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Contents

Foreword

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1 Scope

The present document establishes the Location Measurement Unit (LMU) minimum UTDOA positioning requirement for the FDD and TDD mode of E-UTRAN.

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
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[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 36.305: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Stage 2 functional specification of User Equipment (UE) positioning in E-UTRAN".

[3] 3GPP TS 36.214: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer; Measurements".

[4] 3GPP TS 36.321: "Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification".

[5] 3GPP TS 36.459: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); SLm interface Application Protocol (SLmAP)".

[6] 3GPP TS 36.211: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation".

[7] 3GPP TS 36.104: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] apply.

3.1A Symbols

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

$BW_{Channel}$ Channel bandwidth
BW_{SRS} SRS bandwidth
$\hat{E}_s$ Received energy per RE (power normalized to the subcarrier spacing) during the useful part of the symbol, i.e. excluding the cyclic prefix, at the LMU antenna connector
Io The total received power density, including signal and interference, as measured at the UE antenna connector

Iot	The received power spectral density of the total noise and interference for a certain RE (power integrated over the RE and normalized to the subcarrier spacing) as measured at the LMU antenna connector
$P_{REFSENS}$	The reference sensitivity power level
T_{SRS}	The SRS periodicity in ms
T_s	The basic unit of time defined in TS 36.211 clause 4

3.2 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].

ACS	Adjacent Channel Selectivity
DRX	Discontinuous Reception
E-UTRAN	Evolved Universal Terrestrial Radio Access Network
eNodeB	evolved Node B
E-SMLC	Enhanced Serving Mobile Location Center
ICS	In-channel Selectivity
LMU	Location Measurement Unit
SRS	Sounding Reference Signal
UE	User Equipment
UL	Uplink
UTDOA	Uplink Time Difference Of Arrival

4 General

The UTDOA architecture is described in TS 36.305 [2].

An LMU may be deployed in three ways:

- LMU class 1: LMU integrated into base station
- LMU class 2: LMU co-sited with base station and sharing antenna with the base station
- LMU class 3: standalone LMU with own receive antenna

5 LMU RF Requirements

5.1 General

The requirements in clause 5 are expressed for a single receiver antenna connector. For receivers with antenna diversity, the requirements apply for each receiver antenna connector.

When the LMU is configured to receive multiple carriers for one or more UEs, all RF requirements are applicable for each received carrier. For ACS, blocking and intermodulation characteristics, the negative offsets of the interfering signal apply relative to the lower edge and positive offsets of the interfering signal apply relative to the higher edge.

Receiver test ports for LMU class 1 are illustrated in Figure 5.1-1. Receiver test ports for LMU class 2 are illustrated in Figure 5.1-2. Receiver test ports for LMU class 3 are illustrated in Figure 5.1-3. If any external apparatus, e.g., a RX amplifier, a filter or the combination of such devices is used, LMU RF requirements specified in this specification apply at the far end antenna connector (port B); otherwise, the requirements apply at port A.

Requirements applicability for different LMU classes is summarized in Table 5.1-1.

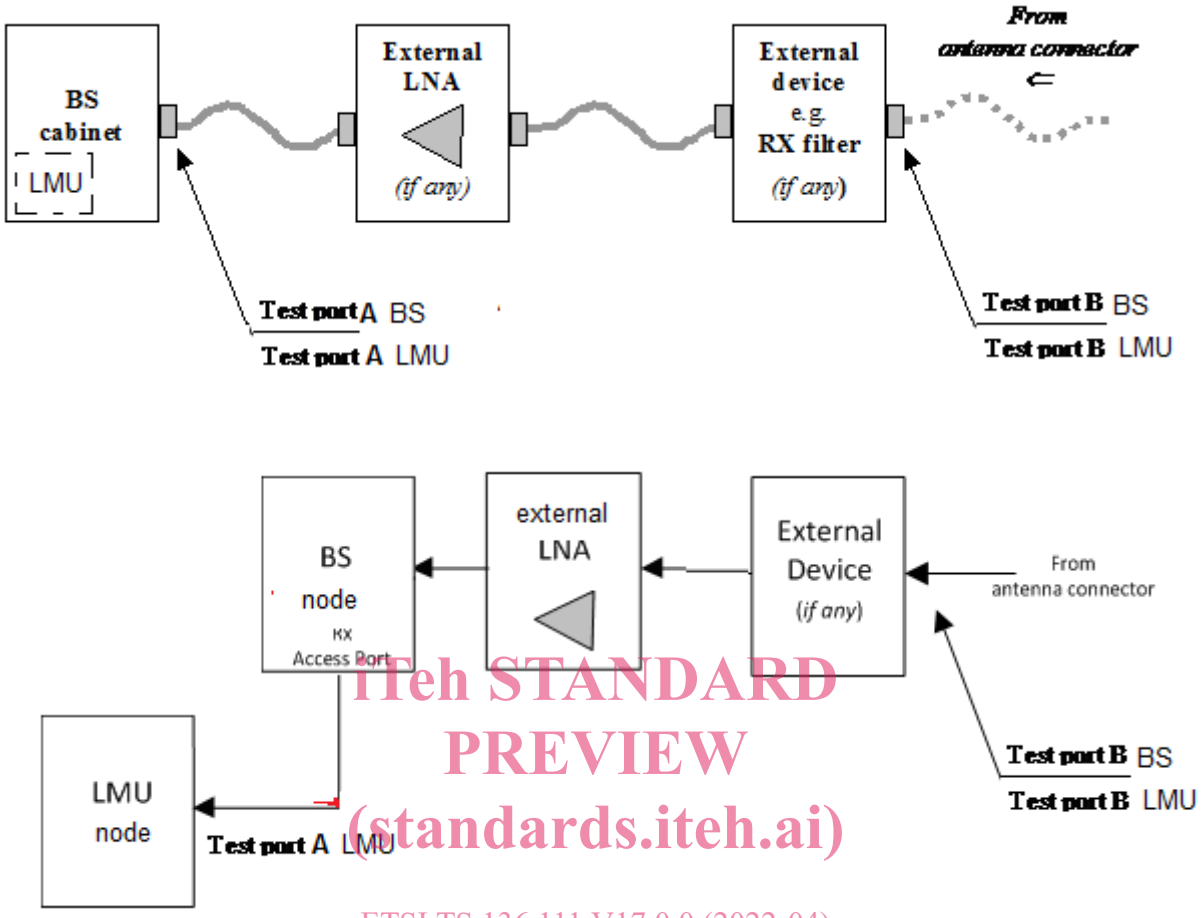

Figure 5.1-1: Two examples of receiver test ports for LMU class 1.

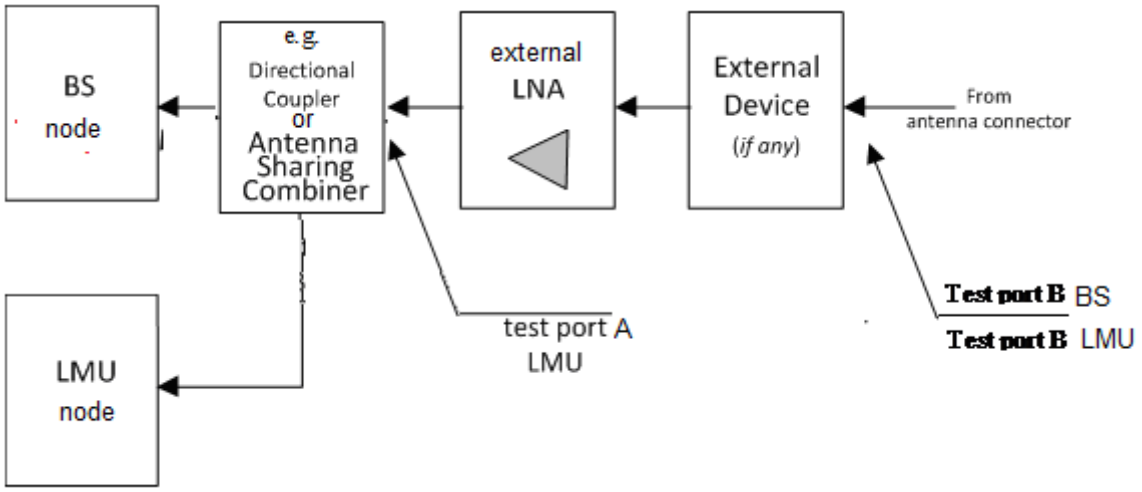

Figure 5.1-2: Receiver test ports for LMU class 2.

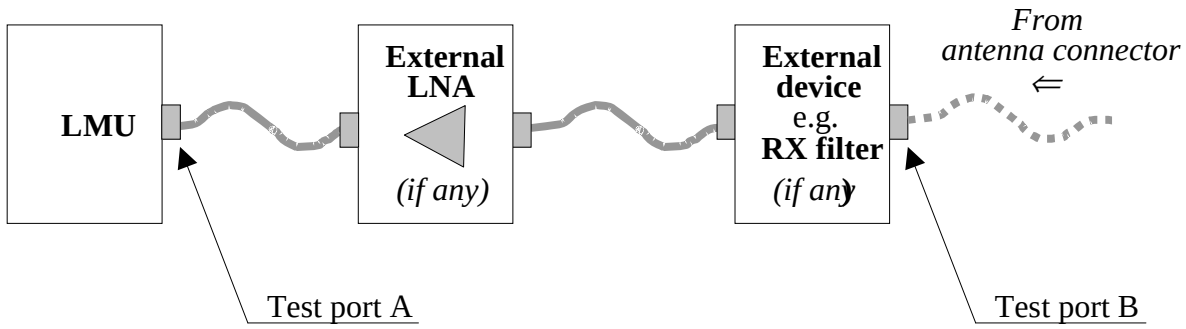

Figure 5.1-3: Receiver test ports for LMU class 3.

Table 5.1-1: Test ports and RF requirements applicability

LMU class	Physical Node	RF Requirements	Test Port	Comments
1	BS	TS 36.104	A or B	Test port determined per TS 36.104
2	BS	Degradation of the base station DL performance and base station UL performance may occur when LMU class 2 is co-sited with the base station.	B	Test port determined per TS 36.104
	LMU	clauses 5.2-5.8	A or B	Test port determined per TS 36.111, Figure 5.1-2
3	LMU	clauses 5.2-5.8	A or B	Test port determined per TS 36.111, Figure 5.1-3

5.1.1 Detection probability requirement and false alarm requirement

The performance metrics used in RF requirements are detection probability and false alarm. The probability of detection is defined as the ratio of received measurement reports to the total number of measurement requests. The false alarm rate is the probability of detection of a signal that is not present, and is defined as the percentage of the received measurement reports to the total number of measurement requests with the measurement configuration of a signal that is not present. The detection probability requirement is 99% and the false alarm requirement is 0.1%. The detection probability requirement and the false alarm requirement apply for any number of receive ports, any channel bandwidth, and all frame structures.

5.1.2 Operating bands

E-UTRA LMUs may operate in one or more of the operating bands defined in Table 5.1.2-1.

Table 5.1.2-1: E-UTRA frequency bands

E-UTRA Operating Band	Uplink (UL) operating band BS receive UE transmit F_{UL_low} – F_{UL_high}	Downlink (DL) operating band BS transmit UE receive F_{DL_low} – F_{DL_high}	Duplex Mode
1	1920 MHz – 1980 MHz	2110 MHz – 2170 MHz	FDD
2	1850 MHz – 1910 MHz	1930 MHz – 1990 MHz	FDD
3	1710 MHz – 1785 MHz	1805 MHz – 1880 MHz	FDD
4	1710 MHz – 1755 MHz	2110 MHz – 2155 MHz	FDD
5	824 MHz – 849 MHz	869 MHz – 894MHz	FDD
6[1]	830 MHz – 840 MHz	875 MHz – 885 MHz	FDD
7	2500 MHz – 2570 MHz	2620 MHz – 2690 MHz	FDD
8	880 MHz – 915 MHz	925 MHz – 960 MHz	FDD
9	1749.9 MHz – 1784.9 MHz	1844.9 MHz – 1879.9 MHz	FDD
10	1710 MHz – 1770 MHz	2110 MHz – 2170 MHz	FDD
11	1427.9 MHz – 1447.9 MHz	1475.9 MHz – 1495.9 MHz	FDD
12	699 MHz – 716 MHz	729 MHz – 746 MHz	FDD
13	777 MHz – 787 MHz	746 MHz – 756 MHz	FDD
14	788 MHz – 798 MHz	758 MHz – 768 MHz	FDD
15	Reserved	Reserved	FDD
16	Reserved	Reserved	FDD
17	704 MHz – 716 MHz	734 MHz – 746 MHz	FDD
18	815 MHz – 830 MHz	860 MHz – 875 MHz	FDD
19	830 MHz – 845 MHz	875 MHz – 890 MHz	FDD
20	832 MHz – 862 MHz	791 MHz – 821 MHz	
21	1447.9 MHz – 1462.9 MHz	1495.9 MHz – 1510.9 MHz	FDD
22	3410 MHz – 3490 MHz	3510 MHz – 3590 MHz	FDD
23	2000 MHz – 2020 MHz	2180 MHz – 2200 MHz	FDD
24	1626.5 MHz – 1660.5 MHz	1525 MHz – 1559 MHz	FDD
25	1850 MHz – 1915 MHz	1930 MHz – 1995 MHz	FDD
26	814 MHz – 849 MHz	859 MHz – 894 MHz	FDD
27	807 MHz – 824 MHz	852 MHz – 869 MHz	FDD
28	703 MHz – 748 MHz	758 MHz – 803 MHz	FDD
29	N/A	717 MHz – 728 MHz	FDD[2]
...			
33	1900 MHz – 1920 MHz	1900 MHz – 1920 MHz	TDD
34	2010 MHz – 2025 MHz	2010 MHz – 2025 MHz	TDD
35	1850 MHz – 1910 MHz	1850 MHz – 1910 MHz	TDD
36	1930 MHz – 1990 MHz	1930 MHz – 1990 MHz	TDD
37	1910 MHz – 1930 MHz	1910 MHz – 1930 MHz	TDD
38	2570 MHz – 2620 MHz	2570 MHz – 2620 MHz	TDD
39	1880 MHz – 1920 MHz	1880 MHz – 1920 MHz	TDD
40	2300 MHz – 2400 MHz	2300 MHz – 2400 MHz	TDD
41	2496 MHz – 2690 MHz	2496 MHz – 2690 MHz	TDD
42	3400 MHz – 3600 MHz	3400 MHz – 3600 MHz	TDD
43	3600 MHz – 3800 MHz	3600 MHz – 3800 MHz	TDD
44	703 MHz – 803 MHz	703 MHz – 803 MHz	TDD
NOTE 1: Band 6 is not applicable. NOTE 2: Restricted to E-UTRA operation when carrier aggregation is configured. The downlink operating band is paired with the uplink operating band (external) of the carrier aggregation configuration that is supporting the configured PCell.			

5.1.3 Operating bands

LMU requirements are for the channel bandwidths listed in Table 5.1.3-1.

Table 5.1.3-1: Transmission bandwidth configuration N_{RB} in E-UTRA channel bandwidths

Channel bandwidth $BW_{Channel}$ [MHz]	1.4	3	5	10	15	20
Transmission bandwidth configuration N_{RB}	6	15	25	50	75	100

Figure 5.1.3-1 shows the relation between the Channel bandwidth ($BW_{Channel}$) and the Transmission bandwidth configuration (N_{RB}). The channel edges are defined as the lowest and highest frequencies of the carrier separated by the channel bandwidth, i.e. at F_C +/- $BW_{Channel}$ /2.

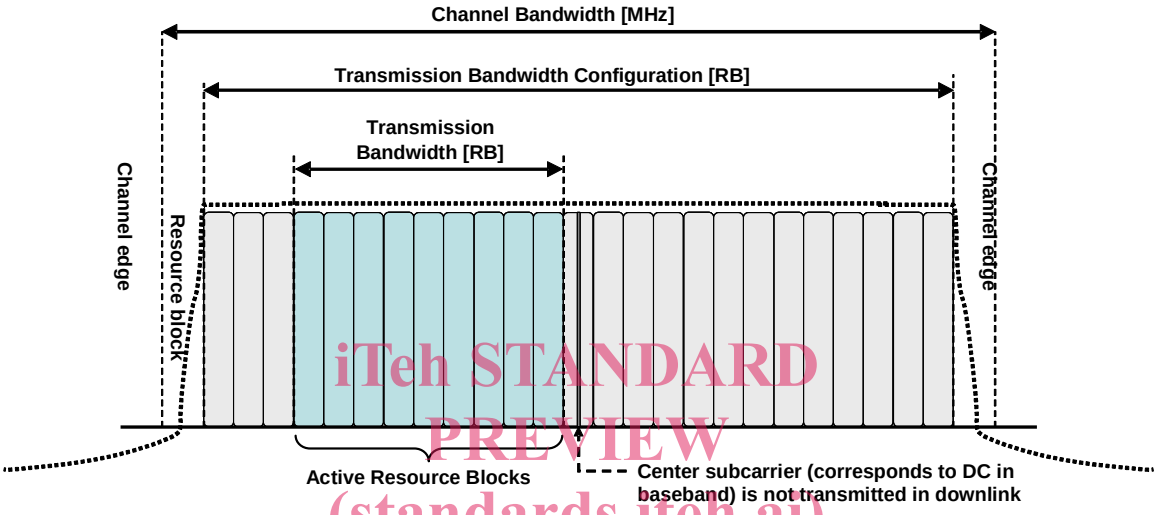

Figure 5.1.3-1: Definition of Channel Bandwidth and Transmission Bandwidth Configuration for one E-UTRA carrier.

Figure 5.1.3-2 illustrates the aggregated channel bandwidth for intra-band carrier aggregation.

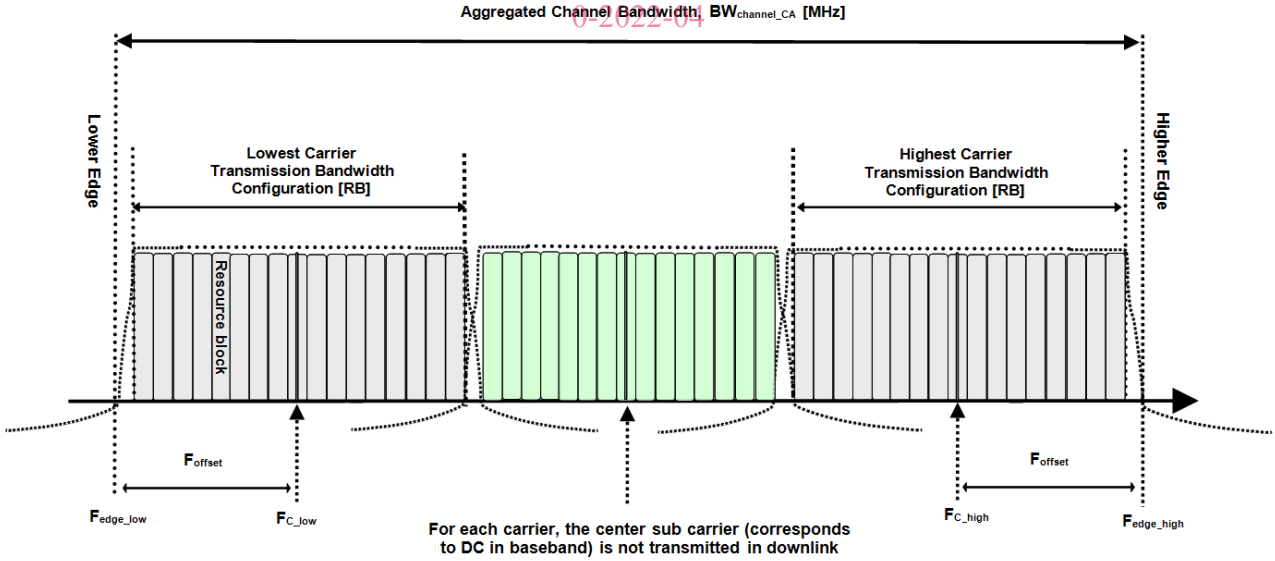

Figure 5.1.3-2: Definition of Aggregated Channel Bandwidth for intra-band carrier aggregation

The lower edge of the Aggregated Channel Bandwidth ($BW_{Channel\_CA}$) is defined as $F_{edge\_low} = F_{C\_low} - F_{offset}$. The upper edge of the aggregated channel bandwidth is defined as $F_{edge\_high} = F_{C\_high} + F_{offset}$. The Aggregated Channel Bandwidth, $BW_{Channel\_CA}$, is defined as follows:

$$BW_{Channel\_CA} = F_{edge\_high} - F_{edge\_low} \text{ [MHz]}$$