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FOURTH QUARTERLY REPORT
R-310.4-53, PIB-249.4

or

MEASUREMENT OF RADIO FREQUENCY CABLE

August 1, 1953 to October 31, 1953

for

BUREAU OF SHIPS

Contract NObsr-63084

Index No. NE-111616, Subtask 10

MRI

POLYTECHNIC INSTITUTE OF BROOKLYN
MICROWAVE RESEARCH INSTITUTE

SECRET INFORMATION

Microwave Research Institute
Polytechnic Institute of Brooklyn
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Report R-310.4-53, PIB-249.4
Contract No. N0bsr-63084
Index No. NE-111616
Subtask 10

Fourth Quarterly Report
on
MEASUREMENT OF RADIO FREQUENCY CABLE
August 1, 1953 to October 31, 1953

for

Bureau of Ships

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Title Page
Abstract
3 Pages of Text
1 Table
7 Pages of Figures

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R-310.4-53, PIB-249.4

ABSTRACT

An outline is given of the work being done on the program of attenuation measurements of radio frequency cables over the frequency range of 2500 to 10,000 mc/sec. Results of measurements on a second set of cables are given for the frequencies completed to date. The program for the evaluation of cable construction as it affects attenuation and plans for implementing the program are discussed. The emphasis is placed on frequencies between 2500 and 10,000 mc/sec where anomalous attenuation behavior has been experienced.

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I. Introduction

The purpose of this contract is to conduct a measurements program on the attenuation characteristics of RF coaxial cables, over a frequency range of from 100 to 10,000 mc/sec. The emphasis is placed upon the 2500 to 10,000 mc/sec range since there has been little published information over this frequency range and it is a region where anomalous attenuation behavior has been experienced. These measurements will bring up to date the attenuation specifications of available cables listed in the publication, "Attenuation of Standard RF Cables", Bureau of Ships, Code 817, dated May 1952, and where possible extend the frequency range to 10,000 mc/sec. The program will also include a limited investigation of attenuation as a function of cable construction in the same region.

The measurements on the first group of 6 cables were completed over the frequency range of 2500 to 10,000 mc/sec. The measurements on a second group of cables have been initiated and data and curves are shown for five RF cables for the frequency range, 2500 to 4000 mc/sec. Most of the special cables needed for the evaluation of cable construction as it affects attenuation above 2500 mc/sec, have been received and are being prepared for test. In addition, equipment and techniques for measuring leakage of cables at these frequencies are being developed under another contract and it is anticipated that these methods will enable us to conduct leakage measurements on the special cables. Reports describing the attenuations measurements that resulted in the publication noted above are being studied.

II. Work in Progress

A. Procurement of Test Samples

The total number of sample cables so far received, either government furnished or purchased, are as follows:

1.	RG-5A/U*	350 ft.
2.	RG-9A/U*	350 "
3.	RG-10A/U**	521 "
4.	RG-21/U*	200 "
5.	RG-116/U*	143 "
6.	RG-118/U	500 "
7.	RG-11/U*	250 "
8.	RG-85/U	300 "
9.	RG-20/U	500 "
10.	RG-34/U	550 "
11.	RG-18/U**	350 "

*Samples used in the first set of measurements.

**Samples used in the second set of measurements.

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12.	RG-141/U**	200 ft.
13.	RG-58A/U*	200 "
14.	RG-8/U**	300 "
15.	RG-55/U**	300 "
16.	RG-35/U	400 "

In addition the following special cables have been received from the Surprenant Manufacturing Company.

1. RG-9A/U Core - Single RG-8 type silver copper braid.
2. " " - Single RG-9 type " " "
(1st braid).
3. RG-9A/U Cable with double Cu braid in place of silver coated Cu.
4. RG-9A/U Cable with a thin dielectric between the two braids.
5. RG-9A/U Cable with a thick dielectric between the two braids.
6. RG-9A/U Core - Single RG-8 type silver coated copper braid and armour with dielectric in place of the jacketing material.
7. RG-9A/U Cable with 1st braid RG-8 type silver coated Cu braid: all else the same.

B. Procurement of Connectors

Connectors and adapters have been obtained for most of the cables involved in the measurement program. Good RF connectors are not presently available for RG-34/U and some of the special cables. However, it may be possible to either adapt available connectors or design new ones for this particular application.

C. Measurement Program

Measurements were initiated on the second group of cables with the exception of RG-34/U. This cable will be measured as soon as the proper connectors are obtained. It is to be noted that cut off frequencies for most of the cables lies above the range of measurement. However, the cut off frequency for RG-18/U is approximately 5.8 kmc and therefore lies within the range of frequencies used. This may affect the attenuation and therefore the cutoff frequency is noted in the curves. The cables being measured are as follows:

*Samples used in the first set of measurements.

**Samples used in the second set of measurements.

<u>Cable Type</u>	<u>Total Length</u>	<u>Connectors Used</u>	<u>Nominal Impedance</u>
7. RG-8/U	300 ft.	UG-21D, UG-23D	52.0
8. RG-10/U	521 ft.	UG-21D, UG-23D	52.0
9. RG-55/U	300 ft.	UG-88/U, UG-89/U	53.5
10. RG-18/U	350 ft.	UG-167A/U	52.0
11. RG-1141/U	200 ft.	UG-88/U, UG-89/U	50.0

The measurement method is that described in previous reports, using equipment and arrangement as shown in Figs. MRI-13096 and MRI-13097.

These cables were measured at 2500, 3000 and 4000 mc/sec. The results are tabulated in Table I along with the sample lengths measured. Curves of attenuation vs. frequency for these cables are shown in Figs. MRI-13669 and MRI-13673. The measurements are being continued up to 10,000 mc/sec.

In addition, the special cables are being prepared for measurements and it is hoped that these measurements can be initiated and continued simultaneously with the other group.

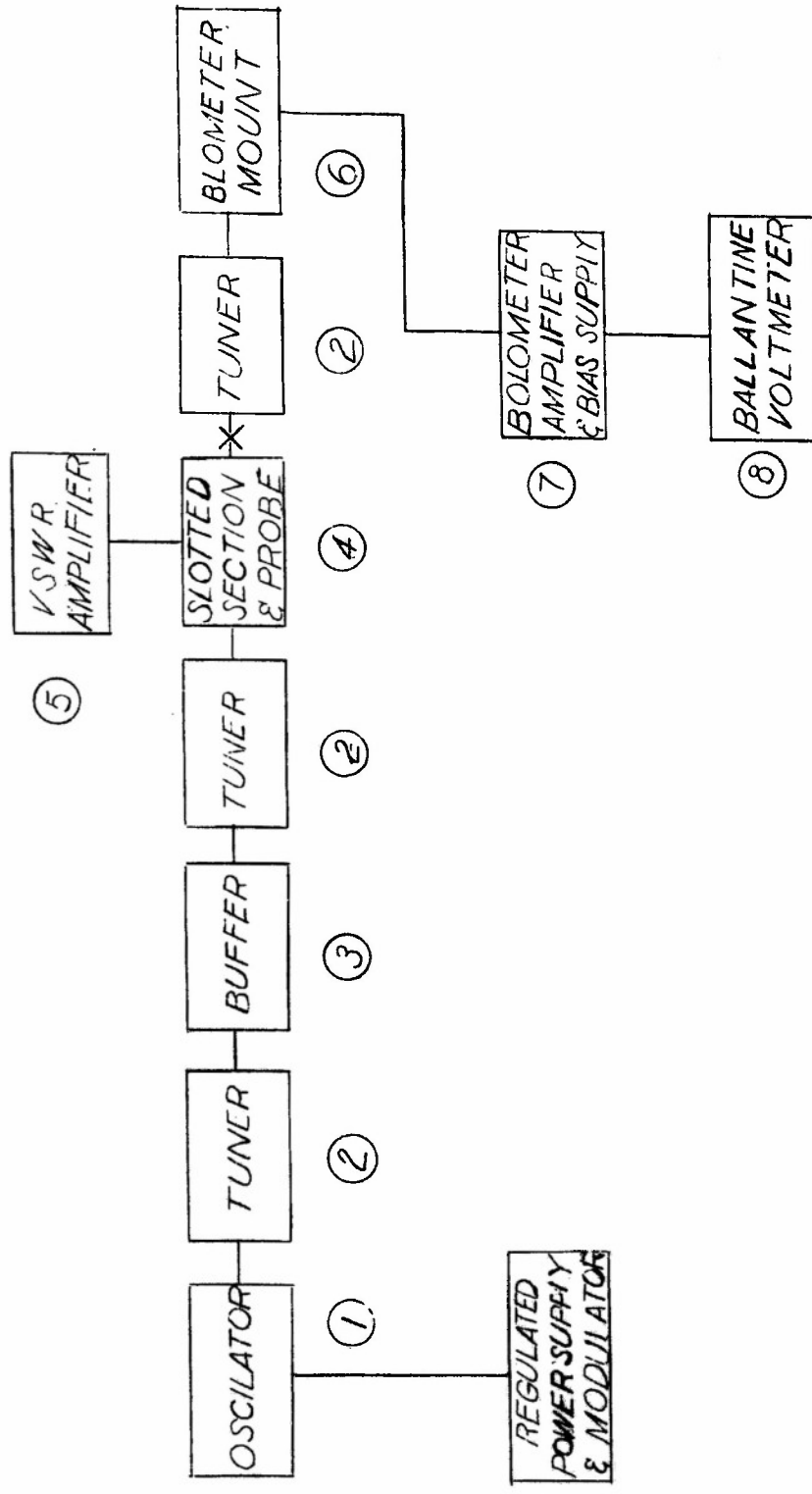
D. Identification of Personnel

The above work is being carried out thru the efforts of the following personnel:

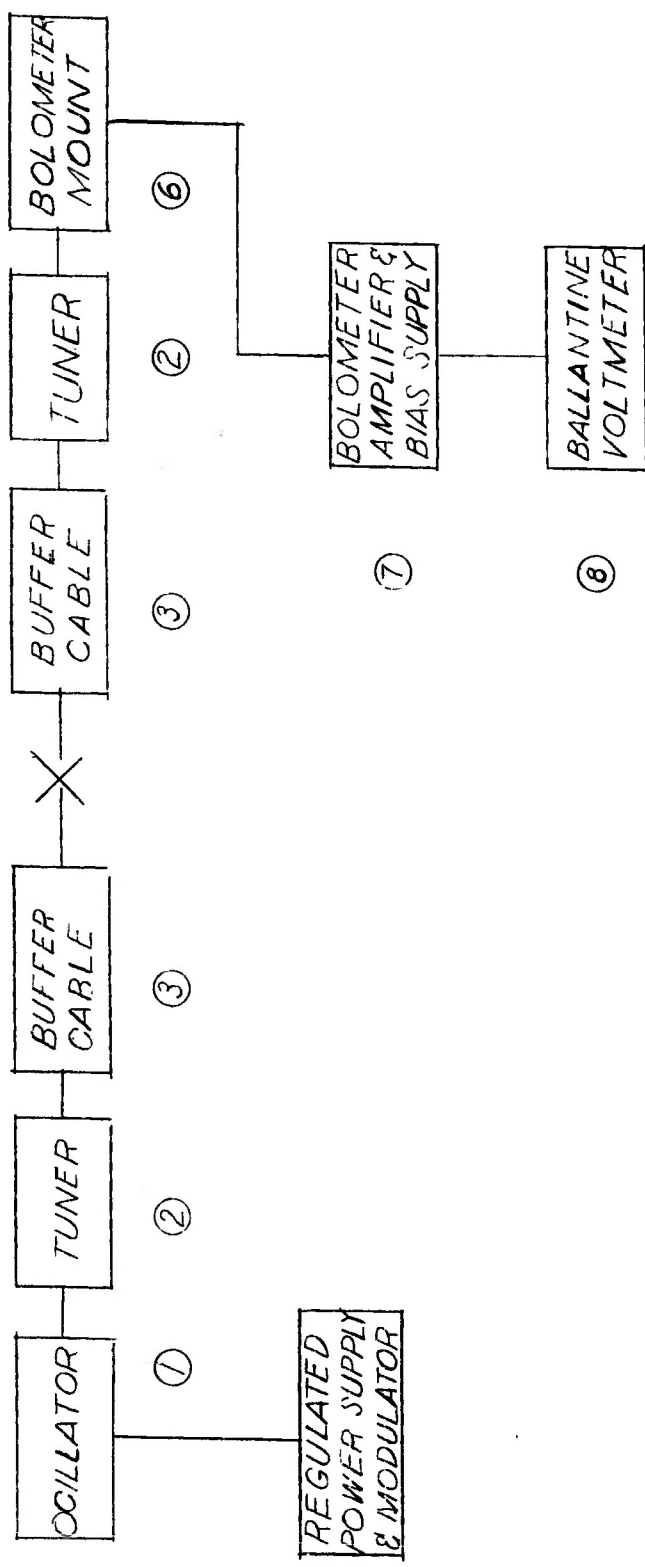
Dr. J. W.E. Griemsmann	Associate Director	Part Time
Mr. S.W. Rosenthal	Research Assistant	
	Professor	Part Time
Mr. W. Zeliger	Technician	Full Time

TABLE I

Frequency	Cable Type	Sample Lengths	Average Att/100 ft. Buffer Method
2500 mc	RG-8/U	50, 100	13.5
	RG-10A/U	60, 100	13.6
	RG-18/U	100	8.2
	RG-55/U	50, 100	27.6
	RG-141/U	30, 50	24.4
3000 mc	RG-8/U	50, 100	15.9
	RG-10A/U	60, 100	15.6
	RG-18/U	100	9.8
	RG-55/U	50, 100	31.4
	RG-141/U	30, 50	26.5
4000 mc	RG-8/U	50, 100	21.4
	RG-10A/U	60, 100	20.9
	RG-18/U	100	13.3
	RG-55/U	50, 100	39.1
	RG-141/U	30, 50	31.8



BALLANTINE VOLTMETER
ATTENUATION MEASURING SET-UP



BALLANTINE VOLTMETER ATTENUATOR
MEASURING SET-UP USING BUFFER CABLES

ATTENUATION OF RF CABLE VS FREQUENCY

40

30

20

10

0

ATTENUATION
db/100 FT

2.5

3

4

5

6

7

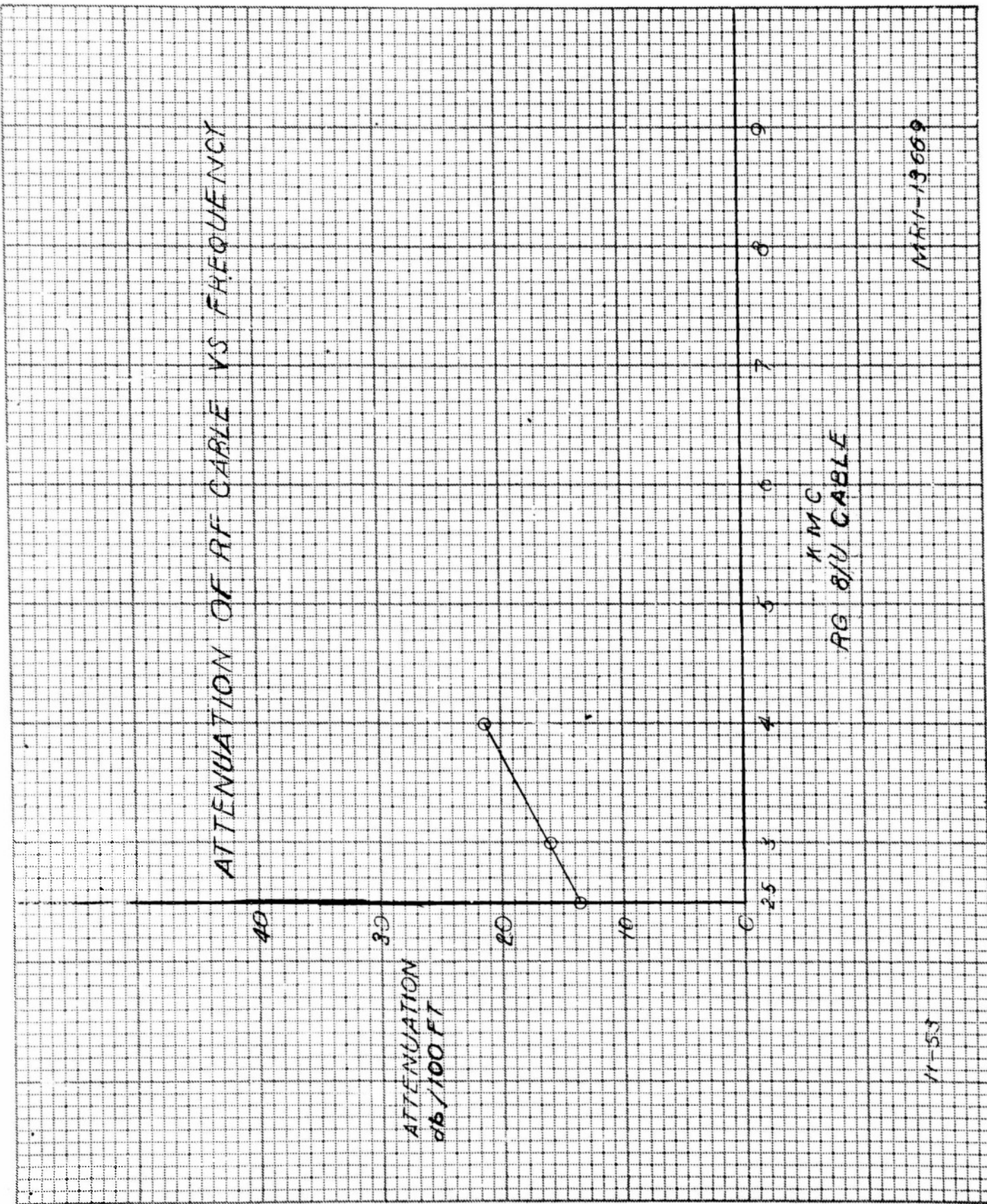
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1 M M C
RG 8/U CABLE

MR1-13669

11-53



ATTENUATION OF RF CABLE VS FREQUENCY

40

30

20

10

0

ATTENUATION
db/100 FT

2.5

3

4

5

6

7

8

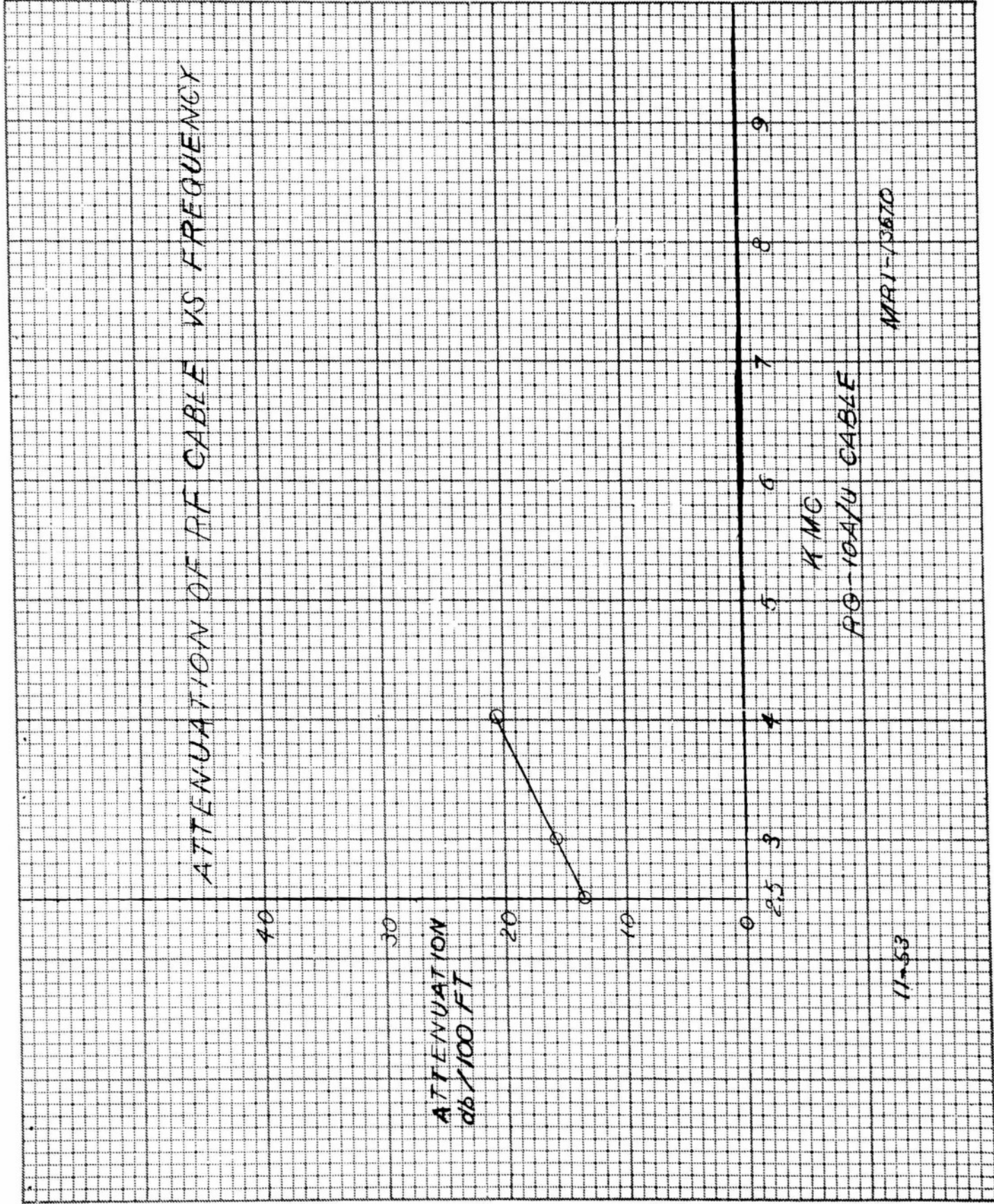
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K MC

RG-10A/U CABLE

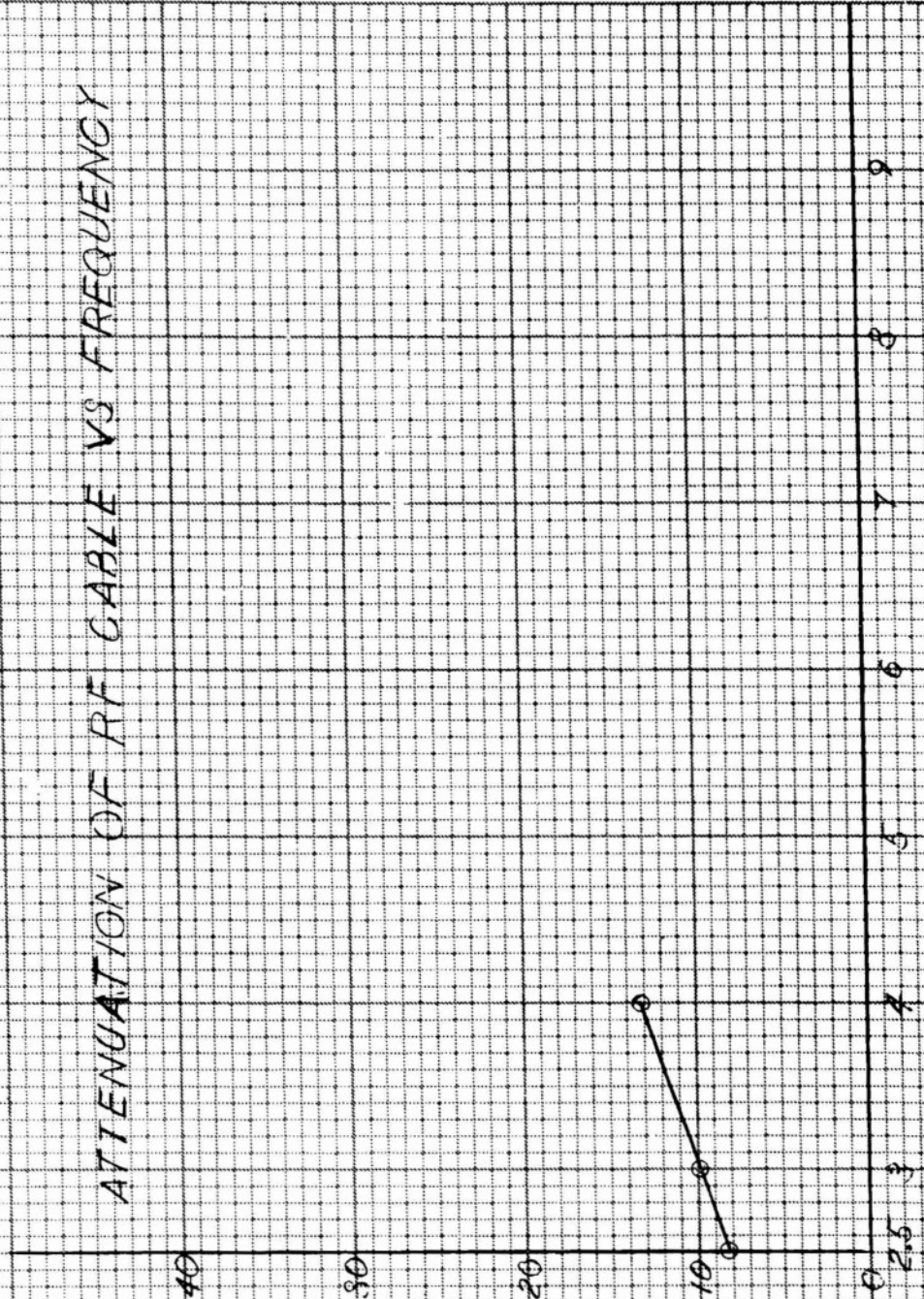
MRI-13570

11-53



ATTENUATION OF RF CABLE VS FREQUENCY

ATTENUATION
db/100FT



KMC
RG-187U CABLE

11-53

MRI-13671

ATTENUATION OF RF CABLE VS FREQUENCY

60

50

ATTENUATION

db/100 FT

30

20

2.5

3

4

5

6

7

8

9

KMC

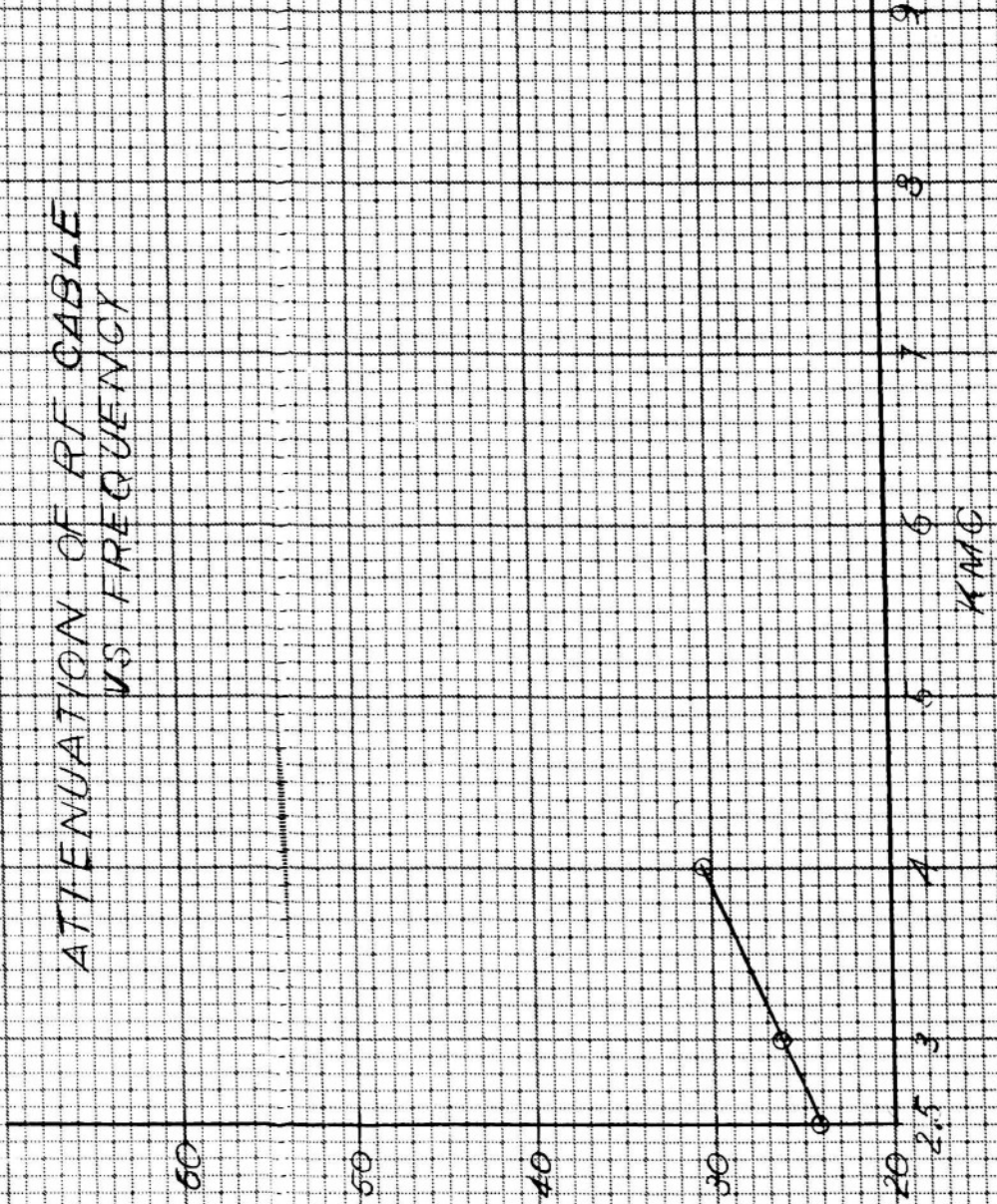
RG-55/U CABLE

MRV-15572

11-53



ATTENUATION OF RF CABLE
VS. FREQUENCY



RG-141/U CABLE

MIL-13673

11-53