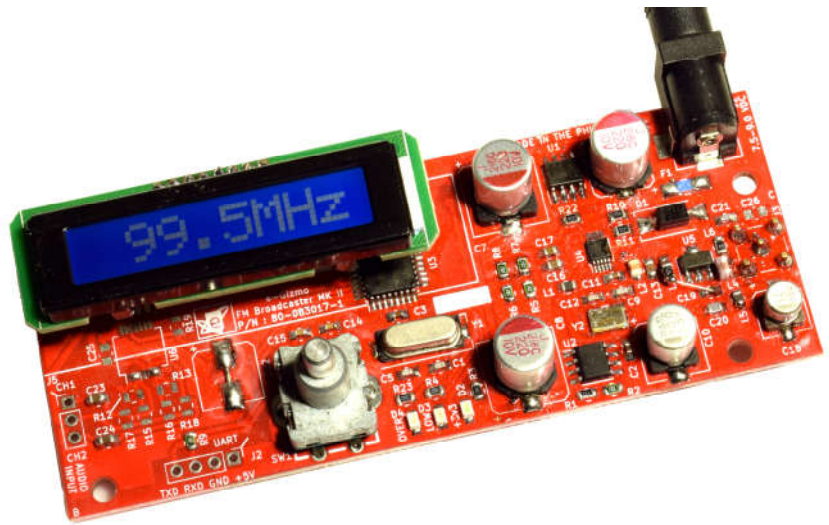# Personal FM Broadcaster MK II

Technical Manual rev 1R0

The Personal FM Broadcaster MK II PFM-II kit is a low power educational FM transmitter unit that can be used for instructional training and practice broadcast. This kit replaces the original FM Broadcaster kit and offers a number of improvements, like more RF output power, and the addition of Modulation indicator LEDS.

Use with a laptop running a sound mixing software and you can instantly become a radio DJ.

Use with a personal MP3 player and you instantly create a central wireless music source.

Communications engineering students will find this useful as a practice transmitter where they can perform hands-on RF transmission experiments.

Owing to its built-in digital control and PLL circuitry, this kit has crystal locked stable frequency source and a broadband RF amplifier .

Main Features

- 87.0-108.0 Mhz PLL Frequency Range, adjustable with 0.1MHz resolution.

  - Phase Lock Loop PLL circuitry locks the broadcast frequency to a stable crystal reference, ensuring drift free operation. Compatible with FM receivers with digital frequency control.

- >20dbm (40-120mW) RF output power

  - The PFM-II RF output power provides clear FM broadcast coverage within a fairly large home or establishment. With the use of external antenna, line of sight (unobstructed) coverage can reach a 500 meter radius.

- Hi Fidelity Stereo Broadcast
  - Broadcast in full stereo.

Other Features

- LCD Frequency Display
- Encoder type frequency control
- Under/Over modulation indicators

LCD Frequency Display

7 to 9V POWER SUPPLY

STEREO
AUDIO INPUT

CH2 GND CH1

FREQUENCY CONTROL
ROTATE TO CHANGE

OVER MODULATION
UNDER MOFULATION
POWER LED INDICATOR

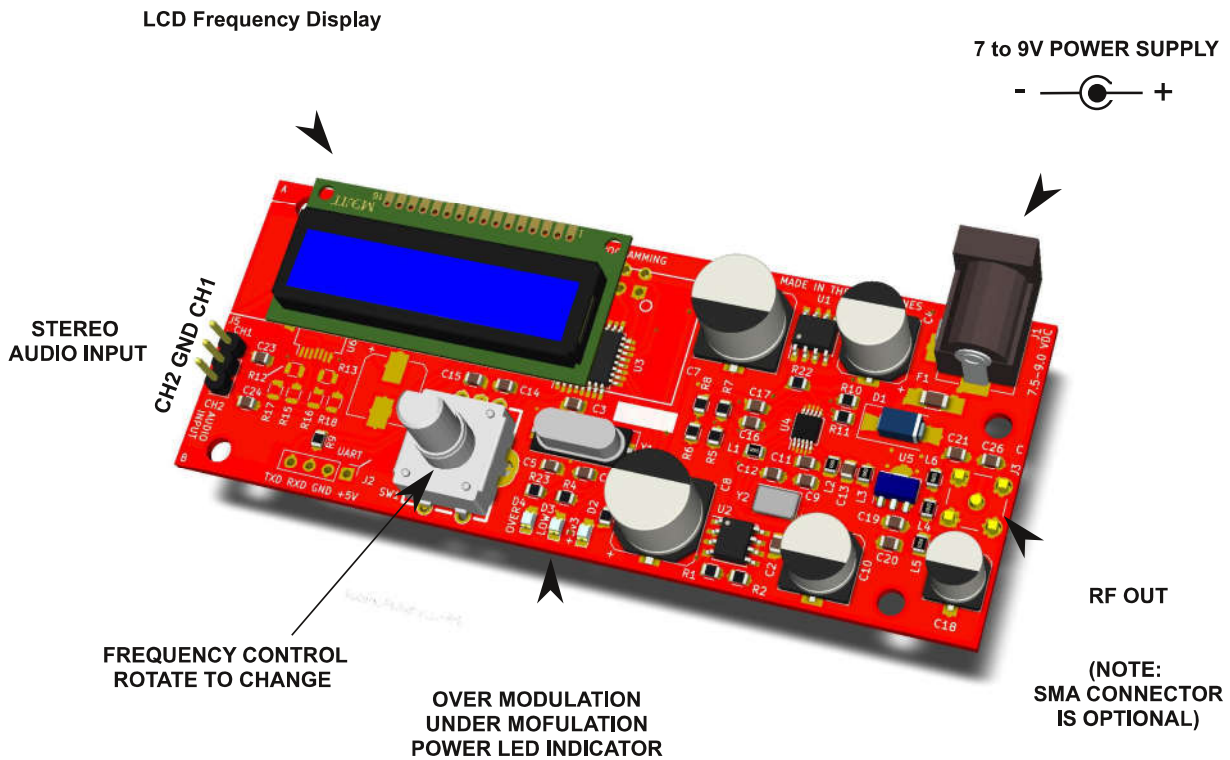RF OUT

(NOTE:
SMA CONNECTOR
IS OPTIONAL)

Figure 1. Layout of the Personal FM Broadcaster kit PFMB identifying relevant controls and indicators. A good 7 to 9V DC power source, rated at least 250mA, is required for its operation.

USING PFM-II

- To change frequency, rotate the frequency control (clockwise to increase frequency, counterclockwise to decrease frequency) until the desired frequency is displayed.

The latest frequency settings will be automatically saved a minute later. The PFM-II will default to the last saved frequency setting on power up.

Important:

For best results, tune the PFMB to a vacant FM Channel frequency. Not only will this ensure a clear and wide coverage, it will also prevent your PFM-II from interfering with FM commercial broadcast. See Table 1 for more details.
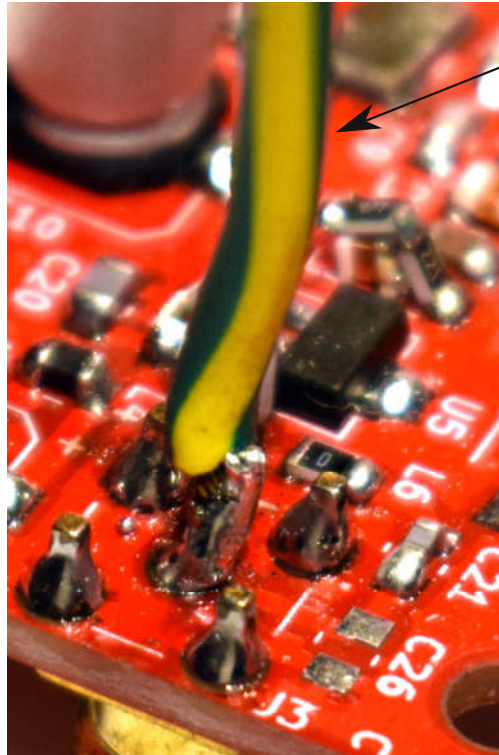
RF OUT
ANTENNA INPUT

(NOTE:
SMA CONNECTOR
IS OPTIONAL)

APPLICATION GUIDELINES

The PFM-II can be driven by various personal audio devices, such as iPod, MP3 players, tablets and smart phones, PCs and notebooks. Simply connect the earphone output of your player with the input terminal of the PFM-II using applicable cables.

At this point, some additional work is needed. The PFM-II input terminal is a 3-pin header type connector with the signal input assigned on the two outer pins, and signal ground on the center pin. If you are using an audio wire with phone plug termination on one end and no termination on the other end, you can directly solder the unterminated end on this terminal. Alternatively, you can connect your desired jack (i.e. RCA, phone jack, DIN jack, etc) on this terminal using a short lenght of wires.

76CM LONG INSULATED HOOK-UP WIRE ANTENNA

Figure 2. An ordinary AWG 18-20 hook-up wire cut to 76 cm can be used as an antenna. A SMA connector may be required if the user intends to connect the PFMB with an external aerial antenna.

1. Prepare a suitable FM receiver -preferably with digital tuning control- by setting its frequency identical to the broadcast frequency setting of your PFM-II. Set the receiver volume to a level low enough for a soft and comfortable listening.

2. With the your personal player now connected to you PFM-II, play a *fast beat dance* music and adjust the personal player's volume to about mid settings.

3. Switch ON the PFM-II, and wait until you hear its broadcast on your FM receiver prepared in step 1.

4. Adjust the music source/personal player volume until you see the "over" modulation red LED flickering on and off with the beat of the music. If the "over" LED does not flicker, your player's volume is too low and need to be adjusted up. If the "over" LED is ON most of the time, reduce the volume until it flickers with the music beat.

Important:

Changing the PFM-II frequency may require the readjustment on your player's volume as described in the steps above.

Table 1. List of FM Stations in Metro Manila

Frequency	Station
88.3	Jam 88.3
89.1	Wave 89.1
89.9	Magic 89.9
90.7	90.7 Love Radio
91.5	91.5 Big Radio
92.3	Radyo5 92.3 News
93.1	Monster Radio RX 93.1
93.9	93.9 i
94.7	Mellow 947
95.5	Pinas 95.5
96.3	96.3 Easy Rock
97.1	Barangay LS 97.1
97.9	97dot9 Home Radio
98.7	98.7 The Master's Touch
99.5	99.5 Play
100.3	RJ 100
101.1	101.1 Yes
101.9	MOR 101.9 For Life!
102.7	102.7 Star
103.5	103.5 K-Lite
104.3	104.3 Business Radio
105.1	105.1 Crossover
105.9	Radio High 105.9
106.7	106.7 Energy
107.5	107.5 Win Radio

Source: Wikipedia

Each broadcast channel are allocated a 400kHz (0.4MHz) bandwidth. The Metro Manila FM band, crowded as it may be, are separated each by 0.8MHz, or by 2 channels. There is a unoccupied channels in between each stations! Select a frequency that is unoccupied, displaced by at least 0.4MHz from a nearest occupied channel. If you live in places where the FM band is not as crowded, good for you. Pick a channel that is farthest away (in frequency) from an occupied channel.

Following is a list of unoccupied FM channels in Metro Manila. You should tune your PFM-II to any one of this channels. Frequency in MHz.

89.5	90.3	91.1	91.9	92.7
93.5	94.3	95.1	95.9	96.7
97.5	98.3	99.1	99.9	100.7
101.5	102.3	103.1	103.9	104.7

BE A DISC JOCKEY

Using a PC (or notebook) running a Mixing (DJ'ing) software opens your broadcasting experience with even more exciting possibilities. There is no shortage of sound mixing/FX software available in the internet at large that can be downloaded for free. For example, in one quick Google search, I found at least two promising free DJ'ing software, Softonic "Virtual DJ" home edition and. "Mixxx". Which one of the two is better, I have no idea. I tried neither of them for a very simple reason- it's not my thing. But hey, as I mentioned, they are free. So why not download them both, in fact download all the free mixing/DJ'ing software you can find, and try each one for yourself to find your perfect fit.

REMINDER

Figure 3. VirtualDJ is just one of the free mixing software you can download from the internet. Surf the internet for more to find the best one for you.

This kit is intended for educational use only and cannot be used for any activities that may be construed as illegal. Remember, your friends and neighbours can pick up your broadcast. So be responsible. Do not broadcast obscene program materials, no foul language; in fact, do not broadcast anything that may offend anyone.

Local laws requires you to stop using the kit if it causes harmful interference to any commercial FM broadcast or any other radio services.
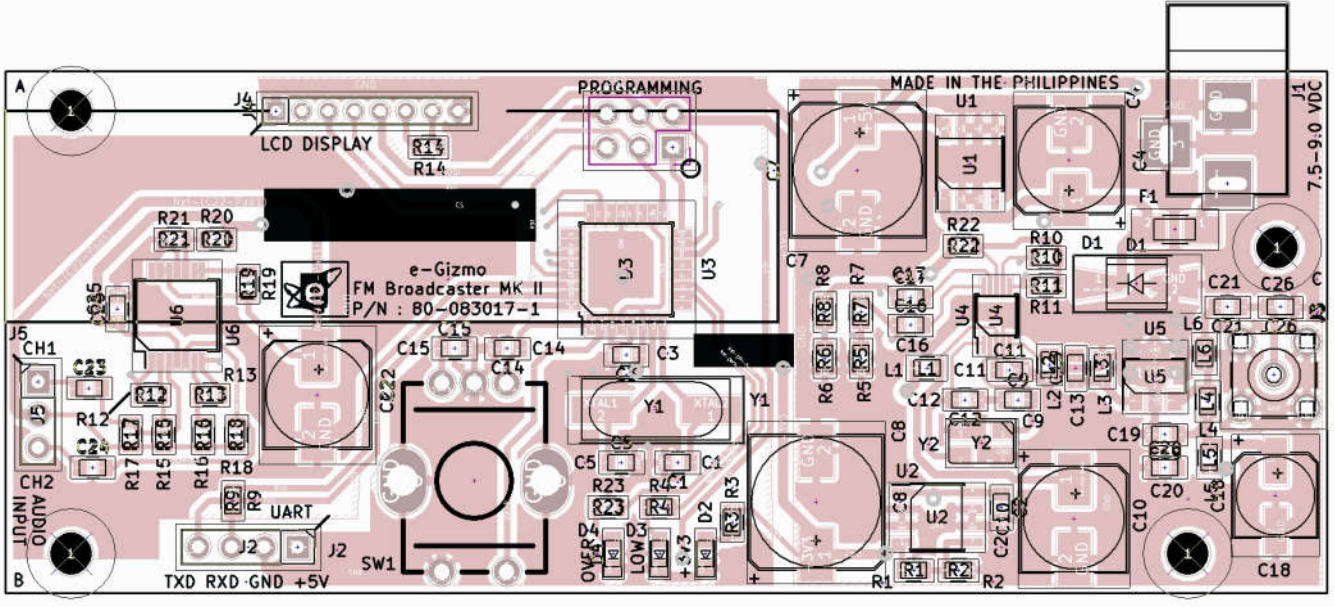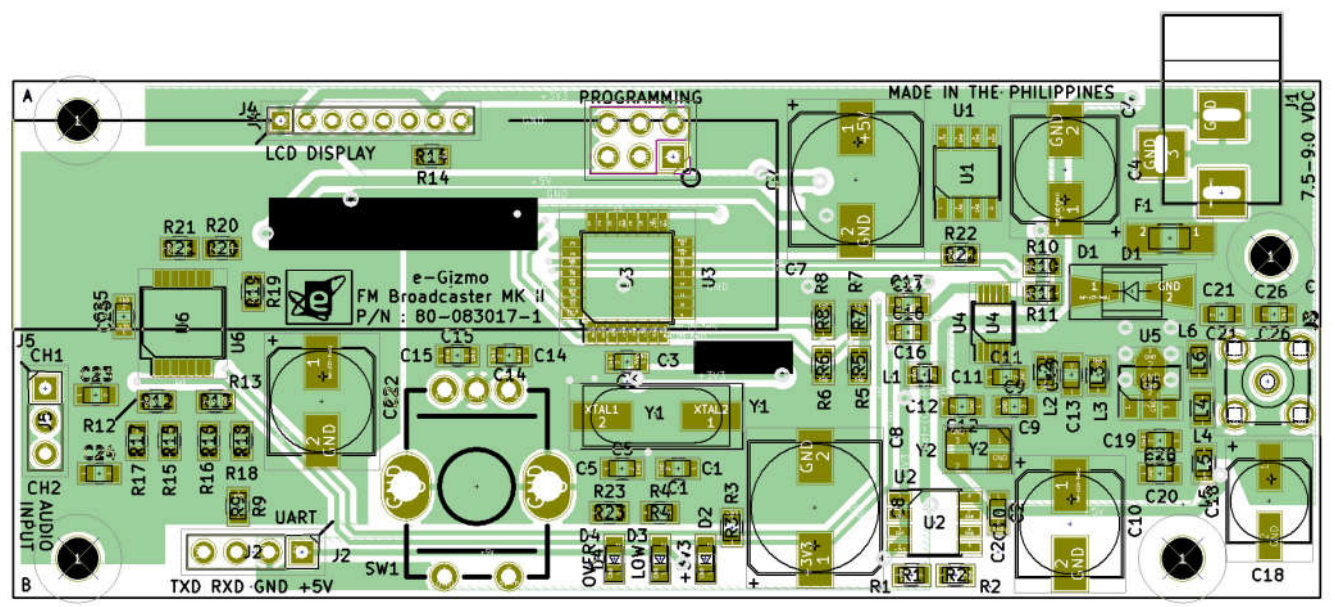
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Figure 4. PCB Top Layer guide.
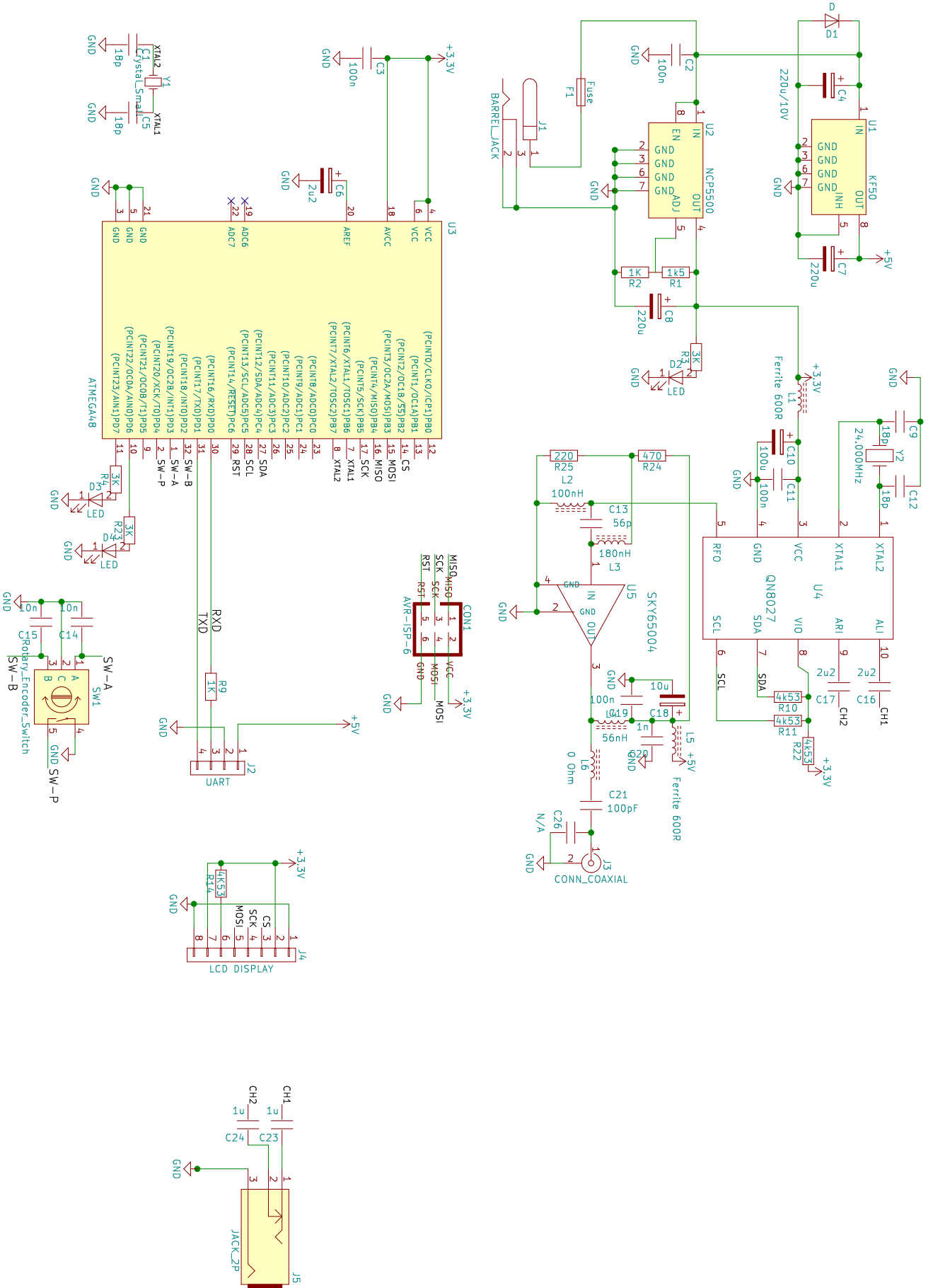

Figure 5. PCB Bottom Layer guide.

Figure 6. Personal FM Broadcaster Mk II schematic diagram.