



February 9, 2015

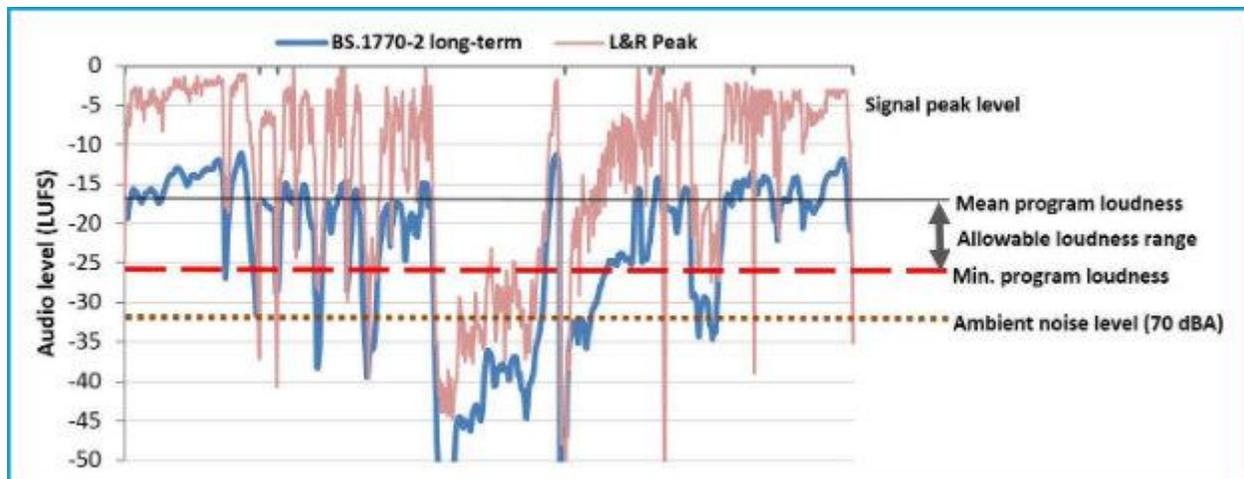
## Study of Audio Loudness Range for Consumers in Various Listening Modes and Ambient Noise Levels

Consumers listen to radio broadcasts on a variety of devices and in multiple types of environments, some quiet, some not so quiet. A study was conducted by NPR Labs in 2014 to investigate the range of audio program loudness that is desired

by listeners in typical environments, such as homes, business offices, automobiles and public transit, using fixed and portable audio playback equipment. A session at this year's NAB Broadcast Engineering Conference (BEC, April 11-16, 2015, Las Vegas, NV) entitled "Radio Technology Forum" includes a paper, excerpted here, discussing this study and the results obtained. The paper is entitled "Study of Audio Loudness Range for Consumers in Various Listening Modes and Ambient Noise Levels," and is authored by John Kean and Eli Johnson, NPR Labs, Washington, DC, and Dr. Ellyn Sheffield, Towson University, Towson, MD.

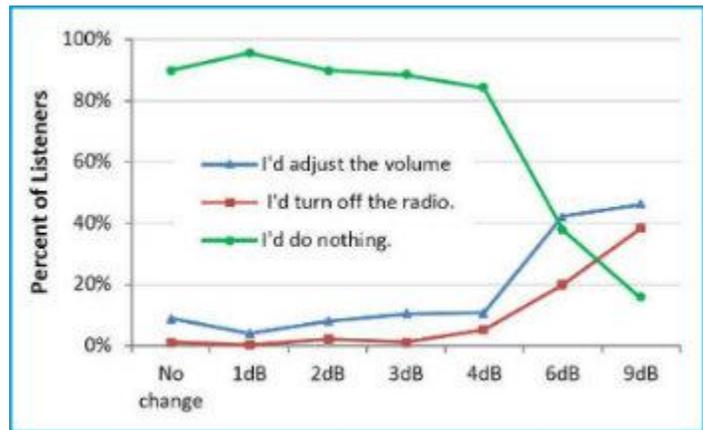


**INTRODUCTION** – to investigate the relation between ambient noise and loudness range, this study measured the sound levels desired by listeners in specific noise environments at known sound pressure levels. The audio content was derived from popular music, fine arts performances, newscasts and talk shows currently distributed by Internet audio streams, podcasts, etc. Both loudspeaker and earbuds listening modes were tested. The figure below illustrates a condition in which the audio level (variation in loudness) drops below the ambient noise level in some sections. The sample audio was taken from an Internet music streaming service, using a "movie music" genre selection, over a 30-minute period. Both loudness, based on the ITU-R BS.1770 meter, and signal peaks are shown below.



### LISTENER CONTROL OF PLAYBACK –

listeners are, of course, at liberty to adjust playback volume, but the necessity to readjust the volume during a program has a cost in terms of annoyance. The authors conducted an earlier test of listener reaction to volume changes during audio streams. The study found the reactions to adjusting the volume are indicative of how listeners may feel about "gain riding" a program with too much variation in loudness. The figure at right shows that listeners were inclined to "do nothing" until changes in loudness reached 4 dB,



above which listeners decided they would adjust the volume knob. At a loudness change of 6 dB, another 20 percent of listeners would "turn off the radio". At a change of 9 dB, the percentage of listeners who would adjust the volume did not increase much, but nearly 40 percent of listeners said they would stop listening. This result suggests that listeners tolerate a degree of loudness range variability, beyond which they may give.

**NOISE ENVIRONMENT AND PLAYBACK SOUND PRESSURE LEVEL** – the A-weighted sound pressure level of the environmental noise, at the position of the listener's head, was measured and set in advance of the experiment. During the test, the environmental noise started at least 20 seconds before the playback of any test material to allow the test subject to become accustomed to the conditions. The loudspeaker tests included an automotive environment simulating the in-cabin noise of a vehicle at highway speeds. The quiet office and restaurant recordings were selected from sound effect tracks with care to avoid any distracting or sudden noises that might disrupt the listener's hearing of the program audio. In lieu of the in-vehicle noise, the ear bud tests included a public transit environment, similar to riding on a modern light rail system.

**ANALYSIS OF LISTENER TEST DATA** – participant's behavior was analyzed separately for loudspeaker listening and earbuds. Preliminary analyses showed that there were both age and gender differences, so these demographic characteristics were considered during analyses. Four analyses were conducted to determine the following behavior:

- How people adjusted their volume at the start of the listening experience to set their nominal listening level
- How people adjusted their volume in response to audio becoming more quiet in the middle;
- How people adjusted their volume in response to audio become louder at the end;
- The difference between their original nominal listening level and the end level after mid-sample adjustments had been made.

This paper will be presented on Sunday, April 12, 2015 at 2:30PM PDT in room S227 of the Las Vegas Convention Center, and will be included in its entirety in the 2015 NAB BEC Proceedings, available at the NAB Show and afterwards, on-line at the NAB Store ([www.nabstore.com](http://www.nabstore.com)). For additional conference information visit the NAB Show web page at [www.nabshow.com](http://www.nabshow.com).

## Last Call for 2015 Technology Innovation Award Nominees



This is the last call for nominations for the NAB Technology Innovation Award.

First presented at the 2009 NAB Show, NAB presents the award to organizations that bring advanced technology exhibits and demonstrations of significant merit to the NAB Show. The nominated exhibit should present advanced research and development projects in communications technologies that have not yet been commercialized.

Candidates for the Technology Innovation Awards must be organizations that are currently exhibiting at the NAB Show. The size of the organization is not a determining factor. Nominated projects may not be commercial products that have been offered for sale prior to or at the NAB Show. The merit of the technology exhibit is the sole factor to be taken into account. The entry deadline is February 20, 2015. The awards will be presented at the NAB Technology Luncheon on April 15, 2015 at the NAB Show in Las Vegas.

Additional information and a nomination form are available on NAB's [website](#). The deadline for nominations is February 20, 2015.

## The Amateur Radio Operators Reception – Call for Prizes:

The Amateur Radio Operators Reception, sponsored by Broadcast Supply Worldwide, Turner Engineering and DX Engineering, is one of the most anticipated events at the NAB Show. We are currently seeking door prizes to be awarded at the Reception. All prize donors will be recognized in a scrolling video display at the event, and in the NAB Radio and TV TechCheck newsletters. Prizes can be of any size and value, but should be selected to appeal to technically inclined individuals who have a passion for their craft.

If you wish to donate a prize, please email Rich Johnson at [rjohnson@nab.org](mailto:rjohnson@nab.org). Thank you in advance for helping us make the 2015 Amateur Radio Operators Reception another outstanding success.



## Important Dates and Upcoming Events

### [Hollywood Post Alliance \(HPA\) Tech Retreat](#)

February 9 - 13, 2015

Indian Wells, Calif.

### [Audio Engineering Society \(AES\) 57th Conference: The Future of Audio Entertainment Technology](#)

March 6 - 8, 2015

Hollywood, Calif.

### [2015 NAB Show](#)

April 11- 16, 2015

Las Vegas, Nev.