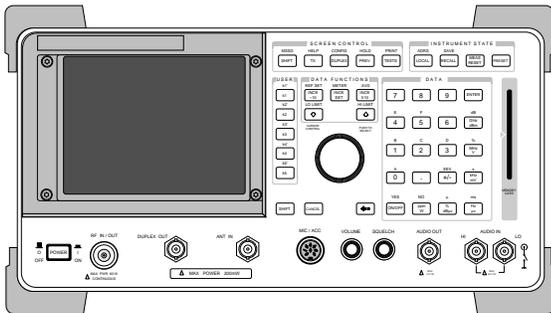


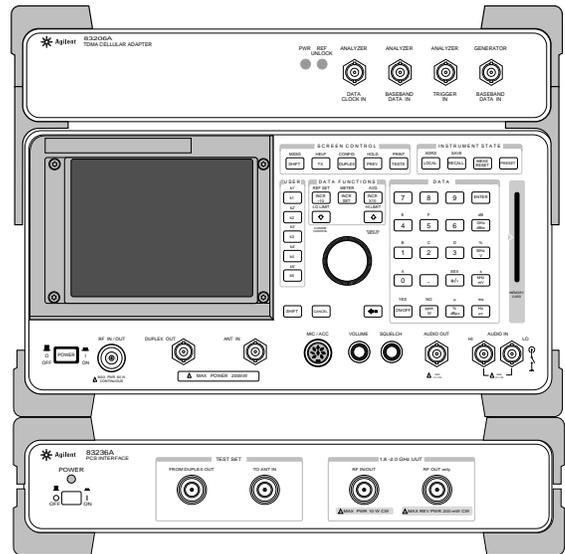
Agilent 8920B

Power Measurements Using Agilent 8920B Solutions for AMPS, NAMPS, and TDMA Mobile Phones

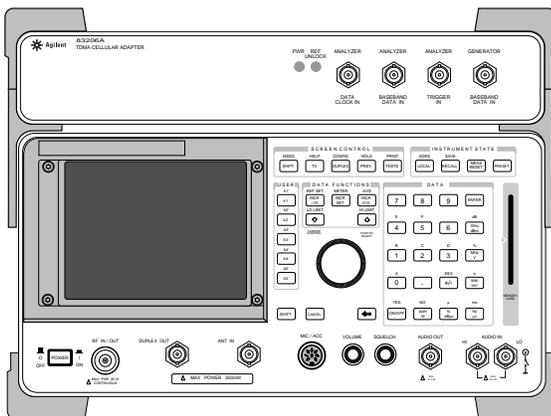
Product Note



8920B RF Communications Test Set



8920B RF Communications Test Set Option 801



8920B RF Communications Test Set Option 800



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Introduction

There is some confusion among users regarding the power measurements that appear on the different screens of Agilent Technologies 8920B Test Set solutions. This document is intended to give 8920B solutions users an insight into the power measurements appearing on different screens of the 8920B RF Communications Test Set, and to remove ambiguities about these measurements.

Target Audience

This document assumes that the reader is an advanced user of Agilent 8920B solutions and is familiar with AMPS, NAMPS, or TDMA technologies. Hence, basic and intermediate steps for accessing the various screens presented in this document are not included.

This document applies specifically to the 8920B RF Communications Test Set and its configured options listed in Table 1 and shown in Figure 1 on the following page.

This document discusses the following topics:

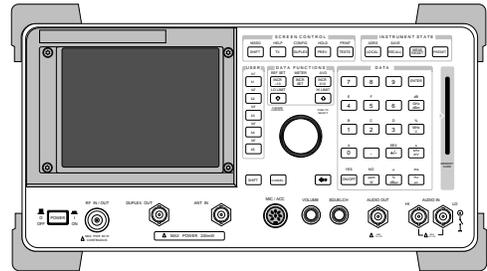
- The analog power measurement as applicable to the 8920B Test Set (basic unit) and its Options 800 and 801. This measurement is displayed as **TX Power** and is available on the RF ANALYZER, ANALOG MEAS (MEASUREMENT), DUPLEX TEST, and CALL CONTROL screens. See page 5.
- The digital power measurements of 8920B Option 800. Specifically, the transmit power measurement **TX Power** and the average power measurement **Average Power** of the CALL CONTROL and DIGITAL MEASUREMENTS screens. See page 7.
- The digital power measurement **TX Power (Avg)** of 8920B Option 801. See page 11.

Table 1. Agilent 8920B Solutions Configurations

	Option Configuration	Application
8920B RF Communications Test Set	Basic unit — no adapters required.	<ul style="list-style-type: none"> • AMPS • NAMPS
8920B RF Communications Test Set Option 800	<ul style="list-style-type: none"> • 8920B RF Communications Test Set (“Average Power” measurement requires one of these options installed in the Test Set: Option 006, 007, or 009.) • TDMA Cellular Adapter 	<ul style="list-style-type: none"> • AMPS • NAMPS • TDMA IS-136 (at cellular frequency band)
8920B RF Communications Test Set Option 801	<ul style="list-style-type: none"> • 8920B RF Communications Test Set Option 800 • 83206A TDMA Cellular Adapter • 83236B PCS Interface (adapter) 	<ul style="list-style-type: none"> • AMPS • NAMPS • TDMA IS-54 • TDMA IS-136 (at cellular and PCS frequency bands)

8920B RF Communications Test Set

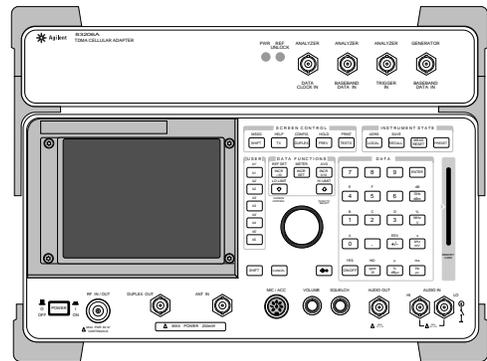
(Base Unit)



**8920B RF Communications Test Set
Option 800**

**83206A
TDMA Cellular
Adapter**

**8920B
RF Communications
Test Set**



**8920B RF Communications Test Set
Option 801**

**83206A
TDMA Cellular
Adapter**

**8920B
RF Communications
Test Set**

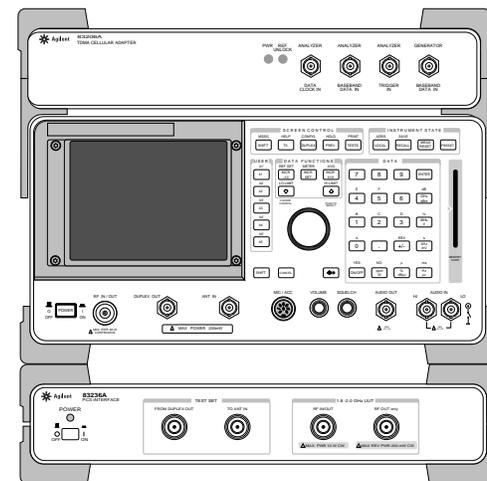


Figure 1. Agilent 8920B Solutions Configurations

I. Analog Power Measurement

The power measurements discussed in this section apply to the 8920B RF Communications Test Set and its Options 800 and 801. Analog power measurements are available on four screens. These screens,

shown in Figure 2, are: RF ANALYZER, ANALOG MEAS, DUPLEX TEST, and CALL CONTROL. These screens display the same **TX Power** measurement reading.

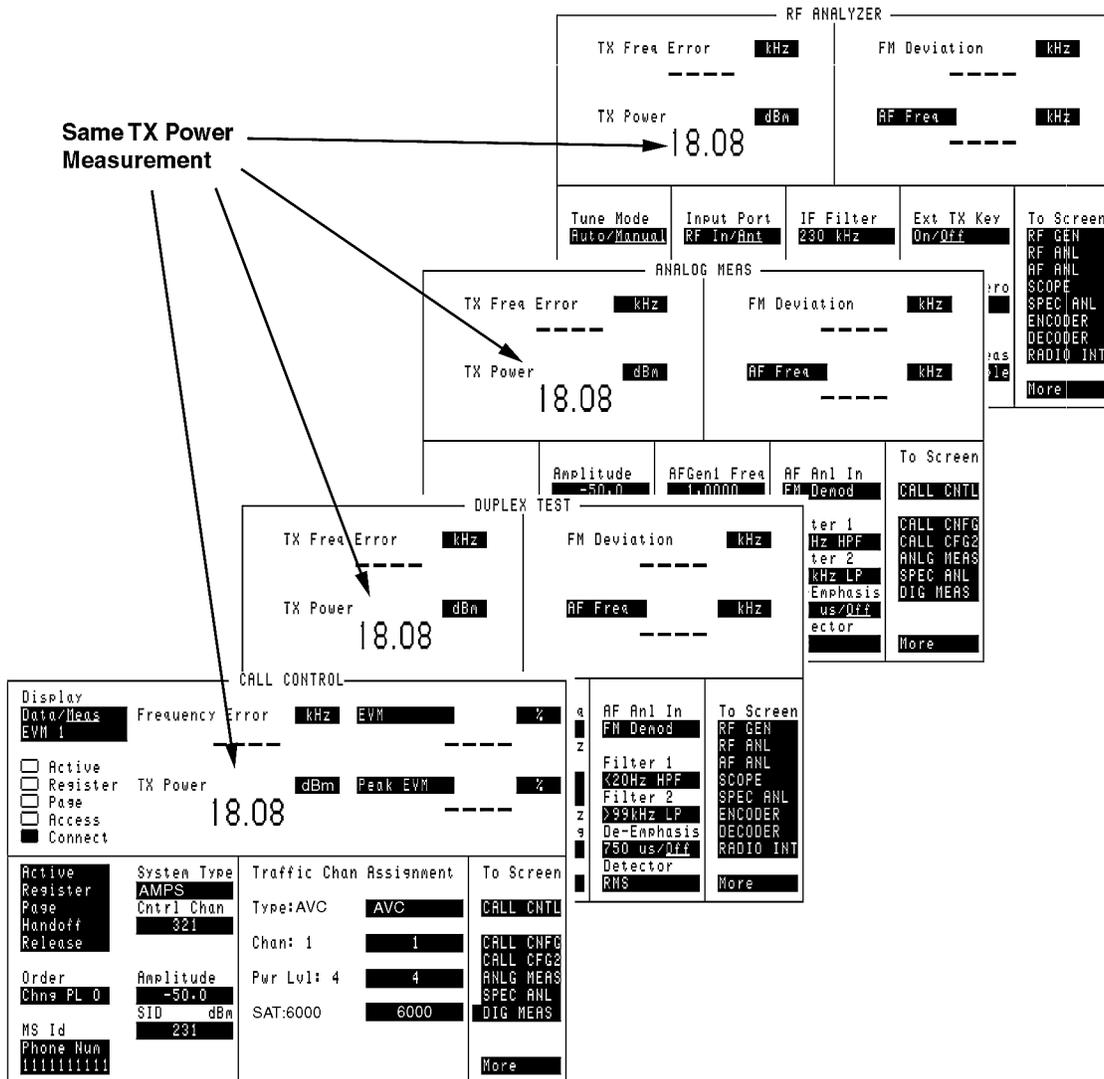


Figure 2. TX Power Measurement on RF ANALYZER, ANALOG MEAS, DUPLEX TEST, and CALL CONTROL Screens

Method of Measurement

The RF input signal is envelope detected by a peak detector circuit in the RF input module of the Agilent 8920B Test Set. This peak detector circuit directly converts the RF signal into a corresponding envelope voltage waveform. This voltage waveform is then sampled and converted to a calibrated power value. This calibrated power value is displayed as **TX Power**.

The peak detector circuit has two modes of operation: **Peak** or **Sample**. This is user selectable from the power measurement field **TX Pwr Meas** on the RF ANALYZER screen (see Figure 3).

When set to **Peak**, the power detector circuit has a slow response time, and captures and maintains the peak envelope voltage. When set to **Sample**, the power detector circuit has a fast response time and tracks the instantaneous envelope voltage.

When measuring an RF signal with amplitude modulation, use the **Peak** mode. When dealing with a continuous wave signal or frequency modulated signal, use the **Sample** mode.

To improve test times, turn off all other measurements when measuring power.

Advantages/Features

- This is an absolute power measurement. For analog measurements, this is the only way to measure power.
- The power signal must be input at the RF IN/OUT connector. The ANT IN connector cannot be used for measuring analog power.
- Useful as an AMPS and NAMPS utility.

Accuracy

- 5% or 0.2 dB.

NOTE: Zero the power meter using the **TX Pwr Zero** function on the RF ANALYZER screen before making an analog power measurement and anytime the measurement mode **Peak/Sample** is switched.

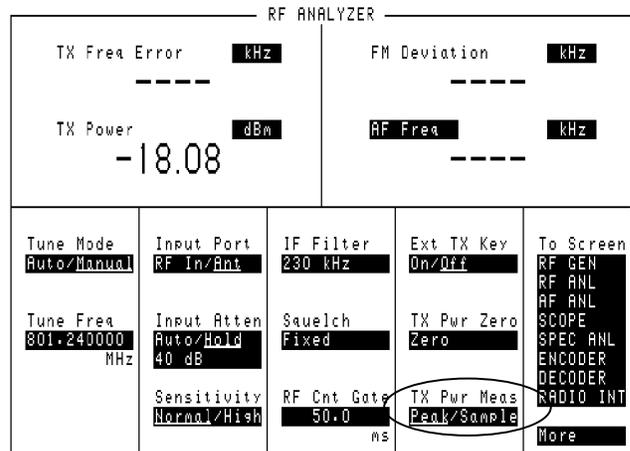


Figure 3. RF ANALYZER Screen

II. Digital Power Measurement (Option 800)

The power measurements discussed in this section apply to Agilent 8920B RF Communications Test Set Option 800. There are two types of power measurements available for measuring TDMA power burst signals:

- Relative power measurement, which is displayed as **TX Power** on the CALL CONTROL and DIGITAL MEASUREMENTS screens (not recommended).
- Absolute power measurement, which is displayed as **Average Power** on the CALL CONTROL and DIGITAL MEASUREMENTS screens (strongly recommended).

A. Relative Power Measurement— TX Power on the CALL CONTROL and DIGITAL MEASUREMENTS Screens

Method of Measurement

This measurement is made without the use of a peak detector circuit. The RF signal is converted to an IF signal in the 8920B Test Set, and is then routed to the Agilent 83206A TDMA Cellular Adapter; see Figure 5. The Digital Signal Processor (DSP) in the 83206A TDMA Cellular Adapter samples the IF signal and makes the power measurement. The power measurement obtained is a relative measurement and not an absolute measurement. Hence, the unit of measurement is “dB” not “dBm.”

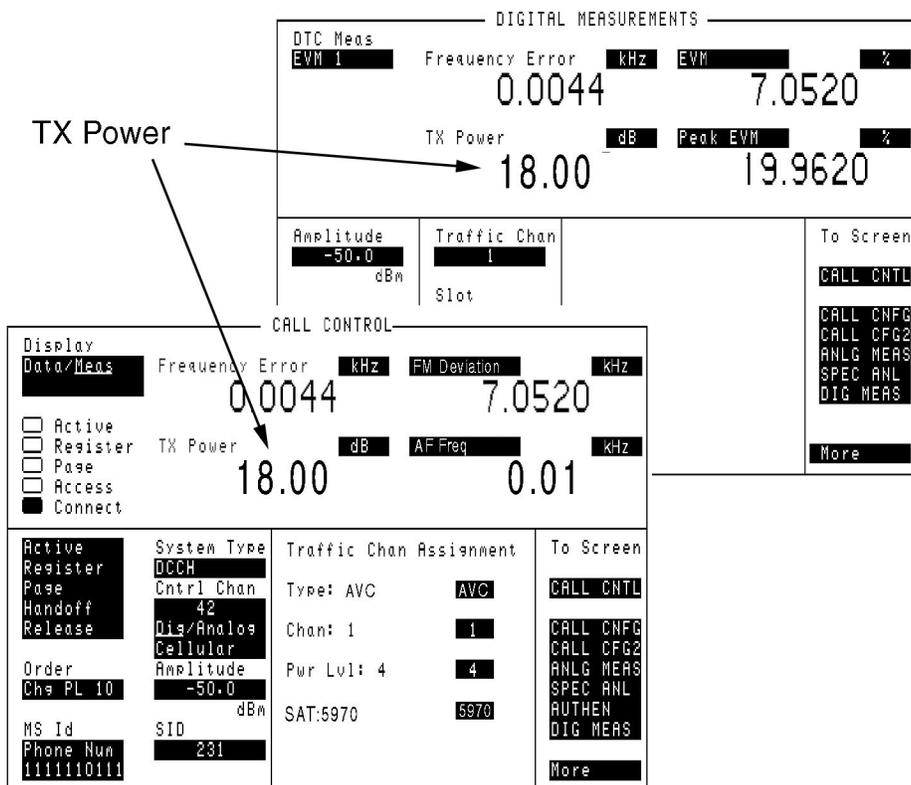


Figure 4. DIGITAL MEASUREMENTS and CALL CONTROL Screens

Make sure that the 83206A TDMA Cellular Adapter is calibrated for TX power measurements. (A periodic calibration program called PERCALD is stored in ROM of the 8920B Test Set. Run PERCALD from the Test Set's TESTS screen. When prompted, select **TX Power** on the Periodic Calibration Menu and proceed as instructed on the screen.) After the periodic calibration is complete, the displayed cal factors for the 0 dB, 20 dB, and 40 dB attenuators must each vary by approximately 20 dB; for example, 15.1, 35.1, and 55.2 dB.

Advantages/Features

- The dynamic range for this measurement is very high. You can use this TX power to measure signals anywhere from a few watts to pico watts (as long as it is above the noise floor).
- Host processor measurements such as EVM1, EVM10, etc., can be displayed simultaneously with TX power measurement. Both RF IN/OUT and ANT IN connectors can be used for measuring TX power.
- To further increase the accuracy of this measurement, the user is required to establish a reference signal. Input a known power at a known frequency and measure the TX power under CALL CONTROL or DIGITAL MEASUREMENTS screen. Use the REF SET data function on the front panel of the 8920B RF Communications Test Set to establish this measurement as reference. Refer to the Operating Overview section in the 8920B Test Set's user's guide. After the reference is established, all TX Power measurements will be relative to this user-established reference.
- This is a DSP power measurement without the use of a power detector.

Disadvantages

- The 83206A TDMA Cellular Adapter used must be calibrated for TX power.
- Difficult to understand.

Accuracy

- Depends on the accuracy of your known power source.

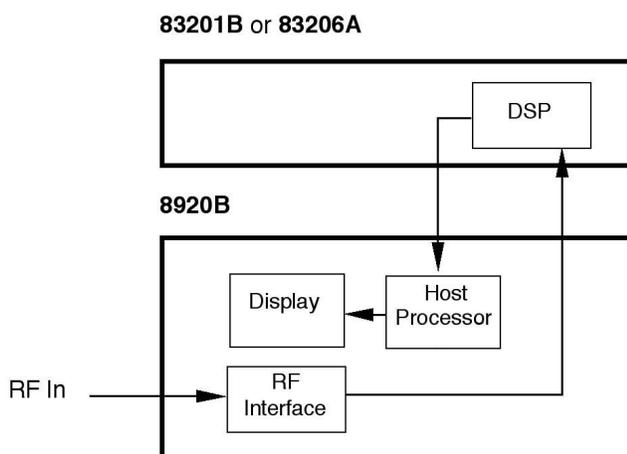


Figure 5.

B. Absolute Power Measurement— Average Power on the CALL CONTROL and DIGITAL MEASUREMENTS Screens

The average power discussed in this section applies to Agilent 8920B Option 800.

Method of Measurement

The RF input power is envelope detected by a peak detector circuit in the 8920B Test Set; see Figure 7. The envelope signal is then digitized in the 83206A

TDMA Cellular Adapter. Each of the instantaneous voltage values is converted to a calibrated and absolute power value by the digital signal processor (DSP) in the TDMA Cellular Adapter. The measurement is displayed as **Average Power** on the CALL CONTROL and DIGITAL MEASUREMENTS screens of the 8920B Test Set; see Figure 6.

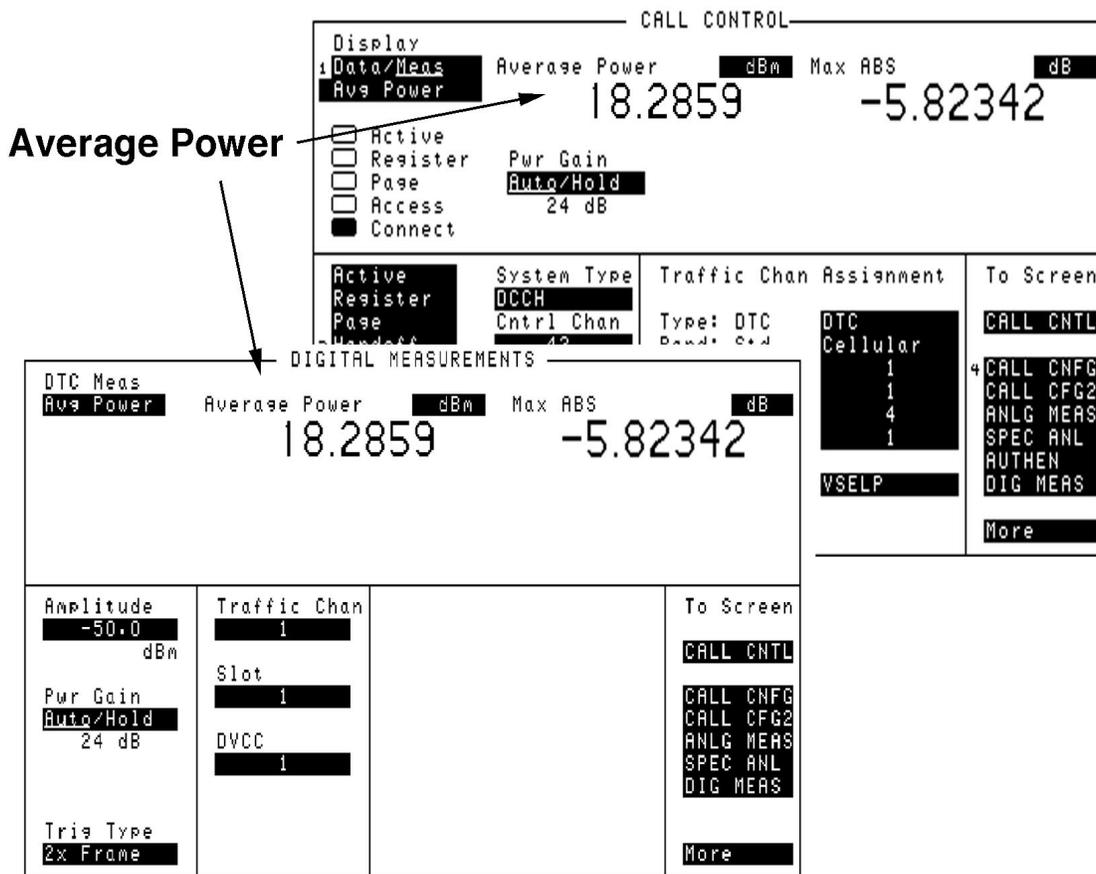


Figure 6. Average Power on CALL CONTROL and DIGITAL MEASUREMENTS Screens

Advantages/Features

- Easy to use and highly recommended for most customers.
- Average power (in this case) is an absolute measurement.
- The power signal must be input at the RF IN/OUT connector. The ANT IN connector cannot be used for measuring average power.

Disadvantages

- You cannot measure average power along with other host processor measurements. That is, you cannot display EVM1 and average power simultaneously.

Accuracy

- 5% or 0.2 dB. **NOTE:** Zero the power meter using the CALL CONFIGURATION screen.

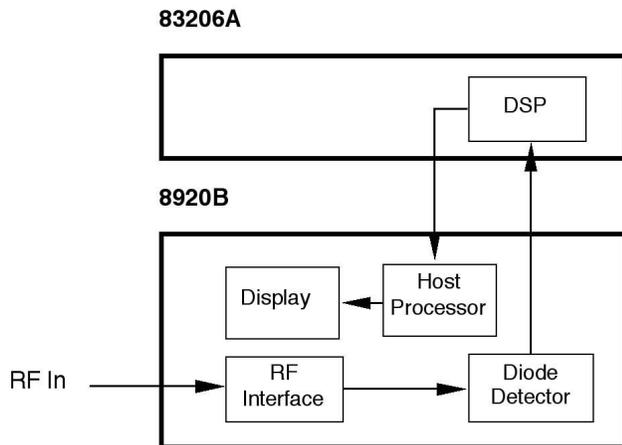


Figure 7.

III. Digital Power Measurement (Option 801 only)

The power measurement discussed in this section applies to Agilent 8920B RF Communications Test Set Option 801. (Refer to Table 1 for this option's configuration.)

When the Agilent 83236B PCS Interface adapter is connected to 8920B RF Communications Test Set Option 800 (and PCS mode is turned ON), only absolute power measurement is available. The relative power measurement is not available with Option 801.

The absolute power measurement is displayed as **TX Power (Avg)** on the CALL CONTROL and DIGITAL MEASUREMENTS screens. The unit of measurement is in watts or dBm; see Figure 8.

The power measurement is made using the power detector and the DSP in the 83236B PCS Interface adapter; see Figure 9. This power detector is used at both cellular and PCS frequencies.

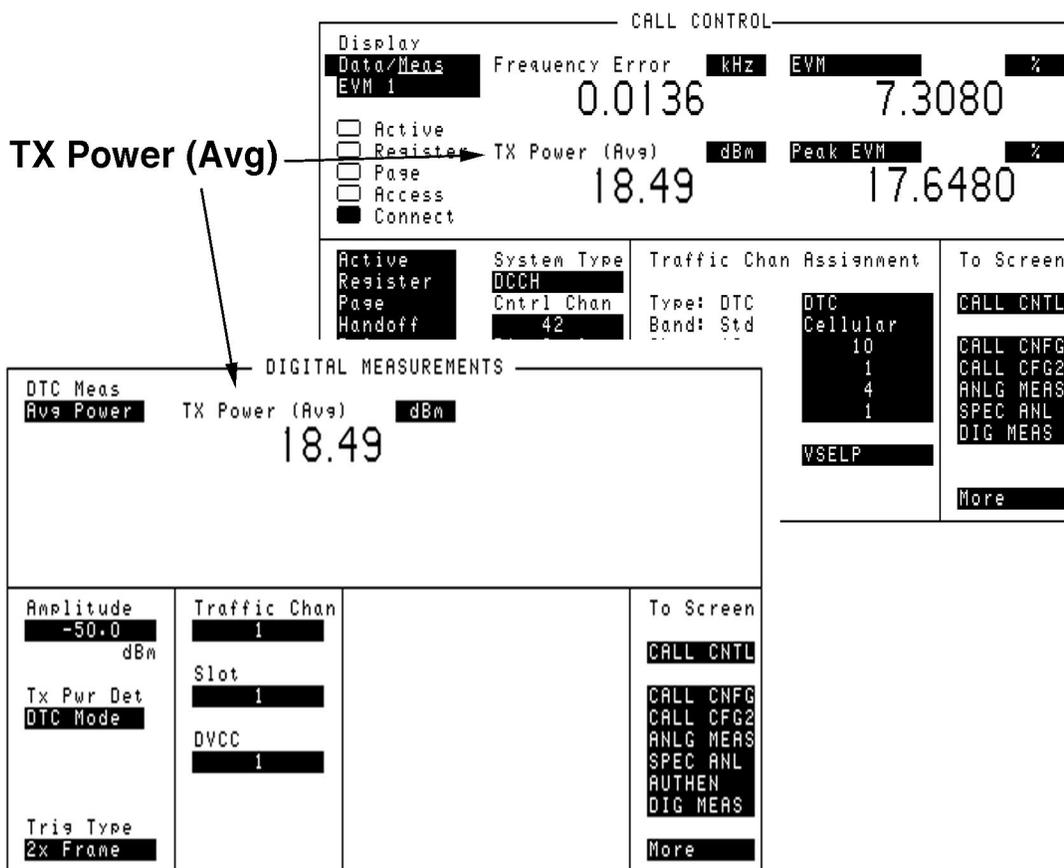


Figure 8. Absolute Power Measurement, TX Power (AVG), of CALL CONTROL and DIGITAL MEASUREMENTS Screens

Method of Measurement

The RF signal is envelope detected by a peak detector circuit in the 83236B PCS Interface Adapter (and not in the 8920B Test Set). This peak detector circuit directly converts the RF signal into a corresponding envelope voltage waveform. This voltage waveform is then sampled and converted to a calibrated power value by the DSP in the 83236B PCS Interface Adapter; see below. This power value is then transferred from the 83236B PCS Interface Adapter to the host processor in the 8920B Test Set through the serial interface, and is displayed as **TX Power (AVG)** on the CALL CONTROL and DIGITAL MEASUREMENT screens; see Figure 8.

Advantages/Features

- **TX Power (Avg)** is an absolute and not a relative measurement, unlike the **TX Power** described in section A, “Relative Power Measurement – TX Power on the CALL CONTROL and DIGITAL MEASUREMENTS Screens.”
- **TX Power (Avg)** is similar to the **Average Power** measurement described in section B, “Absolute Power Measurement – Average Power on the CALL CONTROL and DIGITAL MEASUREMENTS Screens.”
- This measurement is used both at cellular and PCS frequencies.
- The 83236B PCS Interface Adapter is controlled through the 8920B RF Communications Test Set’s serial interface.

Accuracy

- $\pm 5\%$ or 0.2 dB.

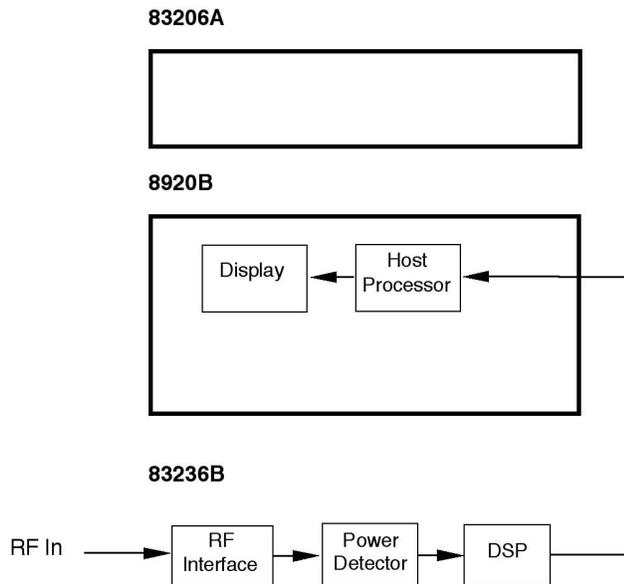


Figure 9.

Author

Shakil Pittal

Acknowledgments

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