



➤ **Innovative
Silicon IDIC[®] Solutions**



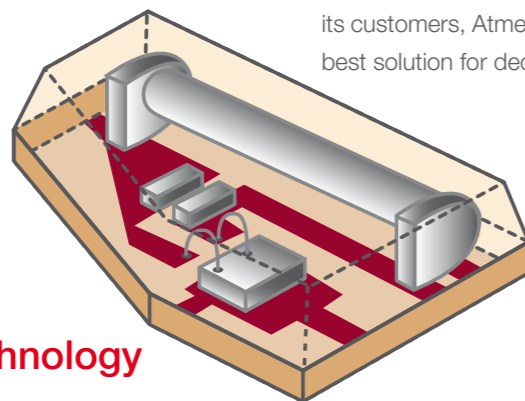
Atmel – The Expert with Long-Term Know-How

Atmel, 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 125 kHz RFID ICs for access control systems. The portfolio also includes ICs addressing the HF segment at 13.56 MHz and the UHF band at 865- 960 MHz.

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.



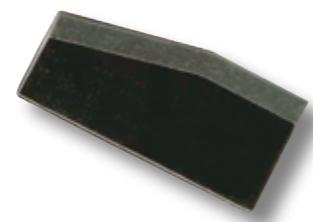
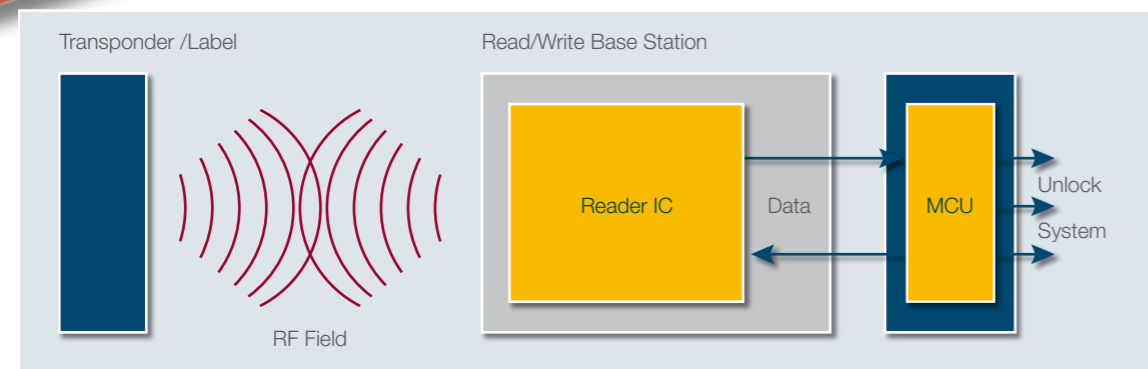
RFID – The Technology

An RFID system consists basically of two components:

- Transponder
(fixed on an object that shall be identified)
- Reader
(or interrogator base station)

A transponder includes the IC, and in LF systems optionally a capacitor and a coil. HF systems only need a coil, UHF systems an antenna. 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 transponder or smart label 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.



RFID Applications

Versatile and flexible products form an Atmel product scope that offers solutions for almost all applications in the main RFID market segments. Atmel's products fulfill the market requirements that call for fast, secure and reliable identification systems.



Manufacturing and Logistics

RFID systems guarantee reliability even in dirty and harsh environments. 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 addition, fast anticollision methods enable identification of a set quantity of products at the same time.

Atmel products address several ISO standards, which are a general demand for open-item management applications (e.g. ISO 18000). In addition, Atmel also provides proprietary solutions.

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



Typical Applications

- Supply Chain Management
- Asset Management
- Bulk Shipment Tracking
- Cylinder Tracking
- Garments
- Inventory/Item Management
- Laundry Automation
- Material Handling and Assembly Equipment
- Toll Collection
- Pallet Tracking
- Pharmaceutical Management
- Parcel Services
- Warehouse Management
- Waste Management





Transportation

Convenience and time efficiency are the reasons why RFID is used in the transportation segment. With increasing travel the employment of faster ID systems becomes necessary. In public transportation, RFID guarantees efficient toll and traffic management, which prevents queues.

Due to long reading distances required by transportation applications such as container tracking, Atmel also provides components for active tags.

Several Atmel products address the ISO 14443 standard that is mainly used in public transportation.



Typical Applications

- Airport Baggage Tagging
- Cargo Tracking
- Electronic Toll and Traffic Management
- Fuel and Maintenance Operations
- Parking Structures
- Loading Docks
- Rail Car Tagging
- Ticketing
- Electronic Payment



Animal Identification

RF identification is significantly involved in the improvement of livestock tracking. Stock monitoring, breeding or disease control are also supported.

And with the outbreak of various animal epidemics such as BSE (i.e. mad cow disease), secure animal identification became even more important.

For example, the RFID tags can easily be injected under the animal's skin. This helps to identify not only livestock but also pets and zoo animals.

In animal sports, RFID systems can help to prevent manipulation and to save the right time of arrival (e.g. in pigeon sports).

Supported standards are, for example, ISO 11784/85, also called FDX-B.



- Animal Ownership Detection
- Animal Tracking
- Fisheries
- Livestock Tracking
- Wildlife Tracking



Security and Access Control

To control access to buildings or other objects 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, loyalty card, prepaid utility card, an electronic

purse for food purchase or parking, RFID provides convenience and security. With available memory partitioning and multiple secure keys available on one device it is possible to combine several of these functions onto one convenient card.

Another advantage of these cards is the convenient handling. As an example, simply walking through the reader field with the ID card in the briefcase identifies a person. There is no need to handle the card. In the automotive sector, RFID-based security keys prevent unauthorized access to vehicles.



Typical Applications

- Automotive Immobilizers
- Building Access Control
- Parking Lot Security and Access
- Anti-counterfeiting/Forgery
- Electronic Purse
- 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 with security 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.

Utilizing the available mutual authentication protocol the system authenticates the component and the component authenticates the system before system operation begins. 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

- Daughter Cards
- Video Cards
- Printer Cartridges
- Copier Toner Cartridges
- Pharmaceuticals
- Glucose Monitors
- Medical Devices
- Electronics





RFID Portfolio

125/134 kHz Read-Only

- Laser Fused
- ISO 11784/85 Compatibility (Optional)

125/134 kHz Read/Write

- Authentication Algorithm for High Security
- Anti-collision Function
- Up to 1 Kbit User Memory
- Different ISO Standards are Addressed
- Dual Interface (Hardwired and Wireless)

13.56 MHz Read/Write

- ISO 14443 Type B Compliant
- Anti-collision Function
- 1 Kbit to 64 Kbit User Memory
- Password protection
- Mutual Authentication
- Encryption

UHF (865 - 960 MHz)

- EPC Class 1 Gen2/ISO18000-6C (upcoming)
- Proprietary
- 1/2 Kbit Memory
- Anti-collision Function
- Secure Locked Unique ID



Technical Features

IPs

Modulation/Coding

Depending on the product, we provide the following modulation modes/codings: FSK, PSK, ASK, Manchester, Biphase, NRZ direct coding, etc.

Security

- UID: each transponder chip has its unique identification number (including traceability code)
- Password protection for read and write access
- Authentication: single or mutual authentication (reader and transponder authenticate each other) for copy protection
- Encryption: data transmission is encrypted, no unauthorized access possible

Anti-collision Function

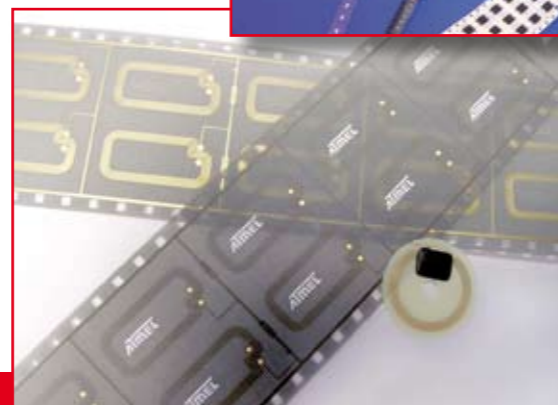
Handling of several transponders in the field at the same time is possible

Memory

- 64-bit read-only up to 64 kbit protected read/write user memory
- 4 – 16 memory zones

Technology

Down to 0.18 μm



Package Delivery Options

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

- Die on Wafer (Chip, Foil/Tape, Bumped)
- Packaged Die (Micromodule, SO, TSSOP)
- Transponder



RFID Product Overview



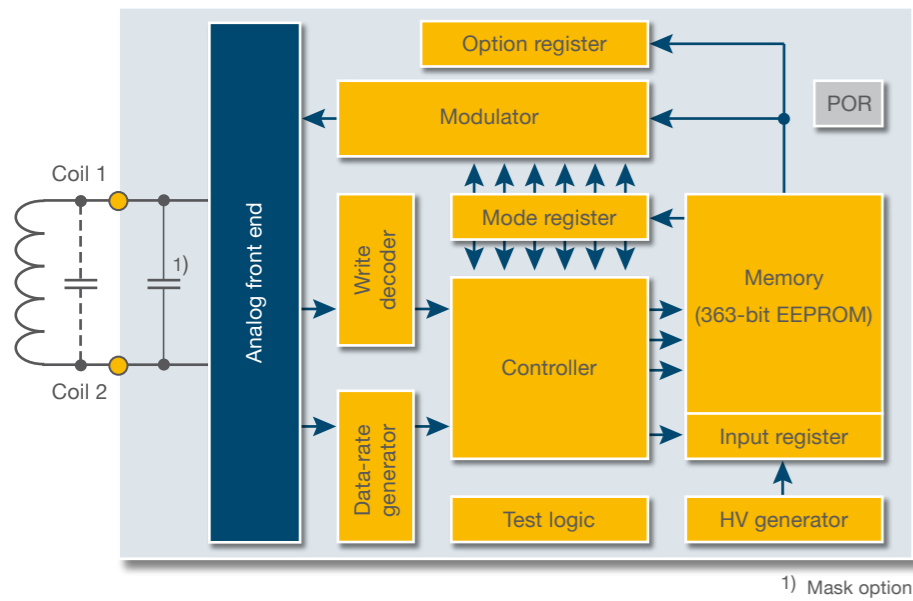
LF Tags (100-150 kHz)

	e5530	TK5551 ¹	T5554	ATA5558	e5561	ATA5567 ²	ATA5570	ATA5577 ³
Memory								
Read only	X	–	–	–	–	–	–	–
Read/Write	–	X	X	X	X	X	X	X
User memory (bit)	128	224	224	1024	288	224	224	224
System memory (bit)	–	40	40	320	32	96	96	128
RF Interface								
Write protection	–	Blockwise	Blockwise	Blockwise	Blockwise	Blockwise	Blockwise	Blockwise
ISO11784/11785	FDX-B	FDX-B		FDX-B		FDX-B	FDX-B	FDX-B
Modulation	ASK	ASK	ASK	ASK	ASK	ASK	ASK	ASK
Encoding	FSK, PSK, Manchester, Bi-phase	FSK, PSK, Manchester, Bi-phase, Binary	FSK, PSK, Manchester, Bi-phase, Binary	Manchester, Bi-phase, NRZ	Manchester, Bi-phase	FSK, PSK, Manchester, Bi-phase, NRZ	FSK, PSK, Manchester, Bi-phase, NRZ	FSK, PSK, Manchester, Bi-phase, NRZ
Bit rate [bits/s]	RF/8 to RF/128	RF/8 to RF/128	RF/8 to RF/128	RF/2 to RF/64	RF/32, RF/64	RF/2 to RF/128	RF/2 to RF/128	RF/2 to RF/128
Capacitor on chip	–	–	70 or 200 pF	75 pF	–	0 or 75 pF	0	0, 75, 130, 250 or 330 pF
Encryption	–	–	–	–	AUT64	–	–	–
Anti-collision function	–	AOR (Answer on Request)	–	Deterministic	–	AOR (Answer on Request)	AOR (Answer on Request)	AOR (Answer on Request)
Packages	Wafer, SO8, wafer pack	Only available as transponder	Wafer, bumped wafer	Wafer	Wafer	Wafer, wafer pack, micromodule, SO8	SO8, wafer	Wafer, wafer pack, micromodule, IC package
Main application areas	Manufacturing, logistic, transportation, animal identification, security control, access control, component authentication	Manufacturing, logistic, security control, access control, component authentication	Logistic, security control, access control, component authentication	Manufacturing, logistic, security control, access control, component authentication	Logistic, security control, access control, component authentication, anti-counterfeiting	Manufacturing, logistic, security control, access control, component authentication	Manufacturing, animal identification, security control, access control, component authentication	Manufacturing, logistic, transportation, animal identification, security control, access control, component authentication
Transponder part no.	TK5530	TK5551	–	–	TK5561	–	–	–
Sensor	–	–	–	–	–	–	Resistor interface 1 bit	–

¹ Only available as transponder

² Successor of T5557

³ Successor of T5557 and ATA5567



Block Diagram ATA5577



LF Demo Kits

Part Number	
TMEB8704	This LF RFID kit is available to demonstrate the key features of various RFID products. The included software supports the following products: U2270B, TK5530/e5530, TK5551, TK5552/T5552, ATA5567 (T5557) comp. mode and TK5561. The kit contains samples, a CD-ROM with installation software and product documentation, as well as all accessories needed.
ATAK2270	This LF RFID kit is available to demonstrate the key features of various RFID products. The included software supports the following products: U2270B, TK5530/e5530, TK5551, TK5552/T5552, ATA5567 (T5557) comp. mode/enhanced mode and ATA5570. ATA5577 is also supported. The kit contains samples, a CD-ROM with installation software and product documentation, as well as all accessories needed.
ATAB5570	This board can be used along with the ATAK2270 and ATA2270-EK1 and allows to demonstrate the features of the LF tag with sensor interface (ATA5570). It has to be ordered as add-on.
ATA2270-EK1	This LF demonstration kit provides a completely self-contained means to begin using RFID systems, even for users with very little prior RFID experience. It supplies an LCD and control buttons to enable interaction with the RFID system. This stand-alone system supports the e5530, T5551, ATA5567 (T5557), ATA5570, ATA5577, and ATA5558 IDIC®s from Atmel®. The included source code and reference designs allow a complete system-level design to be evaluated and prototyped in the shortest amount of time using the building blocks provided in this kit. This kit is supported by all the standard AVR® development tools such as AVR Studio®, STK®500, JTAGICE mkII, etc. For more in-depth evaluation purposes, the TMEB8704 or ATAK2270 is recommended.



LF Reader IC (100 - 150 kHz)

Part Number	Frequency	Type	Max. Bit Rate	Encoding		Package	Temperature [°C]	Vcc [V]
				Bi-phase	Manchester			
U2270B	125/134 kHz	R/W	5 Kbit/s	X	X	SO16	-40 to +105	4.5 - 16



RFID Front-end ICs

Part Number	Frequency	Type	User Memory [Bit]	Total Memory [Bit]	Bit Rate	Encoding		Package	Remark
						Bi-phase	Manchester		
U3280M	125/134 kHz	(R/W) ¹	512	512	0 - 10 Kbit/s ²	X	Code	SS016	Provides power supply for μ C from RF field
U9280M	125/134 kHz	(R/W) ¹	512	512	0 - 10 Kbit/s ²	X	X	SS020	U3280M with MARC4 ATAR092 ³ microcontroller

¹ Feature can be added by software control² Theoretical value, actual minimum bit rate depends on the reader bandwidth³ 4 Kb ROM



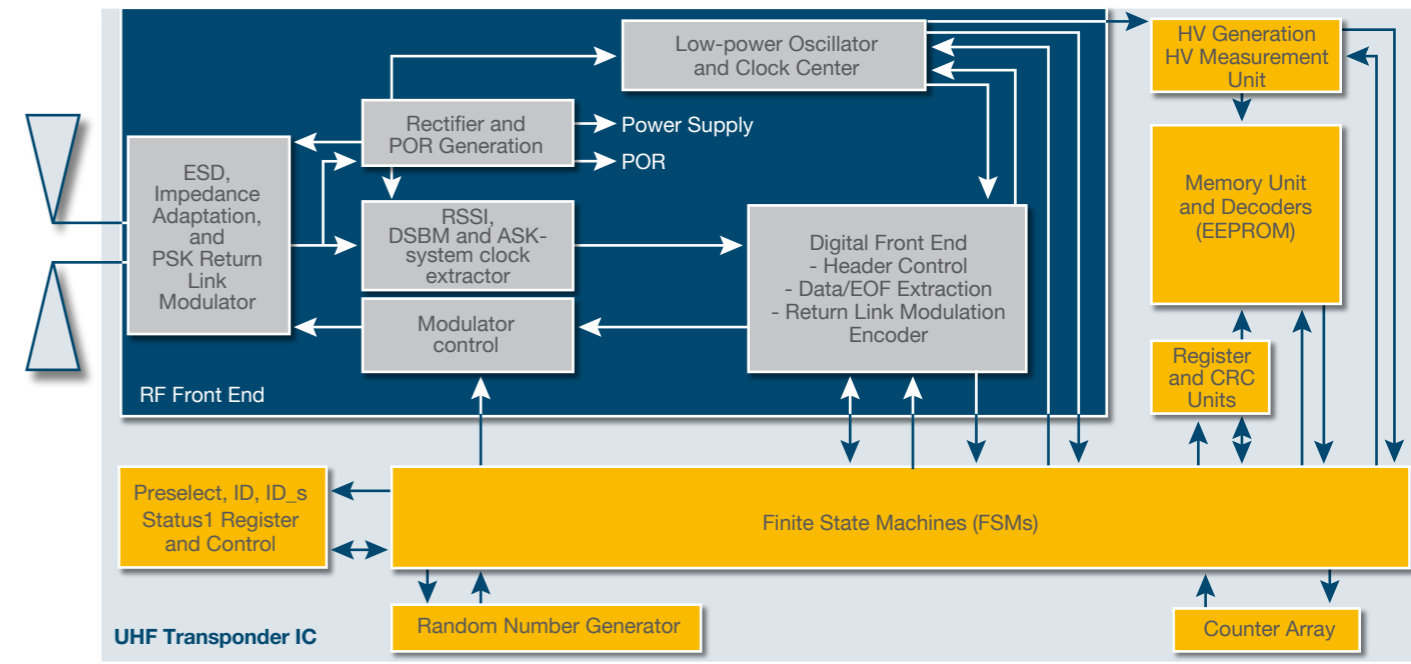
HF Tags (13.56 MHz)

Part Number	AT88RF020	AT88SC0104CRF	AT88SC0204CRF	AT88SC0404CRF	AT88SC0808CRF	AT88SC1616CRF	AT88SC3216CRF	AT88SC6416CRF
Memory								
Size	256 bytes	128 bytes	256 bytes	512 bytes	1 Kbyte	2 Kbytes	4 Kbytes	8 Kbytes
Write endurance	100K cycles	100K cycles	100K cycles	100K cycles	100K cycles	100K cycles	100K cycles	100K cycles
Data retention	10 years	10 years	10 years	10 years	10 years	10 years	10 years	10 years
Organization	32 × 64	32 × 8 × 4	64 × 8 × 4	128 × 8 × 4	128 × 8 × 8	128 × 8 × 16	256 × 8 × 16	512 × 8 × 16
Number of zones	1	4	4	4	8	16	16	16
Identification area	48 bits	128 bits	128 bits	128 bits	128 bits	128 bits	128 bits	128 bits
RF Interface								
ISO	14443 Type B	14443 Type B	14443 Type B	14443 Type B	14443 Type B	14443 Type B	14443 Type B	14443 Type B
Frequency	13.56 MHz	13.56 MHz	13.56 MHz	13.56 MHz	13.56 MHz	13.56 MHz	13.56 MHz	13.56 MHz
Baud rate	106 Kbps	106 Kbps	106 Kbps	106 Kbps	106 Kbps	106 Kbps	106 Kbps	106 Kbps
Anticollision	Timeslot	Timeslot	Timeslot	Timeslot	Timeslot	Timeslot	Timeslot	Timeslot
Operating distance	up to 10 cm	up to 10 cm	up to 10 cm	up to 10 cm	up to 10 cm	up to 10 cm	up to 10 cm	up to 10 cm
Security Options								
Read/Write password	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Encrypted password	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Symmetric dynamic authentication	No	4 × 64 bit keys	4 × 64 bit keys	4 × 64 bit keys	4 × 64 bit keys	4 × 64 bit keys	4 × 64 bit keys	4 × 64 bit keys
Stream encryption	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R/W encrypted checksum	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Unique serial number	32 bits factory prog.	32 bit user prog.	32 bit user prog.	32 bit user prog.	32 bit user prog.	32 bit user prog.	32 bit user prog.	32 bit user prog.
Write protection	Page (8 bytes)	Zone or byte	Zone or byte	Zone or byte	Zone or byte	Zone or byte	Zone or byte	Zone or byte
Access keys	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Encryption algorithm	No	64 bit key	64 bit key	64 bit key	64 bit key	64 bit key	64 bit key	64 bit key
Packaging	Die/tag/module	Die/tag/module	Die/tag/module	Die/tag/module	Die/tag/module	Die/tag/module	Die/tag/module	Die/tag/module
Temperature	0° to +70°C	-45° to +85°C	-45° to +85°C	-45° to +85°C	-45° to +85°C	-45° to +85°C	-45° to +85°C	-45° to +85°C
Tools	Eval./devel. kit	Eval./devel. kit	Eval./devel. kit	Eval./devel. kit	Eval./devel. kit	Eval./devel. kit	Eval./devel. kit	Eval./devel. kit



HF Demo Kits

Part Number	
AT88RF020-DK	This HF RFID demonstration kit provides means to begin using the AT88RF020 HF passive RFID tag even without prior RFID experience. The kit contains an RFID reader, AT88RF020 tag samples, all accessories needed, and a CD ROM containing installation software, software development libraries with source, as well as product documentation.



Structure of ATA5590



UHF Tags (800 - 1000 MHz)

Part Number	Modulation	User Memory	System Memory	Anti-collision	Security	Range
ATA5590	ASK/PSK	1 Kbit	320 Bit	Deterministic binary tree or slotted Aloha	Unique ID	up to 15 m



UHF Demo Kits

Part Number	
ATAK559001-8	This long-range UHF reader demonstration kit supports wireless data transmission using a passive RFID IDIC from Atmel (TAGIDU™ ATA5590), within the ISM frequency bands. The kit contains a Deister long-range UHF reader (UDL500), an interface converter, a power supply, all necessary cables, a label set with different antennas (30 antennas in all), and the software necessary to build up a working UHF reader system. Version for European ISM frequency band (ETSI EN300 208 compliant).
ATAK559001-9	This long-range UHF reader demonstration kit supports wireless data transmission using a passive RFID IDIC from Atmel (TAGIDU ATA5590), within the ISM frequency bands. The kit contains a Deister long-range UHF reader (UDL500), an interface converter, a power supply, all necessary cables, a label set with different antennas (30 antennas in all), and the software necessary to build up a working UHF reader system. Version for the North American ISM frequency band (FCC compliant). This band is available in many other countries worldwide, including in Asia Pacific, South America and Africa.
ATAB559001-8	Stand-alone 865-870 MHz kit including various UHF labels and tags for evaluation purposes.
ATAB559001-9	Stand-alone 902-928 MHz kit including various UHF labels and tags for evaluation purposes.



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