

# **U5E Tune-Up Procedure**

U5E Tune-Up Procedure .....	1
1 Purpose .....	2
2 General descriptions .....	2
2.1 Characteristics of the transmit burst.....	2
2.2 GPRS/EDGE Data Transfer.....	3
3 Parameters .....	4
3.1 Parameters used to shape the burst .....	4
3.2 Parameters used to define the temporal position of the burst .....	4
4 Operating mode.....	5
4.1 How to transmit a $T_{ch}$ burst (Random data), in PCS1900 mode, at power control level max:.....	5
4.2 How to stop $T_x$ measurements: .....	5
4.3 How to transmit a burst after modifying parameters .....	5
5 Purposes .....	6
6 Automatic frequency controls.....	6
7 Static frequency error and range.....	7
8 Output Power .....	8
8.1 BAND GSM850.....	8
8.2 BAND PCS1900.....	8
8.3 GPRS Output Power .....	9
8.4 EGPRS Output Power.....	9
9 Tune-Up WCDMA.....	10
9.1 UMTS band 5 $T_x$ .....	10
9.2 WCDMA OUTPOWER.....	11

# **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:

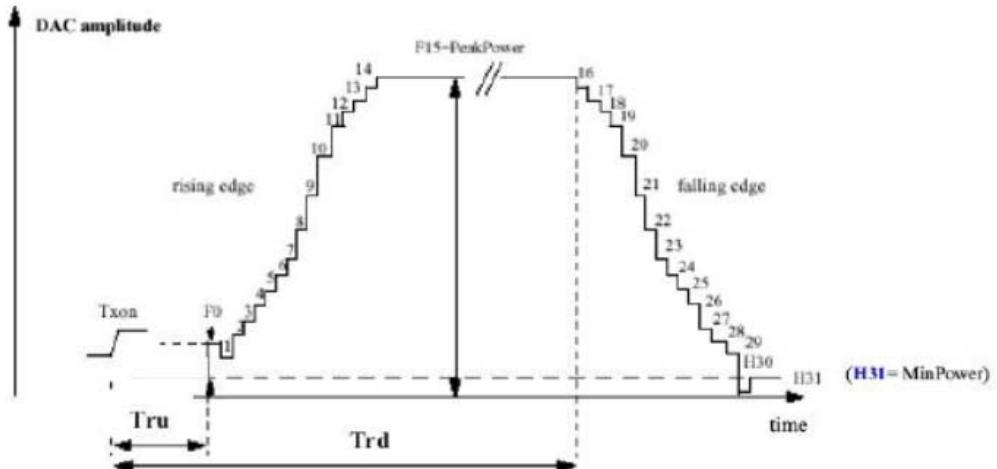
- The characteristics of the transmit burst,
- All the parameters used in the transmit mode,
- The operating mode to make the mobile transmitting

# **2 General descriptions**

## **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 ACPW. The burst is generated by a 10-bit DAC from the ACPW 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  $n = 0 \dots 31$ .



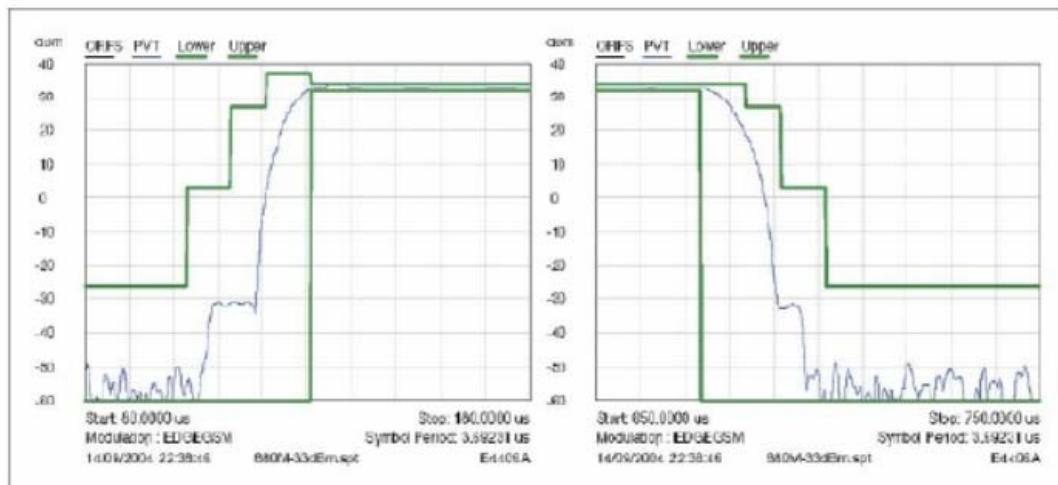
$$Tru = TxTRUDefault + \Delta TRU_P + \Delta TRU_T$$

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

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

## 2.2 GPRS/EDGE 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 up to four uplink slot. 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 APCW.
- 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 AP6684 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  $\Delta$ 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  $\Delta$ 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).

## 4 Operating mode

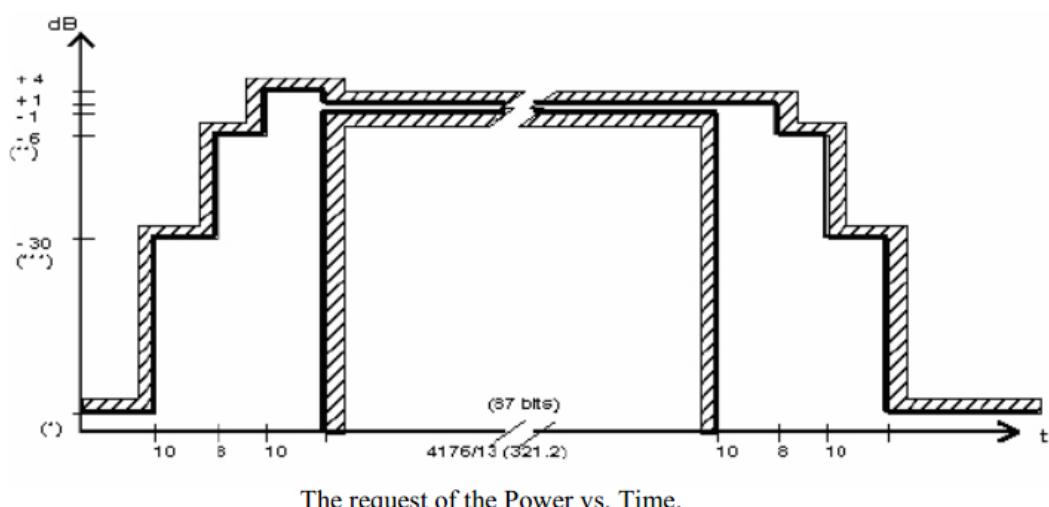
### 4.1 How to transmit a $T_{ch}$ burst (Random data), in PCS1900 mode, at power control level max:

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.



### 4.2 How to stop $T_x$ 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.

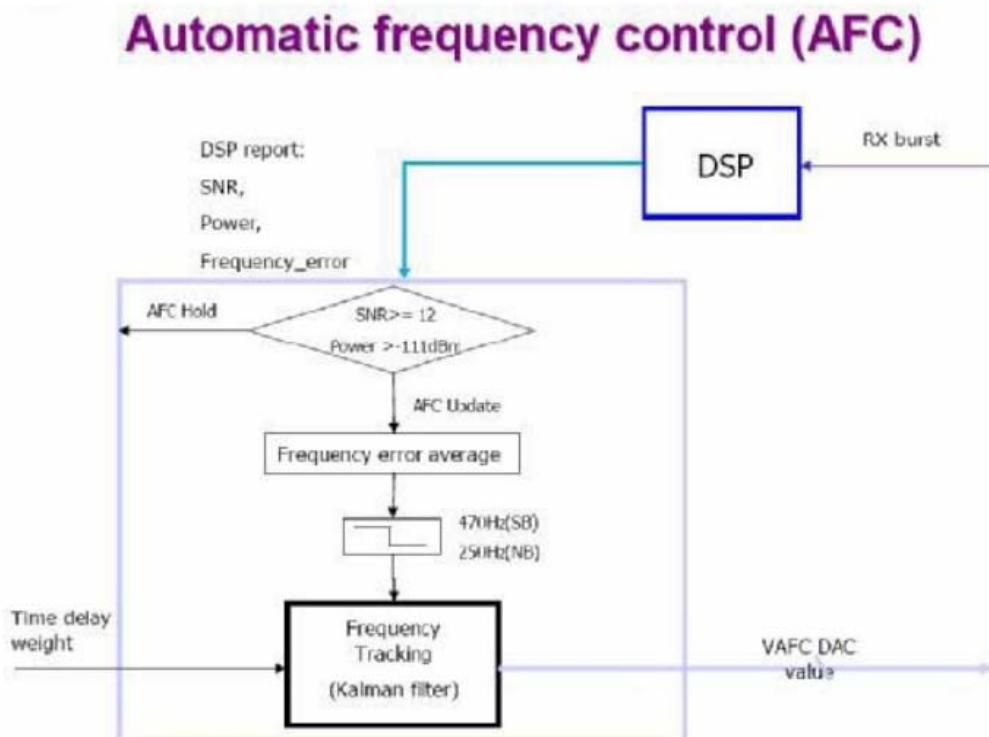
## 5 Purposes

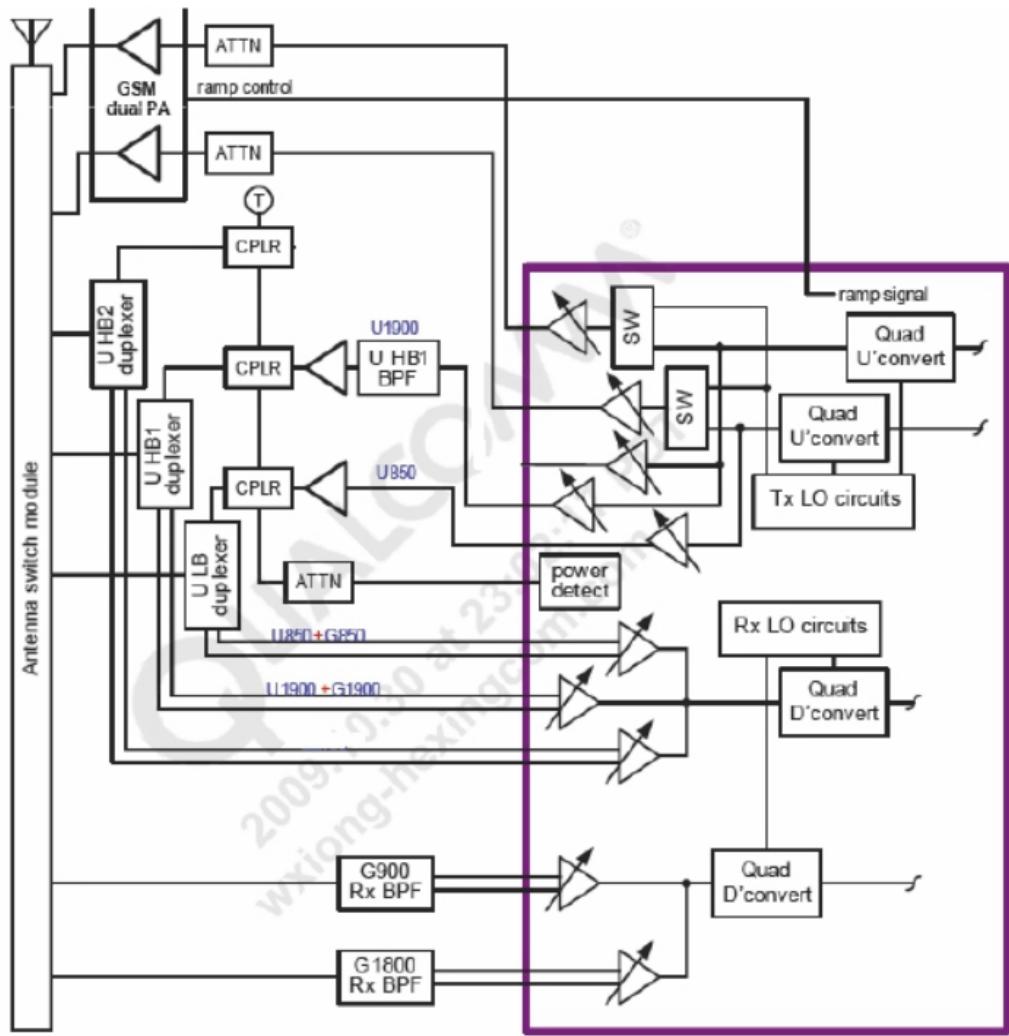
This panel gives the description of the Frequency plan. This window includes both:

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

## 6 Automatic frequency controls

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:





In MT8389, it uses an AFC signal from baseband (DAC) to finish automatic frequency control.

## 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 to MT6167 each time the TCXO is initialized.

## 8 Output Power

### 8.1 BAND GSM850

Power Level Target Unit Tolerance

Power level	Power peak value(dBm)	limit
5	30.9	+/-2dB
6	29	+/-3dB
7	27	+/-3dB
8	25	+/-3dB
9	23	+/-3dB
10	21	+/-3dB
11	19	+/-3dB
12	17	+/-3dB
13	15	+/-3dB
14	13	+/-4dB
15	11	+/-4dB
16	9	+/-4dB
17	7	+/-4dB
18	5	+/-5dB
19	3	+/-5dB

### 8.2 BAND PCS1900

Power Level Target Unit Tolerance

Power level	Power peak value(dBm)	limit
1	27.8	+/-2dB
2	26	+/-3dB
3	24	+/-3dB
4	22	+/-3dB
5	20	+/-3dB
6	18	+/-3dB
7	16	+/-3dB
8	14	+/-3dB
9	12	+/-3dB
10	10	+/-4dB
11	8	+/-4dB
12	6	+/-4dB
13	4	+/-4dB
14	2	+/-5dB
15	0	+/-5dB

## **8.3 GPRS Output Power**

GSM850 & PCS1900 allowed maximum output reduction in a multislots Configuration

GSM850

Multislots	Conducted power (dBm)	Limit
1	30.9	+/-2dB
2	29.9	+/-2dB
3	28.1	+/-2dB
4	27.2	+/-2dB

PCS1900

Multislots	Conducted power (dBm)	Limit
1	27.2	+/-2dB
2	26.1	+/-2dB
3	24.0	+/-2dB
4	23.3	+/-2dB

## **8.4 EGPRS Output Power**

GSM850 & PCS1900 allowed maximum output reduction in a multislots Configuration

GSM850

Multislots	Conducted power (dBm)	Limit
1	25.3	+/-2dB
2	25.3	+/-2dB
3	25.3	+/-2dB
4	25.3	+/-2dB

PCS1900

Multislots	Conducted power (dBm)	Limit
1	22.5	+/-2dB
2	22.4	+/-2dB
3	22.4	+/-2dB
4	22.4	+/-2dB

## 8.5 WIFI Output Power

IEEE 802.11b,g,n20,n40, target Unit Tolerance

Mode	The Tune-up Maximum power(Customer Declared)(dBm)	Range(dBm)
IEEE 802.11b	9.70±0.4	9.30~10.10
IEEE 802.11g	9.60±0.3	9.30~9.90
IEEE 802.11n-HT20	9.60±0.3	9.30~9.90
IEEE 802.11n-HT40	9.60±0.3	9.30~9.90

## 8.6 Bluetooth Output Power

Bluetooth, target Unit Tolerance

Mode	The Tune-up Maximum power(Customer Declared)(dBm)	Range(dBm)
Bluetooth	1.50±0.7	0.80~2.20
BLE	-4.70±0.6	-5.30~-4.10

## 9 Tune-Up WCDMA

### 9.1 UMTS band 5 T<sub>x</sub>

1. Inspect the orientation of the U15 and the surrounding components.
2. If the orientation is wrong, record the findings in the FA report and complete the repair steps as appropriate.
3. Using a microscope, inspect the solder quality of the above and the surrounding components.
4. If soldering problems are found, record the findings and repair as appropriate.
5. Install and power up the UUT into the debug fixture according to the UUT installation.
6. Set the spectrum analyzer to:  
Frequency 836.4 MHz

Span 1 MHz  
REF LVL 0 dBm  
RES BW = AUTO

7. Connect the passive RF probe to the spectrum analyzer.
8. Start the UMTS 850 Tx with maximum power in QRCT FTM. Match the frequency with the one set in the spectrum analyzer.
9. Check the current drawn from the power supply.
10. Measure the power detector range (HDET) reading that is sent to the MSM device in the SSBI bus.
11. Verify the power level in QRCT. Check the power detection circuitry to verify that the couplers are working correctly by comparing with a golden unit.
12. Measure the Tx Power at SW701. Compare that with a golden unit.
13. Retest the UUT in a call-test setup. A passing Max Power but failing ACLR may point to a coupling issue or a PA material issue, while very low output maximum power can point to a component connector along the Tx chain or a PA soldering issue.
14. If not, measure the power at C64 and check the PA output. Compare that with a golden unit. Check section for power detection details.
15. Measure power at C210. If power is low comparing to a golden unit, trace the power level in the chain of components including FL10 and surrounding listed in.
16. Check the spectrum output against golden unit's and record abnormal spurious response.
17. Make sure that TxIQ is working. Please refer to the section for details

## 9.2 WCDMA OUTPOWER

### 9.2.1 WCDMA band 5 OUTPOWER

RF Test items	Channel	Frequency (MHz)	Specification
Minimum output Power	4132	826.4	<-50dBm
	4183	836.6	<-50dBm
	4233	846.6	<-50dBm
Maximum output Power	4132	826.4	$20.7 \pm 2$ dBm
	4183	836.6	$20.7 \pm 2$ dBm
	4233	846.6	$20.7 \pm 2$ dBm