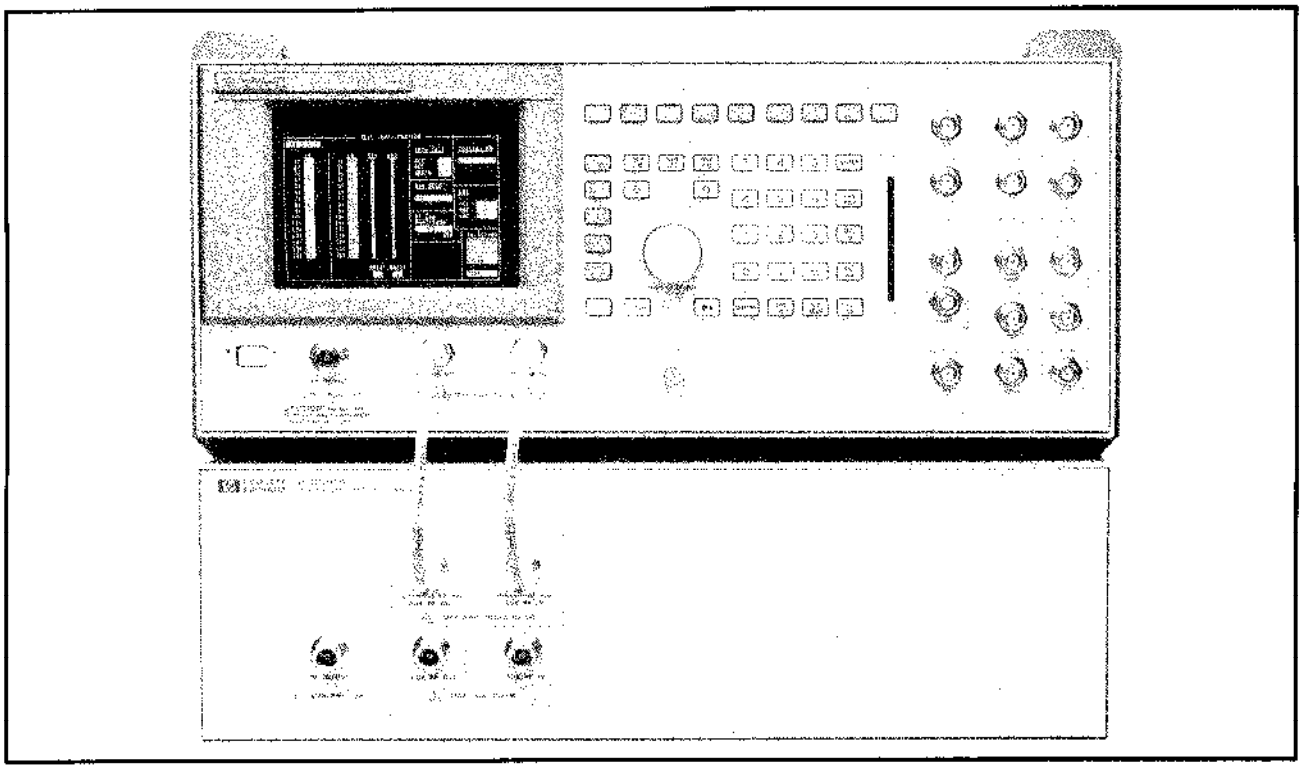
HEWLETT PACKARD

HP 83220A DCS1800 Test Set

Technical Data

1710 MHz to 1880 MHz

HP 8922 Series GSM RF Test Sets
HP 83220A DCS1800 Test Set



The HP 8922 Series with the HP 83220A DCS1800 Test Set is designed to minimize your DCS1800 mobile phone production costs.

The HP 83220A/HP 8922 system is geared to provide fast and accurate testing of DCS1800 mobile radio equipment in the production and servicing environment without sacrificing performance.

The HP 83220A expands the capabilities of the HP 8922 GSM Test Set family to comprehensively test DCS1800 mobile radios across the band 1710 MHz to 1880 MHz. All the features of the RF generator, RF analyzer and general intrumentation of the HP 8922 series are retained.

The RF generator, when configured with the HP 83220A, provides a frequency agile 0.3 GMSK RF signal across the full DCS1800 band. The RF analyzer retains the following functionality: an agile local oscillator, a coherent data demodulator, a pulse demodulator, an FM demodulator, a DSP based analyzer for phase and frequency error, a synthesized spectrum analyzer and a pulsed power meter. The general purpose tools include a digital oscilloscope, a CW RF frequency counter, a CW RF power meter, an AC voltmeter, a DC voltmeter, a 1 kHz distortion/SINAD meter, an audio frequency counter, and a synthesized audio source.

The HP 8922G/E, when configured with the HP 83220A, retains all the HP 8922G/E feature set but can now emulate a DCS1800 base station and establish and maintain a DCS1800 link. Once a link has been established, comprehensive tests can be sequenced across the full DCS1800 band range without interrupting the link.

The HP 83212A GSM/DCS1800 mobile station software automates the testing of GSM and DCS1800 mobiles and gives you the choice of manual testing, quick testing and full parametric testing. The software written for the HP 83220A/HP 8922E/G system is contained on a one-time-programmable card.

The sum of these capabilities make the HP 83220A and HP 8922 configuration an extraordinarily powerful tool for the service and manufacture of DCS1800 radio equipment.

HP 83220A DCS1800 Test Set Specifications

These specifications and supplemental characteristics apply when the HP 83220A DCS1800 Test Set is used in conjunction with the HP 8922 Series GSM RF Test Sets. Refer to the HP 8922A/B Technical Data Sheet (5091-1219) or HP 8922E/G Technical Data Sheet (5091-5753) for specifications from 10 MHz to 1000 MHz.

SPECIFICATIONS
Describe the instrument's warranted performance and apply after a 30 minute warm-up. These SPECIFICATIONS are valid over its Operating/Environmental Range unless otherwise noted.

Supplemental Characteristics
(shown in italics) are intended to provide additional information, useful in applying the instrument by giving typical (expected), but not warranted performance parameters. These characteristics are shown in italics or labeled as "typical", "usable to", or "nominal".

RF Generator Specifications

Frequency
Range: 1710 to 1785 MHz, 1805 to 1880 MHz.
Resolution: 1 Hz.
Accuracy: Reference Accuracy ±0.5 Hz.
Stability: same as Reference.
Supplemental Characteristics
Frequency Overrange: *±10 MHz with uncalibrated output and modulation.*
Switching Speed: *577 µs in hop mode (refer to 0.3 GMSK modulation specifications).*

Output
RF In/Out Connector
Level Range: –19 to –127 dBm.
Level Resolution: 0.1 dB.
Level Accuracy[1]: ±1.0 dB[2], levels ≥–127 dBm.
±1.0 dB[2], typically for levels ≥–127 dBm while hopping.
Reverse Power: 2 watts continuous.
SWR: < 1.5:1.

Aux RF Out Connector
Level Range: +7 to –127 dBm.
Level Resolution: 0.1 dB.
Level Accuracy[1]: ±1.0 dB, levels ≥–127dBm.
±1.0 dB, typically for levels ≥–127 dBm while hopping.
Reverse Power: 200 milliwatts.
SWR: 2.0 : 1, <–4 dBm.

Spectral Purity
Spurious Signals
For ≤1 dBm output level at AUX RF OUT or ≤25 dBm output level at RF IN/OUT.
Harmonics: <–25 dBc.
Non-Harmonic Spurious: <–50 dBc, > 5 kHz offset from carrier.

[1] When using 30 dB pulse modulation, level accuracy is typically ±2 dB. Level accuracy is ±1.5 dB with the HP 8922E.
[2] Level accuracy degrades 0.2 dB when using the RF IN/OUT connector for both RF generator and RF analyzer.
[3] Can be switched to accept data that has already been differentially encoded.
[9] Not available with HP 8922E.

0.3 GMSK Modulation

After one timeslot 577 µs from an isolated RF Generator Hop Trigger.
Phase Error: ≤1° rms.
Peak Phase Error: ≤4° peak.
Frequency Error: ±(0.01 ppm (22 Hz) + reference accuracy) for normal bursts.
Typically ±(0.02 ppm (32 Hz) + reference accuracy), for RACHs.
Amplitude Flatness: ±0.25 dB peak.
Clock Input
Frequency: 270.833 kHz ±2 Hz (relative to reference).
Level: TTL.
Data Input [9]
Format: Non differentially encoded input[3].
Level: TTL.
Supplemental Characteristics
After three timeslots, 1.73 ms, from an isolated RF Generator Hop Trigger.
Phase Error: *≤0.5° rms.*
Peak Phase Error: *≤2.0° peak*
Frequency Error: *±(0.005 ppm (9 Hz) + reference accuracy), for normal bursts.*
±(0.01 ppm (18 Hz) + reference accuracy), for RACH bursts.

Pulse Modulation
Input Levels: TTL.
Rise/Fall Time (10 to 90%): ≤5 µs.
Supplemental characteristics
On/off ratio: *> 80 dB.*

30 dB Pulse Modulation [9]
All timeslots 30 dB higher than desired/active timeslot to test adjacent timeslot rejection.
Input Levels: TTL.
Rise/Fall Time (10 to 90%): 5 µs.

AM for Level Control [9]
For output levels ≤–1 dBm at AUX RF OUT or ≤–25 dBm at RF IN/OUT.
Supplemental Characteristics
Input
Range: *–1.0 V to +0.6 V.*
Impedance: *600 Ω nominal, DC coupled.*
Sensitivity: *100% AM per volt, nominal.*
Calibration: *0 VDC input produces calibrated output from the RF Generator.*
Rise/Fall Time (10 to 90%): *<20 µs.*

RF Analyzer Specifications

Frequency
Range: 1710 to 1880 MHz.
Resolution: 1 Hz.
Hop Mode
Resolution: 100 kHz.
Offset Frequency: ≤50 kHz.
Offset Resolution: 1 Hz for digital data recovery and modulation accuracy measurements.
RF In/Out SWR: <1.5:1.
Supplemental Characteristics
Frequency Overrange: *±10 MHz with unspecified performance.*
Offset Resolution: *500 Hz for FM Demodulation Out.*

CW RF Frequency Measurement
Range: 1710 to 1880 MHz.
Level Range
RF In/Out: –13 to +32 dBm.
Aux RF IN: –23 to +20 dBm.
Input Frequency Setting Error[4]: 500 kHz.
Accuracy: ±(1 Hz + reference accuracy).
Supplemental Characteristics
Minimum Resolution: *1 Hz.*
Frequency Overrange: *±10 MHz with unspecified performance.*

CW RF Power Measurement (RF IN/OUT only)
Range: 0 to +32 dBm.
Input Frequency Setting Error[4]: ± 500 kHz.
Accuracy[5]: ±0.5 dB ± noise effects (0.015 mW).
Supplemental Characteristics
Minimum Resolution: *0.01 dB.*

Peak Transmitter Carrier Power Measurement
RF IN/OUT only. After one timeslot 577 µs, from an isolated Receiver Hop Trigger.
Range: 0 to +32 dBm.
Input Frequency Setting Error[4]: ±10 kHz.
Input Level Setting Error[4]: ±3 dB.
Accuracy[5]: ±0.6 dB ± noise effects (0.015 mW).
Supplemental Characteristics
Minimum Resolution: *0.2 dB.*

[4] When setting up the RF analyzer for measurements, the value is entered for the incoming signal within limits shown for specified performance.
[5] To calculate accuracy, add or subtract the 0.5 dB error (0.6 dB for Peak Transmitter Carrier Power) from the absolute power in dBm then convert to mW and add or subtract the 0.015 mW noise effect.
[6] On an HP 8922E, Pulse ON/OFF Ratio Measurement is only available with option 006.
[7] On an HP 8922E, Output RF Spectrum Measurement is only available with option 006.
[9] Not available with HP 8922E.

Pulse ON/OFF Ratio Measurement[6]
ON power is averaged over the useful part of the burst. OFF power is averaged over a 1 bit interval centered at a user specified time. Non-hopped mode only.
Input Frequency Setting Error[4]: ±10 kHz.
Input Level Setting Error[4]: ±3 dB.
Timing Accuracy: ± 1.7 µs *(±1.1 µs typical).*
Accuracy (ON/OFF ≥ 40 dB, RF In/Out only):

OFF Power (dBm)	ON/OFF Ratio Accuracy
–48 to –19	± 2.4 dB *(±1.1 dB typically)*
–55 to –48	±2.9 dB *(±1.3 dB typically)*

Amplitude Envelope Measurement
After one timeslot, 577 µs, from an isolated Receiver Hop Trigger.
Measurement Range
RF In/Out: –13 to +32 dBm.
Aux RF In: –23 to +20 dBm.
Input Frequency Setting Error[4]: ±10 kHz.
Inaccuracy due to Noise (for overshoots ≤1 dB):

Relative Level	Input Level Setting Error[4] ±1 dB	±3 dB	±3 dB w/5 averages
0 dB	<±0.15 dB pk	<±0.2 dB pk	<±0.2 dB pk
–6 dB	<±0.2 dB pk	<±0.3 dB pk	<±0.3 dB pk
–30 dB	<+3.0 dB –3.8 dB	<+4.2 dB –7.5 dB	<+2.2 dB –2.6 dB

Phase and Frequency Measurement
(As described in GSM recommendation 11.10)
After one timeslot, 577 µs, from an isolated Receiver Hop Trigger.
Range
RF In/Out: –13 to +32 dBm.
Aux RF In: –23 to +20 dBm.
Input Frequency Setting Error[4]: ±10 kHz.
Input Level Setting Error[4]: ±3 dB.
RMS Phase Error Accuracy: ≤1° rms.
Peak Phase Error Accuracy: ≤4° peak.
Frequency Error Accuracy: ±(0.01 ppm (22 Hz) + reference accuracy), for normal bursts.
Typically, ±(0.02 ppm (32 Hz) + reference accuracy), for RACHs.
Supplemental Characteristics
After three timeslots, 1.73 ms, from an isolated receiver hop trigger.
RMS Phase Error Accuracy: *≤0.5° rms*
Peak Phase Error Accuracy: *≤2° peak*
Frequency Error Accuracy: *±(0.005 ppm (9 Hz) + reference accuracy), for normal bursts.*
±(0.01 ppm (18 Hz) + reference accuracy), for RACH bursts.

0.3 GMSK Data Recovery
After one timeslot, 577 µs, from an isolated Receiver Hop Trigger.
Range
RF In/Out: –13 to +32 dBm.
Aux RF IN: –23 to + 20 dBm.
Input Frequency Setting Error[4]: ± 100 Hz.
Required Input Phase
Accuracy: ≤5° rms, ≤20° peak.
Demodulation Duty
Cycle: 1 timeslot per frame.
Outputs: Data, Clock, and Data Valid.
Data Output Clock: Clocked at 1 MHz rate.
Delay, data: ≤1 frame (4.62 ms).
Output Level: TTL.

FM Demodulation Output
Range [9]
RF IN/OUT: –13 to + 32 dBm.
AUX RF IN: –23 to + 20 dBm.
Sensitivity: 20 µV/Hz ±5% (into open circuit).
Input Frequency Setting Error[4]: ±50 kHz, with ≤ 100 kHz pk deviation.
Input Level Setting Error[4]: ±3 dB.
Supplemental Characteristics
3 dB Bandwidth: *DC to 270 kHz.*
Output Impedance: *600 Ω.*
DC Offset: *≤ 5 mV.*

Pulse Demodulation Output
Range [9]
RF IN/OUT: –13 to +32 dBm.
Aux RF IN: –23 to +20 dBm.
Input Frequency Setting Error[4]: ±50 kHz.
Input Level Setting Error[4]: ±3 dB.
Rise time (10 to 90 %): ≤ 2.5 µs.
Fall time (90 to 10 %): ≤ 2.5 µs.
Supplemental Characteristics
Output Impedance: *600 Ω, DC coupled.*
Output Level: *2 Vpk into an open circuit.*

Output RF Spectrum Measurement[7]
After one timeslot, 577 µs, from an isolated Receiver Hop Trigger.
Range
RF IN/OUT: –13 to +32 dBm.
Aux RF IN: 23 to +20 dBm.
Input Levels for Optimum Dynamic Range
RF IN/OUT: –3, +2, +7, +12, +17, +22, +27, +32 dBm.
AUX RF IN: –13, –8, –3, +2, +7, +12, +17, +22 dBm.
Input Frequency Setting Error[4]: ±10 kHz.
Input Level Setting Error[4]: ±3 dB.
Supplemental Characteristics
Log Linearity: *±0.4 dB.*
Amplitude Flatness: *±1.0 dB.*
Amplitude Resolution: 0.4 *dB.*
Dynamic Range (dB): *This describes the spectrum analyzer resolution bandwidth filter used when measuring Output RF Spectrum. The dynamic range of the measurement will be a combination of this filter response and the modulation spectrum of the incoming signal.*

	Offset (kHz)					
	100	*200*	*300*	*400*	*600*	*800 to 1800*
Range (dB)	*29*	*45*	*51*	*63*	*73*	*75*

Note: *When using "Output RF Spectrum due to Ramping" measurement, the dynamic range is decreased by 12 dB (due to Peak Hold).*

Spectrum Analyzer Specifications[8]

Frequency Range: 1710 to 1880 MHz.
Frequency Span/Resolution Bandwidth (coupled):

Span	Bandwidth
<50 kHz	300 Hz
<200 kHz	1 kHz
<1.5 MHz	3 kHz
≤4 MHz	30 kHz

Display: Log, 10 dB/div.
Display Range: 80 dB.
Log Linearity: ±1.1 dB.
Reference Level Range
RF IN/OUT: +35 to –45 dBm.
AUX RF IN: +23 to +55 dBm.
Non-harmonic Spurious Responses: –50 dBc max, for inputs ≤ –30 dBm.
Residual Response: < –70 dBm (no input signal, 0 dB attenuation).
Image Rejection: >50 dB.
Supplemental Characteristics
Level Accuracy: *±2.5 dB.*
Frequency Overrange: *± 10 MHz with unspecified performance.*
Displayed Average Noise Level: *<–116 dBm (Ref Level <–10 dBm [RF IN/OUT] or, <–20 dBm [AUX RF IN], <50 kHz spans).*

Audio Source Specifications

Frequency
Range: DC to 25 kHz.
Accuracy: 0.025% of setting.
Supplemental Characteristics
Minimum Resolution: *0.1 Hz.*

Output Level
Range: 0.1 mV to 4 V_{rms}.
Maximum Output Current: 20 mA peak.
Output Impedance: <1 Ω.
Accuracy: ±(2% of setting + resolution).
Residual Distortion (THD+noise, amplitude >200 mV_{rms}):
0.1%, 20 Hz to 25 kHz in 80 kHz BW.
Supplemental Characteristics
Minimum Resolution: *Level ≤0.01 V: 50 μV.*
Level ≤0.1 V: 0.5 mV.
Level ≤1 V: 5 mV
Level >1 V: 50 mV.
DC Coupled Offset: *< 50 mV.*

[8] On an HP 8922E, the spectrum analyzer is only available with option 006.
[9] Not available with HP 8922E.

Audio Analyzer Specifications

Frequency Measurement
Range: 20 Hz to 400 kHz.
Accuracy: ±(0.02 % + 1 count + reference accuracy).
External Input: 20 mV_{rms} to 30 V_{rms}.
Supplemental Characteristics
Minimum Resolution: *f <10 kHz: 0.01 Hz*
f <100 kHz: 0.1 Hz.
f ≥100 kHz: 1 Hz.

AC Voltage Measurement
Voltage Range: 0 to 30 V_{rms}
Accuracy (20 Hz to 15 kHz, input >1 mV_{rms}): ±3% of reading.
Residual Noise + THD (15 kHz BW): 175 μV.
Supplemental Characteristics
3 dB Bandwidth: *2 Hz to 100 kHz.*
Input Impedance: *1 M Ω 145 pF at AUDIO IN.*
Minimum Resolution: *4 digits for inputs ≥100 mV.*
3 digits for inputs <100 mV.

DC Voltage Measurement
Voltage Range: 100 mV to 42 V.
Accuracy: ±(1.0 % of reading + DC Offset).
DC Offset: ±45 mV.
Supplemental Characteristics
Minimum Resolution: *1 mV.*

Distortion Measurement
Fundamental Frequency: 1 kHz ±5 Hz.
Input Level Range: 30 mV_{rms} to 30 V_{rms}.
Display Range: 0.1 % to 100 %.
Accuracy: ±1 dB (0.5 to 100 % distortion).
Residual THD + Noise (15 kHz BW): the greater of –60 dB or 175 μV.
Supplemental Characteristics
Minimum Resolution: *0.01% Distortion.*

Audio Filters: LPF: 300 Hz, 3 kHz, 15 kHz.
HPF: 50 Hz, 300 Hz.
Notch: 1 kHz.
Deemphasis: 750 μs.

Audio Detectors

RMS	Pk+	Pk–	Pk+hold	Pk–hold
Pk±/2	Pk±/2 hold	Pk±max	Pk±max hold.	

Oscilloscope Specifications

Frequency Range (3 dB): 2 Hz to 50 kHz.
Scale/Division: 10 mV to 10 V in 1, 2, 5, 10 steps.
Amplitude Accuracy (20 Hz to 10 kHz): ±1.5% of reading ±0.1 division.
Time/Division: 10 µs to 100 ms in 1, 2, 5, 10 steps.
External Trigger Level: TTL.
Supplemental Characteristics
3 dB Bandwidth: *Typically >100 kHz.*
Internal DC Offset: *≤0.1 division for ≥50 µV/div sensitivity.*

Remote Programming

HP-IB: Hewlett-Packard's implementation of IEEE Standard 488.2.
Functions Implemented: SH1, AH1, T6, L4, SR1, RL1, LE0, TE0, PP0, DC1, DT1, C4, C11 ,E2.
RS-232: 3-wire RJ-11 connector used for serial data in and out.
Baud Rates: 300, 1200, 2400, 4800, 9600, and 19200 selectable.

General Specifications

Size:
HP 83220A: 133Hx426Wx574D mm. (5.25x16.75x23 in).
HP 83220A + HP 8922: 310Hx426Wx574D mm. (12.25x16.75x23 in).
Weight:
HP 83220A: 16.3 kg, 36 lbs.
HP 83220A + HP 8922: 48.3 kg, 106 lbs.
Operating Temperature: 0° to +55°C.
Storage Temperature: –40° to +70°C.
Power: 100, 120, 220, 240 Vac, 48 to 440 Hz, ±12% of line voltage, approximately 200 VA (HP 83220A) or 640 VA (HP 83220A + HP 8922).
EMI: Conducted and radiated interference meets FTZ 526/527, and MIL STD 461B RE02. Electrostatic discharge meets IEC 801-2. Radiated susceptibility meets IEC 801-3 RSI. Immunity to fast transients/ bursts meets IEC 801-4. Conducted emissions meets CISPR 11B.
Safety: Meets IEC 348.
Acoustics: LpA <70 dB at 0.5m.
Supplemental Characteristics
Leakage: *At RF generator output levels <–40 dBm, typical leakage is <1 µV induced in a resonant dipole antenna 1 inch away from any surface except the rear panel. Spurious leakage levels are typically <5 µV in a resonant dipole antenna 1 inch away from any surface except the rear panel.*

Reference Specifications

(The accuracy needs for testing DCS1800 radios require the unit to be operated with the High Stability Reference (Opt. 001) or an external high stability reference.)

Accuracy (after warm up): ±[(Time since calibration x Aging Rate) + Temperature Effects + Accuracy of calibration].
External Reference Input
Frequency: 13, 10, 5, 2, or 1 MHz, ±30 ppm.
Level: 0 to +10 dBm.
Nominal Impedance: 50 Ω.
Supplemental Characteristics
10 MHz OUT (rear panel BNC)
Level: *>+9.0 dBm nominal.*
Impedance: *50 Ω nominal.*
13 MHz OUT (rear panel BNC)
Level: *>+9.0 dBm nominal.*
Impedance: *50 Ω nominal.*
Fixed Reference Mode
Aging: <2 ppm/year.
Temperature Stability: ±1 ppm (0° to +55°C).
Warm-up Time: <30 seconds, ±2 ppm of final frequency.

Tunable Reference Mode *
Allows offsetting the internal reference by a selected amount relative to the High Stability Reference (Opt. 001 REF OUT) or an external reference.
Required External Reference
Accuracy: ±0.5 ppm.
Tune Range: ±30 ppm.
Reference Accuracy (after calibration): ±1 ppm + accuracy of external reference or High Stability Reference (Opt 001 REF OUT).
Temperature Stability (after calibration, 0° to 55°C): ≤4 ppm, for selected offsets of up to ±30 ppm.

Transit Cases

Part Number 9211-2661: Transit case for HP 83220A.
Part Number 9211-1163: Operating case for HP 83220A + HP 8922 system.

HP Systems Engineering Assistance

Extra assistance from Hewlett-Packard in the form of system installation, productivity assistance, programmer or user training, or solution consulting are available on a consulting basis. Call Hewlett-Packard for a quote.

Ordering Information

HP 83220A DCS1800 Test Set
Option 022: Bundle discount when ordered with HP 8922.
HP 83212A: GSM/DCS1800 Mobile Station Test Software.
HP 8922A: GSM RF Test Set.
HP 8922B: GSM BS Test Set.
HP 8922E: GSM MS Service Test Set.
HP 8922G: GSM Mobile Station Test Set.
Option 0B1: Provides one additional User's Guide (83220-90000) and two Service Manuals (83220-90001).
Option AX4: Rack Mount Flange Kit (5062-4071).
Option 0B3: Adds Service Manual (83220-90001).
Option W30: Extended repair service.

For more information call your local HP sales office listed in your telephone directory or an HP regional office listed below for the location of your nearest sales office.

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