

# ETSI TS 136 101 V14.26.0 (2023-10)



**LTE;**  
**Evolved Universal Terrestrial Radio Access (E-UTRA);**  
**User Equipment (UE) radio transmission and reception**  
**(3GPP TS 36.101 version 14.26.0 Release 14)**



## 6.2 Transmit power

### 6.2.1 Void

### 6.2.2 UE maximum output power

The following UE Power Classes define the maximum output power for any transmission bandwidth within the channel bandwidth for non CA configuration unless otherwise stated. The period of measurement shall be at least one sub frame (1ms).

Table 6.2.2-1: UE Power Class

EUTRA band	Class 1 (dBm)	Tolerance (dB)	Class 2 (dBm)	Tolerance (dB)	Class 3 (dBm)	Tolerance (dB)	Class 4 (dBm)	Tolerance (dB)
1					23	±2		
2					23	±2 <sup>2</sup>		
3					23	±2 <sup>2</sup>		
4					23	±2		
5					23	±2		
6					23	±2		
7					23	±2 <sup>2</sup>		
8					23	±2 <sup>2</sup>		
9					23	±2		
10					23	±2		
11					23	±2		
12					23	±2 <sup>2</sup>		
13					23	±2		
14	31	+2/-3			23	±2		
17					23	±2		
18					23	±2 <sup>5</sup>		
19					23	±2		
20					23	±2 <sup>2</sup>		
21					23	±2		
22					23	+2/-3.5 <sup>2</sup>		
23					23 <sup>6</sup>	±2 <sup>6</sup>		
24					23	+2/-3 <sup>2</sup>		
25					23	±2 <sup>2</sup>		
26					23	±2 <sup>2</sup>		
27					23	±2		
28					23	+2/-2.5		
30					23	±2		
31					23	±2		
...								
33					23	±2		
34					23	±2		
35					23	±2		
36					23	±2		
37					23	±2		
38					23	±2		
39					23	±2		
40					23	±2		
41			26	±2 <sup>2</sup>	23	±2 <sup>2</sup>		
42					23	+2/-3		
43					23	+2/-3		
44					23	+2/[-3]		
45					23	±2		
...								
47			26	±2	23	±2		
48					23	+2/-3		
65					23	±2		
66					23	±2		
68					23	±2		

Table 6.2.5G-1:  $\Delta T_{IB,c}$  for inter-band con-current V2X operation (two bands)

V2X con-current band Configuration	E-UTRA or V2X Operating Band	$\Delta T_{IB,c}$ [dB]
V2X_3A-47A	3	0.0
V2X_7A-47A	7	0.0
V2X_8A-47A	8	0.0
V2X_39A-47A	39	0.0
V2X_41A-47A	41	0.0

Table 6.2.5G-2:  $P_{CMAX,c}$  tolerance in concurrent transmission for V2X UE

$P_{CMAX,c}$ (dBm)	Tolerance $T_{LOW}(P_{CMAX,L,c})$ (dB)	Tolerance $T_{HIGH}(P_{CMAX,H,c})$ (dB)
$P_{CMAX,c} = 26$	3.0	2.0
$23 \leq P_{CMAX,c} < 26$	4.0	2.0
$22 \leq P_{CMAX,c} < 23$	5.0	2.0
$21 \leq P_{CMAX,c} < 22$	5.0	3.0
$20 \leq P_{CMAX,c} < 21$	6.0	4.0
$16 \leq P_{CMAX,c} < 20$	5.0	
$11 \leq P_{CMAX,c} < 16$	6.0	
$-30 \leq P_{CMAX,c} < 11$	7.0	

## 6.3 Output power dynamics

### 6.3.1 (Void)

### 6.3.2 Minimum output power

The minimum controlled output power of the UE is defined as the broadband transmit power of the UE, i.e. the power in the channel bandwidth for all transmit bandwidth configurations (resource blocks), when the power is set to a minimum value.

#### 6.3.2.1 Minimum requirement

The minimum output power is defined as the mean power in one sub-frame (1ms). The minimum output power shall not exceed the values specified in Table 6.3.2.1-1.

Table 6.3.2.1-1: Minimum output power

	Channel bandwidth / Minimum output power / Measurement bandwidth					
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Minimum output power	-40 dBm					
Measurement bandwidth	1.08 MHz	2.7 MHz	4.5 MHz	9.0 MHz	13.5 MHz	18 MHz

#### 6.3.2A UE Minimum output power for CA

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands and intra-band contiguous and non-contiguous carrier aggregation, the minimum controlled output power of the UE is defined as the transmit power of the UE per component carrier, i.e., the power in the channel bandwidth of each component carrier for all transmit bandwidth configurations (resource blocks), when the power on both component carriers are set to a minimum value.

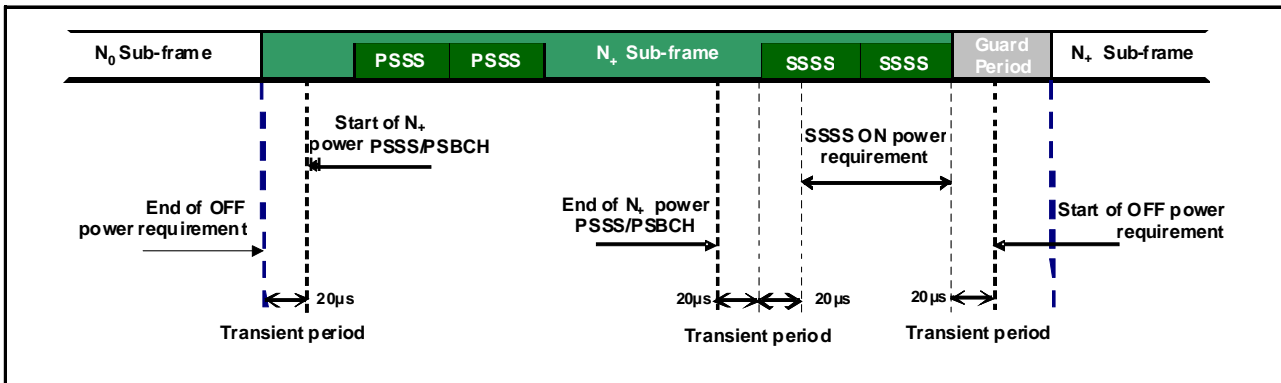


Figure 6.3.4G.1-1: PSSS/SSSS/PSBCH time mask for normal CP transmission for V2X Service

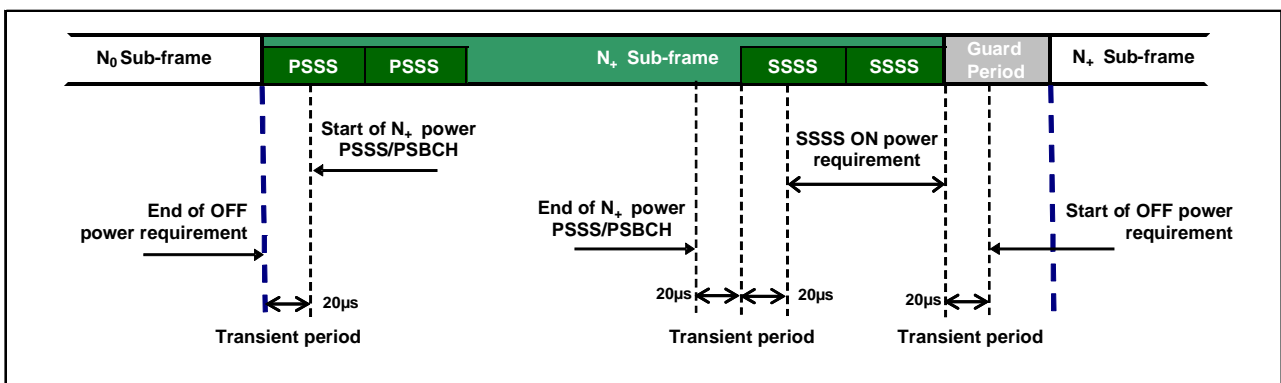


Figure 6.3.4G.1-2: PSSS/SSSS/PSBCH time mask for extended CP transmission for V2X Service

## 6.3.5 Power Control

### 6.3.5.1 Absolute power tolerance

Absolute power tolerance is the ability of the UE transmitter to set its initial output power to a specific value for the first sub-frame at the start of a contiguous transmission or non-contiguous transmission with a transmission gap larger than 20ms. This tolerance includes the channel estimation error (the absolute RSRP accuracy requirement specified in subclause 9.1 of TS 36.133). In the case of a PRACH transmission, the absolute tolerance is specified for the first preamble. The absolute power tolerance includes the channel estimation error (the absolute RSRP accuracy requirement specified in subclause 9.1 of TS 36.133).

#### 6.3.5.1.1 Minimum requirements

The minimum requirement for absolute power tolerance is given in Table 6.3.5.1.1-1 over the power range bounded by the Maximum output power as defined in subclause 6.2.2 and the Minimum output power as defined in subclause 6.3.2.

For operating bands under NOTE 2 in Table 6.2.2-1, the absolute power tolerance as specified in Table 6.3.5.1.1-1 is relaxed by reducing the lower limit by 1.5 dB when the transmission bandwidth is confined within  $F_{UL\_low}$  and  $F_{UL\_low} + 4$  MHz or  $F_{UL\_high} - 4$  MHz and  $F_{UL\_high}$ .

Table 6.3.5.1.1-1: Absolute power tolerance

Conditions	Tolerance
Normal	± 9.0 dB
Extreme	± 12.0 dB

## 7.3.1F Minimum requirements for UE category NB1 and NB2

### 7.3.1F.1 Reference sensitivity for UE category NB1 and NB2

The category NB1 and NB2 UE throughput shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channel as specified in Annex A.3.2 with received signal level as specified in Table 7.3.1F.1-1. Requirement in Table 7.3.1F.1-1 applies for any uplink configuration.

**Table 7.3.1F.1-1: Reference sensitivity for UE category NB1 and NB2**

Operating band	REFSENS [dBm]
1, 2, 3, 5, 8, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 28, 31, 66, 70	- 108.2

### 7.3.1F.2 Void

## 7.3.1G Minimum requirements (QPSK) for V2X

When UE is configured for E-UTRA V2X reception non-concurrent with E-UTRA uplink transmissions for E-UTRA V2X operating bands specified in Table 5.5G-1, the throughput shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channels as specified in Annexes A.8.2 with parameters specified in Table 7.3.1G-1.

**Table 7.3.1G-1: Reference sensitivity of E-UTRA V2X Bands (PC5)**

Channel bandwidth							
E-UTRA V2X Band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex Mode
47				-90.4		-87.5	HD
NOTE 1: Reference measurement channel is defined in A.8.2.							
NOTE 2: The signal power is specified per port.							

**Table 7.3.1.G-1a: Sidelink configuration for reference sensitivity of E-UTRA V2X Bands (PC5)**

E-UTRA Band / Channel bandwidth / $N_{RB}$ / Duplex mode							
E-UTRA V2X Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex Mode
47				50		98	HD

When UE is configured for E-UTRA V2X reception on V2X carrier con-current with E-UTRA uplink for inter-band E-UTRA V2X / E-UTRA bands specified in Table 5.5G-2, E-UTRA V2X sidelink throughput shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channels as specified in Annexes A.8.2 with parameters specified in Table 7.3.1G-2. Also the E-UTRA downlink throughput shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channels as specified in Annexes A.3.3.2.

For the UE which supports V2X in an operating band as specified in Table 5.5G-2, and the UE also supports a E-UTRA downlink inter-band con-current configuration in Table 7.3.1G-2A, the minimum requirement for reference sensitivity in Table 7.3.1G-1 and Table 7.3.1G-2 shall be increased by the amount given in  $\Delta R_{IB,c}$  in Table 7.3.1G-2A for the corresponding E-UTRA V2X band.

**Table 7.3.1G-2: Reference sensitivity for V2X Communication QPSK  $P_{REFSENS}$**

Inter-band V2X reception		Channel bandwidth							
E-UTRA V2X Band	E-UTRA or V2X band	E-UTRA band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex Mode
Band 47	Band 3	3	-101.7	-98.7	-97	-94	-92.2	-91	FDD

		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission Bandwidth Configuration	dBm	-22					
NOTE 1: Reference measurement channel is Annex A.6.2							

### 7.4.1F Minimum requirements for category NB1 and NB2

Category NB1 and NB2 UE maximum input level requirement is – 25 dBm. For this input level the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel as specified in Annex A.3.2.

### 7.4.1G Minimum requirements for V2X

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.8.2 with parameters specified in Table 7.4.1G-1.

**Table 7.4.1G-1: Maximum input level**

Rx Parameter	Units	Channel bandwidth					
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission Bandwidth Configuration	dBm	-	-	-	-22	-	-22
NOTE 1: Reference measurement channel is defined in Annex A.8.2.							

When UE is configured for simultaneous E-UTRA V2X sidelink and E-UTRA downlink reception for inter-band E-UTRA V2X / E-UTRA bands specified in Table 5.5G-2, the requirements in subclause 7.4.1G apply for the E-UTRA V2X sidelink reception and the requirements in subclause 7.4.1 apply for the E-UTRA downlink reception while all downlink carriers are active.

For intra-band contiguous multi-carrier operation, maximum input level is defined as the powers received at the UE antenna port over the Transmission bandwidth configuration of each CC, at which the specified relative throughput shall meet or exceed the minimum requirements for the specified reference measurement channel over each component carrier.

**Table 7.4.1G-2: Maximum input level for intra-band contiguous multi-carrier for V2X UE**

Rx Parameter	Units	V2X Bandwidth Class					
		A	B	C	D	E	F
Power in largest Transmission Bandwidth Configuration CC	dBm		-22 <sup>2</sup>				
Power in each other CC	dBm		-22+ $10\log(N_{RB,c} / N_{RB,largest\ BW})^2$				
NOTE 2: The requirement is applied for 2 carrier intra-concurrent receptions when 2 carrier transmission are activated at the same time							