

**After Sales Technical Documentation
RAE/RAK-1N Series**

Chapter 4

**-Transceiver GE8/GE9 -
UIF Module**

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Introduction

This document describe UIF (GK2 for GSM, GK2-1 for PCN) module. UIF module includes CMT display ,CMT keypad ,PDA soft keypad and antenna matching circuit with connectors. It has also connection to PDALCD (GK1). PDALCD and UIF modules, together these are called the LCDM. The LCDM has all the electronics in the cover side of RAE-1 (for GSM) and RAK-1 (for PCN).

Note: GK2 is for GSM
GK2-1 is for PCN

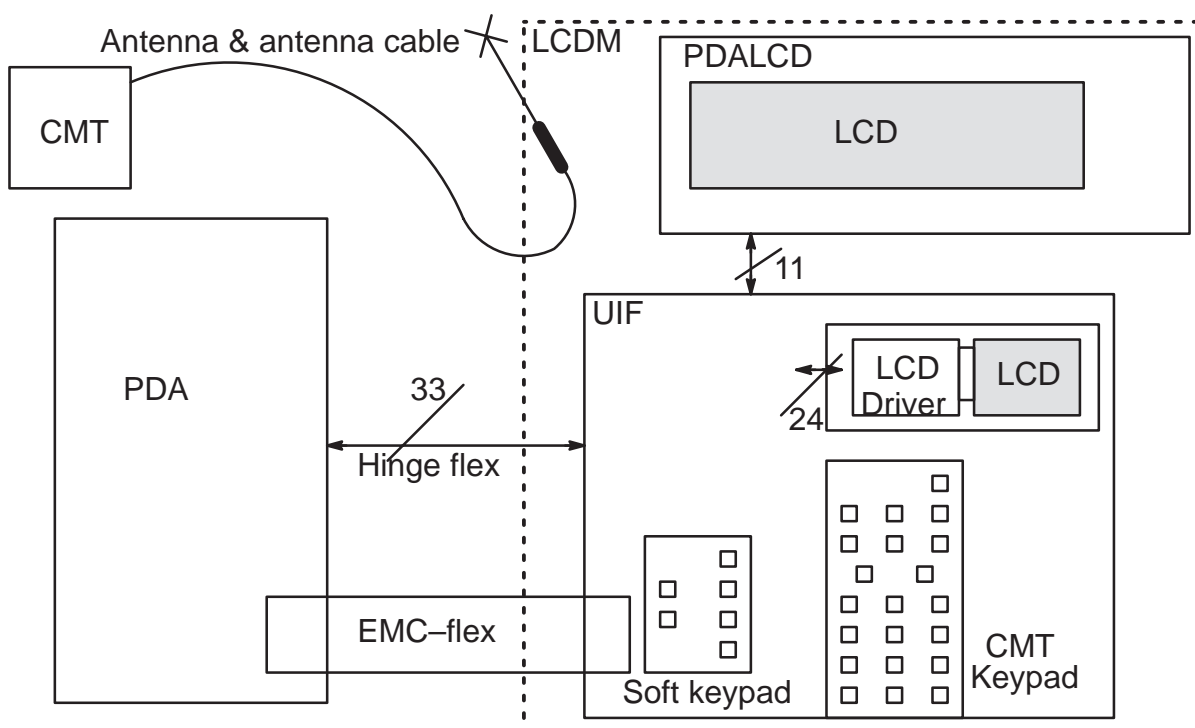


Figure 1. LCDM

Technical Summary

UIF Mechanics

The module is made for 0.6 mm thick Printed Circuit Board. PCB has four-layers. Reasons for that kind of material:

- Four layers are needed because of antenna is also assembled in this module. Additional layers will improve shielding against RF-radiation.
- We do not need Flexible Printed Circuit (As used in HD841) because we do not have side keys.
- PCB is easier to assembly than FPC.
- PCB is cheaper than FPC.

The major parts on the module assembly include the following:

- CMT Display module. Same module as used in HD841 including LCD, Heat seal, LCD driver TAB circuit and Light guide.
- CMT keydome assembly: Adhesive film holding 20 metal domes.
- Soft keys on the other side of PCB: four domes on the other end and two domes on the other end.
- 33-pin flex connector for hinge flex.
- 12-pin flex connector for GK1 display module.
- Coaxial cable connector for antenna cable.
- Antenna clips.
- 11 test pads.

Figure 2. shows the UIF mechanical shape and part placement.

Note: For RAK -1 (GK2_1module) the antenna circuit is different from the one shown in this diagram. See the UIF Component Layout in section 10 for details.

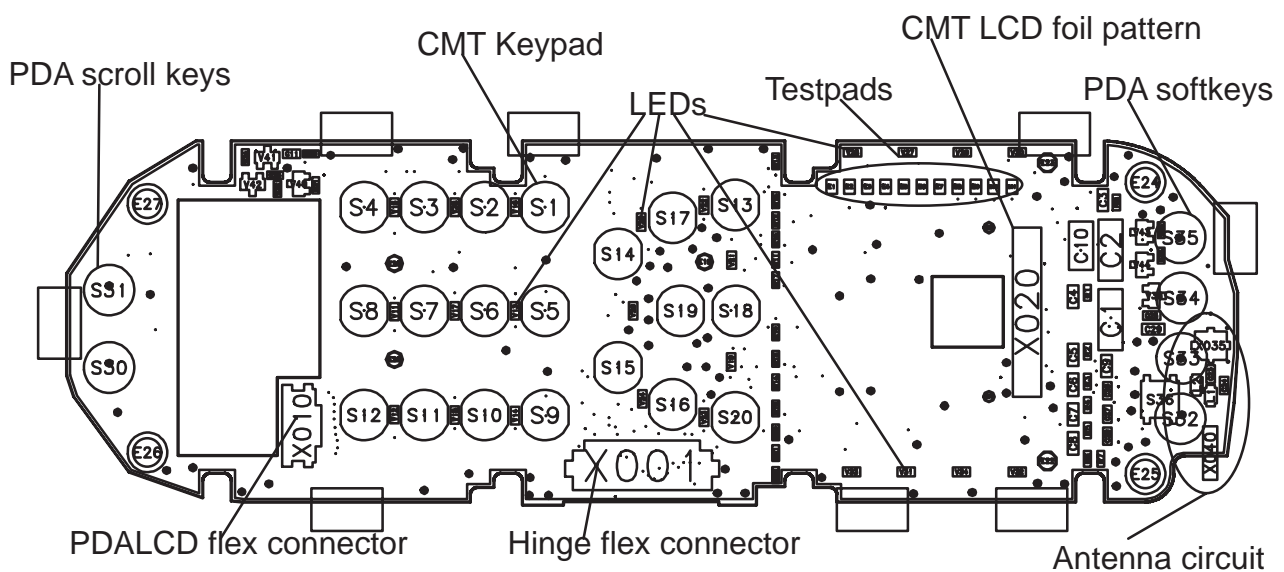


Figure 2. UIF Board

UIF Flexes

There is two flexes that are connected to the UIF module and go through the hinge. The other one is 33-pin flex. It has all active signals for the UIF module and three ground pins. It is connected to the 33-pin flex connector. The other one has one wide ground line. It is connected by using two sided copper tape with conducting adhesive. It is needed to improve EMC characteristics.

Both flexes are made of flexible material. Flexible material is needed because the hinge will be opened thousands of times and the signals must be working all the time.

UIF Electronics

The following sections of circuitry are on the UIF module:

- CMT LCD Display Module
- CMT LCD voltage divider & temperature compensation circuit.
- CMT Keypad & CMT LCD illuminating circuits.
- CMT & Soft keypad matrix.
- Antenna impedance matching circuit.
- Hinge flex connector.
- PDALCD flex connector.

Technical Specification

UIF Electrical Characteristics

DC Characteristics

Table 1. Supply Voltages and Power Consumption

Pin / Conn.	Line Symbol	Minimum	Typical / Nominal	Maximum	Unit / Notes
2/X001	VL1	4.65	4.8	4.95	V
			1.5 mA		LCD material B
			0.8 mA		LCD material D (without temperature compensation)
1/X001	VBATT	5.3	7.2	8.4	V
			40 mA		Display illumination
			40 mA		Keypad illumination
27/X001	LCDVCC		3.3V		PDALCD Logic voltage
28/X001	LCDVEE	17V	22V	25V	PDALCD LCD voltage

Table 2. DC characteristics of PDA Hinge–flex connector on LCDM module

Pin / Type	Line Symbol	Minimum	Typical / Nominal	Maximum	Notes	
10,17,24 / UIF	GND				GND	
6–3 / UIF	LCMUIF(3:0)	0V		0.7V	Output/Input low	keypad row lines/ display data lines
		4.65V	4.8V	4.95 V	Output/Input high	
7 / UIF	LCMUIF4	0V		0.7V	Output/Input low	keypad row read/write strobe for LCD driver
		4.65V	4.8V	4.95 V	Output/Input high	
8 / UIF	LCMUIF5	0V		0.7V	Output/Input low	keypad row LCD driver register select
		4.65V	4.8V	4.95 V	Output/Input high	
9 / UIF	LCMUIF6	0V		0.7V	Output/Input low	enable strobe for LCD driver
		4.65V	4.8V	4.95 V	Output/Input high	
14–11 / UIF	LCMCOL(3:0)	0V		0.7V	Output/Input low	Keypad column write
		4.65V	4.8V	4.95 V	Output/Input high	
15 / UIF	BACKLIGHTO	0V		0.7V	Output low, backlights off	Display and keypad illumination control
		4.65V	4.8V	4.95 V	Output high, backlights on	
16 / UIF	LCMXPWRON	0V	0V	0.7V	Input low, power on/off	Power ON/OFF key
			4.8V		Floating when inactive. A pull-up in PSL+.	
21–18 / PDALCD	LCDD(3:0)			0.4 V	Output low	PDA LCD, Data lines
		2.6 V			Output high	
22 / PDALCD	LP			0.4 V	Output low	PDA LCD, Line pulse
		2.6 V			Output high	
23 / PDALCD	PCLK			0.4 V	Output low	PDA LCD, Pixel clock
		2.6 V			Output high	

Table 2. DC characteristics of PDA Hinge-flex connector on LCDM module (continued)

Pin / Type	Line Symbol	Minimum	Typical / Nominal	Maximum	Notes	
25 / PDALCD	FP			0.4 V	Output low	PDA LCD, Frame Pulse
		2.6 V			Output high	
26 / PDALCD	DISPON			0.4 V	Output low	PDA Display on control signal
		2.6 V			Output high	
31-29 / UIF	KEYD(2:0)			0.4 V	Output low	Keymatrix drive lines
		2.6 V			Output high	Keymatrix drive lines
33, 32 / UIF	KEYS(1:0)	- 0.5 V		0.8 V	Input low	Keymatrix sense lines
		2.0 V		4.1 V	Input high	

AC Characteristics

Table 3. AC characteristics of RF connectors

Conn.	Parameter	Minimum	Typical / Nominal	Maximum	Unit / Notes
X035, X040	Impedance		50		ohms
X035, X040	Transmitter frequency GSM PCN	890		915	MHz
		1710		1785	MHz
X035, X040	Receiver frequency GSM PCN	935		960	MHz
		1805		1880	MHz
X035, X040	Max. output power		2W (33 dBm)		GSM PCN
			1W (30 dBm)		

UIF External Signals and Connections

Table 4. Hinge flex connector (X001) signals

Signal Name	Pin	Signal description	Note
VBATT	1	Battery voltage	
VL1	2	CMT logic voltage	
LCMUIF(3:0)	6-3	keypad row / display data	
LCMUIF4	7	keypad row / Read/Write for strobe for CMT LCD	

Table 4. Hinge flex connector (X001) signals (continued)

Signal Name	Pin	Signal description	Note
LCMUIF5	8	keypad row / LCD driver register select	
LCMUIF6	9	enable strobe for LCD driver	
GND	10	Ground	
LCMCOL(3:0)	11–14	Keypad column write	
BACKLIGHTA	15	Display and keypad illumination control	
LCMXPWRON	16	CMT Power/Off key	
GND	17	Ground	
LCDD(3:0)	21–18	PDA LCD Data	
LP	22	PDA LCD Line Pulse	
PCLK	23	PCD LCD Pixel Clock	
GND	24	Ground	
FP	25	PDA LCD Frame Pulse	
DISPON	26	PDA Display ON Control signal	
LCDVCC	27	PDA LCD Logic voltage	
LCDVEE	28	PDA LCD Voltage	
KEYD(2:0)	31–29	PDA Keymatrix drive	
KEYS(1:0)	33–32	PDA Keymatrix sense lines	

Table 5. PDA LCD flex connector (X010) signals

Signal Name	Pin	Signal description	Note
Dispoff	1	Display On/Off signal	
FP	2	Frame Pulse	
LP	3	Line Pulse	
PCLK	4	Pixel Clock	
LCDD0	5	LCD Data	
LCDD1	6	LCD Data	
LCDD2	7	LCD Data	
LCDD3	8	LCD Data	
LCDVCC	9	LCD Logic Voltage	
GND	10,12	Ground	
LCDVEE	11	LCD Voltage	

Table 6. RF Connectors

Signal Name	Connector	Signal description	Note
RF1	X035	RF Signal to/from CMT module	
RF2	X040	RF Clips connector to/from Antenna	

UIF Mechanical Characteristics

Table 7. UIF Mechanical Characteristics

feature	value	notes
Weight	23g	Typical
Dimensions	165.0x50.8x4.0mm	Typical

Functional Description

UIF Circuit Description

The module is connected with 33 pin flex connector to the PDA Module, 24 pin soldered connection to the CMT LCD module and 12 pin connector to the PDALCD.

The module includes following main blocks:

- CMT keypad and PDA Soft keypad
- illumination
- CMT LCD Module interface
- PDA LCD connector
- Hinge flex connector
- Antenna impedance matching circuit
- Test pads for CMT LCD and LED testing
- Antenna connector and antenna clips

Keypad scanning and display driver control

COL(0–3) are used as column lines in keypad. UIF(0–5) are used as row lines. They are also multiplexed with display driver control signals.

When a key is pressed the ASIC gets an interrupt from a row and the MCU starts scanning. One column at a time is written to low and rows are used to read which key it was. The power off detection is multiplexed with one row; when all keys on the row seems to be pressed the ASIC knows that power key is pressed. The power key is also connected to PSL+ to switch the power on.

Row lines and UIF6 are used for display driver control. UIF(0–3) are used as 4 bit parallel data bus for the driver. UIF4 is used as read/write strobe, UIF5 to select data or instruction register and UIF6 as enable strobe.

Keypad and display illumination

The keypad illumination is achieved by using two transistors wired as simple constant current sinks. Each transistor supplies eight leds. The bases of the transistors are all wired together and supplied by emitter follower V40. The led current is fixed by the values of R33 and R34 and the ratio of R30 to R31. The current is about 5 mA/ each LED.

The display illumination operates in a similar way to the keypad drivers, two transistors are used to drive eight leds. The current in this case is defined by the value of R35, R36 and the ratio of R30 to R31. It is about 10 mA / each LED.

CMT LCD Module Interface

The LCD module includes the LCD and the display driver. The driver TAB is connected with heat seal connection to the LCD. The LCD is FSTN type. The duty ratio is 1/32 and the bias ratio 1/6.7. Viewing direction is 6 o'clock.

The display driver is NJU6406-02 from JRC. It has internal clock oscillator and negative voltage generator. It has 9600 bit character generator ROM and 64 * 8 bits character generator RAM. The display module is connected to the UIF module with 24 pin soldered connection.

The display module contains an oscillator to generate a negative voltage required for operation. The oscillator frequency is fixed on the UIF module by the resistance from pins 2 to 3 of X020, with the values of R6 and R7 shown, the frequency is within 180 kHz to 370 kHz. The negative going pulses appear at pin 9 of X020 where they are smoothed by C1 to give a voltage which is nominally equal but opposite to VL1.

For correct operation of the display, dc voltages between -VL1 and VL1 need to be generated and fed back to the driver chip, at pins 4 to 8 inclusive (of X020). The exact voltages depend on the relative values of the resistors R8, R1, R2, R3, R4 and R5.

The display driver is connected to the radio module with a 4 bit data bus. Data transfer is controlled with the following signals: R/W selects read or write operation ("0" = write, "1" = read), Enable activates read/write operations and RS selects the register ("0" : instruction register (writing) or busy flag (reading), "1" : data register).

PDA soft & scroll keys

Six PDA keys is located in the UIF module. They connected to the same keymatrix as other PDA keys.

Antenna matching circuit

The purpose of the antenna matching circuit is to transform the antenna feedpoint impedance to 50 ohm, which is the nominal impedance of the antenna cable. The matching circuit consists of a series inductor and capacitor and shunt inductor in GSM and series inductor and shunt inductor in PCN. The antenna matching circuit has its own ground area connected to the braid of the antenna cable. Antenna ground and digital ground are not connected together at the UIF Module.

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