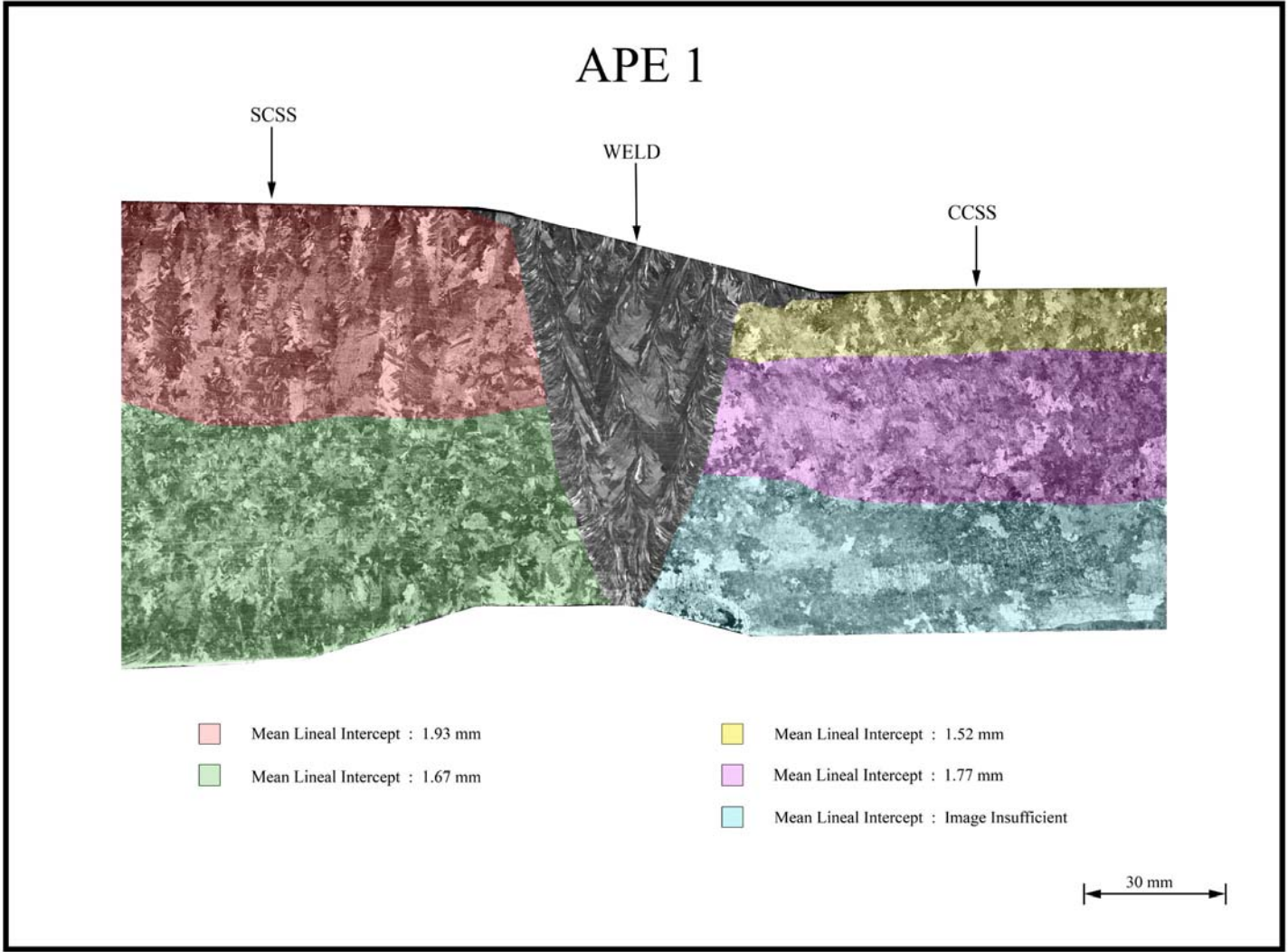
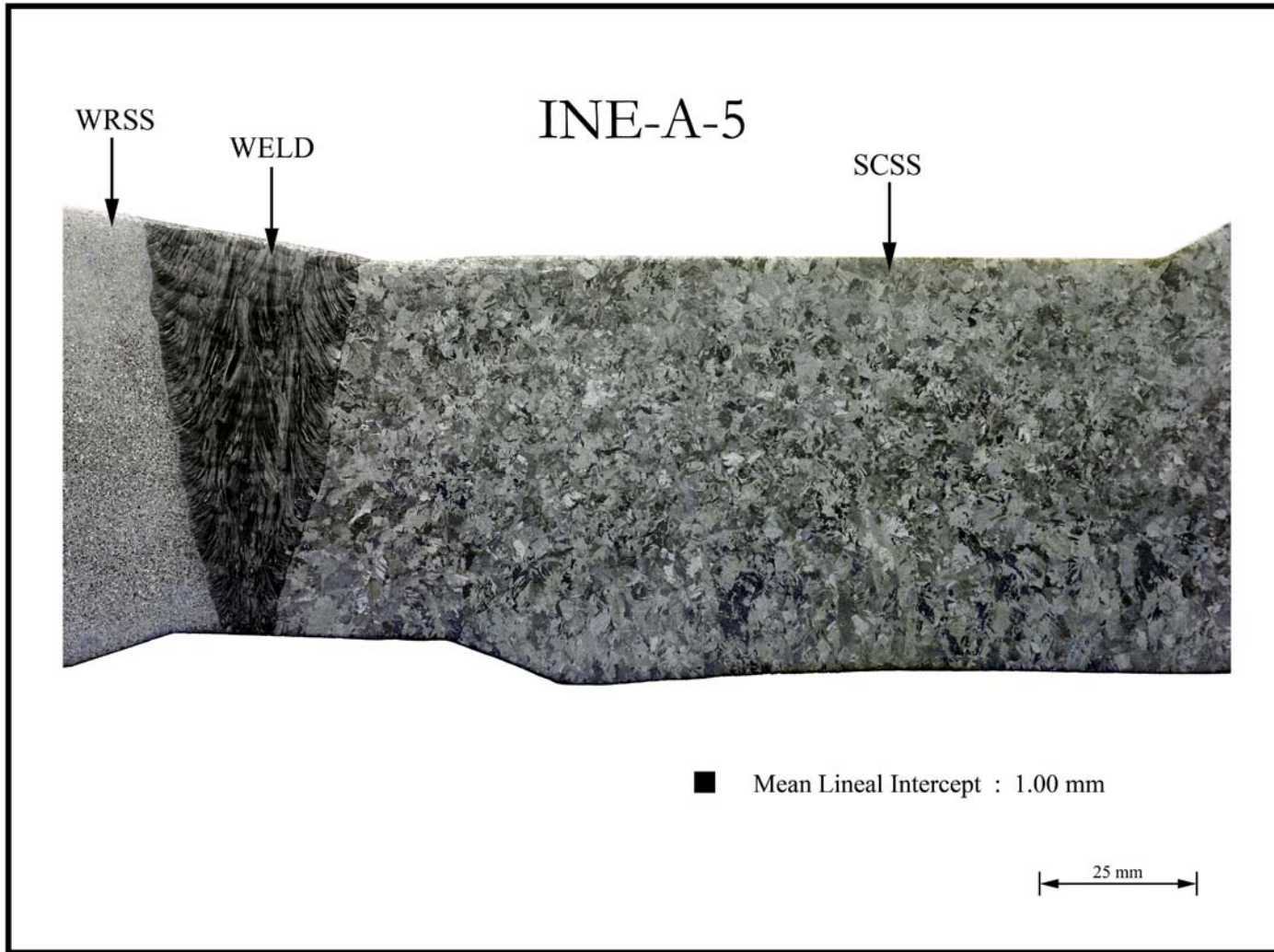


## **Appendix A**

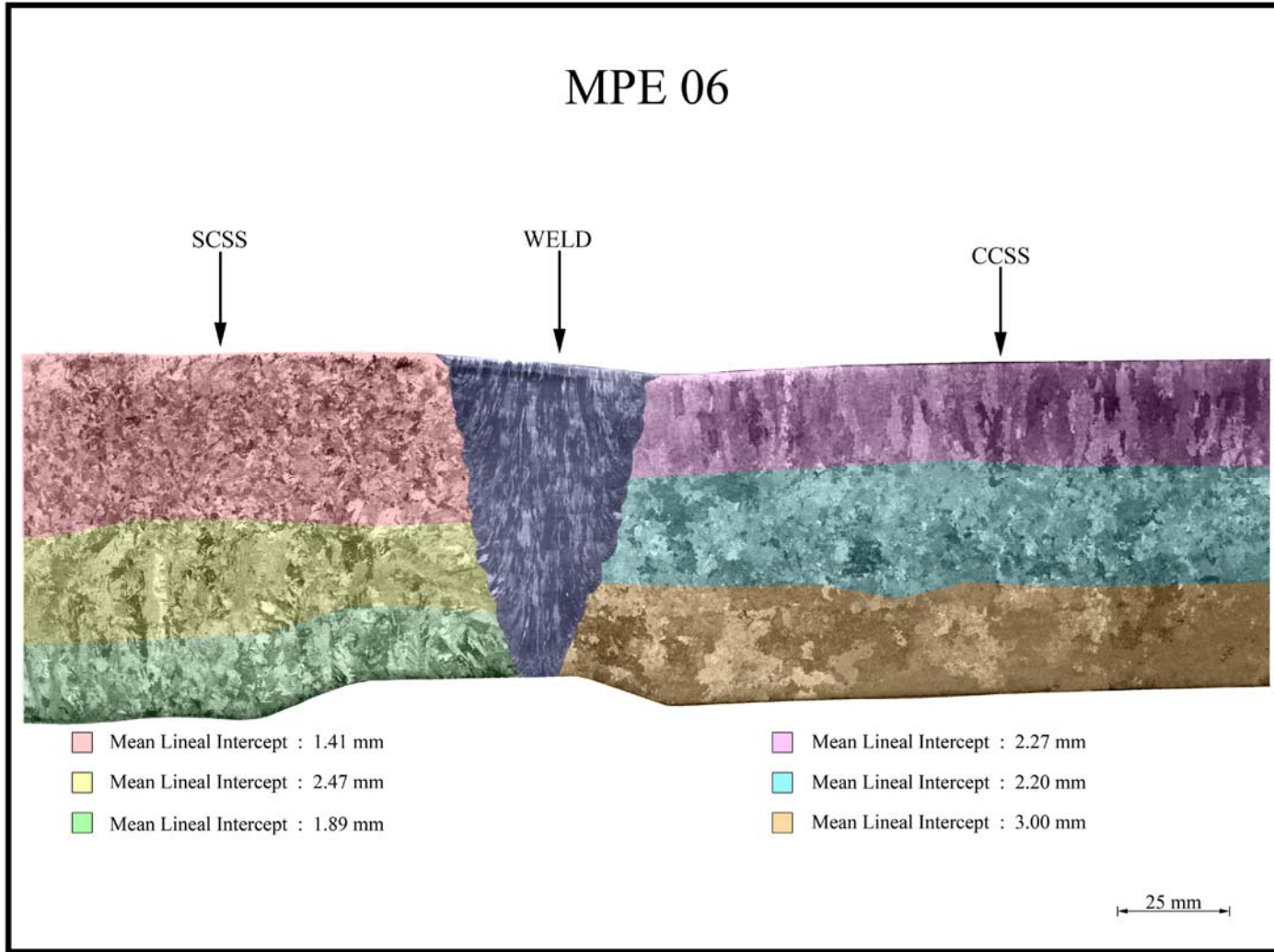
### **Westinghouse Owners Group and PNNL Flawed Weld Specimens**



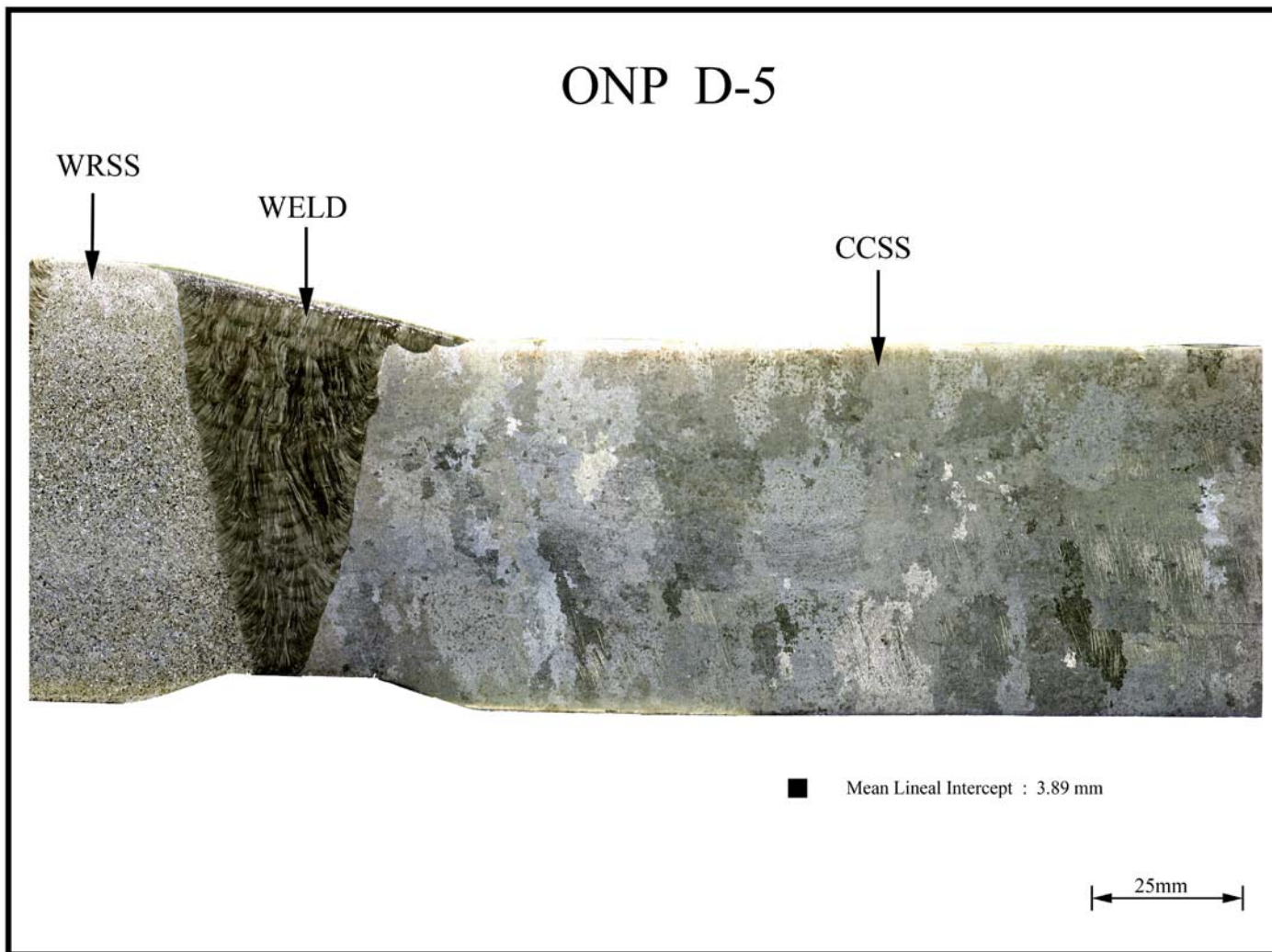
**Figure A.1 Axial-Radial Cross Section of WOG Specimen APE-1, Showing Outside and Inside Diameter Geometry, and Grain Size, Typical of APE Configuration**



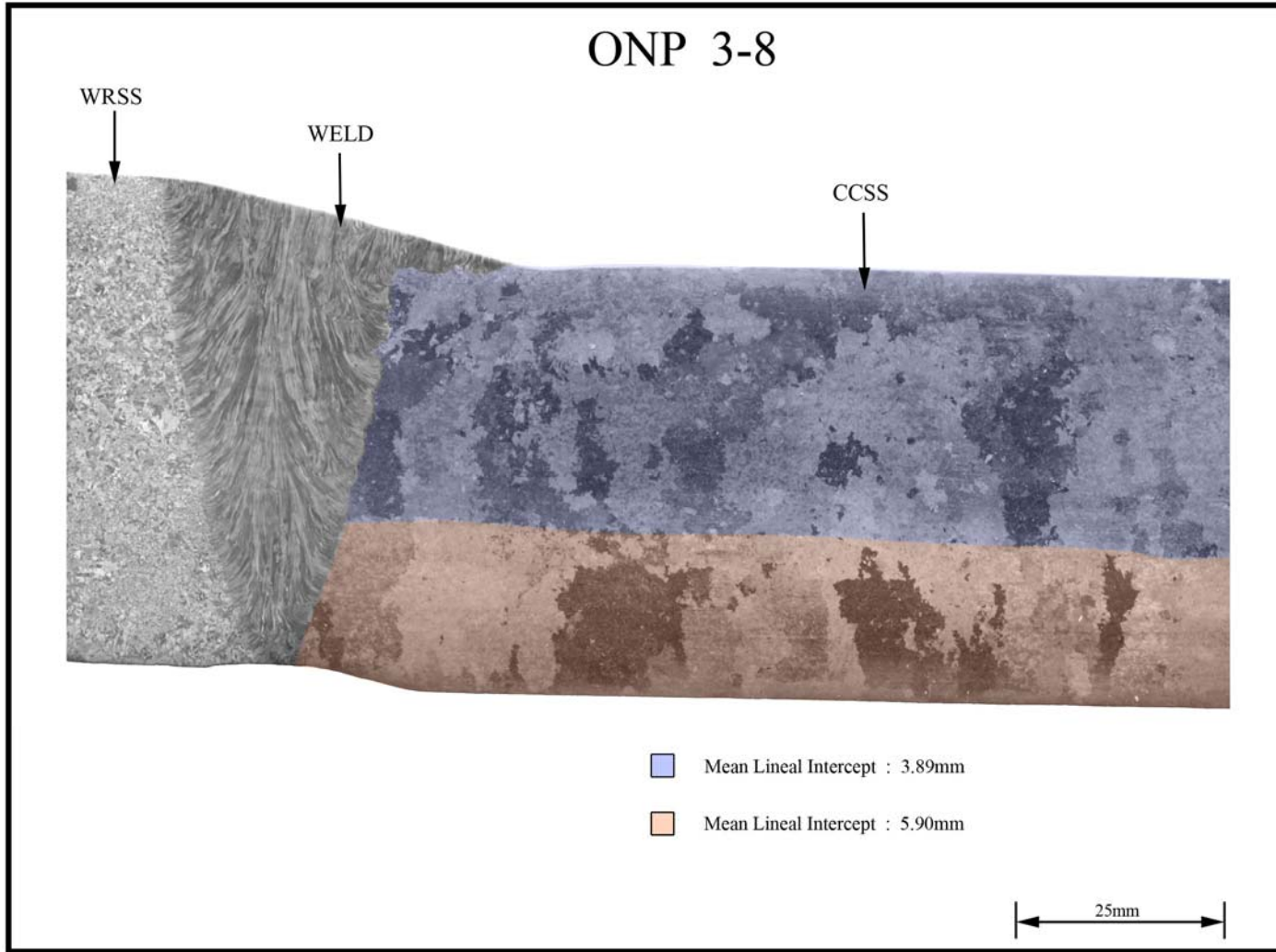
**Figure A.2 Axial-Radial Cross Section of WOG Specimen INE-A-5, Showing Outside and Inside Diameter Geometry, and Grain Size, Typical of INE-A Configuration**



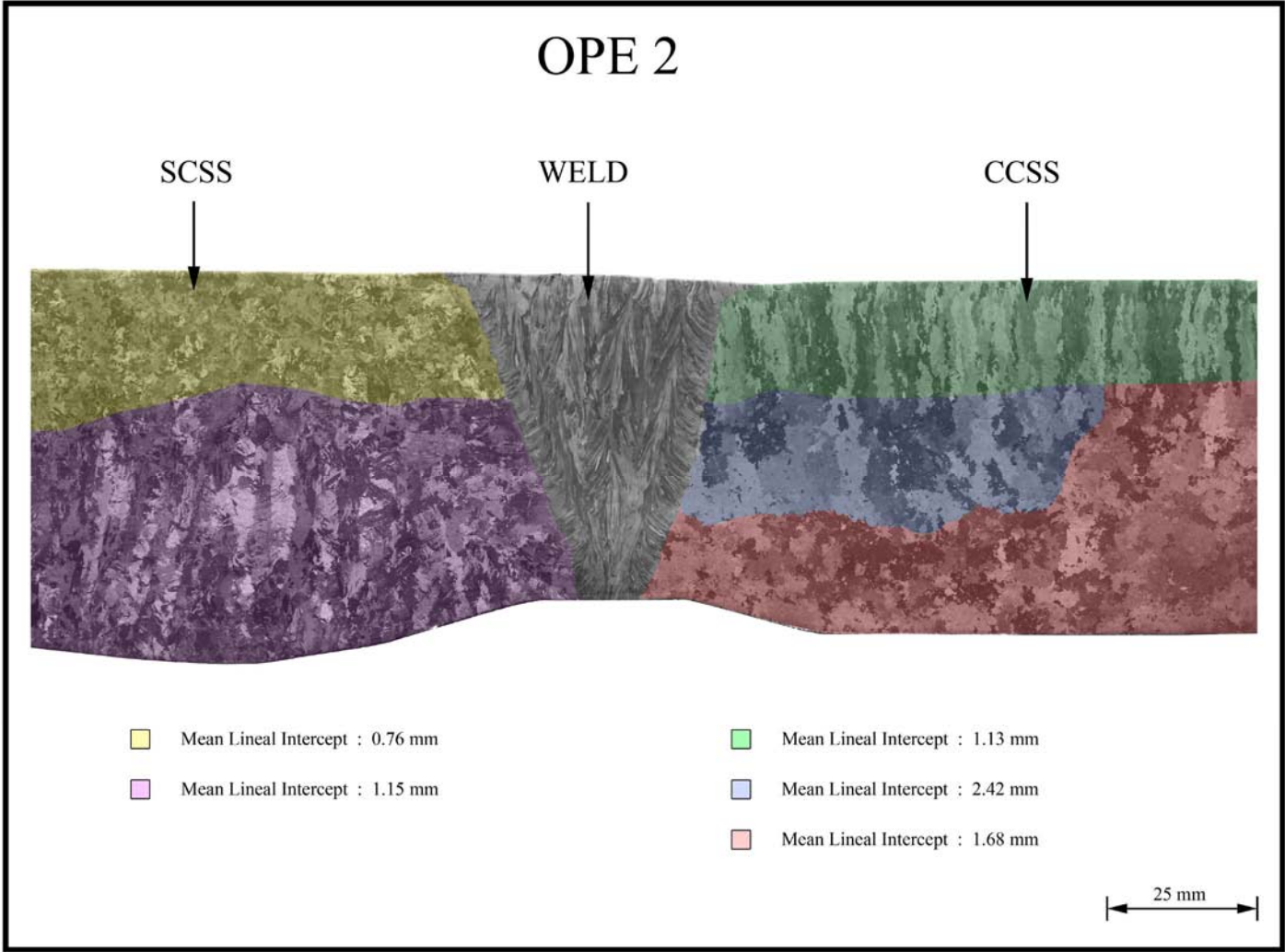
**Figure A.3 Axial-Radial Cross Section of WOG Specimen MPE-06, Showing Outside and Inside Diameter Geometry, and Grain Size, Typical of MPE Configuration**



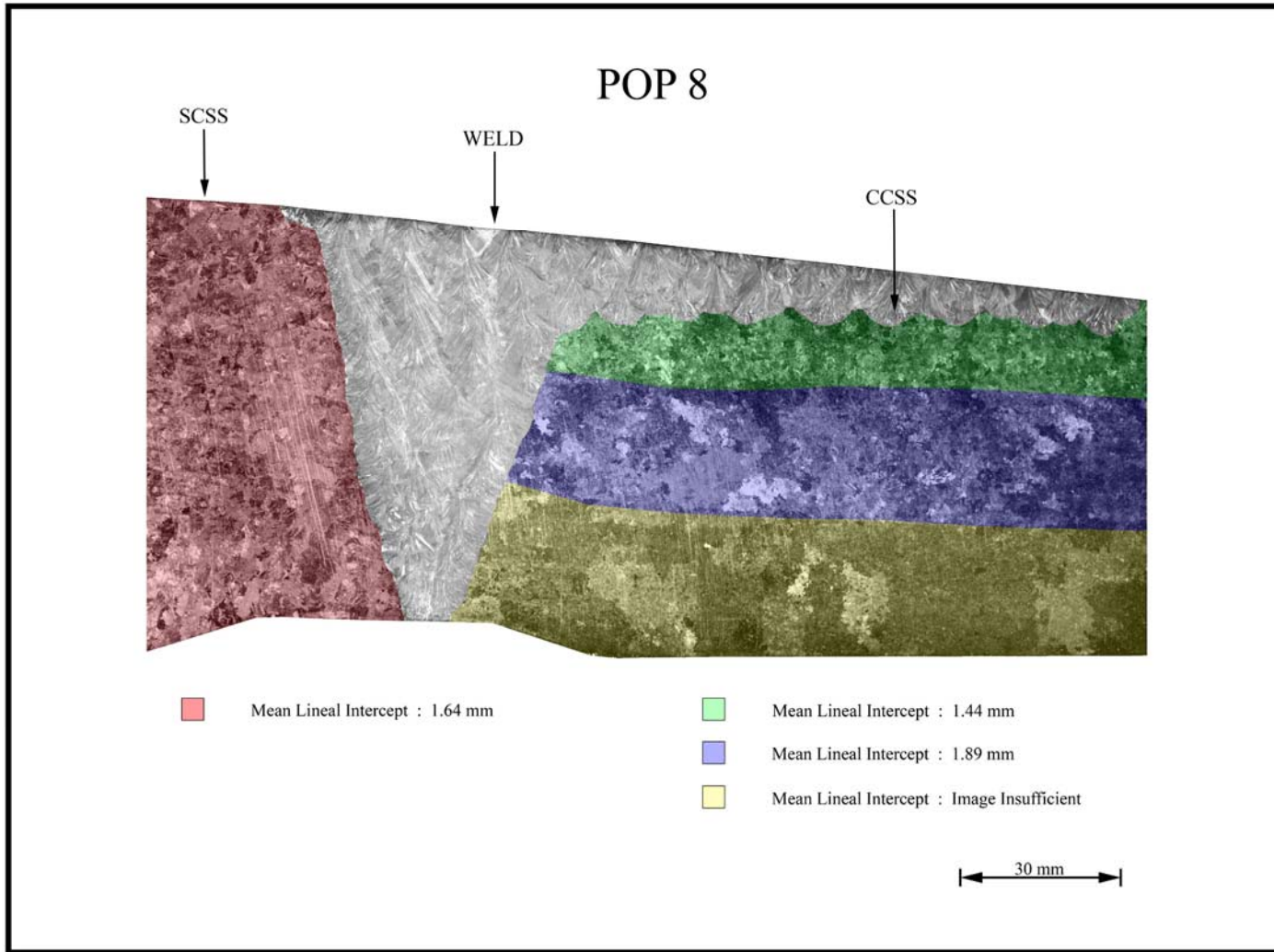
**Figure A.4 Axial-Radial Cross Section of WOG Specimen ONP-D-5, Showing Outside and Inside Diameter Geometry, and Grain Size, Typical of ONP-D Configuration**



**Figure A.5 Axial-Radial Cross Section of WOG Specimen ONP-3-8, Showing Outside and Inside Diameter Geometry, and Grain Size, Typical of ONP Configuration**

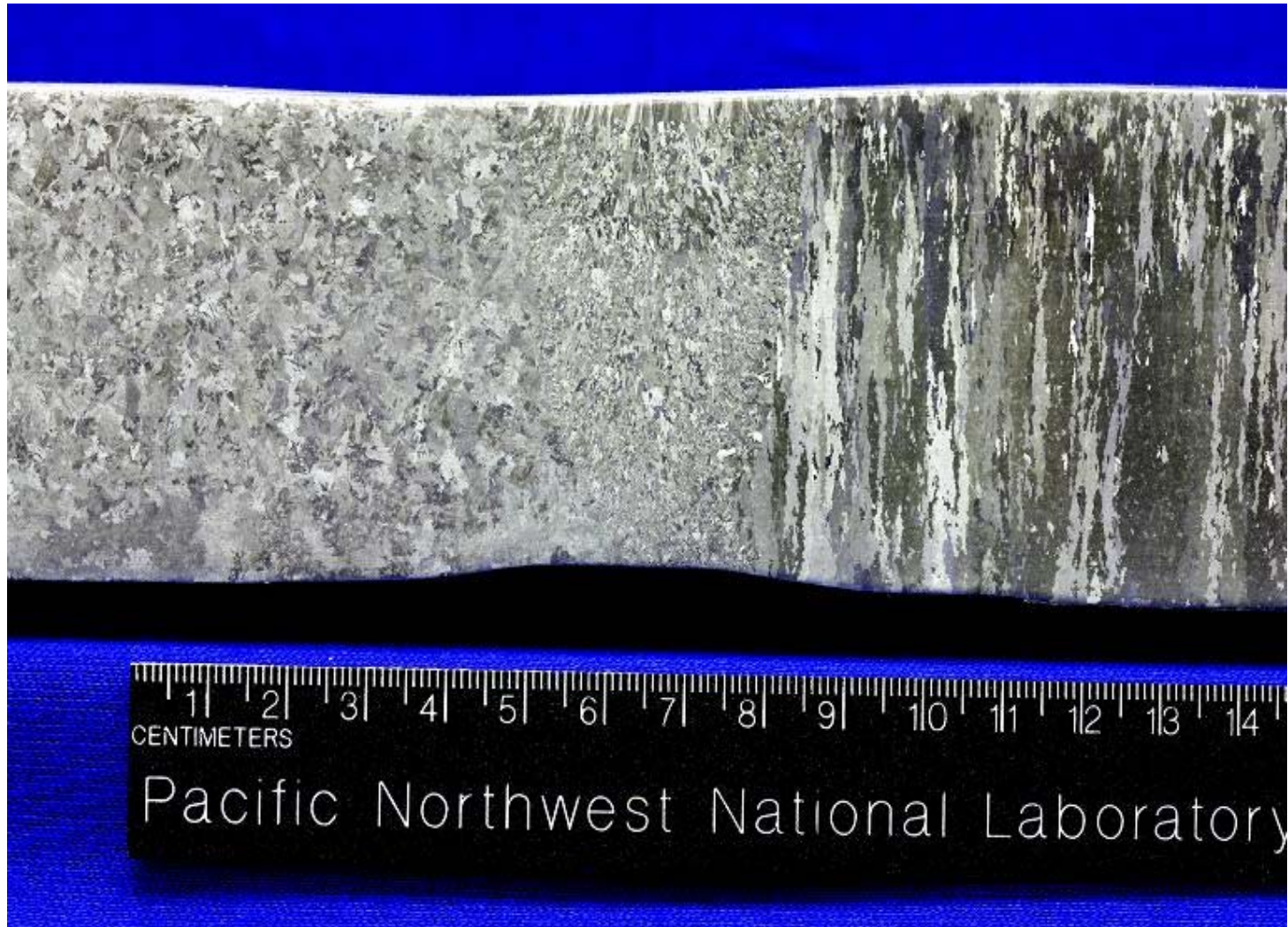


**Figure A.6 Axial-Radial Cross Section of WOG Specimen OPE-2, Showing Outside and Inside Diameter Geometry, and Grain Size, Typical of OPE Configuration**



**Figure A.7 Axial-Radial Cross Section of WOG Specimen POP-8, Showing Outside and Inside Diameter Geometry, and Grain Size, Typical of POP Configuration**



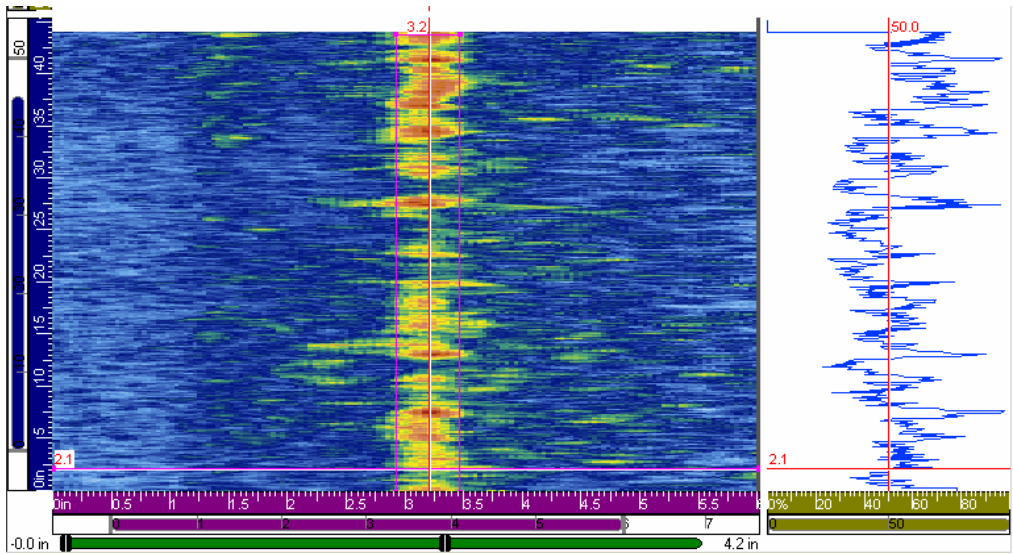


**Figure A.8** Axial-Radial Cross Section of PNNL Specimen B515, Showing Outside and Inside Diameter Geometry, and Grains Typical of PNNL Specimens. The equiaxed CCSS grains on the left have a mean linear intercept of 2.34 mm and the columnar CCSS grains on the right have a mean lineal intercept of 2.48 mm.

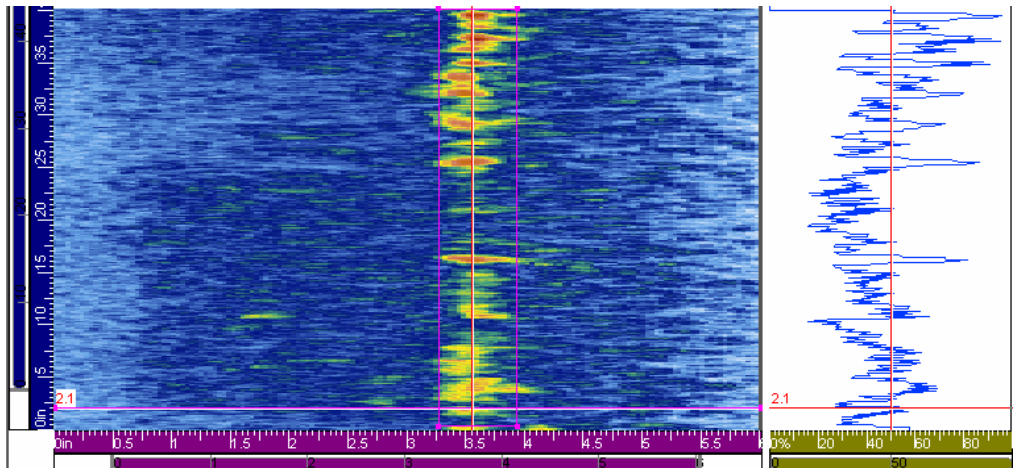
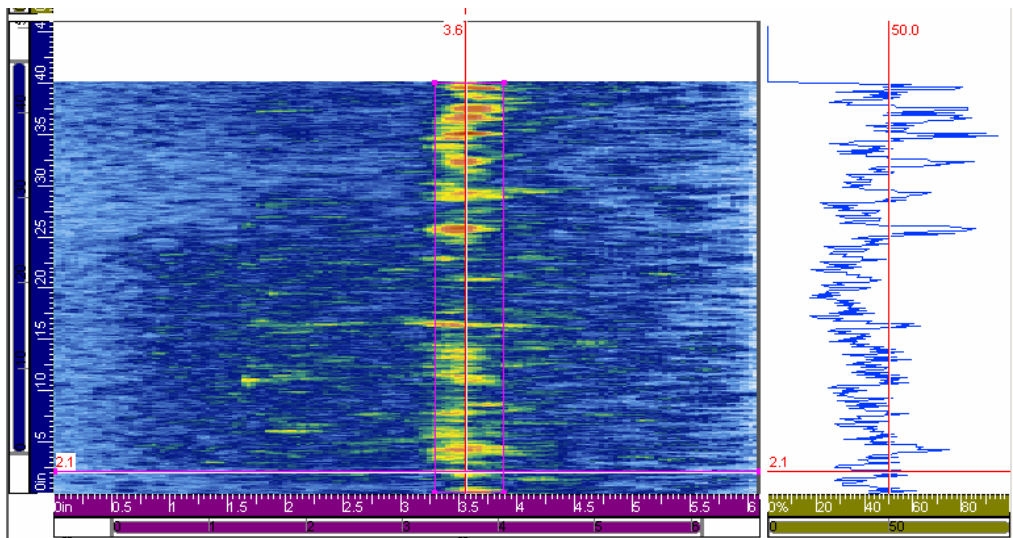
## **Appendix B**

### **Phased Array and Low Frequency Data from the Corner Signal from CCSS Base Metal for Signal-to-Noise Characterization**

(All scales are in inches.)



2



**Figure B.1 IHI-SW Corner Response from Top to Bottom at 500, 750, and 1000 kHz**

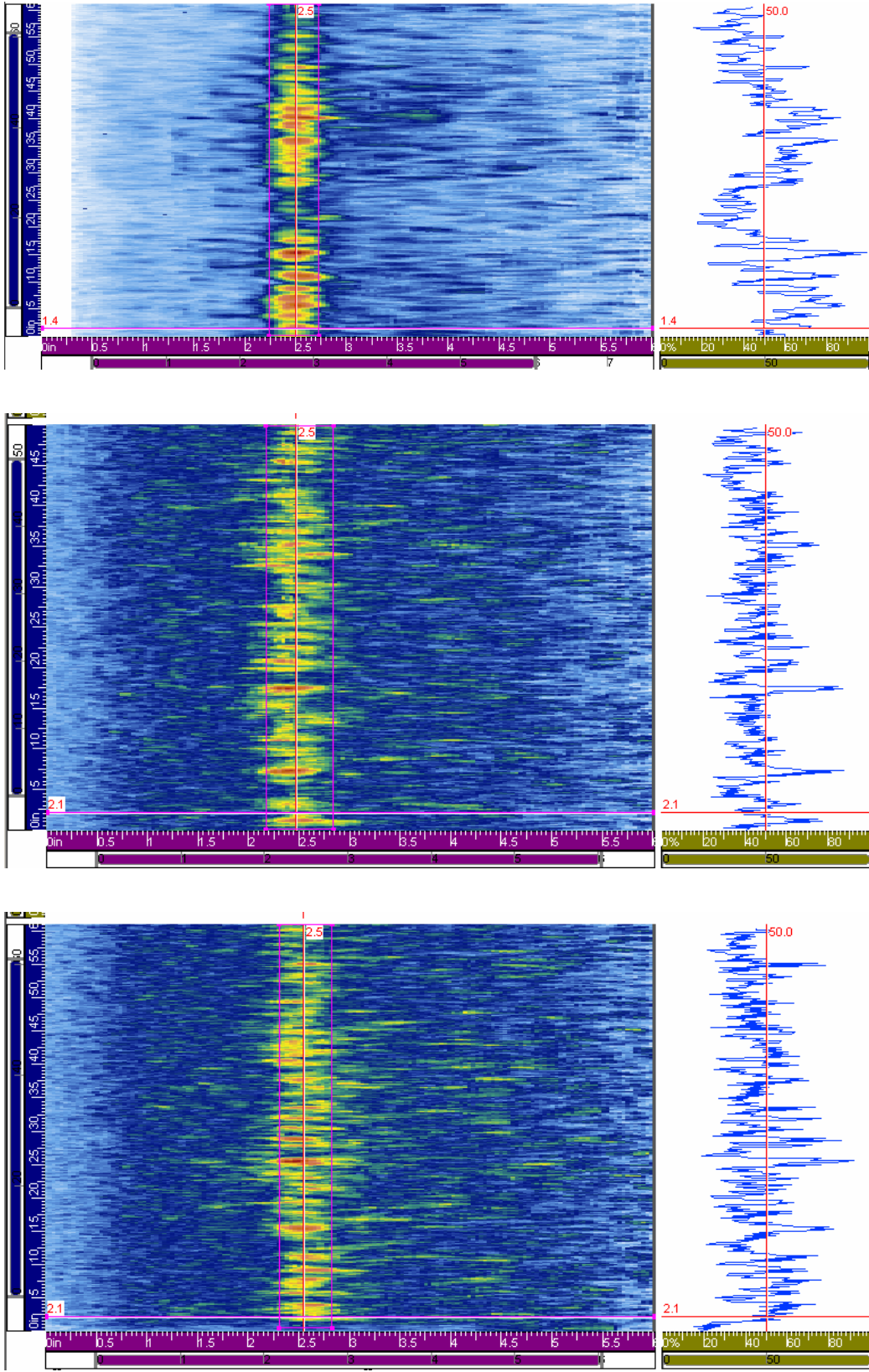


Figure B.2 EPR Corner Response from Top to Bottom at 500, 750, and 1000 kHz

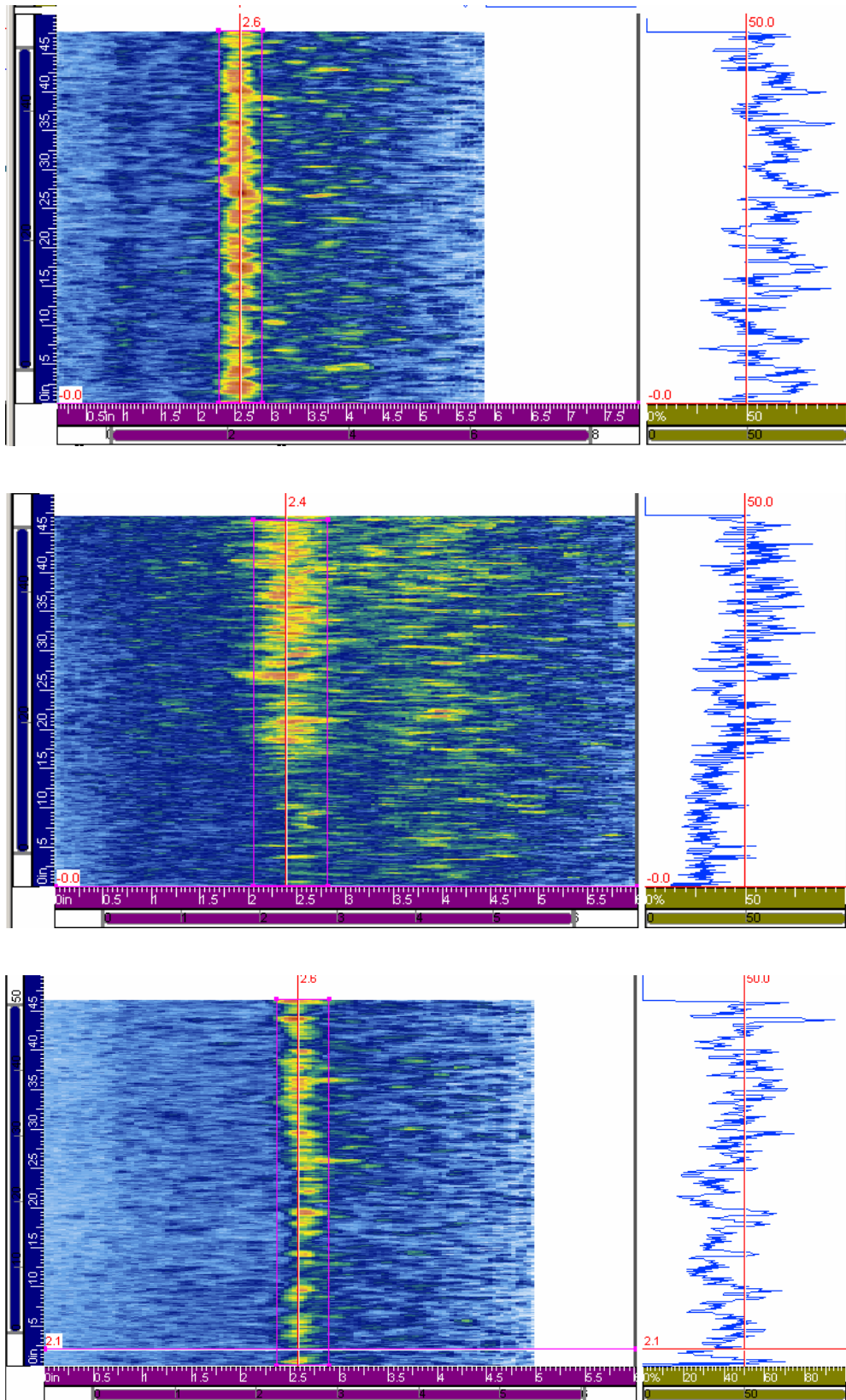


Figure B.3 Westinghouse Corner Response from Top to Bottom at 500, 750, and 1000 kHz

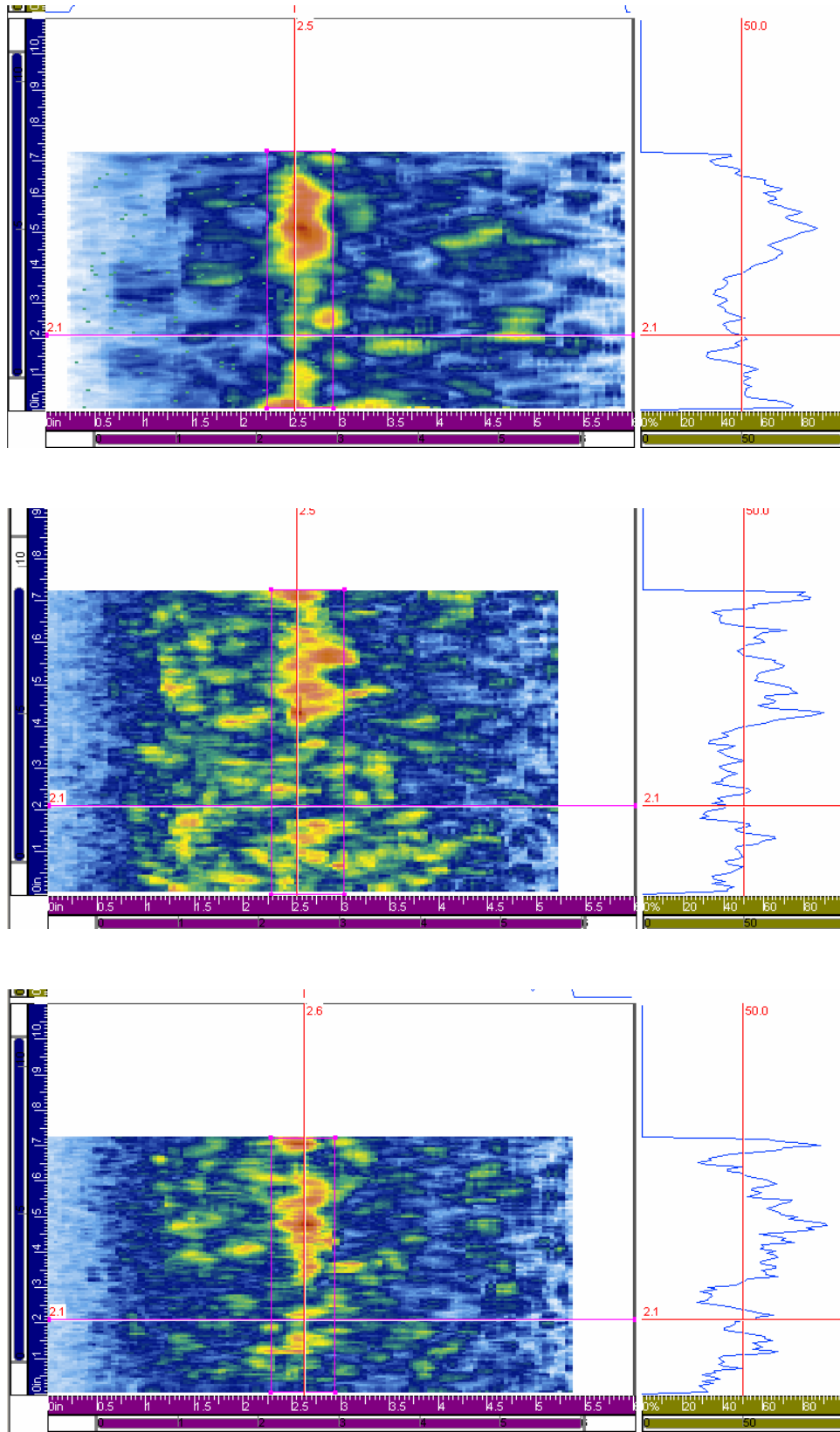


Figure B.4 APE-1 Corner Response from Top to Bottom at 500, 750, and 1000 kHz

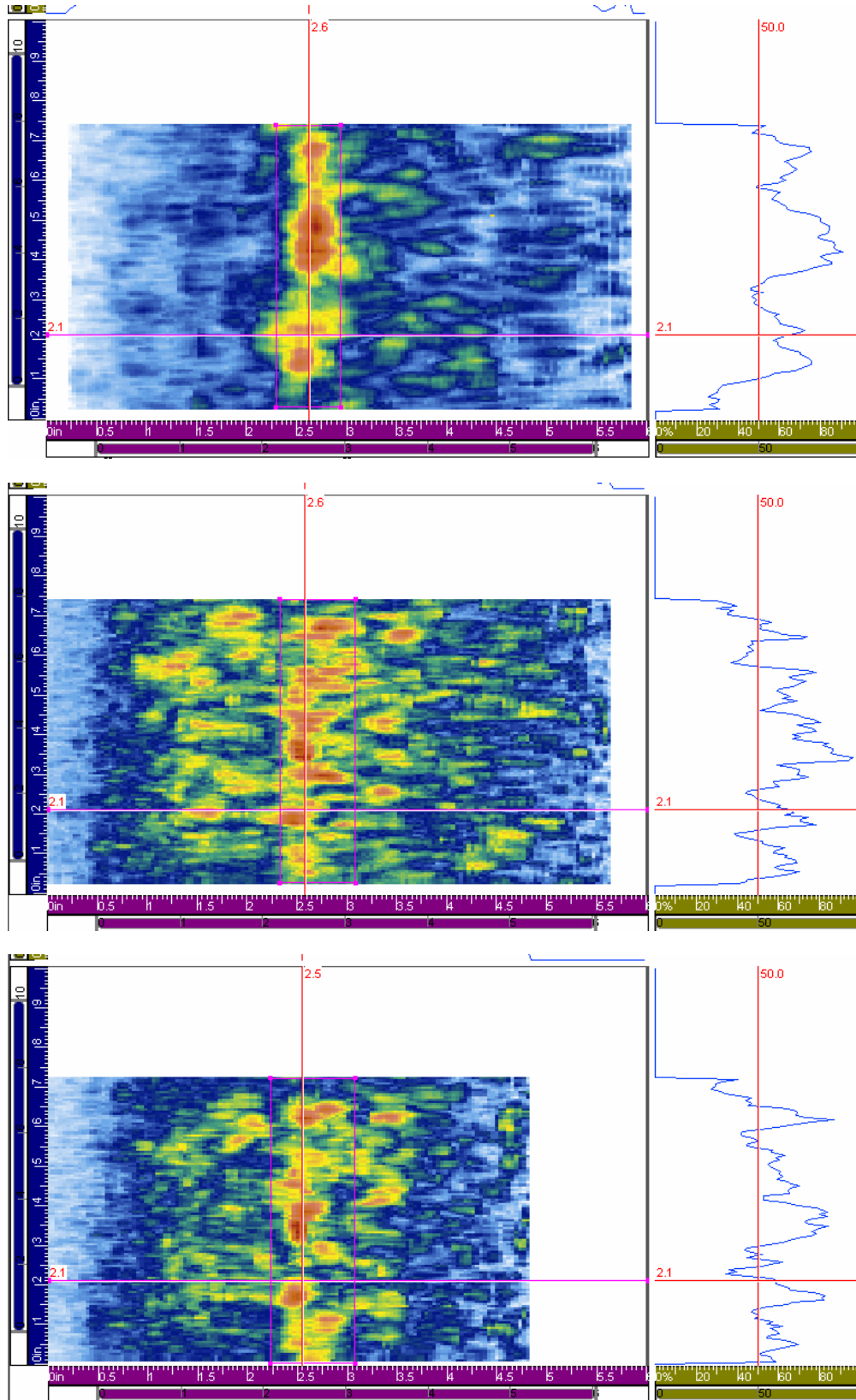


Figure B.5 MPE-3 Corner Response from Top to Bottom at 500, 750, and 1000 kHz

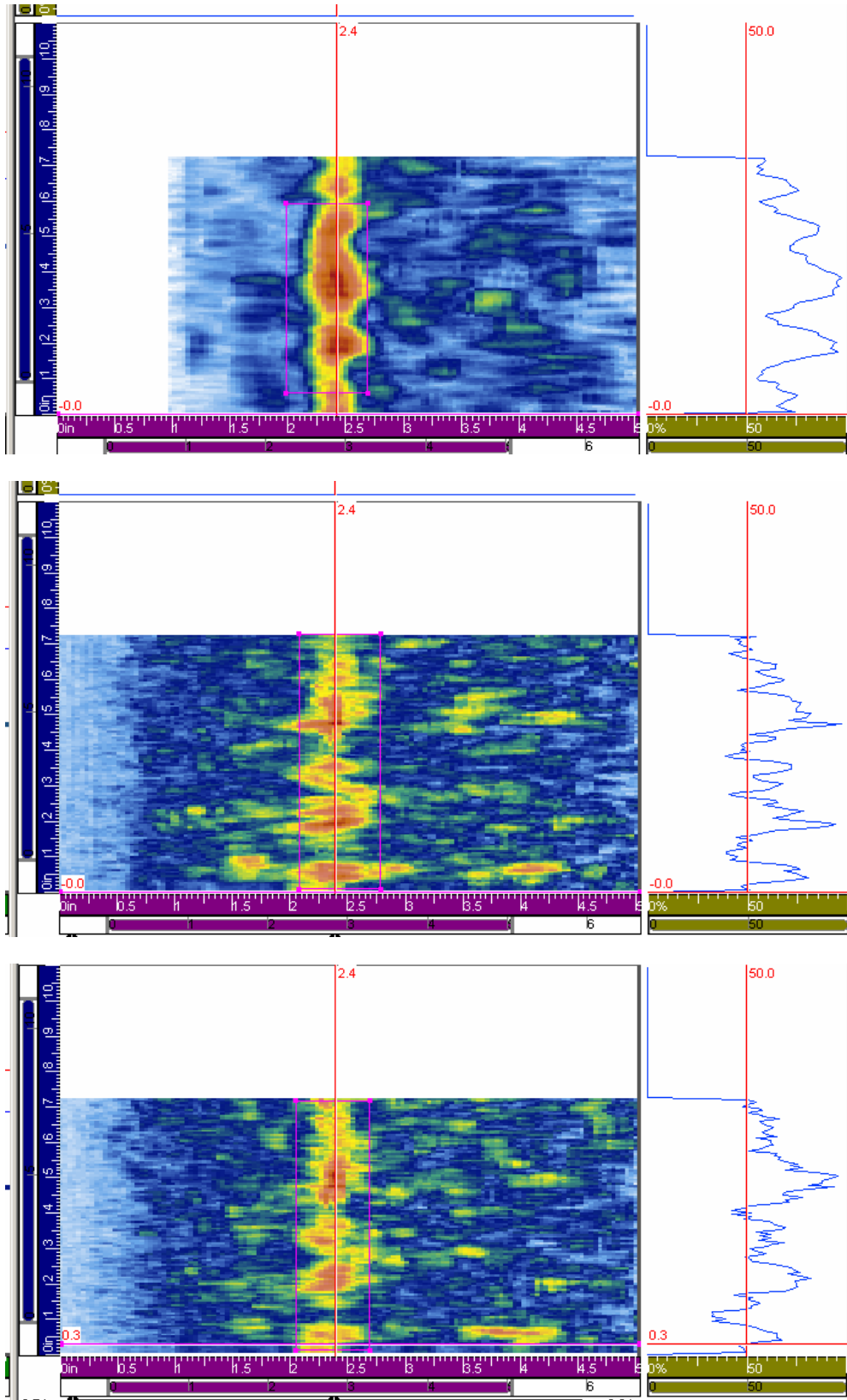


Figure B.6 OPE-5 Corner Response from Top to Bottom at 500, 750, and 1000 kHz



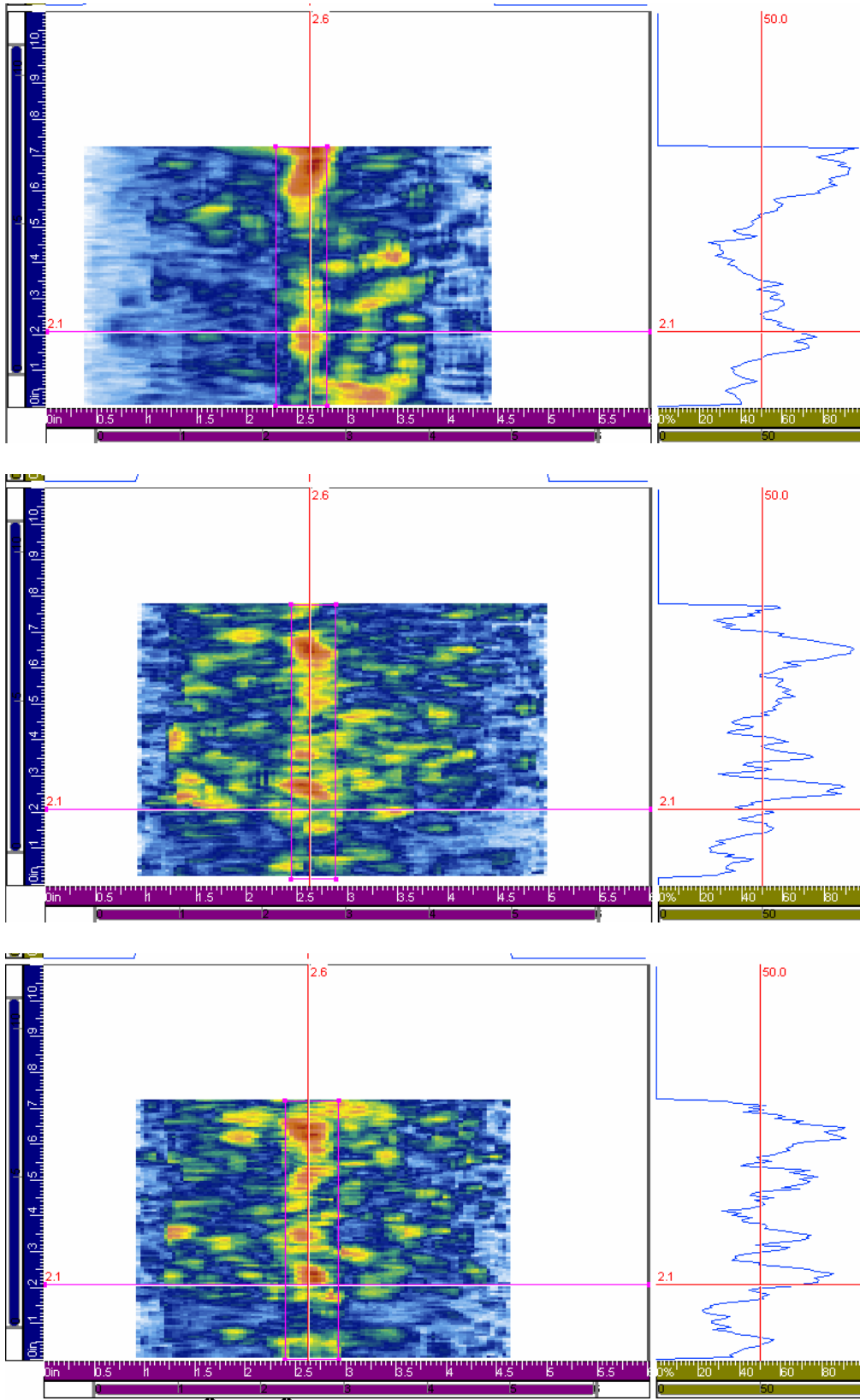
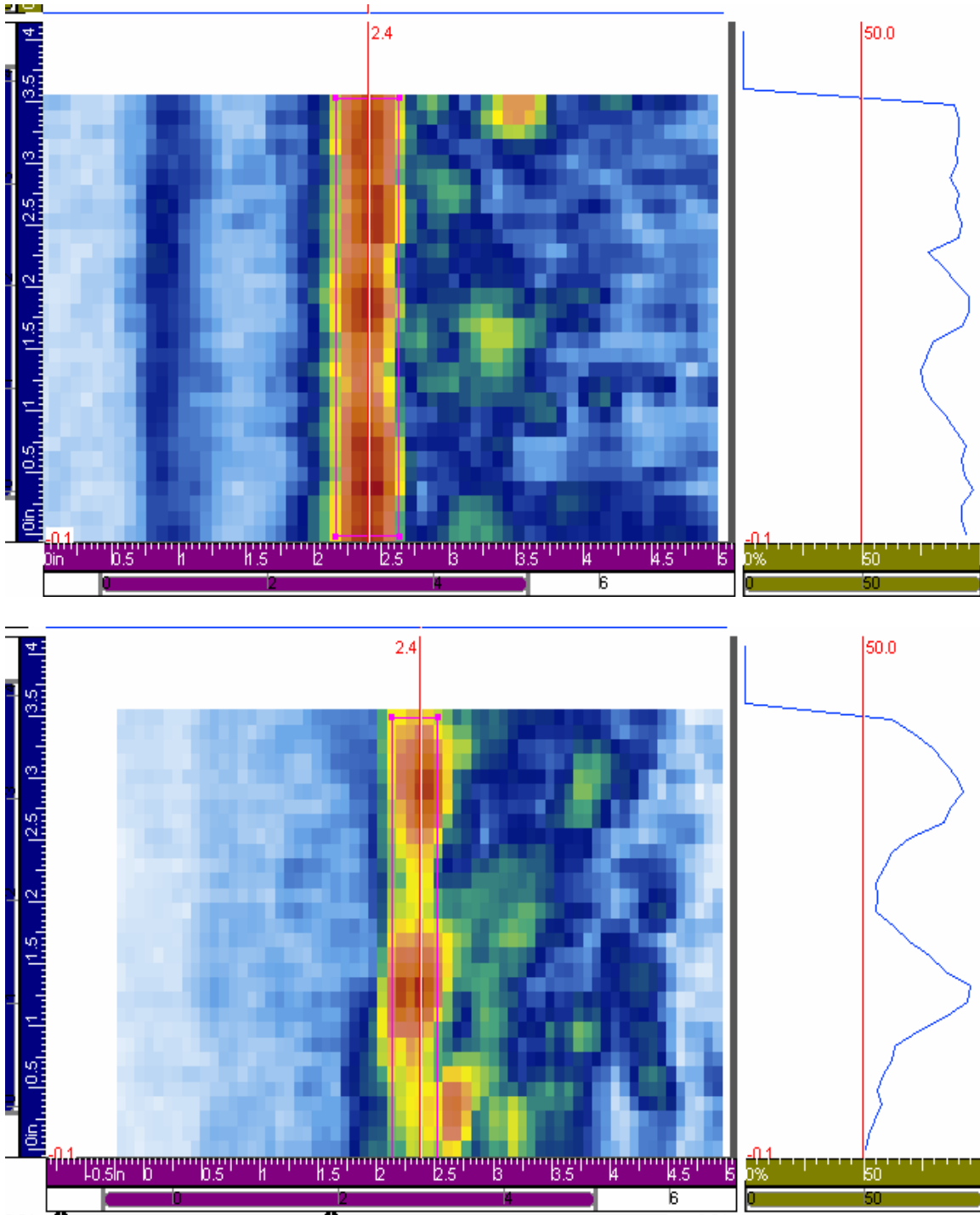
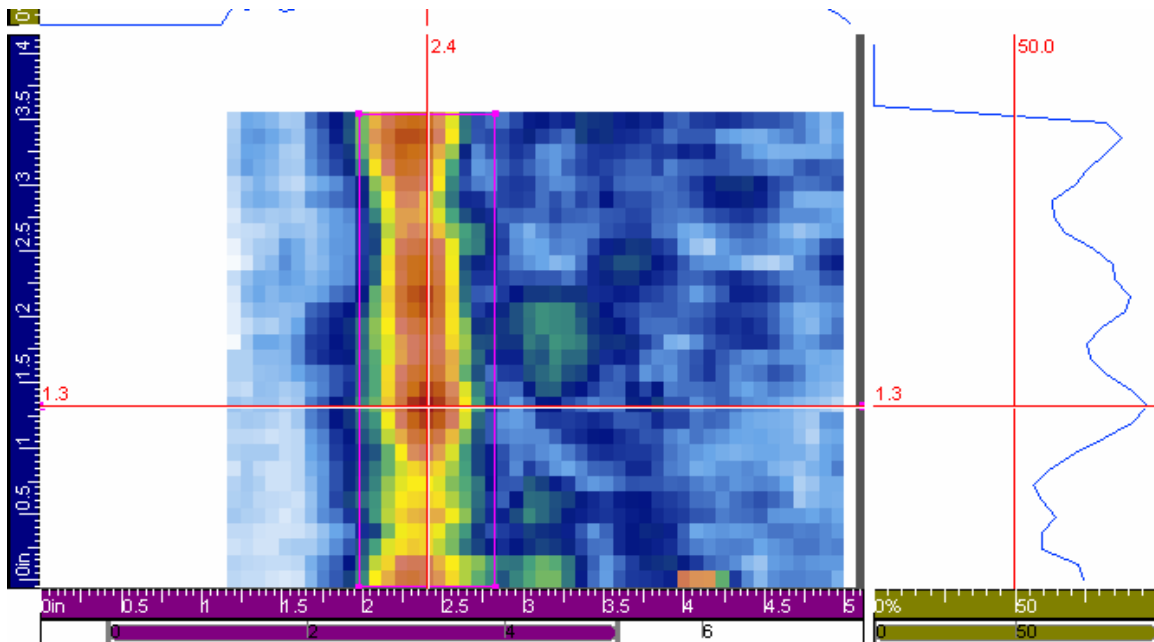
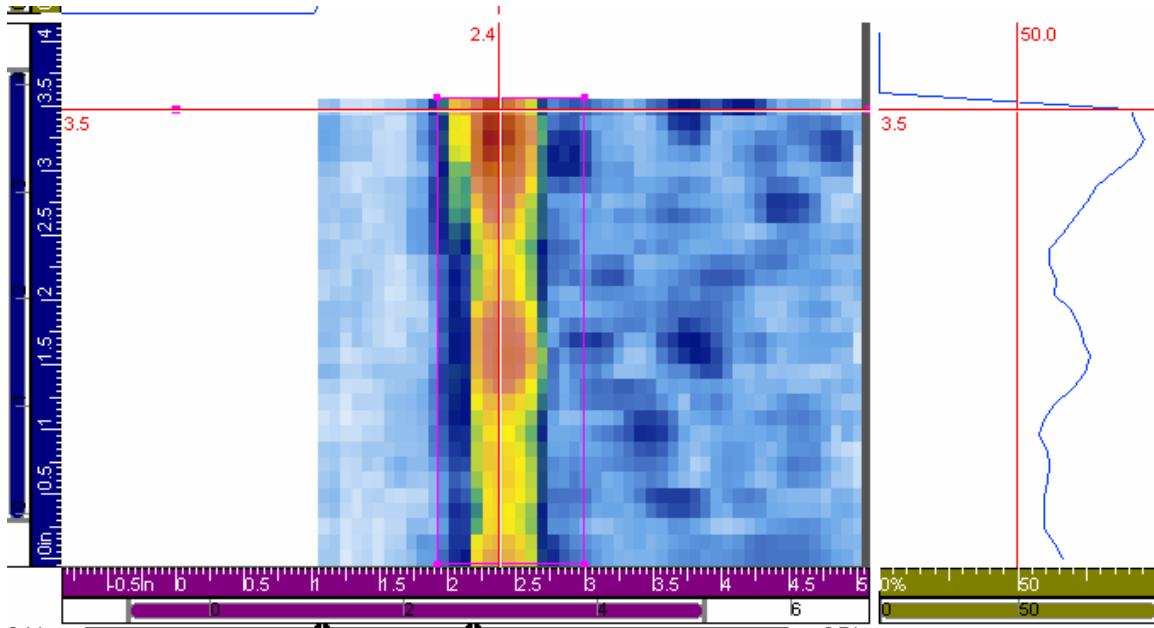


Figure B.7 POP-7 Corner Response from Top to Bottom at 500, 750, and 1000 kHz

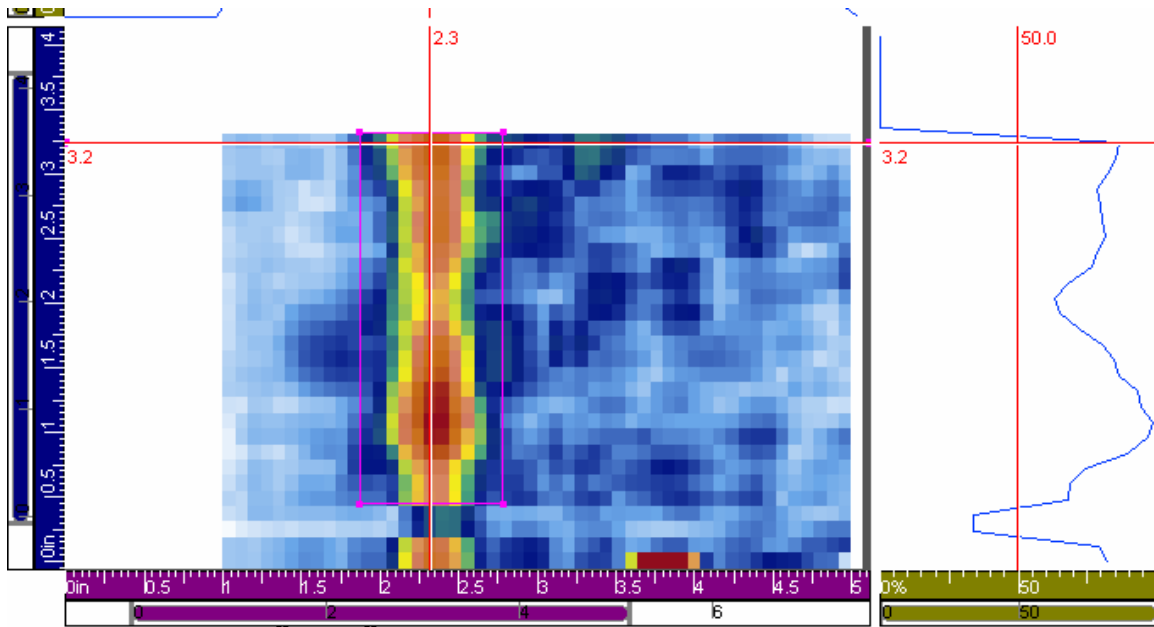
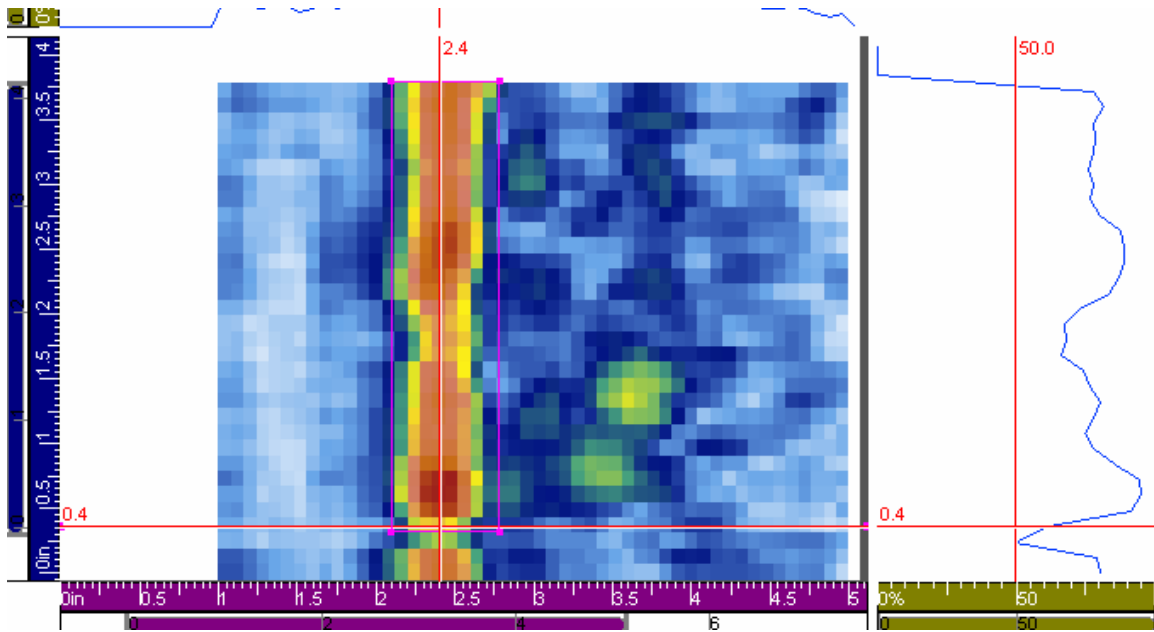
6



**Figure B.8 PNNL Sample B508 Corner Response from the Columnar End (top) and Equiaxed End (bottom) at 500 kHz**



**Figure B.9 PNNL Sample B511 Corner Response from the Columnar End (top) and Equiaxed End (bottom) at 500 kHz**



**Figure B.10 PNNL Sample B520 Corner Response from the Columnar End (top) and Equiaxed End (bottom) at 500 kHz. Due to poor coupling on the rough surface the first approximately 0.5 inch (1.3 cm) of the scan should be ignored. The scan start is at the bottom.**

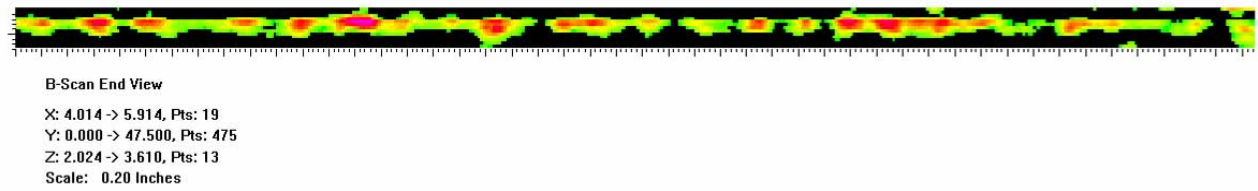
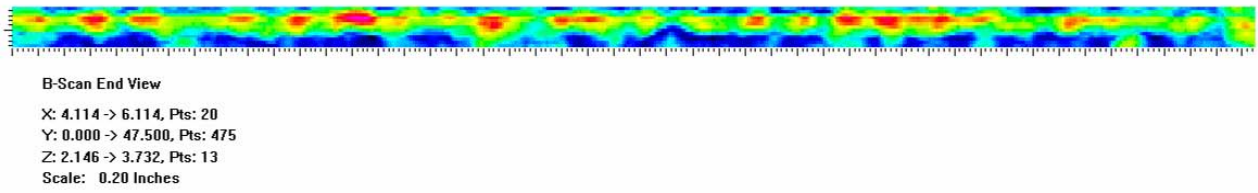
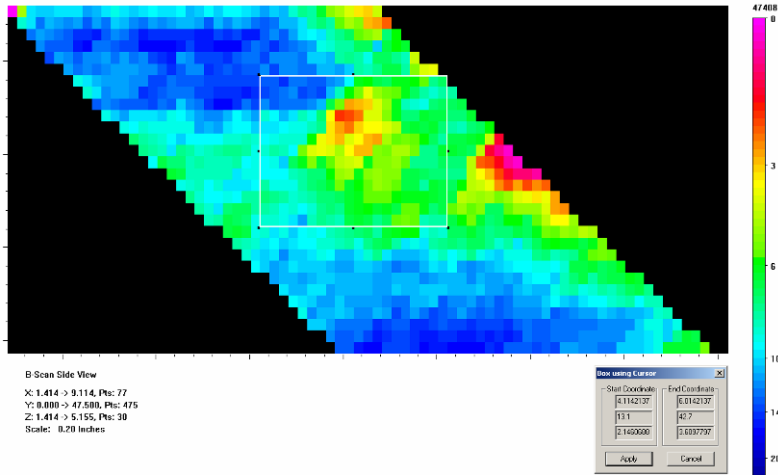


Figure B.11 Westinghouse Top Corner Response at 400 kHz

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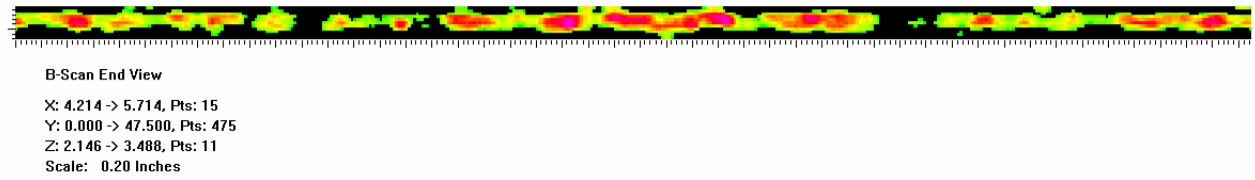
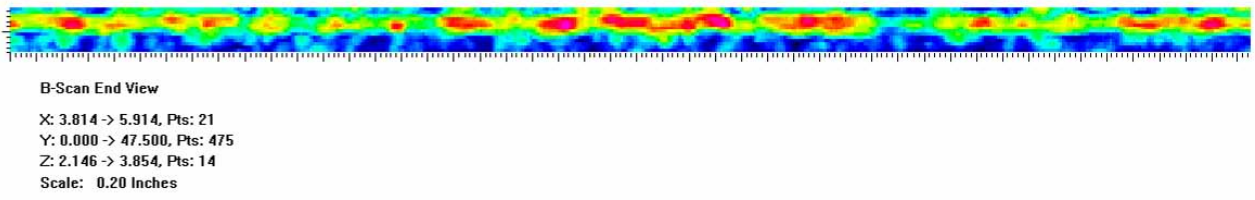
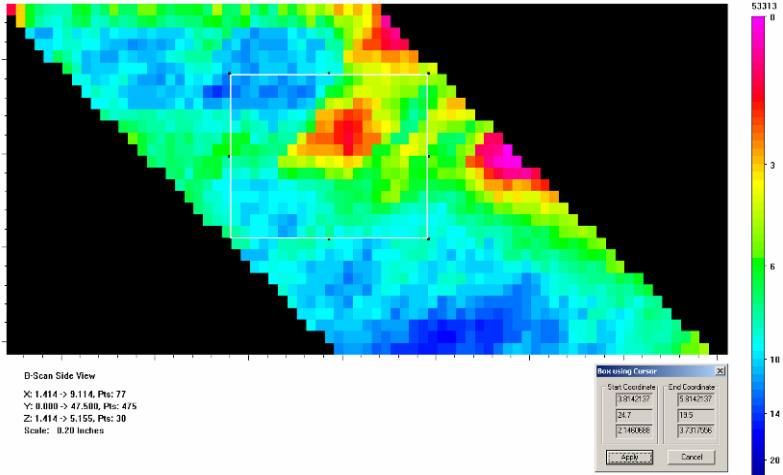
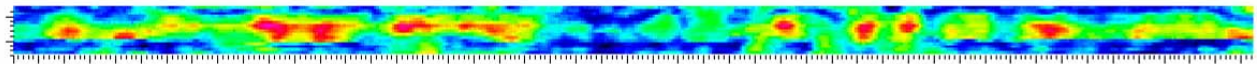
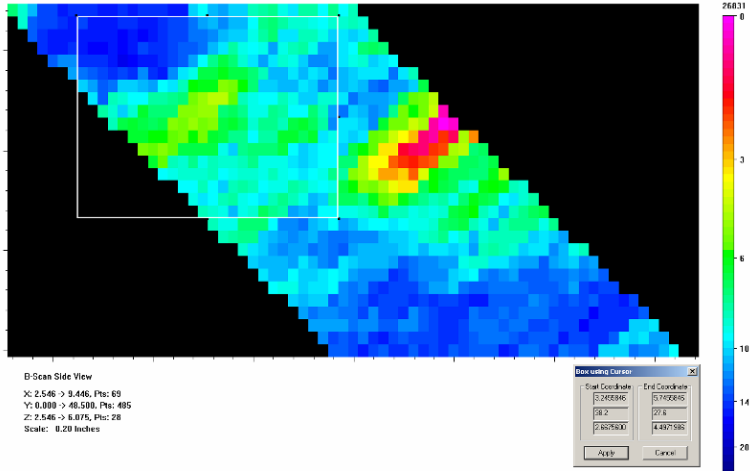
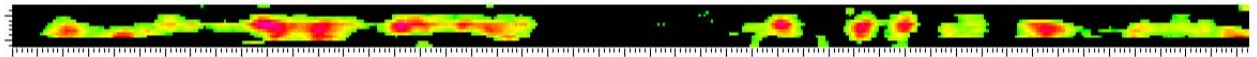


Figure B.12 Westinghouse Bottom Corner Response at 400 kHz



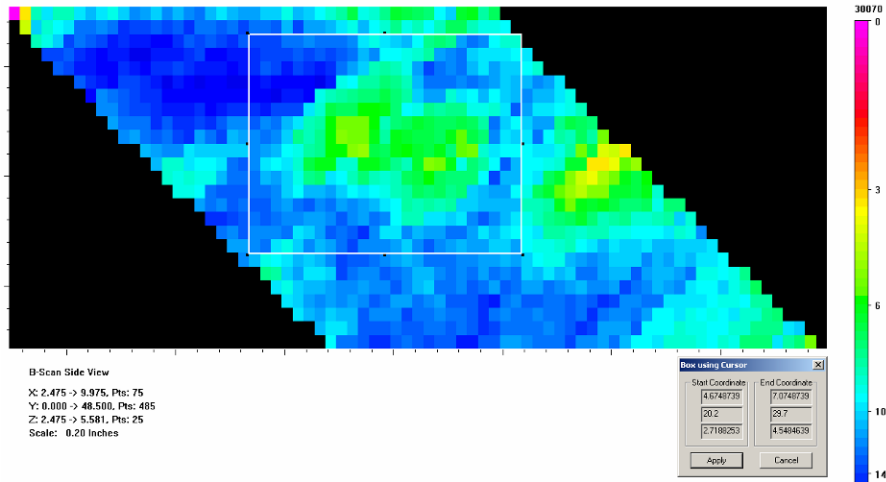
B-Scan End View  
 X: 3.246 -> 5.846, Pts: 26  
 Y: 0.000 -> 48.500, Pts: 495  
 Z: 2.668 -> 4.619, Pts: 16  
 Scale: 0.20 Inches



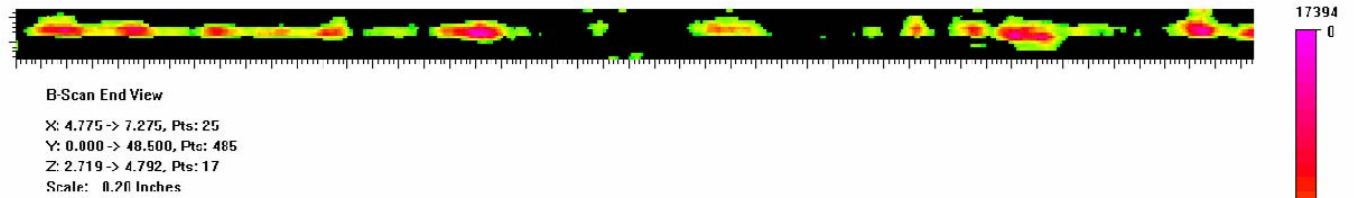
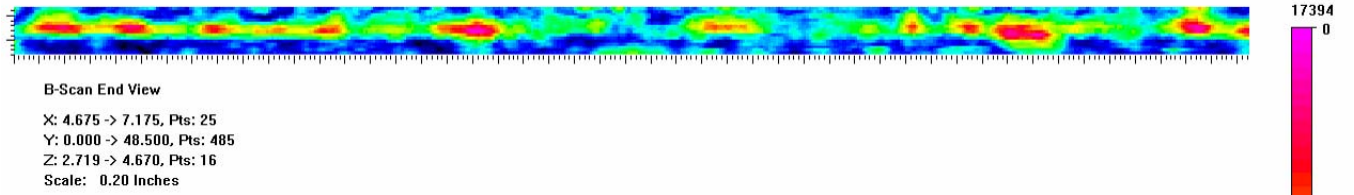
B-Scan End View  
 X: 3.246 -> 5.846, Pts: 26  
 Y: 0.000 -> 48.500, Pts: 495  
 Z: 2.668 -> 4.375, Pts: 14  
 Scale: 0.20 Inches

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Figure B.13 IHI-Southwest Top Corner Response at 400 kHz

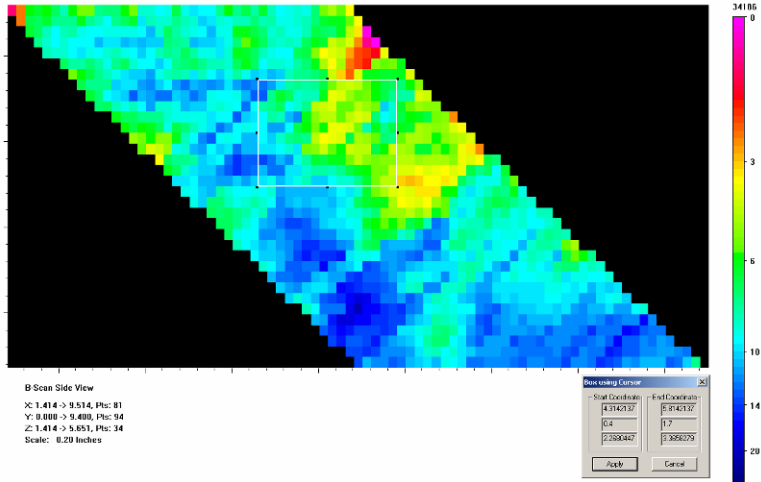


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**Figure B.14 IHI-Southwest Bottom Corner Response at 400 kHz**





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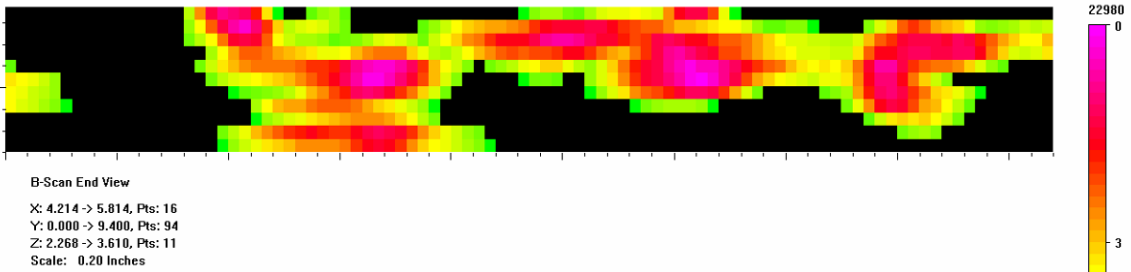
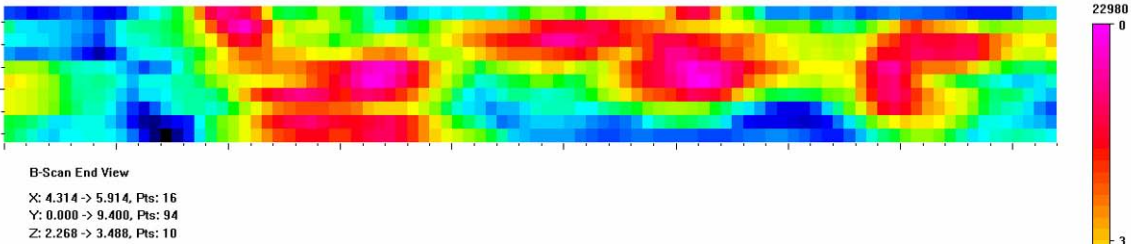


Figure B.15 APE-1 Corner Response at 400 kHz

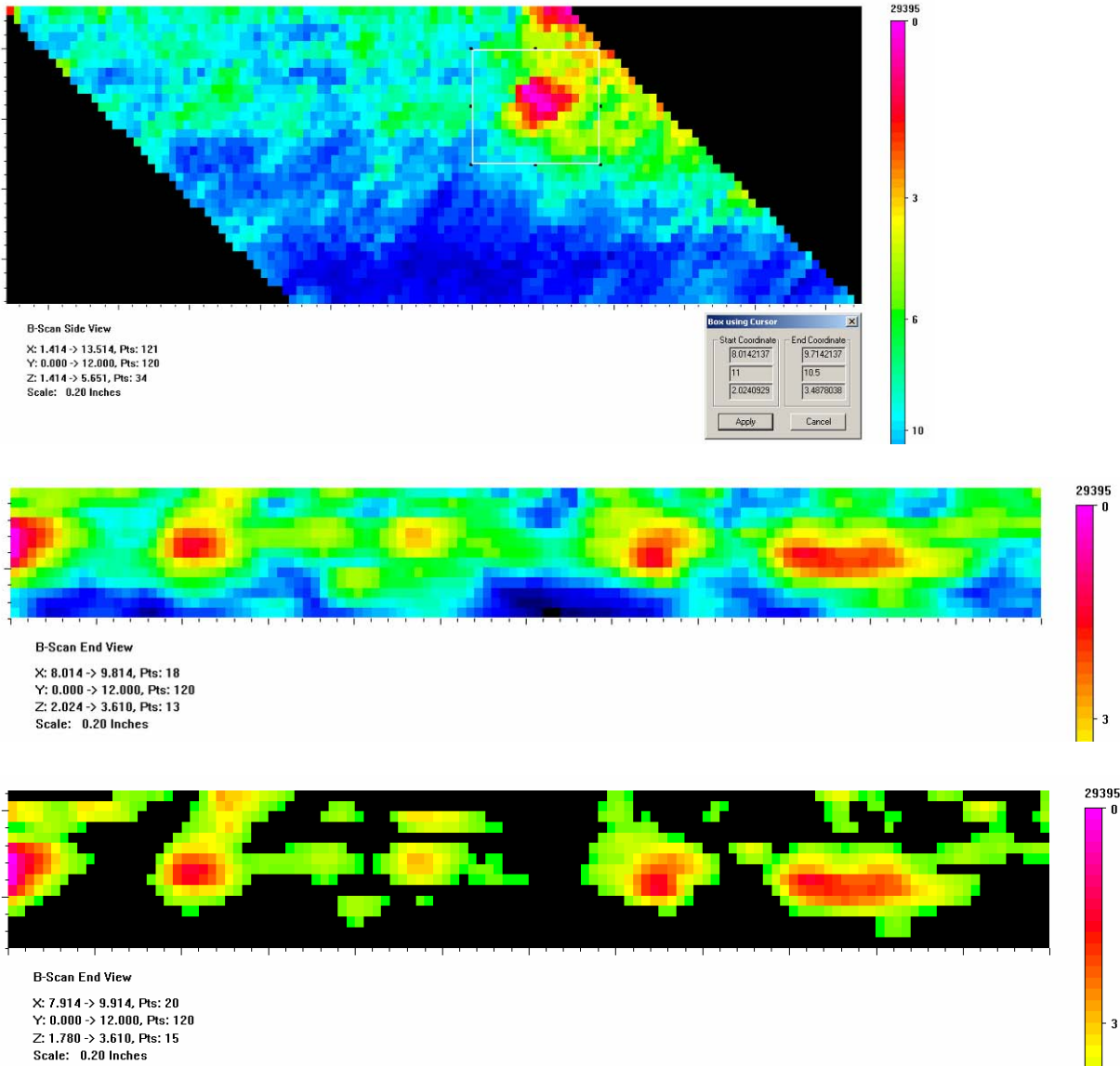
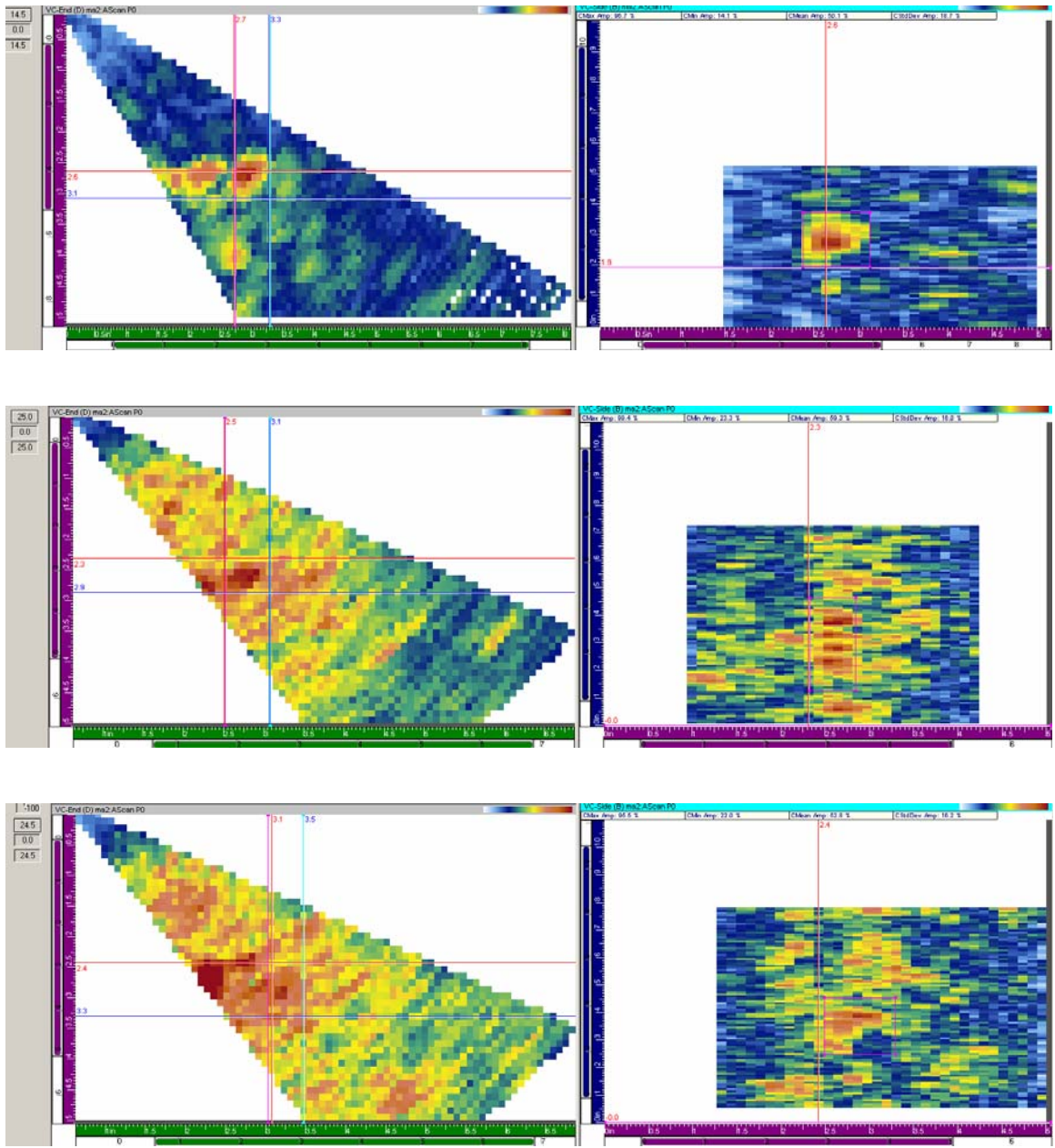


Figure B.16 MPE-6 Corner Response at 400 kHz

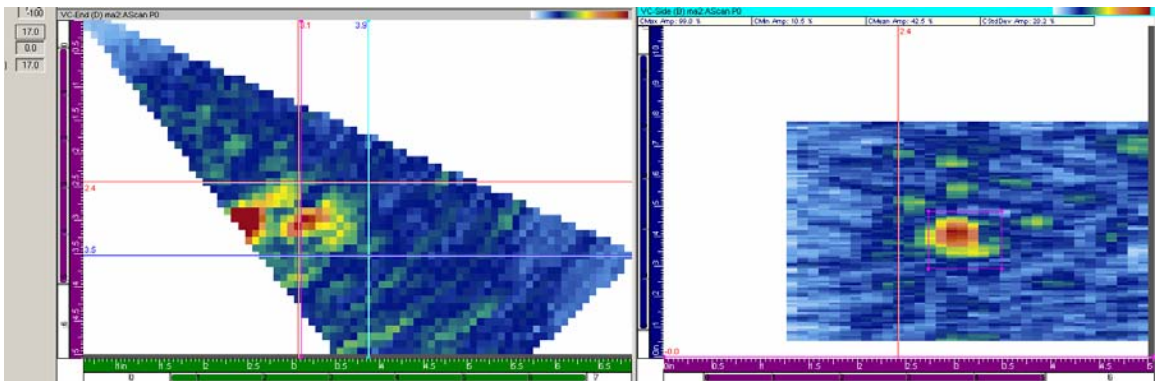
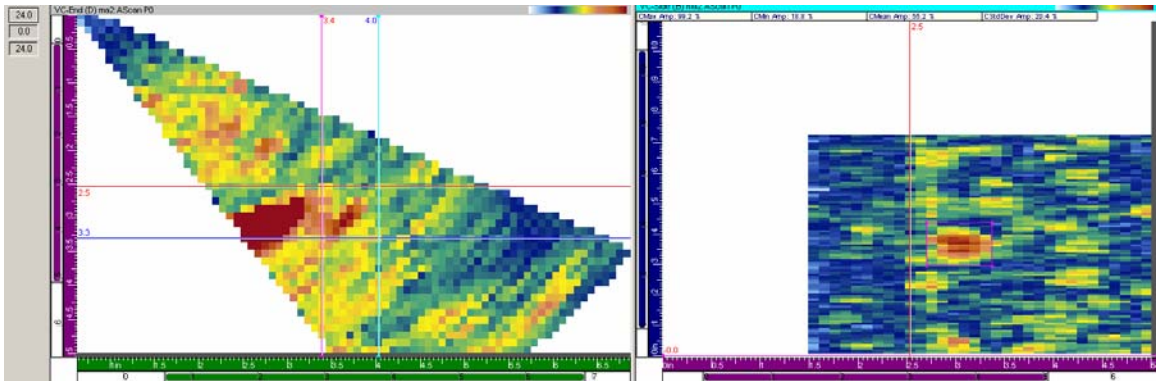
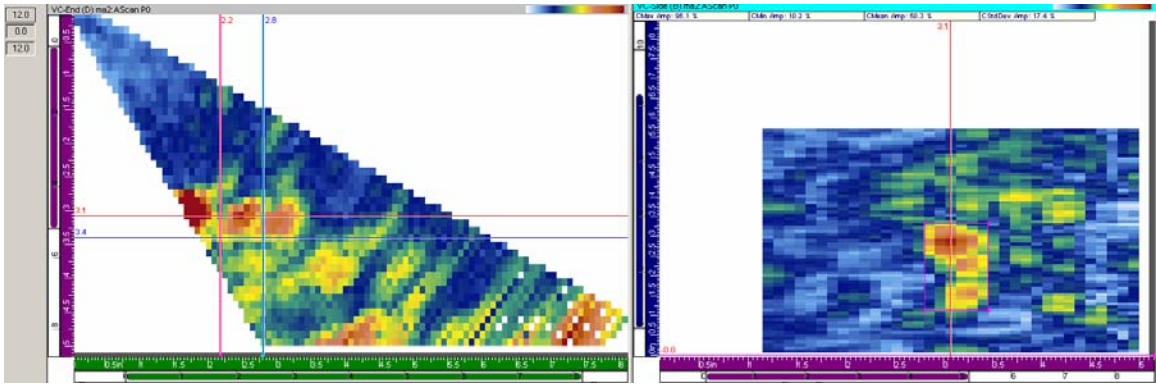
## **Appendix C**

### **Phased Array Detection Data from WOG and PNNL Flaws**

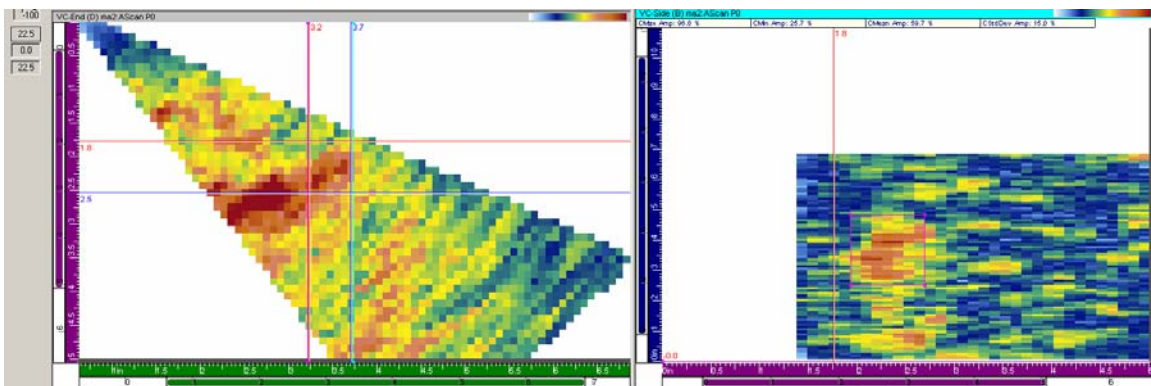
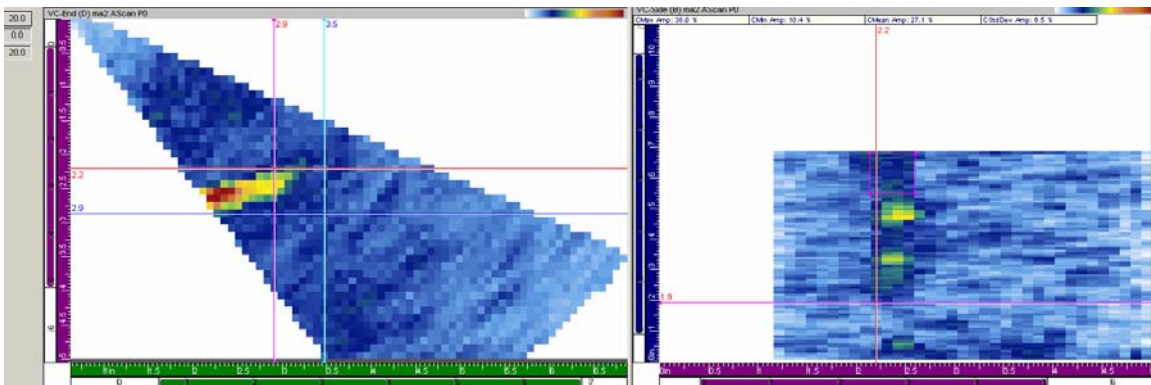
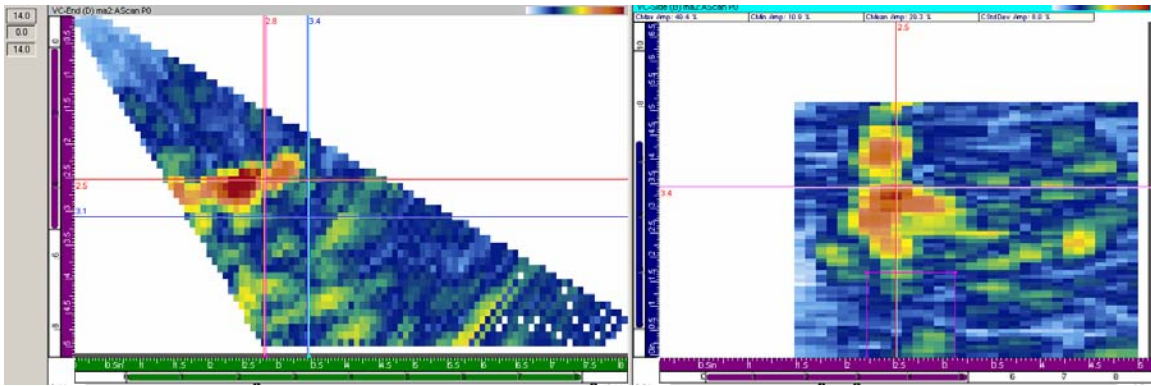
(All scales are in inches.)



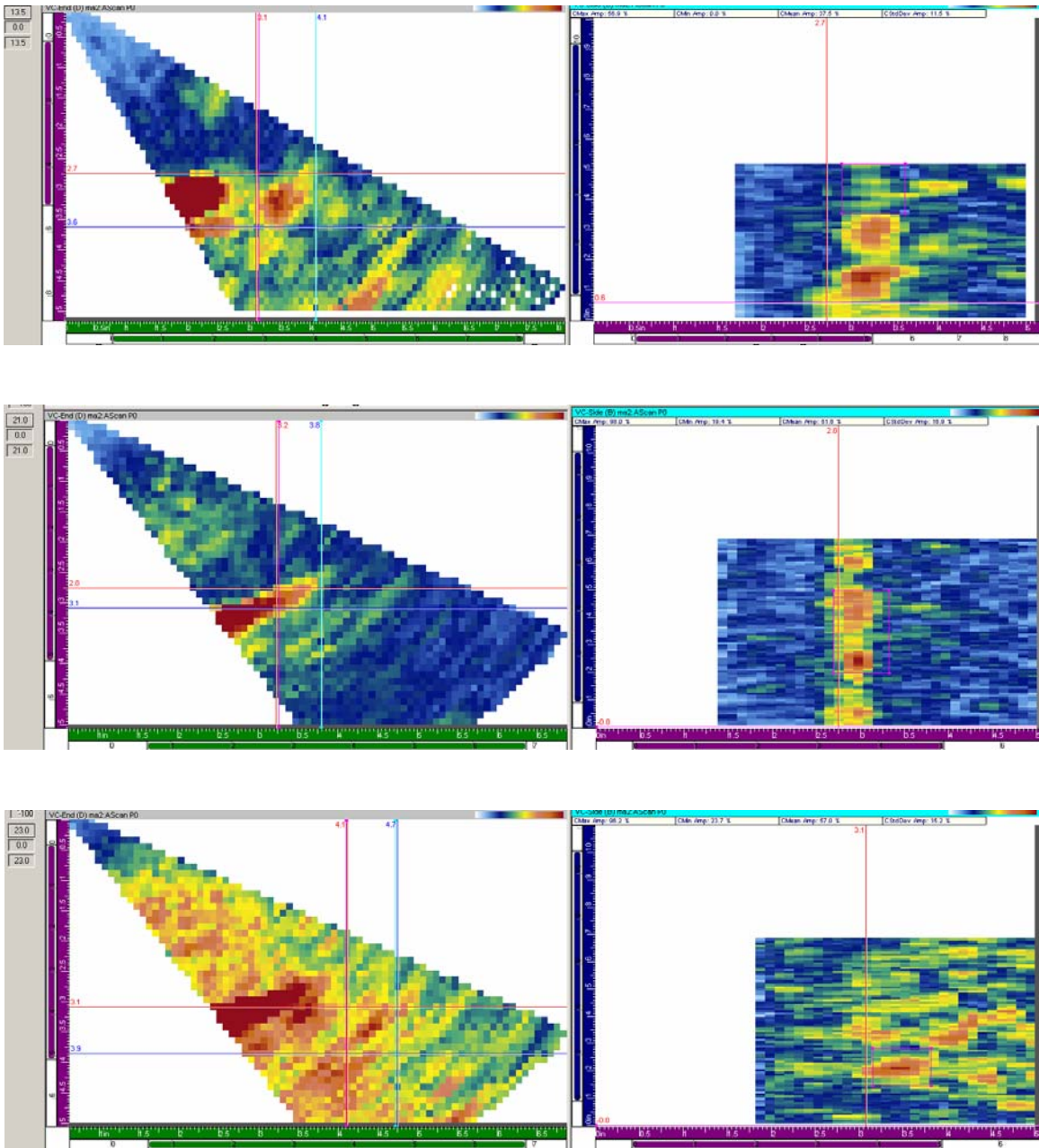
**Figure C.1 WOG Sample APE-1 CCSS from Top to Bottom 500, 750 and 1000 kHz Showing Detection as: Yes, No, and Marginal**



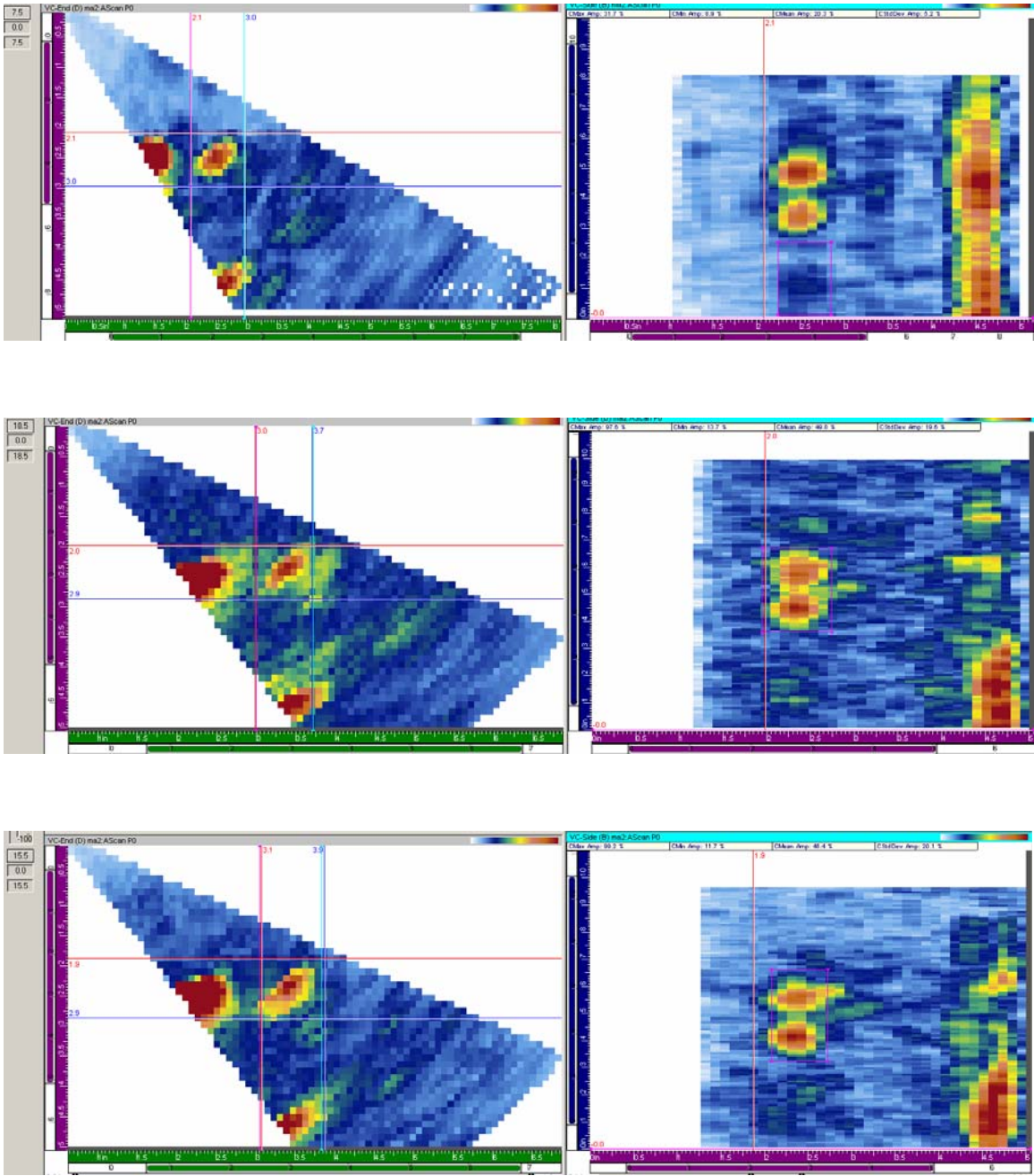
**Figure C.2 WOG Sample APE-1 SCSS from Top to Bottom 500, 750 and 1000 kHz  
Showing Detection as: Yes, Yes and Yes**



**Figure C.3 WOG Sample APE-4 CCSS from Top to Bottom 500, 750 and 1000 kHz  
Showing Detection as: Yes, Yes and Yes**

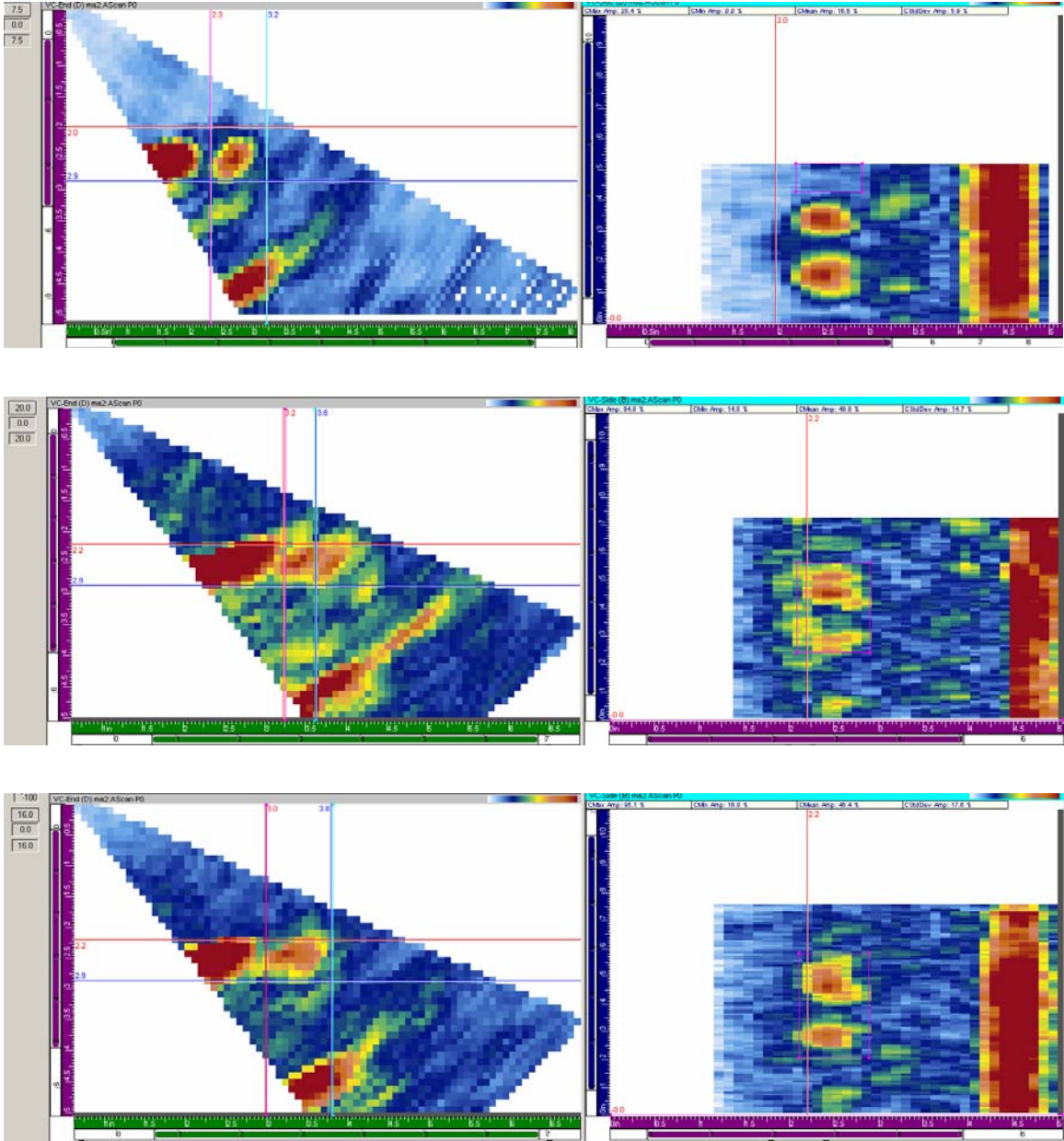


**Figure C.4 WOG Sample APE-4 SCSS from Top to Bottom 500, 750 and 1000 kHz Showing Detection as: Yes, No, and No**

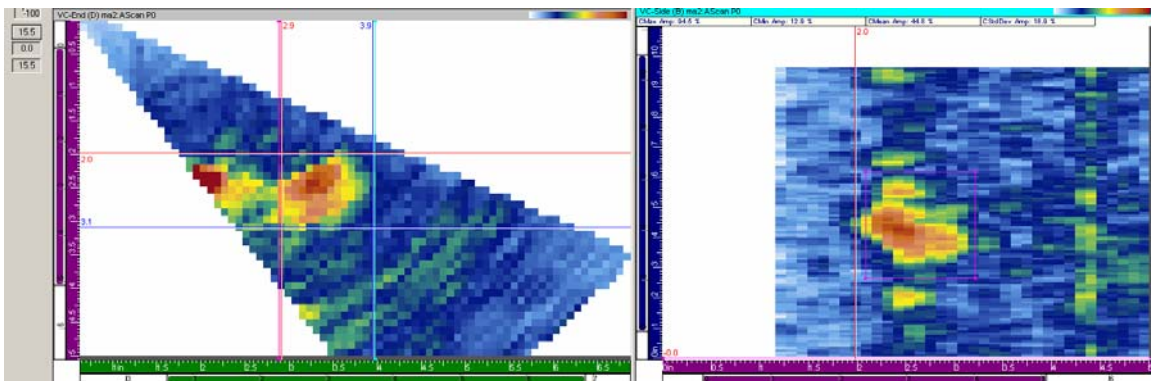
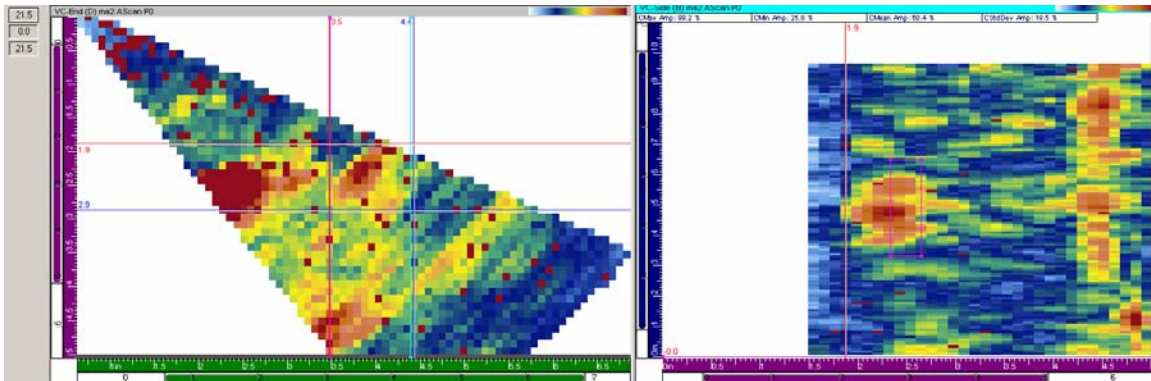
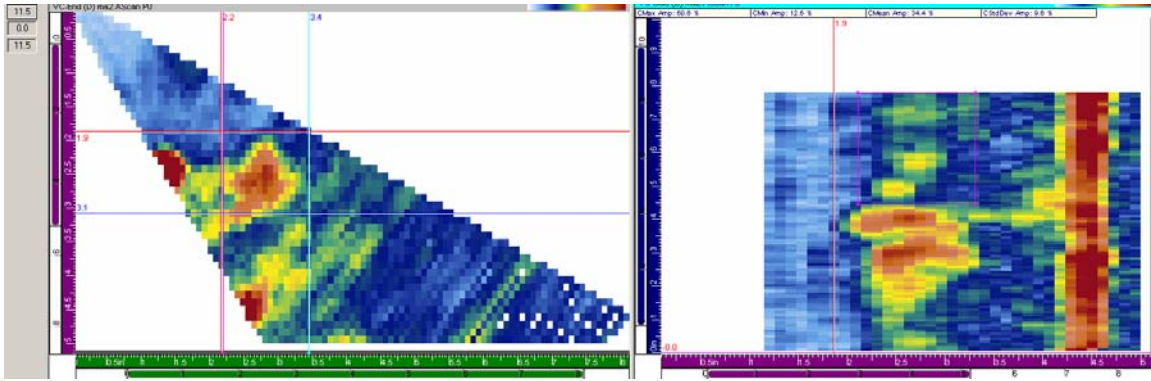


**Figure C.5 WOG Sample INE-A-1 SCSS from Top to Bottom 500, 750 and 1000 kHz  
Showing Detection as: Yes, Yes and Yes**





**Figure C.6 WOG Sample INE-A-4 SCSS from Top to Bottom 500, 750 and 1000 kHz Showing Detection as: Yes, Yes and Yes**



**Figure C.7 WOG Sample INE-A-5 SCSS from Top to Bottom 500, 750 and 1000 kHz Showing Detection as: Yes, Yes and Yes**

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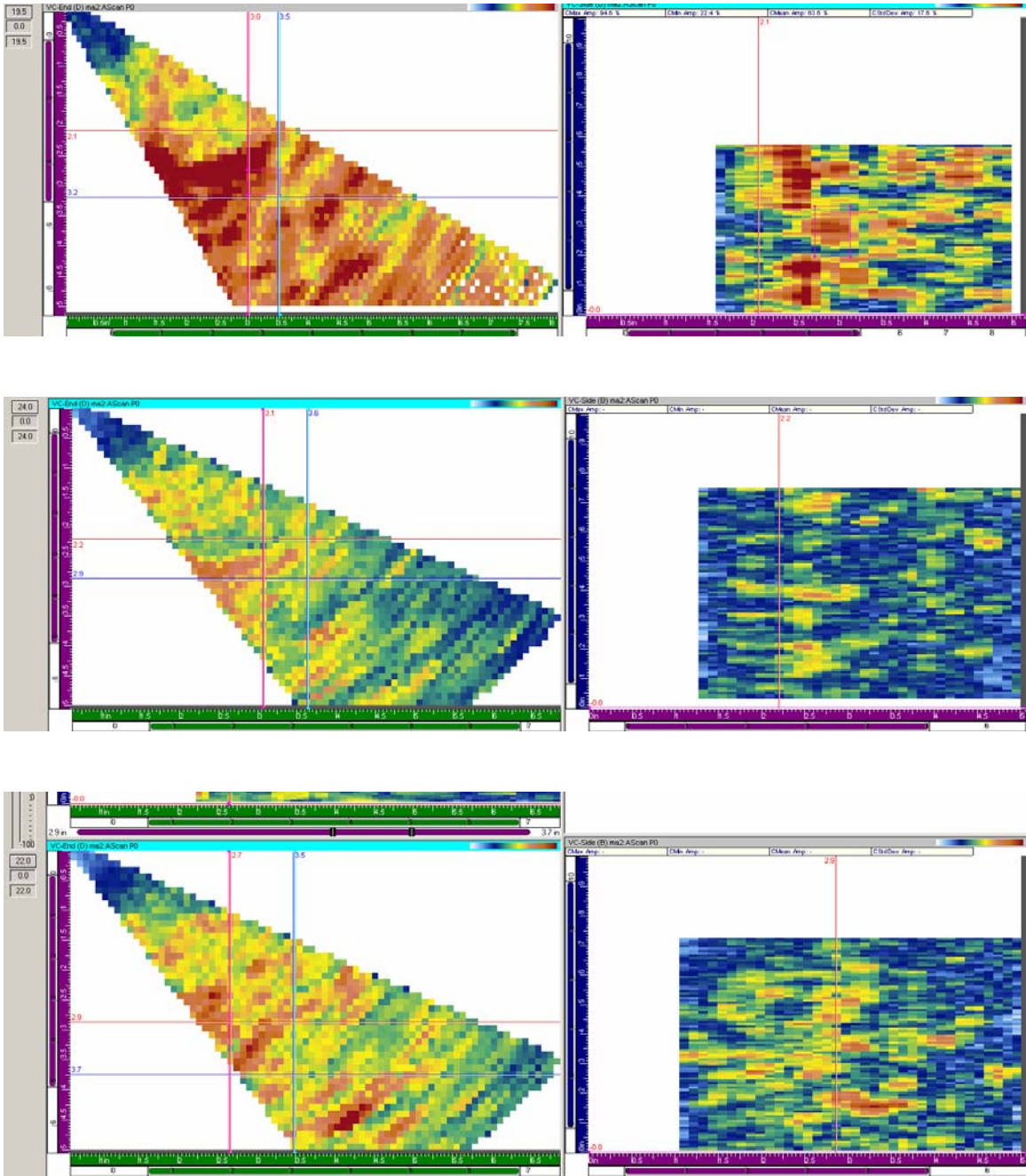


Figure C.8 WOG Sample MPE-3 CCSS from Top to Bottom 500, 750 and 1000 kHz Showing Detection as: Yes, No, and No

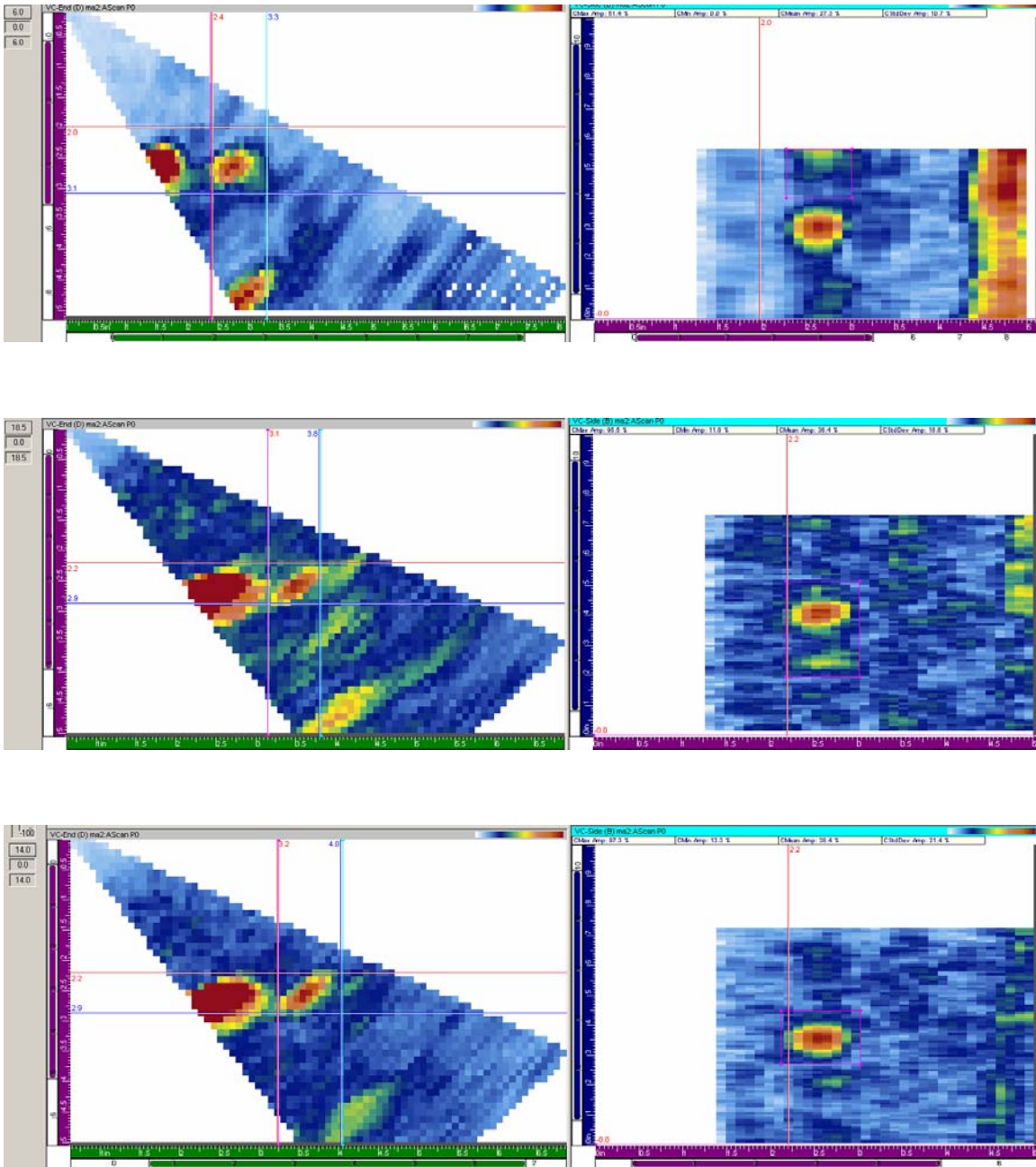


Figure C.9 WOG Sample MPE-3 SCSS from Top to Bottom 500, 750 and 1000 kHz Showing Detection as: Yes, Yes, and Yes

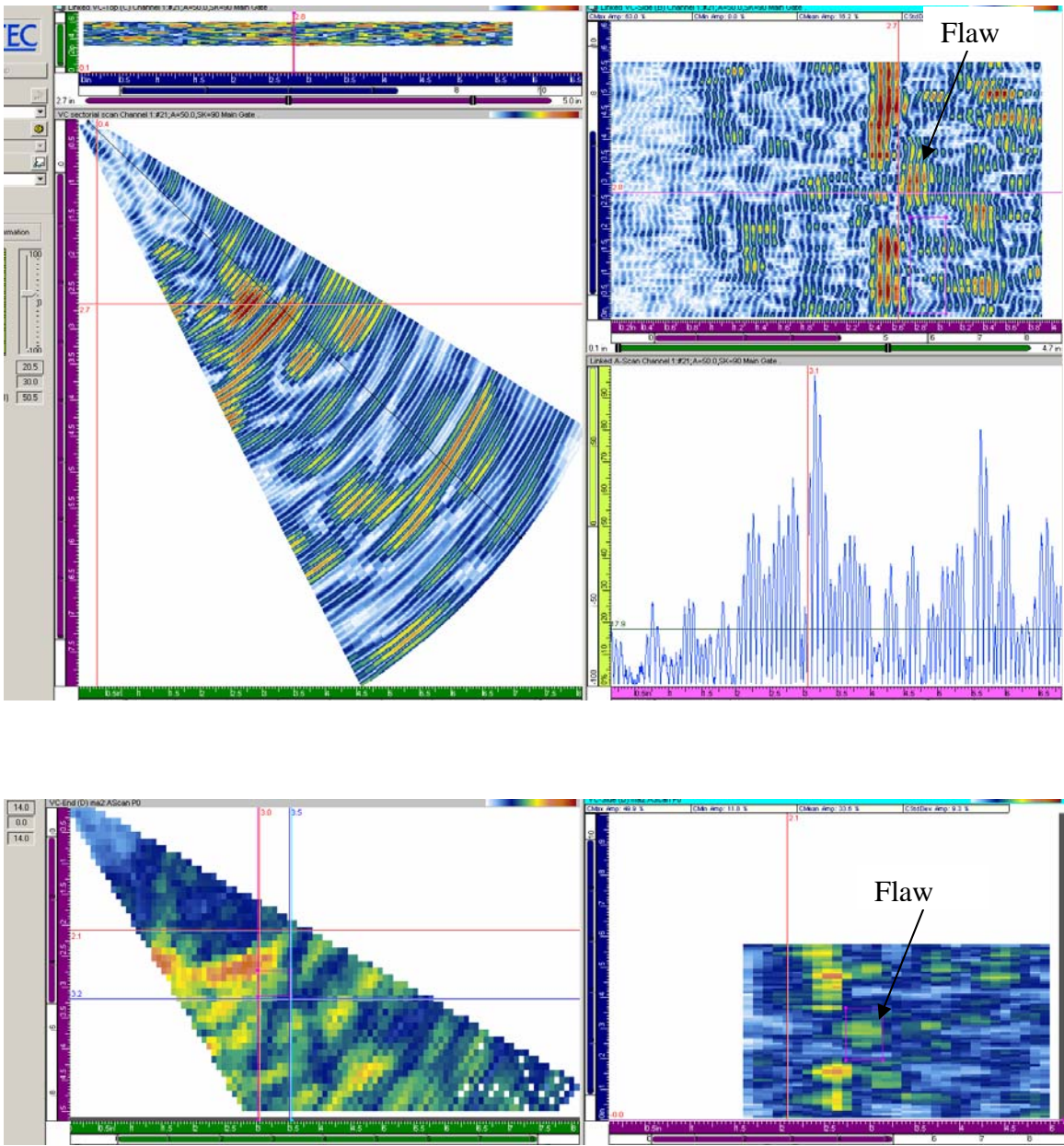
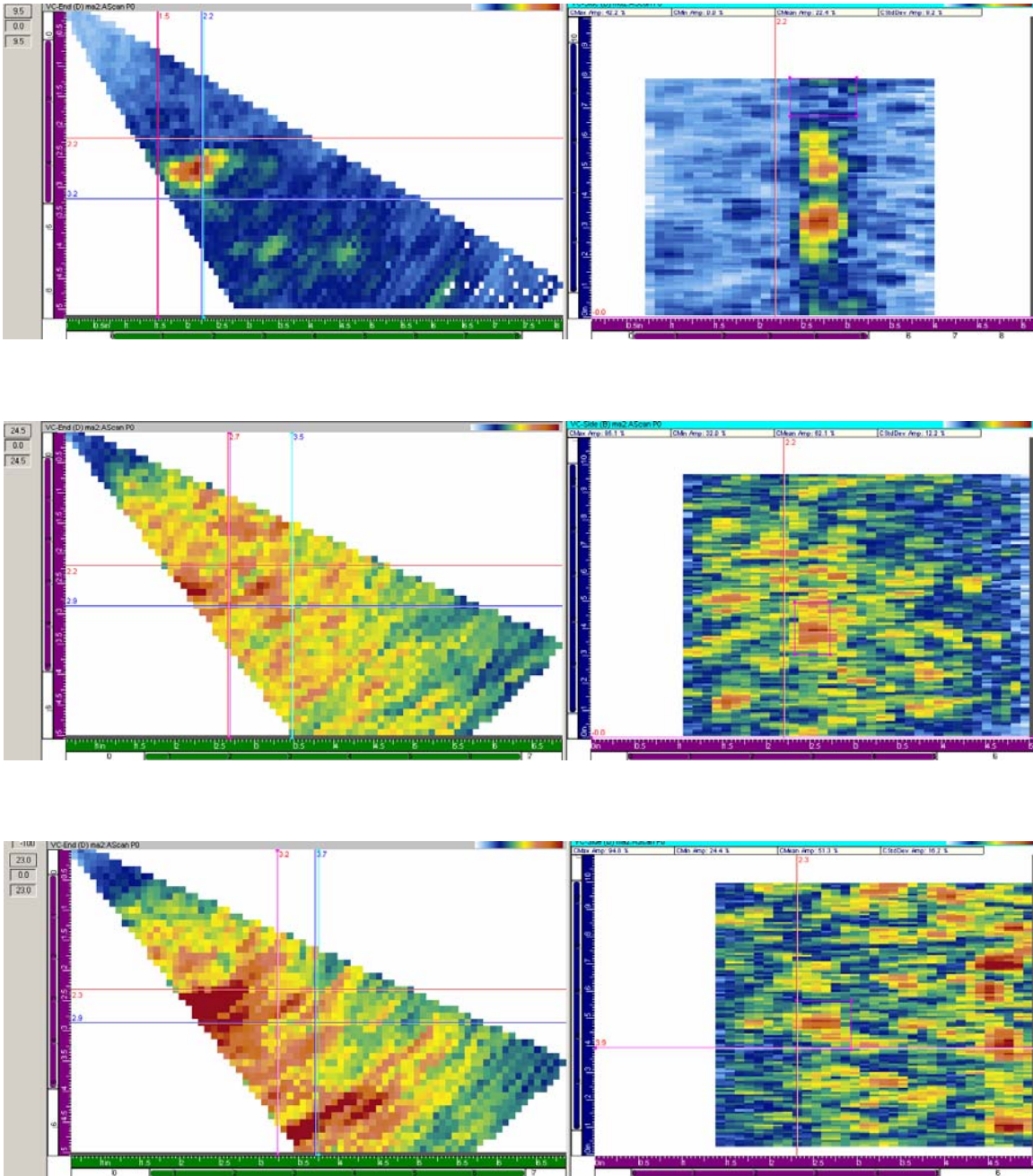
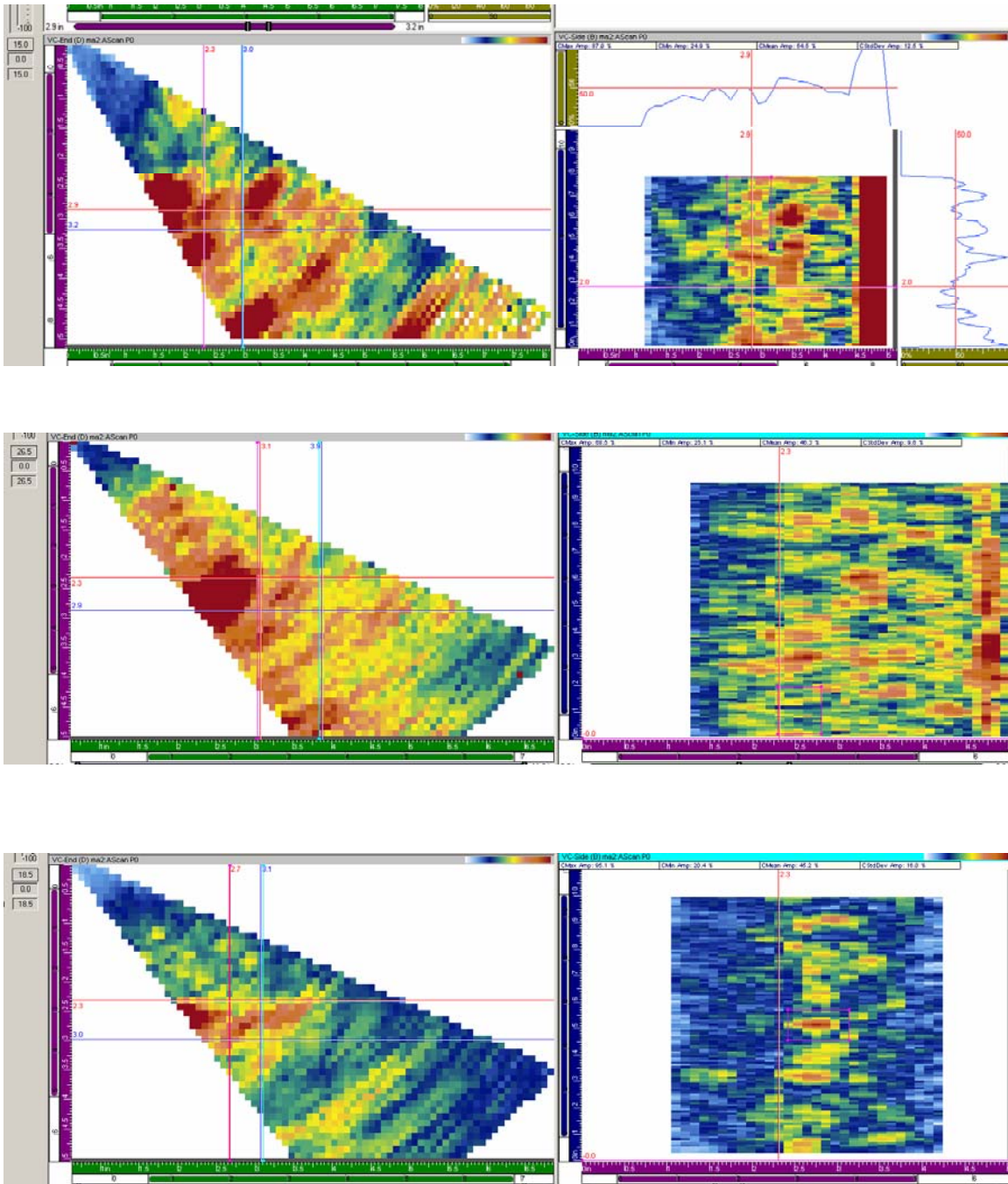


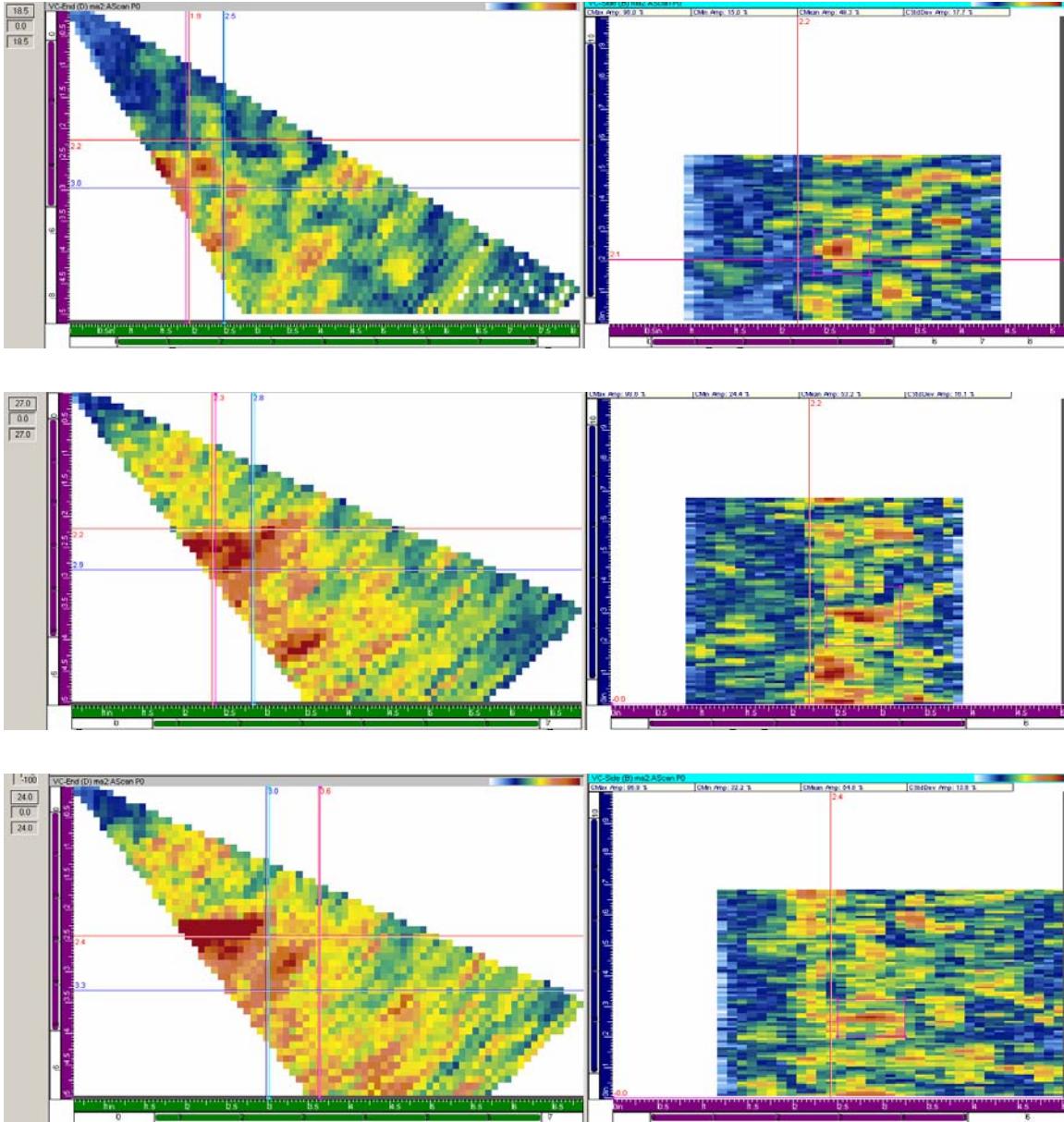
Figure C.10 WOG Sample MPE-3 CCSS at 500 kHz



**Figure C.11 WOG Sample MPE-6 CCSS from Top to Bottom 500, 750 and 1000 kHz Showing Detection as: Yes, Yes, and Marginal**



**Figure C.12 WOG Sample MPE-6 SCSS from Top to Bottom 500, 750 and 1000 kHz Showing Detection as: Marginal, No, and No**



**Figure C.13 WOG Sample ONP-3-5 CCSS from Top to Bottom 500, 750 and 1000 kHz Showing Detection as: Marginal, No, and No**



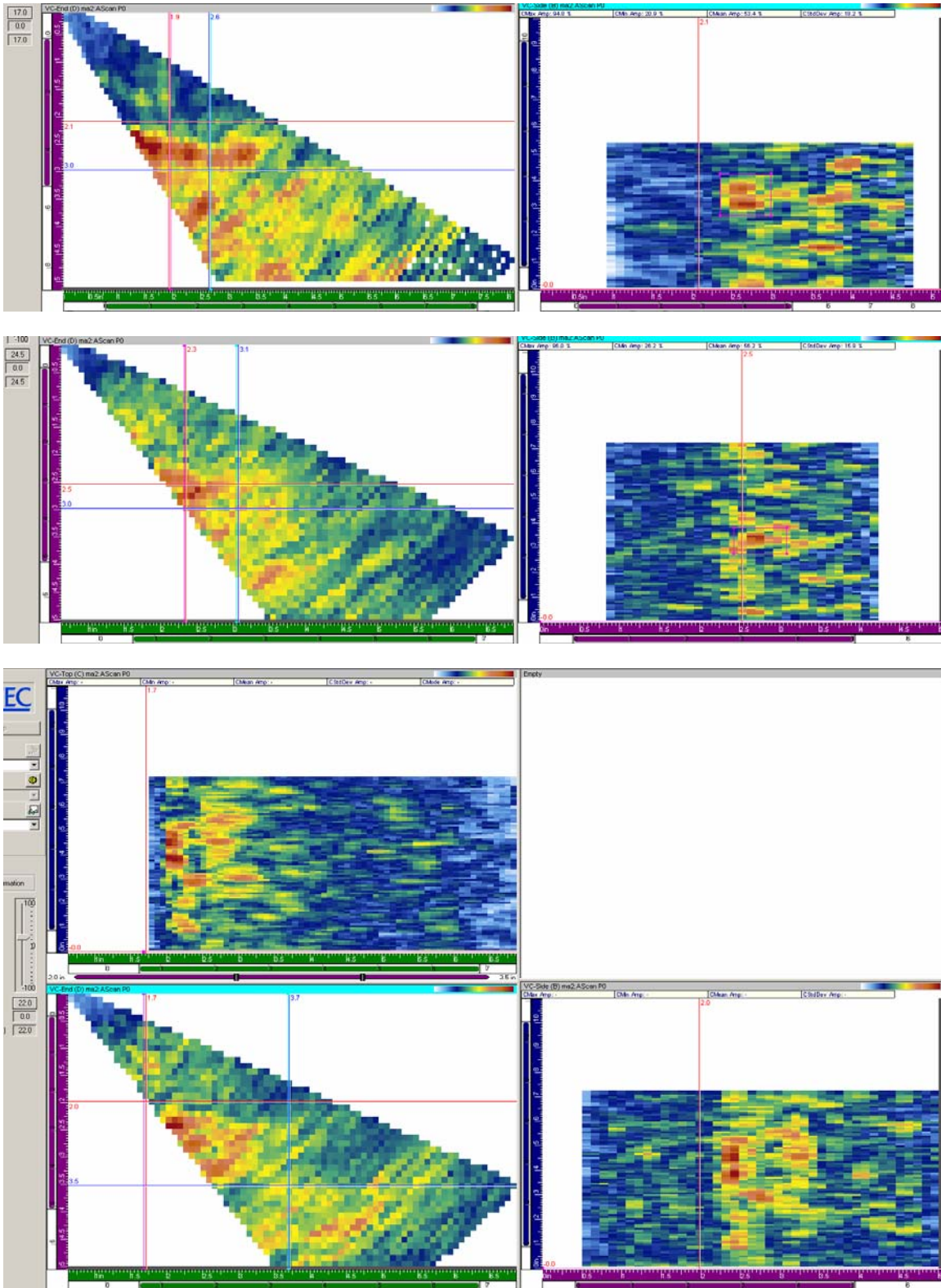


Figure C.14 WOG Sample ONP-3-8 CCSS from Top to Bottom 500, 750 and 1000 kHz Showing Detection as: Marginal, Yes, and Marginal

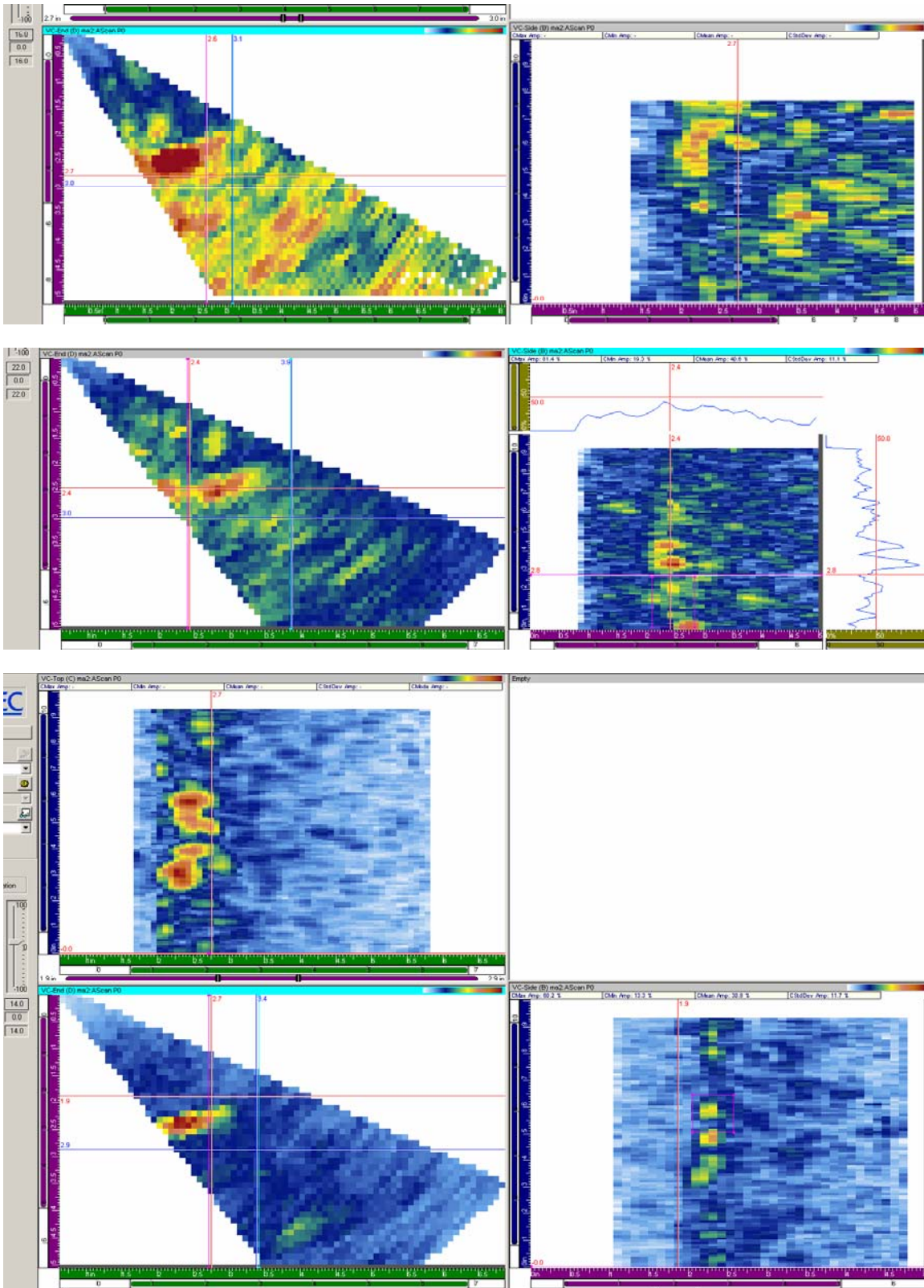
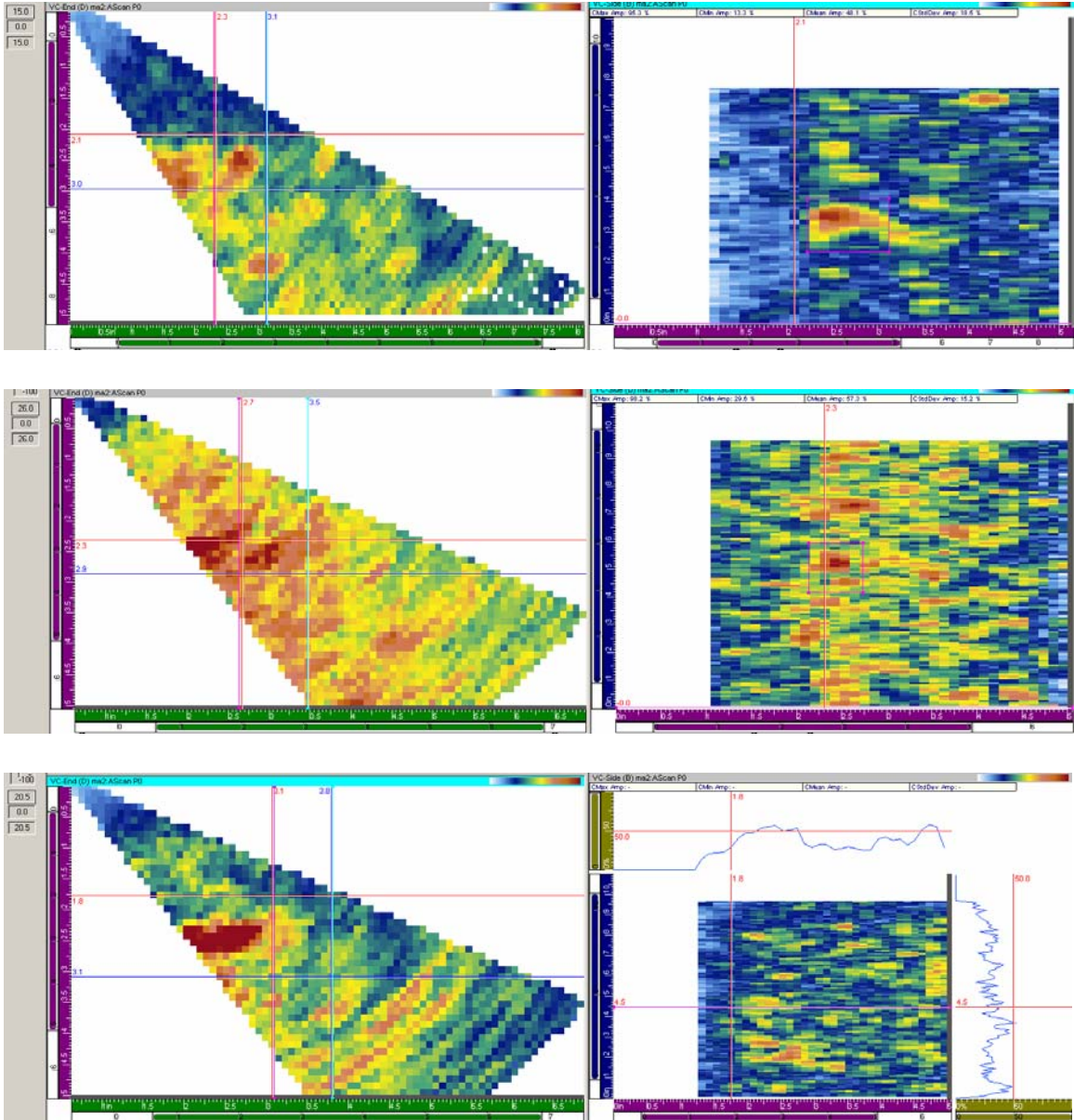
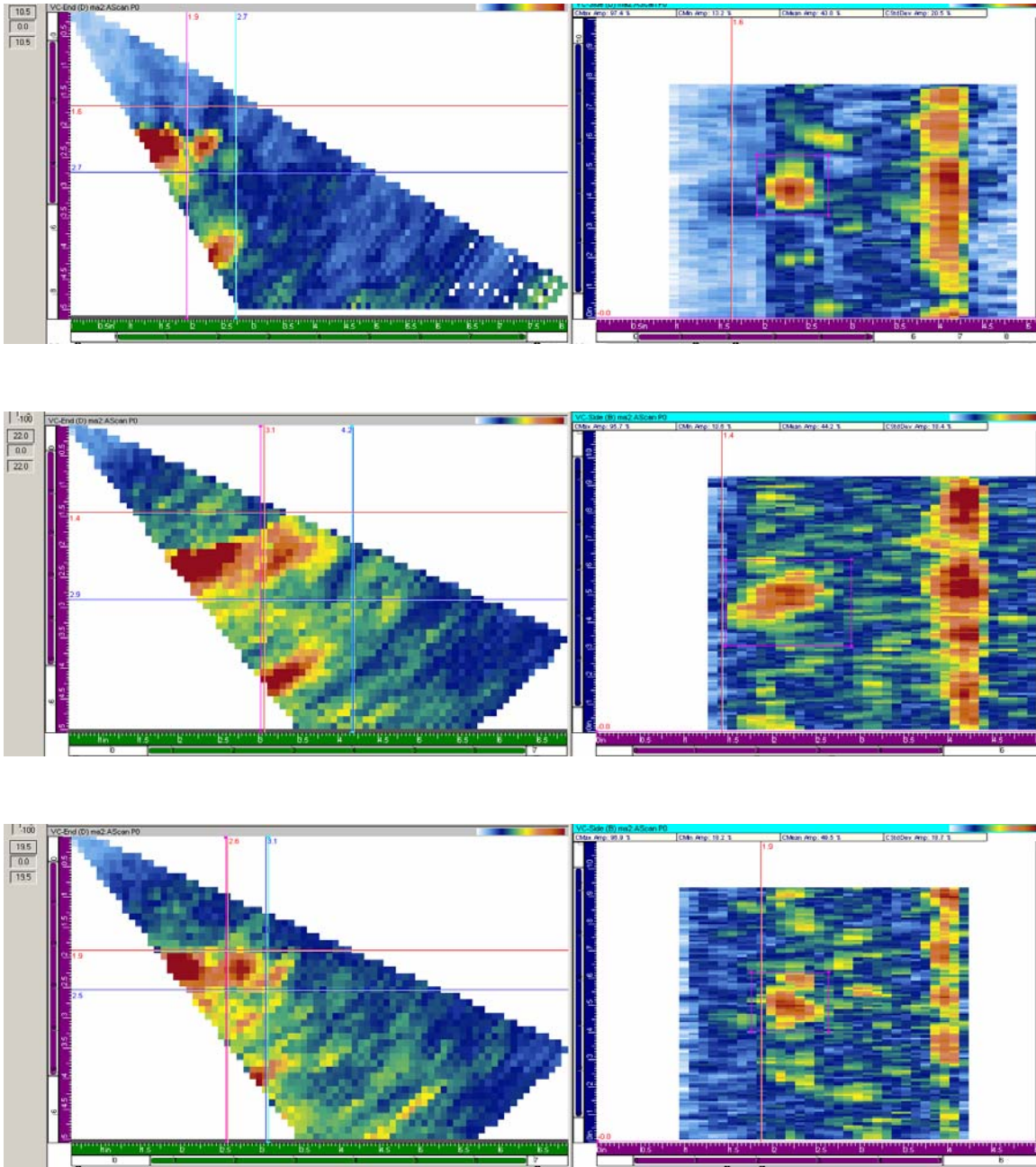


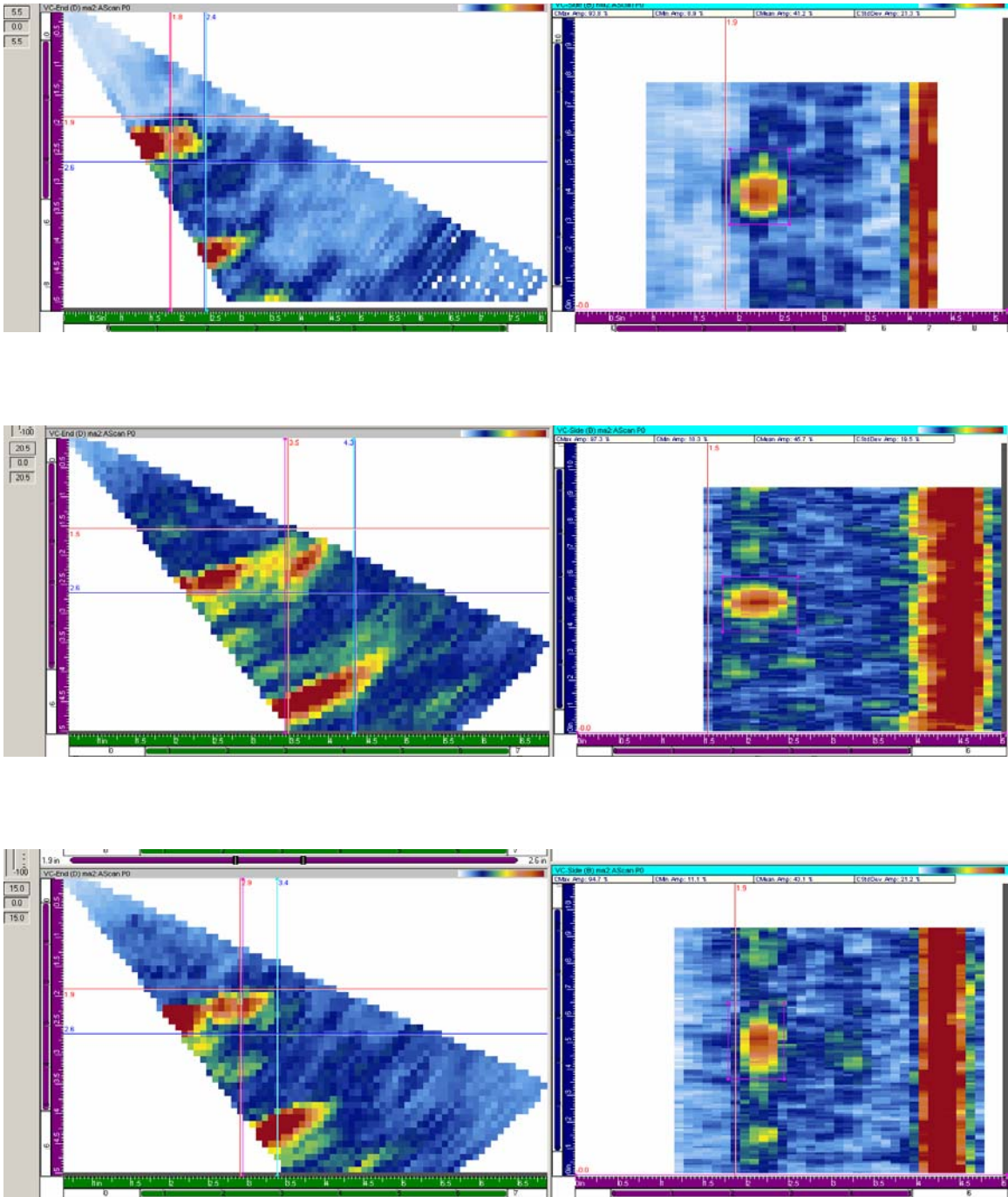
Figure C.15 WOG Sample ONP-D-2 CCSS from Top to Bottom 500, 750 and 1000 kHz Showing Detection as: Marginal, Yes, and Marginal



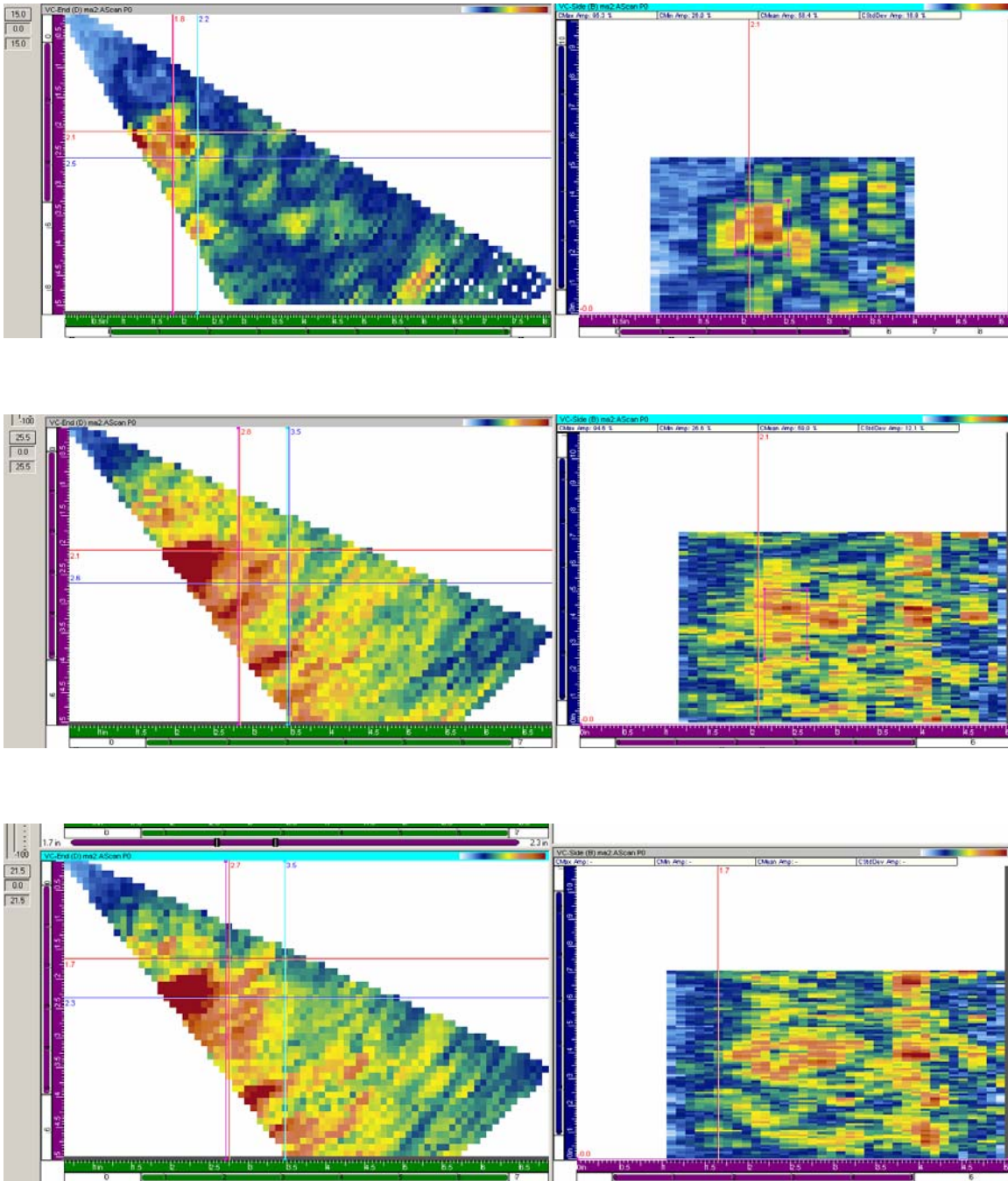
**Figure C.16 WOG Sample ONP-D-5 CCSS from Top to Bottom 500, 750 and 1000 kHz Showing Detection as: Yes, Marginal, and Marginal**



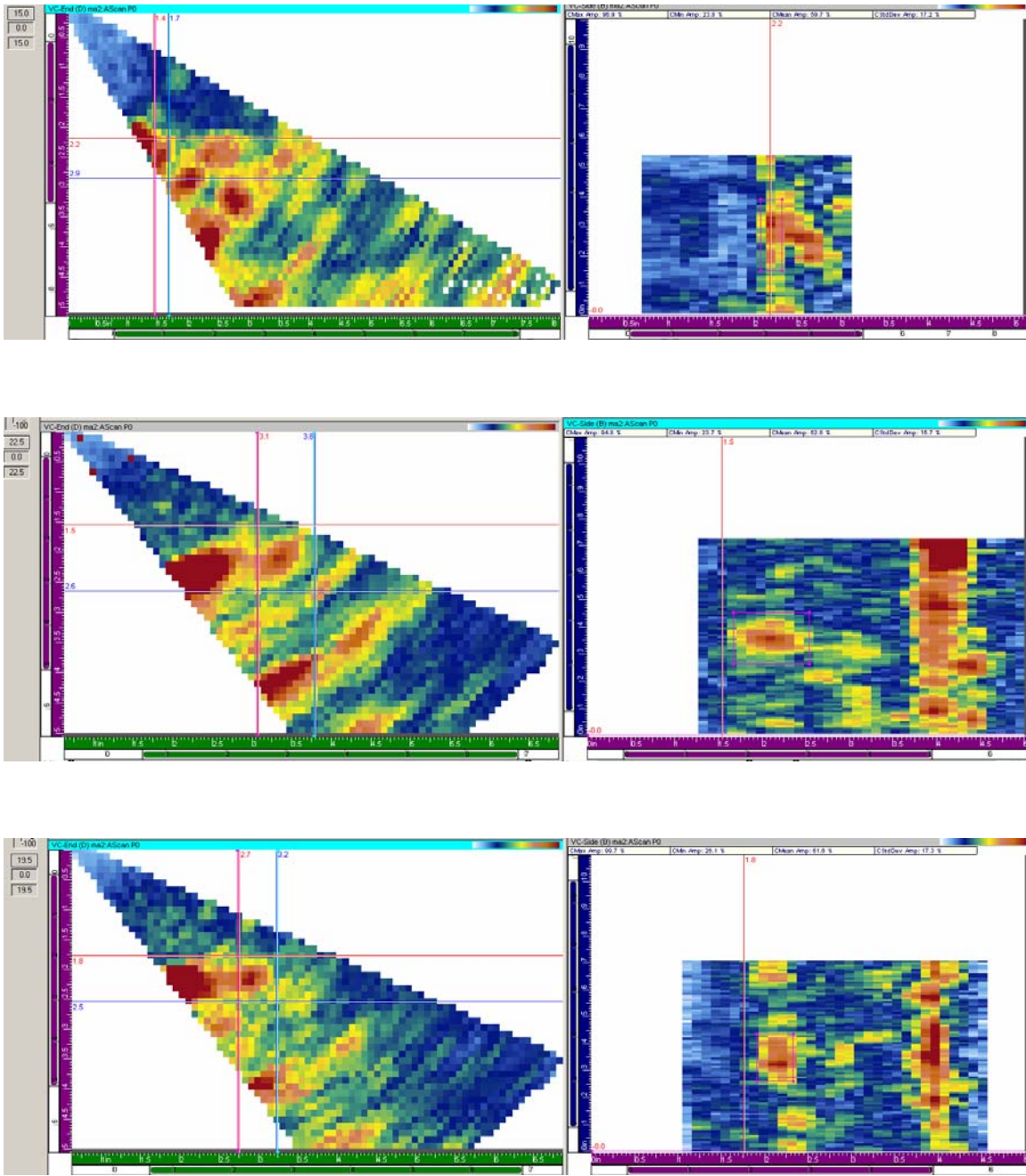
**Figure C.17 WOG Sample OPE-2 CCSS from Top to Bottom 500, 750 and 1000 kHz  
Showing Detection as: Yes, Yes, and Yes**



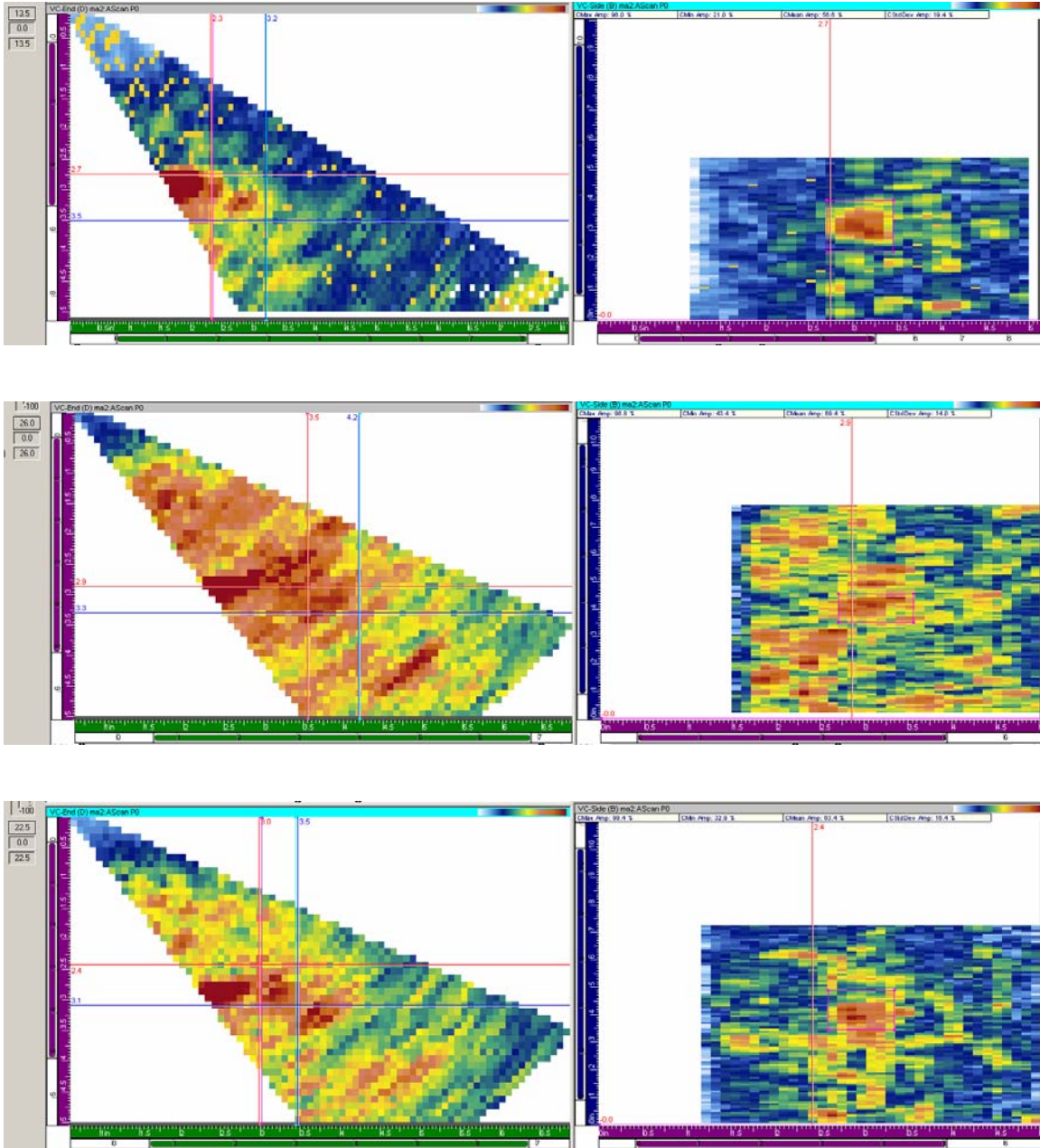
**Figure C.18 WOG Sample OPE-2 SCSS from Top to Bottom 500, 750 and 1000 kHz Showing Detection as: Yes, Yes, and Yes**



**Figure C.19 WOG Sample OPE-5 CCSS from Top to Bottom 500, 750 and 1000 kHz Showing Detection as: Yes, Marginal, and Marginal**



**Figure C.20 WOG Sample OPE-5 SCSS from Top to Bottom 500, 750 and 1000 kHz Showing Detection as: Yes, Yes, and Yes**



**Figure C.21 WOG Sample POP-7 CCSS from Top to Bottom 500, 750 and 1000 kHz Showing Detection as: Yes, No, and Yes**



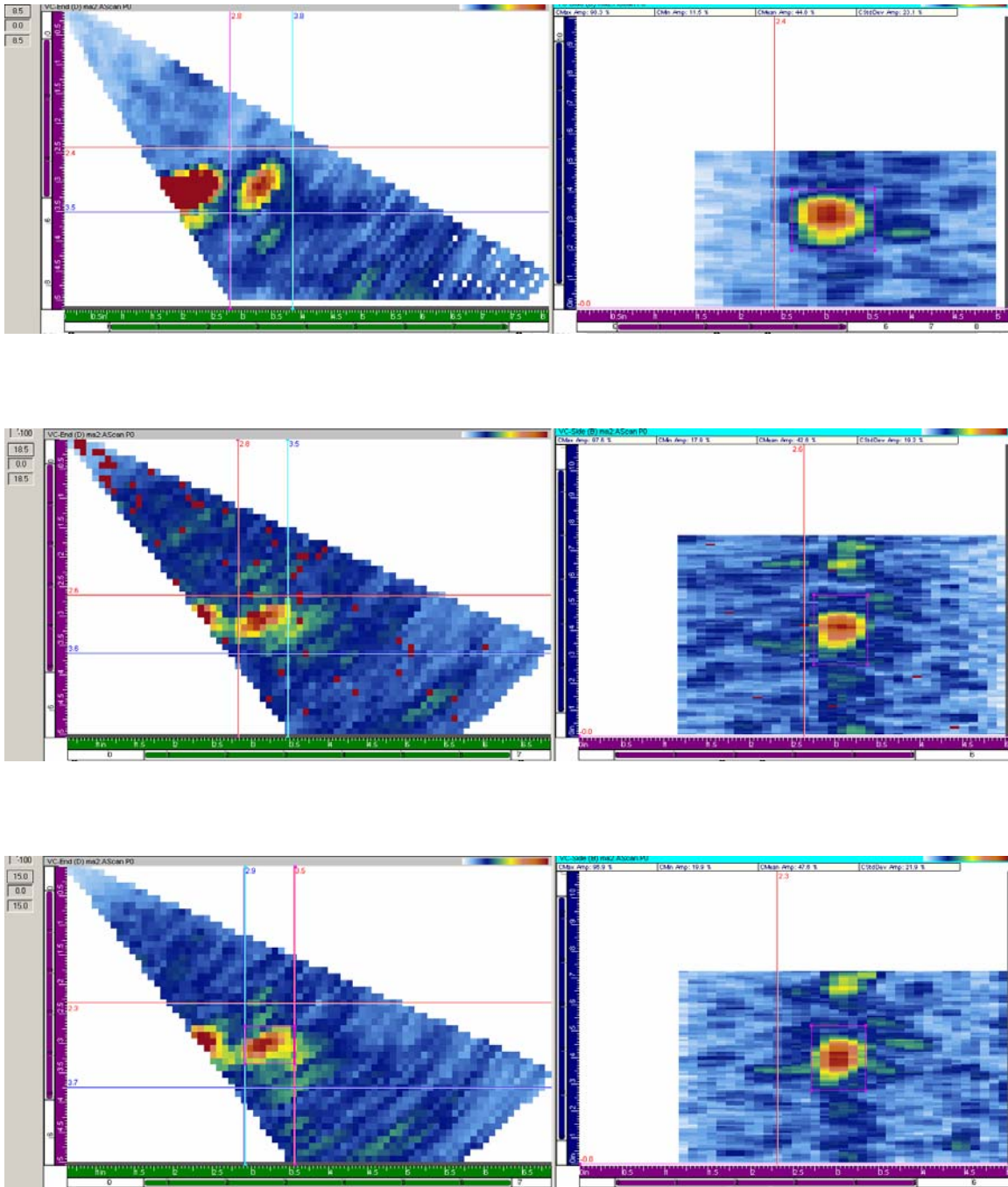
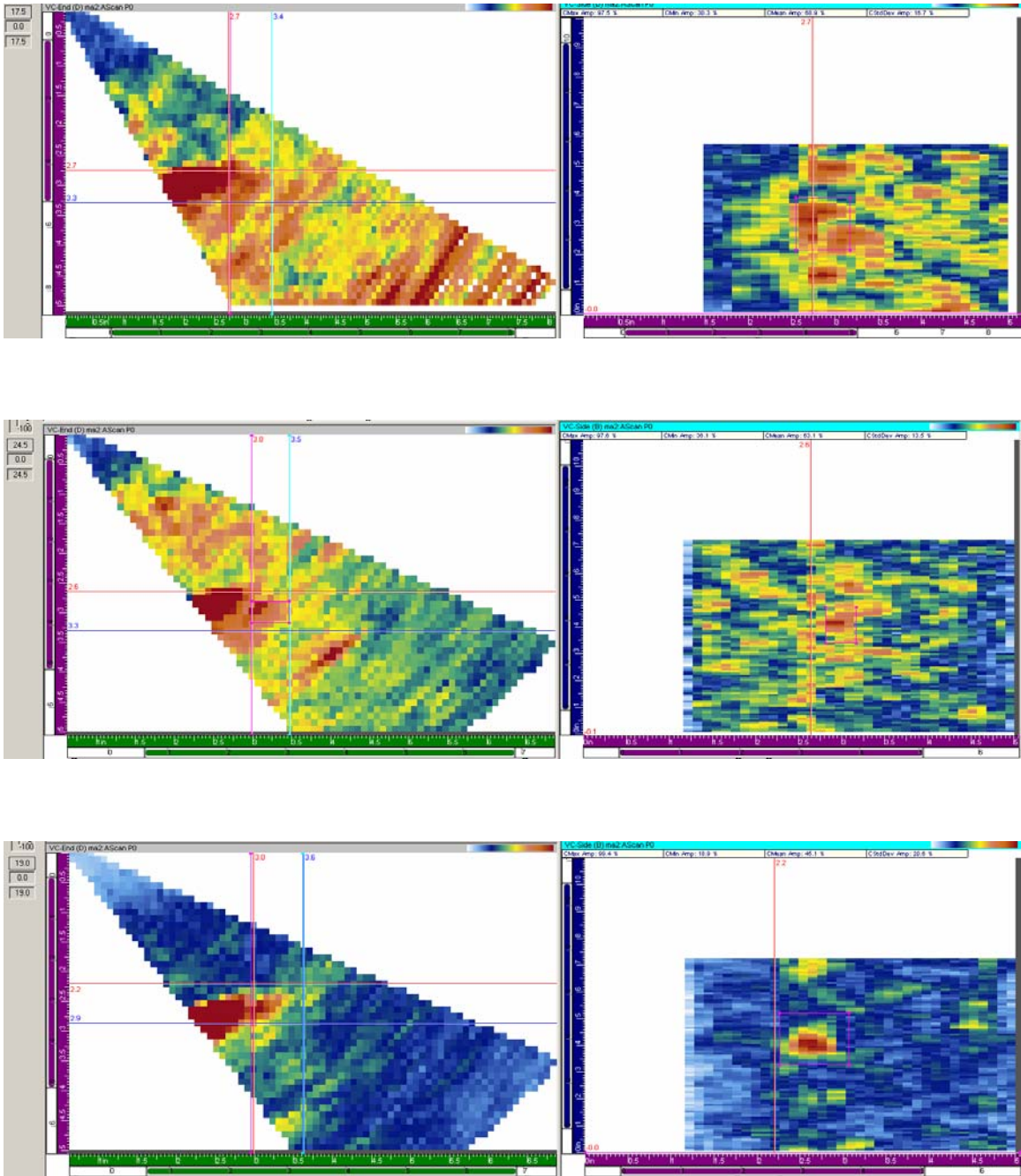
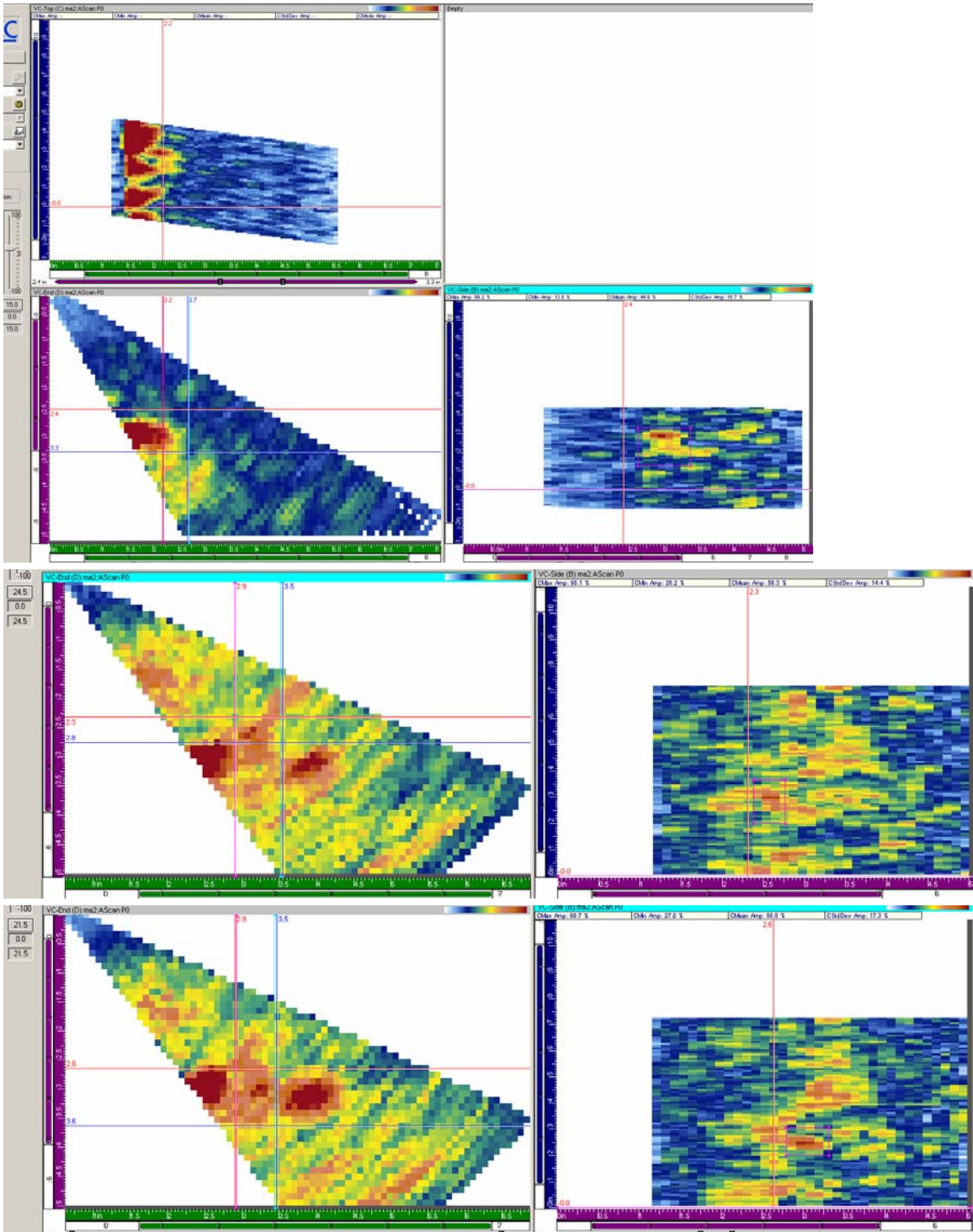


Figure C.22 WOG Sample POP-7 SCSS from Top to Bottom 500, 750 and 1000 kHz Showing Detection as: Yes, Yes, and Yes



**Figure C.23 WOG Sample POP-8 CCSS from Top to Bottom 500, 750 and 1000 kHz Showing Detection as: Marginal, Marginal, and Yes**



**Figure C.24 WOG Sample POP-8 SCSS from Top to Bottom 500, 750 and 1000 kHz Showing Detection as: Yes, Marginal, and Marginal. The 500 kHz data is skewed by 20 degrees.**

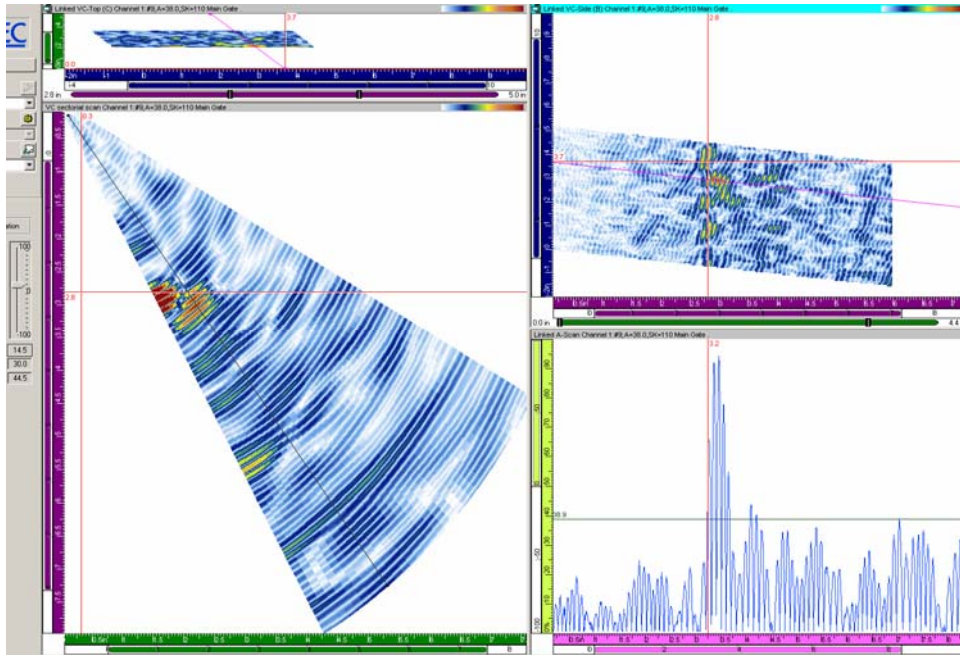


Figure C.25 WOG Sample POP-8 SCSS at 500 kHz with a 20 Degree Skew Showing a Detection

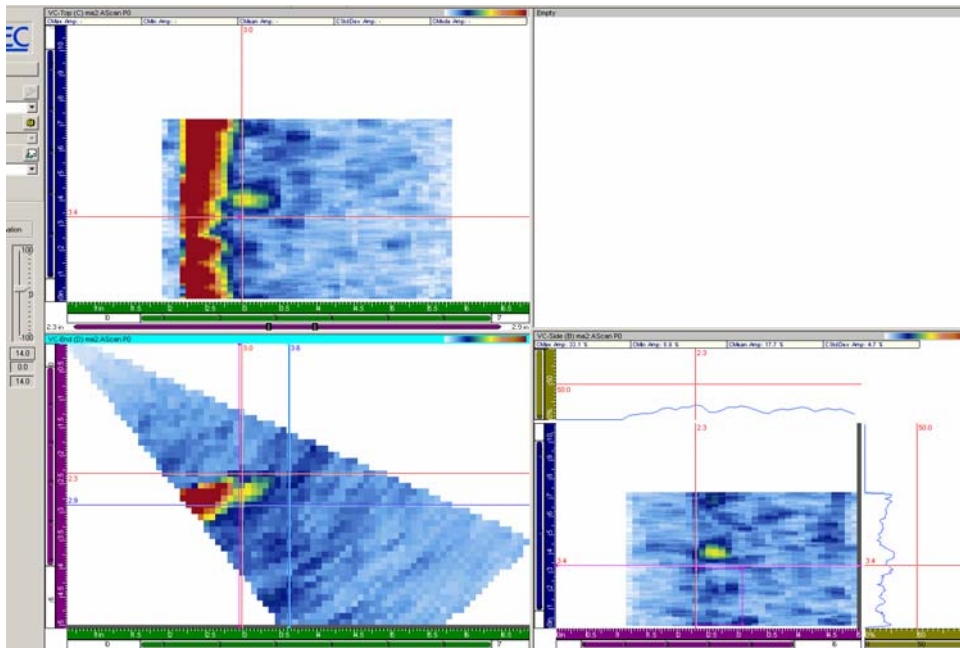


Figure C.26 WOG Sample POP-8 CCSS at 1 MHz Showing a Detection

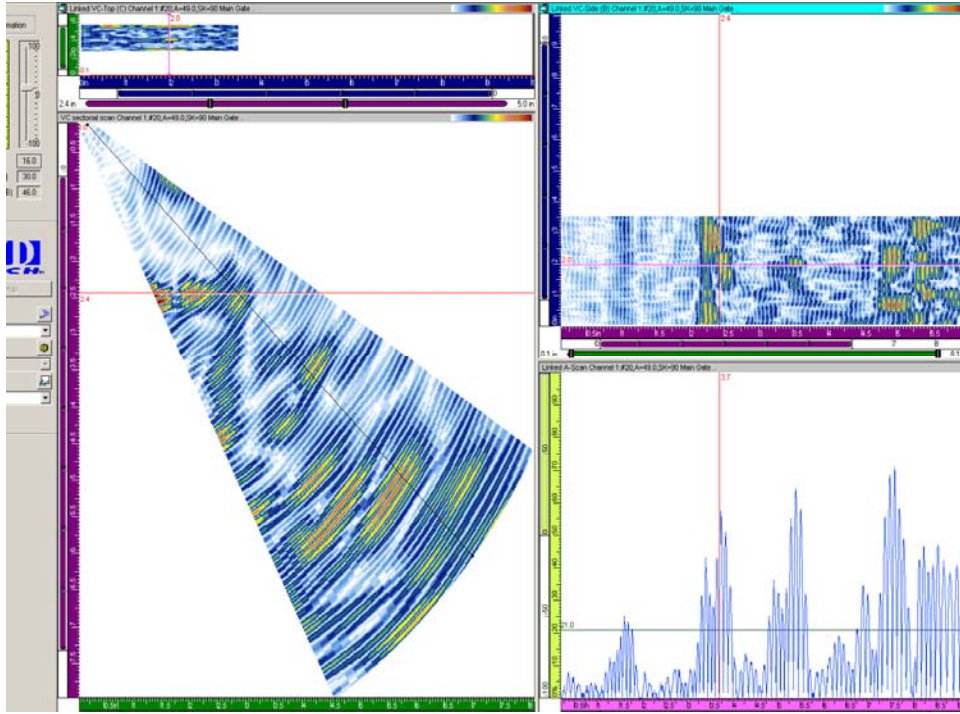


Figure C.27 B501 Sample as Inspected From the Columnar Side of the Weld, Showing a Marginal Detection

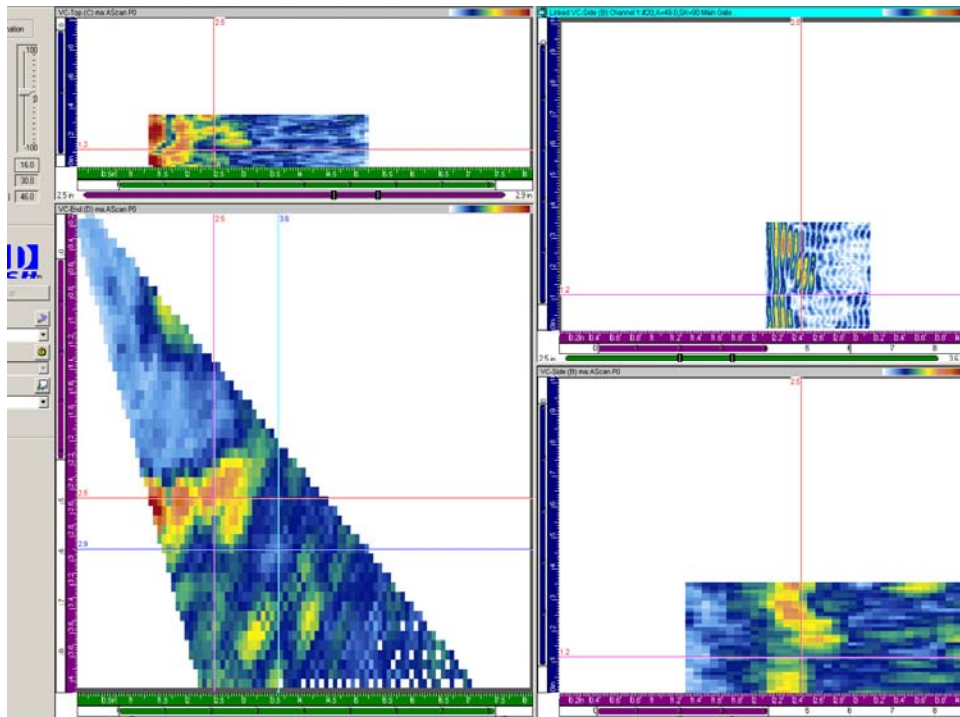


Figure C.28 B501 Sample as Inspected From the Columnar Side of the Weld with Merged Data, Showing a Marginal Detection

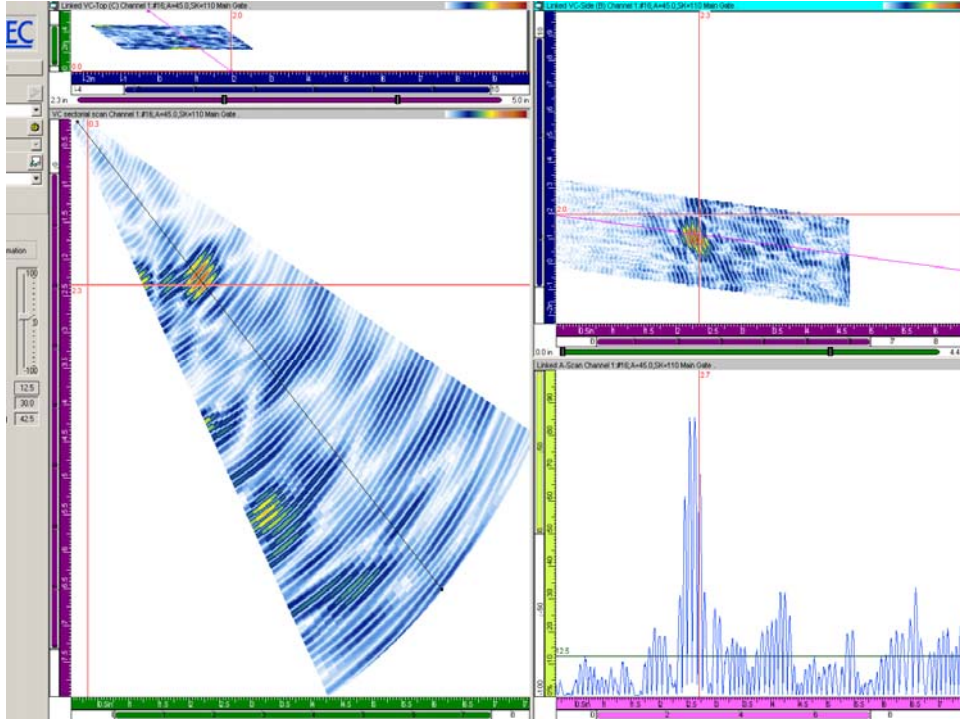
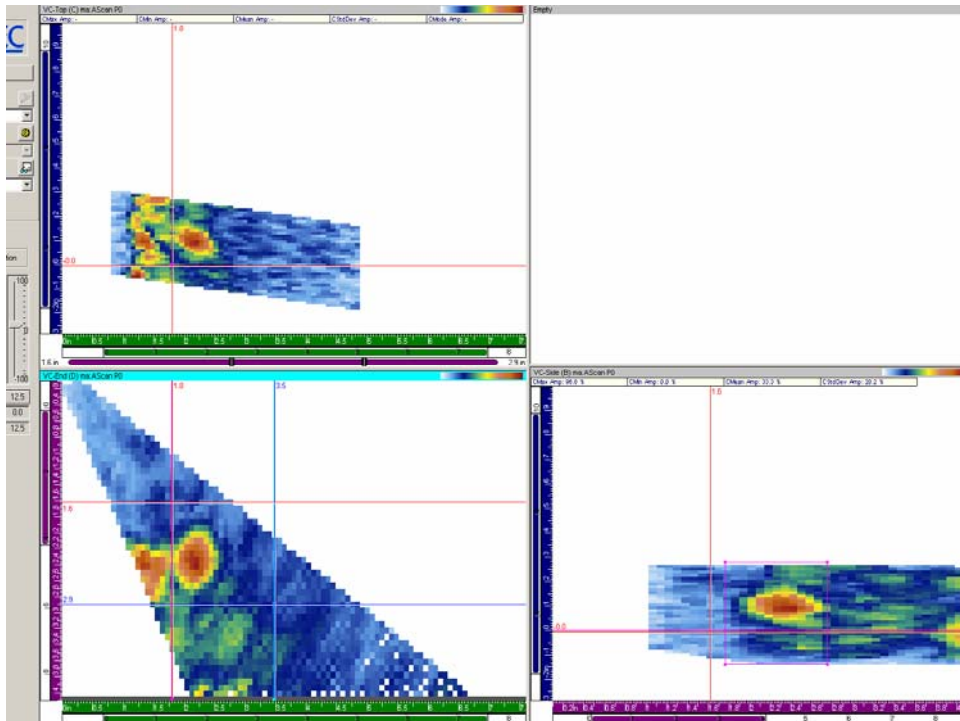
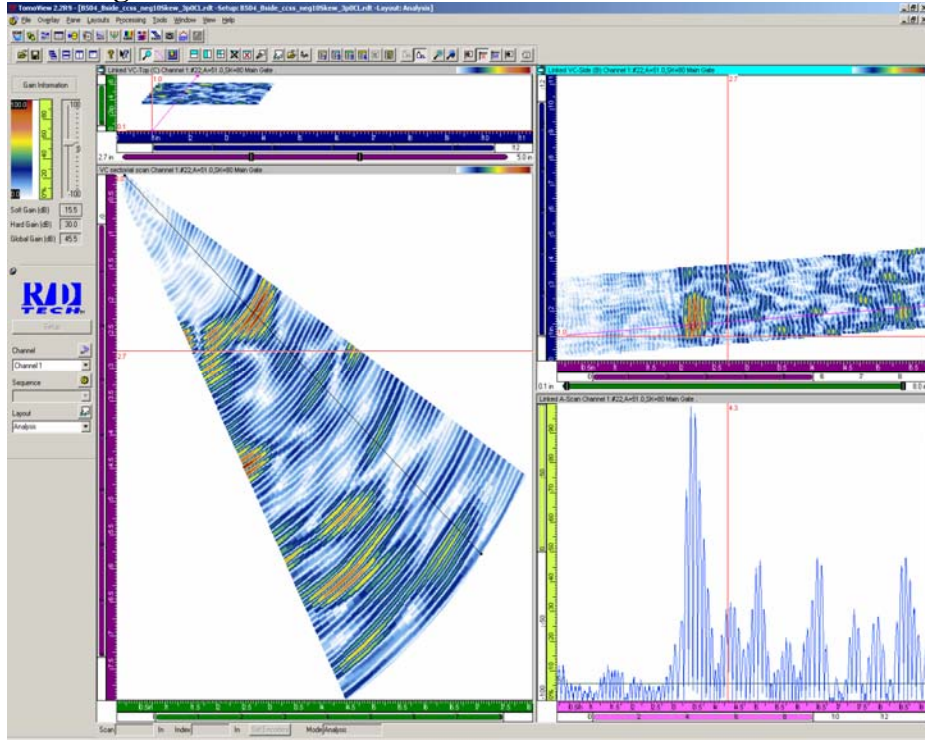


Figure C.29 B501 as Inspected from the Equiaxed Side of the Weld, Showing a Yes Detected

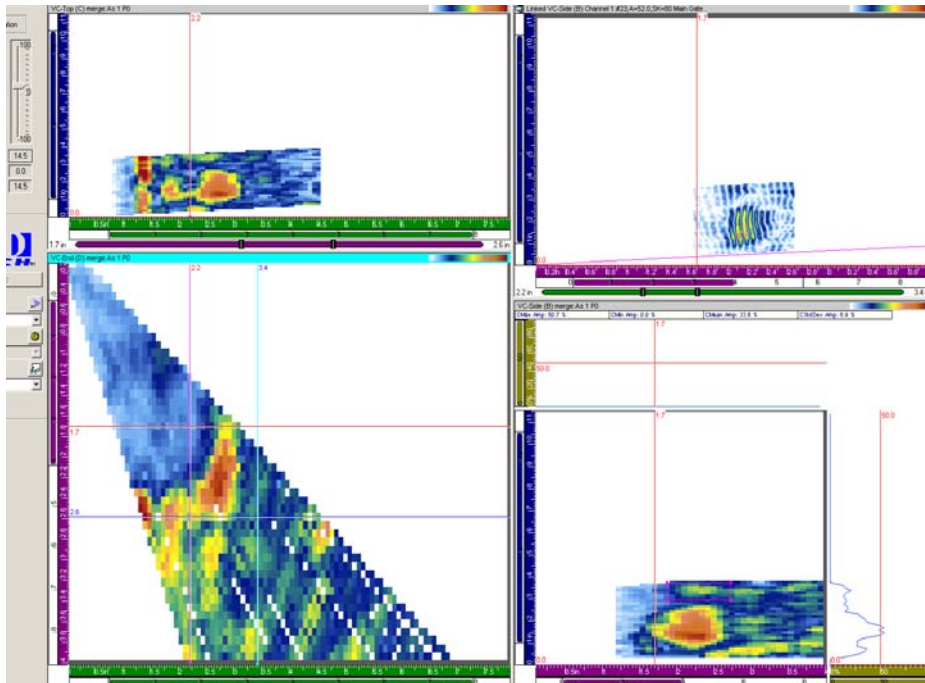


**Figure C.30 B501 as Inspected from the Equiaxed Side of the Weld with Merged Data, Showing a Yes Detected**



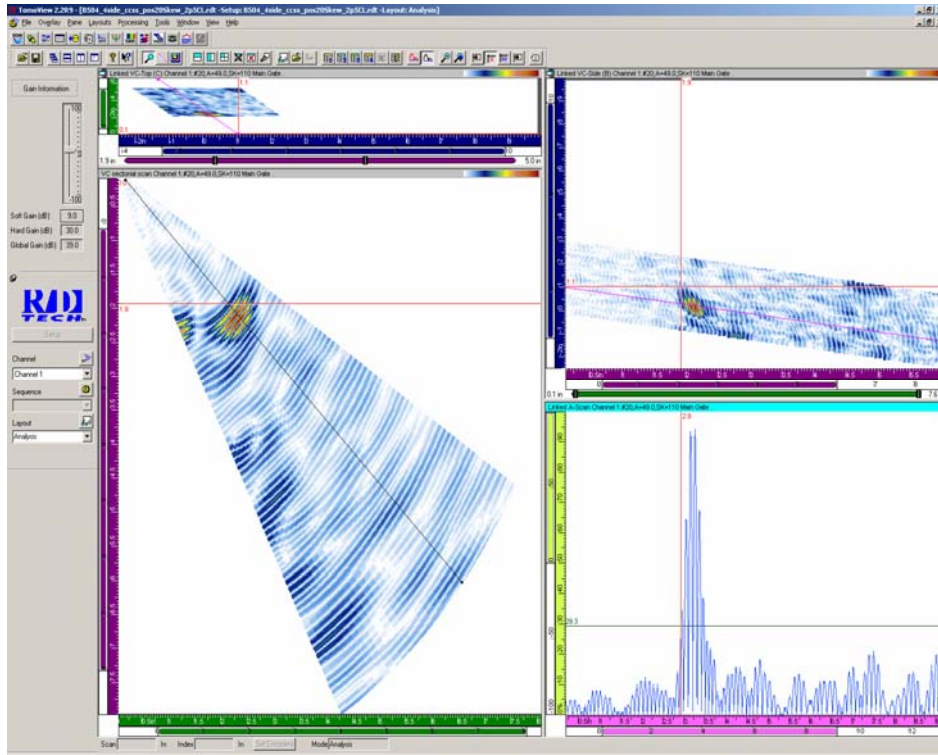
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**Figure C.31 B504 as Inspected from the Columnar Side of the Weld, Showing a Yes Detected**

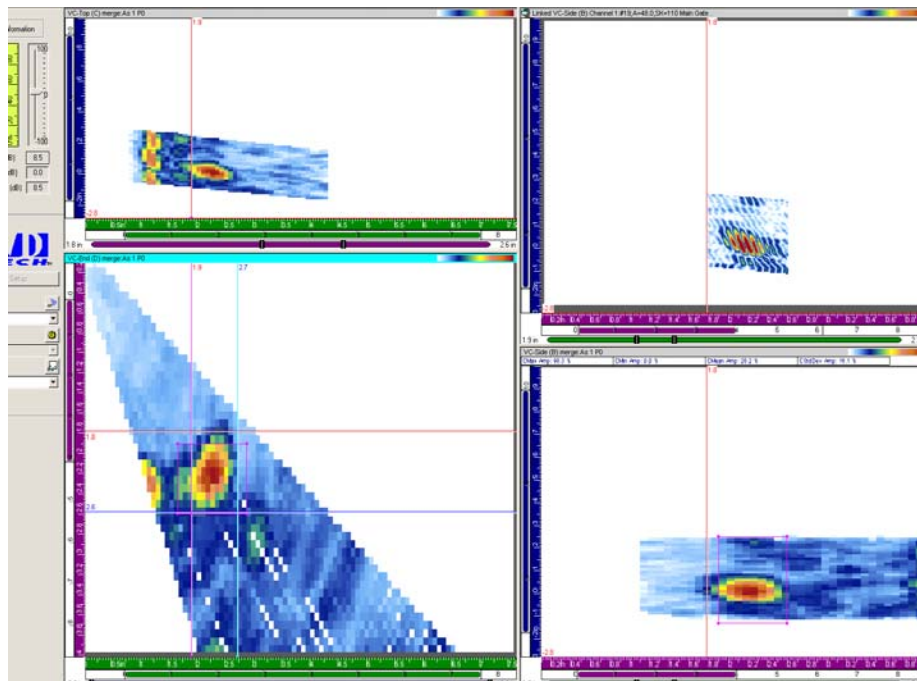


**Figure C.32 B504 as Inspected from the Columnar Side of the Weld with Merged Data, Showing a Yes Detected**





**Figure C.33 B504 as Inspected from the Equiaxed Side of the Weld, Showing a Yes Detected**



**Figure C.34 B504 as Inspected from the Equiaxed Side of the Weld with Merged Data, Showing a Yes Detected**

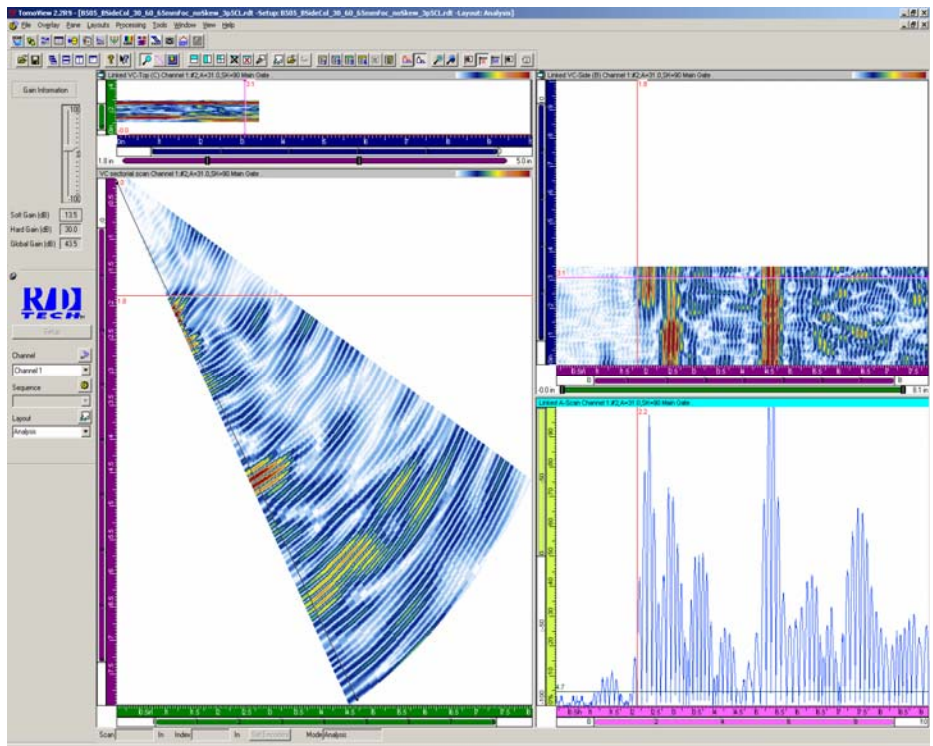


Figure C.35 B505 Inspected from the Columnar Side of the Weld, Showing a Yes Detected

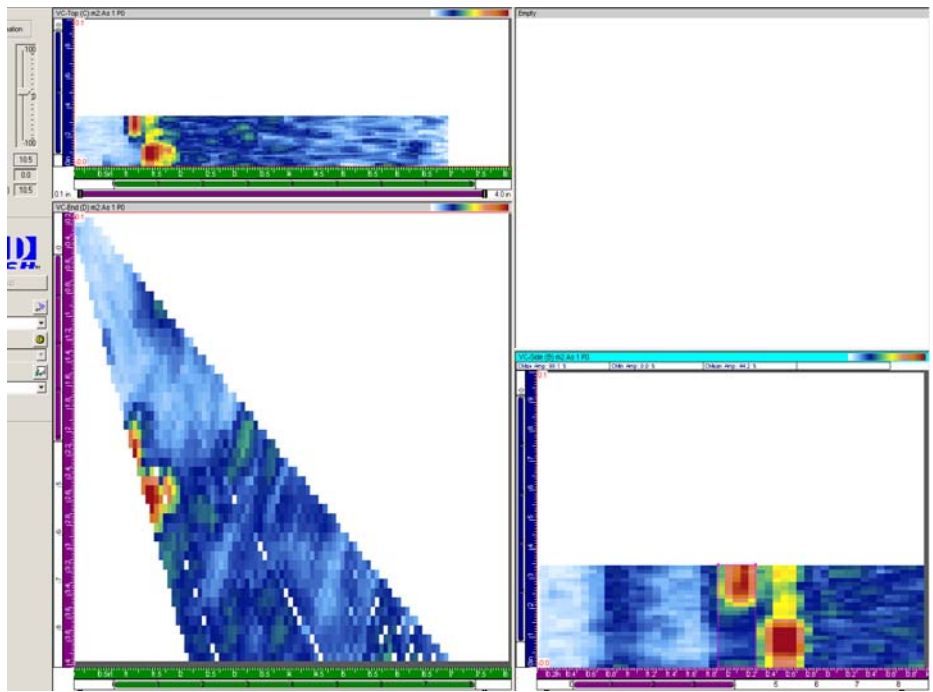


Figure C.36 B505 Inspected from the Columnar Side of the Weld with Merged Data, Showing a Yes Detected

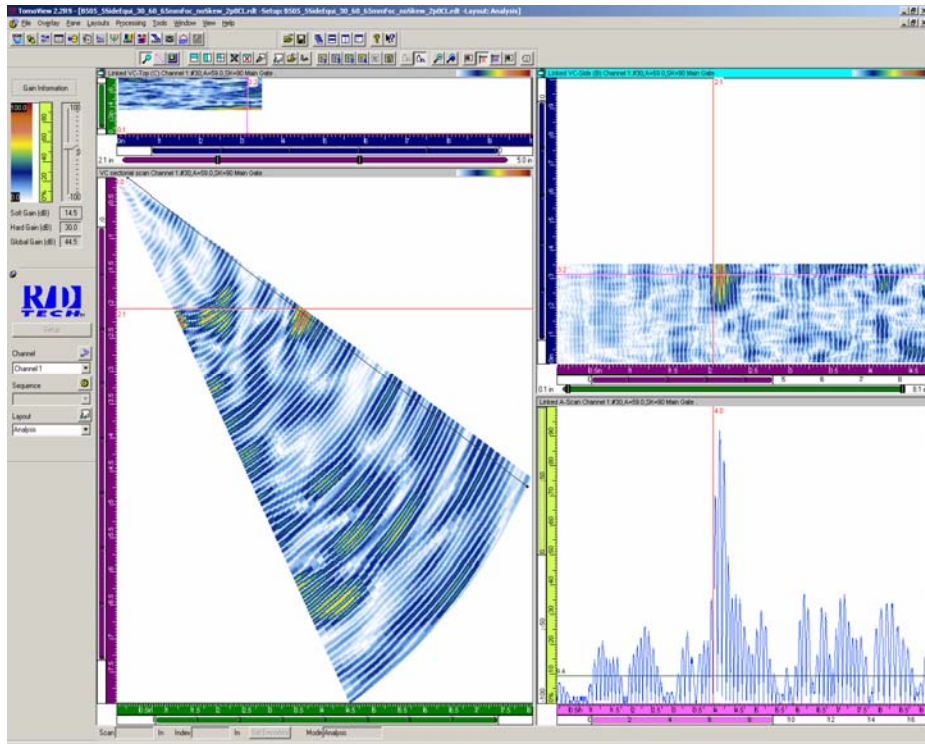


Figure C.37 B505 Inspected from the Equiaxed Side of the Weld, Showing a Yes Detected

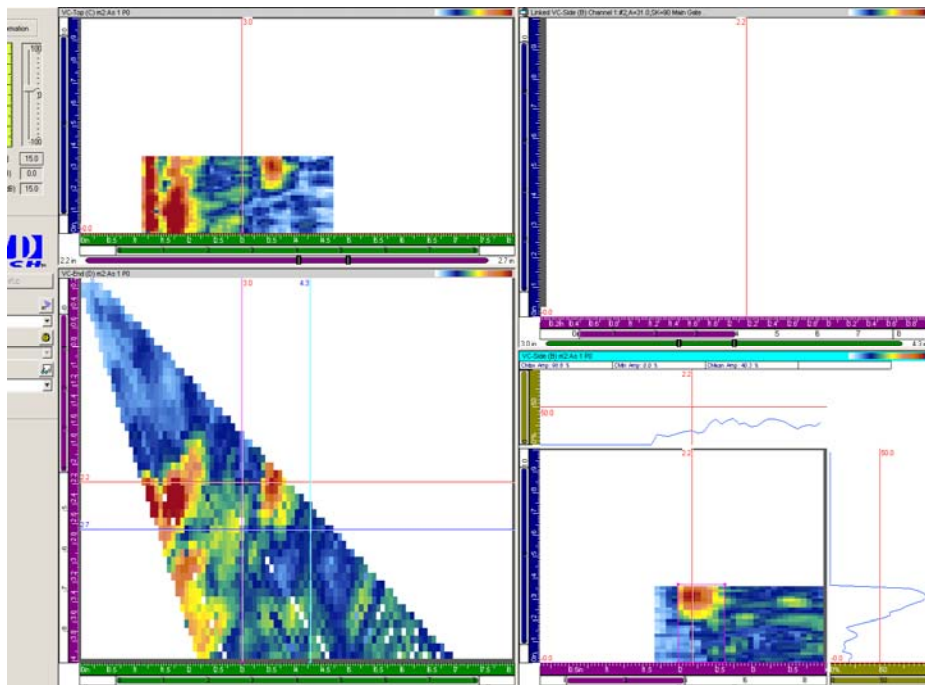


Figure C.38 B505 Inspected from the Equiaxed Side of the Weld with Merged Data, Showing a Yes Detected

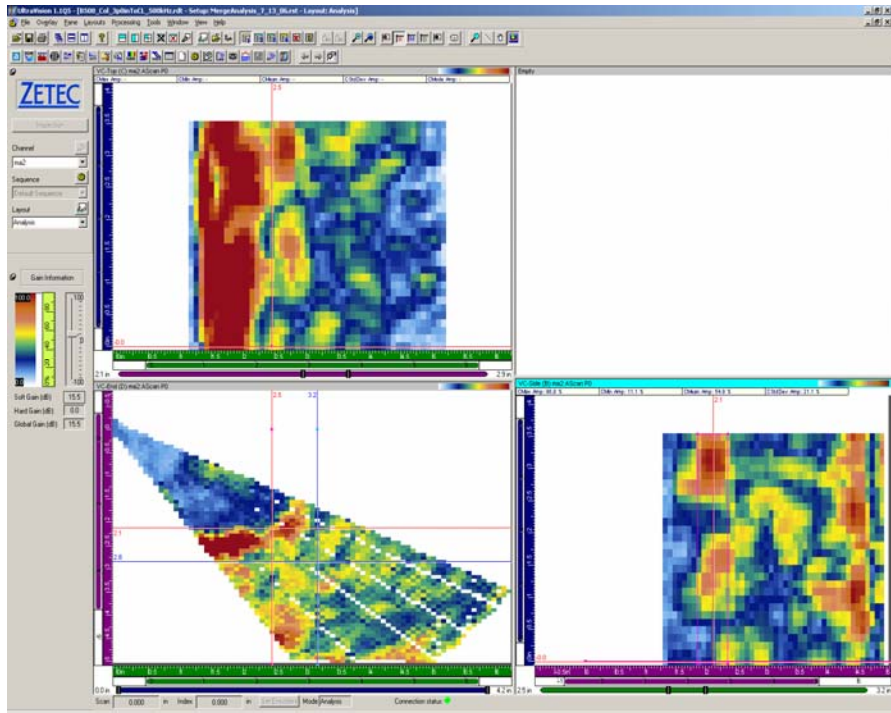
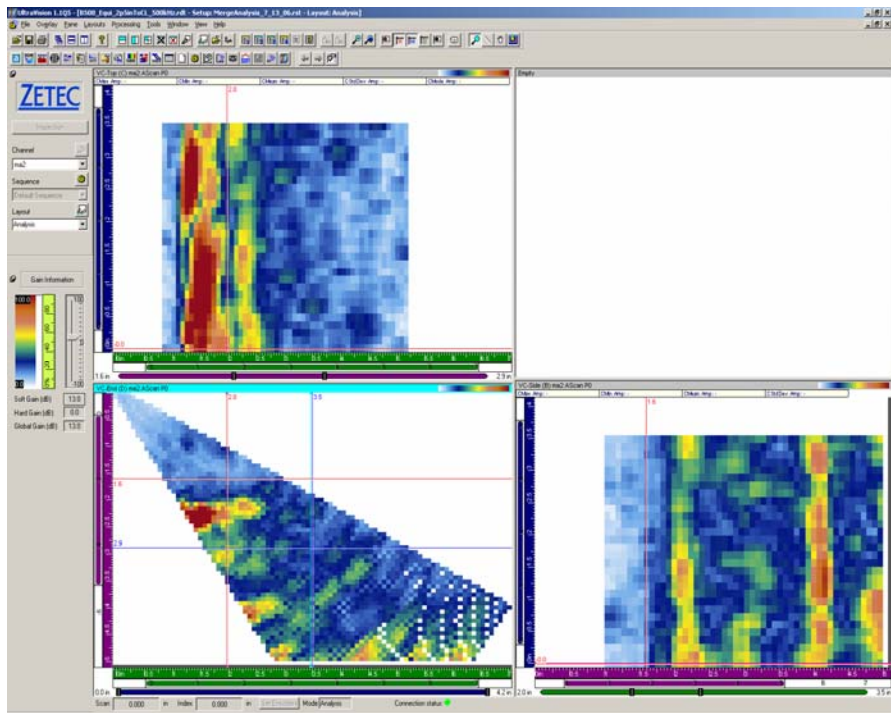
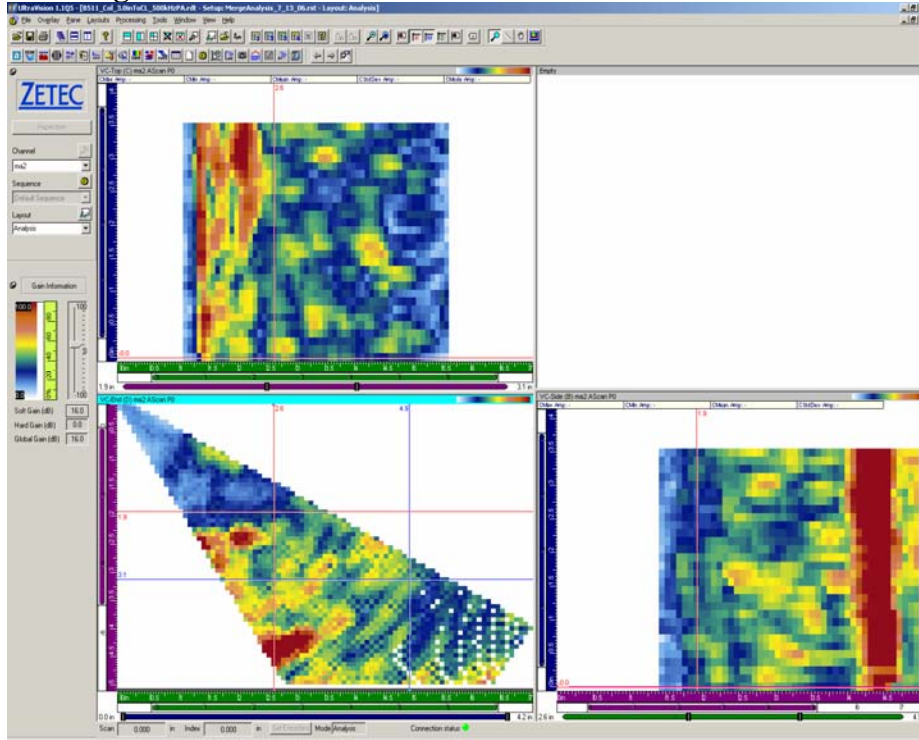


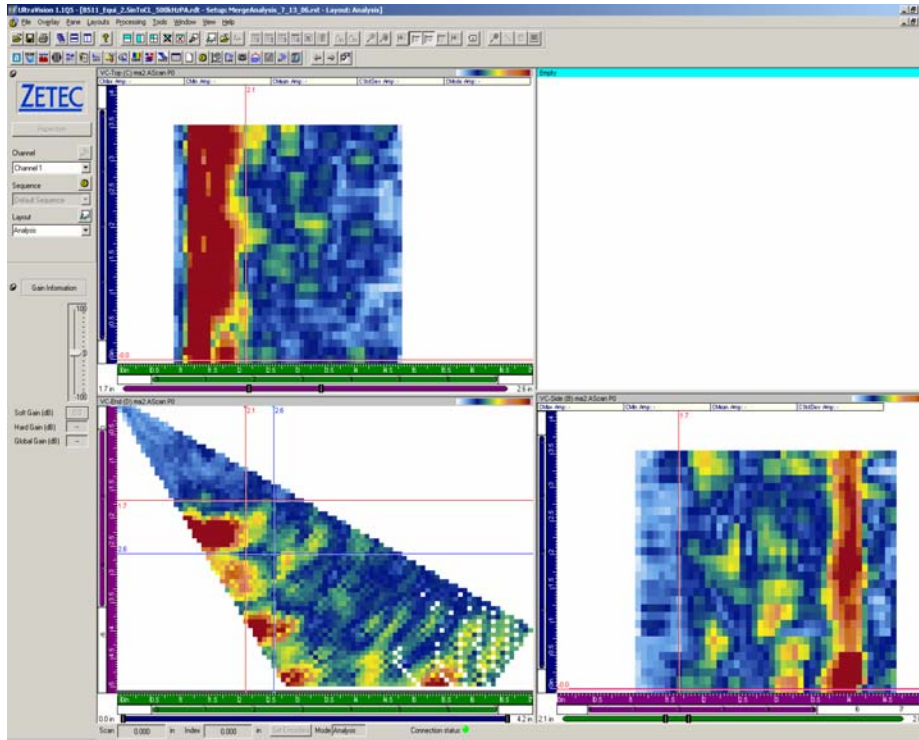
Figure C.39 B508 as Inspected from the Columnar Side of the Weld with Merged Data, Showing a No Detection



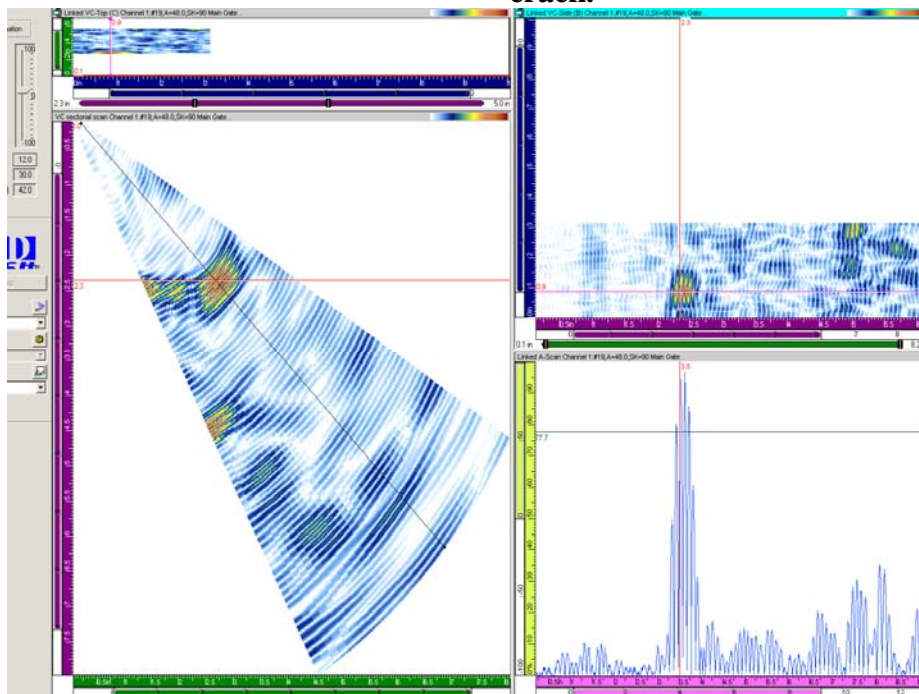
**Figure C.40 B508 as Inspected from the Equiaxed Side of the Weld with Merged Data, Showing a No Detection**



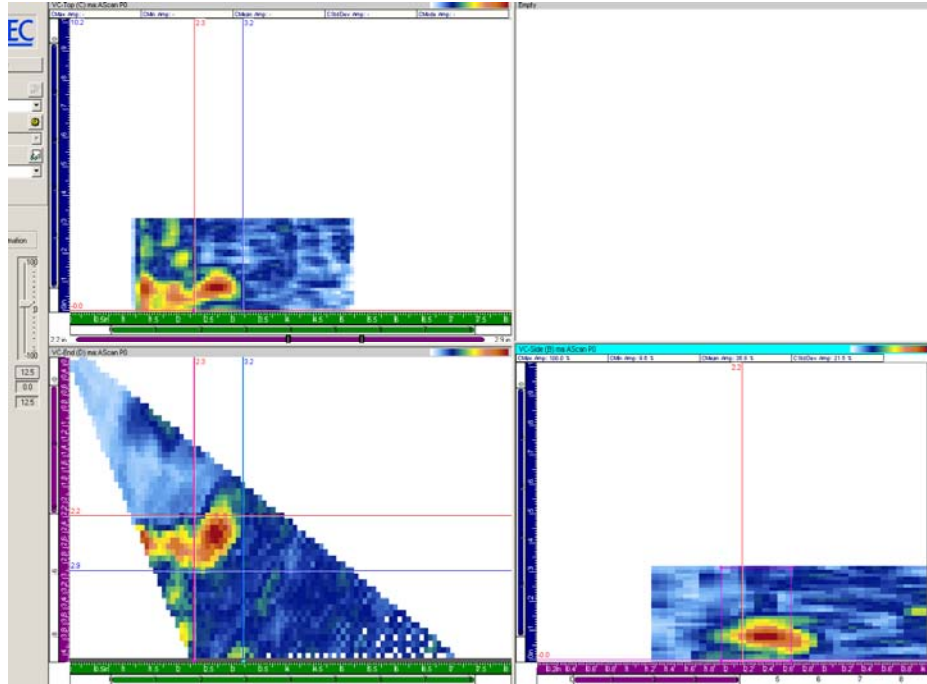
**Figure C.41 B511 as Inspected from the Columnar Side. This is blank material, i.e., no crack.**



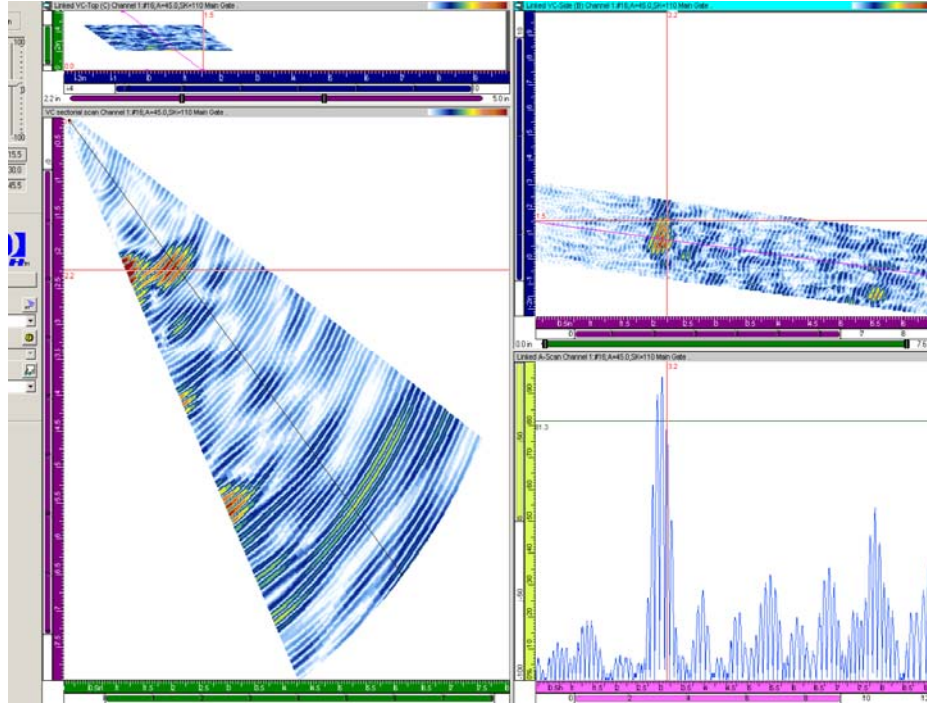
**Figure C.42 B511 as Inspected from the Equiaxed Side. This is blank material, i.e., no crack.**



**Figure C.43 B515 as Inspected from the Columnar Side of the Weld, Showing a Yes Detected**



**FigureC.44 B515 as Inspected from the Columnar Side of the Weld with Merged Data, Showing a Yes Detected**



**Figure C.45 B515 as Inspected from the Equiaxed Side of the Weld, Showing a Yes Detected**

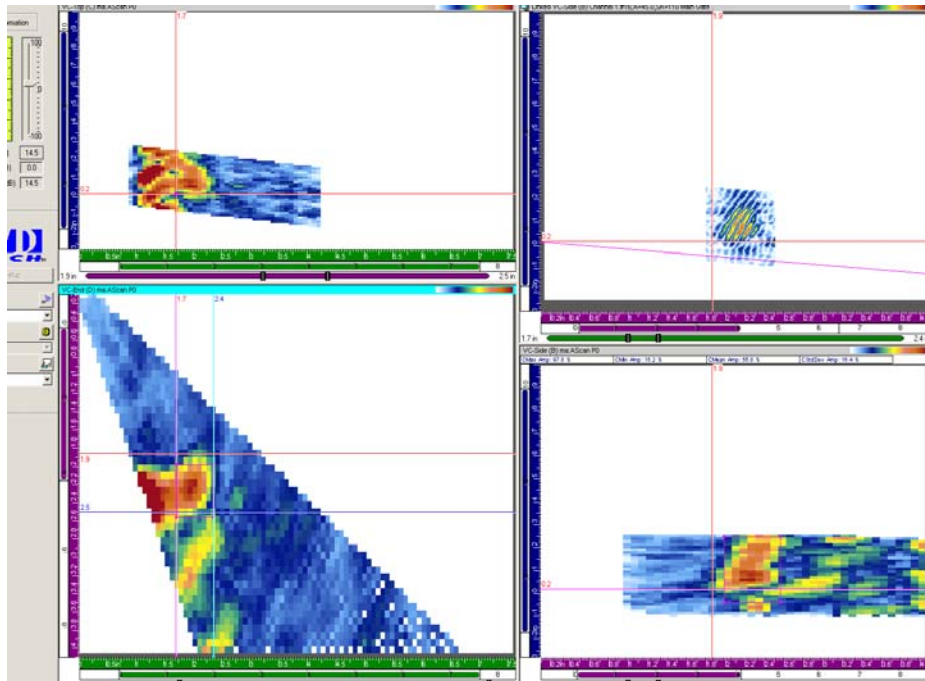
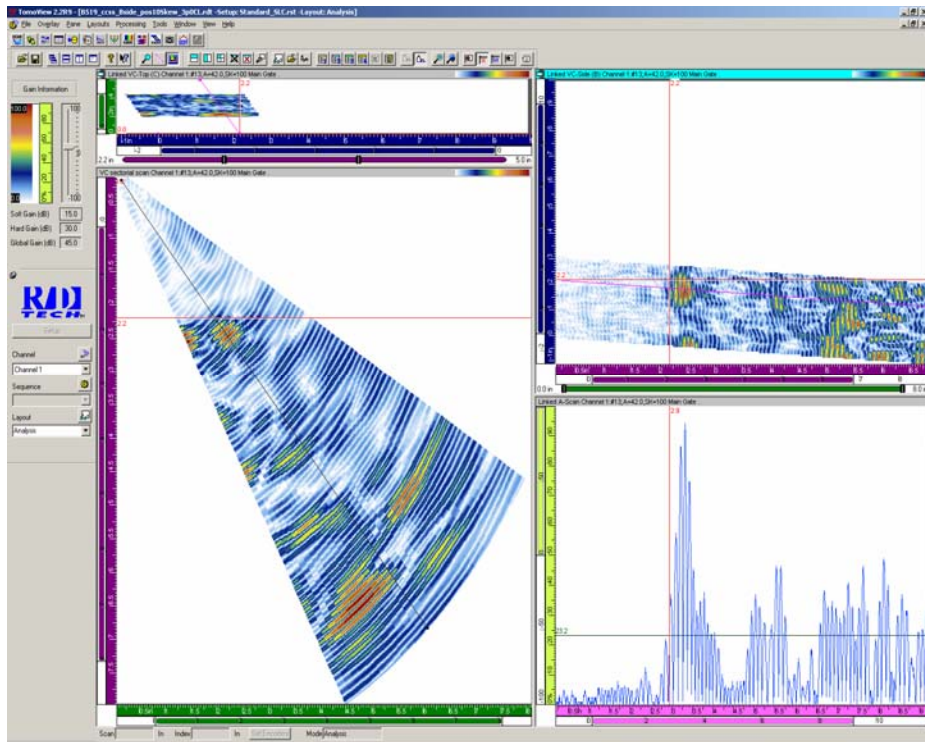
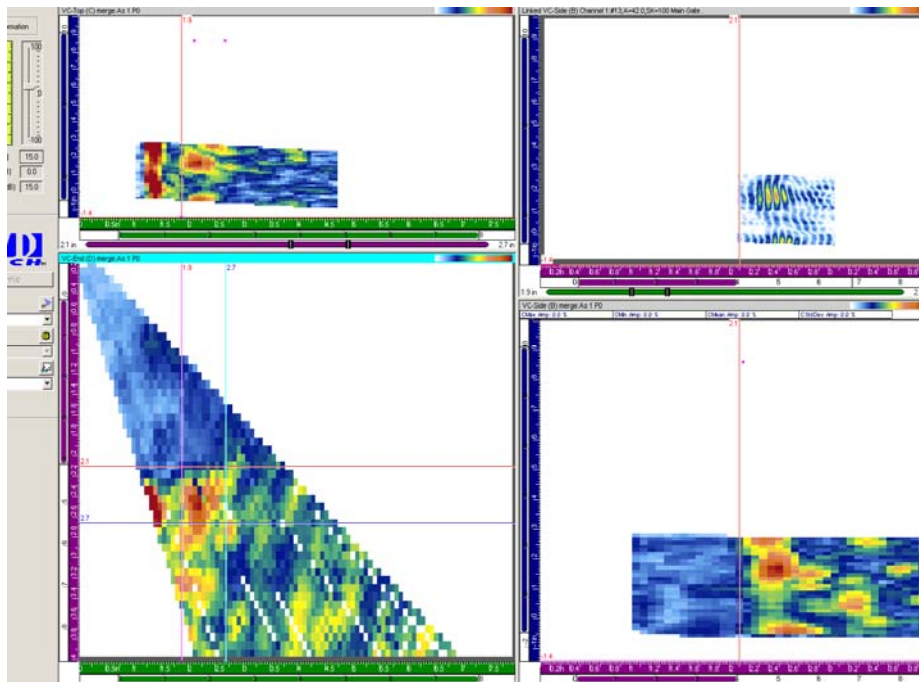


Figure C.46 B515 as Inspected from the Equiaxed Side of the Weld with Merged Data, Showing a Yes Detected





**Figure C.47 B519 as Inspected from the Columnar Side of the Weld, Showing a Marginal Detection**



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**Figure C.48 B519 as Inspected From the Columnar Side of the Weld with Merged Data, Showing a Marginal Detection**

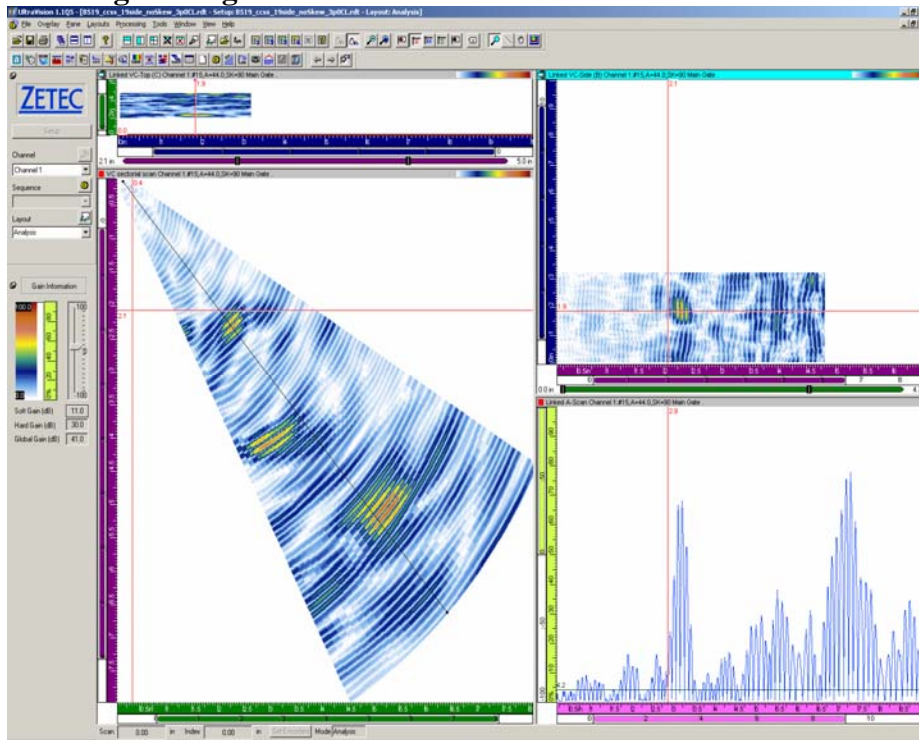
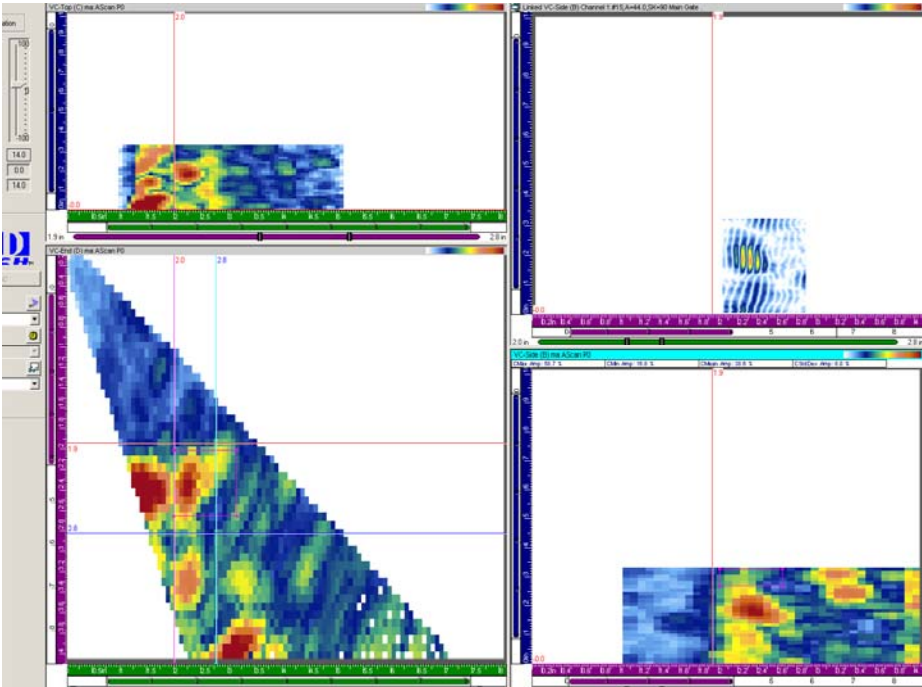
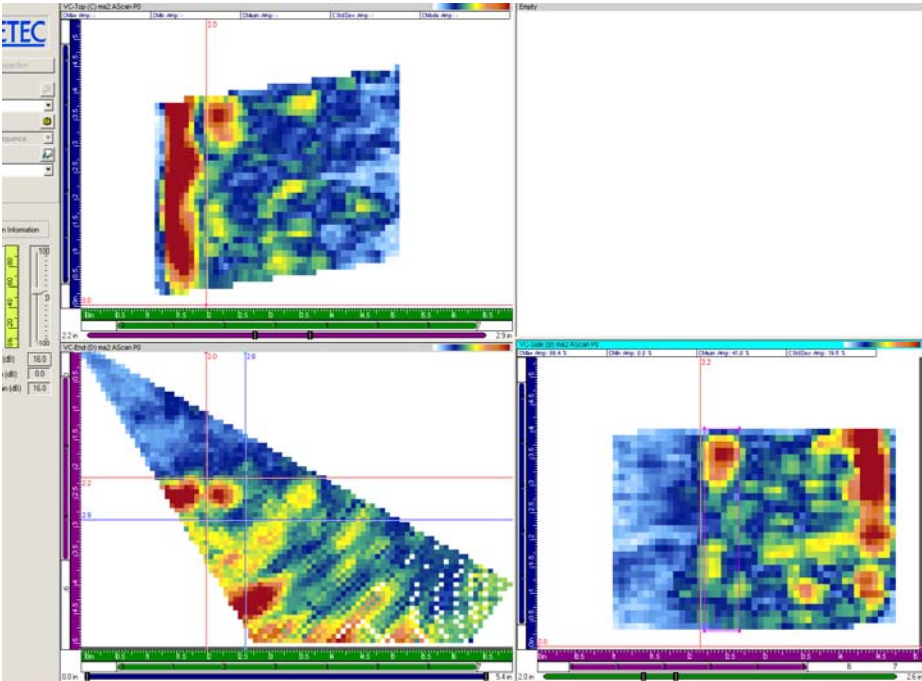


Figure C.49 B519 Inspected from the Equiaxed Side of the Weld, Showing a Yes Detected

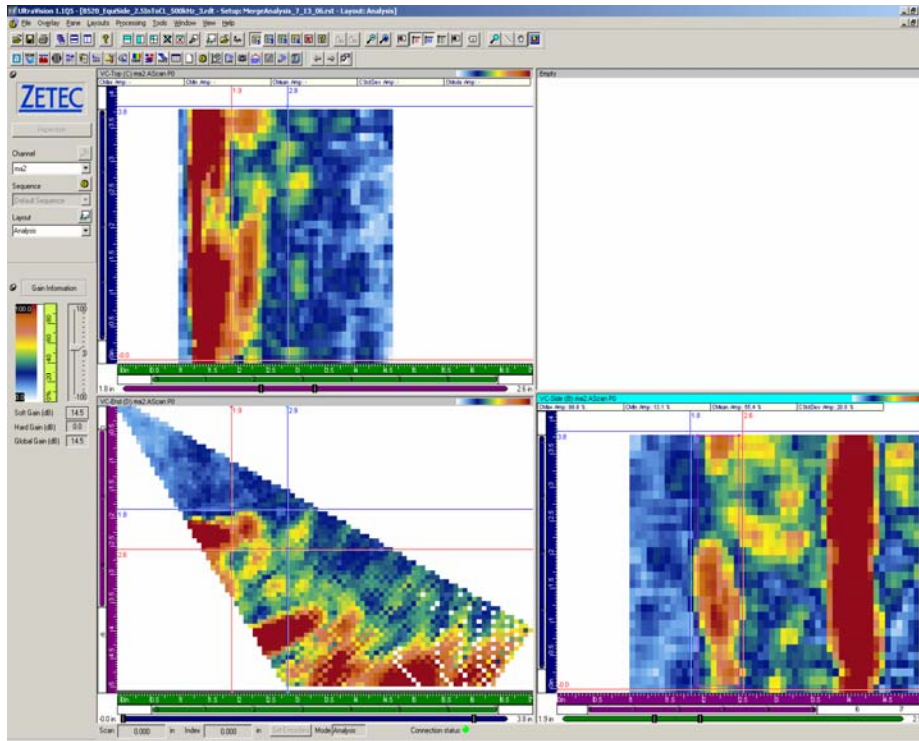


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Figure C.50 B519 as Inspected From the Equiaxed Side of the Weld with Merged Data, Showing a Yes Detected



**Figure C.51 B520 as Inspected from the Columnar Side of the Weld with Merged Data, Showing a Yes Detected**



**Figure C.52 B520 as Inspected from the Equiaxed Side of the Weld with Merged Data, Showing a No Detection**