Audio Processor

FMTX-*series* Transmitters

The FMTX-*series* of transmitters with Audio Processing option have a fully-featured broadcast processor inside. Despite the lack of flashing lights, menus and control knobs normally found on separate Audio Processors, it works in the same way and features powerful DSP (Digital Signal Processing) techniques, just like its counterparts.

First in the processing chain, is the slow gain-riding AGC, familiar to broadcast engineers. This slowly levels and optimises long-term changes in audio variations. Such variations could, for example, be the difference between studio presenters and how they set the mixing desk levels, or differing levels from various program source levels.

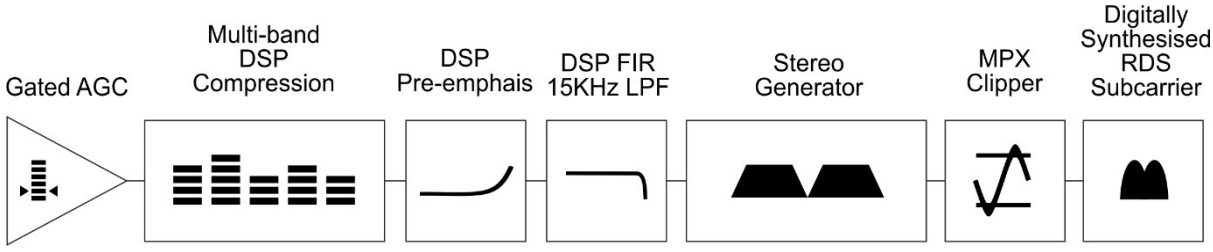
Broadcasters should understand how this section works. If the level of the programme material or music is increased or reduced extremely slowly, it would be easy to conclude that the transmitter has extremely heavy compression and little dynamic range. This is because the Automatic Gain control is keeping-up with such slow changes in levels, and optimising them. Normal increases or fades, however, are handled as expected. Intelligent gating is also applied to the AGC section, so that noise is not amplified if the audio source fails on, say, an analogue studio-transmitter link.

The FMTX-*series* also includes a digital bass enhancement algorithm, for bass levels which match modern Processors.

Next is the multiband compression and limiting section. The audio is split between different frequency bands (similar to a 'graphic equaliser') and limited separately. This prevents the 'pumping' characteristic associated with single-band limiters, when powerful bass tones affect mid-range and treble detail. This optimises loudness and clarity.

Like all FM transmitters, pre-emphasis is applied to the audio which corresponds with the de-emphasis characteristics of an FM radio receiver. In more simple terms, treble frequencies are boosted, which are then reduced back to normal at the listeners' receivers. This overcomes the ever-present 'hiss' contained in all VHF FM communications.

The audio frequency spectrum must then be sharply filtered at 15kHz to ensure that no audio detail above this frequency can pass. This is to protect the 'Pilot tone' (a 19kHz signal that indicates to stereo receivers that a subcarrier is present which includes the stereo 'difference' signal). Also, because the stereo difference signal is a repeat of the audio (centred around a 38kHz subcarrier), the digital FIR15kHz filtering, in effect, protects the RDS data subcarrier at 57kHz, too.



The processed stereo audio is then presented to the stereo generator circuitry, after which it is 'clipped' by distortion cancelling clipping algorithms, in order to keep the programme material to within the permitted deviation levels for FM transmission. This is the 'composite multiplex clipper'.

Audio processing is a complex art. If the limiting and filtering allows too greater energy to enter the clipper, even the best clipper implementation will cause harmonics, which would then cause unwanted spectrum energy. This, in turn, would lead to non-compliance with broadcast regulations, and errors in the RDS data subcarrier.

Indeed, audio processing involves a process of very fine balancing, regrettably it's not just a simple case of setting the tone and loudness to what one would like it to be. This is why some Audio Processor can cost in excess of £10,000 and now include psychoacoustic algorithms which 'trick' the human hearing's level of *perceived* loudness.

For the best results, avoid using program sources which have audio compression already applied. This is not to be confused with data compression. MP3, WAV or similarly compressed data sources are fine. Similarly, do not use products or software that use harmonics to increase audio timbre.

The FMTX-*series* audio processing is the result of many years of expert experience in the audio processing field. The digital circuits use considerable processing power and each stage is skilfully optimised. It achieves results which are as good as is technically possible for such low cost, even though the hard work happens within the transmitter, unseen.