



SAWNICS

COMPANY PROFILE



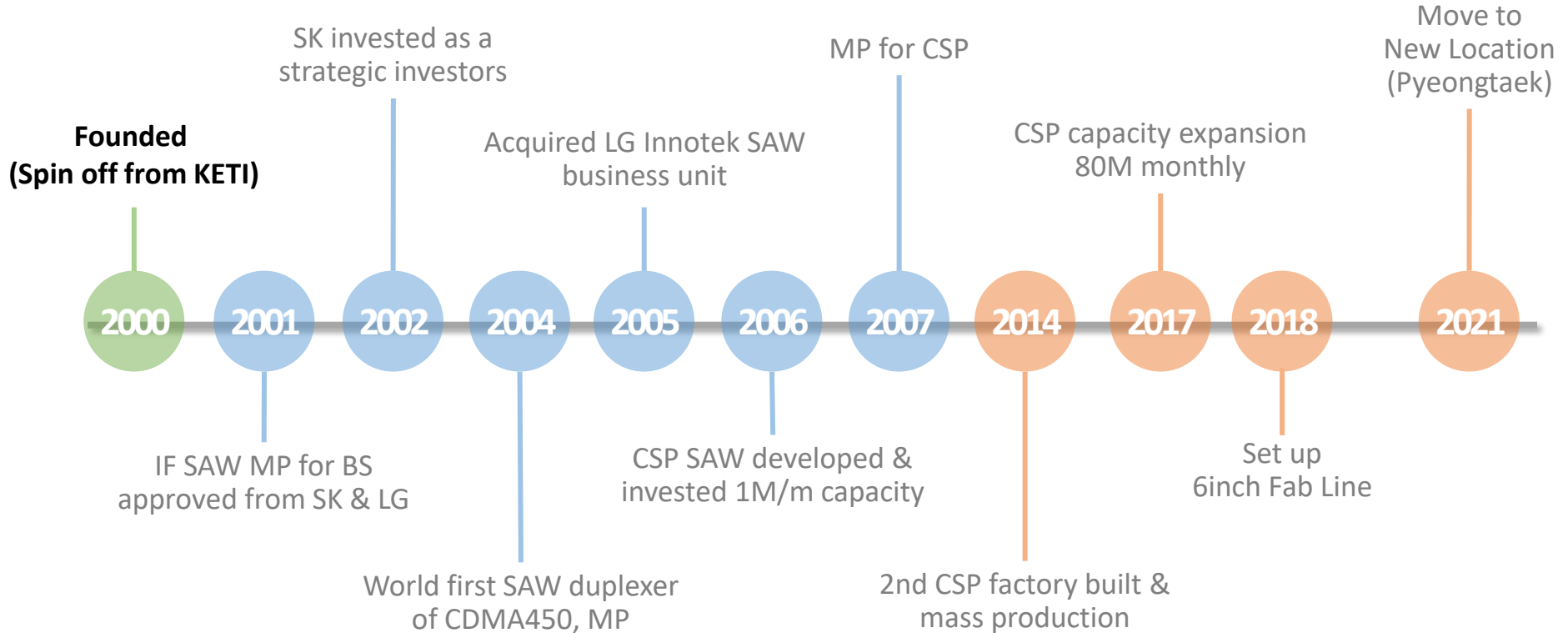
2022 Ver 1.0

COMPANY OVERVIEW

Profile

- **Founded** : October 24, 2000
- **HQ & Main Wafer FAB & Factory** : Pyeongtaek, Republic of Korea
- **Employee in Korea** : 120
- **Business Area** : SAW Filter & Duplexer
SAW Foundry Service
Ceramic Monoblock & Wave guide Solutions
LTCC Solutions
Ceramic Patch Antenna Solutions
RF Components – Cavity / Substrate Filters
- **Market Area** :
Mobile, Automotive, Industry(IoT/M2M, Network Infrastructure)
- **Capacity (Monthly)** :
 - SAW CSP (100Mpcs), SMD (6Mpcs), Wafer FAB (30Kpcs wafers)
 - Dielectric (2Mpcs) / LTCC (400Mpcs)
 - Ceramic Patch Antenna (2Mpcs)

HISTORY



CUSTOMERS

SAWNICS

Partners



Customers

Mobile



IoT/M2M



Network Infra.



A DEFINITE ROLE FROM THE BEYOND EYESHOT GIVE BIRTH TO THE GREAT SUCCESS

Automotive



MARKET AND BUSINESS AREA

Mobile Communications

- Filters, Duplexers and Quadplexer for **LTE/5G NR** Applications (Smart Phone, Tablet Devices, Wearable Devices)
- Filters for Complementary Wireless Application (**Navigation, WLAN, BT/WiFi**)

Industrial Electronics

- Filters and Duplexers for **M2M and IoT** Applications
- Filters(RF/IF/Post PA) and Duplexers for **Small cells** Application
- Filters for Satellite Navigation and WiFi/WLAN

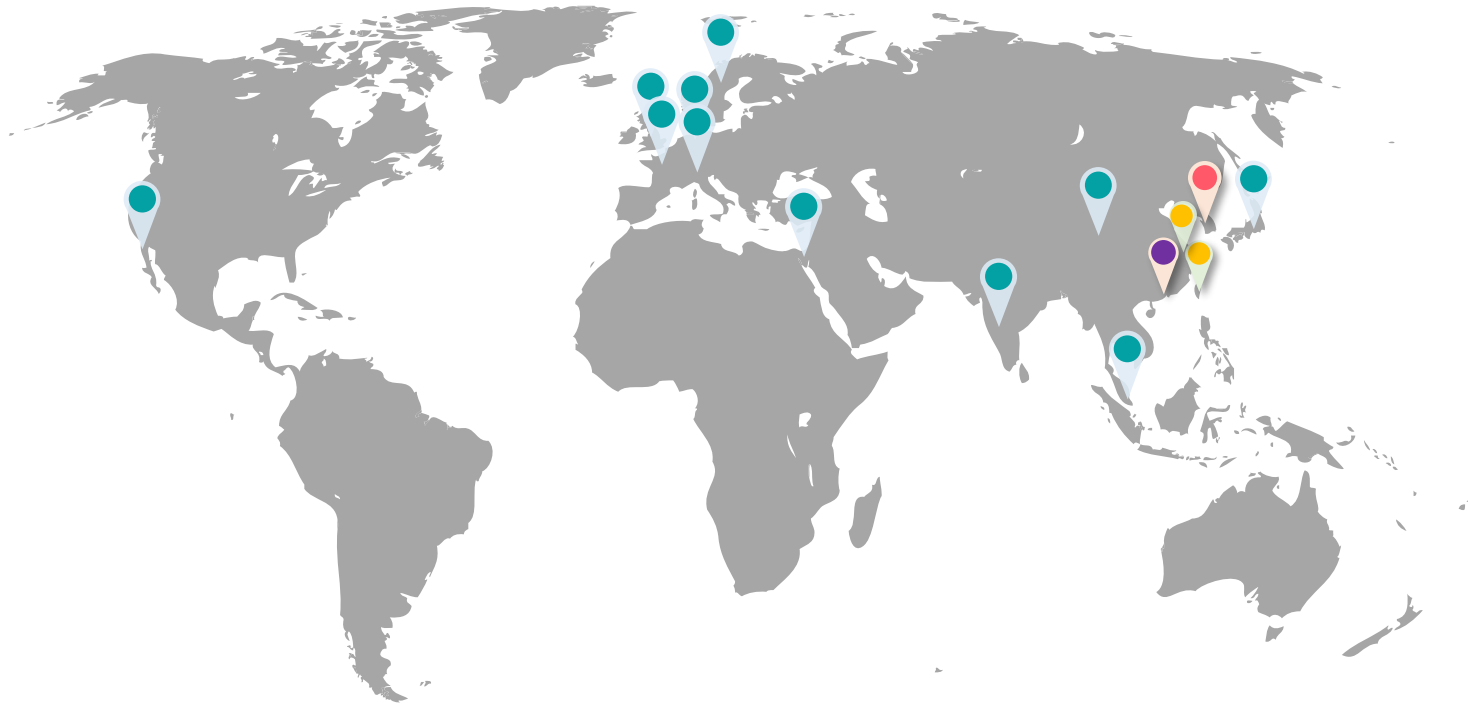
Automotive Electronics

- Filters and Duplexers for **Telematics** Communication
- Filters for **GNSS and 2.4GHz**
- Narrowband / Wideband Filters for **ISM**

FAB Foundry

- Covering from 0.6 to 2.7GHz Frequency
- **High Power SAW/TC-SAW(HPUE)** available
- 4inch and **6inch** Wafers

GLOBAL OPERATION & LOCATION



KOREA (Head Quarter)

- R&D Center
- Wafer FAB
- Assembly
- DR Filter, LTCC
- Antenna

Factory

- Taiwan
- China

Sales Rep

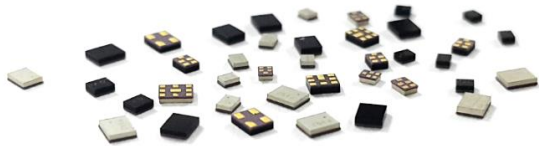
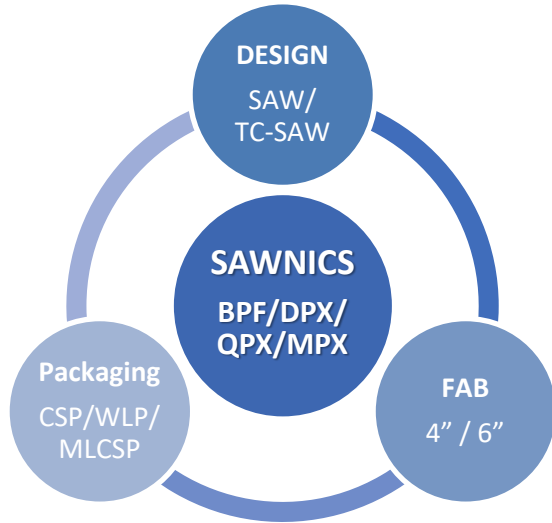
- U.S.A.
- Germany
- U.K.
- France
- Denmark
- Sweden
- Israel
- Taiwan
- China
- Japan
- India
- Singapore
- Malaysia
- Turkey

Sales Office

- Shenzhen, China

SAWNICS STRONG POINT

SAWNICS Technologies of Design, Packaging and Fab Process



01 *Design Technology*

- Traditional SAW : BPF/DPX/IF/DL/Resonator
- TC-SAW : Tx BPF/DPX/QPX
(High Input/Peak Power and Low TCF)

02 *Wafer FAB Technology (Factory in Korea)*

- SAW & TC-SAW(Bonded Wafer)
- 4" and 6" wafers for LB/MB/LB Frequencies
- Supply High Power Filters and Duplexers

03 *Packaging Technology*

- CSP and WLP for Mobile Market
- MLCSP/SSP with MSL1 for Automotive, Telematics Market

PRODUCT CAPABILITY

SAWNICS Solution for SAW / TC-SAW Devices

Product	MSL	Product	Frequency	*Packaging	Application	Power
- SAW - TC-SAW	MSL-3	RF	0.4~3GHz	CSP/WLP	- Mobile - Industry IoT/M2M Small Cells	- 29~32dBm CW - 32~36dBm Peak (depend on F0)
		DPX	0.4~3GHz	CSP		
		QPX	B1/B3	CSP		
	MSL-1	IF	10~900MHz	SSP	- Industry Base Station IoT/M2M Small Cells M/H Precision GPS - Automotive Telematics ISM	
		RF	0.3~3.7GHz	MLCSP ^{TR} SSP		
		DPX	0.3~3.7GHz	MLCSP ^{TR} SSP		

*Packaging: WLP(Wafer Level Packaging), CSP(Chip Scale Packaging), MLCSP(Metal Lid CSP), SSP(Seam Sealing Packaging)

Filters, Duplexers and Quadplexer

- Frequency Band: LTE(FDD/TDD) / 5G NR / GNSS / WLAN & BT
- Packaging(CSP & WLP): 2520 for QPX, 1814 for DPXs, 0907 / 1411 / 1109 for RF BPFs

Applications

- Handset and Smartphone for 4G and 5G
- Portable & Wearable Devices

Feature

- ✓ *SAW & TC-SAW BPFs and Duplexers*
- ✓ *Smaller size of CSP, Possess Technology of WLP*
- ✓ *High power SAW(HPUE) available for 5G*
- ✓ *4" & 6" Facility*

Filters, Duplexers and Quadplexer

- Frequency Band: CDMA / LTE(FDD/TDD) / 5G NR / GNSS / WLAN & BT / ISM
- Packaging(CSP & SSP): 2520 for QPX, 1814 for DPXs, 3030/1411/1109 for BPFs

Applications

- M2M and IoT (Smart Meters and Controls)
- Small Cells, BT and Convergence Application(Femtocells, Internet Access Points)
- Satellite Navigation and ISM(Narrowband and Wideband)

Feature

- ✓ *MSL-1 with MLCSP and SSP*
- ✓ *High power SAW(HPUE) available for Duplexers and Post PA Filters*
- ✓ *High Power Durability at both Tx/Rx ports of Duplexer*

SAWNICS **PRODUCT OVERVIEW** for Automotive Electronics

Filters and Duplexers

- Frequency Band: CDMA / LTE(FDD/TDD) / 5G NR / GNSS / WLAN & BT / ISM
- Packaging(CSP & SSP): 1814 for DPXs, 3030/1411/1109 for RF BPFs

Applications

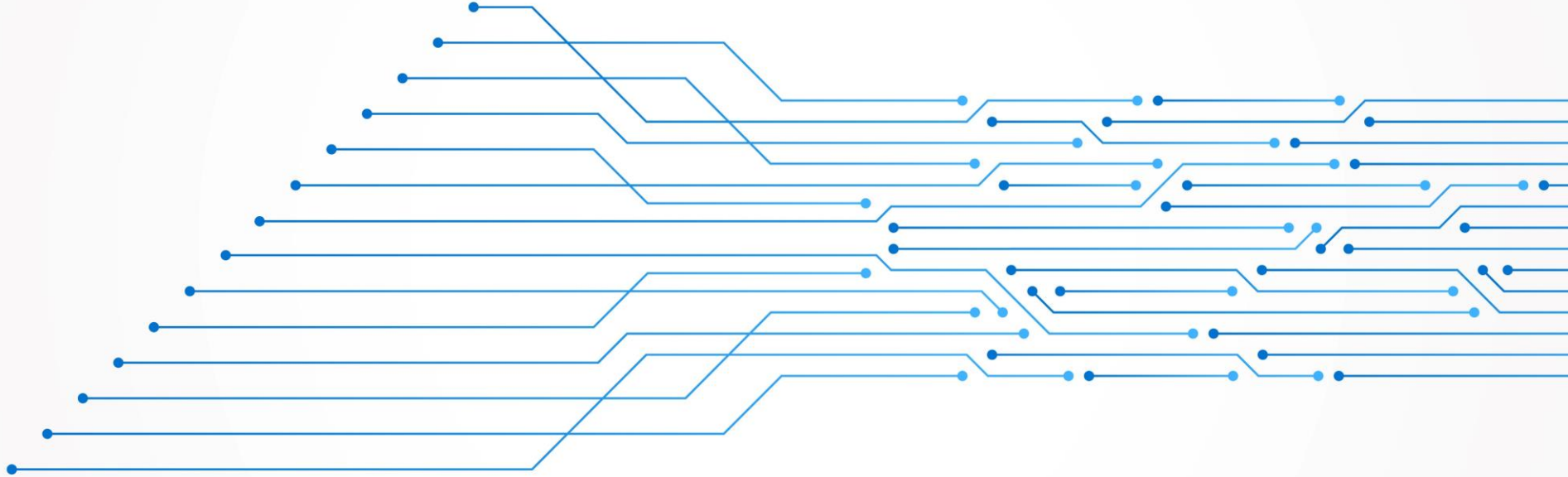
- Telematics Communication for Connected Vehicles
- Tracker, Signal Booster(Telematics Communication, GNSS, ISM)

Feature

- ✓ *MSL-1 with MLCSP and SSP*
- ✓ *Confident Reliability(AEC-Q200)*
- ✓ *High power SAW(HPUE) available for Duplexers and Post PA Filters*
- ✓ *Long Lifetime & Production Cycle*

SAWNICS

SAW Products Line-up



01 Design Capability

- **Product** : BPF(RF/IF), Dual Filter, Diplexer, Duplexer, Module
- **Frequency** : LTE(FDD/TDD), GNSS, WiFi/WLAN, ISM Bands

02 Manufacture Capability

❖ Wafer Fab.(4inch-30Kpcs/month)

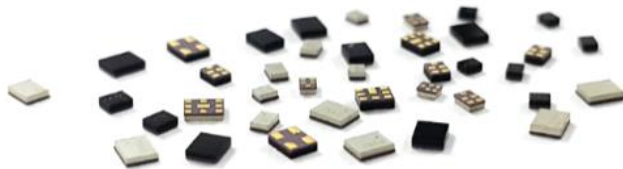
- RF Filter : up to 3.7GHz
- IF Filter : up to 900Mhz
- Duplexer : up to 2.5GHz(High Power Durability)

❖ Assembly(Package size, mm)

- RF Filter : 1.1x0.9 / 1.4x1.1 / 2.0x1.6 / 2.5x2.0 / 3.0x3.0
- IF Filter : 5.0x5.0 / 7.0x5.0 / 13.3x6.5 / 19.0x6.5 / 20.0x9.8
- DPX : 1.8x1.4 / 2.0x1.6 / 3.0x2.5 / 3.8x3.8

03 Applications

- Mobile Phone
- IoT(M2M)
- Automotive
- Infrastructure(Small Cells, Repeater, Router, etc...)



04 Strength & Forte

- Expertise (More than 30% of Engineers)
- High Technical Skill / Experience
(More than 70% of Long-term employed person)
- Stable Production for 21 years
- Free up 30% of capacity
- Customer Satisfaction through Rapid Response

3G/4G LTE Bands

Band	Duplexer(1814 size)		RF Filter (1109 size)			RF Filter (0907 size)
	Rx- Unbalance	Rx- Balance	Tx	Rx		Rx
			Unbalance	Unbalance	Balance	Unbalance
1	SD-2140T3-C62 SD-195002-C63 SD-195004-C63	SD-2140T4-C62 SD-195003-C64 SD-195005-C64	SF-1950T2-C13	SF-2140T4-C13 SF-214002-C14 SF-214007-C12	SF-2140T2-C13 SF-214003-C14	SF-214000-C00 (Engineering Stage)
2	SD-188002-C63 SD-188003-C63	SD-188004-C64	SF-1880T2-C13	SF-1960T4-C13 SF-196001-C14 SF-196007-C12	SF-1960T3-C13 SF-196002-C14	Under Development
3	SD-174701-C63 SD-174703-C63		SF-1747T2-C13	SF-1842T2-C13 SF-184205-C14 SF-184207-C14	SF-1842T3-C13 SF-184206-C14	Under Development
4				SF-2140T4-C13 SF-214002-C14	SF-2140T2-C13 SF-214003-C14	
5	SD-0881T4-C62 SD-083607-C63 SD-083611-C63	SD-0881T5-C62 SD-083609-C64 SD-083610-C64	SF-0836T2-C13	SF-0881T4-C13 SF-088106-C14 SF-088111-C14	SF-0881T2-C13 SF-088107-C14	Under Development
6	SD-0881T4-C62 SD-083607-C63	SD-0881T5-C62 SD-083609-C64	SF-0836T2-C13	SF-088106-C14 SF-0881T4-C13	SF-088107-C14 SF-0881T2-C13	
7	SD-253504-C63 SD-253505-C63			SF-2655T5-C13 SF-265502-C14 SF-265506-C12	SF-2655T4-C13 SF-265503-C14	SF-265500-C00 (Engineering Stage)
8	SD-0942T3-C62 SD-089701-C63 SD-089703-C63	SD-0942T4-C62 SD-089702-C64 SD-089704-C64	SF-0897T2-C13	SF-0942T4-C13 SF-094205-C14	SF-0942T3-C13 SF-094206-C14	Under Development
12			SF-0707T2-C13	SF-0737T2-C13	SF-0737T5-C13	
13	SD-0782T3-C62		SF-0782T2-C13	SF-0751T3-C13	SF-0751T2-C13	

3G/4G LTE Bands



Band	Duplexer(1814 size)		RF Filter (1411 size)	RF Filter (1109 size)		
	Rx- Unbalance	Rx- Balance	Tx	Tx	Rx	
			Unbalance	Unbalance	Unbalance	Balance
14	SD-0793T1-C62					
19	SD-0881T4-C62 SD-083607-C63 SD-083611-C63	SD-0881T5-C62 SD-083609-C64 SD-083610-C64		SF-0836T2-C13	SF-0881T4-C13 SF-088106-C14	SF-0881T2-C13 SF-088107-C14
20	E/S				SF-0806T3-C13	
28				SF-071802-C21(A) SF-073303-C21(B)	SF-0773T1-C13(A) SF-77302-C21(A) SF-0788T1-C13(B) SF-78802-C21(B) Full Band(E/S)	
34			SF-201702-C24	SF-201703-C14	SF-201704-C14	
38			SF-259503-C23	SF-259504-C12	SF-259505-C12	SF-259506-C12
39			SF-190006-C24	SF-190007-C14	SF-190008-C14	
40			SF-235001-C23	SF-235004-C12	SF-235005-C12	SF-235006-C12
41	BW: 105MHz		SF-260512-C24	SF-260202-C12 SF-260511-C14 SF-260513-C14	SF-260204-C12 SF-260205-C12 SF-260509-C14	SF-260203-C12
	BW: 120MHz		SF-259510-C24	SF-259508-C14	SF-259509-C14	
	BW: 194MHz(Full Band)		SF-259302-C27			
	BW: 194MHz, HPUE (2535~2655MHz)		SF-259303-C27			

5G LTE Bands

Band (5G)	Band (4G)	Operating Band(UL)	Operating Band(DL)	Band Width	Part Numbers	Remark
n1	B1	1920 MHz – 1980 MHz	2110 MHz – 2170 MHz	60 MHz	SD-2140T3-C62	
n2	B2	1850 MHz – 1910 MHz	1930 MHz – 1990 MHz	60 MHz	SD-1960T5-C62	
n3	B3	1710 MHz – 1785 MHz	1805 MHz – 1880 MHz	75 MHz	SD-1842T1-C62	
n5	B5	824 MHz – 849 MHz	869 MHz – 894 MHz	25 MHz	SD-083611-C63	
n7	B7	2500 MHz – 2570 MHz	2620 MHz – 2690 MHz	70 MHz	SD-2655T3-C62	
n8	B8	880 MHz – 915 MHz	925 MHz – 960 MHz	35 MHz	SD-0942T5-C62	
n20	B20	832 MHz – 862 MHz	791 MHz – 821 MHz	30 MHz	SD-0847T3-C62	
n28	B28	703 MHz – 748 MHz	758 MHz – 803 MHz	45 MHz	SF-078004-C14	Full band(Rx)
n28	B28	703 MHz – 748 MHz	758 MHz – 803 MHz	45 MHz	SF-072505-C28	Full band(Tx)
n38	B38	2570 MHz – 2620 MHz	2570 MHz – 2620 MHz	50 MHz	SF-259505-C12	



5G LTE Bands

Band (5G)	Band (4G)	Operating Band(UL)	Operating Band(DL)	Band Width	Part Numbers	Remark
n41	B41	2555 MHz – 2655 MHz	2555 MHz – 2655 MHz	100 MHz	SF-260513-C14	BW 100MHz
n41	B41	2496 MHz – 2690 MHz	2496 MHz – 2690 MHz	194 MHz	SF-259302-C27	BW 194MHz(Full)
n66	B66	1710 MHz – 1780 MHz	2110 MHz – 2200 MHz	70/90 MHz	SD-2155T1-C62	
n71	B71	663 MHz – 698 MHz	617 MHz – 652 MHz	35 MHz	SF-063402-C28	
n77	B43	3300 MHz – 4200 MHz	3300 MHz – 4200 MHz	900 MHz	SLB-375001-B48	BW 200MHz
n78	B42	3300 MHz – 3800 MHz	3300 MHz – 3800 MHz	500 MHz	SLH-355001-F30	BW 200MHz
n79		4400 MHz – 5000 MHz	4400 MHz – 5000 MHz	600 MHz	SLB-470005-B48	
n80	B3 Tx	1710 MHz – 1785 MHz	N/A	75 MHz	SF-1747T2-C13	
n81	B8 Tx	880 MHz – 915 MHz	N/A	35 MHz	SF-0897T2-C13	
n82	B20 Tx	832 MHz – 862 MHz	N/A	30 MHz	SF-0847T2-C13	
n83		703 MHz – 748 MHz	N/A	45 MHz	SF-072505-C28	
n84		1920 MHz – 1980 MHz	N/A	60 MHz	SF-1950T2-C13	

Bluetooth / WiFi / WLAN

❖ FEATURES

Application Automotive / Routers / Laptop / Headset / Speaker

Size 1.1 x 0.9 / 1.4 x 1.1 mm

Input Power Max. 28dBm

MSL MSL-1 / 3

❖ LINE UP

P/N	Fc (MHz)	BW (MHz)	Size (mm)	Channel	Input Power dBm Max.	Remark
SF-244101-C23	2441.8	2400~2483.5	1.4x1.1	Ch1~13	26	MSL-3
SF-244104-C24	2442.0	2401~2483	1.4x1.1	Ch1~13	24	MSL-3
SF-2442T1-C26	2442.0	2402.5~2481.5	1.4x1.1	Ch1~13	28	MSL-1
SF-245003-C23	2450.0	2400~2500	1.4x1.1	Ch1~14	28	MSL-3
SF-245004-C12	2450.0	2400~2500	1.1x0.9	Ch1~14	28	MSL-3
SF-245201-C24	2452.0	2421~2483	1.4x1.1	Ch5~13	24	MSL-3

❖ FEATURES

Application	Navigation for Vehicles and Portable
Frequency (MHz)	GPS, GLONASS, COMPASS(BeiDou)
Size (mm)	1.1x0.9 / 1.4x1.1
Package	CSP(Chip Scale Packaging)
Performance Type	Low Loss / High Attenuation

❖ LINE UP

System	Part Number	BW (MHz)	Size (mm)	Impedance (Ω)	Remark
GPS	SF-157503-C23	± 1.0	1.4 x 1.1	50/50	MSL-3
GPS	SF-1575T1-C26	± 1.0	1.4 x 1.1	50/50	MSL-1
GPS	SF-1575T2-C26	± 1.0	1.4 x 1.1	50/100	MSL-1
GNSS	SF-1582T1-C13	± 23.42	1.1 x 0.9	50/50	MSL-1
GNSS	SF-158202-C14	± 23.42	1.1 x 0.9	50/50	MSL-3
GNSS	SF-1582T3-C13	± 23.42	1.1 x 0.9	50/100	MSL-1
GNSS	SF-158206-P80(ES)	± 23.42	0.9 x 0.7	50/50	MSL-3
GPS+GLONASS	SF-158501-C21	± 20.235	1.4 x 1.1	50/100	MSL-3
GPS+GLONASS	SF-1585T1-C26	± 20.233	1.4 x 1.1	50/50	MSL-1
GPS+GLONASS	SF-1585T3-C13	± 20.233	1.1 x 0.9	50/100	MSL-1
GPS+GLONASS	SF-158802-C14	± 15.735	1.1 x 0.9	50/50	MSL-3

HIGH PRECISION GNSS

❖ FEATURES

Application	Agriculture, Road, Rail, Maritime, Timing & Sync., Drone
Frequency (MHz)	GPS, GLONASS, COMPASS(BeiDou), Galileo
Size (mm)	2.5 x 2.0 / 3.0 x 3.0
Impedance	Single-ended or Balanced
Packaging	SMD for MSL-1

❖ LINE UP (MSL-1)

Band	Part Number	BW	Size[mm]	Impedance (Ω)	Remark
GNSS L5/E5a+E5b	SF-119101-S21	50MHz	3.0 x 3.0	50-50	51MHz / 1166~1217MHz
B2I / E5b / Glonass L3	SA1209AM	83MHz	3.0 x 3.0	50-50	87MHz / 1166~1253MHz
GPS L2 / Glonass L2	SF-122505-S21	34MHz	3.0 x 3.0	50-50	57MHz / 1197~1254MHz
GNSS E5b/L2	SF-122505-S21	54MHz	3.0 x 3.0	50-50	57MHz / 1196~1253MHz
GPS L2	SF-122701-S20	20MHz	3.0 x 3.0	50-50	22MHz / 1216~1238MHz
GNSS L band	SA1542FM	34MHz	3.0 x 3.0	50-50	35MHz / 1525~1560MHz
GNSS L band	SF-154201-S21	34MHz	3.0 x 3.0	200-200	35MHz / 1524.5~1559.5MHz
GPS L1	SA1575GL	2MHz	2.5 x 2.0	50-50	4MHz / 1573~1577MHz
GNSS L+L1/G1	SA1567BM1	81MHz	3.0 x 3.0	50-50	85MHz / 1525~1610MHz
GNSS L1 band	SF-158107-S21	51MHz	3.0 x 3.0	50-50	57MHz / 1553~1610MHz
GNSS L1/G1 band	SA1587BM	46MHz	3.0 x 3.0	50-50	55MHz / 1560~1614MHz
GNSS L1/G2 band	SF-158401-S21	46MHz	3.0 x 3.0	200-200	51MHz / 1559~1610MHz

ISM (Narrow Band)

Center Frequency [MHz]	Bandwidth [MHz]	Package Size [mm]	P/N	Cross Reference	Remark
169.4	0.2	5X5	SF-016903-S46	<i>B3942</i>	MSL-1
313.15 / 314	0.2	3.8X3.8	SF-031301-S39	<i>B3535</i>	MSL-1
313.85	0.55	3.8X3.8	SF-031302-S39	<i>B3768</i>	MSL-1
314.45	1.1	3X3	SF-031401-S27	<i>B3950</i>	MSL-1
315	1.06	3X3	SF-031502-S27	<i>B3739</i>	MSL-1
315	0.36	3X3	SF-031503-S27	<i>B3741</i>	MSL-1
315	0.55	3.8X3.8	SF-031504-S39	<i>B3781</i>	MSL-1
433.2 / 434.64	0.2	3.8X3.8	SF-043302-S39	<i>B3533</i>	MSL-1
433.42	0.5	3.8X3.8	SF-043303-S39	<i>B3791</i>	MSL-1
433.92	0.36	3X3	SF-043304-S27	<i>B3732/B3743/B3933 SAFBC433MPB0X00</i>	MSL-1
433.92	1.1	3X3	SF-043305-S27	<i>B3935/B3951</i>	MSL-1
433.92	0.55	3X3	SF-043301-S20	<i>B3936</i>	MSL-1
433.92	0.36	3.8X3.8	SF-043306-S39	<i>B3760 / B3774 / B3790</i>	MSL-1
433.92	1	3.8X3.8	SF-043307-S39	<i>B3780</i>	MSL-1
433.92	1.1	3.8X3.8	SF-043308-S39	<i>B3782</i>	MSL-1
434.42	1.07	3X3	SF-043403-S27	<i>B3733 / B3748</i>	MSL-1
868.3	0.6	3X3	SF-086802-S27	<i>B3734 / B3744</i>	MSL-1
902.875	1.35	3X3	SF-090201-S27	<i>B3934</i>	MSL-1

ISM (Wide Band)

Center Frequency [MHz]	Bandwidth [MHz]	Package Size [mm]	P/N	Cross Reference	Remark
314.35	0.6	3X3	SF-031402-S27	B3714	MSL-1
315	1	3X3	SF-031505-S27	B3719 / B3722 SAFBC315MSP0T00	MSL-1
428	16	3X3	SF-042802-S27	B3411	MSL-1
433.92	1.6	3X3	SF-043309-S27	B3402/ B3721/ B3900/ B3925 SAFBC433MSP0T00	MSL-1
433.92	1.7	3X3	SF-043310-S27	B3710	MSL-1
866.5	7	3X3	SF-086602-S27	B3441	MSL-1
866.5	7	3X3	SF-086603-S27	B3717	MSL-1
869	2	3X3	SF-086910-S27	B3440 / B3725 / B3903	MSL-1
912	12	3X3	SF-091201-S27	B3406	MSL-1
915	26	3X3	SF-091506-S27	B3588	MSL-1
915	10	3X3	SF-091507-S27	B3726	MSL-1
915	26	3X3	SF-091508-S27	B3728	MSL-1
915	26	2.0X1.6	SF-091509-C47		MSL-1
915	26	1.4X1.1	SF-091510-C28	B4301	MSL-1
915	26	1.4X1.1	SF-091511-C28	B4317	MSL-1
916.45	4	3X3	SF-091604-S27	B3718	MSL-1
922.5	5	3X3	SF-092202-S27	B3407	MSL-1
925.2	5.8	3X3	SF-092504-S27	B3919 / B3926 / B3916 / B3921	MSL-1
2441.75	83.5	3X3	SA2441AM	B3918	MSL-1

ISM (Remote Keyless Entry)

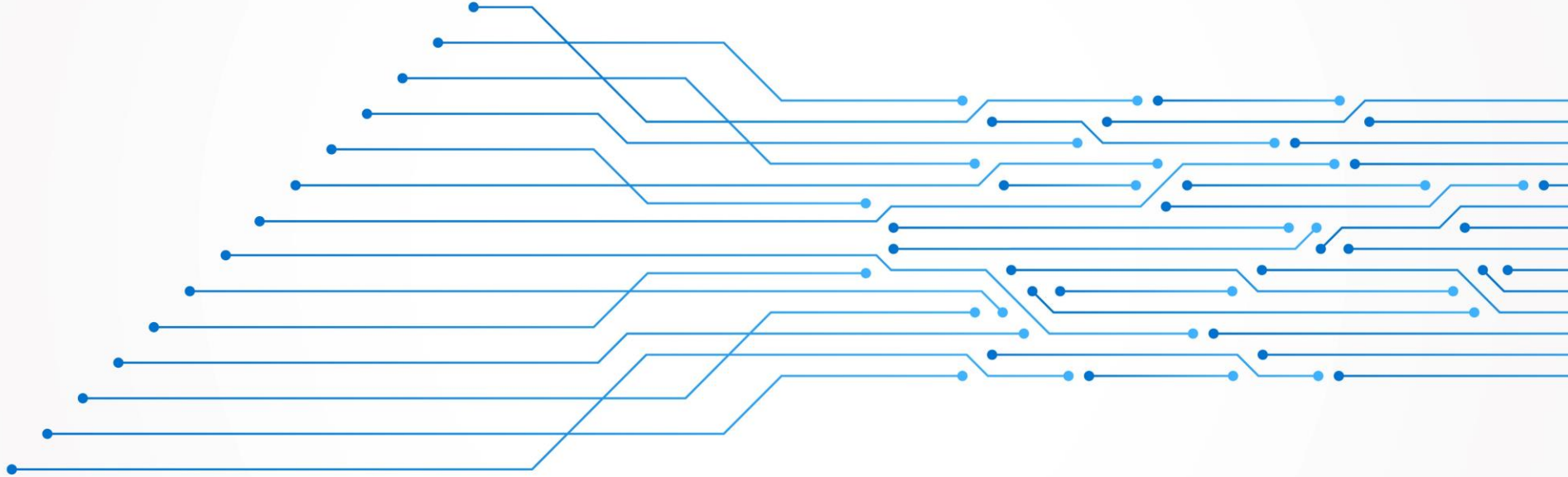
Center Frequency [MHz]	Bandwidth [MHz]	Package Size [mm]	P/N	Cross Reference	Remark
866.5	7	3X3	SF-086603-S27	CC11XX	MSL-1
866.5	7	3X3	SF-086604-S27	B3717	MSL-1
869	2	3X3	SF-086910-S27	B3440/B3725/B3903	MSL-1
869	2	3X3	SF-086911-S27		MSL-1
868.3	1.5	3X3	SF-086804-S28	B3734/B3744	MSL-1
869	2	1.4X1.1	SF-086912-C28	B4316	MSL-3
869.3	1.4	3X3	SF-086913-S27	B3749	MSL-1
869.5	13	3X3	SF-086914-S27	B3418	MSL-1
869.6	1	3X3	SF-086915-S27		MSL-1
902.875	1.35	3X3	SF-090201-S27	B3934	MSL-1

ISM (Metering)

Center Frequency [MHz]	Bandwidth [MHz]	Package Size [mm]	P/N	Cross Reference	Remark
915	26	1.4X1.1	SF-091510-C28	<i>B4317</i>	MSL-3
915	26	1.4X1.1	SF-091512-C28	<i>B4344</i>	MSL-3
915	26	2.0X1.6	SF-091509-C47		MSL-3
915	26	3X3	SF-091508-S27	<i>B3728</i>	MSL-1
915	26	3X3	SF-091506-S27	<i>Microchip/B3588</i>	MSL-1
915	10	3X3	SF-091507-S27	<i>B3726</i>	MSL-1
915	26	3.8X3.8	SF-091514-S38	<i>B4637</i>	MSL-1
922.5	5	3X3	SF-092203-S27	<i>B3407</i>	MSL-1
925.2	5.8	1.4X1.1	SF-092505-C28	<i>B4336</i>	MSL-3
925.2	5.8	3X3	SF-092504-S27	<i>B3926</i>	MSL-1
1795	15	3X3	SF-179502-S27	-	MSL-1

SAWNICS

Ceramic Products Line-up



Ceramic Overview

SAWNICS

Customized Design

01 Design Capability

- **Product** : Filter, Diplexer, Duplexer, Triplexer, Quadplexer, Module Resonator, Waveguide
- **Frequency** : LTE(FDD/TDD), GNSS, WiFi/WLAN, Customized(~20GHz)

02 Manufacture Capability

- ❖ **Capability** : 2Mpcs / Month
- ❖ **Any Customized size**
- ❖ **Frequency up to 20GHz**
- ❖ **Very Low Amplitude Ripple**
- ❖ **High Rejections / Isolation of Cross-Band**
- ❖ **Dual & Multi LTE Band available**

03 Applications

- Base Station
- Repeater
- Small Cells
- Signal Boosters
- Aerospace/ Defense



04 Strength & Forte

- **Expertise / High Technical Skill / Experience**
(More than 70% of Long-term employed person)
- **Stable Production for 21 years**
- **Free up 30% of capacity**
- **Short L/T for customize design**
- **Customer Satisfaction through Rapid Response**

Dielectric Filters for WiFi

Band	Item	Fc (MHz)	BW (MHz)	IL(dB)	Atten.(dB/MHz)	Size (W x L x H mm)	Part Num.
5G UNII1-3	DPX	5250 / 5665	180 / 370	2.0/2.5	60 at 5160~5340 / 40 at 5480~5850	28.0 x 6.5 x 5.2	SD-5250P3-P4A
	DPX	5250 / 5665	180 / 370	2.5/1.5	40 at 5160~5340 / 60 at 5480~5850	28.0 x 6.5 x 5.2	SD-5665P3-P4A
	BPF	5200.0	100 : 5150~5250	2.0(1.4)	30 at 5376 / 35 at 5470	8.6 x 4.0 x 3.0	SF-5200M1-GDA
	BPF	5235.0	180 : 5150~5330	3.0	50 at 5490~5850	8.6 x 4.05 x 3.0	SF-5235M1-CJ4
	BPF	5240.0	200 : 5140~5340	2.1(1.5)	17 at 5480~5860	3.25 x 2.6 x 1.85	SF-5240M1-CJ3
	BPF	5245.0	190 : 5150~5340	2.0	(35) at 5480~5850	8.46 x 4.05 x 3.0	SF-5245M1-CJ4
	BPF	5250.0	160 : 5170~5330	2.0(1.1)	39(41) at 5490 / 50(57) at 5530~5935	8.7 x 4.0 x 2.8	SF-5250M4-GFD
	BPF	5250.0	160 : 5170~5330	2.5(2.0)	40 at 5490~5935	8.6x4.05 x 3.0	SF-5250M1-CJ4
	BPF	5652.5	325 : 5490~5815	2.0(1.2)	35(51) at 5330 / 45(54) at 5210	8.7 x 3.9 x 2.8	SF-5652M3-GFD
	BPF	5665.0	370 : 5480~5850	2.0(1.5)	38 at 5150~5340	8.46 x 3.45 x3.0	SF-5665M1-CJ4
	BPF	5670.0	380 : 5480~5860	2.1(1.5)	17 at 5140~5340	3.25 x 2.6 x 1.85	SF-5670M1-CJ3
	BPF	5697.0	455 : 5470~5925	1.7(1.5)	40 at 5150~5350	12.9 x 5.3 x 4.1	SF-5697M1-H4F5
	BPF	5697.0	360 : 5490~5850	2.5(2.0)	50 at 5150~5330	8.6 x 3.45 x 3.0	SF-5697M1-CJ4
	BPF	5710.0	445 : 5490~5935	2.5(1.7)	40 at 5170~5330	8.6 x 3.45 x 3.0	SF-5710M1-CJ4
	BPF	5735.0	530 : 5470~6000	2.0	20 at 5376 / 35 at 5150	8.6 x 3.8 x 3.0	SF-5735M1-GDA
BPF	5745.0	40 : 5725~5765	3.5	50 at 5835~5875	16.5 x 7.4 x 4.1	SF-5745M2-P46	
BPF	5855.0	40 : 5835~5875	3.5	50 at 5725~5765	16.5 x 7.4 x 4.1	SF-5855M2-P46	
2.4G	BPF	2441.0	84 : 2399~2483	1.5(0.9)	40(49) at 2164.5 / 40(51) at 2724.5	31.0 x 12.0 x 5.0	SF-2441P1-D04

❖ Impedance: 50 Ω

❖ Max Input Power: 1 W

❖ Operating Temperature: -40 to +85 °C

*(): Typical value

Dielectric Filters for GNSS

❖ Satellites Solution

Band	Item	Fc (MHz)	BW (MHz)	IL(dB)	Atten.(dB)	Size (L x W x H mm)	Part Num.
GPS	BPF	1208.0	90	1.0	-	5.7 x 10.8 x 3.85	SF-11208M1-G90
	BPF	1225.5	57	0.9	-	9.9 x 16.2 x 5.4	SF-1225M1-G5H
	BPF	1232.0	136	0.9	-	9.9 x 16.2 x 5.4	SF-1232M1-G1D6
	BPF	1237.0	40	0.8	-	10.1 x 16.2 x 5.4	SF-1237M1-G40
	BPF	1567.5	85	0.8	-	7.8 x 16.2 x 5.4	SF-1567M1-G85
	BPF	1567.5	85	1.7	-	6.5 x 10.8 x 3.85	SF-1567M2-G85
	BPF	1577.5	65	3.2	-	14.7 x 61.8 x 10.5	SF-1577M1-PAC
	BPF	1577.5	65	2.9	-	14.1 x 64.6 x 15.2	SF-1577M2-PAC
	BPF	1577.5	65	2.2	-	15.1 x 46.8 x 10.5	SF-1577M3-PA9
	BPF	1575.42	20	2.5	-	14.0 x 31.0 x 7.0	SF-1575P1-F05
	BPF	1575.42	6	2.5	-	5.2 x 5.1 x 2.1	SF-1575M1-B02
GNSS	BPF	1588.0	46	0.7	55	8.4 x 16.2 x 5.4	SF-1588M1-G46
Satellite	BPF	1975.0	250	1.0	-	12.0 x 26.4 x 9.3	SF-1975P1-P8F
	BPF	4112.5	125	1.7	-	9.0 x 17.0 x 5.0	SF-4112P1-P4H
Inmarsat	BPF	1650.5	49	2.8	54	8.2 x 10.6 x 4.0	SF-1650M1-D04
	DPX	1542 / 1643.5	34	0.9/0.9	65/65	11.3 x 62.0 x 10.3	SD-1542M1-K18

Dielectric Products for LTE

Very Low Ripple *BPF & Duplexer*

Band	Item	Fc [MHz]	BW [MHz]	Ripple[dB]	Mid-band Atten.[dB]	Part Num.
Band-25	UL BPF	1881	63	1.0	15 min.	SF-1881P1-G63
	DL BPF	1963	63	1.0	15 min.	SF-1693P1-G63
B12 B12/13	UL BPF	707	17	1.0	15 min.	SF-0707P1-G17
	DL BPF	742.5	27	1.0 max.	15 min.	SF-0742P1-G27
Extended B5	UL BPF	833	32	1.0 max.	15 min.	SF-0833P1-G32
	DL BPF	878	32	1.0 max.	15 min.	SF-0878P1-G32
	DPX	833/878	32/32	1.5/1.5	30 min.	SD-0833P2-P8L

Dual Band *Diplexer*

Band	Part Name	Size (mm)
Band-1, Band-3	SD-1795M5-H1H	29.8 (W) x 8.3 (L) x 6.7 (H)
Band-5, Band-28	SD-0859M2-H70	32.8 (W) x 14.5 (L) x 8.1 (H)
Band-8, Band-20	SD-0920M1-H80	32.8 (W) x 13.5 (L) x 8.1 (H)
Band-10, Band-25	SD-1922P1-P65	36.0 (W) x 15.1 (L) x 9.2 (H)
Band-25, Band-66	SD-2155P1-P90	36.0 (W) x 15.1 (L) x 9.2 (H)

Dielectric Quadplexer for LTE

Modules: *Quadplexer*

Part Name	LTE Band	Size (mm)
SM-204501-P04	Band 1, Band 3, Band 5, Band 28 Lower(703~788 MHz)	65.0 (L) x 45.0 (W) x 10.0 (H)
SM-204502-P04	Band 1, Band 3, Band 5, Band 28	65.0 (L) x 45.0 (W) x 10.0 (H)
SM-213203-P02	Band 2, Band 4, Band 5, Band 12	65.0 (L) x 45.0 (W) x 10.0 (H)
SM-259501-P03	Band 1, Band 7, Band 8, Band 20	65.0 (L) x 45.0 (W) x 10.0 (H)
SM-262502-P01	Band 1, Band 3, Band 7, Band 8	60.0 (L) x 25.0 (W) x 10.0 (H)
SM-6625P1-PQ1	Band-25, Band-66	110.0 (L) x 32 (W) x 9.8 (H)

01 Design Capability

- Frequency: GPS, Galileo, GLONASS, COMPASS(Beidou)
- Applications
 - ✓ Navigation for Car/Vehicle, PDA and others Mobile device
 - ✓ Satellite Radio
 - ✓ Network Equipment like Small Cells

02 PRODUCTS by Customized Design

❖ Passive Ceramic Patch Antenna :

Size(mm): 12x12, 13x13, 15x15, 18x18, 20x20 25x25, 35x35

Height(mm): 2~6

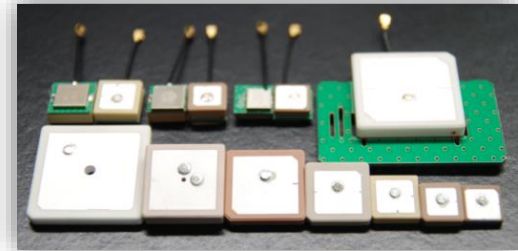
❖ Active Antenna : Internal and External Type

- Gain: 18dB or 28 dB
- Low Noise Figure: 0.75dB or 0.65dB
- Low Supply Voltage: 1.8V or 2.85V, max 5V
- Low Current: 4mA or 6mA
- Mount type: Magnetic or Screw
- RF Cable/Connector: Option

03 INTERNAL TYPE

Passive: Ceramic Patch Ant

Active: Ceramic Patch Ant + SAW + LNA



04 EXTERNAL TYPE

Indoor



Outdoor



Patch Antenna Products - Passive

Band	Dimension [mm]	Fc [MHz]	BW [MHz, min.] @-10dB	VSWR[max.]	Gain[dB]	Polarization	Part Num.
GPS	9 x 9 x 4	1575.42	4.0	1.5	-3.0	RHCP	ST-157501-D09
	10 x 10 x 4	1575.42	4.0	1.5	-2.0	RFCP	ST-157501-D10
	12 x 12 x 2	1575.42	4.0	1.5	-1.0	RHCP	ST-157501-B12
	12 x 12 x 4	1575.42	5.0	1.5	0	RHCP	ST-157501-D12
	13 x 13 x 4	1575.42	5.0	1.5	1.0	RHCP	ST-157501-D13
	15 x 15 x 2	1575.42	4.0	1.5	1.0	RHCP	ST-157501-B15
	15 x 15 x 4	1575.42	5.0	1.5	1.5	RHCP	ST-157501-D15
	18 x 18 x 2	1575.42	5.0	1.5	1.0	RHCP	ST-157501-B18
	18 x 18 x 4	1575.42	8.0	1.5	2.5	RHCP	ST-157501-D18
	20 x 20 x 4	1575.42	8.0	1.5	3.0	RHCP	ST-157501-D20
	25 x 25 x 4	1575.42	10.0	1.5	4.5	RHCP	ST-157501-D25
DAB	25 x 25 x 4	2332.0	20	1.5	4.0	LHCP	ST-233201-D25
GPS+GLONASS	25 x 25 x 4	1575/1602	10(each BW)	1.5	4.0	RHCP	ST-159001-D25
GPS+BEIDOU+GLONASS	35 x 35 x 5	1562/1575/1602	40	1.5	5.0	RHCP	ST-158201-E35

Patch Antenna Products - Active

Internal Type

Optional: Cable and Connector(IPEX, MMCX, SMA, TNC, FAKRA, etc..)

Band	Fc[MHz]	Voltage[v]	LNA Gain[dB]	Noise Figure	Dimension[mm]	Part Num.
GPS	1575.42	3.0 – 5.0	28+/-2	1.5 max.	13.4x13.4x6.0	ST-157521-C12
	1575.42	3.0 +/-0.3	18+/-2	1.8 max.	13.0x13.0x7.0	ST-157520-D13
	1575.42	3.0 +/-0.3	17+/-2	1.8 max.	15.0x15.0x7.0	ST-157522-D15
	1575.42	3.0 – 5.0	28+/-2	1.5 max.	50.0x60.0x8.5	ST-1575Jx-D25
	1575.42	3.0 – 5.0	28+/-2	1.5 max.	49.0x60.0x9.5	ST-1575Jx-E35
GPS+GLONASS	1575/1602	3.0 +/-0.3	17+/-2	1.8 max.	13.0x13.0x7.0	ST-159023-D13
	1575/1602	3.0 +/-0.3	17+/-2	1.8 max.	45.7x49.0x9.7	ST-1590Jx-E35

External Type

Optional: Cable and Connector(IPEX, MMCX, SMA, TNC, FAKRA, etc..), Mounting type

Band	Fc[MHz]	Voltage[v]	LNA Gain[dB]	Noise Figure	Dimension[mm]	Part Num.
GPS	1575.42	3.0 – 5.0	26+/-2	1.5 max.	34.0x41.0x13.5	ST-1575Ax-F34
	1575.42	1.8 – 5.0	32+/-2	1.5 max.	Φ49.5 x 15.5	ST-1575B2-G32
GPS+GLONASS	1575/1601	1.8 – 5.0	32+/-2	1.5 max.	Φ49.5 x 15.5	ST-1575B1-G32

01 Design Capability

● Products

Capacitors : MLCC(Multilayer Ceramic Chip) / Disc

Resistors : Chip Resistors / Thin Film

Inductors

Balun

Coupler

Triplexer

Chip Antenna

Antenna Switch / Switch Module

● Frequency : LTE(FDD/TDD), GNSS, WiFi/WLAN, Customized(~20GHz)

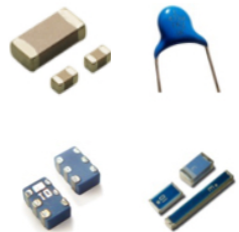
02 Manufacture Capability

❖ **Capability : 400Mpcs / Month**

❖ **Customized Design**

03 Applications

- Automotive
- Smart Phone
- Network Devices
- Industrial



04 Strength & Forte

- Expertise / High Technical Skill / Experience
(More than 70% of Long-term employed person)
- Stable Production for 21 years
- Free up 30% of capacity
- High Capability
- Customer Satisfaction through Rapid Response

06 Ka Band Filter

- Frequency Range from X,Ku,KA band
- PCB Type and High "Q" DR-Puck Designs available
- Bandpass Filter, Band Rejection Filter, Lowpass Filter,
- Excellent Temperature Stability (-40°C to +80°C)
- Suitable for Commercial and Military Applications
- Customized Design and Manufacture



07 Waveguide filter

[Cavity Base]

- Frequency : 9.0~9.4GHz
- VSWR : 1.03:1
- Insertion Loss : 0.2dB under
- Peak Power : 5.0KW
- Finish : Chromate

[Ceramic Base]

- Frequency : ~6.0GHz
- High Power / Small Size



[Waveguide]
Cavity Tech



[Waveguide]
Ceramic Tech

RF Component - Reliability test

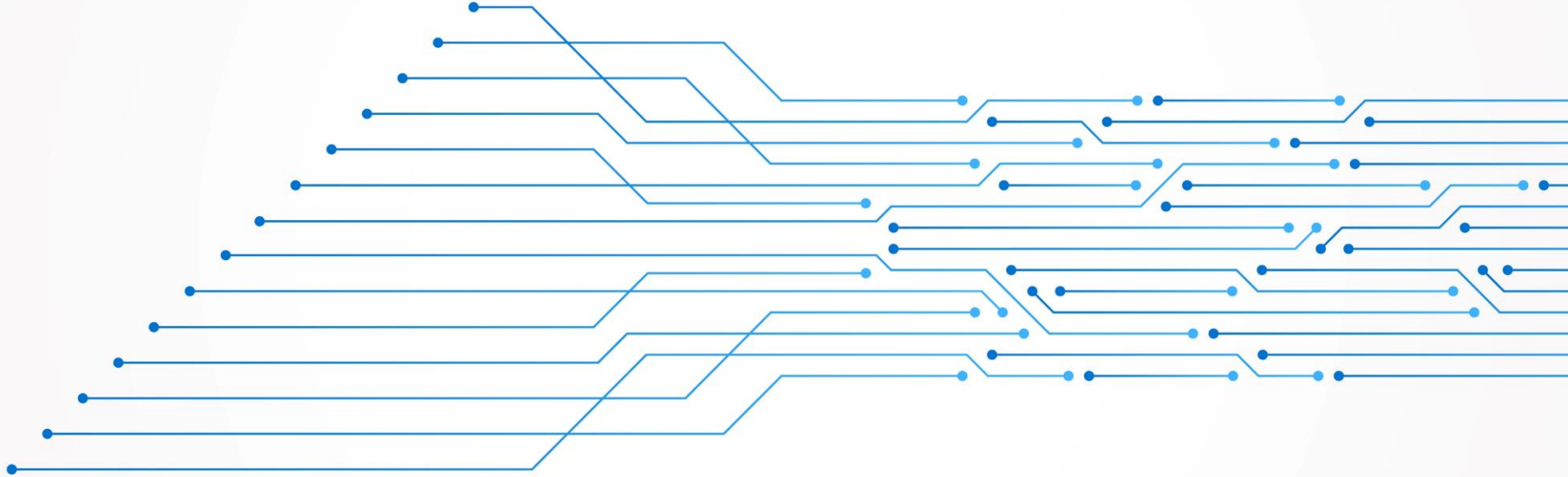
Customized Design

Achieving the customer satisfaction through to ensure product reliability from an early stage of development thanks to the large-capacity Chamber, Power Tester, Testing equipment for PIMD, Multiport Network-Analyzer.



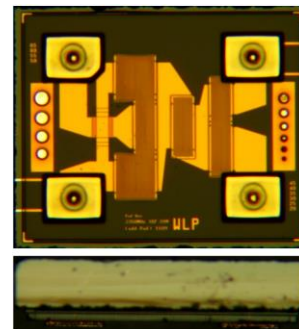
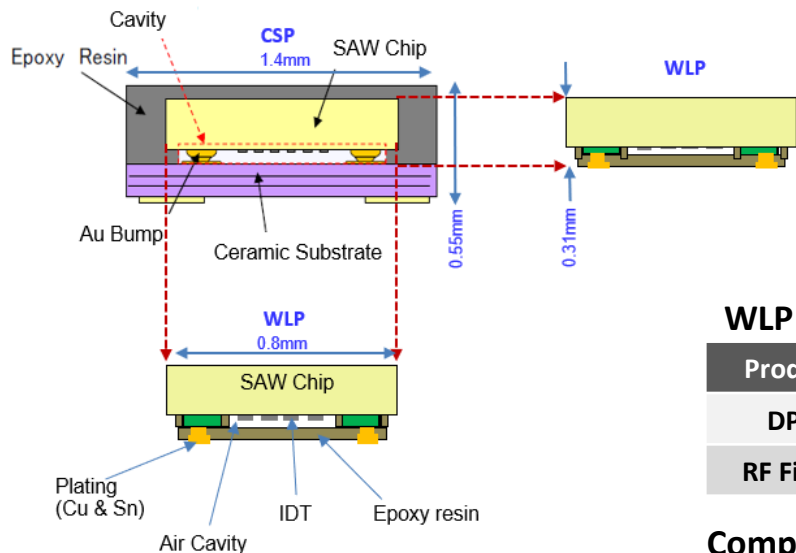
SAWNICS

PACKAGING TECHNOLOGY



WLP(Wafer Level Packaging) for Module Devices

- Smaller SAW Filters and Duplexers for DiFEM / PAMiD



WLP Target Size [mm³]

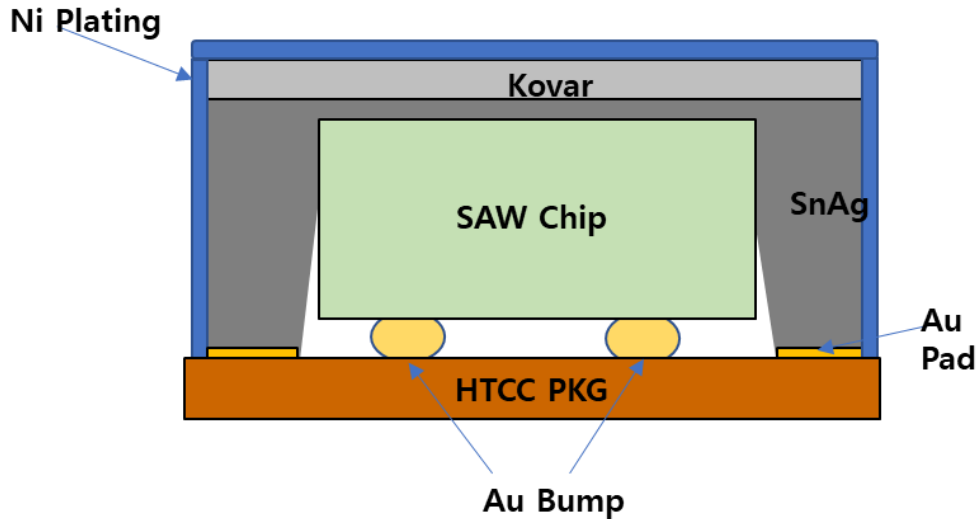
Product	Initial target size	Final target size
DPX	1.5 X 1.1 X 0.35	1.1 X 0.9 x 0.25
RF Filter	0.8 X 0.6 X 0.35	0.6 X 0.5 x 0.25

**Completion of Design and Process Tech .
Production(2022)**

MLCSP Technology for Automotive Market

MLCSP(Metal Lid Chip Scale Packaging) for MSL-1

- Automotive Electronics(Telematics Communication, GNSS, WiFi)
- Size: 1814 for DPXs, 1411/1109 for Filters

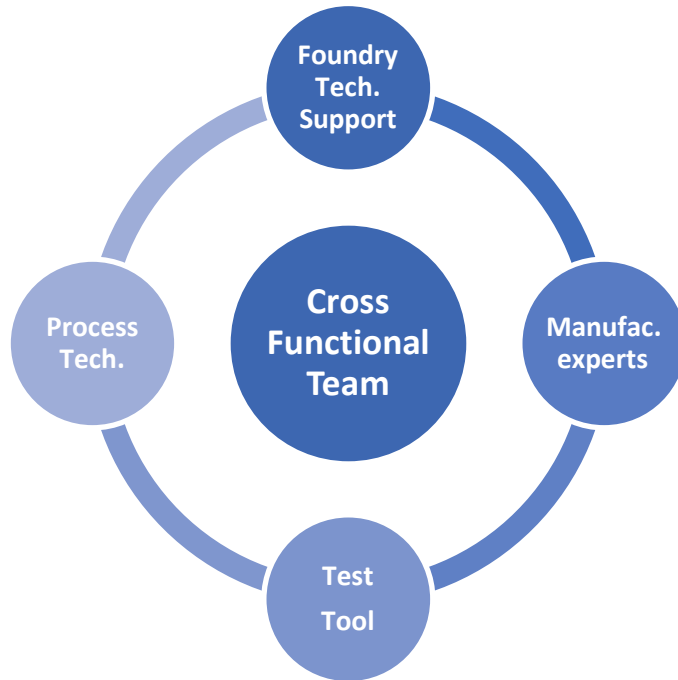


✓ Effect

- Hermetic Packaging
- High Reliability for Automotive

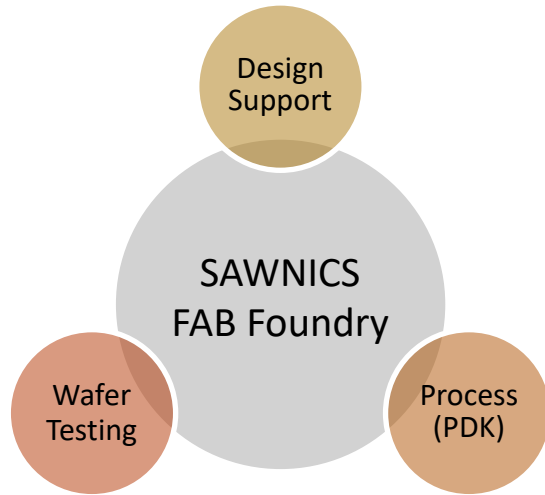
FAB FOUNDRY SERVICES for Strategic Customers

Providing Total Solution of Wafer FAB for Filters, Duplexers, Quadplexer with Traditional SAW and TC-SAW



-
- Both of 4" and 6" FAB in Korea
 - Covering from 0.6 to 2.7GHz
 - High power SAW(HPUE) available
 - Bonded Wafer Solution for 4" & 6"
 - Metal Milling / Frequency Trimming for 6"

TOTAL SOLUTION for FOUNDRY BIZ



Design Support Service

- Solving SAW Design related issues (**Providing Wafer Parameters**)
- Wafer performance verification

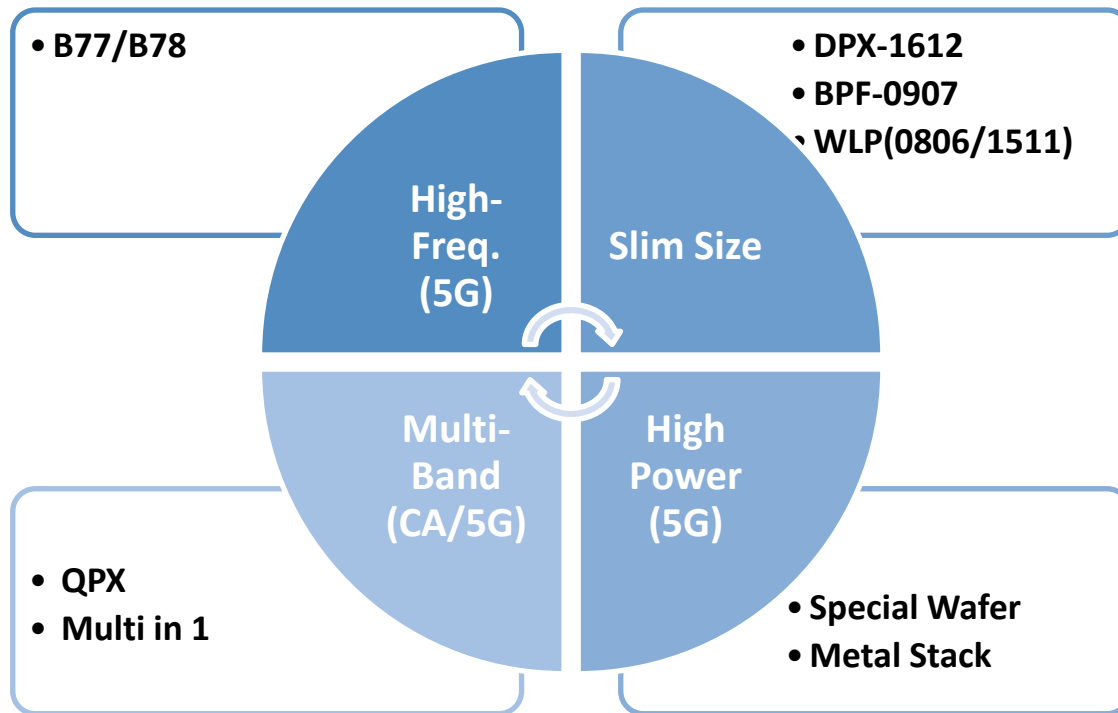
Process Design Kit

- Providing optimized design verification services
- Enhancing the convenience of SAW design

Wafer Testing

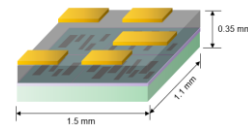
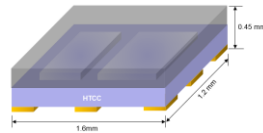
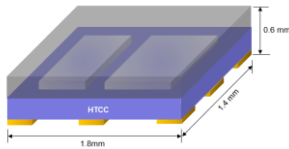
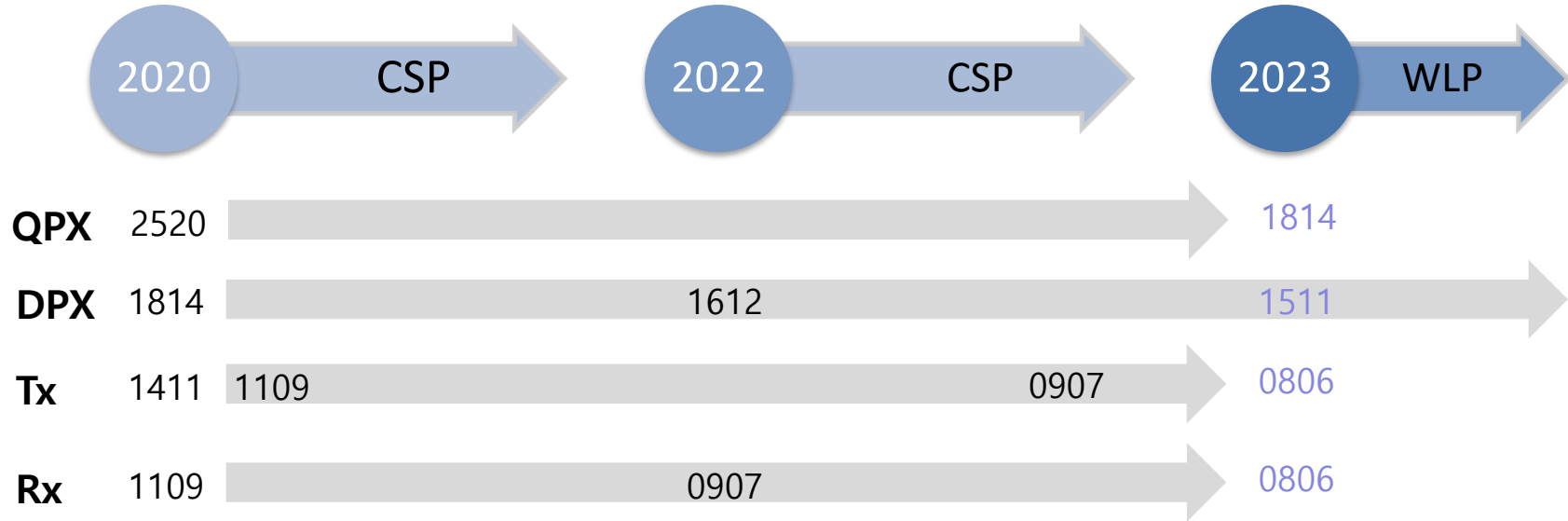
- Supporting RF test program development
- On-wafer test solution

SAWNICS Technical Road Map for 5G NR



TRM for SLIM SIZE

SAWNICS

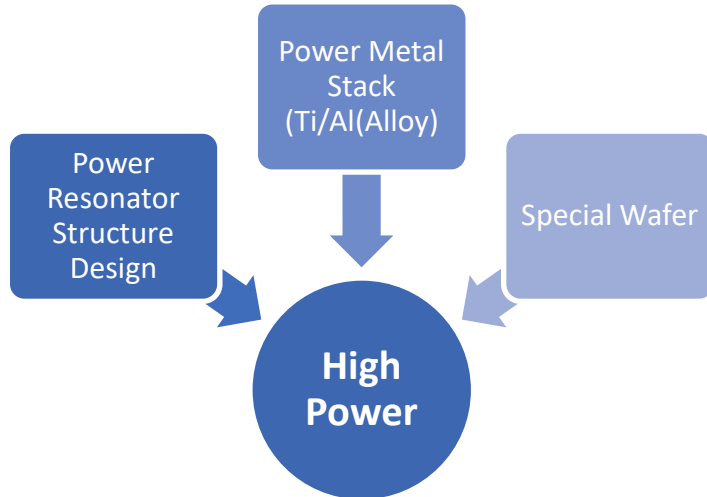


TRM for HIGH POWER for 5G

High Power

2021

- Special Wafer
- Power metal stack (Ti / Al(alloy))
- Power Resonator Structure Design



Power Class 2 (5G) : 26dBm @ antenna port

(26+4.6=30.6dBm @ PA + 2dBm = **32.6dBm**)

Power Class Output Levels

