RaneNote 116

Cost-Effective Noise Masking Systems

- **RA 27 Pink Noise**
- **Zones and Speaker Arrays**

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INTRODUCTION

As the popularity of noise masking systems grows, so too does the cost of the equipment to implement it. However, like other sound system needs, Rane products can contribute a great deal to the cost-effectiveness of noise masking systems wlthout sacrificing reliability or operational requirements.

Properly designed noise masking systems are an art form unto themselves. Their requirements far exceed what can be accomplished in this short space. The purpose of this note is to introduce noise masking designers to Rane products useful in their craft.

REALTIME ANALYZERS

Rane's RA 27 Realtime Analyzer is ideally suited for generating the pink noise signal required to ideally mask ambient noise and conversation in open-plan office environments. Any Rane equalizer may be used to contour the pink noise output. The analyzer is used to set the one-third octave equalizer for the smoothest sounding noise within the environment.

NOISE SOURCE

Most noise masking authorities think the best pink noise sources are generated by pseudo-random digital techniques. The generator in the RA 27 is just such a device. Figure 1 shows a plot of the pink noise output produced by the Rane noise generator. As you can see, it is extremely flat with respect to “log” frequency. This is ideally what is desired as the basis of any masking system. The digital circuitry employed by Rane’s design generates an output which is in reality white noise. This signal, modified by a pink noise curve, appears at the pink noise output jack of the units. The output is activated by the front panel pink noise switch.

The RA 27 is an extremely stable noise generator. Figure 2 illustrates a test conducted at JGL Acoustics in Kirkland, Washington. The hourly A-weighted Leq output levels remained constant over a period of 347 hours (14.4 days).

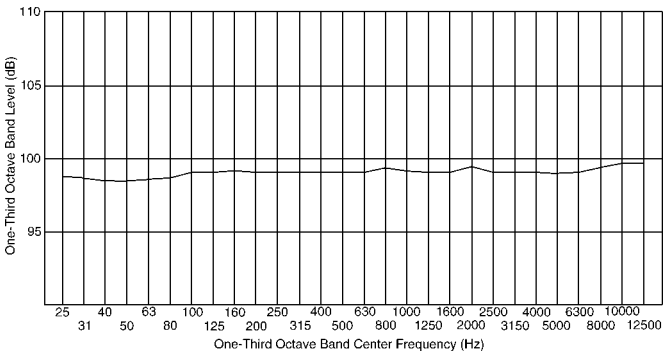

Figure 1. RA 27 Pink Noise Frequency Response

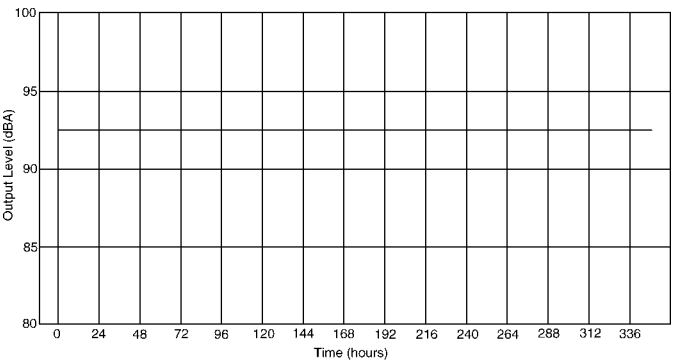

Figure 2. RA 27 Pink Noise Level Stability with Time

BASIC SYSTEM

Figure 3 illustrates the internal functional blocks of a typical noise masking generator. All of these blocks are duplicated in the Rane RA 27 when connected to a graphic equalizer. Connecting the system requires only patching the pink noise output of the RA 27 to the equalizer input, then connect the distribution and amplification electronics to the output of the equalizer. The downstream electronics may be in the form of a Rane SM 26B to provide the necessary splits and level controls for individual zones, followed by a Rane MA 6S power amplifier. The output of the amplifier may then be fed directly to low impedance loudspeakers or to a constant voltage transformer system such as the Rane KTM 6 Multichannel Transformer kit. In any event, the result is an extremely cost effective noise masking system with a minimum of components. Figure 4 depicts such a system.

MULTIPLE ARRAY NOISE MASKING

Simple noise masking systems use one equalized noise generator, distributing the shaped noise throughout the ceiling array. While cost effective, these simple systems too often are, themselves, a distraction. When this happens, the system gets switched off and the customer feels noise masking doesn’t work and they wasted their money.

The evolution of successful noise masking produced the following guidelines (from “Acoustics of Open Plan Rooms,” by Rollins Brook and “Sound System Design,” by Chris Foreman in Glen Ballou, Ed., *Handbook For Sound Engineers* [Howard W. Sams & Co, Indianapolis, 1987]) for creating unnoticeable, yet very effective systems:

- Use three carefully equalized noise sources
- Interlace noise sources driving speaker arrays
- Disperse noise evenly in all areas (±2 dB)
- Use adequate amplification to avoid clipping
- Use separate EQ for the paging source
- Do not attenuate noise during paging

These guidelines result in a fairly complex and expensive system. Luckily, Rane products can help reduce both.

The most random signal results from the use of exactly three noise sources (more do not add more). This way, no two adjacent speakers emit the same sound. Each neighbor produces a randomly different sound. Experience has shown this approach creates the least distracting and most effective masking.

A non-irritating and successful noise source mimics the shape and range of normal speech. This means a maximum frequency range of about 200 Hz to 5 kHz, with an overall rolloff of 5-6 dB/octave beginning at 200 Hz and extending to around 5 kHz. With perfect speakers and no room interference, this can be done with a single capacitor. With actual speakers and normal rooms, this takes a one-third octave equalizer. Such is the cost of living in the real world.

An RA 27 may be used for each zone providing redundancy of pink noise generation. The ME 30B equalizer locations are arbitrary. Placing them between the Mixer and the MA 6S works just as well. Other Rane equalizers may be substituted of course, depending on space, 1/3 or 2/3-octave resolution or U.L. requirements.

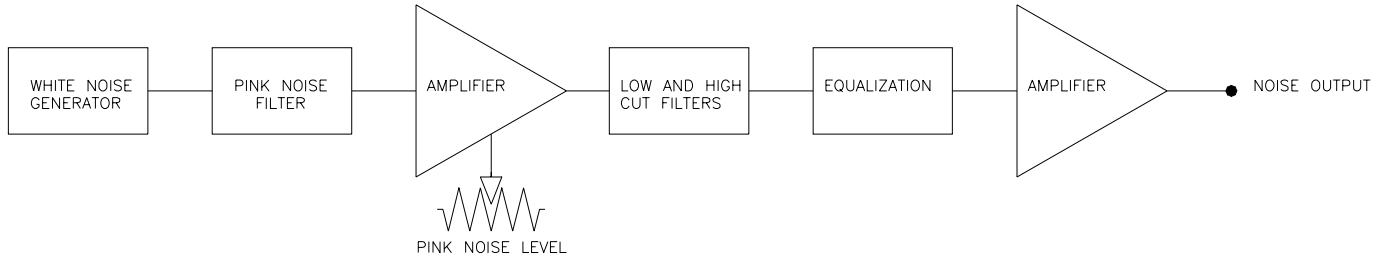

Figure 3. Typical Noise Maksing Generator

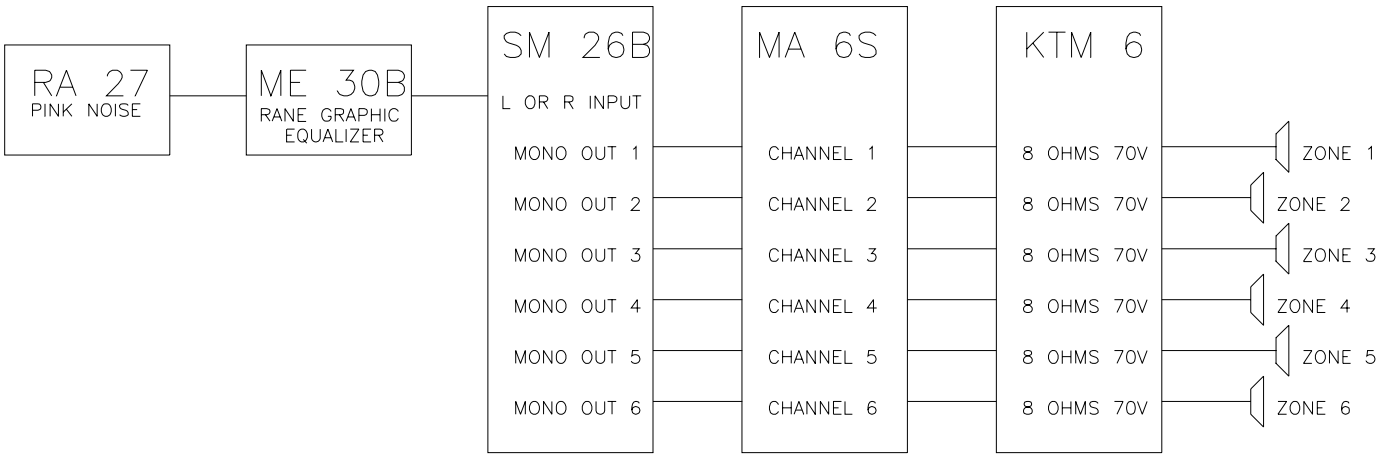

Figure 4. Basic Noise Masking System Example

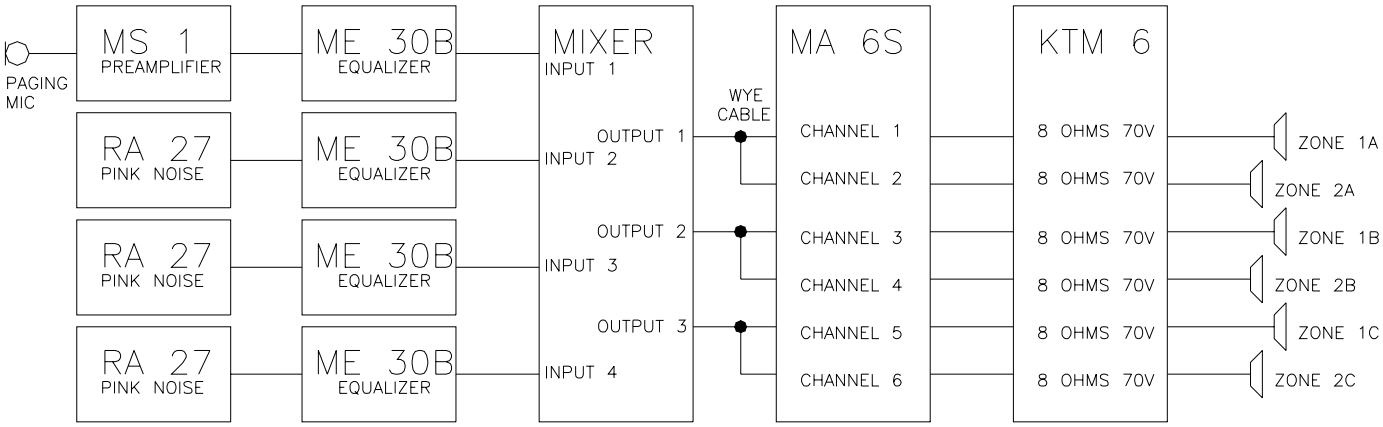

Figure 5. Multiple Array Noise Masking System Example

The Mixer may be any that allows any inputs to be run to any combination of three outputs. At the time of this writing, Rane doesn't make such an animal, though a Rane FPM 44 or CM 86 (both discontinued) would work great.

An MA 6S/KTM 6 combination drives the ceiling array. Use wye cables to connect adjacent channels together as shown in Figure 5. The MA 6S can alternatively handle three channels for noise masking, with the other three for background music in other offices, or simply bridged for three 300 watt zones.

The outputs drive the loudspeakers in an interlaced array as shown by Figure 5. No two adjacent speakers receive the same source. This is not the wiring nightmare it first appears. Notice that the speakers still wire daisychained, just diagonal instead of straight.

The noise must be as uniform as possible throughout the office environment. This demands lots of speakers. The most successful systems extend the noise signal into ancillary areas (storage rooms, copying/FAX centers, closets, etc.) adding even more speakers.

Extension of the basic design given in Fig. 4 is straightforward. Using additional MA 6S/ KTM 6 combos allow easy

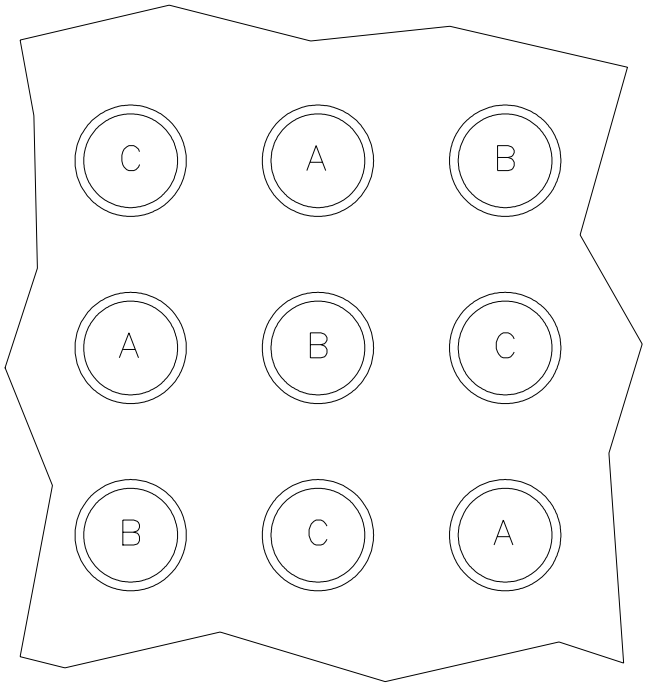

Figure 5. Noise Masking Ceiling Array

REFERENCES

1. “Acoustics of Open Plan Rooms,” by Rollins Brook and “Sound System Design”, by Chris Foreman in Glen Ballou, Ed., *Handbook For Sound Engineers,* Howard W. Sams & Co, Indianapolis, 1987
2. D. Bohn, “Flex Users Guide”, Rane Corporation, revised 1995
3. Measurements courtesy of JGL Acoustics, Inc. Kirkland, Washington, 1994.