



立積電子股份有限公司

2017年營運與未來展望

民國106年12月26日

立積的產品組合

RF Front-end Components	FEM	SW	LNA	PA	PFEM
WiFi – Networking: Router/Gateway/STB/ GPON&EPON	V (3-in-1 & 2-in-1)	V	V	V	V (Duplexer+SW)
WiFi- Mobile phone	V (2-in-1 & 3-in-1)	V	V		
WiFi- Consumer: Speaker/OTT/Game/..	V	V	V	V	
LTE					
Diversity Antenna		V	V		
Main Antenna		V		V (F.Cell)	

SOC

FM Tuner

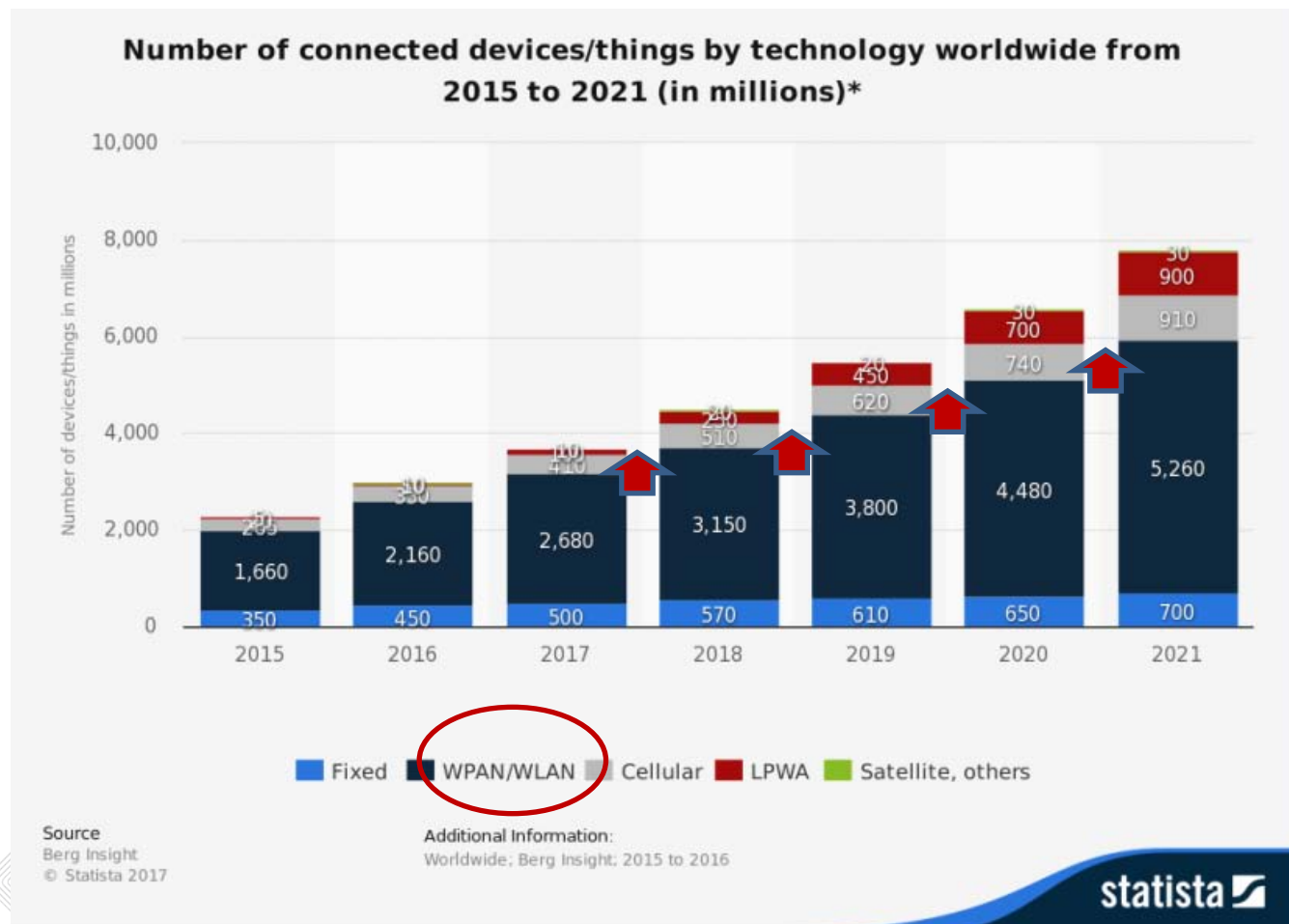
AMFM Tuner

DAV/AAV Transceivers



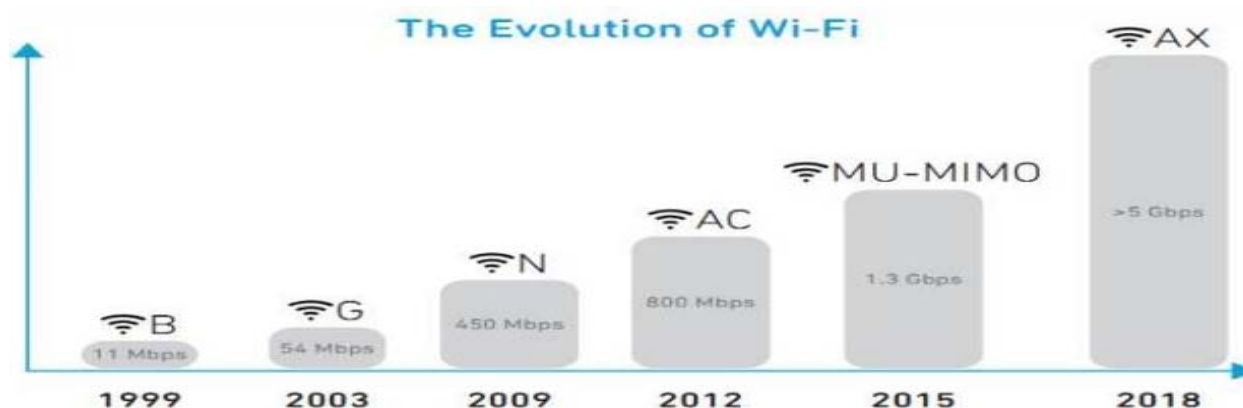
全球Wireless連接點數(connected devices)增加

- WiFi Device持續成長 with ~6Yee/Yr to 8Yee/Yr new points/devices from 2018 to 2021
- WiFi RF-Front-End numbers further multiply by MIMO-number



Wi-Fi 802.11ac /11ax Speed & Capacity 倍數成長

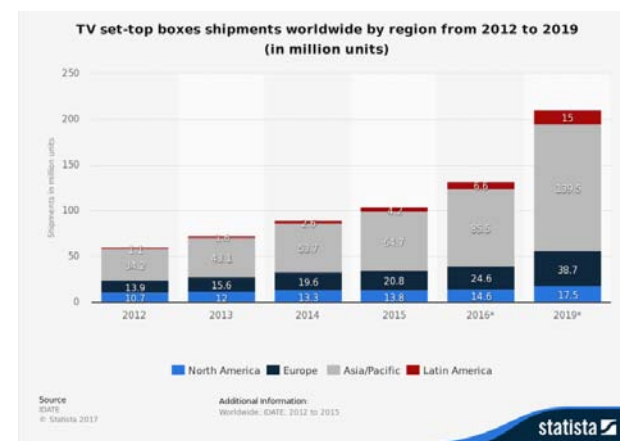
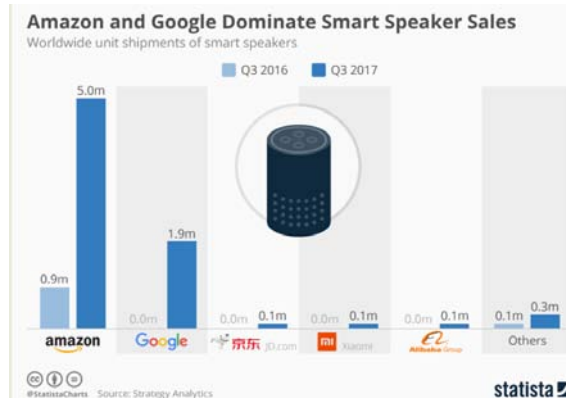
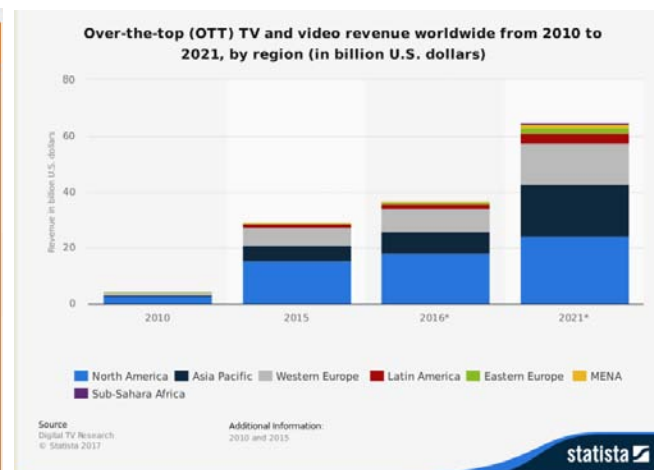
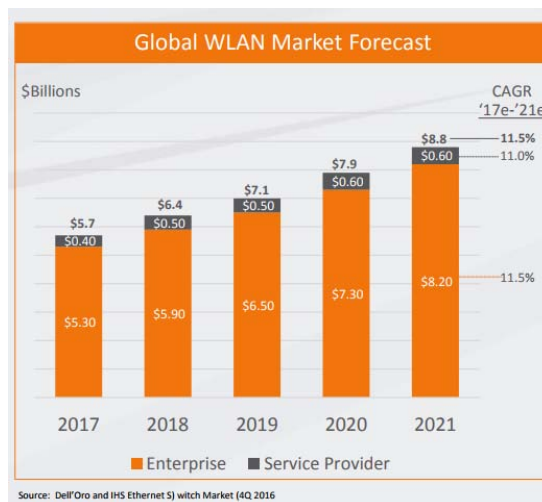
- Fastest data transmission among all standards.
- Last-mile, free-of—mmWave allow robust, complementary with LTE and future 5G.



	802.11g	802.11n	802.11ac	802.11ax
使用頻段	2.4GHz	2.4GHz和5GHz	5GHz	2.4/5 Ghz
使用頻寬	20MHz	20MHz 40MHz	20MHz 80MHz 40MHz 160MHz	20MHZ 80MHZ 40MHZ 160MHZ
最高天線數	1x1 SISO	4x4 MIMO	8x8 MIMO(MU-MIMO)	12x12 MIMO
現有標準速度 (理論值)	54Mbps	150Mbps 300Mbps 450Mbps (頻寬40MHz)	433 Mbps 867 Mbps 1300 Mbps (頻寬80MHz)	600.4 Mbps 9607.8 Mbps
最高速率(理論值)	54Mbps	600Mbps	6.93Gbps	9.6 Gbps

WiFi應用的十大領域- TAM成長於各新舊領域

Segment	應用領域
AP Router-Retail	路由器- 零售
Gateway - Carrier	閘道- 電信商
IP Cam	監視器
STB/ OTT	機上盒
Gaming	遊戲機
Smart Speaker	智慧音箱
Smart TV	智慧電視
Smart Phone	智慧手機
Automotive	汽車
IoT	物聯網
AI/ Robotics	人工智慧



WiFi RF Front-end成長動能與市場趨勢

- Our growth come from:
 - Segment TAM growth
 - WiFi attachment increase
 - MIMO increase
 - 11ac and Dual-band increase
 - RichWave market share increase

Growth Factors	Dual band (2GHz+5GHz)	MIMO	WiFi Attach-rate	Key Driver
AP Router/ Gateway	All 11ac in DB	2x2 => 3x3=> 4x4=> 8x8&higher	All	MIMO-Increase & WW share
PON	<50% DB	2x2 3x3-at TBD	Partial	WiFi Attach & MIMO
STB/OTT	High-end DB Others SB	2x2 => 3x3	Partial	WiFi attach& MIMO
Smart Speaker	DB	1x1 and 2x2	All	Architecture -embedded RF & MIMO

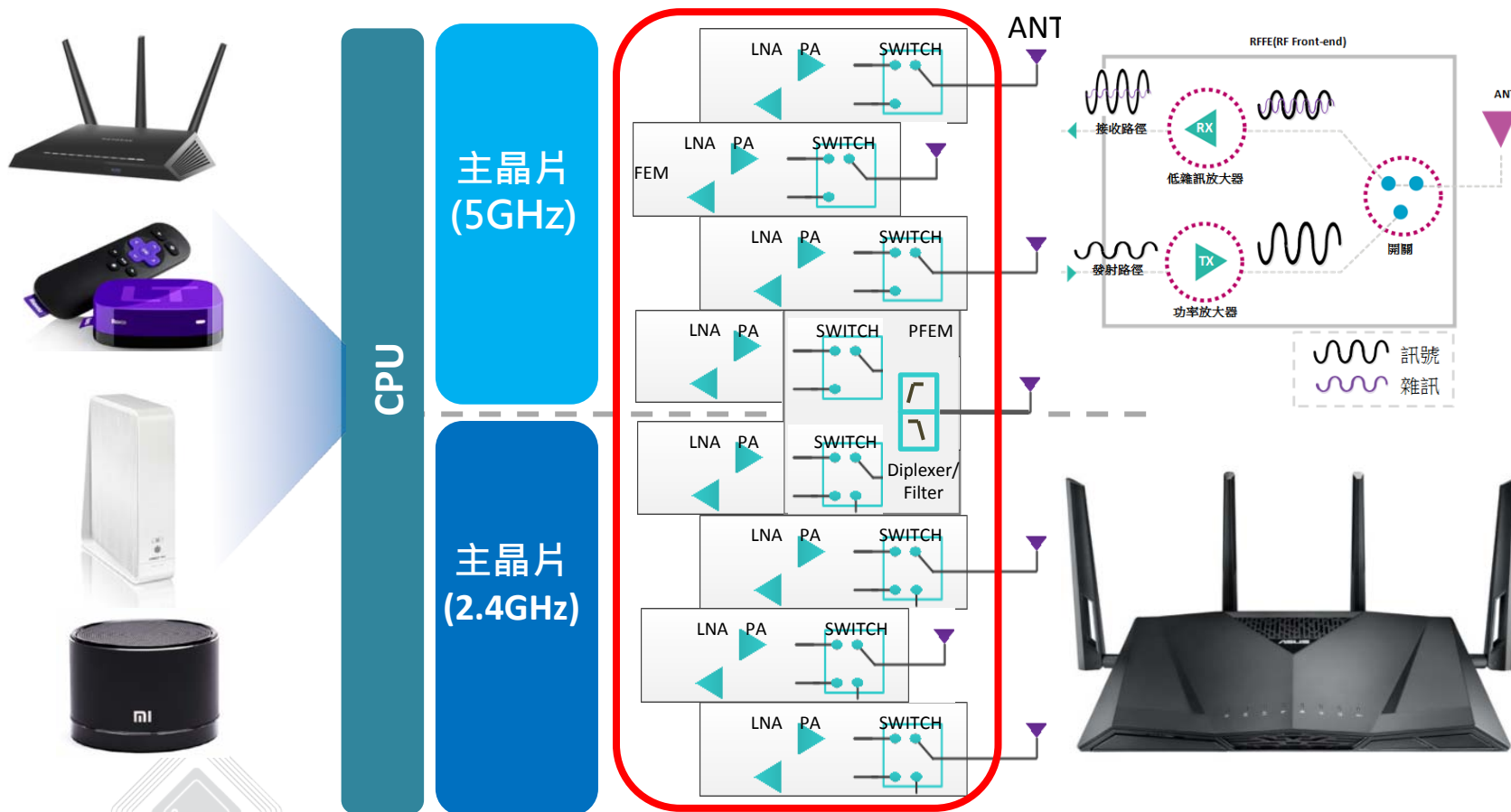
TAM of Segments	2017 (f)	2020 (f)	Growth (%)	Remarks
AP Router (DSL, Cable)	350	400	14%	M units
STB/OTT	380	460	21%	M units, 2020
Smart Phone	1,517	1,697	11.91%	M units
Game Consoles	135.2	184	36%	M units
Smart Speaker	8.3	94	1075%	M units, 2016
IoT	20,000	30,000	50%	M units
Automotive	1,062	7,914	645%	US\$M, 2016

Source: IDC, IHS, Accelerating Biz analysis, frost & Sullivan, Ovum, Statista, IDATE, Gartner, Voicebot.ai, Edison Research, Digital Market Outlook, ABI Research

WiFi MIMO 使傳輸量及RF元件數量倍數增加

- The Front-End enhances coverage-range (PA/LNA) and receiving sensitivity (LNA) – FE performance is Key.

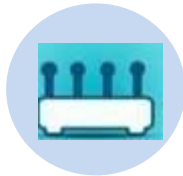
WiFi 802.11AC 4X4 MIMO



WiFi元件/設備-使用RF Front-End 產生 Performance的差異化. WiFi RFFE需具備多元完整產品線及technical-performance

Output Power

H



Data Connected



Video Stream



Set-top box/OTT



Data Connected



Gaming/Speaker/IOT/Sensor

PA	3-in-1 FEM	2-in-1 FEM	SW	LNA
V	V	V		V
V	V	V	V	
		V	V	V

WiFi LTE-WiFi RF-FE產品- 組合多元/ 完整

- Wide Power@EVM range (mid.~high)
- Full-FEM (3-in-1) and Rx-FEM (2-in-1)
- PA/LNA/SW provide flexibility in system-design
- Winning performance for Full-FEM and Rx-FEM

High Power PA		
Parameter		Richwave
Frequency Band	DEVM	Power Level
5GHz	1.8%	23dBm
2GHz	3%	27dBm

Networking: Router/Gateway/STB/OTT

Full FEM					RX FEM			
Parameter				Richwave	Parameter			Richwave
Frequency Band	Power Sagment	Size	DEVM	Power Level	Frequency Band	Power Sagment	Transmisson/ Receive	Power Level
5GHz	H	5x3mm ²	1.8%	22~22.5dBm	5GHz RX FEM	H	TX IP1dB	37dBm
		3x3mm ²	1.8%				RX Gain/NF	14dB/2.6dB
		2.5x2.5mm ²	1.8%			M	TX IP1dB	32dBm
	3x3mm ²	1.8%	20dBm	RX Gain/NF			13.5dB/2.2dB	
	M	2.5x2.5mm ²	1.8%	2GHz RX FEM	H	TX IP1dB	36dBm	
		2x2mm ²	1.8%			20dBm	RX Gain/NF	16dB/1.7dB
2GHz		Pout @ 3% DEVM			27dBm	M	TX IP1dB	32dBm
							RX Gain/NF	15dB/1.6dB

WiFi LTE-WiFi RF-FE產品- 組合多元/ 完整

- Wide Power@EVM range (mid.~high)
- Full-FEM (3-in-1) and Rx-FEM (2-in-1)
- PA/LNA/SW provide flexibility in system-design
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Mobile Phone: WiFi in LTE-phone

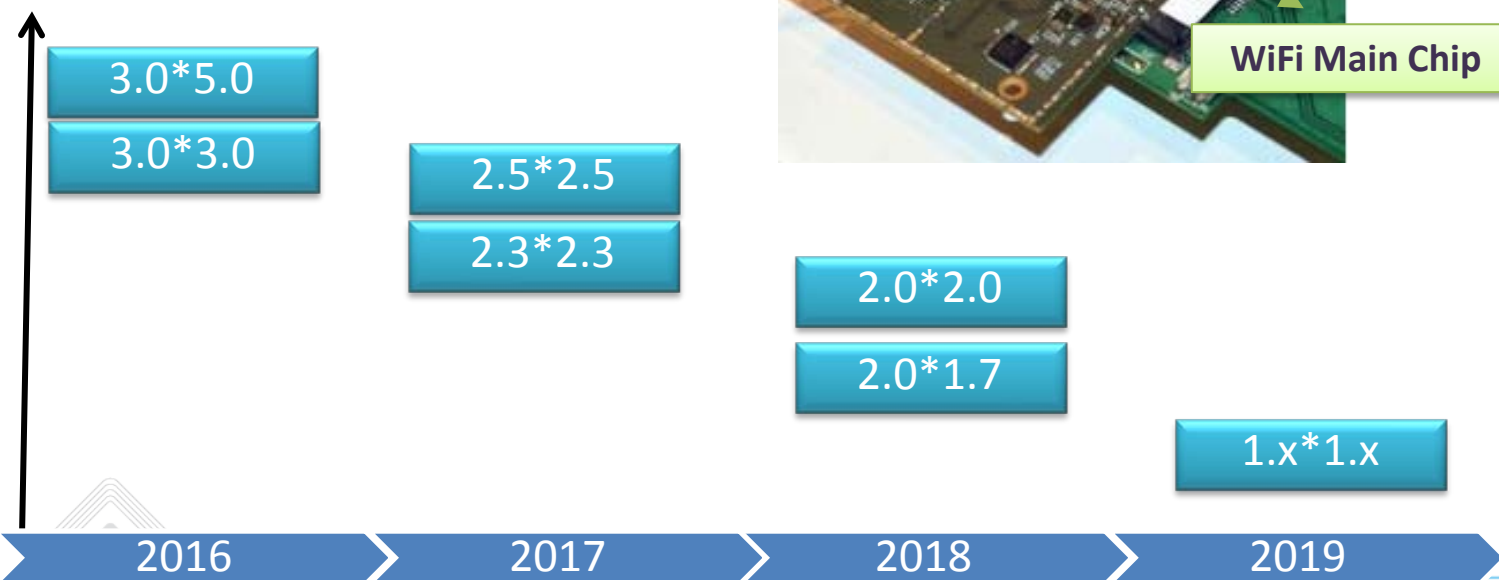
	Parameter		RichWave
5GHz FEM	3 in 1	TX EVM@1.8%	17dBm
		RX Gain/NF	16.5dB/2.0dB
	2 in 1	RX Gain/NF	13.5dB/2.2dB
2GHz RX FEM	3 in 1	TX EVM@1.8%	18.2dBm
		RX Gain/NF	16.5dB/1.5dB
	2 in 1	RX Gain/NF	15dB/1.6dB



WiFi FEM 關鍵特性及趨勢

- EVM ↘
- NF ↘
- Gain ↗
- Package Size ↘

QFN Size



2.4GHz 802.11b/g/n FEM

5GHz 802.11ac FEM



WiFi Main Chip

Source: from Web

經營實績

- WiFi 802.11AC FEM has reached ~8% worldwide share at 2017/E, from ~2% at 2016/E
- Penetrated into leading Global Brands with 802.11AC 3-in-1 FEM, such as Netgear (US), TPLink (China), Technicolor (Europe); and Telecom Operators such as DT, BT (Europe), China Mobile and China Telecom (China), and LGU+ and SKT(Korea)
- Continue winning all Amazon TV-dongle and Smart speaker new models, and penetrated into MII's smart speaker
- Winning LTE LNA on Huawei mobile phone and Nokia phone models
- Winning NB-IOT models with Switch for China Mobile on Smart meters
- Winning FMAM Tuner in Clock Radio and High-end Radio
- FM Tuner continue win on new Mobile models and High-end Boom boxes.

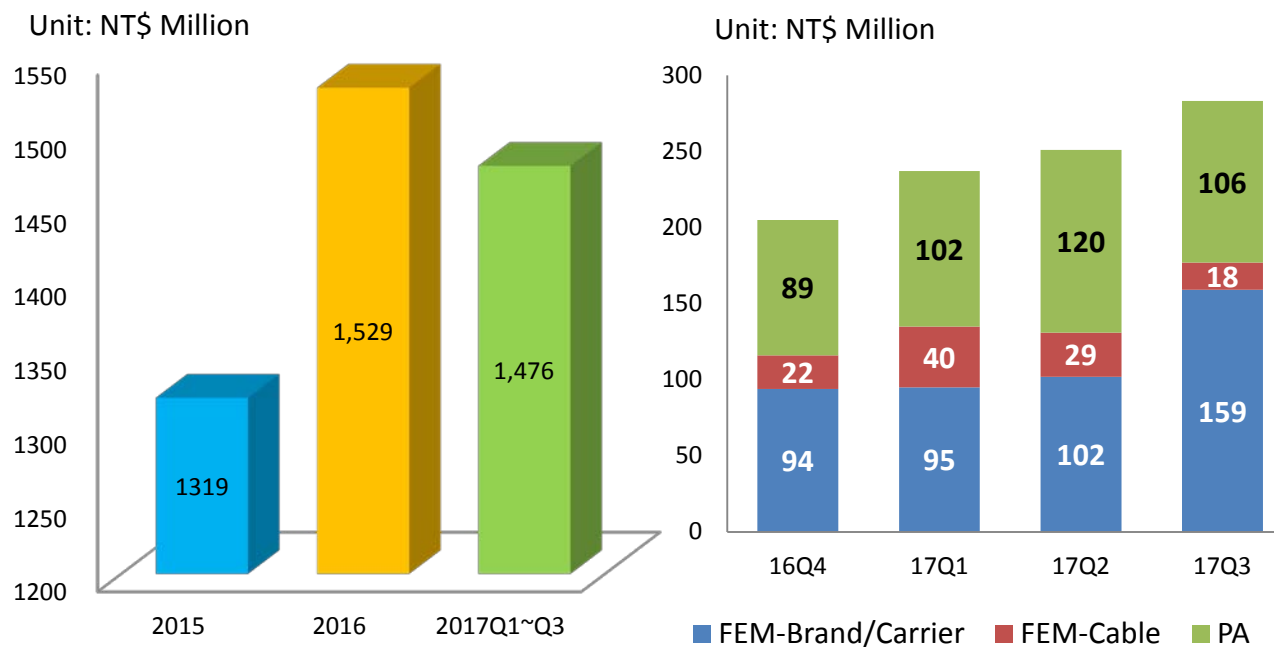


擁有主晶片夥伴超過100項參考設計認證



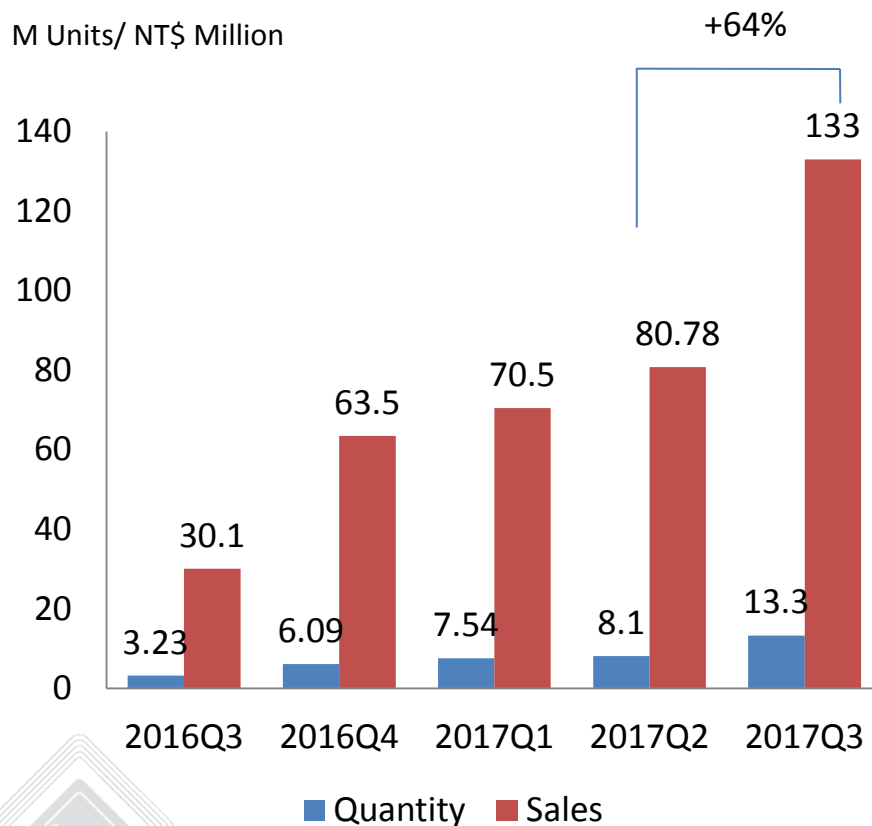
Wi-Fi年成長超過30%

- 2017Q3 FEM 的季增長超過55%，於品牌/電信運營商增加802.11ac
- 2017Q3 WiFi季增長14%，年增長30%以上
- 11ac在全球驅動下，覆蓋範圍擴大，增加MIMO 2x2和3x3的需求成長



WiFi FEM持續進攻全球品牌 Router/Cable/PON/STB / OTT

- 中國&歐美市場，全面布局
- Q4營收在中國&歐美區域放量增加

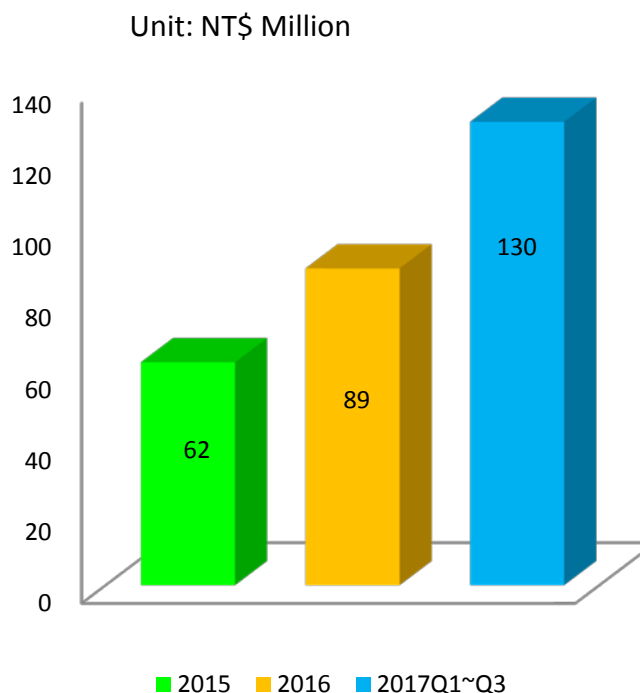
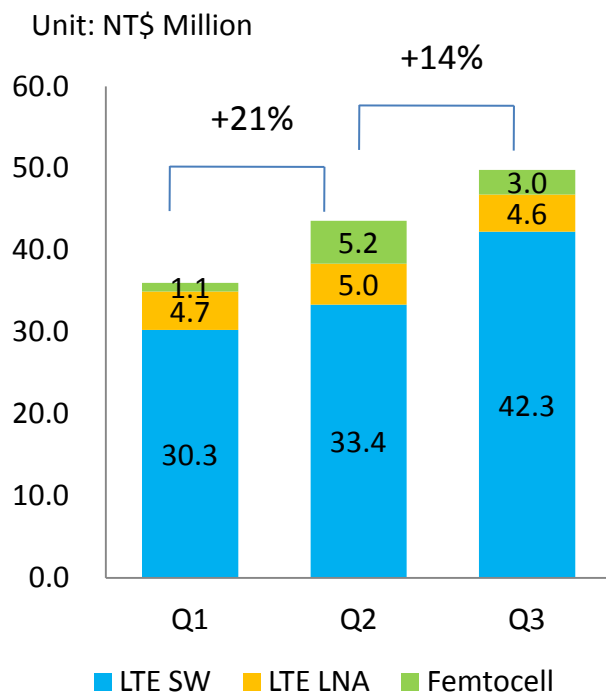


持續贏得智慧音箱客戶青睞



LTE LNA/SW是進入手機市場策略性的步驟

- Focus on Winning LTE LNA
- LTE switch focus on leading Brands

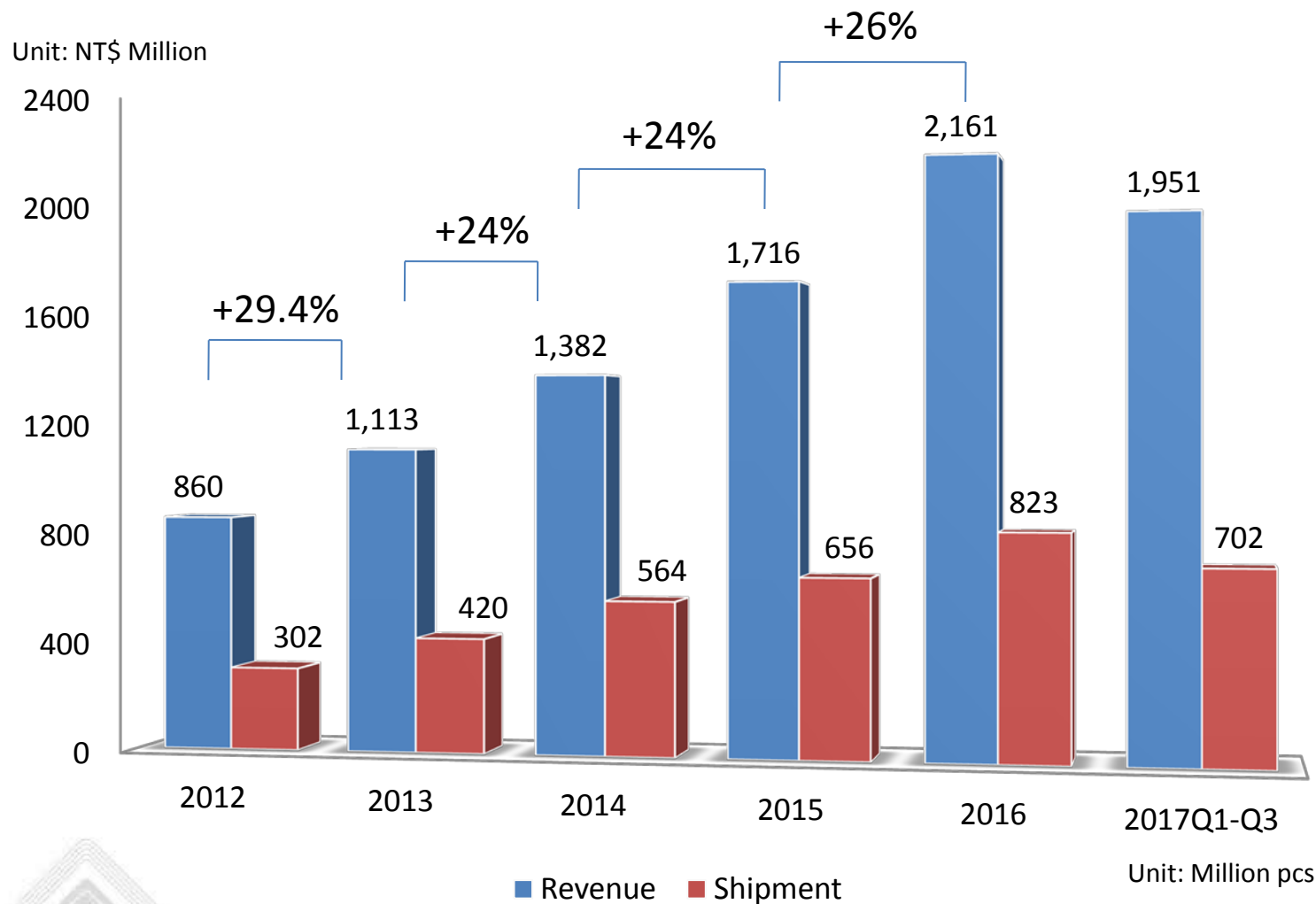


持續耕耘手機FM, 消費性 FM並打入FMAM

- FM 在韓國旗艦手機Note 8 後持續進攻
- AM is penetrating into Clock Radio and Boon box
- 高端技術開發，應用於智慧家庭、物聯網、無人機、倒車後視...的長距離無線HD 影音晶片持續出貨。



連續5年營收>20%成長

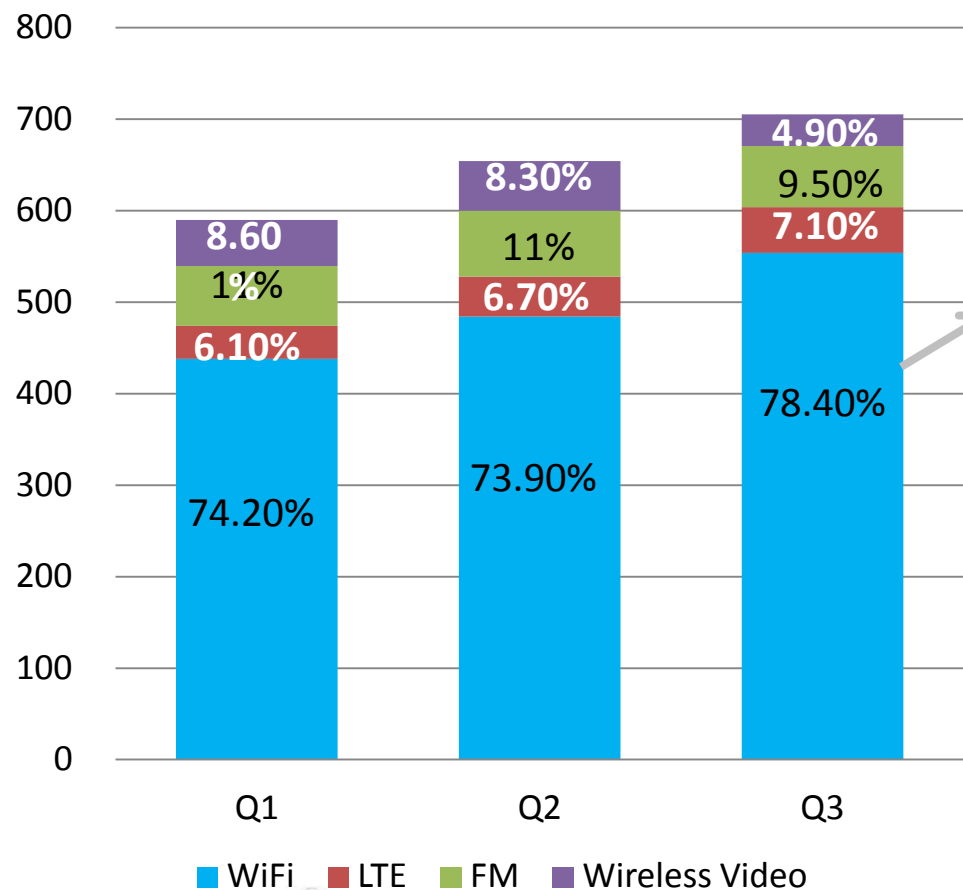


產品組合 WiFi FEM加速成長

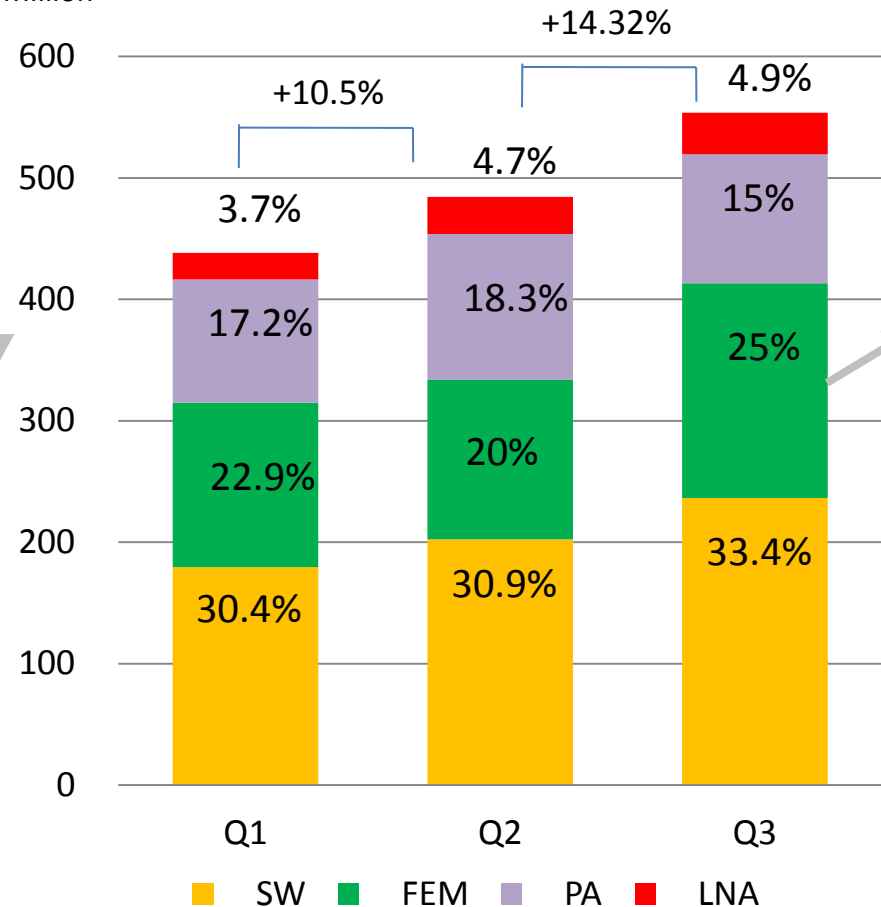
Unit: NT\$ Million

Product Portfolio

Unit: NT\$ Million

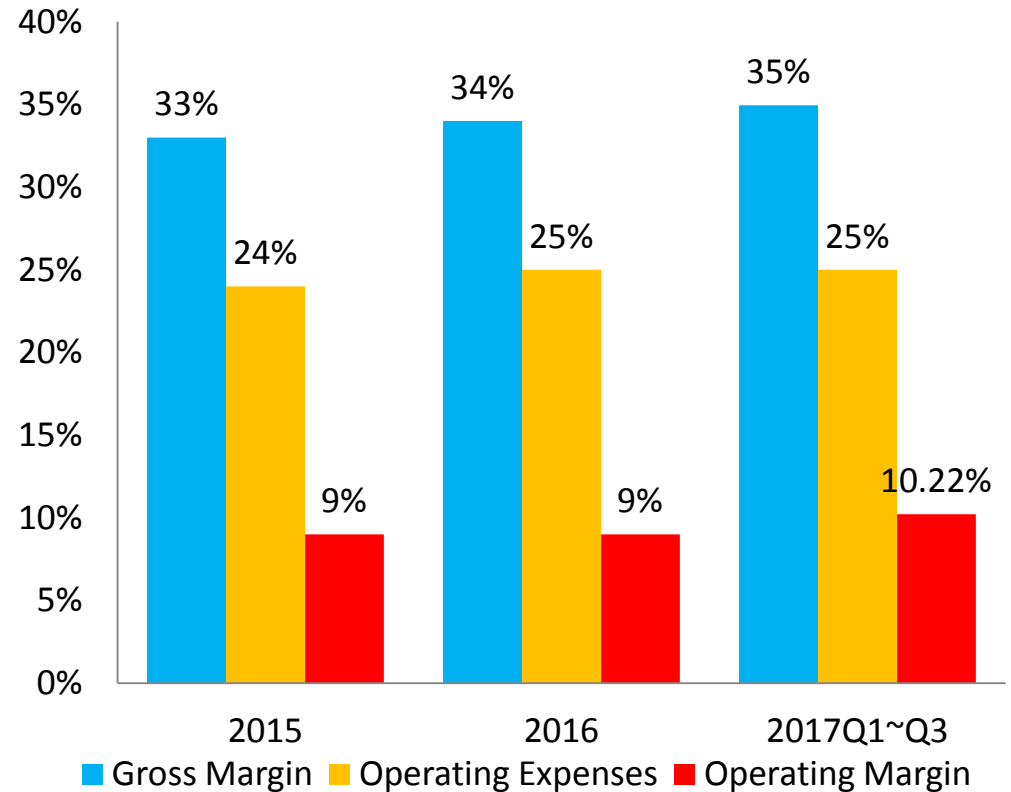
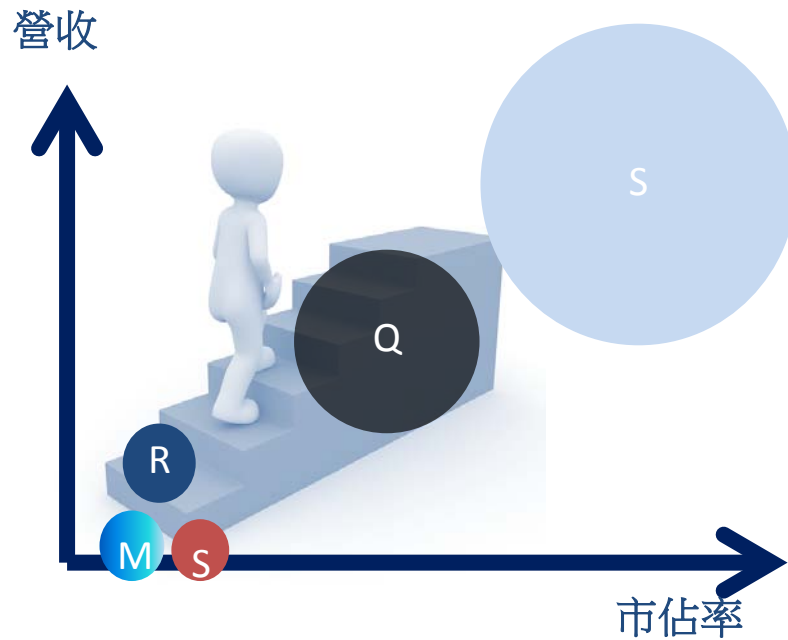


Wi-Fi 產品組合與比例



產品組合轉向高階PA和FEM攻佔市場

營運績效隨市占率成長持續往前邁進





RichWave