



毫米波材料介電特性量測系統

Dielectric properties measurement system in mmWave

技術簡介

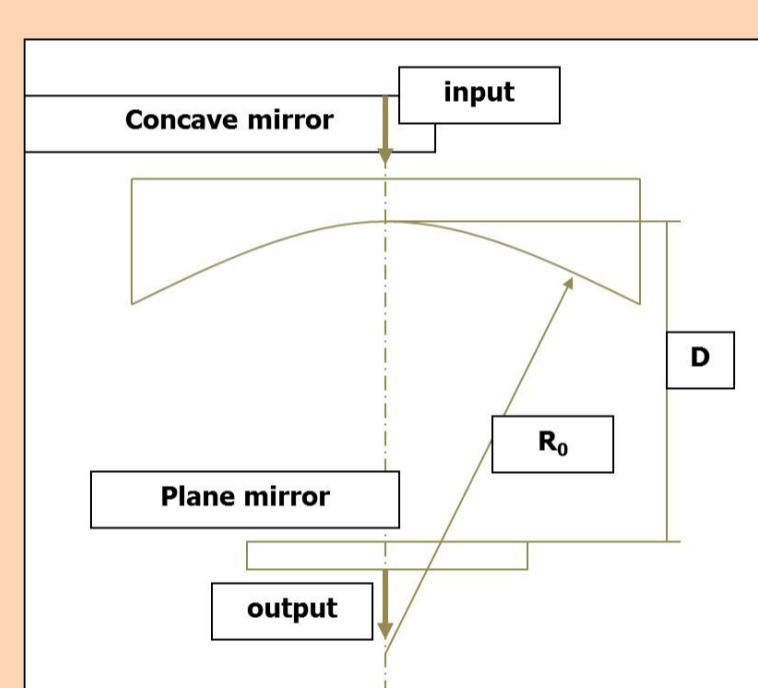
毫米波材料為發展5G 行動通訊之關鍵技術，國內缺乏毫米波材料的檢測技術能量，因此工研院以 Fabry-Perot 共振腔為基礎進行20GHz – 110GHz 材料介電特性量測系統建置，透過高精度和低振動motion 系統與整合式演算法，可將樣品精準定位於電場訊最強位置進行量測，量測自動化整合使系統可達成快速且簡易的量測，提供在毫米波新材料上特性之驗證與解決方案。

技術規格

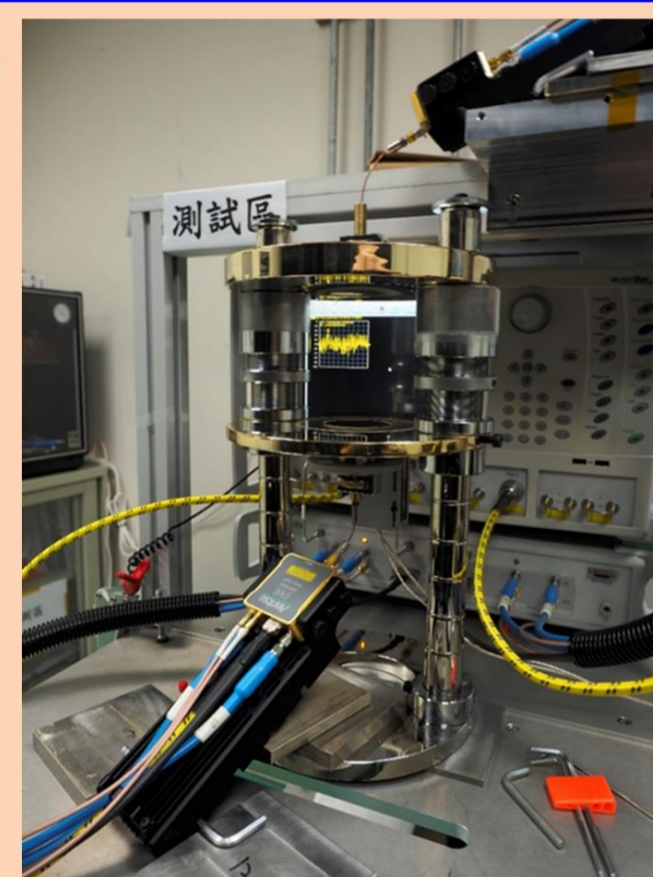
毫米波頻段服務項目:

- 材料介電特性量測Dk, Df
- 材料介電特性量測諮詢
- 量測系統推廣服務
- 量測標準基板提供
- 規劃與舉辦能力試驗

毫米波頻段材料介電特性量測技術服務及量測解決方案提供



Hemispherical Confocal Fabry-Perot open resonator



Technical characteristics

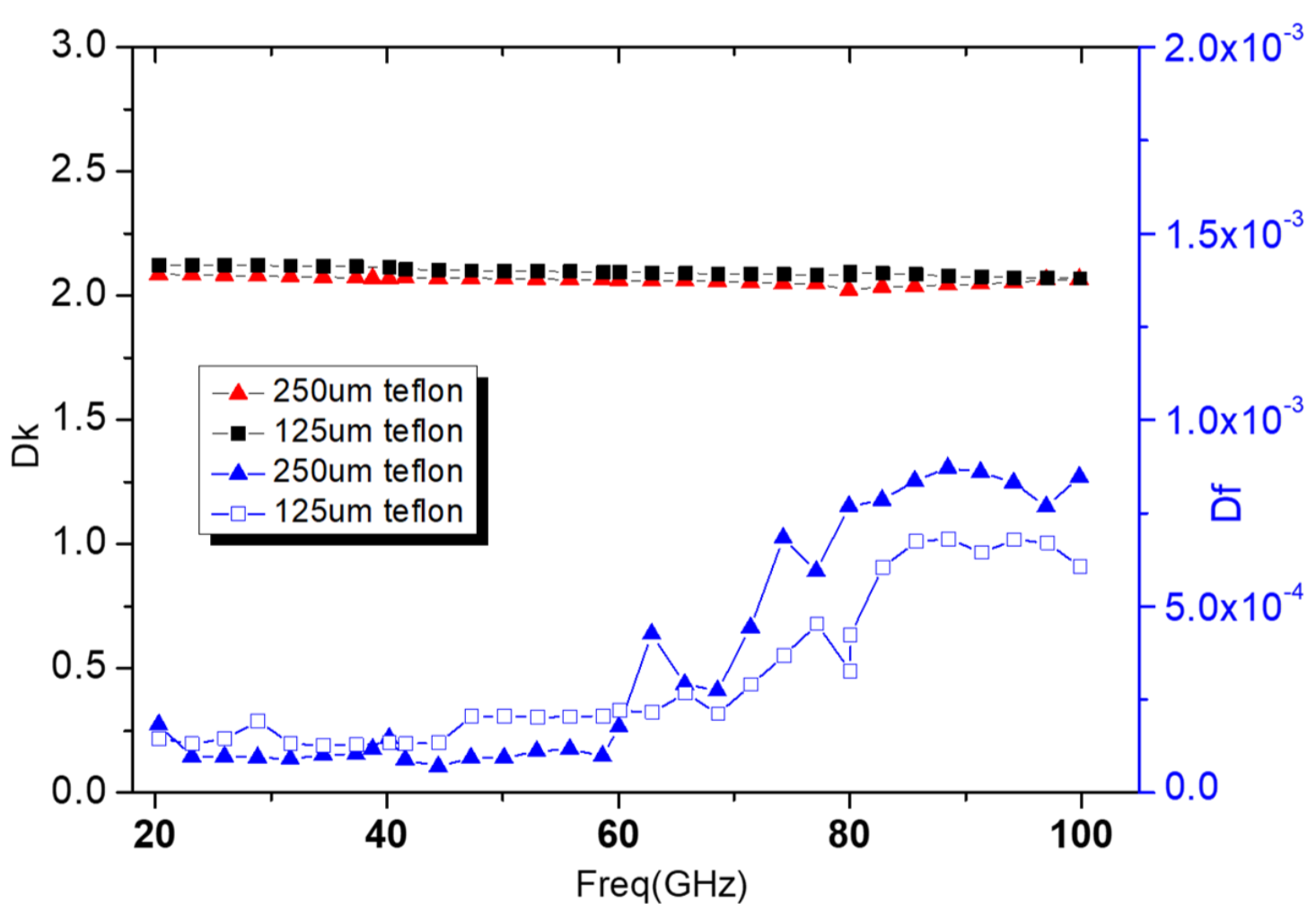
1. Cavity Q_{load} improved
 - Q 20,000 \rightarrow 100,000
 - Loss tangent (Df) Measured up to 10^{-6}
2. Low D_k Material Measurement
 - D_k Range 1~30
 - Area larger than 8cm x 8cm
3. Five Frequency Section Design
 - 20-40GHz; 40-60GHz; 60-80GHz
 - 80-100GHz and 88-105GHz
4. Friendly Software Interface and Automation
 - Automation
 - Fast to Fast Measurement
5. Diversity Material Measurement
 - PCB, Polymer Substrate
 - Ceramic, Oxide or Complex Materials

Product	Spec.
IOP-2040	F:20-40GHz; t = 10um~2mm
IOP-4060	F:40-60GHz; t = 10um~1mm
IOP-6080	F:60-80GHz; t = 10um~0.5mm
IOP-7088	F:80-100GHz; t = 10um~0.5mm
IOP-88105	F:88-105GHz; t = 10um~0.5mm
FOP-20100	F:20-105GHz; t = 10um~0.5mm
SOP-1001	F: Single Freq. For Design
Option	Thin Film; Automatic; High Q Design; Sample Holder

頻段	測試方法	樣品厚度	樣品尺寸
10GHz	SPDR	0.05~0.9mm	30*30 ~ 80*80mm
15GHz	SPDR	0.05~0.5mm	20*50 ~ 35*50mm
20-110GHz	Open Resonator	0.01~2mm	60*60 ~ 90*90mm

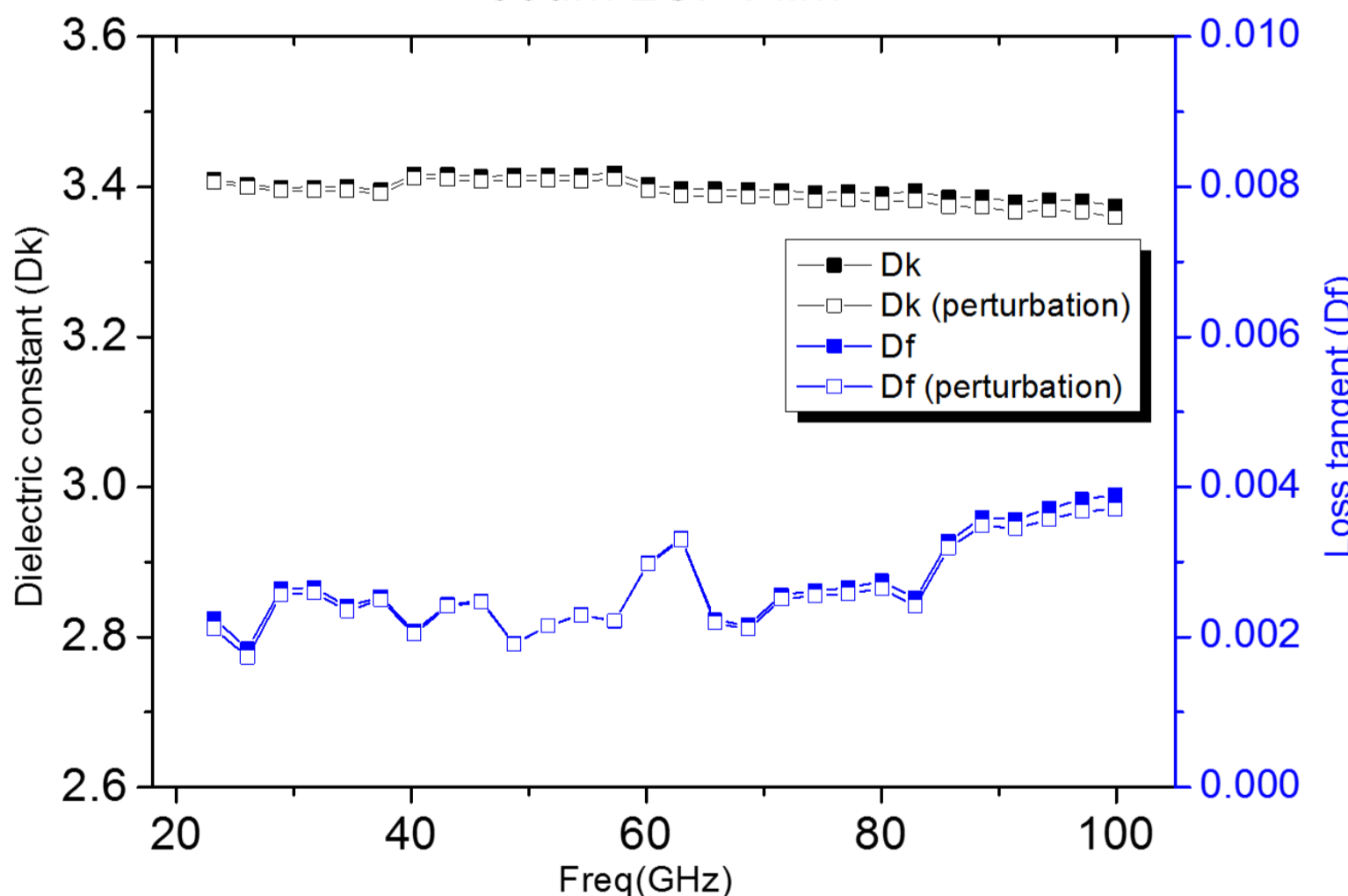
Testing result in 20GHz – 100GHz

250um and 125um teflon



Testing result in 20GHz – 100GHz

50um LCP Film

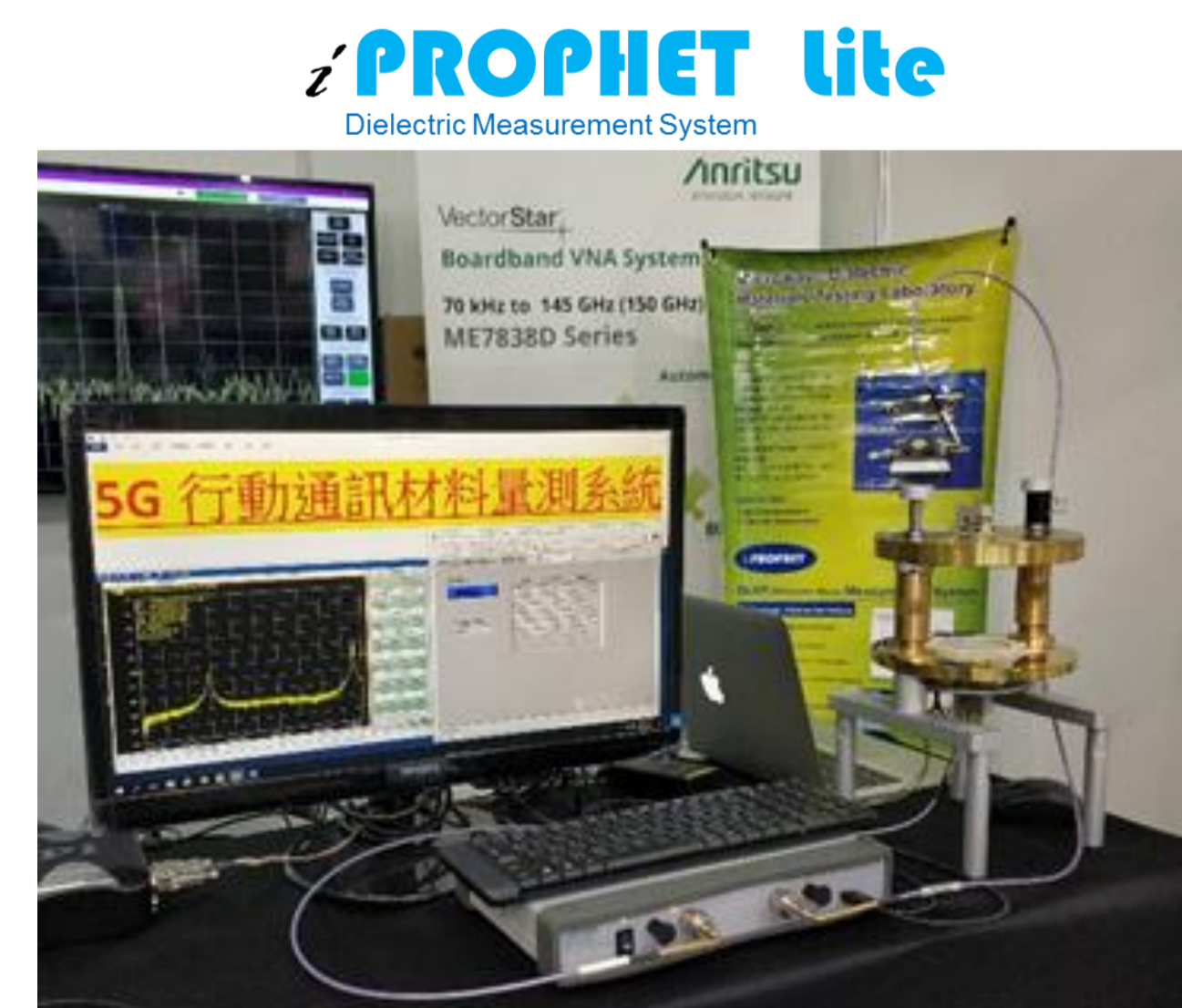


Uncertainty of System

teflon t = 250um		Uc	K	Expanded uncertainty U	Average	Extended relative uncertainty (%)
28GHz	Dk	0.00519	2	0.01037	2.077	0.499
	Df	0.02024	2	4.047E-05	6.183E-04	6.546
38GHz	Dk	0.00519	2	0.01037	2.070	0.501
	Df	0.01554	2	3.109E-05	5.009E-04	6.206
60GHz	Dk	0.00519	2	0.01038	2.053	0.505
	Df	0.01998	2	3.995E-05	5.500E-04	7.264
77GHz	Dk	0.00519	2	0.01039	2.033	0.511
	Df	0.01753	2	3.506E-05	5.340E-04	6.565
Quartz t = 200um		Uc	K	Expanded uncertainty U	Average	Extended relative uncertainty (%)
28GHz	Dk	0.00519	2	0.01038	4.418	0.235
	Df	0.01228	2	2.456E-05	9.976E-05	24.621
38GHz	Dk	0.00519	2	0.01037	4.415	0.235
	Df	0.01256	2	2.512E-05	1.131E-04	22.202
60GHz	Dk	0.00520	2	0.01040	4.415	0.235
	Df	0.01295	2	2.590E-05	1.539E-04	16.833
77GHz	Dk	0.00521	2	0.01043	4.432	0.235
	Df	0.01196	2	2.392E-05	4.075E-04	5.869

產業應用

毫米波材料量測系統可提供產業在開發新材料時之特性之驗證，測試內容可涵蓋產業包含PCB 基板材料、軟板、陶瓷基板、封裝材料等。並整合儀器商提供可涵蓋 28GHz、38GHz 頻段 之簡易版量測解決方案。



整合 **Anritsu MS46122B**
1MHz ~ 43.5GHz 16001點