Hit U – 3G modem
preliminary datasheet

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Contents

1. Introduction

This document describes the hardware of HCP HIT U – USB 3G modem, with interface specifications, electrical and mechanical characteristics.

1.1 Related documents

[1] HC25 AT command set
[2] HC25 Hardware interface description

1.2 Terms and Abbreviations

Abbreviation	Description
ADC	Analog-to-Digital Converter
ARP	Antenna Reference Point
ASIC	Application Specific Integrated Circuit
ATC	AT Cellular
BTS	Base Transceiver Station
CB	Cell Broadcast
CODEC	Coder-Decoder
CPU	Central Processing Unit
DCE	Data Circuit terminating Equipment
DSP	Digital Signal Processor
DSR	Data Set Ready
DTR	Data Terminal Ready
EFR	Enhanced Full Rate
EGSM	Enhanced GSM
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
FDMA	Frequency Division Multiple Access
FR	Full rate
G.C.F.	GSM Conformity Forum
GSM	Global Standard for Mobile Communication
HF	Hands-free
HR	Half rate
HW	Hardware
IC	Integrated Circuit
IF	Intermediate Frequency
IMEI	International Mobile Equipment Identifier
I/O	Input/ Output
IGT	Ignition
ISO	International Standards Organization
ITU	International Telecommunications Union
kbps	kbits per second
Li-Ion	Lithium-Ion
LVD	Low voltage Directive
Mbps	Mbits per second
MMI	Machine Machine Interface
MO	Mobile Originated
MS	Mobile Station
MT	Mobile Terminated
NC	Not Connected
NTC	Negative Temperature Coefficient
PA	Power Amplifier
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
PCS	Personal Communication System

Abbreviation	Description
PDU	Protocol Data Unit
R&TTE	Radio and Telecommunication Terminal Equipment
RAM	Random Access Memory
RF	Radio frequency
RI	Ring Indication
ROM	Read Only Memory
RX	Receive direction
SIM	Subscriber Identification Module
SMS	Short Message Service
SRAM	Static Random Access Memory
SW	Software
TDD	Time Division Duplex
TDMA	Time Division Multiple Access
TX	Transmit direction
UART	Universal Asynchronous Receiver and Transmitter
VAD	Voice Activity Detection
ZIF	Zero Insertion Force

Table 1. Terms and Abbreviations

1.3 Safety Precautions

Safety precautions must be observed during all phases of the operation, usage, service or repair of any cellular terminal from HCP d.o.o.

Failure to comply with these precautions violates safety standards of design, manufacture and intended use of the product. HCP d.o.o assumes no liability for customer's failure to comply with these precautions.

	When in hospitals or other health care facilities, observe the restrictions on the use of mobiles. Switch off the cellular terminal or mobile if to be instructed to do so by the guidelines posted in sensitive areas. Medical equipment may be sensitive to RF energy. The operation of cardiac pacemakers, other implanted medical equipment and hearing aids can be affected by interference from cellular terminals or mobiles placed close to the device. If in doubt about potential danger, contact the physician or the manufacturer of the device to verify that the equipment is properly shielded. Pacemaker patients are advised to keep their hand-held mobile away from the pacemaker, while it is on. This personal subgroup always should check the distance to the mobile
	Switch off the cellular terminal or mobile before boarding an aircraft. Make sure it cannot be switched on inadvertently. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communications systems. Failure to observe these instructions may lead to the suspension or denial of cellular services to the offender, legal action, or both. Check the local and actual laws about these themes.
	Do not operate the cellular terminal or mobile in the presence of flammable gases or fumes. Switch off the cellular terminal when you are near petrol stations, fuel depots, chemical plants or where blasting operations are in progress. Operation of any electrical equipment in potentially explosive atmospheres can constitute a safety hazard.
	Your cellular terminal or mobile receives and transmits radio frequency energy while switched on. Remember that interference can occur if it is used close to TV sets,radios, computers or inadequately shielded equipment. Follow any special regulations and always switch off the cellular terminal or mobile wherever forbidden, or when you suspect that it may cause interference or danger.
	Road safety comes first! Do not use a hand-held cellular terminal or mobile while driving a vehicle unless it is securely mounted in a holder for speakerphone operation. Before making a call with a hand-held terminal or mobile park the vehicle. Speakerphones must be installed by qualified personnel. Faulty installation or operation can constitute a safety hazard. Check the actual and local laws about these themes.
	IMPORTANT! Cellular terminals or mobiles operate using radio signals and cellular networks. In that case connections cannot be guaranteed at all times under all conditions. Therefore, you should never rely solely upon any wireless device for essential communications, for example emergency calls. Remember, in order to make calls or receive calls the cellular terminal or mobile must be switched on in a service area with adequate cellular signal strength. Some networks do not allow for emergency calls if certain network services or phone features are in use (e.g. lock functions, fixed dialing etc.). You may need to deactivate those features before you can make an emergency call. Some networks require a valid SIM card to be properly inserted in the cellular terminal or mobile.
	If a power supply unit is used to supply the device it must meet the demands placed on SELV circuits in accordance with EN60950. The maximum permissible connection length between the device and the supply source should not exceed 3m.
	According to the guidelines for human exposure to radio frequency energy, an antenna connected to the FME jack of the device should be placed at least 20cm away from human bodies.

2. Product Concept

2.1 Key Features of HIT U 3G Terminal

Feature	Implementation
General	
Incorporates Cinterion HC25 module	The HC25 module handles all processing for signal and data within the Hit U Terminal.
Frequency bands	UMTS/HSDPA: Triple band, 850//1900/2100MHz GSM/GPRS/EDGE: Quad band, 850/900/1800/1900MHz
GSM class	Small MS
Output power (according to Release 99, V5)	Class 4 (+33dBm ±2dB) for EGSM850 Class 4 (+33dBm ±2dB) for EGSM900 Class 1 (+30dBm ±2dB) for GSM1800 Class 1 (+30dBm ±2dB) for GSM1900 Class E2 (+27dBm ± 3dB) for GSM 850 8-PSK Class E2 (+27dBm ± 3dB) for GSM 900 8-PSK Class E2 (+26dBm +3 /-4dB) for GSM 1800 8-PSK Class E2 (+26dBm +3 /-4dB) for GSM 1900 8-PSK Class 3 (+24dBm +1/-3dB) for UMTS 2100, WCDMA FDD BdI Class 3 (+24dBm +1/-3dB) for UMTS 1900,WCDMA FDD BdII Class 3 (+24dBm +1/-3dB) for UMTS 850, WCDMA FDD BdV
Power supply	Single supply voltage 8V to 30V DC
Ambient operating temperature according to IEC 60068-2	Normal operation: -20°C to +60°C Restricted operation: -40°C to -20°C, +60°C to +80°C
Physical	Dimensions: 78mm x 53.5mm x 26mm Weight: approx. 100g(approx.)
Housing color	Red
RoHS	All hardware components fully compliant with EU RoHS Directive
HSDPA features	
3GPP Release 5	3.6 Mbps, UL 384 kbps UE CAT. [1-6], 11, 12 supported Compressed mode (CM) supported according to 3GPP TS25.212
UMTS features	
3GPP Release 4	PS data rate – 384 kbps DL / 384 kbps UL CS data rate – 64 kbps DL / 64 kbps UL

Feature	Implementation
GSM / GPRS / EGPRS features	

Data transfer	GPRS
	    - Multislot Class 10
	    - Full PBCCH support
	    - Mobile Station Class B
	    - Coding Scheme 1 – 4
	EGPRS
	    - Multislot Class 10
	    - EDGE E2 power class for 8 PSK
	    - Downlink coding schemes – CS 1-4, MCS 1-9
	    - Uplink coding schemes – CS 1-4, MCS 1-9
	    - BEP reporting
	    - SRB loopback and test mode B
	    - 8-bit, 11-bit RACH
	    - PBCCH support
	    - 1 phase/2 phase access procedures
	    - Link adaptation and IR
	    - NACC, extended UL TBF
	    - Mobile Station Class B
	CSD
	• V.110, RLP, non-transparent
	• 9.6 kbps

SMS	Point-to-point MT and MO Cell broadcast Text and PDU mode
Fax	Group 3; Class 1
Software	
AT commands	AT-Hayes GSM 07.05 and 07.07, Cinterion AT commands for RIL compatibility (NDIS/RIL)
Microsoft® compatibility	RIL / NDIS for Windows Mobile®
SIM Application Toolkit	SAT Class C
Firmware update	Firmware update from host application over USB
Interfaces	
USB	Supports a USB 2.0 Full Speed (12Mbit/s) device interface. The USB interface is the delivery default interface.
Power supply	Via DC jack
SIM interface	Supported chip cards: SIM / UICC 3V, 1.8V
Antenna	Connected via antenna SMA connector
Power on/off, Reset	
Power on	Automatic switch on when power supply is attached
Power off	- Normal switch-off by AT^SMSO command - Automatic switch-off in case of critical temperature and voltage conditions
Reset	- orderly shutdown and reset by AT command - reset by integrated Watchdog timer on board

Table 2. Key feature of HIT U 3G terminal

3. Interface Description

3.1 Overview

HIT U 3G terminal provides the following connectors for power supply, communication and antenna interface.

- DC jack for power supply
- USB type B for connection with PC
- SMA Jack (female) for antenna (Antenna interface)
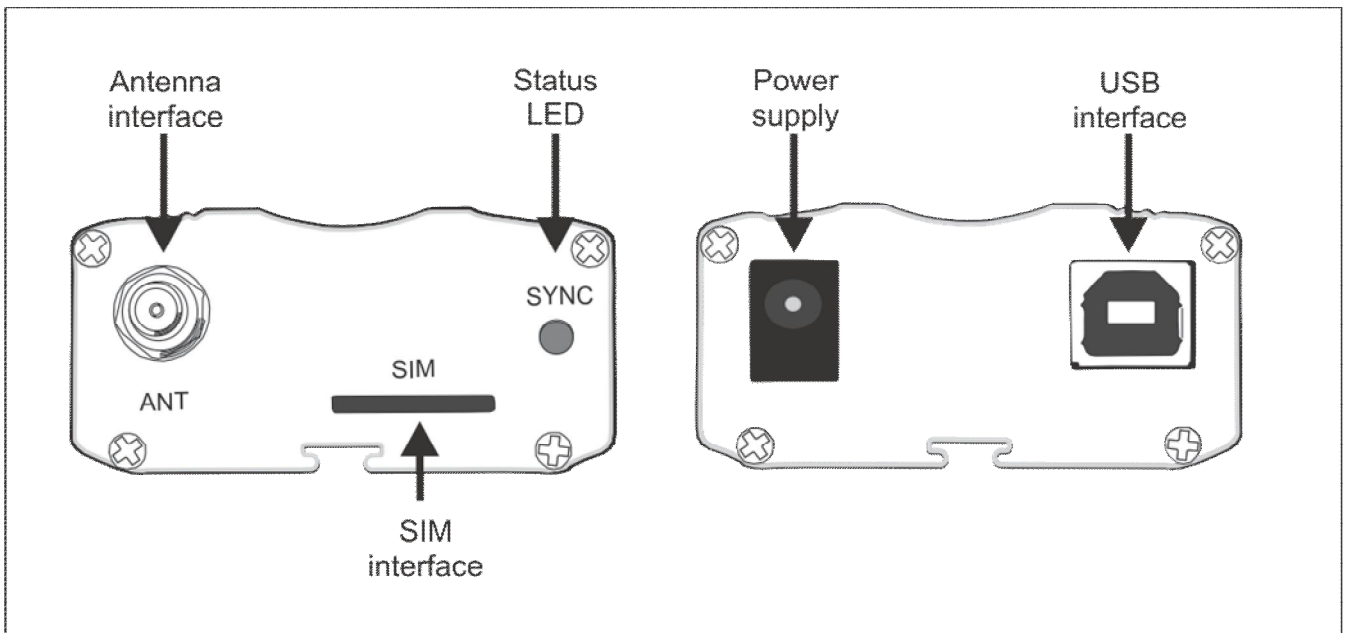- SIM card holder
- Status LED

Figure 1. Front and rear view of HIT U 3G terminal

3.2 Block Diagram

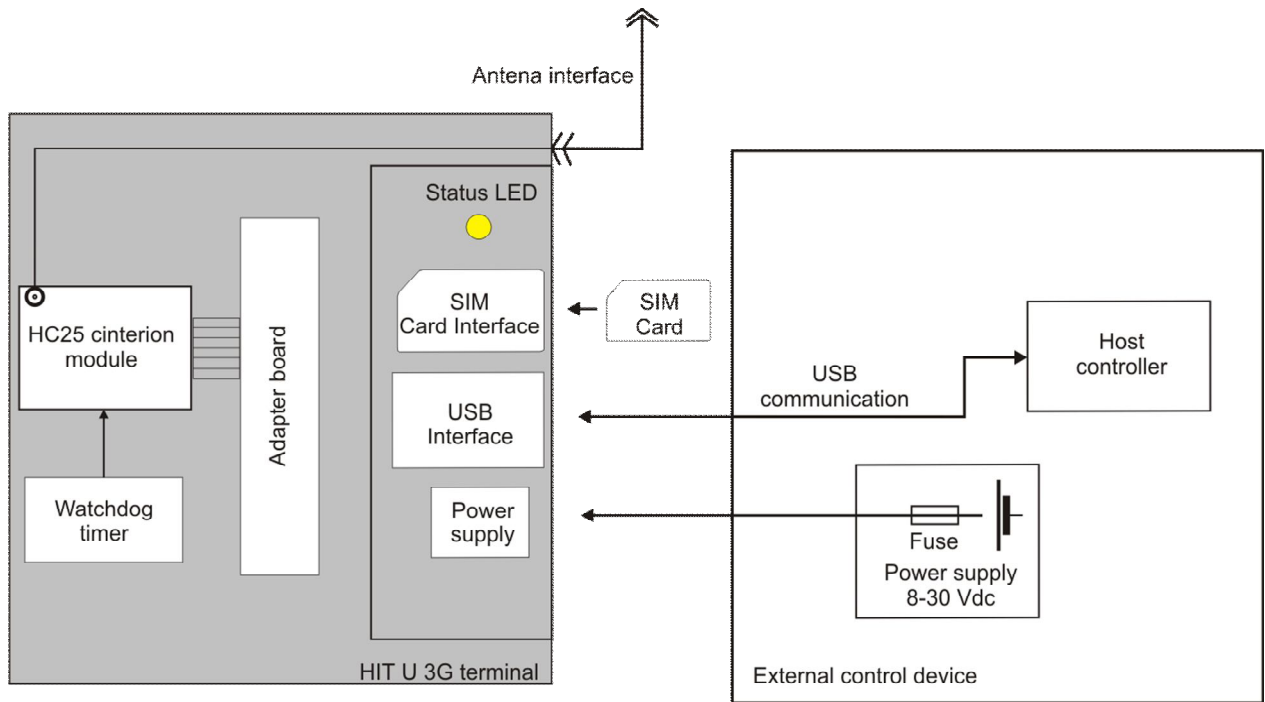Figure 2. shows block diagram of HIT U 3G terminal

Figure 2. Block diagram of HIT U 3G terminal

3.3 Operating Modes of HIT U 3G terminal

The table below briefly summarizes the various operating modes referred to in the following sections.

Mode	Function	
Normal operation	GSM/GPRS/ UMTS/ HSDPA SLEEP	Power saving mode set automatically when no call is in progress and the USB connection is suspended by host.
	GSM IDLE	Software is active. Once registered to the GSM network, paging with BTS is carried out in order to achieve synchrony with the GSM network. The repetition rate depends on the parameter BSPA_Multiframe. The module is ready to send and receive.
	GSMTALK/ DATA	Connection between two subscribers is in progress. Power consumption depends on the GSM network coverage and several connection settings (e.g. DTX off/on, FR/EFR/HR, hopping sequences and antenna connection). The following applies when power is to be measured in TALK_GSM mode: DTX off, FR and no frequency hopping, otherwise same as for IDLE measurements.
	GPRS IDLE	Module is attached and ready for GPRS data transfer, but no data is currently sent or received.
	GPRS DATA	GPRS data transfer in progress. Power consumption depends on network settings (e.g. power control level), uplink / downlink data rates and GPRS configuration (e.g. used multislot settings).
	EGPRS DATA	EGPRS data transfer in progress. Power consumption depends on network settings (e.g. power control level), uplink / downlink data rates and EGPRS configuration (e.g. used multislot settings)
	UMTS / HSDPA IDLE	Module is attached and ready for UMTS / HSDPA data transfer, but no data is currently sent or received.
	UMTS TALK/ UMTS DATA	UMTS data transfer in progress. Power consumption depends on network settings (e.g. TPC Pattern) and data transfer rate.
	HSDPA DATA	HSDPA data transfer in progress. Power consumption depends on network settings (e.g. TPC Pattern) and data transfer rate.
POWER DOWN	The internal power section is shut down. The SW on the module is not active. The interfaces are not accessible.	

Table 3. Operating modes of HIT U 3G terminal

3.4 Power Supply

The power supply of the HIT U 3G terminal has to be a single voltage source of 8V to 30V capable of providing a peak current (pulsed 2x577ms at T=4.615ms) of about 1.2A at 12V during an active transmission.

The uplink burst causes strong ripple (drop) on the power lines. The drop voltage should not exceed 1V, but the absolute minimum voltage during drops must be >7.6V.

The HIT U 3G terminal is protected from supply voltage reversal.
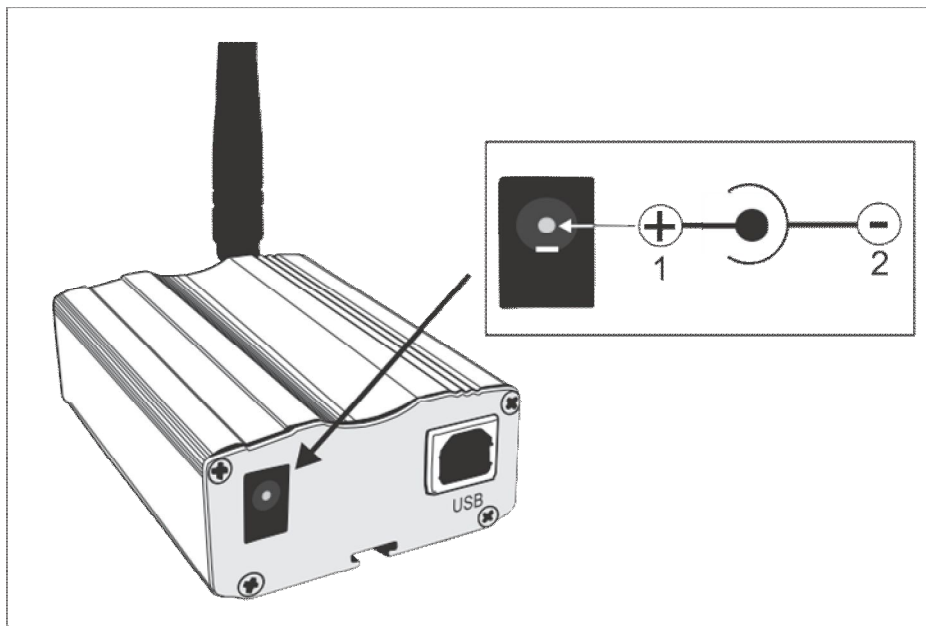

Figure 3. Power supply connector

Pin	Singal name	Use	GParameters
1	Vcc	Positive power supply	8V – 30V DC
2	GND	Ground	0V

Table 4. Power supply connector pins

3.4.1 Turn HIT U terminal on

Hit U GMS module switches on automaticly when power supply is attached. After start-up, the GSM module enters the net searching state.

3.4.2 Reset HIT U terminal

One way to reset HIT U terminal is entering AT command AT+CFUN=x,1. For details on AT+CFUN please refer to [2].

Other ways for restarting HIT U terminal is:

-   unplug both, power supply from DC jack and USB cable

-   automatically by integrated watchdog timer on every 8 to 10 hours.

3.4.3 Turn off HIT U terminal

Normal shutdown:

-   To turn off the HIT U use the AT^SMSO command, rather than disconnecting the power
     supply adapter.

    This procedure lets the HIT U log off from the network and allows the software to enter a secure state and save data before disconnecting the power supply. After AT^SMSO has been entered the HIT U returns the following result codes:

^SMSO: MS OFF
OK
^SHUTDOWN

The "^SHUTDOWN" result code indicates that the HIT U turns off in less than 1 second. After the shutdown procedure is complete the HIT U enters the POWER DOWN mode. The status LED stops flashing.

3.4.4 Disconnecting power supply

Before disconnecting the power supply from the DC connector, make sure that the HIT U 3G terminal is in a safe condition. The best way is to wait 1s after the "^SHUTDOWN" result code has been indicated.

3.4.5 Automatic thermal shutdown

Automatic shutdown takes effect if:

- Hit U GSM module HC25 exceeds the critical limits of overtemperature or
undertemperature .
The board temperature is constantly monitore d by an internal NTC resistor. The values
detected by the NTC resistor are measured directly on the board and are therefore not
fully identical with the ambient temperature.
Each time the board temperature goes out of range or back to normal, HC25 instantly
displays an alert (if enabled).

- URCs indicating the level "1" or "-1" allow the user to take appropriate precautions,
such as protecting the module from exposure to extreme conditions. The presentation
of the URCs depends on the settings selected with the AT^SCTM write command:

  AT^SCTM=1: Presentation of URCs is always enabled.
  AT^SCTM=0 (default): Presentation of URCs is enabled for 15 seconds time after start-
  up of HC25. After 15 seconds operation, the presentation will be disabled, i.e. no alert
  messages can be generated.

For more information about automatic shutdown refer to [1].

3.5 USB Interface

Over USB interface, external device, PC or other control device with USB interface, controls HIT U terminal.

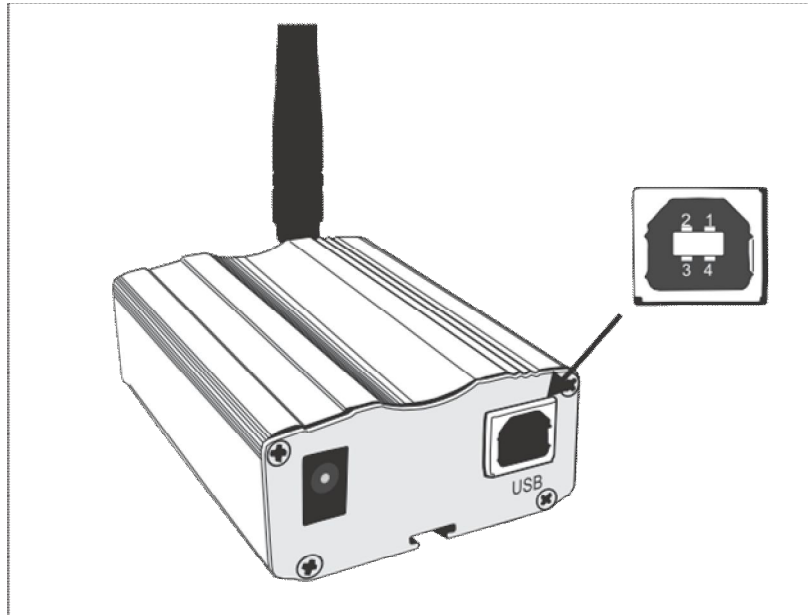**Figure 4.** HIT U USB interface pin assignment (USB type B)

Pin	Singal name	Function
1	Vusb	+5V DC
2	D-	Data -
3	D+	Data +
4	GND	Ground 0V

Table 5. USB type B pin assigment

3.6 SIM interface

HIT U provides SIM interface with automatic detection for 1.8V and 3V SIM cards in accordance with GSM11.11.

The card holder is a six wire interface according to GSM 11.11 with detection whether or not a SIM card is inserted.
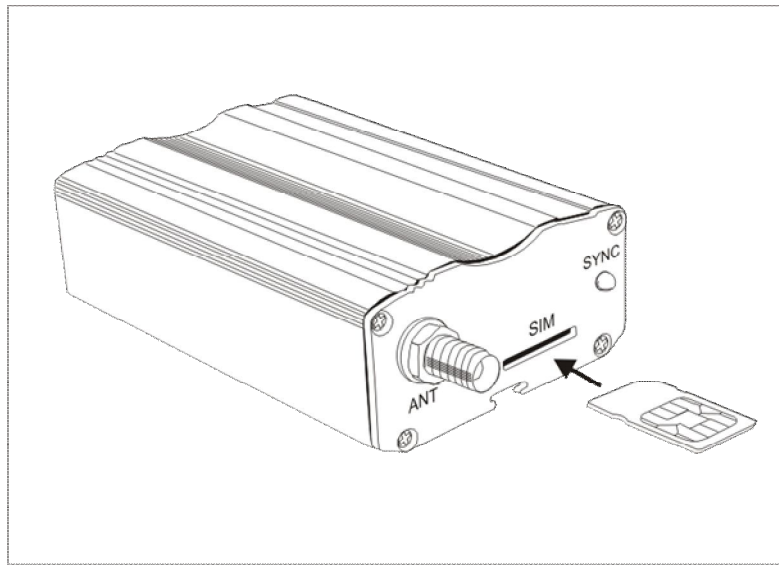

Figure 5. SIM interface

Removing and inserting the SIM card during operation requires the software to be reinitialized. Therefore, after reinserting the SIM card it is necessary to restart HIT U terminal.

Note: *No guarantee can be given, nor any liability accepted, if loss of data is encountered afterremoving the SIM card during operation. Also, no guarantee can be given for properly initializing any SIM card that the user inserts after having removed a SIM card during operation. In this case, the application must restart the HIT U terminal.*

3.7 Status LED

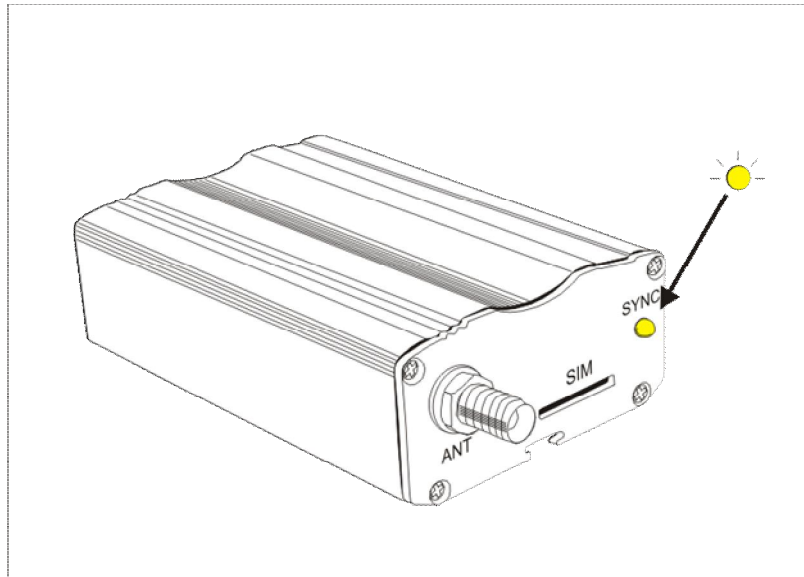Yellow status LED displays the operating status of the HIT U terminal.

Figure 6. Yellow status LED flashing on HIT U terminal

The AT^SLED command controls the LED func tion of the HIT U.

The LEDs indicate the states listed below:

• Lights steadily (if <mode> =1) or flashes (depending on <flash_period> if <mode> =2) when the ME is registered to the GSM network and either awake or in power saving state.
• Flashes at 1Hz and 50% duty cycle (0.5s on, 0.5s off) when the ME is awake and not   registered to any network.
• Flashes at approx. 0.25 Hz and approx. 50% duty cycle (2s on, 2s off) when the ME is in power saving state and not registered to any network.
  When the ME is in power saving state and not registered, the flashing frequency may be less than 0.25Hz and the duty cycle may vary, for example between 45% and 55%. These variations are not regular.
• If not registered the ME checks, at the beginning of each flash period, whether it is awake or in power saving state, ie. whether to flash at 1Hz or at 0.25Hz. This means that a 1Hz or at 0.25Hz flash period always reflects the state that was valid before flashing has started. If a state transition occurs during a flash period (from awake to power saving or vice versa) then the flash period may vary. In the worst case, the LED will indicate a transition from power saving to awake after 4s.
• Is off if the ME is not registered to the GSM network, but registered to the UMTS, or if <mode> =0.
• While the STATUS0 signal is active the STATUS1 signal is inactive.
  LED connected to STATUS1 line:
• Lights steadily (if <mode> =1) or flashes (depending on <flash_period> if <mode> =2) when the ME is registered to the UMTS network and either awake or in power saving state.

3.8 Antenna interface

The external antenna is connected via the HIT U SMA jack (female), look at figure 7.
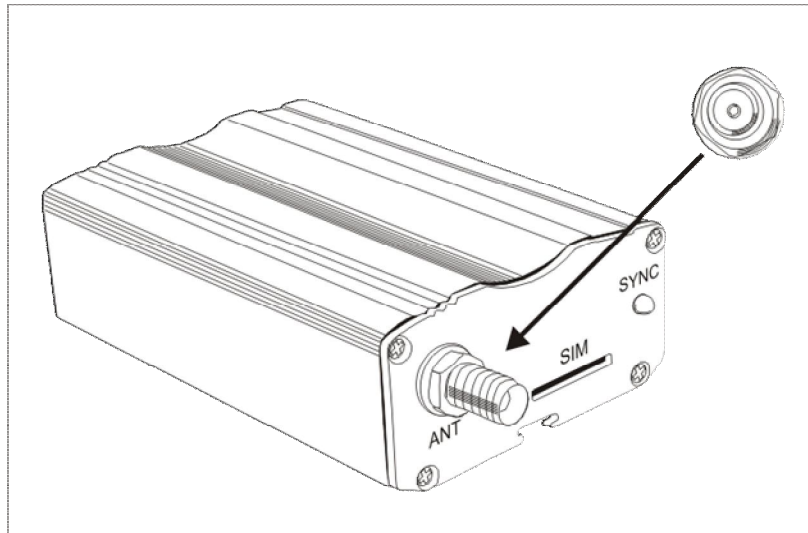

Figure 8. Antenna interface – SMA jack

An internal antenna cable adapts the antenna reference point (antenna connector type U.FL-R-SMT from Hirose) to the SMA (female) connector.

The external antenna must be matched properly to achieve best performance regarding radiated power, DC-power consumption, modulat ion accuracy and harmonic suppression.

Regarding the return loss HC25 provides the following values in the active band:

State of module	Return loss of module	Recommended return loss of application
Receive	≥8dB	≥12dB
Transmit	not applicable	≥12dB
Idle	≤5dB	not applicable

Table 6. Return loss in the active band

4. Electrical and Environmental Characteristics

4.1 Apsolute Maximum Ratings

Parameter	Pin / Parameter	Min.	Max.	Unit
Supply voltage	Vcc	8	32	V
USB interface	Vusb, USB D+, USB D-	-0.3	7.5	V
Protection Class	IP50 (avoid exposing M Terminal to liquid or moisture)		IP50	

Table 7. Apsolute maximum ratings

4.2 Recommended Operating conditions

Parameter	Pin / Parameter	Min.	Typ.	Max.	Unit
Supply voltage	Vcc		12		V
Operating temperature	--	-15	+25	+65	°C

Table 8. Recommended operating conditions

4.3 Electrostatic Discharge

ESD protection provided on HIT U:

• SIM interface: clamp diodes for protection against over voltage.
• USB interface: clamp diodes for protection against over voltage.

Specification	Contact discharge	Air discharge
ESD at SIM port	**± 4kV**	**± 8kV**
ESD at USB interface	**± 4kV**	**± 8kV**

Table 10. Measured electrostatic values

4.4 Storage Conditions

Type	Condition	Unit	Reference
Air temperature: Low High	-40 +85	°C	ETS 300 019-2-1: T1.2, IEC 60068-2-1 Ab ETS 300 019-2-1: T1.2, IEC 60068-2-2 Bb

Humidity relative: Low
                          High
                          Condens.
	10
	90 at 30°C
	90-100 at
	30°C
		%	---
			ETS 300 019-2-1: T1.2, IEC 60068-2-56 Cb
			ETS 300 019-2-1: T1.2, IEC 60068-2-30 Db

Air pressure: Low High	70 106	kPa	IEC TR 60271-3-1: 1K4 IEC TR 60271-3-1: 1K4
Movement of surrounding air	1.0	m/s	IEC TR 60271-3-1: 1K4
Water: rain, dripping, icing and frosting	Not allowed	---	---
Radiation: Solar Heat	1120 600	W/m²	ETS 300 019-2-1: T1.2, IEC 60068-2-2 Bb ETS 300 019-2-1: T1.2, IEC 60068-2-2 Bb
Chemically active substances	Not recomm.		EC TR 60271-3-1: 1C1L
Mechanically active substances	Not recomm.		IEC TR 60271-3-1: 1S1

Table 11. Storage conditions

The conditions stated above are only valid for devices in their original packed state in weather protected, non-temperature-controlled storage locations. Normal storage time under these conditions is 12 months maximum.

4.5 Electrical Specifications of the Application Interface

4.5.1 USB interface

Hit U supports a USB 2.0 Full Speed (12Mbit/s) device interface. A USB host has to supportat least 6 „Message Pipes" (see "Universal Serial Bus Specification Revision 2.0"3 for a definition of the term „Message Pipe") to work with the Hit U USB interface.

The USB I/O-pins are capable of driving the signal at min 3.0V. They are 5V I/O compliant.The Hit U module HC25 USB interface is powered by VUSB. VUSB must be supplied by the USB host in the range 4.5V to 5.25V The maximum load on VUSB is 10mA. While the USB connection is active, the module will not change into SLEEP Mode. To enable switching into SLEEP mode the USB host must bring its USB interface into Suspend state (see "Universal Serial Bus Specification Revision 2.0"3 for a description of the Suspend state). On incoming calls HC25 will then generate a remote wake up request to resume the USB connection.

For more information about USB interface pins refer to [2], and for more information on on how to configure the USB interface by means of AT commands see [1].

4.5.2 Antenna interface

Parameter	Conditions	Min.	Typ.	Max.	Unit
HSDPA/UMTS connectivity	Band I, II, V				
UMTS Frequency range Uplink (UE to Node B)	UMTS 850 Band V	824		849	MHz
	UMTS 1900 Band II	1850		1910	MHz
	UMTS 2100 Band I	1920		1980	MHz
UMTS Frequency range Downlink (Node B to UE)	UMTS 850 Band V	869		894	MHz
	UMTS 1900 Band II	1930		1990	MHz
	UMTS 2100 Band I	2110		2170	MHz
RF Power@ ARP with 50Ohm Load	UMTS 850 Band V	+21	+23	+25	dBm
	UMTS 1900 Band II	+21	+23	+25	dBm
	UMTS 2100 Band I	+21	+23	+25	dBm

Table x. Antena interface

Please refer to [2] for more information about antenna interface (air interface).
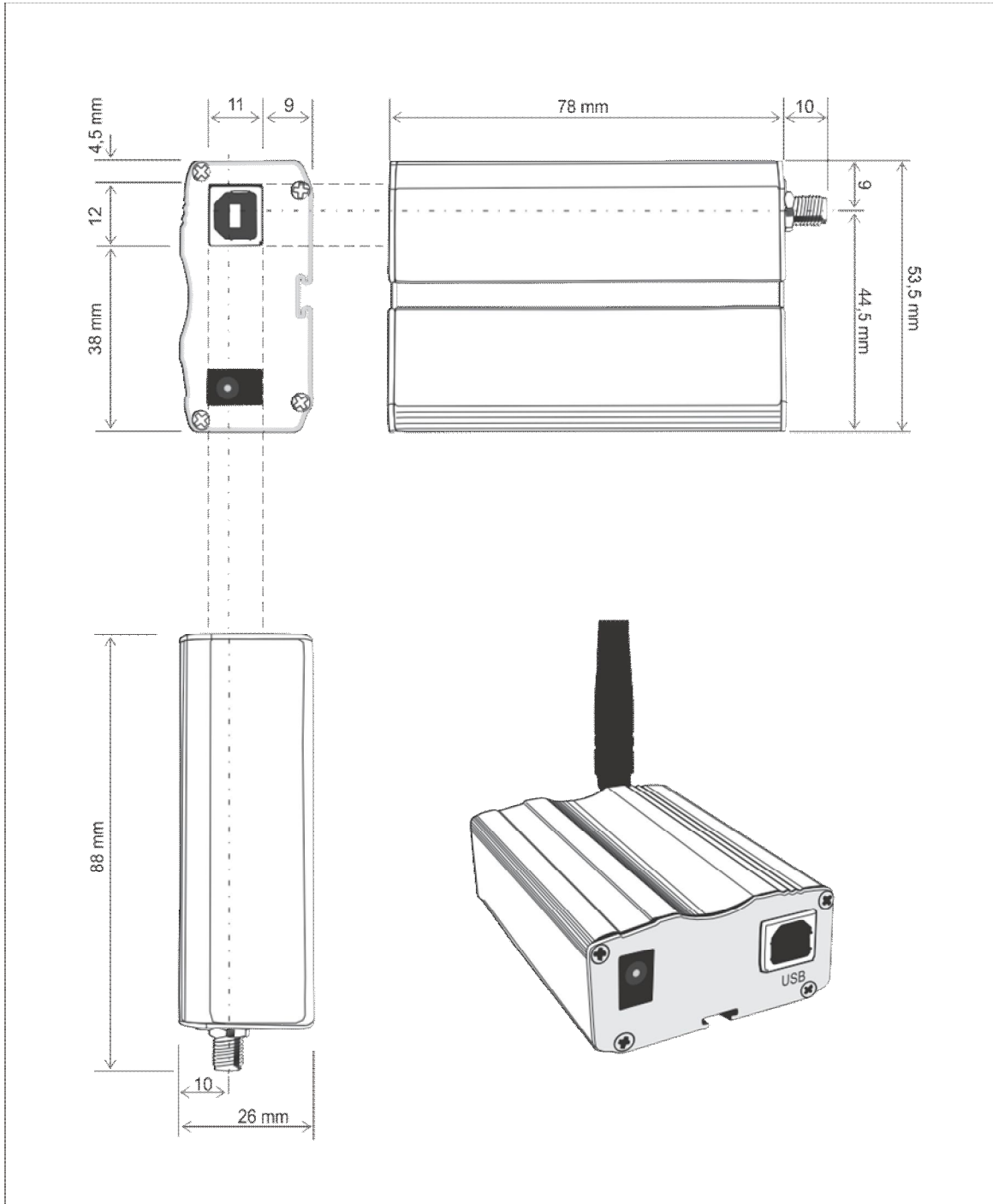
5. Mechanical Characteristics

Figure x. Mechanical characteristics

*all dimensions are in milimeters

6. List of Parts and Accessories

Description	Supplier	Picture
Hit U	**HCP d.o.o**	
SMA antenna	**HCP d.o.o**	
USB cable (USB A to USB B)	**HCP d.o.o**	
Power supply (AC/DC 9V/2A)	**HCP d.o.o**	

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