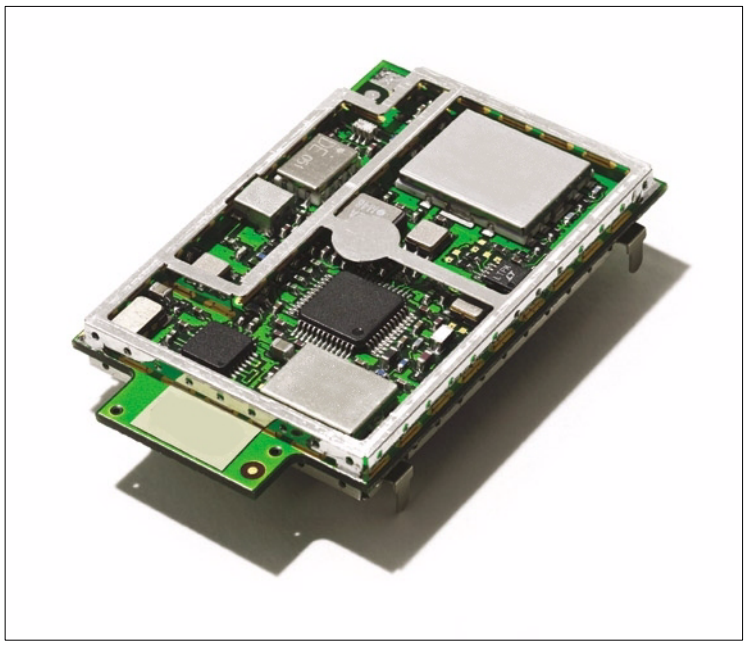

UbiNetics™

GM40x GSM/GPRS Module

Reference Manual

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Note on Revision F

This version (Revision F) of the GM40x GSM/GPRS Module Reference Manual documents software version 1.3.1.

Table of Contents

1.0 Introduction

This document specifies the functionality of the UbiNetics GM40x dual-band GSM/GPRS modules:

- GM400 is a 900 E-GSM and 1800 GSM dual-band module
- GM401 is a 900 E-GSM and 1900 GSM dual-band module
- GM404 is a low- profile 900 E-GSM and 1800 GSM dual-band module
- GM405 is a low-profile 900 E-GSM and 1900 GSM dual-band module.

Both modules provide multislot GPRS operation to MS8 specification.

The products provide GSM/GPRS mobile communication capability, suitable for embedding in PDAs and other devices.

1.1 Summary Specification

1.2 Functional Specification

Parameter	Qualifier	Specification	Notes
Class	Dual band GM400	E-GSM 900 Power Class 4 (2W) GSM1800 Power Class 1 (1W)	
	Dual band GM401	E-GSM 900 Power Class 4 (2W) GSM1900 Power Class 1 (1W)	
	Dual band GM404	E-GSM 900 Power Class 4 (2W) GSM1800 Power Class 1 (1W)	
	Dual band GM405	E-GSM 900 Power Class 4 (2W) GSM1900 Power Class 1 (1W)	
GPRS class	Multislot Class	The product provides multislot operation to MS 8	Maximum total number of slots is 5 Maximum number of receive slots is 4 Maximum number of transmit slots is 1
	Mobile station class	The product provides a Mobile Station of class B (Non-concurrent dual-mode GSM/ GPRS)	
RF	RF bands	E-GSM 900: Tx: 880 – 915 Rx: 925 – 960 MHz GSM 1800: Tx: 1710 – 1785, Rx: 1805 – 1880 MHz GSM 1900: Tx: 1850 – 1910, Rx: 1930 – 1990 MHz	
	Receiver sensitivity	Better than -104 dBm at 900 GSM Better than -102 dBm at 1800/1900 GSM	
	Selectivity	Better than 9dB at 200KHz Better than 41dB at 400KHz	
	Dynamic range	~89dB typical for 900 GSM ~87dB typical for 1800 GSM	
	Electrical performance	Conforms to ETSI 11.10	
	RF connection	Signal and ground PCB pads for attachment of appropriate RF	

Approvals	Safety Radio Protocol EMC SAR Network Environmental	EN60950 3GPP 51.010 3GPP 51.010 EN 301 489 ES59005 GCF PTCRB ETS 300 019	Europe
	Safety Radio Protocol EMC SAR Network Environmental	UL60950 edition 3 FCC part 24 FCC part 15 ANSI C95.1 PTCRB Customer specific	USA
Audio	Voice	2 Microphone and 2 ear-piece interfaces	
	Alert	Sounder output	
Echo Cancellation		Sufficient for small handset enclosures and desktop use	32m second maximum delay; attenuation approximately 40 dB
GSM Data	Asynchronous transparent and non-transparent	9.6kbps / 14.4kbps	
GPRS Data	Asynchronous	9.05, 13.4, 15.6 and 21.4kbps per slot	
GSM Fax	Transparent	9.6kbps and 14.4kbps	
SMS		Full ETSI SMS compliant, including cell broadcast	
Memory	RAM	6Mbit	
	Flash	16Mbit	
SIM		The module supports the following SIM card types: Plug-in SIM card 3V Plug-in SIM card 3V/5V Only SIM cards conforming to ETS 300 607-1 are supported, tested against UK and other European Network Provider SIM cards	
Temperature monitoring		On-board over-temperature protection (+80ºC)[1]	
Power supply	Voltage	3.6V nominal 3.3V minimum	3.2V minimum during (2A) TX burst
Power consumption (average)	Shutdown current	70µA	nominal
	Stand-by current	3.2mA	nominal
	Talk current	See table on page 13	

1.Calls are ended if the internal temperature reaches +80ºC. In worst case conditions, the internal temperature of the module can be up to 20ºC higher than ambient, so temperature protection may trigger at 60ºC ambient temperature.

1.3 Module Interfaces

Parameter	Qualifier	Specification	Notes
Display interface	SPI (5 wire)		2.9 V logic levels
Keyboard	5 x 5 matrix	5 x inputs (rows) 5 x outputs (columns)	2.9 V logic levels
Serial interface	4 lines (TXD, RXD, RTS, CTS)	Compatible with UART 16C750 device	2.9 V logic levels.
General Purpose I/O		3 x GPIO	

1.4 Software

Parameter	Qualifier	Specification
Protocol stack	Layer 1 / 2 / 3	GSM/GPRS Dual Band Protocol Stack
	Layer 2 / 3 Supplementary Services	Caller line identification Call forwarding Call waiting / call hold
	Layer 1 Codec Support	Firmware providing support for: FR, HR, EFR (Dual band)
	Subsidy protection	Network personalisation according to GSM 02.22 for: Network Operator Lock Service Provider Lock Lock to First SIM
Device drivers	Drivers for all hardware devices in the core design	RF SIM UART Audio control Power Supply control
External interfaces	Serial interface with data rate of 56Kbps (57600bps)	Serial interface supporting AT commands, with software multiplexer for use in GPRS Class B mode, or for multiple AT command streams. Multiplexer supports a subset of ETSI 07.10 specification AT command interpreter supports a subset of ETSI 07.05 and 07.07 specifications, including V.25
Application software	Diallers AT Exerciser Flash Upgrader Multiplexer	For PC and other operating systems For driving the module using AT commands For upgrading module firmware

SIM Tool kit (release 98 compliant, ETSI standard 11.14, Version 7.3.1)	Functions supported	Call Control Cell Broadcast Download Event Download MO Short Message Control More Time Polling Off Poll Interval Provide Local Information Refresh Send DTMF Send Short Message Send SS Send USSD Set Up Call Set Up Event List SMS-PP Download Timer Management Timer Expiration Run AT Command
MMI	MMI functions supported	Support available for small or full MMI: details of API available upon request
	Drivers	Keypad SPI GPI/O

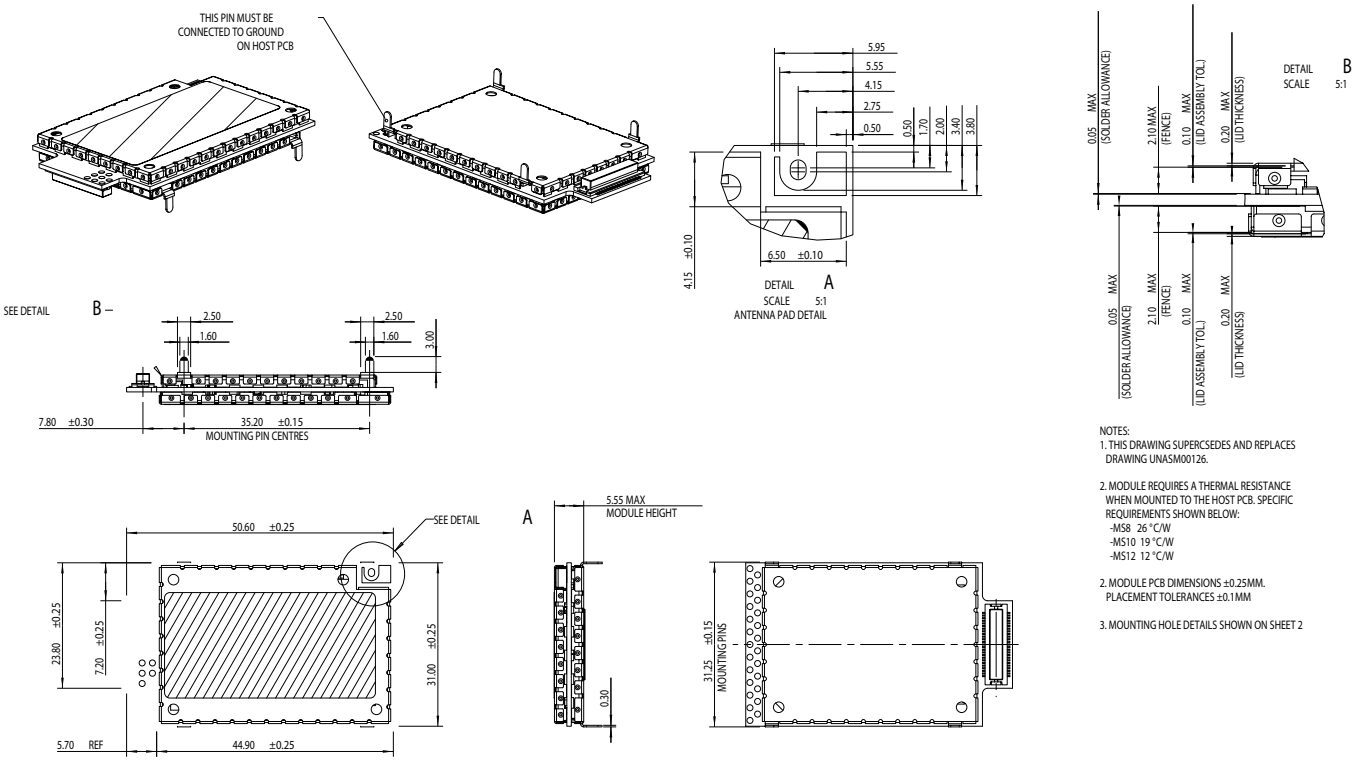
2.0 Hardware Specification

2.1 Mechanical Characteristics

2.1.1 Physical & Environmental Characteristics

Parameter	Qualifier	Specification
Form		PCB, components on both sides, with screening can on both sides
Size & weight	Dual band Weight	Overall size: 50.6 X 31 X 5.25 mm nominal 15 grams
Temperature & Humidity	Storage	-20ºC to +70ºC at 93% relative humidity -40ºC to +70ºC at 30% relative humidity
	Operational	-20ºC to +55ºC at a relative humidity of 93%
Vibration	(no damage)	Random vibration test compliant with IEC60068-2-64 standard
Marking		Type and model number Serial number and IMEI number (alphanumeric and bar code) Ubinetics logo
Hardware interface	Characteristics	As described in the “Hardware Interface Specification” on page 9.
Shock	Shock test	450cm/s impact (impact time 2 - 2.8ms)
	Drop test	1 metre drop test

2.1.2 Mechanical Drawings: GM400/401

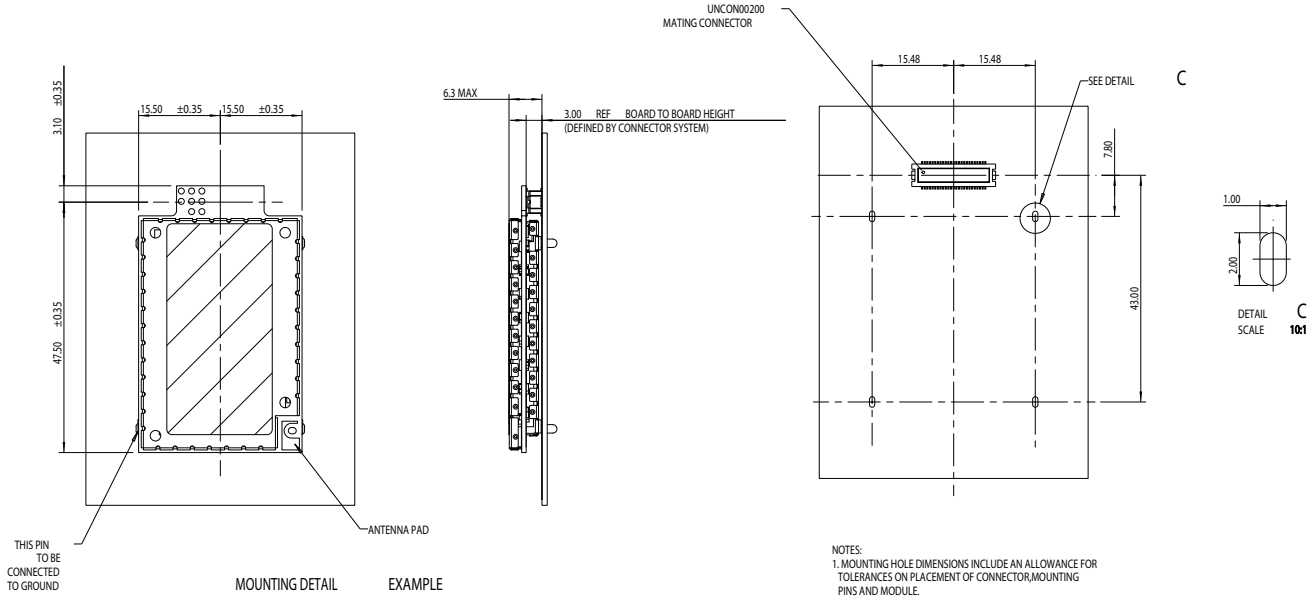


NOTES:
1. THIS DRAWING SUPERCSEDES AND REPLACES DRAWING UNASM00126.

2. MODULE REQUIRES A THERMAL RESISTANCE WHEN MOUNTED TO THE HOST PCB. SPECIFIC REQUIREMENTS SHOWN BELOW:
-MS8 26 °C/W
-MS10 19 °C/W
-MS12 12 °C/W

2. MODULE PCB DIMENSIONS ±0.25MM. PLACEMENT TOLERANCES ±0.1MM

3. MOUNTING HOLE DETAILS SHOWN ON SHEET 2

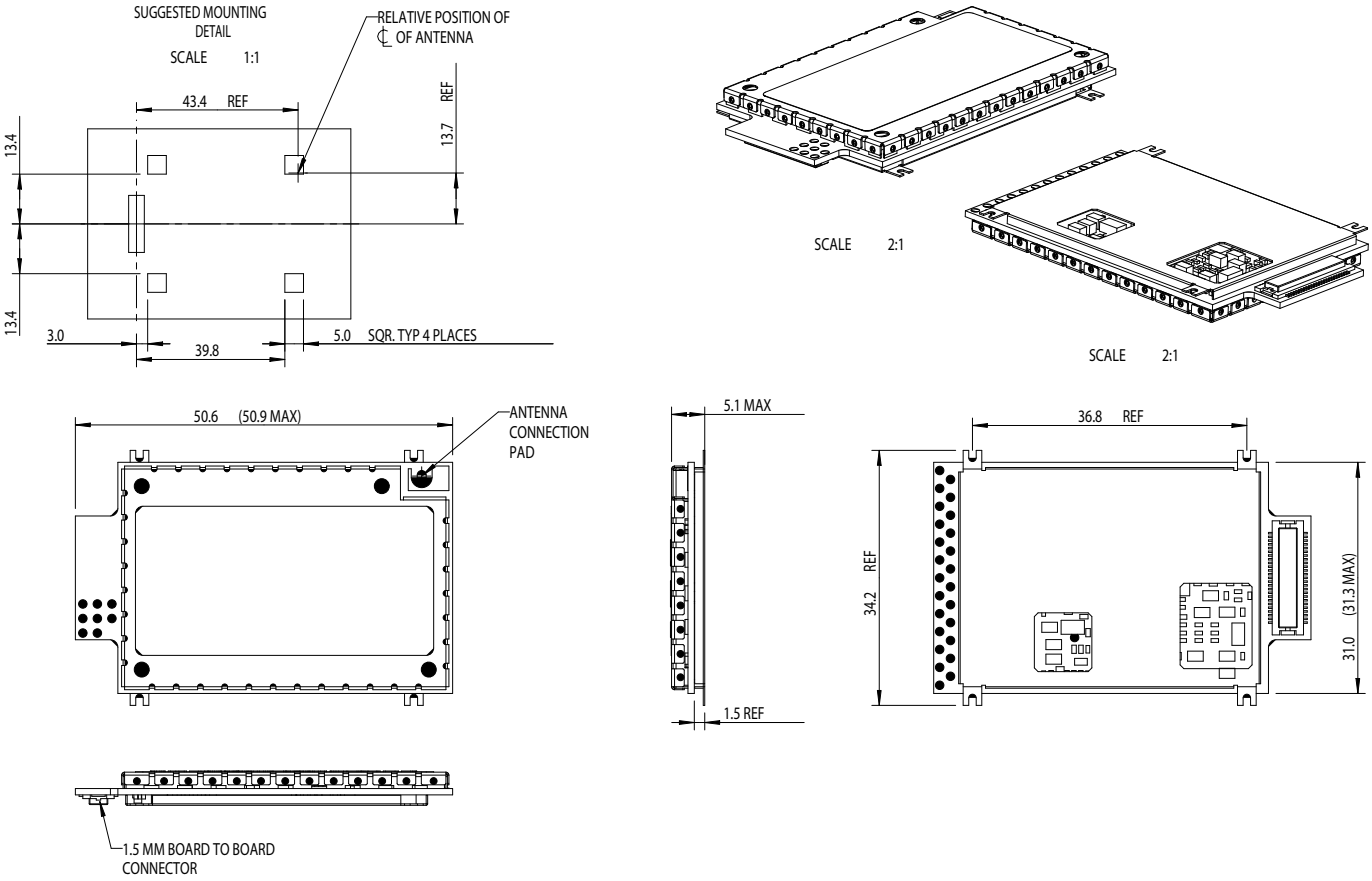


NOTES:
1. MOUNTING HOLE DIMENSIONS INCLUDE AN ALLOWANCE FOR TOLERANCES ON PLACEMENT OF CONNECTOR,MOUNTING PINS AND MODULE.

2. CUSTOMER TO MAKE ALLOWANCE FOR DRILL HOLE PLACEMENT TOLERANCE ON THEIR MOTHERBOARD.

3. TOLERANCE ON PLACEMENT OF MATING CONNECTOR ASSUMED TO BE ±0.1mm. CUSTOMER TO MAKE ALLOWANCE IF TOLERANCE IS DIFFERENT.

2.1.3 Mechanical Drawing: GM404/405



2.2 Hardware Interface Specification

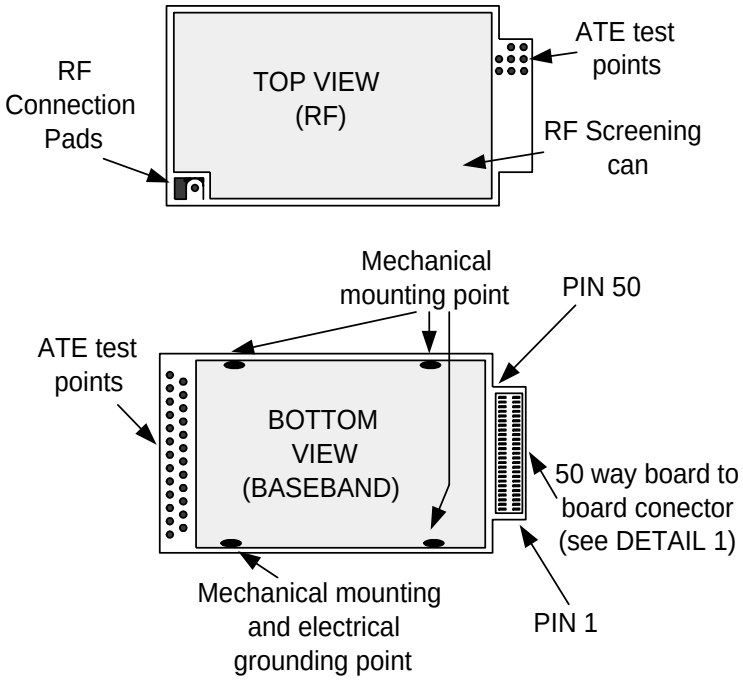
2.2.1 Introduction

This section describes the hardware interface specification for the dual-band GSM/GPRS Module. A 50-way board-to-board connector is used to interface with the host hardware platform. The specification of this connector is given on “Pin out diagram and connector orientation” on page 10. An antenna pad is provided for the RF interface.

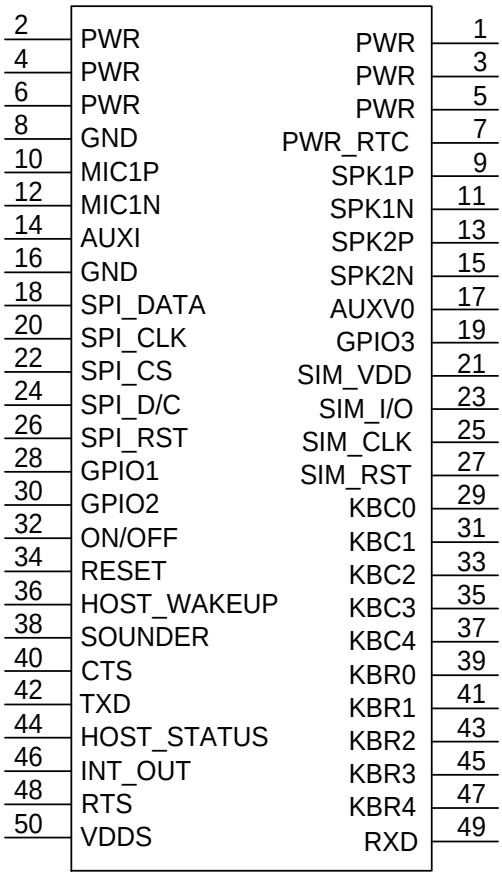
Note:

- The module must be power grounded by the mounting point shown in “Pin out diagram and connector orientation” on page 10.
- The circuit diagrams in this section show circuits *internal* to the module. Exceptions to this are the diagrams in “Backup power supply” on page 17, “Auxiliary microphone” on page 20, “Auxiliary speaker” on page 21 (3-wire headset) and “Sounder output” on page 22, where components may be required in the host.

2.2.2 Pin out diagram and connector orientation



DETAIL 1



2.2.3 Interface connector

The board-to-board connectors required in the host, to provide the interface with the modules are as follows:

GM400/401

Type	Pins	Pitch	Type	Manufacturer	Part number
Plug[1]	50-way	0.5mm	Vertical 'M' type	SMK (http://www.smk.co.jp)	CPB7250-6211

1.Although catalogued as a plug, this is a 'female' receptacle

This plug is available to special order only, and you should allow a lead time of 12 to 14 weeks for delivery from the manufacturer.

GM404/405

Type	Pins	Pitch	Type	Manufacturer	Part number
Socket	50-way	0.5mm	Vertical SMT	Hirose	DF23C-50DS-0.5V(51)

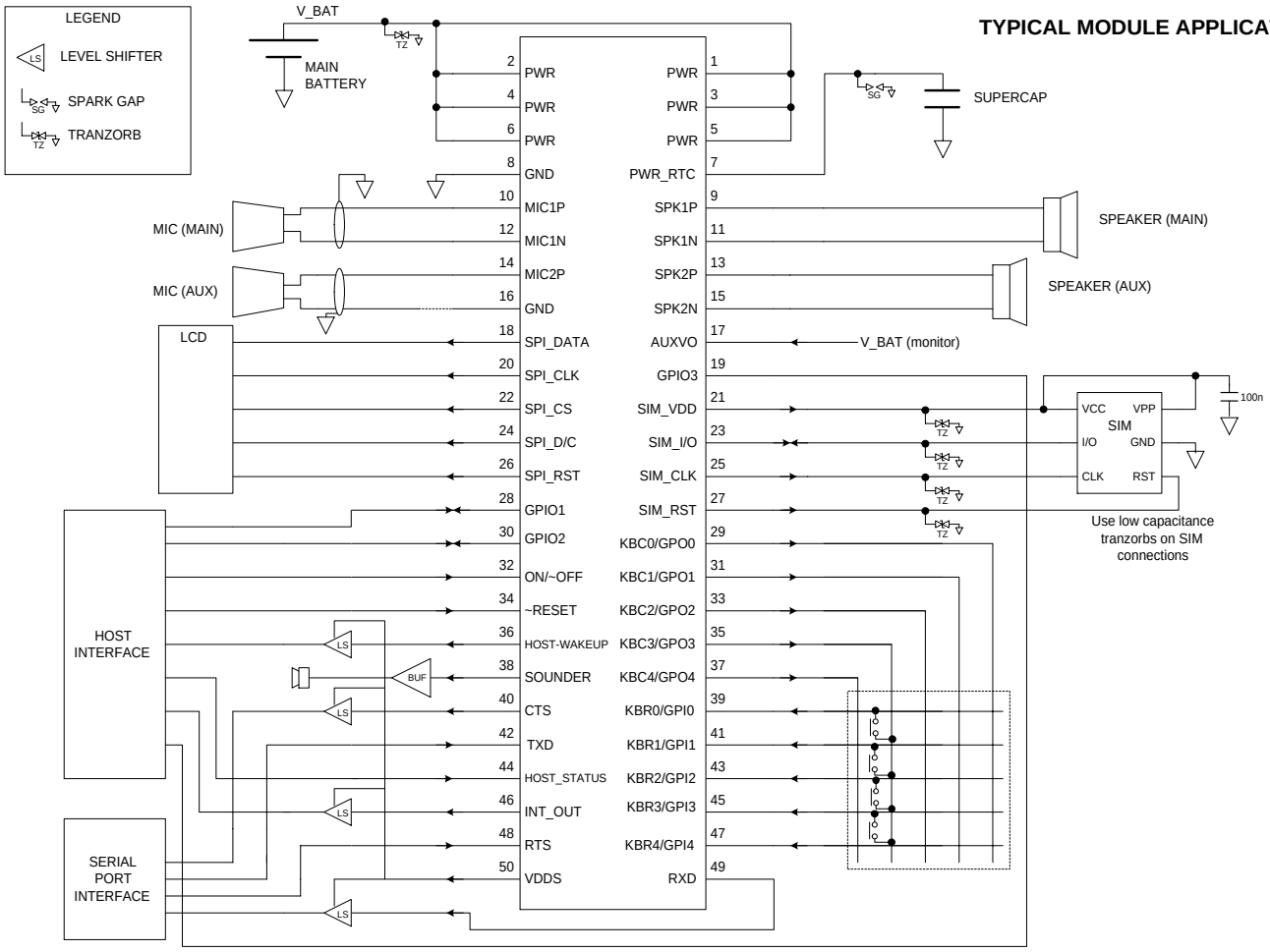
This is a comparatively new part, and may not yet be in all Hirose catalogues.

2.2.4 Typical application circuit

This is a circuit for a typical application incorporating the GSM/GPRS module, using the following interfaces:

- LCD
- Serial port
- Keyboard
- SIM
- GPI/O
- 2 speakers
- 2 microphones
- Main battery
- Backup battery

TYPICAL MODULE APPLICATION



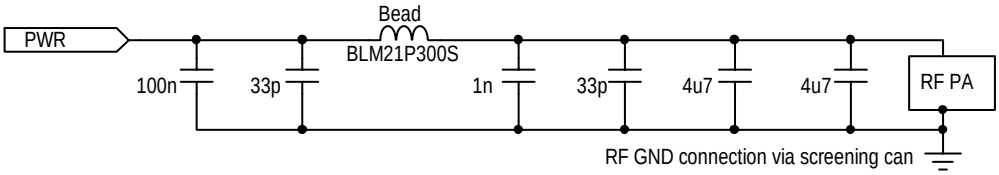
2.2.5 Main power supply

Note that Default State is the pin state on power up.

Pin out

PIN	Pin Name	Description	DIR	Default State	Electrical Specification
1 2 3 4 5 6	PWR	Main power supply to the module. Multiple pins are used for heavy current capacity	SUPPLY	N/A	Normal operating range: 3.3V to 4.5V (3.6V nominal)[1] Minimum 3.0V (typical)[2] Absolute maximum rating: Input Voltage: 5.1 V Peak current: 2.0A[3] See the table below for current consumption under various power modes
8 16	PWR GND	Power Ground Uses screening can fixing point	GND	N/A	Heavy ground current is returned through screening can: one leg only

1.Over full operating temperature range. Note that the input voltage must exceed 3.2V for power-on (undervoltage lockout)
2.Typical figure, in-call at full power at 25ºC ambient: not guaranteed
3.Antenna VSWR <4:1



Power input circuit

Average Power Consumption

All power consumption specifications are given at the nominal voltage of 3.6V and 25ºC.

State	Description	Activity	Conditions	Power cons.
Shutdown	Power on VBAT_IN, and PWR_RTC. Module not powered up	Only power up circuits (UPR) and Real Time Clock (RTC) active		70µA
Stand-by	Power on VBAT_IN, and PWR_RTC. Module powered up Registered on GSM, GPRS attached	Baseband active 13MHz (5%) / 32KHz (95%) clock RF Receive intermittent (5%) Occasional Tx (LU)		3.2mA

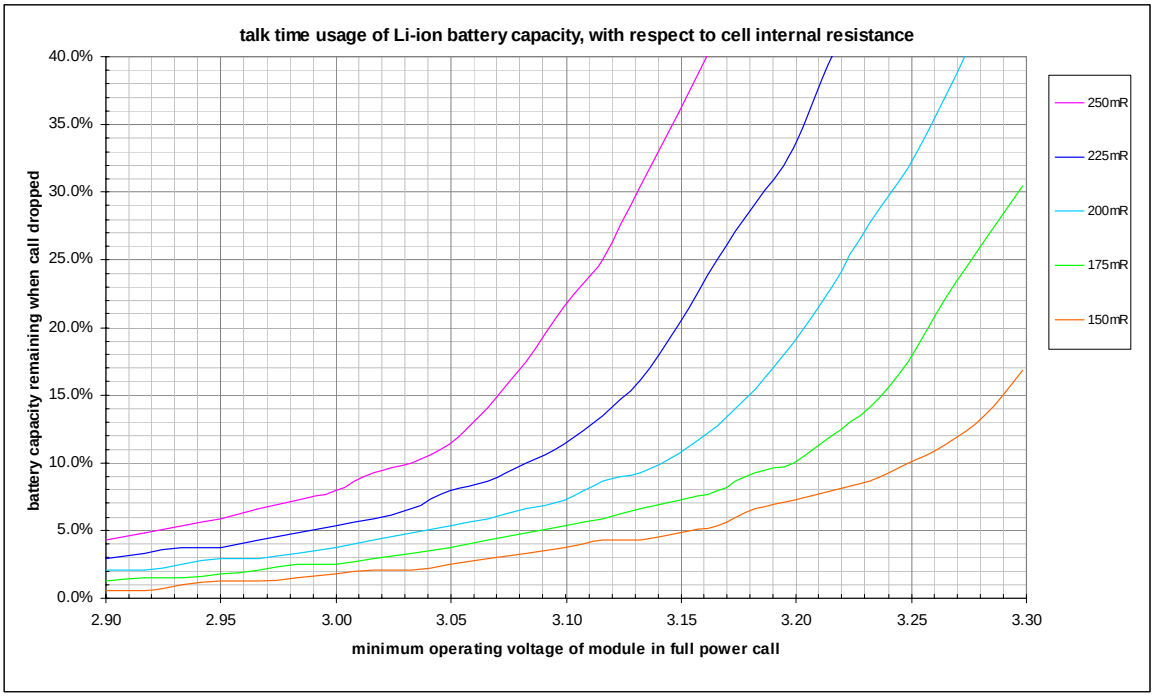
GSM in call: EGSM mode	Power on VBAT_IN, and PWR_RTC. Module powered up 1 TX slot, 1 RX slot	Baseband active 13MHz clock RF active	Average @Pcl5[1]	300mA
			Average @Pcl8[2]	220mA
			During RX bursts	55mA
			During TX bursts @Pcl5	1.8A
GSM in call: DCS mode	Power on VBAT_IN, and PWR_RTC. Module powered up 1 TX slot, 1 RX slot	Baseband active 13MHz clock RF active	Average @Pcl0[3]	225mA
			Average @Pcl3[4]	155mA
			During RX bursts	55mA
			During TX bursts @ Pcl0	1.4A
GPRS Active	Power on VBAT_IN, and PWR_RTC. Module powered up 1 TX slot, up to 4 RX slots	Baseband active 13MHz clock RF Rx/Tx active		<500mA

1. 1.2W
2. 0.5W
3. 1W
4. 0.25W

Power mode specification (average values)

Power supply considerations

The input voltage is expected to be a Lithium-ion cell, or a Ni-MH battery. The cell impedance should be low enough for the output voltage to remain above 3.3V under a GSM/GPRS load.



The relationship between cell ESR, usable battery capacity and minimum operating voltage

Power Sequencing

When the power is first applied, the module is held in reset until the input voltage rises above the undervoltage lockout threshold of 3.2V.

At this point, the module enters Power-on state (as opposed to Switch-on state): only the UPR (uninterrupted power) internal rail is powered. Current consumption is less than 150µA.

The On/Off pin is monitored by a small hardware state machine, which will commence the switch-on sequence when a falling edge is detected on the power On/Off pin. If the power On/Off pin is not held low for at least 50ms, the switch-on sequence is aborted.

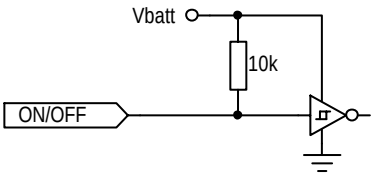
If the On/Off pin is driven low for more than 50ms, the module enters Switch-on state, the main processor resets, boots up and runs. After network registration, the current consumption will fall to 3.2mA, averaged over 60 seconds. The RTC (real-time clock) will be reset only the first time this state is entered. Toggling between Switch-on and Switch-off states will not clear the RTC.

If the On/Off pin is driven low for more than 50ms again, the module enters Switch-off state, with only the RTC and alarm timer running. Current consumption in this mode is less than 150µA. Wake-up interrupts may be programmed using the RTC if required.

If at any time, the main input voltage falls below 2.8V (nominal), and the main input voltage is below the backup battery voltage, then the module enters backup mode. This is identical to switch-off state except that any attempt to switch on will be blocked. The module will exit backup mode if either of the two defining conditions (above) are lifted.

Power ON/OFF line

PIN	Pin Name	Description	DIR	Electrical Specification
32	ON/OFF	External PSU Enable	IN	V_{IH} = Vbatt ±200mV V_{IL} = 0V ±300mV



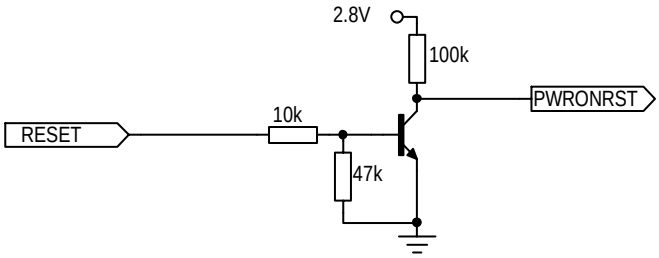
On/Off Input Circuit

The power On/Off pin should be used to power up the module. This is achieved by pulling the line low for more than 50ms (typically 60ms), then high again.

To power down the module, pull the line low for >600ms (typically 700ms). In order to avoid confusion, it is recommended that the module be switched off using the AT+POWER_DOWN command. The VDDS line may be used to monitor the power state of the module: it is high if the module is powered up, and low otherwise.

RESET line

PIN	Pin Name	Description	DIR	Reset active	Reset not active
34	RESET	External reset pin	IN	Vin >1.5V	Vin <0.5V



When the hardware RESET line is asserted the digital baseband chip is immediately reset, including the background functions such as Real Time Clock.

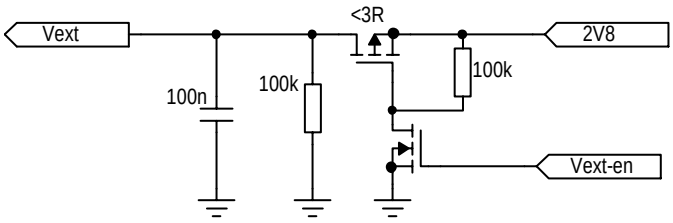
Deasserting RESET causes low-level initialisation of this chip to occur. If the module was in the Switch-ON state (see “Power Sequencing” on page 15) prior to the reset it will return to the Switch-ON state (but not in call). If it was previously in the Switch-OFF state it will remain so.

Note however that the immediate nature of hardware RESET may potentially confuse the network if there is an active GPRS PDP context at that time (because this is only cleared when deactivated or with a GPRS detach). Also, data corruption could occur if it is asserted while writing to the SIM card or to the memory chip. Hence, hardware RESET should only be used if absolutely necessary—the "AT+POWER_DOWN" command (see “+POWER_DOWN Power Down Module” on page 167) or the ON/OFF line should be used to power off if at all possible.

If the motherboard PCB is not shielded from the Antenna RF radiation, it is advisable to add a 33pF decoupler to the Reset and ON/OFF lines as close as possible to the module connector.

VDDS rail

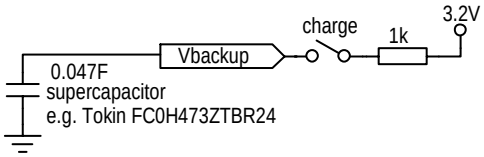
PIN	Pin Name	Description	DIR	Electrical specification	Note
50	VDDS	Power supply for external level shifter	OUT	2.9V nominal 2.7V minimum 3.1V maximum	<10mA to be drawn



This rail is intended to power external level-shifters, if these are required. It also gives a reliable indication of whether the module is powered up or not. The output is high only if the module is in the "Switch-on" state, as defined above.

2.2.6 Backup power supply

PIN	Pin Name	Description	DIR	Electrical Specification	Note
7	PWR_RTC	Back up power for RTC	SUPPLY	3.0V - 5.5V	



The module has provision for a backup supply, to power the RTC (real-time clock) when the module is powered down. This is principally intended to be a double layer supercapacitor. Power is drawn from the backup battery when the main supply voltage is both below 2.8V (nominal) and below the backup voltage.

There is a simple charging facility within the module, whereby a 3.2V (nominal) regulator may be connected to Vbackup by setting a control register bit. Charging current is kept low, and the capacitor will be fully charged within a few minutes. Hold-up time with the part shown is at least ten minutes.

Additional specifications for Vbackup:

	Min	Typical	Max	Notes
Charge voltage	3.0V	3.2V	3.6V	Icharge = 10µA
Charge current (µA)	250	500	800	Vbackup = 2.8V
Voltage at which module enters backup mode	2.6	2.8	2.9	1
Backup current consumption (µA)		50	150	2
Minimum back-up voltage		2.3		3

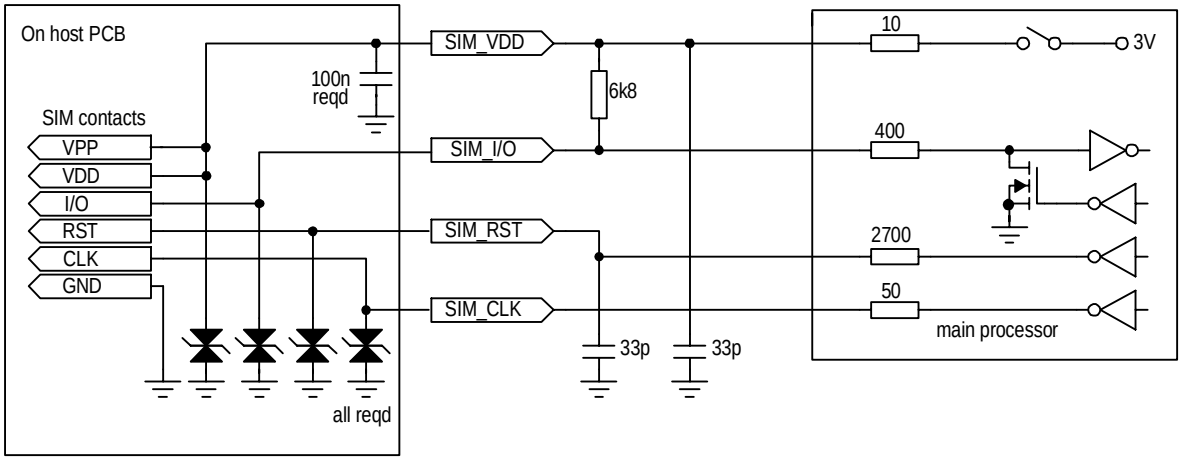
1.Main supply must also be below backup supply before switchover will occur
2.This figure may be revised; it cannot exceed 150µA. Backup mode = 1 (lowest power mode)
3.This figure is not explicitly specified, so may be revised. Backup mode = 1 (lowest power mode)

2.2.7 SIM Interface

The SIM interface conforms to ISO 7816-3 Class B (3V SIM interface).

PIN	Pin Name	Description	DIR	Default State	Min	Max	@ I_O
21	SIM_VDD	SIM power supply	OUT	0	2.7	3.3	6mA
PIN	**Pin Name**	**Description**	**DIR**	**Default State**	**V_{OH} min.**	**V_{OL} max**	**@ I_O**
23	SIM_I/O	SIM Data	I/O	0	See footnote[1]	0.4V	1mA
25	SIM_CLK	SIM Clock	OUT	0	0.7 SVDD	0.2 SVDD	20µA
27	SIM_RST	SIM Reset	OUT	0	0.8 SVDD	0.2 SVDD	200µA

1.Output high voltage V_{OH} is determined by 6k8 pull-up and leakage, ≅SVDD



The SIM Interface circuit

Capacitance on SIM interface lines

The SIM interface specification demands fast rise times for the clock, data and reset signals. This precludes the use of ordinary-type varistors for ESD protection, as the typical capacitance of these parts is 90-200pF. Several low-capacitance ESD protection devices are available from different manufacturers, and these should be used.

	SIMCLK	SIMRST	SIM_I/O	Unit
Measured module capacitance	15.4	45	7.7	pF
Typical driver output impedance	52	2634	6800	Ω

Required risetime	50	1000	1000	ns
Margin by which specs are to be met	20%	20%	20%	%
Allowable gross capacitance	350	138	53	pF

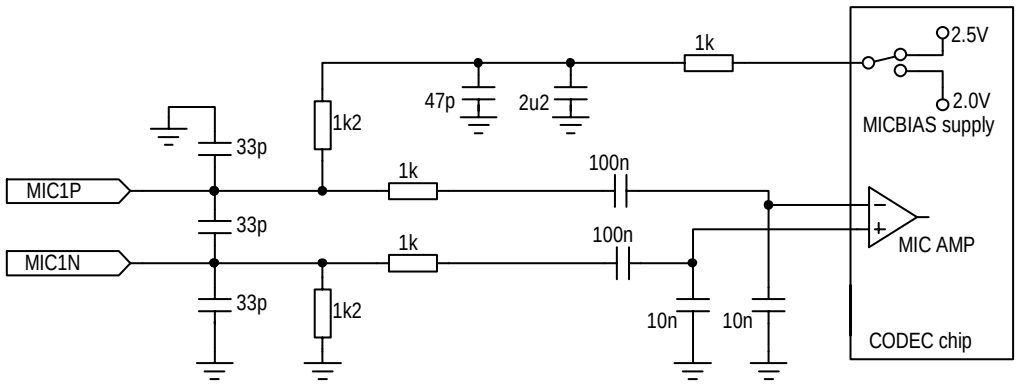
Allowable SIM line capacitances (typical)

2.2.8 Audio Interface

Main microphone

PIN	Pin Name	Description	DIR	DC condition[1]	Digital clipping level	Input impedance
8	AGND	Microphone 1 Ground[2]				
10	MIC1P	Microphone 1 Positive[3]	IN	2.0V	32.5mV RMS	1.2kΩ
12	MIC1N	Microphone 1 Negative[4]	IN	0.5V	32.5mV RMS	1.2kΩ

1. DC conditions assume an electret microphone capsule with a DC resistance of ~4kΩ when biased at 1.5V across the terminals, and a micbias supply of 2.5V. There is DC on these pins.
2. Cable screening, if used, should be grounded at this point.
3. Clipping level is shown with programmable gain trim amplifier set to 0dB. Available range is -12dB to +12dB in 1dB steps
4. Differential input impedance is 1.2kΩ.

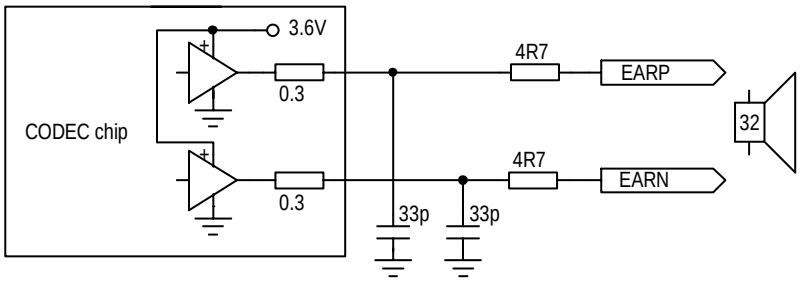


Main microphone input circuit

Main speaker

PIN	Pin Name	Description	DIR	DC condition	Clipping level	Output impedance	Notes
9	SPK1P	Earphone 1 Positive	OUT	1.25V	2Vpp	5Ω typical	1 2 3
11	SPK1N	Earphone 1 Negative	OUT	1.25V	2Vpp	5Ω typical	
9 & 11	SPK1N/P	As Bridge-tied load	OUT	0V	4Vpp	10Ω typical	

1.Differential Maximum capacitive load at EARP-EARN = 100pF max
2.Common Mode Minimum resistive load at EARP or EARN = 200kΩ typical
3.Clipping level is equivalent to two rail-to-rail outputs each driven 3.6Vpp, in antiphase



Main speaker driver circuit

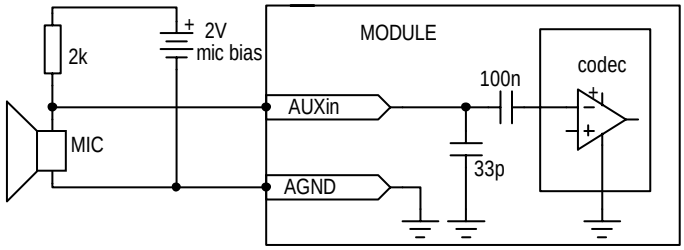
Auxiliary microphone

PIN	Pin Name	Description	DIR	DC condition	Digital clipping level	Input impedance	Notes
14	AUXI	Auxiliary Microphone	IN	N/A	365mV RMS	220kΩ	1 2 3
					24mV RMS	220kΩ	4 2 3
16	AGND	For use with AUXI input					

1.AUXI programmable gain amplifier set to minimum (4.6dB gain)
2.Clipping level is shown with programmable gain trim amplifier set to 0dB, available range is -12dB to +12dB in 1dB step
3.Input impedance is normally defined by the external bias resistor, typically 2kΩ.
4.AUXI programmable gain amplifier set to maximum (28.2dB gain)

The auxiliary microphone input is primarily intended for an external headset. Great care must be taken to ensure that the unbalanced signal input is not corrupted with TDMA noise. The grounding of the external bias generator *must be as shown below.* The bias voltage and resistance will vary according to the microphone capsule specification: indicative values are shown.

Note that ESD protection will be required if these lines are accessible to the user.

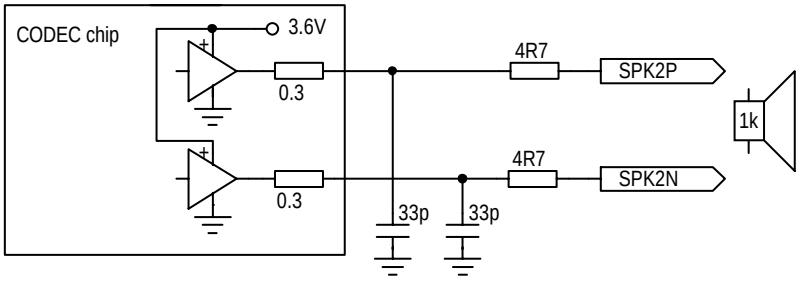


Auxiliary microphone input showing external biasing requirement

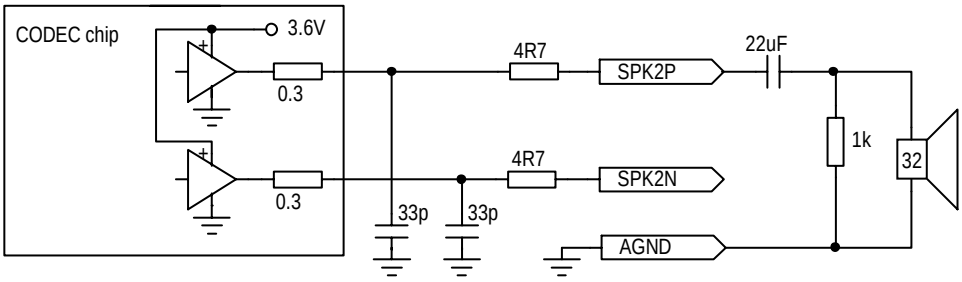
2.2.9 Auxiliary speaker

PIN	Pin Name	Description	DIR	DC condition	Clipping level	Output impedance	Notes
13	SPK2P AUXOP	Auxiliary Earphone positive	OUT	1.25V	1Vpp	50Ω typical	1 2 3 4 5
15	SPK2N AUXON	Auxiliary Earphone negative	OUT	1.25V	1Vpp	50Ω typical	
		Wired as bridge-tied load	OUT	0V	2Vpp	10Ω typical	

1. Clipping level is equivalent to two rail-to-rail outputs each driven 1Vpp, in antiphase
2. Differential Maximum capacitive load at SPK2P - SPK2N = 100pF maximum
3. Common Mode Minimum resistive load at SPK2P or SPK2N = 200kΩ typical
4. Minimum output resistive load at AUXO-AUXON = 1.2kΩ typical, 1.0kΩ minimum, i.e. auxiliary speaker must be greater than 1kΩ impedance - to be confirmed
5. Maximum output swing at AUXOP-AUXON: 5% distortion maximum. Load = 1kΩ = 1.96Vpp typical, 1.6Vpp minimum



Auxiliary output circuit - bridge-tied load



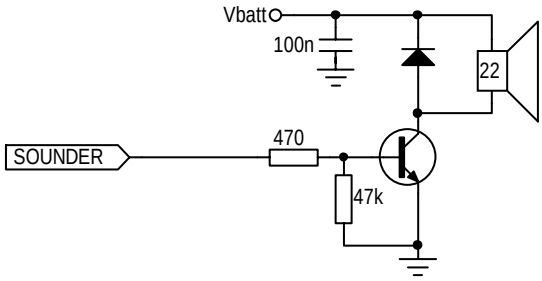
AUX output using 3-wire headset

Note the inclusion of a 1kΩ resistor to avoid loud "pops" in the earphone when the headset is plugged in. The value of the 22µF capacitor is chosen to pass 300Hz, and may be Tantalum or ceramic type.

The codec is designed for both differential and single ended use; however we recommend differential, rather than single-ended mode, to keep TDMA noise to a minimum. It can be difficult to screen out the TDMA noise using the analogue ground as the return.

Sounder output

PIN	Pin Name	Description	DIR	Output level	Min	Max	@ I_O
38	SOUNDER	To drive buzzer	OUT	V_{OH}	0.8*VDDS		2mA
				V_{OL}		0.22*VDDS	



Sounder implementation circuit

The sounder output generates a modulated frequency, programmable between 349Hz and 5276Hz with 12 semitones per octave. The output amplitude is also programmable.

Analogue input

PIN	Pin Name	Description	DIR	Internal name
17	AUXV0	Analog Input[1] [2]	IN	VBAT_MEAS

1.The ADC will output all “1”s for an input voltage of 7V nominal.
2.The input pin is not designed to take more than 5.5V.

This input is intended to be used for battery voltage measurement, which in the case of Lithium-ion batteries, can form a reasonably accurate remaining capacity estimate. Each discrete step in the A/D reading represents approximately 1.5% of the capacity of a typical Lithium-ion battery.

Parameter	Condition	Min	Nom	Max	Unit
AUXV0 input voltage range				5.5	V
Sample acquisition time	16.5µs delay 8µs acquisition		24.5		µs
Sampling Rate			2.17		Samples/s
Resolution			10		Bit
Battery Voltage Measurement Step size	Tolerance indicates ADC Linearity, and is not cumulative	-5%	6.8	+5%	mV
Reference Voltage Tolerance	Temperature drift is 50ppm/°C	-0.5%		+0.5%	
AUXV0 input impedance			10		MΩ
AUXV0 to ADC input attenuation			0.25		V/V
Integral non linearity	Best fitting	-1		+1	LSB
Differential non linearity		-1		+1	LSB

Battery measurement ADC Electrical Specification

2.2.10 Digital I/O

Host Status

PIN	Pin Name	Description	DIR	Notes
44	HOST_STAT	Host Status	IN	See “Standard CMOS logic levels” on page 26

This pin allows the host to be asleep whilst the module is still attached to the network. The host indicates that it is entering suspend mode by taking HOST_STATUS low. The module then inhibits data transfer until HOST_STATUS goes high.

In order to ensure no data is lost in the entry to suspend mode, a specific sequence of checks is required: these are detailed in the software specification.

If this pin is not used, connect a 10kΩ resistor between this pin and VDDS (pin 50).

Host Wakeup

PIN	Pin Name	Description	DIR	Notes
36	HOST_WAKEUP	Alert host of incoming call/data	OUT	See “Standard CMOS logic levels” on page 26. 2mA rated

Active high output. If the host is asleep, and an incoming call is received, or data, or SMS, then the host wakeup pin is driven high for 20µs in order to wake up the host.

2.2.11 Interrupt Output

PIN	Pin Name	Description	DIR	Notes
46	INT_OUT	Interrupt Output	OUT	See “Standard CMOS logic levels” on page 26

Because the AT command interface is host driven, there is no way for the module to output unsolicited data. This interrupt indicates that the module has some message to convey, and would like to be questioned. This is not used by the standard AT command set, only by additional functions programmed into the module by the customer.

2.2.12 Keyboard Interface

PIN	Pin Name	Description	DIR		Notes
29	KBC0/GPO0	Keyboard Column 0	OUT	COLUMN (A6)	See “Standard CMOS logic levels” on page 26. 2mA rated. All row inputs have a 27kΩ (nominal) pull-up resistor integrated within the IC. Every key can generate a keyboard interrupt.
31	KBC1/GPO1	Keyboard Column 1	OUT	COLUMN (A5)	
33	KBC2/GPO2	Keyboard Column 2	OUT	COLUMN (B5)	
35	KBC3/GPO3	Keyboard Column 3	OUT	COLUMN (D5)	
37	KBC4/GPO4	Keyboard Column 4	OUT	COLUMN (E5)	
39	KBR0	Keyboard Row 0	IN	ROW(A4)	
41	KBR1	Keyboard Row 1	IN	ROW(B4)	
43	KBR2	Keyboard Row 2	IN	ROW(D5)	
45	KBR3	Keyboard Row 3	IN	ROW(B3)	
47	KBR4	Keyboard Row 4	IN	ROW(A2)	

2.2.13 Asynchronous Serial Interface

Pin names used are those for DCE device:

PIN	Pin Name	Description	DIR	Notes
40	CTS	Clear to send (to host)	OUT	See “Standard CMOS logic levels” on page 26. 4mA rated. CTS and RTS active LOW. Serial data rate 56Kbps (57600bps)
42	TXD	Transmit Data (from host)	IN	
48	RTS	Request to send (from host)	IN	
49	RXD	Receive Data (to host)	OUT	

2.2.14 General Purpose I/O

PIN	Pin Name	Description	DIR	Notes
28	GPIO1	General purpose I/O	I/O	See “Standard CMOS logic levels” on page 26.
30	GPIO2	General purpose I/O	I/O	
19	GPIO3	General purpose I/O	I/O	

2.2.15 Synchronous Serial Interface

PIN	Pin Name	Description	DIR	Notes
18	SPI_DATA	Serial Data	OUT	See “Standard CMOS logic levels” on page 26.
20	SPI_CLK	Serial Clock	OUT	
22	SPI_CS	Chip Select	OUT	
24	SPI_D/C	Data / Command	OUT	
26	SPI_RST	Reset	OUT	

2.2.16 RF Interface Specification

The RF Connection Pads incorporate a signal and ground PCB pad for soldering a semi-rigid coaxial cable as an interface to the host platform. The pads are also used for RF probing during production test.

Parameter	Specification	Conditions
Output Impedance	50Ω	Across GSM900, DCS1800 & PCS 1900 bands
Output Load Upper Limit	15:1 VSWR[1], but Ipeak increases. Ipeak meets specification at <5:1 VSWR	To maintain PA stability
Output Power	GSM 900: 33dBm ±2dBm (full power) GSM1800: 30dBm ±2dBm (full power) These and other power control levels are compliant with ETSI 11.10 Section 13.3	Units are calibrated to allow for a fixed attenuation from the RF output of the module to the antenna port. The loss should not exceed 0.4dB and is specified to within ±0.1dB.

1.See “RF” on page 37 for the affects on performance of different VSWRs.

2.2.17 Termination of unused lines

If the host design does not require them, unused lines can be terminated as follows:

- SPI bus (pins 18, 20, 22, 24 and 26): leave unconnected
- GPIO1, 2 and 3 (pins 19, 28 and 30): leave unconnected
- Host_wakeup (pin 36): leave unconnected
- Host_status (pin 44) and VDDS (pin 50): connect 10KΩ resistor between the two pins
- Keyboard matrix (pins 29, 31, 33, 35, 37, 39, 41, 43, 45, 47): leave unconnected.

2.3 Electrical Specification

2.3.1 Standard CMOS logic levels

Parameter	Description	Min	Nom	Max	Unit
VDDS	I/O supply voltage	2.7	2.9	3.1	V
V_{IH}	High level input voltage	0.7*VDDS		VDDS+0.5	V
V_{IL}	Low level input voltage	-0.5		0.3*VDDS	V
V_{OH}	High-level output voltage	0.8*VDDS			V
V_{OL}	Low-level output voltage			0.22*VDDS	V
I_{OL}/L_{OH}	Rated output current	2			mA

3.0 Multiplexer

3.1 Introduction

The multiplexer serial interface used by the UbiNetics GPRS module supports a number of different data streams (GPRS data, circuit switched data / fax, AT command interface, control / status information etc.). Some of these can potentially be in operation simultaneously and may be communicating with different host applications and/or drivers. The UbiNetics Multiplexer provides the means of accessing these different data streams on the various host systems.

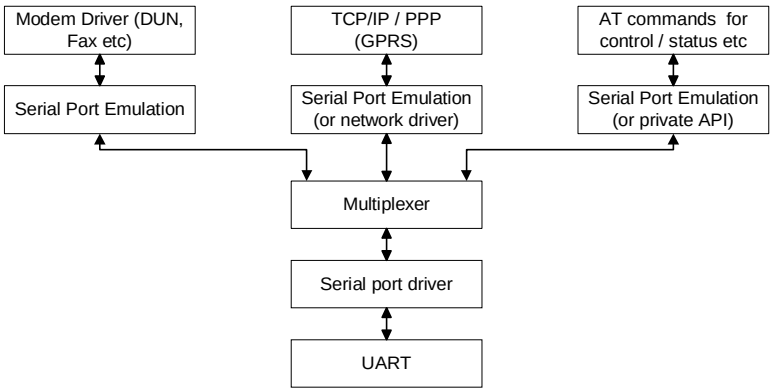
The implementation provides a single multiplexed serial link based on GSM 07.10 / 3G TS 27.010[1]. This supports operation on a wide range of hosts. Depending on the host platform and / or application, it may be necessary to implement the multiplexer within a driver and expose standard interfaces (virtual serial ports) for each of the data channels. Alternatively, in some cases where the GPRS module is used for a dedicated application, it may be desirable to build the serial multiplexer into the application software.

3.2 Overview

The Multiplexer provides a means to transmit and receive multiple data streams over a single asynchronous serial connection. It supports a number of virtual connections between software entities in the host platform and the corresponding entities in the GPRS module. Communication across the multiplexed link uses 8-bit characters arranged into frames delimited by flag bytes.

3.2.1 Software Structure

Possible Host Software Structure

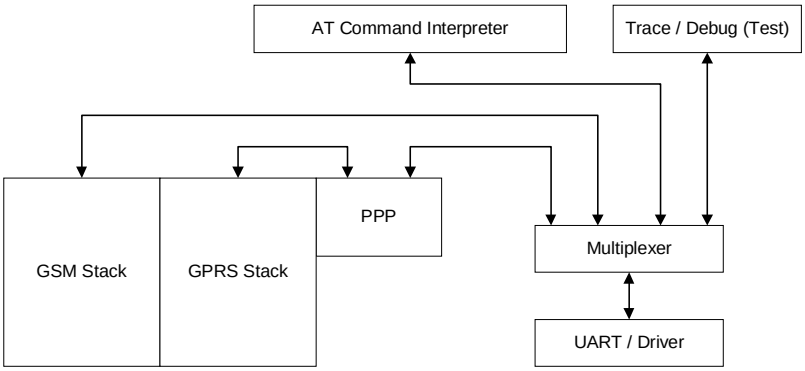


1. ETSI TS 127 010 V3.3.0 (2000-03) Terminal Equipment to Mobile Station (TE-MS) multiplexer protocol (3G TS 27.010 version 3.3.0 Release 1999)

Each of the top-level entities shown above is connected to a corresponding entity in the GPRS unit via one of the multiplexer data channels (Data Link Connections / DLCs). These are set up one at a time, normally on demand when a particular function is required.

GPRS Card / Module Software Structure

Initially each new DLC will connect to an instance of the AT command interpreter. The data channels are connected to the other stack entities either by issuing the appropriate AT commands (e.g. dialling) or explicitly using the multiplexer service negotiation command.



3.3 Supported Functions

The following functions of 3G TS 27.010[1] are supported. Additional functionality may be added at a later stage.

- Multiplexer Advanced option (flag byte transparency) without error recovery
- Multiplexer Start-up / Closedown
- Data Link Connection (DLC) Establish / Release
- Up to 6 user DLCs
- UIH frames for user data (Unnumbered Information with Header check only)
- Flow Control command
- Modem Status command
- Service Negotiation command
- Null convergence layer (unformatted data streams).

3.4 Implementation

For more information on the implementation details, see footnote 1. In particular, control field values and bit allocations are not discussed here.

1. ETSI TS 127 010 V3.3.0 (2000-03) Terminal Equipment to Mobile Station (TE-MS) multiplexer protocol (3G TS 27.010 version 3.3.0 Release 1999)

3.4.1 General

Multiplexer Mode

The multiplexer operates using the advanced option without error recovery. This uses a flag transparency mechanism to allow rapid resynchronisation in the event of any data loss.

Frame Structure

The frame used for the advanced option consists of an opening flag byte, address field byte, control field byte, information field (variable or omitted depending on the frame type), frame check byte, and a closing flag. The closing flag of one frame can be the opening flag of the following frame, so the minimum overhead is 4 bytes per frame.

4.1.3 Supported Frame Types

Frame Type	Use
SABM (Set Asynchronous Balanced Mode)	Establishing a control or data channel.
UA (Unnumbered Acknowledgement)	'OK' Acknowledgement to SABM or DISC frame.
DISC (Disconnect)	Closing a data channel or closing down the multiplexer.
DM (Disconnected Mode)	'Already disconnected' response to DISC or UIH frame.
UIH (Unnumbered Information with Header Check)	User data or multiplexer control command. Frame check applied to header only.

Any other frame types are not currently supported.

Acknowledgements, Timeouts and Retries

Where a frame type has an associated acknowledgement, if the expected response frame is not received within time T1 (default of 100ms) then the sender can retry up to a maximum of N2 times (default of 3).

Frame Check Sequence (FCS)

The frame check sequence uses an 8-bit CRC algorithm. This allows a simple look-up table based implementation to be used (see[1] for algorithm and examples).

3.4.2 Multiplexer Start-up

The GPRS module / card will always start up in non-multiplexed mode. Before the multiplexer is initialised the serial data stream to / from the UART connects directly to the AT command interpreter. The system can be operated exclusively in non-multiplexed mode but use of some functions may be restricted. Multiplexed mode is started with the following sequence:

- Host issues the AT+CMUX command (see the referenced documentation[2] for command syntax). If the GPRS unit supports multiplexed operation and accepts the parameters issued with the command then it will return an "OK" response.
- At this point both the host and the GPRS unit should switch baud rate to that specified in the issued AT+CMUX command and also set any other parameters as per the command (see table below for

1. ETSI TS 127 010 V3.3.0 (2000-03) Terminal Equipment to Mobile Station (TE-MS) multiplexer protocol (3G TS 27.010 version 3.3.0 Release 1999)
2. ETSI TS 127 007 V3.6.0 (2000-10), AT command set for User Equipment (UE) (3GPP TS 27.007 version 3.6.0 Release 1999)

allowable parameter values). The default values will be used for any parameters which are not included.

- The host should then send a SABM frame on DLC0. The GPRS module / PC card will respond with a UA frame. Multiplexed mode is now active.
- Either end can now send commands on the control channel, or establish new user data channels. In practice the establishment of new data channels will only be initiated by the host.

AT+CMUX Command parameters

Parameter	Allowable values
Operation mode	1 (advanced option)
Subset (Frame Type)	0 (UIH frames only)
Port Speed	1-5 (9600 to 115200 baud) (default = current rate)
N1 (Maximum frame size)	31-64 (default = 64)
T1 (Acknowledgement Timer)	10-100 (default 10 = 100ms)
N2 (Maximum Retransmissions)	3-10 (default 3)
T2 (Response Timer)	30-120 (default 30 = 300ms)
T3 (Wakeup Timer)	3-20 (default 10s)
k (Window Size)	Not supported - applies to error recovery mode only

3.4.3 Multiplexer closedown

The multiplexer is closed down by sending either a DISC frame on DLC0, or by using the closedown command (see below). This can be sent from either end of the connection but would normally be sent by the host. Whichever command type is used, any open data channels will be closed and the link will revert to non-multiplexed AT command mode.

3.4.4 Data channel establishment and release

A data channel (Data Link Connection / DLC) is established by sending a SABM frame with the specified DLCI. This will only be initiated by the host. If the DLC can be established then the GPRS unit will respond by sending a UA frame with the same DLCI. If the DLC cannot be established then the response will be a DM frame.

Once the data channel is established it is connected to one instance of the AT command interpreter in the GPRS unit. All newly created data channels are equivalent until dedicated in some way. This can be done in two ways - either by using the service negotiation command to explicitly define what the channel will be used for, or implicitly by establishing a call, GPRS session etc.

The DLC is closed down by sending a DISC frame with the appropriate DLCI. If the DLC can be disconnected then the GPRS unit will respond by sending a UA frame with the same DLCI. If the DLC is already disconnected then the response will be a DM frame.

3.4.5 Data transmission

User data is transferred with UIH frames with the appropriate DLCI. The error recovery mode is not used, so there is no acknowledgement of data receipt, and lost or bad frames are not retransmitted. In addition, due to the use of UIH frames, there is no error check on the information payload, so if the connection is

expected to be prone to errors then error checking (and correction if required) should be performed by the higher layers.

Currently only type 1 (null) convergence layer is supported, so no structure is conveyed or implied in the data. Any additional packet framing etc. required must be implemented with a higher-layer protocol.

Each data channel has an associated priority. The priority of a particular channel is based on the DLCI, with lower DLCI values having higher priority. See the referenced documentation[1] for the priority assignments given to particular DLCI values. The multiplexer will attempt to transmit higher priority data before that of lower priority. Frames already being transmitted will not be interrupted by higher-priority frames. The multiplexer will interleave high and low priority data so as to prevent complete blocking of low-priority data channels, while giving precedence to higher-priority data.

3.4.6 Control channel commands

The multiplexer control channel provides for various control commands and responses to be sent. These are transferred using information frames (UIH) on DLC 0. Each control command frame consists of the standard frame header etc. The information part of the frame contains a type byte which specifies the command type and whether it is a command (C/R bit = 1) or a response (C/R bit = 0), a length byte, and a variable number (may be zero) of value bytes containing the command parameters.

Each command has a corresponding response which has the same format as the command except for the C/R bit mentioned above. The response should be sent as soon as possible after receiving the command. If an unrecognised or unsupported command is received then a 'Non Supported Command Response' should be sent.

If the expected response frame is not received within time T2 (default of 300ms) then the sender can retry up to a maximum of N2 times (default of 3).

Multiplexer Closedown Command

The multiplexer closedown command is used to reset the link into normal AT command mode. This would normally only be sent by the host. The GPRS unit will send the appropriate response and then return to non-multiplexed mode.

Flow Control On / Off Command

The flow control commands are used to handle aggregate flow. Either end of the link can send a flow control off command when it is unable to receive any new data. It should then send a flow control on command when it is again ready to receive.

If a flow control off command is received then the multiplexer should not transmit any more user data. Any new user data requests should be queued or failed. Command frames can still be transmitted as normal.

Modem Status Command

The modem status command is used to transfer virtual V.24 control signals associated with a data stream. The following signals are supported:

Modem Status Command Bit	DTE >DCE	DCE >DTE
RTC (Ready to communicate)	DTR	DSR

1. ETSI TS 127 010 V3.3.0 (2000-03) Terminal Equipment to Mobile Station (TE-MS) multiplexer protocol (3G TS 27.010 version 3.3.0 Release 1999)

RTR (Ready to receive)	RFR(RTS)	CTS
IC (Incoming call)	0	RI
DV (Data valid)	1	DCD

The exact mapping of these signals is detailed in the referenced documentation[1], section 5.4.6.3.7.

The break signal is not supported. The EA bit of the control signal octet should always be set to 1 and the command length should always be 2.

Service Negotiation Command

The service negotiation command is used to specify what a particular data channel will be used for. This allows the GPRS unit to direct incoming call notifications etc. to the appropriate channel. The command frame contains two value bytes — the first defines the general service type (voice or data) and the second defines the specific service.

Service Value Byte	Specific Service Byte	Data type
03 (S2=0, S1=1, EA=1)	01 (V1-V7=0, EA=1)	Normal AT command mode (unspecified data type)
03	03 (V=1)	Circuit-switched data
03	05 (V=2)	GPRS data
03	07 (V=3)	Trace / Debug output
05 (S2=1, S1=0, EA=1)	Any	Voice (not supported)

Further data types may be added. These will continue as above using sequential values in the V1-V7 bits.

If the service negotiation command is not sent, the data channel will default to the normal AT command mode. If there is no data channel specified for a particular service type, it is intended that incoming call notifications for that service be sent on all open data channels which are in the AT mode. Contact UbiNetics for more information about this.

1. ETSI TS 127 010 V3.3.0 (2000-03) Terminal Equipment to Mobile Station (TE-MS) multiplexer protocol (3G TS 27.010 version 3.3.0 Release 1999)

4.0 Host suspend procedure

4.1 Introduction

When the GPRS module is used with a PDA host, it is necessary for the host to be able to suspend operations due to user command or inactivity timeout, while keeping the module active. It is also necessary for the module to be able to bring the host out of suspend mode on certain events. This section describes the procedure that is used to enter and exit host suspend mode.

4.2 Multiplexer

The module contains a serial multiplexer based on the GSM 07.10 specification. However, the module starts in non-multiplexed mode and so it is necessary to have procedures for entering and exiting suspend mode which do not depend on the multiplexer.

The multiplexer specification includes a sleep mode which can be entered into by one party sending a sleep mode request to the other. Also it defines a wake-up procedure of sending flag bytes until a response is received. In theory these could be used to handle the host suspend mode, but since these would only work if the multiplexer were active, another method has been defined which works in non-multiplexed mode also.

4.3 Module power modes

One feature of the module is its ability to conserve power by turning off the 13MHz system clock (deep sleep mode). The deep sleep manager in the module always tries to put the module into deep sleep mode by regularly checking if deep sleep can be enabled.

The conditions for entering deep sleep mode are:

- There is no activity required on the air interface for a number of frames
- There are no timers about to expire
- There are no tasks ready to run
- There has been no activity on the UART Rx, Tx and flow control lines for 30 seconds
- There is no SIM activity
- The backlight is not active.

Deep sleep mode will be exited when:

- The defined sleep period has expired (e.g. for air interface or timer)
- There is an interrupt
- The UART exits sleep mode due to a transition on the Rx or CTS line.

The UART exiting sleep mode and the 13MHz clock starting takes some time. The host does not know when the module is in deep sleep mode, so it is possible that the first character sent to the module (which causes it to exit deep sleep mode) after some time could be lost.

To avoid this, the CTS flow control line is toggled prior to sending an AT command or multiplexer packet if no characters have been sent for some time.

4.4 Host wake-up events

The module provides the following wake-up events that will cause the HOST_WAKEUP output to be toggled:

- Incoming circuit switched call
- SMS received
- GPRS data received
- UART Tx buffer >half full.

The MMI API allows for the first three of these events to be selectively enabled or disabled. The default state is that all events are enabled.

The events will only generate a pulse on the HOST_WAKEUP line if they happen while the host is suspended, or within a fixed time window before the host is suspended. This latter case is to guard against the possibility of losing an event that happens after a suspend operation has been committed to but before the host is suspended.

4.5 Host suspend operation

The host indicates that it is entering suspend mode by taking HOST_STATUS low. The module then inhibits data transfer until HOST_STATUS goes high. In order to ensure no data is lost in the entry to suspend mode, a specific sequence of checks is required.

Host suspend is normally disabled. It can be enabled by the AT command AT+HOST_STATUS (or from the MMI API).

4.5.1 Host suspend procedure

The following procedure should be adopted by the host when suspending:

- Turn off all unsolicited responses (e.g. +CREG etc.)
- Terminate any circuit switched data calls
- Mask the HOST_WAKEUP interrupt within the PDA
- Take the HOST_STATUS output low
- Continue to read serial characters from the UART into a buffer for at least one character period after HOST_STATUS is taken low
- Suspend (unmasking HOST_WAKEUP interrupt).

4.5.2 Module wake-up behaviour

The module acts as follows:

- If HOST_STATUS is low, no characters are sent to the UART (equivalent of CTS flow control, but inverted)
- If a wake-up event is detected and HOST_STATUS is low, the HOST_WAKEUP output is toggled high then low for approximately 20µs
- If a wake-up event is detected and HOST_STATUS is high, a timer is started (or re-started if already running)
- When the timer expires, if HOST_STATUS is high, no action is performed. If HOST_STATUS is low the HOST_WAKEUP output is toggled high then low approximately 20µs. This ensures that a wake-up event that occurred just before or during the suspend operation is correctly serviced.

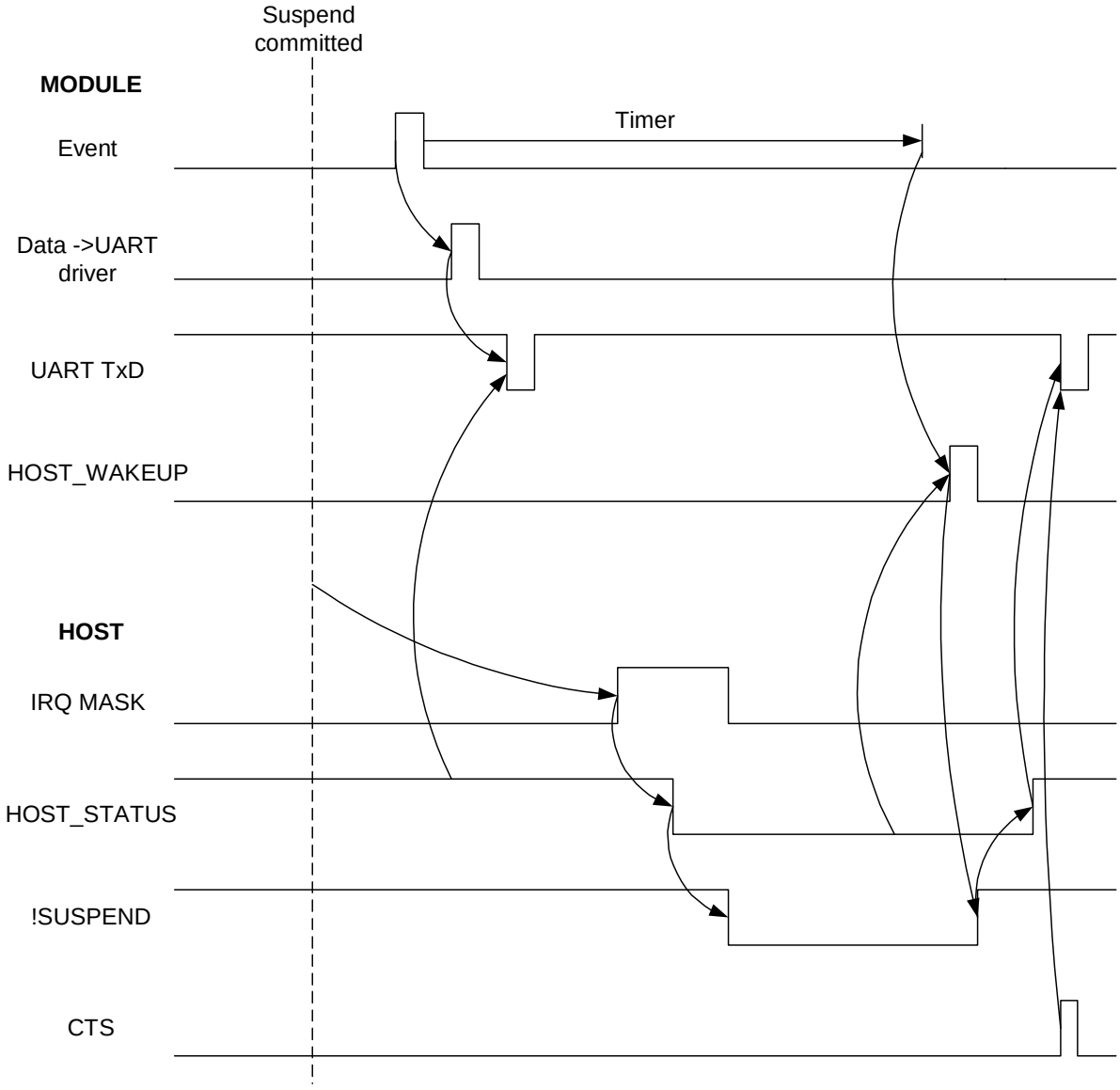
4.5.3 Host wake-up behaviour

The host acts as follows:

- The HOST_WAKEUP pulse causes the host to exit the suspend state
- When it is ready to receive serial characters from the module, the host sets HOST_STATUS high
- Toggle CTS high and low briefly to force module to wake-up and check HOST_STATUS.

4.5.4 Timing diagram

The following diagram shows the behaviour in the worst-case scenario of a wake-up event occurring during the suspend procedure:



The wake-up event happens after the host has committed to the suspend procedure and cannot abort it. Since HOST_STATUS is high, the module starts a timer. It also starts to output the serial string corresponding to the event (e.g. “RING”). The diagram show the case where the first character is

transmitted before HOST_STATUS goes low, and the remainder of the string is transmitted after the host is woken again. The HOST_WAKEUP pulse is generated after the timeout as HOST_STATUS is low at that point. This causes the host to wake up again and receive the rest of the string corresponding to the wake-up event.

This procedure ensures that a wake-up event always causes the host to wake up, but does have the possibility of generating a wake-up when the host has already accepted the event just prior to suspending.

5.0 Integration Guidelines

The following notes are designed to provide general help to those considering integrating the GM400 or GM401 modules into their product.

When designing a product incorporating a GM400 or GM401 module, the main issues to consider are:

- RF
- EMC
- Ground plane connection
- Power supply
- Mechanical
- Firmware upgrading.

5.1 RF

Receiver sensitivity and transmitter output are greatly affected by the design of the RF connection. Great care should be taken with the RF connection in the final product, as the VSWR and insertion losses in the connection to the terminals can reduce transmitter and receiver performance, and increase current consumption.

5.1.1 Receiver

VSWR

The input impedance of the receiver is 50Ω. In order to obtain the maximum power transfer and therefore highest sensitivity, the antenna and any connecting cables should present an impedance as near to 50Ω as possible.

The table below shows how the VSWR effects sensitivity:

VSWR	Reduction in Sensitivity
1:1	0 dB
1.5:1	0.18dB
2:1	0.51 dB
3:1	1.25 dB

Any reduction in sensitivity can be minimised by careful selection of an antenna suitable for the application. A list of suppliers who may be able to help you with this is provided at the end of the section.

It may be necessary to add an external (to the module) matching network in order to ‘tune’ the antenna to 50Ω.

Insertion Loss

The insertion loss of any cables and matching circuit will cause dB for dB a loss in the sensitivity of the completed product. It is therefore important to minimise this as much as possible by

- using high-Q components

- keeping any connecting cables as short as possible.

5.1.2 Transmitter

Power out and current consumption are both affected by the match presented to the RF connection. As with the receiver, the VSWR and insertion loss can adversely affect transmitter performance.

VSWR

Transmitter performance is specified by measuring the power into a 50Ω load at the RF pads on the module. It is important that the module is presented with a 50Ω load, so that the transmitted power is maximised and that current consumption is minimised.

By presenting a load impedance other than 50Ω to the module, some of the power generated by the PA is reflected back into the module. This power is therefore not emitted (reducing product performance) but instead is absorbed by the module, heating it up. If it can, the PA tries to compensate by generating more power, hence drawing more current.

Below is a table showing typical transmitter power reduction and current consumption for different VSWRs at 900MHz and 1800MHz:

VSWR	Peak Current Consumption	Reduction in Power
1:1	1.8 A	0 dB
12:1	3.1 A	-2.1 dB

GSM 900 Channel 62, PCL 5, Vsupply = 3.3 Volts

VSWR	Peak Current Consumption	Reduction in Power
1:1	1.42 A	0 dB
12:1	1.42 A	-1.7dB

GSM 1800 Channel 740, PCL 0, Vsupply = 3.3 Volts

Insertion Loss

As with the Receiver, the insertion loss of any cables and matching circuit will cause dB for dB a loss in the power emitted. It is therefore important to minimise this by using high-Q components and keeping any connecting cables as short as possible.

5.1.3 Sourcing antennae

Companies that provide support for the development of both internal and external antennas include:

- Allgon (www.allgon.com)
- Amphenol (http://www.amphenol.com/)
- Centurion (http://www.centurion.com/antennas.htm)
- Filtronic LK (http://www.lkproducts.com/mobile/index.html)
- Galtronics (http://www.galtronics.com/)
- Moteco (http://www.moteco.com/)
- Panorama (http://www.panorama.co.uk)
- Rangestar (http://www.rangestar.com/search.asp)

This information is provided for your information only and does not represent a recommendation by UbiNetics Ltd. of these companies or their products.

5.2 EMC

Unwanted radiation from a poorly-designed or incorrectly-sited antenna, or from the host application, can adversely affect the performance of the module and of the host application. It is therefore essential that EMC testing be carried out on the application with the module installed as soon as possible during development, to ensure that RF radiation or interference from the application does not cause any problems.

5.2.1 Radiation by the application

The metal screening can surrounding the module shields it from most spurious emissions which may be radiated by the application.

Attention must nevertheless be paid to sources of RF interference within the application — typically processor clocks and buses, and switch-mode power supplies. The supply to these from the battery should be filtered using low-value capacitors (whose self-resonant frequency is in the rejection band required) and lossy ferrite beads, such as the Murata BLM series.

Early EMC tests should be made to pick up any potential problems of this type.

5.2.2 RF interference

(See also “RF” on page 37.)

Apart from ensuring optimum transmit and receive performance, a well-designed and located antenna can also ensure that RF radiation does not adversely affect the performance of the module.

The GSM specification demands extremely high sensitivity from the GSM receiver: an input signal of -100dBm must be recovered with a low bit error rate. This represents only 15pW (15 x 10^{-12} W) of input signal power. Any sources of RF noise must generate less than a tenth of this power in any given receive band, otherwise receiver desensing will occur. This limit is some 40dB below the allowed EMC limits, which themselves are measured at 10 metres. It is therefore possible that equipment that passes EMC testing may render the GSM radio unusable.

Audio circuits (especially microphone inputs) are particularly susceptible to RF interference. Care should be taken to keep RF radiation away from the module interface connector, from which it can find its way onto module tracks.

As much as possible of the RF circuitry should be shielded, and the RF connection and antenna should be separated from the module and the application by a metallic or metallised-plastic case.

Because of the very high data rates on SIM interface lines, these should be kept as short as possible (preferably <8cm), and care should taken to shield them from interference.

Ripple

The module has been tested with a ripple of 250mV P-P sine wave 100Hz to 10KHz on the centre channel of 900 and 1800 bands with the nominal 3.6v supply, with no degradation in performance. It should be noted, however, that half the peak-to-peak ripple on the power supply must be greater than the minimum operating voltage.

5.3 Ground plane connection

The module PCB ground plane is connected to the metal RF screening can which completely encloses the module.

The screening can itself has four legs which provide the mechanical mounting points for the module in the application. Only one of these, however, should be used as the electrical grounding point for the module in the application: this is the leg shown in the drawing in “Pin out diagram and connector orientation” on page 10. Using only this leg for grounding localises the current flow from the PA to ground and minimises radiation accordingly.

5.4 Power supply

The power supply should be adequate to meet the specifications outlined in “Main power supply” on page 13 and “Backup power supply” on page 17.

5.5 Mechanical

“Mechanical Drawings: GM400/401” on page 7 provides the physical dimensions of the module.

The section “Pin out diagram and connector orientation” on page 10 details the type of connector required to interface with the GM400/401 module, and shows the position of the RF connection pads and the mechanical mounting points.

5.6 Firmware upgrading

A flash upgrader program, which runs on a PC, is available for upgrading the firmware on the module. To use this program, the integrator must provide a connection between a PC-compatible device and the module’s serial interface, which is accessible via the module interface connector (see “Asynchronous Serial Interface” on page 24).

6.0 Regulatory Approval

Accredited by the Council for Accreditation

BABT

Certificate

This certificate is issued to

UbiNetics

of

Cambridge Technology Centre
Melbourn
Hertfordshire
SG8 6DP
United Kingdom

to certify that the Equipment known as

GM400

conforms to the essential requirements of the Council Directive 1999/5/EC of the European Parliament and of the Council on the basis of the Technical Construction File number GM400 in relation to the essential requirements of Articles 3.1 (a), 3.1 (b) and 3.2 of the Directive.

Signed: Alan Binks

On Behalf of BABT

Issue Date: 10 December 2001

Number: NC/11554 Issue: 02

This certificate is issued by BABT
The conditions for the validity of this certificate, if any, are listed in the Annex.
This certificate is not transferable and remains the property of BABT.

BABT, Claremont House, 34 Molesey Road, Walton-On-Thames, Surrey KT12 4RQ, U.K.
National Tel: 01932 251251 Fax: 01932 251252
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Web address: http://www.babt.com email: CustomerServices@babt.com

UbiNetics GM40x modules have been designed to meet the most demanding Safety, Radio, Protocol, EMC, Network and Environmental performance standards.

They are tested and approved against the following European and US standards:

Standard		
Europe		**US**
EN60950	**Safety**	UL60950 edition 3
3GPP 51.010	**Radio**	FCC part 24
3GPP 51.010	**Protocol**	3GPP 51.010
EN 301 489	**EMC (Electromagnetic Compatibility)**	FCC part 15
GCF	**Network**	PTCRB
ETS 300 019	**Environmental**	Customer specific

UbiNetics hereby declares that GM40x modules are in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

Because the modules themselves have already obtained Regulatory Approvals under the RTTE Directive, any product that contains a UbiNetics module does not have to undergo such stringent testing as it otherwise would.

For example, your product will not normally have to undergo Protocol or SIM testing, as Protocol and SIM performance is already covered by module approval.

Regulatory Testing of the finished product will normally be limited to Safety, EMC and Environmental standards (which apply to most electronic products in any case), plus Radio, SAR and Network testing. However, the approvals already obtained by the module in these areas mean that the amount of testing of the finished product will normally be less than would otherwise be required.

European and US Regulatory Approvals are accepted in many other countries. UbiNetics can provide an outline of the approvals required for other world markets that have their own specific requirements, or even help you obtain these approvals if you wish.

FCC Requirements

The following statement must be included in the end-user's manual:

"When used in a mobile device a minimum distance of 20cm (8 inches) must be maintained between the antenna and the body of the user and nearby persons to satisfy the FCC RF safety requirements."

The following label should be attached to the device:

"Contains FCC ID: PK5GM401"

In accordance with Part 15 of the FCC rules.

Warning: A maximum antenna gain and cable loss of 3.6 dBI is required to meet the FCC RF exposure requirements.
When used in mobile devices with an antenna above this maximum gain or in portable devices, for example in handset and body-worn devices, a separate approval will be required from the FCC.

How UbiNetics can help

As a world leader in GSM, GPRS and UMTS technology, and with offices in the UK, Hong Kong, India and the United States, UbiNetics Ltd. has wide experience of designing and selling compliant wireless telecommunications products in global markets.

We are now able to offer our Interoperability Test and Approval expertise to other companies that have not yet developed their own, or who merely wish to concentrate on what they do best.

These are some of the services we offer:

- Interoperability testing
- Regulatory approvals
- Network approvals
- Product Design Validation
- EMC and safety testing
- EMC consultancy.

Interoperability Testing

Regulation and test requirements are now struggling to keep pace with the speed of technological development. Interoperability testing is now crucial for demonstrating that products actually work in the varied environments presented by different network infrastructures.

With our detailed knowledge of the infrastructure of major networks, and access to their test beds, we are in a unique position to offer an effective interoperability testing service.

Regulatory Approvals

We have compiled an extensive database on a large number of country requirements, both current and future. We are therefore able to advise on requirements in your target markets during the design phase, and obtain timely approvals for finished products. With this we can offer the following services:

- Product approvals under the R&TTE directive
- World-wide testing, application and management
- In-house Anite protocol testing
- RF and SIM Protocol testing
- Compiling Technical Construction Files
- EMC testing
- Safety/SAR testing.

Network approvals

UbiNetics have established close working relationships with network operators in the UK, Europe and the United States. This enables us to obtain crucial network approvals on target networks with the minimum delay.

Through the relationships we have built up with network operators, we have acquired a depth of knowledge of their network infrastructure and network-specific test requirements. This has enabled us to plan out field trial test routes to cover a comprehensive range of operating situations. All of this allows us to offer the following services:

- Fully-automated field trials testing
- Functional testing against network operator requirements
- Drive testing.

All of these services can be performed for any market in the world.

Product Design Validation

Based at our main test laboratories in Melbourn, near Cambridge in the UK, our engineers have vast experience in product validation. They are able to carry out a wide range of product testing in our laboratories. Our offices in Hong Kong, India and North America co-ordinate testing for those markets. Through our close working relationship with BABT, we have achieved partner status, so we are also able to call upon the global resources of BABT.

We can ensure that your product meets its physical design specification in all areas, using the following services:

- Environmental and mechanical testing
- Accelerated Life Testing (ALT)
- AT command testing
- Supplementary Services testing
- Testing the product against product specifications; this may include compatibility with different operation systems, MMI and compliance with documentation.

EMC and Safety

EMC performance is crucial both for obtaining regulatory approval and for determining product acceptability. We can advise on EMC implications during the design phase, then, with our partners in the UK, carry out the necessary test procedures and evaluate the results. In cases where EMC performance needs to be improved, we are able to suggest product modifications.

Other Services

Our extensive experience of selling wireless products into world markets also enables us to advise clients on many other aspects of doing business around the world, such as

- importing / exporting requirements
- country-specific labelling requirements.

Memberships

Our memberships of the following bodies allows us to keep up to date and even ahead of the game in world regulation and test requirements:

- GSM Association (MoU)
- ETSI
- GCF.

7.0 Definitions and Abbreviations

This section contains a list of common definitions and abbreviations used in this document.

7.0.1 Definitions

Off-line Command State	The modem enters this state after power up i.e. the modem is not in a data call (off-line) and ready to accept AT commands.
On-line Data State	The modem will change from off-line command state to on-line data state after successfully setting up a data call. This allows the mobile station to exchange data with the remote station.
On-line Command State	To change from on-line data state to on-line command state the DTE sends the escape sequence +++. This allows AT commands to be sent to the modem whilst still retaining the data connection to the remote station. The command ATH will end the data call and ATO will return to on-line data state.
Remote Station	This is the term given to describe the equipment or modem at the other end of the link, when making a mobile originated or mobile terminated call.
Mobile Station	Throughout this document this term refers to the UbiNetics modem.
Mobile Originated (MO)	This means a voice call, data call or SMS has initiated by the modem.
Mobile Terminated (MT)	This means a voice call, data call or SMS has been received by the modem.

7.0.2 Syntactical Definitions

The following syntactical definitions are used in this document:

<cr>	Carriage Return character.
<lf>	Line Feed character.
<...>	a sub-parameter enclosed within angle brackets, is a syntactical element. The brackets themselves do not appear in the command line.
[...]	Optional sub-parameter, is enclosed within square brackets. This indicates the element may or may not be present within a result code or can be omitted from the command string. The square brackets themselves do not appear in the command line.
underline	Indicates a default setting of a sub-parameter value after a factory reset.

7.0.3 Abbreviations

The following abbreviations are used in this document:

AT	ATtention, used to start a command line
CBM	Cell Broadcast Message
CCITT	Consultative Committee on International Telegraphy and Telephony
DCE	Data Connection Equipment, refers to the modem which is controlled by the computer and application software. Also see TA

DTE	Data Terminal Equipment, refers to the computer which is used to control the modem via the serial interface.
EMC	Electromagnetic Compatibility
ETSI	European Telecommunications Standards Institute
GPRS	General Packet Radio Service
GSM	Global System for Mobile communications
IMEI	International Mobile station Equipment Identity
ITU-T	International Telecommunication Union = Telecommunication Standardisation Sector
ME	Mobile Equipment; refers to the modem
MO	Mobile Originated, when a call is made from the mobile station
MT	Mobile Terminated, when an incoming call is answered by the mobile station
PA	Power Amplifier (transmitter)
PAD	Packet Assembler/Disassembler
PDU	Protocol Data Unit
PIN	Personal Identification Number: a 4-digit code used to protect the SIM
PPP	Point-to-Point Protocol
PUK	Unblocking Key. An 8-digit code used to unblock SIM PIN
RF	Radio Frequency
RLP	Radio Link Protocol
SAR	Specific Absorption Rate
SIM	Subscriber Identity Module
SMS	Short Message Service
TE	Terminal Equipment. Refers to the computer and application software which is controlling the modem, via the AT command interface
TA	Terminal Adapter. Within this text the TA refers to the modem which is controlled by the application software, via the AT command interface
TAPI	Telephone APplication Interface.
TCP	Transmission Control Protocol
ME	Mobile Equipment. Within this text the ME refers to the UbiNetics modem, which is controlled by the application software. As seen from the AT command interface, the TA and ME have been implemented as a single entity
TIA	Telecommunications Industry Association
UDP	User Datagram Protocol
VSWR	Voltage Standing Wave Ratio

8.0 AT Commands: Introduction

8.1 Overview

UbiNetics Ltd. produces a range of dual-band GSM/GPRS modules, which give compatible mobile devices wireless connectivity using the GSM900/1800/1900 cellular networks.

The modules are controlled by industry-standard AT commands which are defined by ETSI in GSM 07.07, GSM 07.05, V.25ter and T.32. These may be downloaded from http://www.etsi.org or http://www.3gpp.org

This manual lists the AT command set currently supported by the UbiNetics GPRS module. It is not intended to be a full specification of each AT command, but a quick reference to the syntax which includes any details specific to the implementation. For a full specification of each command, please see the original ETSI and ITU documentation.

All other commands not included within this document, whether recognised or not, are not supported and their use is not guaranteed.

8.2 Format of the AT Command String and Result Code

In general AT commands comprise three parts, which start with AT, followed by a command and ended with the line termination character <cr>. The exceptions to this are A/ and +++, which are sent without AT and carriage return.

The response from each command varies and is documented within the following text. In general, a successful command will respond with OK, whilst an unrecognised command will fail with an error. If the command is recognised but fails due to an invalid sub-parameter, equipment error or network error, a more informative result code may be obtained by using the command AT+CMEE=2, to display extended verbose result codes.

8.2.1 Types of Commands

AT commands have three basic structures, some of which are not applicable to all command types. For further information, see the individual commands.

Test Commands

Test Commands (ATxxx=?) test the existence of a command and checks its range of sub-parameter(s). UbiNetics may not support the full range of values returned by this command.

Read Commands

Read Commands (ATxxx?) read the current value of the sub-parameter(s).

Set Commands

Set Commands (ATxxx=a,b) will attempt to set a new subparameter value(s). If the command is successful the AT command interpreter will return OK (if ATV1, ATQ0), otherwise an error or informative result code will be returned.

8.2.2 Command Line Editing

When using a terminal screen to talk directly to the modem, the Back Space <bs> character is useful for deleting previous character(s) sent in error. However Back Space cannot delete the initial AT or the line termination character <cr>.

8.2.3 Command Line Termination

The line termination character Carriage Return <cr> tells the modem to accept and process the command.

8.2.4 Command Formatting

Result code(s) that are sent from the modem use the Line Feed character <lf> appended to a Carriage Return <cr>, to format the text correctly on different lines.

8.2.5 Command Line Echo

In command mode, characters that are sent to the modem are echoed back to the DTE. This can be disabled by using the AT Command ATE0.

8.2.6 Concatenation

Several commands may be joined together to form a single command string, that must be no longer than 350 characters (including the line termination character <cr>).

When concatenating commands, only one AT is required at the beginning of the string and one carriage return at the end. In the middle, commands are joined together in the order to be processed.

Extended commands, i.e. ones which start AT+ also require an additional semi-colon (;). If an error occurs while processing the string, the following commands will not be processed and an error returned. See the examples below:

ATE0V1D123456;<cr>

AT+CMGR=1,2;+CMGR=3,4<cr>

Some AT commands are not suitable for concatenation and careful thought is required before stringing together many AT commands.

8.2.7 Response Code Format

The format of the result code is controlled by ATV. The default setting is verbose <cr><lf>OK<cr><lf>.

8.2.8 Response Code Suppression

Response code suppression is controlled by ATQ. By default response codes are shown.

8.2.9 Final Result Code

This is the last result code returned by the command being processed. In the case of the Dial command this could be OK, NO CARRIER, NO DIALTONE, NO ANSWER, BUSY, ERROR.

8.2.10 Intermediate Result Code

This is a result code which is displayed before the final result code. In the case of the Dial command this could be CONNECT or CONNECT<text>.

8.2.11 Unsolicited Result Code

These are result codes generated by an event not directly linked to the command which is being processed. A good example is an incoming voice call will generate RING or +CRING: VOICE when AT+CRC=1.

9.0 Commands Specified by GSM 07.07

This section covers the AT commands specified within GSM 07.07 and supported by UbiNetics devices.

9.1 General Commands

9.1.1 +CGMI Request Manufacturer Identification

Description

This command causes the modem to return the manufacturer-specific identity.

Command	Possible Response
AT+CGMI=?	
AT+CGMI	Ubinetics Ltd.

Parameters

None.

9.1.2 +CGMM Request Model Identification

Description

This command causes the modem to return the manufacturer-specific model identity.

Command	Possible Response
AT+CGMM=?	
AT+CGMM	<model identity>

Parameters

None.

9.1.3 +CGMR Request Revision Identification

Description

This command causes the modem to return the manufacturer-specific model revision identity.

Command	Possible Response
AT+CGMR=?	
AT+CGMR	<revision>

Parameters

None.

9.1.4 +CGSN Request Product Serial Number Identification

Description

This command causes the modem to return the product serial number.

Command	Possible Response
AT+CGSN=?	
AT+CGSN	<serial number>

Parameters

None.

9.1.5 +CSCS Select DTE Character Set

Description

This command selects the character set used by the modem, to allow correct conversion of the character strings between the DTE and the modem.

Command	Possible Response
AT+CSCS=?	+CSCS: (list of supported <chset>s)
AT+CSCS?	+CSCS: <chset>
AT+CSCS=<chset>	

Parameters

<chset>	GSM	GSM alphabet
	"IRA"	International Reference Alphabet
	HEX	Hexadecimal numbers from 00 to FF

9.1.6 +CIMI Request International Mobile Subscriber Identity

Description

Execution command causes the modem to return the International Mobile Subscriber Identity Number (IMSI), when IMSI attached to a network.

Command	Possible Response
AT+CIMI	<imsi>

Parameters

<imsi>	International Mobile Subscriber Identity number

9.1.7 +WS46 Select Wireless Network

Description

Selects the cellular network Wireless Data Service (WDS) to operate with the modem.

Command	Possible Response
AT+WS46=?	(list of supported <n>s)
AT+WS46?	<n>
AT+WS46=[<n>]	

Parameters

<n> 12 GSM digital cellular

9.1.8 +CSTA Select type of address

Description

Selects the type of number for further dialling commands according to GSM specifications.

Command	Possible Response
+CSTA=?	+CSTA: (list of supported <type>s)
+CSTA?	+CSTA: <type>
+CSTA=[<type>]	

Parameters

<type> type of address octet in integer format

129 default

145 default when dialling string includes the international access code character '+'

9.2 Call Control Commands

9.2.1 D Dial Command

Description

Initiates a mobile-originated call to the destination number <n>.

Command	Possible Response
ATD<n>[<mgsm>][;]	see the table below

Parameters

<n> destination number containing the following characters 0-9,*,#,+,A,B,C,D

<mgsm>

, pause during dialling, ignored

T	tone dialling, ignored
P	pulse dialling, ignored
!	register recall/hook flash, ignored
W	wait for dial tone, ignored
@	wait for quiet answer, ignored
I	restrict CLI presentation, overriding AT+CLIR setting
;	originate a voice call

Note: ATD112; is reserved for emergency calls only.

Verbose Result Code	Numeric Result Code	Description
OK	0	Command executed, no error
CONNECT	1	Connection set up (ATX=0)
CONNECT <text>	1	Connection set up (ATX=n) where n>0
RING	2	Ringing tone is present (AT+CRC=0)
NO CARRIER	3	Call failed to connect or disconnected
ERROR	4	Invalid command or too long
BUSY	7	The called party is currently in another call
NO ANSWER	8	Connection failed up to time out

9.2.2 D> Dial Selected Phone Book

Description

This command initiates a Mobile Originated call, from the specified phone book and location.

Command	Possible Response
ATD><mem><n>[I][;]	see the table within Dial Command

Parameters

<mem>	EN	Emergency Number
	AD	SIM phone book
<n>		Memory location of number to dial
I		Restrict CLI presentation, overriding AT+CLIR setting
;		Originate a voice call

9.2.3 D> Dial Current Phone Book

Description

Initiates a mobile originated call, from the currently selected phone book, location <n>.

Command	Possible Response
ATD><n>[I][;]	see the table within Dial Command

Parameters

<n> number of memory location to dial
I restrict CLI presentation, overriding AT+CLIR setting
; originate a voice call

9.2.4 +CHMOD Call mode

Description

Selects the call mode for dialling commands or for next answering command. The mode can be either single or alternating (for example, voice/data, voice/fax).

Command	Possible Response
+CMOD=?	+CMOD: (list of supported <mode>s)
+CMOD?	+CMOD: <mode>
+CMOD=[<mode>]	

Parameters

<mode> 0 single mode
1 alternating voice/fax
2 alternating voice/data
3 voice followed by data

9.2.5 +CHUP Hangup Call

Description

Execution command hangs up all active calls, giving an assured procedure to terminate an alternating mode call.

Command	Possible Response
AT+CHUP	

Parameters

None.

9.2.6 +CBST Select Bearer Service Type

Description

Set command selects the bearer service for Mobile Originated calls. Values may also be used during mobile terminated data call setup.

Command	Possible Response
AT+CBST=?	+CBST: (list of supported <speed>s),(list of supported <name>s),(list of supported <ce>s)
AT+CBST?	+CBST: <speed>,<name>,<ce>
AT+CBST=[<speed>[,<name>[,<ce>]]]	

Parameters

<speed>	7	9600 bps (V.32)
	12	9600 bps (V.34)
	14	14400 bps (V.34)
	71	9600 bps (V.110)
	75	14400 bps (V.110)
<name>	0	data circuit asynchronous (UDI or 3.1 kHz modem)
<ce>		Sets whether error correction is performed by RLP, or by other means
	0	transparent
	1	non-transparent

9.2.7 +CRLP Radio Link Protocol

Description

Radio link protocol (RLP) parameters used for non-transparent data calls.

Command	Possible Response
AT+CRLP=?	+CRLP: (list of supported <iws>s),(list of supported <mws>s),(list of supported <t1>s),(list of supported <n2>s)]<cr><lf> [+CRLP: (list of supported <iws>s),(list of supported <mws>s),(list of supported <t1>s),(list of supported <n2>s)][...]]
AT+CRLP?	+CRLP: <iws>,<mws>,<t1>,<n2>][<cr><lf> +CRLP:<iws>,<mws>,<t1>,<n2>][...]]
AT+CRLP=[<iws>[,<mws>[,<t1>[,<n2>]]]]	

Parameters

<iws>	0-61	IWF to MS window size
<mws>	0-61	MS to IWF window size
<t1>	39-48-255	acknowledgement timer t1, in 10ms units
<n2>	1-100-255	retransmission attempts n2 (the default subject to change)

Notes

- Only version 1 is supported.
- <ver> and <t4> are not implemented.
- Not all of the combinations of parameters have not been tested.

9.2.8 +CR Service Reporting Control

Description

Set command controls whether or not intermediate result code is returned from the modem to the DTE. If enabled, the intermediate result code is transmitted when the modem has established the speed, which is before the final result code connect.

Command	Possible Response
AT+CR=?	+CR: (list of supported <mode>s)
AT+CR?	+CR: <mode>
AT+CR=[<mode>]	
intermediate result code	+CR: <serv>

Parameters

<mode>	0	disables reporting
	1	enables reporting
<serv>		service supported, displayed after connect message
	ASYNC	asynchronous transparent
	REL ASYNC	asynchronous non-transparent

9.2.9 +CEER Extended Error Report

Description

This command returns information text, which offers the user an extended report for the reason of the failure of the last unsuccessful call set up (originating or answering) or in-call modification.

Command	Possible Response
AT+CEER	+CEER: <report>

Parameters

<report>	no error
	unassigned number
	no route to destination
	channel unacceptable
	operator determined barring
	normal call clearing
	user busy
	no user responding
	user alerting no answer
	call rejected
	number changed

non selected user clearing
destination out of order
invalid number format
facility rejected
response to status enquiry
normal unspecified
no channel available
network out of order
temporary failure
switching equipment congestion
access information discarded
requested channel unavailable
resources unavailable
quality of service unavailable
requested facility unsubscribed
incoming calls barred within CUG
bearer capability not authorized
bearer capability not available
service not available
bearer service not implemented
ACM reached ACM maximum
facility not implemented
only restricted bearer cap. avail.
service not implemented
invalid TI
no member of CUG
incompatible destination
invalid transit network selection
incorrect message
invalid mandatory information
message type not implemented
message type incompatible
info element not implemented
conditional info element error
message incompatible
recovery on time expiry

protocol error
interworking error
bearer service not available
no TI available
timer 303 expiry
establishment failure
no error
operation failed
timeout
bearer service not compatible

9.2.10 +CRC Cellular Result Codes

Description

Set command controls the use of extended format reporting during a MT call set up.

Command	Possible Response
AT+CRC=?	+CRC: (list of supported <mode>s)
AT+CRC?	+CRC: <mode>
AT+CRC=[<mode>]	
unsolicited result code	+CRING: <type>

Parameters

<mode>	0	disables extended format (i.e. +RING)
	1	enables extended format (i.e. +CRING: VOICE)
<type>	ASYNC	asynchronous transparent
	REL ASYNC	asynchronous non-transparent
	VOICE	normal voice
	FAX	Facsimile

9.2.11 +CRING Result code

Description

Result code only generated when AT+CRC=1. See See “+CRC Cellular Result Codes” on page 58.

9.3 Network Service Related Commands

9.3.1 +CSNS Single Numbering Scheme

Description

Selects the bearer or teleservice to be used when a single numbering scheme call is established.

Command	Possible Response
AT+CSNS=?	+CSNS: (list of supported <mode>s)
AT+CSNS?	+CSNS: <mode>
AT+CSNS=[<mode>]	

Parameters

<mode>	0	voice
	1	alternating voice/fax; fax first (TS61)
	2	fax (TS 62)
	3	alternating voice/data, voice first (BS61)
	4	data
	5	alternating voice/fax, fax first (TS61)
	6	alternating voice/data, data first (BS61)
	7	voice followed by data (BS81)

9.3.2 +CNUM Subscriber Number

Description

Action command returns the MSISDNs related to the subscriber. If subscriber has different MSISDN for different services, each MSISDN is returned in a separate line.

Command	Possible Response
AT+CNUM=?	
AT+CNUM	+CNUM: [<alpha1>],<number1>,<type1> [,<speed>,<service>[,<itc>]][<cr><lf> +CNUM: [<alpha2>],<number2>,<type2> [,<speed>,<service>[,<itc>]][...]]

Parameters

<alphax>	optional alphanumeric string associated with <numberx>	
<numberx>	string type phone number of format specified by <typex>	
<typex>	type of address octet in integer format	
<speed>	as defined in AT+CBST	
<service>	service related to the phone number	
	0	asynchronous modem

	1	synchronous modem
	2	PAD access (asynchronous)
	3	packet access (synchronous)
	4	voice
	5	fax
<itc>	information transfer capability	
	0	3.1 kHz
	1	UDI

9.3.3 +CREG Network Registration

Description

Displays network registration status.

Command	Possible Response
AT+CREG=?	+CREG: (list of supported <n>s)
AT+CREG?	+CREG: <n>,<stat>
AT+CREG=[<n>]	
unsolicited result code	+CREG: <stat>

Parameters

<n>	0	disable network registration unsolicited result code
	1	enable network registration unsolicited result code
<stat>	0	not registered new operator to registered and not searching
	1	registered, home network
	2	not registered, currently searching a new operator to register with
	3	registration denied
	4	unknown
	5	registered, roaming

9.3.4 +COPS Operator Selection

Description

Registers/displays network operators available.

Command	Possible Response

AT+COPS=?	+COPS: ([list of supported <stat>,long alphanumeric <oper>,short alphanumeric <oper>,numeric <oper>)s][,,(list of supported <mode>s),(list of supported <format>s)]
AT+COPS?	+COPS: <mode>[,<format>,<oper>]
AT+COPS=[<mode>[,<format>[,<oper>]]] e.g. AT+COPS=1,2,"23410"	

Parameters

<stat> availability of operator

0	unknown
1	available
2	current
3	forbidden

<oper> shows the operator identity, within speech marks, in the format set by <format>

<mode> registration mode

0	automatic (<oper> field is ignored)
1	manual (<oper> field shall be present)
2	de-register from network
3	set only <format> (for read command AT+COPS?). Do not attempt registration / de-registration (<oper> field is ignored); this value is not applicable in read command response
4	manual/automatic (<oper> field shall be present); if manual selection fails, automatic mode <mode>=0) is entered

<format> format of <oper> reports

0	long format alphanumeric <oper>
1	short format alphanumeric <oper>
2	numeric <oper>

9.3.5 +CLCK Facility Lock

Description

This command is used to lock, unlock or interrogate the modem or a network facility. A password is required for some actions.

Command	Possible Response
AT+CLCK=?	+CLCK: (list of supported <fac>s)
AT+CLCK=<fac>,<mode>[,<passwd>],<class>]] e.g. AT+CLCK="SC",0,"1111"	when <mode>=2 and command successful; +CLCK: <status>[,<class1>[<cr><lf> +CLCK: <status>,<class2>[...]]

Parameters

<fac>	(within speech marks)	
	SC	SIM (lock SIM card) SIM asks password in modem power-up and when this lock command issued
	AO	BAOC (Bar All Outgoing Calls)
	OI	BOIC (Bar Outgoing International Calls)
	OX	BOIC-exHC (Bar Outgoing International Calls except to Home Country)
	AI	BAIC (Bar All Incoming Calls)
	IR	BIC-Roam (Bar Incoming Calls when Roaming outside the home country)
	AB	All Barring services
	AG	All outGoing barring services
	AC	All inComing barring services
	FD	SIM fixed dialling memory feature, if PIN2 authentication has not been done during the current session, PIN2 is required as <passwd>
<mode>	0	unlock
	1	lock
	2	query status
<status>	0	not active (when mode=2, indicates no services are active)
	1	active
<passwd>	the same password used by AT+CPWD, within speech marks	
<classx>	a sum of integers each representing a class of information	
	1	voice (telephony)
	2	data (refers to all bearer services; with <mode>=2 this may refer only to some bearer service if TA does not support values 16, 32, 64 and 128)
	4	fax (facsimile services)
	7	all classes

9.3.6 +CPWD Change Password

Description

Action command sets a new password for the facility lock function defined by command facility lock (AT+CLCK).

Command	Possible Response
AT+CPWD=?	+CPWD: list of supported (<fac>,<pwdlength>)s
AT+CPWD=<fac>,<oldpwd>,<newpwd> e.g. AT+CPWD="SC","1234","4321"	

Parameters

<fac> (within speech marks)

	SC	lock SIM card, asks password in modem power-up and when this loc command issued (SIM PIN1)
	AO	bar All Outgoing Calls (BAOC)
	OI	bar Outgoing International Calls (BOIC)
	OX	bar Outgoing International Calls except to Home Country (BOIC-exHC)
	AI	bar All Incoming Calls (BAIC)
	IR	bar Incoming Calls when Roaming outside the home country (BIC-Roam)
	AB	all Barring services
	AG	all outGoing barring services
	AC	all inComing barring services
	P2	SIM PIN2
<pwdlength>	integer type, maximum length of the password for the facility (see AT+CPWD=?)	
<oldpwd>	string type; shall be the same as password specified for the facility from the modem AT command interface or with command Change Password AT+CPWD	
<newpwd>	string type; shall be the new password for the facility from the modem AT command interface or with command Change Password AT+CPWD	

9.3.7 +CLIP Calling Line Identification Presentation

Description

This command allows the called subscriber to get the Calling Line Identity (CLI) of the calling party, in a mobile terminated call.

Command	Possible Response
AT+CLIP=?	+CLIP: (list of supported <n>s)
AT+CLIP?	+CLIP: <n>,<m>
AT+CLIP=[<n>]	
unsolicited result code, displayed when CLI is enabled for the first two rings	+CLIP: <number>,<type>

Parameters

<n>		sets/shows the result code presentation status in the modem
	0	disable
	1	enable
<m>	0	CLIP not provisioned (parameter shows the subscriber CLIP service status in the net work)
	1	CLIP provisioned
	2	unknown (e.g. no network, etc.)
<number>	String type phone number in "quotes", in the format specified by <type>	
<type>	type of number	
	129	dial string without the international access character

145 dial string which includes the international access character "+"

9.3.8 +CLIR Calling Line Identification Restriction

Description

This command enables/disables CLI to the called party, when originating a call.

Command	Possible Response
AT+CLIR=?	+CLIR: (list of supported <n>s)
AT+CLIR?	+CLIR: <n>,<m>
AT+CLIR=[<n>]	

Parameters

<n> sets CLI status for following calls.

0 presentation indicator is used according to the subscription of the CLIR service.

1 CLIR invocation (hide)

2 CLIR suppression (show)

<m> Shows the subscriber CLIR service status in the network

0 CLIR not provisioned

1 CLIR provisioned in permanent mode

2 unknown (e.g. no network, etc.)

3 CLIR temporary mode presentation restricted

4 CLIR temporary mode presentation allowed

9.3.9 +COLP Connected Line Identification Presentation

Description

COLP enables a calling subscriber to get the connected line identity (COL) of the called party after setting up a mobile originated call.

Command	Possible Response
AT+COLP=?	+COLP: (list of supported <n>s)
AT+COLP?	+COLP: <n>,<m>
AT+COLP=[<n>]	
Intermediate result code	+COLP:<number>,<type>[,<subaddr>,<satype>[,<alpha>]]

Parameters

<n> Sets/shows the result code presentation status in the TA

0 disable

1 enable

<m> Shows the subscriber COLP service status in the network

	0	COLP not provisioned
	1	COLP provisioned
	2	unknown (e.g. no network, etc.)
<number>	String type phone number in "brackets" of format specified by <type>	
<type>	Type of address octet in integer format. 145 when the dial string contains +, otherwise 129.	

9.3.10 +CCUG Closed User Group

Description

Allows control of the Closed User Group supplementary service.

Command	Possible Response
AT+CCUG=?	
AT+CCUG?	+CCUG: <n>,<index>,<info>
AT+CCUG=[<n>[,<index>[,<info>]]]	

Parameters

<n>	0	disable CUG temporary mode
	1	enable CUG temporary mode
<index>	0...9	CUG index
	10	no index
<info>	0	no information
	1	suppress OA
	2	suppress preferential CUG
	3	suppress OA and preferential CUG

9.3.11 +CCFC Call Forwarding Number and Conditions

Description

This command allows control over the call forwarding supplementary service providing, registration, erasure, activation, deactivation and status query.

Command	Possible Response
AT+CCFC=?	+CCFC: (list of supported <reason>s)
AT+CCFC=<reason>,<mode>[,<number>[,<type>[,<class>[,<subaddr>[,<satype>[,<time>]]]]]] e.g. AT+CCFC=0,3,"01763262222"	When <mode>=2 and command successful; +CCFC: <status>,<class1>[,<number>,<type>[,<subaddr>,<satype>[,<time>]]][<cr><lf> +CCFC: <status>,<class2>[,<number>,<type>[,<subaddr>,<satype>[,<time>]]][...]]

Parameters

<reason>	0	unconditional
	1	mobile busy
	2	no reply
	3	not reachable
	4	all call forwarding
	5	all conditional call forwarding
<mode>	0	disable
	1	enable
	2	query status
	3	registration
	4	erasure
<number>	String type phone number of forwarding address in format specified by <type>	
<type>	Type of number	
	129	dial string without the international access character
	145	dial string which includes the international access character "+"
<subaddr>	String type sub-address of format specified by <satype>	
<satype>	Type of sub-address octet in integer format	
	128	default
<class>	a sum of integers each representing a class of information	
	1	voice (telephony)
	2	data (refers to all bearer services; with <mode>=2 this may refer only to some bearer service if TA does not support values 16, 32, 64 and 128)
	4	fax (facsimile services)
	7	All classes
	8	short message service
	16	data circuit sync
	32	data circuit async
	64	dedicated packet access
	128	dedicated PAD access
<time>	1-20-30	when "no reply" is enabled or queried, this gives the time in seconds to wait before call is forwarded
<status>	0	not active (when <mode>=2, means not active for all class)
	1	active

9.3.12 +CCWA Call Waiting

Description

This command allows control over the call waiting supplementary service providing activation, deactivation, and status query.

Command	Possible Response
AT+CCWA=?	+CCWA: (list of supported <n>s)
AT+CCWA?	+CCWA: <n>
AT+CCWA=[<n>[,<mode>[,<class>]]]	When <mode>=2 and command successful; +CCWA: <status>,<class1>[<cr><lf> +CCWA: <status>,<class2>[...]]
unsolicited result code (when <n>=1)	+CCWA: <number>,<type>,<class>[,<alpha>]

Parameters

<n> sets/shows the result code presentation status in the modem

- 0 disable
- 1 enable

<mode> when <mode> parameter is not given, network is not interrogated

- 0 disable
- 1 enable
- 2 query status

<class> a sum of integers each representing a class of information

- 1 voice (telephony)
- 2 data (refers to all bearer services; with <mode>=2 this may refer only to some bearer service if TA does not support values 16, 32, 64 and 128)
- 4 fax
- 8 short message service
- 16 data circuit sync
- 32 data circuit async
- 64 dedicated packet access
- 128 dedicated PAD access.

<status>

- 0 not active, (when <mode>=2, means not active for all class)
- 1 active

<number> string type phone number of calling address in format specified by <type>

<type> type of address octet in integer format

<alpha> optional string type alphanumeric representation of <number> corresponding to the entry found in phonebook)

9.3.13 +CHLD Call Related Supplementary Services

Description

This command allows call control using Call Hold and MultiParty.

Command	Possible Response
AT+CHLD=?	+CHLD: (list of supported <n>s)
AT+CHLD=[<n>]	

Parameters

<n> integer type

0	releases all held calls or sets User Determined User Busy (UDUB) for a waiting call
1	releases all active calls (if any exist) and accepts the other (held or waiting) call
1x	releases a specific active call X
2	places all active calls (if any exist) on hold and accepts the other (held or waiting) call
2x	places all active calls on hold except call X with which communication shall be supported
3	adds a held call to the conversation
4	connects the two calls and disconnects the subscriber from both calls (ECT)

9.3.14 +CUSD Unstructured Supplementary Service Data

Description

This command allows control of the Unstructured Supplementary Service Data, for both network and mobile initiated operations.

Command	Possible Response
AT+CUSD=?	+CUSD: (list of supported <n>s)
AT+CUSD?	+CUSD: <n>
AT+CUSD=[<n>[,<str>[,<dcs>]]]	
unsolicited result code	+CUSD: <m>[,<str>,<dcs>]

Parameters

<n>	0	disable the result code presentation in the TA
	1	enable the result code presentation in the TA
<str>	string type USSD-string; when <str> parameter is not given, network is not interrogated	
<dcs>	Cell Broadcast Data Coding Scheme in integer format	
<m>	0	no further user action required (network initiated USSD-Notify, or no further information needed after mobile initiated operation)
	1	further user action required (network initiated USSD-Request, or further information needed after mobile initiated operation)
	2	USSD terminated by network

	3	other local client has responded
	4	operation not supported
	5	network time out Implementation

9.3.15 +CAOC Advice of charge

Description

Advice of Charge supplementary service, enabling users to obtain information on the cost of calls.

Command	Possible Response
AT+CAOC=?	[+CAOC: (list of supported <mode>s]
AT+CAOC?	+CAOC: <mode>
AT+CAOC[=<mode>]	[+CAOC: <ccm>]

Parameters

<mode>	0	Query CCM value
	1	Deactivate the unsolicited reporting of CCM value
	2	Activate the unsolicited reporting of CCM value

9.3.16 +CSSN Supplementary Service Notifications

Description

Supplementary service: enables/disables network-initiated notifications.

Command	Possible response
AT+CSSN=[<n>[,<m>]]	
AT+CSSN?	+CSSN: <n>,<m>
AT+CSSN=?	+CSSN: (list of supported <n>s),(list of supported <m>s)

Parameters

<n>	CSSI result code notification	
	0	disable
	1	enable
<m>	CSSU result code notification	
	0	disable
	1	enable
<code1>	(manufacturer specific)	
	0	unconditional call forwarding is active
	1	some of the conditional call forwardings are active
	2	call has been forwarded

	3	call is waiting
	4	CUG call (also <index> present)
	5	outgoing calls barred
	6	incoming calls barred
	7	CLIR suppression rejected
	8	call deflected
<index>	refer "Closed user group +CCUG"	
<code2>	(manufacturer specific)	
	0	forwarded call (MT call setup)
	1	CUG call (also <index> present) (MT call setup)
	2	call put on hold (during a voice call)
	3	call retrieved (during a voice call)
	4	multiparty call entered (during a voice call)
	5	call on hold has been released (not a SS notification) (during a voice call)
	6	forward check SS message received (can be received whenever)
	7	call is being connected (alerting) with the remote party in alerting state in explicit call transfer operation (during a voice call)
	8	call has been connected with the other remote party in explicit call transfer operation (also number and subaddress parameters may be present) (during a voice call or MT call setup)
	9	deflected call (MT call setup)
<number>	string type phone number of format specified by <type>	
<type>	type of address octet in integer format	
<subaddr>	string type sub-address of format specified by <satype>	
<satype>	type of sub-address octet in integer format	

9.3.17 +CLCC List Current Calls

Description

This returns a list of current call of the modem, if any.

Command	Possible Response
AT+CLCC	[+CLCC: <id1>,<dir>,<stat>,<mode>,<mpty>[,<number>,<type>[,<alpha>]][<cr><lf> +CLCC: <id2>,<dir>,<stat>,<mode>,<mpty>[,<number>,<type>[,<alpha>]][...]]]

Parameters

<idx>	call identification number; this number can be used in AT+CHLD command operations	
<dir>	0	mobile originated (MO) call
	1	mobile terminated (MT) call

<stat>	state of the call	
	0	active
	1	held
	2	dialling (MO call)
	3	alerting (MO call)
	4	incoming (MT call)
	5	waiting (MT call)
<mode>	bearer/teleservice	
	0	voice
	1	data
	9	unknown
<mpty>	0	call is not one of multiparty (conference) call parties
	1	call is one of multiparty (conference) call parties
<number>	phone number in format specified by <type>, within "quotes"	
<type>	type of number	
	129	dial string without the international access character
	145	dial string which includes the international access character "+"
<alpha>	alphanumeric representation of <number> corresponding to the entry found in phonebook	

9.3.18 +CPOL Preferred Operator List

Description

This command is used to edit the SIM preferred list of networks.

Command	Possible Response
AT+CPOL=?	+CPOL: (list of supported <index>s),(list of supported <format>s)
AT+CPOL?	+CPOL: <index1>,<format>,<oper1>[<cr><lf> +CPOL: <index2>,<format>,<oper2>[...]]
AT+CPOL=[<index>][,<format>[,<oper>]]	

Parameters

<index>,<index>	integer type; the order number of operator in the SIM preferred operator list. With the execute command, if <index> is left out, the next free location shall be used	
<format>	If only the <format> is given, the result format changes for the read command	
	0	long format alphanumeric <oper>
	1	short format alphanumeric <oper>
	2	numeric <oper>
<oper>,<oper>	string type; <format> indicates the format of <oper>; also see AT+COPS	

Note: To delete an entry, give <index> but leave out <oper>.

9.3.19 +COPN Read Operator Names

Description

This command returns the list of operator names from the modem.

Command	Possible Response
AT+COPN=?	
AT+COPN	+COPN: <numeric1>,<alpha1>[<cr><lf> +COPN: <numeric2>,<alpha2>[...]]

Parameters

<numericn> string type; operator in numeric format (see AT+COPS)

<alphan> string type; operator in long alphanumeric format (see AT+COPS)

9.3.20 +CPAS Phone Activity Status

Description

Returns the phone activity status.

Command	Possible response
AT+CPAS	+CPAS: <pas>
AT+CPAS=?	+CPAS: (list of supported <pas>s)

Parameters

<pas>	0	ready	allows commands
	1	unavailable	does not allow commands
	2	unknown	not guaranteed to respond to commands
	3	ringing	ringer is active
	4	call in progress	call is in progress
	5	asleep	low functionality state

9.4 Mobile Equipment Control and Status Commands

9.4.1 +CFUN Set Phone Functionality

Description

This command sets the level of functionality provided by the modem.

Command	Possible Response
AT+CFUN=?	CFUN: (list of supported <fun>s)
AT+CFUN?	CFUN: <fun>
AT+CFUN=[<fun>]	

Parameters

<fun>	0	sets minimum functionality. In this mode the modem de-registers from the network and powers down the SIM interface and RF circuitry
	1	sets full functionality

Note: An ERROR returned after entering AT+CFUN=1 usually means the SIM card cannot be read. This can be for several reasons—incorrect insertion, a damaged SIM, or a type of SIM not supported by the module.

9.4.2 +CPIN Enter PIN

Description

This command is used to query and enter a password which is necessary before the modem will operate. If the PIN is to be entered twice, the modem shall automatically repeat the PIN.

Command	Possible Response
AT+CPIN=?	
AT+CPIN?	+CPIN: <code>
AT+CPIN=<pin>[,<newpin>] e.g. AT+CPIN? +CPIN: SIM PIN AT+CPIN="1234"	

Parameters

<pin>,<newpin>		string type values within "quotes"
<code>	READY	no passwords required
	SIM PIN	waiting for SIM PIN i.e. on power up SIM PIN 1
	SIM PUK	waiting for SIM PUK, SIM PIN 1 unblocking code. parameter <newpin> in the new SIM PIN code.
	PH-SIM PIN	waiting for phone-to-SIM card password
	PH-FSIM PIN	waiting for phone-to-very first SIM card password

PH-FSIM PUK	waiting for phone-to-very first SIM card un-blocking password
SIM PIN2	waiting for SIM PIN2 password. This <code> is recommended to be returned only when the last executed command resulted in PIN2 authentication failure (i.e. +CME ERROR: 17)
SIM PUK2	waiting for SIM PUK2 password. This <code> is recommended to be returned only when the last executed command resulted in PUK2 authentication failure (i.e. +CME ERROR: 18)

9.4.3 +CPBS Select Phone Book Memory Storage

This command selects phonebook memory storage <storage>, which is used by other phonebook commands.

Command	Possible Response
AT+CPBS=?	+CPBS: (list of supported <storage>s)
AT+CPBS?	+CPBS: <storage>[,<used>,<total>]
AT+CPBS=<storage> e.g. AT+CPBS="AD"	

Parameters

<storage>	EN	Emergency Number
	AD	SIM phone book
	FD	SIM fixdialling-phonebook
	LD	SIM last-dialling-phonebook
	BD	Barred dialling
	LR	Last-received numbers
	SD	SIM service numbers
	LM	Last missed
	AF	SIM fixed
<used>	The number of used locations in selected memory	
<total>	The total number of locations in selected memory	

9.4.4 +CPBR Read Phone Book Entries

Description

This command returns the phonebook entry for location <index> of the currently selected phone book (AT+CPBS). If all queried locations are empty (but available), no information text lines may be returned.

Command	Possible Response
AT+CPBR=?	+CPBR: (list of supported <index>s),[<nlength>],[<tlength>]
AT+CPBR=<index1>[,<index2>]	[+CPBR: <index1>,<number>,<type> ,<text>[[...]<cr><lf> +CPBR: <index2>,<number>,<type>,<text>]]

Parameters

<index1>,<index2>,<index>	range of location numbers of phonebook memory
<number>	phone number in format <type>
<type>	type of phone number
	129 dial string without international access character
	145 dial string which includes the international access character "+"
<text>	text field of maximum length <tlength>
<nlength>	value indicating the maximum length of field <number>
<tlength>	value indicating the maximum length of field <text>

9.4.5 +CPBF Find Phone Book Entries

Description

This command returns phonebook entries from the current phone book which alphanumeric field start with string <findtext>.

Command	Possible Response
AT+CPBF=?	+CPBF: [<nlength>],[<tlength>]
AT+CPBF=<findtext> e.g. AT+CPBF="UbiNetics"	[+CPBF: <index1>,<number>,<type> ,<text>[[...]<cr><lf> +CBPF: <index2>,<number>,<type> ,<text>]]

Parameters

<index1>,<index2>	values in the range of location numbers of phonebook memory
<number>	phone number of format <type>
<type>	type of phone number
	129 dial string without the international access character
	145 dial string which includes the international access character "+"
<findtext>,<text>	field of maximum length <tlength

<nlength> value indicating the maximum length of field <number>

<tlength> value indicating the maximum length of field <text>)

9.4.6 +CPBW Write Phone Book Entry

Description

This command writes an entry to location number <index> in the current phonebook.

Command	Possible Response
AT+CPBW=?	+CPBW: (list of supported <index>s),[<nlength>],(list of supported <type>s),[<tlength>]
AT+CPBW=[<index>][,<number>[,<type>[,<text>]]] e.g: AT+CPBW=1,"+441763262222",145,"UbiNetics"	

Parameters

<index> range of valid location numbers for the selected phonebook memory. If this is omitted when writing an entry the first free location shall be used

<number> phone number of format <type>

<type> type of phone number

- 129 dial string without the international access character
- 145 dial string which includes the international access character "+"

<text> field of maximum length <tlength>

<nlength> value indicating the maximum length of field <number>

<tlength> value indicating the maximum length of field <text>

Note: To delete an entry, only specify the <index> field.

9.4.7 +CRSL Ringer Sound Level

Description

This command is queries and sets, the sound level of the incoming call ringer.

Command	Possible Response
AT+CRSL=?	+CRSL: (list of supported <level>s)
AT+CRSL?	+CRSL: <level>
AT+CRSL=<level>	

Parameters

<level> integer type value

- 0-175-255 smallest value represents the lowest sound level

9.4.8 +CRSM Restricted SIM access

Description

Transmits SIM commands to mobile equipment. Can be used in place of +CSIM for easier but more limited access to the SIM database.

Command	Possible response
AT+CRSM=?	
AT+CRSM=<command>[,<fileid>[,<P1>,<P2>,<P3>[,<data>]]]	+CRSM: <sw1>,<sw2>[,<response>]

Parameters

<command>

176	READ BINARY
178	READ RECORD
192	GET RESPONSE
214	UPDATE BINARY
220	UPDATE RECORD
242	STATUS

All other values are reserved

NOTE: The ME internally executes all commands necessary for selecting the desired file, before performing the actual command.

<fileid> Integer type: the identifier of a elementary datafile on SIM. Mandatory for every command except STATUS

<P1>, <P2>, <P3> Integer type; parameters passed on by the ME to the SIM. These parameters are mandatory for every command, except GET RESPONSE and STATUS.

<data> Information written to the SIM (hexadecimal character format; refer +CSCS)

<sw1>, <sw2> Integer type; information from the SIM about the execution of the actual command. These parameters are sent to the terminal on successful or failed execution of the command

<response> Response of a successful completion of the command issued (hexadecimal character format: see +CSCS). STATUS and GET RESPONSE return data, which gives information about the current elementary datafield. This information includes the type of file and its size. In response to the READ BINARY or READ RECORD commands the requested data is returned. <response> is not returned after a successful UPDATE BINARY or UPDATE RECORD command

9.4.9 +CLVL Set Speaker Amplifier Gain

Description

This command is used to select the output level of the loudspeaker output.

Command	Possible Response

AT+CLVL=?	+CLVL: (list of supported <level>s)
AT+CLVL?	+CLVL: <level>
AT+CLVL=<level>	

Parameters

<level> integer type value
0-175-255 smallest value represents the lowest sound level

9.4.10 +CMUT Mute Control

Description

Enable or disables voice muting.

Command	Possible response
AT+CMUT=?	+CMUT: (list of supported <n>s)
AT+CMUT?	+CMUT: <n>
AT+CMUT=<n>	

Parameters

<n> 0 muteoff
1 muteon

9.4.11 +CACM Accumulated Call Meter

Description

Allows the call meter to be read and reset.

Command	Possible response
AT+CACM=?	
AT+CACM?	+CACM: <acm>
AT+CACM=[<passwd>]	

Parameters

<passwd> string SIM PIN2
<acm> string accumulated call meter value (see also <ccm> in +CAOC)

9.4.12 +CAMM Accumulated Call Meter Maximum

Description

Allows call meter maximum to be set and values to be read.

Command	Possible response
AT+CAMM?	+CAMM: <acmmax>
AT+CAMM=?	
AT+CAMM=[<acmmax>[,<passwd>]]	

Parameters

<acmmax>	string	accumulated call meter maximum value (see also <ccm> in AT+CAOC)
	0	disables ACMmax
<passwd>	string	SIM PIN2

9.4.13 +CPUC Price Per Unit and Currency Table

Description

Sets the price per unit and currency table to allow conversion between home units and other currency units.

Command	Possible response
AT+CPUC=?	
AT+CPUC?	+CPUC: <currency>,<ppu>
AT+CPUC=<currency>,<ppu>[,<passwd>]	

Parameters

<currency>	string	three-character currency code (e.g. "GBP", "DEM") as specified by AT+CSCS
<ppu>	string	price per unit; dot is used as a decimal separator (e.g. "3.34")
<passwd>	string	SIM PIN2

9.4.14 +CCWE Call Meter Maximum Event

Description

Determines whether the result code +CCWV (which warns when less than 30 seconds call time remains short of the maximum) is sent.

Command	Possible response
AT+CCWE=?	+CCWE: (list of supported<mode>s)
AT+CCWE?	+CCWE: <mode>
AT+CCWE=<mode>	

Parameters

<mode> 0 Disable the call meter warning event

1 Enable the call meter warning event

9.4.15 +CLAC List All Available AT Commands

Description

Returns the AT commands available to the user.

Command	Possible response
AT+CLAC	<AT Command1> [<CR> <LF> <ATCommand2>[…]]
AT+CLAC=?	

Parameters

<AT Command > Defines the AT command, including the prefix AT.

9.5 Mobile Equipment Errors

9.5.1 +CMEE Mobile Equipment Errors

Description

This command controls the presentation of result codes, generated by errors relating the functionality of the modem.

Command	Possible Response
AT+CMEE =?	+CMEE: (list of supported <n>s)
AT+CMEE?	+CMEE: <n>
AT+CMEE=[<n>]	
result code	+CME ERROR: <err>

Parameters

<n> 0 disable result code and use ERROR instead

1 enable result code and use numeric <err> values

2 enable result code and use verbose <err> values

<err> for a complete list of error codes, see CME result codes.

9.5.2 +CME ERROR Mobile Equipment Error Result Code

Description

Similar in operation to the normal ERROR result code. None of the following commands in the same command line is executed.

Parameters

<err>	Numeric format	Verbose format
	0	Phone failure
	1	No connection to phone
	2	Phone-adaptor link reserved
	3	Operation not allowed
	4	Operation not supported
	5	PH-SIM PIN required
	6	PH-FSIM PIN required
	7	PH-SIM PUK required
	10	SIM not inserted
	11	SIM PIN required
	12	SIM PUK required
	13	SIM failure
	14	SIM busy
	15	SIM wrong
	16	incorrect password
	17	SIM PIN2 required
	18	SIM PUK2 required
	20	memory full
	21	invalid index
	22	not found
	23	memory failure
	24	text string too long
	25	invalid characters in text string
	26	dial string too long
	27	invalid characters in dial string
	30	no network service
	31	network timeout
	32	network not allowed - emergency calls only
	40	network personalisation PIN required
	41	network personalisation PUK required
	42	network subset personalisation PIN required
	43	network subset personalisation PUK required
	44	service provider personalisation PIN required
	45	service provider personalisation PUK required

46	corporate personalisation PIN required
47	corporate personalisation PUK required
100	unknown

9.6 Commands from TIA IS-101

9.6.1 +FCLASS Select Mode

Description

This command puts the modem into the correct mode of operation, allowing information to be processed in a suitable manner.

Command	Possible Response
AT+FCLASS=?	(list of supported <n>s)
AT+FLCASS?	<n>
AT+FCLASS=<n>	

Parameters

<n> 0 data
2.0 fax (T.32)

9.6.2 +VTS DTMF Tone Generation

Description

This command allows the transmission of DTMF tones within a voice call. The tones are generated by the network and heard at the remote station.

Command	Possible Response
AT+VTS=?	+VTS: (list of supported <tone>s)
AT+VTS=<dtmf>	

Parameters

<dtmf> single tone, fixed duration
0-9,A,B,C,D,#,* are valid for this command

10.0 Commands Specified by GSM 07.05

This section covers the AT commands that specified within GSM 07.05 and supported by the UbiNetics modems.

10.1 SMS Parameter Definitions

10.1.1 Message Storage Parameters

<index> value in the range of location numbers supported by the associated memory

<mem1> memory from which messages are read and deleted

ME	ME (modem) message storage, not supported
SM	SIM message storage

<mem2> memory to which writing and sending operations are made; refer <mem1> for defined values

<mem3> memory to which received short messages are preferred to be stored, unless forwarded directly to DTE. Also refer to AT+CNMI and <mem1> for defined values. Received CBMs can not be stored and must be sent directly to the DTE.

<stat> displays the status of the message in memory

0	"REC UNREAD"	received unread message (i.e. new message)
1	"REC READ"	received read message
2	"STO UNSENT"	stored unsent message
3	"STO SENT"	stored sent message
4	"ALL"	all messages (only applicable to AT+CMGL)

<total1> total number of message locations in <mem1>

<total2> total number of message locations in <mem2>

<total3> total number of message locations in <mem3>

<used1> number of messages currently in <mem1>

<used2> number of messages currently in <mem2>

<used3> number of messages currently in <mem3>

10.1.2 Message Data Parameters

<ackpdu>	GSM 03.40 RP-User-Data element of RP-ACK PDU; format is same as for <pdu> in case of SMS, but without GSM 04.11 SC address field and parameter shall be bounded by double quote characters like a normal string type parameter
<alpha>	Alphanumeric representation of <da> or <oa> corresponding to the entry found in phonebook
<cdata>	GSM 03.40 TP-Command-Data in text mode responses; ME/TA converts each 8-bit octet into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to DTE as two characters 2A (IRA 50 and 65))
<ct>	GSM 03.40 TP-Command-Type
<da>	GSM 03.40 TP-Destination-Address Address-Value field
<data>	GSM 03.40 TP-User-Data in text mode) response format;
	If <dcs> indicates that GSM 03.38 default alphabet is used and <fo> indicates that GSM 03.40 TP-User-Data-Header-Indication is not set;
	If DTE character set other than "HEX", ME/TA converts GSM alphabet into current DTE character set according to rules
	If DTE character set is "HEX", ME/TA converts each 7-bit character of GSM alphabet into two IRA character long hexadecimal number (e.g. character II (GSM 23) is presented as 17 (IRA 49 and 55))
	If <dcs> indicates that 8-bit or UCS2 data coding scheme is used, or <fo> indicates that GSM 03.40 TP-User-Data-Header-Indication is set: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number
In the case of CBS (GSM 03.41) CBM Content of Message in text mode responses, format:	
	If <dcs> indicates that GSM 03.38 default alphabet is used:
	If DTE character set other than "HEX", ME/TA converts GSM alphabet into current DTE character set according to rules.
	If DTE character set is "HEX", ME/TA converts each 7-bit character of GSM alphabet into two IRA character long hexadecimal number
	If <dcs> indicates that 8-bit or UCS2 data coding scheme is used, ME/TA converts each 8-bit octet into two IRA character long hexadecimal number
<dcs>	GSM 03.38 SMS Data Coding Scheme (default 0), or Cell Broadcast Data Coding Scheme in integer format
<dt>	GSM 03.40 TP-Discharge-Time in time-string format: “yy/MM/dd,hh:mm:ss±zz” where characters indicate year (two last digits), month, day, hour, minutes, seconds and time zone. e.g. 6th of May 1994, 22:10:00 GMT+2 hours equals to “94/05/06,22:10:00+08”
<fo>	First octet of GSM 03.40 SMS-DELIVER, SMS-SUBMIT (default 17), SMS-STATUS-REPORT, or SMS-COMMAND (default 2) in integer format)
<length>	Integer type value indicating in the text mode (AT+CMGF=1) the length of the message body <data> (or <cdata>) in characters; or in PDU mode (AT+CMGF=0), the length of the actual TP data unit in octets (i.e. the RP layer SMSC address octets are not counted in the length)
<mid>	GSM 03.41 CBM Message Identifier in integer format

<mn>	GSM 03.40 TP-Message-Number in integer format
<mr>	GSM 03.40 TP-Message-Reference in integer format, returned to the DTE on successful message delivery
<oa>	GSM 03.40 TP-Originating-Address Address-Value field in string format; BCD numbers (or GSM default alphabet characters) are converted to characters of the currently selected DTE character set, type of address given by <tooa>
<page>	GSM 03.41 CBM Page Parameter bits 4-7 in integer format
<pages>	GSM 03.41 CBM Page Parameter bits 0-3 in integer format
<pdu>	In the case of SMSGSM 04.11 SC address followed by GSM 03.40 TPDU in hexadecimal format ME/TA converts each octet of TP data unit into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to DTE as two characters 2A (IRA 50 and 65))
In the case of CBS GSM 03.41 TPDU in hexadecimal format	
<pid>	GSM 03.40 TP-Protocol-Identifier in integer format
<ra>	GSM 03.40 TP-Recipient-Address Address-Value field in string format; BCD numbers (or GSM default alphabet characters) are converted to characters of the currently selected DTE character set type of address given by <tora>
<sca>	GSM 04.11, Service Centre Address, in format <tosca>
<scts>	GSM 03.40 TP-Service-Centre-Time-Stamp in time-string format
<sn>	GSM 03.41 CBM Serial Number in integer format
<st>	GSM 03.40 TP-Status in integer format
<toda>	GSM 04.11 TP-Destination-Address Type-of-Address octet in integer format (when first character of <da> is + (IRA 43) default is 145, otherwise default is 129)
<tooa>	GSM 04.11 TP-Originating-Address Type-of-Address octet in integer format (default refer <toda>)
<tora>	GSM 04.11 TP-Recipient-Address Type-of-Address octet in integer format (default refer <toda>)
<tosca>	Type of Service Centre Address, 129 for normal dial string, 145 for international access (number which contains '+' character)
<vp>	GSM 03.40 TP-Validity-Period either in integer format (default 167), in time-string format refer <dt>

10.2 General Configuration Commands

10.2.1 +CSMS Select Message Service

Description

This command selects the messaging service and returns the type of messages supported.

Command	Possible Response
AT+CSMS=?	+CSMS: (list of supported <service>s)
AT+CSMS?	+CSMS: <service>,<mt>,<mo>,<bm>
AT+CSMS=<service>	+CSMS: <mt>,<mo>,<bm>

Parameters

<service> type of PDU mode

0 GSM standard

<Mt.> mobile terminated (MT) messages

0 type not supported

1 type supported

<mo> mobile originated (MO) messages)

0 type not supported

1 type supported

<bm> Broadcast type Messages)

0 type not supported

1 type supported

10.2.2 +CPMS Preferred Message Storage

Description

This command selects SMS memory storage types, to be used for short message operations.

Command	Possible Response
AT+CPMS=?	+CPMS: (list of supported <mem1>s),(list of supported <mem2>s), (list of supported <mem3>s)
AT+CPMS?	+CPMS: <mem1>,<used1>,<total1>, <mem2>,<used2>,<total2>, <mem3>,<used3>,<total3>
AT+CPMS=<mem1>, <mem2>,<mem3>	+CPMS: <used1>,<total1>,<used2> ,<total2>,<used3>,<total3>

Note: "SM", SIM is the only supported storage type.

10.2.3 +CMGF SMS Format

Description

This command controls the presentation format of short messages from the modem.

Command	Possible Response
AT+CMGF=?	+CMGF: (list of supported <mode>s)
AT+CMGF?	+CMGF: <mode>
AT+CMGF=<mode>	

Parameters

<mode> 0 PDU mode
1 text mode

10.2.4 +CMS ERROR Message Service Failure Result Code

Description

Result code indicating an error related to mobile equipment or the network. Similar in operation to the normal ERROR result code. None of the following commands in the same command line is executed.

Parameters

See “+CMS ERROR Message Service Failure Result Code” on page 146.

10.3 Message Configuration Commands

10.3.1 +CSCA Service Centre Address

Description

This command updates the short message service centre address, through which mobile-originated short messages are transmitted.

Command	Possible Response
AT+CSCA=?	
AT+CSCA?	+CSCA: <sca>,<tosca>
AT+CSCA=<sca>[,<tosca>] e.g. AT+CSCA=”+44973100973”,145	

Note: Subscription to this service may be required. This number can be obtained from your network provider. Below is a list of the UK service centres:

BT Cellnet +447802000332

Vodafone +447785016005

Orange +447973100973

One 2 One	+447958879879
Virgin	+447958879890

10.3.2 +CSMP Set Text Mode Parameters

Description

This command used to select values for additional parameters needed when short message is sent to the network or placed in storage when text format message mode is selected.

Command	Possible Response
AT+CSMP=?	+CPMS: (list of supported <fo>s),(list of supported <vp>s),(list of supported <pid>s),(list of supported <dcs>s)
AT+CSMP?	+CSMP: <fo>,<vp>,<pid>,<dcs>
AT+CSMP=[<fo>[,<vp>[,<pid>[,<dcs>]]]]	

10.3.3 +CSDH Show Text Mode Parameters

Description

This command controls whether detailed header information is shown in text mode result codes.

Command	Possible Response
AT+CSDH=?	+CSDH: (list of supported <show>s)
AT+CSDH?	+CSDH: <show>
AT+CSDH=[<show>]	

Parameters

<show>	0	do not show header values
	1	show the values in result codes

10.3.4 +CSCB Select Cell Broadcast Message Types

Description

This command selects which types of Cell Broadcast Messages are to be received by the modem.

Command	Possible Response
AT+CSCB?	+CSCB: <mode>,<mids>,<dcss>
AT+CSCB=[<mode>[,<mids>[,<dcss>]]]	

Parameters

<mode>	0	message types specified in <mids> and <dcss> are accepted
<mids>	all different possible combinations of CBM message identifiers	
<dcss>	all different possible combinations of CBM data coding schemes	

10.3.5 +CSAS Save Settings

Description

Saves active message service settings to NV RAM. Several profiles of settings may be stored at a TA, referenced by a setting number. Settings are specified by the commands +CSCA, +CSMP and +CSCB.

Command	Possible response
AT+CSAS=?	+CSAS: (list of supported <profile>s)
AT+CSAS[=<profile>]	

Parameters

<profile> 0...255 manufacturer specific profile number

10.3.6 +CRES Restore Settings

Description

Restores message service settings from a profile held in NV memory to active memory.

Command	Possible response
AT+CRES=?	+CRES: (list of supported <profile>s)
AT+CRES[=<profile>]	

Parameters

<profile> 0...255 manufacturer specific profile number

10.4 Message Receiving and Reading Commands

10.4.1 +CNMI New Message Indications to DTE

Description

This command selects the procedure, how receiving of new messages from the network is indicated to the DTE when DTE is active. Further information can be found in GSM 03.38.

Command	Possible Response
AT+CNMI=?	+CNMI: (list of supported <mode>s),(list of supported <mt>s),(list of supported <bm>s),(list of supported <ds>s),(list of supported <bfr>s)
AT+CNMI?	+CNMI: <mode>,<mt>,<bm>,<ds>,<bfr>
AT+CNMI=[<mode>[,<mt>[,<bm>[,<ds>[,<bfr>]]]]]	

Parameters

<mode> 0 buffer unsolicited result codes in the modem. When the buffer is full, indications may be discarded.

1 discard indication and reject new received message unsolicited result codes when modem-DTE link is reserved (e.g. in on-line data mode). Otherwise forward them directly to the DTE

2 buffer unsolicited result codes in the modem when modem-DTE link is reserved (e.g. in on-line data mode) and flush them to the DTE after reservation. Otherwise forward them directly to the DTE

<mt> the rules for storing received short messages depend on its data coding scheme (GSM 03.38), preferred memory storage (AT+CPMS) setting and this value;

0 no SMS-DELIVER indications are routed to the DTE

1 If SMS-DELIVER is stored into SIM, indication of the memory location is routed to the DTE using unsolicited result code +CMTI:

2 SMS-DELIVERs (except class 2 messages and messages in the message waiting indication group (store message)) are routed directly to the DTE using unsolicited result code +CMT:

Class 2 messages and messages in the message waiting indication group (store message) result in indication as defined in <mt>=1

3 class 3 SMS-DELIVERs are routed directly to DTE using unsolicited result codes defined in <mt>=2. Messages of other data coding schemes result in indication as defined in <mt>=1

<bm> UbiNetics GSM modems do not support storage of CBMs; this value selects whether or not CBMs are routed to the DTE)

0 no CBM indications are routed to the DTE

2 new CBMs are routed directly to DTE using unsolicited result code +CBM:

<ds> 0 no SMS-STATUS-REPORTs are routed to the DTE

1 SMS-STATUS-REPORTs are routed to the DTE using unsolicited result code +CDS:

<bfr> 0 modem buffer of unsolicited result codes defined within this command is flushed to the DTE when <mode> 1 - 3 is entered (OK response shall be given before flushing the codes)

1 modem buffer of unsolicited result codes defined within this command is cleared when <mode> 1 - 3 is entered

10.4.2 +CBM: New Cell Broadcast Message

Description

Command	Possible Response
unsolicited result code, received when <bm>=2 and new CBM is delivered	If PDU mode; +CBM: <length><cr><lf><pdu> If text mode; +CBM: <sn>,<mid>,<dcs>,<page>,<pages> <cr><lf><data>

10.4.3 +CMT: New Mobile Terminated Short Message

Description

Command	Possible Response
unsolicited result code, received when <mt>=2 and new short message is delivered	If PDU mode; +CMT: [<alpha>],<length><cr><lf><pdu> If text mode; +CMT: <oa>,[<alpha>],<scts>[,<tooa>, <fo>,<pid>,<dcs>,<sca>,<tosca>,<length>] <cr><lf><data>

10.4.4 +CDS: New SMS status report message

Description

Command	Possible Response
SMS-STATUS-REPORTs are routed to the DTE using unsolicited result code	+CDS: <length><cr><lf><pdu> (PDU mode enabled)
	+CDS: <fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st> (text mode enabled)

10.4.5 +CMTI: New Mobile Terminated Short Message Indicator

Description

Command	Possible Response
unsolicited result code, is sent by the modem when a new short message is received.	+CMTI: <mem>,<index>

10.4.6 +CMGL List Messages

Description

This command returns messages with status value <stat> from message storage <mem1> to the DTE. If status of the message is 'received unread', status in the storage changes to 'received read'.

Command	Possible Response
AT+CMGL=?	+CMGL: (list of supported <stat>s)
AT+CMGL[=<stat>]	If text mode, command successful and SMS-SUBMITs and/or SMS-DELIVERs: +CMGL: <index>,<stat>,<oa/da>,[<alpha>],[<scts>][,<tooa/toda>,<length>]<cr><lf><data>[<cr><lf> +CMGL: <index>,<stat>,<da/oa>,[<alpha>],[<scts>][,<tooa/toda>,<length>]<cr><lf><data>[...]] If PDU mode, command successful: +CMGL: <index>,<stat>,[<alpha>],<length><cr><lf><pdu>[<cr><lf> +CMGL:<index>,<stat>,[<alpha>],<length><cr><lf><pdu>[...]]

10.4.7 +CMGR Read Message

Description

This command returns short message from location <index>, of message storage <mem1> to the DTE. If status of the message is 'received unread', status in the storage changes to 'received read'.

Command	Possible Response
AT+CMGR=?	
AT+CMGR=<index>	If text mode, command successful and SMS-DELIVERs; +CMGR: <stat>,<oa>,[<alpha>],<scts>[,<tooa>,<fo>,<pid>,<dcs>,<sca>,<tosca>,<length>]<cr><lf><data> if text mode, command successful and SMS-SUBMIT; +CMGR: <stat>,<da>,[<alpha>][,<toda>,<fo>,<pid>,<dcs>,[<vp>],<sca>,<tosca>,<length>]<cr><lf><data> If PDU mode, command successful; +CMGR: <stat>,[<alpha>],<length><cr><lf><pdu>

10.4.8 +CNMA New Message Acknowledgement

Description

Confirms receipt of new message routed directly to the DTE. Used when +CSMS parameter <service> equals 1.

Command	Possible response
if text mode (+CMGF=1): AT+CNMA	
AT+CNMA=?	

10.5 Message Sending and Writing Commands

10.5.1 +CMGS Send Message

Description

This command sends a short message from the modem to the network (SMS-SUBMIT).

Command	Possible Response
If text mode; AT+CMGS=<da>[,<toda>]<cr> text is entered <ctrl+z/esc> If PDU mode; AT+CMGS=<length><cr> PDU mode is given <ctrl+z/esc> e.g. (text mode) AT+CMGS=”01763262222”<cr> >Write your test here <ctrl+z>	If text mode and sending successful; +CMGS: <mr> If PDU mode and sending successful; +CMGS: <mr>

Note:

- Control+z = terminate and send, escape = terminate and quit (without sending).
- After sending the command AT+CMGS="123456"<cr> wait for the character > before sending the text or characters will be lost.
- The text string is terminated by ctrl+z do not use a carriage return like other commands.

10.5.2 +CMSS Send Message from Storage

Description

This command sends a message from SIM storage location value <index> (SMS-SUBMIT).

Command	Possible Response
AT+CMSS=?	
AT+CMSS=<index>[,<da>[,<toda>]] e.g. (text mode) AT+CMSS=1,"01763262222"<cr>	If text mode and sending successful; +CMSS: <mr> If PDU mode and sending successful; +CMSS: <mr>

10.5.3 +CMGW Write Message to Memory

Description

This command writes a message to SIM storage (either SMS-DELIVER or SMS-SUBMIT) to memory storage <mem2>. By default message status will be set to 'stored unsent', but parameter <stat> allows also other status values to be given.

Command	Possible Response
If text mode; AT+CMGW[=<oa/da>[,<tooa/toda>[,<stat>]]]<cr> text is entered<ctrl+z> If PDU mode; AT+CMGW=<length>[,<stat>]<cr> PDU is given<ctrl+z> e.g. (text mode) AT+CMGW="01763262222"<cr> Write your test message here <ctrl+z>	+CMGW: <index>

Note:

- Control+z = terminate and write, escape = terminate and quit (without writing).
- After sending the command AT+CMGW="123456"<cr> wait for the character > before sending the text or characters will be lost.
- The text string is terminated by ctrl+z do not use carriage return like other commands.

10.5.4 +CMGC Send Command

Description

Sends a command message from the DTE to the network.

Command	Possible response

if text mode (AT+CMGF=1):
AT+CMGC=<fo>,<ct>[,<pid>[,<mn>[,<da>[,<toda>]]]]<CR>
text is entered<ctrl-z/Esc>
	if text mode (+CMGF=1) and sending successful:
	+CMGC: <mr>[,<scts>]
	if sending fails:

AT+CMGC=?	

10.5.5 +CMGD Delete Message

Description

This command deletes a message from the location <index> from SIM storage.

Command	Possible Response
AT+CMGD=?	
AT+CMGD=<index>	

11.0 Commands Specified within V.25ter Referenced by GSM 07.07

This section covers the AT commands specified within ITU-T, V.25ter referenced by GSM 07.07.

11.1 Generic DCE Control Commands

11.1.1 +++ Changes from On-line Data to On-line Command mode

Description

This command changes the modem from on-line data mode to on-line command mode, whilst still retaining the data call. No AT or line termination is required.

Command	Possible Response
<wait_for_0.5_second>+++<wait_for_0.5_second>	

11.1.2 A/ Repeat Last Command

Description

This command repeats the last command sent to the modem, which is held in non-volatile memory. No AT or line termination is required.

Command	Possible Response
A/	

11.1.3 Z Reset to Default Configuration

Description

This command instructs the modem to set all parameters to the factory defaults.

Command	Possible Response
ATZ	

11.1.4 &F Set to Factory-Defined Configuration

Description

This command instructs the modem to set all parameters to default values.

Command	Possible Response
AT&F	

11.1.5 I Request Identification Information

Description

This command causes the modem to transmit the manufacturer specific information about the modem.

Command	Possible Response GM400
For the GM400	
ATI[0]	14400
ATI1	Ubinetics Ltd.
ATI2	Ubinetics Ltd.
ATI3	<software version>
ATI4	Ubinetics Ltd.
ATI5	Dual Band PC Card
ATI6	Designed in UK

11.1.6 +GMI Request Manufacturer Identification

Description

Execution command causes the modem to return the manufacturer specific identity.

Command	Possible Response
AT+GMI=?	
AT+GMI	Ubinetics Ltd.

11.1.7 +GMM Request Model Identification

Description

Execution command causes the modem to return the manufacturer specific model identity.

Command	Possible Response
AT+GMM=?	
AT+GMM	<model identity>

11.1.8 +GMR Request Model Revision

Description

Execution command causes the modem to return the manufacturer specific model revision identity.

Command	Possible Response
AT+GMR=?	
AT+GMR	<revision>

11.1.9 +GSN Request Product Serial Number Identification

Description

This command causes the modem to return the product serial number.

Command	Possible Response
AT+GSN=?	
AT+GSN	xx-<model identity>-xx

11.1.10 +GCAP Request Complete Capabilities List

Description

This command causes the modem to return the list of additional capabilities.

Command	Possible Response
AT+GCAP	list of capabilities

11.1.11 S3 Command Line Termination Character

Description

This S-parameter sets the command line termination character, which is set to carriage return. UbiNetics recommend that you do not change this setting.

Command	Possible Response
ATS3=?	S3(list of supported <value>s)
ATS3?	<value>
ATS3<value>	

Parameters

<value> 0 -13-127 13 = carriage return

11.1.12 S4 Response Formatting Character

Description

This S-parameter command sets the response formatting character, which is set to line feed. UbiNetics recommend that you do not change this setting.

Command	Possible Response
ATS4=?	S4(list of supported <values>s)
ATS4?	<value>
ATS4<value>	

<value> 0-10-127 10 = line feed

11.1.13 S5 Command Line Editing Character

Description

This S-parameter sets the command line editing character, which is set to backspace. UbiNetics recommend that you do not change this setting.

Command	Possible Response
ATS5=?	S5(list of supported <values>s)
ATS5?	<value>
ATS5<value>	

Parameters

<value> 0-8-127 8 = backspace

11.1.14 E Command Echo

Description

This command determines whether or not the modem echoes characters received from the DTE during command state.

Command	Possible Response
ATE?	E: <value>
ATE<value>	

Parameters

<value> 0 characters are not echoed

1 characters are echoed

11.1.15 Q Result Code Suppression

Description

This command determines whether or not the modem transmits result codes to the DTE. When result codes are being suppressed, no portion of any intermediate, final, or unsolicited result code header, result text, line terminator or trailer is transmitted.

Information text transmitted in response to commands is not effected by the setting of this parameter.

Command	Possible Response
ATQ?	Q: <value>
ATQ<value>	

Parameters

<value> 0 result codes are sent to the DTE

1 result codes are suppressed

11.1.16 V DCE Response Format

Description

This command determines the contents of the header and trailer transmitted with result codes and information responses. It also determines whether result codes are transmitted in a numeric form or an alphabetic (or "verbose") form. The text portion of information responses not changed by this setting.

Command	Possible Response
ATV?	V: <value>
ATV<value>	

Parameters

<value> 0 DCE transmits limited headers and trailers and numeric text
Example: <numeric code><cr>

1 DCE transmits full headers and trailers and verbose response text
Example: <cr><lf><verbose code><cr><lf>

11.1.17 X Call Progress Result Code Selection

Description

This command determines whether or not the modem transmits particular result codes to the DTE.

Command	Possible Response
ATX?	X: <value>
ATX<value>	

Parameters

<value> 0 CONNECT result code is given upon entering on-line data state. Dial tone and busy detection are disabled

1 CONNECT <text> result code is given upon entering on-line data state. Dial tone and busy detection are disabled

3 CONNECT <text> result code is given upon entering on-line data state. Dial tone detection is disabled, and busy detection is enabled

4 CONNECT <text> result code is given upon entering on-line data state. Dial tone and busy detection are both enabled

11.1.18 &C DCD On or Toggles with Call

Description

Determines how the state of circuit 109 relates to the detection of received line signal from the distant end.

Command	Possible Response
AT&C<value>	

Parameters

<value>

0 DCE always presents the ON condition

1 Circuit changes in accordance with the underlying DCE

11.1.19 &D Circuit 108 (Data Terminal Ready) Behaviour

Description

Determines how DCE responds when circuit 108/2 is changed from ON to OFF during the on-line data state.

Command	Possible Response
AT&D<value>	

Parameters

<value>

0 DCE ignores circuit DTR

1 DCE Online Data Mode to Online Command Mode. Call stays connected

2 DCE instructs the underlying DCE to clear down the call

11.1.20 +IPR Fixed DTE-DCE Rate

Description

This command specifies the data rate at which the modem will accept commands.

Command	Possible Response
AT+IPR=?	+IPR: (list of supported <rate> values)
AT+IPR?	+IPR: <rate>
AT+IPR=<rate>	

Parameters

<rate> 75 baud

300 baud

1200 baud

2400 baud

4800 baud

9600 baud

19200 baud

38400 baud

57600 baud

115200 baud

11.1.21 +ICF DTE-DCE character framing

Description

Used to determine the local serial port start-stop (asynchronous) character framing that the DCE shall use while accepting DTE commands and while transmitting information text and result code, if this is not automatically determined.

+IPR=0 forces +ICF=0 (see "+IPR Fixed DTE-DCE Rate" on page 101). Note that the definition of fixed character format for OnLine Data State is for further study.

<format> determines the number of bits in the data bits, the presence of a parity bit, and the number of stop bits in the start-stop frame. NOTE: The semantics of this command are derived from Recommendation V.58.

<parity> determines how the parity bit is generated and checked, if present.

Command	Possible Response
+ICF=?	+ICF:(list of supported <format> values),(list of supported <parity> values)
+ICF?	+ICF:<format>,<parity>
+ICF=[<format>[,<parity>]]	

Parameters

<format>	0	auto detect (not currently supported)
	1	8 Data 2 Stop
	2	8 Data 1 Parity 1 Stop
	3	8 Data 1 Stop
	4	7 Data 2 Stop
	5	7 Data 1 Parity 1 Stop
	6	7 Data 1 Stop
<parity>	0	Odd
	1	Even
	2	Mark
	3	Space

11.1.22 +IFC DTE-DCE Local Flow Control

Description

This command is used to control the operation of local flow control between the DTE and modem.

Command	Possible Response
AT+IFC=?	+IFC: (list of supported <DCE/DTE values),(list of supported <DTE/DCE values)
AT+IFC?	+IFC: <DCE/DTE>,<DTE/DCE>
AT+IFC=[<DCE/DTE>[,<DTE/DCE>]]	

Parameters

<DCE/DTE> DTE to control the flow of received data from the modem

- 0 none
- 1 XON/XOFF software flow control (filtered characters)
- 2 RTS hardware flow control

<DTE/DCE> modem to control the flow of transmitted data from the DTE

- 0 none
- 1 XON/XOFF software flow control
- 2 CTS hardware flow control

Note: The flow control values must be set in pairs, i.e. RTS/CTS, XON/XOFF, NONE/NONE.

11.1.23 +ILRR DTE-DCE Local Rate Reporting

Description

Controls whether or not the current local port rate is transmitted from the DCE to the DTE.

Command	Possible Response
AT+ILRR=?	+ILRR:(list of supported values)
AT+ILRR?	+ILRR:<rate>
AT+ILRR=<value>	AT+ILRR: <rate>[,<rx_rate>]

Parameters

<value> 0 disables reporting (i.e. +ILRR is not reported)

1 enables reporting

<rate> TXD rate (decimal value, range 77-115200)

11.2 Call Control Commands and Responses

11.2.1 W Wait for Dial Tone

Description

Causes the DCE to wait for a dial tone. If a valid dial tone is detected, the DCE continues processing the remainder of the dial string.

Notes:

- implemented for legacy support only: no function in GSM
- this command and the next two implemented by the Dial command.

Command	Possible Response
ATDW	

11.2.2 T Tone Dialling

Description

Causes subsequent dial string to be signalled using DTMF.

No function in GSM—for compatibility only.

Command	Possible Response
ATDT	

11.2.3 P Pulse Dialling

Description

Causes subsequent dial string to be signalled using pulse dialling.

No function in GSM—for compatibility only.

Command	Possible Response
ATDP	

11.2.4 A Answer

Description

This command instructs the modem to connect to the line immediately and start the answer sequence.

Command	Possible Response
ATA	

11.2.5 H Hook Control

Description

This command instructs the modem to disconnect from the line, terminating any call in progress. All of the functions of the command shall be completed before the modem returns a result code.

Command	Possible Response
ATH	

11.2.6 O Return to On-line Data State

Description

This command returns the modem to on-line data state after being in on-line command state, provided the data connection is still retained.

Command	Possible Response
ATO	

11.2.7 S0 Automatic Answer

Description

This S-parameter controls the automatic answering feature of the modem.

Command	Possible Response
ATS0=?	S0(list of supported <values>s)
ATS0?	<value>
ATS0=<value>	

<value> 0 automatic answering is disabled

1 - 255 enable automatic answering on the ring number specified

11.2.8 S6 Pause Before Blind Dialling

Description

This S-parameter has been implemented for compatibility reasons and does not provide any useful function.

Command	Possible Response
ATS6=?	S6(list of supported <values>s)
ATS6?	<value>
ATS6=<value>	

Parameters

<value> 2-10 number of seconds to wait before blind dialling

11.2.9 S7 Connection Completion Timeout

Description

This S-parameter has been implemented for compatibility reasons and does not provide any useful function.

Command	Possible Response
ATS7=?	S7(list of supported <values>s)
ATS7?	<value>
ATS7=<value>	

Parameters

<value> 0-255 value in seconds for connection to complete, before disconnecting the call

11.2.10 S8 Comma Dial Modifier Time

Description

This S-parameter has been implemented for compatibility reasons and does not provide any useful function.

Command	Possible Response
ATS8=?	S8(list of supported <values>s)
ATS8?	<value>
ATS8=<value>	

Parameters

<value> 0 DCE does not pause when "," encountered in dial string

1-2-255 number of seconds to pause, when a "," is encountered

11.2.11 S10 Hang-up delay

Description

Specifies the length of time, in tenths of a second, that the DCE will remain off-hook after the DCE has indicated the absence of received line signal.

Command	Possible Response
ATS10=<value>	

Parameters

<value> 1-254 Number of tenths of a second of delay.

11.2.12 L Monitor Speaker Loudness

Description

This parameter has been implemented for compatibility reasons and does not provide any useful function.

Command	Possible Response
ATL?	L: <value>
ATL=<value>	

Parameters

<value> adjust monitor speaker level

0 speaker muted

1 low speaker volume

2 medium speaker volume

3 high speaker volume

11.2.13 M Monitor Speaker Mode

Description

This parameter has been implemented for compatibility reasons and does not provide any useful function.

Command	Possible Response
ATM?	M: <value>
ATM<value>	

Parameters

<value>
- 0 speaker is always off
- 1 speaker on until DCE informs DCE that carrier has been detected
- 2 speaker is always on when DCE is off-hook

12.0 Commands Specified by ITU-T Rec. T.32

12.1 Action commands

12.1.1 D — Originate a call

Description

Initiates a call or resumes a session after procedure interruption. If the <dial string> is terminated by a semi-colon, the DCE returns to command state while remaining off-hook.

Command	Possible Response
ATD[<dial string>]<CR>	
ATD[<dial string>];<valid commands><CR>	

12.1.2 A — Answer a call

Description

The DTE issues an A command in response to incoming Ringing.

Command	Possible Response
ATA<CR>	

12.1.3 +FDT — Send a page

Description

The FDT command requests the DCE to transmit a Phase C page. It is issued at the beginning of each page, either in Phase B or in Phase D. When the DCE is ready to accept Phase C data, it issues the negotiation responses and the CONNECT result code to the DTE.

Command	Possible Response
AT+FDT<CR>	

12.1.4 +FDR — Receive a page

Description

The +FDR command initiates transition to Phase C data reception. This can occur after answering, after dialling, after a document is received, or after a page is received.

Command	Possible Response
AT+FDR<CR>	

12.1.5 +FKS Terminate a session

Description

The +FKS command causes the DCE to terminate the session in an orderly manner. In particular, it will send a DCN message at the next opportunity and hang up.

Command	Possible Response
AT+FKS	

12.1.6 +FIP Initialise Service Class 2 parameters

Description

The +FIP command causes the DCE to initialise all Service Class 2 Facsimile Parameters to the manufacturer-determined default settings. This command does not change the setting of +FCLASS. This command has the same effect as if the DTE had issued individual parameter setting commands.

The optional subparameter <value> is a set of manufacturer-specified parameters.

Command	Possible Response
AT+FIP[=<value>]	

12.2 DCE responses

The DCE sends information responses to the DTE as a fax session proceeds. They indicate the state of the fax session and convey needed information.

These are solicited messages, generated in response to the DTE action commands described on page 108.

12.2.1 +FCO Fax connection

Description

The +FCO response indicates connection with a Group 3 facsimile station.

12.2.2 +FCS Report negotiated session parameters, DCS

Description

Reports negotiated parameters. Phase C data is formatted as reported by these subparameters. +FDT or +FDR command execution may generate these responses, before the CONNECT result code, if new DCS frames are generated or received.

Command	Possible Response
AT+FCS:<subparameter string>	

Subparameters

<subparameter string> VR subparameters defined in the table below
BR
WD
LN
DF
EC
BF
ST
JP

T.30 session subparameter codes			
Label	**Function**	**Values**	**Description**
VR	Resolution[1]	00 01 *02 *04 *08 *10 *20 *40	R8 × 3.85 l/mm, Normal R8 × 7.7 l/mm, Fine R8 × 15.4 l/mm R16 × 15.4 l/mm 200 dpi × 100 l/25.4 mm 200 dpi × 200 l/25.4 mm 200 dpi × 400 l/25.4 mm 300 dpi × 300 l/25.4 mm
BR	Bit Rate[2]	0 1 *2 *3 *4 *5	2 400 bit/s 4 800 bit/s 7 200 bit/s 9 600 bit/s 12 000 bit/s 14 400 bit/s
WD	Page Width in pixels	 0 *1 *2 *3 *4	R8 R16 200 300 400 d/mm d/mm dpi dpi dpi 1728 3456 1728 2592 3456 2048 4096 2048 2432 4864 2432 1216 2432 864 1728
LN	Page Length	0 1 2	A4, 297 mm B4, 364 mm Unlimited length
DF	Data Compression Format	0 *1 *2 *3	1-D Modified Huffman (Rec. T.4) 2-D Modified read (Rec. T.4) 2-D Uncompressed mode (Rec. T.4) 2-D Modified modified read (Rec. T.6)

EC	Error Correction	0 *1 *2 *3	Disable ECM Enable Annex A/T.30, ECM Enable Annex C/T.30, half duplex Enable Annex C/T.30, full duplex
BF	File Transfer[3]	 00 *01 *02 *04 *08 *10 *20 *40	Disable file transfer modes Select enable BFT, Rec. T.434 Select document transfer mode Select edifact mode Select basic transfer mode Select character mode Annex D/T.4 Select mixed mode, Annex E/T.4 Select processable mode, Rec. T.505 ST Scan Time/Line
ST	Scan Time/Line	 0 1 2 3 4 5 6 7	VR = 0 VR > 0 0 ms 0 ms 5 ms 5 ms 10 ms 5 ms 10 ms 10 ms 20 ms 10 ms 20 ms 20 ms 40 ms 20 ms 40 ms 40 ms
JP	JPEG for colour and B&W[4]	00 *01 *02 *04 *08 *10 *20 *40	Disable JPEG coding Enable JPEG coding (Rec. T.81) Full colour mode Enable preferred Huffman tables (Note 5) 12 bits/pel/component No subsampling (1:1:1) Custom illuminant Custom gamut range

1. For subparameter VR, values 00, 01, 02, 04, 08, 10, 20 and 40 (hexadecimal) indicate a single choice; they are the only values allowed in the +FCS parameter and +FCS: report. All other values that are sums of these values can only be used to indicate multiple capabilities; these are allowed in +FIS and +FCC parameters. For example, value 07 (01 + 02 + 04) would indicate capability for all metric-based resolutions. Values higher than 7Fh are reserved for future study.
2. Recommendation T.30 does not provide for the answering station to specify all speeds exactly using the DIS frame. Implementation of some BR codes (e.g. code 2) by an answering DCE is manufacturer-specific. Values higher than 5 are reserved for future modulations.
3. For subparameter BF, values 00, 01, 02, 04, 08, 10, 20 and 40 (hexadecimal) indicate a single choice; they are the only values allowed in the +FCS parameter and +FCS: report. All other values which are sums of these values can only be used to indicate multiple capabilities; these are allowed in +FIS and +FCC parameters. For example, to indicate support for BFT, character mode and mixed modes, the DTE should set the BF subparameter to 01 + 10 + 20 = 31. Values higher than 7F are reserved for future study.
4. For each subparameter JP, values 00, 01, 02, 04 08, 10, 20 and 40 (hexadecimal) indicate a single choice. All other values which are sums of these values shall be used to indicate multiple capabilities in +FIS and +FCC subparameters and to indicate the choice in +FCS subparameters. For example, to indicate support for JPEG, full colour mode and no subsampling, the DTE should set the JP subparameter to 01 + 02 + 10 = 13. If one or several of the values 02 up to 40 are not used, that means that the default value for the subparameter (e.g. respectively: gray-scale, custom Huffman tables, 8 bit/pel/component, 4:1:1 subsampling ratio, D50 illuminant, default gamut range) is used, as defined in Annex E/T.30 and Annex G/T.4.

12.2.3 +FTC Report remote capabilities, DTC

Description

+FTC:<subparameter string> report remote fax station capabilities and intentions.

Originate (8.3.1), Answer (8.3.2), +FDT (8.3.3) or +FDR (8.3.4) command execution may generate these responses, if the corresponding frames are received before the OK final result code.

Command	Possible Response
AT+FTC:<subparameter string>	

Subparameters

<subparameter string>

VR	subparameters defined in the table "+FCS Report negotiated session parameters, DCS" on page 109
BR	
WD	
LN	
DF	
EC	
BF	
ST	
JP	

12.2.4 +FIS Report remote capabilities, DIS

Description

+FIS:<subparameter string> report remote fax station capabilities and intentions.

Originate, Answer, +FDT or +FDR command execution may generate these responses, if the corresponding frames are received before the OK final result code.

Command	Possible Response
AT+FIS:<subparameter string>	

Subparameters

<subparameter string>

VR	subparameters defined in the table "+FCS Report negotiated session parameters, DCS" on page 109
BR	
WD	
LN	
DF	
EC	

BF

ST

JP

12.2.5 +FPO Remote polling indication

Description

+FPO indicates that the remote station has a document to poll and invites the DTE to poll it. The +FPO response is delivered between the +FIS:<string>, and the OK final result code, if enabled. Originate, Answer, +FDT or +FDR command execution may generate this response. +FSP=0 inhibits the +FPO response.

The DTE may respond to a +FPO message with either a +FDR command, to poll the remote station, or a +FDT command, if it does not wish to poll.

Command	Possible Response
AT+FPO	

12.2.6 +FTI Report remote ID: Transmit Station ID

Description

This response reports the received remote ID string, if any. Originate, Answer, +FDT or +FDR command execution may generate this response, if the corresponding frames are received.

The DCE shall report the characters in the ID string in reversed time order from the order received from the remote station. For example, if the following ID FIF character string is received (hexadecimal values):

<20><20><20><20><20><31><30><39><38><20><37><36><35><20><34><33><32><20><31><2B>

The result would be:

<CR><LF>+FTI:"+1 234 567 8901 "<CR><LF>

Command	Possible Response
AT+FTI:”<TSI ID string>”>	

12.2.7 +FPI Report remote ID: Polling Station ID

Description

This response reports the received remote ID string, if any. Originate, Answer, +FDT or +FDR command execution may generate this response, if the corresponding frames are received.

The DCE shall report the characters in the ID string in reversed time order from the order received from the remote station. For example, if the following ID FIF character string is received (hexadecimal values):

<20><20><20><20><20><31><30><39><38><20><37><36><35><20><34><33><32><20><31><2B>

The result would be:

<CR><LF>+FPI:"+1 234 567 8901 "<CR><LF>

Command	Possible Response
AT+FPI:”<CIG ID string>”>	

12.2.8 +FCI Report remote ID: Called Station ID

Description

This response reports the received remote ID string, if any. Originate, Answer, +FDT or +FDR command execution may generate this response, if the corresponding frames are received.

The DCE shall report the characters in the ID string in reversed time order from the order received from the remote station. For example, if the following ID FIF character string is received (hexadecimal values):

<20><20><20><20><20><31><30><39><38><20><37><36><35><20><34><33><32><20><31><2B>

The result would be:

<CR><LF>+FCI:"+1 234 567 8901 "<CR><LF>

Command	Possible Response
AT+FCI:”<CSI ID string>”>	

12.2.9 +FNC Report NSC frame: Non-Standard Commands

Description

This response reports any received Non-Standard negotiation frames, one response per frame. Originate, Answer, +FDT or +FDR command execution may generate this response, if the corresponding frames are received.

The NSF Facsimile Information Field (FIF) frame octets (beginning with the country code, but not including the FCS) are presented in hex notation, and separated by spaces. HDLC flags, and zero bits inserted for transparency are removed. Frame octets are reported in the order received. For each frame octet the LSB is the first bit sent or received. For example, the two octet bit string 0001101101000101 would be reported D8 A2.

Command	Possible Response
AT+FNC:”<NSC FIFstring>”>	

12.2.10 +FNF Report NSC frame: Non-Standard Facilities

Description

This response reports any received Non-Standard negotiation frames, one response per frame. Originate, Answer, +FDT or +FDR command execution may generate this response, if the corresponding frames are received.

The NSF Facsimile Information Field (FIF) frame octets (beginning with the country code, but not including the FCS) are presented in hex notation, and separated by spaces. HDLC flags, and zero bits inserted for transparency are removed. Frame octets are reported in the order received. For each frame octet the LSB is the first bit sent or received. For example, the two octet bit string 0001101101000101 would be reported D8 A2.

Command	Possible Response
AT+FNF:<NSF FIF string>	

12.2.11 +FNS Report NSC frame: Non-Standard Setup

Description

This response reports any received Non-Standard negotiation frames, one response per frame. Originate, Answer, +FDT or +FDR command execution may generate this response, if the corresponding frames are received.

The NSF Facsimile Information Field (FIF) frame octets (beginning with the country code, but not including the FCS) are presented in hex notation, and separated by spaces. HDLC flags, and zero bits inserted for transparency are removed. Frame octets are reported in the order received. For each frame octet the LSB is the first bit sent or received. For example, the two octet bit string 0001101101000101 would be reported D8 A2.

Command	Possible Response
AT+FNS:<NSS FIF string>	

12.2.12 +FPW Password (sending or polling)

Description

These responses report the received Addressing or Password string, if any. Originate, Answer, +FDT or +FDR command execution may generate this response, if the corresponding frames are received.

If the corresponding subparameter in the +FAP parameter is set, the DCE shall report the characters in these strings in reversed time order from the order received from the remote station. For example, if the following hexadecimal SUBaddress string is received:

<39><38><37><36><35><34><33><32><31><30><39><38><37><36><35><34><33><32><31><30>

The result would be:

<CR><LF>+FCI:"01234567890123456789"<CR><LF>

Command	Possible Response
AT+FPW:"<PWD string>"	

12.2.13 +FSA Destination SUBaddress

Description

These responses report the received Addressing or Password string, if any. Originate, Answer, +FDT or +FDR command execution may generate this response, if the corresponding frames are received.

If the corresponding subparameter in the +FAP parameter is set, the DCE shall report the characters in these strings in reversed time order from the order received from the remote station. For example, if the following hexadecimal SUBaddress string is received:

<39><38><37><36><35><34><33><32><31><30><39><38><37><36><35><34><33><32><31><30>

The result would be:

<CR><LF>+FCI:"01234567890123456789"<CR><LF>

Command	Possible Response
AT+FSA:"<SUB string>"	

12.2.14 +FPA Selective polling address

Description

These responses report the received Addressing or Password string, if any. Originate, Answer, +FDT or +FDR command execution may generate this response, if the corresponding frames are received.

If the corresponding subparameter in the +FAP parameter is set, the DCE shall report the characters in these strings in reversed time order from the order received from the remote station. For example, if the following hexadecimal SUBaddress string is received:

<39><38><37><36><35><34><33><32><31><30><39><38><37><36><35><34><33><32><31><30>

The result would be:

<CR><LF>+FCI:"01234567890123456789"<CR><LF>

Command	Possible Response
AT+FPA:"<SEP string>"	

12.2.15 +FPS T.30 Phase C page reception

Description

+FPS:<ppr> is generated by the DCE at the end of Phase C data reception, in execution of a +FDR command.

The initial <ppr> is generated by the DCE; it depends on the DCE for T.4 or T.6 error checking capabilities, controlled by the +FCQ parameter. See the table below for <ppr> values. Note that the <ppr> value may be changed by the DCE in response to a remote request for procedure interrupt.

The receiving DCE may count lines, bad lines, maximum consecutive bad lines, and octets lost due to DCE buffer overflow, and report them:

NB: Current implementation includes no T.4 page error detection.

Command	Possible Response
AT+FPS:<ppr>,<lc>,<blc>,<cblc>,<lbc>	

Parameters

<ppr>	see the table below for ppr values and their definitions
<lc>	line count
<blc>	bad line count
<cblc>	maximum consecutive bad line count; this is the number of lines in the largest group of consecutive bad lines
<lbc>	lost octet count

T.30 post page response (ppr) message codes			
Value	**T.30 Label**	**Result code**	**Description**
1	MCF	OK	Page good
2	RTN	ERROR	Page bad; retrain requested
3	RTP	OK	Page good; retrain requested
4	PIP	OK	Page good; remote request for procedure interrupt accepted
5	PIN	ERROR	Page bad; retrain requested; remote request for procedure

12.2.16 +FET Post page message

Description

The +FET:<post page message> response is generated by a receiving facsimile DCE on receipt of the post page message from the transmitting station, in execution of a +FDR command. The <ppm> codes correspond to the T.30 post page messages (see Parameters).

Command	Possible Response
AT+FET:<post page message>	

Parameters

<post page message>

0	MPS	Another page next, same document
1	EOM	Another document next
2	EOP	No more pages or documents
3	PRI-MPS	Another page next, same document, procedure interrupt requested
4	PRI-EOM	Another document next, procedure interrupt requested
5	PRI-EOP	No more pages or documents, procedure interrupt requested

12.2.17 +FHS Call termination status

Description

+FHS indicates that the call has been terminated. The hangup cause is reported, and stored in the +FHS parameter for later inspection. These values are described in Parameters below.

+FHS:<hangup status code> is a possible intermediate result code to any DTE action command. It is always followed by the OK final result code.

Command	Possible Response
AT+FHS:<hangup status code>	

Parameters

<hangup status code>	*00-0F*	*Call placement and termination*
	00	Normal and proper end of connection
	01	Ring detect without successful handshake
	02	Call aborted, from +FKS or <CAN>
	03	loop current
	04	Ringback detected, no answer (timeout)
	05	Ringback detected, answer without CED
	10-1F	*Transmit Phase A and miscellaneous errors*
	10	Unspecified Phase A error
	11	No answer (T.30 T1 timeout)
	20-3F	*Transmit Phase B hangup codes*
	20	Unspecified transmit Phase B error
	21	Remote cannot receive or send
	22	COMREC error in transmit Phase B
	23	COMREC invalid command received
	24	RSPREC error
	25	DCS sent three times without response
	26	DIS/DTC received 3 times; DCS not recognized

27	Failure to train at 2400 bit/s or +FMS value
28	RSPREC invalid response received
40-4F	*Transmit Phase C hangup codes*
40	Unspecified transmit Phase C error
41	Unspecified image format error
42	Image conversion error
43	DTE to DCE data underflow
44	Unrecognized transparent data command
45	Image error, line length wrong
46	Image error, page length wrong
47	Image error, wrong compression code
50-6F	*Transmit Phase D hangup codes*
50	Unspecified transmit Phase D error
51	RSPREC error
52	No response to MPS repeated 3 times
53	Invalid response to MPS
54	No response to EOP repeated 3 times
55	Invalid response to EOP
56	No response to EOM repeated 3 times
57	Invalid response to EOM
58	Unable to continue after PIN or PIP
70-8F	*Receive Phase B hangup codes*
70	Unspecified receive Phase B error
71	RSPREC error
72	COMREC error
73	T.30 T2 timeout, expected page not received
74	T.30 T1 timeout after EOM received
90-9F	*Receive Phase C hangup codes*
90	Unspecified receive Phase C error
91	Missing EOL after 5 seconds (3.2/T.4)
92	Bad CRC or frame (ECM mode)
93	DCE to DTE buffer overflow
A0-BF	*Receive Phase D hangup codes*
A0	Unspecified receive Phase D errors
A1	RSPREC invalid response received
A2	COMREC invalid response received

	A3	Unable to continue after PIN or PIP
	C0-DF	Reserved for future standardization
	E0-FF	Reserved for manufacturer-specific use

NOTE – Except for the set of codes specifically designated for manufacturer-specific use, all other unused codes are reserved for specification in future versions.

12.2.18 +FHT Report transmitted HDLC frame

Description

+FHT reports the HDLC data that was sent by the DCE.

Command	Possible Response
AT+FHT:<transmitted HDLC frame octets>	

12.2.19 +FHR Report received HDLC frame

Description

+FHR reports the HDLC data that was received by the DCE.

Command	Possible Response
AT+FHR:<received HDLC frame octets>	

12.3 Services commands

12.3.1 +FCLASS Service class identification and control

Description

Sets or tests the current Service Class setting of a fax DCE.

NB: Only classes 0, 2.0, 8 currently supported.

Command	Possible Response
AT+FCLASS=<value>	
AT+FCLASS?	
AT+FCLASS=?	<CR><LF>0,1.0,2.0<CR><LF>

Parameters

<value>	0	Data modem (e.g. V.25 ter)
	1.0	Service Class 1 (see Recommendation T.31)
	2.0	Service Class 2

12.3.2 +FCC DCE capabilities parameter

Description

+FCC allows the DTE to sense and constrain the capabilities of the fax DCE, from the choices defined in "+FPS T.30 Phase C page reception" on page 117. When +FCC is modified by the DTE, the DCE shall copy +FCC into +FIS.

NB: For parameters <DF>, <EC>, <BF> and <JP> only the mandatory values are currently supported.

Command	Possible Response
AT+FCC=VR,BR,WD,LN,DF,EC,BF,ST,JP	

Subparameters

VR	subparameters defined in "+FPS T.30 Phase C page reception" on page 117
BR	
WD	
LN	
DF	
EC	
BF	
ST	
JP	

12.3.3 +FIS Current session parameter

Description

The +FIS parameter allows the DTE to sense and constrain the capabilities used for the current session. The DCE uses +FIS to generate DIS or DTC messages directly, and uses +FIS and received DIS messages to generate DCS messages.

The DCE shall set the +FIS parameter from the +FCC parameter on DCE initialization, upon +FIP command execution, when +FCC is written, and at the end of a session.

NB: For parameters <DF>, <EC>, <BF> and <JP> only the mandatory values are currently supported.

Command	Possible Response
AT+FIS=VR,BR,WD,LN,DF,EC,BF,ST,JP	

Subparameters

VR	subparameters defined in "+FPS T.30 Phase C page reception" on page 117
BR	
WD	
LN	

DF

EC

BF

ST

JP

12.3.4 +FCS? Current session results

Description

The +FCS parameter is loaded with the negotiated T.30 parameters for the current session. A transmitting DCE generates DCS; a receiving DCE gets DCS from the remote station. The DTE may only read this parameter.

The DCE shall set the +FCS parameter to the default values on DCE initialization, on +FIP command execution, and at the end of a session.

The contents of +FCS are spontaneously reported during execution of +FDR or +FDT commands, by the +FCS:VR,BR,WD,LN,DF,EC,BF,ST, JP response, using the same compound parameter format.

Command	Possible Response
AT+FCS?	VR,BR,WD,LN,DF,EC,BF,ST,JP

Subparameters (response)

VR subparameters defined in “+FPS T.30 Phase C page reception” on page 117

BR

WD

LN

DF

EC

BF

ST

JP

12.3.5 +FLI= Local fax station ID string, TSI/CSI

Description

The DCE shall send the corresponding ID frame if +FLI is not a null string. +FLI is used for CSI or TSI. Table 3/T.30 includes digits 0-9, "+" and space.

The DCE shall transmit ID string characters to the remote station in reversed time order from the order in the command line. For example, if the command line:

AT+FLI="+1 234 567 8901"<CR>

is issued, the DCE would send a CSI or TSI frame with FIF (hexadecimal) consisting of:

<20><20><20><20><20><31><30><39><38><20><37><36><35><20><34><33><32><20><31><2B>

Command	Possible Response
AT+FLI="<local ID string>"	

12.3.6 +FPI= Local fax station ID, CIG (local polling ID)

Description

The DCE shall send the corresponding ID frame if +FPI is not a null string. +FPI is used for CIG. Table 3/T.30 includes digits 0-9, "+" and space.

The DCE shall transmit ID string characters to the remote station in reversed time order from the order in the command line. For example, if the command line:

AT+FPI="+1 234 567 8901"<CR>

is issued, the DCE would send a CIG frame with FIF (hexadecimal) consisting of:

<20><20><20><20><20><31><30><39><38><20><37><36><35><20><34><33><32><20><31><2B>

Command	Possible Response
AT+FPI="<local ID string>"	

12.3.7 +FNS= Pass-through non-standard negotiation byte string

Description

The DCE shall send the corresponding non-standard facilities frame if +FNS is not a null string. The type of frame is determined by the type of negotiation frame to be sent: NSF sent with DIS; NSS sent with DCS; NSC sent with DTC.

The DCE only delivers the data; the DTE must determine the content. The first octet must be the country code (see Recommendation T.35).

Command	Possible Response
AT+FNS="<string of hexadecimal coded octets>"	

Parameters

"<string of hexadecimal coded octets>" 0-90 octets

12.3.8 +FLP= Indicate document available for polling

Description

+FLP=<value> indicates whether or not the DTE has a document to poll.

If not, the DIS bit 9 will be cleared. Any received DTC frames will be result in an orderly disconnection, with hangup status code +FHS:23.

If it has, the DIS bit 9 will be set, to report this to the remote station. Any received DTC frames will be accepted. The DCE shall reset this parameter to 0 after a polled document is sent.

Command	Possible Response
AT+FLP=<value>	

Parameters

<value>	0	Indicates that the DTE has no document to poll.
	1	Indicates that the DTE has a document ready for polling.

12.3.9 +FSP= Request to poll

Description

+FSP=<value> indicates whether or not the DTE wants to poll.

If not, bit 9 in a received DIS frame will be ignored.

If it does, bit 9 in received DIS frames will be reported by the +FPO response. The DCE shall reset this parameter to 0 after a polled document is received.

Command	Possible Response
AT+FSP=<value>	

Parameters

<value>	0	Indicates that the DTE does not want to poll
	1	Indicates that the DTE can receive a polled document

12.3.10 +FCR= Capability to receive

Description

+FCR=<value> indicates whether or not the DCE will receive message data.

If not, the DCE will not be able to poll a remote device either. This clears bit 10 in the DIS or DTC frame. This can be used when the DTE has insufficient storage, or if the DCE does not have a Phase C demodulator. The DCE can send and can be polled for a document.

If the DCE can receive message data, bit 10 in the DIS or DTC frame will be set.

Command	Possible Response
AT+FCR=<value>	

Parameters

<value>	0	the DCE will not receive message data
	1	the DCE can receive message data.

12.3.11 +FBU= HDLC frame reporting enable

Description

+FBU=<value> enables or disables HDLC frame reporting.

If enabled, the DCE can report the contents of Phase B and Phase D HDLC frames to the DTE, as they are sent and received, in addition to other responses. These will be reported using the +FHT: and +FHR: responses.

Command	Possible Response
AT+FBU=<value>	

Parameters

<value>	0	disables frame reporting
	1	enables frame reporting

12.3.12 +FNR= Negotiation reporting enable

Description

+FNR is a compound parameter, used to control the reporting of messages generated during T.30 Phase B negotiations.

There are four switches, for four types of reports. These switches are described in Table 22:

Command	Possible Response
AT+FNR=<value>	

Parameters[1]

rpr	0	Receiver parameters are not reported
		+FIS: and +FTC: reports are suppressed1Receiver parameters are reported
		+FIS: and +FTC: reports are generated
tpr	0[2]	Transmitter parameters are not reported
		+FCS: reports are suppressed
		(+FCS parameter is still loaded)
	1	Transmitter parameters are reported
		+FCS: reports are generated
idr	0	ID strings are not reported. +FTI:, +FCI: and +FPI: reports are suppressed
	1	ID strings are reported. +FTI:, +FCI: and +FPI: reports are generated

1. The use of additional subparameters for +FNR, in order to control reporting of future optional T.30 negotiation reports, is for future study.
2. If tpr=0, the negotiated image data format will not be reported. Without that report, the DTE must send image data that is mandated by Recommendation T.30 (normal resolution, A4 length, 1728 width, 1-D coding) or it must enable the corresponding format conversion (+FFC). Otherwise, the data format negotiated and the data format sent might not match, causing the facsimile session to fail.

nsr	0	Non-standard frames are not reported. +FNF:, +FNS: and +FNC: reports are suppressed
	1	Non-standard frames are reported. +FNF:, +FNS: and +FNC: reports are generated

12.3.13 +FAP= Address and polling capabilities

Description

Recommendation T.30 defines three 20-digit numeric strings, used for inbound subaddressing, selective polling and passwords. Recommendation T.30 also allows the station to indicate its willingness to accept these strings.

Each of these binary subparameters allow the DTE to indicate these capabilities to the remote station, via the corresponding bits in the DIS or DTC frames: bit 47 for SEP, bit 49 for SUB, bit 50 for PWD.

These subparameters also control the reporting of those frames, if received. For example, if the <sep> subparameter value is set to 0 (disabled), then the DCE shall ignore a received SEP frame; if the <sep> subparameter is set to 1 (enabled), the DCE shall report the received frame using the +FPA: report.

Command	Possible Response
AT+FAP=<sub>,<sep>,<pwd>	

12.3.14 +FSA= Address and polling frames / subaddress

Description

The DCE shall send the numeric string contained in +FSA at the times specified in Recommendation T.30, if the corresponding parameter is not a null string.

The DCE shall transmit digit string characters to the remote station in reversed time order from the order in the command line. For example, if the command line AT+FSA="1 012 3456789**01#" is issued, the DCE would add two space characters, and send a SUB frame with FIF consisting of the following octets (expressed as hexadecimal digits):

<23><31><30><2A><2A><39><38><37><36><35><34><33><20><32><31><30><20><31><20><20>

The +FSA=? test command reports the corresponding range of character values supported. For example, if the DCE supports use of numeric digits only, the response to a +FSA=? command is "(30-39)" in hexadecimal values; if the DCE supports printable T.50, the response is: "(20-7E)".

If less than 20 characters are specified in a non-null string, the DCE shall append space characters (2/0). If the specified string is more than 20 characters in length, an ERROR result code is generated.

Command	Possible Response
AT+FSA="<destination SubAddress string>"	

12.3.15 +FPA= Address and polling frames / polling address

Description

The DCE shall send the numeric string contained in +FPA at the times specified in Recommendation T.30, if the corresponding parameter is not a null string.

The DCE shall transmit digit string characters to the remote station in reversed time order from the order in the command line.

The +FPA=? test command reports the corresponding ranges of character values supported. For example, if the DCE supports use of numeric digits only, the response to a +FPA=? command is "(30-39)" in hexadecimal values; if the DCE supports printable T.50, the response is: "(20-7E)".

If less than 20 characters are specified in a non-null string, the DCE shall append space characters (2/0). If the specified string is more than 20 characters in length, an ERROR result code is generated.

Command	Possible Response
AT+FPA="<selective Polling Address string>"	

12.3.16 +FPW= Address and polling frames / password

Description

The DCE shall send the numeric string contained in +FPW at the times specified in Recommendation T.30, if the corresponding parameter is not a null string. The +FPW parameter is used for the PWD frame sent with either DTC or with DCS. Recommendation T.30 defines these frames for values of digits 0-9, space, * and # characters only.

The DCE shall transmit digit string characters to the remote station in reversed time order from the order in the command line.

The +FPW=? test command reports the corresponding ranges of character values supported. For example, if the DCE supports use of numeric digits only, the response to a +FPW=? command is "(30-39)" in hexadecimal values; if the DCE supports printable T.50, the response is: "(20-7E)".

If less than 20 characters are specified in a non-null string, the DCE shall append space characters (2/0). If the specified string is more than 20 characters in length, an ERROR result code is generated.

Command	Possible Response
AT+FPW="<PassWord string>""	

12.3.17 +FIE= Procedure interrupt enable

Description

Recommendation T.30 provides for either station to initiate Procedure Interrupts. The other station may choose to accept or ignore these requests. A service Class 2 facsimile DCE may negotiate or ignore Procedure Interrupts, conditioned by this parameter.

For transmission (+FDT), Procedure Interrupt Requests from the remote station are not reported directly; only the +FVO response is reported.

For reception (+FDR), Procedure Interrupt Requests from the remote station are reported in the +FET: response. The value stored in the +FPS parameter will be adjusted to values 4 or 5. If the DTE issues a subsequent +FDR command with the +FPS value intact, the DCE will complete the negotiation and issue a +FVO response.

Command	Possible Response
AT+FIE=<value>	

Parameters

<value>	0	Procedure Interrupt Requests from the remote station ignored, and not reported to the DTE
	1	Procedure Interrupt Requests from the remote station accepted, negotiated and reported using the +FVO response

12.3.18 +FPS= Page transfer status

Description

The +FPS parameter contains a value representing the post page response, including copy quality and related end-of-page status. These values correspond to post page response messages defined in Recommendation T.30. The receiving DCE sets this parameter after it receives a page of Phase C data. The transmitting DCE sets this parameter with the status reported by the receiving station. The DTE may inspect or modify this parameter.

Valid <ppr> values are defined in Parameters below. These values are also reported by the +FPS:<ppr> response to the +FDR command.

The DCE may set this parameter to values 1, 2 or 3 based on its own copy quality checking or access to received signal quality. The DCE shall set this parameter to a value of 1 if copy quality checking is disabled (+FCQ=0).

Copy quality checking is the responsibility of the DCE. However, a receiving DTE may do its own Copy Quality checking.

The DTE may request a Procedure Interrupt from the remote station using this parameter. To do so, the DTE shall modify the value reported by the DCE before it issues the next +FDR command, which in turn instructs the DCE to send the resulting post page response to the remote facsimile station.

Command	Possible Response
AT+FPS=<value>	

Parameters

<value>	1	Page good (T.30 mnemonic: MCF)
	2	Page bad; retrain requested (RTN)
	3	Page good; retrain requested (RTP)
	4	Page bad; interrupt requested (PIN)
	5	Page good; interrupt requested (PIP)

12.3.19 +FCQ= Copy quality

Description

The +FCQ compound parameter controls copy quality checking and correction by a facsimile DCE.

The <rq> subparameter controls copy quality checking and correction of data received from the remote station and delivered to the local DTE; the <tq> subparameter controls copy quality checking and correction of image data received from the local DTE and sent to the remote facsimile station.

Receive copy quality checking is the responsibility of the DCE, for any data type supported. However, the DTE may turn off copy quality checking by setting +FCQ=0,0, or by setting +FND=1.

Copy quality checking consists of determining if the incoming image data conforms to the negotiated standard format, e.g. Recommendation T.4 or T.6. Copy quality correction consists of detecting errors and altering the data in some way to guarantee that only valid data (according to negotiated parameters) is delivered. See Parameters below.

The methods used for copy quality checking or for correction are not a subject of this Recommendation. The DCE may use the associated T.30 control parameters to condition its Copy Quality Checking behaviour. Common procedures for Copy Quality correction include deletion of bad lines or replacement of bad lines by previous good lines.

The DCE shall report on Received Copy Quality to the DTE in the page status report, +FPS:<ppr>,<lc>,<blc>,<cblc>,<lbc>, and record it in the +FPS parameter.

NB: Only value 0 is currently supported.

Command	Possible Response
AT+FCQ=<rq>,<tq>	

Parameters

<rq>	0	DCE receive copy quality checking is disabled. The DCE will generate copy quality OK (MCF) responses to complete pages, and set +FPS=1
	1	DCE receive copy quality checking is enabled. The DCE will determine the recommended Post Page Message, and store it into the +FPS parameter
	2	DCE receive copy quality correction is enabled. The DCE will determine the recommended Post Page Message, and store it into the +FPS parameter. The DCE will detect and correct errors in data received from the remote station, by manufacturer-specific means
<tq>	0	DCE transmit copy quality checking is disabled. The DTE is responsible for T.4 or T.6 compliance
	1	DCE transmit copy quality checking is enabled. The DTE is responsible for T.4 or T.6 compliance. The DCE shall return a <CAN> to the DTE if errors are detected
	2	DCE transmit copy quality correction is enabled. The DCE will detect and correct errors in data received from the local DTE, by manufacturer-specific means

12.3.20 +FRQ= Receive quality thresholds

Description

The DCE may use this compound parameter to make the "Copy Quality OK" decision in the T.30 flow chart (Figure A.7/T.30). If used, the DCE shall judge Copy Quality unacceptable if either the percentage of good

lines is too low or too many consecutive lines contain errors. Bad line counts are reported in the +FPS:<blc> response, described in. A value of 0 disables either subparameter for use in copy quality checking.

The first subparameter, <pgl>, specifies the percentage of good lines (e.g. with negotiated number of pixels) required for a page to be considered acceptable. For example, the DCE could count bad lines (as reported in the +FPS <blc> subparameter) and total line count (as reported in the +FPS<lc> subparameter); the percentage of good lines would be computed by the following equation:

100 x (<blc> – <bl>)/<lc>

If the resulting value is less than the value in <pgl>, the page is unacceptable.

The second subparameter, <cbl>, specifies the maximum tolerable number of consecutive bad lines. If this value is exceeded for a given page, the DCE shall consider the page unacceptable.

If the page is found unacceptable by either criteria, the DCE shall report the value 2 for the +FPS <ppr> subparameter, and store that value into the +FPS parameter.

NB: Only mandatory values are currently supported for the parameters.

Command	Possible Response
AT+FRQ=<pgl>,<cbl>	

Parameters

<pgl> percentage of good lines

<cbl> maximum tolerable number of consecutive bad lines

12.3.21 +FAA= Adaptive answer mode

Description

Allows the DCE to determine whether to answer as a Class 2 facsimile device or as a data modem.

NB: Only mandatory values are currently supported for the parameters.

Command	Possible Response
AT+FAA=<value>	

Parameters

<value> 0 The DCE shall answer only as a Class 2 facsimile device

1 The DCE can answer and automatically determine whether to answer as a facsimile DCE or as a data modem.

12.3.22 +FCT= Phase C timeout

Description

This determines how long the DCE will wait for a command after having transmitted all available Phase C data.

For transmission (+FDT), when this timeout is reached, the DCE shall properly terminate any Phase C data transfer in progress, then execute an implied +FKS orderly abort command.

For reception (+FDR), when this timeout is reached, the DCE shall send the T.30 DCN response to the remote station and execute an implied orderly abort command.

NB: Only mandatory values are currently supported for the parameters.

Command	Possible Response
AT+FCT=<value>	

Parameters

<value> 0 - FFH 1-second units (Default value = 1EH — 30 seconds)

12.3.23 +FHS? Call termination status code

Description

This read-only parameter indicates the cause of a hangup. The valid values for this parameter as well as the meaning of each value are shown in Syntax below. +FHS is set by the DCE at the conclusion of a fax session. The DCE shall reset this parameter to 0 at the beginning of Phase A.

Command	Possible Response
AT+FHS?	<hangup status code>

Parameters (response)

<hangup status code>	*00-0F*	*Call placement and termination*
	00	Normal and proper end of connection
	01	Ring detect without successful handshake
	02	Call aborted, from +FKS or <CAN>
	03	loop current
	04	Ringback detected, no answer (timeout)
	05	Ringback detected, answer without CED
	10-1F	*Transmit Phase A and miscellaneous errors*
	10	Unspecified Phase A error
	11	No answer (T.30 T1 timeout)
	20-3F	*Transmit Phase B hangup codes*
	20	Unspecified transmit Phase B error
	21	Remote cannot receive or send
	22	COMREC error in transmit Phase B
	23	COMREC invalid command received
	24	RSPREC error
	25	DCS sent three times without response
	26	DIS/DTC received 3 times; DCS not recognized
	27	Failure to train at 2400 bit/s or +FMS value

28	RSPREC invalid response received
40-4F	*Transmit Phase C hangup codes*
40	Unspecified transmit Phase C error
41	Unspecified image format error
42	Image conversion error
43	DTE to DCE data underflow
44	Unrecognized transparent data command
45	Image error, line length wrong
46	Image error, page length wrong
47	Image error, wrong compression code
50-6F	*Transmit Phase D hangup codes*
50	Unspecified transmit Phase D error
51	RSPREC error
52	No response to MPS repeated 3 times
53	Invalid response to MPS
54	No response to EOP repeated 3 times
55	Invalid response to EOP
56	No response to EOM repeated 3 times
57	Invalid response to EOM
58	Unable to continue after PIN or PIP
70-8F	*Receive Phase B hangup codes*
70	Unspecified receive Phase B error
71	RSPREC error
72	COMREC error
73	T.30 T2 timeout, expected page not received
74	T.30 T1 timeout after EOM received
90-9F	*Receive Phase C hangup codes*
90	Unspecified receive Phase C error
91	Missing EOL after 5 seconds (3.2/T.4)
92	Bad CRC or frame (ECM mode)
93	DCE to DTE buffer overflow
A0-BF	*Receive Phase D hangup codes*
A0	Unspecified receive Phase D errors
A1	RSPREC invalid response received
A2	COMREC invalid response received
A3	Unable to continue after PIN or PIP

C0-DF	Reserved for future standardization
E0-FF	Reserved for manufacturer-specific use

NOTE – Except for the set of codes specifically designated for manufacturer-specific use, all other unused codes are reserved for specification in future versions.

12.3.24 +FRY= ECM retry count

Description

In Error Correcting Mode the transmitting DCE will try to send a partial page four times. These four attempts are called an “attempt block”. If the transmitting DCE is not successful sending an attempt block at a particular signalling rate, it must decide if it should: i) retry the attempt block at the current signalling rate; ii) retry the attempt block at a lower signalling rate, or iii) discontinue trying to send the partial page.

i) The transmitting DCE may continue to retry the attempt block at a particular signalling rate up to +FRY times. If the +FRY parameter is zero, the partial page cannot be resent at the current signalling rate.

ii) The transmitting DCE may select a lower signalling rate subject to the +FMS parameter, and send the partial page at the new lower signalling rate.

iii) The transmitting DCE can only discontinue sending the partial page once +FRY attempt block retries have been made at the lowest permissible signalling rate, as defined by the +FMS command. If the DCE fails to deliver the partial page, it shall send a DCN to the remote device, issue +FHS to the DTE, and disconnect in accordance with Recommendation T.30. If ECM is not required for a particular facsimile transfer, the DCE may alternatively send an EOR to the receiving station and return an ERROR result code for the +FDT command.

This allows the DCE to retry up to +FRY attempt blocks at each signalling rate and ensures +FRY attempt block retries at the lowest signalling rate specified in the +FMS parameter.

NB: Only mandatory values are currently supported for the parameters.

Command	Possible Response
AT+FRY=<value>	

Parameters

<value>	0 - FFF	Units of four retries

12.3.25 +FMS= Minimum phase C speed

Description

This optional parameter limits the lowest negotiable speed for a session. This parameter is useful for limiting the cost of a transmission, by requiring a minimum transmission speed. If the facsimile DCE cannot negotiate to a minimum speed, it shall perform an orderly disconnect.

The units are the same as those defined for the BR Bit Rate subparameter.

Command	Possible Response
AT+FMS=<value>	

Parameters

<value>	0	2 400 bit/s

1	4 800 bit/s
2	7 200 bit/s
3	9 600 bit/s
4	12 000 bit/s
5	14 400 bit/s

12.3.26 +FIT= Inactivity timeout

Description

A service Class 2 facsimile DCE shall provide an inactivity timer that allows the DCE to break away from an unsuccessful connection attempt at any stage of a facsimile transfer. The inactivity timer only works while the DCE is off-hook.

The <time> parameter indicates the inactivity timeout in seconds. The required timeout is 1 to 255 seconds. The value of 0 indicates that timeout is disabled. Any values greater than 255 are optional values for the DCE manufacturer.

The <action> parameter has two meanings. The inactivity timer starts when the DCE has taken some action that requires DTE response. If the DTE does respond, the DCE shall reset the inactivity timer. Tables 25 and 26 define these sets of events.

Command	Possible Response
AT+FIT=<time>,<action>	

Parameters

<time>	0	timeout disabled
	1 - 255	timeout in seconds
<action>	0	Upon timeout, the DCE shall go on-hook, executing an implied ATH command; then reset to +FCLASS=0 if +FCLASS=0 is supported by the DCE
	1	Upon timeout, the DCE shall only go on-hook. This feature is used to detect possible system failure, when either no line or DTE activity has occurred for a minimum amount of time

12.3.27 +FBS? Report buffer size

Description

This parameter allows the DCE to report the size of the DCE's data buffers. The values shall be in hexadecimal and represent the buffer size in octets.

The DCE shall provide sufficient receive buffer to accommodate 3 seconds of flow-control-off at the maximum receive speed; at 9600 bit/s, this is E10h octets (3600 decimal).

A minimum transmit buffer size is not mandated.

Command	Possible Response
AT+FBS?	<tbs>,<rbs>

Parameters (response)

<tbs>	hex number	transmit buffer size in octets
<rbs>	hex number	receive buffer size in octets

12.3.28 +FPP= Packet protocol control

Description

Enables or disables the DCE-to-DTE Packet Protocol (clause 9).

When enabled, all multi-character messages from the DCE are sent to the DTE using a simple Packet Protocol data link, to assure reliable delivery of data.

This command takes effect after the +FPP command is executed, before the final result code is issued by the DCE. If this command is embedded in a command line containing multiple commands, it applies to information text and result codes of subsequent commands.

Command	Possible Response
AT+FPP=<value>	

NB: Only value 0 is currently supported.

Parameters

<value>	0	Disables the DCE-to-DTE Packet Protocol
	1	Enables the DCE-to-DTE Packet Protocol

12.3.29 +FBO= Data bit order

Description

This parameter controls the mapping between PSTN facsimile data and the DTE-DCE link. There are two choices:

- Direct – The first bit transferred of each octet on the DTE-DCE link is the first bit transferred on the GSTN data carrier.
- Reversed – The last bit transferred of each octet on the DTE-DCE link is the first bit transferred on the GSTN data carrier.

There are two data types to control:

- Phase C data – T.4 or T.6 encoded data, or any other type of data (e.g. T.434 BFT), transferred during execution of +FDT or +FDR commands.
- Phase B/D data – T.30 Phase B and Phase D control messages, reported to the DTE in +FHT: and +FHR: reports only (8.6), enabled by the +FBU parameter (8.5.1.10).

Command	Possible Response
AT+FBO=<value>	

Parameters

<value>	0	Selects direct bit order for both Phase C data and for Phase B/D data

1 Selects reversed bit order for Phase C data and selects direct bit order for Phase B/D data

2 Selects direct bit order for Phase C data and selects reversed bit order for Phase B/D data

3 Selects reversed bit order for both Phase C data and for Phase B/D data

12.3.30 +FEA= Phase C received EOL alignment

Description

This parameter enables optional octet-alignment of EOL markers in received T.4 data streams. It does not apply to T.6 data, or to any other form of data (e.g. T.434 BFT).

As per 4.2.2/T.4, the tag bit for two dimensional coding, which indicates the coding used for the following line, shall be included in that line in the octet following the previous EOL.

NB: Only mandatory values are currently supported for the parameters.

Command	Possible Response
AT+FEA=<value>	

Parameters

<value> 0 Determines that T.4 EOL patterns are bit-aligned (as received)

1 Determines that the last received bits of T.4 EOL patterns are octet-aligned by the DCE, with necessary zero fill bits inserted.
There are two 2-octet patterns:
+FBO= binary EOL pattern
0 or 2 0000xxxx 10000000
1 or 3 xxxx0000 00000001
xxxx represent previous data bits, zero bits, or other leading data.

12.3.31 +FFC= Image data format conversion

Description

This compound parameter determines the DCE response to mismatches between the Phase C data delivered after the +FDT command and the data format parameters negotiated for the facsimile session. [See +FCS: response and +FCS parameter]

For mismatch checking, the DCE depends on the DTE to indicate the data format with embedded <DLE><format> character pairs. If these format indicators are not provided, the DCE shall assume that the format is as negotiated for that session.

For each subparameter, value 0 determines that mismatch checking is disabled, and all format codes of this type are ignored. Value 1 determines that mismatch checking is enabled, with session termination if the format codes do not match the negotiated format reported in +FCS: responses. Other values enable degrees of format conversion.

Unspecified values are reserved.

NB: Only mandatory values are currently supported for the parameters.

Command	Possible Response
AT+FFC=<vrc>,<dfc>,<lnc>,<wdc>	

Parameters

<vrc>	0	Vertical resolution format codes ignored
	1	Vertical resolution checking enabled
	2	Vertical resolution conversion enabled for 1-D data
	3	Vertical resolution conversion enabled for 2-D data
<dfc>	0	Data format codes ignored
	1	Data format checking enabled
	2	Data format conversion enabled
<lnc>	0	Page length format codes ignored
	1	Page length checking enabled
	2	Page length conversion enabled for 1-D data
	3	Page length conversion enabled for 2-D data
<wdc>	0	Page width format codes ignored
	1	Page width checking enabled
	2	Page width conversion enabled

12.3.32 +FMI

Modem ID (see +GMI Request Manufacturer Identification)

12.3.33 +FMM

Model ID (see +GMM Request Model Identification)

12.3.34 +FMR

Revision ID (see +GMR Request Model Revision)

12.3.35 +FLO

Flow control (see +IFC DTE-DCE Local Flow Control)

13.0 Condat-specific commands

(Reproduced from Condat document "ACI - Application Control Interface, Condat Specific AT Command Description", May 14, 2000. ID: 8415.052.00.003. Author: Condat AG, Alt Moabit 91d, 10559 Berlin, Germany. Reformatted by UbiNetics to be consistent with the rest of this Reference Manual. These command descriptions are reproduced here for the convenience of the reader; the Condat source document should be regarded as the authoritative source.)

13.0.1 %NRG Network registration and service selection

Description

Set command forces an attempt to select and register the GSM network operator. <regMode> is used to select whether the selection is done automatically by the ME or is forced by this command to operator <opr> (it shall be given in format <oprFrmt>). If the selected operator is not available, no other operator is selected. The selected operator name format shall apply to further read commands (%NRG?) also. <srvMode> is used to specify the different stages of service to register to. <srvMode>=3 can be used to change the behavior of registration in case of a loss of coverage. If connection to the operator is lost and <regMode> was set to automatic, ME tries to register to the previous operator automatically. In case <regMode> was set to manual, ME stays unregistered and waits for a manual registration attempt. Refer subclause 9.2 of [GSM 07.07] for possible <err> values. This command is abortable when registration attempt is made.

Read command returns the current registration mode, service mode, service status and the currently selected operator. If no operator is selected, <oprFrmt> and <opr> are omitted.

Test command returns facility values supported by the TA as a compound value.

NOTE: The command %NRG is an expansion of the +COPS command. The new command allows specifying the service state of the registration. For a list of current available network operators please use the test command of +COPS.

Command	Possible response
AT%NRG=?	%NRG: (list of supported <regMode>s), (list of supported<srvMode>s), (list of supported <oprFrmt>s)
AT%NRG?	%NRG: <regMode>,<srvMode>,<oprFrmt>,<srvStat>,<opr>
AT%NRG=[<regMode>[,<srvMode>[,<oprFrmt>[,<opr>]]]]	+CME ERROR: <err>

Parameters

<regMode>	0	automatic registration (<opr> field is ignored)
	1	manual registration (<opr> field shall be present on registration attempt)
<srvMode>	0	full service
	1	limited service
	2	no service
	3	set registration mode only
<oprFrmt>	0	long format alphanumeric <opr>

	1	short format alphanumeric <opr>
	2	numeric <oprr>
<opr>	string type; <oprFrmt> indicates if the format is alphanumeric or numeric; long alphanumeric format can be up to 16 characters long and short format up to 8 characters; numeric format is the GSM Location Area Identification number (refer GSM 04.08 subclause 10.5.1.3) which consists of a three BCD digit country code coded as in ITU-T E.212 Annex A, plus a two BCD digit network code, which is administration specific; returned <opr> shall not be in BCD format, but in IRA characters converted from BCD; hence the number has structure: (country code digit 3)(country code digit 2)(country code digit 1)(network code digit 2)(network code digit 1)	

13.0.2 %CACM Query accumulated call meter using PUCT

Description

Returns the current value of the accumulated call meter, calculated with the values given by the price per unit and
currency table stored in SIM. Refer subclause 9.2 of [GSM 07.07] for possible <err> values.

Command	Possible response
AT%CACM=?	
AT%CACM	%CACM: <cur>,<price>+CME ERROR: <err>

Parameters

<cur>	string type	three-character currency code (e.g. "GBP", "DEM"); character set as specified by command Select TE Character Set +CSCS
<price>	string type	calculated price value of accumulated call meter; dot is used as a decimal separator (e.g. "2.66")

13.0.3 %CAOC Query current call meter using PUCT

Description

Returns the current value of the current call meter, calculated with the values given by the price per unit and currency table stored in SIM. Refer subclause 9.2 of [GSM 07.07] for possible <err> values.

Command	Possible response(s)
AT%CAOC	%CAOC: <cur>,<price>+CME ERROR: <err>
AT%CAOC=?	

Parameters

<cur>	string type	three-character currency code (e.g. "GBP", "DEM"); character set as specified by command Select TE Character Set +CSCS
<price>	string type	calculated price value of accumulated call meter; dot is used as a decimal separator (e.g. "2.66")

13.0.4 %CGPCO Configures PCO for PDP activation

Description

%CGPCO is used to configure PCO for PDP activation when AT+CGACT=1 is used.

Command	Possible response(s)
AT%CGPCO=<format>,<pco>	

Parameters

<format>	0	hex format
	1	user-friendly format
<pco>	if <format>=0	hex number containing <authentication protocol> (PAP),<user> and <password>
	if <format>=1	<authentication protocol>,<user>,<password>

13.0.5 %CGPPP Configures PPP

Description

%CGPPP is used to configure PPP, indicating which authentication protocol should be used.

Command	Possible response(s)
AT%CGPPP=<protocol>	+CME ERROR: <err>
AT%CGPPP?	%CGPPP: <protocol>
AT%CGPPP=?	%CGPPP: <list of supported <protocols>>

Parameters

<protocol>	0	no authentication
	1	password authentication protocol
	2	challenge handshake authentication protocol
	3	automatic authentication

13.0.6 %CPI Call progress information

Description

This command refers to call progress information, which is indicated by the network during call establishment. The set command enable/disables the presentation of unsolicited notification result codes from TA to TE.

When <n>=1 and a call progress information is received during a call establishment, intermediate result code %CPI: <cId>,<msgType>,<ibt>,tch> is sent to TE. <cId> identifies the call in the call table. The value of <msgType> describes the layer 3 message type that was used to transfer the call progress information. The state of TCH assignment and the use of in-band tones for that call can be monitored by the values of <ibt> and <tch>.

Test command returns values supported by the TA as compound value.

Command	Possible response(s)
AT%CPI=?	%CPI: (list of supported <n>s)
AT%CPI?	%CPI: <n>
AT%CPI=<n>	

Parameters

<n> parameter sets/shows the result code presentation status in the TA

0	disable
1	enable

<cId> integer type call identification number as described in GSM 02.30 subclause 4.5.5.1

<msgType> layer 3 message type

0	setup message
1	disconnect message
2	alert message
3	call proceed message
4	synchronization message

<ibt> status of the usage of in-band tones

0	no in-band tones
1	in-band tones

<tch> TCH assignment

0	TCH not assigned
1	TCH assigned

13.0.7 %CTV Call timer value

Description

Returns the current value of the last call duration in seconds. Refer subclause 9.2 of [GSM 07.07] for possible <err>values.

Command	Possible response(s)
AT%CTV=?	
AT%CTV	%CTV: <dur> +CME ERROR: <err>

Parameters

<dur> integer type represents the duration of the last call in unit of seconds

13.0.8 %SATC Configuration for SIM application toolkit

Description

This command refers to the SIM application toolkit download mechanism, which is used to indicate to the SIM the features that the ME is capable of. The different features that are possible for a proactive SIM card are summarized by a table called a profile, refer to GSM 11.14 for more details. Condat's ACI, SMS and SIM modules already implement some of these features. Therefore the profile that is indicated by <satPrfl> will be combined with the existing one.

The current profile setting could be displayed using the read command. <n> is used to enable/disable the presentation of unsolicited notification result codes from TA to TE.

When <n>=1 and one of the following conditions have occurred, the respective unsolicited result is sent to TE.

- A command received from the SIM that is not handled by ME is indicated to TE by %SATI: <satCmd>.
- The result to an envelope command, which was sent by TE, is indicated using the result %SATE: <satRsp>. For more information regarding the sending of envelope commands to SIM, please refer to the %SATE command description.
- If SIM application toolkit tries to set up a call using the Set Up Call feature described in GSM 11.14, and the conditions for the call are checked by ME successfully, the call is indicated to TE using the result %SATA: [<rdl>]. Using the accept command A, ME tries to establish the call, otherwise the hook-on command H rejects the pending SAT call and sends the respective response to SIM.
- In general, commands or responses sent by ME to SIM or commands handled by ME are indicated to TE using the result %SATN: <satNtfy>. With these notifications, TE shall be able to indicate appropriate messages to a user.

Command	Possible response
AT%SATC=?	%SATC: (list of supported <n>s),(<prflLen>)
AT%SATC?	%SATC: <n>,<satPrfl>
AT%SATC=<n>,<satPrfl>	

Parameters

<n>	parameter sets/shows the result code presentation status in the TA	
	0	disable notification
	1	enable notification
<satPrfl>	string type	SIM application toolkit profile (hexadecimal format; refer +CSCS) starting with first byte of the profile.
<satCmd>	string type	SIM application toolkit command (hexadecimal format; refer +CSCS) starting with command tag.
<satRsp>	string type	SIM application toolkit response (hexadecimal format; refer +CSCS) starting with first byte of response data.
<satNtfy>	string type	commands or responses sent by ME to SIM or commands handled by ME (hexadecimal format; refer +CSCS) starting with first byte of response data or command tag.
<rdl>	integer type	if a pending SIM application toolkit command is alerted to TE using result %SATA:, the value of <rdl> indicates the redial timeout for the call in units of milliseconds.

13.0.9 %SATI: Indication of SAT command

Description

Unsolicited response indicating a command received from the SIM that is not handled by ME. Indication enabled using %SATC.

Parameters

<satCmd>	string type	SIM application toolkit command (hexadecimal format; refer +CSCS) starting with command tag.

13.0.10 %SATN: Notification of commands and responses sent by ACI

Commands or responses sent by ME to SIM or commands handled by ME are indicated to TE using the result %SATN: <satNtfy>. Notification enabled using %SATC.

Parameters

<satNtfy>	string type	commands or responses sent by ME to SIM or commands handled by ME (hexadecimal format; refer +CSCS) starting with first byte of response data or command tag.

13.0.11 %SATE Send SAT envelope command

Description

This command provides the possibility to send a command to the SIM, using the envelope mechanism of SIM application toolkit as described in GSM 11.14. If <satCmd> is present the contents is converted and send directly to SIM. The coding of the SIM command is the task of TE, no checking is done by ME. As soon as a response from the SIM is received, the contents are sent to ME using the result %SATE: <satRsp>.

Command	Possible response(s)
AT%SATE=?	
AT%SATE=<satCmd>	%SATE: <satRsp>

Parameters

<satCmd>	string type	SIM application toolkit command (hexadecimal format; refer +CSCS) starting with command tag.
<satRsp>	string type	SIM application toolkit response (hexadecimal format; refer +CSCS) starting with first byte of response data.

13.0.12 %SATA: SAT Pending Call Alert

Description

User alert that SIM application toolkit is trying to set up a call; must be answered with ATA or rejected with ATH. Alert enabled using %SATC.

Parameters

<rdl>	integer type	the value of <rdl> indicates the redial timeout for the call in units of milliseconds.

13.0.13 %SATR Send SAT Command Response

Description

This command provides the possibility to send a response to previous received SAT command. If a SIM application toolkit command was indicated to TE using the result %SATI: <satCmd>, the TE should send an appropriate response using the %SATR command. If <satRsp> is present the contents is converted and send directly to SIM.

The coding of the SIM response is the task of TE; no checking is done by ME.

Command	Possible response(s)
AT%SATR=?	
AT%SATR=<satRsp>	

Parameters

<satRsp>	string type	SIM application toolkit response (hexadecimal format; refer +CSCS) starting with first byte of response data.

13.0.14 %SATT Terminate SAT Command or Session

Description

This command is used to terminate a SIM application toolkit command or session. If <cs> is present the value is coded and send to the SIM to terminate the command or session. For example, is a SAT Call Set up was indicated with the result %SATA: 60, and the Redialing time is exceeded, TE shall send the cause 'end of redialing reached' to ME.

Command	Possible response(s)
AT%SATT=<cs>	
AT%SATT=?	

Parameters

<cs>	cause of command or session termination	
	0	user stopped redialing
	1	end of redialing reached
	2	user ends session

13.1 CME and CMS Result Codes

This section lists the typical result codes seen from the Mobile Equipment and Message Service, in both numeric and verbose formats.

13.1.1 +CME ERROR Mobile Equipment Error Result Code

0	phone failure
1	no connection to phone
2	phone-adaptor link reserved
3	operation not allowed
4	operation not supported
5	PH-SIM PIN required
6	PH-FSIM PIN required
7	PH-FSIM PUK required
10	SIM not inserted
11	SIM PIN required
12	SIM PUK required
13	SIM failure
14	SIM busy
15	SIM wrong
16	Incorrect password
17	SIM PIN2 required
18	SIM PUK2 required
20	memory full
21	invalid index
22	not found
23	memory failure
24	text string too long
25	invalid characters in text string
26	dial string too long
27	invalid characters in dial string
30	no network service
31	network timeout
32	network not allowed - emergency calls only
40	network personalisation PIN required
41	network personalisation PUK required
42	network subset personalisation PIN required
43	network subset personalisation PUK required
44	service provider personalisation PIN required
45	service provider personalisation PUK required

46	corporate personalisation PIN required
47	corporate personalisation PUK required
100	unknown

13.1.2 +CMS ERROR Message Service Failure Result Code

1	unassigned (unallocated) number
8	operator determined barring
10	call barred
17	network failure
21	short message transfer rejected
22	congestion / memory capacity exceeded
27	destination out of service
28	unidentified subscriber
29	facility rejected
30	unknown subscriber
38	network out of order
41	temporary failure
42	congestion
47	resources unavailable, unspecified
50	requested facility not subscribed
69	requested facility not implemented
81	Invalid transaction Identifier / Invalid short message transfer reference value
95	Invalid message, unspecified / Semantically incorrect message
96	Invalid mandatory information
97	message type non-existent or not implemented
98	message not compatible with short message protocol state
99	Information element non-existent or not implemented
111	protocol error, unspecified
127	Interworking, unspecified
128	telematic interworking not supported
129	short message Type 0 not supported
130	cannot replace short message
143	unspecified TP-PID error
144	data coding scheme (alphabet) not supported

145	message class not supported
159	unspecified TP-DCS error
160	command cannot be actioned
161	command unsupported
175	unspecified TP-Command error
176	TPDU not supported
192	SC busy
193	no SC subscription
194	SC system failure
195	Invalid SME address
196	destination SME barred
197	SM rejected-duplicate SM
198	TP-VPF not supported
199	TP-VP not supported
208	SIM SMS storage full
209	no SMS storage capability in SIM
210	error in MS
211	memory capacity exceeded
212	SIM application toolkit busy
213	SIM data download error
255	unspecified error cause
300	ME failure
301	SMS service of ME reserved
302	operation not allowed
303	operation not supported
304	Invalid PDU mode parameter
305	invalid text mode parameter
310	SIM not inserted
311	SIM PIN required
312	PH-SIM PIN required
313	SIM failure
314	SIM busy
315	SIM wrong
316	SIM PUK required
317	SIM PIN2 required
318	SIM PUK2 required

320	memory failure
321	Invalid memory index
322	memory full
330	SMSC address unknown
331	no network service
332	network timeout
340	no +CNMA acknowledgement expected
500	unknown error

14.0 Additional AT Commands for GPRS

14.1 Introduction

The GSM/GPRS Protocol stack includes support for many of the standard AT commands specified by ETSI and other specifications. The protocol stack provides a method of adding AT commands using the command extension mechanism. This section details the commands that have been added specifically for UbiNetics GPRS products and in accordance with GSM Rec. 07.07. New AT commands are constantly being added: please keep in contact with UbiNetics for details of new commands as they become available.

14.2 Commands specified by GSM Rec. 07.07

14.2.1 +CGDCONT Define PDP Context

Description

Specifies parameter values for a PDP context identified by the (local) context identification parameter, <cid>.

Command	Possible response

AT+CGDCONT=?	+CGDCONT: (range of supported <cid>s),<PDP_type>,,,(list of supported <d_comp>s),(list of supported <h_comp>s)[,(list of supported<pd1>s)[,...[,(list of supported <pdN>s)]]][<CR><LF>+CGDCONT: (range of supported <cid>s),<PDP_type>,,,(list of supported <d_comp>s),(list of supported <h_comp>s)[,(list of supported<pd1>s)[,...[,(list of supported <pdN>s)]]][...]]
AT+CGDCONT?	+CGDCONT: <cid>, <PDP_type>,<APN>,<PDP_addr>, <data_comp>,<head_comp>[,<pd1>[,...[,pdN]]][<cr><lf>+CGDCONT: <cid>, <PDP_type>,<APN>,<PDP_addr>, <data_comp>,<head_comp>[,<pd1>[,...[,pdN]]][...]]
AT+CGDCONT=[<cid> [,<PDP_type> [,<APN>[,<PDP_addr> [<d_comp> [,h_comp> [,<pd1> [,...[,pdN]]]]]]]]	

Parameters

<cid> PDP Context Identifier — Range of permitted values returned by the test form of the command

<PDP_type> Packet Data Protocol type

- IP — Internet Protocol (IETF STD 5)

<APN> Access Point Name; a string parameter which is a logical name used to select the GGSN or the external packet data network.

<PDP_address> String parameter that identifies the MT 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

- 0 — Off (default if value is omitted)
- 1 — On

Other values are reserved.

<h_comp> Numeric parameter that controls PDP header compression

- 0 — Off (default if value is omitted)
- 1 — On

Other values are reserved.

<pd1>,...<pdN> Zero to N string parameters whose meanings are specific to the <PDP_type>

For PDP type OSP:IHOSS the following parameters are defined:

- <pd1> = <host> — the fully formed domain name extended hostname of the Internet host
- <pd2> = <port > — the TCP or UDP port on the Internet host
- <pd3> = <protocol> — the protocol to be used over IP on the Internet - "TCP" or "UDP"

14.2.2 +CGQREC Quality of Service Profile (requested)

Description

Allows the DTE to specify a Quality of Service Profile that is used when the MT sends an Activate PDP Context Request message to the network.

If no Profile exists, an error will be returned.

Command	Possible response
AT+CGQREQ=?	+CGQREQ: <PDP_type>, (list of supported <precedence>s), (list of supported <delay>s), (list of supported <reliability>s) , (list of supported <peak>s), (list of supported <mean>s) [<CR><LF>+CGQREQ: <PDP_type>, (list of supported <precedence>s), (list of supported <delay>s), (list of supported <reliability>s) , (list of supported <peak>s), (list of supported <mean>s) […]]
AT+CGQREQ?	+CGQREQ: <cid>, <precedence >, <delay>, <reliability>, <peak>, <mean>[<CR><LF>+CGQREQ: <cid>, <precedence >, <delay>, <reliability.>, <peak>, <mean>[…]]
AT+CGQREQ=[<cid> [,<precedence > [,<delay>[,<reliability.> [,<peak> [,<mean>]]]]]]	

Parameters

<cid> Numeric parameter specifying a particular PDP context definition (see AT+CGDCONT command).

Parameters defined in GSM 03.60:

<precedence> Numeric parameter specifying the precedence class

<delay> Numeric parameter specifying the delay class

<reliability> Numeric parameter specifying the reliability class

<peak> Numeric parameter specifying the peak throughput class

<mean> Numeric parameter specifying the mean throughput class

If a value is omitted for a particular class, the value is considered to be unspecified.

14.2.3 +CGQMIN Quality of Service Profile (minimum accepted)

Description

Allows the DTE to specify a minimum acceptable profile which is checked by the MT against the negotiated profile returned in the Activate PDP Context Accept message.

Command	Possible response
AT+CGQMIN=?	+CGQMIN: <PDP_type>, (list of supported <precedence>s), (list of supported <delay>s), (list of supported <reliability>s) , (list of supported <peak>s), (list of supported <mean>s) [<CR><LF>+CGQMIN: <PDP_type>, (list of supported <precedence>s), (list of supported <delay>s), (list of supported <reliability>s) , (list of supported <peak>s), (list of supported <mean>s) […]]
AT+CGQMIN?	+CGQMIN: <cid>, <precedence >, <delay>, <reliability>, <peak>, <mean> [<CR><LF>+CGQMIN: <cid>, <precedence >, <delay>, <reliability.>, <peak>, <mean> […]]
AT+CGQMIN=[<cid> [,<precedence > [,<delay> [,<reliability.> [,<peak> [,<mean>]]]]]]	

Parameters

<cid> Numeric parameter specifying a particular PDP context definition (see +CGDCONT command).

Parameters defined in GSM 03.60:

<precedence> Numeric parameter specifying the precedence class

<delay> Numeric parameter specifying the delay class

<reliability> Numeric parameter specifying the reliability class

<peak> Numeric parameter specifying the peak throughput class

<mean> Numeric parameter specifying the mean throughput class

If a value is omitted for a particular class, the value is considered to be unspecified.

14.2.4 +CGATT GPRS Attach or Detach

Description

Attach the MT to, or detach the MT from, the GPRS service.

Command	Possible response
AT+CGATT=?	+CGATT:(list of supported <state>s)
AT+CGATT?	+CGATT:<state>
AT+CGATT=[<state>]	

Parameters

<state> 0 detached

1 attached

14.2.5 +CGACT PDP Context Activate or Deactivate

Description

Activate or deactivate the specified PDP context (s).

Command	Possible response
AT+CGACT=?	+CGACT: (list of supported <state>s)
AT+CGACT?	+CGACT: <cid>, <state>[<CR><LF>+CGACT: <cid>, <state>[...]]
AT+CGACT=[<state> [,<cid>[,<cid>[,...]]]]	

Parameters

<state> the state of PDP context activation

0 Deactivated

1 Activated

<cid> Numeric parameter specifying a particular PDP context definition (see +CGDCONT command).

14.2.6 +CGDATA Enter Data State

Description

Causes the MT to try to establish communication between the DTE and the network, using one or more PDP types.

Command	Possible response
AT+CGDATA=?	+CGDATA: (list of supported <L2P>s)
AT+CGDATA=[<L2P> ,[<cid> [,<cid> [,...]]]]	

Parameters

<L2P> String parameter indicating the layer 2 protocol to be used between the DTE and MT. If omitted, the layer 2 protocol is unspecified.

PPP Point-to-point protocol for a PDP such as IP

<cid> Numeric parameter which specifies a particular PDP context definition (see AT+CGDCONT).

14.2.7 +CGPADDR Show PDP Address

Description

Returns a list of PDP addresses for the specified context identifiers.

Command	Possible response
AT+CGPADDR=?	+CGPADDR=?
AT+CGPADDR=[<cid> [,<cid>[,...]]]	+CGPADDR:<cid>,<PDP_addr>[<CR><LF> +CGPADDR:<cid>,<PDP_addr>[...]]

Parameters

<cid> Numeric parameter specifying a particular PDP context definition (see +CGDCONT). If no <cid> is specified, the addresses for all defined contexts are returned.

<PDP_address> String identifying the MT in the address space applicable to the PDP. The address may be static or dynamic: a static address is the one set by the +CGDCONT command when the context was defined; a dynamic address is the one assigned during the last PDP context activation that used the context definition referred to by <cid>.

14.2.8 +CGAUTO Automatic Response to PDP Context Activation Request

Description

Disables or Enables auto-answer to the receipt of a Request PDP Context Activation message from the network.

Command	Possible response
AT+CGAUTO=?	+CGAUTO: (list of supported <n>s)
AT+CGAUTO?	+CGAUTO:<n>
AT+CGAUTO=[<n>]	

Parameters

<n>	0	Turn off automatic response for GPRS only
	1	Turn on automatic response for GPRS only
	2	Modem compatibility mode, GPRS only
	3	Modem compatibility mode, GPRS and circuit switched calls

14.2.9 +CGANS Manual Response to PDP Context Activation Request

Description

Requests the MT to respond to a network request for GPRS PDP context activation signalled to the DTE by the RING or +CRING: unsolicited result code. The DTE can accept or reject the request.

Command	Possible response
AT+CGANS=?	+CGANS: (list of supported<response>s), (list of supported <L2P>s)
AT+CGANS=[<response>,[<L2P> ,[<cid>]]]	

Parameters

<response> Numeric parameter specifying how to respond to the request. If <response> is omitted, it is assumed to be 0

- 0 Reject the request
- 1 Accept, and request that the PDP context be activated
- <L2P> Layer 2 protocol to be used (PPP)

<cid> Numeric parameter specifying a particular PDP context definition (see +CGDCONT).

14.2.10 +CGCLASS GPRS Mobile Station Class

Description

Sets the MT to operate according to the specified GPRS mobile class.

Command	Possible response
AT+CGCLASS=?	+CGCLASS: (list of supported <class>s)
AT+CGCLASS?	+CGCLASS: <class>
AT+CGCLASS= [<class>]	

Parameters

<class> String parameter indicating the GPRS mobile class

- B Class B
- C Class C in GPRS and circuit switched alternate mode
- CG Class C in GPRS-only mode
- CC Class C in circuit switched only mode (lowest)

14.2.11 +CGEREP GRS Event Reporting

Description

Enables or disables sending +CGEV: xxx unsolicited result codes from the MT to the DTE following certain events occurring in the MT or the network.

Command	Possible response
AT+CGEREP=?	+CGEREP: (list of supported <mode>s), (list of supported <bfr>s)
AT+CGEREP?	+CGEREP: <mode>,<bfr>
AT+CGEREP=[<mode>[,<bfr>]]	

Parameters

<mode>	0	MT buffers unsolicited result codes
	1	Discards unsolicited result codes when in on-line data mode (MT-TE link reserved), otherwise forward them directly to the DTE
	2	Buffers unsolicited result codes in the MT when in on-line data mode and flushes them to the DTE when MT- DTE link becomes available; otherwise forwards them directly to the DTE
<bfr>	0	The MT unsolicited result codes buffer, defined within this command, is cleared on entering <mode> 1 or 2
	1	MT unsolicited result codes buffer, defined within this command, flushed to the DTE on entering <mode> 1 or 2.

14.2.12 +CGREG GPRS Network Registration Status

Description

Controls the presentation of a GPRS MT's network status.

Command	Possible response
AT+CGREG=?	+CGREG: (list of supported <n>s)
AT+CGREG?	+CGREG: <n>,<stat>
AT+CGREG=[<n>]	
Unsolicited Result Code	+CGREG: <stat>

Parameters

<n>	0	Disable network registration unsolicited result code
	1	Enable network registration unsolicited result code +CGREG: <stat>
<stat>	0	Not registered: mobile not searching a new operator to register with
	1	Registered, home network
	2	Not registered, but mobile searching for a new operator to register with
	3	Registration denied
	4	Unknown
	5	Registered, roaming

14.2.13 +CGSMS Select Service for MO SMS Messages

Description

Specifies the MO SMS message service required.

Command	Possible response
AT+CGSMS=?	+CGSMS:(list of currently available <service>s)
AT+CGSMS?	+CGSMS: <service>
AT+CGSMS=[<service>]	

Parameters

<service> Numeric parameter indicating the service or service preference to be used:

0	GPRS
1	Circuit-switched
2	GPRS preferred (use circuit-switched if GPRS not available)
3	Circuit-switched preferred (use GPRS if circuit-switched not available)

14.2.14 D Request GPRS Service

Description

Causes the ME to carry out any actions necessary to establish communication between the DTE and the external PDN.

Command	Possible response
ATD*<GPRS_SC>[*[<called_address>][*[<L2P>][*[<cid>]]]]#	

Parameters

<GPRS_SC> 99 Request to use the GPRS

<called_address> String identifying the called party in the address space applicable to the PDP. For communications software that does not support arbitrary characters in the dial string, a numeric equivalent may be used. The comma character ',' may be used as a substitute for the period character '.'.

For PDP type OSP:IHOSS, the following syntax may be used:

[<host>][@[<port>][@[<protocol>]]]

For a definition of <host>, <port> and <protocol> , see +CGDCONT. For communications software that does not support arbitrary characters in the dial string, a numeric equivalent to the hostname may be used, but this should be avoided if at all possible.

<L2P> String indicating the layer 2 protocol to be used (see +CGDATA). For communications software that does not support arbitrary characters in the dial string, the following numeric equivalents shall be used:

1 PPP

Note: V.250 (and some communications software) does not permit arbitrary characters in the dial string. The <L2P> and <called_address> strings are therefore specified as containing digits only.

<cid> Digit string specifying a particular PDP context definition (see +CGDCONT).

14.2.15 D Request GPRS IP Service

Description

Causes the ME to carry out any actions necessary to establish communication between the DTE and the external PDN.

Command	Possible response
ATD*<GPRS_SC_IP>[*<cid>]#	

Parameters

<GPRS_SC_IP> 98 Request to use the GPRS

<cid> Digit string specifying a particular PDP context definition (see +CGDCONT).

14.2.16 SO Automatic Response to PDP Context Activation Request

Description

Turns off and on the automatic response to a request from the network for a PDP context activation.

Command	Possible response
ATSO=<value>	

Parameters

<value> 0 Off

>0 On

14.2.17 A Manual Acceptance of PDP Context Activation Request

Description

Accepts a request from the network for a PDP context activation (announced by the unsolicited result code RING). See also AT+CGANS.

Command	Possible response
ATA	

14.2.18 H Manual Rejection of PDP Context Activation Request

Description

Rejects a request from the network for PDP context activation (announced by the unsolicited result code RING).

Command	Possible response
ATH [<value>]	
H0	

14.3 UbiNetics General Purpose Commands

This section defines the general purpose commands that are supported by the product for general use.

14.3.1 +ADC ADC Control

Description

This command returns a single ADC value.

Command	Possible response
AT+ADC=<adc>[,<type>]	<value>

Notes

- Currently only ADC 0 (battery voltage) and ADC 6 (RF temperature) are used.
- If the <type> parameter is 0 (or omitted) then the raw 10-bit ADC value is reported in hexadecimal.
- If the <type> parameter is 1 then a converted value is reported in decimal; this is in mV for the battery voltage and °C for the RF temperature.
- Invalid parameter values or an invalid number of parameters will result in an ERROR return.

Parameters

Set parameters:

<adc>	ADC number	in the range of 0 to 8
<type>	ADC conversion type (If omitted then a default of 0 is used)	
	0	Raw 10-bit ADC
	1	Decimal

Return values:

Raw conversions	a hexadecimal number in the range 0 to 3FF
Converted values	depends on the ADC selected and the conversion performed

Examples

Read the RF temperature in °C:

```
AT+ADC=6,1
+ADC: 28
OK
```

14.3.2 +AEC Echo Cancellation Control

Description

This command sets the echo cancellation and speech enhancement parameters.

Command	Possible response
AT+AEC?	+AEC:<aec> <aec_att> <aec_mode> <spenh> <spenh_att>
AT+AEC=<aec>,<aec_att>,<aec_mode>,<spenh>,<spenh_att>	

Notes

- The echo cancellation settings are NOT stored in non-volatile storage. The default setting at power on is AEC and SPENH both off.
- Invalid parameter values or an invalid number of parameters will result in an ERROR return.

Parameters

Set parameters:

<aec>	Echo Cancellation	0	off
		1	on
<aec_att>	AEC attenuation, 0 - 3	0	none
		3	-18dB
<aec_mode>	AEC mode	0	short
		1	long
<spenh>	Speech Enhancement	0	off
		1	on
<spenh_att> = SPENH attenuation, 0 - 3		0	none
		3	-18dB

Return values :

The query command returns a string in the format

AEC <aec> <aec_att> <aec_mode> SPENH <spenh> <spenh_att>

Examples

Set short AEC and SPENH on, no additional attenuation:

AT+AEC=1,0,0,1,0

OK

Get the current echo cancellation settings:

AT+AEC?

+AEC: 0 0 1 SPENH 1 1

OK

14.3.3 +AUDIO Audio Path Control

Description

This command sets or gets the state of the audio path switch. The audio can be switched to the main or auxiliary path. Optionally the audio power can be enabled or disabled; this allows audio loopback tests to be performed when not in call.

Command	Possible response
AT+AUDIO?	+AUDIO:<path>
AT+AUDIO=<path>[,<power>]	

Notes

- The audio switch controls both microphone and ear-piece audio paths, setting the same audio path for both devices. It is not possible to select the main ear-piece and the auxiliary microphone, or vice versa.
- Invalid parameter values or an invalid number of parameters will result in an ERROR return.
- The audio settings are NOT stored in non-volatile storage. The default setting at power on is the main audio path selected, and audio power disabled.
- If the power parameter is omitted then the audio power state is not changed.

Parameters

<path>	1	Auxiliary path
	2	Main path
<power>	0	Audio power off
	1	Audio power on

Examples

Set the audio path to select the main microphone and ear-piece:

```
AT+AUDIO=2
OK
```

Get the current audio path:

```
AT+AUDIO?
+AUDIO: 2
OK
```

Enable loopback test using the main microphone and ear-piece:

```
AT+AUDIO=2,1
OK
```

14.3.4 +AUXIN_GAIN AUX IN gain control

Description

This command is used to set the auxiliary input amplifier gain.

- The gain setting is not stored in non-volatile storage, hence will revert to the default value of LOW (4.6dB) at power up.
- Invalid parameter values or an invalid number of parameters will result in an ERROR return.

Command	Possible response
AT+AUXIN_GAIN?	+AUXIN_GAIN: <LOW/HIGH>
AT+AUXIN_GAIN=<auxin_gain>	

Parameters

<auxin_gain>	0	LOW (4.6dB)
	1	HIGH (28.2dB)

Examples

Set the AUX IN gain to +28.2dB:

AT+AUXIN_GAIN=1

OK

To get the current AUX IN gain:

AT+AUXIN_GAIN?

+AUXIN_GAIN: HIGH

OK

14.3.5 D*#06# Display IMEI Number

Description

This command returns the product IMEI number.

Command	Possible response
ATD*#06#	<IMEI>

Notes

- This command returns the 17 digit programmed IMEI number, including the trailing check digit.
- If the IMEI number has not been programmed, the command returns the product default IMEI.

Example

ATD*#06#

004400352000XXXXX

OK

14.3.6 +DEEP_SLEEP Configure Deep Sleep operation

Description

This command is used to configure the deep sleep (low power mode) operation of the module.This command is not available in versions of software earlier than 1.2.2.

Notes:

- A timeout value of zero disables deep sleep.
- The default state at power up is deep sleep enabled, with a 30-second timeout.
- The module will enter deep sleep if it is in a suitable state to do so, and if no characters have been received on the serial port for at least the defined timeout period.

Command	Possible response
AT+DEEP_SLEEP=<value>	

Parameters

<value> Timeout in seconds

Examples

To set the deep sleep timeout to 10 seconds:

AT+DEEP_SLEEP=10

OK

To disable deep sleep:

AT+DEEP_SLEEP=0

OK

14.3.7 +GPIO_C General Purpose I/O Configure

Description

This command is used to configure the GPIO pins.

Command	Possible response
AT+GPIO_C=<dir0>,<dir1>,<dir2>,<kbc_size>	<level>

Notes

- The GPIO settings are NOT stored in non-volatile storage. The default setting is GPIO1-3 all configured as inputs, all KBC lines used for key pad.
- Invalid parameter values or an invalid number of parameters will result in an ERROR return.
- KBC0..4 lines not used for the key pad can be used as general purpose outputs.

Parameters

<dir0> GPIO0 configuration 0 input

		1	output
<dir1>	GPIO1 configuration	0	input
		1	output
<dir2>	GPIO2 configuration	0	input
		1	output
<kbc_size>	number of KBC lines used by key pad	0 to 5	

Example

To set GPIO1 to an output, GPIO2,3 to inputs and have KBC3,4 as GP Outputs:

AT+GPIO_C=1,0,0,3

OK

14.3.8 +GPIO_R General Purpose I/O Read

This command is used to read the level on the GPIO pins.

Command	Possible response
AT+GPIO_R=<index>	+GPIO_R:<level>

Notes

- Active high logic is assumed, 1 = high
- Reading a pin defined as an output will return the previous value written to that output.
- Invalid parameter values or an invalid number of parameters will result in an ERROR return.

Parameters

<level>	0	logic low
	1	logic high

Example

To read GPIO2:

AT+GPIO_R=1

+GPIO:1

OK

14.3.9 +GPIO_W General Purpose I/O Write

Description

This command is used to control the GPIO pins which are outputs.

Command	Possible response
AT+GPIO_W=<index>,<level>	

Notes

- Attempting to write to an input will return an error result.
- Active high logic is assumed, 1 = high
- Invalid parameter values or an invalid number of parameters will result in an ERROR return.

Parameters

<level> the logic level to write - 0 (low) or 1 (high).

<index> an index into the following table:

Index	I/O line	Direction	Comment
0	GPIO 1	IN/OUT	
1	GPIO 2	IN/OUT	
2	GPIO 3	IN/OUT	
3	KBC0 / GPO0	OUT	Can be used if not used for keypad
4	KBC1 / GPO1	OUT	Can be used if not used for keypad
5	KBC2 / GPO2	OUT	Can be used if not used for keypad
6	KBC3 / GPO3	OUT	Can be used if not used for keypad
7	KBC4 / GPO4	OUT	Can be used if not used for keypad
8	SPI_RST	OUT	
9	INT_OUT	OUT	
10	HOST_STATUS	IN	

Example

Set INT_OUT high:

```
AT+GPIO_W=9,1
OK
```

14.3.10 +HOST_STATUS Host status flow control

Description

Determines whether or not the transmission of serial data depends on the state of the HOST STATUS pin.

Command	Possible response
AT+HOST_STATUS=<value>	

Parameters

<value> 0 disable host status flow control behaviour (default) — serial data is transmitted irrespective of the state of the HOST_STATUS pin

1	enable host status flow control behaviour — serial data is transmitted only when the HOST_STATUS pin is in active state (high).

14.3.11 +MIC_GAIN, +SET_VUS Microphone Gain Control

Description

This command is used to set the microphone amplifier gain.

Command	Possible response
AT+MIC_GAIN?	<mic_gain>
AT+MIC_GAIN=<mic_gain>	
AT+SET_VUS=<mic_gain>	

Notes

- The gain setting is automatically stored in non-volatile storage, and applied at power up.
- A single gain setting is stored in the device. If different settings are required for the two audio paths, then the gain setting must be adjusted by the host application.
- The SET_VUS command is supported for compatibility purposes only. Please use MIC_GAIN in all new applications.
- Invalid parameter values or an invalid number of parameters will result in an ERROR return.

Parameters

The parameter mic_gain has a range 0..255. It is converted to a gain in dB by the following formula:

gain(dB) = -12 + INT(mic_gain / 10)

This gives a range of –12dB to +12dB for the microphone amplifier gain.

Examples

Set the microphone gain to +5dB:

AT+MIC_GAIN=170

OK

Get the current microphone gain:

AT+MIC_GAIN?

170

OK

14.3.12 +MMI Embedded MMI Control

Description

This command is passed to the embedded MMI for interpretation.

Command	Possible response
AT+MMI<string>	Response(s) are determined by embedded MMI.

Notes

- This command is completely dependent on the embedded MMI. The parameters passed to the MMI and the results returned should be defined by the MMI application.
- If there is no embedded MMI then an ERROR result will be returned.

Example

AT+MMITEST

ERROR

14.3.13 +MULTISLOT Change Multislot Class

Description

This command is used to change the default multislot class used by the module so the maximum number of uplink and downlink slots used for data transfer can be changed.

Notes:

- The multislot class must be set before performing a GPRS attach.
- The default state at power up is multislot class 1, i.e. 1 uplink and 1 downlink slot.
- Not all the possible multislot class settings may work correctly under all conditions. Ensure that only valid settings are used

Command	Possible response
AT+MULTISLOT=<msclass>OK	

Parameters

The following parameter values are defined :

<msclass>	1	(1 uplink + 1 downlink slot)
	2	(1 + 2)
	4	(1 + 3)
	8	(1 + 4)

Example

To enable multislot class 2 (1 uplink and 2 downlink slots) :

AT+MULTISLOT=2

OK

14.3.14 I3 Display Software Version Number

Description

This command returns a string containing software version information.

Command	Possible response
ATI3	<version>

Example

ATI3

GPRS EP2 1.2.0.2

OK

14.3.15 +POWER_DOWN Power Down Module

Description

This command switches off the module power. No more commands will be processed—power up has to be carried out in hardware.

Command	Possible response
AT+POWER_DOWN	

Example

AT+POWER_DOWN

14.3.16 +RESET Reset

Description

This command is used to reset the module.

Command	Possible response
AT+RESET	None

Notes

- There is no response produced as the module is reset immediately.

Examples

AT+RESET

14.3.17 +RTC Real Time Clock Control

Description

This command sets or gets the time from the real-time clock..

Command	Possible response
AT+RTC?	+RTC:<date / time string>
AT+RTC=<hour>,<minute>,<second> [,<day>,<month>,<year>]	

Notes

- Time is set and reported in 24-hour format only.
- Date parameters are optional in the set command, and if omitted just the time is set. The year is stored internally as 2 digits only but should be entered as a four digit value, e.g. 2001.
- The individual time and date fields are validated for range, and date validity checking is performed.
- The RTC supports automatic leap year management.

- Invalid parameter values or an invalid number of parameters will result in an ERROR return.

Parameters

Possible 'set' parameter values are as follows:

<hour>	is a value in the range 0..23
<minute>	is a value in the range 0..59
<second>	is a value in the range 0..59
<day>	is a value in the range 1..31
<month>	is a value in the range 1..12
<year>	is a value in the range 2000..2099

Possible return values are:

<date/time string> is a string in the format "HH:MM:SS DD/MM/YYYY"

Examples

Set the RTC to 17:19:00 31/03/01:

```
AT+RTC=17,19,0,31,3,2001
OK
```

Get the current date / time from the RTC:

```
AT+RTC?
17:19:05 31/03/2001
OK
```

14.3.18 +SET_VUS See +MIC_GAIN+SPK_GAINSet the speaker amplifier gain

Description

This command is used to set the speaker amplifier gain.

- The gain setting is not stored in non-volatile storage, and will revert to a default value of 0 (-6dB) at power up.
- A single gain setting is stored in the device. If different settings are required for the two audio paths, the gain setting must be adjusted by the host application.
- Invalid parameter values or an invalid number of parameters will result in an ERROR return.

Command	Possible response
AT+SPK_GAIN?	+SPK_GAIN: <spk_gain>
AT+SPK_GAIN=<spk_gain>	OK

Parameters

<spk_gain>	0 .. 12	range from -6dB to +6dB, in 1dB steps (gain (dB) = spk_gain -6)

Examples

To set the speaker gain to +2dB:

AT+SPK_GAIN=8

OK

To get the current speaker gain:

AT+SPK_GAIN?

+SPK_GAIN: 8

15.0 References

This section lists the references used within this document.

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16.0 Alphabetical List of AT Commands