

Full ANSI-136 cellular phone testing with ACELP and VSELP vocoder in an affordable package



- **Low cost and highly accurate with a full set of troubleshooting features for AMPS, NAMPS and TDMA (ANSI-136) cellular handset testing**
- **Supports VSELP and ACELP vocoder testing**
- **Constellation display of a phone's digital modulation for IQ analysis of $\pi/4$ DQPSK**
- **Plot transmit and receive performance over the handset's operating frequency range**
- **Manual and automatic test modes supported with printout routines**
- **Built-in antenna and cable loss tester**
- **CDPD cellular modem test capable, including GMSK modulation and burst power**
- **Spanish and English instrument personalities with supporting documentation**

IFR's global leadership in AMPS and TDMA (ANSI-136) testing is well known. The sophisticated signaling analysis, voice codecs, and the precise RF power measurement capabilities of IFR's advanced production and laboratory instruments are available now in a portable, low cost and full-featured cellular phone test set, including CDPD modem test capability.

Cellular Phone Tester

The 2959 allows you to perform tests manually or automatically on AMPS, NAMPS and TDMA (ANSI-136) phones as well as on CDPD wireless modems. You have complete control over the entire testing process, including which tests are performed in automatic sequences and the pass/fail tolerances for each test.

Multi-Mode Testing

Multi-Mode AMPS/ANSI-136 phones can be tested quickly and easily. Modes are automatically detected during the registration procedure and the individual aspects of the different modes can also be tested completely in the manual procedures. All types of cross-mode hand-offs are supported. Tests can vary from quick and simple confidence checks to comprehensive tests that pinpoint the cause of handset problems. Graphic displays assists in the quick and efficient identification of problems.

Users can set up and store up to 10 test configurations in the 2959, while retaining factory default setup for quick tests or operator training.

Analog AMPS Testing

Analog testing is simple and straight forward. Connect the phone to the 2959's RF test connector and begin. You can perform simple functional tests over the air interface with an antenna attached to the 2959's RF port or make accurate measurements through a test cable. An audio connector allows access to both sides of the phone's audio: transmit and receive. The user has control over:

- System assignment (A or B) System ID (SID), channel definitions and all pass/fail criteria
- Registration, hand-offs, release orders, page responses, audit orders, hook flash and disconnects
- MO (Mobile Originated) and MT (Mobile Terminated) calls
- SAT and ST frequency error and deviation
- ST duration
- Receiver sensitivity in either 12 dB or 20 dB SINAD

- Forward and Reverse voice modulation
- DTMF tests of the handset
- RF frequency error
- All eight of the phone's RF power levels
- Plots of transmitter and receiver performance over all the phone's operating channels

Digital TDMA (ANSI-136) Testing

To simplify testing, digital phone tests mirror analog test procedures with alterations only to account for the different digital measurements and enhanced features available with modern TDMA (ANSI-136) handsets. Setup and testing of ANSI-136 handsets can be fully automatic for all modes available in the handset, or it can be manual and interactive for diagnostic analysis. In addition to the normal registration and call control functions the 2959 provides control over specialized TDMA (ANSI-136) test features.

- All eleven RF power levels
- TDMA-specific call control such as time slot changes
- DTMF signaling from the handset
- RMS EVM (Error Vector Magnitude), phase error, droop and I/Q origin offset (Carrier leak)
- RMS EVM over the first 10 symbols
- Voice loopback tests or actual voice checks with built-in VSELP and ACELP codecs including the energy ($r0$) variable of the VSELP codec
- BER verification of the phone's receiver
- MAHO RSSI (Mobile Assisted Handoff-Receive Signal Strength Indication) on the alternate channel at -75, -85 and -95 dBm
- Full-featured Constellation display of the transmitter's modulation

New CDPD Testing Functions

Though some handsets may have CDPD modems built in, they always operate separately from the phone and are tested as autonomous devices. The external modems have an RF connector for their antennas and can be either a PCMCIA device or incorporate a separate connector for serial connection to the computer. Modems can also be integrated directly into laptops, cellular phones and PDAs (Personal Digital Assistants).

Testing CDPD mobile data devices is easy with the 2959's recently upgraded CDPD tests. By installing the modem software, connecting it to the computer and connecting the device's RF antenna connection, the 2959 can perform automated or manual tests of the modem.

By stimulating the CDPD base station messaging and RF

parameters, the 2959 provides full external analysis of the mobile CDPD modem. This includes the ability to test both the RF characteristics of the GMSK carrier and the associated protocol or signaling that is required to establish a wireless data call. Tests performed include:

- RF Power Plot
- Frequency Error
- Modulation Index
- Receiver Sensitivity
- Verification of CDPD Protocol Functions
- GMSK Eye Pattern
- Hand-Offs
- Burst Analysis

Specification

RF Signal Generator

FREQUENCY

Range

869.01 to 893 (Mobile Station Rx frequency range)

Resolution

10 kHz

Accuracy

Same as timebase

INTERNAL FM MODULATION

AMPS Test Tone Frequency

1 kHz

AMPS Data

Manchester encoded

NAMPS Test Tone Frequency

1 kHz

NAMPS DSAT/DST

Codes 0 through 6

EXTERNAL FM MODULATION INPUT

Impedance

2 k Ω nominal

Sensitivity

100 Hz/mV peak, $\pm 30\%$ at 1 kHz

Frequency Range

300 Hz to 3 kHz

$\pi/4$ DQPSK MODULATION

RMS Error Vector Magnitude (EVM)

As defined by EIA/TIA-627

CDPD GMSK MODULATION

Data Rate

19.2 kbps, ± 1 bps

Deviation

4.8 kHz peak, ± 240 Hz

B.T. Product

0.5

RF OUTPUT (T/R CONNECTOR)

Level Range

-40 to -127 dBm

Level Resolution

0.1 dB

Level Accuracy

± 1.5 dB

Receiver

FREQUENCY

Range

824.01 to 848.97 MHz (Mobile Station Tx Frequency Range)

Resolution

10 kHz

INPUT POWER

Maximum Input

5 W maximum (continuous into T/R Connector)

SENSITIVITY

FM Audio

-90 dBm, 12 dB SINAD

Meter Functions

RF POWER

Frequency Range

824.01 to 848.97 MHz

Power Range

0.05 mW to 4 W

Accuracy (Reading < 3 mW)

$\pm 20\%$, ± 1 digit

Accuracy (Reading ≥ 3 mW)

$\pm 15\%$, ± 1 digit

T/R Port VSWR

$< 1.5:1$

RF FREQUENCY ERROR

Range

± 10 kHz

Resolution (N/AMPS, TDMA)

1 Hz

Resolution (CDPD)

10 Hz

Accuracy

Same as timebase, ± 2 Hz

ANTENNA VSWR MEASUREMENT

Range

1.20:1 to 4.00:1

Resolution

0.01

AF COUNTER

SAT Range (AMPS)

5,950 Hz to 6,050 Hz

ST Range (AMPS)

9,950 Hz to 10,050 Hz

Resolution

1 Hz

Accuracy

± 1 Hz, ± 1 digit

FREQUENCY DEVIATION

	Minimum		Maximum
SAT Range (AMPS)	± 1 kHz	to	± 3 kHz
ST Range	± 7 kHz	to	± 9 kHz
DSAT/DST Range	± 0.5 kHz	to	± 0.9 kHz
AMPS Voice Range	± 1 kHz	to	± 14 kHz
NAMPS Voice Range	± 1 kHz	to	± 4 kHz

For CDPD GMSK

± 4.8 kHz (with any valid CDPD data)

Deviation Resolution

0.01 kHz

Deviation Accuracy

$\pm 5\%$, ± 1 digit

SINAD

Range

3 to 40 dB

Resolution

0.1 dB

Accuracy

± 1 dB at 12 dB SINAD

Test Frequency

1 kHz

CABLE LOSS MEASUREMENT

Cable Loss Range

0.0 to 20.0 dB

Cable Loss Resolution

0.1 dB

Cable Loss Accuracy

±0.5 dB (0 to 3 dB reading)

$\pi/4$ DQPSK

(EVM)

EVM Range

0% to 23% RMS

EVM Resolution

0.01%

EVM Error

<1.7% RMS

Timebase

INTERNAL TIMEBASE

Frequency

10 MHz nominal

Uncertainty

±0.1 ppm

Temperature Stability

±0.1 ppm

Ageing Rate

±0.1 ppm/year

EXTERNAL TIMEBASE

Level

0.25 to 6.0 V p-p

Frequency

10 MHz

Impedance

1 k Ω nominal

Power Requirements

AC INPUT

Source Voltage

100 to 240 VAC

Source Frequency

47 Hz to 63 Hz

Power Consumption

<75 W

DC INPUT

Source Voltage

11.5 to 15 VDC

Power Consumption

<75 W

Physical Characteristics

DIMENSIONS AND WEIGHT

Outside Dimensions (H x W x D)

164.9 mm x 303.6 mm x 381.5 mm

6.43 in. x 11.84 in. x 14.88 in.

Weight

11.8 kg (not including lid or lid contents)

26 lbs. (not including lid or lid contents)

Versions and Accessories

When ordering please quote the full ordering number information.

Ordering Numbers

Versions

2959	Advanced Multi-Mode Cellular Test Set
2959-C	Advanced Multi-Mode Cellular Test Set with Certificate of Calibration

Accessories

AC0350	2959 Operational Manual (Spanish)
AC1081	CDPD Version 1.4 Software Upgrade
AC1082	CDPD Version 1.4 Software Upgrade for Microcell 100

Extended Warranties

W2959/203	Warranty Extension 1 yr (Total Warranty 3 yrs)
W2959/204	Warranty Extension 2 yr (Total Warranty 4 yrs)
W2959/205	Warranty Extension 3 yr (Total Warranty 5 yrs)

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