



**KTS**SYSTEME

KOMMUNIKATIONSTECHNIK & SYSTEME

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## AT Commands Reference Guide

Firmware 3.xx Devices

Rev. 2.4

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## Contents

1	Introduction.....	3
1.1	Usage and Disclosure Restrictions.....	4
1.2	Applicability Table .....	5
1.3	Scope .....	5
1.4	Audience.....	5
1.5	Document Organization .....	6
1.6	Text Conventions.....	6
2	Elementary Functions.....	7
2.1	AT+A .....	7
2.2	AT+I.....	8
2.3	AT+Inventory .....	9
2.4	AT+ISOSEL.....	9
2.5	AT+Scan .....	10
3	Tag Functions.....	12
3.1	ISO 15693 .....	12
3.1.1	AT+ISO15693 .....	12
3.1.2	AT+LOCK .....	12
3.1.3	AT+NDEF.....	13
3.1.4	AT+R, AT+r .....	14
3.1.5	AT+Read.....	16
3.1.6	AT+S.....	17
3.1.7	AT+W, AT+w .....	17
3.1.8	AT+Write.....	18
3.1.9	AT+WriteAFI .....	19
3.2	ISO 14443 .....	19
3.2.1	AT+Deselect.....	19
3.2.2	AT+Select .....	20
3.2.3	AT+Transceive .....	21
3.2.4	AT+DESFIRE.....	21
3.2.5	AT+DESFIRE_FREEMEM .....	22



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3.2.6	AT+DESFIRE_GETAIDS.....	23
3.2.7	AT+DESFIRE_GETFIDS.....	23
3.2.8	AT+DESFIRE_SELECTAID.....	23
3.2.9	AT+DESFIRE_VERSION.....	24
3.2.10	AT+ISO14443A.....	24
3.2.11	AT+ISO14443B.....	25
4	Reader Functions.....	25
4.1	AT+ANT.....	25
4.2	AT+Config.....	26
4.2.1	Interface Mode Register (0x00).....	27
4.2.2	UART Config Register (0x01).....	28
4.2.3	RF Power & Modulation Control Register (0x02).....	28
4.2.4	External Amplifier Output Power Control Register (0x03).....	28
4.2.5	Scan Mode Flags Register 1 (0x04).....	29
4.2.6	Scan Mode Flags Register 2 (0x05).....	29
4.2.7	Proximity/Touch sensitivity.....	29
4.2.8	Antenna Multiplexer Mode (0x0A).....	30
4.2.9	Antenna Multiplexer Physical Ports (0x0B).....	30
4.2.10	Antenna Multiplexed Logical Ports (0x0C).....	30
4.2.11	HID Output Control Register (0x80 – 0x9f).....	30
4.3	ATE.....	32
4.4	AT+FlashUpdate!.....	33
4.5	ATI.....	33
4.6	AT+P.....	33
4.7	AT+RF.....	34
4.8	ATS.....	35
4.9	AT+Touch?.....	35
4.10	ATZ.....	36
5	Document History.....	37

## 1 Introduction



The KTS family of RFID readers can be controlled via the serial interface using some simple AT commands. Although part of the command set looks like the Hayes command set, in general there is no compatibility to the Hayes command set or the V.250 standard.

## 1.1 Usage and Disclosure Restrictions

### License Agreements

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## 1.2 Applicability Table

In general the AT commands are applicable to the components listed in the table below. In cases where some device or feature specific restrictions are existing they will be mentioned in the specific command description.

Product	Abbreviation	Firmware Versions
KTS – SRR1356 ShortRange HF Reader	SRR	≥ 3.00
KTS – MRR1356 MidRange HF Reader	MRR	≥ 3.00
KTS – RFIDM1356 HF OEM Module	RFID OEM	≥ 3.00
KTS – HER1356 Harsh Environment RFID System	HER	≥ 3.00
KTS – DTR1356 HF Desktop Reader	DTR	≥ 3.00

Feature	Description	Firmware Versions
FEATURE_14443	Enables all ISO 14443 related commands and scanning modes	≥ 3.00
FEATURE_HID	Enables the use of a reader with USB interface as HID (keyboard) device	≥ 3.00
FEATURE_CDC *1)	Enables the use of a reader with USB interface as CDC (serial) device	≥ 3.00

\*1) This feature is required to operate any AT Command described in this document.

## 1.3 Scope

This document is supposed to provide a comprehensive listing as a reference for the complete set of AT commands supported by KTS devices mentioned in Applicability Table in Section 1.2.

## 1.4 Audience

Readers of this document should be familiar with KTS RFID readers and should also be able to establish a communication between a host and a RFID reader via RS232 or USB using a terminal application.

## 1.5 Document Organization

The AT commands are organized in three classes:

- Elementary Functions
- Tag Functions
- Reader Functions

## 1.6 Text Conventions



**Danger** – This information **MUST** be followed or catastrophic equipment failure or bodily injury may occur.



**Caution or Warning** – Alerts the user to important issues about the operation of the components. If these issues are not considered correctly the readers and end user equipment may fail or malfunction.



**Advice or Information** – Provides advice and suggestions that may be useful when integrating and operating the RFID readers.

### Syntactical definitions:

**<\r> Carriage return character** with the default decimal value of 13. In case a terminal application is used for e.g. testing purposes. This character must be sent after pressing the "ENTER" key.

**<...> Angle brackets** enclose mandatory elements. The brackets must not appear in the command line.


**[...] Square brackets** enclose optional elements. The brackets must not appear in the command line.

**RFU:** "Reserved for further use". Do not overwrite values marked as RFU in the device registers.


## 2 Elementary Functions

Elementary functions comprise all basic AT commands which are intended to provide an easy access to all KTS RFID readers and a variety of tags available on the market. These commands are identical and mandatory for all KTS readers now and in the future.

### 2.1 AT+A


Command	Availability	See also
<code>AT+A[,&lt;AFI&gt;]</code>	All KTS RFID readers	AT+Inventory, AT+I
Description	Examples	
<b>Anti Collision Inventory</b>		
<p>Performs an inventory scan and returns the total amount of tags found and a list of unique IDs (UIDs), followed by the corresponding RSSI-values (for both receiver channels separately) for each tag. Each UID is 32, 56, 64 or 80 bit wide. The message is completed with OK.</p> <p>If an AFI value is specified and not zero, any ISO15693 Transponder will not respond, which AFI (Application Family Identifier) value does not match the requested AFI.</p> <p>The AFI parameter is only available in FW 3.17 and higher.</p>	<pre>AT+A&lt;\r&gt; +TAGS=0&lt;\r&gt; OK&lt;\r&gt;</pre> <pre>AT+A&lt;\r&gt; +TAGS=3&lt;\r&gt; +UID=E00402000058913D,+RSSI=5/5&lt;\r&gt; +UID=10C58711,+RSSI=4/3&lt;\r&gt; +UID=E004020000514170,+RSSI=3/2&lt;\r&gt; OK&lt;\r&gt;</pre> <pre>AT+A,01&lt;\r&gt; +TAGS=1&lt;\r&gt; +UID=E004020000514170,+RSSI=3/2&lt;\r&gt; OK&lt;\r&gt;</pre>	
 <p><b>Caution:</b> Anti Collision Inventory scan can only be performed successfully if all automatic scan modes are disabled (AT+Scan=OFF). In all other cases ERROR will be returned! (See also: AT+Scan)</p>		

2.2 AT+I

Command	Availability	See also
<b>AT+I[,&lt;AFI&gt;]</b>	All KTS RFID readers	AT+Inventory, AT+A
Description	Examples	
<b>Inventory</b>		
<p>Performs an inventory scan and returns a single unique ID (UID) of a tag, followed by the corresponding RSSI values for the main and the auxiliary receiver channel. The UID may be 32, 56, 64 or 80 bit wide. Completed with OK.</p>	<pre>AT+I&lt;\r&gt; +UID=E00402000058913D,+RSSI=5/5&lt;\r&gt; OK&lt;\r&gt;</pre>	
<p>If an AFI value is specified and not zero, any ISO15693 Transponder will not respond, which AFI (Application Family Identifier) value does not match the requested AFI.</p>	<pre>AT+I,&lt;\r&gt; OK&lt;\r&gt;</pre>	
<p>The AFI parameter is only available in FW 3.17 and higher.</p>	<pre>AT+I,01&lt;\r&gt; +UID= E004020000514170,+RSSI=3/2&lt;/r&gt; OK&lt;\r&gt;</pre>	
<p>In case no tag is found only OK will be reported.</p>		
		
<p><b>Caution:</b> Inventory scan can only be performed successfully if all continuous scan modes are disabled (AT+Scan=OFF). In all other cases ERROR will be returned! (See also: AT+Scan)</p>		



## 2.3 AT+Inventory

Command	Availability	See also
<code>AT+Inventory[,&lt;AFI&gt;]</code>	All KTS RFID readers	AT+I, AT+A
Description	Examples	
<b>Inventory Scan</b>		
<p>Performs an inventory scan and returns the total amount of tags found and a list of unique IDs (UIDs), followed by the corresponding RSSI-values (for both receiver channels separately) for each tag. Each UID is 32, 56, 64 or 80 bit wide. The message is completed with OK.</p> <p>If an AFI value is specified and not zero, any ISO15693 Transponder will not respond, which AFI (Application Family Identifier) value does not match the requested AFI.</p> <p>The AFI parameter is only available in FW 3.17 and higher.</p>	<pre>AT+Inventory&lt;\r&gt; +TAGS=0&lt;\r&gt; OK&lt;\r&gt;</pre> <pre>AT+Inventory&lt;\r&gt; +TAGS=3&lt;\r&gt; +UID=E00402000058913D,+RSSI=5/5&lt;\r&gt; +UID=10C58711,+RSSI=4/3&lt;\r&gt; +UID=E004020000514170,+RSSI=3/2&lt;\r&gt; OK&lt;\r&gt;</pre> <pre>AT+Inventory,01&lt;\r&gt; +TAGS=1&lt;\r&gt; +UID=E004020000514170,+RSSI=3/2&lt;\r&gt; OK&lt;\r&gt;</pre>	
 <p><b>Caution:</b> Inventory scan can only be performed successfully if all continuous scan modes are disabled (AT+Scan=OFF). In all other cases ERROR will be returned! (See also: AT+Scan)</p>		

## 2.4 AT+ISOSEL


Command	Availability	See also
<code>AT+ISOSEL=&lt;ISO1&gt;,&lt;ISO2&gt;,...</code>	All KTS RFID readers	
Description	Examples	
<b>Select ISO Standard</b>		

Enables the support for ISO standard(s) for inventory and scan functions.

Following parameters can be chosen:

- 15** – ISO 15693
- 14A** – ISO 14443A
- 14B** – ISO 14443B

AT+ISOSEL? reports status of the actually enabled ISO standard.



**Restrictions:**  
ISO 14443A returns only the UID of the tag, no data or file access is supported.  
To enable ISO 14443 Tags the FEATURE\_14443 is required to be enabled.

```
AT+ISOSEL=15,14A<\r>
OK<\r>

AT+ISOSEL? <\r>
+ISOSEL=15<\r>
OK<\r>

AT+ISOSEL=14A<\r>
ERROR="Feature disabled. Cannot select
ISO14443."<\r>
```

## 2.5 AT+Scan

Command	Availability	See also
<pre>AT+Scan=&lt;Flag #1&gt;,&lt;Flag #2&gt;, ... AT+Scan?</pre>	All KTS RFID readers	
Description	Examples	
<b>Enable/Disable Continuous Scan</b>		
<p>Enables or disables the continuous scan mode of the RFID reader with the functionality according to the activated flags. Returns the status of the actually set flags.</p> <p>Meaning of available flags:</p> <ul style="list-style-type: none"> <li><b>AC</b> – Anti collision mode ("bulk reading"): Allows the simultaneous detection of several tags.</li> <li><b>ANT</b> – For each listed tag the number of the antenna (or antennae) detecting the</li> </ul>	<pre>AT+Scan=&lt;\r&gt; OK&lt;\r&gt; SCAN:+UID=E00402000018313E&lt;\r&gt; SCAN:-UID=E00402000018313E&lt;\r&gt;  AT+Scan=AC,RSSI&lt;\r&gt; OK&lt;\r&gt; SCAN:+UID=E00402000018313E,+RSSI=7/6&lt;\r&gt;</pre>	

according tag is provided. On remove of a tag, the antenna which has detected the tag previously is provided. Set the MULTI flag to scan over all antennae.

**RSSI** – Returns the RSSI value for the main and the auxiliary receiver channel for each detected tag.

**SHORT** – Reports only the UID without any further information (not compatible with ANT, RSSI, DATA, TYPE).

**DATA** – During each scan the content of the complete user data space of the tag is returned in binary format.

**MULTI** – Performs a scan covering all antennae of a connected multiplexer. The antenna switching is performed automatically each time the previous antenna was scanned and reported for changes.

**TYPE** – Reports the type of detected tags. Currently following types will be indicated: ISO15693, MIFARE 1k, MIFARE 4k, MIFARE PLUS, MIFARE DESFIRE.

**OFF** – Stops the continuous scan and deletes all activated flags.

AT+Scan? returns a list with all set flags.



**Advice 1:**

To enable an automatic scan mode which only reports single tags without further information, use **AT+Scan=** without flags!

**Advice 2:**



If DATA and RSSI flags are used simultaneously the user memory content will be reported at initial discovery of a tag.

```
SCAN:+UID=E00402000054913F,+RSSI=5/5<\r>
```

```
AT+Scan=AC,RSSI,DATA<\r>
```

```
OK<\r>
```

```
SCAN:+UID=E00402000018313E,+RSSI=5/5,  
+DATA112=1234567abcdefghijklmnopqrst...<\r>
```

```
AT+Scan=AC,RSSI,ANT,DATA<\r>
```

```
OK<\r>
```

```
SCAN:+UID=E00402000018313E,+RSSI=5/5,  
+ANT=6,+DATA112=1234567...<\r>
```

```
AT+Scan=SHORT<\r>
```

```
OK<\r>
```

```
E00402000018313E
```

```
AT+Scan=OFF<\r>
```

```
OK<\r>
```

```
SCAN:-UID=E004020000283F32<\r>
```

```
AT+Scan?<\r>
```

```
+SCAN=AC,RSSI<\r>
```

```
OK<\r>
```



### 3 Tag Functions


The class of tag functions comprises all AT commands designed for enhanced access to specific tag properties.

#### 3.1 ISO 15693

##### 3.1.1 AT+ISO15693

Command	Availability	See also
<b>AT+ISO15693,&lt;Frame&gt;</b>	All KTS RFID readers with FW 3.17 or higher	AT+ISO14443A, AT+ISO14443B
Description	Examples	
<p><b>Exchange an ISO15693 Frame</b> Exchanges a ISO15693 command and response pair. This can be used to issue otherwise unimplemented commands to ISO15693 tags.</p> <p>&lt;frame&gt; consists of a sequence of bytes to be sent as a stream of 2 character hexadecimal values. SOF, EOF and CRC16 will be generated and shall not be included in &lt;frame&gt;</p> <p>Only valid for ISO15693 tags.</p>	<pre>AT+ISO15693,022000&lt;\r&gt; +ISO15693=00E1400E01&lt;\r&gt; OK&lt;\r&gt;  AT+ISO15693,022B00&lt;\r&gt; +ISO15693=000FC046DA7A000104E000011B0301&lt;\r&gt; OK&lt;\r&gt;</pre>	

##### 3.1.2 AT+LOCK

Command	Availability	See also
<b>AT+LOCK ,[&lt;UID&gt;],&lt;Block&gt;</b> <b>AT+LOCK[,&lt;UID&gt;]?</b>	All KTS RFID readers with FW 3.17 or higher	
Description	Examples	
<p><b>Lock Block</b> Sets the security settings of a specific block to write protected.</p>  <p><b>Caution:</b></p>	<pre>AT+LOCK,0&lt;\r&gt; OK&lt;\r&gt;  AT+LOCK,E004015002CCB3B2,7&lt;\r&gt; OK&lt;\r&gt;  AT+LOCK,0&lt;\r&gt;</pre>	



<p>&lt;Block&gt; must be in the range of <math>0 \leq BC-1</math>. (See AT+S)</p>	<p>ERROR="Block already locked"&lt;\r&gt;</p>
<p><b>Get Lock Status</b> Gets the security settings of all blocks on the tag as a list of 1s (write protected) and 0s (no protection)</p>	<p>AT+LOCK,200&lt;\r&gt; ERROR&lt;\r&gt;</p> <p>AT+LOCK?&lt;\r&gt; +LOCK=10000001000000000000000000000000&lt;\r&gt; OK&lt;\r&gt;</p>
<p>Only valid for ISO15693 tags.</p>	

### 3.1.3 AT+NDEF

Command	Availability	See also
AT+NDEF ,[<UID>],[<type>=<value>[,...]]	All KTS RFID readers with FW 3.17 or higher	
Description	Examples	
<p><b>Write NDEF messages</b> Formats and writes NDEF messages onto an ISO15693 transponder.</p> <p>This NDEF message can be of the types</p> <ul style="list-style-type: none"> <li>URL The message represents an URI of the format <a href="http://www.&lt;value&gt;">http://www.&lt;value&gt;</a></li> <li>URI The message represents an URI of any format. &lt;value&gt; needs to be formatted properly including the protocol and other parameters</li> <li>TEL The message represents an URI of the format tel:&lt;value&gt;</li> <li>MIME The message represents a custom message of the MIME type specified in the first line of &lt;value&gt;. Lines are separated</li> </ul>	<p>AT+NDEF,URI=kts-systeme.de&lt;\r&gt; OK&lt;\r&gt;</p> <p>AT+NDEF, E004015002CCB3B2,URI=http://www.kts-systeme.de&lt;\r&gt; OK&lt;\r&gt;</p> <p>AT+NDEF,TEL=+49555599110&lt;\r&gt; OK&lt;\r&gt;</p> <p>AT+NDEF,MIME=text/text\nHello World!&lt;\r&gt; OK&lt;\r&gt;</p>	



with \n (sent as text, not as special <\n> character)

Only valid for ISO15693 tags.




**Info:**

NDEF messages can be used to trigger actions within an NDEF capable device. I.e. let an NDEF (NFC) compatible smart phone open a specific webpage.

**3.1.4 AT+R, AT+r**

Command	Availability	See also
AT+R,<Block>	All KTS RFID readers	AT+Read
AT+R,<Block>[,<Block Count>]		
AT+R,[<UID>],<Block>[,<Block Count>]		
AT+R?		

Description	Examples																														
<p><b>Read Single Block</b></p> <p>Reads data from one specific block &lt;Block&gt; in the user data space of a tag. Returns the amount of data in the block (=BS) as <b>ASCII</b> value and the data itself in <b>binary</b> format.</p>  <p><b>Caution:</b> &lt;Block&gt; must be in the range of <math>0 \leq BC-1</math>. (See AT+S)</p>	<table border="1"> <thead> <tr> <th colspan="4">0</th> <th colspan="4">1</th> <th colspan="2">2</th> </tr> </thead> <tbody> <tr> <td>0</td><td>1</td><td>2</td><td>3</td> <td>4</td><td>5</td><td>6</td><td>7</td> <td>8</td><td>...</td> </tr> <tr> <td>I</td><td>N</td><td>F</td><td>O</td> <td>B</td><td>L</td><td>C</td><td>K</td> <td>!</td><td>...</td> </tr> </tbody> </table> <pre> AT+R,0&lt;\r&gt; +DATA 4:INFO&lt;\r&gt; OK&lt;\r&gt;  AT+R,0,2&lt;\r&gt; +DATA 8:INFOBLCK&lt;\r&gt; OK&lt;\r&gt;                     </pre>	0				1				2		0	1	2	3	4	5	6	7	8	...	I	N	F	O	B	L	C	K	!	...
0				1				2																							
0	1	2	3	4	5	6	7	8	...																						
I	N	F	O	B	L	C	K	!	...																						



**Read Multiple Blocks**

Reads data from several <Block Count> blocks in the user data space starting with block number <Block> and returns the number of delivered bytes (= <Block Count> × BS) as an **ASCII** value and the data itself in **binary format**.

**Caution:**

<Block> must be in the range of  $0 \leq BC-1$ .  
<Block Count > must be in the range of  $1 \leq 31$ .

**Detailed explanations:**

In cases where <Block Count> is greater than BC, the data will be read from user data space starting at block number <Block> until block number BC-1 is reached and the collected data will be returned to the host.

The first access to the user data will be performed by means of the ISO15693 command *Read Multiple Blocks* (0x23). In cases where this approach fails the reader will fall back to several *Read Single Block* (0x20) commands until all required data is collected. This strategy does not affect the output format of the AT command!

**Read Single/Multiple Block(s), addressed**

Allows addressed access to a specific tag within a whole bunch of tags present in the reading area. Only valid for ISO15693 tags.

```
AT+r,E004015002CCB3B2,0<\r>
+DATA 4:INFO<\r>
OK<\r>
```

Alternatively:

```
AT+r,0<\r>
+DATA 4:INFO<\r>
OK<\r>
```

```
AT+r,0,2<\r>
+DATA 8:INFOBLCK<\r>
OK<\r>
```


```
AT+r,E004015002CCB3B2,0<\r>
+DATA 4:INFO<\r>
OK<\r>
```

```
AT+R?<\r>
+TAGS=2<\r>
+UID=E00402000058913D,+MEMSIZE=112<\r>
+UID=E00801CE2084565A,+MEMSIZE=2000<\r>
OK<\r>
```



3.1.5 AT+Read

Command	Availability	See also
<code>AT+Read,&lt;Byte&gt;</code>	All KTS RFID readers	AT+R, AT+r
<code>AT+Read,&lt;Byte&gt;[,&lt;Byte Count&gt;]</code>		
<code>AT+Read,[&lt;UID&gt;],[&lt;Byte&gt;],[&lt;Byte Count&gt;]</code>		
<code>AT+Read?</code>		

Description	Examples																				
<p><b>Read Data from Tag Memory</b></p> <p>Reads data from the user data space of a tag. Returns the amount of collected data as <b>ASCII</b> value and the collected data itself in <b>binary</b> format. Also designed to determine the size of the user data space (MEMSIZE) in bytes.</p>  <p><b>Caution:</b>                      &lt;Byte&gt; must be in the range of <math>0 \leq \text{MEMSIZE}-1</math>.</p> <p>&lt;Byte Count &gt; must be in the range of <math>1 \leq \text{MEMSIZE}-1</math>.</p> <p>&lt;UID&gt; must be a valid tag UID of an ISO15693 tag. This optional parameter allows selective access to one specific tag within a whole bunch of tags.</p>	<table border="1" style="margin-bottom: 10px;"> <tr> <td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>...</td> </tr> <tr> <td>I</td><td>N</td><td>F</td><td>O</td><td>B</td><td>L</td><td>C</td><td>K</td><td>!</td><td>...</td> </tr> </table> <p><code>AT+Read,0&lt;\r&gt;</code>  <code>+DATA 1:I&lt;\r&gt;</code>  <code>OK&lt;\r&gt;</code></p> <p><code>AT+Read,1,3&lt;\r&gt;</code>  <code>+DATA 3:NFO&lt;\r&gt;</code>  <code>OK&lt;\r&gt;</code></p> <p><code>AT+Read,0,9&lt;\r&gt;</code>  <code>+DATA 8:INFOBLCK!&lt;\r&gt;</code>  <code>OK&lt;\r&gt;</code></p> <p><code>AT+Read,E00402000058913D,0,9&lt;\r&gt;</code>  <code>+DATA 8:INFOBLCK!&lt;\r&gt;</code>  <code>OK&lt;\r&gt;</code></p> <p><code>AT+Read?&lt;\r&gt;</code>  <code>+TAGS=2&lt;\r&gt;</code>  <code>+UID=E00402000058913D,+MEMSIZE=112&lt;\r&gt;</code>  <code>+UID=E00801CE2084565A,+MEMSIZE=2000&lt;\r&gt;</code>  <code>OK&lt;\r&gt;</code></p>	0	1	2	3	4	5	6	7	8	...	I	N	F	O	B	L	C	K	!	...
0	1	2	3	4	5	6	7	8	...												
I	N	F	O	B	L	C	K	!	...												






3.1.6 AT+S

Command	Availability	See also
<b>AT+S</b>	All KTS RFID readers	
<b>AT+S[,&lt;UID&gt;]</b>		
Description	Examples	
<b>Get System Information</b>		
<p>Reports a 64-Bit long unique ID, Data Storage Format Identifier (DSFI), Application Field Identifier (AFI), block count (BC) and block size (BS) of the user data space and some manufacturer specific data (IC) for ISO15693 compliant tags.</p> <p>In case no tag is found or the tag does not support the GetSystemInformation-Command (0x2B) only ERROR will be reported.</p>	<pre> AT+S&lt;\r&gt; +UID=E004015002CCB3B2,DSFID=00,AFI=00,BC=28,BS=4,IC=01&lt;\r&gt; OK&lt;\r&gt;  AT+S,E004015002CCB3B2&lt;\r&gt; +UID=E004015002CCB3B2,DSFID=00,AFI=00,BC=28,BS=4,IC=01&lt;\r&gt; OK&lt;\r&gt;  AT+S,E000000000000123&lt;\r&gt; ERROR&lt;\r&gt;                     </pre>	

3.1.7 AT+W, AT+w

Command	Availability	See also
<b>AT+W,&lt;Block&gt;,&lt;Byte Count&gt;&lt;\r&gt;&lt;Data&gt;</b>	All KTS RFID readers	AT+Write
<b>AT+w,&lt;Block&gt;,&lt;Byte Count&gt;&lt;\r&gt;&lt;Data&gt;</b>		
<b>AT+W?</b>		
Description	Examples	
<b>Write Single Block</b>		
<p>Writes amount &lt;Byte Count&gt; of data &lt;Data&gt; into a single block with the number &lt;Block&gt; in the user data space of a tag.</p>	<pre> AT+W0,4&lt;\r&gt;info OK&lt;\r&gt;  Alternatively:                     </pre>	





**Caution:**  
 <Block> must be in the range of  $0 \leq BC-1$ .  
 <Block Count> must be equal to BS.


```
AT+w0,4<\r>info
OK<\r>
```

```
AT+W?<\r>
+TAGS=2<\r>
+UID=E00402000058913D,+MEMSIZE=112<\r>
+UID=E00801CE2084565A,+MEMSIZE=2000<\r>
OK<\r>
```

### 3.1.8 AT+Write

Command	Availability	See also
AT+Write,<Byte>,<Byte Count><\r><Data>	All KTS RFID readers	AT+W, AT+w
AT+Write,[<UID>,<Byte>,<Byte Count><\r><Data>		
AT+Write?		

Description	Examples
<p><b>Write Data to Tag Memory</b></p> <p>Writes data to the user data space of a tag. Also returns the size of the user data space (MEMSIZE) in bytes.</p>	<pre style="color: red;">AT+Write,0,8&lt;\r&gt;abcd1234 OK&lt;\r&gt;</pre> <pre style="color: red;">AT+Write,E00402000058913D,0,8&lt;\r&gt;abcd1234 OK&lt;\r&gt;</pre> <pre style="color: red;">AT+Write?&lt;\r&gt; +TAGS=2&lt;\r&gt; +UID=E00402000058913D,+MEMSIZE=112&lt;\r&gt; +UID=E00801CE2084565A,+MEMSIZE=2000&lt;\r&gt; OK&lt;\r&gt;</pre>
 <p><b>Caution:</b>                  &lt;Byte&gt; must be in the range of <math>0 \leq MEMSIZE-1</math>.</p>	

The number of bytes in the <Data> field must be equal to the parameter <Byte Count>.

<UID> must be a valid tag UID of a ISO15693 tag.  
This optional parameter allows selective access to one specific tag within a whole bunch of tags.

### 3.1.9 AT+WriteAFI

Command	Availability	See also
<b>AT+WriteAFI,&lt;UID&gt;,&lt;AFI&gt;</b>	All KTS RFID readers with FW 3.17 or higher	AT+W, AT+w AT+A, AT+Inventory
Description	Examples	
<b>Write AFI Field of Tag</b>		
Writes the Application Family Identifier (AFI) on the tag. The card will only respond to inventory requests on AT+I, AT+A or AT+Inventory if the inventory is issued with an API equal to the written value or if the inventory is issued with an AFI of 0.	<pre>AT+WriteAFI,0&lt;/r&gt; OK&lt;\r&gt;</pre>	
Only valid for ISO15693 tags.	<pre>AT+WriteAFI,01&lt;/r&gt; OK&lt;\r&gt;</pre> <pre>AT+WriteAFI,E004020000514170,01 OK&lt;\r&gt;</pre>	

## 3.2 ISO 14443

### 3.2.1 AT+Deselect

Command	Availability	See also
<b>AT+Deselect</b>	All KTS RFID readers Requires FEATURE_14443	AT+Select, AT+Transceive
Description	Examples	

**Deselect Tag**

Deselects and closes an open tag for communication on the ISO14443-4 protocol level.

AT+Deselect<\r>

OK<\r>

AT+Deselect<\r>

ERROR="Feature disabled. Cannot use ISO14443 commands."<\r>

3.2.2 AT+Select

Command	Availability	See also
AT+Select	All KTS RFID readers Requires	AT+Deselect, AT+Tranceive
AT+Select,<UID>	FEATURE_14443	

Description	Examples
-------------	----------

**Select Tag**

Selects and opens a tag for communication on the ISO14443-4 protocol level.

AT+Select<\r>

OK<\r>

AT+Select,10C58711<\r>

OK<\r>

AT+Select<\r>

ERROR="Feature disabled. Cannot use ISO14443 commands."<\r>



**Compatibility:**

Not all ISO 14443 tags are ISO14443-4 compatible. I.e. the

- Mifare – Classic
- Mifare – Ultralight

do not implement all required ISO 14443-4 commands.



### 3.2.3 AT+Transceive

Command	Availability	See also
<b>AT+Transceive,&lt;data&gt;</b>	All KTS RFID readers Requires FEATURE_14443	AT+Select, AT+Deselect
Description	Examples	
<b>Transceive protocol level data</b>		
<p>Sends and receives data to a selected tag through the protocol level.</p> <p></p> <p><b>Info:</b> The data format exchanged on the protocol level is tag dependent. It is common to use ISO 7816 compatible APDUs providing a smartcard interface.</p> <p><b>Compatibility:</b> Not all ISO 14443 tags are ISO14443-4 compatible. I.e. the</p> <ul style="list-style-type: none"> <li>• Mifare – Classic</li> <li>• Mifare – Ultralight</li> </ul> <p>do not implement all required ISO 14443-4 commands.</p>	<pre>AT+Transceive,00A4000000&lt;\r&gt; +TRANSCEIVE=9000&lt;\r&gt; OK&lt;\r&gt;</pre> <pre>AT+Transceive,00A4000000&lt;\r&gt; ERROR="Feature disabled. Cannot use ISO14443 commands."&lt;\r&gt;</pre>	

### 3.2.4 AT+DESFIRE

Command	Availability	See also
<b>AT+DESFIRE,&lt;data&gt;</b>	All KTS RFID readers Requires FEATURE_14443 with FW 3.17 or higher	AT+Select, AT+Deselect AT+Transceive
Description	Examples	
<b>Transceive DESfire protocol level data</b>		

Sends and receives data to a selected tag through the DESfire protocol. Including requesting additional frames and concatenating them as a single response.



**Info:**

Some DESfire commands require additional calculations and data before requesting the additional frame – i.e. calculating the response to authorization requests. These commands can only be issued correctly when using the AT+Transceive command.

```
AT+DESFIRE,6A<\r>
+DESFIRE=020000<\r>
OK<\r>
```

```
AT+DESFIRE,6A<\r>
ERROR="Feature disabled. Cannot use ISO14443
commands."<\r>
```

### 3.2.5 AT+DESFIRE\_FREEMEM

Command	Availability	See also
AT+DESFIRE_FREEMEM	All KTS RFID readers Requires FEATURE_14443 with FW 3.17 or higher	

Description	Examples
-------------	----------

**Receive Version Information**

Gets the memory space left available on a DESfire EV1 card.

```
AT+DESFIRE_FREEMEM<\r>
4160 Bytes free<\r>
```



**Info:**

The available memory might be more as the total memory reported by AT+DESFIRE\_VERSION. AT+DESFIRE\_FREEMEM is more accurate.

### 3.2.6 AT+DESFIRE\_GETAIDS

Command	Availability	See also
<b>AT+DESFIRE_GETAIDS</b>	All KTS RFID readers Requires FEATURE_14443 with FW 3.17 or higher	
Description	Examples	
<b>Get Application Identifier</b>		
Get a list of application identifier (AIDs) on the DESfire EV1 transponder. There might be up to 28 AIDs in the list.	<pre>AT+DESFIRE_GETAIDS&lt;\r&gt; 2 Applications:&lt;\r&gt; +AID 010203&lt;\r&gt; +AID 020304&lt;\r&gt; OK&lt;\r&gt;</pre>	

### 3.2.7 AT+DESFIRE\_GETFIDS

Command	Availability	See also
<b>AT+DESFIRE_GETFIDS</b>	All KTS RFID readers Requires FEATURE_14443 with FW 3.17 or higher	
Description	Examples	
<b>Get File Identifier</b>		
Get a list of file IDs on the DESfire EV1 transponder under the currently selected application. There might be up to 31 FIDs in the list.	<pre>AT+DESFIRE_GETFIDS&lt;\r&gt; 1 Files:&lt;\r&gt; +FID 01 – Data file, 80 Bytes&lt;\r&gt; OK&lt;\r&gt;</pre>	

### 3.2.8 AT+DESFIRE\_SELECTAID

Command	Availability	See also
<b>AT+DESFIRE_SELECTAID,&lt;AID&gt;</b>	All KTS RFID readers Requires FEATURE_14443 with FW 3.17 or higher	
Description	Examples	

**Select application**

Selects the application <AID> and makes it the current application.

```
AT+DESFIRE_SELECTAID,010203<\r>
OK<\r>
```

**3.2.9 AT+DESFIRE\_VERSION**

Command	Availability	See also
<b>AT+DESFIRE_VERSION</b>	All KTS RFID readers Requires FEATURE_14443 with FW 3.17 or higher	
Description	Examples	
<b>Receive Version Information</b>		
Gets the version information as reported by a DESfire EV1 card.	<pre>AT+DESFIRE_VERSION&lt;\r&gt; NXP Smart MX, 1.01 8192 Bytes&lt;\r&gt;</pre>	

**3.2.10 AT+ISO14443A**

Command	Availability	See also
<b>AT+ISO14443A,&lt;Frame&gt;</b>	All KTS RFID readers with FW 3.17 or higher Requires FEATURE_14443	AT+ISO15693, AT+ISO14443B
Description	Examples	
<b>Exchange an ISO14443A Frame</b>		
Exchanges a ISO14443A command and response pair. This can be used to issue otherwise unimplemented commands to ISO14443A tags.	<pre>AT+ISO14443A,026A&lt;\r&gt; +ISO14443A=02000160C2 &lt;\r&gt; OK&lt;\r&gt;</pre>	
<frame> consists of a sequence of bytes to be sent as a stream of 2 character hexadecimal values. SOF, EOF and CRC16 will be generated and shall not be included in <frame>		
Only valid for ISO14443A tags.		





3.2.11 AT+ISO14443B

Command	Availability	See also
<b>AT+ISO14443B,&lt;Frame&gt;</b>	All KTS RFID readers with FW 3.17 or higher Requires FEATURE_14443	AT+ISO15693, AT+ISO14443A
Description	Examples	
<p><b>Exchange an ISO14443B Frame</b></p> <p>Exchanges a ISO14443B command and response pair. This can be used to issue otherwise unimplemented commands to ISO14443B tags.</p> <p>&lt;frame&gt; consists of a sequence of bytes to be sent as a stream of 2 character hexadecimal values. SOF, EOF and CRC16 will be generated and shall not be included in &lt;frame&gt;</p> <p>Only valid for ISO14443B tags.</p>	<pre>AT+ISO14443B,0200A4000000&lt;\r&gt; +ISO14443B=029000 &lt;\r&gt; OK&lt;\r&gt;</pre>	

4 Reader Functions

The class of reader functions contains all commands which are designed for configuration and maintenance of the KTS RFID readers. Some of the commands are not supported by all readers. Some may also cause damage if they are not used in the proper way!

4.1 AT+ANT

Command	Availability	See also
<b>AT+ANT=&lt;xx&gt;</b>	MidRange Reader + Mux,	Application Note: "AN002 – Antenna Mux Design"
<b>AT+ANT?</b>	RFID OEM Module + Mux, [USB Short Range Reader]	
Description	Examples	
<p><b>Antenna Selection</b></p> <p>If the reader is used in conjunction with an antenna multiplexer this command allows the selection of the active antenna output.</p>	<pre>AT+ANT=8&lt;\r&gt; OK&lt;\r&gt;</pre>	



It returns also the number of the currently activated antenna and the total amount of antennae presently available.

```
AT+ANT?<\r>
+ANT=8/16<\r>
OK<\r>
```




**Info:**

USB ShortRange reader does not comprise the possibility to connect an antenna multiplexer. AT+ANT? returns always 1/1.

## 4.2 AT+Config

Command	Availability	See also
AT+Config,<address>=<hexvalue>	All KTS RFID readers	
AT+Config,<address>?		

Description	Examples								
<p><b>RFID Reader Config</b></p> <p>Allows writing to and reading from the non-volatile configuration registers of the reader. These values define the initial behavior of the readers.</p>	<pre>AT+Config,4=01&lt;\r&gt; OK&lt;\r&gt;</pre> <pre>AT+Config,0?&lt;\r&gt; +CONFIG 0:01&lt;\r&gt; OK&lt;\r&gt;</pre>								
 <p><b>Caution:</b> Writing wrong values to the registers may cause permanent damage to the device!</p>									
<table border="1"> <thead> <tr> <th>Address</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0x00</td> <td>Interface Mode Register</td> </tr> <tr> <td>0x01</td> <td>UART Config Register</td> </tr> <tr> <td>0x02</td> <td>RF Power &amp; Modulation Control Register</td> </tr> </tbody> </table>	Address	Description	0x00	Interface Mode Register	0x01	UART Config Register	0x02	RF Power & Modulation Control Register	
Address	Description								
0x00	Interface Mode Register								
0x01	UART Config Register								
0x02	RF Power & Modulation Control Register								



0x03	External Amplifier Output Power Control Register	
0x04	Scan Mode Flags Register 1	
0x05	Scan Mode Flags Register 2	
0x06	Proximity Sensor Sensitivity Level Control Register	
0x0A	Antenna Multiplexer Mode	
0x0B	Antenna Multiplexer Physical Ports	
0x0C	Antenna Multiplexer Logical Ports	
0x0D	LED Multiplexed Mode	
0x0E	LED Multiplexer Physical Ports	
0x0F	LED Multiplexer Logical Ports	
0x80 - 0x9f	HID Output Control Register	

#### 4.2.1 Interface Mode Register (0x00)

<b>Function:</b> Configuration of the reader interface							
<b>Default:</b> <b>RFID OEM = 0x3f, MRR = 0x04, SRR = 0x01</b>							
B7	B6	B5	B4	B3	B2	B1	B0
RFU	HID Enable	UART Enable	USB Enable/USB Code				
	Enable/Disable HID mode, check registers 0x80 – 0x9f for further HID settings.	Enable/Disable UART mode, check register 0x01 for further UART settings.	Enable/Disable USB mode, 0x1f: USB disabled, 0x00 – 0x0f: USB device code (0x01=SRR, 0x04=MRR) All other values: RFU				



**Caution:** Changing this register might render the reader unresponsive. Change this register with intense care. To avoid unintended changes to this register it is password protected. Append “,iamreallysure” to the config command to set this register.



**Info:** The HID Enable bit is additionally protected by the FEATURE\_HID and will report an error if set without this feature.



#### 4.2.2 UART Config Register (0x01)

<b>Function:</b> Configuration of the UART interface							
<b>Default:</b> RFID OEM = 0x05, MRR = 0x05, SRR = 0x05							
B7	B6	B5	B4	B3	B2	B1	B0
RFU	Stop Bits	Parity		Baud rate			
	0: 1 stop bit  1: 2 stop bits	0: none 1: odd 2: even 3: RFU		0: 4800 baud 1: 9600 baud 2: 19200 baud 3: 38400 baud 4: 57600 baud 5: 115200 baud ≥6: RFU			

This configuration is not applied on the virtual UART (USB-CDC).

#### 4.2.3 RF Power & Modulation Control Register (0x02)

<b>Function:</b> Configuration of the output power and the modulation depth							
<b>Default:</b> 0x04							
B7	B6	B5	B4	B3	B2	B1	B0
Amp Mod	Modulation ISO14443B		Modulation ISO14443A		TRF Power	Modulation ISO15693	
The modulation is generated by an external amplifier.	0: OOK 1: ASK 10% 2: ASK 22% 3: ASK 30%		0: OOK 1: ASK 10% 2: ASK 22% 3: ASK 30%		0: half 1: full	0: OOK 1: ASK 10% 2: ASK 22% 3: ASK 30%	

#### 4.2.4 External Amplifier Output Power Control Register (0x03)

<b>Function:</b> Configuration of the output power generated by an external power amplifier							
<b>Default:</b> SRR = 0x00, RFID OEM = 0x00, MRR = 0x0A							
B7	B6	B5	B4	B3	B2	B1	B0
RF output power level generated by an external power amplifier							
0x00: 0W (or disabled) – 0xff: 25.5W (or max power available) (0.1W/digit)							

4.2.5 Scan Mode Flags Register 1 (0x04)

**Function:** Configuration of the flags for the default scan mode 1

**Default:** 0x13

B7	B6	B5	B4	B3	B2	B1	B0
DATA	SHORT	ANT	RSSI	RFU	TYPE	AC	Enable



**Info:**

The meaning of the fields is described in section 0 AT+Scan.

4.2.6 Scan Mode Flags Register 2 (0x05)

**Function:** Configuration of the flags for the default scan mode 2

**Default:** 0x20

B7	B6	B5	B4	B3	B2	B1	B0
ISO14443B	ISO14443A	ISO15693	RFU	RFU	RFU	RFU	MULTI

**B5, B6, B7** activate the detection of corresponding ISO standard tags.

4.2.7 Proximity/Touch sensitivity

**Function:** Selects the sensitivity with which the proximity/touch sensor reports changes and activates the RF output.

**Default:** 0x00

B7	B6	B5	B4	B3	B2	B1	B0
n							
0: Disable proximity/touch sense. The RF output is enabled by AT+RF							
1...255: Enable proximity/touch sense. The RF field will be enabled, if within 50 ms a change of n/2,56 percent was detected.							

**B5, B6, B7** activate the detection



#### 4.2.8 Antenna Multiplexer Mode (0x0A)

<b>Function:</b> Configuration of the antenna multiplexing mode							
<b>Default:</b> 0x00							
B7	B6	B5	B4	B3	B2	B1	B0
RFU	RFU	RFU	RFU	RFU	RFU	Inverse Level	Enable
						0: active high 1: active low	0: Antenna Multiplexer disabled 1: Antenna Multiplexer enabled

#### 4.2.9 Antenna Multiplexer Physical Ports (0x0B)

<b>Function:</b> Defines the number of physical connected antenna multiplexer ports							
<b>Default:</b> 0x00							
B7	B6	B5	B4	B3	B2	B1	B0
Number of physical connected multiplexer ports							

#### 4.2.10 Antenna Multiplexed Logical Ports (0x0C)

<b>Function:</b> Defines the number of logical antenna multiplexer ports							
<b>Default:</b> 0x00							
B7	B6	B5	B4	B3	B2	B1	B0
Number of logical multiplexer ports							

#### 4.2.11 HID Output Control Register (0x80 – 0x9f)

All USB enabled KTS RFID Reader can be used as a HID Device (Boot Keyboard). The HID Mode allows the user to customize the keystrokes sent to the USB Host when a tag is detected.

**Info:**



The keyboard implements an english key layout to access most of the ASCII characters. If the Host is set to use a keyboard with a different language setting some ASCII characters will be mapped to a different keystroke. I.e. the ASCII 'z' will be mapped as 'y' on a german keyboard setting.



The HID Output Control Registers are a set of 16 parameter blocks designing the format of the output. Each parameter block consists of 2 config register (an Even and an Odd) defining the type of the block and one 12 bit parameter.

**4.2.11.1 Even HID output control**

<b>Function:</b> Defines an output format parameter block when used in HID mode							
<b>Default:</b> 0x00							
<b>B7</b>	<b>B6</b>	<b>B5</b>	<b>B4</b>	<b>B3</b>	<b>B2</b>	<b>B1</b>	<b>B0</b>
<b>Blocktype</b>				<b>Parameter high</b>			
<ul style="list-style-type: none"> <li>• Undefined block (0)</li> <li>• UID block(1)</li> <li>• Start-of-memory block (2)</li> <li>• End-of-memory, hexadecimal block (3)</li> <li>• End-of-memory, direct block (4)</li> <li>• Separator block (5)</li> <li>• End block (15)</li> </ul>				Highest 4 bits of the 12 bits wide block parameter			

**4.2.11.2 Odd HID output control**

<b>Function:</b> Defines an output format parameter block when used in HID mode							
<b>Default:</b> 0x00							
<b>B7</b>	<b>B6</b>	<b>B5</b>	<b>B4</b>	<b>B3</b>	<b>B2</b>	<b>B1</b>	<b>B0</b>
<b>Parameter low</b>							
Lowest 8 bits of the 12 bits wide block parameter							

Beginning with the first parameter block the output is defined. If the first block is an Undefined block (0), the default output format <UID><\r> is used. Otherwise each block appends to the output

The blocktype selects which keystrokes are sent to the USB host.

1. UID block, Parameter: ignored  
The UID is passed as keyboard strokes.
2. Start-of-memory block, Parameter: Memory address in bytes  
No output is generated. The start of a memory output is prepared.
3. End-of-memory block, hexadecimal, Parameter: Memory end address, last byte to output  
The memory from memory start address to the end address is passed as keystrokes representing the hexadecimal values (i.e. '010203040506')
4. End-of-memory block, direct, Parameter: Memory address of the last byte to output  
The memory from memory start address to the end address is passed as keystrokes for the memory stored ASCII character.



- 5. Separator block, Parameter: Character (ASCII code number) used as separator  
Sends a single keystroke for the specified ASCII character
- 15. End block, Parameter: ignored

**Example output configuration**

Address	Odd/Even	Value	Keystrokes
0x80	Even	0x10	E00402000058913D
0x81	Odd	0x00	
0x82	Even	0x50	<\t>
0x83	Odd	0x09	
0x84	Even	0x20	414243
0x85	Odd	0x00	
0x86	Even	0x30	
0x87	Odd	0x02	,
0x88	Even	0x50	
0x89	Odd	0x44	ABC
0x8A	Even	0x20	
0x8B	Odd	0x00	
0x8C	Even	0x40	<\r>
0x8D	Odd	0x02	
0x8E	Even	0x50	
0x8F	Odd	0x0D	
0x90	Even	0xF0	
0x91	Odd	0x00	

### 4.3 ATE

Command	Availability	See also
<b>ATE</b>	All KTS RFID readers	
Description	Examples	
<p><b>Echo</b></p> <p>Enables (1) and disables (0) echo. When enabled all typed characters will be forwarded to the console. This function is intended for test purposes and not needed for normal operation.</p>	<pre>ATE1&lt;\r&gt; OK&lt;\r&gt;  ATE0&lt;\r&gt; OK&lt;\r&gt;</pre>	





#### 4.4 AT+FlashUpdate!

Command	Availability	See also
<b>AT+FlashUpdate!</b>	All KTS RFID readers	Application Note: "AN001 – KTS RFID Reader Flash Update"
Description	Examples	
<b>Flash Update</b>		
Initiates firmware update.	<pre>AT+FlashUpdate!&lt;\r&gt; OK&lt;\r&gt;</pre>	

#### 4.5 ATI

Command	Availability	See also
<b>ATI</b>	All KTS RFID readers	
Description	Examples	
<b>Product Information</b>		
Returns product and firmware information.	<pre>ATI&lt;\r&gt; KTS GmbH - RFID HF USB (CDC) ShortRange Reader&lt;\r&gt; FW 3.05, Build 22, May 22 2012, 10:36:58&lt;\r&gt; S/N 03081136&lt;\r&gt; OK&lt;\r&gt;</pre>	

#### 4.6 AT+P

Command	Availability	See also
<b>AT+P=&lt;1 2&gt;</b>	USB Short Range Reader,	
<b>AT+P?</b>	RFID OEM Module	
Description	Examples	
<b>Select Output Power</b>		
Selects the RF output power:	<pre>AT+P=1&lt;\r&gt; OK&lt;\r&gt;</pre>	
<b>1</b> – Half (~ 100mW)		



**2 – Full (~ 200mW)**

RFID Reader with an additional amplifier might allow a greater output power range:

- 1 – ~ 100mW
- 2 – ~ 200mW
- 3 – ~ 300mW
- ...
- 10 – ~ 1000mW
- ...
- 40 – ~ 4000mW

```
AT+P?<\r>
+RFPOWER=1<\r>
OK<\r>
```

AT+P? returns the currently set output power value.



**Caution:**

The selection of the output power directly influences the output impedance of the RFID ASIC. Since the matching network remains fix, the output power mentioned above does not necessarily correspond to the power delivered to the antenna!

**4.7 AT+RF**

Command	Availability	See also
AT+RF=<0 1>	All KTS RFID readers	
AT+RF?		
Description	Examples	
<b>Enable/Disable RF Field.</b>		
Enables or disables the RF field. Returns the status of the RF field.	<pre>AT+RF=1&lt;\r&gt; OK&lt;\r&gt;  AT+RF?&lt;\r&gt;</pre>	




```
+RF=1<\r>
OK<\r>
```

### 4.8 ATS

Command	Availability	See also
<b>ATS&lt;duration&gt;</b>	MidRange Reader	
Description	Examples	
<b>Sound</b>		
Creates a sound with the duration of <duration> ms.	<b>ATS250&lt;\r&gt;</b>	<b>OK&lt;\r&gt;</b>

### 4.9 AT+Touch?

Command	Availability	See also
<b>AT+Touch?</b>	Desktop Reader	
Description	Examples	
<b>Proximity/Touch Sense</b>		
Returns the current value of the capacitive proximity and touch sensor.	<b>AT+Touch?&lt;\r&gt;</b>	<b>+TOUCH=61&lt;\r&gt;</b>
The sensor returns values from 0 to 65000, where 0 represents the nearest and 65000 the most far distance to a capacitive recognized object (like a hand or a RFID tag)	<b>OK&lt;\r&gt;</b>	
 <b>Info:</b> This value drifts with environmental changes like humidity and temperature.		



## 4.10 ATZ

Command	Availability	See also
<b>ATZ[&lt;delay&gt;]</b>	All KTS RFID readers	
Description	Examples	
<p><b>Reset</b></p> <p>Performs a hardware reset of the component. Either instantly (no parameter) or after a delay of &lt;delay&gt; ms.</p>	<pre>ATZ&lt;\r&gt; OK&lt;\r&gt;  ATZ1000&lt;\r&gt; OK&lt;\r&gt;</pre>	

## 5 Document History

Version	FW ≥	Date	List of changes	Author
1.0	1.0	18.06.2010	Initial release	GrK
1.0.1	1.0	24.06.2010	spelling erros removed	GrK,MiM
1.1	1.1	30.10.2010	new functions	GrK,TeS
1.5	2.0	31.01.2011	new functions and updates added (ISO14443A)	GrK,TeS
1.6	2.15	20.03.2011	parameter update	GrK,TeS
2.0	3.00	30.11.2011	new functions added (ISO14443B)	TeS,MiM
2.1	3.00	12.02.2012	new functions added (HID)	TeS,MiM
2.2	3.05	24.06.2012	parameter update	TeS,MiM
2.3	3.05	16.08.2012	spelling errors removed	TeS,MiM
2.4	3.17	20.04.2015	new functions added and parameters of AT+, AT+A and AT+Inventory added, example for AT+A corrected	TeS,MiM



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