



new products

JOHANSON PHASE-TRIM

WHAT IS A PHASE-TRIM?

The Johanson Phase-Trim is a miniature mechanical device which enables the user to make rapid, infinitely variable phase length adjustments of microwave transmission lines. Phase length adjustments may be accomplished during systems operation with virtually no corresponding transient responses.

HOW IS A PHASE-TRIM USED?

Phase-Trim is series inserted in a .086 diameter or .141 diameter semi-rigid coaxial transmission line between phase sensitive components such as transmitters, antennas, receivers, decoders or the like. As the common coupling hex nut is rotated, differential threads displace the inner and outer conductors in synchronism to effect a precise increase or decrease in cable length with a multi-turn tuning resolution of 40 per inch.

Physical cable length has a direct mathematical relationship to electrical length as illustrated by the equation:

$$\lambda = \frac{v}{f \sqrt{e}}$$

Where λ is wave length in meters
 v is speed of light (300×10^6 M/Sec.)
 f is frequency in cycles per second
 e is the dielectric constant of the propogation medium

Phase matching of microwave semi-rigid coaxial cables has long plagued the industry with high cost, marginal performance and questionable reliability.

To clarify the advantages of Phase-Trim over "cut and try" methods, perhaps an examination of the step by step traditional method of phase matching would prove useful. Our reference will be a pair of semi-rigid .086 diameter semi-rigid cables with connectors soldered on:



MANUFACTURING CORPORATION

400 Rockaway Valley Road, Boonton, N. J. 07005
(201) 334-2676

Electronic Accuracy Through Mechanical Precision

Represented by:

DEVERELL ASSOCIATES
WELLINGTON

REC. - 8 MAY 1985

ANSO.....

<u>STEP NO.</u>	<u>OPERATION</u>
1	Electrical Measurement
2	Unsolder Connector
3	Unsolder Center Contact
4	Trim predetermined amount from copper jacket
5	Trim predetermined amount from insulation
6	Re-solder center contact
7	Re-solder connector
8	Repeat electrical measurement

The above operations represent the first or initial trimming attempt. One, two, three or more attempts may be required depending on the desired accuracy of the phase match.

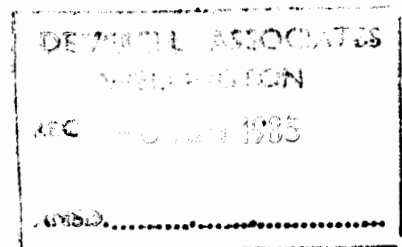
Should you question why more than one attempt need be made, consider matching two cables to $\pm 2^\circ$ at 10 GHz. Two electrical degrees at 10 GHz represents a physical length of approximately six one thousandths of an inch as computed from the equation on page one. This situation is compounded and confounded by any bending of the cable which will cause the original "setting" to change due to resultant displacement of inner conductor, dielectric outer jacket and connector contacts. The difficulty of phase matching should, at this point, be obvious. The ultimate injury results when the cable is cut too short, at which time, it must be discarded and the whole process repeated from scratch.

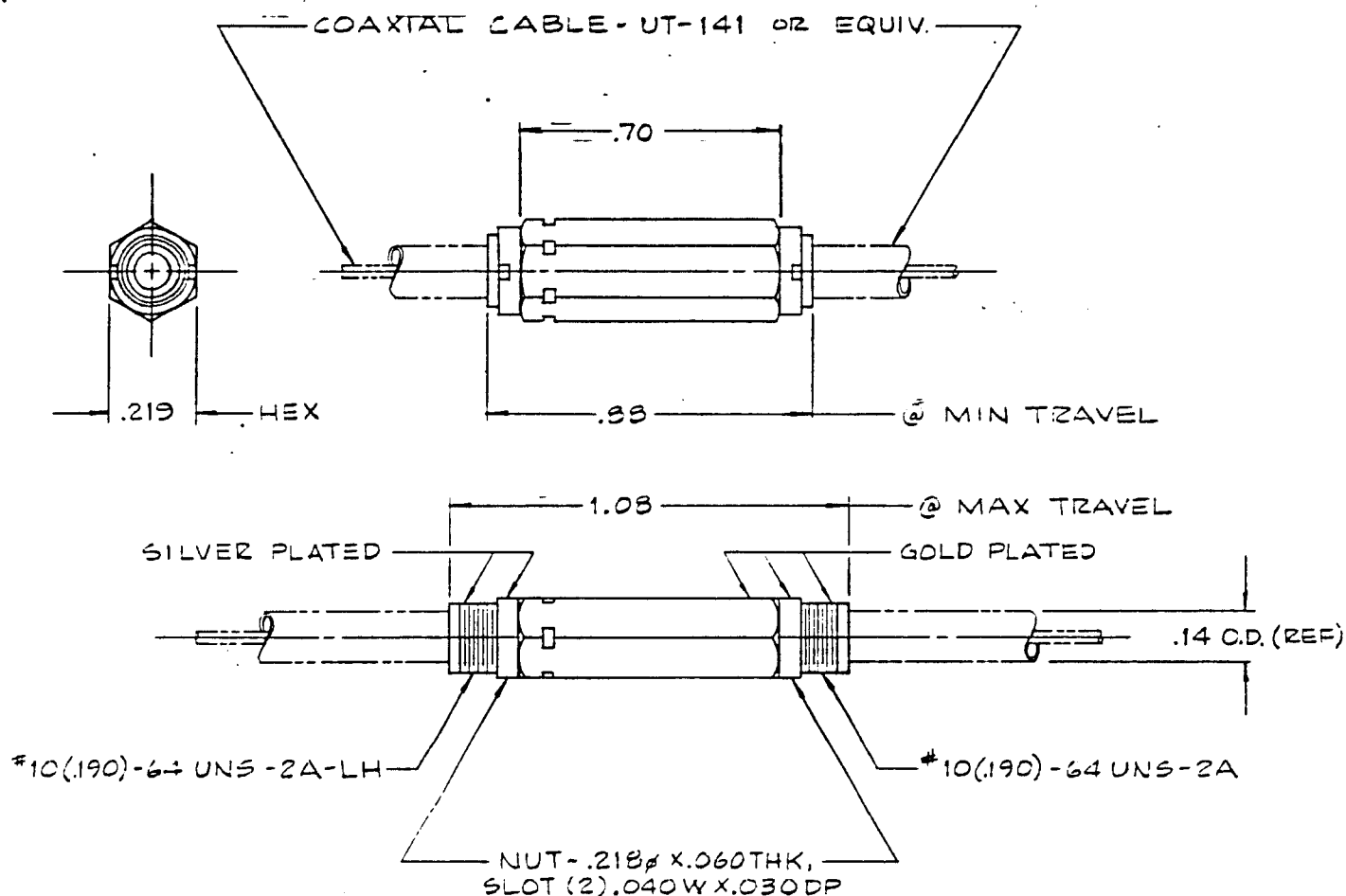
Now consider Phase-Trim as an alternate to cutting:

<u>STEP NO.</u>	<u>OPERATION</u>
1	Electrical Measurement
2	Mechanical Adjustment
3	Set Locknuts

With its inherent speed, accuracy, simplicity and convenience of adjustment, Phase-Trim may be adjusted in the field to optimize systems performance and enhance "on-site" field repair capability.

At this point the Phase Trim's most significant contribution to systems cost reduction should be realized. Phase-Trim is a labor saving device of enormous potential especially when one considers that phased array radars can contain upwards of 1000 phase matched dipoles per antenna.



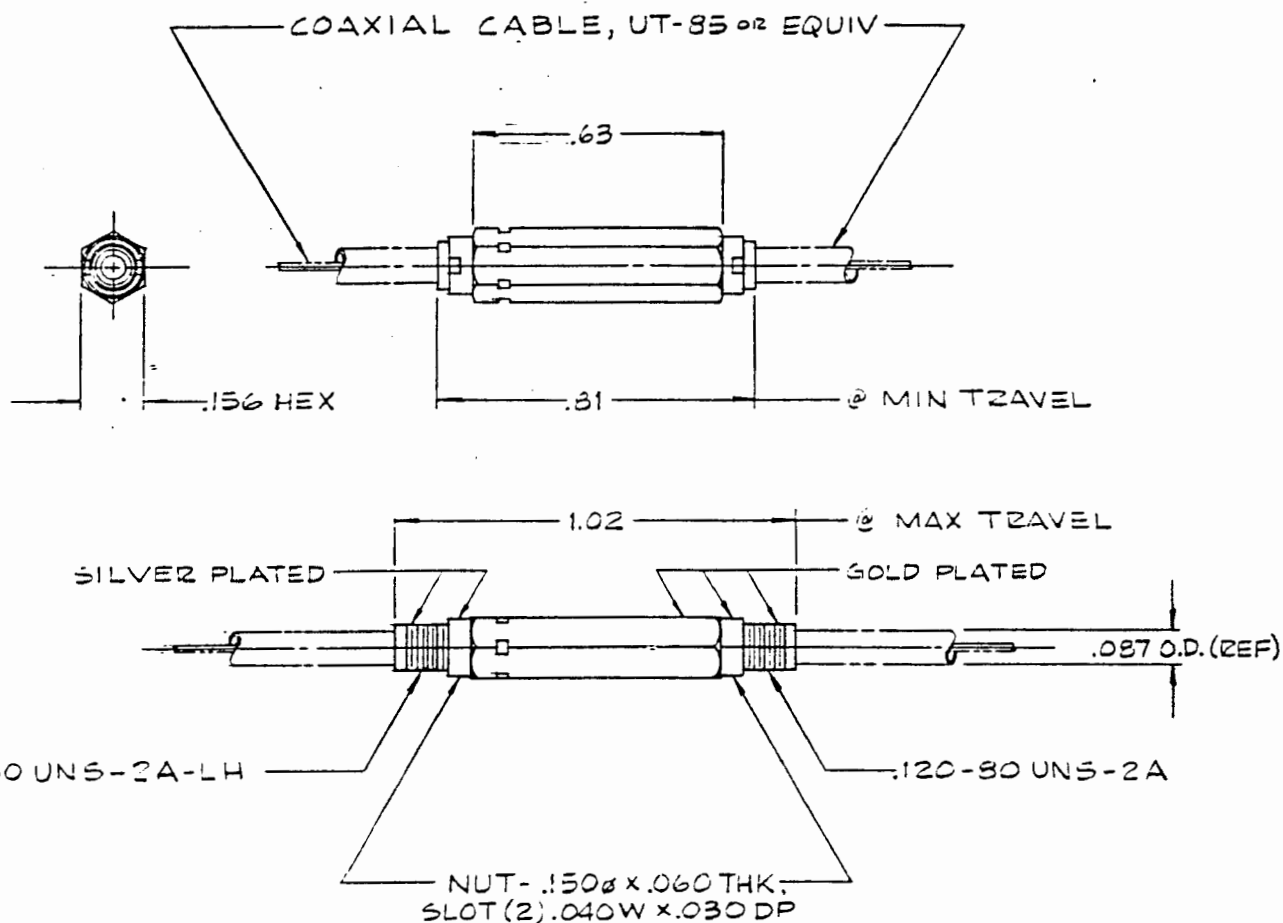


SPECIFICATIONS:

IMPEDANCE	50 Ω
MECHANICAL ADJUSTMENT	>6 TURNS (2,160°)
PHASE ADJUSTMENT	>30° @ 8.2 GHz >50° 12.4 GHz
TORQUE	1.0 TO 5.0 OZ. IN.
MATERIALS	BRASS, Be Cu

PROPRIETARY
INFORMATION CONTAINED
NOT TO BE USED WITHOUT
JOHANSON MFG. APPROVAL

PHASE-TRIM	DRN. <i>AK</i>	APP. <i>AK</i>	SCALE 2 in. = 1 in.
 JOHANSON MANUFACTURING CORPORATION Rockaway Valley Road, Boonton, N.J. 07005 (201) 334-2676 ELECTRONIC ACCURACY THROUGH MECHANICAL PRECISION	DATE 27 MAR 94	DATE 7-6-84	.X X $\pm$.015 .X X X $\pm$.005
	DRG. NO. 3050-0		REV. D 27 APR 94



SPECIFICATIONS:

IMPEDANCE	50 Ω
MECHANICAL ADJUSTMENT	>7 TURNS (2,520°)
PHASE ADJUSTMENT	>30° @ 8.2 GHz >50° @ 12.4 GHz
TORQUE	0.5 TO 3.0 OZ. IN.
MATERIALS	BRASS, Be Cu

PROPRIETARY
INFORMATION CONTAINED
NOT TO BE USED WITHOUT
JOHANSON MFG. APPROVAL

PHASE-TRIM

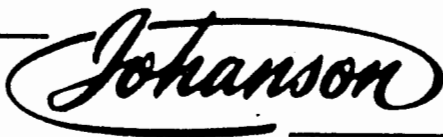
DRN. <i>HL</i>	APP. <i>WJ</i>	SCALE 2 IN. = 1 IN.
DATE 27 MAR 94	DATE <i>4-2-94</i>	.X X $\pm$.015 .X X X $\pm$.005
DRG. NO. 3050-1		REV. <i>D</i> 27 APR 94

Johanson

MANUFACTURING CORPORATION

Rockaway Valley Road, Boonton, N.J. 07005 (201) 334-2676

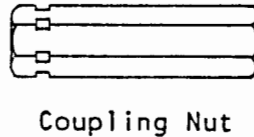
ELECTRONIC ACCURACY THROUGH MECHANICAL PRECISION



Electronic Accuracy Through Mechanical Precision

Instructions for Johanson PHASE-TRIM PHASE ADJUSTERS

PARTS



(Note: Bushing slots should be compressed.)

TO ASSEMBLE THE CENTER PIN AND CENTER CONTACT

1. Cut back cable center conductor and dielectric .060 inches.
2. Coat center conductor with solder paste. Slide on phase adjuster center pin until flush with cable dielectric.
3. Wipe off excess solder paste. Solder using resistance soldering.
4. Clean off flux and remove any excess solder.
5. Repeat with center contact.

TO ASSEMBLE BUSHING TO CABLE OUTER CONDUCTOR

1. Preform a four turn coil of .015 diameter solder by wrapping around a spare piece of cable. Slip solder coil over cable end.
2. Apply one small drop of flux at the cable end and spread around cable circumference for approximately 0.2 inches. Do not over flux.
3. Slide left hand bushing completely on outer conductor of cable with center contact (.160 inches) and slide solder coil to contact it.
4. Hold vertically and apply pressure on bushing and cable to maintain alignment during soldering. Do NOT press on center contact.
5. Solder using resistance soldering and clean thoroughly.
6. Repeat with right hand thread bushing and center pin.

TO ASSEMBLE THE PHASE ADJUSTER

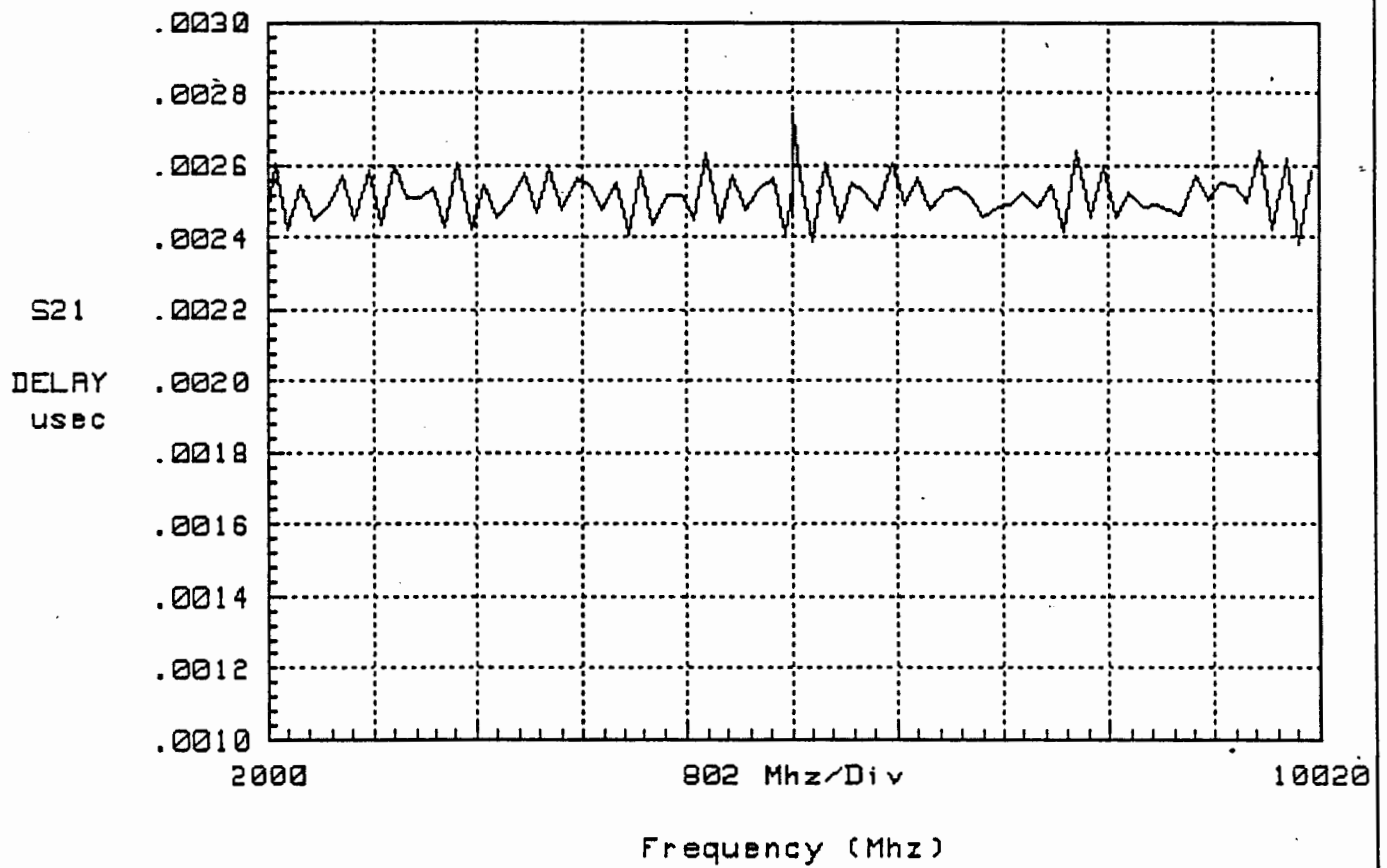
1. Thread the coupling nut completely onto the cable end with the left hand thread.
2. Hold the coupling nut so that it will not rotate.
3. Align the center pin with the center contact, then thread the right hand thread bushing and cable end completely onto the coupling nut. Phase adjuster is now assembled at its minimum length.

TO USE

Cut the cable assembly to slightly less than the required length and install. Length can be increased by .175 inches by rotating the coupling nut counter-clockwise as viewed from the end with the annular groove.

R342A 11/1/83

PHASE SHIFTER
P/N 3050-1
0 REVOLUTIONS FROM FULLY CLOSED ADJ



PHASE SHIFTER

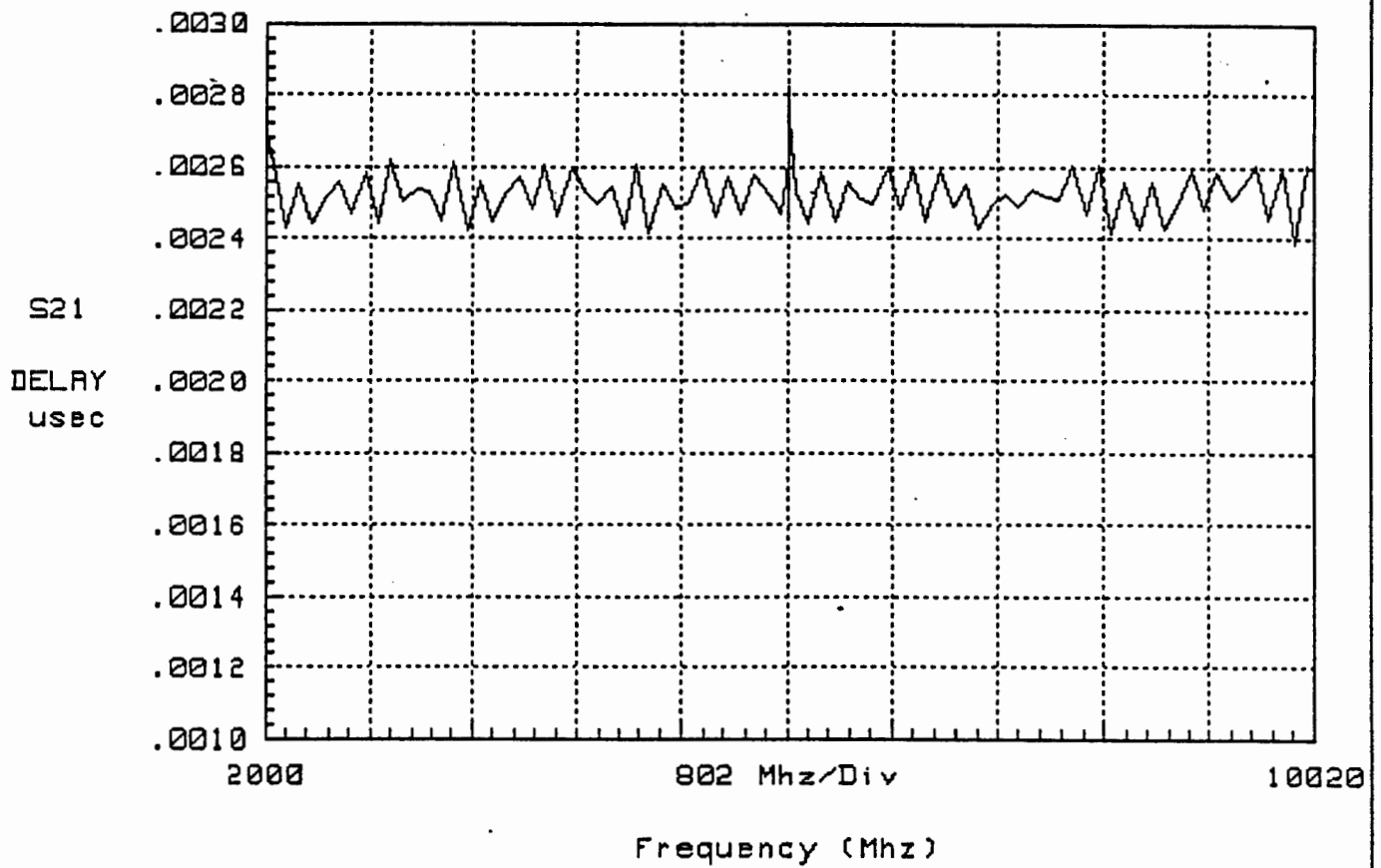
P/N 3050-1

0 REVOLUTIONS FROM FULLY CLOSED ADJ

FREQUENCY MHz	INPUT VSWR S11	LOSS-FORWARD S21			LOSS-REVERSE S12			OUTPUT VSWR S22
		DB	ANG	DELAY u-SEC	DB	ANG		
2000.0000	1.13	.46	-10.8	.0025	.46	-10.7	1.13	
2001.0000	1.13	.46	-11.7	.0025	.46	-11.6	1.13	
2002.0000	1.13	.48	-12.6	.0026	.48	-12.6	1.13	
2003.0000	1.13	.46	-13.5	.0025	.46	-13.5	1.13	
2004.0000	1.13	.46	-14.4	.0026	.46	-14.4	1.13	
2005.0000	1.13	.46	-15.4	.0025	.46	-15.4	1.13	
2006.0000	1.13	.49	-16.2	.0025	.49	-16.2	1.13	
2007.0000	1.13	.50	-17.1	.0025	.50	-17.1	1.13	
2008.0000	1.13	.51	-18.0	.0026	.51	-18.0	1.13	
2009.0000	1.12	.50	-19.0	.0025	.50	-18.9	1.13	
2010.0000	1.12	.48	-19.8	.0026	.48	-19.8	1.12	
2110.0000	1.09	.44	-113.6	.0024	.44	-113.5	1.09	
2210.0000	1.15	.51	159.3	.0025	.47	159.3	1.15	
2310.0000	1.07	.49	67.7	.0024	.49	67.7	1.08	
2410.0000	1.19	.51	-20.5	.0025	.51	-20.5	1.19	
2510.0000	1.03	.51	-110.2	.0026	.46	-110.2	1.03	
2610.0000	1.18	.50	157.3	.0025	.50	157.3	1.18	
2710.0000	1.05	.52	69.1	.0026	.52	69.0	1.05	
2810.0000	1.15	.56	-24.0	.0024	.51	-24.0	1.15	
2910.0000	1.05	.56	-111.8	.0026	.52	-111.8	1.05	
3010.0000	1.12	.55	154.7	.0025	.55	154.8	1.12	
3110.0000	1.11	.54	64.3	.0025	.54	64.3	1.11	
3210.0000	1.08	.55	-26.2	.0025	.55	-26.2	1.08	
3310.0000	1.21	.56	-117.7	.0024	.53	-117.6	1.21	
3410.0000	1.03	.58	154.9	.0026	.56	154.8	1.03	
3510.0000	1.32	.65	61.1	.0024	.63	61.1	1.32	
3610.0000	1.09	.60	-26.1	.0025	.60	-26.1	1.09	
3710.0000	1.34	.66	-117.7	.0025	.66	-117.7	1.34	
3810.0000	1.20	.65	153.9	.0025	.65	153.8	1.20	
3910.0000	1.27	.68	63.9	.0026	.68	63.9	1.27	
4010.0000	1.26	.70	-28.9	.0025	.70	-28.9	1.26	
4110.0000	1.20	.69	-117.9	.0026	.69	-117.9	1.20	
4210.0000	1.23	.68	148.8	.0025	.68	148.8	1.23	
4310.0000	1.21	.68	59.7	.0026	.68	59.7	1.21	
4410.0000	1.25	.79	-32.5	.0025	.79	-32.6	1.26	
4510.0000	1.15	.67	-124.2	.0025	.67	-124.2	1.15	
4610.0000	1.22	.80	146.6	.0025	.80	146.6	1.22	
4710.0000	1.18	.72	54.8	.0024	.72	54.8	1.18	
4810.0000	1.26	.88	-32.0	.0026	.88	-32.0	1.27	
4910.0000	1.10	.76	-125.1	.0024	.73	-125.0	1.10	
5010.0000	1.34	.85	147.3	.0025	.84	147.3	1.35	
5110.0000	1.11	.76	56.7	.0025	.76	56.6	1.12	
5210.0000	1.30	.86	-34.0	.0024	.86	-33.9	1.30	
5310.0000	1.32	.83	-122.1	.0026	.83	-122.1	1.32	
5410.0000	1.22	.79	143.3	.0024	.79	143.3	1.22	
5510.0000	1.59	1.10	55.4	.0026	1.08	55.4	1.59	
5610.0000	1.05	.80	-37.2	.0025	.80	-37.2	1.05	
5710.0000	1.51	1.04	-126.4	.0025	1.01	-126.4	1.52	
5810.0000	1.05	.83	142.4	.0026	.83	142.4	1.05	
5910.0000	1.62	1.12	50.0	.0024	1.13	50.1	1.62	

6010.0000	1.27	.90	-36.7	.0025	.90	-36.6	1.27
6011.0000	1.26	.92	-37.6	.0025	.92	-37.6	1.26
6012.0000	1.26	.94	-38.5	.0026	.94	-38.5	1.26
6013.0000	1.25	.93	-39.4	.0027	.92	-39.5	1.25
6014.0000	1.24	.91	-40.4	.0026	.90	-40.4	1.24
6015.0000	1.24	.90	-41.3	.0026	.89	-41.3	1.23
6016.0000	1.23	.89	-42.3	.0027	.89	-42.3	1.23
6017.0000	1.22	.89	-43.2	.0025	.89	-43.2	1.22
6018.0000	1.22	.87	-44.1	.0027	.85	-44.2	1.21
6019.0000	1.21	.84	-45.1	.0027	.84	-45.1	1.21
6020.0000	1.20	.84	-46.1	.0026	.84	-46.1	1.20
6120.0000	1.44	.99	-138.7	.0024	.99	-138.7	1.45
6220.0000	1.27	.90	135.2	.0026	.90	135.2	1.27
6320.0000	1.28	.94	41.4	.0024	.94	41.4	1.28
6420.0000	1.11	.83	-46.5	.0025	.83	-46.6	1.11
6520.0000	1.28	.95	-138.2	.0025	.94	-138.2	1.28
6620.0000	1.18	.93	130.9	.0025	.92	130.9	1.18
6720.0000	1.52	1.10	41.8	.0026	1.10	41.8	1.52
6820.0000	1.13	.97	-51.9	.0025	.94	-51.9	1.13
6920.0000	1.42	1.12	-141.5	.0026	1.12	-141.6	1.42
7020.0000	1.28	.98	126.0	.0025	.98	126.0	1.29
7120.0000	1.28	1.00	36.7	.0025	1.00	36.8	1.28
7220.0000	1.43	1.10	-54.4	.0025	1.10	-54.4	1.43
7320.0000	1.18	.98	-145.9	.0025	.98	-146.0	1.18
7420.0000	1.65	1.22	123.7	.0025	1.22	123.7	1.65
7520.0000	1.44	1.20	35.3	.0025	1.19	35.3	1.44
7620.0000	1.54	1.16	-54.2	.0025	1.16	-54.2	1.54
7720.0000	1.72	1.51	-143.8	.0025	1.51	-143.9	1.73
7820.0000	1.32	1.11	125.4	.0025	1.11	125.3	1.33
7920.0000	1.75	1.66	35.9	.0025	1.66	35.9	1.76
8020.0000	1.16	1.08	-55.8	.0024	1.08	-55.7	1.16
8120.0000	1.74	1.52	-142.8	.0026	1.52	-142.8	1.75
8220.0000	1.14	1.08	122.1	.0025	1.08	122.1	1.13
8320.0000	1.51	1.39	33.6	.0026	1.38	33.6	1.51
8420.0000	1.29	1.21	-59.8	.0025	1.21	-59.8	1.29
8520.0000	1.38	1.25	-148.2	.0025	1.25	-148.2	1.39
8620.0000	1.57	1.74	120.9	.0025	1.73	121.0	1.56
8720.0000	1.42	1.25	31.4	.0025	1.25	31.4	1.42
8820.0000	1.50	1.60	-58.3	.0025	1.58	-58.4	1.50
8920.0000	1.58	1.31	-147.4	.0025	1.31	-147.4	1.58
9020.0000	1.33	1.30	123.9	.0026	1.29	123.9	1.33
9120.0000	1.43	1.14	31.3	.0025	1.14	31.3	1.43
9220.0000	1.32	1.22	-58.9	.0026	1.22	-58.9	1.32
9320.0000	1.38	1.18	-150.8	.0025	1.18	-150.8	1.38
9420.0000	1.47	1.33	117.5	.0025	1.33	117.5	1.47
9520.0000	1.15	1.16	27.6	.0026	1.16	27.6	1.15
9620.0000	1.84	1.60	-67.3	.0024	1.60	-67.3	1.85
9720.0000	1.26	1.27	-154.4	.0026	1.27	-154.4	1.26
9820.0000	1.96	1.72	111.3	.0024	1.72	111.3	1.97
9920.0000	1.49	1.55	25.6	.0026	1.55	25.7	1.49
10020.0000	1.88	1.93	-67.5		1.93	-67.5	1.89

PHASE SHIFTER
P/N 3050-1
3 REVOLUTIONS FROM FULLY CLOSED ADJ



IL/RL

VS. FREQUENCY

MODEL 3050-1 PHASE SHIFTER

SERIAL NO. 6" CABLE (.085)

ENG. REF. -

PORT THRU

CONDITIONS FULLY CLOSED AND LOCKED

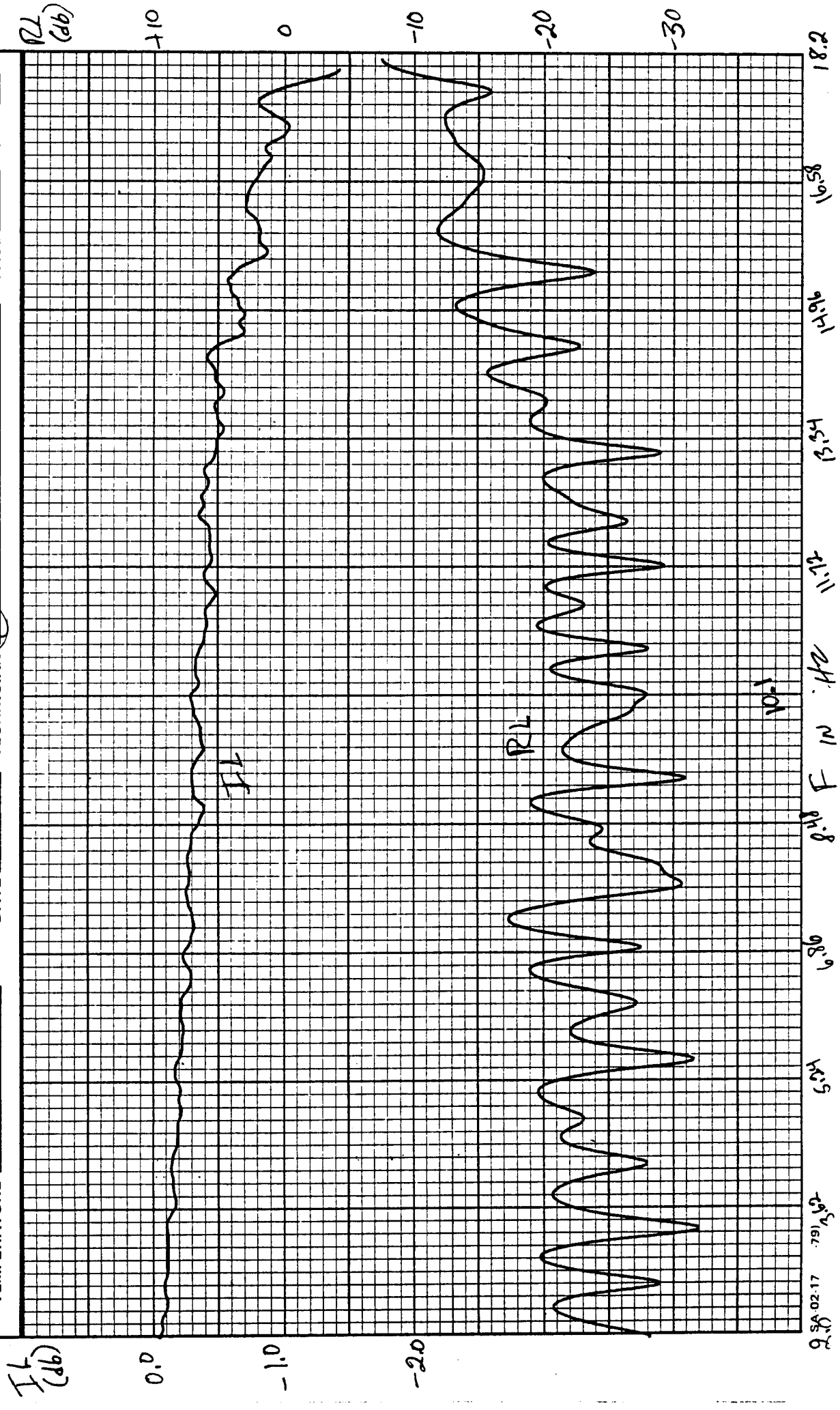
TEMPERATURE Room

DATE 6-15-84

TECHNICIAN (RL)

PAGE 1

OF 5



IL/RL

VS. FREQUENCY

SERIAL NO. 6" CABLE (.085)

ENG. REF. —

MODEL 3050-1 PHASE SHIFTER

PORT THRU

CONDITIONS 2 TURNS FROM CLOSED & LOCKED

TEMPERATURE ROOM

DATE 6-15-84

TECHNICIAN (RL)

PAGE 2 OF 5

IL (dB)

0.0

-1.0

-2.0

RL (dB)

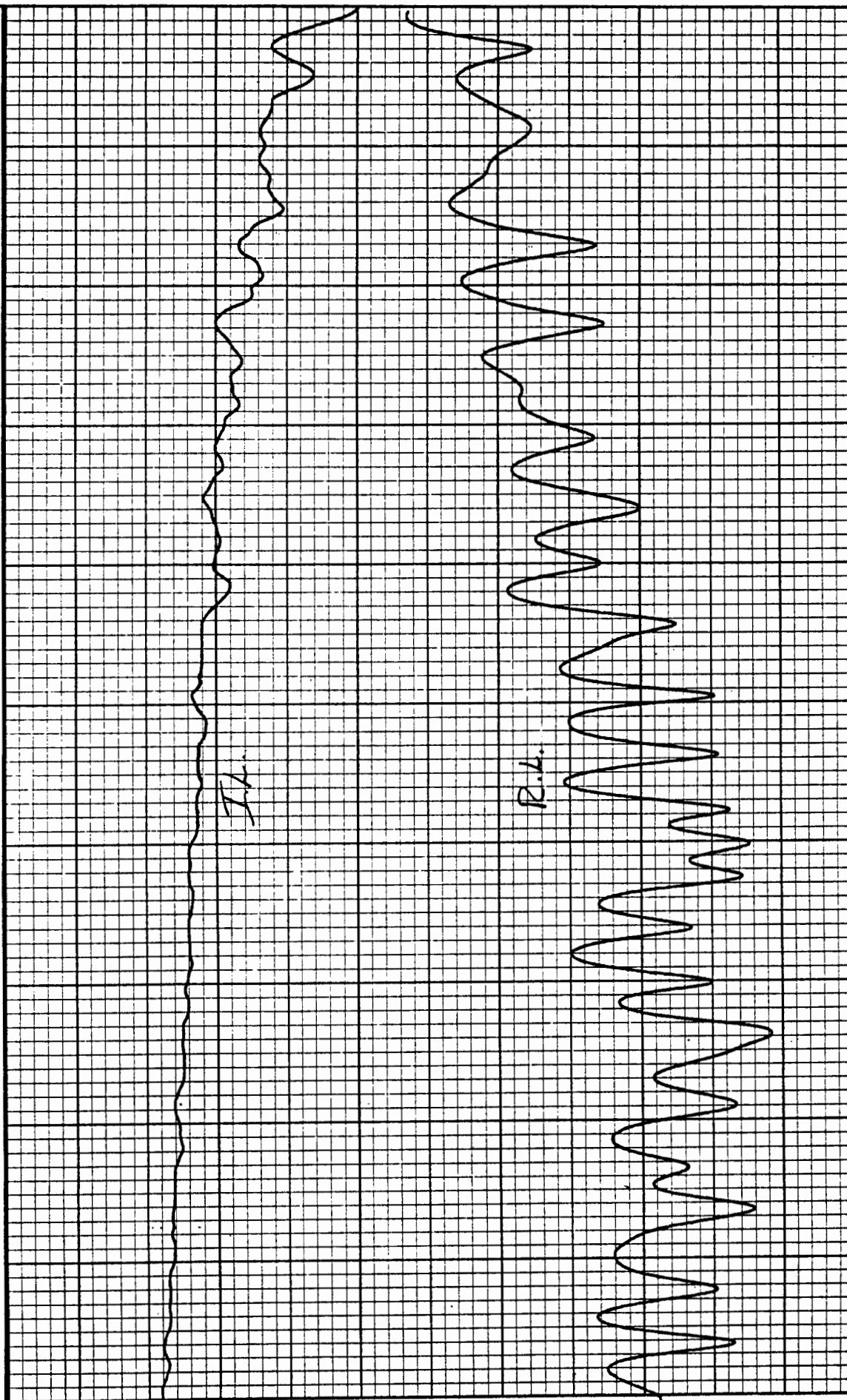
+10

0

-10

-20

-30



IL/RL

VS. FREQUENCY

MODEL 3050-1 PHASE SHIFTER

SERIAL NO. 6" CABLE (085)

ENG. REF. —

PORT 1112W

CONDITIONS 4 TURNS FROM FULLY CLOSED & LOCKED

TEMPERATURE Room

DATE 6-15-84

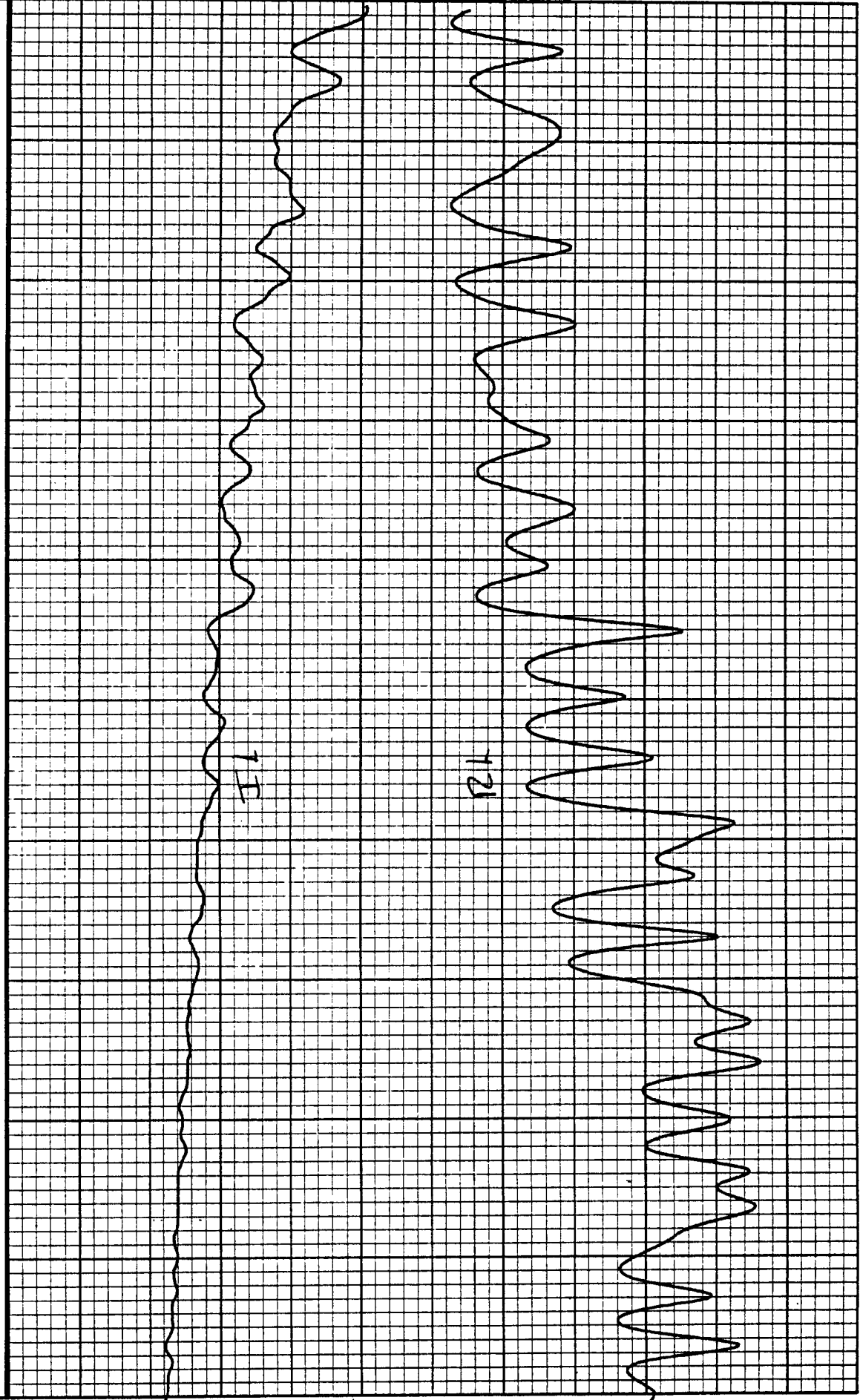
TECHNICIAN (BL)

PAGE 3

OF 5

IL (db)

RL (db)



MODEL 305D-1 PHASE SHIFTER

PORT 17W

TEMPERATURE 200M

IL/RL

VS. FREQUENCY

SERIAL NO. 6" CABLE (085)

ENG. REF. —

CONDITIONS 6 TURNS FROM FULLY CLOSED & LOCKED

TECHNICIAN (BL)

DATE 6-15-84

PAGE 4 OF 5

IL (dB)

0.0

-1.0

-2.0

RL (dB)

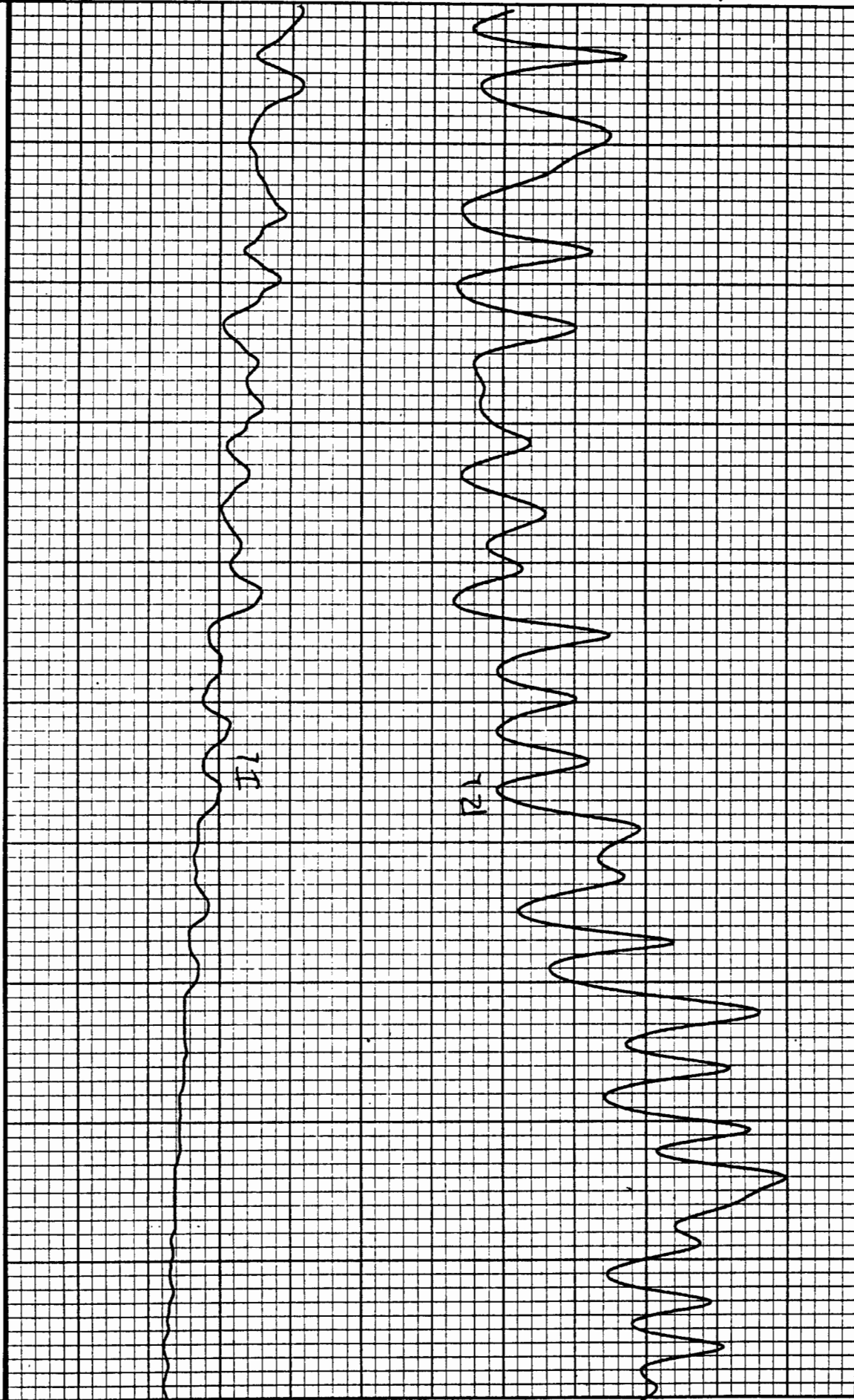
+10

0

-10

-20

-30



MODEL 3050-1 PHASE SHIFTER

PORT THRU

TEMPERATURE ROOM

IL/RL

VS. FREQUENCY

SERIAL NO. 6" CABLE (0.085)

ENG. REF. —

CONDITIONS 8 TURNS FROM FULLY CLOSED & LOCKED

TECHNICIAN (BL)

DATE 6-15-84

PAGE 5 OF 5

IL (db)

0.0

-1.0

-2.0

RL (db)

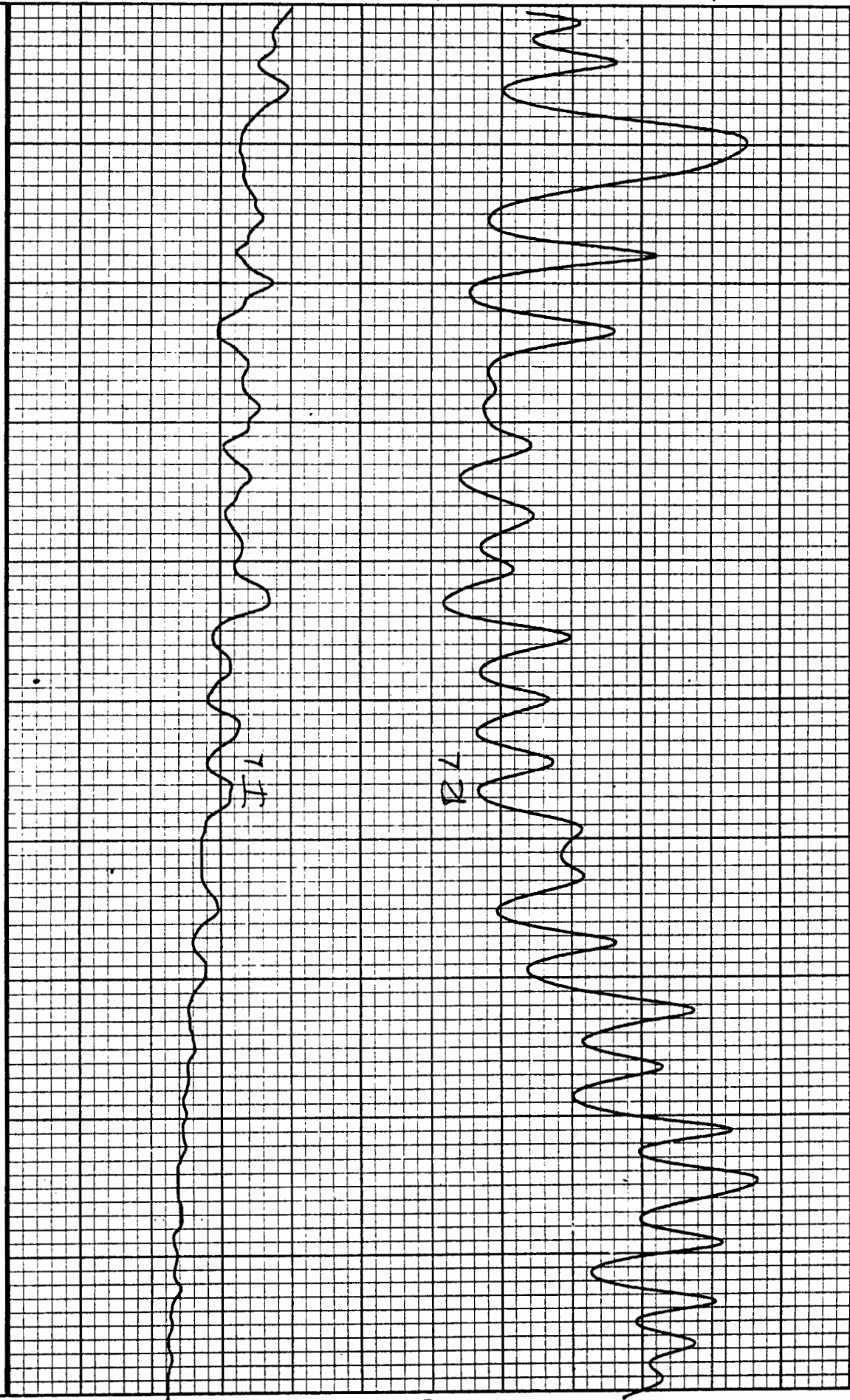
+1.0

0

-10

-20

-30



IL/RL VS. FREQUENCY

MODEL —

SERIAL NO. 6

ENG. REF. —

PORT RAW

CONDITIONS .085" w/ SMA's ON BOTH END

TEMPERATURE Room

DATE —

TECHNICIAN BL

PAGE 1 OF 1

IL
(dB)

RL
(dB)

0

+10

-0.2

0

-0.4

-10

-0.6

-20

