

SDRMK1.5

Andrus

SDR MK1.5 'Andrus'

Application Note

Application note MK1.5AN-001

Firmware update procedure

V1.0

23.Mar.2012

Revision History

	Date	Changelog
1.0	23.Mar.2012	Initial

Synopsis

- This guide will cover the firmware update procedure for SDR MK1.5 radios
- SDR MK1.5 Firmware image, as well as Atmel FLIP utility, are needed to carry on the procedure. No additional hardware or special cables beside standard USB cable are needed.
- While this guide focuses on the upgrade procedures under Windows, the FLIP utility is also supported under Linux. Please follow the instructions given for Linux version of FLIP utility.

Introduction

SDR MK1.5 is a dual-channel Software Defined Radio (SDR) platform based on National Semiconductor LM97593 Diversity Radio Chipset (DRC) and Atmel AT32UC3B0512 32-bit CPU. The CPU incorporates a built-in USB interface and comes manufacturer pre-programmed with DFU bootloader, what allows updating the application software inside the CPU through USB interface.

The SDR MK1.5 ‘Andrus’ project is by nature an open source, published under Creative Commons Attribution-NonCommercial-ShareAlike (CC BY-NC-SA 3.0) license. As most open projects, the SDR MK1.5 is always a “work in progress” and gains features and functionality throughout its lifetime, what can be unlocked by users doing firmware upgrades.

The following guide is a walk-through for carrying on firmware upgrade procedure using Windows platform. The software upgrade is also possible to accomplish using Linux operating system and appropriate version of the FLIP. Please follow the *FLIP User’s Manual* (flip_um.pdf) from Atmel for instructions.

Firmware Upgrade Procedure

1. Download and install the Atmel FLIP utility, found at <http://www.atmel.com/tools/FLIP.aspx>

3.4.7

At the moment of writing this application note, the most recent version is 3.4.5. There are two builds available for download, one which includes the Java Runtime Environment and one what does not. Please note, that as AVR 32-bit CPU's can not be programmed using the graphical user interface of the FLIP, the Java Runtime Environment is not actually needed by the program.

The programming is carried on by the utility **bacthisp.exe** found in FLIP directory, likely located at *c:\Program Files\Atmel\FLIP 3.4.5* after installation.

2. After successful installation of the FLIP, you will also need to download the copy of the firmware. The latest and previous builds of the firmware can be found at <http://code.google.com/p/sdr-mk15/>

The firmware images are with the .HEX extension. ✓

The somewhat important is to store it somewhere, where it could be easily accessible. *My Documents* and *Desktop* are not best places, because we have to change our working directory to this folder later from command line, and both these locations are not the easiest ones to type in.

I would suggest creating new directory to the root folder, something like *c:\sdrfw* for example or anything else you feel suitable. Do not use spaces at the file name, it will make working in command line easier later.

3. The SDR MK1.5 has two buttons at the front panel labeled HWBE and RST. (*For boards without the housing, the RST button is the one closer to the network connector.*) To enter programming mode, connect the radio to the computer using USB cable and press the two buttons in following sequence:
 - Press and hold the HWBE button
 - While holding the HWBE, press RST button momentarily
 - Release the HWBE button (be sure that RST is already released before releasing HWBE)

If the three on-board LED-s can be observed, the first Green LED must be on, while the Red LED is dimly lit.

The radio is now in programming mode and the computer should be looking for the USB driver for the new device found.

Direct computer to look for the driver at the FLIP directory, which is likely at

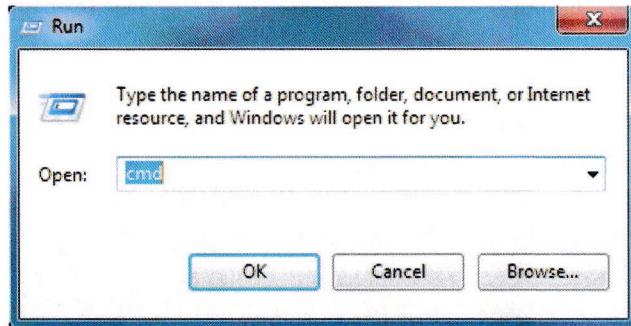
c:\Program Files\Atmel\FLIP 3.4.5\usb . (Numbers may vary.) After successful installation, the new USB device named AT32UC3B appears at device list



4. The most complicated part of the whole procedure is running the actual upgrade commands. As the graphical interface does not support programming AT32 series devices, the commands must be entered manually from command line.

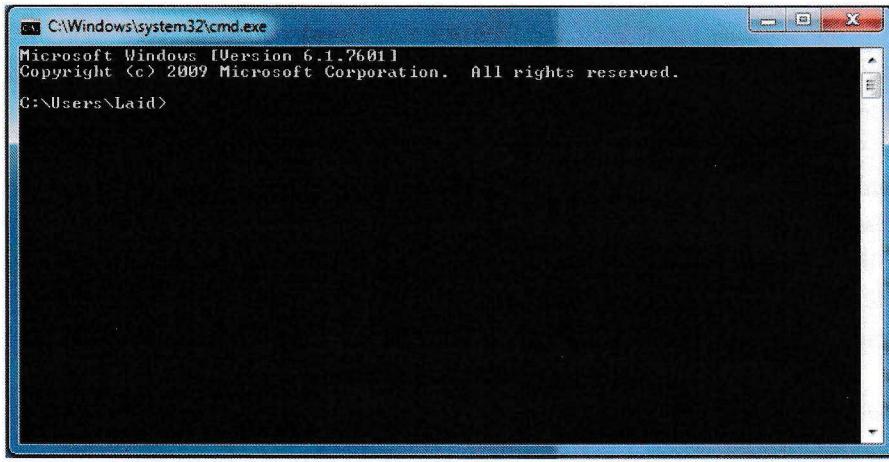
If you are not familiar with the command line window, do not be too worried – it is not as complicated as it may seem at first and there is no chance to ruin anything as long as you do not type in harmful commands.

Open the command line prompt by typing the command **cmd** to the *Run Command* window found at start menu of Windows

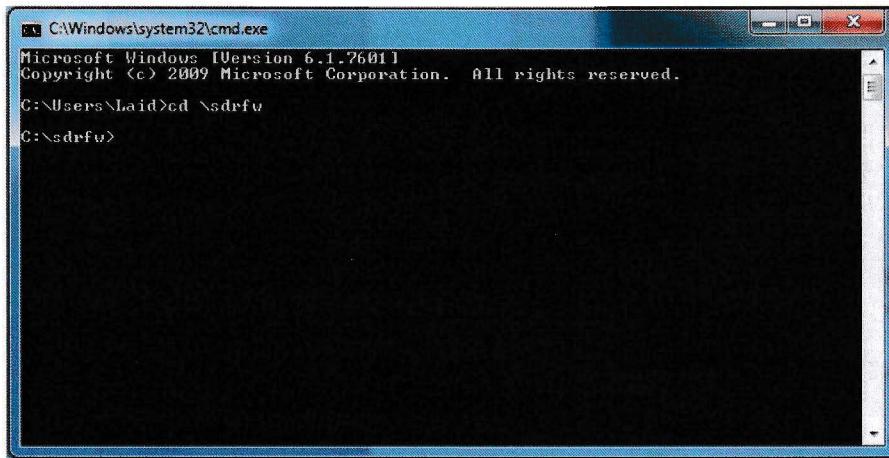


or start the *Command Prompt* manually from the Start Menu -> Accessories

You will end up with something like that:



Navigate to the directory, where you had your firmware file downloaded by typing *cd \yourfilelocation*, like *cd \sdrfw* for example.



Note, that if you still DID have spaces in the directory name, you have to enclose it in quotation marks, so the command line looks like *cd "c:\sdr firmware"* for example.

The following three commands then have to be typed on the command prompt to carry on the actual firmware upgrade procedure. Please read the paragraph below before you do so, and keep in mind, that these should be typed in EXACTLY as seen here.

```
batchisp -hardware usb -device at32uc3b0512 -operation erase f  
batchisp -hardware usb -device at32uc3b0512 -operation loadbuffer sdr_mk1.5_v1.0.hex program  
batchisp -hardware usb -device at32uc3b0512 -operation start reset O
```

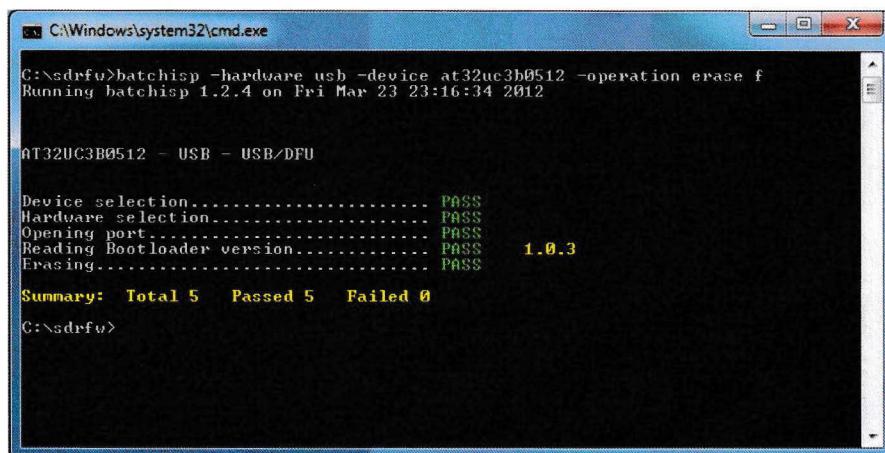
Note, that while you can render the radio temporarily inoperable by typing the commands wrong, it is not possible (or at least should not be ...) to totally “brick” your radio. If anything goes wrong, just start over from Step 3. The driver for AT32UC3B is already there, so you do not have to re-install it.

The **sdr_mk1.5_v1.0.hex** is the fine name for the firmware. If it is located somewhere else than at the directory your command prompt is set with ‘cd’ command , the full path to the file must be given. If the filename or path contains spaces, you must also include quotation marks around it. The .HEX filename may also look different, have the version number different etc., so the second command line may as well look something like:

```
batchisp -hardware usb -device at32uc3b0512 -operation loadbuffer "c:\temp\sdr_mk1.5_v1.15a.hex" program
```

The resulting three commands should look in reality like that:

```
batchisp -hardware usb -device at32uc3b0512 -operation erase f
```



A screenshot of a Windows Command Prompt window titled 'C:\Windows\system32\cmd.exe'. The window shows the following text output:

```
C:\>sdrfu>batchisp -hardware usb -device at32uc3b0512 -operation erase f
Running batchisp 1.2.4 on Fri Mar 23 23:16:34 2012

AT32UC3B0512 - USB - USB/DFU

Device selection..... PASS
Hardware selection..... PASS
Opening port..... PASS
Reading Bootloader version..... PASS 1.0.3
Erasing..... PASS

Summary: Total 5 Passed 5 Failed 0
C:\>sdrfu>
```

SDRMK1.5

Andrus

SDR MK1.5 'Andrus'

**Software Defined
Radio**

Quick Installation Guide

V1.0

10.Apr.2012

Revision History

	Date	Changelog
1.0	10.Apr.2012	Initial
1.1	24.Sep.2012	Added references to libusb-win32 and Bulk interface Corrected +6VDC references to +5VDC

Synopsis

- This quick installation guide will cover the necessary steps for setting up SDR MK1.5 Software Defined Radio for working with Windows 7, Windows Vista and Windows XP, using the HDSDR software found at <http://hdsdr.de>
- This guide will cover the installation procedures required for working with the radio using USB interface. The installation procedures required for Network Interface are described in document "Network Interface Guide"

Introduction

SDR MK1.5 Software Defined radio is equipped with USB 2.0 Full speed interface, provided by Atmel AT32UC3B0512 processor, which is the main processing unit inside the MK1.5 radio.

The radio is fitted with USB Type B or USB Mini-B socket, dependent on hardware revision. It is possible to use the radio entirely by connecting only the antenna and USB cable. While the radio is also equipped with the external +5VDC power connector, it is not normally needed to provide additional power during the operation using USB interface, if desktop computer is used.

Note, that radio consumes 580mA from USB, which is slightly over the maximum specification for single USB device.

While most desktop computers can handle the extra load, it is in most cases necessary for laptops to employ special USB cable with twin connectors for supplying additional power to the device, such as found on portable USB hard disks.



The second Type A connector on the computer side serves as additional power supply, therefore allowing the device connected to use maximum of 1A of power.

Warning! Should it be chosen or necessary to connect external power supply in parallel to the USB connection, the external power supply voltage should NOT EXCEED 5.1VDC !!!

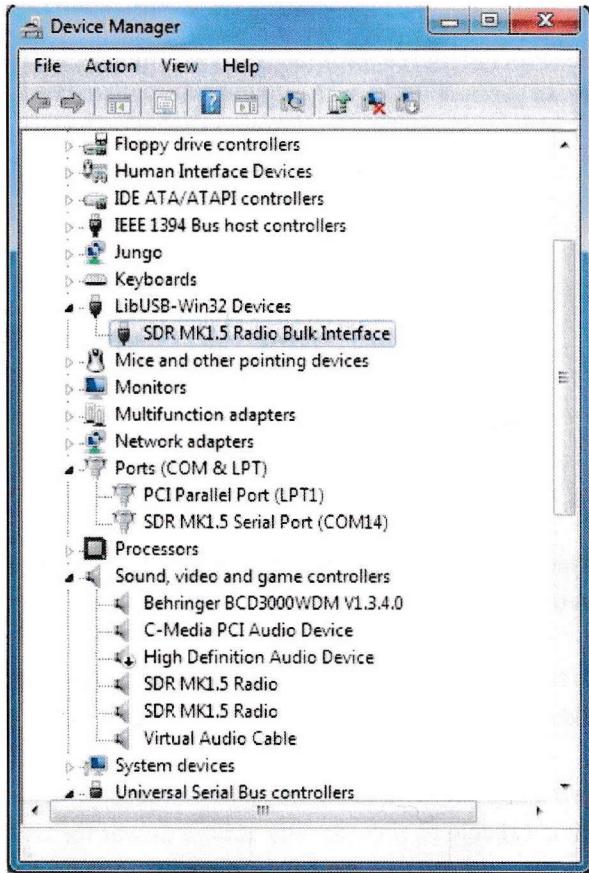
(Note, that so far the only case known when external power is needed to operate the unit while connected to USB interface is with Apple iPad, which is capable to provide only 100mA power for USB devices connected.)

USB Devices

SDR MK1.5 Radio will provide four USB devices when connected:

- 48kHz/16-bit/Stereo USB audio interface for Channel A
- 48kHz/16-bit/Stereo USB audio interface for Channel B
- Virtual Serial Port (CDC) for radio control
- Bulk Data interface (CDC out only) for high-speed I/Q sample data connection
(up to 7.5Mbit/sec)

When all the drivers are installed appropriately, the Device Manager window should look similar to following:



The driver requirements for SDR MK1.5 'Andrus' are following:

- Audio adapters are standard UAC USB audio interfaces and do not require any driver installation
- The SDR MK1.5 Serial Port is a CDC device, which is a form of virtual serial port. While this type of device does not require a special driver besides Windows standard drivers, it does require a separate .INF file in order to be recognized by Windows.
- The LibUSB-Win32 Bulk interface requires a libusb-win32 drivers to operate.

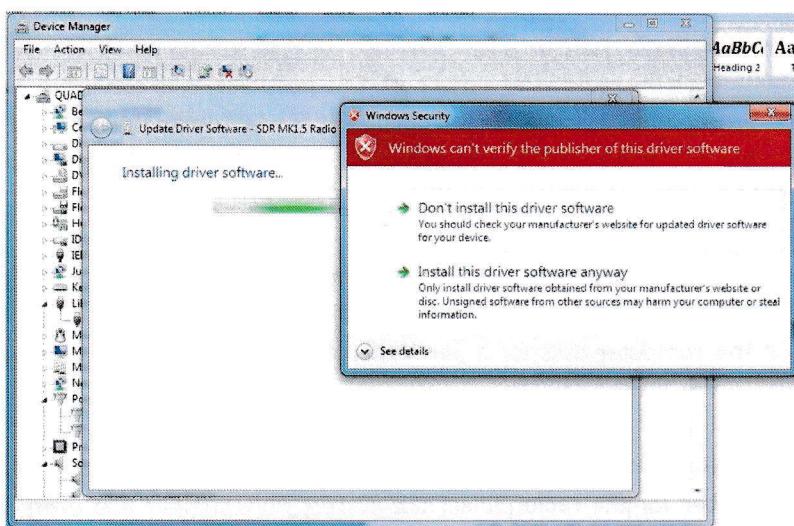
All necessary drivers can downloaded from SDR MK1.5 software repository at

<http://code.google.com/p/sdr-mk15/>

SDR MK1.5 Installation Procedure for Windows 7/Vista/XP

1. Download the latest driver bundle from <http://code.google.com/p/sdr-mk15/>

2. Unpack the driver bundle to known location.
3. Connect the radio with computer using the USB cable. Initially, there will be one green and one red LED lit after power-up. After about 2 seconds, only the two green LED-s (D5 (A) and D6 (B)) must remain lit. If the green LED (D6 (B)) flashes, the radio is experiencing the error during the startup procedure. See Appendix A, Startup Error Codes, for further reference.
4. When the Windows is requesting the drivers for USB devices, point it to a location where driver archive was unpacked. Acknowledge any warnings about the installation of the driver and if the computer is complaining about the driver not being signed, allow the process to continue (choose “Install this driver software anyway”).



5. After the installation is complete, there should be no unknown devices associated with SDR MK1.5 radio and the radio is ready to use. There is no need to re-plug the radio.

Please note, that on the radios with enclosures, which have no additional daughtercards present, the on-board LED-s are difficult to observe. It is, however, possible to check the LED-s through the UHF connector opening in the box.

Installing HDSDR

The HDSDR is a freeware Software Defined Radio software developed by Mario Taeubel and LC. It is largely based on the original Winrad code written by Alberto di Bene (I2PHD) and has been a choice of program for running the SDR MK1 and MK1.5 radios.

HDSDR can be downloaded from its home page at <http://hdsdr.de>

Installation procedure is straightforward, just run the installation file and it performs all the tasks automatically. If the operating system asks permission for installing any software, please allow it to do so.

There are two ways for commanding the radio using serial port. One possibility is to connect to the serial port using the terminal. This procedure is described in the document "Serial Terminal User Guide".

On HDSDR case, it is convenient to use the ExtIO DLL driver, what will create the interface between the SDR MK1.5 radio and the HDSDR software.

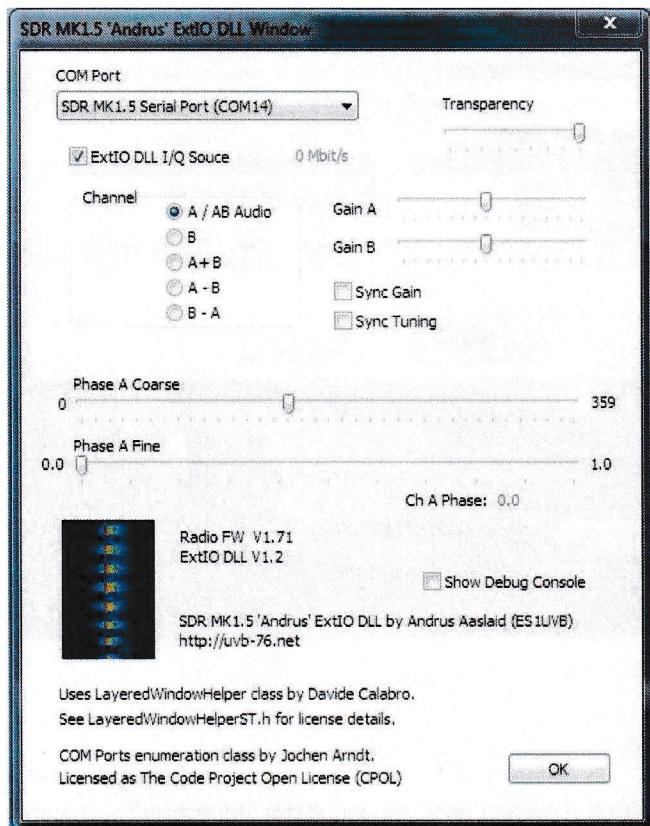
To do so, please download the up to date ExtIO DLL driver from <http://code.google.com/p/extiodll/> repository and copy the file to HDSDR installation directory (normally located at C:\Program Files\HDSDR). If the computer asks for a permission to copy the program to executables directory, allow it to do so.

You must then restart the HDSDR software if it is already running. On next start, the HDSDR should ask for the correct serial port number for the radio. Select the correct port number and press OK. The HDSDR should start up, and the ExtIO button next to frequency display shall become light blue:



Pressing the ExtIO button will launch the info window for ExtIO DLL interface.

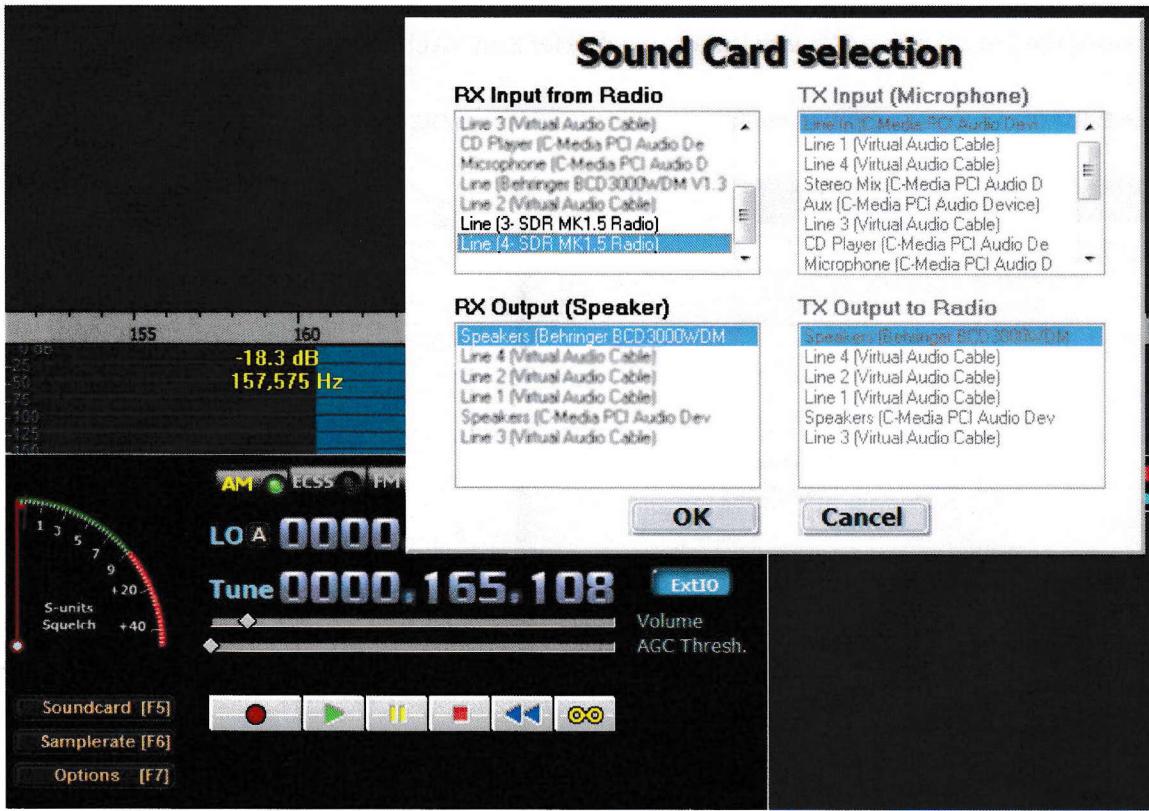
The ExtIO DLL is operating in two modes: Audio mode and ExtIO DLL IQ mode.



It is highly recommended to check the “ExtIO DLL I/Q Source” checkbox. This will use the full-speed Bulk data interface to deliver IF I/Q sample information from radio to HDSDR software, providing therefore a 232kHz IF Bandwidth, as opposed to 48kHz possible to achieve through SDR MK1.5 audio interfaces.

For older firmware revisions and SDR MK1 radios, leave the box unchecked and select the SDR MK1.5 Audio interface as sample source and from the HDSDR “Options” dialog.

Select the correct soundcard settings (the RX Output soundcard must be selected even if ExtIO DLL is used as I/Q data provider) and press OK:



Your radio should be ready to use now!

Be sure that your radio has antenna connected to the correct antenna connector (Innermost is channel A (labeled mistakenly CH B for early housings)) press the "Start" button, and you should see something similar like this:



Congratulations! Your radio is now fully operational!

Appendix A

Startup Error Codes

The SDR MK1.5 radio is performing a quick sequence of self-tests during the startup. Should there be any failures detected, the green LED D6 (B) will flash the error code. The error code is repeated three times with 1 second pauses between the sequences. For example, for error code 3, the LED will flash three times quickly, then have 1 second pause, then flash another three times, then 1 second pause, and finally flash another three times, after which the LED remains off.

Depending on severity of the error, the radio may or may not start with partial functionality present.

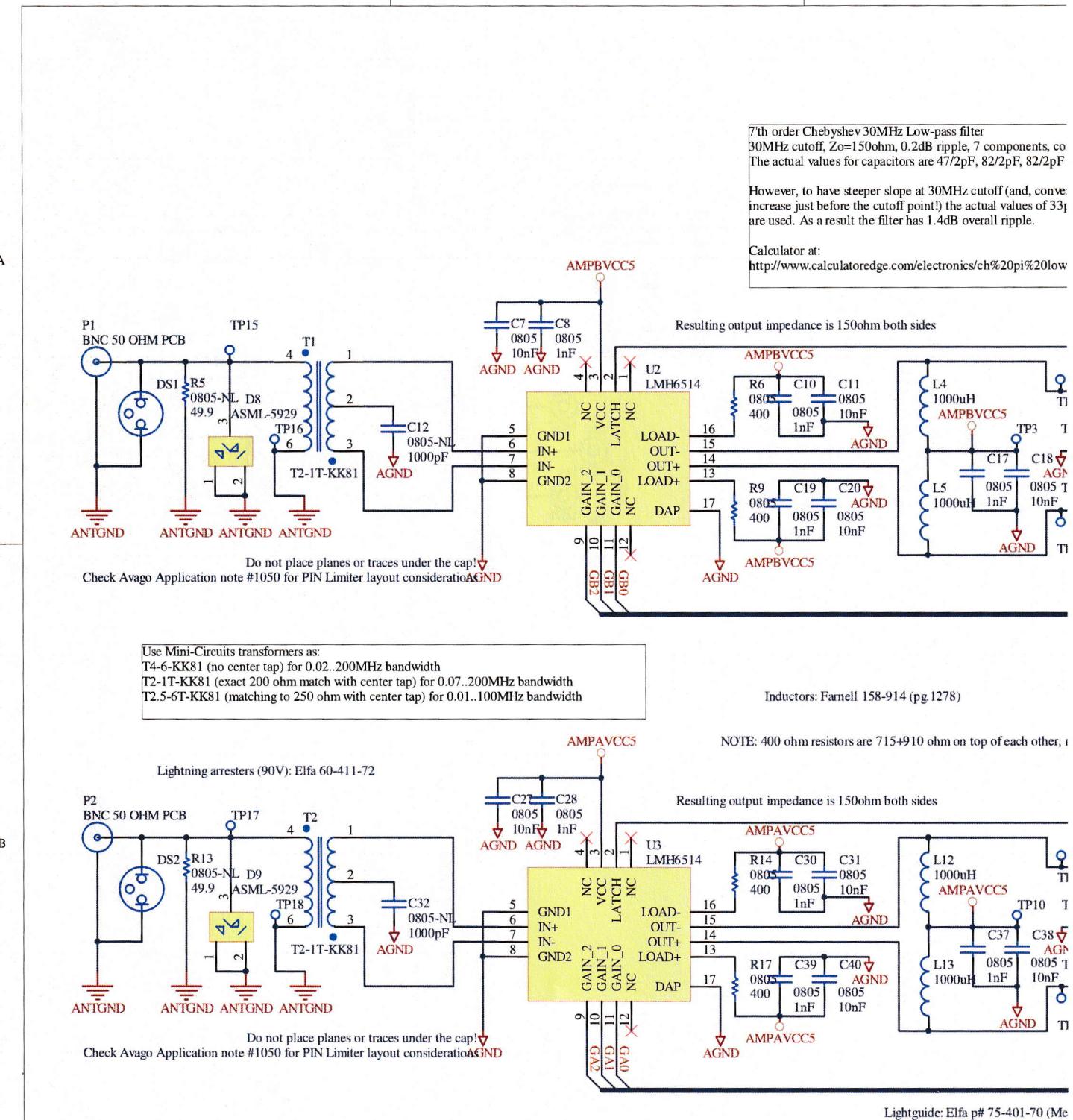
Error codes:

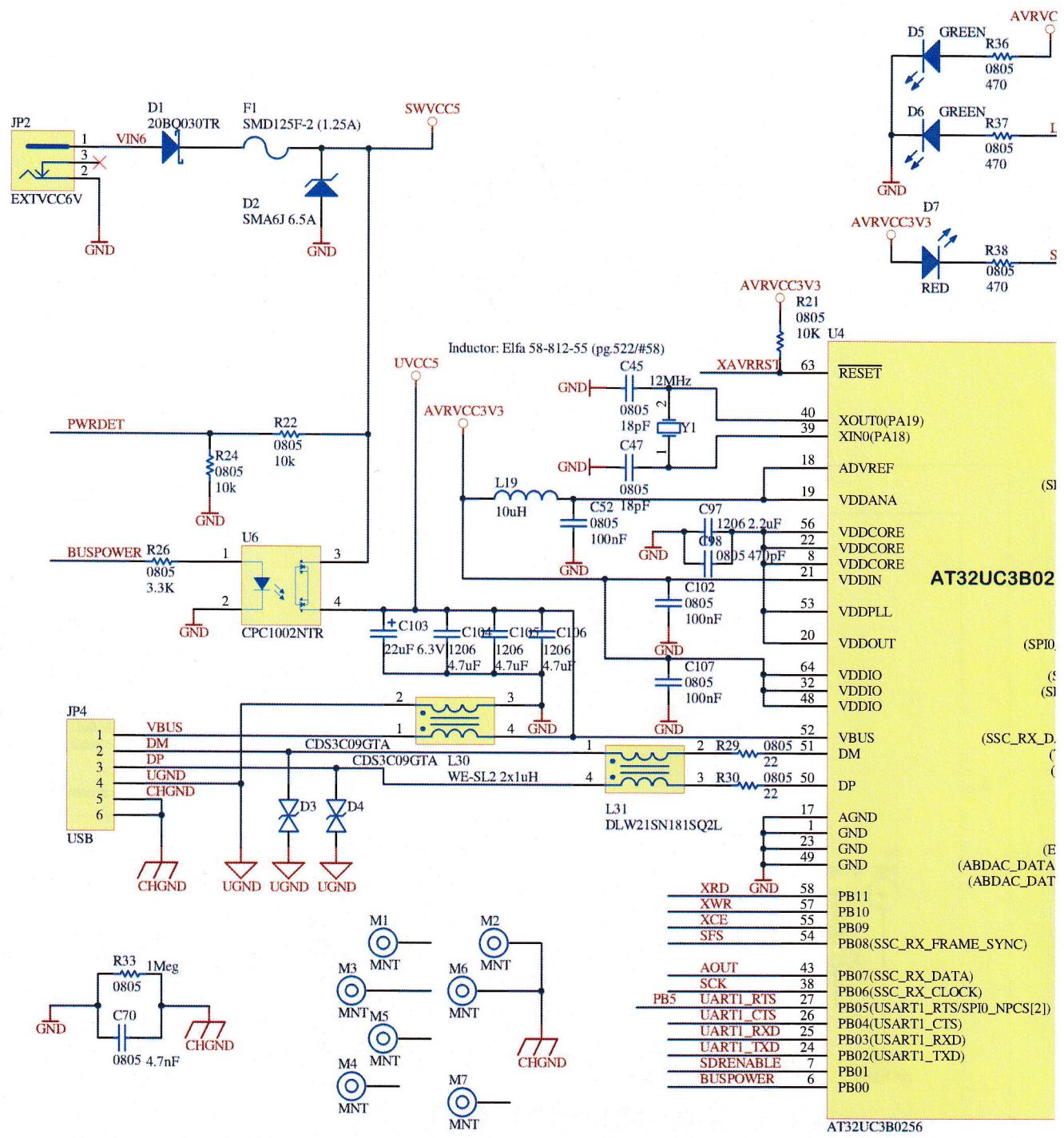
Code	Error	Description
5	NO_IQ_DATA	The LM97593 radio chip does not provide any IQ samples stream. This may also be the consequence of master clock being absent, generated by 27MHz source (Y3) and CDCE913 clock synthesizer (U11). For early V1.05 hardware revisions, this error may appear time to time because of too small capacitor value in LM97593 reset circuitry. The capacitor C6, located underneath the board close to LM97593 chip, has to be replaced with 1uF capacitor on that case.

Q Other reasons are to disconnect high-speed antenna traces to prevent noise when ENV2810 part is not being used.

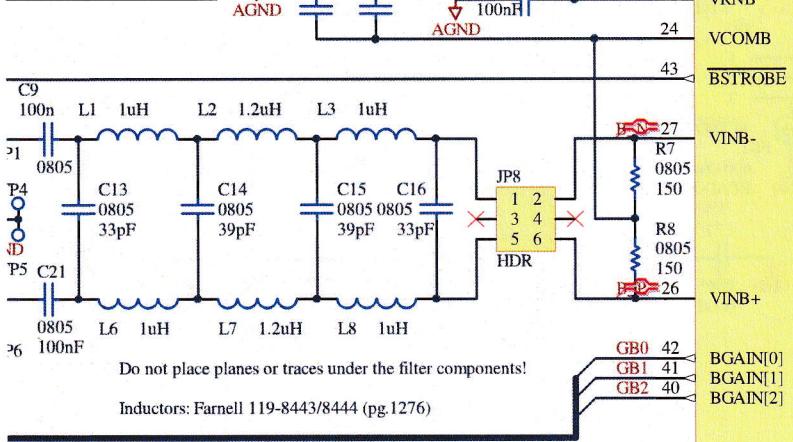
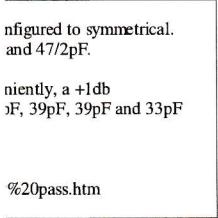
卷之三







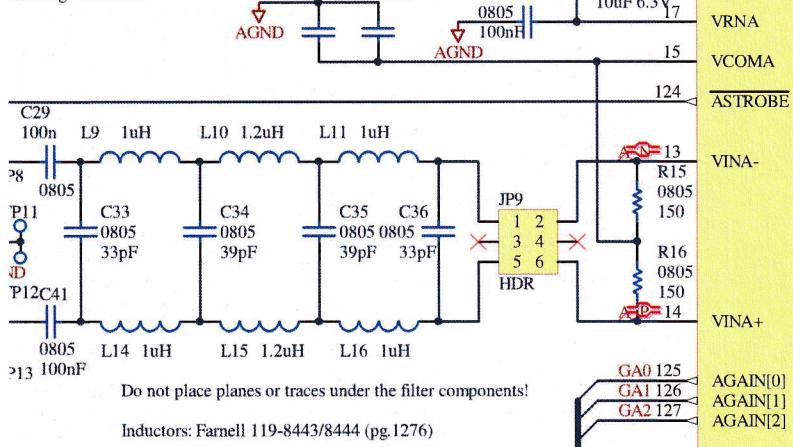
Place 100nF and 10nF caps on all power pin groups here



Do not place planes or traces under the filter components!

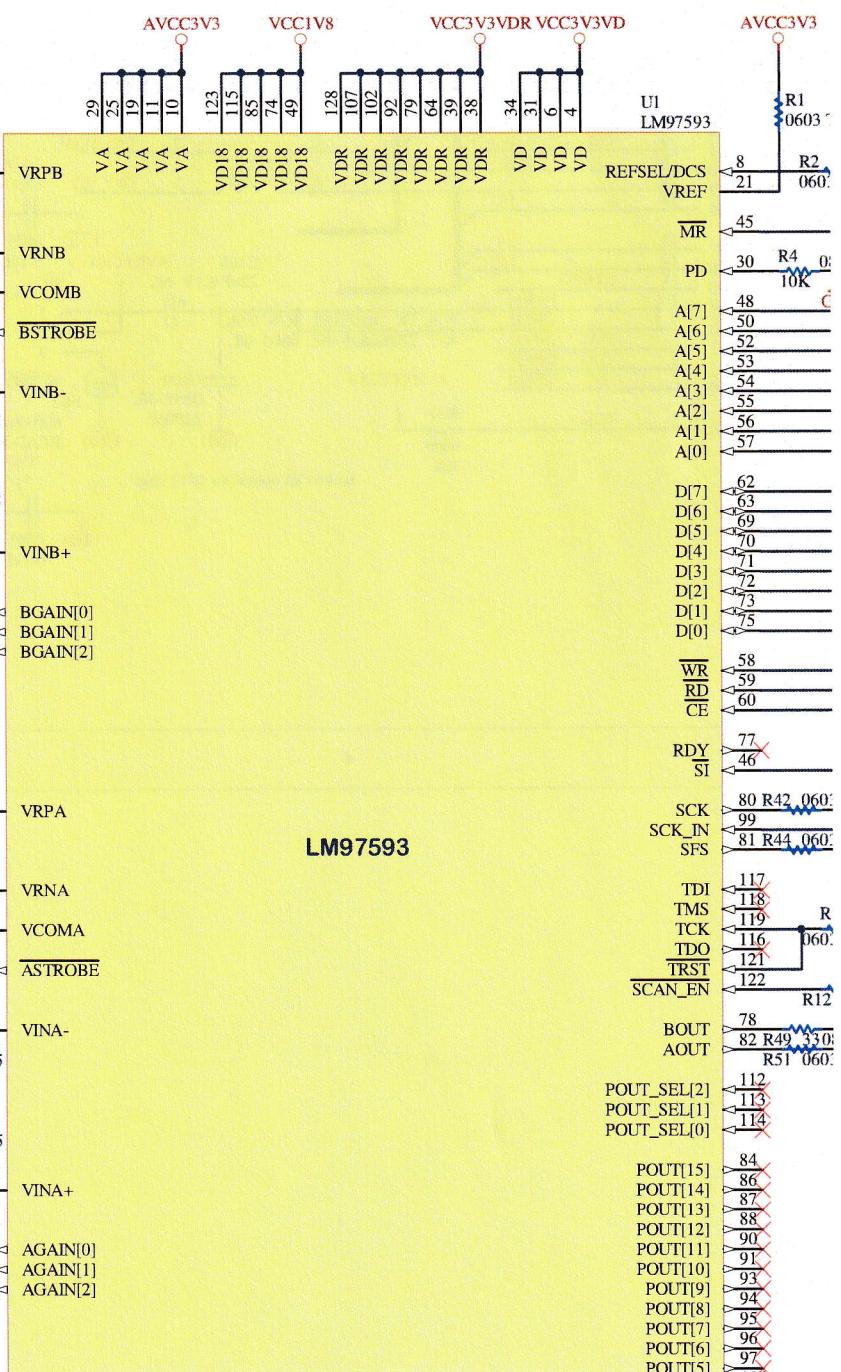
Inductors: Farnell 119-8443/8444 (pg.1276)

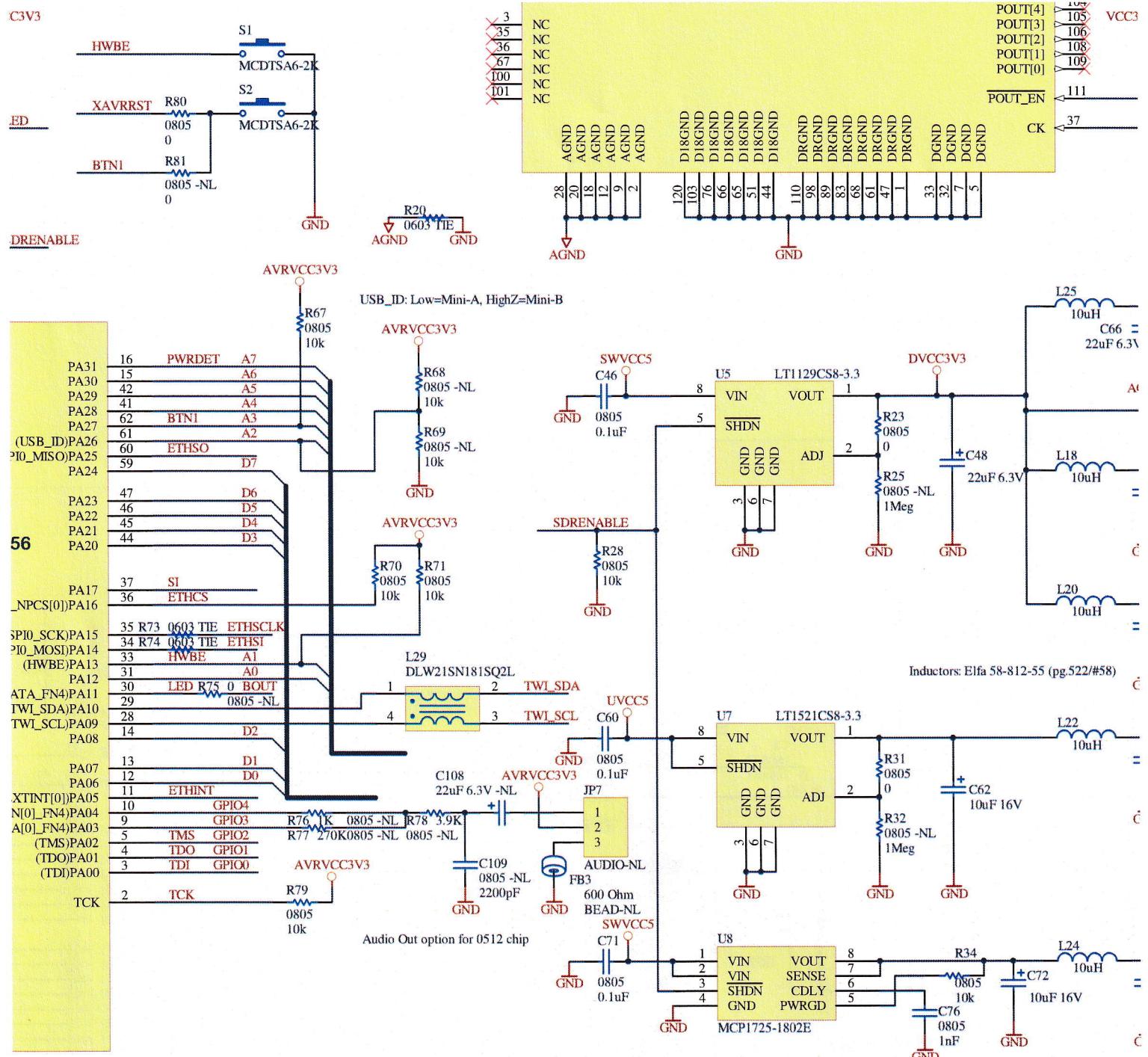
resulting 400.4 ohm



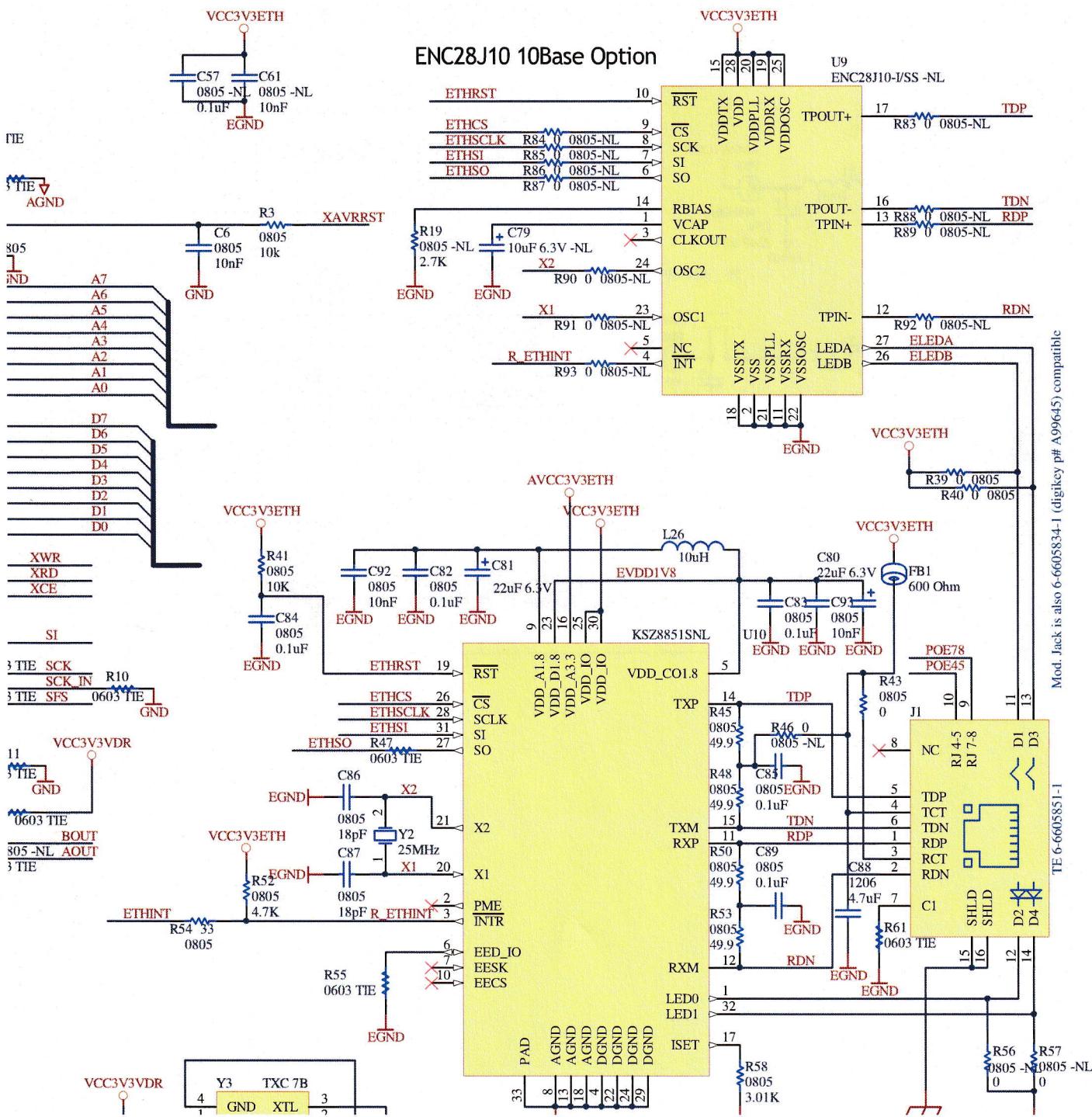
Do not place planes or traces under the filter components!

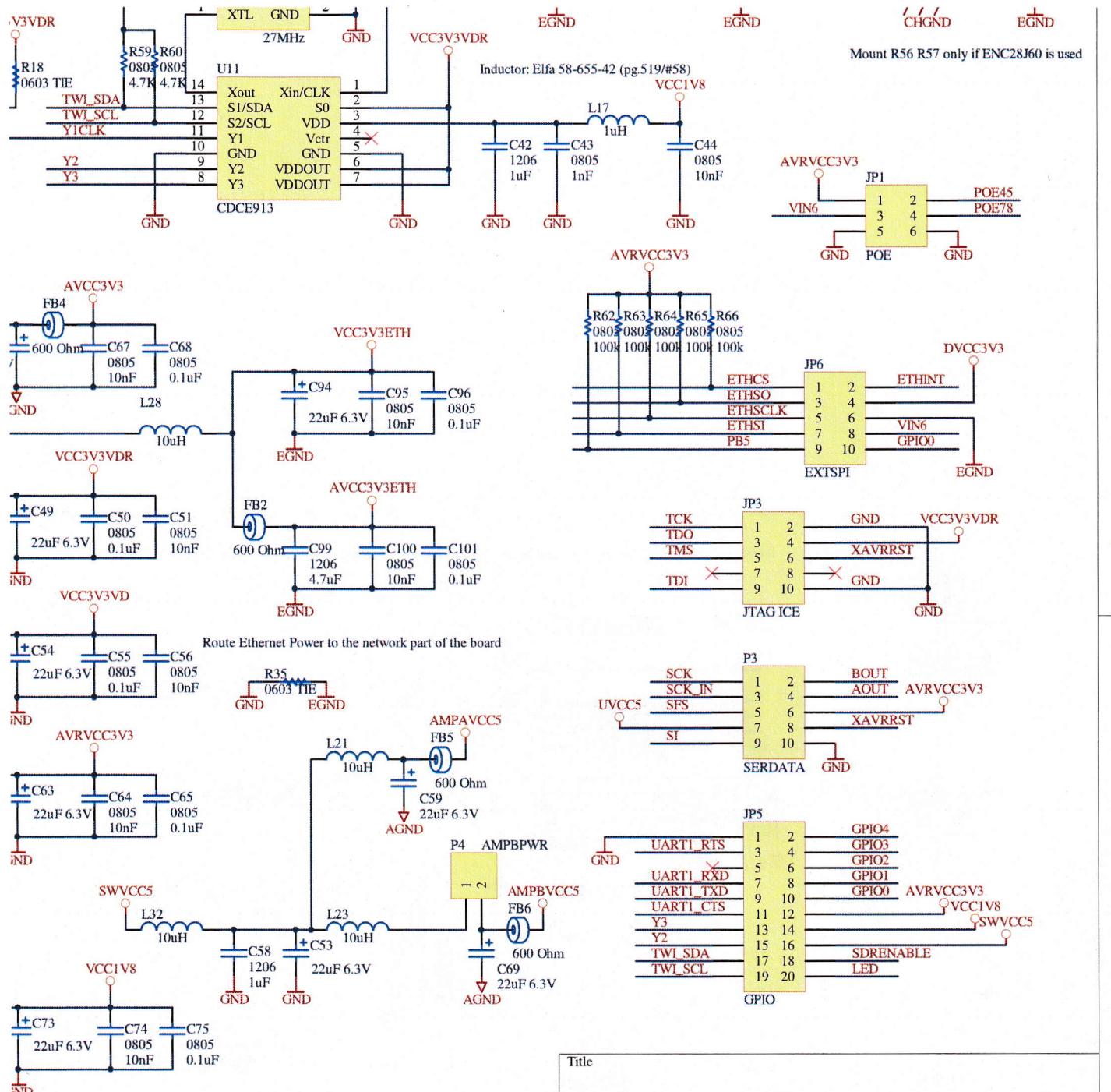
Inductors: Farnell 119-8443/8444 (pg. 1276)





0 Ohm resistors are to disconnect highspeed antenna traces to prevent noise when ENV28J10 part is not loaded





Title	
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