**3GPP TSG RAN #109 RP-25**

**Beijing, China, Sept. 15th – 18th, 2025**

**Title: pCR on Deployment scenarios for TR 38.914**

**Source: Deutsche Telekom (Moderator)**

**Agenda Item: 8.2.1.1**

# Introduction

A total of 30 contributions has been submitted to the agenda item 8.2.1.1 on Deployment Scenarios for the RAN lead SI on 6G. Three documents were misplaced and have been moved to the appropriate agenda item.

# 3 Definitions of terms, symbols and abbreviations

## 3.1 Terms

For the purposes of the present document, the terms given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

**example:** text used to clarify abstract rules by applying them literally.

## 3.2 Symbols

For the purposes of the present document, the following symbols apply:

<symbol> <Explanation>

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

<ABBREVIATION> <Expansion>

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Just for RAN#109 moderation by Axel:

* Marked Text -> contradiction to existing/other proposed text
* Marked Text -> Text from submissions to RAN#109, but captured in existing text by moderator -> needs to be removed
* Marked Text -> Suggestions from submissions to RAN#109 for further FFS
* Marked Text -> agreed in the offline session – to be kept for the final pCR

All chapters, tables and notes needed consistent numbering at the end !

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# 4. Deployment scenarios

*Editor note: Sensing related aspects will be included in section 4*

High-level descriptions on deployment scenarios including carrier frequency, aggregated system bandwidth, network layout / ISD/ Orbit, BS / UE antenna elements, UE distribution / speed and service profile are proposed in this TR. It is assumed that more detailed attributes and simulation parameters, for example, the channel model, BS / UE Tx power, number of antenna ports, etc. should be defined in the new RAT study item.

The deployment scenarios in this section are defined for the sole purpose of evaluating RAN performance requirements or features, not intended to mandate actual deployments or network/device implementation.

Note: Regarding the various carrier frequency configurations and options listed in the tables below, only a sub-set of them will be required to be evaluated for ITU IMT-2030 self-evaluation and 3GPP internal evaluation, others may be optionally used for specific RAN features or requirements evaluation.

## 4.1 Indoor hotspot

The indoor hotspot deployment scenario focuses on small coverage per site/TRxP (transmission and reception point) and high user throughput or user density in buildings. The key characteristics of this deployment scenario are high capacity, high user density and consistent user experience indoor.

Some of its attributes are listed in Table 4.1.

Table 4.1: Attributes for indoor hotspot

|  |  |
| --- | --- |
| Attributes | Values or assumptions |
| Carrier Frequency | Around 2 GHz  Around 4 GHz  Around 7 GHz  Around 15 GHz  Around 30 GHz |
| Aggregated system bandwidth  NOTE1,2 | Around 4 GHz: Up to 300 MHz (DL+UL) NOTE3  Around 7 GHz Up to 400 MHz (DL+UL) NOTE3  Around 15 GHz Up to 400 MHz (DL+UL) NOTE3  Around 30 GHz: up to 1 GHz (DL+UL) NOTE3 |
| Layout | Single layer:  - Indoor floor (Open office) , 120m x 50m  NOTE: co-located layout is assumed for Around 4GHz+Around 7GHz  Note: Co-site & single-layer deployment for Around 4GHz+Around 7GHz is considered. |
| ISD | 20m for around 4 GHz and 7 GHz  30 .. 50m for below 7GHz  20m (Equivalent to 12sites per 120m x 50m)  Other candidate site numbers: 3, 6 |
| BS antenna elements  NOTE 4 | Around 700 MHz: Up to 64 Tx and Rx antenna elements  Around 2 GHz: Up to 288 Tx and Rx antenna elements  Around 4 GHz: Up to [?] Tx and Rx antenna elements  Around 7 GHz: Up to [?]Tx and Rx antenna elements  Around 15 GHz: Up to [?]Tx and Rx antenna elements  Around 30 GHz: Up to [?]Tx and Rx antenna elements  2T2R and 4T4R  Around 4 GHz: Up to 32 32 256 256 256Tx and Rx antenna elements  Around 7 GHz and around 15 GHz: Up to 128 144 1024 1024 2048 Tx and Rx antenna elements  Around 30 GHz: Up to 64 64 1024 1024 Tx and Rx antenna elements |
| UE antenna elements  NOTE 4 | Round 30 GHz: Up to 32 32 Tx and Rx antenna elements  Around 4 GHz and around 7 GHz: Up to 8 8 8 8Tx and Rx antenna elements Note  Note: Possible device types include handheld device, CPE, vehicle, sensing dedicated device etc. Configurations of antenna element more than 2Tx and 4Rx are not necessarily applicable to smart phone.  1T2R as minimum requirement  Around 4 GHz: Up to 8 Tx and Rx antenna elementsAround 7GHz: Up to 16 Tx and Rx antenna elements  Around 7 GHz and around 15 GHz: Up to [8] Tx and Rx antenna elements  Around 30 GHz: Up to 32 Tx and Rx antenna elements  eMBB UE “handheld” device (used in eMBB/Positioning):  • Around 4 GHz: Up to 4 Tx and 4 Rx antenna elements  • Around 7 GHz: Up to 4 Tx and 8 Rx antenna elements  • Around 30 GHz: Up to 8 Tx and 8 Rx antenna elements  Optional  eMBB UE “non-handheld” device (used in eMBB/Positioning):  • Around 4 GHz: Up to 8 Tx and 8 Rx antenna elements  • Around 7 GHz: Up to 8 Tx and 8 Rx antenna elements  • Around 30 GHz: Up to 32 Tx and Rx antenna elements  Note: For around 30 GHz, with multi-panel UE, it is the number of simultaneously used antenna elements. |
| Multi-TRP operation | Around 4GHz and 7GHz: single TRP, or coherent joint transmission multi-TRP  Around 30GHz: single TRP, or non-coherent joint transmission multi-TRP  Note: TRP(s) can be all DL+UL TRP, or randomly selected from {DL+UL TRP, UL-only TRP}. |
| User distribution and UE speed  Service deployment and speed options | eMBB   * Profile 1   100% Indoor, 3km/h, 0km/h  Profile 2 (Optional, for seated people, desktop stations)   * 100% Indoor: 0 km/h, |
| Service profile | NOTE: Whether to use full buffer traffic or non-full-buffer traffic with/without QoS requirement depends on the evaluation methodology adopted for each KPI NOTE6. For certain KPIs, full buffer traffic is desirable to enable comparison with IMT-2020 Advanced values. |
| Sensing target distribution and Sensing target speed | Option 1: TBD  Option 2: To be discussed in working group.  Sensing target distribution and Sensing target speed 100% Indoor, 3km/h  [1] sensing target per TRxP. NOTE5  Whether to use or sense environmental object depends on the evaluation methodology. |

NOTE1: The options noted here are for evaluation purpose, and do not mandate the deployment of these options or preclude the study of other spectrum options. A range of bands from 3300 – 4990MHz identified for WRC-15 are currently being considered and around 4GHz is chosen as a proxy for this range. A range of bands from 6 425-7 125 MHz identified for WRC-23 are currently being considered and around 7GHz is chosen as a proxy for this range. A range of bands from 24.25 GHz – 52.6 GHz identified for WRC-19 are currently being considered and around 30 GHz is chosen as a proxy for this range.

NOTE2: The aggregated system bandwidth is the total bandwidth typically assumed to derive the values for some KPIs such as area traffic capacity and user experienced data rate. It is not allowed to simulate a smaller bandwidth than the aggregated system bandwidth and transform the results to a larger bandwidth. The transformation method should then be described, including the modelling of power limitations.

NOTE3: "DL + UL" refers to either of the following two cases:

1. FDD with symmetric bandwidth allocations between DL and UL.

2. TDD with the aggregated system bandwidth used for either DL or UL via switching in time-domain.

NOTE4: The maximum number of antenna elements is a working assumption. 3GPP needs to strive to meet the target with typical antenna configurations.

NOTE1: It is allowed to simulate a smaller bandwidth than the system bandwidth and transform the results to a larger bandwidth. The transformation method should then be described, including the modelling of power limitations.

NOTE2: "DL + UL" refers to either of the following two cases:

1. FDD with symmetric bandwidth allocations between DL and UL.

2. TDD with the system bandwidth used for either DL or UL via switching in time-domain.

NOTE3: The maximum number of antenna elements is a working assumption. 3GPP needs to strive to meet the target with typical antenna configurations. The specific typical antenna configurations may be different for different device types and need further study.

NOTE4: [10] users per TRxP is the baseline, other number of users per TRxP (e.g. 20, 30, 50) is not precluded.

NOTE5: Sensing target number per TRxP depends on the use cases and sensing target type, [1] sensing target per TRxP are starting point, other number of sensing targets per TRxP (e.g., 5 or others) is not precluded.

NOTE6: For non-full-buffer traffic with QoS requirement, use XR traffic models in TR 38.838 for XR composite requirement evaluation, use FTP-3 with packet delay budget requirement for energy efficiency evaluation, and use AI/ML traffic models for AI/ML related capability evaluation.

## 4.2 Dense urban

The dense urban microcellular deployment scenario focuses on macro TRxPs with or without micro TRxPs and high user densities and traffic loads in city centres and dense urban areas. The key characteristics of this deployment scenario are high traffic loads, outdoor and outdoor-to-indoor coverage. This scenario will be interference-limited, using macro TRxPs with or without micro TRxPs. A continuous cellular layout and the associated interference shall be assumed.

Some of its attributes are listed in Table 4.2.

Table 4.2: Attributes for dense urban

|  |  |
| --- | --- |
| Attributes | Values or assumptions |
| Carrier Frequency | Around 700 MHz  Around 2 GHz  Around 4 GHz  Around 7 GHz  Around 15 GHz  Around 30 GHz  Around 2 GHz + Around 4 GHz  Around 4 GHz + Around 7 GHz  Around 4 GHz + Around 30 GHz  Around 7 GHz + Around 30 GHz  Around 7 GHz + Around 4 GHz + Around 2 GHz + Around 700 MHz |
| Aggregated system bandwidth  NOTE2 | Around 700 MHz: Up to 60 MHz (DL+UL)  Around 2GHz: Up to 200 MHz (DL+UL)  Around 4 GHz: Up to 300 MHz (DL+UL)  Around 7 GHz: Up to 400 MHz (DL+UL)  Around 15 GHz Up to 400 MHz (DL+UL)  Around 30 GHz: Up to 1 GHz (DL+UL) |
| Layout | **Layout option 1**. Single layer:  - Hex. Grid  NOTE: co-located layout is assumed for Around 4GHz+Around 7GHz  **Layout option 2**.  - Macro layer: Hex. Grid  - Micro layer: Random  all outdoor, around 7 GHz and/or around 30 GHz  Two layers for Around 4 GHz/7 GHz + 7 GHz or 4 GHz + Around 4 GHz/7 GHz/30 GHz:  - Macro layer: Hex. Grid, Around 4 GHz/7 GHz  - Micro layer: Random/Fixed drop, Around 4 GHZ/7 GHz or /30 GHz    Micro-layer: (a) Random drop, (b) Fixed drop  [Around 7GHz +Around 4GHz + Around 2GHz+Around 700MHz ([single layer or two layers])]:TBD  Around 7 GHz + Around 2GHz, Around 7 GHz + Around 4GHz, Around 7 GHz + Around 700MHz  Step 1 NOTE3: Around 4 GHz in Macro layer (including macro cell only)  Step 2 NOTE3: Both Around 4 GHz & Around 7 GHz or 30 GHz may be available in Macro & Micro layers (including 1 macro layer, macro cell only)  Two layers for Around 7GHz +Around 4GHz + Around 2GHz+Around 700MHz:  - Macro layer: Hex. Grid, 4GHz + 2GHz + 700MHz (FFS joint or separate BS scheduler for different frequencies)  - Micro layer: Random drop, 7GHz |
| ISD | Single layer: 200m  Macro layer: 200m  Micro layer: 100m 100m At least 57.9 m between micro nodes, 3 micro TRxPs per macro TRxP NOTE4, |
| BS antenna elements NOTE4 | Around 700 MHz: Up to 64 Tx and Rx antenna elements  Around 2 GHz: Up to 288 Tx and Rx antenna elements  Around 4 GHz: Up to [?] Tx and Rx antenna elements  Around 7 GHz: Up to [?]Tx and Rx antenna elements  Around 15 GHz: Up to [?]Tx and Rx antenna elements  Around 30 GHz: Up to [?]Tx and Rx antenna elements  Around 700 MHz: Up to 32 Tx and Rx antenna elements  Around 2 GHz: Up to 64 128 288 Tx and Rx antenna elements 16T16R/64T64R (sub 4GHz),  Around 4 GHz: Up to 128 256 288 512 512 Tx and Rx antenna elements 128T128R/256T256R (higher frequency)  Around 7 GHz and around 15 GHz: Up to 512 1152 2048 2048 2048 Tx and Rx antenna elements  Around 30 GHz: Up to 256 1024 1152 2048 Tx and Rx antenna elements |
| UE antenna elements NOTE4 | Around 700 MHz: Up to 32 Tx and Rx antenna elements  Round 30 GHz: Up to 32 32 Tx and Rx antenna elements  Around 2 GHz up to 4, around 4 GHz up to 8 and around 7 GHz: Up to 4 8 8 16Tx and Rx antenna elements Note  Note: Possible device types include handheld device, CPE, vehicle, sensing dedicated device etc. Configurations of antenna element more than 2Tx and 4Rx are not necessarily applicable to smart phone.  Around 2 GHz: Up to 4 Tx and Rx antenna elements  Around 4 GHz: Up to 8 Tx and Rx antenna elements  Around 7 GHz and around 15 GHz: Up to [8] Tx and Rx antenna elements  Around 30 GHz: Up to 32 Tx and Rx antenna elements  1T2R, 2T2R, 2T4R  eMBB UE “handheld” device (used in eMBB):  • Around 2 GHz: Up to 2 Tx and 4 Rx antenna elements  • Around 4 GHz: Up to 4 Tx and 4 Rx antenna elements  • Around 7 GHz: Up to 4 Tx and 8 Rx antenna elements  • Around 30 GHz: Up to 8 Tx and 8 Rx antenna elements  Note: For around 30 GHz, with multi-panel UE, it is the number of simultaneously used antenna elements. |
| Multi-TRP operation | Around 700MHz, 2GHz, 4GHz and 7GHz: single TRP, or coherent joint transmission multi-TRP  Around 30GHz: single TRP, or non-coherent joint transmission multi-TRP  Note: TRP(s) can be all DL+UL TRP, or randomly selected from {DL+UL TRP, UL-only TRP}. |
| User distribution and UE speed  Service deployment and speed options | **Option** 1: NOTE3: Uniform/macro TRxP, NOTE6, NOTE7  **Option** 2: NOTE3: Uniform/macro TRxP + Clustered/micro TRxP, NOTE6,  Single layer: 10, 30 users per TRxP NOTE5  80% indoor (3km/h), 20% outdoor (30km/h, 60km/h, 0km/h)  eMBB:  • Profile 1 (Majority indoor  20% Outdoor in cars: 30 km/h  80% Indoor: 3 km/h  • Profile 2 (Majority outdoor, “Times Square” scenario)  60% Outdoor: 3 km/h,  20% Outdoor in cars: 30 km/h  20% Indoor: 3 km/h |
| Service profile | NOTE: Whether to use full buffer traffic or non-full-buffer traffic depends on the evaluation methodology adopted for each KPI. For certain KPIs, full buffer traffic is desirable to enable comparison with IMT-2020 Advanced values. |
| Sensing target distribution and Sensing target speed | Option 1: TBD  Option 2: To be discussed in working group.  Sensing target type: Human, or UAV  Distribution:   * 100% outdoor * Horizontal for human or UAV: uniformly distributed within a sensing area (e.g., center cell) * Vertical for UAV: Uniformly distributed between 25m and 300m   Mobility:   * Human: 3km/h * UAV: horizontal - uniform distribution between 0km/h and 180km/h; vertical 0km/h   [10] sensing targets per TRxP NOTE6  UAV is up to 160km/h, Vehicle is up to 60km/h, Human is up to 10km/h.  Whether to use or sense environmental object depends on the evaluation methodology. |

NOTE1: The options noted here are for evaluation purpose, and do not mandate the deployment of these options or preclude the study of other spectrum options. A range of bands from 3300 – 4990MHz identified for WRC-15 are currently being considered and around 4GHz is chosen as a proxy for this range. A range of bands from 6 425-7 125 MHz identified for WRC-23 are currently being considered and around 7GHz is chosen as a proxy for this range. A range of bands from 24.25 GHz – 52.6 GHz identified for WRC-19 are currently being considered and around 30 GHz is chosen as a proxy for this range.

NOTE2: The aggregated system bandwidth is the total bandwidth typically assumed to derive the values for some KPIs such as area traffic capacity and user experienced data rate. It is not allowed to simulate a smaller bandwidth than the aggregated system bandwidth and transform the results to a larger bandwidth. The transformation method should then be described, including the modelling of power limitations.

NOTE3: Step 1 shall be used for the evaluation of spectral efficiency KPIs. Step2 shall be used for the evaluation of the other deployment scenario dependant KPIs.

NOTE4: This value is the baseline and other number of micro TRxPs per macro TRxP (e.g., 6 or 10) is not precluded.

NOTE5: The maximum number of antenna elements is a working assumption. 3GPP needs to strive to meet the target with typical antenna configurations.

NOTE6: 10 users per TRxP is the baseline with full buffer traffic. 20 users per macro TRxP with full buffer traffic is not precluded.

NOTE1: It is allowed to simulate a smaller bandwidth than the system bandwidth and transform the results to a larger bandwidth. The transformation method should then be described, including the modelling of power limitations.

NOTE2: "DL + UL" refers to either of the following two cases:

1. FDD with symmetric bandwidth allocations between DL and UL.

2. TDD with the system bandwidth used for either DL or UL via switching in time-domain.

NOTE3: ISD 200m is the baseline, other number of ISD (e.g., 250 m) is not precluded.

NOTE4: The maximum number of antenna elements is a working assumption. 3GPP needs to strive to meet the target with typical antenna configurations. The specific typical antenna configurations may be different for different device types and need further study.

NOTE5: [10, 30] users per TRxP is the baseline, other number of users per TRxP (e.g., 20, 50) is not precluded.

NOTE6: Sensing target number per TRxP depends on the use cases and sensing target type, [10] sensing targets per TRxP are starting point, other number of sensing targets per TRxP (e.g. 20 or others) is not precluded.

NOTE7: For non-full-buffer traffic with QoS requirement, use XR traffic models in TR 38.838 for XR composite requirement evaluation, use FTP-3 with packet delay budget requirement for energy efficiency evaluation, and use AI/ML traffic models for AI/ML related capability evaluation.

## 4.3 Rural

The rural deployment scenario focuses on larger and continuous coverage. The key characteristics of this scenario are continuous wide area coverage supporting stationary and nomadic devices as well as high speed vehicles (cars, trains). This scenario will be noise-limited and/or interference-limited, using macro TRxPs.

Some of its attributes are listed in Table 4.3.

Table 4.3: Attributes for rural scenario

|  |  |
| --- | --- |
| Attributes | Values or assumptions |
| Carrier Frequency | Around 700 MHz (for ISD 1 or ISD 2)  Around 4 GHz (for ISD 1)  Around 700 MHz + Around 2 GHz (for ISD 2)  Around 7 GHz (ISD 1)  Around 700 MHz + Around 7 GHz (for ISD 1) |
| Aggregated system bandwidth | Around 700 MHz: Up to 60 MHz (DL+UL)  Around 2 GHz: Up to 200 MHz (DL+UL)  Around 4 GHz: Up to 300 MHz (DL+UL)  Around 7GHz: Up to 400 MHz (DL+UL) |
| Layout | Single layer:  Layout Option 1:  - Hex. Grid  Layout Option 2 (for extreme long-distance coverage):  - Single site, around 700 MHz  Around 7 GHz + Around 2GHz, Around 7 GHz + Around 4GHz, Around 7 GHz + Around 700MHz  Note: Co-site & single-layer deployment for Around 700MHz+Around 2GHz/7GHz is considered. |
| ISD | ISD 1: 1732m  ISD 2: 5000m  [ISD 3: 7500m assuming 700MHz] |
| BS antenna elements NOTE3 | Around 700 MHz: Up to 64 Tx and Rx antenna elements  Around 2 GHz: Up to 288 Tx and Rx antenna elements  Around 4 GHz: Up to [?] Tx and Rx antenna elements  Around 7 GHz: Up to [?]Tx and Rx antenna elements  Around 15 GHz: Up to [?]Tx and Rx antenna elements  Around 30 GHz: Up to [?]Tx and Rx antenna elements  Around 700 MHz: 4T4R with passive antenna 2T2R, 4T4R, 8T8R  Around 700 MHz: Up to 32 32 Tx and Rx antenna elements  Around 2 GHz: 4T4R with passive antenna 2T2R, 4T4R, 8T8R  Around 2GHz: Up to 128 288 Tx and Rx antenna elements  Around 700 MHz and around 2 GHz: Up to 64 64 64Tx and Rx antenna elements  Around 4 GHz: Up to 256 256 288 512 512 Tx and Rx antenna elements  Around 7 GHz and around 15 GHz: Up to 1024 2048 Tx and Rx antenna elements  Around 7 GHz: Up to 1152 2048 2048 2048 Tx and Rx antenna elements |
| UE antenna elements  NOTE3 | Around 700 MHz: 1T2R 1T2R, 2T2R, 2T4R  Around 700 MHz: Up to 2 4 4 Tx and Rx antenna elements  Around 2 GHz: 2T4R 1T2R, 2T2R, 2T4R  Around 4 GHz and around 7 GHz: Up to 8 Tx and Rx antenna elements  Note: Possible device types include handheld device, CPE, vehicle, sensing dedicated   device etc. Configurations of antenna element more than 2Tx and 4Rx are not   necessarily applicable to smart phone.  Around 2 GHz: Up to 4 Tx and Rx antenna elements  Around 700 MHz and around 2 GHz: Up to 4 4 Tx and Rx antenna elements  Around 4 GHz: Up to 8 Tx and Rx antenna elements  Around 4 GHz: Up to 8 Tx and Rx antenna elements  Around 4 GHz: Up to 8 Tx and Rx antenna elements  Around 7 GHz and around 15 GHz: Up to [8] Tx and Rx antenna elements  Around 4 GHz: Up to 8 Tx and Rx antenna elements  Around 4GHz: Up to 8 Tx and Rx antenna elements  Around 7GHz: Up to 16 Tx and Rx antenna elements  eMBB UE “handheld” device (used in eMBB)  • Around 700 MHz: 1 Tx and 2 Rx antenna elements (ITU up to 4Tx/Rx)  • Around 2 GHz: Up to 2 Tx and 4 Rx antenna elements  • Around 4 GHz: Up to 4 Tx and Rx antenna elements  • Around 7 GHz: Up to 4 Tx and 8 Rx antenna elements  FWA CPE or Tx/Rx Sensing device (used in FWA, Sensing):  • Around 700 MHz: Up to 2 Tx and 4 Rx antenna elements  • Around 2 GHz: Up to 2 Tx and 4 Rx antenna elements  • Around 4 GHz: Up to 8 Tx and 8 Rx antenna elements  • Around 7 GHz: Up to 8 Tx and 8 Rx antenna elements |
| Multi-TRP operation | Around 700MHz, 2GHz, 4GHz and 7GHz: single TRP, or coherent joint transmission multi-TRP  Note: TRP(s) can be all DL+UL TRP, or randomly selected from {DL+UL TRP, UL-only TRP}. |
| User distribution and UE speed  Service deployment and speed options  (NOTE: each service is set to be evaluated individually. However, evaluation of combination of services is not precluded) | [10% outdoor vehicles (120km/h), 20% outdoor (3 km/h) and 70% indoor (3 km/h)  10/2 users per TRxP  eMBB:  Profile 1  • 15% (Outdoor: 3 km/h),  15% Outdoor in cars: 120 km/h  70% indoor (Indoor: 3 km/h)  Profile 2  • 50% Outdoor in cars: 120 km/h,  50% Indoor: 3 km/h  FWA:  • Rooftop  • 100% Outdoor: 0 km/h,  UAV sensing:  • 100% Outdoor  • Horizontal speed: 0 km/h or ~U(0, 180) km/h  • Vertical speed: 0 km/h, optional {20, 40} km/h  Sensing target assumptions as in Table 7.9.1-1 (TR. 38.901)  Automotive sensing:  • 100% Outdoor  • Speed: 30 km/h  Sensing target assumptions as in Table 7.9.1-2 (TR. 38.901) |
| Service profile | NOTE: Whether to use full buffer traffic or non-full-buffer traffic with/without QoS requirement depends on the evaluation methodology adopted for each KPI NOTE6. For certain KPIs, full buffer traffic is desirable to enable comparison with IMT-2020 Advanced values. |
| Sensing target distribution and Sensing target speed | Option 1: TBD  Option 2: To be discussed in working group.  Sensing target type: Human or UAV  Distribution:   * 100% outdoor * Horizontal for human or UAV: uniformly distributed within a sensing area (e.g., center cell) * Vertical for UAV: Uniformly distributed between 25m and 300m   Mobility:   * Human: 3km/h * UAV: horizontal - uniform distribution between 0km/h and 180km/h; vertical 0km/h   [5] sensing targets per TRxP NOTE5  UAV is up to 160km/h, Vehicle is up to 120km/h, Human is up to 10km/h.  Whether to use or sense environmental object depends on the evaluation methodology. |

NOTE1: The options noted here are for evaluation purpose, and do not mandate the deployment of these options or preclude the study of other spectrum options. A range of bands from 450MHz – 960MHz identified for WRC-15 are currently being considered and around 700MHz is chosen as a proxy for this range. A range of bands from 1427 – 2690MHz identified for WRC-15 are currently being considered and around 2GHz is chosen as a proxy for this range. A range of bands from 3300 – 4990MHz identified for WRC-15 are currently being considered and around 4GHz is chosen as a proxy for this range.

NOTE1: The options noted here are for evaluation purpose, and do not mandate the deployment of these options or preclude the study of other spectrum options. A range of bands from 450MHz – 960MHz identified for WRC-15 are currently being considered and around 700MHz is chosen as a proxy for this range. A range of bands from 1427 – 2690MHz identified for WRC-15 are currently being considered and around 2GHz is chosen as a proxy for this range. A range of bands from 3300 – 4990MHz identified for WRC-15 are currently being considered and around 4GHz is chosen as a proxy for this range. A range of bands from 6 425-7 125 MHz identified for WRC-23 are currently being considered and around 7GHz is chosen as a proxy for this range.

NOTE2: The aggregated system bandwidth is the total bandwidth typically assumed to derive the values for some KPIs such as area traffic capacity and user experienced data rate. For UL User Experienced Data rate it is not allowed to simulate a smaller bandwidth than the aggregated system bandwidth and transform the results to a larger bandwidth.

NOTE2: The aggregated system bandwidth is the total bandwidth typically assumed to derive the values for some KPIs such as area traffic capacity and user experienced data rate. It is not allowed to simulate a smaller bandwidth than the aggregated system bandwidth and transform the results to a larger bandwidth. The transformation method should then be described, including the modelling of power limitations.

NOTE3: Aggregated system bandwidth assumes availability of three FDD carriers each of 10/20 MHz channel bandwidth in different spectrum band in the Around 700 MHz/Around 2 GHz spectrum regions, respectively. Aggregation of the spectrum into one band in each of the bandwidth regions is allowed for simulation purposes.

NOTE3: Consider larger aggregated system bandwidth if 20MHz cannot meet requirement.

NOTE4: 10 users per TRxP is the baseline with full buffer traffic. For evaluation of UL user experienced data rate, the number of users per TRxP can be reduced to 2

NOTE4: The maximum number of antenna elements is a working assumption. 3GPP needs to strive to meet the target with typical antenna configurations.

NOTE1: It is allowed to simulate a smaller bandwidth than the system bandwidth and transform the results to a larger bandwidth. The transformation method should then be described, including the modelling of power limitations.

NOTE2: "DL + UL" refers to either of the following two cases:

1. FDD with symmetric bandwidth allocations between DL and UL.

2. TDD with the system bandwidth used for either DL or UL via switching in time-domain.

NOTE3: The maximum number of antenna elements is a working assumption. 3GPP needs to strive to meet the target with typical antenna configurations. The specific typical antenna configurations may be different for different device types and need further study.

NOTE4: [10] users per TRxP is the baseline, other number of users per TRxP (e.g., 30) is not precluded.

NOTE5: Sensing target number per TRxP depends on the use cases and sensing target type, [5] sensing targets per TRxP are starting point, other number of sensing targets per TRxP (e.g., 10 or others) is not precluded.

NOTE6: For non-full-buffer traffic with QoS requirement, use XR traffic models in TR 38.838 for XR composite requirement evaluation, use FTP-3 with packet delay budget requirement for energy efficiency evaluation, and use AI/ML traffic models for AI/ML related capability evaluation.

## 4.4 Urban macro

The urban macro deployment scenario focuses on large cells providing continuous and ubiquitous coverage; there is no requirement that the continuous coverage is provided on all bands of a multi-band BS. The key characteristics of this scenario are continuous and ubiquitous coverage for stationary and nomadic devices in urban areas. This scenario will be interference-limited, using macro TRxPs (i.e. radio access points above rooftop level).

Some of its attributes are listed in Table 4.4.

Table 4.4: Attributes for urban macro

|  |  |
| --- | --- |
| Attributes | Values or assumptions |
| Carrier Frequency | Around 700 MHz  Around 2 GHz  Around 4 GHz  Around 7 GHz  Around 15 GHz  Around 30 GHz  Around 2 GHz + Around 4 GHz  Around 7 GHz + Around 30 GHz  Around 2 GHz + Around 30GHz  Around 2 GHz + Around 7 GHz  Around 2 GHz + Around 4 GHz + Around 7 GHz  Around 4 GHz + Around 30 GHz  Around 4 GHz + Around 7 GHz  Around 7GHz + Around 4 GHz + Around 2 GHz + Around 700MHz |
| Aggregated system bandwidth  (see NOTE A) NOTE1,2 | Around 700 MHz: Up to 60 MHz (DL+UL)  Around 2 GHz: Up to 200 MHz (DL+UL)  Around 4 GHz: Up to 300 MHz (DL+UL)  Around 7 GHz: Up to 400 MHz (DL+UL)  Around 15 GHz: Up to [400] MHz (DL+UL)Around 30 GHz: Up to 1 GHz (DL+UL) |
| Layout | **Layout Option 1**. Single layer:  - Hex. Grid  NOTE: co-located layout is assumed for Around 4GHz+Around 7GHz  **Layout Option 2**. Two layers:  - Macro layer: Hex. Grid  - Micro layer: Random drop  all outdoor, around 7 GHz and/or around 30 GHz  Two layers for Around 4 GHz/7 GHz + Around 4 GHz/7 GHZ/30 GHz:  - Macro layer: Hex. Grid, Around 4 GHz/7 GHz  - Micro layer: Random/Fixed drop, Around 4 GHz/7 GHz or 30GHz    Micro-layer: (a) Random drop, (b) Fixed drop  [Around 7GHz +Around 4GHz + Around 2GHz+Around 700MHz ([single layer or two layers])]:TBD  Step 1 NOTE3: Around 4 GHz in Macro layer (including macro cell only)  Step 2 NOTE3: Both Around 4 GHz & Around 7 GHz or 30 GHz may be available in Macro & Micro layers (including 1 macro layer, macro cell only)  Two layers for Around 7GHz +Around 4GHz + Around 2GHz+Around 700MHz:  - Macro layer: Hex. Grid, 4GHz + 2GHz + 700MHz (FFS joint or separate BS scheduler for different frequencies)  - Micro layer: Random drop, 7GHz |
| ISD | Single layer: 500m  Macro layer: 500m 500m  Micro layer: At least 144.8m 250m, 6 [3] micro TRxPs per macro TRxP NOTE4,  All micro TRxPs are all outdoor  All micro TRxPs are all outdoor |
| BS antenna elements NOTE3 | Around 700 MHz: Up to 64 Tx and Rx antenna elements  Around 2 GHz: Up to 288 Tx and Rx antenna elements  Around 4 GHz: Up to [?] Tx and Rx antenna elements  Around 7 GHz: Up to [?]Tx and Rx antenna elements  Around 15 GHz: Up to [?]Tx and Rx antenna elements  Around 30 GHz: Up to [?]Tx and Rx antenna elements  Around 700 MHz: 4T4R Up to 32 64 Tx and Rx antenna elements  Around 2 GHz: 4T4R with passive (baseline) and 32T32R with up to 128 128 active antenna elements (optional)  Around 4 GHz: 32T32R with up to 192 active antenna elements  Around 7 GHz: up to 256T256R with up to 1024 active antenna elements  Around 2 GHz: Up to 64 256 288 Tx and Rx antenna elements  Around 4 GHz: Up to 128 256 288 512 512 Tx and Rx antenna elements  Around 7 GHz and around 15 GHz: Up to 512 1152 2048 2048 2048 Tx and Rx antenna elements  Around 30 GHz: Up to 256 1024 1152 2048 Tx and Rx antenna elements |
| UE antenna elements NOTE3 | Around 700 MHz: 1T2R Up to 2 4 Tx and Rx antenna elements  Around 2 GHz: 2T4R  Around 4 GHz: 2T4R  Around 7 GHz: up to 4T8R  Around 2 GHz, around 4 GHz and around 7 GHz: Up to 8 Tx and Rx antenna elements Note  Note: Possible device types include handheld device, CPE, vehicle, sensing dedicated device etc. Configurations of antenna element more than 2Tx and 4Rx are not necessarily applicable to smart phone.  Around 2 GHz: Up to 4 8 Tx and Rx antenna elements  Around 4 GHz: Up to 8 8 8 Tx and Rx antenna elements  Around 7 GHz and around 15 GHz: Up to [8] 8 16 Tx and Rx antenna elements  Around 30 GHz: Up to 32 32 32 Tx and Rx antenna elements |
| FWA: 4Tx and 8 Rx (Around 2GHz / 4GHz / 7GHz)  eMBB UE “handheld” device (used in eMBB, HRLLC, Positioning):  • Around 2 GHz: Up to 2 Tx and 4 Rx antenna elements  • Around 4 GHz: Up to 4 Tx and 4 Rx antenna elements  • Around 7 GHz: Up to 4 Tx and 8 Rx antenna elements  • Around 30 GHz: Up to 8 Tx and 8 Rx antenna elements  Sensing TxRx “non-handheld” device (used in Sensing):  • Around 4 GHz: Up to 8 Tx and 8 Rx antenna elements  • Around 7 GHz: Up to 8 Tx and 8 Rx antenna elements  • Around 30 GHz: Up to 32 Tx and 32 Rx antenna elements  MTC device (used in MTC):  • Around 2 GHz: 1 Tx/Rx antenna elements  • Around 4 GHz: 1 Tx and up to 2 Rx antenna elements  • Around 7 GHz: 1 Tx and up to 2 Rx antenna elements |
| User distribution and UE speed  Service deployment and speed options  (NOTE: each service is set to be evaluated individually. However, evaluation of combination of services is not precluded) | 10% Outdoor pedestrian: 3km/h,  10% 20% Outdoor in cars: 30km/h,  20% Outdoor: 30km/h, 60 km/h, 0km/h  80% Indoor in houses: 3km/h 80% Indoor: 3km/h  20% Outdoor in cars: 30km/h, 80% Indoor in houses: 3km/h20% Outdoor in cars: 30km/h, 80% Indoor in houses: 3km/h  10/2 users per TRxP NOTE4 NOTE4  [  Step1: Uniform/macro TRxP, 10 users per TRxP  Step2: Uniform/macro TRxP + Clustered/micro TRxP, 10 users per TRxP  10 users per TRxP with single-layer only  80% indoor (3km/h), 20% outdoor (30km/h) |
| FWA (Around 2GHz / 4GHz / 7GHz): 100% indoor (0.3km/h), or 100% outdoor (0.3km/h) or [ TBD % outdoor (0.3km/h and TBD % indoor (0.3km/h)  Option 1. Uniform/Macro TRxP  Option 2. Uniform/Macro TRxP and clustered/Micro TRxP  eMBB:  • 10% Outdoor: 3 km/h,  10% Outdoor in cars: 30 km/h  80% Indoor: 3 km/h  HRLLC:  • 20% Outdoor: 3 km/h,  80% Indoor: 3 km/h  Positioning:  • 25% [10%] Outdoor: 3 km/h  25% [10%] Outdoor in cars: 30 km/h  50% [80%] Indoor: 3 km/h  MTC:  • 20% Outdoor in cars: 30 km/h, or Outdoor: 3 km/h (optional 0 km/h)  80% Indoor: 3 km/h, (optional 0 km/h for utility meters, sensors etc)  UAV sensing:  • 100% Outdoor  • Horizontal speed: 0 km/h or ~U(0, 180) km/h  • Vertical speed: 0 km/h, optional {20, 40} km/h  Sensing target assumptions as in Table 7.9.1-1 (TR. 38.901)  Automotive sensing:  • 100% Outdoor  • Speed: 30 km/h  Sensing target assumptions as in Table 7.9.1-2 (TR. 38.901)  Human sensing:  • 100% Outdoor  • Speed: 0 km/h or 3 km/h or ~U(0, 3) km/h  Sensing target assumptions as in Table 7.9.1-3 (TR. 38.901) |
| Service profile | NOTE: Whether to use full buffer traffic or non-full-buffer traffic with/without QoS requirement depends on the evaluation methodology adopted for each KPI NOTE6. For certain KPIs, full buffer traffic is desirable to enable comparison with IMT-2020 values. |
| Sensing target distribution and Sensing target speed | Option 1: TBD  Option 2: To be discussed in working group.  Distribution:   * 100% outdoor * Horizontal for human or UAV: uniformly distributed within a sensing area (e.g., center cell) * Vertical for UAV: Uniformly distributed between 25m and 300m   Mobility:   * Human: 3km/h * UAV: horizontal - uniform distribution between 0km/h and 180km/h; vertical 0km/h   [5] sensing targets per TRxP NOTE5  UAV is up to 160km/h, Vehicle is up to 120km/h, Human is up to 10km/h.  Whether to use or sense environmental object depends on the evaluation methodology. |
| NOTE A: The aggregated system bandwidth for each frequency range is for evaluation purposes only. This does not preclude the aggregation of more bandwidth within those ranges by the 6GR system. | |

NOTE1: The options noted here are for evaluation purpose, and do not mandate the deployment of these options or preclude the study of other spectrum options. A range of bands from 24.25 GHz – 52.6 GHz identified for WRC-19 are currently being considered and around 30 GHz is chosen as a proxy for this range. A range of bands from 1427 – 2690MHz identified for WRC-15 are currently being considered and around 2GHz is chosen as a proxy for this range. A range of bands from 3300 – 4990MHz identified for WRC-15 are currently being considered and around 4GHz is chosen as a proxy for this range.

NOTE1: The options noted here are for evaluation purpose, and do not mandate the deployment of these options or preclude the study of other spectrum options. A range of bands from 1427 – 2690MHz identified for WRC-15 are currently being considered and around 2GHz is chosen as a proxy for this range. A range of bands from 3300 – 4990MHz identified for WRC-15 are currently being considered and around 4GHz is chosen as a proxy for this range. A range of bands from 6 425-7 125 MHz identified for WRC-23 are currently being considered and around 7GHz is chosen as a proxy for this range. A range of bands from 24.25 GHz – 52.6 GHz identified for WRC-19 are currently being considered and around 30 GHz is chosen as a proxy for this range.

NOTE2: The aggregated system bandwidth is the total bandwidth typically assumed to derive the values for some KPIs such as area traffic capacity and user experienced data rate. For UL User Experienced Data rate it is not allowed to simulate a smaller bandwidth than the aggregated system bandwidth and transform the results to a larger bandwidth.

NOTE2: The aggregated system bandwidth is the total bandwidth typically assumed to derive the values for some KPIs such as area traffic capacity and user experienced data rate. It is not allowed to simulate a smaller bandwidth than the aggregated system bandwidth and transform the results to a larger bandwidth. The transformation method should then be described, including the modelling of power limitations.

NOTE3: Aggregated system bandwidth assumes availability of three FDD carriers each of 10/20 MHz channel bandwidth in different spectrum band in the Around 700 MHz/Around 2 GHz spectrum regions, respectively. Aggregation of the spectrum into one band in each of the bandwidth regions is allowed for simulation purposes.

NOTE3: The maximum number of antenna elements is a working assumption. 3GPP needs to strive to meet the target with typical antenna configurations.

NOTE4: This value is the baseline and other number of micro TRxPs per macro TRxP (e.g., 6 or 10) is not precluded.NOTE4: 10 users per TRxP is the baseline with full buffer traffic. 20 users per TRxP with full buffer traffic is not precluded. 10 users per TRxP is the baseline with full buffer traffic. 20 users per TRxP with full buffer traffic is not precluded. For evaluation of UL user experienced data rate the number of users per TRxP can be reduced to 2.

NOTE1: It is allowed to simulate a smaller bandwidth than the system bandwidth and transform the results to a larger bandwidth. The transformation method should then be described, including the modelling of power limitations.

NOTE2: "DL + UL" refers to either of the following two cases:

1. FDD with symmetric bandwidth allocations between DL and UL.

2. TDD with the system bandwidth used for either DL or UL via switching in time-domain.

NOTE3: The maximum number of antenna elements is a working assumption. 3GPP needs to strive to meet the target with typical antenna configurations. The specific typical antenna configurations may be different for different device types and need further study.

NOTE4: [10] users per TRxP is the baseline, other number of users per TRxP (e.g., 30) is not precluded.

NOTE5: Sensing target number per TRxP depends on the use cases and sensing target type, [5] sensing targets per TRxP are the baseline, other number of sensing targets per TRxP (e.g., 10 or others) is not precluded.

NOTE7: For non-full-buffer traffic with QoS requirement, use XR traffic models in TR 38.838 for XR composite requirement evaluation, use FTP-3 with packet delay budget requirement for energy efficiency evaluation, and use AI/ML traffic models for AI/ML related capability evaluation.

## 4.5 Sub-Urban macro

The suburban deployment scenario focuses on providing large cells and continuous coverage; there is no requirement that the continuous coverage is provided on all bands of a multi-band BS. The key characteristics of this scenario are continuous and ubiquitous wide area coverage supporting pedestrian and moderate speed vehicles, energy saving, positioning performance. This scenario will be noise-limited and/or interference-limited, using macro TRxPs.

**The suburban deployment scenario focuses on large cells and continuous coverage. The key characteristics of this scenario are continuous and ubiquitous wide area coverage supporting moderate speed vehicles. This scenario will be noise-limited and/or interference-limited, using macro TRxPs.**

Therefore this scenario deployment can be considered for 6G as well and the values or assumptions are described as Table 4.5.

Table 4.5: Attributes for Sub-Urban macro scenario

|  |  |
| --- | --- |
| Attributes | Values or assumptions |
| Carrier Frequency | Around 700 MHz  Around 2 GHz  Around 4 GHz  Around 7 GHz  Around 15 GHz  Around 700 MHz + Around 7 GHz  Around 7 GHz + Around 4 GHz  Around 2 GHz + Around 7 GHz + Around 30 GHz  Around 2 GHz + Around 700 MHz  Around 7GHz + Around 4 GHz + Around 2 GHz + Around 700 MHz |
| Aggregated system bandwidth  (see NOTE A) | Around 700 MHz: Up to 60 MHz (DL+UL)  Around 2 GHz: Up to 200 MHz (DL+UL)  Around 4 GHz: Up to 300 MHz (DL+UL)  Around 7 GHz: Up to 400 MHz (DL+UL)  Around 15 GHz: Up to 400 MHz (DL+UL)  Around 30 GHz: Up to 1 GHz (DL+UL) |
| Layout | Single layer   * Hex. Grid   [Around 7GHz +Around 4GHz + Around 2GHz+Around 700MHz ([single layer or two layers])]:TBD  NOTE: co-located layout is assumed for Around 4GHz+Around 7GHz  Note: Co-site & single-layer deployment for Around 4GHz+Around 7GHz and Around 2GHz+ Around 700 MHz is considered.  Two layers for Around 7GHz +Around 4GHz + Around 2GHz+Around 700MHz:  - Macro layer: Hex. Grid, 4GHz + 2GHz + 700MHz (FFS joint or separate BS scheduler for different frequencies)  - Micro layer: Random drop, 7GHz |
| ISD | ISD Profile 1: 850m  ISD Profile 2: 1732m |
| TRP antenna elements NOTE3 | Around 700 MHz: Up to 64 Tx and Rx antenna elements  Around 2 GHz: Up to 288 Tx and Rx antenna elements  Around 4 GHz: Up to [?] Tx and Rx antenna elements  Around 7 GHz: Up to [?]Tx and Rx antenna elements  Around 15 GHz: Up to [?]Tx and Rx antenna elements  Around 30 GHz: Up to [?]Tx and Rx antenna elements  Around 700 MHz: 4T4R antenna  Around 700 MHz: Up to 32 32 Tx and Rx antenna elements  Around 2 GHz: 4T4R (for all 4 bands) or 32T32R with up to 128 128 288 active antenna elements (for only the “around 700 MHz and around 2 GHz” scenario)  Around 4 GHz: 32T32R with up to 192 288 active antenna elements  Around 7 GHz: Up to 256T256R with up to 1024 active antenna elements  Around 700 MHz and around 2 GHz: Up to 64 64 Tx and Rx antenna elements  Around 4 GHz: Up to 256 512 512 Tx and Rx antenna elements  Around 7 GHz and around 15 GHz: Up to 1024 1152 2048 2048 Tx and Rx antenna elements  Around 30GHz: Up to 1152 Tx and Rx antenna elements |
| UE antenna elements NOTE3 | Around 700 MHz: 1T2R  Around 2 GHz: 2T4R antenna  Around 4 GHz: 2T4R antenna  Around 7 GHz: Up to 4T8R antenna  Around 2 GHz, around 4 GHz and around 7 GHz: Up to 8 Tx and Rx antenna elements Note  Note: Possible device types include handheld device, CPE, vehicle, sensing dedicated device etc. Configurations of antenna element more than 2Tx and 4Rx are not necessarily applicable to smart phone.  Around 700 MHz: Up to 4 4 Tx and Rx antenna elements  Around 700 MHz and around 2 GHz: Up to 4 Tx and Rx antenna elements  Around 4 GHz: Up to 8 Tx and Rx antenna elements  Around 4 GHz: Up to 8 Tx and Rx antenna elements  Around 4 GHz: Up to 8 Tx and Rx antenna elements  Around 7GHz: Up to 16 Tx and Rx antenna elements  Around 7 GHz and around 15 GHz: Up to [8] Tx and Rx antenna elements  Around 30 GHz: Up to 32 Tx and Rx antenna elements  Around 30 GHz: Up to 32 Tx and Rx antenna elements |
| FWA: 4Tx and 8 Rx (Around 2GHz / 4GHz / 7GHz)  eMBB UE “handheld” device (used in eMBB)  • Around 700 MHz: 1 Tx and 2 Rx antenna elements (ITU up to 4Tx/Rx)  • Around 2 GHz: Up to 2 Tx and 4 Rx antenna elements  • Around 4 GHz: Up to 4 Tx and 4 Rx antenna elements  • Around 7 GHz: Up to 4 Tx and 8 Rx antenna elements  • Around 30 GHz: Up to 8 Tx and 8 Rx antenna elements  FWA CPE device (used in FWA):  • Around 700 MHz: Up to 2 Tx and 4 Rx antenna elements  • Around 2 GHz: Up to 2 Tx and 4 Rx antenna elements  • Around 4 GHz: Up to 8 Tx and 8 Rx antenna elements  • Around 7 GHz: Up to 8 Tx and 8 Rx antenna elements  • Around 30 GHz: Up to 32 Tx and 32 Rx antenna elements |
| Multi-TRP operation | Around 700MHz, 4GHz and 7GHz: single TRP, or coherent joint transmission multi-TRP  Around 30GHz: single TRP, or non-coherent joint transmission multi-TRP  Note: TRP(s) can be all DL+UL TRP, or randomly selected from {DL+UL TRP, UL-only TRP}. |
| User distribution and UE speed  Service deployment and speed options  (NOTE: each service is set to be evaluated individually. However, evaluation of combination of services is not precluded) | eMBB:  10% Outdoor pedestrian: 3km/h,  10% Outdoor in cars: 30 km/h, 40km/h 40 km/h, 60km/h  100% of outdoor users in car  80% Indoor: 3km/h  90% of indoor users in residential building, 10% in commercial buildings  20% Outdoor in cars: 30km/h,  80% Indoor in houses: 3km/h  10/2 users per TRxP NOTE4 NOTE4 |
| FWA (around 2GHz / 4GHz / 7GHz): 100% indoor (0.3km/h), or 100% outdoor (0.3km/h), or [TBD % outdoor (0.3km/h and TBD % indoor (0.3km/h)  FWA:  Profile 1 (Indoor mounted CPE)  • Behind wall or window  • 100% Indoor: 0 km/h,  Profile 2 (Exterior mounted CPE)  • Exterior wall mounted or rooftop  • 100% Outdoor: 0 km/h, |
| Service profile | NOTE: Whether to use full buffer traffic or non-full-buffer traffic with/without QoS requirement depends on the evaluation methodology adopted for each KPI NOTE6. For certain KPIs, full buffer traffic is desirable to enable comparison with IMT-2020 values. |
| Sensing target distribution and Sensing target speed | Option 1: TBD  Option 2: To be discussed in working group. |
| NOTE A: The aggregated system bandwidth for each frequency range is for evaluation purposes only. This does not preclude the aggregation of more bandwidth within those ranges by the 6GR system. | |

NOTE1: The options noted here are for evaluation purpose, and do not mandate the deployment of these options or preclude the study of other spectrum options. A range of bands from 1427 – 2690MHz identified for WRC-15 are currently being considered and around 2GHz is chosen as a proxy for this range. A range of bands from 3300 – 4990MHz identified for WRC-15 are currently being considered and around 4GHz is chosen as a proxy for this range. A range of ...

NOTE2: The aggregated system bandwidth is the total bandwidth typically assumed to derive the values for some KPIs such as area traffic capacity and user experienced data rate. For UL User Experienced Data rate it is not allowed to simulate a smaller bandwidth than the aggregated system bandwidth and transform the results to a larger bandwidth.

NOTE3: Aggregated system bandwidth assumes availability of three FDD carriers each of 10/20 MHz channel bandwidth in different spectrum band in the Around 700 MHz/Around 2 GHz spectrum regions, respectively. Aggregation of the spectrum into one band in each of the bandwidth regions is allowed for simulation purposes.

NOTE4: 10 users per TRxP is the baseline with full buffer traffic. 20 users per TRxP with full buffer traffic is not precluded. For evaluation of UL user experienced data rate the number of users per TRxP can be reduced to 2.

NOTE1: It is allowed to simulate a smaller bandwidth than the system bandwidth and transform the results to a larger bandwidth. The transformation method should then be described, including the modelling of power limitations.

NOTE2: "DL + UL" refers to either of the following two cases:

1. FDD with symmetric bandwidth allocations between DL and UL.

2. TDD with the system bandwidth used for either DL or UL via switching in time-domain.

NOTE3: The maximum number of antenna elements is a working assumption. 3GPP needs to strive to meet the target with typical antenna configurations. The specific typical antenna configurations may be different for different device types and need further study.

NOTE4: [10] users per TRxP is the baseline, other number of users per TRxP (e.g., 30) is not precluded.

NOTE5: Sensing target number per TRxP depends on the use cases and sensing target type, [5] sensing targets per TRxP are the baseline, other number of sensing targets per TRxP (e.g., 10 or others) is not precluded.

NOTE6: For non-full-buffer traffic with QoS requirement, use XR traffic models in TR 38.838 for XR composite requirement evaluation, use FTP-3 with packet delay budget requirement for energy efficiency evaluation, and use AI/ML traffic models for AI/ML related capability evaluation.

## 4.6 High speed

*Editor note: Highway scenario will be considered and whether highway scenario is merged to section 4.6 can be further discussed*

*Editor note: airborne will not be captured in section 4.6.*

The high speed deployment scenario focuses on continuous coverage along track in high speed trains. The key characteristics of this scenario are consistent passenger user experience and critical train communication reliability with very high mobility. In this deployment scenario, dedicated linear deployment along railway line and the deployments including SFN scenarios captured in Section 6.2 of 3GPP TR 36.878 [4] are considered, and passenger UEs are located in train carriages.

Figure 1 illustrates a typical layout of high speed deployment scenario. In this deployment scenario, multiple RRHs connect to one BBU with fiber and share the same cell ID. For each RRH, usually there are two TRPs which orient opposite directions along the track, and 8 RRHs are connected to one BBU with fiber and share the same cell ID to form one large macro cell.

图片包含 徽标

AI 生成的内容可能不正确。

Figure 1. Layout illustration of high speed deployment scenario

Some of its attributes are listed in Table 2.5.

**Table 2.5: High Speed**

|  |  |
| --- | --- |
| **Attributes** | **Values or assumptions** |
| Carrier Frequency NOTE1 | Macro NOTE2 only: Around 4 4 GHz or Around 7 7 GHz  Macro only: Around 4GHz or Around 7GHz  Macro relay nodes:  1) For BS to relay: Around 4 GHz or Around 7GHz  - For relay to UE: Around 30 GHz or Around 7GHz or Around 4 GHz  2) For BS to relay: Around 30 GHz  - For relay to UE: Around 30 GHz or Around 7GHz or Around 4 GHz |
| Aggregated system bandwidth NOTE3 | Around 4 GHz: Up to [200] MHz (DL+UL)  Around 7 GHz: Up to [400] MHz (DL+UL)  Around 4GHz: Up to 200 MHz (DL+UL)  Around 7GHz: Up to 400 MHz (DL+UL)  Around 4 GHz: Up to [200] MHz (DL+UL)  Around 7GHz: Up to [400] MHz (DL+UL)  Around 30GHz or Around 70GHz: Up to 1GHz (DL+UL) |
| Layout | Macro only:   * Around 4 GHz or 7 GHz: Dedicated linear deployment along the railway line as in Figure 1. * RRH site to railway track distance: 100m   Macro only:  - Around 4GHz or Around 7GHz: Dedicated linear deployment along the railway line as following.  RRH site to railway track distance: 100m  Macro + relay nodes:  - Around 4GHz or Around 7GHz: Dedicated linear deployment along the railway line as following.  RRH site to railway track distance: 100m  Ein Bild, das Diagramm, Reihe, Screenshot, Text enthält.  KI-generierte Inhalte können fehlerhaft sein.  - Around 30GHz: Dedicated linear deployment along the railway line as in following.  RRH site to railway track distance: 5m.  Single layer:  - Linear Grid along railway line |
| ISD | * Around 4 GHz or Around 7 GHz: ISD 500m or 1732 1732 m between RRH sites, two TRxPs per RRH site. See Figure 1.   - Around 30GHz: 1732m between BBU sites, 3 RRH sites connected to 1 BBU, one TRxP per RRH site, inter RRH site distance (580m, 580m, 572m).  - Small cell within carriages: ISD = 25m. |
| BS antenna elements NOTE4 | Around 4 GHz: Up to 256 288 512 Tx and Rx antenna elements  Around 7 GHz: Up to 1152 2048 2048 Tx and Rx antenna elements  Around 30GHz: Up to 2048 Tx and Rx antenna elements  *Note: The numbers N= 288 and 1152 allows evenly division of the antenna elements into subarrays of size 1x2,1x3,1x4,1x6,1x8,1x9,1x12,..* |
| UE antenna elements NOTE4 | Relay Tx: Up to 256 antenna elements  Relay Rx: Up to 256 antenna elements  eMBB-HRLLC UE “handheld” device   * Around 4 GHz: Up to 4 8 8 Tx and 4 Rx antenna elements * Around 7 GHz: Up to 4 8 8 Tx and 8 Rx antenna elements   Optional:  eMBB-HRLLC UE “non-handheld” device   * Around 4 GHz: Up to 4 Tx and 8 Rx antenna elements * Around 7 GHz: Up to 4 Tx and 8 Rx antenna elements   Around 30GHz: Up to 32 Tx and Rx antenna elements |
| Multi-TRP operation | Around 4GHz and 7GHz: single TRP, or coherent joint transmission multi-TRP  Around 30GHz: single TRP, or non-coherent joint transmission multi-TRP  Note: TRP(s) can be all DL+UL TRP, or randomly selected from {DL+UL TRP, UL-only TRP}. |
| User distribution and UE speed  Service deployment and speed options  (NOTE: each service is set to be evaluated individually. However, evaluation of combination of services is not precluded) | eMBB with high reliability:  • 100% Outdoor in train: Up to 500 km/h  100% of users in train  For non-full buffer, 300 UEs per macro cell (assuming 1000 passengers per high-speed train and at least 10% activity ratio)  Maximum mobility speed: 500km/h  100% of users in train  For non-full buffer, 300 UEs per macro cell (assuming 1000 passengers per high-speed train and at least 10% activity ratio)  Maximum mobility speed: 500km/h |
| Service profile | Alt 1: Full buffer  Alt 2: FTP model 1/2/3 with packet size 0.5 Mbytes, 0.1 Mbytes (other value is not precluded)  Other traffic models are not precluded, e.g., for critical train communications.  Alt 1: Full buffer  Alt 2: FTP model 1/2/3 with packet size 0.5 Mbytes, 0.1 Mbytes (other value is not precluded)  Other traffic models are not precluded, e.g., for critical train communications.  NOTE: Whether to use full buffer traffic or non-full-buffer traffic depends on the evaluation methodology adopted for each KPI. |

NOTE1: The options noted here are for evaluation purpose, and do not mandate the deployment of these options or preclude the study of other spectrum options. A range of bands from 3300 – 4990MHz identified for WRC-15 are currently being considered and around 4GHz is chosen as a proxy for this range. A range of bands from 6 425-7 125 MHz identified for WRC-23 are currently being considered and around 7GHz is chosen as a proxy for this range.

NOTE2: For Macro, it is assumed RRH sharing the same cell ID or having different cell ID.

NOTE3: The aggregated system bandwidth is the total bandwidth typically assumed to derive the values for some KPIs such as area traffic capacity and user experienced data rate. It is not allowed to simulate a smaller bandwidth than the aggregated system bandwidth and transform the results to a larger bandwidth. The transformation method should then be described, including the modelling of power limitations.

NOTE4: The maximum number of antenna elements is a working assumption. 3GPP needs to strive to meet the target with typical antenna configurations.

## 4.7 Extreme long distance coverage in low density area

The extreme Long Range deployment scenario is defined to allow for the provision of services for very large areas with low density of users whether they are humans and machines (e.g. wilderness, river or water, remote village or island areas, etc). The key characteristics of this scenario are Macro cells with very large area coverage supporting [at least] basic data speeds and voice services, with low to moderate user throughput and low user density.

**Table 4.7: Attributes for extreme rural**

|  |  |
| --- | --- |
| Attributes | Values or assumptions |
| Carrier Frequency | Around 700 MHz  Around 7GHz  Around 30GHz |
| System Bandwidth | [20] 40 MHz (DL+UL) up to 50MHz |
| Layout | Single layer:  Isolated Macro cells |
| Cell range | 50 KM  10km range (Isolated cell) for sensing  100 km range (Isolated cell) to be evaluated through system level simulations for communication.  Feasibility of Higher Range shall be evaluated through Link level evaluation (for example in some scenarios ranges up to 150-300km may be required). |
| User density and UE speed | User density: TBD  Speed up to 160 km/h |
| Traffic model | Average data throughput at busy hours/user: 30 kbps  User experienced data rate: up to 2 Mbps DL while stationary and 384 kbps DL while moving. |

## 4.8 Urban coverage for massive connection

*Editor note: focusing on MTC*

The urban coverage for massive connection scenario focuses on large cells and continuous coverage to provide mMTC. The key characteristics of this scenario are continuous and ubiquitous coverage in urban areas, with very high connection density of mMTC devices. This deployment scenario is for the evaluation of the KPI of connection density.

The urban coverage for massive connection scenario focuses on large cells and continuous coverage to provide mMTC. The key characteristics of this scenario are continuous and ubiquitous coverage in urban areas, with very high connection density of mMTC devices. This deployment scenario is for the evaluation of the KPI of connection density.

The urban coverage for massive connection scenario focuses on large cells and continuous coverage to provide massive MTC. The key characteristics of this scenario are continuous and ubiquitous coverage in urban areas, with very high connection density of massive MTC devices. This deployment scenario is for the evaluation of the KPI of connection density.

Some of its attributes are listed in Table 6.1.7-1.

**Table 6.1.7-1: Attributes of urban coverage for massive connection**

|  |  |
| --- | --- |
| **Attributes** | **Values or assumptions** |
| Carrier Frequency | 700MHz, 2100 MHz as an option  Around 2GHz+Around 700MHz |
| Network deployment including ISD | Macro only, ISD = 1732m, 500m 500m  One layers for Around 2GHz+Around 700MHz:  - Macro layer: Hex. Grid, 2GHz + 700MHz (FFS joint or separate BS scheduler for different frequencies) |
| Device deployment | Indoor, and outdoor in-car devices |
| Maximum mobility speed | 20% of users are outdoor in cars (100km/h) or 20% of users are outdoors (3km/h)  80% of users are indoor (3km/h)  Users dropped uniformly in entire cell |
| Service profile | Non-full buffer with small packets |
| BS antenna elements | 2 and 4 Rx ports (8 Rx ports as optional)  4 and 8 Rx ports (16/32 Rx ports as optional) |
| UE antenna elements | 1Tx  [?Rx] |

|  |  |
| --- | --- |
| **Attributes** | **Values or assumptions** |
| Carrier Frequency | 700 MHz, 2 GHz as an option |
| Network deployment including ISD | Macro only, ISD = 1732m, 500m |
| Device deployment | Indoor, and outdoor in-car devices |
| Maximum mobility speed | 20% of users are outdoor in cars (100km/h) or 20% of users are outdoors (3km/h)  80% of users are indoor (3km/h)  Users dropped uniformly in entire cell |
| Service profile | Non-full buffer with small packets |
| BS antenna elements | 2 and 4 Rx ports (8 Rx ports as optional) |
| UE antenna elements | 1Tx |

## 4.9 Air-to-Ground Scenario

The commercial Air to Ground deployment scenario is defined to allow for the provision of services for commercial aircraft to enable both humans and machines aboard the aircraft to initiate and receive mobile services. It is not for the establishment of airborne based base stations.

The key characteristics of this scenario are upward pointed Macro cells with very large area coverage supporting basic data and voice services, with moderate user throughput that are optimized for high altitude users that are travelling at very high speeds. The commercial airlines aircrafts are likely equipped with an aggregation point (e.g. Relay).

Some of the characteristics of this deployment scenario are listed in Table 4.9.

Table 4.9: Attributes for commercial Air to Ground Scenario

|  |  |
| --- | --- |
| Attributes | Values or assumptions |
| Carrier Frequency | Macro + relay: for BS to relay: 4 GHz, 7 GHz  Below 7 GHz |
| System Bandwidth | Around 4 GHz: Up to 200 MHz (DL+UL)  Around 7 GHz: Up to 400 MHz (DL+UL)  Up to 100 MHz (DL+UL) |
| Layout | Macro + relay nodes NOTE1  Single layer:  - Hex. Grid |
| Cell range | Macro cell: 100 100 km range to be evaluated through system level simulations. Feasibility of Higher Range shall be evaluated through Link level evaluation.  Relay: up to 80 m  Macro cell: 100 km range to be evaluated through system level simulations. Feasibility of Higher Range shall be evaluated through Link level evaluation.  Relay: up to 80 m |
| BS antenna elements | Around 700 MHz: Up to 64 Tx and Rx antenna elements  Around 2 GHz: Up to 288 Tx and Rx antenna elements  Around 4 GHz: Up to 288 Tx and Rx antenna elements  Around 7 GHz: Up to 1152 Tx and Rx antenna elements |
| UE antenna elements | Belly mounted relay antenna |
| Service deployment and speed options | eMBB with high reliability:   * 100% Outdoor in aircraft: Up to 1000 km/h * Altitude up to 15 km |
| User density and UE speed | End user density per Macro: NOTE2  UE speed: Up to 1200 km/h  Altitude: Up to 15 km  End user density per Macro:  UE speed: Up to 1000 km/h  Altitude: Up to 15 km |
| Traffic model | End User experienced data rate: 384 kbps DL. NOTE3  End User experienced data rate: 10Mbps |
| Service profile | NOTE: Whether to use full buffer traffic or non-full-buffer traffic depends on the evaluation methodology adopted for each KPI. |

NOTE1: BS to relay link should be the priority for study compared to relay to UE link.

NOTE2: Evaluate how many users can be served per cell site when the range edge users are serviced with the target user experience data rate.

NOTE3: Target values for UL are lower than DL, 1/3 of DL is desirable.

## 4.10 Non-Terrestrial Network

*Editor note: orbit type and payload type will be captured in section 4.10*



































\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Just for RAN#109 moderation by Axel:

Section above replaced with this joint TP based on the submissions and above section

These deployment scenarios are defined to allow for the provision of services for those areas including vertical space (e.g., up to several kilometers altitude) where terrestrial network service is not available (on a permanent or temporary basis), and also for those services that can be more efficiently supported by Non-Terrestrial Networks.

Non-Terrestrial Networks can overcome coverage limitations of terrestrial networks especially in low-density populated areas and maritime areas.

As such, NTN will mainly contribute to:

* Achieve ubiquitous connectivity and availability of services in remote and sparsely populated areas.
* Improve overall 6G network resiliency, especially in situations where disasters disrupt terrestrial networks or damage undersea communication cables by supporting in priority critical communications and emergency communications (messaging, voice calls).

Non Terrestrial Networks may support messaging, enhanced Mobile BroadBand (eMBB), voice, video, positioning, delay tolerant, machine type communications and other data services. It may also support enablers for Navigation (UE in connected mode) and Timing services.

The attributes of the NTN deployment scenarios are listed in Table 4.10

Table 4.10: Attributes for Non-Terrestrial Network Deployment Scenarios

|  |  |
| --- | --- |
| Attributes | Values or assumptions |
| Carrier Frequency | Around 1.5 GHz  Around 2 GHz  Around 4 GHz  Around 11/13 GHz  Around 20/30 GHz  Around 40/50 GHz |
| Aggregated system Bandwidth | Up to [60] MHz (DL+UL): Around 1.5 GHz and Around 2 GHz  Up to [100] MHz (DL+UL): Around 4 GHz  Up to [200] MHz (DL+UL): Around 11/13 GHz  Up to [800] MHz (DL+UL): Around 20/30 GHz  Up to [1600] MHz (DL+UL): Around 40/50 GHz |
| Orbit types (Note 1) | Any orbit from VLEO (300 to 600 km altitude) to GSO (~35 786 km altitude), including LEO (600 to 2000 km altitude) and MEO (2000 to ~35000 km altitude), |
| Duplex mode | In paired bands (Satellite service allocated bands) and all orbits: FDD (Frequency Division Duplexing) or Half Duplex Frequency Division Duplexing (HD-FDD) mode  In unpaired bands (Satellite service allocated bands) with Max RTD < [TBD] ms (e.g. VLEO/LEO only): TDD (Time Division Duplexing) mode (Note 4) |
| Architecture (Note: 2) | Transparent payload: BS on ground (at feeder gateway)  Regenerative payload: [architectural impact TBD] |
| Satellite access node’s antenna characteristics | Antenna array of MxN elements [details FFS] |
| Radio Cell type (Note: 3) | Earth fixed (GSO), Quasi Earth fixed (NGSO) or Earth moving (NGSO) |
| User distribution | Below 7.125 GHz:   * Case 1 conditions: 100% Outdoor * Case 2 conditions: [TBD%] Outdoor and [TBD%] in adverse propagation conditions (e.g. light indoor, in vehicle)   Above 10.7 GHz: Outdoor only: [100%] Outdoor |
| Note 1: The orbit types can be characterised with a set of parameters (e.g. Maximum Round Trip Delay (ms), Maximum Doppler shift (Hz), Max Differential delay (ms), Max Differential Doppler (Hz), Max Doppler rate (Hz/s), Max delay variation (s-2), Channel model type in TR 38.811).  Note 2: A transparent payload forward transparently the 3GPP radio protocol between the feeder and the service link and vice e versa.  Note 3: A radio cell is able to serve UEs on the earth surface as well as in the space above. It may be realised with one or several beams generated by satellites. Only part of the beams generated by a given satellite may be active.  Note 4: TDD mode design should consider at least for band around 1.5 GHz. | |

Several types of User Equipment may be served by Non Terrestrial Networks: handheld, automotive and IoT devices as well as moving platforms/building mounted terminals or Small size antenna Aperture Terminal (e.g. antenna size smaller than 20 x 20 cm). Moving platforms can refer to such as trains, ships, airplanes, drones.

Editor’s note: Whether and how NTN capable UE types are going to be defined is FFS, see clause 5.3.2.

Note:

* NTN may provide coverage in areas where TN also provides services (overlapping coverage) assuming different carrier frequencies, or where TN does not provide services on a permanent or temporary basis (non-overlapping coverage).
* NTN may be based on a combination of orbit types (e.g. GSO and LEO).

## 4.11 Urban grid

The urban macro deployment scenario focuses on scenario of highly densely deployed vehicles placed in urban area. It could cover a scenario where freeways lead through an urban grid. The main KPI evaluated under this scenario can be consistence UE experience, sensing-related performance and AI-related performance / are reliability/availability/latency/sensing are continuous and ubiquitous coverage, energy saving, positioning performance and sensing-related performance in high network load and high UE density scenarios.

The urban grid deployment scenario where buildings and vehicles are placed in the urban area and vehicles are moving. It could cover a scenario where freeways cutting through an urban grid/area. The main KPI to evaluate under this scenario can be consistence UE experience, sensing-related performance and AI-related performance.

The urban macro deployment scenario focuses on scenario of highly densely deployed vehicles placed in urban area. It could cover a scenario where freeways lead through an urban grid. The main KPI evaluated under this scenario are continuous and ubiquitous coverage, energy saving, positioning performance and sensing-related performance in high network load and high UE density scenarios.

Some of its attributes are listed in Table 4.x.

Some of its attributes are listed in Table 4.11.

Table x: Attributes for Urban grid

|  |  |
| --- | --- |
| Attributes | Values or assumptions |
| Carrier Frequency  NOTE1 | Around 4 4 4 GHz for macro and micro  Around 7 7 GHz |
| Aggregated system bandwidth  NOTE2 | Around 4 GHz: Up to [200 200 200] MHz (DL+UL)  Around 7 GHz: Up to [400 400]MHz (DL+UL)  NOTE1,2 |
| Layout | Single layer:  - Hex. Grid  Baseline: Macro only (with the road configuration in Figure 6.1.9-1 in [1] and BS placement as depicted in Figure A.1.3-1 in [2]) |
| ISD | ISD 1: 500 500 500 m  ISD 2: 250 250 m |
| BS height | Macro BS: antenna height 25m 25m  Micro BS: antenna height 5m |
| Building size | 413m x 230m x 20m |
| BS antenna elements | Up to [2048 2048] Tx and Rx antenna elements for 7GHz  Up to [512 512] for Tx and Rx antenna elements 4GHz |
| UE antenna elements | Around 4GHz:  Tx: Up to [8] Tx  Rx: Up to [8] Rx  Around 7GHz:  Tx: Up to [16] Tx  Rx: Up to [16] Rx  Up to 8 Tx and Rx antenna elements Note  Note: Possible device types include handheld device, CPE, vehicle, sensing dedicated device etc. Configurations of antenna element more than 2Tx and 4Rx are not necessarily applicable to smart phone.  - Type 1 vehicle (passenger vehicle with lower antenna position): length 5 meters, width 2.0 meters, height 1.6 meters, antenna height 0.75 meters  - Type 2 vehicle (passenger vehicle with higher antenna position): length 5 meters, width 2.0 meters, height 1.6 meters, antenna height 1.6 meters  - Type 3 vehicle (truck/bus): length 13 meters, width 2.6 meters, height 3 meters, antenna height 3 meters |
| User distribution and UE speed | Urban grid model (car lanes and pedestrian/bicycle sidewalks are placed around a road block. 2 lanes (3.5m) in each direction, 4 lanes in total, 1 sidewalk (3m), one block size: 433m x 250m)  100% outdoor  Vehicular UE in the lanes with up to 120km/h  Pedestrian UE in the sidewalks with 3km/h  UE changes its direction at the intersection as follows:  - Go straight with probability 0.5  - Turn left with probability 0.25  - Turn right with probability 0.25  - Pedestrian UE dropping using equal space along the sidewalk with a fixed inter-pedestrian X m dropped   Total number of pedestrian UEs is 500   Pedestrian UE is in the middle of the sidewalk   The inter-pedestrian UE distance (m) (i.e., X) is calculated by ‘A/500’, where ‘A’ is the total length of sidewalk where the pedestrian UEs are dropped under the assumption of ‘N’ road grids (i.e., ‘{(250m – 17m) + (433m – 17m)} \* 2 \* N’). For example, if the pedestrian UEs are dropped in ‘14’ road grids, the inter-pedestrian UE distance (m) is ‘36.344’.   Companies should explain how many road grids (i.e., ‘N”) are assumed in the evaluation.  - Pedestrian UE speed is 3 km/h  - The distance between the rear bumper of a vehicle and the front bumper of the following vehicle in the same lane is max {2 meter, an exponential random variable with the average of the speed \* 2 sec}.  - All the vehicles in the same lane have the same speed.  - Vehicle type distribution is not dependent of the lane.  - Vehicle speed for the urban grid scenario in [3] |
| Service profile | NOTE: Whether to use full buffer traffic or non-full-buffer traffic depends on the evaluation methodology adopted for each KPI. |
| Sensing target  distribution and Sensing target speed | Option 1: TBD  Option 2: To be discussed in working group.  Vehicle is up to 120km/h.  how many sensing targets from vehicle distribution per TR 37.885 depend on the evaluation methodology. |
| Environment Objects when sensing enabled | At least including 4 walls modelled per building of size 413m x 230m x 20m and/or other sizes, e.g. 40m x 20m x 30m. How many buildings and building types depends on the evaluation methodology. |

NOTE1: It is allowed to simulate a smaller bandwidth than the system bandwidth and transform the results to a larger bandwidth. The transformation method should then be described, including the modelling of power limitations.

NOTE2: "DL + UL" refers to either of the following two cases:

1. FDD with symmetric bandwidth allocations between DL and UL.

2. TDD with the system bandwidth used for either DL or UL via switching in time-domain.

NOTE3: The maximum number of antenna elements is a working assumption. 3GPP needs to strive to meet the target with typical antenna configurations. The specific typical antenna configurations may be different for different device types and need further study.

NOTE4: The vehicle type is type 1/2 (passenger vehicle) and/or type 3 (truck/bus)

Table 4.11 Attributes for Urban Grid scenario

|  |  |
| --- | --- |
| Attributes | Values or assumptions |
| Carrier Frequency | Around 4GHz, Around 7GHz |
| System bandwidth | Around 4GHz: 200MHz, Around 7GHz: 400MHz NOTE1,2 |
| Layout | Single layer with hexagon cell |
| ISD | 500m  250m |
| BS antenna elements | Around 4GHz:  Tx: Up to [512] Tx  Rx: Up to [512] Rx  Around 7GHz:  Tx: Up to [2048] Tx  Rx: Up to [2048] Rx |
| UE antenna elements | Around 4GHz:  Tx: Up to [8] Tx  Rx: Up to [8] Rx  Around 7GHz:  Tx: Up to [16] Tx  Rx: Up to [16] Rx |
| User distribution and UE speed | * Pedestrian UE dropping using equal space along the sidewalk with a fixed inter-pedestrian X m dropped   + Total number of pedestrian UEs is 500   + Pedestrian UE is in the middle of the sidewalk   + The inter-pedestrian UE distance (m) (i.e., X) is calculated by ‘A/500’, where ‘A’ is the total length of sidewalk where the pedestrian UEs are dropped under the assumption of ‘N’ road grids (i.e., ‘{(250m – 17m) + (433m – 17m)} \* 2 \* N’). For example, if the pedestrian UEs are dropped in ‘14’ road grids, the inter-pedestrian UE distance (m) is ‘36.344’.     - Companies should explain how many road grids (i.e., ‘N”) are assumed in the evaluation. * Pedestrian UE speed is 3 km/h |
| Sensing target distribution and Sensing target speed | Vehicle is up to 120km/h.  how many sensing targets from vehicle distribution per TR 37.885 depend on the evaluation methodology. |
| Environment Objects when sensing enabled | At least including 4 walls modelled per building of size 413m x 230m x 20m and/or other sizes, e.g. 40m x 20m x 30m. How many buildings and building types depends on the evaluation methodology. |
| Service profile | NOTE: Whether to use full buffer traffic or non-full-buffer traffic depends on the evaluation methodology adopted for each KPI. |

NOTE1: It is allowed to simulate a smaller bandwidth than the system bandwidth and transform the results to a larger bandwidth. The transformation method should then be described, including the modelling of power limitations.

NOTE2: "DL + UL" refers to either of the following two cases:

1. FDD with symmetric bandwidth allocations between DL and UL.

2. TDD with the system bandwidth used for either DL or UL via switching in time-domain.

NOTE3: The maximum number of antenna elements is a working assumption. 3GPP needs to strive to meet the target with typical antenna configurations. The specific typical antenna configurations may be different for different device types and need further study.

NOTE4: The vehicle type is type 1/2 (passenger vehicle) and/or type 3 (truck/bus)

**Table 1: Attributes for Urban grid**

|  |  |
| --- | --- |
| **Attributes** | **Values or assumptions** |
| Carrier Frequency | Macro BS: 4GHz  Micro BS: 4GHz |
| Aggregated system bandwidth | 200MHz |
| Layout | Baseline: Macro only (with the road configuration in Figure 6.1.9-1 in [1] and BS placement as depicted in Figure A.1.3-1 in [2]) |
| ISD | Inter Macro: 500m |
| BS antenna elements | Macro BS: antenna height 25m  Micro BS: antenna height 5m |
| UE antenna elements | * Type 1 vehicle (passenger vehicle with lower antenna position): length 5 meters, width 2.0 meters, height 1.6 meters, antenna height 0.75 meters * Type 2 vehicle (passenger vehicle with higher antenna position): length 5 meters, width 2.0 meters, height 1.6 meters, antenna height 1.6 meters * Type 3 vehicle (truck/bus): length 13 meters, width 2.6 meters, height 3 meters, antenna height 3 meters |
| User distribution and UE speed | * The distance between the rear bumper of a vehicle and the front bumper of the following vehicle in the same lane is max {2 meter, an exponential random variable with the average of the speed \* 2 sec}. * All the vehicles in the same lane have the same speed. * Vehicle type distribution is not dependent of the lane. * Vehicle speed for the urban grid scenario in [3] |

4.11.x Urban grid for connected vehicles

The urban macro deployment scenario focuses on scenario of highly densely deployed vehicle UE moving in urban area. It could cover a scenario where freeways lead through an urban grid. The main KPI evaluated under this scenario are availability, reliability, latency and data rate in high network load and high UE density scenarios.

Some of its attributes are listed in Table 4.11-1.

Table 4.11-1: Attributes of urban grid for connected vehicles

|  |  |
| --- | --- |
| Attributes | Values or assumptions |
| Carrier Frequency NOTE1 | Around 700MHz  Around 2GHz  Around 4 GHz  Around 7 GHz  Around 4 GHz + Around 7 GHz  Around 2 GHz + Around 7 GHz]  [Around 7GHz +Around 4GHz + Around 2GHz+Around 700MHz] |
| Aggregated system bandwidth NOTE2 | Around 700 MHz: Up to [60] MHz (DL+UL)  Around 2GHz: Up to [120] MHz (DL+UL)  Around 4 GHz: Up to [200] MHz (DL+UL)  Around 7 GHz: Up to [400]MHz (DL+UL) |
| Layout | Option 1: Single layer:   * Uban Grid/Roof-top   Option 2: Two layers for Around 4 or 2 GHz + Around 7 GHz   * Macro layer: Hex. Grid, 4 or 2 GHz (Uban Grid/Roof-top) * Micro layer: drop at Intersections, 7 GHz |
| ISD | Macro cell : 200m  Micro layer: (at each intersection), values (50m and 100m) should also be considered for option 2 |
| BS configuration | TBD |
| UE configuration | Around 700 MHz: 1T2R  Around 2 GHz: 1T2R and 2T4R  Around 4 GHz: 1T2R and 2T4R  Around 7 GHz: 1T2R and 2T4R |
| User distribution and UE speed | Urban grid model (car lanes and pedestrian/bicycle sidewalks are placed around a road block. 2 lanes in each direction, 4 lanes in total, 1 sidewalk, one block size: 433m x 250m)  Average inter-vehicle distance (between two vehicles’ center) in the same lane is 1sec \* average vehicle speed (average speed 30, 60, 100km/h)  Pedestrian/bicycle dropping: average distance between UEs is 20m |
| Service profile | NOTE: Whether to use full buffer traffic or non-full-buffer traffic depends on the evaluation methodology adopted for each KPI. For certain KPIs, full buffer traffic is desirable to enable comparison with IMT2030 values. |

NOTE1: The options noted here are for evaluation purpose, and do not mandate the deployment of these options or preclude the study of other spectrum options.

[NOTE2: The aggregated system bandwidth is the total bandwidth typically assumed to derive the values for some KPIs such as area traffic capacity and user experienced data rate. It is allowed to simulate a smaller bandwidth than the aggregated system bandwidth and transform the results to a larger bandwidth. The transformation method should then be described, including the modelling of power limitations.]

Table 4.11-2: Details of vehicle UE drop and mobility model

|  |  |  |
| --- | --- | --- |
| Parameter | Urban grid case | Freeway case |
| Number of lanes | 2 in each direction (4 lanes in total in each street) | 3 in each direction (6 lanes in total in the freeway) |
| Lane width | 3.5 m | 4 m |
| Road grid size by the distance between intersections | 433 m \* 250 m. NOTE1 | N/A |
| Simulation area size | Minimum 1299 m \* 750 m | Freeway length >= 2000 m. Wrap around should be applied to the simulation area. |
| Vehicle density | Average inter-vehicle distance in the same lane is 2.5 sec \* absolute vehicle speed. Baseline: The same density/speed in all the lanes in one simulation. | |
| Absolute vehicle speed | 15 km/h, 30, 60 km/h | 60 km/h, 120 km/h |

Illustrative diagram of urban grid.



Figure 6.1.9-1: Road configuration for urban grid

## 4.12 Highway Scenario

The highway deployment scenario focuses on scenario of vehicles placed in highways with high speeds. The main KPIs evaluated under this scenario would be reliability/availability/sensing under high speeds/mobility (and thus frequent handover operations) and sensing-related performance.

The highway deployment scenario focuses on scenario of vehicles placed in highways with high speeds. The main KPIs evaluated under this scenario would be reliability/availability under high speeds/mobility (and thus frequent handover operations) and sensing-related performance.

The highway deployment scenario focuses on vehicle UEs moving on highways with high speeds. The main KPIs evaluated under this scenario are availability, reliability, latency and data rate under high speeds/mobility (and thus frequent handover operations).

Some of its attributes are listed in Table 4.12.

Table 4.12 Attributes for highway scenario

|  |  |
| --- | --- |
| **Attributes** | **Values or assumptions** |
| Carrier Frequency | Around 7GHz, Around 4GHz |
| System bandwidth | Around 7GHz: Up to 400MHz  Around 4GHz: Up to 200MHz |
| Layout | Single layer with hexagon cell |
| ISD | Around 4/7GHz:  ISD=1732m |
| BS antenna elements | Around 4GHz:  Tx: Up to [512] Tx  Rx: Up to [512] Rx  Around 7GHz:  Tx: Up to [2048] Tx  Rx: Up to [2048] Rx |
| UE antenna elements | Around 4GHz:  Tx: Up to [8] Tx  Rx: Up to [8] Rx  Around 7GHz:  Tx: Up to [16] Tx  Rx: Up to [16] Rx |
| Vehicle distribution | Randomly distributed in the middle of each lane. The distance between the rear bumper of a vehicle and the front bumper of the following vehicle in the same lane is set to be the maximum between 2m and a value generated by a variable following exponential distribution with a mean of 2 \* speed m. |
| Vehicle size | Size: 5m x 2m x 1.6m  Antenna height 1.6m |
| User distribution and UE speed | 100% vehicle  Speed is 140km/h |
| Service profile | NOTE: Whether to use full buffer traffic or non-full-buffer traffic depends on the evaluation methodology adopted for each KPI. |

Table 4.12-1: Attributes of Highway

|  |  |
| --- | --- |
| **Attributes** | **Values or assumptions** |
| Carrier Frequency NOTE1 | Macro only:  Around 700 MHz  Around 2 2 GHz  Around 4 4 4 4 GHz  Around 7 7 7 GHz  Around 7GHz +Around 4GHz  Around 2GHz+ Around 700 MHz  [Around 7GHz +Around 4GHz + Around 2GHz+Around 700MHz]  Micro BS: 4GHz |
| System bandwidth  NOTE2 | Around 700 MHz: Up to [60] MHz (DL+UL)  Around 2GHz: Up to [120 200] MHz (DL+UL)  Around 4 GHz: Up to [200 200 200 200] MHz (DL+UL)  Around 7 GHz: Up to [200 400 400]MHz (DL+UL)  Up to 100MHz (SL) |
| Layout | Single macro layer:  - Hex. Grid (only around the highway sides)  Baseline: Macro only (straight line BS placement with Road configuration in [2]) |
| ISD | Macro BS:  500m(Optional)   * 25m for ISD 500m   ISD 1: 1732m (for around 4 and around 7 GHz)   * 35m for ISD 1732m   ISD 2: 5000m  Micro BS: 5m  Micro BS: 5m |
| BS configuration | TBD  Tx: Up to 2048 Tx  Rx: Up to 2048 Rx  Around 4GHz:  Tx: Up to [512] Tx  Rx: Up to [512] Rx  Around 7GHz:  Tx: Up to [2048] Tx  Rx: Up to [2048] Rx |
| UE configuration | Around 700 MHz: 1T2R  Around 2 GHz: 1T2R and 2T4R  Around 4 GHz: 1T2R and 2T4R  Around 7 GHz: 1T2R and 2T4R  Around 4GHz:  Tx: Up to [8] Tx  Rx: Up to [8] Rx  Around 7GHz:  Tx: Up to [16] Tx  Rx: Up to [16] Rx  RSU Tx: Up to 8 Tx  RSU Rx: Up to 8 Rx  Vehicle Tx: Up to 8 Tx  Vehicle Rx: Up to 8 Rx |
| Vehicle size | Size: 5m x 2m x 1.6m  Antenna height 1.6m   * Type 1 vehicle (passenger vehicle with lower antenna position): length 5 meters, width 2.0 meters, height 1.6 meters, antenna height 0.75 meters * Type 2 vehicle (passenger vehicle with higher antenna position): length 5 meters, width 2.0 meters, height 1.6 meters, antenna height 1.6 meters * Type 3 vehicle (truck/bus): length 13 meters, width 2.6 meters, height 3 meters, antenna height 3 meters |
| User distribution and UE speed | 85% outdoor vehicles (120km/h), 15% outdoor vehicles (200 km/h)  100% vehicle, Speed is 140km/h  100% in vehicles  Average inter-vehicle distance (between two vehicles’ center) in the same lane is 0.5sec or 1sec \* average vehicle speed (average speed: 100-300km/h)  Randomly distributed in the middle of each lane. The distance between the rear bumper of a vehicle and the front bumper of the following vehicle in the same lane is set to be the maximum between 2m and a value generated by a variable following exponential distribution with a mean of 2 \* speed m.   * The distance between the rear bumper of a vehicle and the front bumper of the following vehicle in the same lane is max {2 meter, an exponential random variable with the average of the speed \* 2 sec}. * All the vehicles in the same lane have the same speed. * Vehicle type distribution is not dependent of the lane.   Vehicle speed for the highway scenario in [3] |
| Service profile | 50 messages per 1 second with absolute average speed of either  - 100-250 km/h (relative speed: 200 – 500km/h), or  - 30 km/h  NOTE: Whether to use full buffer traffic or non-full-buffer traffic depends on the evaluation methodology adopted for each KPI. For certain KPIs, full buffer traffic is desirable to enable comparison with IMT2030 values.  NOTE: Whether to use full buffer traffic or non-full-buffer traffic depends on the evaluation methodology adopted for each KPI. |
| Sensing target | Sensing target type: vehicle, road for infrastructure collapse monitoring, corner reflector for structural health monitoring  Distribution:   * 100% outdoor * Vehicle: The distance between the rear bumper of a vehicle and the front bumper of the following vehicle in the same lane is max {2 meter, an exponential random variable with the average of the speed \* 2 sec}.   Mobility:   * vehicle: 140km/h * road: 0km/h   corner reflector: 0km/h |

NOTE1: The options noted here are for evaluation purpose, and do not mandate the deployment of these options or preclude the study of other spectrum options.

[NOTE2: The aggregated system bandwidth is the total bandwidth typically assumed to derive the values for some KPIs such as area traffic capacity and user experienced data rate. For UL User Experienced Data rate it is not allowed to simulate a smaller bandwidth than the aggregated system bandwidth and transform the results to a larger bandwidth.]

Table 3.11 Attributes of Highway

|  |  |
| --- | --- |
| **Attributes** | **Values or assumptions** |
| Carrier Frequency | Macro only: ~~Below 6 GHz (around 6 GHz)~~ Around 4GHz, Around 7GHz  ~~Macro + RSUs NOTE2:~~  ~~1) For BS to RSU: Below 6 GHz (around 6 GHz) NOTE3~~  ~~2) RSU to vehicles or among vehicles: below 6 GHz~~ |
| Aggregated system bandwidth | Up to 200MHz (DL+UL)  Up to 100MHz (SL) |
| Layout | ~~Option 1:~~ Macro only  ~~Option 2: Macro + RSUs NOTE2~~ |
| ISD | Macro cell: ISD = 1732m, 500m(Optional)  ~~Inter-RSU distance = 50m or 100m~~ |
| BS antenna elements | Tx: Up to ~~256~~2048 Tx  Rx: Up to ~~256~~2048 Rx |
| UE antenna elements | RSU Tx: Up to 8 Tx  RSU Rx: Up to 8 Rx  Vehicle Tx: Up to 8 Tx  Vehicle Rx: Up to 8 Rx |
| User distribution and UE speed | 100% in vehicles  Average inter-vehicle distance (between two vehicles’ center) in the same lane is 0.5sec or 1sec \* average vehicle speed (average speed: 100-300km/h) |
| Traffic model | 50 messages per 1 second with absolute average speed of either  - 100-250 km/h (relative speed: 200 – 500km/h), or  - 30 km/h |
| Sensing target | Sensing target type: vehicle, road for infrastructure collapse monitoring, corner reflector for structural health monitoring  Distribution:   * 100% outdoor * Vehicle: The distance between the rear bumper of a vehicle and the front bumper of the following vehicle in the same lane is max {2 meter, an exponential random variable with the average of the speed \* 2 sec}.   Mobility:   * vehicle: 140km/h * road: 0km/h * corner reflector: 0km/h |

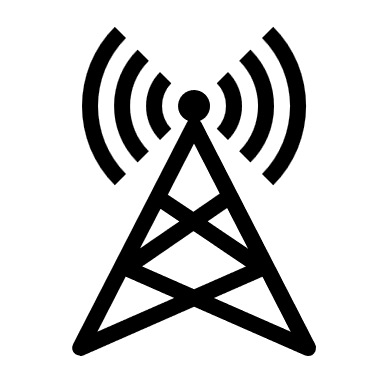
**Table 2: Attributes for Highway**

|  |  |
| --- | --- |
| **Attributes** | **Values or assumptions** |
| Carrier Frequency | Macro BS: 2GHz, 4GHz  Micro BS: 4GHz |
| Aggregated system bandwidth | 200MHz |
| Layout | Baseline: Macro only (straight line BS placement with Road configuration in [2]) |
| ISD | 1732m  500m |
| BS antenna elements | Macro BS:   * 35m for ISD 1732m * 25m for ISD 500m   Micro BS: 5m |
| UE antenna elements | * Type 1 vehicle (passenger vehicle with lower antenna position): length 5 meters, width 2.0 meters, height 1.6 meters, antenna height 0.75 meters * Type 2 vehicle (passenger vehicle with higher antenna position): length 5 meters, width 2.0 meters, height 1.6 meters, antenna height 1.6 meters * Type 3 vehicle (truck/bus): length 13 meters, width 2.6 meters, height 3 meters, antenna height 3 meters |
| User distribution and UE speed | * The distance between the rear bumper of a vehicle and the front bumper of the following vehicle in the same lane is max {2 meter, an exponential random variable with the average of the speed \* 2 sec}. * All the vehicles in the same lane have the same speed. * Vehicle type distribution is not dependent of the lane. * Vehicle speed for the highway scenario in [3] |

## 4.xx Single cell with large coverage

*Editor note: More deployment scenarios can be added based on companies input and discussion*

This deployment scenario is intended for single macro cell deployment in a very low density rural areas where the primary mode of communication is through terrestrial. The following figure shows a possible layout for the single cell deployment with 3 sectors.



Cell radius

Cell Radius = 3km to 8km

Some of the attributes of this deployment scenario are in the following table, Table 2.1.

**Table 2.1: Attributes for eMBB Extreme Rural (Single Cell with Large Coverage)**

|  |  |
| --- | --- |
| Attributes | Values or assumptions |
| **Carrier Frequency** | Around 600 MHz |
| **System Bandwidth** | 20 MHz (DL+UL) |
| **Layout** | Single cell layout [Isolated Macro cell] |
| **Cell radius** | 3km to 8km |
| **User density and UE speed** | 10 users per cell (distributed along cell edge) 40% Outdoor pedestrian: 3km/h  20% Outdoor in cars: 30km/h or 60km/h  40% Indoor: 3km/h |
| **UE height** | 1.5m |
| **Traffic model** | Full buffer |
| **KPI** | DL Coverage, UL Coverage, 5th percentile spectral efficiency, Average spectral efficiency |

**Table 2.2: Attributes for FWA Extreme Rural (Single Cell with Large Coverage)**

|  |  |
| --- | --- |
| Attributes | Values or assumptions |
| **Carrier Frequency** | Around 7GHz |
| **System Bandwidth** | 50 MHz (TDD) |
| **Layout** | Single cell layout [Isolated Macro cell] |
| **Cell radius** | 3km to 8km |
| **User density and UE speed** | 10 users per cell (distributed along cell edge) 40% Outdoor pedestrian: 3km/h  20% Outdoor in cars: 30km/h or 60km/h  40% Indoor: 3km/h |
| **UE height** | 5m |
| **Traffic model** | Full buffer |
| **KPI** | DL Coverage, UL Coverage, 5th percentile spectral efficiency, Average spectral efficiency |

The performance metric Coverage is defined as the cell edge distance of a single cell through link budget analysis. Coverage is one of the performance requirements for this deployment scenario.















\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Just for RAN#109 moderation by Axel:

Section above replaced with this joint TP based on the submissions and above section

## 4.xx Indoor Factory (InF)

The InF scenario focuses on factory halls of varying sizes and with varying levels of density of "clutter", e.g. machinery, assembly lines, storage shelves, etc. The key characteristics of this deployment scenario are clutter type, Clutter density, height of Tx and Rx and LOS/NLOS. The InF scenario is classified further into InF-SL, InF-DL, InF-SH, InF-DH and InF-HH based on a) density of the clutter (S-sparse and D-dense) and b) the height of Tx and Rx (L- low and H-high).

In addition, the indoor factory deployment scenario focuses on small coverage per site/TRxP (transmission and reception point) and high user throughput or user density in buildings. The key characteristics of this deployment scenario are high capacity, high user density and consistent user experience indoor supporting High-Reliability-Low-Latency communication, positioning and sensing.

Some of its attributes are listed in Table 4.xx-1 and 4.xx-2.

Table 4.xx-1: Attributes for Indoor Factory (InF)

|  |  |
| --- | --- |
| Attributes | Values or assumptions |
| Carrier Frequency  NOTE1 | Around 4 GHz  Around 7 GHz  Around 30 GHz  Around 4GHz+Around 7GHz  Note: The same layout is applied to the case of a single carrier frequency or the case of X+Y GHz. |
| Aggregated system bandwidth  NOTE2 | Around 4 GHz: Up to 200MHz (DL+UL)  Around 7 GHz: Up to 400MHz (DL+UL)  Around 30 GHz: 1GHz (DL+UL), Up to 800 MHz (DL+UL) NOTE3 |
| Layout | Single layer  - Indoor floor (Factory) |
| ISD | 50m (Equivalent to 18 TRxPs per 300m x 150m) |
| BS antenna elements | Around 4 GHz: Up to [TBD] Tx and Rx antenna elements  Around 7 GHz: Up to [TBD] Tx and Rx antenna elements  Around 30 GHz: Up to [TBD] Tx and Rx antenna elements |
| UE antenna elements | Around 4 GHz: Up to [4-8] Tx and Rx antenna elements  Around 7 GHz: Up to [8-16] Tx and Rx antenna elements  Around 30GHz: Up to [32] Tx and Rx antenna elements  *Note: For around 30 GHz, with multi-panel UE, it is the number of simultaneously used antenna elements.* |
| User distribution and UE speed | HRLLC:   * Profile 1   100% Indoor: 3km/h  10 users per TRxP   * Profile 2 (Optional, stationary machine)   100% Indoor: 0 km/h  Positioning:  100% Indoor: 3km/h  Sensing Targets: Human, AGV   * 100% Indoor   Sensing target assumptions as in Table 7.9.1-3 or Table 7.9.1-4 (TR. 38.901) |
| Service profile | NOTE: Whether to use full buffer traffic or non-full-buffer traffic depends on the evaluation methodology adopted for each KPI. |

NOTE1: The options noted here are for evaluation purpose, and do not mandate the deployment of these options or preclude the study of other spectrum options. A range of bands from 3300 – 4990MHz identified for WRC-15 are currently being considered and around 4GHz is chosen as a proxy for this range. A range of bands from 6 425-7 125 MHz identified for WRC-23 are currently being considered and around 7GHz is chosen as a proxy for this range. A range of bands from 24.25 GHz – 52.6 GHz identified for WRC-19 are currently being considered and around 30 GHz is chosen as a proxy for this range.

NOTE2: The aggregated system bandwidth is the total bandwidth typically assumed to derive the values for some KPIs such as area traffic capacity and user experienced data rate. It is not allowed to simulate a smaller bandwidth than the aggregated system bandwidth and transform the results to a larger bandwidth. The transformation method should then be described, including the modelling of power limitations.

NOTE3: "DL + UL" refers to either of the following two cases:

1. FDD with symmetric bandwidth allocations between DL and UL.

2. TDD with the aggregated system bandwidth used for either DL or UL via switching in time-domain.

Table 4.xx-2: Attributes for Indoor Factory (InF)

| Parameters | | InF-SL  (sparse clutter, low BS) | InF-DL  (dense clutter, low BS) | InF-SH  (sparse clutter, high BS) | InF-DH  (dense clutter, high BS) | InF-HH  (high Tx, high Rx) |
| --- | --- | --- | --- | --- | --- | --- |
| Layout | Room size | Rectangular: 45000 m2  i.e. 300 x 150 m  A diagram of a dotted line  AI-generated content may be incorrect. | | | | |
| Ceiling height | 5-25 m | 5-15 m | 5-25 m | 5-15 m | 5-25 m |
|  | Effective clutter height | < Ceiling height, 0-10 m | | | | |
|  | External wall and ceiling type | Concrete or metal walls and ceiling with metal-coated windows | | | | |
| Clutter type | | Big machineries composed of regular metallic surfaces.  For example: several mixed production areas with open spaces and storage/commissioning areas | Small to medium metallic machinery and objects with irregular structure.  For example: assembly and production lines surrounded by mixed small-sized machineries. | Big machineries composed of regular metallic surfaces.  For example: several mixed production areas with open spaces and storage/commissioning areas | Small to medium metallic machinery and objects with irregular structure.  For example: assembly and production lines surrounded by mixed small-sized machineries. | Any |
| Typical clutter size, | | 10 m | 2 m | 10 m | 2 m | Any |
| Clutter density (percentage of surface area occupied by clutter) | | Low clutter density  (<40%) | High clutter density  (≥40%) | Low clutter density  (<40%) | High clutter density  (≥40%) | Any |
| BS antenna height | | Clutter-embedded, i.e. the BS antenna height is below the average clutter height | | Above clutter | | Above clutter |
| UT location | LOS/NLOS | LOS and NLOS | | | | 100% LOS |
| Height | Clutter-embedded | | | | Above clutter |

## 4.xx UAV

*Editor note: More deployment scenarios can be added based on companies input and discussion*

The Unmanned Aerial Vehicle (UAV) scenario is defined to allow for the provision of services for general UAV and Urban Air Mobility (UAMs) to initiate and receive mobile services with continuous coverage. The key characteristics of this scenario are deploying dedicated or shared (i.e, for both aerial and terrestrial users) network to support data services for aerial users that might be travelling at high speeds. A continuous cellular layout and the associated interference shall be assumed, providing low altitude and critical UAV communication reliability with high mobility.

The unmanned aerial vehicle (UAV) deployment scenario focuses on continuous coverage for UAVs with low altitude. The key characteristics of this scenario are continuous wide area coverage in low altitude and critical UAV communication reliability with high mobility. A continuous cellular layout and the associated interference shall be assumed.

Some of its attributes are listed in Table 4.XX.**Table 2.9: Attributes for Unmanned Aerial Vehicle**

|  |  |
| --- | --- |
| **Attributes** | **Values or assumptions** |
| Carrier Frequency NOTE1 | Around 700 GHz  Around 4 4 GHz  Around 7 GHz |
| Aggregated system bandwidth NOTE2 | Around 700 MHz: Up to 20 MHz(DL+UL) NOTE3  Around 4 GHz: Up to 200 200 MHz (DL+UL)  Around 7 GHz: Up to 400 MHz (DL+UL) |
| Layout | Single layer  Hex |
| ISD | ISD1: 200m.  ISD2: 500m 500 m  1000m  ISD3: 1732m |
| BS antenna elements NOTE4 | Around 700 MHz: Up to 64 Tx and Rx antenna elements  Around 4 GHz: Up to 256 Tx and Rx antenna elements  Around 7 GHz: Up to 2048 Tx and Rx antenna elements |
| UE antenna elements NOTE4 | Around 700 MHz: Up to 4 Tx and Rx antenna elements  Around 4 GHz: Up to 8 Tx and Rx antenna elements  Around 7 GHz: Up to 8 Tx and Rx antenna elements |
| User distribution and UE speed | Uniformly distributed  Aerial UE altitude: up to [1000] m NOTE1  Maximum mobility speed: 150km/h  Aerial UE speed: up to 250kmph  Number of total aerial UEs per TRxP is up to [5] NOTE2 |
| Service profile | NOTE: Whether to use full buffer traffic or non-full-buffer traffic with/without QoS requirement depends on the evaluation methodology adopted for each KPI. For certain KPIs, full buffer traffic is desirable to enable comparison with IMT-Advanced values. |

NOTE1: The altitude of aerial UEs up to [1000] m is the baseline, other altitude of aerial UEs (e.g., 300 or 600) is not precluded.

NOTE2: [5] aerial UEs per TRxP are the baseline, other number of aerial UEs per TRxP (e.g., 15 or others) is not precluded.

NOTE1: The options noted here are for evaluation purpose, and do not mandate the deployment of these options or preclude the study of other spectrum options. A range of bands from 450MHz – 960MHz identified for WRC-15 are currently being considered and around 700MHz is chosen as a proxy for this range. A range of bands from 3300 – 4990MHz identified for WRC-15 are currently being considered and around 4GHz is chosen as a proxy for this range. A range of bands from 6 425-7 125 MHz identified for WRC-23 are currently being considered and around 7GHz is chosen as a proxy for this range.

NOTE2: The aggregated system bandwidth is the total bandwidth typically assumed to derive the values for some KPIs such as area traffic capacity and user experienced data rate. It is not allowed to simulate a smaller bandwidth than the aggregated system bandwidth and transform the results to a larger bandwidth. The transformation method should then be described, including the modelling of power limitations.

NOTE3: Consider larger aggregated system bandwidth if 20MHz cannot meet requirement.

NOTE4: The maximum number of antenna elements is a working assumption. 3GPP needs to strive to meet the target with typical antenna configurations.

## 4.xx New scenario on multi-layer heterogeneous network with assisting node

*Editor note: More deployment scenarios can be added based on companies input and discussion*

To address the issue of coverage and cell-edge performance along with the overall energy consumption, the deployment with more sustainable assisting nodes, including passive/semi-passive nodes, e.g., Reconfigurable intelligent surfaces (RIS), Network-controlled repeater (NCR) can be considered[3][4][5]. For example, the low consumption can be assumed for RIS to enable the deployment with different needs.

The detailed attributes on multi-layer heterogeneous network with assisting node are listed in Table 3.12.

Table 3.12 Recommended attributes for the new scenario of multi-layer heterogeneous network with assisting node

|  |  |  |
| --- | --- | --- |
| **Attributes** | | **Values or assumptions** |
| Carrier Frequency | | Around 4 GHz  Around 7 GHz  Around 30 GHz |
| Aggregated system bandwidth | | Around 4 GHz: Up to 200 MHz (DL+UL)  Around 7 GHz: Up to 400 MHz (DL+UL)  Around 30 GHz: 1 GHz (DL+UL) |
| Layout | | Two layers:   * Macro or micro TRxPs layers, Hex. Grid   Assisting node layer, dropped assisting nodes randomly or at a fixed distance range from the TRxP as shown in the following.  Ein Bild, das Text, Diagramm, Reihe enthält.  KI-generierte Inhalte können fehlerhaft sein. Ein Bild, das Text, Diagramm, Screenshot, Zahl enthält.  KI-generierte Inhalte können fehlerhaft sein. |
| Configuration of the assisting node | Distribution of assisting nodes | * For dense urban scenarios: uniform/macro TRxPs, e.g., 4 assisting nodes per sector; * For indoor hotspot scenarios: 100% indoor, e.g., 2 assisting nodes per sector; |
| Antenna configuration of assisting nodes | 2D antenna array with the number up to companies’ report |
| Power consumption Per Element | For RIS with adapative beam: 0.4 mw is baseline[4].  For RIS with fixed beam: 0 mw.  Other values are not precluded, which is up to companies’ report. |
| Other attributes, e.g., attributes related to BS and UE | | Same as the value for basic deployment scenarios |

More specifically, we have the following analysis:

* Regarding the layout, the assisting node layer includes multiple assisting nodes (e.g., RIS nodes), which can be dropped randomly or at a fixed distance range from the TRxP as shown in Figure 3-13. Then the distance range value can be determined according to the specific evaluation requirements and the restriction of ISD as well as cell radius. And by deploying such two-layer network with RIS nodes, the increase in energy efficiency can be achieved compared to single-layer network with only TRxPs.
* Regarding the configuration of assisting nodes, similar as the configuration attributes of BS and UE, at least the distribution and antenna elements of assisting nodes shall be considered, and the specific value of parameter highly depends on the deployment scenarios, carrier frequency, and target performance objectives.

## 4.xx New scenario on nearshore water

*Editor note: More deployment scenarios can be added based on companies input and discussion*

In nearshore water scenarios, the sensing targets are ships traveling on nearshore waters or rivers, BSs are primarily land-based as shown in Figure 3-14. Mono-static or bi-static sensing can be performed using TRPs selected from the corresponding communication scenario.



**Figure 3-14** Deployment scenario of nearshore waters

ISAC related descriptions including sensing target characteristics, sensing transmitter and sensing receiver are proposed, some of its attributes are listed in Table 3.14.

Table 3.14 Attributes for nearshore water

|  |  |  |
| --- | --- | --- |
| **Attributes** | **Values or assumptions** | |
| Carrier Frequency | Around 7 GHz  Around 30 GHz | |
| Layout | Macro cell: ISD = at least 500m | |
| BS antenna elements | Up to 2048 Tx and Rx antenna elements | |
| Sensing transmitters and sensing receivers | TRP mono-static, TRP-TRP bi-static | |
| Sensing targets | Sensing target type | Ship |
| Mobility | Uniform distribution between 10km/h and 60km/h |
| Distribution | 100% Outdoor, uniformly distributed within a sensing area |