Agilent 89451A
Radio Test Personality

Product Overview

Reduce the overall time to develop, test, and troubleshoot digital radio transmitters and receivers with the Agilent Technologies 89451A radio test personality. The Agilent 89400 series vector signal analyzers (with Option AYA) serve as the measurement platform that the 89451A customizes for quick setup and testing. NADC, PDC, PHS, and User-defined systems are tested with "one-button" measurement ease—without sacrificing the measurement flexibility needed to troubleshoot difficult system problems.

The radio test personality provides "one-button" tests to measure adjacent channel power, occupied bandwidth, modulation accuracy, power due to modulation (and to full signal), and frequency tolerance. These measurements can easily be performed on either burst or continuous signals. "One-button" setups are pre-defined to measure NADC, PDC, and PHS to the desired results of their standards. The flexibility of the analyzer also allows users to change many of the setup parameters, if needed. The 89451A delivers the accuracy required for stringent R&D applications in addition to speed and ease-of-use.

One-button operation to select desired measurement

The main menu of the radio test personality is a window into the test being performed, the carrier frequency, the signal type (burst or continuous), and the radio system being tested. Tests include occupied bandwidth, adjacent channel power, and modulation accuracy.

If seeing is believing, then quantifying is proof that a system is meeting its performance requirements. The flexible displays allow data to be viewed in a variety of formats to gain maximum information about the signal being measured. Results can be displayed either as an intuitive visual representation of the signal with an abbreviated results summary (Figure 1), or as more detailed, comprehensive data results (Figure 2).
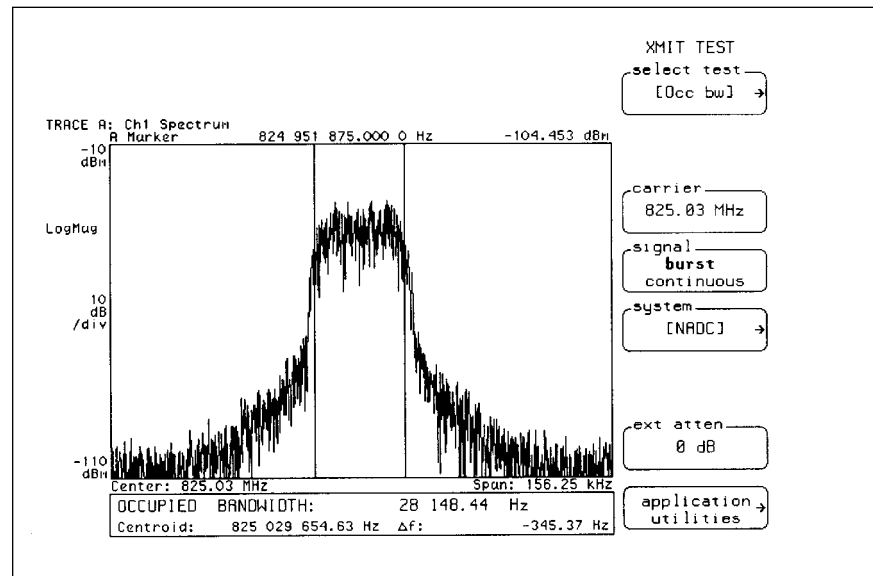

Figure 1. Occupied bandwidth measurement on a burst NADC signal.

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Innovating the HP Way

Complete test setups for adjacent channel power and occupied bandwidth

All Agilent 89400 series vector signal analyzer measurement parameters are automatically set for each test and system selected. Filtering and channel bandwidth spacing default to the system standard test. The 89451A is automatically set to display a single trace along with an abbreviated results summary. For occupied bandwidth and adjacent channel power measurements, activating a "burst view" shows the signal in the time-domain simultaneously (Figure 3). Measurement results update as fast as 9 times per second.

For adjacent channel power and occupied bandwidth testing, compare power due to modulation and power over the entire burst to determine the spectral energy due to burst edges —a primary source of spectral splatter. Up to 5 channel pairs can be measured simultaneously (Figure 4). Their frequency offsets, reference channel bandwidth, and adjacent channel bandwidth are adjustable. ACP measurements can be made so the results are comparable to an MKK approach per several Japanese standards. Determine the bandwidth that contains a specified percentage of power with the occupied bandwidth test.
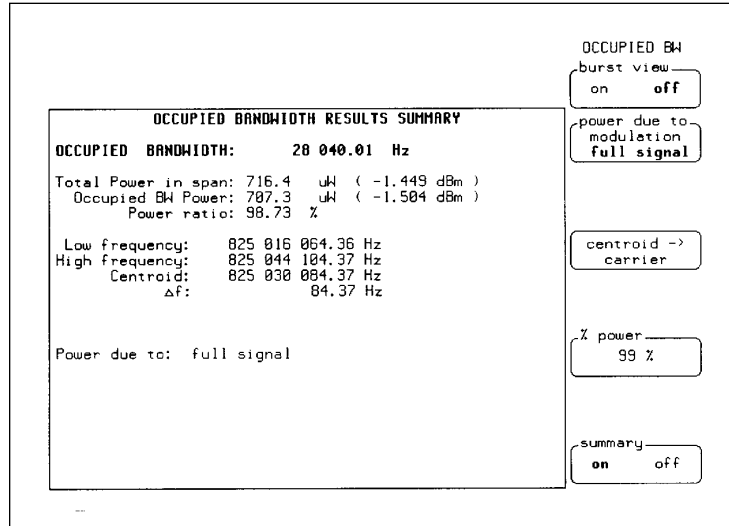

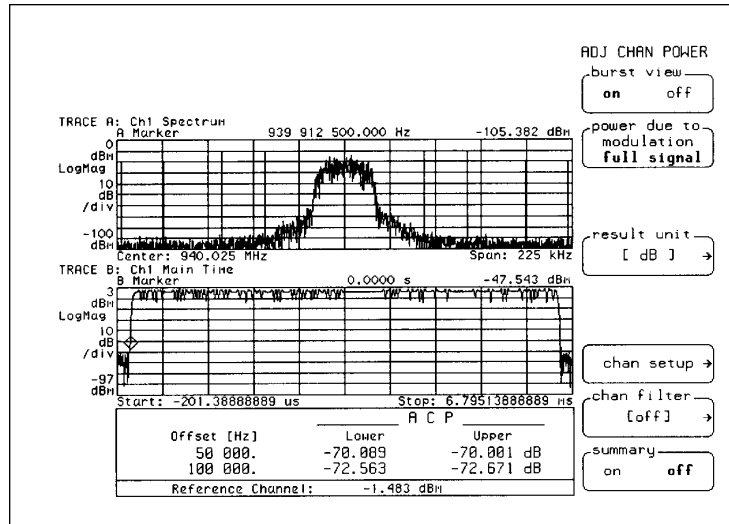Figure 2. Comprehensive data results of occupied bandwidth measurement.

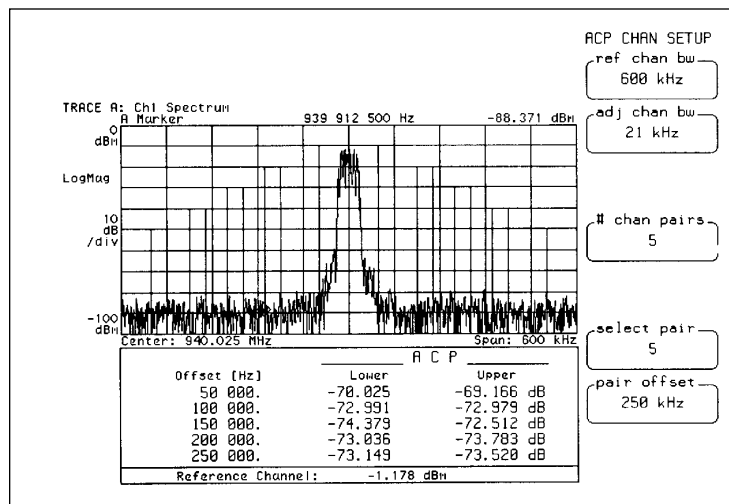Figure 3. Adjacent channel power measurement on a burst PDC signal.

Figure 4. Simultaneous measurement of 5 adjacent channel pairs of continuous PDC signal.

Modulation accuracy measures signal errors

The 89451A characterizes signal errors to determine if a system —or a subassembly within it— is within its allowable error budget. Error vector magnitude (EVM) is comprehensively calculated as an rms average over a full block of demodulated symbols and over the first 10 symbols. The peak error is also reported (and its symbol location). Calculate a 10-burst averaged EVM measurement with the touch of a button. Any errors in carrier frequency and origin offset are reported to the display along with the more visually-intuitive vector diagram.

Sync words can be selected to specify the portion of the signal to be analyzed and demodulated. The sync word number, hexadecimal pattern for the sync word, or a user-defined (binary) sync pattern enables easy alignment of the measured signal.

Enabling summary results display the full error measurements along with a color 4-grid display showing the vector, eye, EVM vs symbol, and demodulated symbols (Figure 5). Measurement results update as fast as 3.5 times per second.

User-defined systems

The user-defined system capability of the 89451A preserves measurement hardware investments. Digital radio systems using any of the many modulation formats, filter, filter rolloff, and symbol rates supported by the 89400 series Option AYA can utilize the power contained in the 89451A. Once a system and its parameters are entered, the measurement configuration may be saved and retained in the analyzer for future use.

Supported modulation formats:

2 and 4 level FSK (including GFSK)
MSK (including GMSK)
8 and 16VSB

QAM implementations of:

BPSK, QPSK, DQPSK, π/4DQPSK, 8PSK, 16 through 256QAM

Supported filter types (modulation accuracy):

Raised cosine (Nyquist)
Square-root raised cosine (root Nyquist)
Gaussian
None
Rectangular
Low pass
User-defined

Applications beyond digital radio systems

The flexibility of the 89451A structure does not restrict the signals being measured to NADC, PDC, PHS, or any type of digital radio system. For example, digital video designers can measure adjacent channel power on their wideband signals when the 89440A (or 89441A) vector signal analyzer is set for frequency spans as wide as 1.8 GHz (or 2.65 GHz). Occupied bandwidth measurements enable rapid spectrum characterizations to be made in surveillance or frequency monitoring applications.
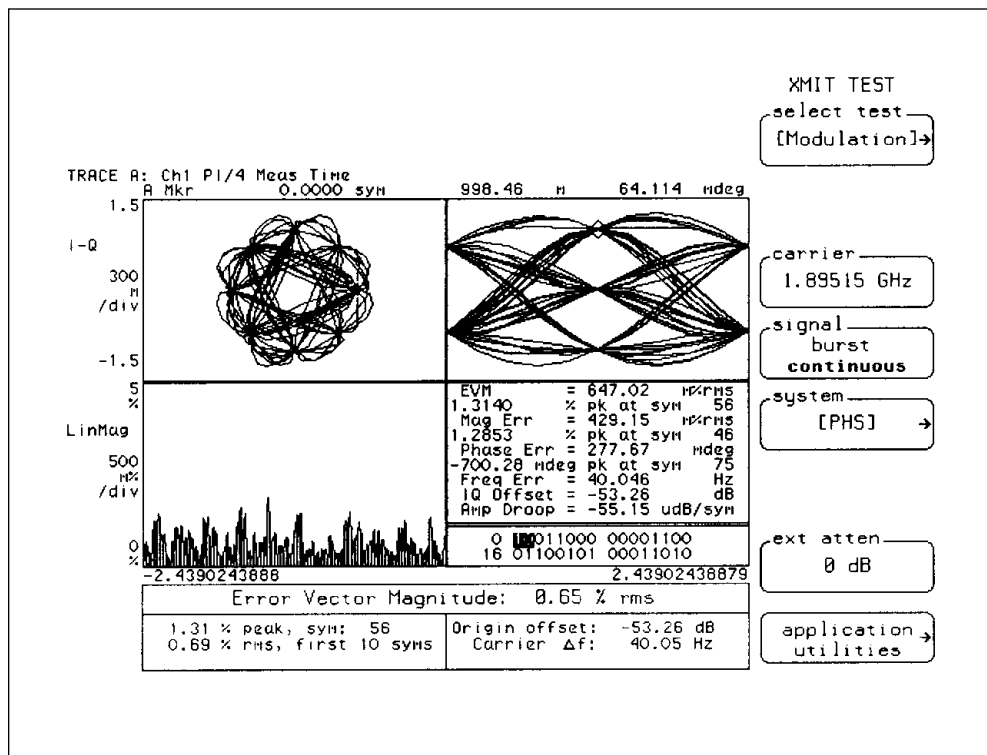

Figure 5. 4-grid (color) modulation accuracy results summary of a continuous PHS signal.

89451A Measurement Specifications

The 89451A implements the following NADC, PDC, and PHS tests:

Occupied bandwidth
Adjacent channel power
Modulation accuracy
Carrier frequency error

Menu formatting and measurement setup

Select Test

  Occupied Bandwidth
    burst view on/off
    power due to modulation/full signal
    centroid → carrier
    % power
    summary on/off

  Adjacent Chan Pwr
    burst view on/off
    power due to modulation/full signal
    result unit
      dB (relative)
      dBm
      W
      mW
      uW
      nW
      pW
    method
      true rms
      pseudo-swept (MKK)
    chan setup
      ref chan bw
      adj chan bw
      # chan pairs
      select pair
      pair offset
      chan filter
        off
        root raised cosine
        raised cosine
        filter width
        filt rolloff
    summary on/off

  Modulation
    ten burst avg on/off
    sync word (unique word for PHS system)
      none
      (S1 to S6 for NADC system)
      (S1 to S12 for PDC system)
      (PS-COM 16/32 and CS-COM for PHS system)
      user
    summary on/off

  None
    save setup as USER test
    test preset

Carrier
Signal burst/continuous
System
  NADC
  PDC
  PHS
  USER
Ext atten

Measurement specifications

and display formats

The 89451A specifications and display formats can be found in the 89410A, 89440A, and 89441A vector signal analyzer technical data sheets.

Required vector signal analyzer configuration

The following analyzers support the 89451A application personality. They must be configured with a minimum of Option AYA (vector modulation analysis).

Agilent 89410A	0 to 10 MHz
Agilent 89440A	0 to 1.8 GHz
Agilent 89441A	0 to 2.65 GHz

Upgrades

Upgrading a vector signal analyzer with the 89451A may require a hardware upgrade. Any analyzer (IF section for the 89440A/89441A) with a serial number less than 3416A00619 requires ordering Agilent part number 89410-69550 digital filter board.