

Appendix K

MODULATION CHARACTERISTICS
CARRIER FREQUENCY STABILITY
AUDIO LOW PASS FILTER RESPONSE
AUDIO FREQUENCY RESPONSE

System 400 Base Station

All tests performed by HM Electronics were performed in accordance with
FCC Part 2 paragraphs 2.987 and 2.995, using test methods of Electronics Industry
Association standard EIA TIA 603.

A handwritten signature in black ink, appearing to read "Seth Schlam". The signature is written in a cursive style with a prominent initial "S".

Seth Schlam

HM Electronics, Sustaining Engineer

Base Station System 400
Test Equipment & Calibration Dates

Hewlett Packard HP8920 RF Communications Test Set
Serial Number 3507A06044
Calibrated on 5 May 1997

Thermotron Model S-8C Environmental Chamber
Serial Number 24289
Calibrated at date of purchase, Sept. 95.

47 CFR Ch 1, paragraph 2.987 (b)

Measurement of Modulation Characteristics
Equipment which employs modulation limiting

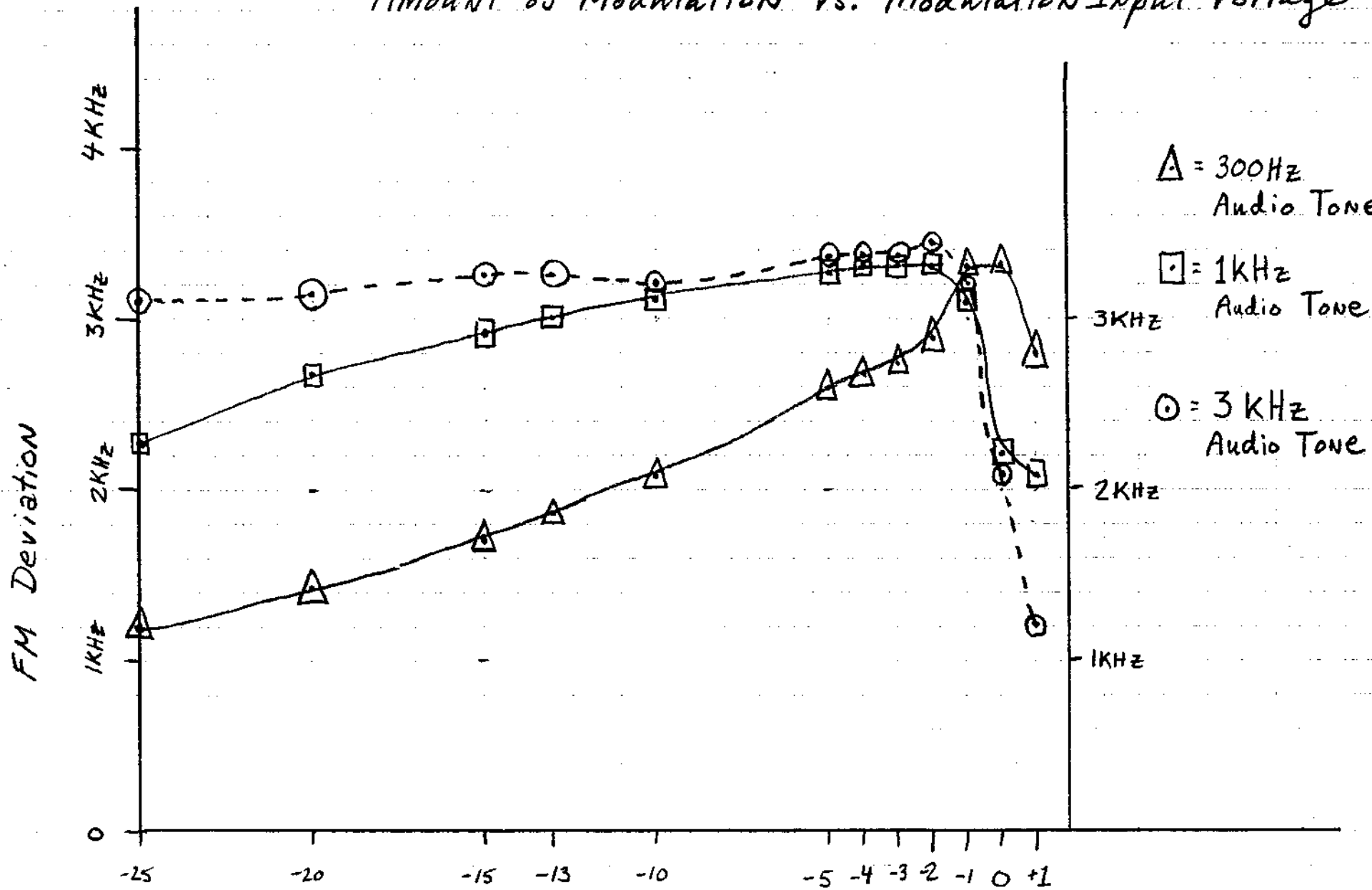
Audio inputs from below the nominal voltage level to above the specification maximum voltage level were applied to the audio input (Pin P1-4) of the RF board and the FM deviation of the carrier was measured. This was done at three different audio frequencies; 300 Hz, 1000 Hz, and 3000 Hz. The data is tabulated below and is also shown in graphical form.

Audio Freq = 300 Hz		Audio Freq = 1000 Hz	
Audio Input level (dBV)	FM Deviation (Hz)	Audio Input level (dBV)	FM Deviation (Hz)
-25	1,200	-25	2,250
-20	1,420	-20	2,660
-15	1,700	-15	2,900
-13	1,850	-13	3,000
-10	2,070	-10	3,120
- 5	2,500	- 5	3,270
- 4	2,680	- 4	3,290
- 3	2,750	- 3	3,300
- 2	2,870	- 2	3,300
- 1	3,350	- 1	3,100
0	3,350	0	2,200
+ 1	2,800	+ 1	2,100

Audio Freq = 3000 Hz

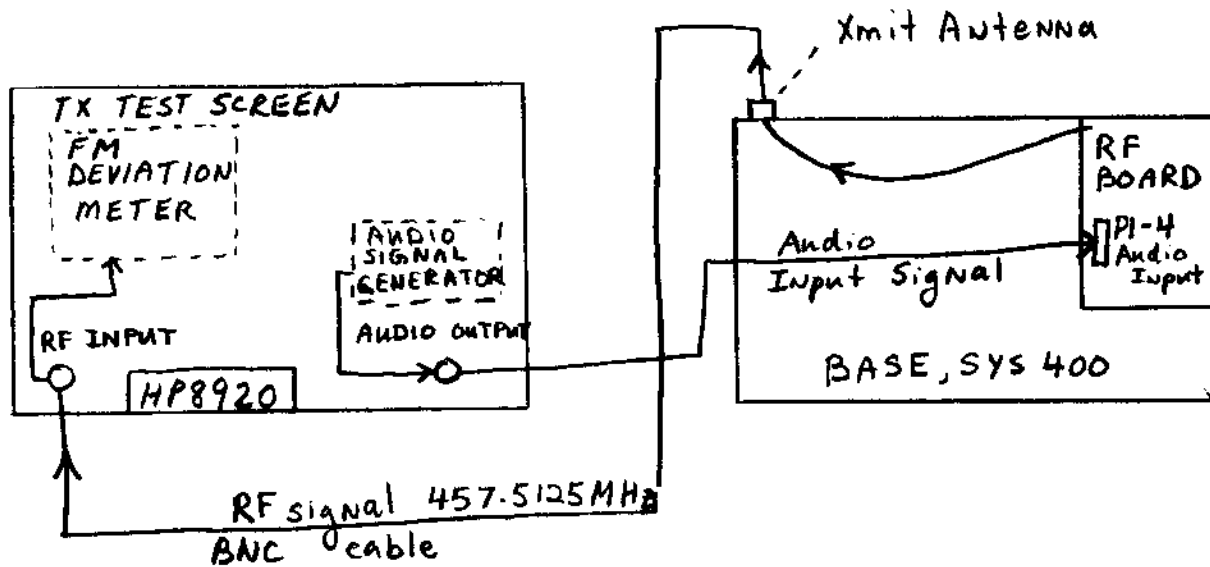
Audio Input level (dBV)	FM Deviation (Hz)
-25	3,150
-20	3,180
-15	3,240
-13	3,250
-10	3,200
- 5	3,360
- 4	3,350
- 3	3,360
- 2	3,430
- 1	3,000
0	2,120
+ 1	1,210

47CFR Ch I 2.987(b) Equipment Employing modulation limiting
 Amount of Modulation vs. Modulation Input Voltage



Audio Input level in dBV Note: -20 dBV is nominal level
 0 dBV is max level

TEST SETUP FOR 47CFR Ch1
2.987(b)



Tested Per EIA Standard

EIA-TIA-603 para 2.2.3

Methods of Measurement for Transmitters
Modulation Limiting

The BASE400 Base-Station is being type accepted under the rules of FCC 90.217. Therefore, the data provided is for information purposes only and no limits are required to be met.

Carrier Frequency Stability:

If the assigned frequency is between 450 MHz to 470 MHz and RF Power is less than 2 Watts then stability should be better than 5.0 ppm. The BASE420 uses 100 mW at 457 MHz.

$$\text{ppm error} = \frac{\text{MCF (MHz)} - \text{ACF (MHz)}}{\text{ACF (MHz)}} \times 10^6$$

Voltage:

Specification Limit: no DFS, Conditions: ±15%

Voltage (Actual)	ACF (MHz)	MCF (MHz)	ppm error
-15% (99.5 VAC)	457.5625 MHz	457.562005 MHz	-1.082
Norm (117.0 VAC)	457.5625 MHz	457.562003 MHz	-1.086
+15% (135.6 VAC)	457.5625 MHz	457.562001 MHz	-1.096

Power was applied and the sample was permitted to stabilize for at least one-half hour at 117 VAC. The voltage test were performed for the WORST CASE. Temperature Chamber was at 25°C ±5°C.

Temperature:

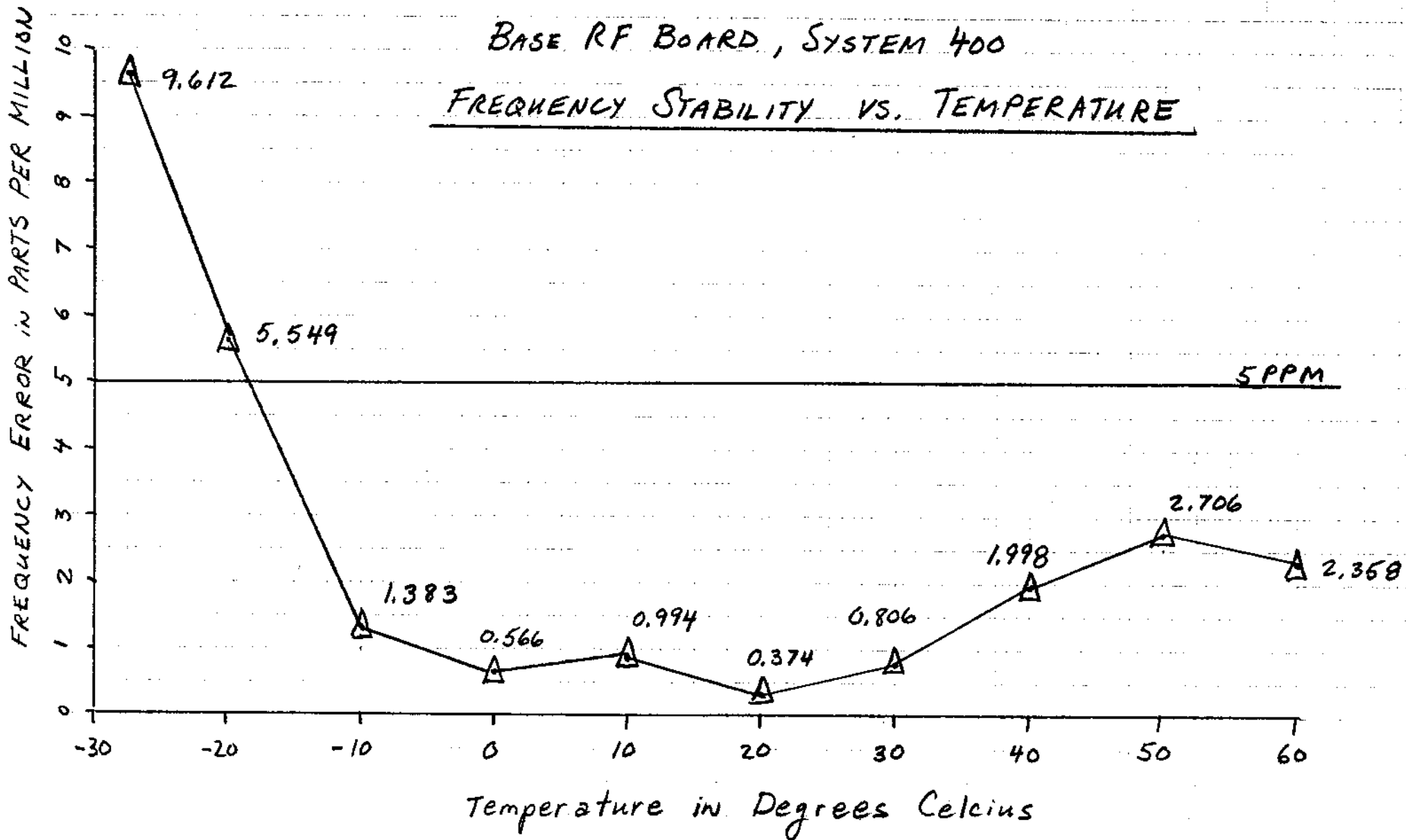
Specification Limit: no DFS, Conditions: -30°C to +60°C

Temperature (± 5°C)	ACF (MHz)	MCF (MHz)	ppm error
-30°C	457.5625 MHz	457.558102 MHz	-9.612
-20°C	457.5625 MHz	457.559961 MHz	-5.549
-10°C	457.5625 MHz	457.561867 MHz	-1.383
0°C	457.5625 MHz	457.562759 MHz	+0.566
+10°C	457.5625 MHz	457.562955 MHz	+0.994
+20°C	457.5625 MHz	457.562671 MHz	+0.374
+30°C	457.5625 MHz	457.562131 MHz	-0.806
+40°C	457.5625 MHz	457.561586 MHz	-1.998
+50°C	457.5625 MHz	457.561262 MHz	-2.706
+60°C	457.5625 MHz	457.561421 MHz	-2.358

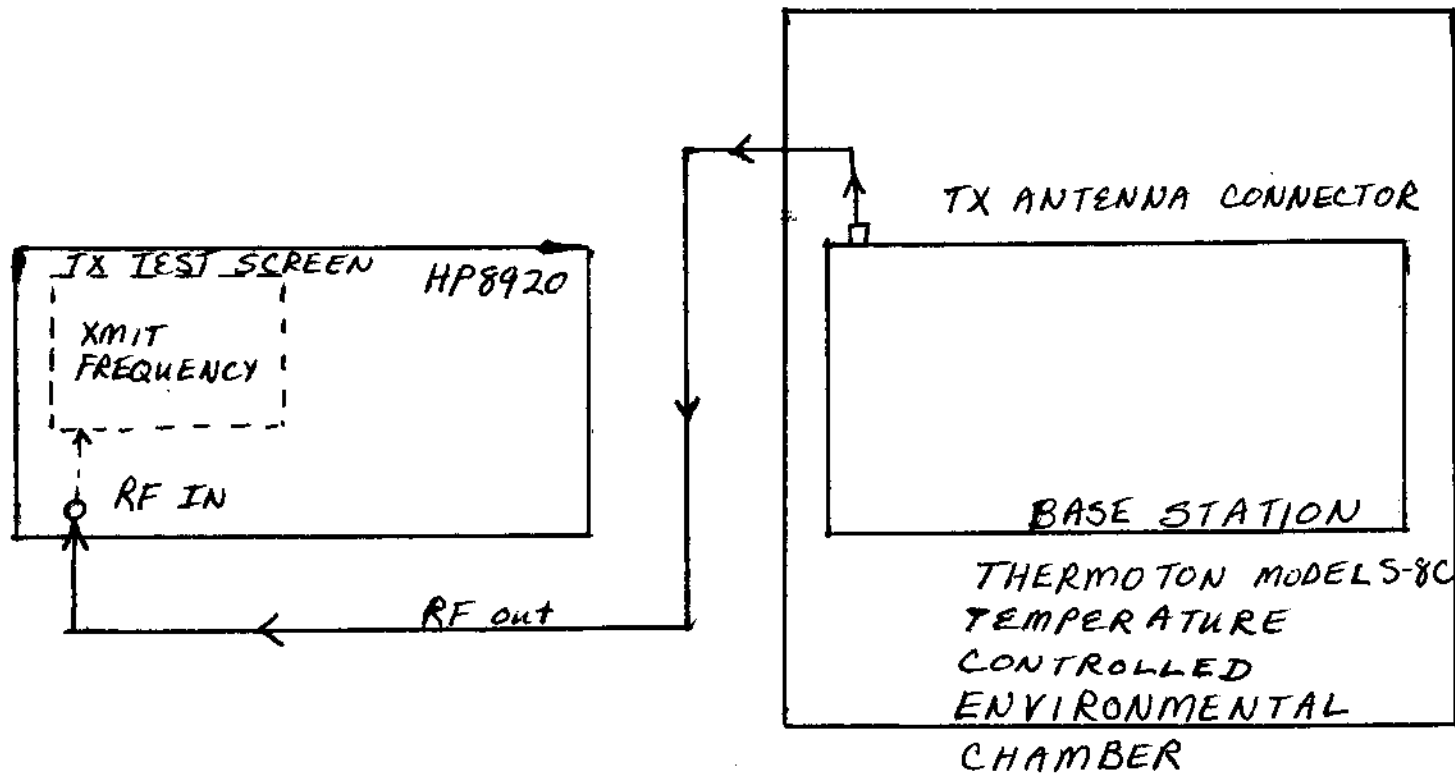
With all power removed, the temperature was decreased to -30°C and permitted to stabilize for three hours. Power was applied and the maximum change in frequency was noted within one minute. With power OFF, the temperature was raised in 10°C steps. The sample was permitted to stabilize at each step for at least one-half hour. Power was applied and the maximum frequency change was noted within one minute.

BASE RF BOARD, SYSTEM 400

FREQUENCY STABILITY VS. TEMPERATURE



TEST SETUP FOR CARRIER FREQUENCY STABILITY



Tested per EIA standard EIA-TIA-603 para. 2.2.2

Methods of Measurement for Transmitters
Carrier Frequency Stability

Audio Low Pass Filter Response:

For audio frequencies above 3000 Hz the audio response of the post limiter low-pass filter shall meet or exceed the following requirements: For equipment operating on channels between 450 MHz through 896 MHz and between 929 MHz through 930 MHz: At frequencies from 3000 Hz through 20,000 Hz the attenuation shall be greater than the attenuation at 1000 Hz by at least: $60 \log_{10}(f/3000)$ dB. At frequencies above 20,000 Hz the attenuation shall be greater than the attenuation at 1000 Hz by at least 50 dB.

200 mV was at the input.

Frequency	Δ dB from 1 KHz	Maximum Allowed
1000 Hz	0dB	N/A
1500 Hz	+0.39 dB	> 0 dB
2000 Hz	+0.87 dB	> 0 dB
2500 Hz	+1.13 dB	> 0 dB
3000 Hz	-0.06 dB	> 0 dB
4000 Hz	-7.52 dB	< -7.5 dB
5000 Hz	-18.14 dB	< -13.3 dB
6000 Hz	-27.02 dB	< -18 dB
7000 Hz	-33.91 dB	< -22 dB
8000 Hz	-38.05 dB	< -25.6 dB
9000 Hz	-40.57 dB	< -28.6 dB
10,000 Hz	-41.96 dB	< -31.4 dB
15,000 Hz	-43 dB	< -41.9 dB
20,000 Hz	-43 dB	< -49.3 dB
25,000 Hz	-43 dB	< -50 dB
30,000 Hz	-43 dB	< -50 dB
40,000 Hz	-43 dB	< -50 dB
50,000 Hz	-43 dB	< -50 dB
60,000 Hz	-43 dB	< -50 dB
70,000 Hz	-43 dB	< -50 dB
80,000 Hz	-43 dB	< -50 dB
90,000 Hz	-43 dB	< -50 dB
100,000 Hz	-43 dB	< -50 dB

Frequencies above 10,000 Hz are limited by the noise of the test equipment.

ACF = Assigned Carrier Frequency

MCF = Measured Carrier Frequency

DFS = Degradation From Standard

Equipment Used:

Hewlett Packard #8920A, S/N 3633A, RF Communications Test Set

Fluke 85, S/N 59140865, Digital Multi-meter

Thermotron #S-8C S/N24289, Test Chamber

Staco Energy Products Co. #3PN1010, Variable Autotransformer

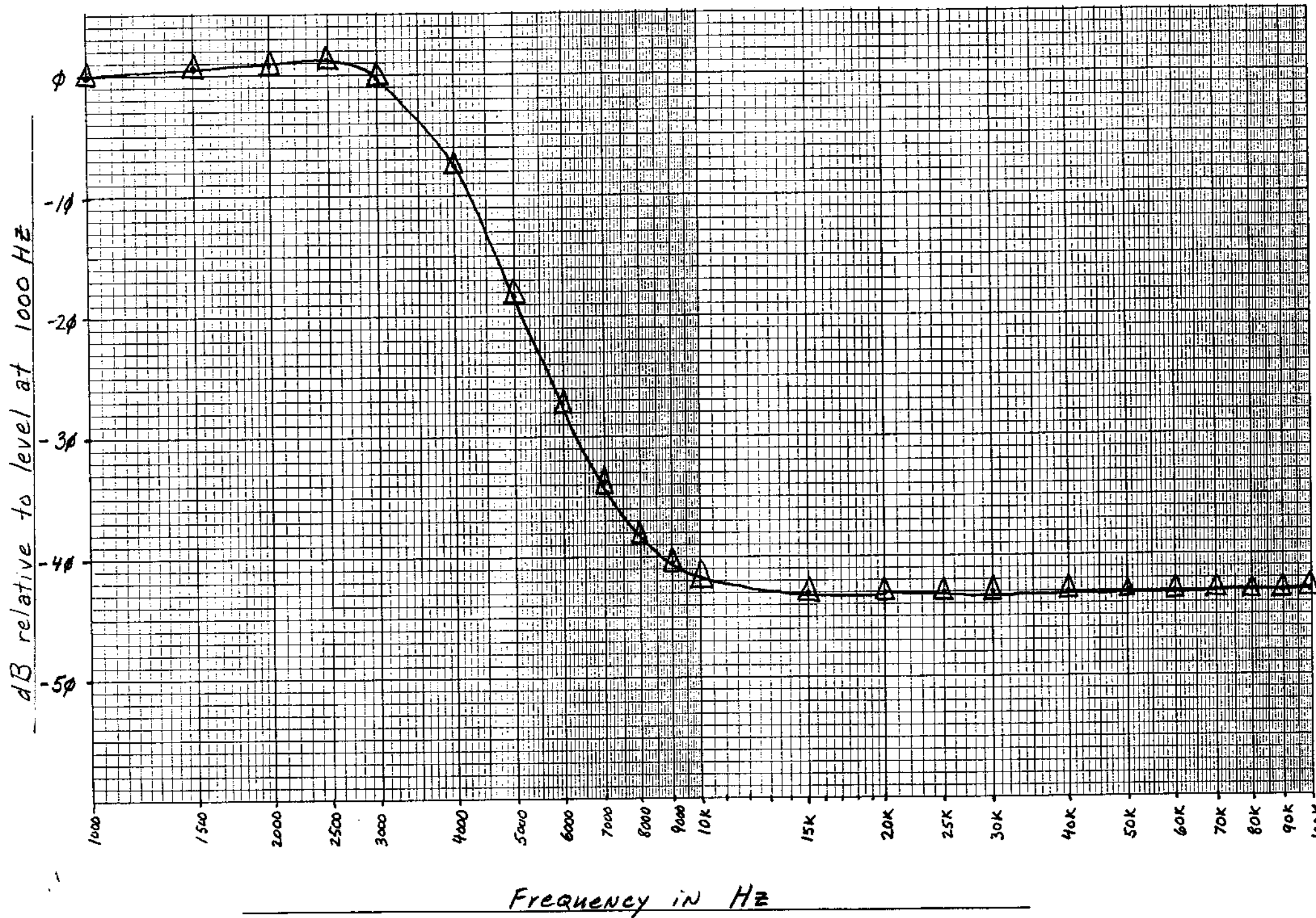
Hewlett Packard #E3611A, S/N KR41807270, Power Supply

Cole Parmer #37950-10, S/N 830185, Thermohygrometer

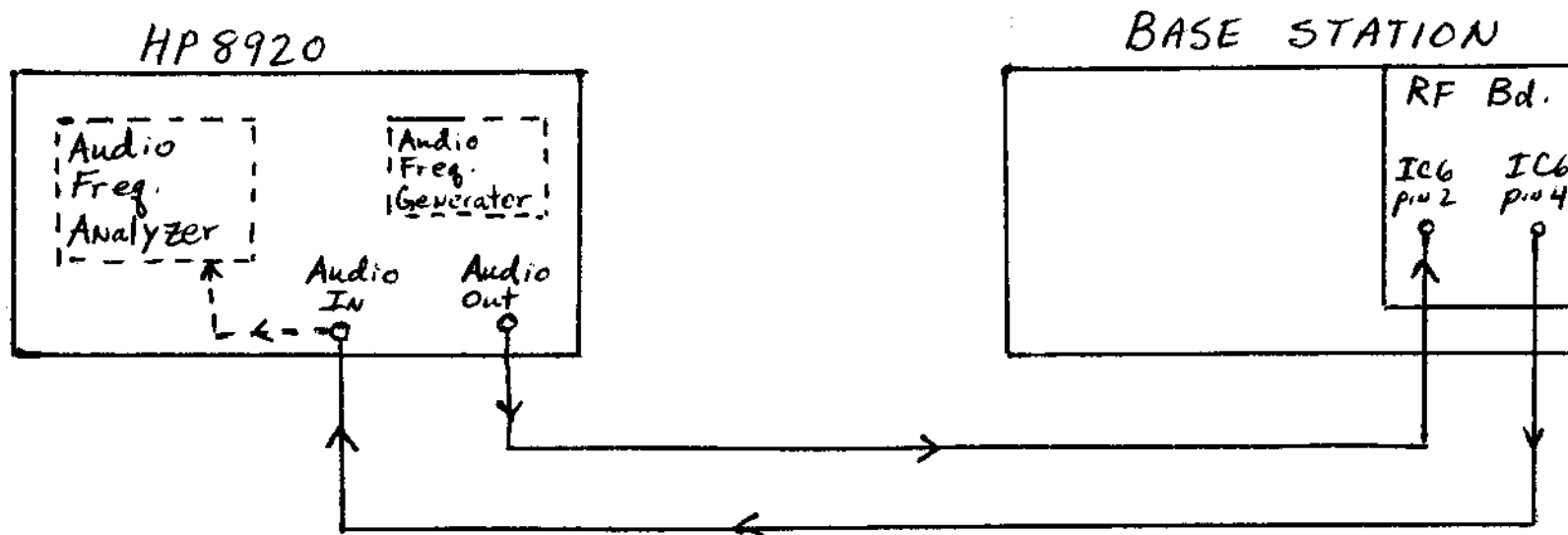
Leader #LAG-126S, Audio Signal Generator

Electronic Technician: John J. Fischer III

Audio Low Pass Filter Response (1000 Hz to 100,000 Hz)



Test Setup For Audio Low Pass FILTER Response



Tested Per EIA standard EIA-TIA-603 para 2.2.15

Methods of Measurement for Transmitters,
Audio Low Pass Filter Response.

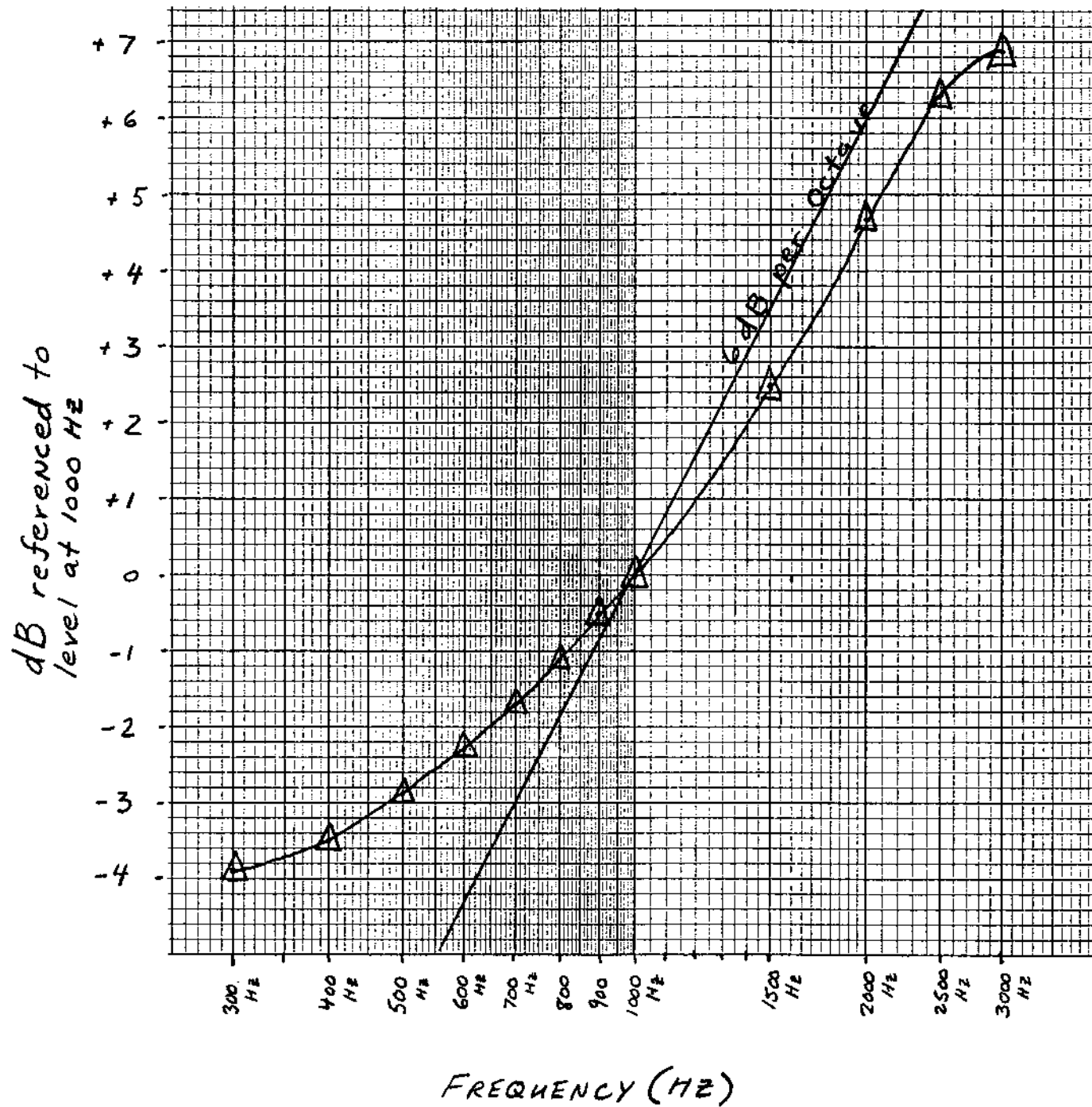
Audio Frequency Response:

The audio frequency response from 300 Hz to 3000 Hz shall not vary more than +1 dB or -3 dB from a true 6 dB per octave pre-emphasis characteristic as referenced to the 1000 Hz level, except from 500 Hz to 300 Hz an additional 6 dB per octave roll-off is allowed. However, permissible exceptions of: an additional 6 dB per octave attenuation is allowed from 2500 Hz to 3000 Hz in equipment operating in the 25 MHz to 869 MHz.

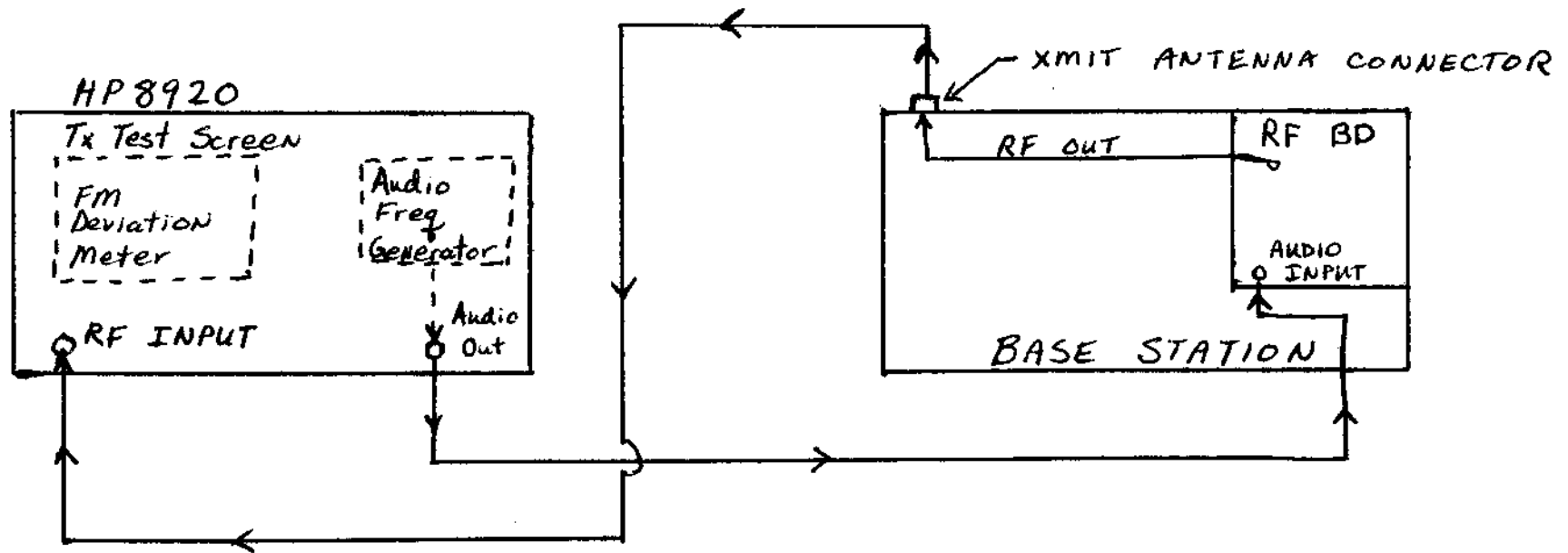
Frequency	dB Measured
300 Hz	-3.93 dB
400 Hz	-3.49 dB
500 Hz	-2.91 dB
600 Hz	-2.31 dB
700 Hz	-1.72 dB
800 Hz	-1.12 dB
900 Hz	-0.57 dB
1000 Hz	0 dB
1500 Hz	+2.51 dB
2000 Hz	+4.64 dB
2500 Hz	+6.30 dB
3000 Hz	+6.85 dB

The HP was at AFGen1 Lvl: 2.55 mV to obtain 1100 Hz Deviation at the frequency of 1000 Hz, the frequency was then changed and the dB was then recorded off the HP 8920A.

AUDIO FREQUENCY RESPONSE from 300 to 3000 Hz



Audio FREQUENCY RESPONSE TEST SETUP



Tested Per EIA standard EIA-TIA-603 para 2.2.6

Methods of Measurement for Transmitters
Audio Frequency Response.