

射頻系統戰力驗證 網路分析儀實務應用

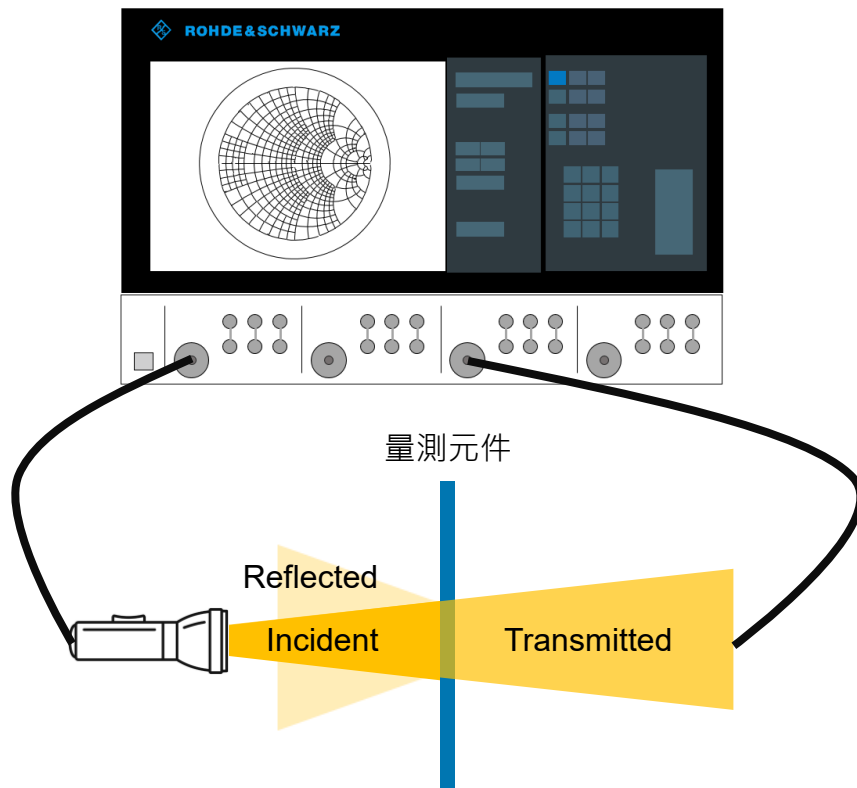
賴正恆

ROHDE & SCHWARZ

Make ideas real



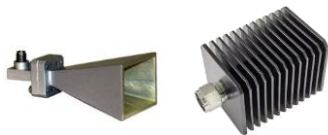
網路分析儀基本架構



射頻/微波元件分類

► 1 Port Devices

- Antennas
- Loads / Terminations



► 2 Port Devices

- Cables
- Amplifiers
- Filters



► 3 Port Devices

- Couplers
- Mixers
- Power Splitters



► 4+ Port Devices

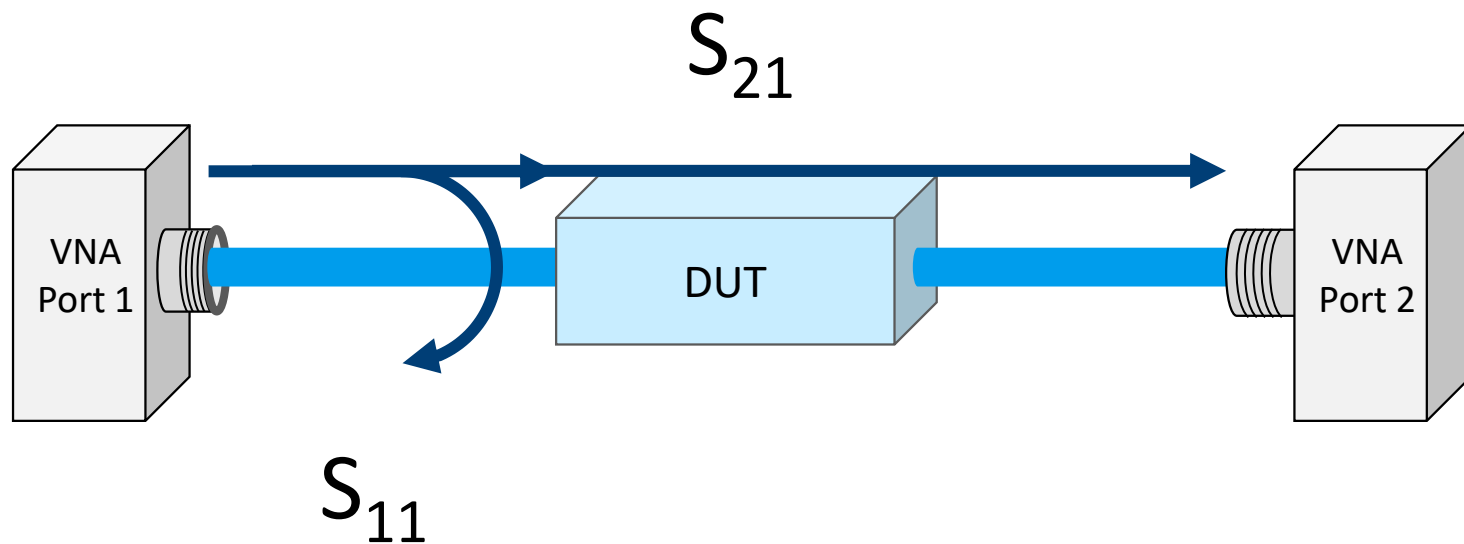
- Circulator
- Switches



網路分析儀描述元件參數

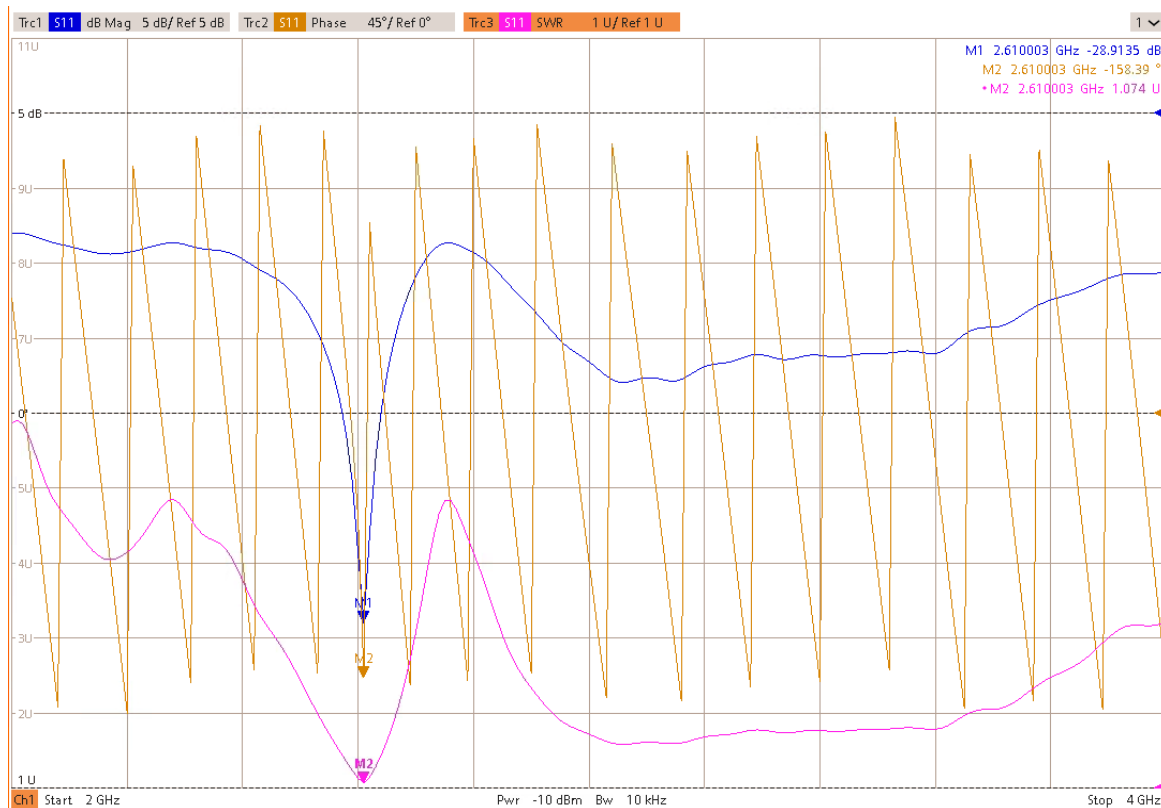
► S參數(S-Parameter)

- 含振幅和相位

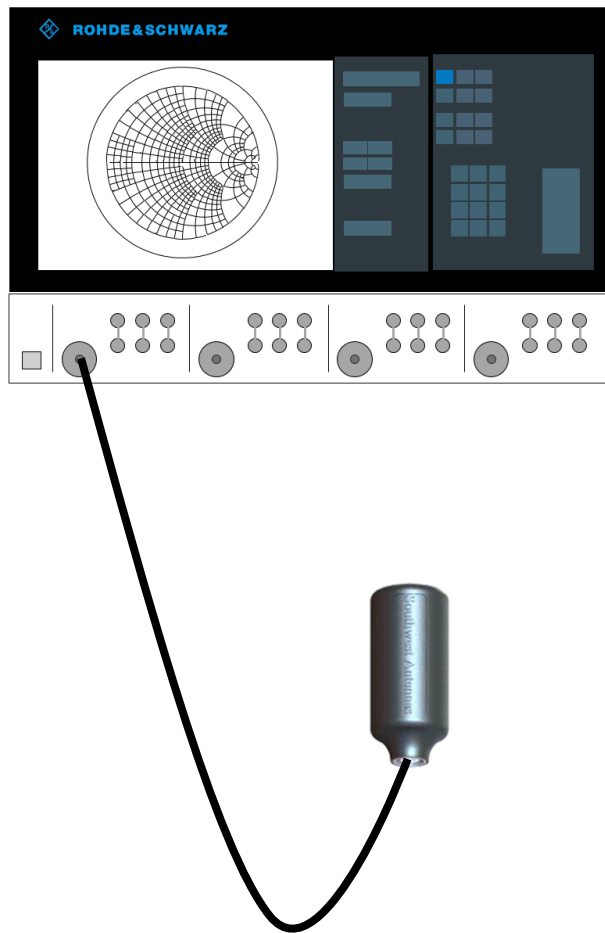
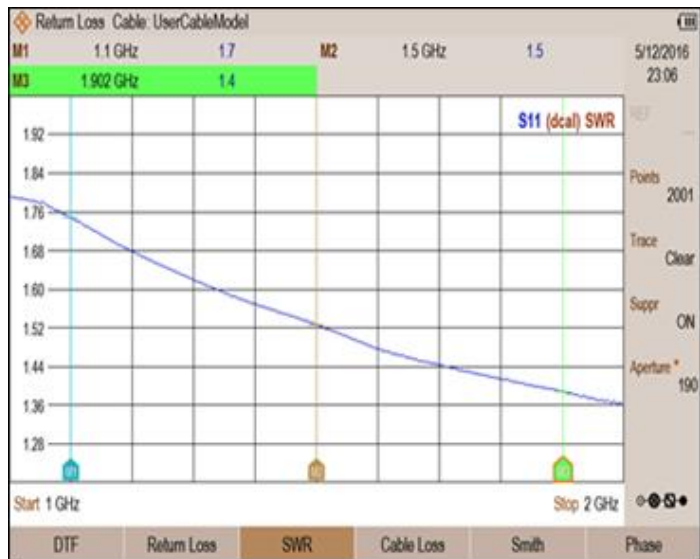


網路分析儀 — 單埠量測參數

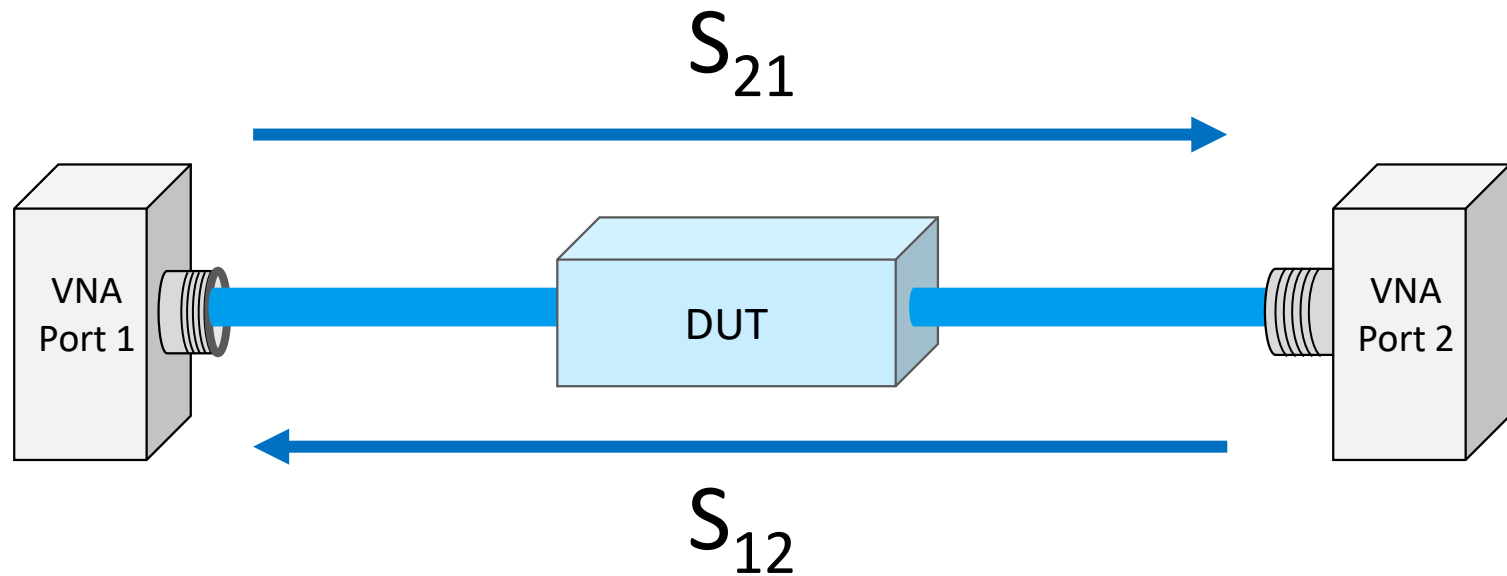
- ▶ 反射系數 S_{11}
 - 振幅 (Return Loss)
 - 相位
 - 反射駐波比 (SWR)



網路分析儀 — 單埠量測參數 天線反射駐波比



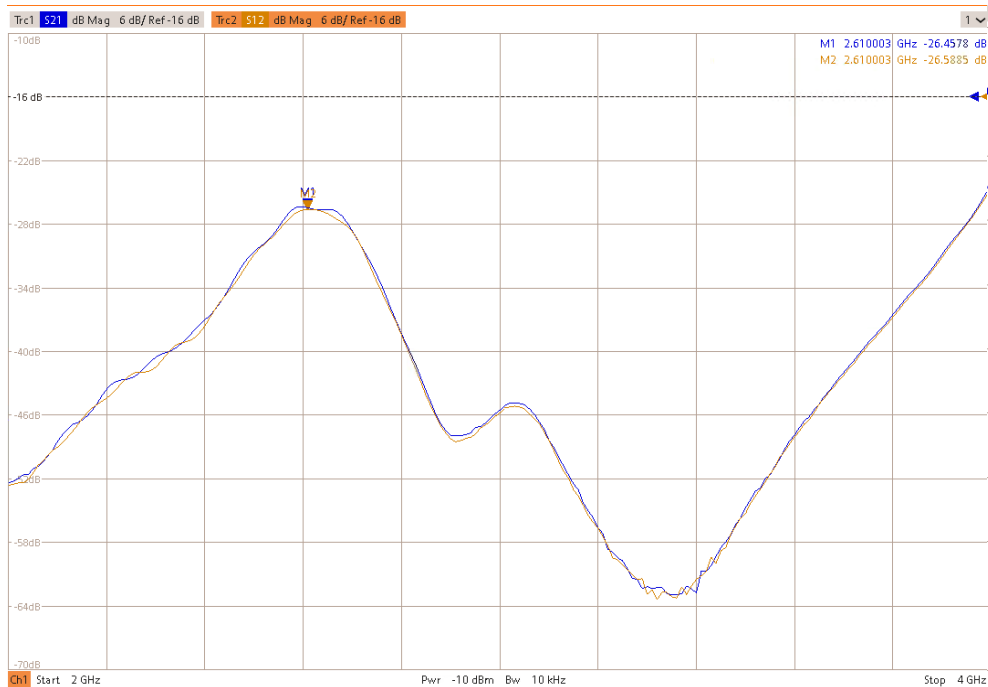
網路分析儀 — 雙埠量測參數



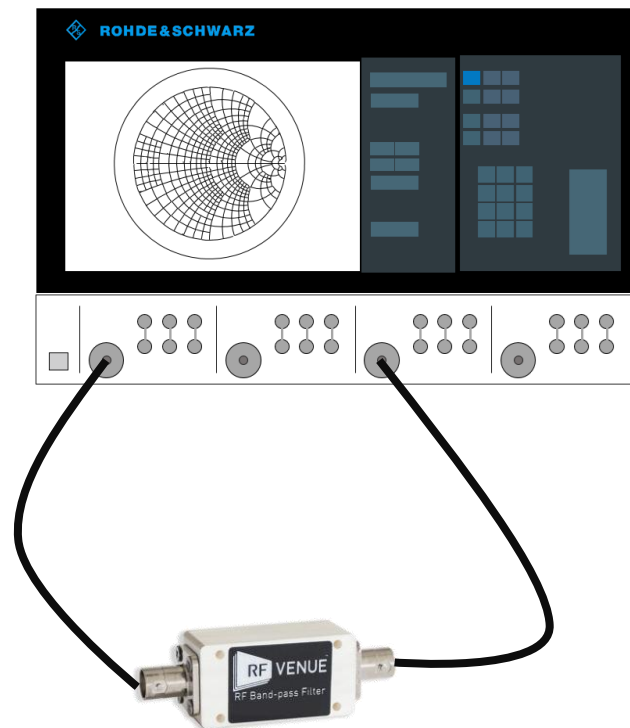
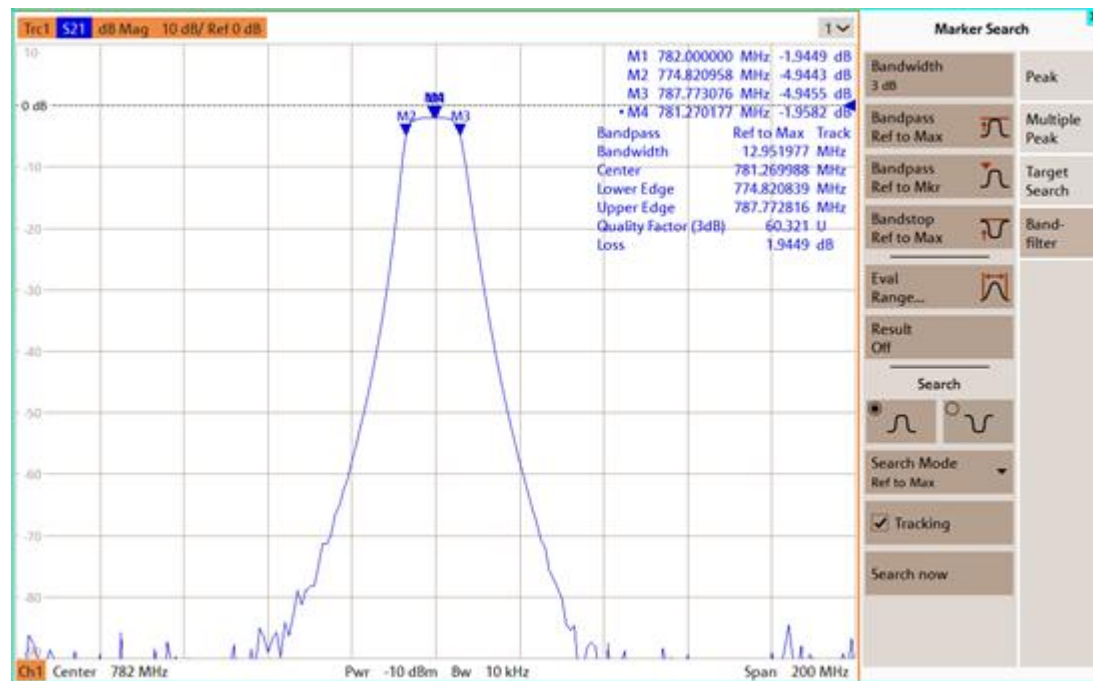
網路分析儀 — 雙埠量測參數

► 傳輸係數 (Transmission Coefficient) S_{21}

- 被動元件 Insertion Loss
- 主動元件 Gain



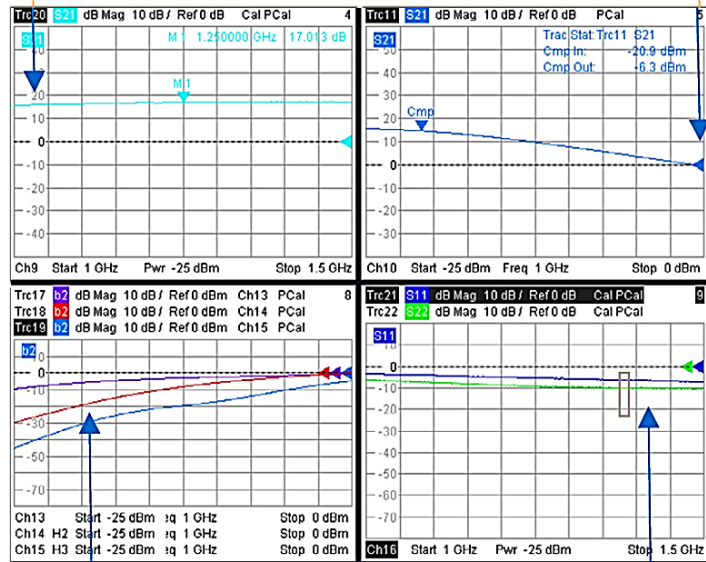
網路分析儀 — 雙埠量測參數 濾波器



網路分析儀 — 雙埠量測參數 功率放大器

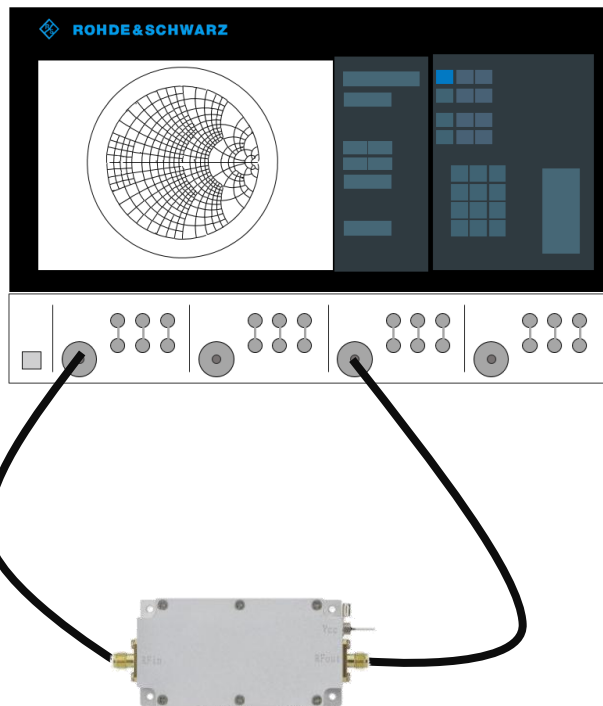
Gain

1dB Compression

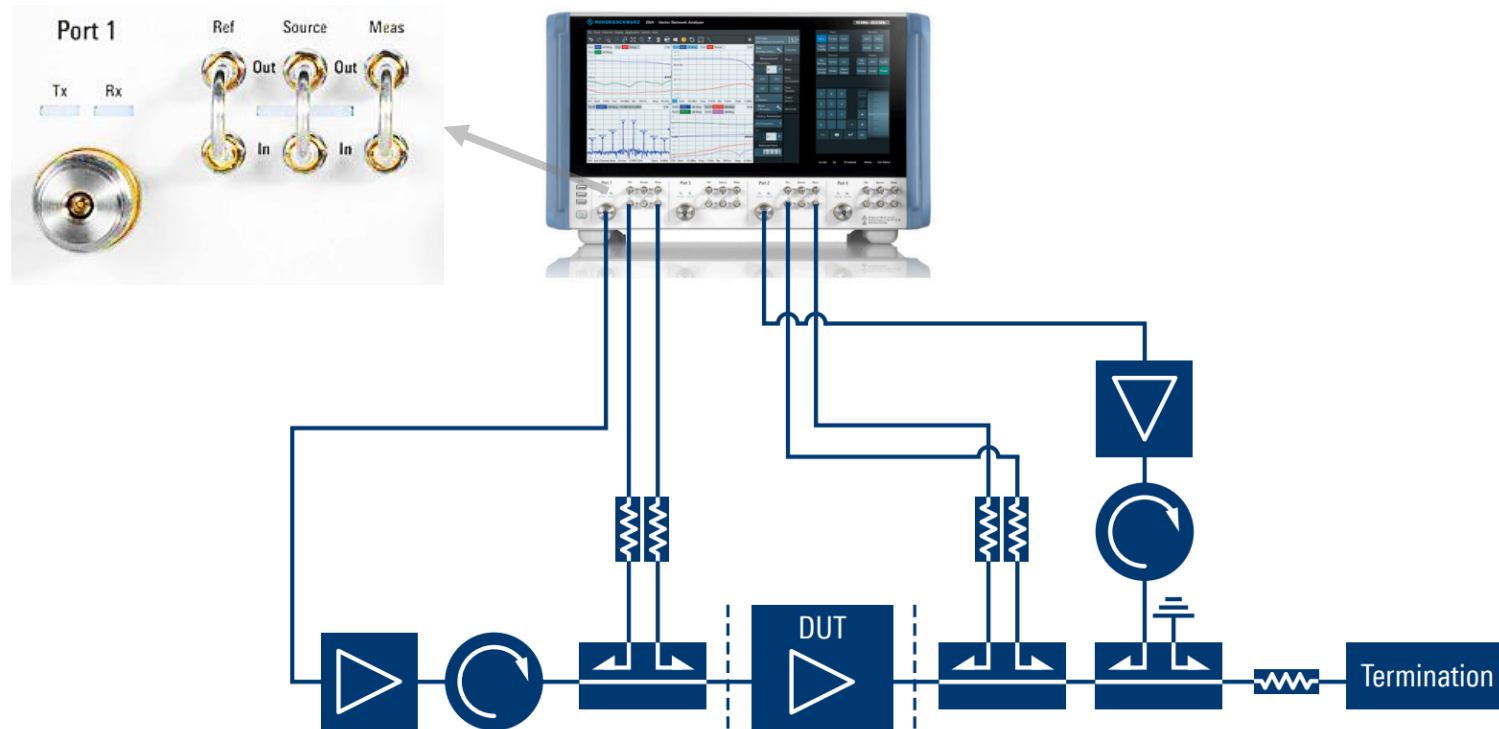


Harmonics

Reflection



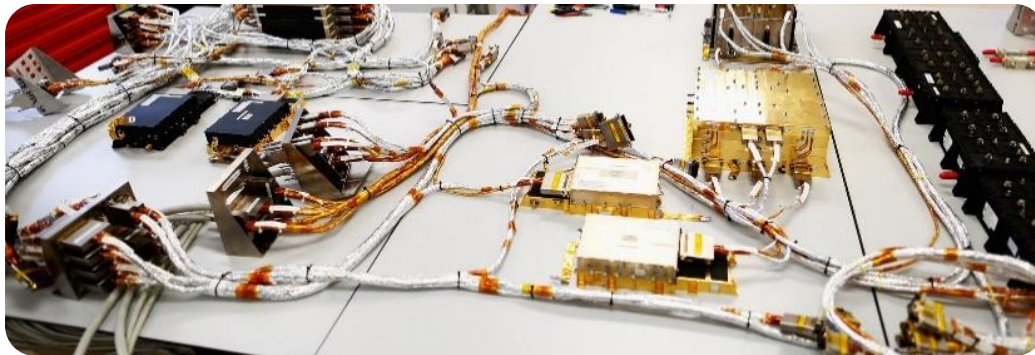
網路分析儀功能 高功率放大器



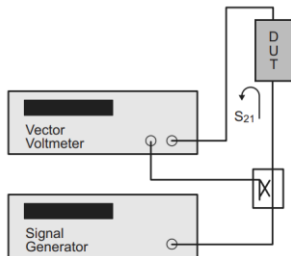
網路分析儀功能 高功率放大器



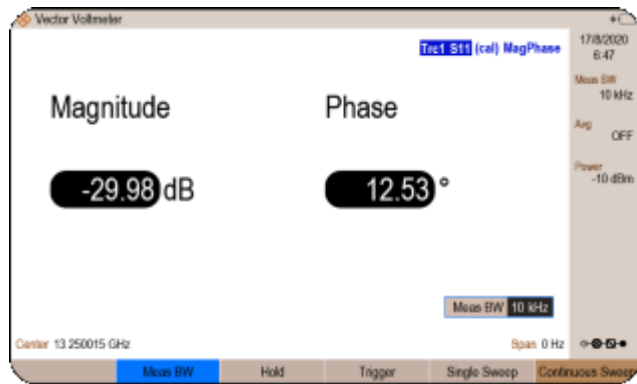
向量電壓計 VECTOR VOLTMETER



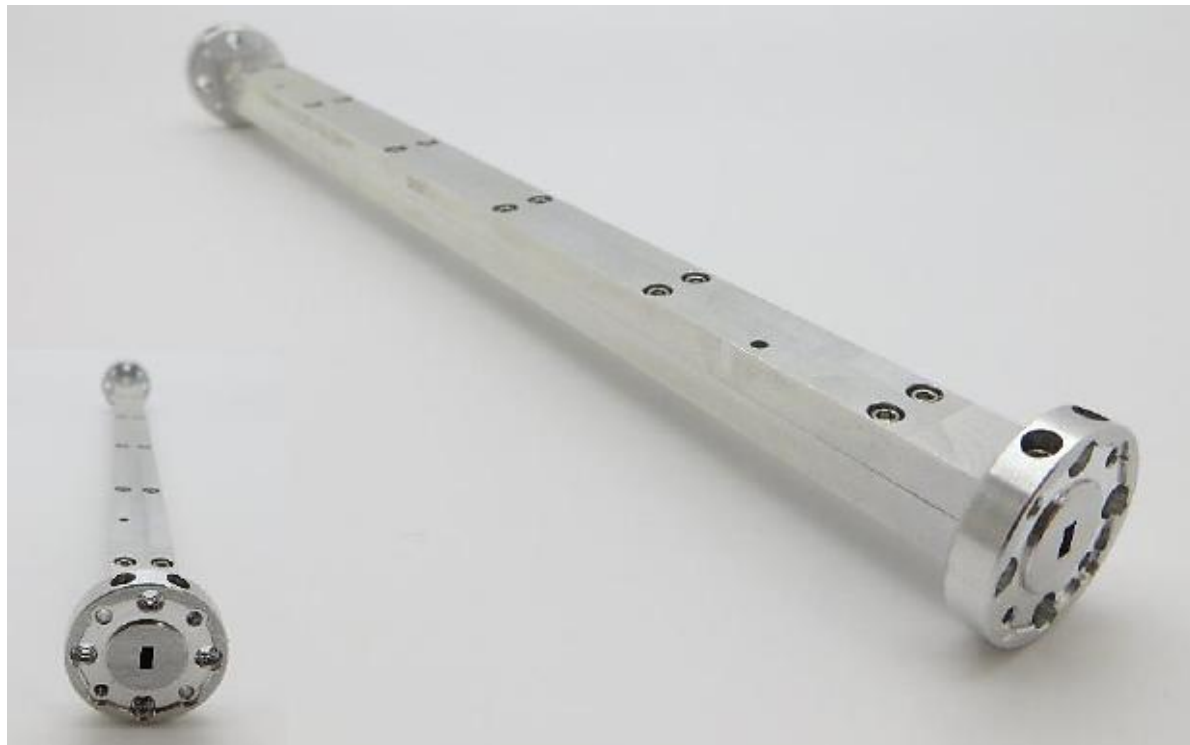
網路分析儀功能 向量電壓計 VECTOR VOLT METER



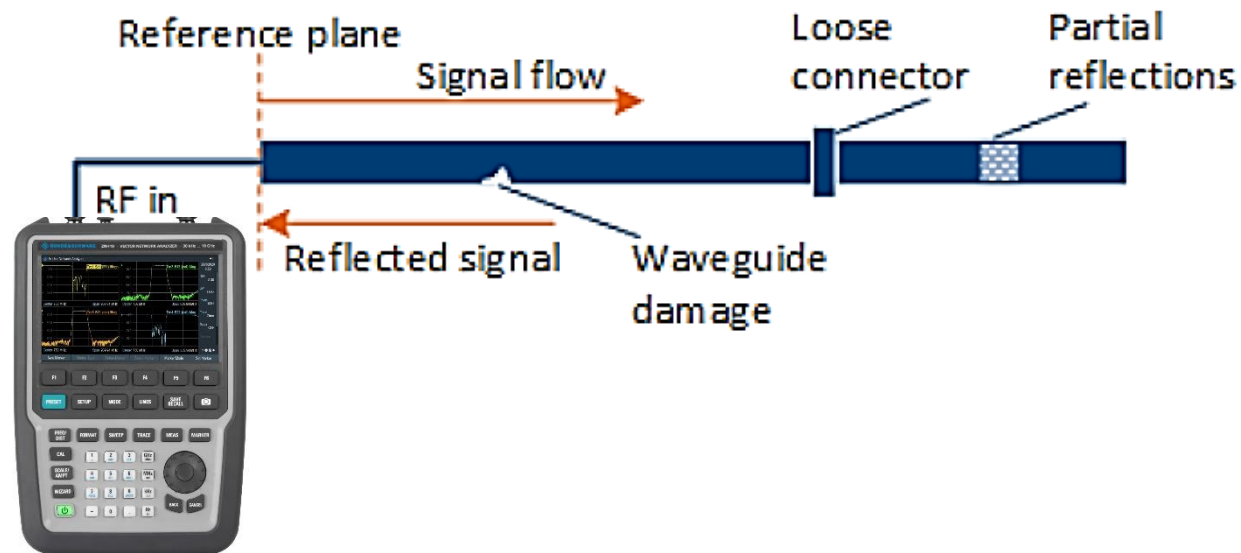
Legacy VVM Solution



導波管量測



網路分析儀功能 導波管



網路分析儀功能 導波管校正程序

轉接頭



校正器



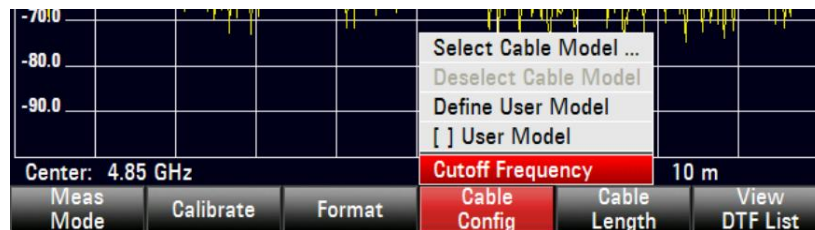
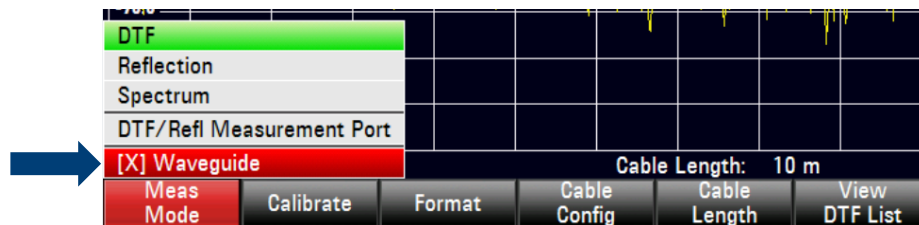
校正器文件

Rhode & Schwarz Network Analyzers

Table 9. Standard Definitions for Rohde & Schwarz

Short Label = G344A Min Freq = 3.151 GHz Max Freq = 5.85 GHz Length = 0.0 mm	Reflect Label = G344A Min Freq = 3.151 GHz Max Freq = 5.85 GHz Length = 0.0 mm
Offset Short Label = SHIM + G344A Min Freq = 3.151 GHz Max Freq = 5.85 GHz Length = 20.504 mm	Through Label = Thru (0 cm) Min Freq = 3.151 GHz Max Freq = 5.85 GHz Length = 0.0 mm
Match Label = Fixed Min Freq = 3.151 GHz Max Freq = 5.85 GHz	Line 1 Label = G322B0.807 Min Freq = 3.151 GHz Max Freq = 5.85 GHz Length = 20.504 mm

網路分析儀功能 導波管校正程序



網路分析儀功能 導波管校正程序

Calibrate SHORT	
For calibration, please connect a "SHORT" to Port 1.	
Press "Continue" to start the calibration.	
Continue	

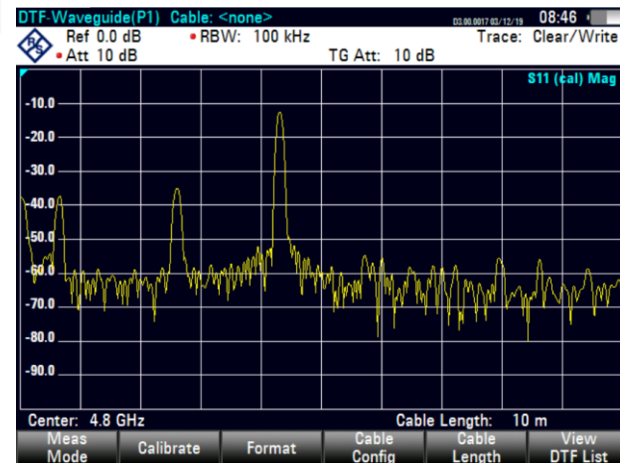
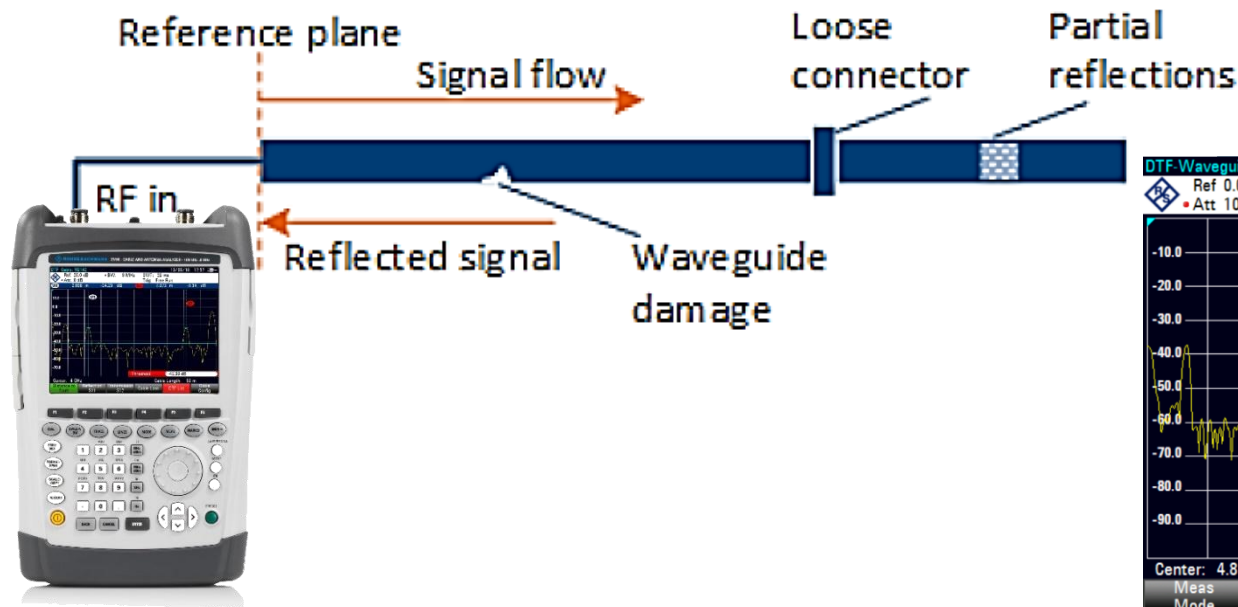
Calibrate OFFSET SHORT	
For calibration, please connect an "OFFSET SHORT" to Port 1.	
Press "Continue" to start the calibration.	
Continue	

Calibrate LOAD	
For calibration, please connect a "LOAD" to Port 1.	
Press "Continue" to start the calibration.	
Continue	Cancel

-90.0	Calibrate								
	Select Calkit								
Center: 4.85	Restore Calibration Settings			Cable Length: 10 m					
Meas Mode	Calibrate	Format	Cable Config	Cable Length				View DTF List	

Calibration Kits X	
Name	EK_WR187_15mm
Description	Calkit WR187 Cutoff=3.153GHz
Calibration	Waveguide
Waveguide	Short/Offs Short/Match
Offset Short	
Length	15 mm

網路分析儀功能 導波管量測



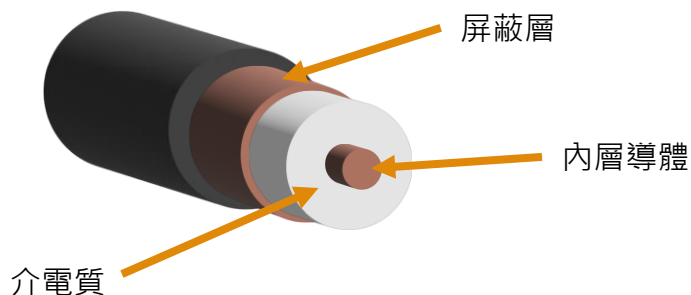
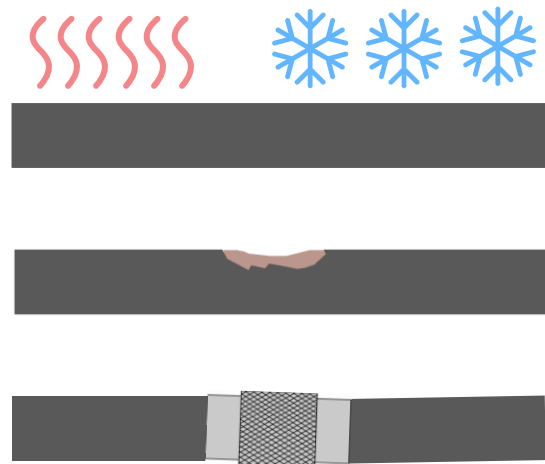
電纜線斷點



網路分析儀功能

射頻電纜線常見問題

- ▶ 電纜線的斷點
 - 可能突然發生或隨時間逐漸累積
 - 導致系統完全失效或降低效能
- ▶ 電纜線中存在許多潛在的問題
 - 環境因素 – 水氣、日曬、高溫/寒冷、雷擊
 - 損傷 – 折痕、割傷、過度彎曲
 - 品質不良或安裝不當的接頭與轉接頭
- ▶ 有問題的電纜造成阻抗改變
 - 改變了中心導體與屏蔽層之間的間距
 - 改變了兩者之間的介電質(Dielectric)特性
- ▶ 阻抗改變導致訊號反射



網路分析儀功能 斷點距離量測

- 利用網路分析儀**反射系數**，讀出纜線斷點



網路分析儀功能

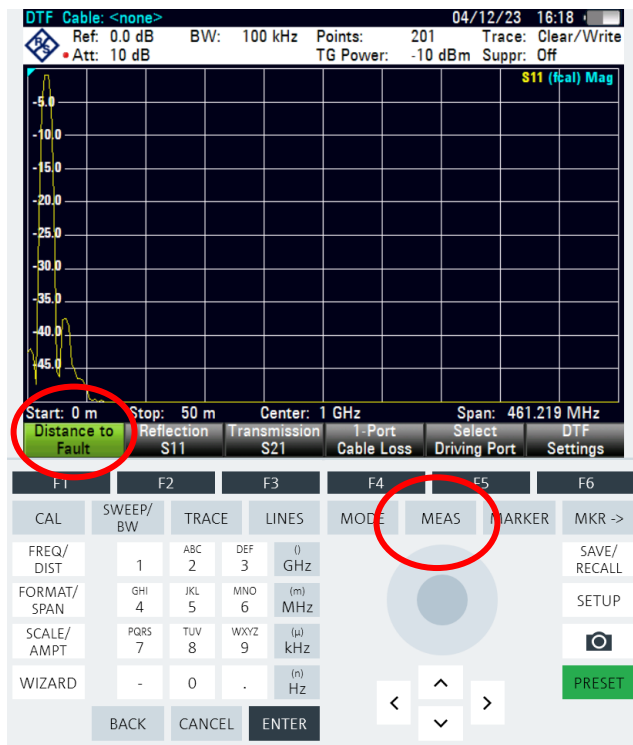
時域反射技術 — 斷點距離量測

- ▶ 送出脈衝至電纜中
- ▶ 該脈衝產生反射，若電纜有短路、開路或阻抗不匹配的情況
- ▶ 多處斷點則會導致多次反射

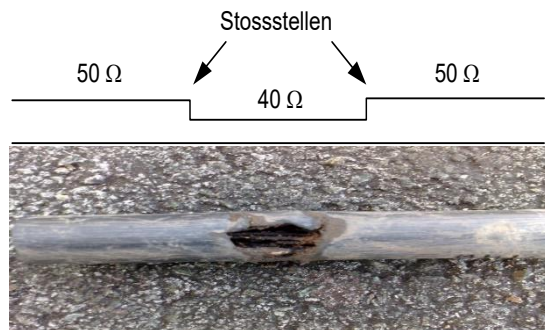


網路分析儀功能

時域反射技術 — 斷點距離量測



網路分析儀功能 時域反射技術 — 故障距離量測





THANK YOU!