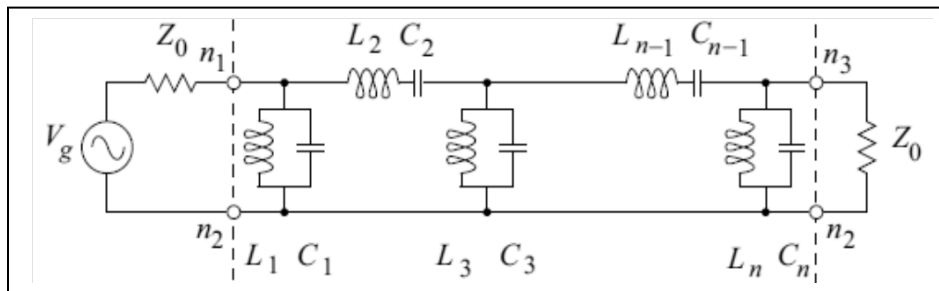# Quick Start User Manual: LEfilter

1.0   Getting Ready:

The software product you purchased is located inside a ZIP file that you can open, by following these steps:

1. Double-click on the ZIP file you purchased. This action starts the ZIP Wizard application, which contains the software product.
2. The ZIP Wizard automatically opens the software product you purchased and stores it inside your computer.
3. Once the software product is unzipped, right-click on the application's *filename* and single-click: "Extract". This action will extract all files located inside the software product and store them inside your computer:
   a. *LEfilter.exe*: The executable software product.
   b. *LEfilter.DEF*: Default Data File read by *LEfilter.exe*
   c. *LPFILTER.DAT*: Default Input Data file for a Lumped Element Lowpass Filter.
   d. *HPFILTER.DAT*: Default Input Data file for a Lumped Element Highpass Filter.
   e. *BPFILTER.DAT*: Default Input Data file for a Lumped Element Bandpass Filter.
   f. *BSFILTER.DAT*: Default Input Data file for a Bandstop Filter.
   g. *Quick Start User Manual*: This User Manual.
   h. *License*: License Agreement for the software product.
4. NOTE: All files unzipped inside your computer must be located in the same file folder, since several Data Files are read by the executable software product.
5. Open the License Agreement so you know the terms & conditions for using the software product. Return the software product for a full refund if you do not agree with those terms & conditions, as stated in the License Agreement.
6. Open the Default Data File: *LEfilter.DEF* using Notepad and read the description contained inside.

Once the above software files are extracted and stored inside your computer, just double-click on the executable file to start using the product.

2.0   How I Works:

Software product: *LEfilter.exe* performs Electrical Synthesis and Frequency Analysis of Lowpass, Highpass, Bandpass or Bandstop Lumped Element Filters constructed with lumped-element inductors and capacitors.

The executable file: *LEfilter.exe* reads the Default Data File: *LEfilter.DEF* each time you start the program. As such, you can change Data Entries inside *LEfilter.DEF* to suite your most common Lumped Element Filter designs, using the guidelines written in *LEfilter.DEF*.

When you start using the software product, you are asked to enter key design parameters for your Lumped Element Filter. If you press <ENTER> on your computer's keyboard, the software product uses the Data Entry from your Default Data File: *LEfilter.DEF* for that design parameter. As such, you can change any/all Data Entries in *LEfilter.DEF* to suite your most common Lumped Element Filter designs, without having to enter those values when asked by the executable file: *LEfilter.exe*. Just press <ENTER> on your computer's keyboard and your Default Data values are used for that Data entry by the software product.

Figure 2-1 shows the baseline data entries for Default Data file: *LEfilter.DEF*.

Certain design parameters have a "default answer", shown as an asterisk (*), which enables you to press <ENTER> on your keyboard, if that "default answer" (= *) is your selection.

Lastly, all Data entries (including Default Data entries) are included in the Output Data format so you know the basis for your Synthesis and for your Analysis of Lumped Element Filters.

Most data entries are straight-forward and easy to understand for those skill-at-the-art of RF/microwave design.......and those not-so-skilled. So, let us know where improvements are needed as you operate the software product.

3.0   Screen Shots: Input Data

Screen-shots for User Input Data entry are shown in Figures 3-1 and Figure 3- 2 for Electrical Synthesis and for Frequency Analysis of your Lumped Element Filters, respectively.

4.0   Screen Shots: Output Data

Screen-shots of Output Data calculated by the software product are shown in Figures 4-1 and Figure 4-2 for Electrical Synthesis and for Frequency Analysis of your Lumped Element Filters, respectively.

The Output Data from the software product can be stored in a User-defined filename:
   A. Enter a *filename*.**xls** for storage in a spreadsheet.
   B. Enter *filename*.**doc** for Output Data storage in a word processor.
   C. Enter *filename*.**txt** for Output Data storage as a text file.

The Output Data files can be used for presentations to your Customers, e-mails to your colleagues, and for graphical plots of your Output Data.

5.0   User Data Files:

For the Analysis Option, the software product reads a User's Input Data filename to analyze the Frequency response of electrical circuit planned for manufacture of your Lumped Element Filter.

You can create any number of User Input Data files, each of which defines the actual electrical circuit of your Lumped Element Filters. Once created, you can enter that Input Data filename

when asked by the software product, for Frequency Analysis and for comparison with actual measured data for that design.

6.0   Software Bugs

Every effort has been applied to minimize "software bugs" inside the software product. Yet, we invite all Users to notify us if you find one. Many thanks!

Inside the software product, you will find "User-friendly Error Traps", which identify errors in your Data Entry. The software product notifies you when an error is detected and asks for a different Data Entry, so the software product performs within the proper technical bounds for the technology.

7.0   Customer Satisfaction:

Many thanks for purchasing our RF/microwave CAE software product. We hope you find the product useful in your high frequency designs, both in Synthesis of your designs and in Analysis of your designs. Please let us know where our software product can be improved, and what your needs are for another software product you could use. . . . .. perhaps we can develop that software product for you.

Our best regards. . . . .

AtlantaRF

This file: LEfilter.DEF contains all Default Data values read by Program: LEfilter.exe
```
  0.02              :AM    = Passband Amplitude Ripple (Chebyshev response)..........dB
  40.0              :A1    = Attenuation at out-of-band skirt frequency (F1)..................dB
 200.0              :FC1   = Low-pass/High-pass cut-off frequency...............................MHz
 400.0              :FH1   = Band-pass/Band-stop upper passband cut-off frequency...MHz
 200.0              :FL1   = Band-pass/Band-stop lower passband cut-off frequency...MHz
 800.0              :Fmax  = Maximum Analysis Frequency.........................................MHz
  25.0              :Fmin  = Mimimum Analysis Frequency...........................................MHz
FILTER.DAT          :FNI   = Default Input Data filename for your Filter
LEfilter.DAT        :FNO   = Default filename for your Output Data Storage
 300.0              :F1    = Skirt frequency for out-of-band Attenuation.......................MHz
  25.0              :Fstep = Analysis Frequency Step Size...........................................MHz
  10.0              :N     = Number of Sections in your Filter
   0.0              :ZIL   = Imaginary part of  Load  impedance…...Ohms
   0.0              :ZIS   = Imaginary part of Source impedance......Ohms
  50.0              :Zo    = System characteristic Impedance..........Ohms
  50.0              :ZRL   =  Real part of  load  impedance...............Ohms
  50.0              :ZRS   =  Real part of source impedance............Ohms
                    |
                    |____ The first 20 characters in each line are read by LEfilter.exe
```

Default Data File: LEfilter.DEF is read by RF/microwave software product: LEfilter.exe
when you start the program. As such, the executable file (LEfilter.exe) and this Default
Data File (LEfilter.DEF) must be located in the same Folder or Subfolder in your computer.

The executable program (LEfilter.exe) reads the first 20 characters in each line from
LEfilter.DEF, so keep those first 20 characters for data, and do not shorten any line
in this Default Data File: LEfilter.DEF.

The User is invited to change any/all data values in LEfilter.DEF to data values that
you commonly use for your RF/microwave designs of Lumped-element Low/Highpass &
Bandpass/stop Filters, so you do not have to enter data values when prompted by LEfilter.exe
(just press ENTER on your computer's keyboard and your Default Data values will be assigned
to that data entry).

NOTE: The default data values shown above are for 10-section Chebyschev Lowpass Filter with
a cut-off frequency = 200MHz that is analyzed from 50MHz to 800MHz in 50MHz step size.

Thank you for choosing Atlanta RF for your RF/microwave CAE software products.

Figure 2-1: Baseline data entries (and Instructions) in **Default Data file**: LEfilter.DEF

Copyright 2012 Atlanta RF Software (www.AtlantaRF.com)
RF/Microwave Computer-Aided Engineering Software
Program: LEfilter (v. 1.0)   Date:10/20/2012

This Program performs Electrical SYNTHESIS and Frequency ANALYSIS
of Lumped Element Low-Pass, High-Pass, Band-Pass and Band-Stop Filters
having a Chebyscheff or Butterworth response across their passband.

Please select a Program FUNCTION:
   1 = Frequency ANALYSIS of a known Filter Design.
  *2 = Electrical SYNTHESIS of a new Filter design.
Program FUNCTION selected = **2**

Please select an OPTION for Filter Design:
  *1 = Chebyschev (Equi-ripple) Response.
  2 = Butterworth (Maximally flat) Response.
Response OPTION selected = **1**

Please select a Filter DESIGN for Synthesis:
  *1 = Low Pass Filter.
  2 = High Pass Filter.
  3 = Band Pass Filter.
  4 = Band Stop Filter.
Filter DESIGN selected = **1**

Please enter the following DESIGN DATA:
  -Low Pass Cutoff Frequency (FC1), MHz = **200.0**
  -Passband Amplitude Ripple (Am), dB   = **0.02**
  -Resultant Passband VSWR level   = 1.145
  -Number of sections in Filter   (N)   = **(No Entry)**
  -Out of Band Skirt Frequency (F1), MHz = **300.0**
  -Attenuation at Skirt Freq.   (A1), dB   = **40.0**
  -Number of sections needed in Filter   = 9
  -Actual Attenuation at   300.00 MHz, dB   = 45.86
  -Impedance Level of System (Zo), Ohms = **50.0**

Is Output Data STORAGE desired (1=YES) = **1**
Enter a FILENAME (up to 20 characters) for Output Data storage:
  -Enter: Filename.xls for storage in a spreadsheet
  -Enter: Filename.doc for storage in a word processor
  -Enter: Filename.txt for storage as a text document
  Enter your FILENAME for Output Data Storage: **LEfilter-SYN.DAT**

User Data Entries are shown in **RED text**

Figure 3-1: Typical Input Data entry for **Electrical Synthesis** in LEfilter.exe

Copyright 2012 Atlanta RF Software (www.AtlantaRF.com)
RF/Microwave Computer-Aided Engineering Software
Program: LEfilter (v. 1.0)   Date:10/20/2012

This Program performs Electrical SYNTHESIS and Frequency ANALYSIS
of Lumped Element Low-Pass, High-Pass, Band-Pass and Band-Stop Filters
having a Chebyscheff or Butterworth response across their passband.

Please select a Program FUNCTION:
   1 = Frequency ANALYSIS of a known Filter Design.
  *2 = Electrical SYNTHESIS of a new Filter design.
Program FUNCTION selected = **1**

Select an OPTION for Analysis of Electrical Circuit:
   1 = User enters values for Filter`s Circuit Elements.
  *2 = User enters Data Filename for Circuit Elements.
Analysis OPTION selected = **2**

Enter a FILENAME that contains Circuit Elements
for your Filter`s Design (up to 20 characters) = **FILTER.DAT**

Attempting to read User Data File: FILTER.DAT .....Completed.
   -Number of sections in Filter (N) = 7

Enter complex Source and Load Impedances of Filter:
   -Source: Real part (Rs), Ohms = **50.0**
   -Source: Imag. part (Xs), Ohms = **0.0**
   -Load : Real part   (Rl), Ohms = **50.0**
   -Load : Imag. Part   (Xl), Ohms = **0.0**

Please enter a Frequency range for Filter ANALYSIS:
   -Analysis Start Frequency, MHz = **25.0**
   -Analysis Stop Frequency, MHz = **800.0**
   -Analysis Step Frequency, MHz = **25.0**

Is Output Data STORAGE desired (1=YES)= **1**
Enter a FILENAME (up to 20 characters) for Output Data storage:
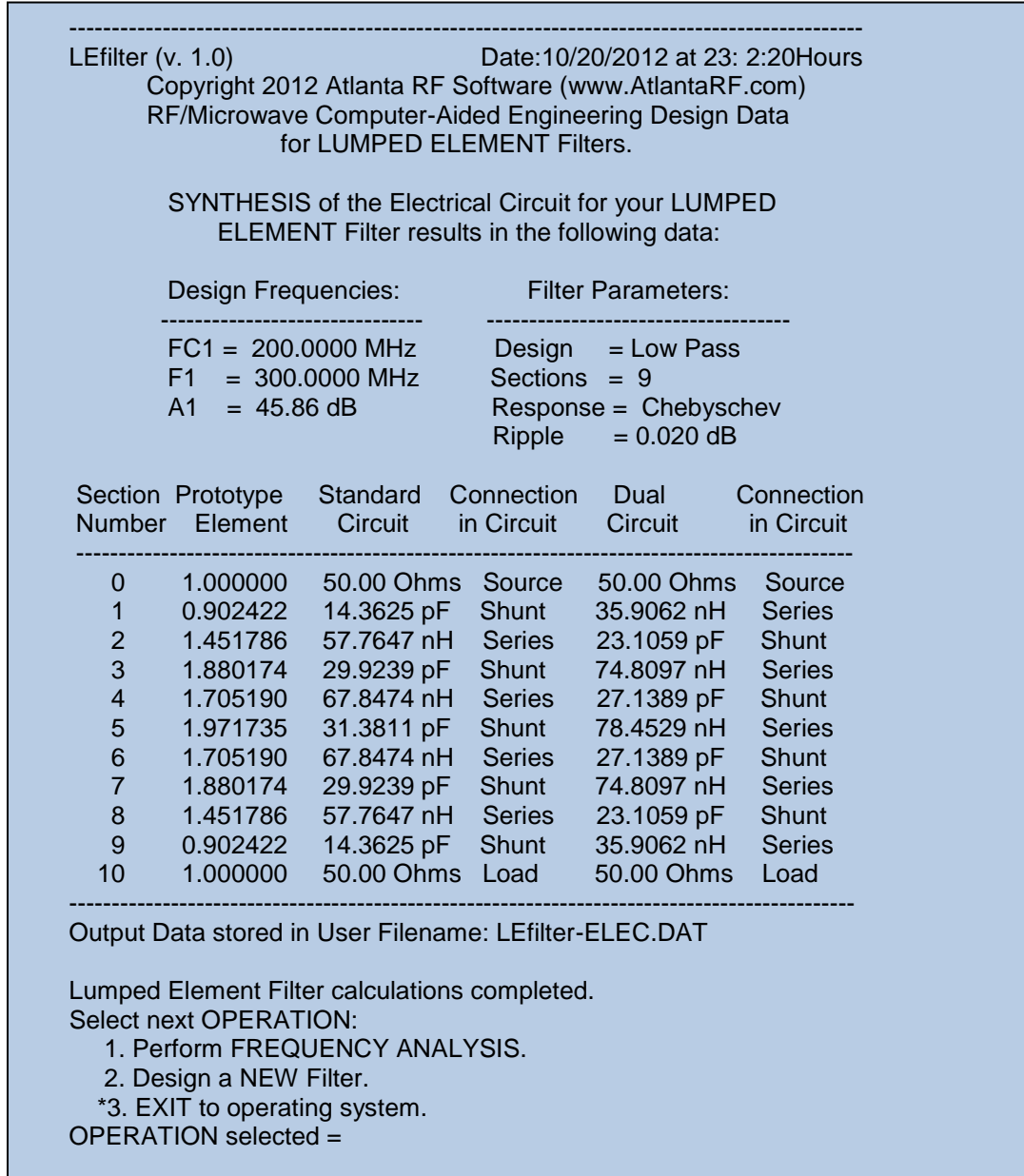   -Enter: Filename.xls for storage in a spreadsheet
   -Enter: Filename.doc for storage in a word processor
   -Enter: Filename.txt for storage as a text document
   Enter your FILENAME for Output Data Storage: **LEfilter-ANA.DAT**

> User Data
> Entries are
> shown in
> **RED text**

Figure 3-2: Typical Input Data entry for **Frequency Analysis** in LEfilter.exe

```
------------------------------------------------------------------------------------------
LEfilter (v. 1.0)                        Date:10/20/2012 at 23: 2:20Hours
         Copyright 2012 Atlanta RF Software (www.AtlantaRF.com)
         RF/Microwave Computer-Aided Engineering Design Data
                   for LUMPED ELEMENT Filters.

         SYNTHESIS of the Electrical Circuit for your LUMPED
            ELEMENT Filter results in the following data:

    Design Frequencies:              Filter Parameters:
    -----------------------------    ------------------------------------
    FC1 =  200.0000 MHz      Design    = Low Pass
    F1   = 300.0000 MHz      Sections  = 9
    A1   = 45.86 dB          Response = Chebyschev
                             Ripple     = 0.020 dB

 Section Prototype   Standard  Connection   Dual      Connection
 Number  Element     Circuit   in Circuit   Circuit   in Circuit
 ------------------------------------------------------------------------------------------
    0    1.000000   50.00 Ohms  Source   50.00 Ohms   Source
    1    0.902422   14.3625 pF  Shunt    35.9062 nH   Series
    2    1.451786   57.7647 nH  Series   23.1059 pF   Shunt
    3    1.880174   29.9239 pF  Shunt    74.8097 nH   Series
    4    1.705190   67.8474 nH  Series   27.1389 pF   Shunt
    5    1.971735   31.3811 pF  Shunt    78.4529 nH   Series
    6    1.705190   67.8474 nH  Series   27.1389 pF   Shunt
    7    1.880174   29.9239 pF  Shunt    74.8097 nH   Series
    8    1.451786   57.7647 nH  Series   23.1059 pF   Shunt
    9    0.902422   14.3625 pF  Shunt    35.9062 nH   Series
   10    1.000000   50.00 Ohms  Load     50.00 Ohms   Load
 ------------------------------------------------------------------------------------------
Output Data stored in User Filename: LEfilter-ELEC.DAT

Lumped Element Filter calculations completed.
Select next OPERATION:
     1. Perform FREQUENCY ANALYSIS.
     2. Design a NEW Filter.
    *3. EXIT to operating system.
OPERATION selected =
```

Figure 4-1: Typical Output Data for **Electrical Synthesis** from LEfilter.exe

```
-------------------------------------------------------------------------------
LEfilter (v. 1.0)                      Date:10/20/2012 at 23: 4:16Hours
        Copyright 2012 Atlanta RF Software (www.AtlantaRF.com)
        RF/Microwave Computer-Aided Engineering Design Data
              for LUMPED ELEMENT Filters.

        Rs = 50.0 Ohms                    Rl = 50.0 Ohms
        Xs =  0.0 Ohms                    Xl =  0.0 Ohms

   Frequency ANALYSIS of the  7-Section User-defined Low Pass
          Filter results in the following response profile:
```

				Thru Path		
Analysis	Input Impedance		Input	------------------------		Time
Frequency	----------------------		Port	Loss	Phase	Delay
(MHz)	Real	Imaginary	VSWR	(dB)	(Deg)	(nsec)
25.0000	42.49	-7.79	1.26	-0.059	-39.12	4.317
50.0000	37.29	-2.36	1.35	-0.096	-77.92	4.344
75.0000	44.38	2.78	1.14	-0.019	-118.02	4.589
100.0000	52.07	-7.51	1.16	-0.025	-160.41	4.810
125.0000	42.56	-11.96	1.36	-0.100	155.48	5.037
150.0000	45.27	-1.39	1.11	-0.012	107.23	5.772
175.0000	61.11	-10.90	1.32	-0.085	51.15	6.712
200.0000	53.94	15.35	1.36	-0.100	-22.81	10.999
225.0000	30.39	-189.34	25.80	-8.427	-118.92	6.997
250.0000	0.41	-73.20	383.71	-19.842	-158.67	2.836
275.0000	0.03	-51.70	999.99	-28.793	-178.08	1.667
300.0000	0.01	-41.60	999.99	-36.170	169.52	1.149
325.0000	0.00	-35.39	999.99	-42.511	160.58	0.859
350.0000	0.00	-31.07	999.99	-48.109	153.72	0.675
375.0000	0.00	-27.84	999.99	-53.142	148.22	0.551
400.0000	0.00	-25.31	999.99	-57.725	143.69	0.458
425.0000	0.00	-23.25	999.99	-61.940	139.88	0.391
450.0000	0.00	-21.54	999.99	-65.849	136.61	0.338
475.0000	0.00	-20.08	999.99	-69.495	133.77	0.294
500.0000	0.00	-18.83	999.99	-72.915	131.28	0.260
525.0000	0.00	-17.74	999.99	-76.138	129.07	0.232
550.0000	0.00	-16.78	999.99	-79.185	127.10	0.208
575.0000	0.00	-15.92	999.99	-82.077	125.32	0.187
600.0000	0.00	-15.15	999.99	-84.829	123.72	0.169
625.0000	0.00	-14.46	999.99	-87.455	122.26	0.156
650.0000	0.00	-13.83	999.99	-89.967	120.92	0.142
675.0000	0.00	-13.26	999.99	-92.374	119.70	0.131
700.0000	0.00	-12.73	999.99	-94.685	118.57	0.120
725.0000	0.00	-12.25	999.99	-96.908	117.53	0.112
750.0000	0.00	-11.80	999.99	-99.050	116.56	0.104
775.0000	0.00	-11.39	999.99	-101.116	115.66	0.096
800.0000	0.00	-11.00	999.99	-103.112	114.82	0.091

```
-------------------------------------------------------------------------------
Output Data stored in User Filename: LEfilter-ANA.DAT
```

Figure 4-2: Typical Output Data for **Frequency Analysis** from LEfilter.exe