

REPORT OF TEST
ON
THE MODEL RAC, RHOMBIC ANTENNA COUPLER

A. R. BERNARDI
THE TECHNICAL MATERIEL CORPORATION

AUGUST, 1956

TEST REPORT ON MODEL RAC			
THE TECHNICAL MATERIAL CORPORATION MAMARONECK, NEW YORK			
DATE	8/14/56	CHKD.	
DRAWN		APPD.	
SHEET	0 OF 20	NO.	S-303

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1.

NOTICES

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2.

ADMINISTRATIVE DATA

PURPOSE OF TEST:

AUGUST, 1956

This test has been conducted to determine if the equipment referred to herein has characteristics which are in accordance with the manufacturer's specifications.

MANUFACTURER: THE TECHNICAL MATERIEL CORPORATION
MANUFACTURER'S TYPE OR MODEL NO: RAC
DRAWING, SPECIFICATION OR EXHIBIT: COMMERCIAL
QUANTITY OF ITEMS TESTED: ONE
SECURITY CLASSIFICATION OF ITEMS: UNCLASSIFIED
DATE TEST COMPLETED: AUGUST 14, 1956
TEST CONDUCTED BY: A. R. BERNARDI
CONTRACT NUMBER AF 30(635)-6812
REPORT AS PER MIL-T-9107(USAF)

3.

FACTUAL DATA

3.1 DESCRIPTION OF TEST APPARATUS:

- (a). Vacuum Tube Voltmeter -- Hewlett-Packard Model 410 --- Calibrated at monthly intervals against a laboratory standard.
- (b). Non-inductive resistors: 70, 200, 700 ohms.
- (c). Radio Frequency Generator -- Measurement Corp. Models 65-B, 80R, TMC Model VOX.
- (d). Radio Frequency Bridge General Radio Model 916A.
- (e). Receiver -- TMC Model GPR-90.
- (f). Converter, TMC #103.

3.2 Test Procedure:

NOTE: SINCE THE FOLLOWING MEASUREMENTS ARE BEING MADE AT RADIO FREQUENCIES, THE TESTS HAVE BEEN CONDUCTED WITH THE TRANSFORMER TR-001, REMOVED FROM THE CASE, TO KEEP DISTRIBUTED CONSTANTS TO A MINIMUM.

3.2.1. Output Impedance vs. Frequency:

- 3.2.1.1. Purpose: To determine the output impedance of a Model RAC Antenna Coupler, when its input terminals of 700 and 200 ohms are respectively terminated in non-inductive resistors.
- 3.2.1.2. Procedure: Resistance and Reactance measurements were made with a General Radio, Model 916A, Impedance Bridge, in accordance with instructions supplied by the manufacturer.
- 3.2.1.3. Test Diagram: Refer to Appendix #1, Part 3.3.1.
- 3.2.1.4. Test Results: Refer to Appendix #2, Parts 3.4.3.1, 3.4.3.2, 3.4.4.1, 3.4.4.2.

3.2.2. Insertion Loss vs. Frequency:

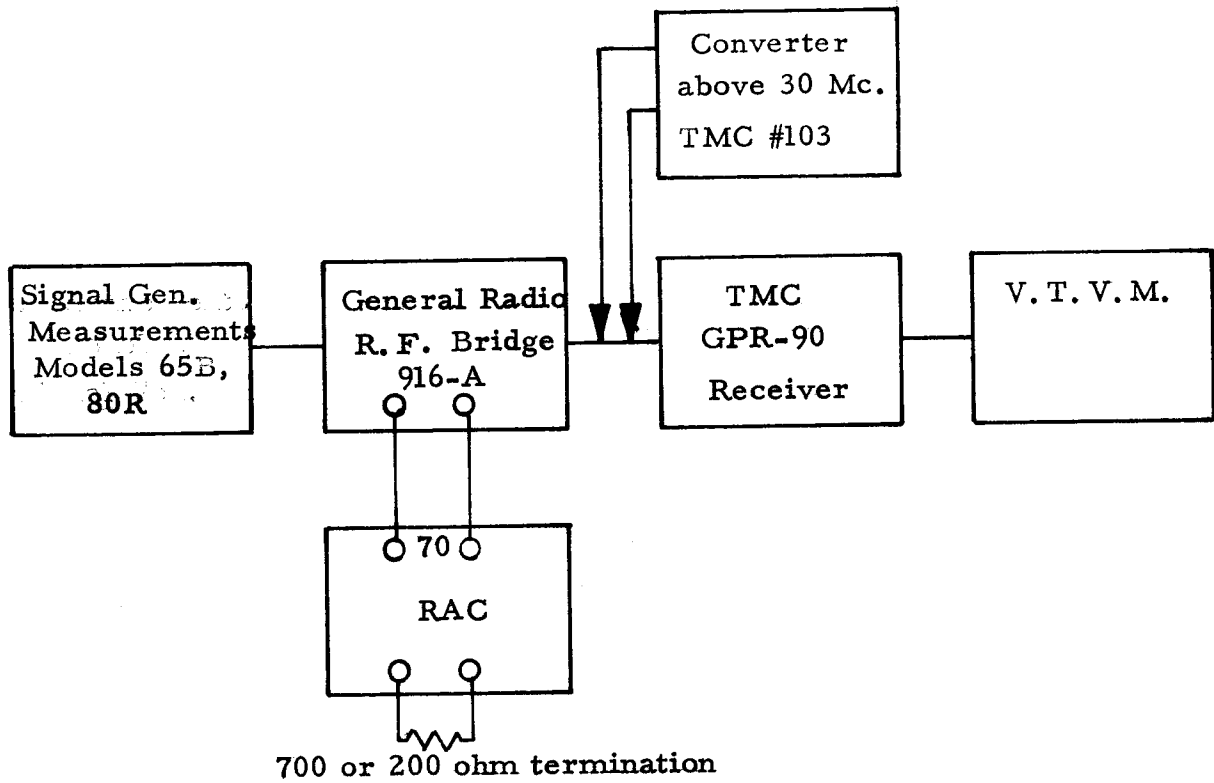
- 3.2.2.1. Purpose: The purpose of this test is to determine the total insertion loss of the Model RAC and its variation with frequency when its input is terminated in a matching non-inductive resistor. The term "insertion loss" as measured and used in this report is defined as the total power loss incurred when the antenna coupling unit is inserted between a 70 ohm generator and a balanced resistive load of the required value as compared to when an ideal impedance matching transformer is inserted between the same generator and load. As such, insertion loss takes into account the normal losses associated with a transformer such as core loss, resistance loss etc, but also that loss caused by variations from the terminating values in the input and output impedances of the device. Although measurements are made at finite frequencies, the spectrum between these finite frequencies should be slowly swept with the signal generator for a possible presence of "holes" in the spectrum.
- 3.2.2.2. Procedure: The procedure consists of determining the power output from the coupler when it is fed by a constant voltage generator of 70 ohms internal impedance and relating it to the maximum power available from a generator of 70 ohms internal impedance.
- 3.2.2.3. Test Diagram and Derivation of insertion loss formulae refer to Appendix #1, Part 3.3.2.
- 3.2.2.4. Test Results: Refer to Appendix #2, Parts 3.4.1.1, 3.4.1.2, 3.4.2.1, 3.4.2.2.

3.3.

APPENDIX #1

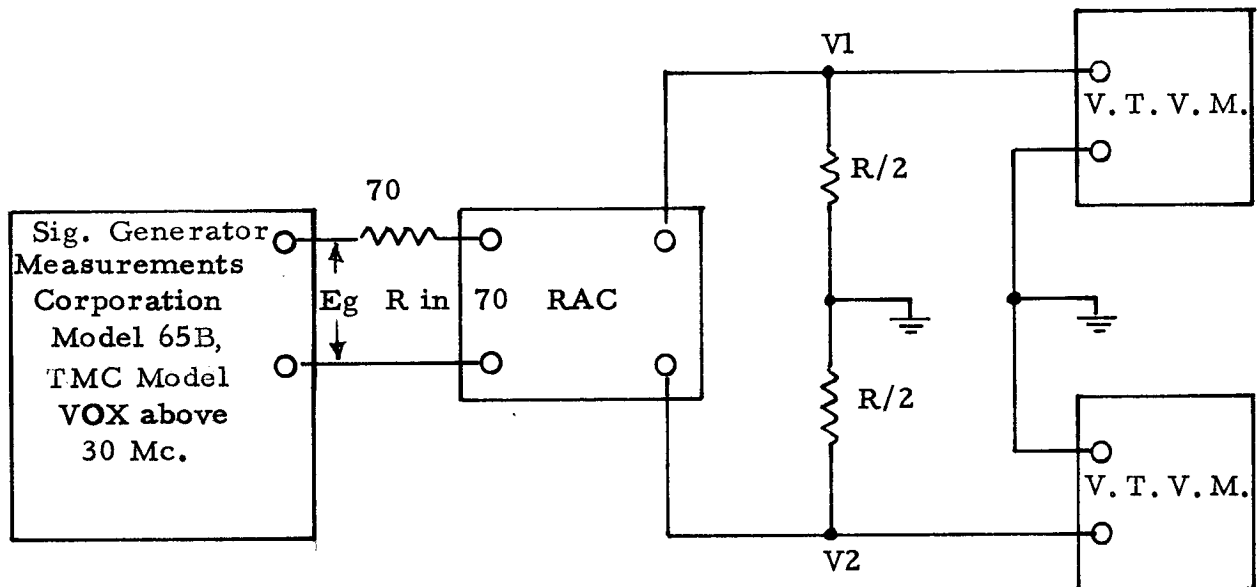
TEST DIAGRAMS

3.3.1. TEST DIAGRAM: Output Impedance



Resistance and Reactance measurements are made in accordance with the instructions supplied by the General Radio Company.

3.3.2. TEST DIAGRAM: Insertion Loss



$R/2 = 350$ ohms for 700 ohm termination
 $R/2 = 100$ ohms for 200 ohm termination

$$\text{Insertion Loss} = 10 \log \frac{\text{Power Available from Generator}}{\text{Power Delivered to Load}}$$

$$= \frac{\frac{E_g^2}{4 R_g}}{\frac{V_1^2 + V_2^2}{R/2}}$$

$$= \frac{E_g^2}{(V_1^2 + V_2^2)} \frac{R}{8 R_g}$$

Since $E_g = 1$ volt $R_g = 70$ ohms

For 700 ohm termination $R = 700$

$$\text{Insertion Loss} = 10 \text{ Log } \frac{1.25}{V_1^2 + V_2^2}$$

For 200 ohm termination $R = 200$

$$\text{Insertion Loss} = 10 \text{ Log } \frac{.375}{V_1^2 + V_2^2}$$

3.4.

APPENDIX #2

TEST RESULTS

APPENDIX #2

3.4.1.1. Insertion Loss vs Frequency

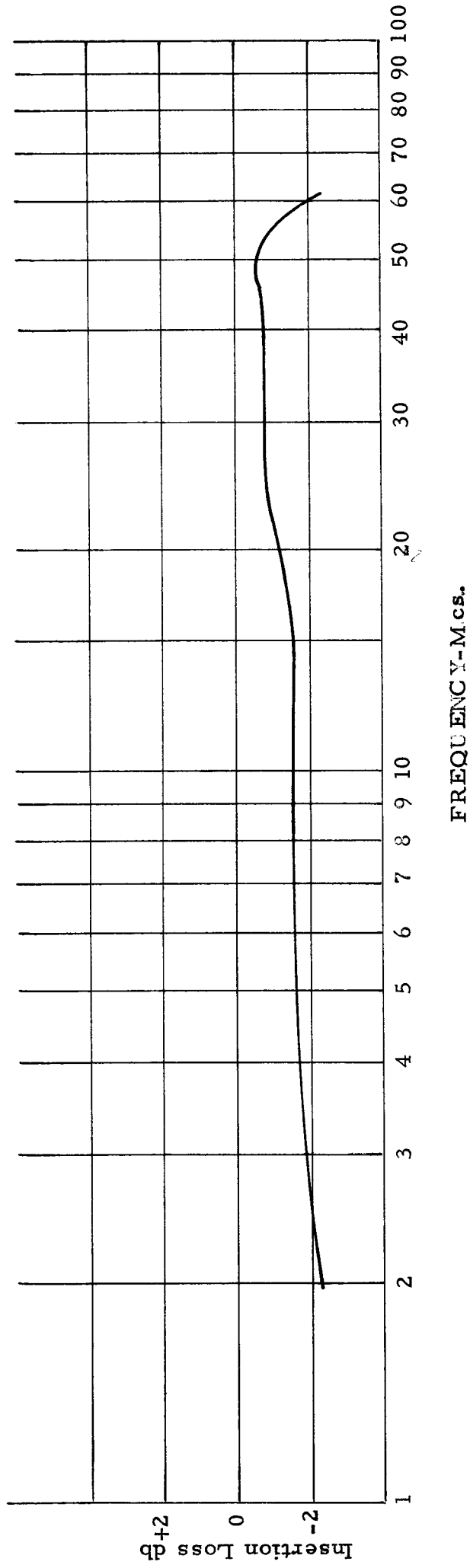
700 Ohm Input Terminated

Frequency (mc/s)	Eg (volts)	V1 (volts)	V2 (volts)	Insertion Loss db
2	1.0	.63	.59	2.2
4	1.0	.67	.61	1.8
8	1.0	.7	.64	1.66
16	1.0	.7	.67	1.6
22	1.0	.71	.71	.93
30	1.0	.7	.73	.88
40	1.0	.7	.72	.9
50	1.0	.68	.79	.56
60	1.0	.6	.65	2.0

3.4.1.2.

INSERTION LOSS vs FREQUENCY

TMC - RAC
700 Ohm Termination



APPENDIX #2

3.4.2.1.

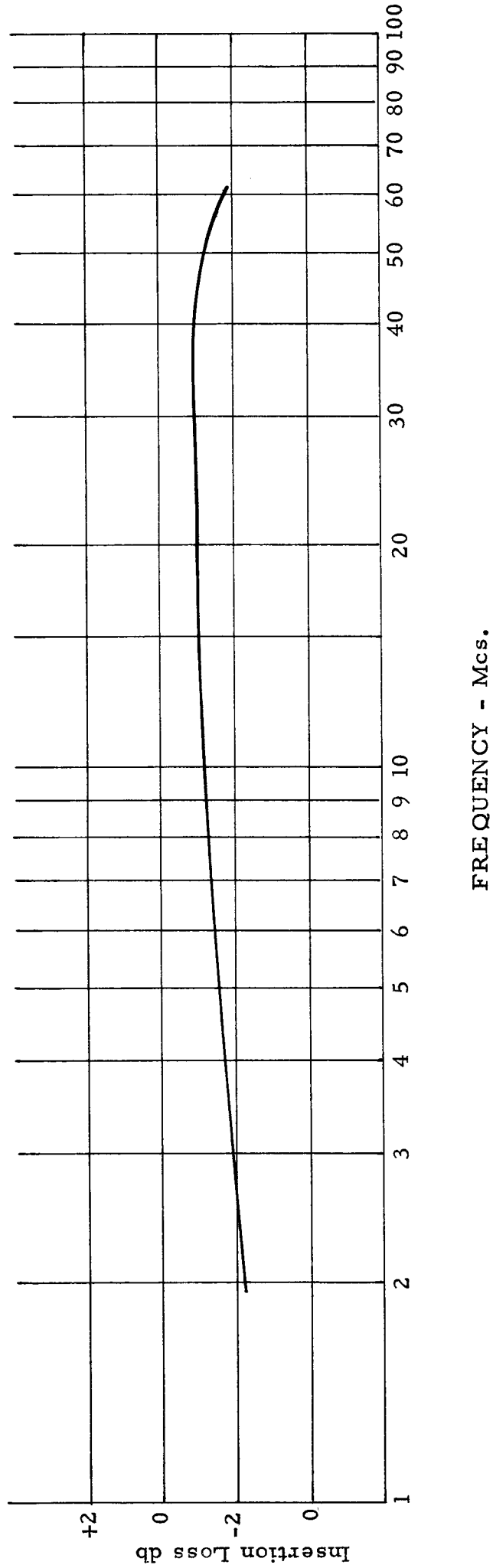
Insertion Loss vs. Frequency

200 Ohm Input Terminated

Frequency (mc/s)	Eg (volts)	V1 (volts)	V2 (volts)	Insertion Loss (db)
2	1.0	.32	.33	2.28
4	1.0	.33	.35	1.84
8	1.0	.34	.37	1.72
16	1.0	.36	.37	1.26
22	1.0	.37	.37	1.14
30	1.0	.4	.36	.9
40	1.0	.42	.35	.94
50	1.0	.41	.34	1.16
60	1.0	.39	.32	1.7

3.4.2.2.

INSERTION LOSS vs. FREQUENCY
TMC- RAC
200 Ohm Termination



3.4.3.1.

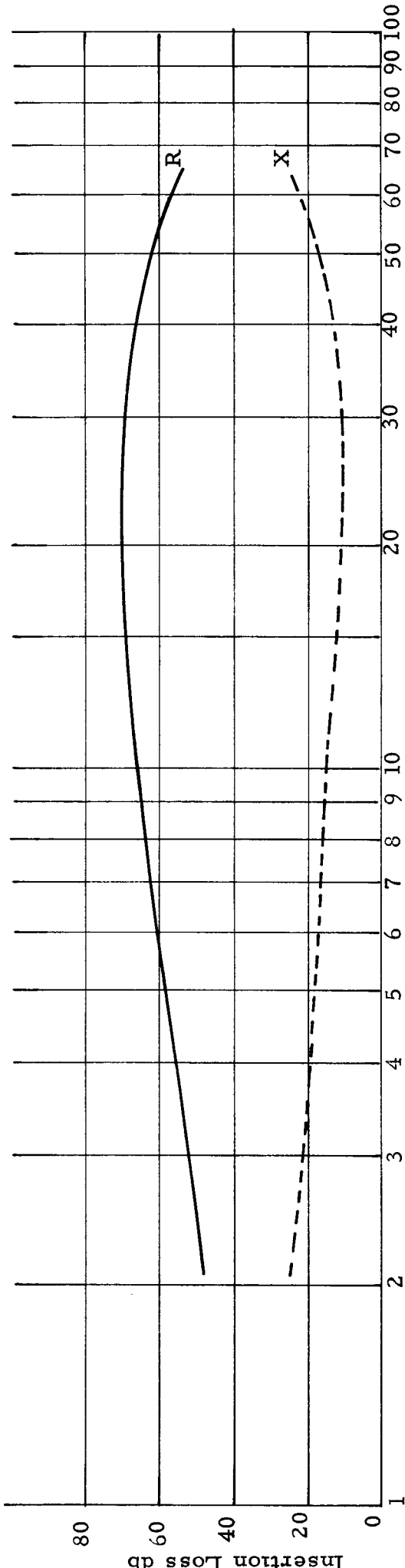
APPENDIX #2

Output Impedance vs. Frequency

700 Ohm input Terminated

<u>Frequency mc/sec</u>	<u>R(ohms)</u>	<u>JX(ohms)</u>
2	47	24
4	56	18.2
8	62	16.0
16	68	13.6
22	71	12.3
30	71	9.7
40	68	12.9
50	63	18.6
60	57	22.4

3. 4. 3. 2.
 OUTPUT IMPEDANCE vs. FREQUENCY
 TMC - RAC
 700 Ohm Termination



FREQUENCY - Mcs

APPENDIX #2

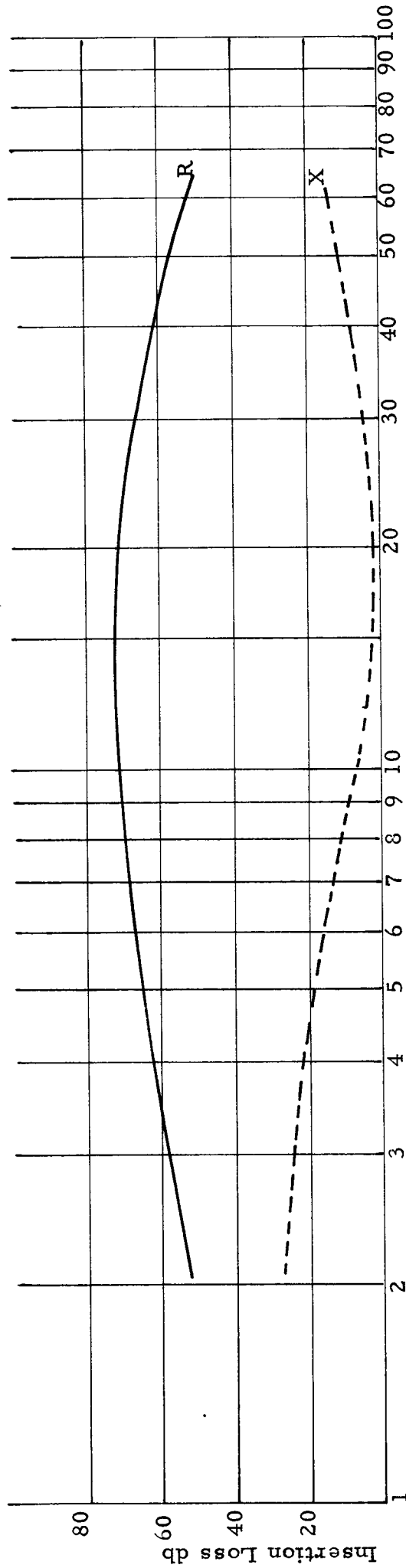
3.4.4.1.

Output Impedance vs. Frequency

200 Ohm input Terminated

<u>Frequency (mc/s)</u>	<u>R(ohms)</u>	<u>JX(ohms)</u>
2	52	27
4	62	20
8	70	12
16	73	1.69
22	69	3.6
30	61	5.3
40	59	8.4
50	56	10.2
60	52	13.7

3. 4. 4. 2.
 OUTPUT IMPEDANCE vs. FREQUENCY
 TMC-RAC
 200 Ohm Termination



FREQUENCY - Mcs.

3.5 Recommendations:

Data merely submitted.

3.6 Signatures:



A. R. BERNARDI,
Project Engineer



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Sig/C Auth. Gov't. Rep.