

U.S. NAVAL SUBMARINE MEDICAL CENTER
U. S. NAVAL SUBMARINE BASE NEW LONDON
GROTON, CONNECTICUT

SPECIAL REPORT NO. 65-5

FREQUENCY-RESPONSE CHARACTERISTICS OF AN IMPROVED
TRANSISTORIZED MILITARIZED INTERCOM SYSTEM PROPOSED
BY THE USN UNDERWATER SOUND LABORATORY FOR USE IN
MAINTENANCE AND TESTING OF THE AN/BQS-6 SONAR SYSTEM

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SUMMARY PAGE

THE PROBLEM

To determine whether the speech-transmission characteristics of an improved transistorized version of the Raytheon Co.'s LS-503/BQS-6B intercommunication system would equal the performance characteristics of the non-militarized system found satisfactory in USN Submarine Medical Center Special Report No. 65-2.

FINDINGS

At the most favorable settings for speech communications in the Master-Slave station mode, frequency passband was 490-4000, harmonic distortion, at 1000 cycles/sec was 14 per cent, the roll-off below the maximum at 1500 cycles/sec was 20 db per octave, and the maximum signal to noise ratio, at 1500 cycles/sec, was 40 db. In the Slave-Master mode, performance was equally good except that harmonic distortion was excessively high at 40 per cent.

APPLICATION

The low frequency slope, which reduces the masking effect of intense low frequency ambient sounds as well as system resonance at 200 cycles/sec, renders this improved militarized variation satisfactory for sonar maintenance and component testing of subject system.

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SONAR SYSTEM

INTRODUCTION

Requested by: Telecon from USN USL Mr. John Soderberg, Systems Development Branch, Submarine Sonar Division.

1. Purpose

To determine the speech handling characteristics of subject voice communication system.

2. Background

Subject intercommunication system, a master with provision for three slaves was built by Raytheon Company for the Bureau of Ships. The first model proved to be unsatisfactory by reason of poor S/N ratio, narrow bandwidth and gentle low frequency roll-off. It was arranged that Mr. Lyle Hill, Design Engineer, Raytheon Company, Portsmouth, Rhode Island, who had been given the responsibility for improving the system, would bring his second variation to SMC, set it up and observe its testing. This was accomplished on 8 September 1965.

3. Action

a. Equipment. Pure tones generated by a General Radio Type 1304-B beat frequency audio generator were produced by a Jensen 15-inch triaxial speaker placed one foot away from the subject Master station in a sound treated room. A Western Electric 640AA microphone was placed six inches in front of the slave in an anechoic chamber. Through an appropriate preamplifier and amplifier system the slave output was led to a General Radio Type 1521-B graphic level recorder, coupled by a drive unit to the audio generator. This whole system, exclusive of the intercom to be measured, is essentially flat ± 5 db from 60-8000 cycles/sec.

b. Gain Settings and Frequency Passbands. Loudspeaker input to the Master in the anechoic chamber was adjusted to produce 85 db sound pressure level at 1 kc. Frequency-response curves (See Figures 1-3) were then drawn for the maximum gain condition, and for the gain reduced 10 and 20 db at 1000 cycles/sec. From each of these three curves the frequency passband was noted, and also the signal/noise ratio. At maximum gain, the passband was 490-4000 cycles/sec, at -10 gain it was 700-4000, and at -20 it was 1100-1900. The signal/noise ratio through the speech frequencies (750, 1000, 1500, 2000, 3000)

averaged 25 db at maximum gain. At -10 db gain the average S/N was 16 db, and at -20 db the average S/N was only 8 db.

c. Low-Frequency Roll-off. In each of the Figures, 1-3, a roll-off of about 20 db per octave is seen.

d. Harmonic Distortion. Total distortion for the mode and gains shown in Figures 1-3 can be seen to be rather high at 500 and 700 cycles/sec, but at higher frequencies to be within the range considered minimally satisfactory for speech communication. In the slave-master mode (See Figures 4-5), the frequency response curves are not strictly different from the master-slave mode, but the harmonic distortion is appreciably higher.

4. Interpretation

When the electroacoustic characteristics of this model are compared with the first version (see USN SMC Special Report No. 65-4), a distinct improvement is apparent. The low frequency roll-off is improved by 5 db/octave, the frequency passband has been extended from 2 octaves to 3 octaves, the signal to noise ratio through the speech frequencies has been raised from 16 to 25 db and the harmonic distortion at 500 cycles has been reduced from 90 to 75 per cent and at 1000 from 20 to 14 per cent. These improvements render subject system comparable to the non-militarized commercial intercom system which has been found satisfactory for the intended purpose (See USN SMC Special Report No. 65-2).

5. Recommendations

Utilize subject system for subject purpose without further attempts to improve electroacoustic characteristics.

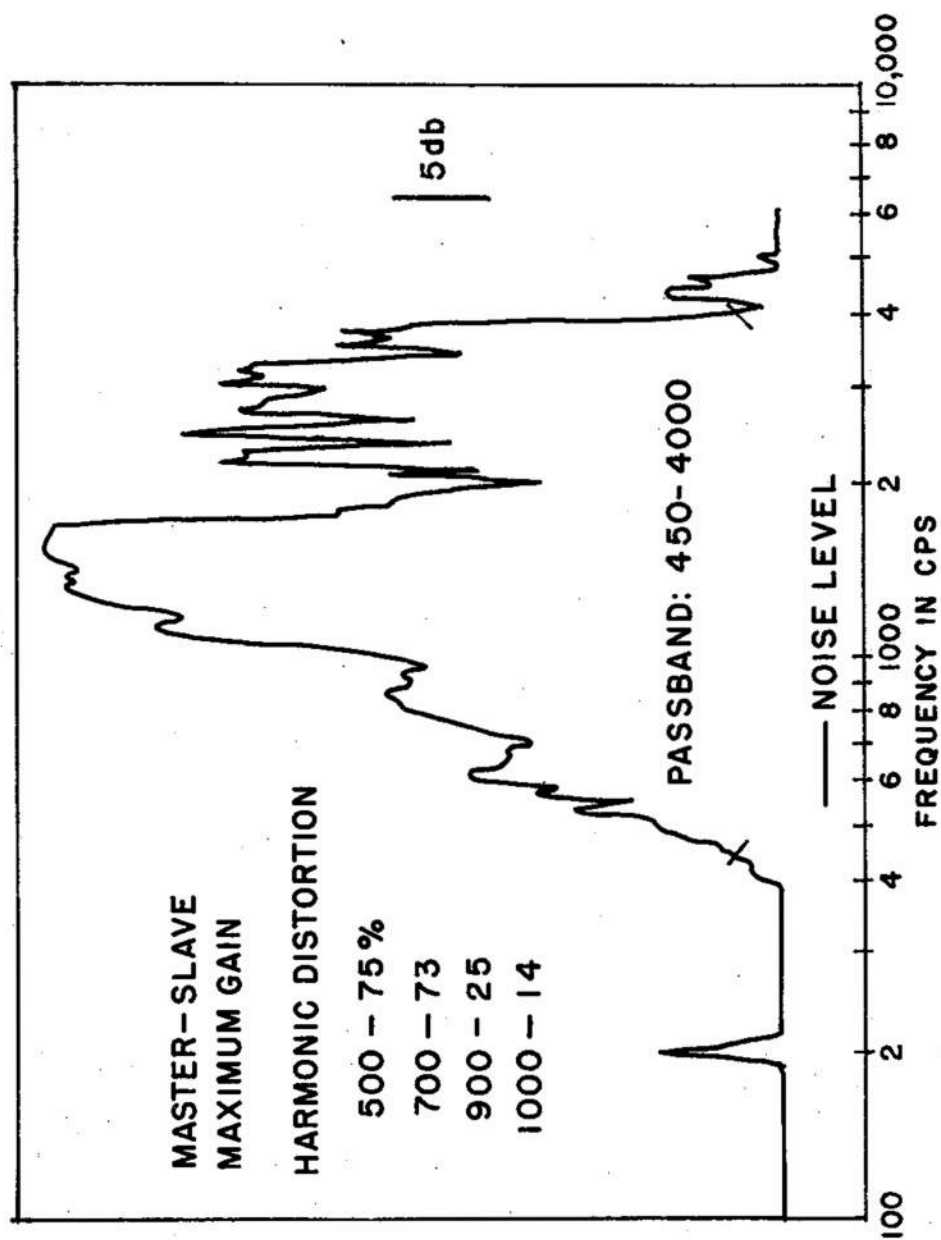


FIGURE 1

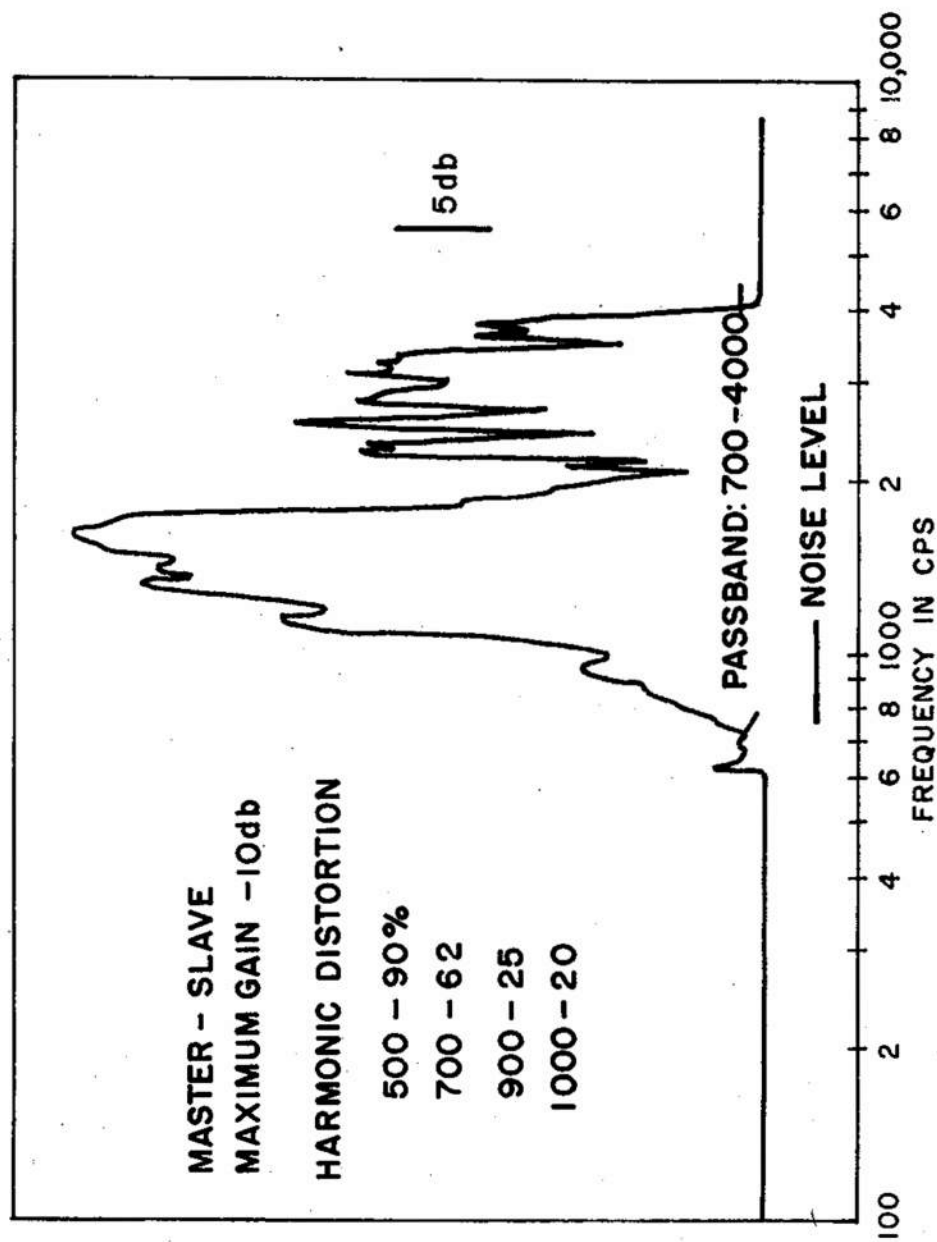


FIGURE 2

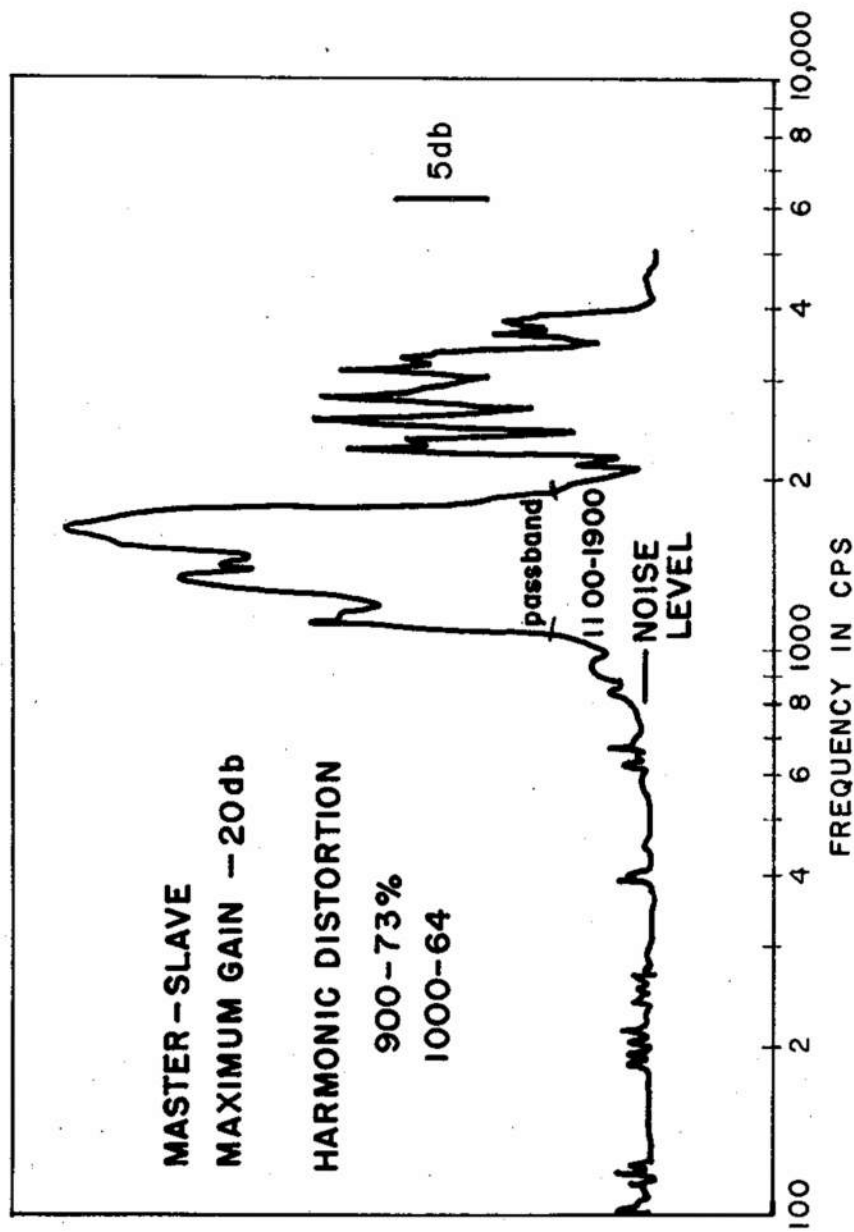


FIGURE 3

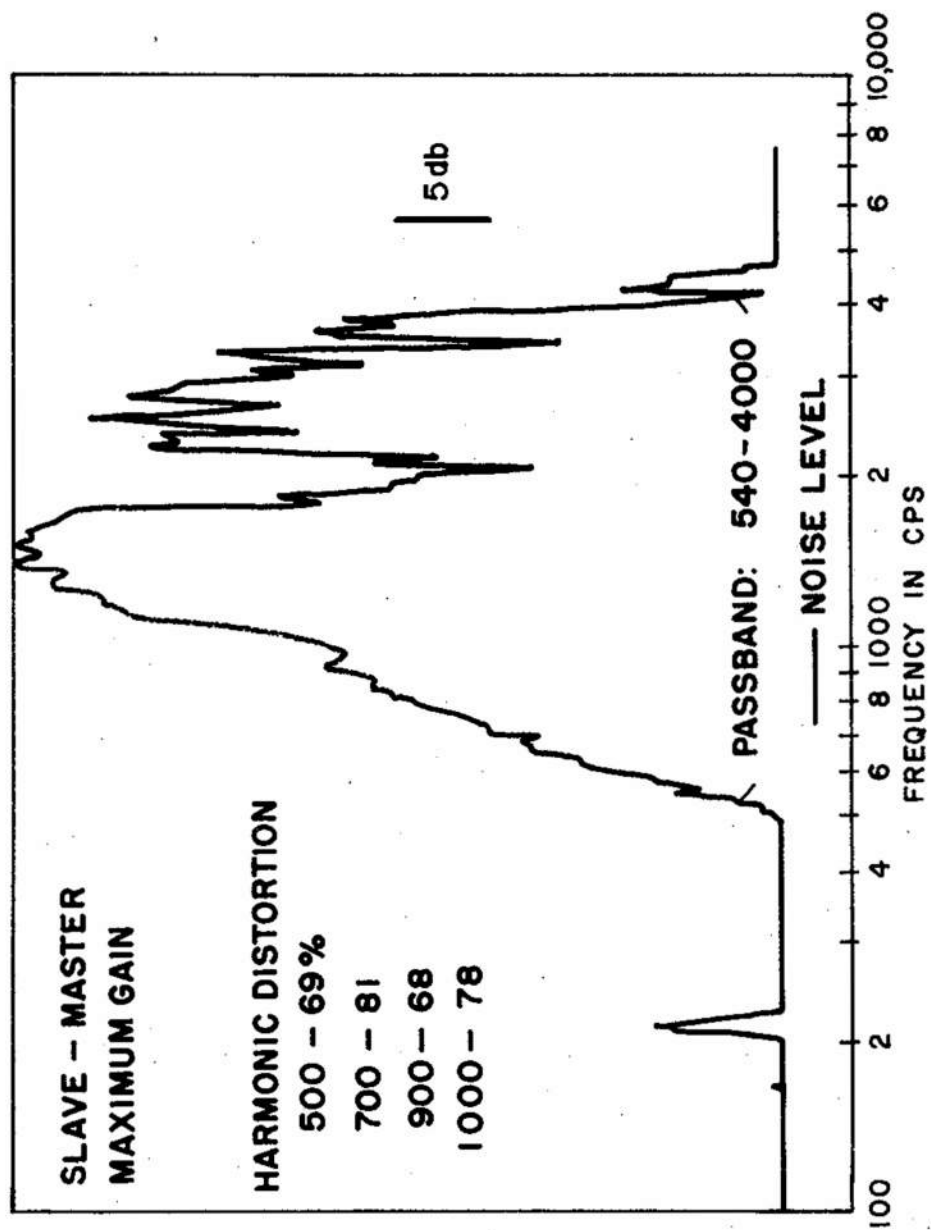


FIGURE 4

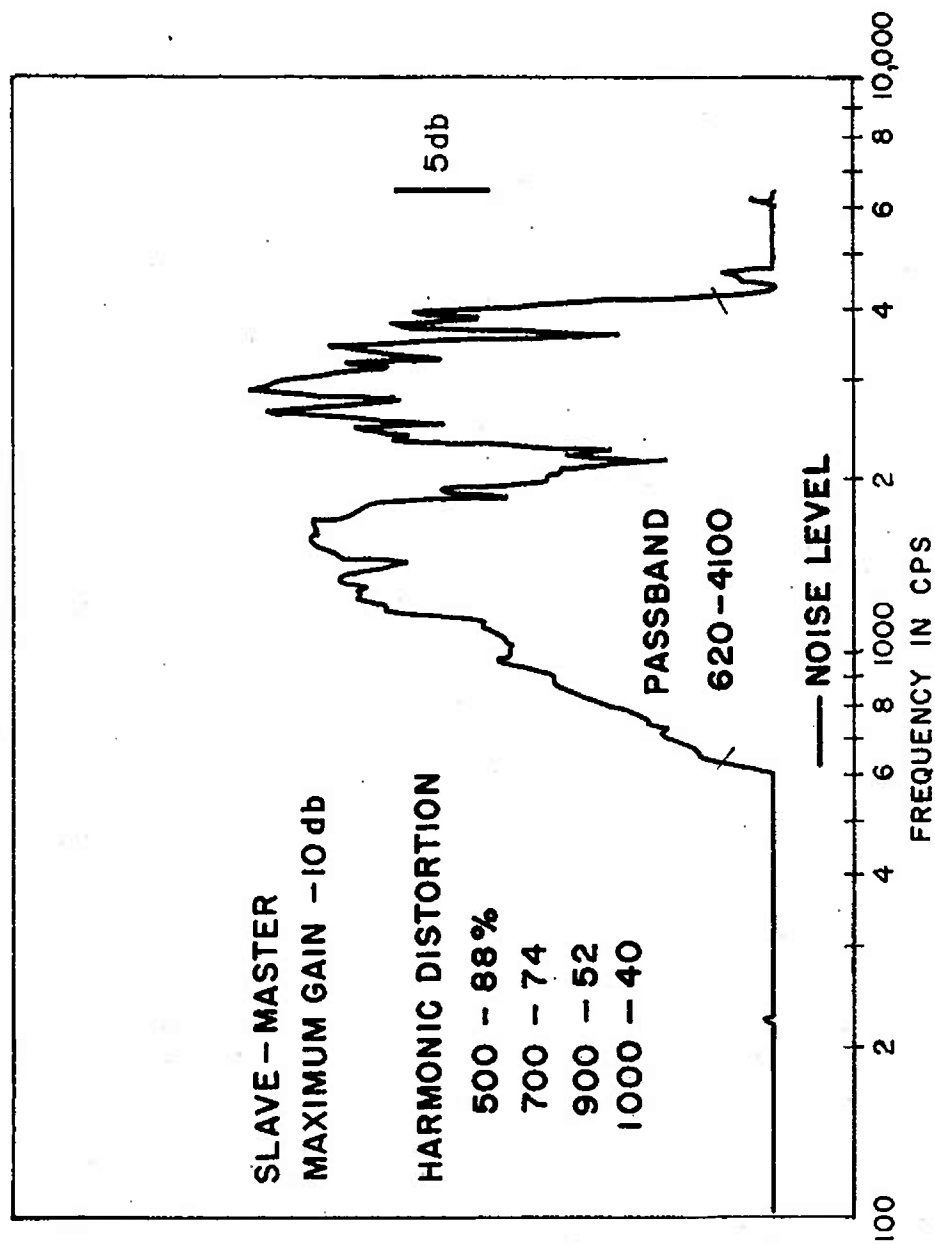


FIGURE 5