FUNCTION OF SEMICONDUCTORS AND OTHER ACTIVE DEVICES

Transceiver

Schematic Ref. Designator	Device Type	Circuit Application	Source
Q740	NPN	receive VCO #1	Motorola
Q780	NPN/PNP Combo	DC supply switch	Phillips
Q785	PNP	DC supply switch	Motorola
Q901	NPN	low noise amplifier	Hewlett Packard
Q930	PNP	DC bias	Motorola
Q931	NPN	low noise amplifier	Motorola
Q935	NPN	Buffer	Motorola
Q940	NPN	Buffer	Motorola
Q980	NPN	receive VCO #2	Motorola
U720	BiCMOS IC	TX/RX synthesizer	Motorola
U721	CMOS IC	OR gate	Toshiba
U760	silicon bipolar IC	buffer amplifier	Motorola
U770	LDMOS	RF power amplifier	Motorola
U771	CMOS IC	operational amplifier	National Semiconductor
U791	CMOS IC	operational amplifier	National Semiconductor
U850	CMOS IC	D/A convertor	Analog Devices
U920	GaAs IC	RX mixer	Triquint
U930	CMOS IC	receiver IF subsystem	Analog Devices
U980	CMOS IC	RX synthesizer	Motorola
U981	CMOS IC	OR gate	Toshiba
Y700	VC TCXO	reference oscillator	Motorola
Y740	Resonator	receive VCO #1	Murata

FUNCTION OF SEMICONDUCTORS AND OTHER ACTIVE DEVICES – CONTINUED

Controller

Schematic Ref. Designator	Device Type	Circuit Application	Source
Q211	P-channel FET	open collector I/O	International Rectifier
Q212	P-channel FET	open collector I/O	International Rectifier
Q213	Dual NPN	open collector I/O	Phillips
Q214	Dual NPN	open collector I/O	Phillips
Q240	PNP	power supply	Rohm
Q280	P-channel FET	backup battery	Motorola
Q281	Dual NPN	backup battery	Phillips
Q283	NPN/PNP Combo	backup battery	Phillips
Q290	NPN/PNP Combo	open collector I/O	Phillips
Q291	Dual NPN	open collector I/O	Phillips
Q292	NPN/PNP Combo	open collector I/O	Phillips
Q293	NPN/PNP Combo	open collector I/O	Phillips
Q294	Dual NPN	open collector I/O	Phillips
Q295	NPN/PNP Combo	open collector I/O	Phillips
Q296	NPN/PNP Combo	open collector I/O	Phillips
Q297	Dual NPN	open collector I/O	Phillips
Q298	NPN/PNP Combo	open collector I/O	Phillips
U100	CMOS IC	microprocessor	Motorola
U110	CMOS IC	digital signal processor	Lucent
U180	CMOS IC	A/D convertor	Analog Devices
U190	CMOS IC	memory	Toshiba
U210	CMOS IC	open collector I/O	Motorola
U211	CMOS IC	open collector I/O	Motorola
U220	CMOS IC	power supply	National Semiconductor
U230	CMOS IC	power supply	Sharp
U240	CMOS IC	power supply	Ricoh
U270	CMOS IC	RS-232	Maxim
U285	CMOS IC	backup battery	Sharp
U290	CMOS IC	Open Collector I/O	Motorola
Y100	Crystal	38.4 KHz Clock	Micro Crystal or Seiko

TUNE-UP PROCEDURE

The following tune-up procedure is similar to what will appear in the final service manual. Only qualified service shops will have the equipment necessary to make transmitter adjustments (frequency and modulation parameters) via Tune Modes.

Recommended Tune/Test Equipment

Intel-based PC running Windows98 operating system (also called “PC”)
CreataLink™ Paging Programming Software for the PC (also called “PPS software”)
Serial Interface cable (for power and a serial connection between CreataLink™ and the PC)
HP53310A Modulation Domain Analyzer with options 031 and 001 (also called “MDA”)
HP8991A Peak Power Analyzer
HP84815A Peak Power Sensor
HP53131A Universal Counter
Signal/oscilloscope probe (for attachment to HP53131A)
20 dB attenuator
10 MHz reference line

Test Mode Descriptions

Typically, the radio is tested in Test Mode first to verify proper radiated performance (FM deviation, silent carrier, etc., all at 901.40625 MHz test frequency). If any parameter needs tuning, the radio is placed in Tune Mode using the PPS software, which reads and writes to the radio via the serial interface cable. Once the parameter is tuned, the radio is tested to verify the correct tuned value. The applicable test modes are:

Test Mode List For Transmitter Tune-Up (TX at 901.40625 MHz)

Test Mode	Radio Output
Reference Oscillator Test	16.8 MHz signal at Test Point TP700
Silent Carrier Test	constant tx: unmodulated carrier
Balance Low Test	constant tx: 100 Hz sinewave at full deviation
Balance High Test	constant tx 1600 Hz sinewave at full deviation
Symbol Deviation Test	constant tx: pseudo-random four-level FSK data sequence
Transmitter On	16 msec tx repeated every 2 sec: simulated ack data
Long Reverse	550 msec tx repeated every 2 sec: four-level stair-step data

TUNE-UP PROCEDURE – CONTINUED

How to Place Radio in Tune Mode

1. Plug the serial interface cable into a wall outlet, then connect it to the PC serial port and to the radio.
2. On the PPS software, click the **Read Device** icon to read the radio's current tuning values. (Note: The radio must be read by the PPS software successfully before any other operations can be performed.)

3. Click on the **Device Tuning** icon. This will bring up the Tuning Toolbar icons.
4. Click on the desired test mode icon. This will create a secondary window showing the current tuning values. Only the tuning values that correspond to the test mode are able to be adjusted.
5. Click on the **Start Test** button. The test mode will now be active; adjust the tuning value as needed.
6. When tuned, the test mode is stopped by selecting the **Stop Test** button.
7. If any tuning values were adjusted, then click on the **Accept** button to accept the new tuning values. Then click on the **Write Device** icon to write the new tuning values to the radio.

Adjust the Reference Oscillator

1. Connect the 10 MHz reference line and signal probe to the HP53131A Universal Counter.
2. Connect the signal probe to TP700 on the transceiver board.
3. Initiate the Reference Oscillator tune mode by clicking the **Reference Oscillator Test** icon on the PPS software and then click on the **Start Test** button.
4. Measure and verify that the reference oscillator is outputting 16.8 MHz at TP700.
5. If the reference oscillator is not outputting within 0.1 ppm of 16.8 MHz at TP700, tune the oscillator as necessary using the PPS software until it meets this tolerance level.
6. Click on the **Stop Test** button to disable the test.
7. Write the final tuned value to the radio by clicking the **Accept** button and then click on the **Write Device** icon.

TUNE-UP PROCEDURE – CONTINUED

Adjust the Silent Carrier Frequency/Verify Carrier Noise

1. Connect the 10 MHz reference line to the HP53310A MDA.
2. Set up the MDA with the following settings:
   Input – channel C
   Function – Frequency (channel C)
   Vertical (Center/Span) – 901.00625 MHz Center Frequency
   Vertical (Span) – 1 KHz
   Timebase – 1 millisecond
   Timebase (Reference) – Left
   Timebase (Delay) – 1 millisecond
   Timebase (Panorama) – off
   Trigger – Automatic, RF Envelope
   Sampling – Automatic
   Frequency Markers – on with Track enabled
   Peak-Peak Deviation function enabled – press blue "SHIFT" key followed by "8" key
3. Connect the 20 dB attenuator to the radio's RF connector and then to the MDA channel C.
4. Initiate the Silent Carrier tune mode by clicking the **Silent Carrier Test** icon on the PPS software and then click on the **Start Test** button. The radio transmits an unmodulated carrier signal until the test is disabled.
5. Measure the carrier frequency; it must be within 100 Hz of 901.00625 MHz; if not, stop the Silent Carrier Test, realign the reference oscillator, and then remeasure the carrier frequency.
6. Measure the peak-peak deviation; it must not exceed 300 Hz pk-pk.
7. Click the **Stop Test** button to disable the test.

Measure Balance Low

1. Set up the MDA the same way as in the Silent Carrier Frequency test EXCEPT for the following settings:
   Timebase – 5 milliseconds
   Vertical (Span) – 8 KHz
3. Connect the 20 dB attenuator to the radio's RF connector and then to the MDA channel C.
4. Initiate the Balance Low tune mode by clicking the **Modulation Balance Low Test** icon on the PPS software and then click on the **Start Test** button.
5. Measure the peak-peak deviation for reference; there is no tuning with this test.
6. Click the **Stop Test** button to disable the test.

TUNE-UP PROCEDURE – CONTINUED

Measure/Adjust Balance High

1. Set up the MDA the same way as in the Silent Carrier Frequency test EXCEPT for the following settings:
   Vertical (Span) – 8 KHz
   Timebase – 0.5 milliseconds
2. Connect the 20 dB attenuator to the radio's RF connector and then to the MDA channel C.
3. Initiate the Balance High tune mode by clicking the **Modulation Balance High Test** icon on the PPS software and then click on the **Start Test** button. The radio transmits a continuous 2400 Hz sinewave at maximum deviation until disabled.
4. Measure the peak-peak deviation. The deviation must be within 250 Hz of the Balance Low reference value recorded above. If the deviation difference is out of this range, tune the modulation balance tuning value as necessary using the PPS software until it meets this range.
5. Click the **Stop Test** button to disable the test.
6. Write the final tuned value to the radio by clicking the **Accept** button and then click on the **Write Device** icon.

Measure/Adjust Symbol Deviation

1. Set up the MDA the same way as in the Silent Carrier Frequency test EXCEPT for the following settings:
   Vertical (Span) – 8 KHz
   Timebase – 0.5 milliseconds
   Trigger – Triggered, RF Envelope
2. Connect the 20 dB attenuator to the radio's RF connector and then to the MDA channel C.
3. Initiate the Symbol Deviation tune mode by clicking the **Symbol Deviation Test** icon on the PPS software and then click on the **Start Test** button. The radio transmits a burst of four-level FSK data, of which the first 20 milliseconds are a stair-step pattern. The levels should be located at 800 Hz and 2400 Hz (peak-peak deviations of 1600 Hz and 4800 Hz, respectively) from the center frequency measured in the Silent Carrier Frequency test.
4. Measure the deviation from the carrier frequency using the frequency markers. Adjust the steps as necessary using the PPS software, reinitiate the test, and remeasure.
5. Click the **Stop Test** button to disable the test.
6. Write the final tuned values to the radio by clicking the **Accept** button and then click on the **Write Device** icon.

TUNE-UP PROCEDURE – CONTINUED

Measure/Adjust RF Power Out

1. Connect the 10 MHz reference line to the HP8991A Peak Power Analyzer.
2. Connect the HP84815A Peak Power Sensor to the Peak Power Analyzer.
3. Set up the Peak Power Analyzer with the following settings:
   Channel - 1
   Carrier Freq - 901.00625 MHz
   Vertical (Scale) 0.5 dB/div
   Bandwidth - Low
   Timebase - 2 ms/div
   Timebase (Delay) - (-1 ms)
   Trigger - Edge
   Trigger - (Rising Edge)
   Display - Normal
   Display (Power Display) - Log

4. Connect the 20 dB attenuator to the radio's RF connector and then to the Peak Power Sensor.
5. Initiate the RF Power Out tune mode by clicking the **Transmitter On Test** icon on the PPS software and then click on the **Start Test** button. The radio transmits a 16 ms data packet transmission, which repeats every 2 seconds.
6. Measure the power out using the amplitude markers. Adjust the Power Amplifier tuning value as necessary until the power out amplitude is +33.0 dBm (2 watts).
5. Click the **Stop Test** button to disable the test.
6. Write the final tuned values to the radio by clicking the **Accept** button and then click on the **Write Device** icon.