# A
# SEARCH UNIT PARAMETERS/CERTIFICATES

The search unit documentation is presented on the following pages.

IMASONIC

# MEASUREMENT REPORT

## 1.5 MHz 2 x 16 elts matrix phased array probe

5155 B105

---

ZETEC QUEBEC

1.5M16x2E32-7

IMASONIC

# CERTIFICATE of CONFORMANCE

| | |
|---|---|
| REFERENCE DOCUMENT | CdC5155-3 |
| PROJECT # | 5155B |
| SERIAL # | 5155B105 |

## Checking of Electrical Performance

| | | Criteria of conformity | Value | Conformity |
|---|---|---|---|---|
| Inter element coupling between neighbouring elements | dB | < -30 | -48.9 | OK |
| Inter element coupling between neighbouring elements | dB | < -35 | -54.8 | OK |

## Checking of Acoustical Performance

| | | Criteria of conformity | Value | Conformity |
|---|---|---|---|---|
| Central Frequency (-6dB) | MHz | [1.35 ; 1.65] | 1.40 | OK |
| Bandwidth (-6dB) | % | > 50 | 55 | OK |
| Pulse Length (-20dB) | ns | < 3.5 | 3.16 | OK |
| Sensitivity | (mV) | na | 15 | OK |
| Homogeneity (probe to probe, within batch) | dB | ± 3 / mean value | -5.8 | OK |
| Homogeneity (between all elements of the probe) | dB | ± 4 / mean value | -1.99 | OK |
| Backwall Echo | dB | < -40 | -42.2 | OK |

## Checking of Elements Wiring

| | |
|---|---|
| conformity | OK |

## Overall Conformity

| | |
|---|---|
| conformity | OK |

Date : 16/11/2006

Signature

Ruch Vincent

# *Phased Array Probe Specifications*
Piezocomposite technology

Zetec reference: 1 5M16x2E32-7
IMASONIC reference: CDC5155-3

## *Technical characteristics and acceptance level*

### *Acoustical characteristics*

| | |
|---|---|
| Centre frequency (-6dB): | 1.5 MHz ± 10 %* |
| Bandwidth (-6dB): | > 50% * |
| Pulse length (-20dB): | < 3.5 µs * |
| Acoustical impedance matching: | rexolite |
| Electrical matching: | none |
| Number of channels: | 16 x 2 |
| Type: | Matrix |
| Active area | 32 x 7 mm |
| Mechanical focusing: | none |
| Elementary pitch in primary axis: | 2 mm |
| Elementary pitch in secondary axis: | 3.5mm |
| Inter element spacing: | 0.2 mm in two directions |
| Homogeneity in sensitivity: | ± 4 dB for the whole array* |
| Homogeneity of probe to probe in sensitivity: | +/-3 dB for a batch which number of probes is agreed between ZETEC and IMASONIC before the order. |
| Inter element coupling: | ≤ -30dB* between adjacent elements |
| Inter element coupling: | ≤ -35dB* between elements separated by one element |
| Backing echoes: | ≤ -40 dB / interface echoes * |

**criteria of conformity measured in the conditions below*

### *Mechanical characteristics*

Housing:
Stainless steel
Geometry and dimensions: according to the drawing reference 5155A0110000

Cable:
Cable output: on side (16th, 32nd elts)
Cable gland

Flanges:
Description: According to the drawing reference 5155A0110000

### *Interconnections*

Cable: 50Ω multi-coaxial with overall shielding
Length: 5 m ± 0.1m
Connector: Hypertronics
Protective jacket: halogen free jacket
Pinout diagram: classical.

## *Phased Array Probe Specifications*
Piezocomposite technology

| | |
|---|---|
| Zetec reference: | 1 5M16x2E32-7 |
| IMASONIC reference: | CDC5155-3 |

***Identification***

| | |
|---|---|
| On the top of the probe: | Logo Zetec<br>Identification of the 1st, 16th, 17th and 32nd elements |
| On side of the probe: | 1.5M16X2E32-7<br>29HBE0029<br>serial number |

## *Recommended using conditions**

| | |
|---|---|
| Chemical constraints: | contact with acoustical gel or water |
| Pressure: | equivalent to a water column of 1m maximum |
| Temperature: | -20° to 60°C (storage)<br>10 to 30°C (functioning) |
| Excitation: | Negative pulse 200Vpp maximum (measured in 50 Ωenvironments)<br>Max repetition frequency: 10 kHz |
| Cleaning: | With water or isopropyl alcohol, with soft tissue, taking care of not wearing the front face with particles between the front face and the tissue |
| Manipulation: | Do not handle the probe by the cable |
| Nuclear radiation: | none |
| **Normative constraints:** | **none** |

Particular constraints of shocks and vibrations are not taken into account by IMASONIC

** Other particular using conditions must be validated by IMASONIC*

## Control of electro acoustical performances

**Electrical Measurements:**
1_Impedance measurement for all the elements at the nominal frequency
2_Inter-element coupling measurement on 2 pairs of adjacent elements
3_Inter-element coupling measurement on 2 pairs of non adjacent elements

*Measurements conditions:*
Performed with HP3577A network analyser (50Ω environment)
Acoustic load on the active part: 1.5 MR
*Supplied documents:*
Value of impedances
Curves of inter –elements coupling

**Acoustical measurements:**
1_Temporal response & frequency spectrum measurement for all the elements

*Measurements conditions:*
Performed on contact on flat steel target with a rexolite delay line in E/R mode
rexolite path: to be determined
steel path: to be determined
couplant: to be defined during the control
Excitation signal: 1 negative pulse
*Supplied documents:*
Value of central frequency, bandwidth (-6dB), pulse length and sensitivity for all elements
Curves of homogeneity sensitivity
Curves for 8 elements

2_Backing Echo

*Measurements conditions:*
Performed in water on flat brass target
Excitation signal: 1 negative pulse
*Supplied document:*
Value of backing Echo

## Supplied documentation (paper and mail)

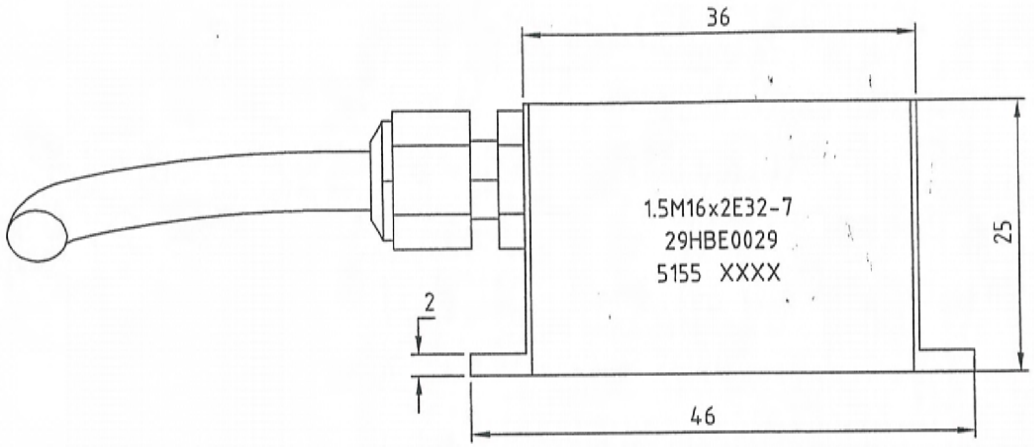
Specifications of the probe
Overall drawing of the probe
Measurement results

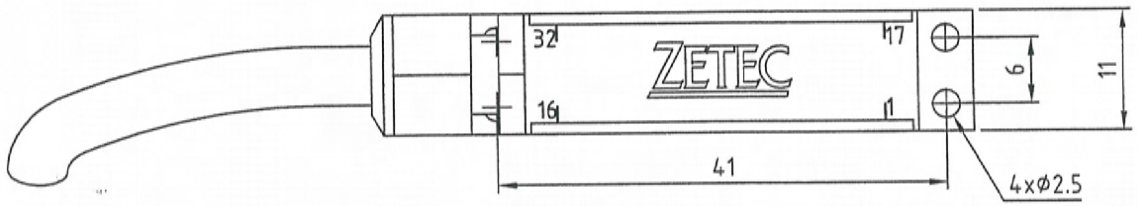
## Casing

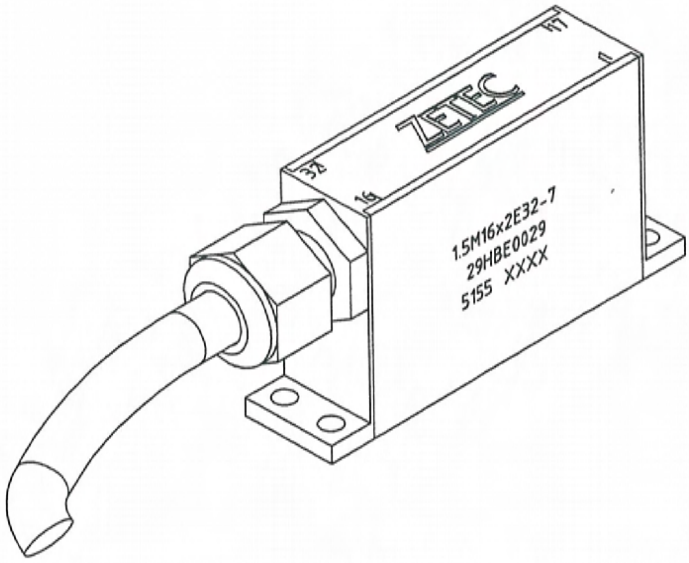
One casing for each probe

## Guarantee conditions

One year guarantee against manufacturing defects in the using conditions above
Other conditions: see Imasonic general selling conditions




| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Façonnage Général : | | Nombre : 1 |
| | | | | Tol gén | Longueurs: js/JS13 | Angles: ±1° |
| | | | | Matière : | | |
| | | | | Traitement thermique : | | |
| Indice | Date | Modifications | par | Protection: | | |
| ∼ = brut | ▽ = 6.5 à 12.5Ra | ▽▽ = 1.6 à 3.2Ra | ▽▽▽ = 0.05 à 0.8Ra | N° | 5155A0110000 | |

Etude: Linear array-1.5MHz-2x16elts

S/Ens.:

Pièce: General drawing

IMASONIC transducteurs et dispositifs électroacoustiques

Dess le: 01/06/05 | Vér. le: ..... | A4 | Folio | 15 Rue Alain SAVARY 25000 BESANCON

17/11/2006

**Impedance measurement for the transducer n°:** **5155 B105** **Operator :** **SA**

*(Acoustic load: 1.5 MR. IMASONIC procedure: INP 410)*

| # | Zr (Ω) | Zi (Ω) | # | Zr (Ω) | Zi (Ω) |
|---|---|---|---|---|---|
| | | | | | |
| 1 | 23.6 | -165.3 | 17 | 21.7 | -165.4 |
| 2 | 22.3 | -167.1 | 18 | 23.6 | -167.4 |
| 3 | 22.8 | -164.9 | 19 | 23.3 | -164.1 |
| 4 | 22.4 | -165.9 | 20 | 22.3 | -165.2 |
| 5 | 21.5 | -165.3 | 21 | 22.2 | -165.2 |
| 6 | 22.9 | -165.8 | 22 | 22.2 | -166.6 |
| 7 | 21.9 | -165.1 | 23 | 21.4 | -168.8 |
| 8 | 20.7 | -166.8 | 24 | 22.3 | -166.0 |
| 9 | 21.5 | -166.9 | 25 | 22.8 | -165.9 |
| 10 | 22.5 | -166.7 | 26 | 21.8 | -168.9 |
| 11 | 21.9 | -165.6 | 27 | 21.5 | -164.5 |
| 12 | 22.4 | -166.1 | 28 | 22.4 | -166.7 |
| 13 | 22.0 | -168.2 | 29 | 22.0 | -165.6 |
| 14 | 20.9 | -167.3 | 30 | 22.2 | -166.6 |
| 15 | 21.7 | -168.9 | 31 | 22.6 | -166.2 |
| 16 | 22.5 | -165.4 | 32 | 21.6 | -167.6 |

| | Zr (Ω) | Zi (Ω) |
|---|---|---|
| **Minimum :** | 20.7 | -168.9 |
| **Maximum :** | 23.6 | -164.1 |
| **Standard deviation :** | 0.7 | 1.2 |
| **Average values :** | 22.2 | -166.3 |

**Inter element coupling measurement :**

*(Acoustic load: 1.5MR. IMASONIC procedure: INP 412.)*

| #/# | Coupling (dB) |
|---|---|
| 5/6 | -48.9 |
| 28/29 | -51.9 |
| 2/18 | -56.2 |
| 5/7 | -54.8 |
| 28/30 | -51.3 |

*See measurement results in appendix 2.*

**Element cabling :**

checking cabling for each element YES

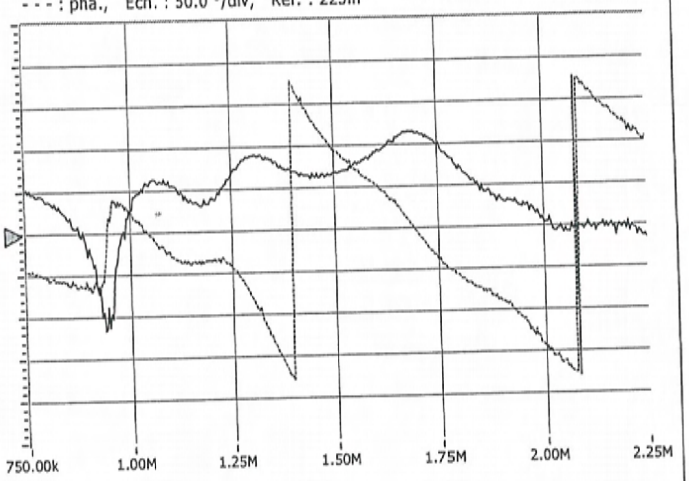
*(See values in appendix 4)*

IMASONIC S.A.
MESURES ELECTRIQUES
Z V4.2

Date : November 20th 2006 13h54
Operator : SA
Transducer : Matrix phased array probe - 2x16 elements
Serial number : 5155 B105
Nominal frequency : 1.5 MHz
Network Analyzer : HP 8751A, IM : 112/113
Acoustic load : 1.5MR on active area
Cable length : *
Instruction : INP 412
*

**Cross coupling measurement**

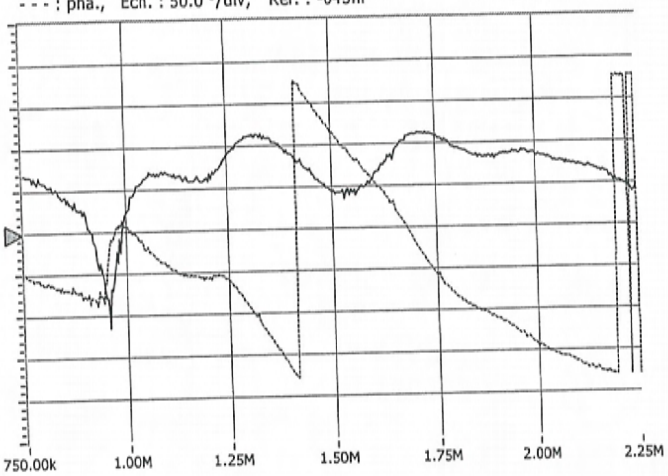
___ : ICI, Ech. : 5.00 dB/div, Ref. : -55.7 dB
- - - : pha., Ech. : 50.0 °/div, Ref. : 225m°




Elements n°5/6

**Cross coupling measurement**

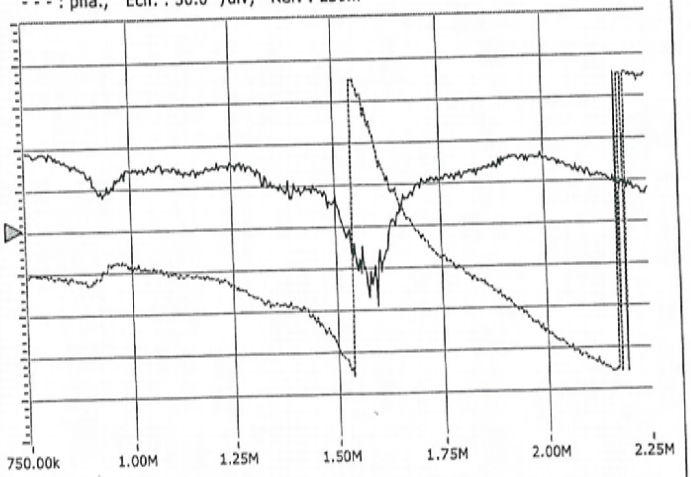
___ : ICI, Ech. : 5.00 dB/div, Ref. : -56.4 dB
- - - : pha., Ech. : 50.0 °/div, Ref. : -645m°




Elements n°28/29

**Cross coupling measurement**

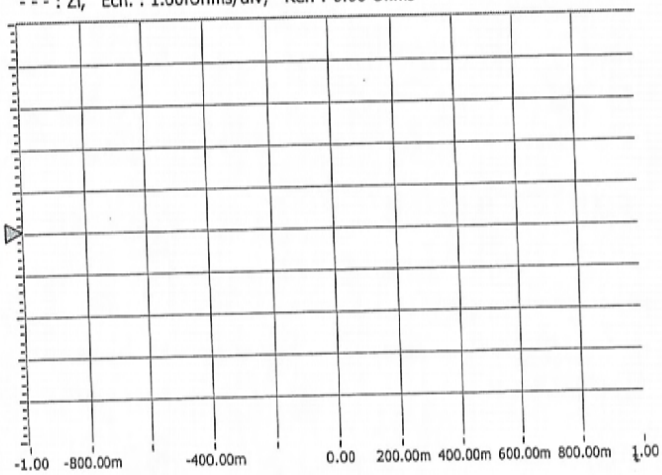
___ : ICI, Ech. : 5.00 dB/div, Ref. : -59.9 dB
- - - : pha., Ech. : 50.0 °/div, Ref. : 230m°




Elements n°2/18

**Cross coupling measurement**

___ : Zr, Ech. : 1.00fOhms/div, Ref. : 0.00 Ohms
- - - : Zi, Ech. : 1.00fOhms/div, Ref. : 0.00 Ohms

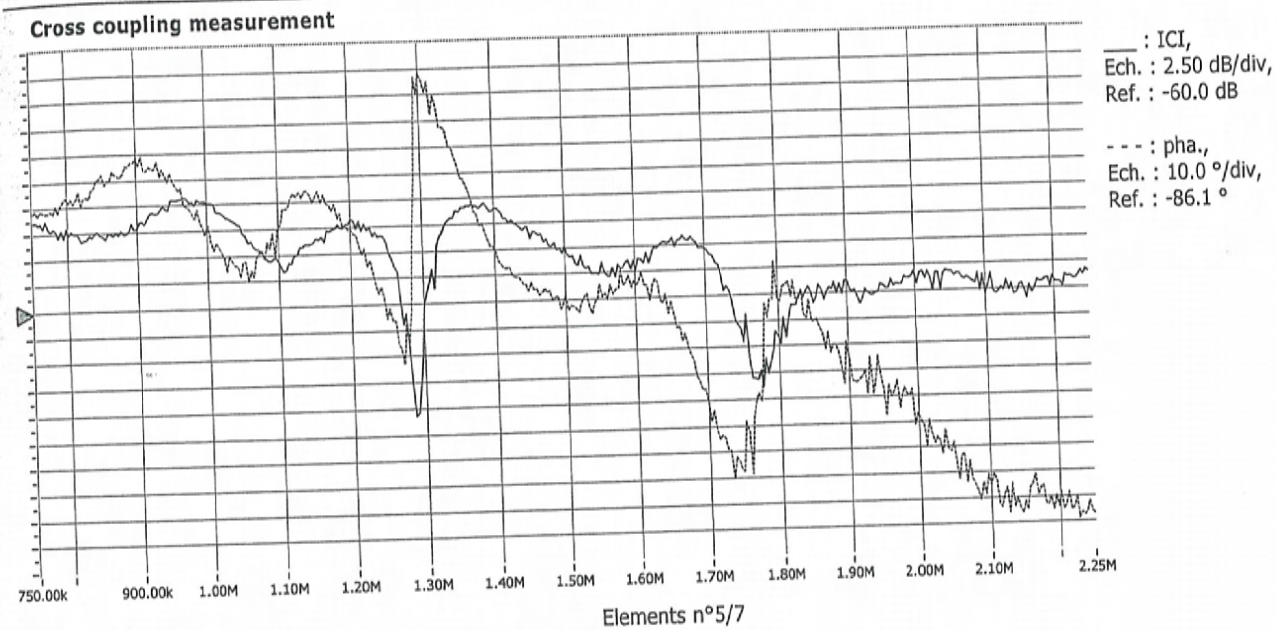



*

IMASONIC S.A.
MESURES ELECTRIQUES
Z V4.2

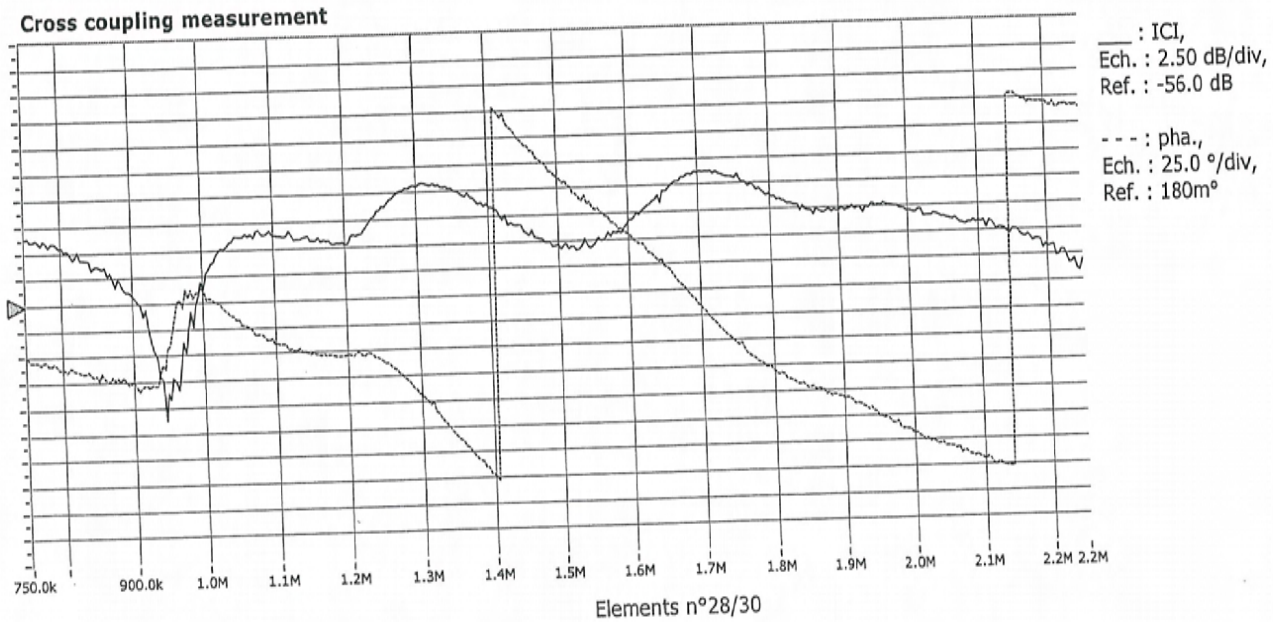
Date : November 20th 2006 13h55
Operator : SA
Transducer : Matrix phased array probe - 2x16 elements
Serial number : 5155 B105
Nominal frequency : 1.5 MHz
Network Analyzer : HP 8751A, IM : 112/113
Acoustic load : 1.5MR on active area
Cable length : *
Instruction : INP 412
*

**Cross coupling measurement**




Elements n°5/7

**Cross coupling measurement**




Elements n°28/30

17/11/2006

**Electroacoustic measurement for the transducer n°:** **5155 B105** **Operator : SA**

*(Acoustic load: 2.45 MR. IMASONIC procedure: INP 413.)* *Nominal Frequency : 1.50 MHz*

*Generator : Multi 2000 V3.4.4, Gain = atten = 70 dB, L. Exc. : 353 ns, U. Exc. : 70 V*

*Target type : Inox h = 20mm + Rexolite h = 15 mm, Target Positioning : 17.78 mm*

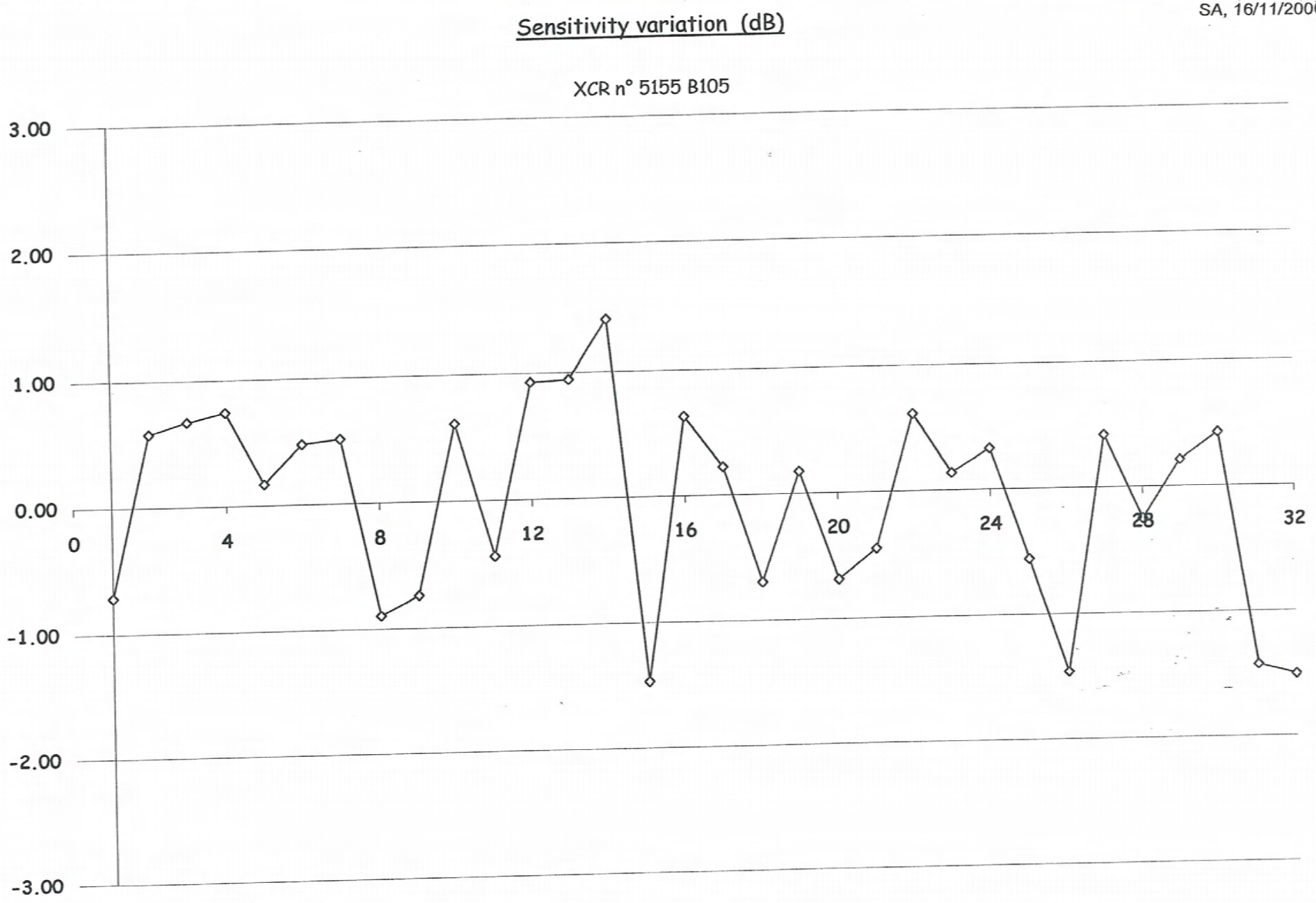
| # | Vpp (mV) | Fc (MHz) | Bw (%) | Lp -20dB (ns) | # | Vpp (mV) | Fc (MHz) | Bw (%) | Lp -20dB (ns) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| 1 | 13 | 1.4 | 56 | 2864 | 17 | 14 | 1.4 | 57 | 2847 |
| 2 | 15 | 1.4 | 57 | 3197 | 18 | 13 | 1.4 | 59 | 3198 |
| 3 | 15 | 1.4 | 53 | 3199 | 19 | 14 | 1.4 | 53 | 3198 |
| 4 | 15 | 1.4 | 54 | 3079 | 20 | 13 | 1.4 | 57 | 3196 |
| 5 | 14 | 1.4 | 54 | 3198 | 21 | 13 | 1.4 | 55 | 3199 |
| 6 | 15 | 1.4 | 55 | 3200 | 22 | 15 | 1.4 | 55 | 3200 |
| 7 | 15 | 1.4 | 55 | 3200 | 23 | 14 | 1.4 | 54 | 3198 |
| 8 | 12 | 1.4 | 55 | 3199 | 24 | 14 | 1.4 | 55 | 3198 |
| 9 | 13 | 1.4 | 53 | 3198 | 25 | 13 | 1.4 | 56 | 3200 |
| 10 | 15 | 1.4 | 53 | 3200 | 26 | 12 | 1.4 | 55 | 3198 |
| 11 | 13 | 1.4 | 53 | 3198 | 27 | 14 | 1.4 | 55 | 3199 |
| 12 | 15 | 1.4 | 55 | 3198 | 28 | 13 | 1.4 | 54 | 3198 |
| 13 | 15 | 1.4 | 56 | 3141 | 29 | 14 | 1.4 | 55 | 3198 |
| 14 | 16 | 1.4 | 55 | 3199 | 30 | 14 | 1.4 | 53 | 3200 |
| 15 | 12 | 1.4 | 56 | 3198 | 31 | 12 | 1.4 | 57 | 3200 |
| 16 | 15 | 1.4 | 59 | 2838 | 32 | 12 | 1.4 | 57 | 3196 |

| | Vpp (mV) | Fc (MHz) | Bw (%) | Lp -20dB (ns) |
|---|---|---|---|---|
| **Minimum :** | 12 | 1.38 | 53 | 2838 |
| **Maximum :** | 16 | 1.42 | 59 | 3200 |
| **Standard deviation :** | 1 | 0.01 | 2 | 104 |
| **Average values :** | 13.7 | 1.40 | 55 | 3160 |

**Homogeneity in sensitivity (dB) :** **-2.92**

*See measurement results in appendix 3 for the elements n° 2;6;10;14;18;22:26:30*

SA, 16/11/2006




ENQ 102 - Final measurements 32 elts

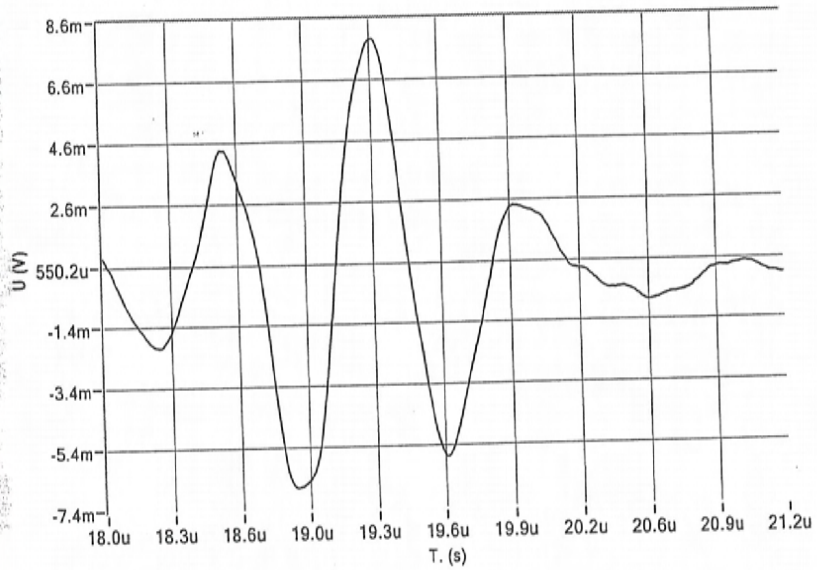
IMASONIC SA
TRANSDUCER DATA SHEET

SPECTRE V5.4

Date : November 16th 2006 16h44
Operator : SA
Transducer : Matrix phased array probe - 2x16 elts
Serial number : 5155 B105
Nominal frequency : 1.50MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 70 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.57mm
Element : 2

## WAVEFORM

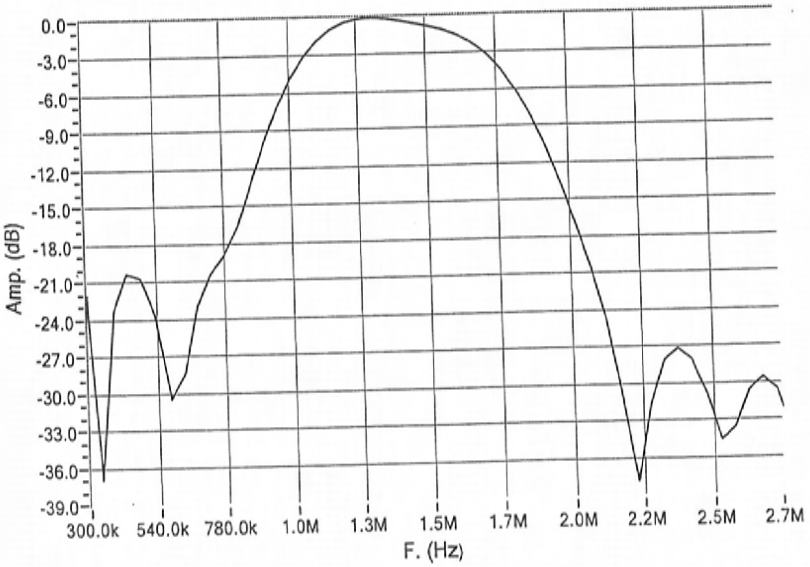
T : 319.0ns/div U : 2.0mV/div




PULSE LENGTH :
-6dB : 1.12µs -20dB : 3.20µs

VOLTAGES :
Vpp = 14.67mV

## TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.40MHz
Ratio Bp/Fc : 57%
Bandwidth : 805.18KHz
Lower Frequency : 1.00MHz
Upper Frequency : 1.81MHz

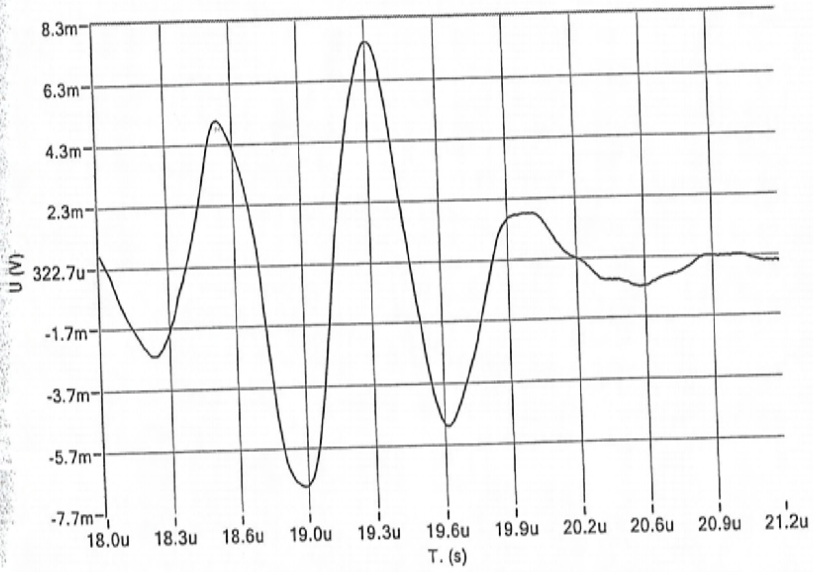
IMASONIC SA
TRANSDUCER DATA SHEET

SPECTRE V5.4

Date : November 16th 2006 16h44
Operator : SA
Transducer : Matrix phased array probe - 2x16 elts
Serial number : 5155 B105
Nominal frequency : 1.50MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 70 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.55mm
Element : 6

## WAVEFORM

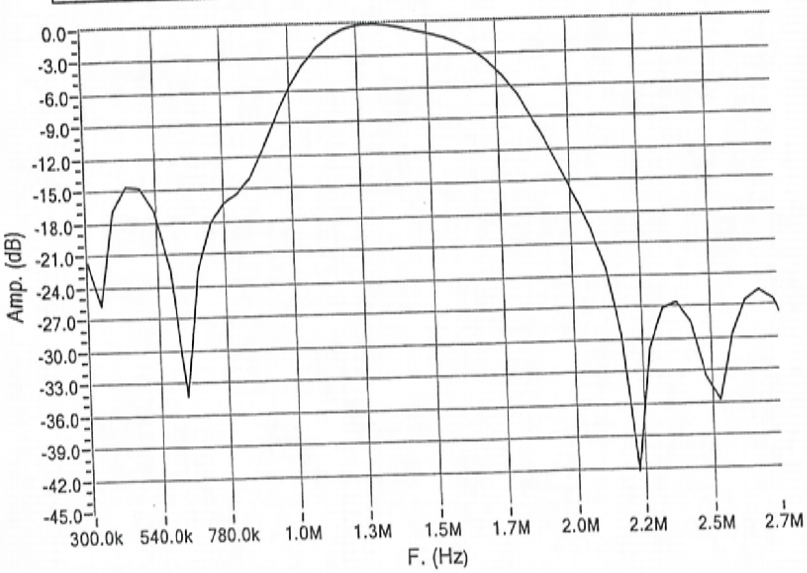
T : 319.0ns/div U : 2.0mV/div




PULSE LENGTH :
-6dB : 911.61ns -20dB : 3.20µs

VOLTAGES :
Vpp = 14.50mV

## TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.40MHz
Ratio Bp/Fc : 55%
Bandwidth : 767.95KHz
Lower Frequency : 1.02MHz
Upper Frequency : 1.79MHz

IMASONIC

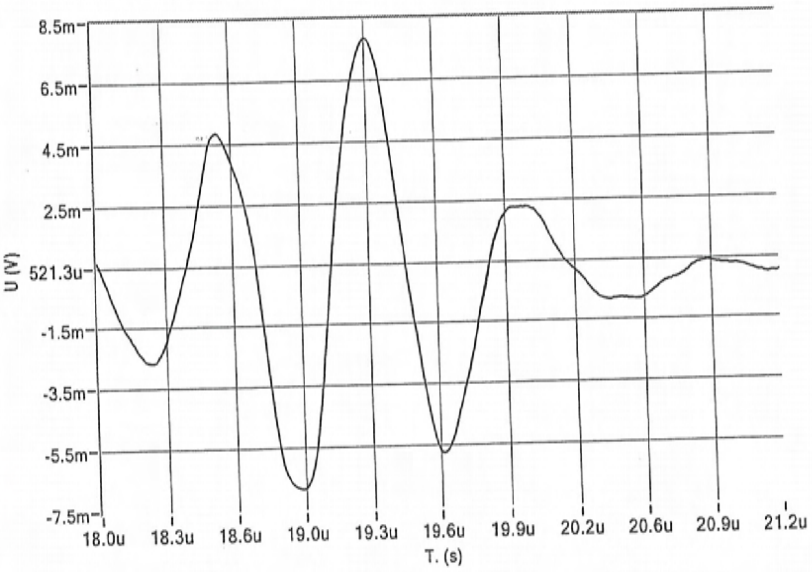
# IMASONIC SA
# TRANSDUCER DATA SHEET

SPECTRE V5.4

Date : November 16th 2006 16h44
Operator : SA
Transducer : Matrix phased array probe - 2x16 elts
Serial number : 5155 B105
Nominal frequency : 1.50MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 70 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.56mm
Element : 10

## WAVEFORM

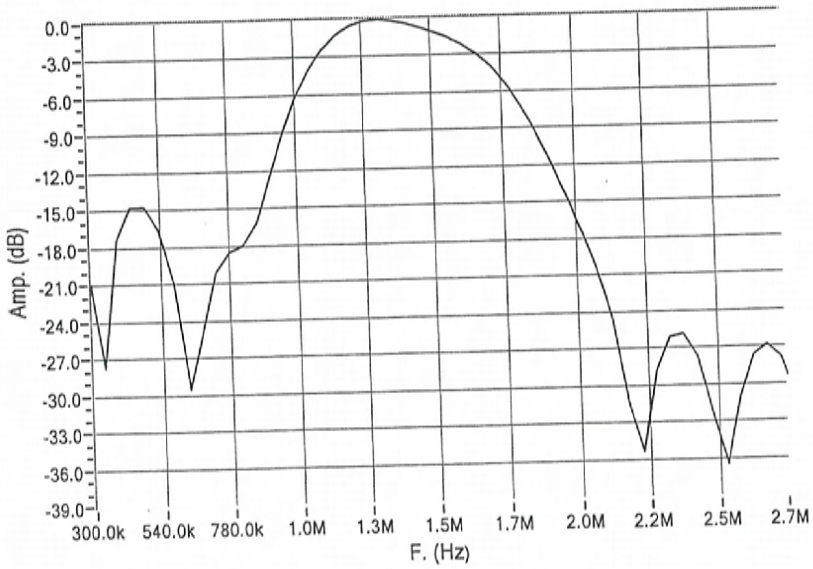
T : 319.0ns/div U : 2.0mV/div




PULSE LENGTH :
-6dB : 903.25ns -20dB : 3.20µs

VOLTAGES :
Vpp = 14.73mV

## TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.40MHz
Ratio Bp/Fc : 53%
Bandwidth : 743.85KHz
Lower Frequency : 1.03MHz
Upper Frequency : 1.77MHz

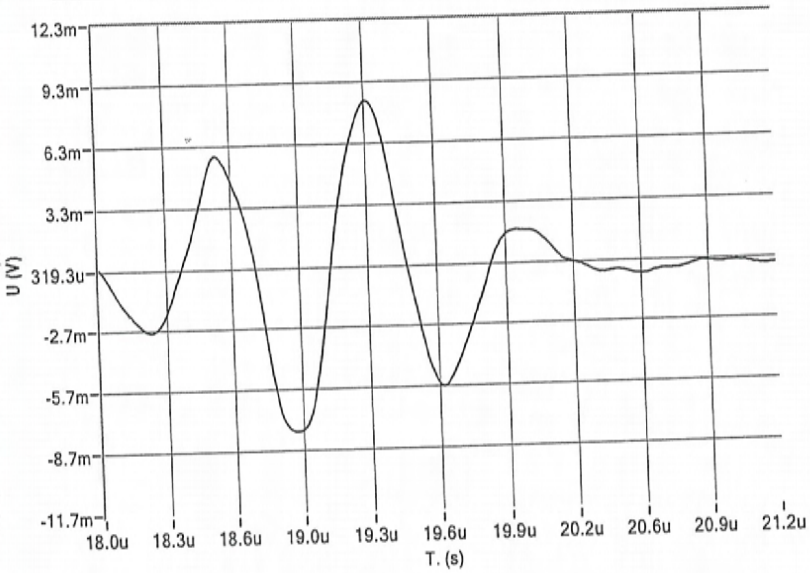
IMASONIC SA
TRANSDUCER DATA SHEET

SPECTRE V5.4

Date : November 16th 2006 16h44
Operator : SA
Transducer : Matrix phased array probe - 2x16 elts
Serial number : 5155 B105
Nominal frequency : 1.50MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 70 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.57mm
Element : 14

WAVEFORM

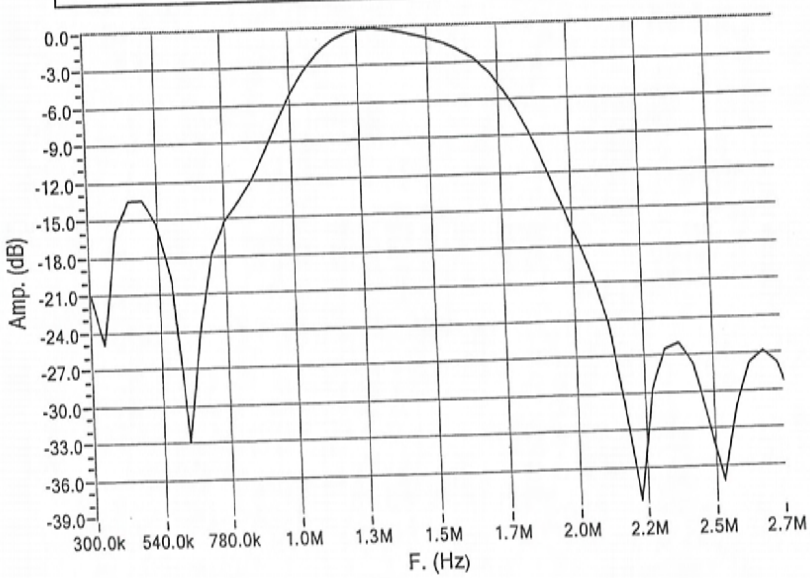
T : 319.0ns/div U : 3.0mV/div




PULSE LENGTH :
-6dB : 923.25ns -20dB : 3.20µs

VOLTAGES :
Vpp = 16.14mV

TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.39MHz
Ratio Bp/Fc : 55%
Bandwidth : 771.07KHz
Lower Frequency : 1.01MHz
Upper Frequency : 1.78MHz

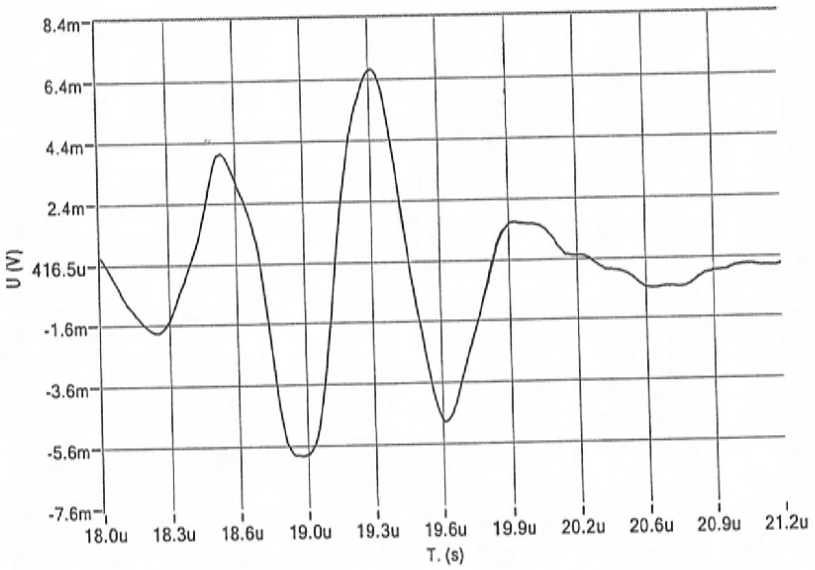
IMASONIC SA
TRANSDUCER DATA SHEET

SPECTRE V5.4

Date : November 16th 2006 16h44
Operator : SA
Transducer : Matrix phased array probe - 2x16 elts
Serial number : 5155 B105
Nominal frequency : 1.50MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 70 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.59mm
Element : 18

## WAVEFORM

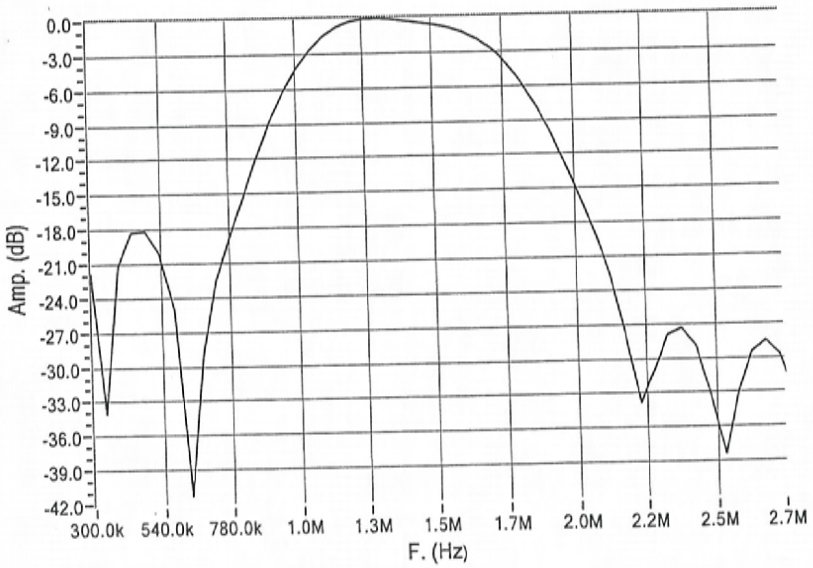
T : 319.0ns/div U : 2.0mV/div




PULSE LENGTH :
-6dB : 1.11µs -20dB : 3.20µs

VOLTAGES :
Vpp = 12.67mV

## TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.40MHz
Ratio Bp/Fc : 59%
Bandwidth : 827.91KHz
Lower Frequency : 985.60KHz
Upper Frequency : 1.81MHz

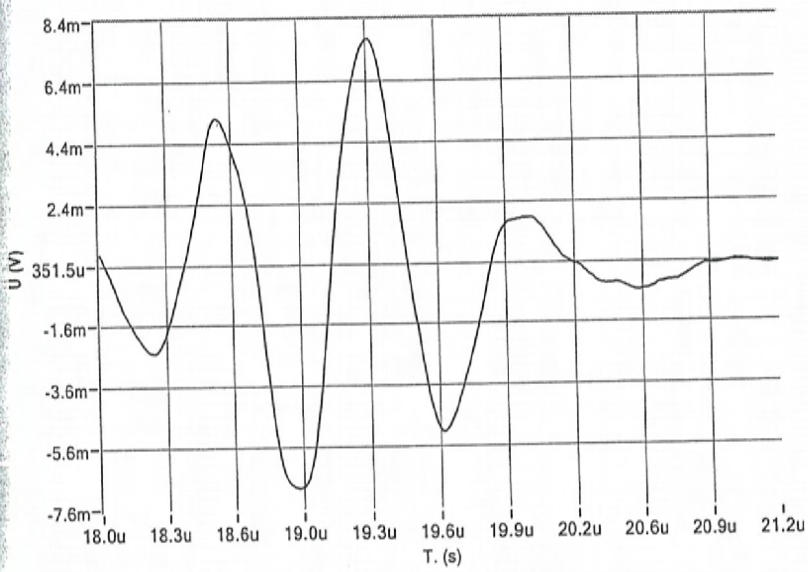
IMASONIC SA
TRANSDUCER DATA SHEET

SPECTRE V5.4

Date : November 16th 2006 16h44
Operator : SA
Transducer : Matrix phased array probe - 2x16 elts
Serial number : 5155 B105
Nominal frequency : 1.50MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 70 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.56mm
Element : 22

## WAVEFORM

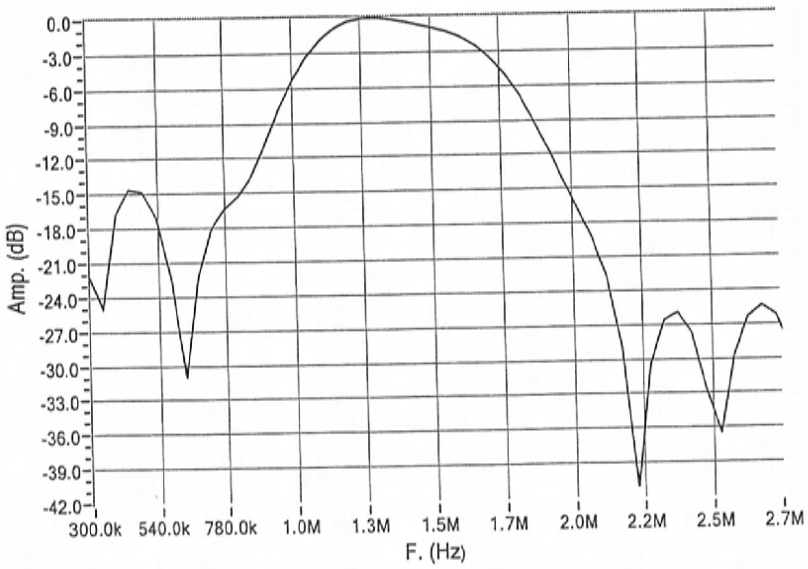
T : 319.0ns/div U : 2.0mV/div




PULSE LENGTH :
-6dB : 911.27ns -20dB : 3.20µs

VOLTAGES :
Vpp = 14.73mV

## TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.40MHz
Ratio Bp/Fc : 55%
Bandwidth : 774.42KHz
Lower Frequency : 1.01MHz
Upper Frequency : 1.79MHz

IMASONIC

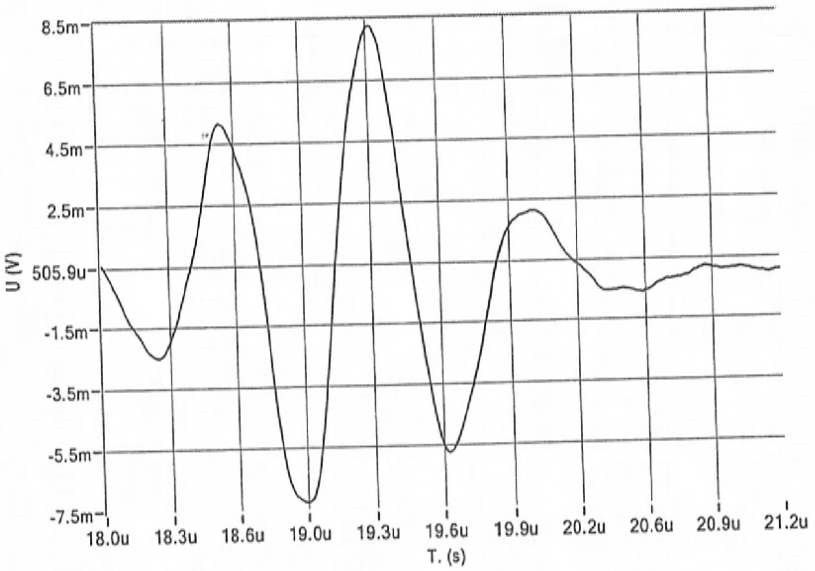
# IMASONIC SA
# TRANSDUCER DATA SHEET

SPECTRE V5.4

Date : November 16th 2006 16h44
Operator : SA
Transducer : Matrix phased array probe - 2x16 elts
Serial number : 5155 B105
Nominal frequency : 1.50MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 70 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.58mm
Element : 26

## WAVEFORM

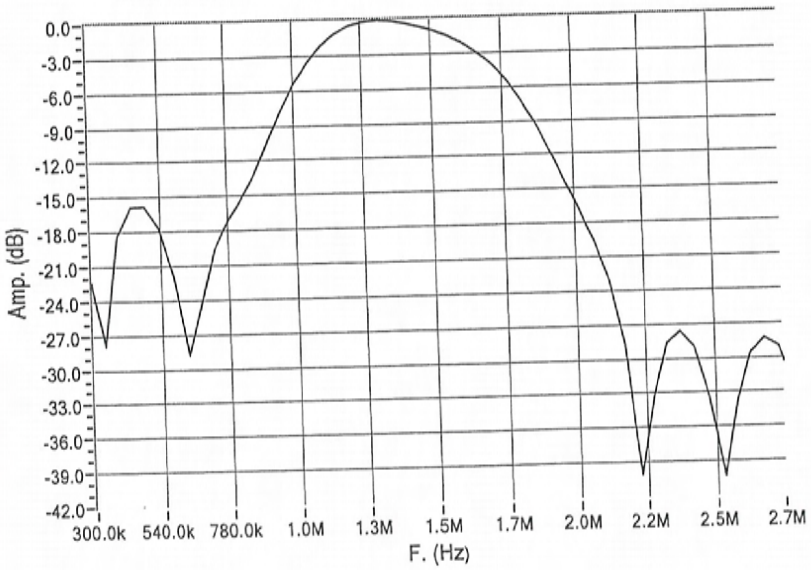
T : 319.0ns/div U : 2.0mV/div




PULSE LENGTH :
-6dB : 903.58ns -20dB : 3.20µs

VOLTAGES :
Vpp = 15.59mV

## TRANSMIT-RECEIVE SPECTRUM

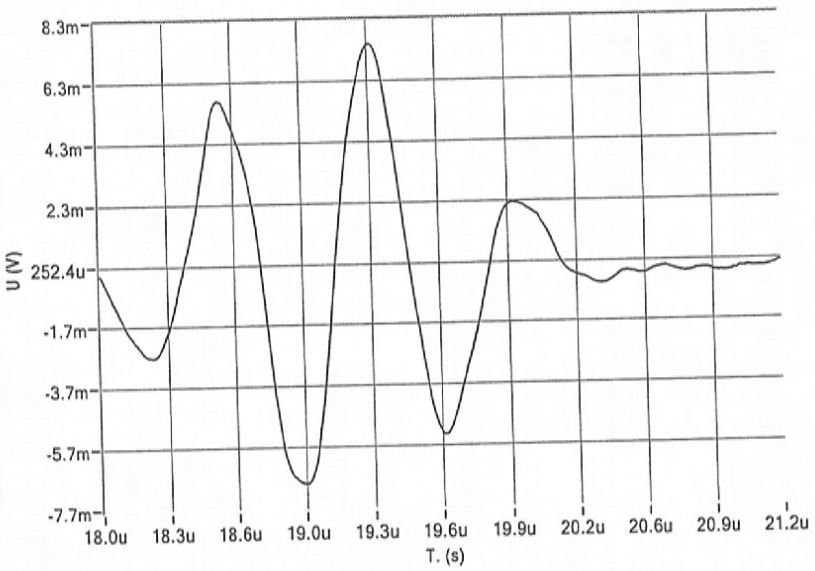



CARACTERISTICS AT -6dB :
Central Frequency : 1.39MHz
Ratio Bp/Fc : 55%
Bandwidth : 760.45KHz
Lower Frequency : 1.01MHz
Upper Frequency : 1.77MHz

Date : November 16th 2006 16h44
Operator : SA
Transducer : Matrix phased array probe - 2x16 elts
Serial number : 5155 B105
Nominal frequency : 1.50MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 70 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.57mm
Element : 30

## WAVEFORM

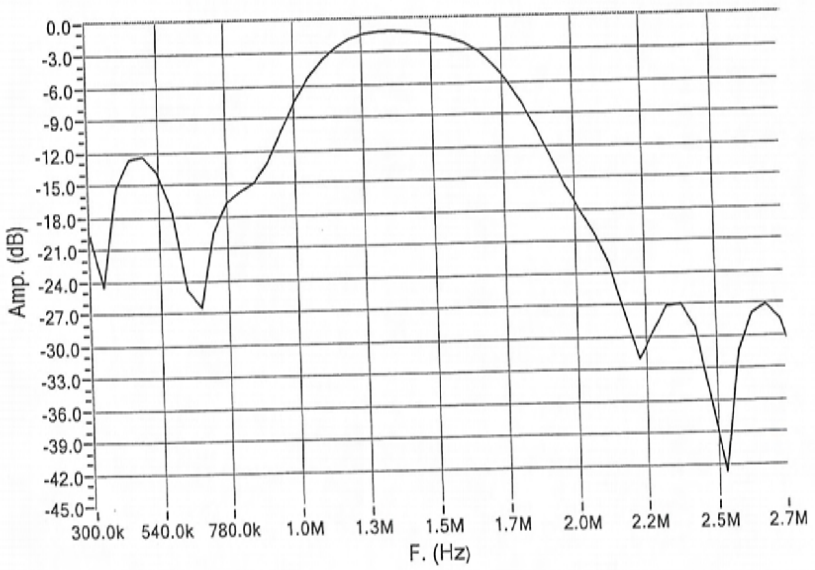
T : 319.0ns/div U : 2.0mV/div




PULSE LENGTH :
-6dB : 926.79ns -20dB : 3.20µs

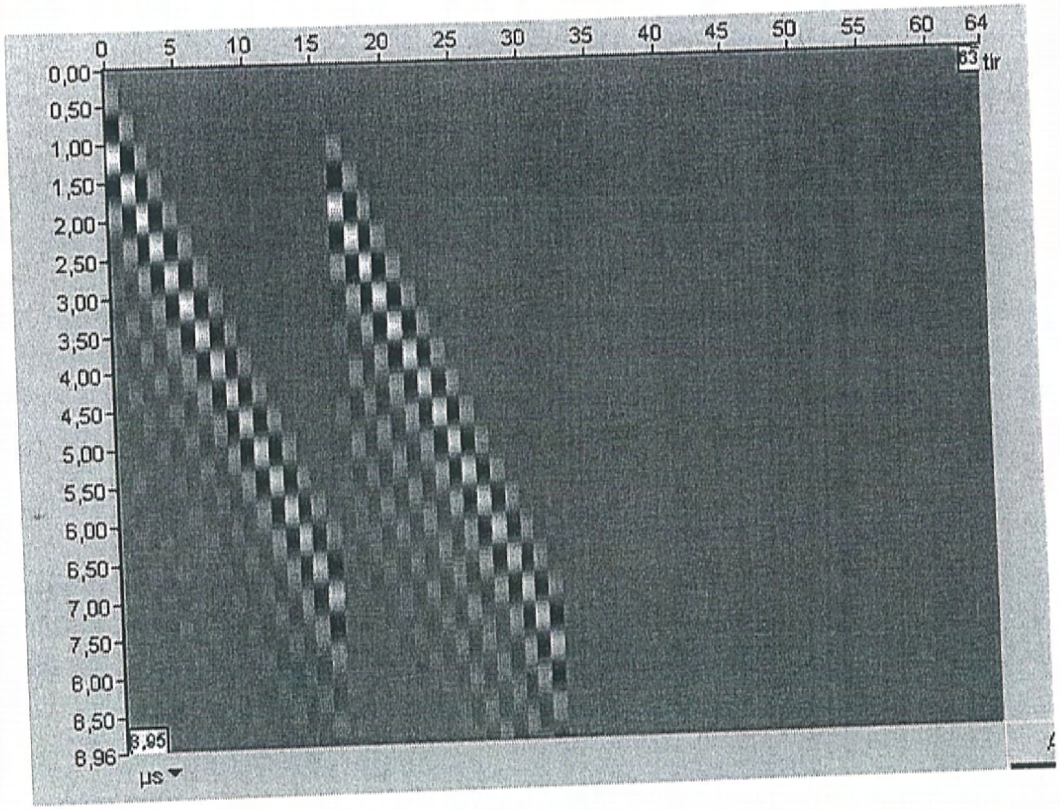
VOLTAGES :
Vpp = 14.41mV

## TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.41MHz
Ratio Bp/Fc : 53%
Bandwidth : 752.85KHz
Lower Frequency : 1.03MHz
Upper Frequency : 1.79MHz

# Cabling order
# Plane matrix 2x16 elements
# 5155 B105



IMASONIC

# MEASUREMENT REPORT

## 1,5 MHz 2 x 32 elts matrix phased array probe

5154 B101

---

ZETEC QUEBEC

1.5M32X2E64-15

IMASONIC

# CERTIFICATE of CONFORMANCE

REFERENCE DOCUMENT CdC5154-5
PROJECT # 5154B
SERIAL # 5154B101

## Checking of Electrical Performance

| | | Criteria of conformity | Value | Conformity |
|---|---|---|---|---|
| Inter element coupling between neighbouring elements | dB | < -30 | -47.5 | OK |
| Inter element coupling between neighbouring elements | dB | < -35 | -54.6 | OK |

## Checking of Acoustical Performance

| | | Criteria of conformity | Value | Conformity |
|---|---|---|---|---|
| Central Frequency (-6dB) | MHz | [1.35 ; 1.65] | 1.4 | OK |
| Bandwidth (-6dB) | % | > 55 | 68 | OK |
| Pulse Length (-20dB) | ns | < 3.5 | 2.82 | OK |
| Sensitivity | (mV) | na | 27 | OK |
| Homogeneity (probe to probe, within batch) | dB | ± 3 / mean value | -0.4 | OK |
| Homogeneity (between all elements of the probe) | dB | ± 3 / mean value | -2.77 | OK |

| | | | | |
|---|---|---|---|---|
| Backwall Echo | dB | < -40 | -61.6 | OK |

## Checking of Elements Wiring

| | |
|---|---|
| conformity | OK |

## Overall Conformity

| | |
|---|---|
| conformity | OK |

Date : 16/11/2006

Signature

Ruch Vincent

# *Phased Array Probe Specifications*
Piezocomposite technology

IMASONIC

Zetec reference: 1.5M32x2E64-15
IMASONIC reference: CDC5154-5

## *Technical characteristics and acceptance level*

### *Acoustical characteristics*

Centre frequency (-6dB): 1.5 MHz ± 10 %*
Bandwidth (-6dB): > 55% *
Pulse length (-20dB): < 3.5 µs *
Acoustical impedance matching: rexolite
Electrical matching: none

Number of channels: 64 (2 rows of 32)
Active area 64x15 mm
Mechanical focusing: none
Elementary pitch in the primary axis: 2 mm
Elementary pitch in the secondary axis: 7.5mm
Inter element spacing: 0.2 mm in two dimensions

Homogeneity in sensitivity: ± 3 dB for the whole array*
Homogeneity of probe to probe in sensitivity: +/-3 dB for a batch which number of probes is agreed between ZETEC and IMASONIC before the order.
Inter element coupling: ≤ -30dB* between adjacent elements
Inter element coupling: ≤ -35dB* between elements separated by one element
Backing echoes: ≤ -40dB / interface echo

**criteria of conformity measured in the conditions below*

### *Mechanical characteristics*

Housing:
Stainless steel
Geometry and dimensions: according to the drawing ref 5154A0110000

Cable:
Cable output: on side, near last element.
Cable gland

Flanges:
Geometry and dimensions: according to the drawing ref 5154A0110000

### *Interconnections*

Cable: 50Ω multi-coaxial with overall shielding
Length: 5 m ± 0.1m
Connector: Hypertronics
Protective jacket: halogen free jacket
Pinout diagram: classical.

## *Phased Array Probe Specifications*
Piezocomposite technology

| | |
|---|---|
| Zetec reference: | 1.5M32x2E64-15 |
| IMASONIC reference: | CDC5154-5 |

### *Identification*

| | |
|---|---|
| On the top of the probe: | Logo Zetec<br>Identification of the 1st, 32nd, 33rd and 64th elements |
| On side of the probe: | 1.5M32X2E64-15<br>29HBE0028<br>serial number |

## *Recommended using conditions**

| | |
|---|---|
| Chemical constraints: | contact with acoustical gel or water |
| Pressure: | equivalent to a water column of 1m maximum |
| Temperature: | -20° to 60°C (storage)<br>10 to 30°C (functioning) |
| Excitation: | Negative pulse 200Vpp maximum (measured in 50 Ωenvironments)<br>Max repetition frequency: 10 kHz |
| Cleaning: | With water or isopropyl alcohol, with soft tissue, taking care of not wearing the front face with particles between the front face and the tissue |
| Manipulation: | Do not handle the probe by the cable |
| Nuclear radiation: | none |
| **Normative constraints:** | **none** |

Particular constraints of shocks and vibrations are not taken into account by IMASONIC

** Other particular using conditions must be validated by IMASONIC*

Zetec reference: 1.5M32x2E64-15
IMASONIC reference: CDC5154-5

## *Control of electro acoustical performances*

**Electrical Measurements:**
1_Impedance measurement for all the elements at the nominal frequency
2_Inter-element coupling measurement on 2 pairs of adjacent elements
3_Inter-element coupling measurement on 2 pairs of non adjacent elements

*Measurements conditions:*
Performed with HP3577A network analyser (50Ω environment)
Acoustic load on the active part: 1.5 MR
*Supplied documents:*
Value of impedances
Curves of inter –elements coupling

**Acoustical measurements:**
1_Temporal response & frequency spectrum measurement for all the elements

*Measurements conditions:*
Performed on contact on flat steel target with a rexolite delay line in E/R mode
rexolite path: 15mm
steel path: 20mm
coupling: to be defined during the control
Excitation signal: 1 negative pulse
*Supplied documents:*
Value of central frequency, bandwidth (-6dB), pulse length (-20dB) and sensitivity for all elements
Curves of homogeneity sensitivity
Curves for 8 elements

2_Backing Echo measurement

*Measurements conditions:*
Performed in water on a flat brass target in E/R mode
Excitation signal: 1 negative pulse
*Supplied documents:*
Value of backing echo

## *Supplied documentation (paper and mail)*

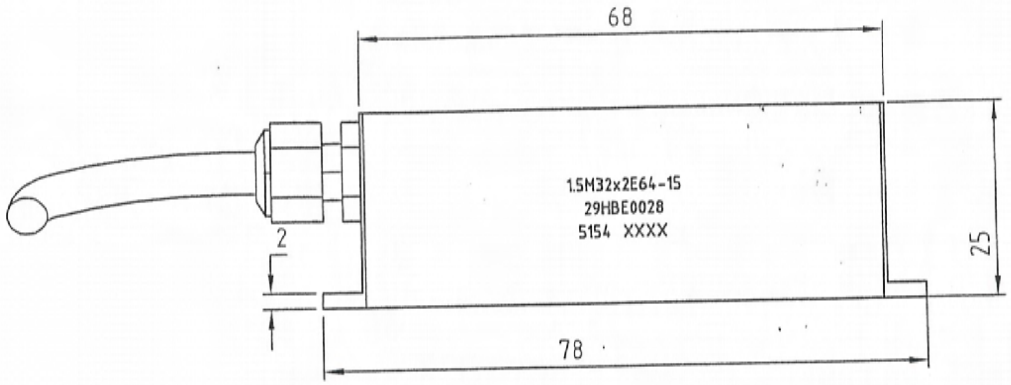
Specifications of the probe
Overall drawing of the probe
Measurement results

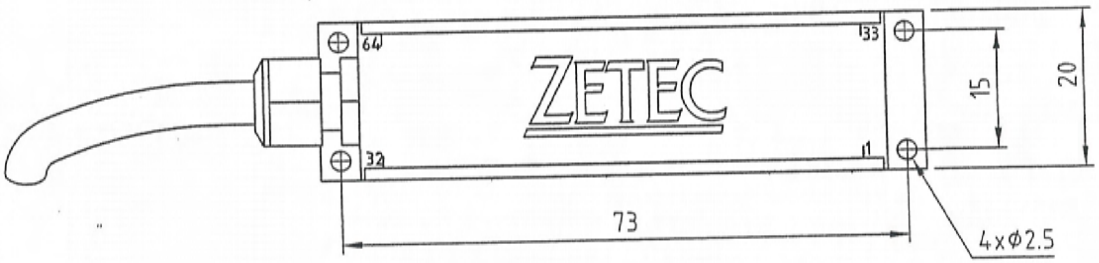
## *Casing*

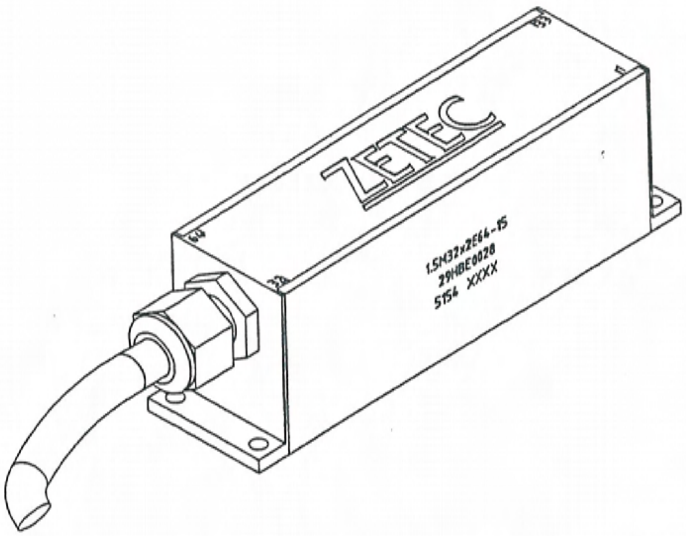
One casing for each probe

## *Guarantee conditions*

One year guarantee against manufacturing defects in the using conditions above
Other conditions: see Imasonic general selling conditions




| | | | | | |
|---|---|---|---|---|---|
| | | | | Façonnage Général : | Nombre : 1 |
| | | | | Tol gén | Longueurs: js/JS13 — Angles: ±1° |
| | | | | Matière : | |
| | | | | Traitement thermique : | |
| Indice | Date | Modifications | par | Protection: | |
| | | | N° | 5154 A 0110000 | |

▽ = brut ▽ = 6.5 à 12.5Ra ▽▽ = 1.6 à 3.2Ra ▽▽▽ = 0.05 à 0.8Ra

Etude: Linear array-1.5MHz-2x32elts

Ens.:

IMASONIC transducteurs et dispositifs électroacoustiques

**Impedance measurement for the transducer n°:** 5154 B101 Operator : SA

*(Acoustic load: 1.5 MR. IMASONIC procedure: INP 410)*

| # | Zr (Ω) | Zi (Ω) | # | Zr (Ω) | Zi (Ω) |
|---|---|---|---|---|---|
| 1 | 21.2 | -145.1 | 33 | 21.8 | -144.0 |
| 2 | 20.4 | -142.9 | 34 | 21.9 | -143.3 |
| 3 | 21.9 | -143.4 | 35 | 22.1 | -142.1 |
| 4 | 23.4 | -142.6 | 36 | 21.8 | -144.2 |
| 5 | 22.2 | -140.0 | 37 | 21.7 | -142.3 |
| 6 | 21.2 | -142.5 | 38 | 21.7 | -141.7 |
| 7 | 21.0 | -143.7 | 39 | 22.3 | -141.5 |
| 8 | 21.2 | -142.1 | 40 | 22.4 | -142.8 |
| 9 | 22.9 | -141.6 | 41 | 20.9 | -141.7 |
| 10 | 23.4 | -142.4 | 42 | 20.7 | -143.8 |
| 11 | 21.4 | -141.5 | 43 | 21.7 | -142.3 |
| 12 | 21.2 | -144.5 | 44 | 22.9 | -141.9 |
| 13 | 20.6 | -144.0 | 45 | 21.7 | -140.4 |
| 14 | 22.0 | -142.1 | 46 | 21.5 | -143.7 |
| 15 | 23.3 | -141.1 | 47 | 20.5 | -144.6 |
| 16 | 23.1 | -141.5 | 48 | 21.1 | -144.0 |
| 17 | 21.2 | -143.5 | 49 | 23.3 | -142.5 |
| 18 | 21.1 | -143.7 | 50 | 23.5 | -142.7 |
| 19 | 22.0 | -142.8 | 51 | 22.3 | -143.1 |
| 20 | 22.4 | -141.6 | 52 | 21.0 | -144.8 |
| 21 | 22.8 | -141.7 | 53 | 21.1 | -144.1 |
| 22 | 22.0 | -142.3 | 54 | 22.2 | -143.5 |
| 23 | 21.8 | -142.7 | 55 | 23.3 | -140.9 |
| 24 | 22.1 | -143.5 | 56 | 22.8 | -141.8 |
| 25 | 22.4 | -142.2 | 57 | 21.6 | -143.7 |
| 26 | 22.0 | -142.1 | 58 | 21.3 | -142.3 |
| 27 | 22.0 | -143.0 | 59 | 21.7 | -142.6 |
| 28 | 21.9 | -142.0 | 60 | 23.2 | -142.6 |
| 29 | 22.2 | -142.9 | 61 | 23.3 | -141.4 |
| 30 | 22.5 | -141.7 | 62 | 21.8 | -141.5 |
| 31 | 22.1 | -142.3 | 63 | 21.5 | -141.7 |
| 32 | 21.2 | -144.5 | 64 | 22.3 | -141.9 |

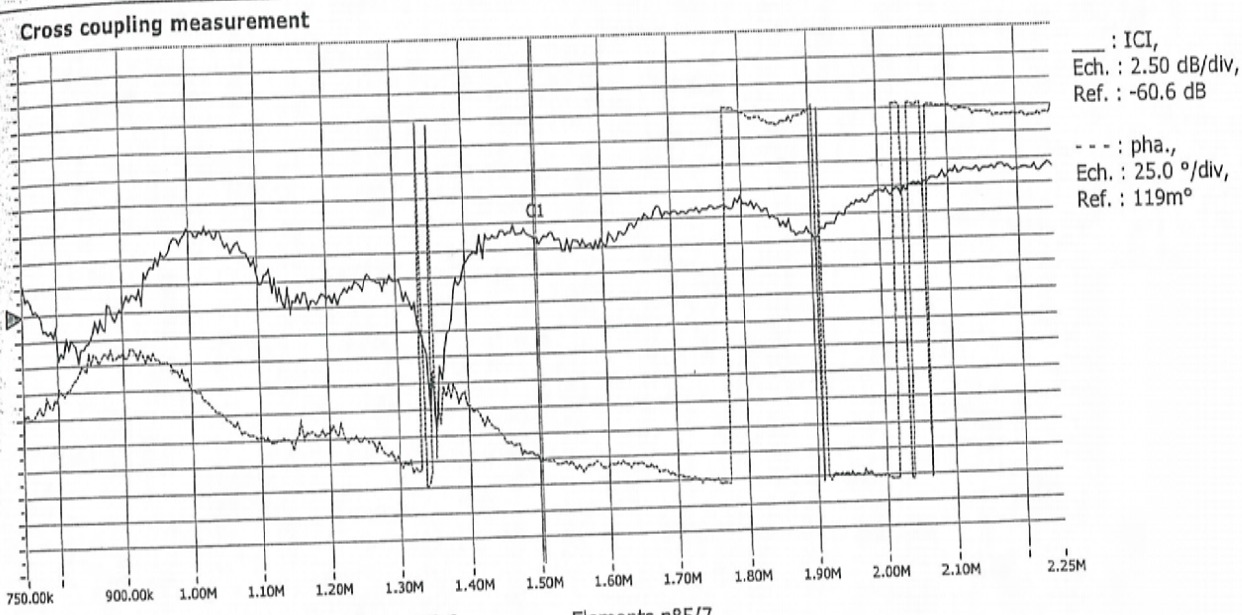
| | Zr (Ω) | Zi (Ω) |
|---|---|---|
| Minimum : | 20.4 | -145.1 |
| Maximum : | 23.5 | -140.0 |
| Standard deviation : | 0.8 | 1.1 |
| Average values : | 22.0 | -142.6 |

**Inter element coupling measurement :**

| #/# | Coupling (dB) |
|---|---|
| 5/6 | -47.5 |
| 28/29 | -48.7 |
| 2/18 | -57.0 |
| 5/7 | -54.6 |
| 28/30 | -46.8 |

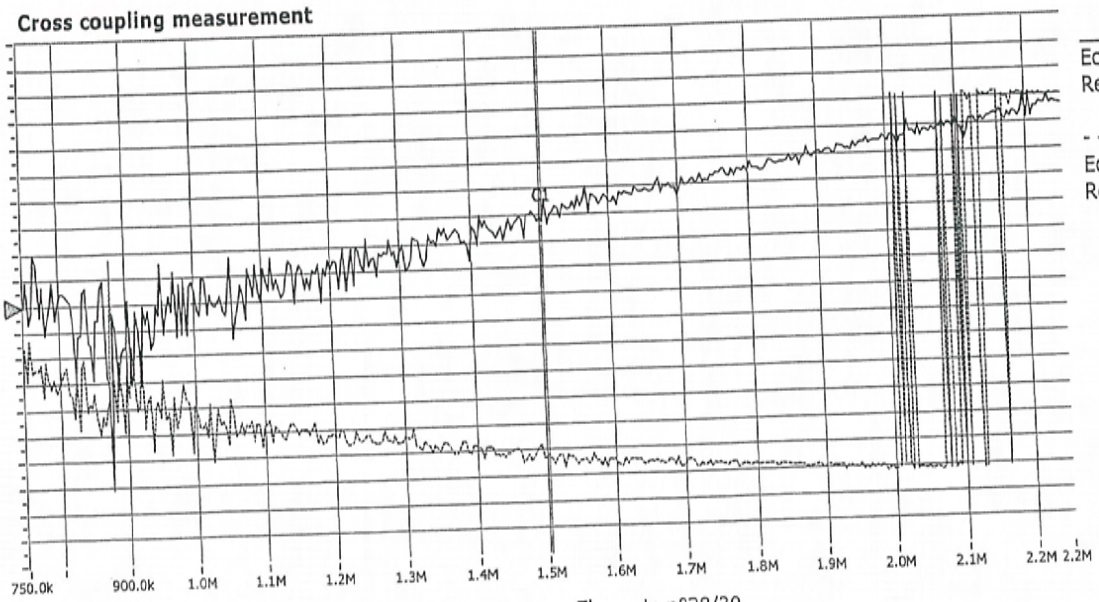
Date : November 15th 2006 14h35
Operator : SA
Transducer : Matrix phased array - 32x2 elements
Serial number : 5154 B101
Nominal frequency : 1.50MHz
Network Analyzer : HP 8751A, IM : 112-113
Acoustic load : 1.5MR on active area
Instruction : INP 412

**Cross coupling measurement**




C1 : F=1.50MHz ICI=-54.6 dB pha.=-152 ° Elements n°5/7

**Cross coupling measurement**




C1 : F=1.50MHz ICI=-46.8 dB pha.=-158 ° Elements n°28/30

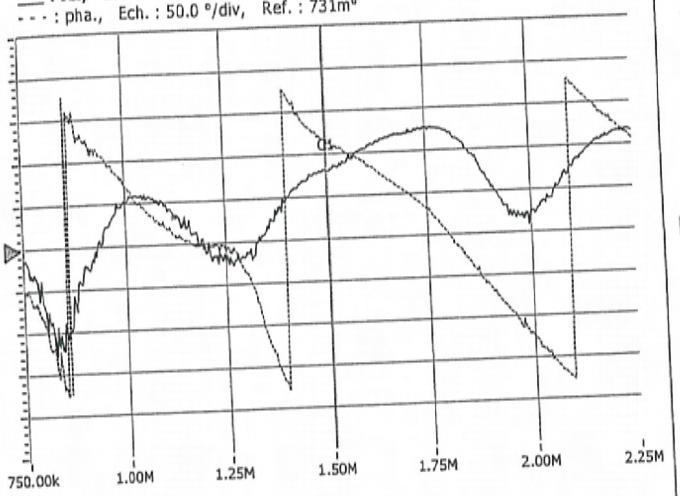
IMASONIC S.A.
MESURES ELECTRIQUES
Z V4.2

IMASONIC

Date : November 15th 2006 14h32
Operator : SA
Transducer : Matrix phased array - 32x2 elements
Serial number : 5154 B101
Nominal frequency : 1.50MHz
Network Analyzer : HP 8751A, IM : 112-113
Acoustic load : 1.5MR on active area
Instruction : INP 412

**Cross coupling measurement**

___ : ICI, Ech. : 5.00 dB/div, Ref. : -55.6 dB
- - - : pha., Ech. : 50.0 °/div, Ref. : 731m°

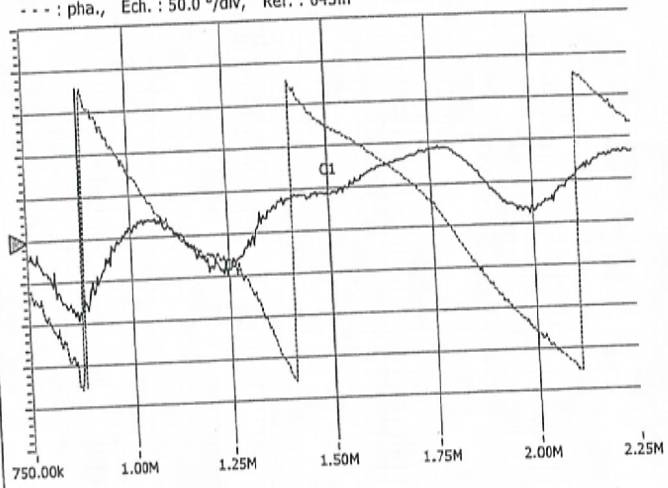



Elements n°5/6

C1 : F=1.50MHz ICI=-47.5 dB pha.=118 °

**Cross coupling measurement**

___ : ICI, Ech. : 5.00 dB/div, Ref. : -52.9 dB
- - - : pha., Ech. : 50.0 °/div, Ref. : 643m°

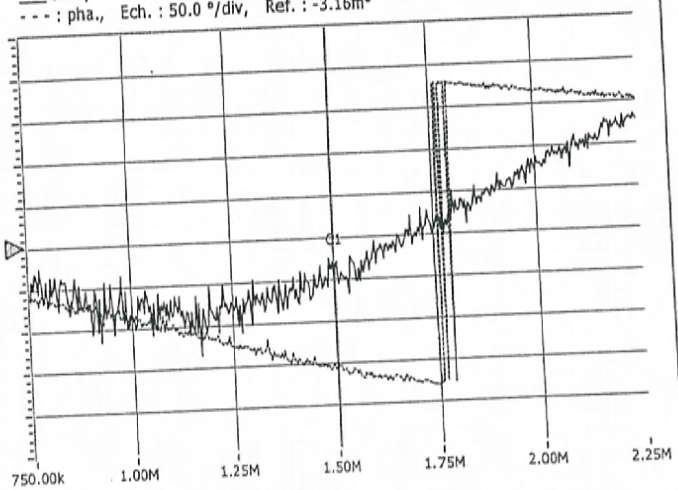



Elements n°28/29

C1 : F=1.50MHz ICI=-48.7 dB pha.=123 °

**Cross coupling measurement**

___ : ICI, Ech. : 2.00 dB/div, Ref. : -55.1 dB
- - - : pha., Ech. : 50.0 °/div, Ref. : -3.16m°

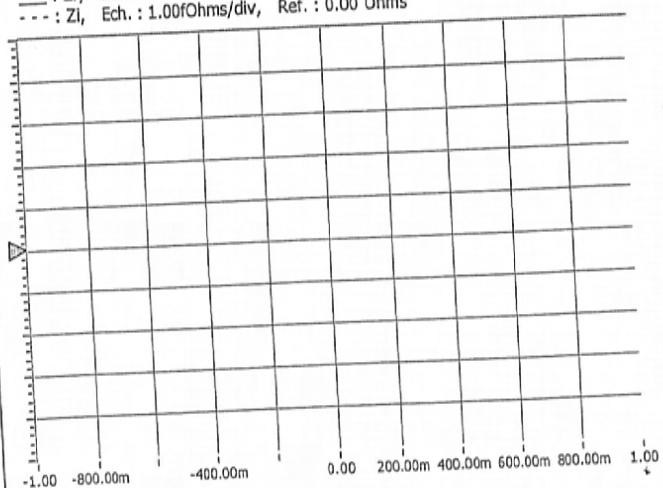



Elements n°2/18

C1 : F=1.50MHz ICI=-57.0 dB pha.=-158 °

**Cross coupling measurement**

___ : Zr, Ech. : 1.00fOhms/div, Ref. : 0.00 Ohms
- - - : Zi, Ech. : 1.00fOhms/div, Ref. : 0.00 Ohms



**Electroacoustic measurement for the transducer n°:** 5154 B101 **Operator : SA**

*(Acoustic load: 2.45 MR. IMASONIC procedure: INP 413.)* *Nominal Frequency : 1.50 MHz*

*Generator : Multi 2000 V3.4.4, Gain = atten = 60 dB, L. Exc. : 353 ns, U. Exc. : 70 V*

*Target type : Inox h = 20 mm + Rexolite h = 15mm*

| # | Vpp (mV) | Fc (MHz) | Bw (%) | Lp -20dB (ns) | # | Vpp (mV) | Fc (MHz) | Bw (%) | Lp -20dB (ns) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 28 | 1.4 | 68 | 3346 | 33 | 28 | 1.5 | 63 | 3590 |
| 2 | 24 | 1.5 | 69 | 2593 | 34 | 26 | 1.5 | 68 | 2654 |
| 3 | 28 | 1.4 | 72 | 2623 | 35 | 28 | 1.4 | 73 | 2610 |
| 4 | 30 | 1.4 | 72 | 2712 | 36 | 27 | 1.4 | 72 | 2997 |
| 5 | 28 | 1.5 | 69 | 2696 | 37 | 27 | 1.5 | 72 | 2732 |
| 6 | 26 | 1.5 | 70 | 2662 | 38 | 27 | 1.5 | 69 | 2584 |
| 7 | 25 | 1.5 | 70 | 2749 | 39 | 28 | 1.5 | 69 | 2712 |
| 8 | 25 | 1.5 | 69 | 2821 | 40 | 28 | 1.4 | 68 | 2680 |
| 9 | 28 | 1.5 | 70 | 2782 | 41 | 25 | 1.5 | 70 | 2670 |
| 10 | 30 | 1.5 | 67 | 2675 | 42 | 25 | 1.5 | 71 | 2682 |
| 11 | 26 | 1.4 | 68 | 2655 | 43 | 27 | 1.4 | 68 | 2643 |
| 12 | 25 | 1.4 | 71 | 2710 | 44 | 30 | 1.4 | 70 | 2733 |
| 13 | 23 | 1.5 | 72 | 2830 | 45 | 27 | 1.4 | 69 | 2732 |
| 14 | 27 | 1.5 | 67 | 2697 | 46 | 27 | 1.4 | 70 | 2680 |
| 15 | 30 | 1.5 | 66 | 2730 | 47 | 24 | 1.4 | 69 | 2601 |
| 16 | 29 | 1.5 | 66 | 2688 | 48 | 25 | 1.4 | 70 | 2612 |
| 17 | 26 | 1.5 | 70 | 2753 | 49 | 28 | 1.5 | 67 | 2787 |
| 18 | 25 | 1.5 | 69 | 2706 | 50 | 30 | 1.4 | 67 | 2681 |
| 19 | 26 | 1.5 | 69 | 2730 | 51 | 29 | 1.4 | 70 | 2717 |
| 20 | 28 | 1.5 | 66 | 2668 | 52 | 25 | 1.5 | 70 | 2699 |
| 21 | 28 | 1.4 | 67 | 2751 | 53 | 24 | 1.4 | 71 | 2705 |
| 22 | 27 | 1.4 | 69 | 2774 | 54 | 28 | 1.4 | 72 | 2709 |
| 23 | 27 | 1.5 | 69 | 3559 | 55 | 30 | 1.4 | 68 | 2665 |
| 24 | 27 | 1.4 | 69 | 3559 | 56 | 29 | 1.4 | 68 | 2689 |
| 25 | 27 | 1.4 | 69 | 2791 | 57 | 26 | 1.5 | 68 | 2680 |
| 26 | 28 | 1.5 | 66 | 2711 | 58 | 26 | 1.5 | 68 | 2701 |
| 27 | 27 | 1.5 | 64 | 3315 | 59 | 27 | 1.4 | 68 | 2726 |
| 28 | 27 | 1.4 | 67 | 2897 | 60 | 30 | 1.4 | 65 | 2696 |
| 29 | 28 | 1.4 | 67 | 2688 | 61 | 31 | 1.4 | 67 | 2722 |
| 30 | 28 | 1.4 | 66 | 2716 | 62 | 28 | 1.4 | 69 | 2691 |
| 31 | 27 | 1.5 | 63 | 3547 | 63 | 28 | 1.5 | 64 | 3770 |
| 32 | 26 | 1.4 | 65 | 3467 | 64 | 28 | 1.4 | 68 | 3456 |

| | Vpp (mV) | Fc (MHz) | Bw (%) | Lp -20dB (ns) |
|---|---|---|---|---|
| **Minimum :** | 23 | 1.4 | 63 | 2584 |
| **Maximum :** | 31 | 1.5 | 73 | 3770 |
| **Standard deviation :** | 2 | 0.0 | 2 | 293 |
| **Average values :** | 27 | 1.4 | 68 | 2822 |

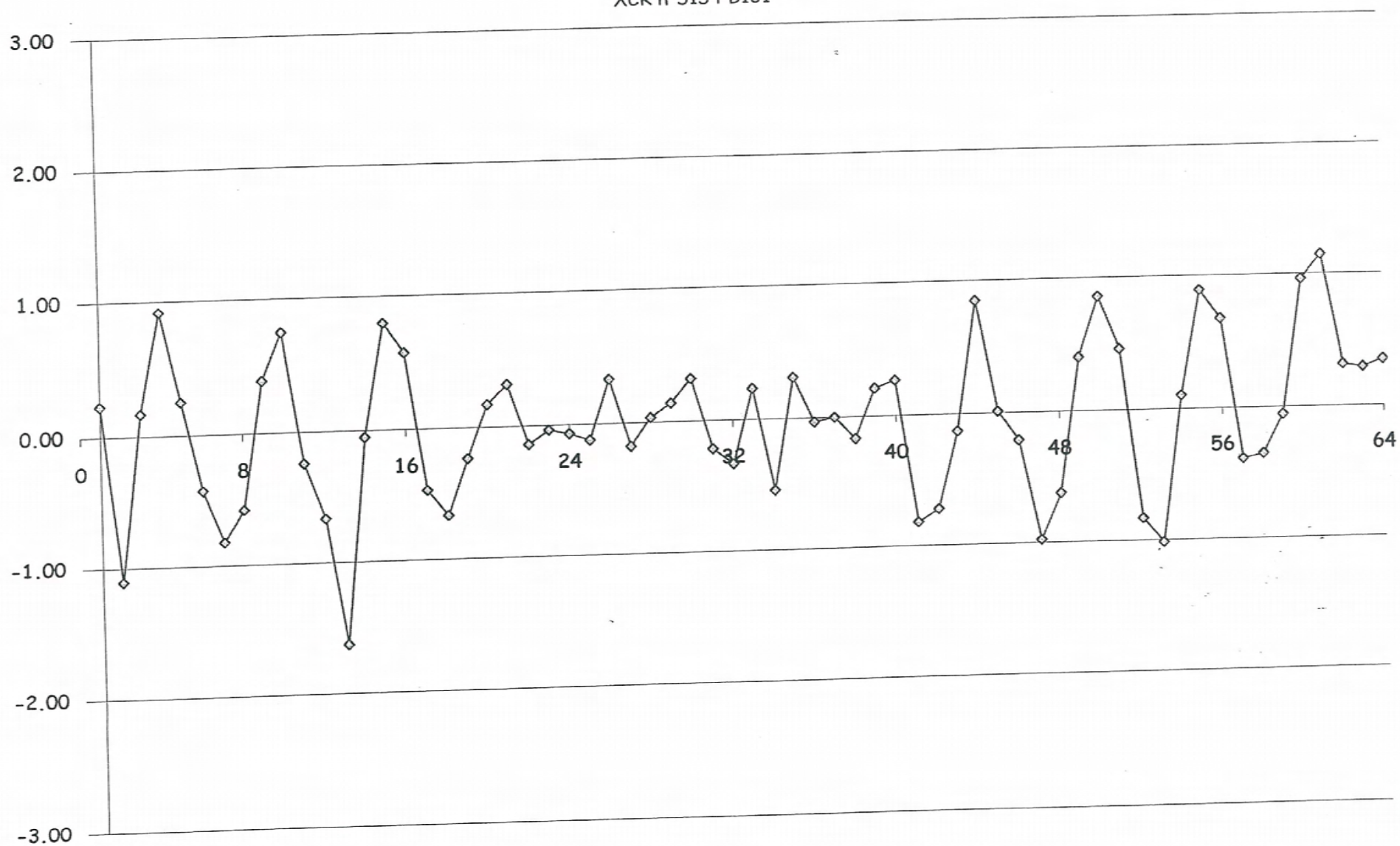
**Homogeneity in sensitivity (dB) :** **-2.77**

*See measurement results in appendix 3 for the elements n° 1, 8, 16, 32, 40, 48, 56 & 64*

SA, 16/11/2006

Sensitivity variation (dB)

XCR n°5154 B101



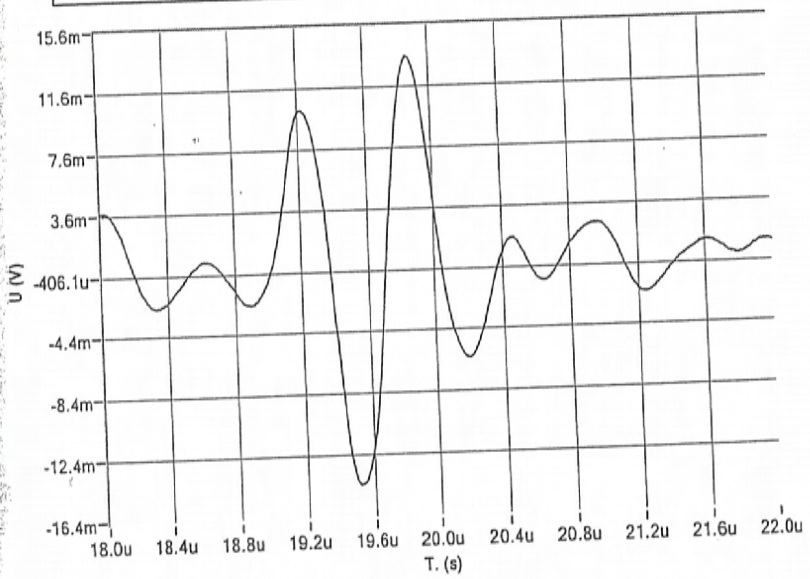

ENQ 102 - Final measurements 64 elts

# IMASONIC SA
# TRANSDUCER DATA SHEET

Date : November 16th 2006 09h49
Operator : SA
Transducer : Matrix phased array - 2x32 elements
Serial number : 5154 B101
Nominal frequency : 1.5MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 60 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP 413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.42mm
Element : 1

## WAVEFORM

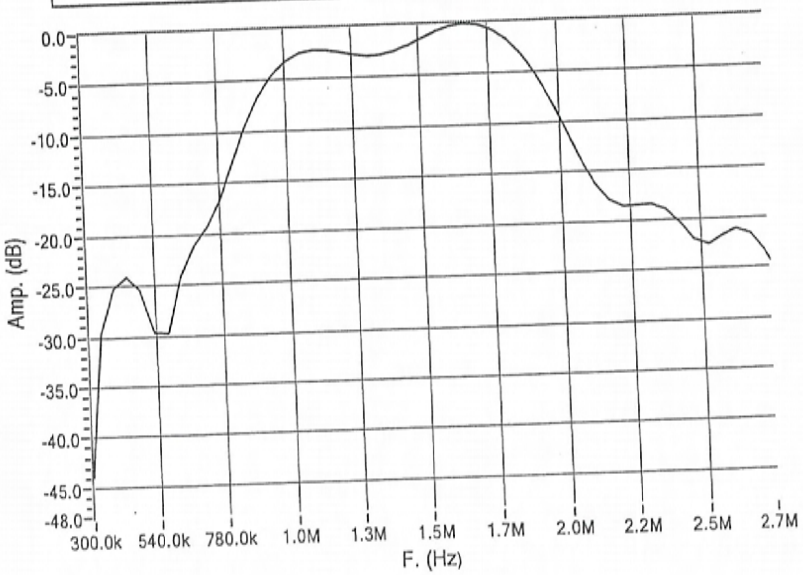
T : 399.0ns/div U : 4.0mV/div




PULSE LENGTH :
-6dB : 824.47ns -20dB : 3.35µs

VOLTAGES :
Vpp = 27.93mV

## TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.43MHz
Ratio Bp/Fc : 68%
Bandwidth : 979.39KHz
Lower Frequency : 942.00KHz
Upper Frequency : 1.92MHz

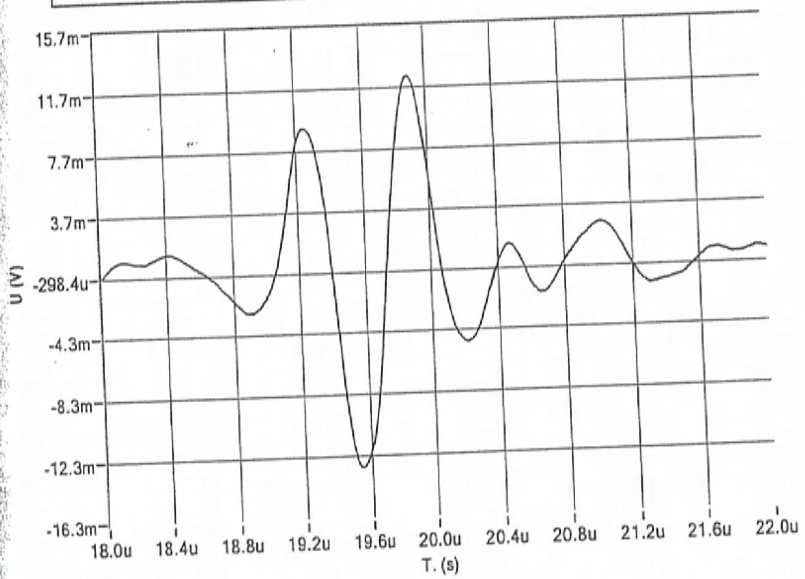
IMASONIC

# IMASONIC SA
# TRANSDUCER DATA SHEET

Date : November 16th 2006 09h49
Operator : SA
Transducer : Matrix phased array - 2x32 elements
Serial number : 5154 B101
Nominal frequency : 1.5MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 60 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP 413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.15mm
Element : 8

## WAVEFORM

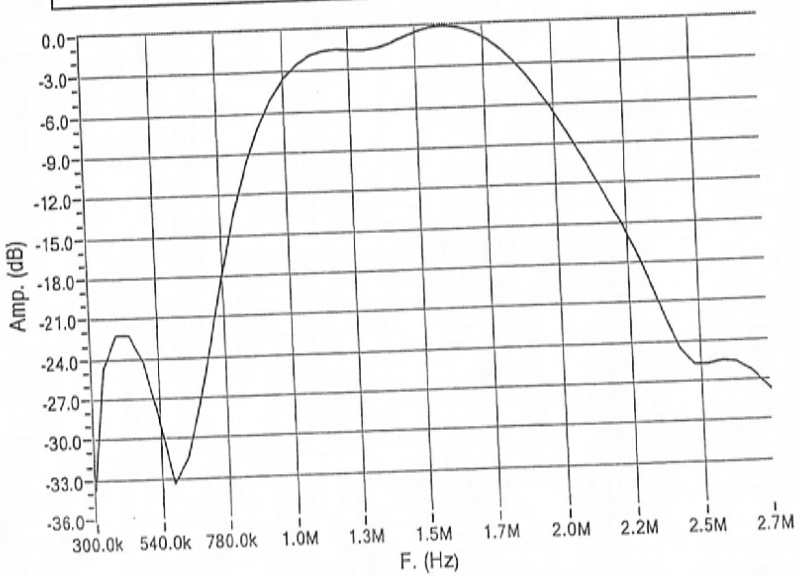
T : 399.0ns/div U : 4.0mV/div




PULSE LENGTH :
-6dB : 798.22ns -20dB : 2.82µs

VOLTAGES :
Vpp = 25.47mV

## TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.46MHz
Ratio Bp/Fc : 69%
Bandwidth : 1.01MHz
Lower Frequency : 954.91KHz
Upper Frequency : 1.96MHz

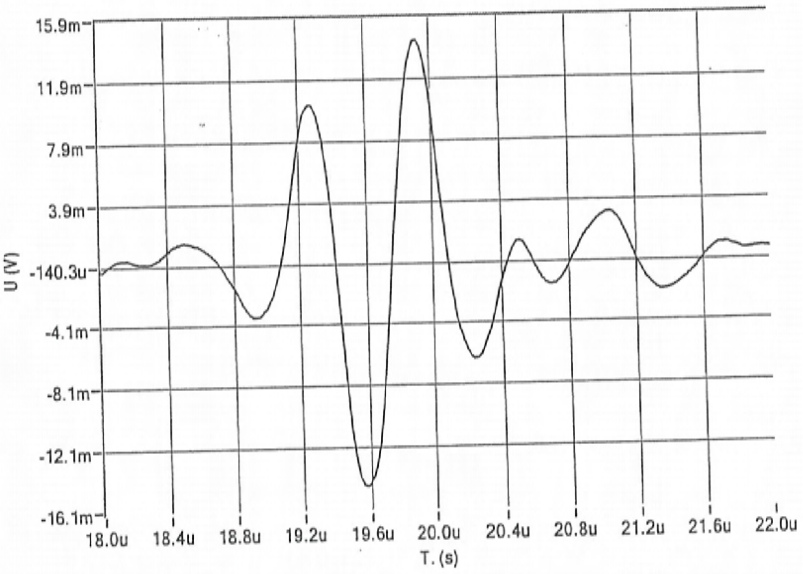
IMASONIC SA
TRANSDUCER DATA SHEET

SPECTRE V5.4

Date : November 16th 2006 09h49
Operator : SA
Transducer : Matrix phased array - 2x32 elements
Serial number : 5154 B101
Nominal frequency : 1.5MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 60 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP 413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.24mm
Element : 16

## WAVEFORM

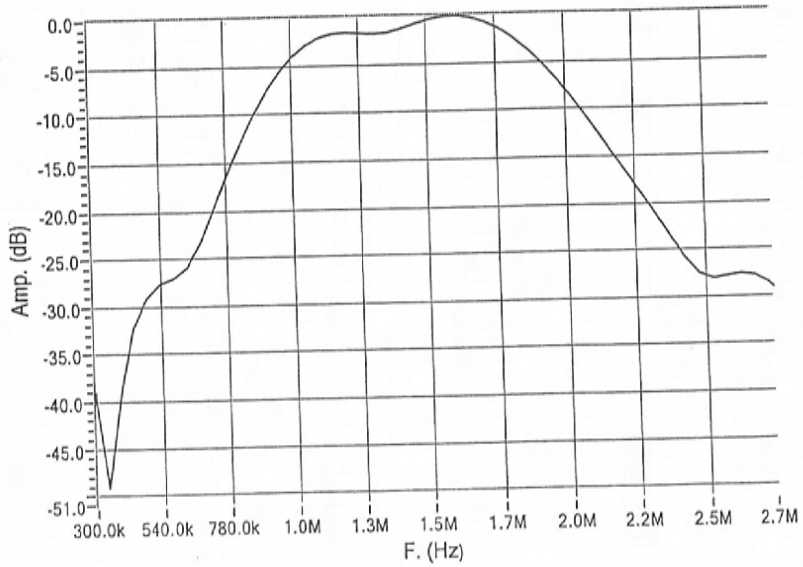
T : 399.0ns/div U : 4.0mV/div




PULSE LENGTH :
-6dB : 829.48ns -20dB : 2.69µs

VOLTAGES :
Vpp = 29.05mV

## TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.45MHz
Ratio Bp/Fc : 66%
Bandwidth : 956.29KHz
Lower Frequency : 971.42KHz
Upper Frequency : 1.93MHz

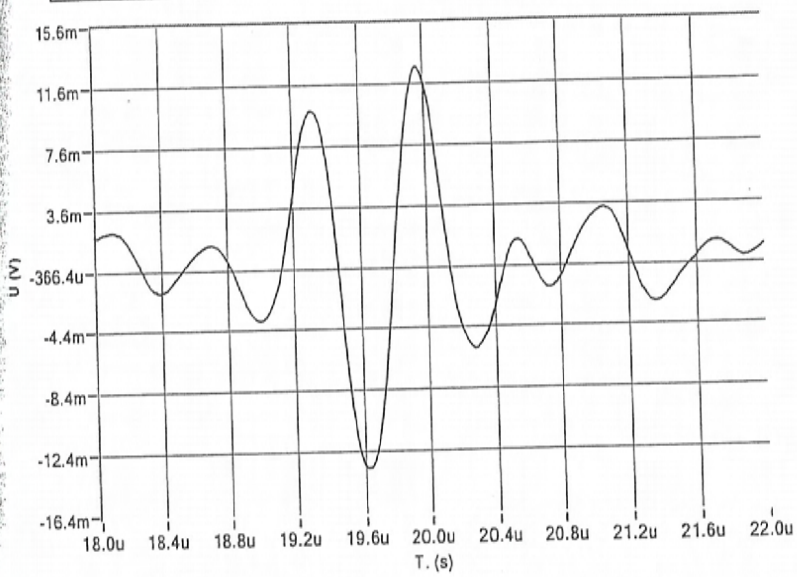
IMASONIC SA
TRANSDUCER DATA SHEET

SPECTRE V5.4

Date : November 16th 2006 09h49
Operator : SA
Transducer : Matrix phased array - 2x32 elements
Serial number : 5154 B101
Nominal frequency : 1.5MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 60 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP 413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.39mm
Element : 32

## WAVEFORM

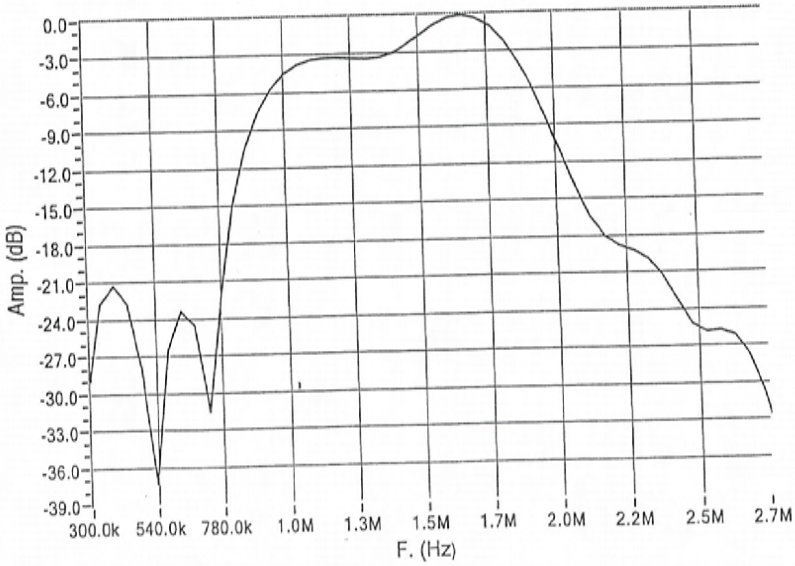
T : 399.0ns/div U : 4.0mV/div




PULSE LENGTH :
-6dB : 803.47ns -20dB : 3.47µs

VOLTAGES :
Vpp = 26.20mV

## TRANSMIT-RECEIVE SPECTRUM



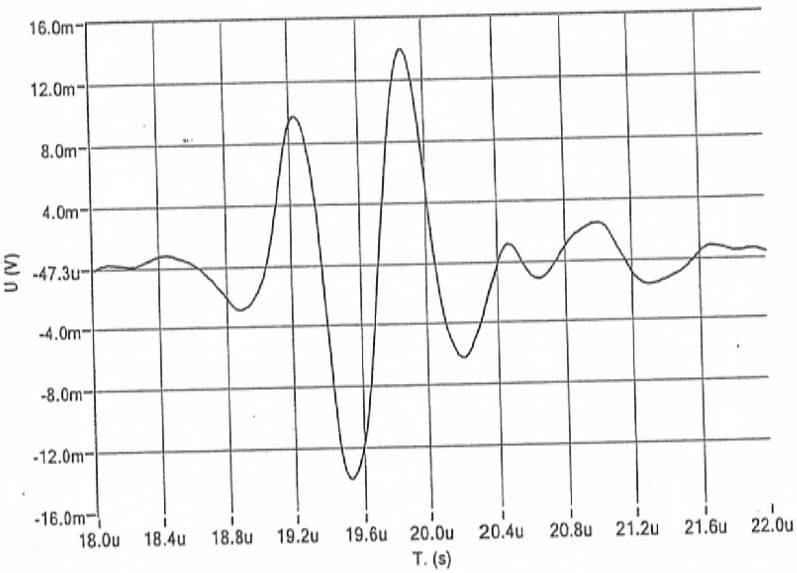

CARACTERISTICS AT -6dB :
Central Frequency : 1.44MHz
Ratio Bp/Fc : 65%
Bandwidth : 935.55KHz
Lower Frequency : 969.65KHz
Upper Frequency : 1.91MHz

# TRANSDUCER DATA SHEET

Date : November 16th 2006 09h49
Operator : SA
Transducer : Matrix phased array - 2x32 elements
Serial number : 5154 B101
Nominal frequency : 1.5MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 60 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP 413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.29mm
Element : 40

## WAVEFORM

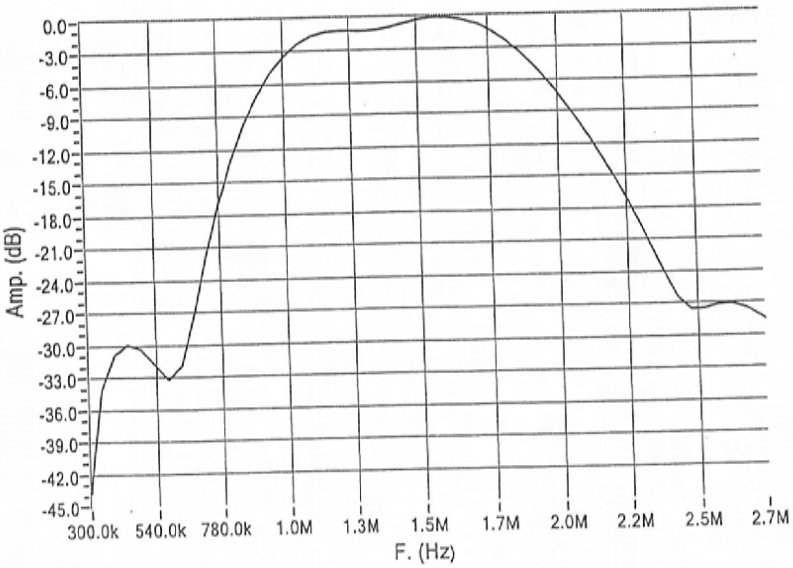
T : 399.0ns/div U : 4.0mV/div




PULSE LENGTH :
-6dB : 823.16ns -20dB : 2.68µs

VOLTAGES :
Vpp = 28.04mV

## TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.45MHz
Ratio Bp/Fc : 68%
Bandwidth : 991.08KHz
Lower Frequency : 953.78KHz
Upper Frequency : 1.94MHz

IMASONIC

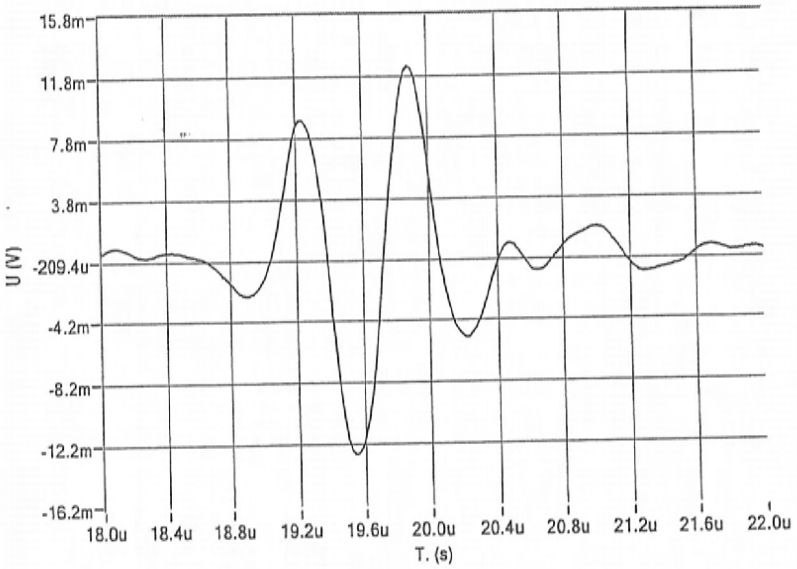
# IMASONIC SA
# TRANSDUCER DATA SHEET

SPECTRE V5.4

Date : November 16th 2006 09h49
Operator : SA
Transducer : Matrix phased array - 2x32 elements
Serial number : 5154 B101
Nominal frequency : 1.5MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 60 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP 413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.32mm
Element : 48

## WAVEFORM

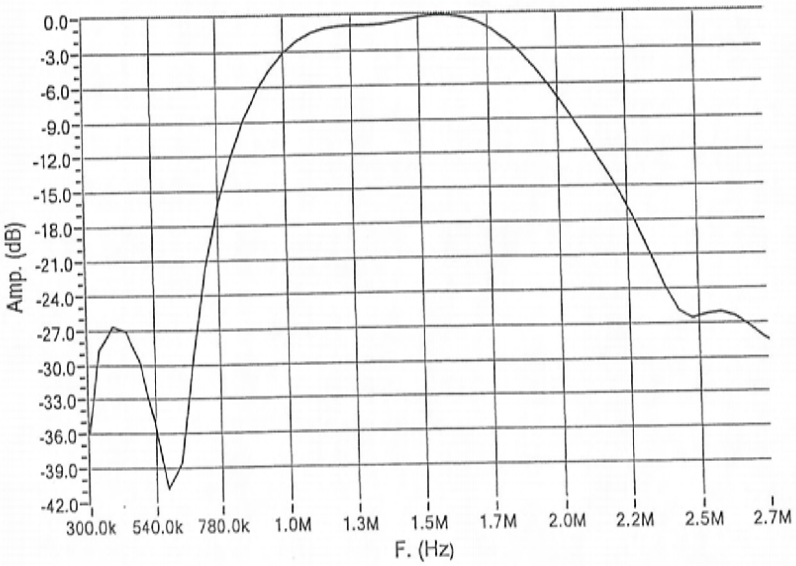
T : 399.0ns/div U : 4.0mV/div




PULSE LENGTH :
-6dB : 818.70ns -20dB : 2.61µs

VOLTAGES :
Vpp = 25.34mV

## TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.44MHz
Ratio Bp/Fc : 70%
Bandwidth : 1.01MHz
Lower Frequency : 937.11KHz
Upper Frequency : 1.95MHz

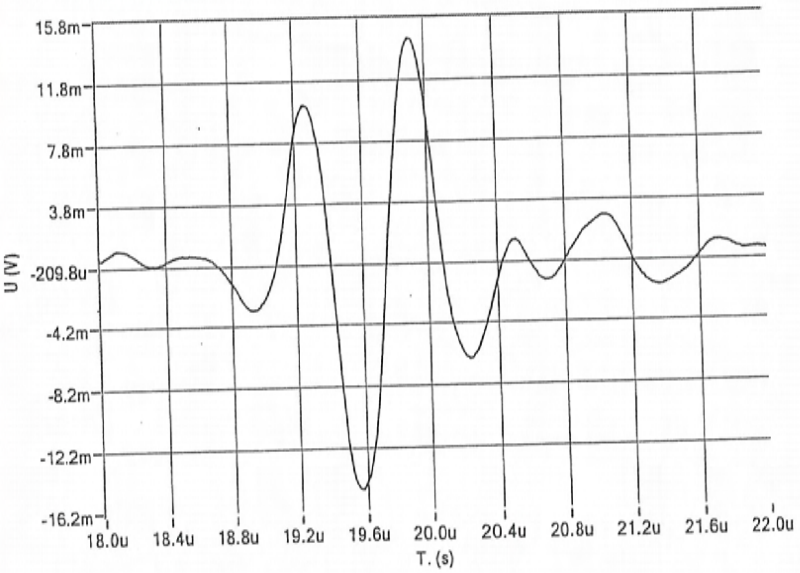
IMASONIC SA
TRANSDUCER DATA SHEET

SPECTRE V5.4

Date : November 16th 2006 09h49
Operator : SA
Transducer : Matrix phased array - 2x32 elements
Serial number : 5154 B101
Nominal frequency : 1.5MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 60 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP 413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.37mm
Element : 56

WAVEFORM

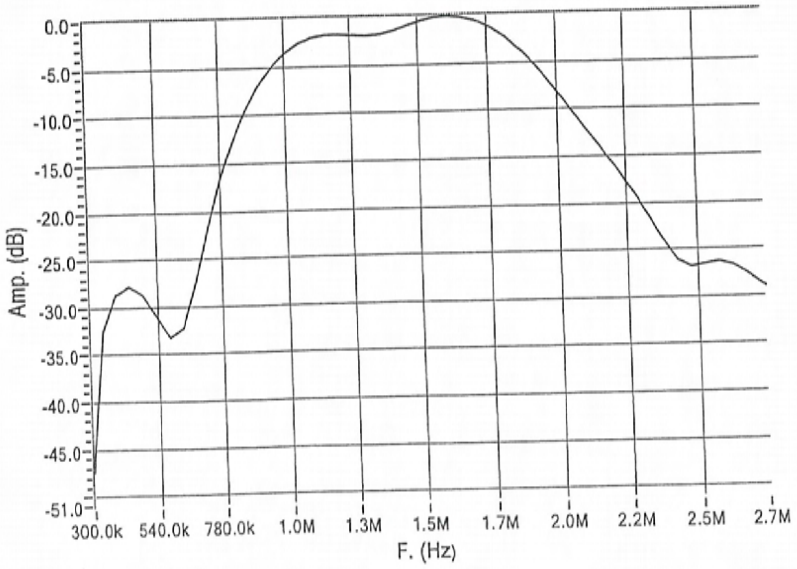
T : 399.0ns/div U : 4.0mV/div




PULSE LENGTH :
-6dB : 818.74ns -20dB : 2.69µs

VOLTAGES :
Vpp = 29.38mV

TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.44MHz
Ratio Bp/Fc : 68%
Bandwidth : 973.03KHz
Lower Frequency : 951.10KHz
Upper Frequency : 1.92MHz

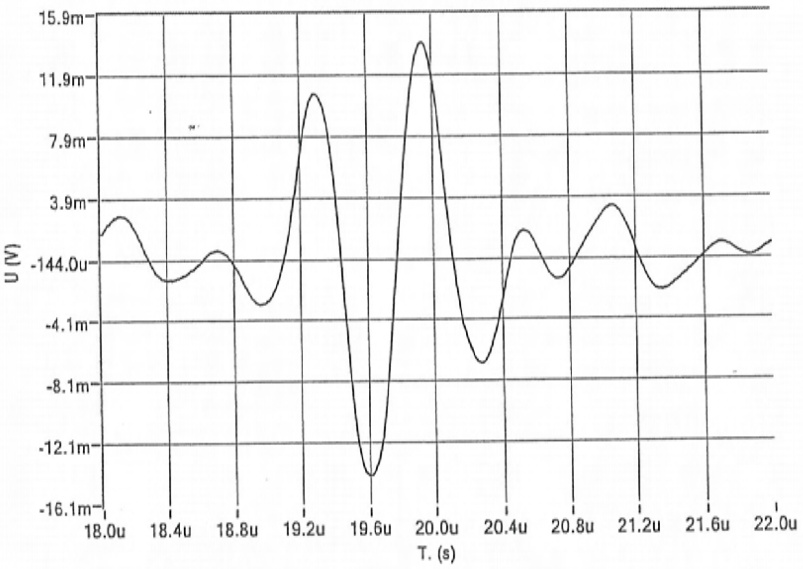
IMASONIC SA
TRANSDUCER DATA SHEET

SPECTRE V5.4

Date : November 16th 2006 09h49
Operator : SA
Transducer : Matrix phased array - 2x32 elements
Serial number : 5154 B101
Nominal frequency : 1.5MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 60 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP 413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.41mm
Element : 64

WAVEFORM

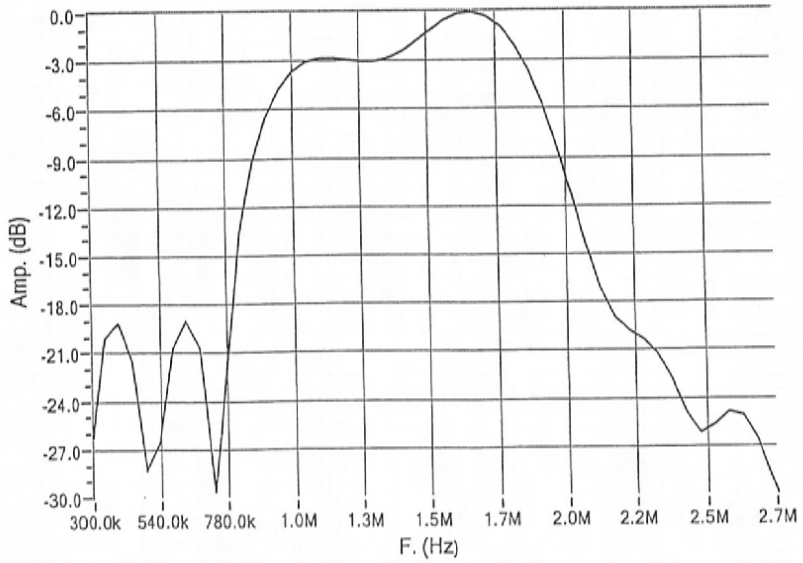
T : 399.0ns/div U : 4.0mV/div




PULSE LENGTH :
-6dB : 1.07µs -20dB : 3.46µs

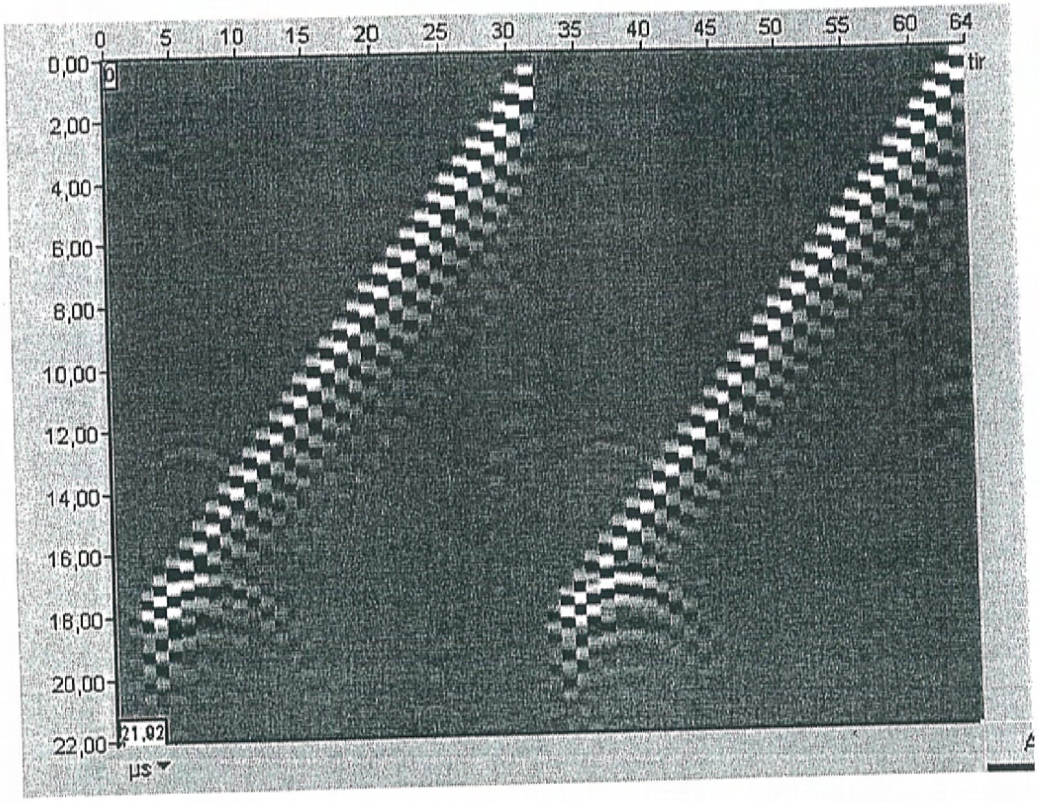
VOLTAGES :
Vpp = 28.31mV

TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.42MHz
Ratio Bp/Fc : 68%
Bandwidth : 968.10KHz
Lower Frequency : 940.94KHz
Upper Frequency : 1.91MHz

# Cabling order
# Matrix phased array – 2x32 elements
# 5154 B101



IMASONIC

# MEASUREMENT REPORT

## 1,5 MHz 2 x 32 elts matrix phased array probe

Serial Number : 5155A103

---

**ZETEC QUEBEC**

Document ref. R5155A3

IMASONIC

# CERTIFICATE of CONFORMANCE

REFERENCE DOCUMENT CdC5155-2
PROJECT # 5155
SERIAL # A103

## Checking of Electrical Performance

| | | Criteria of conformity | Value | Conformity |
|---|---|---|---|---|
| Inter element coupling between neighbouring elements | dB | -30 | -45.3 | OK |
| Inter element coupling between elements separated by one element | dB | -35 | -45.3 | OK |

## Checking of Acoustical Performance

| | | Criteria of conformity | Value | Conformity |
|---|---|---|---|---|
| Central Frequency (-6dB) | MHz | [1.35;1.65] | 1.41 | OK |
| Bandwidth (-6dB) | % | >50 % | 57 | OK |
| Pulse Length (-20dB) | ns | / | 2601 | OK |
| Sensibility | (mV) | / | 7 | OK |
| Homogeneity | dB | 8 | 3 | OK |
| backing Echoes | dB | -40 | -56.3 | OK |

## Checking of Elements Wiring

| | |
|---|---|
| conformity | OK |

## Overall Conformity

| | |
|---|---|
| conformity | OK |

Date : 26/07/05

Signature

Laurent Fournier

## *Phased Array Probe Specifications*
Piezocomposite technology

IMASONIC

Zetec reference: 1 5M16x2E32-7
IMASONIC reference: CDC5155-2

# *Technical characteristics and acceptance level*

### *Acoustical characteristics*

Centre frequency (-6dB): 1.5 MHz ± 10 %*
Bandwidth (-6dB): > 50% *
Pulse length (-20dB): < 3.5 µs (indicative value)
***We issue reserves as for the shape and the length of the signal.***
Acoustical impedance matching: rexolite
Electrical matching: none

Homogeneity in sensitivity: ± 4 dB for the whole array*
Probe to probe homogeneity in sensitivity: ± 3 dB* for the same batch
Inter element coupling: ≤ -30dB* between adjacent elements
Inter element coupling: ≤ -35dB* between elements separated by one element
Backing echoes: ≤ -40 dB / interface echoes *

Number of channels: 16 x 2
Type: Matrix
Active area 32 x 7 mm
Mechanical focusing: none
Elementary pitch in primary axis: 2 mm
Elementary pitch in secondary axis: 3.5mm
Inter element spacing: 0.2 mm in two directions

**criteria of conformity measured in the conditions below*

### *Mechanical characteristics*

Housing:
Stainless steel
Geometry and dimensions: according to the document Zetec in the paragraph Annexe

Cable:
Cable output: on side (16th, 32nd elts)
Cable gland

Flanges:
Position: on side (1st, 16th, 17th and 32nd elements)
Description: According to the Zetec in the paragraph Annexe

*An overall drawing will be sent before manufacturing for the customer approval*

### *Interconnections*

Cable: 50Ω multi-coaxial with overall shielding
Length: 5 m ± 0.1m
Connector: Hypertronics
Protective jacket: halogen free jacket
Pinout diagram: classical.

## *Phased Array Probe Specifications*
Piezocomposite technology

IMASONIC

Zetec reference: 1 5M16x2E32-7
IMASONIC reference: CDC5155-2

***Identification***

| | |
|---|---|
| On the top of the probe: | Logo Zetec<br>Identification of the 1st, 16th, 17th and 32nd elements |
| On side of the probe: | 1.5M16X2E32-7<br>29HBE0029<br>serial number |

## *Recommended using conditions**

| | |
|---|---|
| Chemical constraints: | contact with acoustical gel or water |
| Pressure: | under 1m of water |
| Temperature: | -20° to 60°C (storage)<br>10 to 30°C (functioning) |
| Excitation: | Negative pulse 200Vpp maximum (measured in 50 Ωenvironments)<br>Max repetition frequency: 10 kHz |
| Cleaning: | With water or isopropyl alcohol, with soft tissue, taking care of not wearing the front face with particles between the front face and the tissue |
| Manipulation: | Do not handle the probe by the cable |
| Nuclear radiation: | none |
| **Normative constraints:** | **none** |

Particular constraints of chocks and vibrations are not taken into account by IMASONIC

** Other particular using conditions must be validated by IMASONIC*

## *Control of electro acoustical performances*

**Electrical Measurements:**
1_Impedance measurement for all the elements at the nominal frequency
2_Inter-element coupling measurement on 2 pairs of adjacent elements
3_Inter-element coupling measurement on 2 pairs of non adjacent elements

*Measurements conditions:*
Performed with HP3577A network analyser (50Ω environment)
Acoustic load on the active part: 1.5 MR
*Supplied documents:*
Value of impedances
Curves of inter –elements coupling

**Acoustical measurements:**
1_Temporal response & frequency spectrum measurement for all the elements

*Measurements conditions:*
Performed on contact on flat steel target with a rexolite delay line in E/R mode
rexolite path: to be determined
steel path: to be determined
couplant: to be defined during the control
Excitation signal: 1 negative pulse
*Supplied documents:*
Value of central frequency, bandwidth (-6dB), pulse length and sensitivity for all elements
Curves of homogeneity sensitivity
Curves for 8 elements

2_Backing Echo

*Measurements conditions:*
Performed in water on flat brass target
Excitation signal: 1 negative pulse
*Supplied document:*
Value of backing Echo

## *Supplied documentation (paper and mail)*

Specifications of the probe
Overall drawing of the probe
Measurement results

## *Casing*

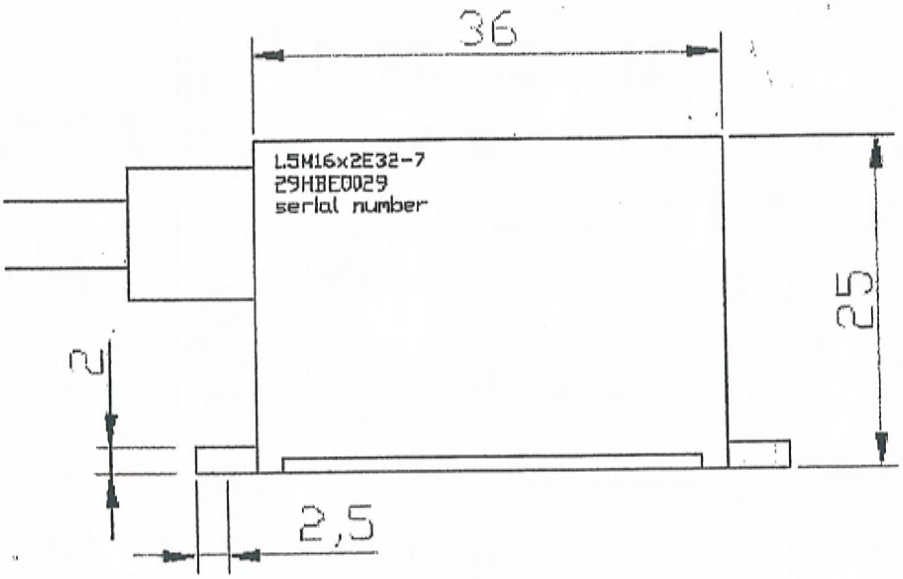
One casing for each probe

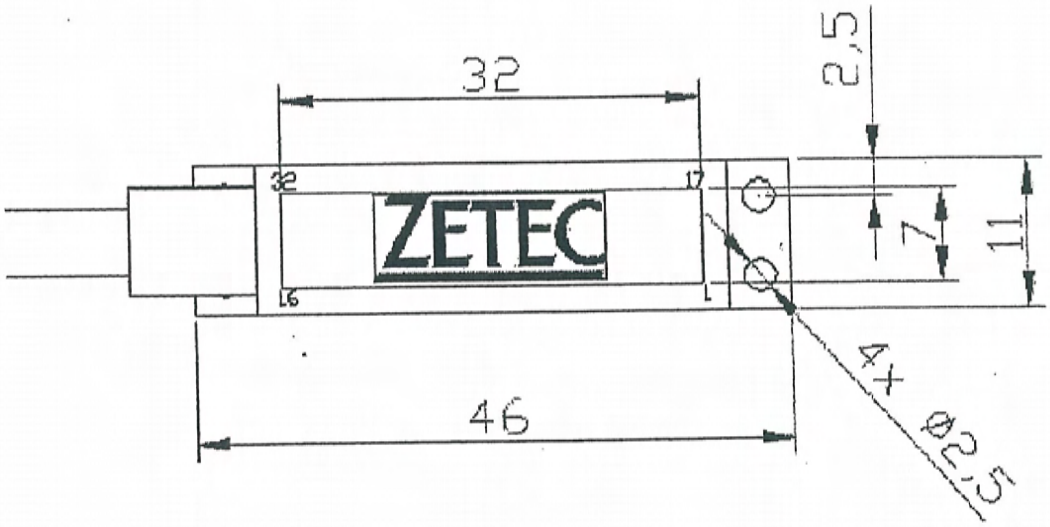
## *Guarantee conditions*

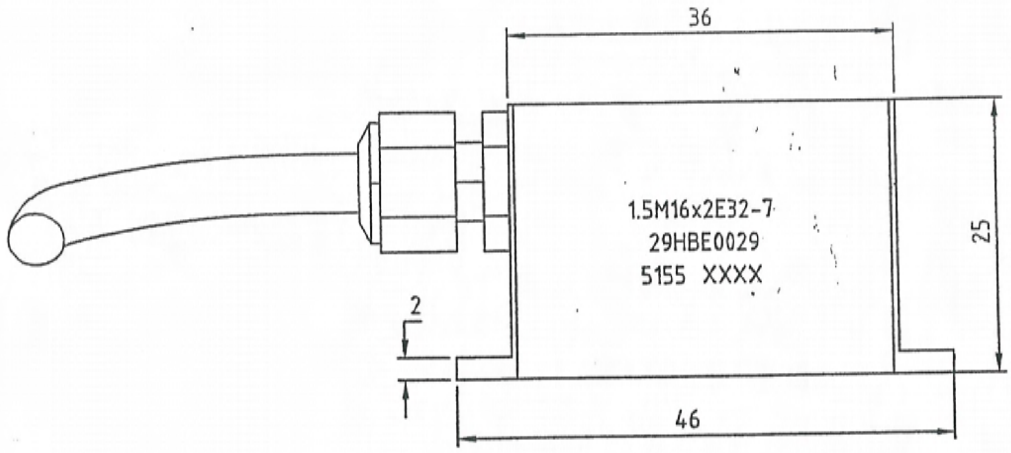
One year guarantee against manufacturing defects in the using conditions above
Other conditions: see Imasonic general selling conditions

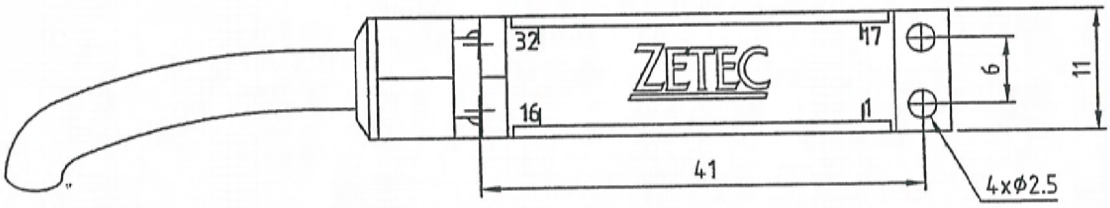
Zetec reference: 1 5M16x2E32-7
IMASONIC reference: CDC5155-2

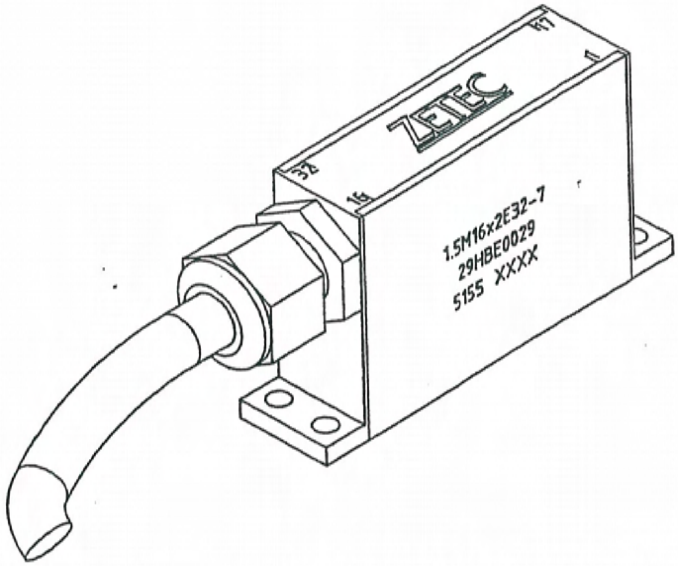
## *Annexes*






| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Façonnage Général : | Nombre : 1 | |
| | | | | Tol gén | Longueurs: js/JS13 | Angles: ±1° |
| | | | | Matière : | | |
| | | | | Traitement thermique : | | |
| Indice | Date | Modifications | par | Protection: | | |
| ∼ = brut | ▽ = 6.5 à 12.5Ra | ▽▽ = 1.6 à 3.2Ra | ▽▽▽ = 0.05 à 0.8Ra | N° | 5155A0110000 | |

Etude: Linear array-1.5MHz-2x16elts

S/Ens.:

Pièce: General drawing

IMASONIC transducteurs et dispositifs électroacoustiques

26/07/2005

**Impedance measurement for the XCR n°: 5155A103** Operator : GD

*(Acoustic load: 1.5 MR. IMASONIC procedure: INP 410)*

| # | Zr (Ω) | Zi (Ω) | # | Zr (Ω) | Zi (Ω) |
|---|---|---|---|---|---|
| | | | | | |
| 1 | 26.0 | -164.6 | 17 | 24.3 | -163.8 |
| 2 | 25.1 | -162.1 | 18 | 23.5 | -165.4 |
| 3 | 23.3 | -162.8 | 19 | 24.4 | -162.3 |
| 4 | 24.5 | -164.2 | 20 | 25.2 | -164.7 |
| 5 | 25.3 | -165.3 | 21 | 24.0 | -164.7 |
| 6 | 24.5 | -166.3 | 22 | 24.1 | -165.3 |
| 7 | 24.8 | -165.0 | 23 | 24.3 | -165.2 |
| 8 | 24.7 | -166.1 | 24 | 24.1 | -166.1 |
| 9 | 22.8 | -162.7 | 25 | 24.1 | -161.9 |
| 10 | 23.5 | -164.6 | 26 | 24.3 | -164.5 |
| 11 | 24.9 | -164.8 | 27 | 23.3 | -164.6 |
| 12 | 24.0 | -165.0 | 28 | 23.3 | -164.8 |
| 13 | 24.0 | -165.9 | 29 | 24.7 | -165.6 |
| 14 | 24.3 | -166.1 | 30 | 24.3 | -165.8 |
| 15 | 23.3 | -165.9 | 31 | 23.9 | -164.7 |
| 16 | 23.7 | -164.3 | 32 | 24.4 | -165.6 |

| | Zr (Ω) | Zi (Ω) |
|---|---|---|
| **Minimum :** | 22.8 | -166.3 |
| **Maximum :** | 26.0 | -161.9 |
| **Standard deviation :** | 0.7 | 1.2 |
| **Average values :** | 24.2 | -164.7 |

*See measurement results in appendix 1 for the elements n°...*

**Inter element coupling measurement :**

*(Acoustic load: 1.5MR. IMASONIC procedure: INP 412.)*

| #/# | Coupling (dB) |
|---|---|
| 5/6 | 45.3 |
| 28/29 | -46.4 |
| 2/18 | -57.4 |
| 5/7 | -45.3 |
| 28/30 | -58.4 |

*See measurement results in appendix 2.*

**Element cabling :**

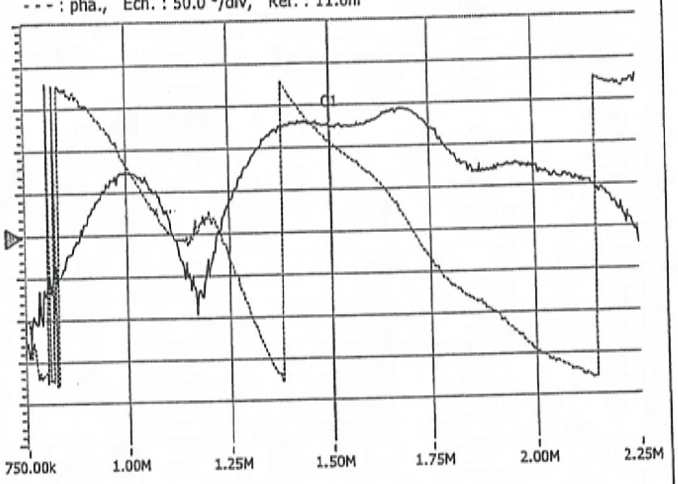
checking cabling for each element Yes

*(See values in appendix 4)*

Date : July 26th 2005 10h24
Operator : CG
Transducer : Phased array
Serial number : 5155A103
Nominal frequency : 1.50MHz
Network Analyzer : HP 8751A, IM : 105&106
Acoustic load : 1.5MR on active area
Cable length :
Instruction : INP 412

**Cross coupling measurement**

___ : ICI, Ech. : 5.00 dB/div, Ref. : -58.1 dB
- - - : pha., Ech. : 50.0 °/div, Ref. : 11.6m°

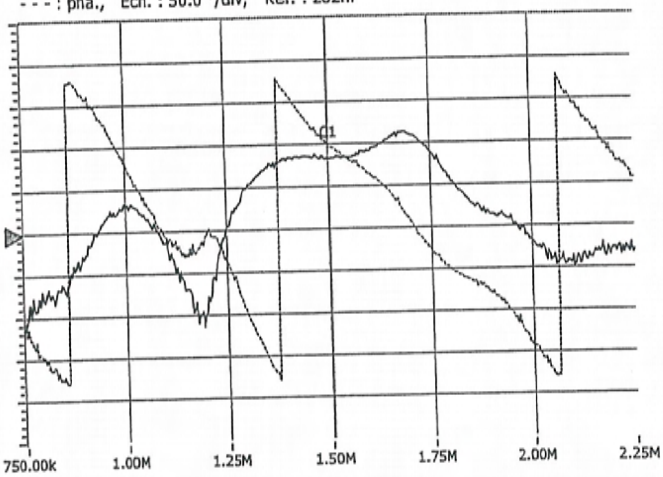



Elements 5/6

C1 : F=1.50MHz ICI=-45.3 dB pha.=108 °

**Cross coupling measurement**

___ : ICI, Ech. : 5.00 dB/div, Ref. : -54.9 dB
- - - : pha., Ech. : 50.0 °/div, Ref. : 282m°

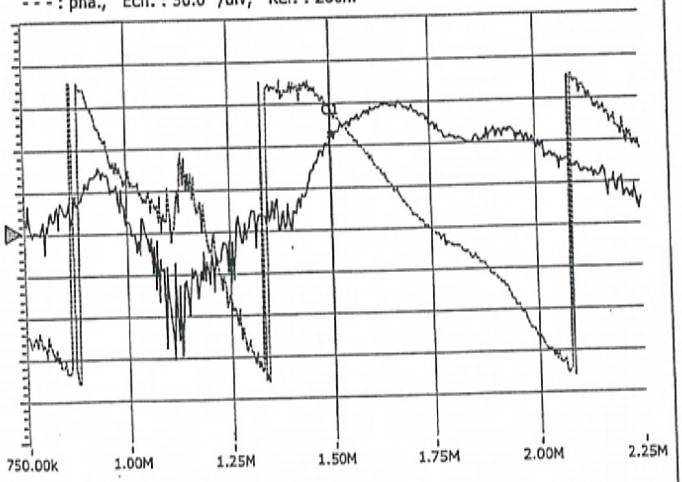



Elements 28/29

C1 : F=1.50MHz ICI=-46.4 dB pha.=102 °

**Cross coupling measurement**

___ : ICI, Ech. : 5.00 dB/div, Ref. : -67.6 dB
- - - : pha., Ech. : 50.0 °/div, Ref. : 268m°



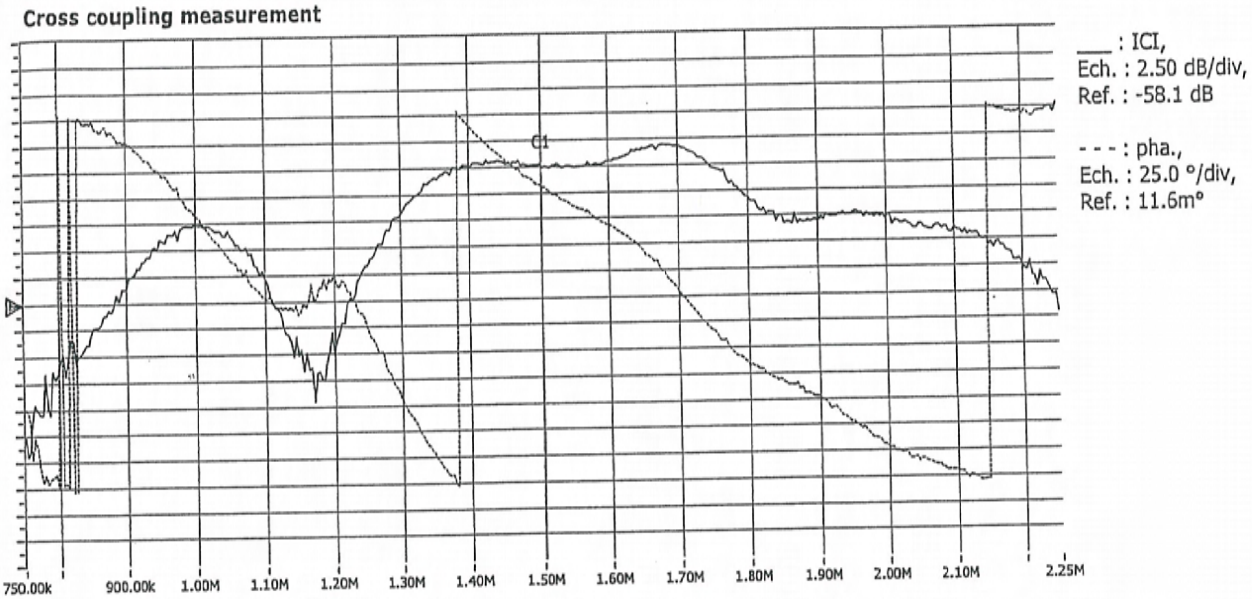

Elemensts 2/18

C1 : F=1.50MHz ICI=-57.4 dB pha.=148 °

IMASONIC S.A.
MESURES ELECTRIQUES
Z V4.1

Date : July 26th 2005 10h24
Operator : CG
Transducer : Phased array
Serial number : 5155A103
Nominal frequency : 1.50MHz
Network Analyzer : HP 8751A, IM : 105&106
Acoustic load : 1.5MR on active area
Cable length :
Instruction : INP 412

**Cross coupling measurement**

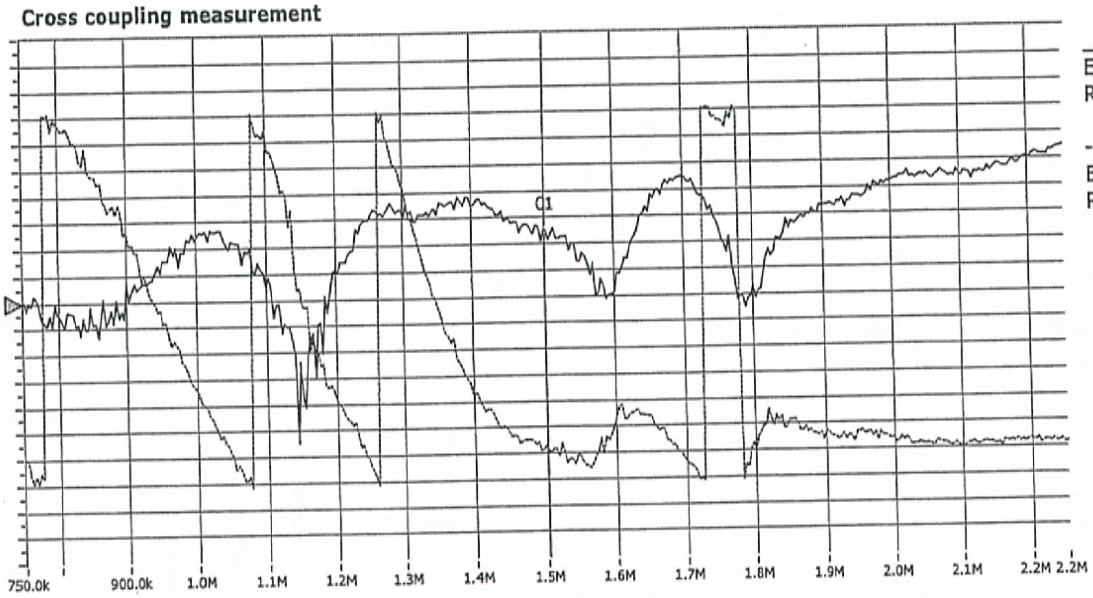



___ : ICI,
Ech. : 2.50 dB/div,
Ref. : -58.1 dB

- - - : pha.,
Ech. : 25.0 °/div,
Ref. : 11.6m°

C1 : F=1.50MHz ICI=-45.3 dB pha.=108 ° Elements 5/7

**Cross coupling measurement**




___ : ICI,
Ech. : 2.50 dB/div,
Ref. : -64.7 dB

- - - : pha.,
Ech. : 25.0 °/div,
Ref. : 336m°

C1 : F=1.50MHz ICI=-58.4 dB pha.=-142 ° Elements 28/30

26/07/2005

**Electroacoustic measurement for the XCR n°:** **5155A103** **Operator : GD**

*(Acoustic load: 2.45 MR. IMASONIC procedure: I, Nominal Frequency : 1.50 MHz*
*Generator : Multi 2000 V3.4.4, Gain Exc. : 0 dB, L. Exc. : 71 bin, U. Exc. : 60 V*
*Target type : , Target Positioning : NaN m*

| # | Vpp (mV) | Fc (MHz) | Bw (%) | Lp -20dB (ns) | # | Vpp (mV) | Fc (MHz) | Bw (%) | Lp -20dB (ns) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| 1 | 7 | 1.4 | 68 | 2769 | 17 | 6 | 1.4 | 47 | 2773 |
| 2 | 7 | 1.4 | 53 | 2676 | 18 | 6 | 1.5 | 52 | 2647 |
| 3 | 7 | 1.5 | 55 | 2767 | 19 | 6 | 1.5 | 45 | 2659 |
| 4 | 6 | 1.4 | 69 | 2767 | 20 | 7 | 1.4 | 59 | 1928 |
| 5 | 7 | 1.4 | 53 | 2768 | 21 | 6 | 1.4 | 70 | 2332 |
| 6 | 7 | 1.4 | 67 | 2763 | 22 | 7 | 1.4 | 66 | 2772 |
| 7 | 8 | 1.4 | 57 | 2769 | 23 | 6 | 1.4 | 58 | 2140 |
| 8 | 6 | 1.5 | 48 | 2765 | 24 | 6 | 1.4 | 57 | 2770 |
| 9 | 7 | 1.4 | 64 | 2768 | 25 | 6 | 1.4 | 53 | 2313 |
| 10 | 6 | 1.4 | 70 | 2768 | 26 | 7 | 1.4 | 50 | 2548 |
| 11 | 7 | 1.3 | 71 | 2369 | 27 | 7 | 1.4 | 48 | 2630 |
| 12 | 7 | 1.5 | 56 | 2766 | 28 | 6 | 1.4 | 56 | 2328 |
| 13 | 7 | 1.3 | 70 | 2529 | 29 | 7 | 1.4 | 53 | 2403 |
| 14 | 8 | 1.4 | 49 | 2769 | 30 | 6 | 1.5 | 44 | 2376 |
| 15 | 6 | 1.5 | 50 | 2769 | 31 | 6 | 1.4 | 63 | 2517 |
| 16 | 7 | 1.4 | 58 | 2533 | 32 | 6 | 1.3 | 59 | 2765 |

| | Vpp (mV) | Fc (MHz) | Bw (%) | Lp -20dB (ns) |
|---|---|---|---|---|
| **Minimum :** | 6 | 1.34 | 44 | 1928 |
| **Maximum :** | 8 | 1.50 | 71 | 2773 |
| **Standard deviation :** | 1 | 0.05 | 8 | 221 |
| **Average values :** | 7 | 1.41 | 57 | 2601 |

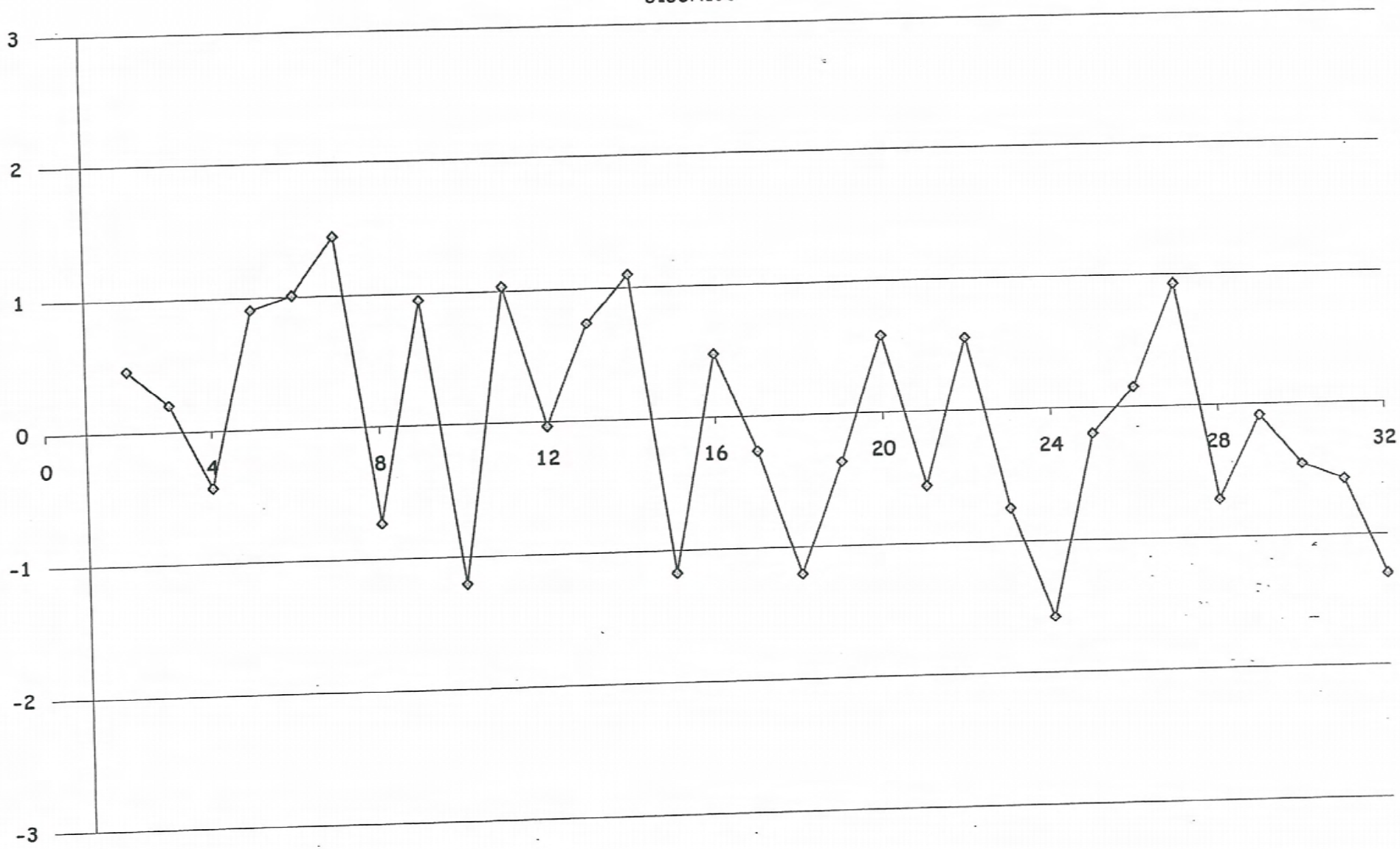
**Homogeneity in sensitivity (dB) :** **-3.0**

*See measurement results in appendix 3 for the elements n° 2;6;10;14;18;22:26:30*

GD, 26/07/2005

Sensitivity variation (dB)

5155A103



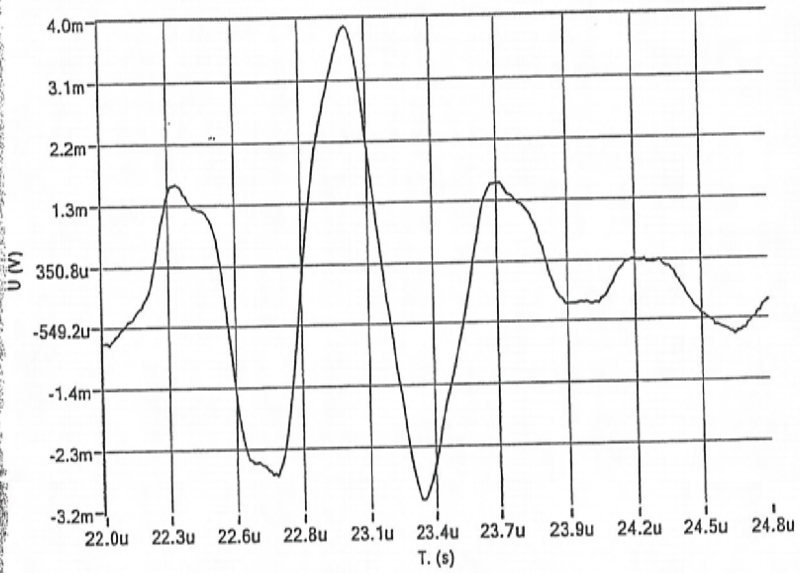

ENQ 102 - Final measurements 32 elts

# TRANSDUCER DATA SHEET

Date : July 25th 2005 16h27
Operator : GD
Transducer : matrix phased Array
Serial number : 5155A103
Nominal frequency : 1.50MHz
Generator : MULTI 2000
Input signal : 60.0 Vpp, Gain : 0.0 dB, Largeur : 71 bin.
Scope : MULTI 2000
Instruction : INP 413
Target type : 15 mm rexolite + 30 mm steel
Target Positioning : 27.97mm
Element : 2

## WAVEFORM

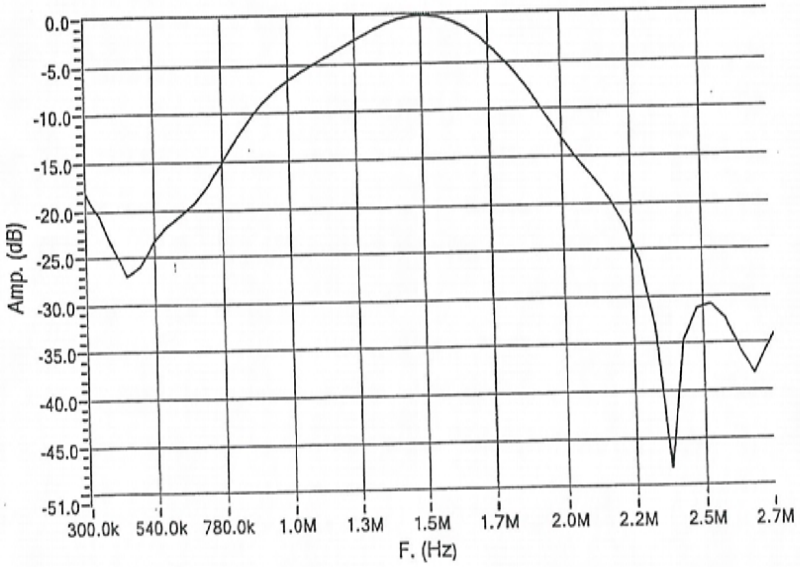
T : 276.0ns/div U : 900.0µV/div




PULSE LENGTH :
-6dB : 825.12ns -20dB : 2.68µs

VOLTAGES :
Vpp = 6.98mV

## TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.44MHz
Ratio Bp/Fc : 53%
Bandwidth : 764.87KHz
Lower Frequency : 1.06MHz
Upper Frequency : 1.82MHz

IMASONIC

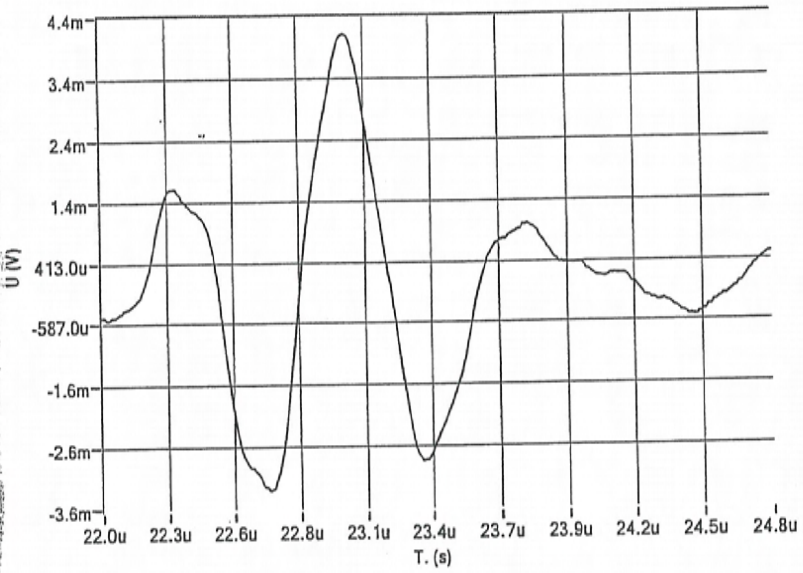
# IMASONIC SA
# TRANSDUCER DATA SHEET

SPECTRE V5.2

Date : July 25th 2005 16h27
Operator : GD
Transducer : matrix phased Array
Serial number : 5155A103
Nominal frequency : 1.50MHz
Generator : MULTI 2000
Input signal : 60.0 Vpp, Gain : 0.0 dB, Largeur : 71 bin.
Scope : MULTI 2000
Instruction : INP 413
Target type : 15 mm rexolite + 30 mm steel
Target Positioning : 27.97mm
Element : 6

## WAVEFORM

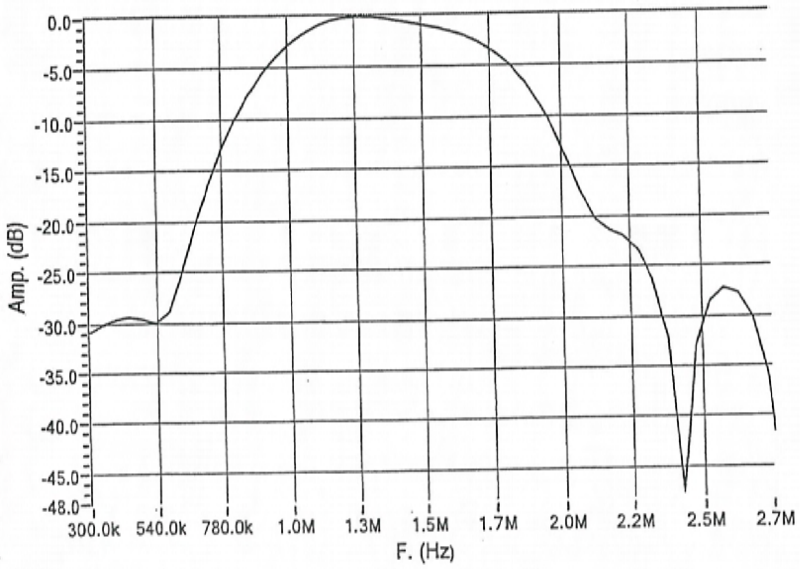
T : 276.0ns/div U : 1.0mV/div




PULSE LENGTH :
-6dB : 886.04ns -20dB : 2.76µs

VOLTAGES :
Vpp = 7.43mV

## TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.38MHz
Ratio Bp/Fc : 67%
Bandwidth : 920.18KHz
Lower Frequency : 920.58KHz
Upper Frequency : 1.84MHz

IMASONIC

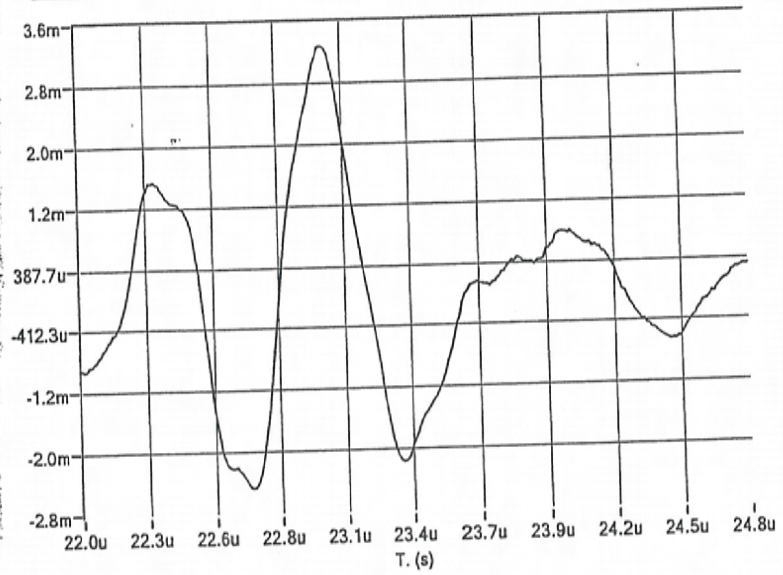
# IMASONIC SA
# TRANSDUCER DATA SHEET

SPECTRE V5.2

Date : July 25th 2005 16h27
Operator : GD
Transducer : matrix phased Array
Serial number : 5155A103
Nominal frequency : 1.50MHz
Generator : MULTI 2000
Input signal : 60.0 Vpp, Gain : 0.0 dB, Largeur : 71 bin.
Scope : MULTI 2000
Instruction : INP 413
Target type : 15 mm rexolite + 30 mm steel
Target Positioning : 27.97mm
Element : 10

## WAVEFORM

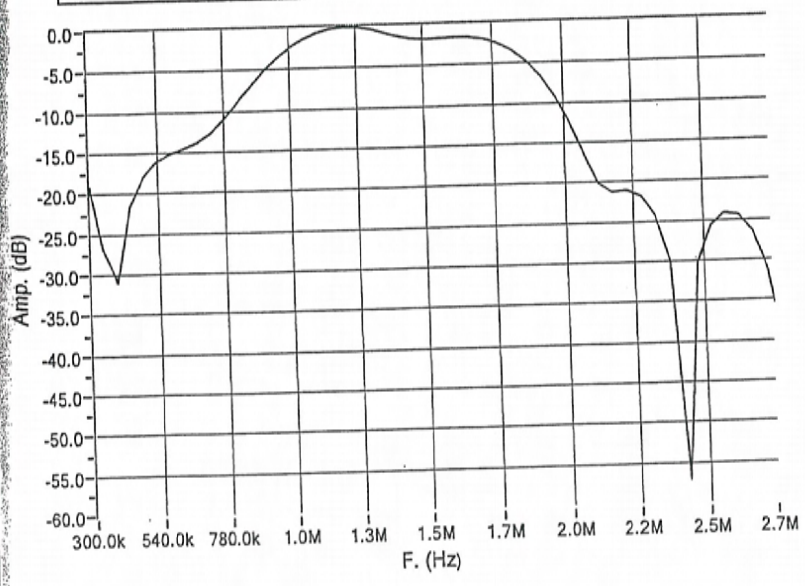
T : 276.0ns/div U : 800.0µV/div




PULSE LENGTH :
-6dB : 1.08µs -20dB : 2.77µs

VOLTAGES :
Vpp = 5.76mV

## TRANSMIT-RECEIVE SPECTRUM



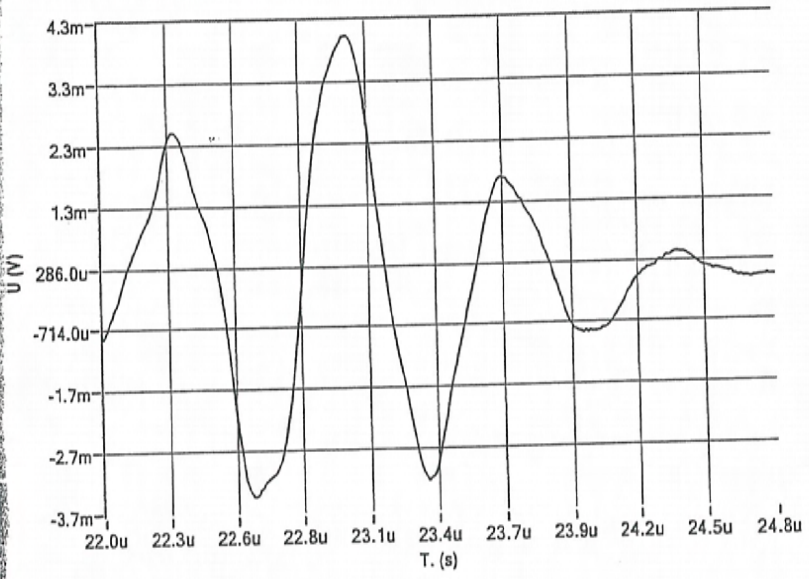

CARACTERISTICS AT -6dB :
Central Frequency : 1.40MHz
Ratio Bp/Fc : 70%
Bandwidth : 980.22KHz
Lower Frequency : 908.69KHz
Upper Frequency : 1.89MHz

# IMASONIC SA
## TRANSDUCER DATA SHEET

Date : July 25th 2005 16h27
Operator : GD
Transducer : matrix phased Array
Serial number : 5155A103
Nominal frequency : 1.50MHz
Generator : MULTI 2000
Input signal : 60.0 Vpp, Gain : 0.0 dB, Largeur : 71 bin.
Scope : MULTI 2000
Instruction : INP 413
Target type : 15 mm rexolite + 30 mm steel
Target Positioning : 27.97mm
Element : 14

### WAVEFORM

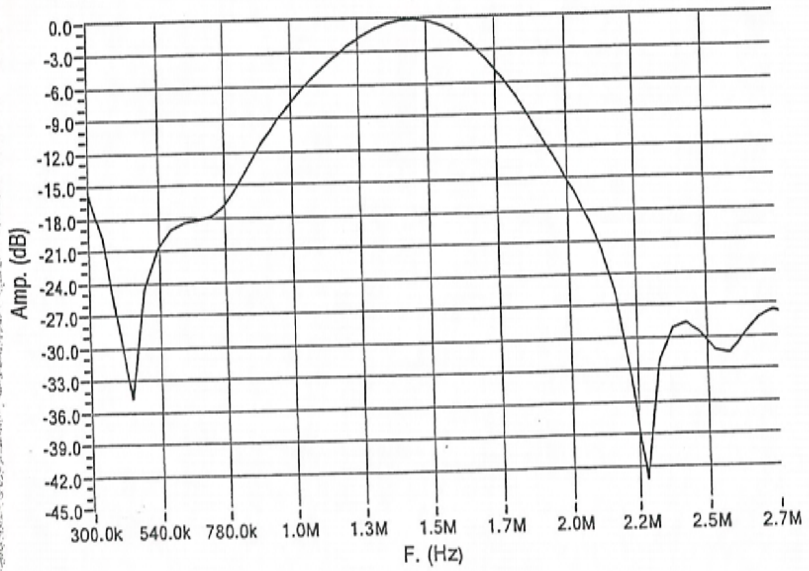
T : 276.0ns/div U : 1.0mV/div




PULSE LENGTH :
-6dB : 1.16µs -20dB : 2.77µs

VOLTAGES :
Vpp = 7.51mV

### TRANSMIT-RECEIVE SPECTRUM

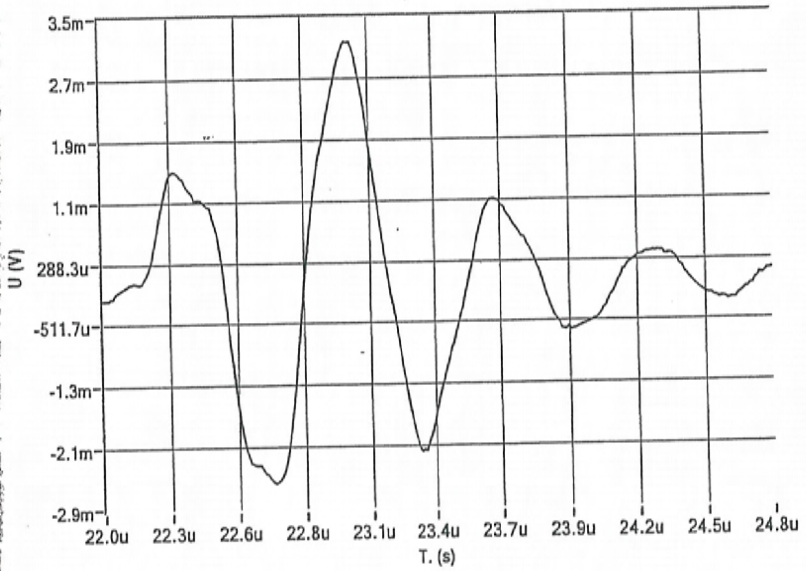



CARACTERISTICS AT -6dB :
Central Frequency : 1.42MHz
Ratio Bp/Fc : 49%
Bandwidth : 699.10KHz
Lower Frequency : 1.07MHz
Upper Frequency : 1.77MHz

Date : July 25th 2005 16h27
Operator : GD
Transducer : matrix phased Array
Serial number : 5155A103
Nominal frequency : 1.50MHz
Generator : MULTI 2000
Input signal : 60.0 Vpp, Gain : 0.0 dB, Largeur : 71 bin.
Scope : MULTI 2000
Instruction : INP 413
Target type : 15 mm rexolite + 30 mm steel
Target Positioning : 27.98mm
Element : 18

## WAVEFORM

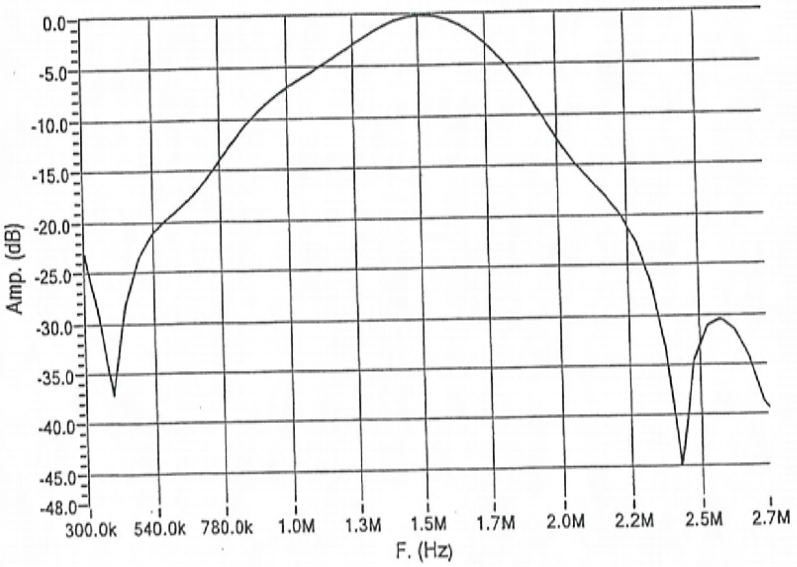
T : 276.0ns/div U : 800.0µV/div




PULSE LENGTH :
-6dB : 870.73ns -20dB : 2.65µs

VOLTAGES :
Vpp = 5.76mV

## TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.46MHz
Ratio Bp/Fc : 52%
Bandwidth : 759.18KHz
Lower Frequency : 1.08MHz
Upper Frequency : 1.84MHz

IMASONIC

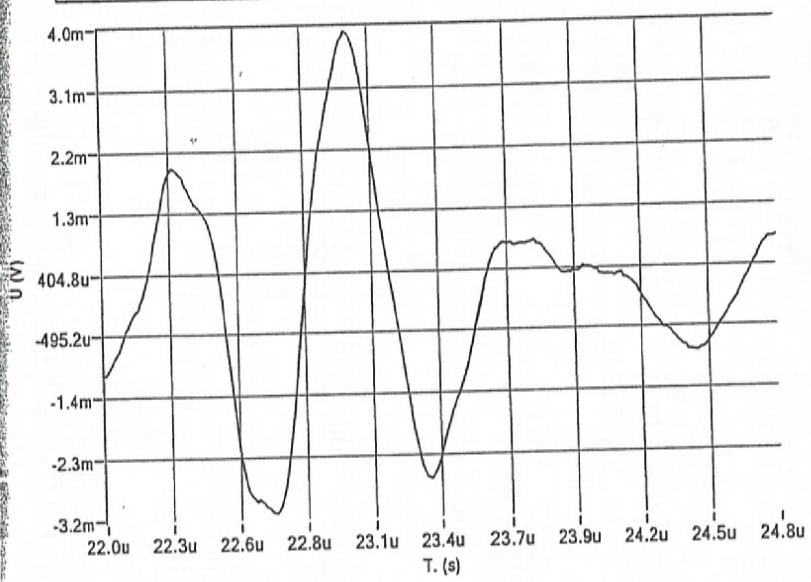
IMASONIC SA
TRANSDUCER DATA SHEET

SPECTRE V5.2

Date : July 25th 2005 16h27
Operator : GD
Transducer : matrix phased Array
Serial number : 5155A103
Nominal frequency : 1.50MHz
Generator : MULTI 2000
Input signal : 60.0 Vpp, Gain : 0.0 dB, Largeur : 71 bin.
Scope : MULTI 2000
Instruction : INP 413
Target type : 15 mm rexolite + 30 mm steel
Target Positioning : 27.97mm
Element : 22

WAVEFORM

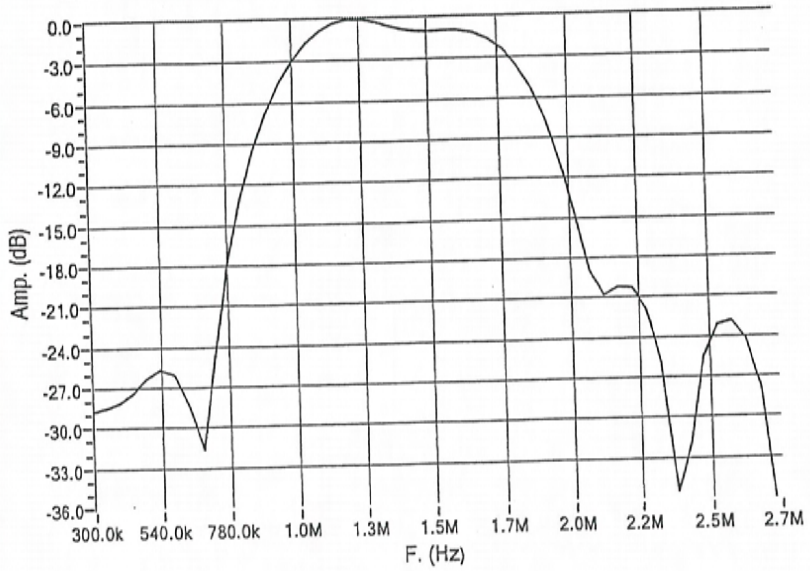
T : 276.0ns/div U : 900.0µV/div




PULSE LENGTH :
-6dB : 861.65ns -20dB : 2.77µs

VOLTAGES :
Vpp = 7.05mV

TRANSMIT-RECEIVE SPECTRUM



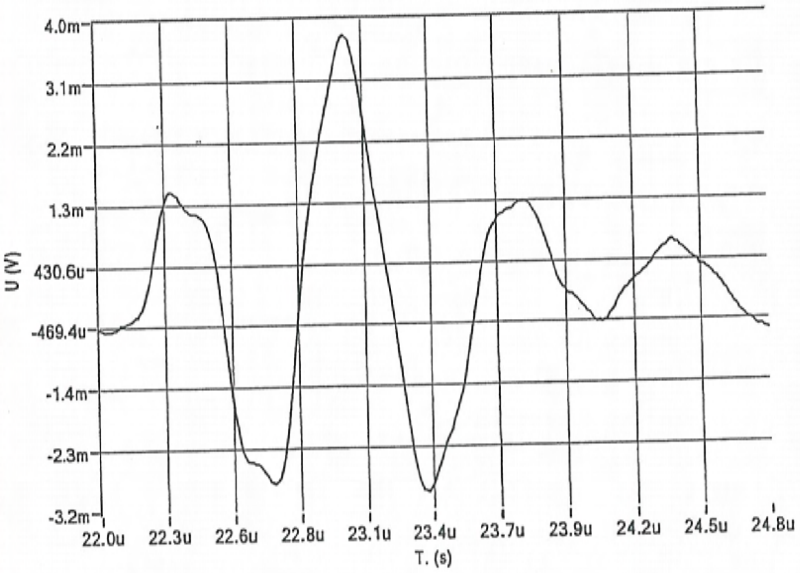

CARACTERISTICS AT -6dB :
Central Frequency : 1.41MHz
Ratio Bp/Fc : 66%
Bandwidth : 924.13KHz
Lower Frequency : 945.97KHz
Upper Frequency : 1.87MHz

# TRANSDUCER DATA SHEET

Date : July 25th 2005 16h27
Operator : GD
Transducer : matrix phased Array
Serial number : 5155A103
Nominal frequency : 1.50MHz
Generator : MULTI 2000
Input signal : 60.0 Vpp, Gain : 0.0 dB, Largeur : 71 bin.
Scope : MULTI 2000
Instruction : INP 413
Target type : 15 mm rexolite + 30 mm steel
Target Positioning : 28.02mm
Element : 26

## WAVEFORM

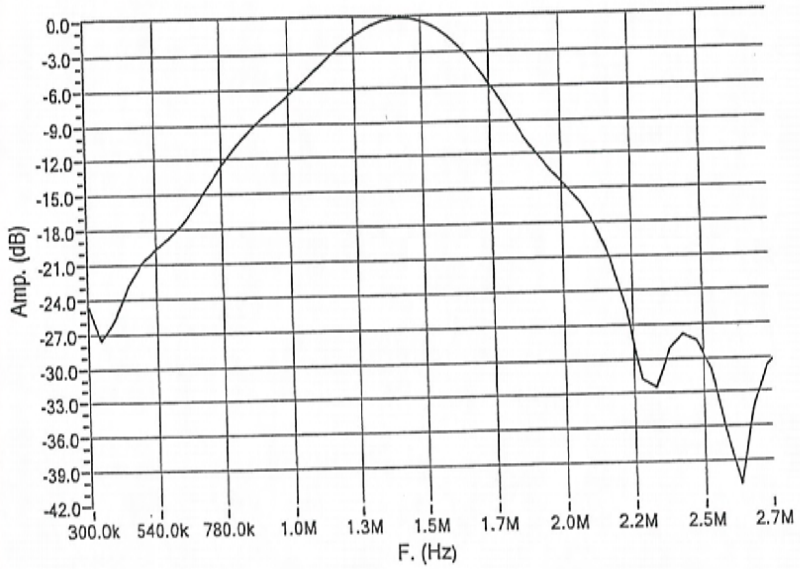
T : 276.0ns/div U : 900.0µV/div




PULSE LENGTH :
-6dB : 867.97ns -20dB : 2.55µs

VOLTAGES :
Vpp = 6.73mV

## TRANSMIT-RECEIVE SPECTRUM

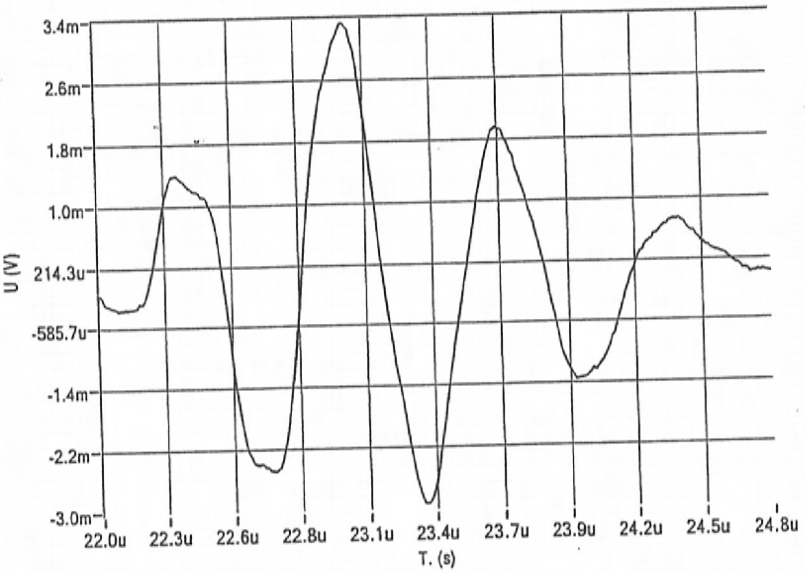



CARACTERISTICS AT -6dB :
Central Frequency : 1.40MHz
Ratio Bp/Fc : 50%
Bandwidth : 695.21KHz
Lower Frequency : 1.05MHz
Upper Frequency : 1.74MHz

Date : July 25th 2005 16h27
Operator : GD
Transducer : matrix phased Array
Serial number : 5155A103
Nominal frequency : 1.50MHz
Generator : MULTI 2000
Input signal : 60.0 Vpp, Gain : 0.0 dB, Largeur : 71 bin.
Scope : MULTI 2000
Instruction : INP 413
Target type : 15 mm rexolite + 30 mm steel
Target Positioning : 28.14mm
Element : 30

## WAVEFORM

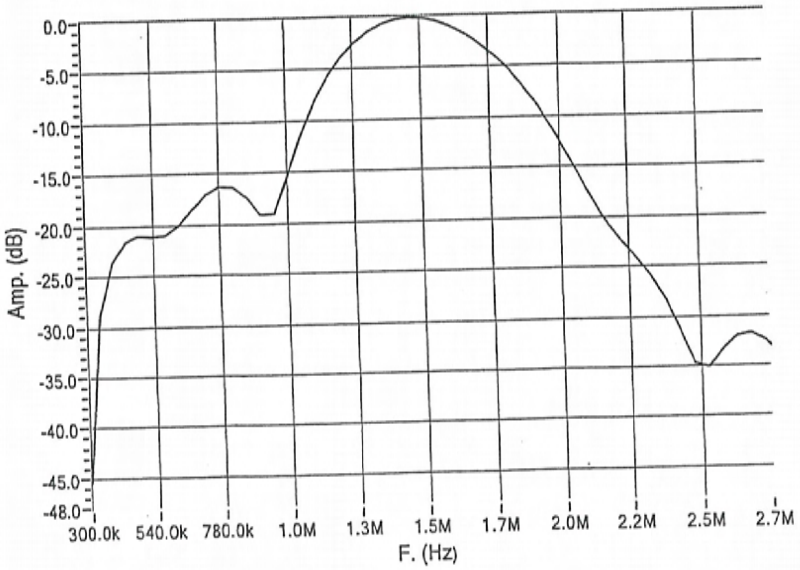
T : 276.0ns/div U : 800.0µV/div




PULSE LENGTH :
-6dB : 1.12µs -20dB : 2.38µs

VOLTAGES :
Vpp = 6.28mV

## TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.50MHz
Ratio Bp/Fc : 44%
Bandwidth : 663.08KHz
Lower Frequency : 1.17MHz
Upper Frequency : 1.83MHz

IMASONIC

# MEASUREMENT REPORT

## 1,5 MHz 2 x 32 elts matrix phased array probe

5154 B102

---

ZETEC QUEBEC

1.5M32X2E64-15

IMASONIC

# CERTIFICATE of CONFORMANCE

REFERENCE DOCUMENT CdC5154-5
PROJECT # 5154B
SERIAL # 5154B102

## Checking of Electrical Performance

| | | Criteria of conformity | Value | Conformity |
|---|---|---|---|---|
| Inter element coupling between neighbouring elements | dB | < -30 | -47.6 | OK |
| Inter element coupling between neighbouring elements | dB | < -35 | -50.1 | OK |

## Checking of Acoustical Performance

| | | Criteria of conformity | Value | Conformity |
|---|---|---|---|---|
| Central Frequency (-6dB) | MHz | [1.35 ; 1.65] | 1.4 | OK |
| Bandwidth (-6dB) | % | > 55 | 69 | OK |
| Pulse Length (-20dB) | ns | < 3.5 | 2.67 | OK |
| Sensitivity | (mV) | na | 26 | OK |
| Homogeneity (probe to probe, within batch) | dB | ± 3 / mean value | -0.1 | OK |
| Homogeneity (between all elements of the probe) | dB | ± 3 / mean value | -3.17 | OK |

| | | | | |
|---|---|---|---|---|
| Backwall Echo | dB | < -40 | -64 | OK |

## Checking of Elements Wiring

| | |
|---|---|
| conformity | OK |

## Overall Conformity

| | |
|---|---|
| conformity | OK |

Date : 16/11/2006

Signature

Ruch Vincent

# Phased Array Probe Specifications
Piezocomposite technology

| | |
|---|---|
| Zetec reference: | 1.5M32x2E64-15 |
| IMASONIC reference: | CDC5154-5 |

## Technical characteristics and acceptance level

### Acoustical characteristics

| | |
|---|---|
| Centre frequency (-6dB): | 1.5 MHz ± 10 %* |
| Bandwidth (-6dB): | > 55% * |
| Pulse length (-20dB): | < 3.5 µs * |
| Acoustical impedance matching: | rexolite |
| Electrical matching: | none |
| Number of channels: | 64 (2 rows of 32) |
| Active area | 64x15 mm |
| Mechanical focusing: | none |
| Elementary pitch in the primary axis: | 2 mm |
| Elementary pitch in the secondary axis: | 7.5mm |
| Inter element spacing: | 0.2 mm in two dimensions |
| Homogeneity in sensitivity: | ± 3 dB for the whole array* |
| Homogeneity of probe to probe in sensitivity: | +/-3 dB for a batch which number of probes is agreed between ZETEC and IMASONIC before the order. |
| Inter element coupling: | ≤ -30dB* between adjacent elements |
| Inter element coupling: | ≤ -35dB* between elements separated by one element |
| Backing echoes: | ≤ -40dB / interface echo |

**criteria of conformity measured in the conditions below*

### Mechanical characteristics

Housing:
Stainless steel
Geometry and dimensions: according to the drawing ref 5154A0110000

Cable:
Cable output: on side, near last element.
Cable gland

Flanges:
Geometry and dimensions: according to the drawing ref 5154A0110000

### Interconnections

Cable: 50Ω multi-coaxial with overall shielding
Length: 5 m ± 0.1m
Connector: Hypertronics
Protective jacket: halogen free jacket
Pinout diagram: classical.

## *Phased Array Probe Specifications*
Piezocomposite technology

| | |
|---|---|
| Zetec reference: | 1.5M32x2E64-15 |
| IMASONIC reference: | CDC5154-5 |

### *Identification*

| | |
|---|---|
| On the top of the probe: | Logo Zetec<br>Identification of the 1st, 32nd, 33rd and 64th elements |
| On side of the probe: | 1.5M32X2E64-15<br>29HBE0028<br>serial number |

## *Recommended using conditions**

| | |
|---|---|
| Chemical constraints: | contact with acoustical gel or water |
| Pressure: | equivalent to a water column of 1m maximum |
| Temperature: | -20° to 60°C (storage)<br>10 to 30°C (functioning) |
| Excitation: | Negative pulse 200Vpp maximum (measured in 50 Ωenvironments)<br>Max repetition frequency: 10 kHz |
| Cleaning: | With water or isopropyl alcohol, with soft tissue, taking care of not wearing the front face with particles between the front face and the tissue |
| Manipulation: | Do not handle the probe by the cable |
| Nuclear radiation: | none |
| **Normative constraints:** | **none** |

Particular constraints of shocks and vibrations are not taken into account by IMASONIC

** Other particular using conditions must be validated by IMASONIC*

## *Phased Array Probe Specifications*
Piezocomposite technology

Zetec reference: 1.5M32x2E64-15
IMASONIC reference: CDC5154-5

## *Control of electro acoustical performances*

**Electrical Measurements:**
1_Impedance measurement for all the elements at the nominal frequency
2_Inter-element coupling measurement on 2 pairs of adjacent elements
3_Inter-element coupling measurement on 2 pairs of non adjacent elements

*Measurements conditions:*
Performed with HP3577A network analyser (50Ω environment)
Acoustic load on the active part: 1.5 MR
*Supplied documents:*
Value of impedances
Curves of inter –elements coupling

**Acoustical measurements:**
1_Temporal response & frequency spectrum measurement for all the elements

*Measurements conditions:*
Performed on contact on flat steel target with a rexolite delay line in E/R mode
rexolite path: 15mm
steel path: 20mm
coupling: to be defined during the control
Excitation signal: 1 negative pulse
*Supplied documents:*
Value of central frequency, bandwidth (-6dB), pulse length (-20dB) and sensitivity for all elements
Curves of homogeneity sensitivity
Curves for 8 elements

2_Backing Echo measurement

*Measurements conditions:*
Performed in water on a flat brass target in E/R mode
Excitation signal: 1 negative pulse
*Supplied documents:*
Value of backing echo

## *Supplied documentation (paper and mail)*

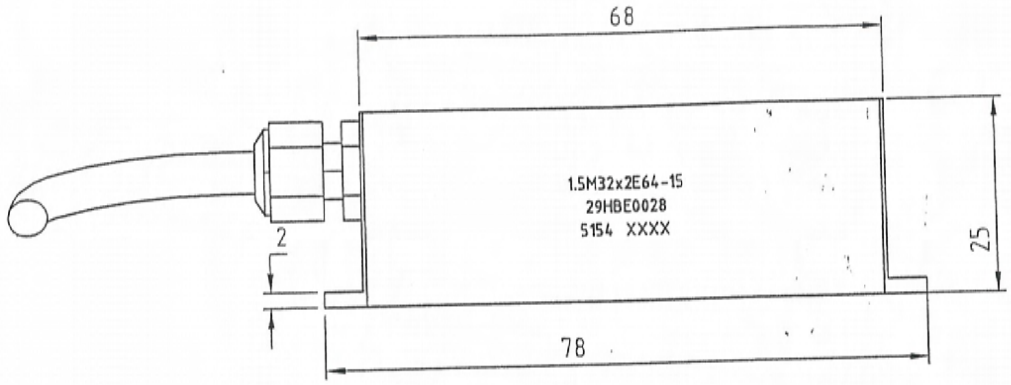
Specifications of the probe
Overall drawing of the probe
Measurement results

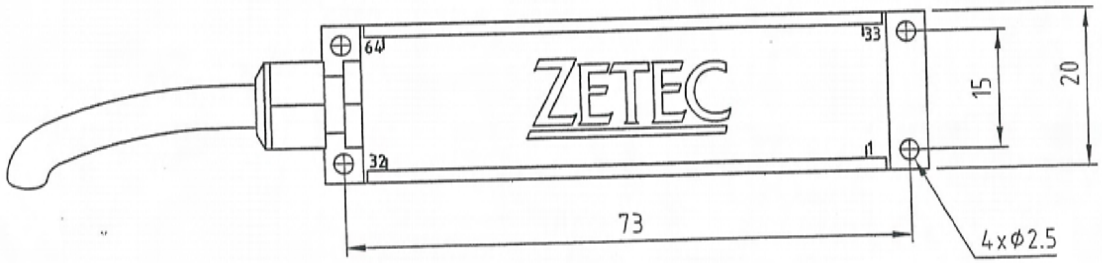
## *Casing*

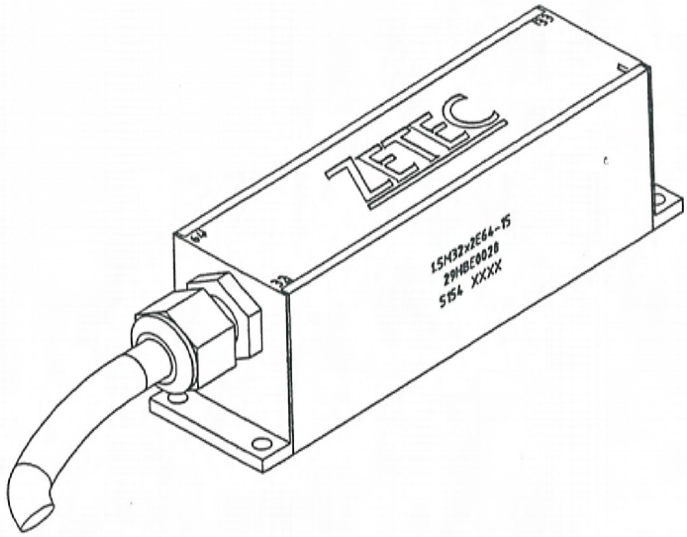
One casing for each probe

## *Guarantee conditions*

One year guarantee against manufacturing defects in the using conditions above
Other conditions: see Imasonic general selling conditions




| | | | | | |
|---|---|---|---|---|---|
| | | | | Façonnage Général : | Nombre : 1 |
| | | | | Tol gén | Longueurs: js/JS13 — Angles: ±1° |
| | | | | Matière : | |
| | | | | Traitement thermique : | |
| dice | Date | Modifications | par | Protection: | |
| = brut | ▽ = 6.5 à 12.5Ra | ▽▽ = 1.6 à 3.2Ra | ▽▽▽ = 0.05 à 0.8Ra | N° | 5154A0110000 |

tude: Linear array-1.5MHz-2x32elts

/Ens.:

IMASONIC
transducteurs et dispositifs électroacoustiques

**Impedance measurement for the transducer n°:** **5154 B102** **Operator : SA**

*(Acoustic load: 1.5 MR. IMASONIC procedure: INP 410)*

| # | Zr (Ω) | Zi (Ω) | # | Zr (Ω) | Zi (Ω) |
|---|---|---|---|---|---|
| 1 | 25.1 | -142.0 | 33 | 22.9 | -145.2 |
| 2 | 23.6 | -144.2 | 34 | 23.9 | -144.1 |
| 3 | 23.3 | -146.8 | 35 | 24.3 | -142.8 |
| 4 | 23.5 | -146.2 | 36 | 24.1 | -143.3 |
| 5 | 23.5 | -141.4 | 37 | 22.8 | -144.0 |
| 6 | 24.4 | -142.7 | 38 | 22.0 | -145.4 |
| 7 | 23.9 | -144.1 | 39 | 22.5 | -144.9 |
| 8 | 23.0 | -144.6 | 40 | 24.4 | -143.9 |
| 9 | 23.3 | -146.2 | 41 | 24.5 | -142.3 |
| 10 | 23.4 | -144.9 | 42 | 23.3 | -144.4 |
| 11 | 23.7 | -141.9 | 43 | 22.3 | -143.1 |
| 12 | 24.1 | -144.6 | 44 | 22.8 | -147.3 |
| 13 | 22.9 | -144.3 | 45 | 22.9 | -142.5 |
| 14 | 23.2 | -143.6 | 46 | 24.6 | -142.9 |
| 15 | 23.9 | -144.1 | 47 | 24.0 | -142.6 |
| 16 | 24.0 | -144.7 | 48 | 22.8 | -144.5 |
| 17 | 23.4 | -144.8 | 49 | 23.3 | -145.0 |
| 18 | 23.1 | -145.3 | 50 | 23.5 | -145.0 |
| 19 | 23.3 | -144.4 | 51 | 23.6 | -143.2 |
| 20 | 24.0 | -144.6 | 52 | 23.9 | -142.1 |
| 21 | 23.9 | -144.1 | 53 | 23.0 | -144.2 |
| 22 | 23.1 | -144.1 | 54 | 23.2 | -144.7 |
| 23 | 22.6 | -146.0 | 55 | 23.8 | -143.7 |
| 24 | 22.9 | -145.4 | 56 | 23.9 | -144.4 |
| 25 | 23.9 | -143.0 | 57 | 24.0 | -144.8 |
| 26 | 24.9 | -141.2 | 58 | 23.8 | -144.2 |
| 27 | 24.1 | -143.3 | 59 | 23.8 | -143.7 |
| 28 | 22.9 | -143.8 | 60 | 23.6 | -142.4 |
| 29 | 23.0 | -144.0 | 61 | 24.3 | -141.2 |
| 30 | 23.3 | -142.8 | 62 | 24.1 | -143.1 |
| 31 | 25.1 | -140.1 | 63 | 23.2 | -142.8 |
| 32 | 25.3 | -141.0 | 64 | 23.6 | -142.7 |

| | Zr (Ω) | Zi (Ω) |
|---|---|---|
| **Minimum :** | 22.0 | -147.3 |
| **Maximum :** | 25.3 | -140.1 |
| **Standard deviation :** | 0.7 | 1.4 |
| **Average values :** | 23.6 | -143.8 |

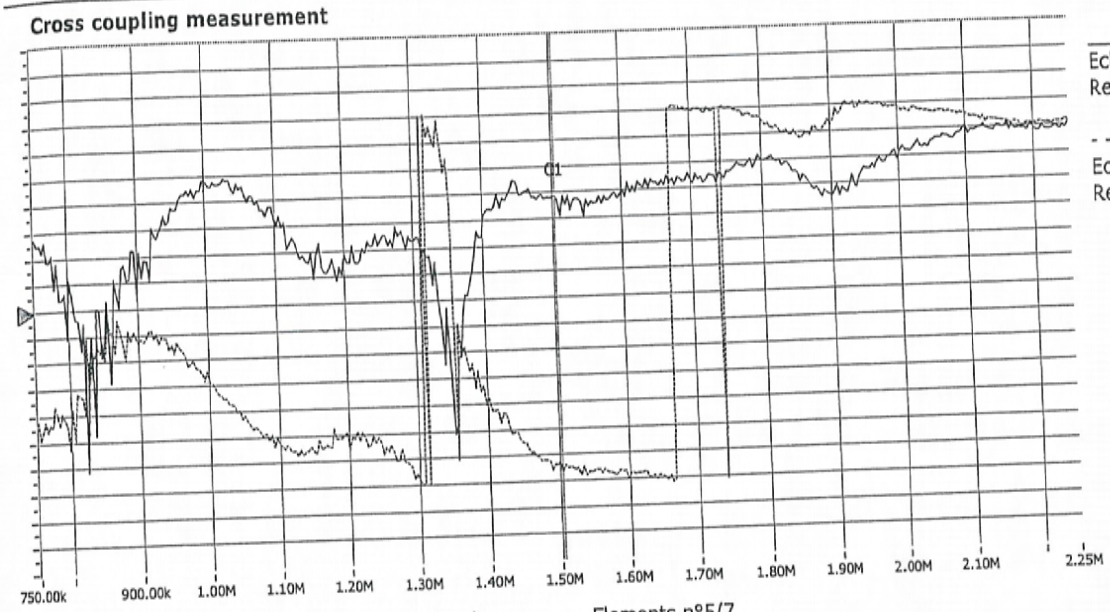
**Inter element coupling measurement :**

| #/# | Coupling (dB) |
|---|---|
| 5/6 | -47.6 |
| 28/29 | -48.3 |
| 1/2 | -50.1 |
| 5/7 | -55.9 |
| 28/30 | -54.3 |

IMASONIC S.A.
MESURES ELECTRIQUES
Z V4.2

Date : November 15th 2006 15h17
Operator : SA
Transducer : Matrix phased array - 32x2 elements
Serial number : 5154 B102
Nominal frequency : 1.50MHz
Network Analyzer : HP 8751A, IM : 112-113
Acoustic load : 1.5MR on active area
Instruction : INP 412

**Cross coupling measurement**

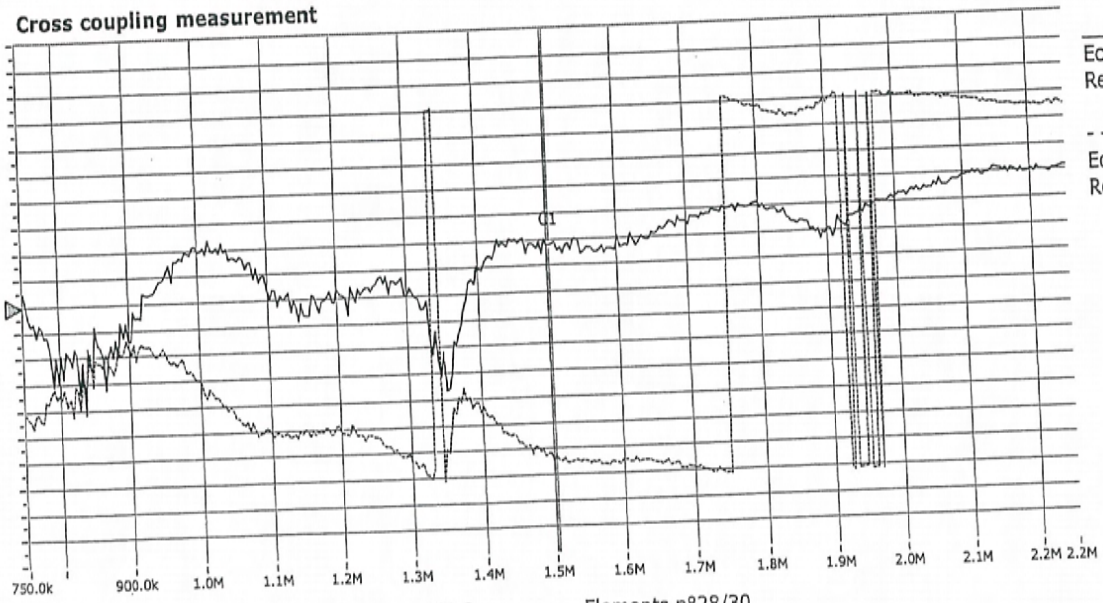



___ : ICI,
Ech. : 2.50 dB/div,
Ref. : -65.5 dB

- - - : pha.,
Ech. : 25.0 °/div,
Ref. : 85.1m°

C1 : F=1.50MHz ICI=-55.9 dB pha.=-157 ° Elements n°5/7

**Cross coupling measurement**




___ : ICI,
Ech. : 2.50 dB/div,
Ref. : -58.7 dB

- - - : pha.,
Ech. : 25.0 °/div,
Ref. : 29.4m°

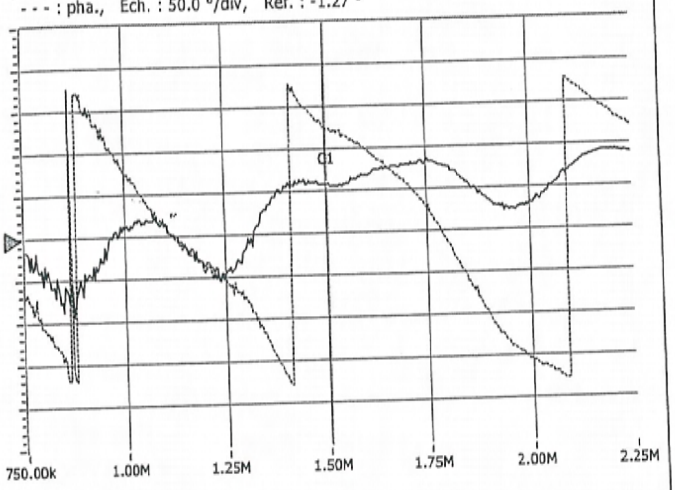
C1 : F=1.50MHz ICI=-54.3 dB pha.=-161 ° Elements n°28/30

IMASONIC S.A.
MESURES ELECTRIQUES
Z V4.2

Date : November 15th 2006 15h16
Operator : SA
Transducer : Matrix phased array - 32x2 elements
Serial number : 5154 B102
Nominal frequency : 1.50MHz
Network Analyzer : HP 8751A, IM : 112-113
Acoustic load : 1.5MR on active area
Instruction : INP 412

**Cross coupling measurement**

___ : ICI, Ech. : 5.00 dB/div, Ref. : -53.4 dB
- - - : pha., Ech. : 50.0 °/div, Ref. : -1.27 °

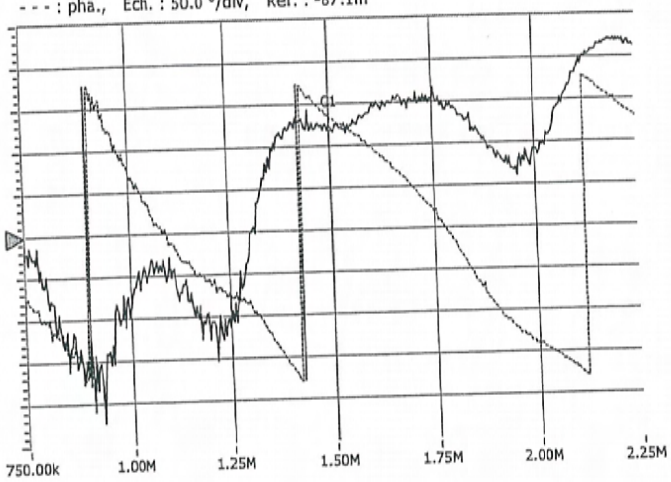



Elements n°5/6

C1 : F=1.50MHz ICI=-47.6 dB pha.=125 °

**Cross coupling measurement**

___ : ICI, Ech. : 2.00 dB/div, Ref. : -53.4 dB
- - - : pha., Ech. : 50.0 °/div, Ref. : -87.1m°

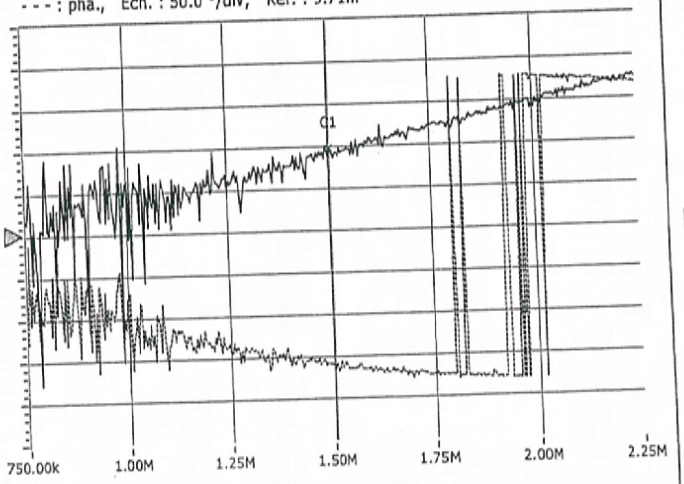



Elements n°28/29

C1 : F=1.50MHz ICI=-48.3 dB pha.=136 °

**Cross coupling measurement**

___ : ICI, Ech. : 5.00 dB/div, Ref. : -58.8 dB
- - - : pha., Ech. : 50.0 °/div, Ref. : 9.71m°

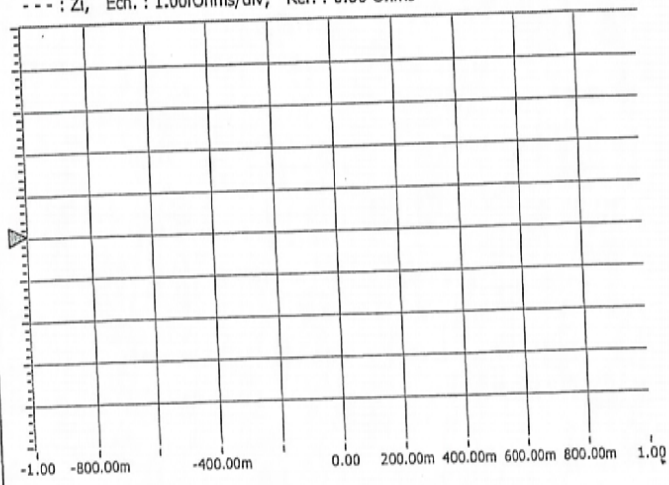



Elements n°2/18

C1 : F=1.50MHz ICI=-50.1 dB pha.=-159 °

**Cross coupling measurement**

___ : Zr, Ech. : 1.00fOhms/div, Ref. : 0.00 Ohms
- - - : Zi, Ech. : 1.00fOhms/div, Ref. : 0.00 Ohms



**Electroacoustic measurement for the transducer n°:** 5154 B102 **Operator : SA**

*(Acoustic load: 2.45 MR. IMASONIC procedure: INP 413.)* *Nominal Frequency : 1.50 MHz*

*Generator : Multi 2000 V3.4.4, Gain = atten = 60 dB, L. Exc. : 353 ns, U. Exc. : 70 V*

*Target type : Inox h = 20mm + Rexolite h = 15mm*

| # | Vpp (mV) | Fc (MHz) | Bw (%) | Lp -20dB (ns) | # | Vpp (mV) | Fc (MHz) | Bw (%) | Lp -20dB (ns) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 30 | 1.4 | 66 | 3593 | 33 | 24 | 1.4 | 70 | 3079 |
| 2 | 25 | 1.5 | 65 | 3590 | 34 | 25 | 1.5 | 66 | 3538 |
| 3 | 25 | 1.4 | 69 | 3597 | 35 | 29 | 1.4 | 68 | 2761 |
| 4 | 24 | 1.5 | 69 | 3576 | 36 | 28 | 1.4 | 71 | 3576 |
| 5 | 26 | 1.4 | 67 | 2823 | 37 | 25 | 1.4 | 70 | 2699 |
| 6 | 27 | 1.5 | 65 | 3022 | 38 | 22 | 1.5 | 69 | 2608 |
| 7 | 25 | 1.5 | 66 | 2741 | 39 | 24 | 1.4 | 71 | 2665 |
| 8 | 25 | 1.4 | 68 | 2697 | 40 | 28 | 1.4 | 67 | 2764 |
| 9 | 24 | 1.5 | 69 | 2647 | 41 | 29 | 1.4 | 67 | 2729 |
| 10 | 26 | 1.4 | 69 | 2779 | 42 | 26 | 1.4 | 66 | 2691 |
| 11 | 27 | 1.4 | 69 | 2682 | 43 | 24 | 1.4 | 70 | 2768 |
| 12 | 27 | 1.4 | 68 | 2726 | 44 | 23 | 1.4 | 70 | 2654 |
| 13 | 23 | 1.5 | 68 | 2711 | 45 | 25 | 1.4 | 70 | 2327 |
| 14 | 25 | 1.4 | 70 | 2788 | 46 | 29 | 1.4 | 67 | 2321 |
| 15 | 26 | 1.4 | 70 | 3522 | 47 | 28 | 1.4 | 67 | 1664 |
| 16 | 26 | 1.4 | 71 | 2725 | 48 | 25 | 1.5 | 69 | 2596 |
| 17 | 25 | 1.4 | 71 | 2808 | 49 | 25 | 1.5 | 71 | 2624 |
| 18 | 24 | 1.4 | 69 | 2760 | 50 | 25 | 1.4 | 69 | 1675 |
| 19 | 25 | 1.5 | 68 | 2636 | 51 | 27 | 1.4 | 68 | 1676 |
| 20 | 27 | 1.4 | 70 | 2598 | 52 | 28 | 1.4 | 69 | 1680 |
| 21 | 26 | 1.4 | 69 | 2315 | 53 | 25 | 1.4 | 69 | 1648 |
| 22 | 25 | 1.4 | 69 | 2570 | 54 | 25 | 1.4 | 70 | 1707 |
| 23 | 23 | 1.4 | 69 | 2606 | 55 | 27 | 1.4 | 69 | 1996 |
| 24 | 24 | 1.4 | 71 | 2708 | 56 | 28 | 1.4 | 68 | 2645 |
| 25 | 27 | 1.5 | 69 | 2659 | 57 | 28 | 1.5 | 68 | 2659 |
| 26 | 30 | 1.4 | 69 | 2676 | 58 | 27 | 1.5 | 67 | 2603 |
| 27 | 28 | 1.4 | 70 | 2330 | 59 | 27 | 1.5 | 67 | 2705 |
| 28 | 25 | 1.4 | 68 | 2347 | 60 | 28 | 1.4 | 68 | 2706 |
| 29 | 24 | 1.4 | 73 | 2677 | 61 | 29 | 1.4 | 72 | 2652 |
| 30 | 26 | 1.4 | 69 | 2656 | 62 | 28 | 1.4 | 69 | 2557 |
| 31 | 30 | 1.4 | 68 | 2784 | 63 | 26 | 1.5 | 71 | 2739 |
| 32 | 32 | 1.5 | 63 | 3030 | 64 | 28 | 1.5 | 66 | 2552 |

| | Vpp (mV) | Fc (MHz) | Bw (%) | Lp -20dB (ns) |
|---|---|---|---|---|
| **Minimum :** | 22 | 1.4 | 63 | 1648 |
| **Maximum :** | 32 | 1.5 | 73 | 3597 |
| **Standard deviation :** | 2 | 0.0 | 2 | 459 |
| **Average values :** | 26 | 1.4 | 69 | 2666 |

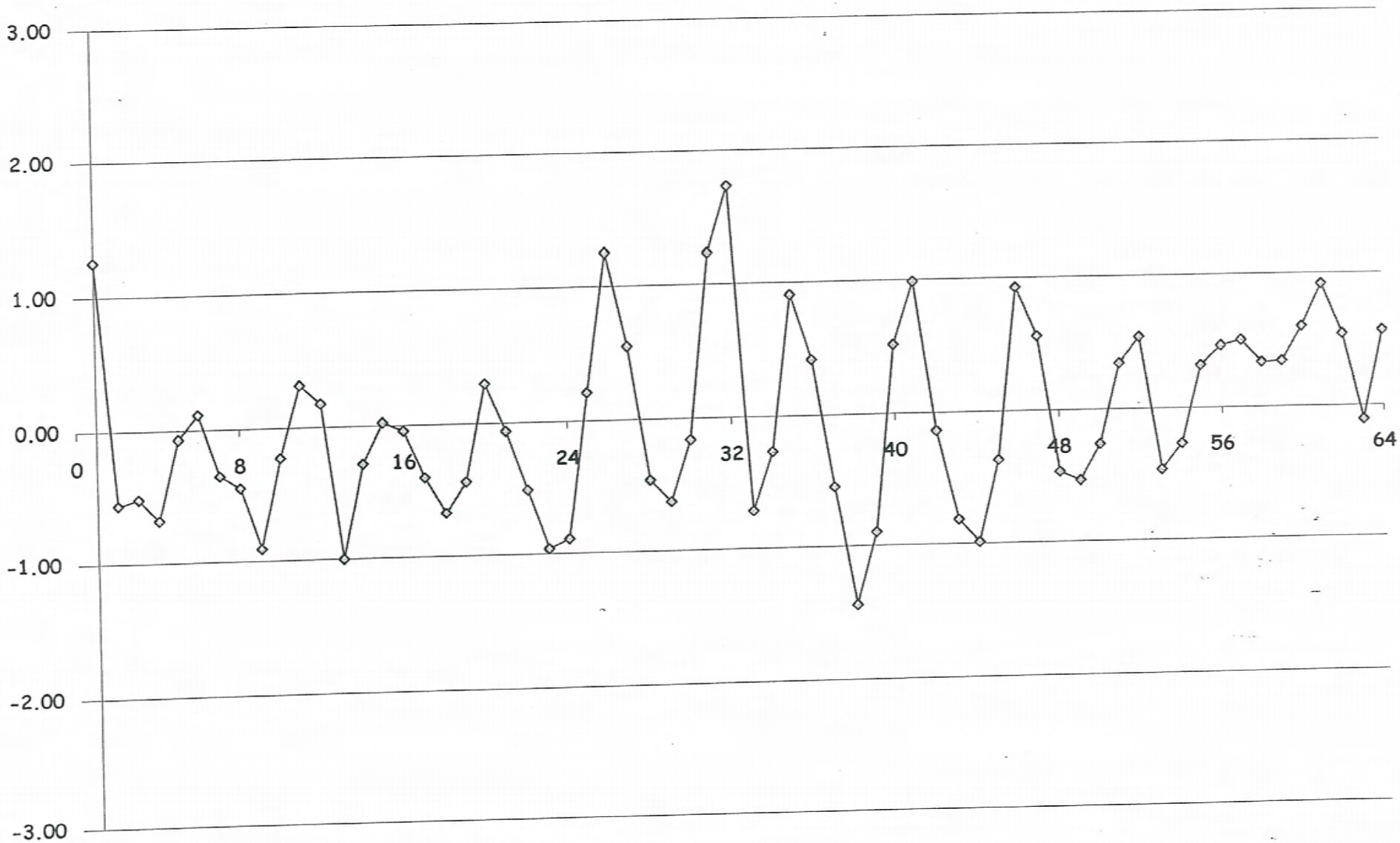
**Homogeneity in sensitivity (dB) :** **-3.17**

*See measurement results in appendix 3 for the elements n°1, 8, 16, 32, 40, 48, 56 & 64*

SA, 16/11/2006

Sensitivity variation (dB)

XCR n°5154 B102



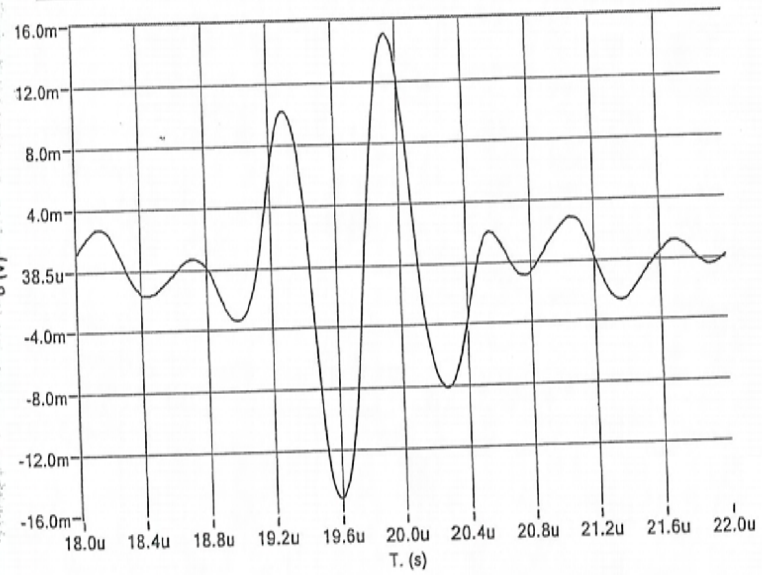

ENQ 102 - Final measurements 64 elts

# IMASONIC SA
# TRANSDUCER DATA SHEET

Date : November 16th 2006 08h45
Operator : SA
Transducer : Matrix phased array - 2x32 elements
Serial number : 5154 B102
Nominal frequency : 1.5MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 60 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP 413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.44mm
Element : 1

## WAVEFORM

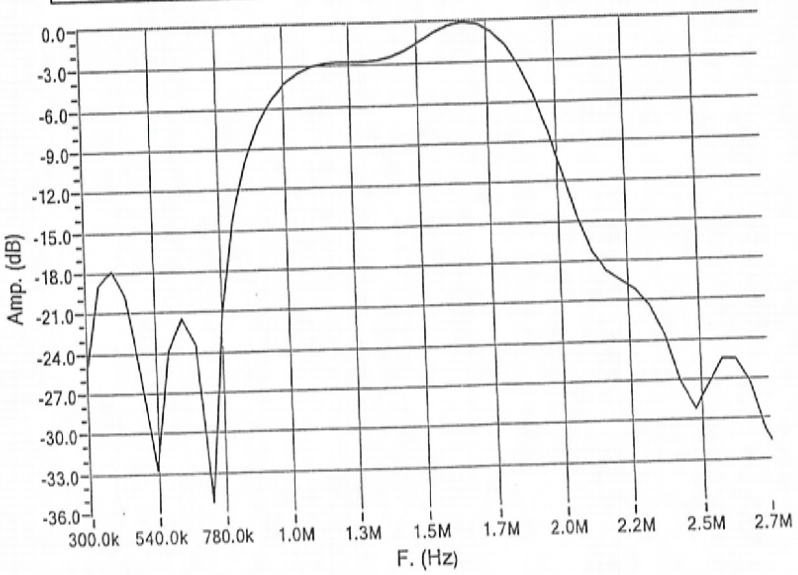
T : 399.0ns/div U : 4.0mV/div




PULSE LENGTH :
-6dB : 1.07µs -20dB : 3.59µs

VOLTAGES :
Vpp = 30.29mV

## TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.44MHz
Ratio Bp/Fc : 66%
Bandwidth : 949.19KHz
Lower Frequency : 962.87KHz
Upper Frequency : 1.91MHz

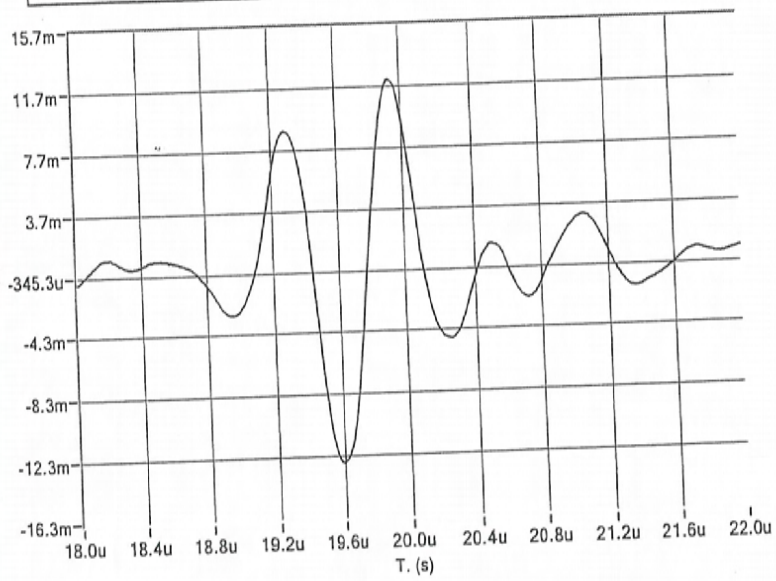
IMASONIC SA
TRANSDUCER DATA SHEET

SPECTRE V5.4

Date : November 16th 2006 08h45
Operator : SA
Transducer : Matrix phased array - 2x32 elements
Serial number : 5154 B102
Nominal frequency : 1.5MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 60 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP 413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.34mm
Element : 8

WAVEFORM

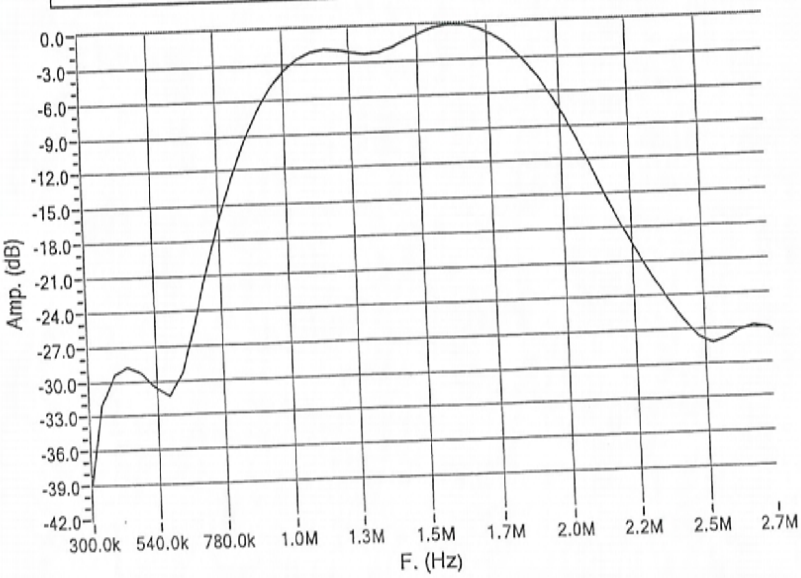
T : 399.0ns/div U : 4.0mV/div




PULSE LENGTH :
-6dB : 819.28ns -20dB : 2.70µs

VOLTAGES :
Vpp = 24.91mV

TRANSMIT-RECEIVE SPECTRUM



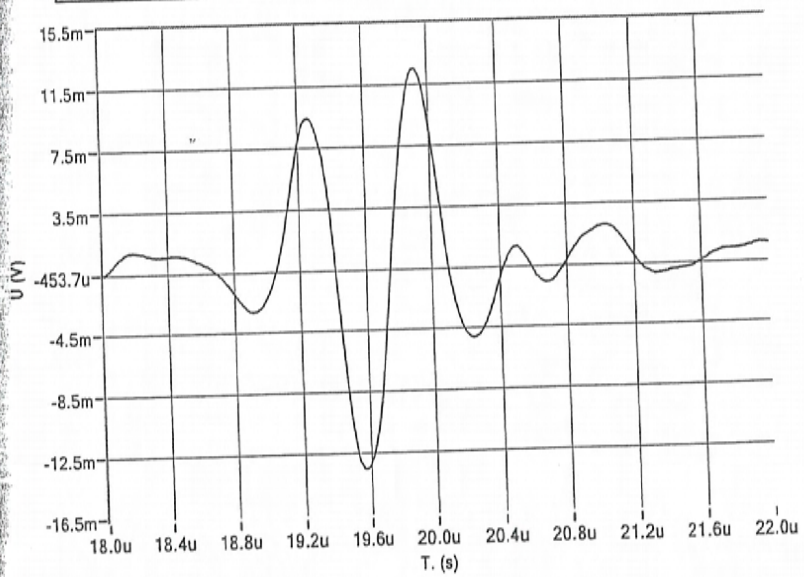

CARACTERISTICS AT -6dB :
Central Frequency : 1.45MHz
Ratio Bp/Fc : 68%
Bandwidth : 990.74KHz
Lower Frequency : 953.55KHz
Upper Frequency : 1.94MHz

# IMASONIC SA
# TRANSDUCER DATA SHEET

Date : November 16th 2006 08h45
Operator : SA
Transducer : Matrix phased array - 2x32 elements
Serial number : 5154 B102
Nominal frequency : 1.5MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 60 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP 413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.25mm
Element : 16

## WAVEFORM

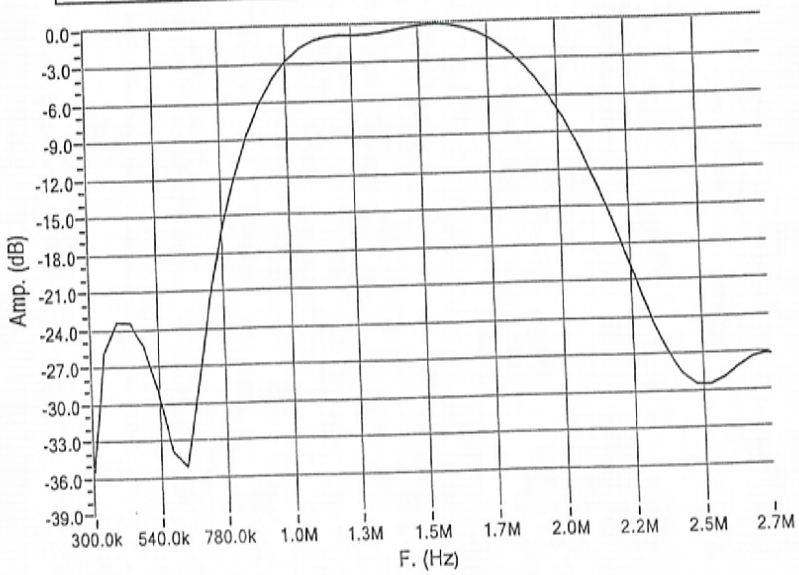
T : 399.0ns/div U : 4.0mV/div




PULSE LENGTH :
-6dB : 816.29ns -20dB : 2.73µs

VOLTAGES :
Vpp = 26.08mV

## TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.44MHz
Ratio Bp/Fc : 71%
Bandwidth : 1.02MHz
Lower Frequency : 928.76KHz
Upper Frequency : 1.95MHz

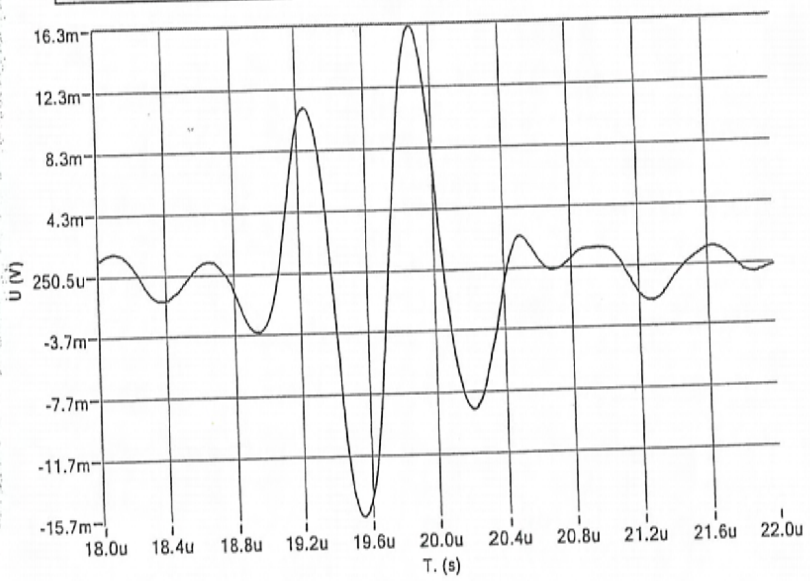
IMASONIC SA
TRANSDUCER DATA SHEET

SPECTRE V5.4

Date : November 16th 2006 08h45
Operator : SA
Transducer : Matrix phased array - 2x32 elements
Serial number : 5154 B102
Nominal frequency : 1.5MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 60 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP 413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.40mm
Element : 32

## WAVEFORM

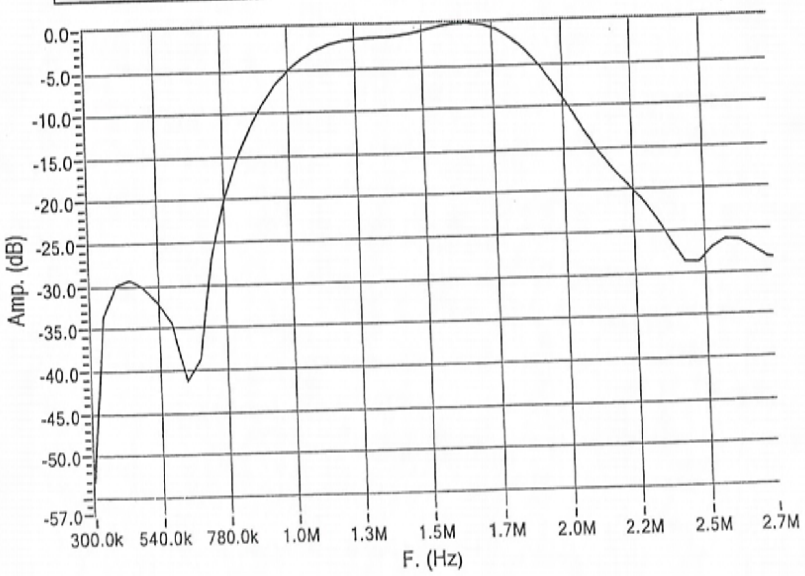
T : 399.0ns/div U : 4.0mV/div




PULSE LENGTH :
-6dB : 1.10µs -20dB : 3.03µs

VOLTAGES :
Vpp = 31.97mV

## TRANSMIT-RECEIVE SPECTRUM



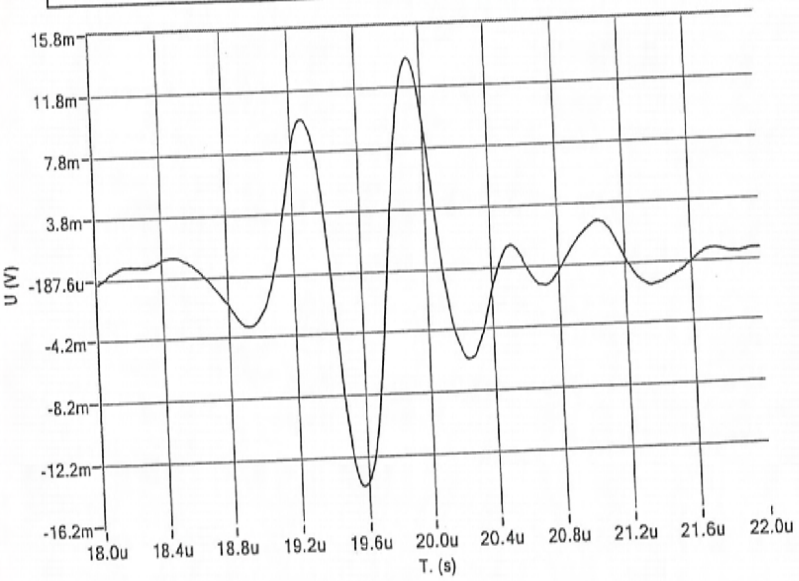

CARACTERISTICS AT -6dB :
Central Frequency : 1.46MHz
Ratio Bp/Fc : 63%
Bandwidth : 923.45KHz
Lower Frequency : 998.39KHz
Upper Frequency : 1.92MHz

# IMASONIC SA
# TRANSDUCER DATA SHEET

Date : November 16th 2006 08h45
Operator : SA
Transducer : Matrix phased array - 2x32 elements
Serial number : 5154 B102
Nominal frequency : 1.5MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 60 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP 413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.19mm
Element : 40

## WAVEFORM

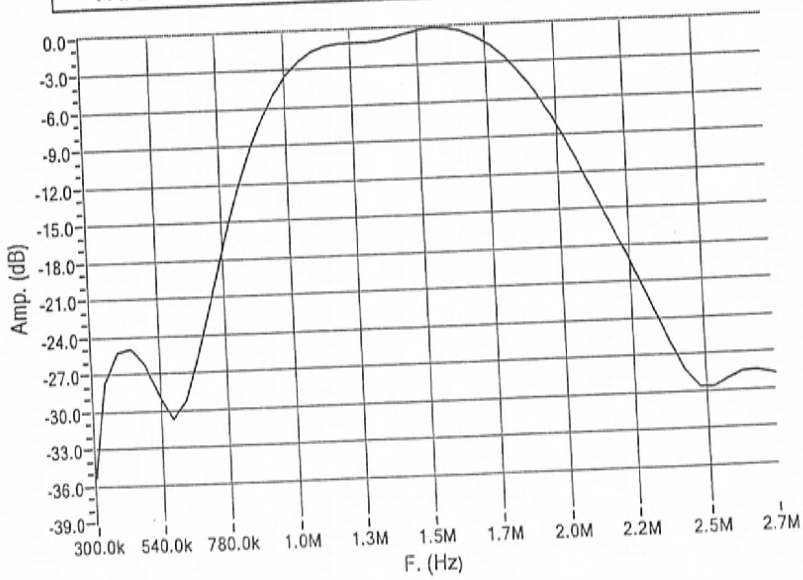
T : 399.0ns/div U : 4.0mV/div




PULSE LENGTH :
-6dB : 826.29ns -20dB : 2.76µs

VOLTAGES :
Vpp = 27.81mV

## TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.44MHz
Ratio Bp/Fc : 67%
Bandwidth : 968.98KHz
Lower Frequency : 956.94KHz
Upper Frequency : 1.93MHz

IMASONIC

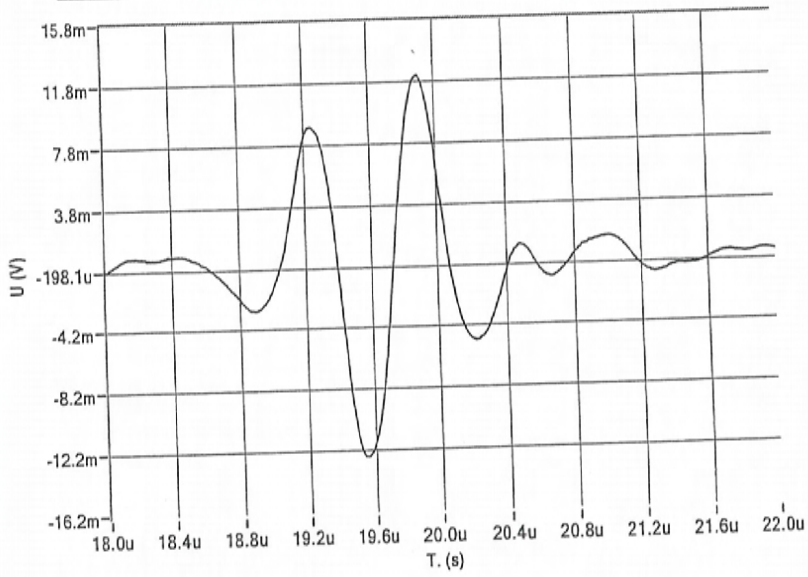
# IMASONIC SA
# TRANSDUCER DATA SHEET

SPECTRE V5.4

Date : November 16th 2006 08h45
Operator : SA
Transducer : Matrix phased array - 2x32 elements
Serial number : 5154 B102
Nominal frequency : 1.5MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 60 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP 413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.21mm
Element : 48

## WAVEFORM

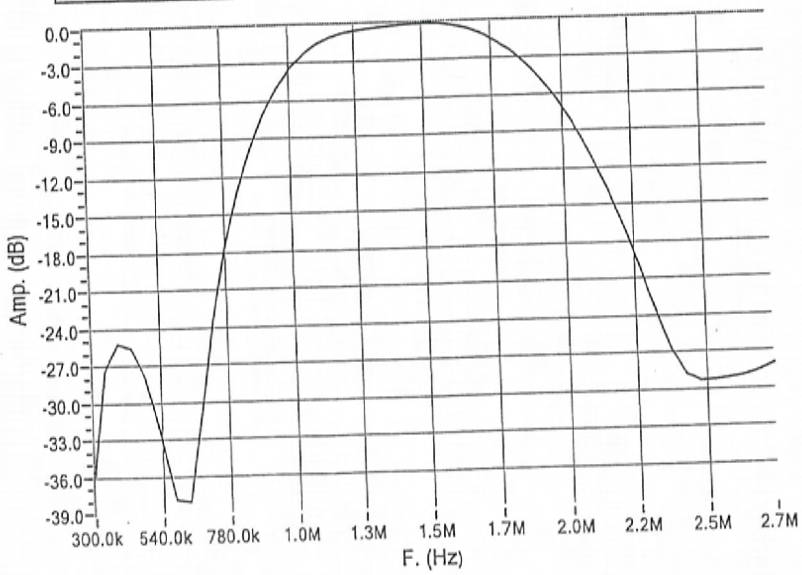
T : 399.0ns/div U : 4.0mV/div




PULSE LENGTH :
-6dB : 820.52ns -20dB : 2.60µs

VOLTAGES :
Vpp = 24.84mV

## TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.45MHz
Ratio Bp/Fc : 69%
Bandwidth : 998.97KHz
Lower Frequency : 952.97KHz
Upper Frequency : 1.95MHz

IMASONIC

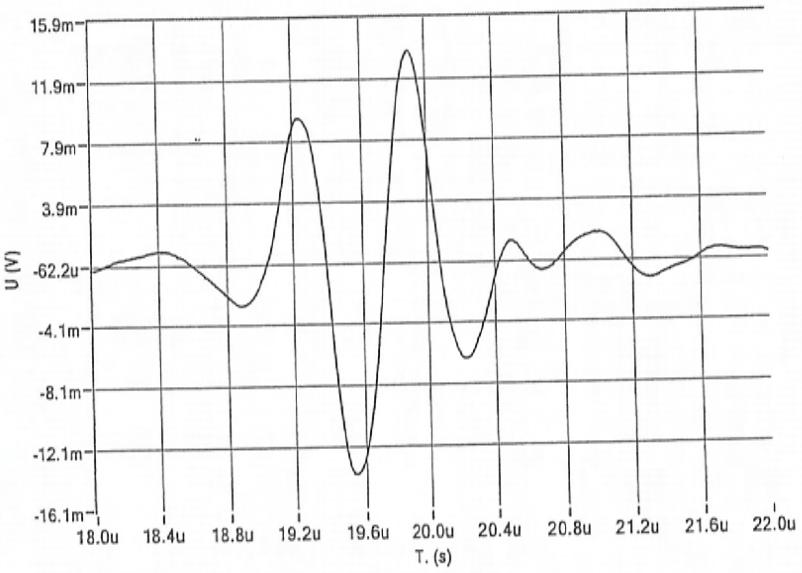
# IMASONIC SA
# TRANSDUCER DATA SHEET

SPECTRE V5.4

Date : November 16th 2006 08h45
Operator : SA
Transducer : Matrix phased array - 2x32 elements
Serial number : 5154 B102
Nominal frequency : 1.5MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 60 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP 413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.22mm
Element : 56

## WAVEFORM

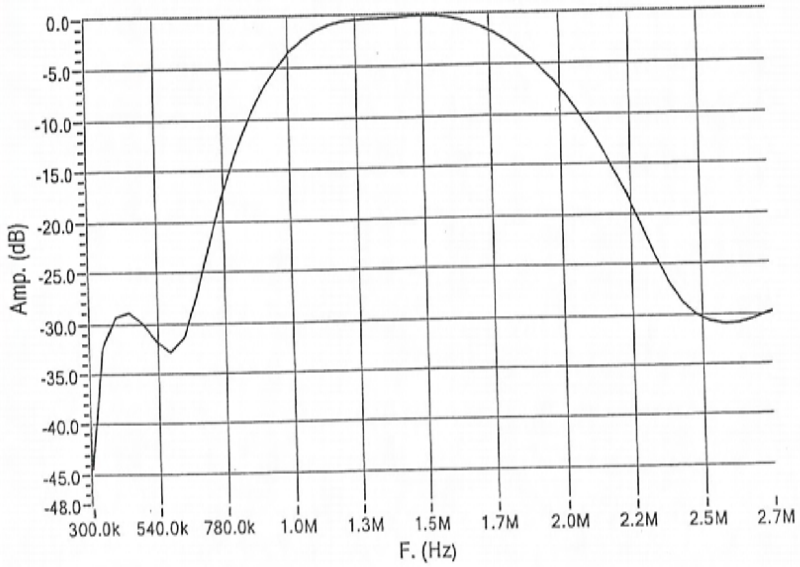
T : 399.0ns/div U : 4.0mV/div




PULSE LENGTH :
-6dB : 828.32ns -20dB : 2.65µs

VOLTAGES :
Vpp = 27.65mV

## TRANSMIT-RECEIVE SPECTRUM



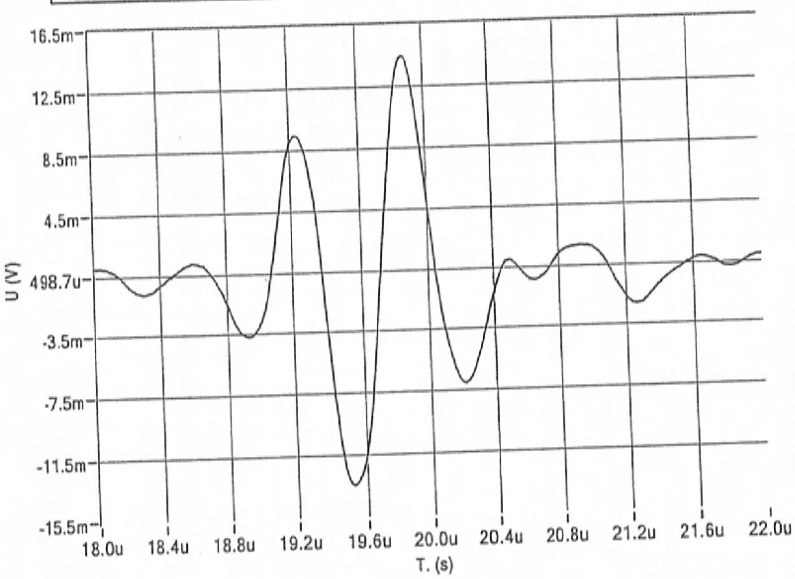

CARACTERISTICS AT -6dB :
Central Frequency : 1.45MHz
Ratio Bp/Fc : 68%
Bandwidth : 983.24KHz
Lower Frequency : 955.19KHz
Upper Frequency : 1.94MHz

# IMASONIC SA
# TRANSDUCER DATA SHEET

Date : November 16th 2006 08h45
Operator : SA
Transducer : Matrix phased array - 2x32 elements
Serial number : 5154 B102
Nominal frequency : 1.5MHz
Generator : MULTI 2000
Input signal : 70.0 Vpp, Gain = atten = 60 dB, Largeur : 353 ns.
Scope : MULTI 2000
Instruction : INP 413
Target type : Inox h = 20mm + Rexolite h = 15mm
Target Positioning : 24.27mm
Element : 64

## WAVEFORM

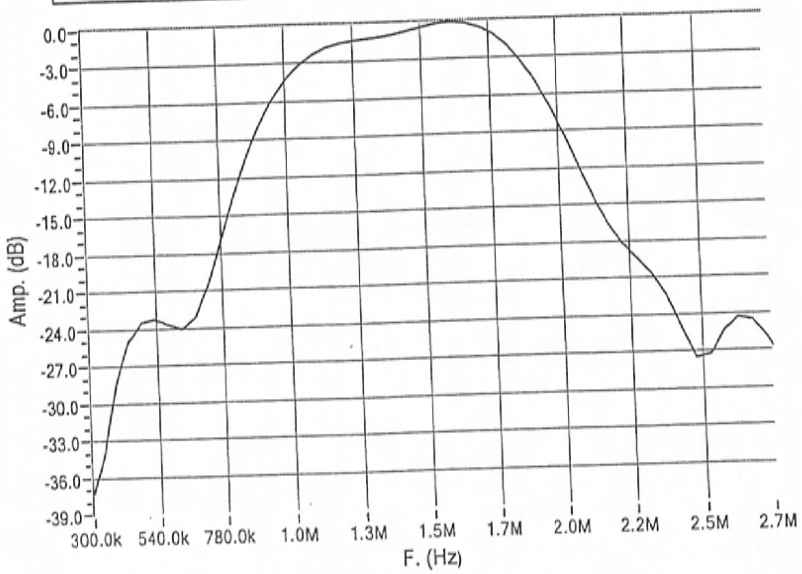
T : 399.0ns/div U : 4.0mV/div




PULSE LENGTH :
-6dB : 817.53ns -20dB : 2.55µs

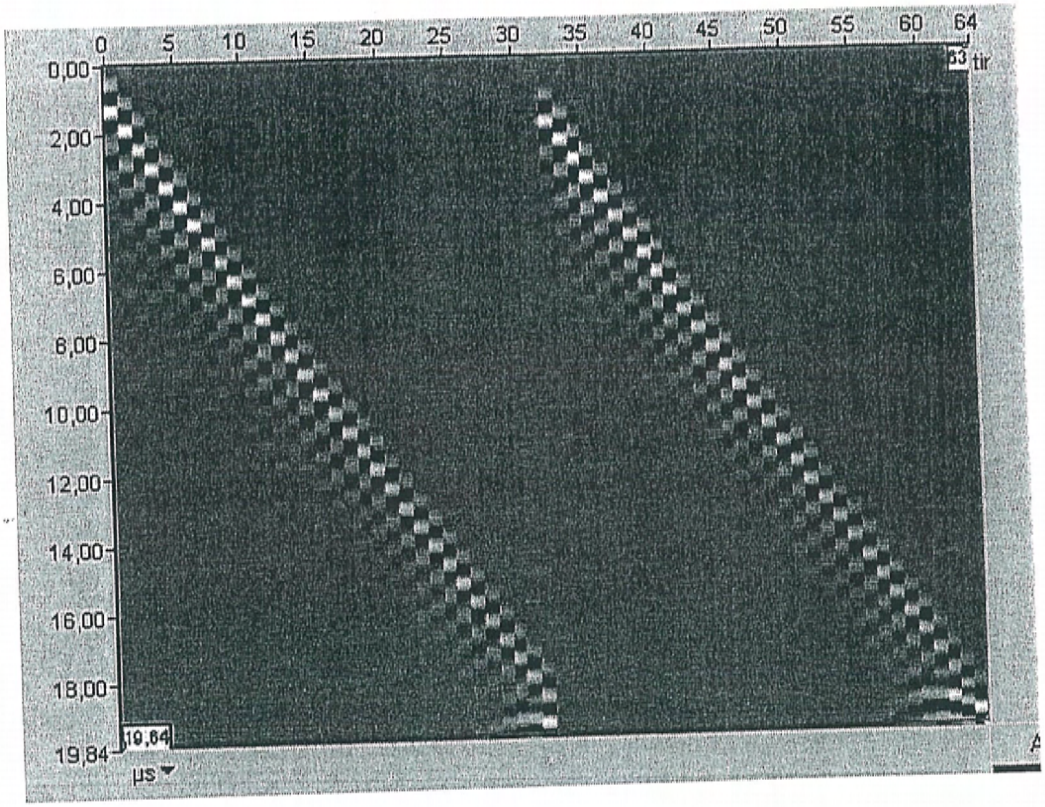
VOLTAGES :
Vpp = 27.96mV

## TRANSMIT-RECEIVE SPECTRUM




CARACTERISTICS AT -6dB :
Central Frequency : 1.45MHz
Ratio Bp/Fc : 66%
Bandwidth : 959.37KHz
Lower Frequency : 972.80KHz
Upper Frequency : 1.93MHz

# Cabling order
# Matrix phased array – 2x32 elements
# 5154 B102



# LINEARITY CHECK DATA SHEET

***Equipment / module :*** **OMNI-MX/OMNI-M-PA32128PR**

***Serial number :*** **OMNI-Z-1012/OMNI-Z-6012**

***Calibration Due*** **11/21/08**

***Procedure :*** **TechDocE_OmniScanPA_SiteLinearityCheck_revA.doc**

***Phased array probe:*** **MODEL-AS SN-5135 G106**

***Reference block:*** **MEUXE005A**

***Verification:*** **PRE EXAMINATION**

| ***Gain Setting*** | ***Gain Value*** (dB) | ***EA*** (%FSH) | ***EB*** (%FSH) | ***EA/2*** (%FSH) |
|---|---|---|---|---|
| ***Nominal Gain*** | 7.7 | 40 | 20 | 20 |
| ***Nominal Gain + 6 dB*** | 13.3 | 76 | 37.6 | 18.8 |
| ***Nominal Gain - 6 dB*** | 1.7 | 20 | 10 | 10 |

| ***Test*** | ***OK / NOK*** |
|---|---|
| ***Vertical Amplification Linearity*** | OK |
| ***Amplitude Control Linearity*** | OK |

***Data Analyst :*** ***Jeff Devers***

***Date/Time :*** ***3/8/2008-1720***

***LMT Review*** ***Todd Blechinger***

***Date :*** ***3/14/08***

***EPRI Review***

***Date :*** ***3/16/08***

***Report #*** ***EPRI-PA-04***



***ANII Review*** ***N/A***

***Date :***

# LINEARITY CHECK DATA SHEET

***Equipment / module :*** **OMNI-MX/OMNI-M-PA32128PR**

***Serial number :*** **OMNI-Z-1012/OMNI-Z-6012**

***Calibration Due*** **21-Nov-08**

***Procedure :*** **TechDocE_OmniScanPA_SiteLinearityCheck_revA.doc**

***Phased array probe:*** **MODEL-AS SN-5135 G106**

***Reference block:*** **MEUXE005A**

***Verification:*** **POST EXAMINATION**

| ***Gain Setting*** | ***Gain Value*** (dB) | ***EA*** (%FSH) | ***EB*** (%FSH) | ***EA/2*** (%FSH) |
|---|---|---|---|---|
| ***Nominal Gain*** | 7.7 | 40 | 20 | 20 |
| ***Nominal Gain + 6 dB*** | 13.3 | 76 | 37.6 | 18.8 |
| ***Nominal Gain - 6 dB*** | 1.7 | 20 | 10 | 10 |

| ***Test*** | ***OK / NOK*** |
|---|---|
| ***Vertical Amplification Linearity*** | OK |
| ***Amplitude Control Linearity*** | OK |

***Data Analyst :*** ***Jeff Devers***

***Date/Time :*** ***3/13/2008-1700***

***LMT Review*** ***Todd Blechinger***

***Date :*** ***3/14/08***

***EPRI Review***

***Date :*** ***3/16/08***

***Report #*** ***EPRI-PA-04***



***ANII Review*** ***N/A***

***Date :***

# PHASED ARRAY CALIBRATION DATA SHEET

***Procedure :*** **ZETEC_Omniscan PA_03_revD** ***Plant / Unit :*** **PSL/1**

***UT equipment :*** **OMNI-M-PA32128PR** ***Ser. Number:*** **OMNI-Z-1012/OMNI-Z-6012**

| *Probe Configuration* | *Serial No.* | *Active Channels* | *Wedge assembly* | *Calibration block* | *Reflector* | *Sens.* (dB) | *UT path* (mm) | *Date* (dd/mm/yy) | *Time* (hh:mm) | *Status* | *Operator* (initials) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CS/ CIRCU TRL 270 | 5155A103 5155B105 | ALL | ADUXE 039A | MEUXE015A | 1.0" | 32.5 | 35.6 | 3/12/08 | 1200 | INITIAL | PB |
| CS/ CIRCU TRL 270 | 5155A103 5155B105 | ALL | ADUXE 039A | MEUXE015A | 1.0" | 32.5 | 35.6 | 3/12/08 | 1915 | FINAL | PB |
| CS/ CIRCD TRL 90 | 5155A103 5155B106 | ALL | ADUXE 039A | MEUXE015A | 1.0" | 32.5 | 35.6 | 3/12/08 | 1150 | INITIAL | PB |
| CS/ CIRCD TRL 90 | 5155A103 5155B106 | ALL | ADUXE 039A | MEUXE015A | 1.0" | 32.5 | 35.6 | 3/12/08 | 1920 | FINAL | PB |
| | | | | | | | | | | | |
| CS/ CIRCD TRS 90 | 5155A103 5155B106 | ALL | ADUXE 039A | MEUXE015A | 1.0" | 28.5 | 35.6 | 3/13/08 | 1200 | INITIAL | PB |
| CS/ CIRCD TRS 90 | 5155A103 5155B106 | ALL | ADUXE 039A | MEUXE015A | 1.0" | 28.5 | 35.6 | 3/13/08 | 1355 | FINAL | PB |
| CS/ CIRCU TRS 270 | 5155A103 5155B105 | ALL | ADUXE 039A | MEUXE015A | 1.0" | 28.5 | 35.6 | 3/13/08 | 1125 | INITIAL | PB |
| CS/ CIRCU TRS 270 | 5155A103 5155B105 | ALL | ADUXE 039A | MEUXE015A | 1.0" | 28.5 | 35.6 | 3/13/08 | 1410 | FINAL | PB |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

**"Sens. (dB)" = gain setting (in dB) required to obtain echo amplitude of 80% SH on reference reflector**

***Data Analyst :*** ***Jeff Devers*** JD
***Date :*** ***3/13/08***

***LMT Review*** ***Todd Blechinger***
***Date :*** ***3/14/08***

***EPRI Review***
***Date :*** ***3/16/08***

***Report #*** ***EPRI-PA-04***



***ANII Review*** ***N/A***
***Date :***

# OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
## WELD # FPLSTL-SRNZL-D01

| Menu item | Setting | Essential / Non-Essential / Not applicable |
|---|---|---|
| **File** | | |
| File | | |
| Destination | Storage Card | Non-Essential |
| Save Mode | A-Scan | Essential |
| File Name | ***FPLSTL-SRNZL-D01_155MM_CIRCD TRL 90_AUTO_CS_ADUXE039A*** | Essential |
| Report | | |
| Template | Complete | Non-Essential |
| File Name | ***FPLSTL-SRNZL-D01_155MM_CIRCD TRL 90_AUTO_CS_ADUXE039A*** | Essential |
| Paper Size | Letter | Non-Essential |
| Format | | |
| User field | Off | Non-Essential |
| Probe | Off | Non-Essential |
| Setup | On | Essential |
| Note | Off | Non-Essential |
| View | Current Layout | Non-Essential |
| User field | | Not applicable |
| Notes | | Not applicable |
| **Reading** | | |
| Result | | |
| Selector | List 1 | Essential |
| Field 1 | A% (Peak Amplitude in Gate) | Essential |
| Field 2 | A^ (Half Path position in Gate) | Essential |
| Field 3 | B% | Not applicable |
| Field 4 | B^ | Not applicable |
| Cursors | | Not applicable |
| Table | | Not applicable |
| Export | | Not applicable |
| **Utilities** | | |
| Pref. | | |
| Units | Millimeters | Essential |
| Bright (%) | 25 | Non-Essential |
| Scheme | Indoor | Non-Essential |
| System | | |
| Clock Set | *Set to correct time* | Essential |
| Date Set | *Set to correct date* | Essential |
| Time Zone | *Set to correct time zone* | Non-Essential |
| Daylight saving | On | Non-Essential |
| Select Key | F2 | Non-Essential |
| Assign Key | Gain | Non-Essential |
| Service | | Not applicable |

| | | | |
|---|---|---|---|
| Options | | | Not applicable |
| Network | *Only for network saving* | | Non-Essential |
| **UT** | | | |
| General | | | |
| Gain | 34.5 | | Essential |
| Start | 0 | | Essential |
| Range | 113.09mm | | Essential |
| Wedge delay | 2.30 | | Essential |
| Velocity | 5890 m/s | | Essential |
| Pulser | | | |
| Pulser | 1 | | Not applicable |
| Tx/Rx mode | PE | | Essential |
| Freq | 1.5 | | Essential |
| Voltage | High | | Essential |
| PW | *Imported from LAW file (333 ns)* | | Essential |
| PRF | 25 | | Essential |
| Receiver | | | |
| Receiver | 1 | | Not applicable |
| Filter | None | | Essential |
| Rectifier | FW | | Essential |
| Video Filter | Off | | Essential |
| Receiver | | | |
| Averaging | 1 | | Essential |
| Reject | 0 | | Essential |
| Beam | | | |
| Gain Offset | *Imported from LAW file* | | Essential |
| Scan Offset | *Imported from LAW file* | | Essential |
| Index Offset | *Imported from LAW file* | | Essential |
| Angle | *Imported from LAW file* | | Essential |
| Skew | *Imported from LAW file* | | Essential |
| Beam Delay | *Imported from LAW file* | | Essential |
| Advanced | | | |
| dB Ref | Off | | Essential |
| Points Qty | 640 | | Essential |
| Scale Factor | 6 | | Essential |
| Sum Gain | *Imported from LAW file* | | Essential |
| **Scan** | | | |
| Encoder | | | |
| Encoder | 1 (Scan) | 2 (Index) | Essential |
| Polarity | Normal | Inverse | Essential |
| Type | Quad | | Essential |
| Resolution | 35.38 | 58.00 | Essential |
| Origin | 0 | | Essential |
| Synchro | | | |

| | | | |
|---|---|---|---|
| Source | Both Axes | | Essential |
| Scan | Encoder 1 | | Essential |
| Index | Encoder 2 | | Not applicable |
| Scan Speed | 25 for scan resolution of 1 mm | | Not applicable |
| Area | | | |
| Scan Start | 0 mm | 245 mm | Essential |
| Scan End | 275mm | 510 mm | |
| Scan Resolution | 1.0 mm | | Essential |
| Index start | -65.7 mm | | Essential |
| Index end | 36.8 mm | | Essential |
| Index resolution | 14.6 mm | | Essential |
| Start | | | |
| Start Mode | Reset All | | Essential |
| Pause | Off | | Non-Essential |
| Data | | | |
| Storage | Last | | Essential |
| **Display** | | | |
| Selection | | | |
| Display | A-S-C | | Essential |
| C-Scan 1 | A% | | Non-Essential |
| Group | Current | | Non-Essential |
| Projection | On | | Not applicable |
| Rulers | | | |
| UT Unit | Sound Path | | Essential |
| % Ruler | Linear(%) | | Essential |
| Grid | Off | | Non-Essential |
| DAC / TCG | Off | | Essential |
| Gate | On | | Essential |
| Cursor | On | | Essential |
| Zoom | | | Not applicable |
| Color | | | |
| Select | Amplitude | | Essential |
| Start (%) | 0.0 | | Essential |
| End (%) | 100.0 | | Essential |
| Properties | | | Not applicable |
| **Probe/Part** | | | |
| Select | | | |
| Group | 1 | | Not applicable |
| Group Link | Off | | Not applicable |
| Select | Select Tx/Rx | | Essential |
| Select Probe | Unknown | | Not applicable |
| Select Wedge | Contact / Contact | | Not applicable |
| Auto Detect | Off | | Essential |
| Scan Offset | 0 | | Essential |

| | | | | |
|---|---|---|---|---|
| Index Offset | 0 | | | Essential |
| Skew | 0 | | | Essential |
| Characterize | | | | Not applicable |
| Parts | | | | Not applicable |
| Wizard | | | | Not applicable |
| **PGM Probe** | | | | |
| Configuration | | | | |
| Group | 1 | | | Not applicable |
| Enable | Off | | | Not applicable |
| Scan Type | Custom | | | Essential |
| Connection P | 1 | | | Not applicable |
| Connection R | 1 | | | Not applicable |
| Aperture | | | | Not applicable |
| Beam | | | | Not applicable |
| Laws | | | | |
| Auto Program | Off | | | Essential |
| Wizard | | | | Not applicable |
| **Gate/Alarm** | | | | |
| Gate | | | | |
| Gate Select | Gate A | B | I | Essential |
| Gate Start | 10 | 0 | 0 | Essential |
| Width | End of time base | 0 | 0 | Non-Essential |
| Threshold | 25 | 0 | 0 | Essential |
| Mode | Positive | | | Not applicable |
| Synchro | Pulse | | | Essential |
| Alarms | | | | Not applicable |
| Output | | | | Not applicable |
| **Gate/Alarm (ctd.)** | | | | |
| DAC / TCG | | | | Not applicable |
| Thickness | | | | Not applicable |
| **Calibration** | | | | |
| Phased Array | | | | Not applicable |
| Axis | | | | Not applicable |
| TCG | | | | Not applicable |
| Code | | | | Not applicable |
| **User** | | | | |
| Gain | | | | Not applicable |
| Start | | | | Not applicable |
| Range | | | | Not applicable |
| Display | | | | Not applicable |
| Gate | | | | Not applicable |

*Focal Law Calculator Inputs*

| **Menu item** | Setting | Essential / Non-Essential / Not applicable |
|---|---|---|
| **Probe (CS) 90°** | | |
| Name | 1.5M16x2E32-7(EWUXE083A) | Essential |
| Probe Skew Angle | 90° | Essential |
| Probe Frequency | 1.5 MHz | Essential |
| Number of elements on primary axis | 16 | Essential |
| Primary axis pitch | 2 mm | Essential |
| Secondary axis width | 7 mm | Essential |
| Pitch and Catch | Checked | Essential |
| Probe separation | | Not applicable |
| Squint angle | "0.0°" | Essential |
| Reverse primary axis | Unchecked | Essential |
| **Specimen** | | |
| Name | Memphis CS LW | Non-Essential |
| Specimen Type | "Pipe OD" | Essential |
| Wave type | "Longitudinal" for TRL | Essential |
| Sound velocity | 90°-5890 m/s | Essential |
| Thickness | 40 mm | Essential |
| Radius | 77 mm | Essential |
| **Wedge** | | |
| Name | ADUXE039A | Essential |
| Footprint | "Curvature along secondary axis" | Essential |
| Wedge angle | 22.3 | Essential |
| Roof angle | 6.0 | Essential |
| Sound velocity | "2330 m/s" | Essential |
| Height at the middle of the first element | "8.17 mm" for ADUXE039A | Essential |
| Primary axis offset of the middle of the first element | "8.43 mm" for ADUXE039A | Essential |
| Secondary axis offset of the middle of the first element | "7.74 mm" for ADUXE039A | Essential |
| Primary axis position of wedge reference | "-50.00 mm" | Essential |
| Secondary axis position of wedge reference | "-15.00 mm" | Essential |
| Wedge length | "50.00 mm" | Essential |

| | | |
|---|---|---|
| Distance between contact points (wedge width) | “30.00 mm” | Essential |
| **Scan** | | |
| Type | “Linear” | Essential |
| **Beam angles selection** | | |
| Primary steering angle | | Not applicable |
| Secondary steering angle | | Not applicable |
| Refracted angle | 90°-30°,45°,60°,70° | Essential |
| Beam skew angle | | Not applicable |
| **Focal points selection** | | |
| Focusing type | Auto | Essential |
| Focal plane position | | Not applicable |
| Emission focus position | | Not applicable |
| Reception focus position | | Not applicable |
| **Elements selection** | | |
| Improved resolution | Checked | Essential |
| Pulser Start | “ 1 “ | Essential |
| Pulser Stop | 9 | Essential |
| Pulser Resolution | “ 1 “ | Essential |
| Receiver Start | “ 1 “ | Essential |
| Primary axis aperture | 8 | Essential |
| Pulser connection | “ 1 “ | Essential |
| Receiver connection | “ 65 “ | Essential |
| **Hardware selection** | | |
| Type | “OmniScan 32/128” | Essential |

| Menu item | Setting | Essential / Non-Essential / Not applicable |
|---|---|---|
| **File** | | |
| File | | |
| Destination | Storage Card | Non-Essential |
| Save Mode | A-Scan | Essential |
| File Name | ***FPLSTL-SRNZL-D01_155MM_CIRCUTRL 270_AUTO_CS_ADUXE039A*** | Essential |
| Report | | |
| Template | Complete | Non-Essential |
| File Name | ***FPLSTL-SRNZL-D01_155MM_CIRCUTRL 270_AUTO_CS_ADUXE039A*** | Essential |
| Paper Size | Letter | Non-Essential |
| Format | | |
| User field | Off | Non-Essential |
| Probe | Off | Non-Essential |
| Setup | On | Essential |
| Note | Off | Non-Essential |
| View | Current Layout | Non-Essential |
| User field | | Not applicable |
| Notes | | Not applicable |
| **Reading** | | |
| Result | | |
| Selector | List 1 | Essential |
| Field 1 | A% (Peak Amplitude in Gate) | Essential |
| Field 2 | A^ (Half Path position in Gate) | Essential |
| Field 3 | B% | Not applicable |
| Field 4 | B^ | Not applicable |
| Cursors | | Not applicable |
| Table | | Not applicable |
| Export | | Not applicable |
| **Utilities** | | |
| Pref. | | |
| Units | Millimeters | Essential |
| Bright (%) | 25 | Non-Essential |
| Scheme | Indoor | Non-Essential |
| System | | |
| Clock Set | *Set to correct time* | Essential |
| Date Set | *Set to correct date* | Essential |
| Time Zone | *Set to correct time zone* | Non-Essential |
| Daylight saving | On | Non-Essential |
| Select Key | F2 | Non-Essential |
| Assign Key | Gain | Non-Essential |

| | | | |
|---|---|---|---|
| Service | | | Not applicable |
| Options | | | Not applicable |
| Network | *Only for network saving* | | Non-Essential |
| **UT** | | | |
| General | | | |
| Gain | 34.5 | | Essential |
| Start | 0 | | Essential |
| Range | 110.78 | | Essential |
| Wedge delay | 2.30 | | Essential |
| Velocity | 5770 m/s | | Essential |
| Pulser | | | |
| Pulser | 1 | | Not applicable |
| Tx/Rx mode | PE | | Essential |
| Freq | 1.5 | | Essential |
| Voltage | High | | Essential |
| PW | *Imported from LAW file (333 ns)* | | Essential |
| PRF | 25 | | Essential |
| Receiver | | | |
| Receiver | 1 | | Not applicable |
| Filter | None | | Essential |
| Rectifier | FW | | Essential |
| Video Filter | Off | | Essential |
| Receiver | | | |
| Averaging | 1 | | Essential |
| Reject | 0 | | Essential |
| Beam | | | |
| Gain Offset | *Imported from LAW file* | | Essential |
| Scan Offset | *Imported from LAW file* | | Essential |
| Index Offset | *Imported from LAW file* | | Essential |
| Angle | *Imported from LAW file* | | Essential |
| Skew | *Imported from LAW file* | | Essential |
| Beam Delay | *Imported from LAW file* | | Essential |
| Advanced | | | |
| dB Ref | Off | | Essential |
| Points Qty | 640 | | Essential |
| Scale Factor | 6 | | Essential |
| Sum Gain | *Imported from LAW file* | | Essential |
| **Scan** | | | |
| Encoder | | | |
| Encoder | 1 (Scan) | 2 (Index) | Essential |
| Polarity | Normal | Inverse | Essential |
| Type | Quad | | Essential |
| Resolution | 35.36 | 58.00 | Essential |
| Origin | 0 | | Essential |

| | | | |
|---|---|---|---|
| Synchro | | | |
| Source | Both Axes | | Essential |
| Scan | Encoder 1 | | Essential |
| Index | Encoder 2 | | Not applicable |
| Scan Speed | 25 for scan resolution of 1 mm | | Not applicable |
| Area | | | |
| Scan Start | 0 mm | 245 mm | Essential |
| Scan End | 275 mm | 510 mm | |
| Scan Resolution | 1.0 mm | | Essential |
| Index start | -41.8 mm | | Essential |
| Index end | 60.7 mm | | Essential |
| Index resolution | 14.6 mm | | Essential |
| Start | | | |
| Start Mode | Reset All | | Essential |
| Pause | Off | | Non-Essential |
| Data | | | |
| Storage | Last | | Essential |
| **Display** | | | |
| Selection | | | |
| Display | A-S-C | | Essential |
| C-Scan 1 | A% | | Non-Essential |
| Group | Current | | Non-Essential |
| Projection | On | | Not applicable |
| Rulers | | | |
| UT Unit | Sound Path | | Essential |
| % Ruler | Linear(%) | | Essential |
| Grid | Off | | Non-Essential |
| DAC / TCG | Off | | Essential |
| Gate | On | | Essential |
| Cursor | On | | Essential |
| Zoom | | | Not applicable |
| Color | | | |
| Select | Amplitude | | Essential |
| Start (%) | 0.0 | | Essential |
| End (%) | 100.0 | | Essential |
| Properties | | | Not applicable |
| **Probe/Part** | | | |
| Select | | | |
| Group | 1 | | Not applicable |
| Group Link | Off | | Not applicable |
| Select | Select Tx/Rx | | Essential |
| Select Probe | Unknown | | Not applicable |
| Select Wedge | Contact / Contact | | Not applicable |
| Auto Detect | Off | | Essential |

| | | | | |
|---|---|---|---|---|
| Position | | | | |
| Scan Offset | 0 | | | Essential |
| Index Offset | 0 | | | Essential |
| Skew | 0 | | | Essential |
| Characterize | | | | Not applicable |
| Parts | | | | Not applicable |
| Wizard | | | | Not applicable |
| **PGM Probe** | | | | |
| Configuration | | | | |
| Group | 1 | | | Not applicable |
| Enable | Off | | | Not applicable |
| Scan Type | Custom | | | Essential |
| Connection P | 1 | | | Not applicable |
| Connection R | 1 | | | Not applicable |
| Aperture | | | | Not applicable |
| Beam | | | | Not applicable |
| Laws | | | | |
| Auto Program | Off | | | Essential |
| Wizard | | | | Not applicable |
| **Gate/Alarm** | | | | |
| Gate | | | | |
| Gate Select | Gate A | B | I | Essential |
| Gate Start | 10 | 0 | 0 | Essential |
| Width | End of time base | 0 | 0 | Non-Essential |
| Threshold | 25 | 0 | 0 | Essential |
| Mode | Positive | | | Not applicable |
| Synchro | Pulse | | | Essential |
| Alarms | | | | Not applicable |
| Output | | | | Not applicable |
| **Gate/Alarm (ctd.)** | | | | |
| DAC / TCG | | | | Not applicable |
| Thickness | | | | Not applicable |
| **Calibration** | | | | |
| Phased Array | | | | Not applicable |
| Axis | | | | Not applicable |
| TCG | | | | Not applicable |
| Code | | | | Not applicable |
| **User** | | | | |
| Gain | | | | Not applicable |
| Start | | | | Not applicable |
| Range | | | | Not applicable |
| Display | | | | Not applicable |
| Gate | | | | Not applicable |

*Focal Law Calculator Inputs*

| **Menu item** | Setting | Essential / Non-Essential / Not applicable |
|---|---|---|
| **Probe (CS) 270°** | | |
| Name | 1.5M16x2E32-7(EWUXE083A) | Essential |
| Probe Skew Angle | 270° | Essential |
| Probe Frequency | 1.5 MHz | Essential |
| Number of elements on primary axis | 16 | Essential |
| Primary axis pitch | 2 mm | Essential |
| Secondary axis width | 7 mm | Essential |
| Pitch and Catch | Checked | Essential |
| Probe separation | | Not applicable |
| Squint angle | "0.0°" | Essential |
| Reverse primary axis | Unchecked | Essential |
| **Specimen** | | |
| Name | Memphis SS LW | Non-Essential |
| Specimen Type | "Pipe OD" | Essential |
| Wave type | "Longitudinal" for TRL | Essential |
| Sound velocity | 270°-5770 m/s | Essential |
| Thickness | 40 mm | Essential |
| Radius | 77 mm | Essential |
| **Wedge** | | |
| Name | ADUXE039A | Essential |
| Footprint | "Curvature along secondary axis" | Essential |
| Wedge angle | 22.3 | Essential |
| Roof angle | 6.0 | Essential |
| Sound velocity | "2330 m/s" | Essential |
| Height at the middle of the first element | "8.17 mm" for ADUXE039A | Essential |
| Primary axis offset of the middle of the first element | "8.43 mm" for ADUXE039A | Essential |
| Secondary axis offset of the middle of the first element | "7.74 mm" for ADUXE039A | Essential |
| Primary axis position of wedge reference | "-50.00 mm" | Essential |
| Secondary axis position of wedge reference | "-15.00 mm" | Essential |
| Wedge length | "50.00 mm" | Essential |

| | | |
|---|---|---|
| Distance between contact points (wedge width) | “30.00 mm” | Essential |
| **Scan** | | |
| Type | “Linear” | Essential |
| **Beam angles selection** | | |
| Primary steering angle | | Not applicable |
| Secondary steering angle | | Not applicable |
| Refracted angle | 270°-30°,45°,60°,70° | Essential |
| Beam skew angle | | Not applicable |
| **Focal points selection** | | |
| Focusing type | Auto | Essential |
| Focal plane position | | Not applicable |
| Emission focus position | | Not applicable |
| Reception focus position | | Not applicable |
| **Elements selection** | | |
| Improved resolution | Checked | Essential |
| Pulser Start | “ 1 “ | Essential |
| Pulser Stop | 9 | Essential |
| Pulser Resolution | “ 1 “ | Essential |
| Receiver Start | “ 1 “ | Essential |
| Primary axis aperture | 8 | Essential |
| Pulser connection | “ 1 “ | Essential |
| Receiver connection | “ 65 “ | Essential |
| **Hardware selection** | | |
| Type | “OmniScan 32/128” | Essential |

# OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
## WELD # FPLSTL-SRNZL-D01

| Menu item | Setting | Essential / Non-Essential / Not applicable |
|---|---|---|
| **File** | | |
| File | | |
| Destination | Storage Card | Non-Essential |
| Save Mode | A-Scan | Essential |
| File Name | ***FPLSTL-SRNZL-D01_155MM_CIRCD TRS 90_AUTO_CS_ADUXE039A*** | Essential |
| Report | | |
| Template | Complete | Non-Essential |
| File Name | ***FPLSTL-SRNZL-D01_155MM_CIRCD TRS 90_AUTO_CS_ADUXE039A*** | Essential |
| Paper Size | Letter | Non-Essential |
| Format | | |
| User field | Off | Non-Essential |
| Probe | Off | Non-Essential |
| Setup | On | Essential |
| Note | Off | Non-Essential |
| View | Current Layout | Non-Essential |
| User field | | Not applicable |
| Notes | | Not applicable |
| **Reading** | | |
| Result | | |
| Selector | List 1 | Essential |
| Field 1 | A% (Peak Amplitude in Gate) | Essential |
| Field 2 | A^ (Half Path position in Gate) | Essential |
| Field 3 | B% | Not applicable |
| Field 4 | B^ | Not applicable |
| Cursors | | Not applicable |
| Table | | Not applicable |
| Export | | Not applicable |
| **Utilities** | | |
| Pref. | | |
| Units | Millimeters | Essential |
| Bright (%) | 25 | Non-Essential |
| Scheme | Indoor | Non-Essential |
| System | | |
| Clock Set | *Set to correct time* | Essential |
| Date Set | *Set to correct date* | Essential |
| Time Zone | *Set to correct time zone* | Non-Essential |
| Daylight saving | On | Non-Essential |
| Select Key | F2 | Non-Essential |
| Assign Key | Gain | Non-Essential |

| | | | |
|---|---|---|---|
| Service | | | Not applicable |
| Options | | | Not applicable |
| Network | *Only for network saving* | | Non-Essential |
| **UT** | | | |
| General | | | |
| Gain | 28.5 | | Essential |
| Start | 0 | | Essential |
| Range | 116.28mm | | Essential |
| Wedge delay | 3.30 | | Essential |
| Velocity | 3230 m/s | | Essential |
| Pulser | | | |
| Pulser | 1 | | Not applicable |
| Tx/Rx mode | PE | | Essential |
| Freq | 1.5 | | Essential |
| Voltage | High | | Essential |
| PW | *Imported from LAW file (333 ns)* | | Essential |
| PRF | 25 | | Essential |
| Receiver | | | |
| Receiver | 1 | | Not applicable |
| Filter | None | | Essential |
| Rectifier | FW | | Essential |
| Video Filter | Off | | Essential |
| Receiver | | | |
| Averaging | 1 | | Essential |
| Reject | 0 | | Essential |
| Beam | | | |
| Gain Offset | *Imported from LAW file* | | Essential |
| Scan Offset | *Imported from LAW file* | | Essential |
| Index Offset | *Imported from LAW file* | | Essential |
| Angle | *Imported from LAW file* | | Essential |
| Skew | *Imported from LAW file* | | Essential |
| Beam Delay | *Imported from LAW file* | | Essential |
| Advanced | | | |
| dB Ref | Off | | Essential |
| Points Qty | 800 | | Essential |
| Scale Factor | 9 | | Essential |
| Sum Gain | *Imported from LAW file* | | Essential |
| **Scan** | | | |
| Encoder | | | |
| Encoder | 1 (Scan) | 2 (Index) | Essential |
| Polarity | Normal | Inverse | Essential |
| Type | Quad | | Essential |
| Resolution | 35.38 | 58.00 | Essential |
| Origin | 0 | | Essential |

| | | |
|---|---|---|
| Synchro | | |
| Source | Both Axes | Essential |
| Scan | Encoder 1 | Essential |
| Index | Encoder 2 | Not applicable |
| Scan Speed | 25 for scan resolution of 1 mm | Not applicable |
| Area | | |
| Scan Start | 0 mm | Essential |
| Scan End | 510 mm | |
| Scan Resolution | 1.0 mm | Essential |
| Index start | -70.2 mm | Essential |
| Index end | -14.3 mm | Essential |
| Index resolution | 14.0 mm | Essential |
| Start | | |
| Start Mode | Reset All | Essential |
| Pause | Off | Non-Essential |
| Data | | |
| Storage | Last | Essential |
| **Display** | | |
| Selection | | |
| Display | A-S-C | Essential |
| C-Scan 1 | A% | Non-Essential |
| Group | Current | Non-Essential |
| Projection | On | Not applicable |
| Rulers | | |
| UT Unit | Sound Path | Essential |
| % Ruler | Linear(%) | Essential |
| Grid | Off | Non-Essential |
| DAC / TCG | Off | Essential |
| Gate | On | Essential |
| Cursor | On | Essential |
| Zoom | | Not applicable |
| Color | | |
| Select | Amplitude | Essential |
| Start (%) | 0.0 | Essential |
| End (%) | 100.0 | Essential |
| Properties | | Not applicable |
| **Probe/Part** | | |
| Select | | |
| Group | 1 | Not applicable |
| Group Link | Off | Not applicable |
| Select | Select Tx/Rx | Essential |
| Select Probe | Unknown | Not applicable |
| Select Wedge | Contact / Contact | Not applicable |
| Auto Detect | Off | Essential |

| | | | | |
|---|---|---|---|---|
| Scan Offset | 0 | | | Essential |
| Index Offset | 0 | | | Essential |
| Skew | 0 | | | Essential |
| Characterize | | | | Not applicable |
| Parts | | | | Not applicable |
| Wizard | | | | Not applicable |
| **PGM Probe** | | | | |
| Configuration | | | | |
| Group | 1 | | | Not applicable |
| Enable | Off | | | Not applicable |
| Scan Type | Custom | | | Essential |
| Connection P | 1 | | | Not applicable |
| Connection R | 1 | | | Not applicable |
| Aperture | | | | Not applicable |
| Beam | | | | Not applicable |
| Laws | | | | |
| Auto Program | Off | | | Essential |
| Wizard | | | | Not applicable |
| **Gate/Alarm** | | | | |
| Gate | | | | |
| Gate Select | Gate A | B | I | Essential |
| Gate Start | 10 | 0 | 0 | Essential |
| Width | End of time base | 0 | 0 | Non-Essential |
| Threshold | 25 | 0 | 0 | Essential |
| Mode | Positive | | | Not applicable |
| Synchro | Pulse | | | Essential |
| Alarms | | | | Not applicable |
| Output | | | | Not applicable |
| **Gate/Alarm (ctd.)** | | | | |
| DAC / TCG | | | | Not applicable |
| Thickness | | | | Not applicable |
| **Calibration** | | | | |
| Phased Array | | | | Not applicable |
| Axis | | | | Not applicable |
| TCG | | | | Not applicable |
| Code | | | | Not applicable |
| **User** | | | | |
| Gain | | | | Not applicable |
| Start | | | | Not applicable |
| Range | | | | Not applicable |
| Display | | | | Not applicable |
| Gate | | | | Not applicable |

*Focal Law Calculator Inputs*

| **Menu item** | Setting | Essential / Non-Essential / Not applicable |
|---|---|---|
| **Probe (CS) 90°** | | |
| Name | 1.5M16x2E32-7(EWUXE083A) | Essential |
| Probe Skew Angle | 90° | Essential |
| Probe Frequency | 1.5 MHz | Essential |
| Number of elements on primary axis | 16 | Essential |
| Primary axis pitch | 2 mm | Essential |
| Secondary axis width | 7 mm | Essential |
| Pitch and Catch | Checked | Essential |
| Probe separation | | Not applicable |
| Squint angle | "0.0°" | Essential |
| Reverse primary axis | Unchecked | Essential |
| **Specimen** | | |
| Name | Memphis CS SW | Non-Essential |
| Specimen Type | "Pipe OD" | Essential |
| Wave type | "Transverse" for TRL | Essential |
| Sound velocity | 90°-3230 m/s | Essential |
| Thickness | 40 mm | Essential |
| Radius | 77 mm | Essential |
| **Wedge** | | |
| Name | ADUXE039A | Essential |
| Footprint | "Curvature along secondary axis" | Essential |
| Wedge angle | 22.3 | Essential |
| Roof angle | 6.0 | Essential |
| Sound velocity | "2330 m/s" | Essential |
| Height at the middle of the first element | "8.17 mm" for ADUXE039A | Essential |
| Primary axis offset of the middle of the first element | "8.43 mm" for ADUXE039A | Essential |
| Secondary axis offset of the middle of the first element | "7.74 mm" for ADUXE039A | Essential |
| Primary axis position of wedge reference | "-50.00 mm" | Essential |
| Secondary axis position of wedge reference | "-15.00 mm" | Essential |

| | | |
|---|---|---|
| Wedge length | “50.00 mm” | Essential |
| Distance between contact points (wedge width) | “30.00 mm” | Essential |
| **Scan** | | |
| Type | “Linear” | Essential |
| **Beam angles selection** | | |
| Primary steering angle | | Not applicable |
| Secondary steering angle | | Not applicable |
| Refracted angle | 90°-45°,60° | Essential |
| Beam skew angle | | Not applicable |
| **Focal points selection** | | |
| Focusing type | Auto | Essential |
| Focal plane position | | Not applicable |
| Emission focus position | | Not applicable |
| Reception focus position | | Not applicable |
| **Elements selection** | | |
| Improved resolution | Checked | Essential |
| Pulser Start | “ 1 “ | Essential |
| Pulser Stop | 9 | Essential |
| Pulser Resolution | “ 1 “ | Essential |
| Receiver Start | “ 1 “ | Essential |
| Primary axis aperture | 8 | Essential |
| Pulser connection | “ 1 “ | Essential |
| Receiver connection | “ 65 “ | Essential |
| **Hardware selection** | | |
| Type | “OmniScan 32/128” | Essential |

# OMNISCAN PHASED ARRAY INSTRUMENT SETTINGS
## WELD # FPLSTL-SRNZL-D01

| Menu item | Setting | Essential / Non-Essential / Not applicable |
|---|---|---|
| **File** | | |
| File | | |
| Destination | Storage Card | Non-Essential |
| Save Mode | A-Scan | Essential |
| File Name | ***FPLSTL-SRNZL-D01_155MM_CIRCUTRS_270_AUTO_CS_ADUXE039A*** | Essential |
| Report | | |
| Template | Complete | Non-Essential |
| File Name | ***FPLSTL-SRNZL-D01_155MM_CIRCUTRS_270_AUTO_CS_ADUXE039A*** | Essential |
| Paper Size | Letter | Non-Essential |
| Format | | |
| User field | Off | Non-Essential |
| Probe | Off | Non-Essential |
| Setup | On | Essential |
| Note | Off | Non-Essential |
| View | Current Layout | Non-Essential |
| User field | | Not applicable |
| Notes | | Not applicable |
| **Reading** | | |
| Result | | |
| Selector | List 1 | Essential |
| Field 1 | A% (Peak Amplitude in Gate) | Essential |
| Field 2 | A^ (Half Path position in Gate) | Essential |
| Field 3 | B% | Not applicable |
| Field 4 | B^ | Not applicable |
| Cursors | | Not applicable |
| Table | | Not applicable |
| Export | | Not applicable |
| **Utilities** | | |
| Pref. | | |
| Units | Millimeters | Essential |
| Bright (%) | 25 | Non-Essential |
| Scheme | Indoor | Non-Essential |
| System | | |
| Clock Set | *Set to correct time* | Essential |
| Date Set | *Set to correct date* | Essential |
| Time Zone | *Set to correct time zone* | Non-Essential |
| Daylight saving | On | Non-Essential |
| Select Key | F2 | Non-Essential |
| Assign Key | Gain | Non-Essential |

| | | | |
|---|---|---|---|
| Service | | | Not applicable |
| Options | | | Not applicable |
| Network | *Only for network saving* | | Non-Essential |
| **UT** | | | |
| General | | | |
| Gain | 28.5 | | Essential |
| Start | 0 | | Essential |
| Range | 113.40 mm | | Essential |
| Wedge delay | 3.30 | | Essential |
| Velocity | 3150 m/s | | Essential |
| Pulser | | | |
| Pulser | 1 | | Not applicable |
| Tx/Rx mode | PE | | Essential |
| Freq | 1.5 | | Essential |
| Voltage | High | | Essential |
| PW | *Imported from LAW file (333 ns)* | | Essential |
| PRF | 25 | | Essential |
| Receiver | | | |
| Receiver | 1 | | Not applicable |
| Filter | None | | Essential |
| Rectifier | FW | | Essential |
| Video Filter | Off | | Essential |
| Receiver | | | |
| Averaging | 1 | | Essential |
| Reject | 0 | | Essential |
| Beam | | | |
| Gain Offset | *Imported from LAW file* | | Essential |
| Scan Offset | *Imported from LAW file* | | Essential |
| Index Offset | *Imported from LAW file* | | Essential |
| Angle | *Imported from LAW file* | | Essential |
| Skew | *Imported from LAW file* | | Essential |
| Beam Delay | *Imported from LAW file* | | Essential |
| Advanced | | | |
| dB Ref | Off | | Essential |
| Points Qty | 800 | | Essential |
| Scale Factor | 9 | | Essential |
| Sum Gain | *Imported from LAW file* | | Essential |
| **Scan** | | | |
| Encoder | | | |
| Encoder | 1 (Scan) | 2 (Index) | Essential |
| Polarity | Normal | Inverse | Essential |
| Type | Quad | | Essential |
| Resolution | 35.38 | 58.00 | Essential |
| Origin | 0 | | Essential |

| | | |
|---|---|---|
| Synchro | | |
| Source | Both Axes | Essential |
| Scan | Encoder 1 | Essential |
| Index | Encoder 2 | Not applicable |
| Scan Speed | 25 for scan resolution of 1 mm | Not applicable |
| Area | | |
| Scan Start | 0 mm | Essential |
| Scan End | 510 mm | |
| Scan Resolution | 1.0 mm | Essential |
| Index start | 9.3 mm | Essential |
| Index end | 65.2 mm | Essential |
| Index resolution | 14.0 mm | Essential |
| Start | | |
| Start Mode | Reset All | Essential |
| Pause | Off | Non-Essential |
| Data | | |
| Storage | Last | Essential |
| **Display** | | |
| Selection | | |
| Display | A-S-C | Essential |
| C-Scan 1 | A% | Non-Essential |
| Group | Current | Non-Essential |
| Projection | On | Not applicable |
| Rulers | | |
| UT Unit | Sound Path | Essential |
| % Ruler | Linear(%) | Essential |
| Grid | Off | Non-Essential |
| DAC / TCG | Off | Essential |
| Gate | On | Essential |
| Cursor | On | Essential |
| Zoom | | Not applicable |
| Color | | |
| Select | Amplitude | Essential |
| Start (%) | 0.0 | Essential |
| End (%) | 100.0 | Essential |
| Properties | | Not applicable |
| **Probe/Part** | | |
| Select | | |
| Group | 1 | Not applicable |
| Group Link | Off | Not applicable |
| Select | Select Tx/Rx | Essential |
| Select Probe | Unknown | Not applicable |
| Select Wedge | Contact / Contact | Not applicable |
| Auto Detect | Off | Essential |

| | | | | |
|---|---|---|---|---|
| Scan Offset | 0 | | | Essential |
| Index Offset | 0 | | | Essential |
| Skew | 0 | | | Essential |
| Characterize | | | | Not applicable |
| Parts | | | | Not applicable |
| Wizard | | | | Not applicable |
| **PGM Probe** | | | | |
| Configuration | | | | |
| Group | 1 | | | Not applicable |
| Enable | Off | | | Not applicable |
| Scan Type | Custom | | | Essential |
| Connection P | 1 | | | Not applicable |
| Connection R | 1 | | | Not applicable |
| Aperture | | | | Not applicable |
| Beam | | | | Not applicable |
| Laws | | | | |
| Auto Program | Off | | | Essential |
| Wizard | | | | Not applicable |
| **Gate/Alarm** | | | | |
| Gate | | | | |
| Gate Select | Gate A | B | I | Essential |
| Gate Start | 10 | 0 | 0 | Essential |
| Width | End of time base | 0 | 0 | Non-Essential |
| Threshold | 25 | 0 | 0 | Essential |
| Mode | Positive | | | Not applicable |
| Synchro | Pulse | | | Essential |
| Alarms | | | | Not applicable |
| Output | | | | Not applicable |
| **Gate/Alarm (ctd.)** | | | | |
| DAC / TCG | | | | Not applicable |
| Thickness | | | | Not applicable |
| **Calibration** | | | | |
| Phased Array | | | | Not applicable |
| Axis | | | | Not applicable |
| TCG | | | | Not applicable |
| Code | | | | Not applicable |
| **User** | | | | |
| Gain | | | | Not applicable |
| Start | | | | Not applicable |
| Range | | | | Not applicable |
| Display | | | | Not applicable |
| Gate | | | | Not applicable |

*Focal Law Calculator Inputs*

| **Menu item** | Setting | Essential / Non-Essential / Not applicable |
|---|---|---|
| **Probe (CS) 270°** | | |
| Name | 1.5M16x2E32-7(EWUXE083A) | Essential |
| Probe Skew Angle | 270° | Essential |
| Probe Frequency | 1.5 MHz | Essential |
| Number of elements on primary axis | 16 | Essential |
| Primary axis pitch | 2 mm | Essential |
| Secondary axis width | 7 mm | Essential |
| Pitch and Catch | Checked | Essential |
| Probe separation | | Not applicable |
| Squint angle | "0.0°" | Essential |
| Reverse primary axis | Unchecked | Essential |
| **Specimen** | | |
| Name | Memphis SS SW | Non-Essential |
| Specimen Type | "Pipe OD" | Essential |
| Wave type | "Transverse" for TRL | Essential |
| Sound velocity | 270°-3150 m/s | Essential |
| Thickness | 40 mm | Essential |
| Radius | 77 mm | Essential |
| **Wedge** | | |
| Name | ADUXE039A | Essential |
| Footprint | "Curvature along secondary axis" | Essential |
| Wedge angle | 22.3 | Essential |
| Roof angle | 6.0 | Essential |
| Sound velocity | "2330 m/s" | Essential |
| Height at the middle of the first element | "8.17 mm" for ADUXE039A | Essential |
| Primary axis offset of the middle of the first element | "8.43 mm" for ADUXE039A | Essential |
| Secondary axis offset of the middle of the first element | "7.74 mm" for ADUXE039A | Essential |
| Primary axis position of wedge reference | "-50.00 mm" | Essential |
| Secondary axis position of wedge reference | "-15.00 mm" | Essential |

| | | |
|---|---|---|
| Wedge length | “50.00 mm” | Essential |
| Distance between contact points (wedge width) | “30.00 mm” | Essential |
| **Scan** | | |
| Type | “Linear” | Essential |
| **Beam angles selection** | | |
| Primary steering angle | | Not applicable |
| Secondary steering angle | | Not applicable |
| Refracted angle | 270°-45°,60° | Essential |
| Beam skew angle | | Not applicable |
| **Focal points selection** | | |
| Focusing type | Auto | Essential |
| Focal plane position | | Not applicable |
| Emission focus position | | Not applicable |
| Reception focus position | | Not applicable |
| **Elements selection** | | |
| Improved resolution | Checked | Essential |
| Pulser Start | “ 1 “ | Essential |
| Pulser Stop | 9 | Essential |
| Pulser Resolution | “ 1 “ | Essential |
| Receiver Start | “ 1 “ | Essential |
| Primary axis aperture | 8 | Essential |
| Pulser connection | “ 1 “ | Essential |
| Receiver connection | “ 65 “ | Essential |
| **Hardware selection** | | |
| Type | “OmniScan 32/128” | Essential |

# OmniScan Report

| Report Date | Report Version | Setup File name | Date of Inspection | Inspection Version | Save Mode |
|---|---|---|---|---|---|
| 2008 / 03 / 12 | 1.4R3 | FPLSTL-SRNZL-D01_155MM_CIRCD TRL 90_AUTO_CS_ADUXE039A.opd | 2008 / 03 / 12 | 1.4R3 | A Scan |
| **OmniScan Type** | **OmniScan Serial #** | **Module Type** | **Module Serial #** | **Calibration Due** | **Data File name** |
| OmniScan MX | OMNI-Z-1012 | OMNI-M-PA32128PR | OMNI-Z-6012 | 2008 / 11 / 21 | FPLSTL-SRNZL-D01_155MM_CIRCD TRL 90_AUTO_CS_ADUXE039A |

**Group 1**

Setup

**A:30.0 Sk:090 L:001**

| Beam Delay | Start (Half Path) | Range (Half Path) | PRF | Type | Averaging Factor |
|---|---|---|---|---|---|
| 12.10 us | -0.02 mm | 113.09 mm | 25 | PA | 1 |
| **Scale Type** | **Scale Factor** | **Video Filter** | **Pretrig** | **Rectification** | **Band Pass Filter** |
| Compression | 6 | Off | 0.00 µs | FW | None (0.52 - 19 MHz) |
| **Voltage** | **Gain** | **Mode** | **Wave Type** | **Sound Velocity** | **Pulse Width** |
| High | 34.50 dB | PC (Pitch And Catch) | User Defined | 5890.0 m/s | 332.50 ns |
| **Scan Offset** | **Index Offset** | **Skew** | | | |
| 0.00 mm | 0.00 mm | N/A | | | |

| Gate | Start | Width | Threshold | Synchro |
|---|---|---|---|---|
| I | 0.04 mm | 1.00 mm | 0.00 % | Pulse |
| A | 10.23 mm | 122.48 mm | 25.00 % | Pulse |
| B | 0.04 mm | 1.00 mm | 0.00 % | Pulse |

Law

| Law File name | Scan Type |
|---|---|
| DM_155_CIRCD TRL 90_AUTO_CS_ADUXE039A.law | Custom |

Part

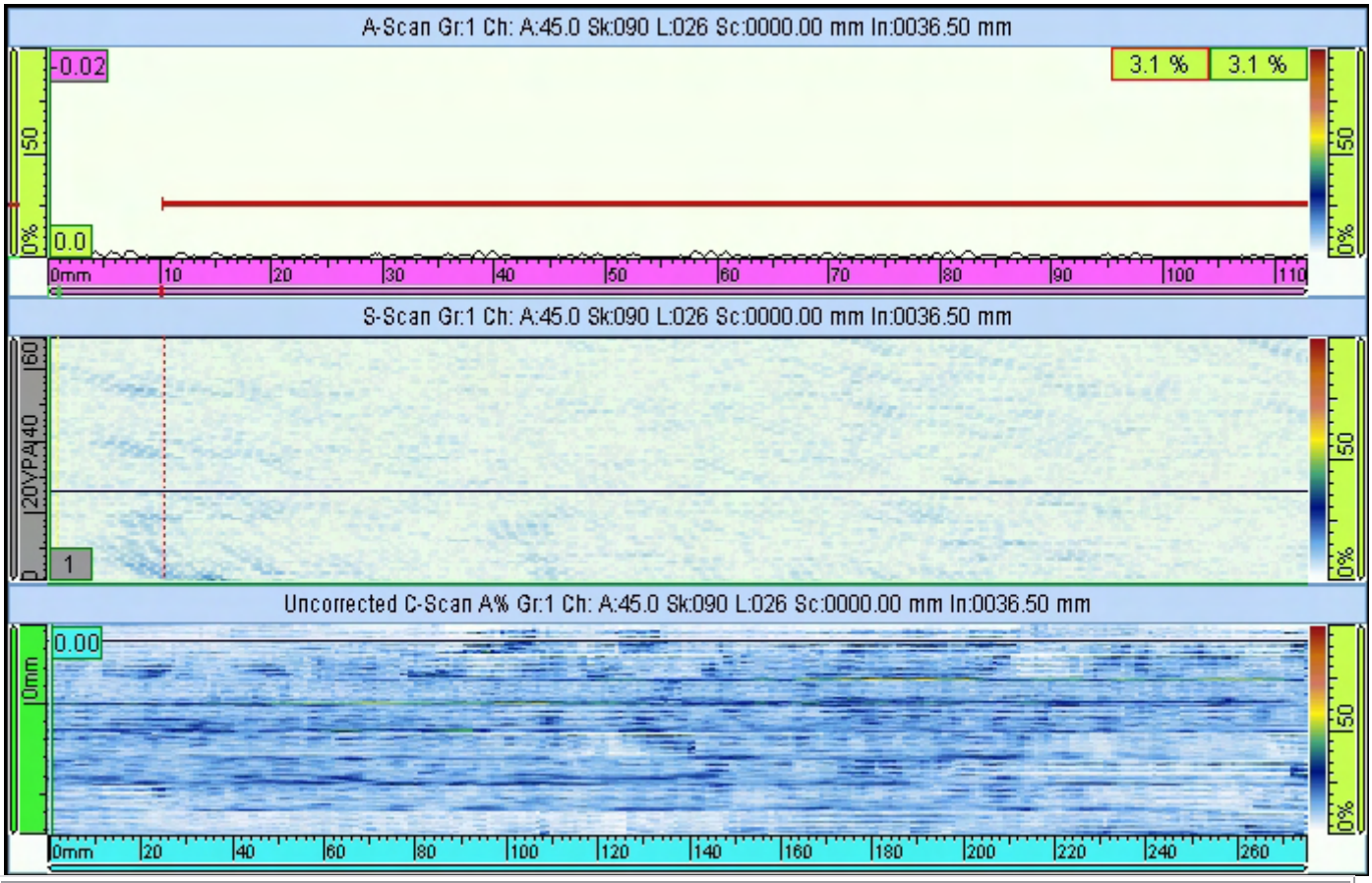
| Material | Geometry | Thickness |
|---|---|---|
| STEEL MILD | Plate | 50.00 mm |

Scan Area

| Scan Start | Scan Length | Scan Resolution | Index Start | Index Length | Index Resolution |
|---|---|---|---|---|---|
| 0.00 mm | 275.00 mm | 1.00 mm | -65.70 mm | 102.20 mm | 14.60 mm |
| **Synchro** | **Max Scan Speed** | | | | |
| Both Axis | 25.00 mm/s | | | | |

| Axis | Encoder | Encoder Type | Encoder Resolution | Polarity |
|---|---|---|---|---|
| Scan | 1 | Quadrature | 35.36 step/mm | Normal |
| Index | 2 | Quadrature | 58.00 step/mm | Inverse |

| A% | A^ | B% | B^ | None | None | None | None |
|---|---|---|---|---|---|---|---|
| 4.3 % | --- mm | 2.7 % | 0.10 mm | | | | |




**Technician Name** Todd P. Blechinger

**Technician Signature**

**Contractor** LMTINC.

**Date** 3/12/08

# OmniScan Report

| Report Date | Report Version | Setup File name | Date of Inspection | Inspection Version | Save Mode |
|---|---|---|---|---|---|
| 2008 / 03 / 12 | 1.4R3 | FPLSTL-SRNZL-D01_155MM_CIRCD TRL 90_AUTO_CS_ADUXE039A245TO510.opd | 2008 / 03 / 12 | 1.4R3 | A Scan |
| **OmniScan Type** | **OmniScan Serial #** | **Module Type** | **Module Serial #** | **Calibration Due** | **Data File name** |
| OmniScan MX | OMNI-Z-1012 | OMNI-M-PA32128PR | OMNI-Z-6012 | 2008 / 11 / 21 | FPLSTL-SRNZL-D01_155MM_CIRCD TRL 90_AUTO_CS_ADUXE039A245TO510 |

**Group 1**

Setup

**A:30.0 Sk:090 L:001**

| Beam Delay | Start (Half Path) | Range (Half Path) | PRF | Type | Averaging Factor |
|---|---|---|---|---|---|
| 12.10 us | -0.02 mm | 113.09 mm | 25 | PA | 1 |
| **Scale Type** | **Scale Factor** | **Video Filter** | **Pretrig** | **Rectification** | **Band Pass Filter** |
| Compression | 6 | Off | 0.00 µs | FW | None (0.52 - 19 MHz) |
| **Voltage** | **Gain** | **Mode** | **Wave Type** | **Sound Velocity** | **Pulse Width** |
| High | 34.50 dB | PC (Pitch And Catch) | User Defined | 5890.0 m/s | 332.50 ns |
| **Scan Offset** | **Index Offset** | **Skew** | | | |
| 0.00 mm | 0.00 mm | N/A | | | |

| Gate | Start | Width | Threshold | Synchro |
|---|---|---|---|---|
| I | 0.04 mm | 1.00 mm | 0.00 % | Pulse |
| A | 10.23 mm | 122.48 mm | 25.00 % | Pulse |
| B | 0.04 mm | 1.00 mm | 0.00 % | Pulse |

Law

| Law File name | Scan Type |
|---|---|
| DM_155_CIRCD TRL 90_AUTO_CS_ADUXE039A.law | Custom |

Part

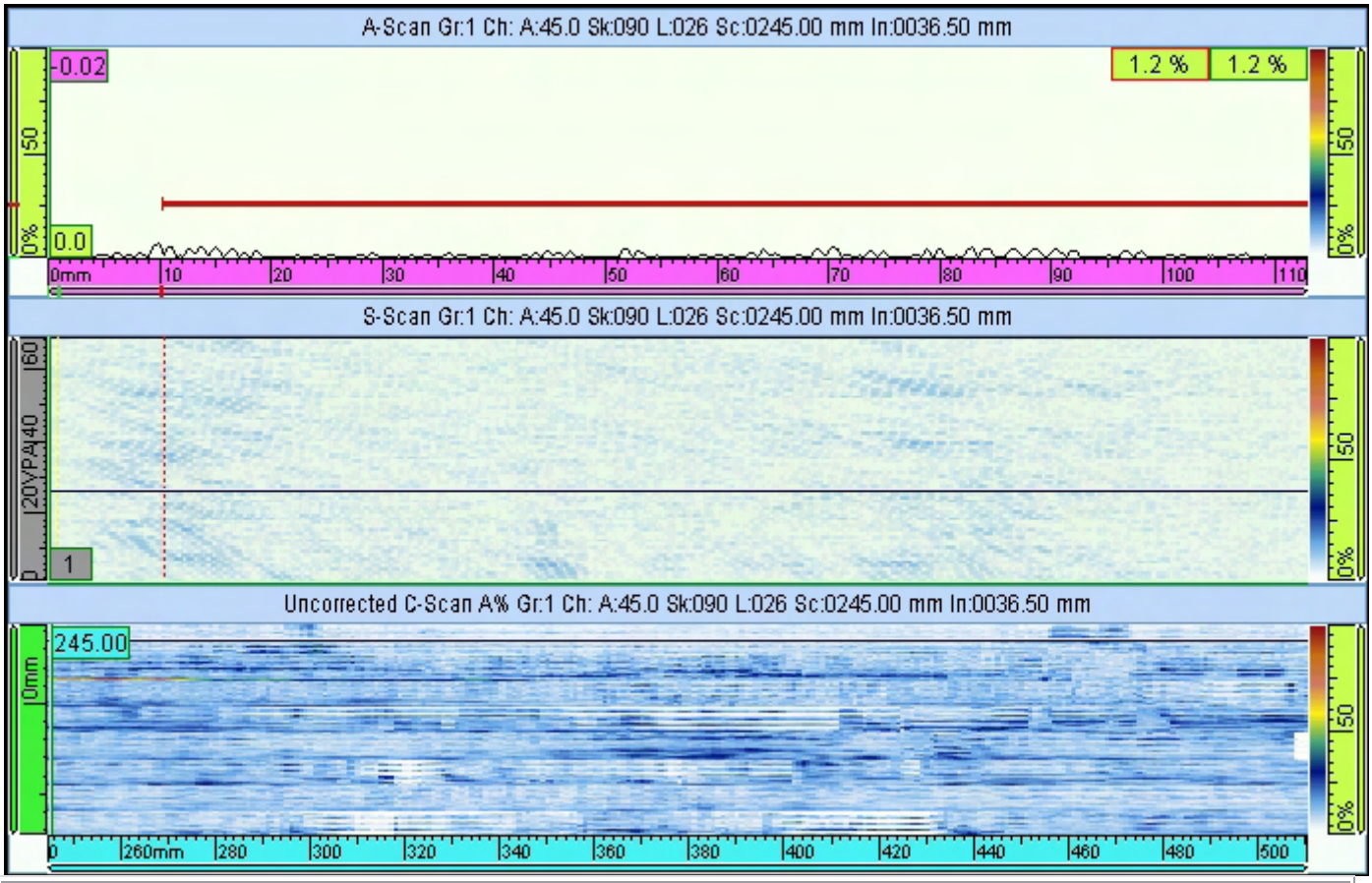
| Material | Geometry | Thickness |
|---|---|---|
| STEEL MILD | Plate | 50.00 mm |

Scan Area

| Scan Start | Scan Length | Scan Resolution | Index Start | Index Length | Index Resolution |
|---|---|---|---|---|---|
| 245.00 mm | 265.00 mm | 1.00 mm | -65.70 mm | 102.20 mm | 14.60 mm |
| **Synchro** | **Max Scan Speed** | | | | |
| Both Axis | 25.00 mm/s | | | | |

| Axis | Encoder | Encoder Type | Encoder Resolution | Polarity |
|---|---|---|---|---|
| Scan | 1 | Quadrature | 35.36 step/mm | Normal |
| Index | 2 | Quadrature | 58.00 step/mm | Inverse |

| A% | A^ | B% | B^ | None | None | None | None |
|---|---|---|---|---|---|---|---|
| 6.3 % | --- mm | 1.2 % | 0.07 mm | | | | |




| | |
|---|---|
| **Technician Name** | Todd P. Blechinger |
| **Technician Signature** | |
| **Contractor** | LMT INC. |
| **Date** | 3/12/08 |

# OmniScan Report

| Report Date | Report Version | Setup File name | Date of Inspection | Inspection Version | Save Mode |
|---|---|---|---|---|---|
| 2008 / 03 / 12 | 1.4R3 | FPLSTL-SRNZL-D01_155MM_CIRCU TRL 270_AUTO_CS_ADUXE039A.opd | 2008 / 03 / 12 | 1.4R3 | A Scan |
| **OmniScan Type** | **OmniScan Serial #** | **Module Type** | **Module Serial #** | **Calibration Due** | **Data File name** |
| OmniScan MX | OMNI-Z-1012 | OMNI-M-PA32128PR | OMNI-Z-6012 | 2008 / 11 / 21 | FPLSTL-SRNZL-D01_155MM_CIRCU TRL 270_AUTO_CS_ADUXE039A |

**Group 1**

Setup

**A:30.0 Sk:270 L:001**

| Beam Delay | Start (Half Path) | Range (Half Path) | PRF | Type | Averaging Factor |
|---|---|---|---|---|---|
| 12.08 us | -0.02 mm | 110.78 mm | 25 | PA | 1 |
| **Scale Type** | **Scale Factor** | **Video Filter** | **Pretrig** | **Rectification** | **Band Pass Filter** |
| Compression | 6 | Off | 0.00 µs | FW | None (0.52 - 19 MHz) |
| **Voltage** | **Gain** | **Mode** | **Wave Type** | **Sound Velocity** | **Pulse Width** |
| High | 34.50 dB | PC (Pitch And Catch) | User Defined | 5770.0 m/s | 332.50 ns |
| **Scan Offset** | **Index Offset** | **Skew** | | | |
| 0.00 mm | 0.00 mm | N/A | | | |

| Gate | Start | Width | Threshold | Synchro |
|---|---|---|---|---|
| I | 0.02 mm | 0.98 mm | 0.00 % | Pulse |
| A | 10.00 mm | 119.99 mm | 25.00 % | Pulse |
| B | 0.02 mm | 0.98 mm | 0.00 % | Pulse |

Law

| Law File name | Scan Type |
|---|---|
| DM_155_CIRCU TRL 270_AUTO_CS_ADUXE039A.law | Custom |

Part

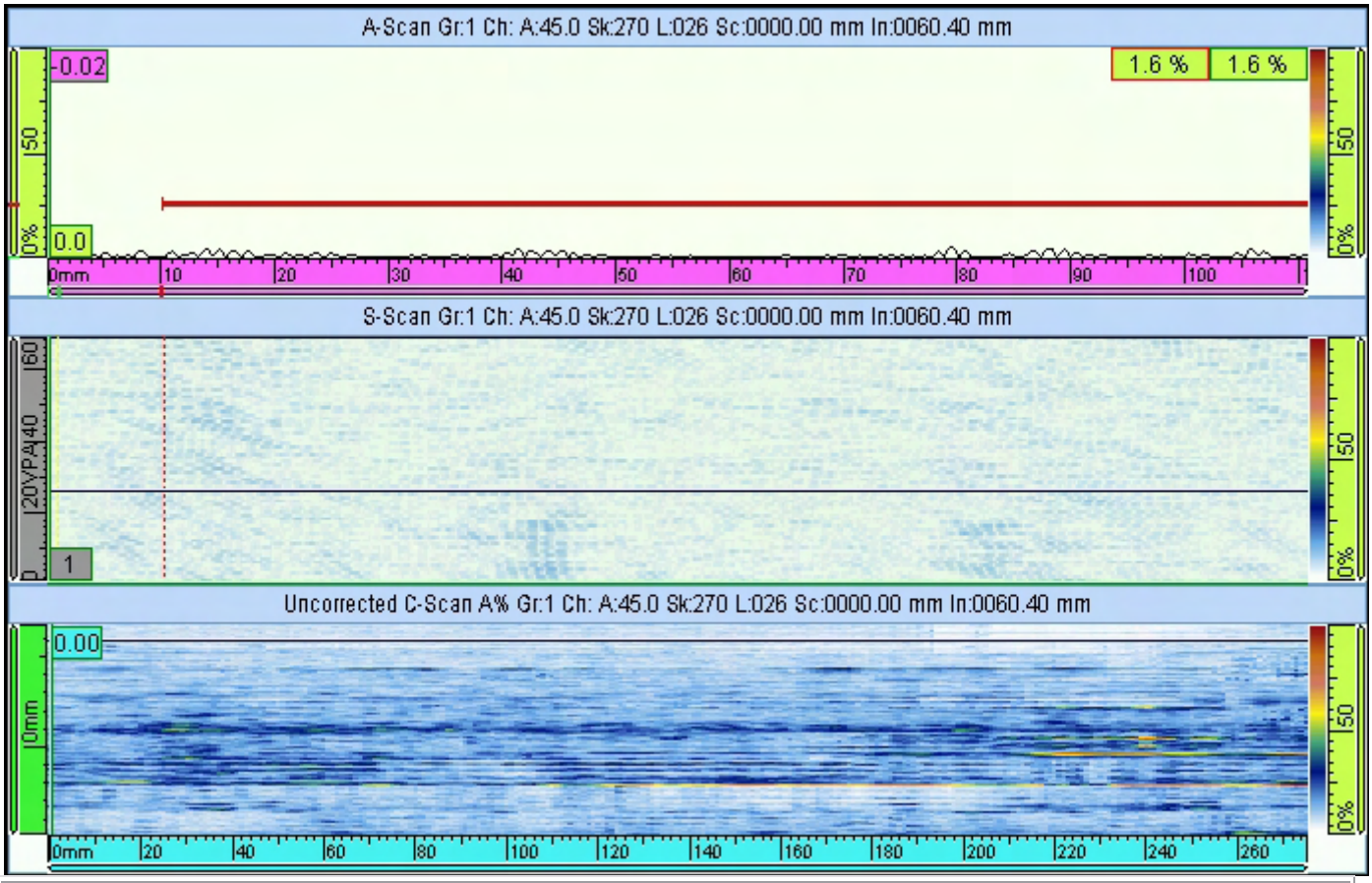
| Material | Geometry | Thickness |
|---|---|---|
| STEEL MILD | Plate | 50.00 mm |

Scan Area

| Scan Start | Scan Length | Scan Resolution | Index Start | Index Length | Index Resolution |
|---|---|---|---|---|---|
| 0.00 mm | 275.00 mm | 1.00 mm | -41.80 mm | 102.20 mm | 14.60 mm |
| **Synchro** | **Max Scan Speed** | | | | |
| Both Axis | 25.00 mm/s | | | | |

| Axis | Encoder | Encoder Type | Encoder Resolution | Polarity |
|---|---|---|---|---|
| Scan | 1 | Quadrature | 35.36 step/mm | Normal |
| Index | 2 | Quadrature | 58.00 step/mm | Inverse |

| A% | A^ | B% | B^ | None | None | None | None |
|---|---|---|---|---|---|---|---|
| 6.3 % | --- mm | 1.6 % | 0.19 mm | | | | |




**Technician Name** Todd P. Blechinger

**Technician Signature**

**Contractor** LMT INC.

**Date** 3/12/08

# OmniScan Report

| Report Date | Report Version | Setup File name | Date of Inspection | Inspection Version | Save Mode |
|---|---|---|---|---|---|
| 2008 / 03 / 12 | 1.4R3 | FPLSTL-SRNZL-D01_155MM_CIRCU TRL 270_AUTO_CS_ADUXE039A_245TO510.opd | 2008 / 03 / 12 | 1.4R3 | A Scan |
| **OmniScan Type** | **OmniScan Serial #** | **Module Type** | **Module Serial #** | **Calibration Due** | **Data File name** |
| OmniScan MX | OMNI-Z-1012 | OMNI-M-PA32128PR | OMNI-Z-6012 | 2008 / 11 / 21 | FPLSTL-SRNZL-D01_155MM_CIRCU TRL 270_AUTO_CS_ADUXE039A_245TO510 |

**Group 1**

Setup

**A:30.0 Sk:270 L:001**

| Beam Delay | Start (Half Path) | Range (Half Path) | PRF | Type | Averaging Factor |
|---|---|---|---|---|---|
| 12.08 us | -0.02 mm | 110.78 mm | 25 | PA | 1 |
| **Scale Type** | **Scale Factor** | **Video Filter** | **Pretrig** | **Rectification** | **Band Pass Filter** |
| Compression | 6 | Off | 0.00 µs | FW | None (0.52 - 19 MHz) |
| **Voltage** | **Gain** | **Mode** | **Wave Type** | **Sound Velocity** | **Pulse Width** |
| High | 34.50 dB | PC (Pitch And Catch) | User Defined | 5770.0 m/s | 332.50 ns |
| **Scan Offset** | **Index Offset** | **Skew** | | | |
| 0.00 mm | 0.00 mm | N/A | | | |

| Gate | Start | Width | Threshold | Synchro |
|---|---|---|---|---|
| I | 0.02 mm | 0.98 mm | 0.00 % | Pulse |
| A | 10.00 mm | 119.99 mm | 25.00 % | Pulse |
| B | 0.02 mm | 0.98 mm | 0.00 % | Pulse |

Law

| Law File name | Scan Type |
|---|---|
| DM_155_CIRCU TRL 270_AUTO_CS_ADUXE039A.law | Custom |

Part

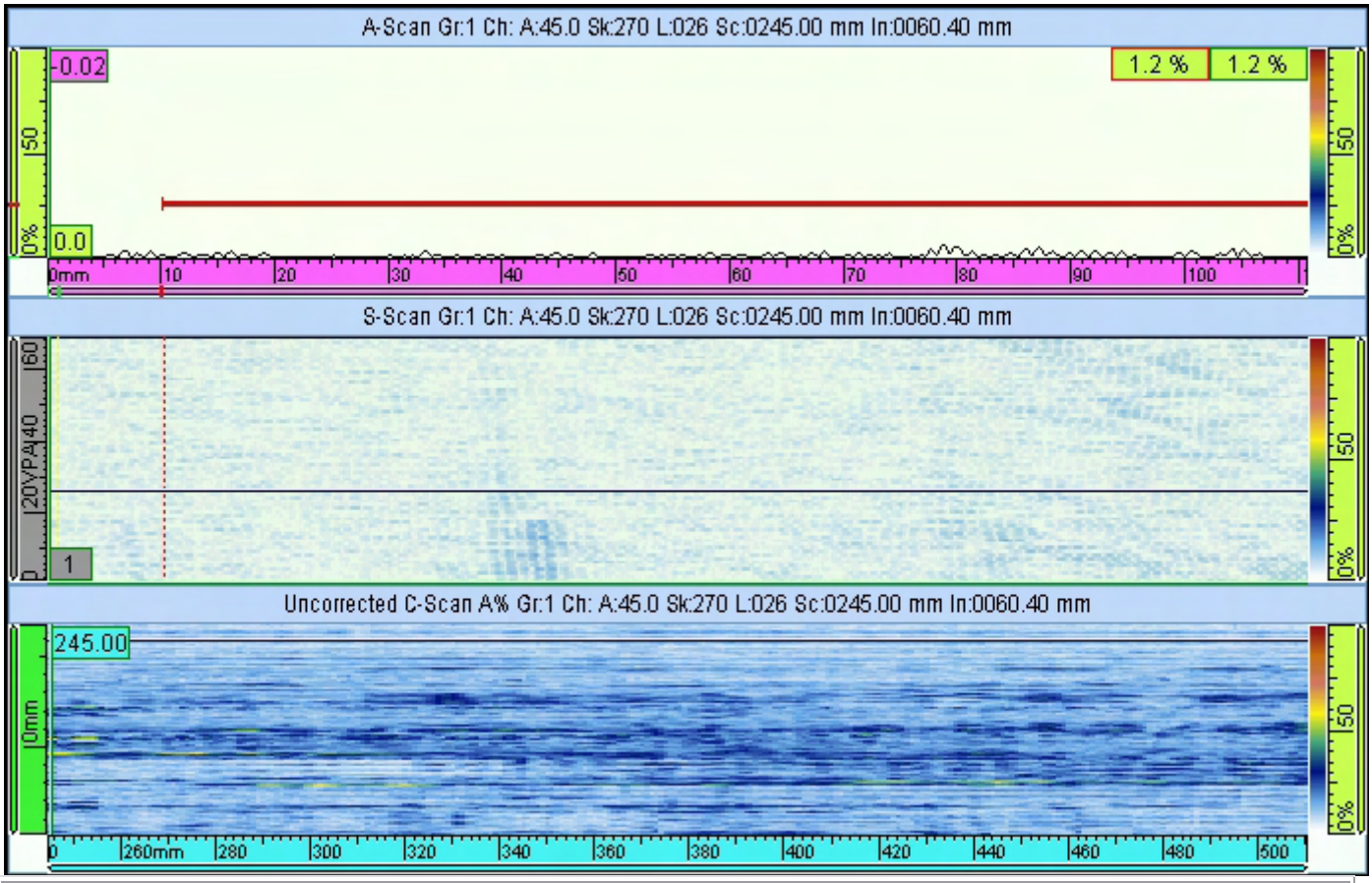
| Material | Geometry | Thickness |
|---|---|---|
| STEEL MILD | Plate | 50.00 mm |

Scan Area

| Scan Start | Scan Length | Scan Resolution | Index Start | Index Length | Index Resolution |
|---|---|---|---|---|---|
| 245.00 mm | 265.00 mm | 1.00 mm | -41.80 mm | 102.20 mm | 14.60 mm |
| **Synchro** | **Max Scan Speed** | | | | |
| Both Axis | 25.00 mm/s | | | | |

| Axis | Encoder | Encoder Type | Encoder Resolution | Polarity |
|---|---|---|---|---|
| Scan | 1 | Quadrature | 35.36 step/mm | Normal |
| Index | 2 | Quadrature | 58.00 step/mm | Inverse |

| A% | A^ | B% | B^ | None | None | None | None |
|---|---|---|---|---|---|---|---|
| 6.7 % | --- mm | 1.2 % | 0.02 mm | | | | |




| | |
|---|---|
| **Technician Name** | Todd P. Blechinger |
| **Technician Signature** | |
| **Contractor** | LMT INC. |
| **Date** | 3/12/08 |

# OmniScan Report

| Report Date | Report Version | Setup File name | Date of Inspection | Inspection Version | Save Mode |
|---|---|---|---|---|---|
| 2008 / 03 / 13 | 1.4R3 | FPLSTL-SRNZL-D01_155MM_CIRCD TRS 90_AUTO_CS_ADUXE039A.opd | 2008 / 03 / 13 | 1.4R3 | A Scan |
| **OmniScan Type** | **OmniScan Serial #** | **Module Type** | **Module Serial #** | **Calibration Due** | **Data File name** |
| OmniScan MX | OMNI-Z-1012 | OMNI-M-PA32128PR | OMNI-Z-6012 | 2008 / 11 / 21 | FPLSTL-SRNZL-D01_155MM_CIRCD TRS 90_AUTO_CS_ADUXE039A |

**Group 1**

Setup

**A:45.0 Sk:090 L:001**

| Beam Delay | Start (Half Path) | Range (Half Path) | PRF | Type | Averaging Factor |
|---|---|---|---|---|---|
| 13.96 us | -0.01 mm | 116.28 mm | 25 | PA | 1 |
| **Scale Type** | **Scale Factor** | **Video Filter** | **Pretrig** | **Rectification** | **Band Pass Filter** |
| Compression | 9 | Off | 0.00 µs | FW | None (0.52 - 19 MHz) |
| **Voltage** | **Gain** | **Mode** | **Wave Type** | **Sound Velocity** | **Pulse Width** |
| High | 28.50 dB | PC (Pitch And Catch) | User Defined | 3230.0 m/s | 332.50 ns |
| **Scan Offset** | **Index Offset** | **Skew** | | | |
| 0.00 mm | 0.00 mm | N/A | | | |

| Gate | Start | Width | Threshold | Synchro |
|---|---|---|---|---|
| I | 0.02 mm | 0.55 mm | 0.00 % | Pulse |
| A | 5.61 mm | 67.17 mm | 25.00 % | Pulse |
| B | 0.02 mm | 0.55 mm | 0.00 % | Pulse |

Law

| Law File name | Scan Type |
|---|---|
| DM_155_CIRCD TRS 90_AUTO_CS_ADUXE039A.law | Custom |

Part

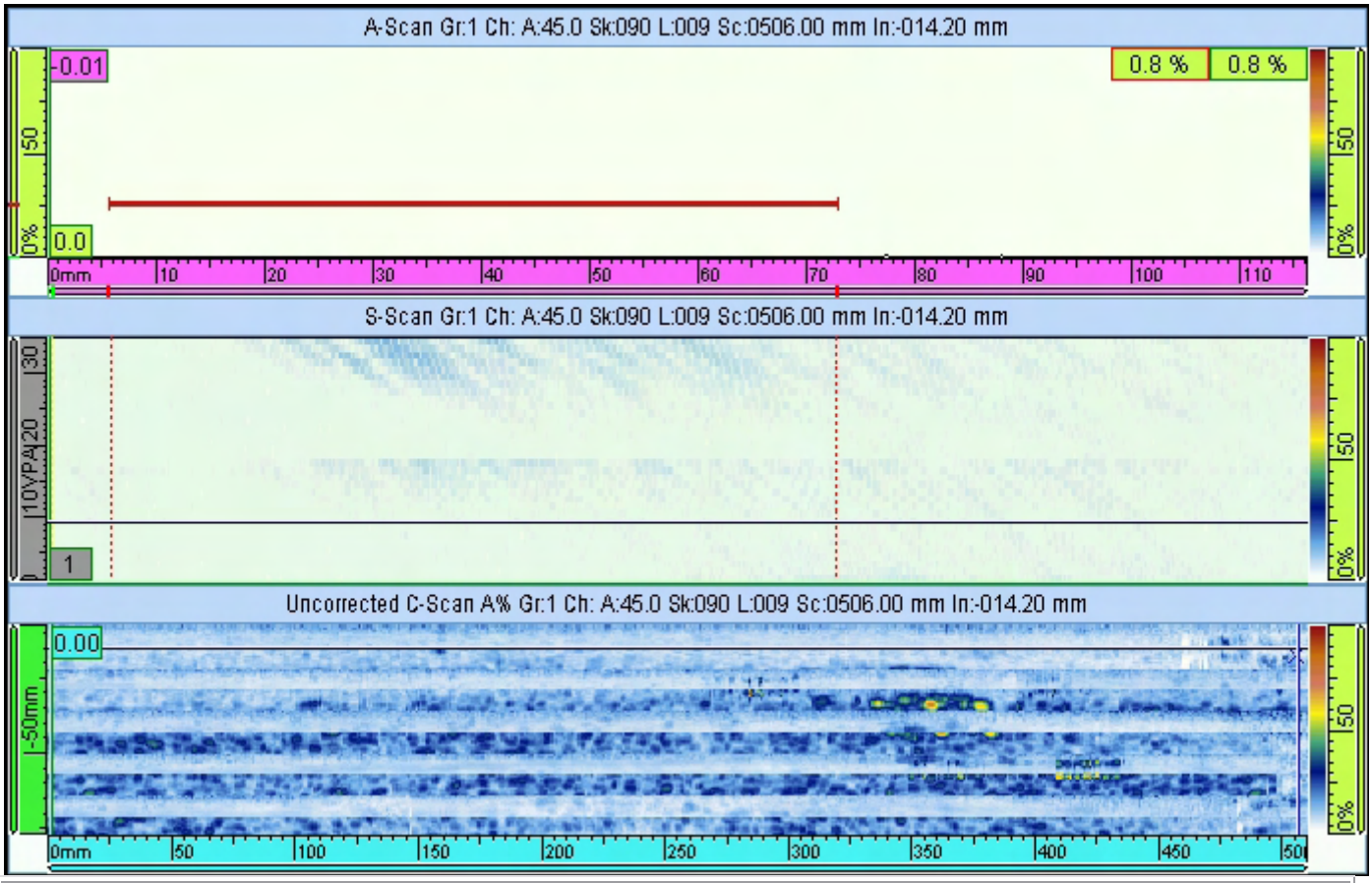
| Material | Geometry | Thickness |
|---|---|---|
| STEEL MILD | Plate | 50.00 mm |

Scan Area

| Scan Start | Scan Length | Scan Resolution | Index Start | Index Length | Index Resolution |
|---|---|---|---|---|---|
| 0.00 mm | 510.00 mm | 1.00 mm | -70.20 mm | 56.00 mm | 14.00 mm |
| **Synchro** | **Max Scan Speed** | | | | |
| Both Axis | 25.00 mm/s | | | | |

| Axis | Encoder | Encoder Type | Encoder Resolution | Polarity |
|---|---|---|---|---|
| Scan | 1 | Quadrature | 35.36 step/mm | Normal |
| Index | 2 | Quadrature | 58.00 step/mm | Inverse |

| A% | A^ | B% | B^ | None | None | None | None |
|---|---|---|---|---|---|---|---|
| 1.6 % | --- mm | 0.8 % | 0.05 mm | | | | |




| | |
|---|---|
| **Technician Name** | Todd P. Blechinger |
| **Technician Signature** | |
| **Contractor** | LMT INC. |
| **Date** | 3/13/08 |

# OmniScan Report

| Report Date | Report Version | Setup File name | Date of Inspection | Inspection Version | Save Mode |
|---|---|---|---|---|---|
| 2008 / 03 / 13 | 1.4R3 | FPLSTL-SRNZL-D01_155MM_CIRCU TRS 270_AUTO_CS_ADUXE039A.opd | 2008 / 03 / 13 | 1.4R3 | A Scan |
| **OmniScan Type** | **OmniScan Serial #** | **Module Type** | **Module Serial #** | **Calibration Due** | **Data File name** |
| OmniScan MX | OMNI-Z-1012 | OMNI-M-PA32128PR | OMNI-Z-6012 | 2008 / 11 / 21 | FPLSTL-SRNZL-D01_155MM_CIRCU TRS 270_AUTO_CS_ADUXE039A |

**Group 1**

Setup

**A:45.0 Sk:270 L:001**

| Beam Delay | Start (Half Path) | Range (Half Path) | PRF | Type | Averaging Factor |
|---|---|---|---|---|---|
| 14.14 us | -0.01 mm | 113.40 mm | 25 | PA | 1 |
| **Scale Type** | **Scale Factor** | **Video Filter** | **Pretrig** | **Rectification** | **Band Pass Filter** |
| Compression | 9 | Off | 0.00 µs | FW | None (0.52 - 19 MHz) |
| **Voltage** | **Gain** | **Mode** | **Wave Type** | **Sound Velocity** | **Pulse Width** |
| High | 28.50 dB | PC (Pitch And Catch) | User Defined | 3150.0 m/s | 332.50 ns |
| **Scan Offset** | **Index Offset** | **Skew** | | | |
| 0.00 mm | 0.00 mm | N/A | | | |

| Gate | Start | Width | Threshold | Synchro |
|---|---|---|---|---|
| I | 0.02 mm | 0.54 mm | 0.00 % | Pulse |
| A | 10.01 mm | 113.76 mm | 25.00 % | Pulse |
| B | 0.02 mm | 0.54 mm | 0.00 % | Pulse |

Law

| Law File name | Scan Type |
|---|---|
| DM_155_CIRCU TRS 270_AUTO_CS_ADUXE039A.law | Custom |

Part

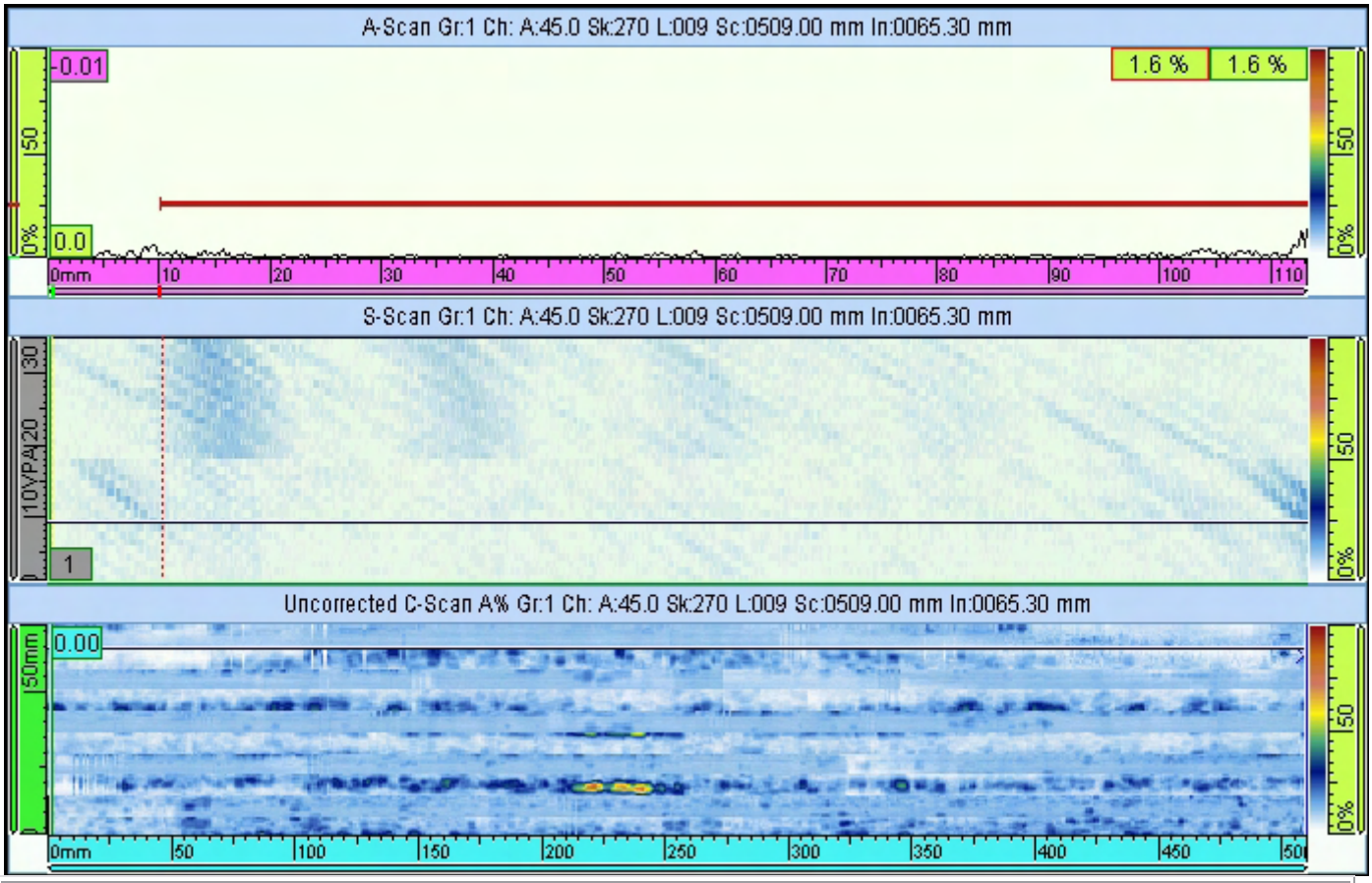
| Material | Geometry | Thickness |
|---|---|---|
| STEEL MILD | Plate | 50.00 mm |

Scan Area

| Scan Start | Scan Length | Scan Resolution | Index Start | Index Length | Index Resolution |
|---|---|---|---|---|---|
| 0.00 mm | 510.00 mm | 1.00 mm | 9.30 mm | 56.00 mm | 14.00 mm |
| **Synchro** | **Max Scan Speed** | | | | |
| Both Axis | 25.00 mm/s | | | | |

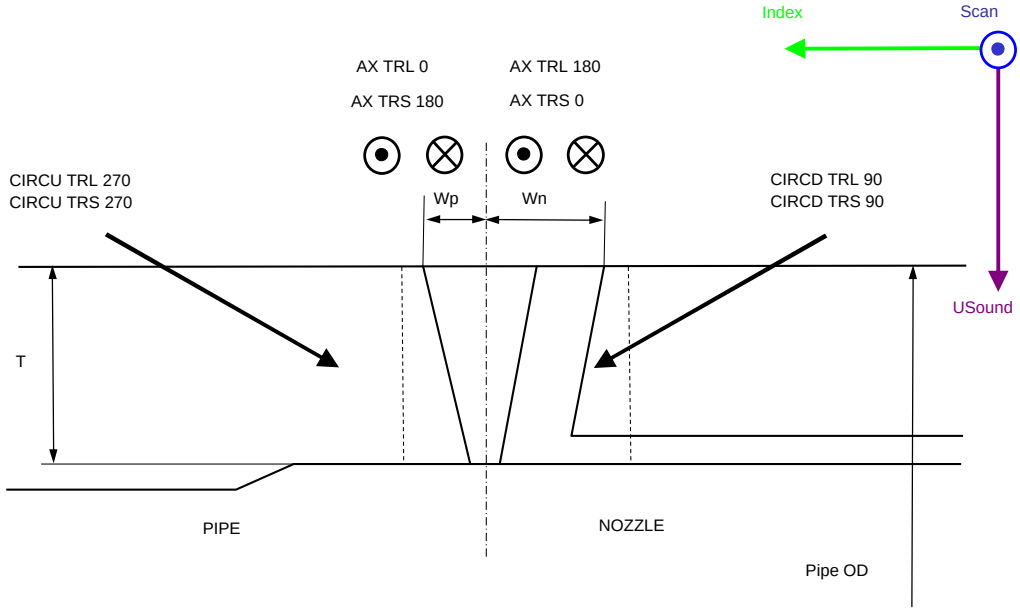
| Axis | Encoder | Encoder Type | Encoder Resolution | Polarity |
|---|---|---|---|---|
| Scan | 1 | Quadrature | 35.36 step/mm | Normal |
| Index | 2 | Quadrature | 58.00 step/mm | Inverse |

| A% | A^ | B% | B^ | None | None | None | None |
|---|---|---|---|---|---|---|---|
| 22.7 % | --- mm | 1.6 % | 0.03 mm | | | | |




| | |
|---|---|
| **Technician Name** | Todd P. Blechinger |
| **Technician Signature** | |
| **Contractor** | LMT INC. |
| **Date** | 3/13/08 |

# SCAN PLAN




| | | | |
|---|---|---|---|
| ***Procedure :*** | ***ZETEC_OmniScanPA_03_revD*** | ***Pipe Thickness T :*** | ***40.0*** mm |
| ***Plant / Unit :*** | ***Memphis*** | ***Pipe OD :*** | ***154.0*** mm |
| ***Weld Id. :*** | ***FPLSTL-SRNZL-D01*** | ***Weld Extent Pipe Side Wp :*** | ***16.5*** mm |
| ***Dual Side Access :*** | ***yes*** | ***Weld Extent Nozzle Side Wn :*** | ***21.5*** mm |
| ***Complete Pipe:*** | ***yes*** | ***Access Limitation Pipe Side Lp :*** | ***118.0*** mm |
| | | ***Access Limitation Nozzle Side Ln*** | ***127.0*** mm |
| | | ***Weld Length:*** | ***484.0*** mm |

## *SCANNING SEQUENCES CIRCUMFERENTIAL FLAWS*

| *Focal law group* | *Probe Type* | *MinTB* (mm) | *MaxTB* (mm) | *# Data Points* | *Scan* Start (mm) | *Scan* End (mm) | *Scan* Resol. (mm) | *Index* Start (mm) | *Index* End (mm) | *Index* Resol. (mm) | *# Lines* | *Done ?* (OK / NA) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *CIRCD TRL 90* | *CS* | *100.0* | *125.0* | *640* | *0.0* | *508.8* | *1.0* | *-65.7* | *36.8* | *14.6* | *8* | *OK* |
| *CIRCU TRL 270* | *CS* | *100.0* | *125.0* | *640* | *0.0* | *508.8* | *1.0* | *-41.8* | *60.7* | *14.6* | *8* | *OK* |
| *CIRCD TRS 90* | *CS* | *100.0* | *125.0* | *800* | *0.0* | *508.8* | *1.0* | *-70.2* | *-14.3* | *14.0* | *5* | *OK* |
| *CIRCU TRS 270* | *CS* | *100.0* | *125.0* | *800* | *0.0* | *508.8* | *1.0* | *9.3* | *65.2* | *14.0* | *5* | *OK* |

## *SCANNING SEQUENCES AXIAL FLAWS*

| *Focal law group* | *Probe Type* | *MinTB* (mm) | *MaxTB* (mm) | *# Data Points* | *Scan* Start (mm) | *Scan* End (mm) | *Scan* Resol. (mm) | *Index* Start (mm) | *Index* End (mm) | *Index* Resol. (mm) | *# Lines* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *AX TRL 0* | | | | | | | | | | | | *NA* |
| *AX TRL 180* | | | | | | | | | | | | *NA* |
| *AX TRS 0* | | | | | | | | | | | | *NA* |
| *AX TRS 180* | | | | | | | | | | | | *NA* |
| *AX TRL 0* | | | | | | | | | | | | *NA* |
| *AX TRL 180* | | | | | | | | | | | | *NA* |

***Data Analyst :*** ***Jeff Devers***
***Date :*** ***3/12/08***

***LMT Review*** ***Todd Blechinger***
***Date :*** ***3/14/08***

***EPRI Review***
***Date :*** ***3/16/08***

***Report #*** ***EPRI-PA-04***



***ANII Review*** ***N/A***
***Date :***

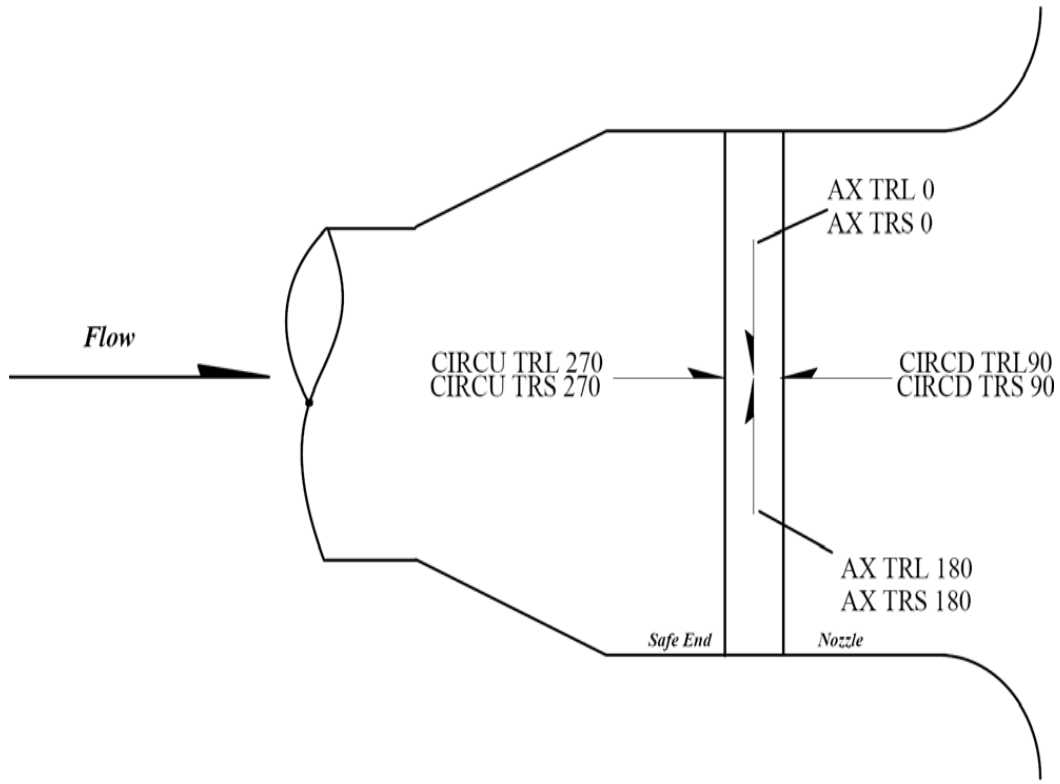
Report # EPRI-PA-04

# Ultrasonic Phased Array Examination Report

| | | | | | |
|---|---|---|---|---|---|
| Plant / Unit | EPRI | OmniScan Software Version | 1.4R3 | Acquisition Tech. Todd Blechinger | Level III |
| Comp / System | FPLSTL-SRNZL-D01 | OmniScanConverter Software Version | 1.7R5 | Acquisition Tech. N/A | Level |
| Component Temp. | 64° | UltraVision Software Revision | 1.1Q5 | | |
| Procedure No. | Zetec_ OmniScanPA_03 | | | | |
| Revision# | rev.D | | | | |

| Focal Law Group Used | Data File Identification | Results |
|---|---|---|
| CIRCD TRL 90 | FPLSTL-SRNZL-D01_155MM_CIRCD TRL 90_AUTO_CS_ADUXE039A | RI-See Attached |
| CIRCU TRL 270 | FPLSTL-SRNZL-D01_155MM_CIRCU TRL 270_AUTO_CS_ADUXE039A | RI-See Attached |
| CIRCD TRS 90 | FPLSTL-SRNZL-D01_155MM_CIRCU TRS 90_AUTO_CS_ADUXE039A | RI-See Attached |
| CIRCU TRS 270 | FPLSTL-SRNZL-D01_155MM_CIRCU TRS 270_AUTO_CS_ADUXE039A | RI-See Attached |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

## Technique Referencing System



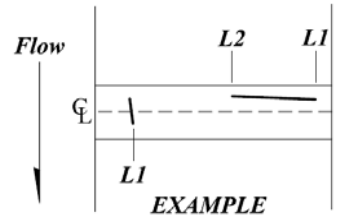

**Comments:**

See attached Phased Array Indication Data Tabulation Sheet for indication information.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Data Analyst | Jeff Devers | Level III | Date 3/13/2008 | LMT Review | Todd Blechinger | Level III | Date 3/14/2008 |
| EPRI REVIEW / DATE | | 3/16/08 | | ANII REVIEW / DATE | | | |

# Phased Array Indication Tabulation Sheet

Report # EPRI-PA-04




| | | | |
|---|---|---|---|
| PLANT/ UNIT | EPRI | REFERENCE LOCATION | 0 Stamp / Weld Centerline |
| COMP / SYSTEM | FPLSTL-SRNZL-D01 | COMP THICKNESS | 1.60" |
| PROCEDURE NO. | Zetec_ OmniScanPA_03 | WELD CROWN WIDTH | 1.50" |
| REV / CHANGE NO. | rev.D | WELD LENGTH | 19.05" |

DATA ANALYST / LEVEI J.L. Devers / III

LMT REVIEW / LEVEL T.P. Blechinger / III

| IND. # | Data File | Merged Data Group Used | Length Sizing Information | | | Thru Wall Sizing Information | | | Indication Position | | Evaluation / Comments | Printout Page # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Start (L1) | Stop (L2) | Length | T.W. Depth | Remain. Ligament | T.W. % | Upstream | Dnstream | | |
| 1 | FPLSTL-SRNZL-D01_155MM_CIRCU TRL 270_AUTO_CS_ ADUXE039A | CIRCU TRL 270 | 7.9" | 9.9" | 2.0" | .4" | 1.2" | N/A | .25" | | Circ. Flaw | 43&45 of 50 |
| 1 | FPLSTL-SRNZL-D01_155MM_CIRCU TRS 270_AUTO_CS_ ADUXE039A | CIRCU TRS 270 | 8.3" | 9.9" | 1.6" | .2" | 1.4" | N/A | .25" | | Circ. Flaw | 44&46 of 50 |
| 2 | FPLSTL-SRNZL-D01_155MM_CIRCD TRL 90_AUTO_CS_ ADUXE039A245to510 | CIRCD TRL 90 | 14.0" | 16.0" | 2.0" | .3" | 1.3" | N/A | | .5" | Circ. Flaw | 47&49 of 50 |
| 2 | FPLSTL-SRNZL-D01_155MM_CIRCD TRS 90_AUTO_CS_ ADUXE039A | CIRCD TRS 90 | 13.0" | 15.0" | 2.0" | .3" | 1.3" | N/A | | .5" | Circ. Flaw | 48&50 of 50 |
| | | | | | | | | | | | | |

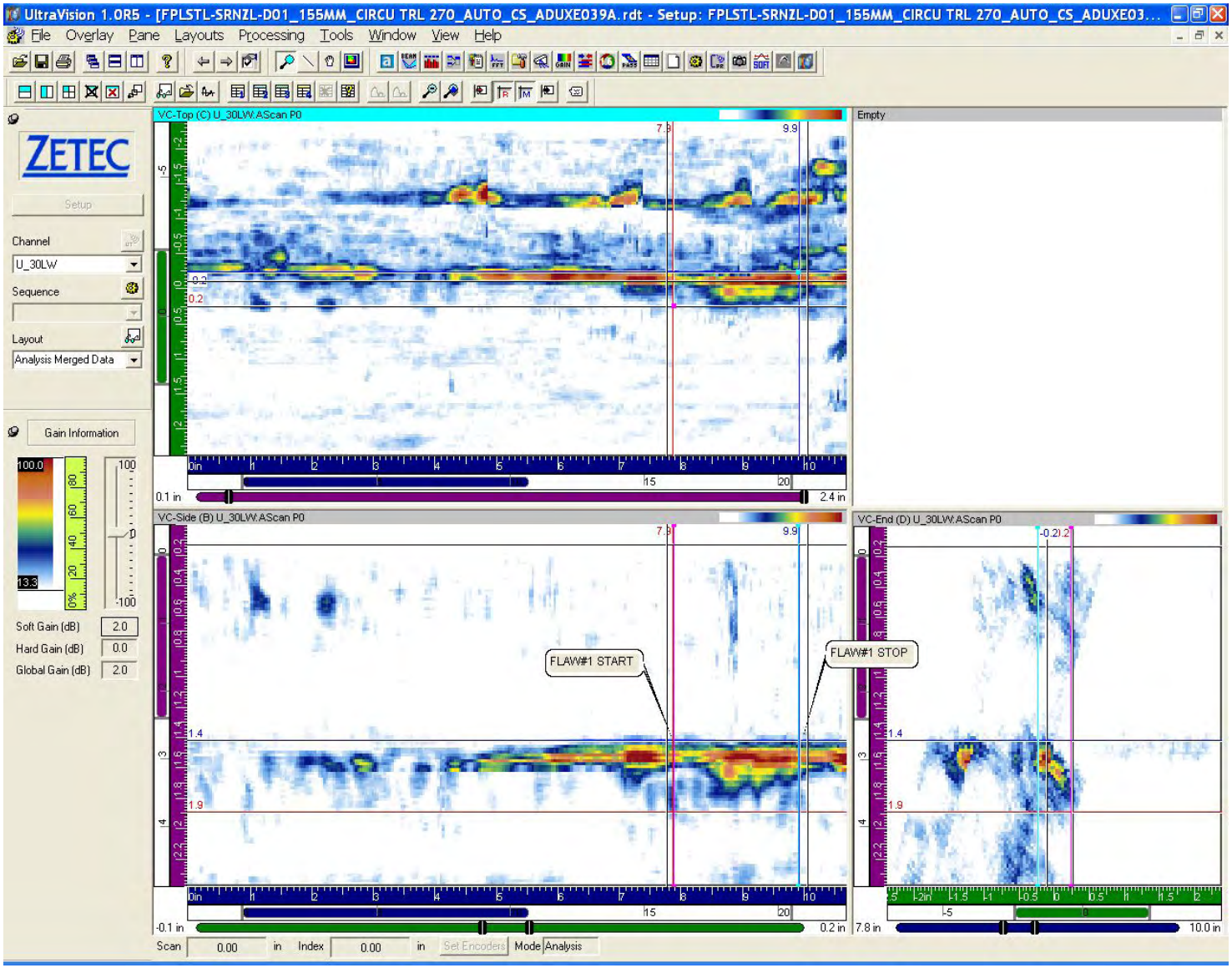
Comments: Used CIRCU TRL 270(Flaw #1), & CIRCD TRL 90(Flaw #2), Focal Law groups for final length and depth sizing results based on flaw locations in weld material.

Data Analyst J.L. Devers Level III Date 3/10/2008

Further Evaluation Required? [ ] Yes [X] No

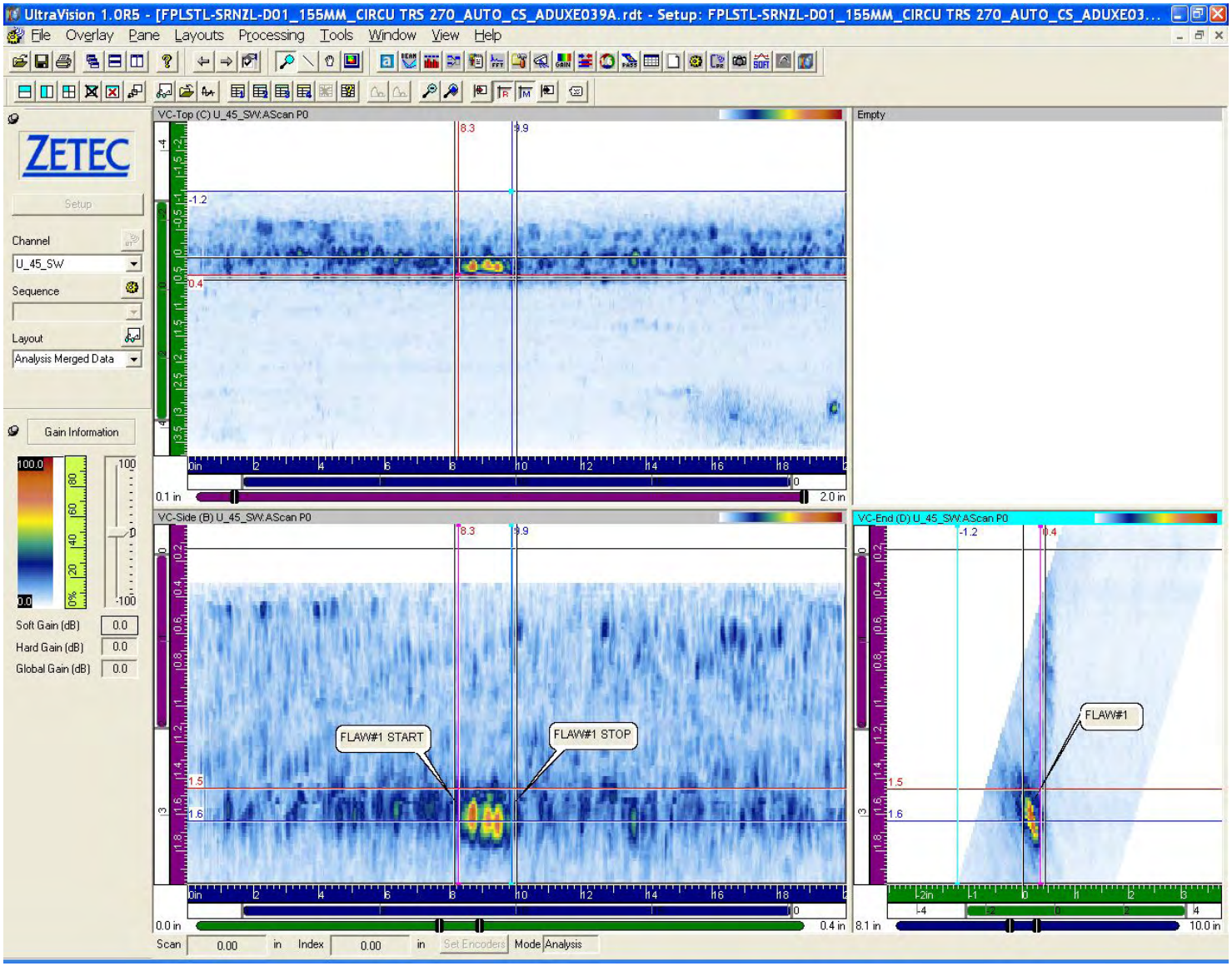
EPRI9i REVIEW / DATE 3/16/08

ANII REVIEW / DATE




**Data Analyst** J. L. Devers **Level** III **EPRI Review**

**LMT Review** T.P. Blechinger **Level** III **ANII Review** **Report#** EPRI-PA-04

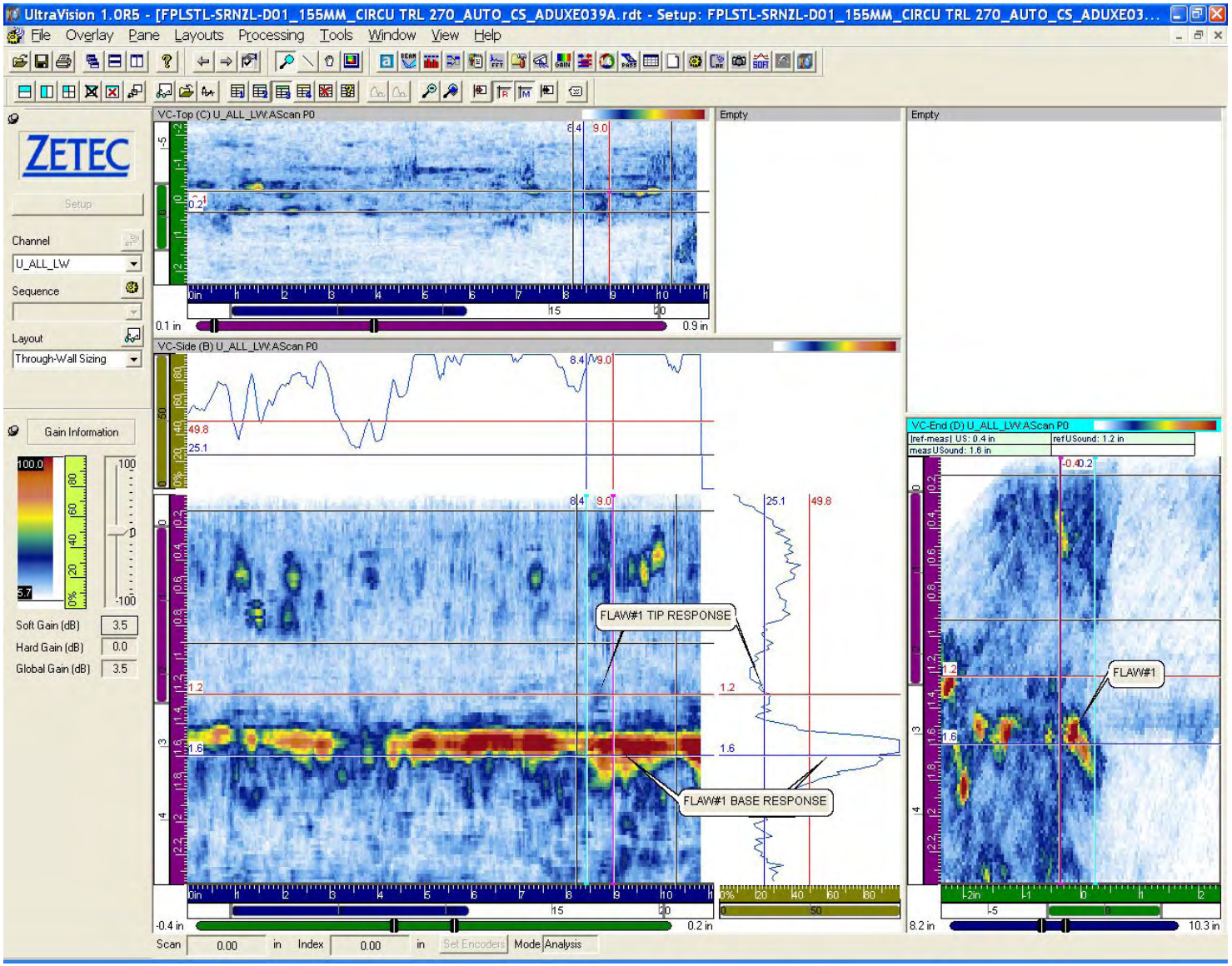



**Data Analyst** _____ **Level** III **EPRI Review** _____

J. L. Devers

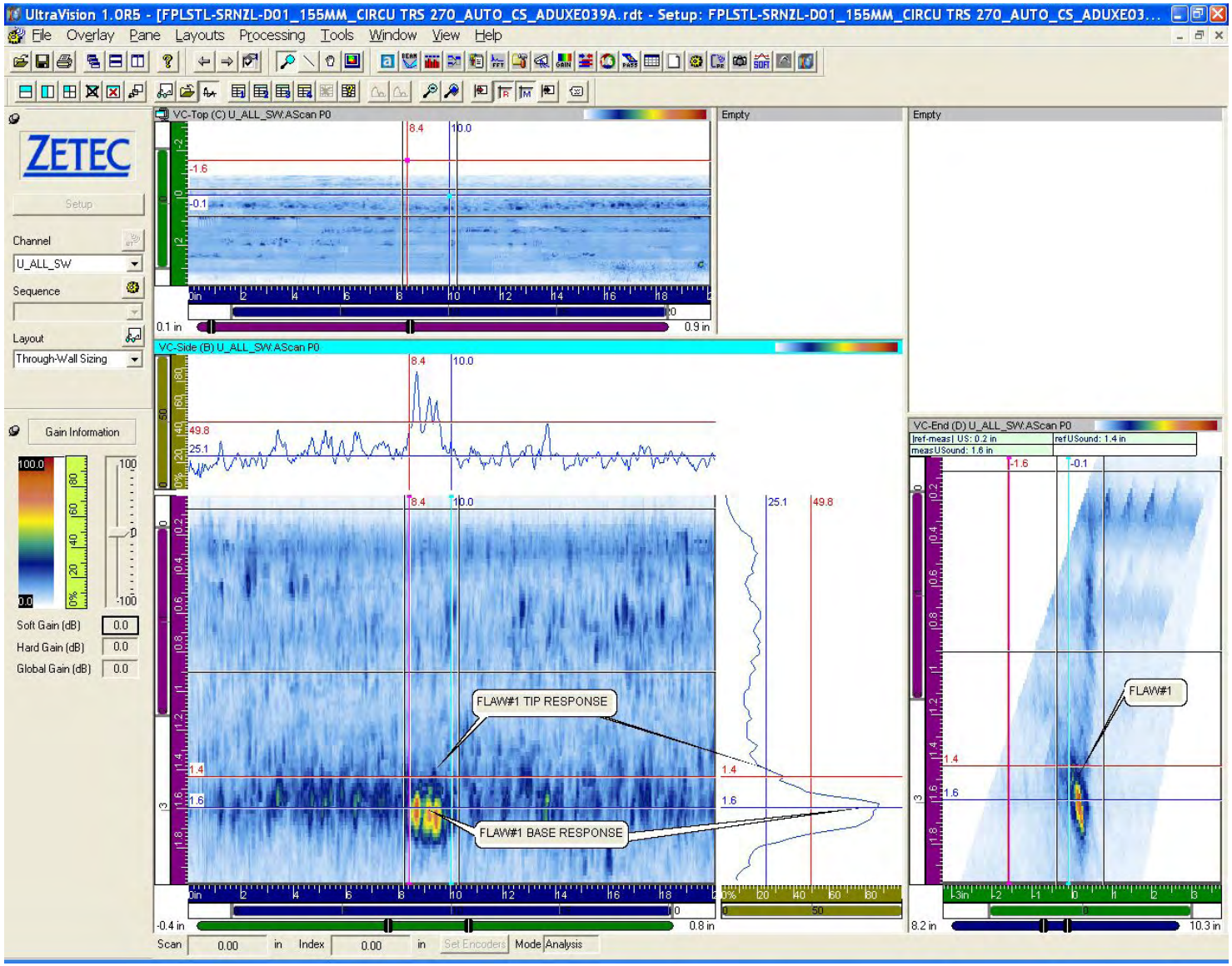
**LMT Review** _____ **Level** III **ANII Review** _____ **Report#** EPRI-PA-04

T.P. Blechinger



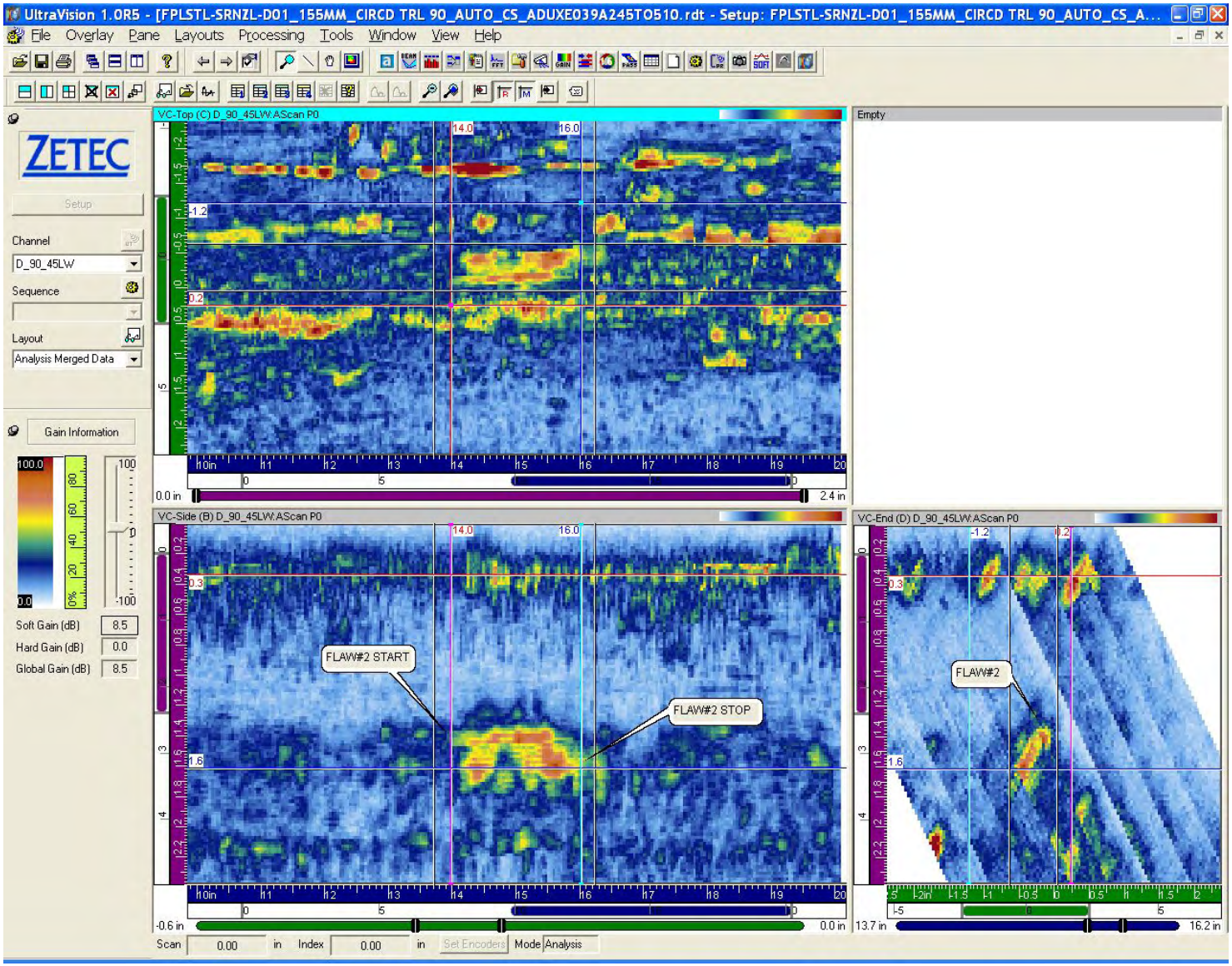

**Data Analyst** J. L. Devers **Level** III **EPRI Review**

**LMT Review** T.P. Blechinger **Level** III **ANII Review** **Report#** EPRI-PA-04



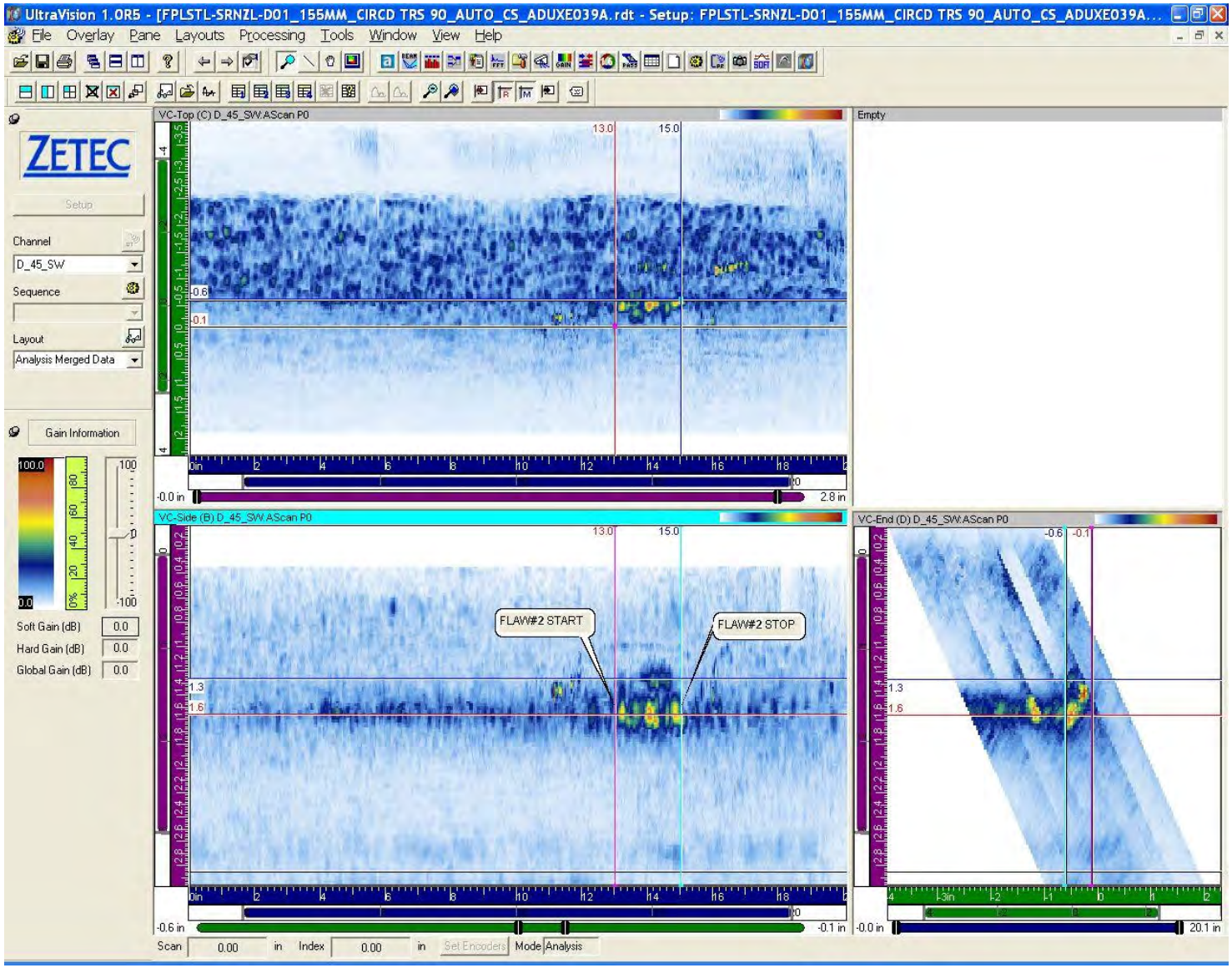

Data Analyst J. L. Devers Level III EPRI Review

LMT Review T.P. Blechinger Level III ANII Review Report# EPRI-PA-04




**Data Analyst** J. L. Devers **Level** III **EPRI Review**

**LMT Review** T.P. Blechinger **Level** III **ANII Review** **Report#** EPRI-PA-04

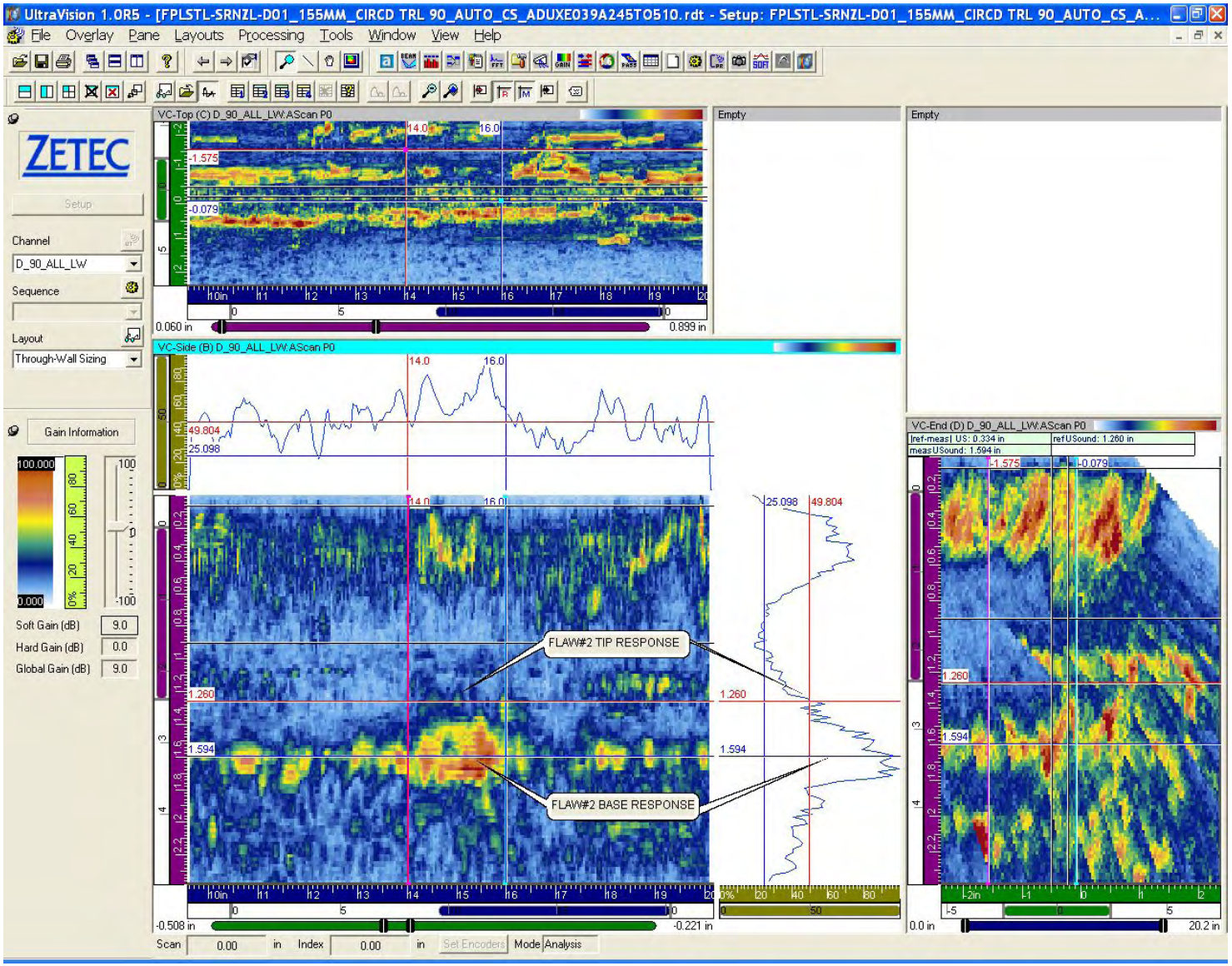



**Data Analyst** _____ **Level** III **EPRI Review** _____

J. L. Devers

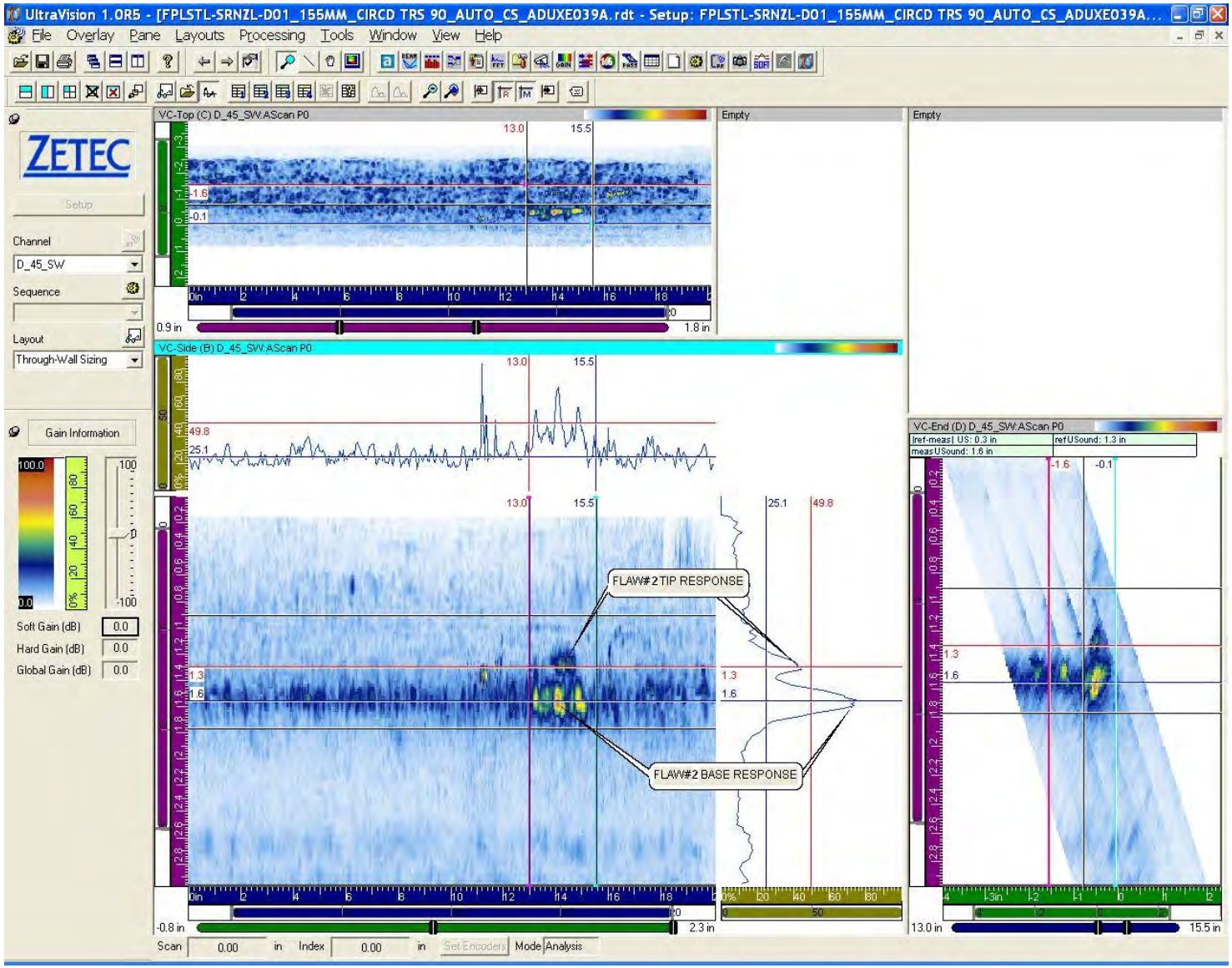
**LMT Review** _____ **Level** III **ANII Review** _____ **Report#** EPRI-PA-04

T.P. Blechinger




**Data Analyst** J. L. Devers **Level** III **EPRI Review**

**LMT Review** T.P. Blechinger **Level** III **ANII Review** **Report#** EPRI-PA-04



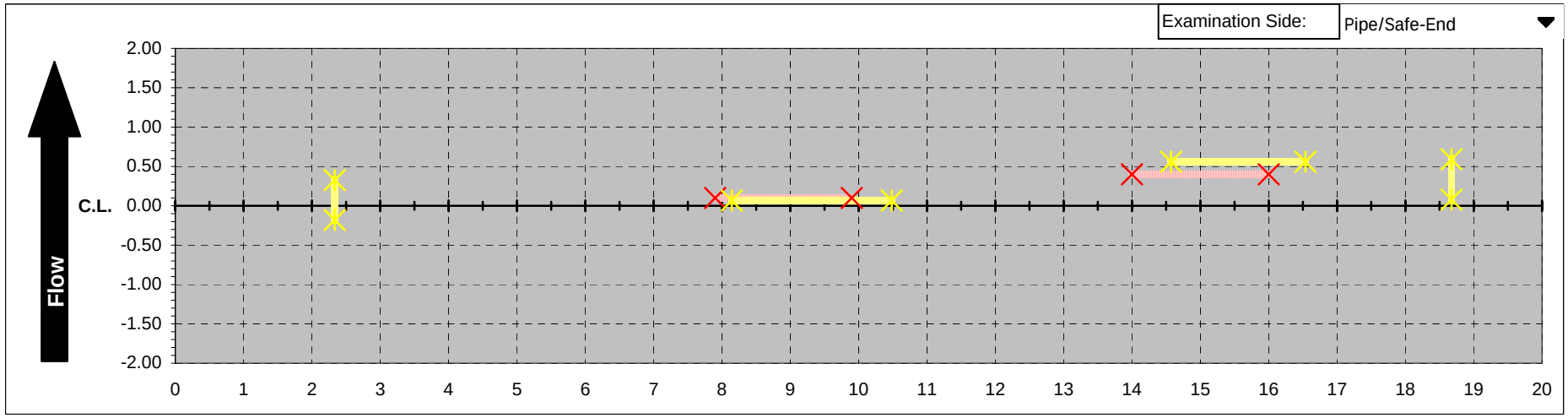

**Data Analyst** J. L. Devers **Level** III **EPRI Review**

**LMT Review** T.P. Blechinger **Level** III **ANII Review** **Report#** EPRI-PA-04

# J. Devers Indication Report

**Sample ID:** **FPLSTL-SRZNL-D01**

| OD: | ID: | OD Circ.: | ID Circ.: | Nom "T": | Ref. Face to CL DNST Side: | Ref. Face to CL UPST Side: |
|---|---|---|---|---|---|---|
| **6.06** | **2.94** | **19.04** | **9.22** | **1.56** | **7.08** | **4.31** |




**J.Devers Information:**

| | IND# 1 | IND# 2 | IND# 3 | IND# 4 | IND# 5 | IND# 6 | IND# 7 |
|---|---|---|---|---|---|---|---|
| Start(X1) | | 7.900 | 14.000 | | | | |
| Stop(X2) | | 9.900 | 16.000 | | | | |
| Y Start | | 0.100 | 0.400 | | | | |
| Y Stop | | 0.100 | 0.400 | | | | |
| Length | 0.000 | 2.000 | 2.000 | 0.000 | | | |
| R.L. | | 1.200 | 1.260 | | | | |

**As-Built Information:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Start(X1) | 2.333 | 8.144 | 14.572 | 18.677 | | | |
| Stop(X2) | 2.333 | 10.484 | 16.539 | 18.677 | | | |
| Y Start | -0.181 | 0.067 | 0.559 | 0.079 | | | |
| Y Stop | 0.327 | 0.067 | 0.559 | 0.591 | | | |
| Length | 0.508 | 2.341 | 1.967 | 0.512 | | | |
| R.L. | 1.262 | 1.252 | 1.252 | 1.256 | | | |

**Deviations:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Length | | -0.341 | 0.033 | | | | |
| R.L. | | -0.052 | 0.008 | | | | |

Notes: Only axial scans were analyzed looking for circumferential flaws.