

Apply ADS Wireless Test Bench to Real Circuit

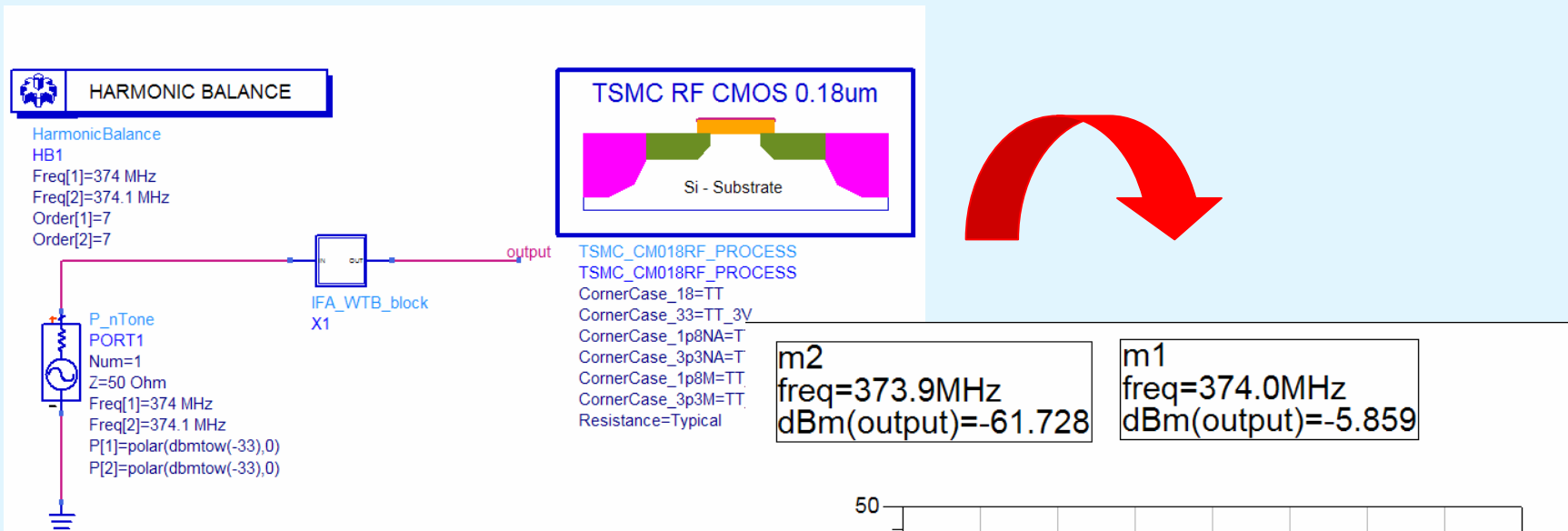
- Agilent EEsof
- Application Engineer
- Wei-li Tsai

Introduction

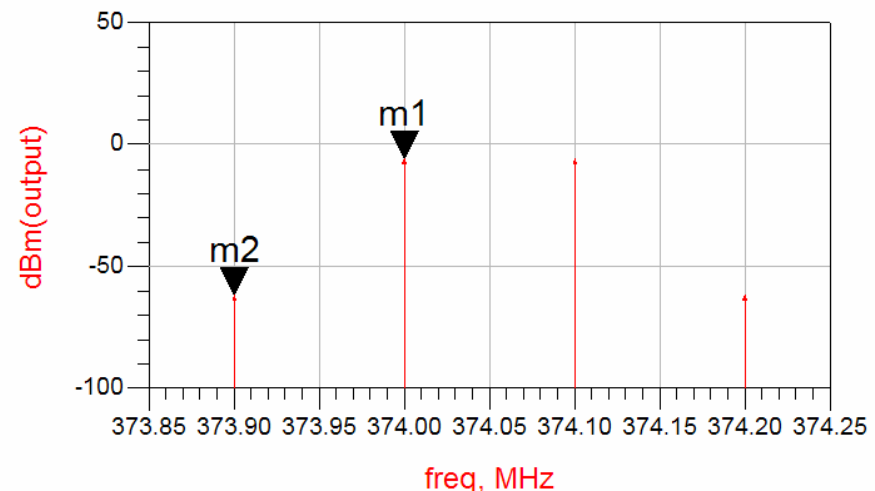
- 結合**ADS Ptolemy** 及 **Circuit Envelope** 模擬器, **ADS** 提供了 **RF/Analog/Baseband Co-Simulation**的功能。
- **WTB (Wireless Test Bench)** 進一步提供一方便的使用者介面，針對不同的通信規格，**WTB**提供您標準的帶寬、調變信號，以及測試/模擬平台。
- 透過 **Co-Simulation**, 系統工程師在定義電路規格時，即可使用帶寬、調變訊號來做系統設計及驗證。
- 透過 **Co-Simulation**, 電路工程師電路設計完成時，也可使用帶寬、調變訊號來做系統層級的驗證。
- **2-tone Simulation is NOT enough.**



Two-Tone Test on IFA_WTB_Block



此處，以中頻放大器
IFA_WTB_Block 為例
2-tone Simulation 顯示
IM3為 $(-5) - (-61) = 56$ dB
線性度良好。



Insert Template

View Insert Options Tools Layout Simulate Window DynamicLink User2 DesignGuide Help

Template...

- Wire W
- Wire/Pin Label... L
- Global Node
- Component
 - Port P
 - GROUND
 - VAR
- Shape
 - Text Ctrl+Shift+T
 - Arrow...
 - Symbol Pin...
 - Power Pin...
- Entry Layer...
- Change Entry Layer To Ctrl+Shift+C
- Coordinate Entry...
- Measure...
- Generate Symbol...

選擇 WLAN_802_11b_Tx

WLAN IEEE 802.11b Transmitter Test Bench

WLAN 802.11b Design Information

802_11b_TX_Info

ENVELOPE

Envelope
WTB
Freq[1]=FSource
Order[1]=3
Step=CE_TimeStep
ABM_Mode=

VAR
VAR1
CE_TimeStep=1.0/11 MHz/6
FSource=2412.0 MHz
FMeasurement=2412.0 MHz

Replace this "Amplifier2" DUT with your own CIRCUIT design.

Amplifier2 DUT

WLAN_802_11b_TX
WLAN_802_11b_TX
CE_TimeStep=CE_TimeStep
FSource=FSource
SourcePower=dbmtow(-20.0)
FMeasurement=FMeasurement
RF_EnvelopeMeasurement=YES
Constellation=NO
PowerMeasurement=NO
SpectrumMeasurement=NO
EVM_Measurement=NO

Notes for setting up Envelope simulation:

- Envelope simulation stop time is set by the wireless test bench measurements (not "Env Setup" Stop time);
- Add additional tones to the "Env Setup" if tones other than FSource are required for Envelope analysis;
- Enable AVI in "Cosim" setup if fast cosim with circuits is desired;
- CE_TimeStep must be set to equal to or less than $1/11e6/OversamplingRatio$. OversamplingRatio is a WLAN_802_11b_TX Signal Parameter.

Notes for Sweep and Optimization:

The SimInstanceName must always use "WTB1" for sweep or optimization controller regardless of the Envelope controller's instance name.

Limitations for using wireless test benches:

- Envelope "Oscillator Analysis" setup is NOT supported;
- Envelope simulation with wireless test bench does NOT save the named nodes data in the dataset.

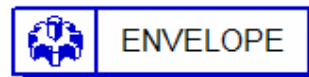


Replace with real circuit IFA_WTB_Block

WLAN IEEE 802.11b Transmitter Test Bench



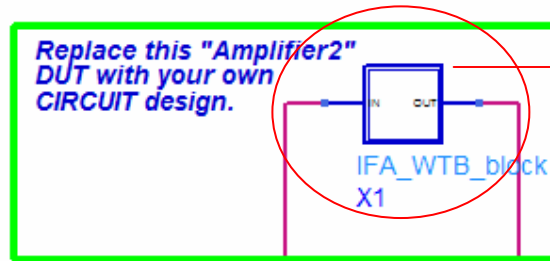
WLAN_802_11b_TX_Info
Information



Envelope
WTB
Freq[1]=FSource
Order[1]=3
Step=CE_TimeStep
ABM_Mode=yes



VAR
VAR1
CE_TimeStep=1.0/11 MHz/6
FSource=374.0 MHz
FMeasurement=374.0 MHz



已置換為
IFA_WTB_Block



WLAN_802_11b_TX
WLAN_802_11b_TX
CE_TimeStep=CE_TimeStep
FSource=FSource
SourcePower=dbmtow(-30.0)
FMeasurement=FMeasurement
RF_EnvelopeMeasurement=YES
Constellation=YES
PowerMeasurement=YES
SpectrumMeasurement=YES
EVM_Measurement=YES

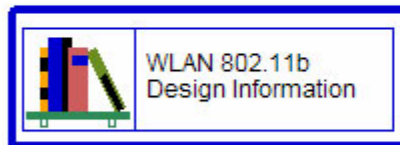
1. 鍵入source Power
2. 將欲模擬的項目改成yes

鍵入input, output的頻率，若無Mixer，
Input & output 頻率應為一致。



Insert Foundry's Model Card

WLAN IEEE 802.11b Transmitter Test Bench



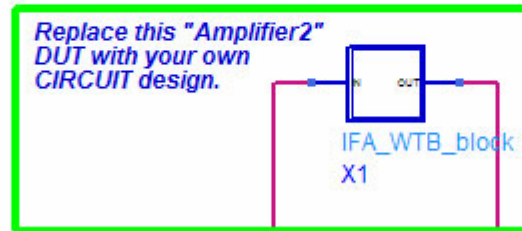
WLAN_802_11b_TX_Info
Information



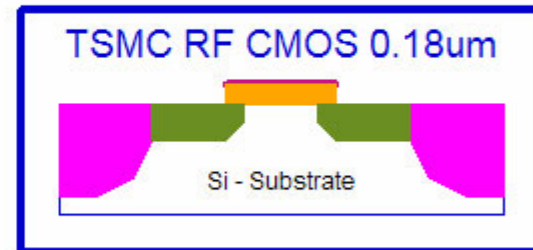
Envelope
WTB
Freq[1]=FSource
Order[1]=3
Step=CE_TimeStep
ABM_Mode=yes



VAR
VAR1
CE_TimeStep=1.0/11 MHz/6
FSource=374.0 MHz
FMeasurement=374.0 MHz



WLAN_802_11b_TX
WLAN_802_11b_TX
CE_TimeStep=CE_TimeStep
FSource=FSource
SourcePower=dbmtow(-30.0)
FMeasurement=FMeasurement
RF_EnvelopeMeasurement=YES
Constellation=YES
PowerMeasurement=YES
SpectrumMeasurement=YES
EVM_Measurement=YES



TSMC_CM018RF_PROCESS
TSMC_CM018RF_PROCESS
CornerCase_18=TT
CornerCase_33=TT_3V
CornerCase_1p8NA=TT_NA
CornerCase_3p3NA=TT_3VNA
CornerCase_1p8M=TT_M
CornerCase_3p3M=TT_3M
Resistance=Typical

別忘了Model Card 喔!!



Worry About Long Simulation Time?

2006 EMG ASIA

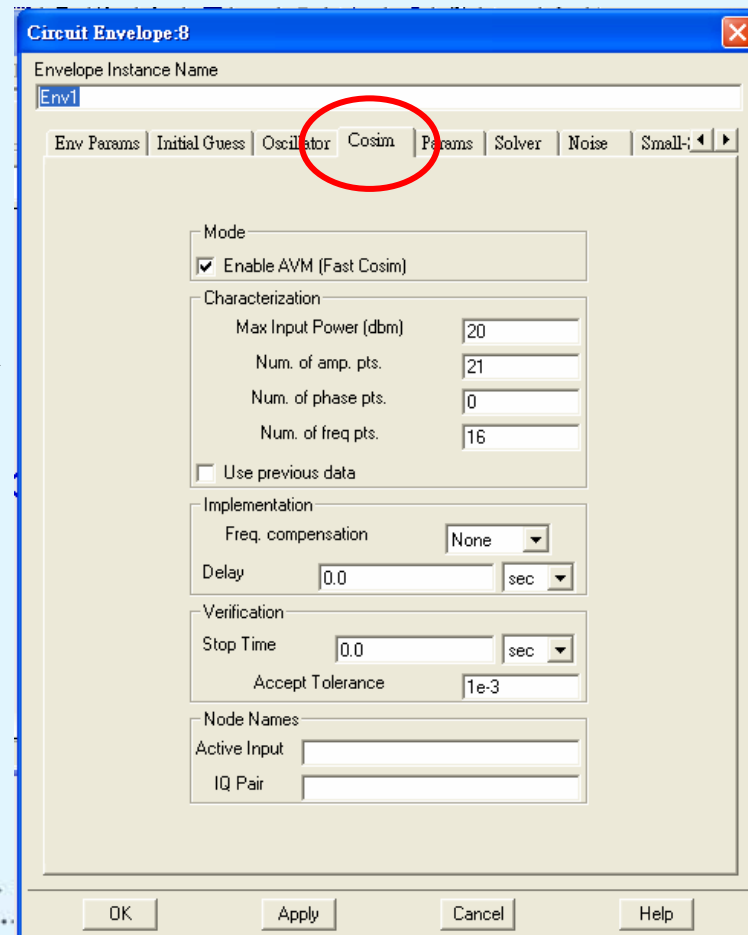
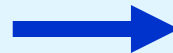
innovation starts with us

擔心Co-Simulation會花很多時間？別擔心～讓ADS在做Co-Simulation之前，自動為您的Analog/RF電路建Behavior Model，再利用該behavior Model繼續Co-Simulation。只需在Circuit Envelop Simulator中點選CoSim，將AVM打勾即可。鍵入Max Input Power，ADS會Sweep Power和Frequency，得到電路的behavior。細部的設定，請參閱Circuit Envelop使用手冊。



Envelope
Env1
Freq[1]=FSource
Order[1]=3
Stop=StopTime usec
Step=CE_TimeStep usec

Double Click



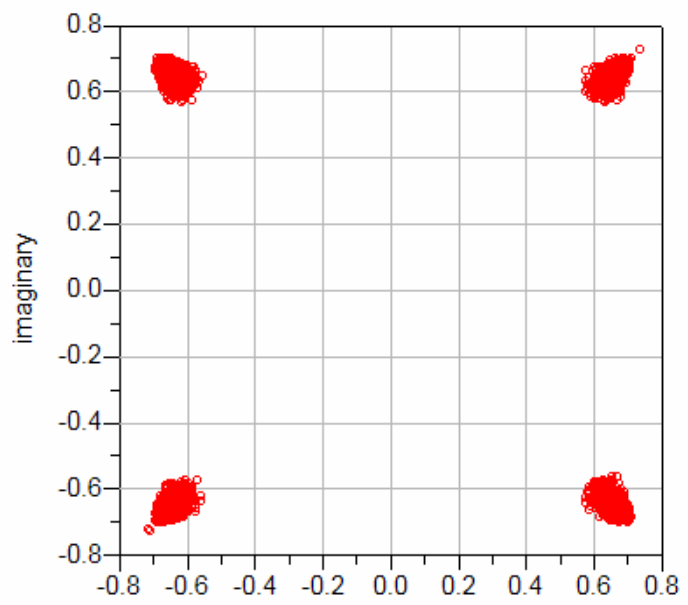
Simulation Result - Constellation

WLAN_80211b_TX Test Bench - Constellation Figures

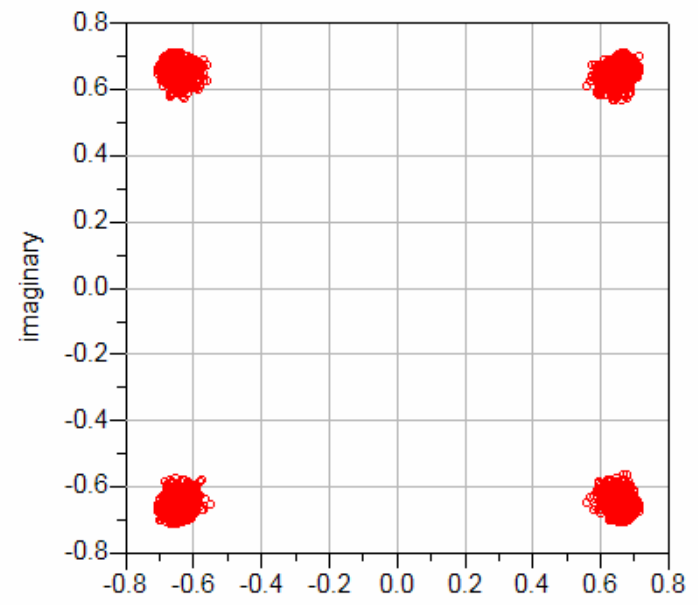
Not defined in IEEE Std 802.11b-1999 Specification

real(RF_FSource) / (1 MHz)	real(RF_R)	...Meas_FMeasurement) / (1 MHz)	real(Meas_R)
374.000	50.000	374.000	50.000
real(BurstTime) / (1 usec)	real(DataTime) / (1 usec)	real(TimeStep) / (1 nsec)	real(BitRate) / (1 Mbps)
322.364	116.364	15.152	11.000

RF Constellation



Meas Constellation



左邊RF部份即是WTB所產生的訊號，右邊Meas部份是經過電路後的結果。
因IFA_WTB_Block的線性度不錯，所以星狀圖的結果良好。

Simulation Result - Spectrum Mask

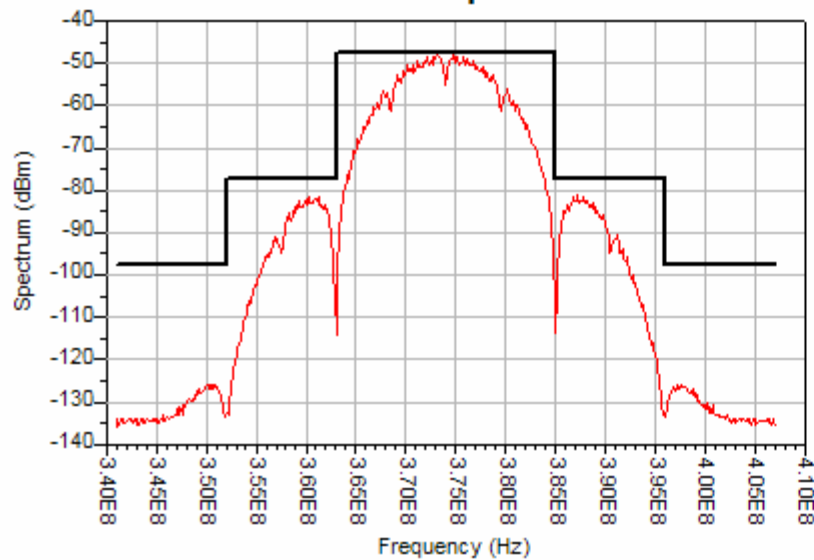
WTB產生的11b訊號

經過電路後的頻譜，
超出Mask即不合規格

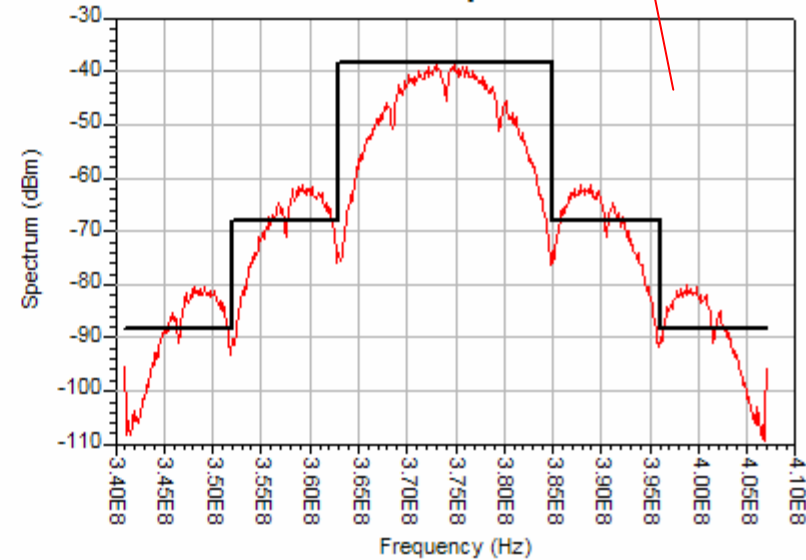
WLAN_802_11b_TX Test Bench - Spectrum Measurement

...al(RF_FSource) / (1 MHz)	real(RF_Power_dBm)	real(RF_R)	...FMeasurement) / (1 MHz)	real(Meas_R)
374.000	-30.000	50.000	374.000	50.000

WLAN 802 11b Spectrum - RF



WLAN 802 11b Spectrum - Meas



WLAN Specification: Transmitted Spectrum Request on IEEE Std 802.11b-1999, section 18.4.7.3

Power levels in dB (relative to the maximum spectral density of the signal)

Frequency offset (MHz)	<=-22	-11	0	11	>=22
Power level (dB) <=	-50	-30	0	-30	-50

Summary

- **ADS WTB** 提供了方便的系統模擬平台
- 由 **IFA_WTB_Block** 的例子可見 --- 針對當前的無線通信系統，如 **WLAN, WiMax, UWB,** 等，傳統的電路模擬方式，如 **2-tone Simulation** 無法直接反應系統規格的要求。
- 從系統設計(定義每個電路的電氣特性)，電路設計，乃至於 **RF Module** 設計，**Analog/RF/Baseband Co-Simulation** 是必須的。
- 如欲利用既有的電路 **IP**，透過 **WTB**，可快速挑選出適合的 **IP**。

