REPORT OF TEST

ON

THE MODEL VOX, VARIABLE FREQUENCY OSCILLATOR

Albert J. Jurafsky

THE TECHNICAL MATERIEL CORPORATION

JULY, 1955

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1. NOTICES

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2. ADMINISTRATIVE DATA

PURPOSE OF TEST: July, 1955

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.:	MODEL VOX-2
DRAWING, SPECIFICATION OR EXHIBIT:	COMMERCIAL
QUANTITY OF ITEMS TESTED:	THREE
SECURITY CLASSIFICATION OF ITEMS:	UNCLASSIFIED
DATE TEST COMPLETED:	JULY 15, 1955
TEST CONDUCTED BY:	A. J. Jurafsky

3. FACTUAL DATA

3.1. DESCRIPTION OF TEST APPARATUS:

(a). Vacuum Tube Voltmeter -- Hewlett-Packard Model 410B -- Calibrated at monthly intervals against a laboratory standard.

(b). Non Inductive Load -- 75 ohm, 2 watt composition resistor.

(c). Communications Receiver -- Technical Materi l Corporation Model GPR 90.

(d). Electronic Counter -- Berkeley Model #5558 -- Calibrated against WWV at monthly intervals and then checked against its internal standard on each occasion of its use.

(e). 5 Mc. Oven Contained Crystal Oscillator -- 48 hour stability under ambient room conditions and varying line voltages should not be worse than one part per million.

(f). Adjustable Line Transformer -- General Radio Type V-5MT.

(g). Line Meter -- 0 to 150 VAC, General Electric Model 8A058VCT42.

(h). Frequency Meter -- Hewlett-Packard Model 500 B.

(i). Graphical Recorder - Esterline-Angus Model A.W.

3.2. Test Procedur

NOTE: BEFORE ANY TESTS RELATING TO FREQUENCY STABILITY ARE PERFORMED, IT IS UNDERSTOOD THAT THE UNIT HAS BEEN PERMITTED A FULL 48 HOUR WARM-UP PERIOD.

3.2.1. 100 Kcs. Oscillator Calibration-

3.2.1.1. Purpose - To determine how closely the int rnal standard approximates its ideal frequency of 100,000 cps.

3.2.1.2. Procedure - The proper approach to this test is one which permits an examination of the oscillator under conditions identical to those encountered normally. For this reason th internal standard is compared with the Master Oscillator in normal fashion while the difference frequency is read on a frequency counter. Simultaneously, the Master Oscillator is z ro beat with primary standard station WWV by means of a communications receiver. It is apparent then, that the Master Oscillator p rforms the function of a transfer device only and the difference frequency being record d is that relating the internal standard to WWV.

3.2.1.3. Set-Up - Please refer to Appendix I, Part 3.2.8.1.

3.2.2. 100 Kcs. Oscillator Line Test:

3.2.2.1. Purpose - To observe the variation of the internal standard frequency as a function of power line voltage changes.

3.2.2.2. Procedure - For the purpose of this test, the internal standard is compared with an external crystal controlled oscillator operating at 5 Mcs. and having a short term stability of better than one part in five million. The comparison is made at five Mcs. (using the fiftieth harmonic of 100 Kcs.) and the deviation observed is then in parts per five million. This serves to render the maximum counter error of ±1 count unimportant.

The line voltage applied to the Model VOX is varied by ±10% around a means of 110 volts and the frequency deviation noted in parts per million.

3.2.2.3. Set-Up - Please refer to Appendix I, Part 3.2.8.2.

3.2.3. 100 Kcs. Oscillator Ambient T st:

3.2.3.1. Purpose - To observe the variation of the internal standard frequency for ambient conditions similar to those that the equipment will be subjected to in the field.

3.2.3.2. Procedure - Once again, as in the preceeding test, a comparison is made with an external crystal controlled oscillator of good short term stability. In this case, however, th recording instrument must be capable of maintaining a continuous record without attendance since the testing period is twenty four hours.

The external oscillator is injected into the mixer (V-103) at the same point normally reserved for the Master Oscillator output (P102). The external oscillator is then s t approximately twenty five cps from the fiftieth harmonic of the 100 Kcs. internal standard and the beat note then appears as a deflection of the frequency meter. Simultaneously, the fr q-uency meter produces current changes in the graphical recorder which are proportional to the difference frequency between the two os-cillators. The frequency meter is then set on its 50 cps scale and the recording continu-

ed for a tw nty four hour period.

Once again, the comparison is made at 5 Mcs. to render any instability inherent in the frequency meter and the wide resolution characteristics of the graphical recorder unimportant. By way of explanation, if the total error in the instruments amounts to three or four cycles, this becomes an error of three or four parts in five million compared to three or four parts in one million had the test been conducted at, perhaps, on Mcs.

3.2.3.3. Set-Up - Please refer to Appendix I, Part 3.2.8.3.

3.2.4. Master Oscillator Line Test:

NOTE: Although the Master Oscillator is a device of high stability, the internal 100 Kcs. standard must, of course, possess stability of a still higher degree. Numerous tests, including those listed in the previous parts of this paper, bear this statement out. Based upon such information all stability investigations involving the Master Oscillator are to be made against the internal standard. When this procedure is followed greater convenience and simplification of the test set-ups are obtained with no perceptible compromise in the accuracy of the results.

3.2.4.1. Purpose - To observe the stability of the Master Oscillator under conditions of changing line voltage.

3.2.4.2 Procedure - The procedure followed here is virtually the same in theory as that followed in 3.2.2.2. The one exception, of course, is that on this occasion the Master Oscillator is compared with the Internal Standard.

The Master Oscillator is set at about 2 Mcs. so that a beat note (in the

neighborhood of one to two hundred Cps.) is produced and recorded. The line is then raised 10% above the 110 volt nominal potential and the Master Oscillator given about 60 seconds in which to reach its maximum excrusion and stabilize before the deviation is noted. This same procedure is followed in brining the line back down to the nominal voltage and then, after the appropriate 60 second pause and reading, to the point which is 10% below nominal voltage.

3.2.4.3. Set-Up - Please refer to Appendix I, Part 3.2.8.4.

3.2.5. Master Oscillator Ambient Test:

3.2.5.1. Purpose - To observe the variation of the Master Oscillator frequency for ambient conditions similar to those that the equipm nt will be subject to in the field.

3.2.5.2. Procedure - The Master Oscillator is set 100 cps. from the twentieth harmonic of the internal standard at 2 Mcs. The recording instrument scales are then chosen so that the 100 Cps. produces a mid scale reading.

This eight hour run should be made only after the Model VOX has been given a 48 hour warm-up period. In the case of a new instrument which has yet to see field service, a still longer initial warm-up period is desirable, although not absolutely necessary.

3.2.5.3. Set-Up - Please refer to Appendix I, Part 3.2.8.5.

3.2.6. Master Oscillator Resetability:

3.2.6.1. Purpose - The object of this test is to determine the error in Master Oscillator frequency when a particular dial setting is disturbed and an attempt made to return the Master Oscillator to its original frequency.

3.2.6.2. Procedure - 2,000,000 Cps. is approached by careful clockwise rotation and the main tuning knob left at this point. The calibrate control is then adjusted so that zero beat is obtained on the visual indicator. The main tuning knob is then rotated counter clockwise by at least 100 Kcs. and the 2,000,000 Cps. point once again carefully approached by clockwise rotation. On this occasion, the Cps. window is not observed but the main tuning knob is set for a reoccurance of zero beat. Onc zero beat has been obtained, the Cps dial is read and the deviation from 2,000,000 Cps. is then recorded as the resetability error.

WARNING: If, by accident, a point is passed because the dial was rotated too quickly in approaching that point, the approach procedure must be repeated until no overturn occurs. A few moments practice will enable any operator to accomplish this proc dur faultlessly.

In ord r to determin the res tability error when an approach is to be made from a counter-clockwise direction, the exact outline is followed except that all approach directions are then reversed.

3.2.6.3. Set-Up - Total set-up is contained within the Model VOX as intended for normal use.

3.2.7. Power Output:

3.2.7.1. Purpose - To determine the maximum power output capability of each section of the Model VOX.

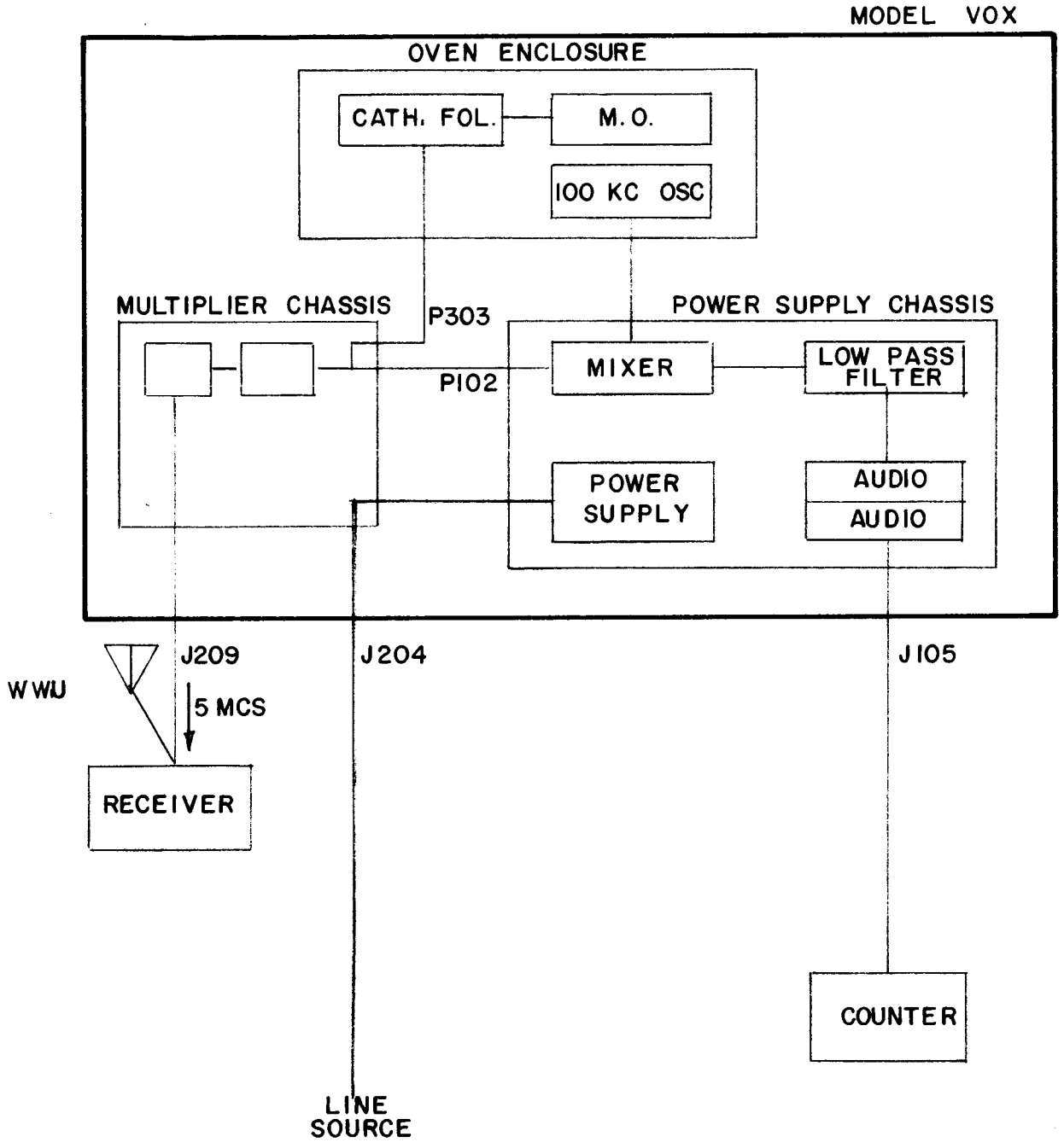
3.2.7.2. Procedure: In the case of the HFO, the power is recorded on each end of each band through the range of 2 to 64 Mcs. In the case of the BFO or the HFO a crystal of a frequency normally used (BFO: 455 Kcs.; HFO: 3.5 Mcs.) is inserted and the power measured.

A 75 ohm load is used for the HFO and IFO while a 1000 ohm load is used for the BFO. All loads are chosen, of course, so that they possess a minimum of reactive component. All output controls are rotated for maximum output.

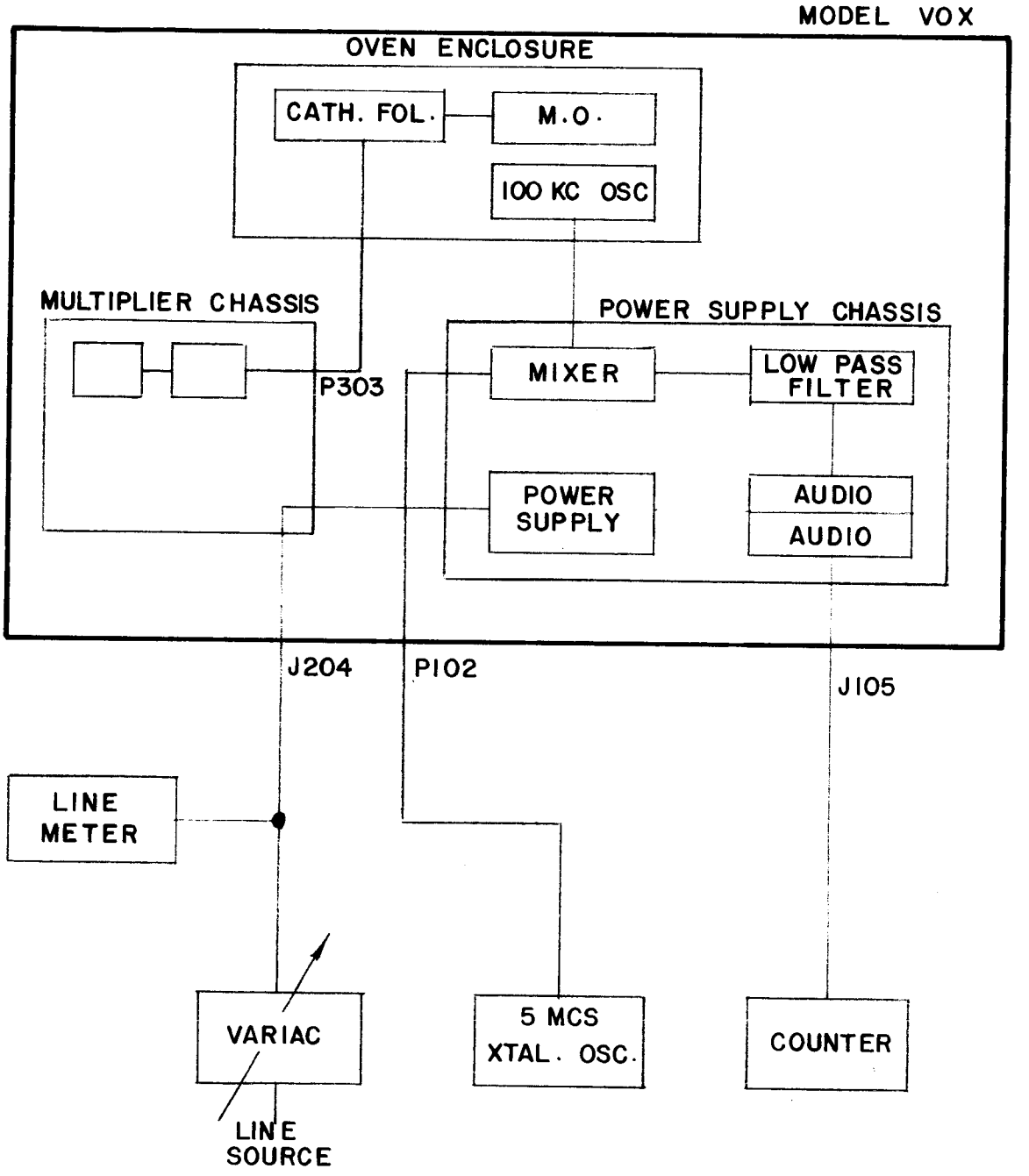
3.2.7.3. Set-Up - Simply connect a VTVM across the appropriate load.

3.2.8. APPENDIX I

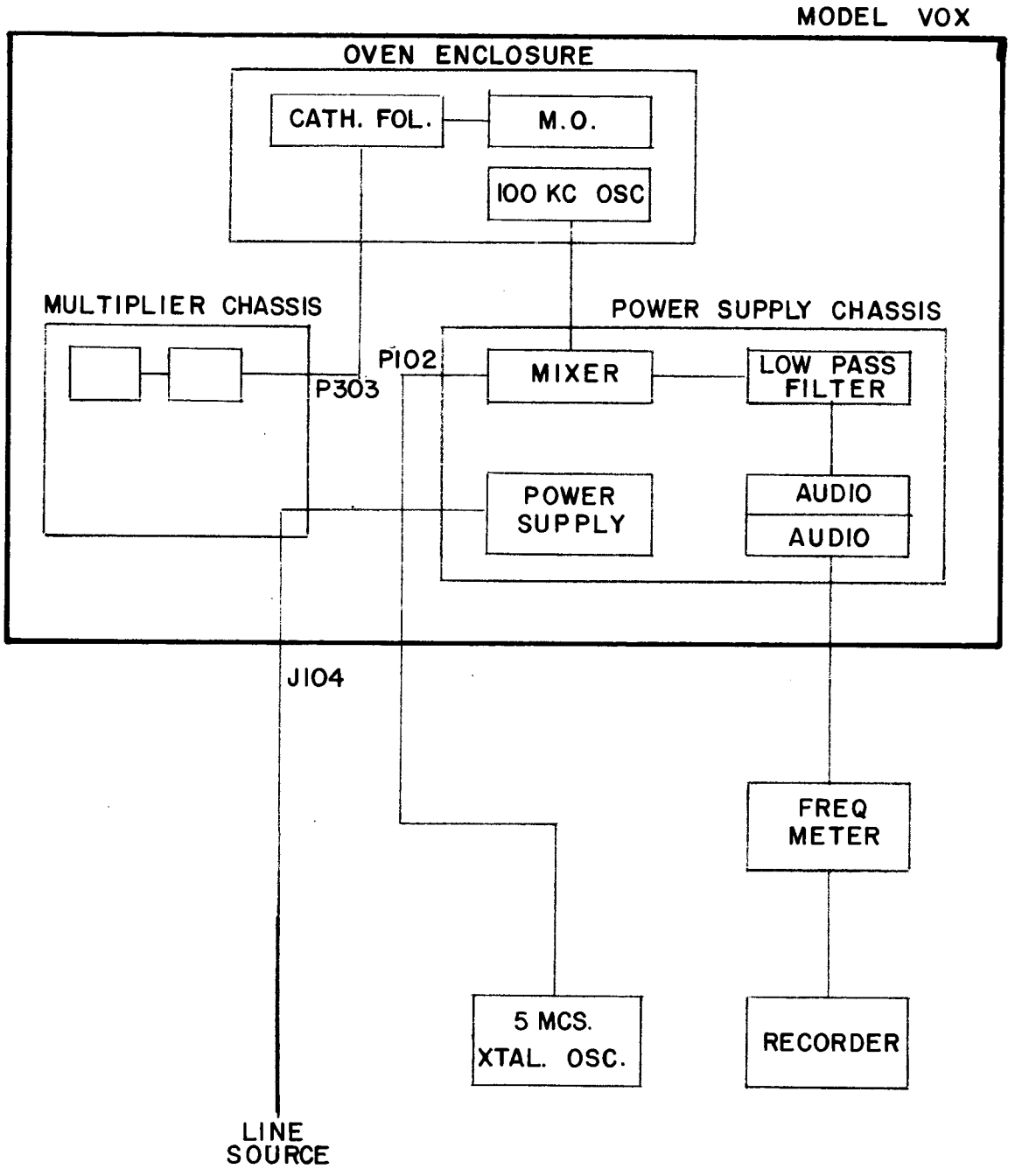
Appendix I contains the block diagrams which serve to illustrate each test set-up in turn.



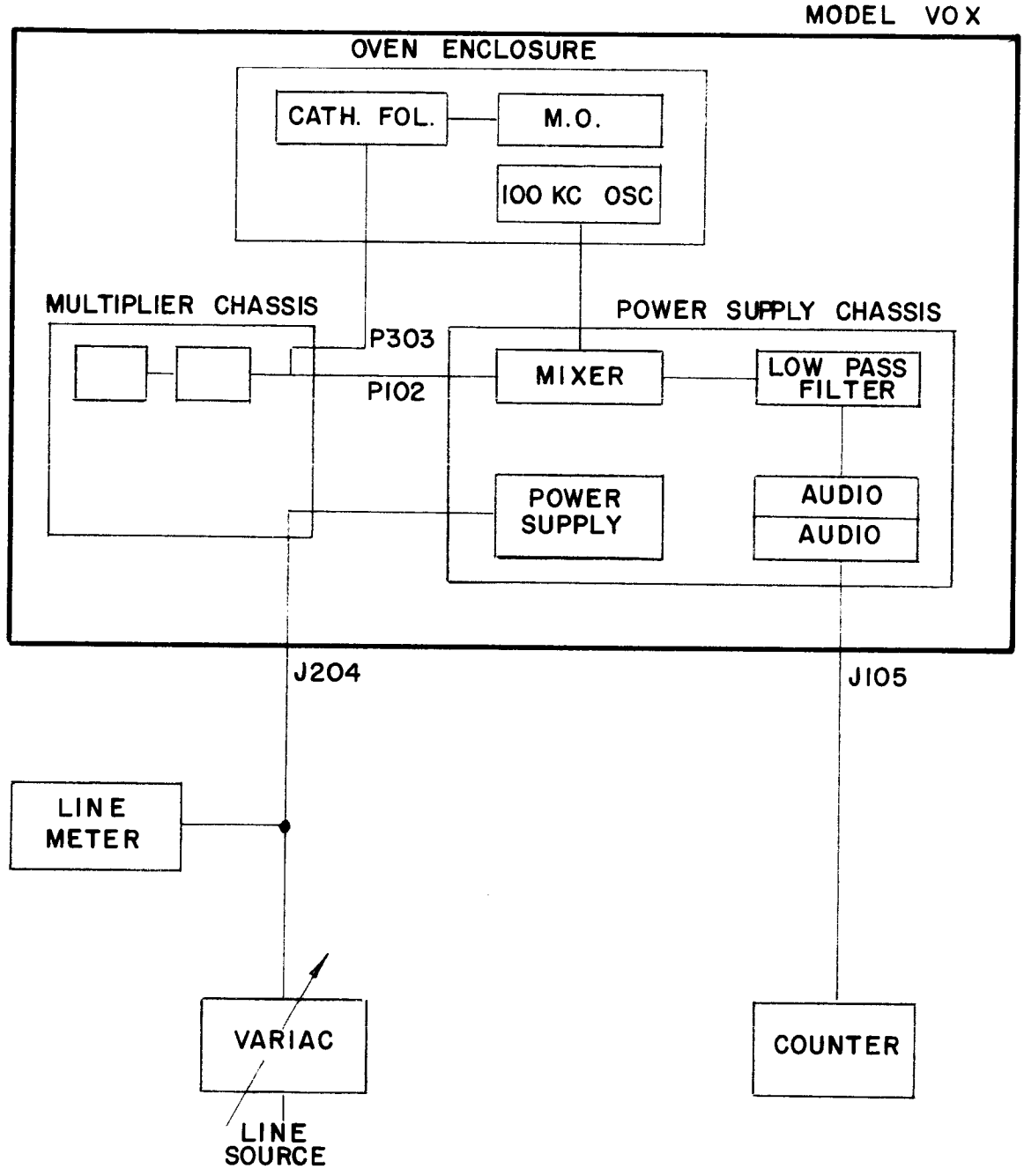
3.2.8.1. 100 Kcs. Oscillator Calibration Test Set-up.



3.2.8.2. 100 Kcs. Oscillator Line Test Set-up.



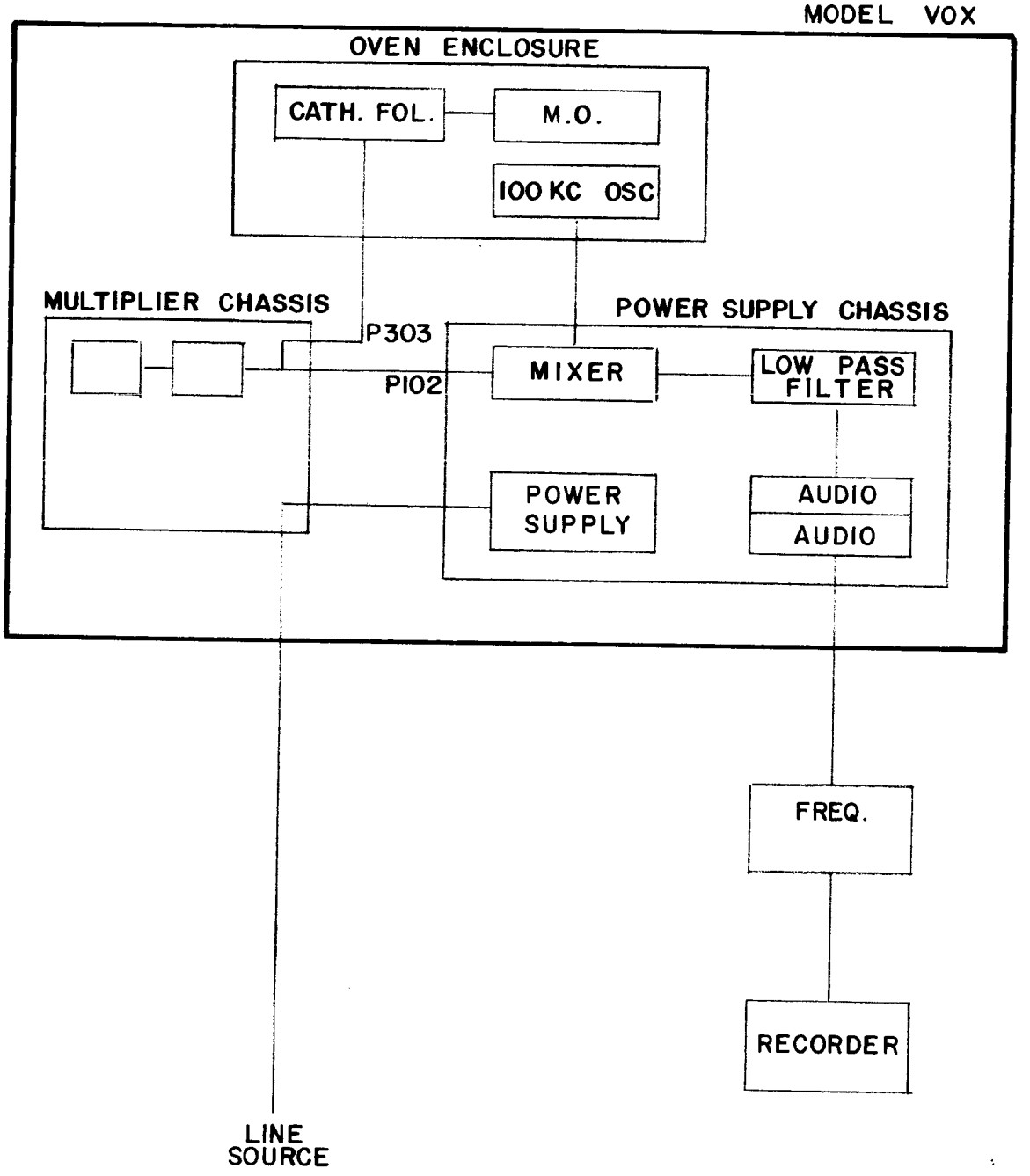
3.2.8.3. 100 Kcs. Oscillator Ambient Test Set-up.



3.2.8.4 Master Oscillator Line Test Set-up.

3.3. TEST SUMMARY SHEET

Reference	Spec. Limits			Measured Values		No. Samples	
				Min.	Max.	Tested	Passed
3.2.1.	-----			0	3PPM	3	3
3.2.2.	-----			.3PPM	1PPM	3	3
3.2.3.	-----			.5PPM	1PPM	3	3
3.2.4.	10 cps.			5 cps	9 cps	3	3
3.2.5.	See Note			6PPM	13PPM	3	3
3.2.6.	20 PPM			0	10PPM	3	3
3.2.7.	HFO Section:						
	Band	f	Min. out.				
	2-4	2 Mcs	2 watts	2.5	2.8	3	3
	2-4	4	2	2.9	3.2	3	3
	4-8	4	.5	1.0	1.5	3	3
	4-8	8	.5	.9	1.2	3	3
	8-16	8	.5	.7	.9	3	3
	1-16	16	.5	.8	1.0	3	3
	16-32	16	.5	.6	.75	3	3
	16-32	32	.5	.9	1.1	3	3
	32-64	32	.5	.5	.6	3	3
	32-64	64	.5	1.5	1.9	3	3
	BFO Section						
	6 volts			6.5	7.0	3	3



3.2.8.5. **Master** Oscillator Ambient Test Set-up.

IFO S ction:				
2 volts	3.0	3.9	3	3

*NOTE: This is a combined test involving temperature, humidity, and line changes. The spec therefore combines all allowances made for these factors.

RECOMMENDATIONS: None. Data merely submitted.

4. Signatures:

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