IP Easy User Guide for HE863

80000ST10094A Rev.1 – 2011-12-28

Making machines talk.

APPLICABILITY TABLE

PRODUCT
HE863-EUD
HE863-EUG
HE863-EUR
HE863-NAD
HE863-NAG
HE863-NAR
HE863-AUD
HE863-AUG
HE863-AUR

SW Version
11.00.XY2

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Contents

1. Introduction

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To get more details on which commands and relative parameters are available on different SW versions, please consult the AT Commands Reference Guide.

1.1. Scope

Scope of this document is to provide a broad description of the new IP Easy feature functionalities and details.

1.2. Audience

The reader is expected to have gained sound experience in GPRS/UMTS/HSPA technologies as well as in Telit's AT Commands interface.

1.3. Contact Information, Support

For general contact, technical support, to report documentation errors and to order manuals, contact Telit's Technical Support Center (TTSC) at:

TS-EMEA@telit.com
TS-NORTHAMERICA@telit.com
TS-LATINAMERICA@telit.com
TS-APAC@telit.com

Alternatively, use:
http://www.telit.com/en/products/technical-support-center/contact.php
For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:
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Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.
Telit appreciates feedback from the users of our information.

1.4. Document Organization

This document contains the following chapters:

"Chapter 1: "Introduction" provides a scope for this document, target audience, contact and support information, and text conventions.

"Chapter 2: "IP Easy Opearation" is about context setting, activation and data states.

"Chapter 3: "IP Easy Extension" provides a broad description of The IP Easy feature, which allows the Telit module users to contact a device on internet and establish with it a raw data flow over the Internet networks.

"Chapter 4: "Command mode connections" is about the ability for Telit's modules to establish a socket connection in command mode.

"Chapter 5: "List of Acronyms"

"Chapter 6: "Document History contains the history of the present document "

1.5. Text Conventions

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

Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.

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

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

1.6. Related Documents

The following is a list of applicable documents downloadable from the Download Zone section of Telit's website http://www.telit.com

- HE863-Family Software User Guide, 1vv0300893
- HE863-Family AT commands Reference Guide, 80377ST10083a

2. IP Easy Operations

2.1. Preliminary context parameters setting

2.1.1. Context parameter setting

The context parameters consist in a set of information identifying the internet entry point interface provided by the ISP. Using these parameters, the network identifies the ISP to be used to gain access to the internet, and defines the value of the IP address for the GPRS device, once connected.

- Send command

AT+CGDCONT[=[<cid>[,<PDP_type>[,<APN>[,<PDP_addr>[,<d_comp>[,<h_comp>[,<pd1>[,…[,pdN]]]]]]]]]

where:

<cid> - (PDP Context Identifier) numeric parameter which specifies a particular PDP context definition.
Values:
1..max - where the value of max is returned by the Test command

<PDP_type> - (Packet Data Protocol type) a string parameter which specifies the type of packet data protocol
Values:
"IP" - Internet Protocol
"IPV6" - Internet Protocol, Version 6

<APN> - (Access Point Name) a string parameter that represents logical name used to select GGSN or external packet data network. If the value is null or omitted, then the subscription value will be requested.

<PDP_addr> - a string parameter that identifies the terminal in the address space applicable to the PDP. The allocated address may be read using the +CGPADDR command.

<d_comp> - numeric parameter that controls PDP data compression
Values:
0 - off (default if value is omitted)
1 – on
2 – V.42bis

<h_comp> - numeric parameter that controls PDP header compression
Values:
0 - off (default if value is omitted)

1 – on
2 – RFC1144 (applicable for SNDCP only)
3 – RFC2507
4 – RFC3095 (applicable for PDCP only)

<pd1>, …, <pdN> - zero to N string parameters whose meanings are specific to the **<PDP_type>**

NOTE:

A special form of the Set command, **+CGDCONT=<cid>**, causes the values for context number **<cid>** to become undefined.
+CGDCONT command permit define 3 PDP context Ids at the same time.

NOTE:

Issuing "**AT+CGDCONT"** is the same as issuing the Read command.

NOTE:

Issuing "**AT+CGDCONT=" r**eturns the OK result code.

wait for response:

Response	Reason	Action
OK	context parameters have been successfully set	proceed ahead
ERROR	some error occurred	check parameters and retry

For example:

Let's assume you want to set-up the context number 1(cid) with your GPRS connection parameters:

APN: ibox.tim.it
IP address: dynamically assigned by the ISP
Packet Data Protocol type: Internet Protocol (IP)
Data compression: OFF
Header compression: OFF

Command:

AT+CGDCONT= 1,"IP","ibox.tim.it","0.0.0.0",0,0

Response:
OK

2.1.2. Minimum Quality of the Service Requested

The minimum quality of service requested parameters represent the boundary under which the connection quality is not anymore acceptable and will be terminated.

- Send command

AT+CGQMIN=[<cid>[,<precedence>[,<delay>[,<reliability>[,<peak>[,<mean>]]]]]]

where:

<cid> - is the index number of the desired context to be written(see +CGDCONT command).
<precedence> - is the precedence class. It is applied when the network has a heavy duty and user precedence must be followed to ensure operations, the higher the priority the better the service.
Values:
0 - subscribed (default)
1 - high priority
2 - normal priority
3 - low priority

<delay> - is the delay class. It represents the maximum allowable time delay class between the sending and the reception of a packet.

Values:
0 - subscribed (default)
1 - delay class 1
2 - delay class 2
3 - delay class 3
4 - delay class 4 (best effort)

<reliability> - is the connection reliability class. It represents the connection reliability requested, the higher is the number the less reliable is the data exchanged.
Values:
0 - subscribed (default)
1 - reliability class 1 (acknowledged GTP,LLC and RLC; protected data)
2 - reliability class 2 (unacknowledged GTP, acknowledged LLC and RLC; protected data)
3 - reliability class 3 (unacknowledged GTP and LLC, acknowledged RLC; protected data)
4 - reliability class 4 (unacknowledged GTP,LLC and RLC; protected data)
5 - reliability class 5 (unacknowledged GTP,LLC and RLC; unprotected data)

<peak> - is the peak data transfer throughput

Values:
0 – subscribed (default)
1 – up to 1kbps
2 – up to 2kbps
3 – up to 4kbps
4 – up to 8kbps
5 – up to 16kbps
6 – up to 32kpbs
7 – up to 64kpbs
8 – up to 128kbps
9 – up to 256kbps

<mean> - is the mean data transfer throughput
Values:
0 – subscribed (default)
1 – up to 100bps
2 – up to 200bps
3 – up to 500bps
4 – up to 1kbps
5 – up to 2kbps
6 – up to 5kbps
7 – up to 10kbps
8 – up to 20kbps
9 – up to 50kbps
10 – up to 100kbps
11 – up to 200kbps
12 – up to 500kbps
13 – up to 1Mbps
14 – up to 2Mbps
15 – up to 5Mbps
16 – up to 10Mbps
17 – up to 20Mbps
18 – up to 50Mbps
31 – best effort

wait for response:

Response	Reason	Action
OK	context parameters have been successfully set	proceed ahead
ERROR	some error occurred	check parameters and retry.

NOTE:

If your minimum requirements are too high, then it can happen that it is impossible to establish a connection, because the network has not enough resources to guarantee that quality of service. If does this happen, then you shall try reducing your minimum quality requirements.

For example:

Let's assume you want to set-up the GPRS context number 1(cid) written before with your GPRS min QoS parameters:

Precedence class: Normal priority
Delay class: subscribed
Reliability class: subscribed
Peak throughput: not less than 16 kbps
Mean throughput: not less than 1kbps

Command:
AT+CGQMIN= 1,2,0,0,5,4

Response:
OK

NOTE:

Telit suggests to setup AT+CGQMIN=1,0,0,0,0,0

2.1.3. Requested Quality of the Service

The requested quality of service parameters represents the connection quality that is requested to the network on context activation.

- Send command

AT+CGQREQ=[<cid>[,<precedence>[,<delay>[,<reliability>[,<peak>[,<mean>]]]]]]

where:

<cid> - is the index number of the desired context to be written (see +CGDCONT command).

<precedence> - is the precedence class

<delay> - is the delay class

<reliability> - is the connection reliability class

<peak> - is the peak data transfer throughput

<mean> - is the mean data transfer throughput

Parameters assume the same values as in the previous section.

wait for response:

Response	Reason	Action
OK	context parameters have been successfully set	proceed ahead
ERROR	some error occurred	check parameters and retry

For example:

Let's assume you want to set-up the context number 1(cid) written before with your GPRS requested QoS parameters:

Precedence class: High priority
Delay class: subscribed
Reliability class: subscribed
Peak throughput: subscribed
Mean throughput: best effort

Command:
AT+CGQREQ= 1,1,0,0,0,31

Response:
OK

NOTE:

Telit suggests to setup AT+CGQREQ=1,0,0,3,0,0

2.1.4. 3G Minimum Quality of the Service Requested

The 3G minimum quality of service requested parameters represent the boundary under which the 3G connection quality is not anymore acceptable and will be terminated.

- Send command

AT+CGEQMIN=[<cid>[,<traffic class>[,<maximum bitrate UL>[,<maximum bitrate DL>[,<guaranteed bitrate UL>[,<guaranteed bitrate DL>[,<delivery order>[,<maximum SDU size>[,<SDU error ratio>[,<residual bit error ratio>[,<delivery of erroneous SDUs>[,<transfer delay>[,<traffic handling priority>]]]]]]]]]]]]

where:

<cid> - the index number of the desired context to be written (see +**CGDCONT** command).
<traffic class> - a numeric parameter that indicates the type of application for which the UMTS bearer service is optimised.
Values:
0 – conversational
1 – streaming
2 – interactive
3 – background
4 – subscribed value (default)

<maximum bitrate UL> - a numeric parameter that indicates the maximum number of kbits/s delivered to UMTS (up-link traffic) at a SAP. (refer TS 24.008 [8] subclause 10.5.6.5).
Values:
0 – subscribed value (default)
1~63 – in 1 kbps steps
64~568 – in 8 kbps steps
576~8640 – in 64 kbps steps

<maximum bitrate DL> - a numeric parameter that indicates the maximum number of kbits/s delivered by UMTS (down-link traffic) at a SAP. (refer TS 24.008 [8] subclause 10.5.6.5).
Values:
0 – subscribed value (default)
1~63 – in 1 kbps steps
64~568 – in 8 kbps steps
576~8640 – in 64 kbps steps
8700~16000 – in 100 kbps steps

<guaranteed bitrate UL> - a numeric parameter that indicates the guaranteed number of kbits/s delivered by UMTS (up-link traffic) at a SAP(provided that there is data to deliver). (Refer TS 24.008 [8] subclause 10.5.6.5).
Values:
0 – subscribed value (default)
1~63 – in 1 kbps steps
64~568 – in 8 kbps steps
576~8640 – in 64 kbps steps

<guaranteed bitrate DL> - a numeric parameter that indicates the guaranteed number of kbits/s delivered by UMTS (down-link traffic) at a SAP (provided that there is data to deliver). (Refer TS 24.008 [8] subclause 10.5.6.5).
Values:
0 – subscribed value (default)
1~63 – in 1 kbps steps
64~568 – in 8 kbps steps
576~8640 – in 64 kbps steps
8700~16000 – in 100 kbps steps

<delivery order> - a numeric parameter that indicates whether the UMTS bearer shall provide in-sequence SDU deliver or not.
Values:
0 – no
1 – yes
2 – subscribed value (default)

<maximum SDU size> - a numeric parameter(1,2,3,…) that indicates the maximum allowed SDU size in octets(refer TS 24.008 [8] subclause 10.5.6.5).
Values:
0 – subscribed value (default)
10~1500
1502
1510
1520

<SDU error ratio> - a string parameter that indicates the target value for the fraction of SDUs lost or detected as erroneous. SDU error ratio is defined only for conforming traffic. The value is specified as 'mEe'. (refer TS 24.008 [8] subclause 10.5.6.5).
Values:
"0E0" (default)
"1E1"
"1E2"
"7E3"
"1E3"
"1E4"
"1E5"
"1E6"

<residual bit error ratio> - a string parameter that indicates the target value for the undetected bit error ratio in the delivered SDUs. If no error detection is requested, Residual bit error ratio indicates the bit error ratio in the delivered SDUs. The value is specified as 'mEe'. (e.g. AT+CGEQMIN=…,"1E2",…)(refer TS 24.008 [8] subclause 10.5.6.5).
Values:
"0E0" (default)
"5E2"
"1E2"
"5E3"
"4E3"
"1E3"
"1E4"
"1E5"
"1E6"
"6E8"

<delivery of erroneous SDUs> - a numeric parameter that indicates whether SDUs detected as erroneous shall be delivered or not.
Values:

0 - no
1 – yes
2 – no detect
3 – subscribed value (default)

<transfer delay> - a numeric parameter (0,1,2,…) that indicates the targeted time between request to transfer an SDU at on SAP to its delivery at the other SAP, in milliseconds (refer TS 24.008 [8] subclause 10.5.6.5).

Values:

0 – subscribed value (default)
10~150 – in 10ms steps
200~950 – in 50ms steps
1000~4000 – in 50ms steps

<traffic handling priority> - a numeric parameter(1,2,3,…) that specifies the relative importance for handling of all SDUs belonging to the UMTS bearer compared to the SUDs of other bearers (refer TS 24.008 [8] subclause 10.5.6.5).

Values:

0 – subscribed value
1…3

wait for response:

Response	Reason	Action
OK	context parameters have been successfully set	proceed ahead
ERROR	some error occurred	check parameters and retry.

NOTE:

If your minimum requirements are too high, then it can happen that it is impossible to establish a PDP activation, because the network has not enough resources to guarantee that quality of service. If does this happen, then you shall try reducing your minimum quality requirements.

NOTE:

Telit suggests to setup AT+CGEQMIN=1,4,0,0,0,0,2,0,”0E0”,”0E0”,3,0,0 (default setting value)

2.1.5. 3G Requested Quality of the Service

The 3G requested qualities of service parameters represent the connection quality that is requested to the UMTS network on PDP context activation.

- Send command

AT+CGEQREQ=[<cid>[,<traffic class>[,<maximum bitrate UL>[,<maximum bitrate DL>[,<guaranteed bitrate UL>[,<guaranteed bitrate DL>[,<delivery order>[,<maximum SDU size>[,<SDU error ratio>[,<residual bit error ratio>[,<delivery of erroneous SDUs>[,<transfer delay>[,<traffic handling priority>]]]]]]]]]]]]]

where:

<cid> - is the index number of the desired context to be written (see +**CGDCONT** command).
<traffic class>
<maximum bitrate UL>
<maximum bitrate DL>
<guaranteed bitrate UL>
<guaranteed bitrate DL>
<delivery order>
<maximum SDU size>
<SDU error ratio>
<residual bit error ratio>
<delivery of erroneous SDUs>
<transfer delay>
<traffic handling priority>

Parameters assume the same values as in the previous section.

wait for response:

Response	Reason	Action
OK	context parameters have been successfully set	proceed ahead
ERROR	some error occurred	check parameters and retry

NOTE:

Telit suggests to setup AT+CGEQREQ=1,4,0,0,0,0,2,0,”0E0”,”0E0”,3,0,0(default setting value)

2.2. Context activation and data state entering

This operation corresponds to the dial and connect of a CSD GSM data call issued to an internet service provider.

- Send command

ATD*99*<cid>#**

where:

<cid> - is the index number of the desired context to be used (see **+CGDCONT** command).

wait for response:

Response	Reason	Action
CONNECT	connection is being processed	proceed ahead with the authentication & Packed data protocol
ERROR	some error occurred	check context parameters and retry.
+CME ERROR: <error code>	some error occurred	check context parameters and retry. check also Network registration status.

For example:

1- Let's assume you want to activate and enter the data state with context number 1(cid) written before with your requested QoS parameters:

Command:
ATD*99***1#

Response:
CONNECT

At this point, your application should start the PPP protocol with the LCP Exchange phase:

➔ LCP Configure Request
➔ LCP Configure Acknowledge

➔ PAP Authentication
➔ PAP-Ack

➔ NCP (IP) Configure Request
➔ NCP (IP) Configure Acknowledge

At this point the TCP/IP - PPP protocol stack is up and data packets can be exchanged.

NOTE:

Explanation of TCP/IP and PPP protocol stack is beyond the scope of this document. Further information on the LCP protocol and PPP protocol definition can be found in the RFC1661. Further information on the PAP protocol definition can be found in the RFC1334. Further information on the IPCP protocol definition can be found in the RFC1332.

NOTE:

The CONNECT result code is raised before complete connection establishment.

2.3. Data state exit

➔ LCP Terminate Request
➔ LCP Terminate Acknowledge

Wait for **NO CARRIER** response.

or in alternative:

- Send escape sequence:

+++

Wait for 2s (default silence time)

wait for response:

Response	Reason	Action
OK	Telit module is in command mode now	proceed ahead
ERROR	some error occurred	check command syntax and timing and retry
NO CARRIER	connection has been closed	proceed ahead

- Send command

ATH

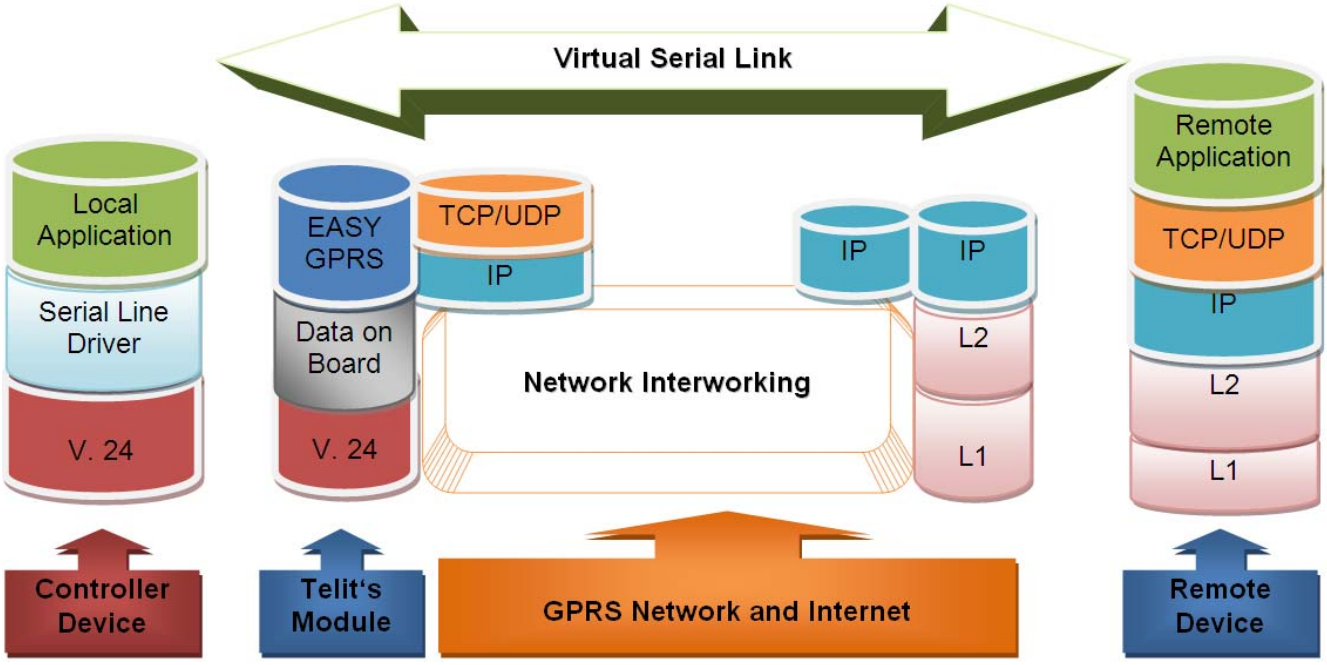
wait for response:

Response	Reason	Action
OK	connection has been closed	
ERROR	some error occurred	check command syntax and retry

3. IP Easy Extension

3.1. Overview

The IP Easy feature allows the **Telit module** users to contact a device on internet and establish with it a raw data flow over the GPRS/UMTS/HSPA and Internet networks.
This feature can be seen as a way to obtain a "virtual" serial connection between the Application Software on the Internet machine involved and the controller of the **Telit module**, regardless of all the software stacks underlying.
An example of the protocol stack involved in the devices is reported:

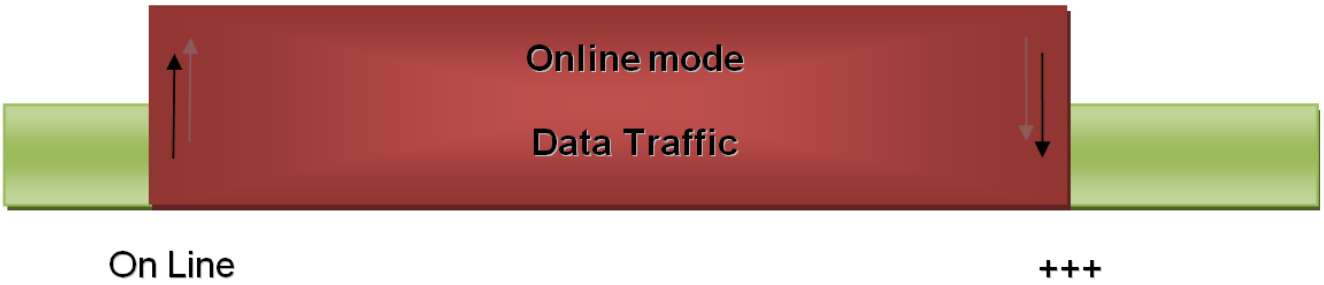


This specific implementation allows the devices to interface to the **Telit module** via GPRS/UMTS/HSPA and Internet packets without the need of an internal TCP/IP stack since this function is already embedded inside the module.

As a new functionality of Telit modules, multisocket is an extension of the Telit IP Easy feature, which allows the user to have two activated contexts (this means two different IP address), more than one socket connection -- with a maximum of 6 connections -- and simultaneous FTP client and client services.

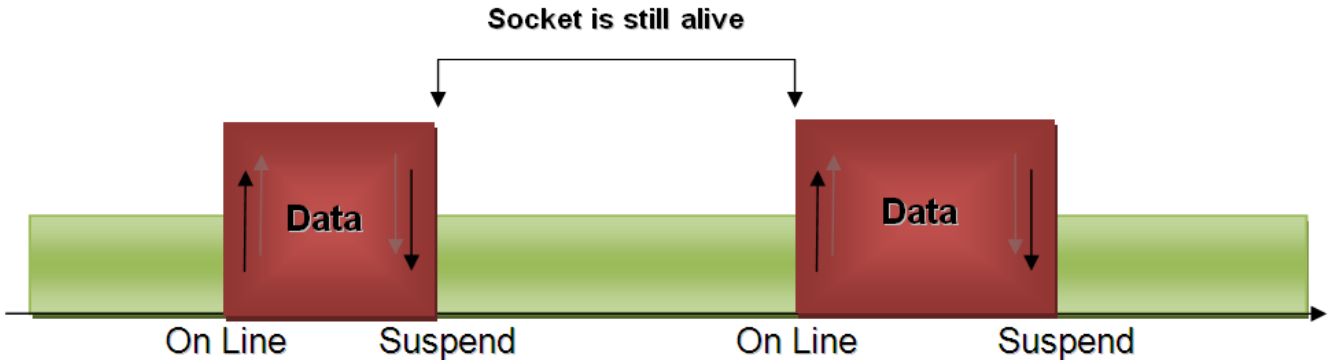
The basic idea behind multisocket is the possibility of suspend a socket connection with the escape sequence +++.

With the #SKTD command it is possible to open a socket connection and get online. When the online activities are concluded, the +++ sequence is used to close the connection (see the figure below).



The green part represents the module command mode while the red part is the online mode.

Now, the online mode can be suspended with the escape sequence +++ by using the multisocket feature. During suspend mode the data received by the socket will be buffered, which data will be displayed after socket resumption, as shown in the figure below:



This new feature allows users to switch between online mode and command mode without closing the connection or even opening another socket (or resuming the suspended one), FTP connection.

Another new feature is the possibility to associate any socket connection to a specific context. This means that we can use different IP addresses for connections (max 2). The Socket Identifier is called Connection Id -- selects which socket we want to use from 1 up to 6 -- and every Connection Id is associated to a context.

3.2. Commands Overview

What follows are new AT command sequences that activate context, sets and opens the socket connection. There will be explained a new listen command and how to use FTP and Easy GPRS at the same time.

NOTE:

For more detailed AT commands and parameters definitions please consult the AT Commands Reference Guide.

3.2.1. IP Easy Outgoing Connection

The IP Easy feature provides a way to place outgoing TCP/UDP connections and keep the same IP address after a connection is made, leaving the context active.
The steps required to open a socket and close it without closing the GPRS context are:

- configuring the GPRS/UMTS/HSPA Access
- configuring the embedded TCP/IP stack behavior
- defining the Internet Peer to be contacted
- request the context to be activated
- request the socket connection to be opened
- exchange data
- close the TCP connection while keeping the context active

All these steps are achieved through AT commands. As far as the common modem interface, two logical statuses are involved: command mode and data traffic mode.

- In Command Mode (CM), some AT commands are provided to configure the Data Module Internet stack and to start up the data traffic.
- In data traffic mode (Socket Mode, SKTM), the client can send/receive a raw data stream which will be encapsulated in the previously configured TCP/IP packets which will be sent to the other side of the network and vice versa. Control plane of ongoing socket connection is deployed internally to the module.

3.2.1.1. Configuring the GPRS/UMTS/HSPA access

The access configuration is done by setting:

- the context number 1 parameters (see +CGDCONT command)
- the Authentication parameters: User Name and Password (see command #SGACT)

3.2.1.2. Configuring the embedded TCP/IP stack

The TCP/IP stack behavior must be configured by setting:

- the packet default size
- the data sending timeout
- the socket inactivity timeout

Before opening a connection we have to set the socket parameters with the new #SCFG command. It is possible to set all the timeout values and packet size for each socket connection with a single AT command. The command syntax is:

AT#SCFG = <connId>, <cid>, <pktSz>, <maxTo>, <connTo>, <txTo>

where:

- **connId** is the connection identifier
- **cid** is the context identifier
- **pktSz** is the minimum data packet sent to the net (default 300 bytes)
- **maxTo** is inactivity timeout (default 90 sec.)
- **connTo** is the connection timeout (default 600, expressed in hundreds of miliseconds)
- **txTo** is the data sending timeout (default 50, expressed in hundreds of miliseconds)

The first two parameters are new and they represent the association between the socket connection and the context set with +CGDCONT. It means that we can have socket connection working on different IP addresses.
The other parameters replace the old IP Easy commands #DSTO, #SKTTO, #SKTCT and #PKTSZ.

If we try to modify the socket configuration of an online connection, an error will appear. So it's recommended to set the socket configuration at the beginning. It is strongly recommended to leave the first Connection Id associated to context one to allow simultaneous FTP, SMTP and IP Easy services.
The values set with this command are saved in NVM.

Example:

We want to associate the Connection Id number 2 to the context number 3 with a minimum packet size of 512 bytes, max inactivity timeout of 30 sec, connection timeout of 30 sec and transmission timeout of 10 sec.

Command:
AT#SCFG = 2, 3, 512, 30, 300,100

Response:
OK if command execution is correct
ERROR if a parameter is wrong or the connection Id is working online

3.2.1.3. Request the context to be activated

This command allows activation of one of the contexts defined with AT command +CGDCONT. With multisocket it is possible to activate simultaneously two contexts of the five that have been set. We can write username and password directly from command line (if required). At least one Connection Id must be associated to the context we want to activate; otherwise an error will be appear.

The command syntax is:

AT#SGACT= <cid>,<stat>, [<userId>],[<pwd>]

where:

- **cid** is the context that we want to activate/deactivate.
- **stat** is the context status (0 means deactivation, 1 activation).

Example:

We want to activate context number two defined with +CGDCONT.

Command:
AT#SGACT = 2,1

Response:
#SGACT: “212.195.45.65”
OK if activation success.

ERROR if activation fails.

The response code to the AT#SGACT=1 command reports the IP address obtained from the network, allowing the user to report it to his server or application.
Deactivating the context implies freeing the network resources previously allocated to the device.

NOTE:

Also the command AT+CGACT activates a context, but in this case the context cannot be used for IP Easy.

3.2.1.4. Open the connection with the internet host

With the AT command #SD (socket Dial) the TCP/UDP request to connect with the internet host starts:

- DNS query is done to resolve the IP address of the host name internet peer if required
- Telit module establishes a TCP/UDP (depending on the parameter request) connection with the given internet host
- Once the connection is up the module reports the code: CONNECT

The command syntax is:

AT#SD = <connId>,<txProt>, <rPort>, <IPaddr> [, <closureType> [, <lPort>[,<connMode>]]]

where:

- **connId** is the connection identifier.
- **txProt** is 0 for TCP and 1 for UDP.
- **rPort** is the port of the remote machine.
- **IPaddr** is the remote address.

To open the remote connection the context to which the Connection Id is associated must be active, otherwise an error will appear.

For example, if we want to connect to a web server with Connection Id number 3 the command is:

AT#SD = 3 , 0 , 80 , “www.telit.com”

If the command is successful we’ll have a CONNECT message, and the socket number 3 will be connected to the Telit webserver.
From this moment the data incoming in the serial port is packet and sent to the Internet host, while the data received from the host is serialised and flushed to the Terminal Equipment.
The +++ sequence does not close the socket, but only suspends it.

NOTE:

Check guard time/S12 parameter before and after escape sequence.

We can suspend the connection and open another one with a different Connection Id.

A typical command sequence is:

AT#SD = 3 , 0 , 80 , “www.telit.com”
CONNECT
(send, receive data….)

(+++)
OK

OK is returned after the escape sequence, it means that the socket has been suspended correctly.
Now the connection number 3 is suspended and the module is in command mode so we can give another #SD command.

AT#SD = 2 , 0 , 80 , “www.google.com”
CONNECT
(send, receive data….)

(+++)
OK
If we try to open a connection while the connId is in suspended state or online an error will be occur.

If a suspended connection receives some data the user will receive an unsolicited SRING indication from the module. In case we receive some data from the suspended connection with Telit server we'll receive this unsolicited message:

SRING: 3

where 3 is the number of the connId with data pending.

NOTE:

The unsolicited SRING indication appears only in command mode.

3.2.1.5. Resuming a suspended connection with #SO

This is the new command to resume a suspended connection, the command syntax is:

AT#SO = <connId>

Example:

AT#SD = 2 , 0 , 80 , "www.google.com"
CONNECT
data sending

(+++)

OK

SRING: 2
AT#SO = 2
CONNECT
data sending

(+++)

In case there is data pending on this socket -- you can know this the unsolicited message SRING has appeared before--, issuing command AT#SO these pending data will be displayed after the CONNECT string.

It is possible to resume a suspended socket without waiting for SRING message or data pending on that connection.

Using AT#SO on a Connection Id in idle state (no socket open or suspended) we obtain a NO CARRIER message.

3.2.1.6. Close the Socket without deactivating the context

The connection can be closed for the following reasons:

- remote host TCP connection close
- socket inactivity timeout
- Terminal Equipment by issuing the escape sequence "+++" and AT#SH that specifies the Connection Id
- Network deactivation

With the new management of the escape sequence we need a command to close the socket connection. The AT command syntax to use is:

AT#SH = <connId>

Example:

AT#SD = 2 , 0 , 80 , “www.google.com”
CONNECT
data sending

(+++)

OK

AT#SH = 2
OK

Now the connection is closed. If we send this command with an idle Connection Id we obtain in any case an OK message.

NOTE:

If there is an escape sequence in the raw data to be sent, then the TE must work it out and sent it in a different fashion to guarantee that the connection is not closed.
The pause time is defined in the parameter S12. To avoid sending of the escape sequence a command AT#SKIPESC should be set at the beginning.

3.2.1.7. Specific settings for TCP/IP options

If needed, it's possible to have direct control on particular TCP/IP settings:

- Maximum TCP/IP payload size accepted in one single TCP/IP datagram.

The command syntax is:

AT#TCPMAXDAT=<size>

where:

- **size** is the maximum TCP payload size accepted in one single TCP/IP datagram; it is sent in TCP header options in SYN packet.
  0 - the maximum TCP payload size is automatically handled by module(default).
  1496..1420 - maximum TCP payload size

Example:

AT#TCPMAXDAT=1000 – maximum TCP payload size accepted from peer set to 1000 bytes

Then, if we open a TCP socket connection we will advise the peer that we will not accept TCP/IP datagrams with a payload bigger than 1000 bytes.

NOTE:

It is also possible to use new feature in command mode
(Please refer to AT Commands Reference Guide).

3.2.2. IP Easy Incoming Connection

The IP Easy feature provides a way to accept incoming TCP/UDP connections and keep the same IP address after a connection, leaving the context active.
The steps that will be required to open a socket in listen, waiting for connection requests from remote hosts and accept these request connections only from a selected set of hosts, then close it without closing the context are:

- configuring the GPRS/UMTS/HSPA Access
- configuring the embedded TCP/IP stack behavior (see par. 3.2.1.2)
- defining the Internet Peer that can contact this device (firewall settings) (see par.3.2.2.1)
- request the context to be activated (see par.3.2.1.3)
- request the socket connection to be opened in listen (see par. 3.2.2.2)
- receive connection requests (see par.3.2.2.3)
- exchange data
- close the TCP connection while keeping the context active (see par.3.2.1.6)

All these steps are achieved through AT commands. As for common modem interface, two logical statuses are involved: command mode and data traffic mode.

- In Command Mode (CM), some AT commands are provided to configure the Data Module Internet stack and to start up the data traffic.
- In data traffic mode (Socket Mode, SKTM), the client can send/receive a raw data stream which will be encapsulated in the previously configured TCP / IP packets which will be sent to the other side of the network and vice versa. Control plane of ongoing socket connection is deployed internally to the module.

3.2.2.1. Defining the Internet Peer that can contact this device (firewall settings)

The Telit module has an internal Firewall that controls the behavior of the incoming connections to the module. The firewall applies for INCOMING (listening) connections; OUTGOING connections will be always done regardless of the firewall settings.

Firewall General policy is DROP, therefore all packets that are not included into an ACCEPT chain rule will be silently discarded.

When packet incomes from the IP address <incoming IP>, the firewall chain rules will be scanned for matching with the following criteria:

<incoming IP> & <net mask> = <IP_address>

If the result is yes, then the packet is accepted and the rule scan is finished, otherwise the next chain is taken into account until the end of the rules when the packet is silently dropped if no matching was found.

For example, let's assume we want to accept connections only from our devices which are on the IP addresses ranging from 197.158.1.1 to 197.158.255.255

We need to add the following chain to the firewall:
AT#FRWL=1,"197.158.1.1","255.255.0.0"

3.2.2.2. Request the socket connection to be opened in listen

The new listen command is now extended to 6 connections; it's possible to set from 1 to 6 sockets listening on a specific port for the incoming connections. Another difference with the old IP Easy is that now we receive an unsolicited indication when someone tries to connect, so we can decide to accept **(AT#SA)** or refuse **(AT#SH)** the incoming connection.

NOTE:

In case you decide to reject an incoming connection request the listening socket will be closed and if you want to re-open it the AT command AT#SL needs to be re-issued.

The command syntax is:

AT#SL = <connId>, <listenState>, <listenPort>[, <lingerT>]

It's not possible to have two connId listening on the same port.

Example:

Suppose that we want to listen on port 6543 Connection Id number 2

AT#SL = 2, 1, 6543
OK

Now the module is listening for incoming connection on port 6543 with Connection Id number 2, if a remote host is trying to connect we'll receive a SRING unsolicited indication with the listening Connection Id:

SRING: 2

3.2.2.3. Accept an incoming connection with #SA

After receiving the SRING indication for an incoming connection we can decide to refuse the remote host connection with #SH command or accept the connection with #SA command.

The command syntax is:

AT#SA = <connId>

Example:

We are listening on Connection Id 3 and port 6543

AT#SL = 3, 1, 6543
OK

A remote host is trying to connect, we receive the unsolicited indication.

SRING: 3

Now we accept the connection

AT#SA = 3
CONNECT

We pass in online mode and the connection is established. With the escape sequence we suspend the socket and the module is back to command mode. To resume the suspended connection we can use the #SO command described above.

In this case no unsolicited indication is received, but the connection is automatically accepted: the CONNECT indication is given and the modem goes into online data mode5.

It's also possible to open a socket listening for an incoming UDP connection on a specified port. The command syntax is:

AT#SLUDP=<connId>, <listenState>, <listenPort>

Also in this case it's possible to receive SRING unsolicited and decide to accept (AT#SA) or refuse (AT#SH).

3.2.2.4. Checking the socket status with #SS

With the old IP Easy socket connection the possible states were: online state or closed, while with multi-socket suspension we have other socket states. With the new command AT#SS we can see the status of all the six sockets.

The command syntax is:

AT#SS[=<connId>]

Suppose that we have suspended some sockets and we are in command mode, in order to verify which Connection Id has been opened, we can use AT#SS command to have a snapshot of sockets status.

The command result is:

#SS: <ConnId>,<Status>,<Local IP>,<Local Port>,<Remote IP>,<Remote Port>

For every Connection Id with have the information about our local IP address, local port, remote IP and port if we are connected.
The Status field represents the socket status:

0 – Socket Closed.
1 – Socket with an active data transfer connection.
2 – Socket suspended.
3 – Socket suspended with pending data.
4 – Socket listening.
5 – Socket with an incoming connection. Waiting for the user accept or shutdown command.

Example:

AT#SS
#SS: 1,4,217.201.131.110,21
#SS: 2,2,217.201.131.110,1033,194.185.15.73,10510
#SS: 3,3,217.201.131.110,1034,194.185.15.73,10510
#SS: 4,1,217.201.131.110,1035,194.185.15.73,10510

#SS: 5,0
#SS: 6,0

OK

In this case we can see Connection Id 1 in listen mode on port 21, number 2 suspended with no data pending, number 3 suspended with pending data and number 1 is online. The last two connections are closed

By issuing AT#SS=<connId> it's possible to get status only of the corresponding socket.

3.2.2.5. Using FTP and IP Easy together

Another new functionality of multi-socket is the simultaneous FTP client service with socket connections. We can use socket suspension mode to give FTP commands as in the old IP Easy, keeping socket alive and eventually resuming socket connections when we need to.

NOTE:

It is recommended to leave Connection Id 1 associated to context 1 for using this functionality. (For more explanation see also paragraph 3.2.1.2)

3.2.2.6. Using CMUX and Multi-socket

Using CMUX we can have up to three virtual port to execute normal AT commands; if we join CMUX with multi-socket we can share the six connections on the three ports (six is the total number in any case) and we can have up to three sockets active (online) at the same time.

FTP with CMUX is locked on the opening port. So if we try to open an FTP client connection on another virtual port the FTP commands will show an error message until the first connection with FTP server is not closed. When the connection is closed we can open another FTP session on another virtual port. In any case we can always have only one FTP session opened at the time.

3.2.2.7. Using old interface command on Multi-socket

The old commands like #SKTD or #SKTL are available also on multi-socket platform and they work like in the old IP Easy platform. If we open a connection with #SKTD we can't suspend the connection, and the +++ sequence will close definitively the connection.
In particular with #SKTD command we have the possibility to open three simultaneous connections using CMUX virtual ports. They are closed using the +++ sequence.

NOTE:

#SKTOP has some limitations. It is available only on the first virtual port of CMUX and it is recommended not to use it with the new multi-socket commands because #SKTOP deactivates the context when the connection is closed. This can generate the closure of suspended sockets. It's strongly recommended in any case to avoid using old IP Easy command with new multi-socket commands.

3.2.2.8. Dial Up with Multisocket

With multi-socket we recommend you to use the first context for a dialup connection and use the other available context for IP Easy socket connection.
The first context must be deactivated to make dialup connection work correctly, if we activate IP Easy and dialup at the same time the performance get worse. It is possible to make web browsing and IP Easy socket connection at the same time.

3.2.3. Known limitations

The implementation of the IP EASY feature has the following known limitations:

- #SKTOP is available only on the first virtual port of CMUX
- PPP and IP Easy functionalities not on the same IP address (PPP uses always the first context Id)
- Multi listen only on different IP ports
- It's not allows to use two Data Traffic mode on CMUX or multiple channels at the same time.

3.3. FTP OPERATIONS

A set of AT commands is available to support the FTP activities. The first command is called #FTPTO (FTP Time-Out) which defines the time-out for FTP operations. The module has already a factory default time defined that is 10 s.

If it is needed to be modified, the syntax is:

AT#FTPTO[=<tout>]

Parameter:
<tout> - time-out in 100 ms units
Values:
100..5000 - hundreds of ms (factory default is 100)

NOTE:

The parameter is not saved in NVM.

NOTE:

if parameter <tout> is omitted the behavior of Set command is the same as Read command.

Example:
AT#FTPTO=1000 (set the timeout to 100sec)
OK

3.3.1. Opening and Closing an FTP Connection

With the command **AT#FTPOPEN=[<server:port>,<username>,<password>,<mode>]** is possible to open the FTP connection.

The parameters are:
<server:port> - string type, address and port of FTP server (factory default port 21).
<username> - string type, authentication user identification string for FTP.
<password> - string type, authentication password for FTP.
<mode>
Values :
0 - active mode (default)
1 - passive mode

In order to close the FTP connection the AT command AT#FTPCLOSE should be used.

3.3.2. Setting the FTP Transfer Type

With the command **AT#FTPTYPE=[<type>]** is possible to configure the file transfer type. The command must be provided during an FTP connection.

Parameter:
<type> - file transfer type:
Values:
0 - binary
1 - ASCII

NOTE:

The command causes an ERROR result code to be returned if no FTP connection has been opened yet.

NOTE:

If the parameter is omitted then the behavior of Set command is the same of Read command.

3.3.3. FTP File transfer to the server

With the command **AT#FTPPUT=[<filename>] ,** to issued during an FTP connection, is possible to open a data connection and starts sending **<filename>** file to the FTP server.

If the data connection succeeds, a **CONNECT** indication is sent, otherwise a **NO CARRIER** indication is sent.

Parameter:
<filename> - string type, name under which you choose to save the file on the server (must have the right extension: es. if the file you're sending is .txt then the **<filename>** can be test.txt)

NOTE:

Use the escape sequence +++ to close the data connection.

NOTE:

Check the guard time/S12 parameter before and after escape sequence.

NOTE:

The command causes an ERROR result code to be returned if no FTP connection has been opened yet.

Example:

Define PDP context:
AT+CGDCONT=1,"IP", "internet.wind.biz"
OK

Context Activation, as response gives IP of the module:
AT#SGACT=1,1
#SGACT: 193.199.234.255
OK

Opening of FTP connection:
AT#FTPTO=1000 (FTP settings of time-out)
OK

AT#FTPOPEN=”199.188.25.77”,”user”,”pass”,0
OK
In this case port of FTP server is not specified, which means that it has the default value: 21

AT#FTPTYPE=0 (FTP settings of file type)
OK

FTP file transfer to the server in the file named “file.txt”:
AT#FTPPUT="file.txt"
CONNECT
(send the file)

+++ (escape sequence +++ to close the data connection)
NO CARRIER

AT#FTPCLOSE (closing FTP connection)
OK

Deactivation of context if required:
AT#SGACT=1,0
OK

3.3.4. FTP File download from the server

The command **AT#FTPGET=[<filename>] ,** issued during an FTP connection, opens a data connection and starts getting a file **<filename>** from the FTP server.

If the data connection succeeds, a **CONNECT** indication is sent, otherwise a **NO CARRIER** indication is sent. The file is received on the serial port.

Parameter:
<filename> - file name, string type.

NOTE:

The command causes an ERROR result code to be returned if no FTP connection has been opened yet.

Example:

Define PDP context:
AT+CGDCONT=1,”IP”, "internet.wind.biz"
OK

Context Activation, as response it gives the IP of the module:
AT#SGACT=1,1

#SGACT: 193.199.234.255
OK

Open the FTP connection:
AT#FTPTO=1000 (FTP settings of time-out)
OK

AT#FTPOPEN=”199.188.25.77”,”user”,”pass”,0
OK

In this case the port of FTP server is not specified, which means that it has the default value of 21

AT#FTPTYPE=0 (FTP settings of file type)
OK

AT#FTPCWD="incoming" (change working directory if required)
OK

In order to get the list of files on the working directory from the server AT command AT#FTPLIST should be used.

Download the FTP file “file.txt” from the server:

AT#FTPGET="file.txt"
CONNECT

(receive the file)

Data connection will be closed automatically when the file sending is terminated:

NO CARRIER

AT#FTPCLOSE (closing FTP connection)
OK

Deactivation of context if required:
AT#SGACT=0
OK

TIP:

The #SGACT command activates the context and it is necessary to start the FTP connection.

3.4. AT Commands Compatibility Table

Telit advises all clients that start a new application development with SW version 7.02.03 or higher to use these new IP Easy AT commands. Below you can find compatibility table for old and new commands:

IP Easy old AT commands	IP Easy new AT commands	Operation description
AT#SKTOP	**AT#SGACT; AT#SD**	socket open
AT#SKTD	**AT#SD**	socket dial
AT#SKTL	**AT#SL**	socket listen
AT#SKTSET	**not required**	
AT#SKTSAV	**not required**	
AT#GPRS	**AT#SGACT**	activation of context
+++ after AT#SKTD	**+++; AT#SH**	socket close
+++ after AT#SKTOP	**+++; AT#SH; AT#SGACT**	
AT#USERID	**AT#SGACT**	authentication
AT#PASSWD	**AT#SGACT**	
AT#PKTSZ	**AT#SCFG**	socket configuration
AT#DSTO	**AT#SCFG**	
AT#SKTTO	**AT#SCFG**	
AT#SKTCT	**AT#SCFG**	

It is strongly recommended not to mix the new commands with the old ones.

3.5. Examples

3.5.1. IP Easy- HTTP client application

Let's suppose we want to connect our embedded device to an HTTP server and retrieve an HTML page using the IP EASY feature.

Initial data:

Server to be contacted	www.telit.com
Application Layer Protocol	HTTP1.0 (RFC1945); HTTP1.1 (RFC2068)
Page to be retrieved	homepage of server
Preliminary settings	
APN	internet
IP of device	dynamically assigned by the network
DNS	assigned by the network
USERID	IPEASY
PASSWORD	IPEASY
Socket parameters	
Connection Identifier	1

Packet size (used by TCP/UDP/IP stack for data sending)	300
Socket inactivity timeout	90
Connection timeout	600
Data sending time out	50

Checking on the RFC990 the HTTP service we can found that the port 80 is dedicated for HTTP service, therefore our HTTP server will be waiting for incoming connections on that port and we will fix the IP EASY port to be contacted on the remote server exactly to 80.
Second thing we have to discover is whether the transport protocol has to be TCP or UDP; on the RFC1945 we can read that the HTTP Application layer protocol is meant to be on top of TCP/IP protocol, therefore the transport protocol choice will fall on TCP.
Now we have all the information needed to configure our system.

With our microcontroller we issue to the Telit module the following AT commands:
AT+CGDCONT = 1,"IP","internet","0.0.0.0",0,0 (GPRS context setting)

For all the socket settings the following AT command will be used:

AT#SCFG=1,1,300,90,600,50
OK

Next step is activation of the context:
AT#SGACT=1,1,“EASY GPRS“,“EASY GPRS“
#SGACT: 193.199.234.255
OK

This command replies with the IP address assigned by the network.

Now we can proceed with contacting the server with AT command for socket dial:
AT#SD=1,0,80,”www.telit.com”,0,0

When we receive the CONNECT indication, then we are exchanging data with the HTTP server program on the remote host machine.

Now following the HTTP protocol we ask for the homepage by sending the following lines on the serial line:
GET / HTTP/1.1<cr><lf>
Host: www.telit.com<cr><lf>
Connection: keep-alive<cr><lf>
<cr><lf>

TIP:

Remember that the strings, which are sent to the HTTP server, have to be ended by line feed character. To see the issued commands enable the local echo.

As a response to our query the HTTP server will reply with the HTML code of the homepage and some debugging responses that we will see directly on the serial line:

HTTP/1.1 200 OK
Date: Thu, 06 2003 10:21:58 GMT
Server: Apache/1.3.27 (Unix)
Last-Modified: Thu, 06 2003 10:21:58 GMT
Content-Type: text/html
Connection: close

<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 3.2 FINAL//EN">
<HTML>
… here is all the HTML code of the page..
</HTML>

<pause>+++<pause>
OK
AT#SH=1
OK

The Telit module is now back to command mode and the socket is closed.

3.5.2. IP Easy - EMAIL sending application

Let’s suppose we want to send with our embedded device an EMAIL by using a SMTP server.

Initial data:

Server to be contacted	smtp.domain.com
SMTP service	port #25
Application Layer Protocol	SMTP (RFC821)
Sender	"module"<module@domain.com>
Receiver	"Receiver"<receiver@server.net>
Subject	Email Test
Message body	This message is sent in order to test IP Easy feature. Hello World!
Preliminary settings	
APN	internet
IP of device	dynamically assigned by the network
DNS	assigned by the network
USERID	IPEASY

PASSWORD	IPEASY
SMTP settings	
SMTP server address	smtp.domain.com
Email account	
USERID	module@domain.com
PASSWORD	telit
Socket parameters	
Connection Identifier	1
Packet size (used by TCP/UDP/IP stack for data sending)	300
Socket inactivity timeout	90
Connection timeout	600
Data sending time out	50

Checking on the RFC990 the SMTP service we can found that the port 25 is dedicated for SMTP service, therefore our SMTP server will be waiting for incoming connections on that port and we will fix the IPEASY port to be contacted on the remote server exactly to 25.

Second thing we have to discover is whether the transport protocol has to be TCP or UDP; on the RFC821 we can read that the SMTP Application layer protocol is meant to be on top of TCP/IP protocol, therefore the transport protocol choice will fall on TCP.
Now we have all the information needed to configure our system.

The email can be sent following three different procedures:

1. Opening socket with SMTP server and then sending directly SMTP commands. The following AT commands should be issued to the Telit module:

AT+CGDCONT = 1,"IP","internet","0.0.0.0",0,0 (context setting)

For all the socket settings the following AT command will be used:

AT#SCFG=1,1,300,90,600,50
OK

Next step is activation of the context:
AT#SGACT=1,1,“EASY GPRS“,“EASY GPRS“
#SGACT: 193.199.234.255
OK

The command gives as response the IP address assigned by the network.

Now we can proceed with contacting the server with AT command for socket dial:
AT#SD=1, 0,25,"smtp.domain.com",0,0

When we receive the CONNECT indication, then we are exchanging data with the SMTP server program on the remote host machine.

Following the SMTP protocol we proceed with the HELO presentation and mail delivery directly over the serial line (in blu you can find the data sent by us, in violet the one received from host):

220 smtp.domain.com ESMTP Service (7.0.027-DD01) ready

HELO pcprova<cr><lf>

250 smtp.domain.com

AUTH LOGIN<cr><lf> (authentication method)

334 VXRlcm8gkXU6

Z204NjJAZG9tYWluLmNvbQ==<cr><lf> (module@domain.com base64 encoding)

334 UHFzc6dcvmQ6

dGVsaXQ= <cr><lf> (telit base64 encoding)

235 2.0.0 OK Authenticated

MAIL FROM: module@domain.com <cr><lf> (Sender)

250 2.1.0 module@domain.com... Sender ok

RCPT TO: receiver@server.net <cr><lf> (Receiver)

250 2.1.5 receiver@server.net... Recipient ok

DATA<cr><lf>

354 Enter mail, end with "." on a line by itself

Return-Receipt-To: < module@domain.com ><cr><lf>
Reply-To: < module@domain.com ><cr><lf>
From: < module@domain.com ><cr><lf>
To: < receiver@server.net ><cr><lf>
Subject: Email test<cr><lf>
Date: Fri, 19 Sep 2003 11:41:32 +0200<cr><lf>
MIME-Version: 1.0<cr><lf>
X-Priority: 3 (Normal) <cr><lf>
X-MSMail-Priority: Normal<cr><lf>
X-Mailer: GM862 TELIT SW, Build 1.0.1000 (1.0.1111.0) <cr><lf>
Importance: Normal<cr><lf>

X-MimeOLE: Produced By GM862 TEST SW<cr><lf>
<cr><lf>
Content-Type: text/plain; <cr><lf>
charset="iso-8859-1"<cr><lf>
Content-Transfer-Encoding: 7bit<cr><lf>
<cr><lf>
This message is sent in order to test IP Easy feature. Hello World!<cr><lf>
<cr><lf>
. <cr><lf>

250 2.0.0 h8J9QNH3008461 Message accepted for delivery

QUIT<cr><lf>

221 2.0.0 smtp.domain.com closing connection

+++
OK
AT#SH=1
OK

The Telit module is now back in the command mode and the socket is closed.

NOTE:

Authentication settings could be different between context and SMTP. This is due to the fact that in the context authentication it is requested user and password of your internet provider, instead of the SMTP authentication where user and password is used to connect to the SMTP server.

3.5.3. IP Easy -EMAIL receiving application

Let's suppose we want to receive with our embedded device an EMAIL by using a POP3 server.

Initial data:

Server to be contacted	POP.mail.server
POP service	port #110
Application Layer Protocol	POP3 (RFC1785)
Receiver	"module"<module@domain.com>
Email account username	module@domain.com
Email account password	telit
Context settings	
APN	internet
IP of device	dynamically assigned by the network

DNS	assigned by the network
USERID	IPEASY
PASSWORD	IPEASY
Socket parameters	
Connection Identifier	1
Packet size (used by TCP/UDP/IP stack for data sending)	300
Socket inactivity timeout	90
Connection timeout	600
Data sending time out	50

Checking on the RFC1785, we can found that the port 110 is dedicated for POP3 service, therefore our POP server will be waiting for incoming connections on that port and we will fix the IP EASY port to be contacted on the remote server exactly to 110.
Second thing we have to discover is whether the transport protocol has to be TCP or UDP; on the RFC1785 we can read that the POP3 Application layer protocol is meant to be on top of TCP/IP protocol, therefore the transport protocol choice will fall on TCP.
Now we have all the information needed to configure our system.

With our microcontroller we can now issue to the Telit module the following AT commands:

AT+CGDCONT = 1,"IP","internet","0.0.0.0",0,0 (1- context setting)

For all the socket settings the following AT command will be used:

AT#SCFG=1,1,300,90,600,50
OK

Next step is activation of the context:
AT#SGACT=1,1,“IPEASY“,“IPEASY“
#SGACT: 193.199.234.255
OK

The commands gives as response the IP address assigned to the module by the network.

AT#SD=1,0,110,"POP.mail.server",0,0
When we receive the CONNECT indication, then we are exchanging data with the POP3 server program on the remote host machine.
Following the POP3 protocol we can proceed with the authentication directly over the serial line (in blue you can find the data sent by us, in violet the one received from host):

+OK POP3 PROXY server ready (7.0.027) <A6B4DDEA93433C73A01@pop4.libero.it>

USER module@domain.com<cr><lf>
+OK Password required


```
PASS telit<cr><lf>
    +OK 1 messages

LIST\r\n
    +OK
    1 19550
    .

RETR 1<cr><lf>
    +OK 19550 bytes
    Return-Path: <module@domain.com>
    Received: from smtp5.libero.it (193.70.192.55) by ims2d.libero.it (7.0.028)
    id 40DFC49A010E5708 for test@libero.it; Tue, 17 Aug 2004 12:24:02+0200
    Received: from smtp.telital.com (194.185.15.65) by smtp5.libero.it (7.0.027-DD01)
    .

QUIT<cr><lf>
    +OK POP3 server closing connection
+++
OK

AT#SH=1
OK
```

3.5.4. Remote connection between two modules

Configuration for the module that receives data (server):

Define PDP Context	AT+CGDCONT=1,”IP”,”ibox.tim.it”,”0.0.0.0”
Context Activation	AT#SGACT=1,1
Firewall Setup	AT#FRWL=1,”198.158.1.1”,”0.0.0.0”
Socket Listen	AT#SL=1,1,0,1024

First you have to define PDP context filling in the information of APN in this example: ibox.tim.it.
Next step is activation of context which gives as reply the IP of the module assigned by network:

```
AT#SGACT=1,1
#SGACT: 217.201.142.223
OK
```

Before opening socket in listen it is possible to define an accept firewall chain in order to filter IP of the senders.
At the end with AT command AT#SL=1,1,1024,0 the socket will be set in listen on the port #1024.

Configuration for the module that opens connection (client):

Define PDP Context	AT+CGDCONT=1,”IP”,”ibox.tim.it”,”0.0.0.0”
Context Activation	AT#SGACT=1,1
Socket Dial	AT#SD=2,0,1024,”217.201.142.223”

First you have to define PDP context filling in the information of APN in this example: ibox.tim.it.
Next step is activation of context which gives as reply the IP of the module assigned by network.
Now you can open the connection with the remote host with IP address 217.201.142.223 on the port 1024 (as in example).

NOTE:

IP of the modules can be verified with the following AT command line: AT#CGPADDR=

4. Command Mode Connections

4.1. Overview

This feature allows Telit's modules to establish a socket connection in command mode.
The "classic" online mode connection is described in the figure below:

With command mode feature now we have:

This means that the socket connection is created, but the user can give AT commands as usually in command mode. If we receive some data on a socket a SRING message is raised.

4.2. Commands Overview

This paragraph describes the configuration and the activation of a command mode connection and the AT commands implemented to use the new configuration socket parameters.
For anything concerning outgoing and incoming connections, you can refer to the chapter "Enhanced IP Easy Extension": there are no differences at sockets level.

NOTE:

For more detailed AT commands and parameters definitions consult the AT Commands Reference Guide.

4.2.1. Opening a socket connection in command mode

To open a socket in command mode we must use the multisocket commands AT#SD or AT#SA. After a PDP context activation with AT#SGACT it is possible to open all sockets associated to this PDP context in command mode using:

AT#SD=<connId>,<txProt>,<rPort>,<IPaddr>[,<closure type>[,<lPort>],1]]

In case of listening, after an unsolicited indication for an incoming connection

SRING: <connId>

We have to use:

AT#SA = <connId>,1

Where the last parameter of AT#SD and AT#SA is <ConnMode>. Default value is 0 which means “classic” online mode, 1 is used for command mode.

Examples:

Open a command mode socket on connection Id number 1:

AT#SD =1,0,10510,”88.37.127.146”,0,0,1
OK

After an unsolicited indication for an incoming connection on a listening connId:

SRING: 1

AT#SA = 1,1
OK

In “classic” online mode, if the connection is successful we have a CONNECT message, in this case we have only an OK message in case of success and we are still in command mode.

To check if the connection is really established we ca use the AT#SS command to control socket status.

AT#SS

#SS: 1,2,217.202.12.22,38158,88.37.127.146,10510
#SS: 2,0
#SS: 3,0
#SS: 4,0

#SS: 5,0
#SS: 6,0

We can see that connection Id 1 is opened in suspended state.

4.2.2. Configuring extended socket parameters

Before opening socket connections it is possible to set extended configuration parameters on each of six sockets available with multisocket.
The main feature regards SRING unsolicited messages. These messages inform the user that there are pending data on a specific connection Id.
We have three modes:

- *Classic SRING*: only one message (SRING: <connId>) when some new data arrive on a socket connection (like it was for a socket connection of multisocket). This message is received also when there's an incoming connection on listening connection Id.
- *Data amount SRING*: an unsolicited message is raised for every new packet received on a socket connection. The message gives information on the connection id and on the number of bytes pending in the socket buffer.
- *View data SRING*: in this message we have connection Id, amount of buffered data by the socket and a string (up to 64 chars) with the dump of data extracted from the socket buffer. An unsolicited is raised until the socket buffer is empty. In this specific case we can decide to see data as text or as hex using the <recvDataMode> parameter (default value is 0 – text).

NOTE:

the data amount is updated until the maximum TCP windows size for reception is reached.

The command syntax is:

AT#SCFGEXT = <connId>,<srMode>,<dataMode>,<keepalive>
[,<unused_A> [,<sendDataMode>]]

where:

- **<connId>** is the connection identifier.
- **<srMode>** is the unsolicited Sring mode.
- **<dataMode>** - sets text or hex data view for received data in command mode
- **<keepalive>** sets TCP keepalive parameter in minutes (up to 240), 0 means keepalive disabled.
- **<unused_A>** is currently not used, 0 means reserved for future use.
- **<sendDataMode>** sets text or hex data mode for sending data in command mode(AT#SSEND)

Examples:

- *AT#SCFGEXT = 1,1,0,0* - Socket 1 set with SRING data amount

- *AT#SCFGEXT = 1,2,1,0* - Socket 1 set with SRING view data mode in hex.
- AT#SCFGEXT = 1,2,1,0,0,1 – Socket 1 set also with hex data mode for sending data[14]

4.2.3. Send data in command mode connections

To send data in command mode we can use the command AT#SSEND.

At the prompt we can write data and send immediately on the socket with CTRL-Z sequence. Maximum number of bytes is 1020, if more characters are written they are truncated in upload. The command syntax is:

AT#SSEND = <connId>

Where <connId> is the connection Id of the socket that we want to use to send data (socket must be opened otherwise an error is raised).

Example:

We send the string “hello” on an echo socket with SRING mode set to Data amount.

AT#SSEND=1
> hello<CTRL-Z>
OK

SRING: 1,5

NOTE:

Through new AT#SSENDEXT command it is possible to include all bytes within data to send, including special characters(ESC, Ctrl-Z and BS) previously reserved with #SSEND.

The command syntax is:

AT#SSENDEXT = <connId>,<bytestosend>

When <bytestosend> bytes have been sent to the serial port, operation is automatically completed.

4.2.4. Receive data in command mode connections

To receive data in command mode it is possible to use the AT#SRECV.

If we receive an unsolicited message SRING we can extract the data from the socket buffer in command mode. The syntax of the command is:

AT#SRECV=<connId>,<maxByte>
where :

<connId> is the connection Id of the socket with data pending
<maxbytes> is the number of pending bytes we want to extract (maximum value is 1500).

Example:

We receive a SRING data amount and then we extract all the five bytes pending with SRECV.

SRING: 1,5

at#srecv=1,5
#SRECV: 1,5
hello

OK

4.2.5. Socket Information command

It is possible to have additional information on every socket with the AT#SI command.
The command syntax is:

AT#SI [= <connId>]

Where connId is an optional parameter, we can see info on a specific socket or for all sockets.
The information shown by the command are:

Data sent on the socket.
Data extracted from the socket buffer.
Data pending on the socket buffer.
Data not acknowledged by the remote.

at#si

#SI: 1,123,400,10,50
#SI: 2,0,100,0,0
#SI: 3,589,100,10,100
#SI: 4,0,0,0,0
#SI: 5,0,0,0,0
#SI: 6,0,98,60,0

OK

Sockets 1,2,3,6 are opened with some data traffic.
For example socket 1 has 123 bytes sent, 400 bytes received, 10 byte waiting to be read and 50 bytes waiting to be acknowledged from the remote side.

4.3. Examples

4.3.1. Open a command mode connection with Classic SRING

Open a connection on an Echo port:

AT#SD=2,0,10510,"88.37.127.146",0,0,1
OK

AT#SSEND=2
>hello
OK

SRING: 2

AT#SSEND=2
>hello
OK

…

Only one SRING unsolicited also if we have other data pending, the user is informed only once.

4.3.2. Open a command mode connection with Data amount SRING

Open a connection on an Echo port:

AT#SD=2,0,10510,"88.37.127.146",0,0,1
OK
AT#SSEND=2
> hello
OK

SRING: 2,5
AT#SSEND=2
> hello
OK

SRING: 2,10

SRing data amount unsolicited is updated every time new data arrives on the socket.

Now we use AT#SI to see info on connection Id 2:

AT#SI=2
#SI: 2,10,0,10,0

Ten bytes sent and ten pending on the socket.

4.3.3. Open a command mode connection with Data view SRING

We configure connection Id 1 for data view in text mode:

AT#SCFGEXT = 1,2,0,0
OK

We configure connection Id 2 for data view in hex mode for received data:

AT#SCFGEXT = 2,2,1,0
OK

Open the two echo connections in command mode:

AT#SD=1,0,10510,"88.37.127.146",0,0,1
OK

AT#SD=2,0,10510,"88.37.127.146",0,0,1
OK

Send some data on the first, text mode:

AT#SSEND=1
> hello
OK

SRING: 1,5,hello

Send some data on the second, hex mode for received data:

AT#SSEND=2
> hello
OK

SRING: 2,5,68656C6C6F

AT#SSEND=1

> testtesttesttesttesttesttesttesttesttesttesttesttesttesttesttesttesttest
OK

SRING: 1,68,testtesttesttesttesttesttesttesttesttesttesttesttesttesttesttesttesttesttesttesttesttesttesttesttesttesttesttesttesttesttest

NOTE:

It's also possible to send data in hex data mode representation.

This is possible through setting #SCFGEXT <dataMode> parameter to 1.The data shall be hexadecimal format (each octet of the data is given as two IRA character long hexadecimal number) and given in one line.

Example:

We configure connection Id 1 for data view in hex mode for received data and also for sending data:

AT#SCFGEXT = 1,2,1,0,0,1
OK

AT#SD=1,0,10510,"88.37.127.146",0,0,1
OK

Send some data in hexadecimal format:

AT#SSEND=1
> 68656C6C6F
OK

SRING: 1,5,68656C6C6F

4.3.4. Open a command mode connection with AT#SA

After using AT#SL we have a <connId> listening on a specific port (only for TCP connections). If we receive an incoming connection an unsolicited code is raised.

AT#SL = 1,1,1000

SRING: 1

Now we can accept the incoming connection:

AT#SA = 1,1

OK

and we stay in command mode, but the connection has been opened.

4.3.5. Passing from command mode to online mode interface

It’s always possible to come back to online mode interface using the command AT#SO = <connId>.

Open an echo socket in command mode:

AT#SD=1,0,10510,"88.37.127.146",0,0,1
OK

SRING: 1,5

Now we come back to online mode with:

AT#SO = 1
CONNECT
Hello

The AT interface is now in online mode and all characters written are interpreted as data to send on the connection Id.

5. List of acronyms

Abbreviation	Description
Ack	Acknowledge
APN	Access Point Name
AT	Attention commands
CM	Command mode
CR	Carriage Return
CSD	Circuit Switched Data
CTS	Clear To Send
DCD	Data Carrier Detected
FTP	File Transfer Protocol
GGSN	Gateway GPRS Serving/Support Node
GPRS	General Radio Packet Service
GSM	Global System for Mobile communication
GTP	GPRS Tunnelling Protocol
HTML	Hyper Text Mark-up Language
HTTP	Hypertext Transfer Protocol
HSCSD	High-Speed Circuit-Switched Data
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
LCP	Link Control Protocol
LLC	Logical Link Control
MS	Mobile Station
MT	Mobile Terminated
NCP	Network Control Protocol
OEM	Other Equipment Manufacturer
PAP	Password Authentication Protocol
PDP	Packet Data Protocol
PDU	Protocol Data Unit
PLMN	Public Land Mobile Network
PPP	Point to Point Protocol
QoS	Quality Of Service
RLC	Radio Link Control
RoHS	Reduction of Hazardous Substances
RTS	Ready To Send
SIM	Subscriber Identity Module
SKTM	Socket Mode
SMTP	Simple Mail Transfer Protocol
TCP	Transmission Control Protocol

6. Document History

Revision	Date	Changes
ISSUE #0	2011-10-24	Initial release
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