Fox Delta

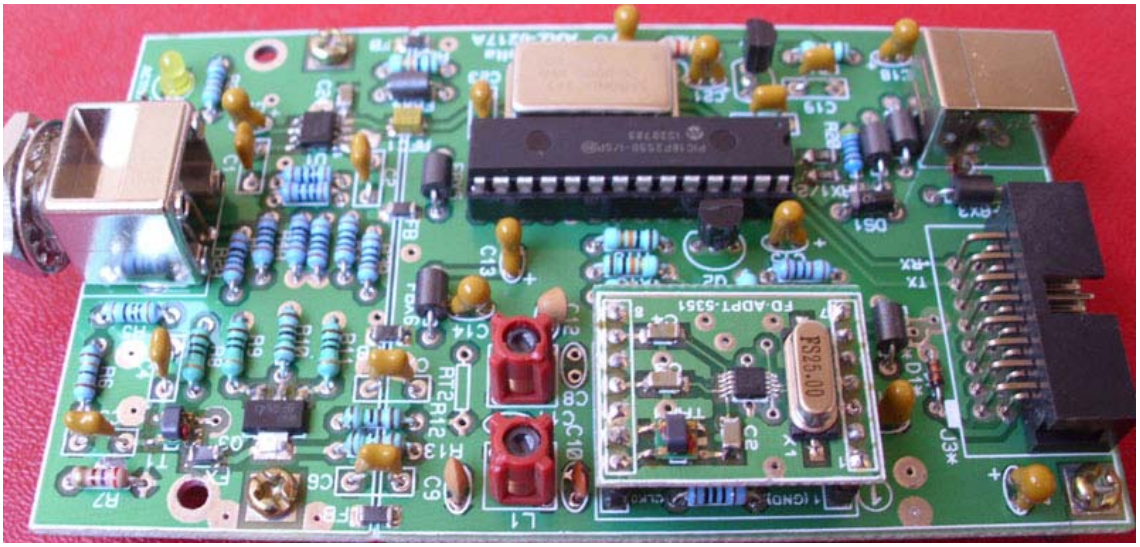
Amateur Radio Projects & Kits

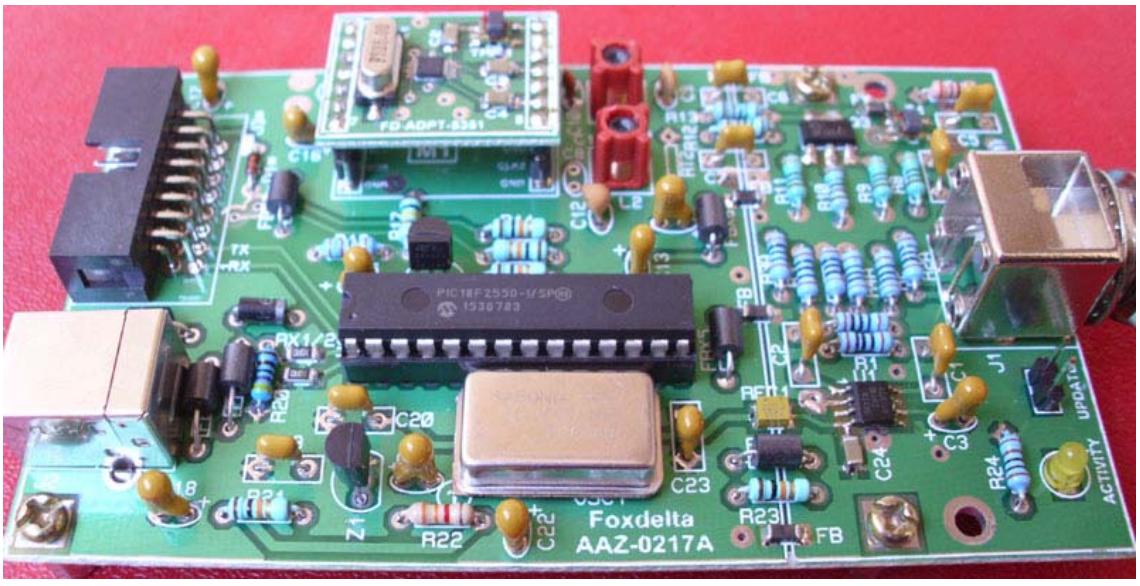
FD- AAZ-0217A

Project Tech Info Doc: 3 - 60MHZ HF PIC18F2550 USB Antenna Analyzer

AAZ- 0217A KIT:

3 - 60MHZ USB Antenna Analyzer



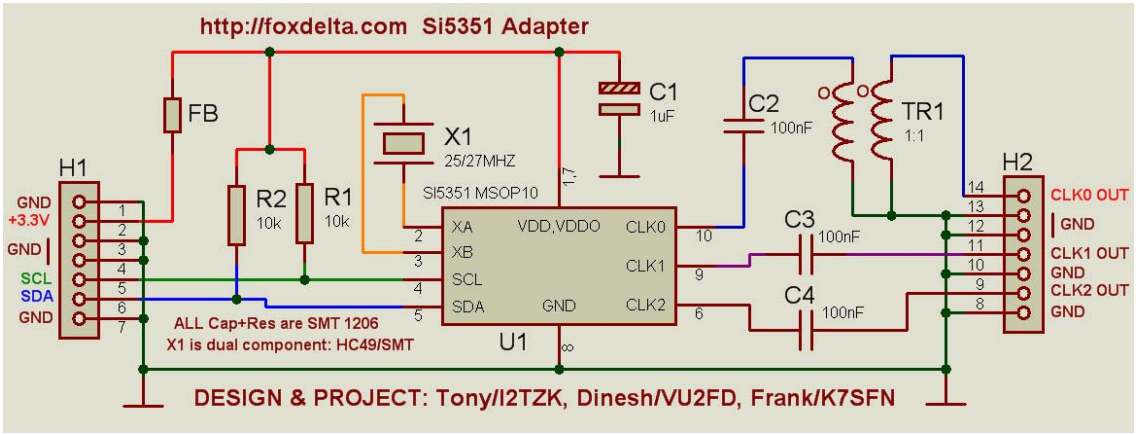


Si5351 Assembly: M1

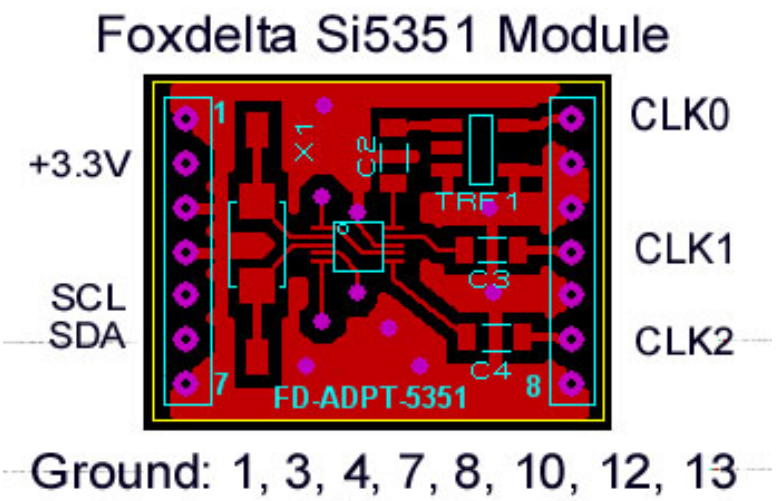
Kits are supplied with Si5351 chip Pre-soldered on a carrier board (M1) for easy assembly.

This plug-in module is supplied assembled and tested for HF range (3 to 60MHZ).

Schematic Module M1:



PINOUT details of M1:



AAZ-0217A: Project Info:

Revision of our USB analyzer project (From AAZ-0616) became a necessity, as we wanted to replace DDS chips, which became difficult to obtain and getting more and more expensive.

Alternative to DDS chips selected (AD9850/51) is an economical Silicon Lab chip called Si5351.

Si5351 is a tiny 10 pin MSOP chip rated to output 3 clock signals from 1 to 160MHZ (and beyond). Since soldering of DDS chips was always a painful job but unavoidable, we decided to go for Si5351, which has only 10pins to solder. After discussing this with Tony/I2TZK who showed great interest in this project, we decided to go ahead with hardware, FW and SW using this chips.

As Si5351 is a good alternative, there are differences from DDS chips:

1. **Si5351 outputs square waves (DDS is sine wave)**
2. **Required re-writing of code as its an I2C device**
3. **A plug-in module must be made for easy kit building.**
4. **Works on 3.3V and requires data line level shifting to match PIC running at 5V**

In addition to basic change of Generator chip, some of the changes are implemented in our first attempt: using Si5351 chip!

1. **HC05 Module fits on an FRC16 Socket Firmware will auto activate BT function when this add-on module in plugged into FRC16 socket**

2. **Dual, auto power select option: PC use or Portable use. AAZ-0217A may be used as an USB device by connecting USB cable to PC. It may also power Bluetooth module (option)**

3. **AAZ-0217A may be powered from external 5V (for field operation) by giving +5V at FRC16 socket. (Future add-on)**

4. **FRC16 socket has RX/TX, I2C and External +5V IN. This will facilitate future expansion of this analyzer to be used with any device that requires RX/TX or I2C data lines.**

5. **Although specified as a 3 to 60MHZ analyzer, AAZ-0217A may cover practically entire HF and major part of VHF range from 1 to 200MHZ. Upper useful range of AAZ-0217A is restricted only by onboard LPF.**

6. **Due to strong harmonics at very low frequency, we have specified AAZ-0217A's lowest freq as 3MHZ, suitable for reasonable analyses.**

7. **Firmware and Software for AAZ-0217A is developed by Tony/I2TZK.**

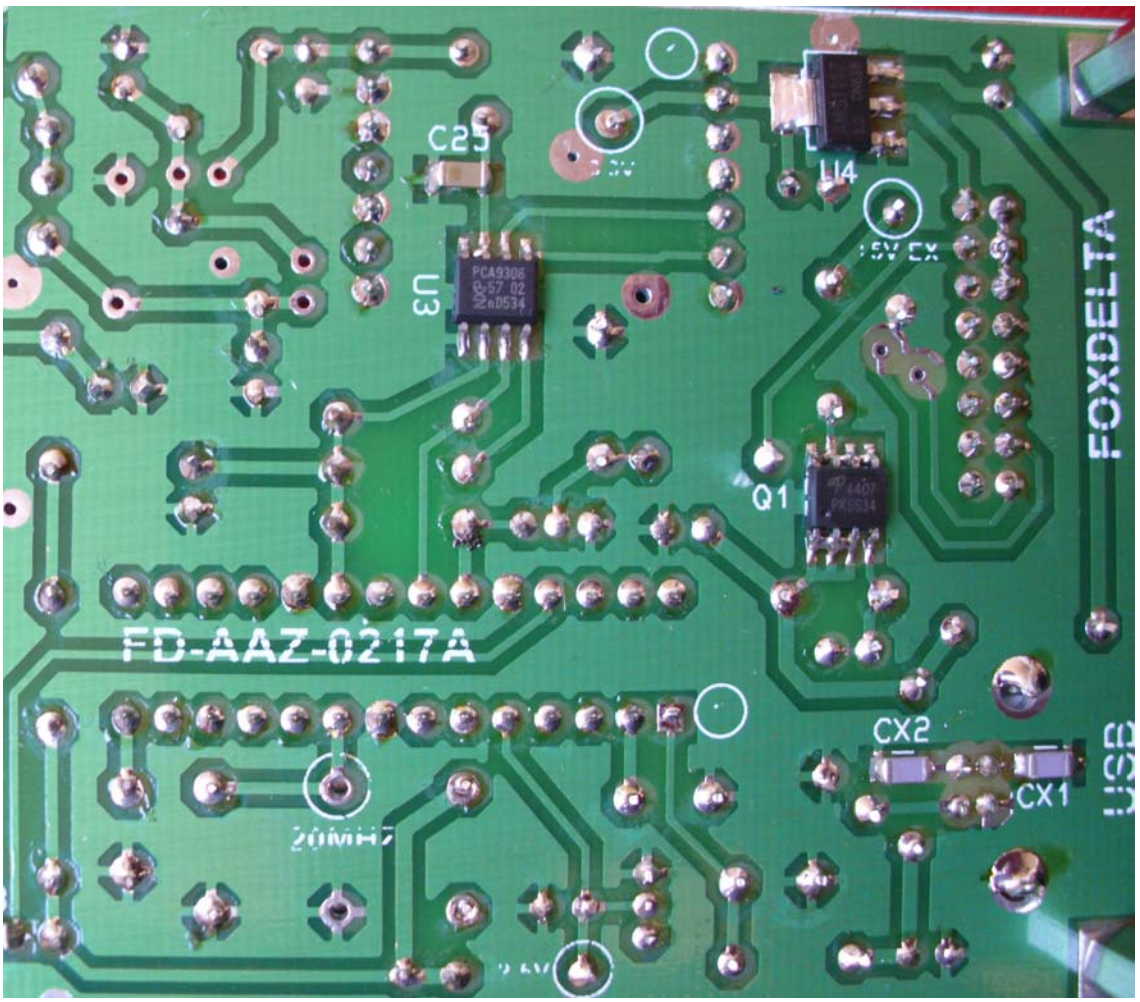
8. **A PC SW works well with WIN7/XP/10. Latest dotnet update is essential for your PC's WIN OS.**

Hardware Information:

AAZ-0217A is a simple single board USB Antenna Analyzer using Si5351 signal generator chip and a return loss bridge, for measurement by a Log Amplifier AD8307.

Si5351 module data communication:

With PIC running on 5V, a level shifting is required. PCA9306 (U3) is used for this purpose.



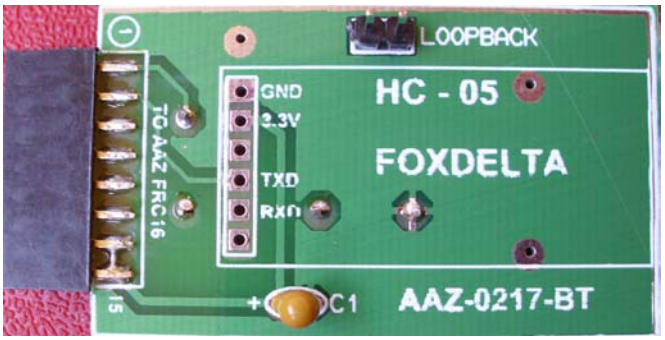
3.3V Supply U4:

AMS1117- 3.3 is used to obtain 3.3V from 5V from USB.

Dual Power: AO4405/07

PFET type AO4405/07 is used as a switch to select 5V from USB or 5V from External source at FRC16. External +5V will be needed to run AAZ-0217A when WIFI Module is added to FRC16. (Future update)

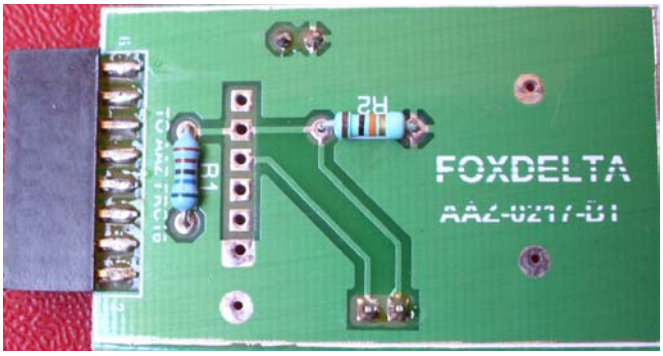
BT Function is realized by using an HC05 module on a FRC Male connector, available as an Option.



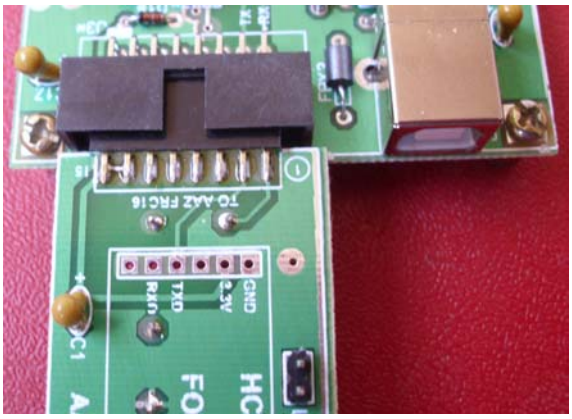
TOP SIDE

Auto power change and BT activation is implemented in BT adapter. No external power is required for BT add-on as it continues to get power from USB port.

Since BT module HC05 (not part of this kit) is a 3.3V device, two resistors are used to match data line level shift for PIC running at 5V



BOTTOM SIDE



BT module plugged into FRC16 Socket:

Do not install upside down!!

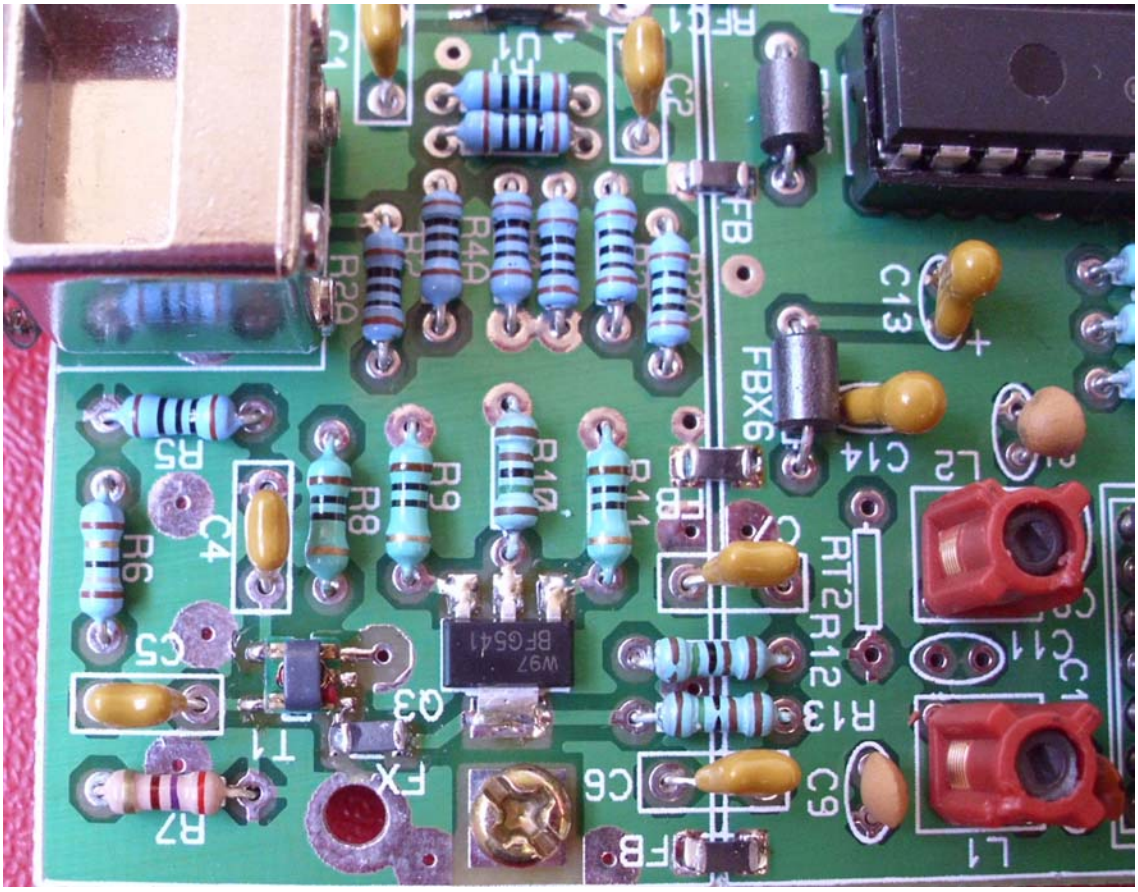
BT add-on PCB with Male FRC16 Connector may be offered free with AAZ-0217A kits. HC05 module is to be purchased by user.

Please note that since there are many versions of android OS and hardware specific setups, no help will be available for phone/tab BT operation. This is an option that user may explore on own.

Q1 and T1:

Although, kits are supplied with all SMT parts pre-soldered, kit builders must keep sharp watch on T1, which is a 1:1 Transformer pre-soldered on main board.

Make sure that you do not damage this tiny transformer while soldering other components.



Tunable Inductors: L1/L2

Two Inductors are used in Low Pass Filter and supplied with cores at mid way. Provides good attenuation of harmonics above 60MHZ.

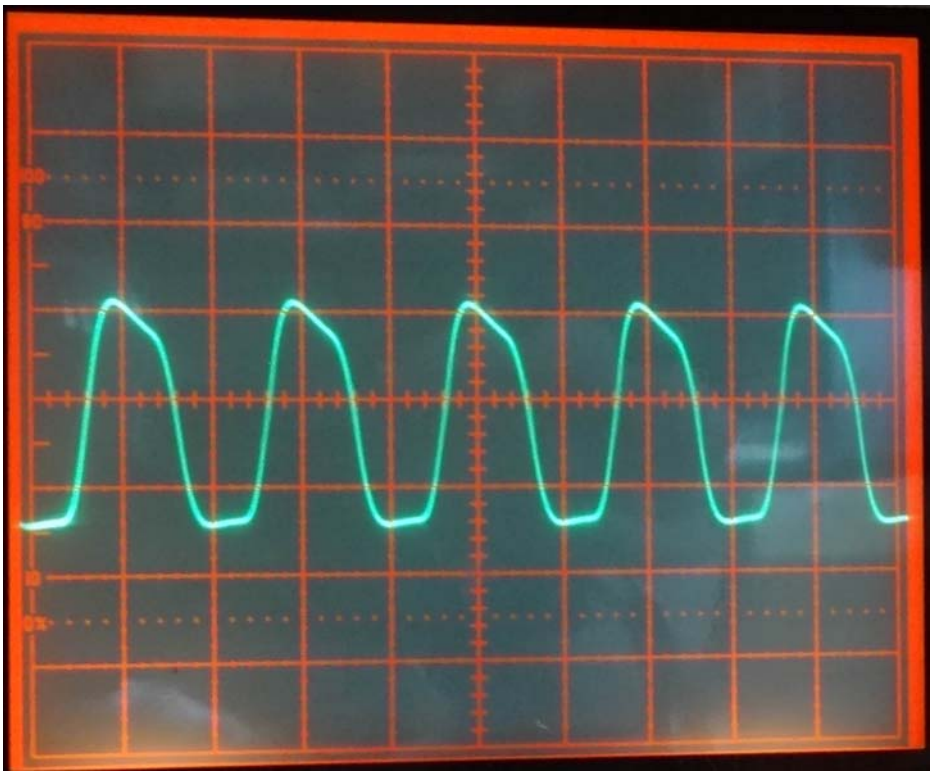
If you desire to use upper most range of Generator (To 160MHZ), This LPF components must be modified. That is: L1, L2, C9, C10 and C12

RT2, C8, C11:
These parts are not used.

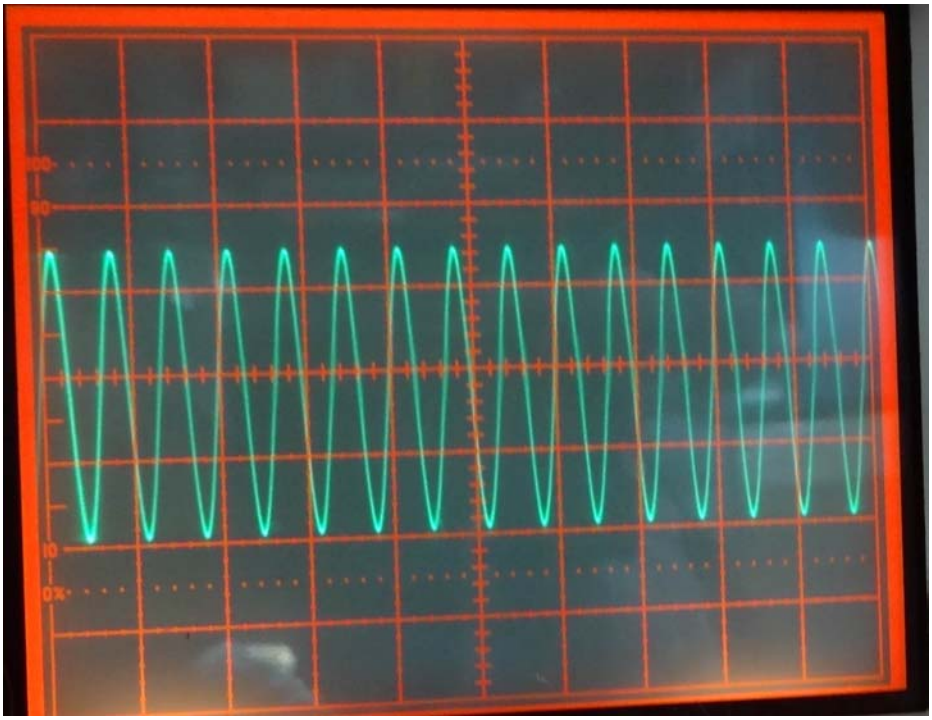
CX3: (Under BNC Socket)
User may improve performance of the analyses by adding a small capacitor at CX3. Typical value may be between 3.3pf to 4.7pf.

Si5351 RF OUTPUT at BNC:

10MHZ:



30MHZ:

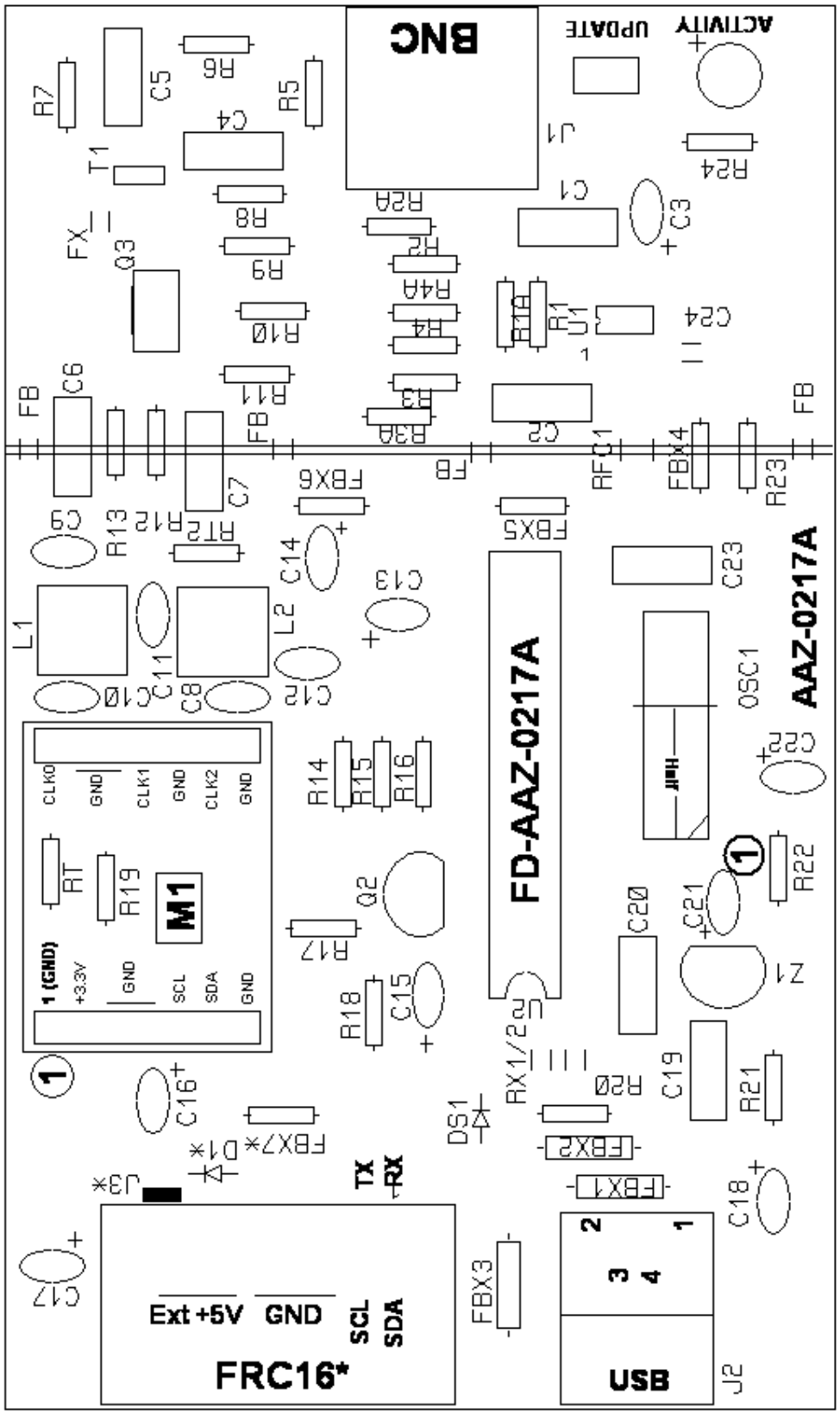


AAZ – 0217A KIT Parts List:

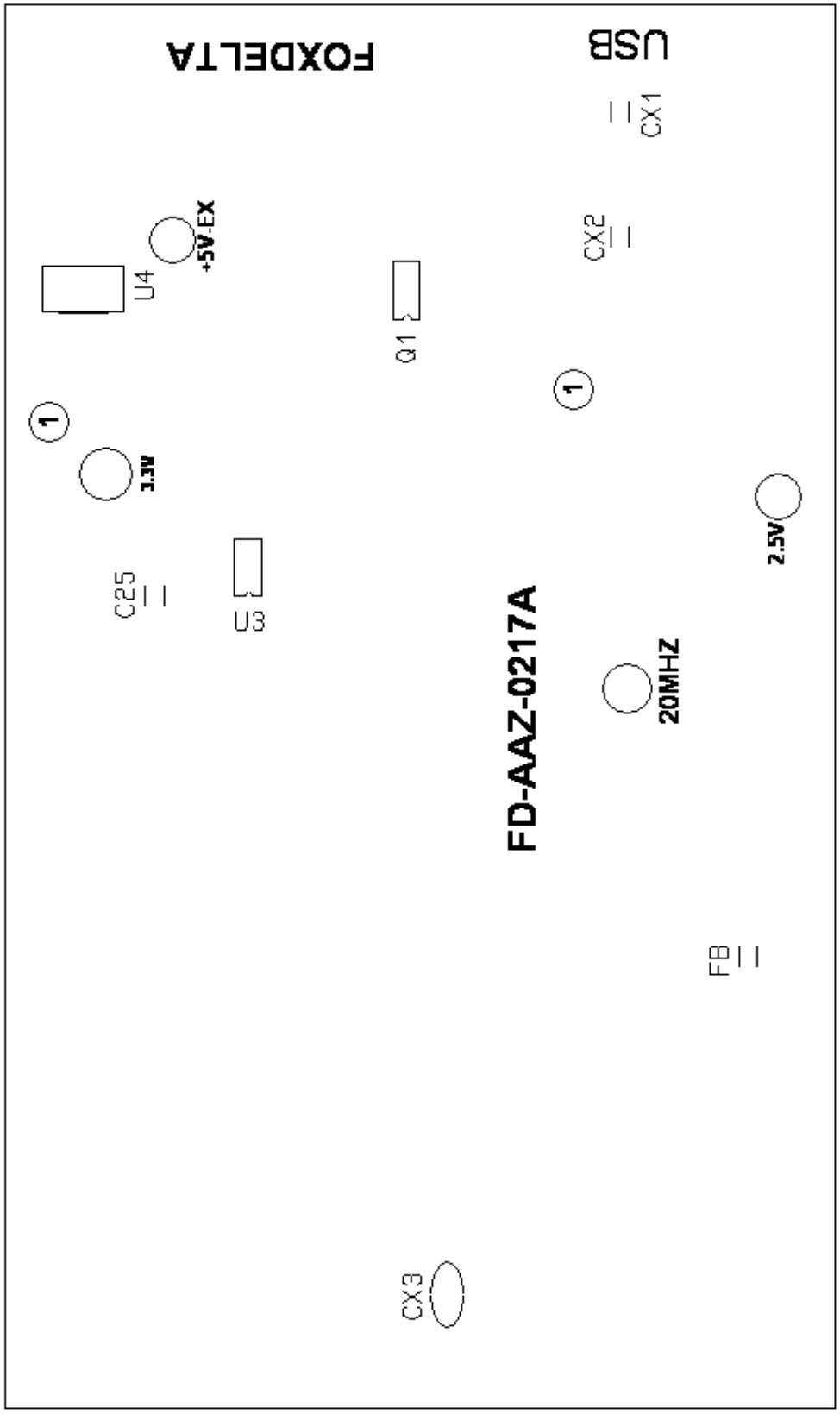
Quantity	Part ID	Part Details
1	U2	PIC18F2550 FW V1.02
1	M1	Si5351: Assembled and Tested
1	U1#	AD8307 SO8
1	U3#	PCA9306 SO8
1	OSC	20MHZ OSC FULL or HALF
1	LED	3mm
1	Q3#	BFG541/BFG591
1	Q2	2N7000
	Q1#	AO4405 (PNP Switch)
1	IC Socket	28PIN DIP
1	PCB	FD-AAZ-0217A DSPTH PCB
1	Z1	LM385-2.5V
1	U4#	AMS1117 – 3.3V
2	L1, 2	Air Inductors
7	FBX1, 2, 3, 4, 5, 6, 7	Ferrite Bead Inductors
1	RFC1	22 -100uH RFC (SMT)
1	J1	BNC R/A PCB
1	J2	USB Socket, R/A, PCB Type
1	J3	FRC16 R/A PCB
6	SMT Ferrite beads #	FX and FB Beads 1206 SMT Pre-Soldered
1	D1	1N4148
1	2PIN Header	FW Update Header
1	DS1	1N5718/19
1	T1#	1:1 RF Transformer
	All Resistors ¼ W 5%	
1	R5	300 Ohms
1	R6	18 Ohms
1	R7	270 Ohms
9	R1/A, R2/A, R3/A, R4/A, RT	100 Ohms
3	R8, 9, 11	10 Ohms
0	RT2	Not Used
1	R17	100K
1	R19	180K
5	R14, 15, 16, 21, 23	10K
3	R10, 12, 13	1.5K
1	R22	3.3K
2	R24, 18	1K
1	R20	4.7K
2	RX1, RX2#	1206 10 to 22 ohms
	Capacitors	
1	C23	0.47uF Poly
2	C19, 20	.001uf Poly
2	C24, 25#	0.1uF 1206
6	C6, 7, 5, 4, 2, 1,	0.1uf Poly
8	C3, 14, 13, 15, 17, 18, 21, 22	1uf Tantalum
1	C16	10uF Tantalum
1	C10	33pf Ceramic
2	C 9, 12	47pf Ceramic
2	C8, 11	Not Used (15pf Ceramic)
2	CX1, CX2#	10 to 22pf 1206

 # Pre-soldered on board

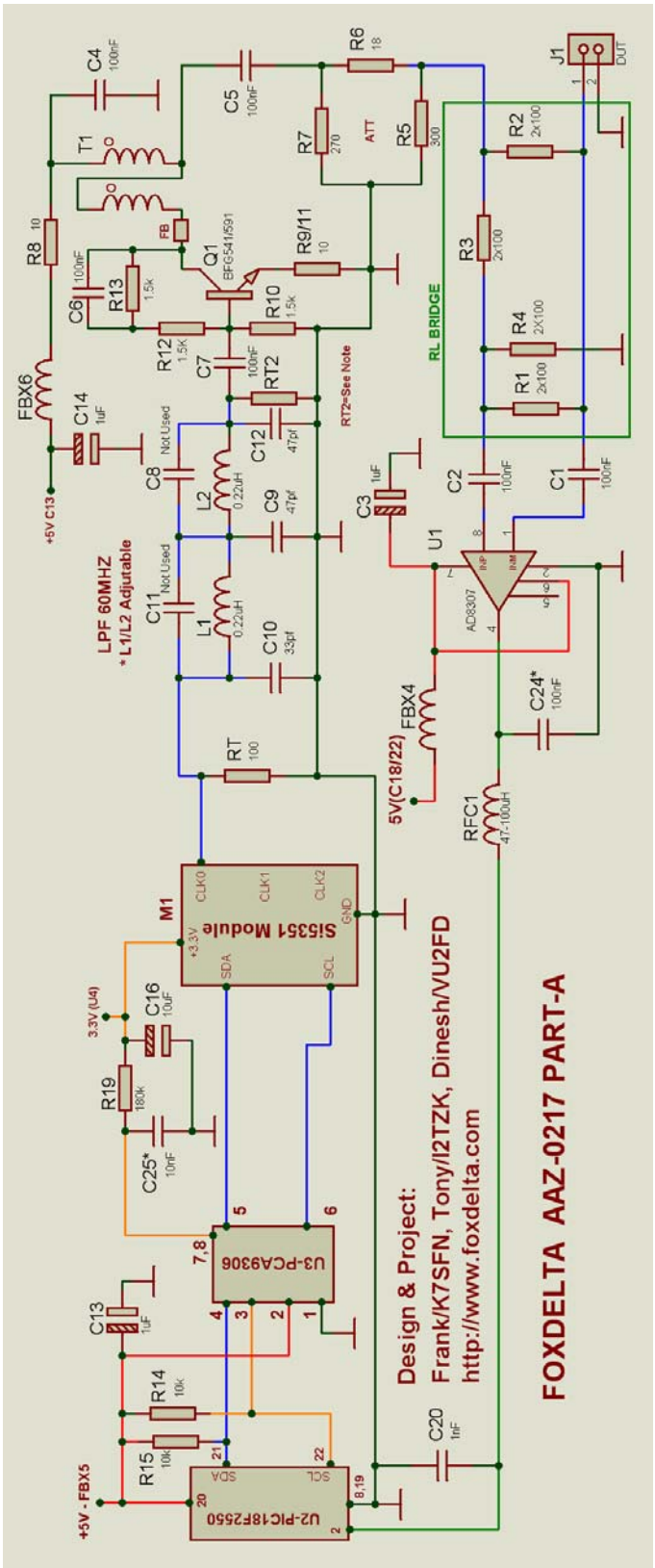
AAZ-0217A SILK: TOP SIDE



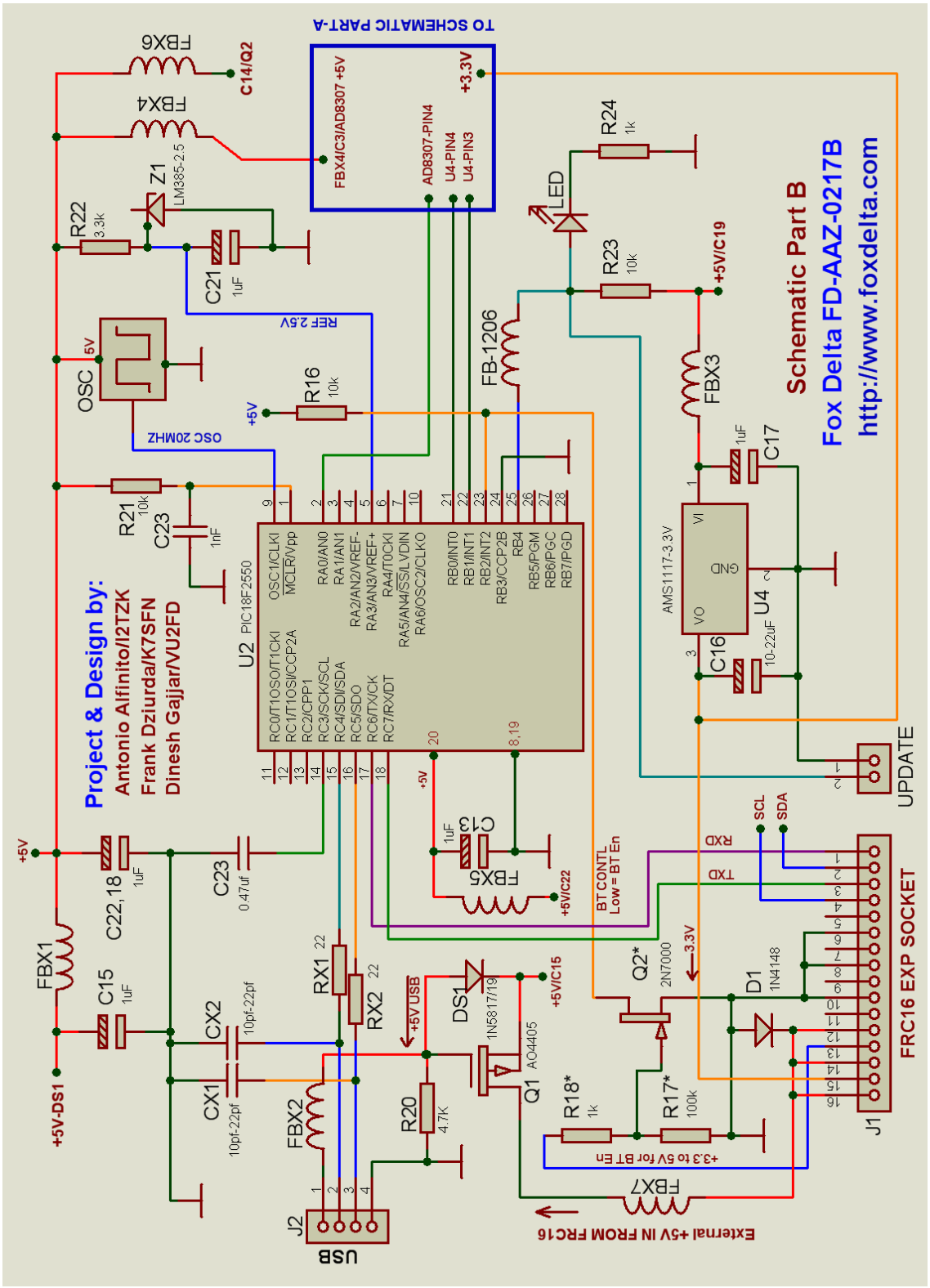
SOLDER SIDE SILK:



AAZ-0217A Schematic A:



AAZ-0217A Schematic B:



73s / Dinesh Gajjar
17th April 2017

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