Tune Up Info for FCC

Type Number：RG4-E02

FCC ID：SP2-RG4-E02

1. Purpose

This document introduce general information of the Orca production test H/W and S/W. Including Test Flow, Test Items List, Required Equipment List and some related information.

2. Responsibility

TECHFAITH TOP 3G Team has responsibility to update and release this document.
Other design teams provide the latest related information.

3. Terms and Acronyms

Abbreviation	Abbreviate from

4. RG4-E02 GSM and WCDMA Calibration

4.1 Channel and Frequency of Operation

4.1.1 WCDMA

WCDMA	Up Link	Down Link
Frequency	1920 to 1980 MHz	2110 to 2170 MHz
Channel	9612 to 9888	10562 to 10838

Channel for Calibration:

Index	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
UL	9612	9630	9648	9666	9684	9702	9720	9738	9756	9774	9792	9810	9828	9846	9864	9883
DL	10562	10580	10598	10616	10634	10652	10670	10688	10706	10724	10742	10760	10778	10796	10814	10833

Reference Channel:

WCDMA Up-Link Reference Channel: 9756

WCDMA Down-Link Reference Channel: 10706

4.1.2 EGSM 900

EGSM 900	Up Link	Down Link
Frequency	880 to 915 MHz	925 to 960 MHz
Channel	975 to 1023, 0 to 124	975 to 1023, 0 to 124

Channel for Calibration:

Index	0	1	2	3	4	5	6	7
CH	1	32	62	92	124	975	1000	1023

Reference Channel: GSM900 Reference Channel: 62

4.1.3 DCS 1800

DCS 1800	Up Link	Down Link
Frequency	1710 to 1785 MHz	1805 to 1880 MHz
Channel	512 to 885	512 to 885

Channel for Calibration:

Index	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Channel	512	537	562	587	612	637	662	687	712	737	762	787	812	837	862	885

Reference Channel: DCS1800 Reference Channel: 662

4.1.4 PCS 1900

PCS 1900	Up Link	Down Link
Frequency	1850 to 1910 MHz	1930 to 1990 MHz

Channel	512 to 810	512 to 810

Channel for Calibration:

Index	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Channel	512	532	552	572	592	612	632	652	672	692	712	732	752	772	792	810

Reference Channel: PCS1900 Reference Channel: 632

4.4 BT Calibration Max Power Target:

GSM900_Level_5_PowerTarget = 32.5 dBm

DCS1800_Level_0_PowerTarget = 29.5 dBm

PCS1900_Level_0_PowerTarget = 29.5 dBm

WCDMA_MaxPower_Target = 24 dBm

WCMDA_PowerCal_Offset = 0dB

4.5 GSM Tx Calibration

4.5.1 GSM Frequency Calibration: TrkLoAdjSlope

Used Default Value:

iPDMXa = 150

iPDMXb = 450

Fc = 902.4 MHz

GSM900_RefCh = 62

Procedure:

Set Phone -> FTM Mode

Set Phone -> GSM900 band and reference channel GSM900_RefCh

Set Phone -> GSM Power Level 10

Set Phone -> VCTCXO PDM: iPDMXa

Set Phone -> Start Tx

Measure Freq Err Ya (KHz)

Set Phone -> VCTCXO PDM: iPDMXb

Measure Freq Err Yb (KHz)

Calc TrkSlope = (Yb – Ya)/ (iPDMXb - iPDMXa) *(1000000/Fc)*65536,

Calc TrkLoAdj = (Ya/ TrkSlope) + iPDMXa

Set Phone -> VCTCXO PDM: TrkLoAdj

Measure Freq Err and verify the result

Set Phone -> Stop Tx

Save TrkLoAdj to NV_VCO_DEFAULT_I

Save TrkSlope to NV_VCO_SLOPE_I

4.5.2 GSM/DCS/PCS Tx Power Calibration: Polar Fx Cal

Band	Fx	Channel
GSM900	F1	975
	F2	62
	F3	124
DCS1800	F1	512
	F2	687
	F3	885
PCS1900	F1	512
	F2	652
	F3	810

Procedure:

Set Phone -> FTM Mode

Set Phone -> Band, Channel, and set TrkLoAdj PDM.

Set the test equipment to Polar test mode;

Set the test equipment for frequency corresponding to Channel;

Set the test equipment number of steps, step timing, and reference level.

Set Phone -> Command the mobile to generate the TX waveform for measurement by test equipment.

Take AM and PM measurements with the test equipment.

Smooth averaged measurement record (AM Vs. DAC; PM Vs. DAC) and format data for NV.

Set Phone -> Write NV data.

4.6 GSM Rx Calibration

4.6.1 GSM_RX_GAIN_RANGE_X_FREQ_COMP Calibration

X: 1 to 4

Procedure:

Set Phone -> FTM Mode

Set Phone -> Band GSM 900

Set Phone -> Rx Gain Range **X**

Set Signal Generator ->Output -65dBm at Each on of GSM900Calibration Channel

Set Phone -> The same Channel and get RSSI[i] from the phone

Calc NV_GSM_RX_GAIN_RANGE_**X**_FREQ_COMP[i] = 16*(10*Log (RSSI[i]) - (-65dBm)).

Loop for each GSM900 calibration channel

Save NV_GSM_RX_GAIN_RANGE_**X**_FREQ_COMP to the phone

4.6.2 DCS_RX_GAIN_RANGE_X_FREQ_COMP Calibration

X: 1 to 4

Procedure:

Set Phone -> FTM Mode

Set Phone -> Band DCS 1800

Set Phone -> Rx Gain Range **X**

Set Signal Generator ->Output -65dBm at Each on of DCS1800Calibration Channel

Set Phone -> The same Channel and get RSSI[i] from the phone

Calc NV_DCS_RX_GAIN_RANGE_**X**_FREQ_COMP[i] = 16*(10*Log (RSSI[i]) - (-65dBm)).

Loop for each GSM900 calibration channel

Save NV_DCS_RX_GAIN_RANGE_**X**_FREQ_COMP to the phone

4.6.3 PCS_RX_GAIN_RANGE_X_FREQ_COMP Calibration

X: 1 to 4

Procedure:

Set Phone -> FTM Mode

Set Phone -> Band PCS 1900

Set Phone -> Rx Gain Range **X**

Set Signal Generator ->Output -65dBm at Each on of PCS1900Calibration Channel

Set Phone -> The same Channel and get RSSI[i] from the phone

Calc NV_GSM_1900_RX_GAIN_RANGE_**X**_FREQ_COMP[i] = 16*(10*Log (RSSI[i]) - (-65dBm)).

Loop for each PCS1900 calibration channel

Save NV_GSM_1900_RX_GAIN_RANGE_**X**_FREQ_COMP to the phone

4.7 WCDMA Tx Calibration

4.7.1 Tx Power VS. PDM Calibration: WCDMA_TX_LIN_MASTER_X

X: 0,1,2,3.

Procedure:

Set Phone -> FTM Mode

Set Phone -> WCDMA

Set Phone -> WCDMA reference channel WCDMA_UL_RefCh

Set Tx AGC PDM with NV_WCDMA_TX_PDM_LIN_X_I[Index] and start TX,

Set Phone -> PA Range X

Measure Range_X_Tx_Power[Index], Add WCMDA_PowerCal_Offset on the measurement return value.

Fill WCDMA TX AGC PDM vs. TX Power Table (index 0 -31) table.

NV_WCDMA_TX_LIN_MASTER_X_I[Index]= (1024/85.3) * (Range_X_Tx_Power[Index] – minimum Tx power), where minimum Tx power = –57 dBm.

For NV_WCDMA_TX_LIN_MASTER_X_I, Index 32 to 36 fills 0.

Save Tx AGC PDM index 0 – 36 to NV_WCDMA_TX_LIN_MASTER_X_I.

4.7.2 Tx Power VS. Frequency Calibration: WCDMA_TX_COMP_VS_FREQ_X

X: 0,1,2,3.

PA_RISE_0: Equal to NV_WCDMA_R1_RISE

PA_RISE_1: Equal to NV_WCDMA_R2_RISE

PA_RISE_2: Equal to NV_WCDMA_R3_RISE

PA_RISE_3: Equal to NV_WCDMA_R4_RISE (Max Power).

Procedure:

Set Phone -> FTM Mode;

Set Phone -> WCDMA

Set Phone -> WCDMA reference channel WCDMA_UL_RefCh

Use WCDMA TX AGC PDM vs. TX Power Table; calculate the Tx_AGC_PDM which correspond to PA_RISE_X.

Set Phone -> Tx_AGC_PDM and Start Tx;

Set Phone -> PA Range X

Measure Tx power PwrX1

Set Phone -> Each one of WCDMA Calibration Channel Ch[i] and Measure TX Power PwrX2 [i]

Calculate NV_WCDMA_TX_COMP_VS_FREQ_0_I[i] = (PwrX2 [i] –PwrX1) * 12

Save NV_WCDMA_TX_COMP_VS_FREQ_0_I to phone

4.7.3 Power Detector VS. AGC Calibration: WCDMA_EXP_HDET_VS_AGC

Procedure:

Set Phone -> FTM Mode

Set Phone -> WCDMA

Set Phone -> WCDMA reference channel WCDMA_UL_RefCh

Set Phone -> Set Tx_AGC_PDM [Index] corresponds to Tx_Power [Index] in below table and start Tx.

Index	Tx Power(dBm)
0	6.68
1	8.01
2	9.34
3	10.67
4	12.01
5	13.34
6	14.67
7	16.00
8	17.34
9	18.67
10	20.00
11	21.34
12	22.67
13	24.00
14	25.33
15	26.67

Read the value of HDET ADC NV_WCDMA_EXP_HDET_VS_AGC [Index]

Loop for each Index

Save NV_WCDMA_EXP_HDET_VS_AGC to the phone

4.7.4 Power Detector VS. Frequency Calibration: WCDMA_TX_LIM_VS_FREQ

Procedure:

Set Phone -> FTM Mode

Set Phone -> WCDMA

Set phone -> high PA range

Set phone -> WCDMA reference channel WCDMA_UL_RefCh

Set phone -> Max power by adjusting TX_AGC_ADJ PDM

Measured the power PwrRef

Record the Tx AGC PDM PDMRef

Read the HDET DAC HDetDacRef from the phone.

Set phone -> the first WCDMA Calibration Channel Ch[i]

Set phone -> Max power by adjusting TX_AGC_ADJ PDM

Measured the power Pwr[i]

Record the TX AGC PDM PDM[i]

Read the HDET DAC HDetDac[i] from the phone.

Calculate:

NV_WCDMA_TX_LIM_VS_FREQ[i] = ((HDetDac[i] - HDetDacRef) * hdetScale) + 12*(Pwr[i] - PwrRef)

Loop for each other WCDMA Calibration Channel

Save NV_WCDMA_TX_LIM_VS_FREQ to the phone

4.7.5 WCDMA_HDET_OFF Calibration

Procedure:

Set Phone -> FTM Mode

Set Phone -> WCDMA

Set phone -> WCDMA reference channel WCDMA_UL_RefCh

Set phone -> TX_AGC_ADJ PDM corresponds to 18dBm.

Read the HDET DAC value HDAC_Off and save to the phone NV_WCDMA_HDET_OFF_I

4.7.6 WCDMA_HDET_SPN Calibration

Procedure:

Set Phone -> FTM Mode

Set Phone -> WCDMA

Set phone -> WCDMA reference channel WCDMA_UL_RefCh

Set phone -> TX_AGC_ADJ PDM corresponds to 26 dBm.

Read the HDET DAC value HDAC_26DBM

HDAC_SPN = HDAC_26DBM - HDAC_Off

Save HDAC_SPN to the phone NV_WCDMA_HDET_SPN_I

4.8 WCDMA Rx Calibration

4.8.1 VGA Gain Calibration: WCDMA_VGA_GAIN_OFFSET

RxMin = -106dBm

RxPower = -74dBm

DynamicRange = 85.3

Procedure:

Set Phone -> FTM Mode

Set Phone -> WCDMA

Set phone -> WCDMA reference channel WCDMA_DL_RefCh

At reference channel WCDMA_DL_RefCh, inject an Rx power RxPower signal to the phone

Calculate AGC_Value = (1023/DynamicRange)*(RxPower - RxMin) – 512

Send GetDVGAOffset command with parameter AGC_Value to get NV_WCDMA_VGA_GAIN_OFFSET

Save NV_WCDMA_VGA_GAIN_OFFSET to the phone

Set NV_WCDMA_VGA_GAIN_OFFSET to the phone register for LNA Calibration items

4.8.2 VGA VS. Frequency Calibration: WCDMA_VGA_GAIN_OFFSET_VS_FREQ

RxMin = -106dBm

RxPower = -74dBm

DynamicRange = 85.3

Procedure:

Set Phone -> FTM Mode

Set Phone -> WCDMA

Set phone -> WCDMA reference channel WCDMA_DL_RefCh

At reference channel WCDMA_DL_RefCh, inject an Rx power RxPower signal to the phone

Calculate AGC_Value = (1023/DynamicRange)*(RxPower - RxMin) – 512

Send GetDVGAOffset command with parameter AGC_Value to get VgaGainOffsetRef

Loop for each other WCDMA DL Calibration Channel to get VgaGainOffset [Index]

Calculate:

NV_WCDMA_VGA_GAIN_OFFSET_VS_FREQ_I [index] =VgaGainOffset [Index] –VgaGainOffsetRef

Save NV_WCDMA_VGA_GAIN_OFFSET_VS_FREQ_I to the phone

4.8.3 WCDMA_LNA_RANGE_OFFSET_X

LnaRangeRise = -70 dBm

RxMin = -106dBm

DynamicRange = 85.3

X: LnaOffsetIndex = 1,2,3

Procedure:

Set Phone -> FTM Mode

Set Phone -> WCDMA

Set phone -> WCDMA reference channel WCDMA_DL_RefCh

At reference channel WCDMA_DL_RefCh, inject an Rx power LnaRangeRise signal to the phone

Calculate AGC_Value = (1023/DynamicRange)*(LnaRangeRise - RxMin) – 512

Send GetLNAOffset command with two parameters: LnaOffsetIndex and AGC_Value

Get NV_WCDMA_LNA_RANGE_OFFSET_I and save to the phone

4.8.4 WCDMA_LNA_OFFSET_VS_FREQ_X Calibration

LnaRangeRise = -70/-44/-34 dBm (for X= 1,2,3)

RxMin = -106dBm

DynamicRange = 85.3

LnaOffsetIndex = 1

Procedure:

Set Phone -> FTM Mode

Set Phone -> WCDMA

Calculate AGC_Value = (1023/DynamicRange)*(LnaRangeRise - RxMin) – 512

Set phone -> The first WCDMA DL Calibration Channel Ch[i]

At the same channel, inject an Rx power LnaRangeRise signal to the phone

Send GetLNAOffset command with two parameters: LnaOffsetIndex and AGC_Value

Get LnaOffsetVsFreq[i]

Calculate LNA_OFFSET_VS_FREQ[i] = LnaOffsetVsFreq[i] – NV_WCDMA_LNA_RANGE_OFFSET_I

Loop for each other WCDMA Calibration Channel

Save LNA_OFFSET_VS_FREQ to NV_WCDMA_LNA_OFFSET_VS_FREQ_I