Fox Delta

Amateur Radio Projects & Kits

FC3-0915

FC3 Project Info: PIC18F4550 50/500MHZ Frequency Counter & RF Meter

This project is developed for Amateur Radio Community by:

Antonio Alfinito / I2TZK
Dinesh Gajjar / VU2FD
Frank Dzuirda / K7SFN

FC3-0915 50/500MHZ Frequency Counter and RF Meter:

FC3-0915: Interesting features of this project:

1. **Its USB and DC12V Powered**

2. **Measures RF Level using Analog Device Log amplifier AD8307**

3. **Count frequency to 50MHZ and 100 to 500MHZ (MC12080)**

4. **2 x 16 LCD Display with BL**

5. **Signal Level measurement in dbm, vpp and rms**

6. **50 ohms input impedance**

7. **Frequency "off-sets" may be set by PC program.**

8. **Free PIC Firmware & PC WIN Software by Tony/I2TZK**

9. **Auto Detect: DC12V (Stand-alone) or USB (with PC Link)**

Design Bases:

FC3 is designed on a Double Sided PTH Board and works on USB or external DC12V power.

FC3 is designed and developed for Radio Amateurs looking for economical frequency counter for their hobby work and wish to measure RF signal Level at the same time. Analog Device's AD8307 is used to measure RF level accurately in DBm, Vpp or RMS.

Counter works with PC or as a Stand-alone. PC Connection is auto detected and so is stand-alone mode.
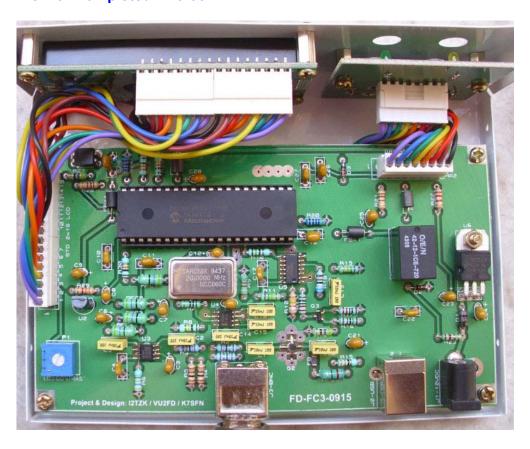
Front panel push buttons are provided for RF Meter Mode and HF/VHF Frequency measurement modes.

A PC program is specially designed for FC3 by Tony/I2TZK is provided for configuration of IF Off-sets and AD8307 related parameter configuration thru USB interface.

FC3 Complete KIT includes AD8307, ERA3SM/SGA3486, 74VHC00, BFR93A, and MC12080 in SMT package. Complete kit is supplied with pre-soldered SMT parts for those who do not like to solder SMT devices.

Assembled FC3 may also be available but buyer will have to calibrate RF Measurement section of meter using PC software provided.

View of Completed FC3-0314:

Basic Operation of FC3:

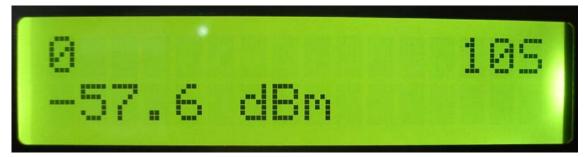**FC3 has single input for measurement of Frequency and RF Signal Level. Both are at 50 Ohms.**

Front Panel Push buttons are:

1. **AD8307 related parameter: DBm, VPP and RMS**
2. **Frequency Division Parameter: Direct, Divide by 10 or 80**

Direct Mode to 50MHZ:

In direct mode, FC3 counts to approximately 50MHZ as the signal is directly feed to PIC for counting.

VHF/UHF Mode:

100 to 500MHZ mode is activated by front panel push button. This mode brings in MC12080 pre-scaler in to circuit and we have two possibilities: Divide by 10 and Divide by 80. (Under processor control)
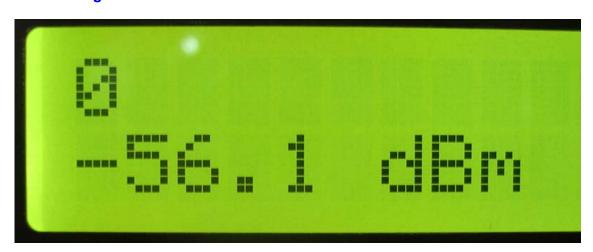
Divide by 80 is a projected scheme of this counter that we call it as a 500MHZ counter. However, MC12080 can count reliably to 1.1GHZ.
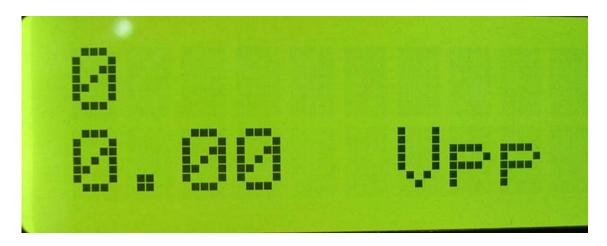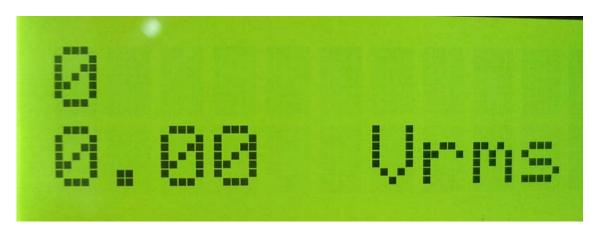

Actual Measurement of VHF Signal:

RF Level Measurement Mode:
Measure signal in DBm:

Measurement in VPP:

Measurement in RMS:

Calibration of AD8307 parameters:

FC3 is using Analog Device's AD8307 Log Amplifier chip in SO8 package for measurement of RF Level. No adjustments are required in hardware.

However, Tony/I2TZK who has written code for PIC18F4550 and have provided a PC software to accurately calibrate measurement values of AD8307 for various Amateur Radio Bands. (1 to 50MHZ)

Remember that AD8307 is connected all the time without any change in any component values for the measurement of RF Level from DC to 500MHZ. (irrespective of either FC3 is in direct or Pre-Scaler mode)

Since AD8307 is guaranteed to work up to 500MHZ, FC3-0915 is stated as a 500MHZ counter, although it may work well above 500MHZ for frequency counting (1GHZ)

FC3-0915 Parts List:

Quantity	Part ID	Details
1	U1	PIC18F4550 DIP40 with FW2.04 pre-loaded
1	PCB	FD-FC3-0915
1	IC Socket	40 PIN DIP
1	U3	AD8307 SO8
1	U2	LM385-2.5V
1	U6	7805
1	U4	MC12080 SO8
1	U5	74VHC00 SO14
1	Q1	IRFD110
1	Q2	ERA-3SM / SGA3486
1	Q3	BFR93A
1	OSC	Oscillator 20MHZ Full size (DIP14)
1	P1	10K Preset
1	D1	1N4007 Diode
2	D2, D3	1N4148
1 each	RFC5+BD	82-100uH+Ferrite Bead (1206)
4	RFC1, 2, 3, 4,	33-47uH
4	FBX1, 2, 3, 4,	FB Inductors
1set	LCD Header	16PIN SIL 0.1INCH (Male+Ribbon) 8+8
1set	KB Header	8PIN SIL 0.1INCH (Male+Ribbon)
2	KB Buttons	12mm push buttons
2	LED	3MM RED, Green
1	KB PCB	FC3-0915-1
1	J3	BNC R/A Connector
1	RLY	OEN42 or Similar 12V 1CO Relay
1	LCD	2x16 LCD with BL
1	J2	USB Connector
1	J1	DC Connector
1	Case	Free powder coated metal case.
1	Set	LCD and KB mounting hardware

Capacitors:

Quantity	Part ID	Details
4	C10, 11, 27, 26	0.001uF Ploy
4	C4, 17, 22, 29	0.1uF Ploy
8	C5, 2, 14, 1, 15, 16, 20, 19	0.01uF Poly
12	C3, 6, 7, 8, 9, 12, 13, 21, 25, 23, 24, 28	1uF Tantalum
1	C18	0.47uf

*BD = Ferrit Bead is SMT part and is pre-soldered on board

Resistors: All 1/4W

Quantity	Part ID	Details
3	R1, 2, 3	18 ohms
2	R4, 5	100 ohms
1	R23	2.2 ohms
1	R6	470K
1	R7	10
1	R8	100K
1	R9	820
1	R10	150
2	R11, 19	750K
2	R14, 27	470
1	R16	1.5K
1	R12	820K
1	R18	680K
2	R13, 17	220
3	R25, 26, 30,	10K
3	R21, 22, 28	1K
2	R20, 24	4.7K
1	R29	3.3K
1	R15	33 ohms

FC3-0915-1 Key Board:

Keyboard PCB has two 12mm push buttons and two LEDs for power indication.

Push Buttons:
1. RF Measurement modes: DBm, Vpp, RMS
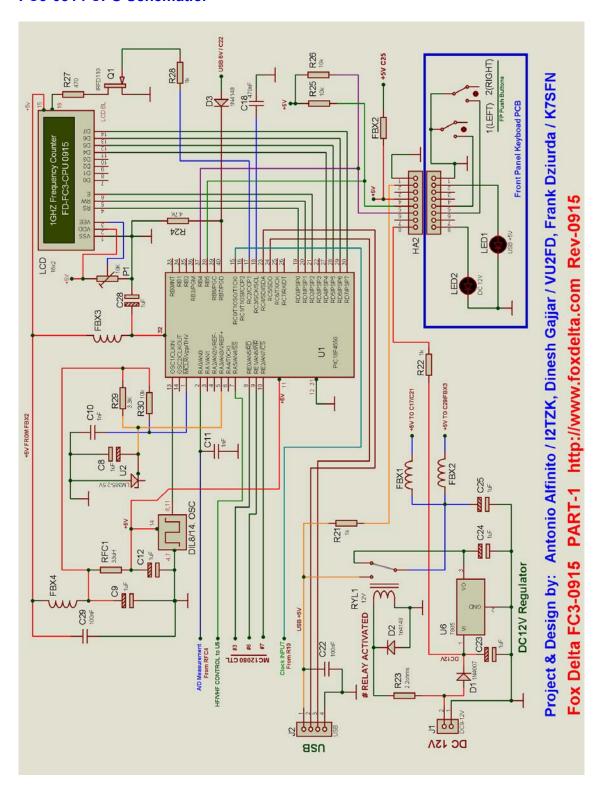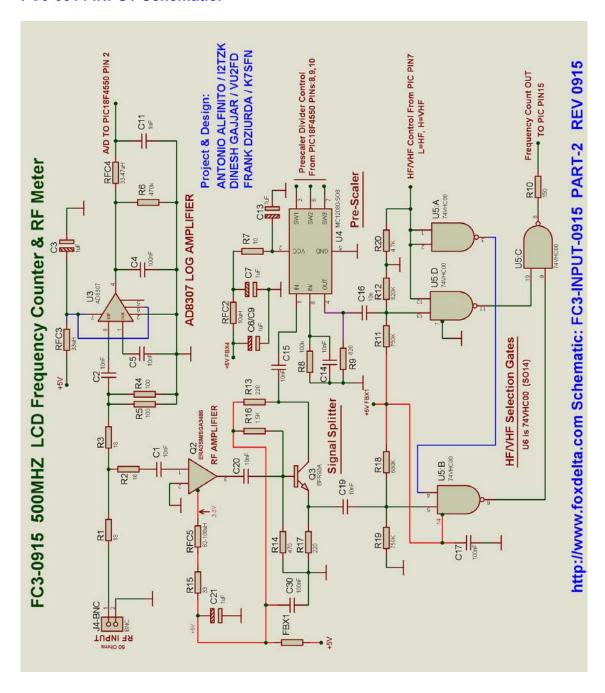2. Frequency Counter Modes: Direct or Div by 10 or 80

LEDs:
1. DC12V
2. USB +5V

SIL8 and Ribbon Cable:

Keyboard PCB is interfaced to main board by 8pin SIL Connectors and 8-wire ribbon cable.
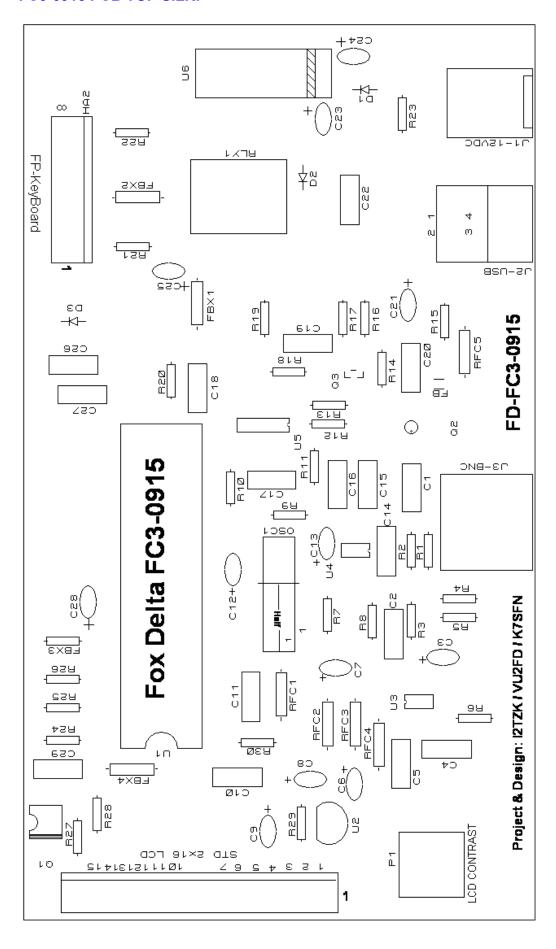
FC3-0314 CPU Schematic:

FC3-0314 INPUT Schematic:

FC3-0915 500MHZ LCD Frequency Counter & RF Meter

http://www.foxdelta.com Schematic: FC3-INPUT-0915 PART-2 REV 0915

Project & Design:
ANTONIO ALFINITO / I2TZK
DINESH GAJJAR / VU2FD
FRANK DZIURDA / K7SFN

AD8307 LOG AMPLIFIER

A/D TO PIC18F4550 PIN 2

Prescaler Divider Control
From PIC18F4550 PINs:8,9,10

Pre-Scaler

HF/VHF Control From PIC PIN7
L=HF, H=VHF

Frequency Count OUT
TO PIC PIN15

HF/VHF Selection Gates
U6 is 74VHC00 (SO14)

Signal Splitter

RF AMPLIFIER

RF INPUT
50 Ohms

FC3-0915 PCB TOP SILK:

Fox Delta FC3-0915

FD-FC3-0915

Project & Design: I2TZK / VU2FD / K7SFN

Note:

FC3 will be available in kits and assembled at small extra cost. We also offer this kit fully assembled free of charge for Senior Radio Amateurs with poor eyesight (like mine own!) Aging has nothing to do with our interest and ability to create!!

Efforts are made to ease construction for kit builders. For that reason kits are supplied with SMT parts pre-soldered.

I hope this project will help many radio amateurs measure frequency and signal level for their hobby development work.

73s
Dinesh Gajjar
23rd September 2015

For more details on this project please visit http://www.foxdelta.com