SC14CVMDECT
Cordless Voice Module

General description

The SC14CVMDECT is a member of the Cordless Module family with integrated radio transceiver and baseband in a single package. It is designed for hosted and embedded cordless voice and data applications in the DECT frequency band. Its simple to use AT Commands set allows setting up of a wireless link between 2 or more nodes without detailed knowledge of the DECT protocol.

Features

- Completely ETSI-certified
- ETSI 300 444 (DECT GAP) compliant
- FCC approved
- Supports EU-DECT (CAT-iq V1 wideband audio), DECT6.0 for North America and Japan DECT (pending approval)
- Up-to 6 portable parts registered per fixed part
- UART interface to external host
- Controllable via AT command set (over UART)
- Support voice and low speed data
- RF range: 1870 - 1930 MHz
- Receiver sensitivity < -93 dBm
- Transmit power 23 dBm (200 mW)
- Antenna's included
- Power supply voltage 1.9 - 3.45V
- Small form factor (25mm * 29mm)
- Contains both PP and FP functionality
- Program memory available for custom software.

Application Examples

- Cordless Intercom
- Cordless baby monitor
- Wireless Data applications up to 1.6 Kbit/s.

System Diagram

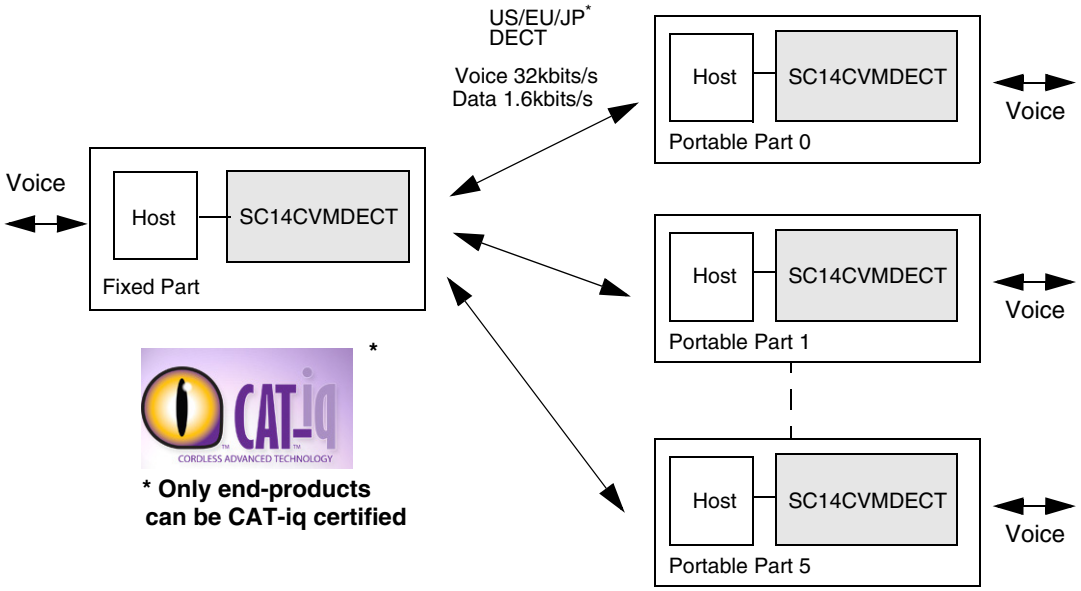


Table of Contents

1.0 Connection Diagram

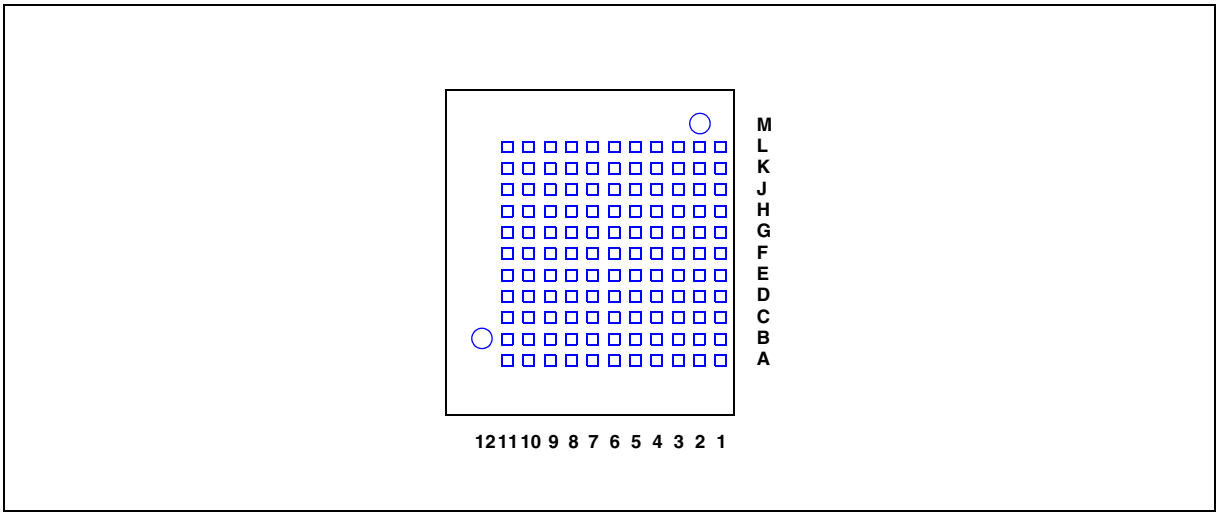


Figure 1 Connection Diagram (Bottom View)

1.1 PIN DESCRIPTION

Table 1: Pin description

Pin	Module Pin name	In/ Out	Iout Drive (mA)	Reset State	Description
A1	**GND**	-	-	-	Ground
A2	**GND**	-	-	-	Ground
A3	**GND**	-	-	-	Ground
A4	NC	-	-	I	leave unconnected
A5	VDDIO	I	-	-	Supply voltage for internal QSPI and data flash. Must be connected to VDD (1.8V).
A6	P1[2]/INT2	IO	2	I-PU	I/O port. INT2: Interrupt Input.
A7	**GND**	-	-	-	Ground
A8	**GND**	-	-	-	Ground
A9	VBAT	I	-	-	Main supply voltage <5.5V. Can be directly connected to a Li-Ion battery.
A10	P0[4] / SPI_EN	IO	8	I-PU	I/O port SPI_EN
A11	RSTn	I	1	I-PU (200k pull-up)	Active low Reset input with Schmitt-trigger input, open-drain output and pull up resistor to internal VDD. Input may not exceed 2.0 V. An internal capacitor of 100nF is mounted on this pin.
B1	**GND**	-	-	-	Ground
B2	**GND**	-	-	-	Ground
B3	CP_VOUT1	O	-	I	Charge Pump Output 1. Must be connected through a capacitor of 1uF to gnd
B4	P1[5]/INT5	IO	8	O-1	I/O Port INT5: Interrupt Input.

Table 1: Pin description (Continued)

Pin	Module Pin name	In/ Out	Iout Drive (mA)	Reset State	Description
B5	**GND**	-	-	-	Ground
B6	P2[6]/INT6 / WTF_IN	IO	2	I-PU	I/O port INT6: Interrupt Input. WTF_IN: -
B7	P0[5] / SPI_CLK	IO	8	I-PU	I/O Port SPI Clock
B8	**GND**	-	-	-	
B9	P0[1] / URX	IO	8	I-PD (10k)	I/O port UART Serial In
B10	VBATT	I	-	-	Secondary supply voltage. Connect to VCCRF.
B11	**GND**	-	-	-	Ground
B12	NC	-	-	-	RF pad, no pad on PCB
C1	**GND**	-	-	-	Ground
C2	PAOUTn	IO	500	O-0 (5k fixed pull-down)	CLASSD loudspeaker positive output
C3	**GND**	-	-	-	Ground
C4	P2[7]/INT7	IO	8	I-PU	I/O port INT7: Interrupt
C5	P1[4]/INT4	IO	1/2	I-PD	I/O port INT4: Interrupt
C6	P1[1]/INT1	IO	2	I-PU	I/O Port INT1: Interrupt LE: - INT6: secondary Interrupt
C7	**GND**	-	-	-	Ground
C8	P0[0] / UTX	O	8	I-PU	I/O Port UART Serial Out
C9	**GND**	-	-	-	Ground
C10	JTAG	IO	8	I-PU	JTAG-SDI+; one wire Debug interface with open-drain. Pullup with R=1k to Vdd.
C11	VCCRF	I	-	-	RFSUPPLY input < 3.45V. Connect to VBAT if VBAT less than 3.45V. Else this pin must be supplied from and external 3.3V LDO. Refer to Table 16 for supply requirements.
D1	**GND**	-	-	-	Ground
D2	PAOUTp	IO	500	O-0 (5k fixed pull-down)	CLASSD loudspeaker positive outputs
D3	PON	I		I (270k fixed pull-down)	Power on, Switches on the device if Voltage > 1.5V. May be directly connected to VBAT, also with Li-Ion batteries

Table 1: Pin description (Continued)

Pin	Module Pin name	In/ Out	Iout Drive (mA)	Reset State	Description
D4	CHARGE	I	-	I-PD (270k fixed pull-down)	Charger connected indication. Switches on the device if voltage > 1.5v. Must be connected to charger via resistor R>(Vcharger_max-3V)/10 mA (round to next largest value in range). If no charger used, Leave unconnected if not used. Charger is currently not supported.
D5	**GND**	-	-	-	Ground
D6	**GND**	-	-	-	Ground
D7	**GND**	-	-	-	Ground
D8	**GND**	-	-	-	Ground
D9	P2[4]/SCL1/ PCM_DO	IO	8	I-PU	I/O port SCL1; I2C clock PCM_DO: PCM Data output
D10	VDD	O	-	-	Digital Core supply voltage (1.8V TYP). Output from internal regulator.
D11	P2[5]/PCM_FSC	IO	8	I-PU	I/O Port PCM_FSC: PCM Frame Sync
E1	VDDPA	I	-	-	CLASSD Audio Amplifier supply voltage up to 3.45V.
E2	**GND**	-	-	-	Ground
E3	CHARGE_CTRL	O	-	O-0	Charge control pin. Leave unconnected if not used. Charger is currently not supported.
E4	SOCn	I	-	I	Battery State Of Charge negative input. Star point connected to the SOC resistor. Charger is currently not supported: connect to GND
E5	**GND**	-	-	-	Ground
E6	**GND**	-	-	-	Ground
E7	**GND**	-	-	-	Ground
E8	**GND**	-	-	-	Ground
E9	**GND**	-	-	-	Ground
E10	P0[7] / SPI_DI	IO	8	I-PU	I/O Port SPI Data Input
E11	**GND**	-	-	-	Ground
F1	SOCp	I	-	I	Battery State of charge positive input. Charger is currently not supported: connect to GND
F2	P1[0]/INT0/ADC1	IO	2	I-PU	I/O Port INT0: Interrupt 0 ADC1; ADC input 1
F3	ADC2/NTC	I	-	I	ADC2 NTC protection input for Li-Ion charger circuit. Charger is currently not supported: connect to GND
F4	NC	-	-	-	leave unconnected
F5	ULP_PORT	I	-	I	Ultra Low Power Port Pin Ultra low power is not supported by the software, connect to gnd.
F6	ULP_VBAT	I	-	I	Ultra Low Power Supply Pin Ultra low power is not supported by the software, connect to gnd.

Table 1: Pin description (Continued)

Pin	Module Pin name	In/ Out	Iout Drive (mA)	Reset State	Description
F7	ULP_MAIN_CTRL		-	I-0	Ultra Low Power Main Control Ultra low power is not supported by the software, connect to gnd.
F8	NC	-	-	-	RF pad, must be left unconnected
F9	P2[3]/SDA1 / PCM_DI	IO	8	I-PU	I/O Port SDA1: I2C Data PCM_DI: PCM Data input
F10	P1[3]/INT3	IO	1/2	I-PD	I/O Port INT3: Interrupt
F11	P0[6] / SPI_DO	IO	8	I-PU	I/O Port SPI Data Out
G1	**GND**	-	-	-	Ground
G2	LSRn	O	-	O	Negative loudspeaker output
G3	**GND**	-	-	-	Ground
G4	P3[3]/ADC0	IO	8	I	I/O Port ADC0; ADC input 0
G5	**GND**	-	-	-	Ground
G6	NC	-	-	-	leave unconnected
G7	**GND**	-	-	-	Ground
G8	NC	-	-	-	leave unconnected
G9	**GND**	-	-	-	Ground
G10	**GND**	-	-	-	Ground
G11	**GND**	-	-	-	Ground
H1	VREFM	-			Negative microphone reference (star point), connect to gnd.
H2	LSRp	O	-	O	Positive loudspeaker output
H3	P3[7]/RINGp	IO	4	I	I/O Port RINGp: Ringer detection input
H4	NC	-	-	-	
H5	GND	-	-	I	Ground
H6	GND	-	-	I	Ground
H7	P2[2]/PCM_CLK	I/O	8	I-PD	I/O Port PCM_CLK: PCM clock input/output
H8	NC	-	-	-	RF pad, must be left unconnected
H9	**GND**	-	-	-	Ground
H10	**GND**	-	-	-	Ground
H11	**GND**	-	-	-	Ground
J1	**GND**	-	-	-	Ground
J2	MICh	I	-	I	Headset microphone input with fixed input protection
J3	**GND**	-	-	-	Ground
J4	P3[5]/RINGING / RINGOUT	IO	4	I	I/O Port RINGING: Ring detection Input RINGOUT: -
J5	**GND**	-	-	-	Ground
J6	NC	-	-	-	RF pad, must be left unconnected

Table 1: Pin description (Continued)

Pin	Module Pin name	In/ Out	Iout Drive (mA)	Reset State	Description
J7	**GND**	-	-	-	Ground
J8	P2[1] / PWM1 / LED4	IO	8	I	I/O Port PWM1: Pulse Width Modulation output LED4: 2.5/5mA LED current sink
J9	**GND**	-	-	-	Ground
J10	**GND**	-	-	-	Ground
J11	**GND**	-	-	-	Ground
K1	VREFp	O	-	I	Positive microphone supply voltage
K2	MICp	I	-	I	Positive microphone input
K3	P3[2]/CIDINp	IO	8	I	I/O Port CIDINp: Caller id opamps positive input
K4	P3[6]/RINGn	IO	3	I	I/O Port RINGn: RING opamp negative input
K5	P3[4]/PARADET	IO	8	I	I/O Port PARADET: Parallel set detection
K6	NC	-	-	-	leave unconnected
K7	NC	-	-	-	leave unconnected
K8	P2[0]/ PWM0 / LED3	IO	8	I	I/O Port PWM0: - LED3: 2.5/5mA LED current sink
K9	**GND**	-	-	-	Ground
K10	NC	-	-	-	No ground under the pad (RF sensitive)
K11	NC	-	-	-	No ground under the pad (RF sensitive)
L1	**GND**	-	-	-	Ground
L2	MICn	I	-	I	Negative handset microphone input
L3	**GND**	-	-	-	Ground
L4	**GND**	-	-	-	Ground
L5	NC	-	-	-	RF pad, must be left unconnected
L6	**GND**	-	-	-	Ground
L7	**GND**	-	-	-	Ground
L8	NC	-	-	-	leave unconnected
L9	**GND**	-	-	-	Ground
L10	NC	-	-	-	No ground under the pad (RF sensitive)
L11	**GND**	-	-	-	Ground
M2	NC	-	-	-	RF pad, no pad on PCB

- "NC" means: leave unconnected.
- **GND** means internally connected to Ground plane of module (51 pins in total)
- GND means connect to Ground (not supported, functional pin)

Reset States:

- I = Input
- O= Output
- I-PD = Input, pulled down
- I-PU = Input, pulled up
- O-0 = Output, low
- O-1 = Output, high

2.0 Introduction

2.1 SCOPE

The SC14CVMDECT is a programmable DECT module for voice and low data rate services. The internal software-stack receives commands and data from the application, for instance to setup a link to other modules. The user interface can be implemented on the module itself or on anexternal host processor. The internal FLASH provides user space where custom applications can be located. The module converts analog signals to a digital stream, compresses/decompresses them according to the DECT standards and transmits/receives them over the air interface. The DECT protocol-stack in each module supports both PP and FP functionality.

2.2 ORDERING INFORMATION

SC14CVMDECT AF01

2.3 REFERENCES

1. SC14CVMDECT AT Commands
2. SC14CVMDECT AT Commands Communication Library
3. SC14CVMDECT_PC_MMI_User_Guide
4. Athena User Manual

2.4 GLOSSARY AND DEFINITIONS

API	Application Programming Interface
AT Command Interface	The software interface between the MCU and SC14CVMDECT
CAT iq	Cordless Advanced Technology, Internet and Quality
Codec	Coder and DeCoder converts analog signals to digital signals and vice versa.
Conference	Same as intercom, but generally including an external party.
CRC	Cyclic Redundancy Check
CVM	Cordless Voice Module
DECT	Digital Enhanced Cordless Telephone
DSP	Digital Signal Processor
EC	Echo Canceller
EMC	Equipment Manufacturer's Code (please refer to ETSI EN 300 175-6)
ESD	Electro Static Discharge
EQ	Equalizer
FP	Fixed Part
GFSK	Gaussian Frequency Shift Keying
HW	Hardware
Inband tones	Tones played by the application itself and not from external e.g. line.
Intercom	Internal call between 2 or more parties.
IPEI	International Portable Equipment Identity (please refer to ETSI EN 300 175-6)
IWU	InterWorking Unit (please refer to ETSI EN 300 175-1)
LCD	Liquid Crystal Display
LDR	Low Data Rate
MCU	Micro Controller Unit
MMI	Man Machine Interface (keypad, LCD, buzzer, microphone, earpiece, speaker, headset)
NTP	Nominal Transmit Power
PAEC	Perceptual Acoustic Echo Canceller
PC	Personal Computer, IBM compatible
PCB	Printed Circuit Board without components
PP	Portable Part
PSTN	Public Switched Telephone Network
POTS	Plain Old Telephone System
RF	Radio Frequency
RFPI	Radio Fixed Part Identity (please refer to ETSI EN 300 175-6)
RLR	Receive Loudness Rating
RSSI	Radio Signal Strength Indication (please refer to ETSI EN 300 175-1)
Sidetone	Feedback of microphone signal to earpiece.
SLR	Sending Loudness Rating
SPI	Serial Peripheral Interface Bus
SW	Software
UART	Universal Asynchronous Receiver and Transmitter.
VAD	Voice Activity Detection
Walky Talky	Two PPs connected without an FP

3.0 Cordless Voice Module functionality

This section describes the key functions and features supported by the SC14CVMDECT as shown in Figure 2.

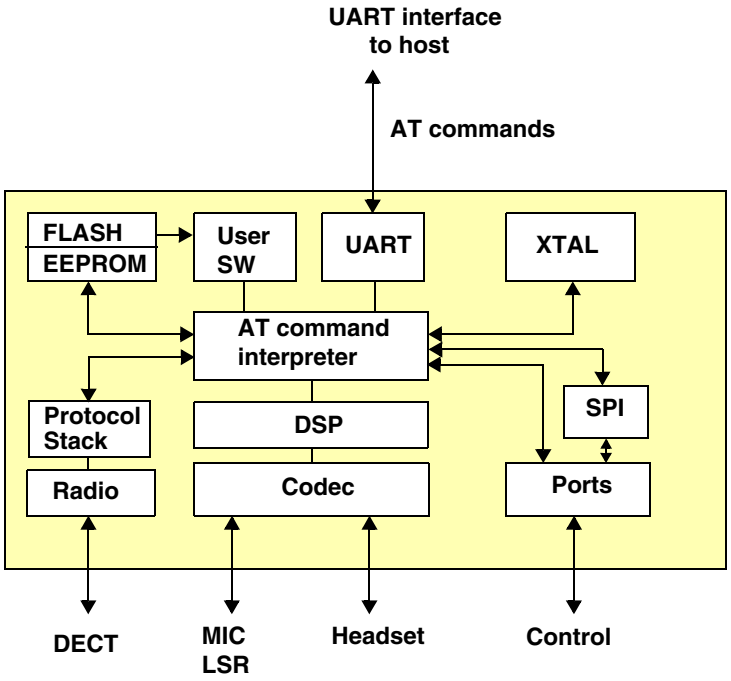


Figure 2 SC14CVMDECT functional overview

3.1 MODULE HARDWARE

The SC14CVMDECT internal hardware consist of:

- An Internal Microprocessor (MCU) running from FLASH handling the AT command interpreter, the protocol stack and further internal control.
- A 4kByte EEPROM used by the protocol stack and for user EEPROM variables.
- A DSP for the Audio signal processing like ADPCM voice compression towards the Codecs.
- A codec to convert the analog signals to digital signals and vise versa.
- Input/Output ports which can be toggled high/low if output or a high/low digital level can be read.
- A 10.368 MHz XTAL clock. This crystal is automatically tuned by the module software for the best Radio Performance.
- Voltage regulators to convert the external supply voltage to a stable supply voltages for the core and I/O's.
- A DECT Radio transceiver with two built-in antenna circuits. The antenna's are on the module, so no RF knowledge is required.
- A UART for communication to a host.

3.2 SOFTWARE CONTROL

The SC14CVMDECT can be controlled via an **AT Command Set** over the UART interface or from the internal user application. The external controller handles the user interface (MMI) and sends/receives AT commands and responses to the internal protocol stack. A detailed functional and data flow description, including an example of the start-up sequence, can be found in document reference [1].

3.3 DECT PROTOCOL STACK

The SC14CVMDECT internal protocol stack is based on the ETSI DECT specifications and is compliant with ETSI 300 444 (GAP).

The product supports up to 6 DECT GAP compliant PP units to one FP station.

3.4 PORTABLE PART CONFIGURATION

A Portable Part configuration with SC14CVMDECT requires additional external parts as shown in Figure 3.

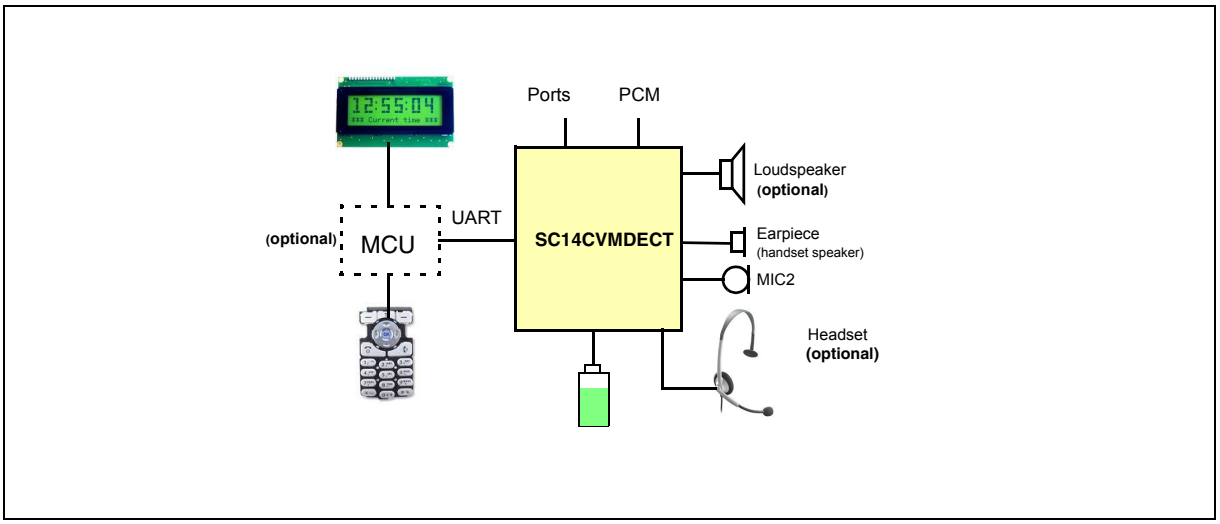


Figure 3 PP Configurations

Table 2 provides the overview of the supported interfaces for a Portal Part.

Table 2: PP Hardware support overview

Item	Supported	Remark
Battery connection	No	Non rechargeable or rechargeable 2 cells NiMH, NiCd or Li-Ion For Li-Ion an 3.3V LDO is required to supply the system.
Battery charger	No	Use external charger.
Keypad	No	on external MCU
Display	No	on external MCU
IO Ports	Yes	4 free digital IO port pins
PCM interface	Yes	1x16 bits, 8,16 kHz, strobes 1,8, 16, 32 bits
PCM voice coding formats	Yes	uLaw (64kbits/s), Alaw (64kbits/s), G.726 ADPCM (32kbits/s), G.722 ADPCM (64kbits/s), Linear (128kbits/s)
UART	Yes	9600-115.2kbaud, used for AT-command
Headset detection	Yes	
Headset earpiece	Yes	Connected to LSRp,LSRn
Headset Microphone	Yes	Connected to MICp
Handsfree Microphone	Yes	Connected to MICh
Handsfree speaker	Yes	Connected to PAOUTP/n (No SW support)
Radio	Yes	Integrated with two antenna's

A portable part supports following main functional features:

- •Conferencing (currently not supported*)
- •Intercom
- •Battery management (currently not supported*)
- •Custom Ringtones (currently not supported*)
- •Earpiece, handsfree and headset.
- •Automatic headset detection (currently not supported*)
- •Baby monitor (currently no VAD support*)

- PCM interface (one channel)
- Walky Talky mode (currently not supported*)
- Low Speed Data (1.6kbit)
- LU10 data channel (54kbit/sec) (Currently not supported*)

* Expected in Q2 2012

3.5 FIXED PART CONFIGURATION

A Fixed Part configuration with SC14CVMDECT requires additional external parts as shown in Figure 4.

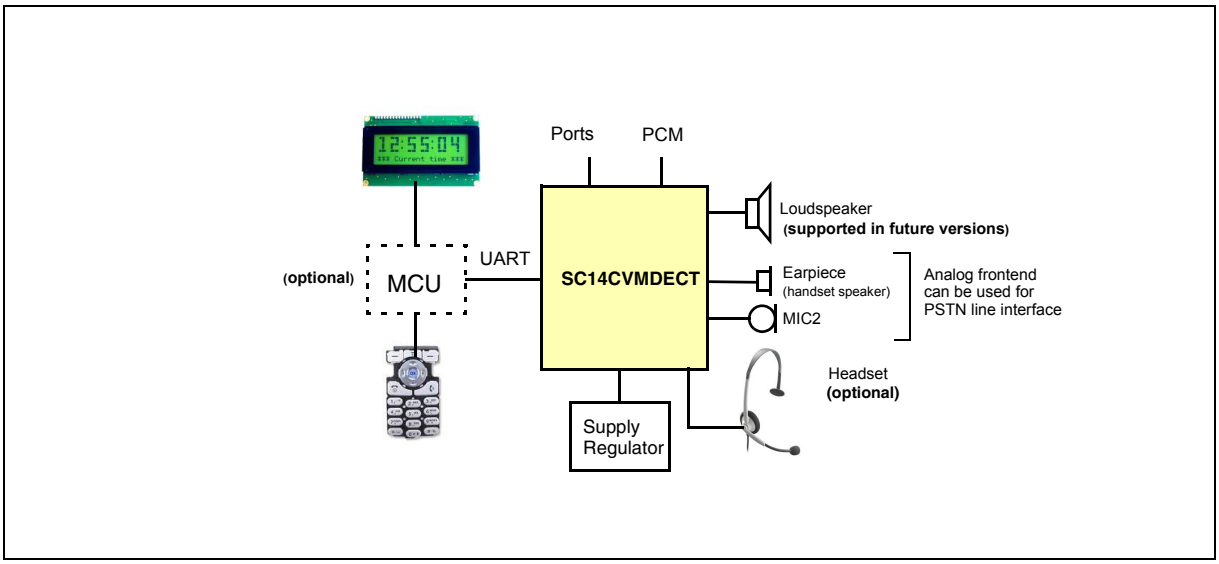


Figure 4 FP Configuration

Table 3 provides the overview of required and available interfaces for a basic or a feature rich cordless FP with the SC14CVMDECT.

Table 3: FP Hardware support overview

Item	Supported	Remark
Supply Regulator	No	Use external 3.3V LDO.
Keypad	No	on external MCU
Display	No	on external MCU
IO Ports	Yes	4 free port pins
PCM interface	Yes	4x16 bits, 8,16 kHz, strobes 1,8, 16, 32 bits
PCM voice coding formats	Yes	uLaw (64kbits/s), Alaw (64kbits/s), G.726 ADPCM (32kbits/s), G.722 ADPCM (64kbits/s), Linear (128kbits/s)
UART	Yes	9600-115.2kbaud, used for AT-command
Headset detection	Yes	
Headset earpiece	Yes	Connected to LSRp,LSRn
Headset Microphone	Yes	Connected to MICp
Handsfree Microphone	Yes	Connected to MICh
Handsfree speaker	Yes	Connected to PAOUTP/n (No SW support)
PSTN Line interface	Yes	CID, Ring detection, Line-in, Linout, Line reversal, paralle set detection (SW On request)
Radio	Yes	Integrated with two antenna's

A fixed part supports following main functional features:

- •Conferencing (currently not supported*)
- •Intercom
- •Custom Ringtones (currently not supported*)
- •Earpiece, handsfree and headset.
- •Automatic headset detection (currently not supported*)

- Baby Monitor (currently not supported*)
- PCM interface (4 channels)
- Low Speed Data (1.6kbit)
- LU10 data channel (54kbit/sec) (Currently not supported*)
- Base Station For Sensor applications (Currently not supported*)

* Expected in Q2 2012

3.6 LIGHT DATA APPLICATION

The SC14CVMDECT supports Low Data Rate (LDR) transmission up to 1.6 kbits/s. Packets with a length of upto 30 bytes payload can be transmitted and received.

One SC14CVMDECT is configured as FP and the others are configured as PPs (Figure 5). The host sends/receives AT commands (over UART) to/from PP or FP as shown in Table 4.

Table 4: Low Data Services

Direction	Supported	Comment
Host to PP to FP	Yes	
Host to FP to PP	Yes	
PP to PP	Yes	Indirect via FP

Up to six PPs can be registered to one FP.

See document reference [1] for more information on the AT commands to support LDR.

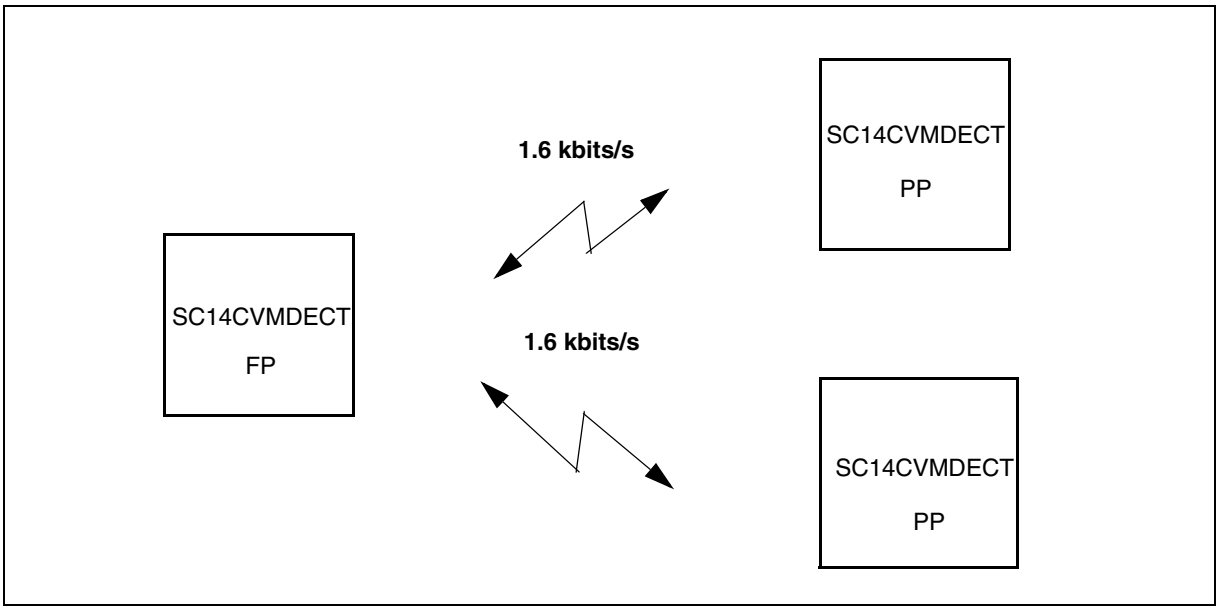


Figure 5 Light Data application

3.7 FUNCTIONAL OVERVIEW

Table 5: Functional overview

Functionality	Sup-ported	Remark
Standard FP audio control feature: Call handling		
PP to FP, FP to PP	Yes	
Intercom	No	PP to FP, FP to PP
Conference call	No	
Call forwarding	No	Transfer call between PPs not possible.
Page call	Yes	FP pages all PPs (PP locator)
Protocol		
Manual registration	Yes	
Number of registered PPs per FP	Yes	1 to 6
Low rate data transfer	Yes	1.6 Kbit/s on the air-interface (30 bytes payload)
Audio and tone		
Microphone mute	Yes	PP only. Mute of MIC in all audio connections are possible
Tone generation	Yes	Melody generator with 7 polyphonic tones
Audio Volume control	Yes	6 steps are adjustable by EEPROM
Tone Volume control	Yes	6 steps are adjustable by EEPROM
Headset support	Yes	
Handsfree/Speakerphone	Yes	PP only
General		
Real time clock	Yes	Accuracy depending directly on crystal
Real time clock synchronization	Yes	All PP clocks are kept in synchronization with the FP
SW EEPROM Storage	Yes	Internal on Module
Battery Charge Management	No	
PSTN line interface support	No	PSTN software on Request
I/O port support	Yes	4 pins I/O
Port Interrupt support	No	

4.0 Functional description

4.1 UART INTERFACE

The UART isnormally used for AT commands, but can also be used for software upgrades and debugging. The UART is a full duplex UART with frame type: 1 start bit, 8 data bits (LSB first), 1 stop bit, no parity and a baud rate of 115.200 kBaud

The UART hardware interface uses 3 wires (see Figure 6)

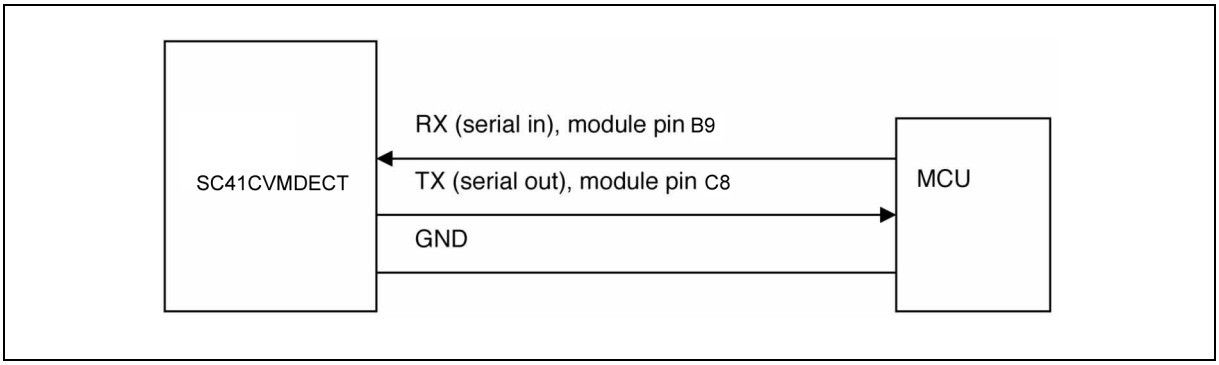


Figure 6 UART hardware configuration

Caution: All signals are 1.8 V. An external V.24 line driver must be provided if the UART port of the module is connected to a standard V.24 device. Connecting the module without a driver may damage the module.

4.2 EEPROM

4.2.1 EEPROM layout

The SC14CVMDECT PP and FP include a 4 Kbyte EEPROM which is divided into two areas (see Table 6).

Table 6: EEPROM map

EEPROM space	Size	Usage
SC14CVMDECT	3.6 Kbyte	Used for RF, audio, battery, tone setup, data base, etc.
User	0.4 Kbyte.	Can be used for MMI applications such as User information.

A detailed overview of the EEPROM parameter is found in document reference [2].

Some parts of the EEPROM parameters are read into the SC14CVMDECT during the start up and other parts are used by the SC14CVMDECT software during execution.

The EEPROM parameters are divided into 2 types:

- Factory type
- normal type.

The factory type is specific for the SC14CVMDECT and should only be set by production. The factory types are either parameters for adjustments used by the baseband or the radio interface, or is used to setup the SC14CVMDECT into special modes. The factory types will only be modified by changing the factory programmed default value. See document reference [2]. Only users with “debug” authorization can modify these EEPROM parameters

The other “normal” EEPROM parameters can be reset to default values by running a soft default setting (default batch file).

4.2.2 EEPROM access by MCU

The host is able to read or modify the EEPROM parameters or limited free EEPROM areas via AT commands AT+WEExx.

Access to the EEPROM parameters depends on the authorization level set by the AT+WULA parameter:

0 = Anonymous User with Lowest Authority (not able to read from and write to EEPROM)

1 = Power User. Able to read from all EEPROM locations and write to locations 0x0F00..0x0FBF (user space). Password: 748357.

2 = Debug User Highest Authority.Able to read from and write to EEPROM (audio and stack related parameters. Contact SiTel Semiconductor for the password.

4.3 PP AUDIO CONFIGURATIONS

The SC14CVMDECT audio is supporting standard DECT audio qualities. The audio gain and volume parameters are placed in the EEPROM. The DECT gains can be adjusted to meet the TBR38 and TBR10 audio level requirements by using the SC14CVMDECT application reference design. For other line and acoustic designs it is needed to adjust and tune the audio setup.

4.3.1 Audio connection

The SC14CVMDECT PP audio connections are show in Figure 7. Refer to “Example Application Diagram” on page 38 for detailed component values.

.

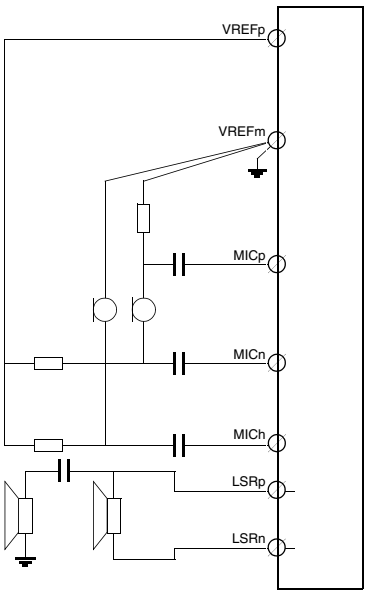


Figure 7 Audio connections

Earpiece or small loudspeaker connection

The earpiece loudspeaker can be connected either differentially or single-ended. Dynamic loudspeakers with an impedance of 30 Ω can be connected as well as ceramic loudspeakers equivalent to 600 Ω and 30 µF can be connected. Refer to Table 11 for a detailed specification or the earpiece loudspeakers.

The earpiece is connected to the LSRp and LSRn pins.

Microphone connection

The microphone can be connected either single-ended via MICp or differentially to MICp and MICn

Headset connection

The headset microphone must be connected to the MICh pin. The headset earpiece is connected to the LSRp.

Microphone supply connection

For active microphones a voltage source with high supply voltage rejection ratio is provided on supply pins VREFp/VREFm. Filtering of internal and external reference voltages is provided with internal capacitor. No external capacitor shall be connected to the VREFp. To avoid audible switching noise it is important that the ground supply signals are directly “star point” connected to the VREFm and not via a common ground plane. From this VREFm star point, one connection is made to the common ground plane.

Loudspeaker connection (supported in future releases)

For the handsfree operation an 4 ohm loudspeaker must be connected to the PAOUTp and PAOUTn pins as shown in Figure 8. The VDDPA is the supply pin.

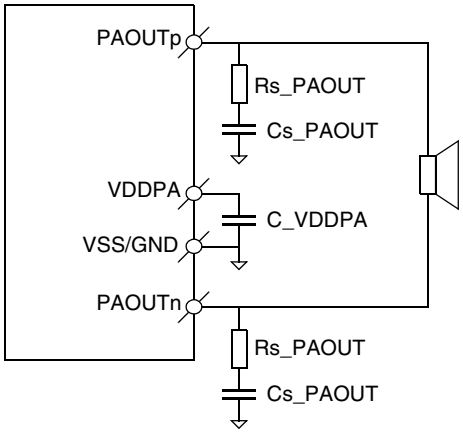


Figure 8 Loudspeaker connection

Refer to Table 12 for a detailed specification of the external components around the loudspeaker. These components are necessary to guarantee lifetime of the module.

4.3.2 Audio Modes

The PP audio handling consists of four audio states. In these states the audio subsystem is configured for a certain audio mode:

1. Idle state (not relevant for microphone configuration)
2. Earpiece Mode (Handset Speaker)
3. Handsfree or Speakerphone Mode
4. Headset mode

Selection between the modes is done by API calls; see document reference [1].

The Alert state is for tone playing and is entered automatically when tones are played using the API calls. The Alert state can originate from idle earpiece, handsfree or headset state

.

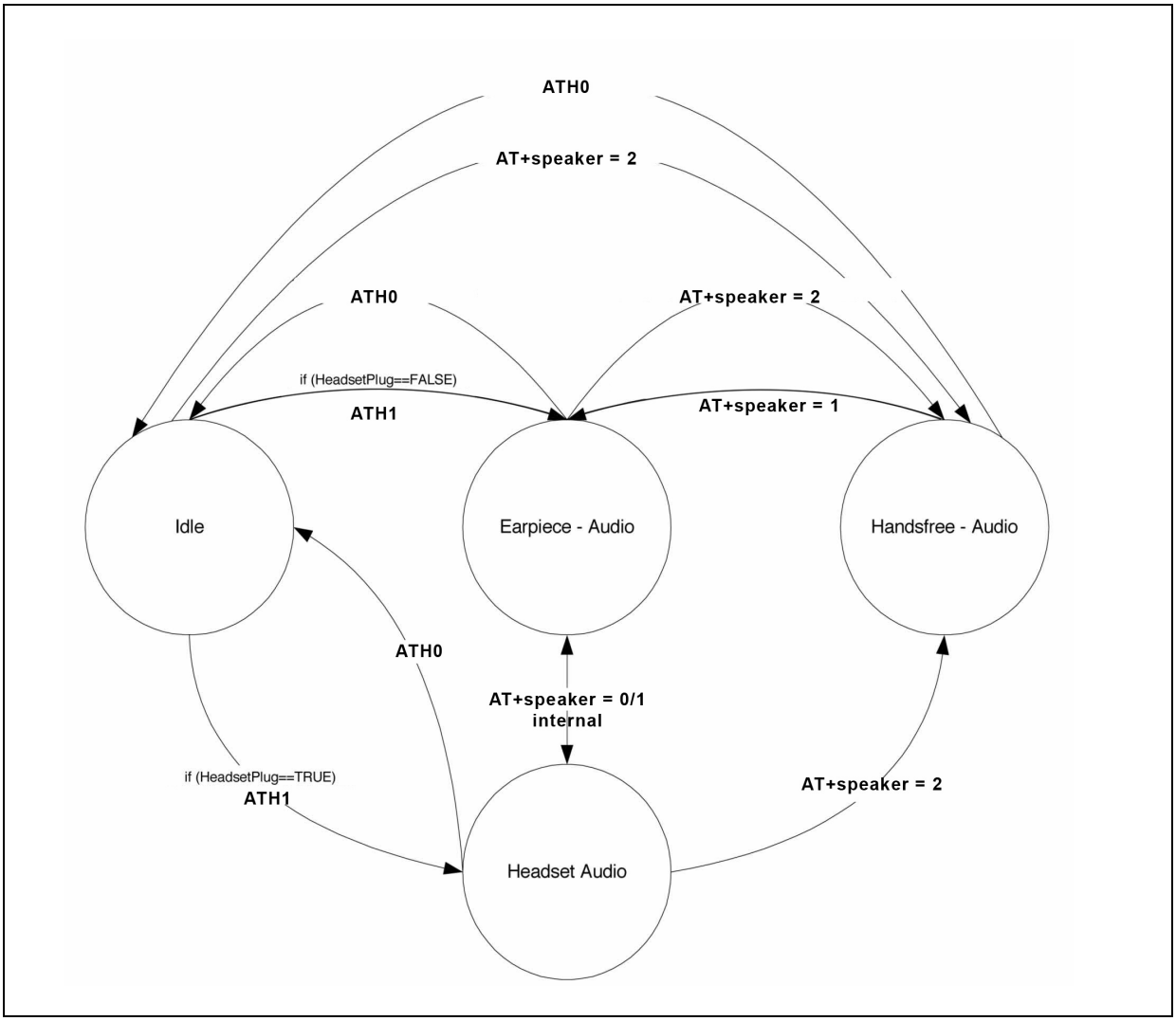


Figure 9 PP Audio mode

4.3.3 PP Audio Codec adjustment

The audio codec settings for the loudspeaker and Microphone must be preconfigured in the EEPROM for each mode. The EEPROM parameter fields for Audio.Earp.xxx, the Audio.Heads.xxx and Audio.SpkPh.xxx have a default value but may be modified to tune the settings.

4.3.4 General Audio adjustment

For each audio mode, the receive (RLR) and transmit (SLR) audio paths must be adjusted. RLR and SLR are adjusted in the registers in the EEPROM for each audio state; see document reference [2].

4.3.5 Power management

To minimize the current consumption the PP will shutdown all codec amplifiers in Idle state. This means that all reference voltages in the front-end will be disabled. This feature can be disabled in the EEPROM if the reference voltages for some reasons are needed in Idle state.

4.3.6 Earpiece Mode

In Earpiece mode (Handset Speaker) an artificial sidetone is generated. The level of the sidetone can be adjusted and setup in the EEPROM through parameter fields Audio.Earp.Vol.Elementx,SideToneGain and Audio.Heads.Elementx.SideToneGain. In Earpiece mode it is possible to adjust the volume in the Earpiece via the API calls. In Earpiece mode the PP audio is routed as shown in Figure 11.

4.3.7 Alert mode

The Alert mode is for generating tone and melodies in the Speakerphone loudspeaker. In Alert mode it is possible to adjust the volume in the speaker via the API calls.

4.3.8 PP Volume

The PP supports 6 volume steps, which are EEPROM configurable through parameter fields Audio.Earp.Vol.xxx, the Audio.Heads.Vol.xxx and Audio.SpkPh.Vol.xxx. The volume steps must be set initially in the EEPROM during production.

.

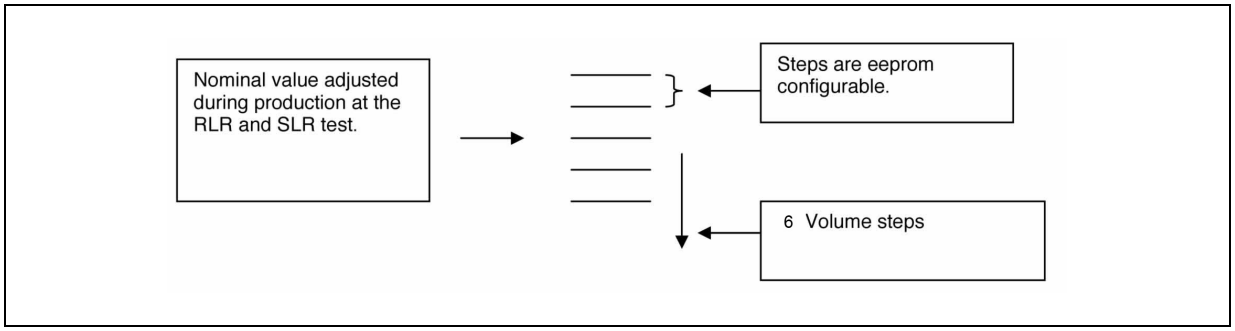


Figure 10 Handset Volume Configuration

Inband tones will be affected by the volume adjustments, since the volume control is placed after tones are added to the signal..Figure 11 shows the Audio flow. Here is the list of main functions:

EQ	Equalizer
nc100Hz	100Hz canceller
Sidetone	Sidetone
EC	Echo Canceller
Vol. Ctrl	Volume Control
Tonegen	Tone generator

.

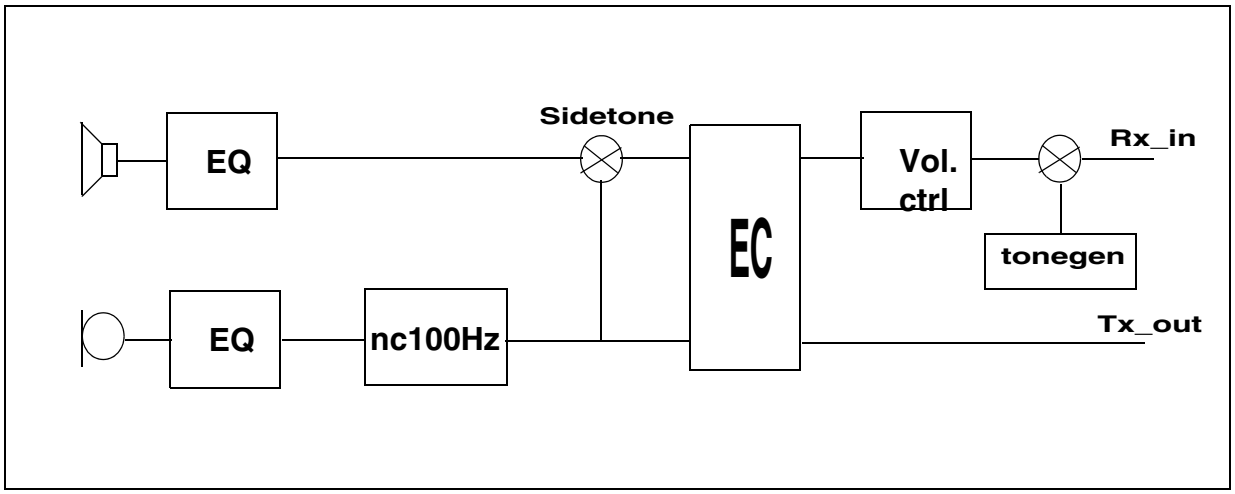


Figure 11 PP Audio Routing

4.3.9 PP Audio equalization

To enable adjustments of the frequency response the PP contains four programmable filters: 2 in RX direction and 2 in TX direction (see Figure 11).

By default these filters are loaded with bypass coefficients, but the API contains commands to load new coefficient for all filters.

Equalizer filters are part of the audio routes for all audio modes and are placed as shown in Figure 11.

For a detailed description of the filter functionality please refer to API documentation; see document reference [1].

4.4 CALL HANDLING

4.4.1 FP to PP Call

When the FP initializes a call to a PP, a radio connection is set up to all the PP applications to make it possible for the PP Application Software to indicate that there is an incoming call.

It is possible to configure the ringing indication using broadcast to make all 6 PPs ringing. When receiving the call, the PP signals the call to the MMI Software.

4.4.2 PP to FP Call

When the MMI Software signals the PP to establish a call, the PP opens the radio connection to the FP.

4.4.3 Intercom and Conference

Not supported.

4.4.4 Call Transfer

Call transfers are not supported.

4.4.5 Page Call

The Page call is a FP functionality used to locate the registered PPs. FP paging does not establish a normal audio connection and is terminated when answered by the PP. In FP Speakerphone mode a voice call can be established when the paging is answered.

4.4.6 Connection scenarios

The following voice connections are supported.

- PP to FP
- FP to PP.

4.5 TONE/MELODY HANDLING

The tone component handles the generation of various tones in the device. Both tones/melodies in a FP and PP configuration are supported. Main features of the tone component are:

The main features of the tone component are:

- Ringer tones and melodies (7 tone polyphonic)
- Alert tones (key sound, error tones, confirmation tones, etc.)
- Inband tones (dial tone, net-congestion tone, busy tone, etc.)
- Single tone generation

4.6 DATE AND REAL-TIME CLOCK

The FP base has a real-time clock feature, which (when activated) broadcasts the date and clock to the PPs. Activation of the date and real-time clock is done by setting the date and clock via the PP.

The clock is with hours, minutes and date. The clock supports the leap year. Daylight saving is not supported and must be handled by the MMI application.

The PP clock is synchronized with the FP every time a broadcast is received. If the PP goes out-of-lock, the PP itself calculates the clock until the PP is again within the range of the FP. The updated clock can then

be read locally from the MMI Software.

To adjust the clock in the base station, a service connection can be setup which can be set by commands from the PP.

The clock can also be read and set directly from an external microprocessor or through the MMI software on the FP base.

The real-time clock accuracy depends directly on the SC14CVMDECT crystal.

When the SC14CVMDECT is configured as a PP, the clock has the same accuracy as the FP clock. But, when the PP synchronises with a FP, the PP crystal is synchronized with the FP crystal and the PP clock will change accordingly.

The accuracy is expected to be within 1 minute for up to 6 weeks without being locked to a FP.

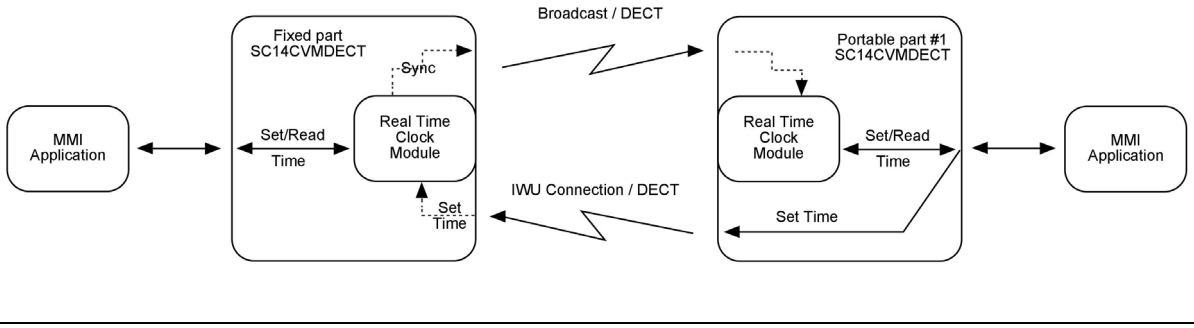


Figure 12 Clock synchronization

4.7 PROTOCOL STACK

The protocol stack handles the RF interface. For the SC14CVMDECT the DECT TDMA is used. The protocol features encryption.

4.7.1 DECT TBR22

The SC14CVMDECT protocol supports the DECT GAP standard. DECT TBR22 GAP type approval however is optional.

To pass a GAP type approval, a disable of the PP authentication and encryption during conversation is needed for some TBR22 test cases (DLC test cases). This can be done via EEPROM address 0x00F0.

4.7.2 Out-of-Range handling

When the PP goes in-range or out-of-range a signal is sent from the PP to the MMI Software indicating whether the PP is in-lock or is out-of-lock with the FP.

4.7.3 Pre-amble Antenna diversity

To optimize the audio quality caused by rapid changing radio paths (fading), the SC14CVMDECT supports pre-amble antenna diversity. The pre-amble diversity algorithm uses RSSI measurements to judge the radio signal strength on both antennas and, as a result of it, the choice of the best performing antenna is determined. The antenna will be used for the receive slot and the next transmit slot.

The pre-amble antenna diversity is supported by default. The pre-amble diversity can be disabled by EEPROM to let the SC14CVMDECT support a single antenna. See document reference [2].

In general an FP uses diversity and a PP does not.

4.7.4 Low Speed Data

During a voice call or using a service call, data can be transferred at a rate of about 1.6 Kbit/s using IWU to IWU messaging.

.

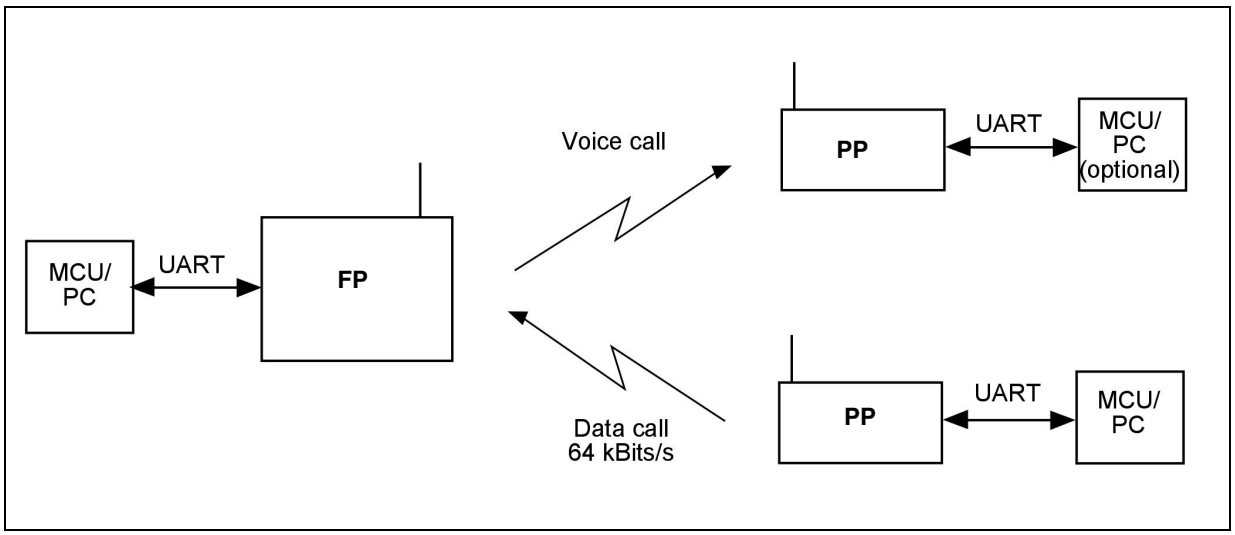


Figure 13 Low Speed Data Scenario

The following data connections are supported:

- PP to PP (point to point)
- FP to PP, PP to FP
- PP to all PPs (broadcast)
- FP to all PPs (broadcast)

All communication is routed via the FP. The FP has number #6. See Figure 14.

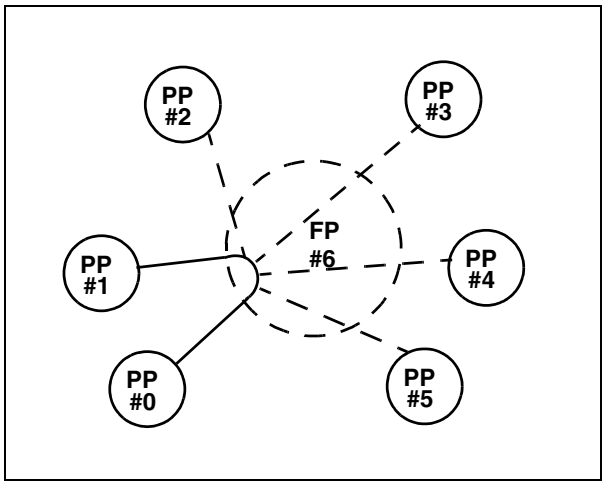


Figure 14 Data connection PP0 to PP1 or all

4.7.5 Broadcasting messages

The broadcast message is 19 bytes at a time and can real-time clock from the FP to the PP when the real-time clock is activated.

When broadcasting data no active connections are established.

The data is transmitted from the FP and received by any registered PP. The communication is only one way. Therefore, the broadcast data is not secured because there is no retransmission.

If the PP does not receive it right the first time, the broadcast data is lost.

4.7.6 IWU to IWU messaging

The protocol in the SC14CVMDECT module is made according to the DECT/GAP standard as defined in EN 300 175 and EN 300 444.

The DECT standard defines an EMC code (see EN 300 175-5, chapter 7.7.23.). This code is unique for a DECT product and must be programmed by the DECT manufacturer to the correct manufacturer code.

The EMC code must be the same for SC14CVMDECT based product families when using the IWU to IWU messaging.

If the SiTel default EMC EEPROM value is changed the IWU to IWU messaging may not operate correctly.

IWU data is transferred in a FA format frame; see chapter 6.1 in EN 300 175-4. This frame has an information field of maximum 63 bytes of which maximum 52 bytes can be used for IWU data. With the SC14CVMDECT it is only possible to send 5 frames in a row without pause. The following frame must be an acknowledge-frame to secure that the internal buffers within the SC14CVMDECT are emptied.

The FA frame is segmented in 5 bytes fragments and transferred over the air-interface in the A-field. The 2-bytes CRC is used to determine if the data is received correct. If the data is not received correct this is signalled back to the transmitter by the Q2 bit, and the data is retransmitted.

The FA frame has a 2 bytes checksum, used to determine if the complete packet is received correct. If A checksum error is signalled back to the transmitter and the complete packet is retransmitted. The packet will re-transmit until it is received correctly, or the link is closed.

More transmitted packets will be received in the same order as they were transmitted. The application must handle flow control, if needed.

4.8 REGISTRATION

The PP and the FP must be paired using a procedure called Registration. Without Registration, the PP will be out-of-lock and will not be able to establish a link to a FP and therefore not be able to make a call. The registration uses the unique product identities and secures the PP and FP to allow no cross-communication. To avoid cross-communication it is very important that all the PPs and the FP use an unique numbering scheme.

The PP can be deregistered from a FP either via the FP or PP MMI Software using the command interface. It is also possible to deregister a PP from another registered PP.

It is possible to pair a PP and FP during the production.

4.8.1 Handling product identities

To secure that the FP and PPs do not make cross-communications a unique ID must be entered into the EEPROM of an FP or PP. For the DECT version the ID for the FP is named RFPI and for the PP the ID is named IPEI. These numbers are factory settings.

After a successful registration, the IPEI is stored in the FP and the RFPI is stored in the PP. In this way the two parts are known to each other and are allowed to make connections. The registration data are automatically stored in EEPROM of the FP and PP while making the registration.

It is possible to register the same PP to 2 FPs, but it can only be used in one FP at the same time.

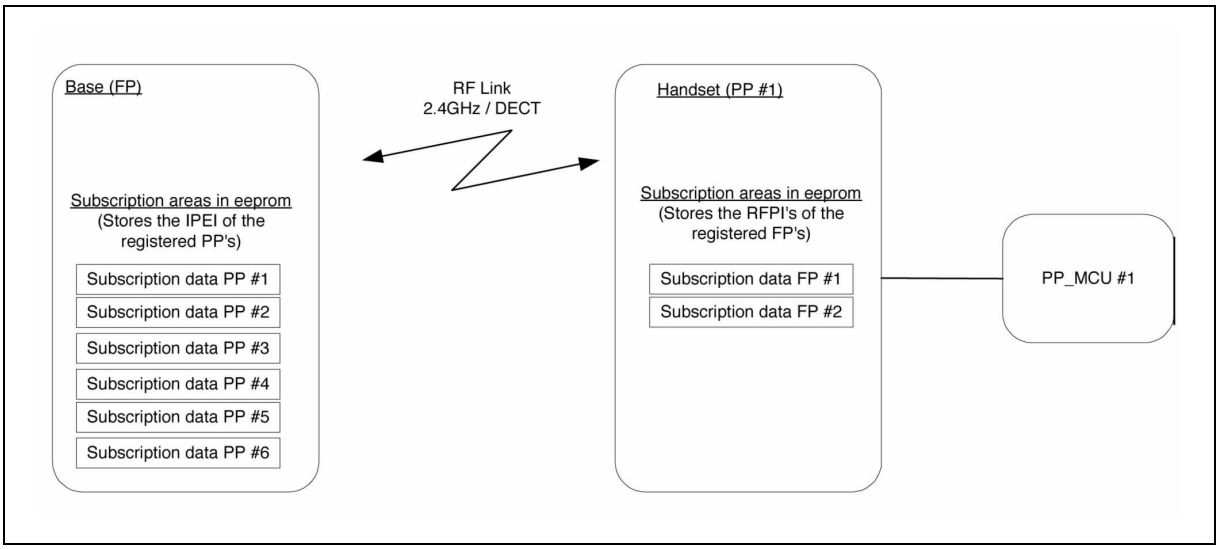


Figure 15 Handling Product Identities

4.8.2 Deregistration

There are two ways of deregistering a PP from an FP:

- Remote FP and PP deregistration
  The correct way to deregister a PP from an FP is to deregister it remotely in the FP. If this is done over a service connection from the PP to the FP, the FP actually performs the deregistration and then it is automatically signalled to the PP which in turn will drop out- of-lock. Using this method it is also possible to deregister other PPs registered to the FP from one PP.

Removing all registration at once from the FP (e.g. in case the original PPs are lost).

4.9 PCM INTERFACE

The audio is routed between the MCU and the CVM via the PCM bus. The MCU is responsible for selection and enabling of the audio path between the PCM bus and the CVM when calls to the external line are established. This is done with AT commands.

The CVM is responsible for connecting the right PCM channel to the right handset for external calls when the audio path between the CVM and the handset is opened.

The physical PCM interface formats are illustrated in the figures in this section.

The CVM supports the following PCM data formats

Linear PCM, 8 kHz sample rate.Used for narrowband calls (G.726).

Linear PCM, 16 kHz sample rate.Used for wideband calls (G.722).

G.711 – A-law, 8 kHz sample rate.Used for narrowband calls (G.726).

G.711 – u-law, 8 kHz sample rate.Used for narrowband calls (G.726).

- Compressed wideband using A-law, 16 kHz sample rate.

The 16 bit PCM data is encoded as two 8 bit audio samples if 8 kHz frame sync is used. Used for wideband calls (G.722).

- Compressed wideband using u-law, 16 kHz sample rate.

The 16 bit PCM data is encoded as two 8 bit audio samples if 8 kHz frame sync is used. Used for wideband calls (G.722).

Synchronization modes

In slave mode the PCM interface can be configured for the following synchronization modes:

- Asynchronous system clock: In this mode the clock of the module is not synchronized to the PCM clock. This means that audio samples will be either discarded in case the master PCM clock is faster than the clock of the module or samples will be repeated in case the master PCM clock is slower.
- Synchronous system clock: In this mode the clock of the module will be adjusted to follow the PCM clock provided by the master. In this case all audio samples will be kept if the provided PCM clock has an accuracy of +/- 5ppm which is a DECT radio requirement.

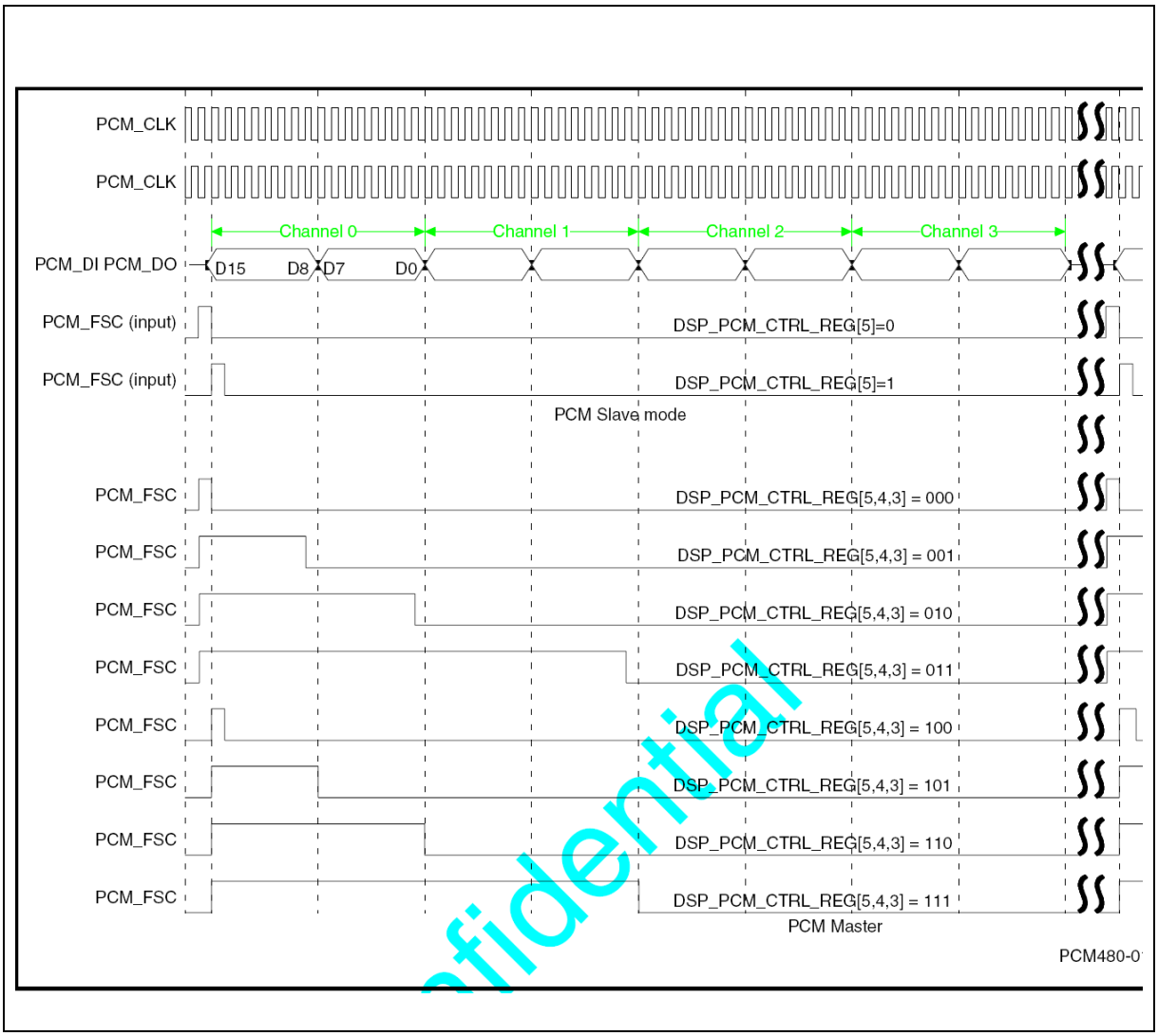


Figure 16 PCM Interface Formats

The MCU must make sure that the PCM data format matches the CODEC selected for the call. Modifying the CODEC requires the PCM data format to be changed too. The following figures illustrate the PCM bus with different PCM data formats (PCM CODEC's).

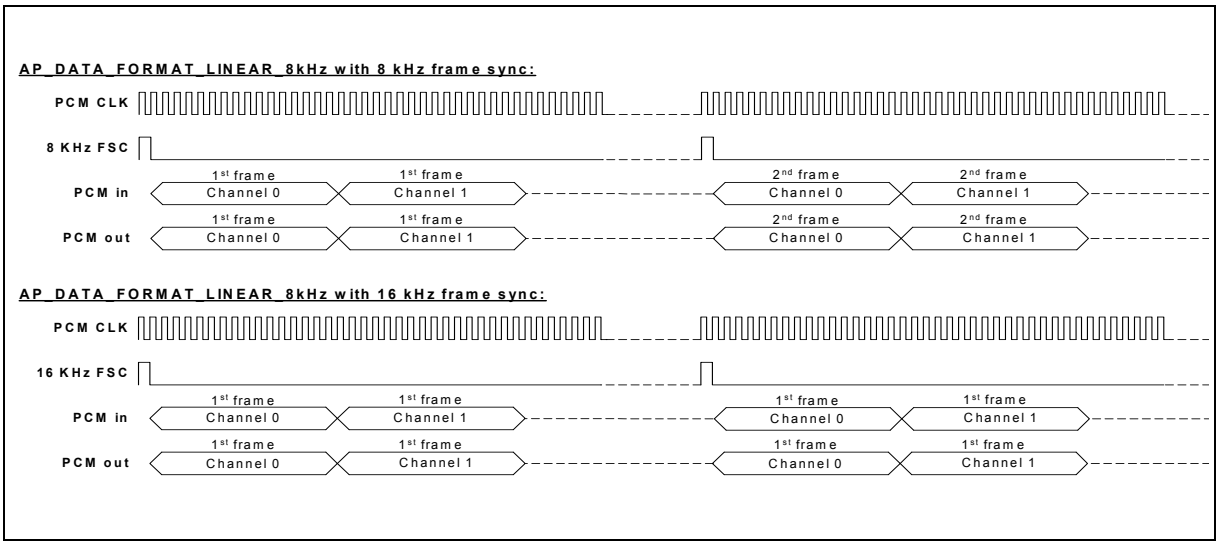


Figure 17 PCM bus with linear PCM, 8kHz sample rate

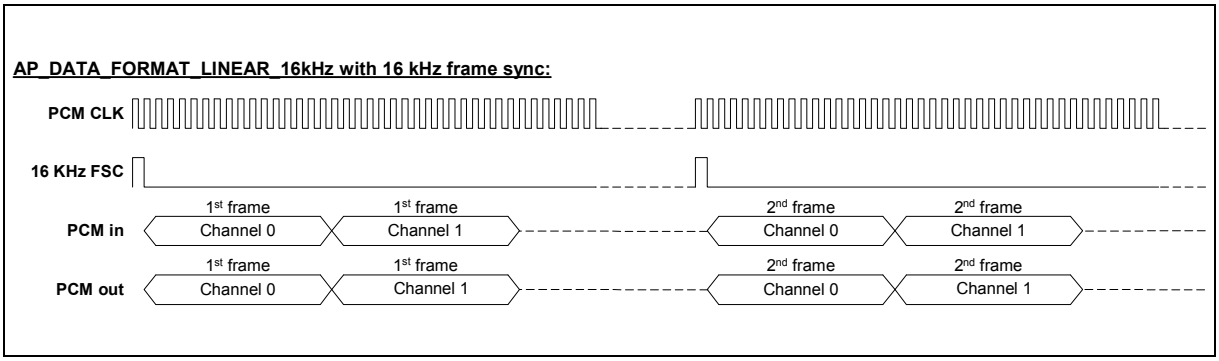


Figure 18 PCM bus with linear PCM, 16kHz sample rate

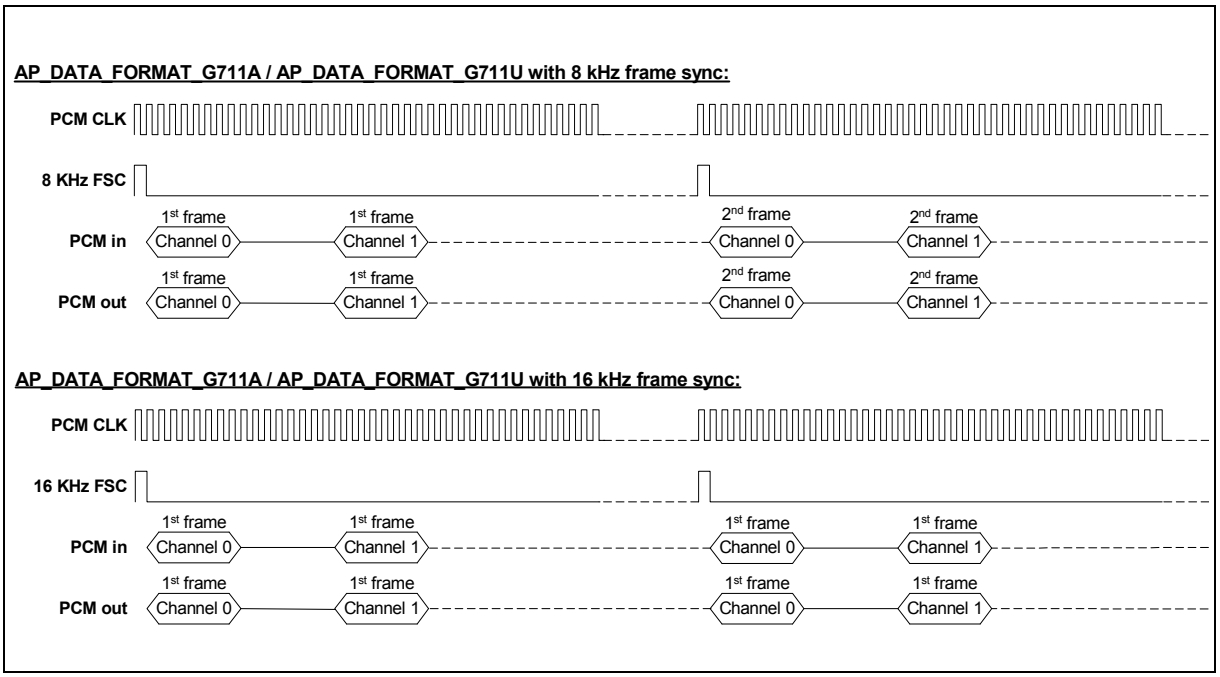


Figure 19 PCM bus with G.711 – A-law/u-law, 8 kHz sample rate

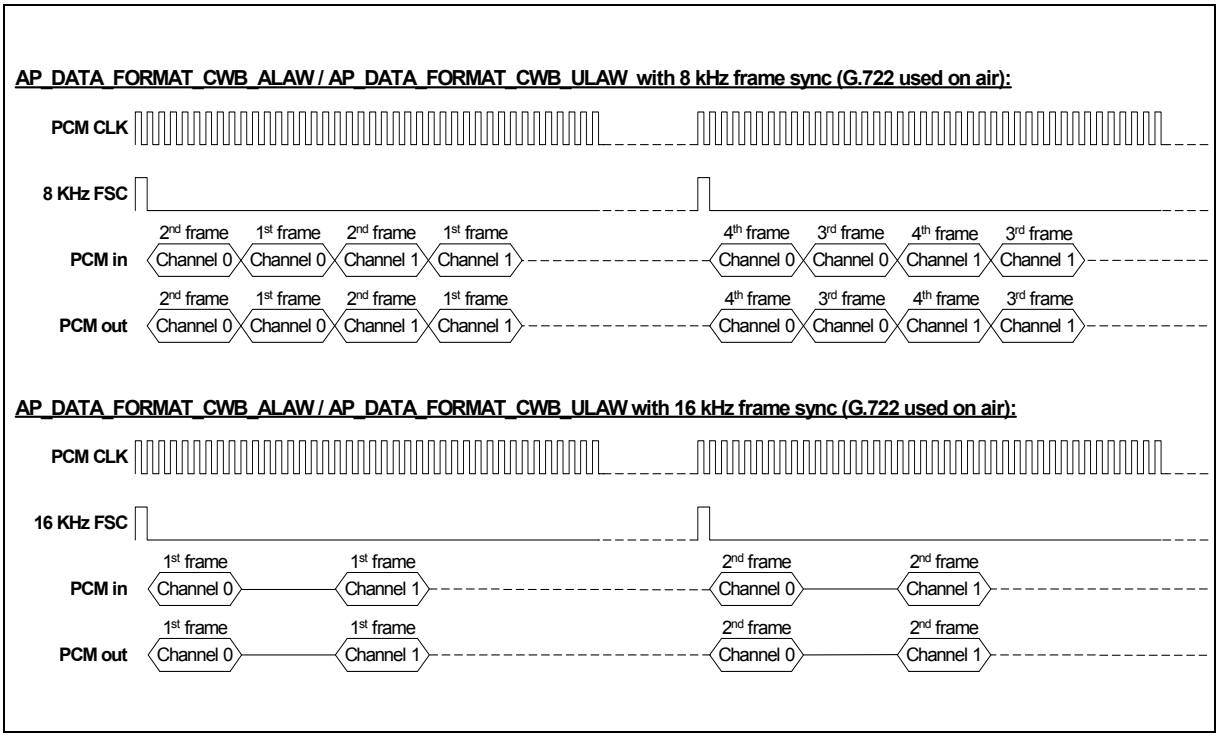


Figure 20 PCM bus with compressed wideband using A-law/ u-law, G722 used on air interface.

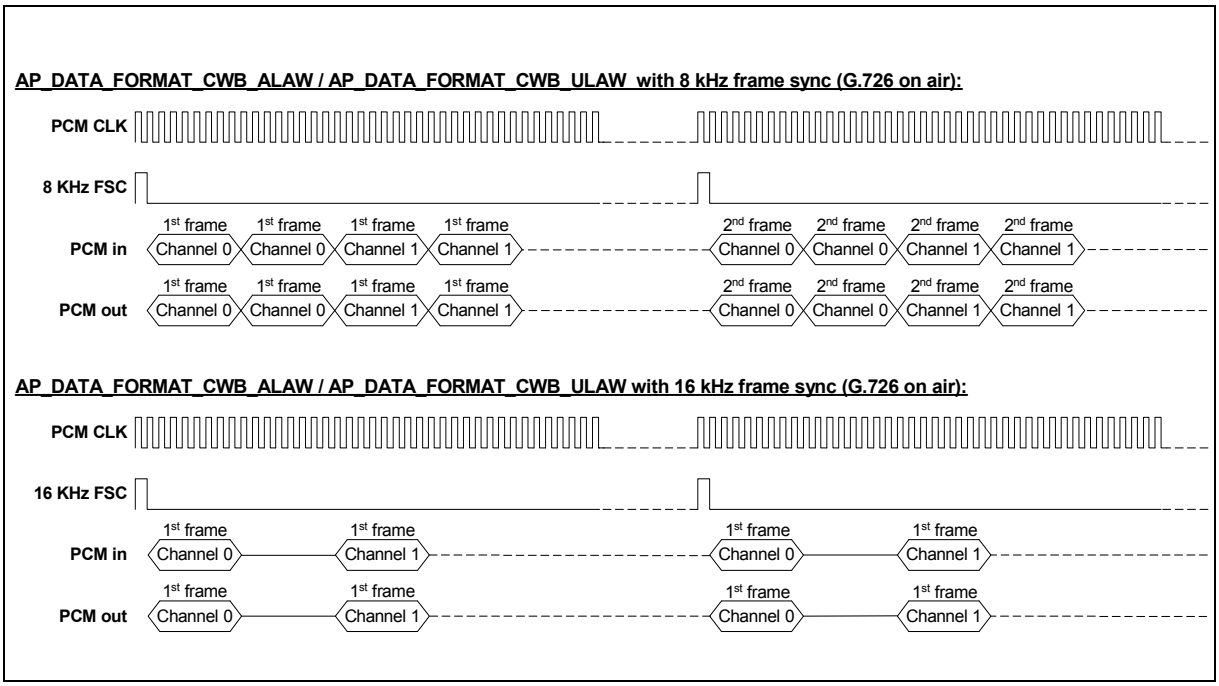


Figure 21 PCM bus with compressed wideband using A-law/ ?-law, G726 used on air interface.

5.0 CAT-iq

5.1 INTRODUCTION

CAT-iq stands for Cordless Advanced Technology, Internet and Quality. It is the new global technology initiative from the DECT Forum, designed for IP-voice services in the next generation networks. CAT-iq is based on the regulatory framework of the mature and reliable

DECT technology. It is fully backward compatible to DECT GAP and, as the new cordless phone standard, focuses on **high quality Audio VoIP (wideband)** as well as low bit-rate data applications as the next generation Cordless Phone standard.

5.2 CAT-IQ PROFILE OVERVIEW

The CAT-iq profiles are split between voice and data services, with CAT-iq 1.0 and CAT-iq 2.0 providing features to support key voice enhancements, and CAT-iq 3.0 and CAT-iq 4.0 providing features to support data. Each profile has a corresponding ETSI specification, the organization where the technical experts have realized the requirements as defined for each profile by the DECT Forum.

5.2.1 CAT-iq 1.0

- Narrowband (G.726) and wideband (G.722) audio and switching between these two codecs is supported.
- CLIP, CNIP, CLIR: Calling Line Identification Presentation, Calling Name Identification, Calling Line Identity Restriction for internal and external calls.

5.2.2 CAT-iq 2.0 (Supported in future releases)

- Synchronization of call lists and telephone books, missed calls list, incoming accepted calls list, internal names list (unique identifier of each handset), base telephone book
- Synchronization of system settings: PPs are enabled to change partly the configuration of the system consisting of FP and PPs, these system settings are handled using the list access method. Using this method, the FP and the PPs support:
  - Synchronization of time and date for FP and PPs, that FP is enabled to transmit time and date to the PPs.
  - Reset to factory settings, means that PP is enabled to reset the FP configuration to it's factory setting.
  - Obtaining FP versions, means that a PP can obtain the software release of the FP.
- Multiple lines handling: The behavior of DECT systems connected to more than one network lines. These lines may be of different types (VoIP and PSTN for example). This feature details how calls are placed in a multiple lines context. This feature also impacts the behaviour of other services in order to ensure attachment of PPs to a line, line settings and several lists properly.
- Parallel calls: initiating a second call in parallel to the first call, toggling between calls, putting a call on hold, resuming calls from on hold, call transfer, 3-party conference with established external and/or internal calls
- DTMF and tones
- Headset support
- Easy PIN code registration
- Easy pairing
- handset location

6.0 Specifications

6.1 ABSOLUTE MAXIMUM RATINGS

Table 7: Absolute Maximum Ratings (Note 1)

Description	Condition	Min	Max	Unit
Maximum supply voltages:				
VBAT			5.5	V
VBATT, VCCRF, VDDPA			3.6	V
VDDIO			2	V
Maximum voltage on pins:				
PON			5.5	V
Port pins			2	V
LED4, LED3			3.6	V
ESD voltage				
all pins	human body model		2000	V
	machine model		100	V

Note 1: Absolute maximum ratings are those values that may be applied for maximum 50 hours. Beyond these values, damage to the device may occur.

Table 8: Operating Conditions

Description	Condition	Min	TYP	Max	Unit
Supply voltage:					
VBAT		2.1		5.5	V
VBATT, VCCRF, VDDPA		2.1		3.45	V
VDD	The module provides an output voltage in this range		1.8		V
VDDIO		1.65	1.65	1.98	V
Voltage on pins:					
PON pin		2.1		5.5	V
P2[0]/LED4, P2[1]/LED3				3.45	V
All other pins				2	V
Maximum Currents through pins					
CHARGE pin	Series resistor R>(Vcharger-3)/10mA			10	mA
CLASSD pins				500	mA
VREFp				1	mA

6.2 DIGITAL INPUT LEVELS

Table 9: DIGITAL INPUT LEVELS

Description	Condition	Min	Max	Units
Logic 0 input level				
all digital pads, except PON, CHARGE	VDD=1.8V		0.3 x VDD	V
PON			0.9	V
CHARGE			0.9	V
RSTn			0.2 x VDD	V
Logic 1 input level				
all digital pads, except PON, CHARGE	VDD = 1.8 V	0.7 x VDD		V
PON		1.5		V
CHARGE		1.5		V
RSTn		0.8xVDD		V

6.3 DIGITAL OUTPUT LEVELS

Table 10: Digital Output Levels

Descriptions	Conditions	Min	Max	Units
Logic 0 output level (For drive capability see pin description)	Iout = 2,4,8 mA VDD = 1.8 V		0.2 x VDD	V
Logic 1 output level	Iout = 2,4,8 mA VDD = 1.8 V	0.8 x VDD		V

6.4 LOUDSPEAKER LOAD CIRCUITS

Table 11: LSRp/LSRn load circuits

PARAMETER	DESCRIPTION	CONDITIONS	MIN	TYP	MAX	UNITS
Cp1_Rl1_inf	Load capacitance	see Figure 22, $R_{L1} = \infty$			**30**	**pF**
Cp1_Rl1_1k	Load capacitance	see Figure 22, $R_{L1} \leq 1\ k\Omega$			**100**	**pF**
Rl1	Load resistance		**28**			Ω
Cp2	Parallel load capacitance	see Figure 23			**30**	**pF**
Cs2	Serial load capacitance				**30**	**µF**
Rl2	Load resistance		**600**			Ω

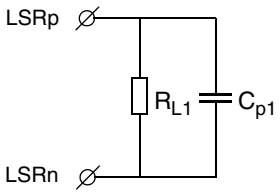


Figure 22 Load circuit A Dynamic loudspeaker

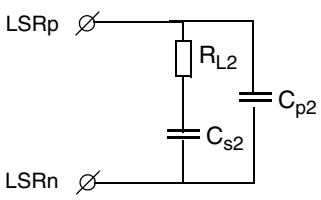
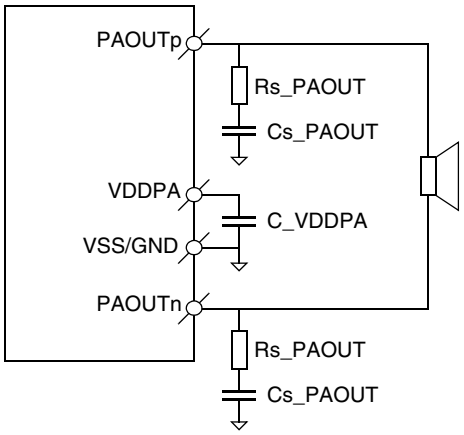


Figure 23 Load circuit B Piezo loudspeaker

Table 12: PAOUTp, PAOUTn external components

PARAMETER	DESCRIPTION	CONDITIONS	MIN	TYP	MAX	UNITS
C_VDDPA	Decoupling capacitor on VDDPA	Required when Class-D is used and guaranteed life time. (see Figure 24)		**1**		µ**F**
Cs_PAOUT	Snubber capacitor (to reduce ringing at PAOUTp/n)	Required when Class-D is used to prevent EMI and guaranteed life time. (see Figure 24)		**1**		**nF**
Rs_PAOUT	Snubber resistor (to reduce ringing at PAOUTp/n)	Required when Class-D is used to prevent EMI and guaranteed life time. (see Figure 24)		**1**		Ω



May 10, 2010

Figure 24 Class-D external components

6.5 GENERAL SPECIFICATIONS

Table 13: SC14CVMDECT module

Item	Condition	Value	Unit
Dimension	l x w x h	25.0 x 29.0 x 2.9	mm
Weight		4.5	g
Temperature Range		-20 to +60	°C
Frequency range	According to DECT standard	1870 to 1930	MHz
Antenna Range	According to DECT standard; (Note 2)		
	- typical outdoor	350	m
	- typical indoor	75	m
Standard Compliancy	ETS 300 444 (DECT GAP), former TBR2214 FCC part 15		
Power supply	2 or 3 cell NiCd/NiMH Note for 1 Li-Ion battery an external LDO is required.	2.10 to 3.45V	V
Maximum PCB warpage	For entire reflow range	0.1	mm

Note 2: The resulting range is very dependent of the mechanical design. SiTel is not responsible for this design and as such SiTel is not responsible for the resulting range performance of the final product.

6.6 BASEBAND SPECIFICATIONS

Table 14: Baseband specifications

Item	Specification	Min	Typ	Max	Unit
Serial Interface baud rate	UART; Interface for external microprocessor or PC			115.2	kBits
Flash Download baud rate	Via UART			115.2	kBits
Flash data space	Module Flash			4	kByte
EEPROM data space	Module EEPROM			0.4	kByte
Analog front-end/Audio	PP/FP Application: Interface for Microphone, Earpiece, Headset				
Power consumption (charge)	FP Application (3.3V):				
	- stand by mode		55	60	mA
	- talk mode		65	70	mA
	PP Application (3.3V):				
	- stand by mode		4,5	6	mA
	- talk mode		30	40	mA

6.7 RADIO PART (RF) SPECIFICATIONS

Table 15: Radio part (RF)

Item	Conditions	Min	Typ	Max	Unit
Receive sensitivity	@ BER = 0.001	-93	-92	-89	dBm
Receive IIP3			-20		dBm

Table 15: Radio part (RF)

Item	Conditions	Min	Typ	Max	Unit
Transmit Power (NTP)	DECT: 200 mW	20	23	25.5	dBm
	DECT6.0: 115 mW (max peak)	18.5	21	24	dBm
TDMA (time division multiple access)	6xRx + 6xTx time slots per carrier				
Data rate			1.152		Mbits/s
Modulation depth	DECT GFSK bandwidth = 20 dB <		1,728		MHz
Antenna diversity	Two built-in antenna's				
Standard Compliancy	ETS 301 406 (former TBR6)				

6.8 FP POWER SUPPLY

Table 16: Requirements for linear supply regulator

Parameter	Description	Condition	Min	Typ	Max	Unit
VCCRF	Voltage at VCCRF	Unloaded V_B Loaded V_B-V_1-V_2-V_3	2.1	3V	3.45	V
V_1	Settling time	I = 50 mA			20	mV
V_2	Receive period	I = 130 mA			100	mV
V_2	Transmit period	I = 400 mA			200	mV
V_3	Drop during transmit				25	mV
	Additional ripple (DC/DC)		none	none	none	mV

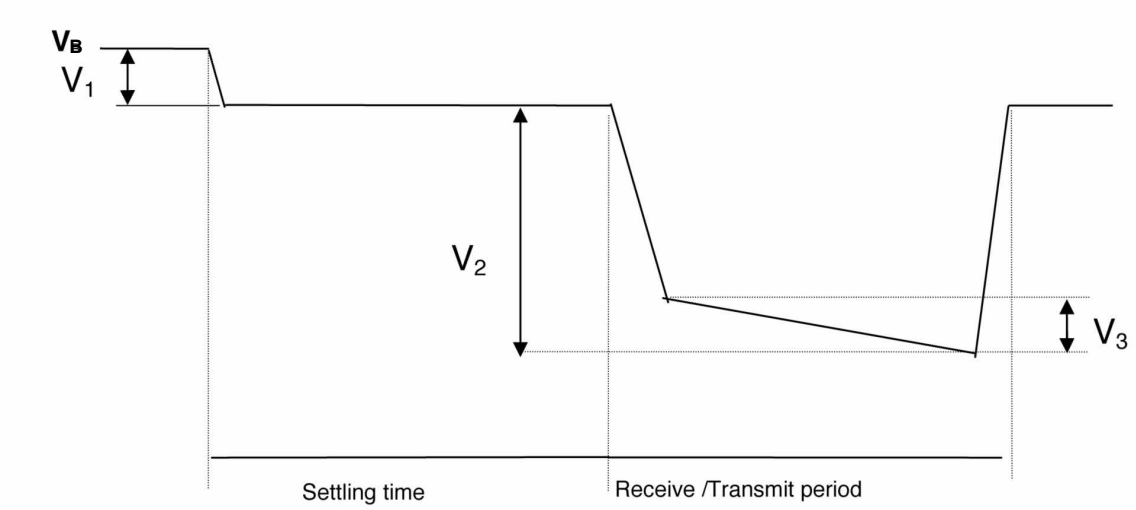


Figure 25 FP power supply

7.0 Design guidelines

This section describes the software and hardware considerations taken into account when designing the target application.

The SC14CVMDECT can be used standalone or next to an MCU that controls the module. In case the module is used standalone the application will be stored in its on-board Flash. In total 324kBytes of Flash are available for this.

Applications can be written with the Athena software development environment (see [4]).

7.1 APPLICATION SOFTWARE FOR PP

In a PP application the following software tasks must be handled by the MCU or within the module itself:

- UART communication (external microprocessor only)
- PP MMI
- Display interface (optional)
- Keyboard interface (optional)
- Battery Charge interface (optional)
- Audio handling
- Tone / Melodies handling

For control commands see document reference [1].

UART communication

The UART communication is the main control interface of the SC14CVMDECT.

PP MMI

The MMI state machine must handle the call setup and call termination on the PP.

Display Interface

The MCU / PP handles the display interface including the display driver.

Keyboard Interface

The MCU/ PP handles the keyboard interface including the keyboard driver.

Battery Charge handling

SC14CVMDECT V3 supports no battery management. This must be done by and external charge circuit on combination with the external MCU. The Application Software must handle the MMI part such as battery status for the user and the PP battery current consumption states.

Audio handling

The Application Software state machine must control when to open and close the audio. The headset plug-in detection must handled by the host, and a status is send to the PP MMI from the PP. The PP MMI must handle the volume control.

Headset detection boundaries can be adjusted in EEPROM. When headset indication is received from the PP Headset detection logic (future release), the Application Software can decide if audio should be switched to the headset and sends a request to the SC14CVMDECT.

The PP audio handling basically consists of 4 audio states (see Figure 9):

1. Idle (Alert) State
2. Earpiece State
3. Handsfree State (Speakerphone)
4. Headset State

Shifting between states is done through the API.

Please refer to the PP application layout for pin connections.

Tone handling

The Application Software state machine must control when to play tones and the volume setting. Custom melodies can be defined in the EEPROM.

7.2 APPLICATION SOFTWARE FOR FP

In an FP application the following software tasks must be handled by the MCU or within the module itself:

- UART communication (external microprocessor only)
- FP MMI
- Display interface (optional)
- Keyboard interface (optional)
- Audio handling
- Tone / Melodies handling

For control commands see document reference [1].

UART Communication

The UART communication forms the basic of the FP operation because via this interface the SC14CVMDECT is controlled.

PP MMI

The MMI state machine must handle the call setup and call termination on the FP.

Display Interface

The MCU/ FP handles the display interface including the display driver.

Keyboard Interface

The MCU/ FP handles the keyboard interface including the keyboard driver.

Audio Handling

The Application Software state machine must control when to open and close the audio. The headset plug-in detection is handled by the FP, and a status is send to the FP MMI from the FP. The FP MMI must handle the

volume control.
Headset detection boundaries can be adjusted in EEPROM. When headset indication is received from the FP headset detection logic (future release), the Application Software can decide if audio should be switched to headset and sends a request to the FP.

Tone Handling

The Application Software state machine must control when to play tones and the volume setting. Custom melodies can be defined in EEPROM.

7.3 HARDWARE DESIGN GUIDELINES

Within this section general design guidelines for SC14CVMDECT FP and PP applications are given.

7.3.1 Circuit design Guidelines

For a reference schematic refer to the SC14CVMDECT reference kit. With the reference kit package a non-cost optimized reference design is presented.

For a FP hardware design the following hardware parts will be needed besides the SC14CVMDECT:

- Supply voltage
- Battery charge
- LED and buttons
- Speakerphone

For a PP hardware design the following hardware parts will be needed besides the SC14CVMDECT:

- Power
- Battery Charger
- Audio:
  - Microphone
  - Earpiece
  - Speaker
  - Headset

7.3.2 PCB Design Guidelines

- Because of the presence of the digital radio frequency burst with 100 Hz time division periods (TDD noise), supply ripple and RF radiation, special attention is needed for the power supply and ground PCB layout.
- Power supply considerations
  Both high and low frequency bypassing of the supply line connections should be provided and placed as close as possible to the SC14CVMDECT. In order to get the best overall performance for both FP and PP applications, a number of considerations for the PCB has to be taken into account.
  - The width of the power amplifier supply line is recommended to be between 0.8 and 1.2 mm due to high current peaks during RF bursts.
  - Make angle breaks on long supply lines to avoid resonance frequencies in respect to DECT frequencies. Maximum 8 cm before an angle break is recommended.
  - Supply lines should be placed as far as possible away from sensitive audio circuits. If it is necessary to cross supply lines and audio lines, it should be done with right angles between supply and audio lines/circuits (microphone, ear-speaker, speakerphone, etc.)
  - Ground plane considerations
    In order to achieve the best audio performance and to avoid the influence of power supply noise, RF radiation, TDD noise and other noise sources, it is important that the audio circuits on both FP and PP applications boards are connected to the GND_ANA pins (analog ground) on the SC14CVMDECT with separate nets in the layout. It is advised to provide the following audio circuits with separate ground nets connected to the GND_ANA pins:
    - Microphone(s)
    - Headset microphone and speaker
    - Speakerphone (signal grounds)

Depending on the layout it may also be necessary to bypass a number of the audio signals listed above to avoid humming, noise from RF radiation and TDD noise with. It is also important to choose a microphone of appropriate quality with a high RF immunity (with built-in capacitor).

- ESD performance
  Besides TDD noise, the ESD performance is important for the end-application. In order to achieve a high ESD performance supply lines should be placed with a large distance from charging terminals, display, headset connector and other electrical terminals with direct contact to the ESD source. On a two-layer PCB application it is important to keep a simulated one layer ground. With a stable ground ESD and TDD noise performance will always improve.

8.0 Audio Level Adjustment

8.1 PP AUDIO LEVEL

For adjusting the audio levels in the PP (SLR/TOLR) and (RLR/OLR) the related eeprom parameters can be adjusted during production.

8.2 FP AUDIO LEVEL)

For adjusting the audio level in the FP (SLR/TOLR) and (RLR/ROLR) he related eeprom parameters can be adjusted during production.

.

9.0 Example Application Diagram

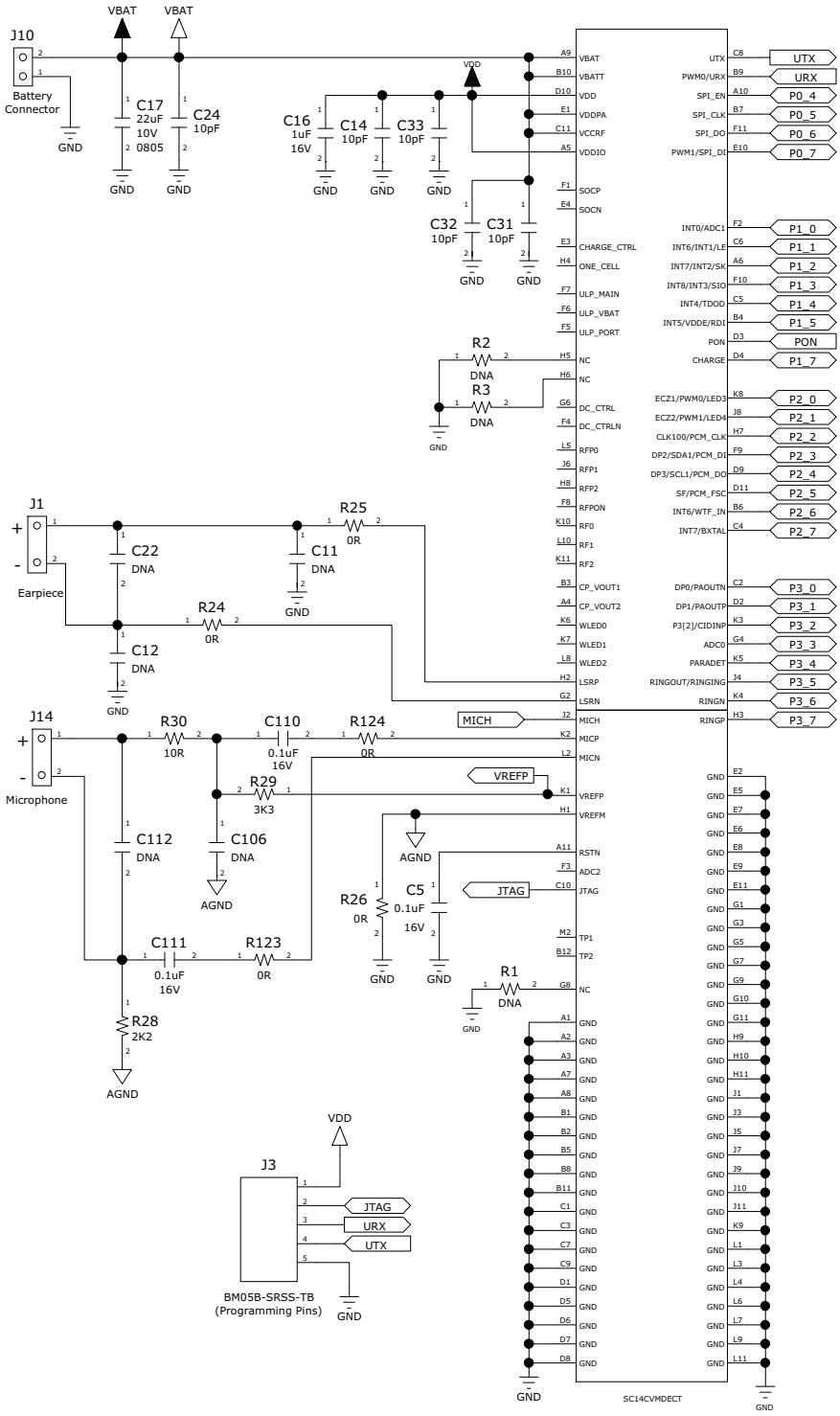


Figure 26 Referencediagram

10.0 Mechanical Dimensions

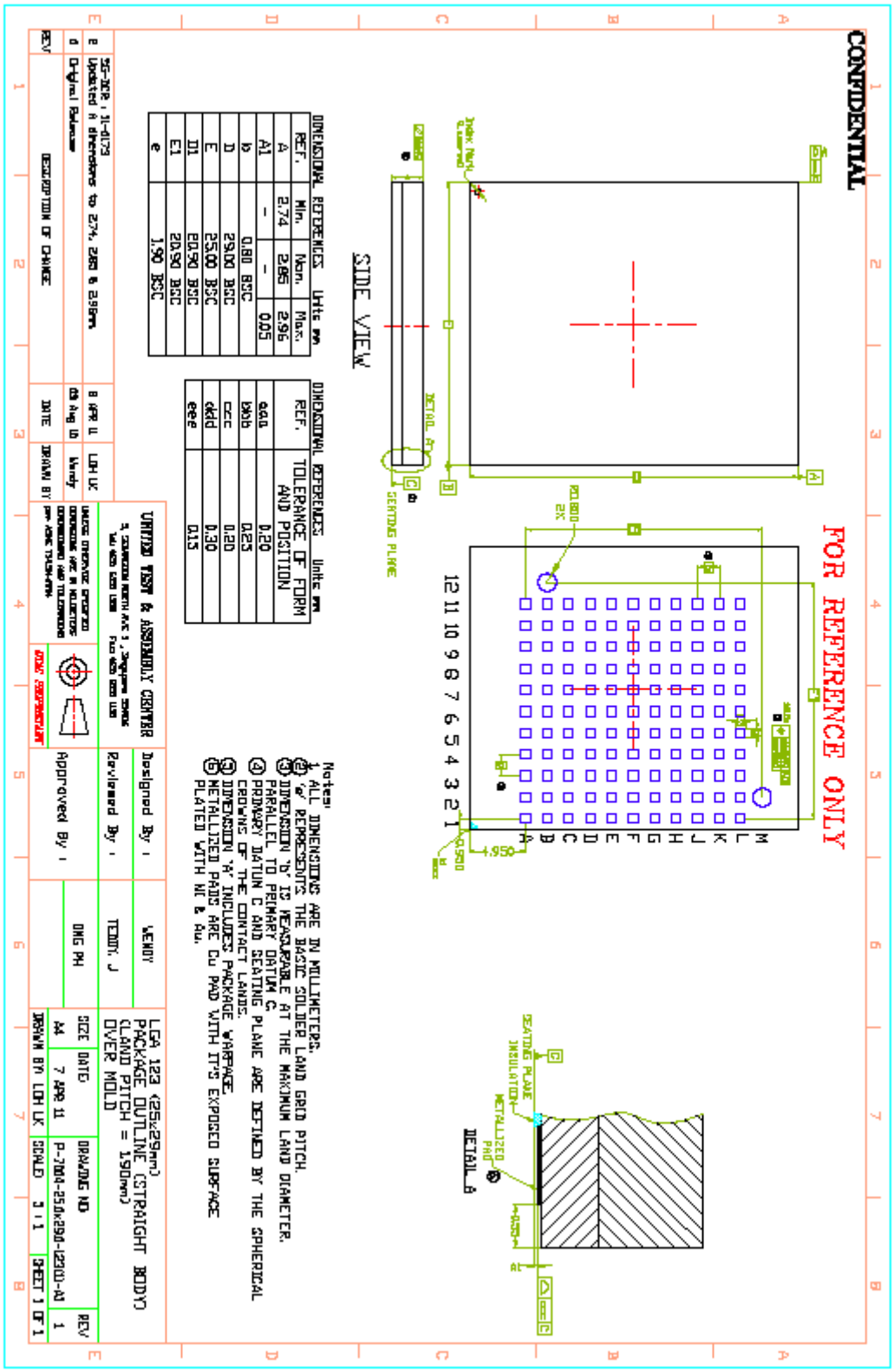


Figure 27 Package Outline Drawing

11.0 Module integration

11.1 MODULE PLACEMENT ON THE MAIN BOARD

In order to ensure FCC compliance, proper coverage and to avoid detuning of the antennas, it required to place the module free on the main board in relation to other surrounding materials.

Keep a distance of at least 10 mm from the antenna elements to conducting objects and at least 5 mm to non-conducting objects.

Keep in mind that electrical shielding objects, even partly surrounding the antennas, will normally cause a significant degradation of the coverage.

Place the module at the corner of the main-board as shown in Figure 28.

If the module has to be placed away from the edge of the main-board, then avoid conducting areas in front of the antennas and make a cut-out in the main board underneath the antennas as shown in the figure.

Keep solid ground on layer 2 out to the edges of the main board as shown.

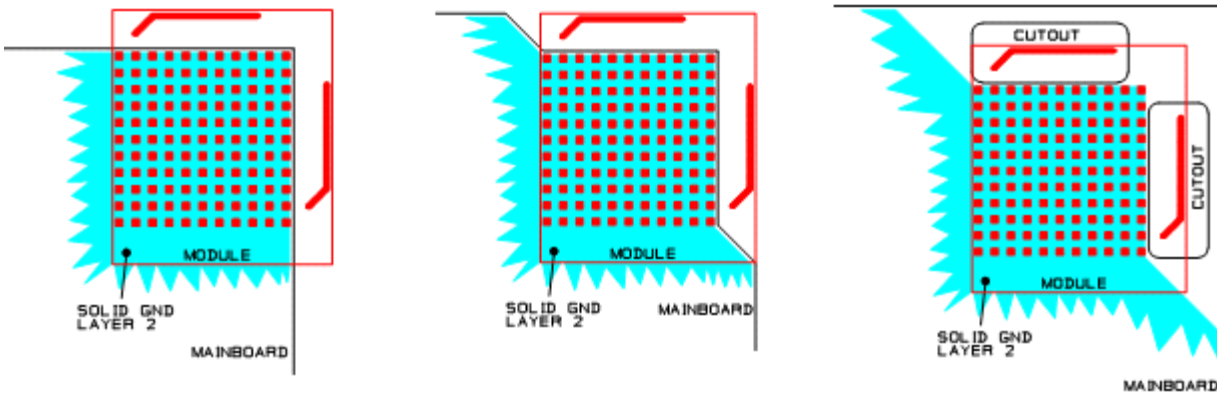


Figure 28 Module placement on the main board (top view)

12.0 UTAM membership waiver

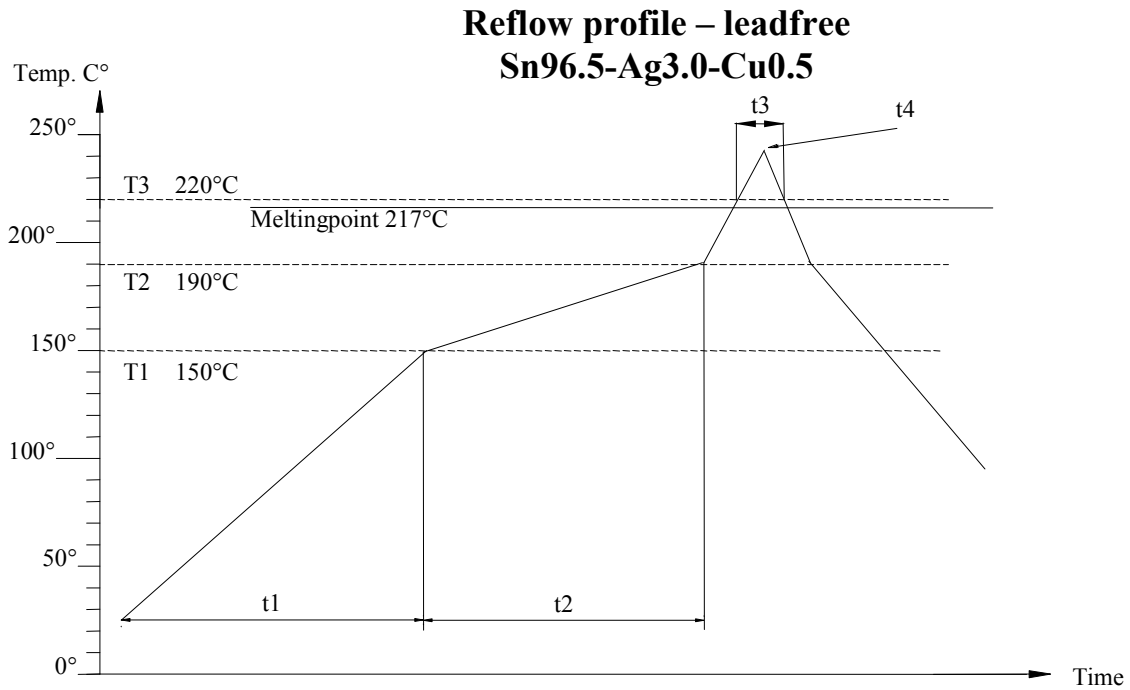
Payment of the Up Front Membership Fee and Per Radiating Device Fees is not required from a manufacturer or distributor that uses an FCC-certified module for which such fees have been paid. Such an “FCC certified module” is defined as a device that contains the complete UPCS-compliant radio modem functionality from a supplier that has a valid UTAM Affidavit. The hardware and firmware implementation of the FCC certified module must not be modified by the manufacturer or distributor in a way that would invalidate its original FCC certification unless the manufacturer of the device that will contain the module secures its own FCC approval. Any applicant for FCC approval seeking to use an FCC certified module must give the FCC ID number of the certified module that it will employ and attest that it is using a module for which UTAM fees have been paid.

See also www.utam.org

13.0 Soldering

13.1 SOLDERING PROFILE

The SC14CVMDECT should be soldered using a standard reflow soldering profile and lead free solder paste as shown below. Adjustments to the profile may be necessary depending on process requirements.



t1: Max. Change in temperature	3°C/sec.
t2: Time in preheat (150°C < temp. < 190°C)	60 - 120 sec.
t3: Time in reflow zone (temp. > 220°C)	30 - 60 sec.
t4: Peak temperature	237°C±5°C
T1 Preheat zone bottom	150°C
T2 Preheat zone top	190°C
T3 Reflow zone	220°C

Figure 29 Reflow profile

13.2 COPPER PAD AND SOLDER OPENING

Recommended Copper Pad and Solder Mask Opening (NSMD).

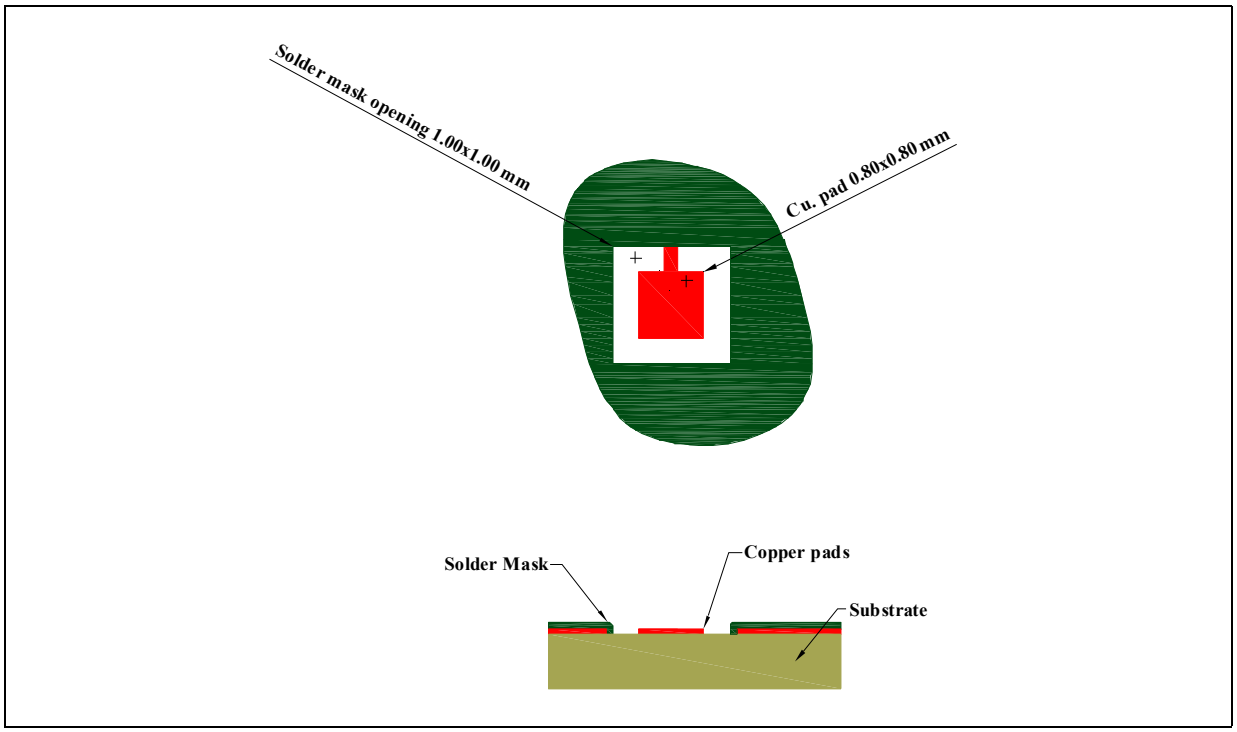


Figure 30 Copper pad and Solder mask opening

13.3 STENCIL

For the stencil a thickness of 0.122 mm is recommended. Recommended opening is as shown below.

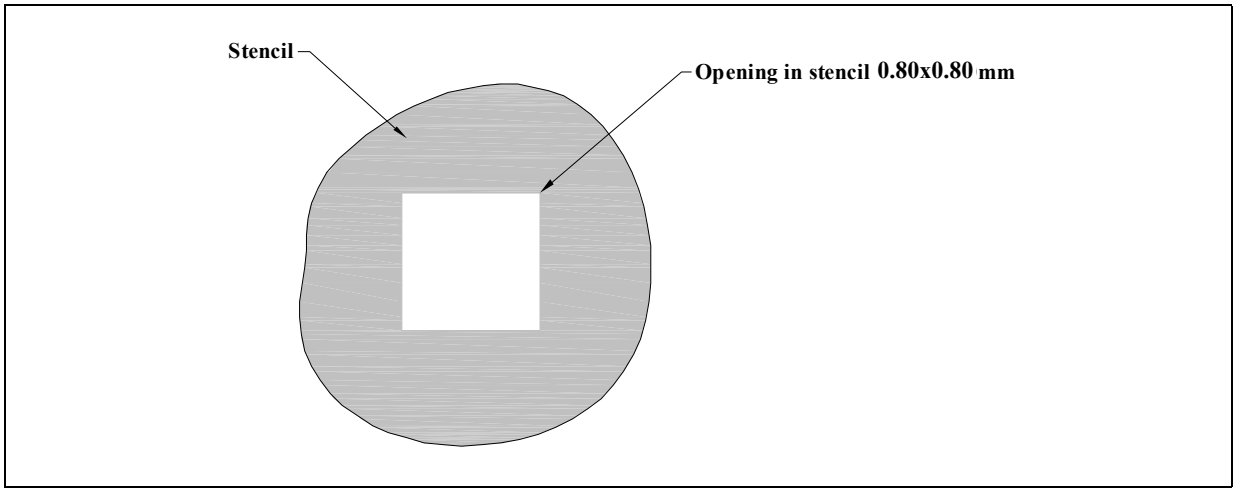


Figure 31 Stencil

14.0 Notices to OEM

14.1 FCC REQUIREMENTS REGARDING THE END PRODUCT AND THE END USER.

This module is for use only in DECT / UPCS handsets and base stations.

The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other transmitter

The end product that the module is integrated into must be marked as follows:

"Contains Transmitter Module FCC ID: Y82-SC14A / IC: 9576A-SC14A"

The literature provided to the end user must include the following wording:

FCC compliance statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation of the device.

Module transmetteur ID IC: 9576A-SC14A

Son fonctionnement est soumis aux deux conditions Suivantes: (1) cet appareil ne doit pas causer D'interférences nuisibles et (2) appareil doit accepter Toute interference recue, y compris les interferences Qui peuvent pertuber le fonctionnement.

Changes or modifications to the equipment not expressly approved by the Party responsible for compliance could void the user's authority to Operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generate, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Privacy of communications may not be ensured when using this phone.

A separation distance of at least 20 cm must be maintained between the base station and all persons (excluding extremities of hands, wrist and feet).

14.2 PRECAUTIONS REGARDING UNINTENDED COUPLING

The SC14CVMDECT does not have any electrical Shielding, so by integration on the main board precautions shall be taken in order to avoid any kind of coupling from the main board to the RF part of the module. If there is any doubt about this, a radio short test should be performed.

14.3 END APPLICATION APPROVAL

The module is intended to be used in an end application. When the requirements in 14.2 are fulfilled, no further test concerning the module is needed. Type approval concerning the end product, except for the module, should off cause be done. Please contact a test-house in order to clarify what is needed.

14.4 SAFETY REQUIREMENTS

This section provides of an overview of the safety requirements you must adhere to when working with the Cordless Voice Module SC14CVMDECT.

- The specific external power supply for the Cordless Voice Module SC14CVMDECT has to fulfill the requirements according to clause 2.5 (Limited power source) of this standard EN 60950-1:2006.
- Interconnection circuits shall be selected to provide continued conformance to the requirements of clause 2.2 for SELV (Safety Extra Low Voltage) circuits according to EN 60950-1:2006 after making connections.
- Interface type not subjected to over voltages (i.e. does not leave the building).
- Requirements additional to those specified in this standard may be necessary for:
- Equipment intended for operation in special environments (for example, extremes of temperature, excessive dust, moisture or vibration, flammable gases and corrosive or explosive atmospheres).
- Equipment intended to be used in vehicles, on Board ships or aircraft, in tropical countries or at altitudes greater than 2000 m.
- Equipment intended for use where ingress of water is possible.
- Installation by qualified personnel only!
- The product is a component intended for installation and use in complete equipment. The final acceptance of the component is dependent upon its installation and use in complete equipment.

Product Status Definitions

Datasheet Status	Product Status	Definition
Advance Information	Formative or in Design	This data sheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This data sheet contains preliminary data. Supplementary data will be published at a later date. SiTel Semiconductor reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
No Identification Noted	Full production	This data sheet contains final specifications. SiTel Semiconductor reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
Obsolete	Not in Production	This data sheet contains specifications on a product that has been discontinued by SiTel Semiconductor. The data-sheet is printed for reference information only.

SiTel Semiconductor reserves the right to make changes without notice to any products herein to improve reliability, function or design. SiTel Semiconductor does not assume any liability arising out of the application or use of any product or circuit described herein; neither does it convey any license under its patent rights, nor the right of others.

Life Support Policy

SiTel'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CIRTICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT AND GENERAL COUNSIL OF SiTel SEMICONDUCTOR. As used herein:

1. Life support devices or systems are devices or systems which,
   (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labelling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

SiTel Semiconductor does not assume any responsibility for use of any circuit described, no circuit patent licenses are implied, and SiTel reserves the right, at any time without notice, to change said circuitry or specifications.

RoHS Compliance

SiTel Semiconductor complies to DIRECTIVE 2002/95/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 January 2003 concerning Restriction of Hazardous Substances (RoHS).

SiTel Semiconductor statement on RoHS can be found on the customer portal http:/portal.SiTel-semiconductor.com. RoHS certificates from our suppliers are available on request.

Contacting SiTel Semiconductor

The Netherlands
SiTel Semiconductor B.V.
Phone: +31 73 640 88 22

North America
SiTel North America
Phone: +1 408 727 3200

Japan
SiTel Semiconductor K. K.
Phone: +81 3 3769 8123

SiTel Semiconductor Japan
Short Range wireless & VoIP
Phone: +81 3 5408 4330

Singapore
SiTel Semiconductor Singapore
Phone: +65 64845419