# 3 Definition of terms, symbols and abbreviations

## 3.1 Terms

For the purposes of the present document, the terms given in 3GPP TR 21.905 [i.1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [i.1].

**beam:** beam (of the antenna) is a radiation pattern without restriction to main lobe.

**C-Plane**: Control Plane: refers specifically to real-time control between O-DU and O-RU, and should not be confused with the UE's control plane.

**Cascade mode**: Mode of Shared cell which is realized by several O-RUs cascaded in chain.

NOTE: See clause 13.

**Category A O-RU**: O-RU within which the DL precoding is not done.

NOTE: See Figure 4.2‑1.

**Category B O-RU**: O-RU within which the DL precoding is performed.

NOTE: See Figure 4.2‑1

**eAxC**: extended Antenna-Carrier: a data flow for a single antenna (or spatial stream) for a single carrier in a single sector.

**FFO**: Fractional Frequency Offset. This is defined as ∆f/f\_norm which is used to describe frequency error, typically on the output of the T-TSC filter in the O-RU.

NOTE: It is the same as the Fractional Frequency Deviation defined in Recommendation ITU-T G.810 [16], clause 4.5.2.

**FHM mode**: Mode of Shared cell which is realized by FHM and several O-RUs.

NOTE: See clause 13.

**GPS Time:** GPS Time is a continuous time scale (no leap seconds) defined by the GPS Control segment. It starts at 0h UTC (midnight) of January 5th to 6th 1980.

NOTE: See IEEE 1588 [3], [33] Annex B for timescales.

**Fronthaul:** A logical link connecting O-DU and O-RU.

NOTE: Fronthaul transports C-Plane, U-Plane, S-Plane and M-Plane traffic.

**Hop**: physical link between two S-Plane nodes (where node can be O-DU, switch or O-RU).

NOTE: As defined in IEEE 802.1CM [11], [12].

**LAA**: Licensed-assisted access: Carrier aggregation with at least one secondary cell operating in the unlicensed spectrum.

**LLS**: Lower Layer Split: logical interface between O-DU and O-RU when using a lower layer (intra-PHY based) functional split.

**LLS-U:** Lower Layer SplitUser Plane: logical interface between O-DU and O-RU when using a lower layer functional split.

**LLS-C:** Lower Layer Split Control Plane: logical interface between O-DU and O-RU when using a lower layer functional split.

**High-PHY**: those portions of the PHY layer processing on the O-DU side of the fronthaul interface.

NOTE: This includes forward error correction encode/decode, scrambling, and modulation/demodulation.

**Low-PHY**: those portions of the PHY layer processing on the O-RU side of the fronthaul interface.

NOTE: This includes FFT/iFFT, digital beamforming, and PRACH extraction and filtering.

**M-Plane**: Management Plane: refers to non-real-time management operations between the O-DU and the O-RU

**User group:** A group of one or more layers for single UE (SU-MIMO) or single/multiple layers for different UEs (MU-MIMO), for which the scheduled layer (s) are using the same range of contiguous or non-contiguous PRBs and symbols in a slot.

**NB-IoT**: Narrowband Internet of Things which is a Low Power Wide Area Network (LPWAN) radio technology standard specified in 3GPP standards to provide extended coverage such as indoor and underground scenarios, support of massive number of low throughput devices, low delay sensitivity, ultra-low device cost, low device power consumption and optimized network architecture.

**O-CU:** O-RAN Central Unit – a logical node hosting PDCP, RRC, SDAP and other control functions

**O-DU**: O-RAN Distributed Unit: a logical node hosting RLC/MAC/High-PHY layers based on a lower layer functional split.

**O-RU**: O-RAN Radio Unit: a logical node hosting Low-PHY layer and RF processing based on a lower layer functional split.

NOTE: This is similar to 3GPP defined TRP or RRH but more specific in including the Low-PHY layer (FFT/iFFT, PRACH extraction).

**PRACH Symbol**: A resource in the time domain having the duration of (1/Subcarrier Spacing), following cyclic prefix (excluded) in a PRACH occasion. Cyclic prefix and one or more of such consecutive PRACH Symbols constitute a PRACH preamble or a NPRACH symbol group defined in 3GPP TS 36.211 [42] and 38.211 [4].

**PRB:** Physical Resource Block. A group of 12 consecutive subcarriers of an OFDM symbol.

**Processing element:** See clause 7.5 of the M-Plane specification [7] for a definition of processing element.

**PRTC**: Primary Reference Time Clock as defined in G.8272 [25] and G.8272.1 [26].

NOTE: There are different types of PRTC defined in both G.8272 and G.8272.1. Unless the specific type is indicated, a reference to a PRTC in the present document could include any of these types.

**Q<I.F>**: denotes a signed two's-complement I+F bit fixed point number with I signed integer bits, and F fractional bits.

**Quality Level:** Referred to in Recommendation ITU G.781 [15] as "clock source quality level." The clock-source quality-level of a synchronous equipment clock or stand-alone synchronization clock is defined as the grade of clock to which it is ultimately traceable.

**RE:** Resource Element. One subcarrier of an OFDM symbol.

**rx-array:** As defined in clause 12.2.

**S-Plane**: Synchronization Plane: refers to traffic between the O-RU or O-DU and a synchronization controller which is generally an IEEE 1588 [3], [33] Grand Master.

NOTE: Grand Master functionality may be embedded in the O-DU.

**Shared Cell**: The operation for the same cell by several O-RUs.

NOTE: See clause 11.

**Shared O-RU:** See clause 14.1 for a definition of Shared O-RU.

**Shared O-RU Host:** See clause 3.1 of the M-Plane specification [7] for a definition of Shared O-RU Host.

**Shared Resource Operator:** See clause 3.1 of the M-Plane specification [7] for a definition of Shared Resource Operator.

**Slot**: a time duration defined in Table 7.5.2.13‑3.

NOTE: This is applicable to both LTE and NR. Slot definition in the present document for LTE is different from the one defined in 3GPP TS 36.211 [42], clause 4.

**Spatial stream**: the data flow on the DL associated with precoded data (may be same as layers or different if there is expansion in the precoding), and on UL associated with the number of outputs from the digital beamforming (sometimes called "beams").

**TE(*t*)**: Time Error – The difference between the time indicated by a clock or timing signal, and that indicated by a reference clock or timing signal.

NOTE: See Recommendation ITU-T G.810 [16], clause 4.5.13.

**TRX**: Refers to the specific processing chain in an O-RU associated with D/A or A/D converters.

NOTE: Due to digital beamforming the number of TRXs may exceed the number of spatial streams, and due to analog beamforming, the number of TRXs may be lower than the number of antenna elements.

**tx-array:** As definedin clause 12.2.

**U-Plane**: User Plane: refers to IQ sample data transferred between O-DU and O-RU

**UNI**: User Network Interface as defined by eCPRI network requirement specification

**UQ<I.F>**: denotes an unsigned I+F bit fixed point number with I unsigned integer bits and F fractional bits

## 3.2 Symbols

For the purposes of the present document, the symbols given in 3GPP TS 38.21 [4] and the following apply:

Δ*f* Subcarrier spacing

*µ* Subcarrier spacing configuration

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [i.1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [i.1].

ACK Acknowledgement

APTS Assisted Partial Timing Support

ACK/NACK Acknowledgement and Negative Acknowledgement

ASM Advanced Sleep Mode

BF Beamforming

BMCA Best Master Clock Algorithm

C/U-Plane C-Plane and U-Plane

CA Carrier Aggregation

CDM Code Division Multiplexing

CID Company IDentification

CoMP Coordinated Multi-Point

CRS Cell Specific Reference Signal

DAC Digital Analogue Converter

DIX Ethernet, named after DEC, Intel and Xerox

DL Downlink

DMRS Demodulation Reference Signal

DRS Discovery Reference Signal

DSS Dynamic Spectrum Sharing

EEC Ethernet Equipment Clock

ESMC Ethernet Synchronization Messaging Channel

eAxC\_ID eAxC Identifier

eEEC enhanced Ethernet Equipment Clock

ePRTC enhanced Primary Reference Time Clock

eNB evolved NodeB (applies to LTE)

FFO Fractional Frequency Offset

FHM Fronthaul Multiplexer

gNB next generation NodeB (applies to NR)

HARQ Hybrid Automatic Repeat request

IE Information element

IQ In-phase and Quadrature-phase

ITU International Telecommunication Union

iFFT inverse Fast Fourier Transformation

LBT Listen Before Talk

LLC Logical Link Control

MAC Media Access Control

MCOT Maximum Channel Occupancy Time

MCS Modulation Coding Scheme

MMSE Minimum Mean Square Error

MTIE Maximum Time Interval Error

MTU Maximum Transmission Unit

NACK Negative Acknowledgement

OTA Over The Air

OTDOA Observed Time Delay Of Arrival

OUI Organizationally Unique Identifier

PCP Priority Code Point

PDV Packet Delay Variation

PHY Physical Layer

PLFS Physical Layer Frequency Support

PLL Phase Locked Loop

PPS Pulse Per Second

PRC Primary Reference Clock

PRG Precoding Resource Block Group

PRTC Primary Reference Time Clock

PTP Precision Time Protocol

PT-RS Phase Tracking Reference Signal

QL Quality Level

RB Resource Block

RE Resource Element

RLC Radio Link Control

RLC-AM RLC Acknowledged Mode

RLC-TM RLC Transparent Mode

RLC-UM RLC Unacknowledged Mode

RoE Radio over Ethernet

RX Receiver

SE Section Extension

SF Subframe

SLA Service Level Agreement

SMO Service Management and Orchestration

SRO Shared Resource Operator

SSB Synchronization Signal Block

SSM Synchronization Status Message

ST Section Type

SyncE Synchronous Ethernet

T-BC Telecom Boundary Clock

T-GM Telecom Grand Master

T-TC Telecom Transparent Clock

T-TSC Telecom Subordinate Clock

TAE Time Alignment Error

TDEV Time DEViation

TLV Type Length Value

TM Transmission Mode

TOD Time of Day

TX Transmitter

UL Uplink

URLLC Ultra Reliable Low Latency Communications

UTC Universal Time Coordinated

VLAN Virtual Local Area Network

vRAN virtualized Radio Access Network

## 3.4 Document conventions

### 3.4.1 Terminologies

In the present document, all material is considered normative except where explicitly or implicitly labeled as informative. Labeling as informative includes content outside of tables and figures labeled as "NOTE", content described as "examples", and content carrying the explicit label of "informative" such as some Annexes.

For the purposes of the present document, the following terminologies apply.

ignored Within the present document, it is sometimes stated that certain information elements are to be "ignored" by the receiver (generally for "reserved" fields but in some cases other fields too). In this case, the fields shall be ignored for the purposes of processing at the O-RAN application level, but in the case of certain packet error-checking such as Ethernet-layer CRC or parity calculations, the fields shall be included in the CRC or parity calculations. As well, in the event of packet encryption, the "ignored" fields shall be encrypted along with the other packet payload information.

### 3.4.2 Fields and bitmasks in messages

For the purposes of the present document, the following conventions apply for the format of messages and data structures within messages.

In accordance with IETF RFC 1166 [10], the left most bit of an octet is the most significant bit (msb) and the right most bit is the least significant bit (lsb). The msb is labelled as 0 and lsb is labelled as 7. This is illustrated by a blue ribbon in tables showing the message format. An example is depicted in Table 3.4.2‑1. Note that this bit labelling convention (specifically the blue ribbon header in some tables) for octets is different from the labelling of bits within a field (bracketed bit numbers shown in tables).

To address specific bits within a field, the following notation is used: "X[k]" represents kth bit in a field X with the convention that bit X[0] is the least significant bit of field X and located in the rightmost bit position. Where applicable, a sequence of bits in a field X can be interpreted as an unsigned integer value calculated with formula:

where N is number of bits in field X.

Notation "X[a:b]" represents a sequence of bits in field X starting from bit X[a] and ending at bit X[b] inclusive, where a > b.

Table 3.4.2‑1 below illustrates the format of messages and data structures using this notation.

Table 3.4.2‑1: Example of table presenting format of a data structure

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 (msb) | 1 | 2 | 3 | 4 | 5 | 6 | 7 (lsb) | # of bytes | octet |
| Y[3:0] | | | | X[11:8] | | | | 1 | N |
| X[7:0] | | | | | | | | 1 | N+1 |

The example data structure presented in Table 3.4.2‑1 is interpreted as follows:

* Field Y has 4 bits. Bits Y[3] to Y[0] of field Y are in octet N; Y[3], the most significant bit of field Y is in the most significant bit of octet N.
* Field X has 12 bits. Bits X[11] to X[8] of field X are in octet N; X[8] is in the least significant bit of octet N.   
  Bits X[7] to X[0] of field X are in octet N+1; X[7] is in the most significant bit of octet N+1 and X[0] is in the least significant bit of octet N+1.

This corresponds to a structure that maps every bit as presented in Table 3.4.2‑2 below.

Table 3.4.2‑2: Interpretation of the example of table presenting format of a data structure

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 (msb) | 1 | 2 | 3 | 4 | 5 | 6 | 7 (lsb) | # of bytes | octet |
| Y[3] | Y[2] | Y[1] | Y[0] | X[11] | X[10] | X[9] | X[8] | 1 | N |
| X[7] | X[6] | X[5] | X[4] | X[3] | X[2] | X[1] | X[0] | 1 | N+1 |