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Apply ADS Wireless Test Bench to Real Circuit

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Introduction

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- 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.**

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Two-Tone Test on IFA_WTB_Block

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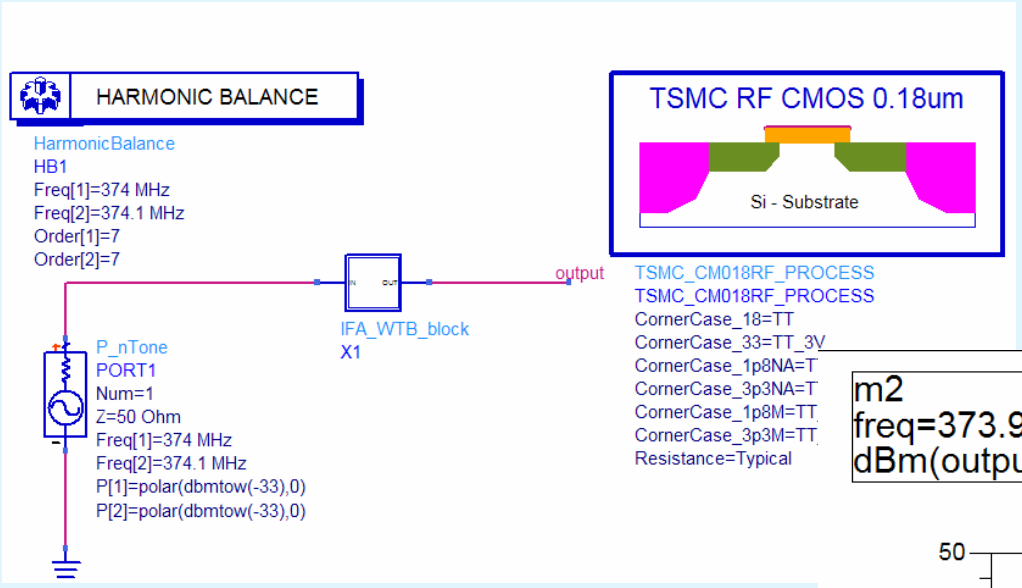

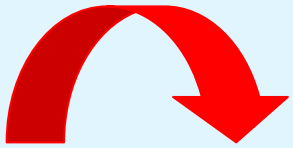

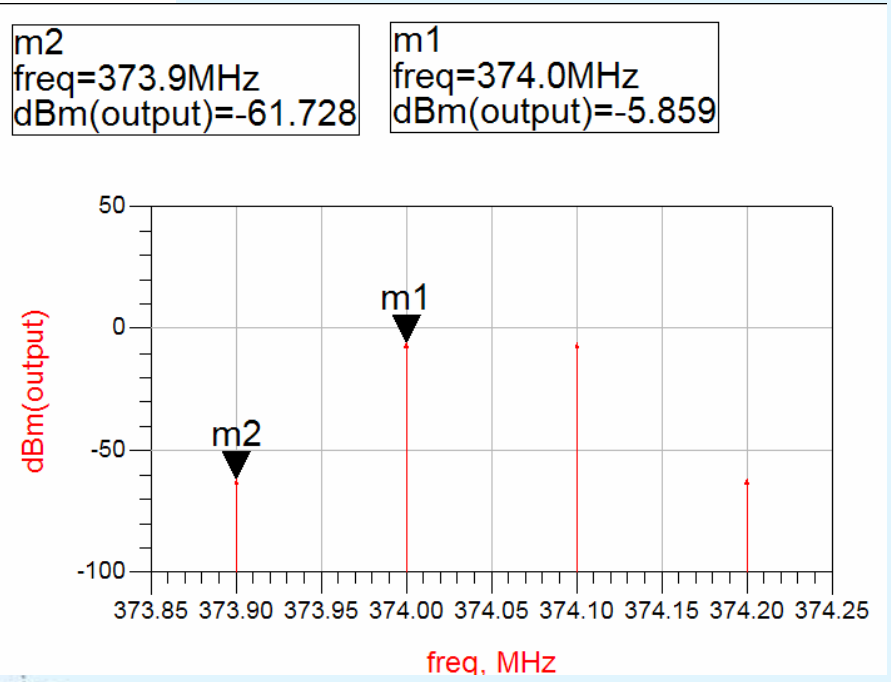

此處，以中頻放大器

IFA_WTB_Block 爲例

2-tone Simulation 顯示

IM3爲 (-5) - (-61) = 56 dB

線性度良好。

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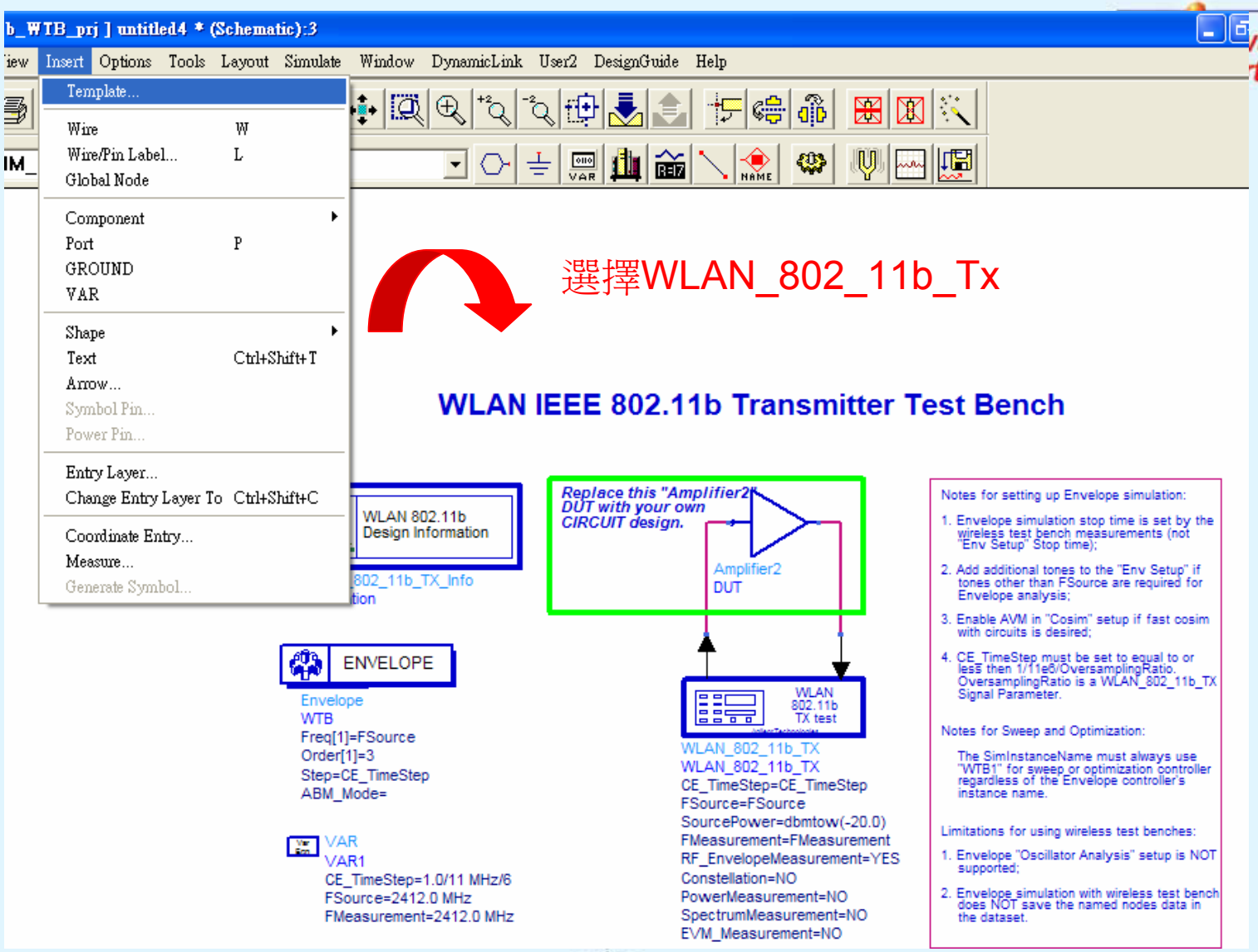
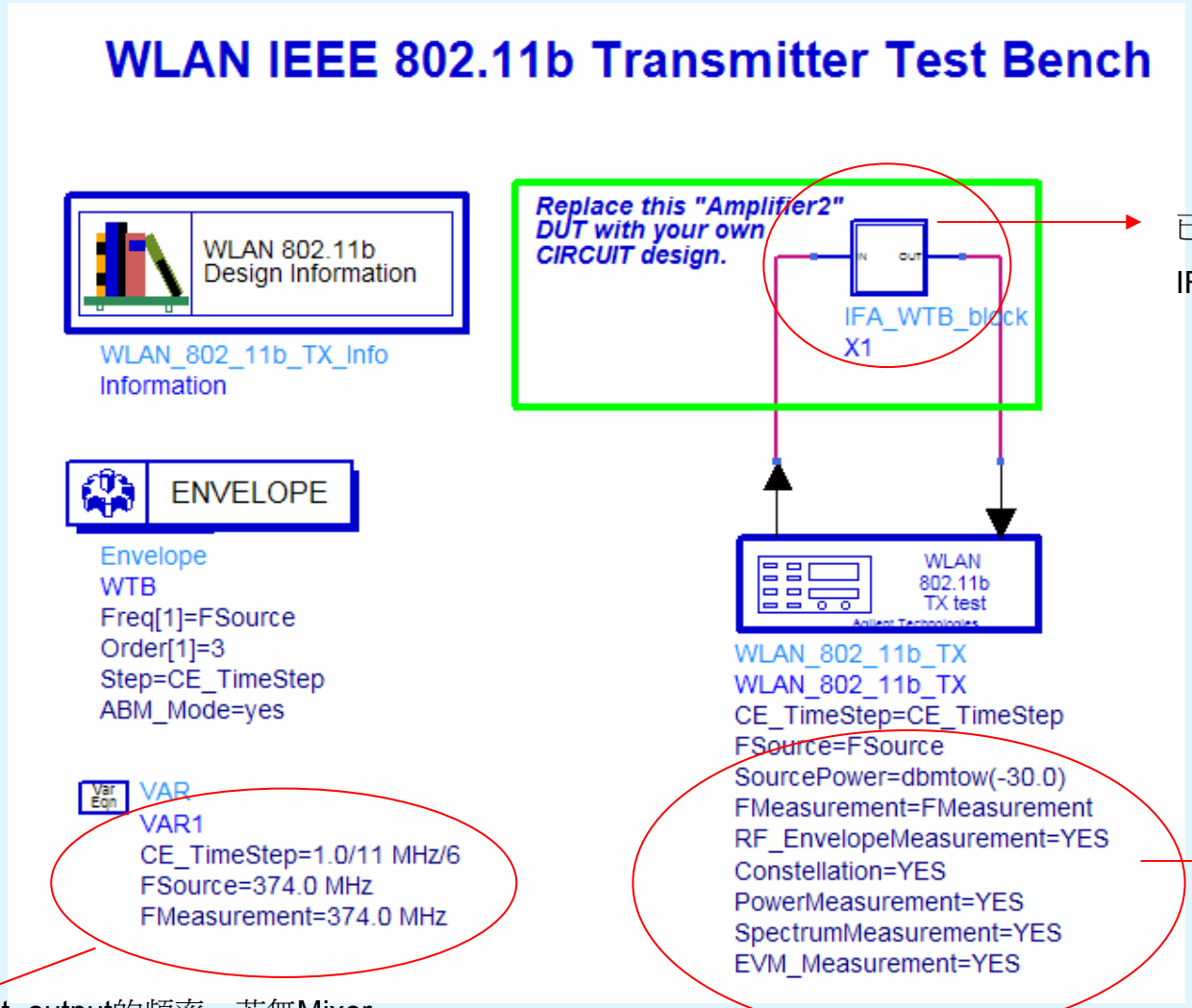
Insert Template



Replace with real circuit IFA_WTB_Block



已置換爲

IFA_WTB_Block

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 頻率應爲一致。

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Insert Foundry's Model Card

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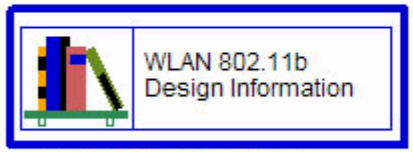
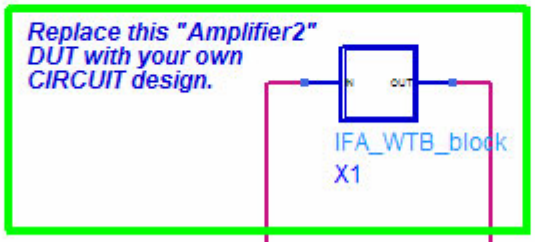
WLAN IEEE 802.11b Transmitter Test Bench



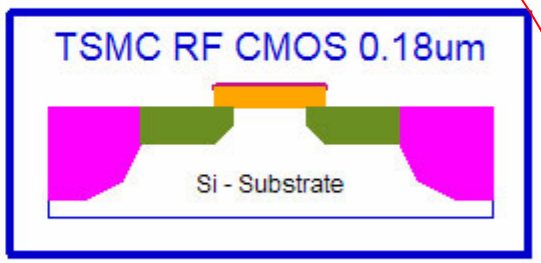
WLAN_802_11b_TX_Info
Information



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!!

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Worry About Long Simulation Time?

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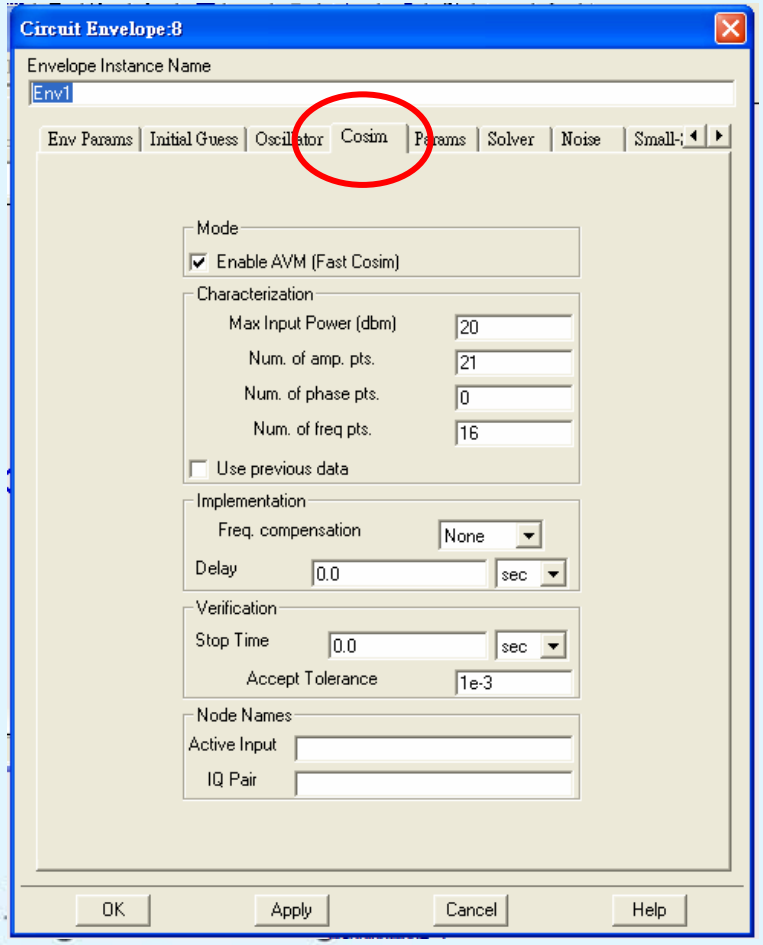
擔心Co-Simulation會花很多時間？別擔心～讓ADS在做Co-Simulation之前，自動爲您的Analog/RF電路建Behavior Model，再利用該behavior Model繼續Co-Simulation。只需在Circuit Envelop Simulator中點選CoSim，將AVM打勾即可。鍵入Max Input Power，ADS會Sweep Power和Frequency，得到電路的behavior。細部的設定，請參閱Circuit Envelop使用手冊。

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

Double Click



Simulation Result - Constellation

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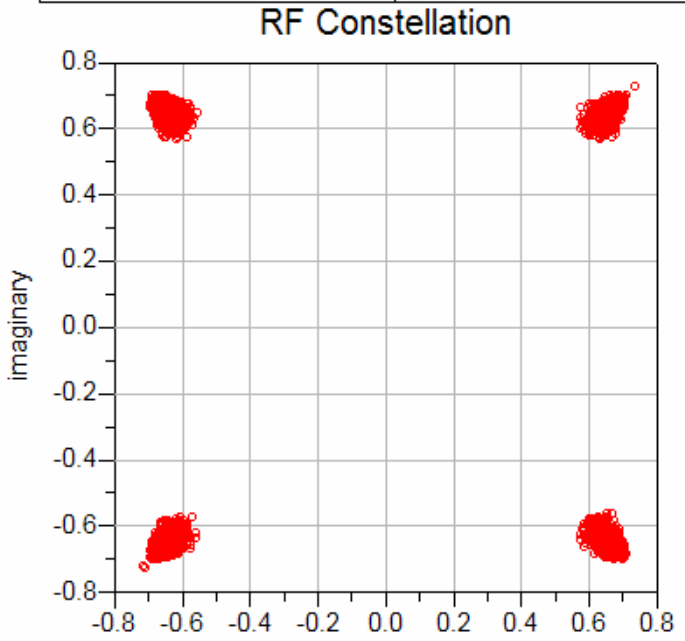
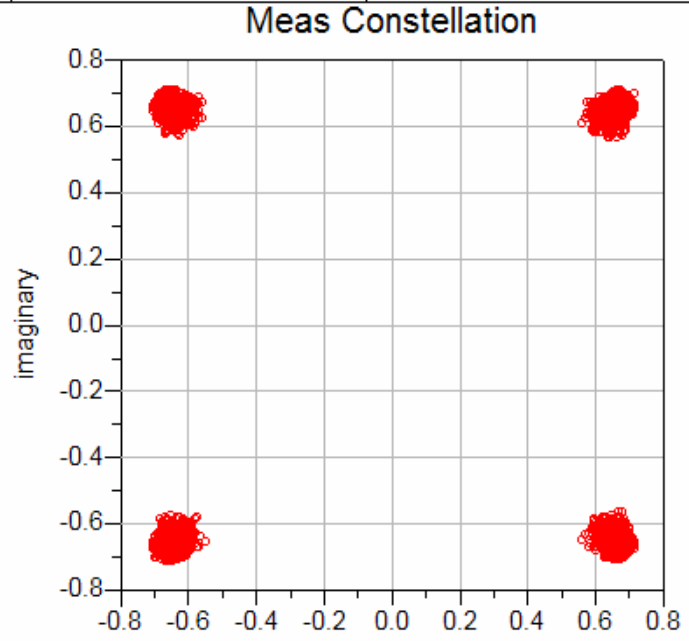
WLAN_80211b_TX Test Bench - Constellation Figures

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





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。

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Simulation Result - Spectrum Mask

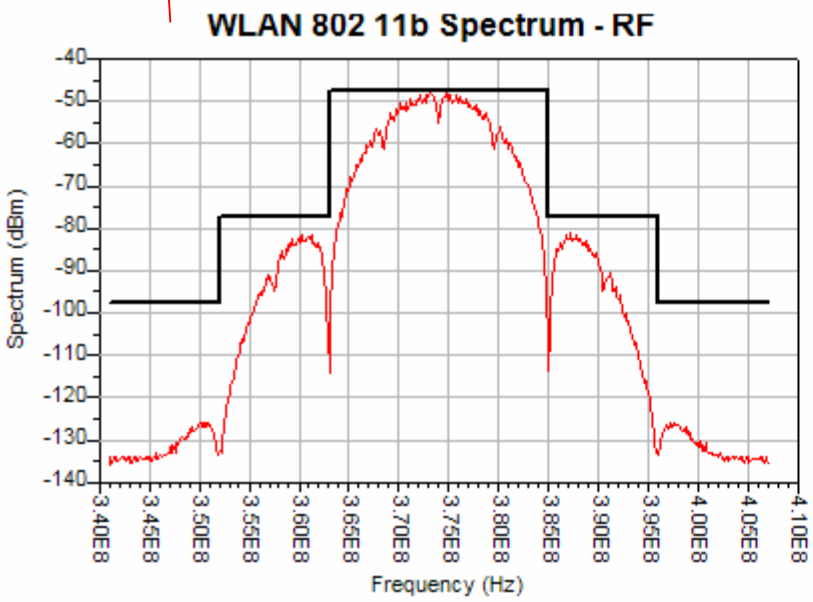
WTB產生的11b訊號

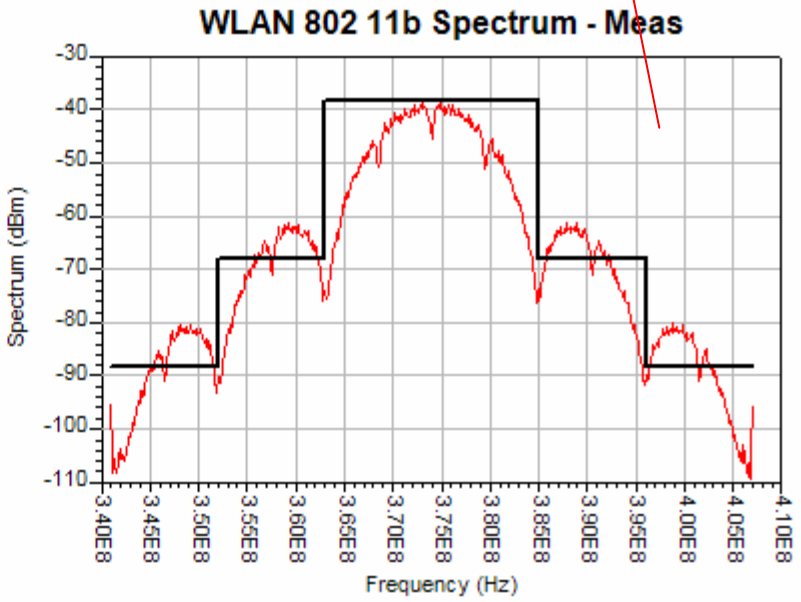
經過電路後的頻譜，

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

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

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

Summary

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- **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-Simulaiton** 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**。

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