

Performance Description Hydra

References

References are external documents (papers, files, articles, and photocopies) which are mentioned to give further information about topics in the document. Remember to write the accurate path for the reference file.

Enclosures

Enclosures are external documents (papers, files, articles, and photocopies) which are an essential part of the document itself, but which cannot be put into the word format.

Revision Information

Created:	Revision	Name	Comments
27.10.04	0.1	AALjfa	Initial revision in PVCS
Modified			
24.11.04	0.2		
29.11.2004	0.99	Keld Christiansen	Document updated, missing values from EA.
30.11.2003	1.0	Keld Christiansen	Updated and released

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1 List of references

1.1 Project specific references

The appendices and enclosures (if present as files) are saved separately on the AAL network under

c:\AALAFS3\PROJECTS\Project\75G_Hydra\PD_Team\Documents_Declarations\M1

NO.	DOCUMENT	Date	FILE NAME
1.	Product description SL75 (EMEA, APAC) / (this document)		Perform- ance_Description_Hydra_V1.0.doc
2.	SL75 Hydra M1 Product Contract		041130_Hydra_M1_final_v10.ppt
3.	M1 declaration «project team»		Project folder M1/declarations
4.	Software Featurelist X75 (EMEA, APAC)		Feature List V2.0_040_02.xls
5.	Software MMI Delta / Slider Specification		Included in SW feature list
6.	SW MMI Specification Hydra		Included in SW feature list
7.	RF-BB Interface description X75 Platform		Placed on the MCH platform drive.
8.	Major Risk Assessment		Risk_list_M1.xls (HW-SW Top 10)
9.	Major Software Risk Management (platform)		Placed in IMS as a common x75 risk list. Top 10 Hydra SW is in the project specific list.
10.	Accessories for the Mobile Phones SL75 (EMEA, APAC)		Portfolio Hydra 2004-09-07

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NO.	DOCUMENT	Date	FILE NAME
11.	Project schedule SL75 (EMEA, APAC)		Placed in Primavera (Master schedule)
12.	Ramp up Plan Hydra (EMEA/ APAC)		Ramp-up Plan Hydra
13.	Project schedule SL75 Accessory		CK BT Portable (HKW-700): 05/05 HS BT Stereo (HHB-750): 09/05 Car Kit Bluetooth 75: 07/05 Car Kit Bluetooth SIM Access: 07/05 Media Link Bluetooth: 07/05 Mobile Music Set: 05/05 Fashion Case (FCL-700): as Hydra

The SL75 Hydra M1 milestone is declared according to "QMS Procedure No.: T008-MP Milestone Results in Product Development" (Issue 6 Published: 28. May 2004).

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1.2 General References

The purpose for this chapter is to give the link to needed information with regards to Type Approval for SL75 Hydra.

Top Level Testplan: Explains the needed testareas for a specific product.

Link:

\\AALAFS3\PROJECTS\Project\75G_Hydra\PD_Team\System_Test\ST2\Testplans\Hydra_ST2_Top_Level_Test_Plan.doc

Performance Description: This document explains the GSM testareas thoroughly and into details.

Link: file:\\mchgclv01\data\projekte\ENTWDOKU\I&T_ALG\Milestone_templates\M1\SRS_Template_current.doc

2 General Data

2.1 Design

The SL75 (EMEA/APAC) Hydra is a slider phone with integrated Mpix Camera.
For SL75 there will be one design.

There will be 3 colour concepts consider for Hydra.
One colour concept composed with 3 colours.

1st Colour Variant for Market launch:
Black

2nd Color Variant :
Silver

3'rd Color Variant :
White

It has been agreed that only two tools are produced from the beginning of production.

The Hydra is positioned in the **exclusive** segment aiming at people who are very style conscious, expressive and like to **make a statement**.

They want to be **surprised & delighted**. To **indulge** themselves and to be **admired** by others is key.

They are looking **for highest convenience** through sophisticated technology but do not make any compromise. **Key buying criteria** is owning a desirable design object that spoils their distinctive taste and impresses others.

Hydra is the **style statement** they are looking for and **captivates** them through **luxurious functionality**.

For design issues please contact Ansgar Tröster ICM MP PM PG75

2.2 Key Features Hydra

General

Design:	Elegant design with high quality finishing
Key Features:	Integrated 1.3 Mega Pixel camera/build in LED flash Bluetooth Video decoding & capturing
Display:	132x176 pixel enhanced TFT 256 k colours, normally black

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Applications & Accessories: Photo messaging/album/editor
Attachable flash light

Battery: Lilon Polymer Battery Pack
Nominal Capacity: 700mAh@0.2CA
GSM Capacity: 670mAh

- Normal talk
- Power Input: 2.0 A (0.6 ms) / 0.25 A (0.4 ms)
- Cut-off Threshold 3.2 V

Stand-by Time: up to 290h (Siemens best case approx. 2.3mA quiescent current)

Talk Time: up to 4.7h (=4h 42min) (Siemens best case 143mA average)

SIM Card: Small (= "Plug In") 1.8 V or 3 V-SIM card (Phase II).


Speech Coder: Half Rate, Full Rate, Enhanced Full Rate and Adaptive Multi Rate
speech coders are available as standard.

Temperature Range: -10°C to + 55°C (Normal operation)
-30°C to + 85°C (Storage capability)

Display:

Type	full graphic
Resolution	132 x 176 Pixel
Technology	Enhanced TFT EPSON
No of Colours	256k
Frame Rate	15 frames/sec
Pixel size / mm	0.21mm x 0.21mm (1 pixel consists of 3 sub-pixels in red, green and blue)
Active area / mm	27.72mm x 36.96mm
Illumination	White (4LEDs integrated) Luminance: 190 cd/m ²

Keypad:

- hard capes backside-printed
- 12-key-block (0-9, #, *)
- two function keys (SEND, END)
- ON/OFF key combined with the END key; the symbol  (I inside O) is used as a symbol for ON/OFF.

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- 5 navi-key with design-cap (soft material)
- 2 soft-keys for different SW-enabled functions
- white as illumination colour
- tactile finder on key "5"
- 2 x 4 white LEDs for keypad (main/slider keypad)

Camera:

- 1.3 Mega-Pixel Camera

Multimedia:

- Video recording / encoding

Acoustics:

- Three-in-one-earpiece for handset, handsfree and ringing tones
- omni-directional microphone
- Loud signal emitter (soundringer) (>100dB(A) SPL @5cm, 'Hongkong-Spec.') only for rectangular sound signals (NOT POSSIBLE for all Soundringer melodies)
- Polyphonic ringer tones (parallel to GPRS: 16 voices; all other Use Cases: 32 voices)
- Hands free mode
- different selectable volume levels for handsfree, handset and ringer mode (for the amount see SW product description)

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2.3 Comparison with Previous Products

Feature	IRIS	HYDRA
Supported Systems	Triple Band (EMEA, APAC) GSM900/GSM1800/GSM1900	Triple Band (EMEA, APAC) GSM900/GSM1800/GSM1900
Stand-by Time	SL65: 230h SL66: 120h (DRX2)	Up to 290h (Siemens best case approx. 2.3mA quiescent current)
Talk Time	SL65: 270min SL66: 130min (GSM850 PowerLevel 5 DTX OFF)	Up to 4.7h (Siemens best case 143 mA average)
Battery Technology Battery Capacity	Li-Ion Battery Pack Nominal Cap.: 700 mAh	IRIS Battery pack Nominal capacity 700mAh
Weight	Approx. 85g	TBD
Volume	Approx. 78 cm ³	approx 78cm ³
Length	90,2mm	92mm
Width	47,6mm	48mm
Thickness	20,9mm	23mm
SIM	Plug-In 1.8V/3V	Small (= "Plug In") 1.8 V or 3 V-SIM card (Phase II)
Antenna	Integrated	Integrated
Antenna Performance in comparison	<u>SL65</u> 28,6dBm@900MHz 26,4dBm@1800MHz 25,2dBm@1900MHz	27,5 dBm @ 900 Mhz 25.0 dBm @ 1800 MHz 23.0 dBm @ 1900 MHz
Half Rate	Yes	Yes
Enhanced Full Rate	Yes	Yes
AMR	Yes	Yes
Fax/Data	Yes	Yes
GPRS	Yes (Class 10)	EDGE / Class 10
Keypad Illumination	Yes (white)	2 * 4 White LED's
Display / Display Illumination	TFT 65k colour	Enhanced TFT 256k Color 4 White LED's
Exchangeable Memory	No	No
Camera	Yes (integrated camera)	1.3M Pixel (integrated)
Ringer volume level	- Typ. ≥ 95dB(A) @ 5cm	Typ. 100dB(A) @ 5cm

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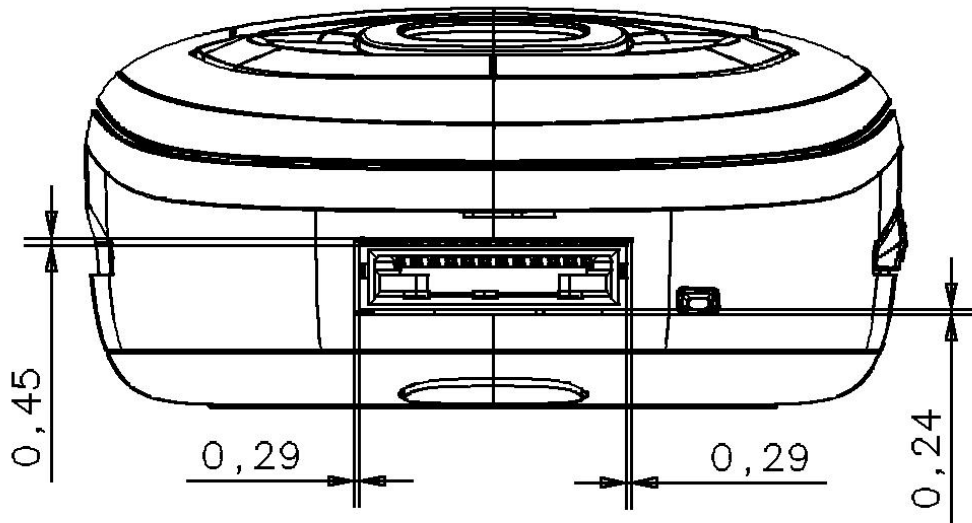
3 Mechanics

3.1 Description

Hydra is a slider devices and the placement of different parts is analog to SL55 and SL65. Hydra is deviate from the former slider devices on two main points slider system and the number of parts. The slider system, which is delivered as one module is made in Magnesium and stainless steel. The slider movement is assisted by 2 springs.

3.2 Accessory interface

Hydra does not have an external coax connection. Further more will the support for the cradles be done by the 3D shape not additional cuts or hulls are introduced. I/O is the standard slim Lumberg known from the 65Generation.



Assembly	Part	SAP no.	SAG no.	N	Supplier
	Slider Cover SL75	A5B00900154511	C39158-A141-B2	1	Oechsler
	Slider Menu Keypad SL75	A5B00900154928	C39158-A141-A600	1	Topbound
Slider As- sembly SL75		A5B00900154502	C39158-A141-A12	1	Lumberg
	Slider Cover Adhesive SL75	A5B00900162091	C39158-A141-B3	1	Lumberg / Oechsler
	Slider Lens SL75	A5B00900162092	C39158-A141-B4	1	Oechsler
	Slider Lens Dustseal SL75	A5B00900167390	C39158-A141-B6	1	Lumberg
	Slider Lens Protection foil SL75	A5B00900162467	C39158-A141-B5		Lumberg
Slider Ring Assembly SL75		A5B00900162093	C39158-A141-A210	1	Oechsler
	Slider Ring SL75	A5B00900154510	C39158-A141-B1	1	Oechsler
	Screw Inserts SL75	A5B00075388573	C39158-A141-C1	4	Oechsler
Guide As- sembly SL75		A5B00900154512	C39158-A141-A30	1	KHVatec
	Guide Case SL75	A5B00900154513	C39158-A141-B10	1	KHVatec
	Guide Frame SL75	A5B00900154514	C39158-A141-B11	1	KHVatec
	Guide Shaft SL75	A5B00900162112	C39158-A141-B12	2	KHVatec
	Guide Spring Bracket SL75	A5B00900167117	C39158-A141-B13	1	KHVatec
	Guide FPC Support SL75	A5B00900167116	C39158-A141-B14	1	KHVatec
	Guide Slider SL75	A5B00900167118	C39158-A141-B15	1	KHVatec
	Guide Spring SL75	A5B00900167119	C39158-A141-B16	2	KHVatec
	Guide Spring Rivert SL75	A5B00900167120	C39158-A141-B17	2	KHVatec
	Guide Bush SL75	A5B00900167221	C39158-A141-B18	4	KHVatec
	Guide Dummy Key SL75	A5B00900162094	C39158-A141-B604	1	KHVatec
	Screw Guide ASM SL75	A5B00075388560	C39158-A141-C2	4	KHVatec
	Magnet/D2,5X1MM	A5B00075014708	V39197-F5014- F708		from Fugu
	Slider Base Ring SL75	A5B00900167222	C39158-A141-B20	1	Oechsler
	ACOU/SPEAKER MODULE (X75- HYDRA)	A5B00075411409	C39212-Z3-C56	1	Hosiden
	Displaymodule SL75 AM132X176DOTS 262K Col	A5B00075342094	V24851-Z1508- A115	1	Epson
	MMI Board Slider Menu SL75	A5B00900162455	S30880-Q3321-A2	1	

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	Slider Menu Keypad MDF SL75	A5B00900161923	C39158-A141-B603	1	Topbound
	FPC Slider SL75	A5B00075342733	S30880-Q3300-F1	1	
	Screw Slider ASM M1,6*3,0 SL75	A5B00075388561	C39158-A141-C3	4	Lumberg
	Base Assembly Colour 1 SL75	A5B00900154515	C39158-A141-A200	1	Lumberg
	Base Frame SL75	A5B00900154516	C39158-A141-B200	1	Oechsler
	Base Antenna SL75	A5B00900154518	C39158-A141-B800	1	Lumberg
	Base BT Antenna SL75	A5B00900154519	C39158-A141-B801	1	Lumberg
	Base Sidekey Button Left SL75	A5B00900154936	C39158-A141-B750	1	Silitech
	Base Sidekey Button Right SL75	A5B00900154953	C39158-A141-B760	1	Silitech
	Switch Side key 5PollG X75	A5B00075427147	C39315-Z77-C255	2	ITT
	Base Flash Reflector SL75	A5B00900154957	C39158-A141-B910	1	Lumberg / Oechsler
	Vi- bramotor/11MM*4MM/CW/R3MM*L4M M	A5B00075040075	C39453-Z5-C251	1	fra Ulysses
	ACO/Microphone KUR0023-018 4mm	A5B00075098861	C39254-Z6-C104	1	fra Hera
	Base Colour 1 Ring SL75	A5B00900154520	C39158-A141-B220	1	Oechsler
	Base Keypad SL75	A5B00900154929	C39158-A141-A700	1	Topbound
	Camera-Modul R65 1.3 Mega-Pixel Color	A5B00075238663	C39453-Z5-C291	1	
	PCB Main	A5B00900146549	S30880-Q3300-A2	1	AT&S
	Shielding RF Compl. X75M	A5B00075238344	C39158-A131-A900	1	Härter
	Shield RF Cover X75M	A5B00900162097	C39158-A131- C150	1	Härter
	Shield BT Complete X75	A5B00075338646	C39158-A141-A951	1	Styner & Bi- enz
	Shield BT Cover X75	A5B00900154530	C39158-A141-B951	1	Styner & Bi- enz
	Shield BB Complete SL75	A5B00075338647	C39158-A141-A952	1	Styner & Bi- enz
	Shield BB Cover SL75	A5B00900154531	C39158-A141-B952	1	Styner & Bi- enz
	Shield PMG Complete SL75	A5B00075338648	C39158-A141-A953	1	Styner & Bi- enz
	Shield PMG Cover SL75	A5B00900154533	C39158-A141-B953	1	Styner & Bi- enz
	Connector/SIM Card Reader/X75	A5B00075371286	C39334-Z97-C407	1	Lumberg
	Base Keypad MDF SL75	A5B00900161929	C39158-A141-B703		Topbound
	Screw Base Asm SL75	A5B00075388572	C39158-A141-C4	4	./.
Battery Lid		A5B00900154522	C39158-A141-A500	1	Oechsler

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Assembly SL75					
	Battery Lid Colour Ring SL75	A5B00900154523	C39158-A141-B500	1	Oechsler
	Battery Lid Button SL75	A5B00900154524	C39158-A141-B501	1	Oechsler
	Battery Lid Mirror SL75	A5B00900154525	C39158-A141-B502	1	Oechsler

Assembly	Part	Part-Nr.	N o	Supplier
Slider assembly SL75		C39158-A141-B603	1	Lumberg
	Acou/speaker Module	C39212-Z3-C56	1	Hosiden
	Slider lens	C39158-A141-B4-1	1	Oechsler
	Display module	V24851-Z1508-A115		Epson
	FPC Slider	S30880-Q3300-F1-1	1	TBD
	Guide Assembly	C39158-A141-A30-3	1	KH Vatec
	Slider Base Ring	C39158-A141-B20-1	1	Oechsler
	Slider Ring Assembly	C39158-A141-A210-2	1	Oechsler
	MMI Board Slider Menu	S30880-Q3321-A2-2		Siemens (Multic, Chin Poon)
Base Assembly SL75			1	Lumberg
	Base Side Key Button Left	C39158-A141-B750-1	1	Lumberg
	Base Side Key Button Right	C39158-A141-B760-1	1	Lumberg
	Base Colour Ring	C39158-A141-A200-3	1	Oechsler
	Base Frame	C39158-A141-B200-1	1	Oechsler
	Base BT Antenna SL75	C39158-A141-B801-1	1	Lumberg
	Base Antenna	C39158-A141-B800-1	1	Lumberg
	Vibra motor	C39453-Z5-C251	1	Shicoh/Nidec
	Microphone	C39254-Z6-C104	1	Bujeon/Hosiden
Battery cover	Battery Lid Assembly SL75	C39158-A141-A500-2	1	Lumberg

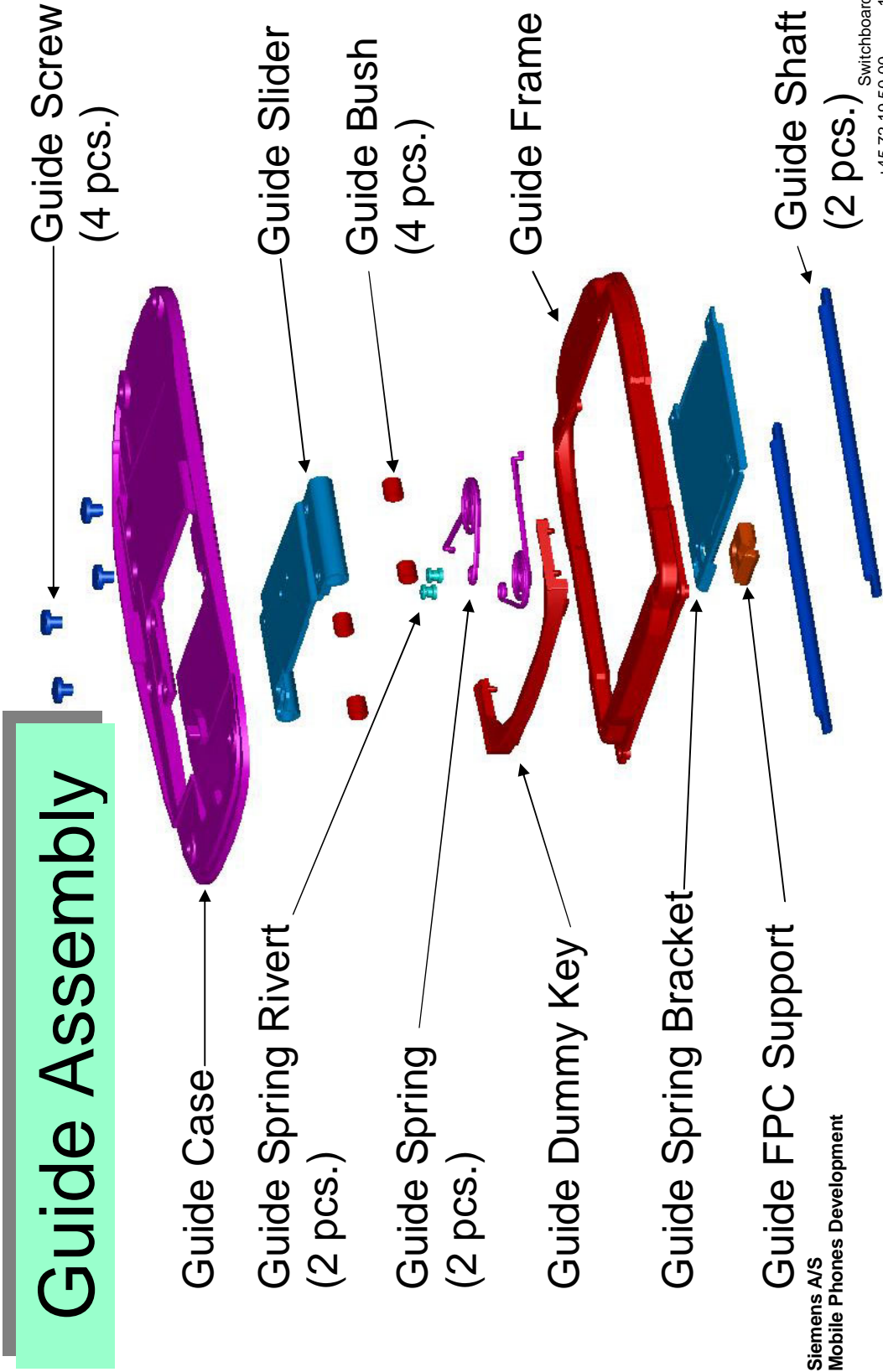
	Base keypad	C39158-A141-B703-1	1	Topbound/Silitec
	Slider Menu keypad	C39158-A141-B603	1	Topbound/Silitec
	Shielding RF	C39158-A113-A900	1	Härter
	Shielding BB	C39158-A123-A910	1	Styner&Binz
	Shielding bluetooth	C39158-A123-A915	1	Styner&Binz
	Shielding PMG	C39158-A117-C210	1	Styner&Binz
	SIM reader	C39334-Z97-C407	1	Lumberg/Molex
	Board to Board Connector	V39197-F5004-F505	1	Molex
	Battery connector	C39334-Z97-C213	1	FCI/Lumberg
	Antenna connector	C39334-Z97-C334	1	Hirose
	I/O connector	C39334-Z93-C303	1	Lumberg
	Camera socket	C39334-Z97-C379	1	APLS/SMK
	Main-PCB		1	TBD
	Camera module	C39453-Z5-C301	1	Samsung/Toshiba
	Battery pack	V30145-K1310-X229-1	1	Sony/Samsung

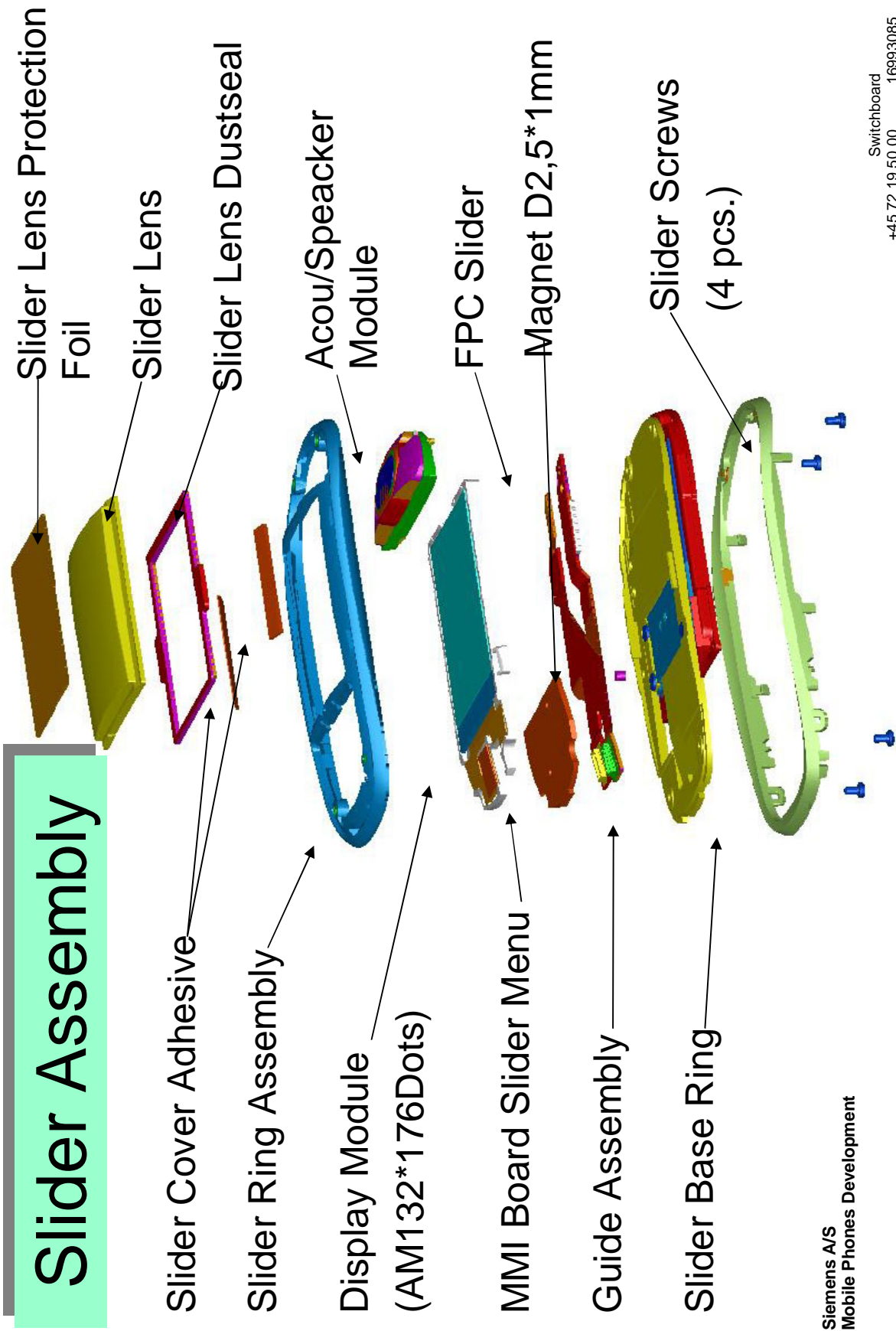
3.3 Housing

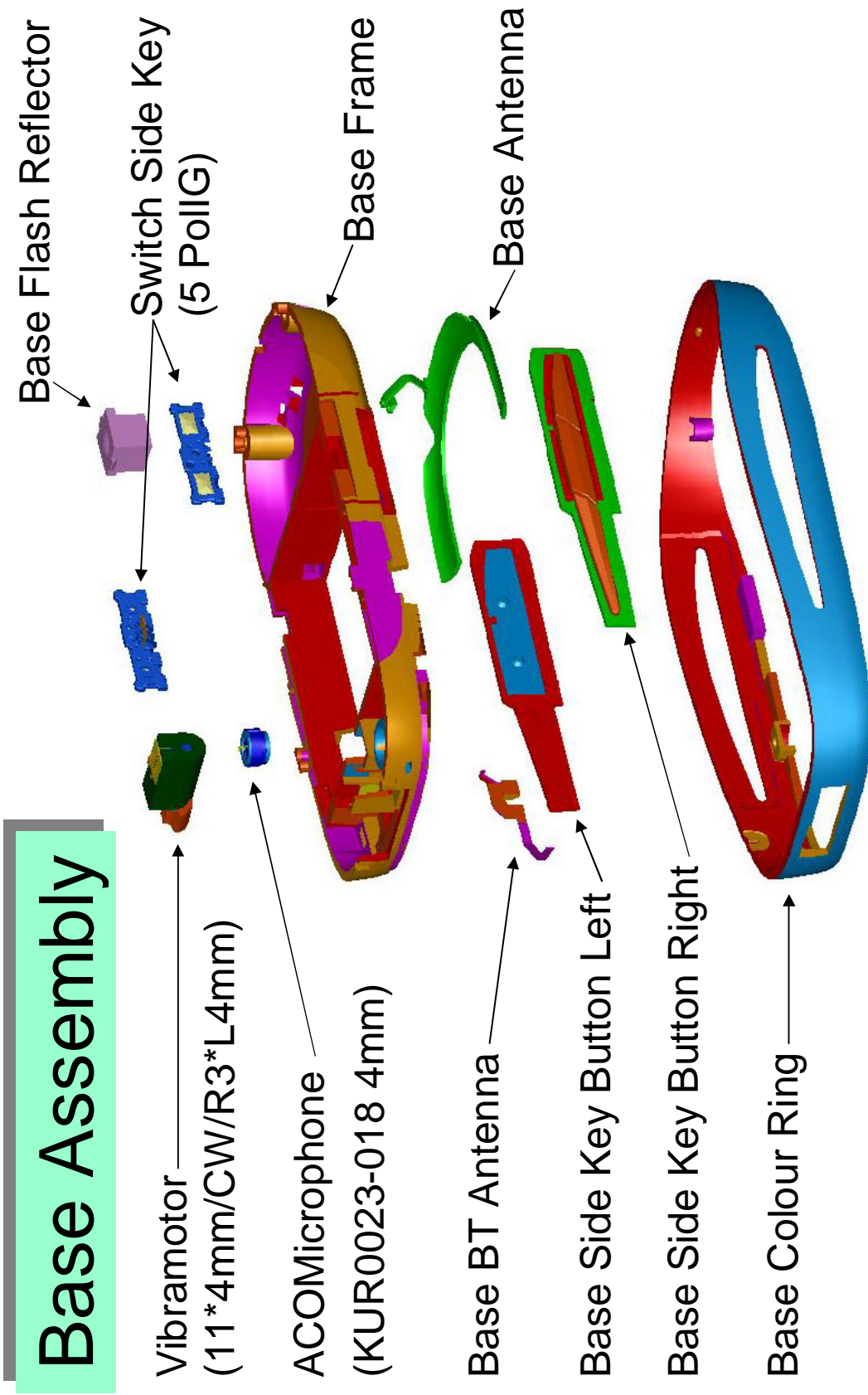
Partname:	Material	Surface	Surfaces Finish
Slider Base Ring	PC/ABS Bayblend T45	EDM Class 20	Electroplated part
Base Frame	PC/ABS Bayblend T65 or T85 Alternatively ULTEM	EDM Class 20	
Base Color Ring	PC/ABS Bayblend T65 or T85	EDM Class 20	Painted
Battery Lid Color Ring	PC/ABS Bayblend T65 or T85	EDM Class 20	Painted
Battery Lid Mirror	PMMA Röhm 8N / PC/ABS Bayblend T65 or T85	Polished	IMD
Battery Lid Button	PC/ABS Bayblend T65 or T85	EDM Class 20	Painted
Slider Ring	PC/ABS Bayblend T45	EDM Class 20	Electroplated part
Slider Cover	PC/ABS Bayblend T65 or T85	EDM Class 20	Painted
Slider Lens	PMMA Röhm 8N	Polished	IMD
Slider Lens Alternative	PMMA Röhm 8N	Polished	IMD. Different Core from the original.
Base Flash Reflector	PMMA	Polished	Possible Electroplated
NEW PART FOR BATTERY LID MIRROR	PMMA Röhm 8N / PC/ABS Bayblend T65 or T85	Polished	Polished if it is a optical part
Guide Assembly (Guide case)	Magnesium		Painted or Electroplated
Basekeypad			Painted
Slider keypad			Painted
Side keys			Electroplated Fallback solution painted.

The Slider Cover, Battery Lid Button, Battery Lid Colour Ring, Base Colour Ring forms the parts which is used to make the colour variants. These will be Black, White and silver.

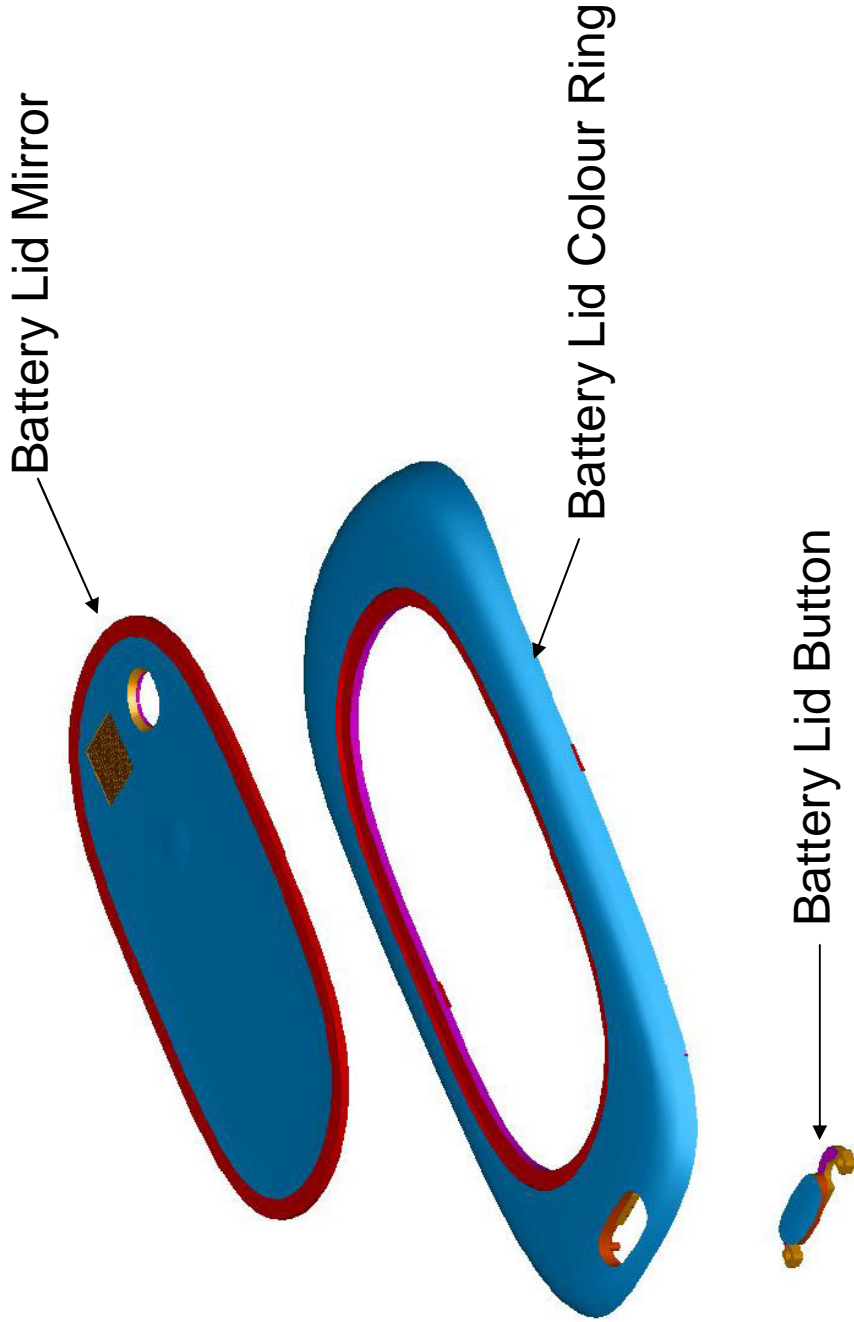
Assembly drawing SL 75 Hydra

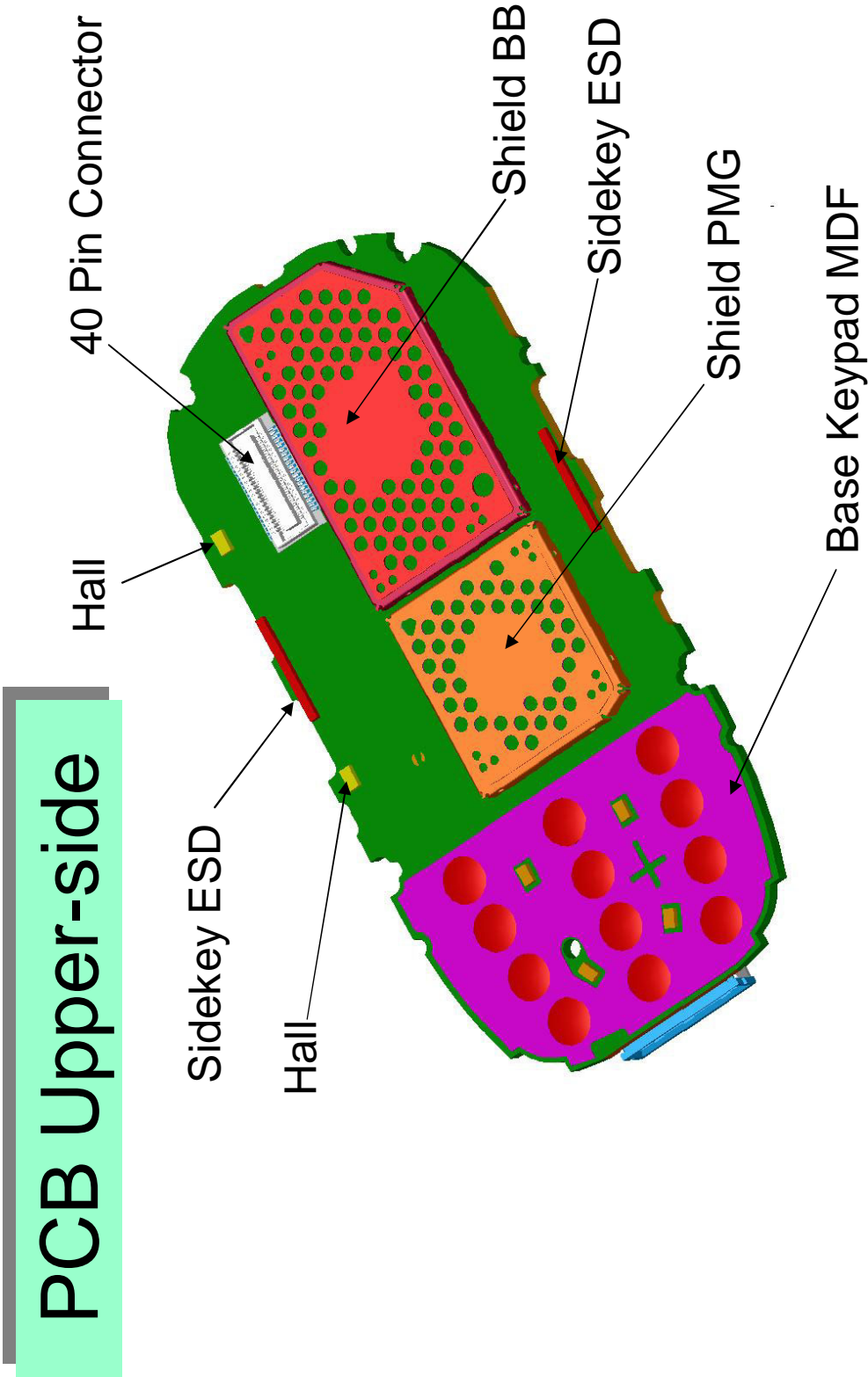


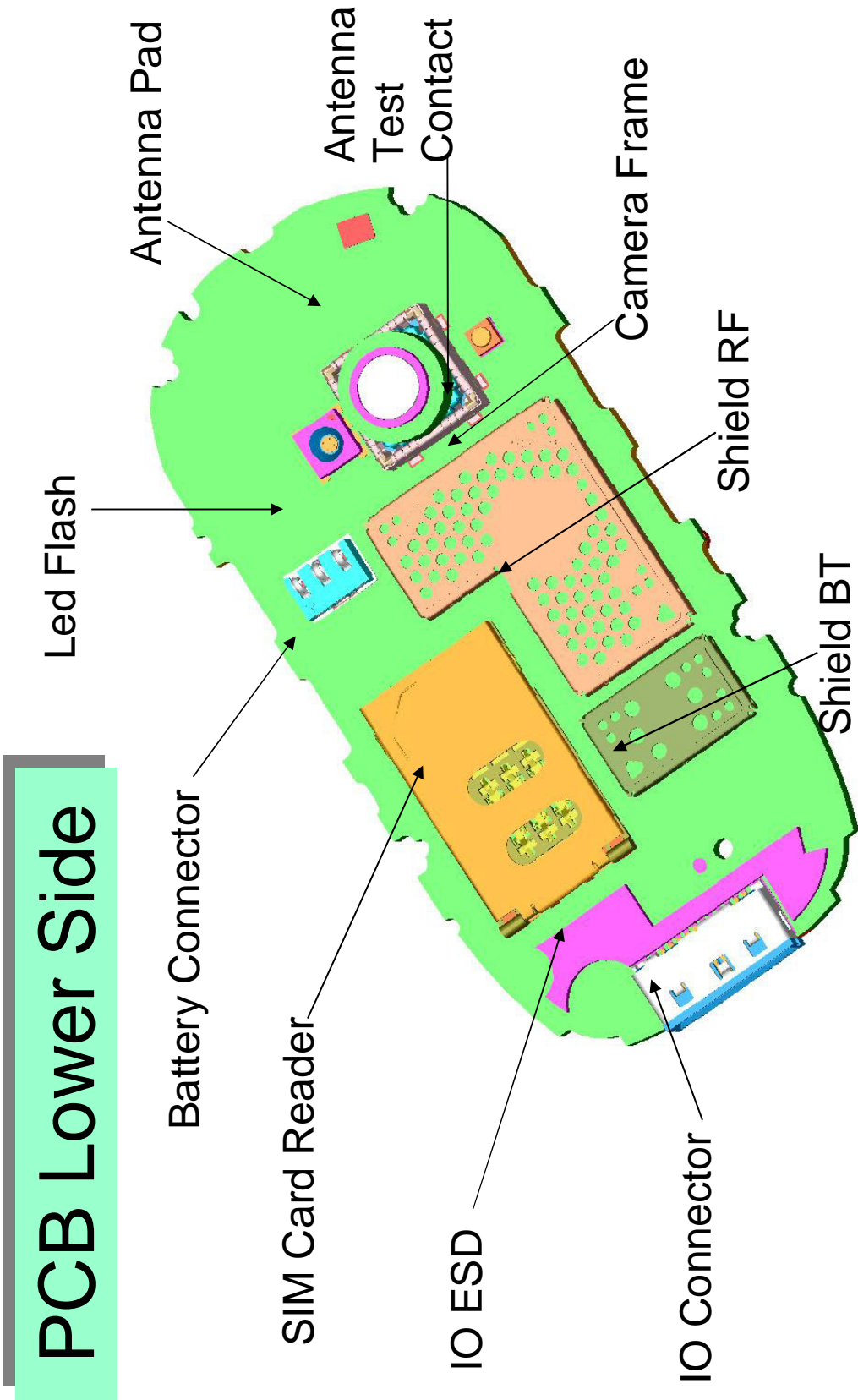


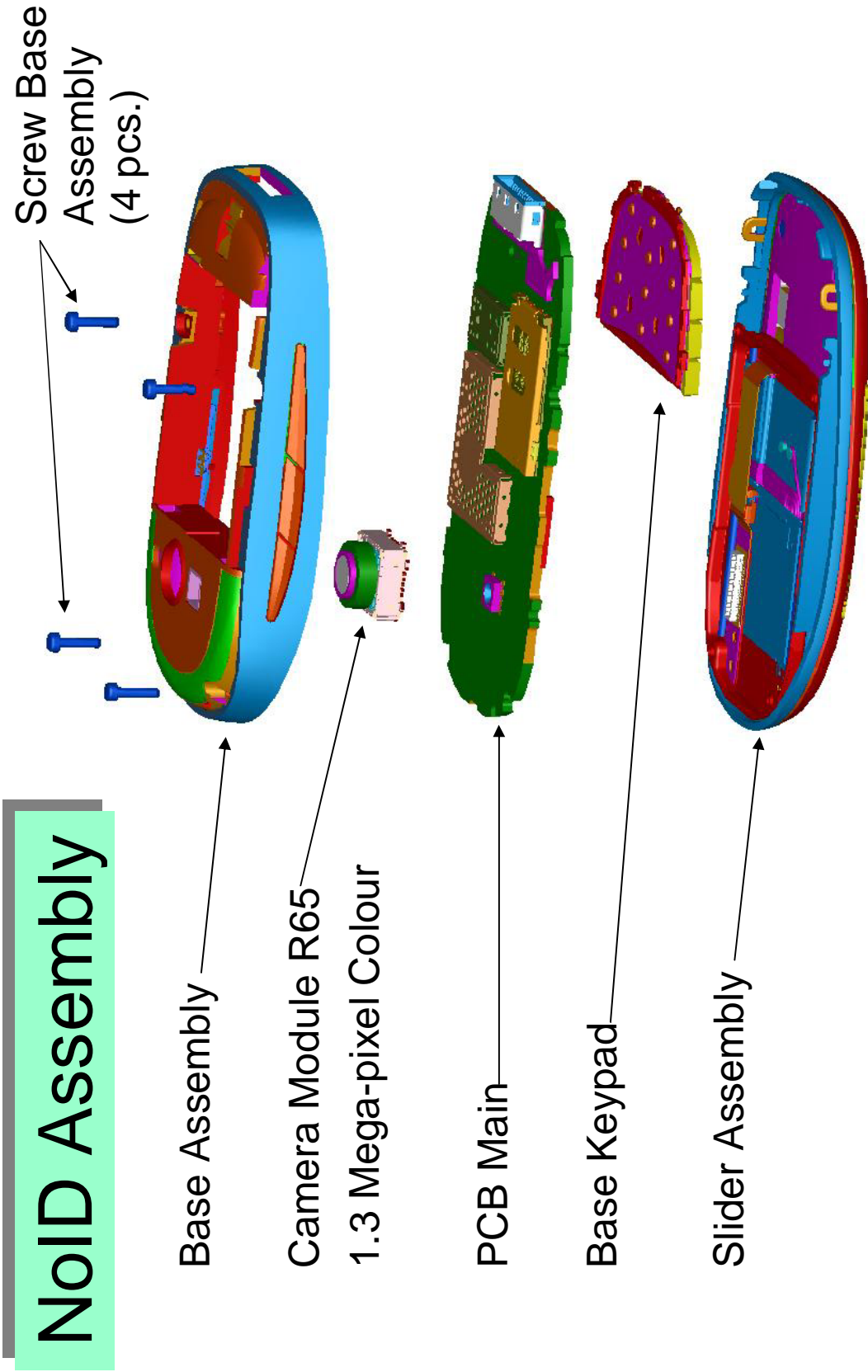


Battery Assembly









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4 Electronic

4.1 Radio part

The radio part realizes the conversion of the GMSK/8PSK RF-signals from the antenna to the baseband and vice versa. In the receiving direction, the signals are split in the I- and Q-component and led to the A/D-converter of the logic part. In the transmission direction, the baseband section generates the GMSK/8PSK signals digitally. After D/A conversion the analogue signals are fed into an IQ modulator and up-converted to radio frequencies by the polar loop system. After that the signals are amplified in the power amplifier.

Transmitter and Receiver are never active at the same time. Therefore full duplex operation is not possible. However the monitoring band (monitoring timeslot) in the TDMA-frame can be chosen independently of the receiving respectively the transmitting band (RX- and TX timeslot of the band).

The RF part is dimensioned for triple band operation in the frequency ranges EGSM900/DCS1800/PCS1900 supporting EGPRS functionality up to multi-class 10.

As depicted in the table, there is only one solution implemented.

RENESAS (single solution)					
Renesas Bright 5PL chip set (HD155153NP)					
<ul style="list-style-type: none"> • PLL for local oscillator LO1 and LO2 and TXVCO • Integrated local oscillators LO1, LO2 (without loop filter) • Integrated TXVCO (without loop filter and core inductors for GSM) • Direct conversion receiver including LNA, DC-mixer, channel filtering and PGC-amplifier • Active part of 26 MHz reference oscillator • Integrated Polar Loop, phase and amplitude control of transmitted output power 					
Renesas LTCC transmit PA PF09026B (incl. integrated power control circuitry for GMSK mode)					
Hitachi Front-end Module					
HWXQ411 including RX-/TX-switch and EGSM900 / DCS1800 / PCS 1900 receiver SAW-filters					
Crystal and passive circuitry of the 26MHz VCXO reference oscillator					

4.1.1 Compliance

The RF part is compliant to **GSM 11.10-1 release 1999 version 8.30**. The transmitter output power is compliant to following power classes:

GMSK mode			8PSK mode		
EGSM900	GSM1800	GSM1900	EGSM900	GSM1800	GSM1900
Power class 4	Power class 1	Power class 1	Power class E2	Power class E2	Power class E2

4.1.2 Renesas Bright 5PL chipset (HD155153NP)

4.1.2.1 First local oscillator (~3.6GHz)

The first local oscillator (LO1) consists of a PLL and VCO inside Bright 5PL and an external loop filter.

4.1.2.2 RF-PLL

The minimum frequency step is 400 kHz in DCS1800/PCS1900 bands and 800kHz in EGSM900 band due to the internal divider by two for DCS1800/PCS1900 and divider by four for EGSM900. The PLL is controlled by the internal state machine.

4.1.2.3 RFVCO (LO1)

The full oscillation range is divided into 16 sub bands and covers 3476 to 3980MHz. The Bright state machine controls the choice of the appropriate band and the complete operation internally.

4.1.2.4 Second local oscillator (~640MHz)

The second local oscillator (LO2) consists of a PLL and VCO that are integrated in Bright 5PL and a second order loop filter that is realized external. Due to the direct conversion receiver architecture, the LO2 is only required for transmit operation. To avoid in-band spurious in the transmit signal the TX IF frequency is not fixed for the whole band. The LO2 covers a frequency range from 640 to 656MHz.

Before the LO2 signal enters the modulator it is divided by 8. So the resulting TX IF frequencies are 80/82 MHz. The Bright internal state machine controls the complete LO2 operation.

4.1.2.5 Receiver

The Bright 5PL incorporates three RF LNAs for EGSM900, DCS1800 and PCS1900 operation followed by direct conversion mixers that are IQ demodulators. The LNA/mixer can be switched in normal-, low- and lower-gain mode. For the "normal gain" state the mixers are optimised in terms of conversion gain and noise figure, in the "low gain" state the mixers are optimised for large-signal behaviour for operation at a high input power levels. The "lower gain mode" reduces the RF-level by activating a differential impedance in front of the LNA to improve the large signal performance.

Furthermore the IC includes a programmable gain baseband amplifier PGA (90dB control range, 2dB steps) with automatic DC offset calibration. The channel filtering is realized inside the chip with a four stage baseband filter for both IQ chains. Only two capacitors which are part of the first passive RC-filters are external. The second, third and fourth filters are active filters and are fully integrated. The distributed channel filter is necessary to suppress adjacent channel and inband-blocking interferer to avoid any compression in each amplifier stage.

The down-converted IQ signals are fed into the A/D converters inside the SGOLD2. A special algorithm keeps the level of the IQ signals constant on a defined level by varying the PGA gain and selecting the appropriate LNA gains.

4.1.2.6 Transmitter

Polar Loop

The generation of the modulated RF signal in Bright 5PL is based on the principle of the polar loop architecture. The IQ signals generated by the SGOLD2 baseband are modulated to the transmit IF

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frequency of 80MHz or 82MHz by an IQ modulator. The required carrier frequency is provided by the LO2.

As in a conventional up-conversion loop the IF signal is up-converted to the transmit frequency. Therefore a down-converter and a phase detector are used in order to compare the IF signal to the down-converted transmit signal. This loop is called PM loop and is used for GMSK operation.

In 8PSK mode the 80MHz or 82MHz IF signal is split into PM and AM components. A second loop is then used to control the AM components. Therefore an AM detector is implemented which compares the 80MHz or 82MHz IF signal and the down-converted transmit signal. The AM loop is also used for power ramping. Inside the AM loop there are two analogue gain controlled amplifiers. These are used for setting the output power level and to keep the loop bandwidth constant.

The separated AM and PM components of an 8PSK signal are finally fit together inside the PA. The PA is driven by the TXVCO signals containing the PM components. The AM component is added by an amplitude control input pin, which controls the supply voltage of the RF transistors and therefore the PA output power level.

TXVCO

The TXVCO is integrated inside Bright 5PL. It consists of 16 VCO bands for EGSM900 and 16 bands for DCS1800/PCS1900. Two independent output buffers, one for each band, deliver the output signal to the PA module input. The choice of the appropriate band is done automatically and controlled by the internal state machine.

4.1.3 Renesas LTCC transmitter power amplifier PF09026B

4.1.3.1 PA Module

The power amplifier is a LTCC (Alumina-oxyd-ceramic) PA module from Renesas, matched to 50 Ω at all signal ports. It contains two separate 3-stage amplifier chains for EGSM900 and DCS1800/PCS1900 operation. It is possible to control the output power level of both bands via one VRAMP port. The appropriate amplifier chain is activated by a logic signal, which is provided by the SGOLD2 (RF_BAND_SW). The module is switched on by a control signal generated by the B5PL internal state machine. The RF transistor bias voltage is generated inside the PA module. The PA module consist also of two additional directional coupler to provide the needed RF feed-back signal for the AM control in 8PSK Mode.

4.1.3.1.1 Power control

In GMSK operation the output power is directly controlled by a control voltage coming from SGOLD2. This voltage is fed through B5PL and connected to the PA module (VRAMP). The 3GPP specification can be fulfilled without power sensing or any type of feedback.

In 8PSK operation the AM loop controls the output power level. Therefore the same SGOLD2 signal is used but connected to the variable gain amplifiers inside B5PL. The AM control voltage finally controls the PA module (VRAMP). The B5PL internal state machine controls all switching between GMSK and 8PSK modes.

4.1.3.2 Hitachi Front-end Module (FEM)

The FEM includes the RX/TX- and bandswitch function based on a combined PIN diode and diplexer-circuit. In the transmit paths a harmonic filtering for EGSM900 and DCS1800/PCS1900 is realized to avoid additional discrete filters. The isolation in TX OFF mode is used to achieve the isolation, which is necessary before the active part of the burst. Two lines from the baseband control the band-selection of the TX switches. The three receiver chains include SAW filter for EGSM900, DCS1800 and PCS1900 to protect the receivers from strong blocking signals according

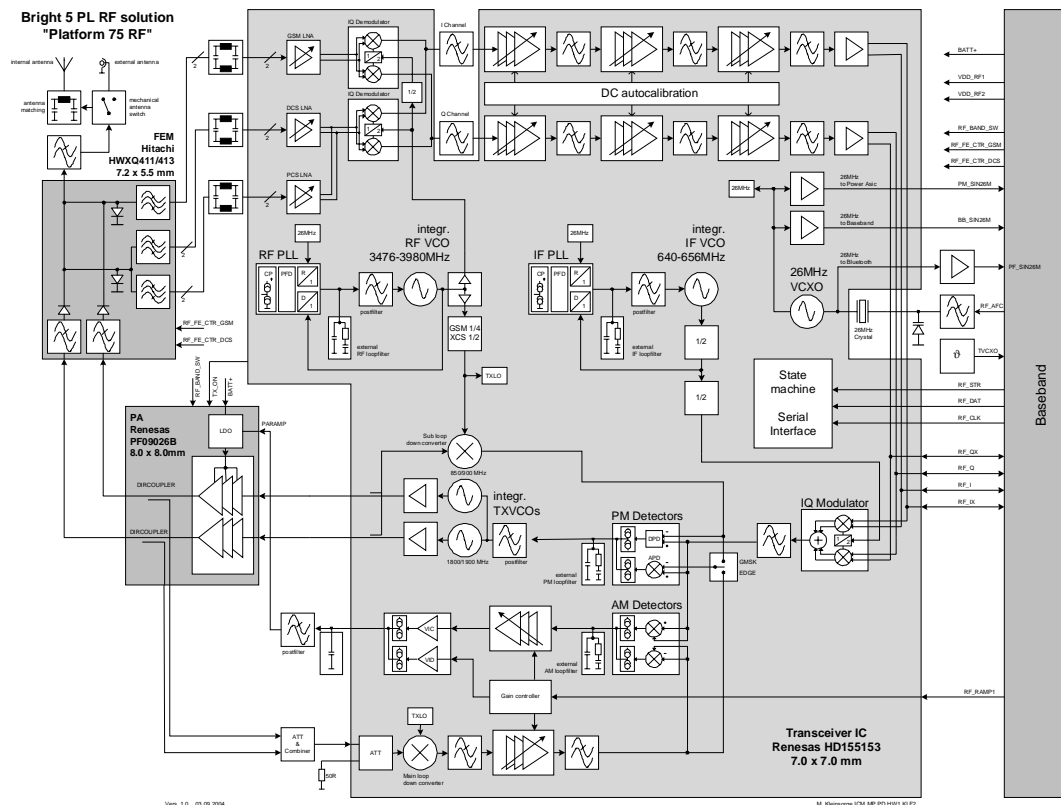
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to the 3GPP specification. To provide symmetrical signals with good balance to the receiver, a discrete balun is used for each band inside the module.

4.1.3.3 Discrete 26MHz VCXO reference oscillator

The 26 MHz signal is created by a discrete VCXO. A Colpitts oscillator is used with a post-connected buffer stage. The active part (cascode circuit of the VCXO and the buffer) is realized within the Bright. For temperature measurements of the VCXO a temperature sensor is used. The frequency of the reference oscillator can be fine tuned by the baseband via a filtered PNM modulated AFC signal. Two active buffer stages are included in Bright 5PL to provide clock signals for the baseband IC and the PMU. An additional external buffer is used to deliver a 26MHz clock signal to the Bluetooth circuitry.

The functional block diagram shows the Renesas RF solution



RFM1_Product_Description_X75_Minors_Bluetooth_040910.doc

4.2 Digital Hardware and Electro Acoustic

The following figure gives an overview about all digital and electro acoustic parts. In the next sections there are a detailed description of each block. The focus points are the use in Hydra and not design documentation.

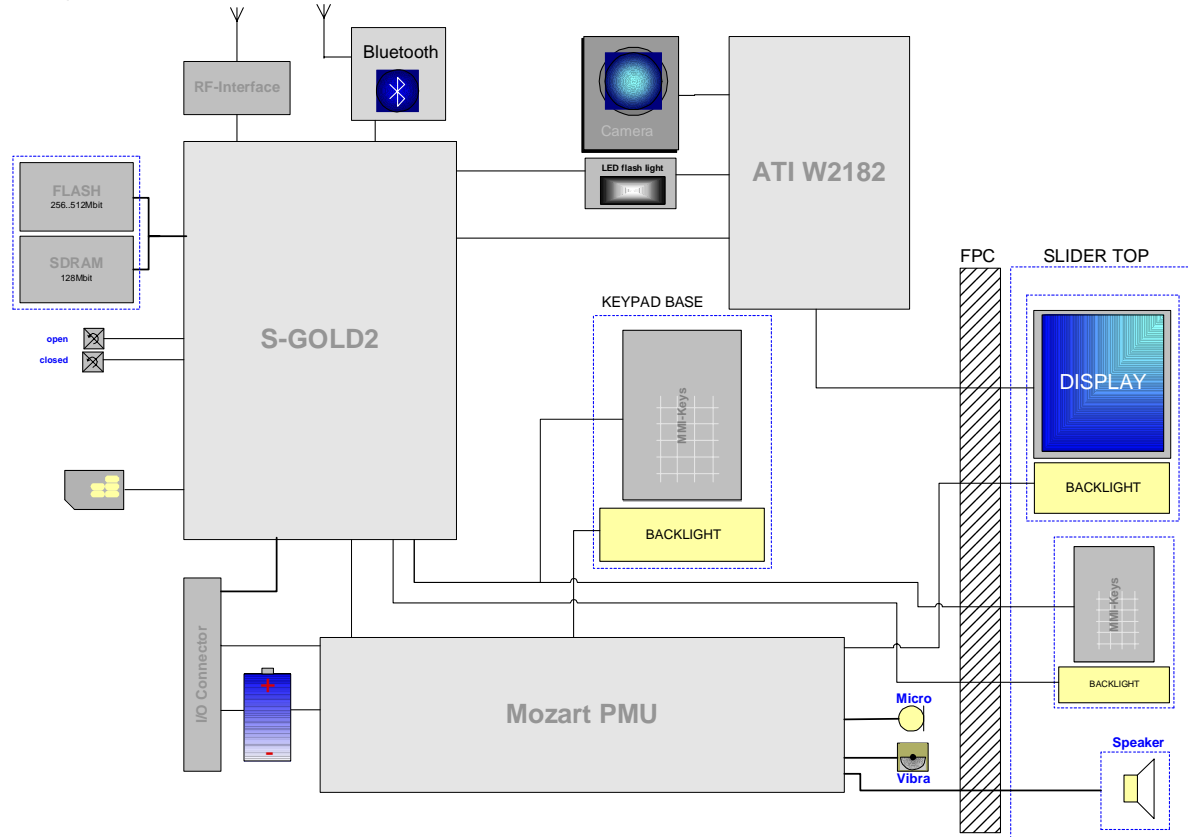


Figure 1 Hydra block diagram

4.2.1 Part Overview

In the table below is shown the used parts in Hydra. The majority of the parts are Platform components marked by a P in brackets (P).

Component	1 st Supplier	2 nd /3 rd Supplier	Notes
Baseband			
S-GOLD2 (P)	Infineon (PMB8876)		No 2 nd source SG-LF2BGA-293 housing (10mm x 10mm, 0.5mm Pitch)
Memory			
FLASH / SDRAM (P)	Intel PF38F4460LVYTB0	AMD S99-50011 Samsung KAS230009M	2 x 256MBit Flash + 128MBit SDRAM stacked device
Power Management Unit			
PMU ASIC (P)	Dialog Semiconductor (Mozart ED)	ST Microelectronic (Twigo4+)	
Camera			

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Component	1 st Supplier	2 nd /3 rd Supplier	Notes
Camera (P)	Premier	SEMCO Toshiba	1.3 Mpixel
Display			
Enhanced TFT display	Epson		Pluto display only used in Hydra
Controller	Epson (F17)	N/A	
Hall Sensor			
Omnipolar hall sensor	Samsung SH248CSP	Toshiba	2 nd source under evaluation
Gimmick Chip			
ATI W2182	ATI		
Vibra			
Vibra-Motor	Shicoh	Copal	Same motor as CX65 (Ulysses)
Speaker			
Speaker module	Hosiden		Back volume 0.8 cm ³
Battery			
Li-Ion 4,2V/670mAh	Sony	Samsung	670 mAh with GSM load, 700 mAh at 0.2C discharge. Iris battery package

Description for each dHW block below is taken from the Platform description, which you can find by pressing the link below. The descriptions are shortened to contain only description and not design documentation. For additional information have a look:

\\MCHGCLV01\data\projekte\PROJ\X75_Platform\X75_General_Platform\PE-Teams\Digital_Hardware\X75_HW_Description

4.2.2 Baseband

The S-GOLD2 is the successor of the SGOLDlite and will be used as the base band solution for low to mid range phones as well as wireless modules.

It will use the ARM 926EJ-S core at 156MHz (208MHz are feasible but will for the moment not be specified for ICM), which is expected to give sufficient performance to the X75 series. A MOVE Copro will be attached. Furthermore the Teaklite DSP will run with up to 138,67 MHz.

Interfaces: USB full speed (12Mbit/s), Bluetooth (medium data rate), Fast IrDa, USIF, prepared for A-GPS, prepared for W-LAN, I2C high speed

Gimmick chip interface

Multimedia capabilities: 1,3 MPixel camera support;

Display interface (up to 176 x 220pxl @ 15fps); 256k color

SGOLD2 features:

Supported Standards

- EGPRS class 12 MCS 1..9
- GSM speech FR, HR, EFR and AMR-NB
- GSM data 2.4kbit/s, 4.8kbit/s, 9.6kbits, and 14.4kbit/s
- HSCSD class 10
- GPRS class 12 CS 1..4

Processing cores

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- ARM926EJ-S 32 bit processor core with operating frequency up to 156 MHz for controller functions. The ARM926EJ-S includes an MMU, and the Jazelle Java extension for Java acceleration.
- TEAKLite® DSP core with operating frequency 138.67 MHz.

Functional Hardware blocks

- CPU and DSP Timers
- Programmable PLL with additional phase shifters for system clock generation
- GSM Timer Module that off-loads the CPU from radio channel timing
- GMSK Modulator according to GSM-standard 05.04 (5/2000)
 - GMSK Modulator: gauss-filter with $B \cdot T = 0.3$
- Hardware accelerators for equalizer and channel decoding
- A5/1, A5/2, A5/3 Cipher Unit
(A5/3 added in S-GOLDlite™ V1.1)
- GEA1, GEA2, GEA3 Cipher Unit to support GPRS data transmission
(GEA3 added in S-GOLDlite™ V1.1)
- Advanced static and dynamic power management features including TDMA-Frame synchronous low-power mode and enhanced CPU modes (idle and sleep modes)
- Incremental Redundancy Memory for EDGE class 12 support
- GMSK / 8-PSK Modulator according to GSM-standard 05.04 (5/2000)
 - GMSK Modulator: gauss-filter with $B \cdot T = 0.3$
 - EDGE Modulator: 8PSK-modulation with linearised GMSK-pulse-filter
- MOVE coprocessor performing motion estimation for video encoding algorithms
(H.263, MPEG-4)

4.2.3 Memory

The memory in Hydra (and all other SGOLD2 Platform products) is a three die stacked device with one Flash for code, one Flash for data and one LP-SDRAM as main memory. The densities are 256Mbit + 256Mbit + 128Mbit.

All memories are sharing the EBU_AHB- BUS to SGold2¹.

Code Flash:

The Code Flash is a non-volatile-, re-programmable- memory (SW-updateable), with a high performance interface. The mobile-SW can be executed directly (XIP- execute in place). The Flash has an unchangeable serial number.

Intel Tyax (L18):

Memory Size:	256 Mbit (32 MByte)
Data Bus:	16 Bit
IO / Core Voltage Supply:	typical 1.8V

¹ The X75 Products that are related to the R65 Platform still have a SGOLD2 and the Memory configurations are 256Mbit Code Flash stacked with 128Mbit LP-SDRAM

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Boot Block:	top
Access Time:	85 ns
- Asynchronous (Initial) Mode:	54 MHz / 14ns clock to data output
- Synchronous Burst Mode:	Support 4-, 8-, 16-, or continuous-burst-read
Architecture:	16 partitions
	- 1 st 4 x 16Kword + 15 x 64Kword blocks
	- 2-16 16 x 64Kword blocks
Dual Operations:	Read while Write (RWW) or Read while Erase (RWE)
Program Feature:	Single Word and Buffer Programming

AMD WS256N:

Memory Size:	256 Mbit (32 MByte)
Data Bus:	16 Bit
IO / Core Voltage Supply:	typ. 1.8V
Boot Block:	Top + Bottom
Access Time:	70 ns
- Asynchronous (Initial) Mode:	54 MHz / 14ns clock to data output
- Synchronous Burst Mode:	16 partitions (banks)
Architecture:	- 1 st 4 x 16Kword + 15 x 64Kword blocks (sector)
	- 2-16 16 x 64Kword blocks
Dual Operations:	Read while Write (RWW) or Read while Erase (RWE)
Program Feature:	Single Word and Buffer Programming

Samsung:

Memory Size:	256 Mbit (32Mbyte)
Data Bus:	16 bit
I/O Core voltage supply	typ. 1,8V
Boot Block	top
Access Time:	90 ns
-Asynchronous (Initial) Mode:	54 MHz, 14.5ns clock to data output
-Synchronous Burst Mode:	16 partitions (banks)
Architecture:	-1 st 8 x 4Kword + 31 x 32Kword
	-2-16 32 x 32Kword blocks
Dual Operations:	Read while Write (RWW) or Read while Erase (RWE)
Program feature:	Accelerated program mode

Data Flash:

The Data Flash is a Non-volatile re-programmable- memory for saving user data (pictures, sounds, videos etc.)

Intel Data Core I (V18):

Memory Size:	256 Mbit (32 MByte)
Data Bus:	16 Bit
IO / Core Voltage Supply:	typical 1.8V
Boot Block:	Top
Access Time:	170 ns access time
- Asynchronous (Initial) Mode:	55ns access time
- Asynchronous Page Mode:	4 word- page
Architecture:	Single partition
	- 4 x 16Kword and 255 x 64Kword blocks
Program Feature:	Single Word and Buffer Programming

AMD RS256N:

Memory Size:	256 Mbit (32 MByte)
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Data Bus:	16 Bit
IO / Core Voltage Supply:	typ. 1.8V
Boot Block:	n.a.
Access Time:	
- Asynchronous (Initial) Mode:	143 ns access time
- Synchronous Burst Mode:	54 MHz / 13.5 ns clock to data output Support , 8-, 16-, 32-, or continuous-burst-read
- Synchronous Latency:	148 ns
Architecture:	Single partition (bank) - 64 x 256Kword blocks (sectors)
Program Feature:	Single Word and Buffer Programming
Accelerate Programming (VPP = 9.0 V)	

Samsung: (same as code flash)

Low Power SDRAM:

The SDRAM (Synchronic Dynamic Random Access Memory) is for volatile data. Since the SDRAM is stacked with the FLASH the supplier will be the same as for the FLASH. In case of Intel we do not know who manufactures the SDRAM in the package.

Memory Size:	128 Mbit (16 MByte)
Data Bus:	16Bit
IO / Core Voltage Supply:	typical 1.8 V
Synchronous Burst Mode:	105MHz (CL=3) Burst
Features :	Four banks operation / Burst read single bit write operation / Auto refresh

4.2.4 Gimmick Chip

ATI W2182 is the multimedia solution supporting still picture shooting up to 2 Mpixel, video encoding/decoding, advanced audio codec and Real Video including display and camera interface. This solution is used on all SGOLD2 products.

Gimmick Chip ATI W2182 Features:

JPEG Full Encoder and Decode Acceleration

- fDCT / iDCT engine (iDCT for JPEG decode only)
- Quantization and variable length encode
- Produces CCITT T.81 compliant baseline sequential JPEG scan
- Supports ISO/IEC IS 10918-1 progressive DCT (Mode 2)
- Encode up to 2.0 Mpix images
- Single shot encoder of incoming video

MPEG-4 Decoder

- Full decoder, stand-alone with no host interaction required once configured.
- Accepts elementary stream input from the host, and displays decoded data in the overlay window on display.
- Full compliance with ISO/IEC14496-2 video simple profile levels L0-L3, H.263 baseline , and H.263 Profile 3 level 10
 - Supports QCIF resolution MPEG-4 decode at 15fps

MPEG-4 Encoder

- Full encoder, stand-alone with no host interaction required once configured.

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Generates elementary stream for consumption by the host from the video capture port.

- Full compliance with ISO/IEC14496-2 video simple profile levels L0-L3 and H.263 baseline and H.263 Profile 3 level 10
- Supports QCIF resolution MPEG-4 encode at 15fps

Advanced 2D Graphics

- BitBLT, ROP3 and ROP4
- DrawLine, Sprites
- Font caching, font antialiasing
- Scaling
- Alpha blending
- 90, 180, and 270 rotation
- Gouraud shading
- Scissoring
- Transparent BLT

Video Capture

- Connect video peripherals (such as a camera or TV tuner) to the handheld device
- Supports high resolution camera modules
- Preview input image – downscale by 1/2/3/5/6/8/10/12
- Zoom Video Support – separate VSYNC, HSYNC
- Interlaced Image Support
- Image cropping through programmable capture rectangle
- Flash Light control and Red Eye minimization
- CCIR 656, YCrCb 4:2:2 with 8-bit data bus
- Second capture port with 8-bit data bus
- Independent horizontal and vertical scaling
- Continuous Digital Zoom

Audio Support

The audio processor supports the following features:

- Standard Audio Components:
 - AAC - LC Codec
 - AMR NB/WB Codec
 - MP3 Decoder
 - SP-MIDI
- Optional Audio Components:
 - MP3 Encoder
 - AAC+ Codec
 - 3D Enhanced/Positional Sound
 - Real Audio
- Audio Interface:
 - I2S Interface
 - I2S bypass mode supported

Host Interface

IMAGEON™ 2182 interfaces seamlessly to the Infineon S-GOLD chipset family.

Bus Configurations Supported

- Direct Addressing Mode: up to 24-bit address bus and 16-bit data bus

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- Indirect Addressing Modes:
 - 1-bit address and 16-bit data bus
 - 1-bit address and 8-bit data bus
 - 1-bit address and 1-bit data (using QSPI)
- Enhanced performance mixed mode with direct writes and indirect reads

Integrated Frame Buffer

- Double-buffer support for up to QVGA resolution

Display Support

Primary:

- 8 bit monochrome, 12/15/16/18 bit colour STN
- 12/15/16/18 bit TFT
- 1-bit serial; 8 / 16-bit parallel sub-display (CLI) interface
- 6-bit serial interface
- Maximum resolution 320x240
- Partial display refresh
- Frame modulation
- Display mirroring on horizontal and vertical
- Panel rotation (90, 180, and 270)
- Dual colour key
- Overlay support
- Alpha blending (with global Alpha) and colour keying of overlay and graphic surfaces
- Input image and preview using overlay
- Full backend scaler

Passthrough (Bypass) Mode:

- Allow direct host control of serial/parallel display when IMAGEON™ 2182 device is in power down or suspend mode

Clock Source

Options available:

- Direct use of an available clock, either 32 KHz or 5-20 MHz

Operating Voltage

- 1.5V / 1.8V / 2.5V / 3V / 3.3V CPU, LCD, SD, VIP, GPIO Interface.
- 1.2V to 1.5V Core Supply. Performance varies with core voltage supply.
- 1.8V in-package memory core voltage, 1.8V to 3.3V in-package memory IO voltage.

Power Saving Features

- Inactive blocks automatically disabled through clock gating
- Low power / Low voltage process
- In-package SDRAM suspend modes fully supported.
 - Suspend < 80µW nominal
 - Display refresh < 1.5mW nominal
 - Average active mode 20mW

Package

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- 10x10mm 259 TFBGA

Please contact ATI Technologies for alternate package offerings.

Development Support

- Reference Design Kit
- Diagnostic utilities
- Demonstration software

API Interface

- AHI (ATI Handheld Interface) device driver for programming 2D, video, other features.

Supported Operating Systems

- Microsoft® Pocket PC, Windows Mobile and SmartPhone
- Windows® CE 5.0
- Symbian, Java and Nucleus
- Other proprietary OS

4.2.5 Power Management

The power management unit in Hydra (and all other SGOLD2 products) is a customer designed ASIC from either Dialog (Mozart ED) or ST Microelectronic (Twigo 4+). The unit contains the LDOs for supplying the voltage domains for base band and RF, the reset logic, charging support circuitry, switches for backlight LEDs and vibra motor and all analog audio functions. It is connected to the BB processor via an I2C, an I2S and an SSC serial interface.

To keep the ASIC alive the pad DSPOUT1 from the SGOLD2 delivers a watchdog signal for the Power-ASIC. This signal has to be toggled periodically by the SGOLD2. Otherwise the Power-ASIC will turn off the power supply.

The PA is supplied directly from the battery.

A number of different LDOs supply different parts of the phone. The external LDO's are supplied directly from the battery.

A DC/DC step-down converter with additional input filters supplies the domains 1.5V_UC and 1.5V_DSP directly while VREG2a/b are switched off.

To supply the audio video interface a switch-able charge pump converter with two voltage options is used. For highest performance 1.5V output voltage is needed, but in other modes 1.2V is sufficient. Whenever possible the lower output voltage should be selected to save as much energy as possible.

The power-ASIC also contains an internal step-up converter. But to fulfill the current requirement an external step-up converter is mounted. This step-up converter generates 18.3V for display and keypad backlight supply. The output of the step-up converter is adjusted to 20.75V when the LED flash is activated.

A single LDO, external to the Power-ASIC, is used to supply the camera.

Charging Circuit:

A double MOSFET is placed between the battery and the charge pin at the IO connector. This enables both normal charging as well as reverse supply from the battery to external accessories, requiring power from the phone. This is for Hydra the Flash (Photo flash).

The charge voltage is detected by the signal VDD_CHARGE. A 100 Ohms resistor R1353 is inserted between POWER and VDD_CHARGE. The purpose is to limit the current in case the polarity of the charge voltage is inverted by accident.

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The DUAL-MOSFET for charging is controlled by the Power-ASIC via the CHARGE_CNTRL signal. The charge FET is either off, fully conducting or current controlled. See the Power-ASIC specification for further details.

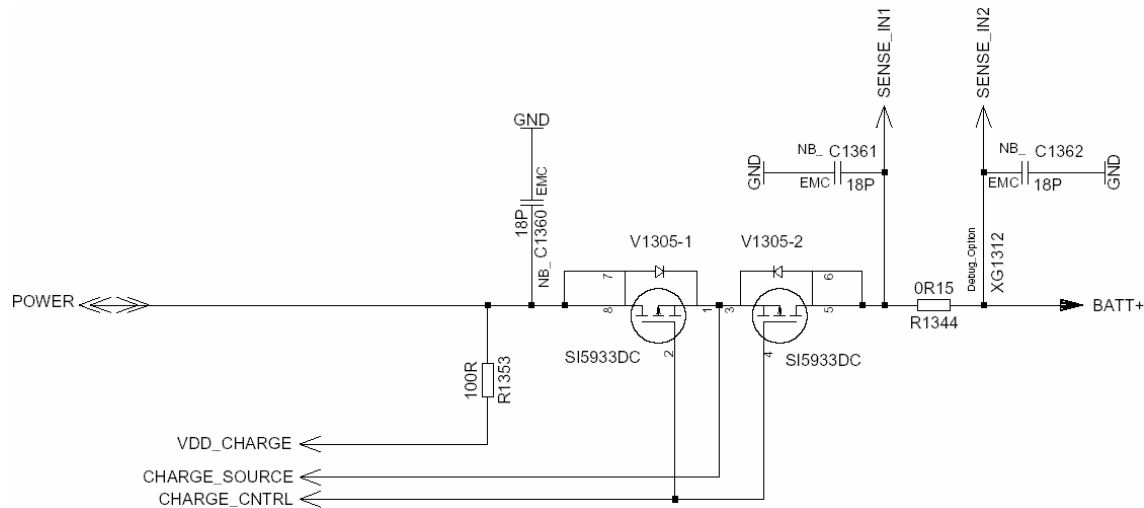


Figure 2 Charging Circuit with Dual MOSFET as Switch

4.2.6 SIM

SIM Cards with supply voltages of 1,8V and 3V will be supported.

4.2.7 Illumination Concept

The illumination of the displays is done by white LEDs integrated in the display modules. The illumination of the keypad is done by 2x4 white LEDs. The keypad matrix is controlled by the S-GOLD2™.

The brightness control of the display and keypad LEDs works with the 3 PWM outputs LIGHT_PWM1, LIGHT_PWM2 and LIGHT_PWM3. With these signals 3 constant current sinks, built up around the double transistors V2302, V2330 and V2800 are controlled in duty cycle. The resistors R2311, R2331 and R2803 determine the currents approximately by $I=0.6/R$.

4.2.8 Battery and Charging Concept

Battery:

In Hydra there will be one of the four batteries available for X75 platform. All batteries contain one Li Ion cell (either Li Ion can type or Li Ion polymer type), safety IC and additional safety part (PTC of Thermo fuse). The main difference of these four batteries is the mechanical dimension and the available capacity. The Hydra Battery is 670 mAh with GSM discharge.

Charging:

Charging is controlled in combination by hardware and software. If the battery voltage is low (< 3.2V) the battery is charged with a limited current, which is hardware, controlled. This mode is called *Trickle Charge*.

When the battery voltage is higher than 3.2 V software takes over and *Fast Charge* is enabled. In fast charge mode the charge current is only limited by the current limitation in the attached charger. In 75 generation where slim Lumberg IO connector is used, two chargers are available. This is the Single Range Charger (420 mA) and the Travel Charger (620 mA).

The power ASIC can support USB charging. If charge voltage is in the range 4.4V to 5.25 V USB charging is ongoing. A switched off mobile phone will not wake up automatically if it is connected to an USB-Interface. During USB charging only limited charging is possible. Charge current is limited

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to 75, 150, 300 or 400 mA. USB charging is supported in Hydra and the other 75 generation SGOLD2 products.

The temperature range in which charging of the phone may be performed is in the ranges from 0...50°C.

4.2.9 Vibra Motor

In Hydra the vibration motor type K2 is used. This vibration motor is designed for phones up to 125 gram. To optimise the performance the motor is driven in PWM mode. This is supported by the Power-ASIC. The vibration level is independent of the battery supply voltage. This is obtained by adjusting the PWM duty cycle according the measurements of the battery voltage. The mapping of duty cycles to battery voltage is defined in an eelite block.

A diode serves as ESD protection. But in PWM mode it is also used for freewheeling when the vibra switch in the Power-ASIC is off. Because of this functionality it is necessary to use a schottky diode, otherwise the negative voltage on the Power-ASIC VIBRA ball will exceed the permitted value.

The vibration motor contacts the PCB via two springs. One terminal of the motor is attached to the Mozart/Twigo4 ASIC's vibra LDO, which is used as a PWM output and not as an ordinary LDO output.

4.2.10 Hall Sensor

The Hall-sensors are used in the sliding mechanism of Hydra to detect the position of upper case in relation to the lower case. For previous slider phones there has been two sources of the sensor; Infineon and Samsung. These are in a SC-59-3 package. Because of the easy-sliding mechanism in Hydra there is not enough room for this sensor in Hydra. Currently only Samsung can provide a sensor in a smaller package (CSP) with the same functionality. Investigations for second source are ongoing, Toshiba seems like a possible 2nd source.

In Hydra two Hall-sensors are used. One is used to detect the open and one to detect the closed position.

The Hall-sensor is an Integrated Hall-Effect sensor designed specifically to meet the requirements of low-power devices, e.g. as an switch in cellular phones. Precise magnetic switching points and high temperature stability are achieved through the unique design of the internal circuit.

An on-board clock scheme is used to reduce the average operating current of the IC. During the operating phase the IC compares the actual magnetic field (2–5 mT) detected with the internally compensated switching points. The output Q is switched at the end of each operating phase. During the stand-by phase the output stage is latched and the current consumption of the device reduced to some µA.

The IC switching behaviour is omni-polar, it can be switched on with either the north or south pole of a magnet. The choice of magnet is a SmCo (Samarium-Cobalt) type. The size from 2.5dia x 1mm allowed a distance of 4-5mm between magnet and sensor. (For detailed information refer to TDD).

The Hall-sensors are supplied from logic voltage 2.65V. The outputs are connected directly to GPIO inputs of baseband processor. The resistors R3251 and R3252 work as external pull up, because the outputs of the Hall-sensors are open collector.

The components R3256, R3253, C3252, C3251, C3255 and C3256 are for EMC protection. This external protection of EMC is necessary for the source Samsung.

If a magnetic field is detected from the Hall-sensor the output line will switch to low signal and generate an interrupt.

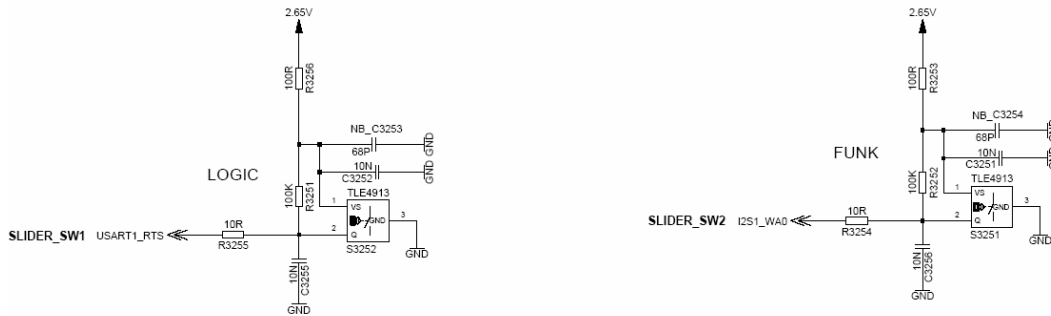


Figure 3 Hall sensor Circuit.

4.2.11 Camera and LED Flash

In all SGOLD2 phones the camera is a 1.3 Mpixel camera mounted in a socket. The socket is SMD mounted on the PCB.

The camera is snapped into the socket and a special release tool is needed to extract the camera again. Shielding is integrated in the socket and camera module (see fig. 4 below).

There are three sources for the camera:

- TCM8240MD [Toshiba]
- OV9650 [Premier/Omnivision(sensor)]
- AU70C [SEMCO]

Below you can see the socket & camera.

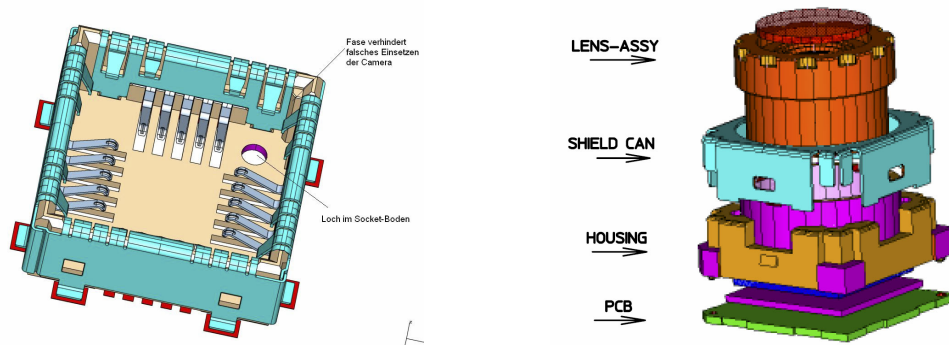


Figure 4 Socket & 1.3 MPixel camera (SEMCO).

General component description:

Resolution: 1.3 MPix
Focus range [mm]: 300 - ∞

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Centre Resolution CTF(30%):
Data Format YUV:

200 lph
MPix, VGA, QVGA, QQVGA, CIF, QCIF

Frame rate:

The camera will be running at max. 15 fps. (frames per second). In low light conditions the frame rate will automatically be adjusted by the camera in the range (6.25fps. - 15fps.).

Video mode: VGA resolution, Frame rate TBD.

LED Flash (Torch mode):

The LED Flash Module is built into the phone and it is also controlled by the Gimmick Chip and could be operated in two modes. One is the video/ torch mode (low current) and the other the flash mode (high current). The duration of the flash will be set by the gimmick chip. The Gimmick Chip guarantees that the flash LED is switched off after the defined flash duration especially after a software breakdown. (HW Timer).

During Video/ Torchlight the light level is 10 Lux at 50 cm. In Flash Light mode 40 Lux at 50 cm. The Internal LED flash can also be operated in Red Eye Reduction/ Pre-flash mode.

Dimensions:	5 mm x 5 mm x 1,5 mm
Luminous Intensity :	6 cd (typ) @ 20mA, forward voltage
Radiation Angle :	+/- 25°
Lifecycle :	30000 flashes

The flash LED consists of four dies, which has to be connected in series. Each die will be driven with about 65mA in flash mode(Pulse) and 7-10mA in the torch mode (DC). The Flash LED would be turned on at least for 2 V-SYNC cycles to guarantee a complete image exposure. The flash LED would only be used in the low light mode of the camera (7,5 fps), that means the minimum switch on time in the flash mode is 266ms. To avoid any damage of the LED the turn on time should not exceed 400ms for high peak currents (~ 70mA).

The internal LED-Flash will work as described below:

- Switch off Flash LED at higher temperatures(> 65°C) and low battery voltages (< 3,6V)
- Display backlight would be switched off during flash pulse
- Red Eye Reduction always used (should not be selectable by the user)
- Automatic Flash Usage, Always On and Off
- Signalization, when the LED could be used

To make a homogeneous light distribution on the pictures a lens system is built into the mechanics. The flash LED consists of four dies with a metallic reflector. The module is soldered on the PCB. When the distance between the PCB and output window is large an optical light guide system has to be used. This is the case for Hydra. The best performance is obtained with a reflector solution with an optical lens window on top. Without any lens the efficiency would be much worse and the light homogeneity is not sufficient for a good camera picture.

During design of the reflector and the micro lens the optical axis of the camera and the LED flash is matched together. The radiation cone of the Flash LED is about +/-25°.

Based on the latest investigations, we only could secure following LED Flash performance for the 75' Generation.

Under low temperature the batteries are not capable to deliver enough current to drive the Flash LED. Therefore the flash performance has to be reduced under low battery voltages.

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Status:

- > 20°C : from 10 to 3 bars of the accu display (10 bars) the full flash performance could be used. Below 3 bars only the reduced performance
- 10°C - 20°C: from 10 to 5 bars of the accu display (10bars) the full flash performance could be used. Below 5 bars only the reduced performance
- 0°C to 10°C: from 10 to 7 bars of the accu display (10bars) the full flash performance could be used. Below 7 bars only the reduced performance
- <0°C only reduced performance available.

Under all use cases the flash executed, but the performance is different.

We recommend a hint in the handbook of the phone, that the flash performance is reduced for low battery voltages.

External Flash (Accessory Photo Flash):

The external strobe flash can be connected to the bottom connector of the phone. The external photo flash will be triggered by the DCD line. The trigger signal is derived from the gimmick chip. Via the RS232 interface the flash duration, the flash execution delay and switch off threshold of the photodiode could be set. Charging is also controlled by this interface.

The luminous intensity of the external photo flash will be automatic controlled by a photodiode placed in the flash. Red eye Reduction / Pre-flash is possible.

The Strobe Flash will work as described below:

- Automatic Flash Usage
- Red Eye Reduction always used (should not be selectable by the user)
- Do not use Strobe Flash for low battery voltages
- Flash Power could be controlled by the user
- Indication, when the Strobe could be used

4.2.12 Display

The display use in Hydra is named Pluto. The Pluto display has a resolution of 132x176 pixels with a colour depth of 262144 colours (6-6-6 RGB). It contains an Active Matrix panel (Vertical Aligned Molecules) normally black panel. The panel is build in accordance to Andromeda panel mechanical design, the panel can therefore be reused in the 75/85 generation. Driving technology is TFD, the controller is mounted on the glass (COG). Read functionality is enabled in order to perform status and/or ID read commands. Contrast adjust is fixed and cannot be changed by mobile user. The display (Type 4 Epson) enables wide viewing angle, no colour inversion, high contrast and high colour gamut. Luminance is set to meet 75 generation (using 4 high brightness white LED in series). FPC including components has been placed below the display module in order to reduce thickness of the module. Interconnection is done by 20-pin B2B connector.

The display controller is supplied 2.9V VDD and 1.8V VDDL. All I/O pins are configured for 1.8V. The 4 white LEDs are mounted in serial. The maximum current is set to 15mA. The voltage for the 4 LEDs is about 18V. Luminance is targeted to be 190 cd/m² with homogeneity deviation of max. 30%.

The typical operation temperatures are: -20°C to +55°C. The reduced functional temperature range is -25°C to +65°C (the contrast will not be according to the specifications, but will still be readable). The contrast ratio is targeted in transmissive mode to be 200 perpendicular to the display, in a viewing cone @ 65 degrees contrast ratio is target to 20.

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No contrast adjustment is necessary. It is not possible to change the contrast by the mobile phone software. The colour adjustment of the display panel is also fixed by the supplier. The display contrast is pre-adjusted by the supplier and can be factory set in Siemens production.

Maximum frame rate guaranteed by supplier is 15 fps @ 25°C.

Partial mode current consumption is target to 300uA.

Characteristic Dimensions and Features

Resolution :	132x176 pixels	
Dimensions :	Panel dimensions: 32,3 x 47,1 mm ² Active area : 27,72 x 36,96 mm ² Module: 34,7 x 50 x 2,6 mm ³	
Pixel Pitch :	0,21 x 0,21 mm ²	1 pixel consists of 3 sub-pixels red, green and blue
Technology :	Vertical Alignment Normally Black	
Operating Temperature:	-20°C to +55°C	
Backlight :	4 high brightness white LED's	Nichia

4.2.13 Audio

Speaker unit:

The speaker module is designed to provide good performance in all three modes like handset handsfree and sound ringer. It includes a sealed back volume of 0,8ccm to minimize the sensitivity of the acoustic performance against a leakage of the mobile's case. The system resonance is located at about 950Hz.

The front volume between the speaker module and the Hydra front part is minimised to get the bandwidth of the speaker response as wide as possible. This is a major advantage for playing music tones and ringing tones.

The used speaker is an electro-dynamic speaker with an elliptical shape diaphragm with dimensions of 12*18mm. The nominal impedance is 8 Ohm. The core is identical for all X75 SGOLD2 products. The housing for the speaker core is custom made for the Hydra form factor.

Since the speaker performance is influenced significantly by the speaker cabinet the speaker module is tested and qualified for each X75 project.

Because the speaker is located in the earpiece position, the risk of acoustic shock has to be minimized by software measures e.g. ramping the sound level in all risky use cases. However the speaker has to fulfil the requirements concerning minimum sound pressure level in buzzer mode (e.g. 'Hongkong-Spec.: min. 100dB_{SPLpeak} @ 5cm distance).

The sensitivity is 77dB/0.89Vrms/10cm @ 2kHz under free field conditions and 104dB/0.1Vrms / 3.2LL coupler @ 2kHz mounted on the surface of the mobile phone housing.

The speaker module is used to perform three different modes: Receiver-, Buzzer- and Hands-free mode. In all modes, the speaker is supplied by the audio amplifier in the Mozart/Twigo4 chip pins MONO1_OUT and MONO2_OUT.

Microphone:

The microphone is built into the Mounting Frame Lower Part and is mechanically fixed and sealed with self-adhesive tape. The contact on the PCB is realised via spiral springs, which are integrated into the plastic holder of the ECM (Electrical Condenser Microphone). Due to using an omnidirectional Microphone type, only one sound inlet is necessary. The plastic holder of the microphone

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has three asymmetrical slits in order to provide non-rotating and to ensure proper contacting. The microphone is water protected (water repellent cloth).

The used microphone is an omnidirectional electret-condenser microphone (S65 / 4mm omni). The sound inlet is located at the bottom ("south end") of the mobile; hidden in the accessory holder recess. The sensitivity is -44dBV/Pa @ 1 kHz.

The microphone assembly consists of the electret capsule itself mounted in a plastic holder, which also takes two coil springs providing electrical contact. On the frontside of the assembly there's a protecting "cloth" and a self adhesive tape to glue the mic into the housing. After being mounted the mic is fixed inside the phone by being pressed between PCB and the housing lower part.

The microphone is voltage supplied with 2.1V by the power-ASIC (Mozart ED/Twigo4+) pin MIC-BIAS via the load resistor. In order to balance out possible noise on the supply balancing resistors are added (bridge circuit). The output of the microphone is lead through the high pass filter.

Power-ASIC Audio part:

The audio part of the ASIC can be used with stereo single ended and with mono differential outputs. Both paths can be seen completely independent. It is possible to use different signals for mono and stereo in parallel. The following operating modes need to be supported:

Supply the speaker in the phone with audio signals including the possibility of hands-free and anti-pop switch on and off via the audio mono amplifier.

Supply of the headset with mono differential signals with audio performance via the audio stereo amplifier.

Supply the speaker in the phone with ringing signal.

Transfer a key click, generated in digital part to the speaker.

Fast start-up with ringer time constant, but with audio multiplexer possibility for stereo and for mono mode.

Both audio amplifiers are adjustable by gain via TWI/SSC register separately.

Audio Mono Amplifier:

The audio mono mode is done with a differential signal with the speaker as external load. The differential signal allows the maximum power, also in low voltage mode. The supply for the audio mono amplifier is VREGA. Only the last output stage is supplied by the battery.

Both amplifier paths are inverting amplifiers with external AC coupling at the input to compensate input offset. The gain of the amplifier is controllable over the TWI/SSC register separate for each channel in 1.5dB steps from 21dB to -54dB and in 3dB steps from -54dB to -75dB.

The output stage of the amplifiers can drive a low impedance load (8Ohms) for the hands-free application. To guarantee an "ANTI-POP" behaviour for switch on and off, a soft start-up with symmetrical ramp-up at each output is implemented.

Audio Stereo Amplifier:

For stereo mode two single ended buffers are used. These buffers will be supplied by the additional regulator with 2.9V to be more stable against the GSM ripple on the battery voltage. Also the reference voltage for the buffers is generated by a high precision, low noise band-gap reference for better performance.

An external capacitor is needed to filter this reference additionally. The gain steps for the programmable gain amplifier are identical with the mono amplifier. No key-click and ringer needed for the stereo part. Gain can be controlled with the TWI/SSC registers STEREO_CH1_AMPLITUDE and STEREO_CH2_AMPLITUDE. The connected speaker has an impedance of typical 16Ohms. To guarantee an ANTI-POP noise a digital start-up is implemented. This will allow a soft start of the VMID and creates a "clean" audio band during the start-up. To eliminate the external coupling capacitor for the speaker, a 3rd amplifier was added. This amplifier creates the virtual ground node for both speakers. Therefore the current capability must be two times of the regular output amplifier. The purpose of this amplifier is to define the DC operating point with no DC current. The gain

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of the amplifier is controllable over the TWI register separate for each channel in 1.5dB steps from 21dB to -54dB and in 3dB steps from -54dB to -75dB.

Ringer Mode:

In ringer mode the ringing signal is transferred directly as audio signal to the speaker. This architecture does not need an additional buzzer. The speaker is controlled with a rectangular signal created supplied by RINGIN pin. Input signal is a digital signal with variable frequency and comes from the S-GOLD2™. The amplitude can be adjusted with the MONO_RINGER_AMPLITUDE register values. For start-up a smaller time constant must be used to allow a fast switch on behaviour. Ringing function can be started at any time. If the audio is off, the start-up is done with RINGER time constant. If audio is starting with AUDIO start-up, the time constant is switched to RINGER mode, too. If the audio amplifier is already up and running, the RINGIN is connected to the amplifier and audio signal is muted due to open multiplexer.

Key-Click Function:

It is possible to program a key-click to accompany each pushing of a key. The key-click is created in digital part as defined in the MONO_CLICK_AMPLITUDE and CLICK_CONTROL registers. A PWM signal with a selectable frequency (1.5, 3.0, 4.5 or 6.0kHz) is created and can be varied for the pulse width. The start-up is similar to the RINGER function. If the audio is off, the start-up is done with KEYCLICK time constant. If audio is starting with AUDIO start-up, the time constant is switched to KEYCLICK, too. If the audio amplifier is already up and running, the KEYCLICK is connected to the amplifier and audio signal is muted due to open multiplexer.

Audio Mono Fast:

The audio fast mode is close to standard audio mode. In operating mode, the MONO FAST time constant is dominated by the external coupling capacitor C_{next} and the internal input resistance. The purpose of this mode is to allow an external ringer or key-click signal to be supplied to the mono amplifier via the audio multiplexer. For this mode, the start-up must be faster compared to standard audio mono mode.

Audio Stereo Fast:

The stereo fast mode is close to standard stereo mode. In operating mode, the STEREO FAST time constant is dominated by the external coupling capacitor C_{next} and the internal input resistance. The purpose of this mode is to allow an external ringer or key-click signal to be supplied to the mono amplifier via the audio multiplexer. For this mode, the start-up must be faster compared to standard audio stereo mode.

Output Audio Multiplexer:

The audio multiplexer will allow switching line inputs or DAC outputs to mono and stereo amplifiers. Line inputs are left open and only connected to SW test points. An inversion of the supplied audio signals can be done. This is necessary to convert the single line signal to a differential signal driving the speaker with the doubled output voltage in a bridge circuit. For this an analog inverter in the multiplexer makes a phase shift of 180° of one channel. It is possible to do this phase shift also directly by the input signal or by a special function of the DAC.

Audio ADC and DAC

Clock Scheme:

The Power-ASIC receives the 26MHz sine wave signal from the RF part and generates with a shaper and a PLL the 104MHz master clock for the modulator and DSP.

Serial Audio I2S Interface:

The audio interface is a bi-directional serial interface. The TX and RX path are independent. The I2S bus is a three-wire connection that handles two time-multiplexed data channels for the DAC and the ADC. The three lines are the clock (CLO), the serial data line (DAO) and the word select

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line (WAO). The data is transmitted MSB first. The word select line indicates the channel being transmitted.

Since the S-GOLD2™ is I2S master in all cases, and since data is transferred in parallel over both interfaces, the CLO signal and the WAO signal is connected to the same pin on the S-GOLD2™. All signals generated by the S-GOLD2™ (CLO, WAO and data going into the Power-ASIC) are filtered by an 18pF capacitor to prevent from system instability, caused by under- and overshoots of the I2S-signals.

Audio DAC:

For audio signals a 24bit sigma delta converter with 5bit feedback is implemented. The digital information is delivered via the I2S interface. To be able to work with all possible operating modes, the sampling frequency can vary from 8kHz to 48kHz. In the R65 phones a resolution of 16 bit and sample rates of 8kHz and 32kHz are used. The performance of the audio output signal must be guaranteed over the full range the human ear is able to hear. This means for FS=8kHz the noise at frequencies higher than FS/2 must be suppressed.

DSP section:

The interpolation filter is organised in 3 sections: the high pass filter (HPF), the low pass filter (LPF) and the high-speed low pass filter (HSLPF). The interpolator and the modulator follow this.

Audio ADC:

The ADC is able to digitise analog input signals in stereo with a resolution of 16bit, with output to the I2S interface. A digital high pass filter is implemented, which can be bypassed. The signal path includes also two amplifier stages with programmable gains. Inverting amplifiers are used to reduce the offset.

ADC Audio Multiplexer:

The audio multiplexer will allow the switching of each of the different input sources to the mono and stereo output signals and to the ADC. For the ADC the selectable sources are the MIC1 and MIC2 inputs from the internal microphone and MICE1 and MICE2 for the external microphone. Also the line inputs LINE 1 and LINE2 can be switched to the ADC. For the speaker and the headset the input can come either from the line inputs or from the DAC1 and DAC2. Additionally, a conversion from mono single ended to differential signals can be done. For this a selectable inverter is integrated.

TWI Interface:

The TWI interface is an I2C-compatible two-wire interface with an additional interrupt pin to inform the S-GOLD2™ about special conditions. The TWI bus interface is configured as a slave unit with 1bit int(), 1bit SDA(serial data) and 1bit SCL(serial clock). The data and the address of the register files are defined including read/write bit, control status bits and the data bits shown on the next pages. The TWI interface is asynchronous to the internal clock. The TWI bus is enabled at RESET_N = HIGH and disabled when the RESET_N becomes LOW for all standard registers. The interrupt function is active after the first read-out of both status registers. If an event occurs before the S-GOLD2™ reads out the status registers, this event will set the dedicated bit, but doesn't set the I2C_INT signal. Afterwards the two status registers will be handled separately. Therefore it is recommended to do a read-out for both status registers after the S-GOLD2™ initialised itself. If more than one interrupt event occurs before the S-GOLD2™ read out the status register, only the current status at interrupt generation and the newest status after read-out will be detected.

SSC Interface:

The SSC interface enables high-speed synchronous data transfer between the S-GOLD2™ and the PMU registers.

SCLK – Serial Clock Signal: As the SSC interface is configured as a slave only, this is an input pin to the SSC.

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MTSR – Master Transmit Slave Receive: As the device operates as a slave this is an input pin.

MRST – Master Receive Slave Transmit: This is an output of the PMU used to transfer data to S-GOLD2™ MRST input.

/SSCSSEL – SSC Select, active low: This is an input to the PMU and is generated by the S-GOLD2™ that it is controlling the PMU. When this signal is held low, data communication is enabled.

4.2.14 Accessory interface

The accessory interface uses the slim Lumberg connector known from 65 generation. For further details about the accessory interface see the [“Hardware Interface Specification X75 V0.1.pdf”](#).

All Bluetooth accessories use the BT interface instead of the slim Lumberg interface.

Accessory supported by HW:

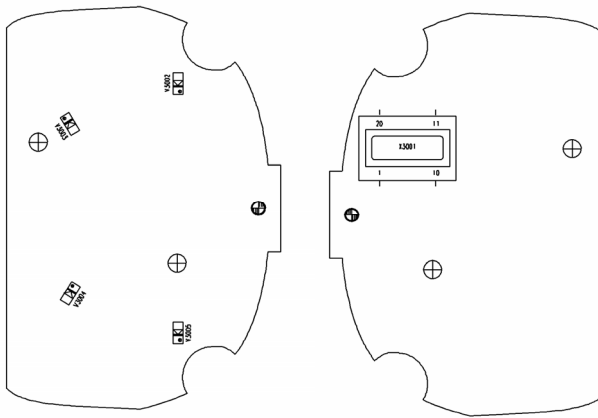
Travel Charger, ETC-500/510
 Car Charger Plus, ECC-600
 Headset BT, HHB-600/610
 BT Stereo Headset, HHB-750
 Headset Purestyle, HHS-610
 Headset, HHS-510
 Headset Basic, HHS-500
 Headset Stereo, HHS-550
 Charger Adaptor, ECA-500
 Car Kit BT Portable, HKW-700
 Car Kit BT 75, HFW-710
 Car Kit BT SIM Access, HKW-720
 Car Kit Portable, HKP-500
 Media Link BT, tbd.
 Mobile Music Set, IMS-700
 Flash IFL-600
 Data Cable DCA-540
 Data Cable USB DCA-540
 SyncStation DSC-600

See also chapter 6 “Accessories”.

PCB-Construction 8-Layer													
Layer Name		DOC-Nr./Part/Vers.		Art-File		Drill-File		Layer Name		DOC-Nr./Part/Vers.		Art-File	
DRILL MASK : plated		79026 000 02		art_21b1_#		dr_111_1_2_#		GOLD MASK (SOLDER SIDE 1)		79026 000 02		art_2_#	
DRILL MASK : plated		79026 000 02		art_21b2_#		dr_111_2_3_#		SOLDER MASK (SOLDER SIDE 1)		79026 000 02		art_4_#	
DRILL MASK : plated		79026 000 02		art_21b3_#		dr_111_3_6_#		Signal_1 (art_5)		79026 000 02		art_5_#	
DRILL MASK : plated		79026 000 02		art_21b4_#		dr_111_6_7_#		PREPREG		79026 000 02		art_6_#	
DRILL MASK : plated		79026 000 02		art_21b5_#		dr_111_7_8_#		Signal_2 (art_6)		79026 000 02		art_7_#	
DRILL MASK : unplated		79026 000 02		art_21b6_#		dr_111_unpl1_#		PREPREG		79026 000 02		art_8_#	
								Signal_3 (art_7)		79026 000 02		art_9_#	
								PREPREG		79026 000 02		art_10_#	
								Signal_4 (art_8)		79026 000 02		art_11_#	
								PREPREG		79026 000 02		art_12_#	
								Signal_5 (art_9)		79026 000 02		art_17_#	
								PREPREG		79026 000 02		art_19_#	
								Signal_6 (art_10)					
								PREPREG					
								Signal_7 (art_11)					
								PREPREG					
								Signal_8 (art_12)					
								SOLDER MASK (SOLDER SIDE 2)					
								GOLD MASK (SOLDER SIDE 2)					
Explanation of PCB - Data													
Drill Data :													
Data format : Excellon XXX.YY : Gerber XXX.YYY													
Scale : 1:1 : Scale													
Units : absolute in [mm] : absolute in [mm]													
Leading zeroes : present : present													
Trailing zeroes : present : present													
Drill file names : dr_x.y (plated holes) : Record length : 80													
X = Drill start (inches) : X = Drill start (inches) : X = number 1,...,21													
Y = Drill end layer : Y = Drill end layer													
Documentation :													
Layer Table : : layer table # ps													
Drill Info : : drill info # ps													
Mech. Dr-eg : : nonconstruction # ps													
Text on Film Layers that has to be replaced by PCB-Manufacturing :													
POS : : Board position within panel (rising number)													
F-LOGO : : Manuf. Company identification													
E-LOGO : : Location for electric test mark													
LOT : : Lot number													
DM : : Data Matrix Ecc200													
All Gerber/Excellon data is generated as top view (based on this layer table) !													
Manufacturing acc. to techn. description : A24651-A1-A30-4-25													
# : 's.GER' Film Data Single Board													
'p.GER' Film Data Panel													
## : 's.TXT' Drill-Data Single Board													
'p.TXT' Drill-Data Panel													
Printed Circuit Board : A5800900160427-19016													
Drill Information : 79026 000 02													
DATE 21.06.2004													
APPR-D Brøndskov													
STD MP PD HW4 AAL													
SIEMENS AG													
oIn 30.09.2004													
pIn 07.07.2004													
NAME													
VERS. CHANGE NUMBER DATE													
Created by PCB number: A5800900146526-15991													
G75 HYDRA MAIN BOARD 1													
PCB													
LAYER STACKUP													
79026													
SHEET													
1 +													

The figure consists of two detailed circuit board layouts, labeled X1504 and X3800. The X1504 layout on the left shows a complex arrangement of components including capacitors (C1300, C1301, C1302, C1303, C1304, C1305, C1306, C1307, C1308, C1309, C1310, C1311, C1312, C1313, C1314, C1315, C1316, C1317, C1318, C1319, C1320, C1321, C1322, C1323, C1324, C1325, C1326, C1327, C1328, C1329, C1330, C1331, C1332, C1333, C1334, C1335, C1336, C1337, C1338, C1339, C1340, C1341, C1342, C1343, C1344, C1345, C1346, C1347, C1348, C1349, C1350, C1351, C1352, C1353, C1354, C1355, C1356, C1357, C1358, C1359, C1360, C1361, C1362, C1363, C1364, C1365, C1366, C1367, C1368, C1369, C1370, C1371, C1372, C1373, C1374, C1375, C1376, C1377, C1378, C1379, C1380, C1381, C1382, C1383, C1384, C1385, C1386, C1387, C1388, C1389, C1390, C1391, C1392, C1393, C1394, C1395, C1396, C1397, C1398, C1399, C1400, C1401, C1402, C1403, C1404, C1405, C1406, C1407, C1408, C1409, C1410, C1411, C1412, C1413, C1414, C1415, C1416, C1417, C1418, C1419, C1420, C1421, C1422, C1423, C1424, C1425, C1426, C1427, C1428, C1429, C1430, C1431, C1432, C1433, C1434, C1435, C1436, C1437, C1438, C1439, C1440, C1441, C1442, C1443, C1444, C1445, C1446, C1447, C1448, C1449, C1450, C1451, C1452, C1453, C1454, C1455, C1456, C1457, C1458, C1459, C1460, C1461, C1462, C1463, C1464, C1465, C1466, C1467, C1468, C1469, C1470, C1471, C1472, C1473, C1474, C1475, C1476, C1477, C1478, C1479, C1480, C1481, C1482, C1483, C1484, C1485, C1486, C1487, C1488, C1489, C1490, C1491, C1492, C1493, C1494, C1495, C1496, C1497, C1498, C1499, C1500, C1501, C1502, C1503, C1504, C1505, C1506, C1507, C1508, C1509, C1510, C1511, C1512, C1513, C1514, C1515, C1516, C1517, C1518, C1519, C1520, C1521, C1522, C1523, C1524, C1525, C1526, C1527, C1528, C1529, C1530, C1531, C1532, C1533, C1534, C1535, C1536, C1537, C1538, C1539, C1540, C1541, C1542, C1543, C1544, C1545, C1546, C1547, C1548, C1549, C1550, C1551, C1552, C1553, C1554, C1555, C1556, C1557, C1558, C1559, C1560, C1561, C1562, C1563, C1564, C1565, C1566, C1567, C1568, C1569, C1570, C1571, C1572, C1573, C1574, C1575, C1576, C1577, C1578, C1579, C1580, C1581, C1582, C1583, C1584, C1585, C1586, C1587, C1588, C1589, C1590, C1591, C1592, C1593, C1594, C1595, C1596, C1597, C1598, C1599, C1600, C1601, C1602, C1603, C1604, C1605, C1606, C1607, C1608, C1609, C1610, C1611, C1612, C1613, C1614, C1615, C1616, C1617, C1618, C1619, C1620, C1621, C1622, C1623, C1624, C1625, C1626, C1627, C1628, C1629, C1630, C1631, C1632, C1633, C1634, C1635, C1636, C1637, C1638, C1639, C1640, C1641, C1642, C1643, C1644, C1645, C1646, C1647, C1648, C1649, C1650, C1651, C1652, C1653, C1654, C1655, C1656, C1657, C1658, C1659, C1660, C1661, C1662, C1663, C1664, C1665, C1666, C1667, C1668, C1669, C1670, C1671, C1672, C1673, C1674, C1675, C1676, C1677, C1678, C1679, C1680, C1681, C1682, C1683, C1684, C1685, C1686, C1687, C1688, C1689, C1690, C1691, C1692, C1693, C1694, C1695, C1696, C1697, C1698, C1699, C1700, C1701, C1702, C1703, C1704, C1705, C1706, C1707, C1708, C1709, C1710, C1711, C1712, C1713, C1714, C1715, C1716, C1717, C1718, C1719, C1720, C1721, C1722, C1723, C1724, C1725, C1726, C1727, C1728, C1729, C1730, C1731, C1732, C1733, C1734, C1735, C1736, C1737, C1738, C1739, C1740, C1741, C1742, C1743, C1744, C1745, C1746, C1747, C1748, C1749, C1750, C1751, C1752, C1753, C1754, C1755, C1756, C1757, C1758, C1759, C1760, C1761, C1762, C1763, C1764, C1765, C1766, C1767, C1768, C1769, C1770, C1771, C1772, C1773, C1774, C1775, C1776, C1777, C1778, C1779, C1780, C1781, C1782, C1783, C1784, C1785, C1786, C1787, C1788, C1789, C1790, C1791, C1792, C1793, C1794, C1795, C1796, C1797, C1798, C1799, C1800, C1801, C1802, C1803, C1804, C1805, C1806, C1807, C1808, C1809, C1810, C1811, C1812, C1813, C1814, C1815, C1816, C1817, C1818, C1819, C1820, C1821, C1822, C1823, C1824, C1825, C1826, C1827, C1828, C1829, C1830, C1831, C1832, C1833, C1834, C1835, C1836, C1837, C1838, C1839, C1840, C1841, C1842, C1843, C1844, C1845, C1846, C1847, C1848, C1849, C1850, C1851, C1852, C1853, C1854, C1855, C1856, C1857, C1858, C1859, C1860, C1861, C1862, C1863, C1864, C1865, C1866, C1867, C1868, C1869, C1870, C1871, C1872, C1873, C1874, C1875, C1876, C1877, C1878, C1879, C1880, C1881, C1882, C1883, C1884, C1885, C1886, C1887, C1888, C1889, C1890, C1891, C1892, C1893, C1894, C1895, C1896, C1897, C1898, C1899, C1900, C1901, C1902, C1903, C1904, C1905, C1906, C1907, C1908, C1909, C1910, C1911, C1912, C1913, C1914, C1915, C1916, C1917, C1918, C1919, C1920, C1921, C1922, C1923, C1924, C1925, C1926, C1927, C1928, C1929, C1930, C1931, C1932, C1933, C1934, C1935, C1936, C1937, C1938, C1939, C1940, C1941, C1942, C1943, C1944, C1945, C1946, C1947, C1948, C1949, C1950, C1951, C1952, C1953, C1954,



MMI assembly



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PCB-Construction 2-Layer

Layer Name	DOC-Nr./Part/Vers.	Art.File	Drill File	Layer Name	DOC-Nr./Part/Vers.	Art.File
 DRILL MASK : plated	96771 000 01	art_21b1_#	drill_1_4_##	 GOLD MASK (SOLDER SIDE 1)	96771 000 01	art_2_#
DRILL MASK : unplated	96771 000 01	art_21b2_#	drill_unpl1_##	SOLDER MASK (SOLDER SIDE 1)	96771 000 01	art_4_#
				Signal_1 (art_5)	96771 000 01	art_5_#
				PREPREG	000	-----_#
				PREPREG	000	-----_#
				PREPREG		
				Signal_4 (art_8)	96771 000 01	art_8_#
				SOLDER MASK (SOLDER SIDE 2)	96771 000 01	art_17_#
				GOLD MASK (SOLDER SIDE 2)	96771 000 01	art_19_#
				SOLDER COVER (SOLDER SIDE 2)	96771 000 01	art_20_#

Explanation of PCB - Data

Drill Data :

Data format : Excellon XXXX.YY
Scale : 1:1
Units : absolut in [mm]
Leading zeroes : present
Trailing zeroes : present
Drill file names : dr_x_y (plated holes)
dr_unpl1 (unplated holes)
x = Drill start layer
y = Drill end layer

Artwork data :

Data format : Gerber XXX.YYY
Scale : 1:1
Units : absolut in [mm]
Leading zeroes : present
Trailing zeroes : present
Record length : 80
Artwork file names : art_x
x = number 1....21

Documentation :

Layer Table : layer_table_#_ps (<.tif) # = Sheet Number of Document
Drill Info : drill_info_data_#_ps (<.tif)
Mech.Dwg : konstruktion_#_rpl (HPGL Pen3=0.25, Pen4=0.35, Pen5=0.5)

Text on File Layers that has to be replaced by PCB-Manufacturing :

PDS : Board position within panel (rising number)
F-LOGO : Manuf. Company identification
D-CODE : Date code
ELP : Location for electric test mark
LOT : Lot number
UM : Data Matrix Ecc200

: 's.GER' File Data Single Board
: 's.TXT' Drill-Data Single Board
: 's.TXT' Drill-Data Panel
Printed Circuit Board : A5800900162420-20016
Drill Information : 96771 000 01

All Gerber/Excellon data is generated as top view (based on this layer table) !
Manufacturing acc. to techn. description : A24851-A1-A30-4-25

			Datum	08.10.2004	Hydra MMI	
			Bearb.	kbr	A1 Layout	
			Bepr.		LAYER STACKUP	
			Mora			
			MP UC RD ED AAL			
			Siemens AG	96771		Blatt
1	20018	08.10.2004	o/h			1+
Zust.	Mitteilung	Datum	Name			

(Created by PCB number: A5800900162420-20018)

4.3 EMC/ESD-Concept

In order to reduce the EMC component count on the PCB and to improve manufacturability, all EMC components that may not be needed, will be left empty at the beginning. Via intensive measurements we will ensure the minimally required number of EMC components are used. We are assuming that the necessary facilities like chambers, equipment, software, time and staff will be available.

4.3.1 ESD

The galvanized rings must be connected the ground. The MMI PCB must be connected to the MAIN PCB GND. The metallic parts of the slider mechanism must be connected to GND. The keyboards both on MAIN PCB and MMI PCB must be covered by a metallic grid, which must be connected to GND in order to attract any ESD sparks and lead it to GND or short the electrically field over the keyboard matrix.

The contact resistance must be less than 1 Ohm for each contact.

Because of no additional mechanical parts between the battery and the PCB, it will be possible to access some electrical components by ESD when removing the battery.

4.3.2 Hitachi Front End Module

Hitachi front-end module fails the Siemens internal requirement (8 kV) during ESD contact discharge with external antenna (GQR test). The front-end modules are stable up to 5.5 kV (limit for approval is 4 kV).

4.3.3 Keypad

Both keypads must be covered by a metal frame, which must be connected in at least one point to ground to get sufficient ESD protection. Because of the "No-Id" concept, the height of the LED's must be lower than the height of the metal frame (Ulysses concept).

4.3.4 SIM

The SIM connector contacts are accessible when the battery is off, hence as in former projects – contact discharging with 8kV (internal limit) could lead to the destruction of the SGOLD2. A limit of 5kV seems to be reachable and fulfills the R&TTE-requirements. A new integrated ESD end EMI filter solution to achieve higher ESD-levels will be tried. This solution will need less area on the PCB, but causes higher costs. Because of a low distance to the antenna the SIM reader must be shielded at least like S65. If the shielding is not sufficient SIM card error can occur.

4.3.5 Camera

The camera must be shielded and connected to the ground in order to reduce self-interference. If the camera is active during a call, self-interference possibly can be observed on some channels as reduced sensitivity.

Maybe we cannot fulfill the Siemens requirements

4.3.6 Display

With the color display higher self-interference is expected. Furthermore, RF power radiated by the antenna or RF-components may have an impact on the display contrast and can cause display flickering.

4.3.7 Electromagnetic Compatibility

EMC tests will be carried out according to R&TTE-requirements.

4.3.8 Antenna performance

GSM-Antenna:

Antenna optimized for European market. I.e. GSM900 and GSM1800 will be optimized at the expense of GSM1900.

The antenna concept is based on same punch bending part as US-version of Hera (Dual Patch Inverted L-Antenna) with the matching circuit implemented using a patch in parallel to a shorting (also based on punch bending).

It will be optimized for European market (only one antenna version).

The antenna will be mounted between the plastic of the lower case and the plastic of the rear-cover.

Bluetooth-Antenna:

The Bluetooth-antenna will be a punch bending part designed as an Inverted L-Antenna using a parallel inductor, a parallel capacitor or a series capacitor for matching.

Because of the overall size of the conductive parts, the radiation pattern will not be omni directional.

The minimum range requirement from BT-spec is 10 m.

4.3.9 SAR

SAR value of 0.8W/kg (1g) is SIEMENS target.

5 Software

5.1 Features

The detailed feature list for the X75 generation V2.0_040_02 or the finally agreed version at M1 is the binding description for all the software that will be provided within the Hydra project

[M1 enclosed documents Hydra\X75_SW_Feature_List_V2.0_040_02.xls](#)

5.2 Requirements to SW

[M1 enclosed documents Hydra\Requirements_to_SW.xls](#)

5.3 User Interface

The user interface is described in the UI specification document, which is not finalized. The pre version of the HMI Spec is

[Link the feature list](#)

5.4 Availability

[M1 enclosed documents Hydra\SW_integration_75_platform.xls](#)







5.5 Customization


The Software will be launched initially with four EMEA variants - Hydra International plus three different operator variants (TMO, E-Plus and O2). Based on a variant specification from the customer (Operator), R&D will create the required initialisation files for the different operator variants. This is necessary because of the complexity of these variants. They have to be tested by the system test group and CCQ (field test). Standard customer variants will support only a limited functionality concerning the customization. This does not include the customer specific initialization of the Flex Menu Tree, Skins, Themes and certificates (i.e. not included in customization guide). A customer may request a more complex customization variant which cannot be handled based on the standard customization guide. Those variants can be supported but the time schedule and the availability of resources has to be agreed with R&D and all parties involved for each variant individually


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Accessories


For the Hydra accessory devices a separate Performance will be available. The following figure gives a preliminary about the planned accessories.


Original Accessories – Portfolio worldwide					Accessory Devices	Hydra
Fashion & Carry 	Energy 	Handsfree Portable 	Car Solutions 	Multi-tainment 	Office 	
Tour Case FCT-660	Li-Ion Battery 700mAh EBA-660	Headset Bluetooth HHB-600 / 610	Car Kit Bluetooth® Portable HKW-700	Bluetooth® Media Gateway IMG-700	Data Cable DCA-500	
Fashion Case FCL-700	Travel Charger ETC-600/610	Headset Bluetooth Stereo HHB-750	Car Kit Bluetooth® HKW-710	Mobile Music Set IMS-700	Data Cable USB DCA-540	
	Car Charger Plus ECC-600	Headset Purestyle HHS-610	Car Kit Bluetooth® SIM HKW-720	Flash IFL-600	SyncStation DSC-600	
	Desk Top Stand	Headset HHS-510	Car Kit Portable HKP-500			
	Car Charger	Headset Basic HHS-500				
		Headset Stereo HHS-550				
		Charger Adapter ECA-500*)				

 Supports Phone Story

 Products compatible with 65 series*

 Products compatible with 75 series

 Phone only

 For bulk only

* Backwards compatible

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*) For HHB-600

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mobile

Siemens A/S
Mobile Phones Development

Siemens Kaj
DK-9400 Nørresundby
Denmark

Switchboard
+45 72 19 50 00

CVR No.
16993085

01.12.04 /aalkec
Revision: 1.0, Page 55 of 83
Performance_Description_Hydra_v1_0

6 Manufacturing Concept

6.1 Overview

The manufacture of the SL75 Hydra main PCB will be done on the standard SMD production lines for mobile phones with 0201 components and **lead free process** (new production technology).

6.2 Modules

The differences of components from top to bottom side will be compensated by the use of combined 3 times top/bottom PCB panel (6 times panel).

6.3 Components Spectrum

6.3.1 SMD Component Number and Number of Types

Main PCB

	No. of components		No. of types	
	Side 1 (Top)	Side 2 (Bottom)	Side 1 (Top)	Side 2 (Bottom)
	209	199	65	107
Total	408		149	

The smallest passive design form is Chip 0201, the smallest grid used is 0,5mm. There will be used 4 Fish - Can shielding.

6.3.2 Manual Soldering

No manual soldering.

6.3.3 Delivered Form of the Components

All SMD Components have to be delivered in 13" tape & reel. Any deviations from this packaging can be decided on or cleared only by SCM NPI or GO2.

All other components must be in tape & reel form. In exception trays can be used, which can be handled at the automatic assembly line (in adjustment with NPI32).

6.4 Production Means and Stages

Soldering pasting Side 1 - SMD placement Side 1 - Optical inspection - SMD placement Side 1

Re-flow soldering Side 1

Soldering pasting Side 2 - SMD placement Side 2 - Optical inspection - SMD placement Side 2

Re-flow soldering Side 2

MDF mounting - Panel separation

Testing/Assembly/Screwing/Camera-Test/Customer Test

Customer Init/Assembly/Packaging

6.5 Basic Assembly Concept

The assembly concept is a top-down mounting. The PCB is mounted in the slider part followed by the base frame assembly. The slider lens and slider keypad will be mounted in the Configuration center.

Also the phone needs to be designed in the way that the automatic assembly line can handle the parts.

6.6 New production technology

- Lead-free Soldering Process

6.7 Expected Production Quantities/Production Capacity (as of 27.10.2004)

For the product the sales figures is 1.04 million units (world) over a life cycle of 13 months. The sales peak is planned to be 100k/month and is expected in October/November 2005 and April to July 2006. The start of the pilot series is planned for CW29/30 2005.

7 Test Rig Planning

7.1 General Requirements

It is absolutely essential to comply with the following requirements and to include these into the product definition.

Any deviations from them must be clarified with GO/NPI3 and are defined during a production-testing workshop. (Contact: H. Poulsen ICM MP SCM NPI31).

Topic: Requirements of Technical Testing for Mobile Phones

Author: ICM MP SCM GO2 KLF Mr. Grein

In this set of regulations the most essential requirements are as follows:

- The central module can be switched on and operated via the IO connector.
- No mechanical adjustments.
- The necessary HF measuring points must have a 50-Ohm impedance or necessary impedance transformation for outside switching must be available from R&D.
- Adjustment with higher requirements as regards accuracy (transmitter output etc.) are only possible in the testing stage Adjustment / System test.
- The free spaces and the test point diameters for test points must be kept (see design regulation).
- Fulfil PCB requirements as regarding the fixing drillings and carrier placing (see design regulation).
- A Windows based software library for controlling the phone functions must be available.

For more details please refer to "Testing technical standards for mobile phones" (Version 3.6; pv1pta36e .doc;13.08.2004)

7.1.1 NPI Quality requirements

Quality key figures SL	unit	01/02	02/03	03/04	Target 04/05	Target 04/05
Test process						FirstPass -Yield
performance board test	[%]	91,0	92,0	92,0	92,0	≥94,0
performance system test	[%]	96,8	97,0	97,0	97,0	≥97,5
performance camera & customer test	[%]	92,1	94,5	94,5	94,5	≥95,0 *)
performance customer init	[%]	92,1	94,5	94,5	94,5	≥99,0

single failure rate **< 1,0**

cpk value for gaussian distributed
processes **>= 1,5**

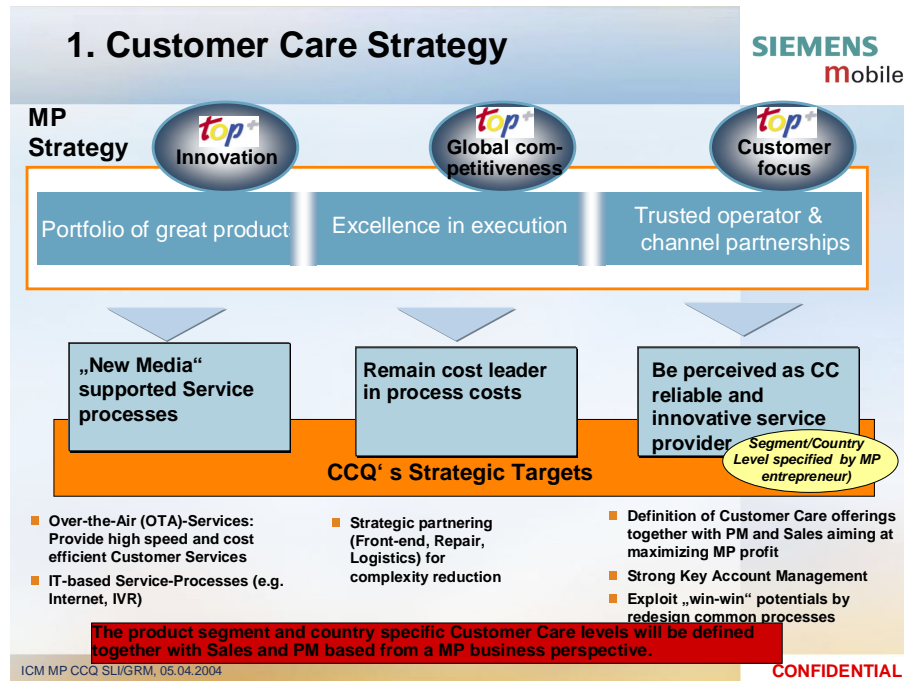
*) Multiply CAM & CT performance

- In addition to the demands for performance rates for each test station, also a single failure rate less than 1% must be committed.

8 Customer Care

8.1 Customer Care strategy

Attached diagram documents contains the CCQ MP Strategy:



The acceptable care standard per region for Hydra as well as the additional service packages has to be defined together with sales and PM.

8.2 Service Objectives

- Siemens bears responsibility for the products with a Siemens Logo and co-branded products
- Local Service Organisations (LSO's) will ensure the international service for a country or a region
- Implementation of hotline for customers (end users)
- Supply of small parts to end user via hotline
- Standard repair fee will be charged for out of warranty repairs
- Car mounting and accessory service will be rendered by business partner (retailers)
- SW update over the air (SWUOTA) as a mandatory feature starting with product launch after 06/04 in order to reduce Level 0 returns
- Strategic wireless Services like phone settings over the air (OTA Standard – SyncMLDM) will be continuously enhanced in order to reduce hotline calls

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- SW update and download of phone settings should be possible for end customer directly via internet
- Self help tool via Internet for the end customer based on the CCQ knowledge database

8.3 Repair level definition

In general, 6 repair levels for mobile phones are defined:

- Level 0
Phone is not disassembled: SW Updates, un-blocking variant configuration, logistics, in-warranty check, error reproduction
- Level 1
Change of non soldered components like housing, keypads etc., exceptions: adjustment for display
- Level 2
Exchange of complete boards
- Level 2.5
Trouble shooting and repair of defined soldered components without adjustment
- Level 2.5e (extended).
Trouble shooting and repair of defined soldered components including adjustment
- Level 3
Trouble shooting and repair of all soldered components including complete adjustment and test. Use of automated test equipment.

8.4 World-wide distribution of service level

- Europe/Near East/RSA/America
 - level 1/2/2.5/2.5e repairs at the LSO and/or service partners
 - swap and/or repair of devices for end users
 - level 3 repair at Siemens workshops
- Far East/Australia
 - level 1/2/2.5/2.5e repairs at the LSO and/or service partners
 - swap and/or repair of devices for end users
 - level 3 repairs at the ASC in Singapore
- Republic of China
 - level 1/2/2.5/2.5e repairs at service partners
 - repair of devices for end users
 - level 3 repairs at the Service Centre Shanghai

8.5 Roll out plan for the service concept

- Acceptable care standard and additional service packages are defined together with PM and sales at market launch at the latest.
- Definition of the service parts when the mechanical design is available (or samples) but 4 month before market launch at the latest.

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- Service parts will be planned on a basis of the expected return rate and quantities (1 month after the availability of the planned quantities of the sales department)
- The procurement of these planned service parts will be initiated.
- The prices for service parts and repair fees will be available via e-commerce two weeks prior to market launch.
- Quantity of swap units/delivery units for the affected LSO's, are agreed and delivery is initiated at market launch at the latest.
- Investment for repair line will be planned (2 month after M1). This planning is put into action at market launch at the latest.
- Carry out of the training for the service partners (LSO's) is planned and will be put into action with market launch.
- Service documentation and training documents will be available via Internet on market launch at the latest.
- Crosscheck of the user guide by the hotline staff.
- Training of the hotline 4 weeks before market launch at the latest.
- Definition and procurement/making of test equipment and test software. This will be available on market launch at the latest.

8.6 Service parts

As soon as the mechanical design is available the service parts will be defined. In principle the following parts will be defined:

Swap:	<ul style="list-style-type: none"> - mobile phone without battery for variants which will be distributed in Germany, China and NAFTA - control board without SIM lock - control boards for each SIM lock type as prepared SIM lock
Spare parts*:	<ul style="list-style-type: none"> display unit/module board lower case shell with pre-assembled antenna but without vibra and microphone vibra motor microphone camera module acoustic sealing upper case shell (cover) battery cover shielding cover keypad accessory components

SAR Frame

MMI Board inclusive metal dome foil

*final decision on spare parts will be made after B1+ prototyping

8.7 Technical Service Requirements

8.7.1 Test equipment

The test concept will be deduced by the concept the production applies (level 2.5e/3). All necessary information regarding change of used hard and software for testing must be provided to the service project responsible immediately by the production implementation responsible.

8.7.2 Technical Service Requirements

The 'Global Repair Requirements' are written down in the M0 Document and available in the project folder: \\Project\75G_Hydra\PD_Team\Customer_Care

"Global Repair Requirements A0 V3.11+2004+06+02.doc

"Global Repair Requirements A1 V3.11+2004+06+02.doc

All Technical Service Requirements of the M0 Document will be fulfilled. The items are listed as a short form for in house products in the X75 feature list, register "Service repair".

9 Quality

9.1 General Quality Requirements

The general quality requirements for phone and accessories are contained in the document "General Quality Requirements for Cellular Deliverables (Cellular Phones / Pocket PCs and Accessories)" that was agreed between Development, Product Marketing, Purchasing and Quality Management.

Currently in force and valid for this project is Rev. 3.1 from January 29th 2002. In case of new revisions of the document after M1, Product Marketing, Development, Business Administration and Quality Management have to agree if any updated requirements shall be applied in this project.

The remainder of this subsection outlines some basic requirements. For details and additional requirements refer to the General Quality Requirements Rev. 3.1.

Temperature Ranges for Mobile Phones

Warehousing	-40°C to +85°C	Mobile phone without packaging
Non-deformation (plastics)	-40°C to +85°C	-30°C for LCD display/ camera
Solar radiation (outdoor)	1120 W/m ² at +55°C	
Battery operation	-10°C to +55°C	Fully operable according to relevant specifications
Operation with external power source	-20°C to +65°C	Additional check for making/ receiving calls (emergency call)
Nondestructive range in switched on mode	-30°C to +70°C	

Ease of Operation

Standards regarding the ease of operation / user-friendliness for different components include, amongst others:

Housing

The casings must keep their shape when pressed in the user's hand. Manual pressure on the casings may not lead to physical damage or impact the function of the test device.

The front and back casings must fit tight; no noticeable play between the casings is allowed. No creaking and grating is accepted. There may be no noticeable projections or protrusions (seam or ridge / overflow). The join must be uniform.

The surface must have a good feel and be dirt resistant. In particular, fingerprints (oil and sweat marks) must not show on the housing surface.

The materials used (housing parts and adhesives) may not be hazardous to the user's health. Also, the housing may not have a noticeable smell.

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Bridges are not allowed to strut on PCB (damaging of copper-tracks).

Keypad

Keys must have a noticeable mechanical pressure point supported by a mechanical resistance or acoustic "click".

The number "5" key must have a nub or other tangible means of orientation (ETSI-Standard; ES201381).

Incorrect pressing of keys (off-center, forceful pressing) may not lead to a mechanical sticking of the keys.

The illumination of the keypad has to conform to the product specification (potential faults are single-edged illuminated keypads or a consistent decrease of the illumination from one side to the other, if a uniform illumination is required).

The printing and/or key markings must be clearly legible.

The individual operating elements must be designed in such a way that they are easy to operate (applies, in particular, to the keypad). The power ON / OFF key must be secured against inadvertent switching on.

If metal domes are in use, the keypad has to be dustproof connected to the PCB (glued).

Display and Window

The contrast and read-out angle should be optimized so that the display is as free from distortion and reflection as possible. The display must be designed in such a way that the user cannot see the insides of the unit. The lighting must be uniform.

The window must be designed in such a way (form and placement) that it is largely protected against inadvertent scratching (for example, the housing may be designed so that it protects the window). At the same time, the window must be designed in such a way that the underlying display is not destroyed if placed under pressure.

The display window shall be designed in such a way that an accumulation of dirt or grime between the glass and the window due to static charging is avoided.

The clearness of the display window may not change (become opaque) due to exposure to climatic factors (neither before, during or after testing). There may be no permanent changes in the colors shown on the display after the various climatic tests have been performed.

The visibility of the display must be correct when using polarization glasses.

SIM Card Reader

Insertion and removal of the SIM card must be easy to handle. The reader / SIM card must allow smooth movement, with only marginal play. The reader may not tilt or jam. To prevent incorrect operation, there must be a clear control to show that the SIM card has been inserted properly. The system must tolerate a possible incorrect operation. The card (holder and reader) may not be damaged if incorrectly inserted. If incorrectly inserted, the card must be easy to remove.

Removal during operation of the phone may not lead to damage of the SIM card.

Plug System

The plug must be easy to plug in, without noticeable play. The plug must go in straight and may not jam. The patch plug must lock cleanly into place.

An incorrect insertion of the plug (upside down, i.e. 180° flip-over) must be prohibited.

Mechanical stress to the soldering points must be avoided.

I/O connector

All pins of the I/O-connector must withstand a short circuit to 0 V or to any other pin without a remaining impact. This is also valid for the external connectors of the battery pack and the contacts of the whole accessory as well. The inversely polarized feed of external voltages to accessories and / or unit may not lead to a hazard of the customer.

Battery Pack

The battery pack must allow smooth movement, with only marginal play. The pack may not tilt or jam when inserted or removed. The lock may not jam, must be easy to operate and may not show any wear and tear for the life of the unit. All moveable parts must be covered to prevent injury to the user. The battery pack must be designed in such a way that it cannot be inserted incorrectly.

If the housing should be specially designed, the color of all related parts must be uniform to ensure a suitable match.

Camera

An illumination control has to be selected for the image performance (typical mode by default).

Blooming, smearing and other effects may not occur in the presence of difficult light situations (illumination control).

Any color changes, any image quality reduction and any impairment caused by the LCD or other components are not allowed.

Sealing

The sealing parts shall have no influence to the performance of the functions (key, camera, I/O).

The colour and form of sealing parts shall remain over the lifetime.

Lifetime and Utilisation

For the complete life of the phone the following functions of the phone must be guaranteed and must remain preserved without any optically visible wear (excerpt from Standard Test Plan):

Number of cycles for operation elements

Operating element:	Number of repetitions:
1. Normal key	150,000
2. Navi key	400,000
3. Soft key	200,000
4. I/O connector	10,000
5. SIM contacts	2,000
6. Flexible cables	100,000
7. Battery lock	2,000
8. Battery contact	2,000
9. Vibrator (tremblings)	250,000
10. MMC contacts	5,000
11. Hinge Funktion	80,000
12. Hinge IP64	20,000
13. Slider function	100,000
14. Led flash used as flash light	30,000
15. Led flash used as torch	> 1000 hours

Other requirements

- The contrast of the LCD display must not reduce by more than 50% within 5 years.
- The phone housing must be distortion-proof for its service life and resistance against fracture from a fall from 1.52m on to a concrete surface.
- No changes of vibrator performance (loudness and vibration) over the lifetime.
- The phone must (with or without a battery) withstand a fall on to a concrete floor from a height of 1.52m in any situation without incurring damage.
The battery must withstand a fall from 1.00 m on to concrete or steel.
- The life of the battery under GSM conditions is around 500 charge cycles and within this time the battery performance must not fall below 80% of its nominal capacity.

Sealing parts in the enclosure shall be resistant against surface abrasion.

Scratch proofness

Tested with hardness tester - Erichsen, model 318 (engraving stylus type Bosch Ø 0.75 mm, speed 10 mm/sec., length 10 mm)

a) Display window:	15N
b) Dyed granulated material:	10N
c) Dyed granulated material, polished:	5N
d) Painted surface:	7 N

Very faint marks that only change the surface shine are not to be considered as scratches.

IP Classes

IP classes (dust and water resistance) for the product are defined as follows:

Cellphone:	IP 50
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Mechanical, Climatic and Ageing Requirements

Mechanical, Climatic and Ageing Requirements for mobile phones and accessories (test specifications and assessment criteria) are contained in detail in the General Quality Requirements Rev. 3.1.

Electromagnetic Compatibility, SAR and Others

Standards and additional Siemens requirements regarding EMC, ESD, SAR and other issues are contained in detail in the General Quality Requirements Rev. 3.1.

These requirements include the Siemens requirements for robustness against ESD discharges (+/- 8 kV direct contact discharge and +/- 15 kV air discharge without ground connection, with permissible functional disturbances but no damage).

9.2 Environmental Protection

Siemens AG places great emphasis on the importance of environmental protection. The law is also making greater demands on the recyclability of products. One of the most significant publications in this respect is the "Electronic Waste Regulation", which prescribes as obligatory the recycling of used electrical appliances. In order to do full justice to these requirements and to our own ecological aims, the following considerations are paramount when dealing with new products:

- The product must be able to be dismantled easily
- No use of welds and adhesives
- A reduction in the variety of materials used
- Avoidance of compound materials
- Marking of plastic parts
- No pollutants must be used
- Recycling/disposal documentation must be drawn up

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Requirements of Recycling Process

As we cannot make any safe predictions on the nature of future recycling technology, the following recommendations are based on the trends recognisable today for future recycling technology. In this respect recycling technology requires that old machines can be dismantled, taken to pieces and sorted out into those materials for which reprocessing capacities exist or which have to be taken to depots or incinerators.

Dismantling or taking to pieces of telephones in:

- Electronic/electrical components (assembled FBG, display,)
- Plastics (by type) (housing, ...)
- Cable and leads (coax cable, ...)
- Metal (screws, ...)
- Paper/cardboard (IMEI plate, ...)
- Waste/other (Keypad mat, earpiece, ...)

Recycling Concept

Depending on the structure of the components the requirements on materials must satisfy motor car requirements:

- No use of Cadmium
- No CFCs
- As far as possible components made of polymer materials must be marked (depending on size)
- Emission of organic compounds
- Free from Asbestos
- Marking of the battery pack (recycling Instructions: don't throw into fire, etc.)

Construction

For a construction sequence, which does justice to recycling factors those operational steps, are important which determine the choice of material and the method of jointing them.

An easy-to-assemble automated construction normally also fulfils the criteria for easy disassembly.

From the point of view of recycling, the rules and basic premises of the standard design and the standard constructional design must be kept and extended.

The following recommendations are a general aid for making sure that when the product is designed and developed, the parts of the newly developed products can be recycled.

For detailed descriptions and information please refer to SN 36350.

General

- As few separate parts as possible
- Avoid material compounding (e.g. sticking together of different materials and laminates)
- Joining and de-jointing wherever possible in one direction
- Guarantee accessibility of disassembly tooling
- Use unified screw heads in respect of type and size

Connections

- Connections should be used which can still be separated easily even after the planned product utilisation life.
- The number of different types of connection should be minimised.
- Standardised connection processes should be selected.
- Self-retaining connection processes (clipping and snapping) should be used.
- In the case of snap connections, one unlocking possibility should always be foreseen. If this is not possible, then the connection should be easy to take apart by knocking.

Materials Selection

- Reduce the number of different materials used
- Only use plastic from the selected or preferred list
- Do not use any materials which are difficult to recycle
- Plastic parts should be marked in line with DIN 54840 or MP-specific regulations (Standard Construction Concept, Sheet 32.1),
- Avoid using material compounding (e.g. injected plugs, sticking of different materials, laminates). If it is not possible to avoid these compound structures, then separating aids should be foreseen, e.g. easy opening points, and these should be included in the User Manual.

9.3 Quality Plan

A project specific quality plan is created and maintained by the QM department. This document contains:

- Checklist of basic failures from former products
- FMEAs (responsible: R&D)
- Environmental Tests (status of device, variants, amount; RD responsible before B2, QM responsible from B2)
- Field trial (status of device, amount)
- Product audit
- Milestone review
- Checklist risk analysis

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- Checklist safety instructions in the user manual

9.4 Department PSQA-plans

Project specific quality assurance plans (PSQA-plans) are defined by the relevant departments and responsible persons are named. These departments are, according to MEP Issue 6 from May 28th 2004: Radio, EMC, Logic, Mechanics and Layout/Production Data.

The PSQA-plans should contain, amongst others:

- Planning of failure mode and effect analysis (FMEAs)
- Planning of design reviews
- Test plans for components / sub-systems / assemblies
- For the mechanical PSQA-plan: Test plans for environmental testing (shock, drop, climatic factors, aging, etc.) in the mechanical test plan
- For the Electrical and EMC PSQA-plans: Test plans for electrical and EMC tests to ensure compliance with the requirements set out in the specifications for the device and the interfaces

9.5 Product Safety and Technical Risk Assessment

A technical risk assessment for this project will be created until M1 by the Quality department. The technical risk assessment contains, amongst others, acoustic shock, short circuits, charger, battery.

For reasons of product liability, the user must be protected from electric shock caused by voltages applied to the outside of the device or the accessories.

The product and supplied accessories (in the following called only "product") must comply with all relevant international and/or national standards in accordance of the country of distribution.

For Europe the product must comply with all relevant EU directives in order to fulfil the requirements for CE marking.

- 1) The Radio and Telecommunications Terminal Equipment Directive
- 2) Low Voltage Directive (LVD)
- 3) EMC Directive
- 4) SAR
- 5) VDA guidelines (Accessories)

For each of the directive the applicable international harmonised standard(s) have to be applied. National deviations or standards (in case international standards are not existing) in accordance to the country of distribution have to be considered.

Where harmonised standards do not exist, latest technical publications have to be considered.

Suitable means (e.g. ramping like in L55) to guarantee protection from acoustic shock have to be implemented.

Special Precautions:

- Precautions (mechanical, software engineering) must be taken to prevent danger to or injury of the user through inadvertent switching on of the device
- In order to protect the user, ramping has to be activated for all tones and melodies (increase of the sound pressure level from a value below 120 dB SPL to the maximum value in 1.5 seconds or longer). If ramping is not possible (short tones, like signal tones), the sound pressure level shall not exceed 120 dB SPL.
The user protection shall be realized by means of hardware (e.g. second speaker, ramping and limitation of sound pressure level realized by an electronic circuit,.... not controlled by software.)

Product Safety and the Software

- Precautions (mechanical, software engineering) must be taken to prevent danger to or injury of the user through inadvertent switching on of the device.
- Software engineering precautions are to be taken to prevent danger to or injury of the user through an acoustic shock as the ringer function or handsfree mode is implemented over the receiver. A separate review must be carried out by R&D-Department to ensure that this requirement is met.

9.6 Software Quality

Software QA Plan

A Software Quality Assurance Plan will be set in place until M1 that sets out both the general and project-specific requirements and stipulates the quality assurance measures that are to be taken during the development process. Reviews by Quality Management are done on the basis of the currently valid milestone checklists and the stipulations set out in the Software Quality Assurance Plan.

Software Process Code

Software is to be developed in accordance with the Software Process Code (QMS - VA T010 SW-Pro) set out in the Software Project Management Guidelines (published on the SW-Initiative homepage) and the Software Quality Assurance Process (QMS - VA Q025-MP SW-QA in projects).

9.7 Field Trials

General

This procedure shall be used for SIEMENS internal products.

9.8 Aim and Focus of the Field Trial

- Confirmation of compliance in home and foreign networks. Tests according to GCF AP (GSM Certification Forum - Application Procedure)

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- Confirmation of hardware and software quality (ready to be introduced into the market)
- Detection of weak points in the HW construction of the mobile phone and accessories, SW errors/bugs by functional tests as well the check of user manual

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9.9 Realisation

- Dependent on the product specification, GCF Field Trial tests in different GSM networks (see also chapter 4.4.2.3) will be performed
- End User test with pre-production samples (SIEMENS B2-samples)
- Extended End User with samples from pilot series
- The accessories for the product shall be included in the Field Trial

9.10 Test Level

9.10.1 Technical Field Trial

Tests in GSM 900/1800/1900 shall be coordinated and performed by QM PV. QM PV will create the corresponded test list.

9.10.2 Time Frame

The following time frame was taken into account:

S25: 24.06.2005

S3: 26.08.2005

S4: 27.01.2006

The basic functionality with the accessory shall be tested and confirmed with B1 samples.

The official Field Trial shall start with the provision of B2 pre-production samples at S3 and shall end with S4 (at least four weeks testing time). The extended Field Trial shall start with the production of the first samples from the pilot series (at least four weeks testing time).

The beginning of the Field Trial shall start under the following conditions:

Hardware

- B2 Field Trial samples are available. Those samples shall have the final layout ready for approval. For the Field Trial it will be taken into account that HW - variants (e.g. alternate display manufacturers) exist. Such different variants shall be available for the Field Trial. The number of samples shall be defined according to Six Sigma tools and depends on the number of different variants.
- For the extended Field Trial, samples from pilot series shall be made available. The number of samples shall be defined according to Six Sigma tools and depends on the number of different variants.
- Agreed accessories shall be available for Field Trial
- The Field Trial samples shall have a valid test IMEI

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- Access to mobile engineering functions shall be possible
- **Full scope of supply is needed**

To avoid any time delay during the Field Trial phase the following shall be ensured:

- The samples shall have the possibility to record a mobile trace via PC – software (not only in office environment, but also in the field). Necessary HW (e.g. tracing cable, adapted devices with 2nd BfBus - connector) and tracing SW shall be made available at S25.
- The provision of a monitor mode in the mobile shall be ensured
- Field Trial samples shall not have a SIMLOCK

Software

- The SW shall be stable (frozen).
- All agreed features are implemented and tested. (Note: Implementation of features during the Field Trial phase will lead to re-tests)
- At milestone S3 (prior to the Field Trial), all known errors shall be recorded and evaluated in a review between R&D and Software Quality Assurance. Errors, which hinder the realisation of the Field Trial, shall be closed.

To avoid any time delay during the Field Trial phase the following shall be ensured:

- During the Field Trial phase, the SW of the mobile phone shall be upgradeable also outside the factory (e.g. SIEMENS LG's). The necessary SW tools + HW (upgrade cable) shall be made available to QM PV at S25. QM PV shall have at least limited EEPROM read/write access (SW exit codes etc.)
- Any SW feature implementation, which leads to the need of a SW update which can not be done in the field (e.g. re-writing the IMEI because of implementation of security features) shall be implemented prior to the start of the Field Trial.

Engineering equipment

The following equipment shall be made available to ICM MP CCQ QM PV:

Description	Number	Date
Mobile phones (B1) including charger (The voltage range of the charger shall include AC220-240V; 50/60Hz or if applicable AC100-120V; 50/60Hz. A plug adapter for standard European socket outlets – if necessary – shall be available). (Note: Those samples are needed to test the Tracer SW, SW upgrade etc. prior to the Field Trial)	-	S25
Tracer Software	-	S25
Tracing Hardware (cable)	25	S25
Tracing Hardware (adapted devices; 2 nd BfBus connector)	16	S25
Mobile – Boot Configuration (e.g. Upgrade cable if different from tracing cable, service box etc.)	25	S25
SW upgrade tools (e.g. SWUP, Initialisation tool)	-	S25
External Antenna (possibility to connect the mobile to a CMD)	-	S25
Access to SW and HW – error tracking database	-	S25

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Others: Overview to the planned SW "standard – variant" (Documentation)	-	S3
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It shall be ensured that those engineering equipment can be used during the whole Field Trial phase (no changes after S25).

9.10.3 Performance aspects covered by Field Trial (Overview)

The following general functions and aspects of the mobile phone shall be tested during the GCF and End User Field Trial. For the End User a questionnaire shall be prepared and evaluated.

- Basic handling, including set up, clear and in-call functions
- Cell selection and reselection
- Automatic & manual PLMN selection
- Handover
- Operation of each basic service, supplementary service and features within the scope of GCF and which is supported by mobile. (fax / data services / GPRS). For speech it includes a degree of subjective speech testing sufficient.
- SMS (MO – PP, MT – PP and CB)
- Interworking with different SIM cards (using different types of SIM/card / profile)
- Interworking with agreed accessories
- Review of user manual
- HW Construction of the mobile phone

9.10.4 Documentation

SW / HW - errors from the Field Trial will be recorded in the relevant error tracking data base (e.g. Clearquest for SW; equivalent HW tracking data base).

At the end of the official Field Trial, a summary report shall be prepared.

The successfully finished Field Trial is the basic for the milestone S4.

Annex A

Quantity Planning Pre-Validation

40pcs of B1 or newer samples

Quantity Planning GCF

For the GCF Field Trial a quantity of **25pcs of B2** or newer samples is needed.

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Quantity Planning customer acceptance test

For the customer acceptance test a quantity of **250pcs** of B2or newer samples for field trial mobiles is needed:

Count:

GCF	25
EMEA	50
APAC	30
China Variant	30
Customer Acceptance	110
US	20 (C65)
SWAP	15

Total: 280pcs (incl. China)

mobiles have to be available latest 2 cw before start of field test (End user test / GCF)

quantity has to be divided into available HW-Variants (variants not yet available)

complete selling volume is needed

Remarks

- **all mobiles need the same boot-kernel**
- **all mobiles have to be signed with the Field Test key**
- open BF Bus (will be done by field test team)
- Information about booting and tooling
- Delta Description for new software versions
- New software has to be available latest until Friday 09:00h (weekly)
- Access to developer drives
- Actual sw has to be available as *.exe file by start of validation (update via data cable)
- Change of blocks, e.g. new NF parameters, have to be available also as *.exe files
- It is not possible to update mapping files global
- Development environment is not global wide available
- Delta map file (eg BRD-Handel) should be available before shipping

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Customization

Customization will be tested within End user test. We're able to perform tests in countries and networks we support with field test activities.

Information and tooling (sw tools, test list etc.) should be available latest 2 weeks before pre-validation starts.

Accessory

Accessory field test will be performed in parallel

Accessory has to be available 2 weeks before start of field trial

Realization:

The Pre-validation will start at the beginning of April 2004 (agreed with Andreas Betting) with the aim of supporting the SW development. It will end with the beginning of the customer acceptance test.

The customer acceptance test will start with a maturity (SW) of S3 and B2 HW. It will take at least 5 weeks.

The GCF fieldtest will start with a maturity (SW) of S3 and B2 HW. It will take approximately 3 weeks of testing (incl. GCF report)

9.11 Requirements for Product Audit

If no antenna connector is accessible for the Product Audit, an antenna tube must be made available for measuring purposes at the Product Audit.

- The responsible department for the developing of this antenna tube must be the RD (the Product Audit has only the possibility to support the RD)
- The coupling between mobile antenna and coupling antenna must be < 12dB
- Reproducibility TX +/- 0,3dB
- In case of different RF-chipsets (e.g. Hitachi/ Infineon), it must be possible to use the tube for both variants
- With the antenna tube, it must be possible to test all items of the Product Audit (excluding spurious emissions). These test items are contained in a separate file which is available to RD.

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9.12 Requirements for outgoing Inspection

A Device Check must be implemented in the software based on the implemented feature set and the current requirements for the factory's outgoing inspection and box opening.

9.13 Robust Development

The phone will be developed using the Robust Development Process with RPD modules and targets as described in the RPD scorecard. The RPD process will be regularly monitored.

9.14 Field Return Rate

Return rate $\leq 13,2\%$ (132.000 dpm)

Return rate DS SW: 5%

Return rate S4 SW: 3%

9.15 Quality of Suppliers and Components

See separate Quality Assurance Agreements (QAAs) for each supplier and component.

9.16 Quality in Production

Required Quality in Production

The medium and long-term aims of QA Production are a continuous improvement in the through-flow rates and Q numbers in the production processes.

To achieve these targets the essential factors are qualified processes with Cpk values larger than 1.33, batch tolerant switchings, simple assembly concepts, a reduction/standardisation of the parts (phone, accompanying packs). In the early developmental stage the pre-requisites should be planned by the departments concerned in order to achieve quality benchmark figures and in the course of the developmental process these should be checked for their effectiveness.

The quality key figures shown in the table are target values that are defined at the beginning of each business year. They are mean values over all products. In the future, detailed target values for different segments might be set.

Quality key figures		FY	FY	FY***	target
A/C/M/S	unit	01/02	02/03	03/04	04/05
Test process					
first pass yield board test	[%]	**	**	**	94,0
first pass yield system test	[%]	**	**	**	97,5
first pass yield customer test	[%]	**	**	**	95,0
first pass yield customer init	[%]	**	**	**	99,0
Delivery process					
Outgoing inspection/mobile	[%]	**	99,88	99,96	99,95
Outgoing inspection/delivery content	[%]	**	99,74	99,92	99,90

* key figure results all products all plants
 ** key figures not existing
 *** cumulated october 03 to august 04

Quality Benchmark Figures

Data source ICM MP CCQ QM SC

NPI requirements

Requirements Set for Electric Specifications for Mass Production Variability of parameters to be balanced

mena +/- 3σ

Receiver sensitivity (all channels, without fading):

GSM	< -104dBm
PCN1800/1900	< -102dBm

Transmit output power (all channels)

GSM	>31.5dBm
PCN1800/1900	>29.4dBm

Transmission phase distortion

GSM / PCN 1800/1900 <3.8°

AF signal-to-noise ratio

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 Performance_Description_Hydra_v1_0

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-S/(N+D)>20dB measured at the receiver capsule at a nominal sound pressure of 94dbspl (1Pa) at 1kHz.

9.17 Deviations from Agreed Quality Level

Any deviations in quality which may occur and the decision as to whether these are to be accepted shall be made by Product Marketing, Business Administration, Development and Quality Management.

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10 System Test

Link to Siemens Standard Requirements:

file:\\mchgcldv01\data\projekte\ENTWDOKU\I&T_ALG\Milestone templates\M1\SRS_Template_current.doc

11 Milestones

X75 Hydra / EMEA & APAC product

	Milestone	Date
M0	Product(s) within platforms are defined	07.07.04 / CW28
S0 HW	Requirement Release – Design freeze	10.09.04 / CW37
S0 SW	Requirement Release – Design freeze	30.11.04 / CW49
M1	Implementation Release	30.11.04 / CW49
S15	A1 Module Operable in Basic Function	15.12.04 / CW51
S2	Tested Functional Sample (B1)	02.03.05 / CW09
C3 SW components		29.04.05 / CW17
S25 HW	Tested Prototype Device B1+	04.05.05 / CW18
S25	Tested Prototype Device B1+	24.06.05 / CW25
AS	Approval Start	08.07.05 / CW27
S3 HW	Pre-Series Release B2 for HW	15.07.05 / CW28
Start Pilot Run*	Release for Unrestricted Series Delivery	15.08.05 / CW33*
MKA	Maturity of Key Applications	05.08.05 / CW31
PS	Production Start	29.08.05 / CW35
S3 SW	Pre-Series Release B2	26.08.05 / CW34
DS	Delivery Start	22.09.05 / CW38
DS APAC	Delivery start APAC	20-10-05 / CW42
S4 HW	Series Production Baseline HW	20.10.05 / CW42
S4 SW	Series Production Baseline	27.01.06 / CW04
M3	Release for Unrestricted Series Delivery	28.02.06 / CW09



* The start of the pilot series is planned for CW33 2005 and it is aimed to produce 3k units of the standard variant.

12 Miscellaneous

12.1 Technical Risks

Please refer to the risk list located under following link :

[Risk list for M1](#)