GULF X-RAY SERVICES, INC.
INDUSTRIAL NDT SUPPLIES AND EQUIPMENT
1418 Dupas Street • Gretna, LA 70053 • Ph: (504) 394-8106

ULTRASONIC INSTRUMENT CALIBRATION CERTIFICATE
16:64 PHASED ARRAY INSTRUMENT

CUSTOMER:	Peak NDT	MANUFACTURER:	Olympus
MODEL:	Omniscan X3	SERIAL #:	QC-0086806
SOFTWARE VERSION:	MXU 5.18.1		

CALIBRATION EQUIPMENT, TRANSDUCERS AND STANDARDS

MFR:	Olympus	TYPE:	5L64	SIZE:	38.4x10	SERIAL #:	N4032
MFR:	Olympus	TYPE:	5L64	SIZE:	38.4x10	SERIAL #:	N3965
MFR:	Olympus	FREQ:	2.25 MHz	SIZE:	½"	SERIAL #:	551838
MFR:	Olympus	FREQ:	2.25 MHz	SIZE:	½"	SERIAL #:	1293138
MFR:	Olympus	PULSER BOX:		E32P1-23UT-EZ		SERIAL #:	1095424-01
MFR:	Olympus	SPLITTER ADAPTER:		OMNI-A-ADP05		SERIAL #:	890289-03
MFR:	Rohde&Schwarz	OSCILLISCOPE:		RTB2004		SERIAL #:	108339
MFR:	Extech	TEMP. & HUMIDTY		RH520a		SERIAL #:	CH45269
IIW:	23-1257			ASTM E2491 PA:			58975
NAVSHIP:	23-1537			ASTM E-127 #5-0025:			91-5842
COUPLANT:	Oil						
TEMPERATURE:	74.7°F			HUMIDTY:	38%		

CALIBRATED TO: Q. A. PROCEDURE UEQ-011P AND UEQ-010 WITH STANDARDS TRACABLE TO N.I.S.T. CERTIFICATE NUMBERS 66857-A & 69069-A. Q.A. PROCEDURE UEQ-010 APPLICABLE DOCUMENTS ARE ASME SECTION V, ABS REQUIREMENTS FOR ULTRASONIC INSPECTION OF HULL WELDS, ASTM E317, AND MANUFACTURER'S SPECIFICATIONS. Q.A. PROCEDURE UEQ-011P APPLICABLE DOCUMENTS INCLUDE ASME SECTION V AND MANUFACTURE'S SPECIFICATIONS.

CALIBRATION DATE: 03-17-25

CALIBRATION DUE: 03-17-26

CALIBRATION PERFORMED BY: Nichols

APPROVED
By Kayla Myers at 8:42 am, Apr 11, 2025

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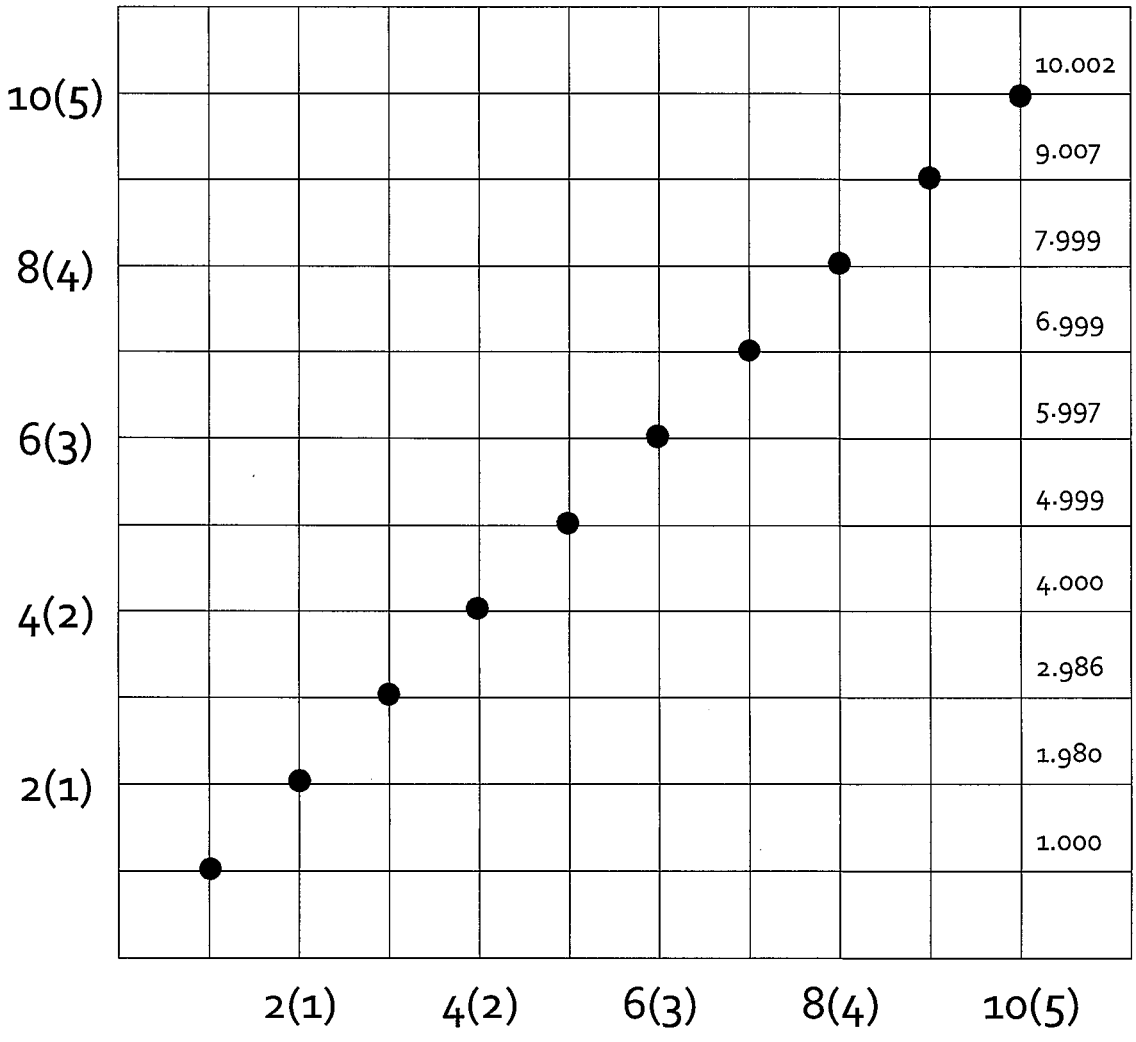
CONVENTIONAL SINGLE ELEMENT PULSER CALIBRATION (P1/R1)

LINEARITY TEST INSTRUMENT SETTINGS

PULSE POWER:	95V	REJECT:	0%	FINE GAIN:	0.0 dB
RANGE:	5" 0.2321/10" 0.2321	FILTER:	BP 2.25 MHz	DELAY:	1.02 / 1.02
DISTANCE LINEARITY GAIN:		12.5 dB	AMPLITUDE LINEARITY GAIN:		23.6 dB

DISTANCE LINEARITY PLOT



PERCENT FULL SCREEN	dB CHANGE	ACTUAL	LIMIT % FULL SCREEN
79.8%	-6 dB	39.9	32% to 48%
79.8%	-12 dB	20.0	16% to 24%
39.9%	+6 dB	80.2	64% to 96%
20%	+12 dB	80.2	64% to 96%

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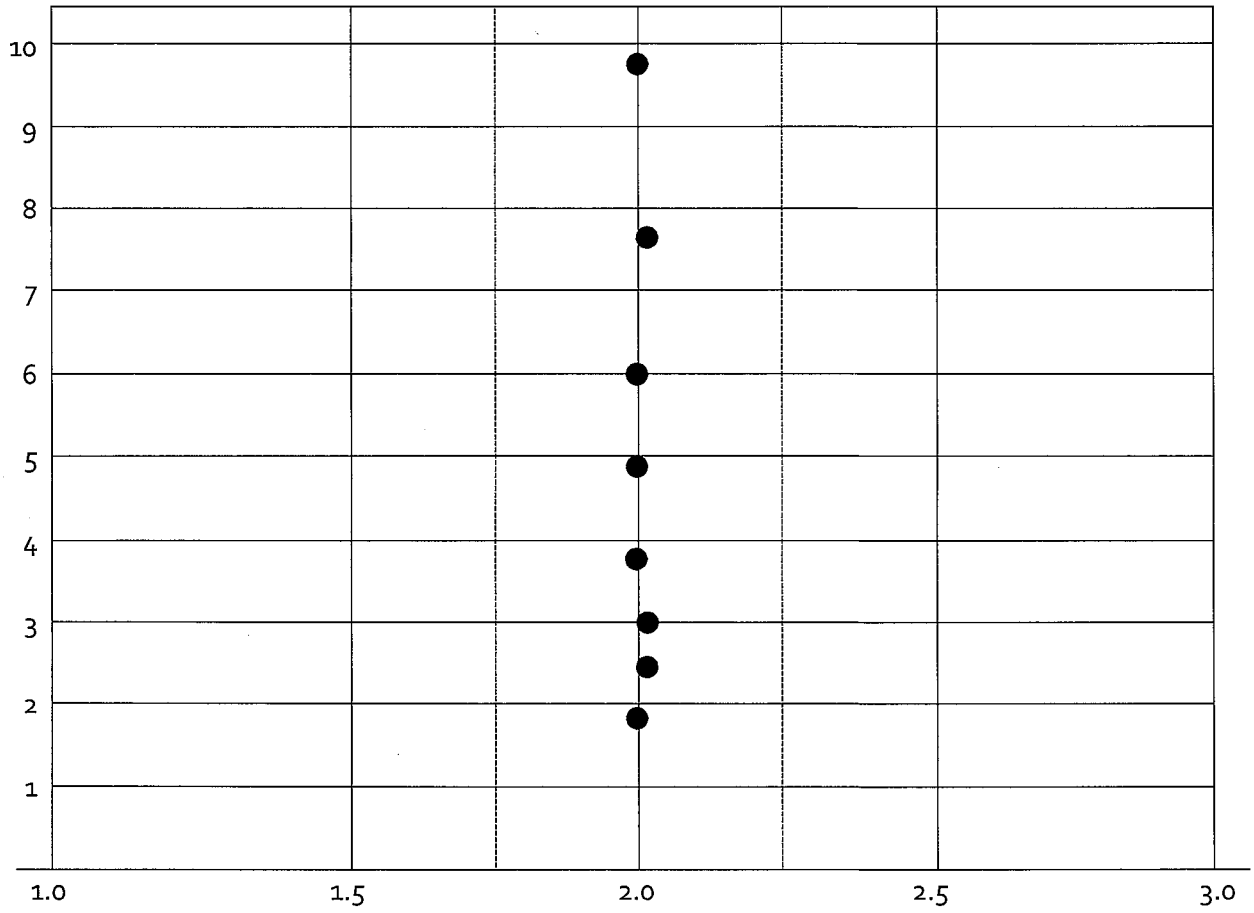
AMPLITUDE LINEARITY PLOT



BACK ECHO	NOTCH ECHO	RATIO
95.1	47.5	2.00 : 1
75.6	37.7	2.01 : 1
60.0	30.0	2.00 : 1
47.7	23.8	2.00 : 1
37.8	18.9	2.00 : 1
30.1	15.0	2.01 : 1
23.9	11.9	2.01 : 1
19.0	9.5	2.00 : 1

CALIBRATION RESULTS

NEAR SURFACE RESOLUTION	ACCEPT	Yes	REJECT	
DEPTH RESOLUTION	ACCEPT	Yes	REJECT	
SHEAR WAVE RESOLUTION	ACCEPT	Yes	REJECT	

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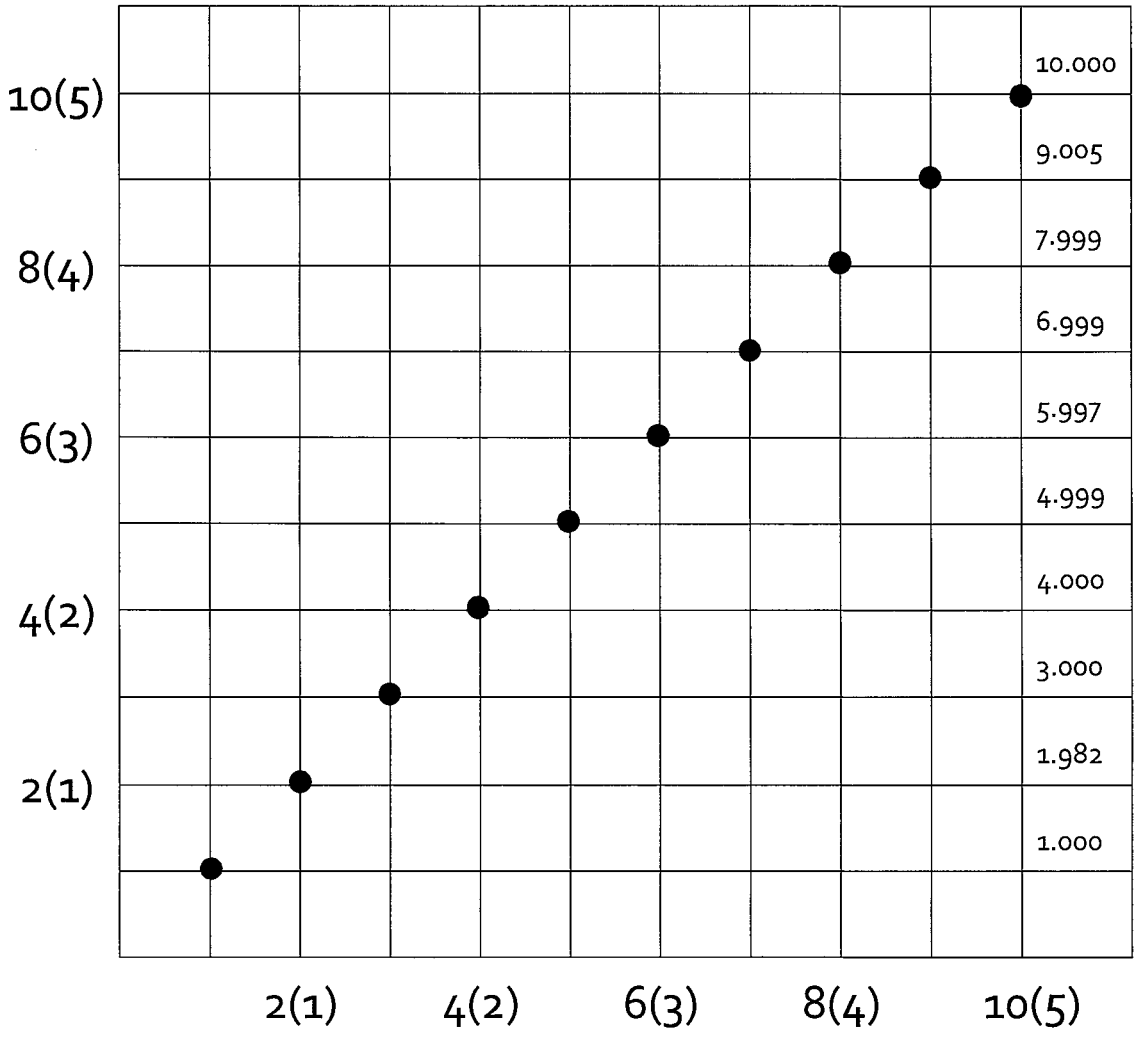
CONVENTIONAL SINGLE ELEMENT PULSER CALIBRATION (P2/R2)

LINEARITY TEST INSTRUMENT SETTINGS

PULSE POWER:	95V	REJECT:	0%	FINE GAIN:	0.0 dB
RANGE:	5" 0.2321/10" 0.2321	FILTER:	BP 2.25 MHz	DELAY:	1.00/1.00
DISTANCE LINEARITY GAIN:		10.1 dB	AMPLITUDE LINEARITY GAIN:		23.6 dB

DISTANCE LINEARITY PLOT



PERCENT FULL SCREEN	dB CHANGE	ACTUAL	LIMIT % FULL SCREEN
79.8%	-6 dB	39.9	32% to 48%
79.8%	-12 dB	20.0	16% to 24%
39.9%	+6 dB	79.8	64% to 96%
20%	+12 dB	79.8	64% to 96%

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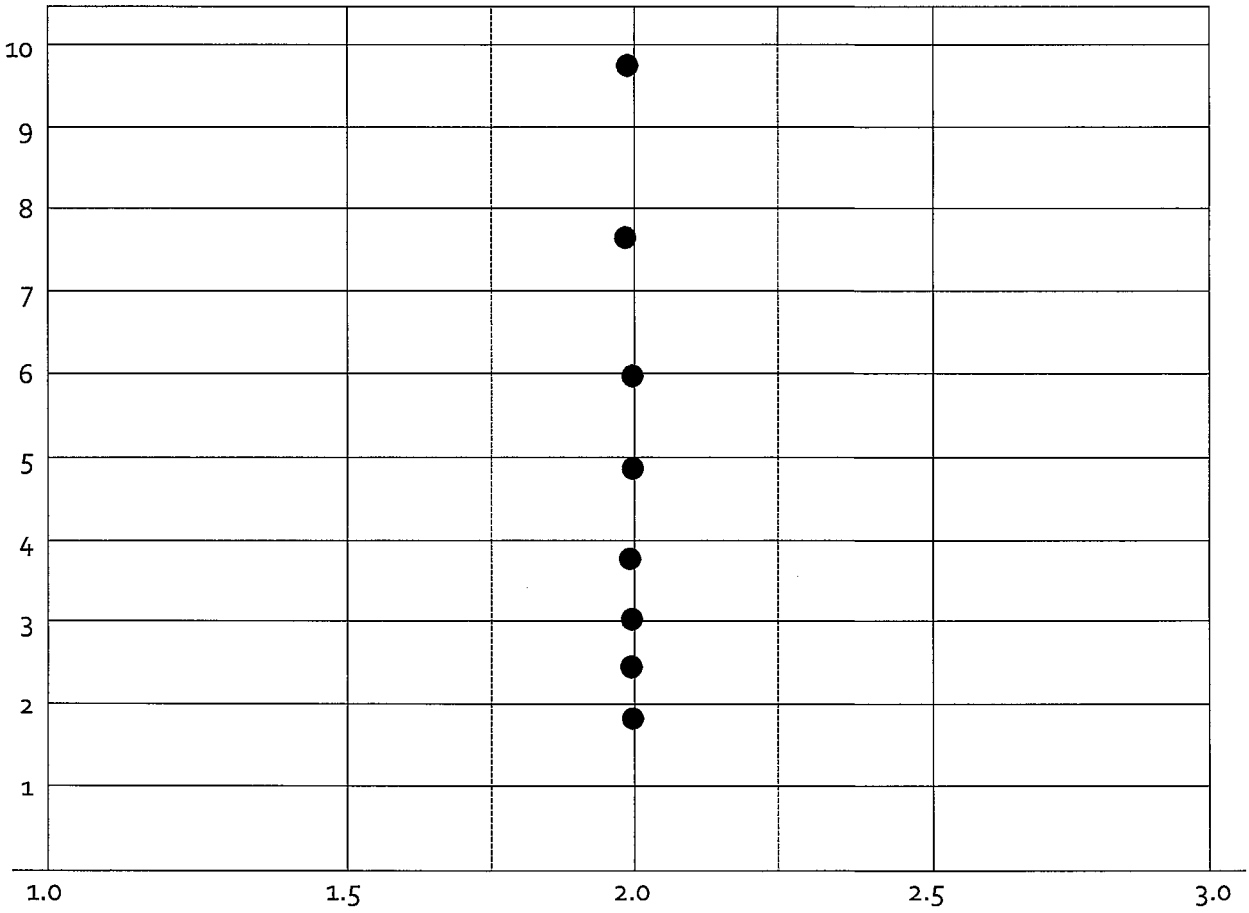
AMPLITUDE LINEARITY PLOT



BACK ECHO	NOTCH ECHO	RATIO
95.6	47.8	2.00 : 1
75.9	37.9	2.00 : 1
60.3	30.1	2.00 : 1
47.9	23.9	2.00 : 1
38.0	19.0	2.00 : 1
30.2	15.1	2.00 : 1
24.0	12.0	2.00 : 1
19.1	9.5	2.00 : 1

CALIBRATION RESULTS

NEAR SURFACE RESOLUTION	ACCEPT	Yes	REJECT	
DEPTH RESOLUTION	ACCEPT	Yes	REJECT	
HEAR WAVE RESOLUTION	ACCEPT	Yes	REJECT	

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16:64 PHASED ARRAY CALIBRATION
PHASED ARRAY BEAM STEERING

The ultrasonic phased array beam steering capabilities of the unit are tested by the method described in ASME Section V, Article 23. The tested unit was capable of steering the ultrasonic phased array beam above 35° in both the positive and negative direction using the method described in QEU-011P.

REFERENCE SDH ANGLE:	-10	AMPLITUDE:	80.3%	REFERENCE dB:	19.9dB
MAXIMUM STEERING ANGLE 1:	-55°	AMPLITUDE:	P		
MAXIMUM STEERING ANGLE 2:	-60°	AMPLITUDE:	P		

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REFERENCE SDH ANGLE:	+10	AMPLITUDE:	80.4%	REFERENCE dB:	19.5dB
MAXIMUM STEERING ANGLE 1:	+55°	AMPLITUDE:	P		
MAXIMUM STEERING ANGLE 2:	+60°	AMPLITUDE:	P		

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PHASED ARRAY VERTICAL LINEARITY

VPA:	1 Element	REFERENCE dB:	18.9 dB
TEST:	20% Full Screen Height		
PERFORMANCE CRITERIA:	+12 dB, Screen Height Between 65% To 95%		

Each VPA is tested at the above reference gain to ensure that each element is within 2% screen height of the required 20% Full Screen Height prior to changing the gain by +12 dB. When the gain is increased by 12 dB, each element is then checked to ensure that each signal is between the stated performance criteria listed above. The results of this test are indicated below.

VPA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
< 2% Dev.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
+12 dB Acc.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
VPA	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
< 2% Dev.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
+12 dB Acc.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
VPA	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
< 2% Dev.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
+12 dB Acc.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
VPA	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
< 2% Dev.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
+12 dB Acc.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

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VPA:	1 Element	REFERENCE dB:	24.9 dB
TEST:	40% Full Screen Height		
PERFORMANCE CRITERIA:	+6 dB, Screen Height Between 65% To 95%		

Each VPA is tested at the above reference gain to ensure that each element is within 2% screen height of the required 40% Full Screen Height prior to changing the gain by +6 dB. When the gain is increased by 6 dB, each element is then checked to ensure that each signal is between the stated performance criteria listed above. The results of this test are indicated below.

VPA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
< 2% Dev.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
+6 dB Acc.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
VPA	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
< 2% Dev.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
+6 dB Acc.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
VPA	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
< 2% Dev.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
+6 dB Acc.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
VPA	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
< 2% Dev.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
+6 dB Acc.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

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VPA:	1 Element	REFERENCE dB:	30.8 dB
TEST:	80% Full Screen Height		
PERFORMANCE CRITERIA:	-6 dB, Screen Height Between 35% To 45%		

Each VPA is tested at the above reference gain to ensure that each element is within 2% screen height of the required 80% Full Screen Height prior to changing the gain by -6 dB. When the gain is decreased by 6 dB, each element is then checked to ensure that each signal is between the stated performance criteria listed above. The results of this test are indicated below.

VPA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
< 2% Dev.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
-6 dB Acc.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
VPA	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
< 2% Dev.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
-6 dB Acc.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
VPA	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
< 2% Dev.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
-6 dB Acc.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
VPA	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
< 2% Dev.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
-6 dB Acc.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

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VPA:	1 Element	REFERENCE dB:	30.8 dB
TEST:	80% Full Screen Height		
PERFORMANCE CRITERIA:	-12 dB, Screen Height Between 15% To 25%		

Each VPA is tested at the above reference gain to ensure that each element is within 2% screen height of the required 80% Full Screen Height prior to changing the gain by -12 dB. When the gain is decreased by 12 dB, each element is then checked to ensure that each signal is between the stated performance criteria listed above. The results of this test are indicated below.

VPA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
< 2% Dev.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
-12 dB Acc.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
VPA	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
< 2% Dev.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
-12 dB Acc.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
VPA	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
< 2% Dev.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
-12 dB Acc.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
VPA	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
< 2% Dev.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
-12 dB Acc.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

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PHASED ARRAY HORIZONTAL LINEARITY

VPA:	1 Element	REFERENCE dB:	24.3 dB
TEST:	1st BWR @ 80% Full Screen Height	VELOCITY:	0.2323 in/us
		WEDGE DELAY:	0.39 us

Each VPA is tested using the method contained in QEU-011P. Each echo must peak at the block thickness and each subsequent multiple for a minimum of 4 multiples for each VPA within ± 3 timing units. The results of this test are indicated below.

VPA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1st BWR	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
2nd BWR	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
3rd BWR	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
4th BWR	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
VPA	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1st BWR	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
2nd BWR	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
3rd BWR	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
4th BWR	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
VPA	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
1st BWR	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
2nd BWR	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
3rd BWR	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
4th BWR	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
VPA	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
1st BWR	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
2nd BWR	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
3rd BWR	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
4th BWR	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

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PULSER OUTPUT RESPONSE

PULSER SETTING:	80 V	PULSER WIDTH:	250 ns
PULSER RISE TIME:	Fixed	PULSER FALL TIME:	Fixed
PULSE REPETITION RATE:	20 Hz	LOAD:	50 Ohm
PERFORMANCE CRITERIA:	Pulser Voltage:45V-55V, Pulser Width+/-25ns, Pulser Rise:2ns-10ns		

Each pulser is checked for response using a single element transducer and an isolator/splitter allowing the testing of the Pulse Width, Voltage, and Rise Time on the Oscilloscope. The results are compared to the criteria shown in QEU-011P and are shown below.

Pulser	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Width(ns)	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Voltage(V)	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Rise Time(ns)	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P