RECOMMENDATION ITU-R BT.803*

The avoidance of interference generated by digital television studio equipment

(1992)

The ITU Radiocommunication Assembly,

considering

a) that equipment built to operate on the Recommendation ITU-R BT.601 digital video standard utilizes a sampling frequency of 13.5 MHz, of which the ninth harmonic coincides exactly with an international distress frequency of 121.5 MHz**;

b) that 243 MHz**, or the eighteenth harmonic of the sampling frequency, is also reserved for international distress use;

c) that these distress signals are usually detected by aircraft or satellite receivers, and sophisticated signal processing is required for reliable detection;

d) that No. 964 of the Radio Regulations prohibits any harmful interference on the emergency frequencies,

recommends

that the design, construction and operation of digital equipment must take into consideration the need to eliminate harmful interference, as a high priority, and the following methods of measurement and limits of radiated interference field strengths should be used.

1 Measurement methods

CISPR Publications 16 and 22 are recommended as detailed specifications and procedures for measuring electromagnetic radiation. When measuring the radiation from a particular item of equipment, the real-life operational conditions of the equipment must be adhered to as far as possible. In particular, all external connections must be present.

2 Acceptable levels of radiation

The electromagnetic radiation limits for Class A equipment*** should conform with the limits**** given in Table 1.

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* Radiocommunication Study Group 6 made editorial amendments to this Recommendation in 2002 in accordance with Resolution ITU-R 44.

** The international distress frequencies, 121.5 MHz and 243 MHz are used by Emergency Location Transmitters (ELT) in the aeronautical service and emergency position indicating radio beacons (EPIRB) in the marine service.

*** Non-domestic low voltage equipment.

**** Some administrations specify the limits given in Annex 1.

TABLE 1

Limits of radiated interference field strength at a test distance of 30 m for Class A equipment

Frequency range (MHz)	Quasi-peak limits (dB(μV/m))
30 to 230	30
230 to 1 000	37

These values correspond to those in CISPR Publication 22.

3 Circuit design

Annex 2 gives advice on circuit design methods.

4 Measurement of radiated interference levels

Some information about measurements carried out is given in Annex 3.

ANNEX 1

TABLE 2

Limits of spurious emissions (CSA Class A)
Maximum field strength at 30 m (dB(μV/m))

Frequency (MHz)	Maximum field strength at 30 m (dB(μV/m))
30 to 88	30
88 to 216	34
216 to 1 000	37

ANNEX 2

Circuit design methods

The following arrangement may be employed in circuit board design:

– circuit board to be partitioned by logic speed, frequency and function;
– impedance matching for high-speed logic devices, e.g. balanced ECL circuit;
– use of multi-layer printed circuit boards with power and ground distribution planes;
– analogue and digital power busses to be isolated from each other;
– decoupling capacitors with low effective series resistance and inductance to be placed close to IC power pins;

– decoupling capacitor to be employed at the point where the power supply enters the board;
– surface mounted components to be used where practical.

The following techniques may be employed for the minimization of electromagnetic radiation from equipment:

– use of connectors that are shielded and earthed to the equipment chassis;
– shielding and compartmentalizing of components or sub-assemblies;
– shielding and minimizing the length of internal wiring;
– bringing earths and shields to a common point;
– use of multi-layer boards with ground-planes for extender modules;
– use of RF-screened chassis;
– use of "twist-'n'-flat" and shielded cable, as well as specially designed circular cables.

ANNEX 3

Measurements of radiated interference levels

Measurements of the levels of radiated signals at 121.5 MHz for a prototype digital PAL-RGB/YC_RC_B decoder based on Recommendation ITU-R BT.601 have been conducted in Australia using a measurement technique conforming with CISPR Publication 22. At a distance of 30 m from the decoder field strength levels of up to 46 dB(μV/m) were measured. With cables removed levels of 37 dB(μV/m) were measured.

Similar measurements were carried out in the United Kingdom again on experimental processing equipment conforming to Recommendation ITU-R BT.601, and adhering closely to the measurement technique outlined in CISPR Publication 22 in order to ensure repeatable results. The equipment under test was mounted on a remotely controlled turntable, and the measuring antenna was adjustable in height and polarization so that worst-case measurements could be obtained, field strength levels (referred to 30 m) of up to 39 dB(μV/m) were measured. However, when the equipment was enclosed in a wire mesh cage a value of 24 dB(μV/m) (referred to 30 m) was obtained.

These measurements on prototype equipment demonstrate that a potential problem exists. Careful attention needs to be paid to the electromagnetic compatibility of equipment based on Recommendation ITU-R BT.601 in design, manufacture and use.

In Japan, measurements of the radiation from commercially produced digital video equipment having a sampling frequency of approximately 14.3 MHz have been conducted. While this equipment does not conform to Recommendation ITU-R BT.601 the levels of measured ninth harmonic (128.7 MHz) radiation may provide a useful guide to the levels that could be obtained from commercially produced equipment conforming with Recommendation ITU-R BT.601. The level of the ninth harmonic radiation measured was 22 dB(μV/m), referred to 30 m.

Results carried out at an experimental digital television studio in France gave mean field strengths which at 30 m would amount to between 29 and 37.8 dB(μV/m). If an additional attenuation of at least 20 dB due to the concrete construction of the studio is taken into account, the resultant field strength would certainly be below the appropriate CISPR limit which is 30 dB(μV/m) at 30 m.