



立積聯結您的生活- WiFi 6 & 6E

立積電子股份有限公司

2020/12/18

無線通訊豐富你我周遭環境

以前 _ (室內為主)



書房



辦公室

(*所有圖片取自網路)

未來 _ (由室內延伸至室外)



智慧燈控



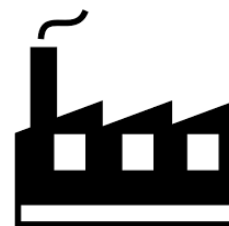
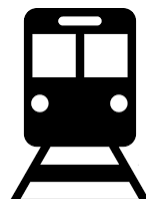
監控



智慧家電



娛樂系統



立積幫助提升無線產品

市場需求

對使用者

提供即時娛樂性
提供方便性
提供隱密性

對企業

幫助數據傳輸
幫助即時溝通
提供遠端自動控制

對社會

提供即時位置訊息
採集即時大數據
協助能源使用優化

相關無線產品

終端產品

手機裝置
筆記型電腦
智慧連網裝置

局端產品

商用級路由器
企業級路由器
用戶終端設備(CPE)

無線感測器

智慧家庭應用
智慧城市應用
智慧工廠應用

RichWave
RichWave Technology Corp.

抗雜訊干擾產品

表面聲波濾波器

- LTE 頻帶濾波器
- WiFi Co-Existence 濾波器

雙頻帶濾波器

增加發送距離

無線功率放大器(PA)

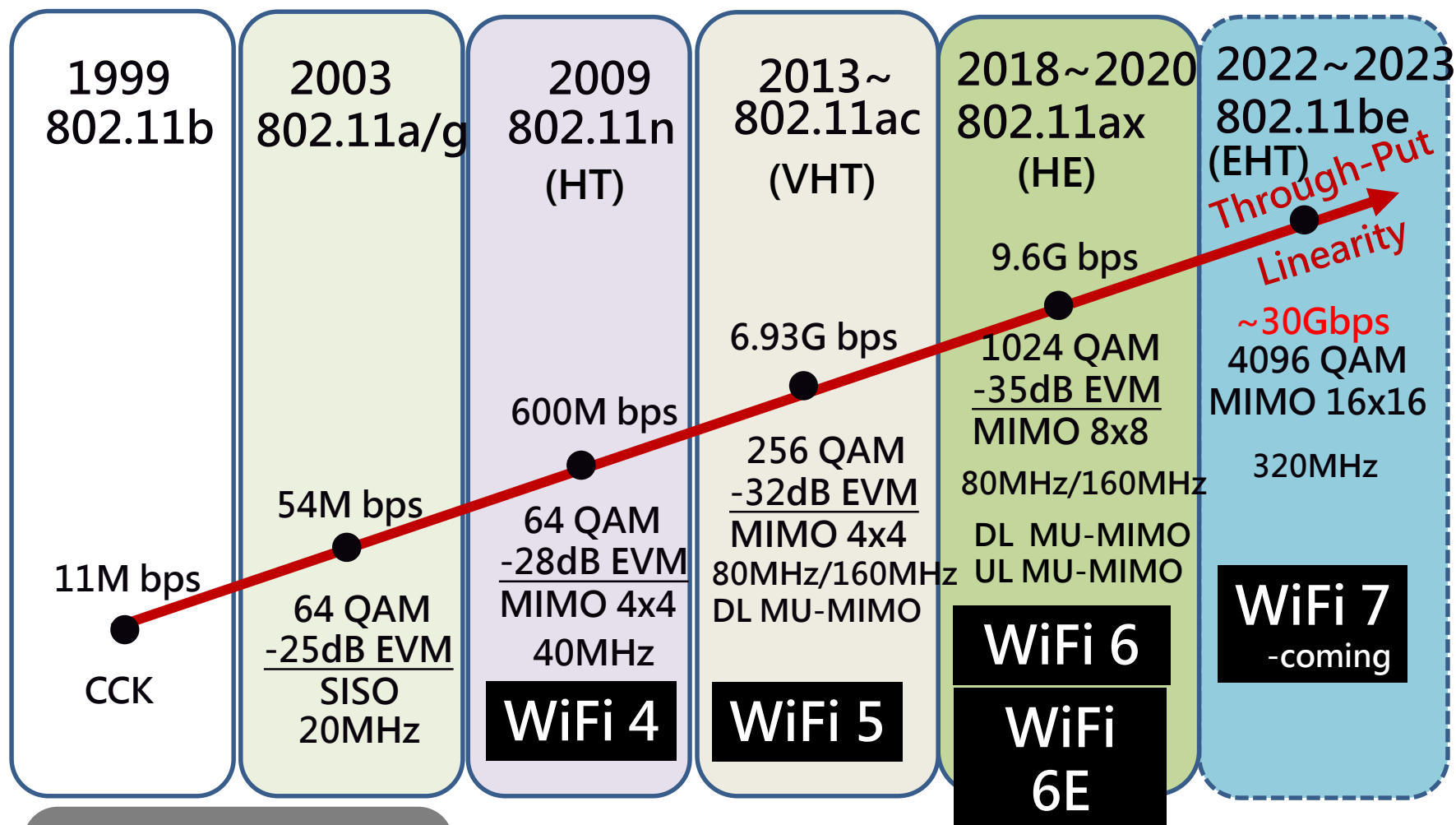
- 高功率/中功率放大器
- 高效率型放大器

提升接收範圍

低雜訊放大器(LNA)

- 低雜訊指數型
- 高增益指數型

立積為WIFI無線技術的前行者之一



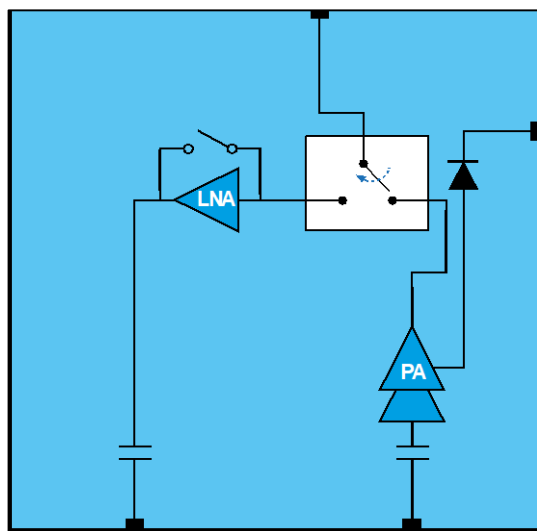
立積客戶的主要無線應用

路由器/個人終端產品(Cable電視盒,光纖數位盒等)

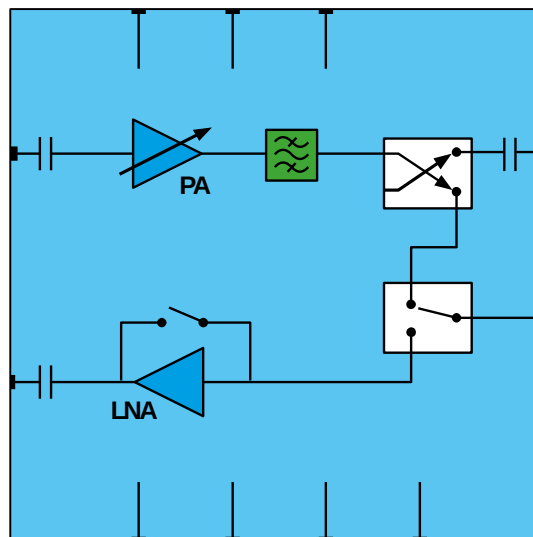
手持裝置/電腦/智慧無線裝置

WIFI 6E 新產品組合

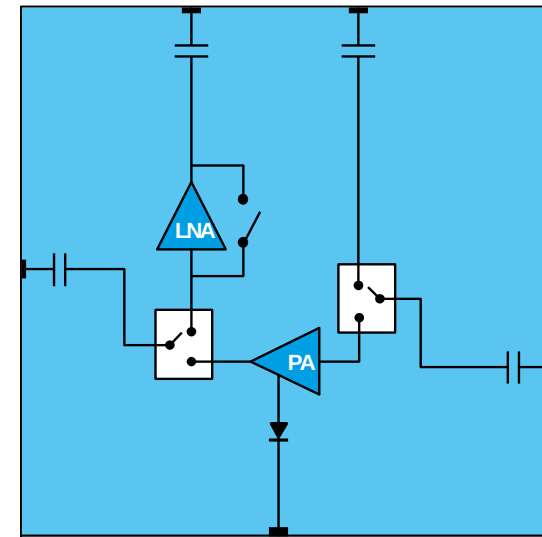
產品型號	產品	分類	試用產品	尺寸
RTC66903	WiFi 6E FEM (6GHz)	中高功率	路由器	3mmx3mm
RTC66910	WiFi 6/6E FEM (5-7GHz)	中功率 (支援功率回授)	手機/電腦	2mmx2mm
RTC66916	WiFi 6/6E FEM (5-7GHz)	中功率 (支援電壓回授)	手機/電腦	2mmx2mm



RTC66903



RTC66910

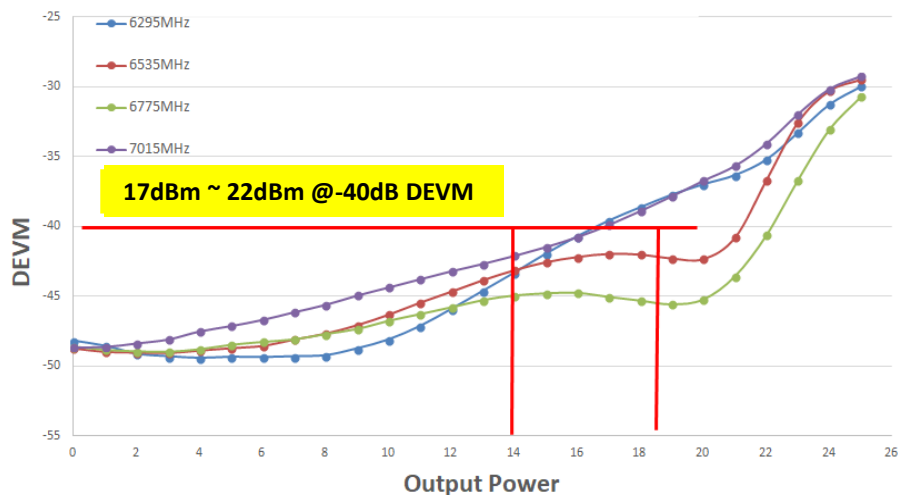


RTC66916

WiFi 6E 產品線性度及雜訊係數特性

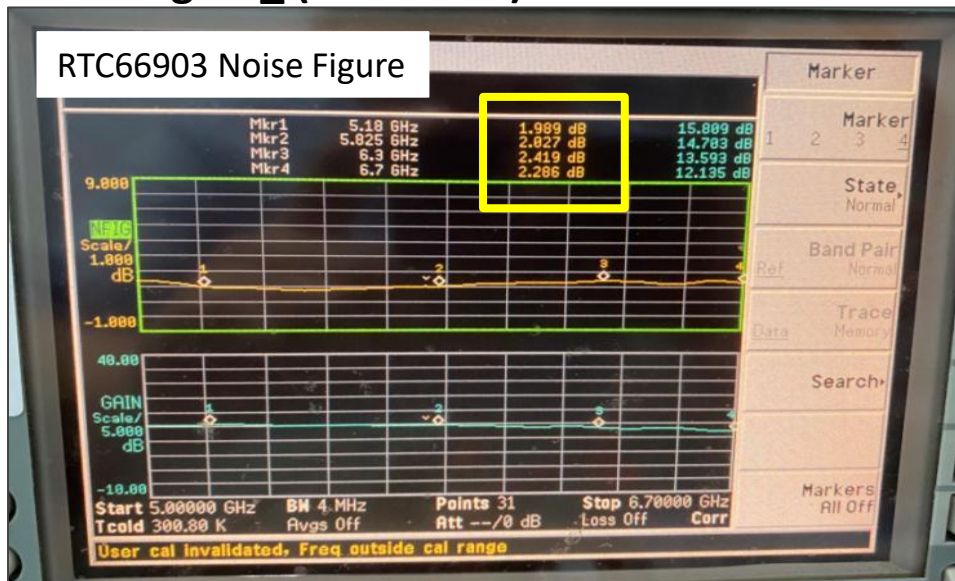
Output Power (6GHz)

RTC66903 MCS11 Pout vs DEVM



Noise Figure_ (1.8~2.0dB)

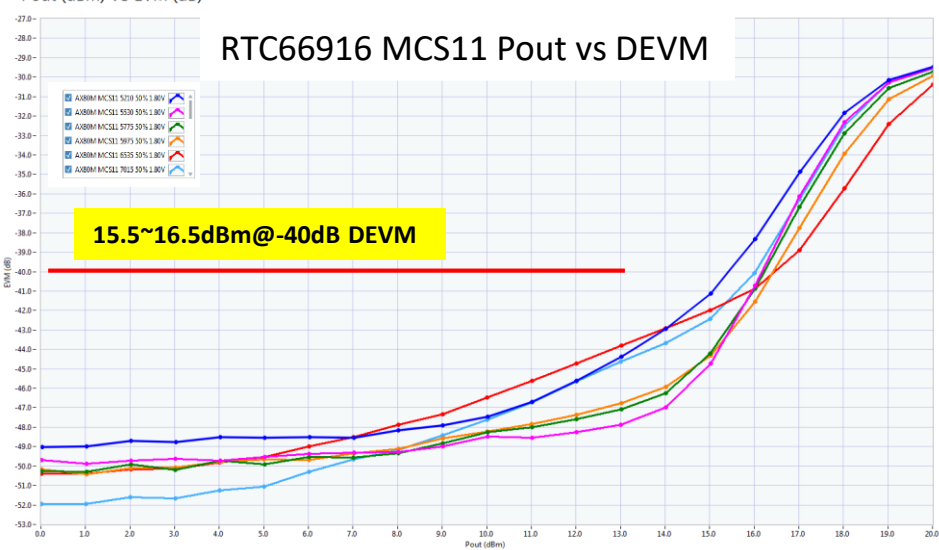
RTC66903 Noise Figure



Output Power (5- 7GHz)

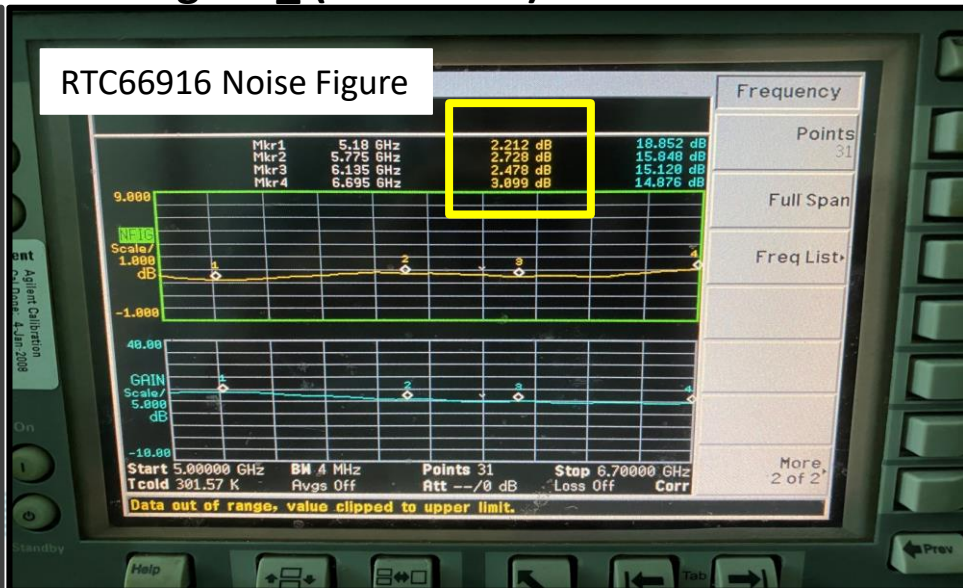
Pout (dBm) VS EVM (dB)

RTC66916 MCS11 Pout vs DEVM



Noise Figure_ (2.0~2.7dB)

RTC66916 Noise Figure



立積提供完整及多元的WIFI 6 無線元件

完整功率分類無線元件

- 在高速率情況下_可提供18dBm/20dBm/>21.5dBm

提供高雜訊抑制度的特性

- 無論2.4GHz or 5G, 雜訊係數可小於 < 2dB

供應高效率無線元件

- 高線性射頻元件with <1W per chain
- 非線性射頻元件用以支援DPD 功能

提供高整合度及各種封裝尺寸

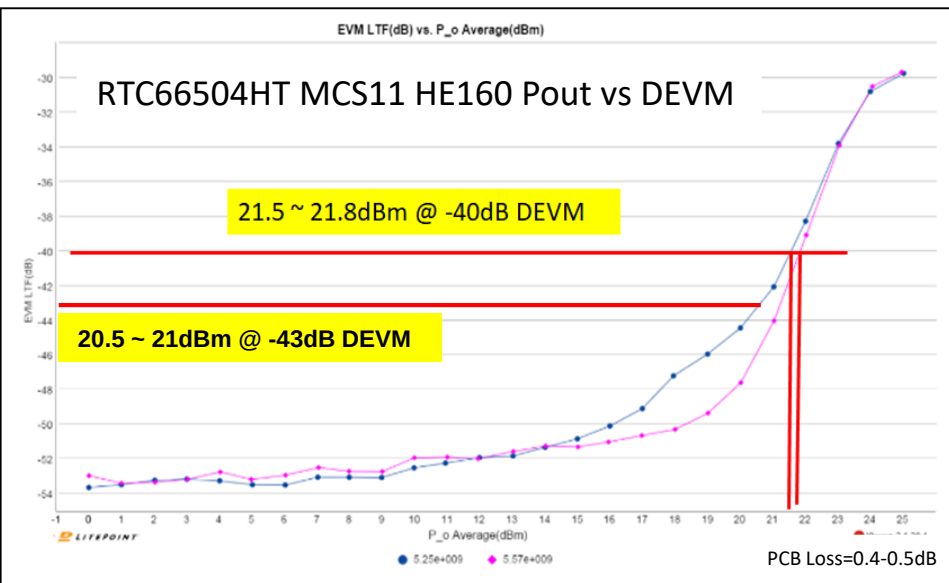
- 從 3.0x3.0mm 到 2.0x1.7mm 的封裝

支援各無線晶片廠的回授需求

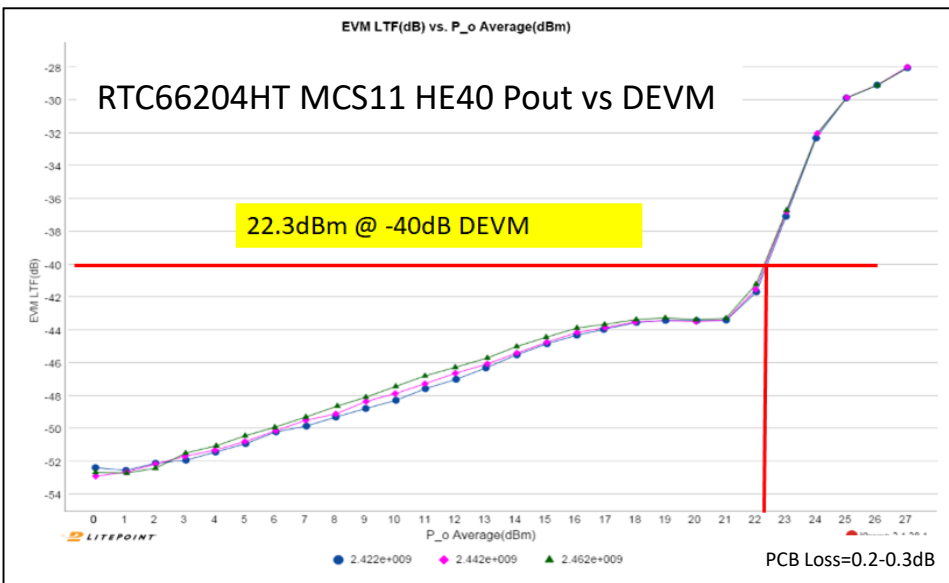
- 無線功率訊號回授/ 電壓回授 / 指數型電壓回授

提供完整輸出功率的無線元件(高功率組)

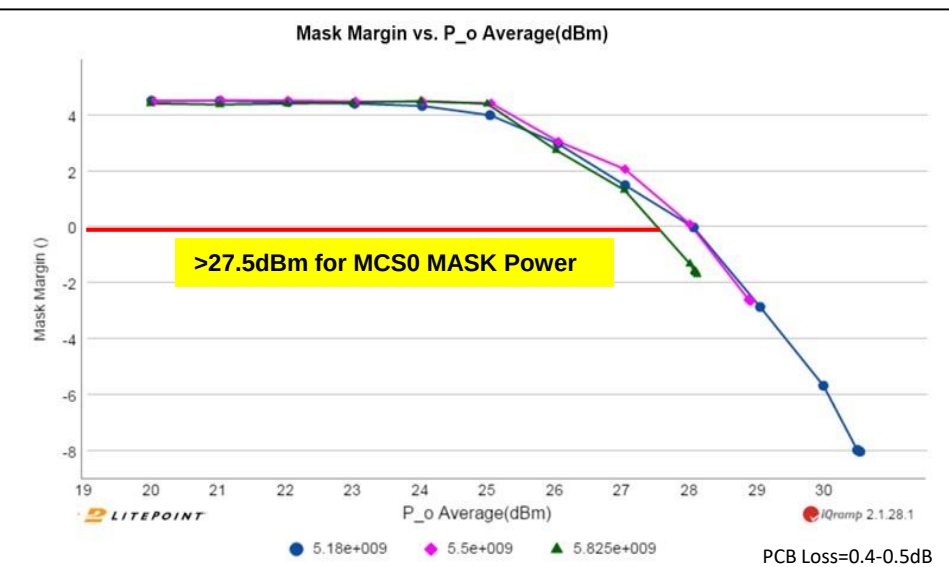
High Output Power_ (5GHz)



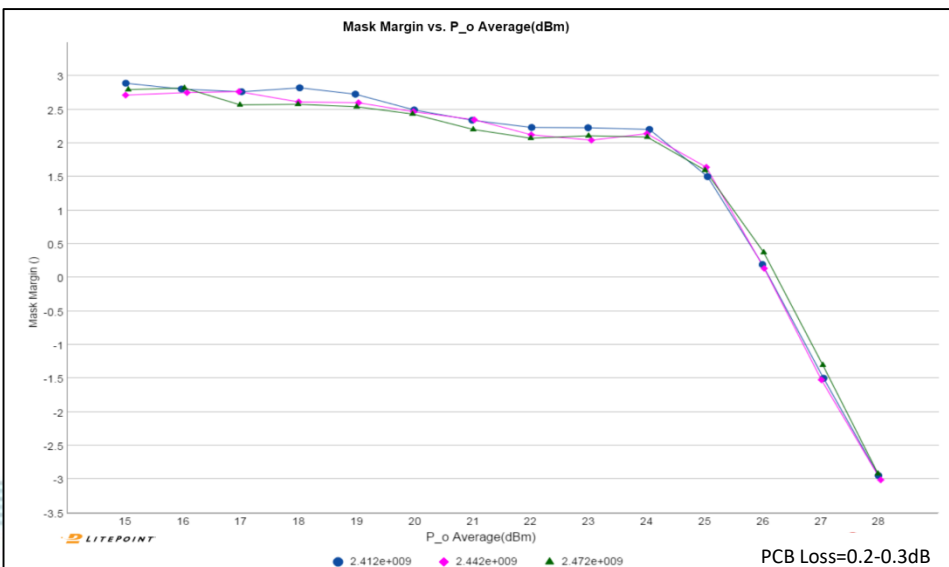
High Output Power_ (2.4GHz)



RTC66504HT MCS0 Mask Compliance Power

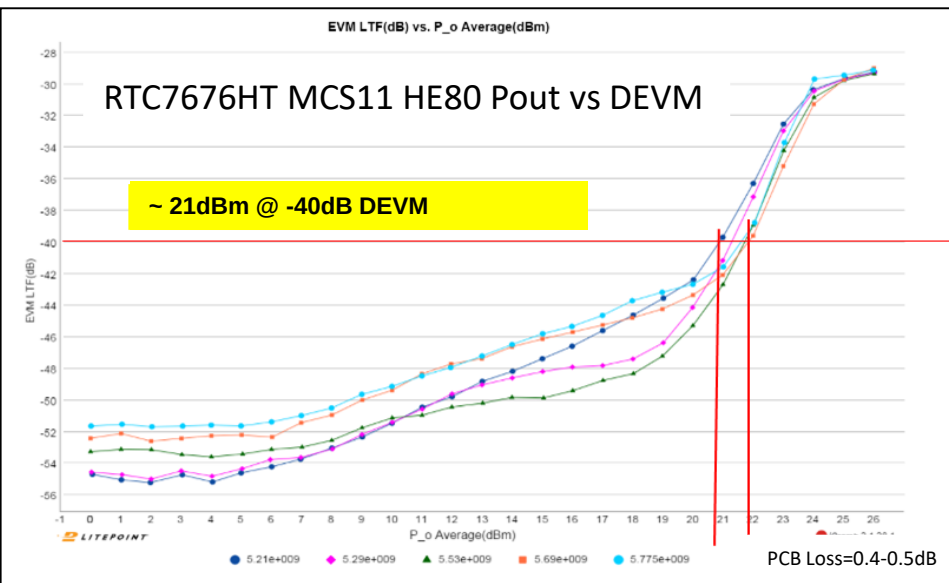


RTC66204HT MCS0 Mask Compliance Power

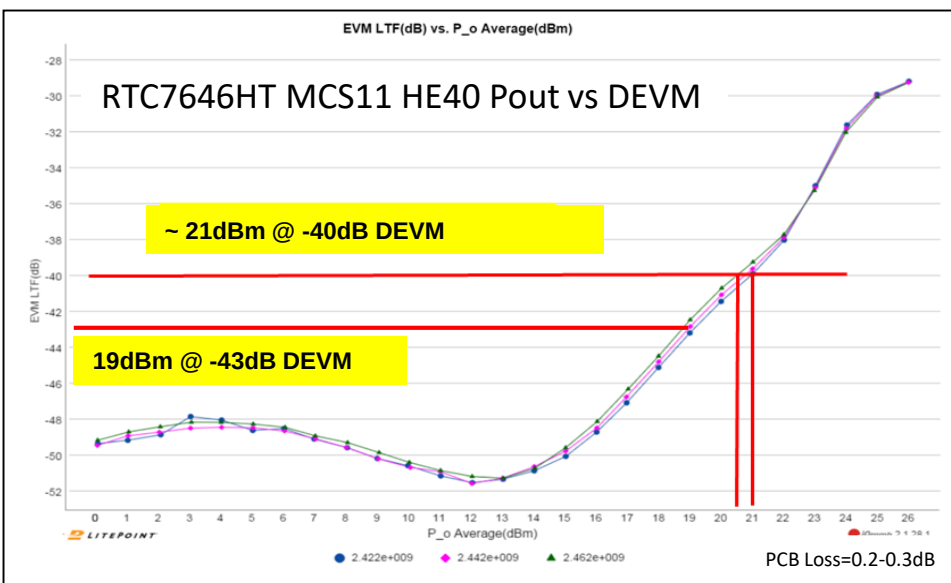


提供完整輸出功率的無線元件(中高功率組)

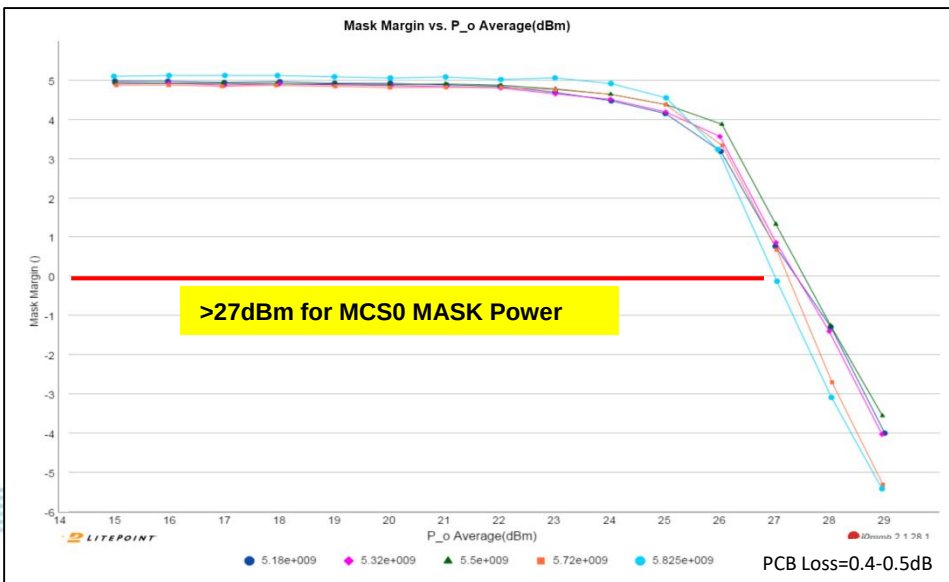
Middle High Output Power _ (5GHz)



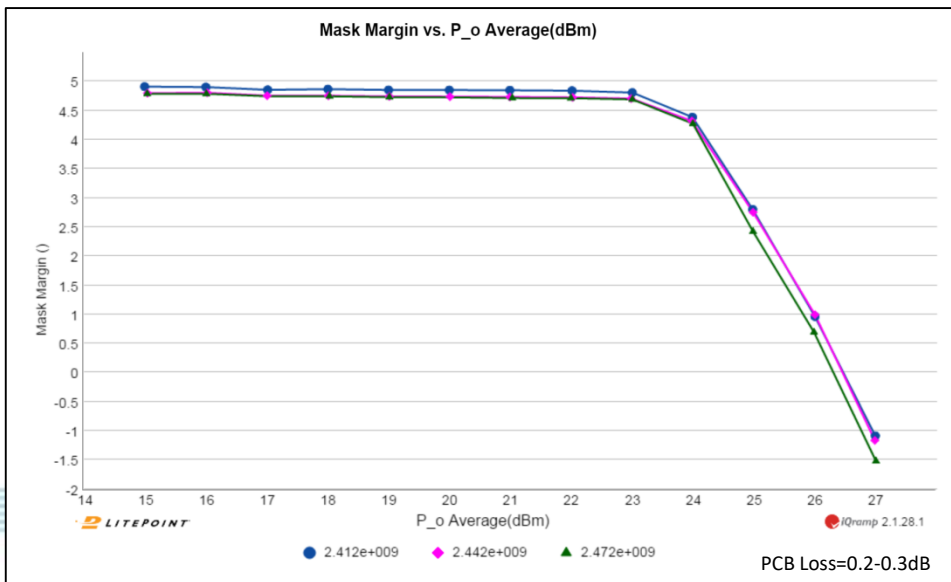
Middle High Output Power _ (2.4GHz)



RTC7676HT MCS0 Mask Compliance Power



RTC7646HT MCS0 Mask Compliance Power



提升整體的產品接收能力

5GHz Solutions

1.6~1.8dB

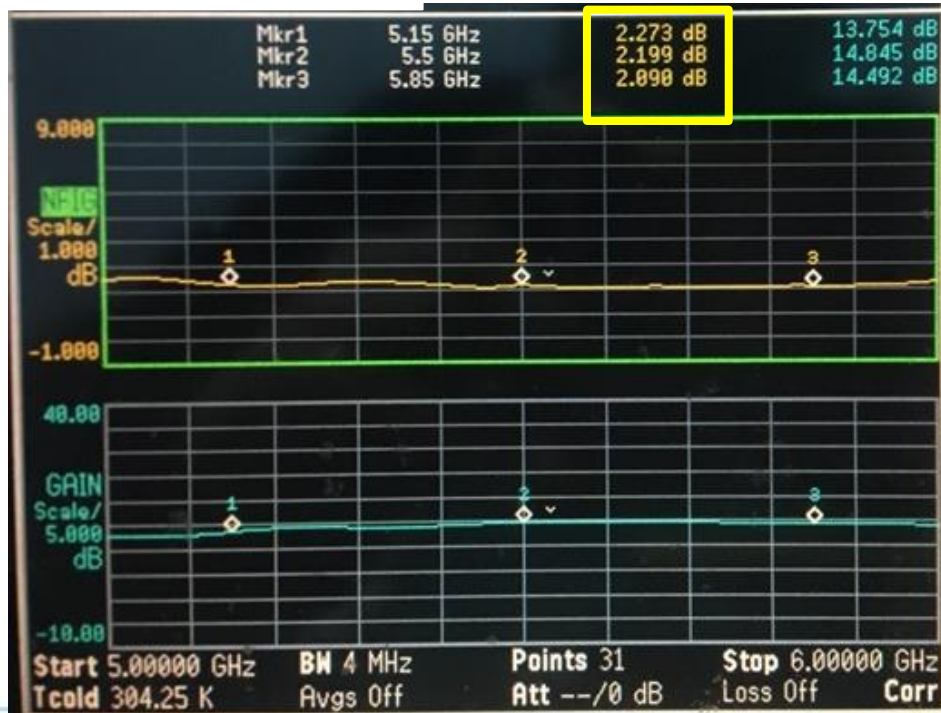
2.4GHz Solution

1.65~1.75dB

(Remark: De-embedded EVB Loss 0.2~0.3dB for 2.4GHz/ 0.4~0.5dB for 2.5dB)

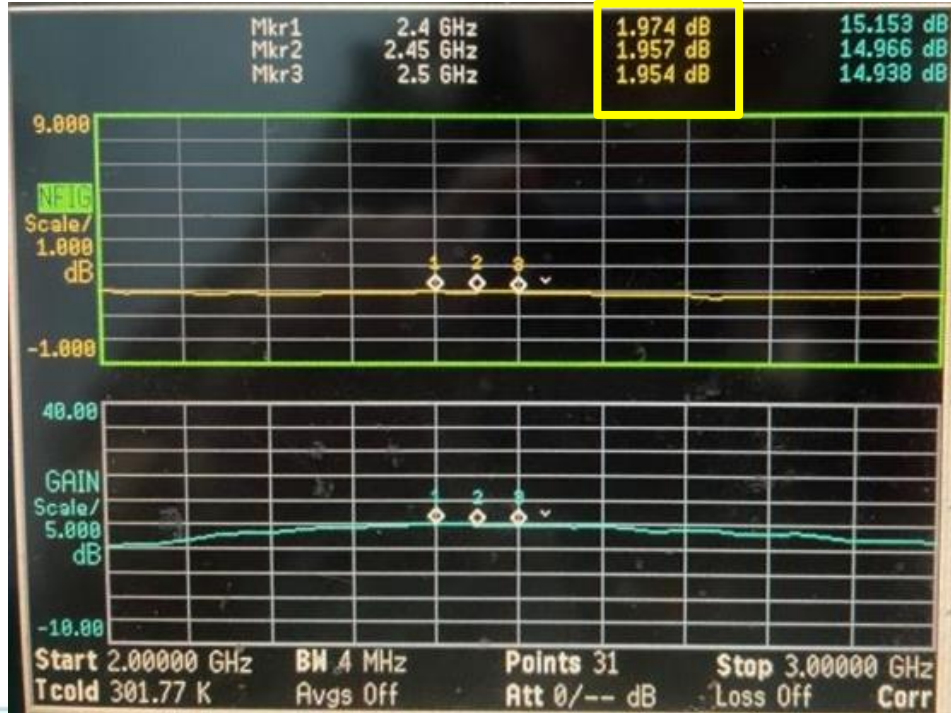
Low Noise Figure_ (5GHz)

RTC66569 Noise Figure



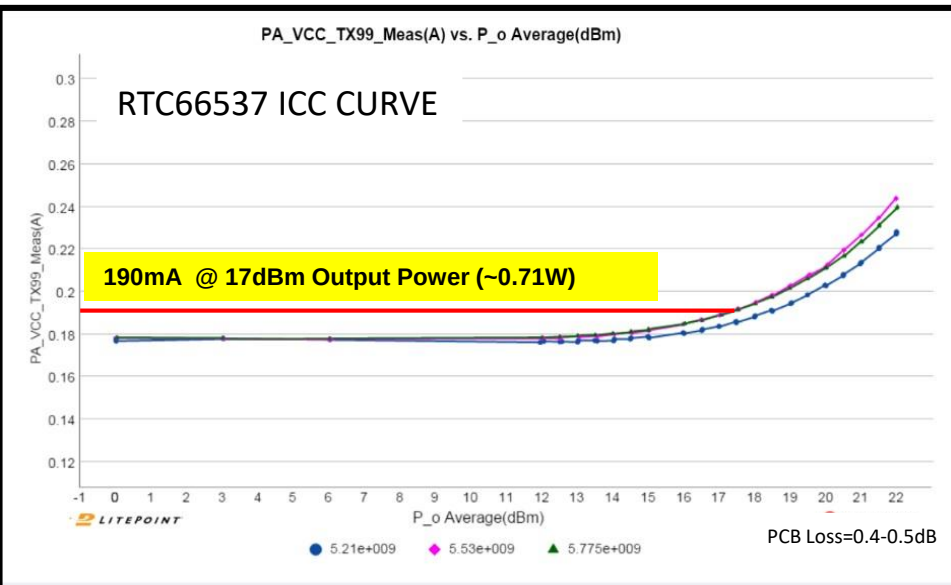
Low Noise Figure_ (2.4GHz)

RTC66266 Noise Figure

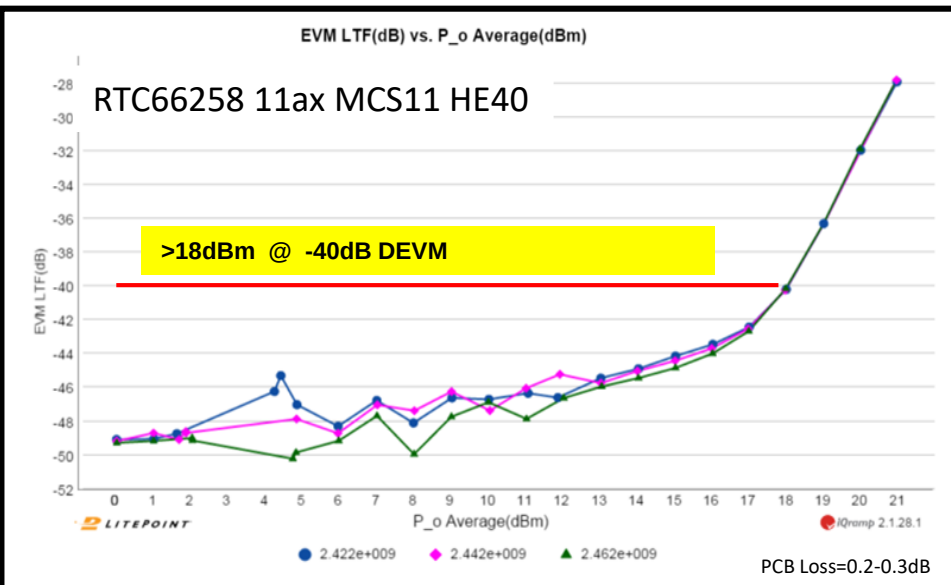
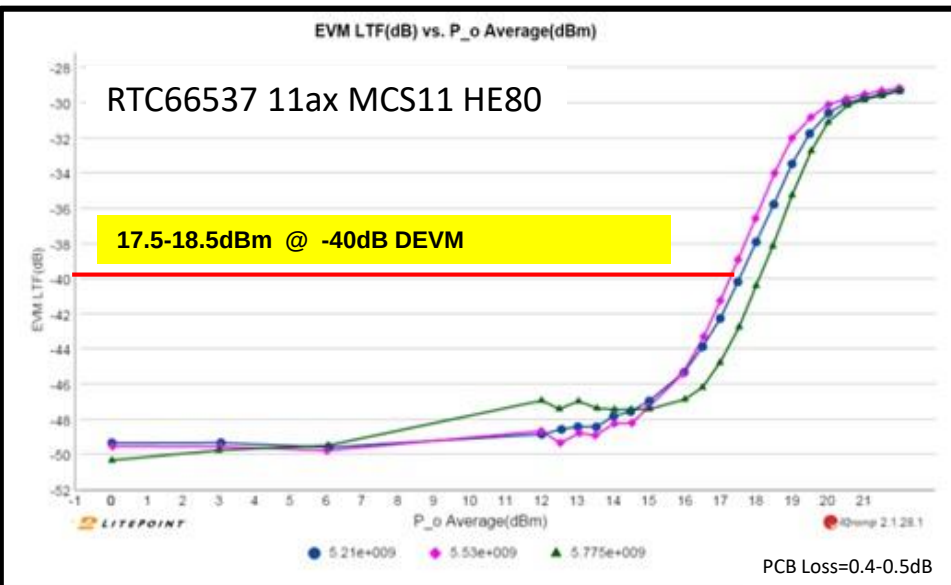
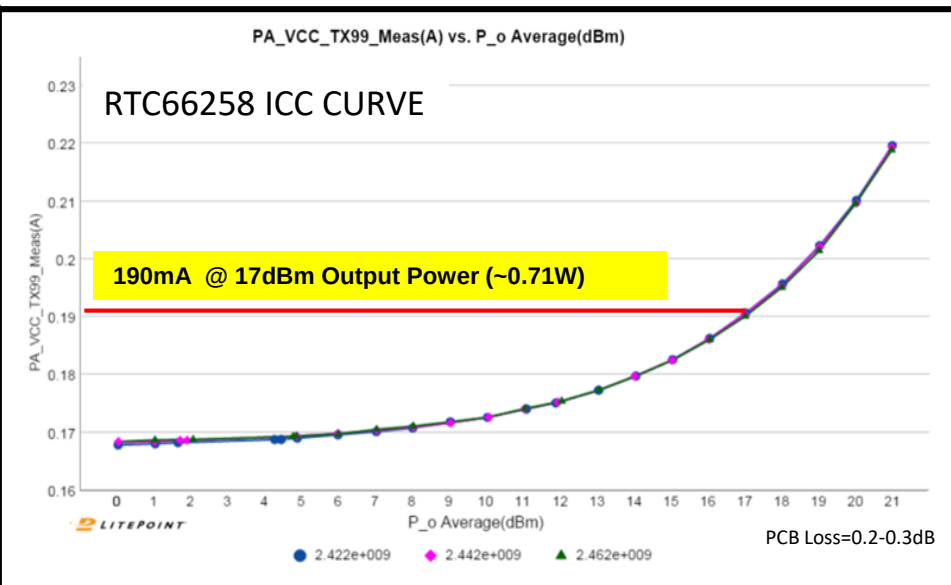


提供高效率型前端無線元件

Linear Solution _ (5GHz)



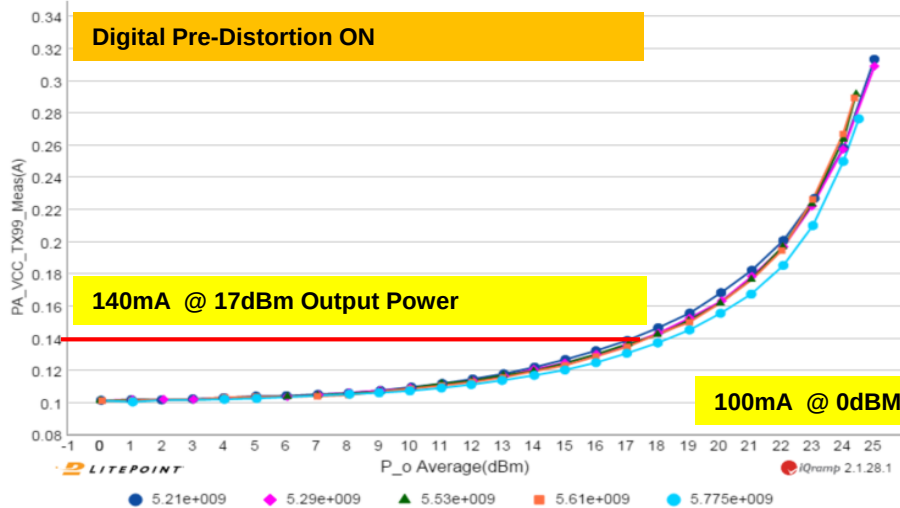
Linear Solution _ (2.4GHz)



提供高效率型前端無線元件

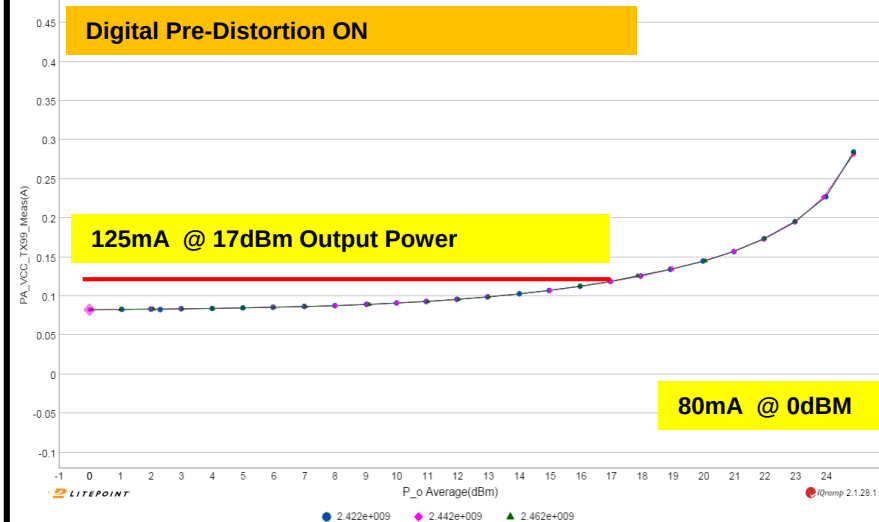
NonLinear Solution _ (5GHz)

PA_VCC_TX99_Meas(A) vs. P_o Average(dBm)

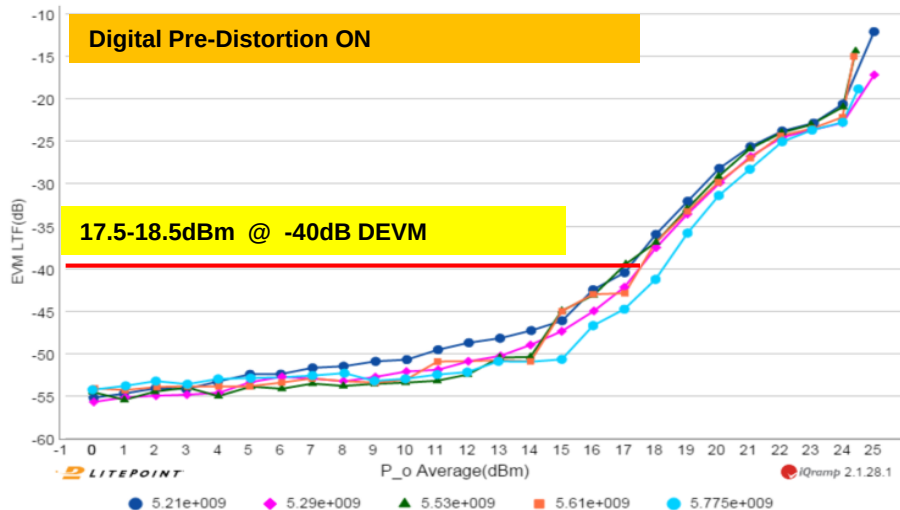


NonLinear Solution _ (2.4GHz)

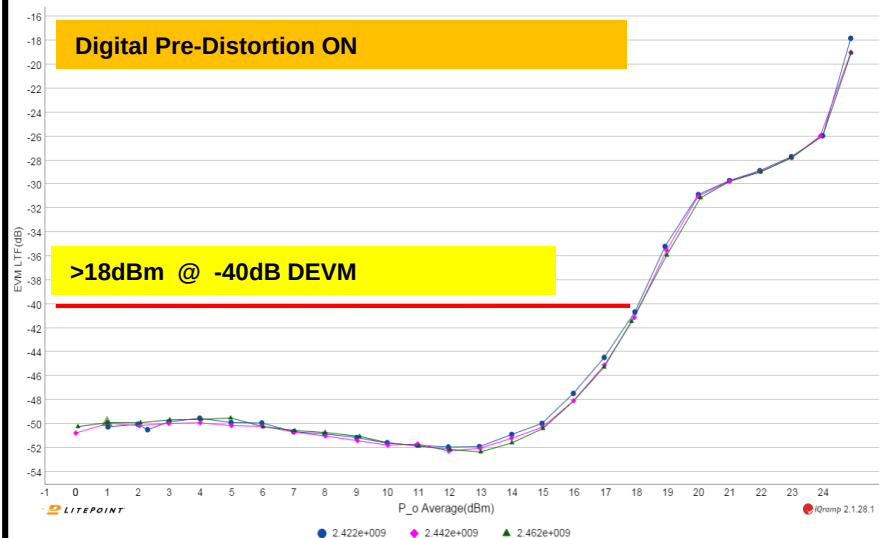
PA_VCC_TX99_Meas(A) vs. P_o Average(dBm)



EVM LTF(dB) vs. P_o Average(dBm)



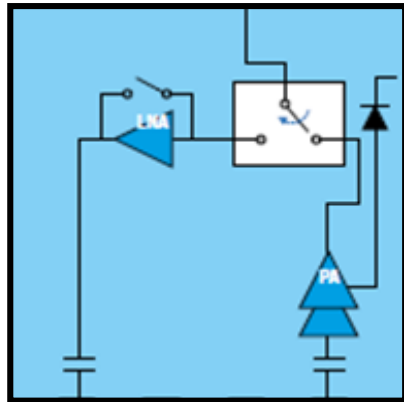
EVM LTF(dB) vs. P_o Average(dBm)



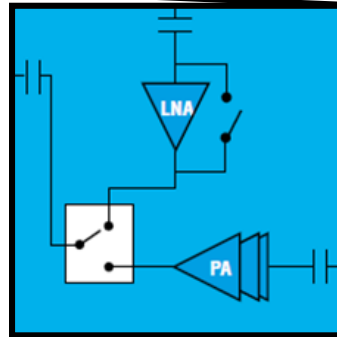
供應各種封裝尺寸

Single FEM

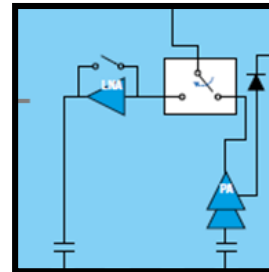
3.0 x 3.0 mm



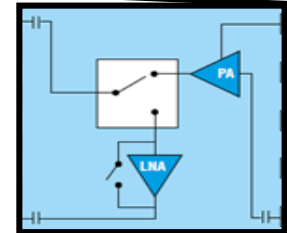
2.5. x 2.5 mm



2.0 x 2.0 mm

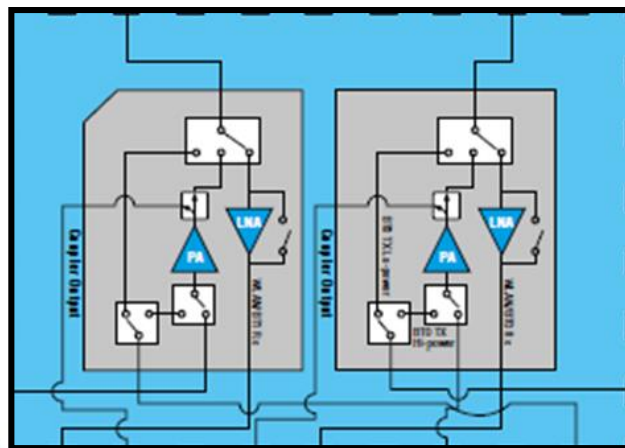


2.0 x 1.7 mm

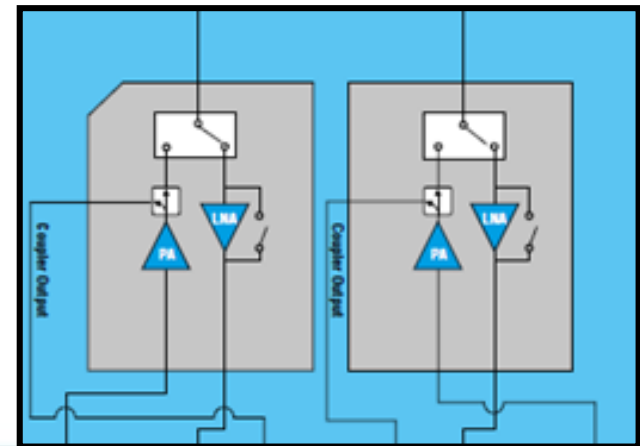


Dual FEM

(2.4GHz Dual-FEM) 3.0 x 4.0 mm



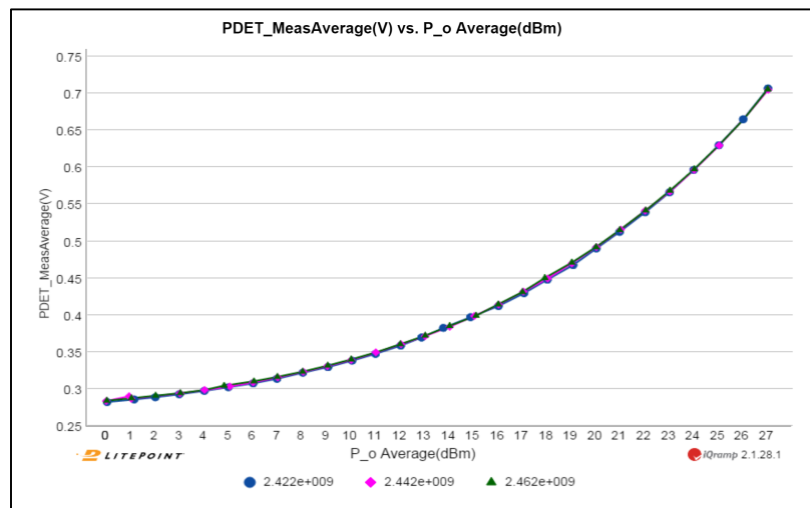
(5GHz Dual-FEM) 3.0 x 4.0 mm



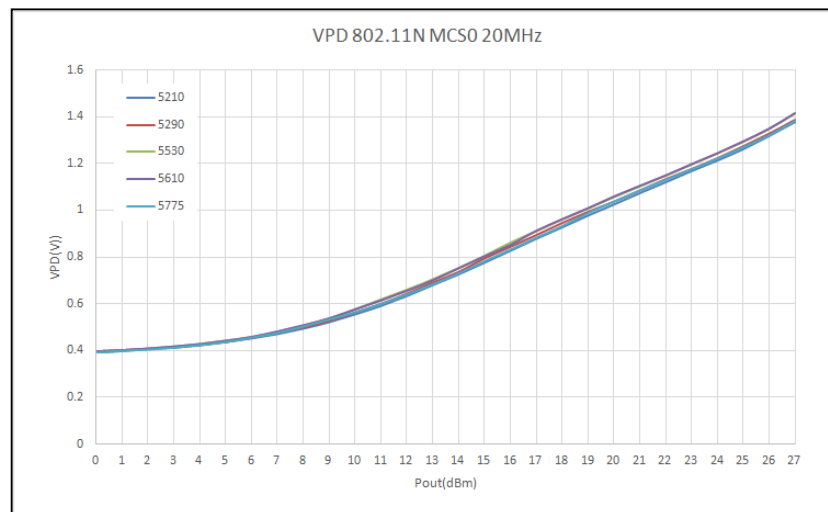
支援多種回授方式 可搭配相關無線晶片需求

Voltage Detector Feedback

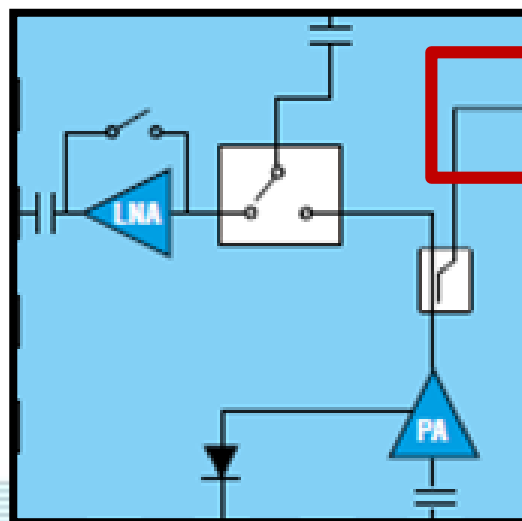
Diode Exponential Curve



Log Linear Type Curve



RF Power Detector Feedback

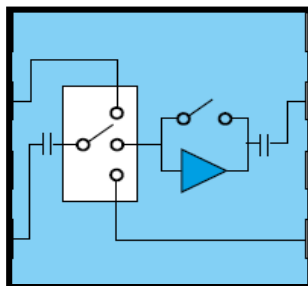


RF Signal
Feedback Output

Chipset

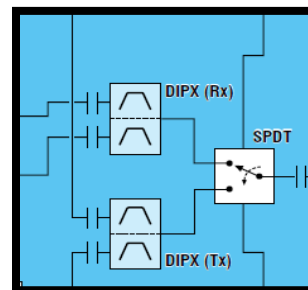
立積提供完整的射頻前端產品組合

Rx-FEM



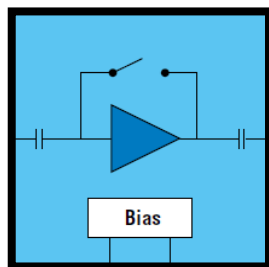
- LNA + SW only
- WiFi 4/5/6/6E
- QFN or WLCSP

Dual Passive FEM



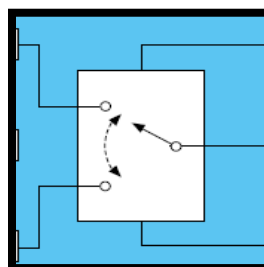
- Diplexer + SW
- Support 2.4+5GHz
- QFN Package

LNA



- Bypass Support
- 2.4/5/6GHz
- QFN Package

Switch



- High/Normal PWR Handling
- 2.4/5/6GHz
- QFN or WLCSP

SAW Filter



- Reject LTE
- WiFi 2.4GHz
- QFN Package

最大化客戶滿意度及價值

完整的研發團隊

RF Circuit Design

Transceiver Design

Analogue Circuit Design

Digital Circuit Design

Thermal Analysis

嚴謹的製造商及品質管理

Product Engineering

Testing Engineering

Quality Analysis

Manufacture Control

全球的在地即時技術服務

Taiwan- Taipei (HQ)

US- San Jose

China- Shanghai, Shenzhen

Korea- Gyeonggi-do

European Sales Rep.

Japan Sales Rep.

建造完整的客戶價值



RichWave



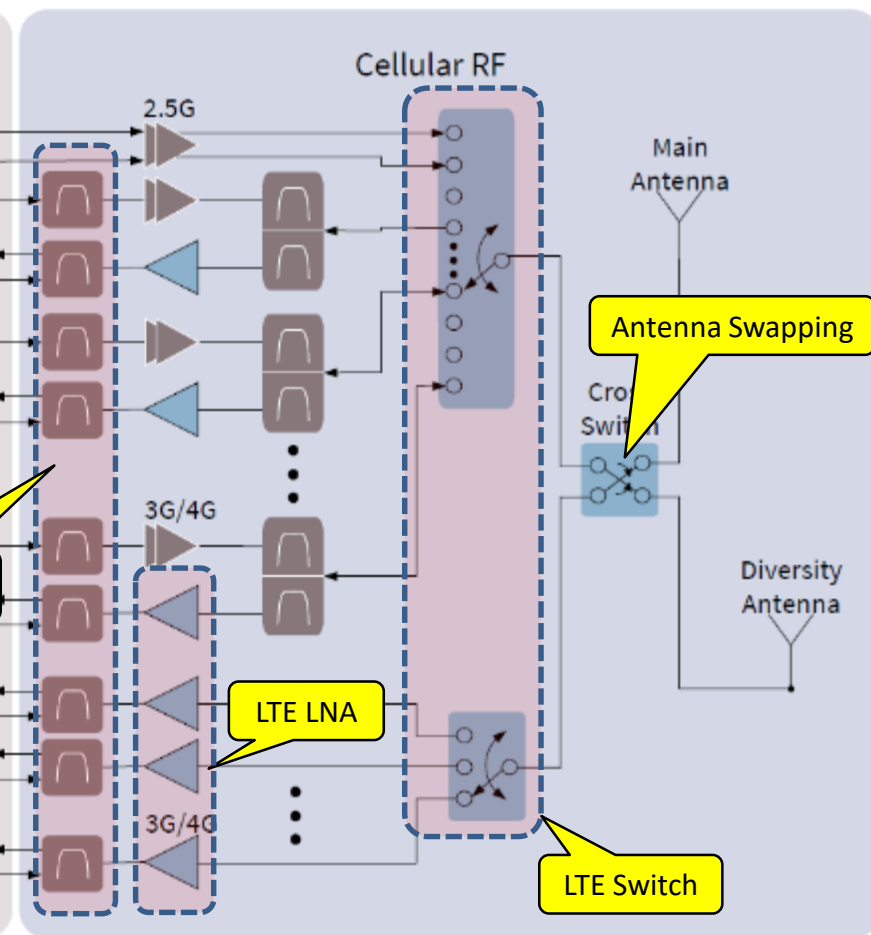
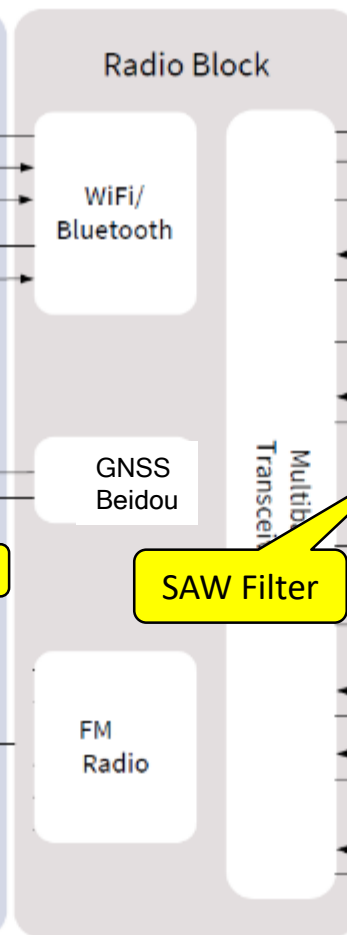
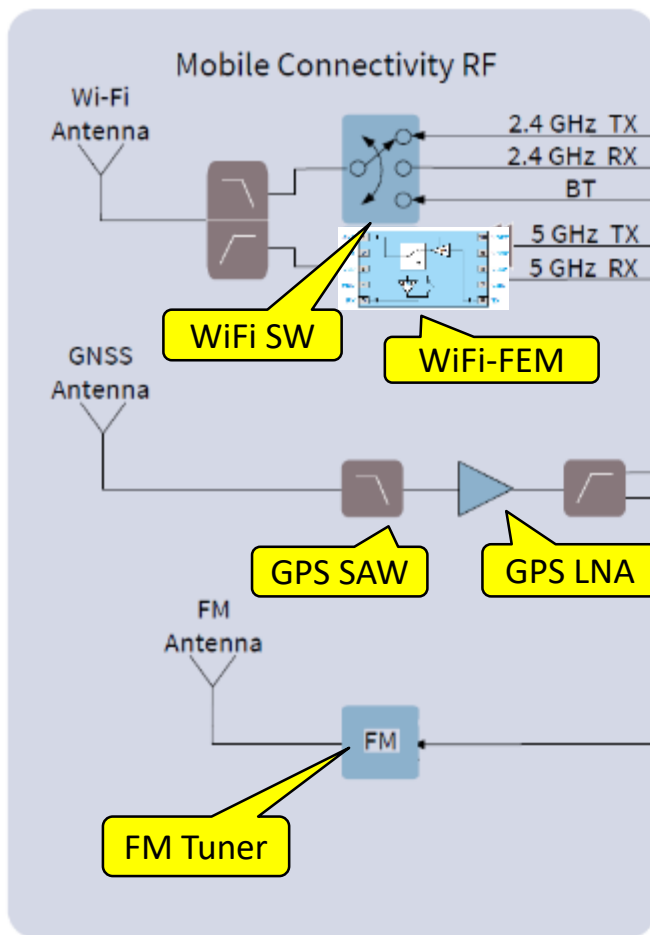
立積5G射頻元件的方向及展望

立積電子股份有限公司

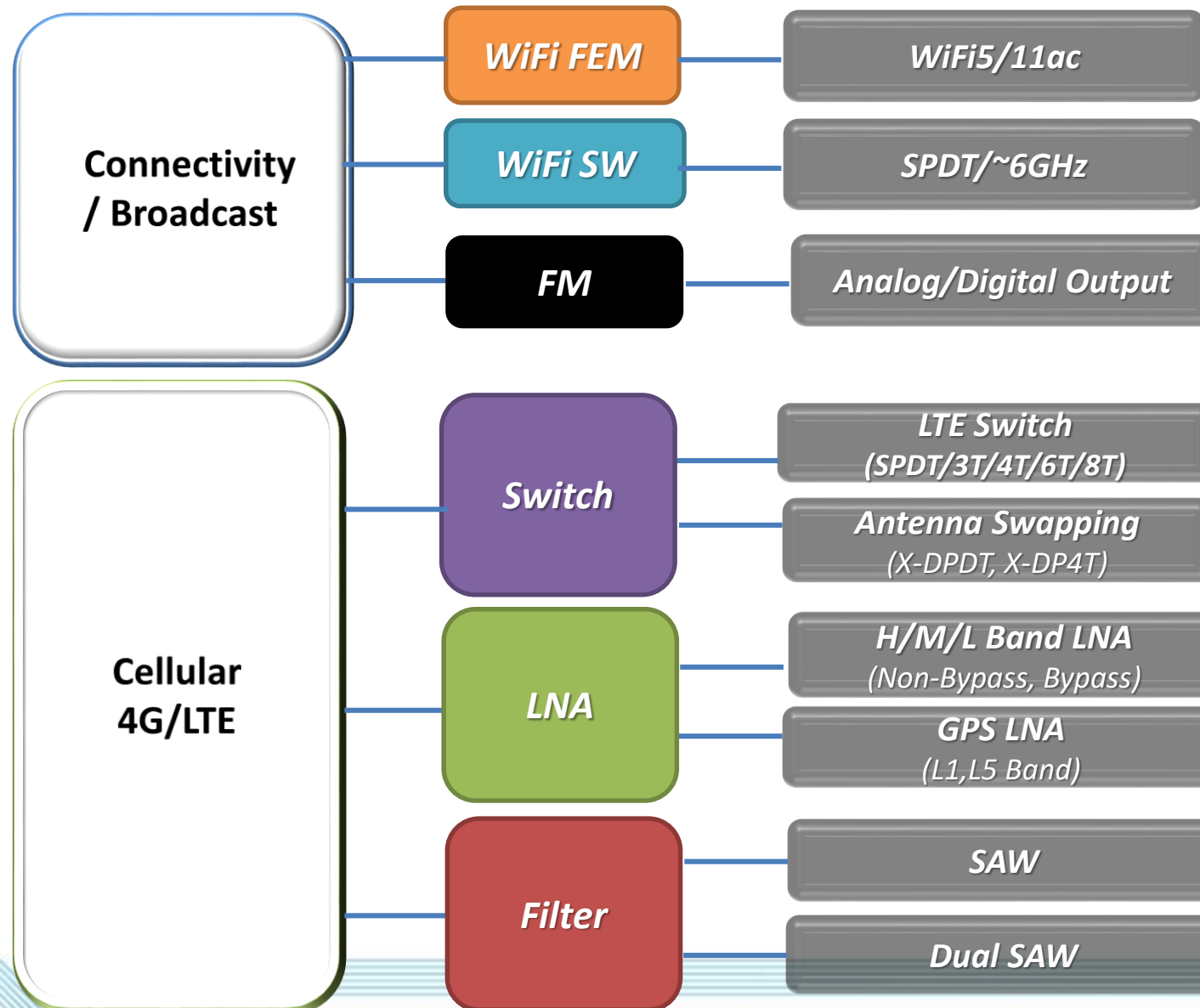
2020/12/18

立積產品在4G手機上的應用

連接/ 廣播



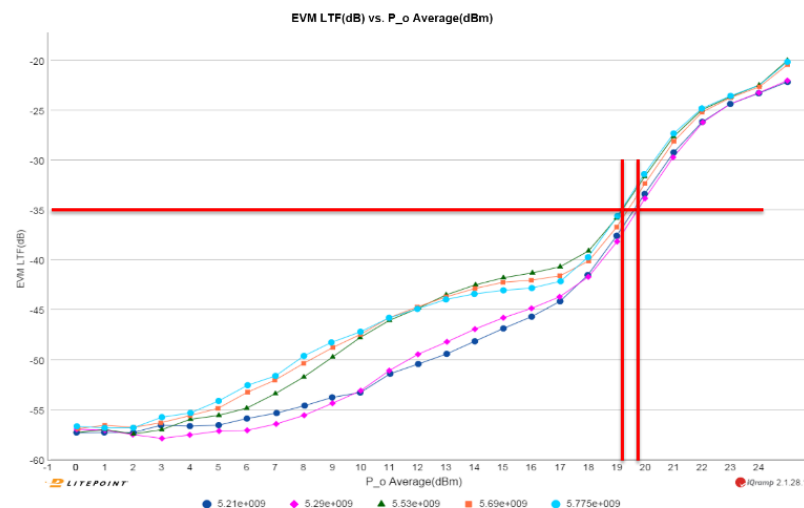
立積4G手機產品線



WiFi 11ac前端模組產品線

11ac MCS9 VHT80 DEVM@-35dB=19.1~19.8dBm

- 完整支持高通&聯發科11ac平台
- 優異線性度:
 - 2G: 20dBm@11ac,MCS9/DEVM=-35dB
 - 5G: 19dBm@11ac,MCS9/DEVM=-35dB
- 市場最小封裝尺寸:
 - 2G:QFN 2.0*2.0 / 5G:QFN 2*1.7

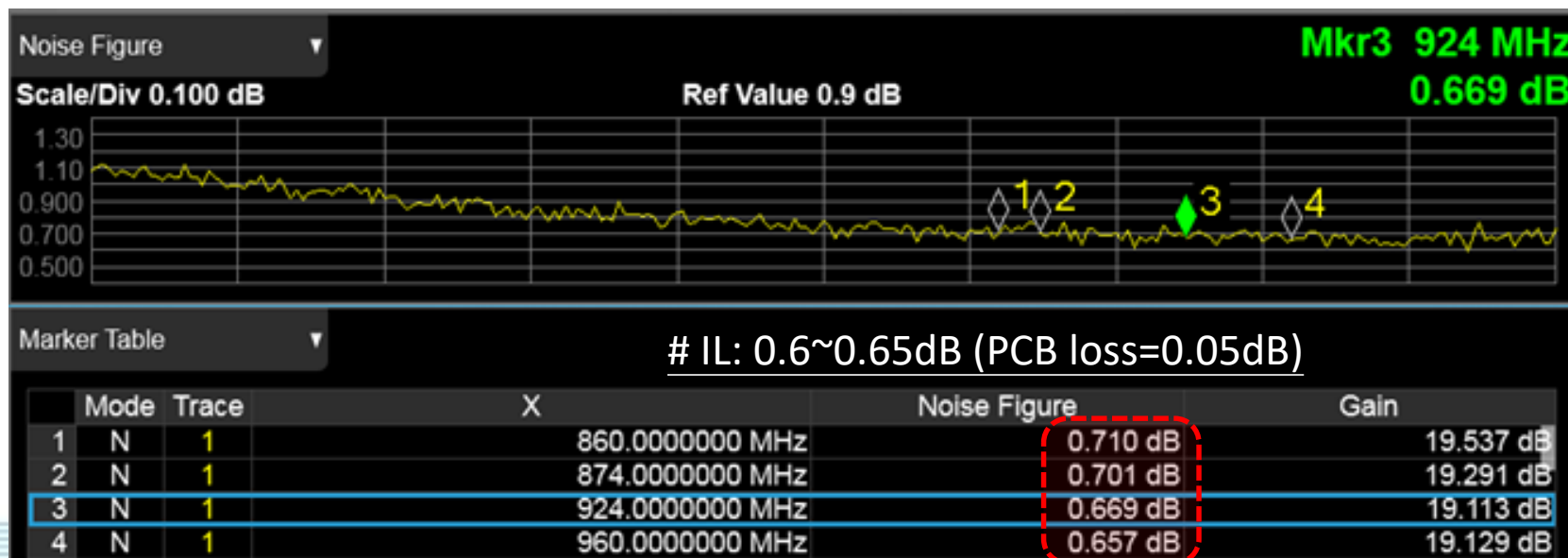


料號	特色	平台
RTC7667	2G FEM (QFN2.3*2.3)	QCOM
RTC7637S	5G FEM (QFN2.3*2.3)	
RTC7682	2G FEM (QFN 2.0*2.0)	
RTC7639	5G FEM (QFN 2.0*1.7)	
RTC66526	RX FEM (QFN 1.5*1.5)	MTK
RTC66202	2G FEM (QFN2.3*2.3)	
RTC7637S	5G FEM (QFN2.3*2.3)	
RTC7639	5G FEM (QFN 2.0*1.7)	

4G 低雜訊放大器產品線

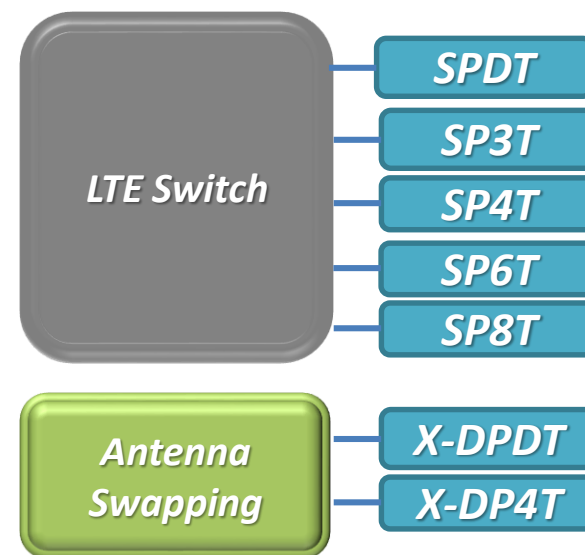
- 支持低供應電壓: : 1.8V/2.8V
- 支持4G全頻段: 617~2690MHz
- 優異的雜訊指數: 0.6~0.65dB
- 小型封裝: QFN 1.1*0.7

增益	支援頻段	特色	封裝
13/15/18dB	低/中/高頻	Bypass & Non-Bypass Mode	QFN 1.1*0.7



4G 開關產品線

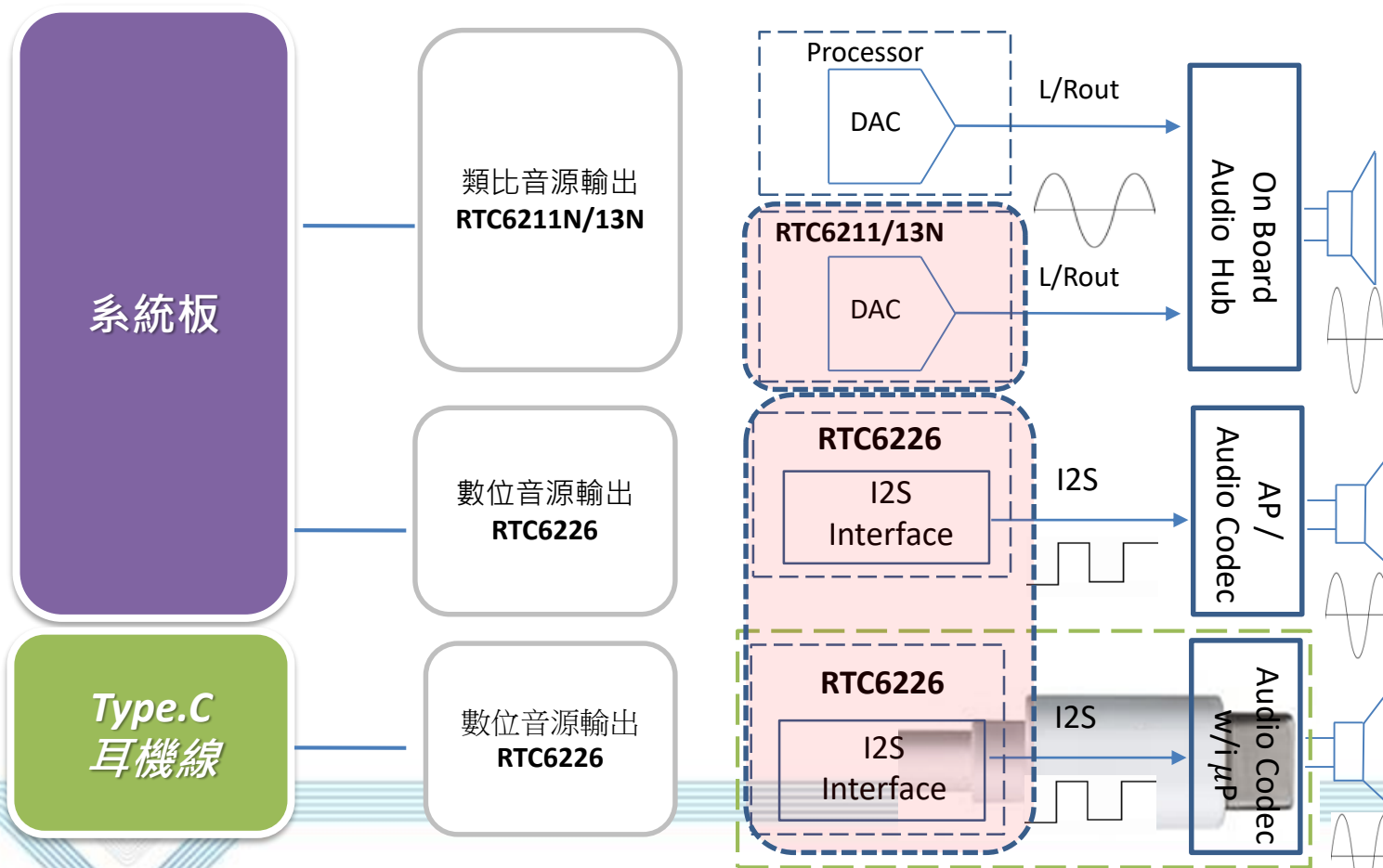
- 針對高通&聯發科之通用開關用料
- 支持4G全頻段: 617~2690MHz
- 低差損
- 高0.1dB功率壓縮點: 38dBm



特色	差損 (dB)	隔離度 (dB)	0.1dB功率壓縮點 (dBm)	封裝 (mm, typ)
SPDT	0.20 @1.0 GHz 0.24 @2.7 GHz 0.37 @ 6.0 GHz 0.60 @ 7.125 GHz	39 @1.0 GHz 28 @2.7 GHz 19 @ 6.0 GHz 15 @ 7.125 GHz	32	6L QFN 1.1x0.7x0.50
SP8T	0.45 @1.0 GHz 0.75 @2.7 GHz	33 @1.0 GHz 23 @2.7 GHz	36	14L QFN 2.0x2.0x0.55
X-DP4T	0.16 @1.0 GHz 0.32 @2.7 GHz	27 @1.0 GHz 26 @2.7 GHz	30	10L QFN 1.2x1.6x0.55
X-DPDT	0.31 @1.0 GHz 0.41 @2.7 GHz	28 @1.0 GHz 20 @2.7 GHz	38	12L QFN 2.0x2.0x0.55

FM產品線在手機端應用

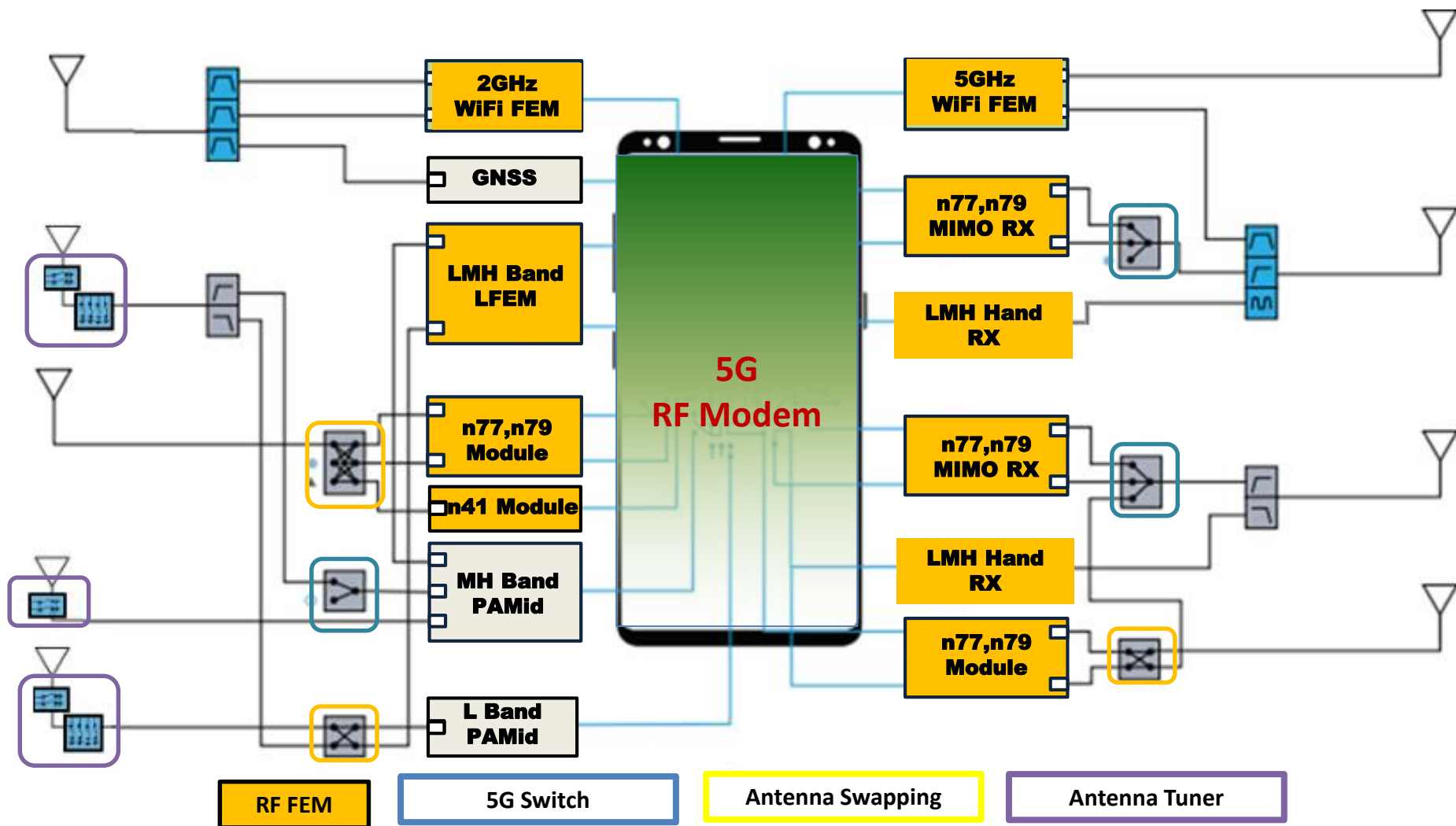
- 支持FM全頻段(64~108 MHz)
- 提供類比與數位音源輸出模式
- 強大的自動搜台判斷機制
- 支持RDS功能
- 優異的接收靈敏度: 1.2 μ V EMF



4G SAW 濾波產品線

GPS/ WIFI 應用			
Part Number	Support Band	Dimension (mm ²)	Application
RTC46S2RUKA	GPS L1	0.9x0.7	GPS SAW
RTC46S3RUKA	GPS L5	0.9x0.7	GPS SAW
Cellular 應用 (Single SAW)			
RTC46SARUHA	B1 Rx	1.1x0.9	Cellular Rx SAW
RTC46SCRUHA	B3 Rx	1.1x0.9	Cellular Rx SAW
RTC46SQTUHA	B40 Tx	1.1x0.9	Cellular Tx SAW
RTC46SGRUHA	B8 Rx	1.1x0.9	Cellular Rx SAW
RTC46SKRUHA	B26 Rx	1.1x0.9	Cellular Rx SAW
RTC46SPRUHA	B39 Rx	1.1x0.9	Cellular Rx SAW
RTC46SQRUHA	B40 Rx	1.1x0.9	Cellular Rx SAW
RTC46SRRUHA	B41 Rx)	1.1x0.9	Cellular Rx SAW
Cellular 應用 (Dual SAW)			
RTC48ACRUFA	B1/B3 Rx	1.5x1.1	Cellular Rx SAW
RTC48PRRUFA	B39/B41 Rx	1.5x1.1	Cellular Rx SAW
Cellular 應用 (Duplexer)			
RTC47CCTUDA	B3 DPX	1.8X1.4	Cellular DPX
RTC47EETUDA	B5 DPX	1.8X.1.4	Cellular DPX
RTC47GGTUDA	B8 DPX	1.8X1.4	Cellular DPX
RTC47FFTUDA	B7 DPX	1.8x1.4	Cellular DPX
RTC47AATUDA	B1 DPX	1.8x1.4	Cellular DPX
RTC47BBTUDA	B2 DPX	1.8x1.4	Cellular DPX
RTC47DDTUDA	B4 DPX	1.8x1.4	Cellular DPX

5G 手機射頻架構



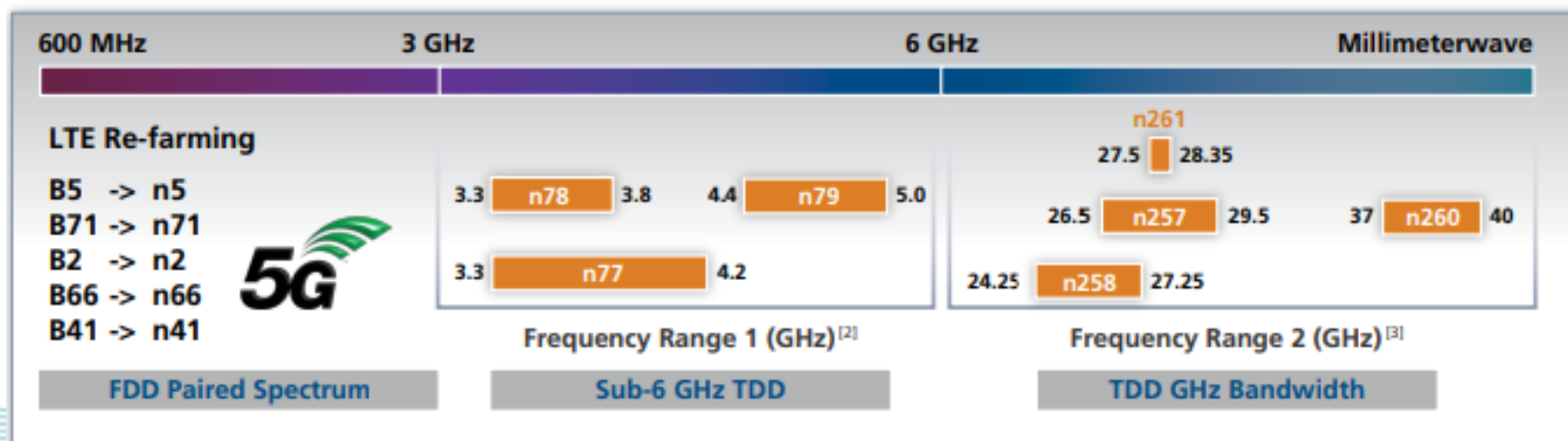
5G NR 射頻前端之挑戰

- 支援上傳路徑的高PAPR 與256QAM的功率放大器
 - 天線端功率26dBm (5G HPUE)
 - 低失真 EVM 要小於 1.85%
 - 100MHz 寬頻
- 高度整合與模組微型化設計技術
 - 4G 到5G 的無縫連接
 - 向下兼容2G/3G/4G, 與WiFi、BT與GPS 共存
 - 支援新的5G sub 6G 頻段，如n77/n78 (3.3-4.2GHz), n79 (4.4-5GHz) and eLAA bands B46, B47 (5.15GHz-5.92GHz).
 - 支援8~10之天線
 - 支援4G/LTE 與 5G NR的雙聯接
 - 支援上傳及下載的LAA and eLAA 頻段
 - 支援上傳 2x2 MIMO

5G 頻譜分布與挑戰

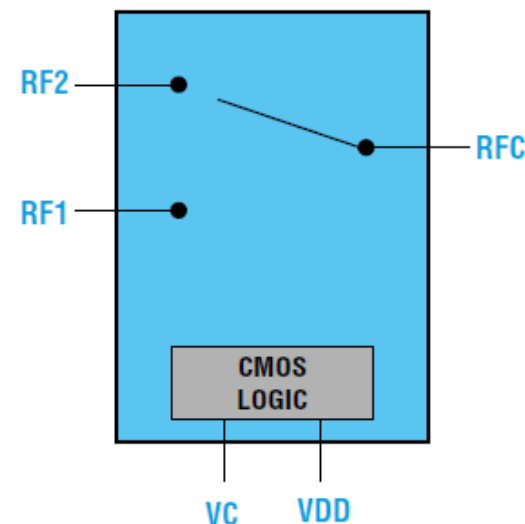
- 高線性度的功率放大器
- 寬頻段&高 Q 值之濾波器
- 寬頻多級增益的低雜訊放大器
- 多製程整合技術
- 模組微型化技術

SPEC. ITEMS	5G NR FR1
頻率範圍 (GHz)	n41: 2.469GHz~2.690GHz n77: 3.3GHz~4.2GHz N78: 3.3GHz~3.8GHz N79: 4.4GHz~5.0GHz
波道頻寬 (MHz)	Up to 100MHz
次載波間隔(KHz)	15, 30, 60KHz
FFT大小	3276 (up to 4096)
最高調變模式	Up to 256QAM
調變波形	CP-OFDMA (UL/DL) DFT-s-OFDMA(UL)
系統EVM (dB)	-29.1dB (3.5%)
功率放大器EVM (dB)	34.66dB (1.85%)



5G SRS 低功率開關

- 頻率支援範圍: 0.6GHz ~ 8.25GHz
- 低操作電壓 : 1.8V
- 極低差損: 0.36dB @ 6GHz
- 快速切換速度: 160ns
- 小型封裝: QFN 1.1*0.7



頻率範圍	差損(dB)	切換速度
617 ~ 960 MHz	0.2	160ns
960 ~ 2170 MHz	0.23	
2170 ~ 2700 MHz	0.24	
3300 ~ 3800 MHz	0.28	
4000 ~ 6000 MHz	0.36	
6000 ~ 7000 MHz	0.54	
7000 ~ 8000 MHz	0.84	
8000 ~ 8250MHz(UWB)	0.91	

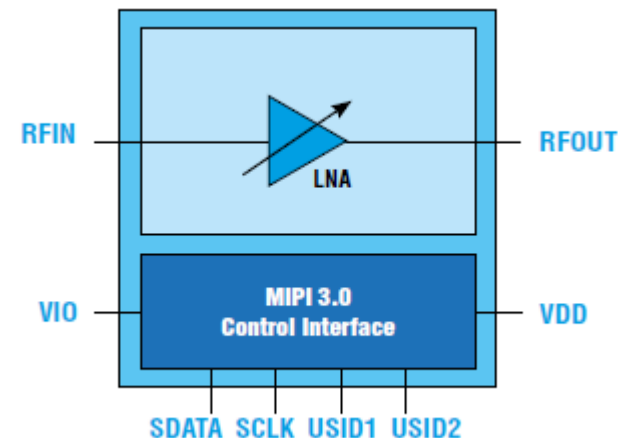
5G 高功率開關 ~SPDT and SP4T

- 頻率支援範圍: 0.6GHz ~ 6GHz
- 低操作電壓: 1.8V
- 極低差損

特色	封裝	參數	符號	頻率	標準值	單位
SPDT	QFN 1.1*0.7	差損	IL	617 – 960 MHz	0.24	dB
				960 – 2170 MHz	0.26	
				2170 – 2700 MHz	0.285	
				3300 – 3800 MHz	0.327	
				3800 – 4200 MHz	0.33	
				4400 – 5000 MHz	0.36	
				5150 – 5925 MHz	0.417	
		0.1dB 功率壓縮點	P0.1dB	2.7 GHz, CW	39	dBm
SP4T	QFN 1.1*1.1	差損(All RF Ports)	IL	617 – 960 MHz	0.26	dB
				960 – 2170 MHz	0.27	
				2170 – 2700 MHz	0.35	
				3300 – 3800 MHz	0.37	
				3800 – 4200 MHz	0.42	
				4400 – 5000 MHz	0.55	
				5150 – 5925 MHz	0.88	
		0.1dB 功率壓縮點	P0.1dB	2.7 GHz, CW	37	dBm

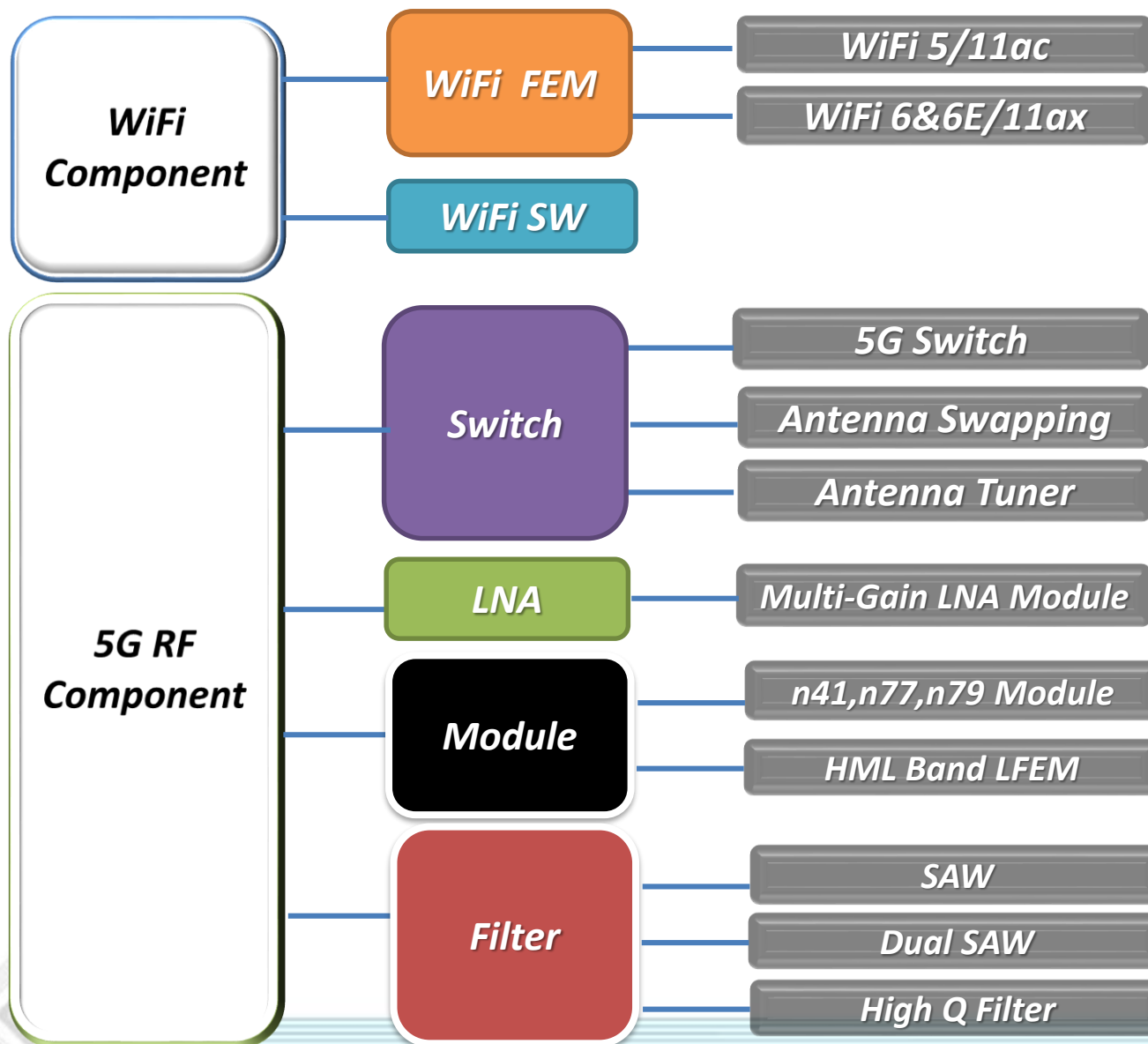
多段增益控制的LNA在LAA頻段

- 操作頻率範圍(B46): 5150 – 5925 GHz
- 低操作電壓: 1.8 V
- 6 級多段增益控制
- 高增益 (19dB) and 低雜音指數 (1.2dB)
- MIPI 3.0 控制介面



參數	Symbol	典型值	單位
頻率範圍	f		MHz
功率增益	G6	19	dB
	G5	13	
	G4	7	
	G3	1	
	G2	-5	
	G1	-11	
雜音指數	G6	1.2	dB
	G5	2	
	G4	3.8	
	G3	11.9	
	G2	14.6	
	G1	17	

立積在5G手機的展望





RichWave



立積射頻元件應用於 IoT & Automotive

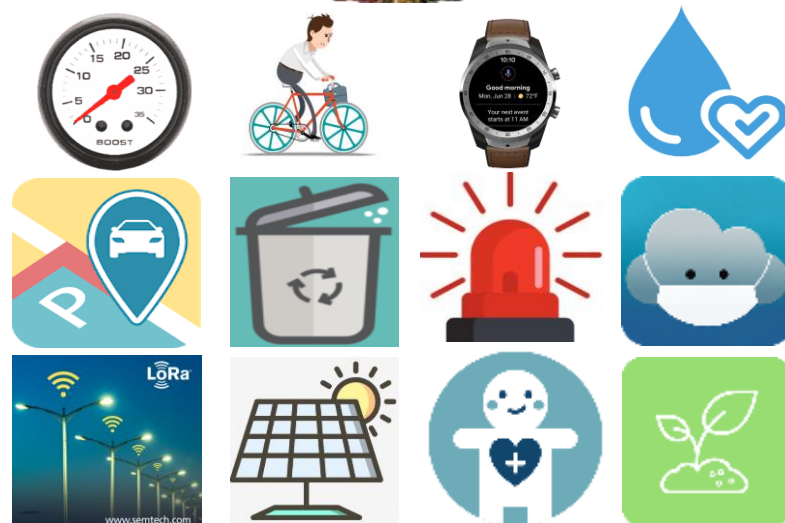
立積電子股份有限公司

2020/12/18



WiFi Bluetooth Zigbee

NB-IoT LoRa Sigfox WiFi-HaLow

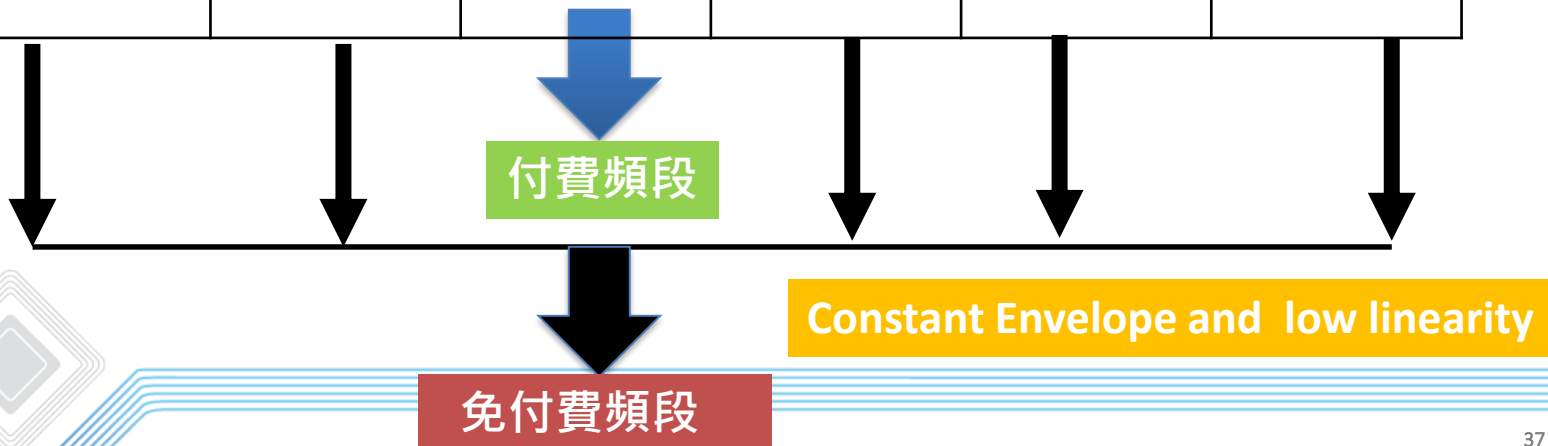


物聯網技術的品質因素

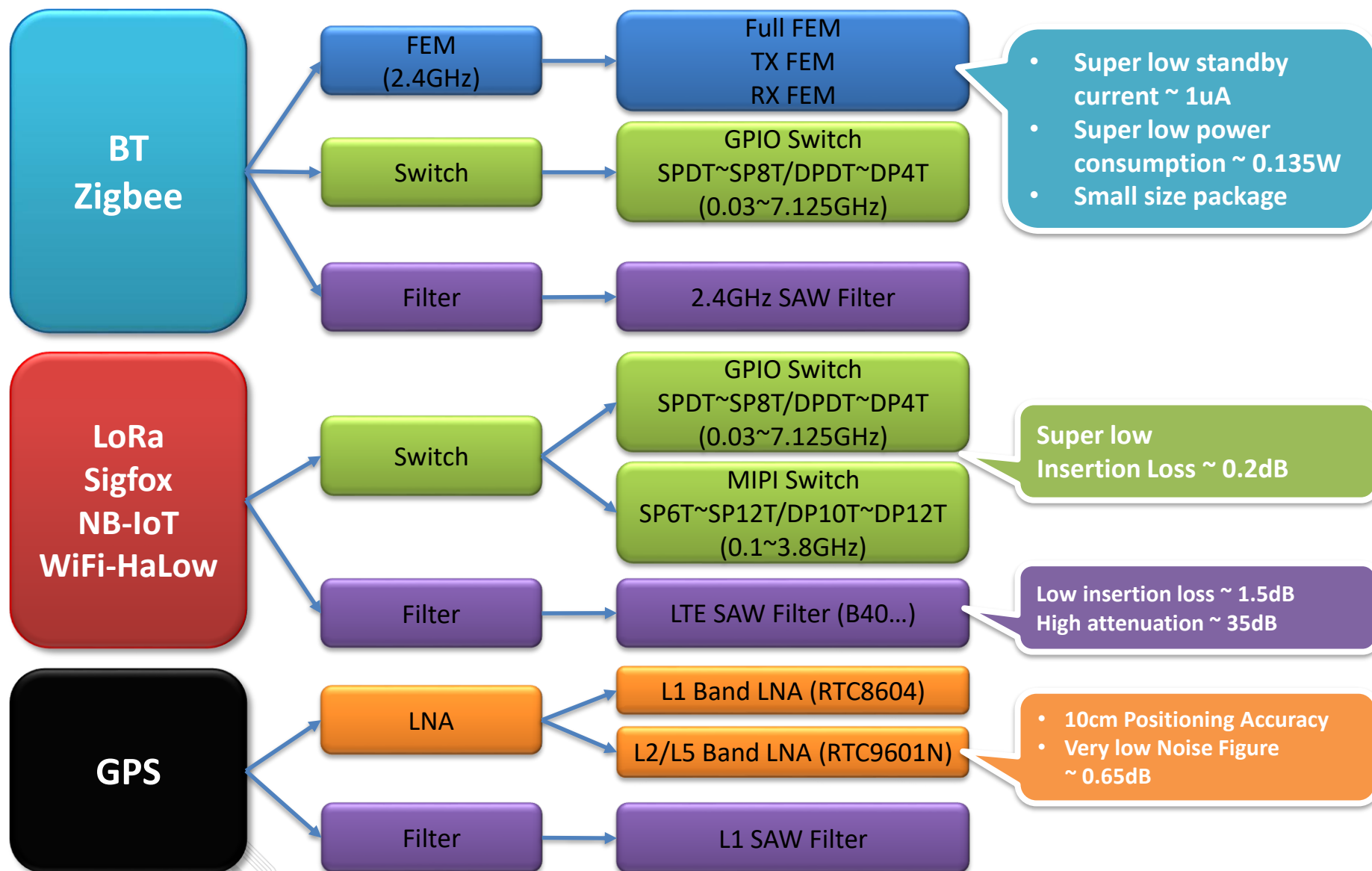


物聯網 PHY規格比較

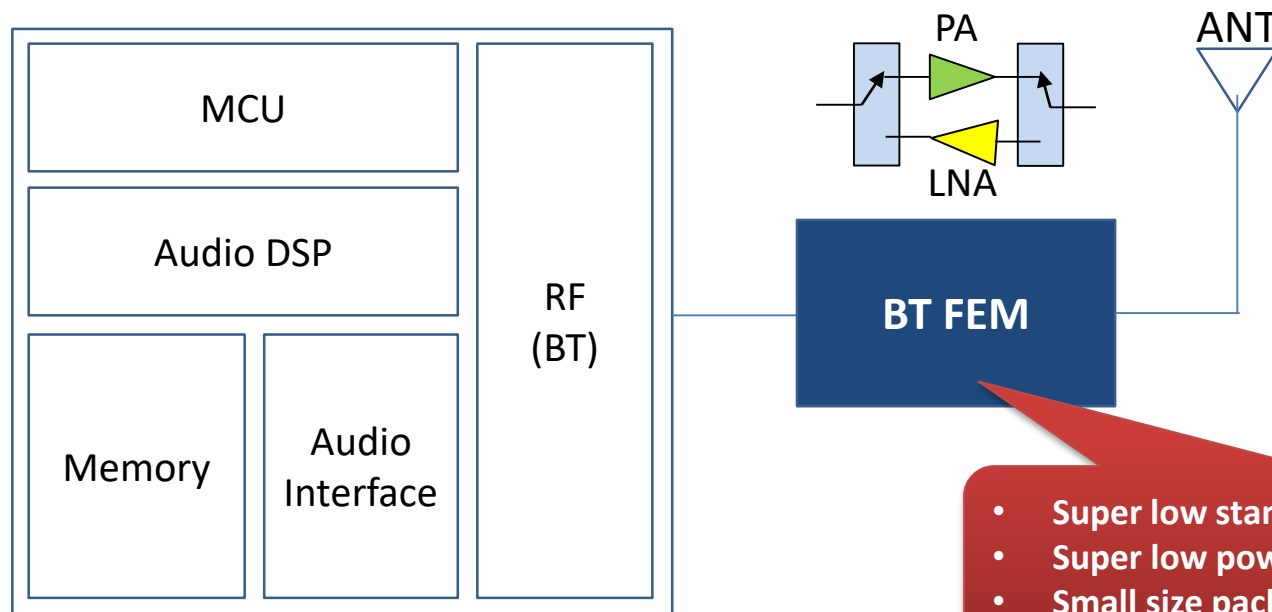
	LoRa	Sigfox	NB-IoT	WiFi HaLow	Zigbee	Bluetooth
頻率範圍	Sub-1GHz ISM (433/868/915MHz)	Sub-1GHz ISM (868/915MHz)	Sub-1GHz/LTE licensed bands (700MHz~2.5GHz)	Sub-1GHz/LTE (868/915MHz)	869/915MHz 2.4GHz	2.4GHz
頻寬 數率	125K/250K/500KHz 300bps~50Kbps	100Hz 100bps/600bps	180KHz 50Kbps	1/2/4/8/16MHz 150Kbps~86.7MHz	0.3/0.6/2MHz 20K~250Kbps	1MHz 1~48Mbps
傳輸距離 調變	20km CSS	50km UNB	20km DL: OFDMA UL: SC-FDMA	1km OFDM	10~100m BPSK QPSK (2.4GHz)	10~300m GFSK
網路連結數量	1 million	1 million	100000	8191	65536	8 (32767 for LE)
技術特徵	1. low-cost infrastructure 2. unlicensed bands 3. low power 4. high penetration ability 5. Open SW architecture	1. unlicensed bands 2. optimal low power 3. ultra long range 4. global networking services 5. provides users with existing networking infrastructure and cloud services	1. operates in licensed bands with minimal interference 2. more stable connection 3. integration in existing LTE and 5G networks	1. low-cost infrastructure 2. unlicensed bands 3. higher transmission speed 4. high penetration ability	1. low-cost infrastructure 2. better than BT in power consumption 3. high-level security 4. low connectivity drop-offs	1. higher transmission speed 2. high-level security 3. widely used in personal communication devices



立積物聯網的產品線



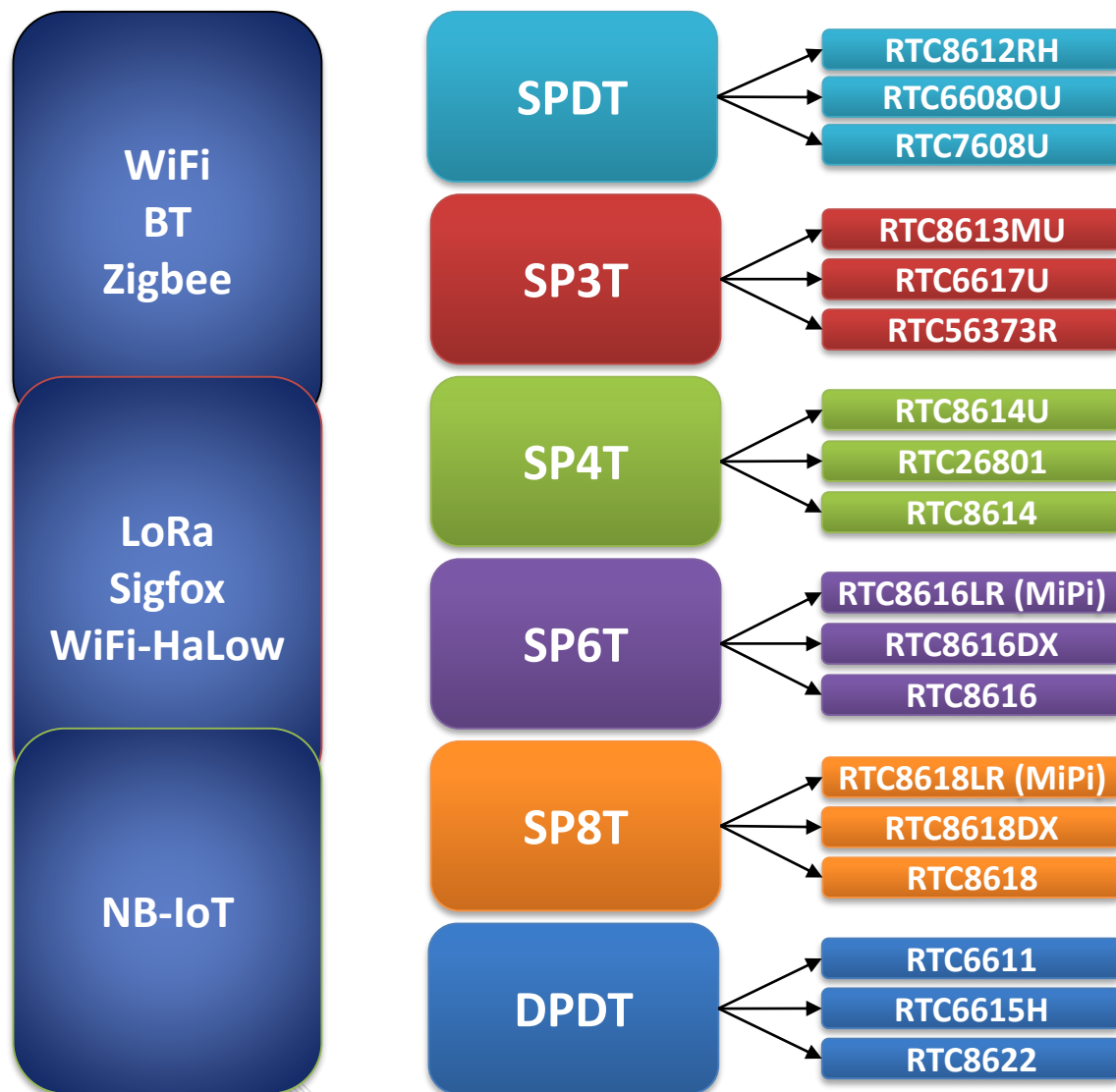
使用於藍芽與Zigbee前端射頻



- Super low standby current ~ 1uA
- Super low power consumption ~ 0.135W (OP)
- Small size package

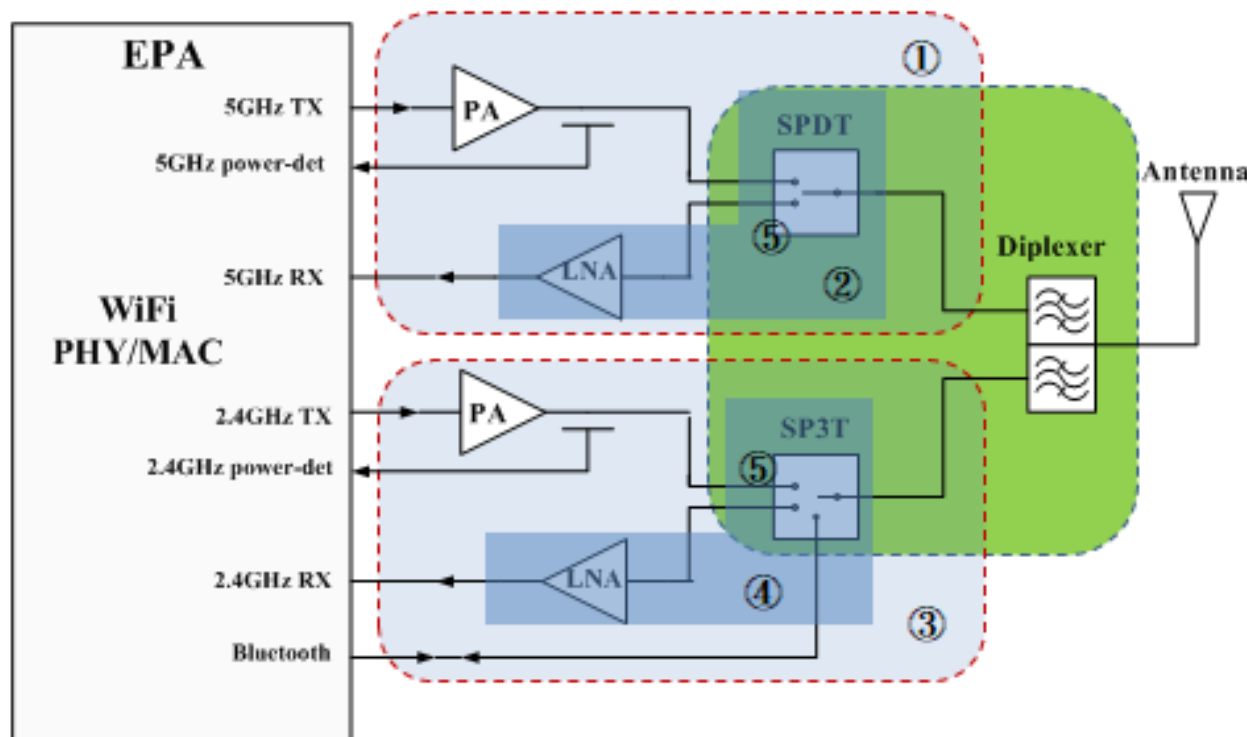
Part Number	Feature	Package Size	Support EDR	
RTC2624	PA+LNA+Switch	16L QFN 2.4x2.4x0.8 mm	NO	Output Power~23dBm
RTC2624E	PA+LNA+Switch	16L QFN 2.4x2.4x0.8 mm	Yes (14dBm)	Output Power~23dBm
RTC26202E	LNA+Switch	6L QFN 1.0x1.0x0.75 mm	NO	Noise Figure~2.0dB
RTC2620	PA+Switch	8L LGA 1.5x1.5x0.6 mm	Yes (14dBm)	Output Power~23.5dBm

使用於NB-IoT, LoRa 及Sub-1G 的 GPIO 開關



- Very low IL ~ 0.2dB
- Switching time < 200ns
- Cover 0.03~7.125GHz
- High P0.1dB ~ 38.5dBm
- Mid P0.1dB ~ 29dBm
- Low P0.1dB ~ 21.5dBm
- Small size ~ 1.0x1.0mm
- Support GPIO and MiPi

立積車用射頻前端組件



5GHz Full FEM (3-in-1)

- ① RTC1630 (11ac, +20dBm)
RTC16504 (11ax, 16.5dBm)

- ② 5GHz RX FEM (2-in-1)
RTC1631 (LNA+SPDT)

- ③ 2.4GHz Full FEM (3-in-1)
RTC1620(11n, +21dBm)
RTC16204 (11ax, 15dBm)

- ④ 2.4GHz RX FEM (2-in-1)
RTC1621 (LNA+SP3T)

- ⑤ Switch
RTC1601(SP3T)
RTC1602(SPDT)
RTC1603(SPDT)
RTC1604(SPDT)

車規AEC-Q100 認證 Level 2

Test Item	Condition	Method
High Temperature Operating Life (HTOL)	Ta=105°C, Vcc max. , 1000hrs	JESD22-A108
Electrostatic Discharge Human Body Model (HBM)	Start from 100V to 2000V, Step: 100V Positive / Negative pulse	AEC Q100-002
Electrostatic Discharge Charged Device Model (CDM)	Start from 250V to 1000V, Step: 250V Positive / Negative pulse	AEC Q100-011
Preconditioning (PC)	MSL-3, 30°C/60%RH, 192hrs Reflow x3 at 260°C	JESD22-A113 J-ST020
Biased HAST (HAST)	130°C/85%RH, VCC Max., 96hrs	JESD22-A110
Unbiased HAST (UHST)	130°C/85%RH, 96hrs	JESD22-A118
Temperature Cycling (TC)	-55°C~125°C (Air to Air), 1000 cycles	JESD22-A104
High Temperature Storage Life (HTSL)	125°C bake, 1000hrs	JESD22-A103
Temperature Humidity Bias (THB)	85°C/85%RH, Vcc max., 1000hrs	JESD22-A101





RichWave



立積RF被動元件的佈局與展望

立積電子股份有限公司

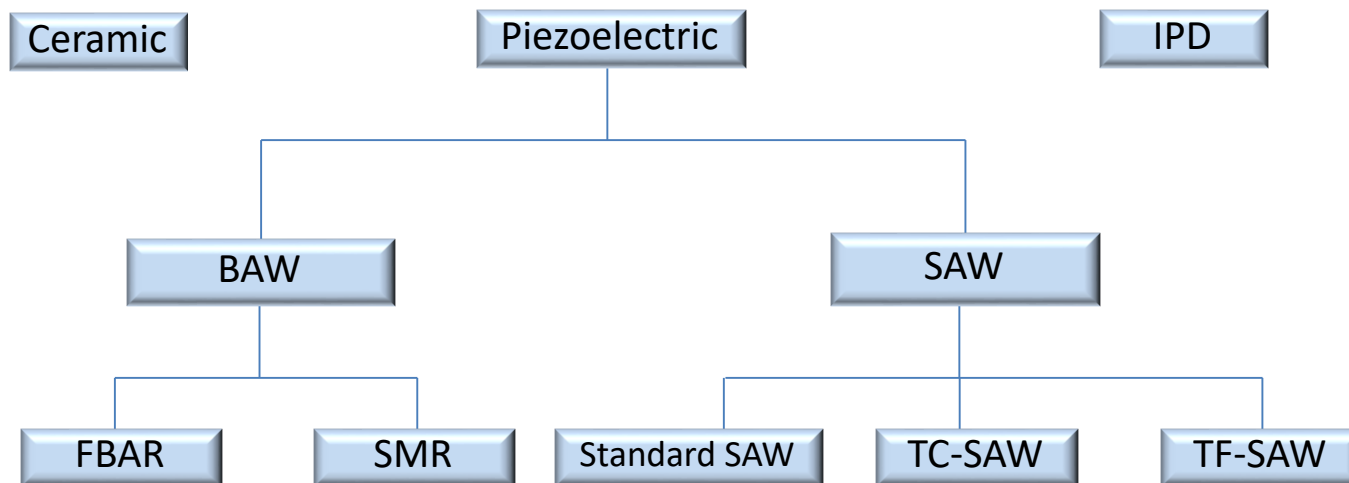
2020/12/18

射頻濾波器在手機和網通應用

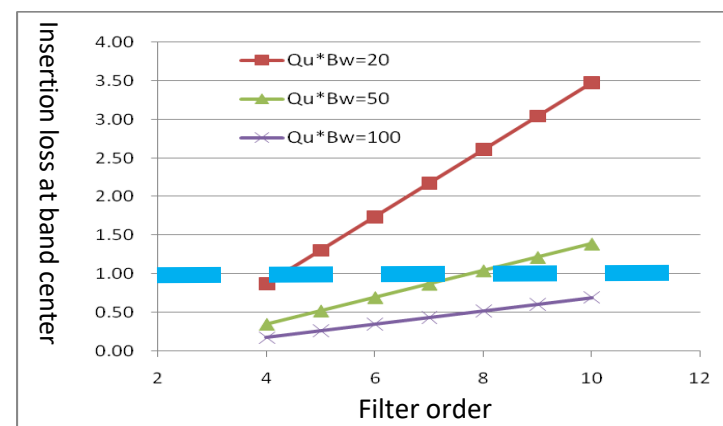


應用	4G/5G手機通訊	WIFI 5/ WIFI 6/ WIFI 6E
立積射頻濾波器建議方案	0.7-3 GHz SAW 濾波器/雙工器 1.7-2.2GHz 四工器 2-6GHz BAW 濾波器/雙工器	2.4GHz SAW/BAW 濾波器 5-7GHz BAW 濾波器 WIFI 分頻器
產品	手機,平板,GPS	路由器, 機上盒, CPE

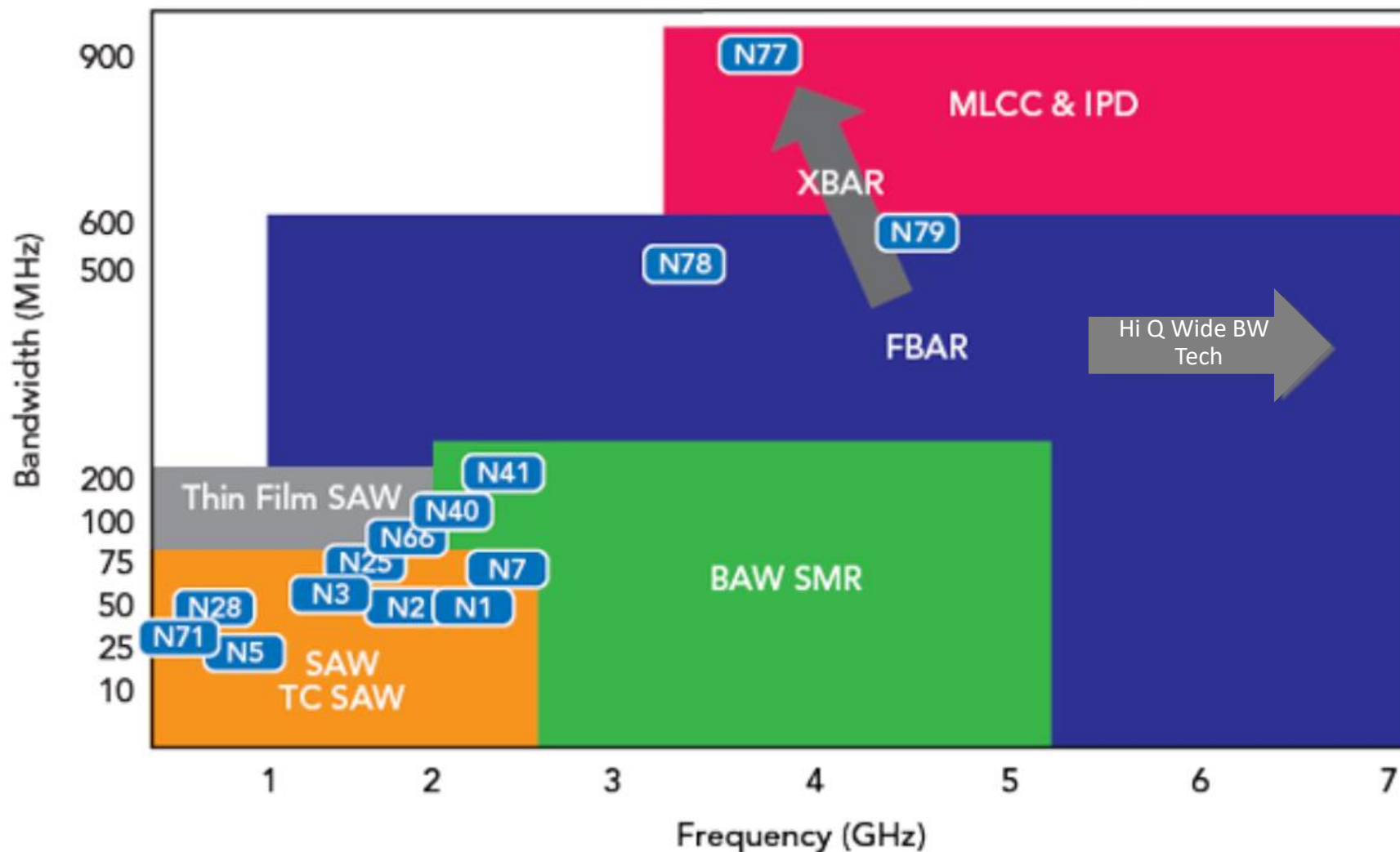
濾波器工藝



- Ceramic:
 - Monoblock: Q: 200~600,
BW: 3~5% , up to 20%
 - LTCC: Q: 60~100, BW > 10%
- IPD:
 - Q: 30~50, BW >10%

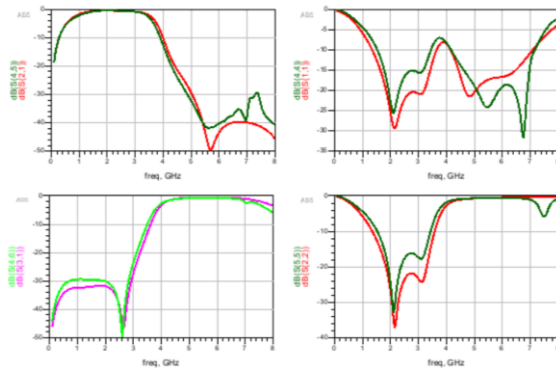
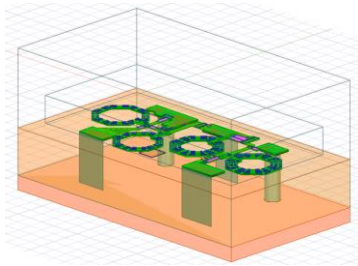
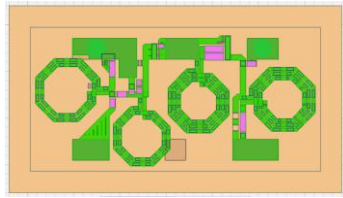


濾波器工藝在5G通訊(頻寬vs頻段)

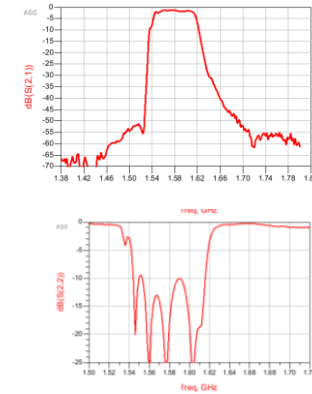
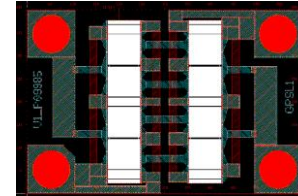


立積射頻被動元件

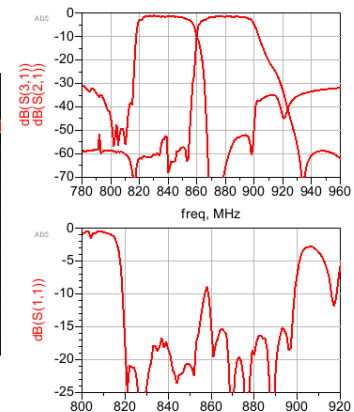
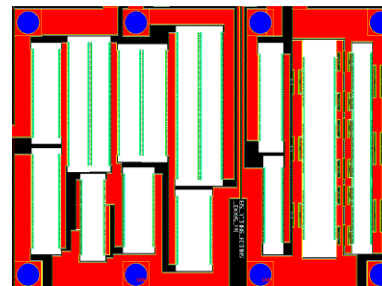
WIFI分頻器



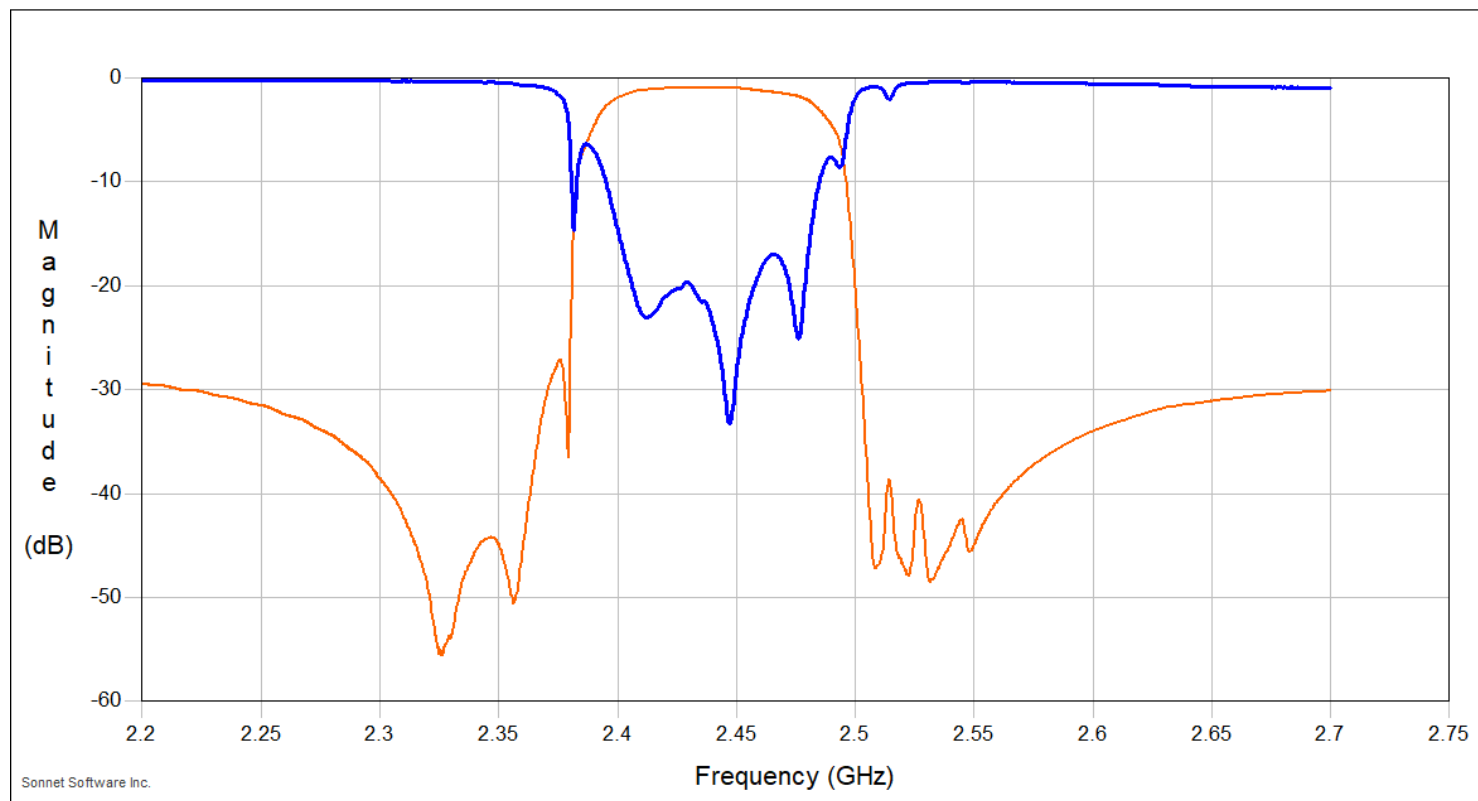
GPSL1 SAW 濾波器



B8 雙工器



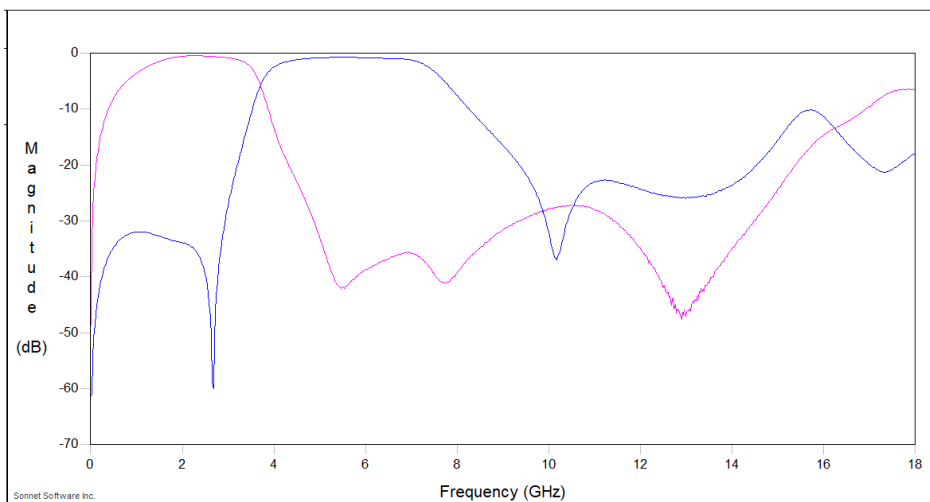
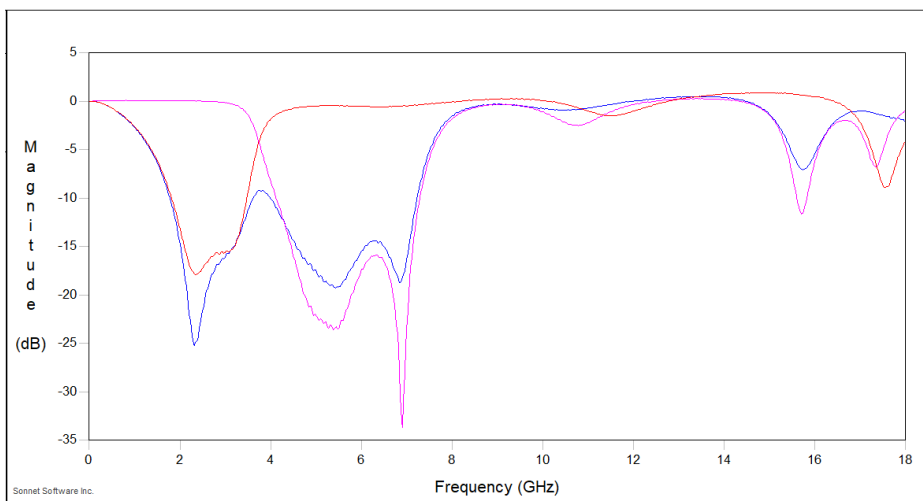
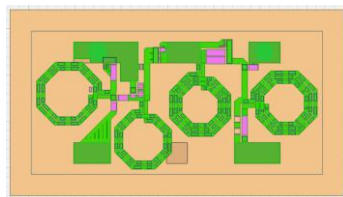
WIFI SAW 濾波器



WIFI 2.4GHz SAW 濾波器在需要的頻段有低的損耗,在LTE的頻段有高的衰減



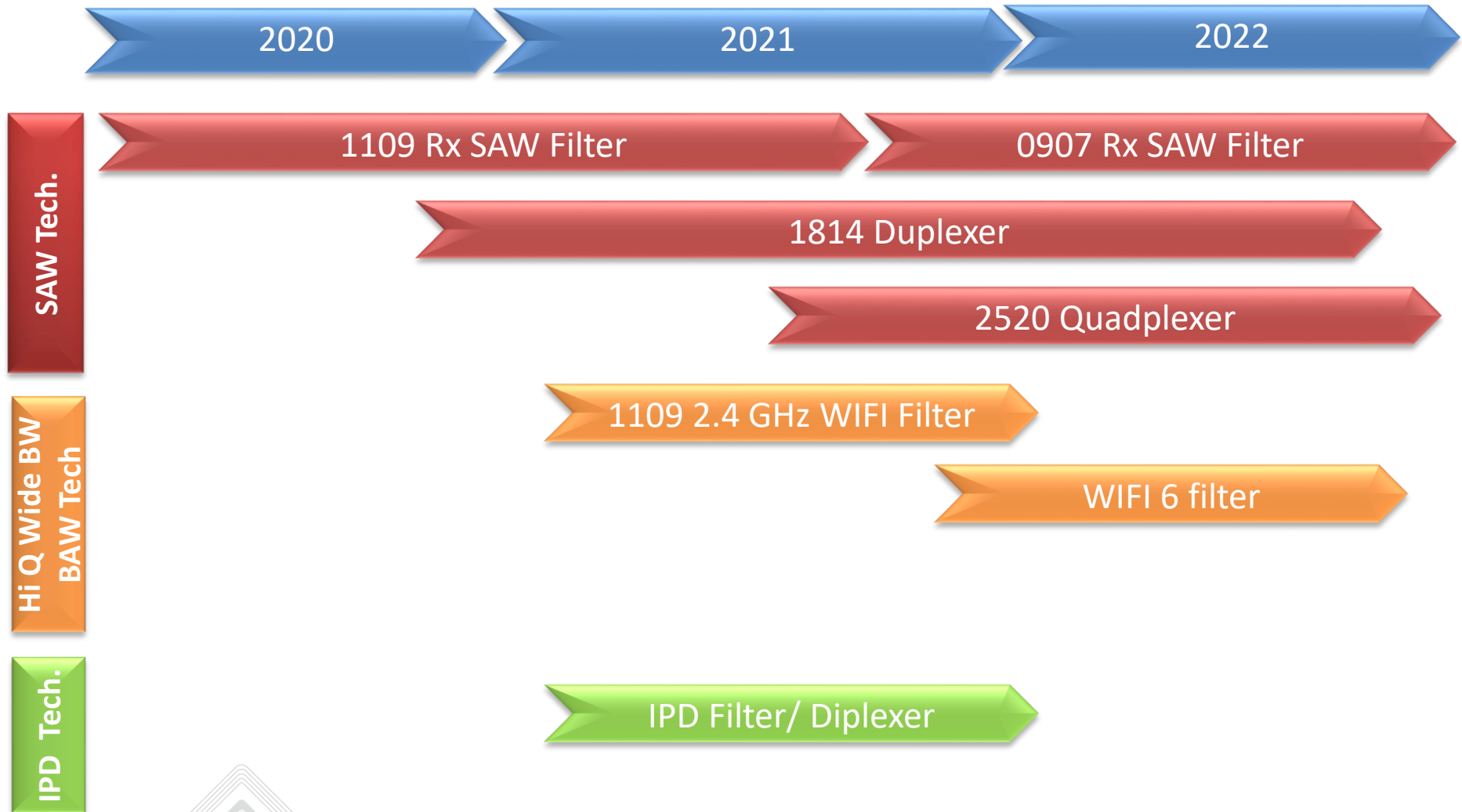
WIFI 分頻器



WIFI 分頻器有低的插入損耗和好的回波損耗



立積射頻濾波器規劃



	Band 1	Band 2 Band 25	Band 3	Band 4	Band 5 Band 26	Band 7	Band 8	Band 12	Band 13	Band 20	Band 34	Band 39	Band 40	Band 41
US	v	v	v	v	v		v	v	v					v
EU	v		v		v	v	v			v				
China	v		v		v		v				v	v	v	v

GPS/ WIFI Application			
Part Number	Support Band	Dimension (mm2)	Application
RTC46S2RUHA	GPS L1	1.1x0.9	GPS SAW
RTC46S0TUHA	WIFI (2.4GHz)	1.1x0.9	WIFI SAW
Cellular Application (Single SAW)			
RTC46SQTUHA	B40 Tx	1.1x0.9	Cellular Tx SAW
RTC46SGRUHA	B8 Rx	1.1x0.9	Cellular Rx SAW
RTC46SKRUHA	B26 Rx	1.1x0.9	Cellular Rx SAW
RTC46SPRUHA	B39 Rx	1.1x0.9	Cellular Rx SAW
RTC46SQRUHA	B40 Rx	1.1x0.9	Cellular Rx SAW
RTC46SRRUHA	B41 Rx (narrow band)	1.1x0.9	Cellular Rx SAW
IOT Application (Single SAW)			
RTC46SUTUHA	B24 Tx	1.1x0.9	IOT SAW
RTC46SURUHA	B24 Rx	1.1x0.9	IOT SAW

開發GPS/ IOT/ WIFI/ Cellular 濾波器

2021立積SAW濾波器/雙工器

GPS/ WIFI Application			
Part Number	Support Band	Dimension (mm ²)	Application
RTC46S2RUKA	GPS L1	0.9x0.7	GPS SAW
RTC46S3RUKA	GPS L5	0.9x0.7	GPS SAW
Cellular Application (Single SAW)			
RTC46SARUHA	B1 Rx	1.1x0.9	Cellular Rx SAW
RTC46SCRUHA	B3 Rx	1.1x0.9	Cellular Rx SAW
Cellular Application (Dual SAW)			
RTC48ACRUFA	B1/B3 Rx	1.5x1.1	Cellular Rx SAW
RTC48PRRUFA	B39/B41 Rx	1.5x1.1	Cellular Rx SAW
Cellular Application (Duplexer)			
RTC47CCTUDA	B3 DPX	1.8X1.4	Cellular DPX
RTC47EETUDA	B5 DPX	1.8X.1.4	Cellular DPX
RTC47GGTUDA	B8 DPX	1.8X1.4	Cellular DPX
RTC47FFTUDA	B7 DPX	1.8x1.4	Cellular DPX
RTC47AATUDA	B1 DPX	1.8x1.4	Cellular DPX
RTC47BBTUDA	B2 DPX	1.8x1.4	Cellular DPX
RTC47DDTUDA	B4 DPX	1.8x1.4	Cellular DPX

小尺寸濾波器(0907)

開發雙工器和LTC-CA用的dual SAW



RichWave



精采生活來自立積雷達感測器

立積電子股份有限公司

2020/12/18

立積雷達感應器產品

	RTC6012	RTC6013/31
頻率	5.8GHz	10GHz
種類	都普勒雷達前端	CW/FMCW 雷達前端 (RTC6013), 內建DSP雷達 SoC (RTC6031)
特性	超低功耗移動偵測	移動, 距離及目標方向偵測
應用	智能燈控 接近感測	人體存在偵測 智能家電應用 生命跡象偵測 液位偵測
狀態	MP @ 2020/Q3	MP @ 2021/Q1

雷達感應器應用

智能照明



室內燈



室外燈



街燈

智能家居



智慧音箱



網路攝影機



空調

雷達感應器應用

智能家居



感應式水龍頭



壁控開關
(手勢)



壁控開關
(存在感測)

智能家居



智慧白色家電



自動開門器



液位感測器

雷達感應器應用

智慧城市



垃圾收集



停車輔助



交通監控

健康照護



生命跡象偵測



睡眠偵測



健康狀態監控

冷暖空調(HVAC)智能化

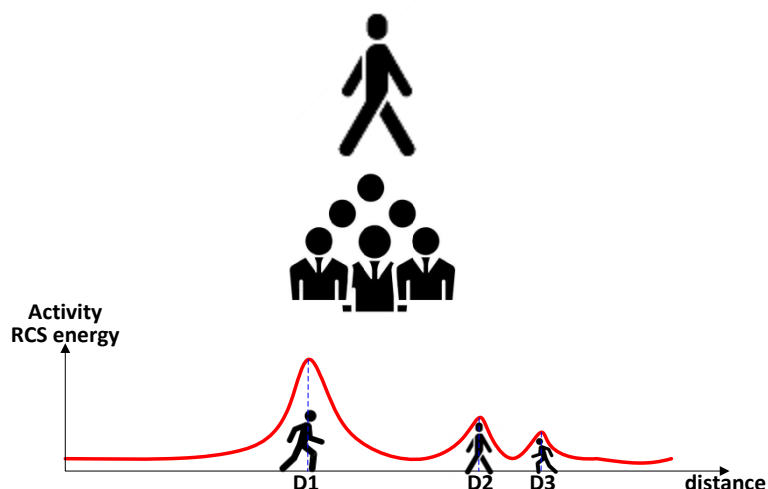


- 根據統計, 美國40%用電為建築內用電.
- 雷達可提供有用的資訊供傳感器融合運用, 包括:

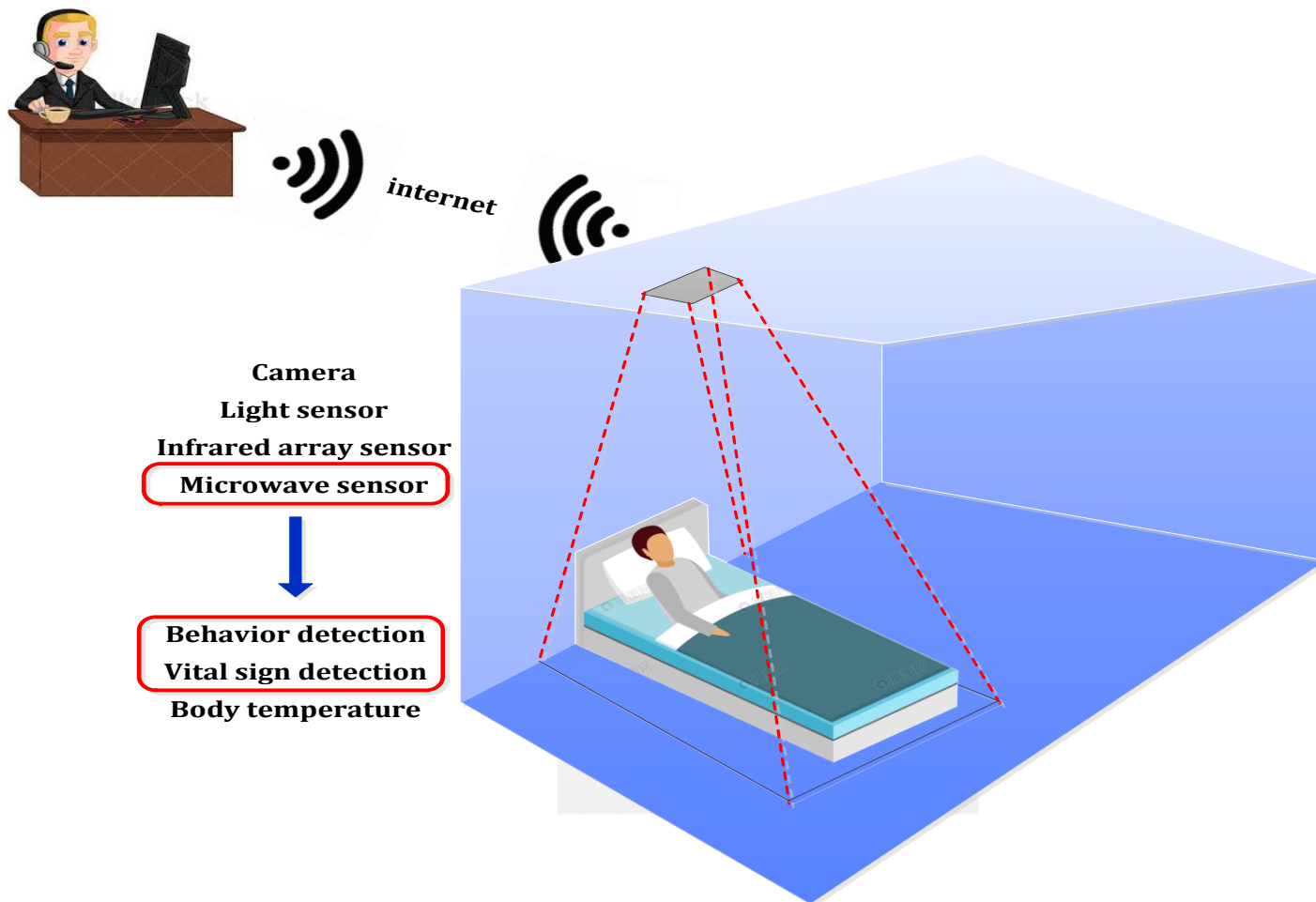
人體移動/存在偵測

室內占用人數計算

人體活動範圍分佈資訊



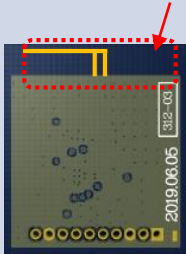
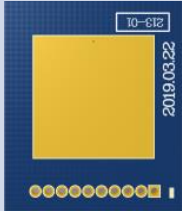
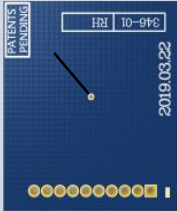
智能醫療照護



RTC6012 主要特性

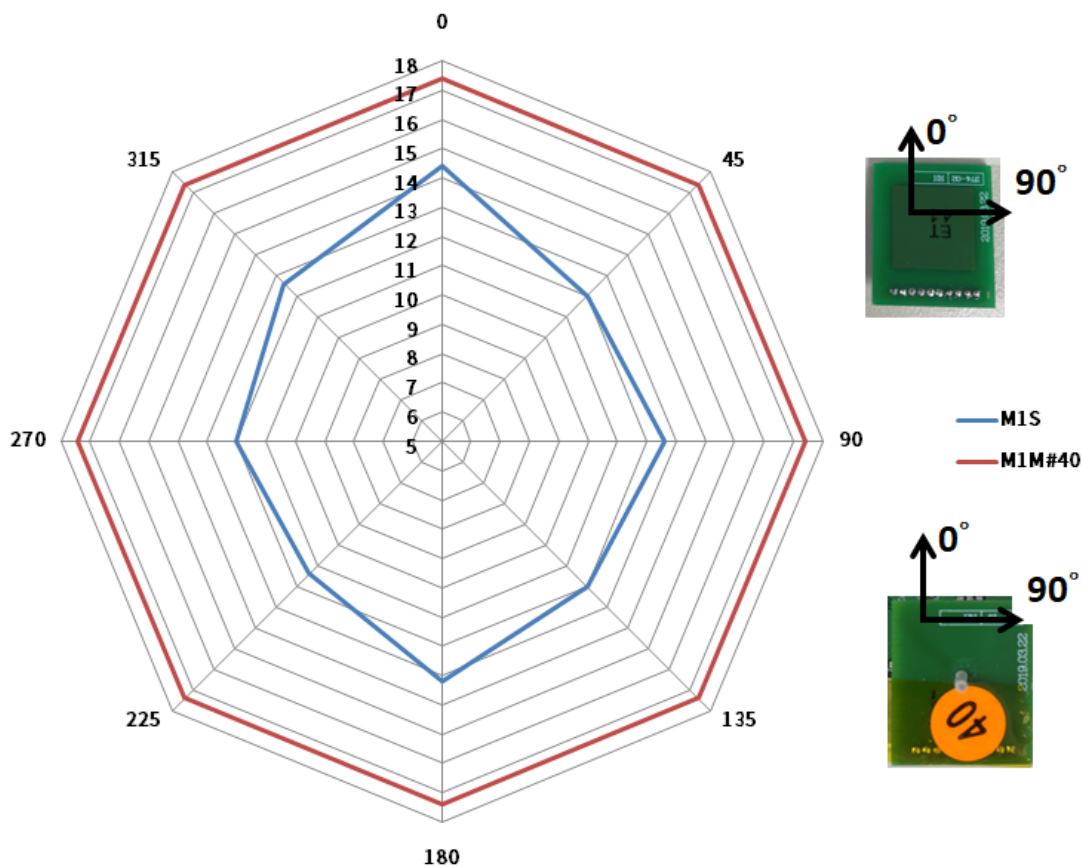
- 5.8 GHz ISM band
- 可與 WiFi 共存
- 輸出功率高
- 高增益中頻放大
- 各種單天線設計 (Patents pending)
- I2C 接口控制
- 快速反應, 可間歇性工作以降低功耗
- 75uA超低功耗
- 市場上最小封裝 : 2.2mm x 2.2mm x 0.6mm

RTC6012 雷達前端參考設計

	M1P (PIFA ANT)	M1S (Patch ANT)	M1M (Monopole ANT)
RTC6012			
尺寸 (mm)	17x20	17x20	17x20
偵測距離 ※	~5m	~15m	~15m
偵測角度 (FoV)	360°	120°	360°

※室內偵測場景

吸頂/掛高3M偵測性能



RTC6013/RTC6031 主要特性

	RTC6013 / RTC6031
高度集成單晶片方案	○ / ○
CW/FMCW 雷達收發器	
9.5 to 10.6 GHz 頻率涵蓋	○ / ○
移動偵測 (CW)	○ / ○
距離偵測 (FMCW)	○ / ○
優異訊雜比 (SNR)	○ / ○
高精度 FMCW chirp engine	○ / ○
原始感應數據數字輸出	○ / ○
內建 DSP 運算核	× / ○
提供各式感測應用代碼	× / ○

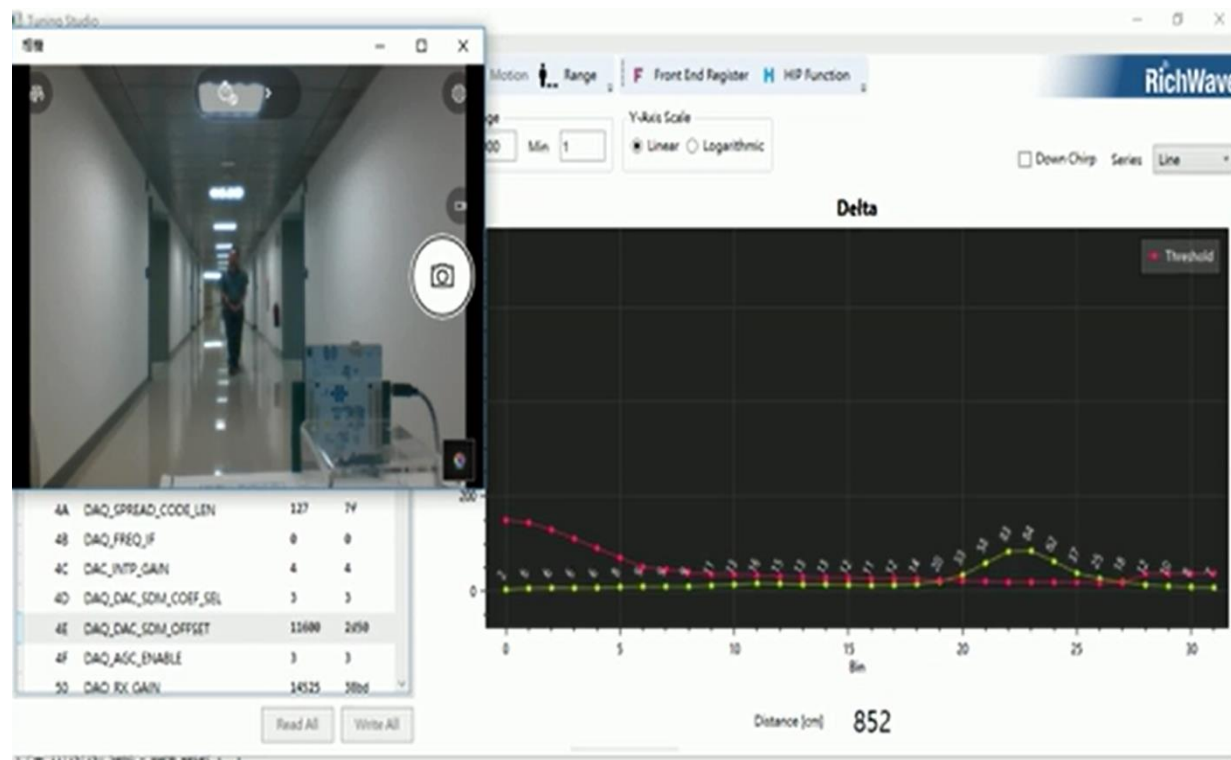


10GHz應用 1 – 距離偵測

- 回報 8~15m 移動物體距離資訊



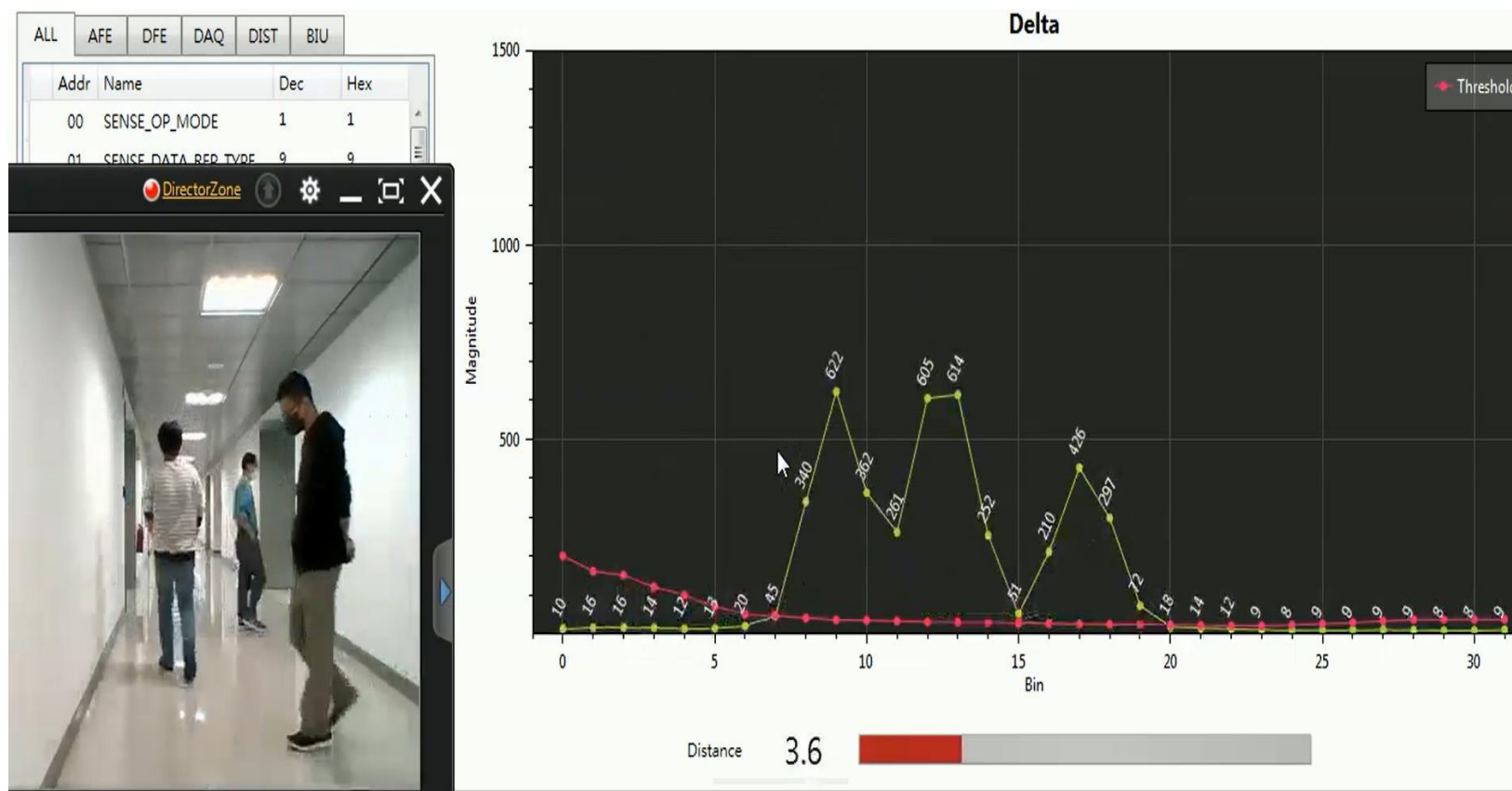
Turnkey



Tuning Studio

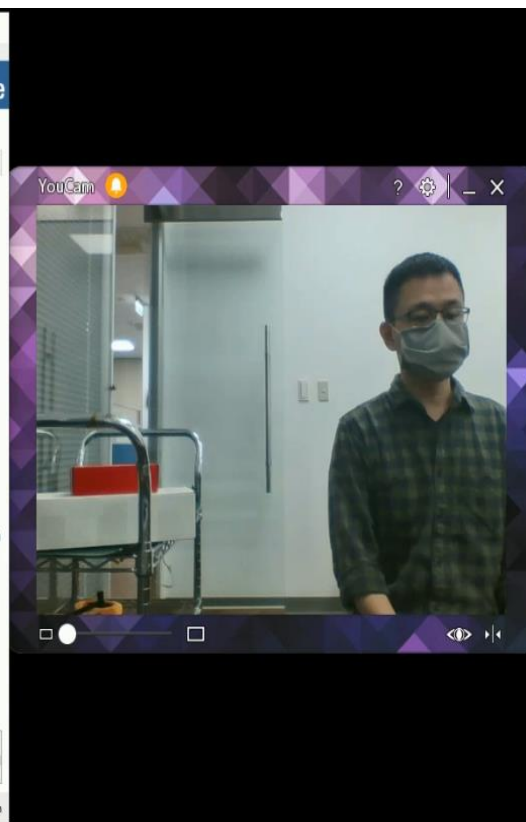
10GHz應用2 – 多點活動偵測

- 同時偵測多點的活動, 回報各點距離



10GHz應用3 – 生命跡象偵測

■ 快速偵測呼吸與心跳速率





RichWave



立積後勤與供應鏈佈局

立積電子股份有限公司

2020/12/18

產能管理



策略布局

全球運籌、在地營運

共創價值, 共享利潤

規模經濟

2021年產能規劃: 成長100%

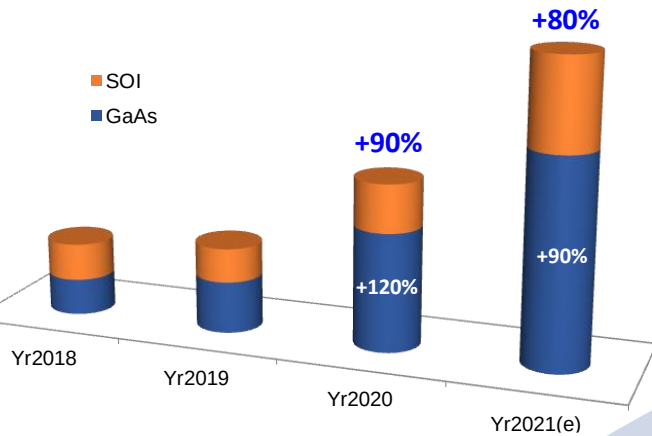
產能提升

2020年產能成長50%

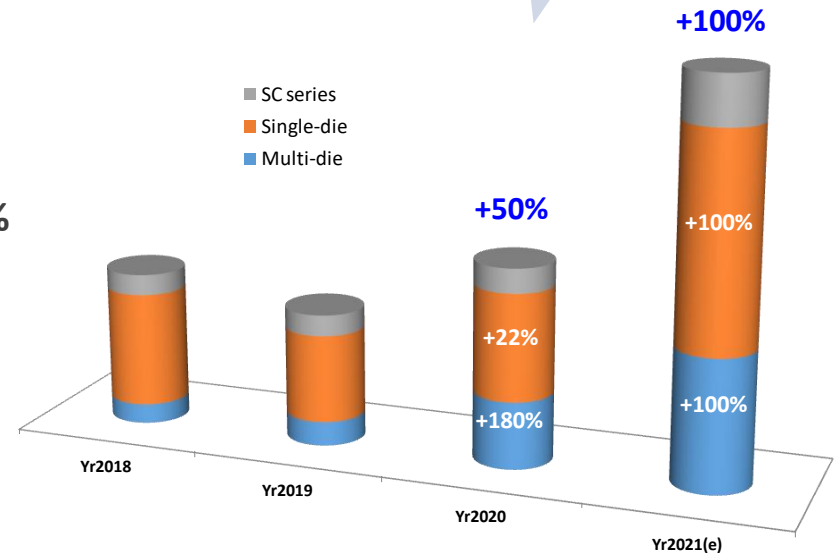
投資自有產能

建立外包互補產能

SOI
GaAs



SC series
Single-die
Multi-die



封裝規劃

高整合 & 高效能

提高散熱效能

增強防干擾能力

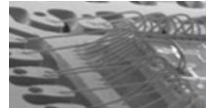
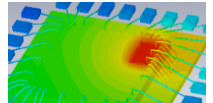
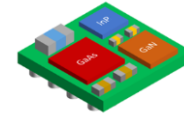
覆晶技術；堆疊式晶片封裝



高密度微型封裝

WLCSP, MCM, SiP

with SAW/BAW filter, Passive components



更小 & 更薄

For mobile/handheld, SAW/BAW



測試規劃

彈性 & 規格

5G NR FR1/FR2 FEM

mmWave and Wi-Fi 6/6E/7

Radar Sensors

Industrial, Automotive Certification



NI PXI



NI STS T1



NI STS T4

先進測試平台

SG9000, GS I2C, NI STS T4, PAX RedDragon

Low/High temperature characterization

高品質 & 高效能 成本競爭力

Dual/Quad-site production



PA



LNA



Filter



SW



FEM



Cohu





RichWave