

Tune-Up Procedure

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 burst,
- All the compensation table 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

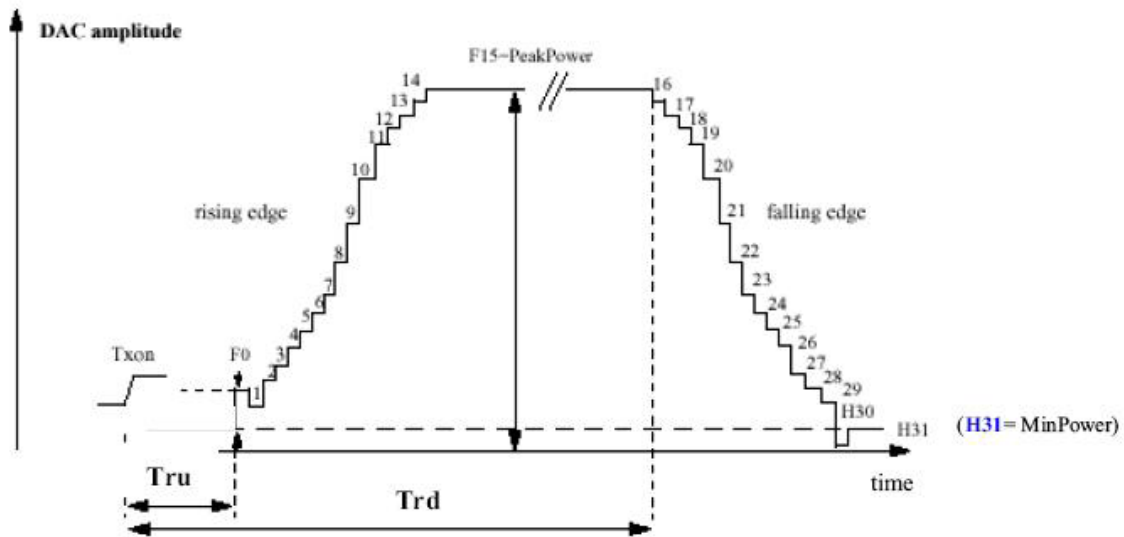
2.1 Characteristics of the transmit burst

The power levels and the shape of a transmit burst are controlled by the power amplifier controller integrated in the main chip, The burst is generated by a 10-bit DAC from the main chip as shown below:

The ramping shape is referenced with the rising edge of Tx-ON (from the Baseband).

There are two types of parameters define the transmit burst: the first one define the shapes of the burst, and the second one define the temporal position of the burst.

The rising and the falling edge of the transmit burst are determined by a set of 32 DAC code values $n = 0 \dots 31$.



$$\text{Tru} = \text{TxTRUDefault} + \Delta \text{TRU}_P + \Delta \text{TRU}_T$$

$$\text{Trd} = \text{TxTRD_NBDefault} + \Delta \text{TRD}_P \text{ (for a normal burst).}$$

$$\text{Trd} = \text{TxTRD_ABDefault} + \Delta \text{TRD}_P \text{ (for an access burst).}$$

2.2 GPRS Data Transfer

GSM mobile phones use a Time Division Multiple Access (TDMA) scheme to transmit data. The TDMA format contains eight time slots. The handset power amplifier typically transmits in one or two or three or four of these up time slots. To prevent interference between cell phones, the time mask profile as specified is very restricted. To meet the GSM time mask, the output power of the PA needs to ramp up and down very quickly while staying within the time mask and not generating extraneous frequency bursts due to too abrupt ramp profiles. As described before, the Vramp input value sets the RF output power. By applying a certain ramp profile to the Vramp pin, the power level (Pout) of the PA is set to obtain the required time mask. A time mask of the PA's output power is displayed. The time mask meets the limits (displayed by green lines) over a wide range of temperature, voltage and load variations.

3 Parameters

F (n) are values coming from the DAC to shape the transmit burst. Some F(n) values have a corresponding

Parameter used in the TAT to align the mobiles.

Parameter used in TAT = [F (n)].

3.1 Parameters used to shape the burst

- **H0** = [F (1)] controls the rate at which energy is given to the control loop at the beginning of the ramp. This energy is needed to bring the PA system control in a closed loop. This is the second code coming from the PA.
- **PeakPow**= [F (15)] corresponds to the peak power of the transmit burst.
- **H30** = [F (30)] corresponds to the last ramping coefficients used to shape the ramp.
- **MinPow**= [F (31)] is a fixed parameter and corresponds to the Code Start of the MT6835V specification. It ensures a fast discharge of accumulated energy during the open loop mode in the summing node.

3.2 Parameters used to define the temporal position of the burst

3.2.1 Optimum position of the burst

This parameter is **TRU** (or Δ **TRU_P**) on the panel, in the Optimal Burst. This is the burst starting time correction, which is optimised for each power control level. (Note that **_P** means that the parameter is a power compensation parameter).

3.2.2 Optimum length of the burst

This parameter is **TRD** (or Δ **TRD_P**) on the panel, in the Optimal Burst. This is the burst length compensation, which is optimized for each power control level. (Note that **_P** means that the parameter is a power compensation parameter).

3.3.3 Tune-Up procedure of WCDMA Tx Power

PA is developed for Wideband Code Division Multiple Access(WCDMA) applications. It has three power modes, low power mode, medium power mode and high power mode. There are different power gain corresponds to the different power mode. The power mode can be controlled by PA. In order to support open/closed loop power control in WCDMA, the output power of PA must be detected quickly by the transceiver, then it can adjust the output power finely to meet the standard requirements.

For MT6197W Gplatform, there are four parameters defined in the calibration stage in production and stored in the NAND flash. The four parameters are PA gain in low power mode, PA gain in medium power mode, PA gain in high power mode, and power detector gain in high power mode.

3.4 Tune-Up procedure of Frequency

TSX provides clock for the transceiver. If it finds a frequency error, it can adjust the output frequency of TSX to correct the frequency error. Transceiver adjusts the load capacitor of TSX to change its output frequency.

How to determine the value of the final AFC use two values, initial-AFC and slope, to mathematic the final AFC. So the initial-AFC and slope must be determined firstly. The two values are defined in the calibration stage in production and stored in the NAND flash.

4 Operating mode

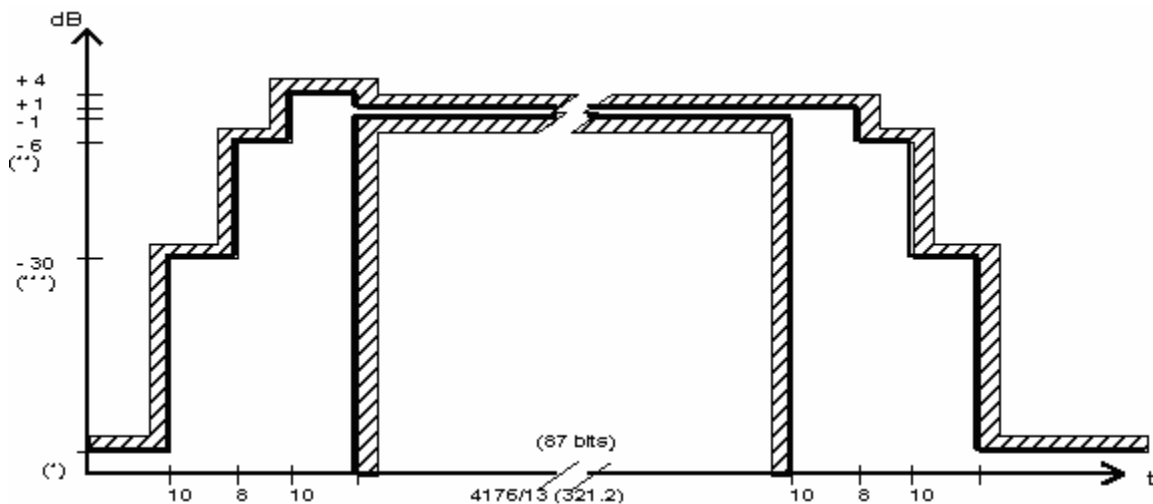
4.1 How to transmit a Tch burst (Random data), in PCS1900 mode, at power control level max:

PCS 1900:

Connect the mobile with special software, Configuration of the common parameters:

- Band: PCS1900,
- Channel: 661,
- RF level: 0,
- Burst select: Mode Tch Random

Press STAR command to start continuous TX, you can check the burst with CMU200 or Agilent 8960; it must fit the curve below.



The request of the Power vs. Time.

4.2 How to stop Tx measurements:

Press STOP command to stop the TX.

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) 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.

5 Purpose

This panel gives the description of the Frequency plan.

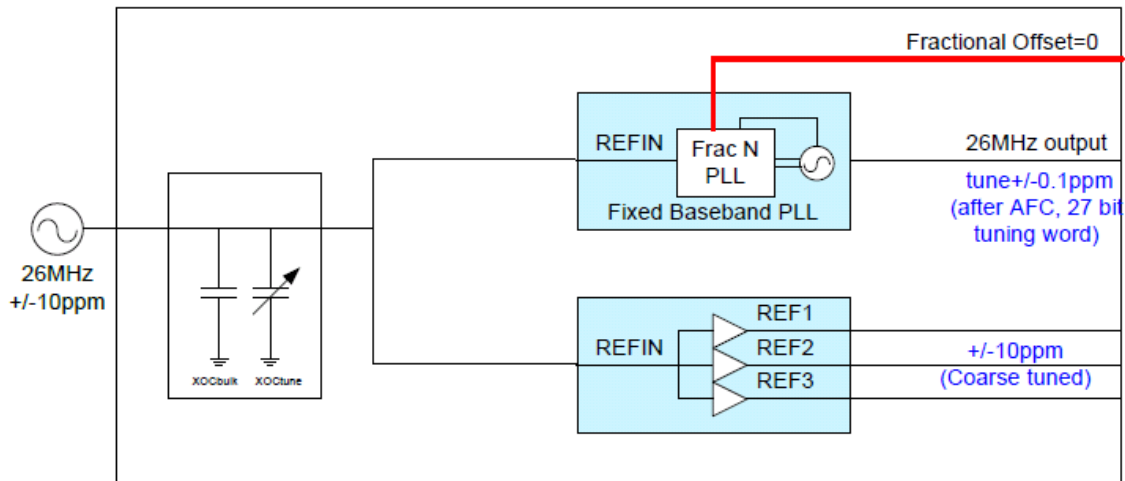
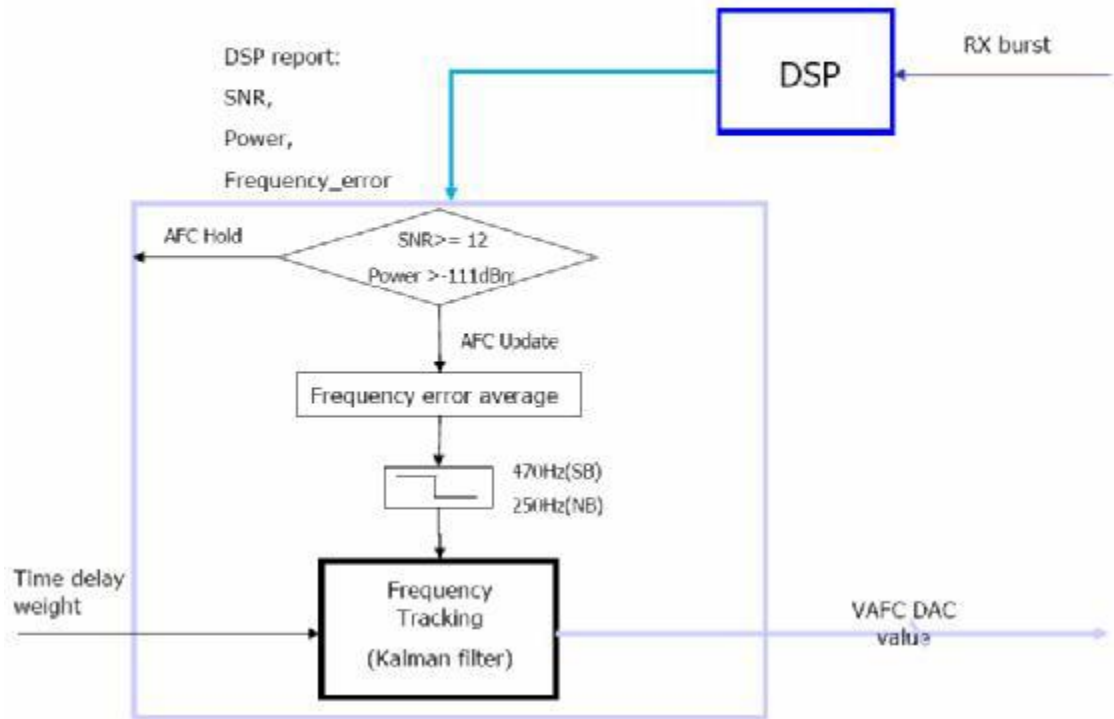
This window includes both:

- Automatic frequency control (AFC),
- Static frequency error and range,
- Dynamic frequency error and range

6 Automatic frequency control

Before a handset is allowed to transmit any signals, it needs to first receive the FSB signal from the base station, demodulate and decode it using its own local oscillator, map it to the constellation plane, calculate the frequency offset, and adjust the local oscillator accordingly, until 0.1ppm of frequency accuracy is achieved. This frequency correction loop is called the automatic frequency control (AFC) loop in GSM standard. The process as below:

Automatic frequency control (AFC)



Reference clock XO module which is used to provide 26MHz reference clock to RF internal circuitries and three 26MHz reference clocks to peripheral.

7 Static frequency error and range

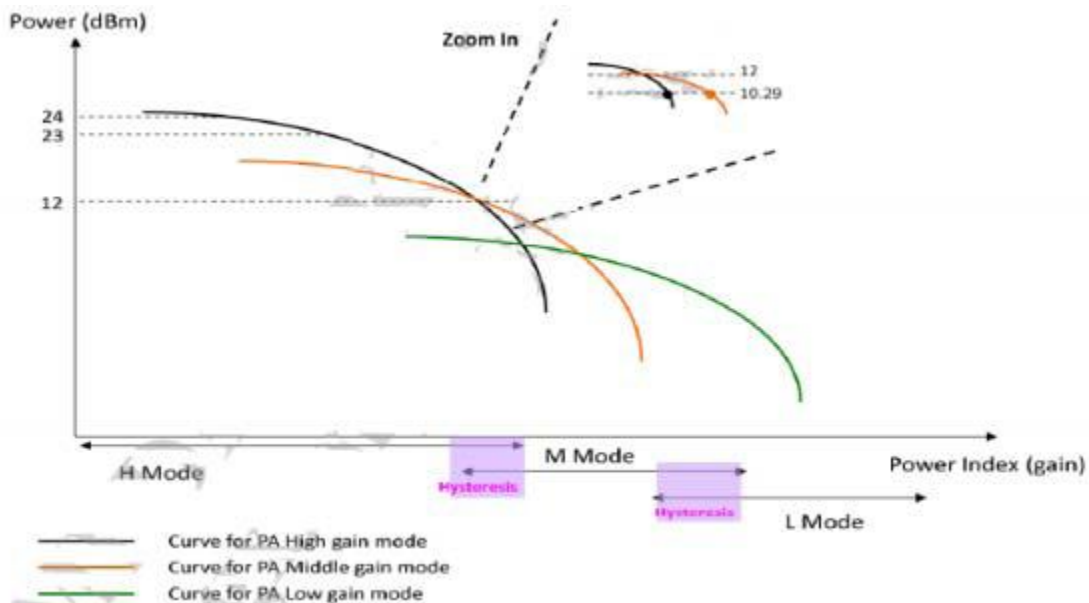
- Factors of static frequency error: manufacturing frequency tolerance in crystal at room temperature, aging,
- Static frequency error is compensated for using 6bits programming capacitor array (CAP ID).
- The static frequency range of capacitor array (CAP ID=0 to63) must larger than 34ppm(+-17ppm).
- The static range depends on crystal 's TS and CL
- The capacitor array calibration is done in production testing by setting the AFC DAC to mid-scale(4196) and adjusting CAP ID to the setting that give closest to 0 ppm error(finish by test software). This CAP ID value is then stored in Flash memory and rewritten each time the TSXO is initialized.

8. TPC level setting

The LTE TPC profile can be divided into two parts. The first part is PA control settings which are used to config the 8-level parameters and composed of PA mode, PRF (Upper limit of this level), PA Gain, DC2CDC level, Vbias DAC, Vm1, Vm2 and hysteresis (Start1/End1:high/middle intersection, Start2/End2: middle/Low intersection). The second part is TX compensation settings which are used to cogfig the compensation values including coupler loss for 3 PA modes, compensation by temperature foe 3 PA modes, subband compensation, PA compensation, and Power Detector (coupler loss) subband compensation.

User can unload or download these relevant values by sub-band from or to flash. User can load or save these values form or files in PC, too.

The hysteresis zone are used to decrease the LNA mode switch frequency as shown in the following figure.



LTE/5G NR Hysteresis

TX Power from high to low:

When $p_{out} \geq \text{Start1}$ (12dBm), PA work at high gain mode; When $p_{out} < \text{Start1}$ (12dBm), PA work at middle gain mode; TX Power form low to high:

When $p_{out} \geq \text{End1}$ (12dBm), PA work at high gain mode; When $p_{out} < \text{End1}$ (12dBm), PA work at middle gain mode;

Maximum Target Output Power

Mode/Band	Max. Target Power(dBm)		
	Low Channel	Middle Channel	High Channel
GSM 850	34.5	34.5	34.5
GPRS 850 1 Slot	34.4	34.4	34.4
GPRS 850 2 Slots	34	34	34
GPRS 850 3 Slots	30.6	30.6	30.6
GPRS 850 4 Slots	29.1	29.1	29.1
EDGE 850 1 Slot	27.2	27.2	27.2
EDGE 850 2 Slots	26.1	26.1	26.1
EDGE 850 3 Slots	24.2	24.2	24.2
EDGE 850 4 Slots	23.2	23.2	23.2
GSM 1900	31.5	31.5	31.5
GPRS 1900 1 Slot	31	31	31
GPRS 1900 2 Slots	30.9	30.9	30.9
GPRS 1900 3 Slots	26.9	26.9	26.9
GPRS 1900 4 Slots	25.3	25.3	25.3
EDGE 1900 1 Slot	25.8	25.8	25.8
EDGE 1900 2 Slots	24.7	24.7	24.7
EDGE 1900 3 Slots	22.7	22.7	22.7
EDGE 1900 4 Slots	21.7	21.7	21.7
WCDMA Band 2	23.4	23.4	23.4
HSDPA	21.1	21.1	21.1
HSUPA	20.9	20.9	20.9
HSPA+	21	21	21
WCDMA Band 5	23.2	23.2	23.2
HSDPA	20.7	20.7	20.7
HSUPA	20.6	20.6	20.6
HSPA+	20.7	20.7	20.7
LTE Band 2	23.4	23.4	23.4
LTE Band 5	23.1	23.1	23.1
LTE Band 12	23.2	23.2	23.2
LTE Band 13	22.9	22.9	22.9
LTE Band 41	24.8	24.8	24.8
5G NR n41	25.6	25.6	25.6
5G NR n66	17.8	17.8	17.8
2.4G WLAN (802.11b)	14.8	14.8	14.8
2.4G WLAN (802.11g)	14.3	14.3	14.3
2.4G WLAN (802.11 n20)	13	13	13

2.4G WLAN (802.11 n40)	10.9	10.9	10.9
5.2G WLAN (802.11a)	13.2	13.2	13.2
5.2G WLAN (802.11 ac20)	13.1	13.1	13.1
5.2G WLAN (802.11 ac40)	14.1	/	14.1
5.2G WLAN (802.11 ac80)	/	11	/
5.8G WLAN (802.11a)	16.1	16.1	16.1
5.8G WLAN (802.11 ac20)	16	16	16
5.8G WLAN (802.11 ac40)	15.9	/	15.9
5.8G WLAN (802.11 ac80)	/	13	/
Bluetooth(BDR/EDR)	0	0	0
BLE_1M	3	5.5	4.5
BLE_2M	3	5.5	4.5