

# Engineering Notes

Information for our clients - William S. Hurst P.E. Editor

## **Comparison of FCC Limits with CISPR Limits CCL Engineering Note 290**

*September 1993*

The Federal Communications Commission (FCC) has amended Part 15 to harmonize the United States standards for radio frequency emissions from digital devices with the international emissions standards for these devices.

The new rules permit parties seeking to authorize a digital device to choose to demonstrate that the device complies with either the Part 15 standards or the international standards found in Publication 22 of the International Special Committee on Radio Interference (CISPR).

In harmonizing the standards, the FCC agreed to accept measurements demonstrating compliance with the standards in the 1985 version of CISPR 22, as amended by the Draft International Standards already adopted by CISPR. The FCC retained its existing standards for emissions above 1000 MHz, but permitted emissions above 1000 MHz to be measured at the test distances specified in CISPR 22. The FCC also requires that testing be performed following the American National Standards Institute (ANSI) C63.4-1992 measurement procedure.

The following tables and graphs illustrate the differences between the FCC Limits and the CISPR Limits:

## Limits on AC Powerline Conducted Emissions

Class A Digital Devices				
	FCC Limits		CISPR Limits	
Frequency (MHz)	Voltage Quasi-peak	(dB $\mu$ V)* Average	Voltage Quasi-peak	(dB $\mu$ V) Average
0.15-0.45	No Limits		79	66
0.45-0.5	60	None	79	66
0.5-1.705	60	None	73	60
1.705-30	69.5	None	73	60

Class B Digital Devices				
	FCC Limits		CISPR Limits	
Frequency (MHz)	Voltage Quasi-peak	(dB $\mu$ V)* Average	Voltage Quasi-peak	(dB $\mu$ V) Average
0.15-0.45	No Limits		66-56.9**	56-46.9**
0.45-0.5	48	None	56.9-56**	46.9-46**
0.5-5	48	None	56	46
5-30	48	None	60	50

\* The comparison of the FCC and CISPR conducted limits must take into account the differences in measurement procedures. While the FCC does not have a limit on the average value of conducted emissions, the measurement procedures permit the FCC quasi-peak limits to be raised by 13 dB if the difference between quasi-peak and average measurements is 6 dB or greater. Under this condition, the limit for Class B digital devices becomes 61 dB $\mu$ V (quasi-peak) and 55 dB $\mu$ V (average, representing the minimum 6 dB difference). Similarly, for Class A devices the limits become 73 dB $\mu$ V (quasi-peak) and 67 dB $\mu$ V (average) for the band 0.45-1.705 MHz and 82.5 dB $\mu$ V (quasi-peak) and 76.5 dB $\mu$ V (average) for the band 1.705-30 MHz.

\*\* The limit decreases linearly with the logarithm of the frequency.

## Limits on Radiated Emissions

Class A Digital Devices		
	FCC Limits*	
	CISPR Limits*	
Frequency (MHz)	Field Strength (dB $\mu$ V/m) @ 10 meters	Field Strength (dB $\mu$ V/m) @ 10 meters
30-88	39	40
88-216	43.5	40
216-230	46.4	40
230-960	46.4	47
960-1000	49.5	47
> 1000	49.5	No Limit

Class B Digital Devices			
	FCC Limits*		CISPR Limits*
	Field Strength (dB $\mu$ V/m) @ 3 meters	Field Strength (dB $\mu$ V/m) @ 10 meters	Field Strength (dB $\mu$ V/m) @ 10 meters
Frequency (MHz)	Field Strength (dB $\mu$ V/m) @ 3 meters	Field Strength (dB $\mu$ V/m) @ 10 meters	Field Strength (dB $\mu$ V/m) @ 10 meters
30-88	40	29.5	30
88-216	43.5	33	30
216-230	46	35.6	30
230-960	46	35.6	37
960-1000	54	43.5	37
> 1000	54	43.5	No Limit

\* The FCC Class B limits were converted to 10 meters using an inverse linear distance extrapolation factor (20 dB/decade), as specified in 47 CFR Section 15.31(f)(1). CISPR limits and FCC limits  $\leq$  1000 MHz are based on quasi-peak measurements. FCC limits above 1000 MHz are based on the use of an average detector. For emissions above 1000 MHz, 47 CFR Section 15.35

also limits the emissions, measured with a peak detector, to 20 dB above the stated average limit, e.g. peak emissions above 1000 MHz for Class A devices, measured at a distance of 10 meters, shall not exceed 3000  $\mu\text{V}/\text{m}$  (69.5 dB $\mu\text{V}/\text{m}$ ). Measurements above 1000 MHz are required under 47 CFR Section 15.33 when the digital device contains an oscillator operating at 108 MHz or higher.

\*\* CISPR Publication 22 states that if the field strength measurement at 10 meters can not be made because of high ambient noise levels or for other reasons measurements may be made at a closer distance, for example 3 meters. An inverse proportionality factor of 20 dB per decade should be used to normalize the measured data to the specified distance for determining compliance. Care should be taken in measurement of large test units at 3 meters at frequencies near 30 MHz due to near field effects.

*Reference: Federal Communications Commission, Notice of Proposed Rule Making, ET Docket No. 92-152, released July 30, 1992 and Report and Order (FCC 93-421) adopted August 20, 1993.*