

MOBILE/CELLULAR RADIO TEST SETS

CDMA Mobile Station Test Set

HP 8924C



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The HP 8924C CDMA Mobile Station Test Set provides the key set of measurements to manufacture high quality Dual Mode CDMA mobile telephones in a single box. Acting as a calibrated, high-performance CDMA base station, the HP 8924C verifies not only the parametric performance of CDMA phones, but also the functional aspects of phone performance. The HP 8924C is optimized to provide high-accuracy measurements with the speed required for efficient manufacturing. The standard HP 8924C tests IS-95A-compliant CDMA phones for use with systems that operate from 500 MHz to 1000 MHz. In addition to its CDMA functionality, the HP 8924C includes full AMPS, NAMPS and TACS analog phone test capability. An optional external translator extends the capabilities of the HP 8924C to test PCS CDMA handsets. When attached, the PCS translator is transparently controlled by the HP 8924C. Together, the HP 83236B PCS translator and HP 8924C appear as one instrument for both manual and HP-IB control applications. With the HP 8924C, you save space and cost by making both analog cellular and CDMA digital cellular/PCS measurements with one instrument.

CDMA Base Station Simulator

The HP 8924C includes a full QPSK signal generator that follows the TIA IS-95A CDMA air interface specifications for base stations. The CDMA Signal Generator supports an AWGN (Additive White Gaussian Noise) source as well as up to two CDMA sectors. Sector A supports the following CDMA channels: Pilot, Sync, Paging, Traffic, and OCNS. Sector B offers only a Pilot channel, Traffic channel and a OCNS channel. Absolute power is individually settable for the AWGN source, Sector A, and Sector B in terms of total power in a 1.23 MHz bandwidth. The total CDMA signal generator power is the sum of these three settings.

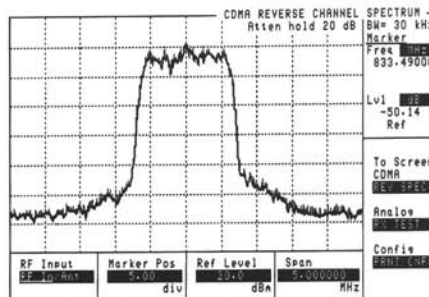
Using industry standard ASICs, the HP 8924C supports the protocol required to emulate a CDMA base station sufficiently for mobile station test. The HP 8924C also includes a full QPSK demodulator for CDMA mobile station transmitter and Frame-Error-Rate receiver measurements. Since CDMA mobiles are tested with a cabled connection to the test equipment, the HP 8924C does not support over-the-air signal reception.

Functional CDMA Mobile Test

The HP 8924C supports both mobile- or base-station-initiated call connect and disconnect. To speed testing, the HP 8924C supports service option negotiation while on a call. Connect the CDMA mobile to the HP 8924C, enter the required RF channel number, wait for the mobile to acquire service, and press the call key to make a CDMA phone call. To check voice quality, the HP 8924C offers a voice-echo mode. When active, the voice-echo mode delays and then re-transmits to the mobile under test any audio spoken into the CDMA mobile. An operator can quickly verify voice quality by speaking into the phone and then listening to the echoed audio in the mobile's handset.

CDMA Transmitter Tests

Transmitter tests include fast, DSP-based average power measurements from +38 dBm down to -10 dBm, and accurate channel power measurements down to -50 dBm. The tuned channel power measurement reports the power in a 1.23 MHz measured at the internal IF of the HP 8924C. By calibrating the tuned channel power measurement against the average power measurement, the HP 8924C achieves accurate low-level CDMA power measurements. These two power measurement modes allow accurate verification of maximum power, minimum power, open-loop power control, and closed-loop power control.



The HP 8924C measures transmitted waveform compatibility by the IS-95-recommended correlated power method "ρ" (rho). This measurement returns the percentage of transmitted power that correlates to the desired code. In addition, the ρ measurement reports the frequency error, modulation phase and amplitude error, and the carrier feedthrough.

CDMA Receiver Tests

The key performance parameter for CDMA mobile station receivers is Frame-Error-Rate performance with and without the presence of AWGN. The built-in, high-accuracy AWGN generator in the HP 8924C guarantees that FER tests provide a true picture of a CDMA mobile in the presence of interfering noise. The HP 8924C fully supports service options 2 and 9 (RF loopback mode) to test receiver FER performance. The HP 8924C optimizes FER measurement time by employing confidence limit technology. With confidence limits, FER measurements are made in the fastest possible time. Simply set the target frame error rate and confidence limit and start the test. The HP 8924C then uses a statistical model to determine if the CDMA phone has passed the test. An HP innovation also extends the confidence limit methodology to stop the test early if the phone fails the confidence limit with the requested confidence interval. Early termination on FER tests eliminates wasted time when testing clearly defective mobiles. The HP 8924C supports FER measurements at all four data rates: full, half, quarter, and eighth for both 9600 bps and 14400 bps voice channels.

Softer Handoff Verification

With two configurable CDMA sectors, the HP 8924C verifies the ability of a CDMA mobile to support softer handoffs. Softer handoff is similar to soft handoff and only differs in that the HP 8924C sends identical power control bits to both CDMA cell sectors. The HP 8924C displays the mobile reported signal strength to allow verification of its ability to acquire and accurately measure pilot power of other signals used for soft handoff. This advanced capability in a single instrument provides a low-cost method of verifying soft handoff functionality without the expense of two base station simulators.

Analog Capabilities

In addition to its powerful CDMA test capabilities, the HP 8924C retains full analog cellular test capability. Based on the HP 8920B RF Communications Test Set, the HP 8924C is backwards compatible with most HP 8920B HP-IB commands. The HP 8924C includes as standard equipment many optional features of the HP 8920B such as: a high-stability timebase, a CCITT filter, a 6 kHz bandpass filter, and spectrum analyzer/tracking generator. In addition, the HP 8924C supports easy CDMA to analog handoffs and "one-button" analog cellular call processing. These analog features not only allow the HP 8924C to test dual mode phones, but also provides an effective suite of measurement tools for radio troubleshooting.

HP 83217A Dual-Mode Mobile Station Test Software

Besides its many measurement functions, the HP 8924C includes a programmable IBASIC controller. This controller allows the creation of custom measurement software. For those who do not wish to write their own software, Hewlett-Packard offers the HP 83217A Dual Mode Mobile Station Test Software. The HP 83217A automates CDMA cellular mobile measurements using the HP 8924C. Automated testing improves consistency and reduces operators errors resulting in lower operation costs and improved product quality.

The HP 83217A offers two options for testing cellular mobile stations. Option 001 supports testing of mobiles that are AMPS, NAMPS, and CDMA compliant while Option 002 supports testing of TACS, ETACS, and CDMA mobiles. Another option that supports PCS CDMA phone testing will be available in the first quarter of calendar 1997. These software packages provide a comprehensive suite of analog and digital tests that can be freely arranged to fit specific requirements. Test points, test limits, and test sequences can be stored for future retrieval.

Analog Mode Specification Summary

Signal Generator

RF Frequency

Range: 250 kHz to 1000 MHz

Output

RF In/Out Connector

Level range: -137 to -9 dBm into 50 Ω

Level accuracy: ± 1.2 dB (Level ≥ -127 dBm)

Reverse power: 6 watts continuous

Duplex Out Connector

Level range: -127 to +7 dBm into 50 Ω

Level accuracy: ± 1.0 dB

Reverse power: 200 mW maximum

Residual FM (CCITT, rms): < 7 Hz for $500 \text{ MHz} < f_c \leq 1000 \text{ MHz}$

FM deviation (rates > 25 Hz): 100 kHz; 501 to 1000 MHz

FM accuracy (1 kHz rate): > 10 kHz dev: $\pm 3.5\%$ of setting ± 500 Hz

Audio Sources (Both internal sources)

Frequency Range: dc to 25 kHz

Output Level Range: 0.1 mV to 4 Vrms

RF Analyzer

Frequency Measurement Range: 400 kHz to 1000 MHz

RF Power Measurement (RF In/Out connector only.)

Frequency range: 30 MHz to 1000 MHz

Measurement range: 0.1 mW to 6 W continuous

Accuracy: $\pm 5\%$ of reading ± 0.01 mW from 15°C to 35°C

FM Measurement

Frequency range: 5 to 1000 MHz (usable to 400 kHz)

Deviation range: 20 Hz to 75 kHz

Accuracy (20 Hz to 25 kHz rates, deviation ≤ 25 kHz): $\pm 4\%$.

Spectrum Analyzer

Frequency Range: 400 kHz to 1000 MHz.

Resolution Bandwidth (coupled to span): 300 Hz to 300 kHz.

Display Range: 80 dB.

AF Analyzer

Frequency Measurement

Measurement range: 20 Hz to 400 kHz.

Accuracy: $\pm 0.02\%$ + resolution + reference oscillator accuracy.

AC Voltage Measurement

Measurement range: 0 to 30 Vrms.

Accuracy (20 Hz to 15 kHz, ≥ 1 mV): $\pm 3\%$ of reading.

SINAD Measurement

Fundamental frequency range: 300 Hz to 10 kHz $\pm 5\%$.

Accuracy: ± 1 dB for frequencies from 300 to 1500 Hz, measured with the 15 kHz LPF (0 to 46 dB SINAD).

Residual THD+Noise: -60 dB or 150 μV , whichever is greater.

Oscilloscope

Frequency Range (-3 dB BW): 2 Hz to 50 kHz.

Scale/Division: 10 mV to 10 V.

Time/Division: 10 μs to 100 ms.

Signaling Encoder/Decoder

Capability for Generating and Analyzing the Following Formats:

AMPS, EAMPS, NAMPS, TACS, JTACS, NTACS, ETACS

Remote Programming

HP-IB: Hewlett-Packard's implementation of IEEE Standard 488.2

RS-232: 3-wire RJ-11 connector used for serial data in and out

Centronics Port: Industry standard parallel printer port

Ovenized Reference

Aging Rate: < 0.005 ppm pk-pk/day, $< \pm 0.1$ ppm per year.

Memory Card

Card Compatibility: Single industry standard PCMCIA slot that accepts type I or type II SRAM and ROM cards

Firmware Upgrades: Accepts PCMCIA memory cards to allow automatic loading of new firmware without opening the unit

CDMA Mode Specification Summary

CDMA Call Processing Functionality

Service Option Modes: Service Option 001, Service Option 002, and echo mode (voice loopback from test set)

Call Control: BS call originate, BS call disconnect, MS call originate, MS call disconnect

Call Status Indicators: Transmitting, Page Sent, Access Probe Received, Connected, Softer Handoff, Hard Handoff

Handoff Capabilities: Hard Handoff and Softer Handoff

Paging Channel User Settable Parameters: Slotted or non-slotted operation, half or full data rate, and SLOT-CYCLE-INDEX

CDMA Signal Generator

CDMA Channels:

Additive White Gaussian Noise

Sector A includes the following channels: Pilot Channel, Sync Channel, Paging Channel, Traffic Channel, and OCNS Channel

Sector B includes the following channels: Pilot Channel, Traffic Channel, and OCNS Channel

Frequency Range: 501 MHz to 1000 MHz

Composite Signal Output level Range:

RF In/Out: -127 dBm/1.23 MHz to -20 dBm/1.23 MHz

Duplex Out: -127 dBm/1.23 MHz to -4 dBm/1.23 MHz

Composite Signal Output Level Accuracy: TBD

Relative CDMA Channel Level Accuracy: TBD

CDMA Analyzer

CDMA Average Power Measurement

Input frequency range: 30 MHz to 1000 MHz

Measurement range: -10 dBm to +40 dBm, RF In/Out only

Measurement accuracy: $\pm 5\% \pm 1 \mu\text{W}$ at $25^\circ\text{C} \pm 10^\circ\text{C}$

CDMA Channel Power Measurement

Measurement range: -50 to +10 dBm/1.23 MHz

Calibration: Must be cross calibrated to average power meter

CDMA Modulation Measurement

Input frequency range: 4 MHz to 1000 MHz

ρ measurement accuracy: TBD

Frequency error measurement accuracy: TBD

Other reported parameter with ρ measurement: Static Timing, Carrier Feedthrough, Amplitude Error, Phase Error

CDMA Frame Error Rate Measurement

FER measurement method: Data loopback per Service Option 2 supporting confidence limits as outlined in TIA IS-98

FER reported parameters: Measured FER, number of errors, number of frames tested, pass or failed confidence limit

General Specifications

Size: 426 mm W \times 177 mm H \times 574 mm D

Weight: 27 kg, 59 lb

Operating Temperature: 0°C to $+55^\circ\text{C}$

Power: 100 V to 240 V, 48 to 66 Hz, nominally 200 VA

Ordering Information Summary

CDMA Mobile Station Test Set

HP 8924C CDMA Mobile Station Test Set

Price

\$55,000

Opt 011 ETACS CCITT Filter

\$0

(Replaces C-Message Filter)

Opt OB1 Assembly Level Repair Manual

\$250

Opt OBW A total of two Assembly Level Repair

\$700

Manuals and two Operating Manuals

Opt AX4 Rack Mount Flange Kit

\$50

CDMA Mobile Station Test Software

HP 83217A Mobile Station Test Software

\$2,000

(Must order one and only one option)

Opt 001 AMPS/NAMPS/CDMA Test

\$0

Opt 002 TACS/ETACS/CDMA Test

\$0