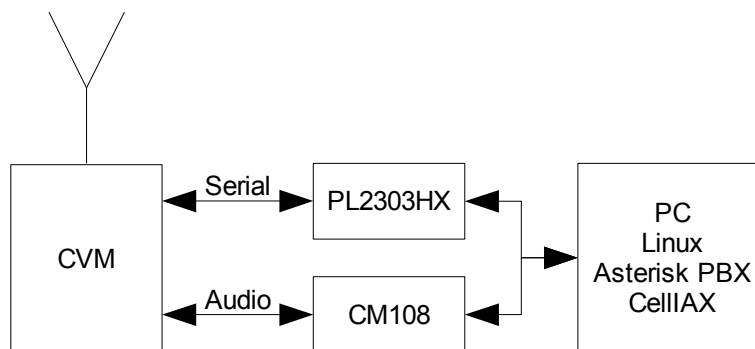


Intro

USB VoIP-DECT gateway is working as a DECT handset. It is intended to enhance existing DECT system with possibility of making VoIP calls. USB DECT module is registered as a handset in DECT base station. To make an outgoing VoIP call, user needs to make an internal call to a USB DECT module. After the connection is established, destination number should be dialed using DTMF (not every DECT handset/base station allows that). An incoming VoIP call can be terminated on any DECT handset registered with same base station as USB DECT module. As DECT base station allows simultaneous internal and external call, it is possible to make two calls at one time, one through VoIP and one through PSTN.

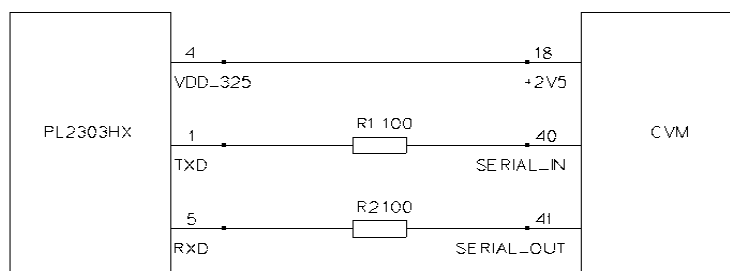
HW Design



The diagram above depicts main modules of USB VoIP-DECT gateway. Gateway consists of SC14CVM1.9FL CVM DECT module, CM108 based usb sound card and PL2303HX based usb-serial converter (cell phone data cable).

Sitel's CVM module (SC14CVM1.9FL) is integrated wireless handset/basestation module. It is available in two versions, DECT (1.9GHz) and DCT (2.4GHz). CVM module can work as a handset (PP) or a base station (FP). It can be controlled through SPI or serial interface. Audio signal can be delivered in analog or ADPCM format. CVM module was bought in 2005 from sales representative of EBV Elektronik <http://www.ebv.com/en/> (about 60E).

PL2303HX is USB-Serial converter made by Prolific. Sitel's CVM module have a 2.5V logic serial interface, PL2303HX was chosen because it's serial interface can work in wide range of low level logic (1.8V – 3.3V). Picture below shows connections between PL2303HX (SSOP28 package) and CVM module. “+2V5” pin of CVM supplies 2.5V reference voltage for PL2303HX.



PL2303HX based cellphone data cable was bought in local GSM repair shop (about 10E).

CM108 based sound card was chosen because it was cheap and offered all functionality needed. It is simple sound card with mono mic in and stereo audio out. In this project it was used as an analog sound source. CM108 based sound card was bought in local computer shop (about 10E).

More info about CVM module:

<http://www.sitelsemi.com/main.php?hmenu=1&smenu=24>

<http://www.rtx.dk/Default.aspx?ID=970>

CVM module

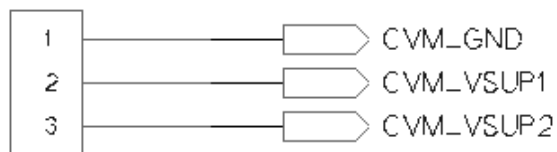
CVM module uses non-standard 50 pin-out package. gEDA and PCB software was used for PCB project. All the needed files (schematics, PCBs in PDFs and CVM module package footprint) should be distributed with this document. As it is a proof-of-concept and also my first such a project, PCBs are not optimal at all :).

Table below contains list of CVM pins that are utilized in PP (handset) mode. All other pins that are not listed in this table are not connected. For more info please see attached CVM docs.

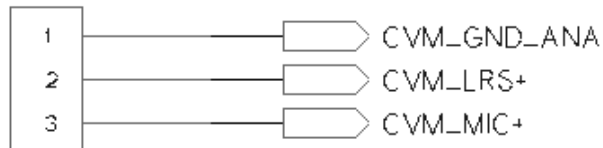
<i>PIN name</i>	<i>Type I/O</i>	<i>PIN no</i>	<i>Notes</i>
GND	-	1, 2, 5, 20, 29, 43, 44, 46, 47, 48, 50	Ground, connected to power supply module ground;
VSUP	-	15, 14	connected to VOUT of power supply module (3,6V, max. 500mA);
/RESET	I	6	Reset signal, N.C.
RESET	I	11	Reset signal, connected to GND
POWER_ON	I	14	Power on signal, connected to 0,5VOUT, (voltage divider made of 2x100K resistors);
+2V5	O	18	2,5V Vref for PL2303HX;
LRS+	O	21	Audio OUT, connected to MIC IN of sound card (bypassed to GND_ANA with 10pF cap, and coupled with 4,7nF cap);
GND_ANA	-	26	Audio GND, connected to sound card GND;
MIC+	I	27	MIC IN, connected to Audio OUT of sound card (bypassed to GND_ANA with 10pF cap, and coupled with 4,7nF cap);
SERIAL_IN	I	40	Serial IN, connected to Serial OUT of PL2303HX (2,5V logic);
SERIAL_OUT	O	41	Serial OUT, connected to Serial IN of PL2303HX (2,5V logic);
ANT	I/O	49	Antenna connector (antenna connected through 1nF ceramic capacitor);

The schematic below show connectors to external modules (power supply, usb sound card and serial-usb converter).

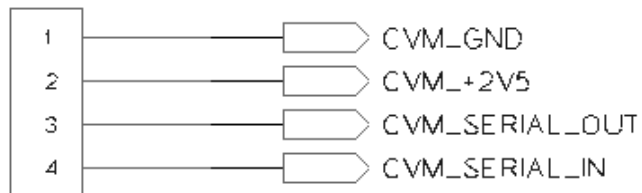
PWR_CONN101

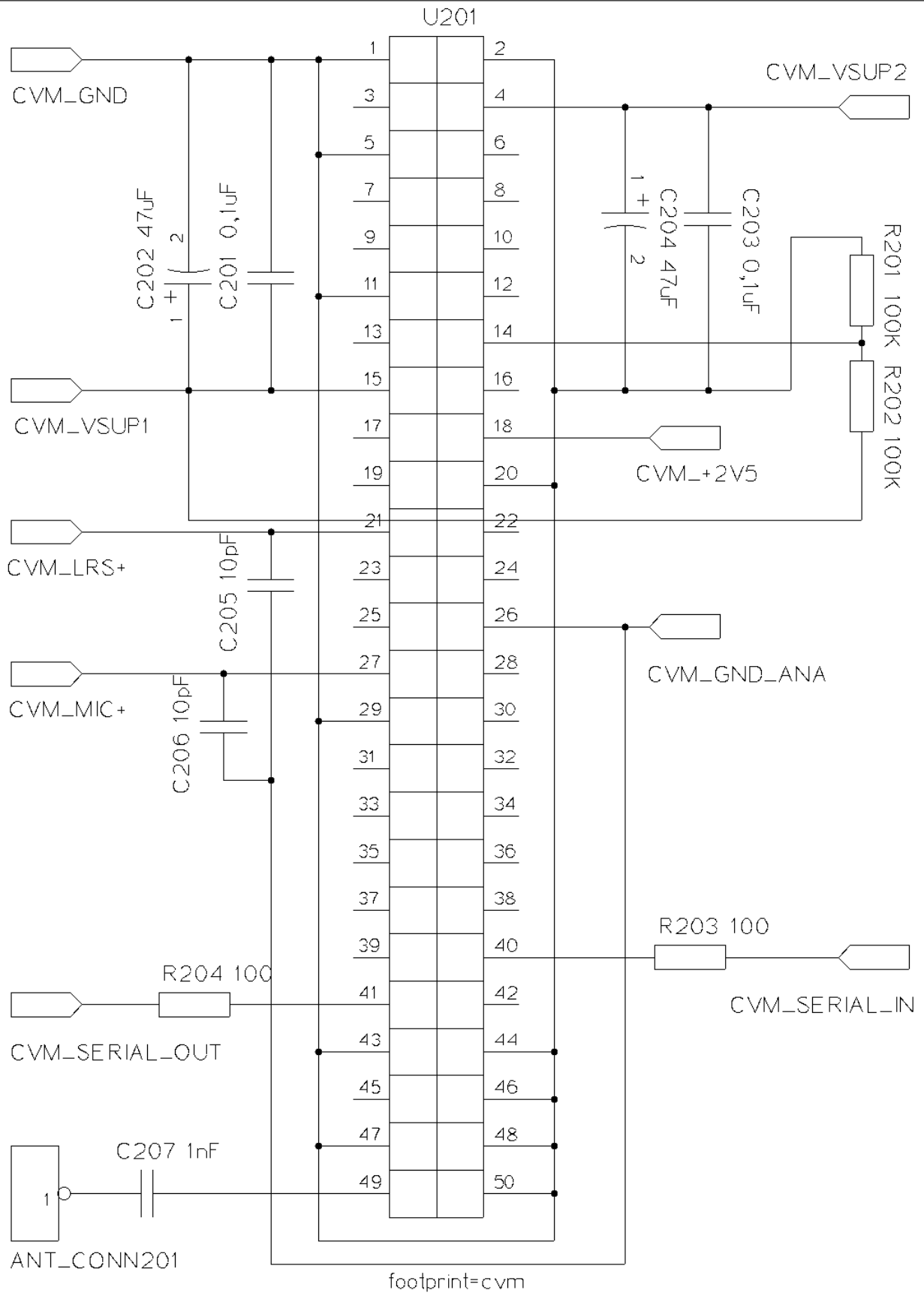


AUDIO_CONN101

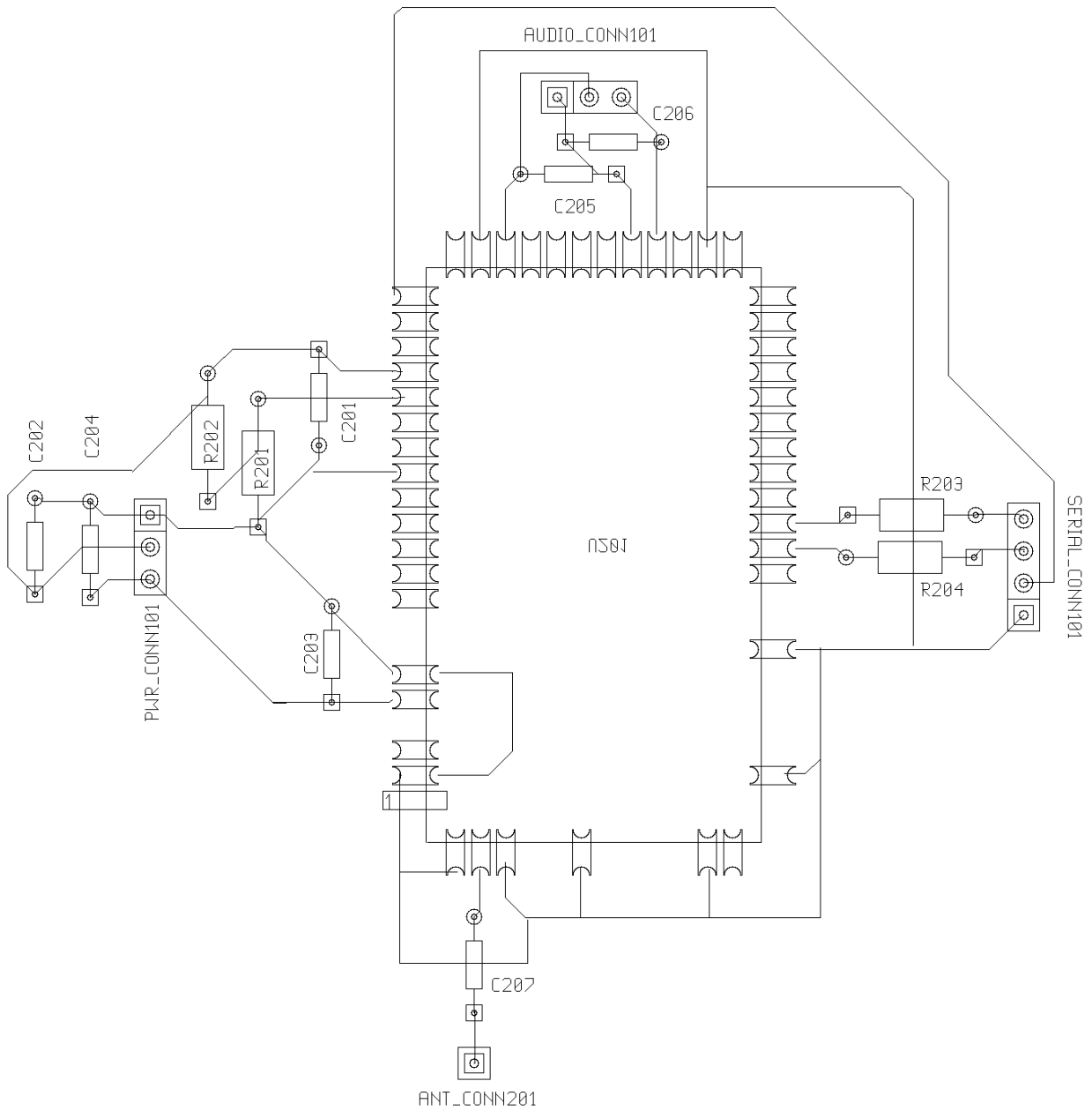


SERIAL_CONN101





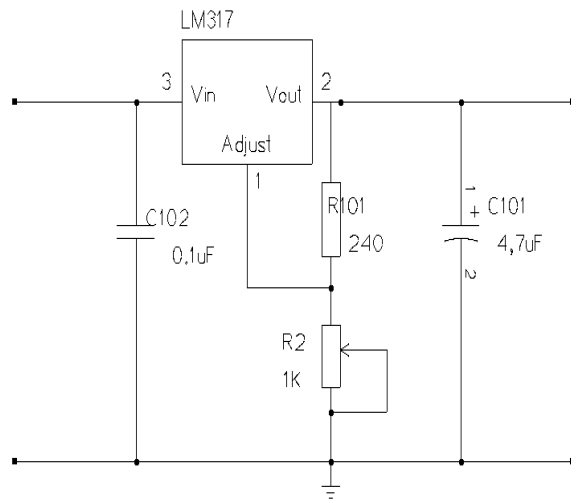
The schematic above shows elements needed by CVM module to operate, and their connection to CVM module. On this schematic CVM module is shown as a 50 pin connector. Most of external elements values are taken from CVM module documentation.



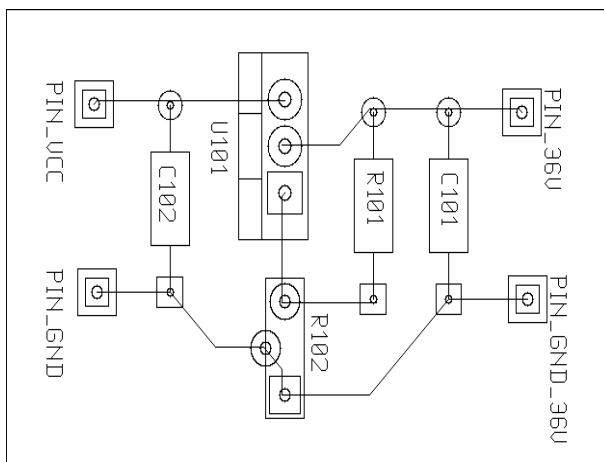
The picture above shows elements layout on PCB.

Power supply module

Power supply module needs to deliver 3,6V max. 500mA (normal PP operation: about 200mA). As there is no fixed 3,6V voltage regulator, LM317 adjustable voltage regulator was used. LM317 in TO-220 package when used with $V_{IN}=6.0V$ is not even getting warm (no radiator at all).



The schematic diagram above is taken from LM317 application note. R2 (R102) pot needs to be adjusted to get $V_{OUT}=3.6V$.



The picture above shows elements layout on PCB.

Software

A modified version of CellIax is used to control USB VoIP-DECT gateway.

Changes in CellIax:

- support for BUSMAIL serial protocol was added;
- control logic coded (simple state machine, support for CVM API)
- new variables in celliax.conf;

New variables added to celliax.conf file:

<i>Variable</i>	<i>Valid values</i>	<i>Notes</i>
debug_cvm	yes, no	enables or disables debug messages;
control_device_protocol	cvm_busmail	this variable gets a new value that informs that this device uses cvm_busmail control protocol;
cvm_subscription_1_pin	4 digit PIN code	PIN code used during registration to FP #1;
cvm_subscription_2_pin	4 digit PIN code	PIN code used during registration to FP #2;
cvm_subscription_no	1,2	which FP we want to be locked to;
cvm_volume_level	0-9	CVM allows to control gain in audio path, there are 10 gain steps, from 0 to 9;
cvm_serial_delay	0-65535	this is for debugging purpose only. I had a problems with serial communication, I tried to resolve the problem by increasing delay between sending/receiving serial data ;

CVM module can be registered to two FPs (FP #1 and FP #2). Registration is a process when FP (base station) learns new PP (handset), it is one time process. To get PP registered to FP, FP must be in registration state, and both FP and PP must know secret PIN code. There is also a process called LOCKING. PP must be locked to FP before FP can be used for communication with other PPs. PP can be locked to only one FP at the time. Locking is only done when PP was already registered with FP earlier.

When celliax starts, it reads "cvm_subscription_no" and tries to lock to desired FP. If locking fails, it reads a PIN code from "cvm_subscription_2_pin" or "cvm_subscription_1_pin" and attempts

to registered to FP.

Example celliax.conf:

```
[voip_dect_gateway]
control_device_name = /dev/ttyUSB0
control_device_speed = 19200
control_device_protocol = cvm_busmail
alsa_capture_device_name = plughw:1
alsa_playback_device_name = plughw:1
playback_boost = -30
capture_boost = -15
```

```
cvm_volume = 4
cvm_serial_delay = 50
cvm_subscription_no = 1
cvm_subscription_1_pin = „0000”
cvm_subscription_2_pin = „0000”
```

Making internal calls:

Example line in extensions.conf file:

```
exten => 700,n,Dial(Celliax/voip_dect_gateway:3)
```

Dial PP #3, PP must be registered to the same FP as a CVM module.

Currently software supports only internal calls (PP-PP), but CVM module allows also external calls (PP-PSTN), small changes in dial code are needed.

Outro

I would like to thank the following people: (alphabetical order)

Dawid Chudy – for support in soldering;

Dorota Nowaczewska – for supporting me all the time;

Giovanni Maruzzelli – for CellIax and support during resolving related problems;

Marcin Gaborski and Mariusz Czapiewski – for support in PCB production;

Wojciech Andrałojć

a_wojtek@wp.pl