Title: Power Tune up procedure for LE910Cx Products Family

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1 Introduction

1.1 Scope

The aim of this document is the description of Tune Up Procedure for the LE910Cx Products family.

1.2 Applicability

This Technical Note is related to the following products: **N/A**

Product	Supported 2G Bands	Supported 3G bands	Supported LTE bands

2 RF power structure and function

2.1 LTE TX Tune Up

LTE Tx tune up is being done with QCOMM tool and performed within two steps:

- Tx linearization & Freq compensation.
- Tx Limiting & Freq Compensation

2.1.1 Tx linearization

The unit transmits in a reference channel (mid) and perform TX sweep on 38-77 & 10-68 AGC values in 2 PA gain states (1, 0) Looking for the max & min power at each PA state using the best HDET value. After completing calibration on the reference channel frequency compensation being done on 3 channels across the band for the 2 gain states (1, 0).

2.1.2 Tx Limiting and Freq Compensation.

The unit transmits in a reference channel searching for the correct bias & HDET values in order to limit the max power for the 2 gain states. Once the values are set compensation for all 3 channels in 2 PA states is being done.

2.1.1 Range of operating RF Power for LTE

The LE910Cx families supports 14 LTE Bands

The nominal power levels and tolerances for the LTE bands are indicated in the following table:

LTE Band	Max Output Power	Tolerances (dB)	
#	dBm	-	+
1	23	2	2
2	23	2	2
3	23	2	2
4	23	2	2
5	23	2	2
7	23	2	2
8	23	2	2
12	23	2	2
20	23	2	2
25	23	2	2
26	23	2	2
28A/28	23	2	2
66	23	2	2
71	23	2	2

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2.2 WCDMA TX Tune Up

WCDMA Tx tune up is being done with QCOMM tool and performed within three steps:

- Tx linearization & Freq Compensation
- Composite Tx/Rx vs frequency
- Tx Limiting & Freq Compensation

2.2.1 Tx linearization & Freq Compensation

The unit transmits in a reference channel (mid) and perform TX sweep while searching for the correct HDET value at each PDM step and generate PDM vs Power tables for the 2 PA gain states (1, 0). After completing calibration on the reference channel frequency the compensation being done on 3 channels across the band.

2.2.2 WCDMA composite Tx/Rx vs frequency calibration procedure

WCDMA composite Tx/Rx vs frequency calibration is using QCOMM GUI. Composite Tx/Rx calibration is an alternative to the serial Tx and serial Rx calibration procedures. Composite Tx/Rx calibration is a fast and efficient calibration procedure that uses the Tx/Rx vs frequency sweep and perform Tx and Rx measurements in parallel.

Overview of Tx/Rx vs frequency sweep

In the Tx/Rx vs frequency sweep measurement, the phone transmits a predefined Tx power sequence and the test equipment measures Tx power. Simultaneously, the test equipment generates a predefined Rx power sequence and the phone performs Rx measurements.

Key features of the measurement are:

>> The mobile's Tx power provides a rising edge for triggering the start of the first sequence.

>> Changes in mobile Tx power and mobile Rx power and Tx and Rx measurements are synchronized to segment boundaries.

>> The sweep is composed of a maximum of 3 sequences typically corresponding to the 3 RF calibration channel frequencies.

>> The test equipment will return results for Tx power measurements and the mobile will return results for Rx measurements along with a list of HDET values.

2.2.3 Tx Limiting & Freq Compensation

Once values are set for the reference channel in 2 gain states. Compensation for all 3 channels at 2 PA states being done accordingly.

2.2.4 Range of operating RF Power for WCDMA

The LE910Cx families support 7 WCDMA Bands

The nominal power levels and tolerances are indicated in the following table:

WCDMA Band	Max Output Power	Tolerances (dB)	
	dBm	-	+
1	24	3	1
2	24	3	1
3	24	3	1
4	24	3	1
5	24	3	1
6	24	3	1
8	24	3	1

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2.3 GSM TX Tune Up

GSM calibration starts with KVCO calibration for all bands in order to insure the corrected VCO slope and good PLL operation.
The TX calibration includes the following sections for all GSM bands:
>> Polar calibration
>> Timing delay calibration

2.3.1 Polar calibration

Polar calibration is used for both GSM and EDGE.
» The unit perform TX sweep for 32 RGI values at 2 gain states (1,0) & three channels (Low, mid & high). The AM-to-AM and AM-to-PM characteristics of the PA being measured by the external equipment.
» The measurement results from the external equipment being processed before they are loaded into the module. The module then uses the AM-to-AM and AM-to-PM tables to provide the appropriate pre-distortion to the PA.
» Calibration is done at high, mid and low frequency channels, and values are interpolated for any frequency in between.
» The AM component being reinserted back after the amplification stage to restore the modulation to its original form.

2.3.2 Timing delay calibration

Existence of two separate waveform paths through the device could lead to different signal delays on the phase path and envelope path, and could affect the waveform quality.
• The best-case delay is determined by finding the delay value that results in the lowest ORFS due to modulation measurement at +400 kHz and -400 kHz. The ORFS due to modulation value tied to each delay is the worse one of +400 kHz and -400 kHz offset.

2.3.3 Range of operating RF Power for GSM

The LE920 supports 4 GSM Bands
The nominal power levels and tolerances are indicated in the following table:

GSM Band	Max Output Power	Tolerances (dB)	
	dBm	-	+
GSM850	32.5	1	1
GSM900	32.5	1	1
DCS1800	29.5	1	1
PCS1900	29.5	1	1