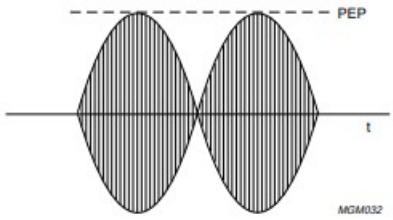

Fig.3-2 Two-tone signal showing the peak envelope power.

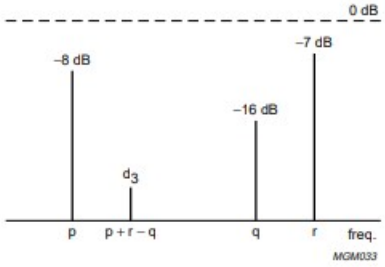

Fig.3-3 Three-tone test. The 3rd-order intermodulation product, d_3, is at p+r–q.

In class-A applications, distortion products are nearly always specified relative to the amplitude of one of the input test tones. As a general guideline, in the linear region of a class-A amplifier, every 1 dB reduction of output power reduces 3rd-order intermodulation distortion by 2 dB.

3.1.1.1.2 3-TONE TEST FOR TV TRANSPOSER APPLICATIONS

In a TV transposer, vision and sound are amplified together, so the distortion requirements are more severe, and it is usual to measure intermodulation using a 3-tone signal. The most popular test (DIN 45004B, para.6.3: 3-tone uses tones of –8 dB, –16 dB and –7 dB with respect to a 0 dB reference power level called the peak sync power. The first tone (–8 dB) represents the vision carrier, the second (–16 dB) a sideband, e.g. the colour carrier, and the third (–7 dB) the sound carrier. This combination of tones has a real peak power which is very close to the 0 dB level, namely: +0.02844 dB or +0.66%.

Another important relationship is the ratio of the average power to the 0 dB level. This ratio is 0.3831, so the 0 dB level is found by multiplying the calorific power by 2.61.

In the 3-tone test, the frequency of the –7 dB tone is 5.5 MHz higher than that of the –8 dB tone, while the frequency of the –16 dB tone is varied between the other two to produce the most intermodulation. If the frequencies of the tones are denoted by p, q and r respectively, we are primarily interested in the 3rd-order intermodulation product p+r–q which is inside the passband and which, in addition, usually has the largest amplitude, see Fig.3-3.

The test requirement for this product for a *complete* transposer is –51 dB with respect to the 0 dB reference level. This implies that the requirements for final stages are more severe (typically –55 dB) while those for driver stages more severe still (typically –60 dB).

In another 3-tone test method, the amplitude of the audio carrier is reduced from –7 dB to –10 dB. This has several effects:

- The actual peak power is only 76.2% of the 0 dB level
- The calorific power is 28.36% of the 0 dB level
- The intermodulation requirements are more severe. Because one of the tones is reduced by 3 dB, the intermodulation product at f_{p+r-q} is also reduced by 3 dB provided the amplifier is operating in the linear region.

3.1.1.1.3 RELATIONSHIP BETWEEN 2- AND 3-TONE TEST RESULTS

Theoretically, the first-mentioned 3-tone test and the 2-tone test measurement of SSB amplifiers are related. When (but only when) the PEP of the 2-tone test and the 0 dB level of the 3-tone test are equal, there is always a 13 dB difference in the intermodulation distortion. For example, if, an intermodulation of –40 dB is measured in the 2-tone test, –53 dB will be measured in the 3-tone test. Further, the 2-tone intermodulation should be measured relative to the two equal-amplitude tones and the 3-tone intermodulation relative to the 0 dB level.

Class-A amplifiers for TV transposers and transmitters behave in a similar way to those for SSB driver stages. So, reducing the output power by 1 dB reduces 3rd-order intermodulation by 2 dB.