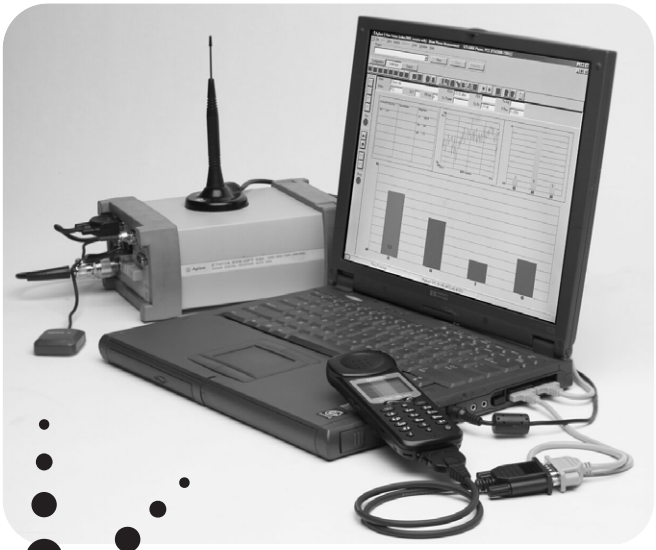
Agilent E7477A
cdma2000 Drive-Test System

Data Sheet



The Agilent E7477A cdma2000 drive-test system is used to obtain RF coverage, service performance and data test measurements for wireless communications networks that use the advanced cdma2000 technology. The system runs on a PC that interfaces with an Agilent digital RF receiver and/or a cdma2000 mobile phone. The system can control up to four receivers and four phones simultaneously. The drive-test system is a platform product which provides the following features: carry-around testing, indoor testing, real-time mapping, as well as measurement capabilities in other technologies such as IS-95 CDMA, W-CDMA (UMTS), GSM, TDMA, and GPRS.

Agilent Technologies

System software

The system software controls Agilent digital RF receivers and cdma2000 and IS-95 CDMA mobile phones. Multiple measurements can be made simultaneously. All measurements can be displayed in real-time and logged to the database. The following system software options are available:

- **Option 105:** cdma2000 phone-based software license
- **Option 110:** cdma2000 receiver-based software license
- **Option 125:** cdma2000 receiver and phone-based software license
- **Option 150:** cdma2000 multiple phone software license
- **Option 160:** Real-time mapping software license
- **Option 180:** Indoor measurement software license
- **Option 200:** cdma2000 data measurement software license
- **Option 220:** cdma2000 data measurement server software license

Option 125 – combined cdma2000 receiver and phone-based measurement software license – combines all of the functions of Options 105 (the phone-based software license) and 110 (the receiver-based software license) into a single, integrated package. Options 105 and 125 have the capability to control a single cdma2000 mobile phone. Option 150 adds multiple phone control capability to Options 105 and 125. Up to four mobile phones can be controlled.

Options 200 and 220 provide cdma2000 data test measurement capability.

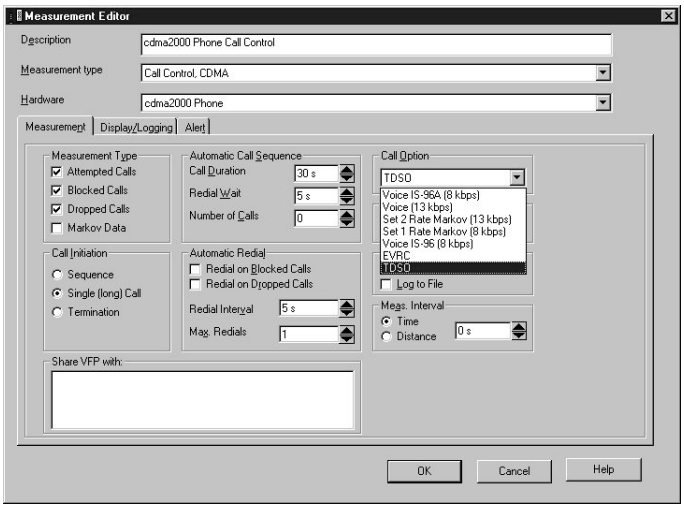
Phone-based software

The E7477A provides phone based measurements for cdma2000 handsets and is fully backwards compatible with IS-95 handsets. The E7477A phone-based Options 105 and 125 provide three primary elements:

- Phone control
- Phone measurements
- Layer 3 messaging
- Mobile debug messaging

Each function element has an associated control and display window called a virtual front panel (VFP). E7477A Options 105 and 125 provide the phone-based function described above for a single cdma2000 mobile phone. Option 150, when combined with Option 105 or 125, extends the phone-based software function to include up to four mobile phones.

Each phone requires a cable to connect to the PC. Agilent offers cables for several handsets. For a list of the handsets supported by the E7477A and cables available from Agilent, see Handset compatibility on page 13.



Phone control

The system software provides automated control of the handset. The phone control virtual front panel provides the control functions listed below.

Call controls

- Call initiation mode
  - Sequence
  - Single (long) call
  - Termination
- Call mode preference
  - No analog (forces phone to digital-only operation)
- Call initiation control
  - Start/continue
  - Pause
  - Stop
- Automatic call sequencing
  - Access time (duration of call)
  - Redial wait (duration between calls)
  - Total calls (number of calls to be executed)
- Automatic redial
  - On a dropped call
  - On a blocked call (failed origination)
  - Redial interval (wait duration after drop or block)
  - Maximum redial attempts
- Phone number pick list
- Call type pick list
  - Voice (8 or 13 kbps)
  - Markov (set 1 or set 2)
  - EVRC
  - TDSO

State controls

- Automatic answer
- Channel display units
  - Channel number
  - Frequency units

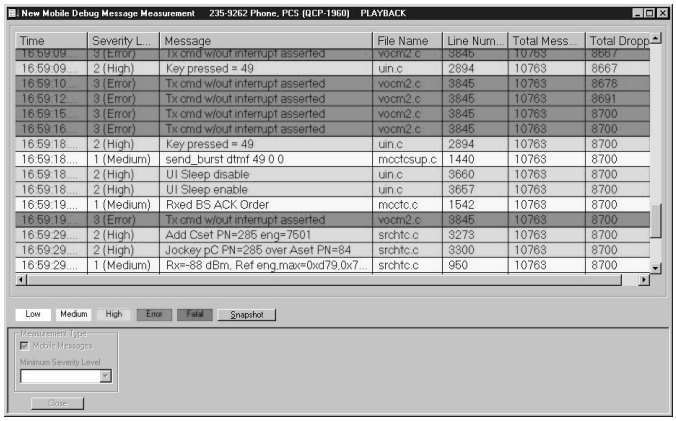
Statistics logging controls

- Attempted calls
- Dropped calls
- Blocked calls (failed originations)
- Markov data

In addition to the control function, the phone control virtual front panel displays the information listed below in a tabular format.

Tabular display (text)

- Channel
- Access time counter
- Redial time counter
- Calls remaining counter
- Total attempts
- Total drops
- Total blocks
- Dropped call rate = Total drops / Total attempts
- Blocked call rate = Total blocks / Total attempts



Phone measurements

The E7477A system extracts measurement data from the mobile handset. Extraction of the specific measurement types is controlled by a set of check boxes. The data types are listed below.

Display fields (text)

- Status (CDMA initialization, CDMA conversation, etc.)
- State (CDMA, Analog, etc.)
- RSSI (mobile received power)
- Mobile transmit power
- Transmit gain adjust
- SAT (supervisory audio tone)
- Pilot increment
- FER (frame erasure rate)
- Protocol revision (IS-95A, IS-2000, etc.)
- Ec/Io
    - Aggregate
    - Dominant

Tabular displays

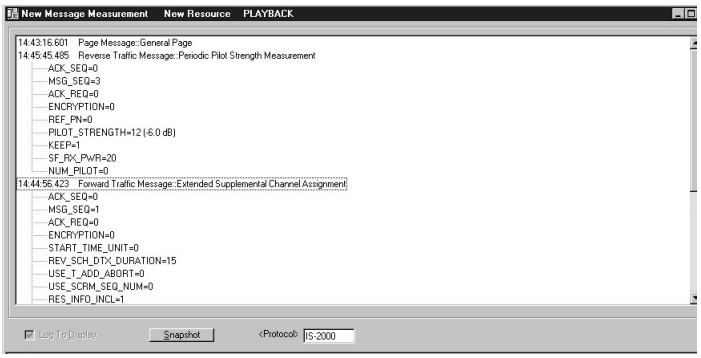
- PN list

Bar graph displays

- Finger data (TA fingers)
- Pilot data
    - Active
    - Candidate
    - Neighbor

Line graph displays

- RX/TX level
- Temporal analyzer (TA searcher)



Layer 3 messaging

The E7477A extracts and decodes over-the-air messaging from the handset. The user can select any or all of the message types listed below to extract and decode. The cdma2000 messages are contained in the message types listed.

Message type selection controls

- Access
- Paging
- Sync
- Forward traffic
- Reverse traffic

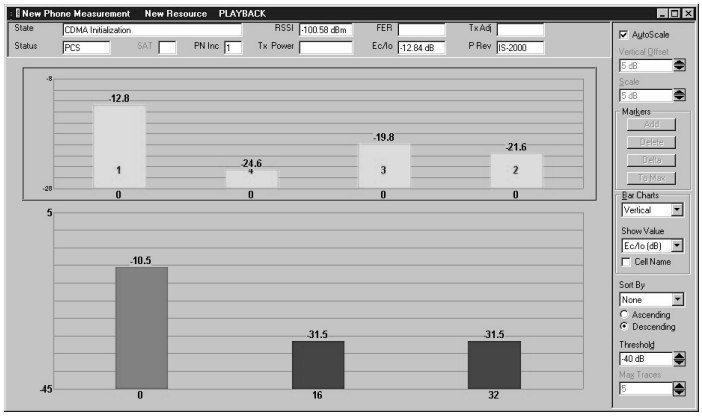
In the messaging display the user can double-click on any message to show the next level of detail. A snapshot function captures the last 50 messages in a separate window while the main display continues to update and record new messages.

Message logging controls

- Log to display
- Snapshot

Mobile debug messaging

The mobile debug display provides debug messages from the handset. The display shows problems and errors relating to the phone.



Multiple phone capability

Option 150, when combined with Option 105 or 125, extends the phone-based software function to include up to four mobile phones. The All Phones windowpane in the call control virtual front panel allows the user to control dialing functions of any or all of the phones from a single window.

Use of multiple phones can significantly improve optimization efficiency. Some applications of multiple-phone configurations include:

- Simultaneously evaluate performance on multiple frequencies
- Execute origination, termination, and dropped call testing simultaneously
- Execute measurements on your network and a competitive network simultaneously

In multiple phone configurations, each phone communicates with the PC via a dedicated serial port. Each phone requires a cable. Agilent offers a choice of cables for several supported handsets. For a list of the phones supported by the E7477A and cables available from Agilent, see Handset Compatibility on page 13.

Data test measurements

The E7477A cdma2000 drive-test system provides data testing capability. The data test measurement capability is provided by the following E7477A options:

- **Option 200:** Data measurement software license
- **Option 220:** Data measurement server software license

The data measurement capability uses a client/server architecture where the client is a test mobile and laptop combination and the server is a remote computer connected to a computer network. Option 200 enables the client capability, while Option 220 enables the server software license. The E7477A system is designed to allow a single server connection and several client connections.

The data control and measurement user interface resides on the client computer. The server is used to capture a number of data flow throughput measurements and to transmit them along with predefined data pages (simulating Internet browsing, e-mail services, file transfer, etc.) back to the mobile client for analysis and characterization.

Option 200 requires the purchase of a data measurement server license. Each Option 220 requires the purchase of at least one data measurement software license and can support several Option 200s (clients).

For detailed information on the data measurement capability, refer to the *Agilent Wireless Data Measurement*, data sheet, literature number 5988-1507EN.

Receiver-based software

The receiver measurement functions of the Agilent E7477A system is provided by Option 110. This option, combined with the appropriate receiver option, is comprised of four primary elements:

- CDMA pilot channel analysis
- Spectrum analysis
- CW power
- Channel power

Each element has an associated control and display window called a virtual front panel (VFP). The software can control up to four digital RF receivers.

The controls listed below are available for the receiver measurements:

- **Measurement interval**
  - Time
  - Distance
- **Averaging**
  - Running
  - Group
  - Max hold
  - At least (CW and channel power only)

The measurement interval defines the duration between measurements. This can be specified in terms of time (execute a measurement every 200 milliseconds), or distance (execute a measurement every 10 meters). If the user defines an interval that the system can not achieve, a busy light indicates this condition.

cdma2000 pilot channel analysis

The E7477A system measures cdma2000, IS-95 and J-STD-008 CDMA pilot channels. These measurements are independent of network parameter settings. The system executes four different types of CDMA pilot channel measurements (listed below). Any or all of them can be executed simultaneously.

Measurement types

All pilots:
The system measures the power, both Ec and Ec/Io, of all 512 pilot channels. The results are displayed as a trace with one point for each of the 512 PN offsets.

Top N:
The system measures all of the pilots in the network and returns the 'N' strongest pilot channels received, where 'N' is a user definable integer from 1 to 20. The results are displayed in bar graph format.

Zoomed pilots:
The user sets the center and span in terms of chips (or PN offsets). The results are displayed as a trace.

User list:
The user manually inputs a list of up to 20 PN offsets to be measured. The measurements are displayed in bar graph format – up to 20 bars.

Measurement controls

- **Carrier frequency**
  - Frequency
  - Channel
- **Measurement types**
  - All pilots
  - Top N pilots
  - Zoomed pilots
  - User list of pilots
- **PN increment**

Display controls

- **Power display (Y-axis parameter)**
  - Ec/Io
  - Ec
- **Show value (bar graphs only)**
  - Peak Ec/Io
  - Peak Ec
  - Aggregate Ec/Io
  - Aggregate Ec
  - Aggregate - peak
  - Delay spread
  - Pilot delay

Markers (trace displays only)

- Multiple markers
- Delta markers
- To max function
- Drag and drop

Measurement results

- Peak Ec/Io
- Peak Ec
- Io
- Aggregate Ec/Io (TopN and user list only)
- Aggregate Ec (TopN and user list only)
- Aggregate – peak (TopN and user list only)
- Delay spread (TopN and user list only)
- Pilot delay
- Carrier frequency error

Peak pilot power (both Ec and Ec/Io) are computed by selecting the strongest peak of the correlation for each pilot. Io is the total received power integrated across the entire 1.2288 MHz signal bandwidth.

Aggregate pilot power (both Ec and Ec/Io) are computed for a given pilot by integrating the power received over the time dispersion of that pilot. Delay spread is the duration of time over which this power is dispersed. Both aggregate pilot power and delay spread are determined with respect to an Ec/Io threshold of –17 dB. The system also reports the difference between the aggregate and peak pilot power (aggregate-peak). This difference along with the delay spread provides a characterization of the multipath effect on that pilot. Aggregate pilot power and delay spread are only measured for the TopN and user list measurement types.

Pilot delay is defined as the difference in time between when a pilot signal is received and when it should have been transmitted, as defined by GPS timing. For example, a base station transmitting PN offset 0 is expected to start a new short-code pattern synchronous with the GPS even second clock. If the signal is received 3 chips after the GPS even second clock, then the pilot delay is said to be 3 chips (1 chip at 0.8 microseconds). Timing offsets can be due to both propagation delay and base station timing problems.

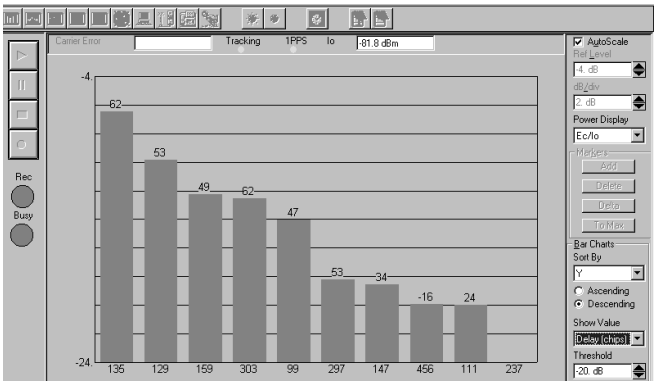


Figure 1. Pilot analyzer

Carrier frequency error is defined as the difference between the measured carrier frequency and the user-specified carrier frequency. The measured carrier frequency is of the dominant pilot signal. Carrier frequency error can be due to both base station carrier error and doppler shift (if moving).

Spectrum analysis

The spectrum display provides the controls listed below. Frequencies can be specified in terms of frequency units or channel number.

Measurement controls

- **Frequency, tunable range**

  Cellular band receiver (Option 300 or 310)
  824 to 849 MHz [819 to 854]
  869 to 894 MHz [864 to 899]

  PCS band receiver (Option 320 or 330)
  1850 to 1910 MHz [1845 to 1915]
  1930 to 1990 MHz [1925 to 1995]

  2.1 GHz IMT 2000 band receiver (E6455C)[1]
  1920 to 1980 MHz [1895 to 1990]
  2110 to 2170 MHz [2100 to 2180]

  Japan cellular band receiver (Option 380 or 381)
  832 to 870 MHz [827 to 875]
  887 to 925 MHz [882 to 920]

  Korea PCS band receiver (Option 390 or 391)
  1710 to 1785 MHz [1705 to 1785]
  1805 to 1880 MHz [1800 to 1885]

- **Frequency, maximum span**

  Cellular band receiver (Option 300 or 310)
  25 MHz [35]

  PCS band receiver (Option 320 or 330)
  60 MHz [70]

  2.1 GHz IMT 2000 band receiver (E6455C)[1]
  60 MHz [80]

  Japan cellular band receiver (Option 380 or 381)
  38 MHz [48]

  Korea PCS band receiver (Option 390 or 391)
  75 MHz [85]

- **IF bandwidth**[2]

  Cellular band, PCS band, and Japan cellular band receivers
  30 kHz
  1.25 MHz

  2.1 GHz IMT 2000 band receiver
  1.25 MHz
  5.0 MHz

  Korea PCS band receiver
  200 kHz
  1.25 MHz

- **Resolution bandwidth**[2]

  Cellular band, PCS band, and Japan cellular band receivers
  8.36 kHz to 1 MHz (1.25 MHz IF bandwidth)
  246 Hz to 28 kHz (30 kHz IF bandwidth)

  2.1 GHz IMT 2000 band receiver
  8.36 kHz to 1 MHz (1.25 MHz IF bandwidth)
  25.08 kHz to 2.85 MHz (5 MHz IF bandwidth)

  Korea PCS band receiver
  8.36 kHz to 1 MHz (1.25 MHz IF bandwidth)
  1.68 kHz to 190 kHz (200 kHz IF bandwidth)

- **Average mode**
  Log power
  Power

Markers

- Multiple markers
- Delta markers
- Marker to max
- Marker value to center frequency
- Drag and drop

Spectrum noise floor (characteristic)[3]:

	Average	Peak
Cellular band, PCS band, Japan cellular band receiver		
30 kHz IF bandwidth/300 kHz span:	–139 dBm	–131 dBm
1.25 MHz IF bandwidth/300 kHz span:	–128 dBm	–119 dBm
30 kHz IF bandwidth/25 MHz span:	–132 dBm	–129 dBm
1.25 MHz IF bandwidth/25 MHz span:	–123 dBm	–117 dBm
2.1 GHz IMT 2000 band receiver		
1.25 MHz IF bandwidth/300 kHz span:	–128 dBm	–119 dBm
5.0 MHz IF bandwidth/300 kHz span:	–124 dBm	–111 dBm
1.25 MHz IF bandwidth/25 MHz span:	–123 dBm	–117 dBm
5.0 MHz IF bandwidth/25 MHz span:	–117 dBm	–113 dBm
Korea PCS band receiver		
200 kHz IF bandwidth/300 kHz span:	–139 dBm	–130 dBm
1.25 MHz IF bandwidth/300 kHz span:	–131 dBm	–121 dBm
200 kHz IF bandwidth/25 MHz span:	–127 dBm	–123 dBm
1.25 MHz IF bandwidth/25 MHz span:	–123 dBm	–117 dBm

Minimum sweep speed (characteristic)[3]:

30 kHz IF bandwidth: 1 MHz per second
200 kHz IF bandwidth: 10 MHz per second
1.25 MHz IF bandwidth: 70 MHz per second
5.0 MHz IF bandwidth: 200 MHz per second

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[1] Spectrum measurement allows tuning ±10 MHz above and below specified frequency ranges. In addition the PHS band is also covered (down to 1895MHz). These extended ranges are shown in brackets – [ ]. The performance is not specified in these extended ranges. Characteristic noise floor increase is 2 dB ±10 MHz. At –25 MHz with respect to specified range, the characteristic noise floor increase is 5 dB. Characteristic amplitude accuracy is unchanged with respect to specified range.

[2] Korea PCS band receiver and 2.1 GHz IMT 2000 Band Receiver does not have 30 kHz IF bandwidth. Korea PCS band receiver has a 200 kHz and a 1.25 MHz IF bandwidth. 2.1 GHz IMT 2000 band receiver has a 1.25 MHz and a 5 MHz IF bandwidth.

[3] Does not imply warranted performance, but rather characteristic performance. Tested with minimum resolution bandwidth: 246 Hz with 30 kHz IF bandwidth, 8.46 kHz with 1.25 MHz IF bandwidth, 1.68 kHz with 200 kHz IF bandwidth (Korean receiver), 25.08 kHz with 5.0 MHz IF bandwidth (2.1 GHz IMT 2000 band receiver).

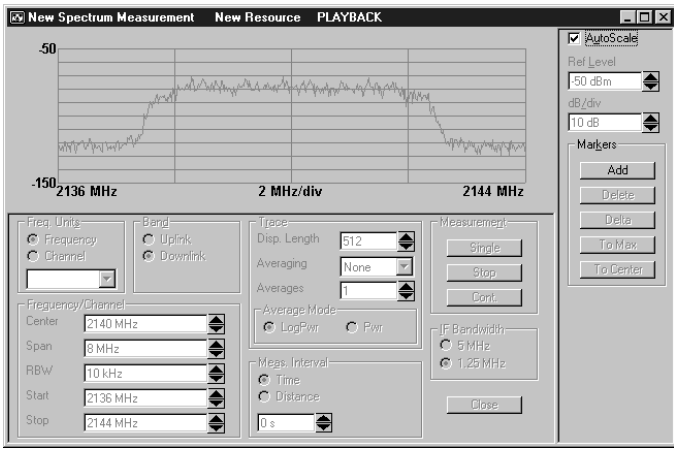

Figure 2. Spectrum analysis

CW power and channel power

The Agilent E7477A can measure the peak power (CW power) at user-defined frequencies within a user-defined resolution bandwidth. The systems can also measure the total power (channel power) within a user-defined bandwidth at a user-defined set of frequencies. Channel power differs from the CW power measurement in that the total power is integrated across the specified channel width. The user can define the frequencies measured in two different ways, indicated below.

Frequency entry methods

List: Enter an arbitrary list of frequencies.

Trace: Enter a start frequency, step size, and count. The system measures at the start frequency, at the (start + step) frequency, ... , (start + (count – 1)*step) frequency. For example, if the start frequency is set to 1900 MHz, the step size is set to 1 MHz, and the count is set to 4; then measurements are made at 1900 MHz, 1901 MHz, 1902 MHz and 1903 MHz.

Frequencies can be specified in terms of frequency units or channel number.

Measurement controls

- **Frequency**
  - Arbitrary list (list)
  - Start / step / count (trace)
- **IF bandwidth**[4]
  - 5.0 MHz (2.1 GHz IMT 2000 band receiver only)
  - 1.25 MHz
  - 200 kHz (Korea PCS band only)
  - 30 kHz
- **Resolution bandwidth (CW power only)**

  Cellular band, PCS band, and Japan cellular band receivers
  - 8.36 kHz to 1 MHz (with 1.25 MHz IF bandwidth)
  - 246 Hz to 28 kHz (with 30 kHz IF bandwidth)

  2.1 GHz IMT 2000 band receiver
  - 8.36 kHz to 1 MHz (with 1.25 MHz IF bandwidth)
  - 25.08 kHz to 2.85 MHz (with 5 MHz IF bandwidth)

  Korea PCS band receiver
  - 8.36 kHz to 1 MHz (with 1.25 MHz IF bandwidth)
  - 1.68 kHz to 190 kHz (with 200 kHz IF bandwidth)
- **Channel width (channel power only)**

  Cellular band receiver (Option 300 or 310)
  - 8.36 kHz to 25 MHz with 1.25 MHz IF bandwidth
  - 246 Hz to 25 MHz with 30 kHz IF bandwidth

  PCS band receiver (Option 320 or 330)
  - 8.36 kHz to 60 MHz with 1.25 MHz IF bandwidth
  - 246 Hz to 60 MHz with 30 kHz IF bandwidth

  2.1 GHz IMT 2000 band receiver (E6455C)
  - 8.36 kHz to 60 MHz (with 1.25 MHz IF bandwidth)
  - 100 kHz to 60 MHz (with 5.0 MHz IF bandwidth)

  Japan cellular band receiver (Option 380 or 381)
  - 8.36 kHz to 38 MHz (with 1.25 MHz IF bandwidth)
  - 246 Hz to 38 MHz (with 5.0 MHz IF bandwidth)

  Korea PCS band receiver (Option 390 or 391)
  - 8.36 kHz to 75 MHz (with 1.25 MHz IF bandwidth)
  - 1.68 kHz to 75 MHz (with 200 kHz IF bandwidth)

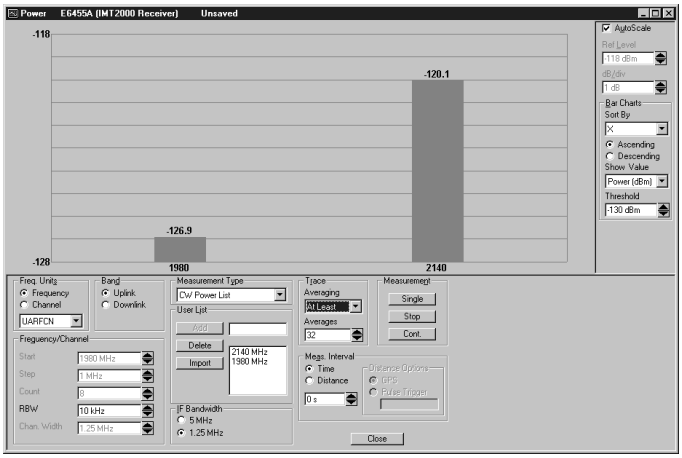

Figure 3. CW/channel power

[4] Korea PCS band receiver and 2.1 GHz IMT 2000 band receiver does not have 30 kHz IF bandwidth. Korea PCS band receiver has a 200 kHz and a 1.25 MHz IF bandwidth. 2.1 GHz IMT 2000 band receiver has a 1.25 MHz and a 5 MHz IF bandwidth.

Link Editor

The E7477A system provides a link editor that allows phone and receiver measurement parameters to be linked to allow common measurement criteria to be tracked on the display.

Alerts and alarms

The E7477A has sophisticated alarm capabilities. An alert is defined as a single condition on a single measurement. An alarm is a boolean expression made up of multiple conditions on multiple measurements. If the alert or alarm condition occurs while data is being logged, each data record includes the alert and alarm information.

The alarm wizard provides fast, easy setup of commonly used alarms. The alarms available for cdma2000 via the wizard are listed below.

- Pilot pollution
- Missing neighbor
- Dropped call
- High FER
- Low phone Ec/Io
- No coverage
- Weak CW
- Lost GPS fix
- No location fix
- Low disk space
- Low battery
- No AC power
- High CPU usage

When an alert or alarm condition occurs, any or all of the actions listed below can be executed.

Actions

- Play a .wav audio file
- Display a text message
- Pause or stop measurements

Alert operators

- Value
- Maximum
- Minimum

Alarm operators

- Value
- Maximum
- Minimum
- Sub-set
- OR
- AND
- XOR (exclusive OR)

Alert conditions

- Greater than (>)
- Greater than or equal to (≥)
- Less than (<)
- Less than or equal to (≤)
- Equal to (=)
- Not equal to (≠)

Alarm conditions

- Greater than (>)
- Greater than or equal to (≥)
- Less than (<)
- Less than or equal to (≤)
- Equal to (=)
- Not equal to (≠)
- Is a sub-set
- Is not a sub-set
- Sets intersect
- Sets do not intersect

Any measurement can be an operand in an alert or alarm. Below are some examples to illustrate alerts and alarms.

Alerts: 1. Value (Io) <–85 dBm
2. Max (Top N Ec/Io) <–10 dB

Alarms: 3. (Value (Io) <–85 dBm) AND
(Max (Top N) <–10 dB)

System status parameters can also be used as operands in alerts and alarms. For example, an alert can be defined to trigger when the available disk space on the PC drops below 10 MB or when the GPS position fix is lost.

System status parameters

- Available disk space
- GPS fix
- Location
- Velocity
- Percent CPU usage
- PC battery level
- PC AC power
- Time of day

Data recording and playback

Logging and playback of data are controlled by easy to use buttons. While logging data, the user can enter notes into the data. Two methods of user note entry are provided. One prompts the user to enter a text string, for example, entering a tunnel. The other automatically enters a numbered note into the database requiring minimum interaction with the keyboard. A summary of record and playback features are listed below.

Record features

- User note
- Automatically numbered note
- Display on/off
- Pause/resume
- User-defined data set name

Playback features

- Play forward
- Play reverse
- Step forward
- Step reverse
- Variable speed
- Advance to alert/alarm
- Advance to user note/auto-numbered note

Report generator and display printing

The E7477A provides fast and easy report generation. All of the current displays (virtual front panels) are captured to an HTML file (each report includes a header section). After selecting generate report, a dialog box prompts the user to enter the header information listed below. Smart defaults and persistent information are used, so minimal text entry is required.

Header elements

- Title
- User name
- Company
- Time
- Date
- Location – defaults to current GPS fix
- Comments – user entered notes

There is no limit to the number of reports that can be generated. Reports can be generated during playback as well as during live data collection.

Any virtual front panel can be printed by selecting the print command from the file menu.

Data export

Data can be exported from the E7477A database for display and post-processing. All measurement data can be exported. The export function provides flexible filtering capability that defines the specific data to be exported. Multiple data types can be exported to a single output file.

The user can save export plans. Once an export plan has been saved it can be retrieved to quickly and easily export the desired data. An export plan is made up of:

- **Data type(s):** Defines which data will be exported. Column order is user definable.
- **Alarms:** Defines which alarms will be exported.
- **Processing functions:** Defines the functions that will be applied to the data during export.
- **Exclusion rules:** Defines a set of conditions that, if true, the associated data will be excluded from the export.
- **Geographic binning:** Data-reduction process in which the data is averaged over geographic area or distance.

Several different operations can be executed in order to provide the desired data in the desired format.

Processing functions

- All values
- Count: Counts number of values above or below a specified threshold
- Count with summary: Same as count with a text file summarizing the results
- Maximum
- Minimum
- Value (x)

Conditionals

- Greater than (>) a threshold
- Less than (<) a threshold
- All values
- Qualified against another measurement

Sorting

- Ascending
- Descending
- None

Geographic binning methods

- **Grid:** Drive area is overlaid by a grid of user-definable size. The average of the data over each square is reported.
- **Linear distance:** User defines a drive distance over which to average. The average of the data over each segment of that distance is reported.
- **None**

The output formats supported by the E7477A are listed below. The system is designed to work with MapInfo in an integrated manner via an object link embedded (OLE) link to the MapInfo application. This exports the data, launches MapInfo, creates the necessary MapInfo tables, and creates a thematic map display in MapInfo. This function requires MapInfo be present. MapInfo is not included with the E7477A system.

Data output formats

- MapInfo OLE
- MapInfo text file
- ArcView text file
- Plain text file (no headers)
- PlaNET result (CW power data only)
- Raw binary

Real-time mapping

The E7477A Option 160 software license provides real-time data mapping. A single measurement parameter is plotted on the map, in color-coded thematic format, as the data is collected. Base station locations are plotted on the map with site names, sector orientations and PN offsets. Alarms are plotted on the map. Double clicking on the alarm symbol displays the corresponding alarm text message.

Measurement parameters that can be plotted on map

- Pilot channel analysis (receiver)
- Best server Ec/Io – from TopN (or best server Eb/Io)
- Best server Ec/Io – from User List (or best server Eb/Io)
- Io – from TopN
- Io – from User List
- Carrier frequency

CW and channel power

- Max CW power list
- Max CW power trace
- Max channel power list
- Max channel power trace

An indicator line is drawn from the current location to the serving sector.

Measurement parameters that can represent serving sector

- Pilot channel analysis (receiver)
  - Best server PN offset – from TopN
  - Best server PN offset – from User List

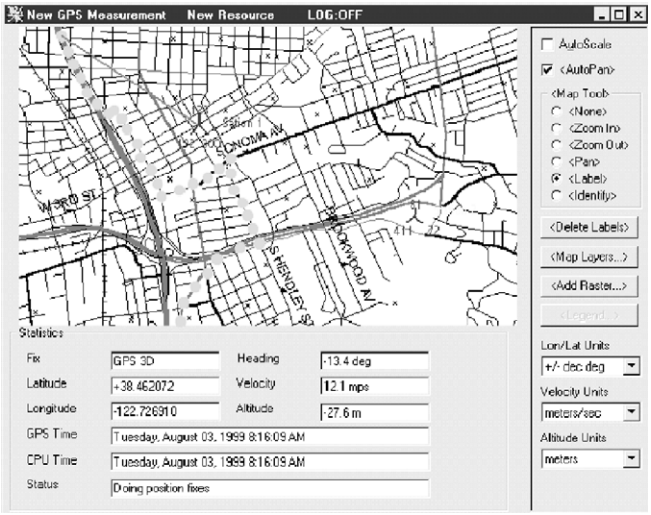

Figure 4. Real-time mapping display

The underlying map is in MapInfo .TAB format. The software can convert a raster image (.GIF or .TIF) to .TAB format, so the user can use any map that is in .TAB, .GIF, or .TIF format.

Indoor measurements

E7477A software Option 180 provides indoor measurement functionality. The indoor measurement virtual front panel provides the ability to make phone based cdma2000 wireless measurements inside of buildings. While walking through a building, waypoints are recorded on a floor plan of the building. Measurements are interpolated between waypoints. Indoor measurements require a floor plan or sketch of the building to be measured. This floor plan can be in .gif, .tif, or .png format.

An essential part of the indoor measurement system is a pen tablet computer which allows the user to correlate measurements with positions on a floor plan. Additional accessories are available which provide a simple, ergonomic way of making indoor measurements (see *CDMA Configuration Guide*, literature number 5968-5553E).

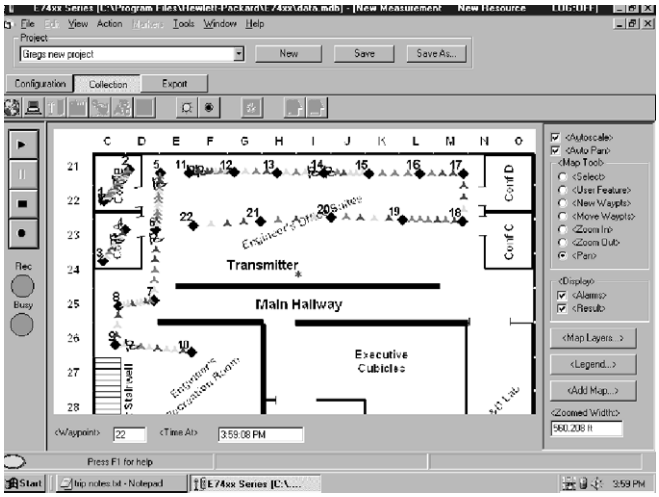

Figure 5. Indoor measurement VFP

Indoor measurement features

- Autoscale
- Autopan
- Auto legend
- Ability to link receiver measurements to plot
- Ability to save plot as a .tab file (Mapinfo)
- Waypoints with interpolation
- Moveable waypoints

RF receiver hardware

There are ten digital RF receiver options for the E7477A system:

Option 300: Cellular band receiver

Option 310: Cellular band receiver with internal GPS receiver

Option 320: PCS band receiver

Option 330: PCS band receiver with internal GPS receiver

E6455C: 2.1 GHz IMT 2000 band receiver with internal GPS receiver

Option 380: Japan cellular band receiver

Option 381: Japan cellular band receiver with internal GPS receiver

Option 390: Korea PCS band receiver

Option 391: Korea PCS band receiver with internal GPS receiver

Note: Specifications describe warranted performance over the temperature range of 0 to 55 degrees Celsius and include a 30-minute warm-up from ambient conditions. Typical and characteristic information provide useful information by giving non-warranted performance parameters. Typical refers to test data at the fiftieth percentile for a 25 degree Celsius room temperature. Characteristic information describes product information for parameters that are either not subject to variation, non-measurable, verifiable through functional pass/fail tests, or as a matter of routine not measured.

The E7477A system with Option 110 has software function for controlling the receivers. The system supports any combination of receivers, up to a total of four. Using multiple receiver configurations can greatly improve drive-test efficiency for applications such as simultaneously monitoring both forward and reverse links, and monitoring competitive networks. In multiple receiver configurations the receivers communicate with each other via a high speed serial ring. Communication with the PC is done via a single RS-232 link to one of the receivers in the ring.

Each receiver option includes:

- RF antenna for the corresponding frequency band
- Cable to connect to other receivers
- Cable to connect to PC
- Kit for mounting receiver in a vehicle
- AC/DC power supply
- Cigarette lighter power cord
- GPS antenna and cables (Options 310, 330, 381, 391, and E6455C only)

Agilent digital RF receiver specifications

(E7477A, Options 300, 310, 320, 330, 381, 390, 391 and E6455C)

Frequency

Frequency range

Options 300, 310: 824 to 849 MHz [819 to 854]
869 to 894 MHz [864 to 899]

Options 320, 330: 1850 to 1910 MHz [1845 to 1915]
1930 to 1990 MHz [1925 to 1995]

Options 380, 381: 832 to 870 MHz [827 to 875]
887 to 925 MHz [882 to 930]

Options 390, 391: 1710 to 1785 MHz [1705 to 1790]
1805 to 1880 MHz [1800 to 1885]

E6455C[5]: 1920 to 1980 MHz [1895 to 1990]
2110 to 2170 MHz [2100 to 2180]

Frequency accuracy: ±1 ppm,
With GPS time synchronization: ±0.05 ppm characteristic

IF bandwidth[6]:
30 kHz characteristic
200 kHz characteristic (Options 390, 391 only)
1.25 MHz characteristic
5 MHz characteristic (Options 360, 361 only)

Aging of TCXO: ±1 ppm/year

[5] Spectrum measurement allows tuning ±10 MHz above and below specified frequency ranges. In addition, for the 2.1 GHz IMT 2000 band receiver the PHS band is also covered (down to 1895 MHz). These extended ranges are shown in brackets – [ ]. The performance is not specified in these extended ranges. Characteristic noise floor increase is 2 dB ±10 MHz. For the 2.1 GHz IMT 2000 band receiver, at –25 MHz with respect to specified range, the characteristic noise floor increase is 5 dB. Characteristic amplitude accuracy is unchanged with respect to specified range.

[6] Korea PCS band receiver and 2.1 GHz IMT 2000 band receiver does not have 30 kHz IF bandwidth. Korea PCS band receiver has a 200 kHz and a 1.25 MHz IF bandwidth. 2.1 GHz IMT 2000 band receiver has a 1.25 MHz and a 5 MHz IF bandwidth.

Amplitude

Accuracy for cellular band, PCS band, and Japan cellular band receiver

30 kHz IF bandwidth:
± 0.5 dB typical from –25 dBm to –110 dBm

1.25 MHz IF bandwidth:
± 0.5 dB typical from –25 dBm to –110 dBm

Noise figure: 8 dB typical

Internally generated spurious, input referred:
–120 dBm for 30 kHz IF bandwidth
–120 dBm for 1.25 MHz IF bandwidth

Adjacent channel desensitization[7]: –25 dBm typical

Adjacent channel rejection[8]: 45 dB typical

Accuracy for 2.1 GHz IMT 2000 band receiver

1.25 MHz IF Bandwidth:
± 0.5 dB typical from 25dBm to –110 dBm

5.0 MHz IF bandwidth:
± 0.5 dB typical from –25dBm to –100 dBm

Noise figure: 8 dB typical

Internally generated spurious, input referred:
–120 dBm for 1.25 MHz IF Bandwidth
–115 dBm for 5 MHz IF Bandwidth

Adjacent channel desensitization[9]: –20 dBm typical

Adjacent channel rejection[10]: 25 dB typical

Accuracy for Korea PCS band receiver

200 kHz IF bandwidth:
± 0.5 dB typical from –25 dBm to –100 dBm

1.25 MHz IF bandwidth:
± 0.5 dB typical from –25 dBm to –100 dBm

Noise figure: 8 dB typical

Internally generated spurious, input referred:
–120 for 200 kHz IF bandwidth
–120 dBm for 1.25 MHz IF bandwidth

Adjacent channel desensitization[11]: –25 dBm typical

Adjacent channel rejection[12]: 45 dB typical

Maximum safe input level: +10 dBm, 20V DC characteristic

1 dB compression point[13]: –15 dBm characteristic

Input/output

RF input: 50 Ω type-N

Connectors

Computer: RS-232 (DB9) male

GPS: RS-232 (DB9) male

Power: DC power jack 100 mils, positive center

Miscellaneous

Operating temperature range: 0 to 55 °C

Maximum relative humidity: 80% for temperatures up to 31 °C, decreasing linearly to 50% relative humidity at 40 °C

Storage temperature range: –40 to 70 °C

Dimensions:
6 in x 3 5/8 in x 8 3/4 in,
15.24 cm x 9.21 cm x 20.32 cm

Weight: 4.6 lbs. (2.1 kg)

Power:
9-34 V DC, 9 W
With internal GPS: 9-34 V DC, 10 W (E7477A Options 310, 330, 381, 391, and E6455C)

Internal GPS (Options 310, 330, 381, 391 and E6455C)

GPS receiver: 8 channel internal GPS receiver

Connector type: SMA

Differential compatible without dead reckoning

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[7] Adjacent channel desensitization applies to the 1.25 MHz IF filter and is defined as the 1 dB compression of tuned signal with interfering signal ±1.25 MHz from tuned signal.

[8] Adjacent channel rejection applies to the 30 kHz IF filter and is defined as the suppression of interfering signal ±30 kHz from tuned signal.

[9] Adjacent channel desensitization for 2.1 GHz IMT 2000 Band Receiver applies to the 5.0 MHz IF filter and is defined as the 1 dB compression of tuned signal with interfering signal ±1.25 MHz from tuned signal.

[10] Adjacent channel rejection for 2.1 GHz IMT 2000 band receiver applies to the 1.25 MHz IF filter and is defined as the suppression of interfering signal ±1.25 MHz from tuned signal.

[11] Adjacent channel desensitization applies to the 1.25 MHz IF filter and is defined as the 1 dB compression of tuned signal with interfering signal ±1.25 MHz from tuned signal.

[12] Adjacent channel rejection for Korea Band Receiver applies to the 200 kHz IF filter and is defined as the suppression of interfering signal ±200 kHz from tuned signal.

[13] It is recommended that the input signal level not exceed –40 dBm.

GPS

The E7477A system has the ability to work with several types of GPS interfaces. The system is compatible with the communications protocols listed below. The physical interface is RS-232 with a DB9 connector.

Compatible protocols

- TAIP
- TSIP
- NMEA

Two different GPS receiver configurations are available from Agilent Technologies for our drive-test systems[14]:

The E7477A receiver offering E6455C includes a GPS receiver mounted inside the receiver enclosure. This configuration provides excellent portability and convenience.

Agilent 86154A Option 210 adds a trimble placer GPS 455 receiver with dead reckoning for external connection to the system.

GPS receiver with E6455C

- 8 channel GPS receiver
- Mounted inside Agilent RF receiver enclosure
- SMA antenna connector
- Bulkhead mount antenna with cable
- Magnetic mount antenna with cable
- Differential compatible
- Not dead reckoning compatible

Note: E6455C receiver does not support connection to external GPS receivers.

Agilent 86154A Option 210

- Trimble Placer GPS 455 with dead reckoning
- Heading sensor
- Interconnect adapter (to connect to the Agilent RF receiver)
- Interconnect cables
- Bulkhead mount antenna with cable
- Magnetic mount antenna with cable
- Differential compatible

The E7477A software includes a virtual front panel for the GPS receiver. This window displays a bar graph with the individual satellite signal strengths (TSIP protocol only), a text display of the GPS statistics, and a map of location history. This map also displays the base station locations and names.

External GPS receivers communicate with the E7477A via an RS-232 serial connection. The table below lists several GPS receiver models and the associated requirements for connection to an E7477A system. For other models of external GPS receivers, consult an Agilent representative for interconnect requirements.

GPS receiver model	Interconnect requirement
Trimble placer GPS/DR:	Option 211
Trimble placer GPS 455:	Option 212
Trimble SveeSix:	Straight-through RS-232 cable
Trimble placer GPS 400:	Straight-through RS-232 cable

If a GPS receiver is purchased from Agilent, all necessary interconnect parts are provided.

Differential GPS can be used with the Agilent E7477A systems, provided the GPS receiver being used is differential compatible. Agilent 86514A Option 230 adds a differential GPS receiver to the system.

Agilent 86154A Option 230: differential GPS receiver

- Differential corrections, incorporated RDS-3000
- Magnetic mount antenna
- Interconnect cables

Handset compatibility

The E7477A cdma2000 drive-test system can interface with the several cdma2000 handsets and is fully compatible with the IS-95 handsets. Each handset requires a cable to connect to the PC. This list is complete as of the time of this printing. At this time, handsets are not available from Agilent. Contact your Agilent representative regarding handset compatibility and availability plans.

Compatible handsets

- Qualcomm Cellular Trial Phone FFA5000-800, 1XRTT
- Qualcomm PCS Trial Phone FFA5000-1900, 1XRTT
- Samsung Cellular SURF5000-800, SCH-X100
- Kyocera QCP-2035
- Qualcomm QCP-820, QCP-1920, QCP-2700
- Qualcomm QCP-860, QCP-1960, QCP-2760
- Qualcomm QCP-800, QCP-1900
- Samsung SCH-1000

Each phone requires a cable to connect to the PC. Agilent offers the following cables for cdma2000 handsets.

Cable model/option	Handsets
86154A Option 719:	Kyocera QCP-2035 (Powered)
86154A Option 720:	Samsung Cellular SURF 5000-800, SCH-X100 (powered)
E6473A Option 801:	QCP-820, QCP-1920, QCP-2700
E6473A Option 802:	QCP-860, QCP-1960, QCP-2760 (no external RF connector)
E6473A Option 803:	QCP-860, QCP-1960, QCP-2760 (with external RF connector

[14] With the Agilent cdma2000 receiver with internal GPS (E6455C), an external GPS source may be used with the receiver even though an internal GPS exists within the receiver housing. This is valuable for differential or dead reckoning measurements that may be needed. Only one GPS source can be used at any given time.

E6473A phone cabling Options 801, 802, and 803 are specially designed to work with the Agilent direct connect USB hub kits. The hub kits not only provide phone connectivity to the PC but also power to the phone. For users who do not wish to use the USB hub kits, a special adapter is provided to allow the phone cable to be directly connected to the PC; however, power is not available for the phone. The USB hub kits are ordered using the drive-test accessory product.

As noted above under compatible handsets, the E7477A cdma2000 drive-test system supports the Qualcomm PCS and Cellular 1XRTT trial phones. These phones must be purchased from Qualcomm directly. Qualcomm provides a phone interface cable for the trial phones when they are purchased. In addition, a dual port adapter must also be ordered directly from Qualcomm if simultaneous voice and data measurements are desired. The part number for the Qualcomm dual-port adapter is TXTDA03B.

Computer hardware

The Agilent E7477A system requires a PC. The minimum PC requirements are listed. If you wish to purchase a laptop computer with the system, the Agilent 86154A Option 010 adds a Hewlett-Packard OmniBook.

Minimum PC requirements

- Pentium processor (233 MHz)
- Windows 95, 98® or Windows NT® (4.0 or greater)
- RS-232 (DB9) serial port
- PCMCIA slot (2 if using more than 2 phones)
- 32 MB RAM if using Windows 95 or 98®
- 64 MB RAM if using Windows NT®
- 50 MB disk space for software installation
- 400 MB disk space recommended for data
- CD-ROM drive recommended
- 800 x 600 display resolution

Agilent 86154A Option 010 PC specifications

- HP OmniBook 6000
- Pentium III processor (700 MHz)
- Windows 98®
- 128 MB RAM
- 10 GB hard disk
- 8X DVD-ROM drive
- Enhanced lithium ion battery pack
- 14.1 inch active matrix display
- 1024 x 768 display resolution

More information on the HP OmniBook can be found at **http://www.hp.com**

Portability accessories

The Agilent E7477A is a lightweight, portable system. The Agilent 86154A Option 531 adds a carrying case.

Agilent 86154A Option 531: briefcase carrier

For transporting an Agilent E7477A system: one Agilent receiver, one mobile phone, laptop PC and connecting cables.

System is not intended to be operated from within case.

Training

One day of on-site start-up assistance is provided with Option 110.

Technical support

One year of on-line technical support is provided with Option 110.

Warranty

One-year warranty on hardware components is included with the Agilent E7477A system. Extended warranties and calibrations services are also available.

- **Option W30:** Three years of customer return repair service
- **Option W32:** Three years of customer return calibration service
- **Option W50:** Five years of customer return repair service
- **Option W52:** Five years of customer return calibration service

Additional Agilent literature

Brochures

E7475A GSM Drive-Test System 5968-5562E

Configuration guides

E7488A Voice Print/Data Print 5988-1643EN

E7473A CDMA Drive-Test 5968-5553E

E7474A TDMA Drive-Test 5968-5861E

E7475A GSM Drive-Test 5968-5563E

E7476A W-CDMA Drive-Test 5980-2307E

E7477A cdma2000 Drive-Test 5980-2308E

E7490A CDMA Over-Air Maintenance Tool . . .5968-8696E

Data sheets

Wireless Data Measurement 5988-1507EN

E7473A CDMA Drive-Test 5968-5555E

E7474A TDMA Drive-Test 5968-5556E

E7475A GSM Drive-Test 5968-5564E

E7490A CDMA Over-Air Maintenance Tool . . .5968-8687E

Product overviews

E7478A GPRS Drive-Test System 5980-2375E

Wireless Data Measurement 5980-2310E

E7490A CDMA Over-Air Maintenance Tool 5968-8697E

Indoor Wireless Measurement System 5968-8689E

N3419A Vehicle Mounted System Display 5980-0721E

Application/product notes

CDMA Drive-Test Product Note 5968-5554E

Spectrum and Power Measurements Using the Agilent CDMA, TDMA, and GSM Drive-Test System 5968-8598E

Optimizing your CDMA Wireless Network Today and Tomorrow Using Drive-Test Solutions 5968-9916E

Optimizing your TDMA Network Today and Tomorrow Using Drive-Testing to Identify Interference in IS-136 TDMA Wireless Networks 5980-0219E

Optimizing your GSM Network Today and Tomorrow UsingDrive-Testing To Troubleshoot Coverage, Interference, Handover Margin, and Neighbor Lists 5980-0218E

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