

80000nt10043a SMS AT RUN and TCP AT RUN Application Note

80000nt10043a Rev.0 – 2010-10-13



APPLICABILITY TABLE

| PRODUCT |
|--------------------------|
| GC864-QUAD |
| GC864-QUAD V2 |
| GC864-PY |
| GT863-PY |
| GT864-QUAD |
| GT864-PY |
| GE863-GPS |
| GE863-SIM |
| GE863-PRO ³ |
| GE864-PY |
| GE864-QUAD |
| GE864-QUAD V2 |
| GE864-QUAD Atex |
| GE864-QUAD Automotive V2 |
| GE865-QUAD |
| GL865-DUAL |



Disclaimer

The information contained in this document is the proprietary information of Telit Communications S.p.A. and its affiliates ("TELIT").

The contents are confidential and any disclosure to persons other than the officers, employees, agents or subcontractors of the owner or licensee of this document, without the prior written consent of Telit, is strictly prohibited.

Telit makes every effort to ensure the quality of the information it makes available. Notwithstanding the foregoing, Telit does not make any warranty as to the information contained herein, and does not accept any liability for any injury, loss or damage of any kind incurred by use of or reliance upon the information.

Telit disclaims any and all responsibility for the application of the devices characterized in this document, and notes that the application of the device must comply with the safety standards of the applicable country, and where applicable, with the relevant wiring rules.

Telit reserves the right to make modifications, additions and deletions to this document due to typographical errors, inaccurate information, or improvements to programs and/or equipment at any time and without notice.

Such changes will, nevertheless be incorporated into new editions of this document.

Copyright: Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights are reserved.

Copyright © Telit Communications S.p.A. 2010.



Contents

| | |
|--|-----------|
| 1. Introduction | 6 |
| 1.1. Scope..... | 6 |
| 1.2. Audience..... | 6 |
| 1.3. Contact Information, Support | 6 |
| 1.4. Related Documents | 7 |
| 1.5. Document History | 7 |
| 1.6. Abbreviations and acronyms | 7 |
| 2. AT Run and Event Monitor Services Introduction | 8 |
| 3. SMS AT Run Services | 9 |
| 4. TCP AT Run Service..... | 12 |
| 5. Event Monitor Service | 16 |
| 6. Remote Room Temperature Control Application | 17 |
| 6.1. SMS AT Run Service..... | 20 |
| 6.2. Event Monitor Service | 30 |
| 6.3. TCP AT Run Service | 33 |
| 6.4. TCP AT Run & Event Monitor Services | 42 |
| 7. Appendix: RRTC Application..... | 49 |
| 7.1. First Demo Hardware Configuration | 50 |
| 7.2. Second Demo Hardware Configuration..... | 58 |
| 7.3. RDTSB board Pictures | 60 |



Figures

| | |
|---|----|
| fig. 1: Basic Configuration | 8 |
| fig. 2: Remote Station without PC..... | 10 |
| fig. 3: Remote Station with PC..... | 11 |
| fig. 4: Local Control Station connected to Local Network..... | 13 |
| fig. 5: Local Control Station using ISP..... | 14 |
| fig. 6: Local Control Station with module..... | 15 |
| fig. 7: Remote Room Temperature Control architecture | 19 |
| fig. 8: RDTSB board & SMS AT Run Service..... | 21 |
| fig. 9: Remote Module running SMS AT Run Service..... | 24 |
| fig. 10: Local Module doesn't run AT Run and Event Monitor Services | 26 |
| fig. 11: Remote Module running Event Monitor Service | 31 |
| fig. 12: Heater State (GPIO9)..... | 32 |
| fig. 13: RDTSB board & TCP AT Run Service | 34 |
| fig. 14: Remote Module running TCP AT Run Service | 35 |
| fig. 15: Combined Services on Remote Module | 44 |
| fig. 16: Telit Serial Port MUX on Local Module. | 45 |
| fig. 17: Remote Digital Temperature Sensor Board | 49 |
| fig. 18: First Configuration Details | 51 |
| fig. 19: Second Configuration Details..... | 59 |

Tables

| | |
|---|----|
| Tab. 1: Default instance for SMS AT Run Service | 23 |
| Tab. 2: Instances vs. Event Monitor Service..... | 31 |
| Tab. 3: Instances vs. TCP AT Run Service | 35 |
| Tab. 4: Combined Services & Instances..... | 43 |

Photos

| | |
|---|----|
| photo 1: RDTSB board & Remote Module..... | 60 |
| photo 2: RDTSB board details..... | 61 |
| photo 3: RDTSB/Module Connection details..... | 62 |



1. Introduction

1.1. Scope

The present document provides the reader with information concerning the use of the SMS AT Run, TCP AT Run and Event Monitor Services. Several local-remote modules configurations are illustrated and some examples are described. In fact, the document objective is to guide the reader throughout the selection of the suitable local and remote station configuration, how to carry out the hardware interface between the remote module and the generic user-equipment and how to develop a simple software application based on the mentioned services.

1.2. Audience

This document is intended for who needs to remotely control or monitor some variables using suitable sensor connected to a remote Telit module.

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:

<http://www.telit.com>

To register for product news and announcements or for product questions contact Telit's Technical Support Center (TTSC).

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. Related Documents

- [1] Running AT Commands Remotely Application Note
- [2] Event Monitor Application Note
- [3] Telit EVK2 User Guide
- [4] AT Commands Reference Guide

1.5. Document History

| Revision | Date | Changes |
|----------|------------|-------------|
| 0 | 2010/10/13 | First issue |

1.6. Abbreviations and acronyms

| | |
|--------|---|
| BTS | Base Transceiver Station |
| DTE | Data Terminal Equipment |
| GGSN | Gateway GPRS Support Node |
| GPIO | General Purpose Input/Output |
| GPRS | General Packet Radio Services |
| I2CBUS | I-squared-C Bus |
| PAP | Password authentication protocol |
| PDP | Packet Data Protocol |
| PLMN | Public Land Mobile Network |
| RDTSB | Remote Digital Temperature Sensor Board |
| RRTC | Remote Room Temperature Control |
| SGSN | Serving GPRS Support Node |



2. AT Run and Event Monitor Services Introduction

The AT Run Services [1] allow the user to run AT Commands on a remote module by means of the support of a communication protocol used to connect the local module operated by the user and the remote module located on a remote site, fig. 1. Telit modules provide the following types of AT Run Services:

- SMS AT Run Service:
 - Simple SMS AT Run Service;
 - Digest SMS AT Run Service.

In general, SMS AT Run Service can be used in GSM mode or in GPRS¹ mode

- TCP AT Run Service
 - in Client mode;
 - in Server (Listen) mode.

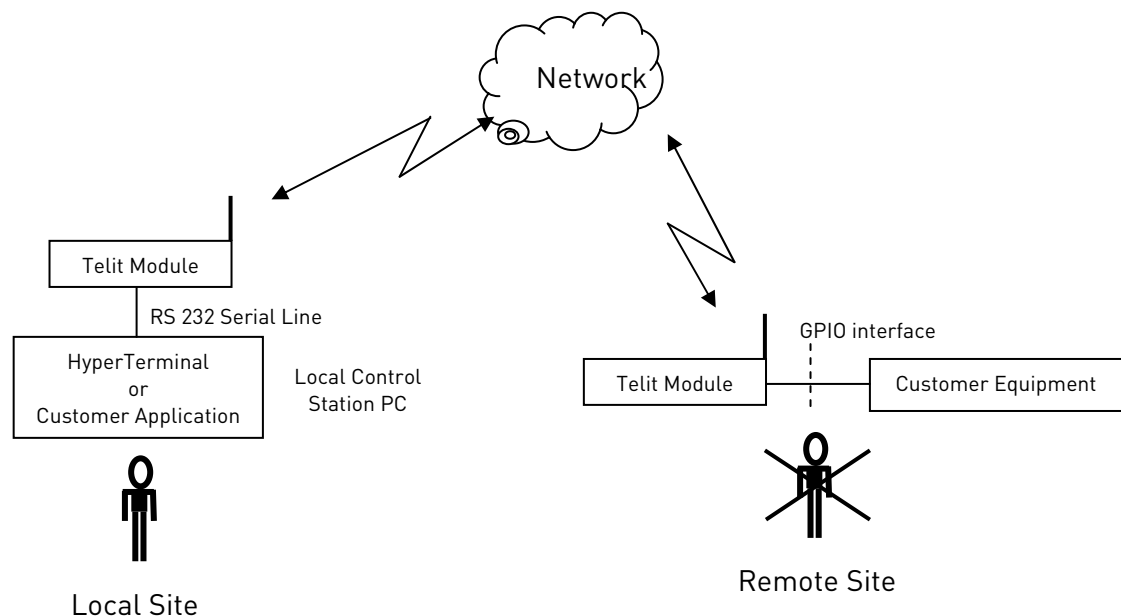


fig. 1: Basic Configuration

The Event Monitor Service [2] provided by the Telit modules allows the user to associate an AT Command to a specified event monitored by the module itself. When the module recognizes the event occurring, it executes the associated AT Command. This service can be used jointly with the AT Run Services as will be shown on the following pages.

¹ The Network Operator must support the SMS in GPRS mode.



3. SMS AT Run Services

The SMS AT Run Service, running on remote module, is supported by the SMS protocol to receive the AT Commands from the local station and send back the results of the relative running.

The fig. 2 shows a remote station configuration without remote PC, the fig. 3 shows a remote station with remote PC running a customer application. Both remote station configurations run SMS AT Run Service and could be without operator.

The hereafter described example shows how to run remotely an AT Command, let's suppose that the user needs to know the signal strength received by the remote module. On local station the AT Commands are entered by the user and the received responses are still manually read by the user using an HyperTerminal session.

Basic steps:

1. the user on the local control station writes and sends an SMS message holding the AT Command: AT#MONI;
2. the remote stand-alone module receives the SMS message, executes the AT Command transported by the SMS and sends to the local module, by means of an SMS message, the result of the just ran AT Command;
3. the local module receives the SMS holding the result and alerts the user that a new SMS has been received;
4. the user reads the received SMS holding the desired information.

In applications where the customer equipment is not requiring specific control actions, the remote PC or the module Python facility could be substituted by the Event Monitor Service provided by the module. Consequently, the remote module will run at the same time: SMS AT Run and Event Monitor Services.



AT Run and Event Monitor Services Remote Room Temperature Control Application Note
80000nt10043a Rev.0 – 2010-10-13

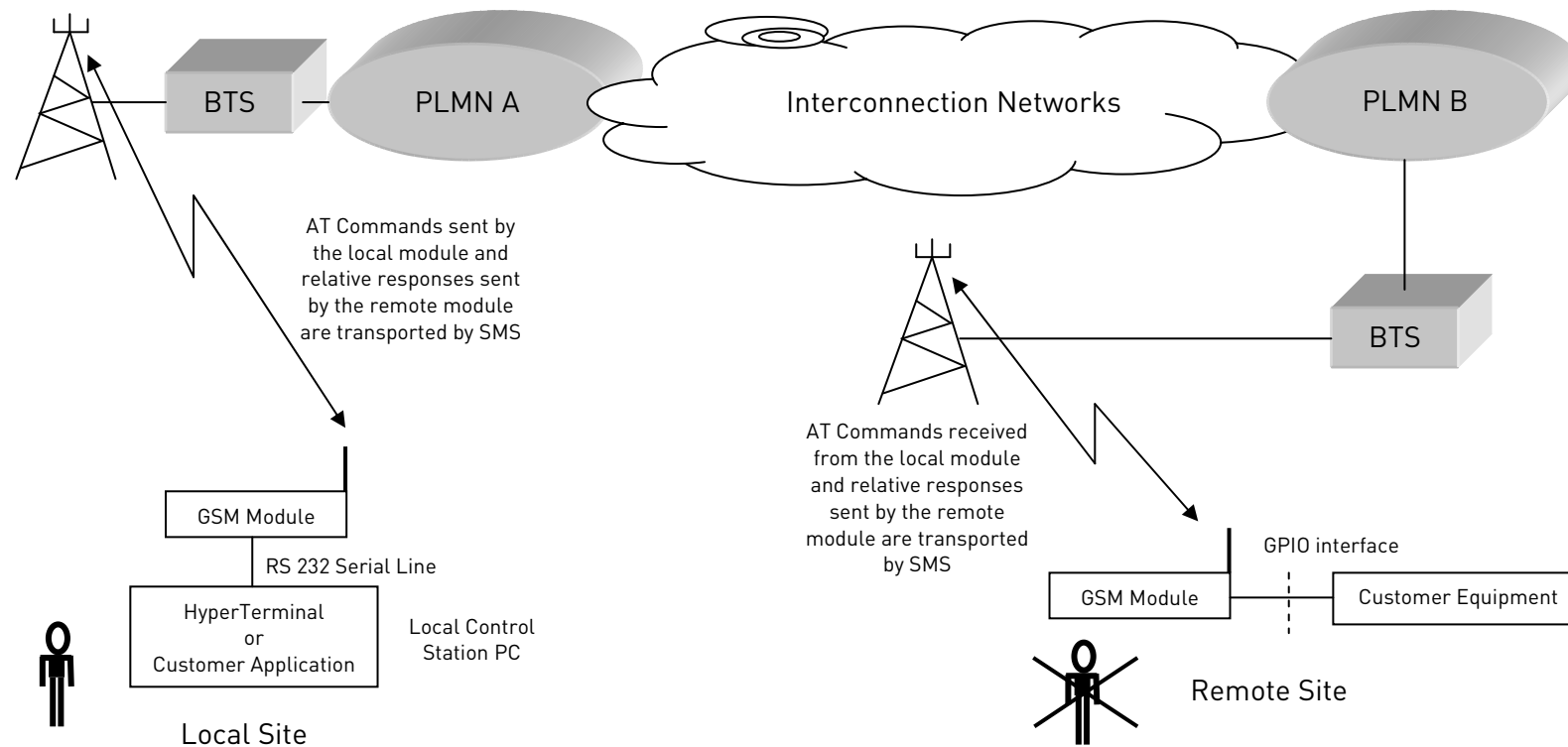


fig. 2: Remote Station without PC

AT Run and Event Monitor Services Remote Room Temperature Control Application Note
80000nt10043a Rev.0 – 2010-10-13

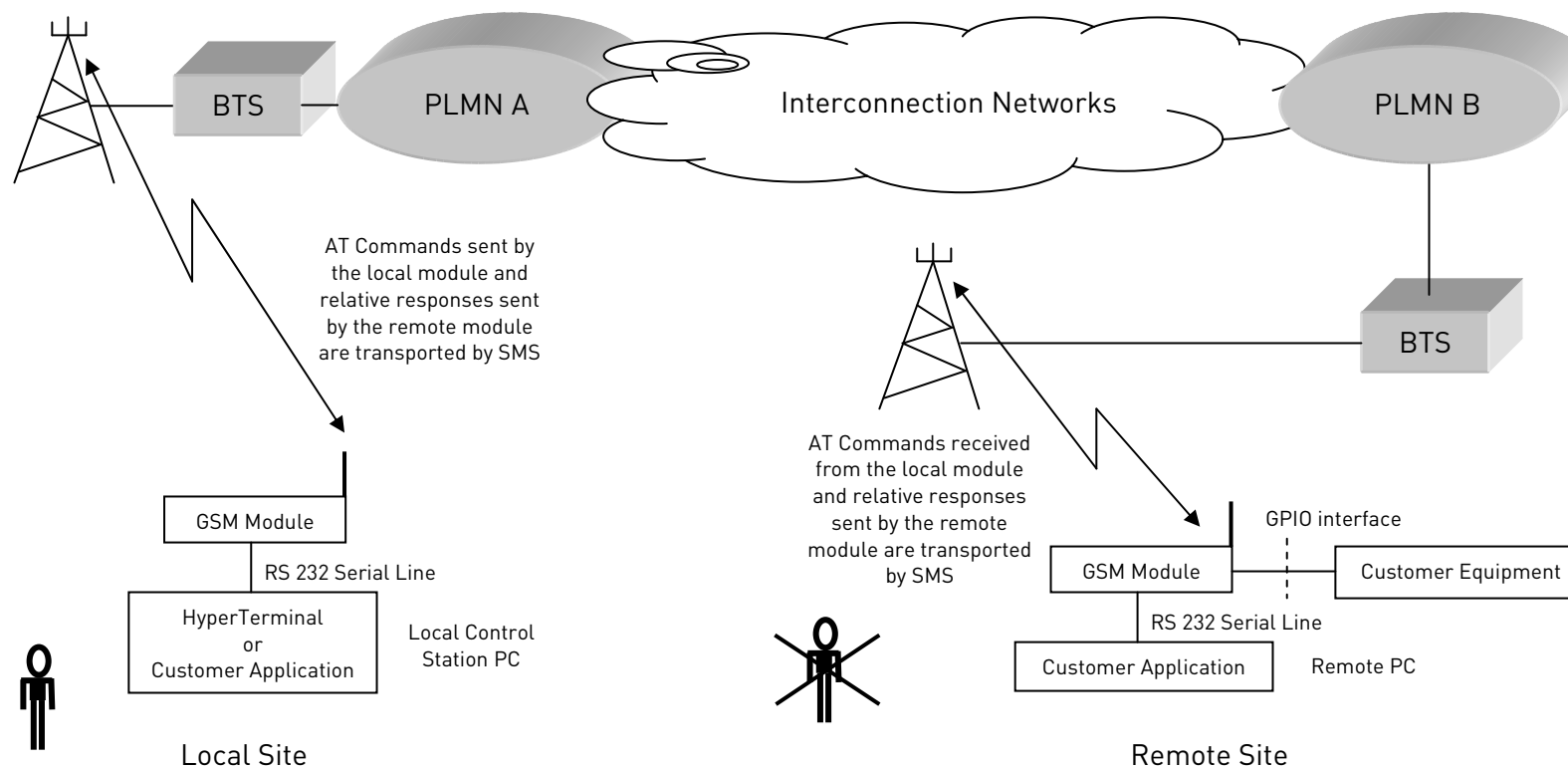


fig. 3: Remote Station with PC

4. TCP AT Run Service

The TCP AT Run Service, running on remote module, is supported by the TCP protocol to receive the AT Commands sent by the local station, refer to fig. 4, fig. 5, fig. 6. The remote module executes the received AT Commands and sends back to the local station the results. In the following example it is assumed that the user needs to know the signal strength received by the remote module, and the TCP connection procedure is successfully completed:

1. the user on local control station enters the AT Command: AT#MONI<CR>;
2. the remote stand-alone module receives the AT Command, executes it and sends to the local control station the Command result holding the required signal strength.

The above described activity can be accomplished using several hardware/software configurations, in accordance with the user requirements. Follow a short description of the showed configurations.

The fig. 4 and fig. 5 show two configurations in which the local control station doesn't use a module. The control station PC runs the TCP/IP protocol stack and it is connected to the local network or uses an Internet Service Provider.

The fig. 6 shows a configuration in which the local control station uses a module. In this solution, the TCP/IP protocol stack runs on module (EASY GPRS). The control station PC is connected to the module through a serial line. In addition, in applications where the customer equipment is not requiring specific control actions, the remote PC could be substituted by the Event Monitor Service provided by the module itself. Consequently, the remote module will run at the same time: TCP AT Run and Event Monitor Services.



AT Run and Event Monitor Services Remote Room Temperature Control Application Note
80000nt10043a Rev.0 – 2010-10-13

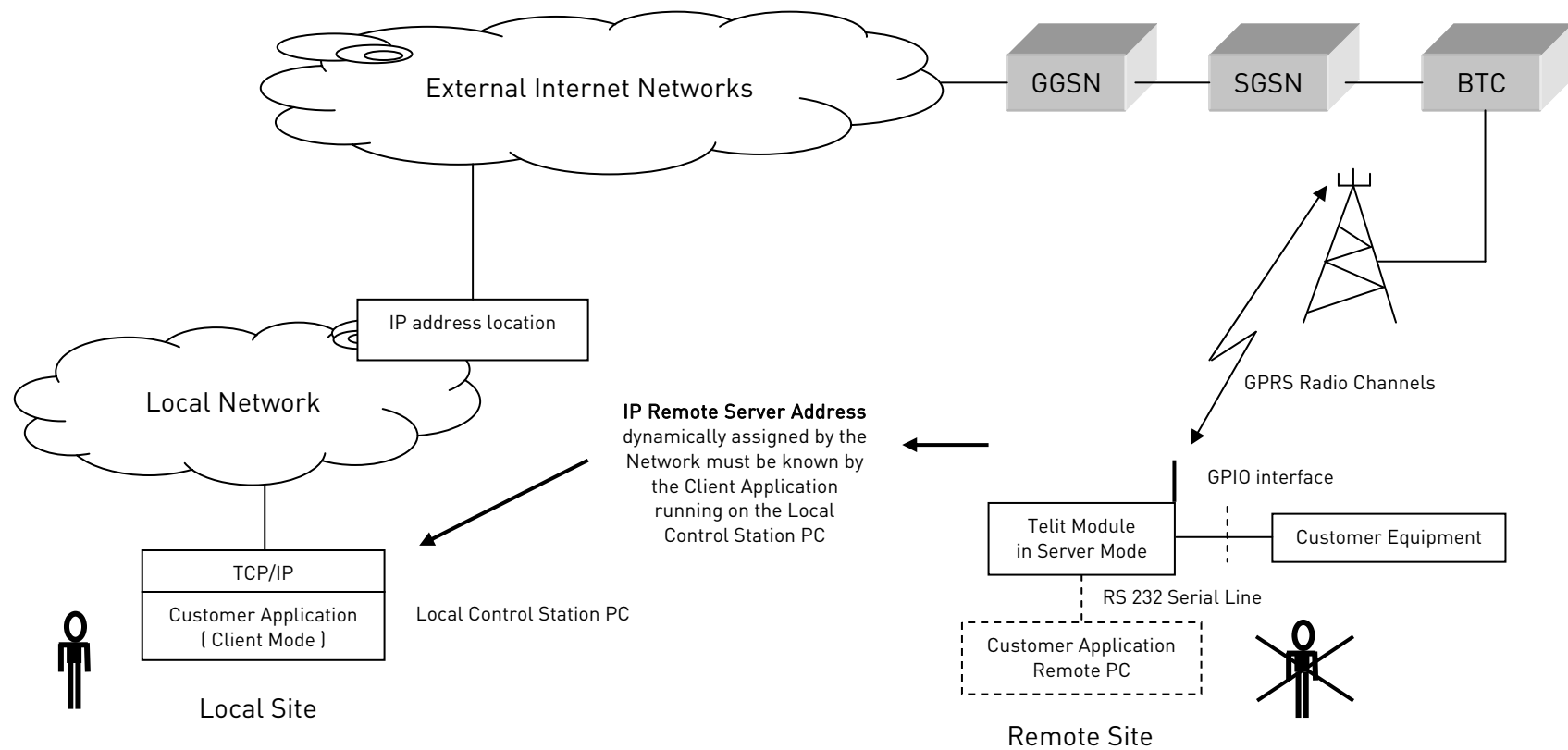


fig. 4: Local Control Station connected to Local Network

AT Run and Event Monitor Services Remote Room Temperature Control Application Note
80000nt10043a Rev.0 – 2010-10-13

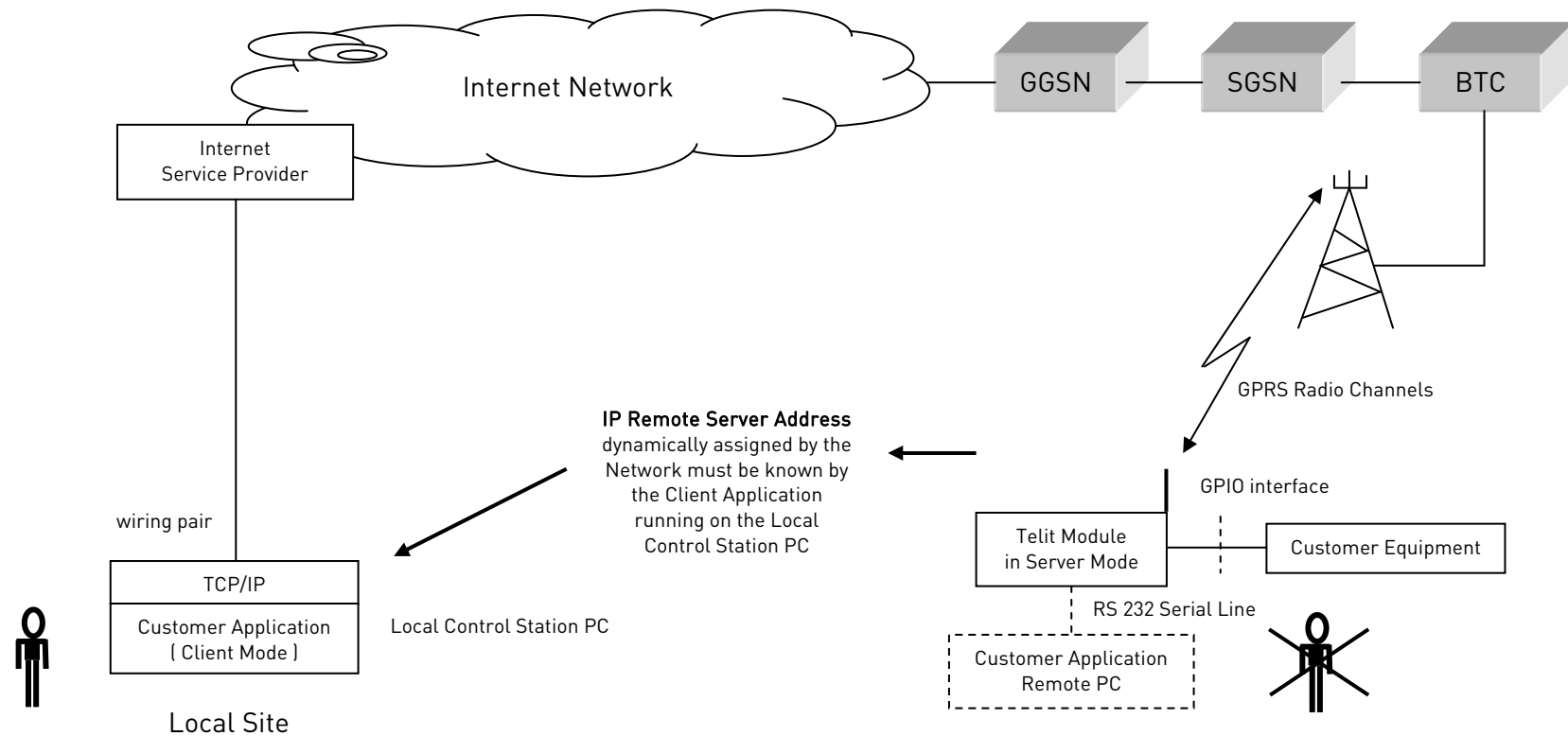


fig. 5: Local Control Station using ISP

AT Run and Event Monitor Services Remote Room Temperature Control Application Note
80000nt10043a Rev.0 – 2010-10-13

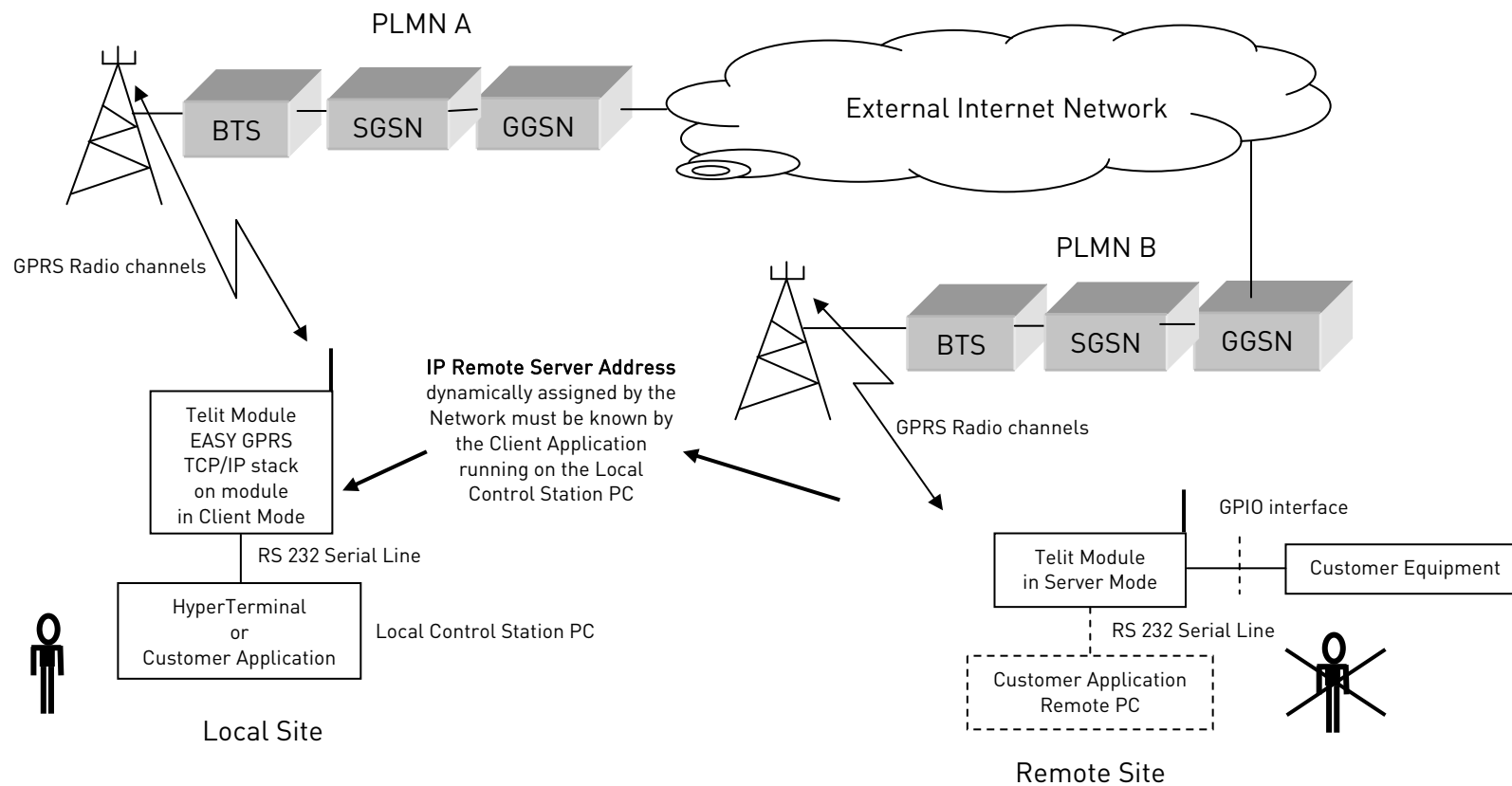


fig. 6: Local Control Station with module



5. Event Monitor Service

The Event Monitor Service [2] provided by the Telit modules allows the user to associate an AT Command to a specified event monitored by the module itself. To perform the monitoring events actions no program or script must be developed by the user. When the module recognizes the event occurring, it executes the associated AT Command.



6. Remote Room Temperature Control Application

Aim of this chapter is to introduce a simple AT Run Services application example. Let's suppose that someone needs to control the temperature of a room located in a remote site. To accomplish the remote room temperature control the following items must be got ready:

Local Site:

- the local module is installed on an EVK board [3] to simplify the interface between the module and the DTE;
- the DTE runs one or more HyperTerminal sessions to enter manually the AT Commands and in the meanwhile monitor the room temperature behavior.

Remote Site:

- the remote room temperature control is based on a Digital Temperature Sensor which can be configured writing its registers by means of the I2CBUS. The temperature is read from the temperature register. The RDTSB board using a solid state relay turns on/off the heater in accordance with the Digital Temperature Sensor set up;
- the remote module is installed on an EVK board [3] to simplify the interface between the module and the RDTSB board. In addition, this configuration permits to use a unique AC/DC Power Supply for remote module and RDTSB board;
- the length of the wiring between the Telit module and the RDTSB board must be compliant with the electrical requirements of the I2CBUS² and GPIO;
- the DTE runs a HyperTerminal session to enter manually the AT Commands to configure the remote module.

Remote room temperature control is accomplished by the Digital Temperature Sensor used as a thermostat in accordance with the programmed high and low temperature limits. On the Local Control Station are available the following functions accomplished by means of the AT Commands executed by the remote module running the selected AT Run Service:

- Digital Temperature Sensor set up (I2C BUS);
- Start conversion and Power Down Mode set up (GPIO in output direction);
- Heating State monitoring (GPIO in input direction).

² standard mode: 100 Kbps or fast mode: 400 Kbps, depends on module type.



AT Run and Event Monitor Services Remote Room Temperature Control Application Note 80000nt10043a Rev.0 – 2010-10-13

The fig. 7 shows a configuration where on remote side is not used a DTE and no operator is super visioning the equipments: the figure depicts an operative configuration.



AT Run and Event Monitor Services Remote Room Temperature Control Application Note
80000nt10043a Rev.0 – 2010-10-13

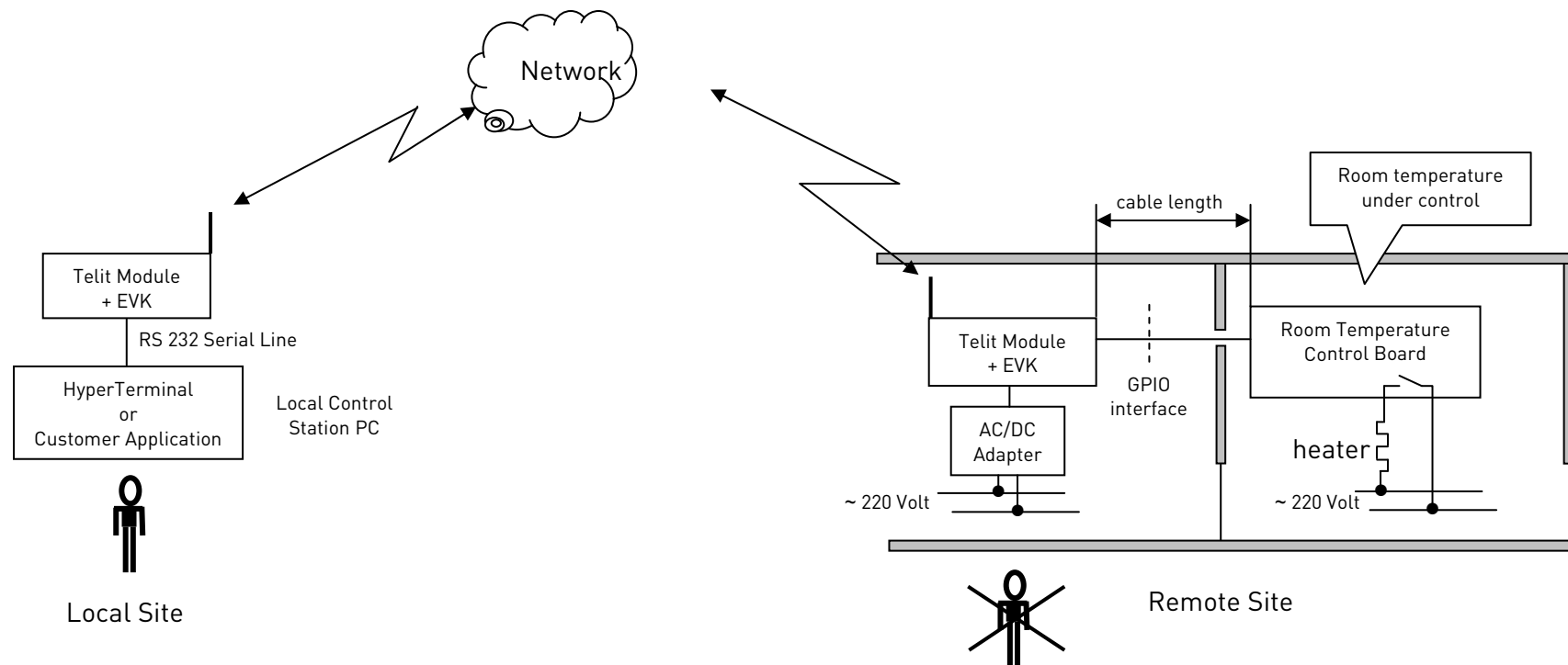


fig. 7: Remote Room Temperature Control architecture

Appendix 7 describes in detail the software and hardware items of the Remote Room Temperature Control application. Before going through the mentioned Appendix it is strongly recommended to examine carefully the following subparagraphs.

To get more information about the AT Commands used hereafter refer to [4].

6.1. SMS AT Run Service

This chapter focuses the attention on the RDTSB board control carried out by means of the SMS AT Run Service running on the remote module and based on the GSM radio channels³, see fig. 8.

Despite the configuration showed by the fig. 8, in the following example it is assumed that the two modules are located close to each other on the same site (LAB) and the user can easily enter the AT Commands on both modules. Anyway, one module will be called “remote” and the second one will be called “local”. This approach permits to clearly show the procedure that must be followed to accomplish the remote room temperature control.

³ As alternative: GPRS radio channels.



AT Run and Event Monitor Services Remote Room Temperature Control Application Note
80000nt10043a Rev.0 – 2010-10-13

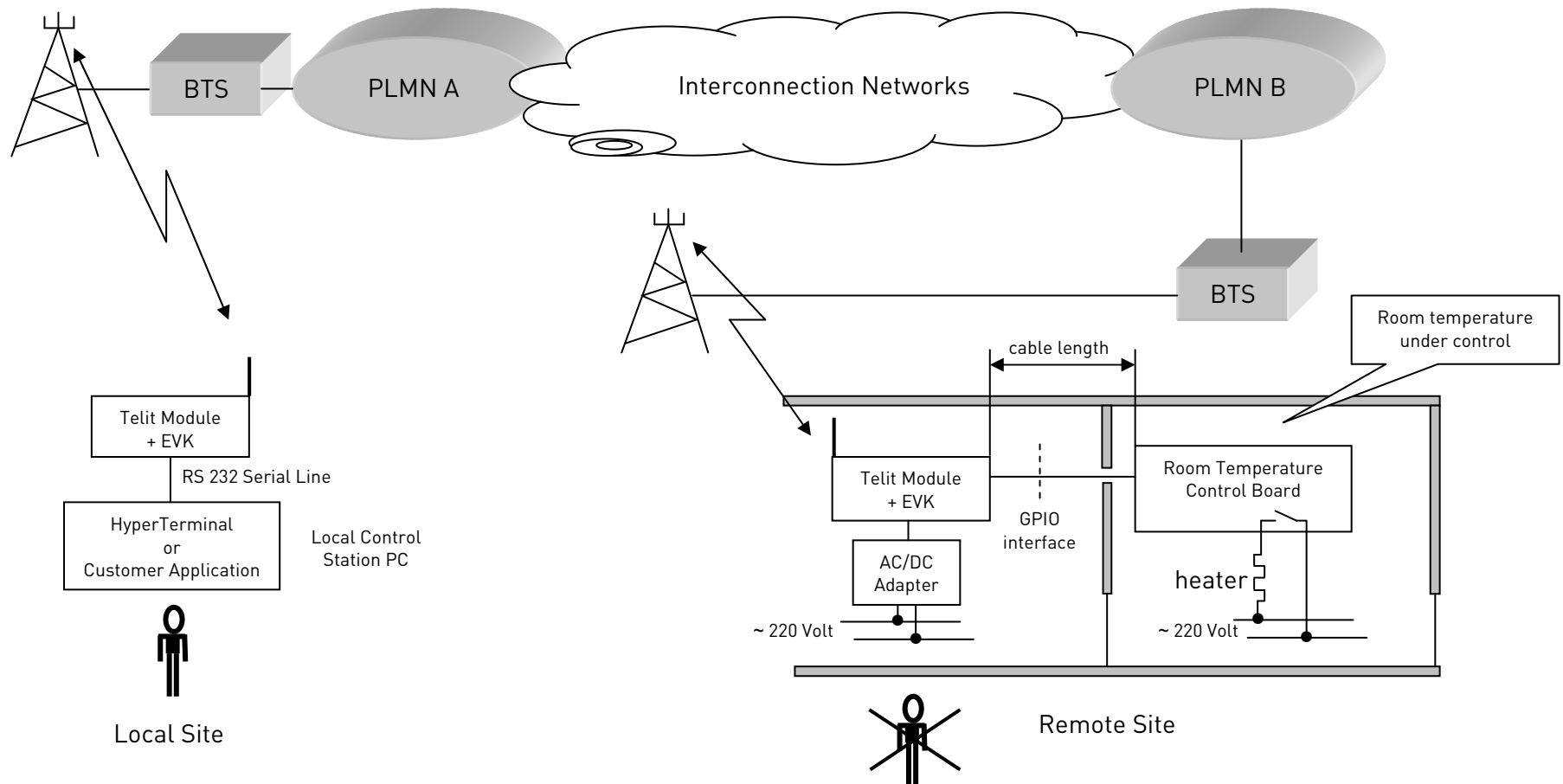


fig. 8: RDTSB board & SMS AT Run Service



AT Run and Event Monitor Services Remote Room Temperature Control Application Note 80000nt10043a Rev.0 – 2010-10-13

Preliminary DTE/REMOTE MODULE connection set up

Remote module runs the SMS AT Run Service to execute the AT Commands sent by the local module, see fig. 9. To set up the DTE/REMOTE MODULE connection follow these steps:

- connect COM1 to ASC0 using an RS 232 straight cable (pins are connected one on one);
- start an HyperTerminal session on DTE.

The HyperTerminal COM1 session will be used to configure the SMS AT Run Service and Digital Temperature Sensor installed on the RDTSB board.

Preliminary REMOTE MODULE set up

```
AT#SELINT=2<CR>
OK
AT#SMSMODE=1<CR>
OK
AT#REGMODE=1<CR>
OK
AT+CMEE=2<CR>
OK
```

Services vs. Instances

Before going on the remote module set up it is advisable to recall the concept of the instances and their relationships with the Services. With the term “instance” is intended an AT Commands Parser: Telit module provides three independent AT Commands Parsers as showed on fig. 9. Tab. 1 shows all the possible connection (☺) between instances and services.



AT Run and Event Monitor Services Remote Room Temperature Control Application Note 80000nt10043a Rev.0 – 2010-10-13

In this example, the remote module runs SMS AT Run Service. On Tab. 1 the default connection between the service and instance number is showed by the shadowed area.

| Services | Instances available for Services | | |
|---------------|----------------------------------|----|----|
| | #1 | #2 | #3 |
| SMS AT Run | / | ☺ | ☺ |
| TCP AT Run | / | ☺ | ☺ |
| Event Monitor | / | ☺ | ☺ |

Tab. 1: Default instance for SMS AT Run Service



AT Run and Event Monitor Services Remote Room Temperature Control Application Note
80000nt10043a Rev.0 – 2010-10-13

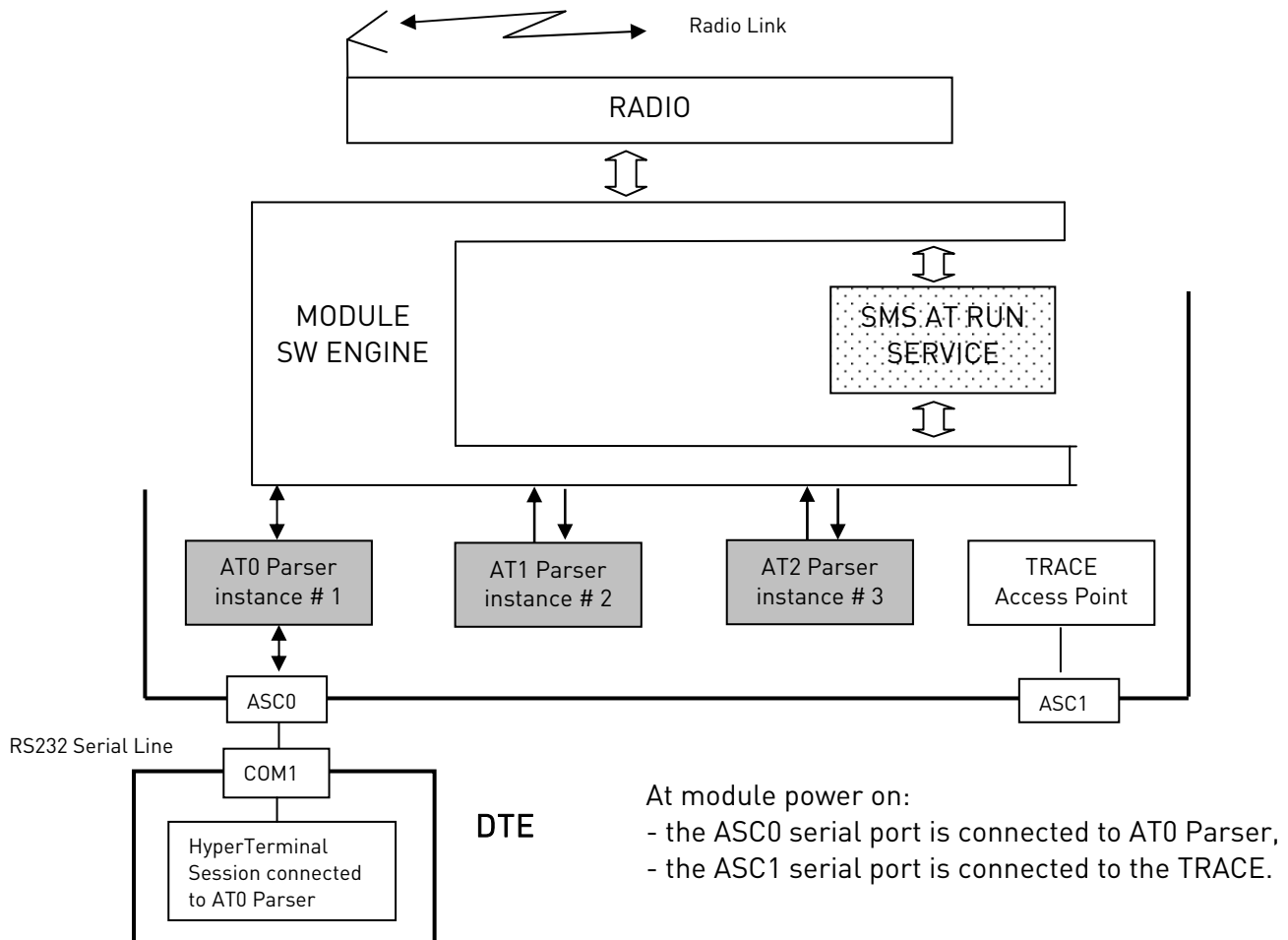


fig. 9: Remote Module running SMS AT Run Service

Make sure that all Services are disabled

```
AT#SMSATRUN=0<CR>
OK
AT#TCPATRNL=0<CR>
OK
AT#TCPATRUND=0<CR>
OK
AT#ENAEVMONI=0<CR>
OK
```



AT Run and Event Monitor Services Remote Room Temperature Control Application Note 80000nt10043a Rev.0 – 2010-10-13

Set up the Digital Sensor Temperature



Warning: the AT#I2CWR Command, due its structure, is not supported by the SMS AT Run service, consequently Digital Temperature Sensor registers must be set up using the DTE connected to the remote module. It is worth remind that AT#I2CWR Command is supported by the TCP AT Run Service as will be described on the next chapters.

| | |
|---|---|
| AT#I2CWR=11,12,50,02,02<CR> >1700CtrlZ OK | set up low temperature limit (Thyst) 0x1700 = 23°C |
|---|---|

| | |
|---|---|
| AT#I2CWR=11,12,50,03,02<CR> >1B00CtrlZ OK | set up high temperature limit (Toti) 0x1B00 = 27°C |
|---|---|

Set up the SMS AT Run Service on remote module

| | |
|---------------------|-------------------|
| AT+CMGF=1<CR> OK | SMS in text mode. |
|---------------------|-------------------|

| | |
|----------------------------------|---|
| AT#SMSATRUNCFG=3,1,5 is OK | set up SMS AT Run Service, instance # 3 assigned to the service, fig. 9. |
|----------------------------------|---|

| | |
|-------------------------------|----------------------------------|
| AT#SMSATWL=0,1,0,"+39*" OK | add an element to the WhiteList. |
|-------------------------------|----------------------------------|

| | |
|---------------------|----------------------------|
| AT#SMSATRAN=1 OK | enable SMS AT Run Service. |
|---------------------|----------------------------|

Yet, the remote module when receives an SMS message holding an AT Command, executes the received AT Command and the relative result is sent back to the local module using the transport protocol provided by the SMS message Service.

Preliminary DTE/LOCAL MODULE connection set up

Local module doesn't run AT Run or Event Monitor Services, see fig. 10. To set up the DTE/LOCAL MODULE connection follow these steps:

- connect COM1 to ASC0 using an RS 232 straight cable (pins are connected one on one);
- start an HyperTerminal session on DTE.



AT Run and Event Monitor Services Remote Room Temperature Control Application Note 80000nt10043a Rev.0 – 2010-10-13

The HyperTerminal COM1 session will be used to read the registers of the Digital Temperature Sensor installed on the RDTSB board or read/write the remote GPIOs.

Preliminary LOCAL MODULE set up

```
AT#SELINT=2<CR>
OK
AT#SMSMODE=1<CR>
OK
AT#REGMODE=1<CR>
OK
AT+CMEE=2<CR>
OK
```

local module is not using the Services.

```
AT#SMSATTRUN=0<CR>
OK
AT#TCPATTRUNL=0<CR>
OK
AT#TCPATTRUND=0<CR>
OK
AT#ENAEVMONI=0<CR>
OK
```

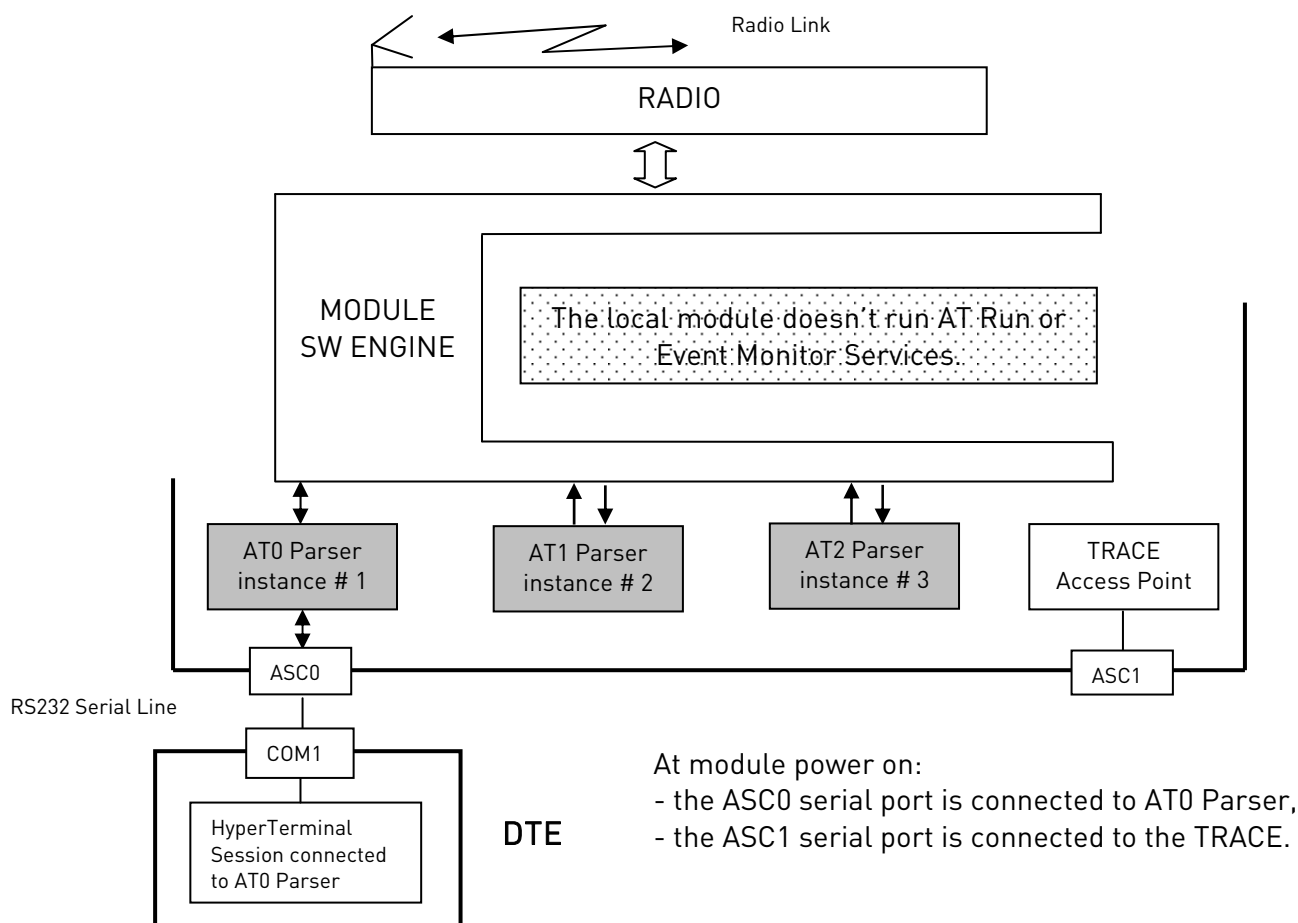


fig. 10: Local Module doesn't run AT Run and Event Monitor Services



AT+CMGF=1<CR>
OK

AT+CNMI=2,1,0,0,0
OK

```
//-----  
AT+CMGS=" +393290569XYZ"<CR>  
>AT#MONI CtrlZ  
+CMGS: 243  
OK
```

+CMTI: "SM",1

$$AT+CMGR=1<CR>$$

+CMGR: "REC UNREAD"

#MONI: I TIM BSIC:21 RxQual:0 LAC:D5BD Id:5265 ARFCN:9 PWR:-89dbm TA: 1

OK

OK

```
//-----  
AT+CMGS="+393290569XYZ"<CR>
```

set up the remote GPIO9 in input mode.

```
>AT#GPIO=9,2,0 CtrlZ
```

+CMGS: 244

OK

+CMTI: "SM",2

$$AT+CMGR=2<CR>$$

display the remote GPIO9 state.

+CMGR: "REC UNREAD"

```
#GPIO: 0.1
```

OK

OK

```
//-----  
AT+CMGS="+393290569XYZ"<CR>
```

get the remote room temperature value.

```
>AT#I2CRD=11.12.50.00.02CtrlZ
```



AT Run and Event Monitor Services Remote Room Temperature Control Application Note

80000nt10043a Rev.0 – 2010-10-13

```
+CMGS: 245
OK
```

The local module operator waits for the response from the remote module.

```
+CMTI: "SM",3
```

unsolicited code indicates that an SMS is received.

```
AT+CMGR=3<CR>
+CMGR: "REC UNREAD" .....
#I2CR: 17C0
OK
OK
```

display the remote room temperature value.

```
//-----
AT+CMGS="+393290569XYZ"<CR>
>AT#I2CRD=11,12,50,01,01CtrlZ
+CMGS: 246
OK
```

get Config Register content

The local module operator waits for the response from the remote module.

```
+CMTI: "SM",4
```

unsolicited code indicates that an SMS is received

```
AT+CMGR=4<CR>
```

display Config Register value.

```
+CMGR: "REC UNREAD", .....
#I2CR: 00
OK
OK
```

```
//-----
AT+CMGS="+393290569XYZ"<CR>
>AT#I2CRD=11,12,50,02,02CtrlZ
+CMGS: 247
OK
```

get low temperature limit (Thyst).

The local module operator waits for the response from the remote module.

```
+CMTI: "SM",5
```

unsolicited code indicates that an SMS is received.

```
AT+CMGR=5<CR>
+CMGR: "REC UNREAD", .....
#I2CR: 1700
OK
OK
```

display low temperature limit (Thyst).



AT Run and Event Monitor Services Remote Room Temperature Control Application Note

80000nt10043a Rev.0 – 2010-10-13

```
//-----
AT+CMGS="+393290569XYZ"<CR>           get high temperature limit (Toti).
>AT#I2CRD=11,12,50,03,02CtrlZ
+CMGS: 248
OK
```

The local module operator waits for the response from the remote module.

+CMTI: "SM",6 unsolicited code indicates that an SMS is received.

```
AT+CMGR=6<CR>                           display high temperature limit (Toti).
+CMGR: "REC UNREAD", .....
#I2CR: 1B00
OK
OK
```

```
//-----
AT+CMGS="+393290569XYZ"<CR>           get heating state (input GPIO9).
>AT#GPIO=9,02CtrlZ
+CMGS: 249
OK
```

The local module operator waits for the response from the remote module.

+CMTI: "SM",7 unsolicited code indicates that an SMS is received.

```
AT+CMGR=7<CR>                           display heating state (input GPIO).
+CMGR: "REC UNREAD", .....
#GPIO: 0,1
OK
OK
//-----
```

This introductory example gives the basic information to:

- develop a suitable software application running on the Local Control Station PC to automatically control the remote room temperature and store its behavior;
- set up the remote module to obtain a stand-alone remote station without DTE and install it in the remote site;
- select the suitable AT Run Service in accordance with the application requirements and AT Run Service capability.



Note: in this configuration all the actions are initiated by the local module, the remote module doesn't take own initiative.



6.2. Event Monitor Service

The example described on the chapter 6.1 shows that all the actions are initiated by the local module. The remote module executes the AT Command received from the local module and sends back the SMS holding the relative result. Using the Event Monitor feature the remote module can send on its initiative the heater state to the local module every time the state goes high (refer to the example on chapter 6.1, GPIO9). In this case the local module doesn't need to send an AT Command to the remote module to read the GPIO associated to the remote heater activity.

This chapter illustrates the set up of the remote module running only the Event Monitor Service, the local module is set up as described on chapter 6.1.

Preliminary DTE/REMOTE MODULE connection set up

Remote module runs the Event Monitor Service, see fig. 11. To set up the DTE/REMOTE MODULE connection follow these steps:

- connect COM1 to ASC0 using an RS 232 straight cable (pins are connected one on one);
- start an HyperTerminal session on DTE.

The HyperTerminal COM1 session will be used to configure the Event Monitor Service and the Digital Temperature Sensor installed on the RDTSB board.

Preliminary REMOTE MODULE set up

```
AT#SELINT=2<CR>
OK
AT#SMSMODE=1<CR>
OK
AT#REGMODE=1<CR>
OK
AT+CMEE=2<CR>
OK
```

Make sure that all Services are disabled

```
AT#SMSATTRUN=0<CR>
OK
AT#TCPATTRUNL=0<CR>
OK
AT#TCPATTRUND=0<CR>
OK
AT#ENAEVMONI=0<CR>
OK
```



AT Run and Event Monitor Services Remote Room Temperature Control Application Note 80000nt10043a Rev.0 – 2010-10-13

Services vs. Instances

In this configuration, the remote module only runs the Event Monitor Service. On Tab. 2 the default relationship between the service and the instance is showed by the shadowed area.

| Services | Instances available for Services | | |
|---------------|----------------------------------|----|----|
| | #1 | #2 | #3 |
| SMS AT Run | / | ☺ | ☺ |
| TCP AT Run | / | ☺ | ☺ |
| Event Monitor | / | ☺ | ☺ |

Tab. 2: Instances vs. Event Monitor Service

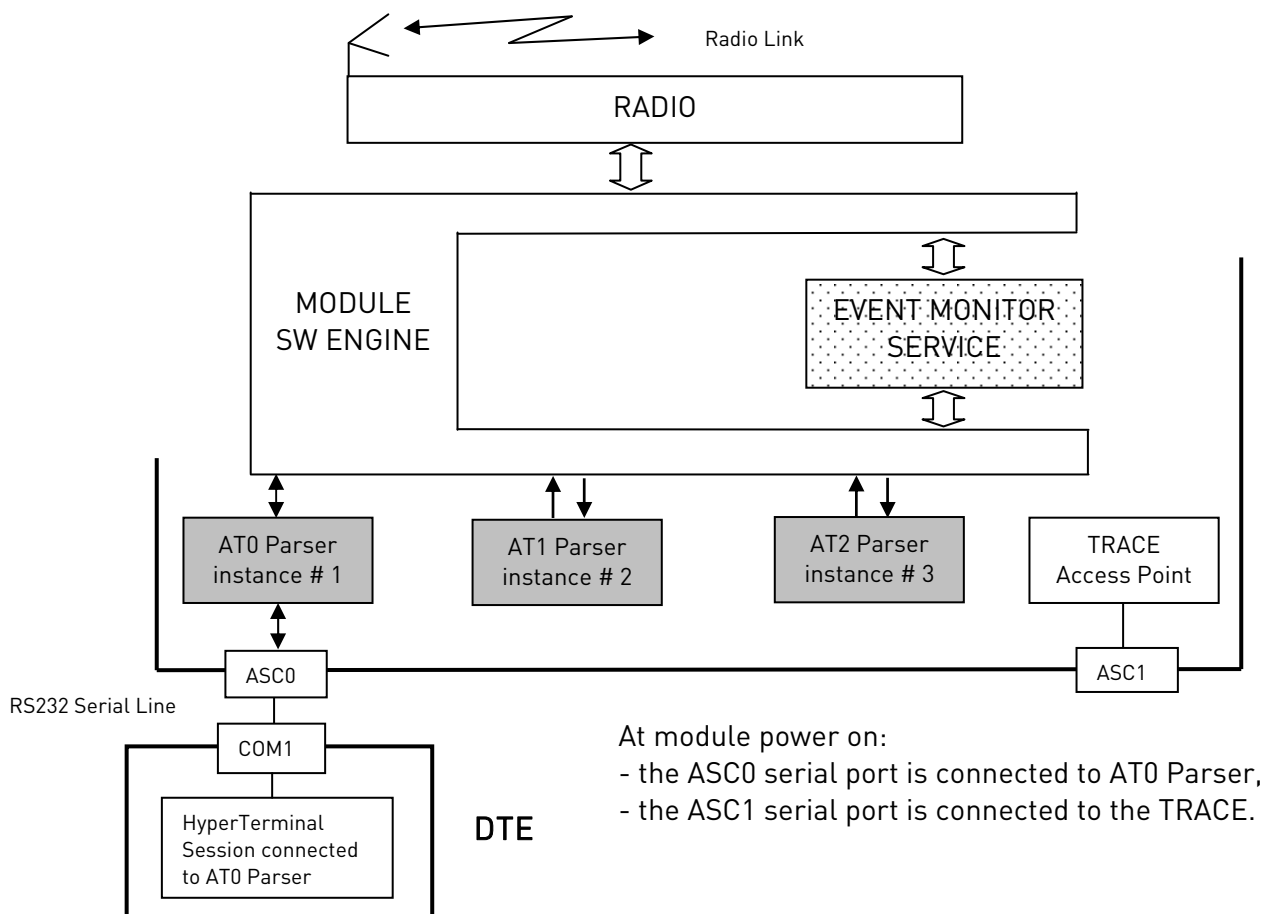


fig. 11: Remote Module running Event Monitor Service



AT Run and Event Monitor Services Remote Room Temperature Control Application Note 80000nt10043a Rev.0 – 2010-10-13

Event Monitor Service configuration

AT#ENAEVMONICFG=3,1,5<CR>
OK

set up Event Monitor Service, instance # 3 is assigned to Event Monitor Service, fig. 11.

AT#EVMONI="GPIO1",0,1,9<CR>
OK

GPIO9 is connected to GPIO1 label.

AT#EVMONI="GPIO1",0,2,1<CR>
OK

GPIO9 = HIGH starts the action.

AT#EVMONI="GPIO1",0,3,5<CR>
OK

time interval (sec) after GPIO9 is gone HIGH the AT Command is sent.

Connect "GPIO1" label with the dispatch of an SMS message and force in SMS text mode the instance #3, fig. 11. The AT Commands managed by the Event Monitor Service are analyzed by the AT2 Parser (instance # 3), in accordance with the analyses results the AT Commands are executed by the remote module:

AT#EVMONI="GPIO1",0,0,"AT+CMGF=1;#CMGS=+393468686XYZ,\22HEATER ON\22"
OK

AT#EVMONI="GPIO1",1
OK

enable the single "GPIO1" Event.

AT#ENAEVMONI=1
OK

enable the Event Monitor Service.

Yet, if the GPIO9 is high or when it goes high, the remote module sends to the local module the configured SMS message.

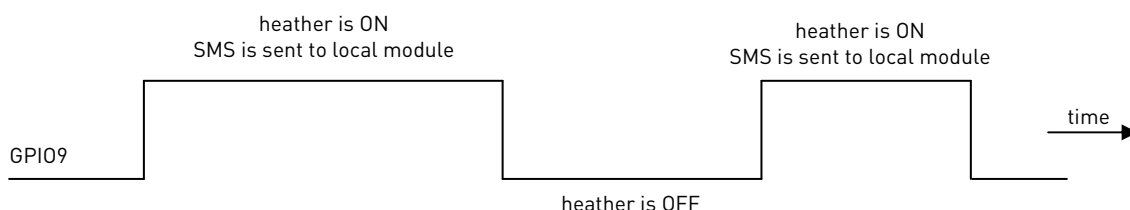


fig. 12: Heater State (GPIO9)



6.3. TCP AT Run Service

This paragraph focuses the attention on the RDTSB board control performed by means of the TCP AT Run Service running on remote module. The fig. 13 shows the configuration target that must be reached to accomplish a remote control. This introductory example assumes that the local module and the remote module are located on the same site (LAB) and the AT Commands are entered by the user through two DTE equipments.

It is assumed that the user enters the AT Commands and waits for the responses from the remote module. This approach permits to clearly show the procedure used to accomplish the remote temperature control.

Preliminary DTE/REMOTE MODULE connection set up

The remote module runs the TCP AT Run Service to execute the AT Commands sent by the local module, see fig. 14. To set up the DTE/REMOTE MODULE connection follow these steps:

- connect COM1 to ASC0 using an RS 232 straight cable (pins are connected one on one);
- start an HyperTerminal session on DTE.

The HyperTerminal COM1 session will be used to configure the TCP AT Run.

Preliminary REMOTE MODULE set up

```
AT#SELINT=2<CR>
OK
AT#SMSMODE=1<CR>
OK
AT#REGMODE=1<CR>
OK
AT+CMEE=2<CR>
OK
```

Make sure that all Services are disabled

```
AT#SMSATTRUN=0<CR>
OK
AT#TCPATTRUNL=0<CR>
OK
AT#TCPATTRUND=0<CR>
OK
AT#ENAEVMONI=0<CR>
OK
```



AI Run and Event Monitor Services Remote Room Temperature Control Application Note
80000nt10043a Rev.0 – 2010-10-13

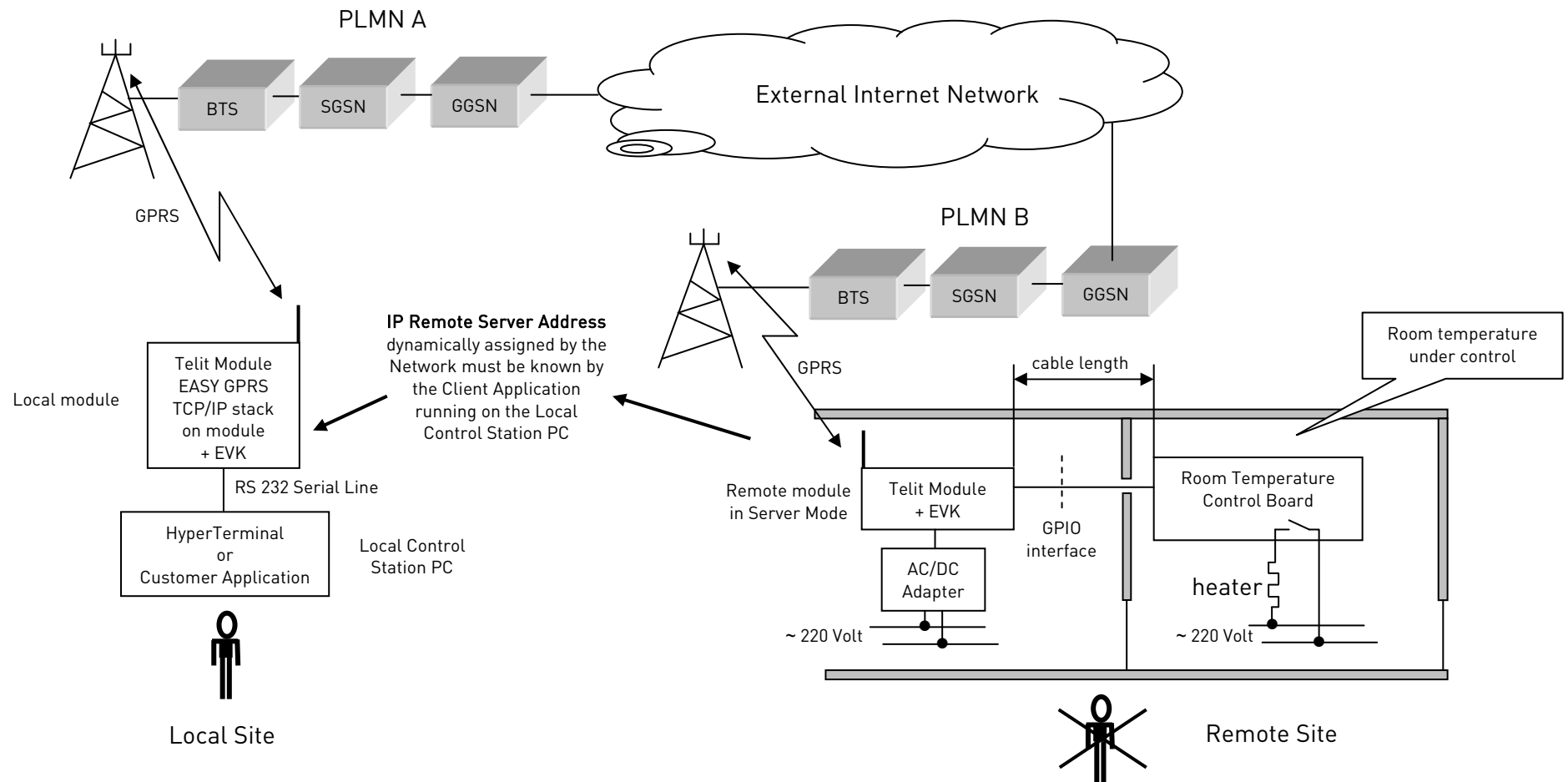


fig. 13: RDTSB board & TCP AT Run Service

Services vs. Instances

In this configuration the remote module only runs TCP AT Run Service. On Tab. 3 the default relationship between service and instance is showed by the shadowed area.

| Services | Instances available for Services | | |
|---------------|----------------------------------|----|----|
| | #1 | #2 | #3 |
| SMS AT Run | / | ☺ | ☺ |
| TCP AT Run | / | ☺ | ☺ |
| Event Monitor | / | ☺ | ☺ |

Tab. 3: Instances vs. TCP AT Run Service

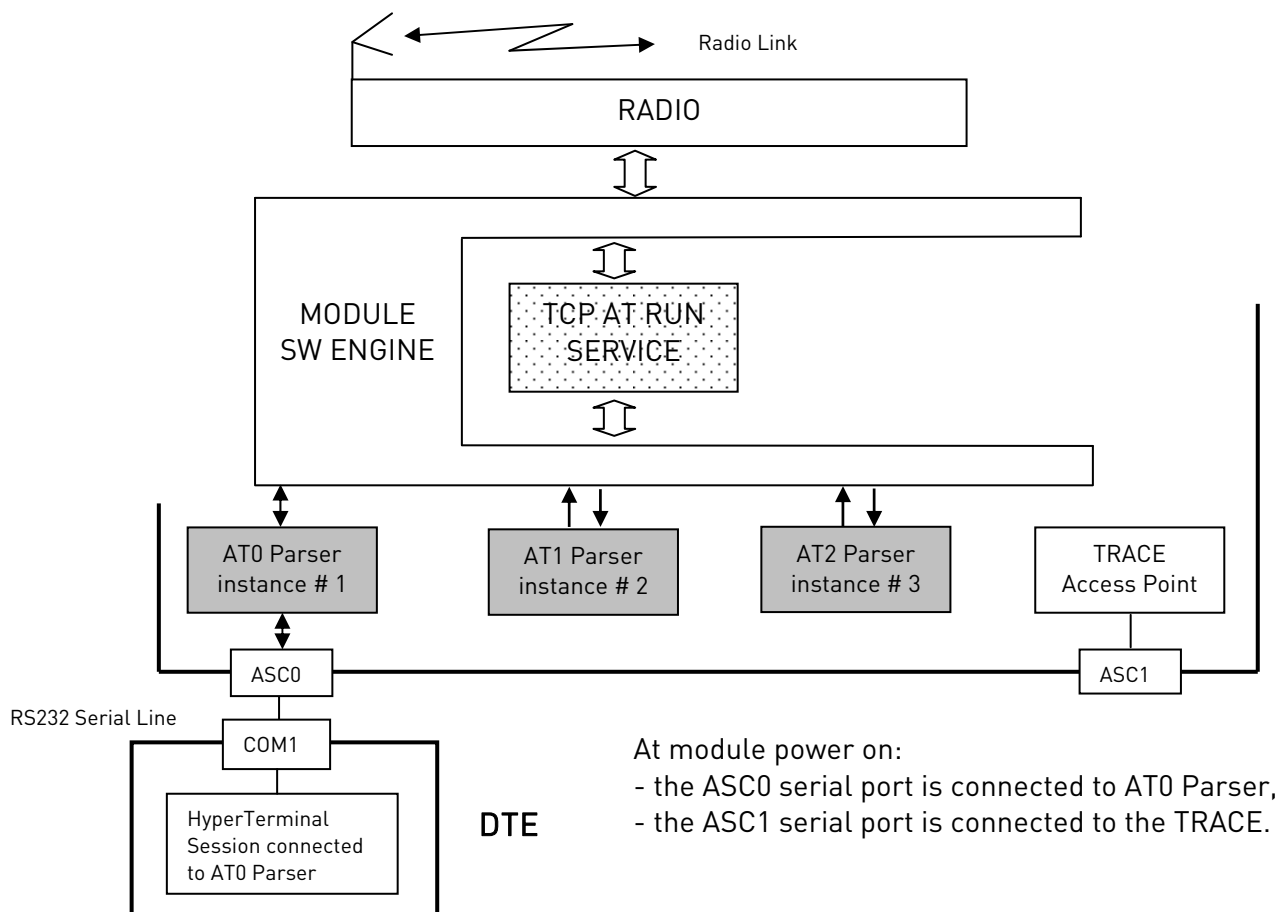


fig. 14: Remote Module running TCP AT Run Service



TCP AT Run Service in Server Mode configuration

```
AT+CGATT?<CR>
+CGATT:1
OK
```

check if the remote module is GPRS attached,
it is attached.

AT+CGDCONT=1,"IP","IBOX.TIM.IT"<CR>
OK

set up PDP Context definition.



Warning: the IP Remote Server Address is dynamically assigned by the Network Operator and it must be known by the local module.

```
AT#SGACT=1,1<CR>
#SGACT: 217.203.146.115
OK
```

PDP activation,
IP address assigned by the Network.

AT#SCFG=1,1,300,0,600,1<CR>
OK

socket configuration



Warning: the remote TCP port must be known by the local module.

The AT Command sent by the local module is received by the remote module, fig. 14. The AT1 Parser (instance # 2) analyzes it and in accordance with the analyses result the AT Command is executed by the remote module, the result is sent back to the local module.

AT#TCPATRUNCFG=1,2,1024,12345,"",1,5,1,5,2<CR>
OK

```
R> TCP AT Run Service configuration,
instance # 2 is assigned to TCP AT Run Service.
```

AT#TCPATRUNFRWL=2<CR>
OK

drop the old firewall configuration.

AT#TCPATRUNFRWL=1,"000.000.000.000","000.000.000.000"<CR>
OK

set up new firewall configuration.

AT#TCPATRUNAUTH=2<CR>
OK

drop old authentication parameters.

```
AT#TCPATRUNAUTH=1,"TESTUSER","TESTPASSW"<CR> set up new authentication parameters.
OK
```

AT#TCPATRNL=1<CR>
OK

enable TCP AT Run service in Server mode.




```
AT#SS<CR>
#SS: 1,4, 217.203.146.115,1024
#SS: 2,0
#SS: 3,0
#SS: 4,0
#SS: 5,0
#SS: 6,0
OK
```

check the Socket Status

Yet, the remote module is running the TCP AT Run Service in Server (Listen) mode, it is waiting for AT Commands from the local module in order to execute them and send back the relative results.

Preliminary DTE/LOCAL MODULE connection set up

Refer to fig. 10: the local module doesn't run AT Run or Event Monitor Services. To set up the DTE/LOCAL MODULE connection follow these steps:

- connect COM1 to ASC0 using an RS 232 straight cable (pins are connected one on one);
- start an HyperTerminal session on DTE.

The HyperTerminal COM1 session will be used to read/write the registers of the Digital Temperature Sensor installed on the RDTSB board or read/write the remote GPIOs.

Preliminary local module set up

local module is not using the Services.

```
AT#SELINT=2<CR>
OK
AT#SMSMODE=1<CR>
OK
AT#REGMODE=1<CR>
OK
AT+CMEE=2<CR>
OK
```

```
AT#SMSATTRUN=0<CR>
OK
AT#TCPATTRUNL=0<CR>
OK
AT#TCPATTRUND=0<CR>
OK
AT#ENAEVMONI=0<CR>
OK
```

Open a TCP connection

```
AT+CGATT?<CR>
```

check if the Remote module is attached,



| | |
|---|---|
| +CGATT:1 OK | it is attached. |
| AT+CGDCONT=1,"IP","WEB.OMNITEL.IT"<CR> OK | PDP Context definition. |
| AT#SGACTAUTH?<CR> #SGACTAUTH: 1 OK | check authentication, PAP authentication (factory default) |
| AT#SCFG=1,1,300,0,600,1<CR> OK | socket configuration. |
| AT#SCFGEXT=1,2,0,0,0,0<CR> OK | extended socket configuration. |
| AT#SGACT=1,1<CR> #SGACT: 109.113.46.58 OK | PDP activation, IP address assigned by the Network. |

Yet, the local module is able to open the connection by means of the configured socket:



Warning: the IP Remote Server Address and remote TCP port must be known.

AT#SD=1,0,1024,217.203.146.115,255,1,0<CR> open the connection

yet, on the DTE is displayed:

| | |
|-------------------|--|
| CONNECT | unsolicited message |
| Username: | message from remote module |
| TESTUSER<CR> | entered by the user, characters are not echoed |
| Password: | message from remote module |
| TESTPASSW<CR> | entered by the user, characters are not echoed |
| Login successful. | message from remote module |

Yet, the local module is in ON Line Mode, it is connected to the remote module running the TCP AT Run Service in Server (Listen) mode, fig. 14. The AT Commands characters entered by the user are echoed on the local DTE by the remote module (instance # 2). The AT Commands are executed by the remote module and their results are sent back to the local module.



ATE1<CR>
OK

enable echo on the instance # 2 of the remote module,
fig. 14.



Remote Digital Temperature Sensor configuration

| | |
|---|--|
| AT#I2CWR=11,12,50,02,02<CR> >1700CtrlZ OK | set up low temperature limit (Thyst) 0x1700 = 23°C |
| AT#I2CWR=11,12,50,03,02<CR> >1B00CtrlZ OK | set up high temperature limit (Toti) 0x1B00 = 27°C |
| AT#GPIO=9,2,0<CR> #GPIO: 0,1 OK | set up the remote GPIO 9 in input mode and display heating state. |

Remote room temperature monitoring

| | |
|--|---|
| get the remote temperature and display it. AT#I2CRD=11,12,50,00,02<CR> #I2CR: 1700 OK | get heating state (input GPIO9) and display it. AT#GPIO=9,02<CR> #GPIO: 0,1 OK |
|--|---|

Exit ON Line Mode

When the user needs to send AT Commands to the local module, the module must exit ON Line Mode and enter Command Mode. To accomplish this action the user must enter the following escape sequence:

| | |
|------------------------|------------------------------|
| +++ ⁴ OK | escape sequence without <CR> |
|------------------------|------------------------------|

Yet, the local module is in Command Mode, the TCP connection with the remote module is still active, but the DTE is not more connected to the used TCP/IP socket. DTE can be used to enter AT Commands addressed to the local module.

Exit Command Mode

If the user needs to modify the configuration of the remote RDTSB board or read the remote temperature room, the ON Line Mode must be entered again.

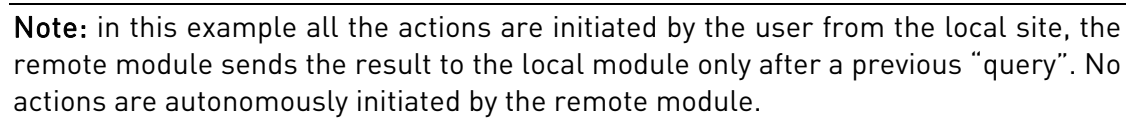
AT#SO=1<CR>
CONNECT

⁴ The remote connection must be open with the AT#SD Command using the <closureType> = 255, [4]



Disconnect

```
AT#SH=1                                disconnect the connection with the remote module.
OK
```



6.4. TCP AT Run & Event Monitor Services

In the last paragraph an introductory example illustrating the use of the TCP AT Run Service was considered. In this paragraph the description is extended to the jointed use of two services on the remote module: TCP AT Run (in Server⁵ mode) and Event Monitor Services.

The combined use of the two services on the remote module, allows the user to read/write the Digital Temperature Sensor registers installed on the RDTSB board and in addition, when the user doesn't need to read the remote room temperature value, the local module can be forced to exit the ON Line Mode, enter the Command Mode and check if some SMS messages are arrived from the remote module to detect if some configured events are happened. In fact, the remote module can send an SMS message in order to communicate that an event is occurred, e.g.: the heater is on.

With the support of the Telit Serial Port MUX application installed on the DTE⁶ connected to the local module it is possible to dedicate an HyperTerminal session to the ON Line Mode, a second HyperTerminal session to the Command Mode and a third HyperTerminal session to the reception of the SMS messages sent by the remote module.

Hereafter is following the set up procedure of the REMOTE and LOCAL MODULES.

Preliminary DTE/REMOTE MODULE connection set up

Remote module must run, at the same time, two services: the TCP AT Run Service to execute the AT Commands sent by the local module and the Event Monitor Service to send an SMS message when a configured event is occurred, see fig. 15. To set up the DTE/REMOTE MODULE connection follow these steps:

- connect COM1 to ASC0 using an RS 232 straight cable (pins are connected one on one);
- start an HyperTerminal session on DTE.

The HyperTerminal COM1 session will be used to configure the TCP AT Run and Event Monitor services.

⁵ Server mode or Listen mode.

⁶ PC running Windows.



Preliminary remote module set up

```
AT#SELINT=2<CR>
OK
AT#SMSMODE=1<CR>
OK
AT#REGMODE=1<CR>
OK
AT+CMEE=2<CR>
OK
```

Make sure that all Services are disabled

```
AT#SMSATTRUN=0<CR>
OK
AT#TCPATTRUNL=0<CR>
OK
AT#TCPATTRUND=0<CR>
OK
AT#ENAEVMONI=0<CR>
OK
```

Services vs. Instances

In this configuration the remote module runs two services at the same time: TCP AT Run and Event Monitor, see fig. 15. On Tab. 4 the relationships between services and instances are showed by the shadowed areas.

| Services | Instances available for Services | | |
|---------------|----------------------------------|----|----|
| | #1 | #2 | #3 |
| SMS AT Run | / | ☺ | ☺ |
| TCP AT Run | / | ☺ | ☺ |
| Event Monitor | / | ☺ | ☺ |

Tab. 4: Combined Services & Instances

Event Monitor Service configuration

Refer to chapter 6.2.

TCP AT Run Service in Server Mode configuration

Refer to chapter 6.3.



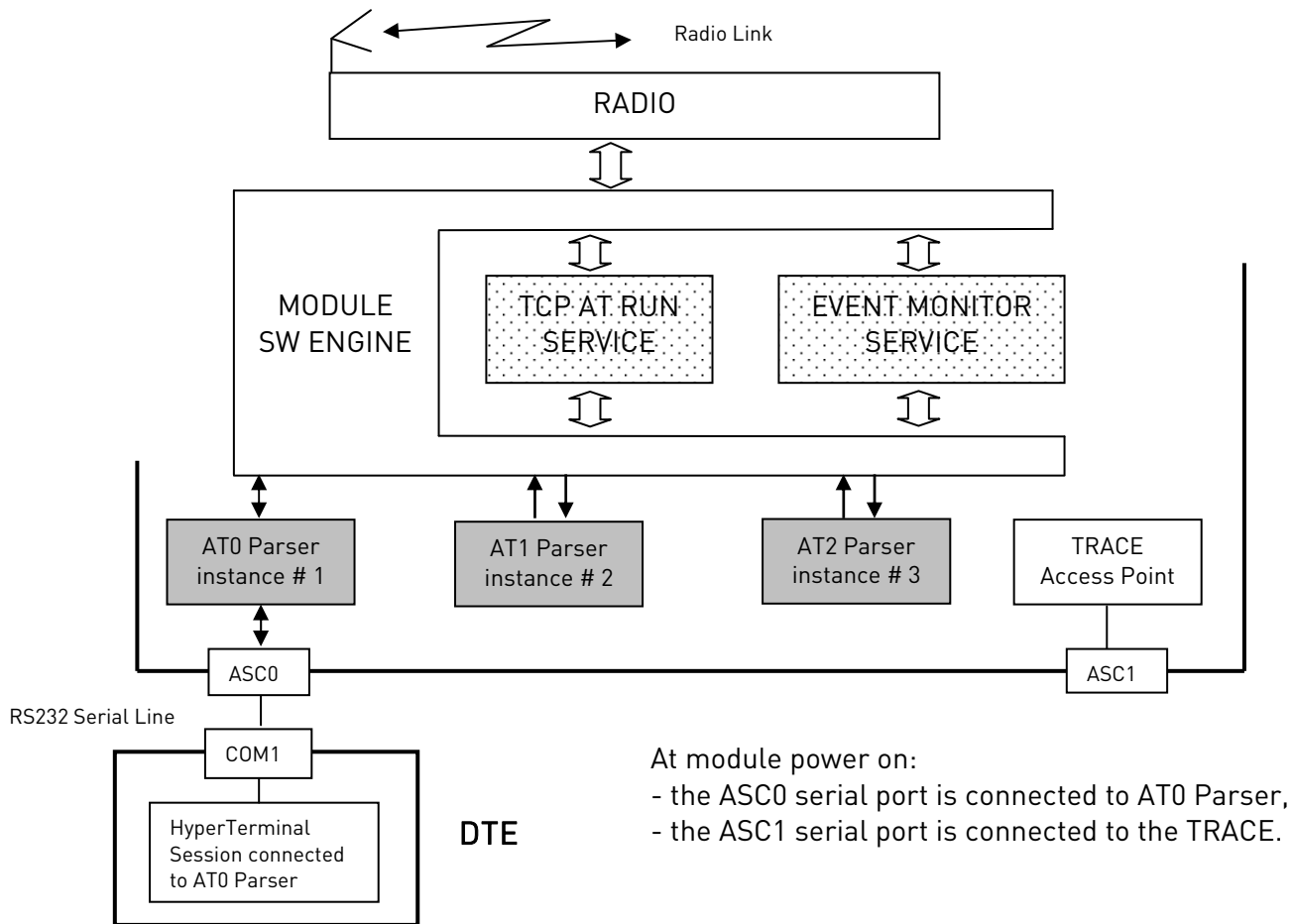


fig. 15: Combined Services on Remote Module

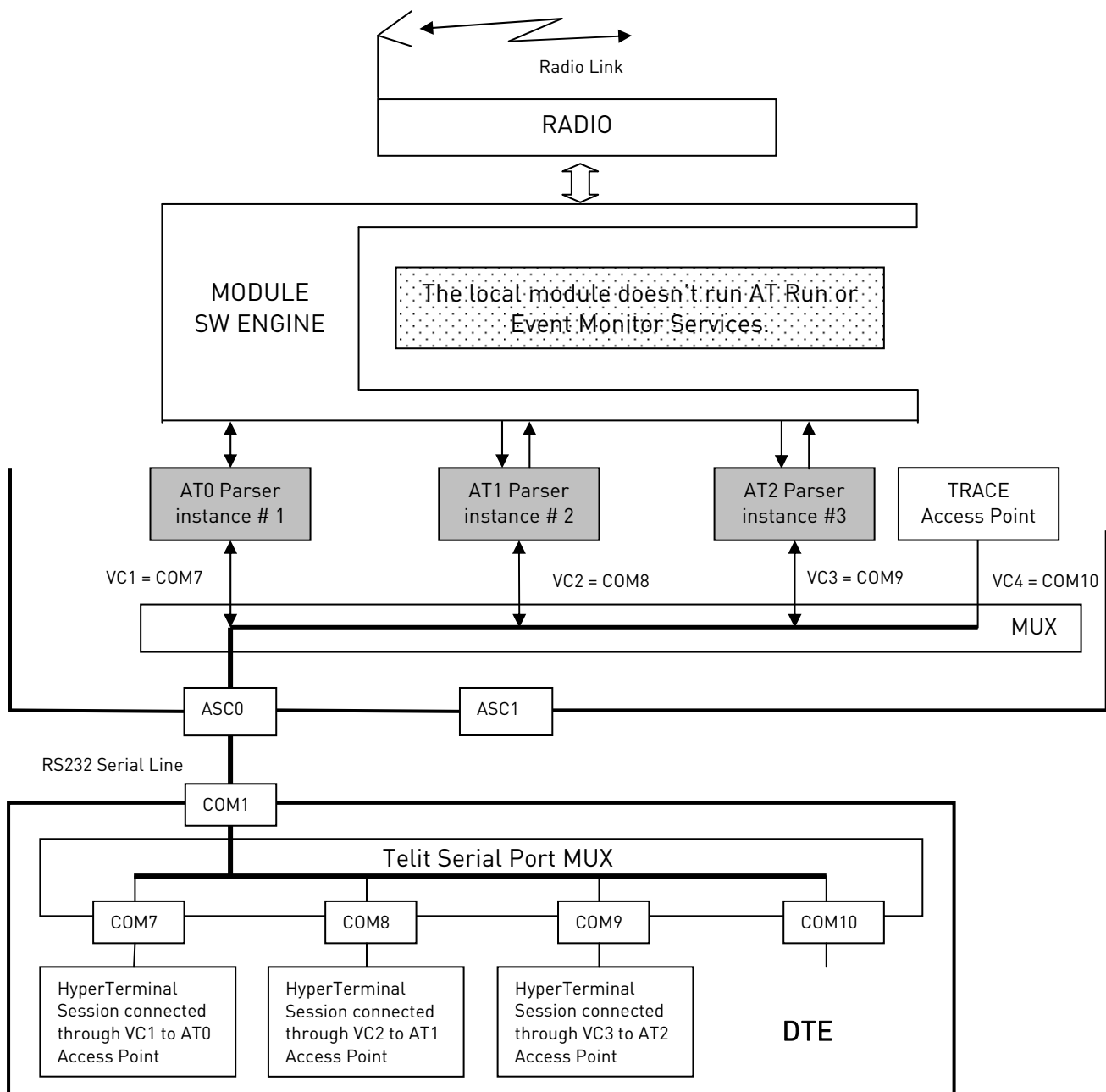
Preliminary DTE/LOCAL MODULE connection set up

At the same time, the local module must manage: the TCP connection to the remote module in order to write/read the remote Digital Temperature Sensor registers and display on DTE the received SMS messages indicating the remote heater status. The SMSs are sent by the remote module using the Event Monitor Service. Follow these steps, see fig. 16:

- load and run on DTE⁷ the Telit Serial Port MUX application;
- connect COM1 to ASC0 using an RS 232 straight cable (pins are connected one on one);
- ran three HyperTerminal sessions: the first one connected to COM7⁸, the second one connected to COM8, the last one connected to COM9.

⁷ PC running Windows.





At module power on, when the Telit Serial Port MUX application is running on the connected DTE, the internal module control establish the following connection:

VC1/COM7/AT0 (instance#1); VC2/COM8/AT1 (instance#2); VC3/COM9/AT2 (instance#3);
VC4/COM10/TRACE.

fig. 16: Telit Serial Port MUX on Local Module.

⁸ COM number is function of the DTE configuration.



AT Run and Event Monitor Services Remote Room Temperature Control Application Note 80000nt10043a Rev.0 – 2010-10-13

The HyperTerminal COM7 (hereafter called HTC7) will be used to manage the TCP remote connection.

The HyperTerminal COM8 (HTC8) will be used to enter AT Commands to the local module.

The HyperTerminal COM9 (HTC9) will be used to display the SMSs sent by the remote module.

Preliminary LOCAL MODULE set up, use HTC7 session

| | |
|--|---|
| AT#SELINT=2<CR> | local module is not using the Services. |
| OK | AT#SMSATRUN=0<CR> |
| AT#SMSMODE=1<CR> | OK |
| OK | AT#TCPATRNL=0<CR> |
| AT#REGMODE=1<CR> | OK |
| OK | AT#TCPATRUND=0<CR> |
| active only on instance #1/HTC7 session. | OK |
| AT+CMEE=2<CR> | AT#ENAEVMONI=0<CR> |
| OK | OK |

Open a TCP connection, use HTC7 session

Refer to chapter 6.3.

Yet, the local module is in ON Line Mode, it is connected to the remote module. The AT Commands characters entered by the user are echoed on the local HTC7 session by the remote module (instance # 2) then, the AT Commands are executed by the remote module and their results are sent back to the local module on HTC7 session.

| | |
|----------|---|
| ATE1<CR> | enable echo on the instance # 2 of the remote module. |
| OK | |

Remote Digital Temperature Sensor configuration, use HTC7 session

Refer to chapter 6.3.

Remote room temperature monitoring, use HTC7 session

Refer to chapter 6.3.



disable New Message Indications on HTC8 session.



+++⁹
OK

escape sequence without <CR>

Yet, the local module is in Command Mode, the TCP connection with the remote module is still active, but the HTC7 session is not more connected to the used socket, it can be used to enter AT Commands for the local module.

Exit Command Mode, use HTC7 session

If the user needs to modify the configuration of the remote RDTSB board or read the remote temperature room, the ON Line Mode must be entered again.

AT#SO=1<CR>
CONNECT

Yet, the operator can read/write registers of the remote RDTSB board.

Disconnect, use HTC7 session

Let's suppose that the module is in Command Mode, to disconnect the connection with the remote module the user must enter the following command:

AT#SH=1
OK

disconnect the connection with the remote module.

⁹ The remote connection must be open with the AT#SD Command using the <closureType> = 255, [4]



7. Appendix: RRTC Application

The objective of this chapter is to provide the reader with the description of a simple demo application of the TCP AT Run and Event Monitor services. The simple application is the Remote Room Temperature Control introduced by chapter 6. To accomplish it a Remote Digital Temperature Sensor Board is needed. Refer to Telit Download Zone to download the DEMO software package and the schematic of the RDTSB board.

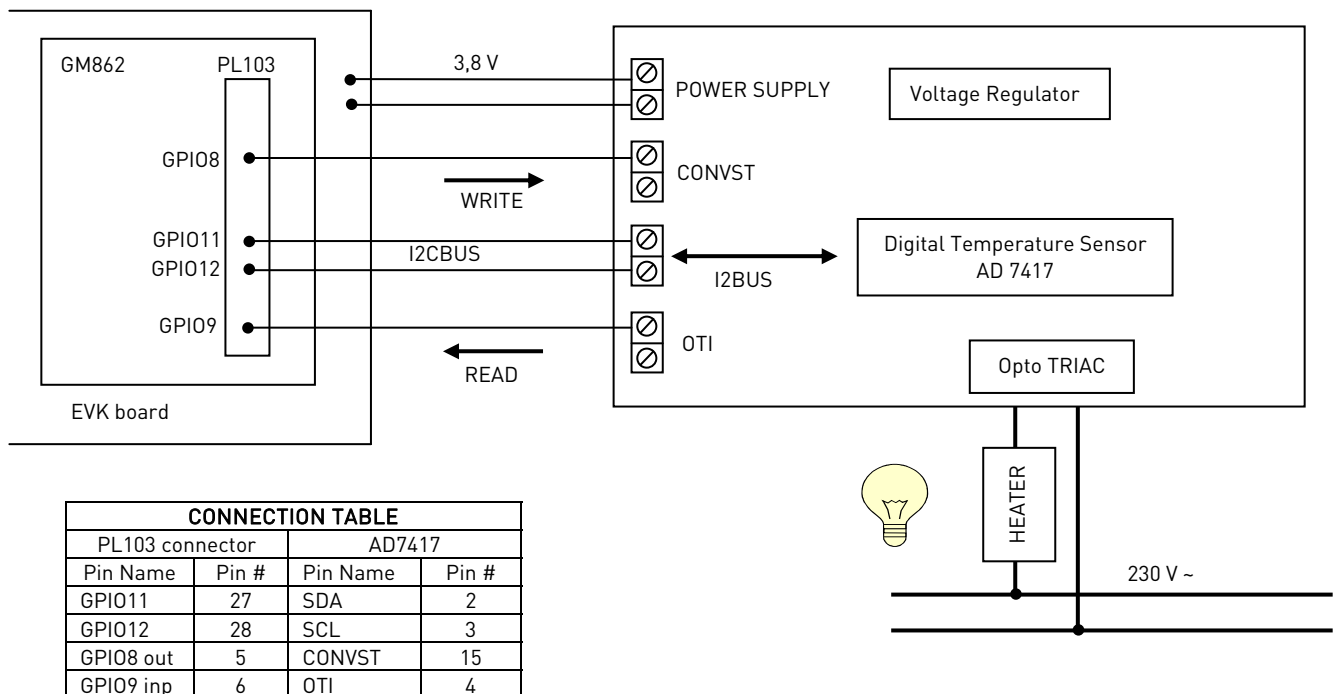


fig. 17: Remote Digital Temperature Sensor Board

For demo purposes the heater is substituted by a light bulb just to create some thing like to the room temperature changes. When the light bulb is on the temperature value goes high, the digital temperature sensor - when the high temperature limit is reached - turns the light bulb off. When the temperature reaches the low limit value, the digital temperature sensor turn the light bulb on ... and so on. The temperature behavior and the light bulb state are monitored and stored by the local module. Refer to paragraph 7.3 to glance at some RDTSB board photos.



7.1. First Demo Hardware Configuration

The “First Demo Hardware Configuration” is showed in detail on fig. 18, it can be used to carry out the architecture showed on fig. 13. For practical arrangement in the LAB, only one PC is used to manage both local and remote Telit modules.

On the LAB PC run the following applications, refer to fig. 18:

TelitSerialPortMUX: creates four virtual ports (e.g. : COM7 ÷ COM10), consequently four application can use at the same time the physical port COM1.

TelitActiveObj: the generic VBScript can access by means of the TelitActiveObj the virtual or physical serial ports and also the TCP/IP stack.

RTMCOM.VBS: opens the connection towards the remote module, sets up the Remote Digital Temperature Sensor Board and monitor the remote room temperature. It is connected to TelitActiveObj instance # 1, virtual port COM7, AT0 Parser instance # 1.

EVMONRX.VBS: receives the SMS messages sent by the Event Monitor Service running on the remote module. It is connected to TelitActiveObj instance # 3, virtual port COM9, AT2 Parser instance # 3.

REMOTE.VBS: enables on the remote module TCP AT Run and Event Monitor Services. It is connected to TelitActiveObj instance # 2, physical port COM2, AT0 Parser instance # 1.

The following pages show how the above mentioned applications announces themselves; the user, before starting the applications, can change the configuration parameters. In addition, are also showed the applications windows during the running.



AI Run and Event Monitor Services Remote Room Temperature Control Application Note 80000nt10043a Rev.0 – 2010-10-13

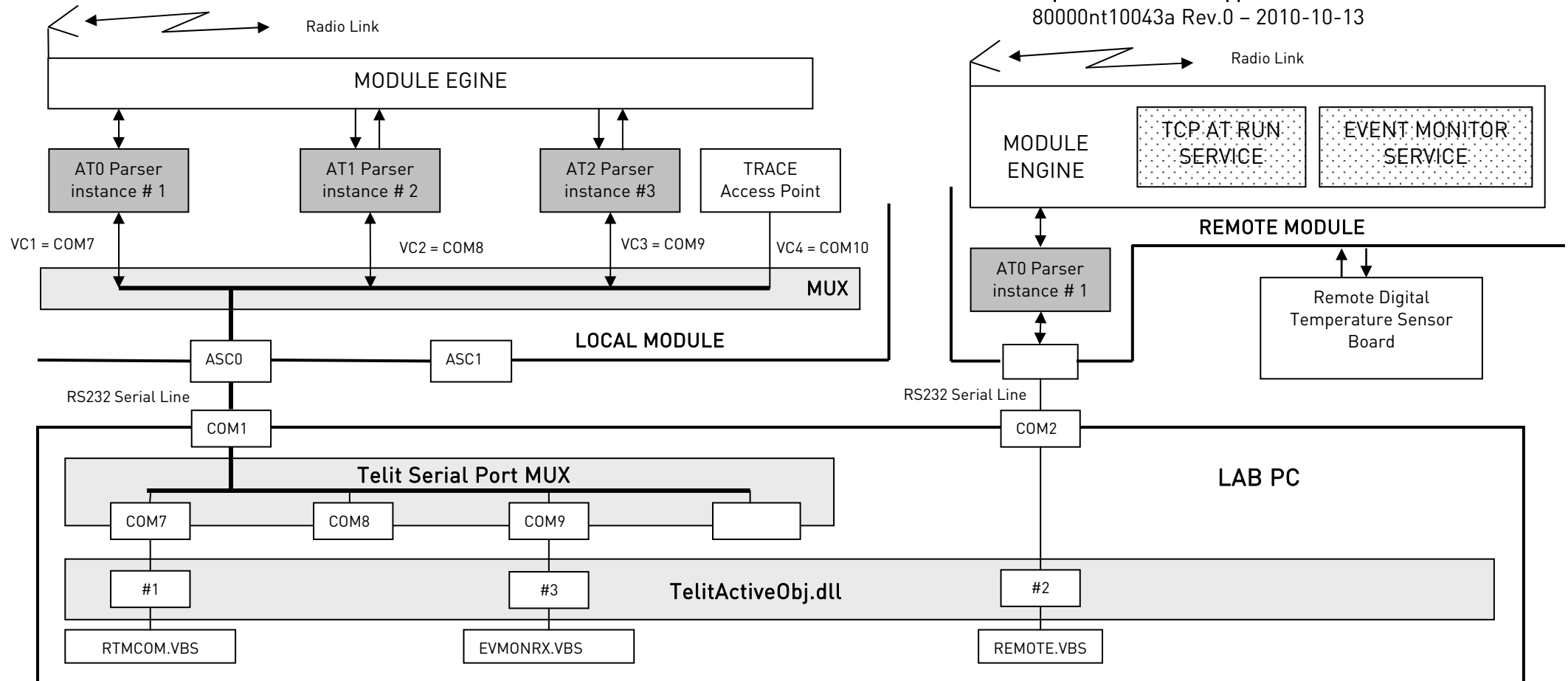
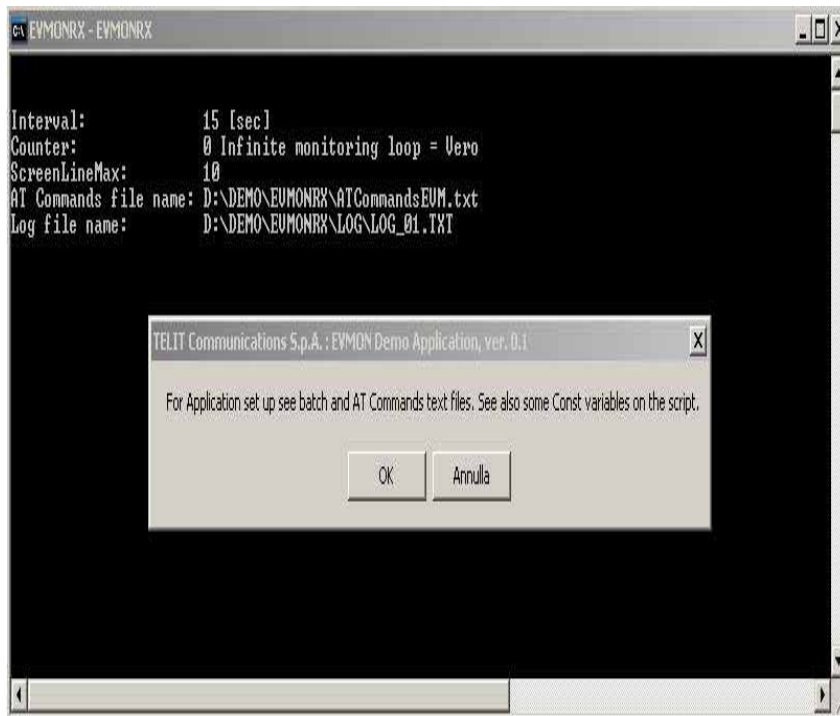


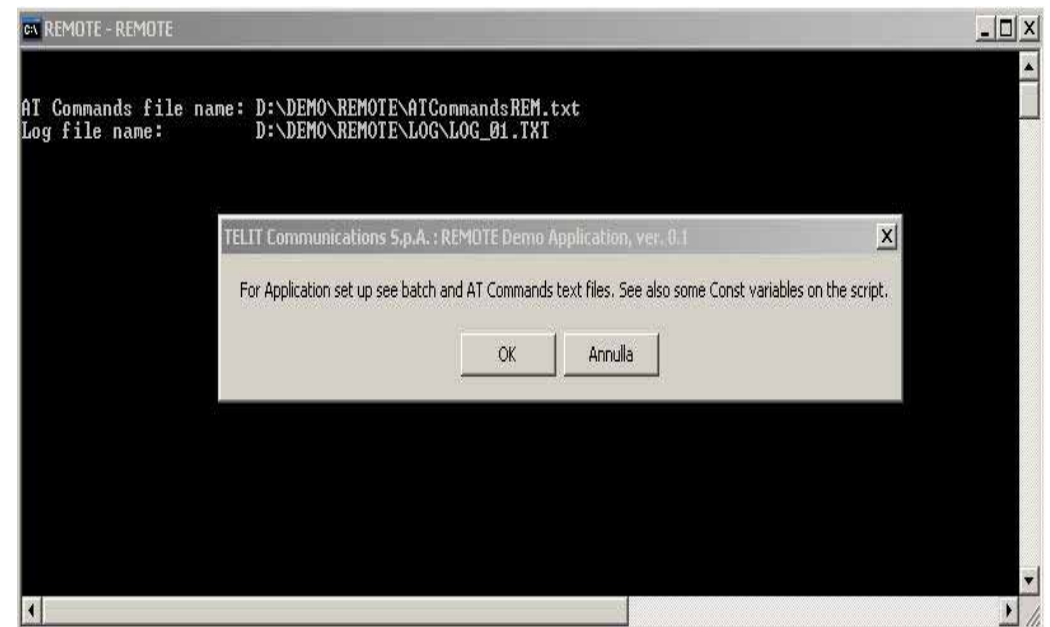
fig. 18: First Configuration Details



AT Run and Event Monitor Services Remote Room Temperature Control Application Note 80000nt10043a Rev.0 – 2010-10-13



EVMONRX window. Push OK button if the configuration parameters are accepted. Otherwise change them following the indications.



REMOTE window. Push OK button if the configuration parameters are accepted. Otherwise change them following the indications.



```

C:\ RTMCOM - RTMCOM
Successfully executed !!!

=====NO MORE SECTIONS TO READ=====

+++++ START REMOTE TEMPERATURE MONITORING +++++

  DATE      TIME      TEMPERATURE [°C]  LOW LIMIT [°C]  HIGH LIMIT [°C]  HEATER STATE
17/03/2010   12.05.16         33,00           35,00           45,00           ON
17/03/2010   12.05.35         35,25           35,00           45,00           ON
17/03/2010   12.05.54         37,25           35,00           45,00           ON
17/03/2010   12.06.14         39,00           35,00           45,00           ON
17/03/2010   12.06.34         40,75           35,00           45,00           ON
17/03/2010   12.06.54         42,00           35,00           45,00           ON
17/03/2010   12.07.13         43,25           35,00           45,00           ON
17/03/2010   12.07.33         44,50           35,00           45,00           ON
17/03/2010   12.07.53         41,00           35,00           45,00           OFF
17/03/2010   12.08.14         37,75           35,00           45,00           OFF
17/03/2010   12.08.34         36,00           35,00           45,00           OFF
17/03/2010   12.09.08         39,75           35,00           45,00           ON
!
  
```

From the above window it is possible to evict that the RTMCOM application reads periodically the remote room temperature, when the light bulb is on the heater state is marked on. In addition, the collected remote information is stored on a log file.



AI Run and Event Monitor Services Remote Room Temperature Control Application Note 80000nt10043a Rev.0 – 2010-10-13

```

C:\> EVMONRX - EVMONRX
***** START REMOTE EVENT MONITOR SMS's MONITORING *****

  DATE      TIME      REMOTE SMS      AUXILIARY INFO.
17/03/2010  12.05.49  ..... LOCAL STATUS: WAITING
17/03/2010  12.06.04  ..... LOCAL STATUS: WAITING
17/03/2010  12.06.20  ..... LOCAL STATUS: WAITING
17/03/2010  12.06.35  ..... LOCAL STATUS: WAITING
17/03/2010  12.06.50  ..... LOCAL STATUS: WAITING
17/03/2010  12.07.05  ..... LOCAL STATUS: WAITING
17/03/2010  12.07.21  ..... LOCAL STATUS: WAITING
17/03/2010  12.07.36  ..... LOCAL STATUS: WAITING
17/03/2010  12.07.51  ..... LOCAL STATUS: WAITING
17/03/2010  12.08.06  ..... LOCAL STATUS: WAITING

  DATE      TIME      REMOTE SMS      AUXILIARY INFO.
17/03/2010  12.08.22  ..... LOCAL STATUS: WAITING
17/03/2010  12.08.37  ..... LOCAL STATUS: WAITING
17/03/2010  12.08.52  ..... LOCAL STATUS: WAITING
17/03/2010  12.09.03  <HEATER IS ON> SMS # 1 Successfully DEL
/
  
```

The above window shows that the EVMONRX application receives the Event Monitor SMS's when the light bulb is turned on. In addition, the received SMS's are stored on a log file.





```

C:\ REMOTE - REMOTE

AT Commands file name: D:\DEMO\REMOTE\ATCommandsREM.txt
Log file name:       D:\DEMO\REMOTE\LOG\LOG_01.TXT

=====EXECUTE AT COMMANDS OF SECTION 1=====

Assigned Remote IP address: 217.203.84.55
Successfully executed !!!

=====NO MORE SECTIONS TO READ=====

+++++++ DISPLAY CONNECTION STATUS AND EVENT MONITOR ACTIVITY ++++++++

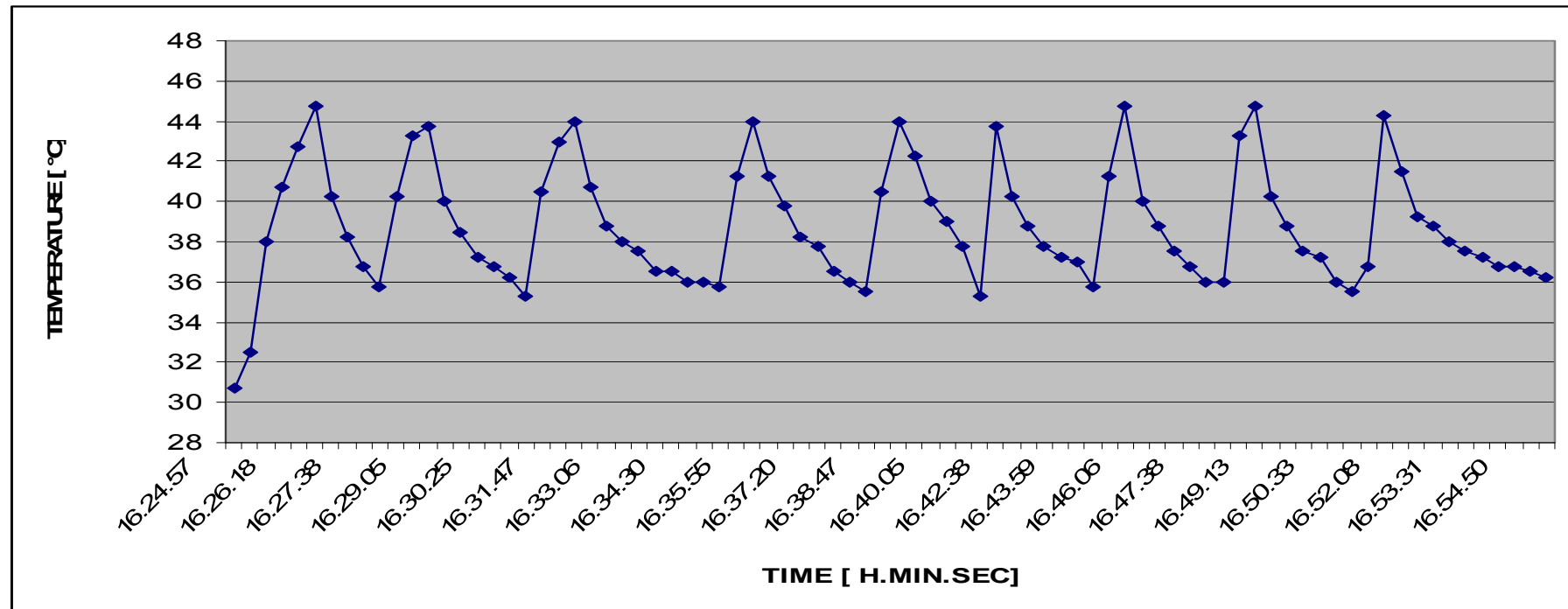
#EUMONI: AT+CMGF=1;#CMGS=+393351510141,"<HEATER IS ON>"
TCPATRUN: <217.201.202.49>
#EUMONI: AT+CMGF=1;#CMGS=+393351510141,"<HEATER IS ON>"
/
  
```

The above window shows that the REMOTE application displays on the screen the remote IP address assigned by the network. When the local module accomplishes successfully the connection, on the screen is displayed the local IP address. In addition, when a Event Monitor SMS is sent, its contents is showed on the screen.



AI Run and Event Monitor Services Remote Room Temperature Control Application Note

80000nt10043a Rev.0 – 2010-10-13



Temperature values collected by the RTMCOM application and stored into a log file, it is possible arrange them into the above graph.



7.2. Second Demo Hardware Configuration

The “Second Demo Hardware Configuration” is showed in detail on fig. 19, it can be used to carry out the architecture showed on fig. 4. For practical arrangement in the LAB, only one PC is used to manage the TCP/IP connection to the Internet Network and the remote Telit module.

On the LAB PC run the following applications, refer to fig. 19:

TelitActiveObj: the generic VBScript can access by means of the TelitActiveObj the virtual or physical serial ports and also the TCP/IP stack.

RTMNET.VBS: opens the connection towards the remote module, sets up the Remote Digital Temperature Sensor Board and monitor the remote room temperature. It is connected to TelitActiveObj instance # 4, ETH port.

REMOTE.VBS: enables on the remote module TCP AT Run and Event Monitor Services. It is connected to TelitActiveObj instance # 2, physical port COM2, AT0 Parser instance # 1.



AI Run and Event Monitor Services Remote Room Temperature Control Application Note
80000nt10043a Rev.0 – 2010-10-13

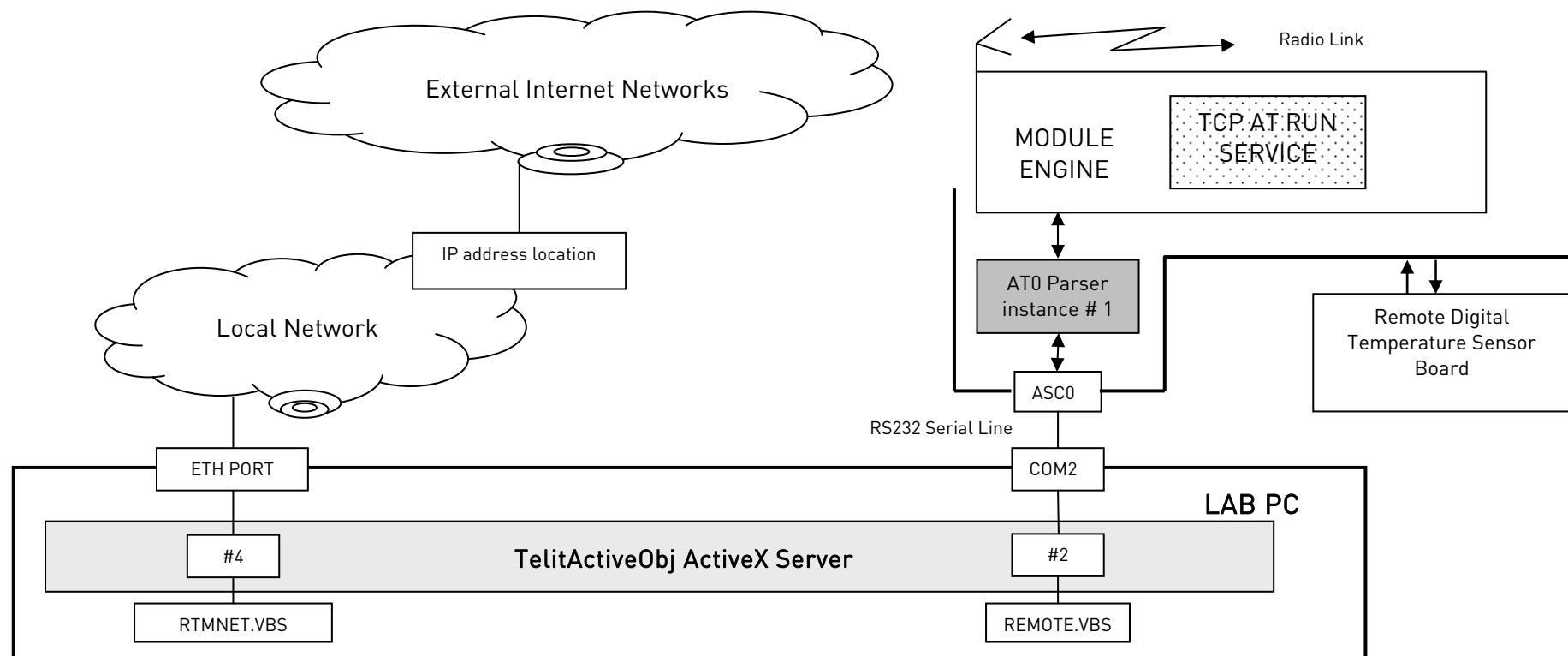


fig. 19: Second Configuration Details



7.3. RDTSB board Pictures



photo 1: RDTSB board & Remote Module



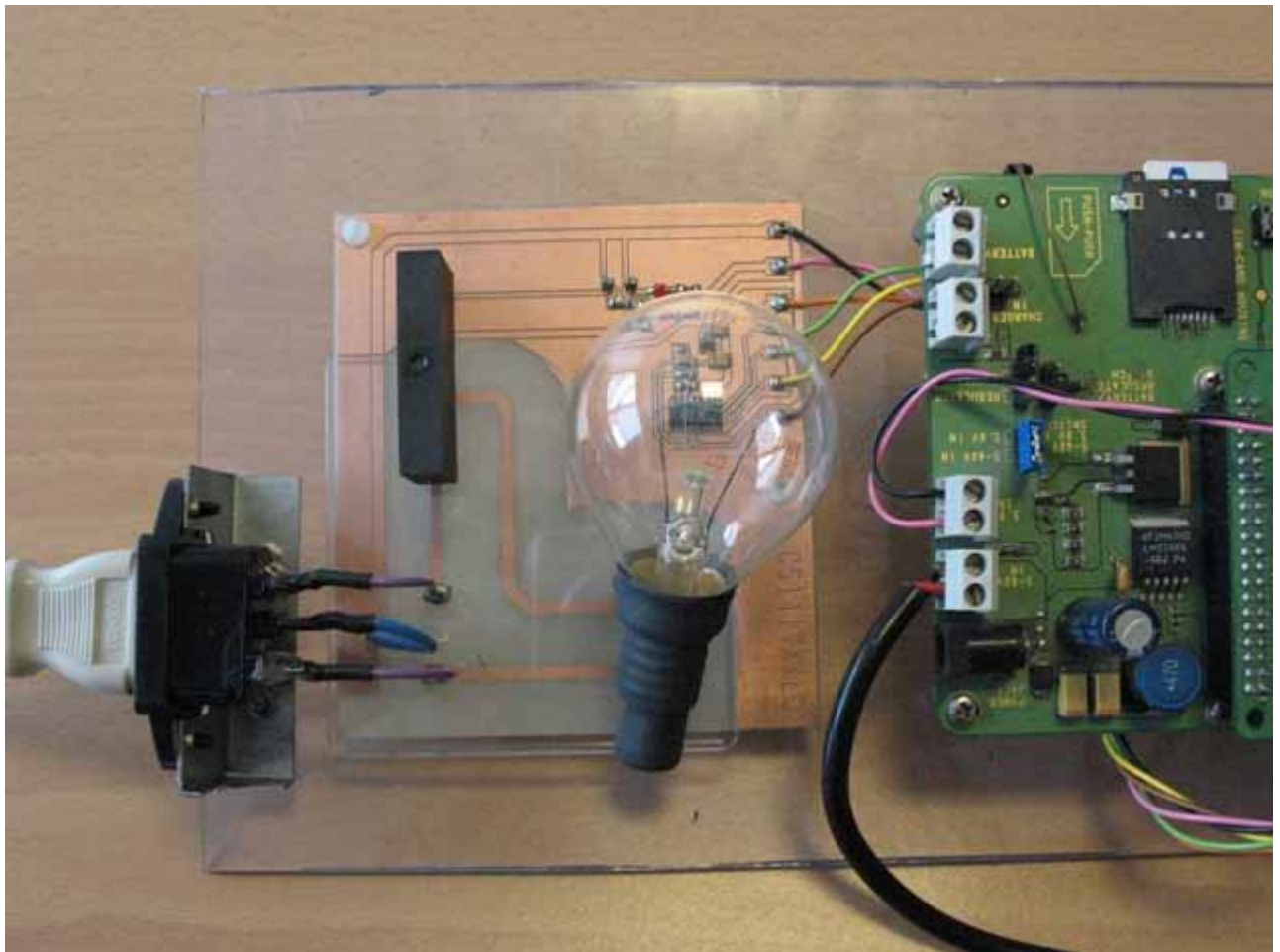


photo 2: RDTSB board details





photo 3: RDTSB/Module Connection details

