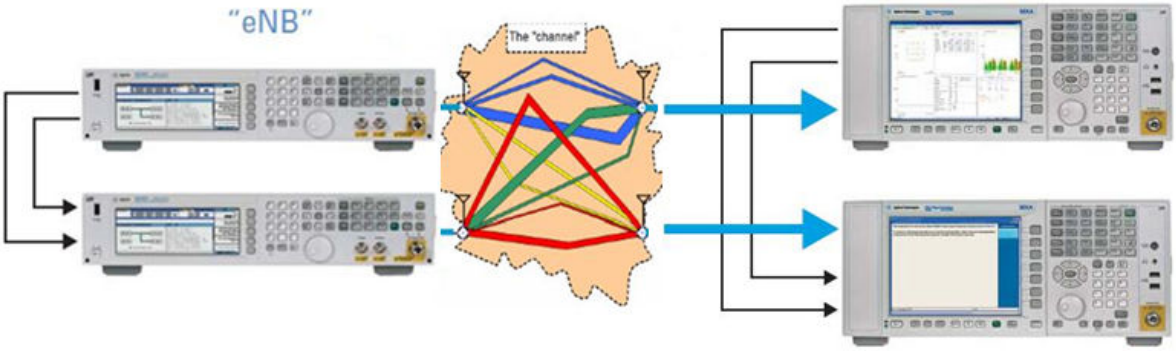
Agilent 3GPP LTE MIMO Solution Guide



한국 **Agilent** 기술 지원부

Agilent Technologies

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1. Signal Generation

1.1 Signal Generators

3GPP LTE MIMO signal을 생성하기 위한 Agilent 솔루션으로는 E8267D PSG, E4438C ESG, N5182A MXG, N5162A ATE, 그리고 N5106A PXB등이 있습니다.

E8267D PSG

Vector Signal Generator

E4438C ESG

Vector Signal Generator

N5182A MXG

Vector Signal Generator

N5162A MXG ATE

Vector Signal Generator

N5106B PXB MIMO receiver tester

1.2 N7624B Signal Studio

1.2.1 Supported Standards

N7624B LTE Signal Studio는 3GPP Standard가 계속 새롭게 업데이트 됨에 따라, 지속적으로 업데이트 되고 있으며, 2009년 2월 9일에 새롭게 릴리즈 된 N7624B 6.0.1.0 버전은 3GPP Standard 2008년 9월 버전을 지원하고 있습니다.

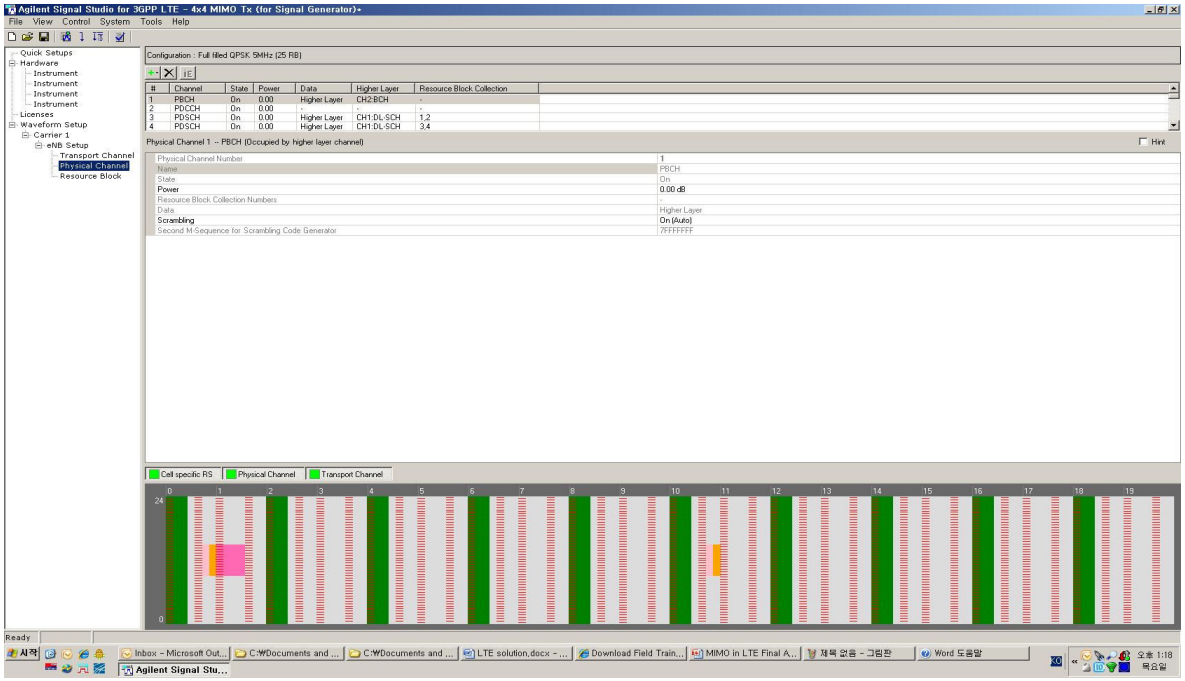
Supported Standards

N7624B Signal Studio for 3GPP LTE supports the following 3GPP standards:

3GPP Standard	Version	Date
Technical Specification 36.211	8.2.0	2008-03
Technical Specification 36.212	8.2.0	2008-03
Technical Specification 36.211	8.4.0	2008-09
Technical Specification 36.212	8.4.0	2008-09
Technical Specification 36.213	8.4.0	2008-09
Technical Specification 36.306	8.2.0	2008-05
Technical Specification 36.141	8.0.0	2008-09
Technical Specification 36.101	8.3.0	2008-09

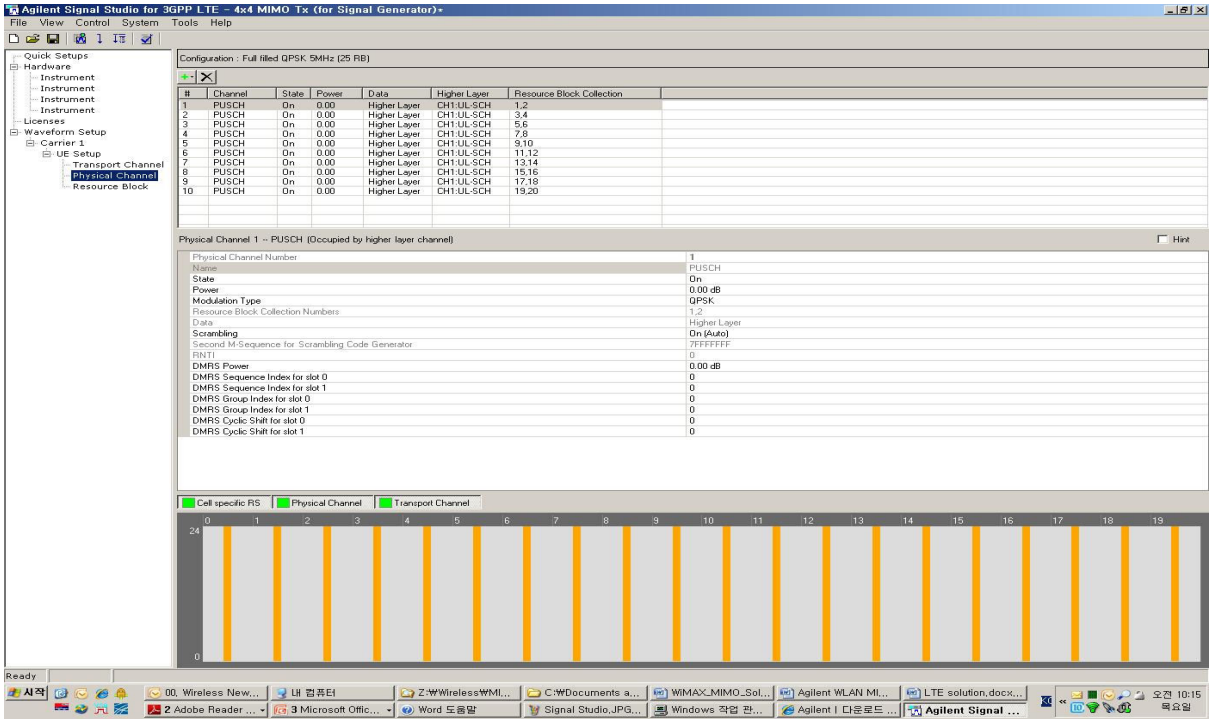
1.2.2 4x4 e-NB Signal Generation

아래 그림은 N7624B Signal Studio에서 4x4 e-NB의 signal을 생성하는 그림입니다.



1.2.3 UE Signal Generation

아래 그림은 N7624B Signal Studio에서 LTE UE의 signal을 생성하는 그림입니다.



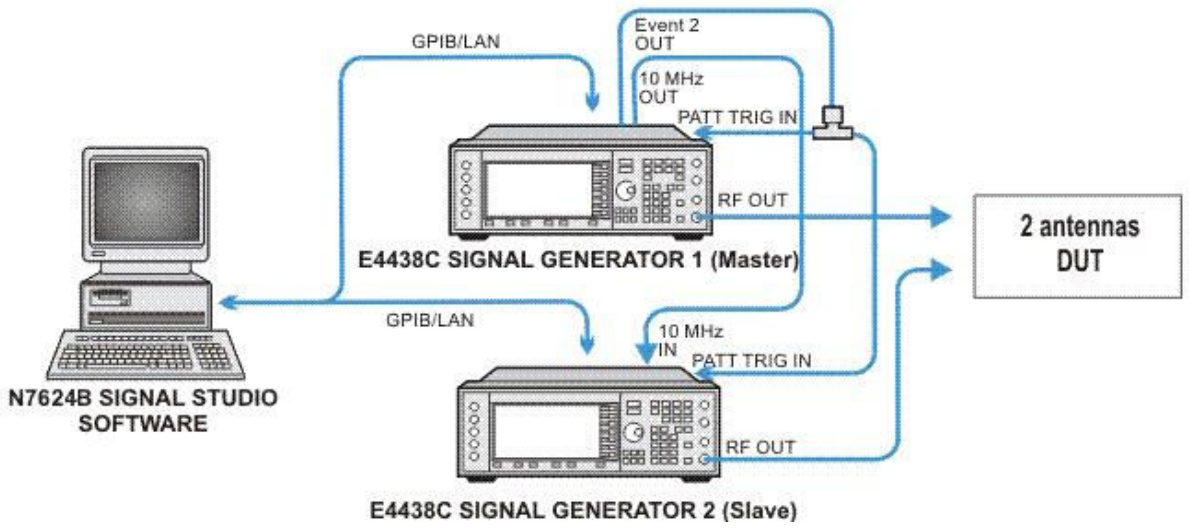
1.3 N7624B Signal Studio Options

아래는 N7624B Signal Studio의 옵션들입니다.

옵션 및 액세서리	
N7624B-1F1	Connect to E4438C signal generator, fixed, 1 month license
N7624B-1FP	Connect to E4438C signal generator, fixed, perpetual license
N7624B-1TP	Connect to E4438C signal generator, transportable, perpetual license
N7624B-3F1	Connect to N5162A/N5182A signal generator, fixed, 1 month license
N7624B-3FP	Connect to N5162A/N5182A signal generator, fixed, perpetual license
N7624B-3TP	Connect to N5162A/N5182A signal generator, transportable, perpetual license
N7624B-6FP	Connect to N5106A PXB, fixed, perpetual license
N7624B-EF1	Basic LTE (3GPP Rel8 July 07) , fixed, 1 month license

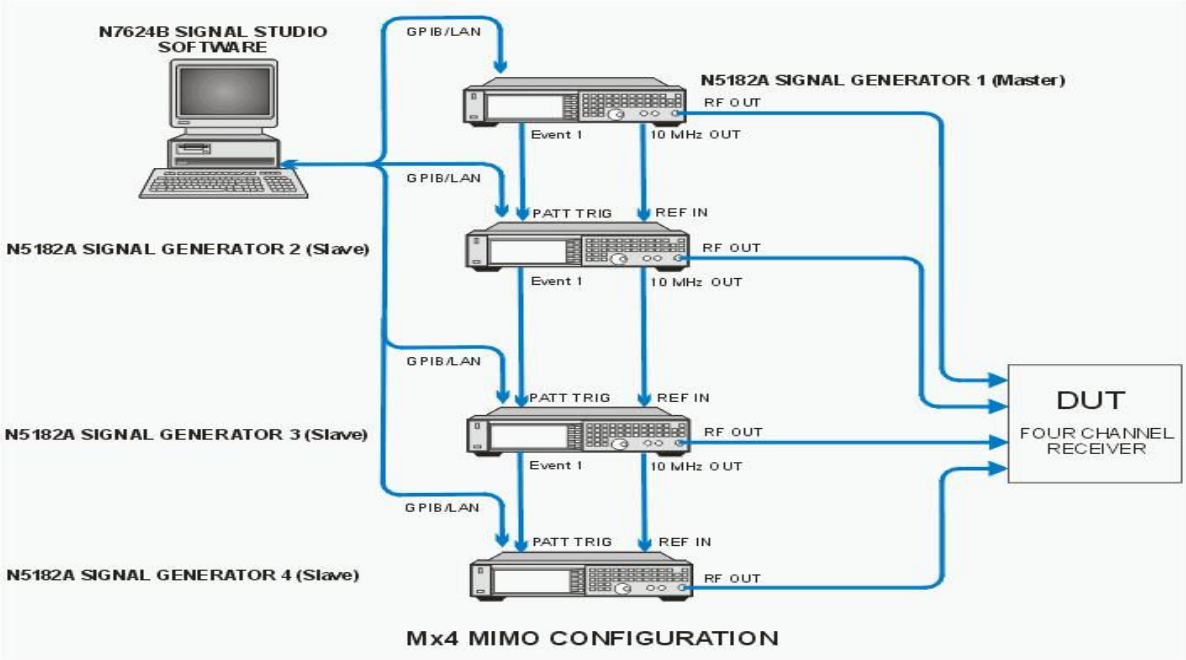
1.4 Hardware Configurations

1.4.1 Multiple Antennas Solution without Baseband Timing Alignment or RF Phase Coherence for MxN MIMO

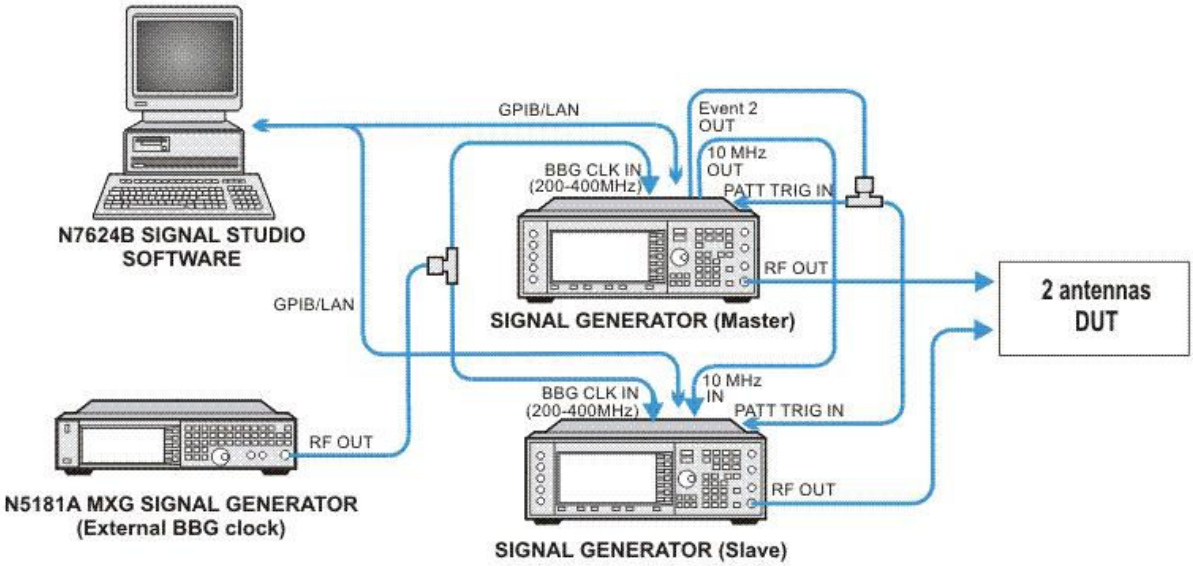


1.4.2 Multiple Antennas Solution with Baseband Timing Alignment without RF Phase Coherence for MxN MIMO

1.4.2.1 Using Four MXG/MXG ATE Signal Generators

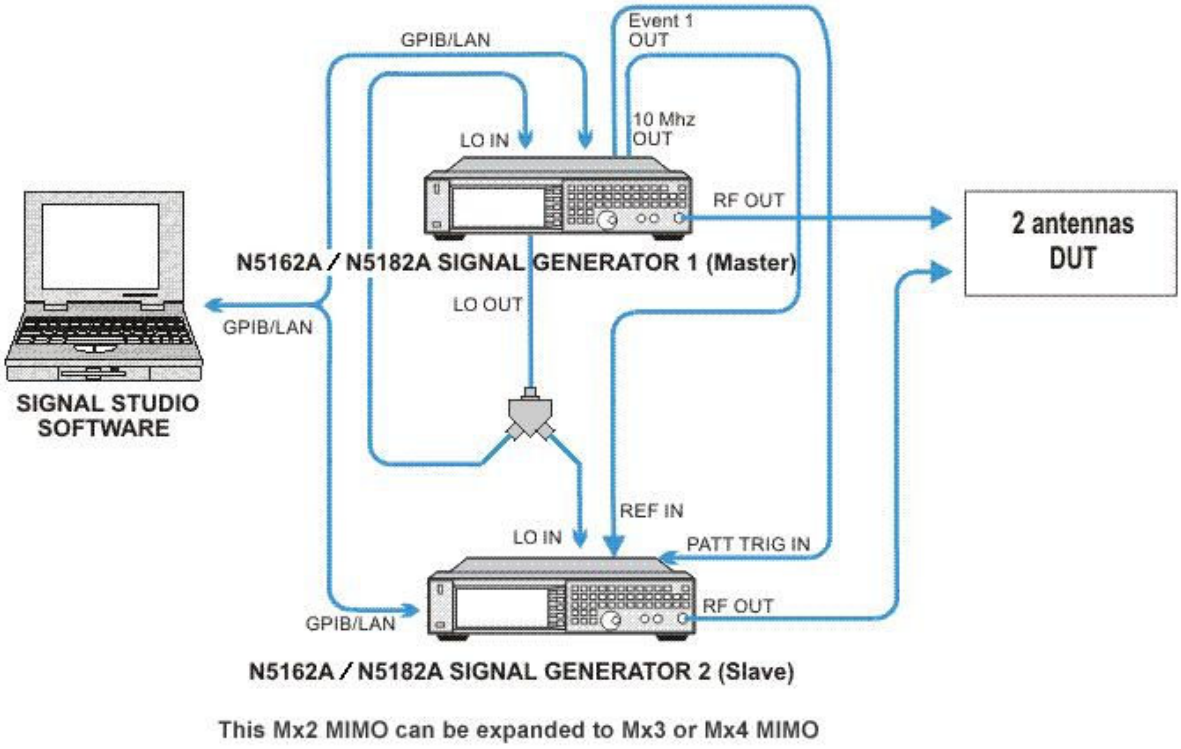


1.4.2.2 Using Two ESG Signal Generators with an N5181A Analog Signal Generator as an External BBG Clock

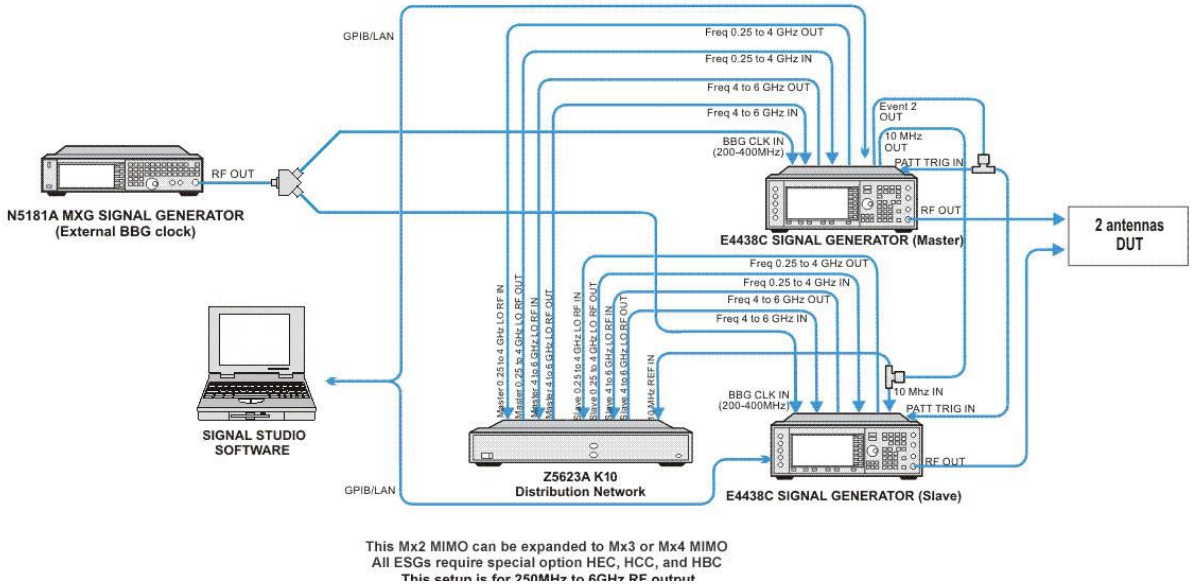


1.4.3 Multiple Antennas Solution with Baseband Timing Alignment and RF Phase Coherence for MxN MIMO

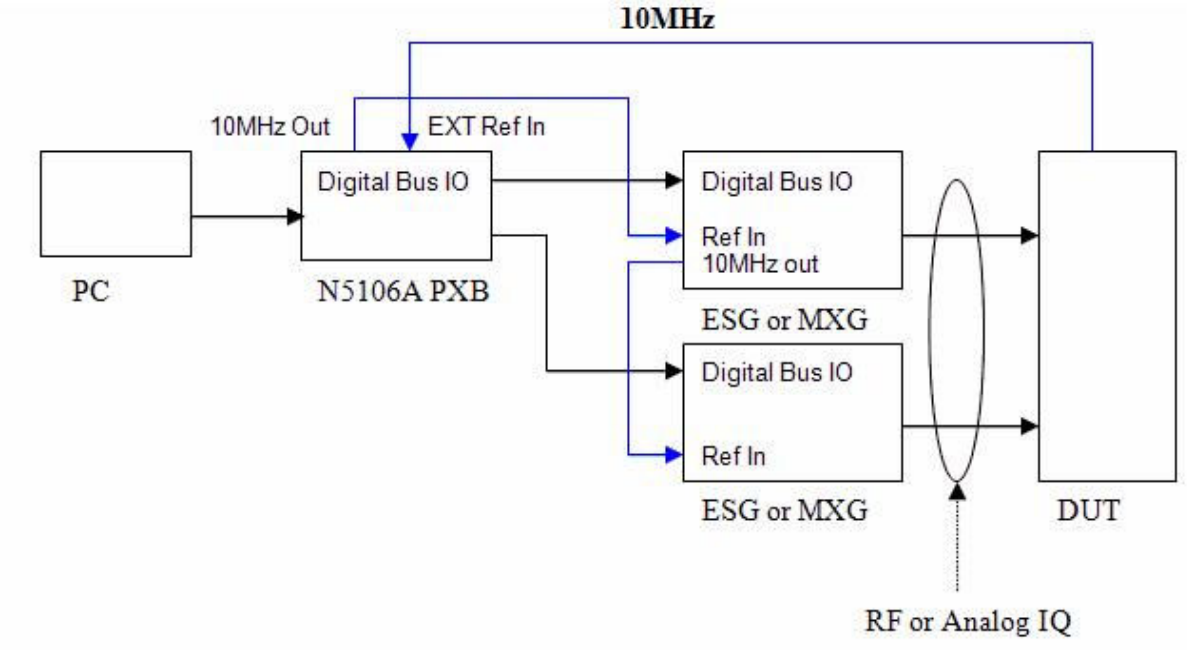
1.4.3.1 Using MXG/MXG ATE Signal Generators



1.4.3.2 Using ESG Signal Generators



1.4.4 Multiple Antennas Solution with PXB

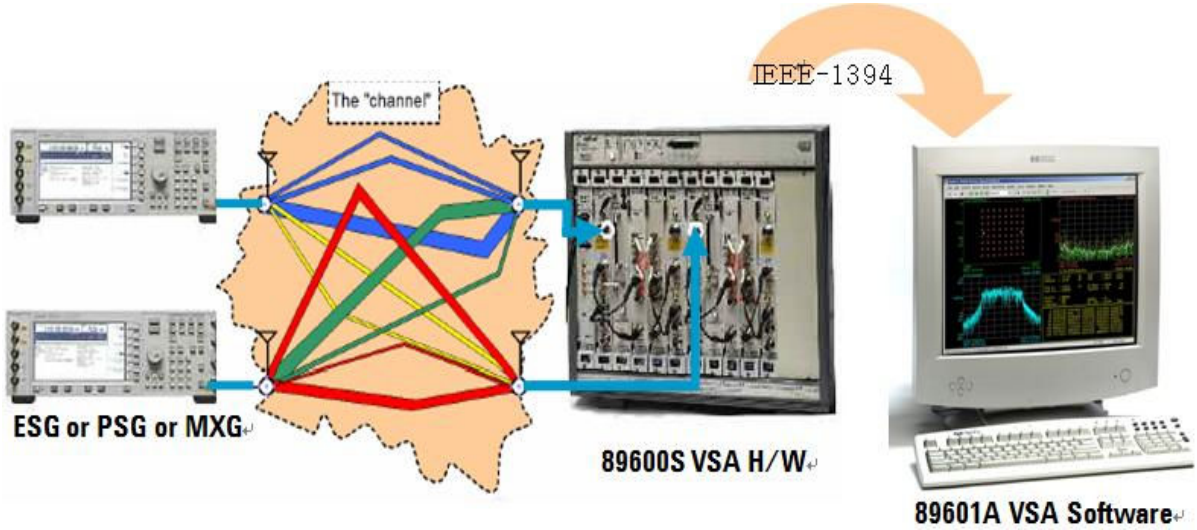


2. Signal Analysis

2.1 Digitizer Hardware

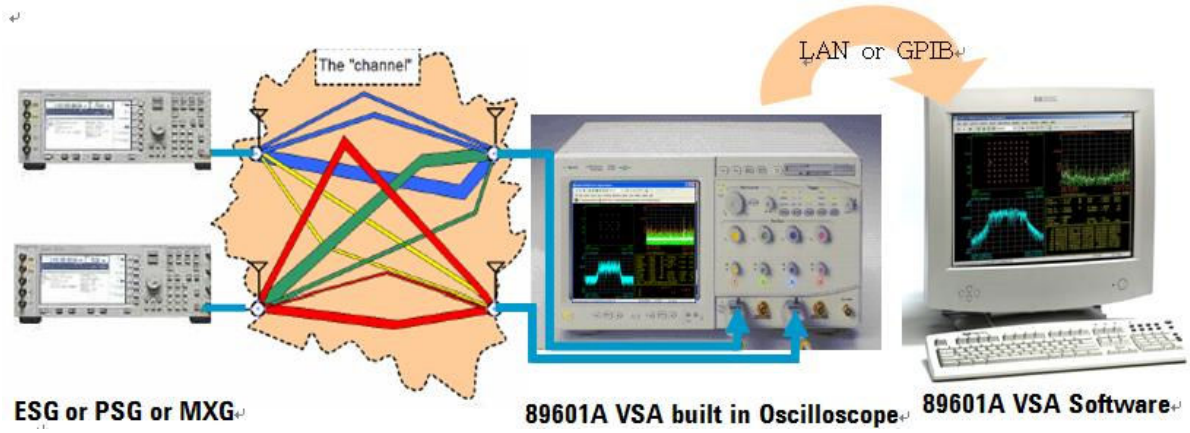
2.1.1 89600s VXI-Based Vector Signal Analyzer

최대 36MHz의 분석 대역폭을 가지며 DC~6GHz의 신호를 분석할 수 있는 장비입니다.
MIMO Application을 위한 2개의 Coherence RF channel 과 BBIQ 분석을 위한 2개의 Baseband/IF channel을 제공합니다.



2.1.2 Oscilloscope

Infiniium Oscilloscope 시리즈는 2x2 MIMO를 지원하며 또한 Baseband I+jQ 신호를 분석 할 수도 있습니다.



아래 표는 VSA가 지원되는 Oscilloscpoe 목록입니다.

Table 1. Infiniium oscilloscopes supported by 89600 VSA software

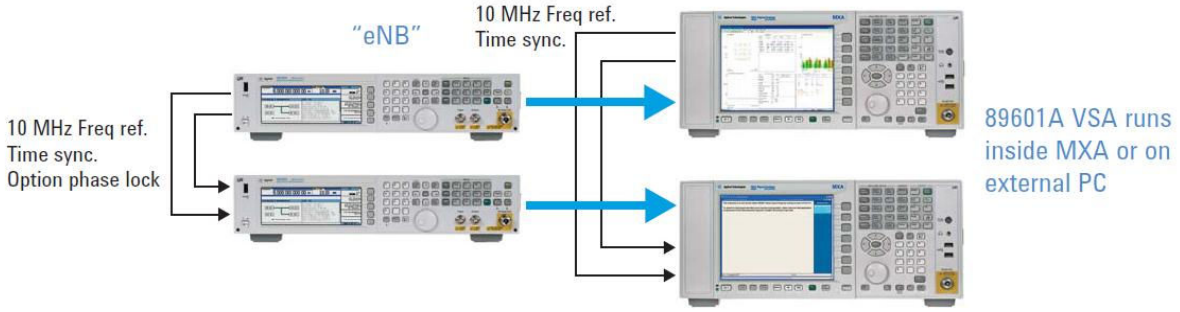
Model	Analysis bandwidth	Max. sample rate	Main time memory options supported
8064	0 to 600 MHz	2 Gsa/s	2 M (4/8/16/32/64 M options)
8104[1]	0 to 1.0 GHz	4 Gsa/s	2 M (4/8/16/32/64 M options)
80204	0 to 2 GHz	10 Gsa/s	512 K (64 M option)
80304	0 to 3 GHz	10 Gsa/s	512 K (64 M option)
80404	0 to 4 GHz	20 Gsa/s	512 K (64 M option)
80604	0 to 6 GHz	20 Gsa/s	512 K (64 M option)
80804[2]	0 to 8 GHz	40 Gsa/s	512 K (64 M option)
81004[2]	0 to 10 GHz	40 Gsa/s	512 K (64 M option)
81204[2]	0 to 12 GHz	40 Gsa/s	512 K (64 M option)
81304[2]	0 to 13 GHz	40 Gsa/s	512 K (64 M option)
90254	0 to 2.5 GHz	10 Gsa/s	10 M (20/50/100/200/500 M/1 G options)
90404	0 to 4 GHz	20 Gsa/s	10 M (20/50/100/200/500 M/ 1 G options)
90604	0 to 6 GHz	20 Gsa/s	10 M (20/50/100/200/500 M/ 1 G options)
90804	0 to 8 GHz	40 Gsa/s	10 M (20/50/100/200/500 M/ 1 G options)
91204	0 to 12 GHz	40 Gsa/s	10 M (20/50/100/200/500 M/ 1 G options)
91304	0 to 13 GHz	40 Gsa/s	10 M (20/50/100/200/500 M/ 1 G options)

Table 2. Software revision numbers

Model #	Infiniium GPIB	Infiniium LAN	89600[1]
8064	A.04.90	A.04.90	6.20
8104	A.04.90	A.04.90	6.20
80204	A.05.00	A.05.00	6.20
80304	A.05.00	A.05.00	6.20
80404	A.05.00	A.05.00	6.20
80604	A.05.00	A.05.00	6.20
80804	A.04.00	A.04.00	6.00
81004	A.04.00	A.04.00	6.00
81204	A.04.00	A.04.00	6.00
81304	A.04.00	A.04.00	6.00
90254	01.00	01.00	8.00
90404	01.00	01.00	8.00
90604	01.00	01.00	8.00
90804	01.00	01.00	8.00
91204	01.00	01.00	8.00
91304	01.00	01.00	8.00

2.2 MXA Based Vector Signal Analyzer

MXA Signal analyzer 두 대와 89601 VSA Software를 이용하게 되면 2X2 MIMO LTE 신호를 분석할 수 있습니다.
장비 구성도는 아래와 같습니다.



아래는 89601VSA SW를 이용하여 2X2 MIMO LTE 신호를 분석한 그림입니다.

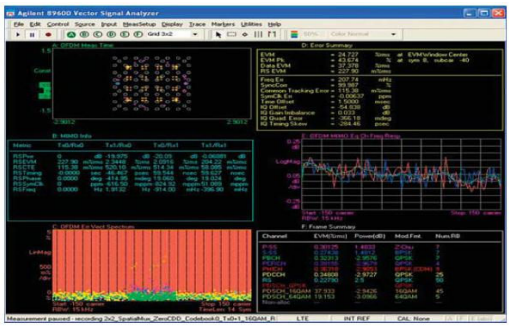


Figure 2. Screen showing Codebook0 direct mapping, with 16QAM on Codeword 0 and QPSK on Codeword 1. Agilent Signal Studio is used to create the test signal, configured with a static channel simulating the following path couplings:
Tx0/Rx0 = 0 dB (16QAM), Tx1/Rx0 = –20 dB (QPSK),
Tx0/Rx1 = –20 dB (16QAM), Tx1/Rx1 = 0 dB (QPSK)

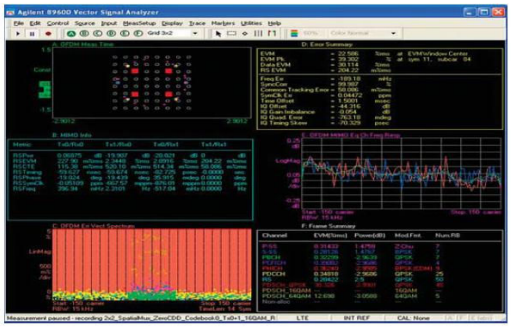


Figure 3. Same signal observed at Input 2 (Rx1) of the 2-channel acquisition, without any PDSCH decoding in the 89600 VSA instrument-receiver. Note that the observed constellation at Input 1 (Rx1) is dominated by QPSK from 0 dB coupling with overlaid 16QAM superimposed "mini" constellations due to the –20 dB cross-path coupling.

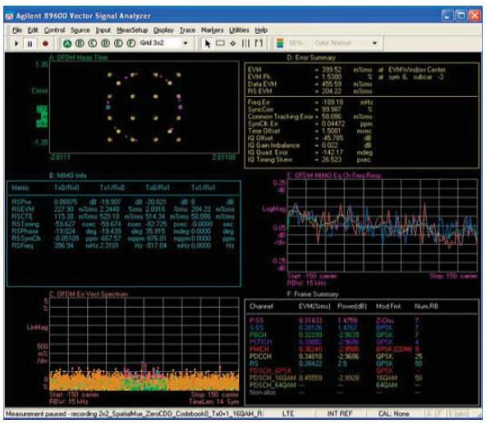


Figure 4. Enabling appropriate Spatial Multiplex decoding for Codeword 0 produces a clean 16QAM constellation with original transmitted data bits for that data stream.

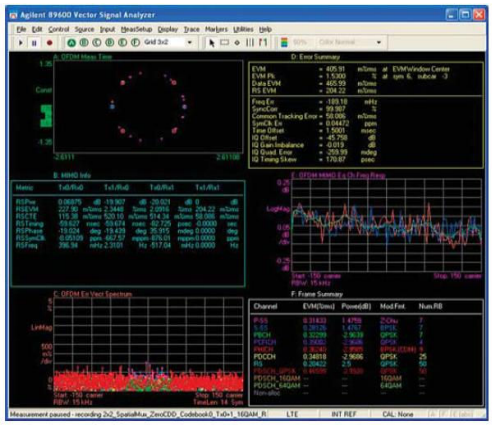


Figure 5. Enabling appropriate Spatial Multiplex decoding for Codeword 1 produces a clean QPSK constellation with original transmitted data bits for that data stream.

3. One Box Tester

3.1 E6620A

Agilent E6620A는 LTE Base Station Emulator 기능을 하는 One Box Tester로써, 2개의 Multiport를 가지고 2x2 MIMO를 지원합니다.

Real time network emulation
- Script-based protocol conformance test
- Bench top state-machine for application test
- End to end IP Data testing

Scalable Platform
- RF and base band interfaces
- 2.7GHz Frequency Range
- LTE BW's and data rates
- 2 Cell capability
- MIMO 2x2 and 4x2
- Integrated fading
- RF Parametric Measurement capability (TX and RX)
- Windows-based PC Controller

Planned LTE R&D Lifecycle Solutions:
- Protocol Development
- Protocol Conformance Test
- Integration and functional test
- RF Design Verification
- Radio Conformance Test
- Interoperability and validation