IndustrialPro™ and MobilityPro™ Gateway Wireless Modems

BEP Reference Document
Version 3.8.16 / 3.9.3

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CHANGE HISTORY

Version	Date	Description
3.8.8	December 14, 2010	Update RF2 payload. GSM modems report the current operator name in the Carrier field.
3.8.6	September 17, 2010	Change document format
3.8.5	September 9, 2010	No change
3.8.4	May 31, 2010	Add precisions for RF2 payload
3.8.3	February 18, 2010	No change
3.8.2	February 12, 2010	No change
3.8.1	January 11, 2010	Change document format

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1 INTRODUCTION

1.1 Scope

This document describes the BlueTree Event Protocol (BEP) used by Sixnet[1] IndustrialPro™ and MobilityPro™ gateway wireless modems (BT-6000 and BT-5000v2) as well as BlueTree legacy modems (BT-4000/BT-5000 Series).
BEP is used by Sixnet industrial wireless modems to communicate information to a centralized server:

- Modem Information
- Digital and Analog Input/Output
- GPS Data
- RF Status
- WAN IP Address Changes
- Authentication

In turn, BEP may be used by a centralized management server to communicate actions to be performed by a Sixnet industrial wireless modem.

1.2 References

[AT] AT Command Reference – Version 3.8.15.

1.3 Modem Configuration

The modem configuration allows defining:

- the content of the BEP messages,
- whether BEP messages are framed by synchronization sequences,
- whether BEP messages sent by the modem shall be acknowledged by the server,
- when BEP messages shall be sent by the modem,
- the memory block size of stored events (AT+BSFMBS).

Please refer to [AT] for details on how to configure event reporting on the modems and more especially to section **26 Event Handling**.

The following AT commands may be used to diagnose issues with the BEP feature:

- AT+BEVLOG: Log BEP messages sent on each BEP destination as well as received BEP ACK messages.
- AT+BSFMST: Store and Forward Memory status (number of free and used memory blocks as well as number of stored event per destination).
- AT+BSFMRM: Erase the content of the Store and Forward Memory.

[1] Formerly BlueTree Wireless Data

2 BEP SPECIFICATION

2.1 Message Format

2.1.1 IP Protocol

BEP messages can be exchanged using TCP/IP or UDP/IP (see [AT]).
IP packet fragmentation may cause messages to arrive in several IP packets.
Each IP packet may contain several BEP messages.

2.1.2 Byte-Ordering and Sign

In the following tables, the information is given in the order it is transmitted (most significant byte/bit first) except that BEP uses little-endian byte ordering for binary data expressed as integers (INT for signed integer, UINT for unsigned integer) or floating point (float) values. Future versions of the protocol may support big-endian byte ordering. The BEP header contains an option flag indicating which encoding is being used in the message.

Signed integers (8, 16 or 32-bit) use 2's complement encoding.

The field types used in the BEP message are described in the following table:

Table 1: BEP Field Types

Size (bytes)	Size (bits)	Type	Description
8		UINT64	Unsigned integer
4		UINT32	Unsigned integer
2		UINT16	Unsigned integer
1		UINT8	Unsigned integer
	1..7	UINT1 … UINT7	Unsigned integer
1		INT8	Signed integer coded in 2's complement
4		INT32	Signed integer coded in 2's complement
4		FLOAT32	Floating point IEEEE 754 encoded
variable		STR	Character string. Its length is given by a preceding length field. It may not be null terminated. The range of possible length is given in the Size column.
variable		STR0	Null terminated character string. An empty string has one null character. The length of payloads using STR0 type must account for the terminating null character. The range of possible length is given in the Size column.

2.1.3 Message Framing

BEP messages may be framed by two sequences of two bytes each. When configured with message framing, the modem sends a start sequence of two bytes before each BEP message and a sequence of two bytes after each BEP message.

The framing sequences are defined by the AT command +BSYNC (see [AT]).

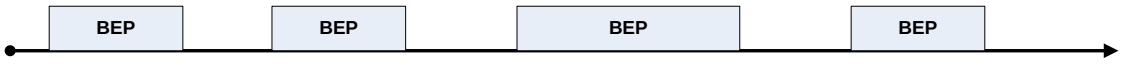

Figure 1: BEP Messages without Framing

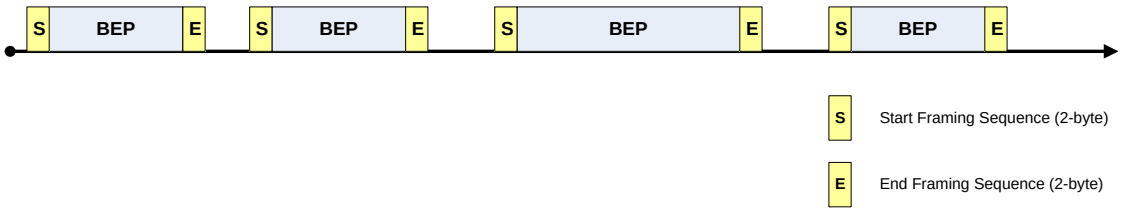

Figure 2: BEP Messages with Framing

Note:

- The framing also applies to messages sent by the server to the modems (BEP ACK); when the modem is configured with BEP message framing, it expects the BEP ACK messages to be framed by the start and end sequences.
- There is no escape mechanism for the content of the BEP message to prevent the occurrence of the Start or End framing sequence in the message itself.
- The sequences are sent in reverse order; the second byte is sent first and the first byte is sent last. For example with the configuration AT+BSYNCF="0xABCD","0x1234" will be sent in the following order on the network:

CD AB <header> <payloads> 34 12.

- Message framing is not applied to messages exchanged between the modem and a management server (MOM) or configuration server (IMOM), no matter the modem +BSYNC configuration settings.

2.1.4 Applications

BEP messages contain an application ID that impacts message exchanges. The following application can be specified:

- AVL (Automatic Vehicle Location). This application allows to report events (I/O, GPS, RF, …) to an application server. It may be used by fixed or mobile installations.
- MOM (Mobile Originated Management). This application allows to report events and also to perform management actions on the modem (configuration changes, status report, firmware upgrade, …). A typical application is BlueVue Group.
- IMOM (Initial Mobile Originated Management). This application allows to perform initial configuration of recently deployed modems. This application is not yet supported.

2.1.5 Message Exchanges

BEP messages are sent by Sixnet Industrial Wireless modems to one or several BEP enabled servers using either TCP/IP or UDP/IP.

The occurrence, periodicity and content of the messages are defined by the modem configuration (see [AT]). Messages sent by the modems may require to be acknowledged by the server.

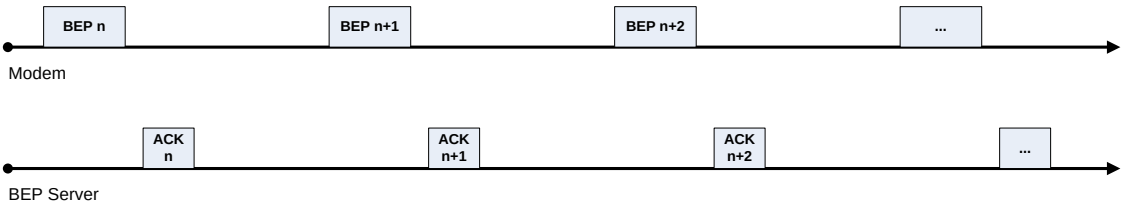

Figure 3: BEP Messages Acknowledgment

When no acknowledgement is received by the modem after a configurable period of time, the modem resends the BEP message.

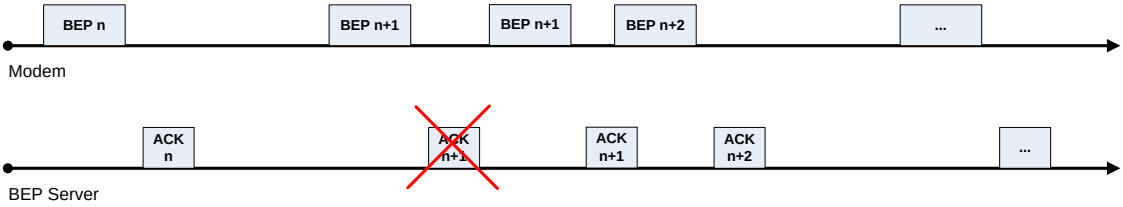

Figure 4: BEP Messages Acknowledgment with Retransmission

When a destination is not reachable messages are stored in memory until they can be sent again (or until no more memory is available). Messages are stored into non-volatile memory during modem shutdown.
When using TCP/IP, the firmware disconnects from the BEP report destination after 15 seconds of inactivity. This inactivity timeout is set to 15 minutes for Management Server (MOM) or Configuration Server (IMOM) applications. It will reconnect as soon as it has to send a new message.

2.1.6 Management and Configuration Servers

For Management Server (MOM) or Configuration Server (IMOM) applications, the modem and the server exchange a series of BEP/BEP ACK messages. The series may last as long as required for the server to run a set of AT commands on the modem.

The sequence is always initiated by the modem which, at the programmed interval, sends a BEP message to the server. The server replies by a BEP ACK whose content indicates whether an action (AT Command) needs to be performed by the modem. When an action needs to be performed by the modem, the BEP ACK message shall have its Acknowledgement field set and have the AC payload contain a non-null ID and an action specified. The modem performs the action and sends a response back to the server in a BEP message. When no more action needs to be performed by the modem, the server sends a BEP ACK message with the Acknowledgement field unset. The modem sends no response and will send a new BEP message at the next programmed frequency.

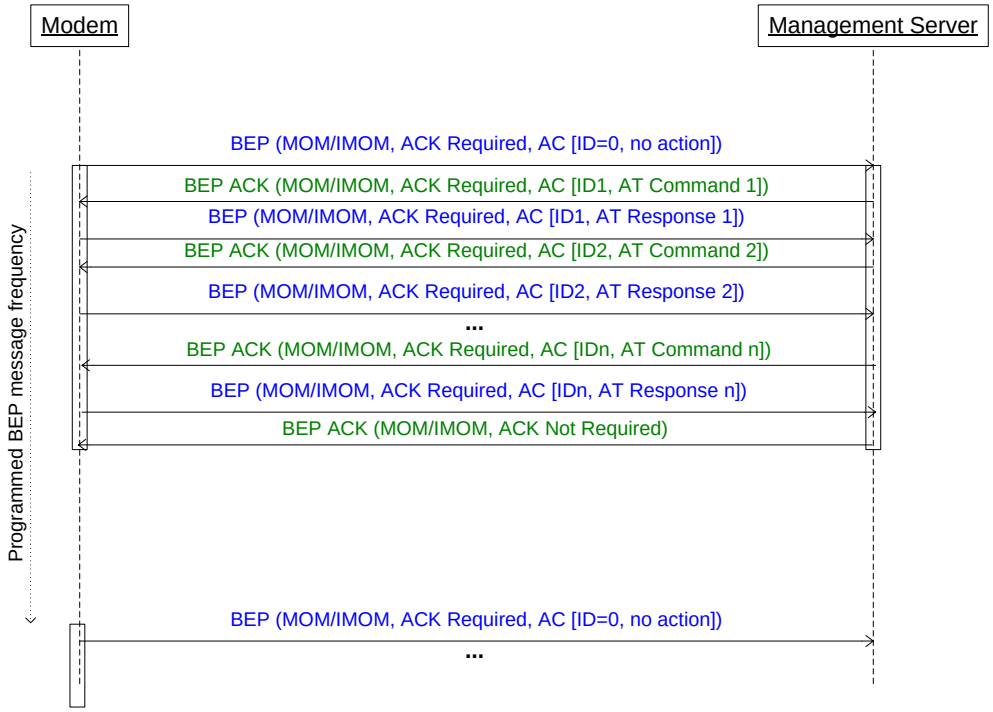

Figure 5: BEP/BEP ACK Messages Exchanges for MOM/IMOM

2.2 Message Structure

Each BEP message is composed of:

- A fixed header:
  - Modem ID (ESN/IMEI)
  - Message options (payload mask 1, acknowledgement required field, application ID and BEP version)
  - Message sequence number
  - Message length
  - Event ID
  - Payload mask 2 or, in the case of acknowledgement message, the sequence number of the message being acknowledged.

- An optional sequence of payloads
  - Various information from the modem (RF status, GPS information, I/O information, …)

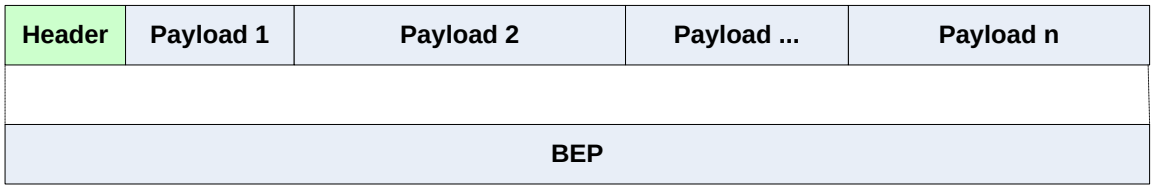

Figure 6: BEP Message Structure

Note:

- Some payloads have their length field coded on one byte (payload size 1..255 bytes), others have their length field coded on two bytes (payload size 1..65535 bytes).

2.2.1 BEP Message Payload Order

Payloads follow the BEP message header in the following order:

1. Modem Info (MI) – as defined in Payload Mask 2
2. RF Info (RF) – as defined in Payload Mask 2
3. I/O Info (IO) – as defined in Payload Mask 2
4. GPS Info (GP) – as defined in Payload Mask 2
5. GPS Odometer Info (GO) – as defined in Payload Mask 2
6. IP information (IP) – as defined in Payload Mask 2
7. Authentication (AU) – as defined in Payload Mask 1
8. Action results (AC) – as defined in Payload Mask 1

2.2.2 BEP ACK Message Payload Order

Payloads follow the BEP ACK message header in the following order:

1. Authentication (AU) – as defined in Payload Mask 1
2. Action (AC) – as defined in Payload Mask 1

2.3 Message Size

BEP messages have a variable size. The message size can be determined from the header content (payload definition) and each payload size.

2.4 Headers

The BEP header has a fixed size of 24 bytes.

2.4.1 BEP Message Header

Table 2: BEP Header

Byte Offset	Field Name	Size (bytes)	Size (bits)	Type	Description
0	Modem ID	8		UINT64	Modem ESN or IMEI
8	**Message options**	**4**			**See details below**
8	**Payload Mask 1**	**1**			**See details below**
	Authentication Info		2	UINT2	Value determines the presence of the authentication info payload and its format: 00_{bin} No Authentication Info payload 01_{bin} AU1: Authentication Info payload format 1 10_{bin} AU2: Authentication Info payload format 2 11_{bin} AU3: Authentication Info payload format 3
	Action		2	UINT2	Value determines the presence of the Action payload and its format: 00_{bin} No Action payload 01_{bin} AC1: Action payload format 1 10_{bin} AC2: Action payload format 2 11_{bin} AC3: Action payload format 3
	Reserved		*4*	*UINT4*	*Reserved for future use. Must be set to 0000_{bin}*
9	*Reserved*		*4*	*UINT4*	*Reserved for future use. Must be set to 0000_{bin}*
	Byte order		1	UINT1	The value of this bit determines the byte order of multi-byte binary fields (INT, UINT, FLOAT): 0_{bin} Little-endian 1_{bin} Network (Big-endian) (not supported)
	Compression		1	UINT1	The value of this bit determines whether compression has been applied to the payload: 0_{bin} No Compression 1_{bin} Compression (not supported)
	Encryption		1	UINT1	The value of this bit determines whether encryption has been applied to the payload: 0_{bin} No encryption 1_{bin} Payload is encrypted (not supported)
	Acknowledgement		1	UINT1	The value of this bit determines whether an acknowledgement message shall be sent by the receiver of this message: 0_{bin} No acknowledgement 1_{bin} Message shall be acknowledged
10	Application ID	1		UINT8	Application ID, shall be set to: 1 AVL application 2 Reserved 3 MOM (Mobile Originated Management) 4 Initial Configuration
11	*Reserved*		*4*	*UINT4*	*Reserved for future use, shall be set to 0000_{bin}*
	Version		4	UINT4	BEP protocol version, shall be set to 0001_{bin}
12	Sequence number	4		UINT32	BEP message sequence number. The first message has the sequence number set to 1. Message sequence numbers persist modem reboot.
16	Packet length	2		UINT16	BEP message total length (including header and all payloads but excluding possible framing). Can be used as offset to the next message (or to the framing end sequence).
18	Event ID	2		UINT16	Index number of the event triggering this message as configured in the modem by +BEVENT=<index>,…

Byte Offset	Field Name	Size (bytes)	Size (bits)	Type	Description
20	**Payload mask 2**	**4**			This field is encoded as an unsigned 32-bit integer. The position of each byte depends on the message byte order field. **See** Table 3: BEP Payload Mask 2 **for the position of each payload type content.**
24					

Table 3: BEP Payload Mask 2

Bit Position	Field Name	Size (bits)	Type	Description
MSB - 32	*Reserved*	*16*	*UINT16*	*Reserved for future use, shall be set to 0000_0000_0000_0000$_{bin}$*
16	Odometer Info	2	UINT2	Value determines the presence of the odometer info payload and its format: 00_{bin} No Odometer Info payload 01_{bin} GO1: Odometer Info payload format 1 10_{bin} GO2: Odometer Info payload format 2 11_{bin} GO3: Odometer Info payload format 3
14	IP info	2	UINT2	Value determines the presence of the IP info payload and its format: 00_{bin} No IP Info payload 01_{bin} IP1: IP Info payload format 1 10_{bin} IP2: IP Info payload format 2 11_{bin} IP3: IP Info payload format 3
12	*Reserved*	*2*	*UINT2*	*Reserved for future use, shall be set to 00bin*
10	*Reserved*	*2*	*UINT2*	*Reserved for future use, shall be set to 00bin*
8	Modem Info	2	UINT2	Value determines the presence of the modem info payload and its format: 00_{bin} No Modem Info payload 01_{bin} MI1: Modem Info payload format 1 10_{bin} MI2: Modem Info payload format 2 11_{bin} MI3: Modem Info payload format 3
6	RF Info	2	UINT2	Value determines the presence of the RF info payload and its format: 00_{bin} No RF Info payload 01_{bin} RF1: Info payload format 1 10_{bin} RF2: Info payload format 2 11_{bin} RF3: Info payload format 3
4	I/O Info	2	UINT2	Value determines the presence of the I/O info payload and its format: 00_{bin} No I/O Info payload 01_{bin} IO1: I/O Info payload format 1 10_{bin} IO2: I/O Info payload format 2 11_{bin} IO3: I/O Info payload format 3
2	GPS Info	2	UINT2	Value determines the presence of the GPS info payload and its format: 00_{bin} No GPS Info payload 01_{bin} GP1: GPS Info payload format 1 10_{bin} GP2: GPS Info payload format 2 11_{bin} GP3: GPS Info payload format 3
LSB				

2.4.2 BEP ACK Message Header

BEP ACK message is used by a BEP server to acknowledge the reception of a BEP message and avoid retransmission. It is identical to the BEP Message header except for the last field containing the ACK sequence number instead of the payload mask.

The following fields must be identical to the message header being acknowledged:

- Modem ID
- Version
- Application ID

- Event ID

The following fields shall be set:

- Sequence number of packets sent by the server to the modem
- Packet Length: shall be set to the length of the header (24) plus the length of the payloads (may be 0 when no payload follows the header)
- ACK Sequence Number: shall be set to the sequence number of the message being acknowledged
- ACK Payload Mask: used by the server to indicate that the BEP header is followed by one or several payloads

Table 4: BEP ACK Header

Byte Offset	Field Name	Size (bytes)	Size (bits)	Type	Description
0	Modem ID	8		UINT64	Modem ESN or IMEI
8	**Payload Mask 1**	**1**			**See details below**
	Authentication Info		2	UINT2	Value determines the presence of the authentication info payload and its format: 00_{bin} No Authentication Info payload 01_{bin} AU1: Authentication Info payload format 1 10_{bin} AU2: Authentication Info payload format 2 11_{bin} AU3: Authentication Info payload format 3
	Action		2	UINT2	Value determines the presence of the Action payload and its format: 00_{bin} No Action payload 01_{bin} AC1: Action payload format 1 10_{bin} AC2: Action payload format 2 11_{bin} AC3: Action payload format 3
	Reserved		*4*	*UINT4*	*Reserved for future use. Must be set to 0000_{bin}*
9	**Message options**	**3**			**See details below**
9	*Reserved*		*4*	*UINT4*	*Reserved for future use. Must be set to 0000_{bin}*
	Byte Order		1	UINT1	The value of this bit determines the byte order of multi-byte binary fields (INT, UINT, FLOAT): 0_{bin} Little-endian 1_{bin} Network (Big-endian) (not supported)
	Compression		1	UINT1	The value of this bit determines whether compression has been applied to the payload: 0_{bin} No Compression 1_{bin} Compression (not supported)
	Encryption		1	UINT1	The value of this bit determines whether encryption has been applied to the payload: 0_{bin} No encryption 1_{bin} Payload is encrypted (not supported)
	Acknowledgement		1	UINT1	The value of this bit determines whether an acknowledgement message shall be sent by the receiver of this message: 0_{bin} No acknowledgement 1_{bin} Message shall be acknowledged
10	Application ID	1		UINT8	Shall be identical to the Application ID field of the message being acknowledged.
11	*Reserved*		*4*	*UINT4*	*Reserved for future use, shall be set to 0000_{bin}*
	Version		4	UINT4	BEP protocol version, shall be set to 0001_{bin}

Byte Offset	Field Name	Size (bytes)	Size (bits)	Type	Description
12	Sequence number	4		UINT32	BEP message sequence number. The first message has the sequence number set to 1, and then it keeps being increased by 1 each time a new BEP ACK is sent.
16	Packet length	2		UINT16	BEP message total length (including header but excluding possible framing). Can be used as offset to the next message (or to the framing end sequence). Set to 24 when the BEP ACK contains no payload, set to 24 + payload total length otherwise.
18	Event ID	2		UINT16	Index number of the event triggering this message as configured in the modem by +BEVENT=<index>,…
20	ACK Seq, number	4		UINT32	Sequence number of the packet being acknowledged.
24					

2.5 Payloads

2.5.1 Modem Information

2.5.2 MI1 Format

The MI1 format contains the following information:

Table 5: MI1: Modem Information 1 Payload

Byte Offset	Field Name	Size (bytes)	Size (bits)	Type	Description
0	Payload content length	1		UINT8	Number of characters of the Modem Name
1	Modem name	1..32		STR	Modem name string containing Length characters. **Note**: The string is not null terminated.
variable					

2.5.3 MI2 Format

The MI2 format contains the following information:

Table 6: MI2: Modem Information 2 Payload

Byte Offset	Field Name	Size (bytes)	Size (bits)	Type	Description
0	Payload content length	2		UINT16	Size in bytes of the remaining of the payload.
2	Model ID	4		UINT32	Sixnet Industrial Wireless modem model ID – See Table 7: Model ID
6	Firmware version	1..32		STR0	Sixnet Industrial Wireless firmware version as returned in the field 'FW:' of ATI1.
	Configuration version	1.32		STR0	Modem configuration version (as returned by AT+BCFGV?).
	PRL version	1..32		STR0	RF Module PRL version as returned in the field 'PRL:' of ATI1. This field is empty (one NUL character) for non CDMA modem.
variable					

Table 7: Model ID

Model	Model ID	Wireless Technology	GPS
BT-4200	*0x4200*	*CDMA 1xRTT*	
BT-4400	*0x4400*	*GSM/GPRS*	
BT-4600	*0x4600*	*CDMA EV-DO rel. 0*	
BT-5200	*0x5200*	*CDMA 1xRTT*	*GPS*
BT-5400	*0x5400*	*GSM/GPRS*	*GPS*
BT-5600	*0x5600*	*CDMA EV-DO rel. 0*	*GPS*
BT-4600A	*0x4601*	*CDMA EV-DO rev. A*	
BT-5600A	*0x5601*	*CDMA EV-DO rev. A*	*GPS*
BT-6600	0x6601	CDMA EV-DO rev. A	
BT-6601	0x6611	CDMA EV-DO rev. A	
BT-6601EB	0x6651	CDMA EV-DO rev. A	
BT-6621	0x6631	CDMA EV-DO rev. A	
BT-5600v2	0x7601	CDMA EV-DO rev. A	GPS
BT-5630v2	0x7605	CDMA EV-DO rev. A w/ Wi-Fi	GPS
BT-6800	0x6800	HSPA	
BT-6801	0x6810	HSPA	
BT-6801EB	0x6850	HSPA	
BT-6821	0x6830	HSPA	
BT-5800v2	0x7800	HSPA	GPS
BT-5830v2	0x7804	HSPA w/ Wi-Fi	GPS
BT-6401	0x6410	GSM/EDGE	
BT-6401EB	0x6450	GSM/EDGE	
BT-6421	0x6430	GSM/EDGE	

2.5.4 MI3 Format

The MI3 format contains the following information:

Table 8: MI3: Modem Information 3 Payload

Byte Offset	Field Name	Size (bytes)	Size (bits)	Type	Description
0	Payload content length	2		UINT16	Size in bytes of the remaining of the payload.
2	Model ID	4		UINT32	Sixnet Industrial Wireless modem model ID – See Table 7: Model ID
6	Modem model	1..32		STR0	Modem model string as returned in the field 'Model:' of ATI1.
	Phone number	1..32		STR0	Phone number string as returned in the field 'Phone:' of ATI1.
	Serial number	1..32		STR0	Modem serial number string as returned in the field 'S/N:' of ATI1.
	Modem name	1..32		STR0	Phone number string as returned in the field 'Name:' of ATI1.
	Firmware version	1..32		STR0	Sixnet Industrial Wireless firmware version as returned in the field 'FW:' of ATI1.
	Configuration version	1..32		STR0	Modem configuration version (as returned by AT+BCFGV?).
	PRL version	1..32		STR0	RF Module PRL version as returned in the field 'PRL:' of ATI1. This field is empty (one NUL character) for non CDMA modem.
	GPS version	1..64		STR0	GPS version as returned in the field 'GPS:' of ATI1. This field is empty (one NUL character) for non GPS modem.
	RF version	1..32		STR0	RF version as returned in the field 'RF:' of ATI1.
	HW version	1..32		STR0	HW version as returned in the field 'HW:' of ATI1.

Byte Offset	Field Name	Size (bytes)	Size (bits)	Type	Description
	OS version	1..32		STR0	OS version as returned in the field 'OS:' of ATI1.
	Boot version	1..32		STR0	Boot version as returned in the field 'BOOT:' of ATI1.
	SIM card number	1..32		STR0	SIM card as returned in the field 'SIM:' of ATI1. This field is empty (one NUL character) for non GSM modem.
variable					

2.5.5 RF Information

2.5.6 RF1 Format

The RF1 format contains the following information:

Table 9: RF1: RF Information 1 Payload

Byte Offset	Field Name	Size (bytes)	Size (bits)	Type	Description
0	Payload content length	1		UINT8	Always set to 1
1	RSSI	1		INT8	Signed RSSI coded in 2'complement on one byte. Possible range is -128 (80_{hex}) to +127 ($7F_{hex}$) dBm (actual range depends on modem model and varies from -113 to -51 dBm)
2					

2.5.6.1 RF2 Format

The RF2 format contains the following information:

Table 10: RF2: RF Information 2 Payload

Byte Offset	Field Name	Size (bytes)	Size (bits)	Type	Description
0	Payload content length	1		UINT8	Size in bytes of the remaining of the payload.
1	RSSI	1		UINT8	True dBm value turned positive (multiplied by -1)
2	Reserved		7	UINT7	Reserved for future use, must be set to 0000000_{bin}
	Roaming		1	UINT1	Value indicates whether the modem is roaming: 0_{bin} Modem is registered to its Home network 1_{bin} Modem is roaming
3	Service Type	1..32		STR0	Service type in use, see Table 11.
	Carrier	1..32		STR0	CDMA (1xRTT, EvDO, EvDO A): Carrier as returned by AT+GMM after the modem model. GSM (GPRS, EDGE, HSPA): Current operator name as returned in the AT+BMDIAG Network field.
variable					

Table 11: Service Type in Use

Service Type in Use	AT+BNSTAT value	Wireless Technology
1xRTT	*6-7*	*CDMA1xRTT, CDMA EV-DO rel. 0,* CDMA EV-DO rev. A
EVDO	*81-87*	*CDMA EV-DO rel. 0,* CDMA EV-DO rev. A
EVDO.A	*91-97*	CDMA EV-DO rev. A
GPRS	*101*	GSM GPRS/EDGE/HSPA
EDGE	*102*	GSM EDGE/HSPA
UMTS	*103*	GSM EDGE/HSPA
HSDPA	*104*	GSM HSPA
HSUPA	*105*	GSM HSPA
HSPA	*106*	GSM HSPA
NONE	*0*	No service

2.5.6.2 RF3 Format

Reserved for future use.

2.5.7 I/O Information

2.5.7.1 IO1 Format

The IO1 format contains the following information:

Table 12: IO1: IO Information 1 Payload

Byte Offset	Field Name	Size (bytes)	Size (bits)	Type	Description
0	Payload content length	1		UINT8	Always set to 20
1	**Digital I/O state**	**4**			**Digital Inputs and Outputs as defined below:**
1	*Reserved*		*3*	*UINT3*	*Reserved for future use. Must be set to 000_{bin}*
	IGN		*1*	*UINT1*	State of the digital input signal IGN (IGNITION): 0_{bin} IGN is OFF 1_{bin} IGN is ON
	DI4		*1*	*UINT1*	State of the digital input signal DI4: 0_{bin} DI4 is OFF 1_{bin} DI4 is ON
	DI3		*1*	*UINT1*	State of the digital input signal DI3: 0_{bin} DI3 is OFF 1_{bin} DI3 is ON
	DI2		*1*	*UINT1*	State of the digital input signal DI2: 0_{bin} DI2 is OFF 1_{bin} DI2 is ON
	DI1		*1*	*UINT1*	State of the digital input signal DI1: 0_{bin} DI1 is OFF 1_{bin} DI1 is ON
2	*Reserved*	*1*		*UINT8*	*Reserved for future use. Must be set to 0.*
3	*Reserved*		*5*	*UINT5*	*Reserved for future use. Must be set to 00000_{bin}*
	DO3		*1*	*UINT1*	State of the digital output signal DO3: 0_{bin} DO3 is OFF 1_{bin} DO3 is ON

Byte Offset	Field Name	Size (bytes)	Size (bits)	Type	Description
	DO2		*1*	*UINT1*	State of the digital output signal DO2: 0_{bin} DO2 is OFF 1_{bin} DO2 is ON
	DO1		*1*	*UINT1*	State of the digital output signal DO1: 0_{bin} DO1 is OFF 1_{bin} DO13 is ON
4	*Reserved*	*1*		*UINT8*	*Reserved for future use. Must be set to 0.*
5	Input power	4		FLOAT32	Single precision floating point value IEEE 754 encoded.
9	Analog Input 1	4		FLOAT32	Single precision floating point value IEEE 754 encoded.
13	Analog Input 2	4		FLOAT32	Single precision floating point value IEEE 754 encoded.
17	Analog Input 3	4		FLOAT32	Single precision floating point value IEEE 754 encoded.
21					

2.5.7.2 IO2 Format

Reserved for future use.

2.5.7.3 IO3 Format

Reserved for future use.

2.5.8 GPS Information

2.5.8.1 GP1 Format

Notes:

- This payload has a 2 bytes length field.

The GP1 format contains the following information:

Table 13: GP1: GPS Information 1 Payload

Byte Offset	Field Name	Size (bytes)	Size (bits)	Type	Description
0	Payload content length	2		UINT	Size in bytes of the following GPS raw NMEA or TAIP message
2	GPS NMEA/TAIP	1..1024		STR	Last GPS raw message read from the GPS module. Depending on the modem protocol setting (+BGPSPR), the message can either be a NMEA message or a TAIP message. **Notes**: • The string is not null terminated, its size is determined by the Payload content length. • The message does not contain the latest valid GPS fix but the last data received from the GPS module. • When set to NMEA, the actual content of the message depends on the +BGPSNM NMEA message selection configuration.
variable					

2.5.8.2 GP2 Format

Reserved for future use.

2.5.8.3 GP3 Format

Reserved for future use.

2.5.9 Odometer Information

2.5.9.1 GO1 Format

The GO1 format contains the following information:

Table 14: GO1: GPS Odometer Information 1 Payload

Byte Offset	Field Name	Size (bytes)	Size (bits)	Type	Description
0	Payload content length	1		UINT8	Always set to 4
1	Odometer	4		INT32	Value of the modem odometer
5					

2.5.9.2 GO2 Format

Reserved for future use.

2.5.9.3 GO3 Format

Reserved for future use.

2.5.10 IP Information

2.5.10.1 IP1 Format

The IP1 format contains the following information:

Table 16: IP1: IP Information 1 Payload

Byte Offset	Field Name	Size (bytes)	Size (bits)	Type	Description
0	Payload content length	1		UINT8	Always set to 4
1	WAN IP	4		UINT32	IPv4 IP address in network byte order. The encoding of this field does not depend on the header byte order field.
5					

2.5.10.2 IP2 Format

Reserved for future use.

2.5.10.3 IP3 Format

Reserved for future use.

2.5.11 Authentication Information

2.5.11.1 AU1 Format

The AU1 format contains the following information:

Table 17: AU1: Authentication Information 1 Payload

Byte Offset	Field Name	Size (bytes)	Size (bits)	Type	Description
0	Payload content length	2		UINT16	Size in bytes of the remaining of the payload.
2	MD5 hash	16		UINT8	MD5 hash computed on the following appended data (in the given order): • Entire BEP packet with this field set to all FF_{hex}, • Last nonce field received for this connection with the server • The modem password (as set by AT+BRPSWD). The password may be empty.
18	Nonce	1..128		STR0	Null-terminated string representing the nonce used for calculating the MD5 hash of the message. When received by the modem, this nonce is used for subsequent MD5 hash calculation.
variable					

2.5.11.2 AU2 Format

Reserved for future use.

2.5.11.3 AU3 Format

Reserved for future use.

2.5.12 Action

2.5.12.1 AC1 Format

The AC1 format contains the following information:

Table 18: AC1: Action 1 Payload

Byte Offset	Field Name	Size (bytes)	Size (bits)	Type	Description
0	Payload content length	2		UINT16	Size in bytes of the remaining of the payload.
2	Request ID	2		UINT16	Identification of the request. This field is used to link a request with its response. The modem copies this field from the BEP ACK it receives to the BEP message it sends with the action response. This field is set to 0 by the modem when it is not associated to a Server request (this is the case for the first message sent by the modem to the server).
4	Action	1..~4k		STR0	AT command to execute (Server → Modem), or AT response to executed command (Modem → Server) The size of the Action field is variable. The maximum size for messages sent by the modem depends on the overall size of the BEP message and on the modem store and forward memory block size (as set by AT+BSFMBS). By default it is about 400 bytes (4 x default block size – header and other payload size).
Variable					

Notes:

- ACK flag is always set in BEP messages Modem → Server for destinations type 3 (Management Server) or 4 (Initial Configuration Server).
- When the ACK flag is set in the message Server → Modem which includes an AC payload, the response to the AT command shall be sent back in a new BEP message having an AC payload.
- When no action needs to be performed, the ACK flag shall be unset in the BEP ACK message sent by the Server to the modem.
- AC1 payload are only processed when coming from destinations type 3 (Management Server) or 4 (Initial Configuration Server).

2.5.12.2 AC2 Format

Reserved for future use.

2.5.12.3 AC3 Format

Reserved for future use.