

## Atmel – The Expert with Long-term Know-how

Atmel<sup>®</sup>, a pioneer in the RFID area, provided the industry's first read-only RFID ICs at the end of the 80's. Since 1995, Atmel has also been offering the world's most flexible read/write ICs. Today, Atmel is a key player for low-frequency-based 100 -150kHz RFID ICs for access control systems.

Through continuous improvement and innovation, Atmel is able to present a product scope that covers all semiconductors required for a complete RFID system. Our RFID ICs provide outstanding performance, they are flexible and easy-to-design-in solutions.

Customers also benefit from Atmel's extensive application support. Atmel engineers with excellent know-how will support even very specific demands, including the development of ASICs. Together with its customers, Atmel defines and helps to realize the best solution for dedicated applications.



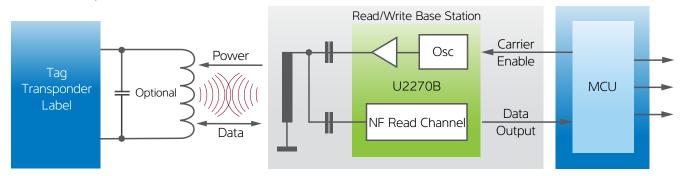
# The Technology Passive RFID

A passive RFID system consists basically of two components:

- Tag, transponder or label
- Reader, interrogator or base station

A tag includes the IC, a coil, and optionally a capacitor. The reader generates an RF field which is used to transmit power and to perform bi-directional, contactless data transmission (no connection or line-of-sight necessary). As soon as a tag gets into the field generated by the reader, the tag transmits information – either immediately or on request only. The reader decodes this information, sends it to a host, or displays it.

#### Passive RFID System





### Active RFID

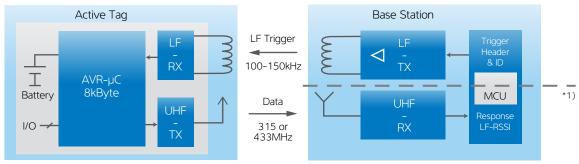
The following two components form an active RFID system:

- Battery-driven tag, transponder or label
- Reader or trigger and receive station

An active RFID system is very similar to passive RFID. The main difference is that the tag or transponder is battery driven. Also, the reader consists of 2 main parts:

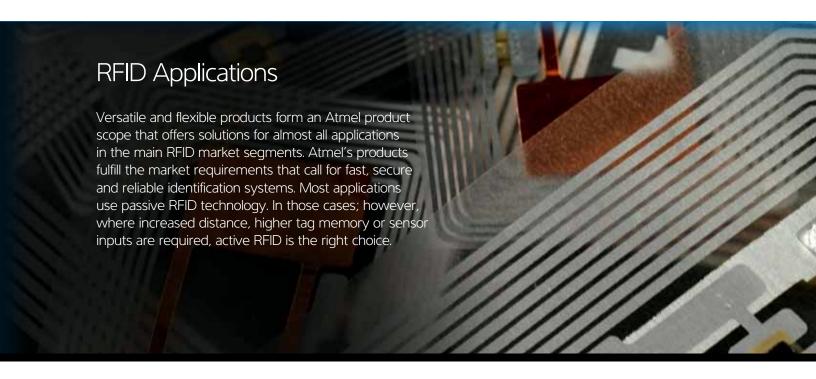
- 1. LF trigger and TX channel: sends the trigger or wake-up signal (not the power for the tag), transmits data to the tag.
- 2. UHF RX channel: receives the return message sent by the tag in the UHF frequency band.

#### Active RFID System



\*1) Graph shows 1 combined Base Station. Option is to split that as RX distance is much higher. So multiple trigger stations and one or few RX stations.





### Security and Access Control

To control access to buildings or other objects such as hotel rooms or lockers by persons or items, ID systems have to ensure absolute security.

The RFID technology is utilized as access control embedded in ID cards. These cards not only prevent unauthorized access to buildings or other objects but are further used for time attendance monitoring.

In addition to identification, an RFID card may be used to store value. Whether as a transportation pass or loyalty/prepaid utility card, RFID provides convenience and security.

In the automotive sector, RFID-based security keys prevent unauthorized access to vehicles.

### **Typical Applications**

- Building access control
- Hotel room access
- Locker locks
- Automotive immobilizers
- Parking lot security and access
- Anti-counterfeiting/forgery prevention
- Company badges
- Loyalty card
- Prepaid card



### Component Authentication

Within consumer and commercial systems there are often components that need to be guaranteed authentic for the proper operation of the system or the safety of the user. RFID provides a convenient and secure method of identifying a removable or replaceable component.

RFID tags can be made in a variety of shapes and sizes specifically designed for the component they are attached to. With no electrical connections required, a solution can be found for just about any component whether it has electronic content or not. To further enhance system operation data may be encrypted and stored on the RFID tag for use by the system or to record historical information during operation.

#### **Typical Applications**

- Printer cartridges
- Copier toner cartridges
- Pharmaceuticals
- Medical devices
- Electronics
- Electronic labels
- Consumables



#### Animal Identification

RF identification is significantly involved in the improvement of livestock and wildlife tracking as well as pet identification. Stock monitoring, breeding or disease control are also supported. And with the outbreak of various animal epidemics, secure animal identification is more important than ever. RFID tags can easily be injected under the animal's skin (pets, equine, wildlife, fish) or attached to the animals ear (livestock). This helps to identify also zoo animals.

In animal sports, RFID systems help prevent manipulation and records the correct time of arrival (e.g., in pigeon sports). The standards ISO 11784/85, also called FDX-B and FDX-A are supported.

#### **Typical Applications**

- Livestock tracking
- Wildlife tracking
- Fisheries
- Pet ownership detection
- Lab animal tracking







### Manufacturing and Logistics

RFID systems guarantee reliability even in dirty and harsh environments. Especially LF RFID is excellently suited for applications in difficult conditions where HF; UHF or Microwave RFID systems are not able to operate, such as under water or surrounded by metal.

Efficient and time-saving systems can be achieved by fast and secure identification solutions that do not need direct contact or line-of-sight.

In this area, accurate manufacturing and logistic systems enable to save time and money. The environmental and velocity factors especially play an important role.

Active RFID technology is well suited for such applications due to its extended communication range that allows for easy location of assets or items.

#### **Typical Applications**

- Asset management
- Cylinder tracking
- Container and cargo tagging
- Material handling
- Assembly control
- Pallet tracking
- Pharmaceutical management
- Parcel services
- Waste management

## **RFID Portfolio**

#### Passive 100 - 150kHz Read/Write

- Up to 288 bits of user memory
- ISO standards 11784 and 11785
- AOR answer-on-request feature
- Security:
  - Password protection
  - Every chip has a unique number on-chip: UID
- Modulation scheme: ASK
- Coding schemes: Manchester, Biphase, FSK, PSK, NRZ

#### Active 100 – 150kHz and 315/433MHz Read/Write

- LF trigger channel
- Active trigger mode with ultra low current consumption
- 8-bit AVR® microcontroller core
- 8kByte user flash memory
- Freely available user ports
- 315MHz and 433MHz versions available
- 7-bit RSSI measurement

# Package Delivery Options

Atmel's RFID products are available as identification ICs or as entire transponder.

- Die on wafer (foil, blister or sticky tape, die in waffle pack)
- Optional gold bumps
- Packaged die:
  - NOA3 micromodule
  - Ultra small and ultra thin XDFN package
- Transponder



# **RFID Product Overview**

LF Tags (100-150kHz)

	TK5551 <sup>1</sup>	ATA55511.4	e5561	ATA5570	ATA5577M1 <sup>2</sup>	ATA5577M2 <sup>2</sup> MEGAPADS	ATA5575M1 MEGAPADS	ATA5575M2 MEGAPADS
Memory								
Read only	-	-	-	-	-	-	-	-
Read/Write	X	X	X	X	X	X	X (OTP)	X (OTP)
User memory (bit)	224	224	288	224	224	224	64, 128	96, 128
System memory (bit)	40	40	32	96	128	128	8	8
RF Interface								
Write protection	Blockwise	Blockwise	Blockwise	Blockwise	Blockwise	Blockwise	Memory complete	Memory complete
ISO11784/ 11785	FDX-B	FDX-B		FDX-A, FDX-B	FDX-A, FDX-B	FDX-A, FDX-B	-	FDX-A, FDX-E
Modulation	ASK	ASK	ASK	ASK	ASK	ASK	ASK	ASK
Encoding	Manchester, FSK, PSK, Bi-phase, NRZ	Manchester, FSK, PSK, Bi-phase, NRZ	Manchester, Bi-phase	Manchester, FSK, PSK, Bi-phase, NRZ	Manchester, FSK, PSK, Bi-phase, NRZ	Manchester, FSK, PSK, Bi-phase, NRZ	Manchester	Bi-phase, FSK
Bit rate [bits/s]	RF/8 to RF/128	RF/8 to RF/128	RF/32, RF/64	RF/2 to RF/128	RF/2 to RF/128	RF/2 to RF/128	RF/64	RF/32, RF/50
Capacitor on chip	-	-	-	-	0 <sup>3</sup> , 75 <sup>3</sup> , 130 <sup>3</sup> , 250 or 330 pF, trimmed, +/- 3%	250 or 330 pF, trimmed, +/- 3%	250 or 330 pF, trimmed, +/-3%	250 or 330 pl trimmed, +/-3
Other Features								
Encryption	_	_	AUT64	-	_	_	_	-
Anti-collision function	AOR (Answer on Request)	AOR (Answer on Request)	-	AOR (Answer on Request)	AOR (Answer on Request)	AOR (Answer on Request)	-	-
Packages	Only available as transponder	Only available as transponder	Wafer	SO8, sawn wafer, waffle pack	Sawn wafer, waffle pack, XDFN-2-pin package, NOA3- micromodule	Sawn wafer, sticky tape, blister tape <sup>3</sup>	Sawn wafer, sticky tape, blister tape <sup>3</sup>	Sawn wafer, sticky tape, blister tape <sup>3</sup>
Main application areas	Manufacturing, logistic, security control, access control, component authentication	Manufacturing, logistic, security control, access control, component authentication	Logistic, security control, access control, component authentication, anti- counterfeiting	1-bit sensors, manufacturing, animal identification, security control, access control, component authentication	Manufacturing, logistic, transportation, animal identification, security control, access control, component authentication	Manufacturing, logistic, transportation, animal identification, security control, access control, component authentication	Access control, manufacturing, logistic, security control	Animal identification, manufacturing logistic, waste management
Transponder part no.	TK5551M-PP	ATA5551M-PP	TK5561A-PP	-	ATA5577M 1330C-PP	-	-	-
Sensor	-	-	-	Resistor interface 1 bit	-	-	-	-
Speciality	-	-	-	-	AFE setting	AFE setting, Mega pads, 200 x 400 micrometers, with gold bumps	Mega pads, 200 x 400 micrometers, with or without gold bumps	Mega pads, 200 x 400 micrometers, with or withou gold bumps

<sup>&</sup>lt;sup>1</sup> Only available as transponder

<sup>&</sup>lt;sup>2</sup> Successor of T5554, T5557, and ATA5567

<sup>&</sup>lt;sup>3</sup> On request

<sup>&</sup>lt;sup>4</sup> Industrial and consumer version of TK5551M





# LF Reader ICs (100-150kHz)

Part Number	μC	Max Bit Rate	Encoding	Package	Temperature [°C]	V <sub>cc</sub> [V]
U2270B	-	5 Kbit/s	Manchester/ Biphase	S016	-40 to 105	4.5 - 16
ATA5505	16 kByte (ATtiny167)	5 Kbit/s	Manchester/ Biphase	QFN38 5 x 7mm	-40 to 85	4.5 - 16

# LF Design Kits

Part Number	Description
ATA2270-EK1	This LF demonstration kit provides a completely self-contained means to begin using RFID systems. It includes an LCD and control buttons to enable interaction with the RFID system and supports the e5530/TK5530, T5551/TK5551, ATA5567 (T5557), ATA5570, ATA5575, ATA5577, ATA5558 IDICs and U2270B from Atmel. Source code and reference designs are also included. This kit is supported by all the standard AVR® development tools such as AVR Studio®, STK®500, STK600, JTAGICE mkll, etc. A GUI for a PC can control the board in several modes.
ATAB5570	The ATA5570 is based on the ATA5567, however, it is enhanced by an additional sensor input. The board is equipped with a switchable sensor resistor. Depending on the impedance, the memory data of the tag is sent in inverse or non-inverse mode. The board design is also suitable for testing other tag versions in SO8 packages.
ATA5505-EK1	This kit is based on the AVR LF reader chip ATA5505. It is provided as a USB reader module in USB memory stick format. In stand-alone mode it automatically reads a UID tag at 125kHz or an animal ID tag (ISO 11784/85) at 134kHz. To test the full range of features the ATA2270-EK1 GUI has to be used.
ATARFID-EK1	This 125kHz reader kit is based on a reader unit supplied by http://www.gis-net.de/. The kit supports Atmel's ATA5575, ATA5577 and ATA5577M3 (Q5), and includes several tag samples. For full control the GUI can be downloaded from GiS' website. This is the first kit in the portfolio supporting both ASK and FSK.
ATARFID-EK2	This 134.2kHz reader kit is based on a reader unit supplied by http://www.gis-net.de/. The kit supports Atmel's ATA5575 and ATA5577 animal ID devices according to ISO 11784/85 at 134.2kHz. Both the FDX-B (Bi-phase) and the FDX-A standard (FSK) are supported. Several tag samples are included. For full control the GUI can be downloaded from GiS' website.



## Active RFID ICs (100-150kHz and 315/433MHz)

Part Number	μС	LF RX	UHF TX Frequency (MHz)	TX Power (dBm)	Vcc[V]	Temperature [°C]	Package
ATA6285	8 kByte	100-150kHz	313-317	6 (max.)	2 – 3.6	-40 to 85	QFN32 5 x 5mm
ATA6286	8 kByte	100-150kHz	432-448	6 (max.)	2 – 3.6	-40 to 85	QFN32 5 x 5mm

## Active RFID Trigger ICs (100-150kHz)

Part Number	f <sub>0</sub> (kHz)	Channels	Max Current (A)	Data Rate Kbit/s	EMC	Output Power	Package
ATA5279	125	6	1	5.7 (max.)	Sinusoidal output	Scalable in 20 steps	QFN48 7 x 7mm
ATA5278	125	1	1	4 (max.)	Square wave	Scalable in 16 steps	QFN28 7 x 7mm
ATA5276	100-150	1	1.5	4 (max.)	Square wave	Shunt duty cycle	QFN20 5 x 5mm

## Active RFID UHF Rx ICs (313-435kHz)

Part Number	f₀ (kHz)	Sensitivity(dBm)	Modulation	Data Rate Kbit/s	V <sub>cc</sub> [V]	Temperature [°C]	Package
ATA5745	433-435	-113 (2.4kBit/s)	ASK, FSK	10 ASK 20 FSK	2.7 – 3.3 or 4.5 – 5.5	-40 to 105	QFN24 5 x 5mm
ATA5746	313-317	-114 (2.4kBit/s)	ASK, FSK	10 ASK 20 FSK	2.7 – 3.3 or 4.5 – 5.5	-40 to 105	QFN24 5 x 5mm

### Active RFID Demo Kits

Part Number	Description
ATA6285-EK3	This kit consists of two main boards and a battery-powered tag. First main board is the control board for the LF (125kHz) trigger circuit based on ATA5279. Second one is the UHF receiver unit to receive the message from the battery-powered tag. This board operates at 315MHz using the ATA5746 receiver IC. The tag incorporates the ATA6285 and operates at 125kHz as well as at 315MHz.
ATA6286-EK3	This kit consists of two main boards and a battery-powered tag. First main board is the control board for the LF (125kHz) trigger circuit based on ATA5279. Second one is the UHF receiver unit to receive the message from the battery-powered tag. This board operates at 433MHz using the ATA5745 receiver IC. The tag incorporates the ATA6286 and operates at 125kHz as well as at 433MHz.



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