User Guide

BTM430/431 Data Module

Version 6.0

Revision History

Version	Date	Notes	Contributors	Approver
1.0	3 Jan 2012	Initial Release	Jonathan Kaye	Jonathan Kaye
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6.0	23 Apr 2025	Ezurio rebranding	Dave Drogowski	Jonathan Kaye

Contents

1. Overview and Key Features

The BTM430 and BTM431 Bluetooth® modules from Ezurio have been designed to meet the needs of developers who wish to add robust, short range Bluetooth data connectivity to their products. They are based on the market leading Cambridge Silicon Radio BC04 chipset, providing exceptionally low power consumption with outstanding range.

With physical sizes as small as 12.5 x 18.0mm and best of class, low-power operation, these modules are the ideal choice for applications where designers need both performance and minimum size. For maximum flexibility in systems integration, the modules are designed to support a separate power supply for I/O.

To aid product development and integration, Ezurio has integrated a complete Bluetooth protocol stack within the modules, including support for the Bluetooth Serial Port Profile. The modules are fully qualified as Bluetooth End Products, allowing designers to integrate them within their own products with no further Bluetooth Qualification. They can then list and promote their products on the Bluetooth website free of charge.

A comprehensive AT command interface is included, which simplifies firmware integration. Combined with a low cost developer's kit, this ensures that the choice of Ezurio Bluetooth modules guarantees the fastest route to market.

1.1 FEATURES AND BENEFITS

- Bluetooth® v2.0+EDR
- Adaptive Frequency Hopping to cope with interference from other wireless devices
- External or internal antenna options
- Comprehensive AT interface for simple programming
- Bluetooth® END Product Qualified
- Compact size
- Class 2 output – 4dBm
- Low power operation
- UART interface
- PCM and SCO for external codec
- GPIO lines under AT control
- Support for multiple profiles
- Wi-Fi co-existence

1.2 APPLICATIONS

- Embedded Devices
- Phone Accessories
- Security Devices
- Medical and Wellness Devices
- Automotive Applications
- Bluetooth Advertising
- ePOS

2 AT Command Set Reference

2.1 Introduction

This document describes the protocol used to control and configure the following Ezurio Bluetooth devices:

- BTM430
- BTM431

The protocol is similar to the industry standard Hayes AT protocol used in telephony modems which is appropriate for cable replacement scenarios, as both types of devices are connection oriented. The telephony commands have been extended to make the Ezurio device perform the two core actions of a Bluetooth device, which is make/break a connection and Inquiry. Other AT commands are also provided to perform ancillary functions, such as, pairing, trusted device database management and S Register maintenance.

Just like telephony modems, the Ezurio device powers up in an unconnected state and will only respond via the serial interface. In this state the Ezurio device will not even respond to Bluetooth Inquiries. Then, just like controlling a modem, the host can issue AT commands which map to various Bluetooth activities. The command set is extensive enough to allow a host to make connections which are authenticated and/or encrypted or not authenticated and/or encrypted or any combination of these. Commands can be saved, so that on a subsequent power up the device is discoverable or automatically connects.

The device has a serial interface which can be configured for baud rates from 1200 up to 921600, and an RF communications end point. The latter has a concept of connected and unconnected modes and the former will have a concept of command and data modes. This leads to the matrix of states shown below.

Table 1: Matrix of mode states

	RF Unconnected	RF Connected
Local Command Mode	OK	OK
Remote Command Mode	ILLEGAL	OK
Data Mode	ILLEGAL	OK

The combinations 'Data and RF Unconnected Mode' and 'Remote Command and RF Unconnected Mode' do not make sense and will be ignored.

Navigation between these states is done using the AT commands which are described in detail in subsequent sections.

2.2 Assumptions

The CSR (Cambridge Silicon Radio) BC04 chipset in Ezurio devices is memory resource limited. Therefore it is NOT proposed that there be full implementation of the AT protocol as seen in modems. The claim made for this device is that it will have a protocol ***similar*** to an AT modem. In fact, the protocol is similar enough so that existing source code written for modems can be used with very little modification with a Ezurio device.

Therefore the following assumptions are made:

- All commands are terminated by the carriage return character 0x0D, which is represented by the string <cr> in descriptions below this cannot be changed.
- All responses from the Ezurio device have carriage return and linefeed characters preceding and appending the response. These dual character sequences have the values 0x0D and 0x0A respectively and shall be represented by the string <cr,lf>.
- All Bluetooth addresses are represented by a fixed 12 digit hexadecimal string, case insensitive.
- All Bluetooth Device Class codes are represented by a fixed 6 digit hexadecimal string, case insensitive.
- All new Bluetooth specific commands are identified by the string +BT**x**, where **x** is generally a mnemonic of the intended functionality.

2.3 Commands

This section describes all available AT commands. Many commands require mandatory parameters and some take optional parameters. These parameters are integer values, strings, Bluetooth addresses, or device classes. The following convention is used when describing the various AT commands.

<bd_addr>	A 12 character Bluetooth address consisting of ASCII characters '0' to '9', 'A' to 'F' and 'a' to 'f'.
<devclass>	A 6 character Bluetooth device class consisting of ASCII characters '0' to '9', 'A' to 'F' and 'a' to 'f'.
n	A positive integer value.
m	An integer value (positive or negative) which can be entered as a decimal value or in hexadecimal if preceded by the '$' character. E.g. the value 1234 can also be entered as $4D2
<string>	A string delimited by double quotes. E.g. "Hello World". The " character MUST be supplied as delimiters.
<uuid>	A 4 character UUID number consisting of ASCII characters '0' to '9', 'A' to 'F' and 'a' to 'f'.

2.3.1 ^^^ {Enter Local Command Mode}

When in data and connected mode, the host can force the device into a command and connected mode so that AT Commands can be issued to the device. The character in this escape sequence is specified in the S2 register, so can be changed. In addition, the escape sequence guard time is specified by S Register 12. By default the guard time is set to 100 milliseconds. Please refer to Section 5: Dropping Connections for more related information.

In modems this escape sequence is usually "+++". "^^^^" is specified to avoid confusion when the module is providing access to a modem.

Response: <cr,lf>**OK**<cr,lf>

2.3.2 !!! {Enter Remote Command Mode}

When in data and connected mode, the host can force the remote device into a command and connected mode so that AT Commands can be issued to the device remotely. The escape sequence guard time is specified by S Register 12 and is the same as per the ^^^ escape sequence. By default the guard time is set to 100 milliseconds. The remote device issues ATO as normal to return to data mode. (Refer to 2.2.12)

For this command to be effective S Register 536 must be set to 1.

Response: <cr,lf>**OK**<cr,lf>

2.3.3 AT

Used to check the module is available.

Response: <cr,lf>**OK**<cr,lf>

2.3.4 ATA {Answer Call}

Accept an incoming connection, which is indicated by the unsolicited string

<cr,lf>**RING 123456789012**<cr,lf> every second. **123456789012** is the Bluetooth address of the connecting device.

Response: <cr,lf>**CONNECT 123456789012**<cr,lf>

2.3.5 ATD<U><Y><bd_addr>,<uuid> {Make Outgoing Connection}

Make a connection to device with Bluetooth address <bd_addr> and profile <uuid>. The <uuid> is an optional parameter which specifies the UUID of the profile server to attach to, and if not supplied then the default UUID from S Register 101 is used. As this is a Ezurio device which utilises the RFCOMM layer as described in the Bluetooth specification, it necessarily implies that only profiles based on RFCOMM can be accessed.

If <U> is not specified, then authentication is as per register 500, otherwise the connection will be authenticated.

If <Y> is not specified, then encryption is as per register 501, otherwise the connection will have encryption enabled.

The timeout is specified by S register 505.

Response: <cr,lf>**CONNECT 123456789012**<cr,lf>

Or <cr,lf>**NO CARRIER**<cr,lf>

Due to a known issue in the Bluetooth RFCOMM stack, it is not possible to make more than 65525 outgoing connections. Therefore if that number is exceeded, then the connection attempt will fail with the following response:

Response: <cr,lf>**CALL LIMIT**

Or <cr,lf>**NO CARRIER**<cr,lf>

In that case, issuing an ATZ to reset the device will reset the count to 0 and more connections are possible.

The following RFCOMM based UUIDs are defined in the Bluetooth Specification:

Profile Name	UUID
Serial Port	1101
LAN Access Using PPP	1102
Dialup Networking	1103
IrMC Sync	1104

Profile Name	UUID
OBEX Object Push	1105
OBEX File Transfer	1106
IrMC Sync Command	1107
Headset	1108
Cordless Telephony	1109
Intercom	1110
Fax	1111
Audio Gateway	1112
WAP	1113
WAP_CLIENT	1114

2.3.6 ATD<U><Y><bd_addr>,<ServiceName> {Make Connection}

Make a connection to device with Bluetooth address <bd_addr> and profile specified via S Reg 101 AND which has a service name starting with the string <ServiceName>. The ServiceName parameter is a string delimited by ".

If <U> is not specified, then authentication is as per register 500, otherwise the connection will be authenticated.

If <Y> is not specified, then encryption is as per register 501, otherwise the connection will have encryption enabled.

The timeout is specified by S register 505.

Response: <cr,lf>**CONNECT 123456789012**<cr,lf>

Or <cr,lf>**NO CARRIER**<cr,lf>

2.3.7 ATD<U><Y>L {Remake Connection}

Make a connection with the same device and service as that specified in the most recent ATD command. The <UY> modifiers are optional. An error will be returned if the 'L' modifier is specified AND a Bluetooth address.

If both 'L' and 'R' modifiers are specified then an error will be returned.

Response: <cr,lf>**CONNECT 123456789012 AE**<cr,lf>

Or <cr,lf>**NO CARRIER**<cr,lf>

2.3.8 ATD<U><Y>R {Make Connection to peer specified in AT+BTR}

Make a connection with the device address specified in the most recent AT+BTR command. The service is as specified in S Register 101. The <UY> modifiers are optional. An error will be returned if the 'R' modifier is specified AND a Bluetooth address.

If both 'R' and 'L' modifiers are specified then an error will be returned.

Response: <cr,lf>**CONNECT 123456789012 AE**<cr,lf>

Or <cr,lf>**NO CARRIER**<cr,lf>

2.3.9 ATEn {Enable/Disable Echo}

This command enables or disables the echo of characters to the screen. A valid parameter value will be written to S Register 506.

E0	Disable echo.
E1	Enable echo.

All other values of n will generate an error.

Response: <cr,lf>**OK**<cr,lf>

Or <cr,lf>**ERROR nn**<cr,lf>

2.3.10 ATH {Drop Connection}

Drop an existing connection or reject an incoming connection indicated by unsolicited RING messages.

Response: <cr,lf>**NO CARRIER**<cr,lf>

2.3.11 ATIn {Information}

This will return the following information about the Ezurio device.

I0	The product name/variant.
I1	The CSR firmware build number.
I2	The Ezurio firmware build number. For internal use only.
I3	The Ezurio firmware revision.
I4	A 12 digit hexadecimal number corresponding to the Bluetooth address of the Ezurio device.
I5	The manufacturer of this device.
I6	The maximum size of trusted device database.
I7	The manufacturer of the Bluetooth chipset.
I8	The chipset format.
I9	0 if not in a connect state and 1 if in a connect state.
I11	The reason why a "NO CARRIER" resulted in the most recent attempt at making an outgoing connection. Where the response values are as follows: 0 = No prior connection 1 = Connection timeout 2 = Connection attempt cancelled 3 = Normal disconnection 4 = Peer device has refused connection 5 = Service profile <uuid> requested not available on remote device 6 = Connection has failed 32 = ATH was entered 33 = Incoming connection aborted because too many rings 34 = Unexpected incoming connection 35 = Invalid address 36 = DSR is not asserted 37 = Call limit of 65531 connections has been reached 38 = Pairing in progress 39 = No link key 40 = Invalid link key 255 = Unknown Reason
I12	The last ERROR response number.
I13	The Sniff status is returned as follows:- **Response:** <cr,lf>**a:b,c,d,e**<cr,lf>**OK**<cr,lf> Where 'a' = 0 when not online and 1 when online and Sniff has been enabled, 'b' is the Sniff Attempt parameter, 'c' is the Sniff timeout parameter, 'd' is the minimum sniff interval and 'e' is the maximum sniff interval. All parameters 'b', 'c', 'd' and 'e' are given as Bluetooth slots which are 625 microseconds long converted from values of S Registers 561, 562, 563 and 564 respectively.
I14	The current boot mode (Only for firmware 1.18.0 and newer)
I15	The maximum length of an AT command, including the terminating carriage return (only for firmware 1.6.10 and newer)
I16	The size of AT command input buffer

I20	Returns the number of bytes pending to be sent in the RF buffer when a connection is up.
I33	Version number of Multipoint application **Note:** ATI is provided for compatibility in multipoint mode; other AT commands are not available.
I42	State information. Where the response values are as follows: 13 = NotOpen 14 = OpenIdle 15 = Ringing 16 = OnlineCommand 172 to 177 = waiting for connectable and/or discoverable where the lowest significant digit equates to the value stored in S Register 512 or 555. **Note**: When n=16, ATI9 will return 1.
I101	The RSSI value in dBm. If a connection does NOT exist then a value of -32786 is returned. A value of 0 means the RSSI is within the golden range this is quite a large band, therefore RSSI is not always a useful indicator. Use ATI111 instead which returns the bit error rate.
I111	Returns LinkQual which in the CSR chipset is defined as BER (bit error rate). This returns a value which is the number of bits in error out of 1 million. Hence a value of 0 is best, and larger values are worse. As the value approaches 1000 (BER = 0.1%) it is an indication that the link is very bad and a large number of Bluetooth packets are being lost.
I333	Returns extended firmware version number.

For recognised values of n. All other values of n will generate an error.

Response: <cr,lf>**As Appropriate**<cr,lf>OK<cr,lf>

Or <cr,lf>**ERROR nn**<cr,lf>

2.3.12 ATO {Enter Data Mode} (letter 'o')

Return to data mode. Assume that the module is in data mode after OK is received. Responds with an error if there is no Bluetooth connection.

Response: <cr,lf> **CONNECT 123456789012**<cr,lf>

Or <cr,lf>**ERROR nn**<cr,lf>

2.3.13 ATSn=m {Set S Register}

As with modems, the Ezurio Bluetooth module employs a concept of registers which are used to store parameters (such as escape sequence character and inquiry delay time) as listed in detail below.

The value part 'm' can be entered as decimal or hexadecimal. A hexadecimal value is specified via a '$' leading character. For example $1234 is a hexadecimal number.

When S register values are changed, the changes are **not** stored in non-volatile memory UNTIL the AT&W command is used. Note that AT&W does not affect S registers 520 to 525 or 1000 to 1010 as they are updated in non-volatile memory when the command is received.

Table 2: S Registers

Register	Default	Range	Comment
S0	1	-1..15	Number of RING indication before automatically answering an incoming connection. A value of 0 disables autoanswer. If -1, then autoanswer on one RING and do NOT send RING/CONNECT response to the host. This emulates a serial cable replacement situation. Setting values >= 0 resets S504 to 0 and <0 forces 504 to 1. If S0 <> 0 and S100 <> 0 then S0 must be < S100. If a value is entered which violates this rule, then ERROR 29 is sent in response. If S504 =1 then this register will return -1, regardless of the actual value stored in non-volatile memory.

Register	Default	Range	Comment
S2	0x5E	0x20..0x7E	Escape sequence character. It is not '+' by default as a Bluetooth serial link can be used to connect to a mobile phone which exposes an AT command set, which will in turn use '+' as default. So if both used '+' there will be confusion. 0x5e is the character '^'.
S12	100	40..5000	Escape sequence guard time in milliseconds, with a granularity of 20ms. New values are rounded down to the nearest 20ms multiple.
S100	15	0..15	Number of RING indications before an auto disconnection is initiated. A value of 0 disables this feature. If S0 < > 0 and S100 < > 0 then S0 must be < S100. If a value is entered which violates this rule, then ERROR 29 is sent in response.
S101	$1101	0..$ffff	UUID of default SPP based profile when not specified explicitly in the ATD command.
S102	1	1..$7F	Defines a set of bits masks for enabling profile servers. Values can be ORed. 1 is Serial Port Profile 2 is Headset (S Reg 580 allows remote volume control bit to be adjusted) 4 is DUN 8 is Audio Gateway (Headset) 16 is Handsfree (S Reg 581 allows supported feature field to be adjusted) 32 is OBEX FTP 64 is Audio Gateway (Handsfree) It is recommended that due to memory resource issues, not more than 2 profiles are activated at the same time.
S103	1	1..7	Boot Mode on cold boot.
S126	?	0 .. 0xFFFF	Primer for changing to Multipoint mode
S127	?	0 .. 0xFFFF	0x100 for At mode 0x200 for Multipoint mode Other values are reserved
S400	0	0..1	Pio deamon. 1 = Hostless Audio gateway Operation
S401	1000	100..5000	In Hostless Audio Gateway Operation – GPIO4 flash period while inquiring
S402	0	0..100	In Hostless Audio Gateway Operation – GPIO4 flash duty cycle while inquiring
S403	1000	100..5000	In Hostless Audio Gateway Operation – GPIO4 flash period when there is an ACL connection only to the headset
S404	0	0..100	In Hostless Audio Gateway Operation – GPIO4 flash duty cycle when there is an ACL connection only to the headset
S405	1000	100..5000	In Hostless Audio Gateway Operation – GPIO4 flash period when there is an ACL and SCO connection to the headset
S406	0	0..100	In Hostless Audio Gateway Operation – GPIO4 flash duty cycle when there is an ACL and SCO connection to the headset
S407	0	0..1	In Hostless Audio Gateway Operation – 'Lift-Hook' output follows SCO state
S408	0	0..1	In Hostless Audio Gateway Operation – if set to 1 then delete trusted device database when inquiry is initiated to look for headsets
S409	0	0..1	In Hostless Audio Gateway Operation – when inquiring and pairing, use the device class code of the response to classify which uuid to connect to the headset when initiating a Bluetooth connection from the gateway
S410	0	0..1	In AudioGateway Hostless mode, if set to 1, AG"" async responses will be forced out from the UART – good for debugging
S411	500	4000	In AudioGateway Hostless mode, Short press duration in milliseconds. 500msec granularity

Register	Default	Range	Comment
S412	500	4000	In AudioGateway Hostless mode, component of medium press duration in milliseconds. 500msec granularity. Actual duration is this value plus S411
S413	500	4000	In AudioGateway Hostless mode, component of long press duration in milliseconds. 500msec granularity. Actual duration is this value plus S412 plus S411
S414	30	240	In AudioGateway Hostless mode, The inquiry to search for headsets will be aborted after this amount of time, in seconds. The granularity is 30 seconds.
S420	0	1	If this is set, then the module maintains a seconds counter. Use ATI420 to read the count value. It is basically the time the module has been powered up in seconds.
S500	0	0..1	Authentication for outgoing connections. Set to 1 to Enable Authentication.
S501	0	0..1	Encryption for outgoing connections. Set to 1 to Enable Encryption.
S502	0	0..1	Authentication for incoming connections. Set to 1 to Enable Authentication.
S503	0	0..1	Encryption for incoming connections. Set to 1 to Enable Encryption.
S504	0	0..1	Setting to 1 will force S0 to -1 and will suppress messages arising from connections or pairing. E.g. CONNECT, NO CARRIER, RING, PAIR etc. Suppressing connection based messaged allows the Ezurio device to be configured in cable replacement mode.
S505	10	2..120	Minimum delay before abandoning connection attempt as a master. Referenced by ATD. In units of seconds. See S Registers 530 and 543 also. Please note that as disconnection time can vary; this register only guarantees the minimum delay. Note that for invalid addresses specified in the ATD command, the “NO CARRIER” response will be immediate. See S register 560 for specifying disconnect max timeout.
S506	1	0..1	Enable/Disable echoes. The ATEn command also affects this.
S507	0	0..2	When set to 0, a connection can be dropped using ^^^ escape sequence only and the state of DSR line is ignored. When set to 1 a connection can be dropped using EITHER the ^^^ escape sequence OR the DSR handshaking line. When set to 2, a connection can only dropped using a deassertion of DSR. Mode 2 provides for the highest data transfer rate. If the status of the DSR line is to be conveyed to the remote device as a low bandwidth signal then this register MUST be set to 0, otherwise a deassertion of DSR will be seen as a request to drop the Bluetooth connection. This register affects S Register 536 – see details of 536 For the Go blue Activator variant this can only be set to 0.
S508	640	10..2550	Page Scan Interval in milliseconds. Minimum is 11.25ms so 10/11ms will give 11.25ms.
S509	320	10..2550	Page Scan Window in milliseconds. Minimum is 11.25ms so 10/11ms will give 11.25ms.
S510	640	10..2550	Inquiry Scan Interval in milliseconds. Minimum is 11.25ms so 10/11ms will give 11.25ms.
S511	320	10..2550	Inquiry Scan Window in milliseconds. Minimum is 11.25ms so 10/11ms will give 11.25ms.
S512	1	0..7	Specify power up state. When set to 0, AT+BTO is required to open the device for Bluetooth activity. When set to 1, it proceeds to a state as if AT+BTO was entered.

Register	Default	Range	Comment
			When set to 2, it will be discoverable only, similar to issuing AT+BTQ. When set to 3, it will be connectable but not discoverable e.g. AT+BTG When set to 4, it will be connectable and discoverable e.g. AT+BTP. When set to 5, it will be like 2, but all UART RX traffic is discarded in absence of a connection while DSR is asserted. If DSR is not asserted, then it behaves exactly as per mode 2. When set to 6, it will be like 3, but all UART RX traffic is discarded in absence of a connection while DSR is asserted. If DSR is not asserted, then it behaves exactly as per mode 3. When set to 7, it will be like 4, but all UART RX traffic is discarded in absence of a connection while DSR is asserted. If DSR is not asserted, then it behaves exactly as per mode 4. Note: By implication, a change to this can only be seen after a power cycle AND if AT&W is actioned prior to the power cycle. If S Reg 554 is non-zero and this register is between 2 and 7 inclusive, then the value of S554 specifies the time in seconds that the device will remain in the specified mode after power up. On timeout, the device will fall back to the mode specified in S Register 555. In modes 5, 6, 7 when all RX activity is ignored, only the special command (capitalised) AT+BT&BISM& terminated by a <cr> will force the module temporarily back into modes 2, 3 and 4 respectively. In some firmware builds, S Registers 565 to 569 inclusive are visible, which allows the start-up mode to depend on the state of RI line (Setting S Reg 565 forces the RI pin to be configured as an input). For this feature to be active, SReg 565 should be set to 1. In that case, on start-up, if RI is asserted, then the start-up mode is defined by S Reg 566 and if deasserted then S Reg 567.
S513	1	0..1	Pairing Authentication, 1 = Enable
S514	10	1..60	Pairing Timeout in seconds. This includes the time a host takes to supply the PIN number when PIN? messages are indicated.
S515	0x001F00	0.. 0xFFFFFF	Default Device Class Code to be used with AT+BTO when it is not explicitly specified. When queried, the value is always printed as a hexadecimal number. To change the device class of the module, after AT+BTO, use the command AT+BTC.
S516	0x000000	0..0x2FFFFFF	Default Device Class filter to be used with AT+BTI when it is not explicitly specified. When queried the value is always printed as a hex number. The seventh most significant digit, can be 0, 1 or 2, and is used to specify the type of device class filter. When 0, it specifies no filtering. When 1, it specifies an AND mask and all 24 bits are relevant When 2, it specifies a filter to look for devices with matching major device class which occupies a 5 bit field from bits 8 to 12 inclusive (assuming numbering starts at bit 0). All other 19 bits MUST be set to 0.
S517	20	2..61	Inquiry Length in units of seconds. This parameter is referenced by the AT+BTI command
S518	8	0..255	Maximum number of responses from an inquiry request. This parameter is reference by the AT+BTI command. If this number is set too high, then AT+BTI will return ERROR 27. For a particular firmware revision, determine the effective maximum value by trial and error. That is, set to a high value, send AT+BTI and if ERROR 27 is returned, then retry with a smaller value. This effective max value will remain unchanged for that particular firmware build.

Register	Default	Range	Comment
S519	500	100..6000	When S507>0, and in a connection, DSR can be used to change from data to command state by deasserting the DSR line for less than the time specified in this register. This value is rounded down to the nearest 100ms
S520	Depends on device – see comments	1200..115200	Change to a standard baud rate. The effect is immediate and in fact the OK will be sent at the new baud rate. Only one of the following baud rates are accepted: 1200,2400,4800,9600,19200,28800,38400,57600,115200. If S register 525=1, then the maximum baud rate is limited to 115200 The default is 9600 for Ezurio' BTM430 / BTM431. For the Go blue Activator variant of the module this register is read only See S Register 526 for further information.
S521	See Comment	1200.. 921600	Change baud rate to non-standard value. Ezurio' modules support any baud rate. The only limitation is the integer arithmetic involved, which may adjust the applied rate slightly. If the internally computed baud rate is more than 2% offset from the desired input value, then an ERROR will be returned and the old baud rate will prevail. To inspect the actual baud rate, do ATS521? S521 should only be sued for non-standard baud rates. For standard baud rates use S520. The effect is immediate and in fact the OK will be sent at the new baud rate. If S Register 525=1, then the max baud rate is limited to 115200 In the event that a non-standard baud rate is requested, it is entirely possible that the host is not capable of generating such a baud rate. In this case the Ezurio device cannot be communicated with. If this happens, there is a procedure to recover from this situation which is described in section titled "Factory Default Mode" The default is 9600 for the Ezurio Module and 115200 for other Ezurio devices. For the Go blue Activator variant of the module this register is read only See S Register 526 for further information
S522	1	1	1 = CTS/RTS hardware handshaking enabled For the Go blue Activator variant of the module this register is read only. See S Register 526 for further information.
S523	1	1..2	Number of Stop bits For the Go blue Activator variant of the module this register is read only. See S Register 526 for further information.
S524	0	0..2	Parity. 0=None, 1=Odd, 2=Even For the Go blue Activator variant of the module this register is read only. See S Register 526 for further information.
S525	See Comment	0..1	Apply multiplier of 8 to baud rate internally. This is set to 0 (disabled) by default for the Ezurio Module/RS-232 Adaptor/Universal RS-232 Adaptor, and set to 1 (enabled) by default for the Ezurio PC Card. It is required in the PC Card because the UART chip on the PC Card is driven by a 14.7456MHZ crystal instead of 1.8432MHz. This means that when a host asks for a baud rate, in reality it gets a baud rate which is 8 times faster. If S Register 521 > 115200 then this register cannot be set to 1. For the Go blue Activator variant of the module this register is read only. See S Register 526 for further information.
S526	3	1..3	This register specifies a 2 bit mask used to qualify how S Registers 520 to 525 are actioned. When bit 0 is 1, the new comms parameter affects the UART immediately. When bit 1 is 1, the new comms parameter is stored in non-volatile memory.

Register	Default	Range	Comment
			For example, to change comms parameters, but have them come into effect only after subsequent power cycles, then this register should be set to 2, and likewise to affect immediately and yet not have it persist over a power cycle, the value should be set to 1. Must be set before the baud rate change.
S530	1000	100..15000	Reconnect delay when configured as master in pure-cable-replacement mode. This value is rounded down to the nearest 100ms. See S Register 505 and 543 also
S531	0	0..5	Specifies the mode on connection establishment. 0 = Normal, that data is exchanged between UART and RF 1 = LOCAL_COMMAND. UART input is parsed by the AT interpreter and RF data is discarded 2 = REMOTE_COMMAND. RF input is parsed by the AT interpreter and UART data is discarded. If S Reg 536 is not 1 then this register cannot be set to 2 and an ERROR will be returned 3=LOCAL_COMMAND. UART input is parsed by the AT interpreter and incoming RF data is sent to the host using the RX<string> asynchronous response. 4=LOCAL_COMMAND and on the RF side, the GPIO is automatically sent when there is a change in input. See section 9.5 for more details. 5=DEAMON mode
S532	0	0..7	If non zero, then on every connection, a SCO channel (audio) will be initiated. Bit 0 for HV1, Bit1 for HV2 and Bit2 for HV3. When the connection is lost, the SCO channel disappears along with it.
S533	1	0..2	If set to 1, then GPIO5 follows RI state, if set to 2 then it follows the state of DSR and if 0 it is not driven and GPIO5 is available as a user I/O. This register will not necessarily be effective immediately after changing the value. It must be saved to non-volatile memory using AT&W and will operate as expected after an ATZ or a power cycle.
S534	1	0..2	When set to 0, GPIO4 is available as user i/o If set to 1 then right LED follows DCD state. If set to 2 then the led behaves as per setting 1, but in addition, when not in a connection, if the device is connectable or discoverable, then the led will blink. This register will not necessarily be effective immediately after changing the value. It must be saved to non-volatile store using AT&W and will operate as expected after an ATZ or a power cycle.
S535	20	0..41	Link Supervision Timeout. If units go out of range, then a NO CARRIER message will be sent to the host after the time specified here
S536	0	0..1	When set to 1, a remote device can 'capture' the AT parser of this unit by it sending this module an escape "!!!" sequence. The inter character timing is set via S Register 12. If S Register 507 is >= 2, then reading this register will always return 0 and writing 1 will result in ERROR 33.
S537	X	X..X	This register is no longer available – see 551,552,553 instead It only exists in firmware version 1.1.12 to 1.1.47 The functionality it controlled is now defined by registers 551,552 and 553
S538	0	0..1	If 1, then when a successful pairing occurs, it is automatically saved in the trusted device database – if it has room to store it.
S539	0	0..1	When set to 1, in idle mode (S512=1), UART Rx characters are discarded if DSR is deasserted.
S540	0	0 48..127	Sets the MTU in L2CAP configuration negotiations. The value of 0 is a special value which is taken to mean that the current value should remain.

Register	Default	Range	Comment
S541	6	-50..6	This sets the power level in dBm when inquiring or paging. Reading this register returns the value stored in non-volatile memory.
S542	6	-50..6	As per S541, however reading this register returns the current power level as set in the base band. The read can be different from S541because the actual power is set using a lookup table and the base band rounds down to the nearest value in the table.
S543	0	0..1	If this is set to 1, then incoming pairing attempts will be accepted (if a pin code has been pre-entered using AT+BTK) while in the wait phase of auto connect cycle initiated by the AT+BTR command. In addition to accepting pairing attempts, if the pairing is successful, then the new device is automatically set as the peer address for automatic connections (as if an explicit AT+BTR command was entered). See S Register 505 and 530 also
S544	1	0..1	Configure the UART for either low latency or maximum throughput. A setting of 1 gives maximum throughput.
S551	0x3211	0xFFFF	This register specifies in each 4 bit nibble, how the outgoing modem status bits to the remote peer gets its value. Bluetooth allows for RTR, RTC, DV and IC bits to be exchanged over an RFCOMM connection. Nibble 0..3 specifies the source for RTC 4..7 specifies the source for RTR 8..11 specifies the source for DV (i.e. DCD) 12..15 specifies the source for IC (i.e. RI) Each nibble can take the following value:- 0 Always set to 0 1 Always set to 1 2 If DCD (pin 8 on module connector) is output then always 1 If DCD is input then 1 if DCD is asserted otherwise 0 3 If RI (pin 6) is output then always 0 If RI is input then 1 if RI is asserted otherwise 0 If DSR (pin 10) is asserted then 1 otherwise 0 In the event that a nibble specifies DSR as the source of its state, be aware that if, S Register 507 is anything other than 0, a de-assertion of DSR will cause the Bluetooth connection to be dropped. If bits 0..3 and 4..7 are set to 0, then some Bluetooth devices will use that as a signal to stop sending any data back. For example, Nokia 6310 stops responding. If this register is changed while in command and connected mode, then on going back online using the ATO command, a fresh signal will be sent to the peer to update the bits.
S552	0x0122	0x0FFF	This register specifies in each 4 bit nibble, how the DTR, DCD, RI output pins are controlled when in a Bluetooth connection Nibble 0..3 specifies the source for DTR 4..7 specifies the source for DCD 8..11 specifies the source for RI Each nibble can take the following value:- 0 Do NOT touch the I/O 1 Always deassert 2 Always assert 3 If RTC bit in CONTROL_IND is 1 then assert otherwise deassert 4 If RTR bit in CONTROL_IND is 1 then assert otherwise deassert 5 If DV bit in CONTROL_IND is 1 then assert otherwise deassert

Register	Default	Range	Comment
			6 If IC bit in CONTROL_IND is 1 then assert otherwise deassert If this register is changed while in command and connected mode, then on going back online using the ATO command, the modem output lines will get refreshed.
S553	0x0201	0x0FFF	This register specifies in each 4 bit nibble, how the DTR,DCD,RI output pins are controlled when NOT in a Bluetooth connection Nibble 0..3 specifies the source for DTR 4..7 specifies the source for DCD 8..11 specifies the source for RI In addition it also refers to S Register 552 to see if the relevant pin is an input or not to be touched. If the nibble in 552 is 0, then the relevant pin is an input. Each nibble can take the following value:- 0 Always deassert 1 Always assert 2 Assert if RING is being sent to the host The default for the Universal RS-232 Adaptor is $0200.
S554	0	0..900	If S Register 512>=2 and <=7 then this register specifies a time in seconds for which the device will stay in the S512 mode after power up or reset. On timeout, it will abort the discoverable and/or connectable and fall back into S512=1 mode, when it is deaf and dumb. Note that if AT+BTR has been used to specify a peer device, then on reverting to mode 1, it will attempt to make a connection to that peer device. A power cycle, reset via BREAK or ATZ is required to see the effects of change.
S555	1	1..7	If S Register 554 is nonzero, then after the post reset window expires, the mode will revert to the mode specified in this register. This allows, for example, the device to be discoverable and connectable on power up (mode 4 or 7) and on window timer expiry to revert to connectable only (mode 3 or 6). A power cycle, reset via BREAK or ATZ is required to see effects of a change. In some firmware builds, S Registers 565 to 569 inclusive are visible, which allows the start-up mode to depend on the state of RI line (Setting S Reg 565 forces the RI pin to be configured as an input). For this feature to be active, SReg 565 should be set to 1. In that case, on start-up, if RI is asserted, then the start-up mode is defined by S Reg 568 and if deasserted then S Reg 569.
S556	0	0..3	Allows GPIO or ADC values to be read via the minor class field in an inquiry response. When this value is non-zero, bits2 to 7 contain information as follow:- 1 :- ADC1 2 :- ADC2 3 :- GPIO1 to GPIO6 – see section 3.11 Known Issues Set to 0 to disable this feature. This allows i/o information to be conveyed without a connection.
S557	32	4..900	Specified in seconds, the update interval for the feature enabled via S Reg 556
S558	0	0..1	When 1, the following responses; “RING”, “NO CARRIER” and “CONNECT” are replaced by “BTIN”, “BTDOWN” and “BTUP” respectively. This will eliminate ambiguity when the module has a Bluetooth connection to an AT modem which also gives these responses.

Register	Default	Range	Comment
S559	0	0..3	This specifies a mask. When Bit 0 is 1, the response word “ERROR“ is replaced by “BTERR” and “OK” is replaced by “ok”. When Bit 1 is 1, then error responses do not include the error number and instead the error number can be retrieved using ATI12.
S560	15	15..120	Disconnect timeout in seconds. This timer specifies how long to wait for confirmation (from the peer device and/or the underlying stack) that the connection has been successfully torn down. There can be instances where a confirmation does not arrive and so in this case this timer is used to 'close off' the procedure and put the state machine back into a proper mode for new operations. Time is specified with 15 seconds intervals.
S561	0	0..1000	Sniff Attempt Time in units of milliseconds. 0 means disable. See section “Power Consumption and Reset” in the user guide for more details.
S562	0	0..1000	Sniff Timeout Time in units of milliseconds. 0 means disable. See section “Power Consumption and Reset” in the user guide for more details.
S563	0	0..1000	Sniff Minimum Interval in units of milliseconds. 0 means disable. See section “Power Consumption and Reset” in the user guide for more details.
S564	0	0..1000	Sniff Maximum Interval in units of milliseconds. See section “Power Consumption and Reset” in the user guide for more details.
S565	0	1	If set to 1, RI (Ring Indicate) line is configured as an input and forces the start-up mode (SReg512) and post-timeout on Start-up mode (SReg555) to be dependent on the state of RI. The RI conditional modes are defined by SRegs 566 to 569 inclusive.
S566	1	7	If S565=1, and RI is asserted then this is the mode the device will start up in.
S567	1	7	If S565=1, and RI is deasserted then this is the mode the device will start up in.
S568	1	7	If S565=1, and RI is asserted then this is the mode the device will assume after the post-start-up timeout defined in SReg 554 instead of mode defined in SReg555
S569	1	7	If S565=1, and RI is deasserted then this is the mode the device will assume after the post-start-up timeout defined in SReg 554 instead of mode defined in SReg555
S580	0	0..1	Remote volume control feature for Headset profile when ATS102 enables headset profile
S581	0	0..63	Lowest 6 bits of the Supported features field for Handsfree profile when ATS102 enables handsfree profile. See also S Reg 594 which allows the HandsFree Profile version number to be selected
S582	0	0..1	FTP Related: 0 = BodyLen in PUT obex packet = 0 1 = BodyLen in PUT obex packet = 1
S583	0xB	0 .. 0x1F	This specifies the initial state of the following modem control lines sent to the peer Bit 0 := RTC (DTR/DSR) Bit 1 := RTR (RTS/CTS)

Register	Default	Range	Comment
			Bit 2 := IC (Ring Indicate RI) Bit 3 := DV (DCD) Bit 4 := FC (Reserved)
S584	0	0..1	Enable/Disable eSCO When changing the unit returns ERROR 14 it implies the device is either in a connection or waiting for a connection and so the new value cannot be accepted. For the former, drop the connection, then issue the command AT+BTX and then set the new value and for the latter issue the command AT+BTX prior to setting the register.
S585	0	0..9	GPIO pin set to 0 to disable the feature
S586	1000	100..5000	Pulse period in milliseconds (rounded down to nearest multiple of 50)
S587	0	0..100	Duty cycle in percentage (rounded to the nearest multiple of 4)
S588	0	0..1	After a disconnection, there will be a cold reset
S589	8	0..F	Codec output gain
S590	1	0..3	Codec input gain
S591	0	0..1FF	Default GPIO output states when not in a connection. This is used when virtual digital i/o cable replacement mode is in operation -- see section 3.11 Known Issues
S592	0	0..1	Set this to 1 to reduce the trusted device database to just 1 record when autosaving of pairing is enabled via S reg 538
S593	0	0..1	Automatically append last 6 digits of local Bluetooth address to the friendlyname which was set via AT+BTN or AT+BTF
S594	0	0..1	Set handsfree profile version in sdp record. Set to 0 for 1.1 and to 1 for 1.5
S595	1	0..1	Set handsfree gateway profile version in sdp record. Set to 0 for 1.1 and to 1 for 1.5
S596	0	1..1FF	Audio Gateway features to be advertised in SDP record. See handsfree profile specification for exact bit mapping.
S597	0	0..2	Audio gateway Mode: 0 for SDP record advert only, 1 for hosted operation and 3 for hostless operation. See Audio Gateway specific documentation for more details
S598	0	0..1	In hostless audio gateway serviced mode, if this is 1, then incoming voice calls will be reflected to bonded headset
S599	0	0..2	Sco control for hostless gateway operation. 0 for normal, 1 for as early as possible, 2 leave SCO to be controlled by headset
S600	?	0..65535	Number of times this module has gone through a reset cycle. This feature is enabled by S Reg 601. Writing any value to this register will initialise it to a certain value
S601	0	0..1	If this is 1, then on reset S Reg 600 value will be incremented.
S610	0	0..7FFF	Set direction of digital I/O lines. This is a mask made up of 5 bits. Setting a bit to 1 makes that I/O line an output. GPIO1 is bit 0, GPIO2 is bit 1, up to bit 4 for GPIO5 – see the Known Issues section.
S611	0	1	Set to 1 to invert the logic of GPIO outputs. For example, ATS621=1 will set the output pin to low and vice versa – see the Known Issues section.
S620	n/a	0..31	Read/Write to all 8 Digital lines in one atomic step. The value is returned as a 4 digit hexadecimal value with trailing 0s.
S621	n/a	0..1	Read/Write to GPIO1
S622	n/a	0..1	Read/Write to GPIO2

Register	Default	Range	Comment
S623	n/a	0..1	Read/Write to GPIO3
S624	n/a	0..1	Read/Write to GPIO4
S625	n/a	0..1	Read/Write to GPIO5 – see the Known Issues section.
S626	n/a	0..1	Read/Write to GPIO6 – see the Known Issues section.
S627	n/a	0..1	Read/Write to GPIO7 – see the Known Issues section.
S628	n/a	0..1	Read/Write to GPIO8
S629	n/a	0..1	Read/Write to GPIO9 – Not available in BTM430 / BTM431
S631	n/a	0..65535	When GPIO1 is configured as an input, low to high transitions are counted. There is no software debouncing. External RC circuit may be required. The counter wraps to 0 when it overflows beyond 65535.
S632	n/a	0..65535	When GPIO2 is configured as an input, low to high transitions are counted. There is no software debouncing. External RC circuit may be required. The counter wraps to 0 when it overflows beyond 65535.
S641	n/a	0..65535	As per 631, but the action of reading the value will reset the count to 0.
S642	n/a	0..65535	As per 632, but the action of reading the value will reset the count to 0.
S701	n/a	0..65535	Read/Write to Analogue Line 0, when reading value is returned in decimal. – Not available in BTM430 / BTM431
S702	n/a	0..65535	Read/Write to Analogue Line 1, when reading value is returned in decimal. – Not available in BTM430 / BTM431
S711	n/a	0000..FFFF	Read/Write to Analogue Line 0, when reading value is returned in hexadecimal. – Not available in BTM430 / BTM431
S712	n/a	0000..FFFF	Read/Write to Analogue Line 1, when reading value is returned in hexadecimal. – Not available in BTM430 / BTM431
S721	0	0	Set direction of Analogue Line 0. – Not available in BTM430 / BTM431
S722	0	0	Set direction of Analogue Line 1. Not available in BTM430 / BTM431
S1001 to S1010		0.. 2^32	10 General Purpose 32 bit Registers for use by host. These are stored in non-volatile memory.

2.3.14 ATSn? {Read S Register Value}

This will return the current value of register n.

For recognised values of n:

Response: <cr,lf>**As Appropriate**<cr,lf>**OK**<cr,lf>

For unrecognised values of n:

Response: <cr,lf>**ERROR nn**<cr,lf>

2.3.15 ATSn=? {Read S Register – Valid Range}

This will return the valid range of values for register n.

For recognised values of n:

Response: <cr,lf>**Sn:(nnnn..mmmm)**<cr,lf>**OK**<cr,lf>

For unrecognised values of n:

Response: <cr,lf>**ERROR nn**<cr,lf>

2.3.16 ATX<string> {Send Data in Local Command and Connected Mode}

This command is used to send data to the remote device when in local command and connected mode.

The parameter <string> is any string not more than 24 characters long. If a non-visual character is to be sent then insert the escape sequence \hh where hh are two hexadecimal digits. The 3 character sequence \hh will be converted into a single byte before transmission to the peer.

Response: <cr,lf>**OK**<cr,lf>

2.3.17 ATY<string> {Send Data in Local Command and Connected Mode}

This command is similar to ATX in syntax and functionality, except that the string is only copied to the output RF buffer. Only when an empty string is presented will all pending data in the output RF buffer be flushed out.

The parameter <string> is any string not more than 24 characters long. If a non-visual character is to be sent then insert the escape sequence \hh where hh are two hexadecimal digits. The 3 character sequence \hh will be converted into a single byte before transmission to the peer.

Response: <cr,lf>**OK**<cr,lf>

2.3.18 ATZ<n> {Hardware Reset and emerge into mode 'n'}

Forces the device through a hardware reset which means it will eventually come alive in the local command and unconnected mode. This allows changes to the PS store to take effect. Prior to version 2.7.0 allow for about 2 seconds for the device to start responding to AT commands again. The best way of determining that the device is alive again, is to keep sending it AT<cr> until it responds with an OK response. Post v2.7.0 it is safe to communicate after receiving an OK.

The optional parameter <n> is only available for firmware 2.7.0 and newer and is a value in the range 0 to 7 (up to version 7.18.0). Post 9.18.6 valid values are 0 to 4 inclusive.

ATZ and ATZ0 signify reset and emerge into the current mode (see command ATI14). ATZ1 to ATZ4 instructs the module to reset and then emerge into the appropriate boot mode. Note that S Reg 103 specifies the boot mode from cold.

For firmware prior to v2.7.0 –

Response: <cr,lf>**OK**<cr,lf>

Note: OK is returned before the RESET.

For firmware v2.7.0 and newer –

Response: <cr,lf>**OK**<cr,lf>

Note: OK is returned after the RESET.

2.3.19 AT&Fn {Set S Register Defaults}

This command will only work when the device is in local command and unconnected mode. Depending on the value of 'n' it installs S Register values appropriate for various power modes, ranging from minimum power consumption to maximum.

Legal values of 'n' are as per the following table. All other values of n will generate a syntax error response. If 'n' is not specified then a default value of 0 is assumed where the baud rate is NOT changed.

&F0 (Default)	Medium power consumption, UART baud rate unchanged, Left LED off, Right LED = DCD
&F1	Minimum power consumption, UART baud rate set to 9600, Left and Right LED off
&F2	Minimum power consumption, UART baud rate set to 38400, Left and Right LED off
&F3	Minimum power consumption, UART baud rate set to 115200, Left and Right LED off
&F4	Medium power consumption, UART baud rate set to 115200, Left LED off, Right LED = DCD
&F5	Maximum power consumption, UART baud rate set to 115200, Left LED=DSR, Right LED = DCD
&F6	Maximum power consumption, UART baud rate set to 115200, Left LED=DSR, Right LED = DCD. Explicitly set higher baud rates using ATS521=n

Please refer to the "Power Consumption" chapter in the relevant Ezurio device user guide for more detailed information of power usage.

The new values are NOT updated in non-volatile memory until the AT&W command is sent to the Ezurio device.

Response: <cr,lf>**OK**<cr,lf>

Or

Response: <cr,lf>**ERROR nn**<cr,lf>

2.3.20 AT&F* {Clear Non-volatile Memory}

The AT&F* variant of the command installs values in S registers as per command AT&F4 and then all other user parameters in non-volatile memory are erased. This means that the trusted device database is cleared, and so are parameters related to the following commands:- AT+BTR, AT+BTN, AT+BTS.

Response: <cr,lf>**OK**<cr,lf>

Or

Response: <cr,lf>**ERROR nn**<cr,lf>

2.3.21 AT&F+ {Clear Non-volatile Memory}

This command erases all user parameters in non-volatile memory except S Registers 520 to 525. This means that the trusted device database is cleared, and so are parameters related to the following commands:- AT+BTR, AT+BTN, AT+BTS.

Response: <cr,lf>**OK**<cr,lf>

Or

Response: <cr,lf>**ERROR nn**<cr,lf>

2.3.22 AT&W {Write S Registers to Non-volatile Memory}

Writes current S Register values to non-volatile memory so that they are retained over a power cycle.

Response: <cr,lf>**OK**<cr,lf>

Or

Response: <cr,lf>**ERROR nn**<cr,lf>

2.3.23 AT+BTAn {Control Audio Channel}

Once a Bluetooth connection is active, **and assuming the peer device is an EZURIO device**, this command is used to start/stop a SCO channel which will connect the PCM interfaces of the two peer devices. This means that if a codec is attached to the PCM pins, then 2-way audio can be established.

+BTA0	Switch off the channel.
+BTA1	Switch on the channel.

On receipt of the command, the following response immediately follows.

Response: <cr,lf>**OK**<cr,lf>

The lower layers then go through the process of setting up the SCO channel, and as soon as a SCO link is established, the following response is asynchronously sent to the host.

Response: <cr,lf>**AUDIO ON**<cr,lf>

Or if the SCO failed to be established.

Response: <cr,lf>**AUDIO FAIL**<cr,lf>

On the peer device, the host will asynchronously get ….

Response: <cr,lf>**AUDIO ON**<cr,lf>

2.3.24 AT+BTC<devclass> {Set Device Class Code}

This command is used to set the device class code which will be sent in subsequent inquiry responses. It can be read back using the AT+BTC? Command, as described below.

<devclass> is a 6 digit hexadecimal number derived as per section "1.2 The Class of Device/Service Field" of the Bluetooth specification "Bluetooth Assigned Numbers".

The 24 bits are made of 4 fields briefly described as follows (bit 0 corresponds to the least significant bit):-

Bits 0-1:	Format Type. This field currently only has a value of 00 (i.e. format type 1).
Bits 2-7:	These 6 bits define the Minor Device Class and the value is interpreted differently based on the Major Device class stored in the next 5 bits.
Bits 8-12:	These 5 bits define the Major Device Class as per Table 1.3 in "Bluetooth Assigned Numbers".
Bits 13-23:	This is an 11 bit field used as a mask to define the Major Service Class, as per Table 1.2 in "Bluetooth Assigned Numbers".

Ezurio devices do not map to any predefined Major Service Class or Major Device Class and so the default devclass as shipped is 001F00, which means no Major Service Class and "Unclassified" Major Device class.

Other examples of device class codes are follows:-

Code (Hexadecimal)	Name	Major Service	Major Device	Minor Device
001F00	Unclassified	None	Unclassified	n/a
200404	Headset	Audio	Audio	Headset

Response: <cr,lf>**OK**<cr,lf>

Or for an invalid <devclass> value (usually a value which is not 6 hexadecimal characters long).

Response: <cr,lf>**ERROR 08**<cr,lf>

2.3.25 AT+BTC? {Read Device Class Code}

This command is used to read the current device class code.

Response: <cr,lf>**123456**<cr,lf>**OK**<cr,lf>

2.3.26 AT+BTD<bd_addr> {Remove Trusted Device}

This command is used to remove the specified device from the list of trusted devices in the non-volatile database. If the device is not in the database then the response will still be an OK.

Response: <cr,lf>**OK**<cr,lf>

2.3.27 AT+BTD* {Remove All Trusted Devices}

This command is used to remove all devices from the list of trusted devices in the non-volatile database. No confirmation will be asked for.

> **WARNING**: If you make an authenticated connection, the link key gets cached in the underlying stack. So if you subsequently delete the key using AT+BTD* and immediately request an authenticated connection to the same device, then the connection will be established. To ensure this does not happen, either send ATZ after the AT+BTD* OR send AT+BTD<bd_addr> for each item in the trusted device database.

Response: <cr,lf>**OK**<cr,lf>

2.3.28 AT+BTF=<string> {Set Friendly Name}

This sets the friendly name of this device as seen by other devices.

Response: <cr,lf>**OK**<cr,lf>

2.3.29 AT+BTF<bd_addr> {Get Remote Friendly Name}

This command gets the remote friendly name of the peer specified.

Response: <cr,lf>**<bd_addr>,"Friendly Name"**

<cr,lf>**OK**<cr,lf>

2.3.30 AT+BTG<bd_addr> {Enable Cautious Page Scanning ONLY}

Enable page scanning and wait for a connection from device with Bluetooth address <bd_addr>. If the specified address is 000000000000 then incoming connections are accepted from any device, is as per AT+BTP without an address. Inquiry Scans are disabled.

This command also has variants which allow authentication and encryption to be explicitly specified. For example:

```
AT+BTGU123456789012

AT+BTGY123456789012

AT+BTGUY123456789012

AT+BTGYU123456789012
```

Response: <cr,lf>**OK**<cr,lf>

2.3.31 AT+BTG {Enable Promiscuous Page Scanning ONLY}

Enable page scanning only and wait for a connection from any device. Inquiry scans are disabled. Authentication and Encryption is as per S registers 502 and 503.

Response: <cr,lf>**OK**<cr,lf>

2.3.32 AT+BTGU {Enable Promiscuous Page Scanning ONLY}

Enable page scanning only and wait for a connection from any device. Inquiry scans are disabled. Authentication is enabled and encryption is disabled.

Response: <cr,lf>**OK**<cr,lf>

2.3.33 AT+BTGY {Enable Promiscuous Page Scanning ONLY}

Enable page scanning only and wait for a connection from any device. Inquiry scans disabled. Authentication is disabled and encryption is enabled.

Response: <cr,lf>**OK**<cr,lf>

2.3.34 AT+BTGUY {Enable Promiscuous Page Scanning ONLY}

Enable page scanning only and wait for a connection from any device. Inquiry scans are disabled. Authentication and encryption are both enabled. The order of U and Y is not significant.

Response: <cr,lf>**OK**<cr,lf>

2.3.35 AT+BTI<devclass> {Inquire}

This will make the device perform an inquiry for device class code for **delay** milliseconds and **max** number of unique responses, where **delay** is specified by S register 517 and **max** is specified by S register 518.

The <devclass> is an optional parameter where the value specifies either a 6 digit device class code or a 2 digit major device class. If it is not specified, then the value is taken from S register 516.

When <devclass> is 6 hexadecimal characters long, it specifies an AND mask which is used to filter inquiry responses. When <devclass> is 2 hexadecimal characters long, it forces the inquiry to filter responses to devices that match their major device class code to this value – which can only be in the range 00 to 1F.

Response: <cr,lf>**12346789012**

<cr,lf>**12345678914**

<cr,lf>**OK**<cr,lf>

If the module is waiting for an incoming connection, (entered via AT+BTP, AT+BTG, AT+BTQ), then it will respond with ERROR 14. To perform the inquiry, send AT+BTX to put the module back into idle mode.

Response: <cr,lf>ERROR 14<cr,lf>

2.3.36 ERROR RESPONSE

A Bluetooth inquiry process is such that for a single inquiry request a device could respond many times. To ensure that an address is sent to the host only once for a particular AT+BTI, an array of addresses is created at the start of each AT+BTI and is filled as responses come in. This array of addresses is stored in dynamic memory and as such if the memory allocation fails then the inquiry procedure is aborted and in that case an error response is sent to the host.

To clarify, a single AT+BTI will **never** return the same Bluetooth address more than once, but as long as the responding device is active, all AT+BTI commands will always return it.

Response: <cr,lf>**ERROR 27**<cr,lf>

2.3.37 AT+BTIV<devclass> {Inquire}

As per AT+BTI but the response includes the device class code for all inquiry responses. Please refer to the 'ERROR RESPONSE' note in the description for AT+BTI<devclass>.

Response: <cr,lf>**12346789012,123456**

<cr,lf>**12345678914,123456**

<cr,lf>**OK**<cr,lf>

2.3.38 AT+BTIN<devclass> {Inquire}

As per AT+BTI but the response includes the device class code and friendly name for all inquiry responses. Please refer to the 'ERROR ESPONSE' note in the description for AT+BTI<devclass>. The friendly name strings are in UTF-8 format as per the Bluetooth specification.

Response: <cr,lf>**12346789012,123456,"TDK SYSTEMS AT DONGLE 1"**

<cr,lf>**12345678914,123456, "TDK SYSTEMS RS232"**

<cr,lf>**OK**<cr,lf>

Note: Many releases of firmware will return the product name as TDK SYSTEMS, e.g.
Response: <cr,lf>12346789012,123456,"TDK SYSTEMS AT DONGLE 1"
<cr,lf>12345678914,123456, "TDK SYSTEMS RS232"
<cr,lf>**OK**<cr,lf>

Note: We strongly recommend that any software implementation that uses this command should check for any of Ezurio, EZURIO and TDK SYSTEMS to ensure backwards and forwards compatibility.

2.3.39 AT+BTK=<string> {Set Passkey}

This command is used to provide a passkey when **PIN? 12345678** indications are received asynchronously. If a pairing is not in progress then the pin is written to non-volatile memory for future use. Specifying an empty string deletes the key from the non-volatile memory.

The string length must be in the range 0 to 8, otherwise an error will be returned.

Response: <cr,lf>**OK**<cr,lf>

2.3.40 AT+BTM<bd_addr> {Set Incoming Peer Address}

This command is used to store a peer address for incoming connections in non-volatile memory. A value of 000000000000 has the special meaning of invalid peer address.

When S register 512 = 3, 4, 6 or 7 then it will wait for an incoming connection from the peer address specified. If the peer address is not 000000000000, then it waits for a connection from the specified master, otherwise will connect to anyone.

Response: <cr,lf>**OK**<cr,lf>

2.3.41 AT+BTM {Delete Incoming Peer Address}

This command is used to delete the peer address previously stored using AT+BTR<bd_addr>.

Response: <cr,lf>**OK**<cr,lf>

2.3.42 AT+BTM? {Read Incoming Peer Address}

This command is used to display the peer address stored in non-volatile memory, used to put the module in pure cable replacement mode.

Response: <cr,lf>**12346789012**

<cr,lf>**OK**<cr,lf>

If the location is empty the response is as follows.

Response: <cr,lf>**00000000000**

<cr,lf>**OK**<cr,lf>

2.3.43 AT+BTN=<string> {Set Friendly Name in Non-volatile Memory}

This sets the default friendly name of this device as seen by other devices. It will be stored in non-volatile memory. Use AT+BTF to make the name visible to other devices. Use AT+BTN? To read it back. An empty string (“”) will delete the string from non-volatile memory which will force the default name to be used.

Response: <cr,lf>**OK**<cr,lf>

2.3.44 AT+BTN? {Read Friendly Name from Non-volatile Memory}

Read the default friendly name from non-volatile memory.

Response: <cr,lf>**"My FriendlyName"**<cr,lf>

<cr,lf>**OK**<cr,lf>

2.3.45 AT+BTO<devclass> {Open and make Unit Detectable}

After power up and ATZ, this command is sent so that RFCOMM is initialised and opened and the service name as specified in AT+BTN is exposed via the SDP registry.

The <devclass> value specifies an optional fixed length hexadecimal device class code. If it is not specified, then the device class code is taken from S Register 515.

For this command to be effective, S Register 512 must be set to 0.

Response: <cr,lf>**OK**<cr,lf>

2.3.46 AT+BTP<bd_addr> {Enable Cautious Page/Inquiry Scanning}

Enable page scanning and wait for a connection from device with Bluetooth address <bd_addr>. If the specified address is 000000000000 then incoming connections are accepted from any device, is as per AT+BTP without an address. Inquiry scanning is also enabled.

This command also has variants which allow authentication and encryption to be explicitly specified. For example:

AT+BTPU123456789012

AT+BTPY123456789012

AT+BTPUY123456789012

AT+BTPYU123456789012

Response: <cr,lf>**OK**<cr,lf>

2.3.47 AT+BTP {Enable Promiscuous Page/Inquiry Scanning}

Enable page scanning and wait for a connection from any device. Inquiry scanning is also enabled. Authentication and Encryption is as per S registers 502 and 503.

Response: <cr,lf>**OK**<cr,lf>

2.3.48 AT+BTPU {Enable Promiscuous Page/Inquiry Scanning}

Enable page scanning and wait for a connection from any device. Inquiry scanning is also enabled. Authentication is enabled and encryption is disabled.

Response: <cr,lf>**OK**<cr,lf>

2.3.49 AT+BTPY {Enable Promiscuous Page/Inquiry Scanning}

Enable page scanning and wait for a connection from any device. Inquiry scanning is also enabled. Authentication is disabled and encryption is enabled.

Response: <cr,lf>**OK**<cr,lf>

2.3.50 AT+BTPUY {Enable Promiscuous Page/Inquiry Scanning}

Enable page scanning and wait for a connection from any device. Inquiry scanning is also enabled. Authentication and encryption are both enabled. The order of U and Y is not significant.

Response: <cr,lf>**OK**<cr,lf>

2.3.51 AT+BTQ {Enable Inquiry Scans ONLY}

When inquiry scan is enabled, it implies that this device will respond to inquiries from other devices. Use AT+BTX to disable inquiries.

Response: <cr,lf>**OK**<cr,lf>

2.3.52 AT+BTR<bd_addr> {Set Outgoing Peer Address}

This command is used to store a peer address for outbound connections in non-volatile memory. A value of 000000000000 has the special meaning of invalid peer address.

This command is used to set up a module in pure cable replacement mode.

If S register 512 = 1 and the peer address is NOT 000000000000, then it will periodically (time specified via S register 505) attempt to connect to the peer address specified. In this circumstance all commands from the host are buffered in the receive buffer, until a Bluetooth connection is established with the peer device and it then sends0 the buffer across. This means that if the peer device is not in the vicinity and will never be there, the device effectively becomes useless, as in this circumstance a host would want to get attention of the AT parser to send it new commands – probably one to delete the peer device.

In this circumstance, a recovery is possible by one of two methods. The first method assumes that the DTR from the host is connected to the DSR line of the module and the second method assumes that this connection is absent. In the first method it is enough to deassert the DTR line from the host and that will abort the autoconnect cycle. The second method is initiated by resetting the device and then ensuring that the text string "AT+BT&BISM&<cr>" is sent (where <cr> is the carriage return character). There is special code which looks out for this magic command and terminates the autoconnect cycle if it sees it and confirms to the host of that fact by sending an "OK" response.

Response: <cr,lf>**OK**<cr,lf>

2.3.53 AT+BTR {Delete Outgoing Peer Address}

This command is used to delete the peer address previously stored using AT+BTR<bd_addr>.

Response: <cr,lf>**OK**<cr,lf>

2.3.54 AT+BTR? {Read Outgoing Peer Address}

This command is used to display the peer address stored in non-volatile memory, used to put the Ezurio device in pure cable replacement mode.

Response: <cr,lf>**12346789012**
<cr,lf>**OK**<cr,lf>

If the location is empty the response is as follows.

Response: <cr,lf>**00000000000**
<cr,lf>**OK**<cr,lf>

2.3.55 AT+BTS=<string> {Set Service Name}

This writes the name to non-volatile memory. It will be used after ATZ, power cycle or AT+BTO if it has not been issued yet. Use **AT+BTS?** to read it back from non-volatile memory. An empty string ("") will delete the string from non-volatile memory which will force the default service to be used.

Response: <cr,lf>**OK**<cr,lf>

If the service name cannot be set for any reason then an error response **ERROR 11** is returned.

2.3.56 AT+BTS? {Read Service Name from Non-volatile Memory}

Reads the default service name from non-volatile memory.

Response: <cr,lf>**"My ServiceName"**<cr,lf>

<cr,lf>**OK**<cr,lf>

2.3.57 AT+BTT {Add Trusted Device}

This command is used to store the cached link key in the non-volatile database. If the database is full it will respond with an ERROR. If the device is already in the database, then the key is replaced.

If the link key cache is empty, that is, a pairing has not been performed since the device was powered, then the response will be an ERROR.

Response: <cr,lf>**OK**<cr,lf>

Or

Response: <cr,lf>**ERROR**<cr,lf>

2.3.58 AT+BTT? {List Trusted Device}

This command is used to list the contents of the trusted device database. The link key is NOT displayed so the response is as shown below. If the list is empty then just the OK response is sent otherwise an OK is used to terminate the list. Use the command ATI6 to read the maximum size of the trusted device database.

Response: <cr,lf>**12346789012**

<cr,lf>**12345678913**

<cr,lf>**12345678914**

<cr,lf>**OK**<cr,lf>

2.3.59 AT+BTV<U><Y><bd_addr>,<uuid> {SDP Query for Service }

This command is used to interrogate the SDP database of the peer device <bd_addr> for the service <uuid>. It results in an ACL connection and then a SDP transaction.

If the <uuid> service is present then

Response: <cr,lf>**0**

<cr,lf>**OK**<cr,lf>

If the <uuid> service is not present then

Response: <cr,lf>**1**

<cr,lf>**OK**<cr,lf>

If the device < bd_addr > cannot be reached, or is in non-connectable mode then

Response: <cr,lf>**2**

<cr,lf>**OK**<cr,lf>

If the SDP database is corrupt or invalid then

Response: <cr,lf>**3**

<cr,lf>OK<cr,lf>

If the device is not in idle mode then

Response: <cr,lf>**4**

<cr,lf>**OK**<cr,lf>

and in this case, the command AT+BTX may put the device into the correct idle mode.

2.3.60 AT+BTW<bd_addr> {Initiate Pairing}

This initiates pairing with a device whose Bluetooth address is <bd_addr>. An OK response is sent and when the PIN is required, asynchronous indications will be sent to the host in the form **PIN? <bd_addr>** where the address confirms the device with which the pairing is to be performed. To supply a PIN, use the AT+BTK command.

For a successful pairing, the link key is stored in a volatile cache which is overwritten every time a new pairing is initiated using this command. The link key can be stored in a non-volatile database within the device. The list of trusted devices is managed using commands AT+BTT?, AT+BTT and AT+BTD. The AT+BTT? command produces a list of trusted Bluetooth addresses (link key is NEVER displayed) and AT+BTT is used to store the cached link key. The command AT+BTD123456789012 is used to remove the specified device from the database.

The "OK" response is sent immediately on receipt of the AT+BTW command. On pairing completion, an unsolicited message will be sent to the host which will be in the form PAIR n <bd_addr>. See the section on Pairing and Trusted Devices

If AT+BTI or AT+BTP or AT+BTG or AT+BTQ or ATD is issued between the AT+BTW command and the subsequence PAIR asynchronous response, then an ERROR response will be sent to those commands as the device is not in a mode from where such commands can be actioned.

Response: <cr,lf>**OK**<cr,lf>

2.3.61 AT+BTW? {List Cached Trusted Device}

This command is used to list the cached trusted device.

Response: <cr,lf>**12346789012**

<cr,lf>**OK**<cr,lf>

If the cache is empty the response is as follows.

Response: <cr,lf>**OK**<cr,lf>

2.3.62 AT+BTX {Disable Page/Inquiry Scanning}

Disable page/inquiry scanning. This means it will not accept incoming connections or inquiry requests. In fact this negates the effect of AT+BTQ, AT+BTG and AT+BTP commands.

Response: <cr,lf>**OK**<cr,lf>

2.3.63 AT+AG<command><parm> {Audio gateway Control}

See audio gateway specific specification for more details.

2.4 Unsolicited Responses

The 'AT' Protocol is a command/response type of protocol. This means that the Ezurio device will normally only respond to AT commands.

Under special circumstances, unsolicited responses will be sent to the host. They are described in the following subsections.

2.4.1 RING

This string is sent to the host when a remote device is initiating a serial port connection. The fully qualified string is in the form RING 012345678901 where 012345678901 is a 12 digit hexadecimal number which corresponds to the remote device's Bluetooth address. This response is sent to the host every 2 seconds until the host either accepts the connection using the ATA command or rejects it using the ATH command.

2.4.2 PIN?

This response is sent to the host during a pairing negotiation.

The fully qualified string is PIN? 012345678901 where 012345678901 is the Bluetooth address of the peer device. In response, the host must supply a pin code which is entered using the AT+BTK command.

If the peer address does not supply the address in the message exchange, then the address is specified as 000000000000 – and the paring will proceed as normal.

2.4.3 AUDIO ON

This response is sent to the host when a SCO channel has been established.

2.4.4 AUDIO OFF

This response is sent to the host when an existing SCO channel has been closed.

2.4.5 AUDIO FAIL

This response is sent to the host when a SCO channel setup fails.

2.4.6 ERROR 27

This response is sent to the host on power up if the firmware is unlicensed.

2.4.7 PAIR n <bd_addr>

This response is sent to the host on termination of a pairing process. If pairing was successful then 'n' = 0, if a timeout occurred then 'n'=1 and for all other unsuccessful outcomes the value will be 2.

The parameter <bd_addr> is the address of the peer device if available.

2.4.8 PAIR 0 <bd_addr> MM

This response is sent to the host on termination of a successful pairing process. The optional MM is sent only if S Register 538 is set to 1 to automatically save the link key. The value MM indicates the result of the save operation and a value of 00 implies success, otherwise the value corresponds to an error code.

2.4.9 RX<string>

This response is sent to the host when the unit is in online-command mode and S Register 531 is set to 3 and data arrives from a peer.

If the data from the string contains non-visual characters (for example ASCII 0 to 31 and ASCII 128 to 255), then those characters are translated into a 3 character escape sequence starting with '\'. For example the embedded <cr><lf> sequence would be sent as the 6 character string \0D\0A.

If the data contains the character '"' then it is sent as \22.

If the data contains the character '\' then it is sent as \5C

2.4.10 AG<string>

This response is sent to the host when a serviced audio gateway connection is in progress and the profile requires some action from the host.

2.5 Incoming Connections

The Ezurio device can be configured using the AT+BTP or AT+BTG command so that it will scan for incoming connections from other Bluetooth devices. It can also be configured via S Register 512 to be in this mode by default on power up.

When the lower layers detect an incoming call, a RING 123456789012 string is sent to the host every second. The command ATA is used to accept the connection and ATH to reject it.

On connection, if the S0 Register is >=0 then confirmation to the host is in the form:-

```
CONNECT 123456789012
CONNECT 123456789012 A
CONNECT 123456789012 E
CONNECT 123456789012 AE
```

Where 'A' means authenticated connection and 'E' means encryption has been enabled.

When S0 register is -1, neither RING nor CONNECT is sent to the host and the connection is silently accepted.

If the S 100 register is non-zero, then after the ring indications specified by this register have been sent to the host, and the host has failed to accept or reject the incoming connection, then an automatic 'hangup' is initiated.

2.6 Dropping Connections

In a conventional telephony modem, a call is normally terminated by first sending a +++ character sequence enveloped by an escape sequence guard time (of the order of 100 to 1000 milliseconds) to enter local command and connected mode and then the ATH command.

Ezurio Bluetooth modules provide a variety of ways of dropping a connection. One method is similar to the above, but instead a ^^^ character sequence is used, this is to eliminate ambiguity when a data call is in progress via a mobile phone which was established using the mobile phone's Bluetooth AT modem. The second method involves the host dropping the DTR (DSR from the module's viewpoint) handshaking line.

Being able to drop a connection using the escape sequence ^^^ has a **severe** penalty on data throughput, in fact, the data rate is of the order of 85kbps instead of about 200kbps. To cater for this performance hit, the device's connection drop capability is configurable to be in one of two modes.

One mode allows for a connection to be dropped using either method, and the other mode allows for a connection drop using the DTR method only. By default, the device is in former mode. This mode is selected using the S507 register. See S register table described in an earlier section.

To reiterate, the escape sequence is as follows:

<Guard time><Esc Chr><Guard time><Esc Chr><Guard time><Esc Chr><Guard time>

This means that even when a file transfer is occurring and it happens to be full of <Esc Chr> characters then it is not going to drop into command mode because, when transferring a file it is going to happen as fast as possible and so the inter character gap is going to be significantly shorter than the <Guard time>.

The <Esc Chr> character can be changed via the S2 register and the <Guard time> interval can be specified via the S12 register.

2.7 Pairing and Trusted Devices

When authentication is enabled via S register 500 or when using the 'u' modifier in the ATD and AT+BTP commands, a connection attempt will require a link key for the peer device. The link key can be obtained prior to connection by invoking the AT+BTW and AT+BTK commands. A new link key can be obtained as often as required and is stored in a volatile cache. At any time, this cached link key can be added to the trusted devices database using the AT+BTT command. A trusted device can be deleted using the AT+BTD command. To view a list of trusted device issue the command AT+BTT?.

In addition, if S Register 538 is set to 1, then on a successful pairing, the link key will be automatically saved to the trusted device database. In that case, the asynchronous message PAIR 0 <bd_addr> has an error code appended at the end to convey the result of the save operation.

When a connection attempt requires a link key, the trusted device database will be searched automatically and if one exists will be provided without host interaction. If the link key is not present, then the connection attempt will be terminated and a NO CARRIER response will be given to the ATD command.

A typical session to pair an Ericsson T68i (for example) to a serial module would be:

- Make the T68i discoverable and send AT+BTI to the serial module. This will result in inquiry responses from all devices. Make a note of the Bluetooth address of the phone e.g. 123456789012
- On the T68i start pairing procedure by selecting "Phone accepts" in the relevant Bluetooth menu.
- Send command AT+BTW123456789012 to the serial module
- Confirm that you get an OK response and then PIN? responds on a two second interval.
- Enter a pin code on the phone. Say it is 12345768
- Then enter the command AT+BTK="12345678".
- The phone will confirm success and likewise the serial module will respond with OK
- On success the serial module will send an unsolicited message in the form of PAIR 0 <bd_addr>
- Send AT+BTT to the serial module so that the pairing information is stored in the non-volatile database.
- Confirm that the link key has been stored by sending the command AT+BTT?. This will result in a list of all devices paired with the module.

If two Ezurio devices need to be paired, then it can be accomplished as follows:

- To device 1 send ATI4, it will respond with the local Bluetooth address. E.g. 123456789001
- To device 1 send AT+BTP. It will become discoverable and connectable.
- To device 2 send AT+BTW123456789001 and it will respond with OK
- Then on both devices you will see PIN? asynchronous responses
- To both modules send AT+BTK="12345678"
- On success the serial module will send an unsolicited message in the form of PAIR 0 <bd_addr>
- The pairing link key, is at this stage, in volatile memory, so send AT+BTT to both.
- The two units now have pairing information which will survive a power cycle.

2.8 Error Responses

All error responses from the Ezurio device will be in the form <cr,lf>**ERROR nn**<cr,lf>, where nn will be a number in the range 00 to 99.

Error	Description
01	Register not recognised
02	Value for register is out of range
03	Incoming call NOT pending
04	No call to connect to. This error code has meaning for ATO only
05	Syntax Error
06	Empty String
06	Device Class could not be stored
08	Invalid Device Class Code
09	Invalid Bluetooth Address
10	Could not set Service or Friendly name
11	PS Store Write
12	PS Store Read
13	Not Idle
14	Incorrect Mode
15	Already Scanning
16	Pairing is already in progress
17	Not USED
18	Not USED
19	Not USED
20	Not safe to write to Non-volatile Store - Ongoing Bluetooth Connection
21	Link Key Cache is Empty
22	Link Key Database is Full
23	Malloc returned NULL - Resource Issue
24	Remote Address same as Local Address
25	Connection Setup Fail, DSR Not asserted
26	Unauthenticated licence
27	Max Responses (See S Register 518) too high. Memory allocation error
28	The length of Pin in AT+BTK is too long
29	Invalid Ring count specified for S Register 0 or 100. If S0<>0 and S100<>0 then S0 must be < S100
30	ADC Error

Error	Description
31	Analogue Value cannot be read as it is set for output
32	Analogue Value cannot be written as it is set for input
33	S Register Value is invalid
34	Both L and R modifier cannot be specified in ATD command
35	Invalid Major Device Class – valid value in range 0x00 to 0x1F inclusive
36	Pairing in progress – Command cannot be actioned – try again later
37	Invalid Sniff parameter specified. E.g. new Attempt value greater than MinInterval. Solution is to first increase MinInterval and re-enter the Attempt value.
38	Get Remote Friendly name Failed
39	Failed to change mode to Multipoint
40	7 Bit mode requires parity to be even or odd

2.9 Factory Default Mode

Ezurio devices are capable of operating at a very wide range of baud rates. S Registers 520 and 521 allow the baud rate to be set very easily. The baud rate clock generator in the Ezurio device is more versatile that that available in a standard 16550 UART commonly available in PCs.

In fact, as long as the equation BAUDRATE * 0.004096 produces an integer value, then there will be 0% error in clocking for that baud rate.

So it is possible to set a baud rate that a PC cannot cope with, and in that circumstance it is virtually impossible to communicate with it.

To cater for this circumstance, the Ezurio device will come out of reset using 9600,N,8,1 comms settings for exactly 750 milliseconds and then revert to the comms parameters as per the S Registers.

If the host sends the string **!<BISM>!<cr>** where <cr> is the carriage return character within that 750ms period, then the module will remain at 9600,N,8,1 and will also configure itself using factory default S Register values.

2.10 Miscellaneous Features

This chapter describes various features which cannot be categorized appropriately.

2.10.1 RI dependent Start-up Mode

The UART_RI line can be configured as an input and on power its state can be used to force the device into one of two modes. See description for S Registers 565 to 569 inclusive for more details.

For example, the feature could allow a device to make an outgoing connection if RI is in one state, and be ready for an incoming connection in the other.

Pulse a GPIO pin

To flash a GPIO pin, set it as an output using S reg 610 and then use S reg 585 to 587 inclusive to set the pin, period and duty cycle respectively – see the Known Issues section.

2.10.2 Flash LED on Connectable Mode

S reg 534 now takes a value up to 2. A value of 2 configures it so that it will blink when the module is in connectable mode.

2.10.3 Reset via BREAK

The module can be reset by sending a BREAK signal. A BREAK signal exists when the module's UART_RX input is in a non-idle state (0v) for more than 125 milliseconds.

2.10.4 Digital I/O Cable Replacement

The module has a number of general purpose digital I/O pins. The direction of these is specified via S Reg 610.

When S Reg 531 is set to 4 at both ends of the connection, then on connection, any changes in the states of the inputs at one end will be transmitted to the peer, which will then reflect those states on the appropriate I/O pins if they have been configured as outputs.

It is recommended that the value of S Reg 610 at one end be the one's complement of the other end. That way, inputs at one end are mirrored at the other end and vice versa.

In addition S Reg 506 MUST be set to 0, which disables echoes.

Note that due to inherent latency of Bluetooth transmission, expect the change of state to be delayed. This value is typically 100ms and can be much more if the quality of the link is bad which results in many retries.

It is assumed that an audio channel is not active at any time.

2.10.5 Append Bluetooth Address to Friendly name

If S Reg 593 is set to 1, then the last 6 hex digits of the Bluetooth address are automatically appended to the friendly name. This allows multiple devices with the same name in a neighbourhood to be differentiated.

2.11 Known Issues

This chapter outlines any known issues in BTM430 / BTM31 firmware.

Issue #	FW Release #	Issue Description	Workaround
1	V11.28.1.0	The issue on the BTM430 / BTM431 is that GPIO5, GPIO6 and GPIO7 can only be used as outputs if certain conditions are met. They work fine as inputs without preconditions.	The Preconditions for BTM430 / BTM431 are as follows: For GPIO5 to work as an output, the lowest nibble in the value of S Reg 552 must be zero (0). For GPIO6 to work as an output, S Reg 534 must be zero (0). For GPIO7 to work as an output, S Reg 533 must be zero (0). S Reg 533 & 534 allow you to use certain GPIO's as LED indications for DCD and RI.

2.12 Disclaimers

EZURIO'S WIRELESS PRODUCTS ARE NOT AUTHORISED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE MANAGING DIRECTOR OF EZURIO.

The definitions used herein are:

a. Life support devices or systems are devices which (1) are intended for surgical implant into the body, or (2) support or sustain life and whose failure to perform when properly used in accordance with the instructions for use provided in the labelling can reasonably be expected to result in a significant injury to the user.

b. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

Ezurio does not assume responsibility for use of any of the circuitry described, no circuit patent licenses are implied and Ezurio reserves the right at any time to change without notice said circuitry and specifications.

2.13 Data Sheet Status

Ezurio reserve the right to change the specification without prior notice in order to improve the design and supply the best possible product.

2.14 Changes between release

Although every effort is made to ensure compatibility, the functionality of some features has changed due to the evolution of the Bluetooth chips and stack implementations. Users migrating between firmware variants should check the following differences:

ATZ

AT+BTIN

S626 – S629 *Please see the Known Issues section for BTM430 / BTM431.*

Please check with Ezurio for the most recent data before initiating or completing a design.

3 PCM CODEC Interface

PCM_OUT, PCM_IN, PCM_CLK and PCM_SYNC carry up to three bi-directional channels of voice data, each at 8ksamples/s. The format of the PCM samples can be 8-bit A-law, 8-bit µ-law, 13-bit linear or 16-bit linear. The PCM_CLK and PCM_SYNC terminals can be configured as inputs or outputs, depending on whether the module is the Master or Slave of the PCM interface.

Contact a Ezurio FAE for further details.

The Module is compatible with the Motorola SSI TM interface and interfaces directly to PCM audio devices including the following:

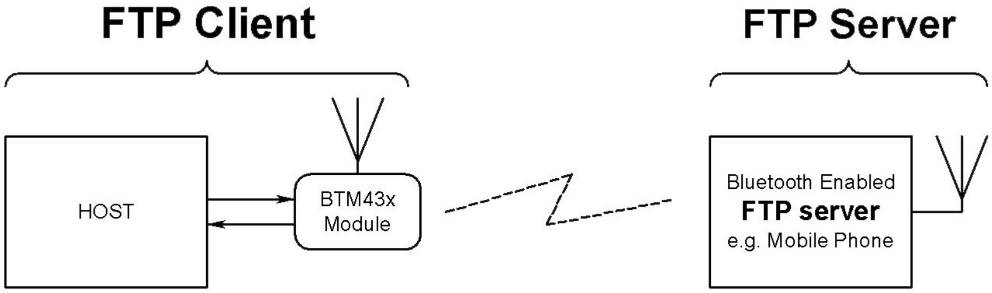
3.1 Compatible Codec Chips

- Winbond W61360 13-bit linear CODEC (Motorola MC145483 compatible)
- OKI MSM7702 single channel A-law and µ-law CODEC
- OKI MSM7705 four channel A-law and µ-law CODEC

The default codec support is for the Winbond W61360

4 FTP Client Profile Commands

The FTP profile provides a capability allowing a host to act as an 'ftp client' to a peer device providing an 'ftp server' profile as shown in the diagram



below.

An FTP client capability implies the ability to send and receive files and also to manipulate file objects in the remote device. The Bluetooth FTP server profile specification describes the profile as one built on Obex Exchange (OBEX) which is in turn built on SPP.

The FTP implementation allows a host attached to the module to send and receive files and in addition to manipulate files and folders.

The format used for describing this protocol is a series of message sequence charts with accompanying notes as appropriate, which unambiguously convey how a host and the module shall interact to perform the task.

4.1 Generic Notes and Guidance

In the message sequence charts the following abbreviations apply:-

- <filename> shall mean a string delimited by the " character. For example, "hello.txt"
- <foldername> shall mean a string delimited by the " character.
- nnn shall be a decimal number with at least one digit.
- The backspace character is not supported.
- All FTP commands are case sensitive.
- FTP Commands shall not exceed 32 characters in total.
- While an FTP session is open, the host shall not deassert the modules UART_CTS line and conversely the host MUST always be ready to accept data.

- When Unicode data is transmitted, it shall be assumed that the most significant byte is transmitted first.
- If an FTP command is expecting a Unicode string as a parameter and the host has an ASCII string, the string shall be expanded with a 0 byte in the most significant position.

4.2 FTP related AT Commands

4.2.1 AT+FTP<bd_addr>

This command is used to establish a connection to an FTP server profile in a peer device with Bluetooth address <bd_addr>.

When a connection is successfully established, the host shall assume that the current folder is the root folder. This root folder is always relative to the host. It is NOT necessarily the absolute root folder of the host machine.

4.2.2 AT+OFT<bd_addr>

This command is used to establish a connection to an FTP server profile in a peer device with Bluetooth address <bd_addr> and functions similarly to AT+FTP, but instead of the responses being "\r\nNNN FTP\r\n" it will be "\r\nNNN OBX\r\n", where NNN is a decimal number.

This capability of choosing the response type is to allow a host to cater generically a connection which is either FTP or ObexPush.

4.2.3 ATSn=m

The following values of n are relevant to FTP operation: 582. A description of these values is given in Table 2: S Registers.

4.3 FTP related Subcommands

This section describes FTP related subcommands that the host can use to control the ftp session.

4.3.1 PUT <filename> <length> (Send file)

This ftp subcommand is used to send a file to the ftp server.

The length of <filename> shall not exceed 24 characters.

The optional <length> value is inserted into the OBEX length header field. This is optional for FTP.

There is some ambiguity as to how the first OBEX PUT packet is formed with respect to the 'Body' header. The OBEX specification does not prohibit the first 'Body' header to be empty; neither does it say that it must NOT be empty. If the first body is NOT empty when sending a file to a Nokia 6820 phone then it seems to confuse it. Hence Ezurio have taken to sending out an empty 'Body' header by default which is also what the Windows PC based Widcomm Bluetooth stack does.

To cater for future devices which NEED the first 'Body' header to be non-empty, a new S Register 582 has been added to allow a host to have control over how the first body header is constructed.

The new S register 582 takes values in the range 0 to 1. The default value is 0 which implies that the first 'Body' header in the PUT obex packet will be empty. A value of 1 forces that 'Body' header to have 1 byte of data – and in this case when the module prompts the host for a length value it shall respond accordingly.

Ezurio hope that the default value of 0 will suffice for all occasions, but provide the control to modify the packet as required.

4.3.2 PUT -nnn <length> (Send file)

This ftp subcommand is used to send a file to the ftp server where the filename is in UNICODE text and the filename is -nnn bytes long.

The optional <length> value is inserted into the OBEX length header field. This is optional for FTP.

See comment above with regards to S Reg 582.

4.3.3 GET <filename> (Retrieve a file)

This ftp subcommand is used to retrieve a file from the ftp server.

The length of <filename> shall not exceed 24 characters.

4.3.4 GET -nnn (Retrieve a file)

This ftp subcommand is used to retrieve a file from the ftp server where the filename is in UNICODE and the filename is –nnn bytes long

4.3.5 DIR (Get folder listing)

This ftp subcommand is used to retrieve the folder listing.

The Bluetooth ftp specification requires a server to transmit a folder listing as a properly formed XML document. In a properly formed document, the character '&' is supposed to be escaped into a 5 character string &amp;. Testing has shown that the Widcomm Bluetooth stack and also the Microsoft Windows CE Bluetooth stack do not comply with that requirement and send the '&' unescaped.

This means that if a folder contains filenames with '&' characters, it will result in a failed parsing of the xml document and this command will fail with the response "090 FTP".

In this circumstance, the only way for the host to extract the folder listing from the server is to request the folder listing in raw xml form. This is expedited using the command described next.

4.3.6 DIR -RAW (Get folder listing, XML document)

This ftp subcommand is used to retrieve the folder listing. In this variant the obex response packet, which is in ASCII XML format, is sent to the host verbatim.

WARNING: Be aware that the Widcomm stack seems to append 2 null characters at the end of the XML document. This means extra care if the host stores data as null terminated strings – because the final "200 FTP" prompt will seem to be corrupted when it is not.

4.3.7 MD <foldername> (Create a folder)

This ftp subcommand is used to create (make) a subfolder.

The length of <foldername> shall not exceed 24 characters.

4.3.8 MD -nnn (Create a folder)

This ftp subcommand is used to create (make) a subfolder which is specified in unicode.

4.3.9 CD <foldername> (Change folder)

This ftp subcommand is used to navigate to the subfolder specified.

The length of <foldername> shall not exceed 24 characters

4.3.10 CD -nnn (Change folder)

This ftp subcommand is used to navigate to the subfolder specified in unicode

4.3.11 CD \ (Change folder to root)

This ftp subcommand is used to navigate to the root folder.

4.3.12 CD .. (Change folder to parent)

This ftp subcommand is used to navigate to the parent folder.

RD <foldername> (Delete a folder)

This ftp subcommand is used to delete the folder specified. Some FTP servers do not allow non-empty folders to be deleted. In that case an appropriate error response shall be returned to the host.

The length of <foldername> shall not exceed 24 characters

4.3.13 RD -nnn (Delete a folder)

This ftp subcommand is used to delete the folder specified where the foldername is specified in unicode.

4.3.14 DEL <filename> (Delete a file)

This ftp subcommand is used to delete the file specified.

4.3.15 DEL -nnn (Delete a file)

This ftp subcommand is used to delete the file specified where the filename is specified in Unicode.

4.3.16 ABORT (Abort current ftp command)

This ftp subcommand is used to abort a file transfer where appropriate.

To abort a PUT session, please send 0 when the module prompts for a length value.

4.3.17 QUIT (Terminate the FTP session)

This ftp subcommand is used to terminate the ftp session and will also result in the Bluetooth connection being terminated.

4.3.18 MAX (Max outgoing obex packet size)

This ftp subcommand is used to get the maximum obex packet size tolerated by server and can be used by the host to optimize the data throughput.

4.4 FTP related subresponses

All FTP related sub responses sent from the module to the host SHALL be 11 characters long in the format:

<cr><lf>nnn AAA<cr><lf>.

The characters nnn shall be decimal digits '0' to '9', then there is a space character and finally a 3 character word followed by <cr><lf>.

The <cr><lf> envelope plus the fixed length will hopefully make the parsing task in the host much simpler.

Values for 'nnn' are as specified for HTTP status codes, and reproduced from the OBEX specification as follows:

OBEX Response Code	HTTP Status Code	Definition
0x00 to 0x0F	None	Reserved
0x10 (0x90)	100	Continue
0x20 (0xA0)	200	OK, Success
0x21 (0xA1)	201	Created
0x22 (0xA2)	202	Accepted
0x23 (0xA3)	203	Non-Authoritative Information
0x24 (0xA4)	204	No Content
0x25 (0xA5)	205	Reset Content
0x26 (0xA6)	206	Partial Content
0x30 (0xB0)	300	Multiple Choices
0x31 (0xB1)	301	Moved Permanently
0x32 (0xB2)	302	Moved temporarily
0x33 (0xB3)	303	See Other

OBEX Response Code	HTTP Status Code	Definition
0x34 (0xB4)	304	Not modified
0x35 (0xB5)	305	Use Proxy
0x40 (0xC0)	400	Bad Request - server couldn't understand request
0x41 (0xC1)	401	Unauthorized
0x42 (0xC2)	402	Payment required
0x43 (0xC3)	403	Forbidden - operation is understood but refused
0x44 (0xC4)	404	Not Found
0x45 (0xC5)	405	Method not allowed
0x46 (0xC6)	406	Not Acceptable
0x47 (0xC7)	407	Proxy Authentication required
0x48 (0xC8)	408	Request Time Out
0x49 (0xC9)	409	Conflict
0x4A (0xCA)	410	Gone
0x4B (0xCB)	411	Length Required
0x4C (0xCC)	412	Precondition failed
0x4D (0xCD)	413	Requested entity too large
0x4E (0xCE)	414	Request URL too large
0x4F (0xCF)	415	Unsupported media type
0x50 (0xD0)	500	Internal Server Error
0x51 (0xD1)	501	Not Implemented
0x52 (0xD2)	502	Bad Gateway
0x53 (0xD3)	503	Service Unavailable
0x54 (0xD4)	504	Gateway Timeout
0x55 (0xD5)	505	HTTP version not supported
0x60 (0xE0)	- - -	Database Full
0x61 (0xE1)	- - -	Database Locked

For more details of these values, please refer to the irDA specification which can be freely downloaded from www.irda.org.

In addition, values in the range 050 to 099 and 250 to 299 inclusive are specific to this Ezurio application and are defined as per the table below.

Response Code 'nnn'	(Ezurio Specific) Definition
050	Syntax Error / Command Unrecognized
051	Server sent unexpected information in obex packet
052	Obex connection fail, because it is unauthorized
053	Memory allocation failure (Please contact Ezurio with details)
055	Unicode File/Folder name length cannot be an odd value
056	Command not recognized
090	An XML parsing error occurred (while processing response to DIR command)
099	The Bluetooth connection has unexpected been dropped. For example, remote out of range etc.

Response Code 'nnn'	(Ezurio Specific) Definition
250	GET procedure was aborted

4.4.1 nnn FTP

This ftp response is used, when the connection was opened using AT+FTP, to convey the
outcome of a subcommand to the host where 'nnn' is a fixed 3 digit decimal number as defined in the irDA specification and map to HTTP status codes.

For example, a value of n=200 implies successful operation, any other value usually
conveys an error as described in the irDA specification (except the range 050 to 099 inclusive and 250 to 299 inclusive).

Note: When a Bluetooth OBEX session is established, we will be specifying v1.0 in the header packets by default as that is what the Widcomm stack seems to be using and the ftp specifies.

4.4.2 nnn OBX

This has the same meaning as "nnn FTP" and is used when AT+OFT command was used to open an FTP connection.

4.4.3 nnn GET

This ftp response is used during a GET file operation. See appropriate message sequence charts for more details. See above for 'nnn' values.

4.5 FTP line multiplexing commands

When transferring a file, the single serial interface between the host and the module, is used to send and receive data and commands. This means a scheme is required to unambiguously determine when a byte on the line corresponds to a command or data belonging to a file.

The module uses negotiated multiplexing to achieve this, and commands are used to toggle the line between command and data mode.

This scheme is symmetrical and the commands for toggling the state of the line are relevant for both direction. The only difference being that the terminator is <cr> in the host to module direction and <crlf> in the reverse direction.

The commands are described in the following sub sections.

4.5.1

This command is used to ask the other end how many bytes of a filename or foldername it will send next.

4.5.2 >

This command is used to inform the other end that it is safe to send the number of bytes belonging to a filename or foldername as indicated in the most recent # command.

4.5.3 !

This command is used to ask the module/host how many bytes of data it will send next.
If the module/host sends a length value too big to cope with, then it can be rejected by sending the ! command again. This is because accepting a value implies this end should send a ? prompt to trigger the data phase (see next section).

4.5.4 ?

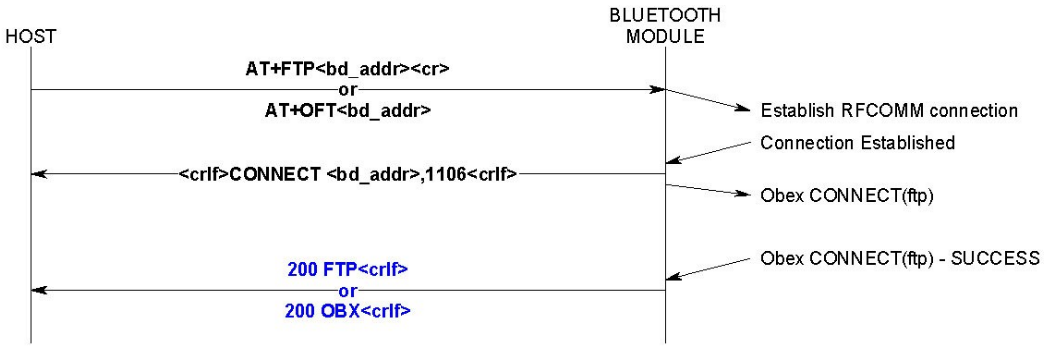
This command is used to inform the other end that it is safe to send the number of bytes belonging to 'data' phase indicated in the most recent ! command.

4.6 Message Sequence Charts

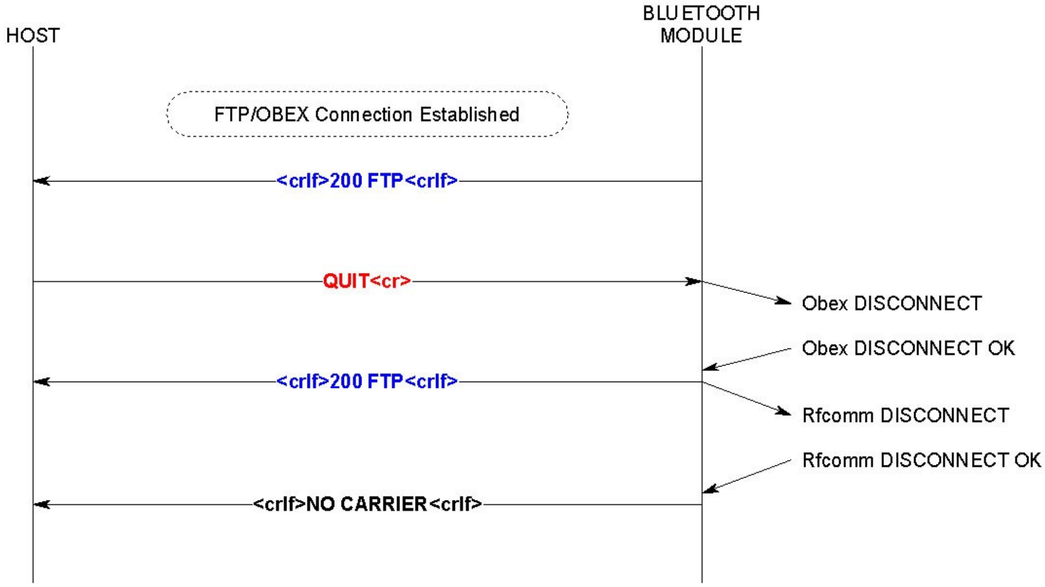
In the following sections, the color scheme uses RED text as commands from a host to the module and BLUE text as responses and prompts from the module to the host. Command/responses shown in BLACK are associated with non-ftp related states.

Apart from FTP connection and disconnection scenarios, to avoid repetition, all message sequence charts shall assume that the module is in a FTP connected state. It also assumes that where "nnn FTP" occurs, it can be read as "nnn OBX" if the command AT+OFT was used to initiate the command.

4.6.1 Usage: Make FTP connection (No Authentication)

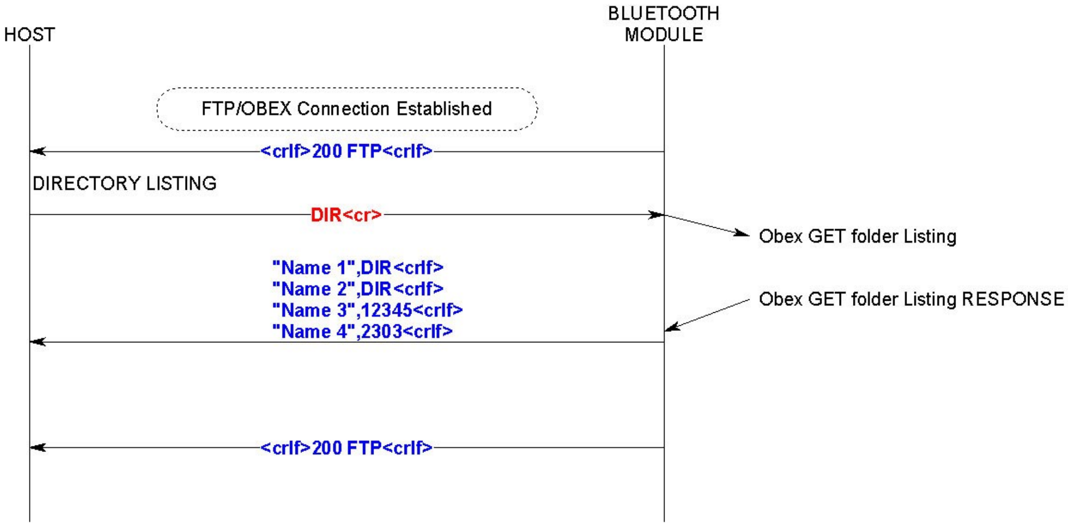


4.6.2 Usage: FTP Disconnection



4.6.3 Usage: Folder Listing

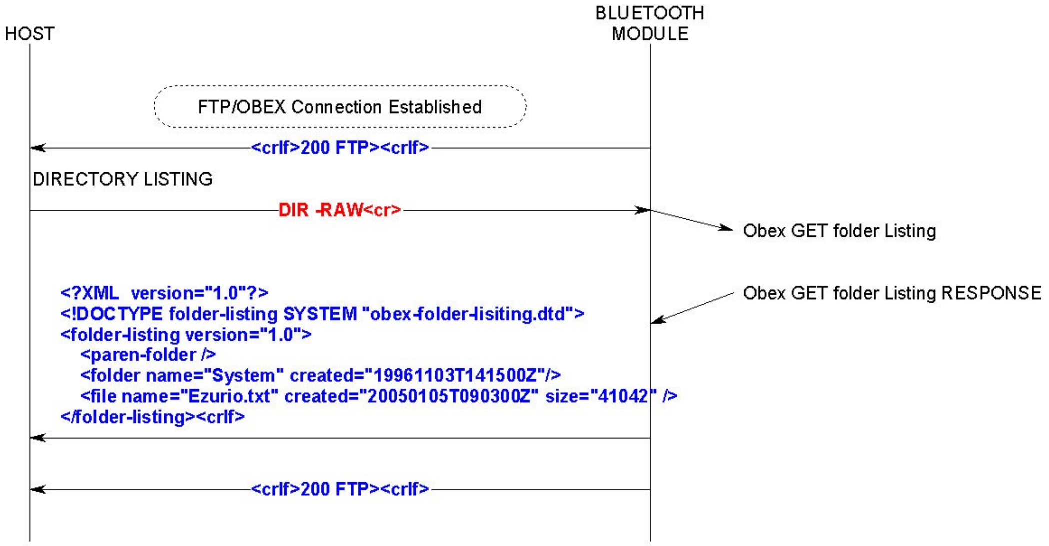
Note: If a number follows a name then that implies a file.



```
"Name 1",DIR<crlf>
"Name 2",DIR<crlf>
"Name 3",12345<crlf>
"Name 4",2303<crlf>
```

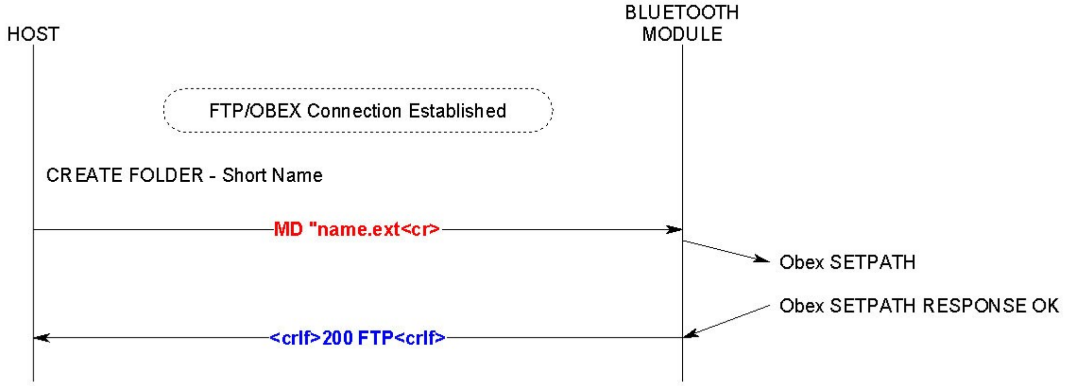
4.6.4 Usage: Folder Listing (Raw Output)

Note: The raw output is ASCII text and is in XML format.



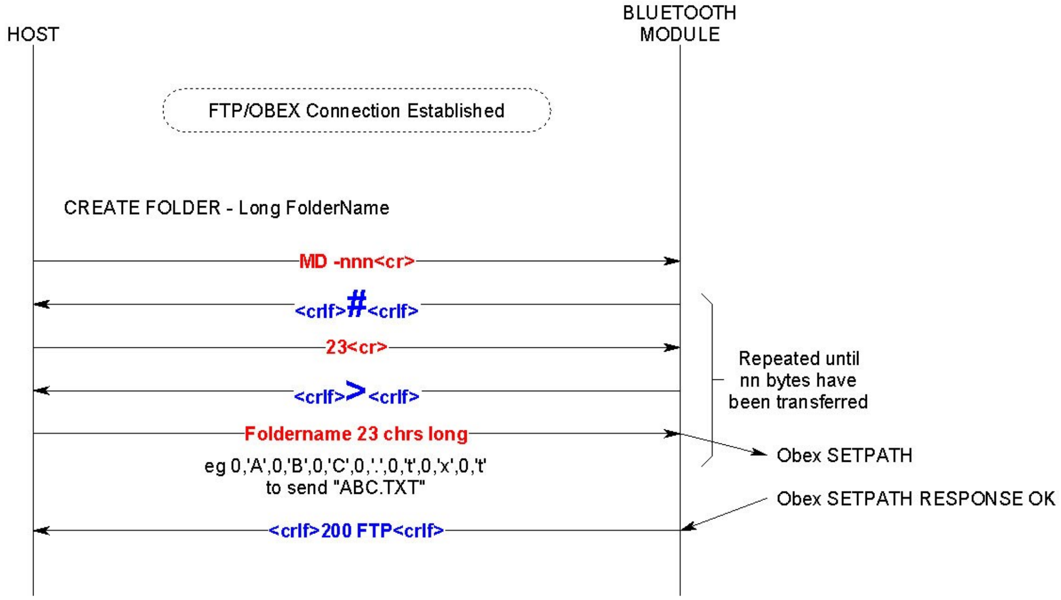
```
<?XML  version="1.0"?>
<!DOCTYPE folder-listing SYSTEM "obex-folder-lisiting.dtd">
<folder-listing version="1.0">
   <paren-folder />
   <folder name="System" created="19961103T141500Z"/>
   <file name="Ezurio.txt" created="20050105T090300Z" size="41042" />
</folder-listing><crlf>
```

4.6.5 Usage: Create Folder (Short Folder name)

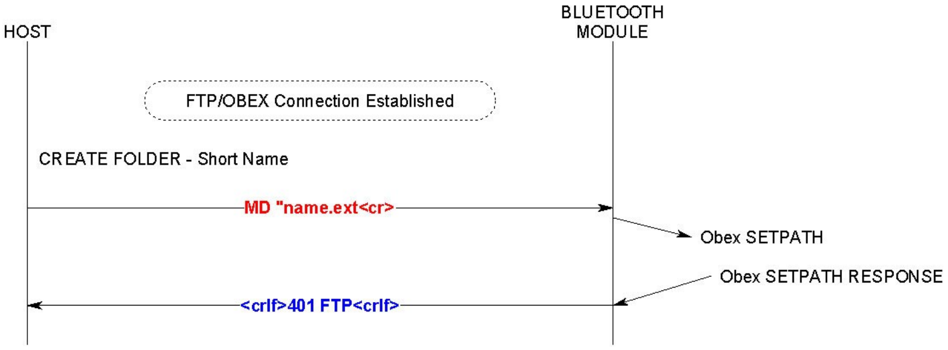


4.6.6 Usage: Create Folder (Long Folder name - UNICODE)

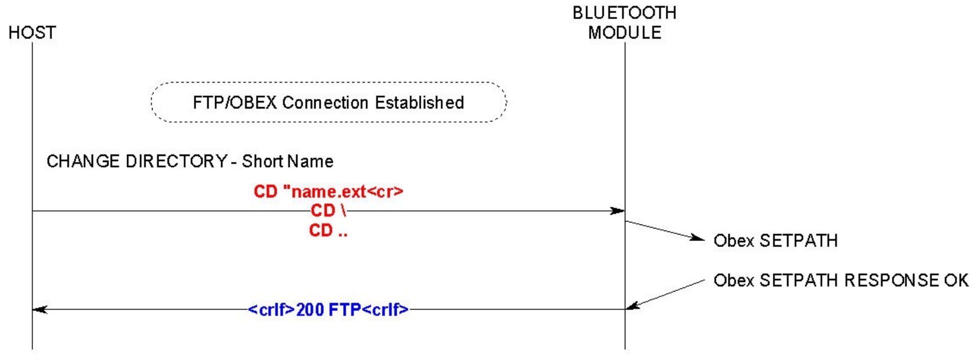
Note: 'nn' is the size of folder name in bytes. The folder name is supplied in Unicode.



4.6.7 Usage: Create Folder (Unsuccessful)

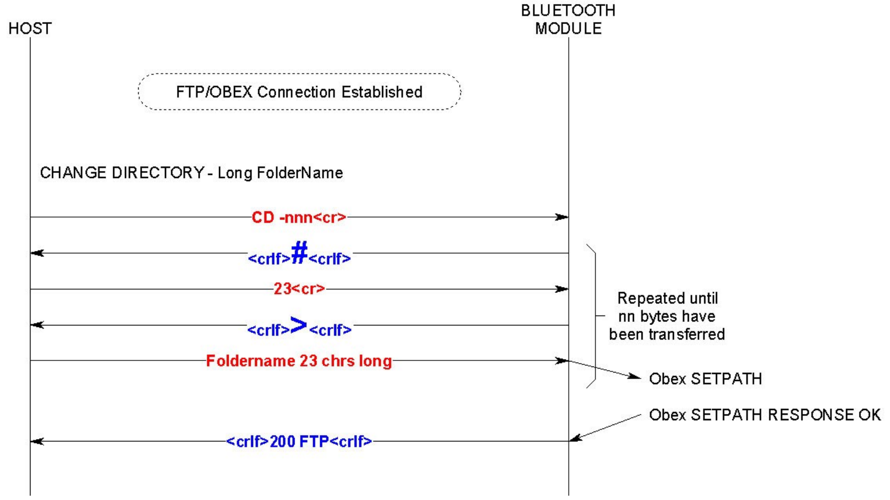


4.6.8 Usage: Change Folder (Short Folder name)

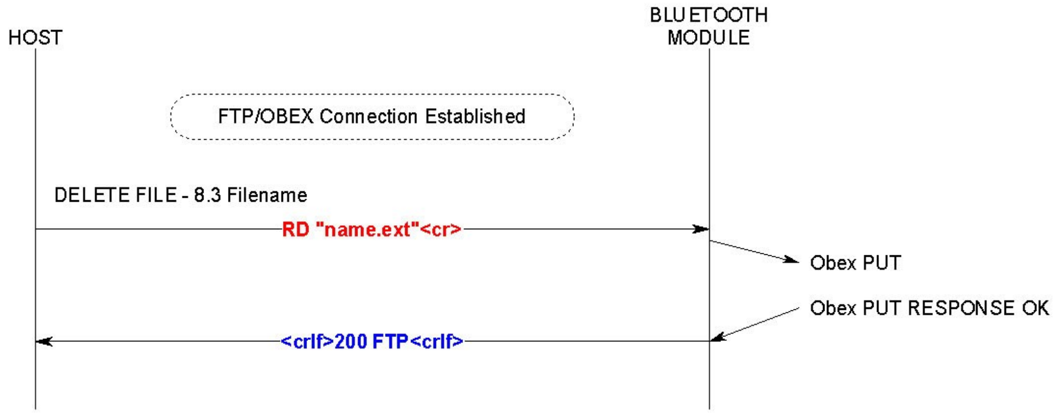


4.6.9 Usage: Change Folder (Long Folder name - UNICODE)

Note: 'nn' is the size of folder name in bytes. The folder name is supplied in Unicode.

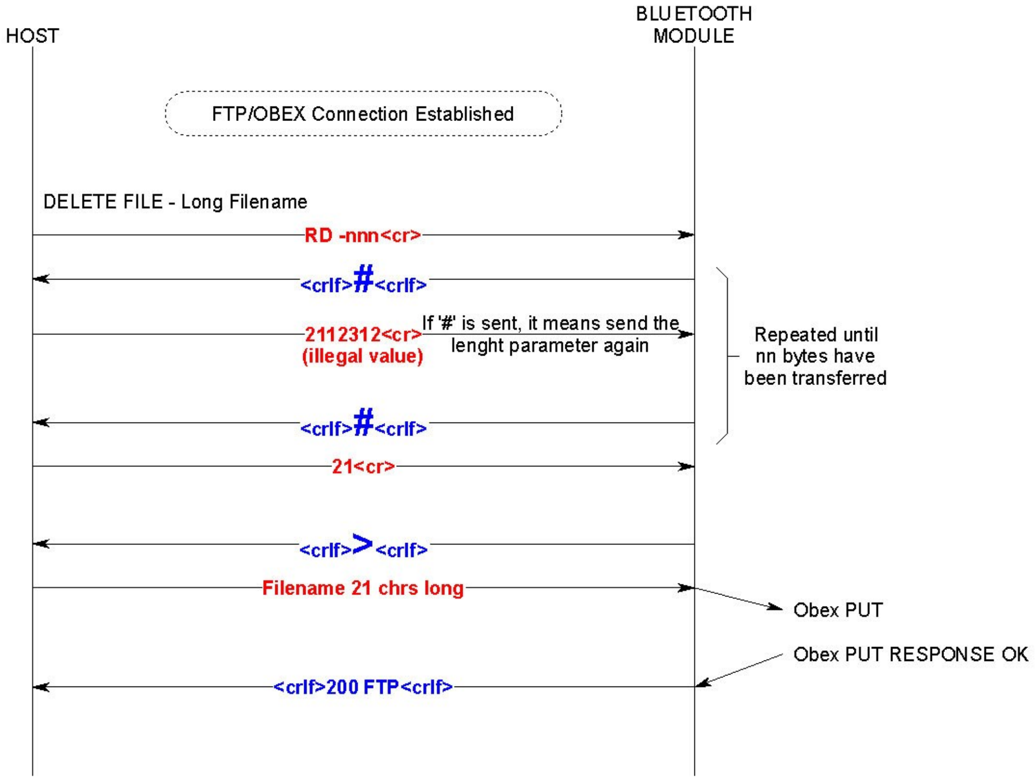


4.6.10 Usage: Remove Folder (Short Folder name)

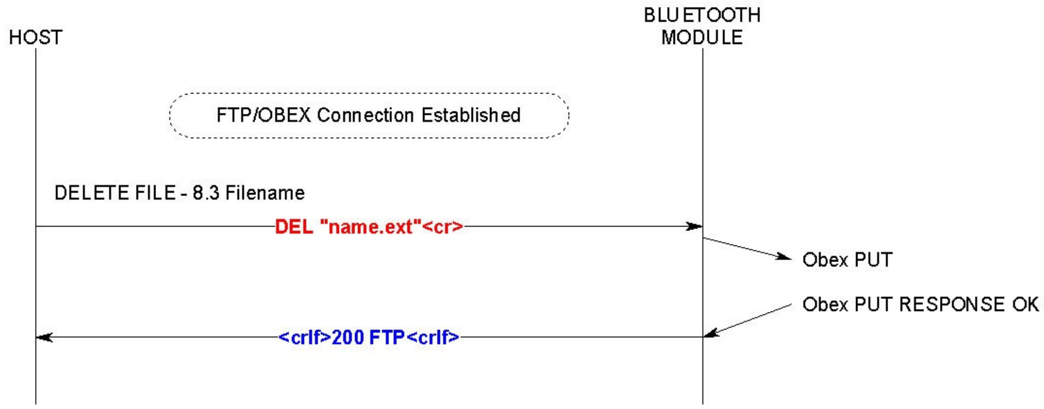


4.6.11 Usage: Remove Folder (Long Folder name – UNICODE)

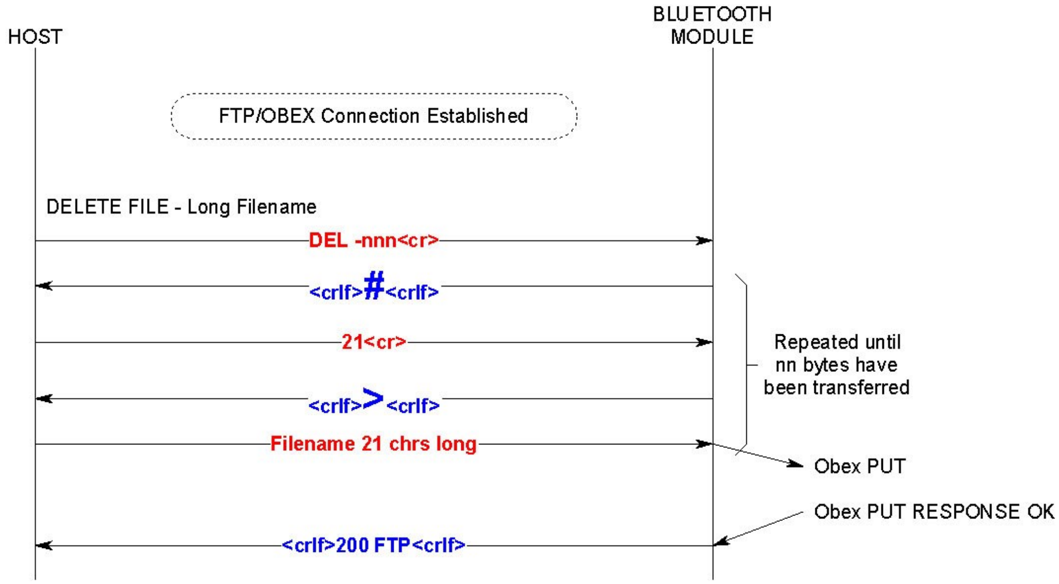
Note: 'nn' is the size of folder name in bytes. The folder name is supplied in unicode.



4.6.12 Usage: Delete File (Short Filename)



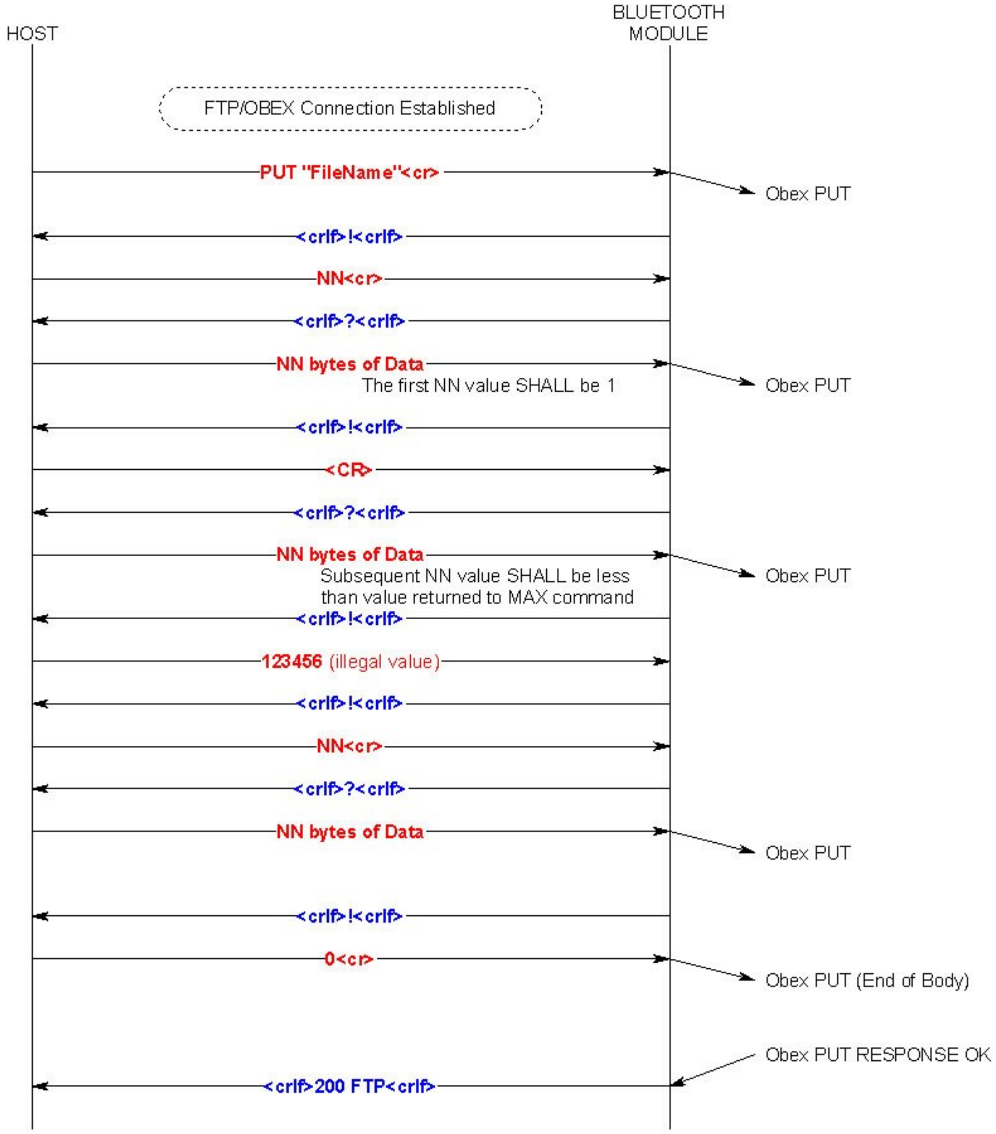
4.6.13 Usage: Delete File (Long Filename – UNICODE)



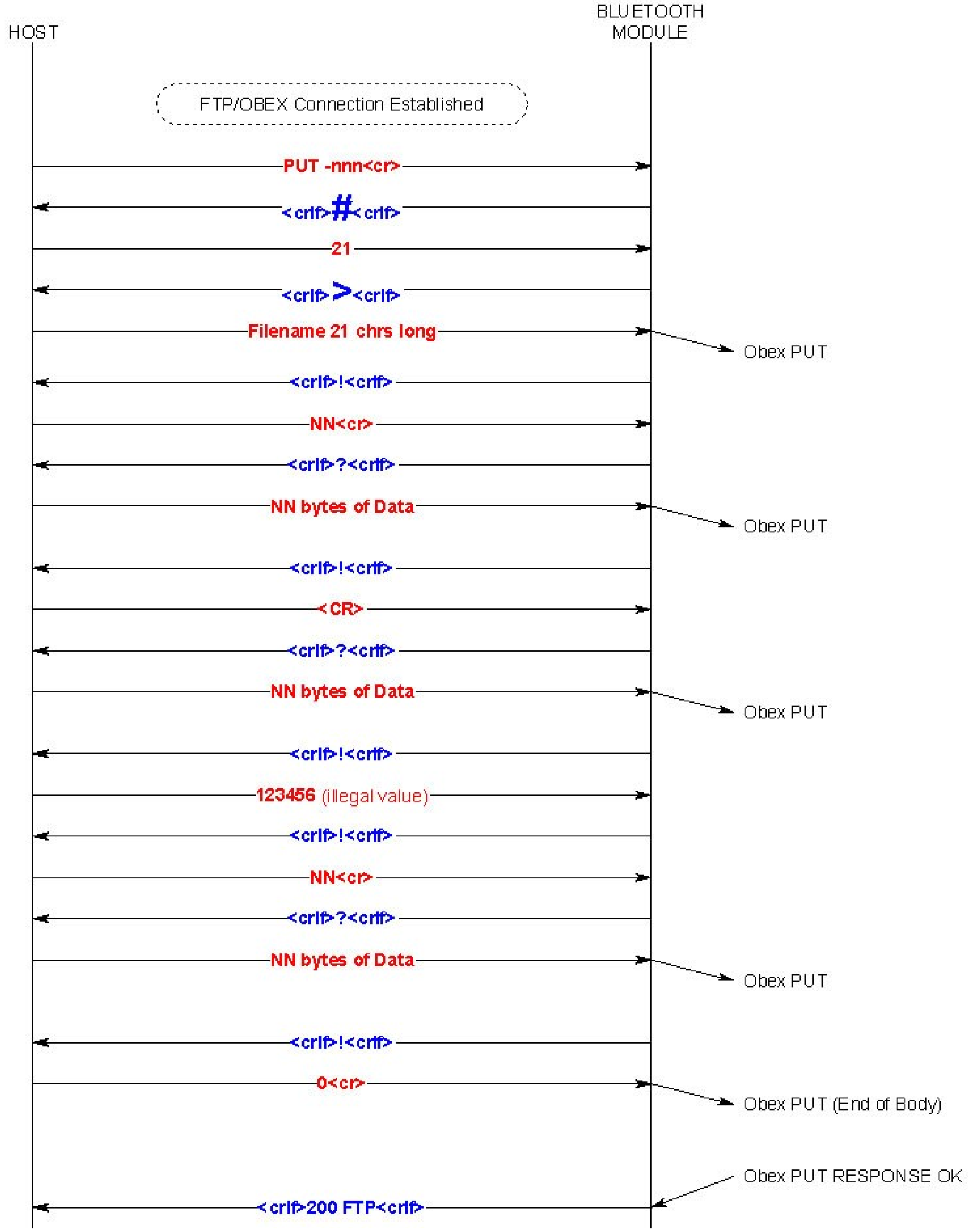
4.6.14 Usage: Put File (Short Filename)

Notes:

1. The first NN from the host shall specify a value of 1.
2. Subsequent NN values shall be less than the value returned to command MAX



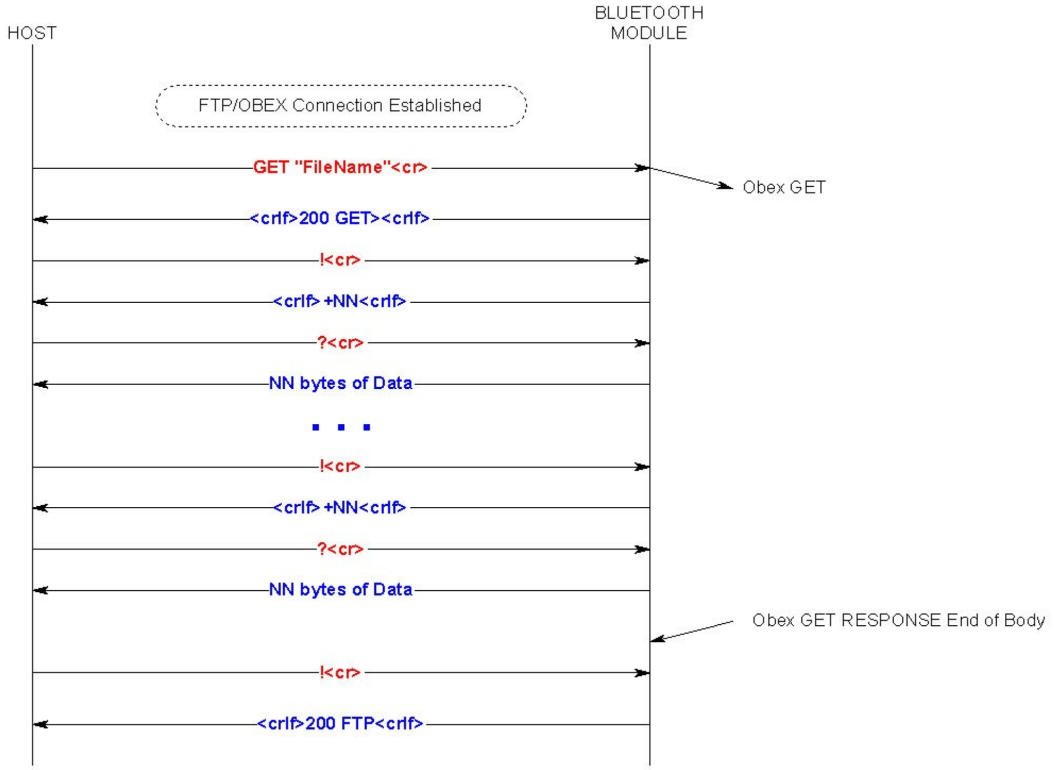
4.6.15 Usage: Put File (Long Filename - UNICODE)



4.6.16 Usage: Get File (Short Filename)

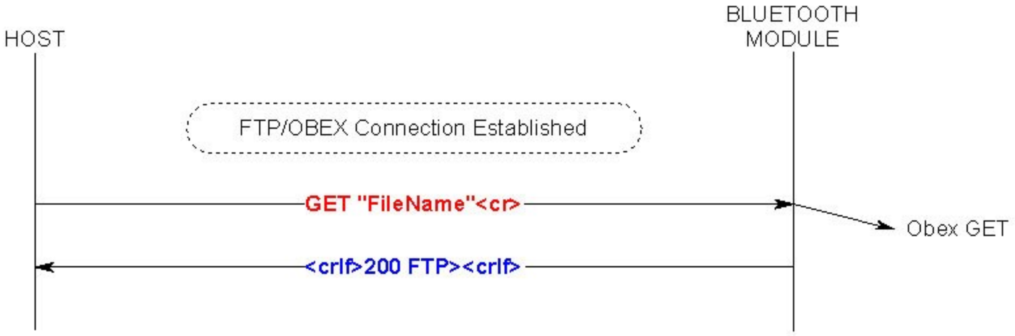
Notes:

1. After each **!** command, if a +NN response is not received after 2 seconds, the host can repeat that command.
2. The response to ! is "+NN" instead of just "NN" to make easier for the host to predict the command, since on completion the standard response is "200 FTP" which also happens to start with a number. The '+' shall be early warning to the host that the procedure is not complete.

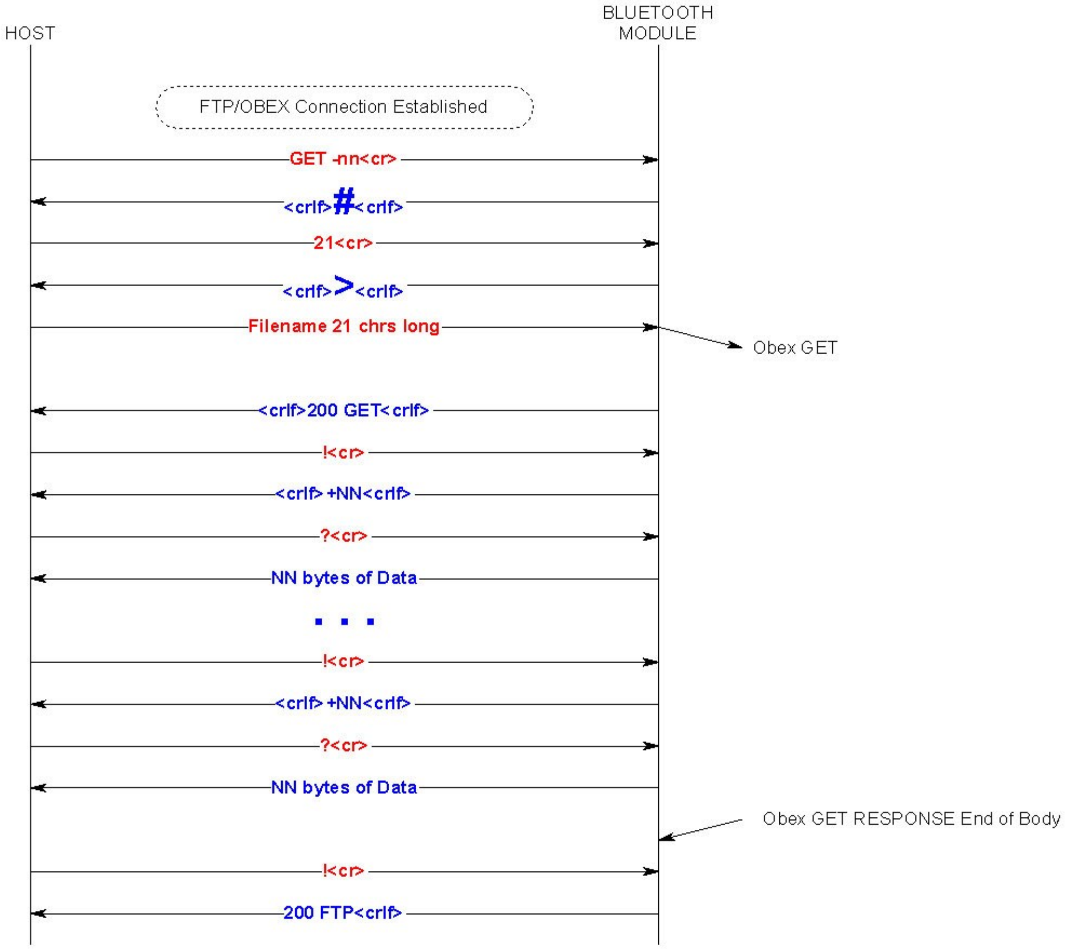


4.6.17 Usage: Get File (Empty file in server)

Note: If the file size is 0, then the host shall receive “200 FTP” instead of “200 GET”. The latter is invitation to the host that data needs to be marshalled across.

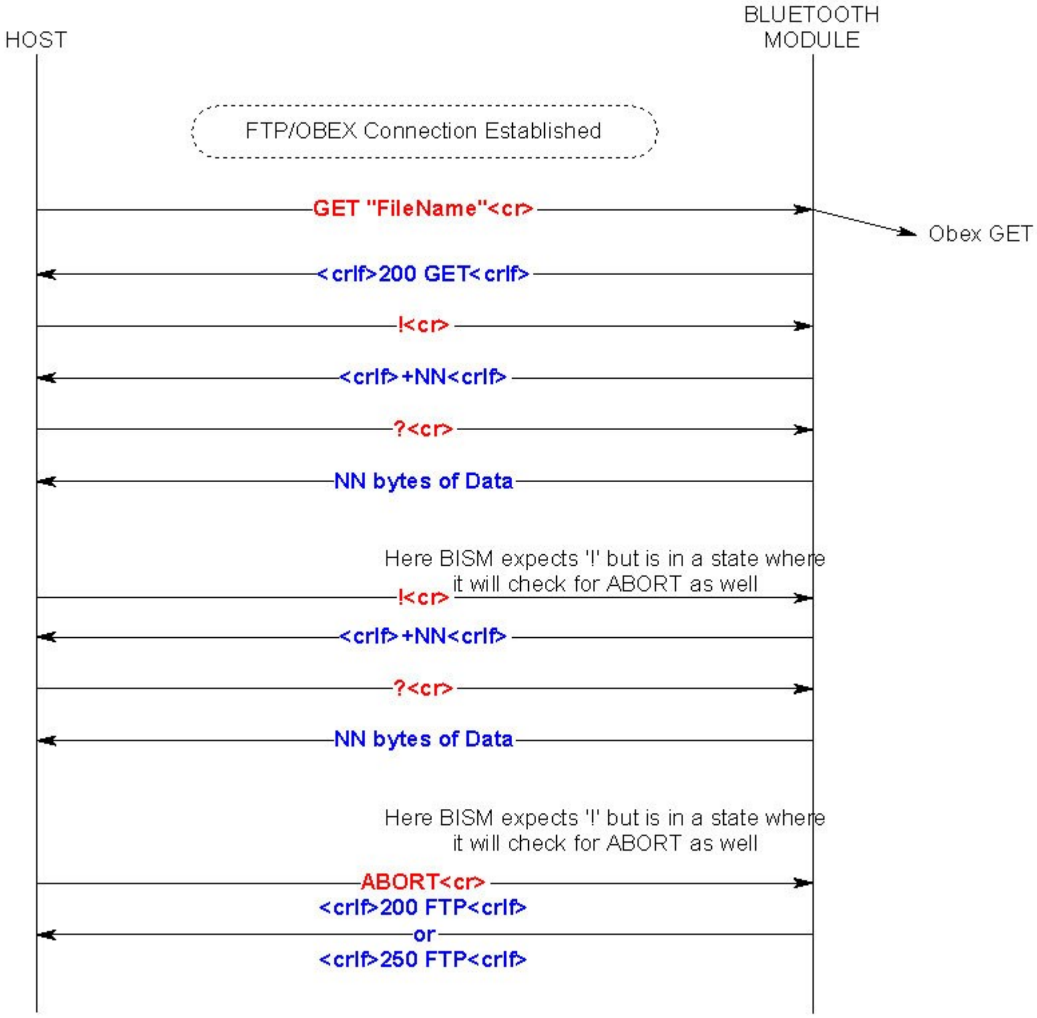


4.6.18 Usage: Get File (Long Filename - UNICODE)



4.6.19 Usage: Get File – ABORT

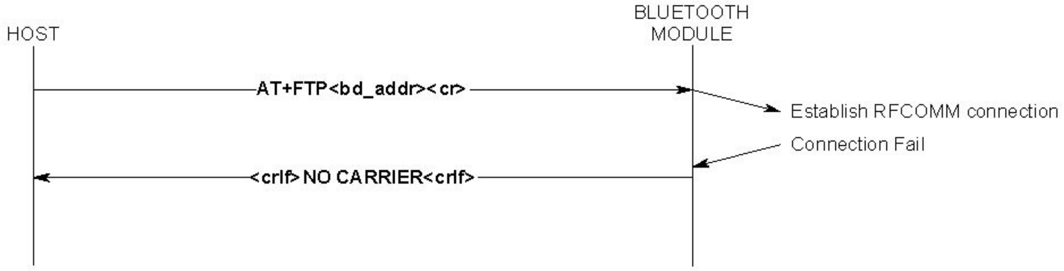
Note: If “200 FTP” is received after submitting an ABORT command then it implies that the entire file was transferred before the abort had been received.



4.6.20 Usage: Unsuccessful FTP connection

Note: Reason for connection failure could be:

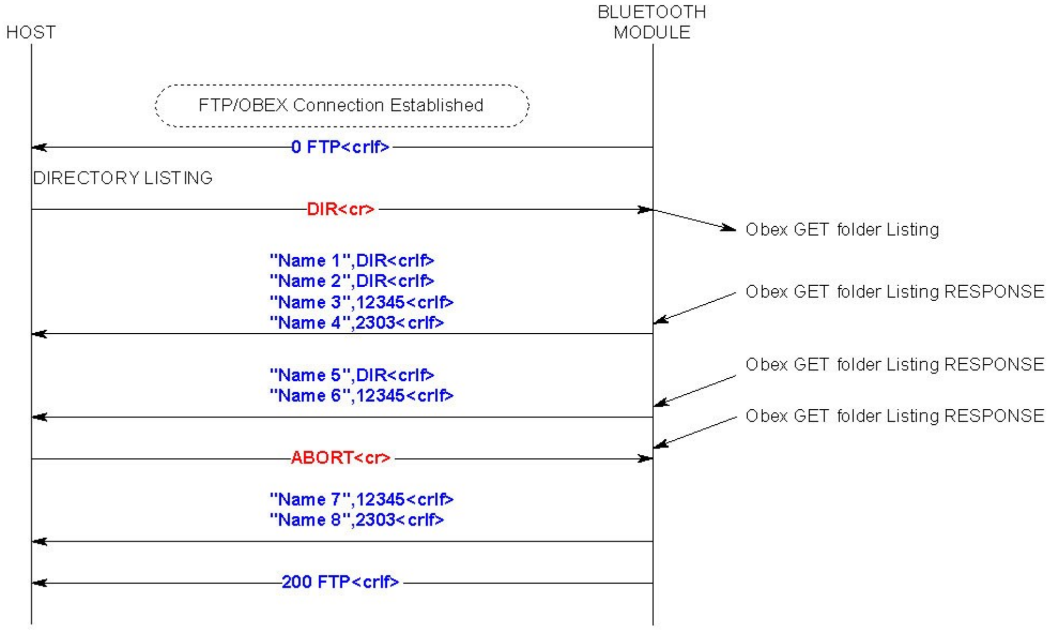
1. Device is not in range
2. Device is not connectable
3. Device does not support FTP server profile.



4.6.21 Usage: ABORT a DIR request

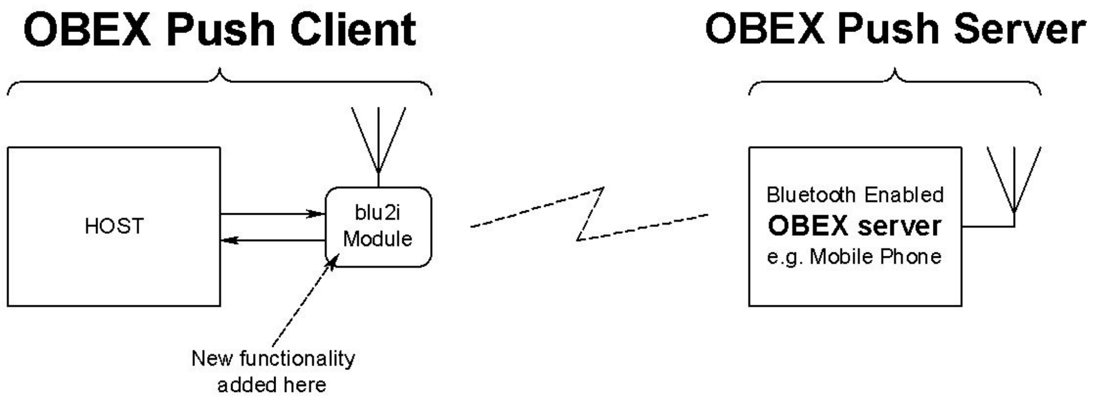
Notes: The host may get more file/folder names after submitting an ABORT request because the device could have received a folder data OBEX packet at the same time but slightly earlier so it may have started processing it.

Hence the host must look out for a "200 FTP<crlf>" to be sure that the DIR operation has terminated. Some ftp servers (like widcomm stack) will return a 500 response code.



5 OBEX Profile Commands

This section describes the OBEX implementation on BTM430/431 which allows performing the role of 'Obex Push Client' as illustrated in the diagram below.



The OBEX Push profile implementation provides the capability to a host to act as an 'OBEX Push client' to a peer device providing an 'OBEX push server' profile.

An OBEX Push client capability implies the ability to send and optionally receive a default file. The Bluetooth OBEX Push server profile specification describes the profile as one built on OBEX Exchange (OBEX) which is in turn built on SPP.

The Object Push Profile [3] describes the profile as having 3 features as follows:

- Object Push – Mandatory
- Business Card Pull – Optional
- Business Card Exchange – Optional

This implementation only offers the Mandatory Object Push feature.

The implementation on BTM430/431 allows a host attached to the module to send and receive files and in addition to manipulate files and folders.

The format used in this document for describing this protocol is a series of message sequence charts with accompanying notes as appropriate, which unambiguously convey how a host and the module shall interact to perform the task.

5.1 Generic Notes and Guidance

In the message sequence charts the following abbreviations apply:-

- <crlf> shall mean a two character sequence made up of the ASCII characters 0x0D (carriage return) and 0x0A (line feed).
- <cr> shall mean a one character sequence made up of the ASCII character 0x0D.
- <lf> shall mean a one character sequence made up of the ASCII character 0x0A.
- <bd_addr> shall mean a 12 digit string consisting of only hexadecimal digits 0-9,A-F and a-f
- <filename> shall mean a string delimited by the " character. For example, "hello.txt"
- <foldername> shall mean a string delimited by the " character.
- nnn shall be a decimal number with at least one digit.
- The backspace character is not supported.
- All OBEX commands are case sensitive.
- OBEX Commands shall not exceed 32 characters in total.
- While an OBEX session is open, the host shall not deassert the modules UART_CTS line and conversely the host MUST always be ready to accept data.
- When Unicode data is transmitted, it shall be assumed that the most significant byte is transmitted first.
- If an OBEX command is expecting a Unicode string as a parameter and the host has an ASCII string, the string shall be expanded with a 0 byte in the most significant position.

5.2 OBEX Push related AT Commands

5.2.1 AT+OPS<bd_addr>

This command is used to establish a connection to an Obex Push server profile in a peer device with Bluetooth address <bd_addr>.

5.2.2 ATSn=m

The following values of n are relevant to OBEX operation: 582. A description of these values is given in Table 2: S Registers.

5.3 OBEX Push related Subcommands

This section describes Obex Push related subcommands that the host can use to control the obex push session.

5.3.1 PUT <filename> length (Send file)

This obex subcommand is used to send a file to the obex server.

The length of <filename> shall not exceed 24 characters

The length value is inserted into the OBEX length header field.

There is some ambiguity as to how the first obex PUT packet is formed with respect to the 'Body' header. The OBEX specification does not prohibit the first 'Body' header to be empty, neither does it say that it must NOT be empty. If the first body is NOT empty when sending a file to a Nokia 6820 phone then it seems to confuse it. Hence Ezurio have taken to sending out an empty 'Body' header by default which is also what the Windows PC based Widcomm Bluetooth stack does.

To cater for future devices which NEED the first 'Body' header to be non-empty, a new S Register 582 has been added to allow a host to have control over how the first body header is constructed.

The new S register 582 takes values in the range 0 to 1. The default value is 0 which implies that the first 'Body' header in the PUT obex packet will be empty. A value of 1 forces that 'Body' header to have 1 byte of data – and in this case when the module prompts the host for a length value it shall respond accordingly.

Ezurio hope that the default value of 0 will suffice for all occasions, but provide the control to modify the packet as required.

5.3.2 PUT -nnn length (Send file)

This obex subcommand is used to send a file to the obex push server where the filename is in UNICODE text and the filename is -nnn bytes long.

The length value is inserted into the OBEX length header field.

See comment above with regards to S Reg 582.

5.3.3 ABORT (Abort current OBEX command)

This obex subcommand is used to abort a file transfer where appropriate.

To abort a PUT session, please send 0 when the module prompts for a length value.

5.3.4 QUIT (Terminate the OBEX Push session)

This obex subcommand is used to terminate the obex push session and will also result in the Bluetooth connection being terminated.

5.3.5 MAX (Max outgoing OBEX packet size)

This obex subcommand is used to get the maximum obex packet size tolerated by server and can be used by the host to optimize the data throughput.

5.3.6 WHO (Identify current profile)

This obex subcommand is used to identify the current profile. 0 shall mean ObexPush and 1 shall mean FTP.

5.4 OBEX Push Related Subresponses

All Obex Push-related sub responses sent from the module to the host SHALL be 11 characters long in the format:

<cr><lf>**nnn AAA**<cr><lf>.

The characters nnn shall be decimal digits '0' to '9', then there is a space character and finally a 3 character word followed by <cr><lf>.

The <cr><lf> envelope plus the fixed length will hopefully make the parsing task in the host much simpler.

Values for 'nnn' are as specified for HTTP status codes, and reproduced from the OBEX specification:

OBEX Response Code	HTTP Status Code	Definition
0x00 to 0x0F	None	Reserved
0x10 (0x90)	100	Continue
0x20 (0xA0)	200	OK, Success
0x21 (0xA1)	201	Created
0x22 (0xA2)	202	Accepted
0x23 (0xA3)	203	Non-Authoritative Information
0x24 (0xA4)	204	No Content
0x25 (0xA5)	205	Reset Content
0x26 (0xA6)	206	Partial Content
0x30 (0xB0)	300	Multiple Choices
0x31 (0xB1)	301	Moved Permanently
0x32 (0xB2)	302	Moved temporarily
0x33 (0xB3)	303	See Other
0x34 (0xB4)	304	Not modified
0x35 (0xB5)	305	Use Proxy
0x40 (0xC0)	400	Bad Request - server couldn't understand request

OBEX Response Code	HTTP Status Code	Definition
0x41 (0xC1)	401	Unauthorized
0x42 (0xC2)	402	Payment required
0x43 (0xC3)	403	Forbidden - operation is understood but refused
0x44 (0xC4)	404	Not Found
0x45 (0xC5)	405	Method not allowed
0x46 (0xC6)	406	Not Acceptable
0x47 (0xC7)	407	Proxy Authentication required
0x48 (0xC8)	408	Request Time Out
0x49 (0xC9)	409	Conflict
0x4A (0xCA)	410	Gone
0x4B (0xCB)	411	Length Required
0x4C (0xCC)	412	Precondition failed
0x4D (0xCD)	413	Requested entity too large
0x4E (0xCE)	414	Request URL too large
0x4F (0xCF)	415	Unsupported media type
0x50 (0xD0)	500	Internal Server Error
0x51 (0xD1)	501	Not Implemented
0x52 (0xD2)	502	Bad Gateway
0x53 (0xD3)	503	Service Unavailable
0x54 (0xD4)	504	Gateway Timeout
0x55 (0xD5)	505	HTTP version not supported
0x60 (0xE0)	- - -	Database Full
0x61 (0xE1)	- - -	Database Locked

For more details of these values, please refer to the irDA specification which can be freely downloaded from www.irda.org.

In addition, values in the range 050 to 099 and 250 to 299 inclusive are specific to this Ezurio application and are defined as per the table below.

Response Code ‘nnn’	(Ezurio Specific) Definition
050	Syntax Error / Command Unrecognized
051	Server sent unexpected information in OBEX packet
052	OBEX connection fail, because it is unauthorized
053	Memory allocation failure (Please contact Ezurio with details)
055	Unicode File/Folder name length cannot be an odd value
056	Command not recognized
090	An XML parsing error occurred (while processing response to DIR command)
099	The Bluetooth connection has unexpected been dropped. For example, remote out of range etc.
250	GET procedure was aborted

5.4.1 nnn OBX

This OBEX response is used to convey the outcome of a subcommand to the host where ‘nnn’ is a fixed 3 digit decimal number as defined in the irDA specification and map to HTTP status codes.

For example, a value of n=200 implies successful operation, any other value usually conveys an error as described in the irDA specification (except the range 050 to 099 inclusive and 250 to 299 inclusive).

Note: When a Bluetooth OBEX session is established, we will be specifying v1.0 in
the header packets by default.

5.5 OBEX Push Line Multiplexing Commands

When transferring an object, the single serial interface between the host and the module, is used to send and receive data and commands. This means a scheme is required to unambiguously determine when a byte on the line corresponds to a command or data belonging to a file.

The module uses negotiated multiplexing to achieve this, and commands are used to toggle the line between command and data mode.

This scheme is symmetrical and the commands for toggling the state of the line are relevant for both direction. The only difference being that the terminator is <cr> in the host to module direction and <crlf> in the reverse direction.

The commands are described in the following sub sections.

5.5.1

This command is used to ask the other end how many bytes of a filename/ or object it will send next.

5.5.2 >

This command is used to inform the other end that it is safe to send the number of bytes belonging to a filename or object as indicated in the most recent # command.

5.5.3 !

This command is used to ask the module/host how many bytes of data it will send next.
If the module/host sends a length value too big to cope with, then it can be rejected by sending the ! command again. This is because accepting a value implies this end should send a ? prompt to trigger the data phase (see next section).

5.5.4 ?

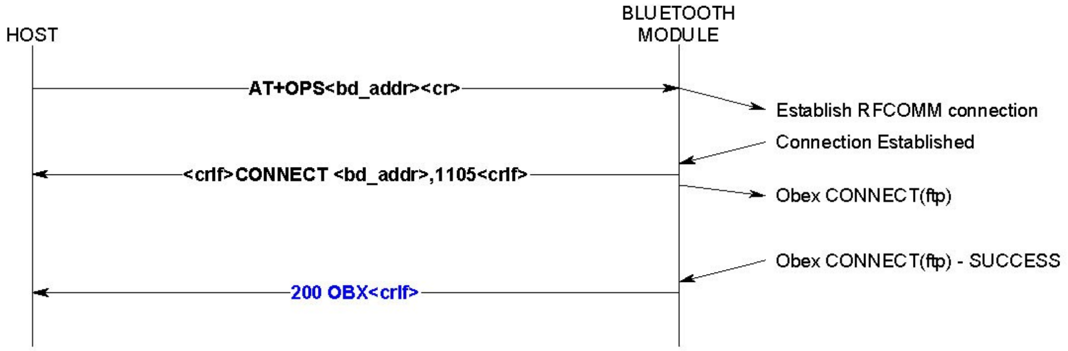
This command is used to inform the other end that it is safe to send the number of bytes
belonging to 'data' phase indicated in the most recent ! command.

5.6 Message Sequence Charts

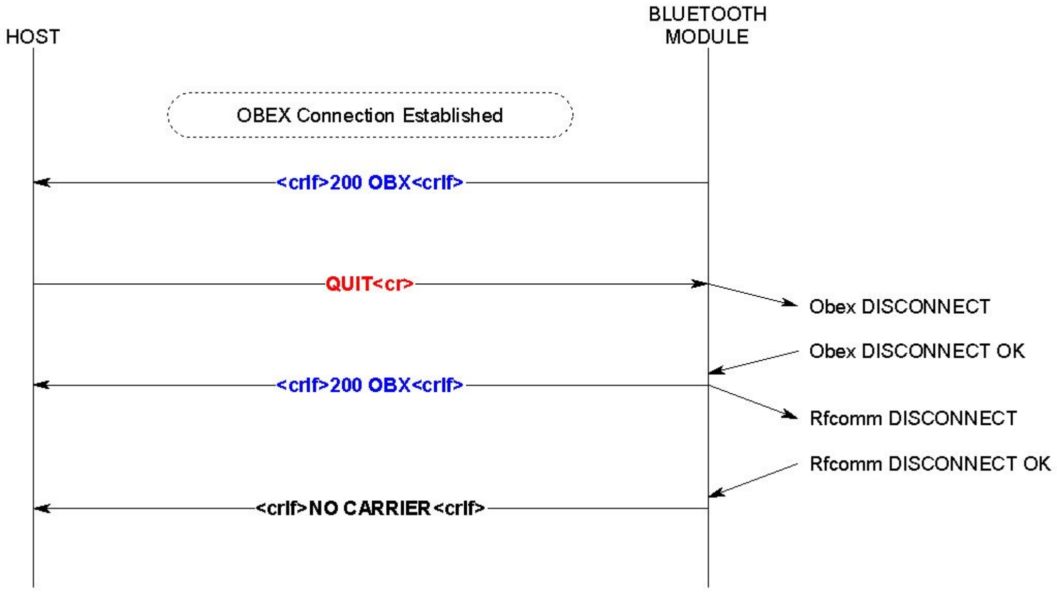
The color scheme uses RED text as commands from a host to the module and BLUE text as responses and prompts from the module to the host. Command/responses shown in BLACK are associated with non-obex related states.

Apart from OBEX connection and disconnection scenarios, to avoid repetition, all message sequence charts shall assume that the module is in an Obex connected state.

5.6.1 Usage: Make OBEX PUSH connection (No Authentication)



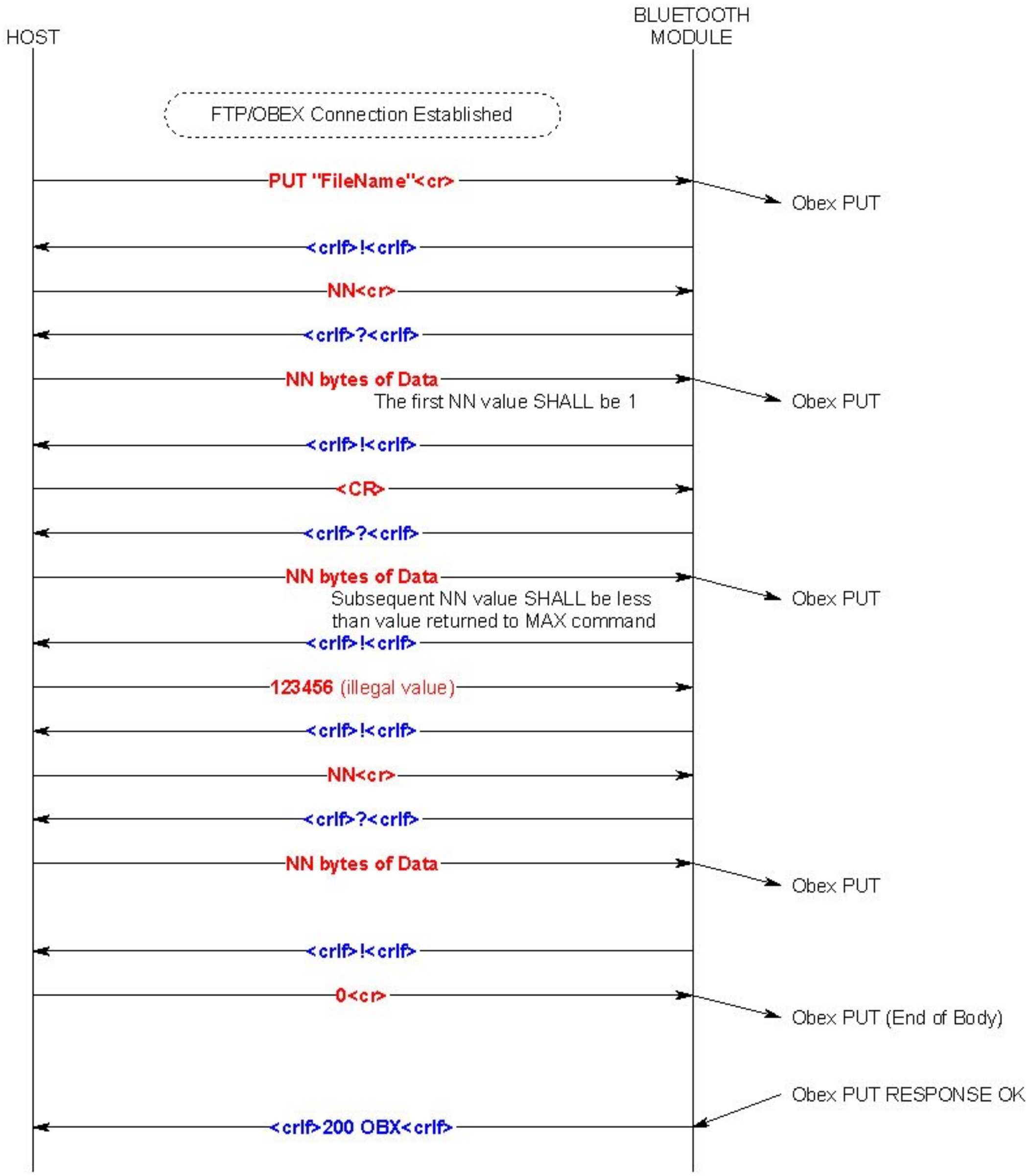
5.6.2 Usage: OBEX Push Disconnection



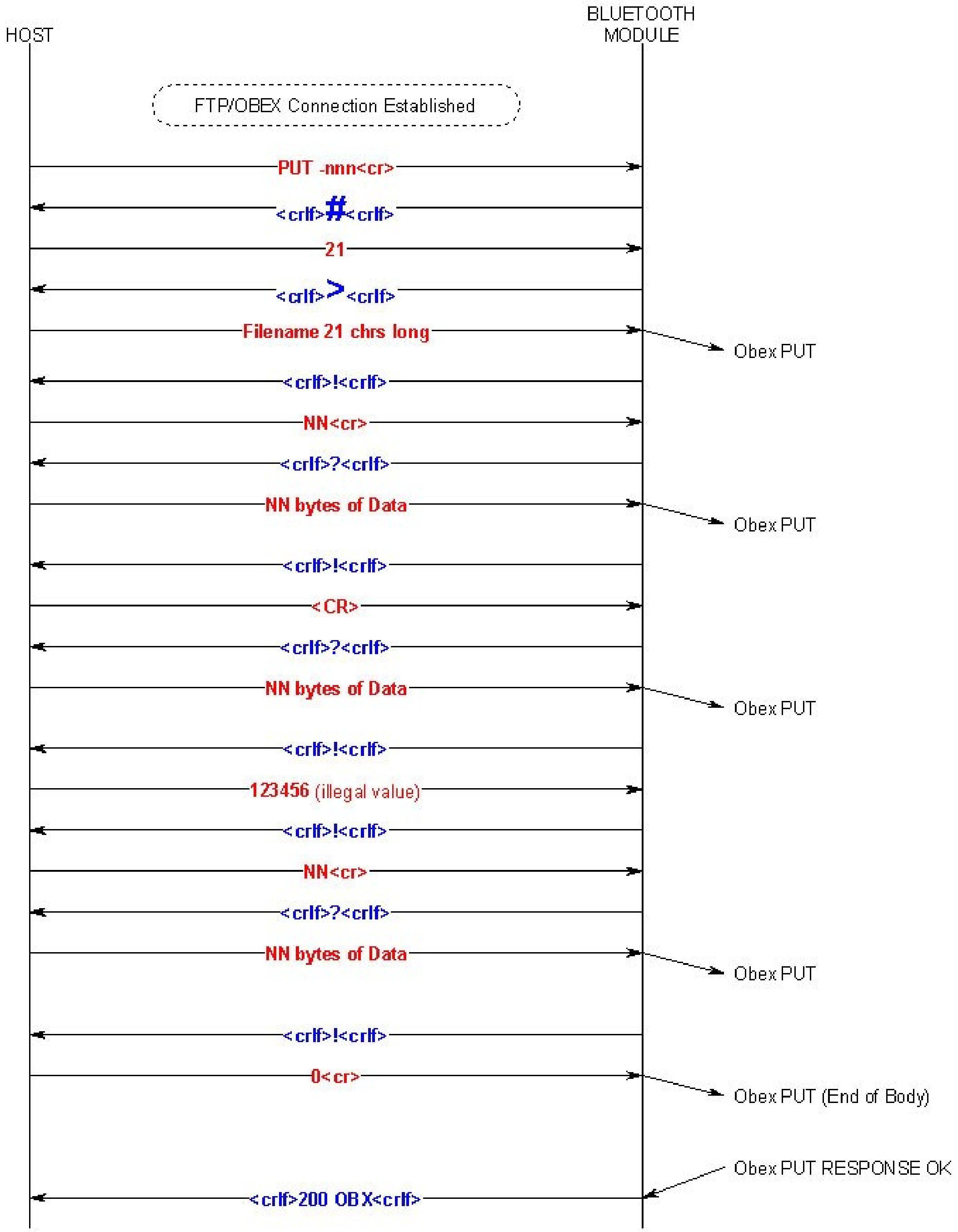
5.6.3 Usage: Put File (Short Filename)

Notes:

1. The first NN from the host shall specify a value of 1.
2. Subsequent NN values shall be less than the value returned to command MAX



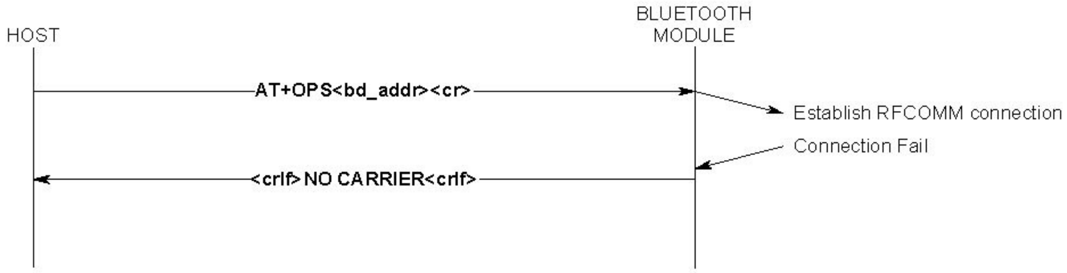
5.6.4 Usage: Put File (Long Filename - UNICODE)



5.6.5 Usage: Unsuccessful OBEX Push connection

Note: Reason for connection failure could be:

1. Device is not in range
2. Device is not connectable
3. Device does not support OBEX Push server profile



6 Related Documents

The following additional BTM430/431 technical documents are also available from the BTM430/431 product page under the Documentation tab:

- Product Brief
- Hardware Integration Guide
- Firmware Release Notes - Version 11.28.1.0
- Development Kit Schematics

7 Additional Information

Please contact your local sales representative or our support team for further assistance:

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