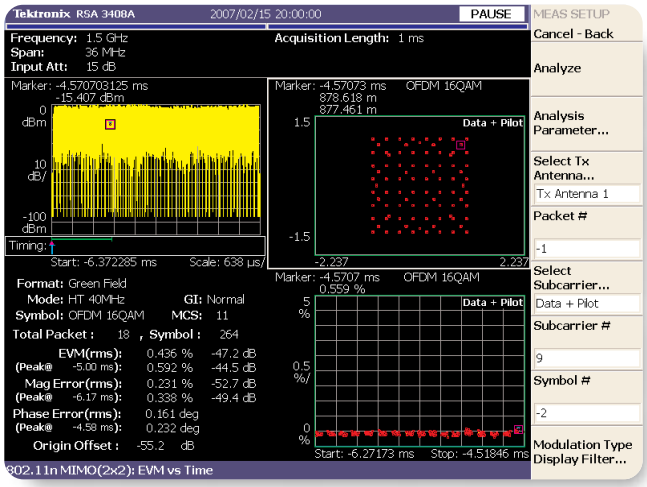
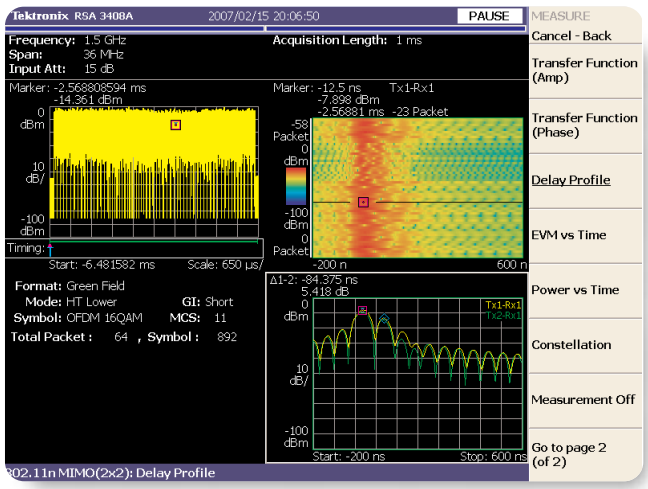
Draft IEEE802.11n Measurement Solution and Multiple Input Multiple Output (MIMO) Measurement Challenge



▶ **Figure 1.** *Mainview shows EVM vs time. EVM measurement summary is shown in readout area. Packet format, MCS and other at marker position on overview are indicated too. In this case, analyzer shows EVM result by -47dB for MIMO signal.*



▶ **Figure 2.** *Subview is Delayogram which is 3D display that vertical axis is packet number, horizontal axis is delay time and color is power. Delayogram shows delay spread change over various packets. Mainview shows delay spread of each channel streams at specific packet where is selected by marker on overview.*

Draft IEEE802.11n Standard

Increasing data rates of WLAN system has been demanded in the market to expand application areas which are streaming media (HDTV, DVD), interactive gaming and high speed data link in hot spots. The IEEE802.11n is an evolution of existing IEEE802.11a/b/g system and promises to have enhanced data rates, better spectral efficiency, better quality and more robust system when compared to the existing IEEE802.11a/b/g system. The fundamental requirements for IEEE802.11n Project Authorization Request (PAR) are:

– Define Physical Layer (PHY) and Media Access Control (MAC) modifications to enable at least 100 Mbps at the MAC Service Access Point (SAP)

– Spectral Efficiency: Highest mode achieves > 3 bps/Hz

– Backward Compatibility with .11a and .11g (OFDM base)

Several ideas have been considered to support these requirements. Data rates have been enhanced by increasing the number of sub-carriers from the 54 sub-carriers used in 802.11a/g systems to 114 sub-carriers. However, this requires slightly over twice the current occupied spectrum and does not contribute to the robustness or spectrum efficiency. Therefore, it was decided to adopt the Mulitple Input Mulitple Output (MIMO) technology in IEEE 802.11n standards. MIMO is a family of techniques for multi antenna wireless transmission and reception that increases the achievable data throughput within the same occupied bandwidth, increases quality of communication, and allows dramatically increased spectral efficiency. While offering substantial benefits to system performance, it also increases the challenges in design and system evaluation and validation. New measurements need to be considered for testing MIMO systems.

Tektronix Draft 802.11n Measurement Solution on Real Time Spectrum Analyzer (RTSA)

Tektronix has provided a measurement solution of Draft 802.11n MIMO with RTSA. In a MIMO system, we must consider the characteristics of the multipath fading channel and propagation characteristics of transmission that include multipath fading channel in addition to just measuring a single transmitter's performance at the antenna connector.

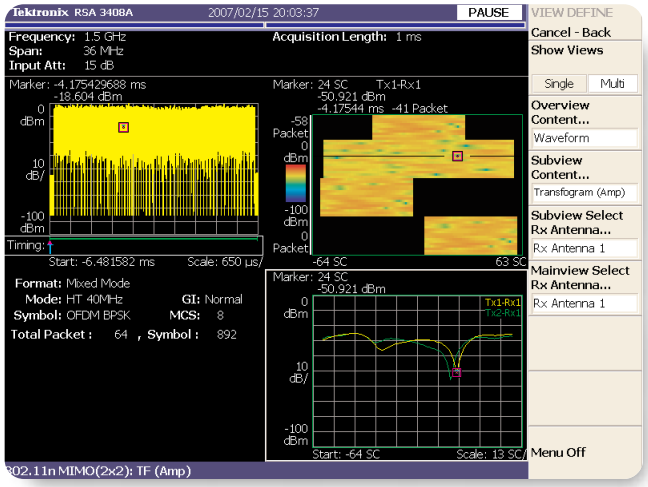
– Supports both 20MHz and 40MHz mode

– Supports up to 2X2 MIMO measurements

– Separate TX streams from MIMO combined signal

– EVM analysis of up to two streams

Tektronix
Enabling Innovation



▶ **Figure 3.** *Subview is Transfogram which is 3D display that vertical axis is packet number, horizontal axis is sub carrier frequency and color is power or phase. Transfogram shows transfer function change over various packets. Mainview shows transfer of each channel streams at specific packet where is selected by marker on overview.*

– Signal field content are shown – PHY format, operation mode, MCS number, modulation type, GI type

– Automatically detects PHY format and PHY operation mode in frequency domain

– MIMO Transfer function in amplitude and phase analysis for characterizing propagation channel environment

– Transfogram – MIMO transfer function over time user can see various channel environments changing over time by reason of door open/close or others

– Characterize delay spread for each stream. In case of 2x2 MIMO, analyzer shows 4 propagation channels characteristics

– Delayogram – MIMO delay spread over time display allow showing characteristics of propagation channel in various changing environment

– Frequency error over time measurement – checking frequency error between AP and UE in case of interoperability problem

– Spectrum Emission Mask (SEM) test for both 20MHz and 40MHz mode.

– Result summary provides several measurement results in one page

– CSV file save function for several measurement results

Contact Tektronix:

ASEAN / Australasia (65) 6356 3900
Austria +41 52 675 3777
Balkan, Israel, South Africa and other ISE Countries +41 52 675 3777
Belgium 07 81 60166
Brazil & South America (11) 40669400
Canada 1 (800) 661-5625
Central East Europe, Ukraine and the Baltics +41 52 675 3777
Central Europe & Greece +41 52 675 3777
Denmark +45 80 88 1401
Finland +41 52 675 3777
France +33 (0) 1 69 86 81 81
Germany +49 (221) 94 77 400
Hong Kong (852) 2585-6688
India (91) 80-22275577
Italy +39 (02) 25086 1
Japan 81 (3) 6714-3010
Luxembourg +44 (0) 1344 392400
Mexico, Central America & Caribbean 52 (55) 5424700
Middle East, Asia and North Africa +41 52 675 3777
The Netherlands 090 02 021797
Norway 800 16098
People's Republic of China 86 (10) 6235 1230
Poland +41 52 675 3777
Portugal 80 08 12370
Republic of Korea 82 (2) 528-5299
Russia & CIS +7 (495) 7484900
South Africa +27 11 254 8360
Spain (+34) 901 988 054
Sweden 020 08 80371
Switzerland +41 52 675 3777
Taiwan 886 (2) 2722-9622
United Kingdom & Eire +44 (0) 1344 392400
USA 1 (800) 426-2200

For other areas contact Tektronix, Inc. at: 1 (503) 627-7111

Updated 15 September 2006

Our most up-to-date product information is available at: **www.tektronix.com**

2/07 FLG/WOW 37W-20469-0

Tektronix
Enabling Innovation

www.tektronix.com/rsa