Tune-up procedure

During manufacturing each phone is individually calibrated. Measurement is performed in a fully calibrated setup using an Agilent 8960 base station simulator (system tester). Measurement procedure is outlined below:

Measurement Procedure:

1. Set the phone to operational voltage and on a predefined band class and channel.

2. The maximum output power is measured when the power control bit is set as all UP bits. The UMTS/GSM/LTE RF output power will be adjusted equal or lower than tested power shown in the test report.

3. The WIFI specific RF characteristics were measured by spectrum analyzer and power meter.

The user has no possibility to change these settings.

Tune up procedure shall be over the power range or at specific operating power levels.

1. It must provide an operational voltage (3.6 ~ 4.34V DC) to turn on the device and on one certain channel in service mode by means of company proprietary software.

2. The Base station simulator measures the WWAN device specific RF characteristics.

3. The maximum gains of each individual device are adjusted until the target value met.

Technology/Band	***Mode***	***Target Power and Tolerance*** **(dBm)**
GSM 850	**GSM850**	33.5±0.5 dBm
	GPRS8,(GMSK)	33.5±0.5 dBm
	GPRS12,(GMSK)	28.5±0.5 dBm
	EDGE8,(8PSK)	26.5±0.5 dBm
	EDGE12,(8PSK)	23.5±0.5 dBm
GSM 1900	**GSM1900**	31.0±0.5 dBm
	GPRS8,(GMSK)	30.6±0.5 dBm
	GPRS12,(GMSK)	27.0±0.5 dBm
	EDGE8,(8PSK)	25.5±0.5 dBm
	EDGE12,(8PSK)	23.1±0.5 dBm
WCDMA Band II	**RMC12.2K**	24.0±0.5 dBm
WCDMA Band V	**RMC12.2K**	24.0±0.5 dBm
LTE band 4	**QPSK/16QAM**	23.5±0.5 dBm
LTE band 7	**QPSK/16QAM**	23.5±0.5 dBm
LTE band 17	**QPSK/16QAM**	24.2±0.5 dBm

WIFI:

2.4G	**802.11b**	**802.11g**
	18.0±0.5 dBm	16.0±0.5 dBm
	802.11n HT20	
	12.0±0.5 dBm	
5G Band I	**802.11a**	**802.11n HT20**
	12.5±0.5 dBm	12.5±0.5 dBm
	802.11n HT40	
	13.0±0.5 dBm	
5G Band II	**802.11a**	**802.11n HT20**
	12.5±0.5 dBm	12.5±0.5 dBm
	802.11n HT40	
	13.0±0.5 dBm	
5G Band III	**802.11a**	**802.11n HT20**
	12.5±0.5 dBm	12.5±0.5 dBm
	802.11n HT40	
	13.0±0.5 dBm	
5G Band IV	**802.11a**	**802.11n HT20**
	13.0±0.5 dBm	13.0±0.5 dBm
	802.11n HT40	
	12.5±0.5 dBm	

Then these appropriate gain settings are stored in each device individually. The user has no possibility to change these settings later on, and during manufacturing each device will be individual calibrated. The measurement is done in fully calibrated setup, which is based on the base station simulator. Furthermore, the highest power level is verified afterwards in a call measurement on the middle channel.

For HSUPA, the following table lists the MPR target values:

HSPA MPR Targets	
HSUPA 3GPP Subtest	**Band II / V MPR Target (dB)**
1	0
2	2
3	1
4	2
5	0

When evaluating HSPA power reduction, HSPA transmit power measurements should be referenced to HSDPA subtest 1 (CM=1, MPR=0) per Note 2 of TS 3GPP 34.121 Table C.11.1.3.

Based on the hardware characteristics and HSUPA measurement error inherent in the 34.121 procedure, HTC Corporation expects HSUPA transmit power result to be within **+/-1.0 dB** of the expected MPR target values.

Remark: the CM calculation is based on note2 of TS 3GPP 34.121, and the MPR is also based on the commercial Power Amplifier characteristic in this project. This is also traded off by transceiver setting and Power Amplifier tuning. Of course, we also could guarantee the mass production criteria will be in this setting.

The cubic metric (CM) below is defined by 3GPP [4] to be used for estimating the MPR. And the power reduction is computed as MAX (CM-1, 0), where

$$CM = CEIL\{ [20 * \log10 ((v\_norm^3)_{rms}) - 20 * \log10 ((v\_norm\_ref^3)_{rms})] / k, 0.5 \}.$$

The function CEIL{ x, 0.5 } means rounding upwards to the closest 0.5dB, i.e. CM $\in$ [0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5].

The computation of CM, as given above, depends on the HSUPA configuration. In particular, the configuration of DPDCH to DPCCH power ratio, the HS-DPCCH to DPCCH power ratio, the E-DPDCH to DPCCH power ratio, the number of E-DPDCH code channels, and the spreading factors on each E-DPDCH channel. These power ratios further depend on the mobility environment and power control behavior, etc.

2. HSUPA
   3GPP TS 34.121-1
   User Equipment (UE) conformance specification; Radio transmission and reception (FDD); Part 1: Conformance specification
   Annex C (normative): Measurement channels
   C.11.1 UL reference measurement channel for E-DCH tests
   Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH
   Sub-test 1 (CM=1.0dB, MPR=0.0dB)

LTE Maximum Power Reduction ("MPR")

The EUT enables maximum power reduction in accordance with 3GPP 36.101. The LTE MPR targets are shown in the table below and are within the values allowed by 3GPP 36.101. The MPR settings are configured during the manufacture process and are not configurable by the network, carrier, or end user.

Maximum Power Reduction (MPR) for Power Class 3

Modulation	Channel bandwidth / Transmission bandwidth configuration [RB]						3GPP 36.101 requirement MPR (dB)	MPR setting (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz		
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1	1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1	1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2	2

HTC Corporation expects LTE transmit power result to be within **0~1dB** of the expected MPR target values.