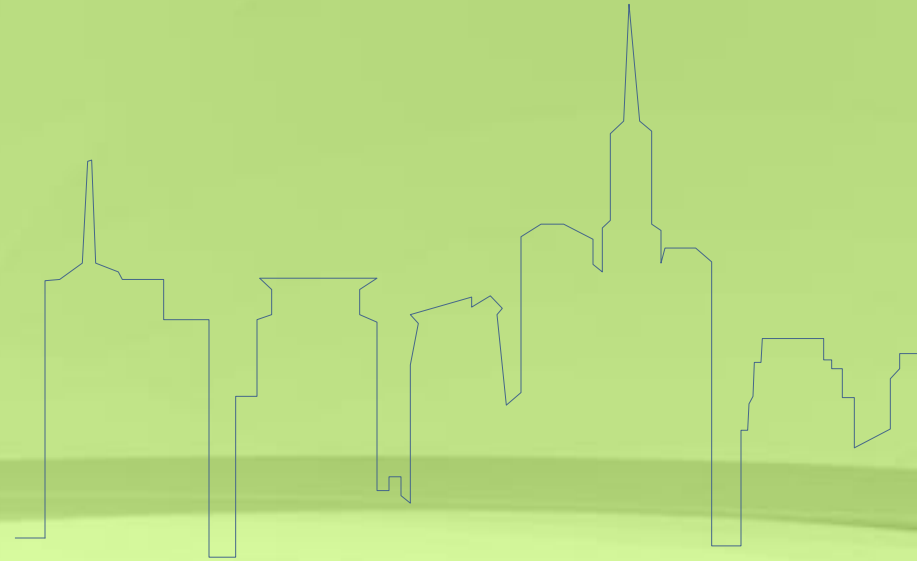


Innertron, Inc.

Company Presentation



August, 2018

Communication Infrastructure Solutions
An Expert in RF & Microwave Components



Company Introduction



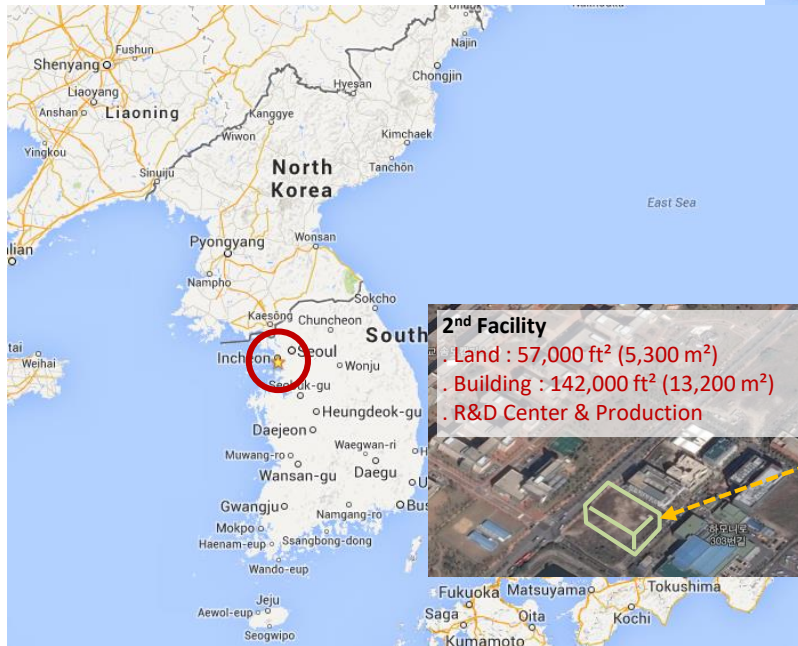
- Company Name : Innertron, Inc.
- Established : February, 2002
- CEO: Mr. H.R. Cho
- Headquarters & Factories : Incheon-City, Korea
 - Sales Office in Japan : Kawasaki-shi, Established in June, 2003
 - Sales Office in Bangkok (Southeast Asia), est. 2018
 - Sales and Technical Support Office in North America, Established in 2009
- Sales Turnover
 - Y2015 : 26M USD
 - Y2016 : 31M USD
 - Y2017 : 33M USD
- Employees : 115
 - ISO 9001 Certified - Initial Certification Date : November, 2004 (DAS, U.K)
 - ISO 14001 Certified - Initial Certification Date : November, 2004 (DAS, U.K)
- Core Competency
 - Customized RF & Microwave Components Systems and Sub-systems

Confidential

Company Introduction

❖ Geographical Advantage

- Superb Logistics
- Industrial Infrastructure



Confidential

Company Introduction



❖ 1st Facility (Song-Do, Incheon City, Korea)

- . Land : 20,000 ft² (1,800 m²)
- . Building : 35,500 ft² (3,300 m²)
- . Office & Production



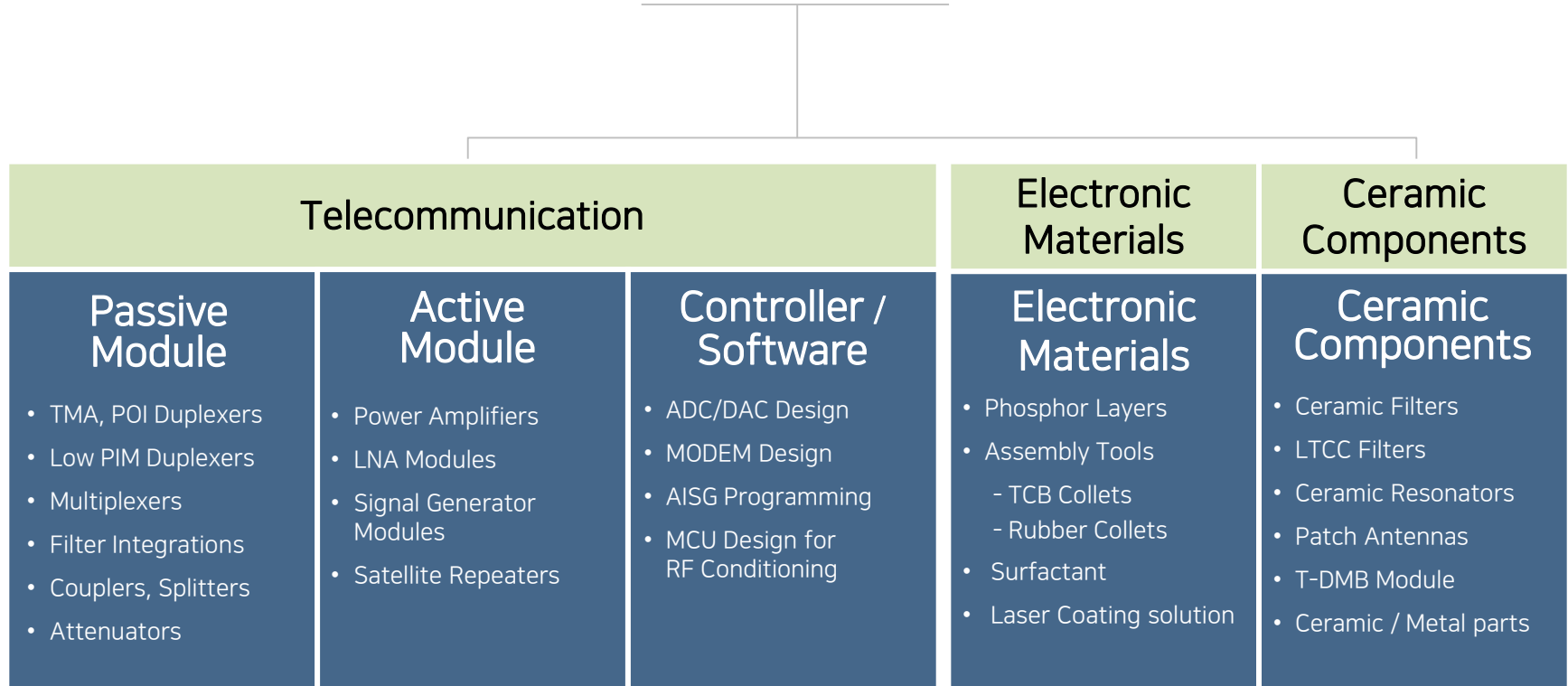
❖ 2nd Facility (Song-Do, Incheon City, Korea)

- . Land : 57,000 ft² (5,300 m²)
- . Building : 142,000 ft² (13,200 m²)
- . 1F – LED Component R&D and Production Line
- . 2F – In-building System Production and Test Line
- . 3F – Ceramic Filter Production and Test Line
- . 4F – Environmental Test Line & Other Commercial Production Line
- . 5F – R&D Center and Office

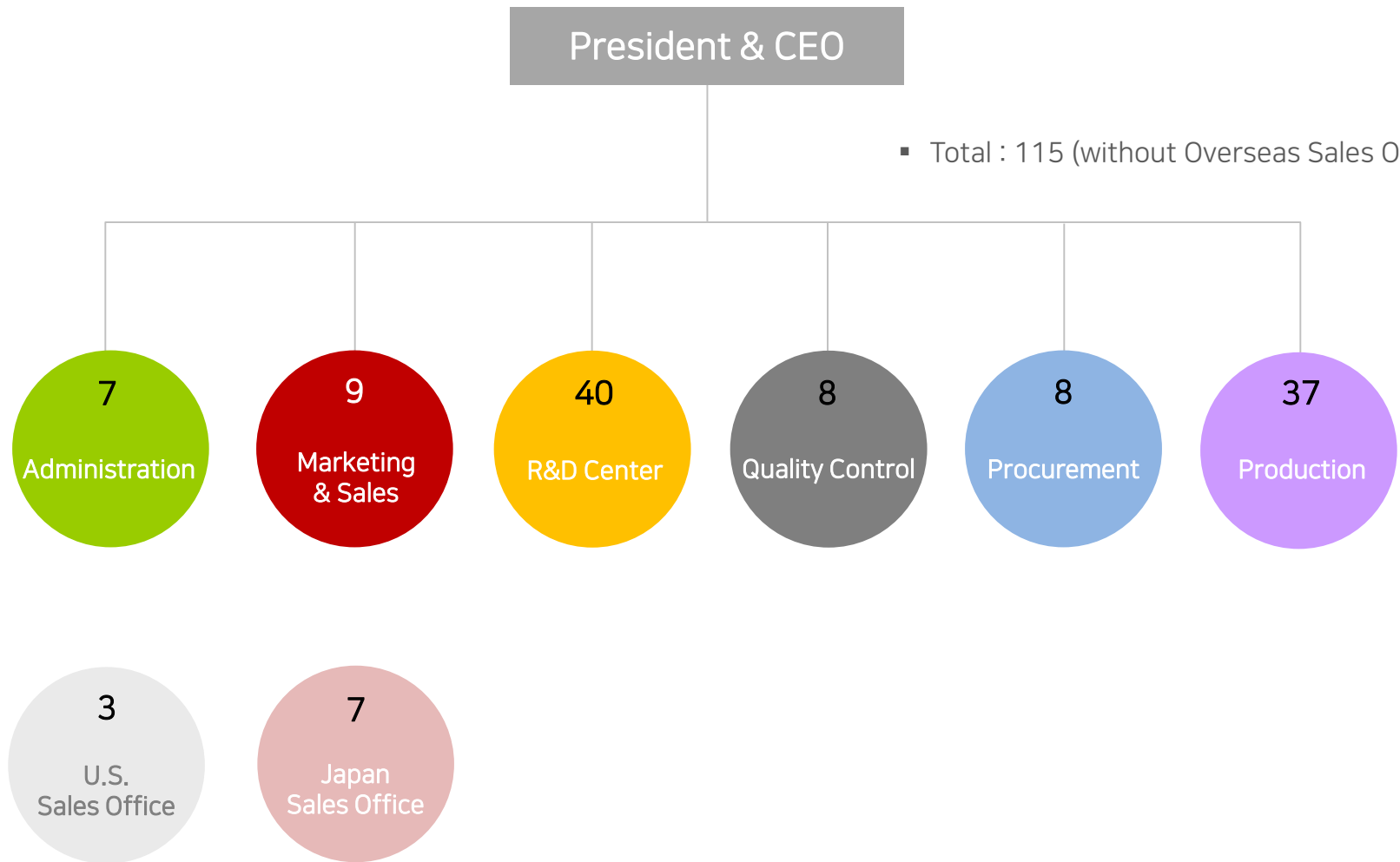
Confidential



Innertron, Inc.



Overall Organization



▪ Total : 115 (without Overseas Sales Office)

Confidential

R&D Center

Engineering Resources



	Passive Module	Active Module	Controller/ Software	Mechanical Design	Electronic Materials	Ceramic Components	Advanced Research	Total
Principal Engineer	1	1	1	1	2	1	1	8
Senior Research Eng.	2	1	2	2	1	2	1	11
Research Engineer	2	2	3	2	1	0	0	10
Engineer	3	3	1	2	1	0	1	11
Total	8	7	7	7	5	3	3	40

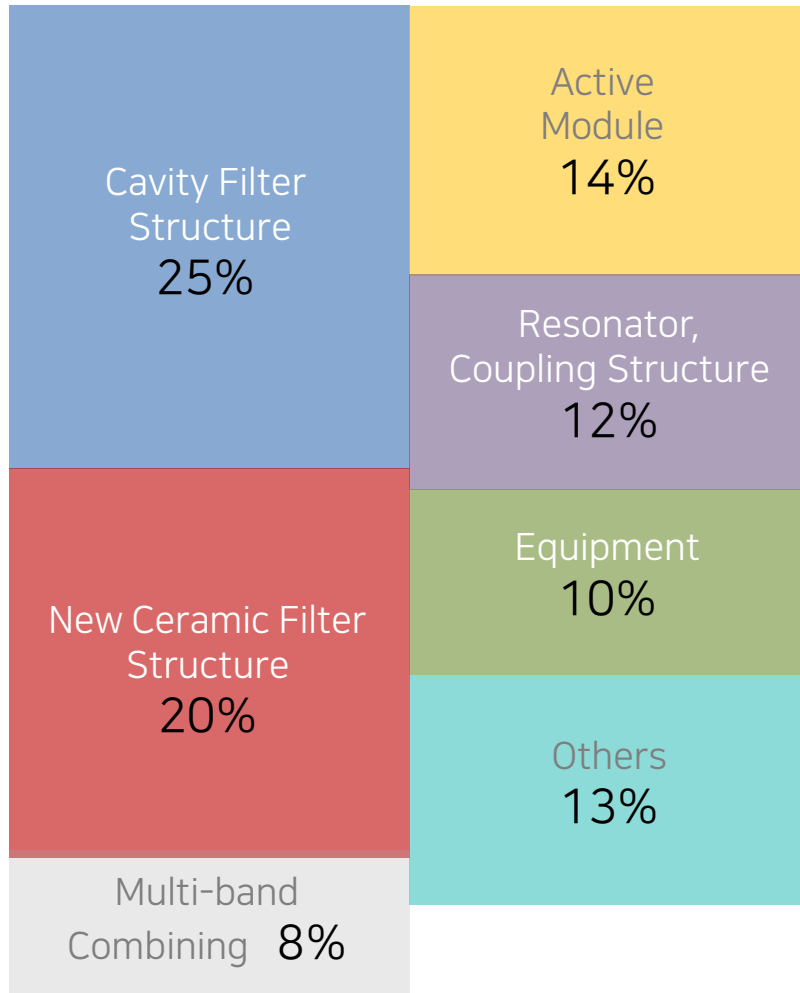
❖ Working closely with JEJU National University and other national research institutes on new product development

Position	Career
Principal Engineer	> 15 years
Senior Research Engineer	6 - 12 years
Research Engineer	4 - 6 years
Engineer	< 4 years

- ✖ Filter products include - (Multiplexers, TMA, FE U, M/W etc)
- ✖ Component products includes LNAs, Isolators, Switches, Couplers, Bias-T and so on
- ✖ Embedded Logic, DSP, System SW capabilities

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Patent Status



81 Local Patent Issued

17 Local Filed Applications

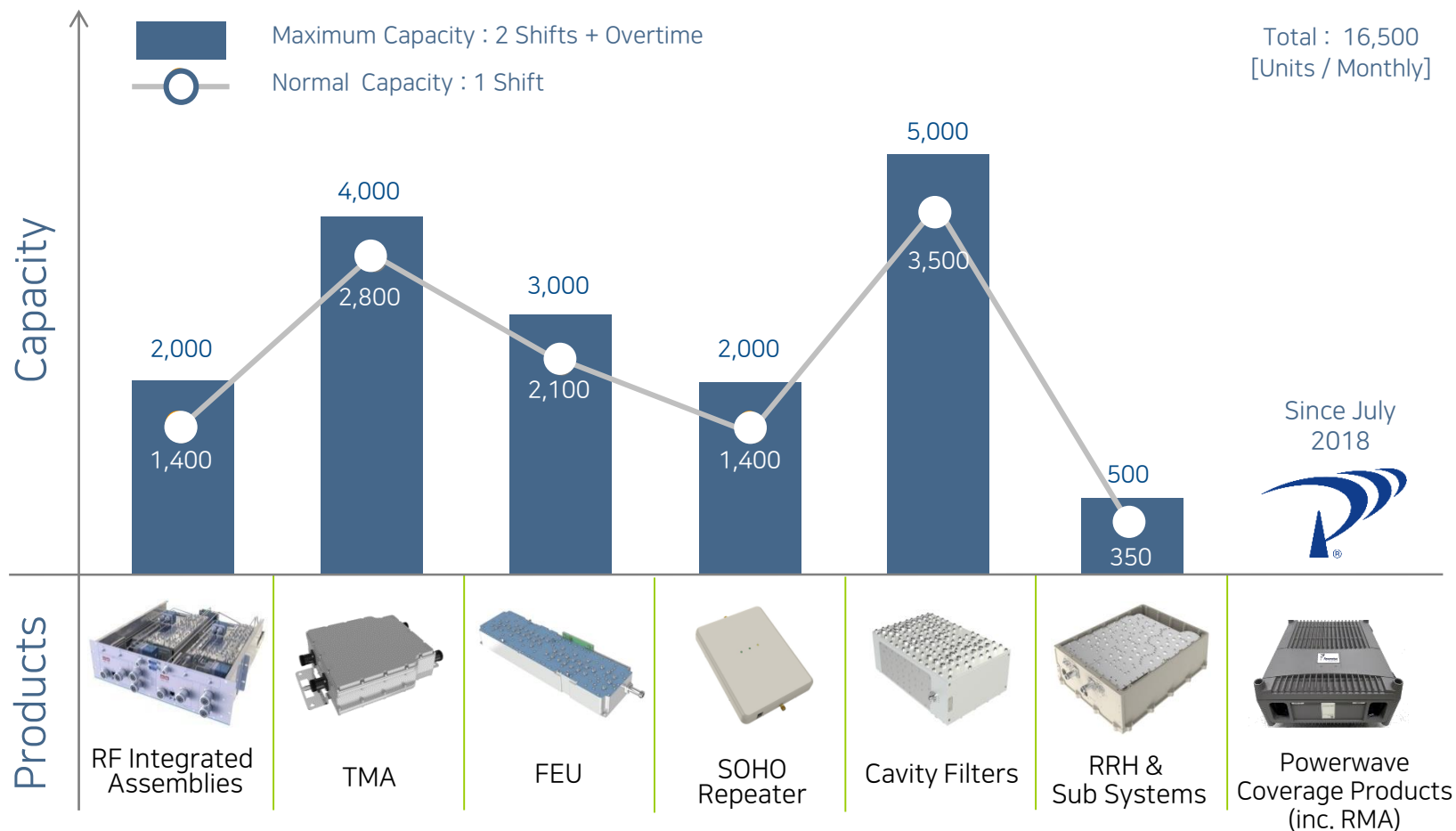
22 Foreign Patent Issued

15 PCT & Foreign Filed Applications

- All filed applications have been issued
- Generating patents from new technology research
- Incentive award program
- Patent review process
- 10~15 applications per year



Manufacturing Capabilities for RF Components

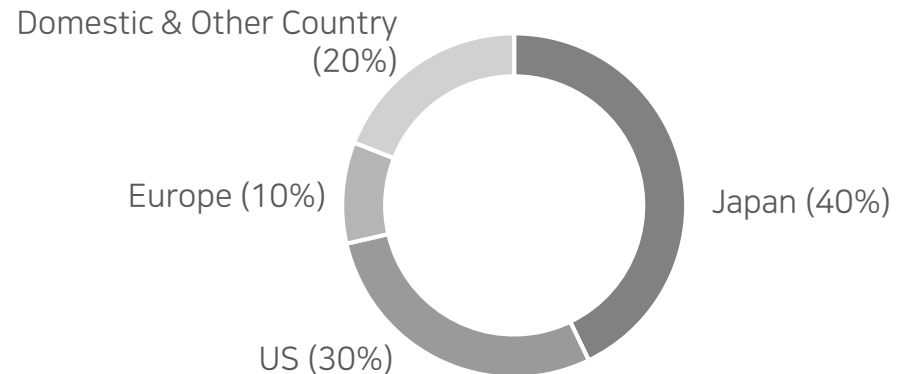
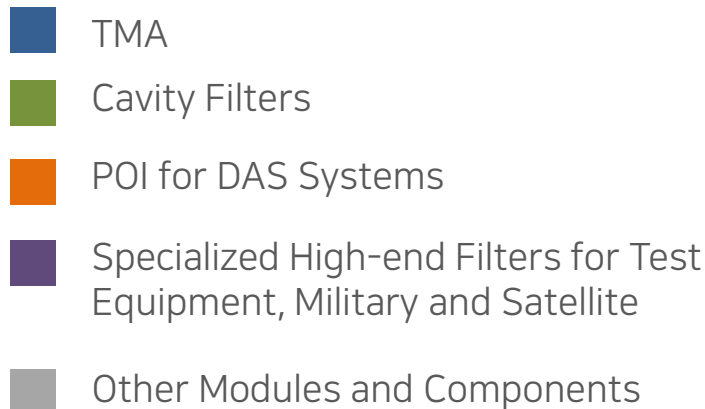
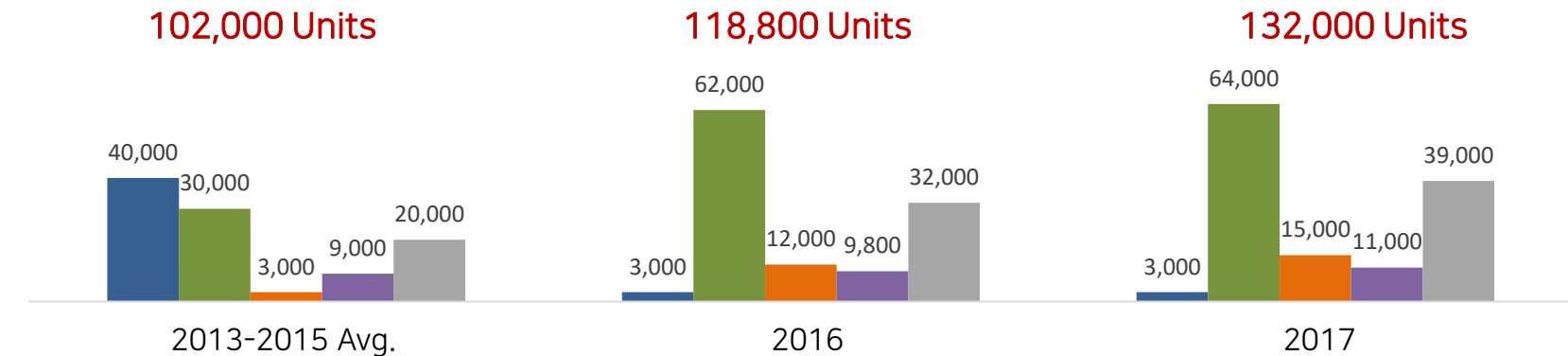


• Capacity Utilization : Normal capacity is 70% of Maximum Capacity

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Manufacturing Capabilities

❖ Production Breakdown (Unit)



<Year 2013-2017 Sales by Region>

ISO Certifications

Quality Management System – ISO 9001, 14001




Certificate No. QE140298

CERTIFICATE OF REGISTRATION

Quality Management System

INNERTRON INC.
12, Venture-ro 100beon-gil, Yeonsu-gu, Incheon, Korea

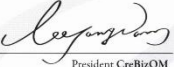
CREBIZQM hereby certifies that the Management System of the above organization conforms with the requirement of the following standard :

Standard of Certification
KS Q ISO 9001:2015 / ISO 9001:2015

Scope of Certification
Development and manufacture of RF & microwave components and EMI shielding products

Valid until : 28, November, 2019 / Date : 29, November, 2016
Issue Date : 08, December, 2017


KAB-QC-03


Approved by : _____
President CreBizQM

7F., Seongsan Bldg., 127, Yanggyeong-ro, Yeongdeungpo-gu, Seoul, Korea

CREBIZQM Co., Ltd. has accredited by Korea Accreditation Board as a Certification Body for Quality Management System (Accreditation number: KAB-QC-03).
This certificate remains the property of CREBIZQM and is bound by the conditions of contract.

* Initial certification : 2014. 11. 14 / * Transition of standard : 2017. 12. 08


Certificate No. QE140298

CERTIFICATE OF REGISTRATION

Environmental Management System

INNERTRON INC.
12, Venture-ro 100beon-gil, Yeonsu-gu, Incheon, Korea

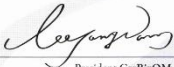
CREBIZQM hereby certifies that the Management System of the above organization conforms with the requirement of the following standard :

Standard of Certification
KS I ISO 14001:2015 / ISO 14001:2015

Scope of Certification
Development and manufacture of RF & microwave components and EMI shielding products

Valid until : 28, November, 2019 / Date : 29, November, 2016
Issue Date : 08, December, 2017


KAB-EC-02


Approved by : _____
President CreBizQM

7F., Seongsan Bldg., 127, Yanggyeong-ro, Yeongdeungpo-gu, Seoul, Korea

CREBIZQM Co., Ltd. has accredited by Korea Accreditation Board as a Certification Body for Environmental Management System (Accreditation number: KAB-EC-02).
This certificate remains the property of CREBIZQM and is bound by the conditions of contract.

* Initial certification : 2014. 11. 14 / * Transition of standard : 2017. 12. 08

Confidential

Product Portfolio

In-building Solutions : DAS, Repeaters



Hybrid DAS

- Suitable area : Mid & large size buildings
- Mater Unit + Hub Unit + Remote Unit
- Standard Configuration - (MU + HU + RU / 1 : 16 : 192)
- Using UTP cables for unit connections

Network DAS

- Suitable area : Small size buildings
- Link Unit + Main Hub Unit + Hub Unit + Access Point
- Standard Configuration - (LU + MHU + HU + AP / 1 : 1 : 8 : 64)
- Using UTP cables for unit connections

Pico DAS

- Suitable area : Small offices
- Mater Unit + Remote Unit
- Standard Configuration - (MU + RU / 1 : 8)
- Using UTP cables for unit connections

Analog Optic DAS

- Suitable area : Small offices
- Mater Unit + Remote Unit
- Standard Configuration - (MU + RU / 1 : 8)
- Using [fiber optic with power cables](#) for unit connections

Small DAS

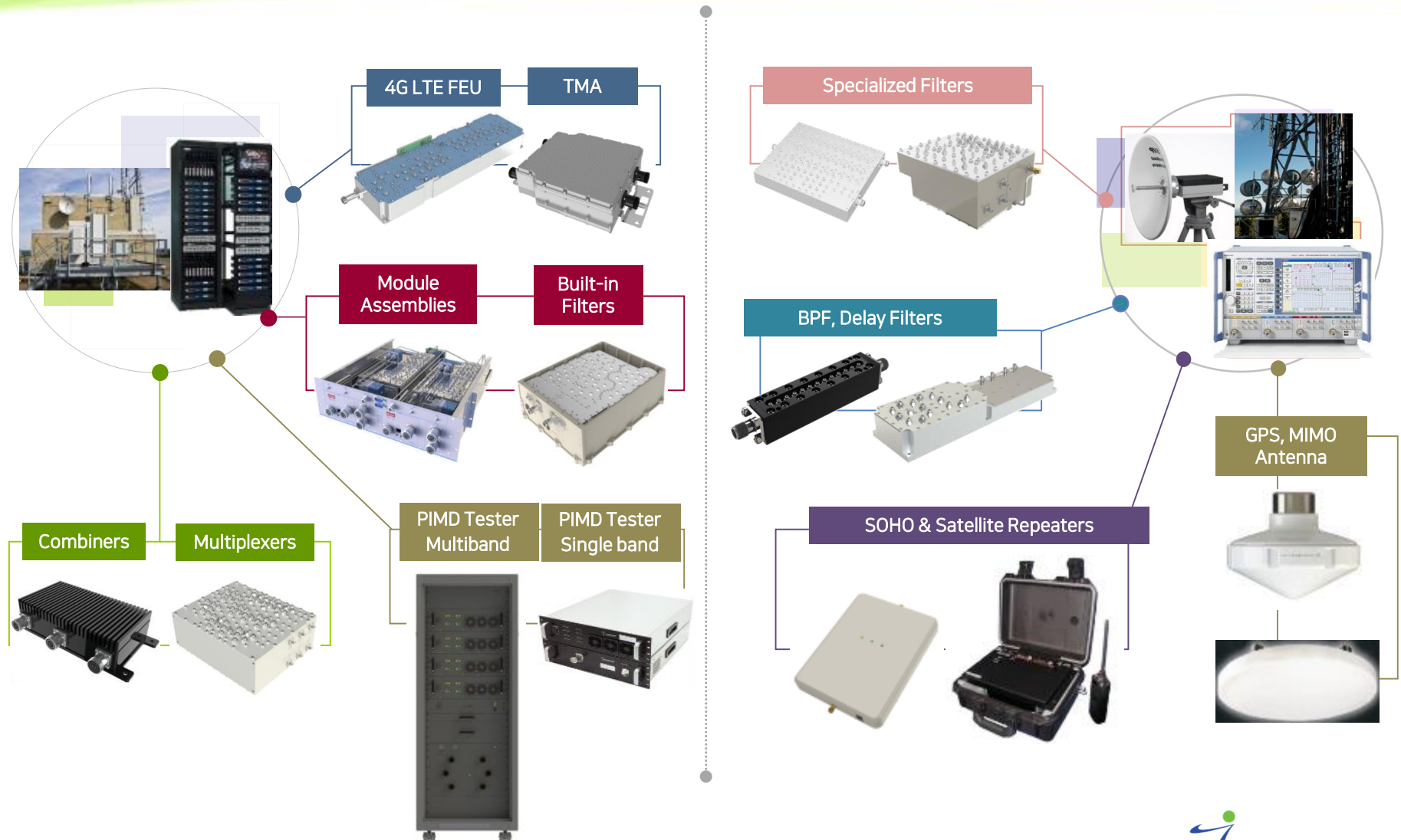
- Suitable area : Underground parking lots
- Donor Unit + Power Supply Unit + Remote Unit
- Standard Configuration - (DU + PSU + RU / 1 : 1 : 4)
- Using coaxial cables for unit connections

RF Repeaters

- Suitable area : Small buildings
- Single, dual, triple bands
- Donor, repeater separated or integrated in one body
- 60-80dB gain

Product Portfolio

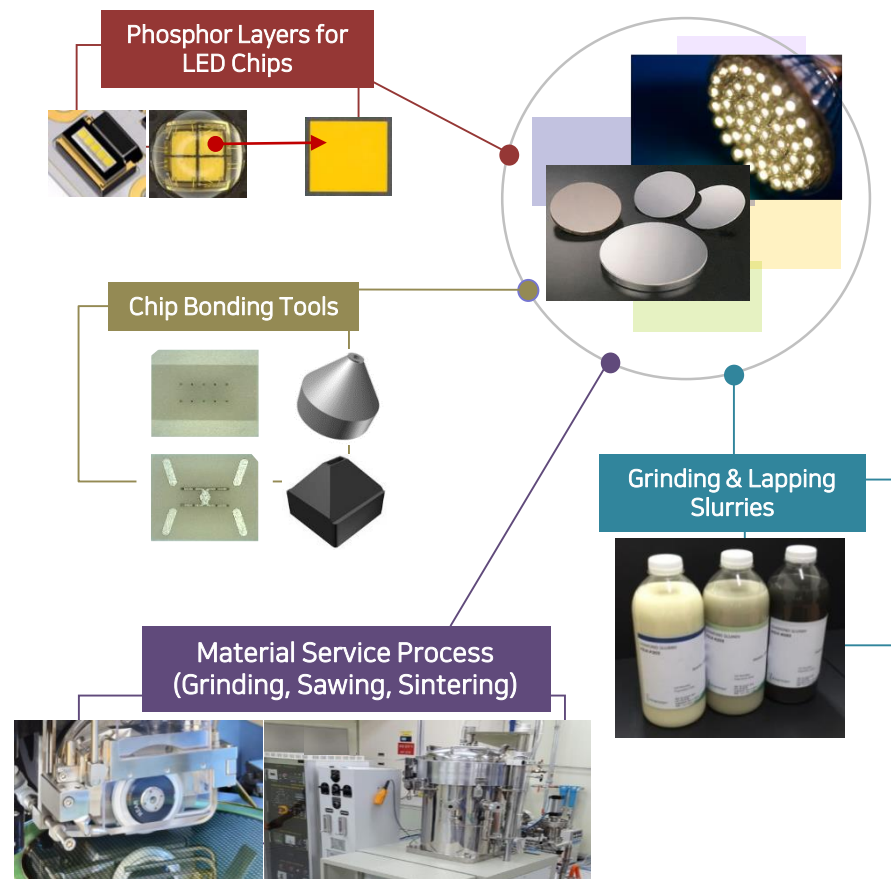
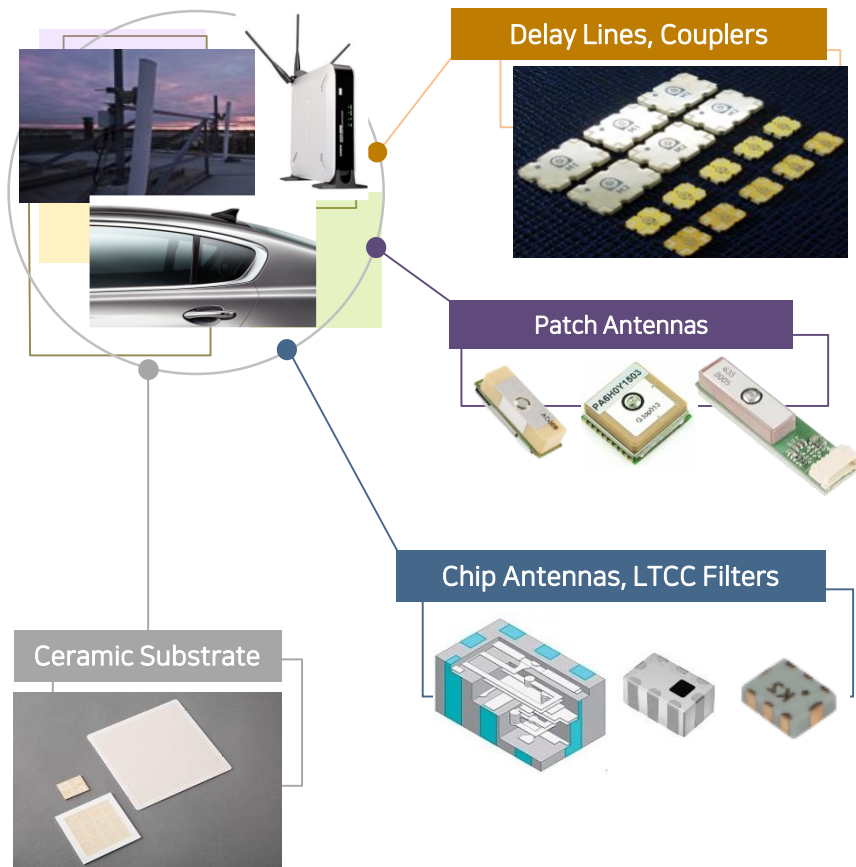
RF & Microwave Components for Telecommunications



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Product Portfolio

Ceramic Components and Electronic Materials for Semiconductor



Product Portfolio

Powerwave Coverage Products: Repeaters & Radio Heads

Since July 2018, Innertron commenced manufacture Powerwave's range of coverage products including turnkey coverage and capacity products and solutions. Powerwave specializes in innovative products and solutions from the simplest to the most challenging indoor and outdoor environments that help improve coverage, signal quality and capacity. Powerwave's efficient, modular and integrated solutions drive down capital and operating expenses.

Repeater products provide cost-effective coverage solutions for airports, railway stations, tunnels, convention centers, canyons and other environments where structures or natural obstructions interfere with signals. What sets Powerwave repeater products apart is our exceptionally low total lifetime cost.

Powerwave's high level of integration delivers a compact form factor that eliminates/ minimizes site rental costs. With support for 2G/3G/4G technologies, Powerwave provides a futureproof solution.

As new wireless services, technologies and opportunities emerge, the ability to rapidly adapt will become even more vital to network operators, building owners and public safety agencies. That's why Powerwave engineers flexibility into every system. It's why we choose components that are modular and adaptable. And it's why our coverage solutions are built from the ground up to be versatile.

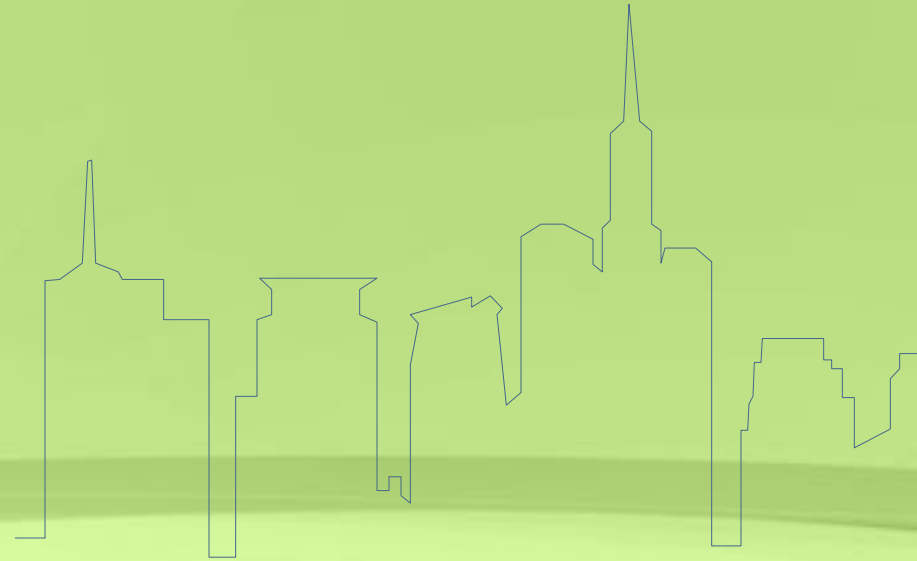
Award winning technology leadership:

- Multiple Awards for Universal WiMAX™ & LTE® Digital Radio Head
- Leading Product Design & Reliability



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Components for Distributed Antenna System

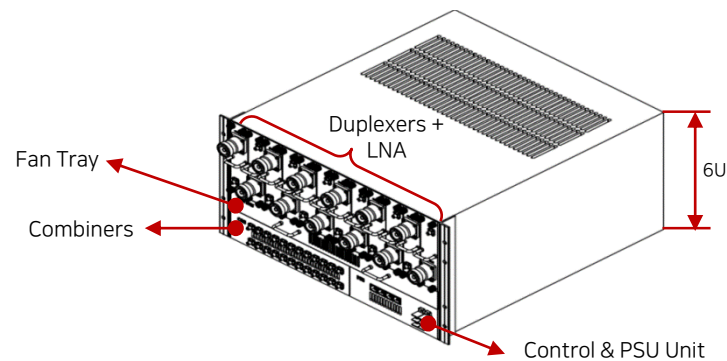


Low loss, Low PIM Components for Headend and Remote Ends of Distributed Antenna System (DAS)

Components for Distributed Antenna System (DAS)

Active DAS POI

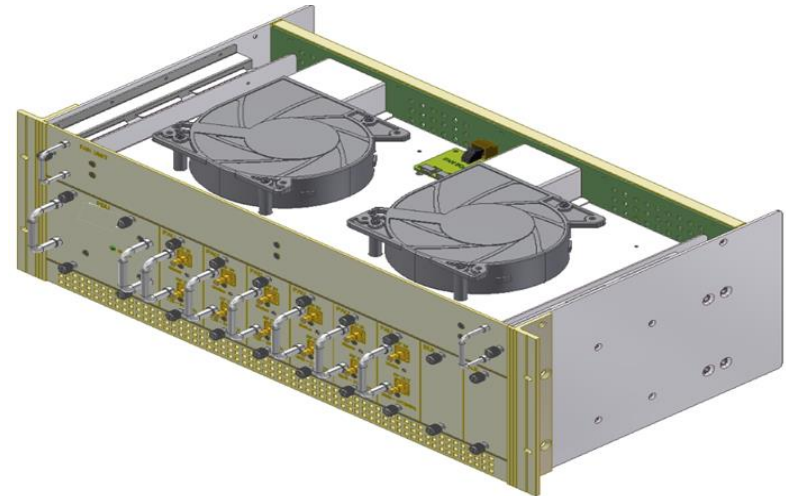
- . Active DAS POI : Duplexer + Amp. + Combiners + Control Units
- . Supports up to 12 base station TX/RX Inputs



<Front>

Amplifier Unit for DAS : (2W X 8)

- . 33dB gain amplifier shelf covering all bands between 698MHz to 2100MHz
- . Wideband 365MHz BW
- . PAU Slot check via LED Status on Front Panel

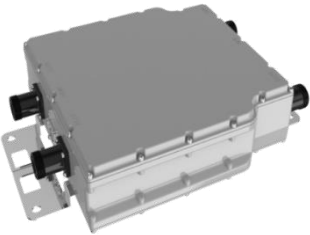
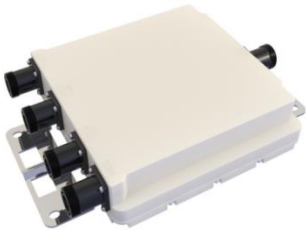
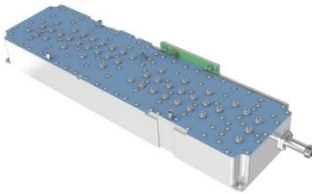
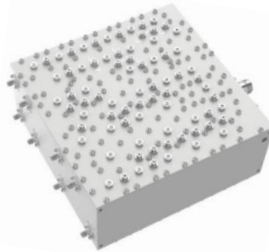
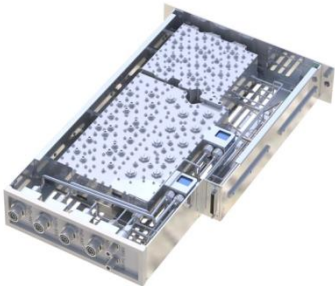


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Components for Distributed Antenna System (DAS)



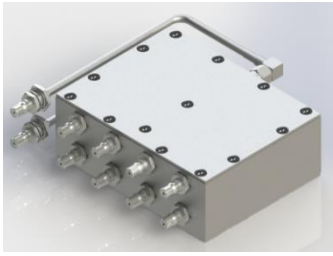
- Supporting all 3GPP configuration

TMA's	Combiners	Duplexers	Multiplexers	RF Assemblies
 				
• Exported 40K to Softbank (Japan) year 2012 to now • A member of AISG and supporting AISG 2.0 software protocol	• Both indoor and outdoor combiners with low insertion loss and PIM	• From simple Tx/Rx duplexers to Front End Units based on various frequencies	• 4 bands to 9 bands • Typical PIM @ each port : -155dBc • Typical insertion loss @ each port : -1.2dB	• Comprised of Input, output duplexers, LNA, relay switches, VSWR monitors, surge arrestors and etc.

Components for Distributed Antenna System (DAS)



- Wide Band and Low PIM Passive Components

Smart Bias-Ts	4 Way Divider	Attenuator	Terminations	Couplers
 				
• 698-2700MHz • Exporting 20K to various overseas foreign customers in Europe and Australia	• 698-2700MHz • I/L : 0.2dB (Max.)	• 698-2700MHz • I/L : 0.2dB (Max.) • PIM : -160dBc (Typical)	• 1-2700MHz • 70 x 70 x 170 with Con' • PIM : -155dBc (Typical)	• 380-2700MHz • Isolation : -22dB (Min.) • PIM : -155dBc (Min.)

Customized PIM Test Equipment



2-Tone and Multi-Tone Passive Inter-Modulation Test Equipment.
Customization available for Any Telecommunication Frequency.

PIM Test Equipment

Standard Single Band PIMD Test Equipment



❖ Technical Specifications

- . Power Level : 30 ~44dBm
(Optional : 46dBm @ 700MHz-2.7GHz)
- . Chanel Power Accuracy : 0.25dB
- . IM Measurement (Reverse / Forward) : -172dBc
 - ** Forward Input Power : Max. -30dBm
- . Average Noise Floor : -140dBm



❖ Available Frequencies

Band	Tx Frequency F1, F2		Rx Frequency (PIM)
700 Lower ABC	728-746	F1 : 728 F2 : 735-746	698-716
700 Upper C	746-757	F1 : 746-750 F2 : 757	777-787
EGSM 900	925 -960	F1 : 925 F2 : 935-960	880-915
Cell 850	869-894	F1 : 869 F2 : 879-894	824-849
DCS 1800	1805-1880	F1 : 1805 F2 : 1825-1880	1710-1785
PCS 1900	1930-1995	F1 : 1930 F2 : 1950-1995	1850-1915
UMTS 2100	2110-2170	F1 : 2110 F2 : 2157-2170	1920-1980
LTE 2600	2620-2690	F1 : 2620 F2 : 2670-2690	2500-2570

PIM Test Equipment

Customized 2-Tone PIMD Test Equipment 700/1500MHz



❖ Comprised of only two trays (User control integrated into the filter tray)



➤ Amplifier Tray Specifications

- . Bandwidth : 725-795MHz, 1470-1520MHz
- . HPA maximum output : 47dBm
- . LNA Gain : 30 ± 1.0 dB
- . Power source : AC 110-220V
- . Power consumption : 350W
- . Size : 482.6 x 177.0 x 498.0 mm (Width x Height x Depth)

➤ Filter Tray Specifications

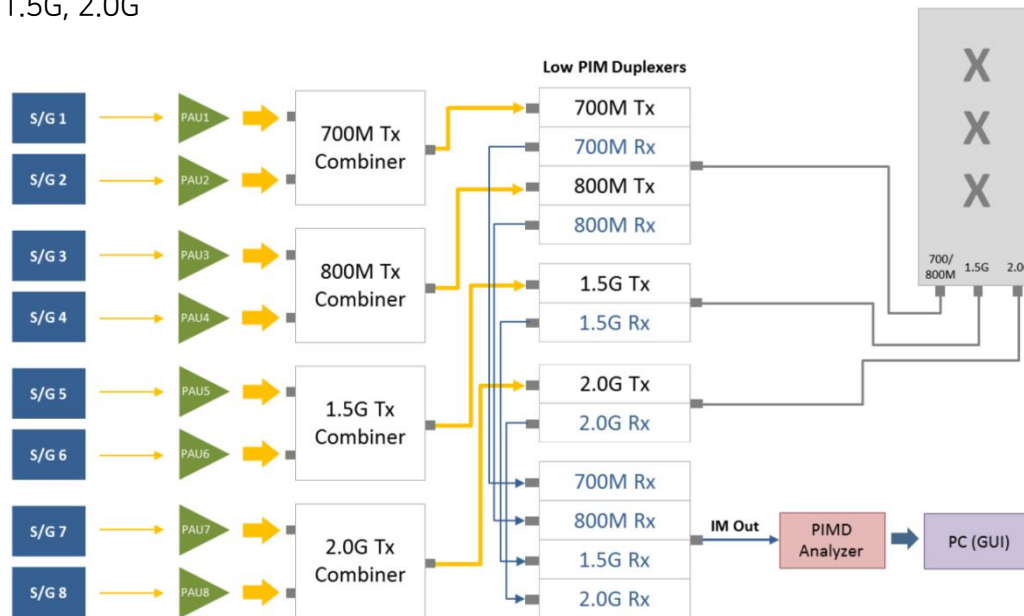
- . Bandwidth : 702-732MHz(Tx), 763-793MHz(Rx), 1480-1510MHz(Tx)
- . Insertion Loss (Maximum) : 1.0dB@700MHz, 0.5dB@1500MHz
- . Return Loss (Minimum) : 20dB@700, 1500MHz
- . Rejection (Minimum) : 80dB@700, 1500MHz
- . Size : 482.6 x 132.0 x 498.0 mm (Width x Height x Depth)

PIM Test Equipment

Customized Multi-Band PIMD Test Equipment



- ❖ Customized Platform, Optimized Performance – any 3GPP configuration can be supported
- ❖ Example : 700M, 800M, 1.5G, 2.0G



<Equipment Block Diagram>

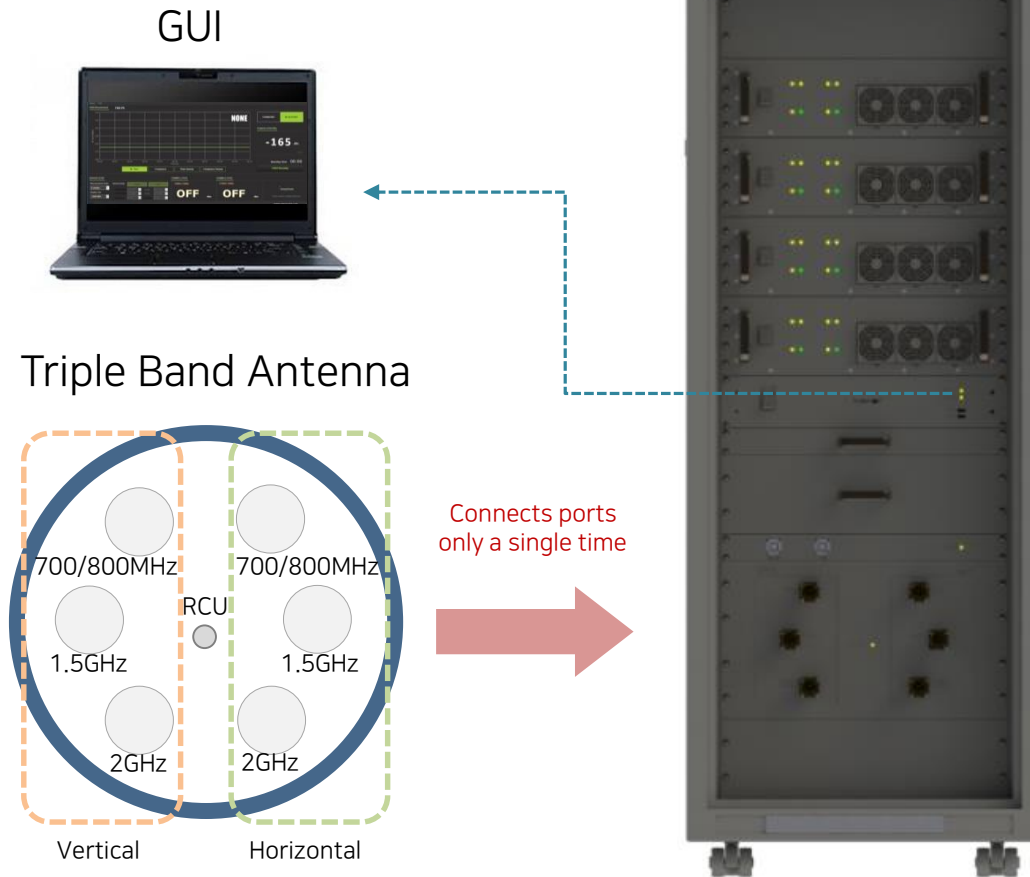
Conventional Method	Test Method	Multi-Band PIM Tester
Connecting to different frequency equipment	TEST FREQUENCY CHANGE	By clicking frequency buttons in GUI
High	CAPEX	Minimum 30% Decrease
High	OPEX	Minimum 40% Decrease
30 Min. (ex. 4-Bands)	TEST TIME	10 Min (ex. 4-Bands)

PIM Test Equipment

Customized Multi-Band PIMD Test Equipment (Continue)



❖ Example : 700M, 800M, 1.5G, 2.0G



No.	Test Frequencies	TX	RX(PIMD)
1	700MHz V	773.0MHz	723.0MHz
		783.0MHz	
2	700MHz H	773.0MHz	723.0MHz
		783.0MHz	
3	800MHz V	860.0MHz	815.0MHz
		875.0MHz	
4	800MHz H	860.0MHz	815.0MHz
		875.0MHz	
5	1500MHz V	1485.9MHz	1445.9MHz
		1495.9MHz	
6	1500MHz H	1485.9MHz	1445.9MHz
		1495.9MHz	
7	2000MHz V	2110.0MHz	1930.0MHz
		2130.0MHz	
8	2000MHz H	2110.0MHz	1930.0MHz
		2130.0MHz	
9	700MHz V / 1500MHz V	773.0MHz	722.0MHz
		1495.0MHz	
10	700MHz V / 1500MHz H	773.0MHz	722.0MHz
		1495.0MHz	
11	700MHz H / 1500MHz V	773.0MHz	722.0MHz
		1495.0MHz	
12	700MHz H / 1500MHz H	773.0MHz	722.0MHz
		1495.0MHz	
13	Automatic	No. 1~12 Automatic	
+α	Change the tilting angle		

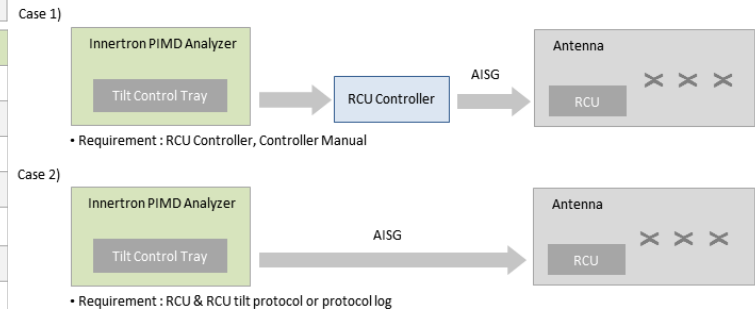
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PIM Test Equipment

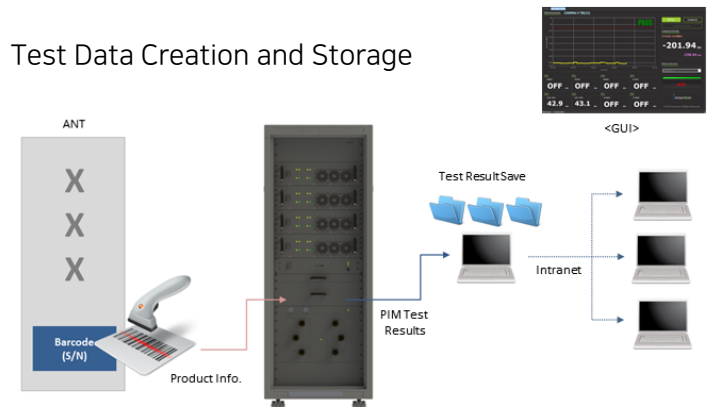
Customized Multi-Band PIMD Test Equipment (Continue)

Supportable Frequency Band			
700 Lower ABC	700 Upper C	EGSM 900	Cell 850
DCS 1800	PCS 1900	UMTS 2100	LTE 2600
Amp Tray			
Power Level	30~44dBm (1.0dB Step) [Initial setting 43dBm, Option :46dBm]		
Display Power Accuracy	±0.3dB		
ALC Accuracy	±0.3dB		
Input Power	AC 100 ~ 240V		
Operating Temperature	0~65℃		
Size	482.6 × 132.0 × 498.0 mm (Width × Height × Depth)		
Connector	N Type, 8Pin Circular, BNC Connector		
Filter Tray			
Any frequency Combination Available			
Size	482.6 × 132.0 × 498.0 mm (Width × Height × Depth)		
Connector	N Type, 8Pin Circular, BNC Connector		
S/A Board			
Average Noise Floor	-140dBm		
IM Measure	-162dBc		
Warm-up Time	1Minutes		
Size	482.6 × 88.0 × 503.00 mm (Width × Height × Depth)		
Connector	N Type, 8Pin Circular, BNC Connector		
Tilt Tray			
AISG 2.0 Complement			
Size	482.6 × 43.6 × 503.00 mm (Width × Height × Depth)		
Connector	RET, 8Pin Circular Connector		

❖ Automatic Antenna Tilt Angle Control



❖ Test Data Creation and Storage



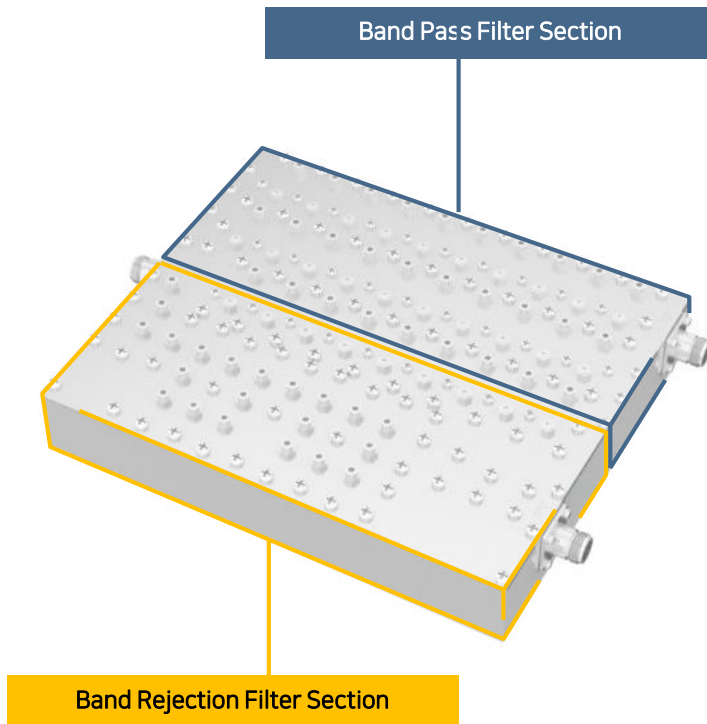
Specialized Products



Customized Ultra Low PIM for Measuring Equipment
and Broadcasting, Satellite Communication Components

Specialized Products

BPF + BRF Combined Diplexer



- ❖ Patent Status
 - 2 Patents Issued (Korea) / 2 Patents Pending (U.S.)

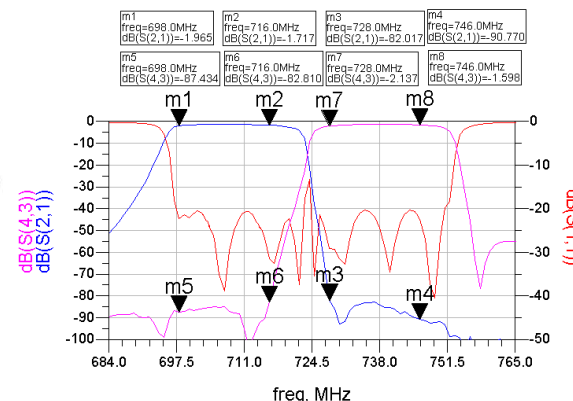


Band Pass Section		
Pass band	925 to 960 MHz	
Insertion loss	-	Max. 1.0
Flatness	-	Max. 0.4dB
Return loss	-	Min. 15dB
Rejection band	9 kHz~915 MHz	Min. 65dB
	1005~1610MHz	Min. 118dB
Band Reject Section		
Rejection band	925 - 960MHz	Min. 90dB
Pass band	9 kHz - 915 MHz, 1005 - 1610MHz	
Insertion loss	-	Max. 1.1dB
Flatness	-	Max. 0.7dB
Return loss	-	Min. 10dB
Common		
PIMD	+43dBm X 2tone	-162dBc

Specialized Products

Small Cavity Filter

- Intended for mid-power wireless infrastructure applications
- 20% volume, 65% weight reduction over traditional cavity filters
- Low PIM
- Low insertion loss
- High isolation
- 10 to 15 Watts average power
- Custom ports and form factors available



Band	Frequency		Insertion Loss	Return Loss	Rejection	PIM (@2x37dBm)	Power	
	Low	High					Avg.	Peak
700MHz ABC	698-716	728-746	2.2dB Max.	20dB Min.	80dB	-150dBc Max.	10W	100W
700MHz Upper C	776-787	746-757	1.9dB Max.	20dB Min.	80dB	-150dBc Max.	10W	100W
800MHz	824-849	869-894	2.0dB Max.	20dB Min.	80dB	-150dBc Max.	10W	100W
1800MHz	1710-1785	1805-1880	2.4dB Max.	20dB Min.	80dB	-150dBc Max.	10W	100W
1900MHz	1850-1915	1930-1995	2.8dB Max.	20dB Min.	80dB	-150dBc Max.	10W	100W
UMTS 2100MHz	1920-1980	2110-2170	0.9dB Max.	20dB Min.	80dB	-150dBc Max.	10W	100W
AWS 2100MHz	1710-1755	2110-2155	1.0dB Max.	20dB Min.	80dB	-150dBc Max.	10W	100W

Specialized Products

Band Pass Filters (4GHz–14GHz) for Broadcasting Equipment



Item	Specification			
Center Frequency	4231MHz		6-7GHz	6997.5MHz
Pass Band	16MHz	40MHz	44MHz	Fc±130MHz
Insertion Loss	3.0dB Max.	2.5dB Max.	2.0dB Max.	1.0dB Max.(0.85dB)
Flatness	1.5dBp-p Max.	1.5dBp-p Max.	0.2dBp-p Max. at fc±10MHz	0.5dBp-p Max.
Group Delay	20nsp-p Max.	15nsp-p Max.	3nsp-p Max. at fc±10MHz	10ns Max.
Attenuation	35dB Min. at 4187-4207MHz 35dB Min. at 4255-4275MHz 75dB Min. at 3231-4123MHz 75dB Min. at 4339-8000MHz	35dB Min. at 4131-4171MHz 35dB Min. at 4291-4331MHz 75dB Min. at 3000-4131MHz 75dB Min. at 4331-8000MHz	36dB Min. at fc±70MHz 60dB Min. at fc±150MHz 74dB Min. at 2 X fc MHz	60dB Min. at Fc±400MHz

Item	Specification		
Center frequency	10.3125GHz		12.9-13.3GHz
Bandwidth	8MHz (10.3085-10.3165GHz)	220MHz (10.2025-10.4225GHz)	44MHz
Insertion Loss	2.5dB Max. at Fc	2.0dB Max. at Fc	3.5dB Max. at fc
Ripple	0.4dB Max.	0.4dB Max.	0.5dBp-p Max. at fc±10MHz
Group Delay	1ns Max. (10.3075-10.3175GHz)	1ns Max. (10.3075-10.3175GHz)	3nsp-p Max. at fc±10MHz
Attenuation	20dB Min. at 10.2725GHz 20dB Min. at 10.3525GHz	30dB Max. at 10.0125GHz 30dB Max. at 10.6125GHz	56dB Min. at fc±70MHz 60dB Min. at fc±110MHz 60dB Min. at fc±150MHz 74dB Min. at 2 X fc MHz

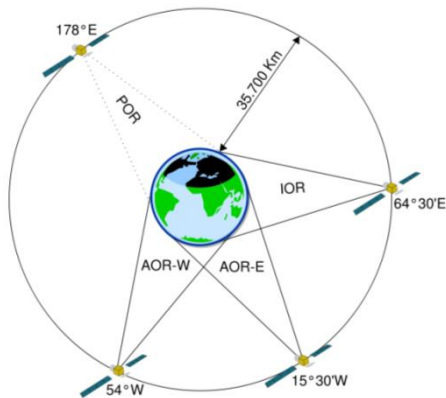


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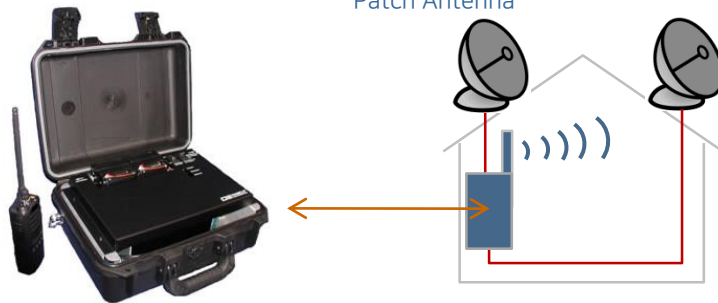
Specialized Products

Satellite Repeater (Inmarsat and Iridium)

- ❖ Enabling users access to wireless voice and data from land, at sea, or air.
- ❖ Connecting users globally through Inmarsat's geostationary satellites located in geosynchronous orbit 37,786 kilometers (22,240 statute miles) above the Earth



<Inmarsat Satellite Coverage>



<Inmarsat Satellite Repeater>

❖ Inmarsat Satellite Repeater Electrical Specifications

UP LINK	
Frequency	1625.5-1660.5MHz
Gain	69±0.3dB
NF	1.4±0.2dB
Output Power (P1dB)	39dBm
Output third order intercept (IP3)	50dBm@30dBm 2 tone output power
Input Return Loss	15dB
Output Return Loss	22dB
DOWN LINK	
Frequency	1625.5-1660.5MHz
Gain	69±0.3dB
NF	1.4±0.2dB
Output Power (P1dB)	39dBm
Output third order intercept (IP3)	50dBm@30dBm 2 tone output power
Input Return Loss	15dB
Output Return Loss	22dB

Specialized Products

SOHO Repeater – Dual Bands (800/1900MHz)

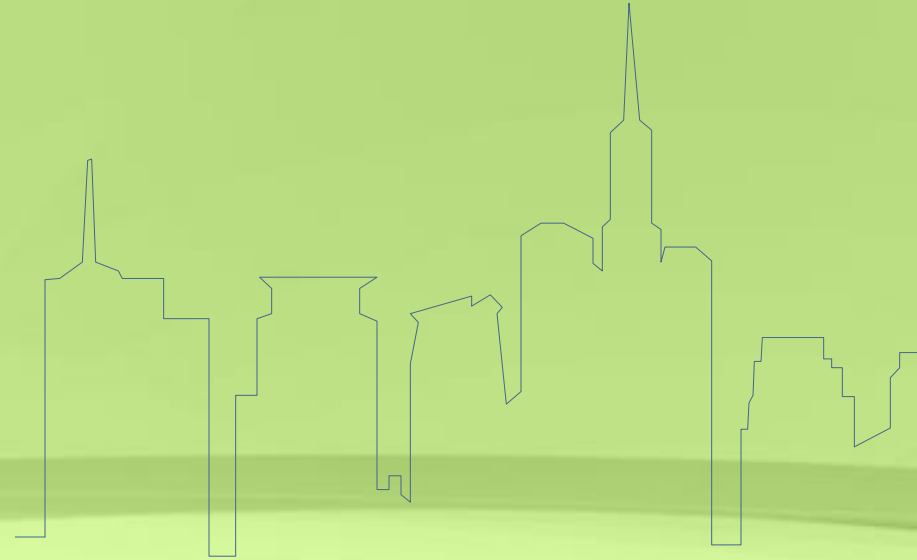


- . Power Overload Protection
- . Dual Band
- . 3,000 – 5,000sq ft coverage
- . Easy to install and simple to use



Frequency	Cellular Uplink : 824-849MHz	Cellular Downlink : 869-894MHz
Gain	50dB - 54dB[Mean]	60dB[Mean]
Max Output Power	8dBm	0dBm / Total Power
Max Input Power	-32dBm (Typ.)	-40dBm
Gain Flatness	6dB	4.5dB
ALC Commence Level	≥ -52dBm	≥ -60dBm
Frequency	PCS Uplink : 1850-1910MHz	PCS Downlink : 1930-1990MHz
Gain	50dB - 54dB[Mean]	60dB[Mean]
Max Output Power	8dBm	0dBm / Total Power
Max Input Power	-32dBm (Typ.)	-40dBm
Gain Flatness	6dB	4.5dB
ALC Commence Level	≥ -52dBm	≥ -60dBm
Power Delay	3 Sec	
DC Adaptor	5.0-3.8V, ≥3A	
Input Impedance	50 Ohm	

Ceramic Business Unit



Various Antenna Components for Automobile and filters and couplers for communication devices

Ceramic Business Unit



- ❖ In March 2015, Innertron, Inc. acquired ceramic business division of Kwangsung Electronics, Inc. including key research & development resources and IP

Acquisition	Main Products	Synergy Effects
• Complete LTCC & ceramic filter manufacturing lines • Key research & development engineers and Intellectual Properties	• Patch antenna, chip antenna for automobile • LTCC delay lines and couplers for repeaters • Mono-block and array type ceramic filters for wireless devices	• Complete RF filter lineup from LTCC filters to cavity filters • Accelerating new filter development for various in-building systems

Main Equipment



<Mills and Mixers>



<Tape Caster>



<Belt Furnace>

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Ceramic Business Unit

Ceramic Products

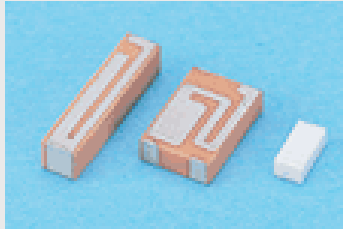
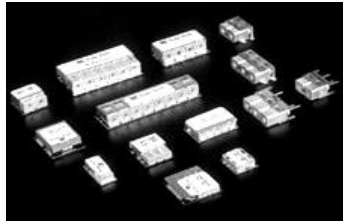


Products	Features	Appearance	Application
Mono Block Filter	- Small, compact, lightweight, and cost effective - SMD and reflow soldering is available - Low insertion for using high Q-value dielectric resonator - Excellent temperature stability		- GPS, XM, Sirius-band - 2.4G Bluetooths, W-Lan, Wi-Fi, ISM-Band - Standard types for Wibro, WiMAX and other wireless broadband solutions, from 2.3-5.8GHz - PCS Base Station Repeater System - AMPS, IMT-2000, WLL(Wireless Lan)
Multi-Layer Chip Antenna	- LTCC Based designs - Easy to mount PCB(SMT) - Monolithic SMD with small, low-profile - Light-weight type - Wide bandwidth - Stable temperature characteristics		- Bluetooth device (mobile Phone, headset, carkit, serial port, dongle, MP3, Notebook, PDA) - WLAN (AP, card) - DMB (receiver, PMP) - HPi (High-speed portable internet), PCMCIA Card
Resonator	- High dielectric constant - Low temperature coefficient - High quality factor - Wide range of resonant frequency - Surface mounting available.		- Dielectric resonator oscillator - Microwave filters and Combiners - Cellular radio-mobile/Base station - Satellite Communications - Oscillators (DRO/VCO) - Wireless headphone filter& Duplexer

Ceramic Business Unit

Ceramic Products



Products	Features	Appearance	Application
Multi-Layer LC Filter	- Miniature size and low-profile type - High attenuation rate and low insertion loss. - Operating temperature range -40 ~ +85°C (LTCC Based designs)		- FM Radio, T-DMB, DAB L-Band, DECT - 2.4G Bluetooths, W-Lan, Wi-Fi, ISM-Band - Cordless phone, WSPK - 5.8G W-Lan, WiMAX, ISM-Band
Bulk Chip Antenna	- Omni-directional antenna - Small, compact, lightweight, and cost effective - High gain, uniform directivity - Rugged, monolithic construction		- GPS, Wireless LAN (802.11b, 802.11g, 802.11a) Bluetooth and UWB - Suitable for PCMCIA, USB, or MiniPCI cards - PHS, DECT, GPS. etc
Array Type Filter	- Discrete & Mono-Block Type - Low Insertion Loss - High Frequency selectivity - Excellent Temperature Stability - High Reliability - Easy to Mount Design		- TRS, GSM, Cellular - Base Station Repeater System - WLL (Wireless LAN) - DCS, PCS, UMTS, IMT-2000, W-CDMA - TRS, GSM, Cellular - Cordless Phone

Ceramic Business Unit

Ceramic Products

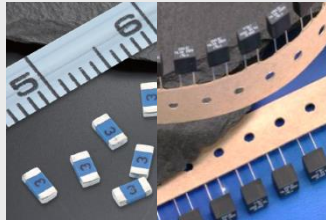


Products	Features	Appearance	Application
Patch Antenna	- High sensitivity - Low temperature coefficient - Customized center frequency - Hi frequency characteristics with silver plated electrode - Wide frequency range(900~5.8GHz)		- Satellite Radio - GPS, XM, Sirius Satellite Modems - Bluetooth, Wireless LANs - Automobile Antennas
Delay Line	- High stability at high frequency (2GHz) - Small, thin and light, utilizing multilayer construction / LTCC Based designs - Reflow solderable - Supplied on tape and Reel		- Optical communication network, Microwave communication - Broadcasting Equipment - High Speed Data Processing Equipment - Power Amplifier
Coupler	- UMTS and other 3G - Low I.L, High directivity, Excellent coupling flatness - Very low loss, High Isolation - Tight Amplitude Balance		- CDMA, GSM, Cellular, PCS - IMT-2000, UMTS, WLL - Wireless System - Power Amplifier

Ceramic Business Unit

Ceramic Products

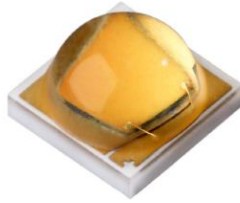
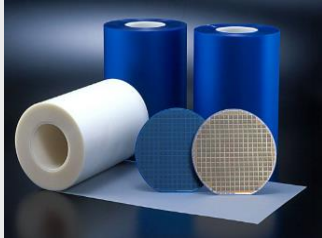


Products	Features	Appearance	Application
LTCC Module Substrate	- Glass ceramic materials for high frequency and high speed devices - Low resistance conductors for low loss design		- Automotive ECU - RF microwave module - Bluetooth modules, - Filter Modules (Triplexer, ASM, FEM..)
Ceramic Chip Fuse (SMD)	- Small, thin and light, utilizing multilayer construction - LTCC Based designs / Silver fusing element - High Current Ratings		- LED(LCD) TV & Monitor, Notebook PCs - Lithium ion Batter Packs - Set top Boxes - Consumer electronics - LED SMPS
MCP Circuit Board (Metal Ceramic PCB)	- High Thermal(Heat) Conduction -Direct print Circuit pattern on Al - Design Free - Low Material Consumption - Quick Design Changes		- High Power / High Bright LED - High Power electronics (E-Vehicles) - Heatsink on the aluminum

Ceramic Business Unit

Ceramic Products

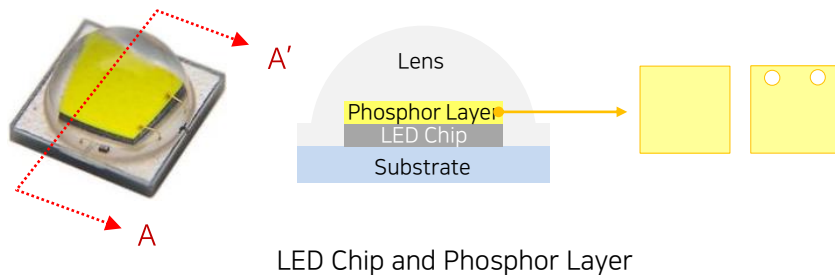


Products	Features	Appearance	Application
Mold Release Film	Ceramic Phosphor Plate		. LED Chip for high power automobile head lights
UV / Non UV Tapes	For wafer backside grinding and dicing		. PO and PET base . Thickness and adhesion customization
Diamond Slurries	- Polishing wafers after fine grinding process - Higher polishing rate and surface finish - Low surface thickness variation		- For rapid polishing process with finest surface finish by optimizing viscosity and chemical composition and specially formulated to be easily cleaned

PL - Phosphor Layer (1/3)



- Directly attached on LED chip
- Converting R, G, B light to white, red, amber and etc.
- Glass base PL : High reliability products / Silicon base PL : Mid reliability product



Glass Base PL

Suitable Applications

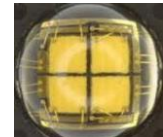
- Automobile Exterior
- High reliability products
- VOCs free products



Silicon Base PL

Suitable Applications

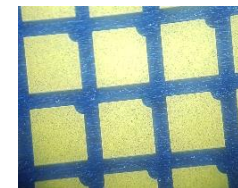
- Lighting
- Mid cost products
- Mid reliability products



❖ PL (Phosphor Layer) Production Process

Different Mixing Ratio

One path process in Innertron, Inc.



→ Customers
←

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Diamond Slurries



❖ For Sapphire, Ceramic Wafer Polishing / Lapping

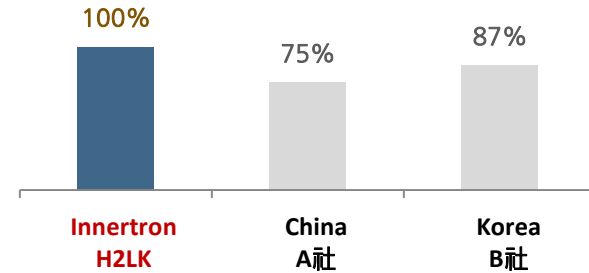
- Oil and water base
- Thickness and roughness control setting service
- Customization based on diamond type, size and concentration available



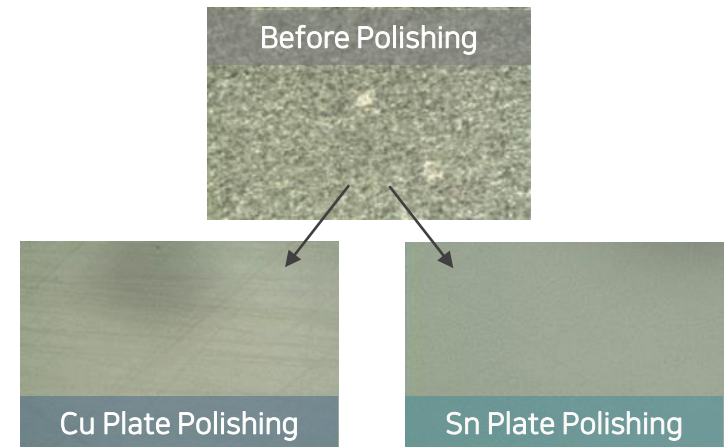
❖ Diamond Size for Main Slurry Products

Micron Size	Median (D50)	Upper Limit (D99)
um	um	um
2-4	3.12	6.20
2-6	4.27	8.29
3-7	5.17	10.02
4-8	6.38	12.3

<Polishing Removal Rate Comparison>



<Wafer Backside Condition Before/After Polishing>



THANK YOU!

