

## Digital Sound

Is Digital Sound Beautiful? - It can be! – Or it can be absolutely awful!

First, consider sound as an elaborate photograph showing many details, contrast Levels and colours.

Now, like on a children's "Connect the Dots" cartoon, place say 50 dots on suitable intersects, connect the dots and you have a very rough picture, now try again placing 500 dots and connect these and you get a much better picture.

Sound, particularly Classical music is similar to a picture, containing many frequencies (details), sound levels (contrast levels), and subtleties in particular instruments and voices (colours).

Live (Non Amplified) Sound from acoustic instruments contains an enormous amount of subtle details such as different levels and blends of different frequencies (Infinite number of Dots).

The majority of these details are retained in High Quality Analog Sound Recordings, which effectively provides a very large number of "Dots".

Digital Sound, or rather Digitized Analog Audio, whether live or recorded is made up from a finite number of "Dots" with the audio quality determined by the quantity of "Dots".

Nobody can actually hear Digital Sound, the sound you hear from your Speakers or Headphones, is Analog Audio converted to Digital Data, and then converted back from Digital Data to Analog Audio.

The "Dots" referred to represents individual Digitized Analog Audio Levels.

Compact Disk is a Benchmark for Audio Quality with a well-recorded CD capable of producing truly Beautiful Sound Quality.

Compact Disk use 16 Bit Sampling and a sampling rate of 44.1 KHz, effectively painting 44,100 pictures per second with each made up from 65,536 "Dots".

This is not considered good enough by some of the more serious Recording Studios who for Original Master Recording use 24 Bit Sampling and a sampling rate of 96 KHz, or 96,000 pictures per second each made up from 16,777,216 "Dots".

This gives the Recording Studio true "High Definition Digitized Audio" as required for the editing, multitrack mixdown and final Mastering Process.

Digitized Audio recordings of the above quality are not normally released for sale, but converted to the standard 16 Bit 44.1 KHz CD Format and marketed as Compact Disks to the general public.

On the other end of the scale are Mobile Phones, VOIP Voice over Internet Phones, Basic Hand Held Note Takers for Dictation etc, most of which use very low Bit and Sampling rates giving barely acceptable speech quality and certainly not "Beautiful Digital Sound".

All of the Hand Held MP3 Players available on the market use Digital Audio Compression with some particularly "Brand Named" units are quite good, while others are absolutely terrible.

For convenience of playing recorded material To-Air the majority of Radio Broadcast Stations create a Music and "Spot" Library by transferring Audio Data from CD's and other sources to Computer Based, Digital Audio Delivery Systems.

Some quality conscious Radio Stations, particularly Government and Leading Commercial store Audio Data in the CD format and suffer no loss of quality, but does require High Performance Computer Systems, and banks of High Capacity Hard Disk Drives for this.

For economy, many small Commercial and most Community Radio Stations use Audio Compression to reduce the amount of Hard Disk Drives required.

There is a bewildering number of different Digital Audio Compression formats available for Music storage in Broadcast applications to choose from and unfortunately most formats are non compatible.

A few Examples of Digital Audio Compression formats suitable for Music are Musicam, AD-PCM, MPEG-1 Layer 1 2 and 3, MPEG-1 Layer 3 is also known as MP3, then there is the more professional MPEG-2, and the up and coming AAC reputed to be better than any of the above, very confusing.

There are many more Speech Compression formats in use in non-Broadcast applications such as Telephony and Voice Recording and on the Internet, I won't even attempt to list these here.

All are of the "Lossy Type" and work on the principle of "Throwing Away" fine details and subtleties on the assumption that these are masked by louder sounds and won't be missed.

MP3 is inexpensive, it will run on ordinary PC's and Sound Cards and the one most commonly used by Community Radio Broadcasters.

MP3 is quite satisfactory for FM Broadcasting at Bit Rates of 160 K Bit's per Second or higher provided the Audio Files are "First Generation" carefully generated or ripped from original Wave Files, we recommend the excellent "Alto MP3" Ripper, and preferably normalized for levels using "MP3 Gain" available free from the internet.

MP3, may be copied as Data Files without any quality loss, however Decoding MP3 files to Analog, and then Encoding them again from Analog back to MP3 or other format does cause a serious Audio Quality Loss.

After all, you have already thrown the subtleties away during the first Encoding, something else will have to be thrown away during the second encoding, and that usually causes audible artifacts resulting in "Not So Beautiful Digital Sound".

Multiple or Cascaded Audio Encoding and Decoding are necessary steps in Digital Audio Broadcasting and does affect Audio Quality very badly and will be discussed in a future article on Digital Audio Broadcasting.

As mentioned earlier, MPEG-1 Layer 3 (MP3) at bit rates of 160 K Bit Sec or higher is OK for FM Stereo Broadcasting but highly unlikely to be satisfactory for Digital Audio Broadcasting due to the need for multiple Encoding, Decoding and Conversion steps.

MP3 at 128 K Bit Sec is of marginal quality for Serious Music on FM Stereo and should be avoided if at all possible although it might be quite satisfactory for certain types of Pop Music and Speech.

A question often raised in connection with Digital Audio Broadcasting

Q: Will a Digital Audio Mixer be necessary for Digital Audio Broadcasting

A: Absolutely not, an Analog Mixer is completely universal and will interface to any broadcast system, AM Mono, FM Stereo, DAB as well as Internet Streaming and probably sound better than a Digital Audio Mixer

Is Digital Sound Beautiful?

It can be, for example playing a well recorded standard CD on a High Quality CD Player, Amplifier and Speaker System or even from moderately Compressed Digital Audio.

It can also be absolutely terrible using aggressive Audio Compression, or even worse, Audio which has been Compressed and De-Compressed several times, that certainly does not sound beautiful.

Written by Poul Kirk

Elan Audio  
2 Steel Court  
South Guildford WA 6055