

Antenna Solution

AMOTECH

www.amotech.co.kr

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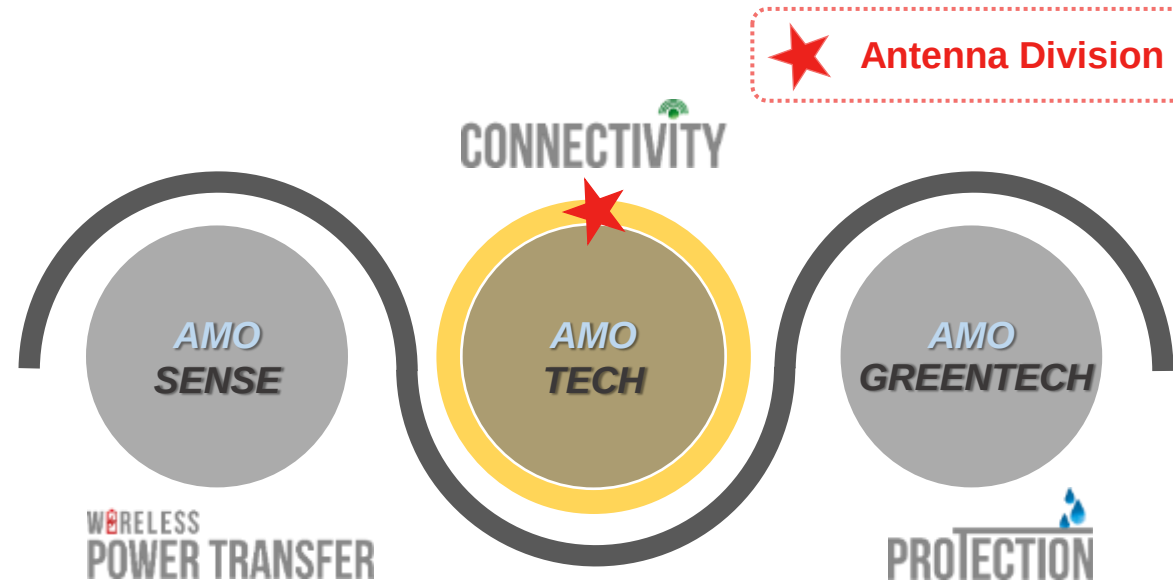
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- 6 BT/WiFi/GNSS Ceramic Antenna Solution
- 7 NFC Antenna Solution



AMO Group overview

Part I AMO Group Overview

Fact At a Glance



Head office

Incheon, South Korea

Factories

8 sites (5 in Korea & 2 in China & 1 in Vietnam)

Sales offices

6 locations in worldwide

R&D centers

8 centers (6 in Korea & 2 in China)

Type

KOSDAQ-listed in 2003 (stock symbol : AMOTECH)
Established in 1994

Part I AMO Group Overview

Factories



IATF16949 & ISO14001 Certified

Korea



Incheon

- Passive components (ESD/EMI)
- Antennas (BT/Wifi, 3G/4G)
- MLCC



Pyeongtaek

- Shielding sheet (Ferrite, AWS)
- BLDC motor



Cheonan

- Ceramic substrate
- LTCC substrate
- IOT module
- Automotive modules (BLE, CSM)
- HTF



Gimpo (2 factories)

- Amorphous core
- Nano fiber membrane
- Air vent

China



Qingdao, China

- BLDC Motor
- LCF, In-car sensor
- WPT (Wireless Power Transfer)
- Automotive module



Zibo, China(2 buildings)

Building 1

- Antennas (GPS, NFC)

Building 2

- Magnetic core
- Current transformer
- Choke

Vietnam

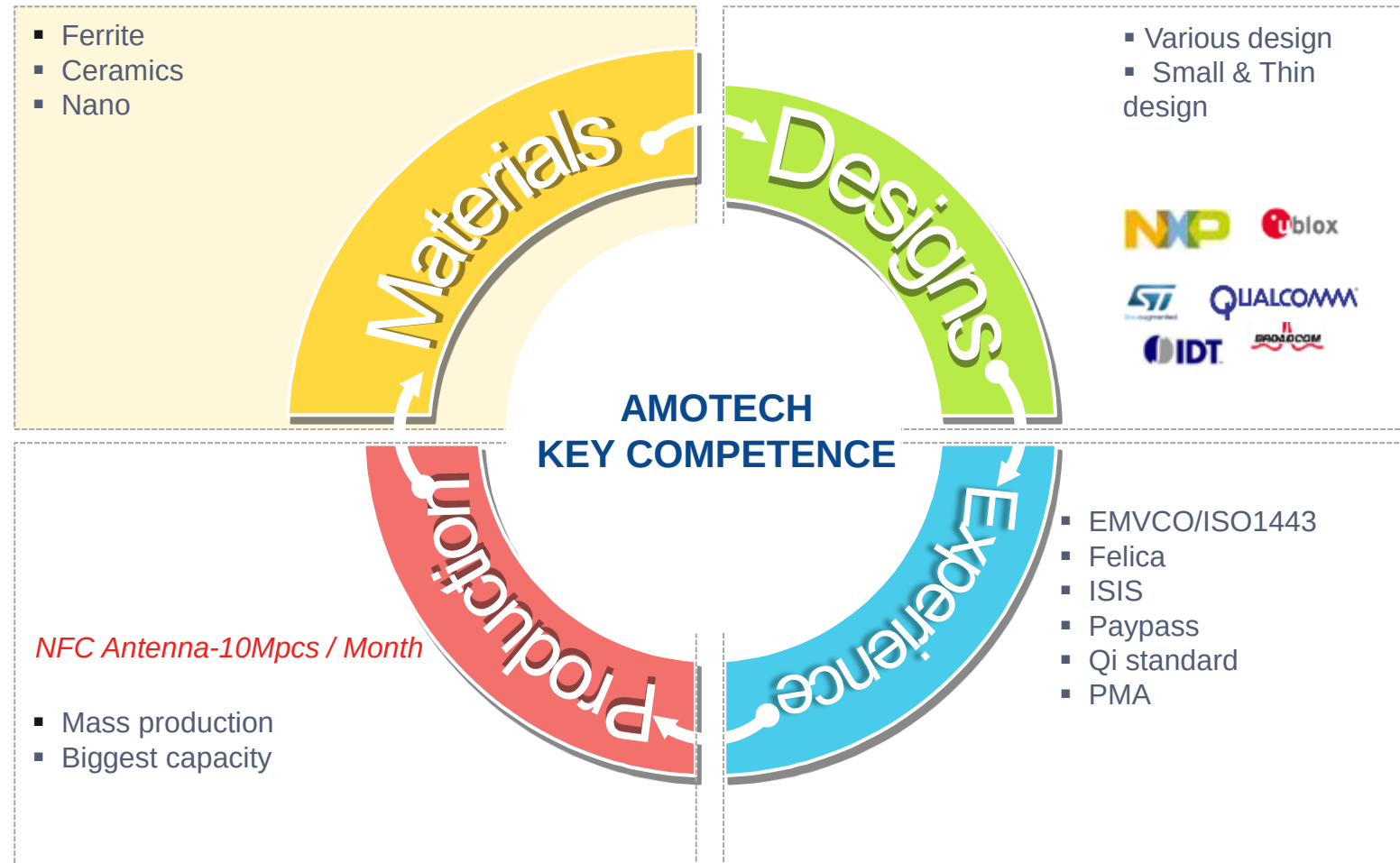


Hanoi, Vietnam

- NFC antennas
- NFC+WPC combo antennas
- WPC Rx & Tx antennas
- LED cooling fan
- In-car sensor
- Current transformer(ET)

Part I AMO Group Overview

“ Own powder alloy and manufacturing ”

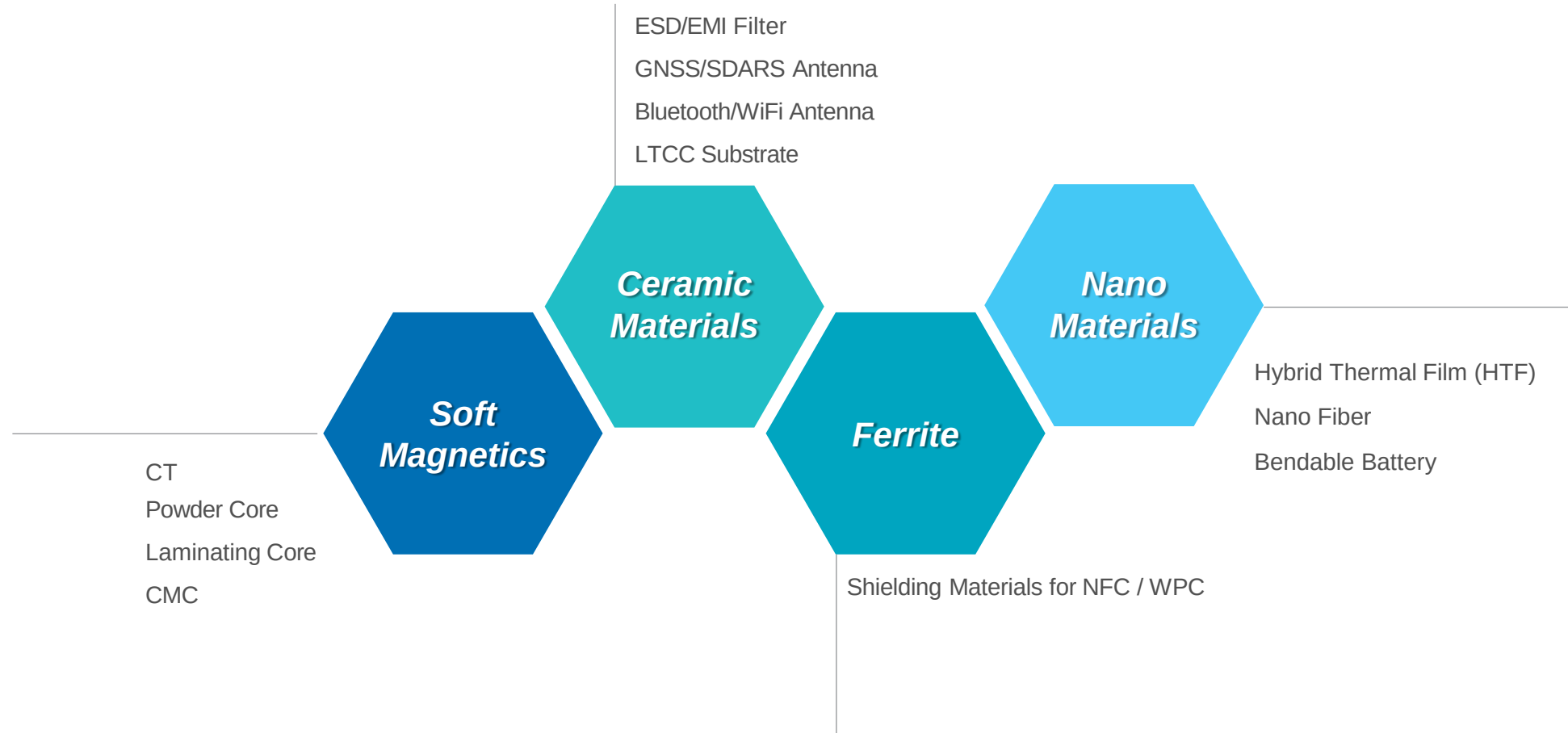


Part I AMO Group Overview

Products by Materials

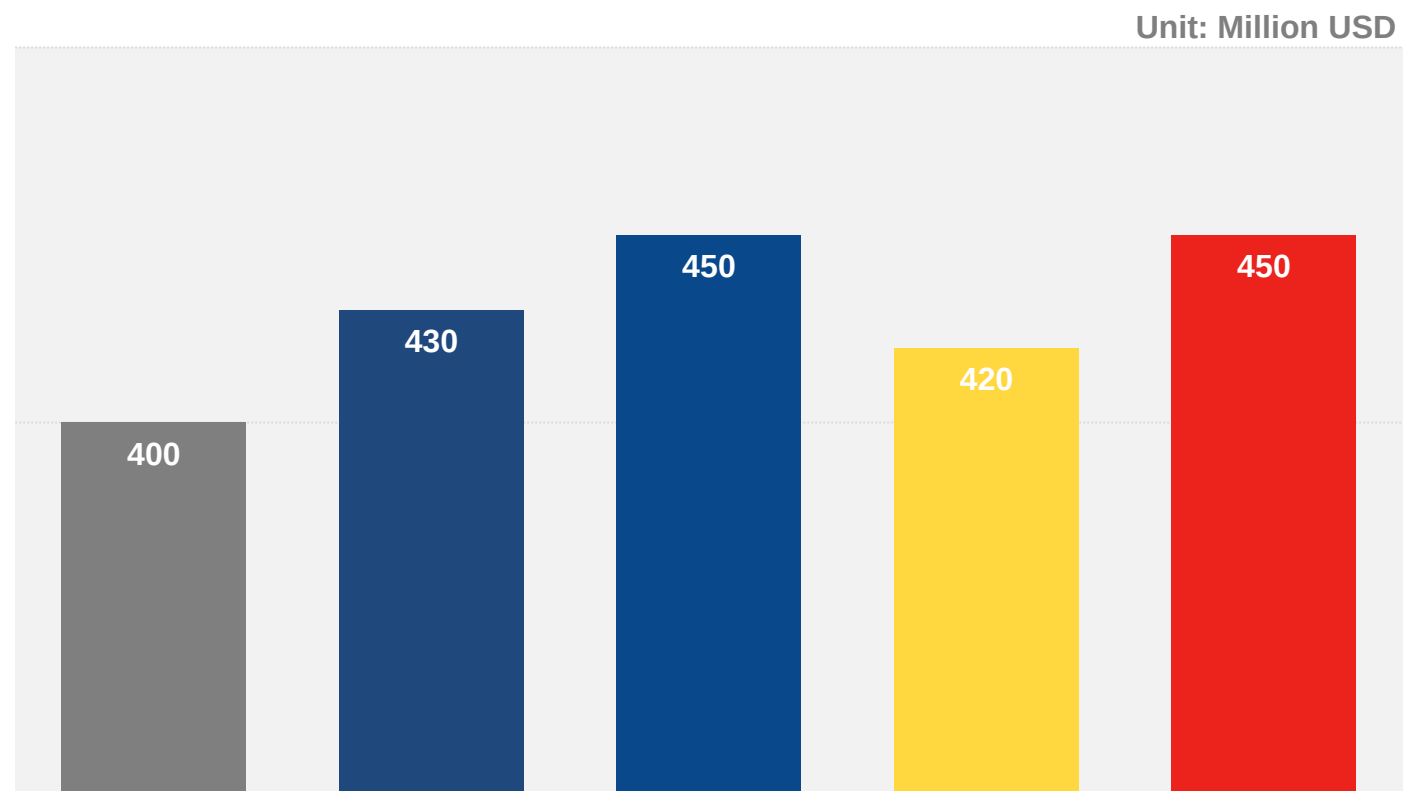


Major Key Points *Material Composition Technology*



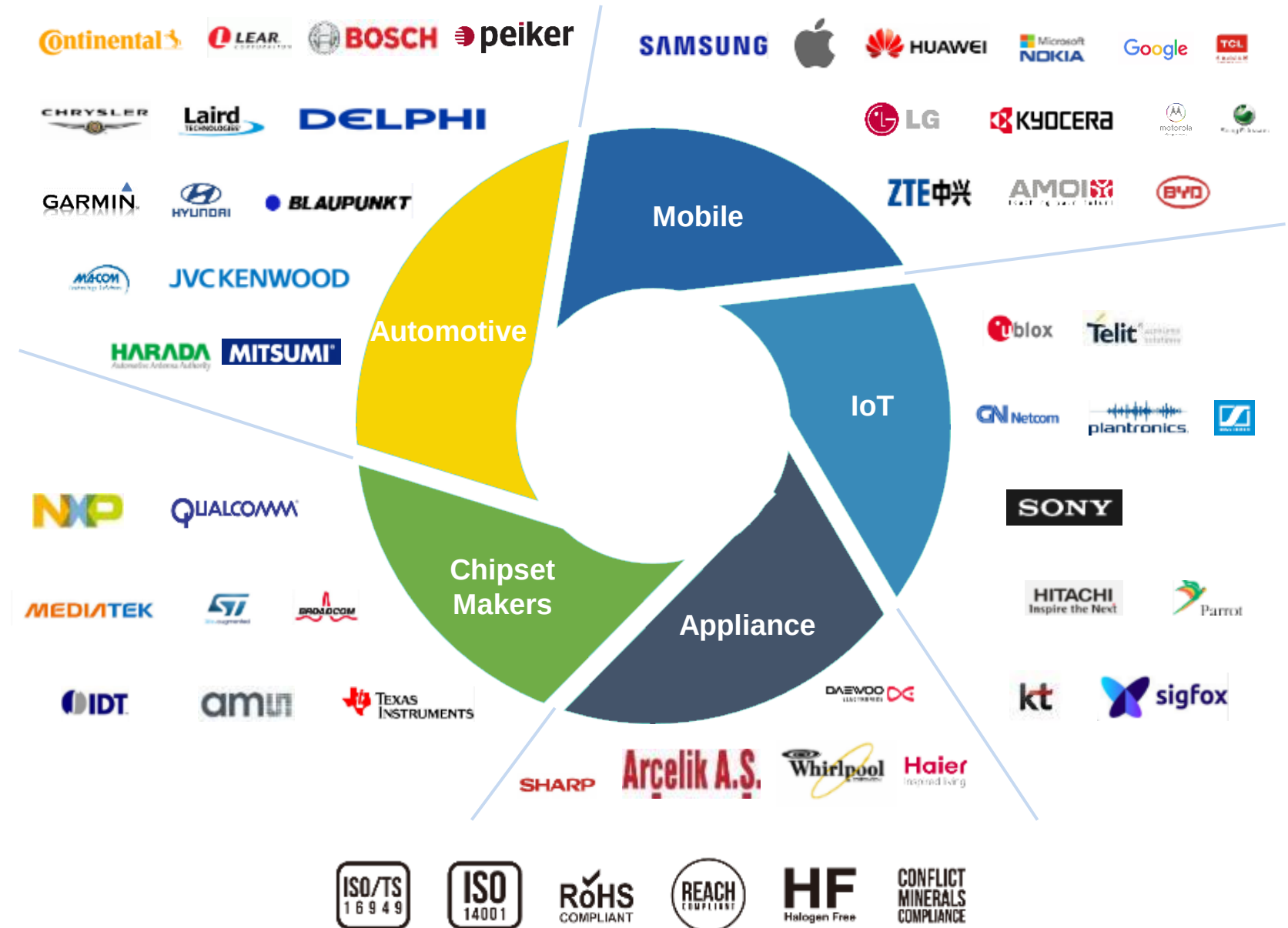
Part I
AMO Group
Overview

Sales Revenue



Valued Customers

Part I AMO Group Overview

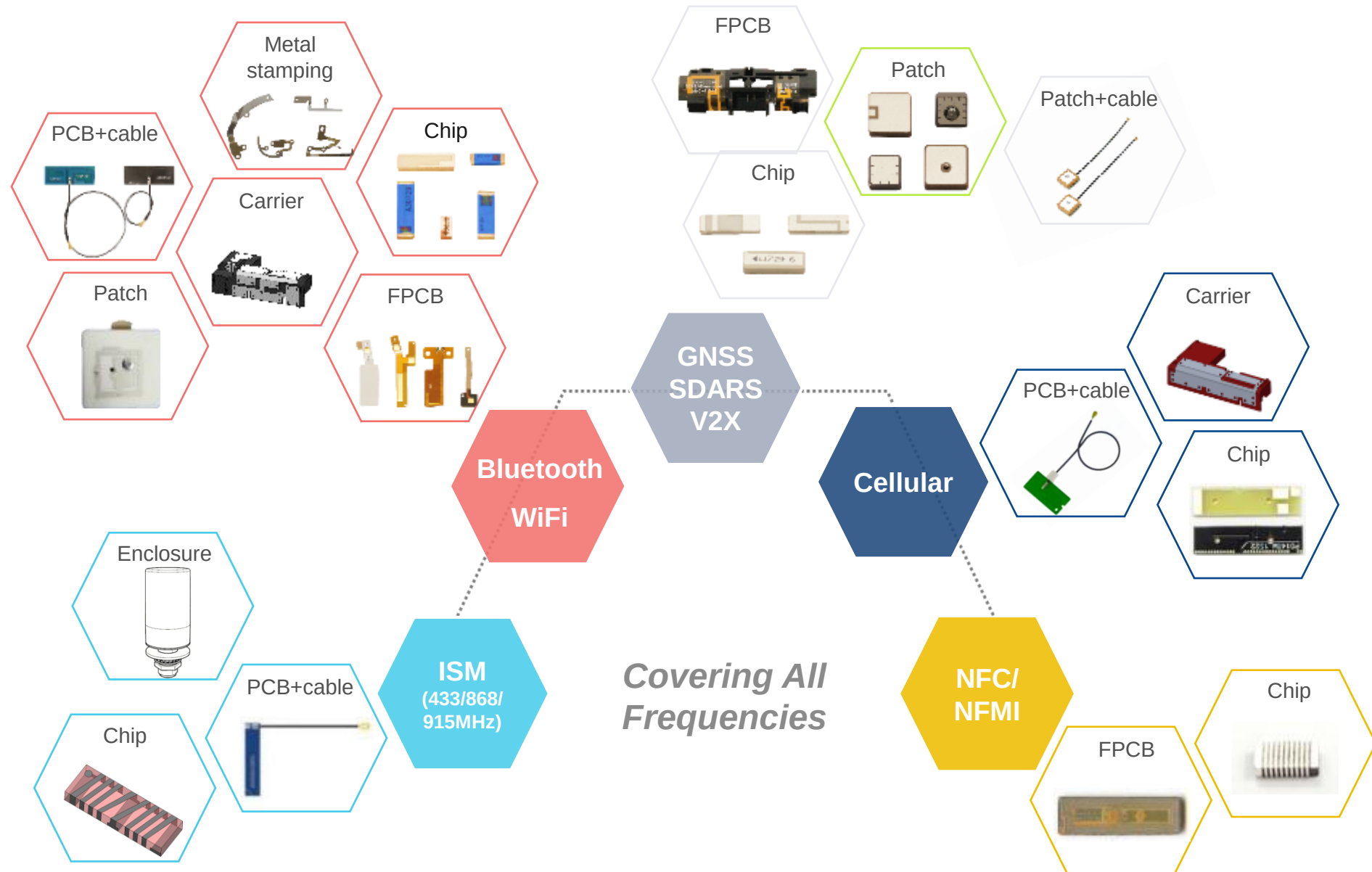




Antenna Solution

Part II Antenna Solution

Various Type



Part II Antenna Solution

AEC-Q 200 & IATF 16949 Certified



For AVN / Infotainment

- Bluetooth(LE) antenna
- WiFi antenna
- NFC antenna



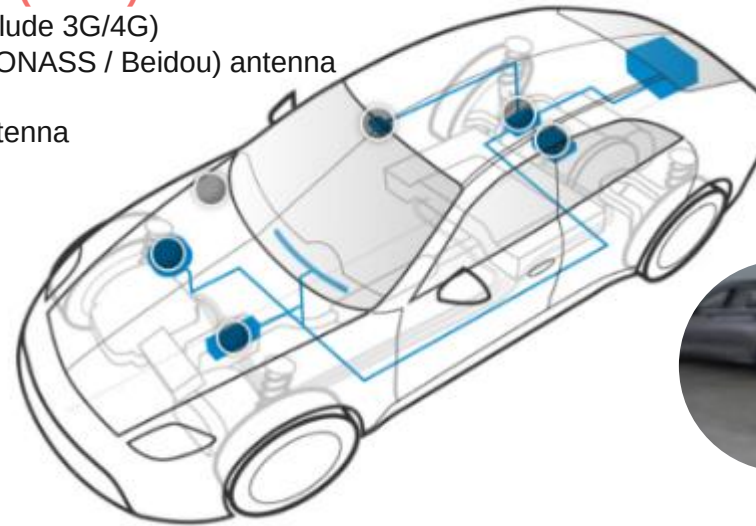
For Shark antenna

- GNSS (GPS / GLONASS / Beidou) antenna
- SDARS antenna



For Telematics (e-call)

- LTE antenna (include 3G/4G)
- GNSS(GPS / GLONASS / Beidou) antenna
- WiFi antenna
- Bluetooth(LE) antenna



For V2X

- 5.9GHz antenna



For car sharing

- NFC antenna
- GPS antenna



For Smart entry / Key fob

- 433MHz antenna
- NFC antenna

For BCM / SMK / IBU

- 433MHz antenna

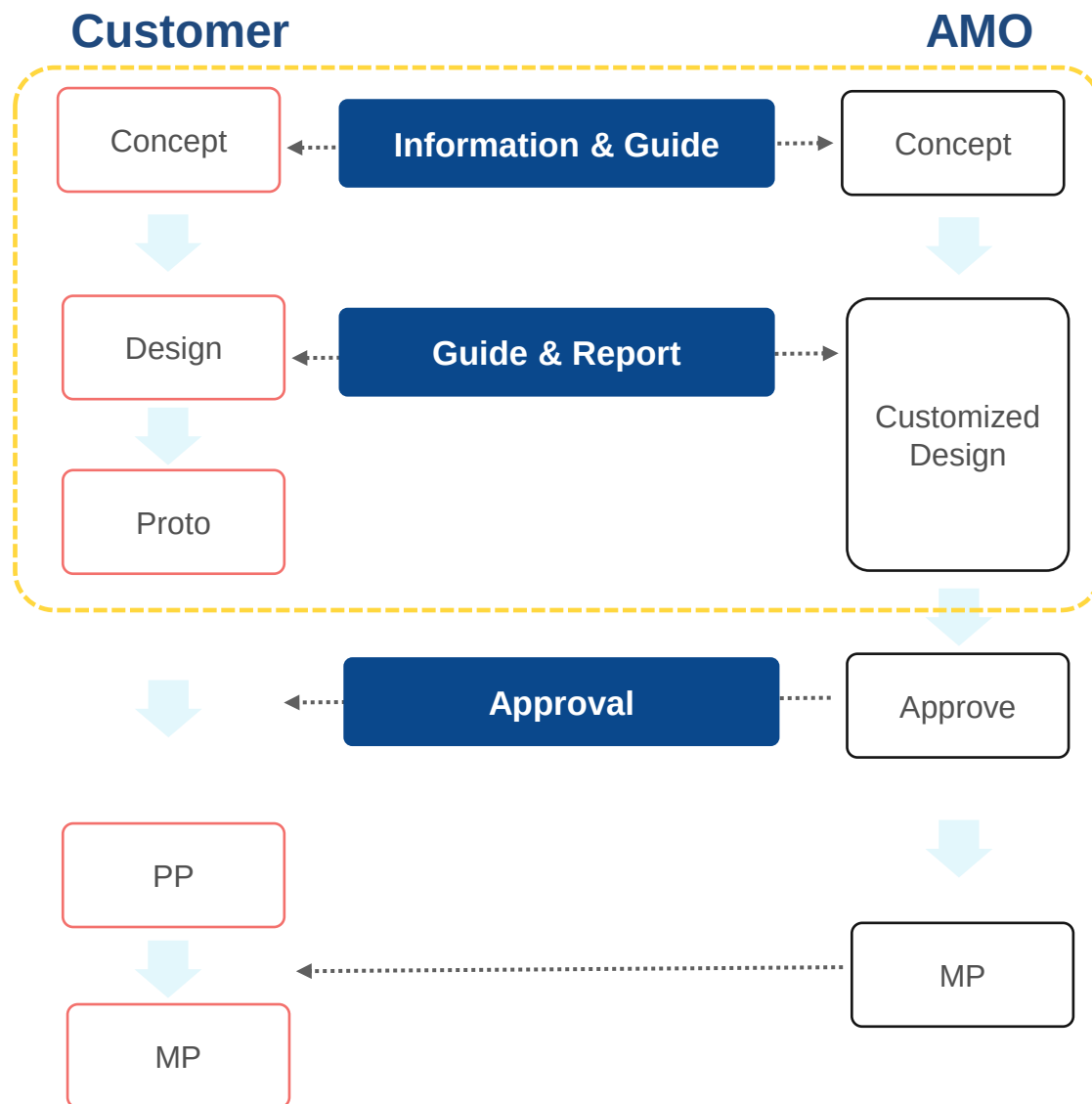




Design Capability

Part III Design Capability

Customized Design



Major Process

- Design guide
- Simulation
- Optimization
- Measurement
 - Gain & efficiency
 - Isolation
 - Radiation pattern
 - OTA (TRP/TIS)



Simulation Tools

Items	Tool
EM simulation	HFSS
	CST
	SEMCAD
PCB design	CADSTAR
	ALTIUM
Mechanical design	AUTOCAD
	SOLIDWORKS
	RHINO

● Equipment

Item	Equipment
Center Frequency & Return-loss	Network Analyzer
2D/3D Anechoic Chamber	8x4x4(2D) / 6x3x3(3D) / 2.8x1.6x1.8(3D)
GPS signal generator	Spirent STR4500
NFC EMVCo	3 Sets of EMVCo Full Test Bench
Bluetooth Tester	TC3000C (Tescom)
WiFi Tester	MT9960C R&S PTW70 (Anritsu)
Cellular TRP/TIS	E5515C 8960 (Agilent), MT8820C(LTE)

● Design Simulation

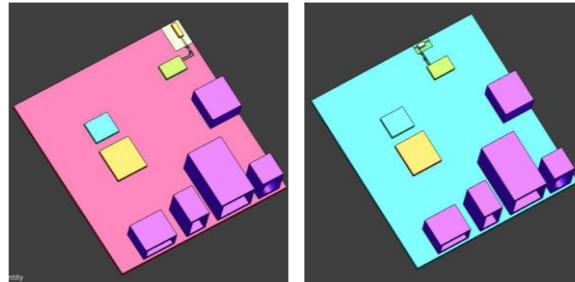


Design Service

Part III Design Capability

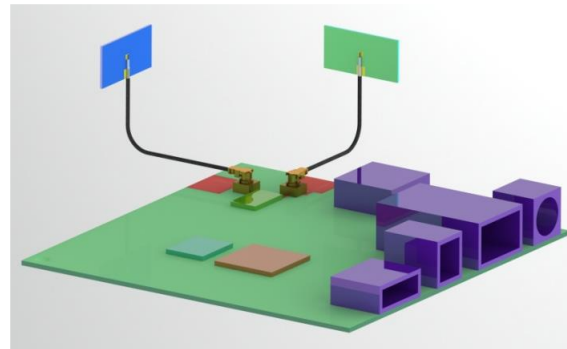
1.

Customized antenna design & device layout optimization



▲ Monopole

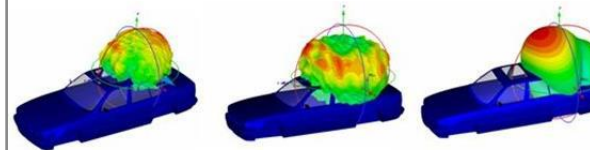
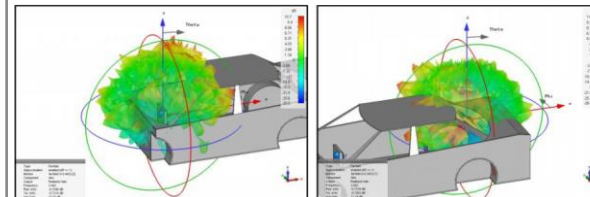
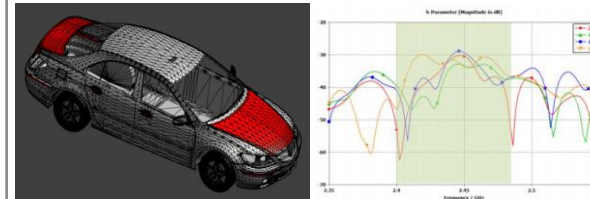
▲ PIFA



▲ Cable assembly

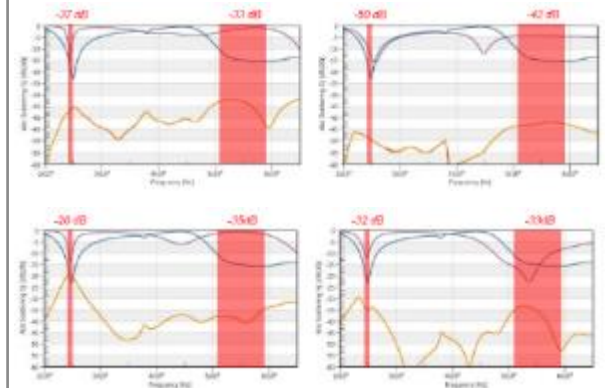
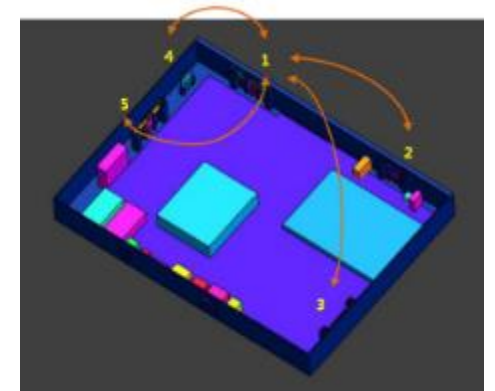
2.

Capability of electro magnetic simulation



3.

Antenna co-existence test



Part III Design Capability

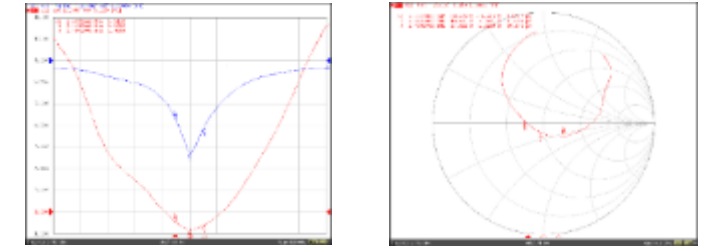
Measurement

1. Matching Information



Test No.	#1-1
Antenna	AMAN301512ST01
Series	1.8nH
Shunt	N/C
GND	1.0nH

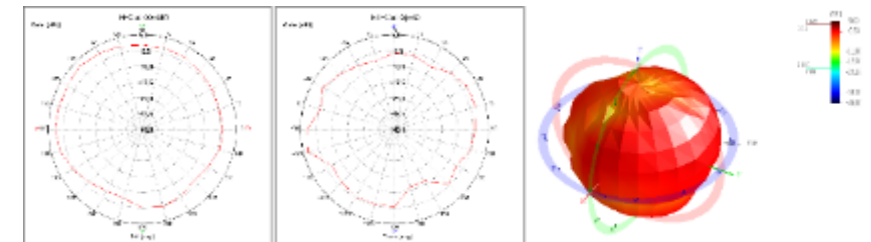
2. Passive Result : VSWR / Smith Chart



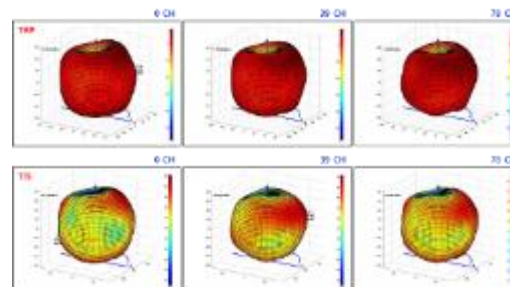
3. Passive Antenna Gain

Freq. (MHz)	Efficiency (%)	Avg. gain (dBi)	Peak gain (dBi)
2400 MHz	65.21	-1.86	3.15
2442 MHz	69.58	-1.58	3.11
2485 MHz	61.22	-2.13	2.97

4. Passive Antenna 2D / 3D Radiation Pattern



5. Active Measurement



✖ AMOTECH Measurement

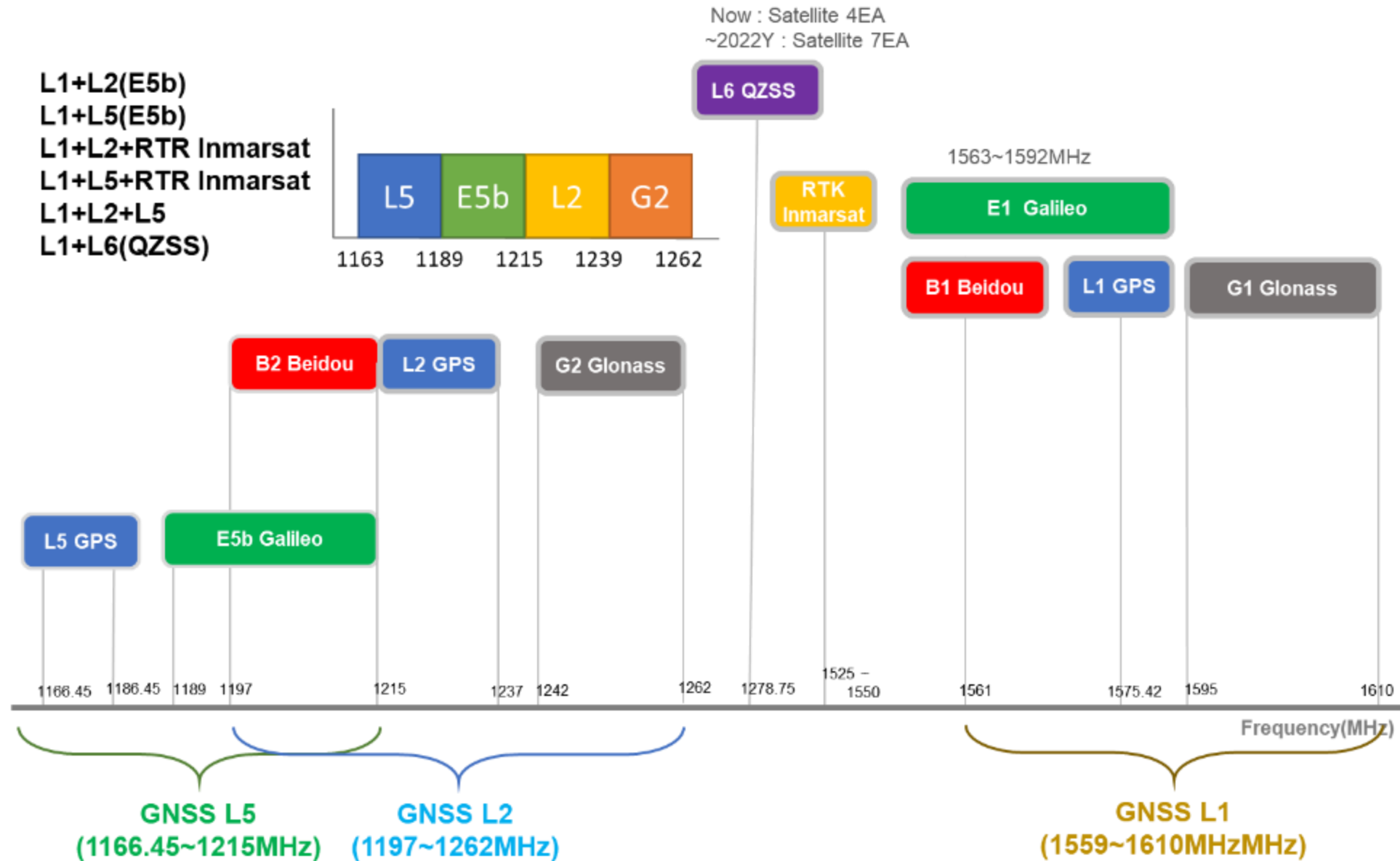
- ✓ Providing a test report including No. 1 ~ 5
- ✓ Ensuring the customer can achieve target specification



Ceramic Patch Antenna Solution

GNSS Frequency

Part IV Ceramic Patch Antenna Solution



Passive Antenna Overview

Part IV Ceramic Patch Antenna Solution



With single feed



With dual feed
25x25x6mm
35x35x6mm
Dia.42x6mm



33x33x6mm



High performance
Slim shape
Small shape



Dia.42x4mm + Dia. 42x8mm
Dia.42x8mm + 48x48x8mm



One ceramic body



38x38x10mm
Under development (~OCT. 2019)

Part IV Ceramic Patch Antenna Solution

Active Antenna Overview



AGA393914-S0-A6

- 40x40x15.1mm
- IP66, magnetic mount



AGA556022-S0-A4

- 55x60x22mm
- IP67, magnetic mount

AGA556022-S0-A14

- 55x60x22mm
- IP67, magnetic and screw mount



AGA424208-S0-A1 (slim/light)

- 42x42x11mm, adhesive and screw

AGA424214-S0-A1

- 42x42x16mm, adhesive and screw



AGA556022-S0-A7

- 55x60x22mm
- IP67, magnetic mount



AGA556022-S0-A13

- 55x60x22mm
- IP67, magnetic mount



Under development (end of Aug.)

New GNSS L1/L2/E5b



AGAD6623-S0-A1

- Dia. 66.5 - 23.5mm
- IP67, roof mount (TNC FM)

Part IV Ceramic Patch Antenna Solution

Stack-up Antenna GNSS L1 + L2



High performance ASPA-A35A

• GNSS L1 (1559~1608MHz)

Peak Gain [dBic]	3.2~4.4
Axial Ratio [dB]	0.7~1.3
Isolation [dB]	Min. 23.50

• GNSS L2 (1215~1255MHz)

Peak Gain [dBic]	2.2~4.3
Axial Ratio [dB]	1.2~1.5
Isolation [dB]	Min. 22.23

• Size : Dia. 42-13T

- GNSS L1 (Dia. 42-4T)
- GNSS L2 (Dia. 42-8T)



Slim ASPA-A36A [Smart]

• GNSS L1 (1559~1608MHz)

Peak Gain [dBic]	3.2~4.4
Axial Ratio [dB]	1.0~1.5
Isolation [dB]	Min. 33.96

• GNSS L2 (1215~1255MHz)

Peak Gain [dBic]	-1.5~1.0
Axial Ratio [dB]	1.8~3.2
Isolation [dB]	Min. 20.63

• Size : Dia. 42-8T

- GNSS L1 (Dia. 42-3T)
- GNSS L2 (Dia.42-4T)



Small ASPA-A37A [Shark fin]

• GNSS L1 (1559~1608MHz)

Peak Gain [dBic]	3.1~5.0
Axial Ratio [dB]	1.2~1.8
Isolation [dB]	Min. 17.9

• GNSS L2 (1215~1255MHz)

Peak Gain [dBic]	0.7~4.0
Axial Ratio [dB]	0.9~2.7
Isolation [dB]	Min. 23.4

• Size

- GNSS L1 (25x25-6T)
- GNSS L2 (33x33-8T)



Part IV Ceramic Patch Antenna Solution

Stack-up Antenna GNSS L1 + L2 + L5

Requirement check : customer requirement

GNSS L1 :

L1 : 4dBic @1565.42~1585.42MHz
 G1 : 2.5dBic @1599~1619MHz
 B1 : ?dBic @1559.098~1563.098MHz
 E1 : 4dBic @1609MHz and 1558~1592MHz

GNSS L2 :

L2 : 4dBic @1217.6~1237.6MHz
 G2 : 2.5dBic @1242~1262MHz
 B2 : 2.5dBic @1197.14~1217.14MHz

GNSS L5 :

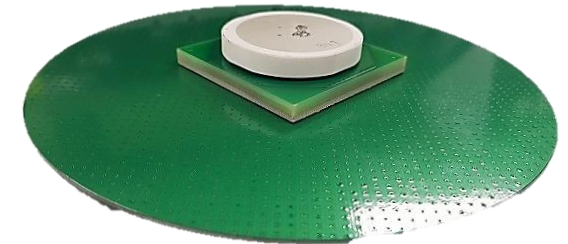
L5 : -1.5dBic @1166.45~1186.45MHz
 E5 : -1.5dBic @1177~1207MHz

• Case1 : GNSS L1(Dia.42-6T) / GNSS L2&L5(50x50-4.8T)

Band	Performance	G/P 1,000mm	G/P 150mm
GNSS L1 1525~1608M	Zenith Gain [dBic]	0.5~4.2	3.5~5.4
	Axial Ratio [dB]	1.5~2.5	1.6~2.5
GNSS L2/L5 1164~1255M	Zenith Gain [dBic]	-3.7~1.2	0~4.5
	Axial Ratio [dB]	1.5~2.0	1.4~2.0

• Case2 : GNSS L1(Dia.42-4T) / GNSS L2/L5 (Dia. 42-8T)

Band	Performance	G/P 1,000mm	G/P 150mm
GNSS L1 1558~1619M	Zenith Gain [dBic]	-	3.2~4.9
	Axial Ratio [dB]	-	Max. 2.5
GNSS L2/L5 1166~1262M	Zenith Gain [dBic]	-	-2.4~4.0
	Axial Ratio [dB]	-	Max. 2.5



▲ GNSS L1 : Dia.42-6T
 GNSS L2/L5 : 50x50-4.8T



▲ GNSS L1 : Dia.42-4T
 GNSS L2/L5 : Dia. 42-8T

Part IV Ceramic Patch Antenna Solution

GNSS L1+L2+RTK Inmarsat or GNSS L1+L5+RTK Inmarsat



■ GNSS L1 + L2 + RTK Inmarsat

Band	Performance	G/P 1,000mm	G/P 150mm
GNSS L1 + Inmarsat 1525~1608M	Zenith Gain [dBic]	-	4.2~5.3
	Axial Ratio [dB]	-	0.6~2.3
GNSS L2 1197~1262M	Zenith Gain [dBic]	-	4.2~6.0
	Axial Ratio [dB]	-	1.5~2.5

- ▶ GNSS L1+Inmarsat : Dia.46-8T
- ▶ GNSS L2 : 50x50-8T

■ GNSS L1 + L5 + RTK Inmarsat

Band	Performance	G/P 1,000mm	G/P 150mm
GNSS L1 + Inmarsat 1525~1608M	Zenith Gain [dBic]	-	4.2~5.3
	Axial Ratio [dB]	-	0.6~2.3
GNSS L5 1166~1207M	Zenith Gain [dBic]	-	4.5~6.2
	Axial Ratio [dB]	-	1.6~2.5

- ▶ GNSS L1+Inmarsat : Dia.46-8T
- ▶ GNSS L2 : 50x50-8T

Part IV Ceramic Patch Antenna Solution

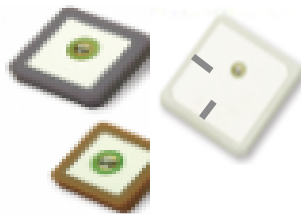
01

E-call



02

Shark fin



03

GNSS module



04

Shark fin



05

GNSS module

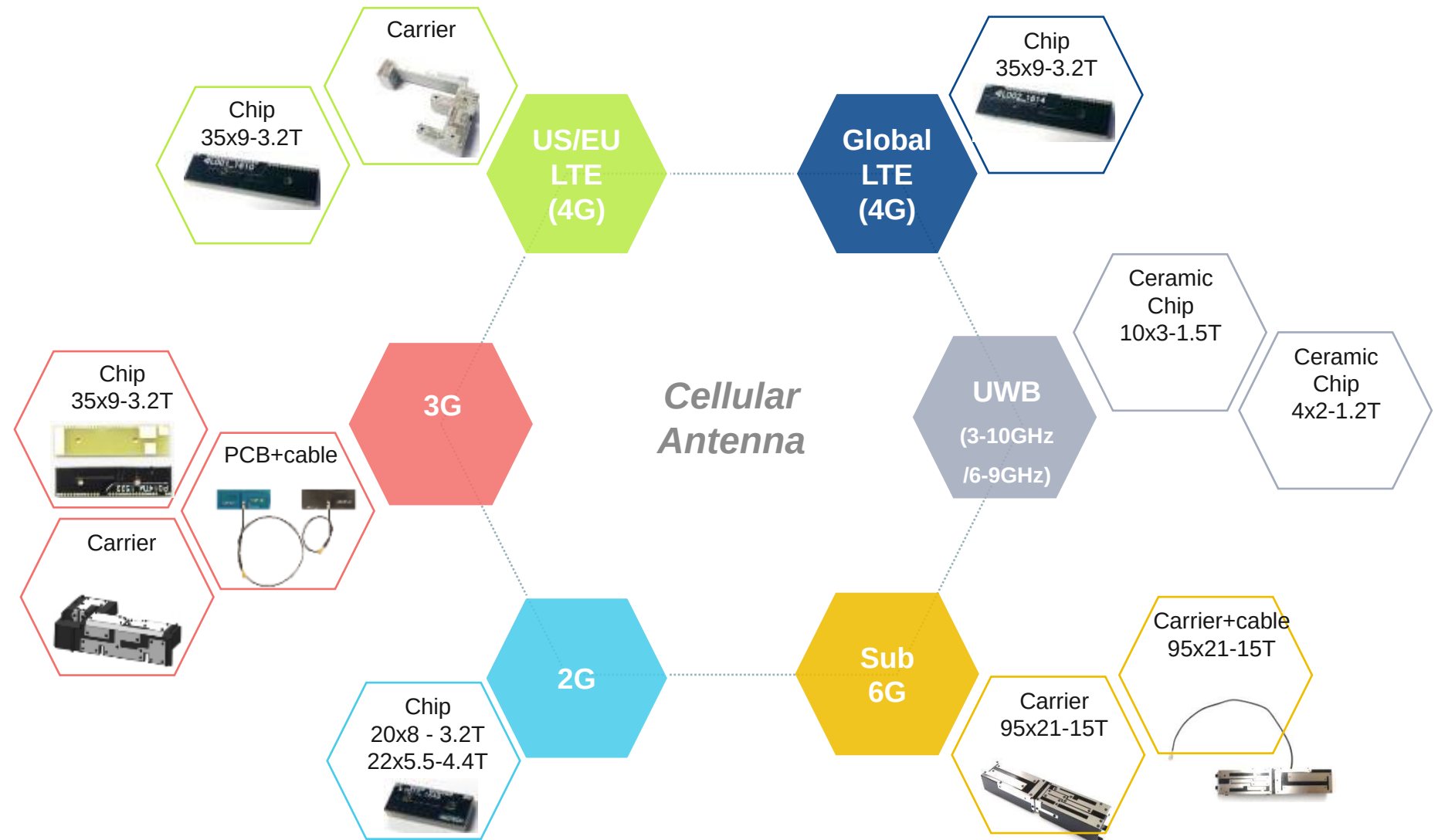




Cellular Antenna Solution

Part V Cellular Antenna Solution

Various Type



Part V Cellular Antenna Solution

Product Line-up

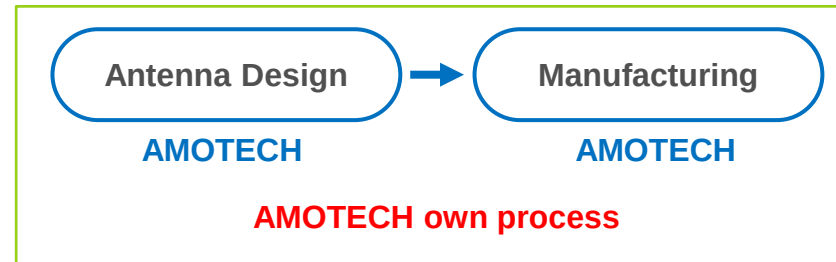


Type	Part Number	Size (mm)	Frequency	VSWR	Gain (dBi)		EVB Size (mm)
					Average	Peak	
PCB + cable	AMMAP007(FR4)	40.0x15.0x0.55	GSM850	3:1	-1.0	3.0	-
	AMMAP008(FPCB)	40.0x15.0x0.14		3:1	-3.0	4.0	-
	AMMAP009	40.0x15.0x0.14		3:1	Min. -4.5	-	-
Customizing	Press or FPCB with carrier	Optional	GSM900	-	-	-	-
Cellular Chip (SMD)	AMMAP017	20x8-3.2T	DCS1800	3:1	Min. -3.5	3.4	114x50
	AMMAP003(F)	24.0x5.5x4.4	PCS1900	3.5:1	Min. -3.7	4	114x45
	AMMAP005(R)	24.0x5.5x4.4	WCDMA	3.5:1	Min. -3.7	4	114x45
	AMMAQ002	22.0x5.5x4.4	UMTS	3.5:1	Min. -3.3	3	114x45
	AMMAP014_L AMMAP020_R	35.0x9.0x3.2	US LTE (704~2170MHz)	2.7:1	Min. -3.3	3	110x50
	AMMAL001_L AMMAL007_R	35.0x9.0x3.2		2.7:1	Min. -2.6	3	120x50
	AMMAL002_L AMMAL003_R	35.0x9.0x3.2	EU LTE (791~2690MHz)	3.0:1	Min. -3.4	3	120x50
	AMMAL004_L AMMAL008_R	35.0x9.0x3.2	Global LTE (704~2690MHz)	3.8:1	Min. -3.6	3	141X50
	AMMAL006_L AMMAL009_R	35.0x8.0x3.2	Global LTE (704~2690MHz)	3.8:1	Min. -3.6	3	141X50
	AMMAL021_L AMMAL022_R	39.0x9.0x3.2	US LTE (B71) (617~2170MHz)	2.7:1	Min. -2.5	4	167x55
	AMMAL014	20X8X3.2T	Sub 6G RX 1710~5000MHz	3.5:1	Min. -2.5	4	120x50
Carrier+Cable	TBD	95x21x15mm(H)	5G (LTE+Sub6G)	2.0:1	Min. -2.0	3.0	-
FPCB+Cable	AMMAL024	120x30x?	5G(B71) (LTE+Sub6G) 617~5000MHz	4.0:1	Min. -2.0	3.0	-
Ceramic Chip (Monopole)	AMOCA3H15U1PA	10.0x3.0x1.5	3-10GHz Ultra-Wideband	2.0:1			
	AMAN402012ST02A	4.0x2.0x1.2	6-9GHz Ultra-Wideband	3.2:1			

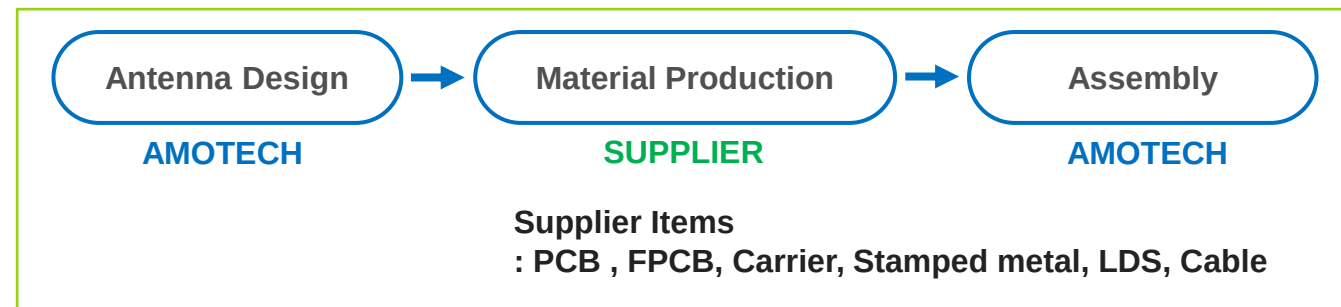


BT/WiFi/GNSS Ceramic Antenna Solution

1. Ceramic Chip Antenna



2. Carrier Antenna / (F)PCB & Cable Assembly Antenna / LDS / Metal Stamped Antenna



Part VI BT/WiFi/GNSS Ceramic Antenna Solution

Product Line-up – BT/WiFi Ceramic Antennas



Type	Part number	Size [mm]	Frequency [MHz]	VSWR	Gain [dBi]		Remark
					Average	Peak	
Chip Antenna	ALA321C3	3.2 x 1.6 x 1.2	2400~2485	3.0:1	-1.6	2.3	
	ALA621C4	6.0 x 2.0 x 1.2		2.5:1	-1.0	3.5	
	ALA621C5	6.0 x 2.0 x 1.0		2.5:1	-1.0	3.5	
	ALA931C5	9.0 x 3.0 x 1.2		2.5:1	-0.5	3.5	
	ALA131C3	11.0 x 3.0 x 1.2		2.5:1	-0.5	4.0	
	AMAN201510ST01	2.0 x 1.5 x 1.0	2400~2485	3.0:1	-1.0	3.0	
	AMAN301512ST01	3.0 x 1.5 x 1.2		3.0:1	-1.0	3.0	
	AMAN402012ST01	4.0 x 2.0 x 1.2		3.0:1	-1.0	3.0	
	AMAN1003030ST02 [Dual band]	10.0 x 3.0 x 3.0	2400~2485 5150~5850	2.5:1	-2.0	-	
	AMAN1003030ST03	10.0 x 3.0 x 3.0	2400~2485	3.0:1	-1.0	3.0	ON-GND
	AMAN1003015ST04	10.0 x 3.0 x 1.5	5150~5850	2.0:1	-1.4	-	
	AMAN1003015ST05	10.0 x 3.0 x 1.5		2.0:1	-1.6	-	
	AMAN1003015ST06 [Dual band]	10.0 x 3.0 x 1.5	2400~2485 5150~5850	2.5:1	-1.2	-	
	AMOCA3H15F7PA [Dual band]	10.0 x 3.0 x 3.0	2400~2485 5150~5850	2.5:1	-2.0	-	
	AMOCA4H40F7PA [Dual band]	10.0 x 3.0 x 3.0	2400~2485 5150~5850	2.5:1	-2.0	-	
Press Antenna	AMAPST001	14.0 x 3.0 x 3.0	2400~2485	3.0:1	-1.2	3.0	
	AMAPST002	20.0 x 8.0 x 6.0	2400~2485	3.0:1	-2.7	1.4	ON-GND

※ AMAN & AMO series can be customized by customer's request.

Part VI
BT/WiFi/GNSS
Ceramic
Antenna
Solution

Product Line-up – GNSS Ceramic Chip Antennas



Type	Part number	Size (mm)	Frequency (MHz)	VSWR	Gain	
					Average	Peak
PIFA type	AMAN1003030ST01	10x3.0x3.0	GPS	3.0:1	-0.3	3.7
	AMAN1003015ST01	10x3.0x1.5	GPS	3.0:1	-1.1	1.0
	AMAN1003015ST02		Glomass	3.0:1	-1.1	2.3
	AMAN1003015ST03		GPS+Glomass	3.0:1	-0.7~-0.1	2.8, 2.2
Monopole Type	AMOCA3H30G4PA	10x3.0x3.0	GPS+Glomass+Beidou+Galileo	3.0:1	-1.3	2.6

Part VI BT/WiFi Antenna Solution

01

AVN



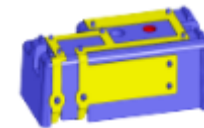
02

AVN



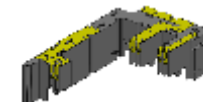
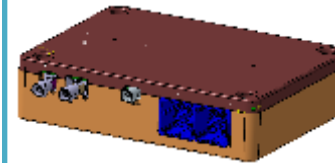
03

AVN



04

Telematics



05

Telematics



Part VI BT/WiFi Antenna Solution

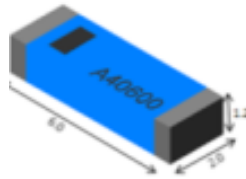
01

Speaker



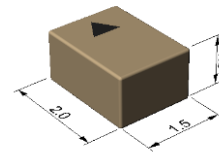
02

Bluetooth
Headphone



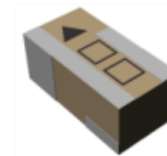
03

Health
tracker



04

Remote-
control



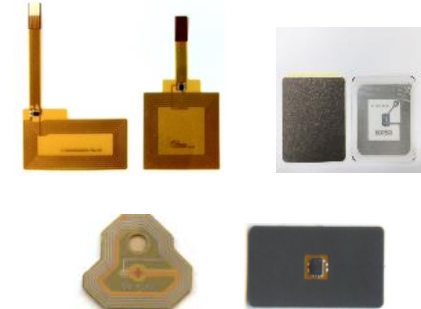


NFC Antenna Solution

Part VII NFC Antenna Solution

NFC tag module

- Convenient wireless pairing
- User setting & S/W update available with pairing
- Dynamic data exchange with mobile having NFC
- Information long download with I2C, SPI, UART
- Suitable for home appliance application



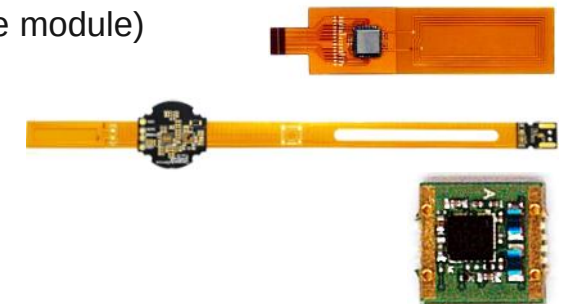
NFC+WLC combo

- Thin thickness but high antenna performance
- Having special shielding sheet for NFC and WLC antenna
- Payment & Wireless power charging
- Suitable for mobile or home appliance application



NFC full module

- Tag & R/W & Peer-to-peer NFC full support (active module)
- Payment available
- All type of NFC tag support (Type A, B, A/B, F)
- Compact size
- Suitable for mobile or wearable application



Part VII NFC Antenna Solution

01

AVN



02

Key fob



03

Door



04

Car
payment



05

WLC
armrest



Wearable Application

Part VII NFC Antenna Solution

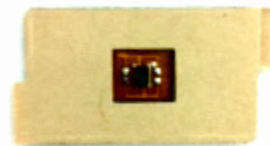
01

Portable WiFi
audio



02

Bluetooth
speaker



03

Bluetooth
headset



04

Payment ring



05

Bluetooth
headset



THANK YOU!

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