An introduction to Jabra PeakStop™ and noise control systems

Several criteria are used when selecting a headset solution for the contact center or office. Headset robustness, weight, and design should be prioritized high, but another important factor is acoustic safety and comfort. This white paper provides insight into headset acoustics, the relevant regulations and standards, and the personal protection offered by Jabra headset and amplifier solutions. At the end of the white paper, a definition of terminology and an overview of acoustic standards can be found.[1)]

GN offers active noise protection

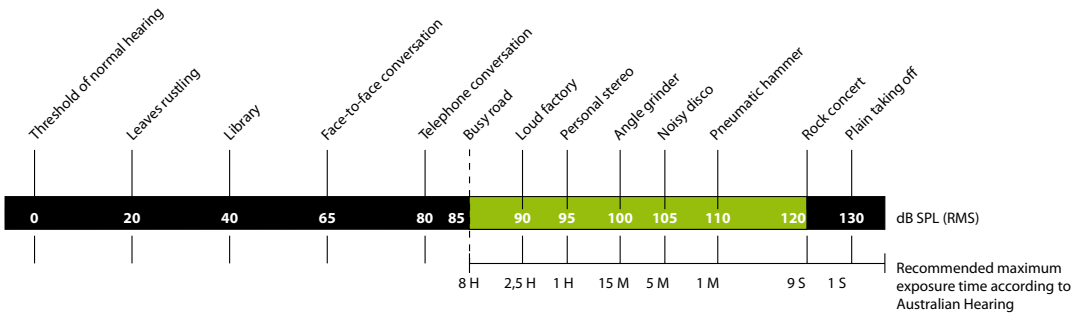
GN supplies solutions (headsets and amplifiers) that protect the hearing and well-being of the headset user. Our technologies unequivocally reduce the risk of the rare, but latent, occupational hazards that can be caused by exposure to too high levels of noise. GN is an active partner in the international standardization of acoustic safety in telecommunication equipment. Our participation helps to ensure that pertinent requirements serve and protect the users of headsets and correspond to recommendations agreed upon by health authorities and hearing experts. Hence, all GN products are compliant with - and often even surpass - the strictest regulations and standards in the world.

Why can sound levels be a problem to headset users?

For headset users in contact centres and offices who are on the phone for many hours every day, two potential hazards exist. One is the risk of sudden, very loud sounds due to e.g. a fault in the telephone network, which can lead to a so-called acoustic shock and potentially affect your hearing and well-being, if your headset does not have built-in protection. The other is quite different, as it is not related to sudden loud noises, but instead is concerned with the average noise levels throughout the day. A too high level of noise from machines – and even from high volume speech through headsets – can over time lead to inconveniences such as hearing fatigue and stress, jeopardizing employee productivity and commitment. Well designed headset equipment is paramount to avoid these hazards.

Figure 1 shows typical sound levels from familiar sources, including the recommended maximum exposure time.

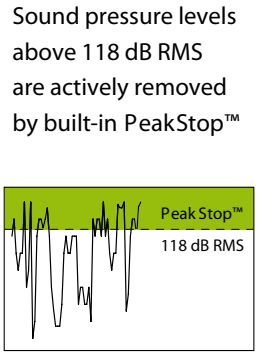
Figure 1:
Sound levels and exposure time



Peaks are actively removed

All Jabra Contact Center and Office (CC&O) headsets are fitted with PeakStop™, an electronic peak control gateway (transistor) that does not allow excessively loud sounds to pass to the ear. It reacts instantly and removes potentially harmful sound spikes before they reach the headset speaker. PeakStop™ actively protects the user by keeping the absolute sound level and the energy of the peak in the safe zone at all times. As a result, the headset user will never be exposed to the full effect of the peak and consequently the risk of harming the sensitive mechanisms of the ear is minimized. The figure 2 illustrates how PeakStop™ continuously monitors the sound flow from the telephone to the headset speaker and actively reduces critical sound peaks to a safe level.

Figure 2:
PeakStop™ protection

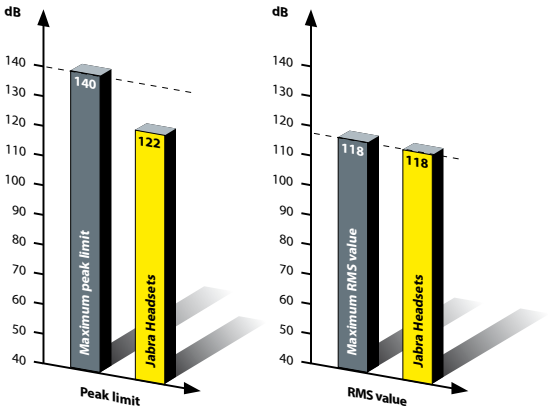


Meeting global standards

Legal requirements from national authorities and recommendations from telecommunications specialists and health authorities are met by all Jabra CC&O headsets. Our experienced acoustic experts are selected to be active participants in the acoustic safety specification work in international standardization organization such as International Telecommunication Standardization Sector (ITU-T) and European Telecommunications Standards Institute (ETSI).

When focusing on protection against extremely high sound levels, the two most important measurements are 'Maximum absolute peak value' and 'RMS value' see definition on page 5. The figures below show that GN complies with and even exceeds the global requirements for sound level exposure:

Figure 3:
Headset protection – Peak and RMS levels



Peak limit

Leading EU and US authorities agree that 140 dB should be the maximum absolute peak level for loud sound exposure. GN headsets are comfortably below that with PeakStop™ built-in active peak control gateway setting the maximum absolute peak level to a maximum of 122 dB.

RMS value

Root Mean Square – the effective energy in the sound waves. Leading EU and US authorities agree that 118 dB (RMS value) should be the maximum level for total sound exposure from a peak. All Jabra headsets meet this limit thanks to the PeakStop™ from built-in active peak control gateway.

GN8210

Jabra GN8210 offers superior safety

Although protecting hearing, analog peak control does not offer a sophisticated reduction of noise levels as it is unable to distinguish frequencies and offer a more robust reduction of piercing, high-frequency tones. Only digital technologies render these benefits and advanced features such as reduction of incoming background noise from outdoor environments and mobile phone calls. When exposed to this type of noise throughout an extended period of time, it can result in hearing fatigue and stress symptoms.

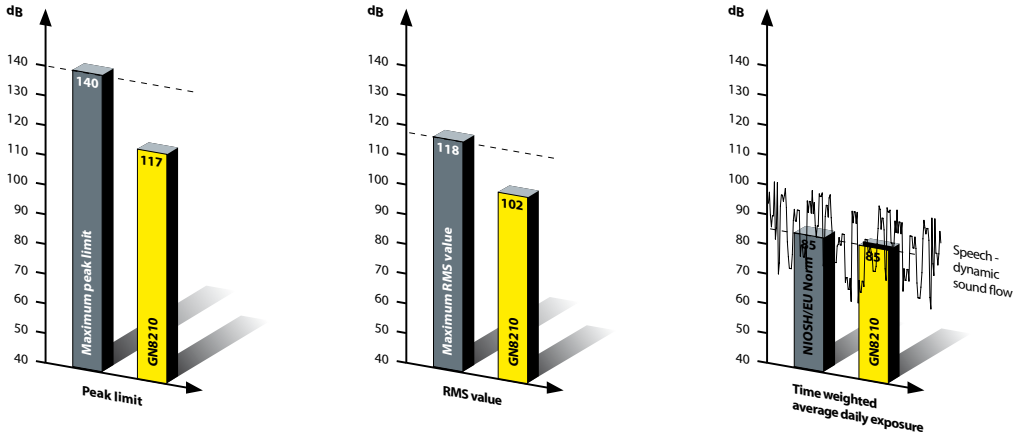
The completely digital GN8210 utilizes Digital Signal Processing (DSP) technology to enhance the incoming signal and to reduce background noise, thus improving the 'voice/noise' balance radically. GN8210 is equipped with inbound noise suppression, automatic volume control and personal customizing features giving the user the best individual sound quality with the highest degrees of protection against long-time noise exposure and acoustic shocks.

Loudness and exposure time
For headset users the effects of noise exposure depend on two major factors:

Factor A:
How loud is the noise
Occasionally, sudden loud noises occur as sound peaks in a telephone conversation. The most common peaks are malfunctions within the telephone or network. As these extreme noises are unexpected they are often referred to as 'acoustic shocks' which are uncomfortable and potentially harmful. Normally, you would instantly distance the handset from your ear in order to physically remove the sound, but when you are wearing a headset the reaction time is prolonged. It takes somewhat longer to remove a headset, and by then a harmful sound level may have reached your ear, if your headset does not have PeakStop™ or an equivalent active protection against peaks.

Factor B:
For how long are you exposed to noise
Noise does not have to be extremely loud or unexpected to affect your well being or hearing. Lower sounds, such as background sounds from office environments or even from regular telephone conversation can also be harmful if the exposure time is too long. This type of noise is measured over a period of time, often an 8-hour workday and it is the average exposure that considered hazardous. According to US recommendations and the latest EU regulation on occupational noise exposure, it is recommended to keep average noise exposure below a time-weighted level of 85 dB(A) over an 8-hour workday. These recommendations cover all workplaces, including headset users. Most headset users are well below this level, but as comprehensive studies show that the main over part of noise exposure comes through the headset, it becomes increasingly important for employers in telephone intensive industries to take a proactive approach and ensure optimal conditions for employees.
When the 'voice/noise' balance is improved and volume is controlled automatically, you can decrease the general sound level and hence reduce the total long-term average noise exposure significantly (see page 1 for a definition).

Figure 4:
GN8210 Amplifier



Exceeding global standards

The GN8120 is designed to reduce noise to meet the US and EU recommended level of 85 dB(A) time-weighted average exposure, and the digital intelligence of the GN8210 also offers advanced protection against peaks and acoustic shocks exceeding the legal requirements quite substantially.

A second-to-none feature offered by the GN8210 is its ability to decrease the more disturbing high-frequency sounds more than the low-frequency sounds. The sharp sound of a whistle affects your hearing and well-being more than the soft sound of a drum (even though the dB level is the same), hence the GN8210 protects the headset user by offering frequency-dependant reduction of the RMS sound pressure level. The more high-pitched the sound is, the more it is decreased in accordance with the ACIF Guideline G616:2004, developed by leading Australian authorities (please see page 6).

Figure 4 shows that GN8210 far surpass the most important global standards for peak exposure and fully match the toughest regulations on average noise exposure:

Peak limit

Leading EU and US authorities agree that 140 dB is the maximum absolute peak level for loud sound exposure. The GN8210's protection is comfortably below that limit with a maximum absolute peak level exposure of 117 dB.

RMS value

Root Mean Square – the effective energy in the sound waves. Leading EU and US authorities agree that 118 dB (RMS value) should be the maximum level for total sound exposure in a peak. Thanks to digital intelligence, the GN8210 is able to meet both the 118 dB limit and the very tough Australian draft standard, ACIF (see page 6).

Time weighted average exposure

Leading EU and US authorities agree that the time-weighted average exposure limit for a working day should not exceed 85 dB(A). The GN8210 meets this demanding requirement.

Detailed information about the GN8210 can be found at www.jabra.com. For more sound safety solutions also see GN1220 and GN9350.

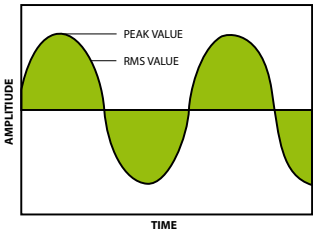
Acoustic Definitions and Standards

In theory, noise exposure for telephone users is defined as the sum of background noise + sound signals received via the phone. In practice, the background noise in contact centers does not contribute significantly to total exposure, and exposure for headset users equals the output from the headset. However, it must be recognized that background noise can make a contact center agent turn up the volume in order to counteract the background noise. Therefore, attention should be paid to the general sound level in the office or contact center environment. Sound levels are measured in dB SPL, and when evaluating the effects of noise exposure, 3 different measurements are typically performed, as defined below. Peak value and RMS value are often used when discussing sudden, loud sound levels, whereas timeweighted average is applied for long term noise exposures.

Noise exposure: dB SPL or Sound Pressure Level

Sound pressure levels are measured in decibel - dB SPL. The level of reference for sound pressure level is the threshold of hearing for a 1kHZ tone, equal to 0 dB SPL. The decibel scale is logarithmic, meaning that an increase of 6 dB actually equals twice the sound pressure. This is why the maximum recommended exposure time to a noise decreases rapidly across the dB scale: e.g. for 85 dB SPL the recommended maximum exposure time is 8 hours per day, whereas for 90 dB SPL the same value is 2.5 hour. See figure 1 on page 1 for an impression of the importance of exposure time in relation to the harmful effects of noise.

Figure 5:
Peak and RMS value



Absolute peak value
The absolute peak value is the maximum value of a sound that can be transmitted to the receiver. Internationally, 140 dB is accepted as the agreed limit for absolute peak value that the ear should be exposed to. Conforming to a maximum of 122 dB absolute peak value, all Jabra headsets are significantly below this limit. The GN8210 takes protection further to a maximum of 117 dB.

RMS value
In most cases it is more relevant to look at the RMS value (Root Mean Square) of the exposure, as this is the actual energy within the signal. When the focus is excessively loud sounds, RMS value is often used instead of peak value, where the energy of the sound waves are measured instead of their peak values. For headsets, the proposed international level for maximum RMS values is 118 dB, which all Jabra headsets meet. The GN8210 takes protection further at a maximum RMS value of 102 dB.

Time weighted average exposure
Exposure to relatively low noises can also affect your hearing, if the exposure time is long enough. It is important to differentiate between the instantaneous peak levels and the long-term effect of the time weighted average exposure. The latter is evaluated over an extended period of time, often an 8-hour workday, and is measured in dB(A), which takes the frequency sensitivity in the human ear into account. The term average is important. A worker can be exposed to an average of 90 dB(A) for 1 hour every day with peak levels at 100 dB without any problems, if he/she, for the remaining part of the day sits in an office with an average noise level of e.g. 75dB(A).

Table 1:
ACIF Acoustic shock protection

Frequency (Hz)	Maximum RMS dB(A) SPL at DRP (Drum Reference Point)	Maximum RMS dB(A) SPL at ERP (Ear Reference Point)
410	102	102
516	102	101
649	102	101
818	102	101
972	102	101
1090	102	100
1223	102	100
1372	102	99
1540	102	98
1728	102	97
1939	102	96
2175	102	94
2441	102	93

Noise exposure regulations and standards

In the US, the recommended time-weighted average exposure limit for an 8-hour workday is 85 dB(A). This corresponds to the upper action value in the newest EU regulation, which became mandatory in all EU member states February 2006. This regulation covers all workplaces, also contact centers where the main part of the noise exposure is through the headset.

According to the EU regulation, the maximum exposure value is 87 dB(A), which must never be exceeded. If the upper exposure value of 85 dB(A) is exceeded, instant action must be taken. In a contact center, this could be done by providing a contact center agent with a headset amplifier designed to ensure a maximum average exposure of 85 dB(A), such as the GN8210 with their corded headset or the GN9350 wireless solution. Between 80 and 85 dB(A), it should be ensured that the average exposure does not exceed 85 dB(A). In a contact center, this could be done by providing a contact center agent with a headset amplifier designed to ensure maximum average exposure of 85 dB(A).

ACIF Guideline G616:2004

The AS/ACIF G616:2004 specifies a new guideline for telecommunications equipment for very strict protection against acoustic shock. According to the guideline, the maximum RMS sound pressure level of an acoustic protective device shall be less than the values specified in Table 1. This is assuming any receiver volume control is set to maximum when using the test methods described by the Australian Communication Industry Forum **www.acif.org.au**

The two columns in the table are the so-called DRP (Drum Reference Point) and ERP (Ear Reference Point) levels. The difference is due to the physical characteristics of the ear, which results in higher frequencies being perceived higher by the eardrum (DRP) than the actually measured value outside the ear (ERP). In order to live up the guideline, protective equipment must reduce the sound level depending on its frequencies – at the ERP level. This protects the eardrum (DRP) from levels above 102 dB RMS across all frequencies. Only a digital amplifier can provide this protection and only if it is designed according to the ACIF Guideline, as is the GN8210.

Sound is money

People react differently to noise. But research in psychoacoustics and occupational use of headsets in contact centers and offices unambiguously shows that noise exposure has a direct impact on productivity over the short and long term. Superior safety, optimized sound quality and comfortable headsets create economic value because employees will be less absent due to discomforts created by hearing fatigue and sound peak exposure. To the individual employee, a general experience of comfort and feeling safe increases motivation and commitment.
And an improved 'voice/noise' balance enables clearer calls. Sound is money and concise conversations. Jabra headsets from GN are based on in-depth understanding of sound and hearing and the working environments where our products are used. GN has more than 25 years of experience in analyzing and processing sounds, especially human speech, in a way so that desired sounds can be reproduced naturally and undesired sounds can be eliminated. This experience and know-how lie at the core of our headsets and amplifiers. Our know-how makes telephone communication a comfortable, and profitable as well as safe occupation for headset users all around the world.

Basic noise protection:
Jabra GN1220 with GN2000

Advanced noise protection:
Jabra GN8210 with GN2100

Wireless noise protection:
Jabra GN9350

1) In this document, dB is used as synonymous with dB SPL (sound pressure level).

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