



# GSM900 Evaluation Board For PLL Frequency Synthesizer

EVAL-ADF4113EB1

## FEATURES

**Self-Contained Board including Synthesizer, VCO and Loop Filter for generating GSM frequencies (819MHz to 915MHz)**

**Designed for 20kHz Loop Bandwidth**

**Accompanying Software allows complete control of synthesizer functions from PC**

**Battery Operated: Choice of 3V or 5V supplies**

**Typical Phase Noise Performance of -91dBc/Hz @ 1kHz offset**

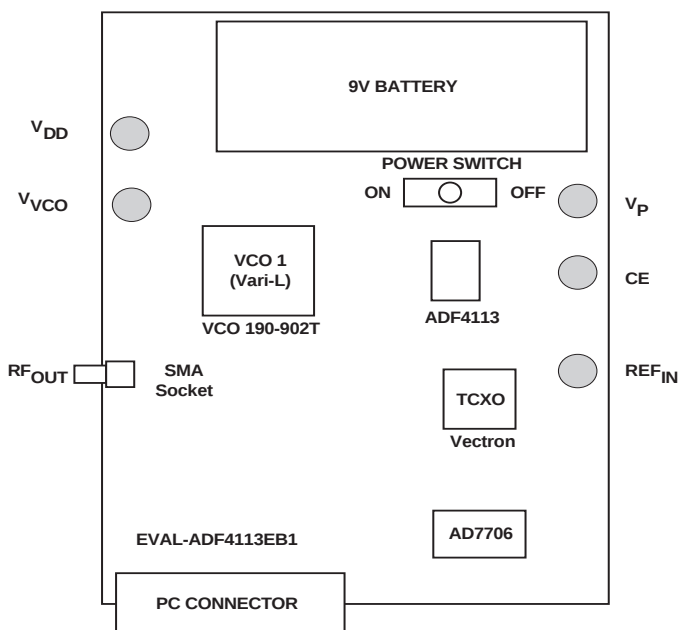
**Typical Spurious Performance of better than -90dBc at 200kHz offset from carrier**

## GENERAL DESCRIPTION

This board is designed to allow the user to evaluate the performance of the ADF4113 Frequency Synthesizer for PLL's (Phase Locked Loops). The block diagram of the board is shown below. It contains the ADF4113 synthesizer, a pc connector, SMA connector for the reference input, power supplies and RF output. There is also a loop filter (20kHz bandwidth) and a VCO on board. A cable is included with the board to connect to a pc printer port.

The package also contains windows software to allow easy programming of the synthesizer.

## BLOCK DIAGRAM



REV.PrB 04/00

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## Hardware Description

The evaluation board comes with a cable for connecting to the printer port of a PC. The silk screen and cable diagram for the evaluation board are shown below. The board schematic is shown on pages 3 and 4.

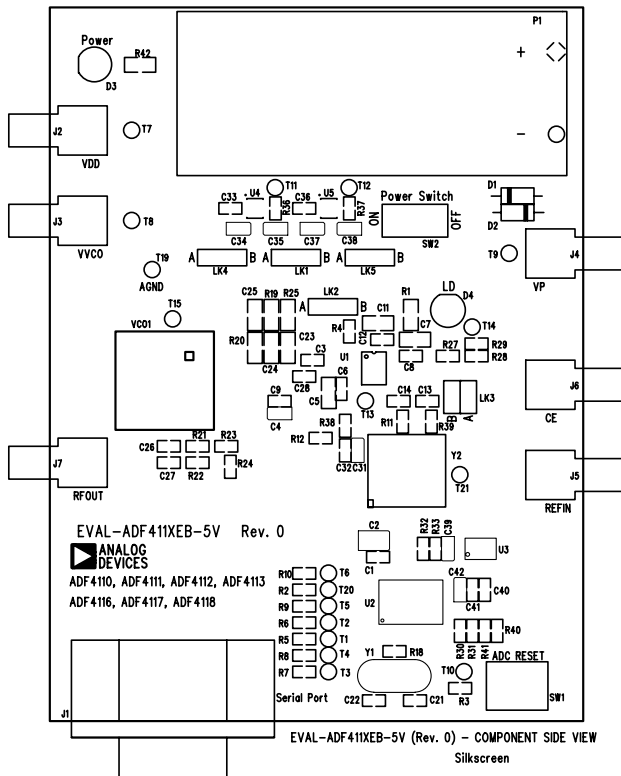


Figure 1. Evaluation Board Silkscreen

The board is powered from a single 9V battery. The power supply circuitry allows the user to choose either 3V or 5V for the ADF4113  $V_{DD}$  and  $V_P$ , and for the VCO supply. The default settings are 3V for the ADF4113  $V_{DD}$  and 5V for the ADF4113  $V_P$  and for the VCO supply. **It is very important to note that the ADF4113  $V_{DD}$  should never exceed the ADF4113  $V_P$ . This can damage the device.**

All components necessary for LO generation are on-board. The 13MHz TCXO from Vectron provides the necessary Reference Input. The PLL is made up of the ADF4113, passive loop filter (20kHz bandwidth) and the VCO 190-902 from Vari-L. The output is available at RFOUT through a standard SMA connector. If the user wishes they may use their own power supplies and reference input. In this case, they need to insert SMA connectors to as shown on the silkscreen and block diagram.

The AD7706 A/D converter is used to monitor the power supply voltage and current consumption of the ADF4113. This helps the user pick the optimum synthesizer settings for power consumption and also provides an alert if the battery voltage is too low to sustain the required 3V or 5V for the board supply.

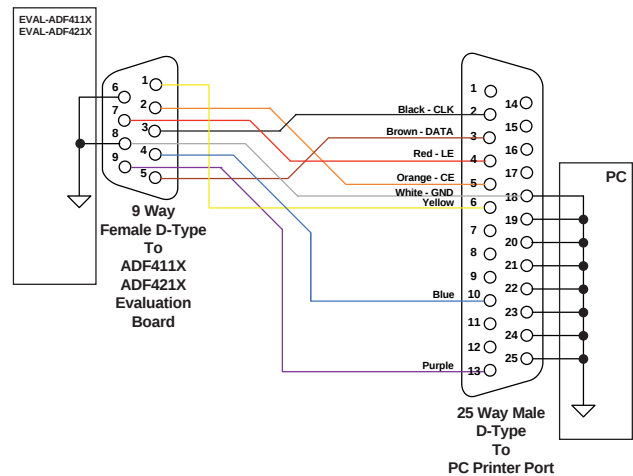
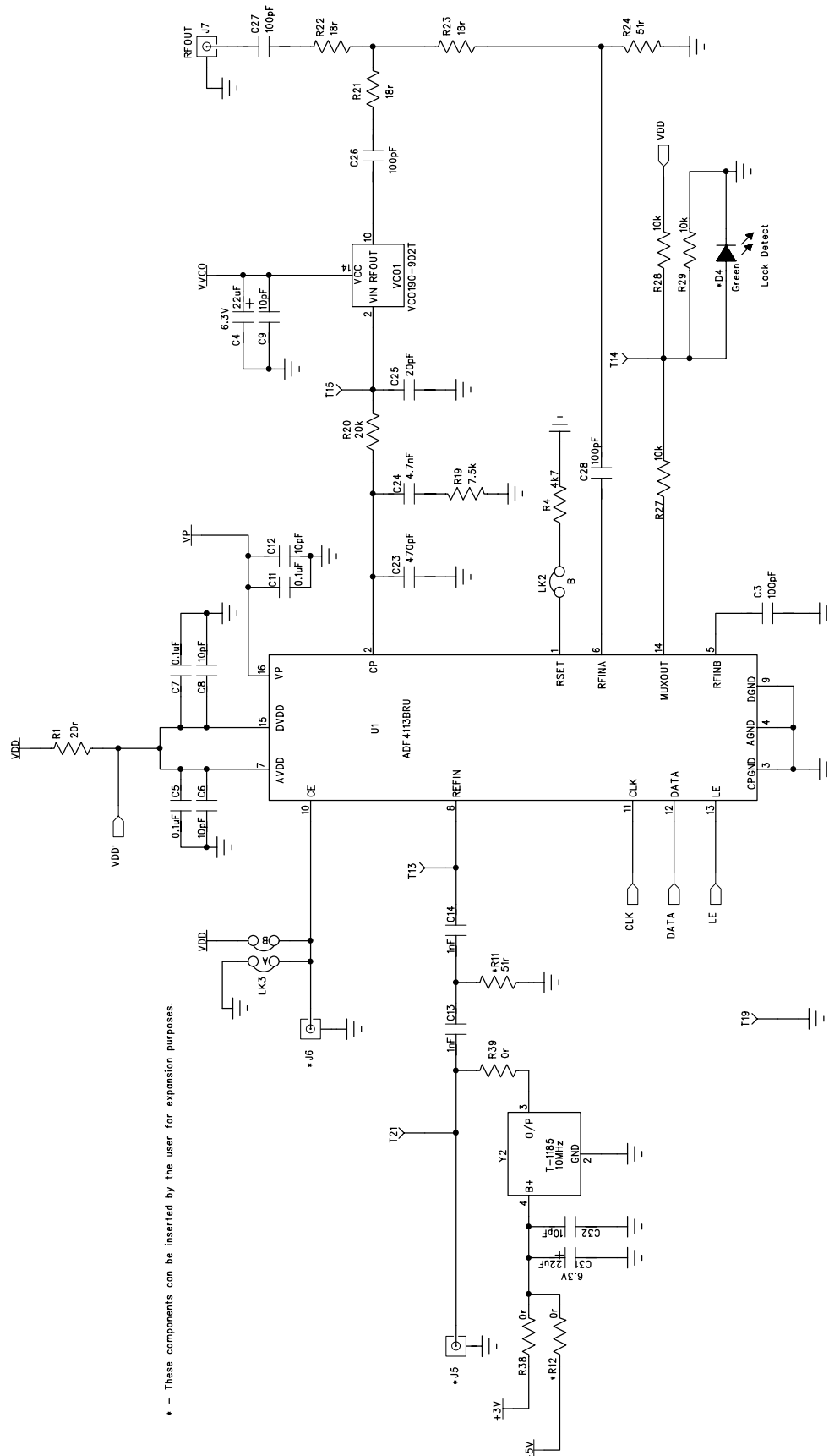


Figure 2. PC Cable Diagram

Loop component values shown in the circuit diagram are for 900MHz RF output, 5mA CP current, VCO190-902T, 200kHz channel spacing and 20kHz loop bandwidth.



\* -- These components can be inserted by the user for expansion purposes.

Figure 3. Evaluation Board Circuit Diagram (Page 1)

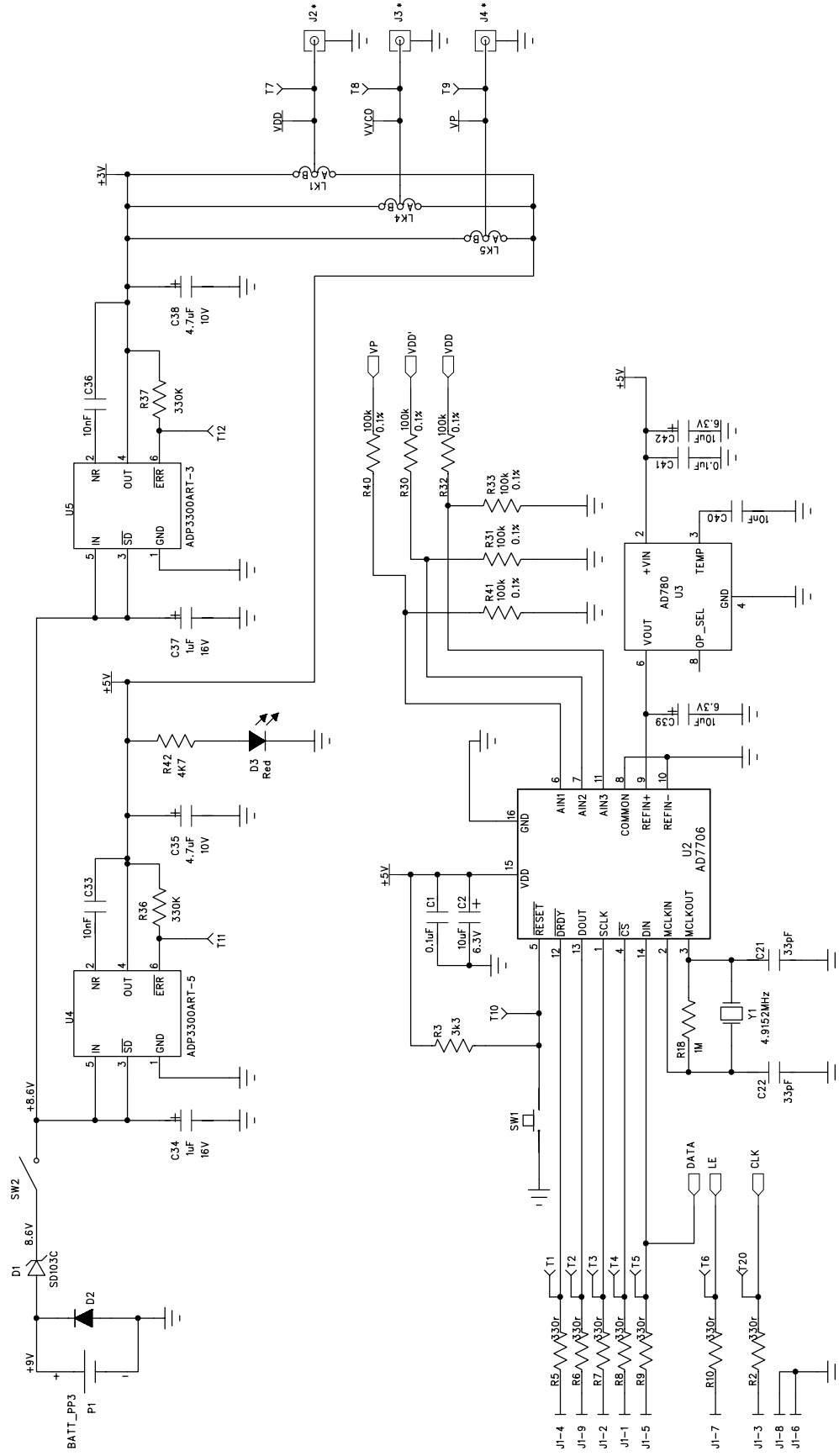


Figure 4. Evaluation Board Circuit Diagram (Page 2)

### Software Description

The evaluation board software is contained on a CD-ROM which comes in the package. To load the software the user should click on "setup.exe", then the install wizard installs the software. Follow the on-screen directions. The software will be installed in a default directory called "C:/Program Files/Analog Devices". To run the software, simply go to the Start Menu and choose Program/ADF4XXX/ADF4XXX\_rev0. This will open the software for the evaluation board. The user will be asked to choose which device is being evaluated. Click on the ADF4113 button. Hit OK. The window shown below will now appear.

In this panel, click on the "Eval Board" button. Choose ADF4113EB1 from the list on offer. Hit OK. The synthesizer will now be programmed with the correct settings for a GSM system working at 900MHz. 200kHz PFD frequency is set up, 32/33 prescaler is chosen and charge pump current of 5mA is programmed.

If the user wishes to change any of the settings then place the cursor over the desired parameter (RF VCO Output Frequency, for example) and click once. This brings up a screen where it is possible to either type in a new value of output frequency or else increment and decrement by the channel spacing.

The software also allows monitoring of the device supply voltage, supply current and the charge pump voltage. Simply hit the "Update Voltage and Current Display" button to get an up-to-date reading.

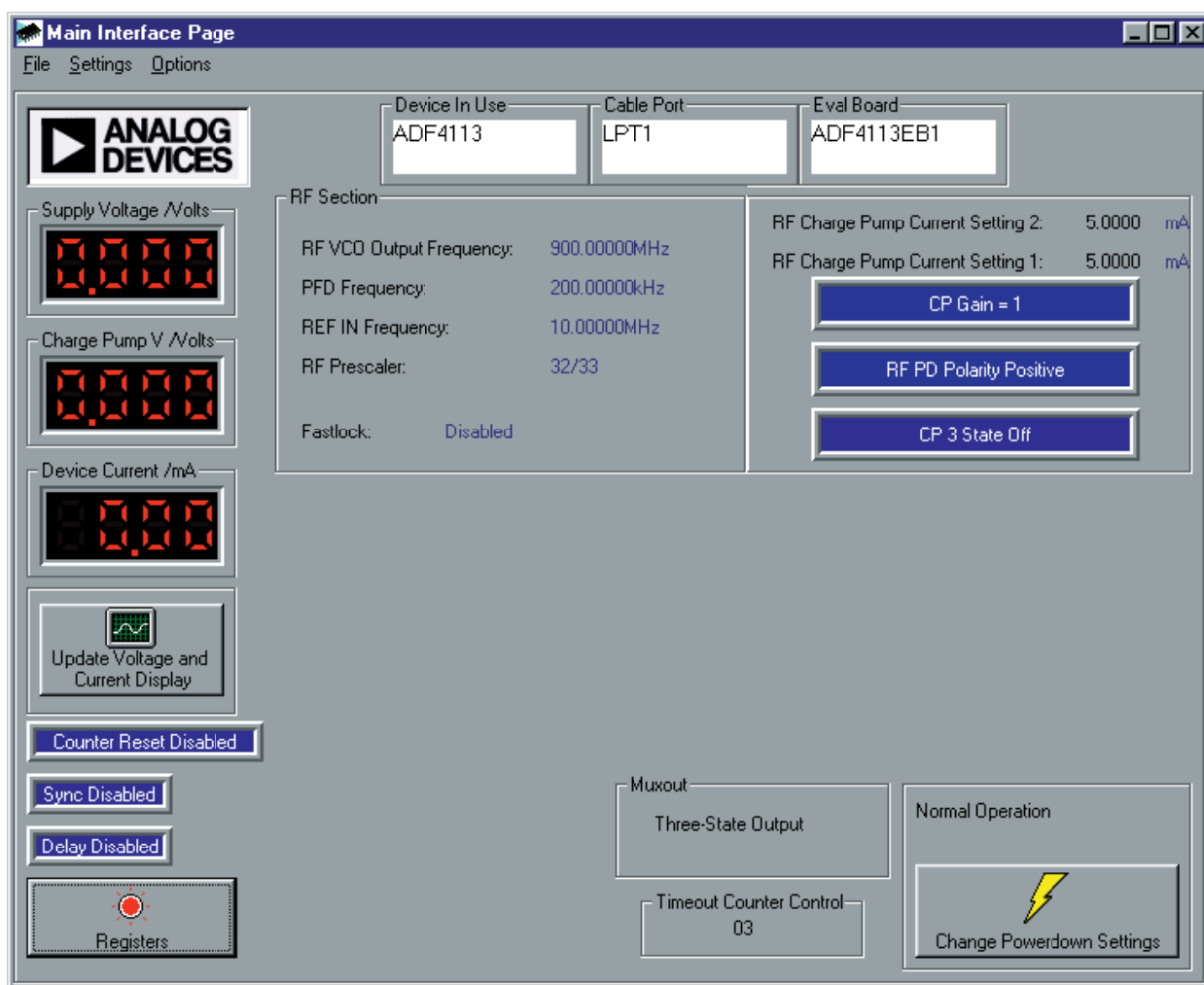


Figure 5. Software Front Panel

Table 1. Bill of Materials for the EVAL-ADF4113EB1

| Qty | Reference Designator                                             | Description                         | Manufacturer                | PCB DECAL        | VALUE        |
|-----|------------------------------------------------------------------|-------------------------------------|-----------------------------|------------------|--------------|
| 1   | U1                                                               | ADF4113BRU                          | ADI                         | TSSOP-16         | ADF4113BRU   |
| 1   | U2                                                               | AD7706BR                            | ADI                         | SO16WB           | AD7706BR     |
| 1   | U3                                                               | AD780AR                             | ADI                         | SO8NB            | AD780AR      |
| 1   | U4                                                               | ADP3300ART-5                        | ADI                         | SOT23-6          | ADP3300ART-5 |
| 1   | U5                                                               | ADP3300ART-3                        | ADI                         | SOT23-6          | ADP3300ART-3 |
| 1   | VCO1                                                             | VCO190-902T                         | Vari-L (Acal Elect. = Dist) |                  | VCO190-902T  |
| 1   | Y1                                                               | 4.9152MHz Crystal                   | Vectron International       | HC49 low profile | VXA4-1011    |
| 1   | Y2                                                               | 10 MHz TCXO                         | Vectron International       |                  | T-1185       |
| 1   | D1                                                               | SD103C Schottky Diode               | General Semiconductor       | DO35             | SD103C       |
| 1   | D2                                                               | IN4001                              |                             | DO35             | FEC 365-117  |
| 1   | D3                                                               | Red Low Power LED                   | Vishay                      | LED              | FEC 657-130  |
| 1   | D4                                                               | Green Low Power LED (Do Not Insert) | Vishay                      | LED              | FEC 657-141  |
| 2   | C1 C41                                                           | 0.1uF Multi Layer Ceramic Capacitor | Murata                      | Case 0603        | FEC 499-675  |
| 1   | C2                                                               | 10uF 6.3V Tantalum Capacitor        | AVX                         | CAP\TAJ_B        | FEC 197-014  |
| 4   | C3 C26 C27 C28                                                   | 100pF Multi Layer Ceramic Capacitor | Murata                      | Case 0603        | FEC 499-122  |
| 2   | C4 C31                                                           | 22uF 6.3V Tantalum Capacitor        | AVX                         | CAP\TAJ_A        | FEC 197-038  |
| 3   | C5 C7 C11                                                        | 0.1uF Multi Layer Ceramic Capacitor | Murata                      | Case 0805        | FEC 317-627  |
| 5   | C6 C8 C9 C12 C32                                                 | 10pF Multi Layer Ceramic Capacitor  | Murata                      | Case 0603        | FEC 499-110  |
| 2   | C13 C14                                                          | 1nF Multi Layer Ceramic Capacitor   | Murata                      | Case 0603        | FEC 317-202  |
| 2   | C21 C22                                                          | 33pF Multi Layer Ceramic Capacitor  | Murata                      | Case 0603        | FEC 498-555  |
| 1   | C23                                                              | 470pF Multi Layer Ceramic Capacitor | Murata                      | Case 0805        |              |
| 1   | C24                                                              | 4.7nF Multi Layer Ceramic Capacitor | Murata                      | Case 0805        |              |
| 1   | C25                                                              | 20pF Multi Layer Ceramic Capacitor  | Murata                      | Case 0805        |              |
| 3   | C33 C36 C40                                                      | 10nF Multi Layer Ceramic Capacitor  | Murata                      | Case 0603        | FEC 499-146  |
| 2   | C34 C37                                                          | 1uF 16V Tantalum Capacitor          | AVX                         | CAP\TAJ_A        | FEC 498-701  |
| 2   | C35 C38                                                          | 4.7uF 10V Tantalum Capacitor        | AVX                         | CAP\TAJ_A        | FEC 498-658  |
| 2   | C39 C42                                                          | 10uF 6.3V Tantalum Capacitor        | AVX                         | CAP\TAJ_A        | FEC 197-014  |
| 1   | R1                                                               | 20r 5% Resistor (Surface Mount)     | Multicomp                   | Case 0805        | FEC 771-132  |
| 7   | R2 R5 R6 R7 R8 R9 R10                                            | 330r 1% Resistor (Surface Mount)    | Multicomp                   | Case 0603        | FEC 911-143  |
| 1   | R3                                                               | 3k3 1% Resistor (Surface Mount)     | Multicomp                   | Case 0603        | FEC 911-290  |
| 1   | R4                                                               | 4k7 1% Resistor (Surface Mount)     | Multicomp                   | Case 0603        | FEC 911-318  |
| 2   | R11 R25                                                          | Do Not Insert                       |                             | Case 0805        |              |
| 1   | R18                                                              | 1M 1% Resistor (Surface Mount)      | Multicomp                   | Case 0603        | FEC 911-598  |
| 1   | R19                                                              | 7k5 1% Resistor (Surface Mount)     |                             | Case 0805        |              |
| 1   | R20                                                              | 20k 1% Resistor (Surface Mount)     |                             | Case 0805        |              |
| 3   | R21 R22 R23                                                      | 18r 1% Resistor (Surface Mount)     | Multicomp                   | Case 0603        | FEC 911-021  |
| 1   | R24                                                              | 51r 1% Resistor (Surface Mount)     | Multicomp                   | Case 0603        |              |
| 3   | R27 R28 R29                                                      | 10k 1% Resistor (Surface Mount)     | Multicomp                   | Case 0603        | FEC 911-355  |
| 6   | R30 R31 R32 R33 R40 R41                                          | 100k 0.1% Resistor (Surface Mount)  | Meggitt                     | Case 0603        | FEC 911-471  |
| 2   | R36 R37                                                          | 330K 1% Resistor (Surface Mount)    | Multicomp                   | Case 0603        | FEC 911-537  |
| 2   | R38 R39                                                          | 0r 1% Resistor (Surface Mount)      | Multicomp                   | Case 0603        | FEC 772-227  |
| 1   | R12                                                              | 0r 1% Resistor - Do Not Insert      | Multicomp                   | Case 0603        | FEC 772-227  |
| 1   | R42                                                              | 4k7 1% Resistor (Surface Mount)     | Multicomp                   | Case 0805        | FEC 911-938  |
| 1   | SW1                                                              | Push Button Switch                  | Omron                       | SWPB-SMALL       | FEC 176-986  |
| 1   | SW2                                                              | SPDT Switch - (Washable)            | Apem                        | SW SIP-3P        | FEC 150-559  |
| 18  | T1-15 T19-21                                                     | Red Testpoint                       | W Hughes                    | TESTPOINT        | FEC-240-345  |
| 1   | J1                                                               | 9 PIN D-TYPE MALE (HORIZ)           | McMurdo                     | DCON9M           | FEC 150-750  |
| 5   | J2 J3 J4 J5 J6                                                   | Do Not Insert                       |                             | SMA              |              |
| 2   | J7                                                               | GOLD 50Ω SMA SOCKE                  | Pasternack                  | SMA              | PE4118       |
| 3   | LK1 LK4 LK5                                                      | 3 pin header                        | Harwin                      | SIP-3P           | FEC 512-047  |
| 1   | LK2-B                                                            | Wire Link                           |                             |                  |              |
| 1   | LK3                                                              | 2 pin header                        | Harwin                      | SIP-2P           | FEC 512-035  |
| 4   | LK1 LK3-5                                                        | Shorting Shunt                      | Harwin                      |                  | FEC 150-410  |
| 2   | P1                                                               | Pair PCB snap-on battery connector  | Keystone                    | BATT_PP3         | FEC 723-988  |
| 1   | P1                                                               | 9V PP3 Battery                      | Duracell                    |                  | FEC 908-526  |
| 4   | Each Corner                                                      | Rubber Stick-On Feet                | 3M                          |                  | FEC 148-922  |
| 1   | EVAL-ADF4113EB1                                                  | PCB                                 | ADI                         |                  |              |
|     | Parts Free issued by ADI.                                        |                                     |                             |                  |              |
|     | Leave position blank - Do not insert.                            |                                     |                             |                  |              |
|     | Vari-L - UK Distributors - Acal Electronics Tel 0044 1252 858585 |                                     |                             |                  |              |