

# Getting Your Levels Right - PPMs, clipping and all that

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This article explains the correct audio levels for use within a (Hospital) Radio studio, how the PPM works, and the theory behind the practice.

The "meter of choice" for measuring audio levels is the PPM, or Peak Programme Meter. As you might guess from this name, it measures the peak level of the sound. Why the peak level? Well, when it comes to ensuring you don't overload the electronics in the mixer and all the other audio equipment between it and the ward or transmitter, the peak level is the most important. After all, it's the peaks of the signal that will get distorted ("clipped") first.

The PPM works by having a fast "attack" time, and a very slow "decay" time. This means that it reacts very quickly (almost instantaneously) to an increase in volume, but takes a long time to return to a lower reading. The meter therefore closely tracks the peaks of the sound. Some of you may be more familiar with the good old-fashioned VU (Volume Unit) meter. As you will be aware, the needle on VU meters is not damped like that of a PPM, it constantly moves around tracking the peaks and troughs of the sound level, making it very difficult to assess the real audio level.

In the UK, the PPM is usually a black meter with a white scale, marked between 1 and 7. Elsewhere in the world the meter is sometimes marked differently. There is a very simple conversion to get between PPM levels and "proper" levels in dBu. Line-up or reference level (0dBu) is PPM 4. Each division on the PPM scale represents 4dB, so the full conversion scale is:

PPM	dBu
1	-12
2	-8
3	-4
4	0
5	+4
6	+8
7	+12

Conversion  
between  
PPM  
markings  
and Audio  
Levels

PPMs are available in mono and two stereo forms. Mono meters usually have a white needle. Left/Right stereo meters have red (left) and green (right) needles. Also available, and usually used to monitor feeds to/from FM radio transmitters, are mono/stereo or sum/difference meters. These have white (mono or sum) and yellow (stereo or difference) needles. In this case the white needle shows the level of the mono (left + right) signal, and the yellow needle shows the stereo (left - right) signal. Both needles will be moving if the meter is being fed with a stereo signal, but only the white needle will be moving if the signal is mono.

Custom and practice in the broadcast audio industry (at least in the UK) says that you aim to have the

peak signal in normal broadcasts 8dB above the reference or line-up level (0dBu / PPM 4). This equates to PPM 6. The system can handle signals up to 12dB above reference (PPM 7), giving 4dBs of "head-room" just in case. Note that this does not mean that you can let your levels creep up to PPM 7, the meters aren't 100% accurate for sharp spikes, they may not be 100% correctly calibrated (even us engineers aren't perfect), and some piece of equipment may not be up to spec and start to clip early.

OK. So that's explained the magic number of PPM 6 and why the red lights fitted to many PPMs start to flash when you exceed that level. The next thing you have to understand is that you do not always set the levels to peak at PPM6. The actual audio peak level you should set depends on the type of audio! The following table is taken from an old Independent Broadcasting Authority guidelines document:

<b>Programme Type</b>	<b>Normal Peaks</b>	<b>Full Range</b>
<b>Speech</b>		
Talks, News, Drama, Documentaries, Discussions, Panel Games & Quiz Shows	5	3 - 6
<b>Music</b>		
Variety, Dance Music	4.5	2 - 6
Brass Bands, Military Bands	4	2 - 5
Orchestral Concerts	-	1 - 6
Light Music	5.5	2 - 6
"Pop" records (and any recorded programme) containing a high degree of compression	4	2 - 4
Record programmes, live "pop" shows, neither containing a high degree of compression	5	2 - 6
<b>Commercials/Jingles</b>		
Highly compressed	4	2 - 4
Slightly compressed	5	2 - 6

Peak Programme Levels at Station Output

Now why do you have to set pop music to peak at PPM 4, rather than PPM 6? Pay attention. Here's the science bit...

Your ear doesn't judge loudness on the peak level of the sound. Instead it uses the average, or mean, level. "So what?", you say. Well, consider the average pop music track. Do you notice much change in level? No. It's almost always at the same level. Now think about speech. There's lots of quiet gaps between words and syllables. This means that speech producing the same peak levels as the pop music will sound quiet relative to the music. So, to make them sound the same, we have to increase the peak level of the speech above that of the pop music. But, as we've described above, we can't have the peak level of anything going above PPM 6, so we turn the music down, and peak it at a lower level (such as PPM 4). Does that make sense?

*[Nigel Dallard](#), Chief Engineer, Winchester Hospital Radio*

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