Aerospace & Defence | Lighting | Power Management | Internet of Things | Transportation

Components – EMEA

Antenna Guide

Five Years Out

arrow.com

At Arrow, thinking Five Years Out is a way of life. Procuring millions in inventory to support your supply needs for decades to come is a sign of our steadfast commitment to your future.

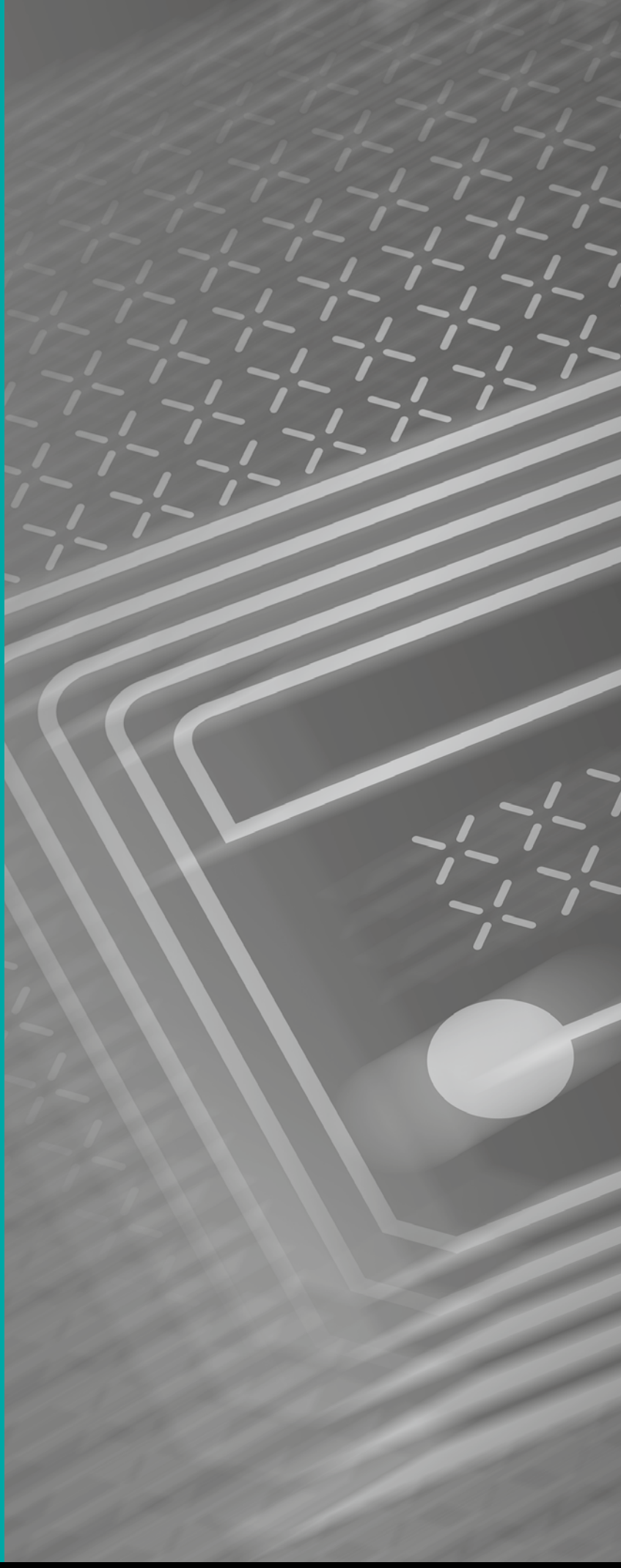


Table of Contents

What is an Antenna?

An Antenna is a transducer that converts radio frequency (RF) fields into alternating current or vice versa. There are both receiving and transmission Antennas for sending or receiving radio transmissions. Antennas play an important role in the operation of all radio equipment. They are used in wireless local area networks, mobile telephony and satellite communication.

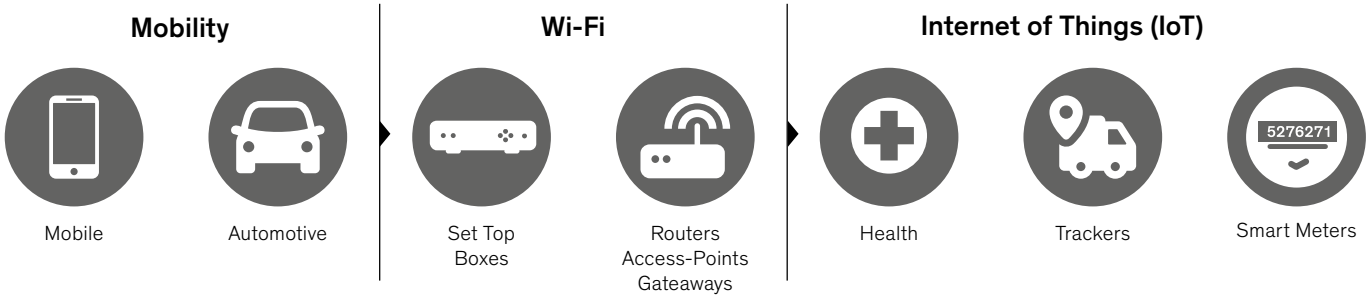
Antennas

An Antenna has an arrangement of metallic conductors with an electrical connection to a receiver or transmitter. In a radio transmitter, current is forced through these conductors by the transmitter to create an alternating magnetic field. In a radio receiver, this field induces a voltage at the Antenna terminals, which are connected to the receiver input. In remote transmission, the oscillating magnetic field is coupled with a similar oscillating electric field, which defines electromagnetic waves capable of propagating the signal for long distances. Radio waves are electromagnetic waves that carry signals through space at the speed of light without any transmission loss. Antennas can be omni-directional, directional or arbitrary.

Main Types of Antennas

There are several different types of Antennas. The two most common are monopole and dipole Antennas, which originated from transmission line theory. A dipole is a half-wavelength, open-ended transmission line that is fed at the midpoint of the Antenna. A monopole is a quarter-wavelength-fed open-ended transmission line.

Passive & Active Antennas



Trends in Wireless Applications
Exponential Increase in traffic especially for 5G Enhanced RF requirements for coverage, efficiency and battery life

Why are there Different Antennas?
Antenna performance depends on proper implementation and the environment.

Challenges
The coexistence of different standards, miniaturization, interference, in-band noise, CostRF and knowledge.

How do I Know the Antenna is Good Enough?
Supplier Labs and Arrow ECS will find out and provide a cost-efficient solution.

Get the best performance and speed up time to market. Contact the Arrow Field Application Engineer to understand how to integrate Antenna in your design.

Christoph Kollmann
Technology & Supplier Business Manager, EMEA, Arrow

Antennas – Design-In and Integration

Successful integration of an Antenna into a wireless device depends on the understanding that the entire device is part of the Antenna. The Antenna cannot be added at the end of the design phase; it must be designed in from the very beginning of the product concept.

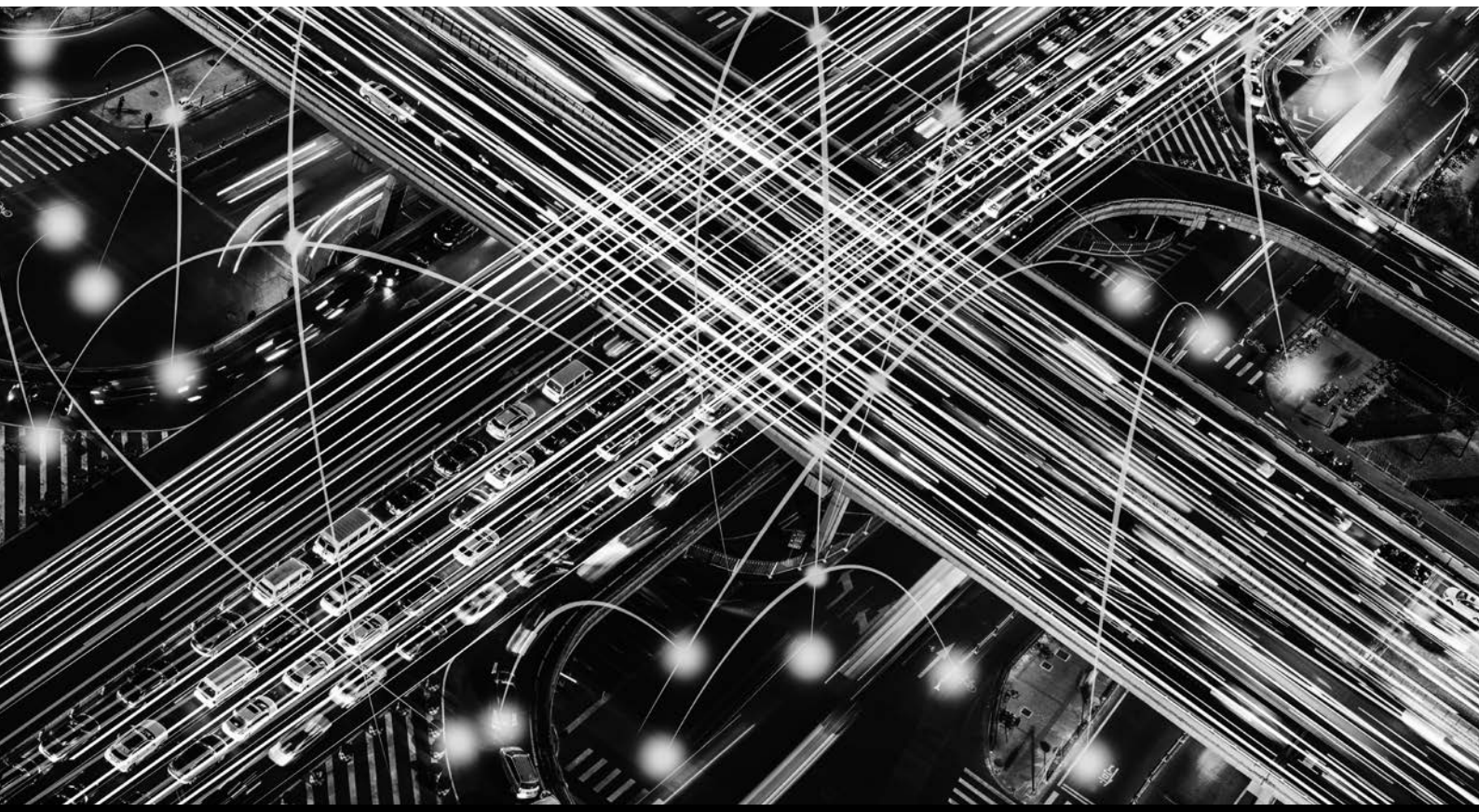
Fixing Antenna problems at the end or after prototyping at a testing facility is difficult, time consuming, and expensive.

The primary Antenna performance goal must be efficiency. Antenna tuning and impedance issues can usually be adjusted to some degree during development. However, an Antenna design with inherent low efficiency, most often because of size constraints imposed by the industrial design, will often require substantial product re-design for improvement.

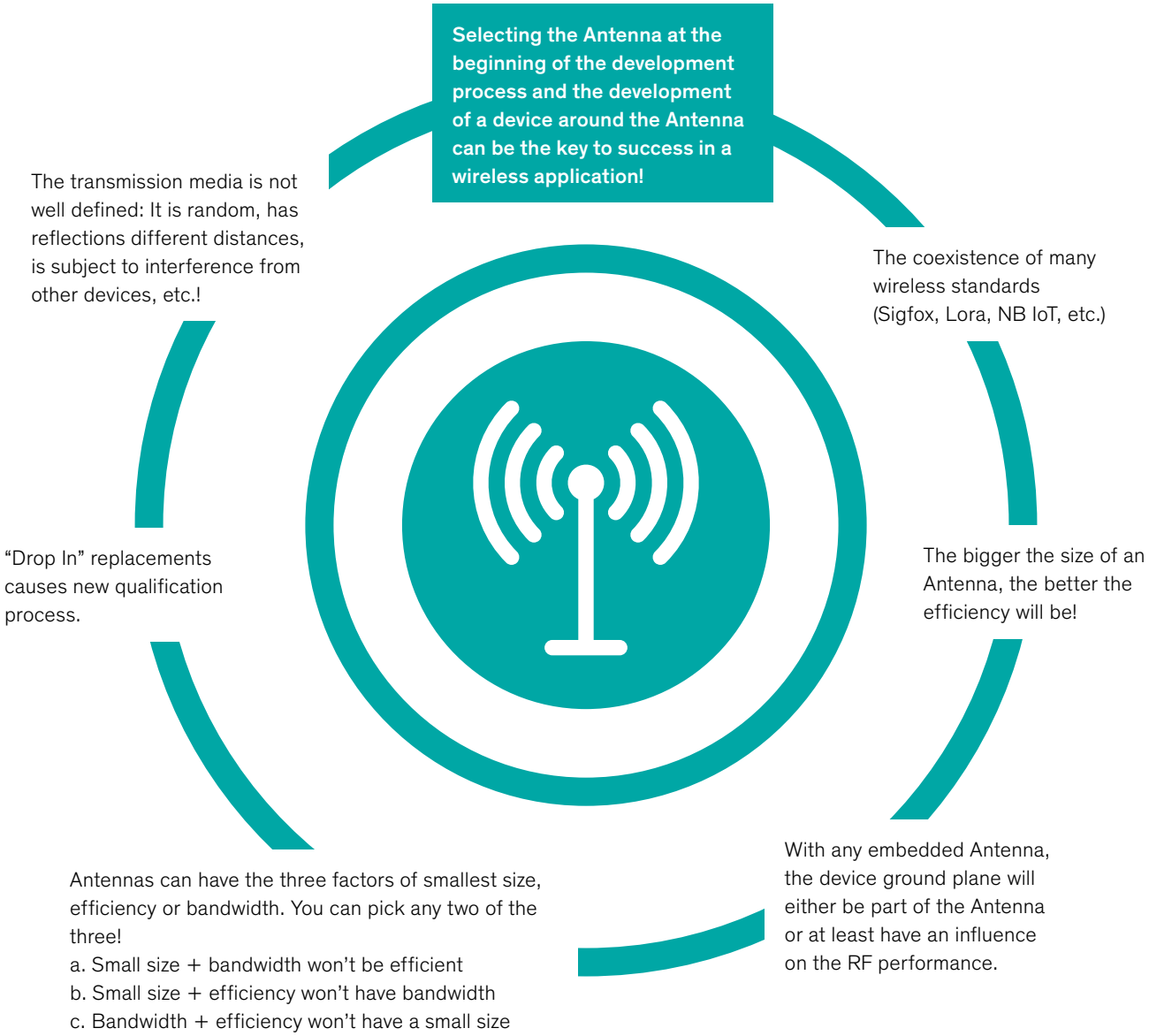
Antenna design requires suitable test equipment and know-how to obtain optimal performance. It is strongly recommended to use the professional services of firms specializing in the design and placement of Antennas. Arrow and our partners can help in the design process.

To support Arrow's customers with the right partner, product and services, we have developed this Antenna Guide. This brochure is intended to help solve problems before they appear and speed up the time to market for new end products in very fast-developing market conditions.

Source: AT&T Antenna Technical Brief and TE Connectivity



Consider at the Beginning of the Design Phase



Arrow Engineering Solution Center – ESC

> **ESC (Engineering Solution Center) – EMEA**
Embedded HW/SW, Linux, IoT, FPGA, Power, Analog, Sensor, Memory, Security, Lighting, RF, PEMCO, Mechanical Design, Project Management
Locations: Budapest (HU); Neu-Isenburg (GE); Gdansk (PL)

> **ESC (Engineering Solution Center) – NA**
IoT, ACES & ASIC, Connectivity, Mechanical & Industrial Design, Embedded HW/SW, Timing, FPGA, Analog, Power, PEMCO, Project Management

> **ESC (Engineering Solution Center) – APAC**
Embedded, Connectivity, Motor Drives, Power, Sensor, etc. + Lab

Arrow's 3rd Party Network and ESC

> **More 50 existing Arrow 3rd Party Partner**
Arrow has an extensive 3rd party company network to extend Arrow services and custom support.

> **Multiple of technologies**
Arrow's 3rd party partners are exprienced and in different kind of technologies and engineering services including the RF technologies.

> **Connections**
Arrow can provide support in different technologies, 100 % covering the custom application.

> **Countinously growing partner network**

Benefits

Faster time to market

Cost saving

Customer relationship

Wider support

Arrow ESC – Antenna Related Activities

Appropriate Antenna Selection

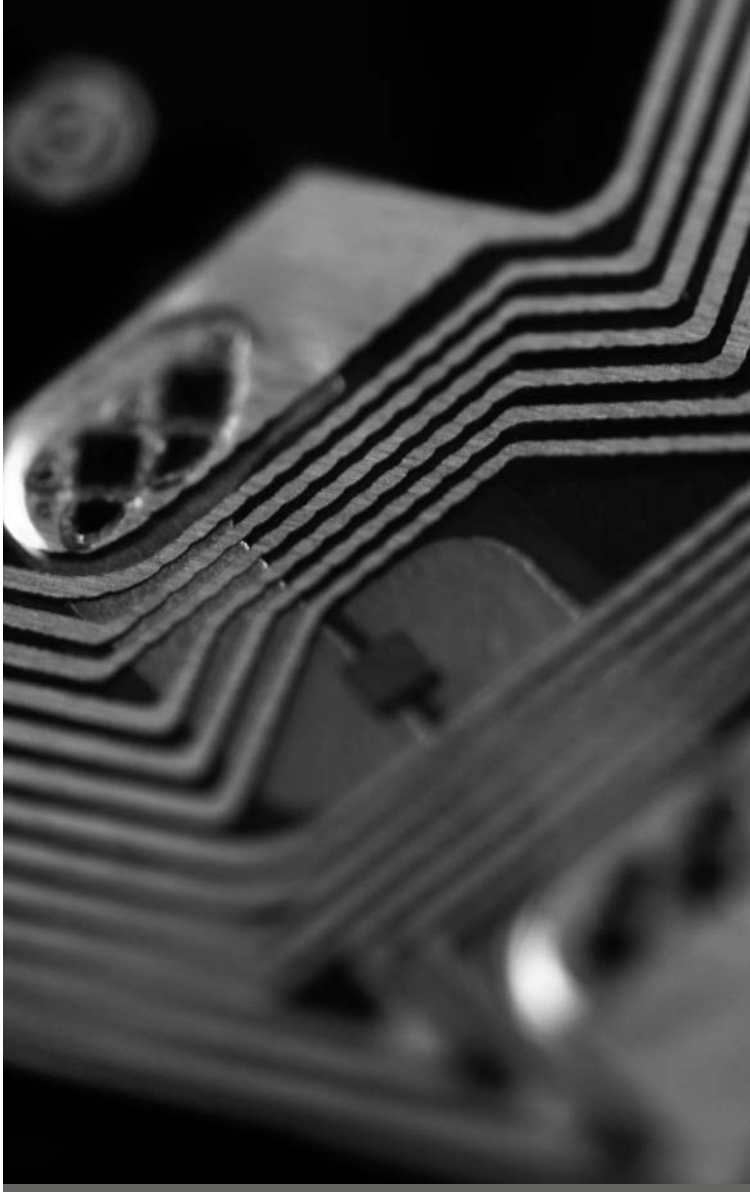
> Antennas for indoor and outdoor applications.
> Antennas for different frequencies, technologies covering the multi-band applications.
> Antennas in different form factors like chip, stick, flex etc.

Customized Antenna Design

> Customized Antenna design support from slight standard Antenna modification up to complete new design inculding cable assemblies.
> PCB Antenna design support.
> Matching circuit design support to achieve the best performance.
> Antenna measurement and optimization services via 3rd party companies.
> Simulation of Antenna performance.

RF Certification

> RF certification via 3rd party companies considered the world region.



Arrow can deliver different kind of Antennas from stock. In case of specified application we can propose Antennas from Arrow's wide range line card which mostly fit the customer's requirements in best price!

Wireless Communication Standards

Technology	Frequency	Typical Data Rate	Distance
Cellular	GSM: 850, 900, 1800, 1900 Mhz	GPRS up tp 80 kbit/s	
Mobile Communication	UMTS: 850, 1900, 2100 Mhz	EDGE up to 1.6 Mbit/s	
	LTE: 800, 900, 1800, 2600 Mhz	UMTS up to 384 kbit/s	-
		HSDPA up to 7.2 Mbit/s	
		LTE up to 100 Mbit/s	
Sigfox	868 Mhz Europe	Sigfox up to 100 bit/s	Sigfox up to 20,000 m
LoRa	915 Mhz North America	LoRa up to 50 kbit/s	LoRa up to 15,000 m
GNSS	Between 1.2 Ghz–1.6 Ghz depending on System	-	-
Global Navigation Satellite System (GPS, Glonass, Galileo, Compass)			
WLAN	802.11a–5.0 Ghz	802.11a up to 54 Mbit/s	802.11a up to 120 m
Wireless Local Area	802.11b–2.4 Ghz	802.11b up to 11 Mbit/s	802.11b up to 140 m
Network	802.11g–2.4 Ghz	802.11g up to 54 Mbit/s	802.11g up to 140 m
	802.11n–2.4 Ghz/5.0 Ghz	802.11n up to 600 Mbit/s	802.11n up to 250 m
	802.11ac–5 Ghz	802.11ac up to 867 Mbit/s 802.11ad up to 7 GBit/s	802.11ac up to 250 m
	802.11ad–60 Ghz		802.11ad a few cm
Bluetooth	2.4 Ghz	Version 1.2 up to 1 Mbit/s, Version 2 up to 3 Mbit/s	Class 1 up to 100 m
Wireless data exchange		Version 3/4 up to 24 Mbit/s, Low Energy (LE) up to 1 Mbit/s	Class 2 up to 10 m
over short distances			Class 3 up to 1 m
			Low Energy (LE) up to 50 m
Low Rate WPAN	433 Mhz: Europe	20 kbit/s to 250 kbit/s	Depending on network topology and protocol standard
IEEE 802.15.4, ZigBee,	868.0–868.6 Mhz: Europe		Point to point 802.15.4 ranging up to 100 m
wireless HART, MiWi,	902–928 Mhz: North America		ZigBee Pro up to 1500 m
6LoWPAN, Thread	2400–2483.5 Mhz: Worldwide use		High power Sub Ghz up to 20,000 m
Wireless M-Bus &	169 Mhz	Up to 115,2 kbit/s	Up to 1000 m urban environment
KNX-RF	868 Mhz Europe Standard only		
NFC	ISO 18092: 13.56 Mhz	Up to 424 kbit/s	A few cm
TransferJet	4.48 Ghz	Up to 560 Mbit/s	A few cm

Start the Design for an Antenna

Questionnaire

1. What wireless services will be used?

☐ SIGFOX ☐ LoRa ☐ 4G ☐ 5G ☐ ☐ GPS ☐ NB-IoT ☐ wifi ☐ GNSS ☐

2. Does your design use dual band radio communication?

- ☐ Sub-Ghz & 2.4 Ghz
- ☐ 2.4 Ghz & 5 Ghz
- ☐ Other combinations _____

3. How will you build your design?

- ☐ Discrete RF IC's
- ☐ Pre-certified Modules **with** integrated Antenna
- ☐ Pre-certified Modules **without** integrated Antenna

4. What kind of Antenna does your design require?

- ☐ Board or an external mounted Antenna?
- ☐ Outside the box
- ☐ Outdoor usage
- ☐ W/O articulated arm

What are the dimensions? _____

5. Additional requirements?

- ☐ Board or an external mounted Antenna?
- ☐ Outside the box
- ☐ Outdoor usage
- ☐ W/O articulated arm

What are the dimensions? _____

6. What is the housing made off?

- ☐ Metal
- ☐ Plastic

7. Does your design require Omni or Directional Antenna?

- ☐ Omni
- ☐ Directional
- ☐ Bidirectional

8. What is the target for the efficiency? What transmission radiated efficiency is the design targeting?

Antenna Efficiency _____

Permittable return loss _____

Peak gain _____

9. What is the operating area? Where will the device be used?

- ☐ Private Homes
- ☐ Sensor Network
- ☐ Offices
- ☐ Building with several levels
- ☐ Cars
- ☐ Metropolitan areas
- ☐ Others _____

10. What is the use case/application?

- ☐ Computer accessories like mouse, headset etc.
- ☐ Access point, Routers, Small Cell
- ☐ Wireless handheld device
- ☐ Remote monitoring and control, like sensor, camera, lighting etc.
- ☐ M2M (Machine to Machine)
- ☐ Wearable, Healthcare, Smart Home, Automotive
- ☐ Others _____

11. How will the device be powered?

- ☐ Device connected to **Power**
- ☐ Device is **Battery** driven

The answer is a Battery?

Be aware that the cost for the battery can be *eventually* reduced if the Antenna has a better efficiency!

12. What are the target markets?

- ☐ Europe
- ☐ USA
- ☐ Asia

Wireless & Connectivity | Suppliers by Technology

Supplier	GNSS	Cellular	Sigfox/LoRa	DECT	WLAN	Bluetooth	Combo BT/ WLAN	802.15.4/ ZigBee	SubGhz	6LowPAN	Thread	Wireless M-Bus/ KNX-RF	RF Amplifiers	RF ID/NFC	TransferJet	Design Services	Antennas/Balun	
Analog Devices								•		•								Modules
Amber Wireless						•		•	•	•		•				•		
Anaren					•	•		•	•									
Connect One					•													
Cypress (incl. Broadcom)					•	•												
Digi International		•			•			•	•		•					•		
GNS	•																•	
H&D wireless					•		•									•		
Intel					•		•											
IMST			•					•	•	•		•				•		
Lantronix		•			•													
Laird Technology (incl. LSR)			•		•	•	•	•	•	•						•	•	
Longthink					•													
Microchip (incl. Atmel)			•		•	•	•	•	•	•								
Murata			•		•	•	•	•	•					•	•		•	
NXP						•		•		•						•		
Panasonic					•	•	•	•	•	•								
Redpine Signals					•		•	•										
Rigado						•					•							
Silex					•		•											
Silicon Labs					•	•		•	•		•	•						
Siretta		•																
STMicroelectronics					•	•		•										
TDK-EPC						•												
Telit	•	•	•			•		•	•			•						
Toshiba															•			
Analog Devices		•						•	•	•		•	•			•		Chipset/Components
Cypress (incl. Broadcom)					•	•	•	•						•				
Infineon	•							•				•	•					
Intel	•	•		•	•	•	•											
Microchip (incl. Atmel)			•		•	•	•	•	•	•		•	•					
Microsemi									•									
Molex																	•	
NXP (incl.Freescale)						•		•	•	•	•	•	•	•				
ON Semiconductor								•	•	•	•	•						
Pulse																	•	
Redpine Signals					•		•	•								•		
Silicon Labs						•		•	•	•	•	•						
STMicroelectronics	•				•	•		•	•	•		•		•			•	
TE Connectivity																	•	
Toshiba						•								•	•			
Vishay																	•	

Antenna | Suppliers by Technology

Supplier	GNSS (Glonas, Beidou, Galileo)	GPS	Cellular (GSM, UMTS, LTE, WWAN)	ISM	Sigfox/LoRa/Z-Wave	DECT	Wifi/WLAN	Bluetooth/BLE	Combo BT/WLAN	802.15.4/ZigBee/ MiWi	Patch/Active Patch	SubGhz	NB-IoT	6LowPAN	Thread	Wireless M-Bus/ KNX-RF	RF ID/NFC	TransferJet	Tetra	Design Services, Test Facilities	Balun
Abracon LLC	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•		•	Yes	•
Amphenol	•	•	•	•	•		•	•	•	•			•				•		•	Yes	
AVX (Ethertronics)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	Yes	•
Johanson	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	Yes	•
LAIRD		•	•	•	•		•	•	•			•	•				•		•	Yes	
Molex	•	•	•	•	•		•	•	•			•	•	•	•		•			Yes	
Murata Electronics				•	•	•	•	•	•				•				•				•
Pulse	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			Yes	
SIRETTA LTD	•	•	•	•	•		•	•	•	•	•		•							Yes	
TDK	•	•		•			•	•	•	•		•									•
TE Connectivity	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		Yes	
Walsin Technology	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			Yes	•
Yageo	•	•	•				•	•	•	•	•	•					•			Yes	•

Services | by Suppliers

Supplier	FAE Support/Field Support	Antenna Design	System Design	Measurement/ Optimization	Test Lab/Test Chamber
Abracon Corporation	•	•	•	•	•
Amphenol	•	•		•	•
AVX (Ethertronics)	•	•	•	•	•
Johanson	•	•	•	•	•
LAIRD	•				•
Molex		•		•	•
Murata Electronics					
Pulse	•	•	•	•	•
SIRETTA LTD	•	•			
TDK	•				
TE Connectivity	•	•	•	•	•
Walsin Technology	•	•		•	•
Yageo	•				

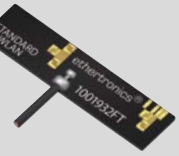
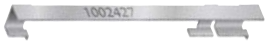
How to know that the Antenna works properly

To understand if an Antenna design works properly it is not enough just to send or receive some test signals. It might be the case that a design works in test environment but it fails in the field or within some different use cases which were not tested within the simulation because nobody expected the user to do so or nobody described the use case exact.

Therefore it is important to understand the use case, the possible installation of the devices and the environemt where the application will be used.

To really understand if the design is working as expected/ required it is highly recomended to do a simulation test or network analyzer test. This is the only way to understand if the Antenna is working correctly and shows the right performance.

Antennas for every Frequency and Application

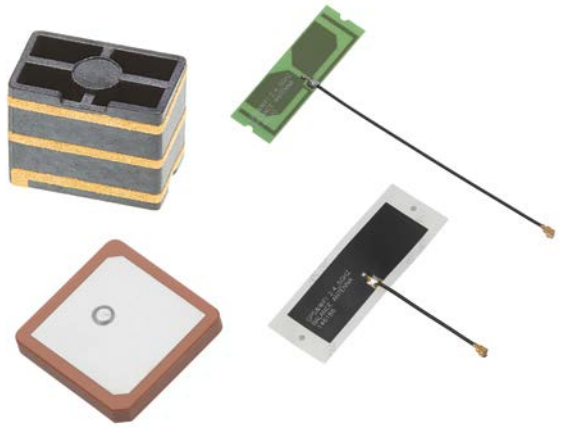
Frequency Spectrum	Embedded Directly embedded on the PCB. SMD capable	Off-Board Antenna is placed off the circuit board and attaches to the board via a standard connector and cable. Antenna consists of a radiating element, a coax cable, and connector
2.4 Ghz Wi-Fi, BLE, ZigBee, ISM, Bluetooth	FR4: 1001013 Stamped Metal: 1000146, 1002295, 1002298, 1001388/1001430, 1002427 Ceramic: 1001312, M310220, M830520 	PCB: 1001932PT Stamped Metal: 1001435, 1000418, 1000423 FPC: 10011932FT 
LTE	FR4: P822601/P922602, 1002436 	FR4: 1003657 FPC: 1002292,1002289 
Cellular (3G)	FR4: P522304 	-
ISM (868/915)	Ceramic: M620720 Stamped Metal: 1002427 	-
Geolocalization (GPS, GLONASS, BEIDU, COMPASS)	FR4: 1001011 Stamped Metal: 1002427 Ceramic: M830120 Ceramic Patch: 1002429, 1001039 	Ceramic Patch: 1004138 
COMBO (GPS, GLONASS, BEIDU, ISM)	Stamped Metal: 1002427 	-

External Mounted externally via standard connectors (usually SMA, RPSMA). Not rated for outdoor use	Frequency Spectrum
1004239, 1004112 	LTE
1002857 	Geolocalization (GPS, GLONASS, BEIDU, COMPASS)

Ready-to-Use Antennas

In today's connected world, Antennas enable devices to communicate wirelessly – even across great distances. This not only allows people to move freely without compromising their connectivity, but also provides the ability to create wireless networks of devices and sensors. Antennas make it easy and cost effective for connected homes, automated building networks and remotely controlled applications to become a reality.

Molex has extensive experience in Antenna technologies from concept to completion, using state of the art simulation software and measuring equipment. The Molex range of ready-to-use Antennas, featuring patented technologies, are compact, high performing and available in multiple form factors for all common Antenna protocols and frequencies used in IoT, automotive, industrial and medical applications.



With frequencies up to 6 Ghz and various mounting options available such as SMT, cabled or adhesive, the Molex portfolio of ready-to-use Antennas includes:

- Internet of Things (IoT) Antennas: Wi-Fi, Bluetooth, Zigbee
- LTE Cellular Antennas
- GNSS/GPS Antennas
- Combo Antennas
- Near Field Communication (NFC) Antennas
- Ultra-Wideband (UWB) PCB Antenna with Balanced Transmission
- Industrial, Scientific and Medical (ISM) Antennas
- PowerLife Wireless Charging Coils

To find out more, contact your Molex representative at Arrow or visit www.molex.com and search Antenna Solutions.

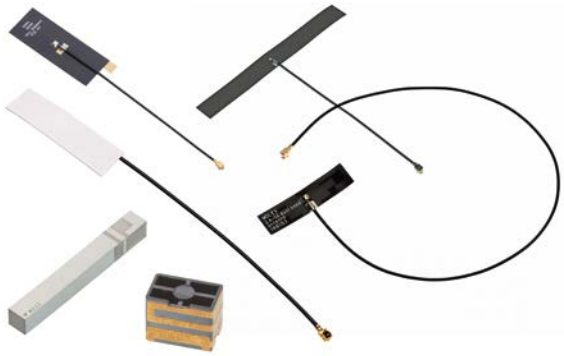
ORDERABLE SERIES

146153, 146179, 146184, 146186, 146236, 105262, 105263, 206650, 206640, 206866

Internet of Things (IoT) Antennas from Molex

2.4/5-Ghz and 900-Mhz ultra-thin Ceramic and LDS/MID Antennas offer cabled, flex and PCB formats to enable fast and easy RF integration into connected systems – ideal for embedding high-performing internet and data connectivity in compact devices.

Molex's IoT Antennas are efficient, high-gain Antennas and, combined with massive expansions of wireless and data networks, have changed the ways that devices are designed and developed. The external Antenna has given way to PCB and internally cabled Antennas in practically all of today's connected devices. Molex Antenna Products provide many choices to designers of wireless-enabled devices that support one or more protocols, including Bluetooth, Wi-Fi, Zigbee and WLAN.



Features include

- Molex Antennas are available in various form factors, such as SMD mounting, internally cabled PCB Antennas as well as cabled internal adhesive Antennas
- High Antenna radiation performance with total efficiency values of 80% minimum (2.4 Ghz band) and 70% minimum (5 Ghz band)
- Triple-band ceramic Antennas enable multi-vendor operability, offering greater power efficiency and long-range connectivity to Wi-Fi-certified products
- A wide selection of micro-coaxial cable lengths from 50 to 300 mm, extending connectivity for maximum design flexibility

Molex IoT Antennas are suitable for a wide range of applications, including infotainment systems, home automation equipment, industrial machine-to-machine communications and wireless LANs.

ORDERABLE SERIES

146153, 146175, 146186, 201932, 206513, 206866

Ready-to-Use RF Antennas – Overview

Product Name		Description	Applications
Internet of Things (IoT) Antennas: Wi-Fi, Bluetooth, Zigbee		2.4/5-Ghz and 900-Mhz ultra-thin Ceramic and LDS/MID Antennas offer cabled, flex and PCB formats to enable fast and easy RF integration into connected systems and are ideal for embedding high-performing internet and data connectivity in compact devices	- Automotive - Consumer - Telecommunications
LTE Cellular Antennas		Molex provides best-in-class compact, high-gain 3G and 4G/LTE Cellular Antennas for connected smart devices and today's high-performance LTE networks	- Automotive - Smart Phones and Mobile Devices - Consumer - Industrial - Telecommunications/ Networking
GNSS/GPS Antennas		Providing superior RF performance for US and global satellite systems (e.g., GLONASS, Baideo, Galileo), LDS/MID and Ceramic GNSS/GPS Antennas combine ease of integration with reduced cost of implementation over a variety of wireless navigation device applications	- Commercial Vehicle - Consumer - Industrial
Combo Antennas		Molex Combo Antennas offer expanded frequency ranges to handle a combination of multiple wireless communication protocols, while also delivering long-range connectivity, high-power efficiency, a compact form factor and easy integration	- Automotive - Consumer - Industrial
Near Field Communication (NFC) Antennas		NFC Antennas maximize quick, 2-way read/write operations over a range of detection distances from metallic and nonmetallic substrates, making them ideal for payment systems, RFID and device-pairing applications	- Automotive - Consumer - Industrial
Ultra-Wideband (UWB) PCB Antenna with Balanced Transmission		UWB Antennas offer high-radiation efficiency for optimal performance making them ideal for data transmission due to the high bandwidth of frequencies	- Automotive - Consumer - Industrial - Medical
Industrial, Scientific and Medical (ISM) Antennas		ISM Standalone Antennas combine high RF performance with ease of integration over 433, 868 and 915 Mhz bands for advanced industrial, scientific and medical devices	- Industrial - Medical

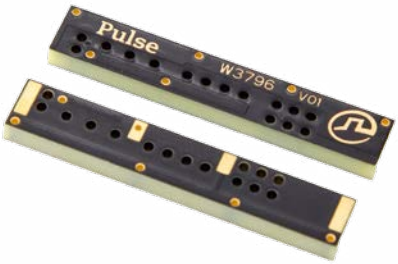
Internet of Things (IoT) Protocols and Molex Antenna

	Protocols	Molex Antenna Products
Bluetooth	Standard: Bluetooth 4.2 core specification Frequency: 2.4 Ghz (ISM) Range: 50–150 m (Smart/BLE) Data Rates: 1 Mbps (Smart/BLE)	**Cabled Flex/PCB Antenna** • 146153: 2.4/5 Ghz Balance Flexible Antenna • 146187: 2.4/5 Ghz Balance PCB Antenna • 204281: 2.4/5 Ghz Flexible Antenna side-fed cable • 206994: 2.4/5 Ghz Flexible Antenna (half small size than 146153, 204281) • 206995: 2.4/5 Ghz PCB Antenna (for mounting on metal) • 208482: 2.4/5 Ghz Flexible Antenna 2×MIMO • 146186: 2.4/5 Ghz & GPS combo Flexible Antenna • 146220: 2.4/5 Ghz & GPS combo PCB Antenna
zigbee	Standard: ZigBee 3.0 based on IEEE802.15.4 Frequency: 2.4 Ghz Range: 10–100 m Data Rates: 250 kbps	
	Standard: Thread, based on IEEE802.15.4 and 6LowPAN Frequency: 2.4 Ghz (ISM) Range: N/A Data Rates: N/A	
Wi Fi	Standard: Based on 802.11n (most common usage in homes today) Frequencies: 2.4 Ghz and 5 Ghz bands Range: Approximately 50 m Data Rates: 600 Mbps maximum, but 150–200 Mbps is more typical, depending on channel frequency used and number of Antennas (latest 802.11-ac standard should offer 500 Mbps to 1 Gbps)	**Embedded SMT Antenna** • 47948: 2.4 Ghz SMT MID Chip Antenna • 206513: Ceramic low cost version of 47948 • 146175: 2.4/5 Ghz SMT MID Chip Antenna • 203006: 2.4 Ghz ceramic SMT Antenna • 201932: 900 Mhz & 2.4/5 Ghz Triple-band ceramic Antenna • 203007: GPS/WiFi combo chip Antenna
6LowPAN	Standard: RFC6282 Frequency: (adapted and used over a variety of other networking media including Bluetooth Smart (2.4 Ghz) or ZigBee or low-power RF (sub-1 Ghz) Range: N/A Data Rates: N/A	
Z-WAVE	Standard: Z-Wave Alliance ZAD12837/ITU-T G.9959 Frequency: 900 Mhz (ISM) Range: 30 m Data Rates: 9.6/40/100 kbit/s	• 105262: 868/915 Mhz flexible Antenna • 206764: 868/915 Mhz dipole flexible Antenna • 211140: 868/915 Mhz monopole flexible Antenna (38×10 mm, half size of 105262) • 204774: 790–2700 Mhz ceramic Antenna • 204287: 433 Mhz Ceramic Antenna
sigfox	Standard: Sigfox Frequency: 900 Mhz Range: 30–50 km (rural environments), 3–10 km (urban environments) Data Rates: 10–1000 bps	
neul	Standard: Neul Frequency: 900 Mhz (ISM), 458 Mhz (UK), 470–790 Mhz (White Space) Range: 10 km Data Rates: Few bps up to 100 kbps	
CELLULAR	Standard: GSM/GPRS/EDGE (2G), UMTS/HSPA (3G), LTE (4G) Frequencies: 900/1800/1900/2100 Mhz Range: 35 km max for GSM; 200 km max for HSPA Data Rates (typical download): 35–170 kps (GPRS), 120–384 kbps (EDGE), 384 kbps–2 Mbps (UMTS), 600 kbps–10 Mbps (HSPA), 3–10 Mbps (LTE)	**Cabled Flex/PCB Antenna** • 105263: Cellular 824~2700 Mhz Flexible Antenna (size 106×13 mm) • 146185: Cellular 824~2700 Mhz Flexible Antenna (size 84×15 mm) • 207235: Cellular 824~2170 Mhz Flexible Antenna (size 40×15 mm) • 146234: Cellular 698~6000 Mhz Flexible Antenna (size 140×20 mm) • 209142: Cellular 698~4000 Mhz Flexible Antenna (size 85×14.5 mm) • 207901: Cellular 600~6000 Mhz Flexible Antenna (size 147×25 mm) **Embedded SMT Antenna** • 146200 (202519): 698~2700 Mhz Ceramic Antenna (size 40×5×5 mm) • 206760: 698~2700 Mhz Ceramic Antenna (size 38×8×3 mm) • 204774: 790–2700 Mhz Ceramic Antenna (size 33×6×3 mm) • 206649: 698~960 Mhz Ceramic Antenna(size 20×10×1.2 mm) • 208485: 600~4000 Mhz Ceramic Antenna (size 38×8×3 mm)
LoRa	Standard: LoRaWAN Frequency: Various Range: 2–5 km (urban environment), 15 km (suburban environment) Data Rates: 0.3–50 kbps	
NB-IoT	NarrowBand-Internet of Things (NB-IoT) is a standards-based low power wide area (LPWA) technology developed to enable a wide range of new IoT devices and services. NB-IoT significantly improves the power consumption of user devices, system capacity and spectrum efficiency, especially in deep coverage. Battery life of more than 10 years can be supported for a wide range of use cases. Supported by all major mobile equipment, chipset and module manufacturers, NB-IoT can co-exist with 2G, 3G, and 4G mobile networks.	
	Standard: ISO/IEC 18000-3 Frequency: 13.56 Mhz (ISM) Range: 10 cm Data Rates: 100–420 kbps	146236: NFC rectangular Antenna
GNSS (Global Navigation Satellite System) **Beidou (China)** **GPS (US)** **GLONASS (Russia)** **Gallieo (EU)** **NAVIC (India)** **QZSS (Japan)**		**Passive Ceramic Patch Antenna** • 146168: GPS 25×25 mm • 204286: GNSS 25×25 mm • 208890: GPS 18×18 mm **Passive chip Antenna** • 146216: GPS RHCP MID Antenna • 146235: GPS Helix MID Antenna • 204283: GPS Ceramic chip Antenna (Linear) • 203007: GPS/WiFi combo chip Antenna **Passive cabled Flex Antenna** • 206560: GNSS Flexible Antenna • 146186: 2.4/5 Ghz & GPS combo Flexible Antenna • 146220: 2.4/5 Ghz & GPS combo PCB Antenna **Active Antenna module** • 206640: GNSS 28dB Antenna cabled pigtail

Embedded Antennas for IoT

The booming of hugely fragmentized Internet of Things (IoT) created a lot of new technologies like LTE Cat M1, NB-IoT, LoRa and Sigfox, essentially to support its broad spectrum of application. Independently from the technology your IoT device is using, PulseLarsen offers a variety of embedded, internal or even outdoor Antenna solutions.

PulseLarsen would like to Introduce our All-Time Favorite 3G/4G LTE and NB-IoT Embedded Antenna: W3796
The W3796 Antenna is currently the smallest form factor of 3G/4G LTE Antenna PulseLarsen offers. The size of the Antenna is 40 × 7 mm in length and width respective, but only 3 mm in height. It is designed to be SMT component and packed in tape and reel, enabling the pick and place process for SMT. It is ideal to be embedded onboard with other electrical components.



PulseLarsen provides an evaluation board kit for W3796 Antenna with the part number W3796-K. The kit comes with a ready-to-test evaluation board and a few loose W3796 Antenna. The PCB layout required to embed the Antenna is also readily available on https://pulselarsenantennas.com/online-tools/

For Antenna Variant to be Applied for other Technologies, we Highlight

W3136
Our Best in Class 868–915 Mhz Helix Antenna for Sigfox, LoRa and Private ISM Networks.

W3139
For small devices, this 14×3 mm 868–915 Mhz Helix Antenna is the best compromise between size and performance.

W3403
operating at both ISM868 and ISM915. It is a stamping part which is also ideal embedded solution. Detuned Antenna due to the size difference of the PCB can be tuned back using the tuning slot feature on the PCB layout.

ORDERABLE SERIES
- W3796
- W3136
- W3139
- W3403

Multi-Band Transportation Antennas

PulseLarsen has been committed to produce the very best vehicular Antennas for the last 50 years and we couldn't be prouder of our current line of multi-band Antennas. These Antennas may be utilized on any type of vehicles, including but not limited to cars, buses, trains and trams, boats, emergency vehicles, agricultural vehicles etc. Currently, we have 5 multi-band Antenna families, each model has varying levels of form factor, frequencies, performance levels, mounting option and color.

PulseLarsen would like to introduce our best performance multi-band Antenna family, Razorback: RAZ52211DM
When performance is the major concern, Razorback Antenna is the top choice solution by trading off a little bit of the Antenna height. It has a narrow form factor to be more aesthetic pleasing. The RAZ52211DM has 5 leads with two MIMO LTE Antennas, two MIMO WiFi Antennas and one navigational Antenna within one Antenna package.

The Razorback family can support up to 6 leads within one Antenna package with two MIMO LTE antennas, three MIMO WiFi Antennas and one navigational Antenna. It is available in black and white color, providing the benefit to blend into the surrounding background. PulseLarsen is also providing 3 mounting option; direct mount with a tamper-proof stud, magnetic mounting and adhesive mounting.

Other multi-band Antenna families are

Panther Series (GPSMB)
Good peformance and best port-to-port isolation, including variants complying with railroad standards.

Armadillo Series (ARM)
Low profile, ideal for discrete and inconspicuous applications.

Jaguar Family (GPSLP)
Low profile and excellent performance on non-metallic surfaces.

Shark Fin (GPSDM700/5800)
Typical aesthetically pleasing solutions.

ORDERABLE SERIES
- RAZ52211DM
- GPSMB502
- Armadillo
- GPSLPMB403
- GPSDM700_5800

SNYPER Signal Analysers

SNYPER Signal analysers determine network provider signal strengths so you can review all available network signals in the area.

With summary page ranking – the best network operator choice can be made quickly based on both signal strength and number of usable cells.

SNYPER Antenna analysis – connect your shortlist of chosen Antennas to fi nd the best design and location to site it.

Features
- Intuitive Menu
- Multlingual Operation
- Antennas and cables included
- Battery Capacity 2000 mAh
- Multi-Region Power Supply Included
- Surveys Download to PC for Analysis
- Hard Carry Case Included

Snyper LTE – European Frequency Coverage
Cellular Frequency Bands Covered:
- 2G – 900/1800 Mhz
- 3G – 900/2100 Mhz
- LTE – 800/1800/2600 Mhz

Snyper LTE Spectrum – European Frequency Coverage
Cellular Frequency Bands Covered:
- 2G – 900/1800 Mhz
- 3G – 900/2100 Mhz
- LTE – 800/1800/2600 Mhz

Snyper LTE Graphyte – European Frequency Coverage
Cellular Frequency Bands Covered:
- 2G – 900/1800 Mhz
- 3G – 850/900/2100 Mhz
- LTE – 800/900/1800/2100/2600 Mhz

	Feature	Snyper-LTE	Snyper-LTE Spectrum	Snyper-LTE Graphyte
Surveys	Ability to set signal threshhold to view within summary page	YES	YES	YES
	Saved Survey Storage	1 Survey	50 Surveys	> 100 Surveys
	Autosave Completed Surveys	NO	NO	YES
	USB download for saved sureveys (CSV & HTML)	YES	YES	YES
	SIM Required	YES	YES	NO
	Automatic Sequential Survey Logging	NO	NO	YES
Scans	LiveSCAN for 'locking-on' to individual basetation signals	NO	YES	YES
	LiveSCAN datalogging via USB download (CSV)	NO	NO	YES
	Realtime Directional LiveSCAN Antenna included in kit	NO	YES	YES
Display	Display Type	15 Characters – 12 Rows – Full Colour	15 Characters – 12 Rows – Full Colour	15 Characters – 12 Rows – Full Colour
	Display Cusomisation Settings	YES	YES	YES
Charging	USB Charging	YES	YES	YES
	USB Car Charger in Kit	YES	YES	YES
	Mounting Cradle & Tripod Stand in Kit	NO	NO	YES

High Performance Antennas

Siretta high performance Antennas you can rely on. A wide range with custom configuration options for connectors and cable lengths.

	Adhesive	**Alpha 11** *2G/3G ISM 868 & 915 Mhz* ALPHA11/2.5M/SMAM/S/S/20
	Stick	**Delta 1A** *2G/3G ISM 868 & 915 Mhz* DELTA1A/x/SMAM/S/S/11
	Stick	**Delta 2A** *2G/3G ISM 868 & 915 Mhz* DELTA2A/x/SMAM/S/RA/11
	Adjustable Stick	**Delta 6A** *2G/3G ISM 868 & 915 Mhz* DELTA6A/x/SMAM/S/S/11
	Embedded	**Echo 1A** *2G/3G ISM 868 & 915 Mhz* ECHO1A/0.1M/IPEX/S/S/11
	Embedded	**Echo 14** *2G/3G/4G ISM 868 & 915 Mhz* ECHO14/0.2M/UFL/S/S/15
	Embedded	**Echo 18** *WiFi 2.4–2.5 Mhz* ECHO18/0.1M/UFL/S/S/15
	Wall Mount	**Oscar 1A** *2G/3G* OSCAR1A/5M/FMEF/S/S/32

	Wall Mount	**Oscar 17** *2G/3G* OSCAR17/x/TNC/S/S/19
	Wall Mount	**Oscar 40** *2G/3G/4G WiFI* *ISM 868/915/2450 Mhz* OSCAR40/10M/LL/SMAM/S/S/33
	Through Hole	**Tango 11A** *2G/3G ISM 868 & 915 Mhz* TANGO11A/1.5M/SMAM/S/S/19
	Through Hole MIMO	**Tango 22** *2G/3G WiFi 2.4G GPS* *ISM 868 & 915 Mhz* TANGO22/0.1M/SMAFBKD/ SMAFBKD/SMAFBKD/S/S/26
	Through Hole	**Tango 23** *WiFi 2.4 and 5.8 Ghz* TANGO23/1M/SMAM/S/RP/19
	Through Hole	**Tango 24** *WiFi 2.4* TANGO24/1M/SMAM/S/RP/17
	Through Hole	**Tango 44** *2G/3G/4G WiFi 2.4* TANGO44/1M/LL/SMAM/S/S/19
	Through Hole MIMO	**Tango 420** *2G/3G/4G WiFi 2.4* TANGO420/2.5M/SMAM/SMAM/ S/S/17

See the Siretta website for the full range of Antenna options and technical specifications.

TE Antennas for 5G-IoT

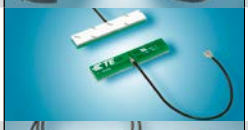
TE 20+ years of experience in mainly cellular, but also non cellular Antenna development and production enables quick and efficient solutions for cellular and non cellular market:

- **Antennas for wireless servers**
  Base stations, small cells, access points, data collection centres, gateways
- **Antennas for wireless clients**
  IoT across all industries, Automotive, Infotainment, Transportation, Mobile and Asset Tracking, Machine to Machine applications, Smart Cities, -Home, -Industry, Energy, Healthcare
- **TE Antenna implementation service**
  Holistic approach, Innovative, Efficient, Competent, Metaspan® inside

TE Antennas Service Model

Antenna Design	System Design	OTA Optimization
RF Engineering	RF Engineering	Benchmarking
Prototyping	Quality of Service	Throughput Optimization
Verification	Verification	Maximum Battery life

Application		Assembly method	P/N	Frequency range	Dimensions	Notes
LTE/allCAT/ 3G/2G; NB-IoT		Adhesive	2118308-1	698–894 Mhz; 1710–2170 Mhz; 2496–2700 Mhz	110×14×1.3 mm	cable and connector customized
LTE/all CAT/ 3G/2G; NB-IoT		PCB through hole	2118310-1	698–894 Mhz; 1710–2170 Mhz; 2496–2700 Mhz	74×11×1.6 mm	Metaspan® technology
LTE/all CAT/ 3G/2G; NB-IoT		PCB through hole	2118615-1	698–894 Mhz; 1710–2170 Mhz; 2496–2700 Mhz	50×20×1.6 mm	Metaspan® technology
LTE/all CAT/ 3G/2G; NB-IoT		PCB SMD	2108994-1	698–960 Mhz; 1710–2170 Mhz; 2300–2700 Mhz	40×10×3.2 mm	

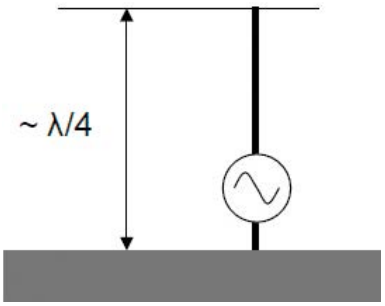
Application		Assembly method	P/N	Frequency range	Dimensions	Notes
Device Internal Antennas non Cellular						
ISM; IoT; IIoT		PCB SMD	2108991-1	698–960 Mhz	18×9×1.6 mm	flexible GND plane conditions
WLAN Dual Band		PCB SMD on GND	1513164-1	2.4 Ghz, 5 Ghz	d 16×h 6 mm	
WLAN Dual Band		Adhesive	2118309-1	2.4 Ghz, 5 Ghz	40×8×1 mm	cable and connector customized
WLAN Dual Band		Chassis mount	1513472-5	2.4 Ghz, 5 Ghz	29×12×10 mm	cable and connector customized
Bluetooth; BLE		PCB SMD	1513797-1	2.4 Ghz	9×7×0.8 mm	
GNSS		PCB SMD	2118900-1	1.575–1.615 Ghz	8×11×0.8 mm	
External Antennas Combo						
LTE, GNSS		SMA mount	2195736-1	698–960 Mhz; 1440–1610 Mhz; 1710–2170 Mhz; 2300–2700 Mhz	158×17 mm	
MIMO LTE/ GNSS/WLAN		Panel mount	2332157-4	698–3800 Mhz; 1562–1612 Mhz; 2.4 Ghz; 5.8 Ghz	170×60×50 mm	for options see catalogue
4G/3G/2G/ GNSS/WLAN		Screw mount on metallic or non metallic ground	920-630-001	698–2690 Mhz; 1575–1615 Mhz; 2.4 Ghz; 5.8 Ghz	124×80×31 mm	for options see catalogue

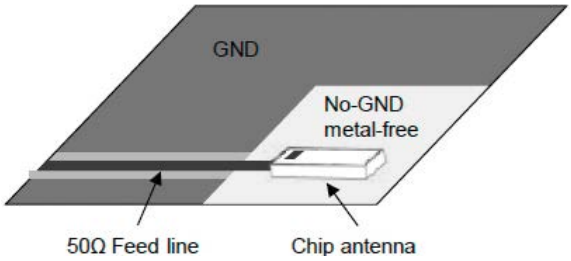
Chip Antenna for 2.4 Ghz Single Band

All systems use carrier frequencies that can propagate through the media (generally air). The Antenna should be matched to the media at the chosen carrier frequency to ensure good sensitivity.

Modern systems will also impose requirements on its size, directional sensitivity, and possibly its sensitivity to out-of-band signals.

Chip Antenna Characteristics
- A quarter-wave (/4) monopole system
- Works with GND plane to form dipole system
- Certain “No-GND” metal-free space necessary

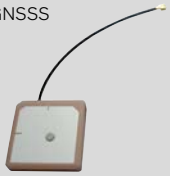




ORDERABLE SERIES
- ANT016008LCS2442MA1
- ANT016008LCS2442MA2

Complete Frequency Range Antennas for All Applications!

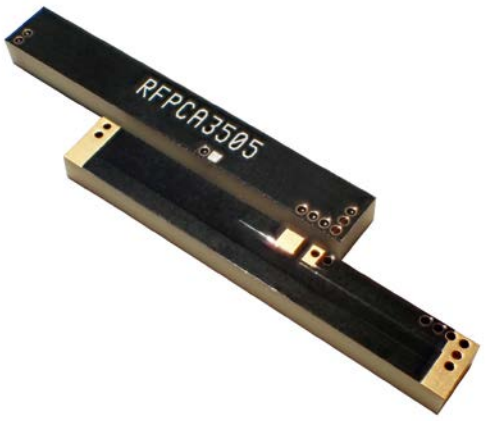
Yageo produces a comprehensive range of wireless components, including metal/PCB/FPCB Antennas, patch Antennas (ceramic bulk), chip Antennas, active Antennas, RF IPD (Integrated Passive Device, filter/Balun/coupler/diplexer) and modules (internal GPS active Antenna, external GPS active Antenna, NFC module, N-Tag module).

Frequency Spectrum	Embedded – SMD type	Internal	External
Short-range (169 ~ 915 Mhz)	ANT1204×x, ANT2405F001R0169A, ANT2405F001R0098A 		
2.4 Ghz, WLAN/BT/ISM	ANT3216LL00R2400A, ANT3216LL05R5000A, ANT3216LL15R1575A, ANT3216LL11R2400A, ANT7020LL05R0870A, ANT7020LL05R2400A, ANT8010LL04R2400A, ANT8010LL05R1575A, ANT8010LL05R1516A, ANT8010JLC1B1516A 		
Cellular WWAN (698 ~2690 Mhz)	ANTX100P001BWPEN3, ANTX150P001BWPEN3, ANTX200P001BWPEN3 		
Dual Band (2.4 and 5G)	ANTX100P112B24553, ANTX200P002B24553, ANTX300P002B24553, ANTX150P001B24553 		
GPS, GPS+GLONASS, GNSS		**GPS:** ANT1818JB00B1575S ANT1212JB31B1575A ANT8010JLB3B1575A **GPS+GLONASS:** ANT1818JB13B1516A ANT1212JB10B1516A ANT1606JB11B1516A **GNSS:** **(GPS+GLONASS+Beidou)** ANT2525JB20BGNSSS 	**GPS:** ANT3831EM3MB1575S **GPS+GLONASS:** ANT4938EN00B1516S ANT4938EN01B1516S **GNSS:** **(GPS+GLONASS+Beidou)** ANT5555ENS1BGNSSS ANT4938EN00BGNSSS 

3G/4G LTE and NB-IoT Solution

Walsin's RFPCA3505 series provide the best choice for design with Smart Home, Medical and Automotive Communication applications.

- Multi-Band Chip Antenna – 697~960 Mhz/1710~2690 Mhz
- Small Package – 35 × 5 × 3 mm
- Low profile and fully SMD compatible



LoRa, SigFox, Z-Wave and Zigbee Solution

WALSIN's RGRFA1204 series provide the best choice for design with Smart Grid, Smart City and Smart Factory applications.

- Wide Transmit and Receive Range – 855~885 Mhz/900~930 Mhz
- Small Package – 12 × 4 × 1.6 mm
- Low profile and fully SMD compatible

Customized Antenna Products

WALSIN provides various customized Antenna solutions which cover different market design applications and trends such as UHF, WIFI, Bluetooth, Cellular, GPS, NFC, WPC, Sub-G, etc.

- External Dipole Antenna
- NFC/WPC Antenna
- PCB/Flexible PCB Antenna
- Metal Stamping Antenna
- Antenna Cable Assemble/Connector

Sub-6G Solution

WALSIN's new DPA series support LTE full band and Sub-6G design for Enterprise Small Cells and Residential Femtocells application.

77G Solution

WALSIN has strong design capability and materials to support 77G Automotive Radar Systems application and also for 5G NR standard such as 28G and 38G solutions.

Are You Five Years Out?

Most people live in the present. The world of now. But a handful of us work in a unique world that doesn't quite exist yet—the world of Five Years Out.

Five Years Out is the tangible future. And the people who live and work there know that new technologies, new materials, new ideas and new electronics will make life not only different, but better. Not just cheaper, but smarter. Not just easier, but more inspired.

Five Years Out is an exciting place to be. So exciting that, once you've been there, it's hard to get excited about the present. Because we know what's coming is going to be so much better.

Five Years Out is a community of builders, designers, engineers and imaginers who navigate the path between possibility and practicality. Creating the future of everything from cars to coffeemakers.

Are you one of them? Then you're probably working with us.

In Person

+49 (0) 6102 5030 0
Call to talk or set up a face-to-face meeting with one of our knowledgeable representatives.

Online

arrow.com
Visit our website for everything from the latest news to line card information.

Five Years Out

Arrow Electronics, Inc.
Components

Frankfurter Straße 211
63263 Neu-Isenburg, Germany

ARR_Broschuere_Antenna-Guide_1809