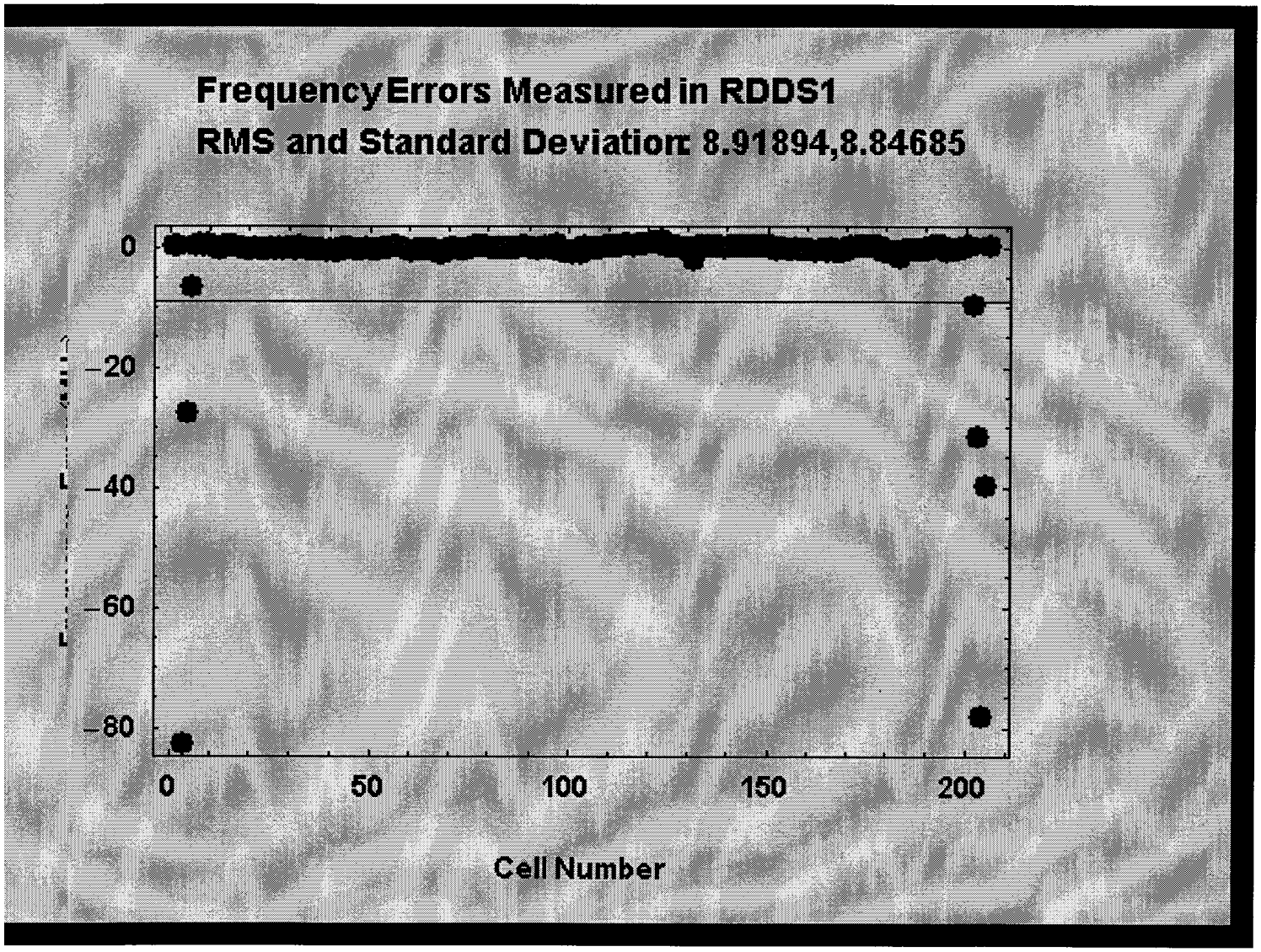
4. Influence of Post-Bonding Errors of Fabrication on the RDDS1 Wakefield

In the fabrication of the RDDS the cells were measured prior to bonding with a CMM (Coordinate Measuring Machine) and they were also measured both indivually and in stacks by microwave transmission. After bonding, CMM measurements have recently been made and this reveals that the last few cells are innacurate to the extent of several hundred microns (200 μm at worst).

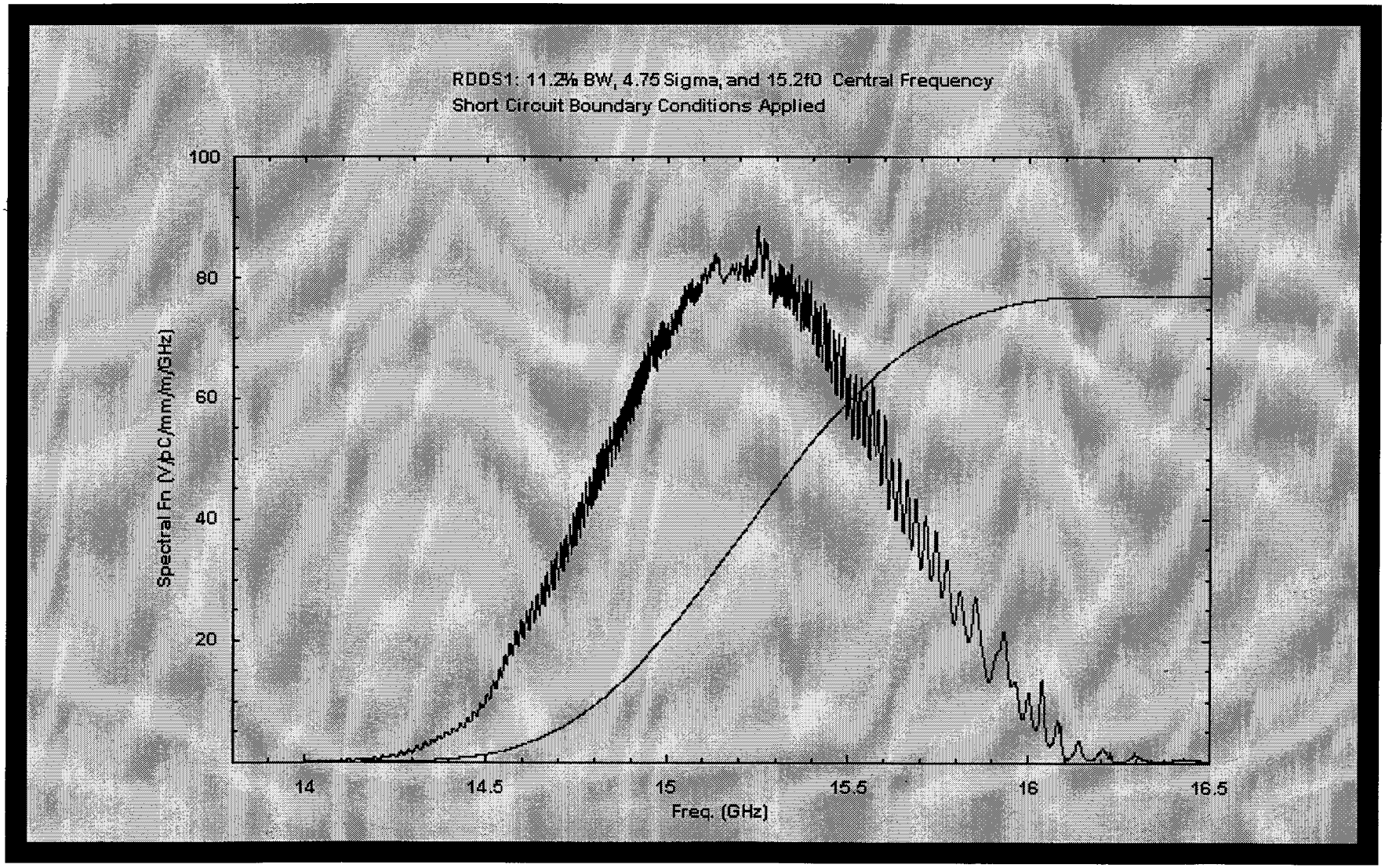
We infer a synchronous frequency error based on the geometrical data and calculate the wakefield that results.

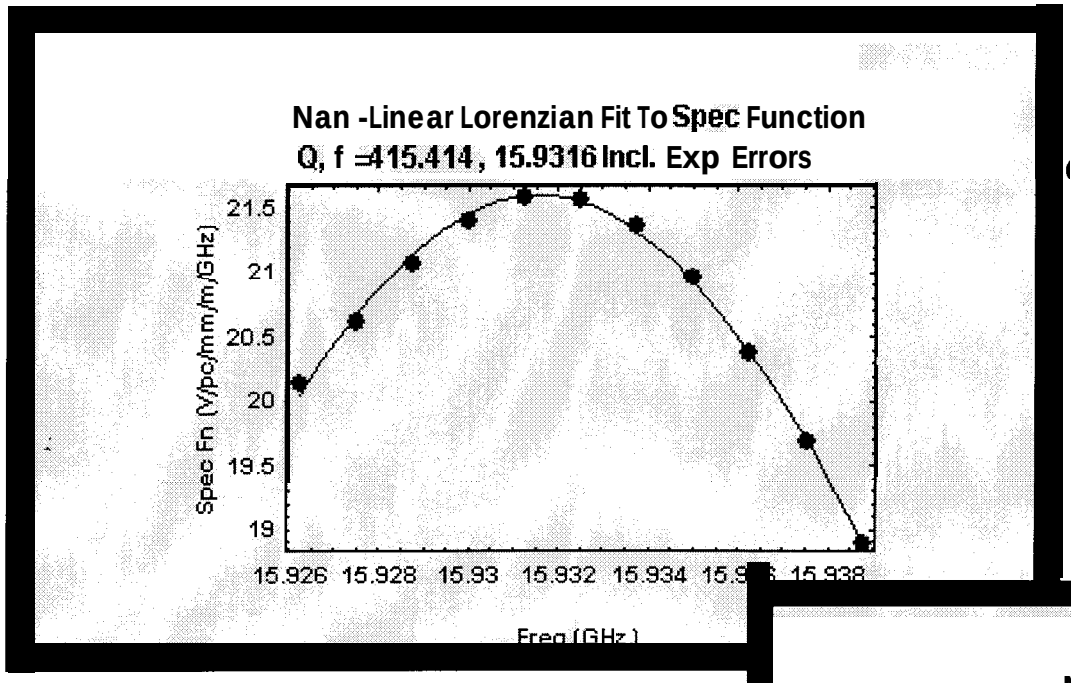
The wakefield which results from purely Pre-Bonding errors (with an RMS of ~0.46MHz) is largely unaffacted.

Post-Bonding errors introduce significant flaring to the ends of the structure and we anticipate frequency errors of the order of 80MHz or so. The wakefield that results from these errors is unacceptable as for the first 2 m or so the wakefield lingers above the 1 V/pC/mm/m value. This is expected to put the beam in the BBU regime. Curing this error by squeezing the cells is underway

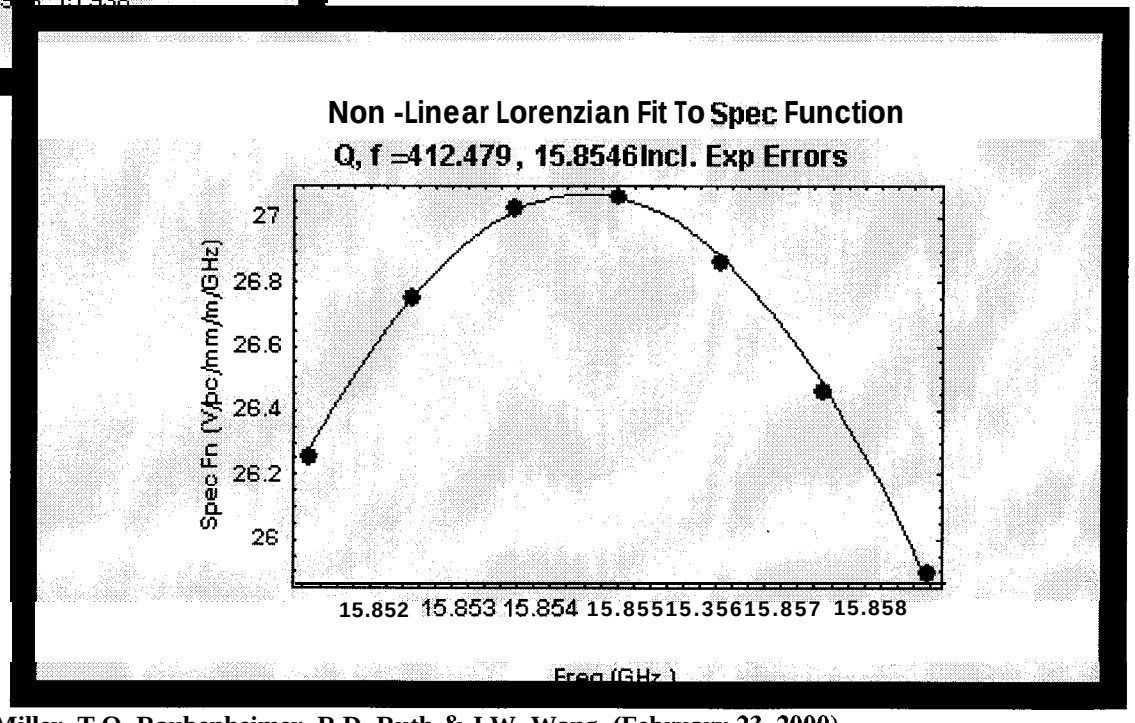

FrequencyErrors Measured in RDDS1
RMS and Standard Deviation: 8.91894,8.84685
0
-20
-40
-60
-80
0
50
100
150
200
Cell Number

RDDS1 Incl. 4 Cells Decoupled, Fundamental Coupler Loading and VSWR of Load. Post-Bonding Errors are Included (Only Low Energy Cell Errors Allowed) .

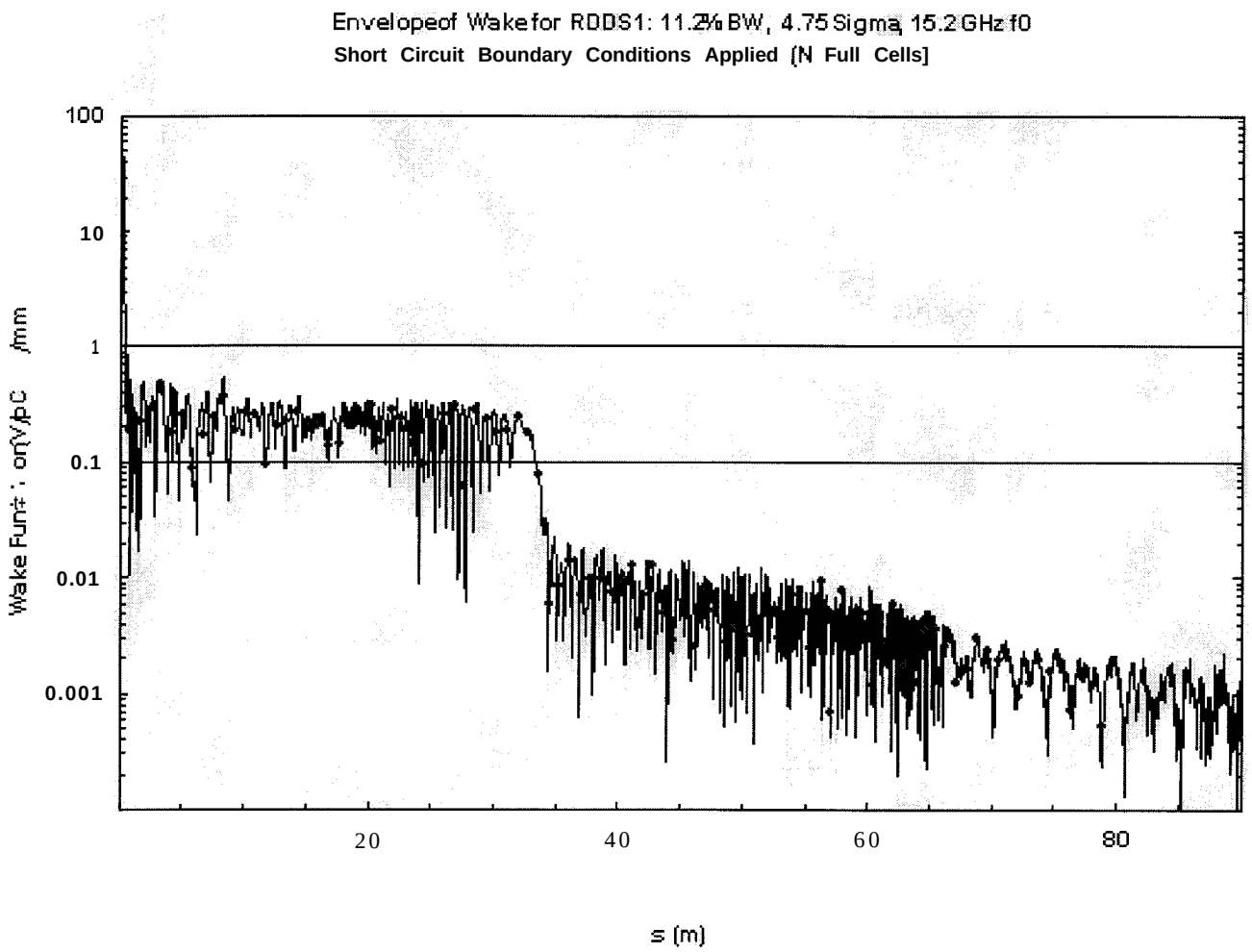




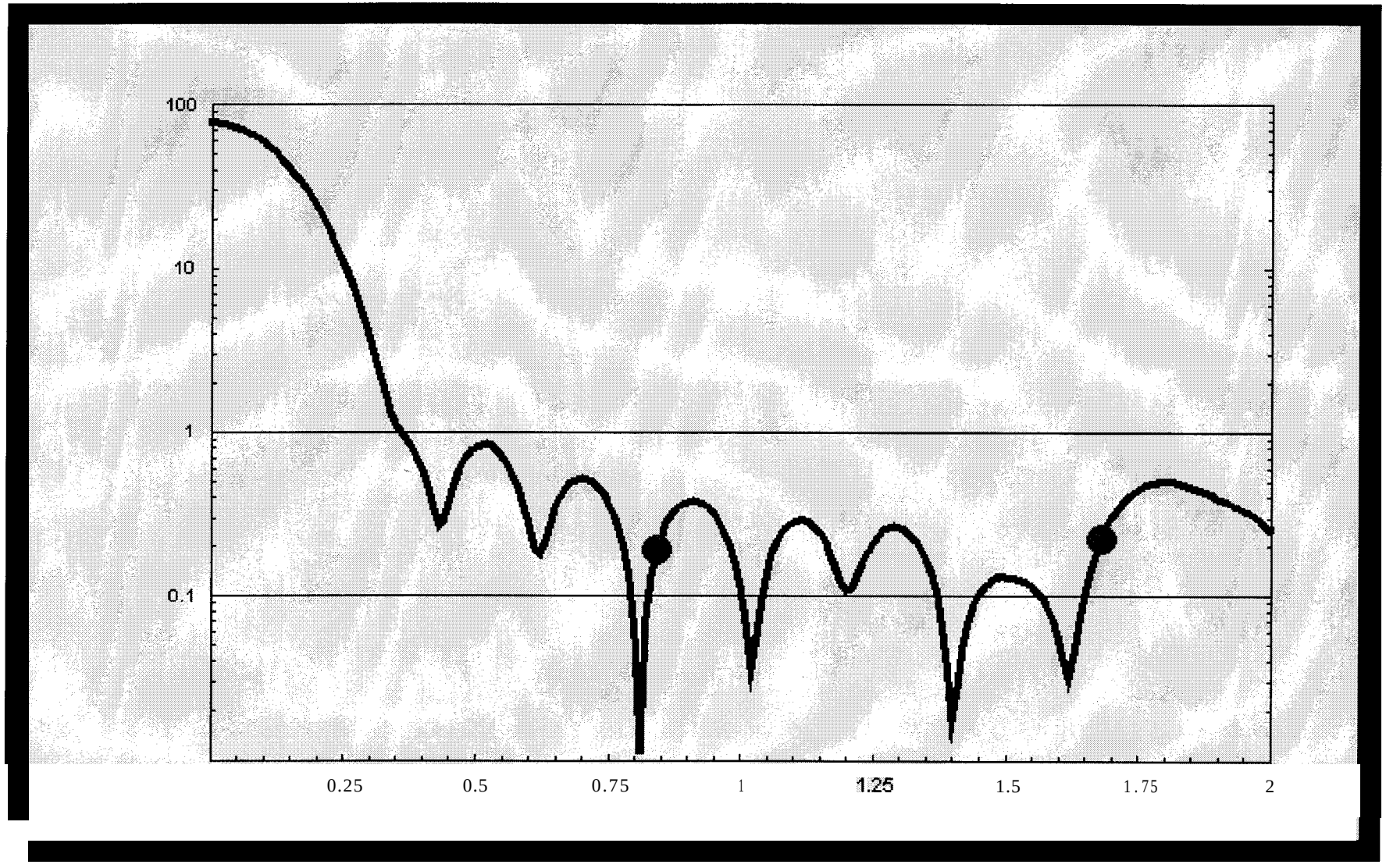
RDDS1 Incl. 4 Cells Decoupled, Fundamental (Coupler Loading and VSWR of Load. Post Bonding Errors are Included (Only Low Energy Cell Errors Allowed) .



RDDS1 Incl. 4 Cells Decoupled, Fundamental Coupler Loading and VSWR of Load. Post-Bonding Errors are Included (Only Low Energy Cell Errors Allowed) .

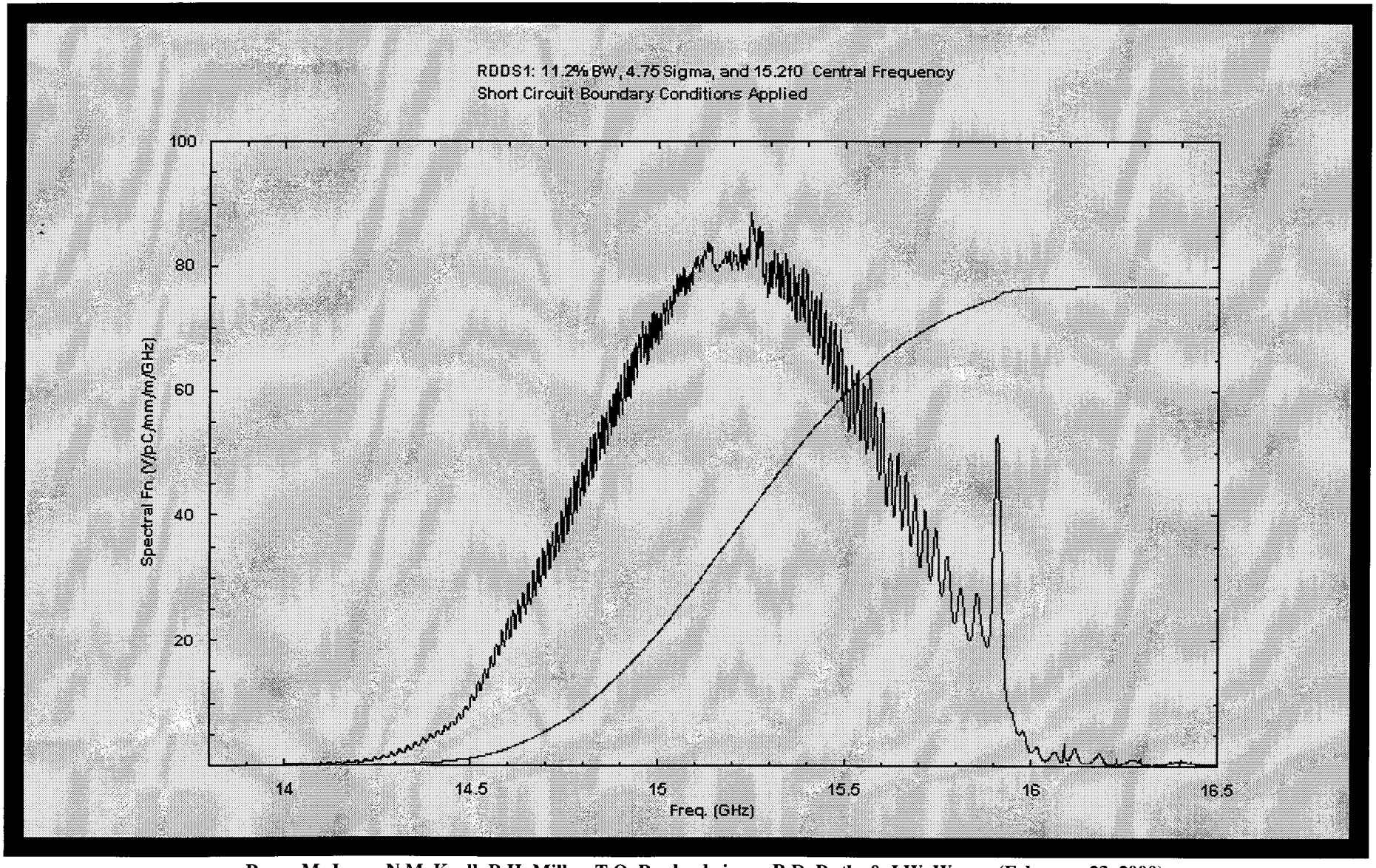


RDDS1 Incl. 4 Cells Decoupled, Fundamental Coupler Loading and VSWR of Load. Post-Bonding Errors are Included (Only Low Energy Cell Errors Allowed) .



Roger M. Jones, N.M. Kroll, R.H. Miller, T.O. Raubenheimer, R.D. Ruth & J.W. Wang. (February 23, 2000)

RDDS1 Incl. 4 Cells Decoupled, Fundamental Coupler Loading and VSWR of Load.
Post-Bonding Errors are Included



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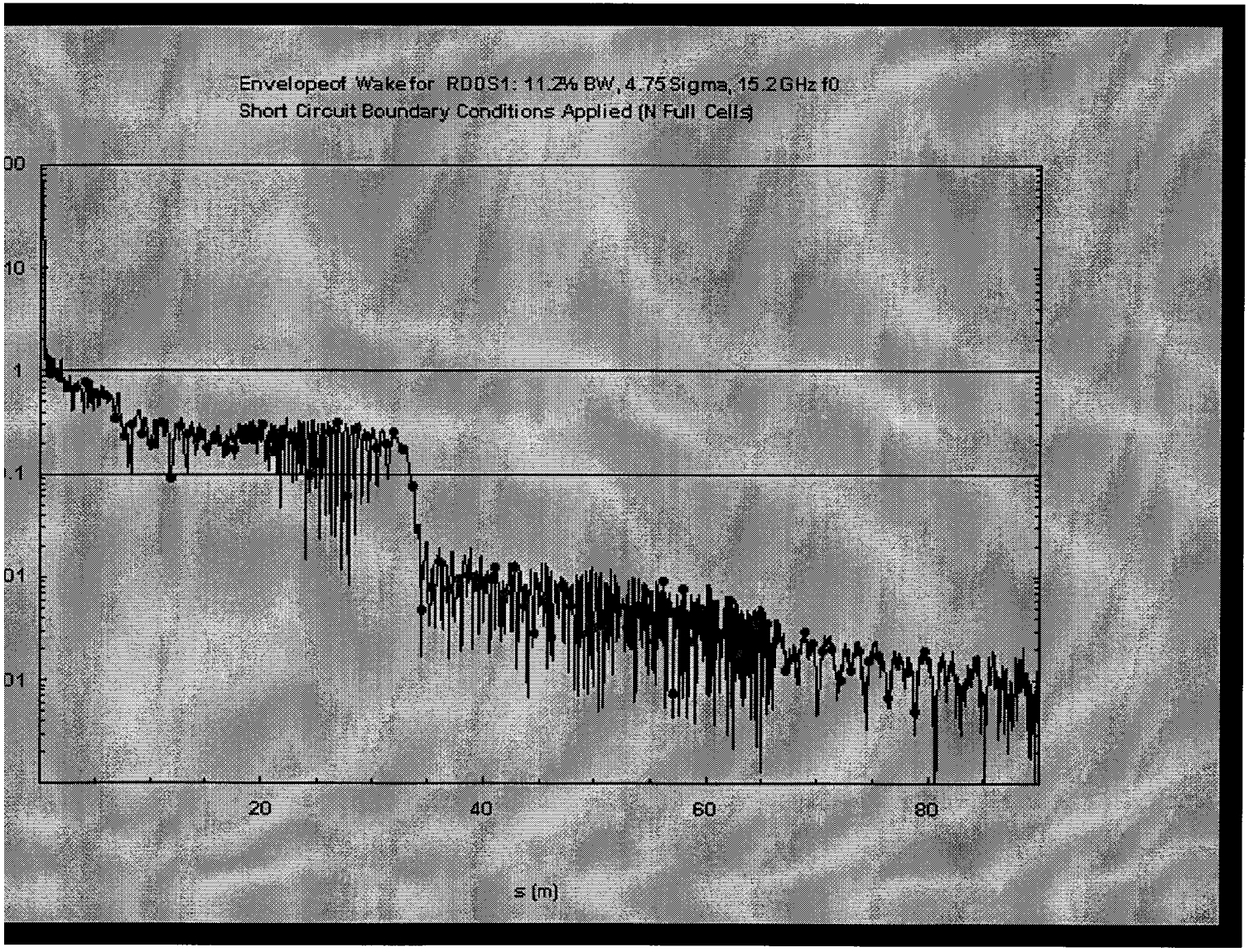
S1 Incl. 4 Cells Decoupled, Fundamental Coupler Loading and VSWR of Load. Post-Bonding Errors are Included



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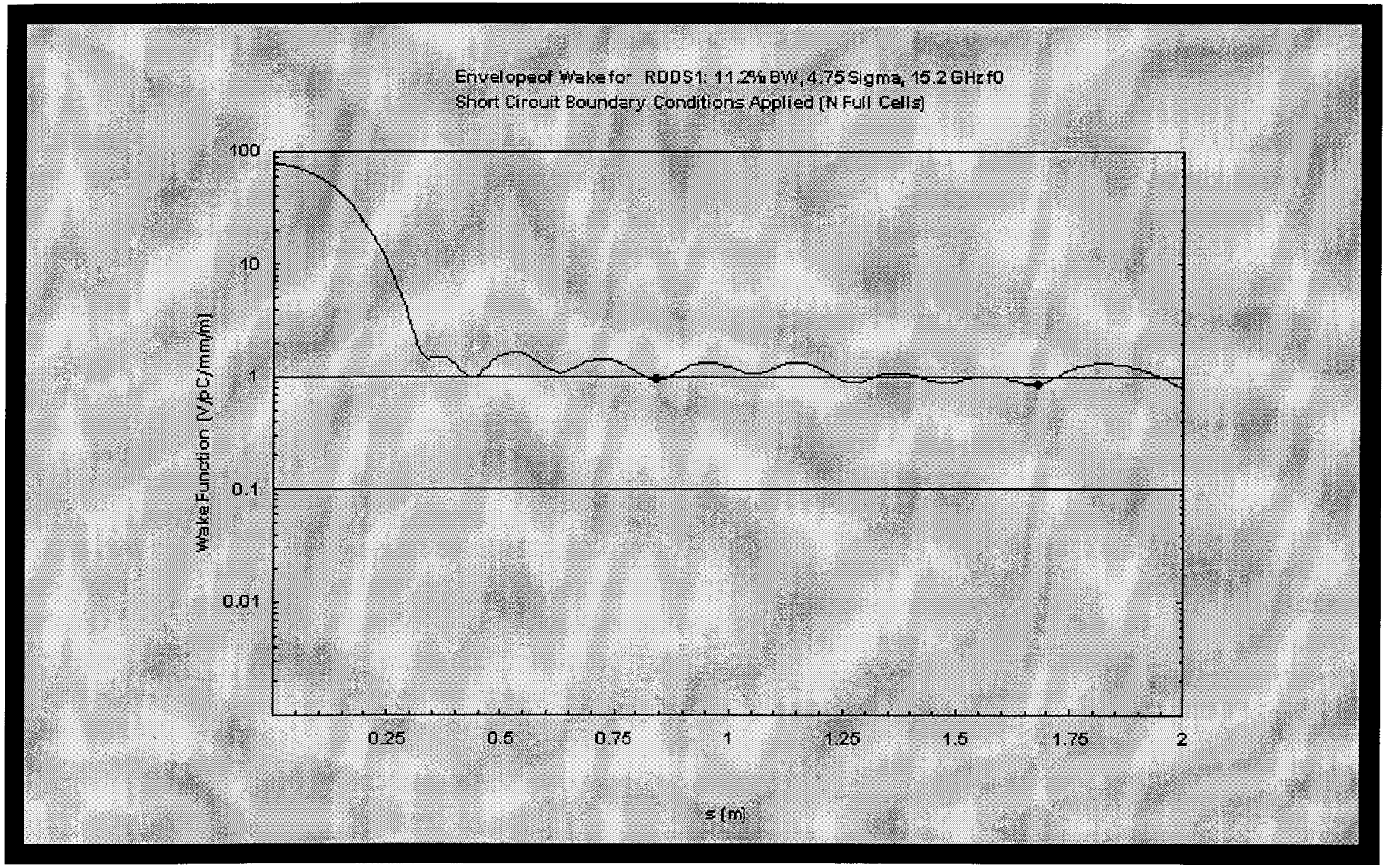
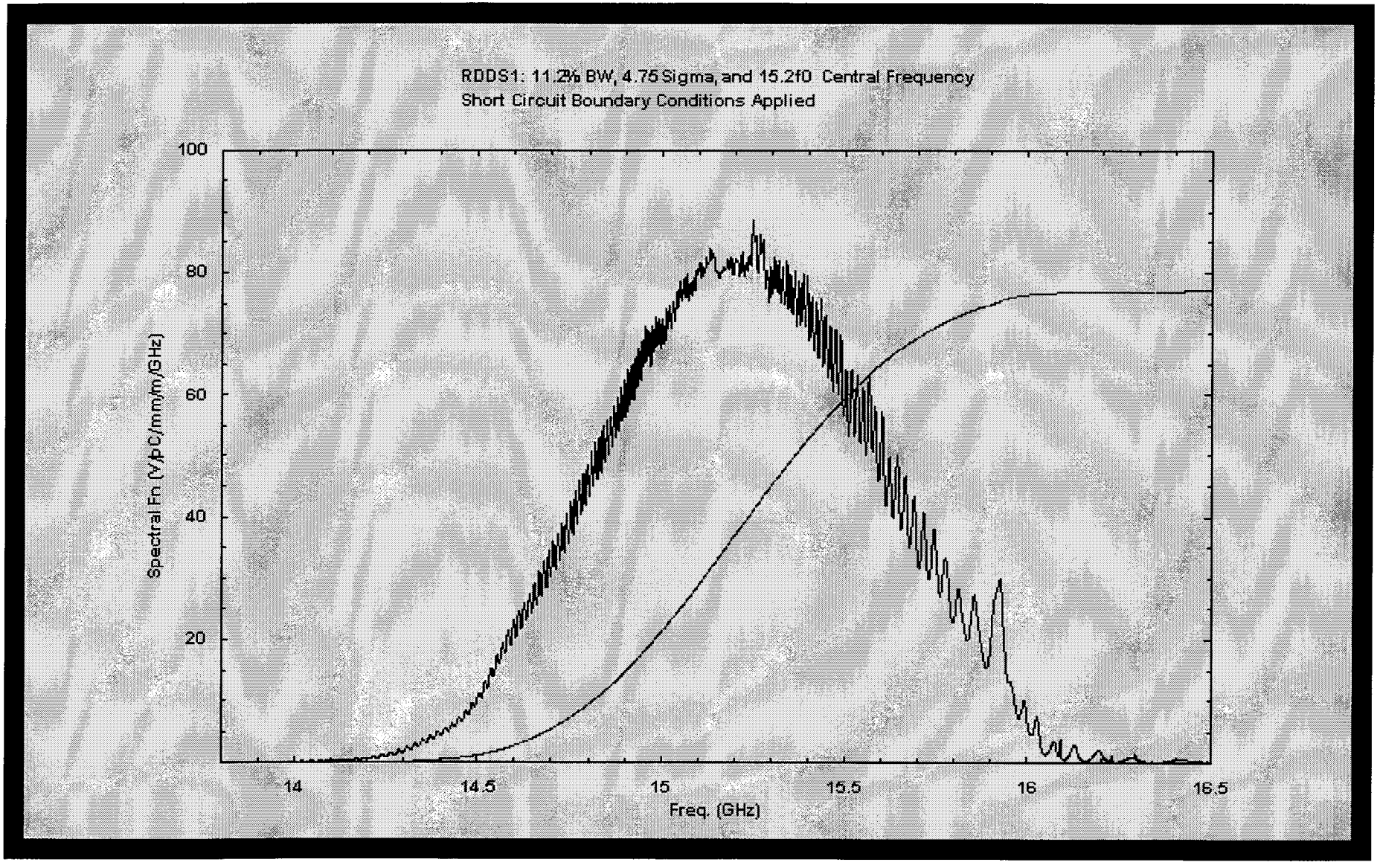
RDDS1 Incl. 4 Cells Decoupled, Fundamental Coupler Loading and VSWR of Load. Post-Bonding Errors are Included



RDDS1 Incl. 4 Cells Decoupled, Fundamental Coupler Loading and VSWR of Load. Post-Bonding Errors are Included (50% Reduced High Energy Cell Errors).



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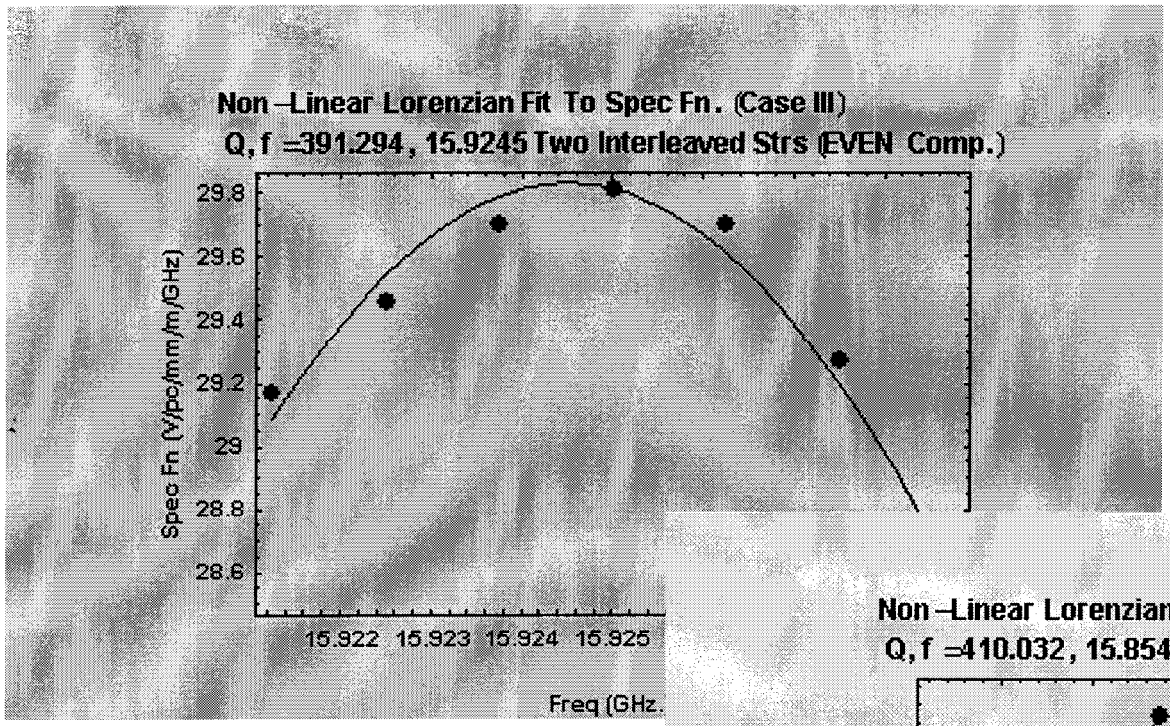

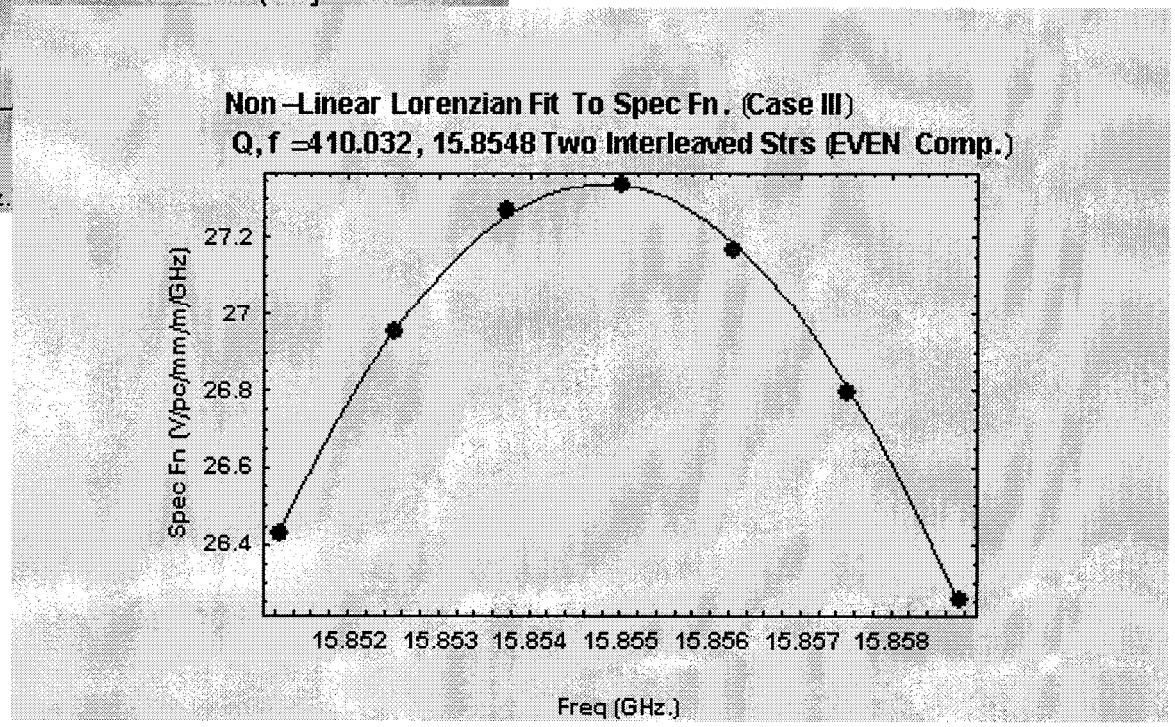

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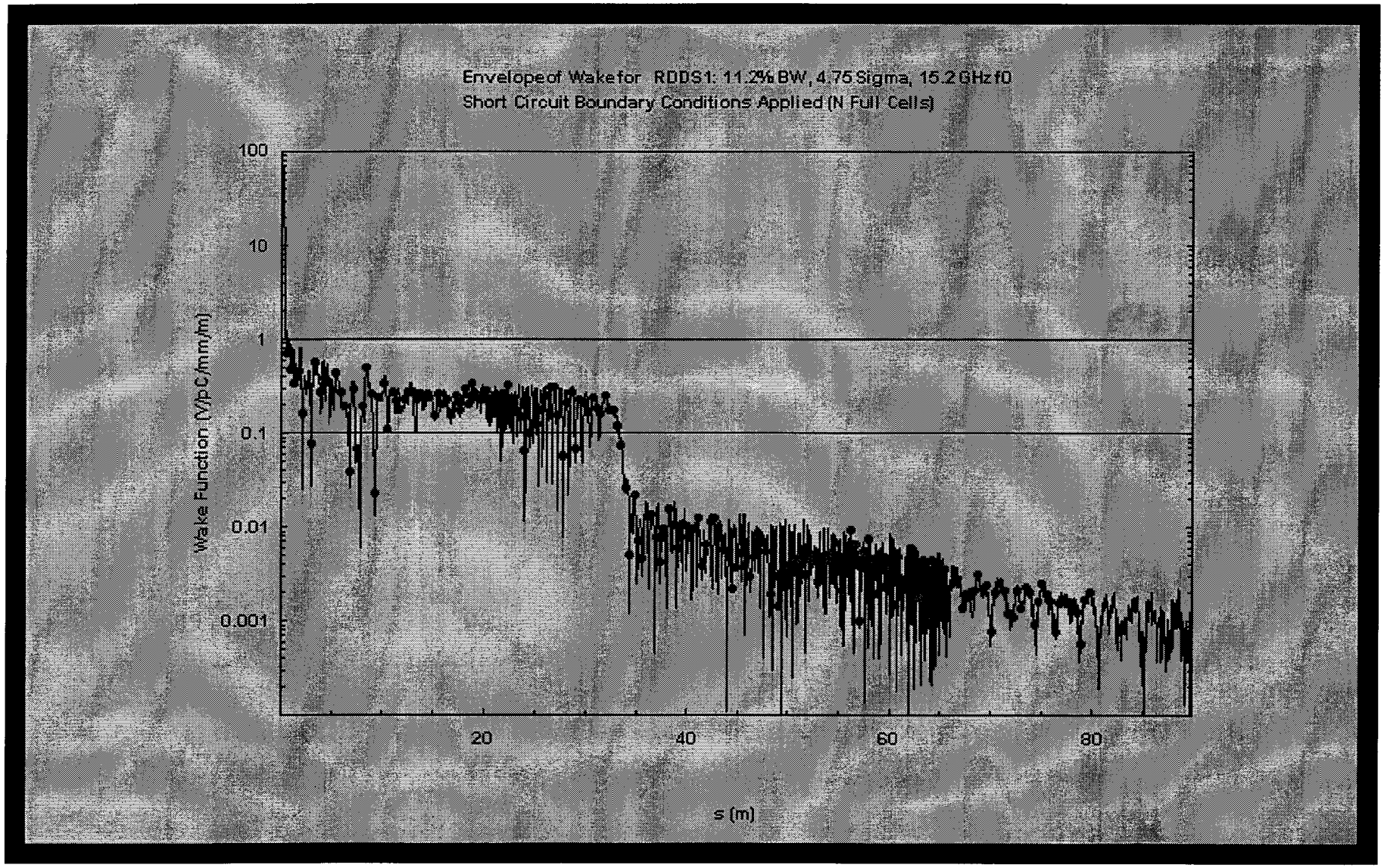

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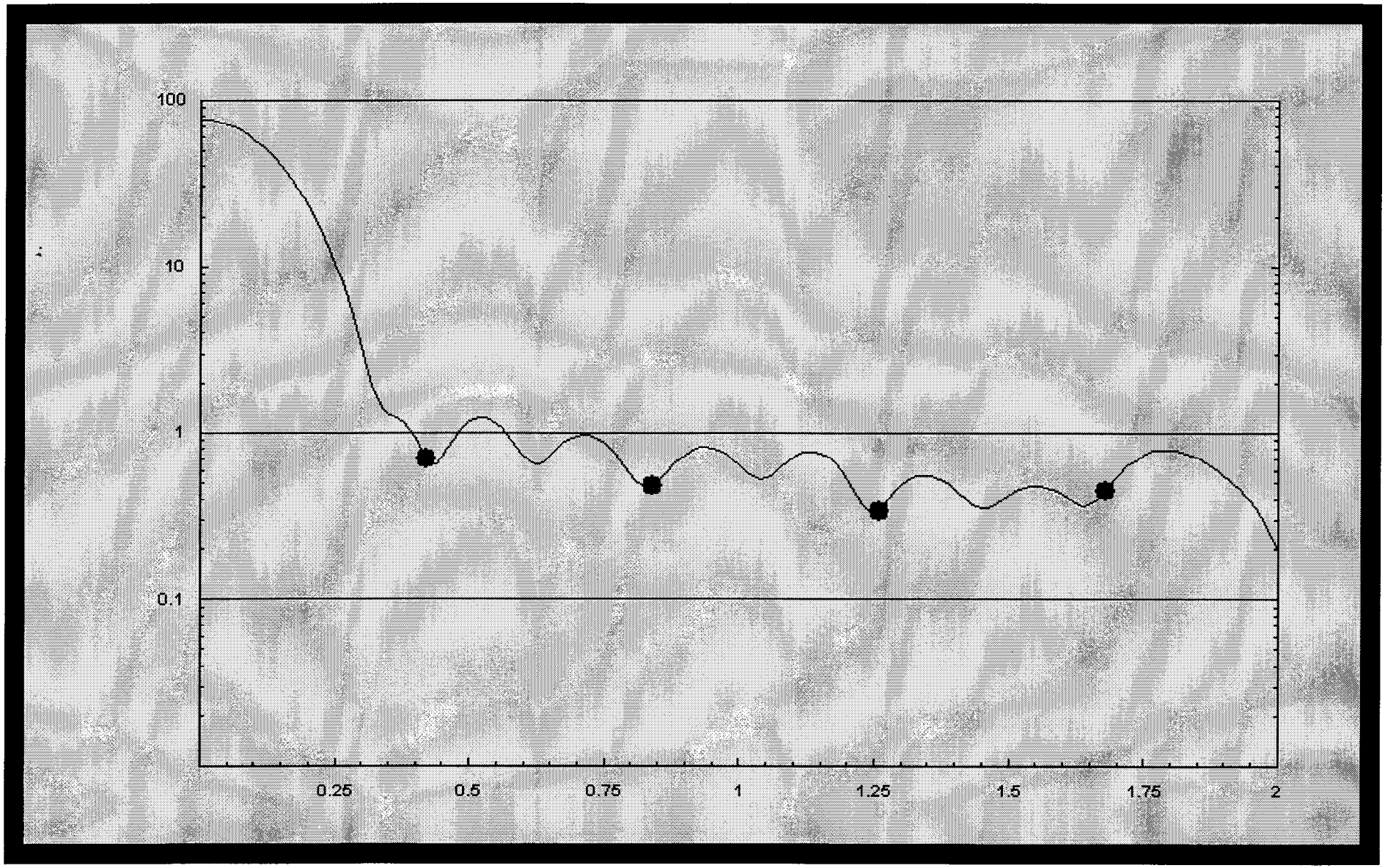

Roeer M. Jones, N.M. Kroll, R.H. Miller, T.O. Raubenheimer, R.D. Ruth & J.W. Wang. (February 23, 2000)

Conclusions On:
Progress Since Last KEK/SLAC ISG- Meeting

1. More complete understanding of errors and their influence on BBU and emittance dilution.

2. Studying 2MHz RMS errors indicates that little ill effects occur at the nominal bunch spacing. A systematic error, that is repeatable from structure-to-structure can give rise to BBU. However, in reality there will also be random errors that occur from cell-to-cell and from structure-to-structure and simulations indicate that even in the worst case, BBU will not occur.

Random errors in the synchronous frequency with an RMS as large as 5MHz results in a significant deteriation in the damping of the wakefield and indeed if these errors are repeatable from structure-to-structure then BBU is expectecd to occur. In practice it is expected that the random errors within a particular structure will occur randomly from structure-to-structure and this effectively interleaves the structure frequencies and hence does not give rise to BBU

3. RDDS1 has been measured: both pre-bonding (single-cell microwave measurement) and post-bonding (outer and inner cell with a Coordinate Measuring Machine). The wakefield and the emittance are not affected to a significant degree for the pre-bonding case. After bonding the cells there is a large frequency error introduced into the last few cells (80 MHz at worst) and this adversely affects the wakefield in the first five meters or so. It is important the a cure be affected and this is in process via squeezing the cells. Frequency errors in the low energy cells are not expected to pose a problem.

4. Introduction of distributed losses into the manifold significantly affects the wakefield. Tapering the losses (maximum loss towards the high energy end) merits further investigation. Also, locally loading a limited number of cells significantly improves the wakefield. Further work is needed on optimisation of the loading with a view to reducing the number of cells required.

5. Of the 2 possible redesigns for RDDS2 the Self-Convolved Triangle Function appears the most promising as it has a reduced Standard Deviation of the Sum Wake from the Mean and hence it will show little sensitvity to fabrication errors.