AT Commands Interface Guide

eCall In-Band Modem Library

SIERRA WIRELESS

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Document History

Version	Date	Updates
1.0	May 11, 2011	Creation
2.0	October 7, 2011	Added the AT+INBMTIMERCFG command.
3.0	May 30, 2012	Updated document legal boilerplate. Added Note and its details to the Channel and MSD AT Command Call Requirements section. Modified the <MSD> parameter definition in the Command +INBMSETMSD section.
4.0	July 28, 2014	Updated document legal boilerplate. Added the CECALL commands section and subsections. Command +INBMTIMERCFG T5 default value updated to 5.

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1. Introduction

The following subsections present introductory information regarding the eCall In-Band Modem Library AT Commands.

1.1. Overview

This document provides Sierra Wireless customers with the AT Commands for eCall In-Band Modem, available when using the eCall In-Band Modem Library in their application for IVS system application.

1.2. Related Documents

[1] eCall In-Band Modem Functional Specification Document
Reference: WM_DEV_INBM_FCS_001

[2] eCall In-Band Modem Architecture Specification Document
Reference: WM_DEV_INBM_ARS_001

[3] Road transport and traffic telematics — ESafety — ECall minimum set of data (MSD) (CEN/TC 278)

[4] 3GPP TS 26.267 V9.3.0 - V8.6.0

[5] 3GPP TS 26.268 V9.4.0 - V8.6.0

[6] 3GPP TS 26.269 V9.2.0 - V8.3.0

[7] 3GPP TS 27.007 V11.4.0

[8] ETSI TS 131.102 V10.1.0

1.3. Abbreviations

Abbreviation	Definition
ADL	Application Development Layer
ACK	Acknowledgement
GSM	Global System for Mobile Communication
IVS	In-Vehicle System
MSD	Minimum Set of Data
PSAP	Public Safety Answering Point

2. User Guide

This section provides introduction and high level description of the eCall In-Band Modem Library features and AT command set.

2.1. Features

This sample provides an In-Vehicle System (IVS) interface to use various features of the eCall In-Band Modem Library. It requires connecting to an eCall PSAP server over a GSM voice call.

This application provides custom AT commands, using which a single In-Band Modem channel can be associated with a GSM voice call. The IVS can be set to either PULL mode or PUSH mode. By default the application would be in PULL mode. In this mode, the application will start listening on the Rx line monitoring for the incoming START messages from the PSAP server. On detecting the START, the application would send the MSD frames and again listen on the Rx line waiting for LACK and HLACK indications.

In case of PUSH mode, the application will transmit the SEND_MSD_REQUEST indication to the PSAP server and start to listen on the Rx line waiting for the START message. The SEND_MSD_REQUEST will be sent immediately if the voice call is already established, or just after call establishment if the voice call was not yet established. Once the START is received, or if START time out occurs, PUSH mode is exit and the flow is same as the above described PULL mode.

When the In-Band modem channel is still kept active and is in IDLE state, a new MSD can be set using the respective command.

The application during the MSD transaction (i.e. for the time In-Band modem channel is Active) switches to 104MHz frequency mode.

The references specifications for the IVS sample application are the 3GPP and CEN specifications version as indicated in "Related Document" section.

3. eCall In-Band Modem Library Application States

This section provides information about the eCall In-Band Modem application states, their transitions, and allowed AT commands for each state.

3.1. State Machine

Below is a diagram of states and transitions of the eCall In-Band Modem Library and channel application.

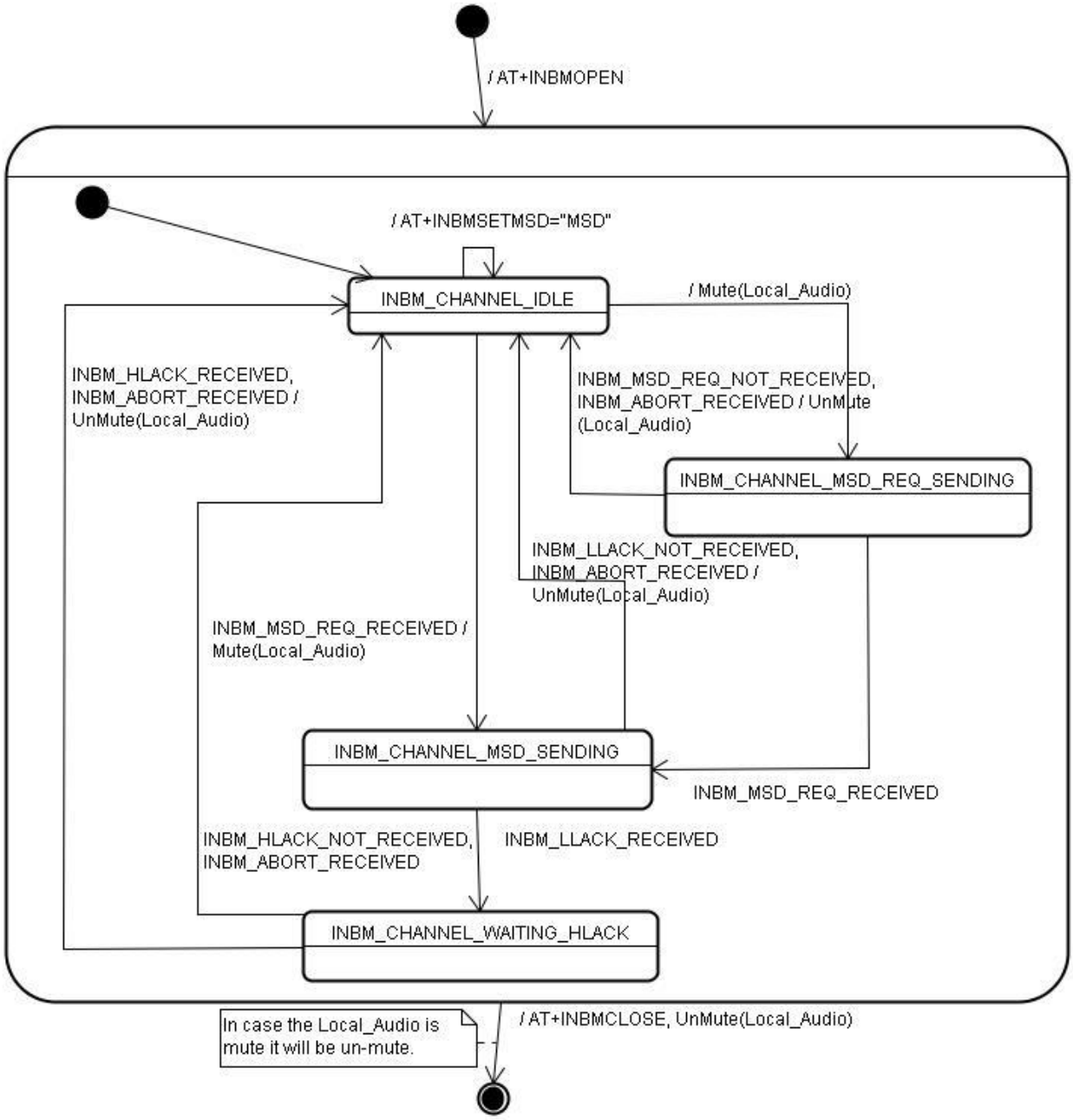

Figure 1. In-Band Modem Channel State Diagram

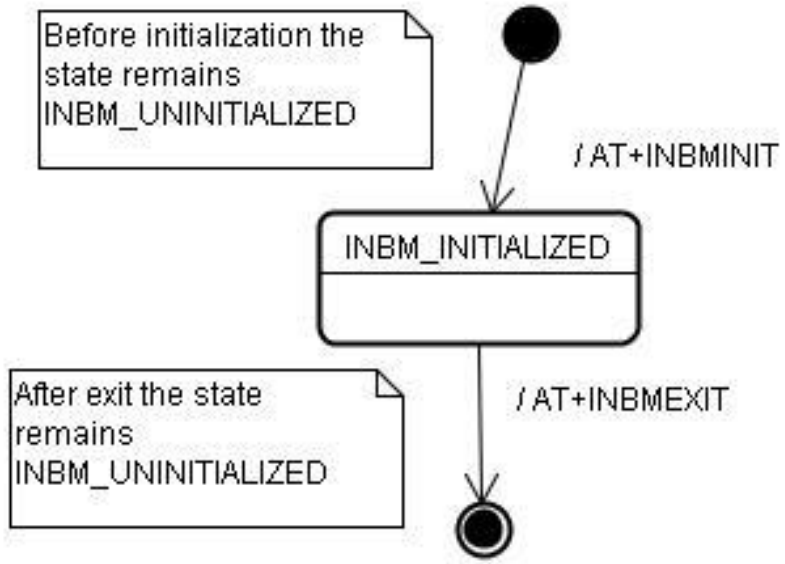

Figure 2. In-Band Modem Library State Diagram

3.2. AT Commands Calls Requirements

The following tables present the prerequisites when using the eCall In-Band Modem AT commands.

'X' means the AT Command is authorized in the corresponding state.

'-' means the AT Command is NOT authorized in the corresponding state.

3.2.1. Library Control AT Command Call Requirements

The Library Control API calls are allowed according to the Library state as follows in the table below.

Table 1. Library Control APIs Calls Requirements

Function	INBM_UNINITIALIZED	INBM_INITIALIZED
AT+INBMINIT	X	-
AT+INBMEXIT	-	X
AT+INBMSTATE	X	X
AT+INBMGETVER	X	X
AT+INBMOPEN	-	X
AT+INBMMSDFORMAT	-	X
AT+INBMTIMERCFG	-	X

3.2.2. Channel and MSD AT Command Call Requirements

All Channel and MSD API, except inbm_OpenChannel, require a valid channel to be opened and provided as input parameter. These API calls are allowed according to the specified channel state as follows:

Table 2. Channel Control APIs and MSD APIs Call Requirements

Function	INBM_CHANNEL_IDLE	INBM_CHANNEL_MSD_REQ_SENDING	INBM_CHANNEL_MSD_SENDING	INBM_CHANNEL_WAITING_HLACK
AT+INBMCLOSE	X	X	X	X
AT+INBMSETMSD	X	-	-	-
AT+INBMCHSTATE	X	X	X	X
AT+INBMPUSH	X	-	-	-

Note: For efficient plugin operations, it is recommended that the below mentioned settings are made when the In-Band Modem channel is being used.

- Set speaker gain and volume to 0dB:
  - AT+WBHV=8,1 (to set gain unit to dB)
  - AT+WDGR=1,0
  - AT+WDGR=2,0
- Set microphone gain to 0dB:
  - AT+WDGT=1,0
- Disable echo cancellation:
  - AT+ECHO=0
- Disable sidetone:
  - AT+SIDET=0
- Disable audio filtering:
  - AT+WADF=0,1 (high pass filter in TX mode)
  - AT+WADF=0,2 (high pass filter in RX mode)
  - AT+WADF=0,3 (low pass filter in TX mode)

- AT+WADF=0,4 (low pass filter in RX mode)
- AT+WADF=0,5 (finite impulse response numeric filter in TX mode)
- AT+WADF=0,6 (finite impulse response numeric filter in RX mode)

4. AT Command Syntax

This section describes the AT command format and the default values of their parameters.

4.1. Command Line

Commands always start by the standard prefix “AT+INBM” and end with the <CR> character. Optional parameters are shown in brackets [ ].

Example:

AT+INBMcmd=<Param1>[,<Param2>]

<Param2> is optional. When the AT+INBMcmd is executed without <Param2> the default value of <param2> is used.

Default value is the last configured parameter or the last saved parameter value after the Embedded Module reset or factory default value if parameters were not saved.

4.2. Information Responses and Result Codes

Responses start and end with <CR><LF>.

- If command syntax is incorrect, the "ERROR" string is returned.
- If command syntax is correct but transmitted with wrong parameters, the " +INBMERROR: <Id>" string is returned with adequate error codes. Please refer to In-Band AT commands error codes description for more details about error code values.
- If the command line has been executed successfully, an "OK" string is returned.

In the following examples <CR> and <CR><LF> are intentionally.

5. AT Commands Reference

The following AT commands enable the control of eCall In-Band Modem Library Services for basic operation. They are listed under the categories presented in the subsections below.

5.1. Library Control Commands

5.1.1. Command +INBMINIT

5.1.1.1. Description

This AT Command is used to initialize the eCall In-Band Modem Library.

5.1.1.2. Syntax

Action command

AT+INBMINIT=[<SrcType**>]**

OK

Test command

AT+INBMINIT=?

```
+INBMINIT: (list of supported <at_command>s)
OK
```

5.1.1.3. Parameters and Defined Values

<SrcType>:		This parameter gives the value of the source type
	0	If the source specified is GSM, then this value is specified

5.1.1.4. Examples

Command	Responses
AT+INBMINIT=? *Note: displays all supported AT command format.*	+INBMINIT: 0 OK

Command	Responses
AT+INBMINIT=0	OK or +INBMERROR: <id> (In case the command fails. <id>, specifies the error cause)

5.1.2. Command +INBMEXIT

5.1.2.1. Description

This AT command cleans up the eCall In-Band Modem Library.

5.1.2.2. Syntax

Action command

AT+INBMEXIT

OK

5.1.2.3. Examples

Command	Responses
AT+INBMEXIT	OK or +INBMERROR: <id> (In case the command fails. <id>, specifies the error cause)

5.1.3. Command +INBMGETVER

5.1.3.1. Description

This AT command is used to request to get the In-Band Modem Library version

5.1.3.2. Syntax

Read command

AT+INBMGETVER?
[In-Band Modem Library version information]
OK

5.1.3.3. Examples

Command	Responses
AT+INBMGETVER? *Note: request the version of the In-Band Modem Library in use*	The In-Band Modem Library version information followed by: OK or *+INBMERROR: <id> (If the command fails. <id>, specifies the error cause.)*

5.1.4. Command +INBMSTATE

5.1.4.1. Description

The above command requests for the state of In-Band Modem Library.

5.1.4.2. Syntax

Read command

AT+INBMSTATE?
+INBMSTATE:<state>
OK

5.1.4.3. Parameters and Defined Values

<state>:		State value
	0	If the state is uninitialized, then this value is returned.
	1	This value is returned when the state is initialized.

5.1.4.4. Examples

Command	Responses
AT+INBMSTATE?	+INBMSTATE: 0 OK OR *Note: 0 if state is not initialized.* +INBMSTATE: 1 OK *Note: 1 if state is initialized.* *OR* +INBMERROR: <id> (In case the command fails. <id>, specifies the error cause)

5.2. In-Band Channel Control Commands

5.2.1. Command +INBMOPEN

5.2.1.1. Description

This AT command is used to activate the In-Band Modem channel.

If “MSD” is not specified along with “AT+INMBOPEN” command, then default MSD value will be sent as follows:

“0x015C0681D54970D65C3597CA0420C41464583ADE68AC52E9BB8413F149C07414FB414F6010180813E82181823230"

5.2.1.2. Syntax

Action command

AT+INBMOPEN=<mode>,[“MSD”]

OK

Test command

AT+INBMOPEN=?

+INBMOPEN: (list of supported <mode>s),(<”MSD”>)

OK

5.2.1.3. Parameters and Defined Values

<mode>		The mode in which the channel must be opened
	0	Pull mode
	1	Push mode
<MSD>	maximum 140 byte string permitted	This is an optional parameter. If the MSD is not provided a default 140 bytes of MSD would be considered. The MSD should be in double quotes.

5.2.1.4. Examples

Command	Responses
AT+INBMOPEN?	+INBMOPEN:(0,1),<MSD> *OK*
AT+INBMOPEN=0,"MSD" *Note: 0 if mode is pull mode.*	+INBMOPEN: 0 OK +INBMEV: <ev>
AT+INBMOPEN=1,"MSD" *Note: 1 if mode is push mode.*	+INBMOPEN: 1 OK +INBMEV: <ev> OR +INBMERROR: <id> (In case the command fails. <id>, specifies the error cause)
AT+INBMOPEN=0,"2541DE22" *Note: 0 if mode is pull mode.*	+INBMOPEN: 0 OK +INBMEV: <ev>
AT+INBMOPEN=1,"6574FE24DD78" *Note: 1 if mode is push mode.*	+INBMOPEN: 1 OK +INBMEV: <ev> OR +INBMERROR: <id> (In case the command fails. <id>, specifies the error cause)

5.2.2. Command +INBMCLOSE

5.2.2.1. Description

This AT command is used to de-activate/close the In-Band modem channel. Once the channel is de-activated, no MSD transaction would occur.

5.2.2.2. Syntax

Action command

AT+INBMCLOSE

OK

5.2.2.3. Examples

Command	Responses
AT+INBMCLOSE	OK or +INBMERROR: <id> (In case the command fails. <id>, specifies the error cause)

5.2.3. Command +INBMCHSTATE

5.2.3.1. Description

This AT command helps in retrieving the channel state.

5.2.3.2. Syntax

Read command

AT+INBMCHSTATE?

+INBMCHSTATE:<ch_state>
OK

5.2.3.3. Parameters and Defined Values

<ch_state >:		Channel state is defined by this variable. It can have following values.
	0	INBM_CHANNEL_IDLE

	1	INBM_CHANNEL_MSD_REQ_SENDING
	2	INBM_CHANNEL_MSD_SENDING
	3	INBM_CHANNEL_WAITING_HLACK

5.2.3.4. Examples

Command	Responses
AT+INBMCHSTATE?	+INBMCHSTATE: 0 *OK* *OR* *+INBMERROR: <id> (In case the command fails. <id>, specifies the error cause)*

5.3. MSD Control Commands

5.3.1. Command +INBMSETMSD

5.3.1.1. Description

This AT command is used to provide an updated MSD. Collects the MSD and provides the same the Library for further processing. The channel will have to be in IDLE State to issue this command

5.3.1.2. Syntax

Action command

AT+INBMSETMSD=”MSD”

OK

5.3.1.3. Parameters and Defined Values

<MSD >:	This defines the length of Minimum Set of Data sent. • If MSD data is in ASCII format , the maximum data length will be up to 140 bytes. • If MSD data is in Binary format , the maximum data length will be up to 280 digits.

5.3.1.4. Examples

Command	Responses
AT+INBMSETMSD=?	OK or +INBMERROR: <id> (In case the command fails. <id>, specifies the error cause)
AT+INBMSETMSD="015C0681D54970D65C3597CA0420C41464583ADE68AC52E9BB8413F149C07414FB414F6010180813E82181823230"	OK
AT+INBMSETMSD="SIERRA WIRELESS"	OK

5.3.2. Command +INBMPUSH

5.3.2.1. Description

This AT command is used to Command to activate the PUSH mode.

5.3.2.2. Syntax

Action command **AT+INBMPUSH** OK

5.3.2.3. Examples

Command	Responses
AT+INBMPUSH	+INBMOPEN: 1 OK or +INBMERROR: <id> (In case the command fails. <id>, specifies the error cause)

5.3.3. Command +INBMMSDFORMAT

5.3.3.1. Description

This AT command is used to set the MSD format either in Binary or ASCII.

Default value is 0 which indicates MSD format is in Binary.

5.3.3.2. Syntax

Action command

AT+INBMMSDFORMAT=<MSD_format>

OK

Read command

AT+ INBMMSDFORMAT?

+ INBMMSDFORMAT:<MSD_format>
OK

5.3.3.3. Parameters and Defined Values

<MSD_format >:		Format of the MSD string being sent. It can have following values.
	0	Binary format
	1	ASCII format

5.3.3.4. Examples

Command	Responses
AT+INBMMSDFORMAT=?	**+INBMMSDFORMAT: (0-1)** OK or +INBMERROR: <id> (In case the command fails. <id>, specifies the error cause)
AT+INBMMSDFORMAT?	**+INBMMSDFORMAT: 0** OK or **+INBMMSDFORMAT: 1** OK or +INBMMSDFORMAT: <id> (If the command fails. <id>, specifies the error cause)

5.3.4. Command +INBMTIMERCFG

5.3.4.1. Description

This AT command is used to configure the eCall In-Band Modem HLAP timer values.

5.3.4.2. Syntax

Action command: Used to set the timer values. The number of timer values that can be set is minimum of 1 parameter and maximum of 5 parameters.

AT+INBMTIMERCFG =<T2>,<T3>,<T5>,<T6>,<T7>

or

AT+INBMTIMERCFG =<"T2">,<"T3">,<"T5">,<"T6">,<"T7">
OK

(Where <T2>,<T3>,<T5>,<T6>,<T7> are timer values to be set.)

Test command: Used to get the valid range of timer values.

AT+INBMTIMERCFG=?
OK

Read command: Used to present the timer values' settings.

AT+INBMTIMERCFG?

```
+INBMTIMERCFG: T2 timer value, T3 timer value, T5 timer value, T6 timer
value, T7 timer value
OK
```

5.3.4.3. Default Timer Values

The default timer values are CEN values as specified in the table below.

Table 3. Default Timer Values

Timer	Default values (in seconds)
T2	3600
T3	2
T5	5
T6	5
T7	20

5.3.4.4. Valid Ranges of Timer Values

The valid ranges of timer values are specified in the table below.

Table 4. Valid Range of Timer Values

Timer	Minimum (in seconds)	Maximum (in seconds)
T2	1	3600
T3	1	3600
T5	1	3600
T6	1	3600
T7	1	3600

5.3.4.5. Examples

Command – Assuming IVS core is initialized	Description	Responses
AT+INBMTIMERCFG=3600,2,2,5,20	To set all the 5 (Maximum permissible limit is 5) timer values	OK
AT+INBMTIMERCFG=3600,2,2,5	To set few of the timer values	OK
AT+INBMTIMERCFG=3600,2,2,5,	To set few of the timer values	OK (For valid timer values) or +INBMERROR: <id> (For invalid timer value)
AT+INBMTIMERCFG?	This is read command used to give the Information on Timer values set	+INBMTIMERCFG: 3600,2,2,5,20 OK
AT+INBMTIMERCFG=?	This is a test command used to get the valid range of timer values	+INBMTIMERCFG:(1-3600),(1-3600),(1-3600),(1-3600),(1-3600)
AT+INBMTIMERCFG	This is used to test syntax of the command	+INBMERROR: <id> (<id>, specifies the error cause)
AT+INBMTIMERCFG=	This is used to test syntax of the command	ERROR
AT+INBMTIMERCFG=3600,2,2,5,20,8	To set the timer values, exceeding the max permissible limit (5)	ERROR

5.4. CECALL Commands

5.4.1. Command +CECALLINIT

5.4.1.1. Description

This AT command initializes the AT+CECALL functionality. If the SIM is eCall Only as described in [8], it enables spy mode.

5.4.1.2. Syntax

Action command **AT+CECALLINIT** OK

5.4.1.3. Parameters and Defined Values

No parameters

5.4.1.4. Examples

Command	Responses
AT+CECALLINIT	OK or ERROR (if already called)

5.4.2. Command +CECALL

5.4.2.1. Description

This AT command implements the AT command AT+CECALL as described in 3GPP standard document [7].

If the SIM is eCall Only as described in [8], it disables Spy Mode during the call. It will also stay registered on the network for the duration of the T10 timer the call has finished, and then go back to Spy Mode.

5.4.2.2. Syntax

Action command

AT+CECALL=<type_of_eCall>
OK

Test command: Used to get the valid range of <type_of_eCall> values.

AT+CECALL=?
+CECALL: (list of supported <type_of_eCall>s)
OK

Read command: Used to get the current running eCall, if any.

AT+CECALL?
+CECALL: [<type_of_eCall>]
OK

5.4.2.3. Parameters and Defined Values

<type_of_eCall>:		Format of the MSD string being sent. It can have following values.
	0	Test Call. The number must be present on the SIM in accordance to [8]. If the number is not present this command will fail.
	1	Reconfiguration call eCall. The number must be present on the SIM in accordance to [8]. If the number is not present this command will fail.
	2	Manually initated eCall
	3	Automatically initated eCall.

5.4.2.4. Examples

Command	Description	Responses
AT+CECALL=3	Start an automated eCall.	OK
AT+CECALL=0	Start a test call.	OK

5.4.3. Full Examples

Example of using AT+CECALL to initiate an automatic eCall:

AT+CECALLINIT
OK

```
AT+INBMINIT=0
OK

AT+INBMOPEN=1
+INBMOPEN: 1
OK

AT+INBMSETMSD="015C0681D54970D65C3597CA0420C41464583ADE68AC52E9BB8413F149C0
7414FB414F6010180813E82181823230"
OK

AT+CECALL=3
OK
```

Example of using AT+CECALL to initiate a reconfiguration eCall.

Note: The InBand modem should be closed during a reconfiguration call.

```
AT+CECALLINIT
OK

AT+INBMINIT=0
OK

AT+INBMOPEN=1
+INBMOPEN: 1
OK

AT+INBMSETMSD="015C0681D54970D65C3597CA0420C41464583ADE68AC52E9BB8413F149C0
7414FB414F6010180813E82181823230"
OK
...
AT+INBMCLOSE=0
OK

AT+CECALL=3
OK

…
(after call)

AT+INBMOPEN=1
+INBMOPEN: 1
OK
```

6. Asynchronous Events

When the channel is opened, a series of events are generated as the MSD transmission takes place. These events are unsolicited responses which provide information about the progress of the open channel.

The events are associated with the +INBMOPEN AT Command described in this document.

6.1. Syntax

Unsolicited response

```
+INBMEV: <ev> (Unsolicited events to display the progress on the open
channel)
```

6.2. Parameters and Defined Values

<ev>:		The parameter specifies the value returned to display the progress of the open channel.
	0	INBM_MSD_REQ_RECEIVED. It specifies that the MSD request has been received.
	1	INBM_MSD_REQ_NOT_RECEIVED. It specifies that the MSD request has not been received.
	2	INBM_LLACK_RECEIVED
	3	INBM_HLACK_RECEIVED.
	4	INBM_LLACK_NOT_RECEIVED
	5	INBM_HLACK_NOT_RECEIVED
	6	INBM_ABORT_RECEIVED
	7	INBM_HLACK_RECEIVED_CLEARDOWN

7. Example of AT Command Sequence

The following are the AT command sequences for *Pull* mode and *Push* mode.

7.1. Pull Mode

1. AT+INBMINIT =0

   OK

2. Generate a Voice Call to the PSAP server.

3.AT+INBMOPEN=0,”015C0681D54970D65C3597CA0420C41464583ADE68AC52E9BB8413F149C07414FB414F6010180813E82181823230"

   +INBMOPEN: 0

   OK

4. Wait for START messages from the PSAP.

   Monitor the MSD transaction progress through the Call back (unsolicited) events

   +INBMEV: 0

   +INBMEV: 2

   +INBMEV: 3

5. AT+INBMCHSTATE?

   +INBMCHSTATE: 0

   OK

6. AT+INBMSETMSD=”015C0681D54970D65C3597CA0420C41464583ADE68AC52E9BB8413F149C07414FB414F6010180813E82181823230"

[Note: Only If the channel State is IDLE]

   OK

7. AT+INBMPUSH [Send the MSD_SEND_REQ to PSAP server to initiate the MSD transaction]

   +INBMOPEN: 1

   OK

8. AT+INBMCHSTATE?

   +INBMCHSTATE: 1

   OK

9. AT+INBMCLOSE

   OK

10. AT+INBMEXIT

   OK

11. Disconnect the Voice call with PSAP Server.

7.2. Push Mode

1. AT+INBMINIT =0

   OK

2. Generate a Voice Call to the PSAP server.

3.AT+INBMOPEN=1,”015C0681D54970D65C3597CA0420C41464583ADE68AC52E9BB8413F149C07414FB414F6010180813E82181823230"

   +INBMOPEN: 1

   OK

4. MSD_SEND_REQ would be sent to PSAP.

   Wait for START messages from the PSAP. Monitor the MSD transaction progress through the Call back events

   +INBMEV: 0

   +INBMEV: 2

   +INBMEV: 3

5. AT+INBMCHSTATE?

   +INBMCHSTATE: 0

   OK

6. AT+INBMCLOSE

   OK

7. AT+INBMEXIT

   OK

8. Disconnect the Voice call with PSAP Server.

8. In-Band AT Command Error Codes

The following error codes could be returned from In-Band AT commands.

Table 5. Location AT Commands Error Codes

Error Code	Error name	Description
-1	INBM_ERROR	The function has been called in an unauthorized application state
-21	INBM_ERR_INIT/INBM_ERR_EXIT	The requested action has been already performed and the target application state is currently activated.
-22	INBM_ERR_INVOPT	Invalid input parameter.
-23	INBM_ERR_INTERN	This feature or configuration is not available for software and/or hardware version.
-24	INBM_ERR_BAD_STATE	A state transition is in progress.
-25	INBM_ERR_BAD_CHANNEL_STATE	The initialization of the porting layer failed (Internal error)
-26	INBM_ERR_MAX_CHANNEL_ALREADY_OPENED	Application initialization error
-27	INBM_ERR_AUDIO	IO initialization error
-28	INBM_ERR_CHANNEL	Bus initialization error
-29	INBM_ERR_CHANNEL_STILL_OPENED	Scheduler initialization error
-30	INBM_ERR_UNKNOWN_HANDLE	Application core software initialization error
-31	INBM_ERR_SEMAPHORE	Non-Volatile memory initialization error
-32	INBM_ERR_SEMAPHORE_SERVICE_LOCKED	Application task schedule error.
-33	INBM_ERR_TIMER	Timer error

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