



1418 Dupas Street • Gretna, LA 70053 • Ph: (504) 394-8106

#### ULTRASONIC INSTRUMENT CALIBRATION CERTIFICATE 16:64 PHASED ARRAY INSTRUMENT

CUSTOMER:	Pea	k NDT	MANUFACTU	DED.	Olympus
MODEL:		Omniscan X3	 SERIAL #:		086806
SOFTWARE VER	RSIO	N: MXU 5.15.1		200	

#### CALIBRATION EQUIPMENT, TRANSDUCERS AND STANDARDS

MFR:	Oly	mpu	5	TYPE:	5L64		SIZE:	28	4X10	SERIAL #:	NI	
MFR:		mpu		TYPE:							N4032	
MFR:					5L64		SIZE:		4X10	SERIAL #:	N3965	
		mpu		FREQ:	2.25	MHz	SIZE:	1⁄2″		SERIAL #:	551838	
MFR:	Oly	mpu	5	FREQ:	2.25	MHz	SIZE:	1/2"	,	SERIAL #:	1293138	
MFR:	Oly	mpus	5	PULSER E	BOX:		E32P1-23UT-EZ			SERIAL #:	1095424-01	
MFR:	Oly	mpus	5	SPLITTER ADAPTER:			OMNI-A-ADPo5					
MFR:		-	Schwarz							SERIAL #:	890289-03	
							RTB2004			SERIAL #:	108339	
MFR:	Exte	ech		TEMP. & HUMIDTY			RH520a			SERIAL #:	CH45269	
IIW:	23-1	257				AST	M E2491	PA.				
NAVSHIP:	23-1	527									58975	
COUPLANT		1551	Oil	ASTM E-127 #5-0025: 91-5842								
TEMPERAT	URE:		75.4°F				HUMIDT	Y:	41%			

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: CALIBRATION DUE:	03-07-24	CALIBRATION PERFORMED BY:
	APPROVED By Kayla Myers a Page 1 of 13	at 2:40 pm, Mar 27, 2024

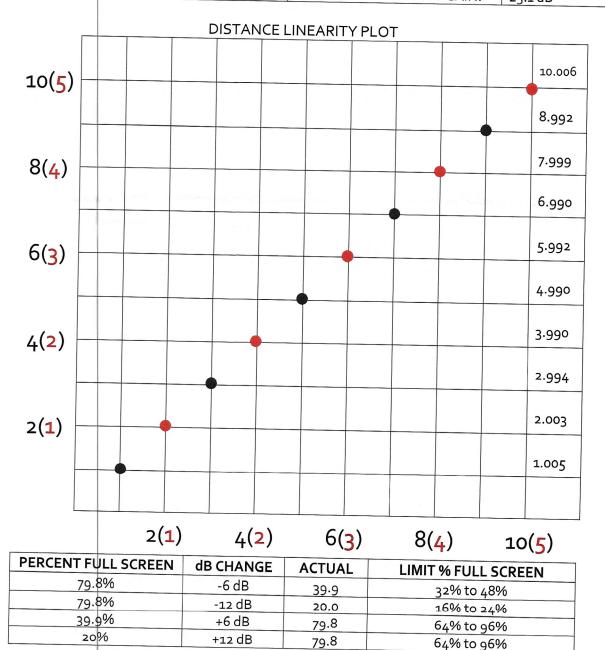


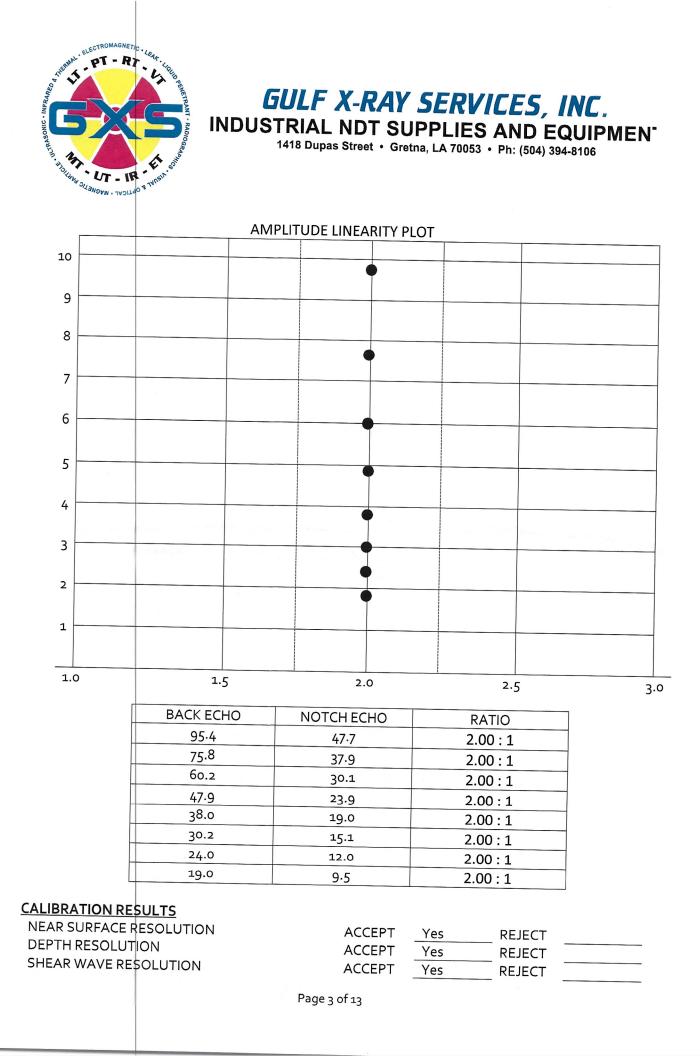
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#### CONVENTIONAL SINGLE ELEMENT PULSER CALIBRATION (P1/R1)

#### LINEARITY TEST INSTRUMENT SETTINGS

PULSE POWER: 95V	REJECT:	0%	FINE GAIN:	o.o dB
RANGE: 5" 0 2321/10" 0.2321	FILTER:	BP 2.25 MHz	DELAY:	1.04/1.04
DISTANCE LINEARITY GAIN:	16.0 dB	AMPLITUDE LINEAR	ITY GAIN:	25.1 dB







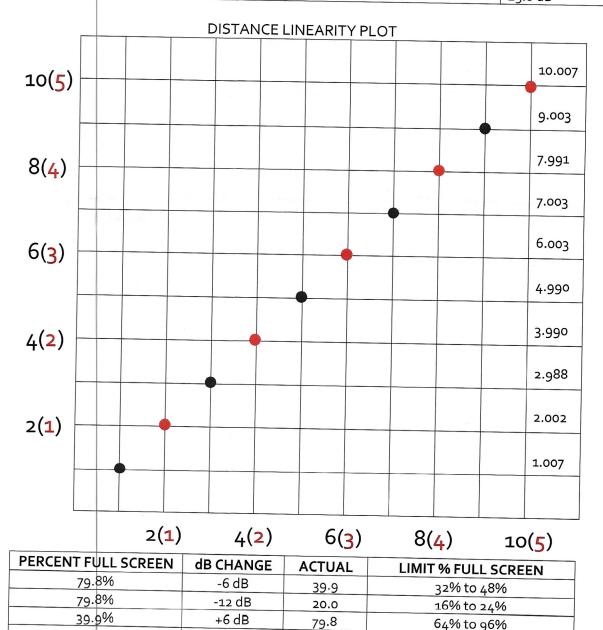
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#### CONVENTIONAL SINGLE ELEMENT PULSER CALIBRATION (P2/R2)

#### LINEARITY TEST INSTRUMENT SETTINGS

20%

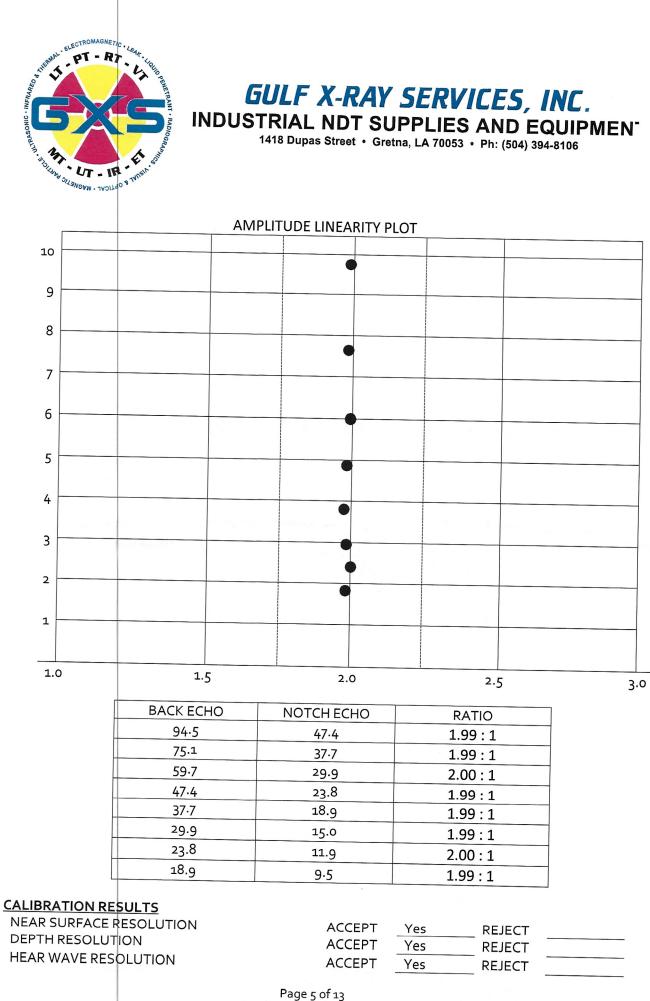
PULSE POWER: 95V	REJECT:	0%	FINE GAIN:	o.o dB
RANGE: 5" 0.2325/10" 0.2325	FILTER:	BP 2.25 MHz	DELAY:	1.00/1.00
DISTANCE LINEARITY GAIN:	17.1 dB	AMPLITUDE LINEAR	RITY GAIN:	25.0 dB



79.8

64% to 96%

+12 dB



Page 5

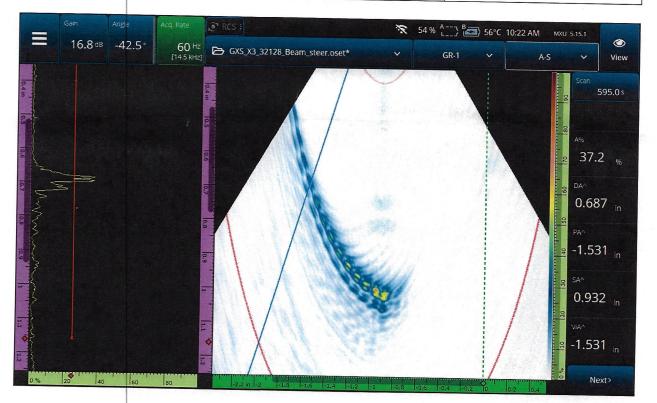


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#### 16:64 PHASED ARRAY CALIBRATION PHASED ARRAY BEAM STEERING

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.

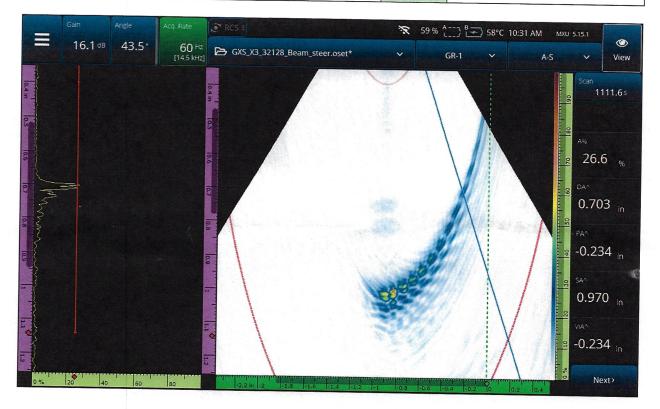
REFERENCE SDH ANGLE:	-10	AMPLITUDE:	80.1%	REFERENCE dB:	16.8dB
MAXIMUM STEERING ANGLE 1:	-45°	AMPLITUDE:	Р		
MAXIMUM STEERING ANGLE 2:	-50°	AMPLITUDE:	Р		





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REFERENCE SDH ANGLE:	+10	AMPLITUDE:	80.2%	REFERENCE dB:	16.1dB
MAXIMUM STEERING ANGLE 1:	+45°	AMPLITUDE:	Р		
MAXIMUM STEERING ANGLE 2:	+50°	AMPLITUDE:	Р		





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#### PHASED ARRAY VERTICAL LINEARITY

VPA:	1 Element		REFERENCE dB:	21.7 dB
TEST:	20% Full Screen Height			
PERFOR	MANCE CRITERIA:	+12 dB, Scree	en 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			1	1	
< 2% Dev.	P	Р	P	P	P	P	P	P	P	P	P	12 D	13	14	15	16
+12 dB Acc.	Р	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Р
								Contraction of the local division of the loc	Contraction of the	F	F	P	P	Р	Р	Р
VPA	17	18	19	20	21	22	23	24	25	26	27	28				
< 2% Dev.	Р	Р	Р	P	Р	Р	P	P	P	P	2/ P	20 P	29 P	30 P	31	32
+12 dB Acc.	Р	Р	Р	Р	P	P	P	P	P	P	P	P	P	P	P	P
										All of the particular states	and the second second second	The loss of the loss	COMPANY STATE	Contraction of	Contraction of the	For the
VPA	33	34	35	36	37	38	39	40	41	42	43		15	.6		.0
< 2% Dev.	P	Р	P	P	P	P	P	P	P	P	43 P	44 P	45 P	46	47	48
+12 dB Acc.	P	Р	Р	Р	P	P	P	P	P	P	P	P	P	P	P	P
	1	1		1000000	Sec. 20								F	P	P	P
VPA	49	50	51	52	53	54	55	56	57	58	50	60	61	62	6-	
< 2% Dev.	Р	Р	Р	P	P	P	P	D	P	P	59 P	P		and the second second	63	64
+12 dB Acc.	Р	Р	Р	P	P	P	P	P	P	P	P	P	P	P	P	P



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VPA:	1 Element		REFERENCE dB:	27.1 dB
TEST:	40% Full Screen Height			27.100
PERFOR	MANCE CRITERIA:	+6 dB, Scree	n Height Between 659	% То 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		10		1	1			
< 2% Dev.	Р	P	P	P	P	D	P	P	9	10	11	12	13	14	15	16
+6 dB Acc.	Р	Р	P	P	P	P	P	P	P	P	P	P	P	P	P	P
VPA	17	18										r	r	P	P	P
< 2% Dev.	/ P	D IO	19	20	21	22	23	24	25	26	27	28	29	30	31	32
and the second diversion of th	Contraction of the		Р	P	Р	Р	Р	P	Р	Р	P	Р	P	P	P	P
+6 dB Acc.	Р	P	Р	P	P	Р	Р	P	P	Р	Р	Р	Р	P	P	P
VPA	33	34	35	36	37	38	39	40	41	42						
< 2% Dev.	P	P	P	P	P	P	P	P	P D	42 D	43 P	44	45	46	47	48
+6 dB Acc.	P	P	P	P	P	P	P	P	Sec. Frank			Ρ	P	P	Р	P
and the second			and a second		E	F	P	P	P	P	Ρ	P	Р	P	P	P
VPA	49	50	51	52	53	54		56		-0	-	-				
< 2% Dev.	P	P	P	P	 P	D	55 P	50	57	58	59	60	61	62	63	64
+6 dB Acc.	P	P	P	P	p	P	P	P	P	P	P	Р	Ρ	Ρ	P	P
		and the second second		State of the second		E.M. Saturd	- F	- F	C. P. C.	P	P	P	P	P	P	P



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VPA:	1 Element		REFERENCE dB:	33.1 dB
TEST:	80% Full Screen Height			55.1 00
PERFOR	MANCE CRITERIA:	-6 dB, Screer	h Height Between 35%	6 То 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								
< 2% Dev.	Р	P	P	P	P	P	D	P	9 P	10	11	12	13	14	15	16
-6 dB Acc.	Р	Р	P	P	P	P	P	P	P	P	P	P	P	P	P	P
								and the second se	Concernance of the second		F	P	P	Р	P	P
VPA	17	18	19	20	21	22	22	24								
< 2% Dev.	P	Р	P	P	P	P	23	24 P	25	26	27	28	29	30	31	32
-6 dB Acc.	P	P	P	P	P	P			Р	Р	Р	Р	Р	P	Р	P
o ab / icc.			F	F	P	P	Ρ	Р	Р	Ρ	Р	P	P	P	Р	Р
VPA	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
< 2% Dev.	P	Р	Р	Ρ	Р	Р	Р	Р	P	P	P	P	P	P	- 4/ P	1 Townson and a state of the st
-6 dB Acc.	Р	Ρ	Р	Р	Р	Р	Р	P	P	P	P	P	P	P		P
										and a second	F	r	P	P	Р	P
VPA	49	50	51	52	53	54		56		-0						
< 2% Dev.	P	P	P	P	- 55 P	54 P	55 P	P	57 P	58	59	60	61	62	63	64
-6 dB Acc.	Р	P	P	P	P	P	P			Р	Р	Р	Р	Р	Р	Р
	11 11 11 11 11 11 11 11 11 11 11 11 11		Contract Participation	and the second	F	P	P	Р	Р	P	P	P	P	P	P	P



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VPA:	1 Element		REFERENCE dB:	33.1 dB
TEST:	80% Full Screen Height		up.	35.140
PERFOR	RMANCE CRITERIA:	-12 dB, Scree	en 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	0				1			
< 2% Dev.	Ρ	Р	P	P	P	P	P	P	9 P	10	11	12	13	14	15	16
-12 dB Acc.	Р	P	P	P	P	P	P			Р	Р	Р	Р	Р	Р	P
			and the second		F	F	P	P	Р	Р	P	Р	Р	P	Р	Р
VPA	17	18	10													
< 2% Dev.	-1/ P	P	19 P	20	21	22	23	24	25	26	27	28	29	30	31	32
				Р	Р	P	P	P	P	P	Р	Р	P	P	P	P
-12 dB Acc.	Р	Р	Р	P	Р	P	Р	P	P	Р	P	P	P	P		Lange Color
	aries.						A COLORADO					, r	F	P	Р	Р
VPA	33	34	35	36	37	38	39	10	1.7							
< 2% Dev.	Р	P	P	P	P	P	39 P	40 P	41 P	42	43	44	45	46	47	48
-12 dB Acc.	Р	P	P	P	P	Contraction 2		and the second	and the property	Р	Р	Р	Р	Ρ	Р	P
12 00 / 100.			F	P	P	P	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р
VPA	49	50	51	52	62			-0	_	-		1.00				
< 2% Dev.	P	P	P	- 52 P	53	54	55	56	57	58	59	60	61	62	63	64
	and the second of					P	Р	Р	Ρ	Р	Ρ	Ρ	Ρ	Р	Р	P
-12 dB Acc.	P	P	Ρ	Ρ	Р	P	Р	P	P	Р	P	P	P	P	P	P



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#### PHASED ARRAY HORIZONTAL LINEARITY

VPA:	1 Element		
VIA.	TElement	REFERENCE dB:	26.8 dB
TEST:	1 <sup>st</sup> BWR @ 80% Full Screen Height		20:0 0D
	Puil 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		10				1		
1 <sup>st</sup> BWR	Р	Р	P	P	P	P	P	P	9 P	10 P	11	12	13	14	15	16
2 <sup>nd</sup> BWR	Р	Р	Р	Р	P	P	P	P	P	Part of the second	P	P	Р	Р	Р	Р
3 <sup>rd</sup> BWR	Р	Р	Р	Р	P	P	P	P	P	P	Р	P	Р	Р	P	Р
4 <sup>th</sup> BWR	Р	P	Р	P	P	P	p	P	P	P	P	Р	Р	Р	Р	P
VPA	17	18	10	20				and the state of the	Contraction of the	P	Р	Р	Р	P	Р	Р
1 <sup>st</sup> BWR	/ P	P	19 P	20 P	21	22	23	24	25	26	27	28	29	30	31	32
2 <sup>nd</sup> BWR	P	P	P		P	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	P
3 <sup>rd</sup> BWR	P	P		Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р
	P	1	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	P
4 <sup>th</sup> BWR	P	Р	Р	Р	Р	Р	Р	Р	Р	Ρ	Р	P	Р	Р	P	P
VPA	33	34	35	36	37	38	39	40	41	42	12					OPPORT SALES
1 <sup>st</sup> BWR	Ρ	Р	Р	Р	Р	P	P	P	P	9 P	<u>43</u>	P	45	46	47	48
2 <sup>nd</sup> BWR	Р	Р	Р	Р	P	Р	P	P	P	P	P	P	P	Р	Р	Р
3 <sup>rd</sup> BWR	Р	Р	Р	Р	Р	Р	P	P	P	P	P	Letter and the second	P	Р	Р	P
4 <sup>th</sup> BWR	Р	Р	Р	P	Р	Р	P	P	P	P	Service Services	P	P	Р	Р	Р
VPA	49	50	51	52	50					Contraction of the local data	P	Р	Р	Р	Р	Р
1 <sup>st</sup> BWR	P P	P	<u>D</u>	52 P	53	_54	55	56	57	58	59	60	61	62	63	64
2 <sup>nd</sup> BWR	P	P	p	P	P	Р	Р	Р	Р	Р	Р	Р	Р	P	Р	P
3 <sup>rd</sup> BWR	P	P	P		P	Р	Р	Ρ	Р	Р	P	Р	P	Р	P	Р
	P			Р	Р	Р	Р	Р	Р	Р	Р	P	Р	P	Р	р
4 <sup>th</sup> BWR	F	Р	Ρ	Р	Р	Р	P	Р	Р	Р	Р	Р	P	Р	р	P



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		PULSER OU	JTPUT RESPONSE								
PULSER SETTING:	80	V	PULSER WIDTH:	250.05							
PULSER RISE TIME:	Fix		PULSER FALL TIME:	250 ns							
PULSE REPETITION RATE:	20		LOAD:	Fixed							
PERFORMANCE CRITERIA:		Pulser Voltage: 45V-1		50 Ohm							
PERFORMANCE CRITERIA: Pulser Voltage:45V-55V, Pulser Width+/-25ns, Pulser Rise:2ns-1ons											

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	2	1	-	E		0								
Width(ns)	Р	P	P	P P	5	0	7	8	9	10	11	12	13	14	15	16
Voltage(V)	P	P	D	D	P	P	Р	Р	Р	Р	Р	Ρ	Р	Р	P	Р
Rise Time(ns)	P	P	P	P	P	P	Р	Р	Ρ	Р	Р	Р	Р	Р	Р	P
		a set for an	E	F	P	Р	P	Р	Р	Р	Р	Р	P	D	D	