

Tone Notching, AGC & Noise Reduction



Problem

Air Traffic Controllers have identified three significant problems with many current voice switches:

- High frequency tones accidentally induced into their headsets,
- Improper balancing of the volume of incoming A/G and G/G audio (i.e. no Automatic Gain Control)
- High Idle Channel Noise in the headset, especially when multiple radios are selected for receive

The consequences of these problems are significant:

- The improper balancing of the volume causes controllers to constantly readjust volume settings for ground-to-ground (G/G) and air-to-ground (A/G) calls and increases the probability that a critical message could be missed. This increases the controller's workload and induces a significant safety hazard
- The high frequency tones are a health issue since they cause extreme pain, temporary losses of hearing and, in some cases, permanent hearing damage. These can result in both short-term absences from work (one day to several weeks) and long-term disabilities
- High idle channel results in unnecessary operator fatigue and discomfort resulting in loss of efficiency

Solution

Digital Signal Products (DSP), Inc. has developed an Audio Signal Processor (ASP) that simultaneously solves all of these problems. The ASP uses a digital signal processor to perform Analog to Digital conversion of all incoming signals. The digital signal processor analyzes the signal and removes up to two extraneous tones simultaneously within 70 milliseconds. This operation is performed without reducing the quality of normal voice signals.

The ASP also measures the strength of all incoming voice signals and adjusts the volume of all calls to the same level. A controller can select one volume that is comfortable and all incoming calls are adjusted to this volume. If the incoming signal level is below -33dBm a high speed VOX (approx. 5ms) ensures that the unit outputs silence to the operator's headset/loudspeaker. The ASP is placed directly behind the controller's head set jack box or it can be incorporated into the jack box.

The Tone Notching and AGC ASP has been successfully tested and installed at approx. 2000 ATC positions in the Litton RDVS, DENRO RDVS-D and STVS Voice Switching systems.

The system is available both as stand alone box and a chassis, which can feed multiple positions.



Tone Notching and Automatic Gain Control

Specifications

Input Impedance: 600 Ohms, Balanced, Output Impedance: 600 Ohms, Balanced
Frequency Response: +/- 2.0 dB (300-3000 Hz) with respect to 1 KHz, Gain: 0 dB (no gain, no loss)
Input Signal Range: +3.0 dBm to -50 dBm (no adjustment required)
Output Signal Range: +3.0 dBm to -50 dBm (no adjustment required)
Fail Safe Operation: Automatic bypass in case of DSP or power failure within 3-5 seconds. Relay contact closure and a red LED are provided to announce a card failure
Operating Voltage: 105-120 / 210-250 VAC, 50-60 Hz or -48 VDC or +24VDC
Power Consumption: Typical: 5 watts Maximum: 7 watts
DSP Speed: 160 MIPS
Digitization Scheme: 16 bit linear, for improved audio performance, Sampling rate: 8 KHz
Inter-channel Crosstalk Attenuation: 65 dB minimum
Total Harmonic Distortion: Less than 2%
4-Wire Echo Return Loss: 20 dB minimum @ 600 Ohms'
Idle Channel Noise with VOX function selected: 6 dBnc0 max.
Number of channels per card: One operator position
AGC Attack Time: 5-10 msec, AGC Release Time: 400-800 msec, AGC Range: +/- 8 dB
VOX Attack Time: 5-10 msec, VOX Release Time: Programmable 50-350 msec, VOX Detect: Programmable -30 to -36 dBm
VOX Hysteresis: 3dB
Tone Notching: 45 dB minimum
Card Size: 5.5" x 5.5" or 3U chassis
Connections: 25 pin Amp-Champ or a card edge. Any other suitable connector, as per customer's requirements, can also be provided.

Other ATC Products

Voice Clipping – In some communication switches, there are call types (Voice Call) where a caller will start speaking before the connection to the receiving position is complete. The Audio Clipping ASP prevents the loss of the initial portions of an incoming call when the connection times within the switch are too slow and up to 1 second of the message is lost.

Best Signal Selection (BSS) – In some radio communication systems, there are more than one receiver for a given frequency. This occurs for reasons such as too great a distance or terrain interference with only one receiver. Under some circumstances, multiple receivers will have a signal that exceeds an audible threshold, but the strength and quality may be significantly different. The Best Signal Selection ASP monitors all receivers and within 70 msec routes the call using the highest quality signal.

Radio Control Equipment (RCE) – DSP has developed an RCE that provides full duplex voice and data communications between a control site and a remote site over unconditioned telephone lines and satellite links. The control end modem trains the remote end modem to achieve the highest possible data transmission rate. The operator voice bandwidth is 300-3300 Hz end-to-end. The design employs speech encoding at 8 Kbits/s.

Digital Voice & Data Recorder – DSP, Inc.'s Voice/Data Recorder Model 2025 is specially designed for demanding applications. It uses state of the art carrier grade server with 16-channel Line Interface cards to provide the necessary audio record functionality. Up to six such Line Interface cards can be directly plugged into the server providing 96-channel recorder system. The system is designed to record and playback TPX-42 RADAR data in a synchronized manner. For larger systems (up to 1200 channels) the Line Interface cards can be plugged into a separate chassis. DSP, Inc. has received a 5-year contract for supplying these recorder for all US Navy ships and Coast Guard cutters.

Battery Monitoring System - DSP, Inc. has designed a Battery Monitoring system that constantly and un-invasively checks the health of each battery and reports its status every 10 seconds. If a battery degrades or fails an audio/visual alarm is provided to the maintenance staff. You do not have to find a bad battery in your backup system the hard way, at the time when you need it the most. With the DSP, Inc.'s Battery Monitor in your installation, battery degradations are reported quickly before a failure occurs, eliminating the need for a periodic maintenance action.

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