Anritsu envision:ensure

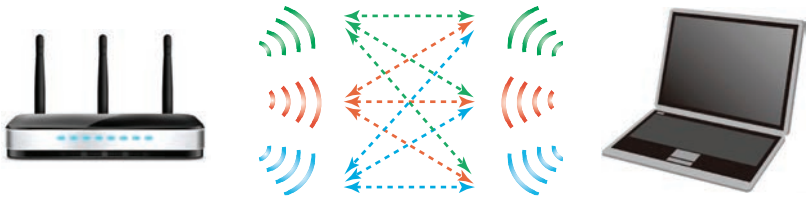
WLAN MIMO Measurement

Maximizing MT8870A Performance with Applications

Universal Wireless Test Set MT8870A

WLAN MIMO Technology

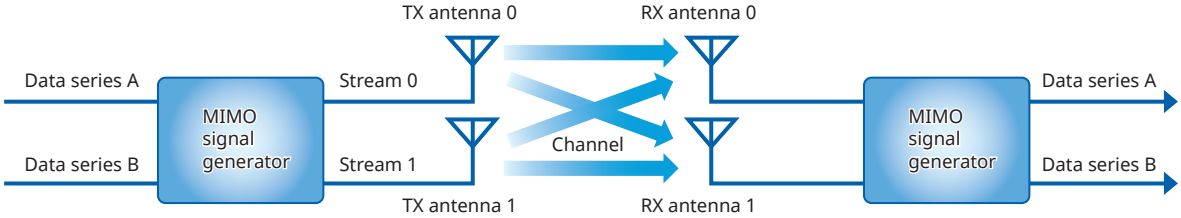
Access points and WLAN routers are key parts of the infrastructure supporting typical portable devices like tablets. Multiple-Input Multiple-Output (MIMO) WLAN technology standardized by 802.11n is being used increasingly as a method for improving the speed and quality of data transfers between wireless sections and it is now being deployed in 802.11ac networks. WLAN networks using MIMO has become widespread dramatically.



MIMO uses multiple antennas and the MIMO processes handling assignment of data to each antenna, etc., are managed by the baseband chip. Although the baseband chip assures the MIMO functions, developers and manufacturers of WLAN appliances must still test the WLAN MIMO technology during the development phase in an environment that is as realistic as possible while also considering ways to cut costs and tact time during the manufacturing phase, all the while ensuring quantitative measurement results.

Outline of MIMO

Using MIMO, multiple data streams are sent over the air (channels) using multiple TX antennas and these streams are received from the air using multiple RX antennas. If each stream carries the same information, even if the transmission quality of one or more streams drops, the original signal can still be recovered with high fidelity and the overall quality of the transmission is maintained. On the other hand, if each stream carries different information, the data transmission capacity is increased to increase the transmission speed.
In a 2×2 MIMO system using two send (TX) and two receive (RX) antennas, the two data series A and B at the transmitter are formed into two streams by the MIMO signal generator processing and are sent at the same timing and frequency from antenna 0 and antenna 1. The receiver receives the data at the two RX antennas and reproduces the data series A and B using the MIMO signal separator processing. The signal input to the receiver MIMO signal separator block is a mixture of multiple streams arriving from multiple signal paths. The path from one antenna at the TX side to one antenna at the RX side is called a channel, and there are 4 channels in a 2×2 MIMO system.



WLAN 802.11n/11ac MIMO Measurement

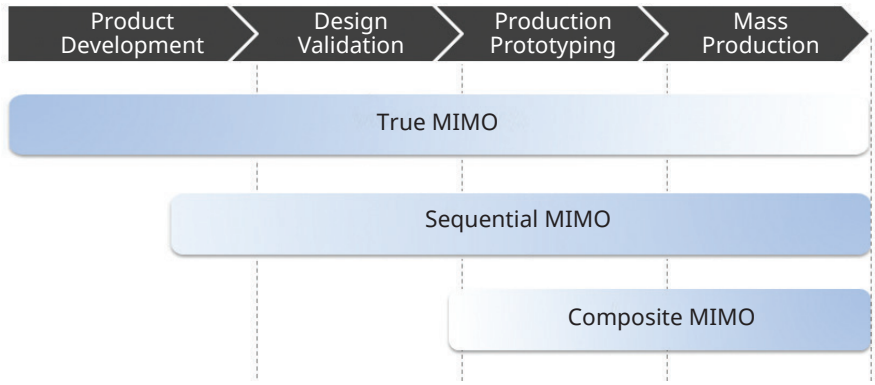
Installing up to four units of the TRX Test Module MU887000A/01A (MU88700xA) in the Universal Wireless Test Set MT8870A main frame along with the WLAN 802.11b/g/a/n/ac TX Measurement software MX88703xA and the WLAN 802.11b/g/a/n/ac Waveforms MV88703xA supports evaluation of WLAN MIMO devices at every stage from R&D to manufacturing, offering makers an ideal, high-performance, high value-added MIMO measurement solution.
Usually, system setup is performed using a collection of up to four units of the same measuring instrument when measuring each antenna of a MIMO device (streaming). Synchronization of the timing between the signal generators required at MIMO measurement as well as synchronization of the 10-MHz reference frequency generator and control of each measuring instrument requires complex cable connections. This type of system setup is troublesome for engineers performing MIMO measurements, causing a lot of extra work and costs. The MT8870A with installed MU887000A/01A is the ideal measurement solution because — unlike conventional MIMO measurement systems — complex cable connections are not required for signal synchronization.

The MT8870A measurements support the following three MIMO functions for up to 4×4 MIMO devices.

MIMO Function	Cost	Features	TX Test	RX Test
True MIMO	High	Uses multiple MU88700xA to test WLAN MIMO devices.	The measurement for each antenna can be performed independently and simultaneously	The MIMO signal for each channel is synchronized and output from the MU88700xA to measure the RX sensitivity.
Sequential MIMO	Medium	Tests MIMO device by switching four test ports at one MU88700xA.	The TX measurement for each antenna can be performed by switching each antenna.	RX sensitivity is measured using SISO for each antenna by switching antennas.
Composite MIMO	Low	Uses external splitter* to synthesize MIMO device signal for testing with one MU88700xA.	The signal outputs from each antenna are combined to display the measurement results for the synthesized signal at one MU88700xA.	The same SISO signal is simultaneously input to each antenna. As a result, RX sensitivity of composite MIMO RX test will be better than SISO RX test by effect of diversity antenna.

* Recommended product: Mini-Circuits, ZN4PD1-63 + (Frequency range: 2000 MHz to 6000 MHz)

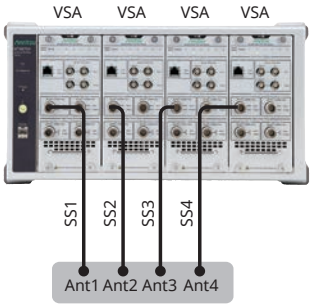
MIMO Measurement Function Phase



Connection Example for Each MIMO Measurement Function

TX Test

True MIMO



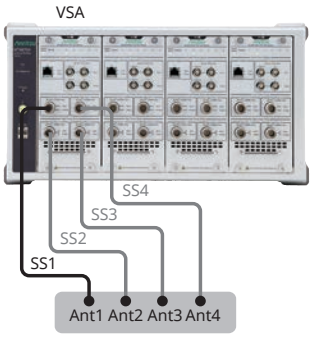
Test sequence:

Antenna 1
Antenna 2
Antenna 3
Antenna 4

Test results:

Antenna 1: EVM_1, Power_1, Spectral mask_1 ...
Antenna 2: EVM_2, Power_2, Spectral mask_2 ...
Antenna 3: EVM_3, Power_3, Spectral mask_3 ...
Antenna 4: EVM_4, Power_4, Spectral mask_4 ...

Sequential MIMO



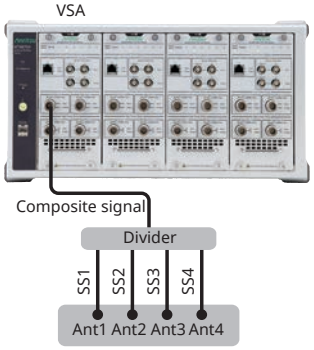
Test sequence:

Antenna 1
Antenna 2
Antenna 3
Antenna 4

Test results:

Antenna 1: EVM_1, Power_1, Spectral mask_1 ...
Antenna 2: EVM_2, Power_2, Spectral mask_2 ...
Antenna 3: EVM_3, Power_3, Spectral mask_3 ...
Antenna 4: EVM_4, Power_4, Spectral mask_4 ...

Composite MIMO



Test sequence:

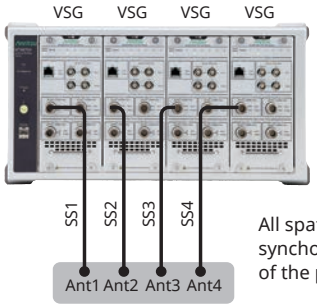
Composite

Test results:

EVM_Avg, Power_Avg, Spectral mask_Avg ...

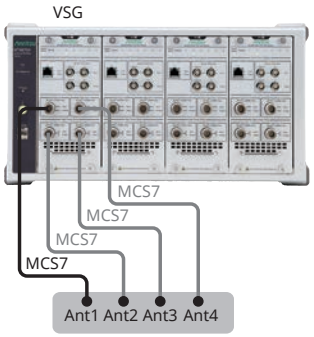
RX Test

True MIMO

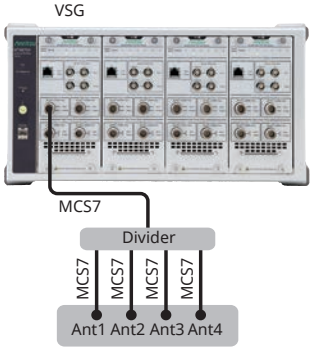


All spatial streams must be synchoronized to the start of the packet.

Sequential MIMO



Composite MIMO



Universal Wireless Test Set MT8870A

The MT8870A has been specifically designed for the high volume manufacturing test of cellular and connectivity wireless systems. Up to four MU887000A/01A each with a built-in Vector Signal Generator (VSG) and Vector Signal Analyzer (VSA) can be installed in the MT8870A main frame to perform RF tests of both transmitters and receivers. An external PC controls the MT8870A main frame with up to four MU887000A/01A.

Recommended Configuration for WLAN MIMO Measurements

Model	Name	Sequential MIMO Composite MIMO	True MIMO		
			2×2	3×3	4×4
MT8870A	Universal Wireless Test Set	1	1	1	1
MU887000A/01A	TRX Test Module	1	2	3	4
MU887000A/01A-001	6 GHz Frequency Extension	1	2	3	4
MX887030A	WLAN 802.11b/g/a/n TX Measurement	1	1	1	1
MX887031A	WLAN 802.11ac TX Measurement	1	1	1	1
MV887030A	WLAN 802.11b/g/a/n Waveforms	1	1	1	1
MV887031A	WLAN 802.11ac Waveforms	1	1	1	1

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MT8870A	Universal Wireless Test Set
	Options
MT8870A-001	GPIB Control
MT8870A-101	GPIB Control Retrofit
	Test module
MU887000A	TRX Test Module
MU887001A	TRX Test Module
	Options for test module
MU887000A-001	6 GHz Frequency Extension
MU887000A-101	6 GHz Frequency Extension Retrofit
MU887000A-002	Audio Measurement Hardware
MU887000A-102	Audio Measurement Hardware Retrofit
MU887001A-001	6 GHz Frequency Extension
MU887001A-101	6 GHz Frequency Extension Retrofit
MU887001A-002	Audio Measurement Hardware
MU887001A-102	Audio Measurement Hardware Retrofit

Model/Order No.	Name
	Measurement software
MX887010A	Cellular Standards Sequence Measurement
MX887011A	W-CDMA/HSPA Uplink TX Measurement
MX887012A	GSM/EDGE Uplink TX Measurement
MX887013A	LTE FDD Uplink TX Measurement
MX887014A	LTE TDD Uplink TX Measurement
MX887015A	CDMA2000 Reverse Link TX Measurement
MX887016A	1xEV-DO Reverse Link TX Measurement
MX887017A	TD-SCDMA Uplink TX Measurement
MX887021A	W-CDMA/HSPA Downlink TX Measurement
MX887023A	LTE FDD Downlink TX Measurement
MX887030A	WLAN 802.11b/g/a/n TX Measurement*1
MX887031A	WLAN 802.11ac TX Measurement*1
MX887032A	WLAN 802.11p TX Measurement
MX887040A	*Bluetooth* TX Measurement
MX887040A-001	DLE TX Measurement
MX887050A	Short Range Wireless Average Power and Frequency Measurement
MX887060A	IEEE 802.15.4 TX Measurement
MX887061A	Z-Wave TX Measurement
MX887070A	FM/Audio TRX Measurement*2
MX887090A	Multi-DUT Measurement Scheduler
	Waveforms
MV887011A	W-CDMA/HSPA Downlink Waveforms
MV887012A	GSM/EDGE Downlink Waveforms
MV887013A	LTE FDD Downlink Waveforms
MV887014A	LTE TDD Downlink Waveforms
MV887015A	CDMA2000 Forward Link Waveforms
MV887016A	1xEV-DO Forward Link Waveforms
MV887017A	TD-SCDMA Downlink Waveforms
MV887021A	W-CDMA/HSPA Uplink Waveforms
MV887023A	LTE FDD Uplink Waveforms
MV887030A	WLAN 802.11b/g/a/n Waveforms*1
MV887031A	WLAN 802.11ac Waveforms*1
MV887032A	WLAN 802.11p Waveforms*1
MV887040A	*Bluetooth* Waveforms
MV887040A-001	DLE Waveforms
MV887060A	IEEE 802.15.4 Waveforms
MV887061A	Z-Wave Waveforms
MV887070A	FM RDS Waveforms
MV887100A	GPS Waveforms
MV887101A	Galileo Waveforms
MV887102A	GLONASS Waveforms
MV887103A	BeiDou Waveforms
MV887110A	DVB-H Waveforms
MV887111A	ISDB-T Waveforms
MV887112A	ISDB-Tmm Waveforms

∗1: Requires MU887000A/01A-001 for 5 GHz (802.11a/n/p/ac) frequency measurements
∗2: Requires MU887000A/01A-002 for Audio Signal measurements