

Who is afraid of steep

by Karl-Otto Müller

Most modern communication systems, including the GSM mobile radio standard, operate with “digital modulation”. The term “digital” play a pivotal role in the debate over the compatibility of electromagnetic fields in organisms, especially the human organism. In this context, it always stands for transmissions where the emitted carrier frequency is pulsed. Basically, this has not much to do with the term “digital modulation” for there are digitally modulated transmissions where the radiofrequency amplitude is constant over time. But since the term “digital” is fashionable and handy, it is readily used in discussions dealing with the dangers of mobile radio. It is always overlooked in this respect that it is just this type of signal transmission that helps to minimize the strength of emitted energy.

It is technically correct to speak of pulse amplitude modulation, as the digitally prepared signal ultimately is imprinted onto the radiofrequency carrier and transmitted this way. There is no reason to assume that an organism responds to the modulation content, however prepared; if at all, it responds to the strength of RF energy and its time course. Up to this point, there is agreement – even if achieved with some difficulty – in public discussions of which the author has seen a great many. But then, inevitably, follows the argument of “mobile radio steep edges”. These are purported to be particularly harmful, completely new and unheard of in presently used communication transfer systems. This assertion is simply plain wrong. One look at the level diagrams of the CCIR and FCC standards (fig. 1) shows that the carri-

er amplitude in television is gated in a distinctly shorter time than in mobile radio, namely, in about one-half microsecond versus about 10 microseconds in GSM (fig. 2). The often heard objection – that is, amazingly, rarely contradicted even by experts – is that television operates on analog signals. But this is only true for the image content; image and line synchronization is ensured by synchronous pulses which, on top of that, are emitted at the highest level. These synchronous peaks have field strengths exceeding the highest value for analog modulation (“black level”) by a factor 1.33. Regarding transmission power, they are thus 78 % larger than the highest analog value (black image). Under these conditions, it is fully justified to compare television field strengths existing in Germany since the middle of the fifties of the last century to the emissions of GSM networks regarding their effect on living organisms: Today television is, seen from an energetic perspective, a pulsed operation system, except that the pulse frequency for the frame rate is 50 Hz, and 15.625 kHz for the line rate, in contrast to the GSM system where an in-between pulse frequency (217 Hz) is used. Since there is no scientifically validated proof yet that living organisms are that frequency selective, i.e. that they are able to distinguish these different pulse frequencies, we have to instead assume that the influence of electromagnetic fields as produced by TV transmitters basically is not different from that of mobile radio transmitters.

It is undisputed that the field strengths found at public access (“non-controlled”) areas in Germany over-

edges?

all are below international permissible exposure limits; only so-called non-thermal influences of modulated fields are controversial. Quantitatively speaking, the safety distance to the aforementioned exposure limits for base stations almost everywhere exceed the factor 100, but mostly are even above 1000 up to 50,000. There are general safety distances of 1000 to 10,000 for the field strengths of television emissions. It is typical for television signals that their field strengths outside of towns do not differ much, due to the large distance to centrally located strong transmitters. Base stations – that are weak in comparison – cover only small areas; so the local dependency of their field strengths is more pronounced. In other words: In free spaces, the fields of television transmitters prevail, in limited developed areas, the same goes for the fields of mobile radio base stations.

Since about 60 years, nobody in Germany can escape these ubiquitous fields. When addressing the issue of non-thermal field effects, it does not make any sense to discuss about safety distances of 100, 1000 or 10,000. It is a fact that, despite this permanent exposure to the pulsed fields of TV transmitters, and after all this time, there are no proven negative effects on human health. So we may justly hope that the just as weak fields of mobile radio base stations with pulse edges that are less steep than those of television signals by a factor 20, will have no real influence on human well-being.

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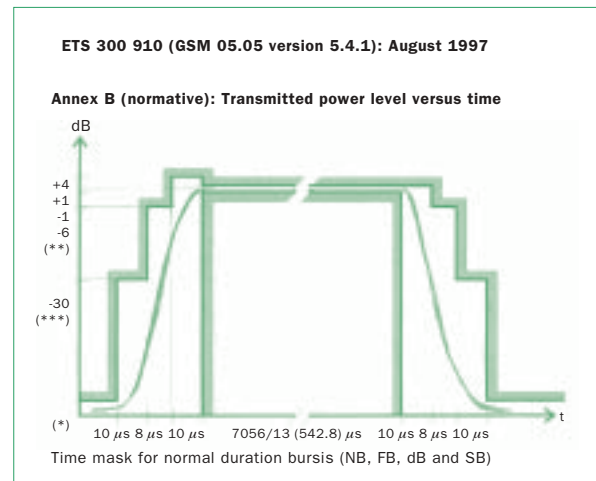


Fig. 1: Line synchronization pulse according to CCIR, as is nowadays applied by all television transmitters in Europe. One can see that the rise time between white pulse (= 10 % of the maximum value) and the so-called synchronous pulse is $0.3 \mu\text{s} \pm 0.1 \mu\text{s}$.

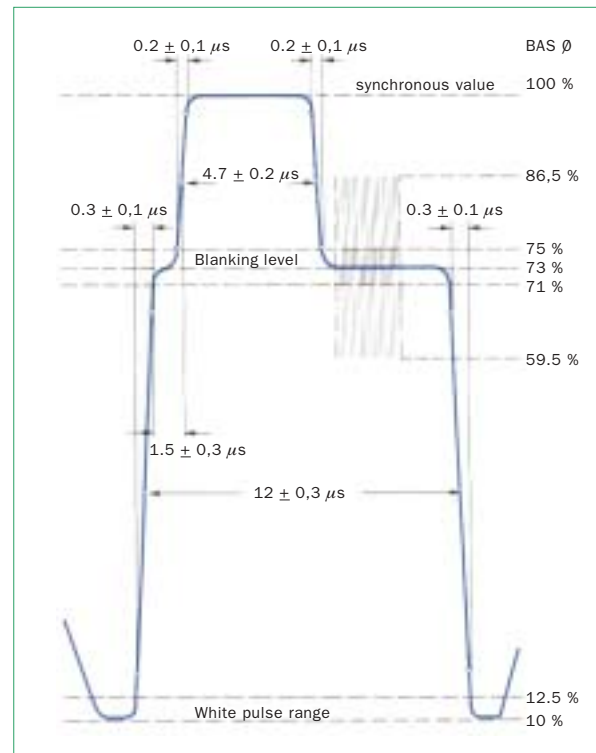


Fig. 2: Tolerance mask of the ETSI standard ETS 300 910; a possible amplitude course is depicted. The tolerance field is fully used whenever possible in order to keep the amount of bandwidth used as small as possible, i.e. pulse edges are kept as flat as is permissible.