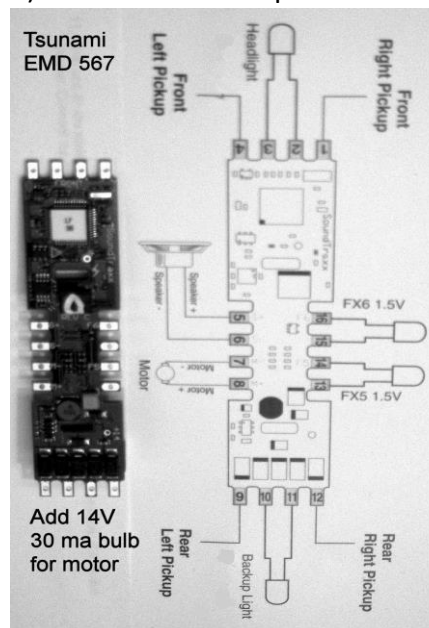


Measure your diesel horn

By Robert Frey

1) Add a bulb and speaker.



2) Set the Sound Meter.



Turn on the **Low** Range.

A switch= On

Max.= Off

S switch= On

Sound meter on a stool at 4 feet from speaker.

3) Add Vrms and Vp-p wires to the speaker terminals.



The 14V 30 ma bulb indicates a motor voltage. (There is no motor noise with a bulb load.) You need the motor, if you want to read the CV numbers on the program track. How to measure Vp-p is on the back.

Tsunami by Soundtrax EMD 567

CV128	dB@4'	Vp-p
Idle	52	2.40
192	69	4.45
228	70	5.05
254	72	5.30
H+Run	73	5.55
Vr/Vp	41%	47%
CV128	Vrms	Watts
Idle	0.54	0.04
192	0.91	0.11
228	1.05	0.14
254	1.16	0.15
H+Run	1.31	0.21



Digitrax SFX006 Soundbug Diesel Horn 4 Ohms

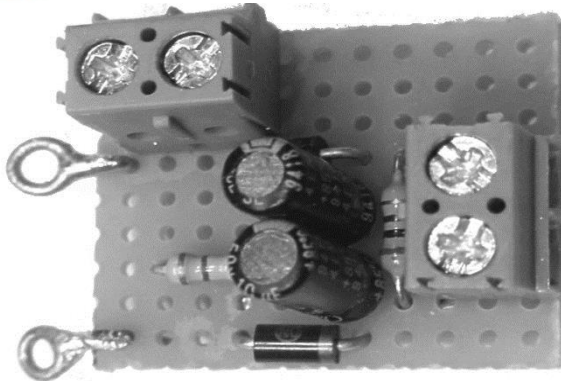
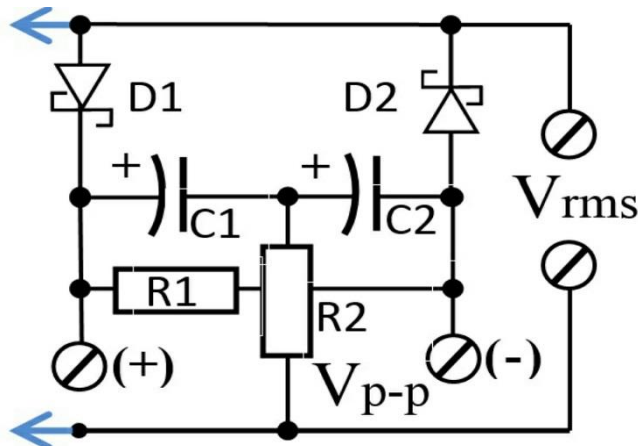
CV58	dB@4'	Vp-p
Idle	46	0.60
9	67	3.45
12	70	4.50
15	72	4.60
H+Run	72	4.65
Vr/Vp	50%	68%
CV58	Vrms	Watts
Idle	0.27	0.02
9	0.86	0.19
12	1.21	0.37
15	1.44	0.52
H+Run	1.56	0.61



The factory default for Master Volume CV128 is 192. Horn is **69 dB@4'** **Vp**= 2.22 Volts, then $0.91 / 2.22 = 0.41$ and $0.91 \times 0.91 / 8 = 0.11$ W

The factory default for Master Volume CV58 is 9. Horn is **67 dB@4'** **Vp**= 1.72 Volts, then $0.86 / 1.72 = 0.50$ and $0.86 \times 0.86 / 4 = 0.19$ W

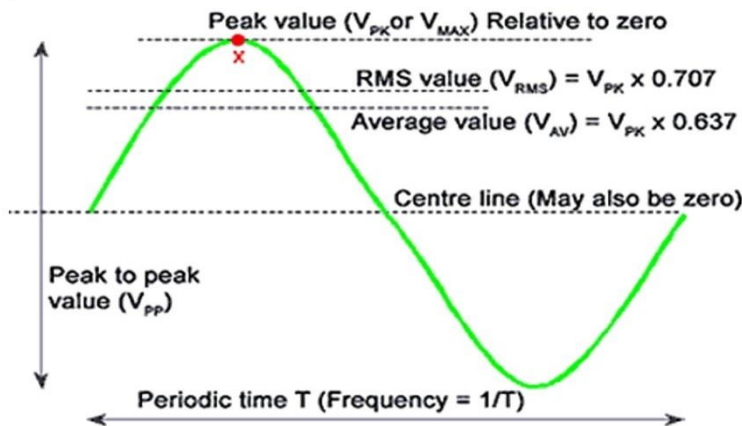
Measure Voltage Peak to Peak



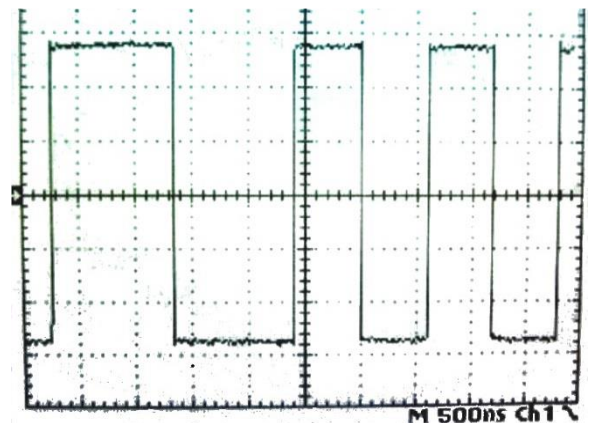
Part No.	Description	http://www.digikey.com/
MBR160GOS-ND	D1, D2	
	DIODE SCHOTTKY 60V 1A AXIAL	
P10316-ND	C1, C2	
	CAP ALUM 10UF 50V 20% RADIAL	
CF14JT1M00CT-ND	R1	
	RES 1M OHM 1/4W 5% CARBON FILM	
CF14JT220RCT-ND	R2	
	RES 220 OHM 1/4W 5% CARBON FILM	
277-1667-ND	Vp-p and Vrms	
	TERM BLOCK PCB 2POS 5.0MM GREEN	
340K-ND		
	BREADBOARD 1/16"DIA 2.00X4.50"	

A Schottky diode has a low forward voltage drop and a fast switching action.

In this Vp-p circuit, **D1** charges **C1** to the +Peak and **D2** charges **C2** on the negative part of any AC wave. The charge on **C1** & **C2** is the total Vp-p DC reading. Then **R1** makes for a very slow discharge of **C1** & **C2**.



DCC Track Voltage: 14.4 Vrms, 28.8 Vp-p



That 1 Vrms sinewave has a peak voltage of 1.414 V, and a peak-to-peak voltage of 2.828 V

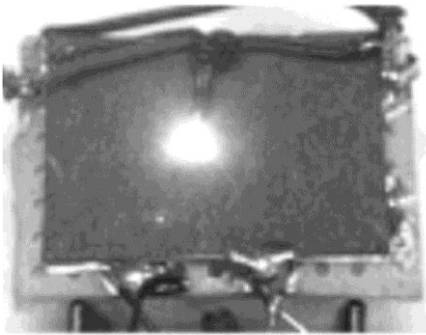
Vrms	Vp-p	Diodes	2.828 x Vrms
24.0	67.1	0.80	67.9
12.0	33.3	0.60	33.9
6.0	16.4	0.50	16.9
3.0	8.04	0.40	8.48
1.50	3.90	0.35	4.25
0.80	1.96	0.30	2.26
0.40	0.88	0.25	1.13

1.0 Vrms sinewave or square wave applied across a 1.0 Ω resistor produces 1.0 Watt of heat.

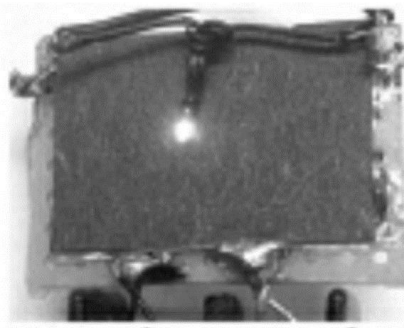
The DCC Track Voltage measures 28.2 Volts DC peak to peak with the Vp-p voltage tester. Add 0.6 for the diodes drop and this is 28.8 Vp-p. Divide by 2 and you get 14.4 Volts true rms, for a square wave! 2 of 8

1Watts is 2.82 Vrms on an 8 Ohm speaker

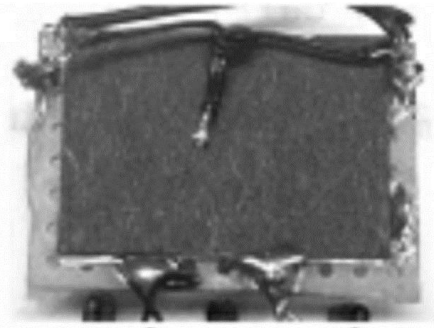
A 1.5 Vdc bulb has the same amount of heat and light as with a 1.5 Vrms AC sine wave.



3.8 Vdc at 24 Ma dc



2.8 Vdc at 21 Ma dc



1.5 Vdc at 15 Ma dc



**Measure a
0.5 to 3.0 Vrms
Horn Wave**

[http://www.digikey.com/
160-1030-ND](http://www.digikey.com/160-1030-ND) Photo
Transistor NPN 3mm
IR Dark (940 NM)

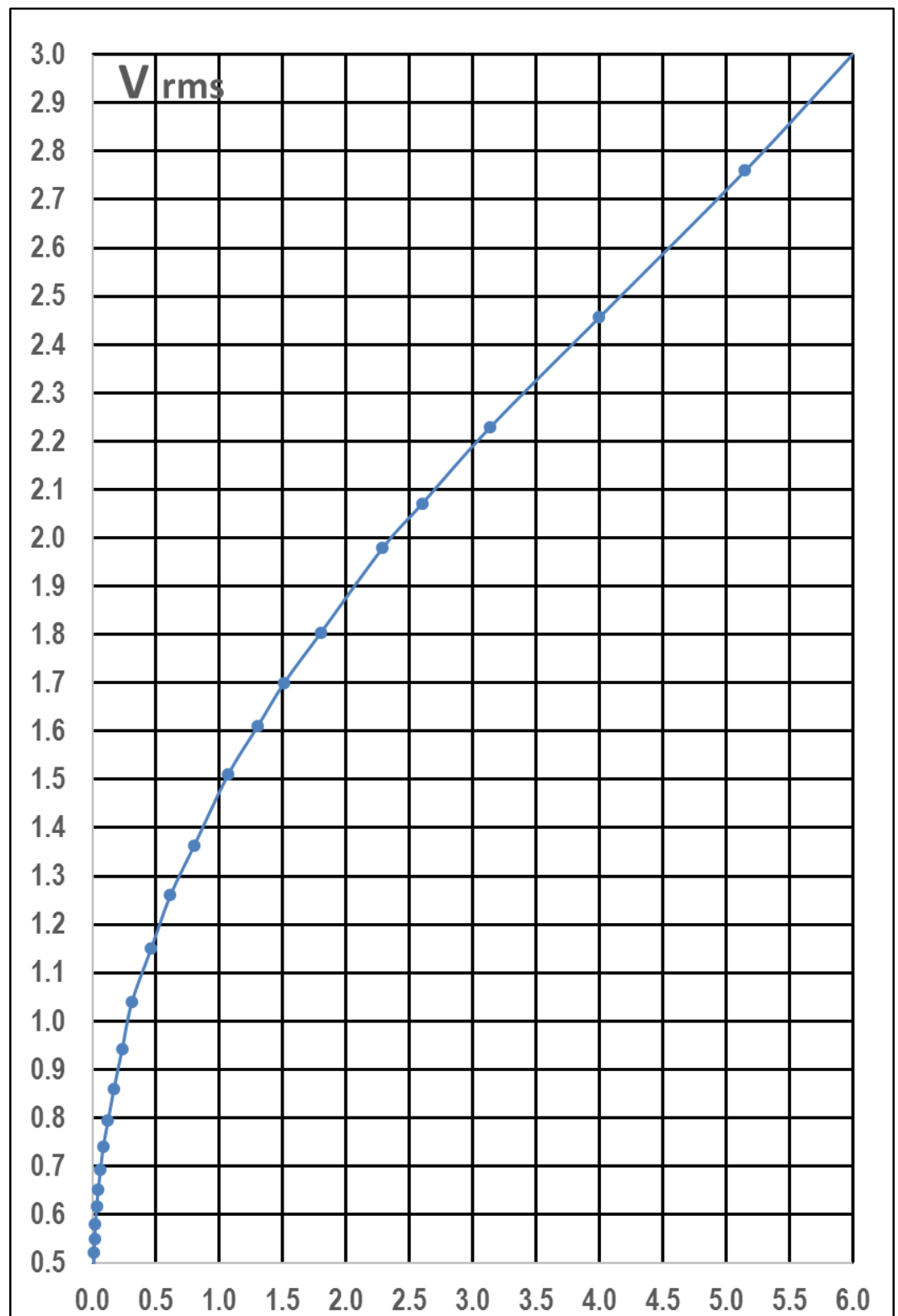
330 Ohms Resistor
with a 20 Ma. DC
Amp meter with a
True 9.6 Volt
Rechargeable
Battery.

A1 **B1** The **IR** ma and **Vdc** data points are in **Bold**.

A2 **B2** = **B3** + (A2- A3) / (A1 - A3) * (B1 - B3) = the estimate for **V_{rms}**

A3 **B3** Two "D" cell batteries and a 100 ohm pot makes for many data points.

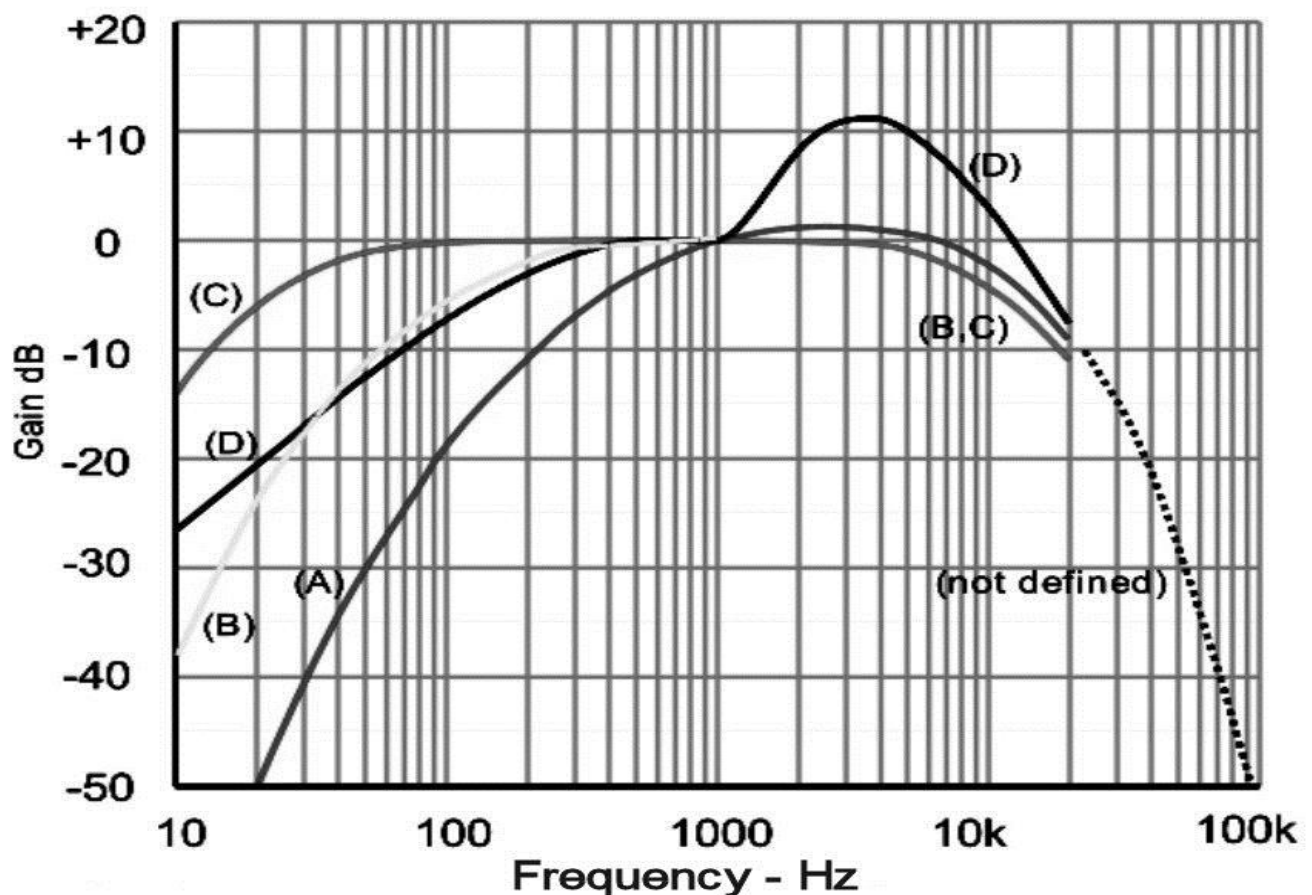
IR ma	Vdc
6.70	3.20
6.00	3.00
5.15	2.76
4.00	2.46
3.14	2.23
2.60	2.07
2.29	1.98
1.80	1.80
1.51	1.70
1.30	1.61
1.067	1.51
0.800	1.36
0.611	1.26
0.460	1.15
0.308	1.04
0.230	0.94
0.166	0.86
0.120	0.79
0.0811	0.74
0.0600	0.69
0.0407	0.65
0.0300	0.62
0.0188	0.58
0.0140	0.55
0.0092	0.52
0.0060	0.48
0.0031	0.44



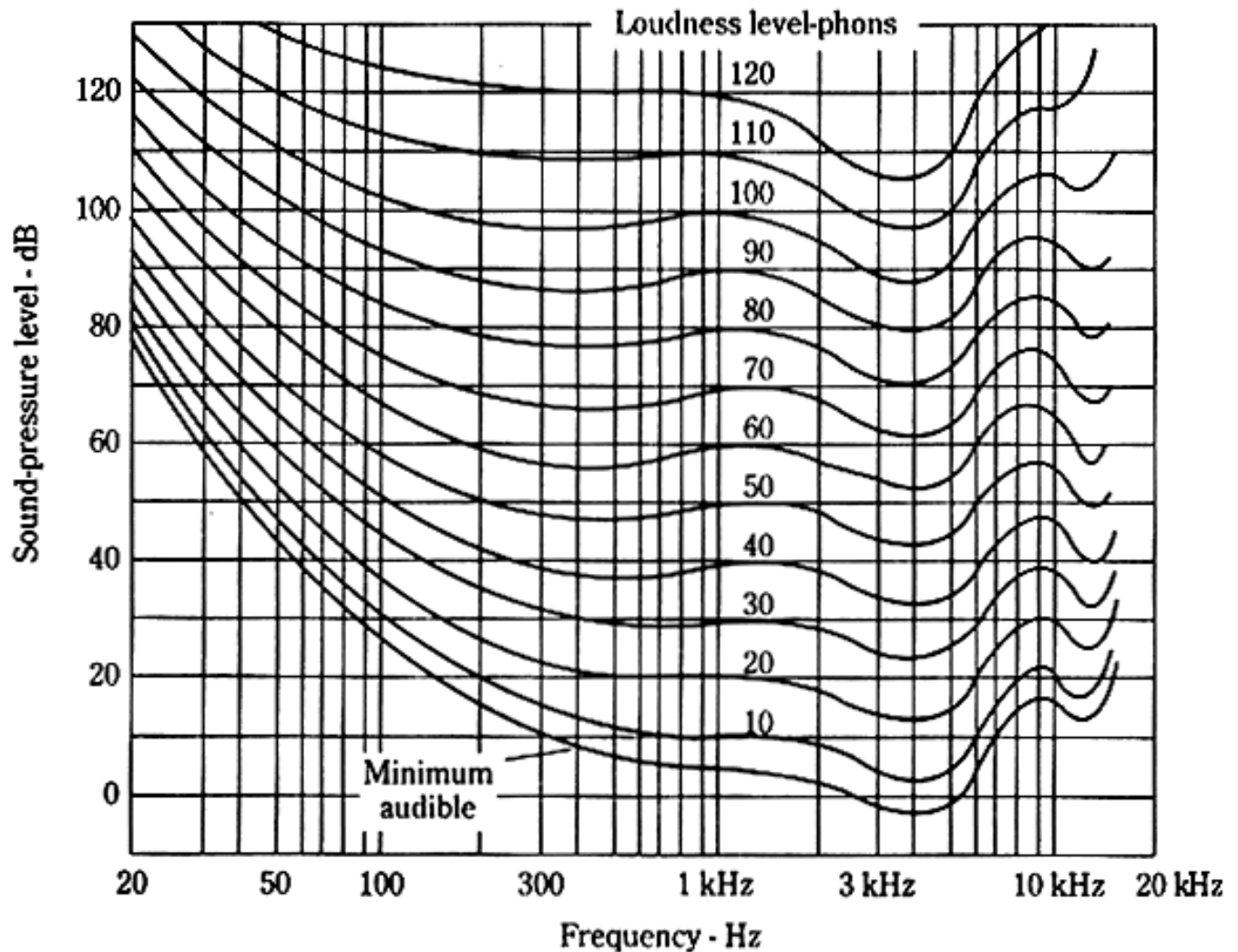
International Standard

https://en.wikipedia.org/wiki/Sound_level_meter

The IEC 61672-1:2013 mandates the inclusion of an “A”-frequency-weighting filter in all sound level meters. In almost all countries, the use of “A”-frequency-weighting is mandated to be used for the protection of workers. “C”-frequency-weighting is for music. (This is flat over a large frequency range.)



The first research on the topic Fletcher and Munson in 1933.



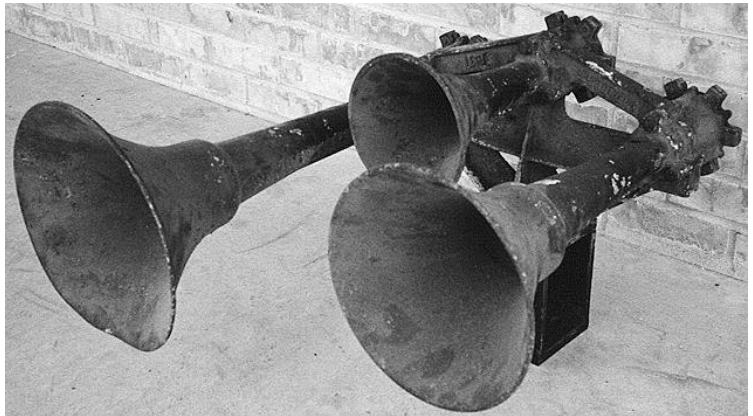
equal-loudness contour

An equal-loudness contour is a measure of sound pressure (dB SPL), over the frequency spectrum, for which a listener perceives a constant loudness when presented with pure steady tones. The “A-weighting scale” is now commonly used for the measurement of environmental noise, industrial noise and even our Diesel Horn.

3 Chime Diesel Horn

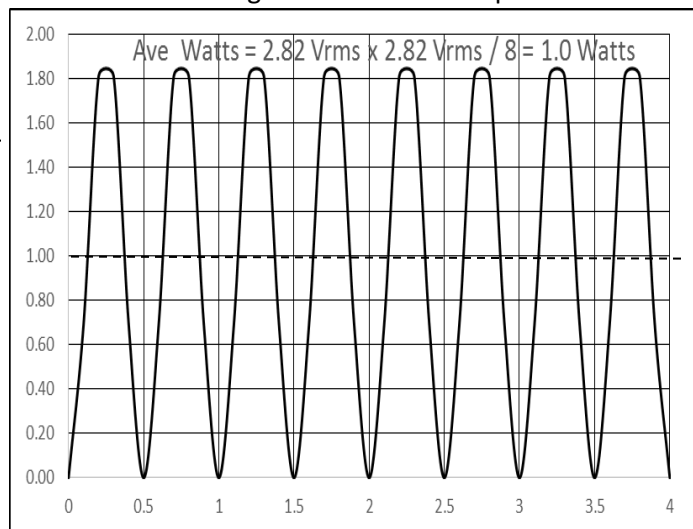
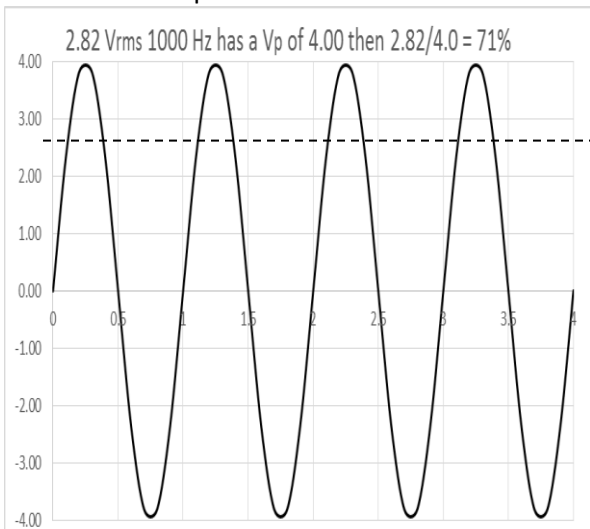
<http://atsf.railfan.net/airhorns>

The Prime Manufacturing Corp. of Oak Creek, WI produced a horn identical to the S-3L which they called the PM-920. Factory tuning for both was:
B inverted 7th (B, D#, A) or 493, 633, 880 Hz.

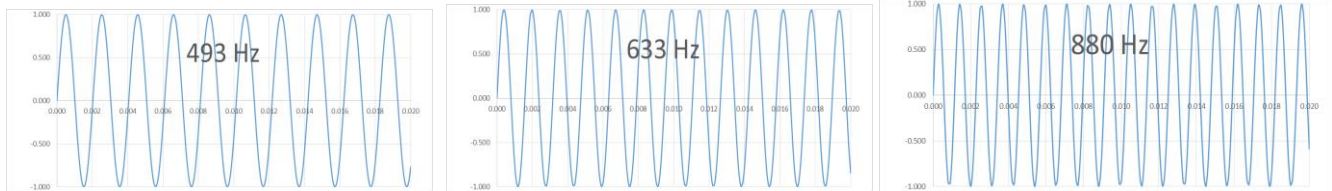


For the freight locomotive above, all three horns are in the same direction.
For a general purpose locomotive, the small one is reversed.

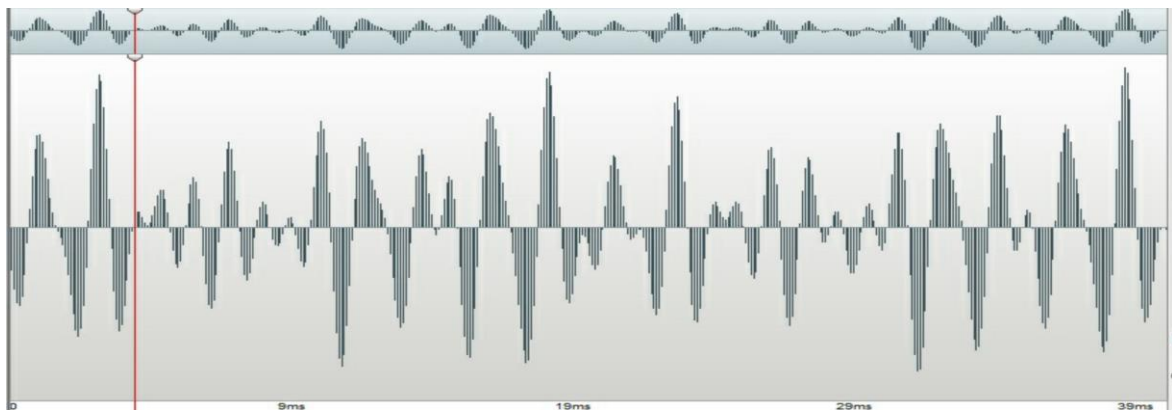
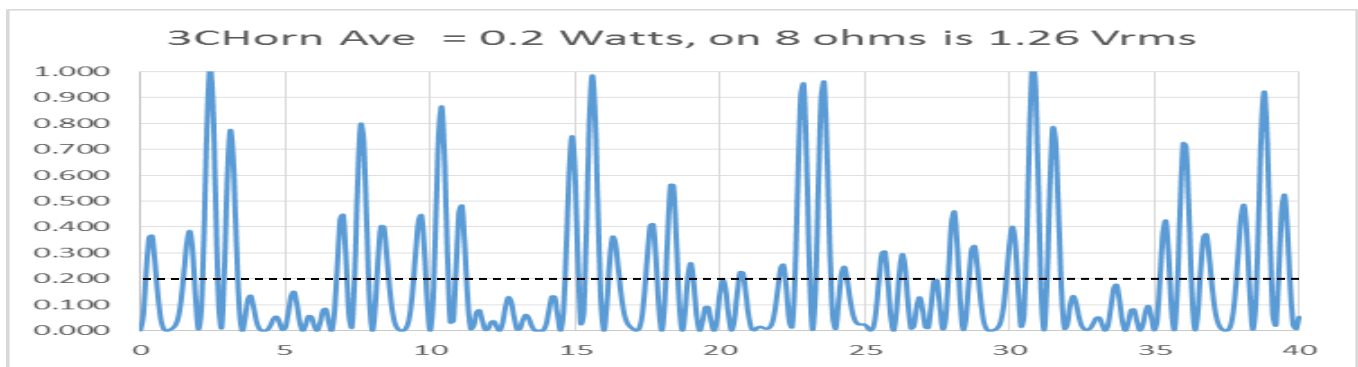
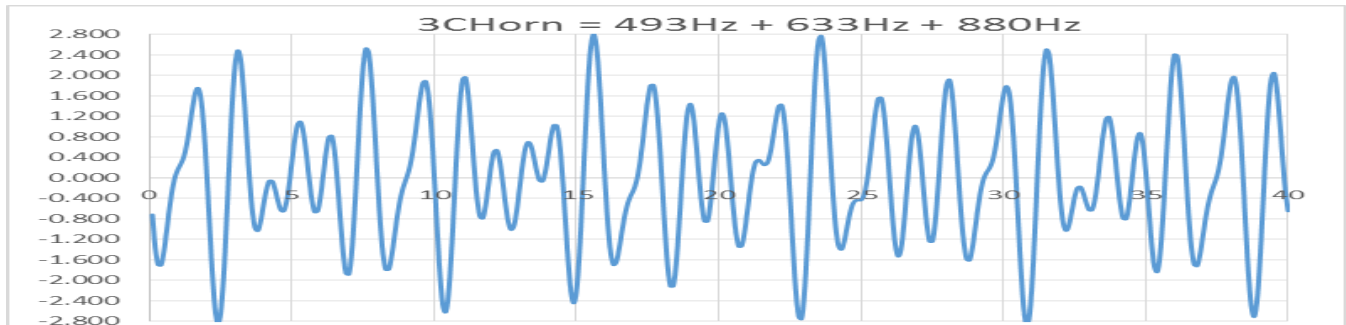
If the horn is replaced with a 2.82 Vrms 1000 Hz Sine wave. This voltage is on one 8 Ohm speaker.



For one 8 Ohm speaker, 2.82 Vrms at the terminals of the speaker is an average of 1.0 Watt of sound power from the amplifier.



Say each horn was 0.7 Vrms or 1.0 Vp, charts below: $V_p = 2.5 \text{ V}$, $V_{rms} = 1.26 \text{ V}$ then $1.26/2.5 = 50\%$



3 Chime Diesel Horn, 8 Bit Wave (Ratio V_{rms} to V_p for this PM-920 Horn wave = 50%)

Version 6.1 of SPJHelper, by Fred Miller is available at: <http://www.fnbcreations.net/spjhelper/index.html>
 Projects of SPJHelper and other articles, Fred Miller's web site: <http://www.fnbcreations.net/projects.htm>
 Document.pdf: <http://www.fnbcreations.net/Articles/All%20About%20Digitrax%20Sound%20Decoders.pdf>
 General Purpose Player: <http://www.fnbcreations.net/Articles/General%20Purpose%20Sound%20Player.pdf>
 Using Digitrax's SoundLoader and a PR3, you can change sound: <http://www.digitrax.com/sound-depot/>
 The old PR3 product has been replaced by the [SoundFX USB Decoder Programmer \(PR3XTRA\)](http://www.digitrax.com/sound-depot/soundloader/)
 Digitrax SoundLoader v2.0 and Utilities are at: <http://www.digitrax.com/sound-depot/soundloader/>
 Save a sound project (.spj) file with a new SPJHelper name. Now get any horn from another (.spj) files.
 PR3XTRA & JMRI: WiFi Throttles: <http://jmri.org/help/en/package/jmri/jmrit/witthrottle/UserInterface.shtml>