



Fox Delta

Amateur Radio Projects & Kits

FD- AAZ-0612

Tech Info Doc: HF 30MHZ PIC18F4550/4553 USB Antenna Analyzer

This project is developed for Amateur Radio Community by:

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[Dinesh Gajjar / VU2FD](#)

[Frank Dzuirda / K7SFN](#)

Completed HF 30MHZ Antenna Analyzer in a metal case:



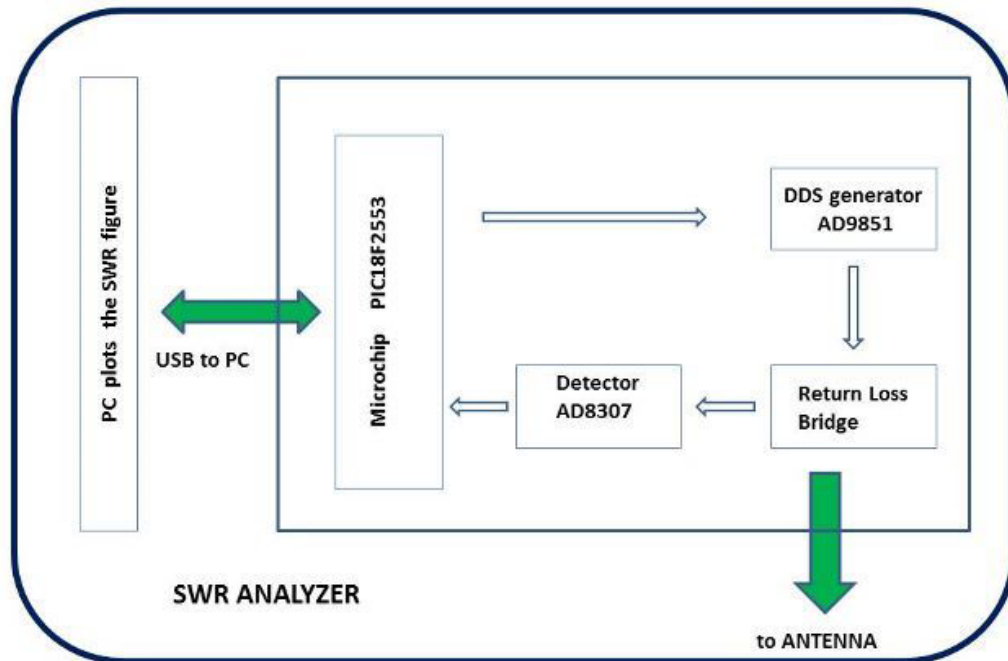
Front View:



Project Introduction:

Fox Delta "SWR Analyzer" AAZ-0612 is a smart, cheap and easy to assemble "Antenna Analyzer".

The project is focused to measure the antenna performances across the HF Ham radio bands without having a requirement to connect a transmitter to the antenna. Here is a basic block of the project:



Antenna Analyzer consists of following main components:

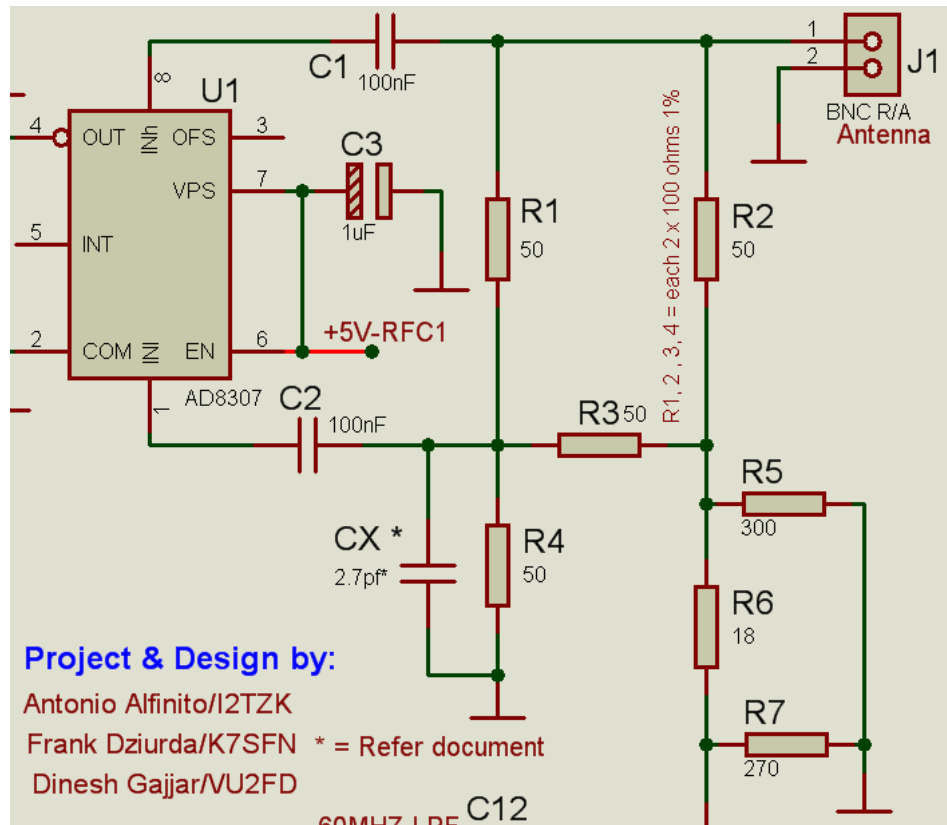
- Microchip PIC18F2553 or 2550
- DDS generator AD9851
- Return Loss Bridge
- Detector AD8307

The Microcontroller PIC18F2553 or 2550 interfaces the PC receiving commands to drive a RF Generator (DDS) and sending back the voltage values read from the Return Loss Bridge.

The Analog Devices AD9851 is a [Direct Digital Synthesizer](#) (DDS) device which can generate a sinusoidal wave output up to 180MHz.

The Micro-controller drives the DDS to generate the RF signal Swept in the HF frequency range from 1MHz to 35MHz, that feeds one end of the Return Loss Bridge.

The return loss bridge is the wideband resistive bridge network used to verify the impedance at the antenna connector. It works by comparing the "unknown" antenna impedance to a purely resistive 50 ohms, the Output DC voltage corresponds to the level of impedance mismatch between the 50 ohms and the antenna impedance.



Generally, the higher the DC voltage output, the worst the impedance mismatch is.

The following stage (AD8307 configured as detector/differential comparator) amplifies the RLB output converting the signal level to a decibel form and delivering it to the Micro-controller.

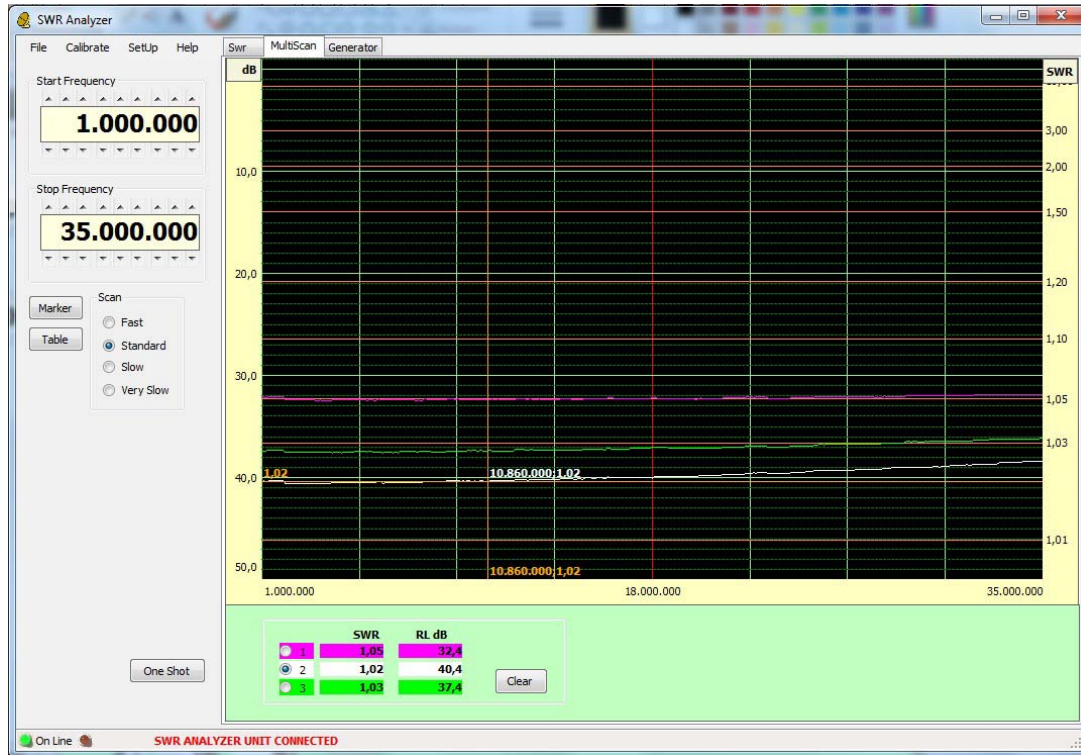
The Analog to Digital Converter (ADC) embedded into the Micro-controller provides to generates the digital measure of the impedance, the measure is sent back to the PC.

Finally the PC program calculates the dBm values, translates the measure in a SWR figure and plots the mismatch diagram of the antenna.

The PC program, Windows based, allow us to explore a single HF Band or the full range from 1 to 30MHz and plot the resonance figure.

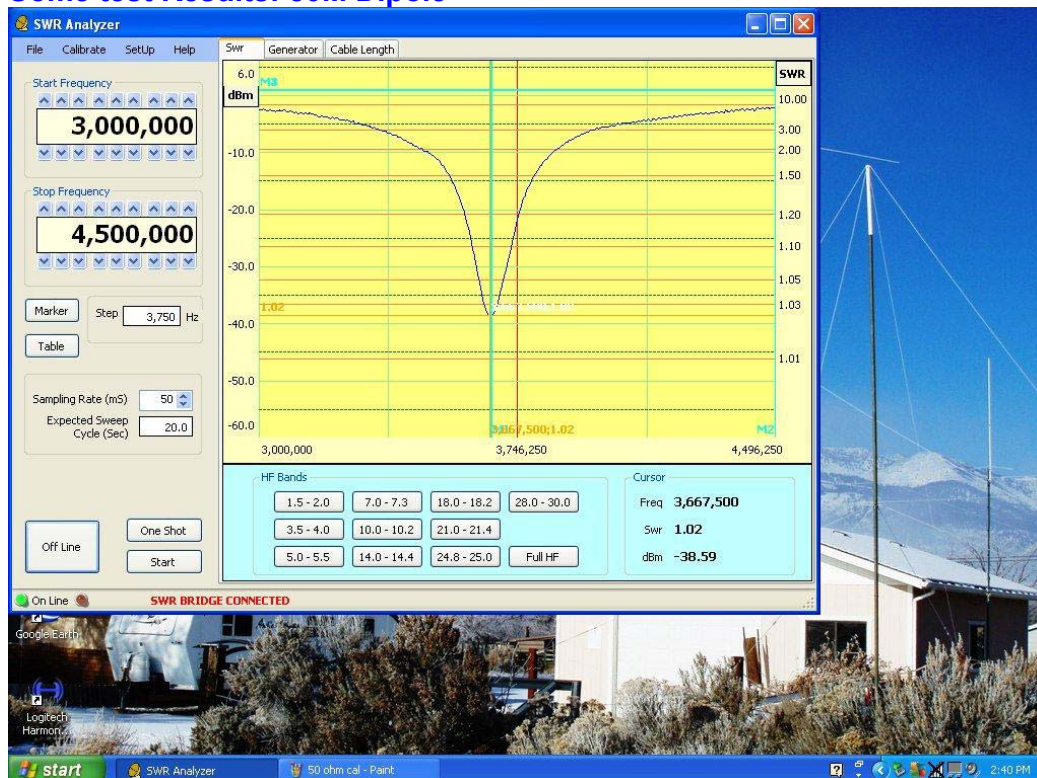
In view to make kits easy to build by Radio Amateurs, it was decided to make final PCB with a carrier board for AD9851 and a DIP package for AD8307.

Effect of optional capacitor CX:

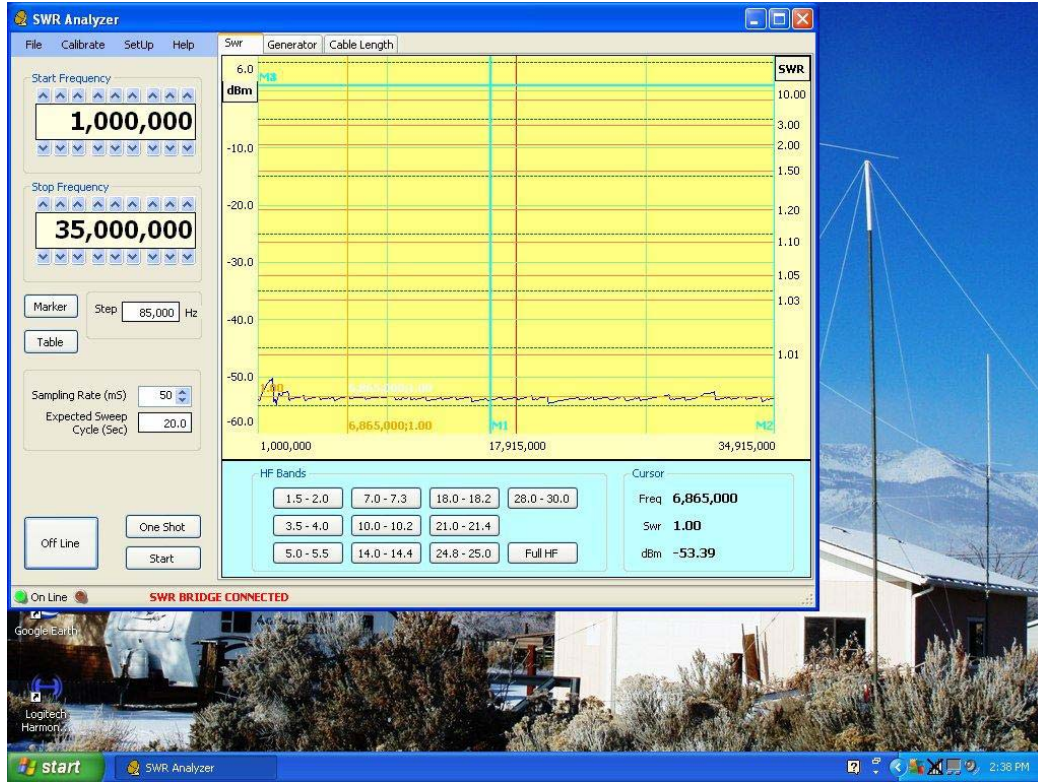


Value of CX is expected to be 2.7pf but some experimentation is required to achieve best value for optimal performance.

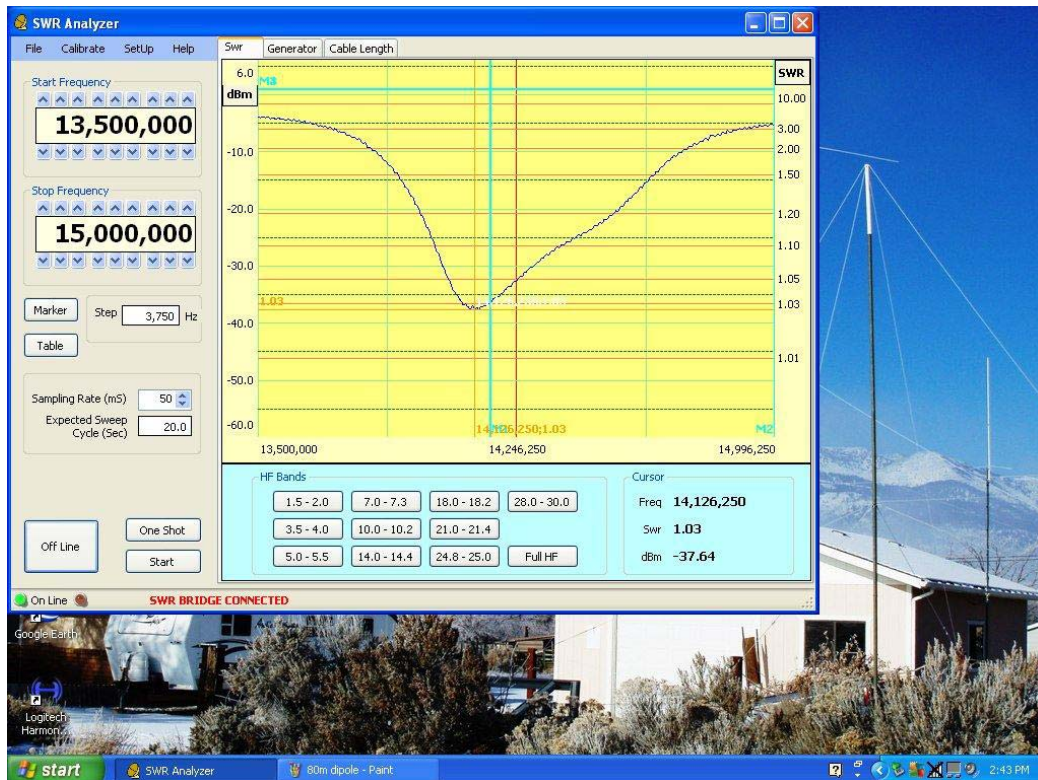
Some test Results: 80M Dipole



50 Ohms Calibration:



20Mtr Stripper Antenna:



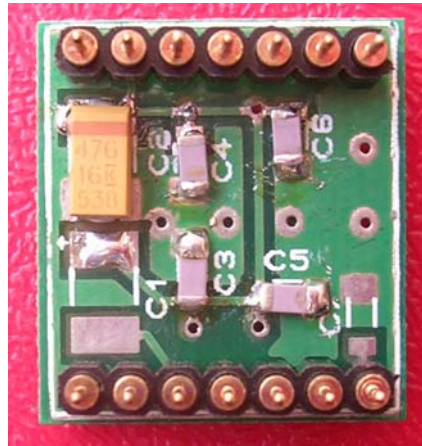
DDS Assembly:

AD9851 is used in this project for signal generation. This chip comes in a 28 pin SSOP package and requires high level of skill to handle/Solder.

As most kit builders may not be familiar with soldering this chip direct to PCB, we decided to make a carrier board. Carrier board with associated parts and header pins is supplied with kits.

All you need to do is bring this carrier board and AD9851 to a workshop offering soldering facility (or use your own hot air gun or a microwave oven!!) to solder.

At this writing, we are making all attempts to supply carrier with pre-soldered AD9851 so that kit assembly becomes easy and painless.



Carrier board is a part of KIT and includes:

1. Set of 0.1IN Male/Female headers,
2. 4 SMT 0.1uf 1206 capacitors and
3. One 47uF/5V Tantalum capacitors are part of DDS Assembly.

PIC18F2550 or 2553:

Tony / I2TZK has made suitable PC software for this project. PC Software supports either 2550 or 2553 chips.

AAZ-0612 kits are supplied with 2550 but there may be an option to get kits with 2553 chips. 2553 has better A/D and may produce better results. You may also update you kit at any later date by simply changing from 2550 to 2553. However, you may require a PIC programmer for the same.

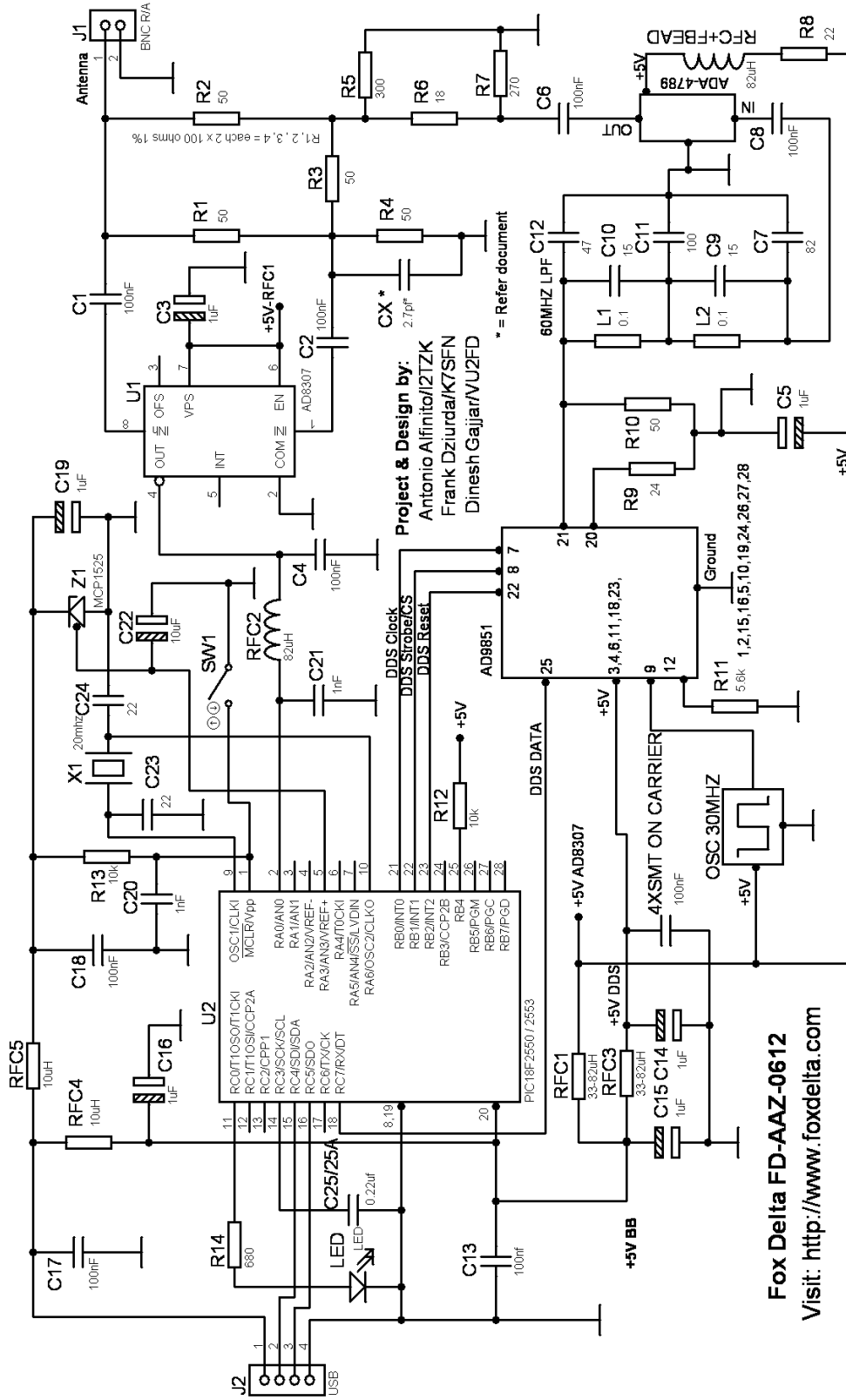
Future updates do not require PIC programmer as it may be done using a PC Program. A bootloader is already in firmware. Refer to "Update" instructions by Tony / I2TZK

AAZ-0612 KIT Parts List:

Quantity	Part ID	Part Details
1	U2*	PIC18F2550 Pre-Programmed
1	SSOP28***	Adapter PCB for AD9851
X	U1#	AD8307 (Not part of this kit)
1	OSC	30MHZ Oscillator (FULL)
1	X1	20MHZ Crystal HC49
1	SW1	Push Switch R/A
1	LED	3mm LED
1	Q1**	ADA-4789
1	IC Socket	8PIN DIP
1	IC Socket	28PIN DIP
1	PCB	FD-AAZ-0612 DSPTH PCB
1	Z1	MCP1525-2.5V
3	RFC4, 5	10uH
2	RFC1, 2, 3	33-82uH
2	L1, 2	0.1uH RFC
1	RFC+Bead	82uH RFC+ Ferrite Bead
1	J2	USB Socket R/A PCB
1	J1	BNC R/A PCB
1	LED	3MM
1	Case	Free Powder Coated Metal Case
All Resistors ¼ W 5%		
1	R5	300 Ohms
1	R6	18 Ohms
1	R7	270 Ohms
8	R1/A, R2/A, R3/A, R4/A	100 Ohms
1	R8	22 Ohms
1	R9	24 Ohms
1	R10	50 Ohms
2	R12, 13	10K
1	R14	680 Ohms
Capacitors		
2	C25/25A	0.22uf Poly
2	CC21, 20	.001uf Poly
8	C1, 2, 4, 6, 8, 13, 17, 18	.1uf Poly
6	C3, 5, 14,15, 16, 19	1uf Tantalum
2	C24, 23	22pf Ceramic
1	C22	10uF Tantalum
1	C7,	82pf Ceramic
2	C10, 9	15pf Ceramic
1	C12	47pf Ceramic
1	C11	100pf Ceramic

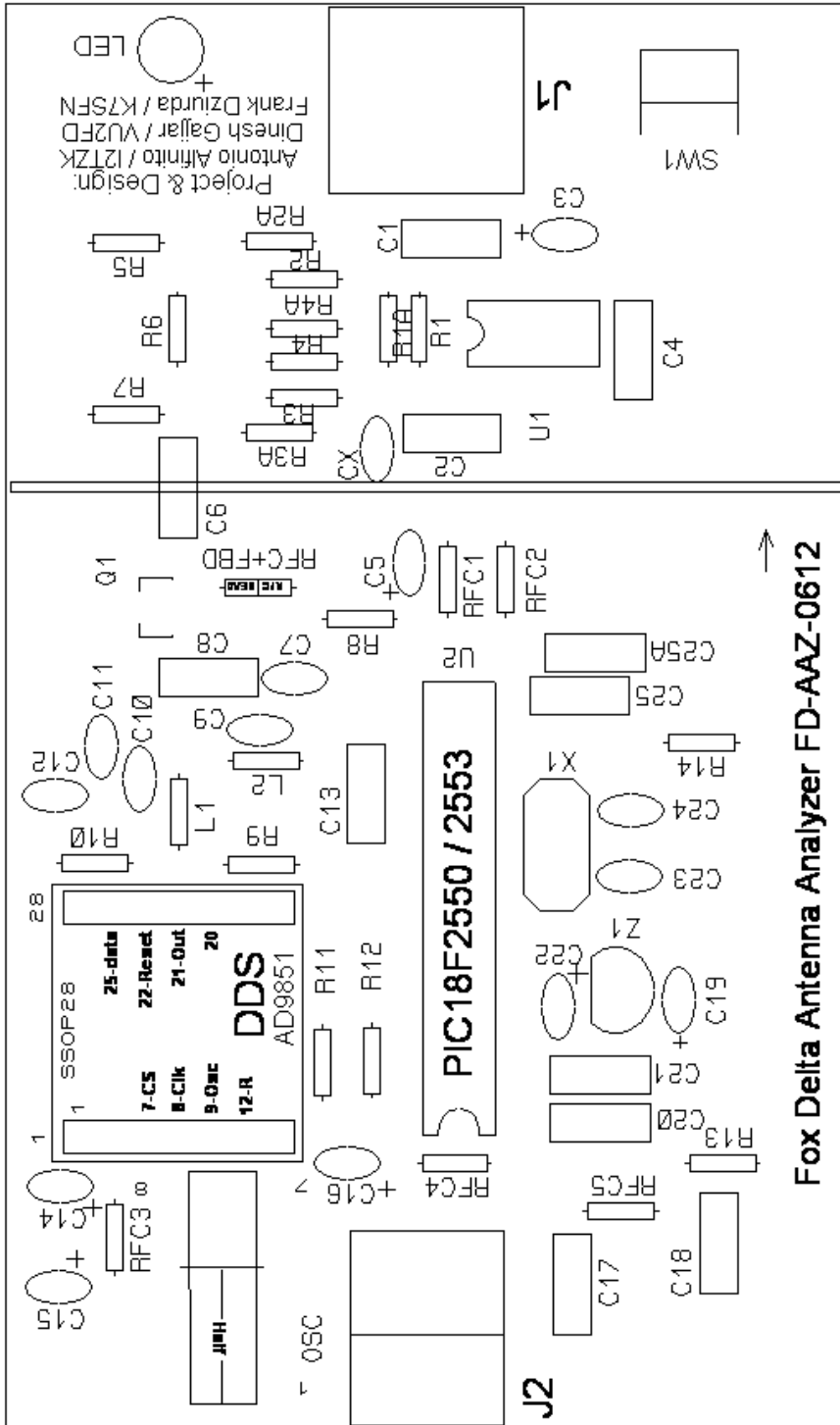
- * = PIC18F2550 is standard. PIC18F2553 may be available.
- ** = Q1 is pre-soldered on PCB.
- *** = SSOP Adapter PCB and components are standard. AD9851 is not part of this kit
- # = AD8307 is not supplied with kits or assembled. DIP8 package is used

AAZ-0612 Schematic:



Fox Delta FD-AAZ-0612
 Visit: <http://www.foxdelta.com>

AAZ-0612 COMPONENT SIDE SILK:



73s

Dinesh Gajjar
28th June 2012

For more details, please visit Project Page: <http://www.foxdelta.com>