NOKIA 30 GSM CONNECTIVITY TERMINAL

TECHNICAL SPECIFICATION

NOKIA

Contents

DEFINITIONS AND TERMINOLOGY

AT	Attention
CORBA	Common Object Request Broker Architecture
CTS	Clear To Send
DAI	Digital audio interface
DCD	Data Carrier Detect
DCE	Data Circuit-terminating Equipment; see TA
DTE	Data Terminal Equipment; see TE
DTR	Data Terminal Ready
DSR	Data Set Ready
EMC	Electro-Magnetic Compatibility
GIOP	General Inter-ORB Protocol, General Inter- Object Request Broker Protocol
GPRS	General packet radio service
GSM	Group Special Mobile, Global System for Mobile communications
HSCSD	High Speed Circuit Switched Data
IDL	Interface Definition Language
ME	Mobile Equipment, e.g. a GSM connectivity terminal
MO	Mobile Originated
MT	Mobile Terminated
MS	Mobile Station
ORB	Object Request Broker
PC	Personal Computer
PCM	Pulse Code Modulation
PIN	Personal Identity Number
PUK	Personal Unblocking Key
RI	Ring Indicator
RTS	Request To Send
SC	System Connector
SIM	Subscriber Identity Module
SM	Short Message
SMS	Short Message Service
TA	Terminal Adapter, the physical equipment where AT command interpreter resides (may be combined with ME)
TE	Terminal Equipment, the physical equipment from where applications communicate with TA using AT commands
USSD	unstructured supplementary services data

REFERENCES

Please visit http://www.forum.nokia.com or http://www.forum.nokia.com for referenced documents.

Reference 1	Nokia M2M system protocol description
Reference 2	Nokia 30 AT command guide
Reference 3	M2M System Connector electrical specification for Nokia 30
Reference 4	Audio application note for M2M
Reference 5	IDL reference guide

1. INTRODUCTION

Nokia 30 is the Nokia GSM Connectivity Terminal over EGSM 900/GSM 1800 networks. It includes a GSM transceiver with built-in data capabilities, a SIM card reader, an internal antenna, an external antenna connector, and an M2M system connector.

The Terminal functionality is controlled by a mobile handset and/or a customer application (server and/or remote application) using text messages, AT commands or CORBA messages respectively. The Terminal can be plugged into the remote customer application with the 50-pin M2M system connector. With M2M system connector the Nokia 30 communicate with the application by using CORBA messages, where the data is transferred over the M2M system connector interface by M2M System Protocol (based on MAP27 data link layer protocol) or AT commands. Alternatively the Terminal can be plugged into the remote customer application with 9-pin D connector by using RS232 adapter (accessory) and communicate by using AT commands.

Nokia 30 provides GSM data and voice functionality. General Packet Radio Service (GPRS), Circuit Switched Data (CSD), High Speed Circuit Switched Data (HSCSD), Short message Service (SMS) and Unstructured Supplementary Services Data (USSD) of GSM services can be used to send data and messages wirelessly. Establishing a voice call is possible with the Digital Audio Interface (DAI) or analogue audios.

The terminal is a dual band transceiver designed for operation in EGSM 900, GSM 1800 and EGSM 900/GSM 1800 dual band networks. Nokia 31 GSM Connectivity Terminal is a frequency variant for Nokia 30 operating in GSM 850, GSM 1900 and GSM 850/GSM 1900 dual band networks.

This document gives a general overview of the Nokia 30 GSM Connectivity Terminal technical issues.

For more detailed information about Nokia 30 GSM Connectivity Terminal, Nokia M2M Platform or application development, please visit our website at http://www.forum.nokia.com and M2M links.

2. NOKIA 30 OPERATION MODES

Nokia 30 can be used in three different operation modes: User Control Mode, AT Command Mode and M2M System Mode.

2.1 USER CONTROL MODE

User Control Mode enables simple applications to be controlled by mobile handsets with text messages (SMS). The control or monitoring is through general-purpose inputs and outputs of the Terminal.

There are three general-purpose inputs and five general-purpose outputs on the M2M system connector. The inputs can be used in either digital (on/off) or analog (continuous signal) mode. The outputs can be used in digital mode only (set something on/off).

There are three levels of access control for User control mode. Access can be secured by specifying from which phone number the requests for control are allowed, by defining user specified user name and/or by defining user specified password.

2.2 M2M SYSTEM MODE

The M2M System Mode offers an effective serial interface for controlling the Nokia 30 terminal. The objective is to provide network-transparent programming through a vendor, operating system and language-independent CORBA architecture.

M2M system mode offers an effective and reliable protocol, namely the M2M system protocol, for controlling the terminal via M2M System Connector. M2M system protocol is a data link layer protocol and it is described in Reference 1.

The connection between the Nokia 30 GSM Connectivity Terminal and the customer application is checked periodically.

2.3 AT COMMAND MODE

In AT command mode, the Nokia 30 terminal acts as a normal cellular modem using AT commands. It can be connected to a PC or a compatible device. Normal communication applications (e.g. e-mail, fax, WWW) can be used.

All the mandatory and optional ITU-T V.25ter /1/, ETS GSM 07.07 /2/, and ETS GSM 07.05 /3/ commands that are applicable to the Nokia 30 are included in the Nokia 30 command set. The 'de facto' commands that are widely used with modems are also supported. Note that the ITU-T V.25ter is a combination of three TIA standards (TIA-602, TIA-615, IS-131). Supported AT commands are described in detail in Reference 2.

3. FEATURES

Nokia 30 supports the following features:

Dual band EGSM 900/GSM 1800 MHz	
Wireless bearer selection (In M2M System mode)	
GPRS multi-slot class	Class 6 (3+1, 2+2, 2+1, 1+1)
GPRS mobile station class	Class B
CSD	Up to 14.4 kbps
HSCSD multi-slot class	Class 6 (3+1, 2+2, 2+1)
Messaging services	SMS, USSD
Supplementary services	GSM Phase 2/2+ supported
Audio services	Digital audio interface (DAI), Analogue audios
Remote I/O control	Server/User controlled I/O, 3 digital/analogue inputs, 5 digital outputs
Reliability & security features	GSM encryption, GSM security codes, AutoPIN, Platform authentication, System monitoring

3.1 DATA CONNECTIONS

Nokia 30 supports HSCSD (High Speed Circuit Switched Data), GPRS (General Packet Radio Service) and CSD (Circuit Switched Data) for wireless data connections. In addition, Nokia 30 supports wireless bearer selection that enables changing between bearers (GPRS, CSD, HSCSD, SMS and USSD) dynamically.

In the HSCSD, the Terminal can use several time slots at the same time. That makes the data transfer rate higher. The time slot usage is presented as the number of downlink and uplink slots used.

In GPRS data is transferred over the network in small, standardized packets, whereas in the circuit switched data transfer uplink and downlink slots are reserved for the whole duration of the transfer. Transferring data as packets makes the transfer more efficient. In GPRS a mobile can send data packets using several time slots at the same time, and time slot usage is presented as the number of downlink and uplink slots used.

3.2 MESSAGING SERVICES

Nokia 30 supports Short Message Service (SMS) and Unstructured Supplementary Services Data (USSD) messaging.

The Short Message Service allows the user to send and receive messages of up to 160 characters with the Nokia 30. The service can deliver messages to the Nokia 30 whenever it is connected to the network, even when the terminal is engaged on an active call. SMS is a convenient way to pass data quickly and easily to and from Nokia 30 terminals. Nokia 30 supports unicode SMS messages for graphical character sending.

USSD offers reliable interactive messaging services. It allows the user to send and receive messages of up to 182 characters with the Nokia 30. When USSD is used, a session is established for the duration of the connection. This increases data transfer reliability, as the delay is known. In addition, it shortens response times.

4. HARDWARE SPECIFICATIONS

4.1 PRODUCT TYPE

The transmitting (RF) power of the Nokia 30 is 2W (max) in EGSM 900 and 1W (max) in GSM 1800 networks. The Nokia type designation of the Nokia 30 GSM Connectivity Terminal is TME-3.

4.2 ELECTRICAL CHARACTERISTICS

During a call, the average input power for a Nokia 30 GSM Connectivity Terminal depends on the call type and RF power level. Average input power levels required by the Nokia 30 in are listed in Table 1. The rest of the essential electrical characteristics are specified in Table 2.

Table 1 Average input powers in different call modes and power levels.

Call Mode:	Max RF Power level	Average input power
GSM 900 voice call	2W	3.0 W
GSM 1800 voice call	1W	2.2 W
GSM 900 GPRS/HSCSD (2+2) call	2W	4.3 W
GSM 1800 GPRS/HSCSD (2+2) call	1W	3.4 W

Table 2 Nokia 30 electrical characteristics

Parameter	Min	Typical	Max	Unit
Supply voltage (System connector)	4.75		15.0	V
Supply voltage (DC plug)	6.2	13.5	14.0	V
Average supply current TX GSM 900 HSCSD (2+2) call		425		mA
Supply current idle		20		mA
Peak current		600		mA

4.3 MECHANICAL SPECIFICATIONS

- Dimensions: 84 × 53 × 26 mm (length × width × height)
- Weight: 65 g

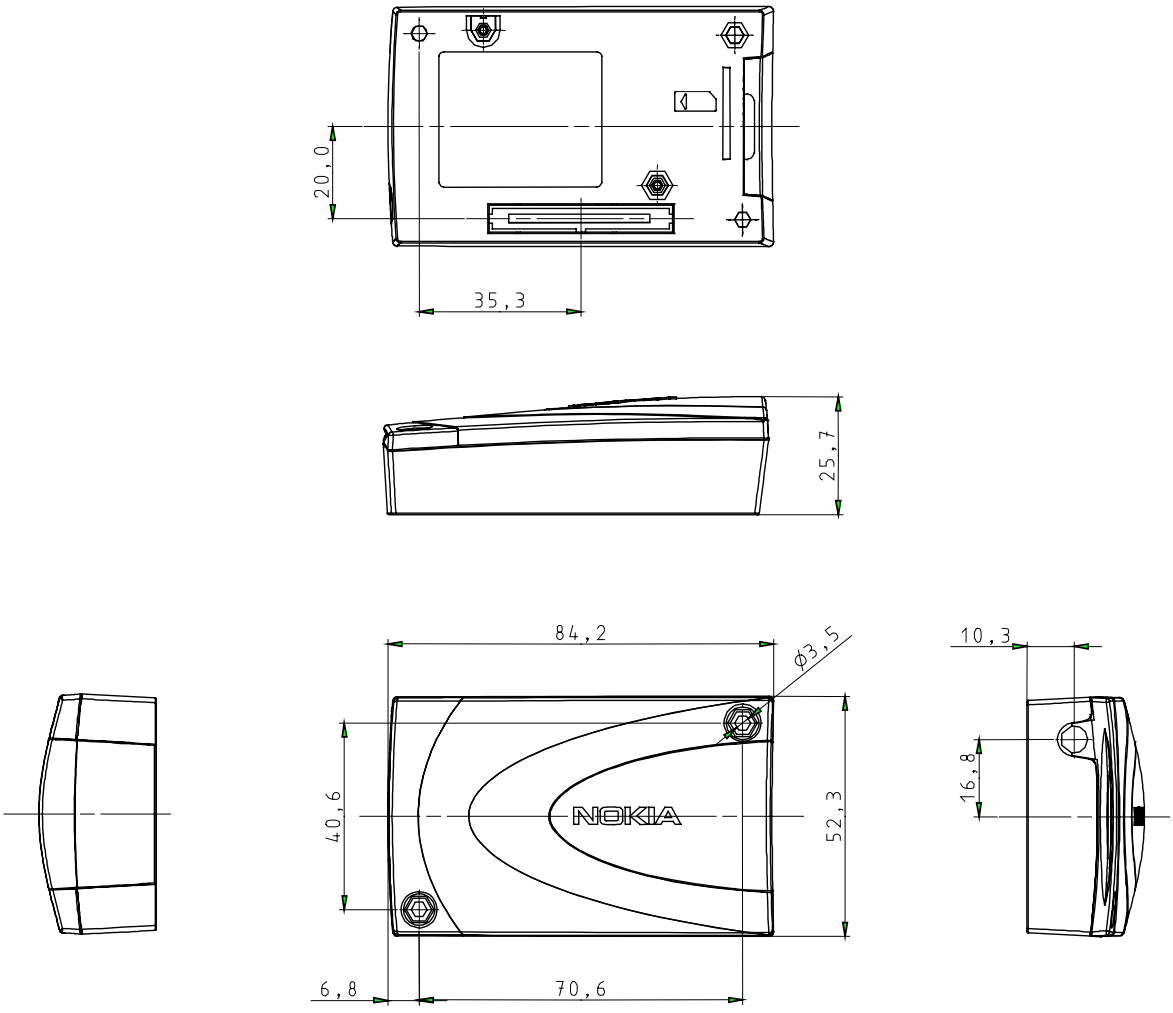

Figure 1 Nokia 30, mechanical dimensions

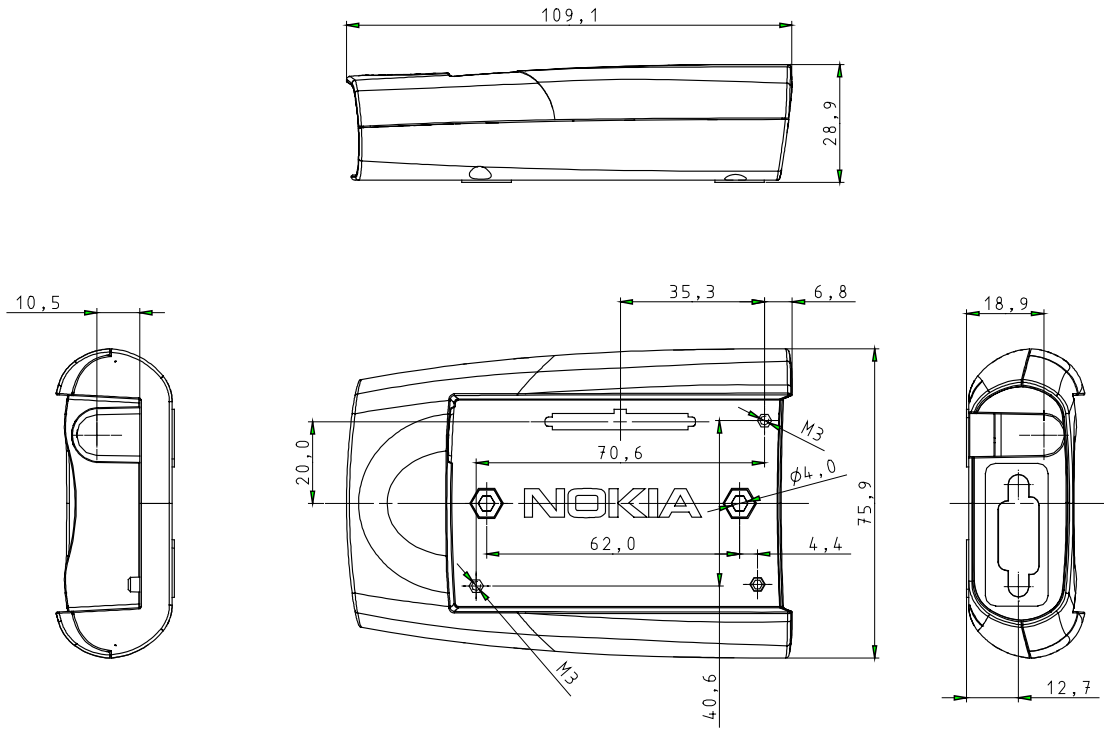

Figure 2 Mechanical dimensions of data adapter RS-232.

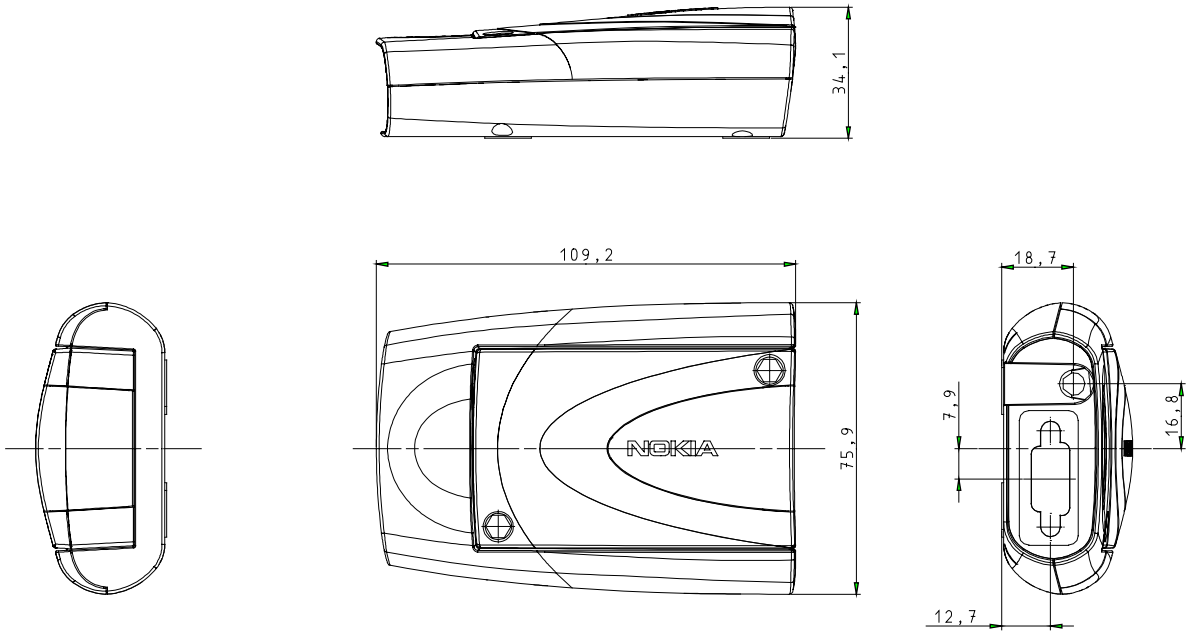

Figure 3 Mechanical dimensions of Nokia 30 with data adapter RS-232.

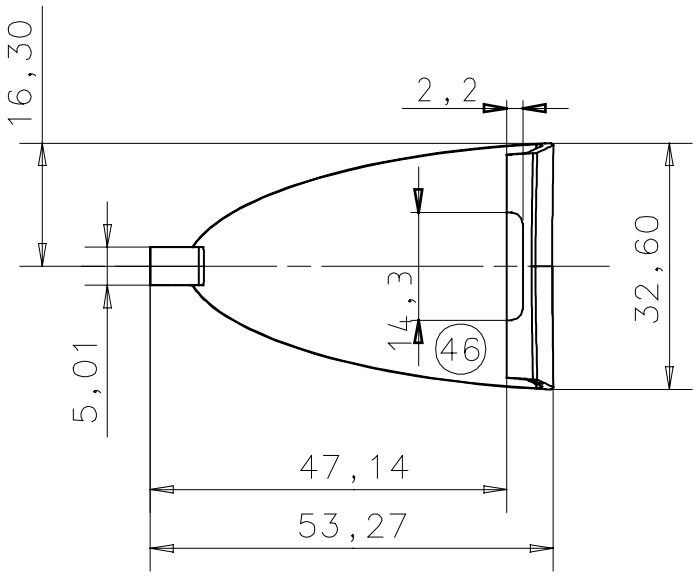

Figure 4 SIM cover dimensioning

4.4 ENVIRONMENTAL SPECIFICATIONS

- Temperature range, operation: -10...+55 °C
- Temperature range, storage: -40...+85 °C
- Humidity range, operation: 20...75 % non-condensing
- Humidity range, storage: 5...95 % non-condensing
- The terminal is not protected against ingress of water.

5. NOKIA 30 INTERFACES

Nokia 30 GSM Connectivity Terminal main interfaces are showed in Figure 5 and Figure 6.

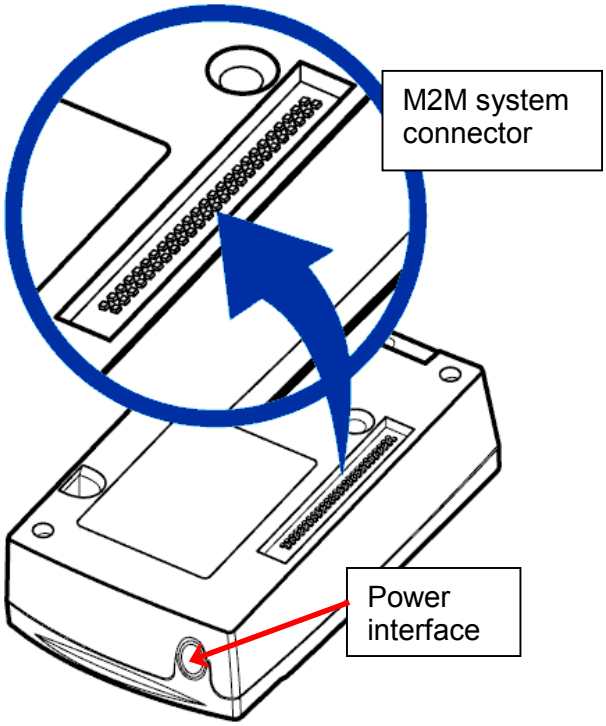

Figure 5 Nokia 30 GSM Connectivity Terminal, bottom view

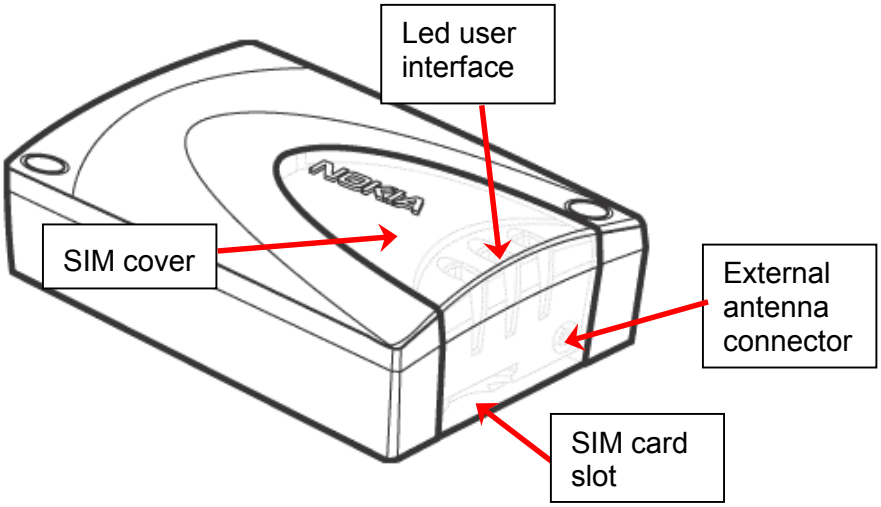

Figure 6 Nokia 30 GSM Connectivity Terminal, top view

5.1 M2M SYSTEM CONNECTOR INTERFACE

The primary physical interface to the application is through the 50-pin M2M System Connector. The M2M system connector offers serial bus, power input/output, Digital Audio Interface (DAI), analogue audios, remote I/O control and fax. There is also a D9 connector for the RS-232 available with an accessory.

The 50-pin system connector is connected to the application module with a flat cable connector (e.g. Samtec FFSD-25-D-X-01, X = cable length in inches). The flat cable is connected to a pin header connector on the customer application (e.g. Samtec FTSH-125-01-L-DV-K-P-TR). A board-to-board connector that is connected directly to the M2M system connector of the Nokia 30 can also be used in the customer application.

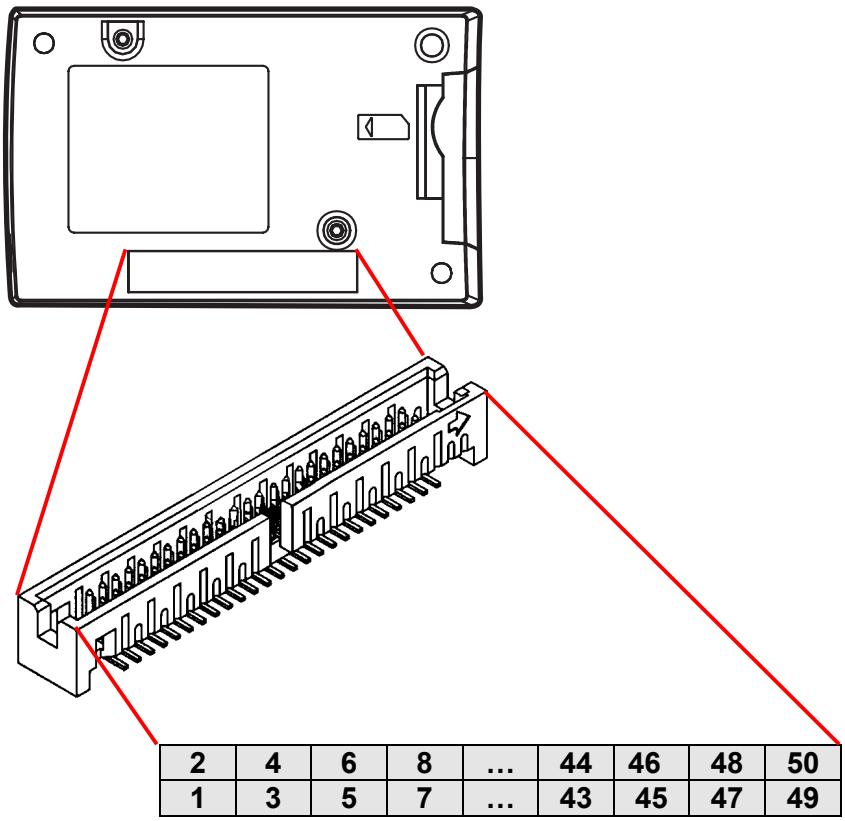

Figure 7 Nokia 30 Terminal, pin configuration

Table 3 describes the pins of the M2M System Connector.

Table 3 M2M System Connector pin outs.

Alternate	Name	Pin	Pin	Name	Alternate
	VBB	1	2	GND	
	VBB	3	4	GND	
	VBB	5	6	GND	
	VBB	7	8	GND	
	VBB	9	10	GND	
	VCCAM	11	12	Reset	
	GND	13	14	M2MRXD	
	M2MTXD	15	16	GND	
	M2MRTS	17	18	M2MCTS	
	GND	19	20	Reserved	
	Reserved	21	22	GND	
MIC+	PCMDCLK	23	24	GND	
MIC-	PCMSCLK	25	26	PCMRX	EAR+
	GND	27	28	PCMTX	EAR-
	GND	29	30	TXD	
INPUT1	Reserved	31	32	GND	
INPUT2	DTR	33	34	RXD	
	GND	35	36	RTS	INPUT3
OUTPUT1	Reserved	37	38	GND	
OUTPUT2	DCD	39	40	DSR	OUTPUT3
	GND	41	42	CTS	OUTPUT4
OUTPUT5	RI	43	44	GND	
	Reserved	45	46	Reserved	
	GND	47	48	Reserved	
	Reserved	49	50	GND	

For more information about the characteristics of the M2M System Connector, please see Reference 3.

5.2 AUDIO INTERFACES

The Nokia 30 has two alternative audio interfaces available on the M2M system connector: digital audio interface (DAI) and analogue audio interface. For more information on using the audio interfaces, see Reference 4.

5.2.1 Digital Audio Interface

The audio data interface between the Nokia 30 and external audio codec consists of 4 signals: PCM master clock, frame synchronisation clock, digital audio output and digital audio input. Both clock signals must be supplied to the Nokia 30 by the external device.

5.2.2 Analogue audio interface

The analogue audio interface consists of differential Mic and Ear signals.

5.3 POWER INTERFACE

The Nokia 30 has a 3.0 mm DC plug for Nokia ACW-5A power supply (See **Figure 5**).

- DC input voltage range: 6.2 V – 14.0 V
- Positive is connected to the centre

The M2M system connector provides regulated voltage for the application. Alternatively, the application module can supply the terminal with a wide voltage range.

- DC input voltage range: 4.75 V – 15.0 V

The Nokia 30 has a regulated switchable power output for the customer application.

- DC output voltage: 3.6 V
- Maximum DC output current: 300 mA

5.4 USER INTERFACE

Three light indicators (LEDs) form the user interface of the Nokia 30. LED 1 shows the terminal status while the other two are reserved for the application module after start-up. During start-up and special operations, all three light indicators are in terminal use. The functionality of the three light indicators in start-up, normal and special situations is described in Tables 4, 5 and 6 respectively. All three LEDs can also be configured so that they will not show any status and will stay shut down during any operation.

Table 4. Nokia 30 light indicator states during start-up.

LED 1	LED 2	Status LED	Description	
-	-	-	Power off / silent mode	
Green scan	Green scan	Green scan	Power on, connecting to network	
-	Red blink	-	PIN query / new PIN query	
-	Red blink	Red blink	PUK query	
			Intensity of Field Strength:	
Red blink	-	-	Non-acceptable	<-105 dBm
Green Blink	-	-		-105 … -100 dBm
Green	-	-	Weak	-100 … -95 dBm
Green	Green Blink	-		-95 … -90 dBm
Green	Green	-	Moderate	-90 … -85 dBm
Green	Green	Green Blink		-85 … -80 dBm
Green	Green	Green	Good	>-80 dBm

Table 5. Nokia 30 light indicator states during normal operation.

LED 1	LED 2	Status LED	Description
*	*	Green	In service
*	*	Green blink	Call on
*	*	Green blink	Incoming call
*	*	Green/Red blink	Message received / Voice mail in box
*	*	Red blink	Message arriving and memory is full

*) Application module controllable

Table 6. Nokia 30 light indicator states in special situations.

LED 1	LED 2	Status LED	Description
Green/Red blink	Green/Red blink	Green/Red blink	Insert SIM card
Red blink	Red blink	Red blink	Failure, contact service
Yellow	Yellow	Yellow	Initialising

5.5 SIM CARD INTERFACE

The Nokia 30 supports small-sized 3 V SIM card. The SIM card slot is shown in **Figure 5**.

5.6 RS-232 INTERFACE

In the AT Command Mode, the terminal is controlled by AT commands and RS-232 handshake signals. RS-232 signals are available at both the M2M System Connector and 9-pin D connector with RS232 adapter.

The Nokia 30 supports autobauding (9600-115200) for RS-232.

5.6.1 RS-232 Hardware Specifications - M2M System Connector

The RS-232 handshake signals are optionally available at 3V level using the M2M System Connector. The signals are described in Table 7.

5.6.2 RS-232 Hardware Specifications - Data adapter RS-232

RS-232 handshake signals are available at standard level using an RS-232 data adapter (available as an accessory) 9-pin D connector (female). Signal levels are:

Minimum: +/- 3 V
Maximum: +/- 15 V

The terminal sets the flow control signal (CTS) when it is ready to receive AT commands.

The terminal functions as DCE (Data Communication Equipment / Modem) in a PC-environment.

The signals are described in Table 7. The signals' electrical performances are compatible with the RS-232 standard with a maximum data rate of 115,200 bps.

Table 7 RS-232 signals

Terminal (DCE) D9 Female Pin#	Signals			PC (DTE)	
				D9 Male Pin#	D25 Male Pin#
	Signal	Name	Direction		
1	DCD	Carried Detect	From GSM	1	8
2	RxD	Received Data	From GSM	2	3
3	TxD	Transmit Data	To GSM	3	2
4	DTR	Data Terminal Ready	To GSM	4	20
5	GND	Signal Ground	-	5	7
6	DSR	Data Set Ready	From GSM	6	6
7	RTS	Request To Send	To GSM	7	4
8	CTS	Clear To Send (*)	From GSM	8	5
9	RI	Ring Indicator	From GSM	9	22

5.7 ANTENNA INTERFACE

The Nokia 30 GSM Connectivity Terminal is equipped with an internal dual-band antenna.

It is also possible to use an external antenna with a standard FME connector. Nokia provides a special adapter cable between the Nokia 30 and FME connectors (accessory). A piece of the terminal's SIM cover can be removed to fit it. The Nokia type code of this adapter cable is XRM-1.

Figure 8. Nokia 30, external antenna cable

In Figure 8, both connectors in the antenna cable are showed. The terminal side connector is a coaxial type specific connector (IMS 2813.91.1310.021) and the connector on the external antenna side is a standard male FME antenna connector.

Table 8 shows the RF characteristics of the antenna cable and the connectors.

Table 8 Specification for the antenna cable and the connectors

Parameter	**Minimum**	**Typical**	**Maximum**	**Unit**
Operating frequency range				MHz
Insertion loss in GSM 900 band			1.5	dB
Insertion loss in GSM 1800 band			2	dB
Nominal impedance		50		Ohm
VSWR GSM 900 band			1.4	
VSWR GSM 1800 band			1.6	
Length		600		mm
Diameter		2.7		mm

6. NOKIA 30 ACCESSORIES

The following accessories are available for the Nokia 30.

- Power supply ACW-5A
- Data package including data adapter RS-232, data cable RS-232, installation screws and Nokia 30 CD-ROM
- Antenna adapter
- Configurator software

7. MEAN TIME BETWEEN FAILURES

MTBF (Mean Time Between Failures) of the Nokia 30 GSM Connectivity Terminal is 20 years.

8. NOKIA 30 TYPE APPROVALS

The Nokia 30 GSM Connectivity Terminal bears the EC conformity marking, CE mark.

Applicable EC directives: 89/336/EC (EMC Directive), 73/23/EC (Low Voltage Directive) and 1999/5/EC (Directive on Radio Equipment and Telecommunications Terminal Equipment)

The Nokia 30 GSM Connectivity Terminal fulfils the essential requirements of R&TT directive 5/1999/EC.

The Nokia 30 GSM Connectivity Terminal is type approved with the accessories described in this document. The CE mark is valid with the accessories described in this document. A remote customer application connected to the M2M System Connector of Nokia 30 using CORBA messages or AT commands does not require additional type approval.

9. CORBA AND NOKIA 30

The CORBA (Common Object Request Broker Architecture) is a widely distributed computing infrastructure, standardised by the Object Management Group (OMG) consortium. In short, CORBA applications are composed of objects which can be located within different machines. Objects have services and they are utilised with request messages. The CORBA hides the underlying transferring network, such as the Internet or GSM network as well as the underlying protocols, so that a user can use functions as local procedure calls.

Object services are described with an abstract language named IDL (Interface Definition Language). The IDL also provides the necessary information required to develop clients that use an object's interface operations. The interface definition specifies which member functions, data types, attributes and exceptions are available to a client, without making any assumptions about an object's implementation. An IDL compiler is responsible for mapping IDL interfaces onto the particular programming language, such as C, C++ or Java. Thus, the programming language that is used in CORBA implementation does not have to be object-oriented.

Example applications implemented using CORBA IDL can be found at the Forum Nokia web pages; http://www.forum.nokia.com.

9.1 THE NOKIA 30 GSM CONNECTIVITY TERMINAL IDLS

The Nokia 30 offers services through three IDLs: *wirelessDevice*, *Nokia GSM connectivity terminal* and *Remote IO Control*. The wirelessDevice IDL is common for all kinds of devices. Terminal-specific services are described in the Nokia GSM Connectivity Terminal IDL and features related to remote input/output control in the Remote IO Control IDL.

The services offered by WirelessDevice IDL are divided into four groups: *Device*, *ParamObserver*, *EventObserver* and *IOControlObserver*. The Device group has functions to handle dynamic parameters and counters. It also has functions to manage event and parameter observation. The EventObserver services are used to provide information regarding unusual events like incoming calls or network connection loss. ParamObserver functions are used in the same way, but in their case, are used to receive notification of changes in dynamic parameters. The IOControlObserver is used to indicate changes in the general-purpose input and output pins.

The Nokia GSM connectivity terminal IDL provides GSM-related operations, such as call control, SMS, USSD, supplementary service and light indicator control functions. They provide easy access to basically all mobile network services.

Remote IO Control IDL has functions for the remote control of input/output pins residing in the M2M System Connector.

All dynamic parameters and counters in the Nokia GSM connectivity terminal are described with XML (Extensible Markup Language) so they are easily available in a simple and universal format.

For more information about Nokia 30 IDLs, please see Reference 5.