Digital Radiocommunication Tester CMD80

Precise high-speed measurements on CDMA, TDMA and analog mobiles

For use in
- production
- quality assurance
- service
- development
CMD80 – the multitalent

Additional capability continues to be added to the proven CMD80 platform. In addition to CDMA, AMPS (N-AMPS) and TACS (J/N/E-TACS), digital AMPS (IS-136) measurements on mobile stations are now possible with option B84. CMD80 is thus able to support all multiple access methods presently used in mobile communications (FDMA, CDMA, TDMA) on a single hardware platform.

CMD80 with option B84 provides unsurpassed test coverage for the IS-136 standard, offering many capabilities that are not available on some dedicated IS-136 test sets. Among these are half-rate channel support, peak and statistical adjacent-channel power measurements, carrier switching time measurements, etc. This broad IS-136 test coverage will enhance the CMD80’s use in manufacturing tests as well as in engineering applications.

All standards at a glance

<table>
<thead>
<tr>
<th>Frequency band</th>
<th>Type designation</th>
<th>Airlink standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>US Cellular (800 MHz)</td>
<td>CDMA, TDMA, AMPS/N-AMPS</td>
<td>IS-95</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IS-136, TIA-553, IS-91</td>
</tr>
<tr>
<td>Japan Cellular</td>
<td>CDMA, NTACS/J-TACS</td>
<td>TS2, IS-95</td>
</tr>
<tr>
<td>China Cellular</td>
<td>CDMA, E-TACS/TACS</td>
<td>IS-95</td>
</tr>
<tr>
<td>US PCS (1900 MHz)</td>
<td>CDMA, TDMA</td>
<td>JSTD008, UB-IS-95, IS-136</td>
</tr>
<tr>
<td>Korea PCS (1800 MHz)</td>
<td>CDMA</td>
<td>JSTD008, UB-IS-95</td>
</tr>
<tr>
<td>Korea2 PCS</td>
<td>CDMA</td>
<td>JSTD008, UB-IS-95</td>
</tr>
</tbody>
</table>
The family members at a glance

**CMD80 – CMDA, IS-136, AMPS and more**
- CDMA, digital AMPS, AMPS, TACS in one box
- High measurement accuracy and speed
- Remote control via IEEE488/IEC625 bus
- Autotest and remote control via RS232
- Suitable for production, development and service

**CMD52 – the leading GSM900 production tester**
- All signaling required for GSM900 testing
- Highest measurement accuracy and speed
- Remote control via IEEE488/IEC625 bus
- Autotest and remote control via RS232
- Go/nogo test as well as service mode for exact fault location

**CMD55 – the multiband GSM production tester**
- GSM900, GSM1800 and GSM1900
- Testing of handover from GSM900 and back
- Other features as CMD52

**CMD60 – pure DECT dedication**
- Compact, lightweight and extremely fast
- Suitable for service, production and development
- Remote control via IEEE488/IEC625 bus + RS232
- Automated regression and stress testing of DUT
- Automatic go/nogo testing of fixed and portable part

**CMD65 – the most versatile production tester**
- GSM plus DECT in a single box
- Features equal the combination of CMD55 and CMD60 in almost all respects
Manual operation philosophy
Research and development engineers have found the CMD’s large clear LC display and user interface with logically structured menus unsurpassed when measuring RF parameters. This is true both in the manual test mode and in the flexible module test with system-specific signal generator and burst analyzer. During call setup the network and system-specific signaling parameters allow the R&D engineers to control the influence of signaling parameters on the mobile’s behavior in the network.

User-definable autotest
The user-friendly display and operation of the CMD is a main requirement when testing manually, but for automated testing the engineer wants a quick and easy way to a ready-made autotest. The CMD family of testers offers different ways of creating such autotests and test scripts, depending on the CMD model and the test requirements.
Fast IEEE bus
In a production line there are two main factors that contribute to high throughput and product quality: IEEE-bus speed and measurement repeatability. The high speed is obtained by parallel measurements and the possibility of issuing multiple commands in a single IEEE string. With combined measurements and measurements like RF peak power which takes only milliseconds, time-consuming power level adjustments where multiple measurements are required are completed in seconds. The high level of measurement repeatability offered ensures the highest possible quality of the end product leaving the factory.

Covering any need for test modes
Service and repair of digital mobiles and cordless phones call for a variety of tests, ranging from simple voice loopback test to complete factory-like production tests. The CMD range of products offers cost-effective solutions for manual testing, stand-alone autotest, as well as remote RS232 operation solutions covering any testing need. Every CMD comes with the same large display and user interface for manual testing of phones and/or modules and RS232 interface for remote operation.

Base-station survey measurements
These are often done on real base stations or by using analog signal generators with power amplifiers. The CMD is able to simulate any CDMA, IS-136, AMPS and TACS base station. This feature enables close-to-life conditions without having to use a real BTS.
The individual measurements for the various standards are derived directly from the relevant specifications and are preconfigured. Measurements can thus be performed without in-depth knowledge of the relevant network.

Basically, CMD80 provides two different measurement modes for each network. Measurements can be performed either as a module test (i.e., without call setup to the DUT) or as a manual test with full signaling. In the latter case a call setup for performing the measurement can be made from the base station (which is simulated by the CMD80) and from the mobile. In this mode it is also possible to set up a call with voice loopback. The audio data picked up by the microphone of the mobile phone are buffered in the CMD80 and reflected to the mobile under test after a delay of about two seconds. In this way speech quality of the DUT can be verified.

In the signaling mode, implicit handoffs can be made within the same standard (i.e., a DAMPS handoff to another digital traffic channel—a new channel number—or changeover to another timeslot at the same TDMA frequency) as well as handoffs to other standards, if defined. This is an important criterion for testing multimode/multiband mobile phones. The measurements themselves are adapted to the relevant transmission standard.
CDMA

Code Division Multiple Access (CDMA) is a new concept in wireless communications. It has gained widespread international acceptance by cellular radio system operators as a method that will increase both their system capacity and their service quality.

In addition to transmitter and receiver tests, power control tests play an important role for CDMA. This is more true since power control mechanisms have a decisive influence on the network capacity.

The main CDMA tests include:

- **Power control measurements**
  - Open-loop time response
  - Gated output power
  - Minimum output
  - Maximum output

- **Receiver quality measurements**
  - Frame error rate (FER) measurements
  - Additionally with AWGN generator (option B81) to simulate noise that is caused by other CDMA calls at the same frequency

- **Transmitter quality measurements**
  - Carrier feedthrough and I/Q imbalance
  - Carrier frequency error and transmit time error
  - Waveform quality ($\rho$ factor)
  - Phase error
  - Magnitude error
  - Error vector magnitude
TDMA

D-AMPS (Digital Advanced Mobile Phone Service) is a digital version of AMPS, the original analog standard for cellular phone service in the United States. Both D-AMPS and AMPS are now used in many countries. D-AMPS adds Time Division Multiple Access (TDMA) to AMPS to get three users for each AMPS channel, tripling the number of calls that can be handled on a channel. D-AMPS is known as IS-136 from the Electronics Industries Association/Telecommunication Industries Association (EIA/TIA).

As with CDMA, the various measurements for IS-136 are subdivided into groups. The main IS-136 tests include:

- **Transmitter measurements**
  - Adjacent channel power (due to modulation/due to switching), six adjacent/alternate channels
  - Power versus time measurement
  - Origin offset (carrier crosstalk)
  - I/Q imbalance (measure of uneven gain in the I/Q path of the transmitter modulator)
  - Frequency error
  - Amplitude droop (level difference between the start and end of a TDMA burst)
  - Phase error
  - Magnitude error (amplitude error)
  - Error vector magnitude (magnitude of the vectorial error function versus time)

- **Receiver measurements**
  - Bit error rate measurement
  - Time alignment (in manual test only)
  - SMS transfer from base to mobile station (in manual test only)
  - Simulation of mobile assisted handoff (MAHO) – in manual test only

**Analog**

AMPS (Advanced Mobile Phone Service), N-AMPS is a standard system for analog signal cellular telephone service in the United States and is also used in other countries. It is based on the initial frequency spectrum allocation for cellular service by the Federal Communi-
TACs (Total Access Communications System), J/N/E-TACs
Signaling and measurements for the TACs implementations are very similar to those for the AMPS standard, with only a few minor changes. The channel ranges and their associated frequency assignments are different from the AMPS standard, and the default values for many parameters are adjusted to appropriate values for the TACs standards.

Within the various AMPS/TACs measurements both the RF parameters and the audio signal of the mobile phone are investigated.

The main AMPS/TACs tests include:
- **Carrier power**
- **Carrier frequency error**
- **SAT frequency error/peak deviation**
- **ST frequency error/peak deviation**
- **Carrier power measurement**
- **Receiver measurements**
  - Sensitivity
  - Hum/noise
  - Harmonic distortion
  - Audio frequency response
- **Transmitter measurements**
  - Hum/noise
  - Modulation noise/distortion
  - Audio frequency response
  - Modulation limiting

Within the MODULATION LIMITING menu CMD80 measures the maximum frequency deviation which the mobile transmitter allows.

When the tester measures the audio frequency response in normal mode, a de-emphasis filter is active and the configuration menu can be used to set limit lines for the measurement.

The modulation noise and distortion result is highlighted if the percentage of modulation noise and distortion exceeds the limit specified in the configuration menu.
Digital Radiocommunication Tester CMD80

Applications

Autorun

The various autorun applications allow the full testing of mobile phones without need for an additional process controller and without specialized knowledge of the different networks. Such applications are ideal for final testing in production and in the service. The measurement applications are based on the specifications of the various standards and can be configured via a functional user interface. Upon completion of the test sequence the results are clearly displayed in a test report.

CMD80go

The CMD80go program offers comprehensive remote control capabilities for the Digital Radiocommunication Tester via a convenient Windows software package (versions are available for Windows 95 and Windows NT). This application software features an autotest that can be configured according to the different standards for testing mobile phones. The results are summarized in a comprehensive test report which can be printed or stored for further processing with other programs (e.g., Microsoft Excel).
**Fading application**

The receiver quality of a CDMA mobile phone in line with the IS-95 standard is determined by measuring the frame error rate in the presence of an AWGN noise signal.

The combination of Vector Signal Generator SMIQ with the options
- Noise Generator and Distortion Simulator (SMIQB17)
- Fading Simulator (SMIQB14)

and Digital Radiocommunication Tester CMD80 with the optional I/Q Modulator Outputs (B17) allows simple performance of the receiver quality tests.

In this application, CMD80 assumes the function of the base station. SMIQ then generates both the required multipath signal and the AWGN signal and combines these two signals at its output. The fading profiles specified by the IS-98 standard can be called on SMIQ from a list of preprogrammed standards at a keystroke. Moreover, the user can edit further multipath profiles.

For these tests the mobile phone is set to the loopback mode. At the same time, the base station is measuring the frame error rate. Measurements are carried out at different bit rates.

There is a similar application for testing D-AMPS mobile phones.
Options in detail

Message Monitor *)

The Message Monitor allows to display and record the communication between the base station (CMD80) and the CDMA mobile station. The messages from the forward and reverse link thus become transparent and visible.

The option uses the service port of CMD80 to display the data on an external PC via a special cable. The program runs on all PC-compatible computers under Windows 95 or Windows NT.

*) Option B83 for R&S, MM18 for Tektronix

Memory Card Interface*)

The memory card option makes software updates extremely easy. Simply plug in the card with the new firmware release, switch on and that’s all. There is just no easier way. Moreover, instrument settings can be stored on a memory card and transported to another instrument. Screenshots can also be stored on the memory card in the form of PCX files.

*) R&S option B62, fitted as standard in basic model for North America

Access Channel Registration Message

```
[ 8] ACCESS CHAN: Registration Message - (Type 1)  
[ 3] Neg Seq: 5  
[ 1] Ack Req: 1  
[ 1] Valid Ack: 0  
[ 3] Ack Type: 2  
[ 3] Mobile Station Identifier (MSID) Type 3  
[ 4] Length=10  
[32] ESN: D01AD96h  
[ 2] IMSI Type: 2  
[10] MCC: 310  
[34] IMSI_S: 0000007590  
[ 2] Authentication Mode: 0 None  
[ 4] Registration Type: Timer Based  
[ 3] Slot Cycle Index: 2  
[ 0] Station Class Mark: A00  
[ 1] Mobile Terminated Calls Accepted: True  
[ 6] Reserved 0  
[30] CPC: 1E1E1A7Fh
```
<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>K1</td>
<td>IS-95 CDMA 800 MHz Test Capabilities</td>
<td>CDMA cellular extension. Allows measurements on CDMA mobile phones which are operating in cellular band (800 MHz)</td>
</tr>
<tr>
<td>K2</td>
<td>PCS1900/1700 MHz Test Capabilities</td>
<td>CDMA PCS extension. Allows measurements on CDMA mobile phones which are operating in PCS band (1900/1700 MHz)</td>
</tr>
<tr>
<td>B1</td>
<td>OCXO Reference Oscillator</td>
<td>OCXO reference oscillator, aging ±1x10⁻⁷. Ensures high absolute accuracy, minimum temperature-dependent drift and especially high long-term stability. Used for measurements with exacting requirements on frequency stability</td>
</tr>
<tr>
<td>B3</td>
<td>Reference Frequency Inputs/Outputs</td>
<td>Multifrequency reference input/output. For synchronizing DUT and measuring instruments with internal or external frequencies. Allows synchronization of CMD to an internal or external frequency of 2.048, 10, 13, 26, 39, 52 MHz</td>
</tr>
<tr>
<td>B14</td>
<td>Rate Set 2 (13k vocoder support)</td>
<td>Rate set 2 extension for CDMA mobile phones. Allows testing of CDMA mobiles which support 13 kbit/s data rate</td>
</tr>
<tr>
<td>B17/B17IQ</td>
<td>I/Q Modulator Outputs</td>
<td>I/Q signals from the CMD modulator and burst trigger signals are provided for Rohde &amp; Schwarz Signal Generator SMIQ for conformity tests under fading conditions</td>
</tr>
<tr>
<td>B60</td>
<td>Carrier Board for B61/B62</td>
<td>Adapters for B6x options</td>
</tr>
<tr>
<td>B61</td>
<td>IEE/IEC-Bus Interface</td>
<td>IEC625/IEEE488-bus interface. Remote control alternative to the RS232C interface fitted as standard. Used for fast remote control of CMD</td>
</tr>
<tr>
<td>B62</td>
<td>Memory Card Interface</td>
<td>Memory card interface. Allows storage of instrument setups as well as fast and easy upgrades to new software features. Highly recommended</td>
</tr>
<tr>
<td>B81</td>
<td>AWGN Generator</td>
<td>The AWGN extension allows to add additional white Gaussian noise to the base station signal. This option is used to simulate the noise floor of additional CDMA traffic channels.</td>
</tr>
<tr>
<td>B82</td>
<td>Analog Option</td>
<td>Analog extension. Allows measurements on AMPS, N-AMPS, J/N/E-TACS mobile stations</td>
</tr>
<tr>
<td>B83, MM18</td>
<td>Message Monitor</td>
<td>The message monitor operates with the CMD80 to interpret and display CDMA forward/reverse link messages on an IBM PC-compatible computer running Windows 95/NT</td>
</tr>
<tr>
<td>B84</td>
<td>IS-136 (D-AMPS) Test Capabilities</td>
<td>IS-136 extension. Allows testing of DAMPS (IS-136) mobile phones</td>
</tr>
<tr>
<td>U22</td>
<td>Controller Board Upgrade</td>
<td>The controller board upgrade option is equipped with current CPU and RAM.</td>
</tr>
<tr>
<td>U82</td>
<td>Analog Board Upgrade</td>
<td>The analog board upgrade is part of option B82 (mod.12/14). It replaces the old analog board of option B82 (mod. 02/04)</td>
</tr>
<tr>
<td>U84</td>
<td>Link Handler Upgrade</td>
<td>Link handler upgrade replaces link handler of CMD80 (mod. 80/81)</td>
</tr>
<tr>
<td>CTS-Z10</td>
<td>Mobile Coupling Device</td>
<td>The mobile coupling device is suitable for development and service purposes</td>
</tr>
<tr>
<td>CTS-Z12</td>
<td>Shielding Box</td>
<td>The shielding box together with the coupling device [CTS-Z10] protects the mobile from external electromagnetic influence</td>
</tr>
<tr>
<td>ZZA-94/1R</td>
<td>Rackmount Adapter</td>
<td>Adapter for mounting the CMD into a 19&quot; rack</td>
</tr>
<tr>
<td>ZKZ-943</td>
<td>CMD Transportation Box</td>
<td>The transportation box protects the CMD against mechanical shock</td>
</tr>
</tbody>
</table>

*) The upgrade options U22/U82/U84 are necessary only if a CMD80, model 80/81, has to be upgraded to IS-136 test capabilities.
Specifications

Signal generator

**Frequency**
- **Range** US Cellular: 869 MHz to 894 MHz
- **Resolution** 1 Hz

**Output level**
- **RF IN/OUT**: −124 dBm to −20 dBm
- **RF OUT 2**: −105 dBm to 0 dBm

**Modulation**
- **Carrier suppression**: 30 dB

Analyzer

**Frequency**
- **Range** US Cellular: 824 MHz to 849 MHz
- **Resolution** 1 Hz

**Output level**
- **RF IN/OUT (full scale)**: −28 dBm to +41 dBm
- **RF IN 2 (full scale)**: −65 dBm to +41 dBm

**Demodulation**
- **Modulation analyzer**: QPSK

RF signal generator

**Frequency**
- **Range** AMPS: 869 MHz to 894 MHz
- **Resolution** 1 Hz

**Output level**
- **RF IN/OUT**: −124 dBm to −20 dBm
- **RF OUT 2**: −105 dBm to 0 dBm

**Modulation**
- **Carrier suppression**: 30 dB

Spectral purity

**SSB phase noise**
- ≤−94 dBc at 50 kHz offset
- ≤−106 dBc at 100 kHz offset

Modulation analyzer

**Power versus time**
- **Level error**: <1.5 dB down to 20 dB below reference level, 3 dB else

Signaling

**Digital modes**
- IS-136A

TDMA – option B84

**Signal generator**

**Frequency**
- **Range** US Cellular: 869 MHz to 894 MHz
- **Resolution** 1 Hz

**Output level**
- **RF IN/OUT**: −120 dBm to −20 dBm
- **RF OUT 2**: −100 dBm to 0 dBm

**Modulation**
- **Carrier suppression**: ≤−2.5 dB

**Spectral purity**
- ≤−94 dBc (1 Hz at 50 kHz offset)
- ≤−106 dBc (1 Hz at 100 kHz offset)
Reference level range
RF IN/OUT (full scale)
RF IN 2 (full scale)
-28 dBm to +41 dBm
-69 dBm to 0 dBm

RF frequency measurement
Dynamic range (from ref. level)
Resolution
<40 dB
1 Hz
Error
<resolution + timebase error

RF power measurement
Narrowband (RF IN/OUT, DSP):
Reference level range
Range
Error
<1.5 dB
0 dBm to +41 dBm
0 dB to 30 dB below reference level
<1.5 dB

FM rate range
0 kHz to 12 kHz
Deviation range
0 kHz to 30 kHz
((2 x deviation) + (4 x rate))

FM measurement
Error <1.5 dB

Range
Wideband:
Error <1.5 dB
Reference level range
0 dBm to +41 dBm
Narrowband (RF IN/OUT, DSP):
RF power measurement
Error <resolution + timebase error
Resolution 1 Hz
Dynamic range (from ref. level)
Frequency 1004 Hz
Input voltage range
100 mV to 30 V, rms
Bandwidth limited by C-message filter
SINAD measurement
Error <5% + inherent distortion

Audio filters, notch filters
automatically selected based on the specific measurement configuration

Timebase
Standard timebase
Nominal frequency
10 MHz
Frequency drift in temperature
range 5 °C to 35 °C
<1 x 10^-4 / year (at 35 °C)
OCXO reference oscillator
option B1
Nominal frequency
10 MHz
Frequency drift in temperature
range 5 °C to 45 °C
<1 x 10^-7 / year, <0.5 x 10^-9 /day
Warmup time (at 25 °C)
approx. 5 min

Reference frequency
inputs/outputs
Synchronization input
Impedance
1.25 ms power control frame
Input voltage range
RF frequency measurement
Error <resolution + timebase error
Resolution 1 Hz
Frequency measurement
AF analyzer
Error <5% + inherent distortion
Resolution 0.1 dB
Inherent distortion <0.2 %
Input voltage range
100 mV to 30 V, rms
Bandwidth limited by C-message filter
Distortion measurement
Error <5% + inherent distortion
Resolution 0.1 dB
Audio filters, notch filters
automatically selected based on the specific measurement configuration

Carrier board
Synchronization output
Option B60
 selectable between:
2 s (even second pulse)
80 ms super frame
20 ms paging frame
26.67 ms sync frame
1.25 ms power control frame
19.6608 MHz system clock
d for D-AMPS: 80 ms super frame
Option B60 is required for options B61, B62 and B82

DC measurements
DC voltage measurement
Error <2% + resolution
Resolution 10 mV
Input voltage range
632 mV (pp) to 5 V (pp)
Impedance approx. 100 Ω
Common-mode rejection ± 30 V
Range ± (0 to 30) V
DC voltage measurement
Error <2% + resolution
Resolution 10 mV
Range ± (0 to 30) V
Common-mode rejection ± 30 V
Range ± (0 to 30) V

Interfaced
IEEE/IEC-bus interface
option B61
interface to IEC625-1
Other interfaces
Centronics (25-contact)

Special calibration (Modcalc)
Service option Z8, special calibration for TX path
valid for CDMA output signals (all values at room temperature (25 ± 5) °C)
Absolute level error
RF IN/OUT [-108 to -20 dBm]
RF OUT 2 [-103.5 to -18 dBm]
Relative level error
(linearity at one frequency)
RF IN/OUT [-108 to -38 dBm]
all values are in a range of ±0.5 dB
RF OUT 2 [-103.5 to -18 dBm]
all values are in a range of ±0.5 dB
Important note:
The range of T dB has to be determined over all measured values inclusive
(it is not determined ±0.5 dB with respect to any one particular value)
Valid network handoffs

<table>
<thead>
<tr>
<th>Network</th>
<th>Handoff from standard</th>
<th>Valid handoff to standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>US Cellular</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDMA (IS-95)</td>
<td>AMPs</td>
<td>AMPs or N-AMPS</td>
</tr>
<tr>
<td></td>
<td>N-AMPS</td>
<td>N-AMPS</td>
</tr>
<tr>
<td></td>
<td>AMPS</td>
<td>AMPS</td>
</tr>
<tr>
<td></td>
<td>TDMA (IS-136A)</td>
<td>TDMA (IS-136A)</td>
</tr>
<tr>
<td></td>
<td>TDMA (IS-136A)</td>
<td>US PCS TDMA (IS-136A)</td>
</tr>
<tr>
<td>Japanese Cellular</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDMA (IS-95)</td>
<td>J-CDMA (T53)</td>
<td>J-TACS or N-TACS</td>
</tr>
<tr>
<td></td>
<td>J-TACS</td>
<td>J-TACS or N-TACS</td>
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<td></td>
<td>N-TACS</td>
<td>N-TACS</td>
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<tr>
<td></td>
<td></td>
<td>J-TACS</td>
</tr>
<tr>
<td>Chinese Cellular</td>
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</tr>
<tr>
<td>CDMA (IS-95)</td>
<td>E-TACS or TACS</td>
<td></td>
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<tr>
<td>US PCS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDMA (J-STD008)</td>
<td></td>
<td>AMPs or N-AMPS</td>
</tr>
<tr>
<td>TDMA (IS-136A)</td>
<td></td>
<td>AMPs</td>
</tr>
<tr>
<td>TDMA (IS-136A)</td>
<td></td>
<td>US Cellular TDMA (IS-136A)</td>
</tr>
</tbody>
</table>

General data

- **Rated temperature range**: 5 °C to 45 °C to DIN IEC 68-2-1/2
- **Storage temperature range**: -40 °C to +60 °C
- **Electromagnetic compatibility**: complies with requirements of EMC directive 89/336/EEC (EN50081-1 and EN50082-2)
- **Mechanical resistance**
  - **Vibration, sinusoidal**: meets IEC68-2-6, IEC1010-1, EN61010-1, MIL-T-28800 D class 5, 5 Hz to 55 Hz, max. 2 g, 55 Hz to 150 Hz, 0.5 g const.
  - **Vibration, random**: meets DIN IEC 68-2-36, DIN 40046 T24, 10 Hz to 300 Hz, 1.2 g rms
  - **Shock**: meets DIN IEC 68-2-27, 40 g shock spectrum
- **Power supply**: 90 V to 265 V, 45 Hz to 440 Hz
- **Power consumption (without options)**: approx. 80 W
- **Electrical safety**: meets EN61010-1, EN60950, IEC 1010-1, VDE 0411, class 1
- **Dimensions (W x H x D)**: 435 mm x 192 mm x 363 mm
- **Weight (without options)**: approx. 15 kg
### Ordering information

**Digital Radiocommunication Tester CMD80**

<table>
<thead>
<tr>
<th>Designation</th>
<th>Type</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>[basic unit, CMD-K1 and/or CMD-K2 required]</td>
<td>CMD80</td>
<td>1050.9008.84</td>
</tr>
</tbody>
</table>

**Options**

- **IS-95 CDMA 800 MHz Test Capabilities**: CMD-K1 1082.2550.02
- **PCS 1900/1700 MHz Test Capabilities**: CMD-K2 1082.2650.02
- **OCXO Reference Oscillator**: CMD-B1 1051.6002.04
- **Reference Frequency Inputs/Outputs**: CMD-B3 1051.6202.02
- **Rate Set 2 (13k vocoder support)**: CMD-B14 1059.6101.02
- **I/Q Modulator Outputs**: CMD-B17 1099.3003.02
- **Carrier Board for B61/B62**: CMD-B60 1059.5405.02
- **IEEE/IEC-Bus Interface**: CMD-B61 (*) 1051.7609.02
- **Memory Card Interface**: CMD-B62 (*) 1051.8205.04
- **AWGN Generator**: CMD-B81 1059.7508.02
- **Analog Option [AMPS, TACS]**: CMD-B82 ***) 1059.4344.12
- **Message Monitor**: CMD-B83 1099.5706.02
- **IS-136 (D-AMPS) Test Capabilities**: CMD-B84 **) 1099.5806.02
- **Controller Board Upgrade**: CMD-U22 1099.5906.02
- **Analog Board Upgrade**: CMD-U82 1129.0306.02
- **Link Handler Upgrade**: CMD-U84 1129.0606.02
- **Mobile Coupling Device**: CTS-Z10 1079.1240.02
- **Universal RF Shielding Box**: CTS-Z12 1079.1470.02
- **Rackmount Adapter**: ZZK-94 0396.4905.00
- **CMD Transportation Box**: ZZK-943 1013.9350.00

*) Option B60 required  ***) Option B82 required  **) Option K1 and B60 required
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