



Fox Delta

Amateur Radio Projects & Kits

FD- AAZ-0217MX

Project Tech Info Doc: 1 - 60MHZ HF PIC18F2550 USB Antenna Analyzer

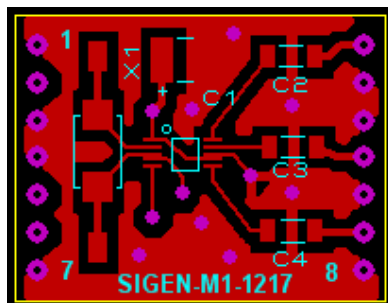
AAZ- 0217MX KIT: (MX stands for "Mixer" Type): PCB Rev 0324

1 - 60MHZ USB Antenna Analyzer

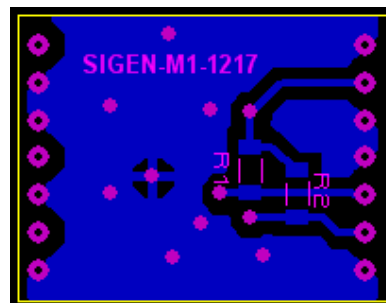


PCB Revised to 0324, which accommodate either BNC or SMA connector, expansion socket is now SIL8 and most FBX are now in 1206 SMT

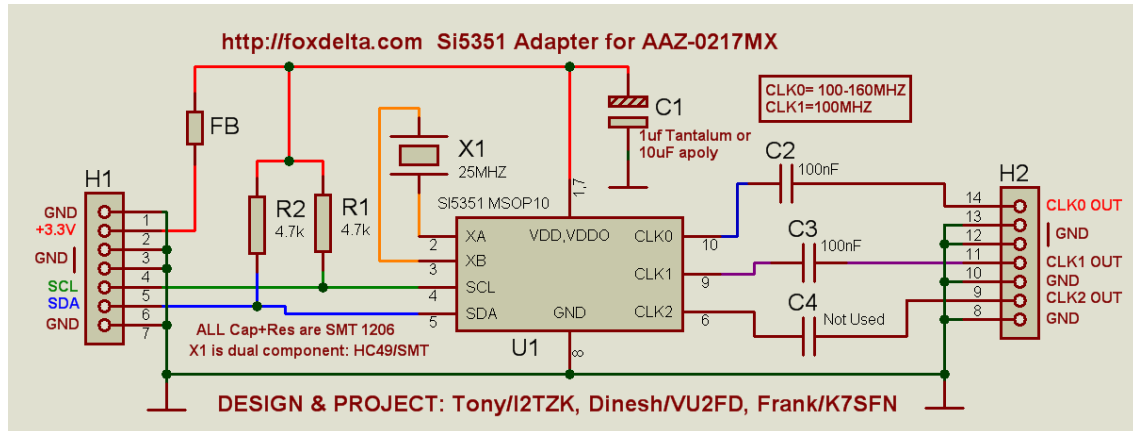
Si5351 Module: M1



M1 Bottom View:



Schematic: Module M1



AAZ-0217MX: Project Info:

Revision of our USB analyzer project 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 new hardware using this chips.

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

1. Si5351 outputs square waves (AD9850 has sine wave output)
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

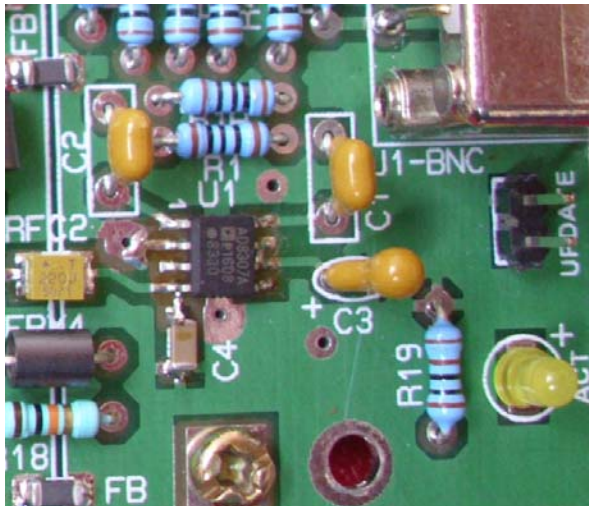
In addition to basic change of Generator chip, some of the changes are implemented in our this AAZ-0217MX version:

1. When used with HC05 Module (Future Project), which fits on SIL8 Socket, Firmware will auto activate BT function. (USB Data Disabled)
2. SIL8 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 UART-RX/TX or I2C data lines.

3. Specified as a **1 to 60MHZ analyzer**. AAZ-0217MX is not intended to generate analyzing freq above 60MHZ. Since VHF Mixing scheme is used to generate 1- 60MHZ analyzing signal, Si5351 chip is running from 101 to 160MHZ and generates a second fix freq signal of 100Mhz.
4. LPF in AAZ-0217MX is set around 70 - 80MHZ, suppressing all frequencies above 90MHZ and only allow mixing product of band used for analyzing signal at RL Bridge, i.e. below 60MHZ.
5. Firmware and Software for AAZ-0217MX is developed by [Tony/I2TZK](#).
6. PC SW developed by Tony/I2TZK works well with WIN7/XP/10. **Latest dotnet update is essential for your PC's WIN OS.**

Hardware Information:

AAZ-0217MX 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.



Left side picture: AD8307 and Part of RL Bridge.

Si5351 module data communication:

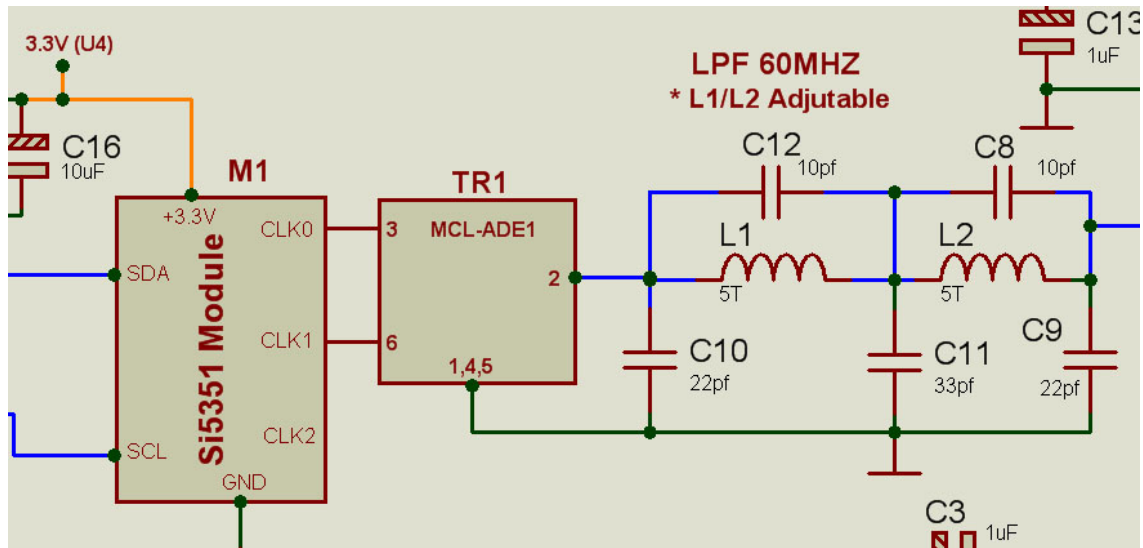
With PIC running at 5V, a level shifting is required for Si5351 (3.3V) Communication. 2 X BSS138 are used for this purpose.

Si5351 module, under FW V105MX, Generates two independent signals.

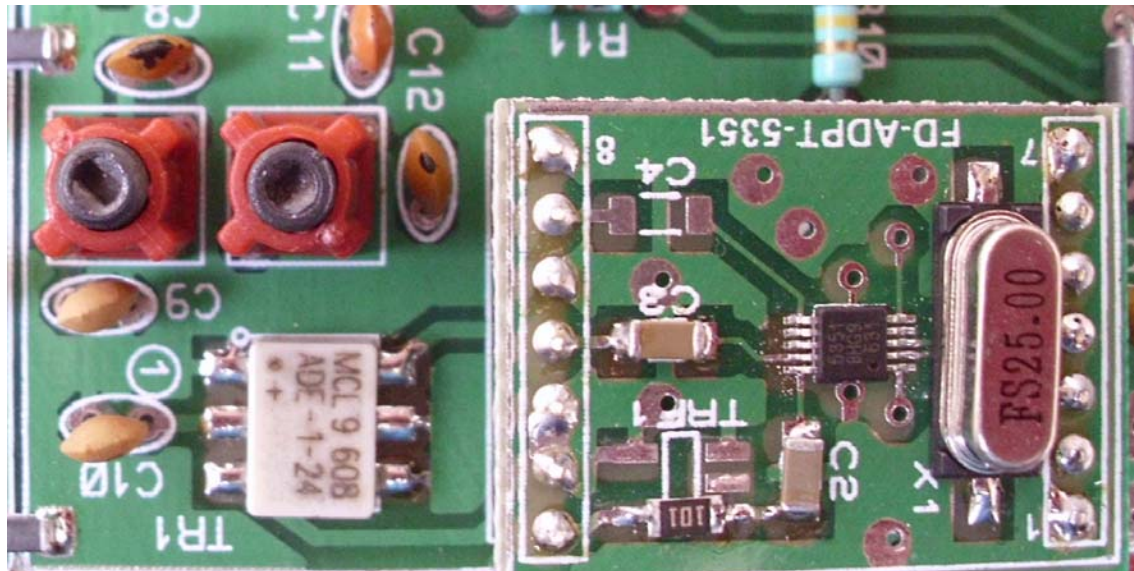
CLK0: 101 to 160MHZ and
CLK1: Fix freq of 100MHZ.
CLK2: Not used

Mixer output: 0 – 60MHZ to RL Bridge

Schematic of Si5351 Module, ADE1 mixer and LPF:



Two frequencies are mixed in a MCL ADE1 Double Balanced Mixer.



Upper freq (LPF Freq around 70- 80MHZ) Generated by Si5351are suppressed by Low Pass Filter comprising L1 / L2 and 5 ceramic capacitors.

Lower frequencies. Product of two VHF signals mixing, that is 1 to 60MHZ, are then further amplified by ERA3/5 Amp and used at RL Bridge for antenna analyzing.

CLK2 of Si5351 is not used in this project

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.

3.3V Supply U4:

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

Q3:



ERA3SM (or ERA5SM) amp is used to amplify signal coming out of LPF.

ERA3SM requires a series resistor of 22 ohms and if ERA5SM is used, an 18ohms resistor is used. In either case, amp current is approx 30-35ma

OSC and 2.5V Reference:



LM385-2.5V is a reference diode. Provides 2.5V to CPU.

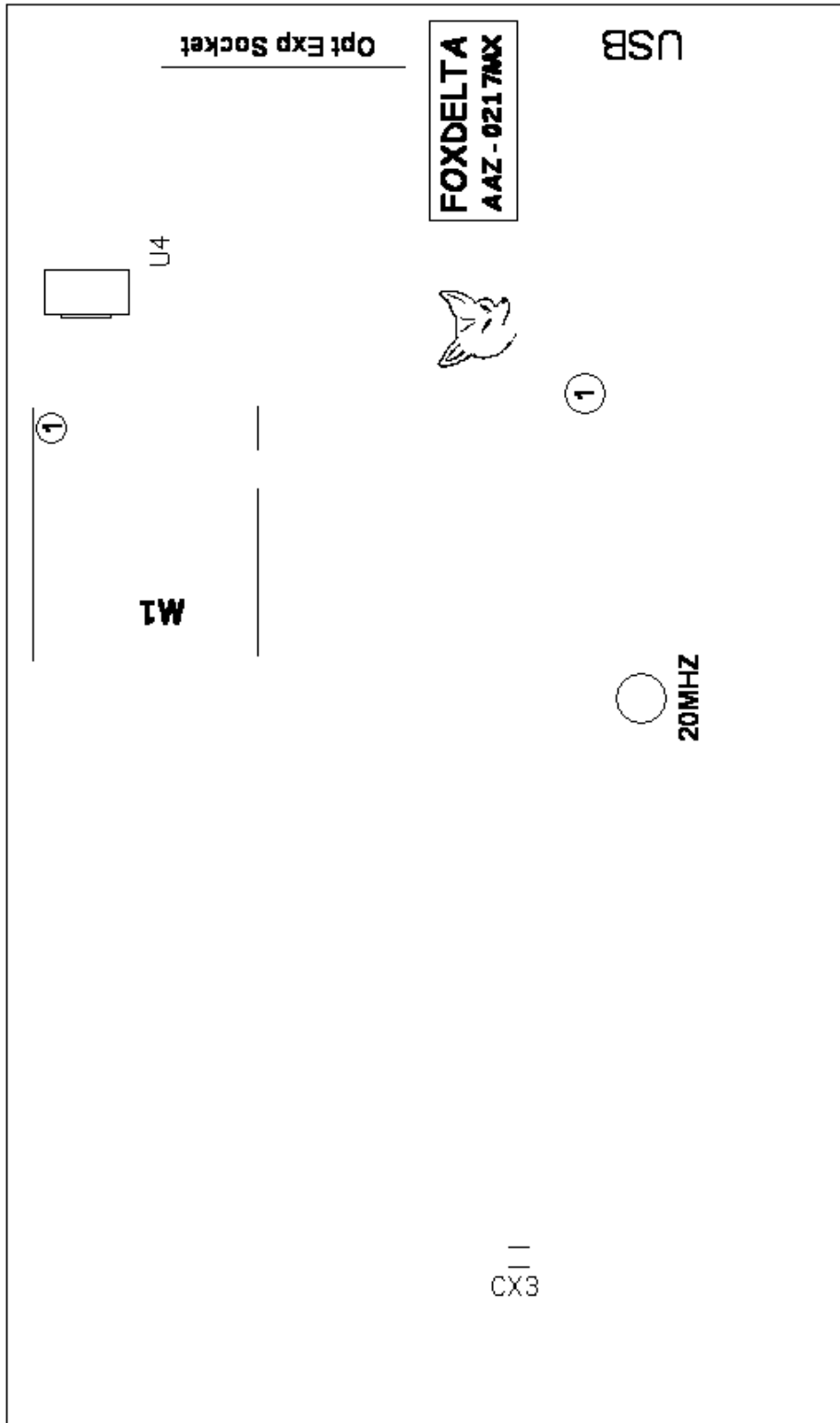
20MHZ clock Osc is a 14DIP or 8DIP 5V package. Ensure that edge-notch on Osc match with "1" on Board.

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 10pf.

For kits and assembled, we supply CX3 as 10pf in 1206.

AAZ-0217MX Rev 0324 SOLDER SIDE SILK:



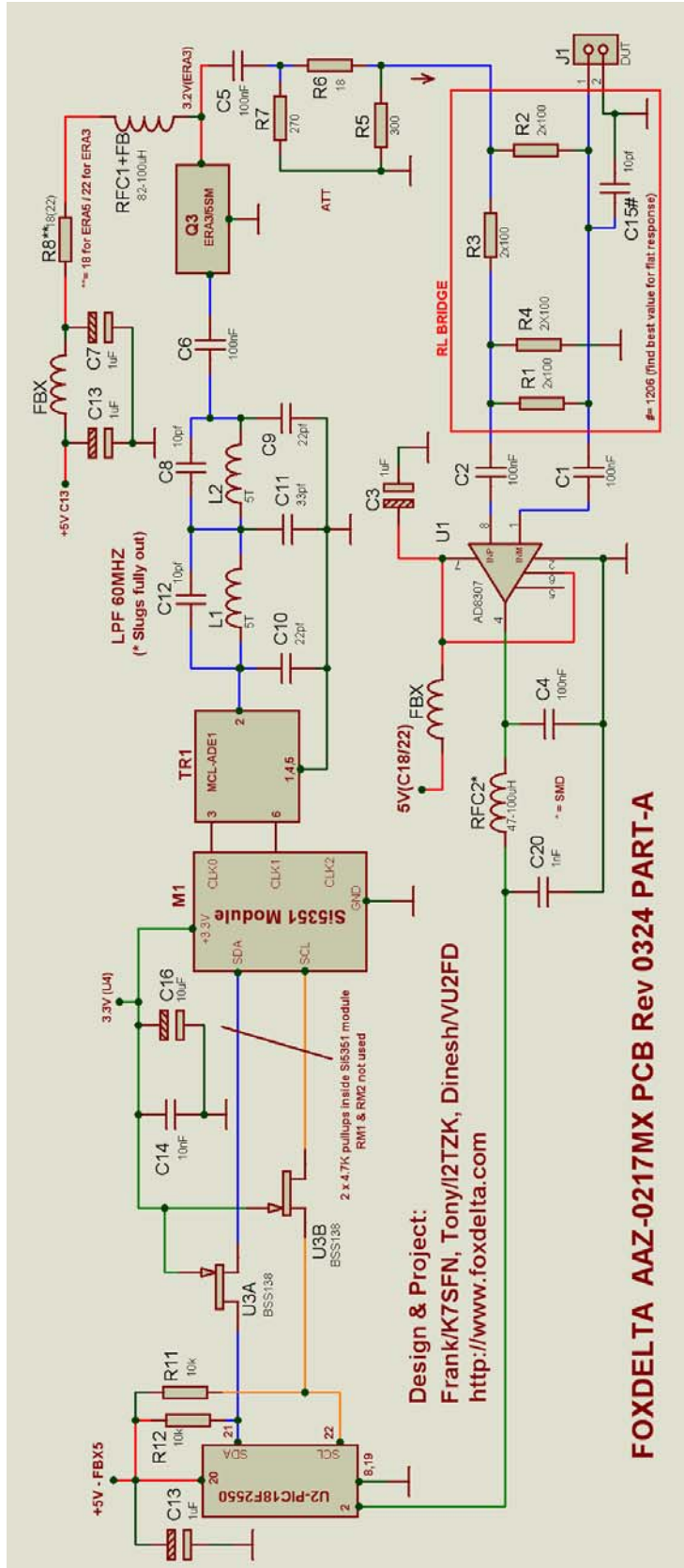
AAZ – 0217MX Rev 0521 KIT Parts List:

Quantity	Part ID	Part Details
1	U2	PIC18F2550 FW V1.05
1	M1#	Si5351: Assembled and Tested
1	U1#	AD8307 SO8
1	TR1#	ADE1 SO6
2	U3A / U3B#	BSS138 SMT
1	OSC	20MHZ OSC FULL or HALF
1	LED	3mm
1	Q3#	ERA3SM / ERA5SM
1	Q2	2N7000
1	IC Socket	28PIN DIP
1	PCB	FD-AAZ-0217MX DSPTH PCB Rev0324
1	Z1	LM385-2.5V
1	U4#	AMS1117 – 3.3V
2	L1, 2	Air Inductors
1	FBX	RFCs (10-47uH)
9	FB#	1206 Ferrite beads
1	RFC1	82 -100uH RFC
1	RFC2#	1206 RFC 22 – 47uH
1	BNC / SMA	BNC or SMA R/A PCB
1	J2	USB Socket, R/A, PCB Type
1	J1	SIL 8 R/A PCB (Exp Socket)
1	2PIN Header	FW Update Header
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	18 Ohms ERA5 / 22 Ohms ERA3
1	R10	100K
5	R11, 12, 13, 16, 18	10K
1	R17	3.3K
2	R14, 19	1K
0	R9, R15, RM1, RM2	NOT USED IN THIS DESIGN
2	RX1, RX2#	1206 10 ohms
Capacitors		
1	C23	0.47uF Poly
2	C19, 20	.001uf Poly
6	C4, 6, 5, 2, 1, 14	0.1uf Poly
8	C3, 7, 13, 15, 17, 18, 21, 22	1uf Tantalum
1	C16	10-22uF Tantalum
2	C10, 9	22pf Ceramic
1	C11	33pf Ceramic
2	C8, 12,	10pf Ceramic,
2	CX1, CX2, CX3#	10 pf 1206

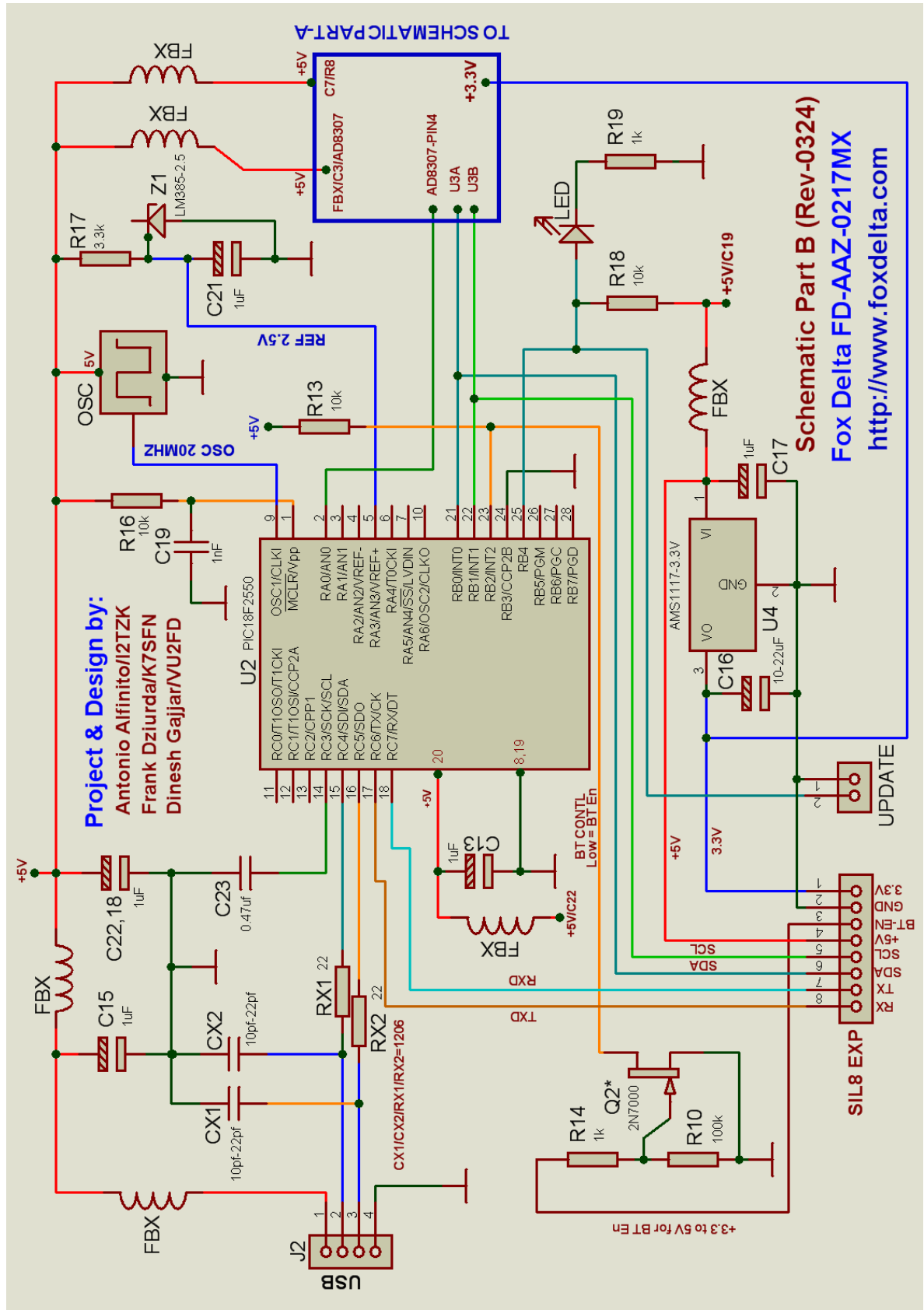
Note:

- 1: Q1, R9, R15 are not in this design**
- 2. # Parts are Pre-soldered on board**
- 3. R8 is Specific resistor to Q3: ERA3SM=22ohms, ERA5SM=18ohms**

AAZ-0217MX Schematic A:



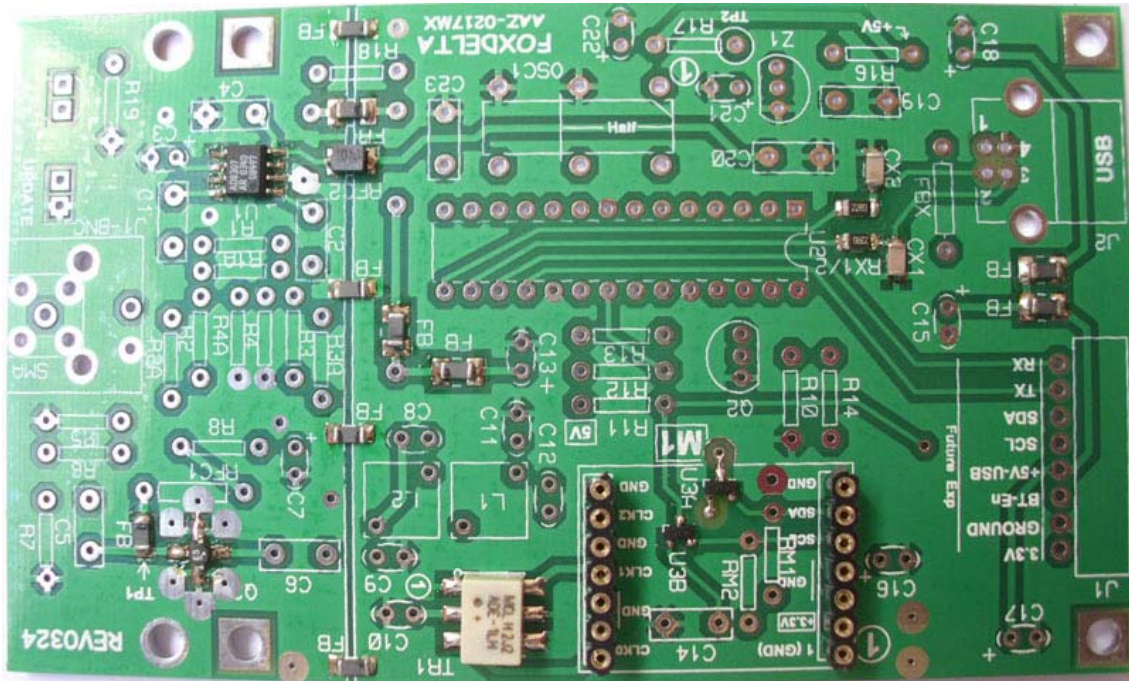
AAZ-0217MX Schematic B:



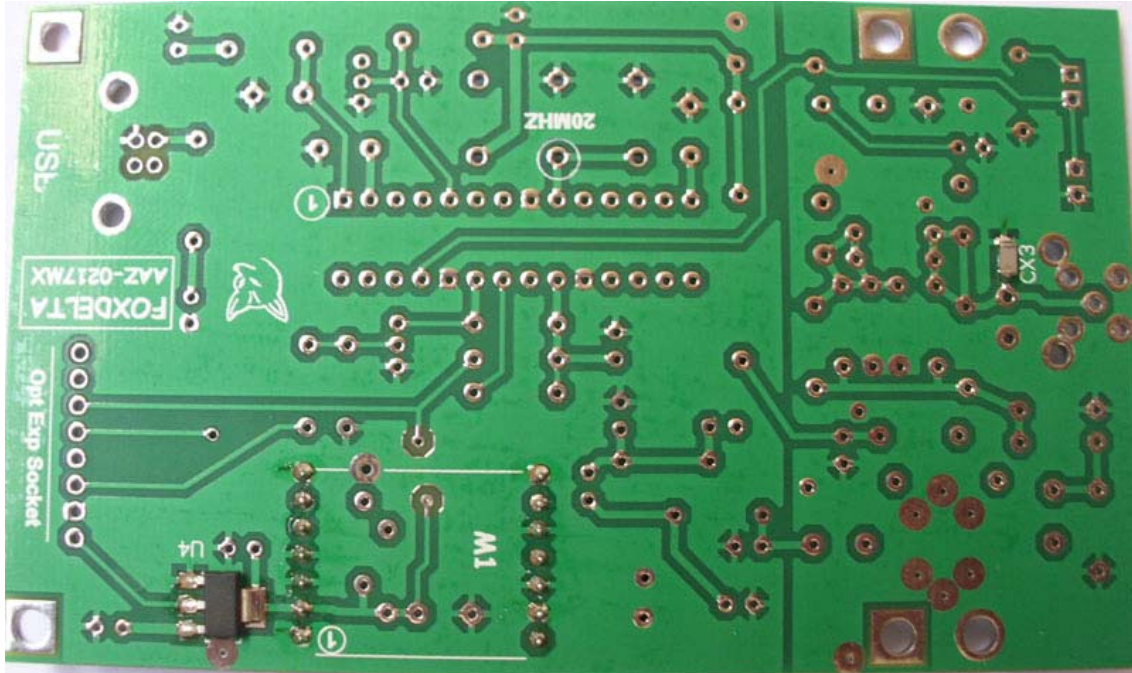
Pictures of the Rev0324 PCB supplied for kits:

All SMD components are pre-soldered:

TOP:



BTM:



73s / Dinesh/VU2FD, Frank/K7SFN, Tony/I2TZK
10th Sept 2024

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