

ATMEL

SMART RF

RF WIRELESS

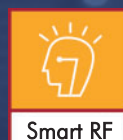
DATA/CONTROL SOLUTIONS

FOR INDUSTRIAL

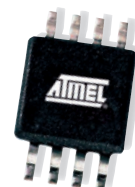
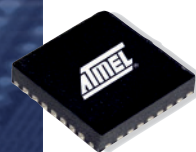
AND CONSUMER

APPLICATIONS

IN THE ISM BANDS



Smart RF



**ATMEL**<sup>®</sup>



## ATMEL SMART RF

Atmel offers a broad range of integrated circuits for a variety of RF applications in the ISM bands. The product portfolio includes single-channel transmitter ICs, receiver and transceiver ICs, as well as multi-channel transceiver circuits and transmitters with an integrated MARC4 4-bit or AVR® microcontroller.

The frequency range spans from 250-450 MHz to 868-870 MHz, 902-928 MHz and 2.4 GHz, thus enabling all kinds of applications in the industrial and consumer area.

All Atmel ISM products provide a high integration level and enable easy implementation.

## APPLICATIONS

### Home Automation

- Door Opening Systems (Garage Doors)
- Weather Stations: Lights, Humidity, Wind, Radiation
- Heating/Air Conditioning Monitoring
- Blinds, Roller Shutters
- Wall Sockets
- TV, Hi-fi, Video Remote Controls
- Emergency Systems for Elderly People
- Computer Peripherals (Mouse, Keyboard, Joystick, etc.)
- Intercom

### Automatic Meter Reading

- Gas, Water, Electricity

### Advanced Toys and Gaming

- Toys (Remote-controlled Cars)
- Gaming (Wireless Game Controller)

### Industrial

- Measurements: Lights, Humidity, Wind, Radiation
- Production Monitoring and Controlling
- Remote Control (e.g., Cranes)
- Logistics/Stock Management (Wireless Handheld Terminals, e.g. Bar Code Readers)
- Telematics

### Headsets

### Wireless Audio/Video

### High-speed Data Communications

### Wireless USB

### Infotainment and Conference Systems

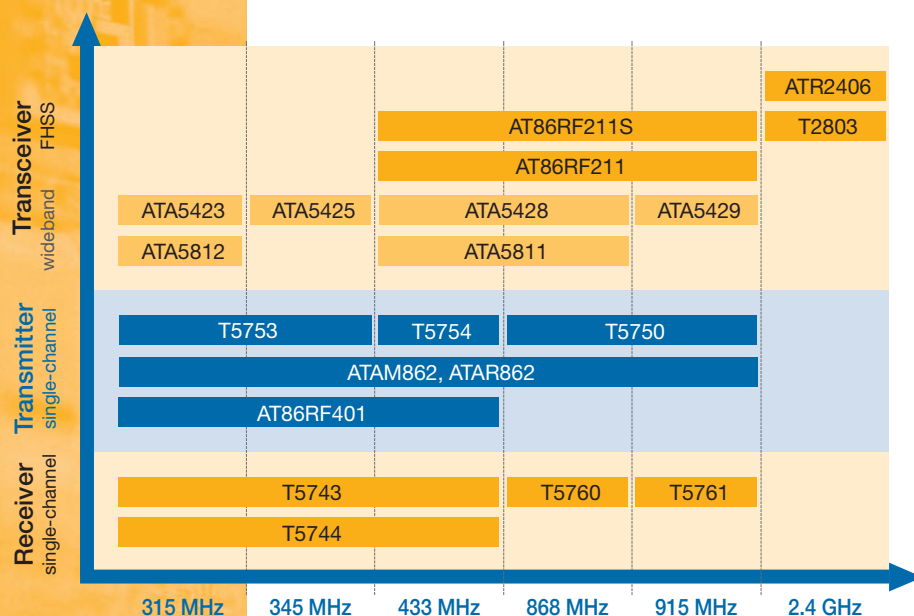
### Wireless Communications

- Walkie-Talkie

### Electronic Point of Sales Systems

### Alarm and Security Systems

- Wireless Warning Systems (Tension, Temperature, Heart Problems etc.)
- Alarm Systems, Smoke and Presence Detectors



## SYSTEM SOLUTIONS

An ISM system consists typically of at least two RF nodes. The most simple system has a transmitter on one side and a receiver on the other side. For many applications such as remote controls for lights, garage doors, air conditioning systems etc., this is sufficient.

For mobile or handheld end products, a highly integrated system allows the manufacturing of very small transmitters. This solution is based on one-way communication, but using a micro-transmitter on the transmitter side.

Two-way communication systems may have a very simple link with low data transmission rates, but high data rates of up to 1 Mbit/s as required for wire-

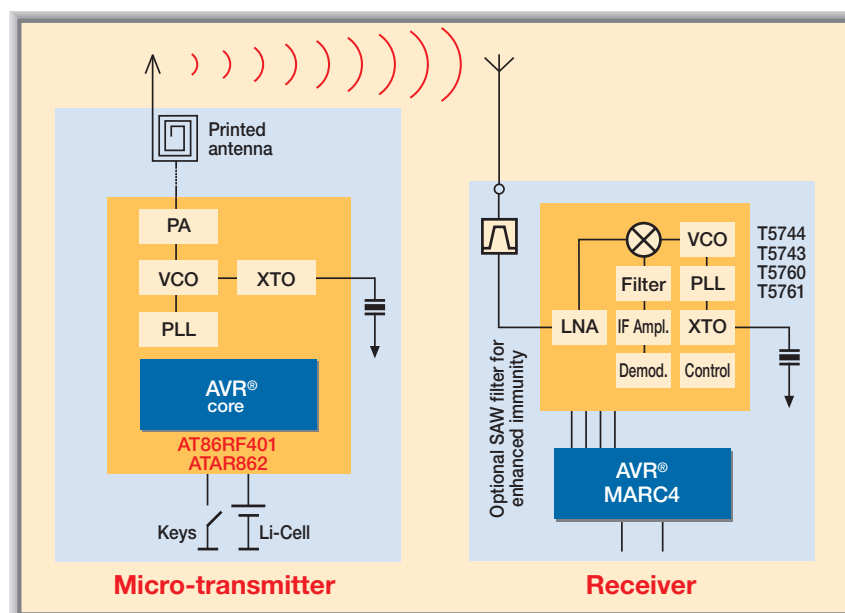


less data transfer, control or gaming are also possible.

The system diagram shows a typical one-way link application with an AVR® micro-transmitter. By replacing the transmitter and the receiver by a transceiver on each side, a two-way communication system can easily be designed.

## ATMEL'S ISM SYSTEM BENEFITS

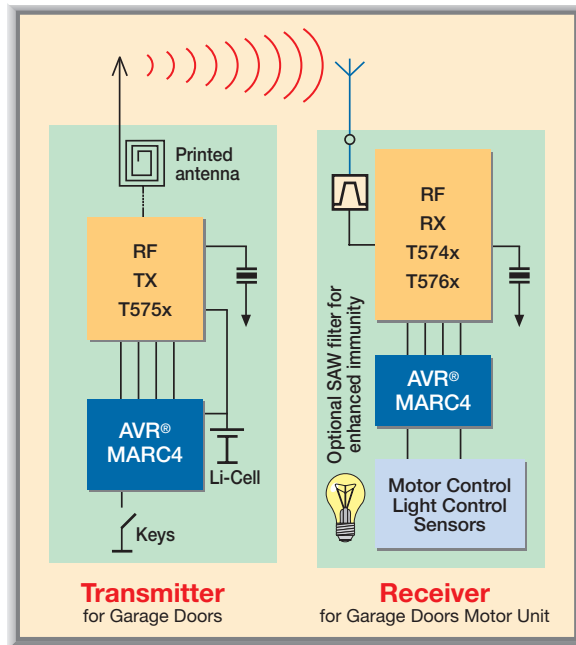
- Complete Radio Product Portfolio Covers All ISM Bands from 250 MHz to 2.4 GHz
- Compliant to FCC CFR 46, Part 15 (US) and EN300 328/400 (Europe)
- Low Cost and Low Power Consumption
- Fast Data Rates (1.152 Mbit/s Maximum)
- Using Atmel's SiGe PAs, the Maximum Output Power of 14 dBm Can Be Increased up to 35 dBm for Extended Link Ranges
- Atmel Provides All Further Devices Needed for a Complete ISM System Solution: MARC4 4-Bit and AVR Microcontrollers, SiGe PAs, EEPROM, Flash etc. as well as Application Support and Design Kits



Standard ISM System Using a Micro-transmitter

## ONE-WAY RF TRANSMITTER

(e.g. Remote Control for Garage Door Openers)

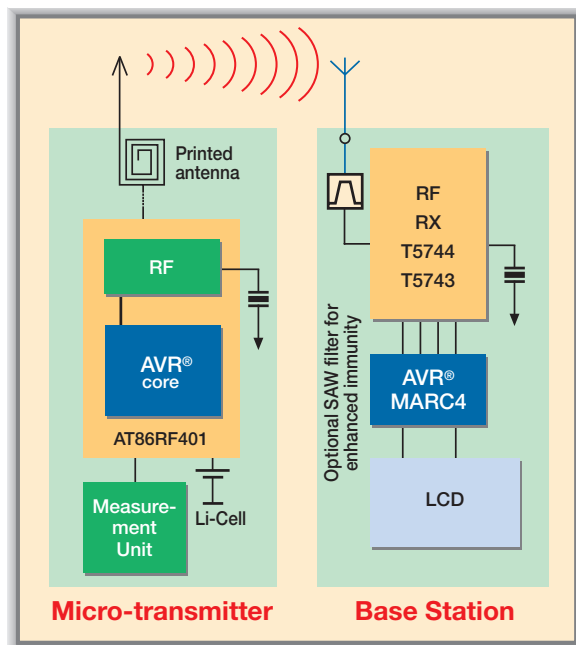


### Key Benefits

- Tiny Transmitter Package
- Intelligent Receivers with Automatic Decoding
- Frequency Range 315 to 928 MHz
- Crystal Sharing with MARC4 Device Saves BOM
- Printed PCB Antenna Allows Small Housings
- MARC4 Enables Long Battery Lifetime

## AVR-MICRO-TRANSMITTER SYSTEM

(Next Integration Level of One-way RF Transmitter Systems, e.g., Outside-temperature Data Transmission)



### Key Benefits

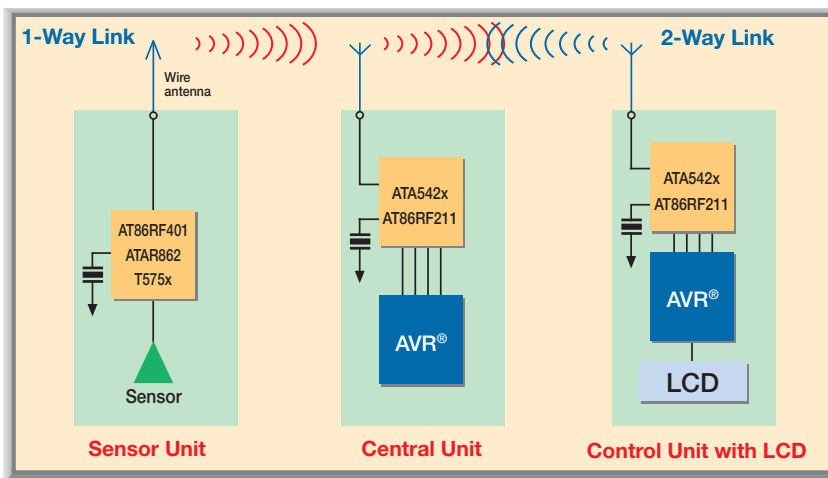
- Tiny Micro-transmitter Package
- Only One IC in the Sensor Unit
- AVR Core with 2-kbyte Flash Memory
- AVR on Receiver Side with Integrated LCD Driver
- AVR Tools Can Be Used
- Suitable for Different ISM Bands

## TRANSCEIVER SYSTEM

(Uni- and Bi-directional RF Link for Alarm Systems)

### Key Benefits

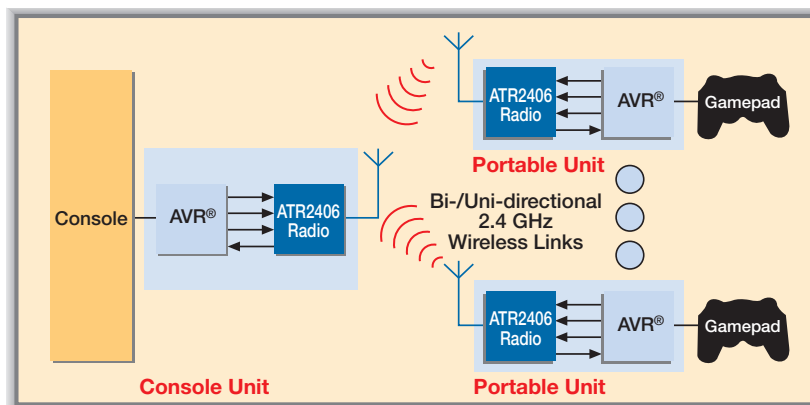
- Bi-directional Circuits for Central and Control Units
- Uni-directional Circuits for Sensors
- Very Robust by Design
- Low Current Consumption Enables Extended Battery Life
- Long Distances Due to High Output Power
- Suitable for Several ISM Bands
- Small Housing Since the RF Transmitter Integrates the AVR Microcontroller



## WIRELESS GAME CONTROLLER SYSTEM

### Key Benefits

- 2.4-GHz Transceiver for World-wide Usage
- Frequency Hopping Spread Spectrum (FHSS) Supported to Minimize Interferences with Other 2.4-GHz Systems such as Bluetooth® or WLAN
- Well Suited for Multi-user Support (Point-to-multipoint)
- Data Rates up to 1.152 Mbit/s
- Low Average Power Consumption Due to Burst Mode Operation



## Transmitter ICs

| Part No. | Frequency Range [MHz] | Modulation ASK/FSK | Data Rate <sup>1)</sup> [kHz] | V <sub>S</sub> [V] | I <sub>sleep</sub> Max. [μA] | I <sub>active</sub> Typ. [mA] | I <sub>transmit</sub> Typ. [mA] | P [dBm] | Package |
|----------|-----------------------|--------------------|-------------------------------|--------------------|------------------------------|-------------------------------|---------------------------------|---------|---------|
| U2741B   | 300-450               | X X                | 20                            | 2.0-5.5            | 0.35                         | 4.7                           | 10                              | 3       | SSO16   |
| U2745B   | 310-440               | X                  | 20                            | 2.2-4.0            | 2                            | 4.7                           | 10                              | 3       | SSO16   |
| T5750    | 868-928               | X X                | 32                            | 2.0-4.0            | 0.35                         | 3.6                           | 8.5                             | 5.5     | TSSOP8  |
| T5753    | 310-350               | X X                | 32                            | 2.0-4.0            | 0.35                         | 3.7                           | 9                               | 8       | TSSOP8  |
| T5754    | 429-439               | X X                | 32                            | 2.0-4.0            | 0.35                         | 3.7                           | 9                               | 7.5     | TSSOP8  |

<sup>1)</sup> 32 kHz means 32 kBit/s Manchester coding or 64 kBit/s NRZ coding

## Micro-transmitter ICs

| Part No.                  | Frequency Range [MHz] | μC Core | Modulation ASK/FSK | Data Rate <sup>1)</sup> [kHz] | V <sub>S</sub> [V] | I <sub>sleep</sub> Max. [μA] | I <sub>active</sub> Typ. [mA] | I <sub>transmit</sub> Typ. [mA] | P [dBm] | Package |
|---------------------------|-----------------------|---------|--------------------|-------------------------------|--------------------|------------------------------|-------------------------------|---------------------------------|---------|---------|
| AT86RF401                 | 250-450               | AVR     | X                  | 10                            | 2.0-3.5            | 0.5                          | 13                            | 18                              | 6       | TSSOP20 |
| ATAx862 <sup>2)</sup> -R3 | 310-330               | MARC4   | X X                | 32                            | 2.0-4.0            | 0.35                         | 3.7                           | 9.5                             | 8       | SSO24   |
| ATAx862 <sup>2)</sup> -R4 | 429-439               | MARC4   | X X                | 32                            | 2.0-4.0            | 0.35                         | 3.7                           | 9.5                             | 7.5     | SSO24   |
| ATAx862 <sup>2)</sup> -R8 | 868-928               | MARC4   | X X                | 32                            | 2.0-4.0            | 0.35                         | 3.6                           | 9                               | 5.5     | SSO24   |

<sup>1)</sup> 32 kHz means 32 kBit/s Manchester coding or 64 kBit/s NRZ coding

<sup>2)</sup> ATAR862 = ROM version, ATAM862 = Flash/MTP, replaces T48C862

## Receiver ICs

| Part No. | Frequency Range [MHz] | Modulation ASK/FSK | Data Rate <sup>1)</sup> [kHz] | V <sub>S</sub> [V] | I <sub>off</sub> [μA] | I <sub>active</sub> [mA] | Sensitivity [dBm] ASK | Sensitivity [dBm] FSK | Package    |
|----------|-----------------------|--------------------|-------------------------------|--------------------|-----------------------|--------------------------|-----------------------|-----------------------|------------|
| U3741BM  | 300-450               | X X                | 10/3.2                        | 4.5-5.5            | 190                   | 7                        | -110                  | -98.5                 | SO20       |
| U3742BM  | 300-450               | X X                | 10/3.2                        | 4.5-5.5            | 190                   | 7                        | -110                  | -98.5                 | SO20       |
| U3745BM  | 310-440               | X                  | 10/—                          | 4.5-5.5            | 190                   | 7                        | -110                  | —                     | SO20       |
| T5743    | 300-450               | X X                | 10/10                         | 4.5-5.5            | 170                   | 7.5                      | -110                  | -104                  | SO20       |
| T5744    | 300-450               | X                  | 10/—                          | 4.5-5.5            | 190                   | 7                        | -110                  | —                     | SO20 SSO20 |
| T5760    | 868-870               | X X                | 10/10                         | 4.5-5.5            | 170                   | 7.6                      | -112                  | -106                  | SO20       |
| T5761    | 902-928               | X X                | 10/10                         | 4.5-5.5            | 170                   | 7.6                      | -112                  | -106                  | SO20       |

<sup>1)</sup> 32 kHz means 32 kBit/s Manchester coding or 64 kBit/s NRZ coding

## Wideband Transceiver ICs

| Part No.                      | Frequency Range [MHz] | Modulation ASK/FSK | Data Rate <sup>1)</sup> [kHz] | V <sub>S</sub> [V] | I <sub>off</sub> [mA] | I <sub>active</sub> [mA] at 10 dBm | Sensitivity [dBm] ASK | Sensitivity [dBm] FSK | P [dBm] | Package |
|-------------------------------|-----------------------|--------------------|-------------------------------|--------------------|-----------------------|------------------------------------|-----------------------|-----------------------|---------|---------|
| ATA5811                       | 433-435 868-870       | X X                | 10/20                         | 2.4-3.6            | 0.01                  | 15.8 17.3                          | -116.5 -114           | -109.5 -107           | 10      | QFN48   |
| ATA5812 ATA5423 <sup>3)</sup> | 314-316               | X X                | 10/20                         | 2.4-3.6            | 0.01                  | 15.7                               | -117.5                | -110.5                | 10      | QFN48   |
| ATA5425 <sup>3)</sup>         | 345                   | X X                | 10/20                         | 2.4-3.6            | 0.01                  | 15.7                               | -117.5                | -110.5                | 10      | QFN48   |
| ATA5428 <sup>3)</sup>         | 433-435 868-870       | X X                | 10/20                         | 2.4-3.6            | 0.01                  | 15.8 17.3                          | -116.5 -114           | -109.5 -107           | 10      | QFN48   |
| ATA5429 <sup>3)</sup>         | 915                   | X X                | 10/20                         | 2.4-3.6            | 0.01                  | 17.3                               | -114                  | -107                  | 10      | QFN48   |

<sup>1)</sup> 32 kHz means 32 kBit/s Manchester coding or 64 kBit/s NRZ coding

<sup>3)</sup> Available end of 2004

## Multi-channel Transceiver ICs

| Part No.   | Frequency Range [MHz] | Modulation | Data Rate [kbit/s] | Output Power [dBm] | Rx Sensitivity [dBm] | V <sub>S</sub> [V] | IIP3 [dBm] | Package |
|------------|-----------------------|------------|--------------------|--------------------|----------------------|--------------------|------------|---------|
| AT86RF211  | 433, 868, 915         | FSK        | 64                 | 14                 | -99                  | 2.4-3.75           | -15        | TQFP48  |
| AT86RF211S | 433, 868, 915         | FSK        | 100                | 16                 | -99                  | 2.4-3.75           | -15        | TQFP48  |
| ATR2406    | 2,400-2,483           | GFSK       | 0-1,152            | 3                  | -93                  | 3.0-4.6            | -15        | QFN32   |
| T2803      | 2,400-2,483           | GFSK       | 0-1,152            | 3                  | -78                  | 3.0-4.6            | -7         | QFN48   |

## Development Kits with Software

| Part No.                          | Application                                     | Ordering No.                     | Remarks                             |
|-----------------------------------|-------------------------------------------------|----------------------------------|-------------------------------------|
| <b>AT86RF211/<br/>AT86RF211S</b>  | AVR mother boards for RF evaluation/development | AT86RF211-DK                     | RF modules ordered separately       |
| <b>AT86RF401</b>                  | RF evaluation kit<br>AVR transmitter            | AT86RF401E-EK1<br>AT86RF401U-EK1 | 433.92 MHz<br>315 MHz               |
| <b>AT86RF401,<br/>T5744</b>       | RF development kit<br>AVR transmitter + RX      | ATAK4015744E<br>ATAK4015744U     | 433.92 MHz/no SAW<br>315 MHz/no SAW |
| <b>ATR2406</b>                    | AVR-based development kit                       | ATR2406-DEV-KIT                  | 2 RF modules included               |
| <b>T5750/T5760/<br/>MARC4/AVR</b> | RF development kit 868.3 MHz                    | ATAK5750-60-N<br>ATAK5750-60-S   | No SAW<br>SAW                       |
| <b>T5750/T5761/<br/>MARC4/AVR</b> | RF development kit 915 MHz                      | ATAK5750-61-N                    | No SAW                              |
| <b>T5753/T5743/<br/>MARC4/AVR</b> | RF development kit 315 MHz<br>300 kHz IF-BW     | ATAK5753-43P3-S                  | SAW                                 |
| <b>T5753/T5743/<br/>MARC4/AVR</b> | RF development kit 315 MHz<br>600 kHz IF-BW     | ATAK5753-43P6-S                  | SAW                                 |
| <b>T5754/T5743/<br/>MARC4/AVR</b> | RF development kit 433.92 MHz<br>300 kHz IF-BW  | ATAK5754-43P3-S                  | SAW                                 |
| <b>T5754/T5743/<br/>MARC4/AVR</b> | RF development kit 433.92 MHz<br>600 kHz IF-BW  | ATAK5754-43P6-S                  | SAW                                 |

## Development Boards

| Part No.                         | Application                                                        | Ordering No.                                                         | Remarks                                                              |
|----------------------------------|--------------------------------------------------------------------|----------------------------------------------------------------------|----------------------------------------------------------------------|
| <b>ATA5811</b>                   | RF transceiver board 433 MHz<br>868 MHz                            | ATAB5811-4L<br>ATAB5811-8L                                           | P = + 5 dBm                                                          |
|                                  | RF transceiver board 433 MHz<br>868 MHz                            | ATAB5811-4H<br>ATAB5811-8H                                           | P = + 10 dBm                                                         |
| <b>ATA5812</b>                   | RF transceiver board 315 MHz                                       | ATAB5812-3L<br>ATAB5812-3H                                           | P = + 5 dBm<br>P = + 10 dBm                                          |
| <b>AT86RF211/<br/>AT86RF211S</b> | UHF FSK transceiver board<br>868 and 915 MHz                       | AT86RF211DB-BIBAND                                                   | Same hardware for 868 and 915 MHz, printed antenna                   |
| <b>AT86RF211/<br/>AT86RF211S</b> | UHF FSK transceiver board<br>433, 868 and 915 MHz                  | AT86RF211DB-433TRI                                                   | Only a few passives changed to swap frequencies                      |
| <b>AT86RF211/<br/>AT86RF211S</b> | UHF FSK transceiver board<br>868 or 915 MHz                        | AT86RF211DB-868LNA or<br>AT86RF211DB-915LNA                          | LNA, SAW filter printed antenna and inductors                        |
| <b>AT86RF211/<br/>AT86RF211S</b> | UHF FSK transceiver board<br>433, 868 or 915 MHz                   | AT86RF211DB-433107 or<br>AT86RF211DB-868107 or<br>AT86RF211DB-915107 | SAW and IF filters used, all devices are SMD components              |
| <b>AT86RF211/<br/>AT86RF211S</b> | UHF FSK transceiver board<br>433, 868 or 915 MHz                   | AT86RF211DB-433LT or<br>AT86RF211DB-868LT or<br>AT86RF211DB-915LT    | SAW and IF filters used, low-cost lead-through components            |
| <b>ATR2406</b>                   | ISM transceiver board<br>2.4 GHz, 1.152 Mb/s                       | ATR2406-DEV-BOARD                                                    | Low-cost reference design                                            |
| <b>T5744</b>                     | UHF ASK receiver board<br>300-450 MHz                              | ATAB5744-N4<br>ATAB5744-S4<br>ATAB5744-N3<br>ATAB5744-S3             | 433.92 MHz/no SAW<br>433.92 MHz/SAW<br>315 MHz/no SAW<br>315 MHz/SAW |
| <b>T5743P3</b>                   | UHF ASK/FSK receiver board<br>300-450 MHz,<br>IF bandwidth 300 kHz | ATAB5743P3-S4<br>ATAB5743P3-S3                                       | 433.92 MHz/SAW<br>315 MHz/SAW                                        |
| <b>T5743P6</b>                   | UHF ASK/FSK receiver board<br>300-450 MHz,<br>IF bandwidth 600 kHz | ATAB5743P6-S4<br>ATAB5743P6-S3                                       | 433.92 MHz/SAW<br>315 MHz/SAW                                        |
| <b>T5750</b>                     | UHF ASK/FSK transmitter board<br>868.3/915 MHz                     | ATAB5750-8<br>ATAB5750-9                                             | 868.3 MHz<br>915 MHz                                                 |
| <b>T5753</b>                     | UHF ASK/FSK transmitter board<br>315 MHz                           | ATAB5753                                                             |                                                                      |
| <b>T5754</b>                     | UHF ASK/FSK transmitter board<br>433.92 MHz                        | ATAB5754                                                             |                                                                      |
| <b>T5760</b>                     | UHF ASK/FSK receiver board<br>868.3 MHz                            | ATAB5760-N<br>ATAB5760-S                                             | No SAW<br>SAW                                                        |
| <b>T5761</b>                     | UHF ASK/FSK receiver board<br>915 MHz                              | ATAB5761-N                                                           | No SAW                                                               |

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