Application Note

Integration of Signal Analyzer and Visual System Simulator™

MS2690A/MS2830A Series
Signal Analyzer

Contents

1. Outline

Integration between the MS2690A/MS2691A/MS2692A or MS2830A Signal Analyzer and the AWR Visual System Simulator™ Simulation Software supports efficient design of communication systems.

<Main Purpose>

- Design integrating hardware with simulation
- Wireless communication standards test
- Integrated simulation with circuit and end-to-end simulation
- RF component specification R&D

The system supports easy design in cooperation with test and simulation processes using a signal analyzer/vector signal generator, as well as effective optimization of RF components and overall system performance.

Using simulation based on actual measurement data reduces the amount of design and prototyping work, cutting R&D time and costs. Moreover, it can help match performance to requirements, preventing over-specification waste and cutting product costs.

This solution also supports faster product time-to-market (TTM), helping beat competitors and cutting costs.

This application note explains system design using the Signal Analyzer and Visual System Simulator™ simulation software, the setup procedure, how to integrate with the Visual System Simulator™, and gives an example of amplifier module system simulation using LTE FDD Uplink test signals.

1.1. Equipment

Table 1-1 lists the equipment used in this application note.

Table 1-1. Equipment List

Signal Analyzer (minimum configuration example)		
Model	Name	Note
MS2690A MS2690A-020	- Main Frame - Signal Analyzer (50 to 6.0 GHz) - Option - Vector Signal Generator (125 MHz to 6.0 GHz)	Use a signal analyzer and vector signal generator option from the MS2690A or MS2830A series. See item 6. Ordering Information (summary).
MS2830A MS2830A-040 MS2830A-005 MS2830A-020	- Main Frame - Signal Analyzer - Options - Signal Analyzer (9 kHz to 3.6 GHz) Analysis Bandwidth 10 MHz 3.6 GHz Vector Signal Generator (250 kHz to 3.6 GHz)	
Software by AWR		
Visual System Simulator™ TestWave™ (bundled under the tradename as AWR Connected™ for Anritsu)		
External Controller PC		
PC VISA Driver Ethernet Cable	(NI-VISA download from NATIONAL INSTRUMENTS website) (Crossover cable)	

1.2. MS2690A/MS2830A Signal Analyzer Series

Since the MS2690A/MS2830A Signal Analyzer series support the Vector Signal Generator (MS2690A/91A/92A option-020 and MS2830A option-020/021), digitizer function, and waveform memory required for TRx simulation measurement validation all in one unit, a measurement environment is quick and easy to establish.

The digitizing function of Signal Analyzer corrects instrument errors automatically as shown in *Figure 1-1*, eliminating troublesome calculation using correction data and validation of correction data. The digitized waveform data can be used with simulation tools.

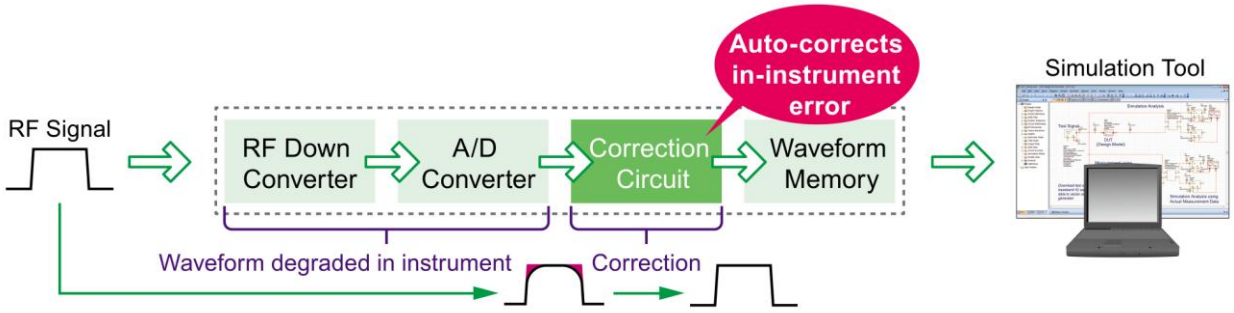


Figure 1-1. Digitizing Function

1.3. Visual System Simulator™ Software by AWR

The Visual System Simulator™ software is a communication system/radar simulator tool using a block-element GUI. Marketed under the tradename of AWR Connected™ for Anritsu, this solution supports integrated operation between Visual System Simulator™, the Signal Analyzer, and the Vector Signal Generator using a system block-element GUI (TestWave™ software) to set and control the measuring instruments for testing via an external interface such as Ethernet. Installing the software supports simple integration between the validation and simulation processes using an actual measurement unit.

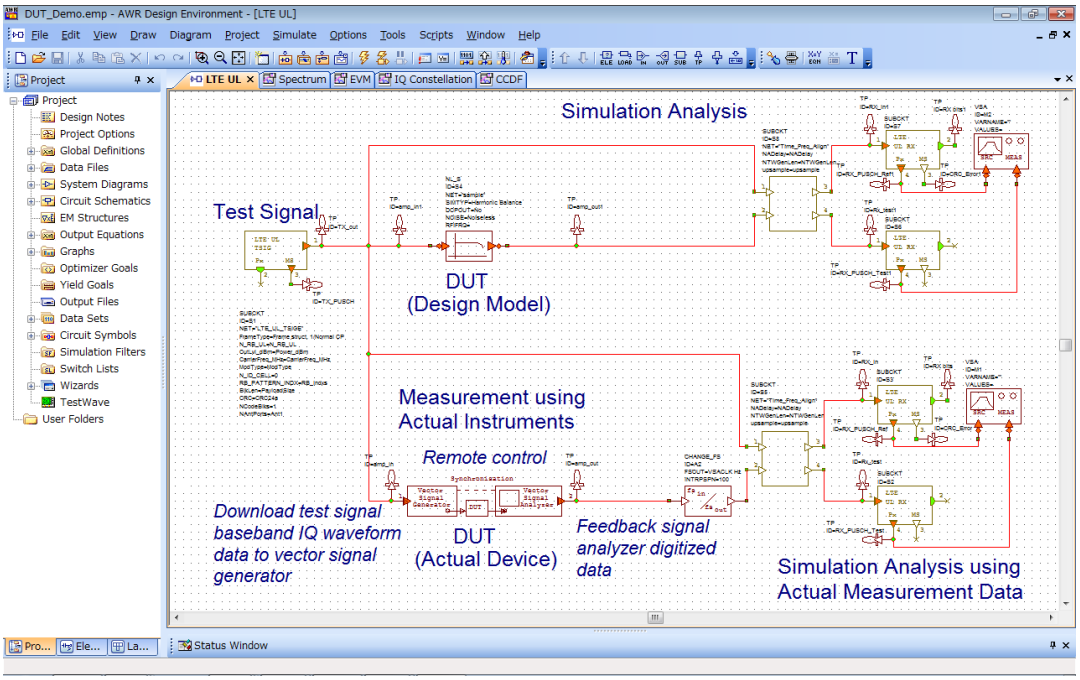


Figure 1-2. Visual System Simulator™ System Diagram

1.4. Integration between Signal Analyzer and Visual System Simulator™

Figure 1-3 shows an integrated design image for an RF component (DUT: Device Under Test) using the Signal Analyzer and Visual System Simulator™.

The baseband IQ waveform data of the simulation evaluation signal generated by Visual System Simulator™ is downloaded to the Vector Signal Generator and simulation signals are output for evaluation like from a Vector Signal Generator. The actually tested DUT output signal is captured by the Digitizer of Signal Analyzer. This digitized data is fed-back for verifying the simulation design cycle.

Linked control of the Signal Analyzer is made easy via the Ethernet interface using Visual System Simulator™.

It supports easy design in cooperation with test and simulation processes using a signal analyzer and vector signal generator for efficient optimization of RF components and overall system performance.

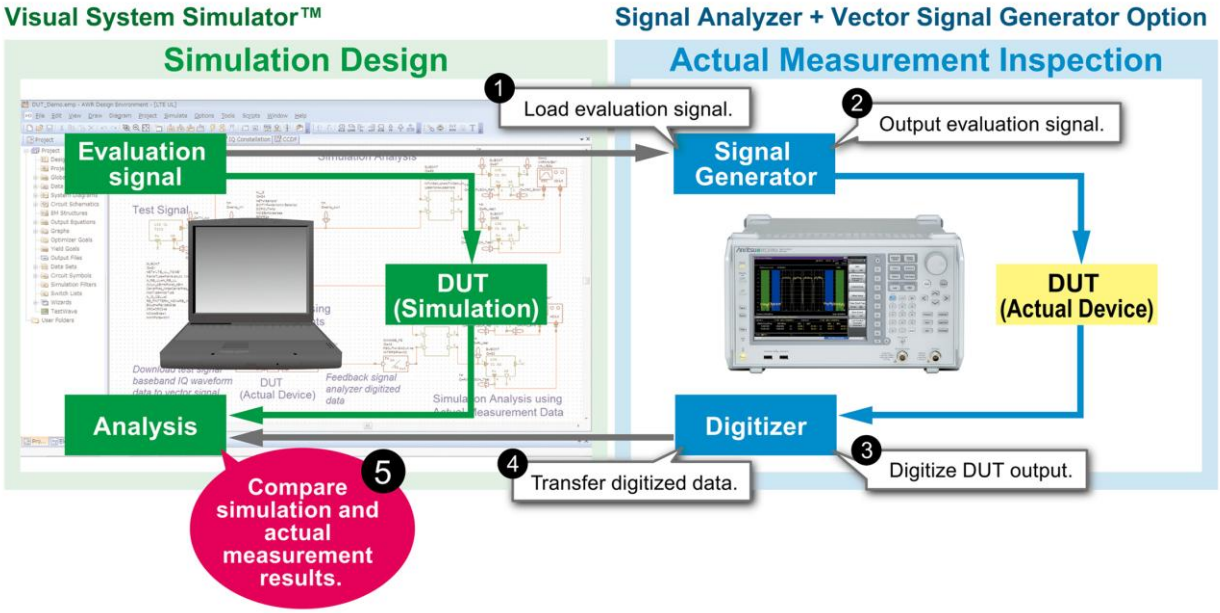


Figure 1-3. Integrated Design for Measurement and Simulation

2. Setup

2.1. VISA (Virtual Instrument Software Architecture) Driver Setup

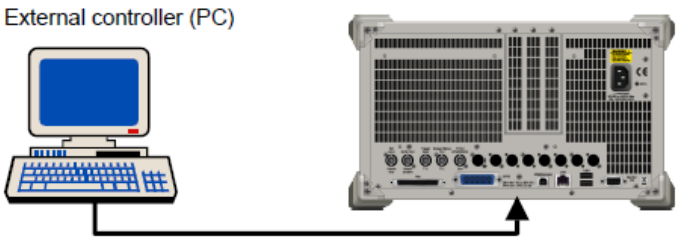
Install the VISA driver in the external PC controller to control the Signal Analyzer over Ethernet (TCP/IP) as required.

The NI-VISA driver can be downloaded from the NATIONAL INSTRUMENTS website.

2.2. Ethernet Connection Setup for PC and Signal Analyzer

The Signal Analyzer has a built-in Ethernet interface on the back panel for remote control.

Connect the Signal Analyzer and PC controller via the dedicated connector as shown in *Figure 2-1*.



MS2690A/91A/92A Back Panel

MS2830A Back Panel

Figure 2-1. Signal Analyzer Ethernet Connector

2.3. Ethernet Interface Setting

This section explains how to set the Signal Analyzer Ethernet interface.

<Procedure>

(1) Click System Config (System Config) to display the Configuration screen. Next, click F1 (Interface Settings) to display the Interface Settings screen shown in *Figure 2-2*.

(2) Confirm and set the network settings.

Confirm the IP Address, Subnet Mask, Host Name for the Ethernet Settings.

Turn off DHCP to manually set the IP Address, Subnet Mask, and Default Gateway at the Configuration screen.

The Resource Name for describing the control program with VISA is:

When IP Address = 192.168.100.1

TCPIP0:: 192.168.100.1::inst0::INSTR

(3) Change the delimiter.

Set Terminator of Terminator Settings to "CR/LF", "LF", or "None (EOI only)".

(4) Set the Raw Socket Port Number.

Set the Raw Socket Port Number of Ethernet Settings as follows:

Setting range: 1 to 65535

Default: 49153

Resolution: 1

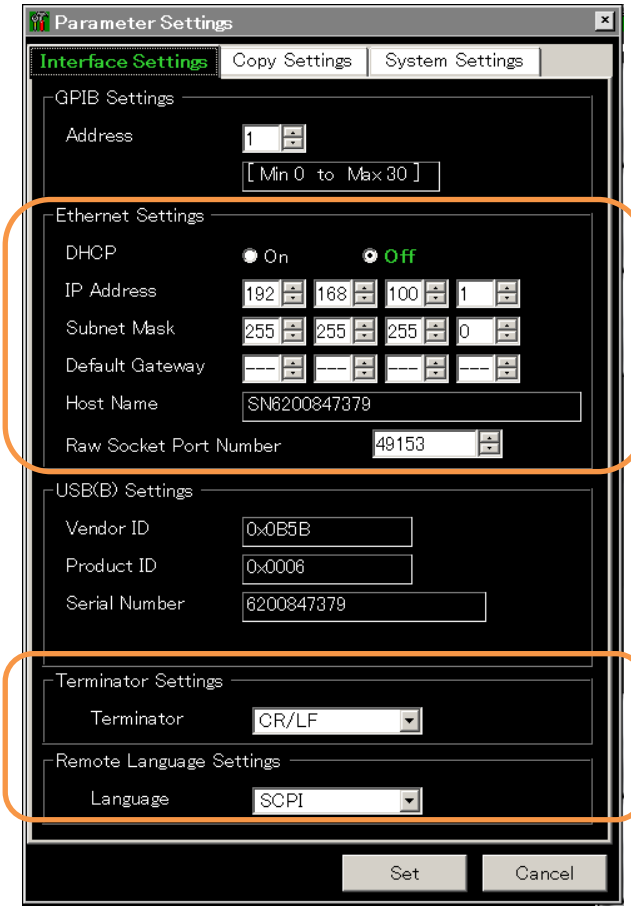


Figure 2-2. Interface Settings Screen

2.4. Save Destination Folder Setting for Evaluation Signal Waveform Pattern

The baseband IQ waveform data of the simulation evaluation signal generated by Visual System Simulator™ is downloaded to the Vector Signal Generator and simulation signals are output for evaluation like from a Vector Signal Generator. Linked control of settings from waveform data download to signal output is performed via the Ethernet interface using Visual System Simulator™ and TestWave™

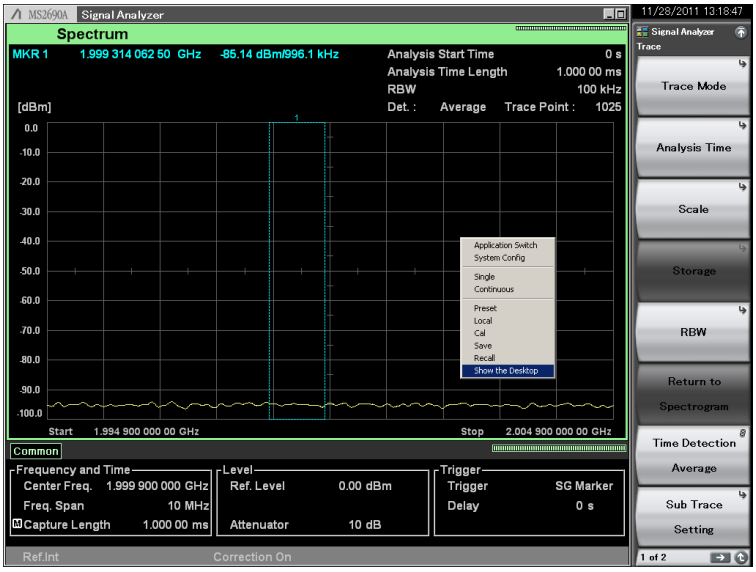
The simulation waveform data are downloaded to the internal hard disk of the Signal Analyzer as waveform pattern files for the Vector Signal Generator.

The procedure for sharing the Signal Analyzer waveform pattern destination folder [Waveform] is explained below.

<Procedure>

(1) Connect a mouse to the Signal Analyzer.

(2) Right-click the Signal Analyzer application screen and select "Show Desktop".

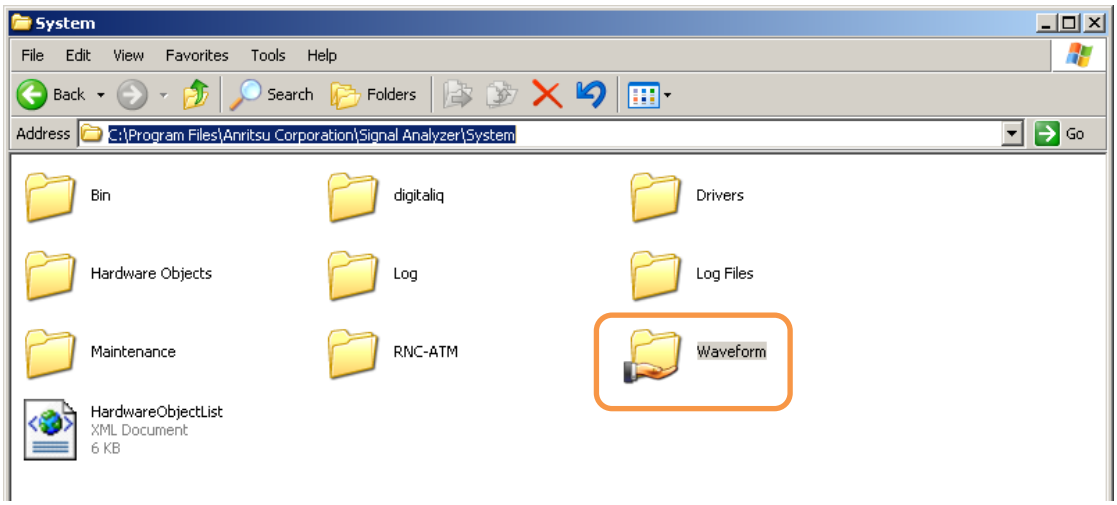


(3) Open "My Computer".

Set sharing for folder [Waveform] in the path

C:¥Program Files¥Anritsu Corporation¥Signal Analyzer¥System.

DO NOT CHANGE THE FOLDER NAME.



3. Integration between Signal Analyzer and Visual System Simulator™ Software

Figure 3-1 shows an example of a Visual System Simulator™ system diagram.

AWR Connected™ for Anritsu operates the Signal Analyzer, Vector Signal Generator option and Visual System Simulator™ as an integrated system.

The TestWave™ option of Visual System Simulator™ provides the [TESTWAVE_2PORT] block element for configuring and controlling the signal analyzer and vector signal generator from the system diagram.

Using the [TESTWAVE_2PORT] element shown in *Figure 3-2* makes it easy to download the waveform pattern and read the actual measured data (digitized data) by connecting the Signal Analyzer and Vector Signal Generator over Ethernet.

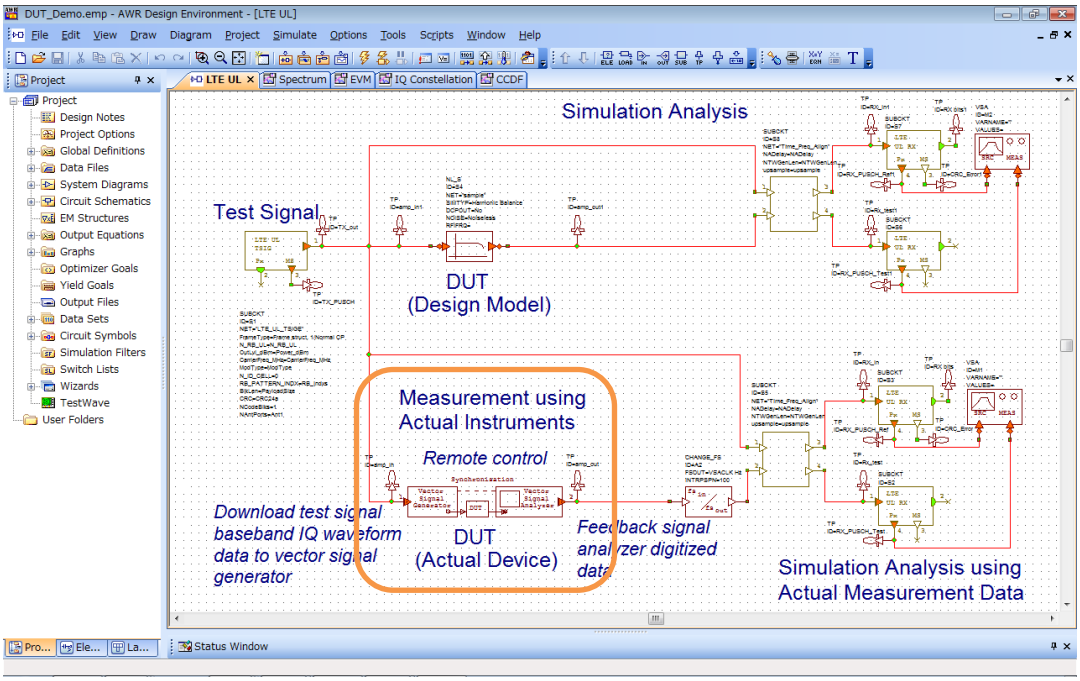


Figure 3-1. Visual System Simulator™ System Diagram

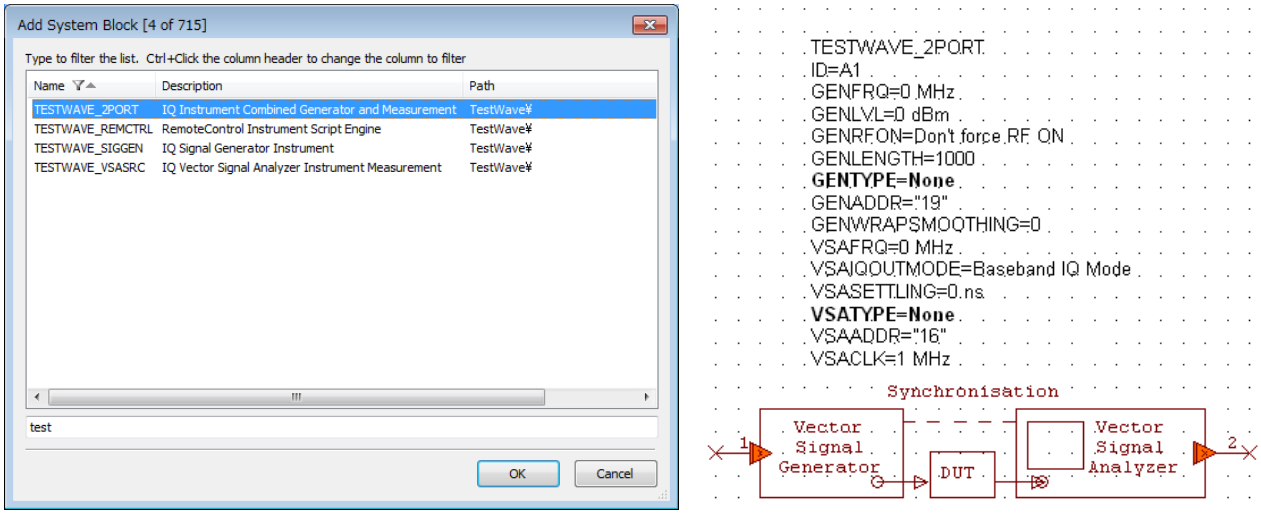


Figure 3-2. TestWave™ TESTWAVE_2PORT Element

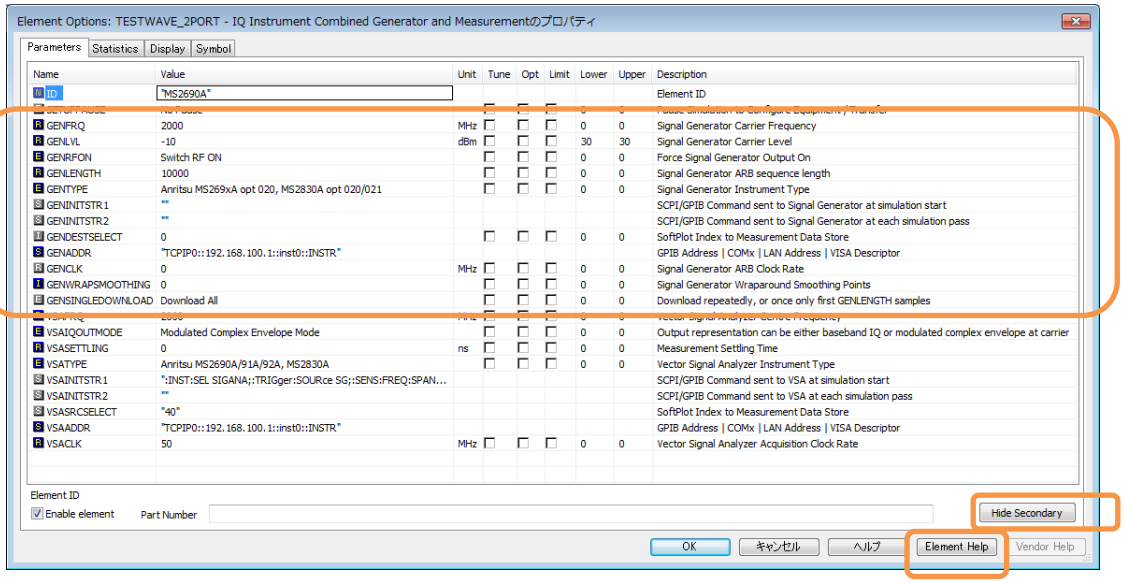
3.1. Download Simulation Evaluation Signal Waveform Pattern to Vector Signal Generator

The baseband IQ waveform data of the simulation evaluation signal generated by Visual System Simulator™ is downloaded to the Vector Signal Generator and simulation signals are output for evaluation like from a Vector Signal Generator.

Set the TESTWAVE_2PORT element parameter.

<Procedure>

(1) Double-click the TESTWAVE_2PORT element to open the Element Options.



(2) Click [Secondary] and set the items show in *Table 3-1*.

Refer to [Element Help] in the dialog for details of the setting items.

Table 3-1. Vector Signal Generator Control Parameter Settings

Setting	Value
GENFREQ	Center frequency of output signals
GENLVL	Output signal level
GENRFON	Select [Switch RF ON]
GENLENGTH	Number of sample of simulation waveform data downloaded to Vector Signal Generator
GENTYPE	Select [Anritsu MS269xA opt 020, MS2830A opt 020/021]
GENDESTSELECT	0
GENADDR	Resource name of Siganal Analyzer to control VISA When IP Address = 192.168.100.1 TCPIP0::192.168.100.1::inst0::INSTR

3.2. Measurement Data Feedback from Signal Analzyer

The actually tested DUT output signal is captured by the digitizer of Signal Analyzer and the digitized data is fed-back into the simulation design cycle.

The digitizing function of Signal Analyzer automatically correct errors in the measurement instrument as shown in *Figure 3-3*, eliminating troublesome calculations using correction data and validation of correction data. The digitized waveform data can be used with simulation tools.

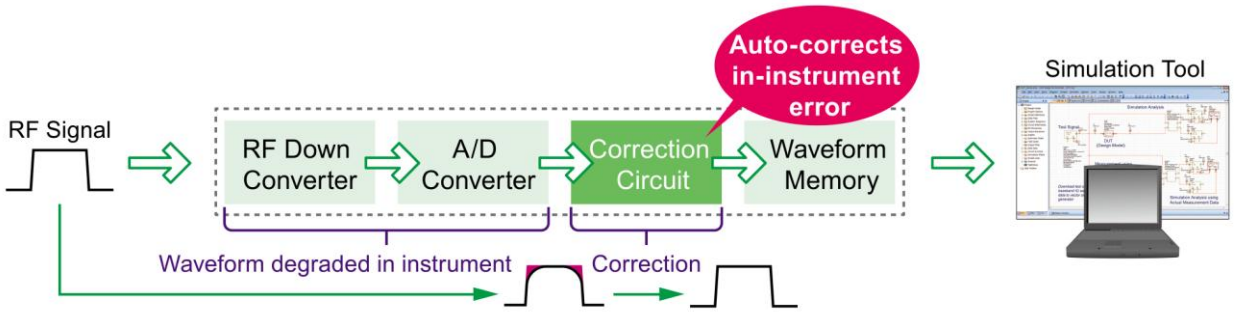
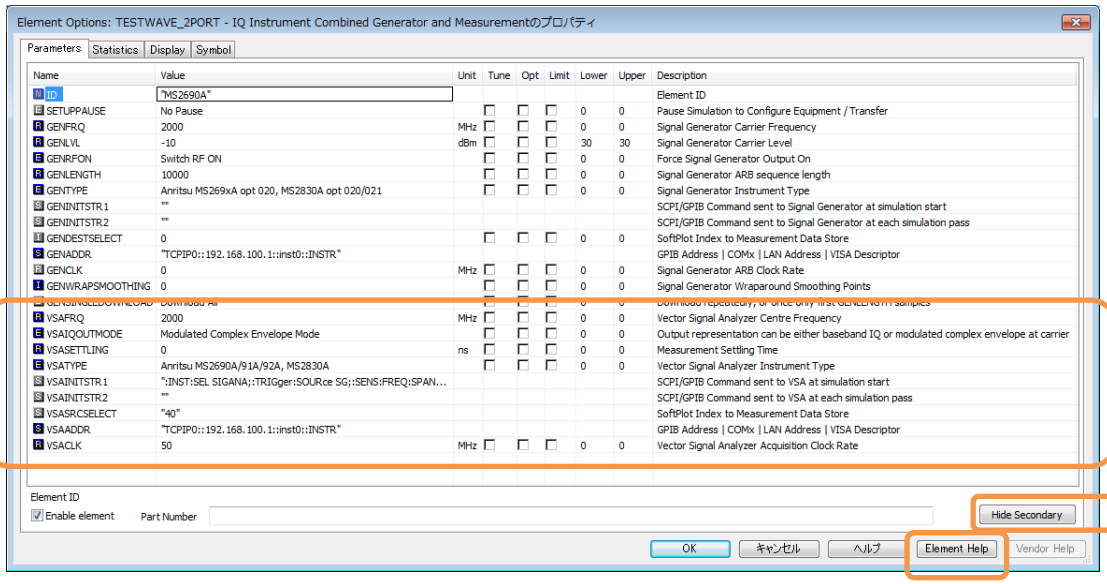


Figure 3-3. Digitizer Function

Set the TESTWAVE_2PORT element parameter.

<Procedure>

(1) Double-click the TESTWAVE_2PORT element to open the Element Options.



(2) Click [Secondary] and set the items shown in *Table 3-2*.

Refer to [Element Help] in the dialog for details of the setting items.

Table 3-2. Signal Analyzer Control Parameter Settings

Setting	Value
VSAFREQ	Center frequency of output signals
VSAIQOUTMODE	Select [Modulated Complex Envelope Mode]
VSATYPE	Select [Anritsu MS2690A/91A/92A, MS2830A]
VSAINITSTR1	Command sent to Signal Analyzer at simulation start Example) Switch the control target to Signal Analyzer, Trigger signal source: SG marker, Span frequency: 31.25 MHz, Output rate when executing save captured data: 50 MHz, Waveform capture time: 1 ms, Switch the control target to Signal Generator. ":INST:SEL SIGANA;:TRIGger:SOURce SG;:SENS:FREQ:SPAN 31250000;:MMEMory:STORe:IQData:RATE 50000000;:SENSe:SWEep:TIME 0.001;:INST:SEL SG" Refere to MS2690A/MS2691A/MS2692A and MS2830A Signal Analyzer Operation Manual “Main Frame Remote Control”, “Signal Analyzer Function Remote Control” for details of commands.
VSASRCSELECT	40
VSAADDR	Resource name of Signal Analyzer to control VISA When IP Address = 192.168.100.1 TCPIP0::192.168.100.1::inst0::INSTR
VSACLK	Settings in *Table 3-3* according to analysis frequency span setting

Table 3-3. VSACLK Set Value

Frequency span	VSACLK	Note
1 kHz	2 kHz	*1
2.5 kHz	5 kHz	*1
5 kHz	10 kHz	*1
10 kHz	20 kHz	*1
25 kHz	50 kHz	*1
50 kHz	100 kHz	*1
100 kHz	200 kHz	*1

Frequency span	VSACLK	Note
250 kHz	500 kHz	*1
500 kHz	1 MHz	*1
1 MHz	2 MHz	*1
2.5 MHz	5 MHz	*1
5 MHz	10 MHz	*1
10 MHz	20 MHz	*1

Frequency span	VSACLK	Note
25 MHz	50 MHz	*2
31.25 MHz	50 MHz	*2
50 MHz *	100 MHz	*3
62.5 MHz *	100 MHz	*3
100 MHz *	200 MHz	*4
125 MHz *	200 MHz	*4

*1: MS2690A/91A/92A: Standard MS2830A: With MS2830A-006 or With MS2830A-005/006

*2: MS2690A/91A/92A: Standard MS2830A: With MS2830A-005/006

*3: MS2690A/91A/92A: With MS269xA-077 or With MS269xA-077/078

*4: MS2690A/91A/92A: With MS269xA-077/078

4. Amplifier Module System Simulation using LTE FDD Uplink

This section introduces an example of system simulation for an amplifier module using LTE FDD Uplink test signals.

4.1. System Diagram

Figure 4-1 shows the system diagram.

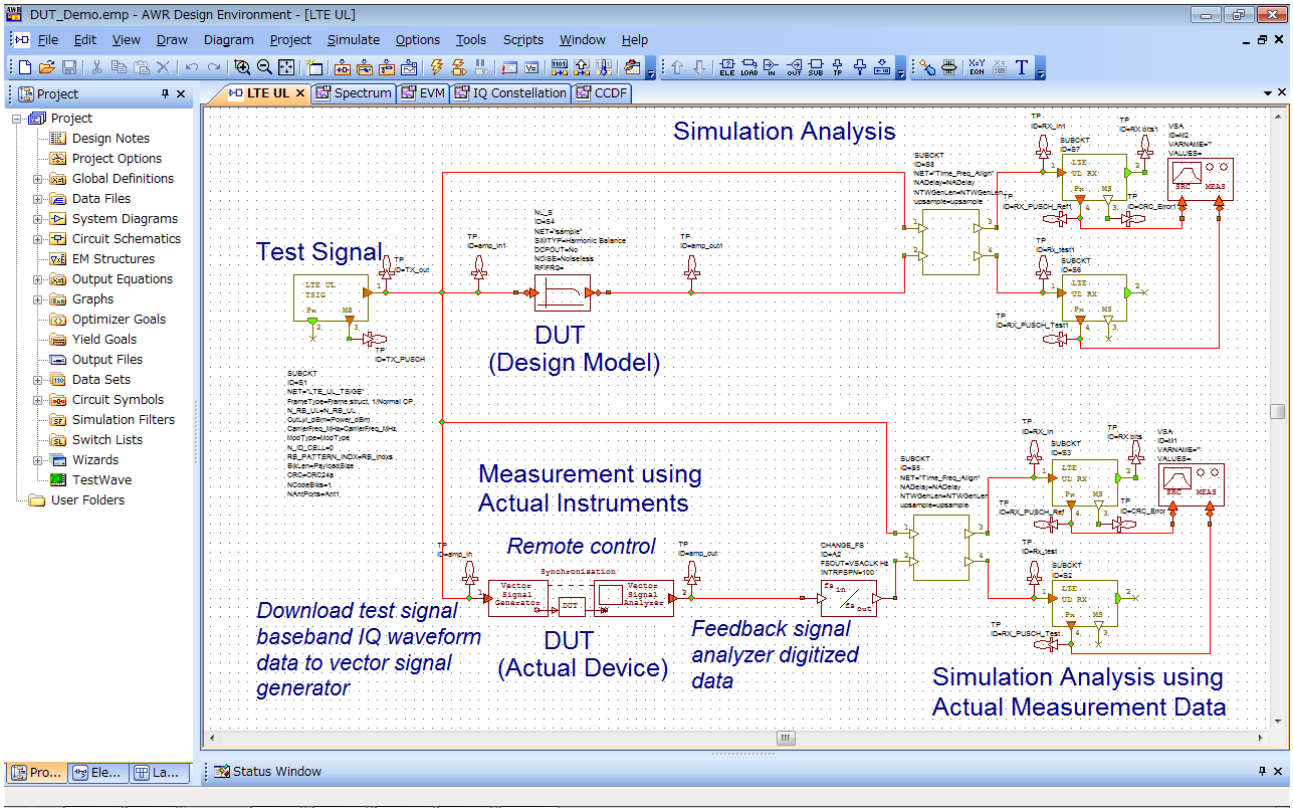


Figure 4-1. System Simulation for Amp Module using LTE FDD Uplink Test Signals

Using the LTE FDD Uplink test signal created by Visual System Simulator™, the amplifier module simulation is analyzed for comparative evaluation with the actual measurements using measuring instruments.

The DUT design model block is an amplifier module design created using the Microwave Office® circuit simulation software.

On the other hand, the LTE FDD Uplink test signal baseband IQ waveform data is downloaded to the Vector Signal Generator to input the same signal to the tested amplifier module as at simulation. The amplifier module signal output is digitized by the Signal Analyzer. The measured data is fed-back to the simulation to analyze the prototype amplifier module characteristics by simulation.

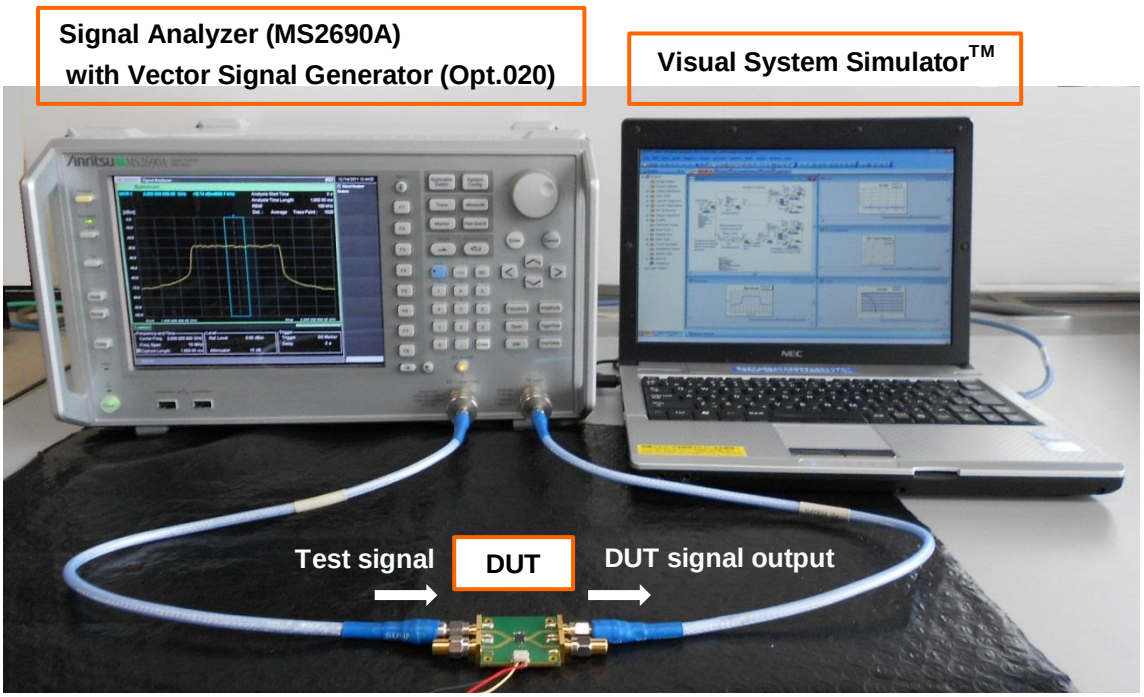


Figure 4-2. Appearance of Actual Measurement Verification

4.2. Analysis Results Graph Display Function

Results can be analyzed using the graph display function of Visual System Simulator™.

Figure 4-3 shows examples of spectrum, constellation, CCDF, and EVM graphs. The results indicated by the blue lines in these graphs are the analysis results for actual data for the amplifier module prototype. Results indicated by pink lines are analysis results for the simulated amplifier module design. Comparison of these results can help optimize design parameters to meet the product R&D specifications.

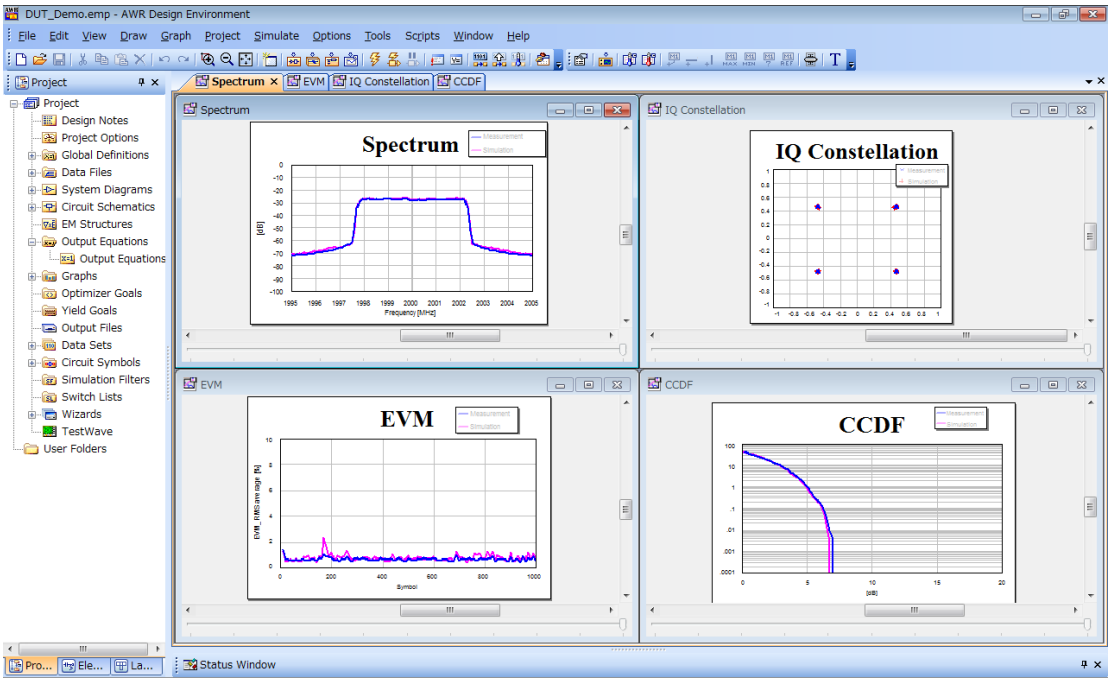


Figure 4-3. Example of Analysis Result Graphs

5. Summary

Repeated verification of design simulations and actual prototypes at the first stage of system design is costly in both time and money.

Using actual measurement data in simulations including assumed conditions and unknown elements can help effective optimization of the performance of RF components and the communication system overall. This solution uses integrated operation of the MS2690A/MS2691A/MS2692A, MS2830A, and Visual System Simulator™ software to optimize design of communication systems. Simulation is made easy by using actual measured data obtained through integrated control of the measuring instruments from output of evaluation signals to capture of actual measured data.

6. Ordering Information (extract)

MS2690A Signal Analyzer Series

Model	Name	Note
	- Main Frame -	
MS2690A	Signal Analyzer	50 Hz to 6.0 GHz
MS2691A	Signal Analyzer	50 Hz to 13.5 GHz
MS2692A	Signal Analyzer	50 Hz to 26.5 GHz
	Analysis Bandwidth 31.25 MHz	Standard
	- Options -	
MS269xA-077	Analysis Bandwidth Extension to 62.5 MHz	
MS269xA-078	Analysis Bandwidth Extension to 125 MHz	MS269xA-077 required
MS2692A-067	Microwave Preselector Bypass	Can be installed in MS2692A
MS269xA-020	Vector Signal Generator	125 MHz to 6.0 GHz

MS2830A Signal Analyzer Series

Model	Name	Note
	- Main Frame -	
MS2830A	Signal Analyzer	
	- Options -	
MS2830A-040	3.6 GHz Signal Analyzer	9 kHz to 3.6 GHz
MS2830A-041	6 GHz Signal Analyzer	9 kHz to 6.0 GHz
MS2830A-043	13.5 GHz Signal Analyzer	9 kHz to 13.5 GHz
MS2830A-005	Analysis Bandwidth Expansion 31.25 MHz	MS2830A-006 required
MS2830A-006	Analysis Bandwidth Expansion 10 MHz	
MS2830A-020	3.6 GHz Vector Signal Generator	250 kHz to 3.6 GHz
MS2830A-021	6 GHz Vector Signal Generator	250 kHz to 6 GHz

AWR Corporation Software (Contact AWR Corporation for details.)

AWR Connected™ for Anritsu:
Visual System Simulator™
TestWave™

Note

Anritsu

Specifications are subject to change without notice.

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