Improve the Circuit Evaluation Efficiency of Wireless LAN Equipment Design

- **Efficient Balanced IF SAW measurement without using baluns**
- **Efficient design improvement using built-in simulator: circuit embedding**
- **4-port ECal drastically reduces calibration procedure and time**

Introduction

A network analyzer is a necessary tool for wireless LAN equipment design, since there are so many components and circuits to be measured in the design process as shown in Fig.1.

A network analyzer is mainly used for two purposes: one is the evaluation of components themselves, such as IF SAW filters, in order to ensure that their actual performance meets the requirement for the equipment design. The other is the evaluation of circuit blocks for design improvement. When the equipment does not meet the system performance requirements, detailed evaluation of the related circuit blocks is imperative to know how to fix the problem. A network analyzer is an indispensable tool for these purposes.

The ENA series network analyzer, with its balanced measurement function, significantly improves the evaluation efficiency of a balanced IF SAW filter, which is a key component of wireless LAN equipment. The ENA's matching circuit embedding function facilitates design improvement.

Problems of conventional method for balanced IF SAW evaluation

The conventional method of non-50Ω balanced SAW filter measurement using a network analyzer requires baluns (balanced-unbalanced transformers) and matching circuits. (Fig. 2) They are necessary evils: baluns limit measurement frequency range and designing actual matching circuits consumes valuable development time. Moreover, both of those external circuits introduce additional errors.

ENA Solution for IF SAW evaluation

The ENA has a fixture simulator that can perform the balance-unbalance conversion and virtual arbitrary impedance matching by calculation. Therefore, you can get rid of baluns and actual matching circuits, which enables more efficient and accurate evaluation (Fig. 3).

The N4431A 4-port ECal further simplifies measurement by providing fast, accurate, automatic calibration.

Finally, the built-in VBA allows you to eliminate repetitive tasks in filter evaluation. For example, you can automatically display major filter parameters such as bandwidth, Q value, and insertion loss as shown in Fig. 4. (A sample VBA program is provided with the ENA.)
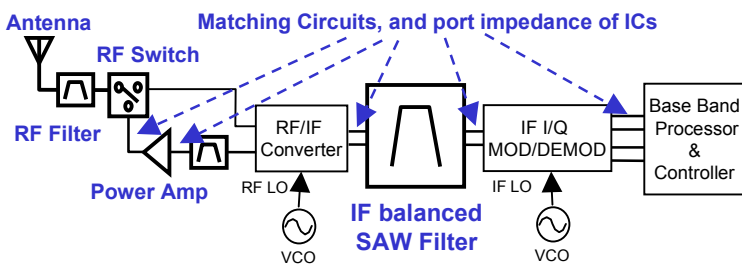

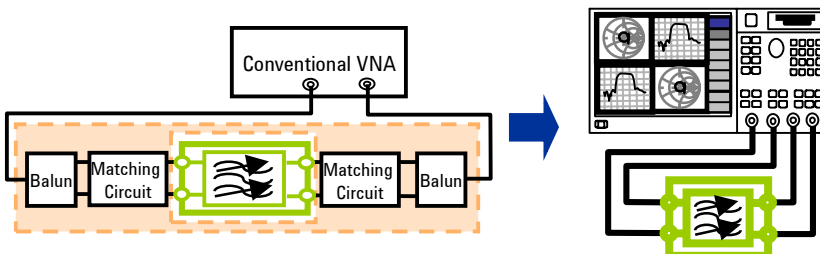**Figure 1. Wireless LAN block diagram with key NA measurement points**

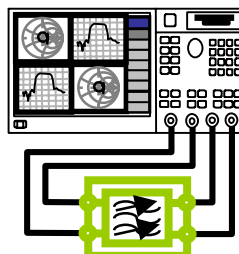

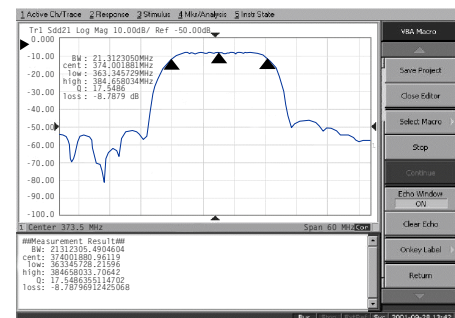**Figure 2. Conventional VNA test setup**

Figure 3. ENA Series test setup

Figure 4. Quick filter parameter measurements with VBA

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Built-in Simulator facilitates design improvement

For circuit design improvement, a very useful feature of the ENA's built-in fixture simulator is that you can easily embed simple matching circuits to the measured circuit. Fig. 5. lists the matching circuits available for embedding. For example, you can see how the circuit would response when 1 pF shunt capacitor were added to the circuit, and the display is updated real-time when you change the matching circuits. In many cases, simple circuit simulation of this kind is enough for small design improvement, although more complicated simulation is required sometimes. The ENA supports the Touchstone format for data transfer to an external circuit simulator, such as ADS.
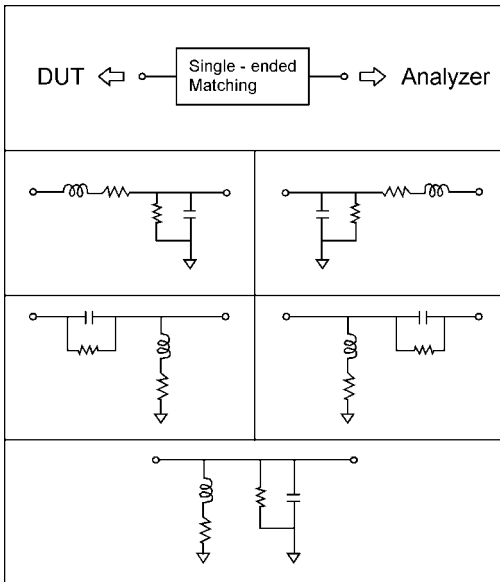

Figure 5. Matching circuits available for embedding

For more information, please refer to the following literature:

• *Agilent ENA Series Network Analyzer Product Overview*
(P/N 5988-3765EN)

• *Introduction to the Fixture Simulator Function of the ENA Series*
[P/N 5988-4923EN]

• *Evolution of Test Automation Using the Built-in VBA with the ENA Series*
[P/N 5988-4923EN]

• Agilent URL for ENA
http://www.agilent.com/find/ena

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