4.5 Emission mask according to FCC part 90 paragraph 210

4.5.1 General

Any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0: Zero dB.
(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27(f_d – 2.88 kHz) dB.
(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least 50 + 10 log(P) dB or 70 dB, whichever is the lesser attenuation.

4.5.2 Test procedure

For test setup refer to Photographs 4.2.1, 4.2.2, 4.5.1.

The emission mask, calculated according to formulas (1) – (3) is shown in Figures 4.5.1, 4.5.2.

Spurious emissions outside the specified bandwidth (f_0 – 12.5 kHz, f_0 + 12.5 kHz) were compared with the limit, expressed as follows:

$$Att_{min} = 50 + 10 \log(P),$$

where

for transmission frequency F = 451.017 MHz
P = 17.06 dBm = 0.05 W,
and
Att_{min} = 50 + 10log 0.05 = 50 – 13 = 37 dB, refer to Figure 4.5.1,

for transmission frequency F = 460.65 MHz and 469.98 MHz
P = 20.06 dBm = 0.1 W,
and
Att_{min} = 50 + 10log 0.1 = 50 – 10 = 40 dB, refer to Figure 4.5.2.

No spurious emissions were found in frequency range 9 kHz to 30 MHz.

Test results are shown in Plots 4.4.2 to 4.4.18.

Reference numbers of test equipment used

HL 0029	HL 0041	HL 0411	HL 0465	HL 0521	HL 0557	HL 0589	HL 0604
HL 0661	HL 1116	HL 1175					

Full description is in Appendix A.

Figure 4.5.1
Emission mask (F_0 = 451.017)

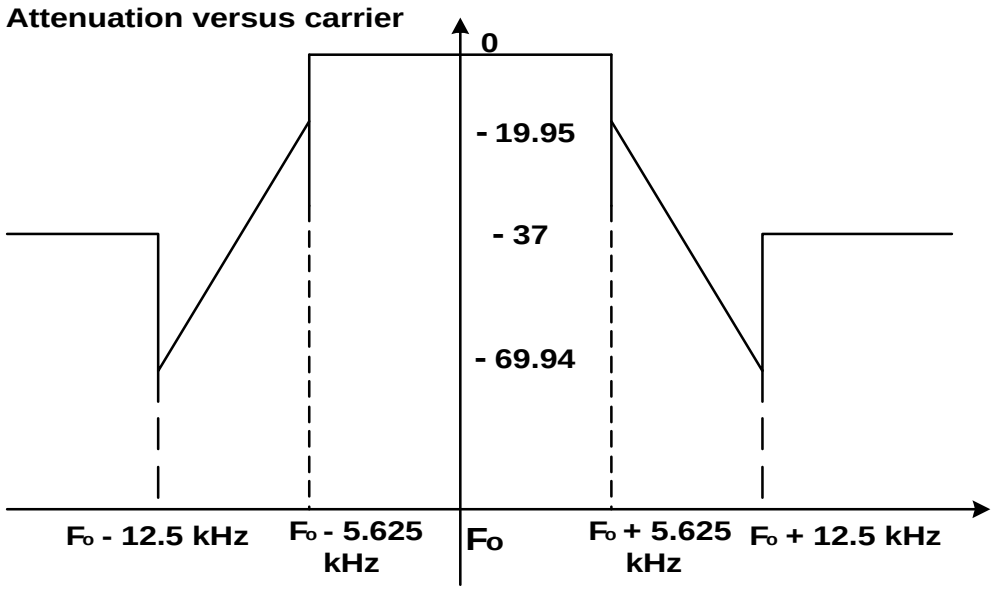


Figure 4.5.2
Emission mask (F_0 = 460.65, F_0 = 469.98)

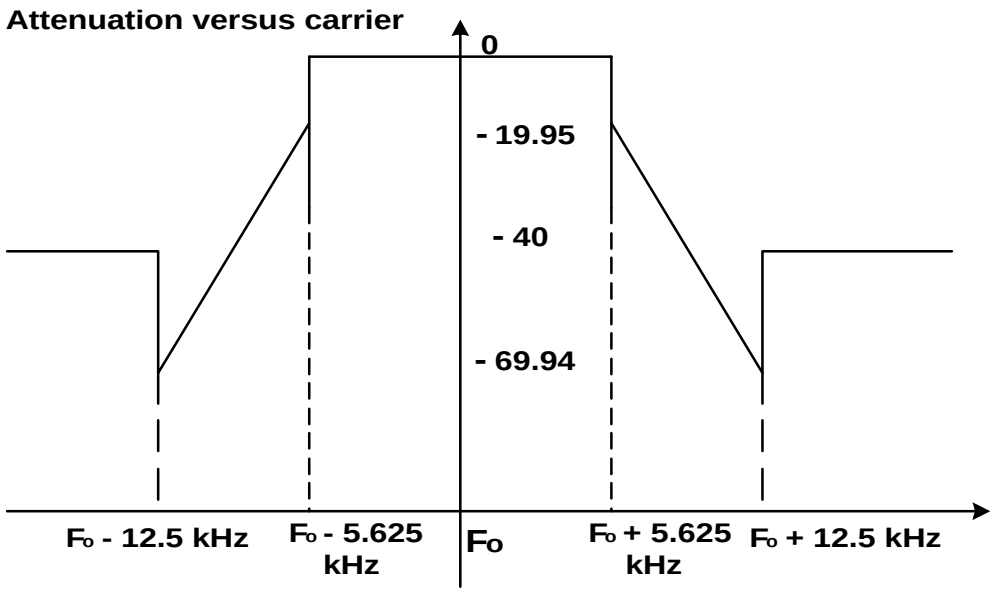
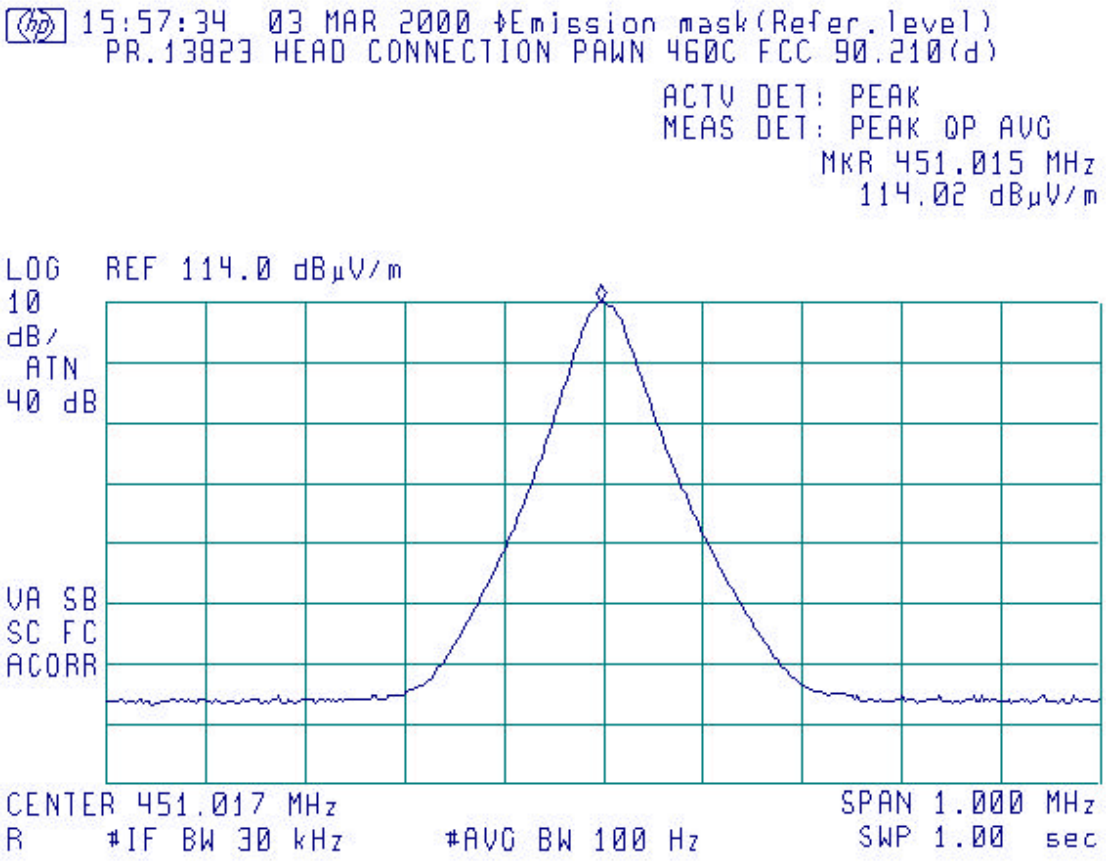


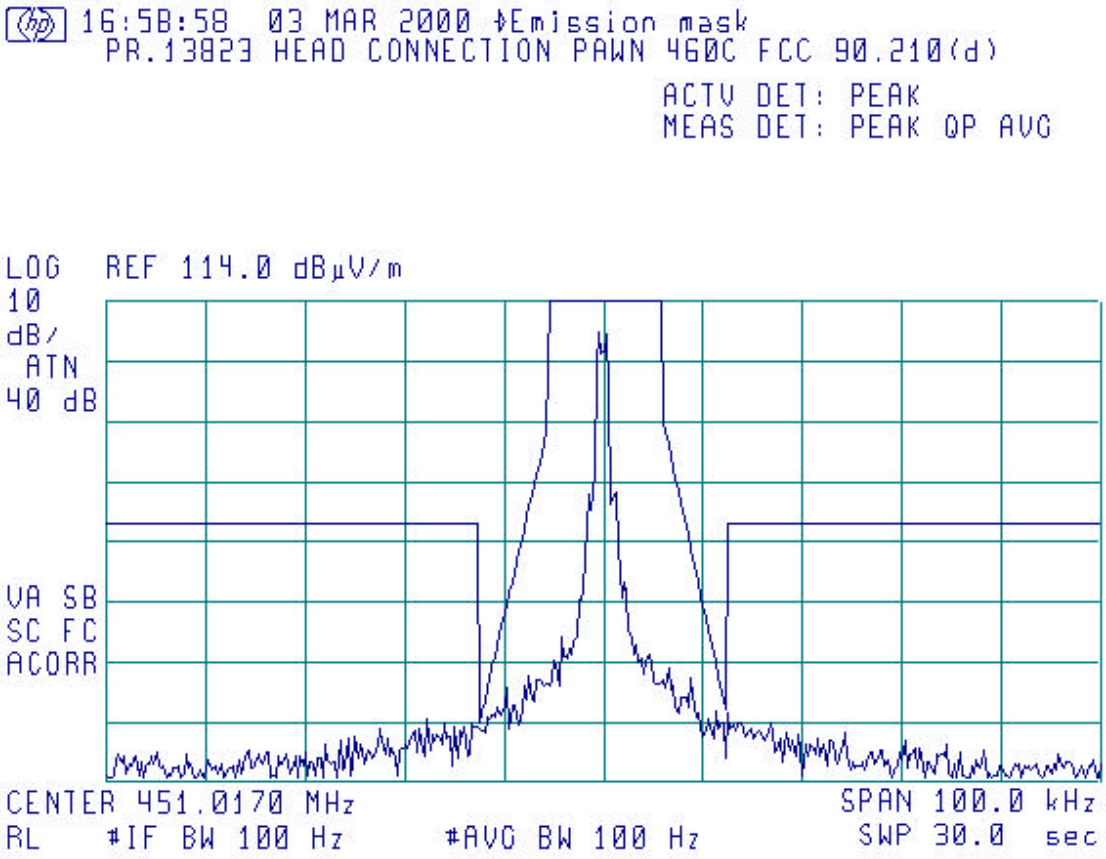
Table 4.5.1
Spurious emissions test results

Frequency, MHz	Peak Ampl, dBm	P gen, dBm	Cable loss, dB	Gain ant, dB	P out., dBm	Limit, dBm	Pass / Fail
902.032184	69.56	-28	0.7	1.84	-26.9	-20	Pass
921.294175	68.73	-28	0.7	1.84	-26.9	-20	Pass
939.959875	68.73	-28	0.7	1.84	-26.9	-20	Pass
1353.033452	72.34	-30	0.8	7.0	-23.8	-20	Pass
1381.945000	71.81	-30	0.8	7.0	-23.8	-20	Pass
1409.945000	60.97	-41	0.8	7.0	-34.8	-20	Pass
1804.183682	58.83	-34	0.9	6.8	-28.1	-20	Pass
1842.542500	61.97	-40	0.9	6.8	-34.1	-20	Pass
1879.968750	67.04	-35	0.9	6.8	-29.1	-20	Pass
2255.167176	59.61	-42	1.0	6.9	-36	-20	Pass
2303.358750	61.87	-40	1.0	6.9	34.1	-20	Pass
2349.697500	61.69	-40	1.0	6.9	-34.1	-20	Pass
2764.020000	58.50	-43	2.1	7.5	-37.6	-20	Pass

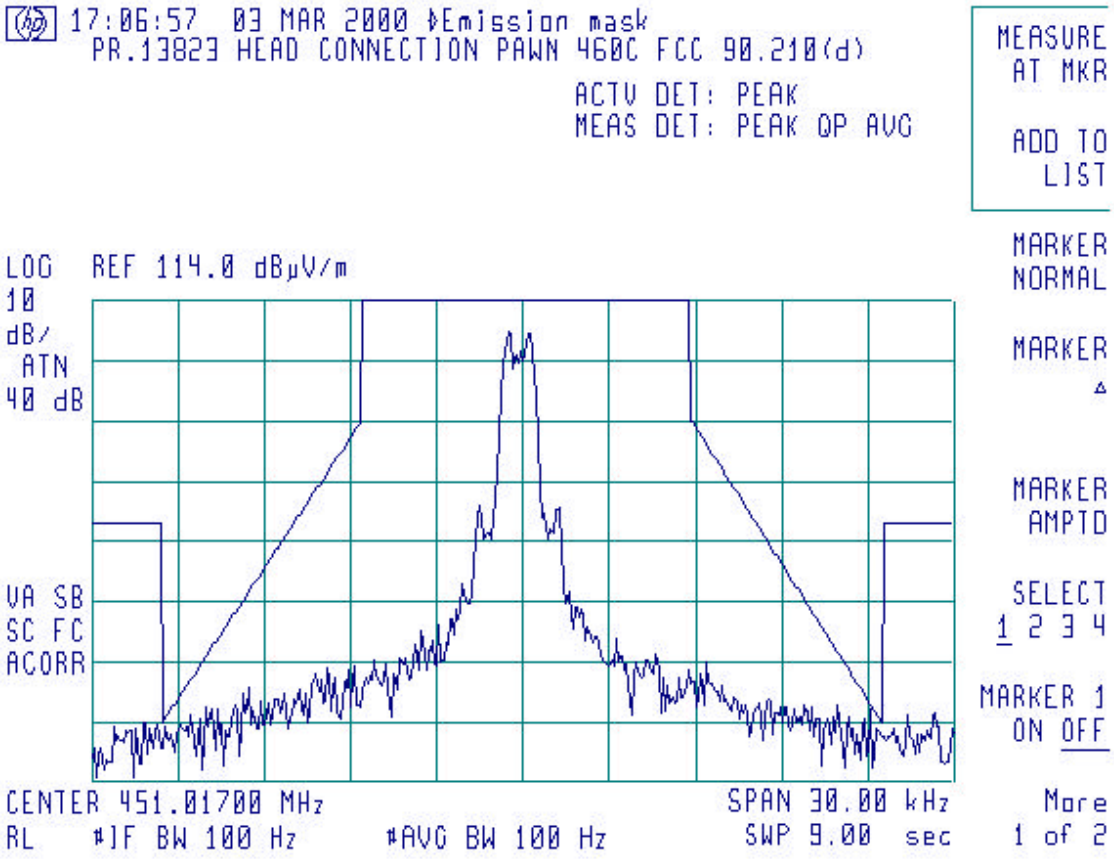
Plot 4.5.1
Reference level, F_0 = 451.017



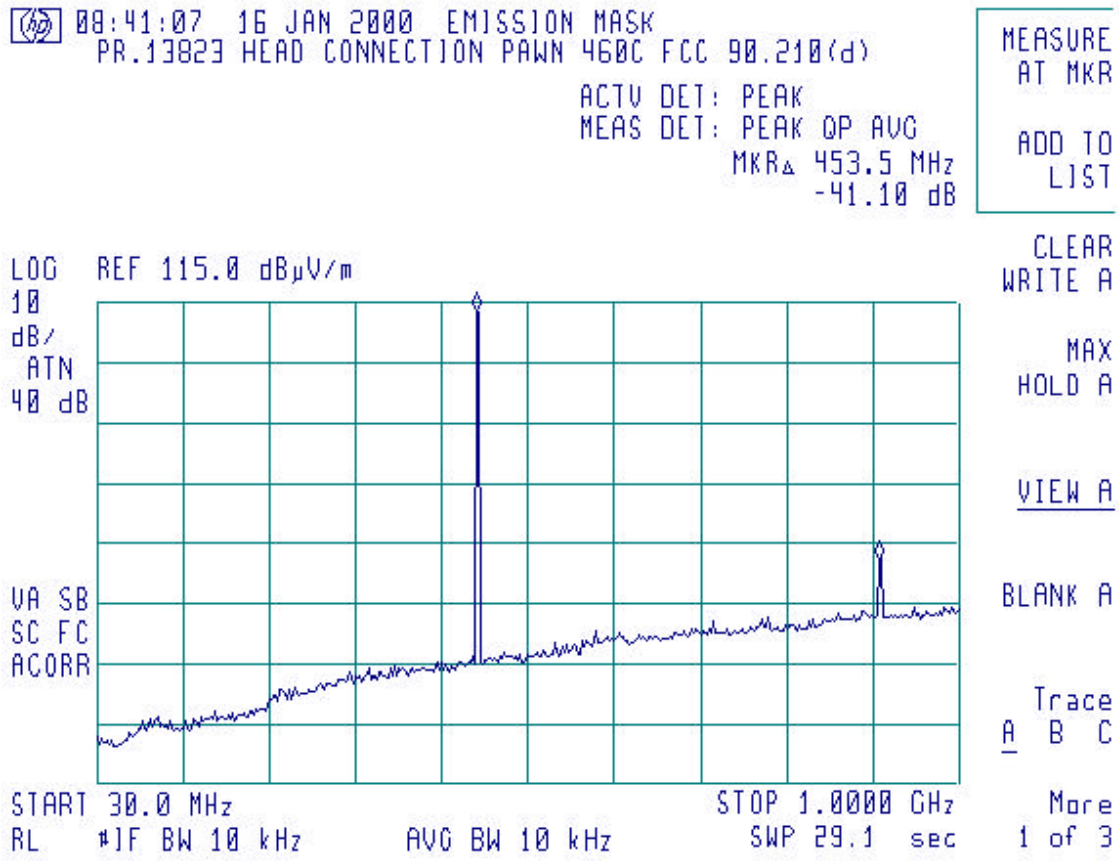
Plot 4.5.2
Emission mask, F_0 = 451.017



Plot 4.5.3
Emission mask, F_0 = 451.017



Plot 4.5.4
Spurious emissions, F_0 = 451.017



Signal	Frequency, MHz	Peak Ampl, dBm	P gen, dBm	Cable loss, dB	Gain ant, dB	P out., dBm
1	451.016046	115.12	17	05	0.56	17.06
2	902.032184	69.56	-28	0.7	1.84	-26.9