(WCDMA)Part A : Tune-up

Content

1. Purpose

This panel gives the possibility to manage the mobile in the transmit mode.
This window includes both:
- all the parameters (frequency band, RF channel, RF level to get the desire antenna output power…) the user needs to make the mobile transmitting,
- all the parameters needed to define a Transmit ON/OFF burst,
- all the compensation table, temperature alignment parameters … to be able to align the mobile in production.

This Tx_commands user guide is describing:
- the characteristics of the transmit burst,
- all the parameters used in the transmit mode,
- the operating mode to make the mobile transmitting

2. General description

2.1. Frequency bands and channel arrangement

This project only have two frequency band as below:

Operating Band	UL Frequencies UE transmit, Node B receive	DL frequencies UE receive, Node B transmit
II	1850 -1910 MHz	1930 -1990 MHz
V	824 - 849 MHz	869-894 MHz

The nominal channel spacing is 5 MHz, but this can be adjusted to optimise performance in a particular deployment . The channel raster is 200 kHz, which for all bands except Band II means that the centre frequency must be an integer multiple of 200 kHz. In Band II , 12 additional centre frequencies are specified according to the table in 5.4.3 and the centre frequencies for these channels are shifted 100 kHz relative to the normal raster.

The carrier frequency is designated by the UTRA Absolute Radio Frequency Channel Number (UARFCN). The UARFCN values are defined as follows:

UARFCN definition

	UARFCN	Carrier frequency [MHz]
Uplink	$N_u = 5 * F_{uplink}$	0.0 MHz ≤ F_{uplink} ≤ 3276.6 MHz where F_{uplink} is the uplink frequency in MHz
Downlink	$N_d = 5 * F_{downlink}$	0.0 MHz ≤ $F_{downlink}$ ≤ 3276.6 MHz where $F_{downlink}$ is the downlink frequency in MHz

UARFCN definition (Band II additional channels)

	UARFCN	Carrier frequency [MHz]
Uplink	$N_u = 5 * (F_{uplink} – 1850.1 MHz)$	F_{uplink} =1852.5, 1857.5, 1862.5, 1867.5, 1872.5, 1877.5, 1882.5, 1887.5, 1892.5, 1897.5, 1902.5, 1907.5
Downlink	$N_u = 5 * (F_{downlink} – 1850.1 MHz)$	$F_{downlink}$ =1932.5, 1937.5, 1942.5, 1947.5, 1952.5, 1957.5, 1962.5, 1967.5, 1972.5, 1977.5, 1982.5, 1987.5

The following UARFCN range shall be supported for each paired band

UTRA Absolute Radio Frequency Channel Number (According to 3GPP TS 25.101)

Band	Uplink (UL) UE transmit, Node B receive		Downlink (DL) UE receive, Node B transmit	
	General	Additional	General	Additional
I	9612 to 9888	-	10562 to 10838	-
II	9262 to 9538	12, 37, 62, 87, 112, 137, 162, 187, 212, 237, 262, 287	9662 to 9938	412, 437, 462, 487, 512, 537, 562, 587, 612, 637, 662, 687
III	937 to 1288	-	1162 to 1513	-
IV	1312 to 1513	1662, 1687, 1712, 1737, 1762, 1787, 1812, 1837, 1862	1537 to 1738	1887, 1912, 1937, 1962, 1987, 2012, 2037, 2062, 2087
V	4132 to 4233	782, 787, 807, 812, 837, 862	4357 to 4458	1007, 1012, 1032, 1037, 1062, 1087

3. Parameters

3.1. Parameters used to define the transmit power

The following Power Classes define the nominal maximum output power. The nominal power defined is the broadband transmit power of the UE, i.e. the power in a bandwidth of at least (1+α) times the chip rate of the radio access mode.The period of measurement shall be at least one timeslot.

UE Power Classes (According to 3GPP TS 25.101)

Operating Band	Power Class 1		Power Class 2		Power Class 3		Power Class 3bis		Power Class 4	
	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)
Band I	+33	+1/-3	+27	+1/-3	+24	+1/-3	23	+2/-2	+21	+2/-2
Band II	-	-	-	-	+24	+1/-3	23	+2/-2	+21	+2/-2
Band III	-	-	-	-	+24	+1/-3	23	+2/-2	+21	+2/-2
Band IV	-	-	-	-	+24	+1/-3	23	+2/-2	+21	+2/-2
Band V	-	-	-	-	+24	+1/-3	23	+2/-2	+21	+2/-2

3.2. Parameters used to define the Open loop power control

Open loop power control is the ability of the UE transmitter to sets its output power to a specific value.
The UE open loop power is defined as the mean power in a timeslot or ON power duration, whichever is available.

Open loop power control tolerance

Conditions	Tolerance
Normal conditions	± 9 dB
Extreme conditions	± 12 dB

3.3. Parameters used to define inner loop power control in the uplink

Inner loop power control in the Uplink is the ability of the UE transmitter to adjust its output power in accordance with one or more TPC commands received in the downlink.

The power control step is the change in the UE transmitter output power in response to a single TPC command, TPC_cmd, derived at the UE.

The UE transmitter shall have the capability of changing the output power with a step size of 1, 2 and 3 dB according to the value of Δ_{TPC} or $\Delta_{RP\text{-}TPC}$, in the slot immediately after the TPC_cmd can be derived
a) The transmitter output power step due to inner loop power control shall be within the range shown in Table 6.4.
b) The transmitter average output power step due to inner loop power control shall be within the range shown in Table 6.5. Here a TPC_cmd group is a set of TPC_cmd values derived from a corresponding sequence of TPC commands of the same duration.

The inner loop power step is defined as the relative power difference between the mean power of the original (reference) timeslot and the mean power of the target timeslot, not including the transient duration. The transient duration is from 25μs before the slot boundary to 25μs after the slot boundary.

Transmitter power control range

TPC_ cmd	Transmitter power control range					
	1 dB step size		2 dB step size		3 dB step size	
	Lower	Upper	Lower	Upper	Lower	Upper
+ 1	+0.5 dB	+1.5 dB	+1 dB	+3 dB	+1.5 dB	+4.5 dB
0	-0.5 dB	+0.5 dB	-0.5 dB	+0.5 dB	-0.5 dB	+0.5 dB
-1	-0.5 dB	-1.5 dB	-1 dB	-3 dB	-1.5 dB	-4.5 dB

Transmitter aggregate power control range

TPC_ cmd group	Transmitter power control range after 10 equal TPC_ cmd groups				Transmitter power control range after 7 equal TPC_ cmd groups	
	1 dB step size		2 dB step size		3 dB step size	
	Lower	Upper	Lower	Upper	Lower	Upper
+1	+8 dB	+12 dB	+16 dB	+24 dB	+16 dB	+26 dB
0	-1 dB	+1 dB	-1 dB	+1 dB	-1 dB	+1 dB
-1	-8 dB	-12 dB	-16 dB	-24 dB	-16 dB	-26 dB
0,0,0,0,+1	+6 dB	+14 dB	N/A	N/A	N/A	N/A
0,0,0,0,-1	-6 dB	-14 dB	N/A	N/A	N/A	N/A

The UE shall meet the above requirements for inner loop power control over the power range bounded by the Minimum output power as defined in subclause 6.4.3, and the Maximum output power supported by the UE (i.e. the actual power as would be measured assuming no measurement error). This power shall be in the range specified for the power class of the UE in subclause 6.2.1.

3.4. Minimum output power

The minimum controlled output power of the UE is when the power is set to a minimum value
The minimum output power is defined as the mean power in one time slot. The minimum output power shall be less than –50 dBm.

4. Operating mode

4.1 How to transmit a Tch burst (Random data), in WCDMA bandII mode, channel 9400, at power control level max

Configuration of the common parameters

For Wcdma band II:
- band: " WCDMA bandII "
- channel: 9400
- RF level: All bits up

For Wcdma band V:
- band: " WCDMA band V"
- channel: 4183
- RF level: All bits up

Power on the mobile, connect the mobile.

4.2. How to stop Tx measurements:
On hook the mobile ,the test will be stop.

4.3. How to transmit a burst after modifying parameters.
Please note that each time a parameter (such as parameter used to shape the burst, or temperature compensation parameter), is changed, then the user have to: **download to flash** to validate the parameter modification. If the command is not performed, the old parameters are taken into account.

(LTE)Part A : Tune-up

Content

Minimum output power

1. Purpose

This panel gives the possibility to manage the mobile in the transmit mode.
This window includes both:
- all the parameters (frequency band, RF channel, RF level to get the desire antenna output power…) the user needs to make the mobile transmitting,
- all the parameters needed to define a Transmit ON/OFF burst,
- all the compensation table, temperature alignment parameters … to be able to align the mobile in production.

This Tx_commands user guide is describing:
- the characteristics of the transmit burst,

- all the parameters used in the transmit mode,
- the operating mode to make the mobile transmitting

2. General description

2.1. Frequency bands and channel arrangement

E-UTRA Operating Band	Uplink (UL) operating band BS receive UE transmit	Downlink (DL) operating band BS transmit UE receive	Duplex Mode
	$F_{UL\ low}$ – $F_{UL\ high}$	$F_{DL\ low}$ – $F_{DL\ high}$	
4	1710 MHz – 1755 MHz	2110 MHz – 2155 MHz	FDD

Table 5.6-1 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 5.6-1 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.

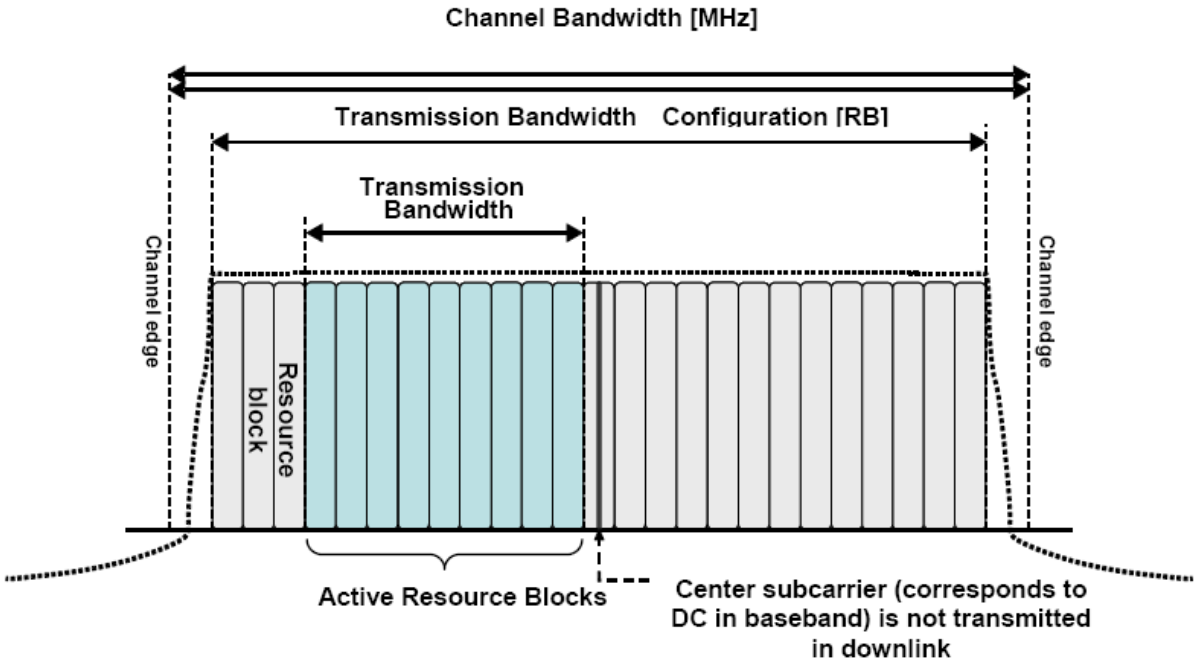


Figure 5.6-1 Definition of Channel Bandwidth and Transmission Bandwidth Configuration for one E-UTRA carrier

- Channel bandwidths per operating band

a) The requirements in this specification apply to the combination of channel bandwidths and operating bands shown in Table 5.6.1-1. The transmission bandwidth configuration in Table 5.6.1-1 shall be supported for each of the specified channel bandwidths. The same (symmetrical) channel bandwidth is specified for both the TX and RX path.

Table 5.6.1-1: E-UTRA channel bandwidth

E-UTRA band / channel bandwidth						
E-UTRA Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
4	Yes	Yes	Yes	Yes	Yes	Yes

b) The use of different (asymmetrical)) channel bandwidth for the TX and RX is not precluded and is intended to form part of a later release.

-Channel arrangement

Channel spacing

The spacing between carriers will depend on the deployment scenario, the size of the frequency block available and the
channel bandwidths. The nominal channel spacing between two adjacent E-UTRA carriers is defined as following:
Nominal Channel spacing = $(BW_{Channel(1)} + BW_{Channel(2)})/2$
where $BW_{Channel(1)}$ and $BW_{Channel(2)}$ are the channel bandwidths of the two respective E-UTRA carriers. The channel spacing can be adjusted to optimize performance in a particular deployment scenario.

Channel raster

The channel raster is 100 kHz for all bands, which means that the carrier centre frequency must be an integer multiple
of 100 kHz

Carrier frequency and EARFCN

The carrier frequency in the uplink and downlink is designated by the E-UTRA Absolute Radio Frequency Channel Number (EARFCN) in the range 0 - 65535. The relation between EARFCN and the carrier frequency in MHz for the
downlink is given by the following equation, where F_{DL_low} and $N_{Offs\text{-}DL}$ are given in table 5.7.3-1 and N_{DL} is the downlink EARFCN.

$F_{DL} = F_{DL\_low} + 0.1(N_{DL} – N_{Offs\text{-}DL})$

The relation between EARFCN and the carrier frequency in MHz for the uplink is given by the following equation where F_{UL_low} and $N_{Offs\text{-}UL}$ are given in table 5.7.3-1 and N_{UL} is the uplink EARFCN.

$F_{UL} = F_{UL\_low} + 0.1(N_{UL} – N_{Offs\text{-}UL})$

Table 5.7.3-1 E-UTRA channel numbers

E-UTRA Operating Band	Downlink			Uplink		
	F_{DL_low} (MHz)	$N_{Offs-DL}$	Range of N_{DL}	F_{UL_low} (MHz)	$N_{Offs-UL}$	Range of N_{UL}
4	2110	1950	1950 – 2399	1710	19950	19950 – 20399
NOTE: The channel numbers that designate carrier frequencies so close to the operating band edges that the carrier extends beyond the operating band edge shall not be used. This implies that the first 7, 15, 25, 50, 75 and 100 channel numbers at the lower operating band edge and the last 6, 14, 24, 49, 74 and 99 channel numbers at the upper operating band edge shall not be used for channel bandwidths of 1.4, 3, 5, 10, 15 and 20 MHz respectively.						

3. Parameters

3.1 UE Maximum Output Power

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

Table 6.2.2-1: UE Power Class

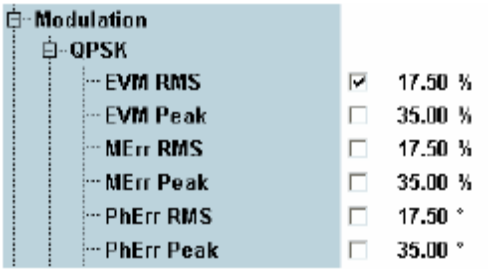
EUTRA band	Class 1 (dBm)	Tolerance (dB)	Class 2 (dBm)	Tolerance (dB)	Class 3 (dBm)	Tolerance (dB)	Class 4 (dBm)	Tolerance (dB)
1					23	±2		
2					23	±2[2]		
3					23	±2[2]		
4					23	±2		
Note 1: The above tolerances are applicable for UE(s) that support up to 4 E-UTRA operating bands. For UE(s) that support 5 or more E-UTRA bands the maximum output power is expected to decrease with each additional band and is FFS								
Note 2: For transmission bandwidths (Figure 5.6-1) confined within F_{UL_low} and F_{UL_low} + 4 MHz or F_{UL_high} – 4 MHz and F_{UL_high}, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB								
Note 3: $P_{PowerClass}$ is the maximum UE power specified without taking into account the tolerance								

3.2 Transmit Modulation Limits

A poor modulation accuracy of the UE transmitter increases the transmission errors in the uplink channel of the LTE network and decreases the system capacity. The Error Vector Magnitude (EVM) is the critical quantity to assess the modulation accuracy of an LTE UE.

According to 3GPP, the EVM measured at UE output powers _ `40 dBm and under normal operating conditions shall not exceed 17.5 % for QPSK-modulated signals and 12.5% for 16-QAM-modulated signals.

The EVM limits can be set in the configuration dialog, depending on the modulation scheme and along with limits for the other measured quantities.

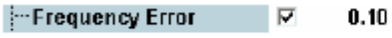


Modulation limit settings for QPSK

Characteristics	Refer to 3GPP TS 36.521, section...	Specified Limit
EVM (RMS)	6.5.2.1 Error Vector Magnitude (EVM)	≤ 17.5 % (QPSK) ≤ 12.5 % (16-QAM) tbd (64-QAM)

3.3 Frequency Error Limits

According to 3GPP, the UE modulated carrier frequency shall be accurate within ±0.1 PPM, compared to the nominal carrier frequency. The frequency error can be set in the configuration dialog, depending on the modulation scheme.

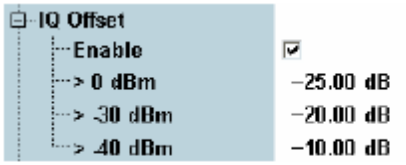


Frequency error limit settings

Characteristics	Refer to 3GPP TS 36.521, section...	Specified Limit
Frequency Error	6.5.1 Frequency Error	< 0.1 ppm

3.4 I/Q Origin Offset Limits

An I/Q origin offset is due to an additive sinusoid waveform at the frequency of the reference signal. The standard specifies the I/Q origin offset power limit as a function of the output power of the UE transmitter ("TX Power", see table below).
I/Q origin offset limits for three different TX power ranges can be set in the configuration dialog, depending on the modulation scheme.



I/Q origin offset limit settings

Characteristics	Refer to 3GPP TS 36.521, section...	TX Power	Specified Limit
I/Q Origin Offset	6.5.2.2 IQ-component	> 0 dBm 0 dBm to –30 dBm < –30 dBm to –40 dBm	–25 dBc –20 dBc –10 dBc

3.5 Inband Emissions Limits

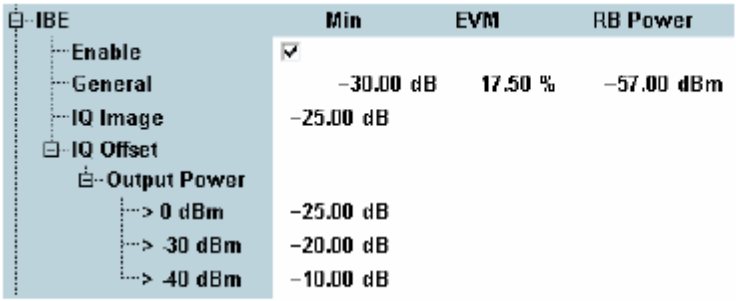
The inband emission is the relative UE output power of non-allocated resource blocks (RBs). Inband emissions are interferers in the subcarrier range that is potentially used by other connected UEs. 3GPP defines several limits for the relative inband emissions for a given non-allocated RB. An overview is given in the table below.
The general limit is considered for all non-allocated RBs. The IQ image limit is considered for non-allocated RBs at image frequencies of allocated RBs. And the IQ offset limit is considered for RBs at or adjacent to the carrier frequency. The limit to be applied is defined as the maximum of these three limits.

Category	Limit Value	Applicable RBs
General	$\max\left[\begin{array}{l} <\text{Min}>, \\ -25-10\cdot\log_{10}\left(\frac{<\text{All RB}>}{<\text{No RB}>}\right), \\ 20\cdot\log_{10}<\text{EVM}>-3-\frac{5\cdot(<\text{Offset}>-1)}{<\text{No RB}>}, \\ -<\text{RB Power}>-<\text{RB Power Meas}> \end{array}\right]$ dB	all non-allocated RBs
IQ Image	-25 dB	image frequencies
IQ Offset	-25 dBc to -10 dBc depending on TX Power see I/Q Origin Offset Limits	carrier frequency

The variables are defined as follows:

- <Min> = –30 (configurable)
- <All RB> = total number of RBs within the channel bandwidth (as defined by 3GPP, e.g. 75 RBs for 15 MHz channel bandwidth)
- <No RB> = number of allocated RBs in the slot
- <EVM> = maximum allowed EVM in percent (configurable), see Transmit Modulation Limits
- <Offset> = distance of the RB from the closest allocated RB
- <RB Power> = -57 (configurable)
- <RB Power Meas> = arithmetic mean value of the average powers in all allocated resource blocks in dBm/180 kHz

The general variables <Min>, <EVM> and <RB Power>, the IQ image limit and the IQ offset limits can be set in the configuration dialog, depending on the modulation scheme.



Inband emissions limit settings for QPSK

Characteristics	Refer to 3GPP TS 36.521, section...	Specified Limit
IBE Min	6.5.2.3 In-band emissions for non allocated RB	see table above

3.6 Occupied Bandwidth Limits

The occupied bandwidth is the width of a symmetric frequency interval around the nominal RF carrier frequency that contains 99 % of the total integrated power of the transmitted spectrum. According to 3GPP the occupied bandwidth shall be less than the (theoretical) channel bandwidth. The limit for the occupiped bandwidth can be set in the configuration dialog, depending on the channel bandwidth.

Occupied bandwidth limit setting for 20 MHz channel bandwidth

Characteristics	Refer to 3GPP TS 36.521, section...	Specified Limit
Occupied Bandwidth (OBW)	6.6.1 Occupied bandwidth	< channel bandwidth

3.7 Spectrum Emission Mask

The energy that spills outside the designated radio channel increases the interference with adjacent channels and decreases the system capacity. The amount of unwanted off-carrier energy is assessed by the out-of-band emissions (excluding spurious emissions) that are specified in terms of the spectrum emission mask and the Adjacent Channel Leakage power Ratio (ACLR).

The spectrum emission mask is divided into several out-of-band frequency areas. In the configuration dialog the start and stop frequencies of each area are defined relative to the edge of the assigned channel bandwidth.

Example: Assume 0 MHz as start frequency and 1 MHz as stop frequency for a channel bandwidth of 1.4 MHz. The resulting area ranges from +0.7 MHz to +1.7 MHz relative to the carrier frequency. As all ranges are symmetrical, it ranges also from -0.7 MHz to -1.7 MHz relative to the carrier frequency.

The spectrum emission mask is defined in the configuration dialog, depending on the channel bandwidth. You can define the borders of each area and set an upper power limit and the resolution bandwidth to be used.

Emission mask settings for 1.4 MHz channel bandwidth

The emission mask requirements are defined in 3GPP TS 36.521, section 6.6.2.1

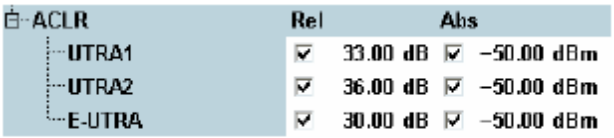
"Spectrum Emission Mask" and shown in the following table. The frequencies in the table header indicate the channel bandwidth. The frequency ranges in the first column are defined relative to the edge of the assigned channel bandwidth.

Freq. Range [MHz]	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	RBW
0 - 1	-10	-13	-15	-18	-20	-21	30 kHz
1 - 2.5	-10	-10	-10	-10	-10	-10	1 MHz
2.5 - 5	-25	-10	-10	-10	-10	-10	1 MHz
5 - 6		-25	-13	-13	-13	-13	1 MHz
6 - 10			-25	-13	-13	-13	1 MHz
10 - 15				-25	-13	-13	1 MHz
15 - 20					-25	-13	1 MHz
20 - 25						-25	1 MHz

Power limits in dBm, depending on frequency range and channel bandwidth

3.8 ACLR Limits

The Adjacent Channel Leakage power Ratio (ACLR) limits complement the Spectrum Emission Mask. The limits can be set in the configuration dialog, depending on the channel bandwidth.



ACLR limit settings

According to 3GPP the relative limit shall be evaluated only if the measured adjacent channel power is greater than –50 dBm (absolute limit). In that case the ACLR (i.e. the mean power in the assigned E-UTRA channel divided by the mean power in an adjacent channel) shall be greater than the limits listed in the following table. The ACLR must be evaluated for the first adjacent UTRA channel (UTRA1), the second adjacent UTRA channel (UTRA2) and the first adjacent E-UTRA channel (E-UTRA). The default settings shown in the figure above are suitable to check the 3GPP requirements. The relative limits are only evaluated if the corresponding absolute limit is exceeded. If you disable an absolute limit, the corresponding enabled relative limit is always evaluated.

Characteristics	Refer to 3GPP TS 36.521, section...	Relative Limit
ACLR	6.6.2.3 Adjacent Channel Leakage power Ratio	UTRA1: 33 dB UTRA2: 36 dB E-UTRA: 30 dB

3.9 Power Control

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 than20ms. This tolerance includes the channel estimation error (the absolute RSRP accuracy requirement specified in clause
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 clause 9.1 of TS36.133).

Absolute power tolerance

Conditions	Tolerance
Normal	± 9.0 dB
Extreme	± 12.0 dB

3.10 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.

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

4. Operating mode

4.1 How to transmit a Tch burst (Random data), in LTE Band4 mode, channel 20175

Configuration of the common parameters

For LTE BAND 4
- band: " LTE BAND 4 "
- channel: 20175

- RF level: Max power

4.2. How to stop Tx measurements:
On hook the mobile ,the test will be stop.

4.3. How to transmit a burst after modifying parameters.
Please note that each time a parameter (such as parameter used to shape the burst, or temperature compensation parameter), is changed, then the user have to: **download to flash** to validate the parameter modification. If the command is not performed, the old parameters are taken into account.