



BlueMod+S42/ADC/TWI AT Command Reference

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APPLICABILITY TABLE

PRODUCTS

- BLUEMOD+S42/ADC/TWI

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1. INTRODUCTION

1.1. Scope

This document specifies the command interface for the BlueMod+S42/ADC/TWI firmware.

1.2. Audience

This document is intended for Telit customers, especially system integrators, about to implement Bluetooth modules in their application.

1.3. Contact and Support Information

For general contact, technical support services, technical questions and report documentation errors contact Telit Technical Support at:

- TS-SRD@telit.com

Alternatively, use:

<https://www.telit.com/contact-us>

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<https://www.telit.com>

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates feedback from the users of our information.

1.4. 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 points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.



Tip or Information – Provides advice and suggestions that may be useful when integrating the module.

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.

1.5. Related Documents

- [1] BlueMod+S42 Hardware User Guide, 1VV0301303
- [2] BlueMod+S42 Software User Guide, 1VV0301318
- [3] Bluetooth 4.0 Core Specification
- [4] AIOS Profile Specification
- [5] UICP+ UART Interface Control Protocol, 30507ST10756A

2. FEATURES

The BlueMod+S42/ADC/TWI supports AT command mode.

In the factory-default configuration the BlueMod+S42/ADC/TWI is set to AT command mode using a UART baud rate of 115,200 bps, 8 data bits, no parity, 1 stop bit (8N1) and hardware flow control.

Each command line consists of a prefix, a body and a terminator.

All command lines begin with the prefix AT (ASCII 065, 084) or at (ASCII 097, 116).

The body is a string of characters in the ASCII range 032-255. Control characters other than <CR> (carriage return; ASCII 013) and <BS> (back space; ASCII 008) in a command line are ignored.

Note: The control characters are configurable via S registers.

- Carriage return character (CR) S3 register
- Line feed character (LF) S4 register
- Back space character (BS) S5 register

The terminator is <CR>.

There is no distinction between upper-case and lower-case characters. A command line can have a maximum length of 80 characters. It is automatically discarded if the input is longer. Corrections are made using <BS>. Multiple commands on the same command line are not allowed.

Commands have the following syntax:

Syntax	Description
AT<command>=<value><CR>	Write the value of the command
AT<command>?<CR>	Read the value of the command



Exceptions of this syntax are marked separately.

Responses are sent back to the host and can be any of the following:

Responses	Description
<CR><LF>value<CR><LF>	Current value
<CR><LF> list entry 1<CR><LF> list entry 2<CR><LF> ... list entry n<CR><LF> <CR><LF>	List value (e.g. AT+BNDLIST)
<CR><LF>OK<CR><LF>	Successful final message
<CR><LF>ERROR<CR><LF>	Error message, command not supported

3. COMMAND SUMMARY

The description of the commands is structured into the following parts:

- General commands
- Bluetooth Low Energy (BLE) specific commands

The factory-default values of the commands are marked using the bold letter format.

3.1. General

%B	Baud Rate
-----------	------------------

AT syntax: **AT%B<value>**

This command determines the baud rate for the UART.

The following standard baud rates are supported:

Value	Description
4	9,600 bps
5	19,200 bps
6	38,400 bps
7	57,600 bps
8	115,200 bps
9	230,400 bps
22	460,800 bps
23	921,600 bps

Additionally to the standard baud rates described above, it is possible to set the following baud rates.

Value	Description
1200	1,200 bps
2400	2,400 bps
4800	4,800 bps
9600	9,600 bps
14400	14,400 bps
19200	19,200 bps
28800	28,800 bps
38400	38,400 bps
57600	57,600 bps
76800	76,800 bps
115200	115,200 bps
230400	230,400 bps
250000	250,000 bps
460800	460,800 bps
921600	921,600 bps
1000000	1,000,000 bps

To set a baud rate write the desired value in the command.

Examples:

AT%B9	Set baud rate to 230,400 bps
AT%B250000	Set baud rate to 250,000 bps



Information regarding the deviation of the real baud rate to the value set can be found in the *BlueMod+S42 Hardware User Guide* [1].

&F

Load Factory Defaults

AT syntax: **AT&F<value>**

The factory-default values will be loaded. For storing values in non-volatile memory, use the **AT&W** command.

Value	Description
0	Set all parameters except bndlist to factory defaults
1	Set all parameters to factory defaults

When **AT+LEPRIVACY=2** is active (Link Layer Privacy enabled) the **AT&F1** command generates a new Identity Resolving Key (IRK). This key is used to calculate the local random resolvable address and exchanged during bonding. By changing the IRK all previously bonded peer devices are no longer able to resolve the local random resolvable address.



In case of value=1 the non volatile bonding information will be deleted. Some restored values require an additional reset to get active (e.g. AT+UICP).

&W Store Active Configuration

AT syntax: **AT&W**

The active configuration is stored in non-volatile memory.

+ADCREF Set ADC Reference Source

AT syntax: **AT+ADCREF=<selector>,...**

This command sets the ADC reference source and prescaling factor.

The settings defined with this command will become persistently stored with the **AT&W** command.

The settings defined with this command will become active during the next system startup if saved persistently.

Additional mandatory parameters depend on the value of <selector>:

<selector> = int:

AT+ADCREF=int,p=<prescaler>

<selector> = vddq:

AT+ADCREF=vddq,p=<prescaler>,v=<refvolt>

Selector	Description
int	Internal reference voltage 600 mV is used (default)
vddq	Voltage on pin VDD divided by 4 is used as reference voltage

Parameter <prescaler> will select the factor used to scale down the input voltage before it is exposed to the internal ADC:

Prescaler	Description
1	Input voltage prescaler is 1/3 (default)
3	Input voltage prescaler is 1
4	Input voltage prescaler is 1/6
5	Input voltage prescaler is 1/5
6	Input voltage prescaler is 1/4
7	Input voltage prescaler is 1/2
8	Input voltage prescaler is 2
9	Input voltage prescaler is 4

Refvolt	Description
Value	Reference voltage (VDD/4) in mV if <selector> = vddq Valid range is 0 to 975 (see notes on general constraints below)

The maximum input voltage on the analog input AIN depends on various parameters.

General constraints:

- The analog IO must not be exposed to higher voltage than $VDD + 0.3\text{ V}$ and not higher than 3.9 V if $VDD > 3.6\text{ V}$.

Depending on the selected reference voltage source additional constraints apply.

<selector> = int:

- Maximum input voltage on the analog input AIN depends on the <prescaler> value:
 - <prescaler> = 1: $1.8 (=0.6/(1/3))\text{ V}$
 - <prescaler> = 3: $0.6 (=0.6/(3/3))\text{ V}$
 - <prescaler> = 4: $3.6 (=0.6/(1/6))\text{ V}$, but see general constraint above

<selector> = vddq:

- Maximum input voltage on the analog IO depends on the <prescaler> value and the supply voltage VDD:
 - <prescaler> = 1: $3/4 * VDD (VDD/4)/(1/3)\text{ V}$
 - <prescaler> = 3: $1/4 * VDD (VDD/4)/(3/3)\text{ V}$
 - <prescaler> = 6: $VDD (VDD/4)/(1/4)\text{ V}$

+ADCSR	Set ADC Sample Rate
---------------	----------------------------

AT syntax: **AT+ADCSR=<sample rate>**

This command sets the ADC sample rate.

The settings defined with this command will become persistently stored with the **AT&W** command.

The settings defined with this command will become active instantly in case ADC sampling is not active or after the next ADC sample in case ADC sampling is active.

Sample rate	Description
0	Sample on request only (default)
5...2000	Sample rate in ms



To configure mean value calculation to reduce signal noise see command AT+ADCSM.

+ADCSM	Set Number of ADC Samples for Mean Value Calculation
---------------	---

AT syntax: **AT+ADCSM=<number of samples>**

This command specifies the number of ADC samples used to calculate a mean value.

The settings defined with this command will become persistently stored with the **AT&W** command.

The settings defined with this command will become active instantly; no system restart is required for activation.

If this command is used to define a number of ADC samples, the new configuration will be active for the next mean value calculation.

Number of samples	Description
Value	Number of samples used for mean value calculation. Valid range is 1 to 16, Default is 1



To configure sampling rate see command ADCSR.

+ADCTHLD	Set ADC Threshold Value
-----------------	--------------------------------

AT syntax: **AT+ADCTHLD=<threshold>,edge=<dir>**

This command defines a threshold for an ADC value and the type of action to be taken when the value is reached.

The settings defined with this command will become persistently stored with the **AT&W** command.

The settings defined with this command will become active instantly; no system restart is required for activation.

If this command is used to define a threshold value, an alarm will be instantaneously generated.

Threshold	Description
Value	Threshold value in mV Valid range is 0 to 3900

Dir	Description
r	Mean voltage rising above threshold triggers alarm
f	Mean voltage falling below threshold triggers alarm
c	Mean voltage crossing threshold triggers alarm
d	Threshold detection disabled (threshold value is ignored) (default)



To reduce noise of the measured voltage the mean voltage calculation mechanism can be used.

To configure mean value calculation see command +ADCSM in this document.

Behavior for dir=r:

In case the dir (direction) parameter is configured to “r” (rise) the alarm will be triggered once as soon as the current mean voltage rises to or above the configured threshold value.

To trigger the next alarm the current mean voltage must fall below the configured threshold value first.

Behavior for dir=f:

In case the dir (direction) parameter is configured to “f” (fall) the alarm will be triggered once as soon as the current mean voltage falls to or below the configured threshold value.

To trigger the next alarm the current mean voltage must rise above the configured threshold value first.

Behavior for dir=c:

In case the dir (direction) parameter is configured to “c” (cross) the alarm will be triggered once as soon as the current mean voltage crosses the configured threshold value.

So if the current mean voltage is below the configured threshold value the next alarm will be triggered when the voltage rises above the configured threshold value. If the current mean voltage is above the configured threshold value the next alarm will be triggered when the voltage falls below the configured threshold value.

Behavior for dir=d:

In case the dir (direction) parameter is configured to “d” (disabled) the alarm will be triggered for every new mean voltage calculated. The configured threshold value will be ignored.

+BIOCAP SSP I/O Capabilities

AT syntax: **AT+BIOCAP=<value>**

This command sets the input and output capabilities of the device used for SSP.

The settings defined with this command will be reset to default configuration by activating the CNF-RES# hardware signal.

Value	Description	Related commands	Related events
0	Display only	n.a.	SSPPIN
1	Display Yes/No	+BSSPCONF (secure connection)	SSPPIN (LE legacy pairing) SSPCONF (secure connection)
2	Keyboard only	+BSSPPIN	SSPPIN
3	No input no output	n.a.	n.a.
4	Display and keyboard	+BSSPPIN (LE legacy pairing) +BSSPCONF (secure connection)	SSPPIN (LE legacy pairing) SSPCONF (secure connection)

+BNAME Local Device Name

AT syntax: **AT+BNAME=<name>**

This command allows the modification of the local device name. The device name is shown on a remote Bluetooth device during device/service discovery. It is limited to 19 characters.

The device name can contain a format element to include the device’s own address or parts of it in the name.

In BLE advertising the name is truncated to the first 8 characters.

Format: “%[<s>][<d>]a”

“%”	Identifier start format element
<s>	Character separator on byte order (optional)
<d>	Number (1-12) of digits included in device name (optional, default is 4)
“a”	Identifier end format element

Examples: Device address = “0123456789AB”

AT+BNAME=ADC42 %2a	Display on remote end: ADC42 AB
AT+BNAME=ADC42 %4a	Display on remote end: ADC42 89AB
AT+BNAME=ADC42 %:3a	Display on remote end: ADC42 9:AB
AT+BNAME=ADC42 %3a	Display on remote end: ADC42 9AB
AT+BNAME=ADC42 %:12a	Display on remote end: ADC42 01:23:45:67:89:AB

+BNDDEL Delete Bonding Information

AT syntax: **AT+BNDDEL=<value>**

This command deletes the bonding information stored by the BlueMod+S42/ADC/TWI.

Value	Description
Bluetooth address	Delete the bond of the device with specified address from the bonded-device list
*	Delete all bonded devices from the bonded-device list



This command can only be executed while not connected.

+BNDLIST Show Bonded Device List

AT syntax: **AT+BNDLIST**

This command shows information about the devices bonded with the BlueMod+S42/ADC/TWI. Each entry in the bonded-device list contains the Bluetooth address and the linktype (see chapter 4.2).

Example:

AT+BNDLIST	0080254800DA 0x02 9C04EB06ACA2 0x03 OK
------------	--

+BNDS Storage Mode for Bonds

AT syntax: **AT+BNDS=<mode>**

This command controls the storage mode for bonding information (link keys).

Mode	Description
0	Bonds persists for the duration of the authenticated connection
1	Bonds are permanently stored in the NVRAM of the module



By setting AT+BNDS the bonded-device list is deleted internally. The bonding information is stored in the module flash. If your application does not need to store bonds switch this parameter to 0, to protect the module flash from unnecessary clear and write operations. Every flash has a limited number of clear cycles.

+BNDSIZE Bonded Devices List Size

AT syntax: **AT+BNDSIZE=<value>**

This command reduces the number of devices (1..4) the bonded-device list can hold.

The BlueMod+S42/ADC/TWI can store up to 4 devices. The default size is **4**.



Modification of this parameter will delete all devices in the bonded-device list.

Example:

AT+BNDSize=1	Limit the number of bonded devices to 1
--------------	---

+BOAD Bluetooth Own Device Address

AT syntax: **AT+BOAD**

This command reads the Bluetooth devices' own device address.



This command is read only.

+BPAIRMODE Configure Pairable Mode

AT syntax: **AT+BPAIRMODE=<mode>**

This command controls the pairable mode of the BlueMod+S42/ADC/TWI.

The settings defined with this command will be reset to default configuration by activating the CNF-RES# hardware signal.

When set to "0" the module is only connectable for clients stored in the local bondlist. New pairing requests will be rejected.

Mode	Description
0	No pairing allowed, BlueMod+S42/ADC/TWI advertises TIO as "functional"
1	Pairing allowed, BlueMod+S42/ADC/TWI advertises TIO as "bondable and functional"

+BSSPCONF Security Pairing Confirmation

AT syntax: **AT+BSSPCONF <Bluetooth address>,<address type>,<value>**

If a pairing is initiated and LE secure connection is supported, depending on the security settings AT interface generates an event SSPCONF and asks the user for confirmation.

Event: SSPCONF <Bluetooth address>,<address type> <passkey> ?

The user has to confirm the passkey with the above command. If no confirmation is sent by the user within the bonding timeout or in case of active reject, the pairing is rejected with NO CARRIER message.

Value	Description
0	Reject passkey confirmation request
1	Accept passkey confirmation request

Example:

SSPCONF 00802507C08D,t2 794851 ? AT+BSSPCONF 00802507C08D,t2,1	Receive SSP pairing request Send SSP pairing confirmation
OK	

+BSSPPIN SSP Passkey Response

AT syntax: **AT+BSSPPIN <Bluetooth address>,<address type>,<SSP passkey>**

If an authentication is initiated (**AT+SECAIOS=3** or **AT+SECSCIS=3**), depending on the I/O capabilities (**AT+BIOCAP**) the AT interface generates an event SPPIN and asks the user for the SSP passkey.

Event: SPPIN <Bluetooth address>,<address type> ?

The user has to answer this request with the SSP passkey displayed on the remote device.

Example:

SSPPIN 00802507C08D,t2 ? AT+BSSPPIN 00802507C08D,t2,314546	Receive SSP passkey request Send SSP passkey response
OK	

+BSSPDBG SSP Debug Mode

AT syntax: **AT+BSSPDBG=<value>**

This command allows to enable the SSP debug mode of the device. This mode is required to trace the SSP Bluetooth connection by using a sniffer.

Value	Description
0	SSP debug mode off
1	SSP Debug mode on



SSP debug mode is for tracing purposes only and shall be deactivated for normal operation. Otherwise the connection may be unsecure.

+DFUMODE	Device Firmware Update Mode
-----------------	------------------------------------

AT syntax: **AT+DFUMODE=<value>**

This command sets the device firmware update mode.

The settings defined with this command will become persistently stored with the **AT&W** command.

The settings defined with this command will become active during the next system Startup if saved persistently.

To activate the mode it is necessary to store the settings and perform a reset with **BOOT#** activated or use the command **DFUSTART**.

Value	Description
1	Device firmware update over serial interface (default)
2	Device firmware update over the air (OTA)

+DFUNAME	Over The Air Update Name
-----------------	---------------------------------

AT syntax: **AT+DFUNAME=<value>**

This command sets the device name for the over the air firmware update mode.

The settings defined with this command will become persistently stored with the **AT&W** command.

The settings defined with this command will become active during the next system startup if saved persistently.

Valid name length is 0 to 8 characters.

Value	Description
BM+S_DFU	Device firmware update name is "BM+S_DFU" (default)

+DFUSTART	Start Bootloader
------------------	-------------------------

AT syntax: **AT+DFUSTART**

This command sets the device into the configured firmware update mode. The command times out after 2 minutes.

The settings defined with this command will not become persistently stored with the **AT&W** command.

The settings defined with this command will become active instantly; no system restart is required for activation.

If the firmware receives this command OTA via the SCIS service, the connection will be automatically disconnected and the switch to update mode will be made after transmission of "OK" result code.

E	Local Echo
----------	-------------------

AT syntax: **ATE<value>**

This command selects the local echo in command mode.

Value	Description
0 or empty	No local echo
1	Local echo on in command phase

I	Display Version Information
----------	------------------------------------

AT syntax: **ATI<value>**

Displays different information about version number and settings.

Value	Description
0 or empty	Returns the device name (e.g. "ADC42 %2a")
1	Returns "0"
2	Returns "OK"
3	Returns the version string: "V1.xyz"
4	Returns the manufacturers name: "Stollmann E+V GmbH"
5	Returns "ERROR"
6	Returns the copyright string: "(c) Copyright Telit"
7	Returns "OK"
8	Returns "ERROR"
9	Returns "OK"
77	Returns bootloader version
99	Returns the firmware creation date

+GPIO**Configure IO Pin**

AT syntax: **AT+GPIO=<logical pin>,dir=<dir>,...**
 AT+GPIO? [<logical pin>]

This command is used to configure the DIO pins of the device.

For each of the 8 supported DIOs the direction (dir) can be configured.

For DIOs that are configured as input a pull resistor (pull) configuration is required

For DIOs that are configured as output the default signal level for device startup configuration is required as well as a configuration that defines the DIO behavior in case a connection is terminated intentionally or unintentionally (fallback value).

The settings defined with this command will become active instantly; no system restart is required for activation.

The settings defined with this command will become active during the next system Startup if saved persistently.

Additional mandatory parameters depend on the value of <dir>:

<dir> = d (no additional parameters):

AT+GPIO=<logical pin>,dir=d

<dir> = i:

AT+GPIO=<logical pin>,dir=i,pull=<pull type>

<dir> = o:

AT+GPIO=<logical pin>,dir=o,fbv=<fallback value>

The command “AT+GPIO” used with “?” shows the active configuration of all logical pins. The command “AT+GPIO” used with “?<logical pin>” shows the active configuration of the selected logical pin.

Logical pin	Description
Value	Logical number of GPIO: 0,1,...,7 The logical number identifies the GPIO in the array of the 2-bit values of the digital characteristic (see [4]): index = logical number. For the mapping of logical pin number a physical pin refer to [X1]. Valid range is 0 to 7

dir	Description
d	GPIO is disabled (default)
i	Direction of GPIO is input
o	Direction of GPIO is output (drive strength 0.5 mA)

Pull type	Description
n	GPIO has no pull resistor applied (default)
u	GPIO has pull up resistor applied
d	GPIO has pull down resistor applied

Fallback value	Description
0n	Startup default output signal is low, fallback to low if connection is shutdown
0p	Startup default output signal is low current signal level is preserved if connection is shutdown
1n	Startup default output signal is high, fallback to high if connection is shutdown
1p	Startup default output signal is high, current signal level is preserved if connection is shutdown



If a GPIO is configured as input to detect signal changes, a changed signal must be stable for at least 50ms to be detected reliably. A non-reliable debouncing mechanism is in place to reduce GPIO state change detection due to signal glitches shorter than 30ms.



In case the GPIO configuration of a device is changed with this commands while connection is established an GATT notification for the digital input characteristic (see [4]) will be triggered when the characteristic value is changed due to this configuration.

+IOACFG	Config of Pin IOA
----------------	--------------------------

AT syntax: **AT+IOACFG=<value>**

This command configures the function of the IOA pin (GPIO8). GPIO8 can be configured as output signal "Device Ready". The signal is low active, a low level shows the device ready to process commands and establish Bluetooth connections after startup.

Value	Description
0	Input: Analog (no function, lowest power consumption)
1	Output: Signal "Device Ready"

+LOAD	Load Stored Parameter Setting
--------------	--------------------------------------

AT syntax: **AT+LOAD**

This command loads all parameters stored in non-volatile RAM.

+PNPPID	PnP Product ID
----------------	-----------------------

AT syntax: **AT+PNPPID=<value>**

This command sets the product ID provided in the device information service (DIS). The format is a 16 bit hex value. The default value is 0xB0016 (Telit product ID for BlueMod+S42/ADC/TWI firmware).

+PNPPVER	PnP Product Version
-----------------	----------------------------

AT syntax: **AT+PNPPVER=<value>**

This command sets the product version provided in the device information service (DIS). The format is a 16 bit hex value. The default value is the version number of the particular Telit BlueMod+S42/ADC/TWI firmware, e.g. 0x1000 for firmware version 1.000.



After setting the vendor ID (AT+PNPVID) to a different value than the default 0x008F the user has to set his own product version (otherwise the value 0x0100 will be used).

+PNPVID	PnP Vendor ID
----------------	----------------------

AT syntax: **AT+PNPVID=<value>**

This command sets the vendor ID provided in the device information service (DIS). The format is a 16 bit hex value. The default value is 0x008F (Telit vendor ID).

+PNPVSRC	PnP Vendor ID Source
-----------------	-----------------------------

AT syntax: **AT+PNPVSRC=<value>**

This command sets the vendor ID source provided in the device information service (DIS).

Value	Description
1	Bluetooth SIG assigned company ID
2	USB assigned company ID

Q	Suppress Results
----------	-------------------------

AT syntax: **ATQ<value>**

This command allows/suppresses result codes and messages.

Value	Description
0 or empty	Enable result messages after command input
1	Suppress result messages after command input

+RESET	Reset Device
---------------	---------------------

AT syntax: **AT+RESET**

This command resets the whole functionality of the BlueMod+S42/ADC/TWI by a forced hardware reset (like power off/on).



No OK response will be sent before the device performs a reset.
If this command is initiated via the SCIS (OTA) interface, the command will be executed and the connection will be terminated.

+RFMAXTXPWR	Maximum Output Power
--------------------	-----------------------------

AT syntax: **AT+RFMAXTXPWR=<value>**

This command sets the maximum output power of the Bluetooth radio of the device. A changed value becomes active immediately.

Value	Description
-128	Use factory default maximum output power of 4 dBm
4	4 dBm
3	3 dBm
0	0 dBm
-4	-4 dBm
-8	-8 dBm
-12	-12 dBm
-16	-16 dBm
-20	-20 dBm
-30	-30 dBm

All other values in the range of -127 to 127 could be set with this command as well, but the equal or next lower value from the power table will be set internally. Furthermore the value will be set to a value amongst minimum and maximum output power value of the device.

Example:

AT+RFMAXTXPWR=0	The maximum output power will be set to 0 dBm
-----------------	---

+SECAIOS Set Security Level Automation I/O

AT syntax: **AT+SECAIOS=<value>**

This command sets the security level required for the OTA access to the AIOS characteristic values.

The settings defined with this command will become persistently stored with the **AT+W** command.

The settings defined with this command will become active during the next system startup if saved persistently.

Value	Description
1	No security requirements default for AIOS
2	Unauthenticated pairing with encryption (SSP without MITM)
3	Authenticated pairing with encryption (SSP with MITM)
4	Authenticated LE secure connections pairing with encryption (MITM required, LE secure connections required)

+SECSCIS	Set Security Level OTA Configuration
-----------------	---

AT syntax: **AT+SECSCIS=<value>**

This command sets the security level required for the OTA access to the SCIS characteristic values.

The settings defined with this command will become persistently stored with the **AT&W** command.

The settings defined with this command will become active during the next system startup if saved persistently.

Value	Description
2	Unauthenticated pairing with encryption (SSP without MITM)
3	Authenticated pairing with encryption (SSP with MITM), default for SCIS
4	Authenticated LE secure connections pairing with encryption (MITM required, LE secure connections required)



To allow authentication with MITM, a fixed PIN must be configured (see command LEFIXPIN).

+SECTWIS	Set Security TWIS
-----------------	--------------------------

AT syntax: **AT+SECTWIS=<value>**

This command sets the security level required for the OTA access to the TWIS characteristic values.

The settings defined with this command will become persistently stored with the **AT&W** command.

The settings defined with this command will become active during the next system startup if saved persistently.

TWIS Service is only started at system startup if TWI master mode was configured and saved persistently.

Value	Description
1	No security requirements, default for TWIS
2	Unauthenticated pairing with encryption (SSP without MITM)
3	Authenticated pairing with encryption (SSP with MITM)
4	Authenticated LE secure connections pairing with encryption (MITM required, LE secure connections required)



To allow authentication with MITM, a fixed PIN must be configured (see command LEFIXPIN).

+SYSTEMOFF Enter System Off Mode

AT syntax: **AT+SYSTEMOFF**

This command sets the module into low power mode during the time the module is not used.

When setting AT+SYSTEMOFF (or AT+SYSTEMOFF=1) the module will wake-up on GPIO activity. To achieve the lowest power consumption set AT+SYSTEMOFF=2. In this case the module will wake-up by RESET signal.

The host can use the IOA pin to monitor the system status.

Value	Description
1	Wake-up by GPIO
2	Wake-up by RESET signal

Possible use cases and an usage example are described in the *BlueMod+S42 Software User Guide [2]*.



If this command is initiated via the SCIS (OTA) interface, the command will be executed but no OK response will be sent before the connection will be terminated.

+TWI	Configure and Access Two Wire Interface
-------------	--

AT syntax:

```

AT+TWI?CONFIG
AT+TWI=CONFIG,ROLE=D
AT+TWI=CONFIG,ROLE=M[,CLOCK=<mclock>]
AT+TWI=SCAN
AT+TWI=TRANS,ADDR=<saddr>[,READ=<length>][,<hexdata>]

```

This command enables and configures the TWI interface and transfers data.

Parameter	Description
CONFIG	Configure TWI port to a new role
ROLE	Identify new role of TWI port Valid role identifiers are: m: configure port as master d: disable TWI port
CLOCK	Configure port speed Valid port speeds are: 100000: configure bitrate to 100 kBit/s 100K: configure bitrate to 100 kBit/s 250000: configure bitrate to 250 kBit/s 250K: configure bitrate to 250 kBit/s 400000: configure bitrate to 400 kBit/s 400K: configure bitrate to 400 kBit/s Default port speed is 100 kBit/s.
SCAN	Scan for devices in 0x08 – 0x78 slave device address range
TRANS	Read and / or write data from / to TWI slave.
ADDR	Define TWI slave address with the TRANS command. Valid range is 0x08 – 0x78.
READ	Define number of bytes to be read from slave with the TRANS command. If omitted or zero, no bytes are read.

Valid sequences to e.g. activate the TWI interface in master mode are:

```
AT+TWI=CONFIG,ROLE=M
```

```
AT+TWI=CONFIG,ROLE=M,CLOCK=400K
```

If the TWI interface is in master mode valid sequences to transfer data to / from slave address 0x20 are:

Send two bytes data “0x31 0x32” to slave device:

```
AT+TWI=TRANS,ADDR=0x20,3132
```


Send one byte 0x41 to slave device and read 2 byte from device:

```
AT+TWI=TRANS,ADDR=0x20,READ=2,41
```

The settings defined with this command will become persistently stored with the **AT&W** command.

If TWI configured as master is saved persistently, during the next system startup the TWIS service will be started.

+UICP	Set UART Interface Control Protocol
--------------	--

AT syntax: **AT+UICP=<value>**

This command sets the mode of the UART Interface Control Protocol (UICP [5]).

To activate UICP, it is necessary to store the settings and perform a reset.

Value	Description
0	UICP off
1	UICP on

The valid sequence to e.g. activate UICP is:

```
AT+UICP=1
```

```
AT&W
```

```
AT+RESET
```

V	Result Message Format
----------	------------------------------

AT syntax: **ATV<value>**

This command determines the format of the result messages.

Value	Description
0 or empty	Result message is presented numerically (followed by <CR>)
1	Result message is presented as text

3.2. Bluetooth Low Energy

+LEFIXPIN Fix PIN for Pairing Procedure

AT syntax: **AT+LEFIXPIN=fixpin**

This command specifies a 6 digit SSP passkey, to be used for the security procedure. If this value has a length of 0 (no digit specified in command) **AT+LEFIXPIN=** a randomly generated PIN is used instead. To use this feature see also commands **AT+SECSCIS**, **AT+SECAIOS**, **AT+BIOCAP** and Hayes event SSPPIN.

The settings defined with this command will be reset to default configuration by activating the CNF-RES# hardware signal.

For further information see *BlueMod+S42 Software User Guide [2]*.

Parameter	Description
fixpin	6 digits pin value (digit 0...9 only), default is "890880"

+LEADINTMAX Maximum Advertising Interval

AT syntax: **AT+LEADINTMAX=<value>**

This command configures the maximum advertising interval (in milliseconds) for a Bluetooth Low Energy Peripheral.

Value	Description
$n=20\dots10240$	Use maximum advertising interval of n ms
1280	Use maximum advertising interval of 1280 ms



Make sure that the value of AT+LEADINTMAX is higher or equal the value of AT+LEADINTMIN.

+LEADINTMIN Minimum Advertising Interval

AT syntax: **AT+LEADINTMIN=<value>**

This command is not used in the BlueMod+S42/ADC/TWI. It is just provided for compatibility reasons. The used advertising interval is set by **AT+LEADINTMAX** parameter.

+LECONINTMAX	Maximum Connection Interval
---------------------	------------------------------------

AT syntax: **AT+LECONINTMAX=<value>**

This command configures the maximum connection interval for a Bluetooth Low Energy connection. The unit is in 1.25 milliseconds timeslots.

Value	Description
<i>n</i> =6...3200	Use maximum connection interval of $n * 1.25$ ms
32	Use maximum connection interval of 40 ms



Make sure that the value of AT+LECONINTMAX is higher or equal the value of AT+LECONINTMIN.

+LECONINTMIN	Minimum Connection Interval
---------------------	------------------------------------

AT syntax: **AT+LECONINTMIN=<value>**

This command configures the minimum connection interval for a Bluetooth Low Energy connection. The unit is in 1.25 milliseconds timeslots.

Value	Description
<i>n</i> =6...3200	Use minimum connection interval of $n * 1.25$ ms
16	Use minimum connection interval of 20 ms



Make sure that the value of AT+LECONINTMAX is higher or equal the value of AT+LECONINTMIN.

+LECONPARAM	Connection Parameter Handling
--------------------	--------------------------------------

AT syntax: **AT+LECONPARAM=connHnd, [connIntMin],connIntMax,
slaveLat[,connTimeout]**

AT+LECONPARAM?connHnd

The command “AT+LECONPARAM” used with “=” requests new connection parameters to be used for the connection defined by connHnd.

The command “AT+LECONPARAM” used with “?” shows the active connection parameters used by the connection defined by connHnd. A LECONPARAM event is generated containing the active connection parameters.

Parameter	Description
connHnd	Set to zero
connIntMin	6...3200 minimum connection interval in steps of 1.25 ms (mandatory for peripheral)
connIntMax	6...3200 maximum connection interval in steps of 1.25 ms
slaveLat	0...499 connection intervals
connTimeout	Optional connection supervision timeout in steps of 10 ms. Will be calculated internally if not specified. Has to be calculated according to Bluetooth core spec.

The new connection parameters are signalled by event LECONPARAM.

+LEPRIVACY	Enable Link Layer Privacy
-------------------	----------------------------------

AT syntax: **AT+LEPRIVACY=<value>**

This command controls the signaling of LERESOLVED events and the use of Link Layer Privacy for new BLE connections.

Value	Description
0	No LERESOLVED events are signaled during pairing. The local device uses its public address for all Bluetooth roles.
1	When pairing with a peer device that is using a resolvable random address a LERESOLVED event is signaled. When scanning (AT+LESCAN) for a bonded peer device that is using a resolvable random address, the displayed address is the public address from the bond database. When connecting (ATDxxx) to a bonded peer device that is using a resolvable random address, the public address from the bond database can be used. The local device uses its public Bluetooth address for all Bluetooth roles.
2	Same as 1. The local device uses a random resolvable address for all Bluetooth roles. This address is changed every 15 minutes.

+LESLAVELAT	Slave Latency
--------------------	----------------------

AT syntax: **AT+LESLAVELAT=<value>**

This command configures the slave latency (in connection intervals) for a Bluetooth Low Energy connection.

Value	Description
$n=0\dots499$	Use a slave latency of n connection intervals
0	Use no slave latency

+LEADDATA Setup Advertise Data for Customized Advertising

AT syntax: **AT+LEADDATA=<value₁> .. <value_n>**

This command is used to setup the advertise data for a customized advertising.

$Value_k$ represents an octet in hexadecimal format, $k \leq 31$.

The coding of the data is according to the *Bluetooth 4.0 Core Specification / Vol. 3, Part C, Chapter 11 and 18 (Length/Type/Value coding) [3]*.

Example:

AT+LEADDATA=02010603020F18	Set flags + UUID of battery service
----------------------------	-------------------------------------

+LEADE Enable Customized Advertising

AT syntax: **AT+LEADE=<value>**

This command controls the advertising behavior.

The settings defined with this command will be reset to default configuration by activating the CNF-RES# hardware signal.

With **AT+LEADE=4** only the build in AIOS service is advertised.

With **AT+LEADE=1** only the customized advertising value is advertised.

With **AT+LEADE=3** the module stops all advertising. With disabled advertising the client (e.g. iPhone) is not able to discover the device or to connect to the device. This should only be done when the service is not in use to save battery power.

Value	Description
0	Reserved for future use
1	Customized advertising enabled, internal ADC advertising disabled
2	Reserved for future use
3	Advertising off, customized advertising disabled, AIOS advertising disabled
4	Customized advertising disabled, internal ADC advertising enabled

+LEADPAR Setup Parameters for Customized Advertising

AT syntax: **AT+LEADPAR=par₁=<value₁>[, .. [,par_n=<value_n>]]**

This command is used to setup parameters for a customized advertising.

par _n	value _n
advtype	Type of advertising: 0: undirected (default)
Optional	2: scannable
Coding: decimal.	3: non-connectable

This command is optional, if not submitted these defaults apply:

- advtype = 0 - advertising type “undirected”



The values for the minimum and maximum of the advertising interval may be set with the AT+LEADINTMIN and AT+LEADINTMAX commands.

Example:

AT+LEADPAR=ADVTYPE=0	Set type of advertising “undirected”
----------------------	--------------------------------------

+LESCDATA Setup Scan Response Data for Customized Advertising

AT syntax: **AT+LESCDATA=<value₁> .. <value_n>**

This command is used to setup the scan response data for a customized advertising.

Value_k represents an octet in hexadecimal format, k <= 31.

The coding of the data is according to the *Bluetooth 4.0 Core Specification / Vol. 3, Part C, Chapter 11 and 18 (Length/Type/Value coding)* [3].

Example:

AT+LESCDATA=03020F18	Set UUID of battery service
----------------------	-----------------------------

4. APPENDIX

4.1. Bluetooth Address

The BlueMod+S42/ADC/TWI supports public and random Bluetooth addresses. The differentiation between the address types is done using the parameter “t2” for public addresses and “t3” for random addresses.

A Bluetooth address value itself is a special byte array variant. There are two valid representations.

The Bluetooth addresses “008025540203” and **00:80:25:54:02:03** are equivalent.

E.g. public address: 00:80:25:54:02:03,t2 or 008025540203,t2
 random address: F1:B9:EB:41:D8:1E,t3 or F1B9EB41D81E,t3

4.2. Linktype

Linktype	Meaning
0x02	Bluetooth low energy using public address
0x03	Bluetooth low energy using random address

4.3. AT Result Codes

Result codes (numerical and verbose):

Numeric	Text	Meaning
0	OK	Command completed
4	ERROR	Illegal command or error that cannot be indicated otherwise

4.4. Events

SSPCONF	SSP Passkey Confirmation
----------------	---------------------------------

Syntax: **SSPCONF Bdaddr,tx Passkey ?**

With this event the module requests the confirmation of the passkey displayed on both devices.

Parameter	Description
Bdaddr	Remote Bluetooth address
tx	x is the remote Bluetooth address type (see chapter Bluetooth Address)
Passkey	Passkey to be acknowledged on local side (see command +BSSPCONF)



To receive this event via the SCIS (OTA) configuration interface, the SCIS client characteristics must be configured accordingly in advance.

SSPPIN
SSP Passkey Request

Syntax: **SSPPIN Bdaddr,tx ?**

With this event the module requests the entry of the passkey displayed on the remote device.

Parameter	Description
Bdaddr	Remote Bluetooth address
tx	x is the remote Bluetooth address type (see chapter Bluetooth Address)



To receive this event via the SCIS (OTA) configuration interface, the SCIS client characteristics must be configured accordingly in advance.

SSPPIN
SSP Passkey Display

Syntax: **SSPPIN Bdaddr,tx Passkey**

With this event the module shows the passkey to be entered on the remote device.

Parameter	Description
Bdaddr	Remote Bluetooth address
tx	x is the remote Bluetooth address type (see chapter Bluetooth Address)
Passkey	Passkey to be entered on remote side



To receive this event via the SCIS (OTA) configuration interface, the SCIS client characteristics must be configured accordingly in advance.

LECONPARAM Connection Parameters Updated

Syntax: **LECONPARAM:connHnd,connInt,slaveLat,connTimeout**

With this event the user is informed about the active connection parameters of the peripheral link if any. This is the answer to a AT+LECONPARAM=0 command.

Parameter	Description
connHnd	Is always zero
connInt	Actual connection interval in steps of 1.25 ms
slaveLat	Actual slave latency in connection intervals
connTimeout	Actual connection supervision timeout in steps of 10 ms



To receive this event via the SCIS (OTA) configuration interface, the SCIS client characteristics must be configured accordingly in advance.

LERESOLVED Bluetooth Address Resolved

Syntax: **LERESOLVED:<privacy-bd>,<privacy-bd-type>,<public-bd>,<public-bd-type>**

With this event the user is informed during pairing about a relation between the currently used random resolvable address of a peer device and its public address stored in the bond database.

Parameter	Description
privacy-bd	Current privacy address used by the peer device
privacy-bd-type	Privacy address type (currently only 0x03)
public-bd	Public address of the peer device
public-bd-type	Public address type of the peer device

5. GLOSSARY AND ACRONYMS

ADC	Analog to Digital Converter
AT	Attention Command
GAP	Generic Access Profile
GATT	Generic Attribute Profile
IRK	Identity Resolving Key
SSP	Secure Simple Pairing
TWI	Two Wire Interface
UART	Universal Asynchronous Receiver/Transmitter
UICP	UART Interface Control Protocol
UUID	Universal Unique Identifier

6. DOCUMENT HISTORY

Revision	Date	Changes
r0	2017-11-17	First issue



SUPPORT INQUIRIES

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