precoding | random | 13 | 18.6 | 18 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | Zeroforcing | random | 13 | 14.7 | 14 | 91% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | cooperative MIMO/precoding | random | 13 | 22.1 | 22 | 90% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 13.59 | 13 | 92.43% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 14.4 | 14 | 91.84% | Note 1, 7 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 20.78 | 20 | 92.54% | Note 1, 8 |
| Source 6, CMCC | R1-2109307 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 7 | 7 | 94.56% | Note 1, 7 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 10 | 12.5 | 12 | 90% | Note 1, 9 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 10 | 13.6 | 13 | 92% | Note 1, 9, 10 |
| Source 4, CEWiT | R1-2111360 | DDDSU | MU-MIMO | reciprocity-based precoding | same | 10 | 5.78 | 5 | 94% | Note 2 |
| Source 10, Intel | R1-2111521 | DDDSU | MU-MIMO |  | random | 10 | 7.15 | 7 | 91.7 | Note 1, 20, 22 |
| Source 10, Intel | R1-2111521 | DDDSU | MU-MIMO |  | random | 10 | 7.5 | 7 | 95.71 | Note 1, 6, 20, 22 |
| Source 10, Intel | R1-2111521 | DDDSU | MU-MIMO |  | random | 10 | 10.57 | 10 | 94.71 | Note 1, 22 |
| Source 10, Intel | R1-2111521 | DDDSU | MU-MIMO |  | random | 10 | 7.59 | 7 | 93.81 | Note 1,20, 21 |
| Source 10, Intel | R1-2111521 | DDDSU | MU-MIMO |  | random | 10 | 10.99 | 10 | 96.09 | Note 1, 21 |
| Source 11, InterDigital | R1-2111830 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 3.9 | 3 | 99% | Note 2 |
| Source 7, Ericsson | R1-2112551 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 11.2 | 11 |  | Note 1 |
| Source 7, Ericsson | R1-2112551 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 12.9 | 12 |  | Note 1, 11 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 13.4 | 13 | 92% | Note 1 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 11 | 95% | Note 1, 12 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 15 | 91% | Note 1, 13 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 16 | 92% | Note 1, 14 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 17 | 94% | Note 1, 15 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 13 | 95% | Note 1, 16 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 16 | 92% | Note 1, 17 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 16 | 95% | Note 1, 18 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 18 | 90% | Note 1, 19 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2)  Note 3: DL scheduler for dynamic grant based PDSCH scheduling: Frame Level Integrated Transmission (FLIT)  Note 4: X = 99.5  Note 5: X =95  Note 6: Without jitter  Note 7: DL scheduler for dynamic grant based PDSCH scheduling: Delay aware (DA)  Note 8: stream packet generation rate (Fps or Hz): 120  Note 9: 64QAM  Note 10: the traffic model for [3, 109, 91]% relationship  Note 11: ADU dropping  Note 12: ADU awareness, PDB=10ms: ADU capacity  Note 13: ADU awareness, PDB=15ms: ADU capacity  Note 14: ADU awareness, PDB=20ms: ADU capacity  Note 15: ADU awareness, PDB=50ms: ADU capacity  Note 16: ADU awareness, PDB=10ms: PKT capacity  Note 17: ADU awareness, PDB=15ms: PKT capacity  Note 18: ADU awareness, PDB=20ms: PKT capacity  Note 19: ADU awareness, PDB=50ms: PKT capacity  Note 20: Target BLER: 1%  Note 21: Discard packet not meeting PDB  Note 22: Not discard packet not meeting PDB | | | | | | | | | | |

Table 3 FR1, DL, DU, VR/AR 45Mbps, 60FPS, SU-MIMO, 100Mbps badwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | SU-MIMO | Close loop rank adaptation | random | 10 | 2.1 | 2 | 91.29% | Note 1 |
| Source 9, Huawei | R1-2110811 | DDDSU | SU-MIMO | Close loop rank adaptation | random | 10 | 2.7 | 2 | 95.00% | Note 1, 3 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 5.77 | 5 | 96.51% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 8.03 | 8 | 90.48% | Note 1, 4 |
| Source 4, CEWiT | R1-2111360 | DDDSU | SU-MIMO | reciprocity-based precoding | same | 10 | 2.04 | 2 | 90% | Note 2 |
| Source 19, Xiaomi | R1-2112573 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 5 | 5 | 94.71% | Note 2 |
| Source 15, Nokia | R1-2111828 | DDDSU | SU-MIMO |  | random | 10 | 4.1 | 4 | 92% | Note 2 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 5.2 | 5 | 93% | Note 1, 9 |
| Source 16, Qualcomm |  | DDDSU | SU-MIMO | reciprocity-based precoding | All Sync | 10 | 4.5 | 4 | 98% | Note 1,10 |
| Source 16, Qualcomm |  | DDDSU | SU-MIMO | reciprocity-based precoding | Random | 10 | 5.9 | 5 | 99% | Note 1,10 |
| Source 16, Qualcomm |  | DDDSU | SU-MIMO | reciprocity-based precoding | Evenly Spaced | 10 | 6.1 | 6 | 92% | Note 1,10 |
| Source 16, Qualcomm |  | DDDSU | SU-MIMO | reciprocity-based precoding | All Sync | 10 | 1.8 | 1 | 97% | Note 1,5,10 |
| Source 16, Qualcomm |  | DDDSU | SU-MIMO | reciprocity-based precoding | Random | 10 | 3.6 | 3 | 95% | Note 1,5,10 |
| Source 16, Qualcomm |  | DDDSU | SU-MIMO | reciprocity-based precoding | Evenly Spaced | 10 | 9 | 5 | 90% | Note 1,5,10 |
| Source 5, China Unicom | R1- 2112079 | DDDSU | SU-MIMO |  |  | 10 | 1.7 | 1 |  | Note 1 |
| Source 7, Ericsson | R1-2110144 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 5.3 |  |  | Note 1 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 10 | 6 | 6 | 91.75% | Note 1 |
| Source 14, MediaTek | R1-2112296 | DDDDD DDDUU (2.6GHz) | SU-MIMO | codebook-based Type 2 | random | 10 | 0 | 0 | N/A | Note 1 |
| Source 14, MediaTek | R1-2112296 | DSUDD SUUDD (4.9GHz) | SU-MIMO | codebook-based Type 2 | random | 10 | 4.2 | 4 | 91.93% | Note 1 |
| Source 14, MediaTek | R1-2112296 | DDDDD DDDUU (2.6GHz) + DSUDD SUUDD (4.9GHz) | SU-MIMO | codebook-based Type 2 | random | 10 | 10.3 | 10 | 91.53% | Note 1 |
| Source 14, MediaTek | R1-2112296 | DDDDD DDDUU (2.6GHz) + DSUDD SUUDD (4.9GHz) | SU-MIMO | codebook-based Type 2 | random | 10 | 12.3 | 12 | 92.15% | Note 1 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | random | 10 | 5.2 | 5 | 94% | Note 1 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | evenly spaced | 10 | 5.4 | 5 | 97% | Note 1 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | same | 10 | 4.4 | 4 | 96% | Note 1 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | random | 10 | 5.4 | 5 | 95% | Note 1, 8 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | evenly spaced | 10 | 6.6 | 6 | 96.49 | Note 1, 9 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | same | 10 | 4.4 | 4 | 97% | Note 1, 9 |
| Source 8, FUTUREWEI | R1-2108799 | DDDSU | SU-MIMO | Zeroforcing | random | 10 | 6 | 6 | 90% | Note 1 |
| Source 8, FUTUREWEI | R1-2108799 | DDDSU | SU-MIMO | cooperative MIMO/precoding | random | 10 | 7 | 7 | 90% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2)  Note 3: DL scheduler for dynamic grant based PDSCH scheduling: Frame Level Integrated Transmission (FLIT)  Note 4: stream packet generation rate (Fps or Hz): 120  Note 5: stream packet generation rate (Fps or Hz): 30  Note 6: 64QAM  Note 7: Jitter STD=2ms, Jitter range Min=0ms, Jitter range Max=8ms  Note 8: Without jitter  Note 9: Discard packet not meeting PDB  Not 10: Not discard packet not meeting PDB | | | | | | | | | | |

Table 4 FR1, DL, DU, VR/AR 45Mbps, 60FPS, MU-MIMO, 100Mbps badwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 10 | 5.3 | 5 | 91.90% | Note 1 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 10 | 6.6 | 6 | 92.59% | Note 1, 3 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 6.91 | 6 | 95.63% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 11.42 | 11 | 91.77% | Note 1, 4 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 10 | 7.8 | 7 | 97% | Note 1, 5 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 10 | 7.9 | 7 | 97% | Note 1, 5, 6 |
| Source 7, Ericsson | R1-2110403 | DDDSU | MU-MIMO |  | random | 10 | 6.4 |  |  | Note 1 |
| Source 11, InterDigital | R1-2111830 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 2.4 | 2 | 95% | Note 2 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 8.4 | 8 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2108799 | DDDSU | SU-MIMO | Zeroforcing | random | 10 | 7.6 | 7 | 91% | Note 2 |
| Source 8, FUTUREWEI | R1-2108799 | DDDSU | SU-MIMO | cooperative MIMO/precoding | random | 10 | 14.3 | 14 | 91% | Note 2 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2)  Note 3: DL scheduler for dynamic grant based PDSCH scheduling: Frame Level Integrated Transmission (FLIT)  Note 4: stream packet generation rate (Fps or Hz): 120  Note 5: 64QAM  Note 6: the traffic model for [3, 109, 91]% relationship | | | | | | | | | | |

Table 5 FR1, DL, DU, VR/AR 60Mbps, 60FPS, MU-MIMO, 100Mbps badwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different Ues | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 4.6 | 4 | 94.50% | Note 1,2 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 0 | 0 | N.A. | Note 1,3 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 2.8 | 2 | 92.90% | Note 1,4 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 0 | 0 | N.A. | Note 1,5 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 2 | 2 | 90.10% | Note 1,6 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 0 | 0 | N.A. | Note 1,7 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: Soft HARQ-Ack, k3 = 4  Note 3: Baseline HARQ-Ack, k3 = 4  Note 4: Soft HARQ-Ack, k3 = 6  Note 5: Baseline HARQ-Ack, k3 = 6  Note 6: Soft HARQ-Ack, k3 = 8  Note 7: Baseline HARQ-Ack, k3 = 8 | | | | | | | | | | |

* + - * 1. Multi-stream traffic model

Table 6 FR1, DL, DU, GOP-based 30Mbps, SU-MIMO, 100Mbps badwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Traffic arrival offset among different Ues | Alpha | [I\_PD, P\_PDB] (ms) | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 2 | [10,10] | 6 | 6 | 93.34% | Note 1,2 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 2 | [10,10] | 6 | 6 | 93.81% | Note 1,3 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 2 | [10,10] | 2 | 2 | 91.91% | Note 1,4 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 2 | [17, 9] | 9 | 9 | 89.60% | Note 1,2 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 2 | [15,10] | 10 | 10 | 90.39% | Note 1,2 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 2 | [15,10] | 10 | 10 | 94.00% | Note 1,3 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 2 | [10,10] | 8 | 8 | 94.05% | Note 1,2,5 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 2 | [10,10] | 8 | 8 | 94.41% | Note 1,3,5 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 2 | [10,10] | 2 | 2 | 89.53% | Note 1,4,5 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 2 | [17, 9] | 11 | 11 | 88.30% | Note 1,2,5 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 2 | [15,10] | 11 | 11 | 90.65% | Note 1,2,5 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 2 | [10,10] | 6 | 6 | 93.34% | Note 1,3,5 |
| Source 5, China Unicom | R1-2112079 | DDDSU | SU-MIMO |  | 1..5 | [10,10] | 1.5 | 1 |  | Note 1, 2 |
| Source 5, China Unicom | R1-2112079 | DDDSU | SU-MIMO |  | 2 | [10,10] | 6.1 | 6 |  | Note 1, 2 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: [PER\_I, PER\_P] = [1%, 1%]  Note 3: [PER\_I, PER\_P] = [1%, 5%]  Note 4: [PER\_I, PER\_P] = [0.5%, 5%]  Note 5: Delay aware scheduler | | | | | | | | | | |

Table 7 FR1, DL, DU, GOP-based 30Mbps, MU-MIMO, 100Mbps badwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Traffic arrival offset among different Ues | Alpha | [I\_PD, P\_PDB] (ms) | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 1 | [10,10] | 10 | 10 | 90.08% | Note 1,2 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 2 | [10,10] | 6.7 | 6 | 93.12% | Note 1,2 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 2 | [15, 9] | 8.8 | 8 | 94.35% | Note 1,2 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 2 | [10,10] | 6.7 | 6 | 93.12% | Note 1,3 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 2 | [15,10] | 9.1 | 9 | 90.87% | Note 1,2 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 2 | [15,10] | 9.6 | 9 | 92.06% | Note 1,3 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 2 | [10,10] | 6 | 6 | 90.08% | Note 1,4 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 2 | [17, 9] | 9.5 | 9 | 91.45% | Note 1,2 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 2 | [17, 10] | 10.5 | 10 | 91.59% | Note 1,2 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 2 | [17, 10] | 11.8 | 11 | 93.51% | Note 1,3 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 2 | [10,10] | 7.4 | 7 | 91.38% | Note 1,4,5 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 2 | [10,10] | 8.6 | 8 | 95.44% | Note 1,4,6 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 1.5 | [10,10] | 8.5 | 8 | 93.95% | Note 1,2 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 3 | [10,10] | 4 | 4 | 90.12% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 1.5 | [10,10] | 6.74 | 6 | 93.12% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 1.5 | [10,10] | 6.74 | 6 | 93.12% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 1.5 | [10,10] | 6.39 | 6 | 91.67% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 1.5 | [15,10] | 12.58 | 12 | 92.20% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 1.5 | [15,10] | 12.8 | 12 | 92.86% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 1.5 | [15,10] | 12.25 | 12 | 91.14% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 1.5 | [15,9] | 12.39 | 12 | 91.53% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 1.5 | [15,9] | 12.53 | 12 | 92.06% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 1.5 | [15,9] | 12.2 | 12 | 90.87% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 5.2 | 5 | 91.14% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 5.2 | 5 | 91.14% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 4.74 | 4 | 94.84% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 5.35 | 5 | 91.47% | Note 1,2,5 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 5.35 | 5 | 91.47% | Note 1,3,5 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 4.97 | 4 | 90.87% | Note 1,4,5 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [15,10] | 10.06 | 10 | 90.32% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [15,10] | 10.06 | 10 | 90.32% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [15,10] | 9.12 | 9 | 90.40% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [15,9] | 9.19 | 9 | 92.70% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [15,9] | 9.97 | 9 | 92.83% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [15,9] | 8.99 | 8 | 93.55% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 3 | [10,10] | 2.21 | 2 | 92.86% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 3 | [10,10] | 2.21 | 2 | 92.86% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 3 | [10,10] | 2.09 | 2 | 91.27% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 3 | [15,10] | 5.73 | 5 | 93.58% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 3 | [15,10] | 5.73 | 5 | 93.75% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 3 | [15,10] | 4.91 | 4 | 94.44% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 3 | [15,9] | 5.69 | 5 | 93.17% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 3 | [15,9] | 5.69 | 5 | 93.17% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 3 | [15,9] | 4.84 | 4 | 93.58% | Note 1,4 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO |  | 2 | 10 | 10.8 | 10 | 94% | Note 1, 2, 9 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO |  | 2 | 10 | 12.2 | 12 | 92% | Note 1, 7, 9 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO |  | 2 | 10 | 10.9 | 10 | 94% | Note 1, 8, 9 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO |  | 2 | 10 | 10.9 | 10 | 94% | Note 1, 3, 9 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: [PER\_I, PER\_P] = [1%, 1%]  Note 3: [PER\_I, PER\_P] = [1%, 5%]  Note 4: [PER\_I, PER\_P] = [0.5%, 5%]  Note 5: Based on PF, prioritize the transmission of I frame  Note 6: [PER\_I, PER\_P] = FLIT and prioritize the transmission of I frame  Note 7: [PER\_I, PER\_P] = [10%, 1%]  Note 8: [PER\_I, PER\_P] = [1%, 10%]  Note 9: 64QAM | | | | | | | | | | |

Table 8 FR1, DL, DU, GOP-based 45Mbps, SU-MIMO, 100Mbps badwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Traffic arrival offset among different Ues | Alpha | [I\_PD, P\_PDB] (ms) | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 1.5 | [10,10] | 2 | 2 | 89.05% | Note 1,2 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 1.5 | [10,10] | 3 | 3 | 89.53% | Note 1,2,4 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 1.5 | [10,10] | 3 | 3 | 90.16% | Note 1,3,4 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 1.5 | [17, 9] | 4 | 4 | 89.77% | Note 1,2,4 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 1.5 | [15,10] | 4 | 4 | 88.58% | Note 1,2 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 1.5 | [15,10] | 5 | 5 | 91.24% | Note 1,3 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 1.5 | [15,10] | 5 | 5 | 89.72% | Note 1,2,4 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 1.5 | [15,10] | 6 | 6 | 89.21% | Note 1,3,4 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 3 | [10,10] | <2 | <2 | N/A | Note 1,2 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 3 | [10,10] | 2 | 2 | 87.62% | Note 1,2,4 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 3 | [10,10] | 2 | 2 | 89.53% | Note 1,3,4 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 3 | [15,10] | 4 | 4 | 95.00% | Note 1,3 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 3 | [15,10] | 4 | 4 | 96.91% | Note 1,2 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 3 | [15,10] | 6 | 6 | 88.26% | Note 1,3,4 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | random | 3 | [15,10] | 6 | 6 | 89.85% | Note 1,2,4 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: [PER\_I, PER\_P] = [1%, 1%]  Note 3: [PER\_I, PER\_P] = [1%, 5%]  Note 4: Delay aware scheduler | | | | | | | | | | |

Table 9 FR1, DL, DU, GOP-based 45Mbps, MU-MIMO, 100Mbps badwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Traffic arrival offset among different Ues | Alpha | [I\_PD, P\_PDB] (ms) | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 1.5 | [10,10] | 1.4 | 1 | 97.14% | Note 1,2 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 1.5 | [10,10] | 2.6 | 2 | 92.83% | Note 1,2,3 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 1.5 | [10,10] | 3.2 | 3 | 90.79% | Note 1,2,4 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: [PER\_I, PER\_P] = [0.5%, 5%]  Note 3: Based on PF, prioritize the transmission of I frame  Note 4: [PER\_I, PER\_P] = FLIT and prioritize the transmission of I frame | | | | | | | | | | |

Table 10 FR1, DL, DU, Slice-based 30Mbps, MU-MIMO, 100Mbps badwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Traffic arrival offset among different Ues | Alpha | [I\_PD, P\_PDB] (ms) | Capacity | C1=floor (Capacity) | % of satisfied Ues when #Ues/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 2 | [10,10] | 14.9 | 14 | 91.67% | Note 1,2 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 2 | [10,10] | 15.7 | 15 | 91.17% | Note 1,4 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | random | 2 | [10,10] | 17.3 | 17 | 90.87% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 1.5 | [10,10] | 13.78 | 13 | 92.38% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 1.5 | [10,10] | 16.74 | 16 | 91.52% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 1.5 | [10,10] | 16.74 | 16 | 91.52% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 1.5 | [15,10] | 13.93 | 13 | 92.87% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 1.5 | [15,10] | 16.79 | 16 | 91.72% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 1.5 | [15,10] | 16.77 | 16 | 91.62% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 1.5 | [15,9] | 13.27 | 13 | 90.86% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 1.5 | [15,9] | 16.37 | 16 | 90.92% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 1.5 | [15,9] | 16.33 | 16 | 90.82% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 13.69 | 13 | 92.25% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 16.84 | 16 | 91.77% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 16.59 | 16 | 91.27% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 13.54 | 13 | 91.72% | Note 1,2,5 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 16.23 | 16 | 90.77% | Note 1,3,5 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [10,10] | 16.17 | 16 | 90.57% | Note 1,4,5 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [15,10] | 13.73 | 13 | 92.44% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [15,10] | 16.95 | 16 | 91.96% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [15,10] | 16.8 | 16 | 91.67% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [15,9] | 13.36 | 13 | 91.21% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [15,9] | 16.74 | 16 | 91.46% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 2 | [15,9] | 16.66 | 16 | 91.36% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 3 | [10,10] | 13.77 | 13 | 92.46% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 3 | [10,10] | 16.89 | 16 | 91.67% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 3 | [10,10] | 16.89 | 16 | 91.67% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 3 | [15,10] | 13.84 | 13 | 92.63% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 3 | [15,10] | 16.98 | 16 | 92.06% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 3 | [15,10] | 16.89 | 16 | 91.85% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 3 | [15,9] | 13.46 | 13 | 91.43% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 3 | [15,9] | 16.75 | 16 | 91.54% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | random | 3 | [15,9] | 16.72 | 16 | 91.48% | Note 1,4 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO |  |  | [10,10] | 12.7 | 12 | 93% | Note 1, 2, 6 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO |  |  | [10,10] | 14.6 | 14 | 91% | Note 1, 3, 6 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: [PER\_I, PER\_P] = [1%, 1%]  Note 3: [PER\_I, PER\_P] = [1%, 5%]  Note 4: [PER\_I, PER\_P] = [0.5%, 5%]  Note 5: Based on PF, prioritize the transmission of I frame  Note 6: 64QAM | | | | | | | | | | |

Table 11 FR1, UL, DU, Video stream 30Mbps+Data/audio stream 1.12Mbps + pose/control 0.2 Mbps , SU-MIMO, 100Mbps badwidth

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme  Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 1, Apple | R1-2111902 | DDDSU | SU-MIMO |  | 10 for video  30 for data/audio | 6 | 6 |  | Note 1 |
| Note 1: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1,8,2) | | | | | | | | | |

* + - 1. CG

Table 12 FR1, DL, DU, CG 8Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 24.4 | 24 | 93% | Note 1 |
| Source 5, China Unicom | R1- 2112079 | DDDSU | SU-MIMO |  |  | 10 | >30 | >30 |  | Note 1 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 15 | >20 | >20 | N/A | Note 1 |
| Source 7, Ericsson | R1-2110144 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | >36 |  |  | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8) | | | | | | | | | | |

Table 13 FR1, DL, DU, CG 8Mbps, 60FPS, MU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 15 | 56.6 | 56 | 92% | Note 1 |
| Source 7, Ericsson | R1-2110144 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 15 | >36 |  |  | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8) | | | | | | | | | | |

Table 14 FR1, DL, DU, CG 30Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | SU-MIMO | Close loop rank adaptation | random | 15 | 7.6 | 7 | 92.52% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | Zeroforcing | random | 15 | 10.3 | 10 | 91% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | cooperative MIMO/precoding | random | 15 | 11.4 | 11 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | SU-MIMO | Zeroforcing | random | 15 | 12.4 | 12 | 91% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | SU-MIMO | cooperative MIMO/precoding | random | 15 | 14.9 | 14 | 92% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 11.68 | 11 | 94.81% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 13.58 | 13 | 94.90% | Note 1, 3 |
| Source 3, CATT | R1-2111234 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 15 | 10 | 10 | 92% | Note 4, 5 |
| Source 4, CEWiT | R1-2108869 | DDDSU | SU-MIMO | reciprocity-based precoding | same | 15 | 5.57 | 5 | 94% | Note 2 |
| Source 10, Intel | R1-2111521 | DDDSU | SU-MIMO |  | random | 15 | 6.17 | 6 | 91.01% | Note 1 |
| Source 10, Intel | R1-2111521 | DDDSU | SU-MIMO |  | random | 15 | 7.99 | 7 | 97.14% | Note 1, 8 |
| Source 19, Xiaomi | R1-2112573 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 8 | 8 | 92.88% | Note 2 |
| Source 6, CMCC | R1-2111632 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 10 | 10 | 91.46% | Note 1, 3 |
| Source 15, Nokia | R1-2111828 | DDDSU | SU-MIMO |  | random | 15 | 8.5 | 8 | 97% | Note 2 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 10 | 10 | 91% | Note 1 |
| Source 5, China Unicom | R1- 2112079 | DDDSU | SU-MIMO |  |  | 15 | 6.7 | 6 |  | Note 1 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 15 | 13 | 13 | 90.41% | Note 1 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | random | 15 | 10.2 | 10 | 92% | Note 2 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | evenly spaced | 15 | 10.3 | 10 | 93% | Note 2 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | same | 15 | 10.3 | 10 | 94% | Note 2 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | random | 15 | 10.5 | 10 | 94% | Note 2, 7 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | evenly spaced | 15 | 11 | 11 | 91% | Note 2, 7 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | same | 15 | 10.1 | 10 | 93% | Note 2, 7 |
| Source 7, Ericsson | R1-2110144 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 11 |  |  | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2)  Note 3: DL scheduler for dynamic grant based PDSCH scheduling: Delay aware (DA)  Note 4: 64QAM  Note 5: Jitter STD=2ms, Jitter range Min=0ms, Jitter range Max=8ms  Note 6: Without jitter  Note 7: the traffic model for [3, 109, 91]% relationship  Note 8: Target BLER = 1% | | | | | | | | | | |

Table 15 FR1, DL, DU, CG 30Mbps, 60FPS, MU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 15 | 16.1 | 16 | 90.77% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | Zeroforcing | random | 15 | 12.3 | 12 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | cooperative MIMO/precoding | random | 15 | 19.7 | 19 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | Zeroforcing | random | 15 | 17.1 | 17 | 91% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | cooperative MIMO/precoding | random | 15 | 22.9 | 22 | 91% | Note1 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 15 | 19.65 | 19 | 92.56% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 15 | 19.75 | 19 | 92.86% | Note 1, 3 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 15 | 14.7 | 14 | 93% | Note 1, 4 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 15 | 14.8 | 14 | 93% | Note 1, 4, 5 |
| Source 4, CEWiT | R1-2111360 | DDDSU | MU-MIMO | reciprocity-based precoding | same | 15 | >8 | 8 | 91% | Note 2 |
| Source 10, Intel | R1-2111521 | DDDSU | MU-MIMO |  | random | 15 | 7.47 | 7 | 94.35 | Note 1, 6 |
| Source 10, Intel | R1-2111521 | DDDSU | MU-MIMO |  | random | 15 | 8.2 | 8 | 90.14 | Note 1, 6,7 |
| Source 10, Intel | R1-2111521 | DDDSU | MU-MIMO |  | random | 15 | 11.26 | 11 | 91.82 | Note 1 |
| Source 6, CMCC | R1-2111632 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 15 | 10.1 | 10 | 90.53% | Note 1, 3 |
| Source 11, InterDigital | R1-2111830 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 15 | 5 | 5 | 90% | Note 2 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 15 | 16.5 | 16 | 93% | Note 1 |
| Source 7, Ericsson | R1-2110144 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 15 | 15.1 |  |  | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2)  Note 3: DL scheduler for dynamic grant based PDSCH scheduling: Delay aware (DA)  Note 4: 64QAM  Note 5: the traffic model for [3, 109, 91]% relationship  Note 6: Target BLER = 1%  Note 7: Without jitter | | | | | | | | | | |

Table 16 FR1, DL, DU, CG 45Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | random | 15 | 6.3 | 6 | 94% | Note 1 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | evenly spaced | 15 | 6.3 | 6 | 94% | Note 1 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | same | 15 | 6.4 | 6 | 96% | Note 1 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | random | 15 | 6.7 | 6 | 98% | Note 1, 2 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | evenly spaced | 15 | 7.1 | 7 | 90% | Note 1, 2 |
| Source 17, OPPO | R1-2111349 | DDDSU | SU-MIMO |  | same | 15 | 6.3 | 6 | 95% | Note 1, 2 |
| Note 1: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2)  Note 2: Without jitter | | | | | | | | | | |

* + 1. InH Scenario
       1. VR/AR
          1. Single stream traffic model

Table 17 FR1, DL, InH, VR/AR 30Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 8.27 | 8 | 92.71% |  |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 10.77 | 10 | 95.20% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 11.63 | 11 | 95.28% | Note 2 |
| Source 19, Xiaomi | R1-2112573 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 7 | 7 | 91.82% |  |
| Source 15, Nokia | R1-2111828 | DDDSU | SU-MIMO |  | random | 10 | 5.2 | 5 | 94% |  |
| Source 12, ITRI | R1-2112175 | DDDSU | SU-MIMO |  | synchronized | 10 | 4.85 | 4 | 100.00% |  |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 7 | 7 | 91% |  |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 10 | 8 | 8 | 88.13% |  |
| Source 7, Ericsson | R1-2110144 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 8.5 |  |  |  |
| Source 6, CMCC | R1-2109307 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 1 | 1 | 100% | Note 1 |
| Note 1: DL scheduler for dynamic grant based PDSCH scheduling: Delay aware (DA)  Note 2: stream packet generation rate (Fps or Hz): 120 | | | | | | | | | | |

Table 18 FR1, DL, InH, VR/AR 30Mbps, 60FPS, MU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 10.8 | 10 | 92.50% |  |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 12.4 | 12 | 93.06% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 16.53 | 16 | 92.71% | Note 2 |
| Source 3, CATT | R1-2111234 | DDDSU | MU-MIMO | codebook-based Type 2 | random | 10 | 12 | 12 | 96% |  |
| Source 3, CATT | R1-2111234 | DDDSU | MU-MIMO | codebook-based Type 2 | random | 7 | 8 | 8 | 96% |  |
| Source 3, CATT | R1-2111234 | DDDSU | MU-MIMO | codebook-based Type 2 | random | 10 | 16 | 16 | 95% | Note 3, 4,5 |
| Source 3, CATT | R1-2111234 | DDDSU | MU-MIMO | codebook-based Type 2 | random | 10 | 20 | 20 | 92% | Note 3, 4,6 |
| Source 3, CATT | R1-2111234 | DDDSU | MU-MIMO | codebook-based Type 2 | random | 10 | 20 | 20 | 91% | Note 3, 4,7 |
| Source 3, CATT | R1-2111234 | DDDSU | MU-MIMO | codebook-based Type 2 | random | 10 | 12 | 12 | 90% | Note 3, 4,8 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 10 | 11.4 | 11 | 92% | Note 3 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 10 | 11.8 | 11 | 94% | Note 9 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 10 | 16.6 | 16 | 91% | Note 3, 10 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 10 | 11.8 | 11 | 94% | Note 3, 11 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 10 | 8.5 | 8 | 95% | Note 3, 12 |
| Source 11, InterDigital | R1-2111830 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 5.8 | 5 | 96.80% |  |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 10.3 | 10 | 93% |  |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 9 | 91% | Note 13 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 11 | 92% | Note 14 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 12 | 93% | Note 15 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 13 | 94% | Note 16 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 10 | 94% | Note 17 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 12 | 93% | Note 18 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 12 | 95% | Note 19 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 13 | 95% | Note 20 |
| Source 7, Ericsson | R1-2110144 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 9.2 |  |  |  |
| Source 6, CMCC | R1-2109307 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 5 | 5 | 91.67% | Note 1 |
| Note 1: DL scheduler for dynamic grant based PDSCH scheduling: Delay aware (DA)  Note 2: stream packet generation rate (Fps or Hz): 120  Note 3: 64QAM  Note 4: Jitter STD=2ms, Jitter range Min=0ms, Jitter range Max=8ms  Note 5: gNB scheduling awareness of 2 frames UE playout buffer  Note 6: gNB scheduling awareness of 3 frames UE playout buffer  Note 7: gNB scheduling awareness of 4 frames UE playout buffer  Note 8: XR-dedicated PDCCH monitoring window  Note 9: the traffic model for [3, 109, 91]% relationship  Note 10: Ehanced Preemption (XR vs. uRLLC)  Note 11: Rel-15 Preemption (XR vs. uRLLC)  Note 12: No Preemption (XR vs. uRLLC)  Note 13: ADU awareness, PDB=10ms: ADU capacity  Note 14: ADU awareness, PDB=15ms: ADU capacity  Note 15: ADU awareness, PDB=20ms: ADU capacity  Note 16: ADU awareness, PDB=50ms: ADU capacity  Note 17: ADU awareness, PDB=10ms: PKT capacity  Note 18: ADU awareness, PDB=15ms: PKT capacity  Note 19: ADU awareness, PDB=20ms: PKT capacity  Note 20: ADU awareness, PDB=50ms: PKT capacity | | | | | | | | | | |

Table 19 FR1, DL, InH, VR/AR 45Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 4.65 | 4 | 97.22% |  |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 6.59 | 6 | 97.22% | Note 1 |
| Source 19, Xiaomi | R1-2112573 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 5 | 5 | 93.25% |  |
| Source 15, Nokia | R1-2111828 | DDDSU | SU-MIMO |  | random | 10 | 3.27 | 3 | 97% |  |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 4.3 | 4 | 97% |  |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 10 | 4.6 | 4 | 96.30% |  |
| Source 7, Ericsson | R1-2110144 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 4.8 |  |  |  |
| Note 1: stream packet generation rate (Fps or Hz): 120 | | | | | | | | | | |

Table 20 FR1, DL, InH, VR/AR 45Mbps, 60FPS, MU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 5.91 | 5 | 96.67% |  |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 9.22 | 9 | 91.36% | Note 1 |
| Source 3, CATT | R1-2109200/R1-2111234 | DDDSU | MU-MIMO | codebook-based Type 2 | random | 10 | 8 | 8 | 94% | Note 2, 3 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 10 | 7.2 | 7 | 92% | Note 2 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 10 | 7.3 | 7 | 93% | Note 2, 4 |
| Source 11, InterDigital | R1-2111830 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 3.5 | 3 | 98% |  |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 6.4 | 6 | 93% |  |
| Source 7, Ericsson | R1-2110144 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 5.4 |  |  |  |
| Note 1: stream packet generation rate (Fps or Hz): 120  Note 2: 64QAM  Note 3: Jitter STD=2ms, Jitter range Min=0ms, Jitter range Max=8ms  Note 4: the traffic model for [3, 109, 91]% relationship | | | | | | | | | | |

Table 21 FR1, DL, InH, VR/AR 60Mbps, 60FPS, MU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 3, CATT | R1-2111234 | DDDSU | MU-MIMO | codebook-based Type 2 | random | 10 | 4 | 4 | 100% | Note 1, 2 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 2.93 | 2 | 97.70% | Note 3 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 0 | 0 | N.A. | Note 4 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 2.1 | 2 | 91.25% | Note 5 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 0 | 0 | N.A. | Note 6 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 1.17 | 1 | 91.25% | Note 7 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 0 | 0 | N.A. | Note 8 |
| Note 1: 64QAM  Note 2: Jitter STD=2ms, Jitter range Min=0ms, Jitter range Max=8ms  Note3: Soft HARQ-Ack, k3 = 4  Note4: Baseline HARQ-Ack, k3 = 4  Note5: Soft HARQ-Ack, k3 = 6  Note6: Baseline HARQ-Ack, k3 = 6  Note7: Soft HARQ-Ack, k3 = 8  Note8: Baseline HARQ-Ack, k3 = 8 | | | | | | | | | | |

* + - * 1. Multi-stream traffic model

Table 22 FR1, UL, InH, Video stream 30Mbps+Data/audio stream 1.12Mbps, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | | | TDD format | | SU/MU-MIMO | | Transmission scheme | | Traffic arrival offset among different UEs | | [PDB\_video, PDB\_data/audio] (ms) | | | | Capacity | | | C1=floor (Capacity) | | % of satisfied UEs when #UEs/cell =C1 | | | Notes |
| Source 1, Apple | R1-2111902 | | | DDDSU | | SU-MIMO | |  | | Random | | [10,10] | | | | 4.1 | | | 4 | | 91% | | |  |
| Source 20, ZTE | R1-2111531 | | | DDDSU | | MU-MIMO | | reciprocity-based precoding | | Random | | [10,10] | | | | 8.4 | | | 8 | | 92% | | | Note 1, 2 |
| Source 20, ZTE | R1-2111531 | | | DDDSU | | MU-MIMO | | reciprocity-based precoding | | Random | | [10,10] | | | | 5.7 | | | 5 | | 95% | | | Note 1, 3 |
| Source 20, ZTE | R1-2111531 | | | DDDSU | | MU-MIMO | | reciprocity-based precoding | | Random | | [10,10] | | | | 4.9 | | | 4 | | 92% | | | Note 1, 4 |
| Note 1: 64QAM  Note 2: Enhanced Preemption (Audio/data streams vs. Video streams)  Note 3: Rel-15 Preemption(Audio/data streams vs. Video streams)  Note 4: No Preemption (Audio/data streams vs. Video streams) | | | | | | | | | | | | | | | | | | | | | | | | |

Table 23 FR1, DL, InH, slice-based multi-streams traffic model and single stream video traffic model, MU-MIMO

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | [I\_PDB, P\_PDB, PDB\_video] (ms) | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | [10,10, 10] | 10.2 | 10 | 90% | Note 1, 2 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | [10,10, 10] | 7.1 | 7 | 90% | Note 1, 3 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding | Random | [10,10, 10] | 4.5 | 4 | 93% | Note 1, 4 |
|  | | | | | | | | | | |



* + - 1. CG

Table 24 FR1, DL, InH, CG 8Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 22.3 | 22 | 94% |  |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 15 | >20 | >20 | N/A |  |
| Source 7, Ericsson | R1-2110144 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | >38.7 |  |  |  |
|  | | | | | | | | | | |

Table 25 FR1, DL, InH, CG 8Mbps, 60FPS, MU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 15 | 44.1 | 44 | 90% |  |
| Source 7, Ericsson | R1-2110144 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 15 | >38.7 |  |  |  |
|  | | | | | | | | | | |

Table 26 FR1, DL, InH, CG 30Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 10.14 | 10 | 91.67% |  |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 11.43 | 11 | 96.06% | Note 1 |
| Source 19, Xiaomi | R1-2112573 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 8 | 8 | 93.54% |  |
| Source 6, CMCC | R1-2111632 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 6.8 | 6 | 92.98% | Note 1 |
| Source 15, Nokia | R1-2111828 | DDDSU | SU-MIMO |  | random | 15 | 5.96 | 5 | 99% |  |
| Source 12, ITRI | R1-2112175 | DDDSU | SU-MIMO |  | synchronized | 15 | 9.4 | 9 | 91.67% |  |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 8.4 | 8 | 97.5 |  |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 15 | 9 | 9 | 89.55% |  |
| Source 7, Ericsson | R1-2110144 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 10.5 |  |  |  |
| Note 1: DL scheduler for dynamic grant based PDSCH scheduling: Delay aware (DA) | | | | | | | | | | |

Table 27 FR1, DL, InH, CG 30Mbps, 60FPS, MU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 15 | 16.2 | 16 | 91.15% |  |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 15 | 16.67 | 16 | 92.01% | Note 1 |
| Source 3, CATT | R1-2111234 | DDDSU | MU-MIMO | codebook-based Type 2 | random | 15 | 15 | 15 | 90% | Note 2, 3 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 15 | 12.9 | 12 | 90% | Note 2 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 15 | 13.3 | 13 | 92% | Note 2, 4 |
| Source 6, CMCC | R1-2111632 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 15 | 7.3 | 7 | 90.67% | Note 1 |
| Source 11, InterDigital | R1-2111830 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 15 | 7.2 | 7 | 97.57% |  |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 15 | 12.8 | 12 | 95% |  |
| Source 7, Ericsson | R1-2110144 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 15 | 12.3 |  |  |  |
| Note 1: DL scheduler for dynamic grant based PDSCH scheduling: Delay aware (DA)  Note 2: 64QAM  Note 3: Jitter STD=2ms, Jitter range Min=0ms, Jitter range Max=8ms  Note 4: the traffic model for [3, 109, 91]% relationship | | | | | | | | | | |

* + 1. Uma Scenario
       1. VR/AR
          1. Single stream traffic model

Table 28 FR1, DL, Uma, VR/AR 30Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | SU-MIMO | Close loop rank adaptation | random | 10 | 4.5 | 4 | 92.38% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | Zeroforcing | random | 10 | 5.4 | 5 | 94% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | cooperative MIMO/precoding | random | 10 | 6.5 | 6 | 93% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | SU-MIMO | Zeroforcing | random | 10 | 7 | 7 | 90% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | SU-MIMO | cooperative MIMO/precoding | random | 10 | 8.8 | 8 | 92% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 7.24 | 7 | 92.48% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 8.56 | 8 | 92.64% | Note 1, 3 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 11.7 | 11 | 95.40% | Note 1, 4 |
| Source 4, CEWiT | R1-2108869 | DDDSU | SU-MIMO | reciprocity-based precoding | same | 10 | 2.98 | 2 | 98% | Note 2 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 4.4 | 4 | 94% | Note 1 |
| Source 5, China Unicom | R1- 2112079 | DDDSU | SU-MIMO |  |  | 10 | 5.5 | 5 |  | Note 1 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 10 | 8 | 8 | 89.05% | Note 1 |
| Source 7, Ericsson | R1-2110144 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 7.2 |  |  | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2)  Note 3: DL scheduler for dynamic grant based PDSCH scheduling: Delay aware (DA)  Note 4: stream packet generation rate (Fps or Hz): 120 | | | | | | | | | | |

Table 29 FR1, DL, Uma, VR/AR 30Mbps, 60FPS, MU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 10 | 9.3 | 9 | 91.22% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | Zeroforcing | random | 10 | 6.3 | 6 | 91% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | cooperative MIMO/precoding | random | 10 | 9.5 | 9 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | Zeroforcing | random | 10 | 7.7 | 7 | 94% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | cooperative MIMO/precoding | random | 10 | 11.6 | 11 | 92% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 8.82 | 8 | 93.75% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 9.55 | 9 | 92.30% | Note 1, 2 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 14.59 | 14 | 92.06% | Note 1, 3 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 10 | 10 | 10 | 90% | Note 1, 4 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 5.2 | 5 | 91% | Note 1 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 4 | 91% | Note 1, 5, 9 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 6 | 91% | Note 1, 6, 9 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 7 | 90% | Note 1, 7, 9 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 8 | 90% | Note 1, 8 ,9 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 5 | 91% | Note 1, 5, 10 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 7 | 90% | Note 1, 6, 10 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 7 | 92% | Note 1, 7, 10 |
| Source 16, Qualcomm |  | DDDSU | MU-MIMO |  | random | 10 |  | 8 | 91% | Note 1, 8 ,10 |
| Source 7, Ericsson | R1-2110144 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 8.7 |  |  | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: DL scheduler for dynamic grant based PDSCH scheduling: Delay aware (DA)  Note 3: stream packet generation rate (Fps or Hz): 120  Note 4: 64QAM  Note 5: ADU awareness, PDB=10ms: ADU capacity  Note 6: ADU awareness, PDB=15ms: ADU capacity  Note 7: ADU awareness, PDB=20ms: ADU capacity  Note 8: ADU awareness, PDB=50ms: ADU capacity  Note 9: 50ms packet discard time, capacity measured for AER target of 1%  Note 10: 50ms packet discard time, capacity measured for PER target of 1% | | | | | | | | | | |

Table 30 FR1, DL, Uma, VR/AR 45Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | SU-MIMO | Close loop rank adaptation | random | 10 | 1.8 | 1 | 94.29% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 4.17 | 4 | 91.63% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 6.75 | 6 | 96.03% | Note 1, 3 |
| Source 4, CEWiT | R1-2111360 | DDDSU | SU-MIMO | reciprocity-based precoding | same | 10 | 1.85 | 1 | 100% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 2.4 | 2 | 93% | Note 1 |
| Source 5, China Unicom | R1- 2112079 | DDDSU | SU-MIMO |  |  | 10 | 4.7 | 4 |  | Note 1 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 10 | 4.2 | 4 | 92.86% | Note 1 |
| Source 7, Ericsson | R1-2110144 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 3.7 |  |  | Note 1 |
| Source 8, FUTUREWEI | R1-2108799 | DDDSU | SU-MIMO | Zeroforcing | random | 10 | 4.4 | 4 | 94% | Note 1 |
| Source 8, FUTUREWEI | R1-2108799 | DDDSU | SU-MIMO | cooperative MIMO/precoding | random | 10 | 5.4 | 5 | 93% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2)  Note 3: stream packet generation rate (Fps or Hz): 120 | | | | | | | | | | |

Table 31 FR1, DL, Uma, VR/AR 45Mbps, 60FPS, MU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 10 | 4 | 4 | 90.00% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 4.68 | 4 | 94.05% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 8.12 | 8 | 90.87% | Note 1, 2 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 10 | 6 | 6 | 90% | Note 1, 3 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 2.9 | 2 | 93% | Note 1 |
| Source 7, Ericsson | R1-2110144 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 10 | 4.6 |  |  | Note 1 |
| Source 8, FUTUREWEI | R1-2108799 | DDDSU | SU-MIMO | Zeroforcing | random | 10 | 4.9 | 4 | 96% | Note 1 |
| Source 8, FUTUREWEI | R1-2108799 | DDDSU | SU-MIMO | cooperative MIMO/precoding | random | 10 | 7.7 | 7 | 92% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: stream packet generation rate (Fps or Hz): 120  Note 3: 64QAM | | | | | | | | | | |

* + - * 1. Multi-stream traffic model

Table 32 FR1, DL, Uma, GOP-based 30Mbps, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 5, China Unicom | R1-2112079 | DDDSU | SU-MIMO |  | 1..5 | [10,10] | 4.2 | 4 |  | Note 1, 2 |
| Source 5, China Unicom | R1-2112079 | DDDSU | SU-MIMO |  | 2 | [10,10] | 2.4 | 2 |  | Note 1, 2 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: [PER\_I, PER\_P] = [1%, 1%] | | | | | | | | | | |

* + - 1. CG

Table 33 FR1, DL, DU, CG 8Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 17.5 | 16 | 94% | Note 1 |
| Source 5, China Unicom | R1- 2112079 | DDDSU | SU-MIMO |  |  | 10 | >30 | >30 |  | Note 1 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 15 | >20 | >20 | N/A | Note 1 |
| Source 7, Ericsson | R1-2110144 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 32.9 |  |  | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8) | | | | | | | | | | |

Table 34 FR1, DL, DU, CG 8Mbps, 60FPS, MU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 15 | 23.8 | 23 | 93% | Note 1 |
| Source 7, Ericsson | R1-2110144 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 15 | >36 |  |  | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8) | | | | | | | | | | |

Table 35 FR1, DL, Uma, CG 30Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | SU-MIMO | Close loop rank adaptation | random | 15 | 6.5 | 6 | 92.86% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | Zeroforcing | random | 15 | 7.2 | 7 | 91% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | cooperative MIMO/precoding | random | 15 | 8.7 | 8 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | SU-MIMO | Zeroforcing | random | 15 | 9.7 | 9 | 92% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | SU-MIMO | cooperative MIMO/precoding | random | 15 | 11.4 | 11 | 91% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 10.33 | 10 | 91.90% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 11.94 | 11 | 93.78% | Note 1, 3 |
| Source 4, CEWiT | R1-2108869 | DDDSU | SU-MIMO | reciprocity-based precoding | same | 15 | 4.08 | 4 | 90% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 5.4 | 5 | 92% | Note 1 |
| Source 5, China Unicom | R1- 2112079 | DDDSU | SU-MIMO |  |  | 10 | 7.9 | 7 |  | Note 1 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 15 | 9.5 | 9 | 92.35% |  |
| Source 7, Ericsson | R1-2110144 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 9.2 |  |  | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2)  Note 4: DL scheduler for dynamic grant based PDSCH scheduling: Delay aware (DA) | | | | | | | | | | |

Table 36 FR1, DL, Uma, CG 30Mbps, 60FPS, MU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 15 | 12.4 | 12 | 92.46% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | Zeroforcing | random | 15 | 8.4 | 8 | 91% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | MU-MIMO | cooperative MIMO/precoding | random | 15 | 12.4 | 12 | 91% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | Zeroforcing | random | 15 | 11.1 | 11 | 90% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDSU | MU-MIMO | cooperative MIMO/precoding | random | 15 | 14.2 | 14 | 91% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 15 | 14.33 | 14 | 91.33% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 15 | 14.45 | 14 | 91.73% | Note 1, 2 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 15 | 11.6 | 11 | 93% | Note 1, 3 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 15 | 8 | 8 | 90% | Note 1 |
| Source 7, Ericsson | R1-2110144 | DDDSU | MU-MIMO | reciprocity-based precoding | random | 15 | 12.1 |  |  | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: DL scheduler for dynamic grant based PDSCH scheduling: Delay aware (DA)  Note 3: 64QAM | | | | | | | | | | |

* 1. FR1 UL
     1. DU Scenario
        1. VR/CG (Pose/control-stream)

Table 37 FR1, UL, DU, VR/CG 0.2Mbps, 250FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | single layer transmission | evenly spaced | 10 | 178.4 | 178 | 90% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 20 | 20 | 99.99% | Note 1 |
| Source 15, Nokia | R1-2111828 | DDDSU | SU-MIMO |  | random | 10 | 45.77 | 45 | 98% | Note 2 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | codebook-based Type 1 | random | 10 | 224.9 | 224 | 92% | Note 1 |
| Source 14, MediaTek | R1-2109555 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 10 | >30 | >30 | 100% | Note 1 |
| Source 7, Ericsson | R1-2110144 | DDDUU | SU-MIMO | reciprocity-based precoding | random | 10 | 39.9 |  |  | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2) | | | | | | | | | | |

Table 38 FR1, UL, DU, VR/CG 0.2Mbps, 250FPS, MU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 10 | >15 |  | 100% (15) | Note 1 |
| Source 11, InterDigital | R1-2111830 | DDDSU | MU-MIMO | 32-port CSI-RS Type I codebook | evenly spaced | 10 | 8 | 8 | 96.50% | Note 2 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | codebook-based Type 1 | random | 10 | >240 | 240 | 99% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2) | | | | | | | | | | |

* + - 1. AR (1 stream: Scene/video/data/voice-stream)

Table 39 FR1, UL, DU, AR (1 stream: Scene/video/data/voice-stream), 10Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 30 | 9.49 | 9 | 92.95% | Note 1 |
| Source 10, Intel | R1-2111521 | DDDSU | SU-MIMO |  | random | 30 | 7.8 | 7 | 98.23 | Note 1, 3 |
| Source 10, Intel | R1-2111521 | DDDSU | SU-MIMO |  | random | 30 | 7.81 | 7 | 98.09 | Note 1 |
| Source 15, Nokia | R1-2111828 | DDDSU | SU-MIMO |  | random | 30 | 4.77 | 4 | 91% | Note 2 |
| Source 7, Ericsson | R1-2112551 | DDDUU | SU-MIMO | reciprocity-based precoding | random | 30 | 7.5 | 7 |  | Note 1 |
| Source 7, Ericsson | R1-2112551 | DDDUU | SU-MIMO | reciprocity-based precoding | random | 30 | 8.4 | 8 |  | Note 1, 4 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | codebook-based Type 1 | random | 30 | 4.5 | 4 | 93.3% | Note 1 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 30 | 9.39 | 9 | 90% | Note 1 |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | single layer transmission | random | 30 | 7.4 | 7 | 93% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2)  Note 3: Target BLER 1%  Note 4: Elastic BSR | | | | | | | | | | |

Table 40 FR1, UL, DU, AR (1 stream: Scene/video/data/voice-stream), 10Mbps, 60FPS, MU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 30 | 8.1 | 8 | 91.67% | Note 1 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 10 | <1 |  |  | Note 1 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 15 | 5.4 | 5 | 92.19% | Note 1 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 60 | 8.3 | 8 | 93.81% | Note 1 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 30 | 8.3 | 8 | 93.10% | Note 1, 4 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 30 | 8.4 | 8 | 94.05% | Note 1, 5 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 30 | 10.9 | 10 | 94% | Note1, 6 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 30 | 9.5 | 9 | 95% | Note1, 6, 7 |
| Source 10, Intel | R1-2111521 | DDDSU | MU-MIMO |  | random | 30 | 10.49 | 10 | 95.24 | Note 1, 8 |
| Source 10, Intel | R1-2111521 | DDDSU | MU-MIMO |  | random | 30 | 10.5 | 10 | 95.29 | Note 1 |
| Source 11, InterDigital | R1-2111830 | DDDSU | MU-MIMO | 32-port CSI-RS Type I codebook | random | 30 | 2.3 | 2 | 96% | Note 2, 3 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | codebook-based Type 1 | random | 30 | 7.3 | 7 | 90% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2)  Note 3: with jitter  Note 4: X=95  Note 5: X =90  Note 6: 64QAM  Note 7: legacy BSR  Note 8: Target BLER 1% | | | | | | | | | | |

Table 41 FR1, UL, DU, AR (1 stream: Scene/video/data/voice-stream), 20Mbps, 60FPS, MU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 30 | 3.4 | 3 | 91% | Note 1, 2, 3 |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 30 | 5.1 | 5 | 90% | Note 1, 2, 4 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: 64QAM  Note 3: legacy BSR  Note 4: Enhanced BSR | | | | | | | | | | |

* + - 1. AR (2 streams: Pose/control-stream + scene/video/data/voice-stream)

Table 42 FR1, UL, DU, AR (2 streams: Pose/control-stream + scene/video/data/voice-stream), 10.2Mbps, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10; 30 | 7.43 | 7 | 92.29% | Note 1 |
| Source 10, Intel | R1-2111521 | DDDSU | SU-MIMO |  | random | 10; 30 | 3.35 | 3 | 91.9 | Note 1, 2 |
| Source 10, Intel | R1-2111521 | DDDSU | SU-MIMO |  | random | 10; 30 | 3.41 | 3 | 91.58 | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | codebook-based Type 1 | random | 10; 30 | 4.1 | 4 | 90.4% | Note 1 |
| Source 7, Ericsson | R1-2110144 | DDDUU | SU-MIMO | reciprocity-based precoding | random | 10 | 2.6 |  |  | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: Target BLER 1% | | | | | | | | | | |

Table 43 FR1, UL, DU, AR (2 streams: Pose/control-stream + scene/video/data/voice-stream), 10.2Mbps, MU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 10; 30 | 1.5 | 1 | 92.38% | Note 1 |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 10; 30 | 5.6 | 5 | 94.48% | Note 1, 3 |
| Source 10, Intel | R1-2111521 | DDDSU | MU-MIMO |  | random | 10; 30 | 4.57 | 4 | 90.75 | Note 1, 4 |
| Source 10, Intel | R1-2111521 | DDDSU | MU-MIMO |  | random | 10; 30 | 4.91 | 4 | 90.98 | Note 1 |
| Source 11, InterDigital | R1-2111830 | DDDSU | MU-MIMO | 32-port CSI-RS Type I codebook | random | 10; 30 | 0 | 0 | 0% | Note 2, 5 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | codebook-based Type 1 | random | 10; 30 | 5.8 | 5 | 92.4% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1:8,2)  Note 3: Aware-traffic  Note 4: Target BLER 1%  Note 5: video-stream with jitter | | | | | | | | | | |

* + - 1. AR (3 streams: Video stream+Data/audio stream+Pose/control stream)

Table 44 FR1, UL, DU, AR (3 streams: Video stream 10Mbps+Data/audio stream 1.12Mbps+Pose/control stream 0.2Mbps), SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 1, Apple | R1-2111902 | DDDSU | SU-MIMO |  |  | 10; 30; 10 | 3 | 3 |  | Note 1 |
| Note 1: BS antenna parameters: 32 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,2,2,1,1,8,2) | | | | | | | | | | |

* + - 1. AR (3 streams: Pose/control-stream + I/P-stream)

Table 45 FR1, UL, DU, AR (3 streams: Pose/control-stream + I/P-stream with alpha = 2) 10.2Mbps, MU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 10; 30; 30 | 3.5 | 3 | 92.06% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8) | | | | | | | | | | |

* + 1. InH Scenario
       1. VR/CG (Pose/control-stream)

Table 46 FR1, UL, InH, VR/CG 0.2Mbps, 250FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 20 | 20 | 100.00% |  |
| Source 3, CATT | R1-2111234 | DDDUU | SU-MIMO | codebook-based Type 2 | random | 10 | >12 | >12 |  | Note 1 |
| Source 15, Nokia | R1-2111828 | DDDSU | SU-MIMO |  | random | 10 | 54.59 | 54 | 97% |  |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | codebook-based Type 1 | random | 10 | 198 | *192* | 99% |  |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 10 | >30 | >30 | 100% |  |
| Source 7, Ericsson | R1-2110144 | DDDUU | SU-MIMO | reciprocity-based precoding | random | 10 | >40 |  |  |  |
| Note 1: 64QAM | | | | | | | | | | |

Table 47 FR1, UL, InH, VR/CG 0.2Mbps, 250FPS, MU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 20, ZTE | R1-2111351 | DDDSU | MU-MIMO | reciprocity-based precoding |  | 10 | >40 | 40 | 100% | Note 1 |
| Source 11, InterDigital | R1-2111830 | DDDSU | MU-MIMO | 32-port CSI-RS Type I codebook | evenly spaced | 10 | 20 | 20 | 100% | Note 2 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | codebook-based Type 1 | random | 10 | >240 | 240 | 99% |  |
| Note 1: 64QAM  Note 2: with jitter | | | | | | | | | | |

* + - 1. AR (1 stream: Scene/video/data/voice-stream)

Table 48 FR1, UL, InH, AR (1 stream: Scene/video/data/voice-stream), 10Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 30 | 13.95 | 13 | 93.59% |  |
| Source 3, CATT | R1-2111234 | DDDUU | SU-MIMO | codebook-based Type 2 | random | 30 | 6 | 6 | 100% | Note 1 |
| Source 15, Nokia | R1-2111828 | DDDSU | SU-MIMO |  | random | 30 | 4.66 | 4 | 99% |  |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | codebook-based Type 1 | random | 30 | 4.4 | 4 | 97.3% |  |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 30 | 5.09 | 5 | 90% |  |
| Source 7, Ericsson | R1-2110144 | DDDUU | SU-MIMO | reciprocity-based precoding | random | 30 | 6.1 |  |  |  |
| Note 1: 64QAM | | | | | | | | | | |

Table 49 FR1, UL, InH, AR (1 stream: Scene/video/data/voice-stream), 10Mbps, 60FPS, MU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 11, InterDigital | R1-2111830 | DDDSU | MU-MIMO | 32-port CSI-RS Type I codebook | random | 30 | 11.5 | 11 | 94.50% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | codebook-based Type 1 | random | 30 | 7.1 | 7 | 95% |  |
| Note 1: video-stream with jitter | | | | | | | | | | |

* + - 1. AR (2 streams: Pose/control-stream + scene/video/data/voice-stream)

Table 50 FR1, UL, InH, AR (2 streams: Pose/control-stream + scene/video/data/voice-stream), 10.2Mbps, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10; 30 | 12.71 | 12 | 93.29% |  |
| Source 15, Nokia | R1-2111828 | DDDSU | SU-MIMO |  | random | 10; 30 | 4.05 | 4 | 94% |  |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | codebook-based Type 1 | random | 10; 30 | 4.1 | 4 | 91.9% |  |
| Source 7, Ericsson | R1-2110144 | DDDUU | SU-MIMO | reciprocity-based precoding | random | 10 | 5.8 |  |  |  |
|  | | | | | | | | | | |

Table 51 FR1, UL, InH, AR (2 streams: Pose/control-stream + scene/video/data/voice-stream), 10.2Mbps, MU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 11, InterDigital | R1-2111830 | DDDSU | MU-MIMO | 32-port CSI-RS Type I codebook | random | 10; 30 | 7.2 | 7 | 94% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | codebook-based Type 1 | random | 10; 30 | 7.4 | 7 | 95.4% |  |
| Note 1: video-stream with jitter | | | | | | | | | | |

* + - 1. AR (3 streams: Video stream+Data/audio stream+Pose/control stream)

Table 52 FR1, UL, InH, AR (3 streams: Video stream 10Mbps+Data/audio stream 1.12Mbps+Pose/control stream 0.2Mbps), SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 1, Apple | R1-2111902 | DDDSU | SU-MIMO |  |  | 10; 30; 10 | 4.1 | 4 | 91% |  |
|  | | | | | | | | | | |

* + 1. Uma Scenario
       1. VR/CG (Pose/control-stream)

Table 53 FR1, UL, Uma, VR/CG 0.2Mbps, 250FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | single layer transmission | evenly spaced | 10 | 142.4 | 142 | 95% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 20 | 20 | 97.70% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | codebook-based Type 1 | random | 10 | 143 | *136* | 94% | Note 1 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 10 | >30 | >30 | 100% | Note 1, 2 |
| Source 7, Ericsson | R1-2110144 | DDDUU | SU-MIMO | reciprocity-based precoding | random | 10 | 17.4 |  |  | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: downtilt: 12 | | | | | | | | | | |

Table 54 FR1, UL, Uma, VR/CG 0.2Mbps, 250FPS, MU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 10 | >15 |  | 95.56% (15) | Note 1, 2 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | codebook-based Type 1 | random | 10 | >240 | 240 | 93% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: downtilt: 12 | | | | | | | | | | |

* + - 1. AR (1 stream: Scene/video/data/voice-stream)

Table 55 FR1, UL, Uma, AR (1 stream: Scene/video/data/voice-stream), 10Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 8, FUTUREWEI | R1-2110885 | DDDUU | SU-MIMO | single layer transmission | random | 30 | <1 | 0 | 100% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 30 | <1 | 0 | 74.60% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | codebook-based Type 1 | random | 30 | 0 | 0 | N.A. | Note 1 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 30 | 1.34 | 1 | 90% | Note 1, 2 |
| Source 7, Ericsson | R1-2110144 | DDDUU | SU-MIMO | reciprocity-based precoding | random | 30 | <1 |  |  | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: downtilt: 12 | | | | | | | | | | |

Table 56 FR1, UL, Uma, AR (1 stream: Scene/video/data/voice-stream), 10Mbps, 60FPS, MU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 9, Huawei | R1-2110811 | DDDSU | MU-MIMO | Close loop rank adaptation | random | 30 | <1 |  |  | Note 1, 2 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | MU-MIMO | codebook-based Type 1 | random | 30 | 0 | 0 | 0% | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8)  Note 2: downtilt: 12 | | | | | | | | | | |

* + - 1. AR (2 streams: Pose/control-stream + scene/video/data/voice-stream)

Table 57 FR1, UL, Uma, AR (2 streams: Pose/control-stream + scene/video/data/voice-stream), 10.2Mbps, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | codebook-based Type 1 | random | 10; 30 | 0 | 0 | N.A. | Note 1 |
| Source 7, Ericsson | R1-2110144 | DDDUU | SU-MIMO | reciprocity-based precoding | random | 10; 30 | <1 |  |  | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8) | | | | | | | | | | |

Table 58 FR1, UL, Uma, AR (2 streams: Pose/control-stream + scene/video/data/voice-stream), 10.2Mbps, MU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO | codebook-based Type 1 | random | 10; 30 | 0 | 0 | N.A. | Note 1 |
| Note 1: BS antenna parameters: 64 TxRU, (M, N, P, Mg, Ng; Mp, Np) = (8,8,2,1,1;4,8) | | | | | | | | | | |

* 1. FR2 DL
     1. DU Scenario
        1. VR/AR
           1. Single stream traffic model

Table 59 FR2, DL, DU, VR/AR 30Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 13.44 | 13 | 95.24% |  |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 14.16 | 14 | 91.27% | Note 1, 2 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 16.28 | 16 | 93.55% | Note 1, 3 |
| Source 15, Nokia | R1-2111828 | DDDSU | SU-MIMO |  | random | 10 | 6.35 | 6 | 96% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 8.5 | 8 | 91% | Note 1, 5 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 4 | 4 | 90% | Note 1, 6 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 8.5 | 8 | 91% | Note 1, 7 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 0 | 0 | n/a | Note 1, 5, 9 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 3 | 3 | 90% | Note 1, 6, 9 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 5 | 5 | 90% | Note 1, 8, 9 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 14.5 | 14 | 92% | Note 1, 10 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 15 | 15 | 90% | Note 1, 11 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 0 | 0 | n/a | Note 1, 10, 13 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 10 | 10 | 90% | Note 1, 12, 13 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 7 | 7 | 90% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 30 | 30 | 90% | Note 1, 4 |
| Source 16, Qualcomm | R1-2110402 | DDDDU | SU-MIMO |  | random | 10 | 5.5 | 5 | 93% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDDU | SU-MIMO |  | random | 10 | 21.5 | 21 | 92% | Note 1, 4 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 10 | 10 | 10 | 88.58% | Note 14 |
| Source 7, Ericsson | R1-2110144 | DDDUU | SU-MIMO | codebook-based Type 1 | random | 10 | 4.2 |  |  | Note 1 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top)  Note 2: Delay aware (DA) scheduler  Note 3: stream packet generation rate (Fps or Hz): 120  Note 4: 400MHz bandwidth  Note 5: baseline, 2CC(30&39GHz) CA, no blocking  Note 6: PDCP duplication, 2CC(30&39GHz) CA, no blocking  Note 7: network coding(50% redundancy), 2CC(30&39GHz) CA, no blocking  Note 8: network coding(100% redundancy), 2CC(30&39GHz) CA, no blocking  Note 9: periodic blocking(4/10ms) on 30GHz CC  Note 10: baseline, 4CC(30,30.4,39&39.4GHz) CA, no blocking  Note 11: network coding(20% redundancy), 4CC(30,30.4,39&39.4GHz) CA, no blocking  Note 12: network coding(120% redundancy), 4CC(30,30.4,39&39.4GHz) CA, no blocking  Note 13: periodic blocking (4/10ms) on 39&39.4GHz CCs  Note 14: UE antenna configuraiton: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2) | | | | | | | | | | |

Table 60 FR2, DL, DU, VR/AR 45Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 8.2 | 8 | 93.25% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 10.32 | 10 | 93.97% | Note 1, 2 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 43.89 | 43 | 91.92% | Note 1, 3 |
| Source 15, Nokia | R1-2111828 | DDDSU | SU-MIMO |  | random | 10 | 3.94 | 3 | 98% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 4.5 | 4 | 91% | Note 1, 4 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 2.5 | 2 | 94% | Note 1, 5 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 5 | 5 | 90% | Note 1, 6 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 0 | 0 | n/a | Note 1, 4, 8 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 2 | 2 | 89% | Note 1, 5, 9 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 3 | 3 | 89% | Note 1, 7, 8 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 10 | 10 | 92% | Note 1, 9 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 10 | 10 | 92% | Note 1, 10 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 0 | 0 | n/a | Note 1, 9, 12 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 6 | 6 | 90% | Note 1, 11, 12 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 10.5 | 10 | 92% | Note 1, 13, 15 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 9 | 9 | 90% | Note 1, 13, 16 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 5 | 5 | 91% | Note 1, 14, 16 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 5 | 5 | 90% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 22.5 | 22 | 93% | Note 1, 3 |
| Source 16, Qualcomm | R1-2110402 | DDDDU | SU-MIMO |  | random | 10 | 2.5 | 2 | 93% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDDU | SU-MIMO |  | random | 10 | 16.5 | 16 | 90% | Note 1, 3 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 10 | 4.7 | 4 | 92.62% | Note 17 |
| Source 7, Ericsson | R1-2110144 | DDDUU | SU-MIMO | codebook-based Type 1 | random | 10 | 2 |  |  | Note 1 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top)  Note 2: stream packet generation rate (Fps or Hz): 120  Note 3: 400MHz bandwidth  Note 4: baseline, 2CC(30&39GHz) CA, no blocking  Note 5: PDCP duplication, 2CC(30&39GHz) CA, no blocking  Note 6: network coding(50% redundancy), 2CC(30&39GHz) CA, no blocking  Note 7: network coding(100% redundancy), 2CC(30&39GHz) CA, no blocking  Note 8: periodic blocking(4/10ms) on 30GHz CC  Note 9: baseline, 4CC(30,30.4,39&39.4GHz) CA, no blocking  Note 10: network coding(20% redundancy), 4CC(30,30.4,39&39.4GHz) CA, no blocking  Note 11: network coding(120% redundancy), 4CC(30,30.4,39&39.4GHz) CA, no blocking  Note 12: periodic blocking (4/10ms) on 39&39.4GHz CCs  Note 13: network coding (100% redundancy), mTRP (2ms evaluation interval)  Note 14: network coding (100% redundancy), mTRP (10ms evaluation interval)  Note 15: periodic blocking (4/10ms) with probability 0.2  Note 16: periodic blocking (40/10ms) with probability 0.2  Note 17: UE antenna configuraiton: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2) | | | | | | | | | | |

* + - * 1. Multi-stream traffic model

Table 61 FR2, DL, DU, 2 stream: VR 30Mbps+audio-stream 0.756Mbps, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 6 | 6 | 90% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 6.5 | 6 | 93% | Note 1, 2 |
| Source 16, Qualcomm | R1-2110402 | DDDDU | SU-MIMO |  | random | 10 | 3.5 | 3 | 92% | Note 1 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top)  Note 2: Delay aware (DA) scheduler | | | | | | | | | | |

* + - 1. CG

Table 62 FR2, DL, DU, CG 8Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 15 | 32.5 | 32 | 94% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 15 | >45 | >45 | N/A | Note 1, 3 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 15 | >20 | >20 | N/A | Note 2 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top)  Note 2: UE antenna configuraiton: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2)  Note 3: 400MHz bandwidth | | | | | | | | | | |

Table 63 FR2, DL, DU, CG 30Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 16.16 | 16 | 92.36% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 16.82 | 16 | 96.73% | Note 1, 3 |
| Source 15, Nokia | R1-2111828 | DDDSU | SU-MIMO |  | random | 15 | 8.25 | 8 | 93% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 15 | 8 | 8 | 90% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 15 | 32.5 | 32 | 93% | Note 1, 4 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 15 | 11 | 11 | 90.60% | Note 2 |
| Source 7, Ericsson | R1-2110144 | DDDUU | SU-MIMO | codebook-based Type 1 | random | 15 | 5.1 |  |  | Note 1 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top)  Note 2: UE antenna configuraiton: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2)  Note 3: Delay aware (DA) scheduler  Note 4: 400MHz bandwidth | | | | | | | | | | |

* + 1. InH Scenario
       1. VR/AR
          1. Single stream traffic model

Table 64 FR2, DL, InH, VR/AR 30Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 8.72 | 8 | 92.01% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 8.83 | 8 | 92.36% | Note1, 3 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 10.23 | 10 | 91.94% | Note 1, 4 |
| Source 20, ZTE | R1-2111351 | DDDSU | SU-MIMO | reciprocity-based precoding |  | 10 | 7.8 | 7 | 91% | Note 2, 5 |
| Source 15, Nokia | R1-2111828 | DDDSU | SU-MIMO |  | random | 10 | 10.17 | 10 | 98% | Note 1 |
| Source 7, Ericsson | R1-2112551 | DDDSU | SU-MIMO | codebook-based Type 1 | random | 10 | 6.2 | 6 |  | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 7 | 7 | 90% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 34 | 34 | 90% | Note 1, 6 |
| Source 16, Qualcomm | R1-2110402 | DDDUU | SU-MIMO |  | random | 10 | 5.5 | 5 | 93% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDUU | SU-MIMO |  | random | 10 | 25 | 25 | 90% | Note 1, 6 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 10 | 10 | 10 | 89.00% | Note 2 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top)  Note 2: UE antenna configuraiton: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2)  Note 3: Delay aware (DA) scheduler  Note 4: stream packet generation rate (Fps or Hz): 120  Note 5: 64QAM  Note 6: 400MHz bandwidth | | | | | | | | | | |

Table 65 FR2, DL, InH, VR/AR 45Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 4.67 | 4 | 94.44% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 6.03 | 6 | 90.28% | Note 1, 3 |
| Source 15, Nokia | R1-2111828 | DDDSU | SU-MIMO |  | random | 10 | 6.09 | 6 | 98% | Note 1 |
| Source 7, Ericsson | R1-2112551 | DDDSU | SU-MIMO | codebook-based Type 1 | random | 10 | 3.2 | 3 |  | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 5 | 5 | 90% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 27 | 27 | 90% | Note 1, 4 |
| Source 16, Qualcomm | R1-2110402 | DDDDU | SU-MIMO |  | random | 10 | 2.5 | 2 | 93% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDDU | SU-MIMO |  | random | 10 | 19 | 19 | 90% | Note 1, 4 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 10 | 4.7 | 4 | 96.26% | Note 2 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top)  Note 2: UE antenna configuraiton: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2)  Note 3: stream packet generation rate (Fps or Hz): 120  Note 4: 400MHz bandwidth | | | | | | | | | | |

* + - * 1. Multi-stream traffic model

Table 66 FR2, DL, InH, 2 stream: I/P Frame Traffic Model GOP-Based, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 1.5 | [10,10] | 5.37 | 5 | 91.20% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 1.5 | [10,10] | 5.43 | 5 | 91.55% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 1.5 | [10,10] | 4.98 | 4 | 93.75% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 1.5 | [15,10] | 7.07 | 7 | 90.34% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 1.5 | [15,10] | 7.43 | 7 | 91.61% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 1.5 | [15,10] | 6.8 | 6 | 93.06% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 1.5 | [15,9] | 6.91 | 6 | 93.98% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 1.5 | [15,9] | 7.11 | 7 | 90.56% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 1.5 | [15,9] | 6.93 | 6 | 94.44% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 2 | [10,10] | 3.53 | 3 | 92.01% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 2 | [10,10] | 3.87 | 3 | 92.71% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 2 | [10,10] | 2.73 | 2 | 93.06% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 2 | [15,10] | 5.23 | 5 | 91.15% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 2 | [15,10] | 5.52 | 5 | 92.71% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 2 | [15,10] | 4.91 | 4 | 94.94% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 2 | [15,9] | 4.99 | 4 | 94.68% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 2 | [15,9] | 5.33 | 5 | 91.67% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 2 | [15,9] | 4.78 | 4 | 94.14% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 3 | [10,10] | 2.29 | 2 | 93.06% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 3 | [10,10] | 2.29 | 2 | 93.06% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 3 | [10,10] | 2.03 | 2 | 90.28% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 3 | [15,10] | 3.29 | 3 | 91.32% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 3 | [15,10] | 3.29 | 3 | 91.32% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 3 | [15,10] | 2.68 | 2 | 93.06% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 3 | [15,9] | 3.29 | 3 | 90.97% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 3 | [15,9] | 3.29 | 3 | 90.97% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 3 | [15,9] | 2.68 | 2 | 93.06% | Note 1,4 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top)  Note 2: [PER\_I, PER\_P] = [1%, 1%]  Note 3: [PER\_I, PER\_P] = [1%, 5%]  Note 4: [PER\_I, PER\_P] = [0.5%, 5%] | | | | | | | | | | |

Table 67 FR2, DL, InH, 2 stream: I/P Frame Traffic Model Slice-Based, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 1.5 | [10,10] | 8.23 | 8 | 92.53% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 1.5 | [10,10] | 10.61 | 10 | 92.08% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 1.5 | [10,10] | 10.46 | 10 | 91.67% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 1.5 | [15,10] | 8.24 | 8 | 92.71% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 1.5 | [15,10] | 10.77 | 10 | 92.50% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 1.5 | [15,10] | 10.55 | 10 | 91.94% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 1.5 | [15,9] | 8.14 | 8 | 91.67% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 1.5 | [15,9] | 10.51 | 10 | 91.48% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 1.5 | [15,9] | 10.43 | 10 | 91.39% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 2 | [10,10] | 8.24 | 8 | 92.71% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 2 | [10,10] | 10.73 | 10 | 92.50% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 2 | [10,10] | 10.46 | 10 | 91.67% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 2 | [15,10] | 8.24 | 8 | 92.71% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 2 | [15,10] | 10.72 | 10 | 92.50% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 2 | [15,10] | 10.66 | 10 | 92.22% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 2 | [15,9] | 8.18 | 8 | 92.01% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 2 | [15,9] | 10.38 | 10 | 91.39% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 2 | [15,9] | 10.45 | 10 | 91.53% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 3 | [10,10] | 8.23 | 8 | 92.53% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 3 | [10,10] | 10.61 | 10 | 92.08% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 3 | [10,10] | 10.38 | 10 | 91.39% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 3 | [15,10] | 8.28 | 8 | 93.06% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 3 | [15,10] | 10.63 | 10 | 92.22% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 3 | [15,10] | 10.55 | 10 | 91.94% | Note 1,4 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 3 | [15,9] | 8.22 | 8 | 92.36% | Note 1,2 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 3 | [15,9] | 10.46 | 10 | 91.49% | Note 1,3 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | random | 3 | [15,9] | 10.48 | 10 | 91.67% | Note 1,4 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top)  Note 2: [PER\_I, PER\_P] = [1%, 1%]  Note 3: [PER\_I, PER\_P] = [1%, 5%]  Note 4: [PER\_I, PER\_P] = [0.5%, 5%] | | | | | | | | | | |

Table 68 FR2, DL, InH, 2 stream: VR 30Mbps+audio-stream 0.756Mbps, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 6 | 6 | Source 16, Qualcomm | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 7 | 7 | Source 16, Qualcomm | Note 1, 2 |
| Source 16, Qualcomm | R1-2110402 | DDDDU | SU-MIMO |  | random | 10 | 4 | 4 | Source 16, Qualcomm | Note 1 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top)  Note 2: Delay aware (DA) scheduler | | | | | | | | | | |

* + - 1. CG

Table 69 FR2, DL, InH, CG 8Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 7, Ericsson | R1-2112551 | DDDSU | SU-MIMO | codebook-based Type 1 | random | 15 | 28 | 28 |  | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 15 | 31 | 31 | 90% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 15 | 44 | 44 | 90% | Note 1, 3 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 15 | >20 | >20 | N/A | Note 2 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top)  Note 2: UE antenna configuraiton: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2)  Note 3: 400MHz bandwidth | | | | | | | | | | |

Table 70 FR2, DL, InH, CG 30Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 9.91 | 9 | 95.37% | Note 1 |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 15 | 10.23 | 10 | 91.11% | Note 1, 3 |
| Source 20, ZTE | R1-2111351 | DDDSU | SU-MIMO | reciprocity-based precoding |  | 15 | 9.9 | 9 | 93% | Note 2, 4 |
| Source 15, Nokia | R1-2111828 | DDDSU | SU-MIMO |  | random | 15 | 11.45 | 11 | 99% | Note 1 |
| Source 7, Ericsson | R1-2112551 | DDDSU | SU-MIMO | codebook-based Type 1 | random | 15 | 6.9 | 6 |  | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 15 | 7.5 | 7 | 94% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 15 | 32 | 32 | 90% | Note 1, 5 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 15 | 11 | 11 | 90.46% | Note 2 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top)  Note 2: UE antenna configuraiton: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2)  Note 3: Delay aware (DA) scheduler  Note 4: 64QAM  Note 5: 400MHz bandwidth | | | | | | | | | | |

* 1. FR2 UL
     1. DU Scenario
        1. VR/CG (Pose/control-stream)

Table 71 FR2, UL, DU, VR/CG 0.2Mbps, 250FPS, SU-MIMO, , 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 20 | 20 | 96.51% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 7.5 | 7 | 92% | Note 1, 3, 5 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 8.5 | 8 | 92% | Note 1, 2, 3, 5 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 15 | 15 | 90% | Note 1, 3, 6 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 18.5 | 18 | 91% | Note 1, 4, 5 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 26.5 | 26 | 92% | Note 1, 4, 6 |
| Source 16, Qualcomm | R1-2110402 | DDDUU | SU-MIMO |  | random | 10 | 18.5 | 18 | 93% | Note 1, 3, 6 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 10 | >30 | >30 | 99% | Note 7 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top)  Note 2: 400MHz bandwidth  Note 3: Regular slot  Note 4: Minislot  Note 5: Full antena  Note 6: FDM/SDM  Note 7: UE antenna configuraiton: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2) | | | | | | | | | | |

* + - 1. AR (1 stream: Scene/video/data/voice-stream)

Table 72 FR2, UL, DU, AR (1 stream: Scene/video/data/voice-stream) 10Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 30 | 8.3 | 8 | 92.66% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDUU | SU-MIMO |  | random | 30 | 9 | 9 | 90% | Note 1 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 30 | 1.29 | 1 | 90% | Note 2 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top)  Note 2: UE antenna configuraiton: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2) | | | | | | | | | | |

Table 73 FR2, UL, DU, AR (1 stream: Scene/video/data/voice-stream) 20Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2110402 | DDDUU | SU-MIMO |  | random | 60 | 5 | 5 | 90% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDUU | SU-MIMO |  | random | 15 | 3.5 | 3 | >90% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDUU | SU-MIMO |  | random | 30 | 5 | 5 | 90% | Note 1 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top) | | | | | | | | | | |

* + - 1. AR (2 streams: Pose/control-stream + scene/video/data/voice-stream)

Table 74 FR2, UL, DU, AR (2 streams: Pose/control-stream + scene/video/data/voice-stream) 10.2Mbps, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2110402 | DDDUU | SU-MIMO |  | random | 10; 30 | 4.5 | 4 | 94% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10; 30 | 1.5 | 1 | 94% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDUU | SU-MIMO |  | random | 10; 30 | 7 | 7 | 90% | Note 1, 2 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top)  Note 2: 400MHz bandwidth | | | | | | | | | | |

Table 75 FR2, UL, DU, AR (2 streams: Pose/control-stream + scene/video/data/voice-stream) 20.2Mbps, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2110402 | DDDUU | SU-MIMO |  | random | 10; 30 | 2 | 2 | 90.00% | Note 1 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top) | | | | | | | | | | |

* + 1. InH Scenario
       1. VR/CG (Pose/control-stream)

Table 76 FR2, UL, InH, VR/CG 0.2Mbps, 250FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 10 | 20 | 20 | 97.69% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 7 | 7 | 90% | Note 1, 3, 5 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 7 | 7 | 90% | Note 1, 2, 3, 5 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 11.5 | 11 | 94% | Note 1, 3, 6 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 20 | 20 | 90% | Note 1, 4, 5 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10 | 26 | 26 | 90% | Note 1, 4, 6 |
| Source 16, Qualcomm | R1-2110402 | DDDUU | SU-MIMO |  | random | 10 | 19 | 19 | 90% | Note 1, 3, 6 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 10 | 12.09 | 12 | 90.28% | Note 7 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top)  Note 2: 400MHz bandwidth  Note 3: Regular slot  Note 4: Minislot  Note 5: Full antena  Note 6: FDM/SDM  Note 7: UE antenna configuraiton: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2) | | | | | | | | | | |

* + - 1. AR (1 stream: Scene/video/data/voice-stream)

Table 77 FR2, UL, InH, AR (1 stream: Scene/video/data/voice-stream), 10Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 18, vivo | R1-2111046 | DDDSU | SU-MIMO | reciprocity-based precoding | random | 30 | 8.59 | 8 | 95.14% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDUU | SU-MIMO |  | random | 30 | 10 | 10 | 90% | Note 1 |
| Source 14, MediaTek | R1-2112296 | DDDSU | SU-MIMO | codebook-based Type 2 | random | 30 | 1 | 1 | 90% | Note 2 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top)  Note 2: UE antenna configuraiton: 4Tx/4Rx: (M, N, P, Mg, Ng; Mp, Np) = (2,4,2,1,2;1,2) | | | | | | | | | | |

Table 78 FR2, UL, InH, AR (1 stream: Scene/video/data/voice-stream), 20Mbps, 60FPS, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2110402 | DDDUU | SU-MIMO |  | random | 60 | 6 | 6 | 90% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDUU | SU-MIMO |  | random | 15 | 5 | 5 | 90% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDUU | SU-MIMO |  | random | 30 | 6 | 6 | 90% | Note 1 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top) | | | | | | | | | | |

* + - 1. AR (2 streams: Pose/control-stream + scene/video/data/voice-stream)

Table 79 FR2, UL, InH, AR (2 streams: Pose/control-stream + scene/video/data/voice-stream), 10.2Mbps, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2110402 | DDDUU | SU-MIMO |  | random | 10; 30 | 5 | 5 | 90% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDSU | SU-MIMO |  | random | 10; 30 | 2.5 | 2 | 93% | Note 1 |
| Source 16, Qualcomm | R1-2110402 | DDDUU | SU-MIMO |  | random | 10; 30 | 7.5 | 7 | 94% | Note 1, 4 |
| Source 16, Qualcomm | R1-2110402 | DDDUU | SU-MIMO |  | random | 10; 30 | 6.5 | 6 | 95% | Note 1, 3 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top)  Note 2: 400MHz bandwidth  Note 3: Delay aware (DA) scheduler | | | | | | | | | | |

Table 80 FR2, UL, InH, AR (2 streams: Pose/control-stream + scene/video/data/voice-stream), 20.2Mbps, SU-MIMO, 100MHz bandwidth

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| source | Tdoc source | TDD format | SU/MU-MIMO | Transmission scheme | Traffic arrival offset among different UEs | PDB (ms) for stream | Capacity | C1=floor (Capacity) | % of satisfied UEs when #UEs/cell =C1 | Notes |
| Source 16, Qualcomm | R1-2110402 | DDDUU | SU-MIMO |  | random | 10; 30 | 3.5 | 3 | 93% | Note 1 |
| Note 1: UE antenna configuraiton: (M, N, P) = (1, 4, 2), 3 panels (left, right, top) | | | | | | | | | | |