

## SDS SERIES

### INTRODUCTION

# “Piezo Sound Technology, an endless world of possibilities”

**S**onitron **D**igital **S**quare refers to a technology that is driving a piezo cup membrane mounted in a cavity, with a square wave. The combination of drive frequency and the high quality response of the cup membrane adjusted to the best acoustic function of the cavity in which the cup membrane is mounted, offers an extremely high sound output.

The drive signal to the piezo is a square wave with a sufficient (Vpp) peak to peak voltage. Square wave pulses contain very rich harmonic content of energy.

The tuned square wave signal with rich harmonics is driving the piezo cup membrane, the acoustic function of the cavity combined with the piezo cup and the drive frequency is tuned until max. sound output for several harmonic frequencies. The character and pitch of the sound output wave can be adjusted to the desired acoustic signal.

Endless possibilities are revealed...

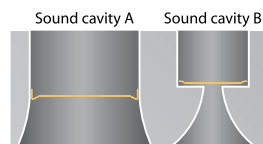
### Prototype model



A combination of 2 cup acoustic cavities, are used for making the car horn sound.

According to directive 70/388/ECC of the European Commission, an audible warning device for motor vehicles must produce a total SPL of min 105 dB(A) and max 118 dB(A) at a distance of 2m.

The spectrum of the sound emitted by the device, measured at a distance of 2m, must show a sound pressure higher than that of any frequency component above 3550Hz in the 1800 to 3550Hz frequency band, and in no case less than 105 dB(A).



**Cup A** delivers the body of the sound. It is a mixed combination of low frequencies with a loud sound pressure level, tuned on the human ear to warn for a situation with a non aggressive touch.

**Cup B** delivers the high sound component of min 105 dB(A) with a frequency between 1800Hz and 3550Hz.

Basic terms: see "Considerations about sound" in addendum

### Piezo acoustic system Cup A

To design a useful housing for a car horn, an acoustic system that amplifies a few low frequencies to a high amplitude will give a typical warm warning sound.

The red line in figure one shows the pink noise response\* of a high quality piezo cup system that results in a first peak around 400Hz. A square wave is analysed (figure 2) and tuned on the amplification peaks of the piezo vibrating system.

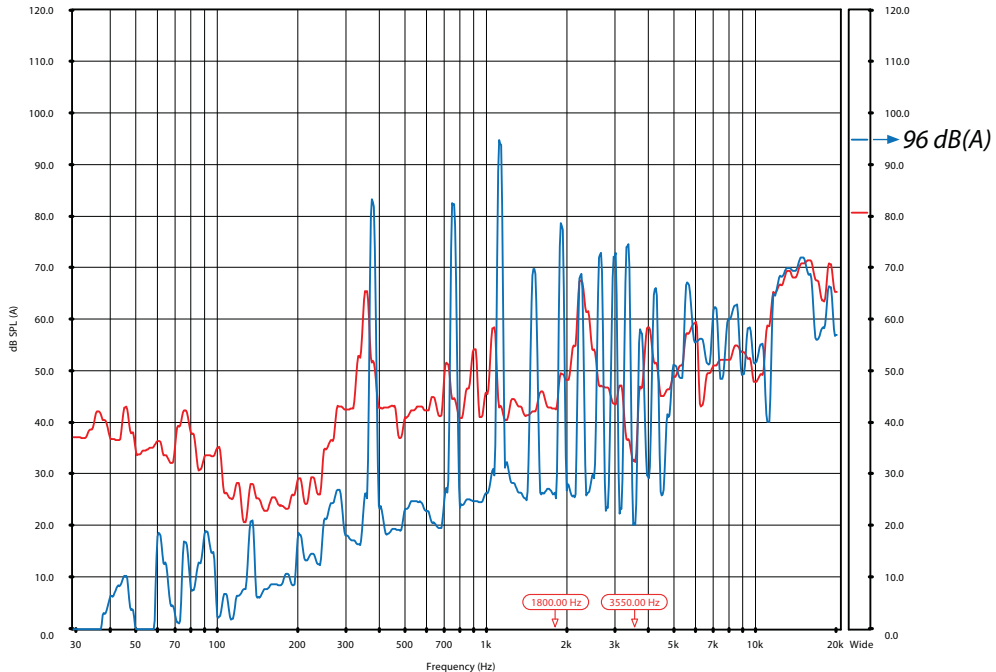


Figure 1: pink noise graph (red) and total SPL (blue)

The total sound pressure level is shown in the right table of figure one (blue line) and reaches 96dB(A) at 2m. The character of the sound is mainly formed by three sine waves at 374Hz (f), 748Hz (2f) and 1122Hz (3f).

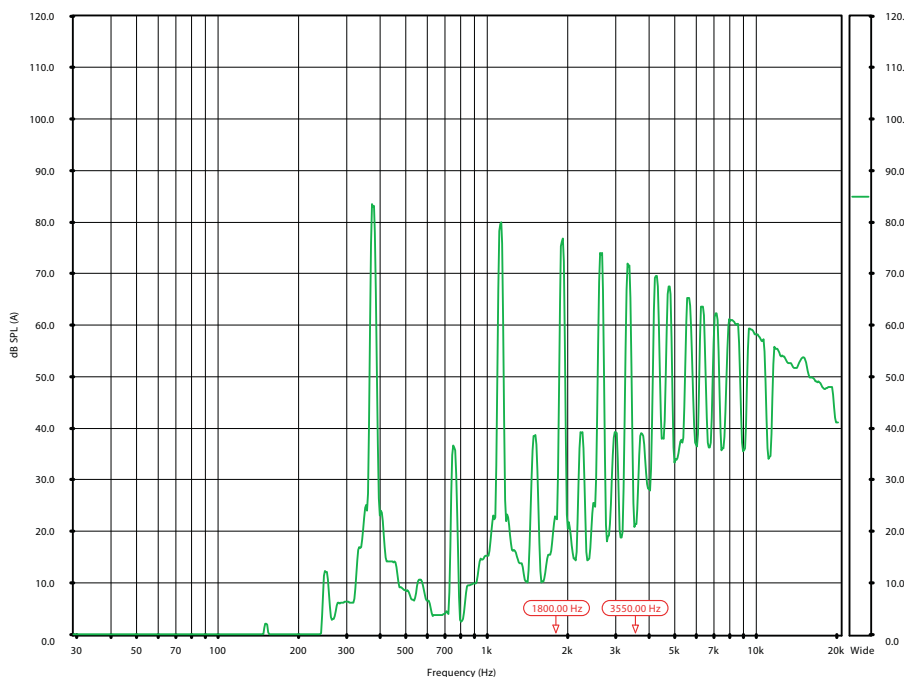


Figure 2: Fourier analyse square wave 374 Hz

\*definitions see sound considerations in addendum

### Piezo acoustic system cup B

To reach the description of the European Commission the highest peak has to be a frequency between 1800 Hz and 3550 Hz with a minimum level of 105 dB(A) at 2m.

For this challenge we use a high quality cup vibrating system with an amplification peak in the region 2000Hz to 3000Hz. The red line in figure 3 defines the pink noise graph.

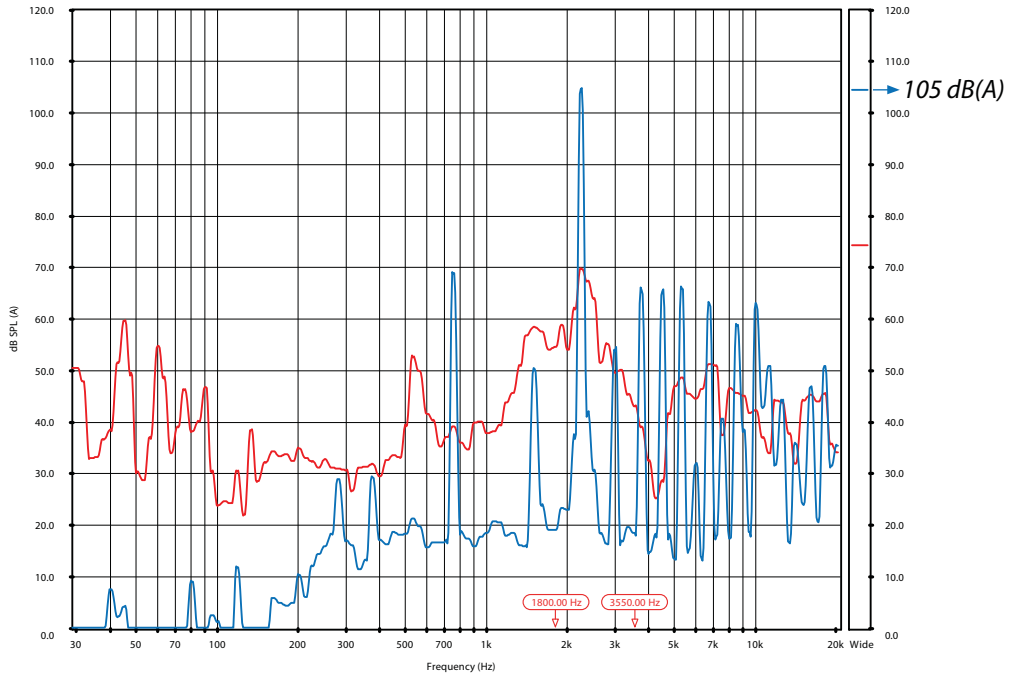


Figure 3: pink noise graph (red) and total SPL (blue)

The blue line in figure 3 shows the total sound pressure with a total SPL of max. 105dB(A) at 2m with the highest peak at 2260Hz (3f).

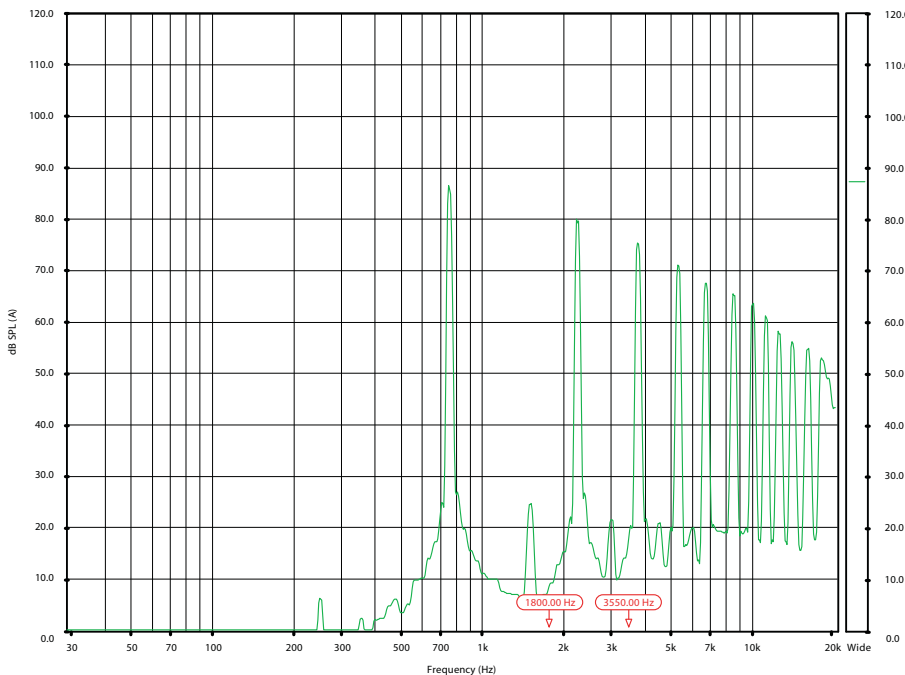


Figure 4 : Fourier analyse square wave 754 Hz

A square wave signal of 754 Hz (figure 4) is analyzed with the third harmonic tuned on the peak response of the acoustic chamber.

The digital pulse drive signal rich in harmonics is adjusted in frequency, until the drive signal harmonic's are synchronized with the acoustic cavity max. sound peaks.

The combination of both systems enables the creation of an endless number of sound signals or different alarm applications such as vehicle industry, sirens, security warning in acces and door controls, red light stop warning, ultrasound detection process, optical sensor detection, etc...

**A typical car horn adjusted with two piezo systems as described above is consuming only 20% of a traditional magnetic car horn, adjusted to a specific acoustic sound signal with a specific complex low frequency content.**

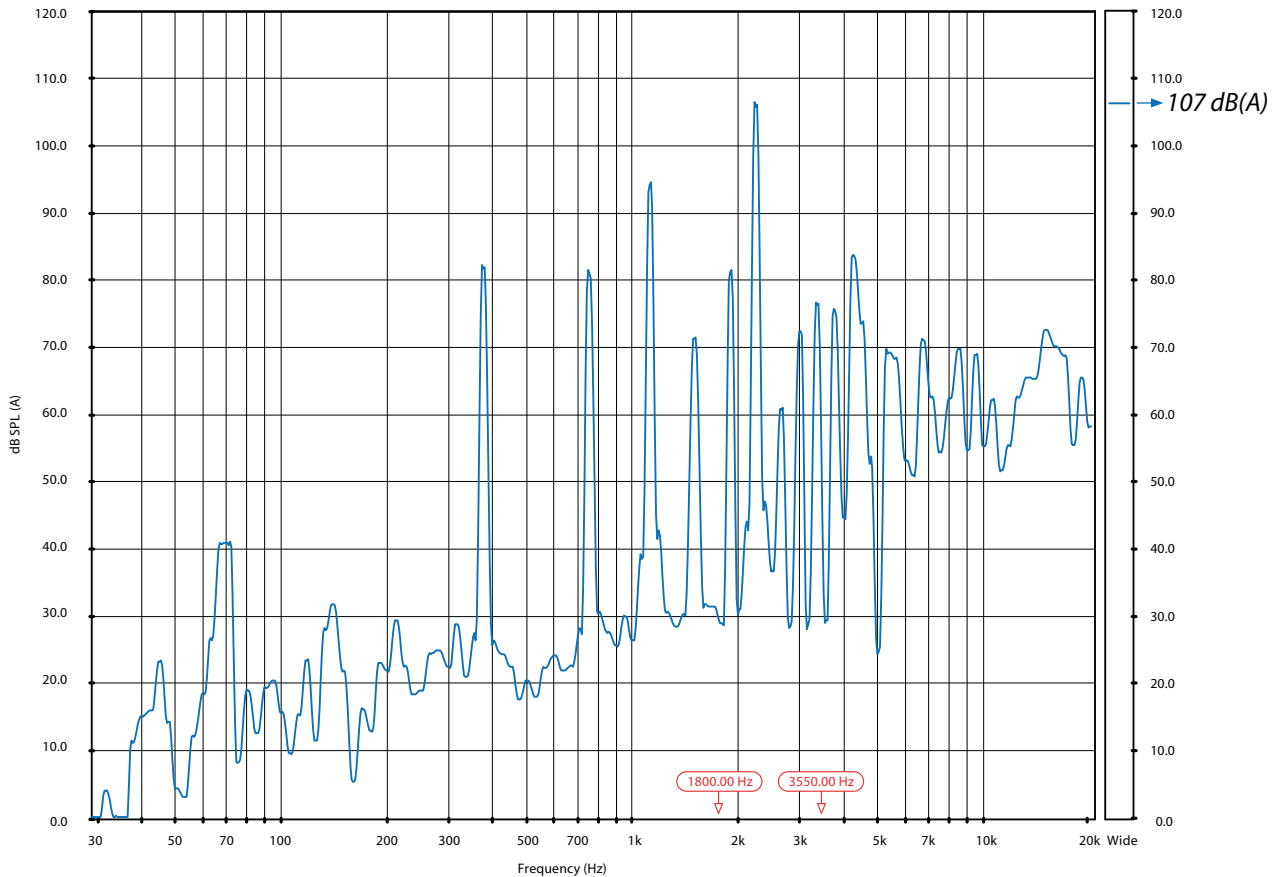
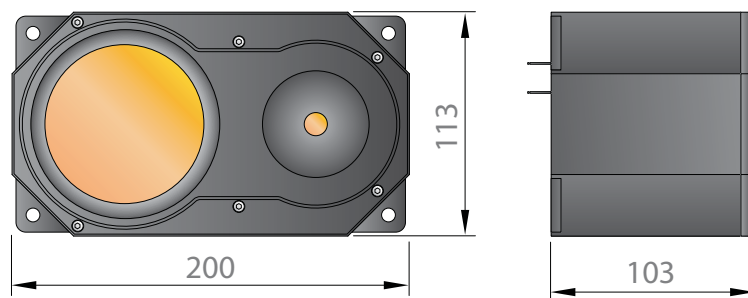


Fig 5: Frequency response and total SPL of the car horn prototype model at 2m.

### DIMENSIONS (car horn prototype model)



**Specific acoustic systems and electric drive circuits can be designed and developed by SONITRON on demand of the customer.**

**Mail to [support@sonitron.be](mailto:support@sonitron.be) for more information and models on request**