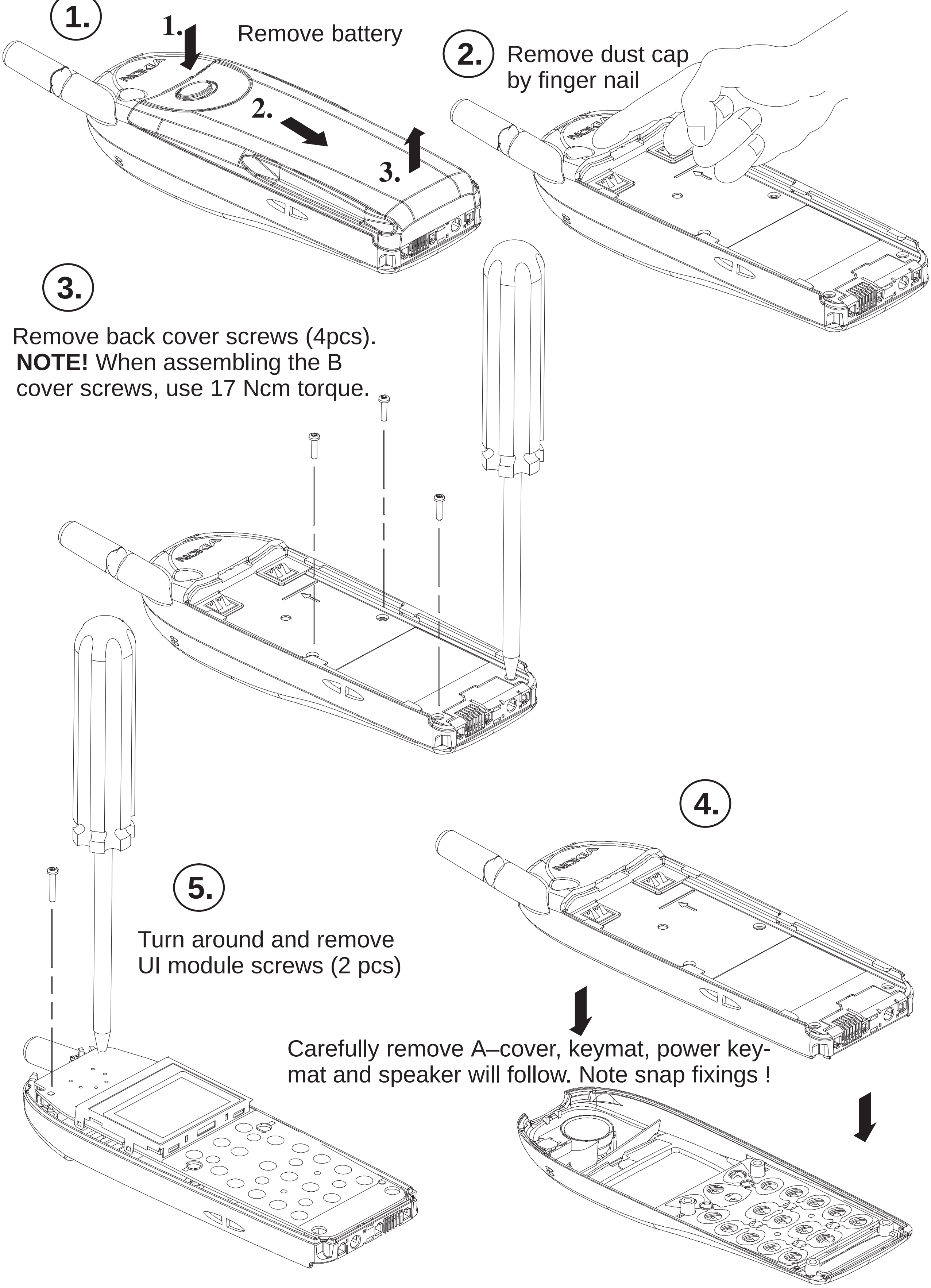
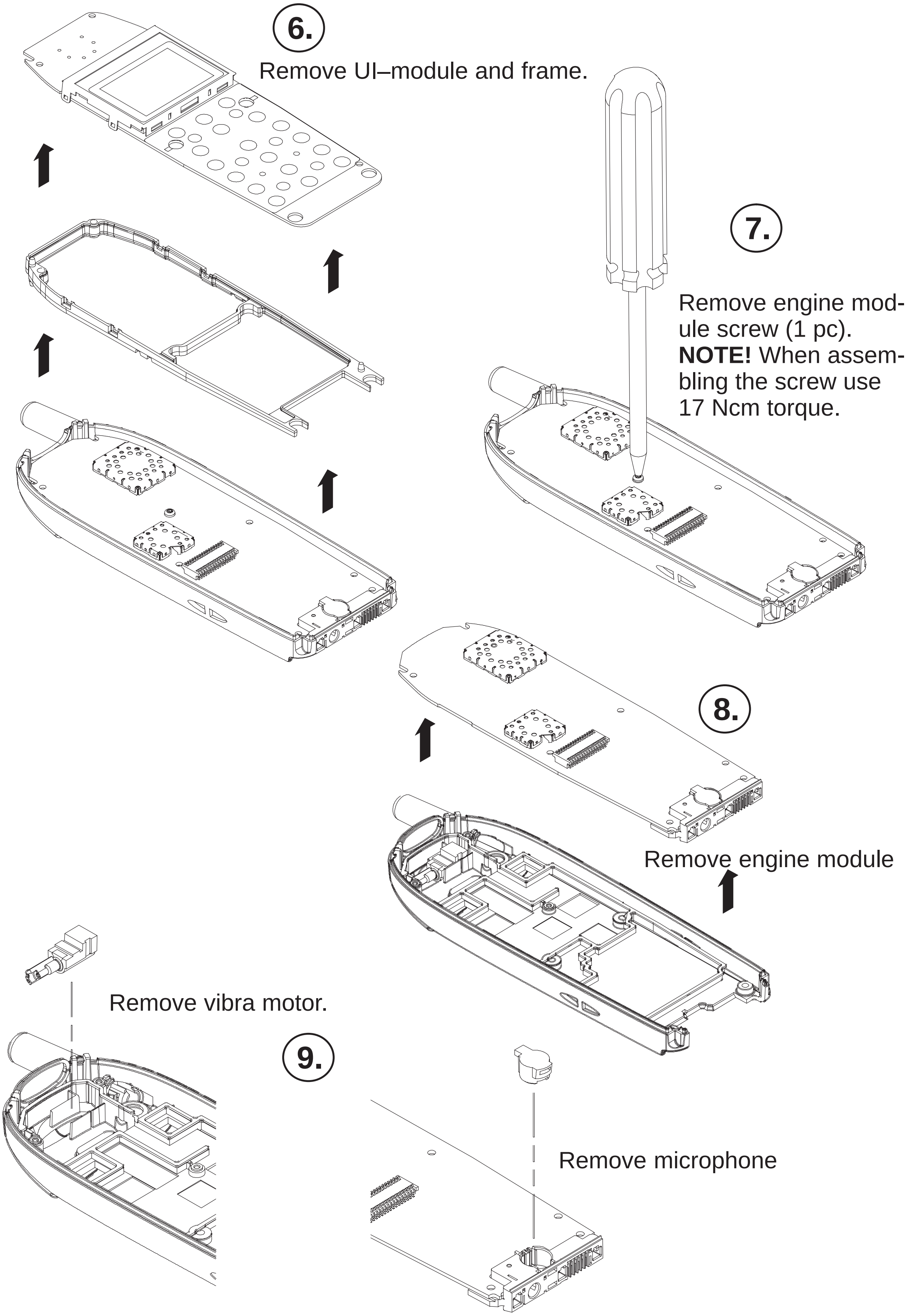
Disassembly / Troubleshooting Instructions

CONTENTS

NOTE: Do not attempt to remove the antenna from the B–cover.




6.
Remove UI–module and frame.
7.
Remove engine module screw (1 pc).
NOTE! When assembling the screw use 17 Ncm torque.
8.
Remove engine module
Remove vibra motor.
9.
Remove microphone

Trouble Shooting

Baseband Troubleshooting

Each main portion of the circuit will be described in enough detail for the troubleshooter to determine whether or not that part of the circuit being evaluated is functional. It will be helpful to use the placement diagram, which illustrates all of the necessary testpoints in the baseband circuit, to troubleshoot the phone. The placement diagram is intended to be used concurrently with this document.

Main Circuit Sections

Power Circuitry

There are two ASICs in the baseband section, which supply power to most of the phone. CCONT is the main power management ASIC, and PENTA is used to supply additional switchable regulators for use in RF. Two discrete linear regulators are used as well.

CCONT

CCONT is the main power management ASIC. It's features include eight 2.8V linear regulators, a linear regulator with adjustable output, a reference voltage output, a 5V switch mode regulator, an 8 channel A/D converter, and 32kHz clock circuitry. Each of the main functions and signals are described below, including information on how to verify correct operation.

Vbat

CCONT is powered directly from the battery voltage, Vbat. Since CCONT is a uBGA, the physical connection of CCONTs power pins can not be verified. Vbat must be checked instead at the closest external component, which is shown as TP1. Valid voltages are 3.1–4.1V and should always be powered; assuming voltage is applied to the battery terminals.

Vref

Vref is used as a reference voltage both internal and external to CCONT. It is switchable between the nominal voltages of 1.500V and 1.251V, with the default at power up being 1.500V. The phone uses the 1.251V reference, so once flash software is running Vref should switch to 1.251V. Check Vref at TP2. Valid voltages are 1.478 – 1.523V and 1.244 – 1.258V, respectively.

Linear Regulators

1. Vbb

Vbb supplies power to most of the baseband circuitry. This regulator should be on at all times during CCONTs power on, reset, and sleep modes. Nominal voltage is 2.8V, but anything in the range 2.7–2.87V is valid. Vbb is found at TP3.

2. RF Regulators (VR1–VR7)

VR1 through VR7 are referred to as the RF regulators. Most are switchable, and all should be within 2.67 – 2.85V when they are on (2.8V nominal). VR1 and VR6 are always on during CCONTs power on mode. The rest of the regulators are switchable and are normally on during one or more of the various phone states, but may be turned on at any time with the service software in order to verify their output. The RF regulators can be checked at the following test points.

a) **VR1** – TP10
b) **VR1_SW** – TP11
c) **VR2** – TP32
d) **VR3** – TP30
e) **VR4** – TP4
f) **VR5** – TP31
g) **VR6** – TP9
h) **VR7** – TP33

3. V2V (VMAD)

The V2V regulator is intended to power the MAD4 ASIC core. The output is adjustable from 1.3V to 2.65V in 0.225V steps, and is used with MAD4 ver 3 (but not MAD4 ver 2). The output at V2V when MAD4 ver 3 is stuffed should be 1.750V ±5% and can be checked on TP2.

Switch mode regulator

1. V5V (+5V_POWER)

V5V is a 5V switch mode regulator, which always remains on during CCONT power on mode. Valid voltages are 4.8V to 5.2V, and it can be checked at TP13.

2. VSIM (3V_5V)

VSIM is powered by the same switch mode regulator as V5V, however, it is switchable between 3V and 5V. The phone uses VSIM as the 3V FLASH programming voltage, so it should remain off unless the phone is being flashed. Valid voltages are 2.8V to 3.2V, and it can be checked at TP7.

A/D Conversion

CCONT contains a 10–bit A/D converter that is multiplexed between 8 different inputs. They are used mainly for battery and charger monitoring. The 8 inputs are Vbat (battery voltage), ICHAR (charger current), VCHAR (charger voltage), BSI (battery type), BTEMP (battery temperature), VCXOTEMP (PA temperature), RSSI (AMPS receive signal strength), and EAD (accessory detection). These readings can be accessed through the service software. Check for shorts or opens on the resistor networks connected to these signals if the flash align test software reports that they are out of range.

Watchdog

CCONTs watchdog circuitry consists of an eight bit down counter that causes CCONT to power down when zero is reached. The counter may be reset by loading a new, non–zero value into the watchdog register via CCONTs serial bus. It is difficult to verify the watchdog function, but the serial bus may be verified.

There is a watchdog disable pin which allows the watchdog timer to expire without shutting down the phone, but this pin is mainly used as one of the methods to turn on CCONT from power off mode. While the phone power key is pressed, this pin should be pulled low and can be checked at TP29.

The watchdog can be disabled by pulling down the above mentioned pin(WDDISX) by installing a 0 Ohm resistor at R307, and removing R325.

Serial bus

Since the serial bus is used to control almost all of CCONTs functions, any shorts or open circuits on these three lines would cause CCONT to be completely nonfunctional. The main symptoms are the following: CCONT will turn on when the power key is pressed (verify this by checking Vbb), but will then power off after 32 seconds. All three serial bus signals (CCONTCSX, UIF_CCONT_SDIO, and UIF_CCONT_SCLK) should toggle when attempting to write to a CCONT register.

Note: If the LCD does not come on during this time, however, it may indicate that the serial bus is functional, but phone does not have valid flash code.

PENTA

PENTA supplies power to the RF section. It has 5 independently switchable regulators that are controlled via separate enable pins. There is also a common enable pin that must be active in order to turn on any of the regulators. Each of the regulators, P1–P5, should have output voltages between 2.7V and 2.85V (2.8V nominal). These can be checked at the following test points.

a) P1 – TP16
b) P2 – TP15
c) P3 – TP17
d) P4 – TP18
e) P5 – TP19

External regulators

There are three regulators used in addition to CCONT and PENTA. One is controlled by CCONTs VR7 regulator output and used as a low noise power source for RF. This regulator is 2.8V nominal and can be checked at TP8.

The second regulator is used to power the data cable accessory, so output is enabled only when a data cable accessory is detected. This regulator is also 2.8V nominal and can be checked at TP42 (shares SGND).

The third regulator is used to power the DSP portion of MAD4. It is enabled by Vbb, and difference between the rise times of the DSP regulator and Vbb should be less than 200usec. This regulator is 2.8V nominal and can be checked on pin 1, 30, or 115 of the MAD4 ASIC.

Clocks

Sleep Clock

The 32kHz sleep clock is generated by CCONT, and can be checked at TP26. The 32kHz square wave will be present only after the phone is turned on. If no signal is present on this line, check the output of the oscillator at R304. This signal should be a 2Vp–p clipped signal riding on 1.5V DC.

System Clock

The 19.2MHz system clock is generated by the VCTXO in the RF section, and then squared in CAFE. Check TP20, which should be approximately a 0.5V sinewave riding on 1.8V DC. Check TP22, which should be a 2.8V squarewave. This clock is not active during the phone’s sleep mode (CLK_EN is low during sleep mode).

CDMA clock

The CDMA clock is 9.8MHz and is generated in CAFE with a PLL. This should be a 2.8V square wave and can be verified at TP21.

Charging Circuit

The charging switch, CHAPS, is controlled by a PWM from CCCONT. This PWM can be at 1Hz or at 32Hz, with varying duty cycles, and should only be active when a charger is detected. The frequency should be 1Hz when an ACP–7 is detected and 32Hz when an ACP–9 is detected. To verify correct operation of CHAPS, monitor the charging current (ICHAR) with the service software. When the PWM is off, current should be approximately 200uA. When the PWM is on, it should be greater than approximately 300mA.

CAFE

The CAFE ASIC performs various functions with respect to the RF circuitry and audio. It digitizes the analog voice signals from the microphone as well as converts received digital data to voice signals to be sent to the earpiece. This also includes accessory microphones and speakers. It also generates and decodes I and Q data for CDMA, and demodulates FM (AMPS) signals. CAFE also acts as a clock squaring circuit and CDMA clock generator.

Microphones

The internal microphone is biased using transistor V201, which is powered by VR1_SW (TP11 2.75VDC). Check also the output of V201).

V201, R220 and C212 should be installed, and R202 should not be installed. MICP should be about 1.7VDC, and MICN should be about 0.4VDC. Internal microphone bias should only be active during a call.

The XMIC is biased by the AUXOUT signal (pin 75) through R209 and R208. The output voltage at pin 75 is about 1.5V.

Earpiece and XEAR

The internal earpiece is driven differentially from pins 77 and 80 (EARP and EARN). The DC voltage on these two pins is 1.35V. The difference in the DC voltage between these two pins should not be more than 50mV.

The XEAR signal drives audio to the external accessories. The CAFE signal name is HF (pin 81). The DC level on this pin should be 1.35V. HFCM (pin 82) should also be at 1.35V. The difference in DC voltage between these two pins should not be more than 50mV.

Note that SGND is the return path for XMIC and XEAR.

Clock circuit

A 19.2MHz sinusoid should appear on pin 25 (Also TP20). This is from the VCTCXO in the RF. The CAFE will then produce a 19.2MHz clock at pin 18 (TP22), and a 9.83MHz clock on pin 19 (TP21). See also Clocks section.

AMPSMOD

AMPSMOD is the voice signal to modulate (FM) the RF carrier for transmission. It is the voice signal that has been processed by the DSP (MAD4) for transmission in AMPS mode. It represents a modified version of the signal produced by the microphone (CAFÉ pin 58).

Transmit and Receive RF Signals

In CDMA mode, receive I and Q channel RF signals [RXIQ(3:0)] come into CAFÉ at pins 44, 45, 47, and 48. C207, C208, C209, and C210 can also be checked for these signals since they are in series with the CAFÉ pins. Transmit I and Q RF signals [TXIQ(3:0)] can be seen at pins 55, 56, 59, and 60 and C201, C204, C222, and C224.

In AMPS mode, the modulated receive RF signals (LIM_P and LIM_N) can be seen coming into pins 23 and 24 and C216 and C217. For the AMPS Transmit signal, see AMPSMOD above.

MAD4

The MAD4 ASIC is the core of the baseband functionality and basically contains the DSP, MCU, and CDMA logic. The DSP is used to perform functions such as RF control, DTMF tone generation, and it implements the vocoder. The MCU is used to perform functions that do not require as much power. These are higher level functions such as UI software (key presses, backlighting, LCD functions, etc.) and mode control.

DSP

The DSP sends control signals to the RF via PDMs. In order to control RF parameters such as TX_VCO_CAL or TX_LIM_ADJUST, a continuously variable analog signal must be used. Since the DSP outputs only digital signals, a PDM RC circuit is used to convert the digital output signal to an average analog voltage. A PDM line will always have a series resistor followed by a shunt capacitor. The output of the MAD4 PDM lines will appear as squarewave signals. However, after the shunt capacitor the signals will appear to be DC with perhaps a slight ripple. The RC circuit acts as an integrator in order to yield the average value (DC) of the squarewave signal.

The transmit data bus (TXD(7:0)) is 8 bits wide. In CDMA this bus is multiplexed between sending I and Q data. The signals required to transfer TX data are TXGATE, CLK9M80, and IQSEL. TXGATE must be high to transfer data, and the data is clocked by CLK9M80, which is running at 9.8MHz. In AMPS mode, CLK9M80 is running at 120kHz, therefore, data is being transferred from MAD4 to CAFE at 120kHz.

The JTAG lines are intended to be used to operate the DSP (and/or MCU) externally.

External Regulator

A separate 2.8V external regulator was added to power the Lead (DSP) independently due to noise on VBB. Eventually, the next version of MAD4 will be used and the Lead may be powered by VMAD from CCONT. See External Regulators section under CCONT/Linear Regulators. Note: This regulator is also mentioned in section Power Circuitry.

MCU

The MCU is used to perform functions that require less processing power than the DSP. It runs UI software, mode control, interfaces to MBUS, downloads code to flash, reads and writes the EEPROM, controls charging, and interprets A/D data from CCONT.

Memories

MAD4 interfaces to three memories—Flash, SRAM, and EEPROM. All of them are powered by 2.8V (Vbb). During Flash programming, Vpp (signal name is Vff on schematic) is driven with 12V in the factory, and 3V at the PC flash stations.

Failures

Most of the failures will be due to SMD errors. Either solder got where it wasn't supposed to be, parts slid off their pads, or possibly the parts were placed incorrectly. A good visual inspection will uncover a large percentage of failing phones.

Won't power up

Do a visual inspection. Verify that all parts are on the board correctly, and that none are missing.

Check that the 32kHz clock turns on when attempting to power up.

Check the power circuitry. This includes VBAT, Vref, and all of the linear regulators, as well as the Penta regulators. Verify also that the external regulator that powers MAD4 (LEADVCC) is functional.

Flash Align

Test 9

High current: This indicates that the problem is likely caused by a shorted component. Check orientation of major components (including RF), and check for shorts. Likely components are those which are powered directly from Vbat such as CCONT, the PAs, and various capacitors.

Low current: This indicates that CCONT is not powering on. Verify CCONT circuitry.

Test 10

Flash: Failure to flash is the main baseband failure. Check all the CCONT regulators, especially Vbb, VR1, and VR6 for shorts. Check clocks and reset circuitry. Check for shorts on the address, data, and chip enable lines on the memories and MAD4. If a short is detected, it may be that it is beneath the BGA flash and may have to be replaced.

NOTE: Unfortunately, there is no ROM software that can be run when the phone does not flash. Typically, this software would be used to test all of the interfaces between MAD4 and its peripherals. Therefore, it must be visually (or by Ohmmeter) determined whether there is a possible short between two or more of the address or data lines.

In the field

Solder joints may be adequate for passing manufacturing requirements, however, they may not hold up to mechanical stress or heat cycling. Cracked or broken solder may cause failures to occur from simple use. Reflowing some of the major components may fix problems where the phone exhibits strange behavior (some buttons may not work, the phone may not ring, etc.) or may not power on anymore.

Battery will not charge

If the battery won’t charge (phone won’t allow the battery to charge), check CHAPS and the charging circuit. It may also be necessary to verify the A/D functionality of CCONT since this is the method of detecting battery type, charger type, etc

Audio failures

If audio fails to be heard from the earpiece (or XEAR), it could be a number of possible problems. Check the following:

Check earpiece contacts.

Verify that the CAFÉ EARP and EARN bias is on. If necessary, check the entire receive path—Rx voice data comes from the RF through the RXIQ bus (CDMA) or LIM_P and LIM_N (AMPS), then to MAD4 through RXD (11:0) (Refer to schematic). See the Baseband section of the Service Manual for more detail on RXD bus usage.

The Rx voice data then goes back to CAFE on CAFESIO (0), and then to the earpiece or XEAR. CAFESIO (2) must also be active.

Conversely, if the transmit audio is not working, the fault could be anywhere in the transmit path. Check the following:

Check microphone contacts.

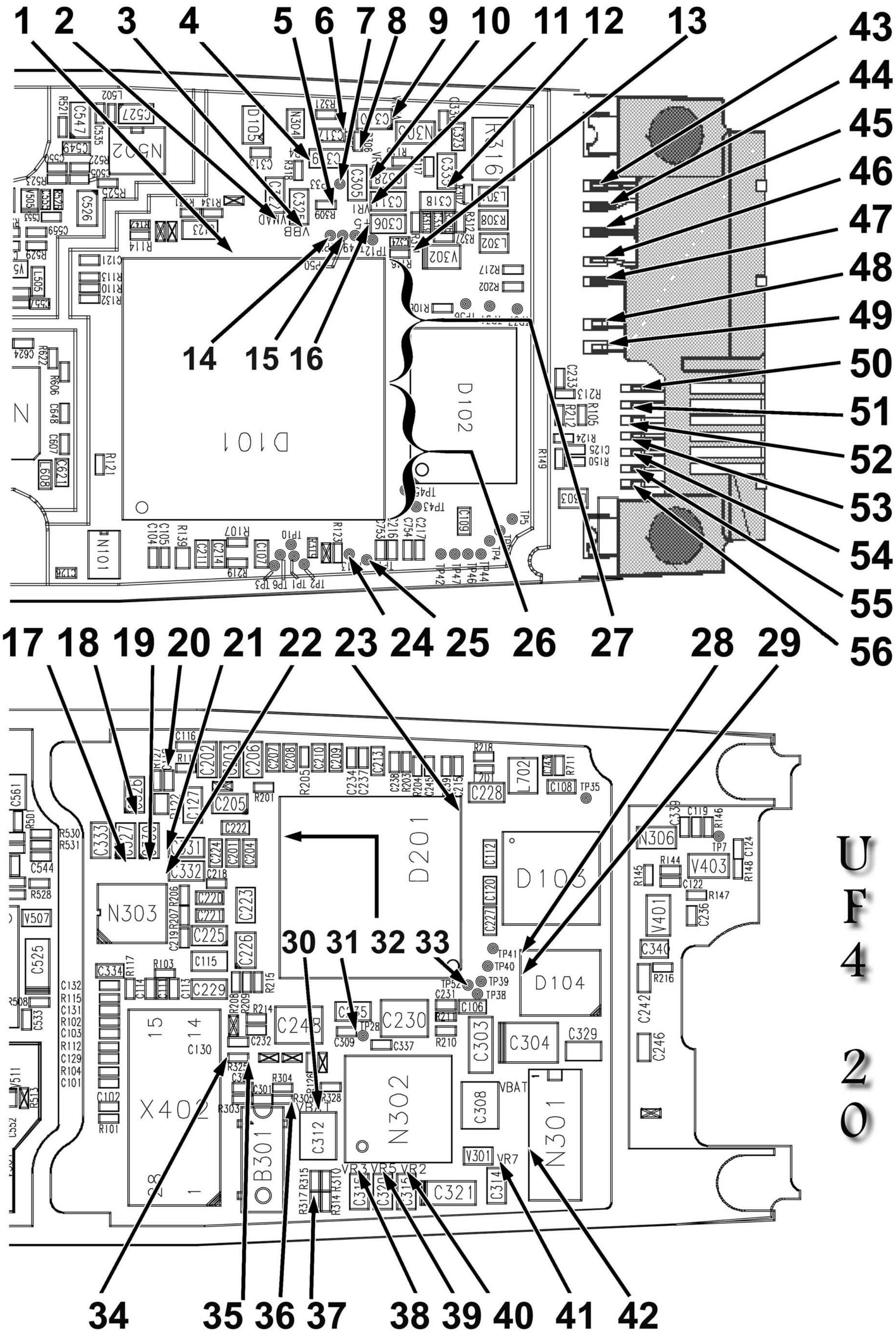
Microphone bias.

Tx voice data is transferred from CAFÉ to MAD4 on CAFESIO (1). CAFESIO (2) must also be active. Tx voice data is then sent back to CAFÉ on the TXD bus (See schematic). See the Baseband section of the Service Manual for more detail on RXD bus usage.

Tx voice data is then sent to RF on the TXIQ bus (CDMA) or AMPSMOD (AMPS).

Test Point Designator	Signal Name	General Characteristics	General Signal Destination
31	SleepClock	32.768 KHz typical Square waveform	From CCONT to MAD4
25	Clk19m20	19.2 MHz Square waveform	From CAFÉ to MAD4
23	Clk19M2rf (D201–25)	19.2 MHz Sinusoidal waveform	From RF Synthesizer to CAFÉ and other RF Synthesizers
24	Clk9m8	9.8 MHz Square waveform	From CAFÉ to MAD4
36	CRB	32Khz – 2.8V	From 32K crystal to CCONT
14	MemRdX	0 / 2.8 V (active low)	From MAD4 to Flash and RAM output enables
15	MemWrx	0 / 2.8 V (active low)	From MAD4 to Flash and RAM write enables
13	ROM1SelX	0 / 2.8 V (active low)	From MAD4 to Flash chip enable
5	Clk_En	0 / 2.8	From MAD4 to FLASH, CCONT and CAFE
1	PurX (D101–116)	0 / 2.8 V (active low)	From CCONT to MAD4
35	WdDisX	2.8 V (active low)	CCONT test point for phone diagnosis mode
34	PwrOnX	0 / 2.8 V (active low)	From UI Power Key to MAD4 and CCONT
33	ResetX	0 / 2.8 V (active low)	From MAD4 to CAFE
30	Vbat	3.1 – 4.1 V valid battery range (3.1 – 5.2 with charger connected)	From Battery connector to CCONT and other various parts of phone
3	Vbb	2.8 V typical (2.7 – 2.87 V)	From CCONT to MAD4 and Memories
2	Vmad	N / A	From CCONT to MAD4
11	Vr1	2.8 V typical (2.67 –2.85 V)	From CCONT to 19.2MHz VCTCXO
12	Vr1_Sw (MIC bias)	0 / 2.75V	From CCONT to V201 to CAFE
40	Vr2	0 / 2.8 V typical (2.67 –2.85 V)	From CCONT to CELL Receiver
38	Vr3	0 / 2.8 V typical (2.67 –2.85 V)	From CCONT to RF Receiver
4	Vr4	2.8 V typical (2.67 –2.85 V)	From CCONT to PCS Transmitter
39	Vr5	0 / 2.8 V typical (2.67 –2.85 V)	From CCONT to CELL Transmitter
10	Vr6	2.8 V typical (2.67 –2.85 V)	From CCONT to CAFE
41	Vr7	0 / 2.8 V typical (2.67 –2.85 V)	From CCONT to RF Synthesizer
9	Vr7a	0 / 2.8 V	
6	Vref	1.251 typical (1.244 – 1.258)	From CCONT to CAFE
16	+5_Power (V5V)	5 V typical (4.8 – 5.2 V)	From CCONT to CELL and PCS Transmitters
7	3V_5V (VSIM)	0 / 2.8 – 3.2 V	From CCONT to Flash
18	P1	0 / 2.8 V typical (2.7 – 2.85)	From PENTA to CELL Synthesizer
17	P2	0 / 2.8 V typical (2.7 – 2.85)	From PENTA to AMPS Receiver
19	P3	0 / 2.8 V typical (2.7 – 2.85)	From PENTA to PCS Synthesizer
21	P4	0 / 2.8 V typical (2.7 – 2.85)	From PENTA to CELL Receiver
22	P5	0 / 2.8 V typical (2.7 – 2.85)	From PENTA to PCS Receiver
43	V_in	ACP–7: 3.5V**AC**(rms) to 8.5V**AC**(rms) ACP–9 : 4.3V**DC** to 8V**DC**	From Bottom Connector to CHAPS Note: Lower VBAT = lower Vin levels
44	L_Gnd	0V	From Bottom Connector, through an inductor to Phone Ground
45	V_in	ACP–7: 3.5V**AC**(rms) to 8.5V**AC**(rms) ACP–9 : 4.3V**DC** to 8V**DC**	From Bottom Connector to CHAPS Note: Lower VBAT = lower Vin levels
46	Chrg_Ctrl	0 / 2.8 V	From MAD4 to CHAPS
47	Chrg_Ctrl	0 / 2.8 V	From MAD4 to CHAPS

48	MicP	1.7VDC (no voice activity)	From Bottom Connector to CAFÉ internal microphone input
49	MicN	0.4VDC (no voice activity)	From Bottom Connector to CAFÉ internal microphone input
50	Xmic	0.9VDC (no voice activity)	From Bottom connector to CAFÉ external microphone input
51	Sgnd	Approximately 0.0V	From CAFÉ to Bottom Connector
52	Xear	2.8VDC (no voice activity)	From CAFE to Bottom Connector
53	Mbus	0 / 2.8 V	Bi–directional Serial bus to MAD4 and the Bottom Connector
54	Fbus_Rx	0 / 2.8 V	Serial bus from Bottom Connector to MAD4
55	Fbus_Tx	0 / 2.8 V	Serial bus from MAD4 to the Bottom Connector
56	L_Gnd	0V	From Bottom Connector, through an inductor to Phone Ground
37	BTEMP	Variable DC	From Battery terminal to CCONT
42	VCHAR	Vin divided by 10	From System connector to CHAPS and CCONT
8	PA_Temp	Variable DC	From Shark thermister to CCONT A/D
20	Vibra	0 / 2.8 (11Khz when Vibra active)	From MAD4 to Vibra Motor
29	EEPROMsclk	0 / 2.8	From MAD4 to EEPROM
28	EEPROMsda	0 / 2.8	From MAD4 to EEPROM
32	Amps_Mod	Analog data (voice)	From CAFÉ to RF section
26	Address (23:0)	0 / 2.8 V	From MAD4 to Flash and RAM
27	Data (15:0)	0 / 2.8 V	From MAD4 to Flash and RAM


1 2 3 4 5 6 7 8 9 10 11 12 13
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D201
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N303
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RF Troubleshooting

This document is written for use in conjunction with the WinTesla Tuning and Testing software. Pictures of the menu structures are shown through out the document. This document should be used in conjunction with the phone's schematics which are referred to in detail throughout.

WinTesla has 3 key menus:

Configure Basic set up covered in WinTesla General Set Up

Testing This menu allows switching on the phone in different modes

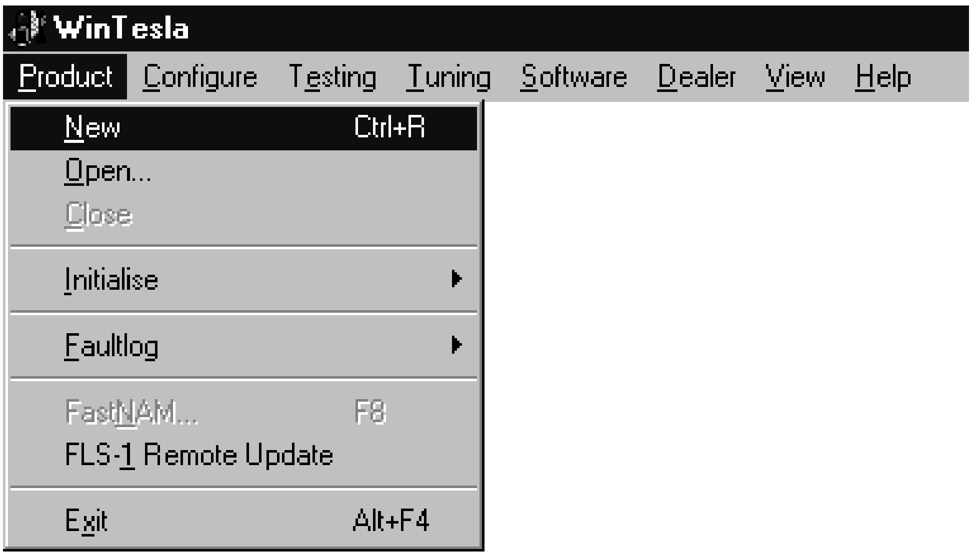
Tuning This menu allows tuning and storing of data to eeprom

Tuning is described in four parts:

A description of the tuning: Describes the tuning process
Definition of result: What tuning is storing to eeprom
Manual Verification: How to use WinTesla to tune the phone
Trouble Shooting: Outlines key components to be checked

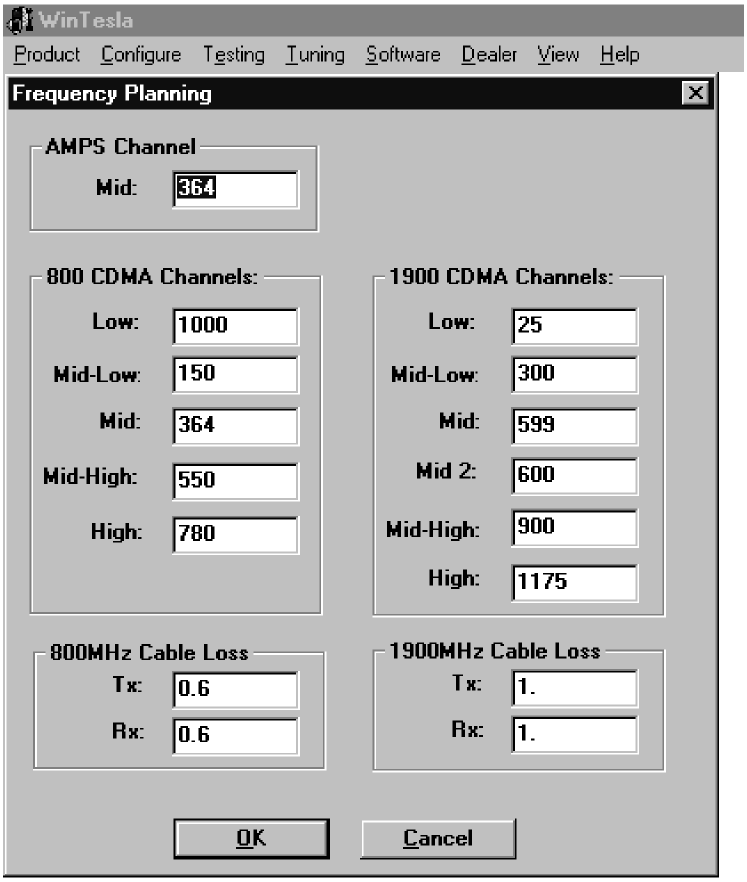
WinTesla General Set Up

Connect the phone to the PC COM port and start WinTesla. Select "Product" and "New" and the phone configuration will be selected automatically.



Select "Configure" and "Frequency Plan". You will then be able to see and also change the default AMPS and CDMA Channels. The cable loss should also be entered here.

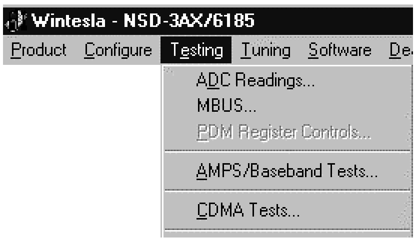
Note: It is possible to enter a Tx and Rx cable loss separately, however if a single cable is being used then both losses should be the same. Also the loss will be different for the 1900MHz band and the 800MHz band hence sections for both.


WinTesla
Product Configure Testing Tuning Software Dealer View Help
Frequency Planning
AMPS Channel
Mid: 364
800 CDMA Channels:
Low: 1000
Mid-Low: 150
Mid: 364
Mid-High: 550
High: 780
1900 CDMA Channels:
Low: 25
Mid-Low: 300
Mid: 599
Mid 2: 600
Mid-High: 900
High: 1175
800MHz Cable Loss
Tx: 0.6
Rx: 0.6
1900MHz Cable Loss
Tx: 1.
Rx: 1.
OK
Cancel

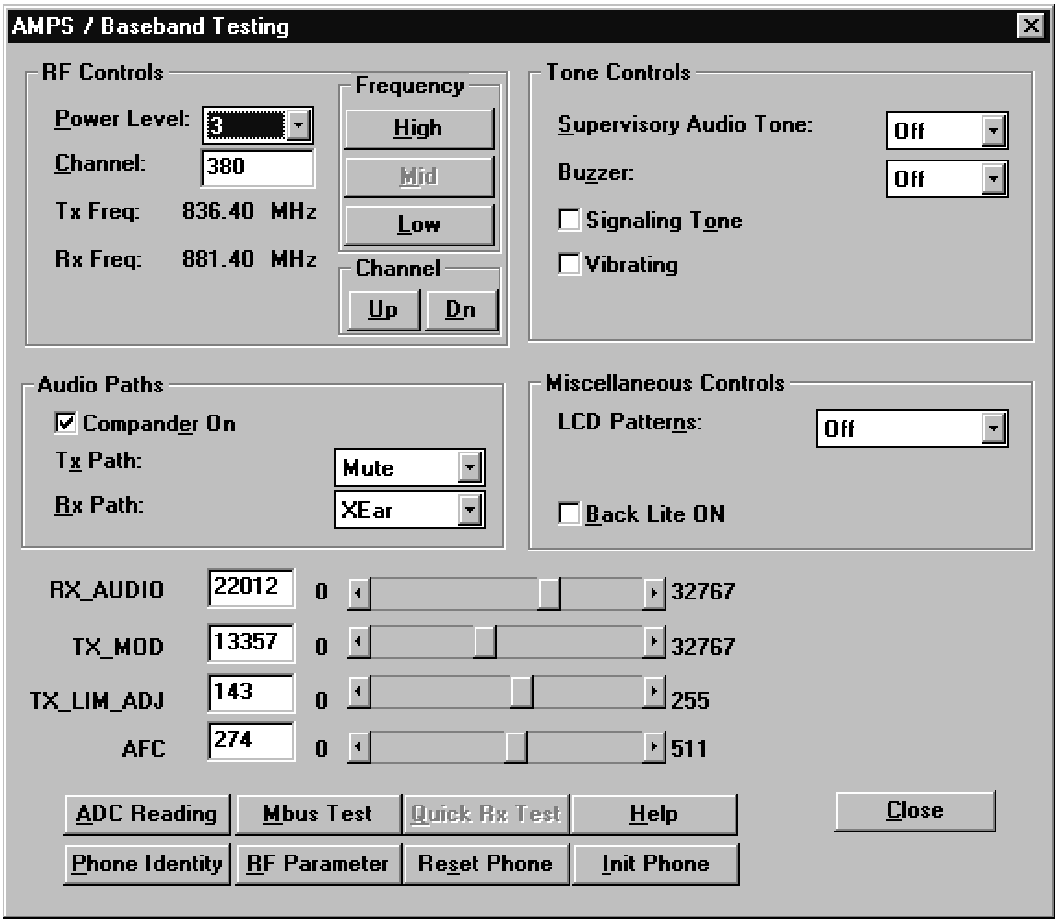
Testing Menu

AMPS Fault Finding Setup

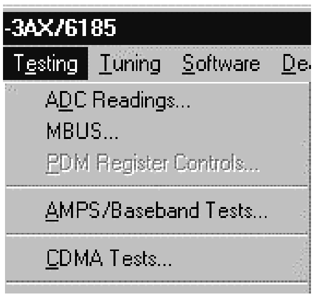
For all AMPS transmitter and receiver testing and trouble shooting select “Testing” and then “AMPS/Baseband Tuning”. This automatically sets the receiver on and the transmitter on Channel 380 Power level 3.



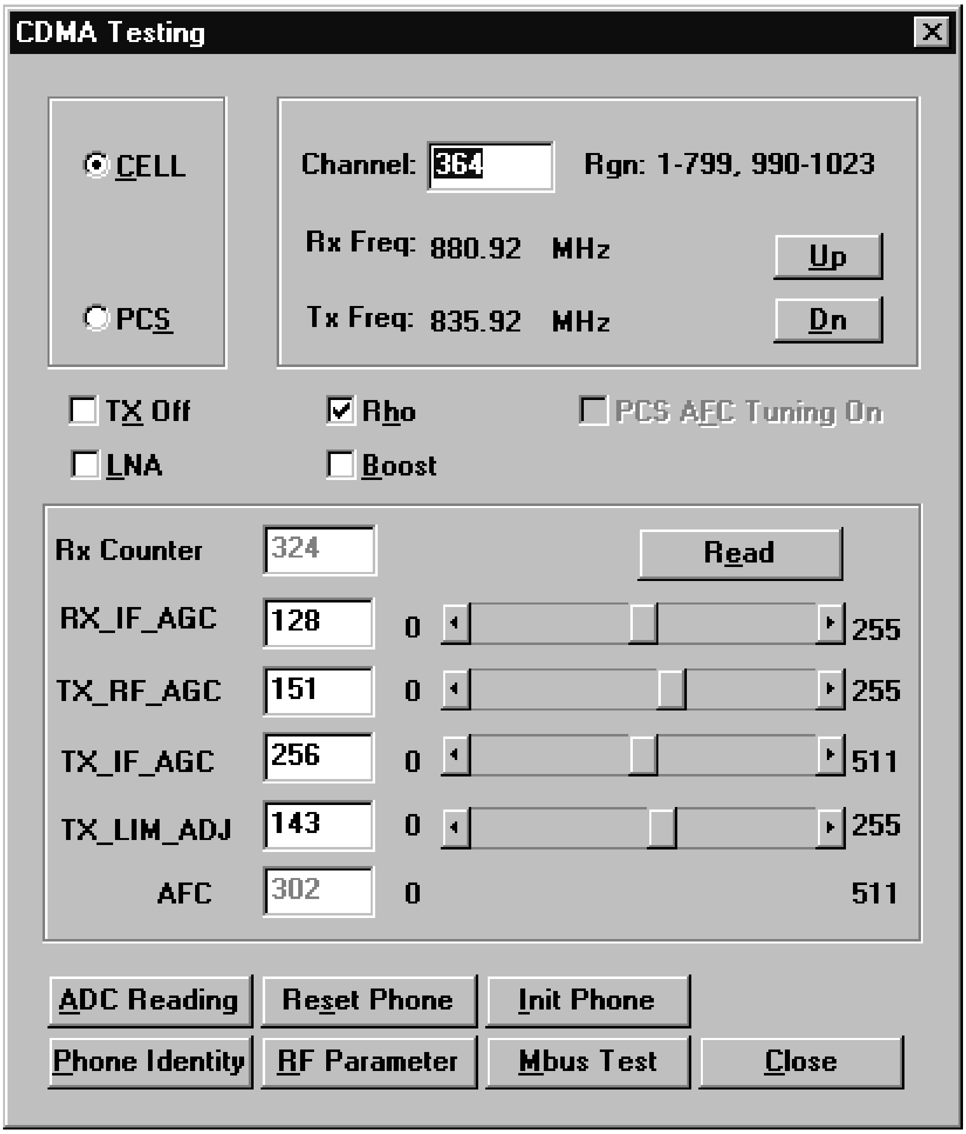
The transmitter power level can be set by selecting the “Power Level”. The TX_LIM_ADJ and other PDMs can be adjusted by selecting “PDM Ctrl”.



Cell Band CDMA Fault Finding Setup



Both 1900MHz and 800MHz CDMA is started from the same selection of “Testing” and “CDMA”. Entering this screen switches on both the transmitter and receiver on Channel 364. For PCS simply click the PCS box. The PDMs can be adjusted with the slider or by entering a value. The transmitter is switched off by clicking the “Tx Off” Box. The RX_IF_AGC is read by clicking the “Read” button. The LNA defaults to ON and OFF can be switch by ticking the “LNA” box.



PCS Band CDMA Fault Finding Setup

Use the same Testing menu as Cell CDMA, once in the CDMA Testing Window click PCS in the top left hand corner. See previous section.

Tuning Menu

The tuning menu is divided into the following sections:

Battery
AMPS
800 CDMA
1900 PCS

In all the tunings WinTesla will prompt you with the equipment settings. At the end of the tuning WinTesla will give you the option to save the new tuning values to EEPROM or to exit without saving new values to EEPROM.

AMPS Tuning AFC

Description of Test

This test tunes the VCTCXO to exactly 19.2 MHz using a DC voltage (TP100) controlled by the AFC PDM. The resulting PDM is stored to eeprom. The unmodulated AMPS transmitter is set on Channel. The output carrier is monitored with a spectrum analyzer. Click on WinTesla Help for equipment set up. The AFC PDM is tuned until the RF carrier frequency is within ±250Hz of 841.5MHz (i.e. Channel 550). The AFC must be tuned if the VCTCXO is replaced.

On SSP Phones where there is no AMPS the PCS Transmitter is used however the CDMA IQ modulation is switched off and the AFC is tuned on the CW carrier.

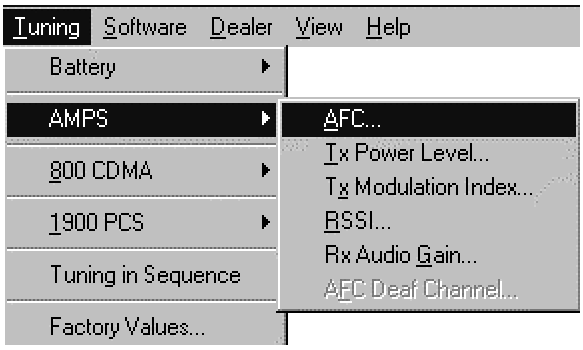
NOTE: The Spectrum Analyzer must be connected to a high stability 10MHz reference at the rear of the instrument, if this is not done then the tuning will not be accurate.

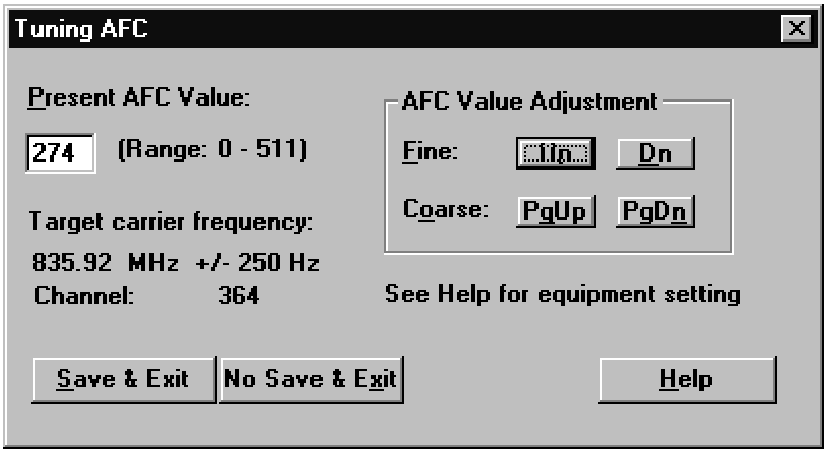
Definition of Result

The result of this tuning is the AFC PDM stored to eeprom which puts the VCTCXO at the correct frequency.

Manual Verification

Use WinTesla as follows:





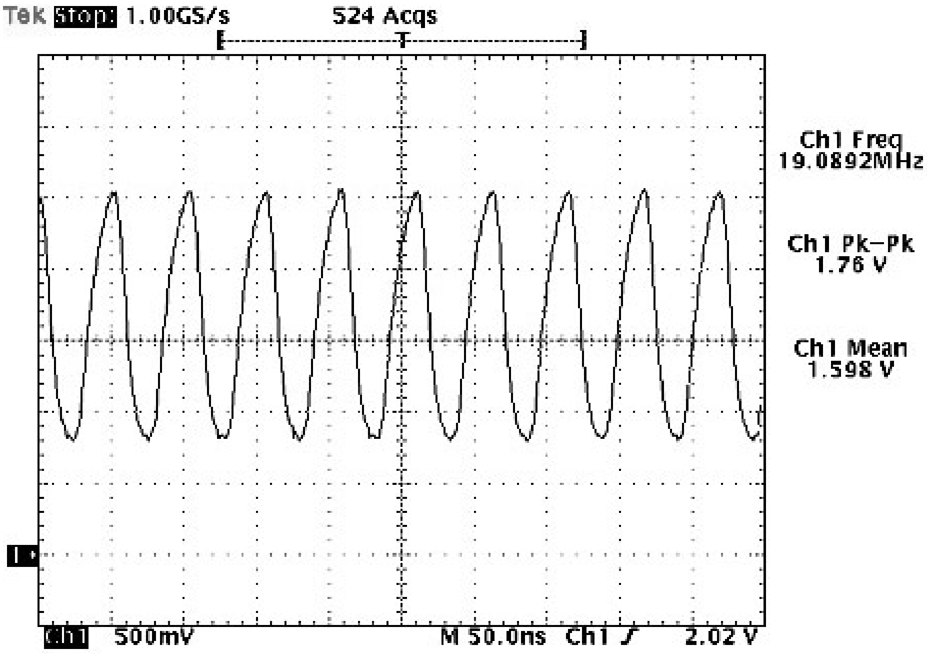
Trouble Shooting

The VCTCXO reference designator is G501. VR1 is supplies 2.7v to the VCTCXO (TP101) through R501 and decoupled with C561. The VCTCXO is controlled by a DC level from the AFC PDM in MAD connected to Pin 132. The PDM is filtered by R114 and C130 in the base band section and by R504 and C507 in the RF section. Resistors R503 and R538 center the PDM voltage. Typically a correctly tuned VCTCXO should have approximately 2 volts on pin 1 (TP100).

Adjustment of the AFC PDM from 0 to 511 should result in a voltage change on G501 Pin 1 (TP100) between 1.9 and 2.2 volts with a 10KHz change in the transmitter output frequency in Cel or a 22KHz change in PCS.

On SSP phones which do not have AMPS, clicking the “PCS AFC Tuning On” box will disable the CDMA modulation allowing AFC tuning to be performed on the RF carrier feed through.

19.2MHz measured at the output of the VCTCXO Buffer (TP102) with a 10 Mohm probe.



AMPS Tuning Tx Power Levels

Description of Test

These tests tune all the AMPS power levels 2 to 7 to the required output power level by changing the TX_LIM_ADJ PDM (TP103). This is done with the phone in AMPS mode with transmitter on and the TX_RF_AGC PDM set to FF and TX_IF_AGC set to 1FF.

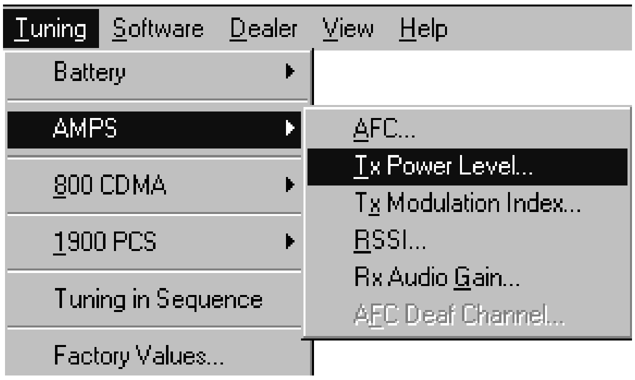
NOTE: The AMPS Transmitter band is frequency compensated with fixed values, these are referenced to the channel with the lowest loss which is Channel 550. It is **very** important to tune the transmitter using Channel 550 otherwise the maximum allowable power may be exceeded.

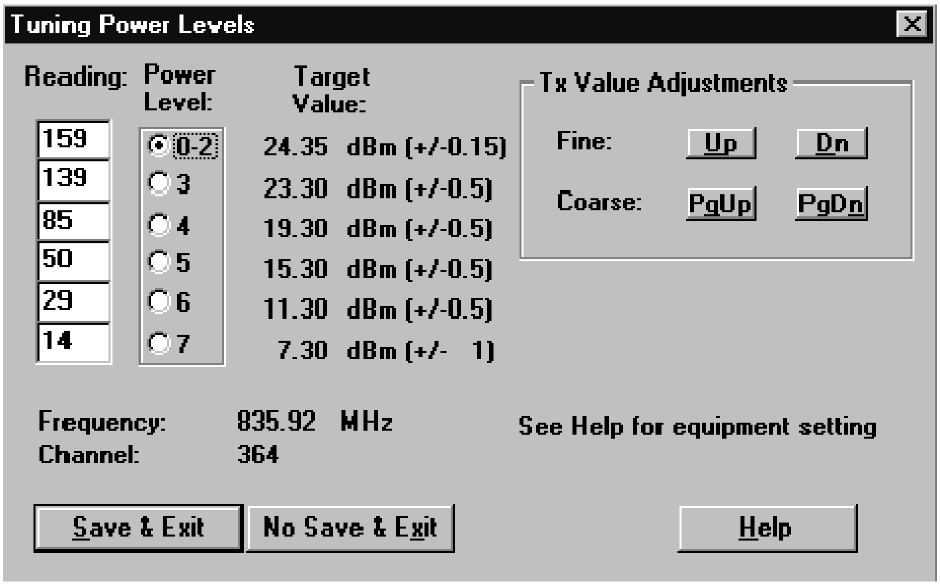
Definition of Result

When all the power levels have been correctly tuned the values of TX_LIM_ADJ PDM are stored in eeprom RF_TUNE_AMPS_TX_LIM_ADJ_HANDLE.

Manual Verification

Use WinTesla as follows:





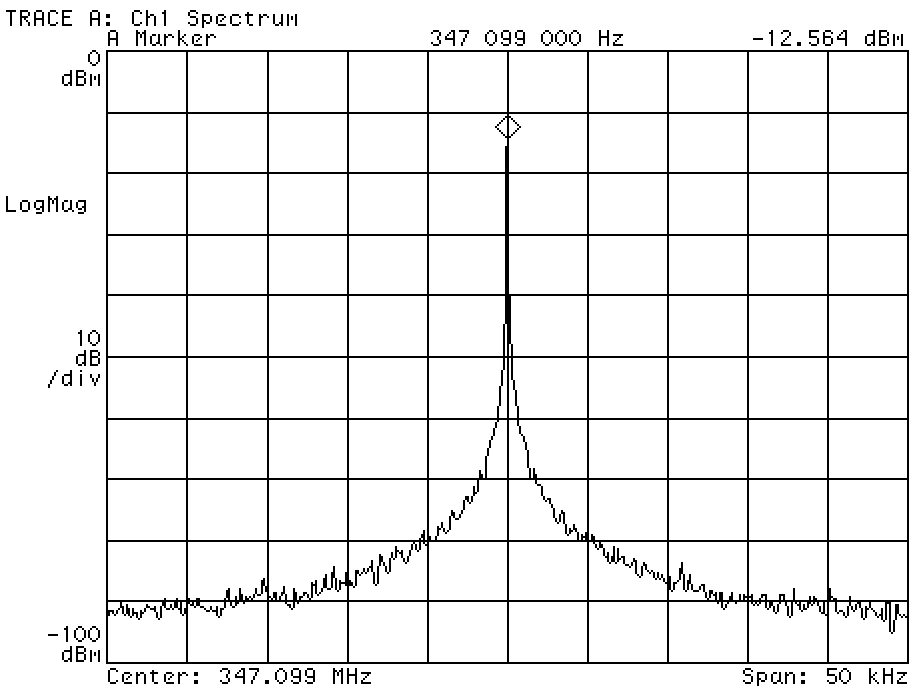
NOTE: This window was taken from WinTesla with the cable loss set at 0.7dB. The power levels tuned at the phones RF connector are:

Power Level	Nominal Power	Range
0–2	25.05 dBm	+/– 0.15 dB
3	24 dBm	+/– 0.5 dB
4	20 dBm	+/– 0.5 dB
5	16 dBm	+/– 0.5 dB
6	12 dBm	+/– 0.5 dB
7	8 dBm	+/– 1 dB

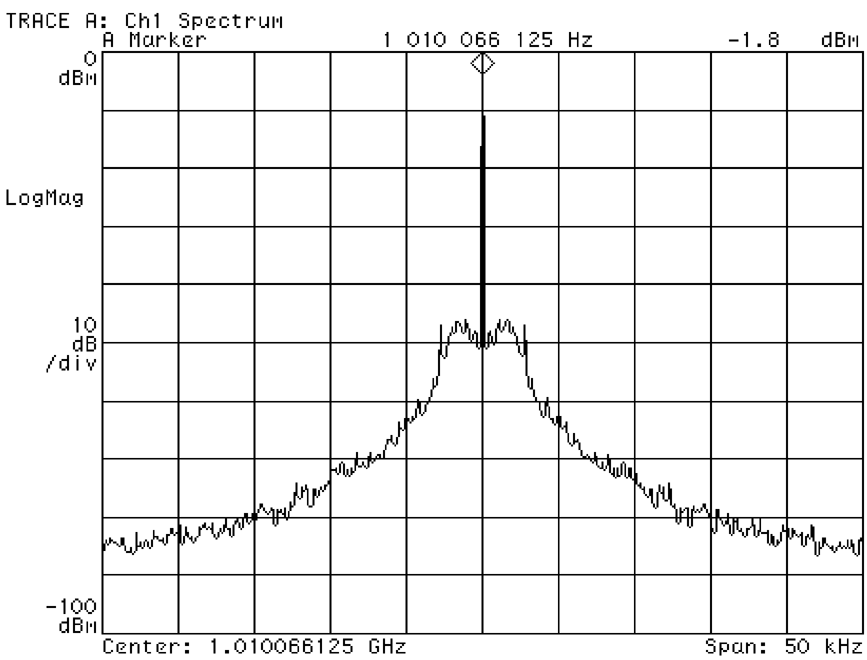
Trouble Shooting

If only the top PL2 or PL3 power levels fail then the transmitter is slightly short of gain. This could be caused by many transmitter faults. Check the PA N605 output Pins 11,12,13,14 (TP104) are not shorted to ground. **Note:** This should be done with the phone switched off. If these pins (TP104) are shorted the PA must be replaced, and it is likely that inductor L618 will have burnt out and become open circuit. Also check that the Tx VHF LO (TP105) and UHF LO (TP106) are present at the correct frequency and level (see below).

Tx VHF LO Measured at TIF N604 Pin 3 (TP105) with a Hi Z Probe:



UHF Cel LO measured at Odyssey N703 Pin 2 (TP106) with Hi Z probe when set to Channel 384:



AMPS Tuning Tx Modulation Index

Description of Test

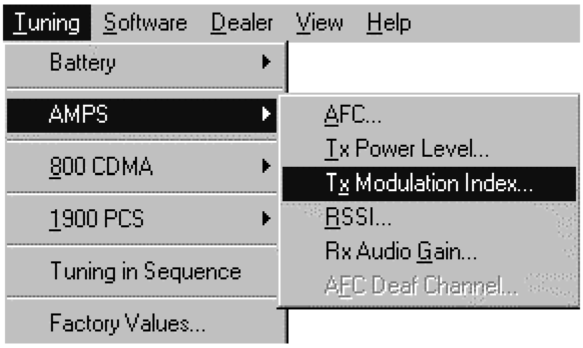
This test tunes the Gain in the DSP so that the amplitude of TX_MOD going into the Tx VHF VCO produces the correct peak deviation of the RF. Click the WinTesla Help button for equipment set up.

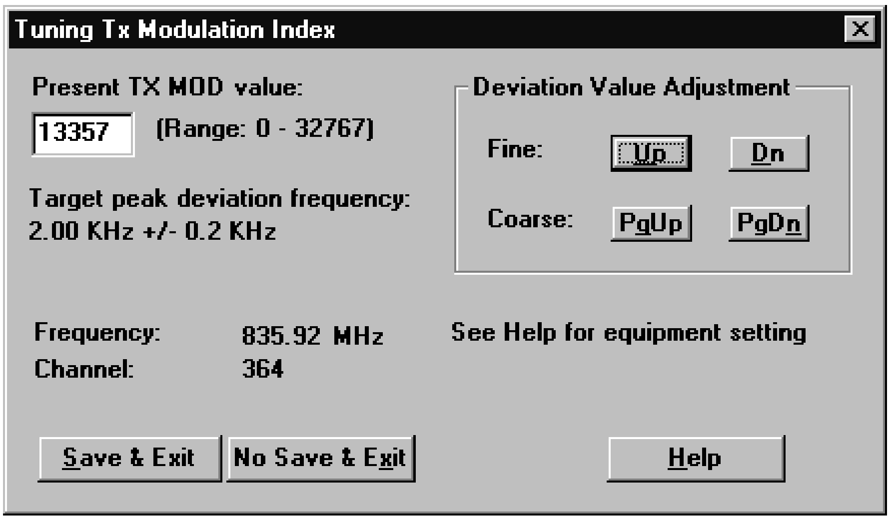
Definition of Result

The result is the DSP Gain, which gives 2KHz +/–0.05KHz peak deviation at the RF output. This DSP Gain is stored to eeprom.

Manual Verification

Use WinTesla as follows:





Trouble Shooting

Check the following components in the Tx VHF VCO to see if they are damaged V501, V504, V508, V511 and L504.

NOTE: If any of these components are replaced then the Tx Modulation Index must be re–tuned.

AMPS Tuning RSSI

Description of Test

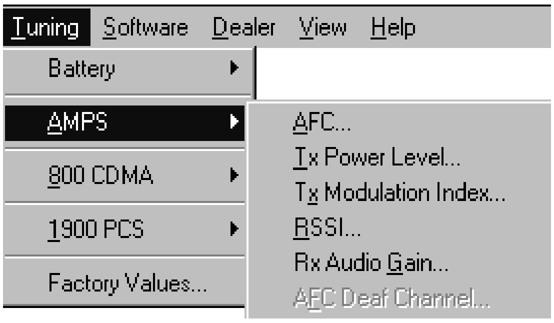
Changing the AMPS receiver input level results in different Gains in the Limiting amplifier in RIF to produce a limited output. This test measures AMPS RSSI with high receiver input signal and low receiver input signal, and then stores these values to eeprom. WinTesla will prompt with what level to set going into the receiver.

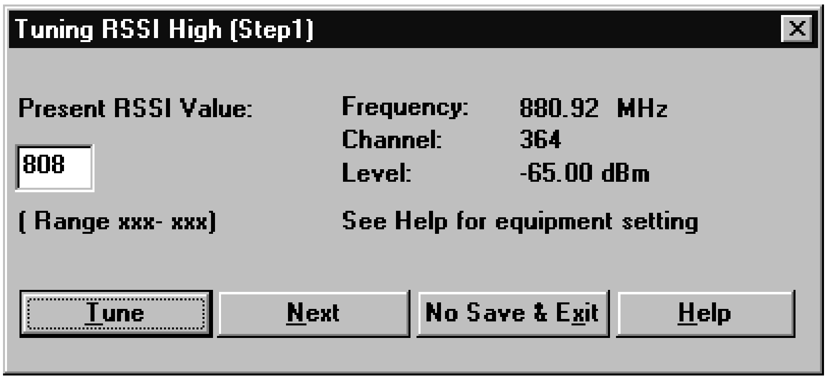
Definition of Result

The reported result is the ADC value from CCONT. For RSSI Lo the result should be between 570 and 970 and is stored to eeprom under the handle RF_TUNE_AMPS_RSSI_LO_HANDLE. For RSSI Hi result should be between 750 and 1050 and is stored to eeprom under the handle RF_TUNE_AMPS_RSSI_HI_HANDLE.

Manual Verification

Use WinTesla as follows:

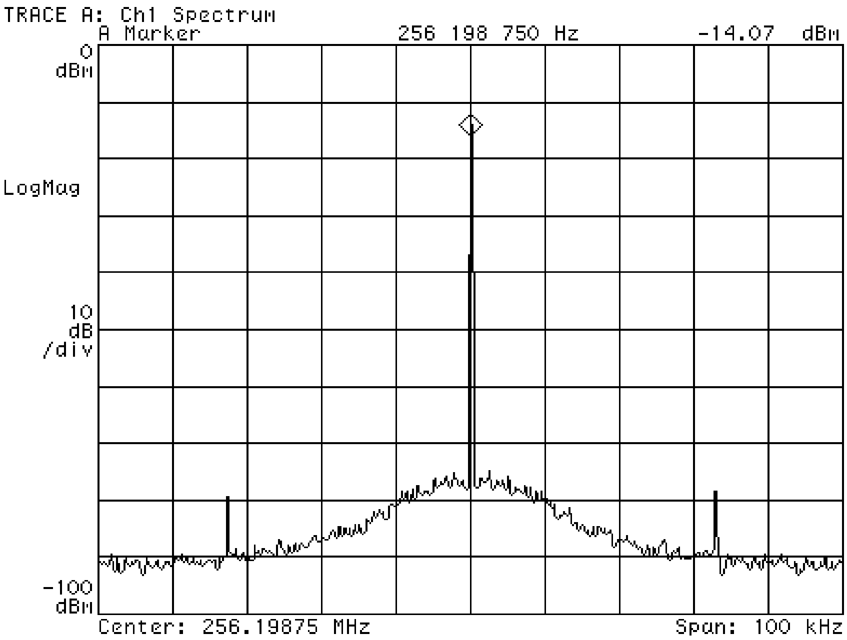




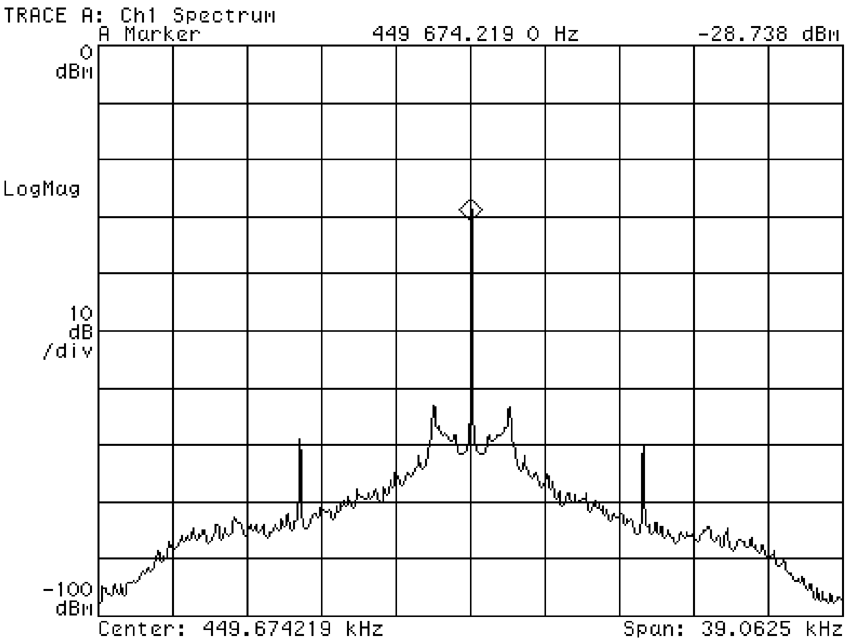
Trouble Shooting

Check components in the AMPS receiver chain starting with the Duplexer Z701, Down Converter IC N703, 128.55MHz IF SAW filter Z702, 450KHz Ceramic filters Z706 and Z708 and RIF N702. Check the Rx VHF LO RIF N702 Pin 20 (TP107) see below. Also check RIF 450KHz output LIM_P Measured at RIF Pin 17 (TP108) and the RSSI voltage at RIF N702 Pin 16 (TP109) which indicates the signal level into the receiver.

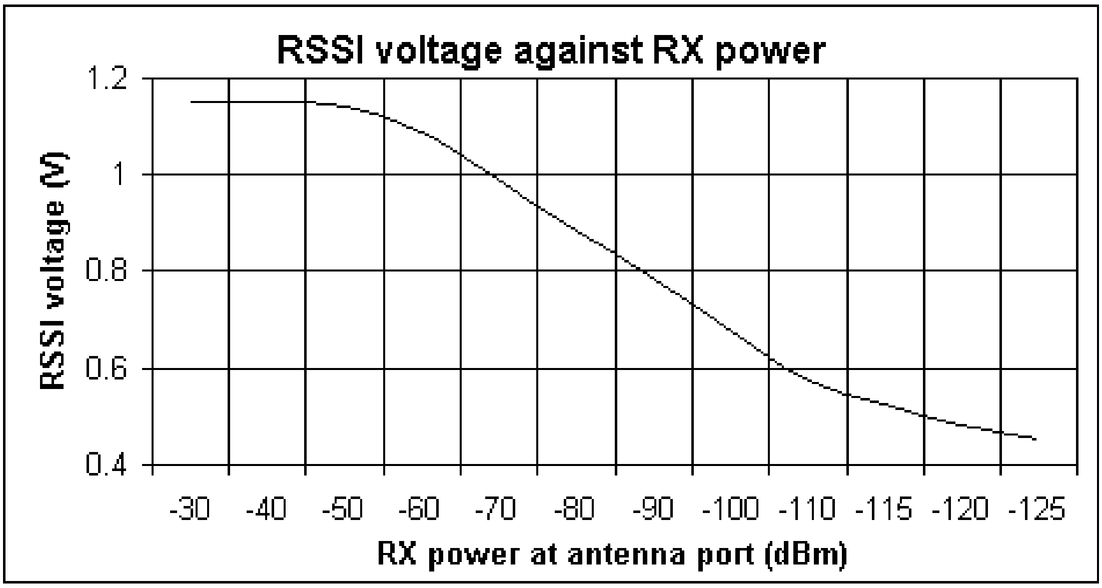
Rx VHF LO Measured at RIF N702 Pin 20 (TP107) with a Hi Z Probe:



LIM_P Measured at RIF Pin 17 (TP108) with a 10 Mohm probe:



RSSI Voltage at RIF N702 Pin 16 (TP109) versus Rx Power at RF connector:



AMPS Tuning Rx Audio Gain

Description of Test

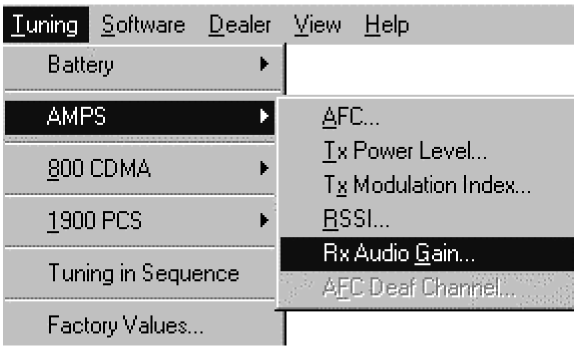
This test tunes the DSP Gain so that an RF input signal with 2.9KHz deviation and 1KHz modulation results in a voltage at the receiver output of 57.4 +/–3 mV RMS. The DSP Gain is then stored to eeprom.

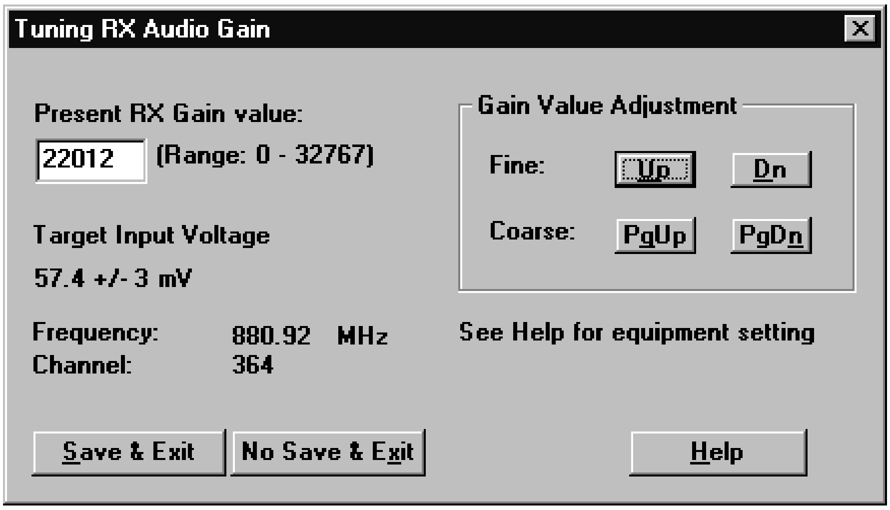
Definition of Result

The stored eeprom value will result in 57.4mV RMS at XEAR when using JBA4 and receiving an RF signal with 1KHz tone and 2.9KHz deviation.

Manual Verification

Use WinTesla as follows:





Trouble Shooting

Verify that the signal on RIF N702 Pin 17 (TP108) shown in the plot above is present on CAFÉ Pin 24 (TP110). If this is the case then check the test set up.

800 CDMA Tuning Tx IF AGC

Description of Test

The RIF and TIF AGC is approximately a second order curve, this curve is split into 16 segments for both Transmitter and Receiver. Offset and slope values are stored in eeprom for each of these 16 segments. The offset for the segments is computed from the 3–point calibration performed in this test. After test a 2^{nd} order approximation is made and the Offset and Slope computed.

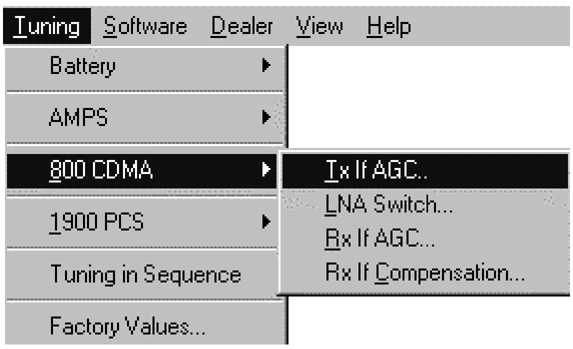
TX_IF_AGC must be adjusted to achieve the correct power level for Point 1, when this is done the process must be repeated for Points 2 and 3.

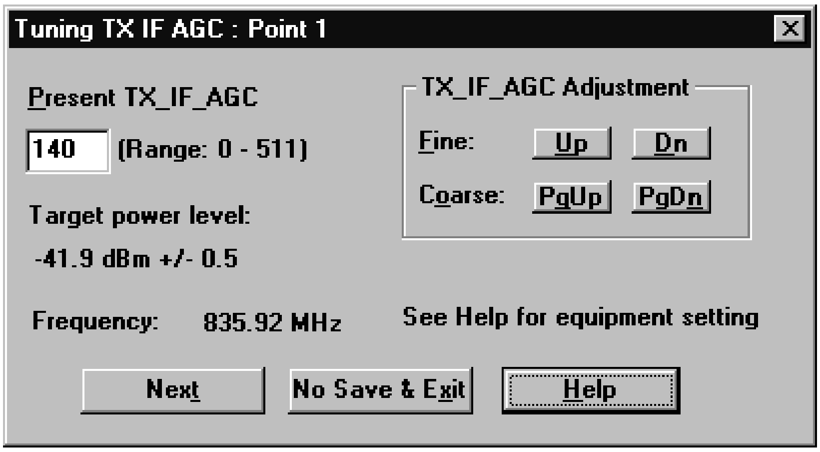
Definition of Result

The results of the 3 point tuning are the 16 slope and offset values, which are stored to eeprom RF_TUNE_CELL_TX_AGC_OFFSET_SLOPE_HANDLE.

Manual Verification

Use WinTesla as follows:



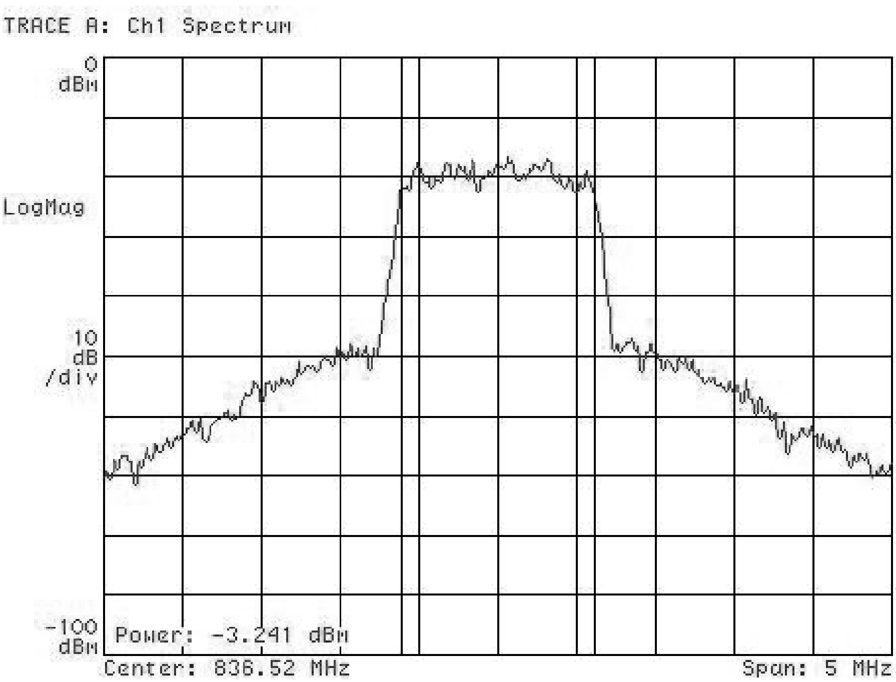


Trouble Shooting

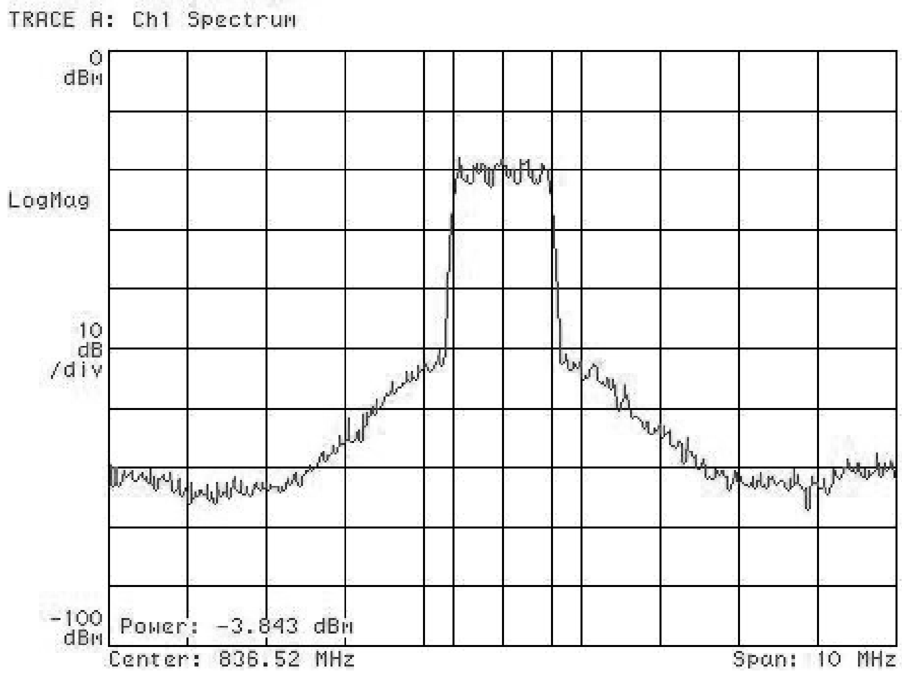
If this tuning fails it is probably the highest power level indicating that there is a gain loss in the transmitter path. This could be caused by many transmitter faults. Check the PA N605 output Pins 11,12,13,14 (TP104) are not shorted to ground. Note this should be done with the phone switched off. If these pins are shorted the PA must be replaced, and it is likely that inductor L618 will have burnt out. Also check that the Tx VHF LO (TP105) and UHF LO (TP106) are present at the correct frequency and level (see the AMPS Tuning Tx Power Levels section).

NOTE: If any of these components are damaged and are replaced then the Tx IF AGC must be retuned.

Tx Output spectrum at RF Connector with 30dB attenuator on Spectrum Analyzer:



Tx Output spectrum at RF Connector with 30dB attenuator on Spectrum Analyzer:



800 CDMA Tuning LNA Switch

Description of Test

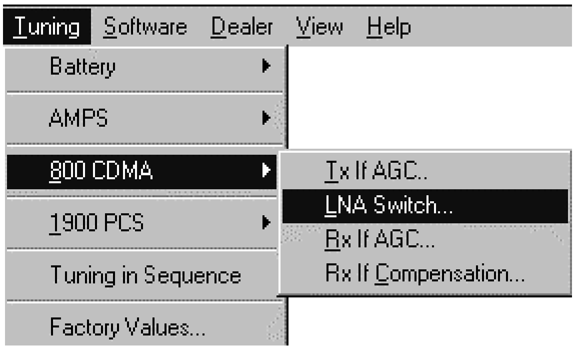
In this test the phone is set to continuous receive mode, a CW signal is put into the receiver via the RF connector. WinTesla with indicated the amplitude. There is a frequency offset of 300KHz from the center of the receiver. The RX_IF_AGC is adjusted by the phones software to make the best use of the CAFÉ ADC. The setting of RX_IF_AGC is then read from the phone. The LNA is switched from High Gain mode to Low Gain Mode. The RX_IF_AGC is allowed to readjust itself to again make the best use of the CAFÉ ADC and the RX_IF_AGC is read a second time. The result is the Gain delta between High Gain and Low Gain modes.

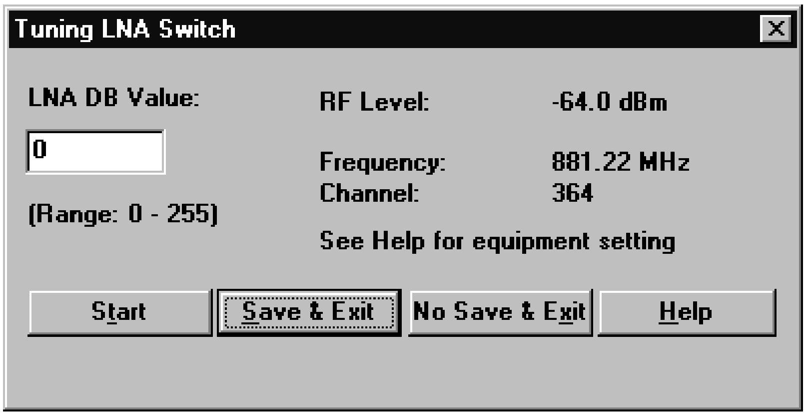
Definition of Result

The displayed result is the High Gain – Low Gain delta in dB after applying the PDM difference to the previously computed 3–point curve fit. This delta should be between 21 and 24dB. This is stored to eeprom handle RF_TUNE_RX_GS_HANDLE.

Manual Verification

Use WinTesla as follows:





Trouble Shooting

Check that the RX_GS line on the up–converter N703 Pin 15 (TP111) is changing from high to low. If this is and the Gain does not change significantly then the Up–converter IC N703 is probably faulty and should be replaced.

800 CDMA Tuning Rx IF AGC

Description of Test

The RIF and TIF AGC is approximately a second order curve, this curve is split into 16 segments for both Transmitter and Receiver. Offset and slope values are stored in eeprom for each of these 16 segments. The offset for the segments are computed from the 3–point calibration performed in this test. After test a 2nd order approximation is made and the Offset and Slope are computed.

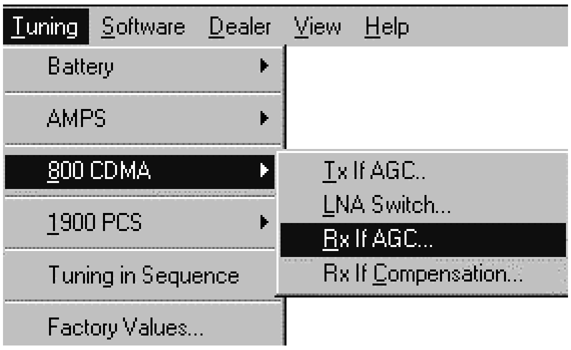
This tuning is done by putting signal level 1 into the receiver, the RX_IF_AGC will then automatically adjust for max CAFÉ input and the RX_IF_AGC is noted. This process is then repeated for signal levels 2 and 3.

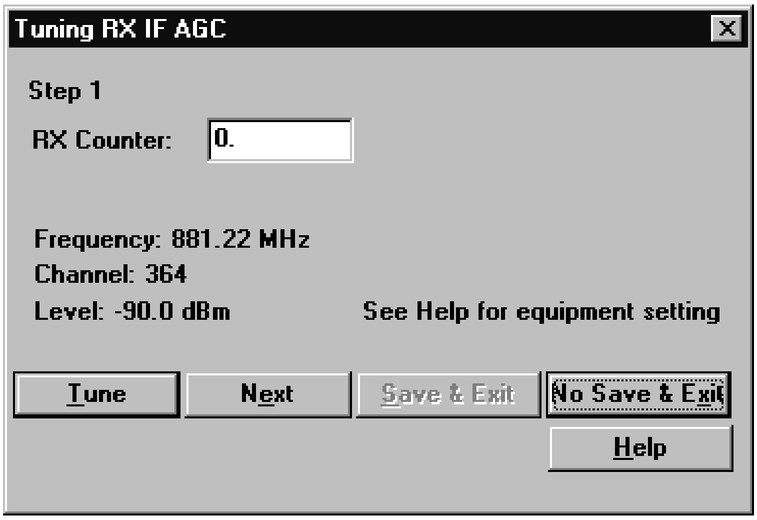
Definition of Result

The results of the 3 point tuning are the 16 slope and offset values, which are stored to eeprom RF_TUNE_CELL_RX_AGC_OFFSET_SLOPE_HANDLE.

Manual Verification

Use WinTesla as follows:





Trouble Shooting

Check components in the 800 MHz receiver chain, from the Duplexer N701, Down converter N703, the 128.1MHz CDMA IF SAW filter Z704 and RFI N702. Check that the RX_IF_AGC RIF Pin 7 (TP112) changes as the receiver input signal level is adjusted.

NOTE: If any of these components are damaged and are replaced then the Rx IF AGC second order curve must be retuned.

800 CDMA Tuning Rx IF Compensation

Description of Test

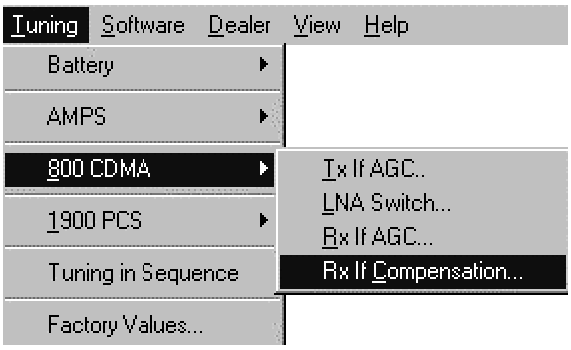
In this tuning the receiver is calibrated at five different frequencies across the band. WinTesla instructs the Signal Generator to be set at five specific frequencies and a fixed amplitude. The RX_IF_AGC is adjusted by the phones software to make the best use of the CAFÉ ADC. The setting of RX_IF_AGC is then read from the phone at each of the five frequencies.

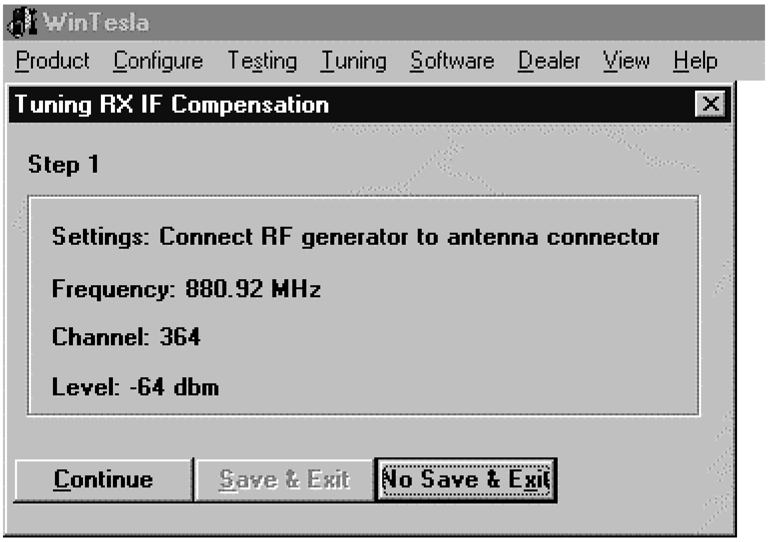
Definition of Result

The five different values of RX_IF_AGC are stored to EEPROM.

Manual Verification

Use WinTesla as follows:





Trouble Shooting

See section 800 CDMA Tuning Rx IF AGC

1900 CDMA Tuning Tx IF AGC

Description of Test

The RIF and TIF AGC is approximately a second order curve, this curve is split into 16 segments for both Transmitter and Receiver, Offset and slope values are stored in eeprom for each of these 16 segments. The offset for the segments are computed from the 3–point calibration performed in this test, then a 2^{nd} order approximation is made and the Offset and Slope computed.

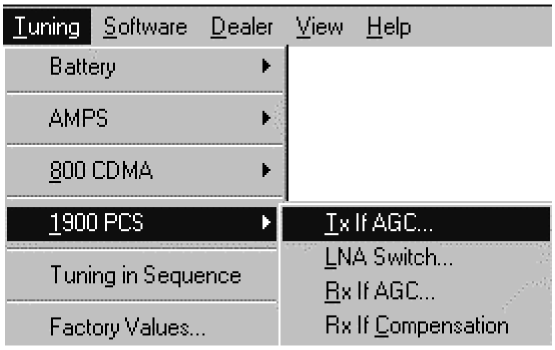
TX_IF_AGC must be adjusted to achieve the correct power level for Point 1, when this is done the process must be repeated for Points 2 and 3.

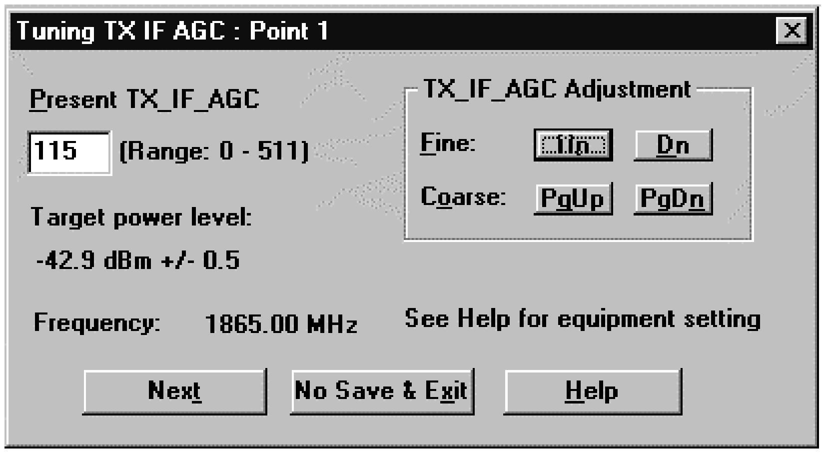
Definition of Result

The results of the 3 point tuning are the 16 slope and offset values, which are stored to eeprom RF_TUNE_PCS_TX_AGC_OFFSET_SLOPE_HANDLE.

Manual Verification

Use WinTesla as follows:





Trouble Shooting

If this tuning fails it is probably the highest power level indicating that there is a gain loss in the transmitter path. This could be caused by many transmitter faults. Check the PA N606 output Pins 11,12,13 and 14 (TP113) are not shorted to ground. If this is the case PA must be replaced. Also it is likely that inductor L611 has burnt out and has open circuit. Check the switch to the split band filter N609 and it's control transistor V614 and control line FILT_SEL (TP114). Check also the Up Converter, N601 and also TIF, N604. Also check that the Tx VHF LO (TP105) and UHF LO (TP115) are present at the correct frequency and level.

NOTE: If any of these components are damaged and are replaced then the Tx IF AGC must be retuned.

1900 CDMA Tuning LNA Switch

Description of Test

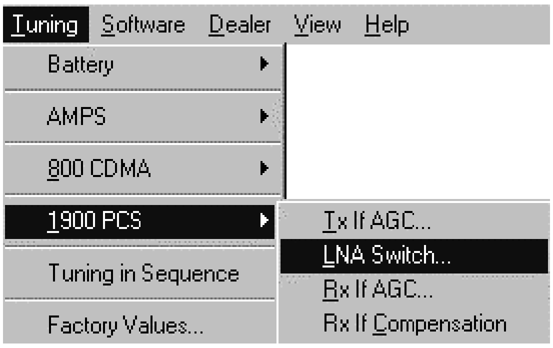
In this test the phone is set to continuous receive mode, a CW signal is put into the receiver via the RF connector with amplitude of dBm and offset 300KHz from the center of the receiver. The RX_IF_AGC adjusts to make the best use of the CAFÉ ADC. The setting of RX_IF_AGC is then read from the phone. The LNA is switched from High Gain mode to Low Gain Mode. The RX_IF_AGC is allowed to readjust itself to again make the best use of the CAFÉ ADC and the RX_IF_AGC is read a second time. The result is the Gain delta between High Gain and Low Gain modes.

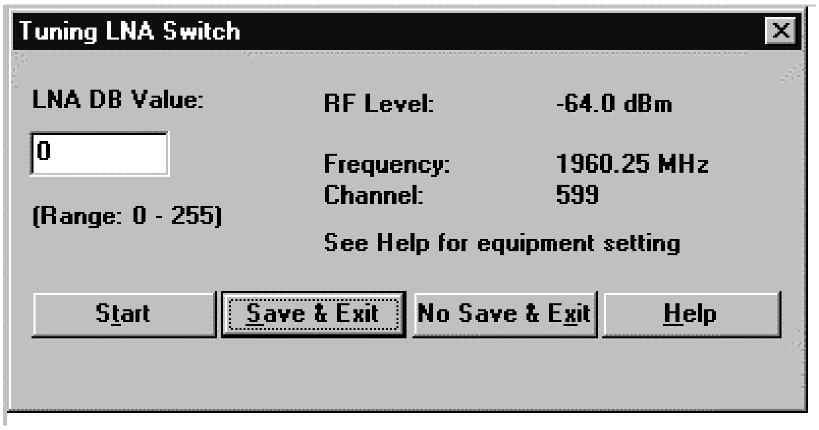
Definition of Result

The displayed result is the High Gain – Low Gain delta in dB after applying the PDM difference to the previously computed 3–point curve fit. This delta should be between 21 and 30dB. It is stored to eeprom handle RF_TUNE_RX_GS_HANDLE.

Manual Verification

Use WinTesla as follows:





Trouble Shooting

In the PCS band the RX_GS input to the up–converter N01 is NOT used. Instead the external LNA is switched on and off with Penta N303 Pin 9 (output P5) (TP116). Check that the external LNA is being switched on and off by probing. If this is the case then there is probably a fault with the external LNA. Check the transistor V705 and it’s collector components L710. Also check the bias circuitry V704 and L708.

NOTE: If any of these components are damaged and are replaced then the Rx IF AGC must be retuned.

1900 CDMA Tuning Rx IF AGC

Description of Test

The RIF and TIF AGC is approximately a second order curve, this curve is split into 16 segments for both Transmitter and Receiver. Offset and slope values are stored in eeprom for each of these 16 segments. The offset for the segments are computed from the 3–point calibration performed in this test, then a 2^{nd} order approximation is made and the Offset and Slope computed.

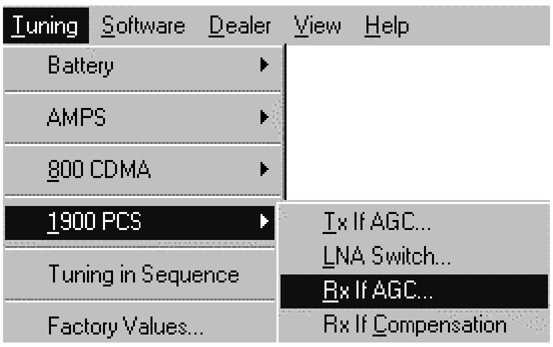
This tuning is done by putting signal level 1 into the receiver, the RX_IF_AGC will then automatically adjust for max CAFÉ input and the RX_IF_AGC is noted. This process is then repeated for signal levels 2 and 3.

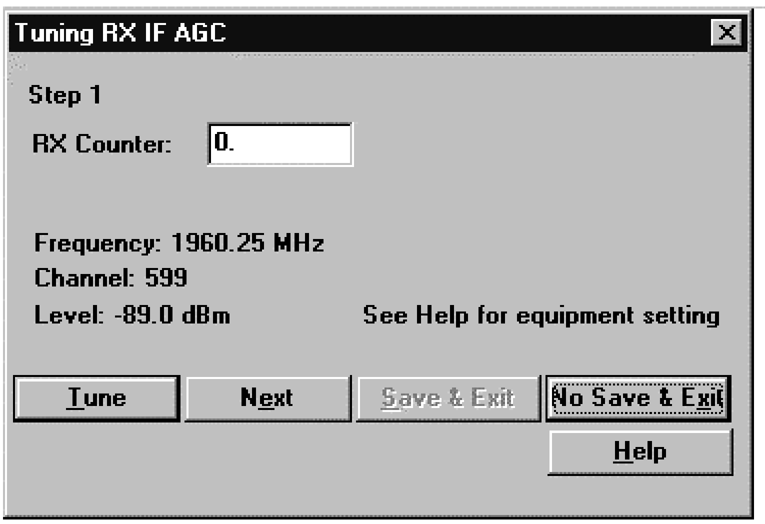
Definition of Result

The results of the 3 point tuning are the 16 slope and offset values which are stored to eeprom RF_TUNE_PCS_RX_AGC_OFFSET_SLOPE_HANDLE.

Manual Verification

Use WinTesla as follows:





Trouble Shooting

Check components in the 1900 MHz receiver chain, from the Duplexer N711, External LNA V705, Down converter N701, the 128.1MHz CDMA IF SAW filter Z704 and RFI N702. Check that the RX_IF_AGC RIF Pin 7 (TP112) changes as the receiver input signal level is adjusted.

NOTE: If any of these components are damaged and are replaced then the Rx IF AGC must be retuned.

1900 CDMA Tuning Rx IF Compensation

Description of Test

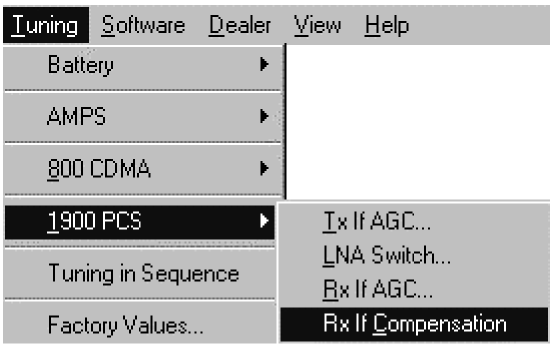
In this tuning the receiver is calibrated at six different frequencies across the band. WinTesla instructs the Signal Generator to be set at six specific frequencies and a fixed amplitude. The RX_IF_AGC is adjusted by the phones software to make the best use of the CAFÉ ADC. The setting of RX_IF_AGC is then read from the phone at each of the six frequencies.

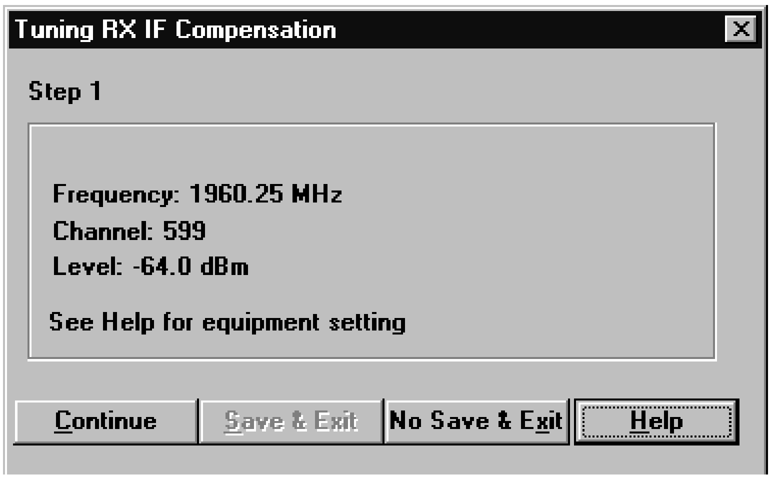
Definition of Result

The five different values of RX_IF_AGC are stored to EEPROM.

Manual Verification

Use WinTesla as follows:





Trouble Shooting

See section 1900 CDMA Tuning Rx IF AGC.

Test Point values

NOTE: Test Point layout pictures are at the back of the binder.

Test Point Designator	Signal Name	General Characteristics	General Signal Destination
100	AFC	VCTCXO Control voltage	PDM from MAD4
101	VR1	2.7v supply to VCTCXO	CCONT to VCTCXO
102	19.2 MHz	19.2 MHz from VCTCXO buffer	VCTCXO Buffer to CAFÉ and PLL IC’s
103	TX_LIM_ADJ	Detector demand voltage	PDM from MAD4 Pin 128 detector circuit at RF output
104	800 MHz PA Output	RF output from PA check for short with phone switched OFF	RF output from PA to Isolator
105	Tx VHF LO	VHF LO to TIF (PCS 416.2 MHz / CELL CDMA 346.2 MHz / AMPS 347.1 MHz)	LO from PLL to TIF IC
106	Tx UHF LO 1 GHz	UHF LO to Odyssey up converter IC	LO from 1 GHz VCO to Odyssey up converter IC
107	Rx VHF LO	256.2 MHz VHF LO to RIF	LO from PLL to RIF
108	LIM_P	450 KHz signal from RIF	RIF 450 KHz output to CAFÉ
109	RSSI	dc voltage indicating signal level into receiver	RIF output to CCONT Pin A1 A to D converter
110	LIM_P	450 KHz signal into CAFÉ	RIF 450 KHz output to CAFÉ
111	RX_GS	0v or 2.7v for LNA OFF or ON	Voyager down converter LNA control from MAD4 Pin 2
112	RX_IF_AGC	Dc voltage proportional to signal level into receiver in CDMA mode	AGC control voltage from MAD4 Pin 133 to RIF Pin 7
113	1900 MHz PA Output	RF output from PA Check for short with phone switched OFF	RF Output from PA to Isolator
114	FILT_SEL	0v or 2.7v for PCS High band or Low band	Filter control line from MAD4 Pin 129
115	Tx UHF LO 2GHz	UHF LO to Apache Up converter IC	UHF LO from VCO to Apache up converter N601 Pin 6
116	Penta P5	0v or 2.7 from Penta P5 to PCS LNA for LNA OFF or ON	Control for PCS LNA from Penta N303 Pin 9