Technical Data:
VBEPS

MuEps SOFTWARE

Software & Training services for measurement, prediction, and design of electromagnetic materials.

Software for Calculation of Permittivity by Transmission Measurement

VBEPS is a Windows based an all inclusive program for the computation of complex permittivity from transmission measurement.

The underlying assumption is that transmission measurements have been made by a network analyzer such as Hewlett Packard HP-8510 and the I-Q, (In-phase and Quadrature phase), output has been saved as an ASCII file which can be read by a PC.

The program will read the CITIFILE header format of the HP network analyzer and it can be optionally customized to read any other header format which contains additional information such as the layer thickness. Such customization must be specified at the time of purchase.

Version 2.6 added the display and tabulation of the loss tangent which some users indicated that they would like to have.

VBEPS will compute complex permittivity for the following cases:

1. Single layer, normal incidence.

   Such measurements are usually made in free space, microwave tunnel and in a coax fixture.

2. Single layer arbitrary angle of incidence TE and TM polarization modes.

3. Single layer in a rectangular waveguide operating in the dominant TE10 mode.

4. All above with multiple layers, where the unknown layer is sandwiched between layers whose properties are known.

   Chief application is the measurement of liquids which can be placed in a sample holder and materials such as paints which can be deposited on a substrate.

   The program assumes that the "known" layers are materials whose properties are frequency independent over the frequency range of interest. This is almost always the case with low loss materials which are commonly used for containers or substrates.

A version of this program which could read the "known" material properties from the user specified material data base or data files could be provided as an option.

Measured complex permittivity can be least square fitted (LSF'd) to a Debye and/or Lorentzian oscillator. This will allow the user to quantify the measured results in a concise way. Debye representation is especially useful in the quantification of artificial dielectrics such as embedded carbon fibers in a foam matrix. Lorentzian representation is useful for artificial dielectrics with highly conductive particles. Both are useful for a limited extrapolation of measured permittivity to frequencies outside the measured range.

Quite frequently segments of the measured data, particularly at the low and the high ends of the frequency band are clearly in error. With few clicks of the mouse, these questionable segments of measured data can be readily excluded from the Debye and Lorentzian analysis and make these representations more meaningful.

All inputted and computed parameters are automatically displayed by tables with vertical scroll bars and full screen graphics. To facilitate reading of graphics, pressing the left key of the mouse will display the x and y coordinates of the selected point.

Graphics can be interactively customized by the user. The user can change scales, colors of the plots, fonts, labels, grid display and many other features.

With a click of the mouse all graphics can be printed or stored on the clipboard as bit maps which can then be scaled and pasted into slides and documents.

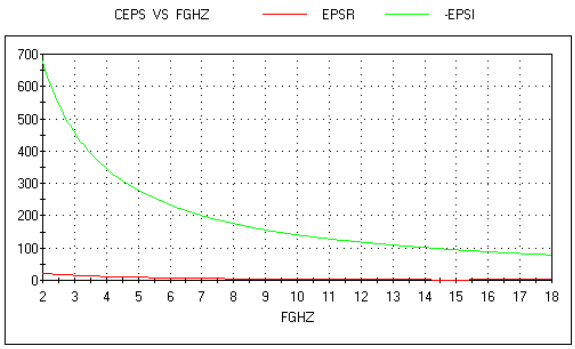
All computed information is automatically stored in ASCII files winch can be easily ported to spread sheets, or incorporated into reports.

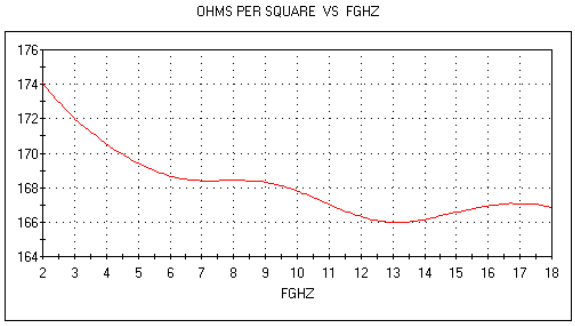
User interface is written in Microsoft Visual Basic Version 6. Virtually all mathematical computations are performed by FORTRAN subroutines embedded in DLL, the Dynamically Linked Library. Fortran compiler is the Microsoft Power Station 4. Graphics are the Olectra Chart, Version 5.02 by KL Group. All files generated by the program are ASCII files. The output for the free space measurement of a resistive film is shown below.

VBEPS VER 2.7 - CEPS FROM TRANSMISSION - DEMO COPY - BY STEVEN WEISBROD - JANUARY 2004.

Exit Open I-Q DBT PHT CEPS LTAN Ohms/Sq. Clear X Debye Lorentzian .INI File GAMMA Help

Output file is H:\RJ DOCUMENTS\VBROP\ROPDATA\AMERICAN
T_IN=0.0030; T_CM=0.0076; AOI=0.0000; POL=TE; N2PI=0; NL=1; NK=1





06011-23-1 THROUGH 10
DBT, PHT, CEPS, LTAN, and Ohms/Square vs FGHZ
Input File is H:\RJ DOCUMENTS\VBROP\ROPDATA\American

X	#	FGHZ	DBT	PHT	EPSR	EPSI	LTAN	OPS	FL
	1	2.000	6.371	-0.961	22.093	-677.536	30.667	174.082	0
	2	2.080	6.375	-0.962	21.272	-652.116	30.656	173.912	0
	3	2.160	6.380	-0.962	20.511	-628.579	30.645	173.741	0
	4	2.240	6.386	-0.968	19.925	-607.018	30.465	173.487	0
	5	2.320	6.391	-0.973	19.336	-586.659	30.341	173.318	0
	6	2.400	6.396	-0.979	18.822	-567.761	30.164	173.117	0
	7	2.480	6.399	-0.981	18.268	-549.850	30.098	172.990	0
	8	2.560	6.403	-0.985	17.782	-533.090	29.979	172.853	0
	9	2.640	6.407	-0.987	17.297	-517.442	29.915	172.684	0
	10	2.720	6.411	-0.988	16.809	-502.685	29.905	172.525	0
	11	2.800	6.415	-0.990	16.377	-488.712	29.842	172.388	0
	12	2.880	6.419	-0.990	15.941	-475.574	29.833	172.229	0
	13	2.960	6.424	-0.991	15.530	-463.174	29.824	172.060	0
	14	3.040	6.427	-0.990	15.111	-451.374	29.871	171.912	0
	15	3.120	6.430	-0.995	14.819	-440.095	29.699	171.797	0
	16	3.200	6.434	-0.996	14.463	-429.435	29.691	171.660	0
	17	3.280	6.437	-0.998	14.149	-419.217	29.628	171.555	0
	18	3.360	6.440	-0.996	13.801	-409.538	29.674	171.429	0
	19	3.440	6.442	-1.000	13.538	-400.160	29.557	171.366	0
	20	3.520	6.445	-1.004	13.292	-391.352	29.443	171.240	0
	21	3.600	6.448	-1.007	13.032	-382.913	29.382	171.125	0
	22	3.680	6.452	-1.009	12.784	-374.864	29.322	170.999	0
	23	3.760	6.455	-1.013	12.569	-367.135	29.210	170.885	0
	24	3.840	6.458	-1.013	12.319	-359.751	29.202	170.759	0
	25	3.920	6.461	-1.015	12.100	-352.625	29.142	170.654	0
	26	4.000	6.464	-1.016	11.870	-345.827	29.136	170.529	0
	27	4.080	6.467	-1.018	11.668	-339.254	29.077	170.424	0
	28	4.160	6.470	-1.018	11.453	-332.934	29.069	170.320	0
	29	4.240	6.472	-1.019	11.245	-326.813	29.062	170.236	0
	30	4.320	6.475	-1.019	11.047	-320.978	29.056	170.121	0
	31	4.400	6.477	-1.019	10.854	-315.278	29.048	170.048	0
	32	4.480	6.479	-1.018	10.649	-309.820	29.093	169.953	0
	33	4.560	6.482	-1.016	10.451	-304.535	29.138	169.869	0
	34	4.640	6.484	-1.011	10.224	-299.451	29.288	169.774	0
	35	4.720	6.487	-1.011	10.060	-294.557	29.281	169.670	0
	36	4.800	6.489	-1.010	9.881	-289.790	29.327	169.587	0
	37	4.880	6.491	-1.012	9.743	-285.145	29.268	169.524	0