Functional Specification

GSM Dual Band Engine

Richard Machin

9th July 1999

Source: Functional Specification GSM Dual Band Engine 20.doc

Version 2.0

1. INTRODUCTION

1.1.Overview

This document provides a functional specification for the Simoco Dual Band GSM engine. The radio is of modular design incorporating the AD20msp425 baseband chipset, and a dual band GSM Radio Module. The Simoco Dual Band GSM engine is a fully functional GSM terminal (Voice, Data, Fax and SMS) intended for use as a component for integration into customer applications. It has Man Machine Interface (MMI) application support including keypad and display. It also offers internal and external SIM facility.

1.2.Purpose

The purpose of this document is to provide a top-level definition of all externally visible functions and interfaces and any relevant internal functions of the Simoco Dual Band GSM engine.

1.3.Scope

This document defines the Simoco Dual Band GSM engine from a "black box" point of view, save where the internal details of its construction influence the external characteristics of the unit.

1.4.Terminology

- DTA Data Terminal Adapter. This is a system designed to convert data from a PC to a format required to be sent over the GSM air interface.
- TE Terminal Equipment. A mobile phone is an example of a TE.
- DTE Data Terminal Equipment. A DTA combined with a TE will yield a DTE, the product here specified is a DTE.
- DCE Data Connection Equipment. Usually a PC, or equivalent.
- MNP Microcom Network Protocol. An error correcting protocol used over asynchronous full duplex channels. Developed by Microcom, the simpler classes of this are now accepted as part of the ITU error correcting standard V.42 as an alternative to LAP-M.

2. FUNCTIONS

The module provides the following functions:

- GSM900 (Small MS) and DCS1800 operation
- Voice calls (Enhanced and Standard Full Rate codecs) using external microphone and speaker
- Group 3 transparent fax (GSM 03.45)
- SMS (MO and MT)
- SMS-CB
- Transparent data at 2400, 4800, 9600 and 14400bps
- Non-transparent data at 9600 and 14400 bps
- V.42 *bis* Compression
- Enhanced AT command set to (GSM 07.05 and 07.07)
- Conforms to GSM Phase 2 standard
- Three I/O pins for OEM applications support
- Digital Audio Interface (DAI)
- GSM900 Class 4 (2w power output)
- DCS1800 Class 1 (1w power output)

3. INTERFACES

3.1.System Interfaces

- 50 - way miniature System connector (for pin-out see section 3.5)
- 10 - way miniature Power connector (for pin-out see section 3.6)
- Bi-directional serial port for control information and user data traffic (RXD, TXD and ground only, RTS / CTS flow control available), RS-232 levels. Bit rates are software configurable up to 19.2kbps for AT commands, etc.
- Bi-directional serial port for programming and diagnostic logging (RXD, TXD and ground) RS-232 levels. Bit rates are software configurable up to 57.6kbps.
- SIM interface using internal mini-SIM slot or external interface. Supports3 V and 5 V SIM cards
- Analogue speech interface for external handset or hands-free operation, balanced microphone and speaker signals.
- 3 GPIO pins available for OEM applications support.
- DC power input 5V +/-5%.
- Current consumption: Standby/Idle mode <10mA, Call in progress (average) <250mA, Call in progress (peak) <2A
- Digital speech interface for high-performance external audio including hands-free, bi-directional serial interface, 3v logic levels, may be TDD single-wire or two-wire full duplex.

3.2.Keypad

6 rows of 4 columns cross-wire keyboard interface.

3.3.Display

Conventional display interface supporting 4 x 16 alphanumeric display.

3.4.Antenna Port

50Ω SMR Nano RF connector provides connection for an external antenna.

3.5.Signal & I/O Connector

Pin No	Name	Function	Notes
1	SPKR+	Speaker - balanced signal	
2	MIC+	Microphone - balanced signal	
3	SPKR-	Speaker - balanced signal	
4	MIC-	Microphone - balanced signal	
5	GND	Ground	
6	GND	Ground	
7	CTS	Clear To Send	
8	RTS	Request To Send	
9	TXD2	Transmit Data 2	
10	TXD1	Transmit Data 1	
11	RXD2	Receive Data 2	
12	RXD1	Receive Data 1	
13	GND	Ground	
14	ON/OFF	Power on/ Power off	
15	SIM_RESET	External SIM connection - Reset	
16	SIM_SUPPLY	External SIM connection - Supply	
17	SIM_DATAIO	External SIM connection - Data	
18	SIM_CLK	External SIM connection - Clock	
19	KEYB_COL4	MMI Keyboard Column 4	
20	KEYB_COL3	MMI Keyboard Column 3	
21	KEYB_COL2	MMI Keyboard Column 2	
22	KEYB_COL1	MMI Keyboard Column 1	
23	KEYB_ROW6	MMI Keyboard Row 6	
24	KEYB_ROW5	MMI Keyboard Row 5	

25	KEYB_ROW4	MMI Keyboard Row 4	
26	KEYB_ROW3	MMI Keyboard Row 3	
27	KEYB_ROW2	MMI Keyboard Row 2	
28	KEYB_ROW1	MMI Keyboard Row 1	
29	GND	Ground	
30	DISP_REGSEL	MMI Display Register Select	
31	DISP_LCDCTL	MMI Display LCD control	
32	DISP_CS	MMI Display Chip Select	
33	DISP_WR	MMI Display Write	
34	DISP_RD	MMI Display Read	
35	DISP_D0	MMI Display Data D0	
36	DISP_D1	MMI Display Data D1	
37	DISP_D2	MMI Display Data D2	
38	DISP_D3	MMI Display Data D3	
39	DISP_D4	MMI Display Data D4	
40	DISP_D5	MMI Display Data D5	
41	DISP_D6	MMI Display Data D6	
42	DISP_D7	MMI Display Data D7	
43	DA_RESET	Digital Audio Reset	
44	GPIO3	General Purpose I/O 3	
45	DA_1	Digital Audio 1	
46	GPIO2	General Purpose I/O 2	
47	DA_0	Digital Audio 0	
48	GPIO1	General Purpose I/O 1	
49	FTC	Factory test - calibration	
50	FTB	Factory test - boot mode	

For orientation of the connector and pin indications, please refer to the mechanical drawings in section 5.

3.6.Power Connector

Pin No	Name	Function	Notes
1	V_IN	Power Supply	Max Current 0.5A per pin
2	GND	Power Supply	Max Current 0.5A per pin
3	V_IN	Power Supply	Max Current 0.5A per pin
4	GND	Power Supply	Max Current 0.5A per pin
5	V_IN	Power Supply	Max Current 0.5A per pin
6	GND	Power Supply	Max Current 0.5A per pin
7	V_IN	Power Supply	Max Current 0.5A per pin
8	GND	Power Supply	Max Current 0.5A per pin
9	V_IN	Power Supply	Max Current 0.5A per pin
10	GND	Power Supply	Max Current 0.5A per pin

3.7.Connectors and Mating Halves

Reference	Description	Manufacturer	Part number
J1	Power connector 10-way	Samtec	FTS-105-01-L-DV
J1	Power connector 10-way	Toby Electronics	SPNB2-10-020
J1-mating	Power connector 10-way (4.85mm mating height)	Samtec	FLE-105-01-G-DV
J1-mating	Power connector 10-way (2.5mm mating height)	Samtec	CLP-105-02-F-D
J1-mating	Power connector 10-way (3.4mm mating height)	Toby Electronics	QPOF2-10-020
J1-mating	Power connector 10-way (2.2mm mating height)	Toby Electronics	SPNAF-10-020
J4	System connector 50-way	Samtec	FTS-125-01-L-DV
J4	System connector 50-way	Toby Electronics	SPNB2-50-020
J4-mating	System connector 50-way (4.85mm mating height)	Samtec	FLE-125-01-G-DV
J4-mating	System connector 50-way	Samtec	CLP-125-02-F-D

	(2.5mm mating height)		
J4-mating	System connector (3.4mm mating height)	Toby Electronics	QPOF2-50-020
J4-mating	System connector 50-way (2.2mm mating height)	Toby Electronics	SPNAF-50-020
J6	RF connector SMR-Nano	IMS	572.31.1520.001
J6-mating	RF connector SMR-Nano plug (f) crimp angle	IMS	31.2420.011
J6-mating	RF connector SMR-Nano plug (f) crimp straight 19.1mm	IMS	31.2410.011
J6-mating	RF connector SMR-Nano plug (f) crimp straight 16.7mm	IMS	237.31.2410.011
J6-mating	RF connector SMR-Nano plug (f) crimp straight 21.1mm	IMS	947.31.2410.011
J6-cable	Cable assembly SMR-Nano/N-type 0.5m	Quadrant	PRCS/0304
J6-cable	Cable assembly SMR-Nano/N-type 1.0m	Quadrant	PRCS/0305
J6-cable	Cable assembly SMR-Nano/N-type 2.0m	Quadrant	PRCS/0306
J6-cable	Cable assembly SMR-Nano/FME 1.0m	Quadrant	PRCS/0307
J6-cable	Cable assembly SMR-Nano/FME 2.0m	Quadrant	PRCS/0308
J10	SIM connector	AMP	2-338063-8

Note: SAMTEC connectors available from TOBY Electronics Ltd
Note: IMS connectors available from Quadrant Meter Co. Ltd

Toby Electronics Ltd
14 Canada Close
Marley Way Industrial Estate
Banbury
Oxon
OX16 7RT
Tel: + INT (0)1295 271777
Fax: + INT (0)1295 271744
e-mail: toby@btinternet.com
Web: http://www.toby.co.uk

Quadrant Meter Co. Ltd
Quadrant Works
567 Watling Street
Radlett
Herts
WD7 7HZ
Tel: + INT (0)1923 851419
Fax: + INT (0) 1923 857

Amp of Great Britain Ltd
Merrion Avenue
Stanmore
Middlesex
HA7 4RS
Tel: + INT (0) 181 4208050
Fax: + INT (0)181 4208029

4. AT-COMMAND SUPPORT

4.1.Core Command Support (GSM 07.07)

The core data-on-board product will support a subset of the full GSM07.07 command set. Below is a table listing the commands that are supported in the current software release.

Service	Reference	Command	Descriptions
	5.1	AT+CGMI	Request Manufacturer Identification
	5.2	AT+CGMM	Request Model Identification
	5.3	AT+CGMR	Request Revision Identification
	5.4	AT+CGSN	Request Product Serial Number Identification
	5.5	AT+CSCF	Select TE Character set
ITU-T V. 25ter Generic TA Commands, references relate to GSM07.07			
	5.6	ATZ<n>	Set all TA parameters to user defined default
	5.6	AT&F<n>	Set all TA parameters to manufacturer defaults
	5.6	ATI<n>	Request Manufacturer Information about TA
	5.6	AT+GMI	Request Manufacturer Identification
	5.6	AT+GMM	Request TA Model Identification
	5.6	AT+GMR	Request TA Revision Identification
	5.6	AT+GSN	Request TA Serial Number identification
	5.6	AT+GCAP	Request overall capabilities for TA
	5.6	AT+GOI	Request ISO System Global Object Identification
Call Control Commands, references relate to GSM07.07			
	6.7	AT+CBST	Select Bearer Service Type
	6.8	AT+CRLP	Radio Link Protocol Parameters
	6.9	AT+CR	Service Reporting Control
	6.10	AT+CEER	Extended Error Reporting
	6.11	AT+CRC	Select Cellular Result Codes
ITU-T V.25ter Call Control Commands			
		(+++)	ESC from data mode (Hayes patent. +++at<cr> also supported)
		A/	Repeat previous command
		AT&V	Display current configuration
		AT&W	Store current users configuration
Establish Outgoing Call	6.12/V.25ter - 6.3.1	ATD<n>	Mobile originating call to dialable number <n>
	6.12/V.25ter - 6.3.2, 6.3.3	ATDT, ATDP	tone/pulse dialling switches are ignored
Answer Incoming Call	6.12/V.25ter - 6.3.5	ATA	Answer a call
Release Call	6.12/V.25ter - 6.3.6	ATH<n>	Hang-up a single mode call; for alternate mode call refer AT+CHUP
	6.12/V.25ter - 6.3.7	ATO<n>	Returns TA to online data state from online command mode
Configure	6.12/V.25ter - 6.3.8	ATS0=<n>	Sets the number of call indications (rings) before automatically answering the call
	6.12/V.25ter - 6.3.9	ATS6=<n>	Ignored (pause before blind dialling)
	6.12/V.25ter - 6.3.10	ATS7=<n>	Sets number of seconds to wait for completion of a call answering or originating procedure before giving up and disconnecting

	6.12/V.25ter - 6.3.11	ATS8=<n>	Sets number of seconds to wait when comma dial modifier encountered in dial string of D command
	6.12/V.25ter - 6.3.12	ATS10=<n>	Sets number of tenths of seconds to wait before disconnecting after TA has indicated the absence of received line signal
	6.12/V.25ter - 6.3.13, 6.3.14	ATL, ATM	Monitor speaker loudness/modes are ignored
ITU-T V.25ter TE-TA interface Commands, references relate to V.25ter			
	6.2.1	ATS3=<n>	command line termination character <n>, default IRA 13
	6.2.2	ATS4=<n>	response formatting character <n>, default IRA 10
	6.2.3	ATS5=<n>	command line editing character <n>, default IRA 8
	6.2.4	ATE<0|1>	command echo
	6.2.5	ATQ<0|1>	result code suppression
	6.2.6	ATV<0|1>	TA response format
	6.2.7	ATX<n>	defines CONNECT result code format
	6.2.8	AT&C<n>	determines how ITU-T V.24 circuit 109 (or equivalent) relates to the detection of received line signal from remote end
	6.2.9	AT&D	determines how TA responds when ITU-T V.24 circuit 108/2 (or equivalent) is changed from ON to OFF condition during online data state
	6.2.10	AT+IPR=<n>	fixed TE data rate
	6.2.11	AT+ICF= ...	TE-TA character framing
	6.2.12	AT+IFC= ...	TE-TA local flow control
	6.2.13	AT+ILRR=<n>	determines whether the used local TE-TA data rate is informed using intermediate result code +ILRR: <rate> before going online data state after call answering or originating
ITU V.25bis Call Control Commands, reference Table 3/V.25bis (commands for further study are not mentioned here)			
			Activate V.25bis Mode Support via AT+IMODE=1
	4.1.2.1	CRN <n>	Call request with provided number <n>
	4.1.2.4	DIC	Disregard incoming call
	4.1.2.5	CIC	Connect incoming call
		AT	Switch to AT mode Support via EXC+IMODE=0
ITU-T V.42bis Data Compression Commands			
	6.13/V.25ter - 6.6.1	AT+DS=...	controls ITU-T recommendation V.42bis data compression functions
	6.13/V.25ter - 6.6.2	AT+DR=<n>	determines whether the use of V.42bis is informed using intermediate result code +DR: <type> before going online data state after call answering or originating
Short message service, references relate to GSM07.05			
	3.2.1	AT+CSMS	Select message service
	3.2.2	AT+CPMS	Preferred Message Storage
	3.2.3	AT+CMGF	SMS format
	3.3.1	AT+CSCA	Service Centre Address
	3.3.2	AT+CSMP	Set text mode parameters
	3.3.3	AT+CSDH	Show text mode parameters
	3.3.4	AT+CSCB	Select Cell Broadcast Message Types

	3.4.1	AT+CNMI	New Message Indications to TE
	3.4.2	AT+CMGL	List Messages
	3.4.3	AT+CMGR	Read Message
	3.5.1	AT+CMGS	Send Message
	3.5.2	AT+CMSS	Send Message from Storage
	3.5.3	AT+CMGW	Write Message to Memory
	3.5.4	AT+CMGD	Delete Message
Facsimile class 1 commands according to TIA/EIA-578-A, all references relate to this standard			
	8.2.1-3	AT+FCLASS	select, read or test service class
	8.2.4	AT+FMI?	report manufacturer ID
	8.2.4	AT+FMM?	report model ID
	8.2.4	AT+FMR?	report revision
	8.3.1	AT+FTS=<time>	stop transmission and wait <time>*10ms intervals 0-255
	8.3.2	AT+FRS=<time>	wait for silence <time>*10ms intervals 0-255
	8.3.3	AT+FTM=<mod>	transmit data with <mod> carrier
	8.3.4	AT+FRM=<mod>	receive data with <mod> carrier
	8.3.5	AT+FTH=<mod>	transmit HDLC data with <mod> carrier
	8.3.6	AT+FRH=<mod>	receive HDLC data with <mod> carrier
Result codes (common)			
	9.2/Annex B	+CME ERROR	Error report
	6.9/Annex B	+CR	Service reporting control
	6.13/Annex B	+DR	Data compression control
	4.3/Annex B	+ILRR	determines whether the used local TE-TA data rate is informed using intermediate result code +ILRR: <rate> before going online data state after call answering or originating
Result codes facsimile class 1, all references relate to TIA-578-A			
	7.5 / 8.4	+FCERROR	facsimile error report
	6.7	OK	see common result codes defined in V.25ter
	6.7	CONNECT	see common result codes defined in V.25ter
	6.7	NO CARRIER	see common result codes defined in V.25ter
	6.7	ERROR	see common result codes defined in V.25ter
V.25bis result codes (indications)			
		CFI <n>	Call failure indication, failure type <n>
		DLC <n>	Delayed call indication <n> minutes
		INC	Incoming call
		VAL	Valid
		INV <n>	Invalid, error type <n>
SIM Access			
	8.3	AT+CPIN	Enter PIN

4.2.Additional Command Support

4.2.1. General AT Commands

Service	Reference	Command	Descriptions
	3.3.5	AT+CSAS	Save Settings
	3.3.6	AT+CRES	Restore Settings

4.2.2. SIM Access

Service	Reference	Command	Descriptions
	8.11	AT+CPBS	Select Phonebook Memory Storage
	8.12	AT+CPBR	Read Phonebook Entries
	8.13	AT+CPBF	Find Phonebook Entries
	8.14	AT+CPBW	Write Phonebook Entries
	6.3	ATD><str> ...	originate call to phone number which corresponding alphanumeric field is <str>
	6.3	ATD>*mem*<n>...	originate call to phone number in memory *mem* entry location <n>
	6.3	ATD><n>...	originate call to phone number in entry location <n>

4.2.3. Supplementary Services

Service	Reference	Command	Descriptions
Network Service Related Commands			
	7.2	AT+CREG	Network registration
	7.3	AT+COPS	Operator selection
	7.5	AT+CPWD	Change Password
Supplementary service, reference related to GSM07.07			
BAOC BOIC BOIC-exHC BAIC BAIC-Roam	7.4	AT+CLCK, additional barring functions available	Call barring/ Facility Lock Barring of All Outgoing Calls Barring of Outgoing International Calls Barring of Outgoing International Calls except to Home PLMN Barring of All Incoming Calls Barring of Incoming Calls when Roaming Outside Home PLMN
CLIP	7.6	AT+CLIP	Calling Line Identification Presentation
CLIR	7.7	AT+CLIR	Calling Line Identification Restriction
CoLP	7.8	AT+COLP	Connected Line Identification Presentation
CUG	7.9	AT+CCUG	Closed User Group
CFU CFB CFNRy CFNRc AllCF all cond. CF	7.10	AT+CCFC	Call Forwarding Number and Conditions
CW	7.11	AT+CCWA	Call Waiting
HOLD	7.12	AT+CHLD	Call Hold and Multiparty
Mobile Equipment Control and Status Commands, references relate to GSM07.07			
	8.1	AT+CPAS	Phone Activity Status
	8.4	AT+CBC	Battery Charge
	8.5	AT+CSQ	Signal Quality and bit error rate
	8.7	AT+CKPD	Keypad Control
Mobile Equipment Errors			
	9.1	AT+CMEE	Report Mobile Equipment Errors
Voice Control Interim Standard for Async DCE, references relate to GSM 07.07			
All the commands in this section can be omitted if a second audio CODEC is used and analog splitting/combining is employed.			
	C.2.11	AT+VTS	DTMF and Tone Generation
	C.2.12	AT+VTD	Tone duration
Result codes			
	7.11/Annex B	+CCWA	Call waiting indication

	7.6/Annex B	+CLIP	Calling line identification presentation
	7.8/Annex B	+COLP	Connected Line Identification Presentation
	7.2/Annex B	+CREG	Network registration
	6.11/Annex B	+CRING	Extended format: incoming call indication
	7.16/Annex B	+CSSI	intermediate result indication / Supplementary service notifications
	7.16/Annex B	+CSSU	unsolicited result indication / Supplementary service notifications
	7.14/Annex B	+CUSD	Unstructured supplementary service data

5. PHYSICAL CHARACTERISTICS

5.1.Mechanical

The Simoco GSM Dual-Band engine is housed in a robust die-cast case. The overall cased dimensions of the module are 90.5mm (L) x 49.5mm (W) x 11.7mm (H).
The overall height of the engine maybe reduced to 10.1mm when mounted on a PCB that includes an aperture

5.2.Environmental

- Operating Temperature range –20c to +55c.
- Storage temperature ranges -40c to +85c.
- Vibration and shock [TBD].
- The module complies with relevant EMC/EMI specifications [TBD].

5.3.Engine dimensions