LTE_UL_FDD_TX_TestBench

Where To Find This Example

Select **Help > Open Examples...** from the menus and type either the example name listed above or one of the keywords below.

Or in Version 13 or higher you can open the project directly from this page using this button. Make sure to select the **Enable Guided Help** before clicking this button.

Open Install Example

Design Notes

LTE FDD Uplink User Equipment TX Test Bench

This example demonstrates:

LTE FDD Uplink TX, compliant with 3GPP specifications.

Specification document: TS 36.104, TS 36.211, TS 36.212

Configurable options include:

• NFramesSweep: number of 10ms frames used in each sweep

• FrameType: frame type and cycling preffix:

- 0: Frame structure type 1 / Normal CP: FDD

- 1: Frame structure type 2 / Normal CP: TDD

- 2: Frame structure type 1 / Extended CP: FDD

- 3: Frame structure type 2 / Extended CP: TDD

• Carrier Frequency (MHz)

• TxOutLvlStart, TxOutLvlSpan, TxOutLvlStep (dBm): Define swept power of transmitted signal

• N_RB_UL: number or resource blocks used for transmission

• State of each uplink PUSCH channel (up to four users currently supported, more users may be easily added)

• N_RB_Channel: number or resource blocks used by each user

• ModType_Channel: modulation type used by each user (QPSK, 16QAM, 64QAM)

• UL_DL_Config: Uplink/Downlink Configuration for TDD (0, 1, 2, 3, 4, 5 or 6)

• PTS_Format: Pilot Time Slot Format for TDD (0, 1, 2, 3, 4, 5, 6, 7 or 8)

The test bench can be used to monitor:

• The CCDF at the input and output of DUT

• The TX signal spectrum at the input and output of DUT

• EVM %rms vs. output power

• The impact of phase noise on EVM

• The impact of phase/amplitude and DC offset on EVM

• ACPR

N_RB_UL defines the channel bandwith as defined in the specifications (See Global Definitions for relationship between N_RB_UL and channel BW).

4 PUSCH channels (users) can be activated individually. Each PUSCH can be assigned an arbitrary number of resource blocks. The sum of assigned resource blocks should be less or equal to N_RB. More PUSCH channels may be added to the system.

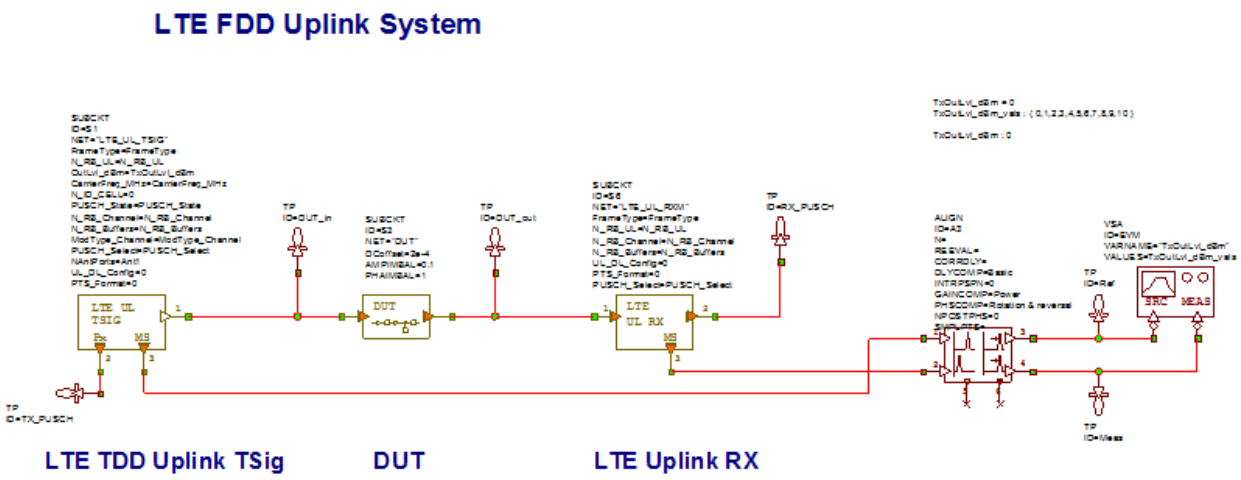
Note that the amplifier model is based on a text data file. It can be replaced with an MWO circuit or a VSS behavioral amplifier model that accounts for frequency dependency. This test bench is used to illustrate several capabilities of VSS.

This example can be used to test a PA's error vector magnitude (EVM) performance vs. output power.

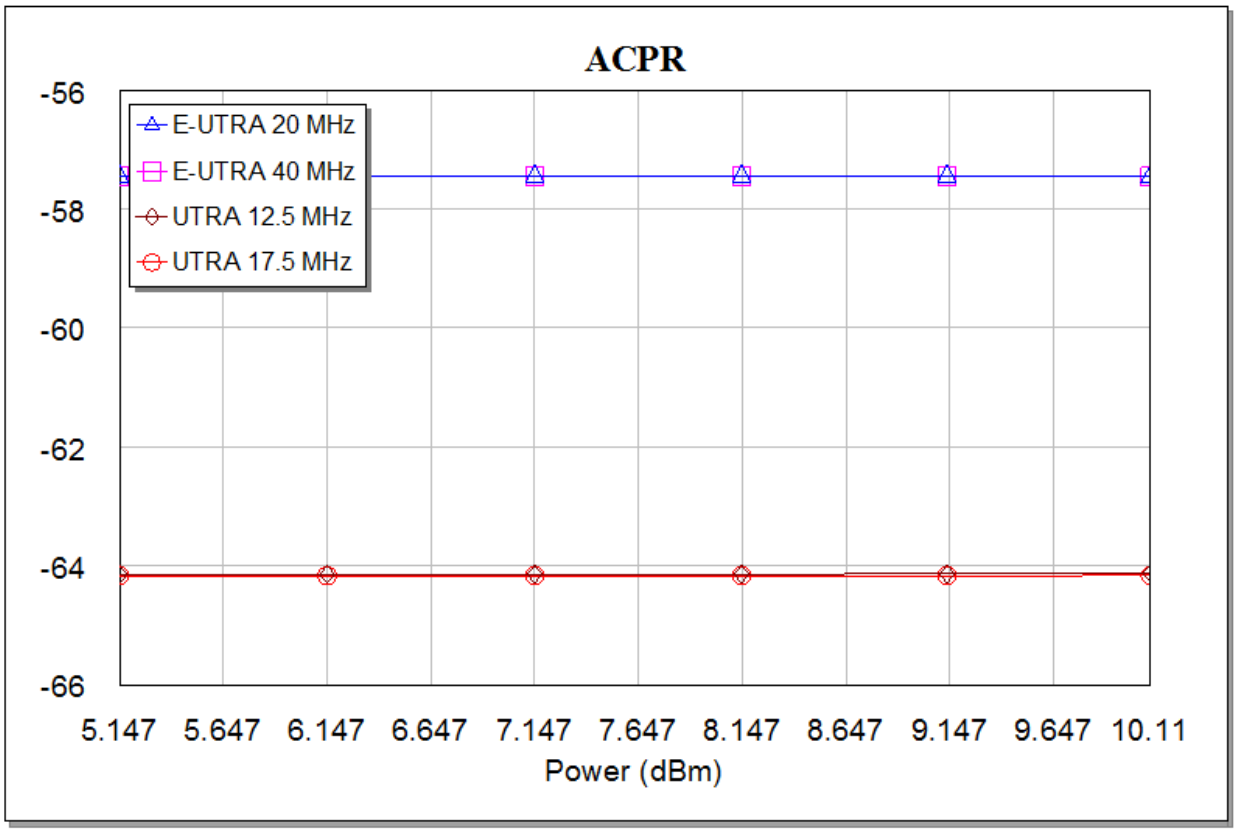
A reference IQ plot versus the measured IQ plot is shown. EVM measurements are calculated for each power level and plotted in the "EVM vs. Output Power" graph.

Please read the online help for information on any of the blocks that are used in the system diagrams. In addition, please read the online help for ACPR and EVM measurements.

System Diagram - LTE UL



Graph - ACPR



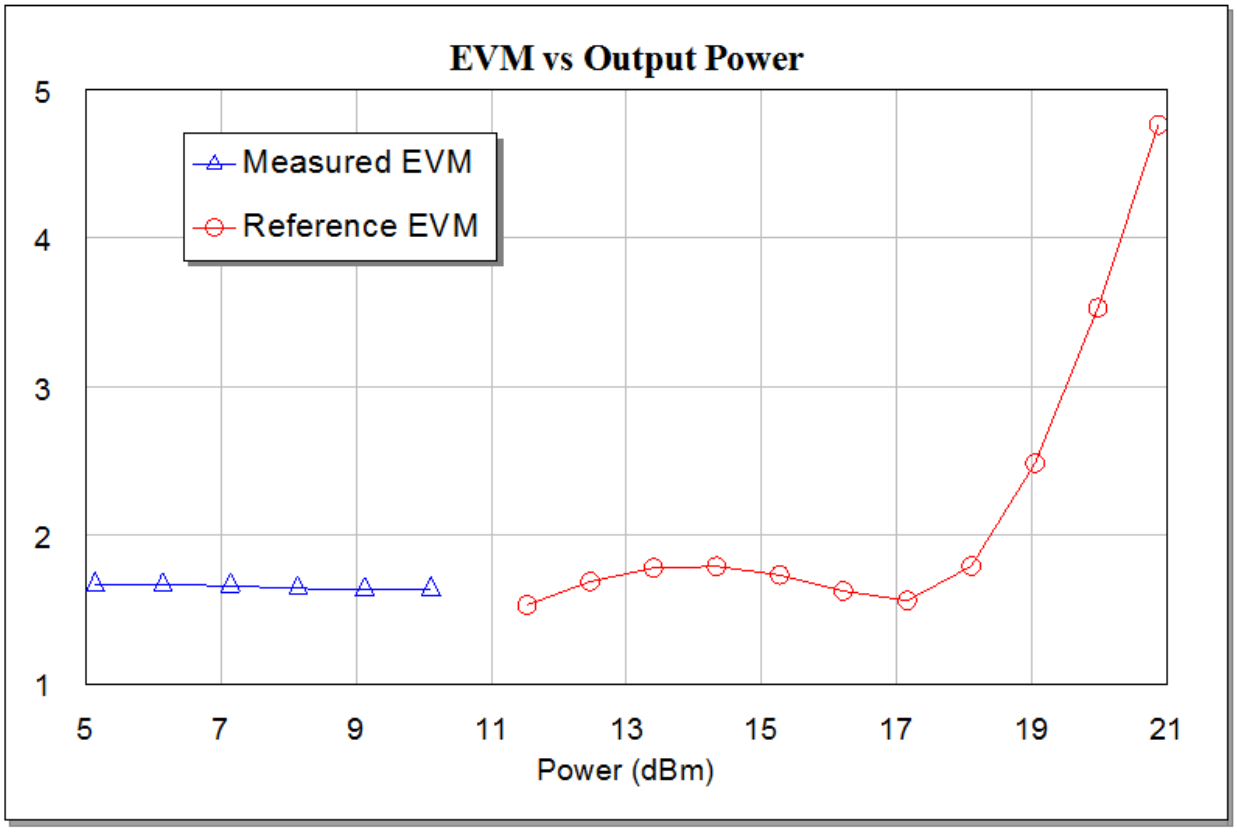
Graph - EVM

DB(EVM(VSA.EVM,1,1,1,12,1,0,1,0,1,1,10,0,0,0,0,0)) (us) LTE UL Time	DB(EVM(VSA.EVM,1,1,1,12,1,0,1,0,1,1,10,0,0,0,0,0)) LTE UL
9443.81	-34.36

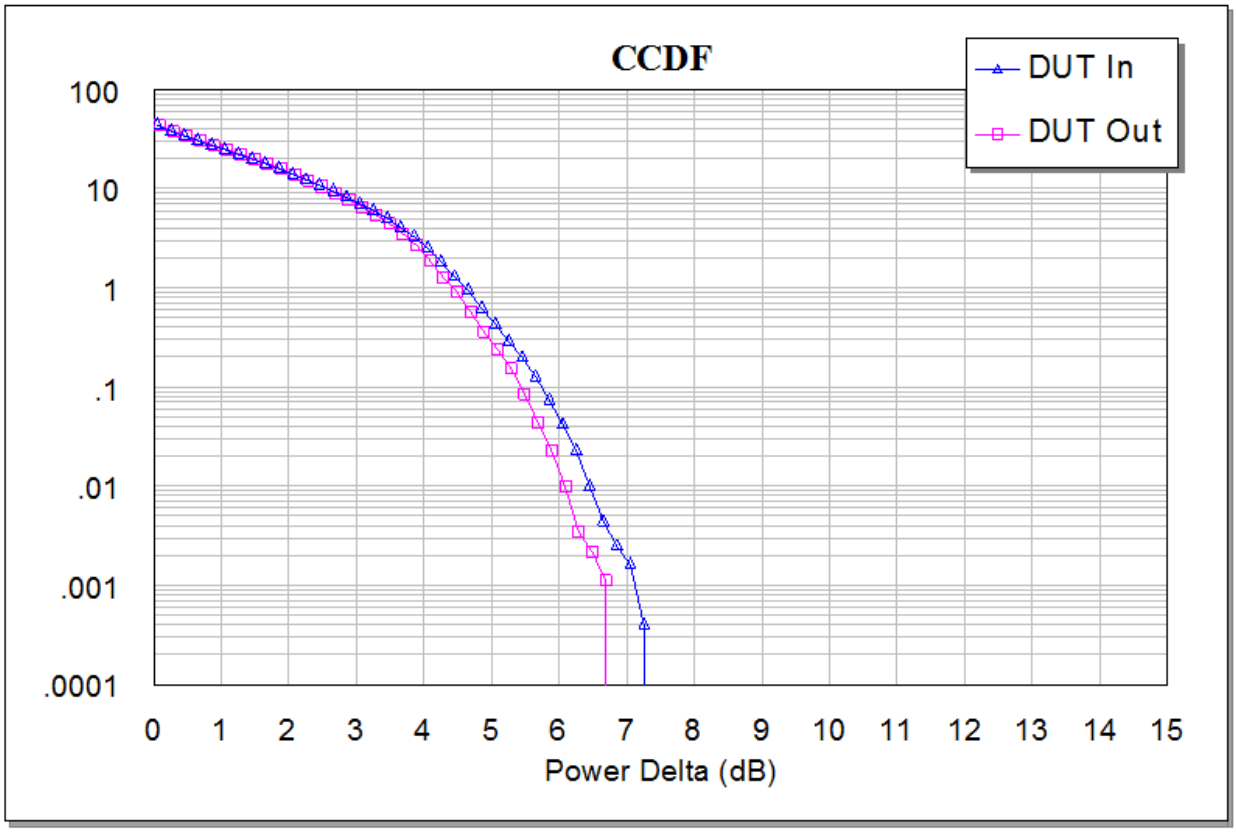
Graph - Power Levels

x Data (Unitless)	DB(PWR_MTR(TP.DUT_in, 1,0,1,0,0,1,0,1,0,0,1000,0,10,0,-1,0, -1,0,0.5,0,0,0))[x] (dBm) LTE UL	DB(PWR_MTR(TP.DUT_out, 1,0,1,0,0,1,0,1,0,0,1000,0,10,0,-1,0, -1,0,0.5,0,0,0))[x] (dBm) LTE UL	DB(PWR_MTR(S1\S1\TP.ModOut1, 1,0,1,0,0,1,0,1,0,0,1000,0,10,0,-1,0, -1,0,0.5,0,0,0))[x] (dBm) LTE UL	DB(PWR_MTR(S1\S1\TP.ModOut2, 1,0,1,0,0,1,0,1,0,0,1000,0,10,0,-1,0, -1,0,0.5,0,0,0))[x] (dBm) LTE UL
0	-6.65546	5.14735		
1	-5.65546	6.14728		
2	-4.65546	7.14659		
3	-3.65546	8.14301		
4	-2.65546	9.13256		
5	-1.6494	10.1152		
6				
7				
8				
9				
10				

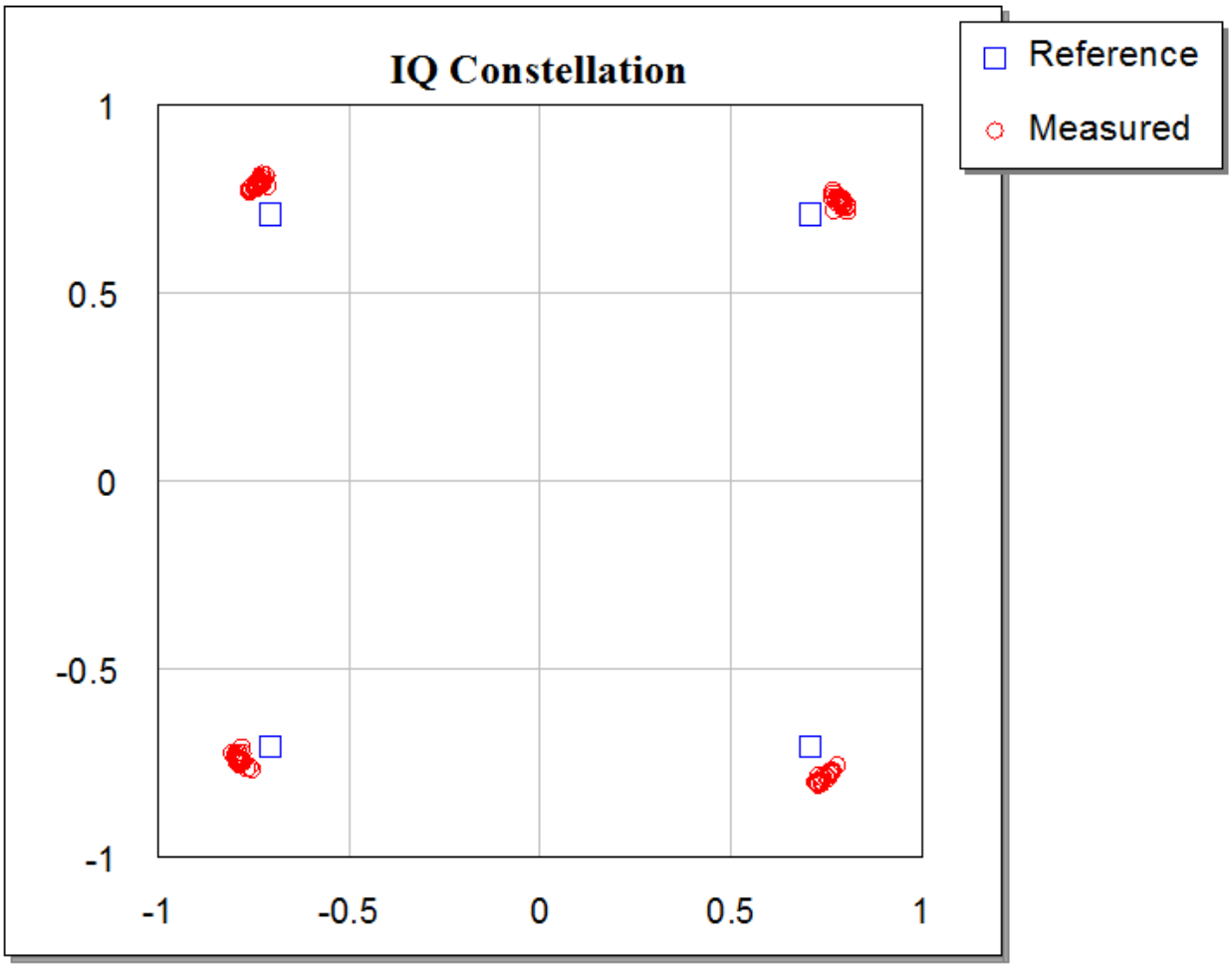
Graph - EVM vs Output Power



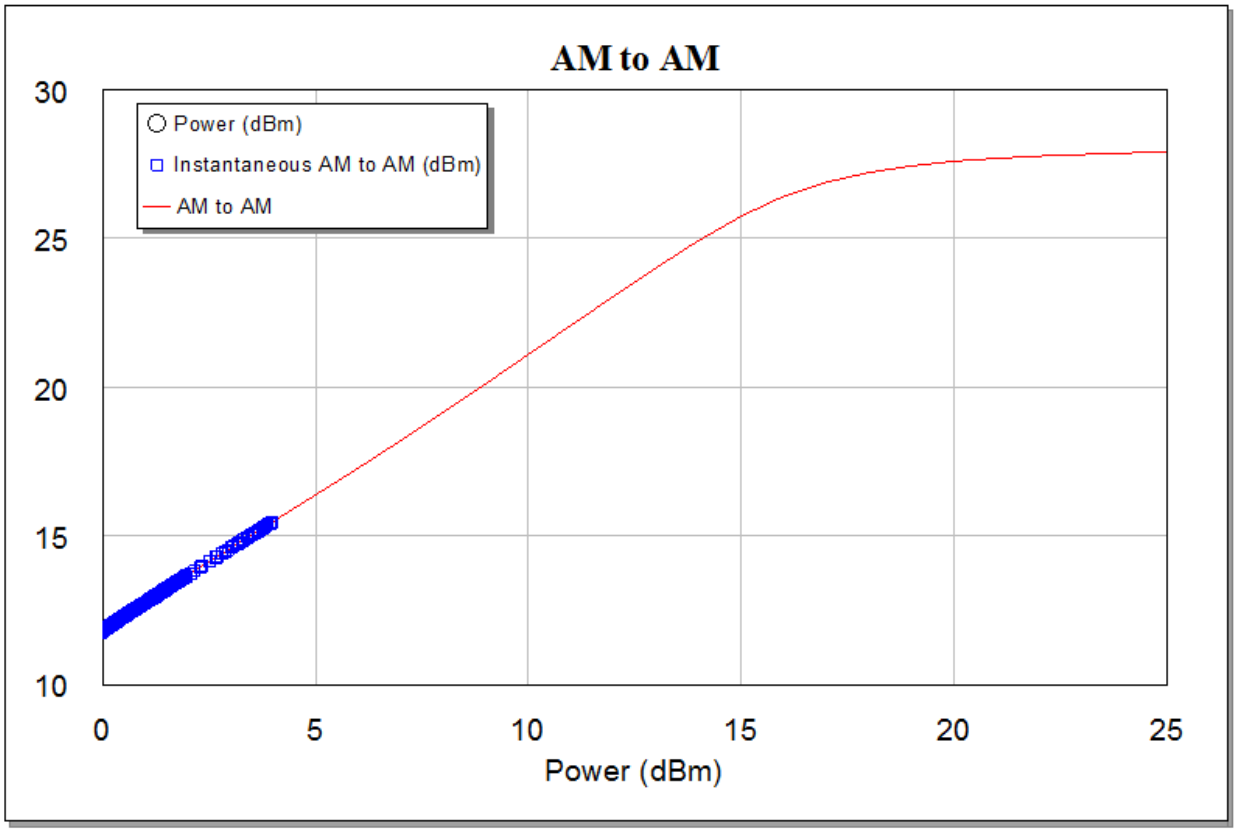
Graph - CCDF



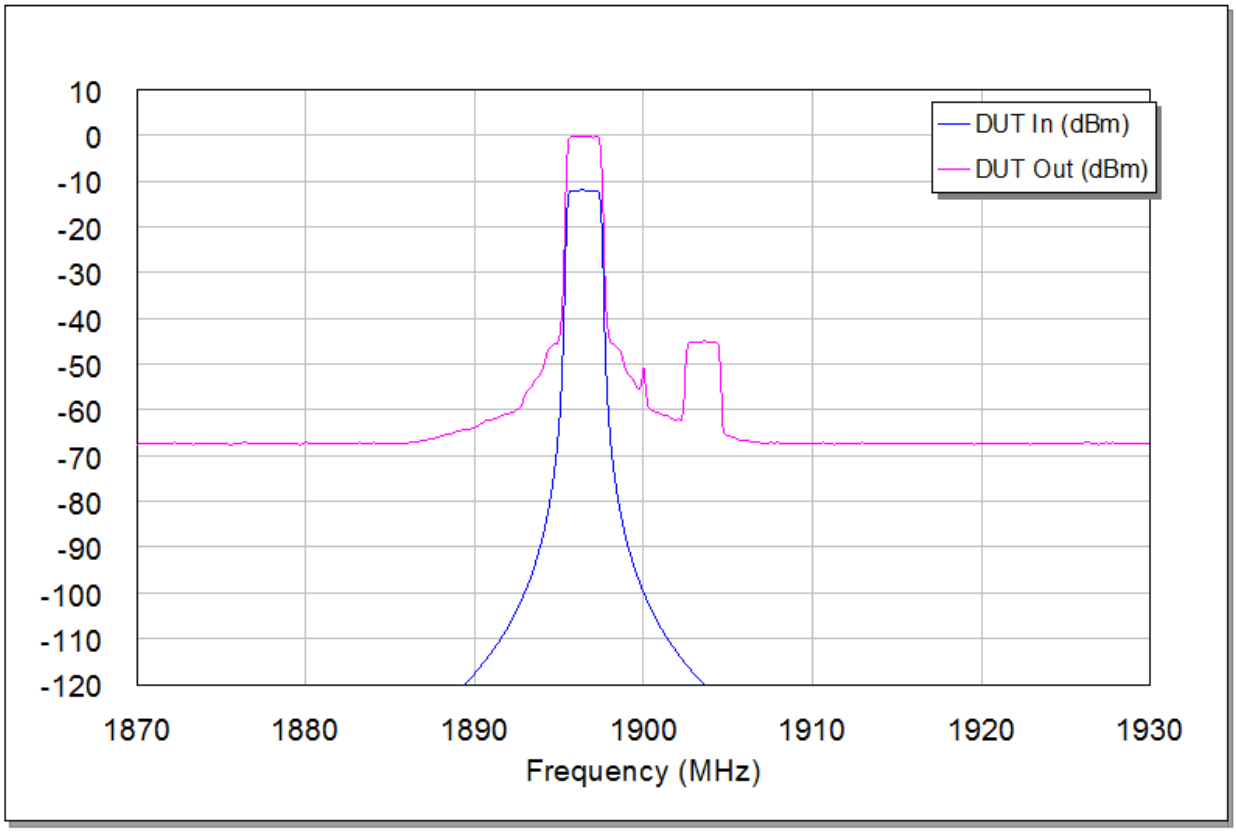
Graph - IQ Constellation



Graph - AM to AM



Graph - Spectrum


10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
1870
1880
1890
1900
1910
1920
1930
Frequency (MHz)
DUT In (dBm)
DUT Out (dBm)