CHAPTER V

CONCLUSION

In this investigation, two stilbene compounds, namely oxyresveratrol (AL1) and resveratrol (AL2) were isolated from the heartwood of *Artocarpus lakoocha* Roxb. Nine pure compounds were identified from the roots of A. gomezianus Wall. ex Trec. These compounds are the flavonoids isocyclomorusin (AG3), cycloartocarpin (AG4), artocarpin (AG5), norartocatpetin (AG6), cudraflavone C (AG7) and albanin A (AG9). The others are the stilbene resveratrol (AG8), the benzenoid resorcinol (AG10) and the naphthalene phenyl-β-naphthylamine (AG2). Moreover, the presence of two steroids, viz β-sitosterol and stigmasterol (AG1) was detected. The unambiguous ^{13}C NMR assignments of oxyresveratrol, resveratrol, phenyl-β-naphthylamine and cycloartocarpin were obtained for the first time in this study. The ^{13}C NMR assignments of isocyclomorusin were revised. The stilbenes oxyresveratrol and resveratrol showed the most potent tyrosinase inhibition. Strong inhibitory effect on tyrosinase was also observed for the unprenylated flavonoid norartocarpetin. The hight contents of stilbene compounds in *A. lakoocha* and norartocarpetin in *A. gomezianus* provide possibilities for the development of new whitening agents from these plants.

APPENDIX

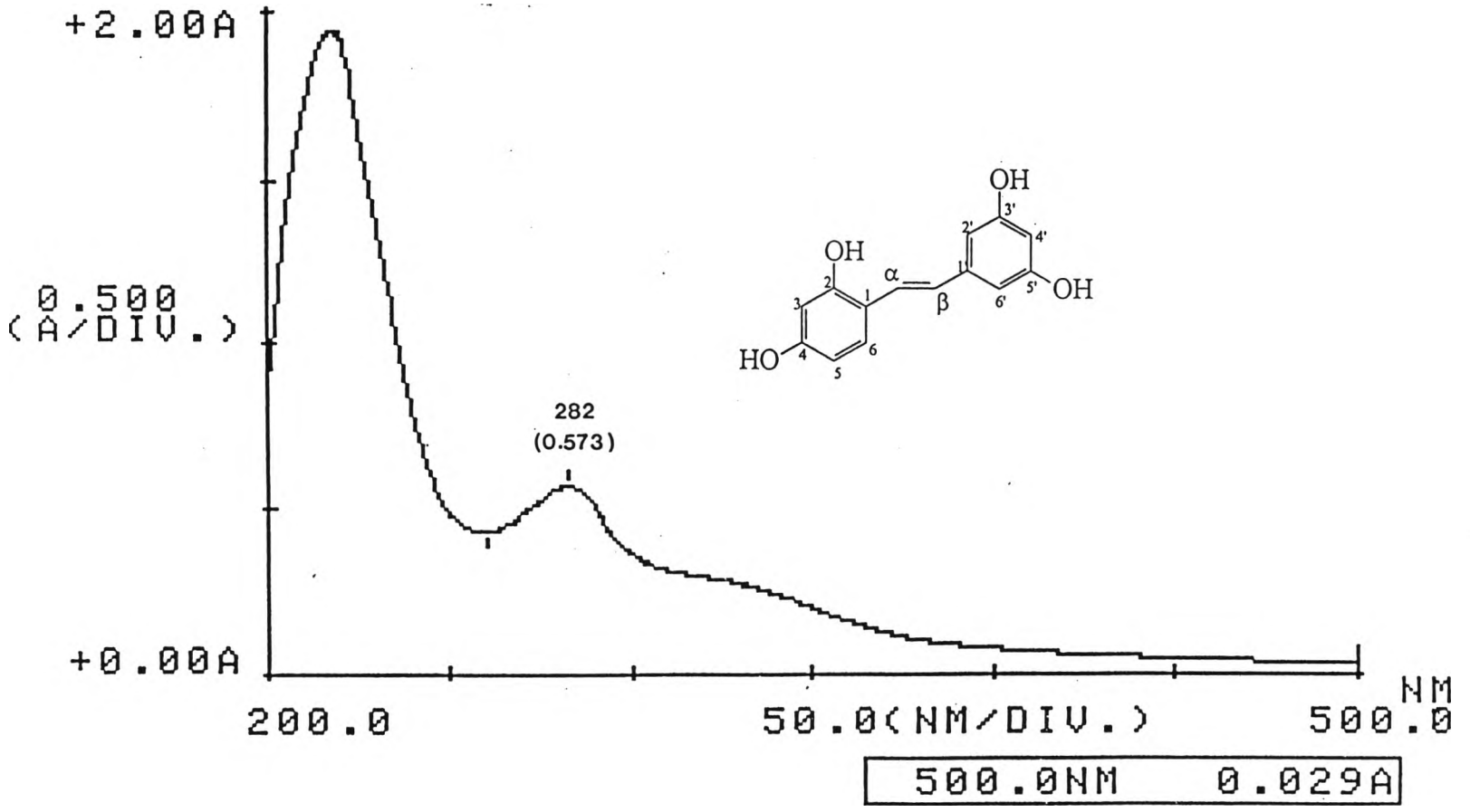


Figure 4 UV spectrum of compound AL1 (in methanol)

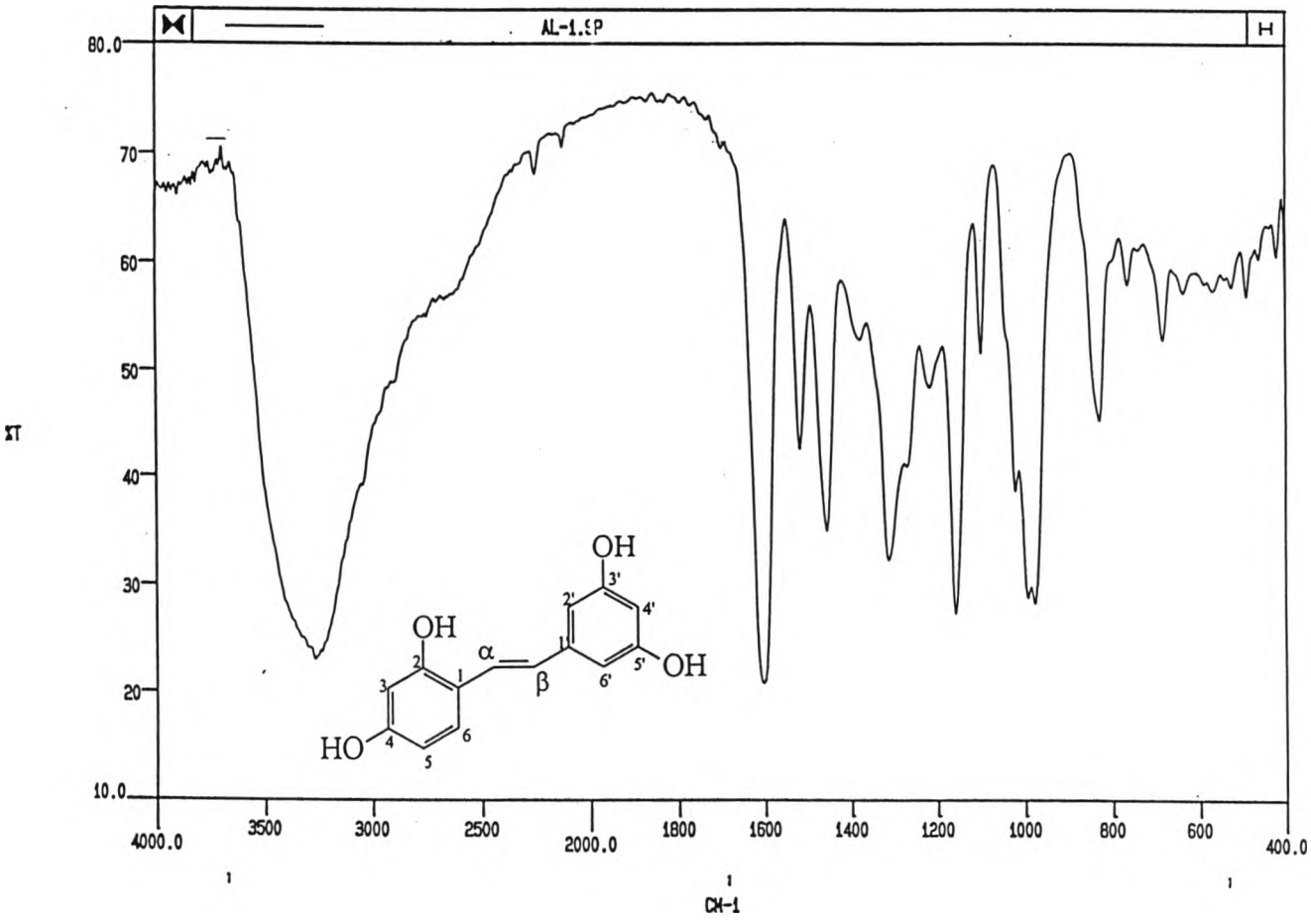


Figure 5 IR spectrum of compound AL1 (KBr disc)

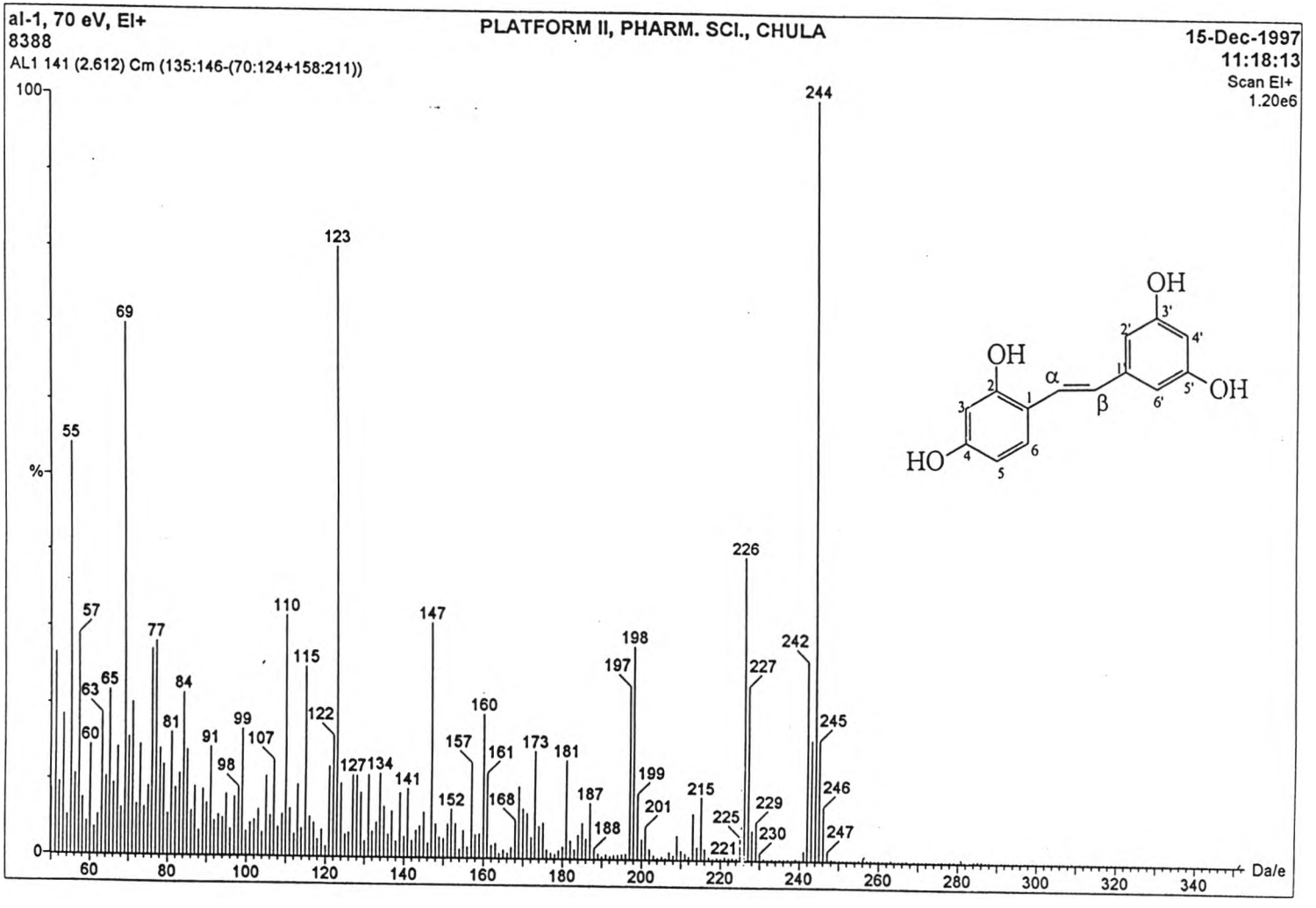


Figure 6 EI mass spectrum of compound AL1

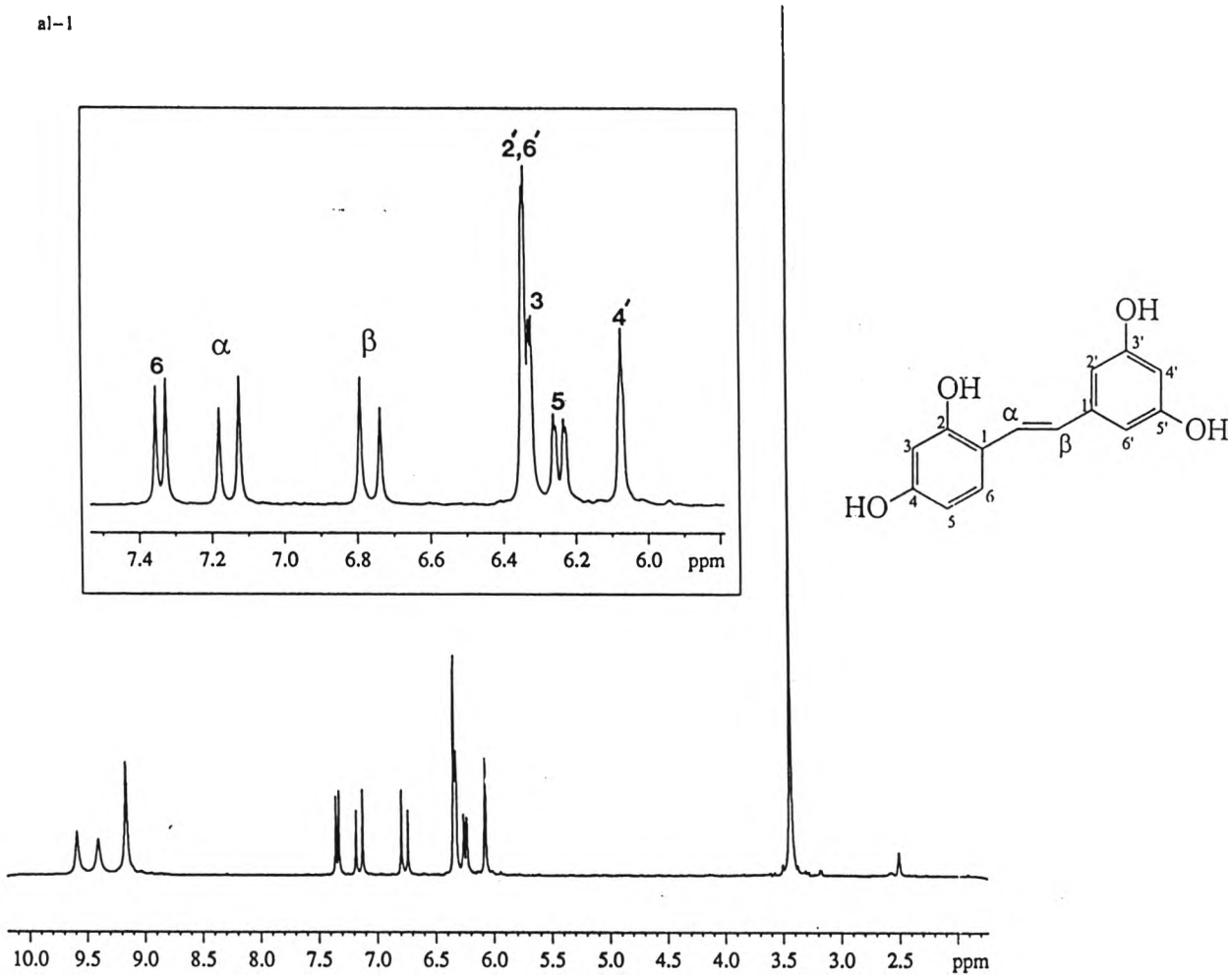


Figure 7 300 MHz ^{1}H NMR spectrum of compound AL1 (in DMSO-d_6)

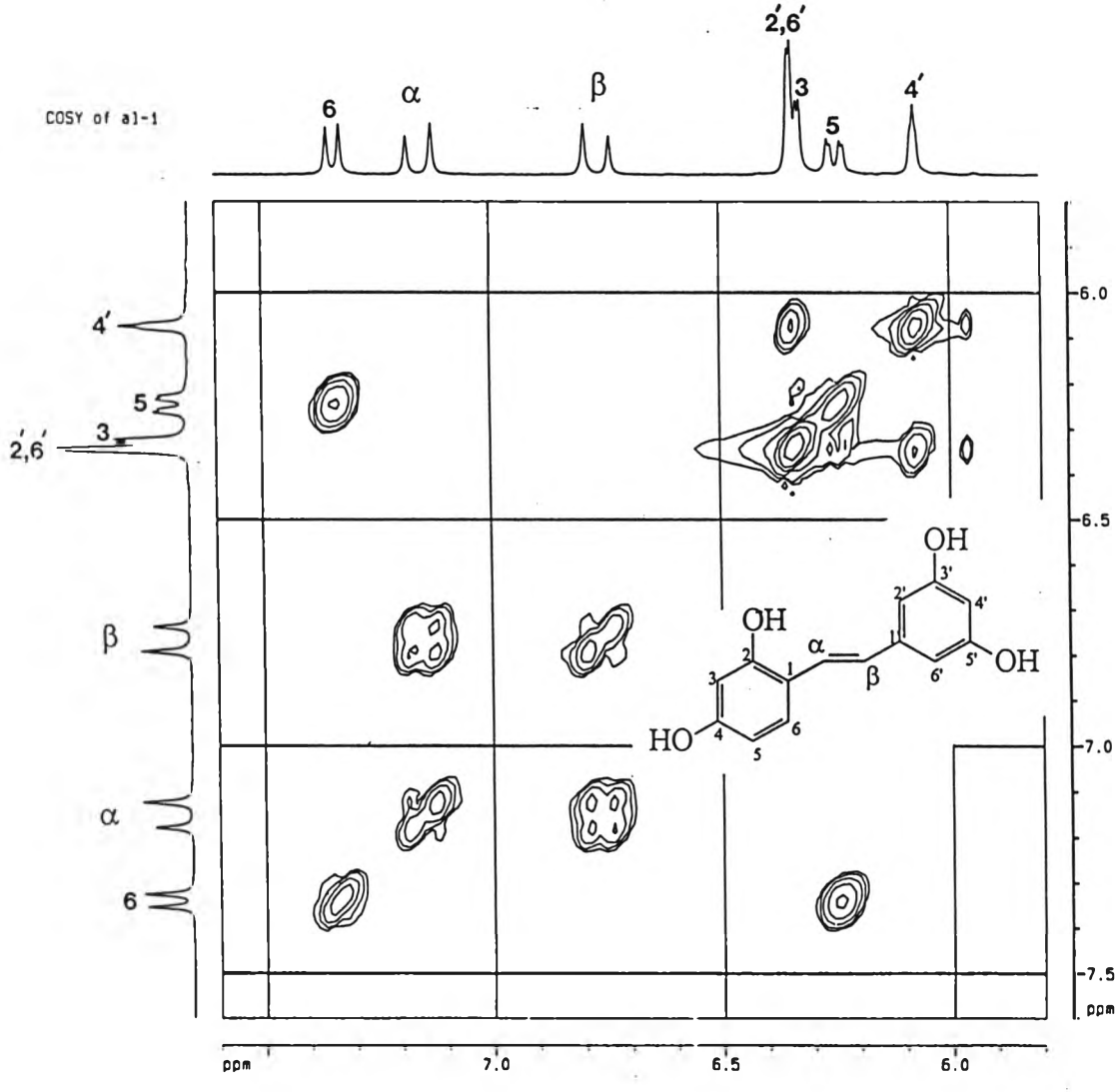


Figure 8 ^{1}H-^{1}H COSY spectrum of compound AL1 (in DMSO-d_6)

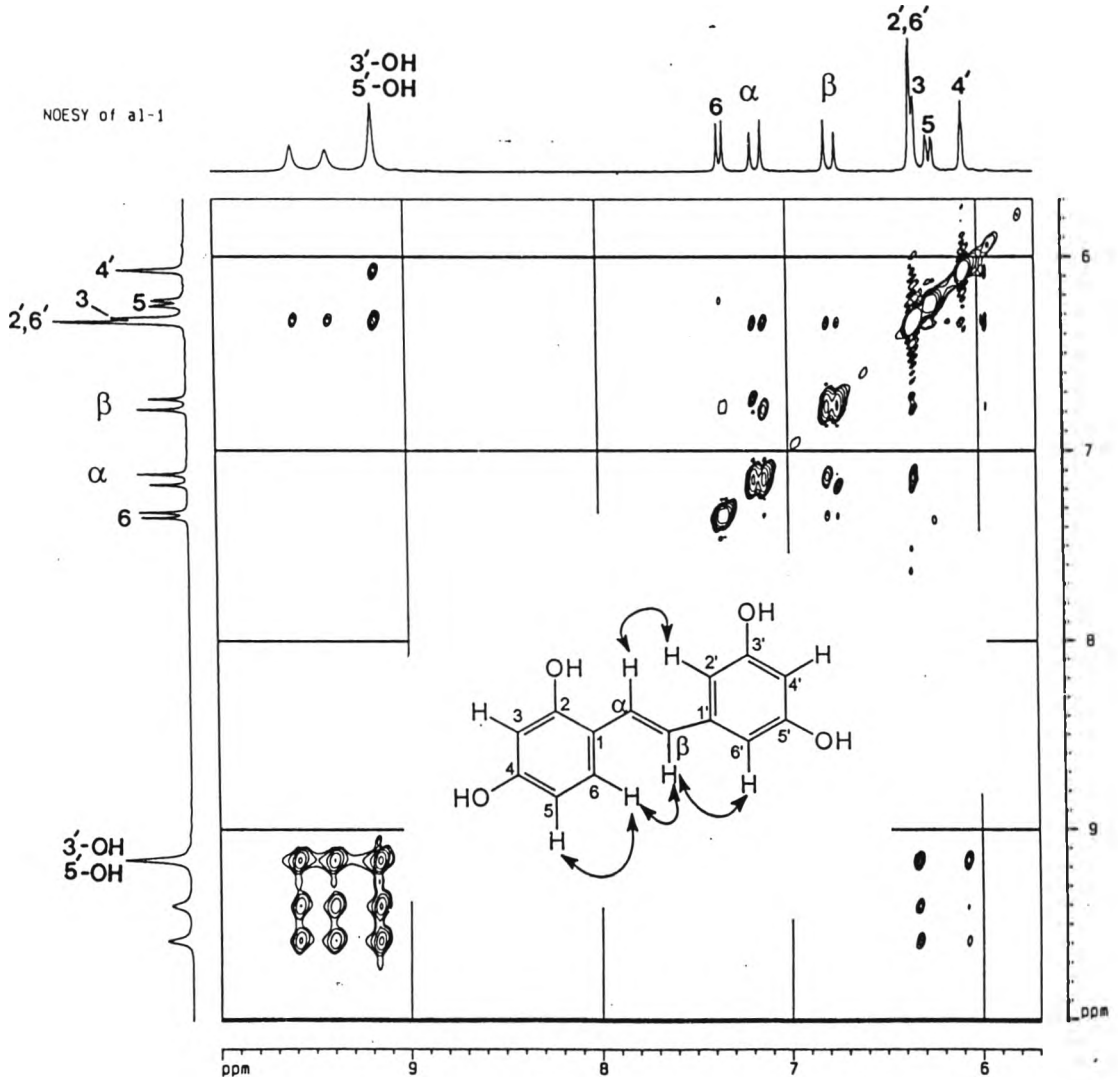


Figure 9 NOESY spectrum of compound AL1 (in DMSO-d_6)

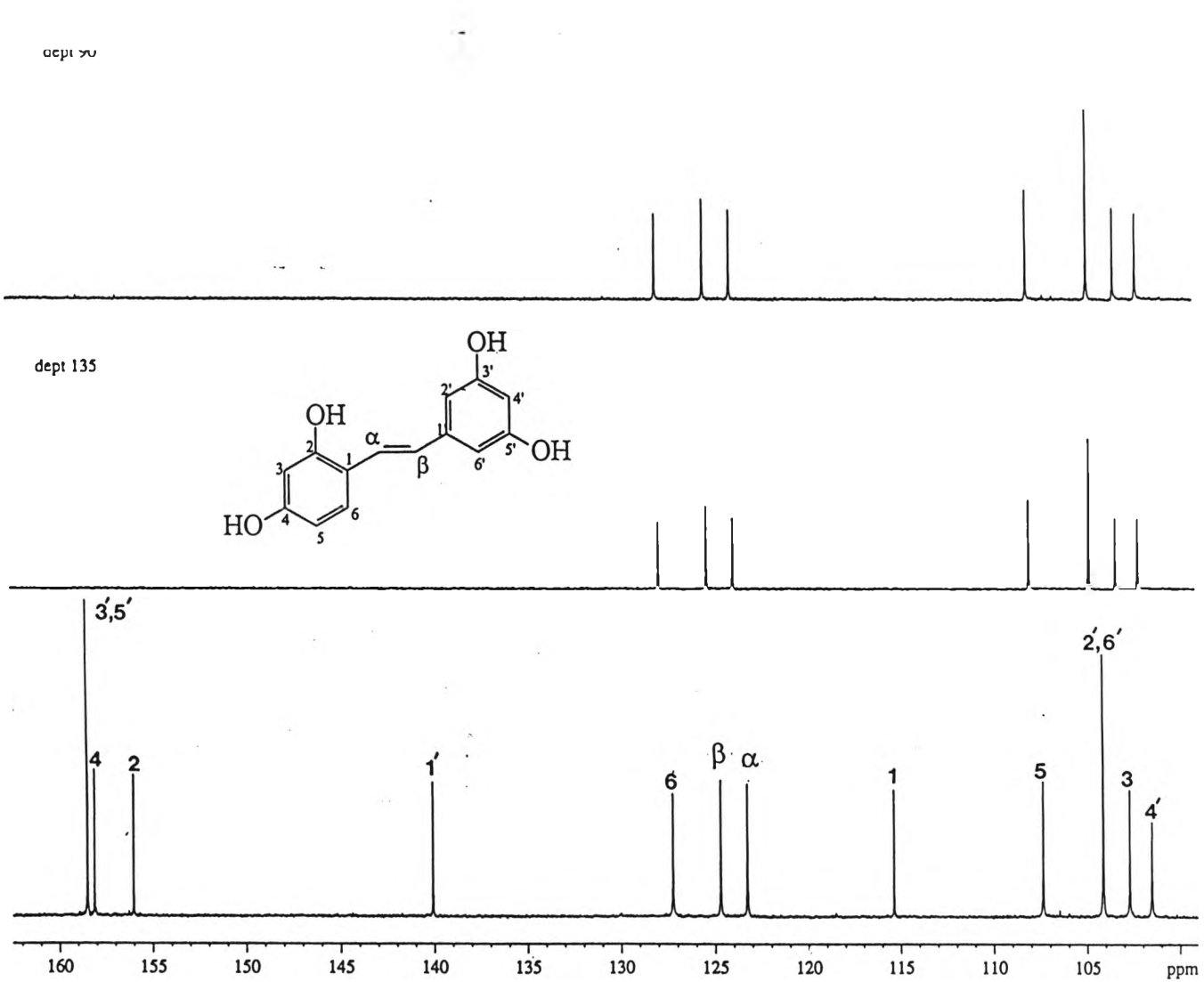


Figure 10 75 MHz ^{13}C NMR, DEPT 90 and DEPT 135 spectra of compound AL1 (in DMSO-d_6)

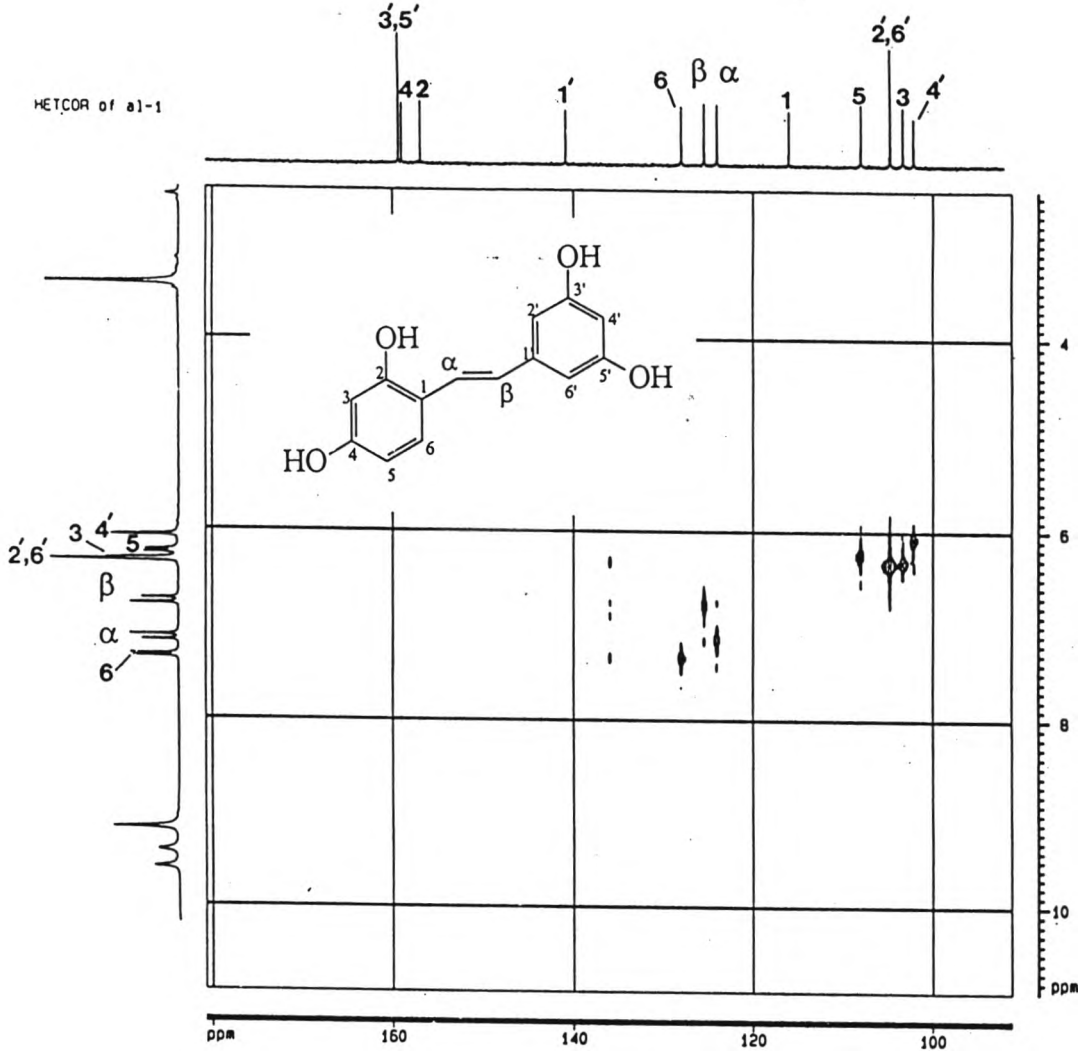


Figure 11 HETCOR spectrum of compound AL1 (in DMSO-d_6)

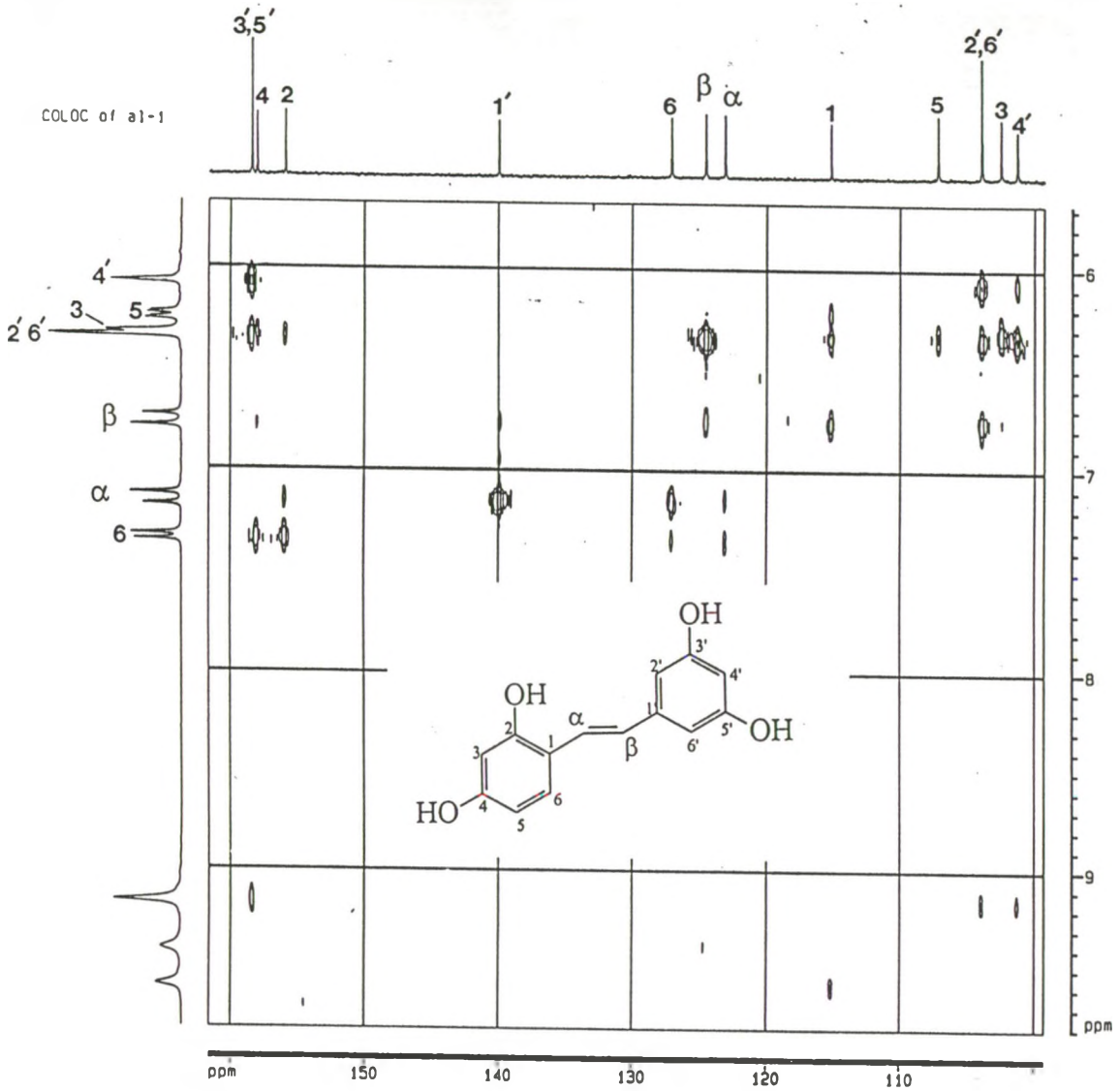


Figure 12 COLOC spectrum of compound AL1 (in DMSO-d_6)

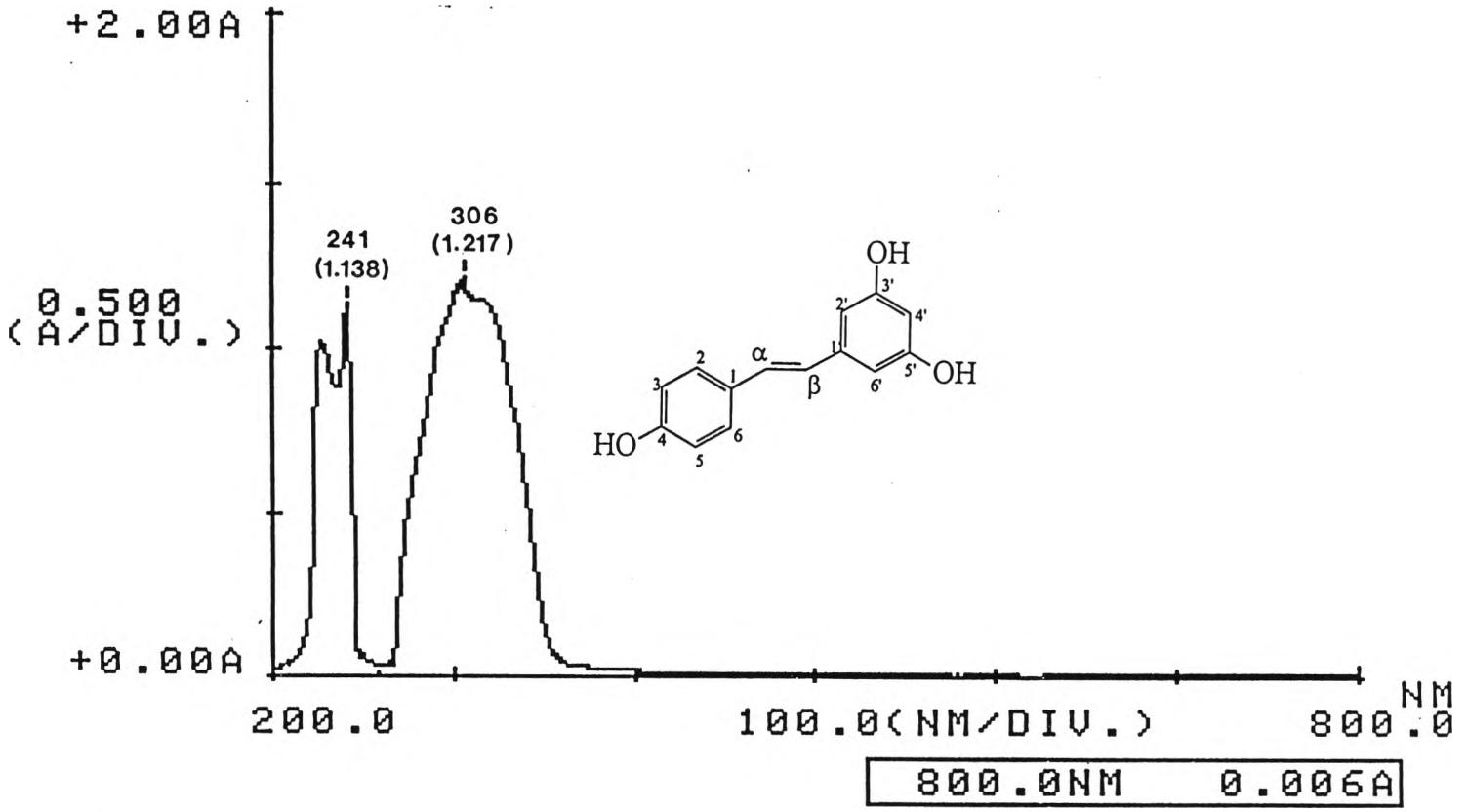


Figure 13 UV spectrum of compound AL2 (in methanol)

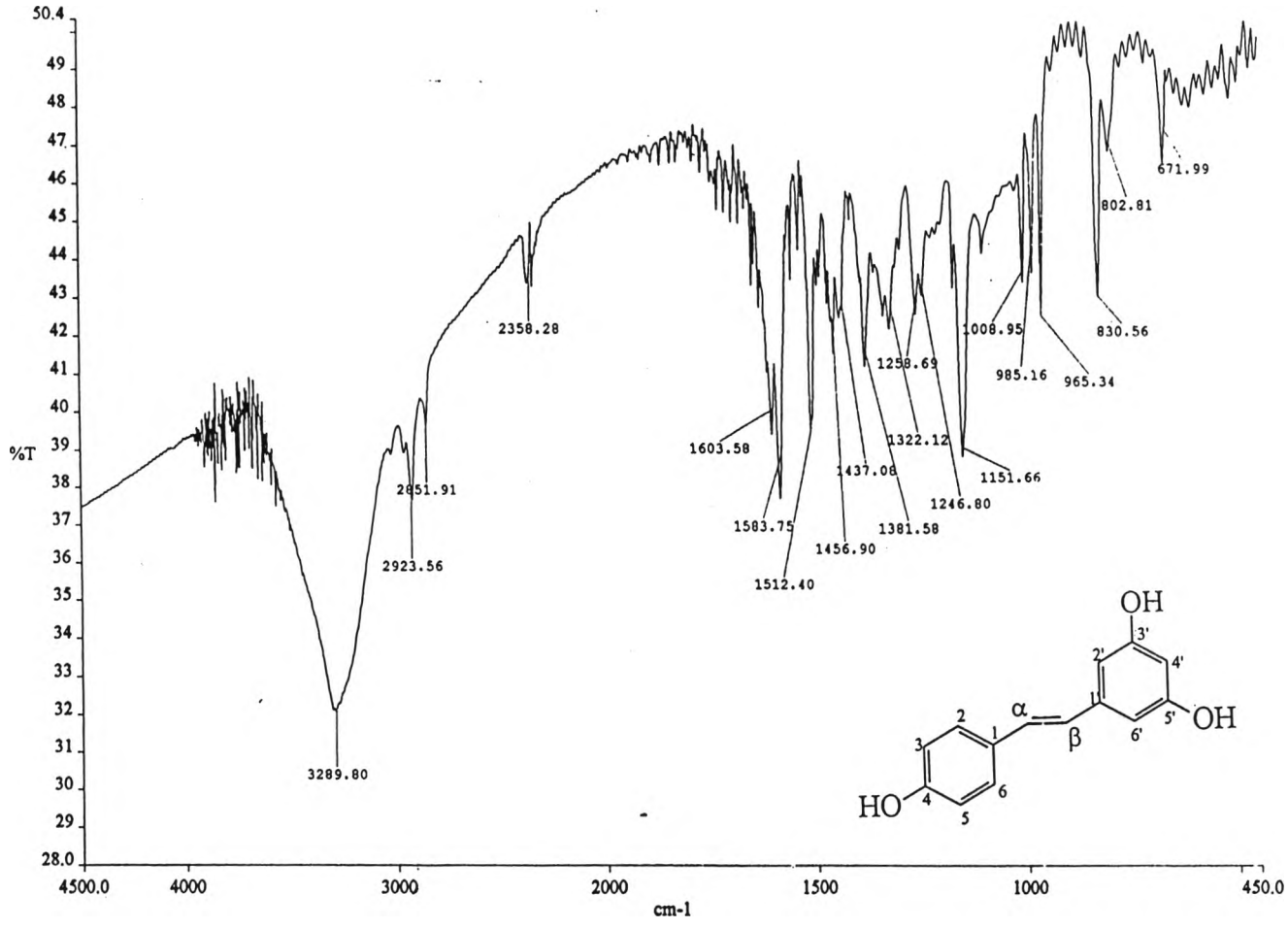


Figure 14 IR spectrum of compound AL2 (KBr disc)

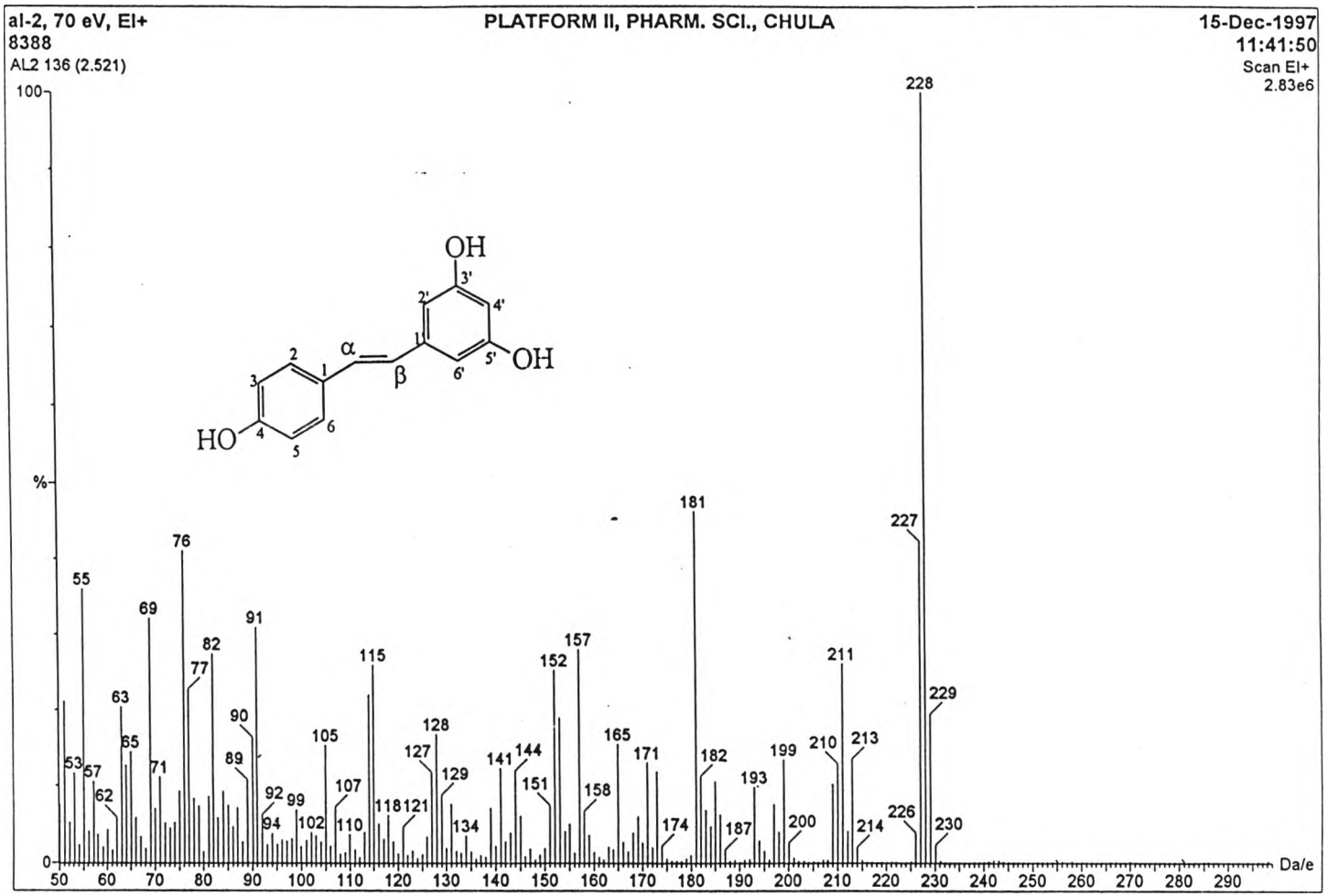


Figure 15 EI mass spectrum of compound AL2

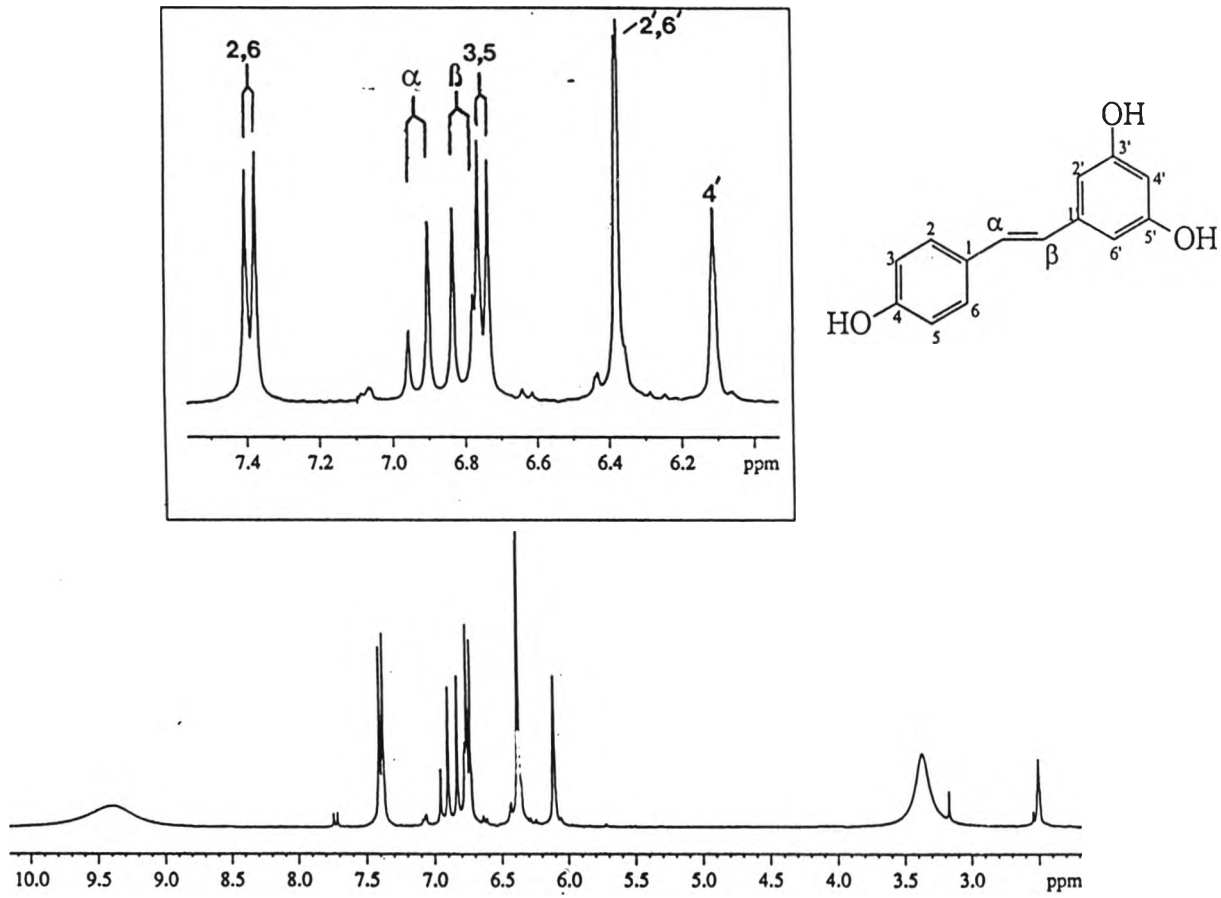


Figure 16 300 MHz ^{1}H NMR spectrum of compound AL2 (in DMSO-d_6)

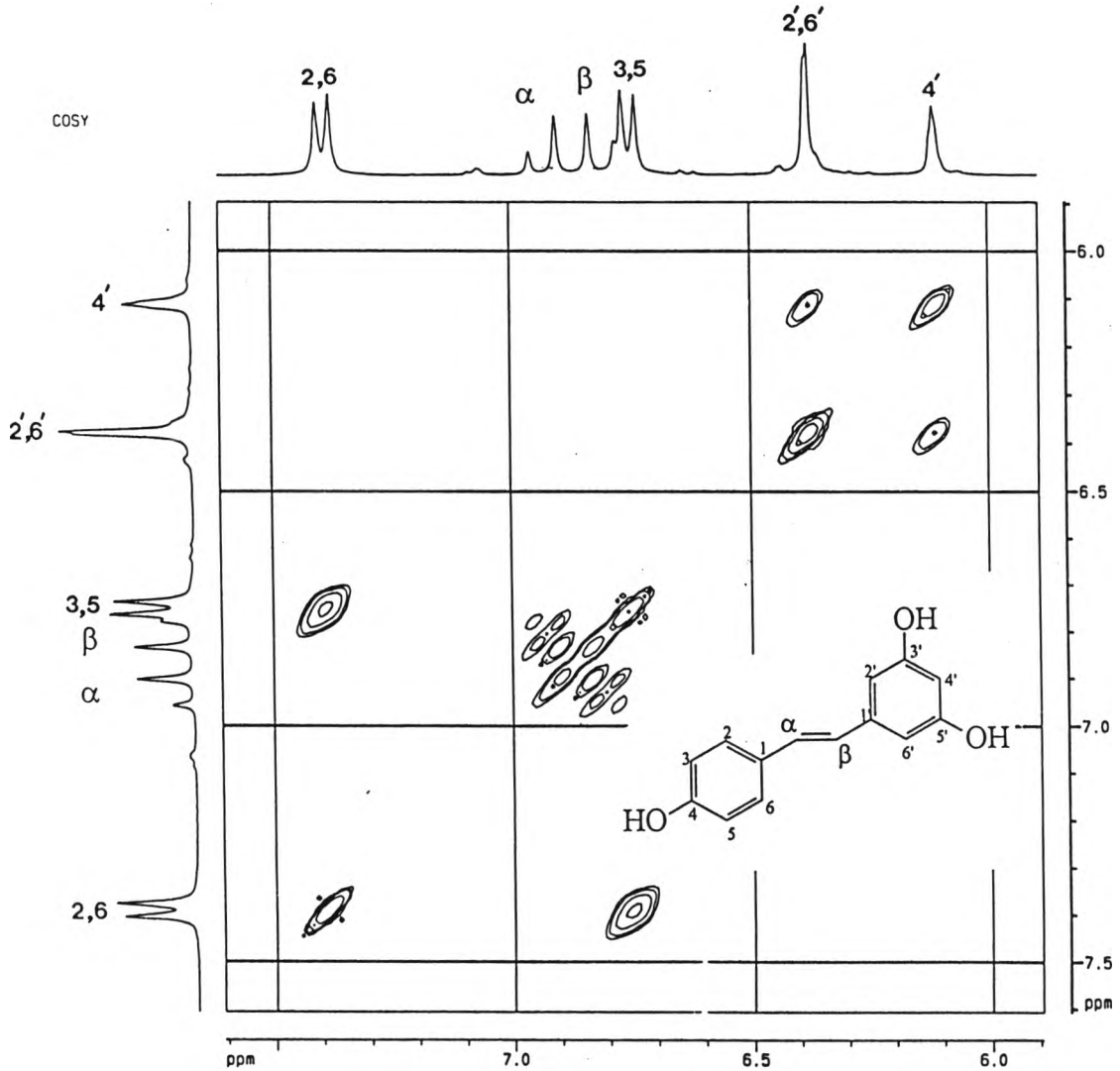


Figure 17 ^{1}H-^{1}H COSY spectrum of compound AL1 (in DMSO-d_6)

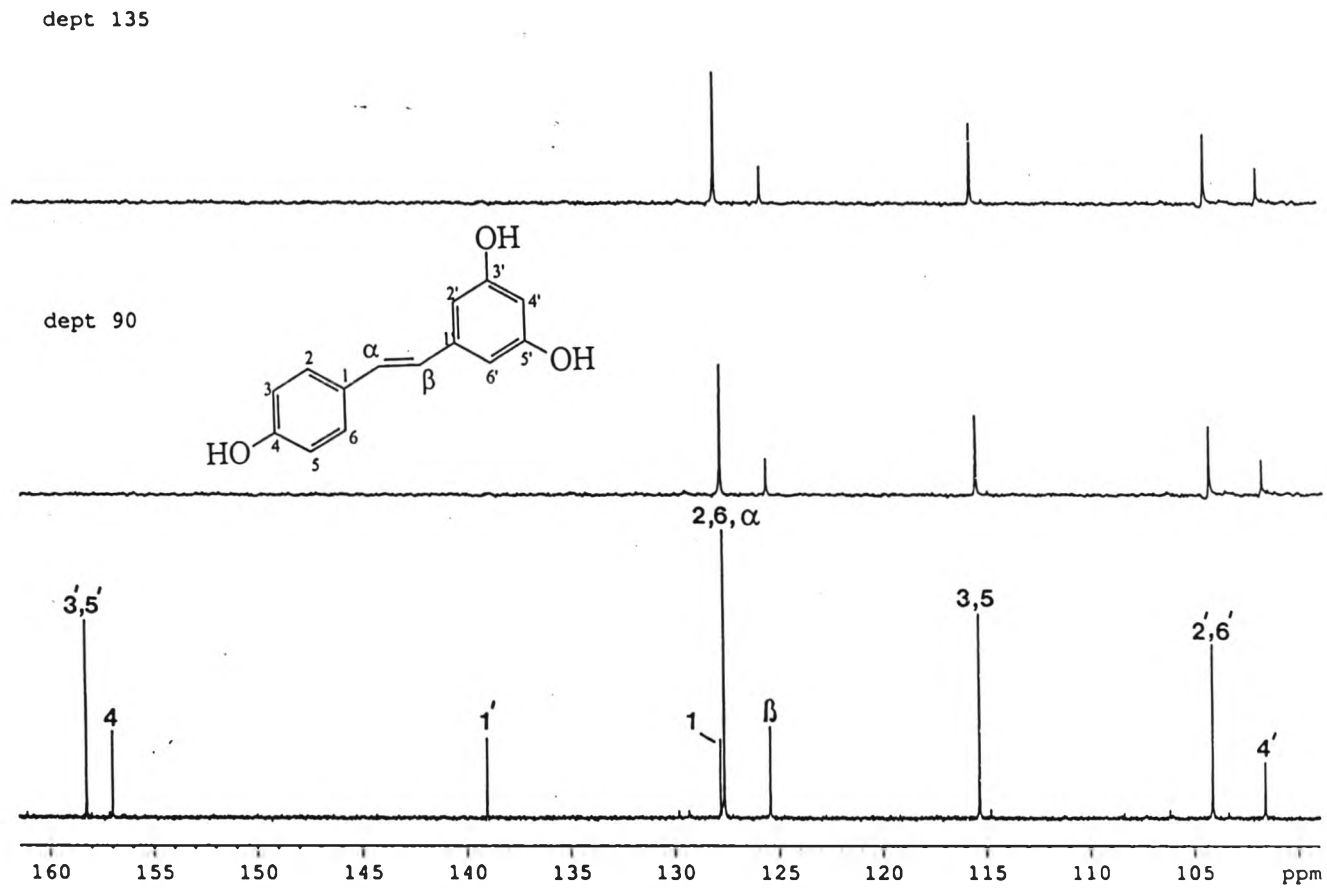


Figure 18 75 MHz ^{13}C NMR, DEPT 90 and DEPT 135 spectra of compound AL2 (in DMSO-d_6)

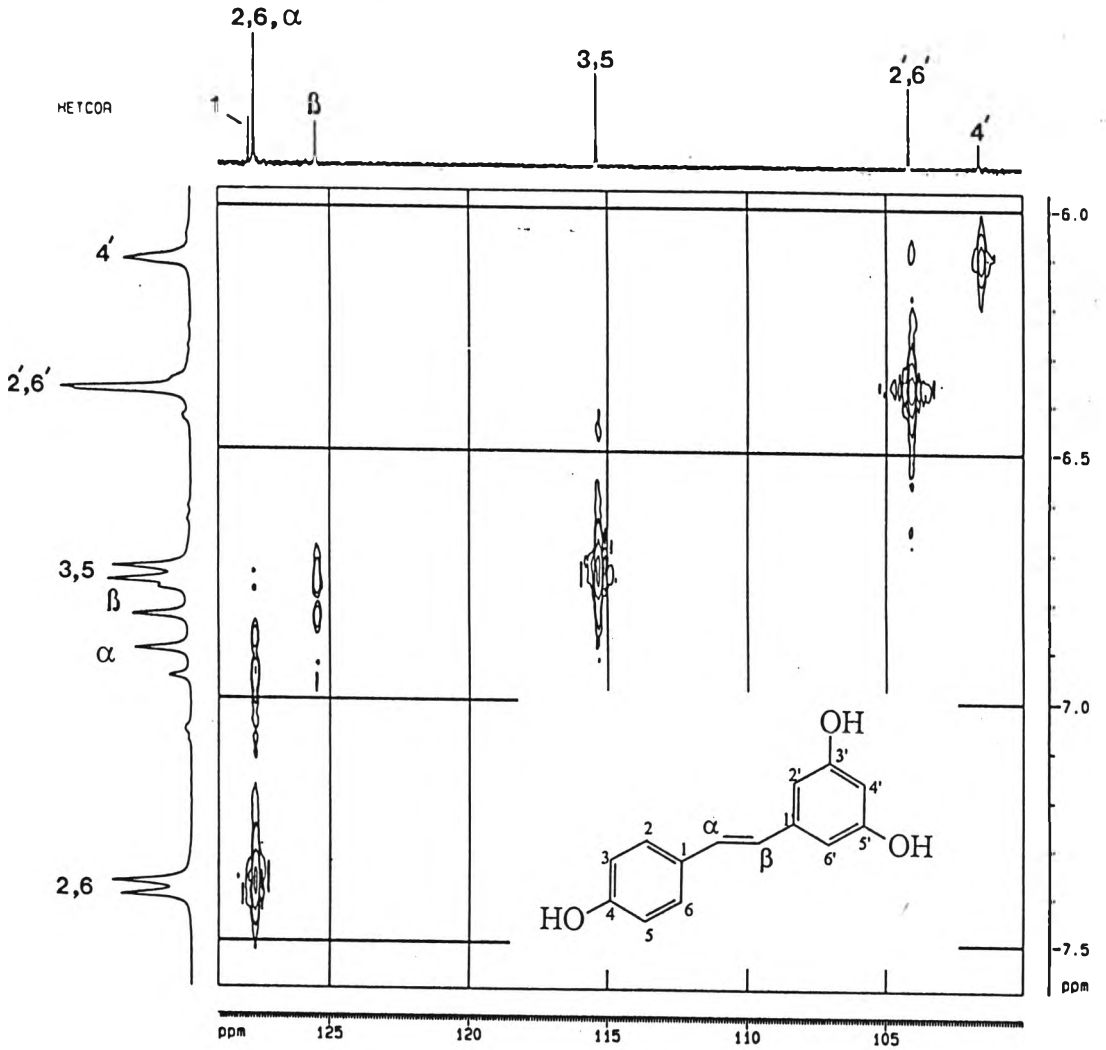


Figure 19 HETCOR spectrum of compound AL2 (in DMSO-d_6)

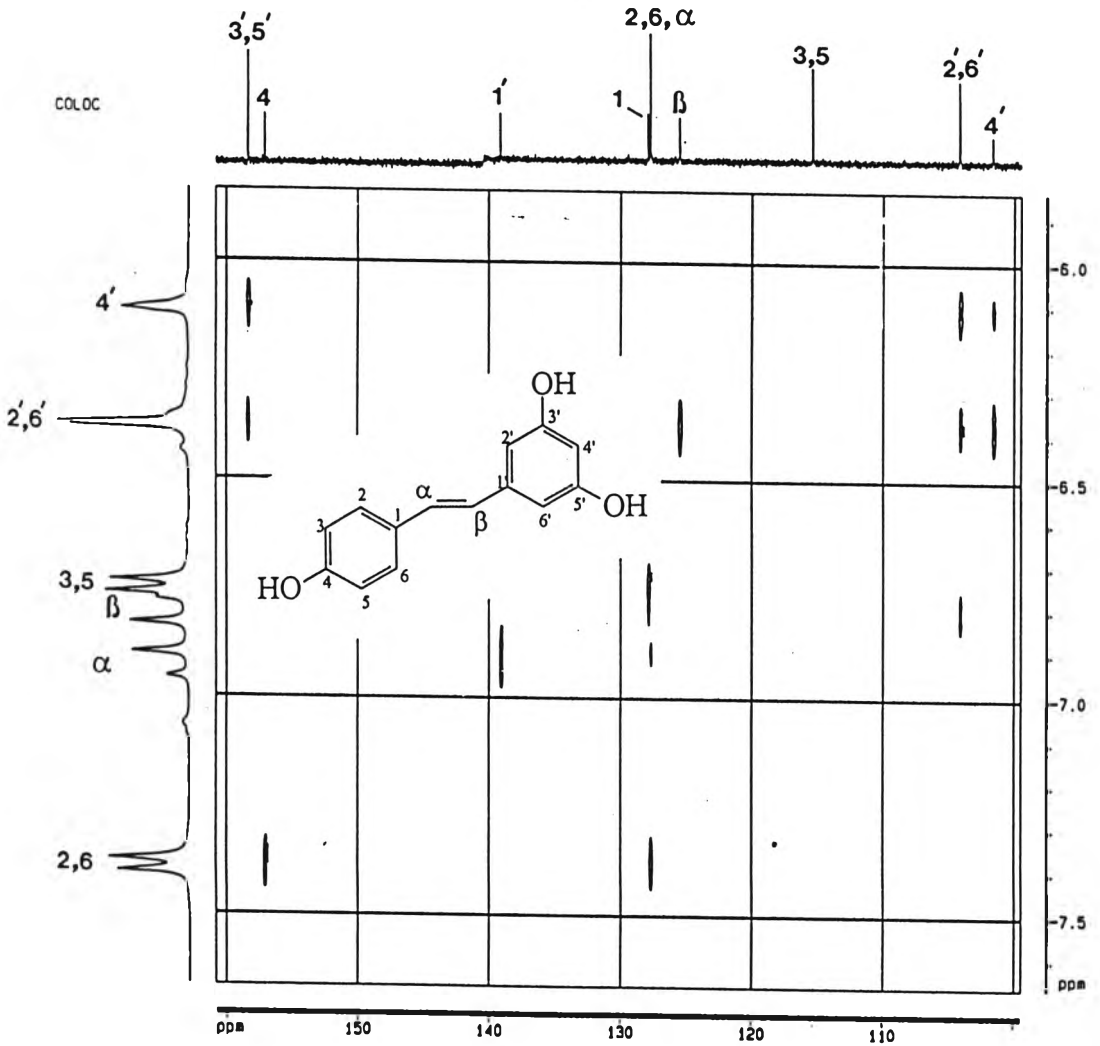


Figure 20 COLOC spectrum of compound AL2 (in DMSO-d_6)

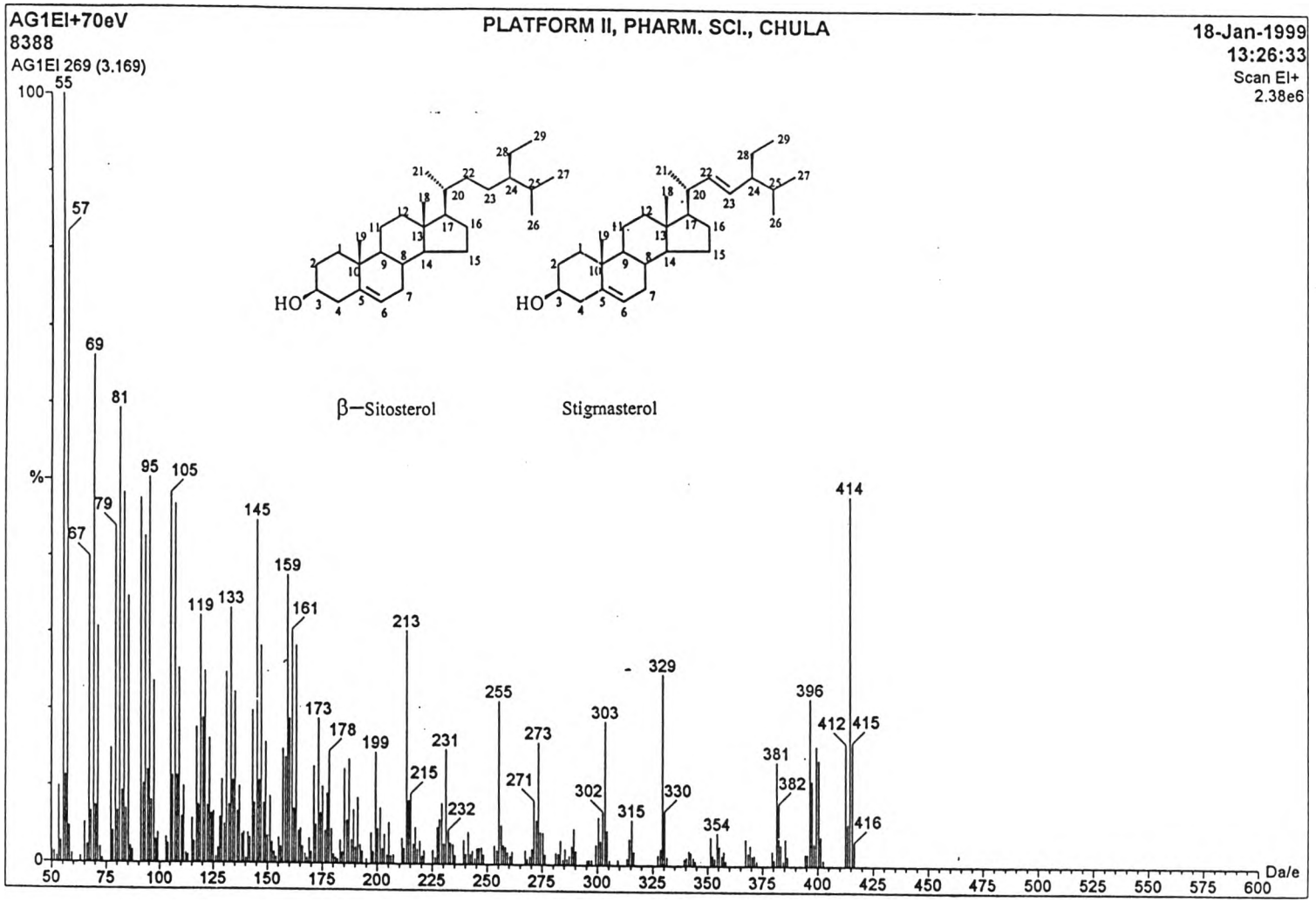


Figure 21 EI mass spectrum of compound AG1

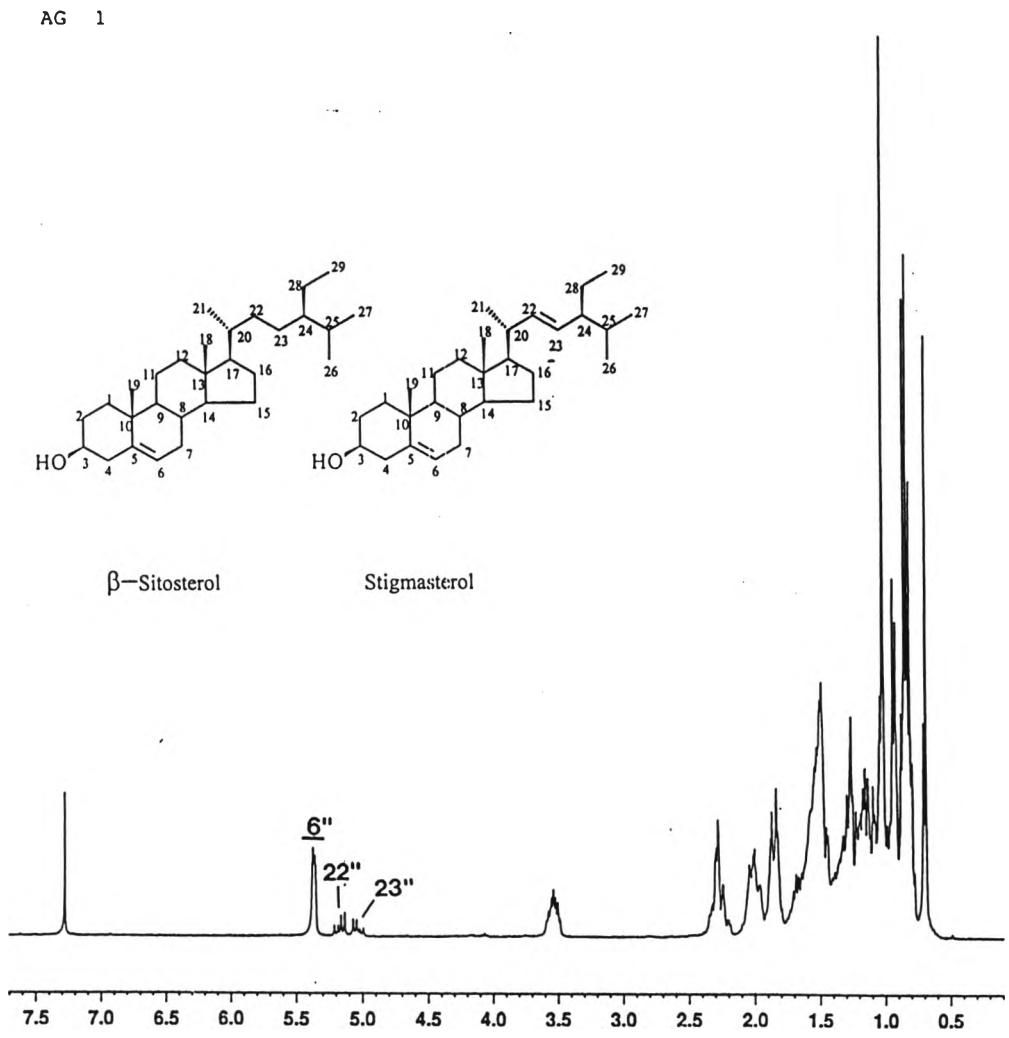


Figure 22a 300 MHz ^{1}H NMR spectrum of compound AG1 (in $CDCl_3$)

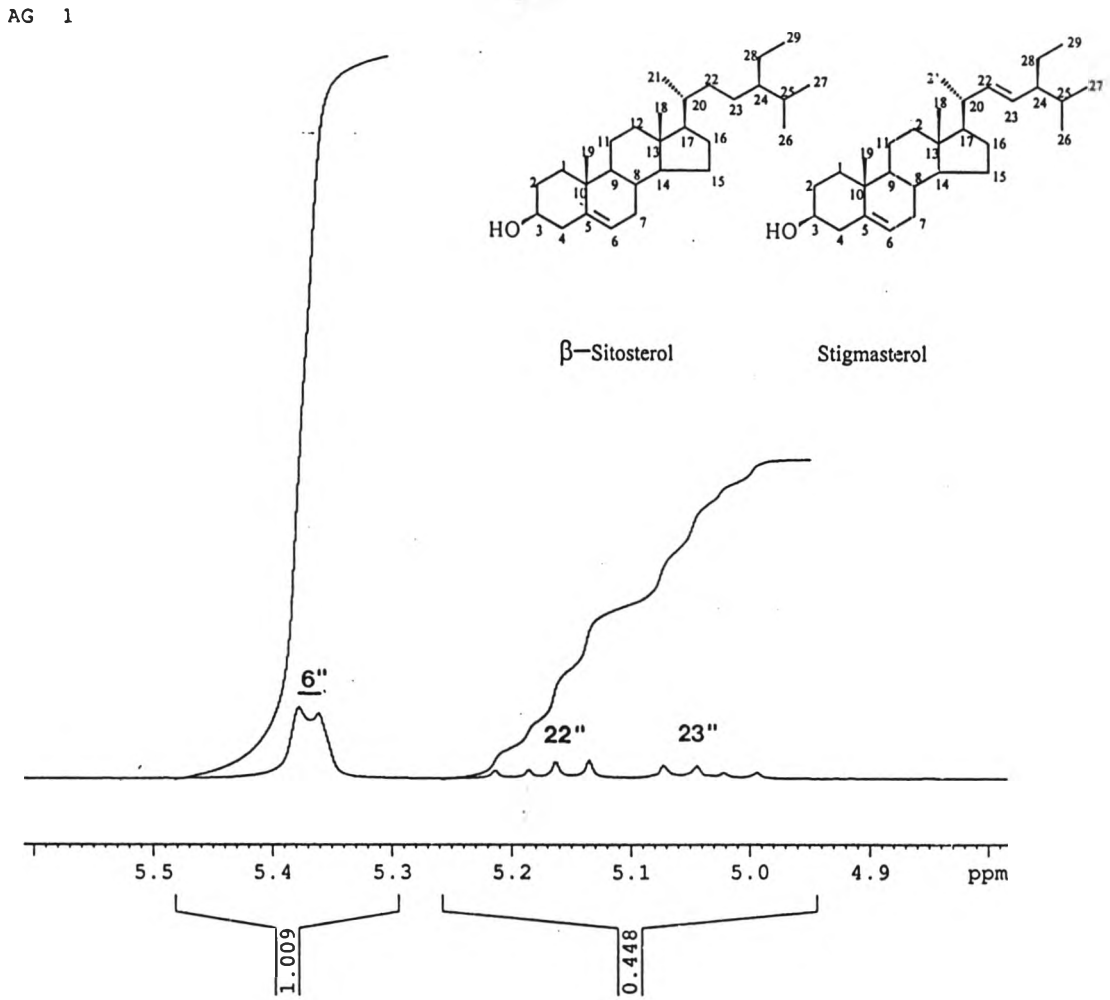


Figure 22b 300 MHz ^{1}H NMR spectrum of compound AG1 (in $CDCl_3$) (expanded from 4.8 to 5.6 ppm)

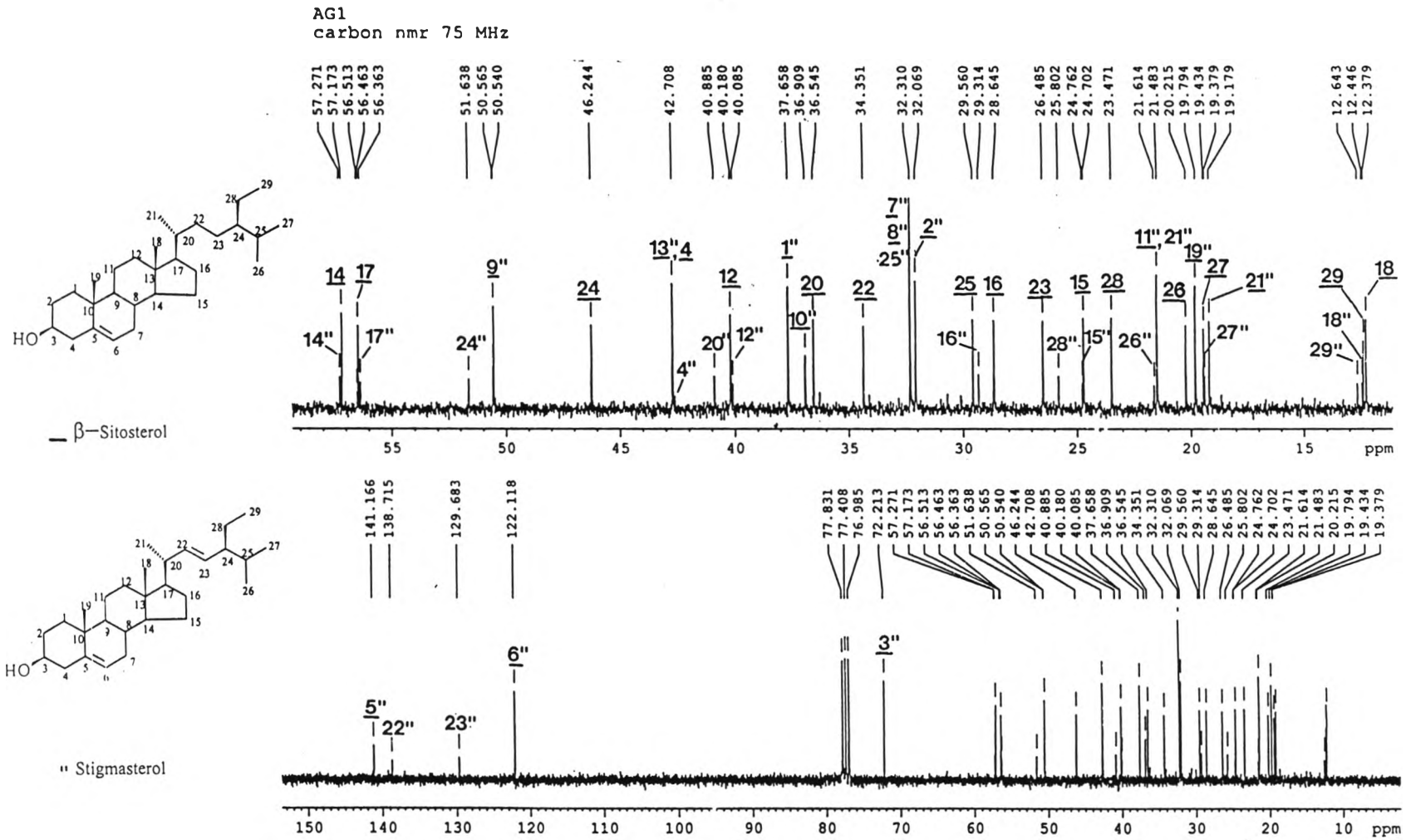


Figure 23 75 MHz ^{13}C NMR spectrum of compound AG1 (in $CDCl_3$)

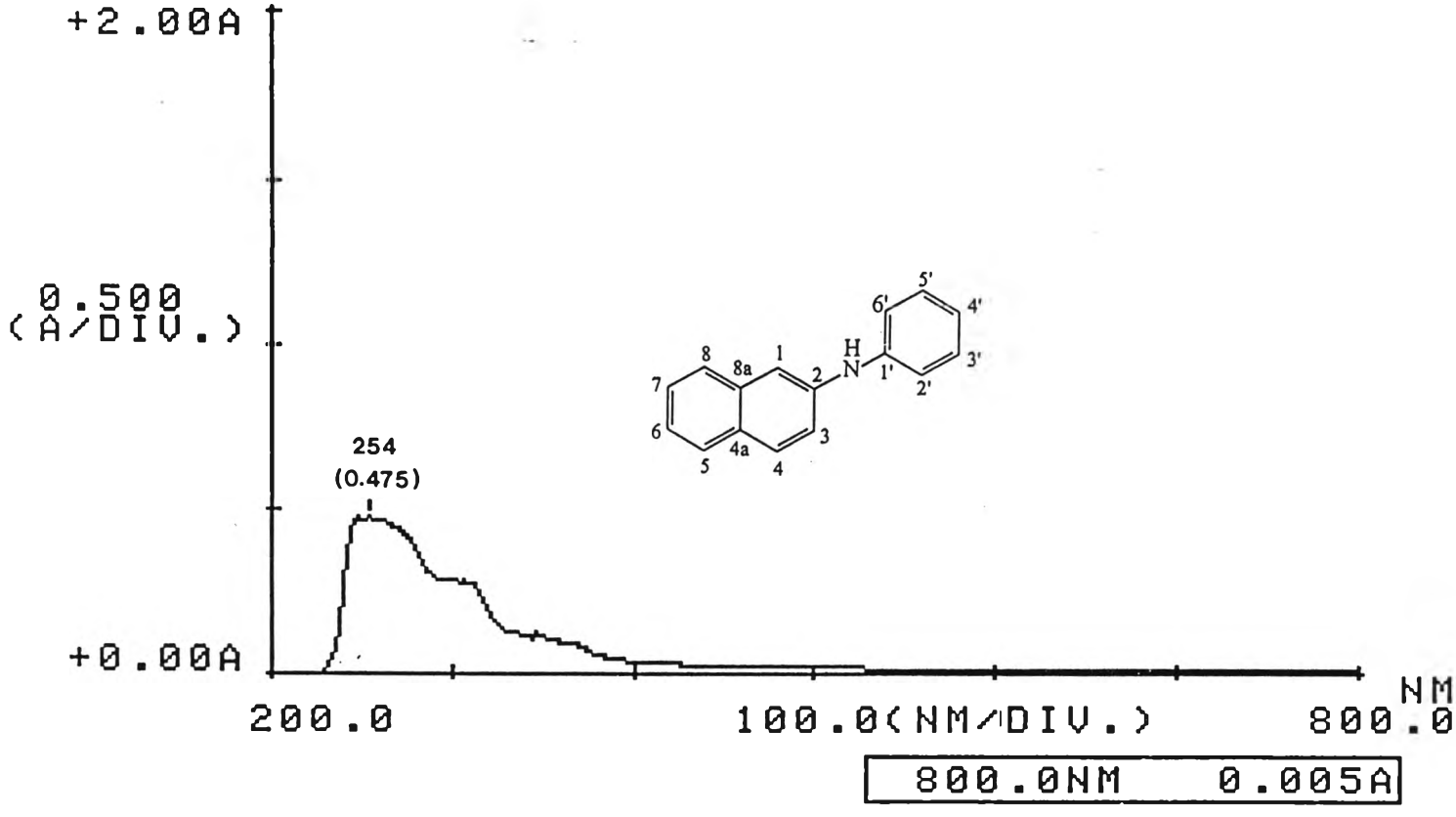


Figure 24 UV spectrum of compound AG2 (in $CHCl_3$)

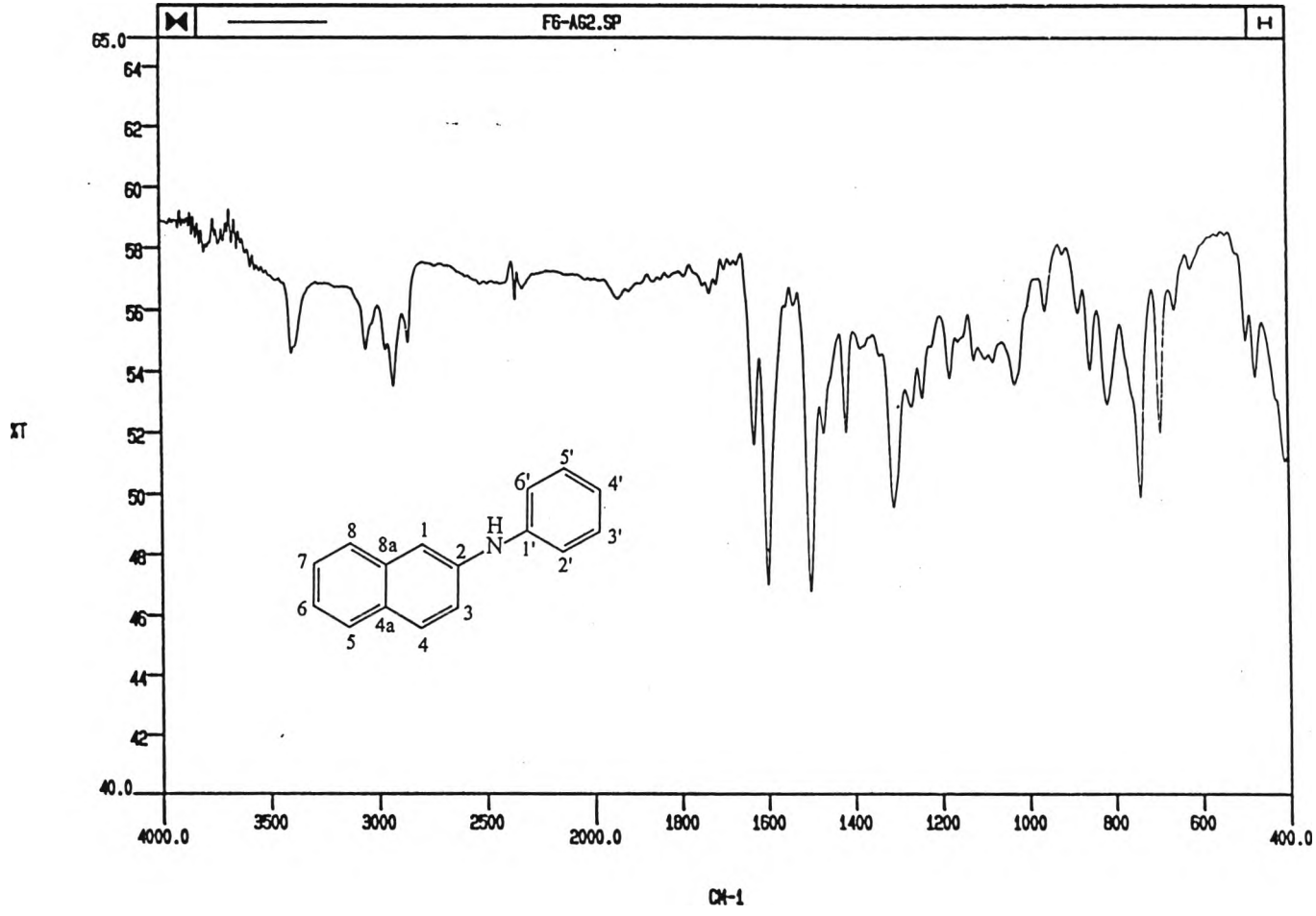


Figure 25 IR spectrum of compound AG2 (Film)

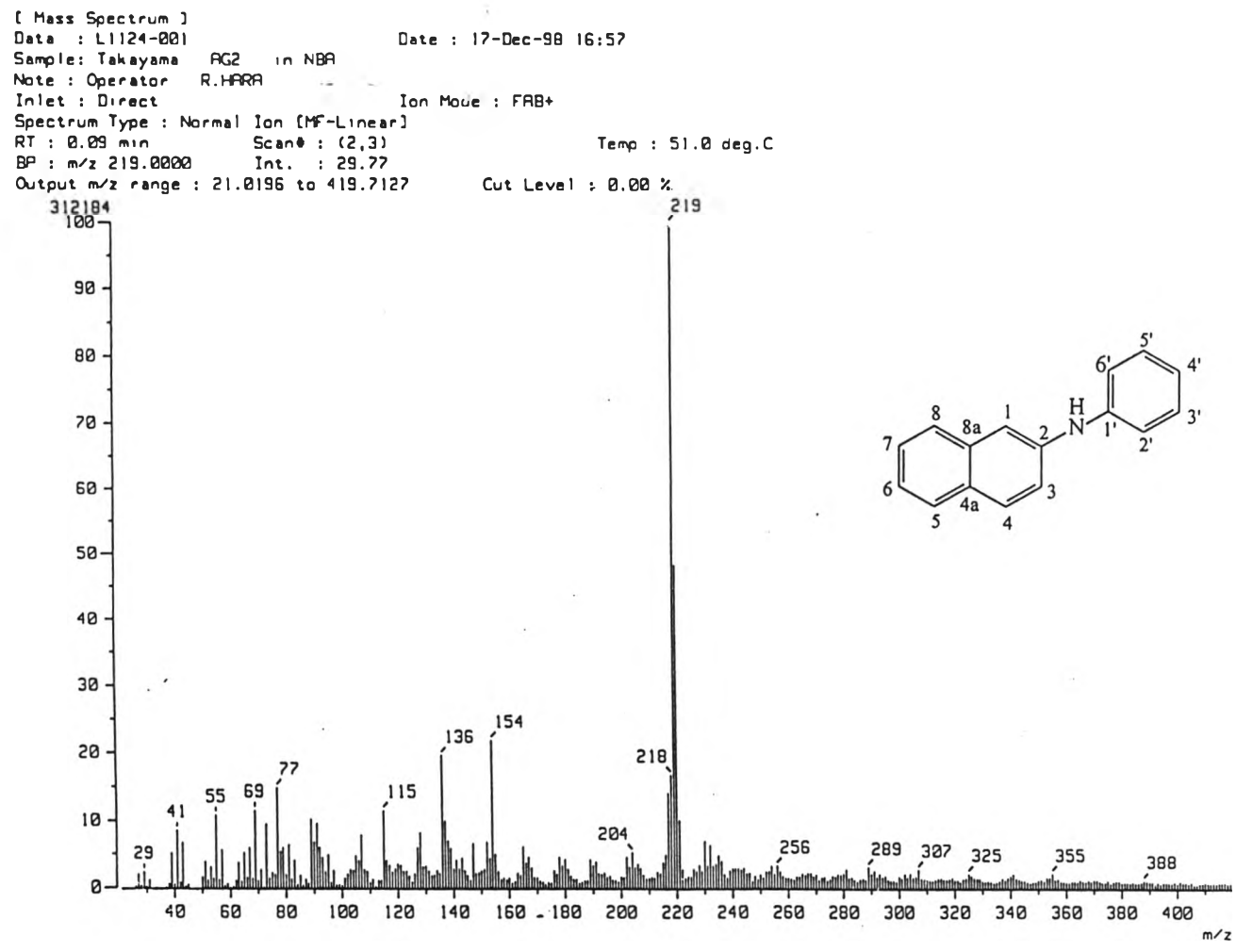


Figure 26 HRMS spectrum of compound AG2

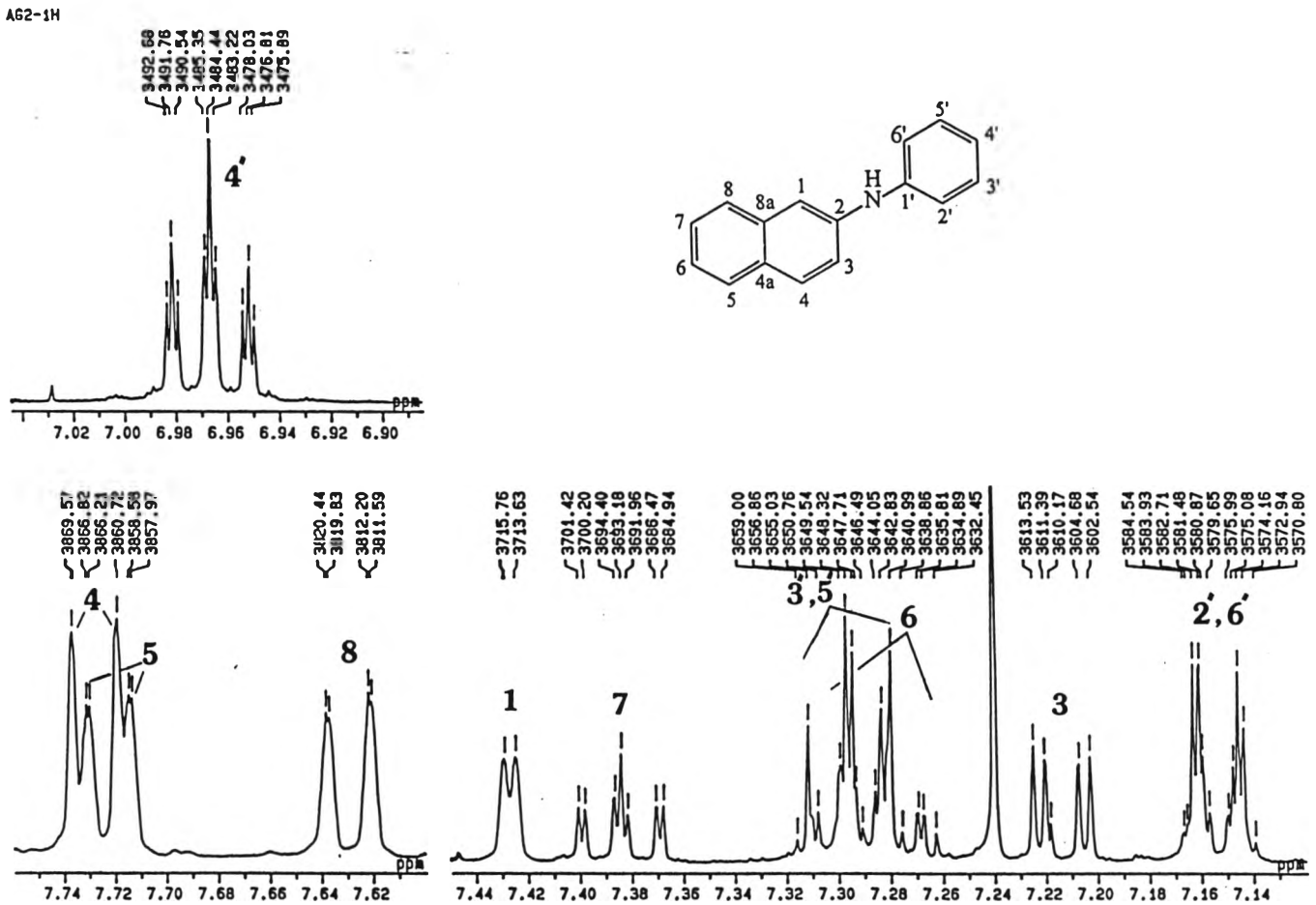


Figure 27 500 MHz ^{1}H NMR spectrum of compound AG2 (in $CDCl_3$)

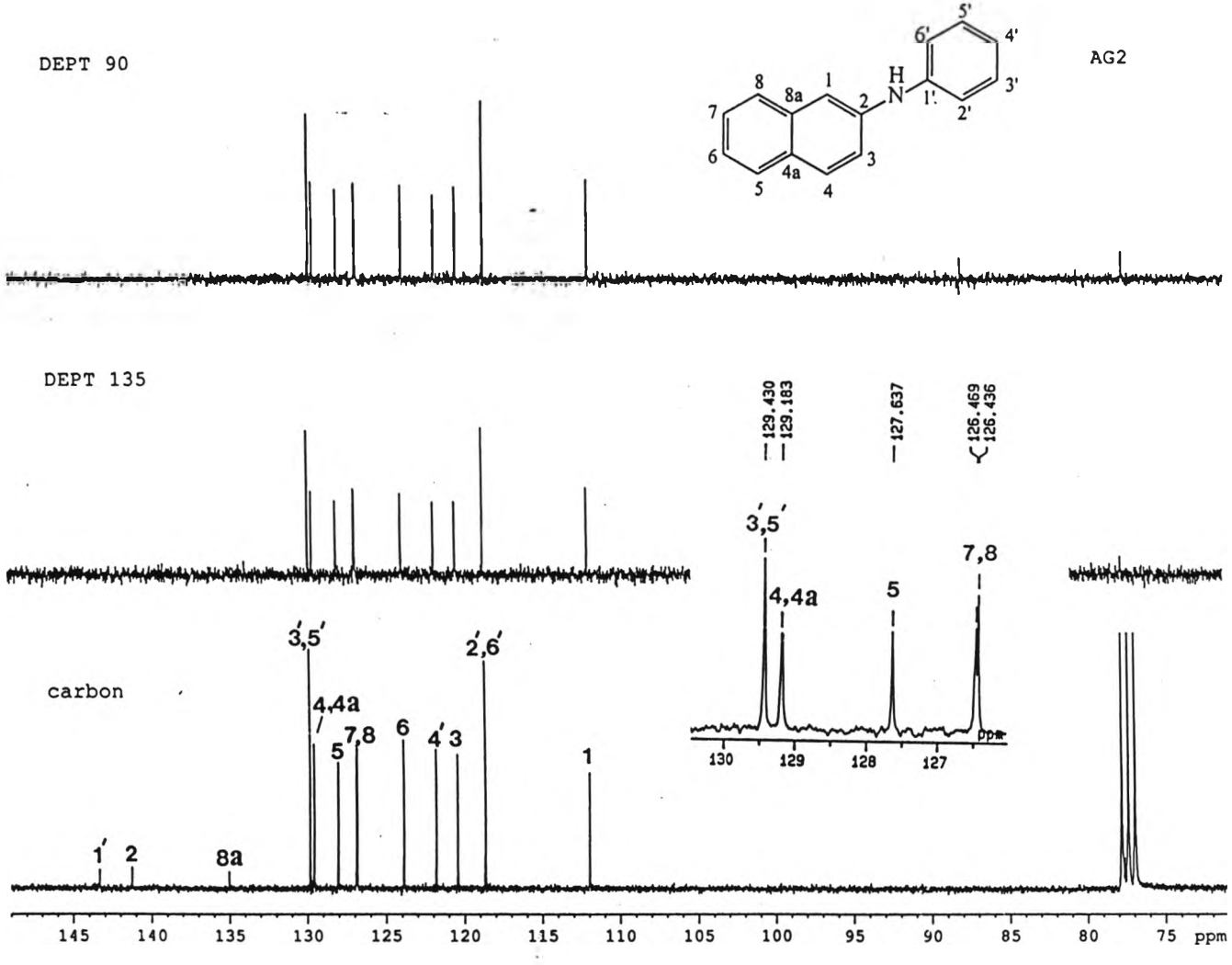


Figure 28 75 MHz ^{13}C NMR, DEPT 90 and DEPT 135 spectra of compound AG2 (in $CDCl_3$)

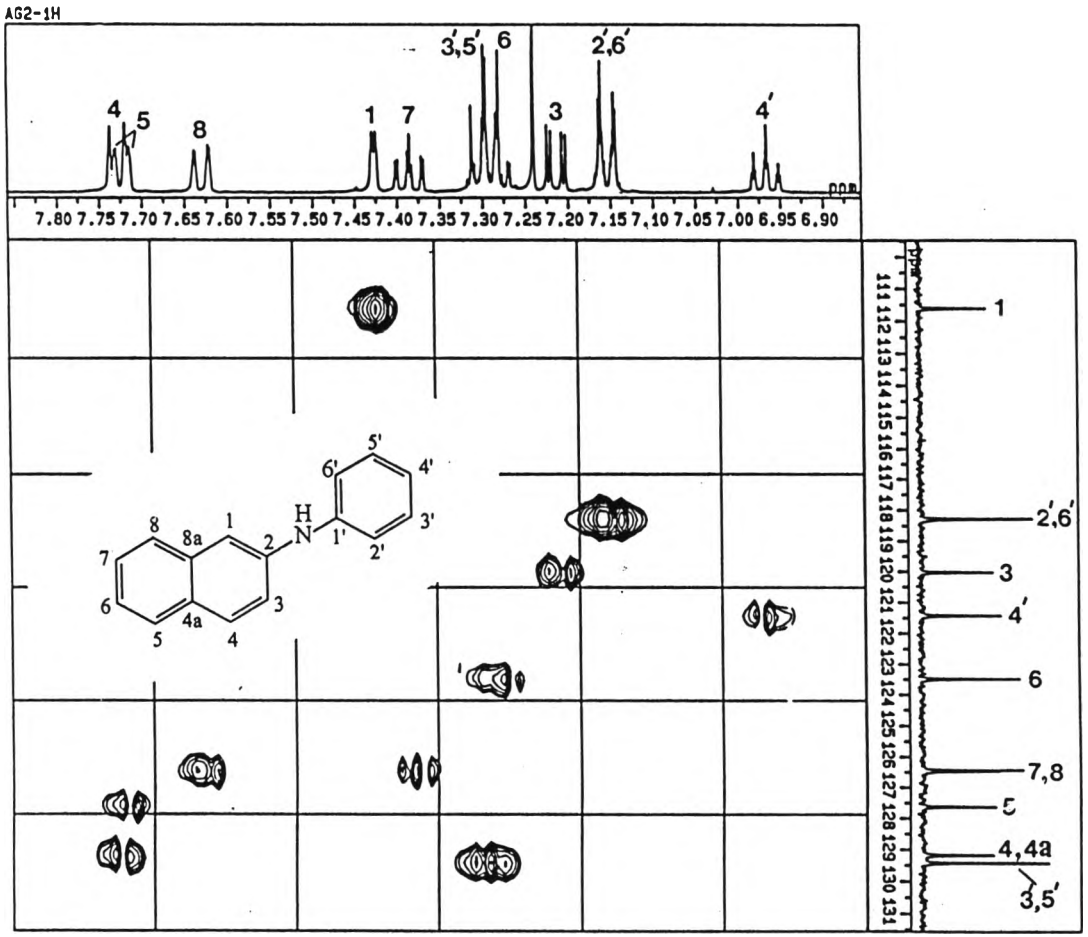
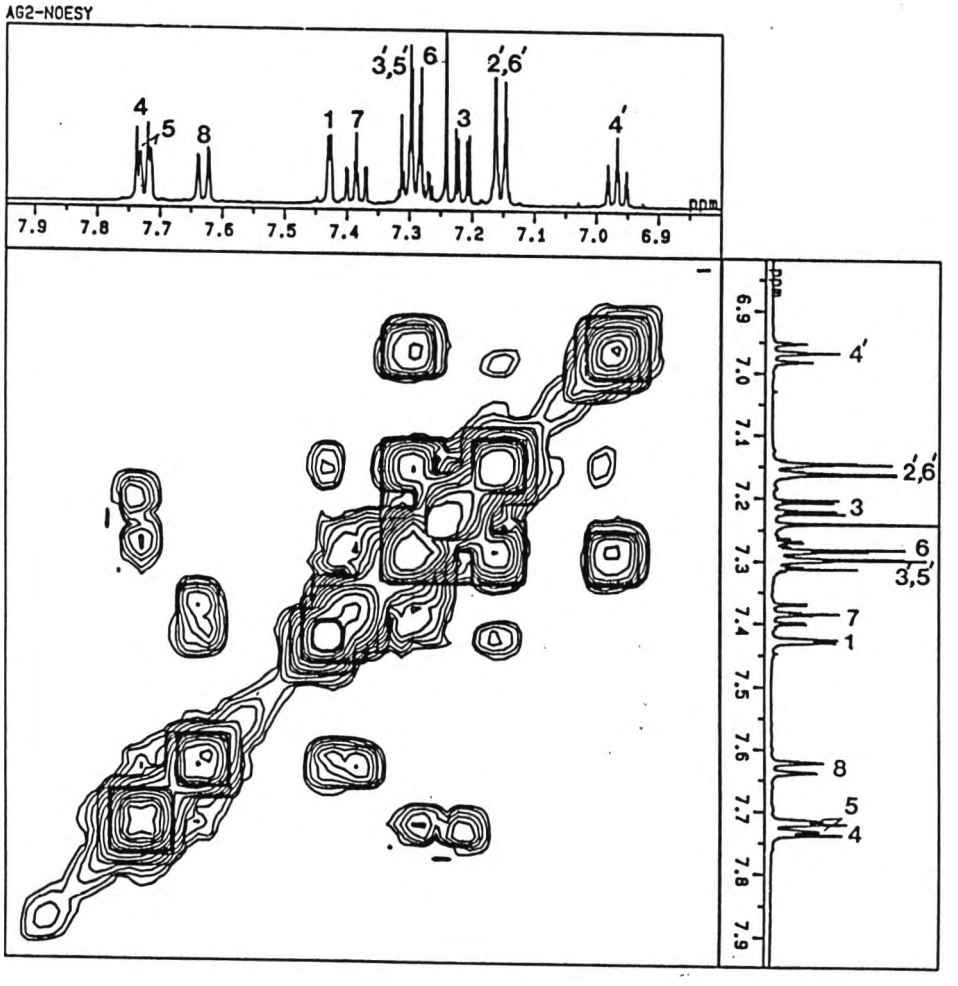


Figure 29 HMQC spectrum of compound AG2 (in $CDCl_3$)



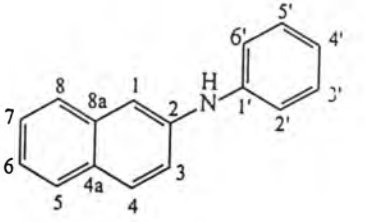


Figure 30 NOESY spectrum of compound AG2 (in $CDCl_3$)

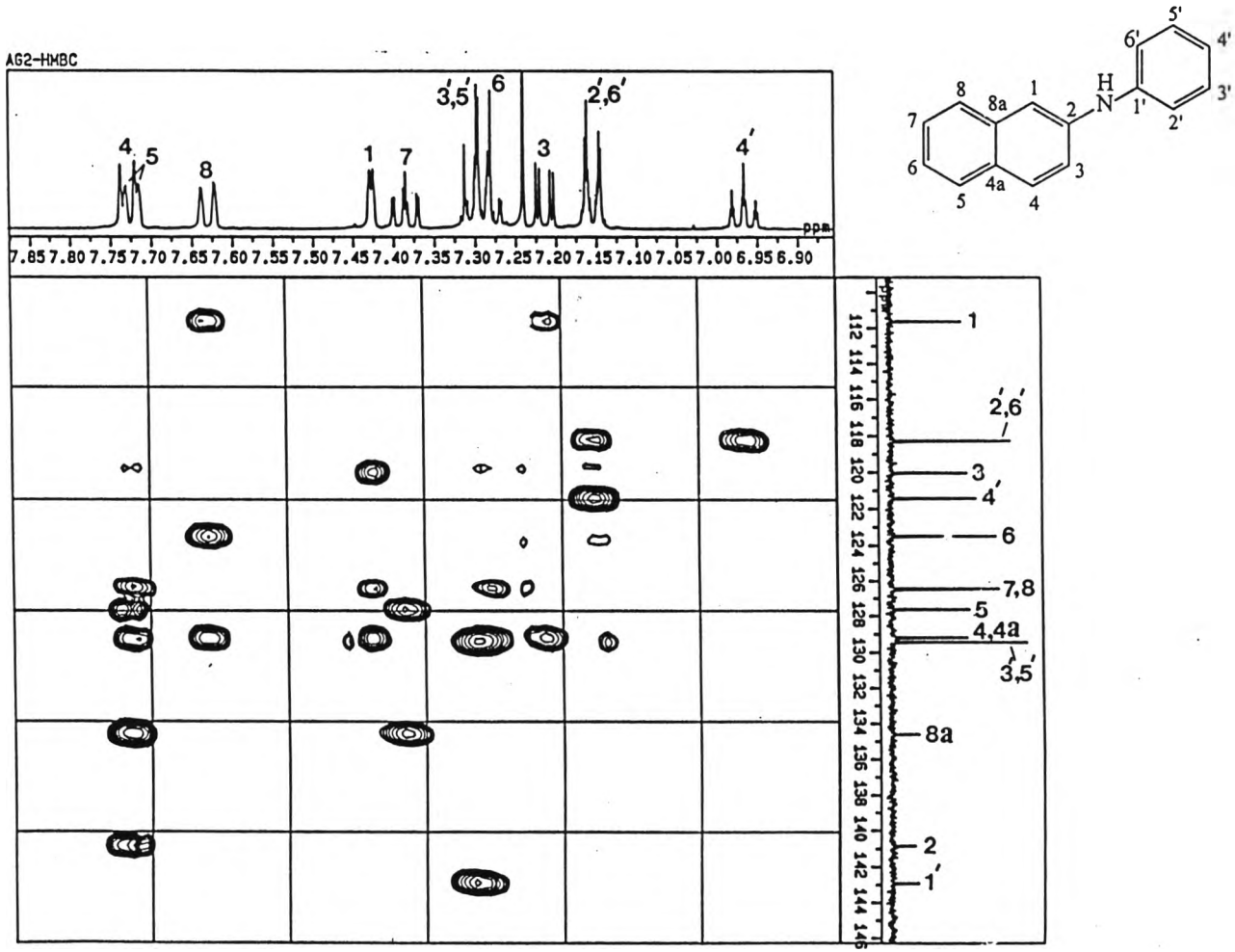


Figure 31 HMBC spectrum of compound AG2 (in $CDCl_3$)

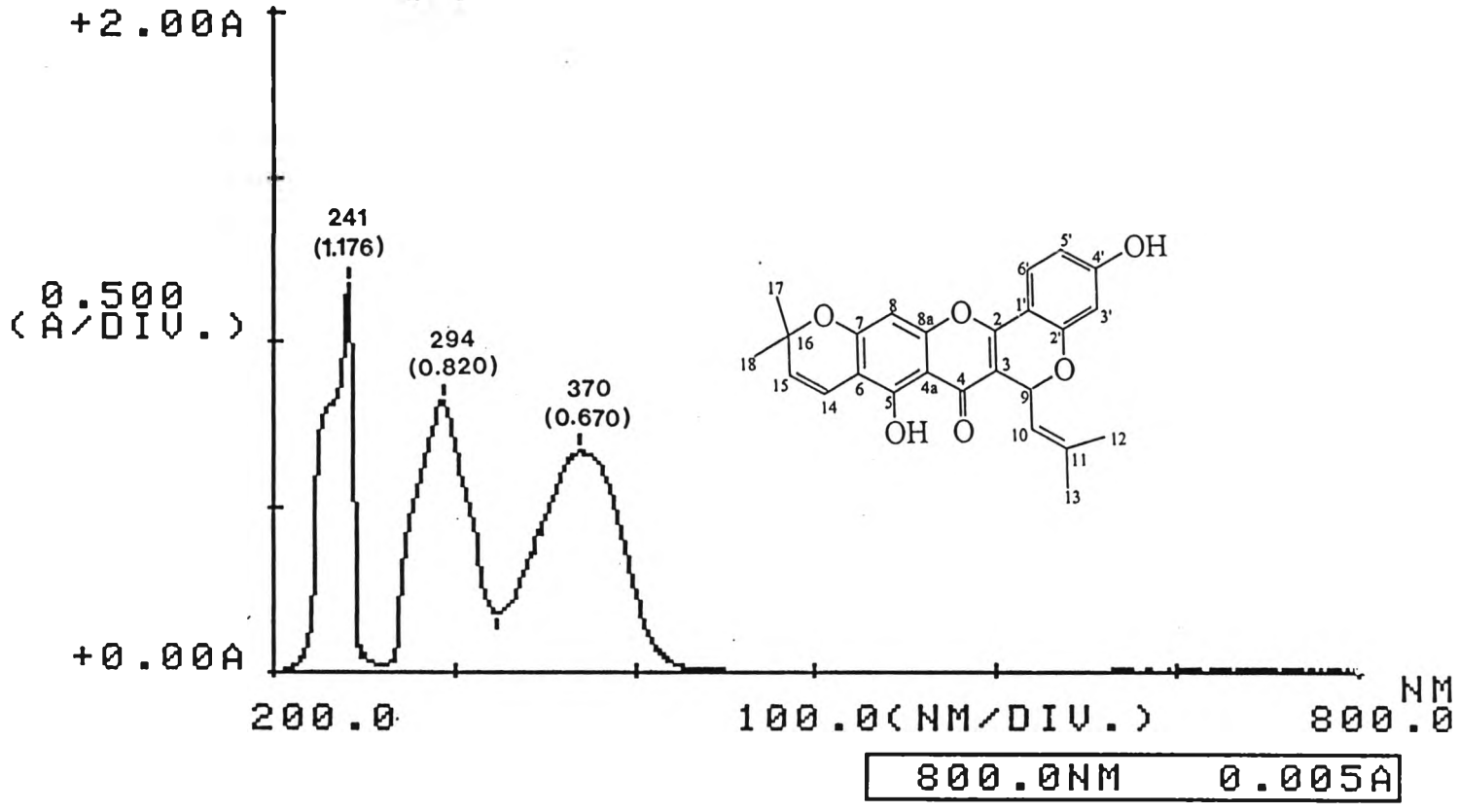


Figure 32 UV spectrum of compound AG3 (in methanol)

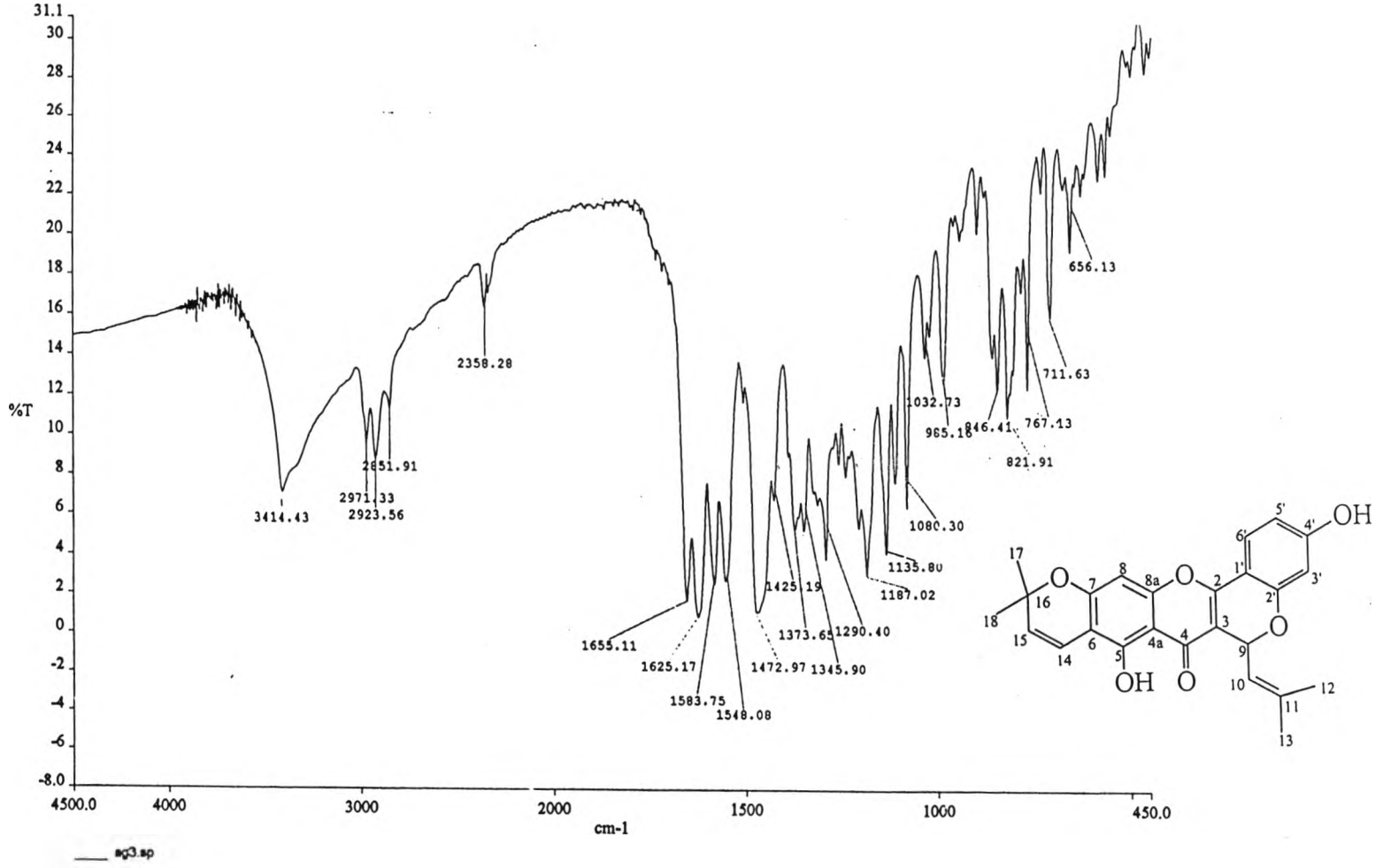


Figure 33 IR spectrum of compound AG3 (KBr disc)

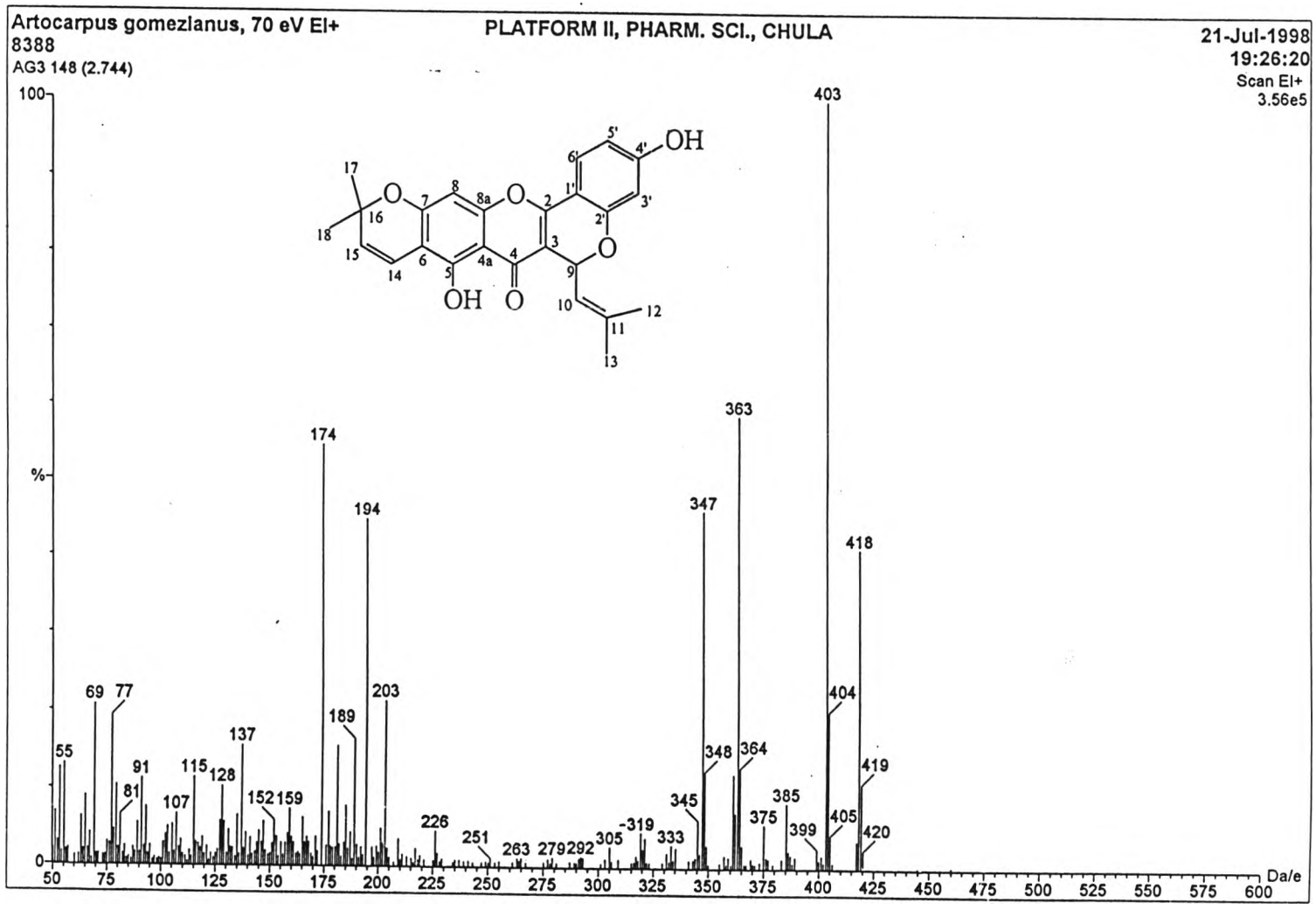


Figure 34 EI mass spectrum of compound AG3

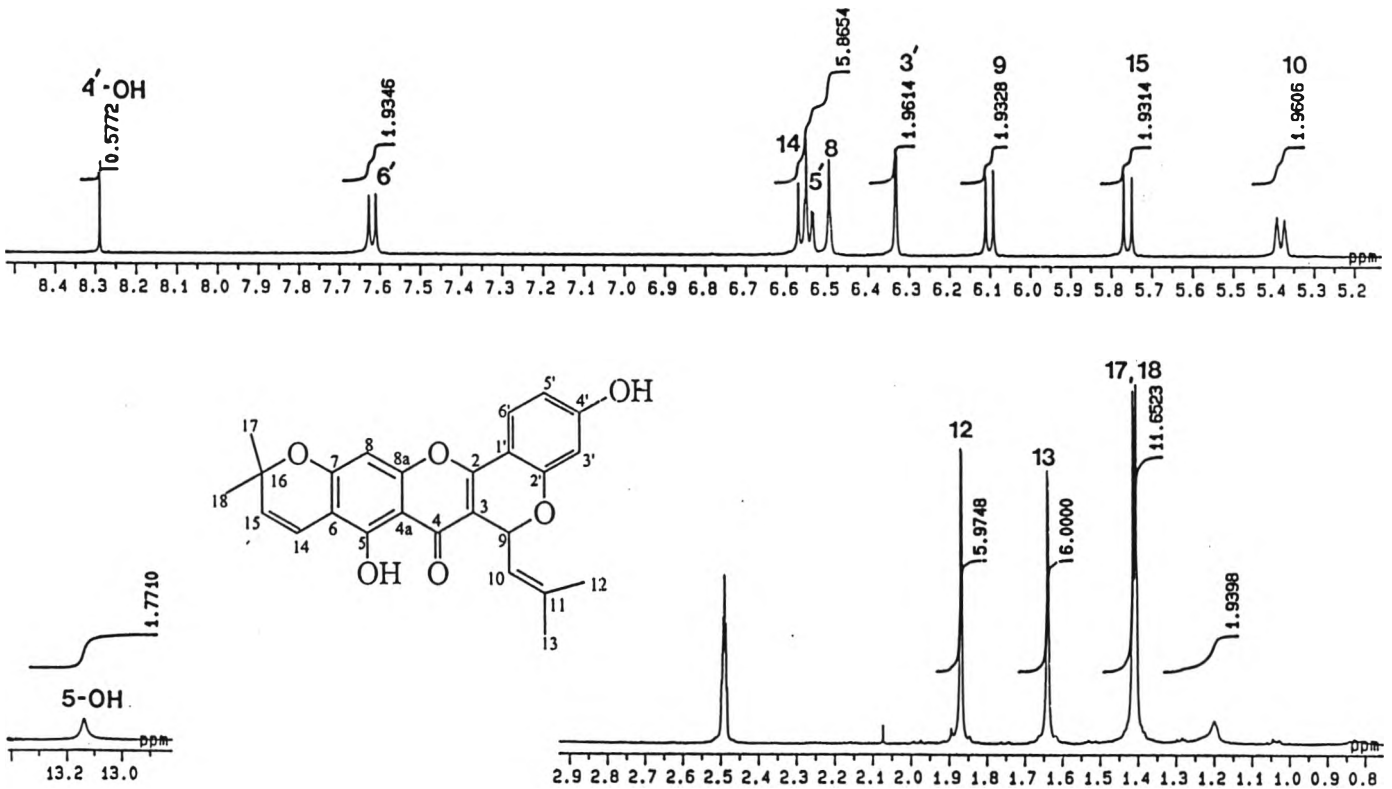


Figure 35 500 MHz ^{1}H NMR spectrum of compound AG3 (in DMSO-d_6)

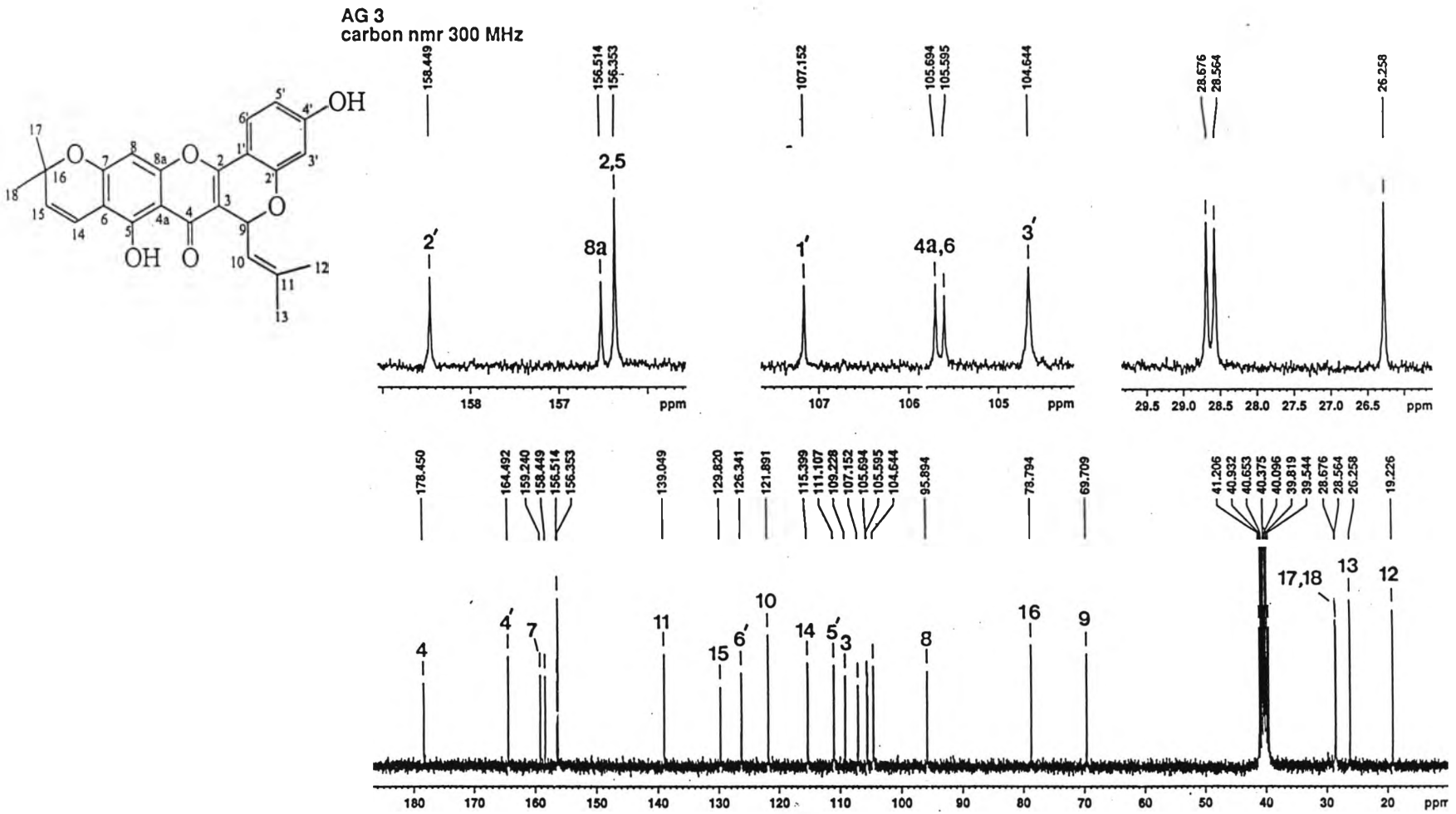


Figure 36 75 MHz ^{13}C NMR spectrum of compound AG3 (in DMSO-d_6)

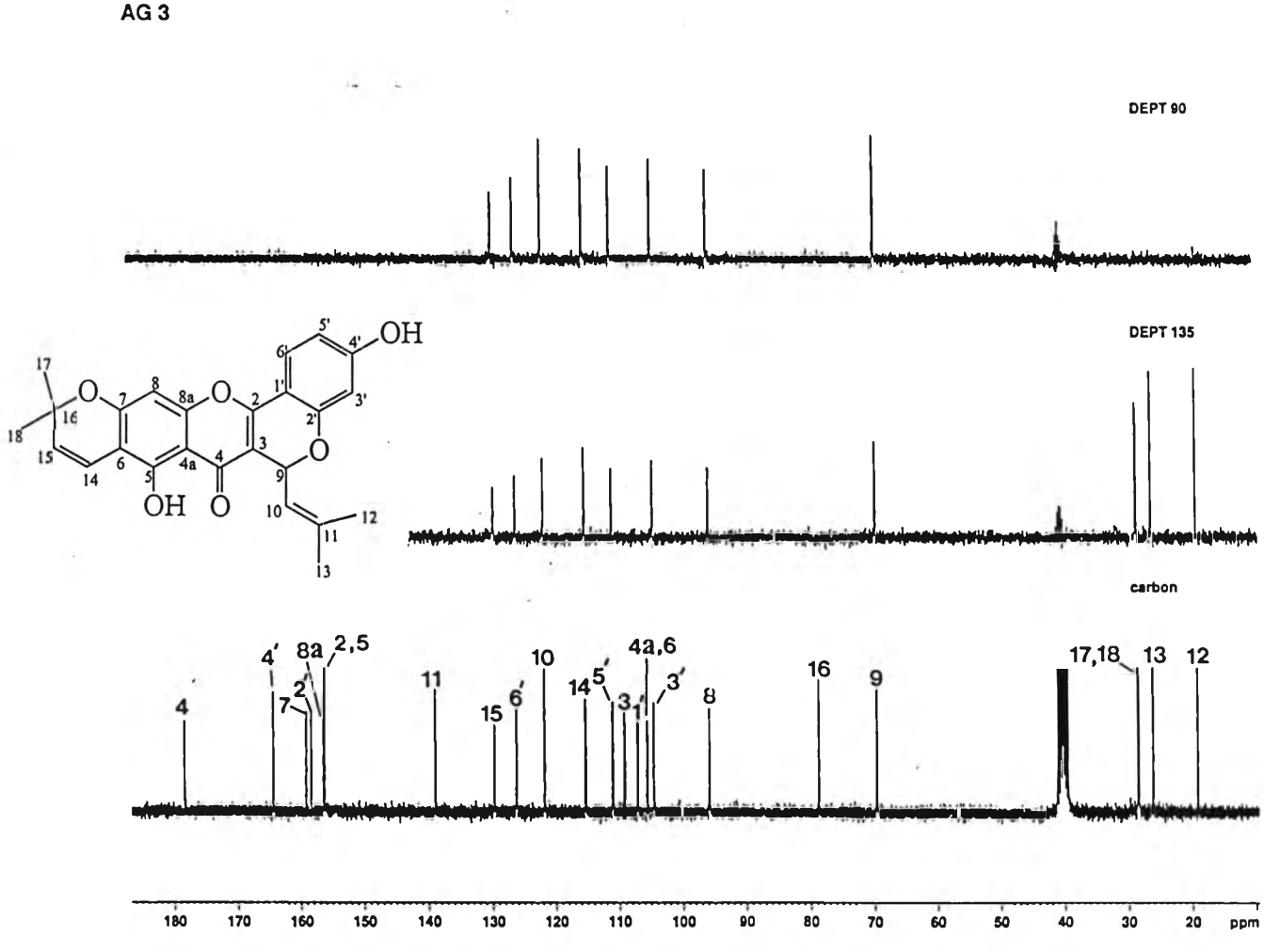


Figure 37 DEPT 90 and DEPT 135 spectra of compound AG3 (in DMSO-d_6)

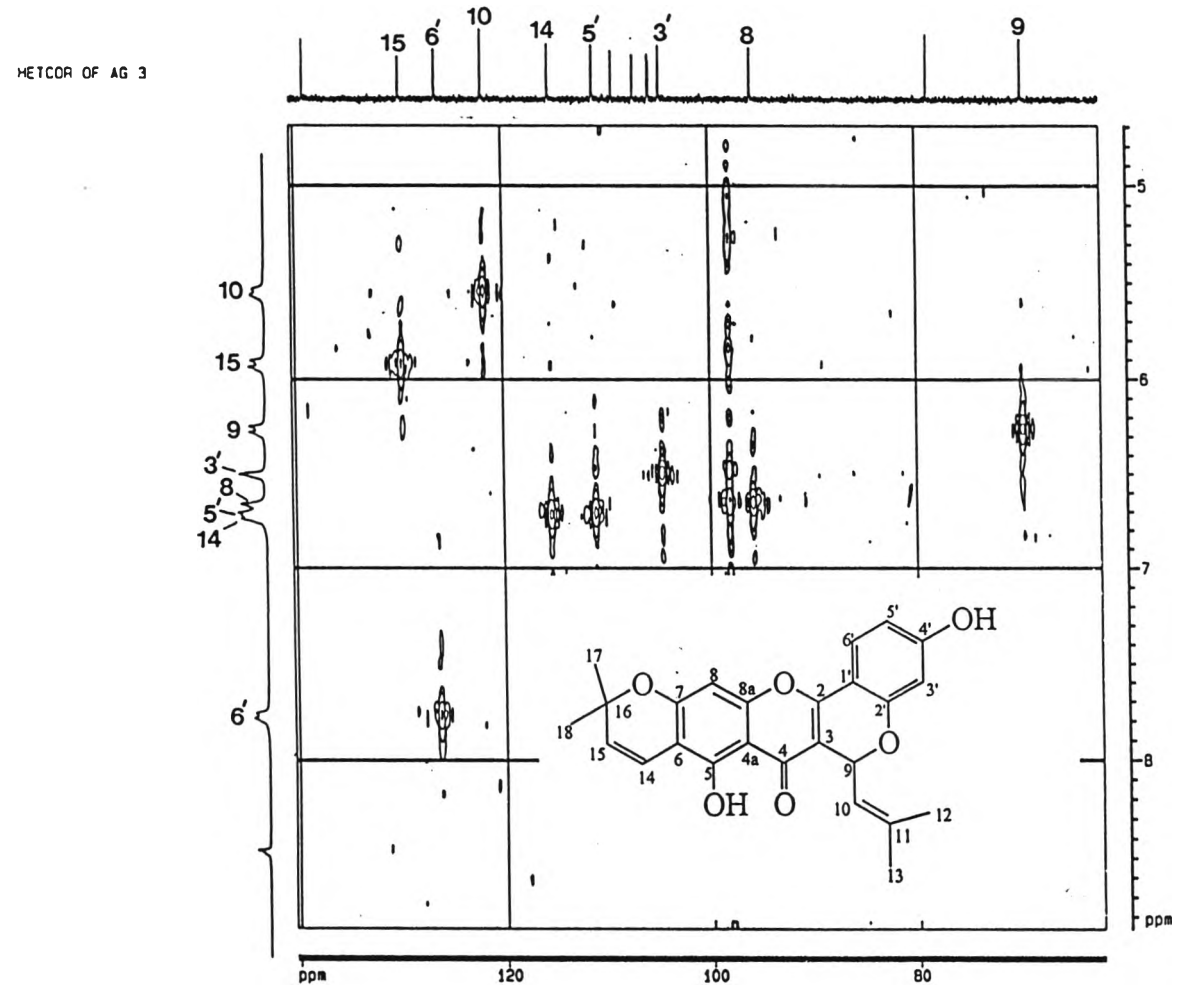


Figure 38a HETCOR spectrum of compound AG3 (in DMSO-d_6) [δ_H 4.7-8.9 ppm, δ_C 70-130 ppm]

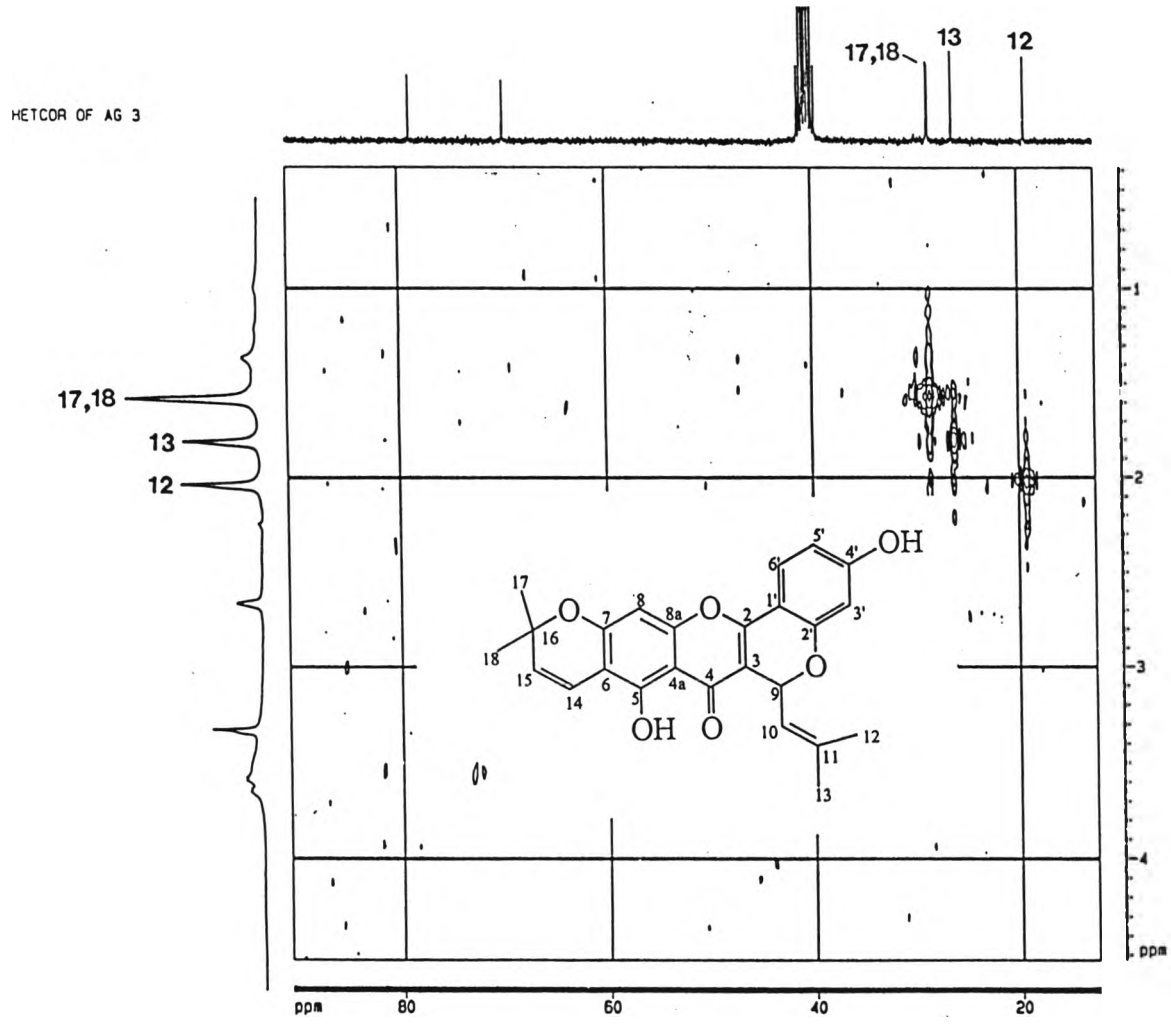


Figure 38b HETCOR spectrum of compound AG3 (in DMSO-d_6) [δ_H 0.4-4.5 ppm, δ_C 12-90 ppm]

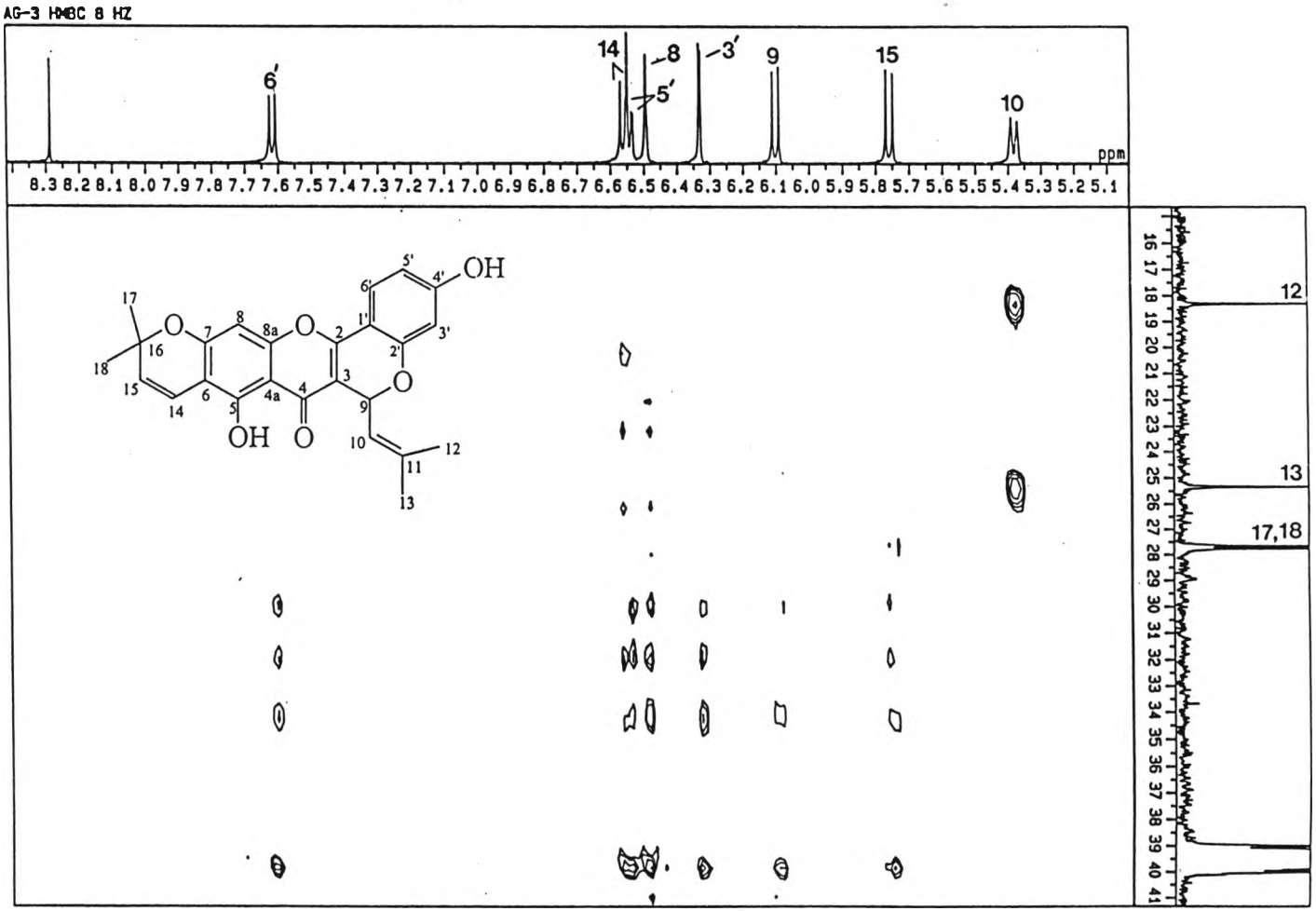


Figure 39a HMBC spectrum of compound AG3 (in DMSO-d_6) [δ_H 5.1-8.4 ppm, δ_C 15-41 ppm]

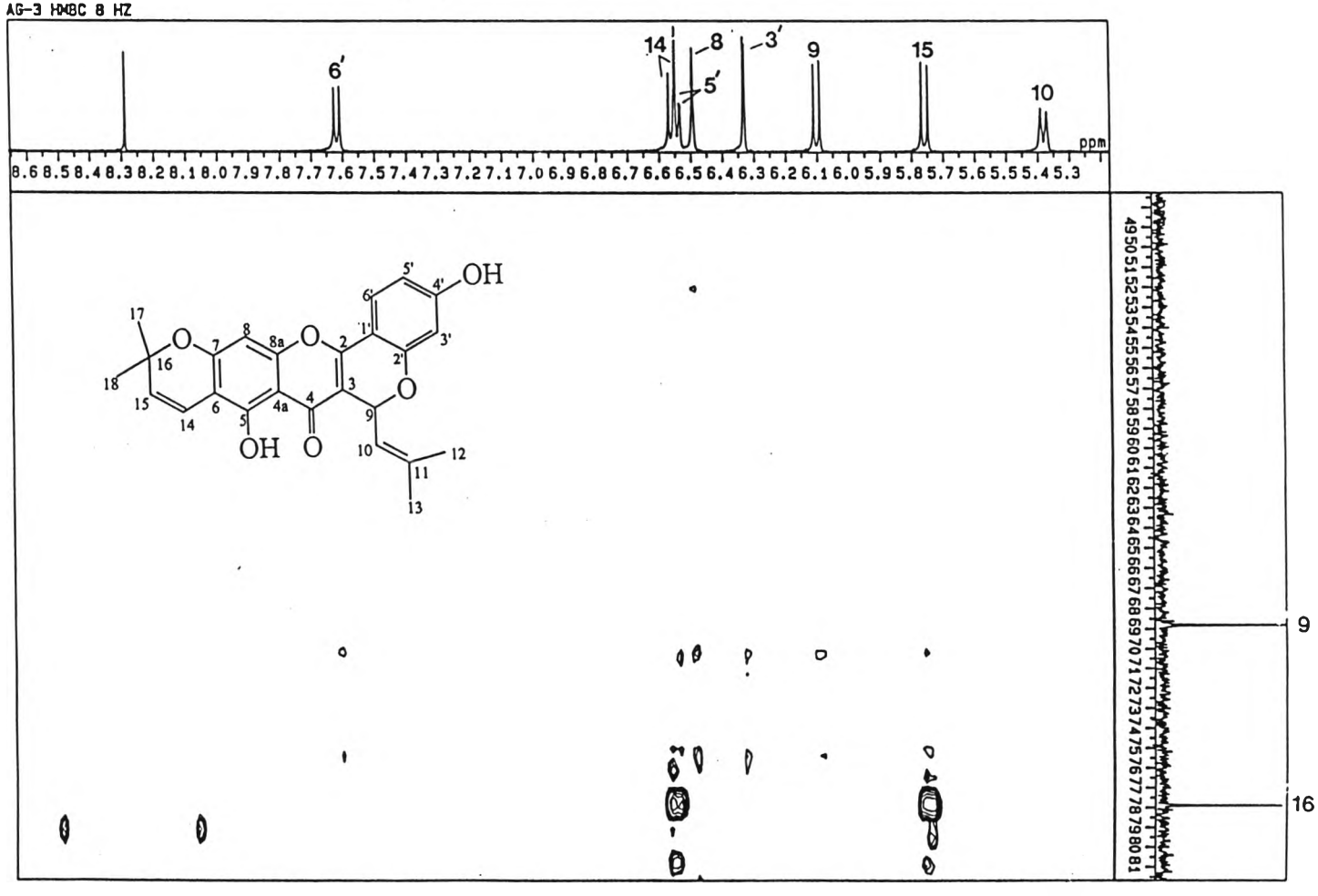


Figure 39b HMBC spectrum of compound AG3 (in DMSO-d_6) [δ_H 5.2-8.6 ppm, δ_C 49-81 ppm]

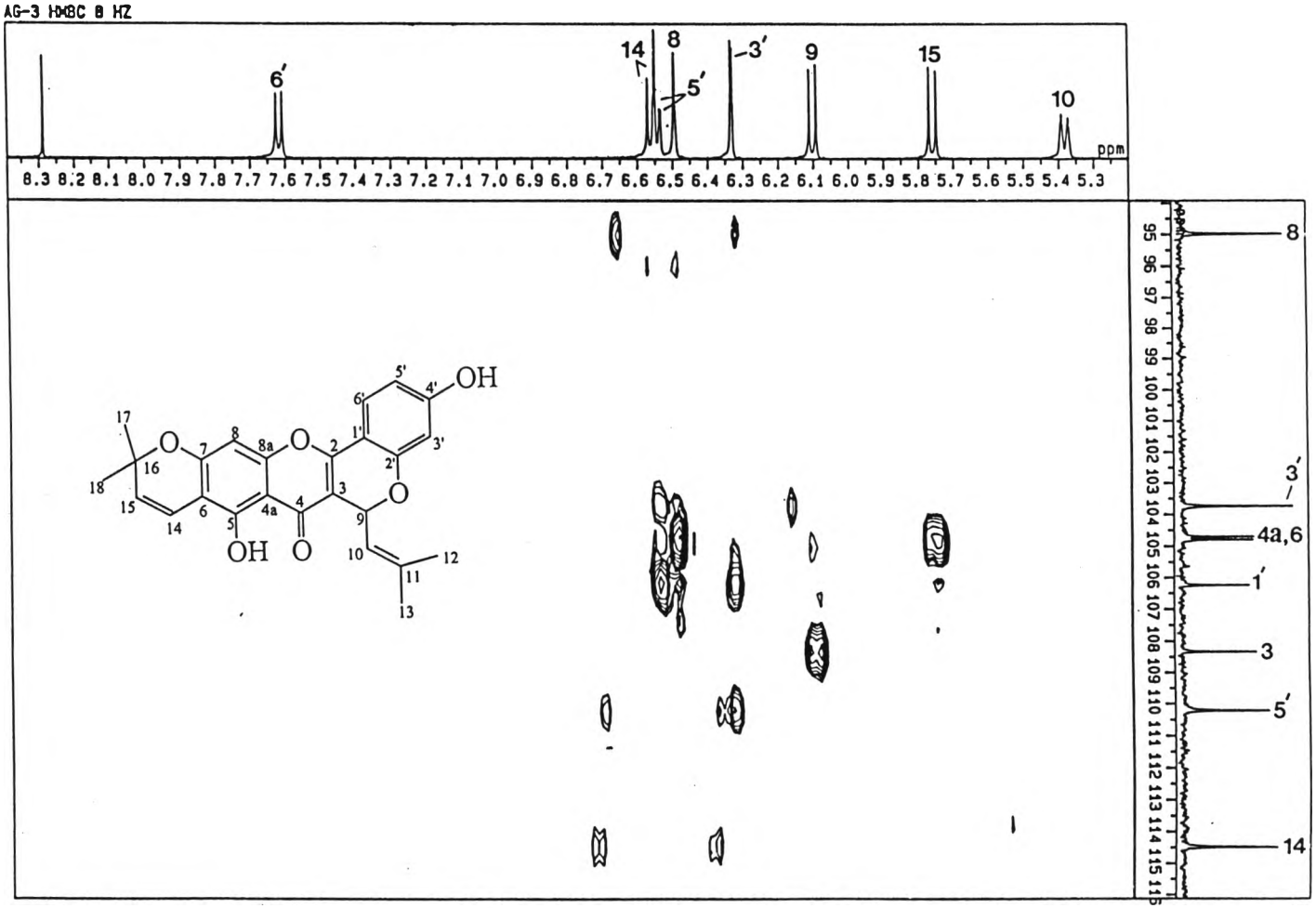


Figure 39c HMBC spectrum of compound AG3 (in DMSO-d_6) [δ_H 5.3-8.4 ppm, δ_C 94-116 ppm]

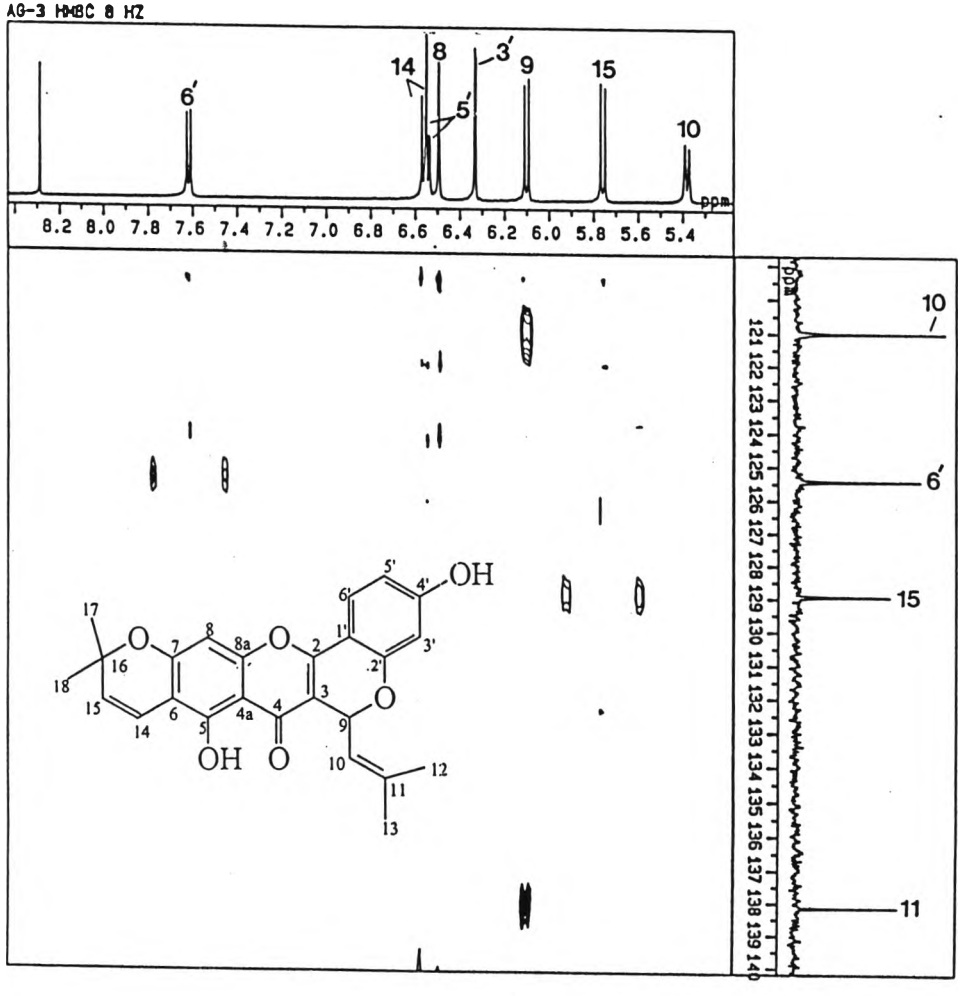


Figure 39d HMBC spectrum of compound AG3 (in DMSO-d_6) [δ_H 5.3-8.3 ppm, δ_C 119-140 ppm]

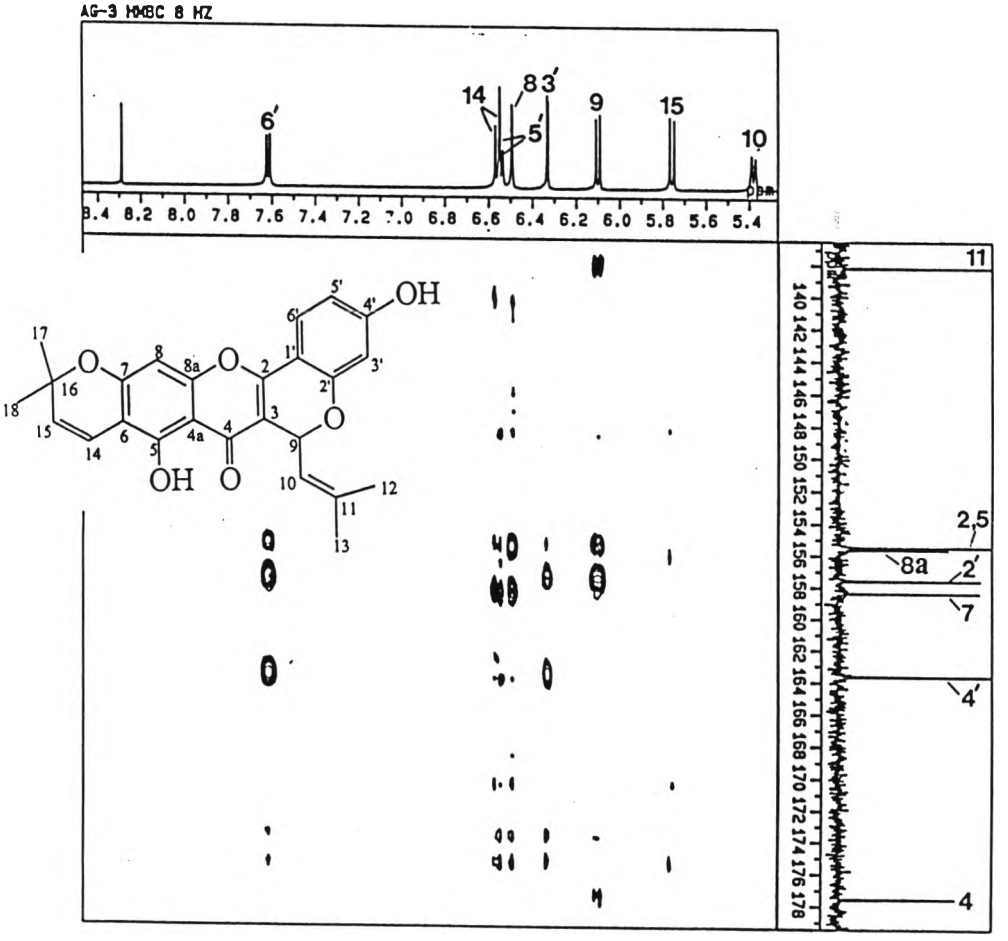


Figure 39e HMBC spectrum of compound AG3 (in DMSO-d_6) [δ_H 5.3-8.4 ppm, δ_C 139-178 ppm]

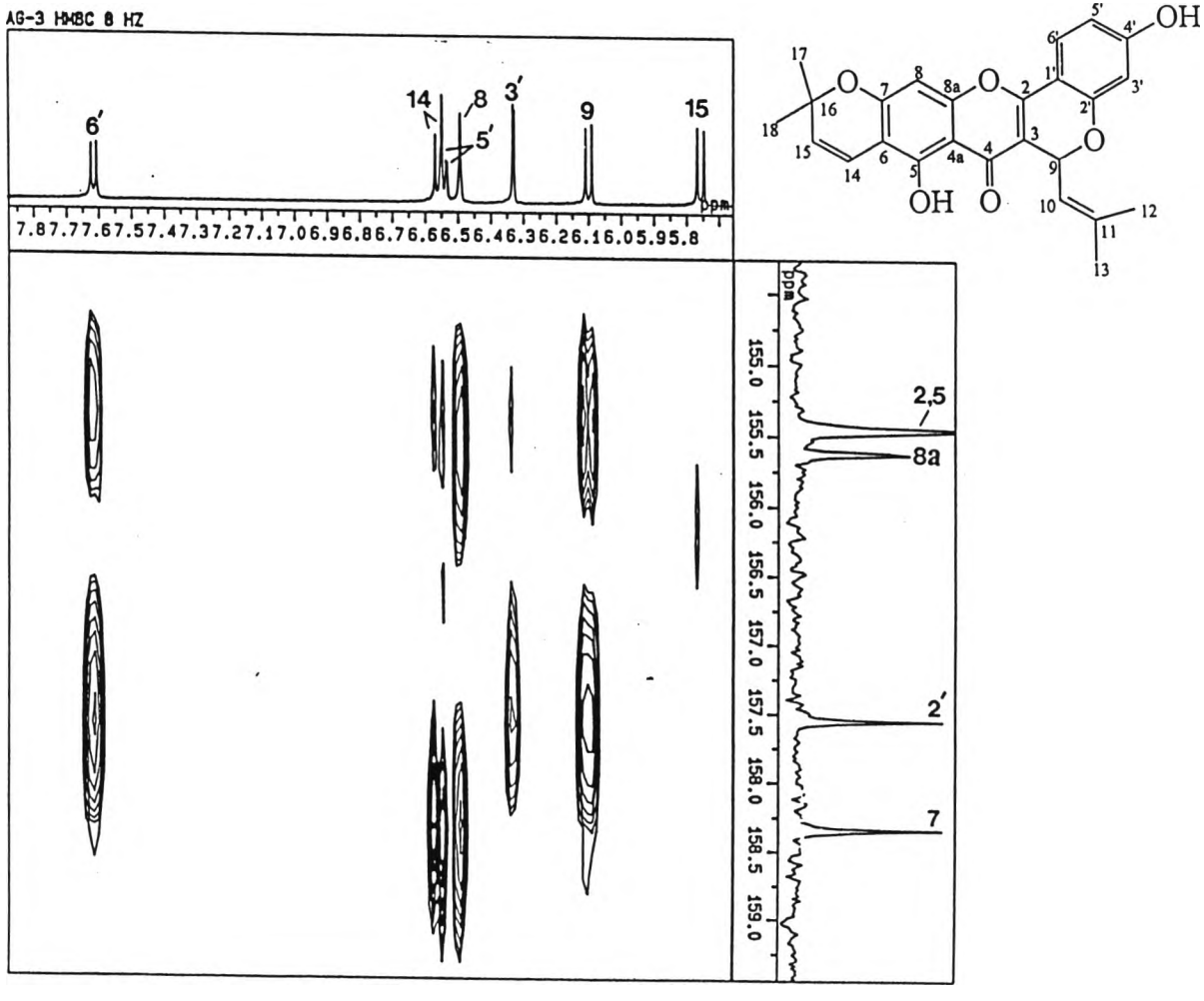


Figure 39f HMBC spectrum of compound AG3 (in DMSO-d_6) [δ_H 5.7-7.8 ppm, δ_C 154-159 ppm]

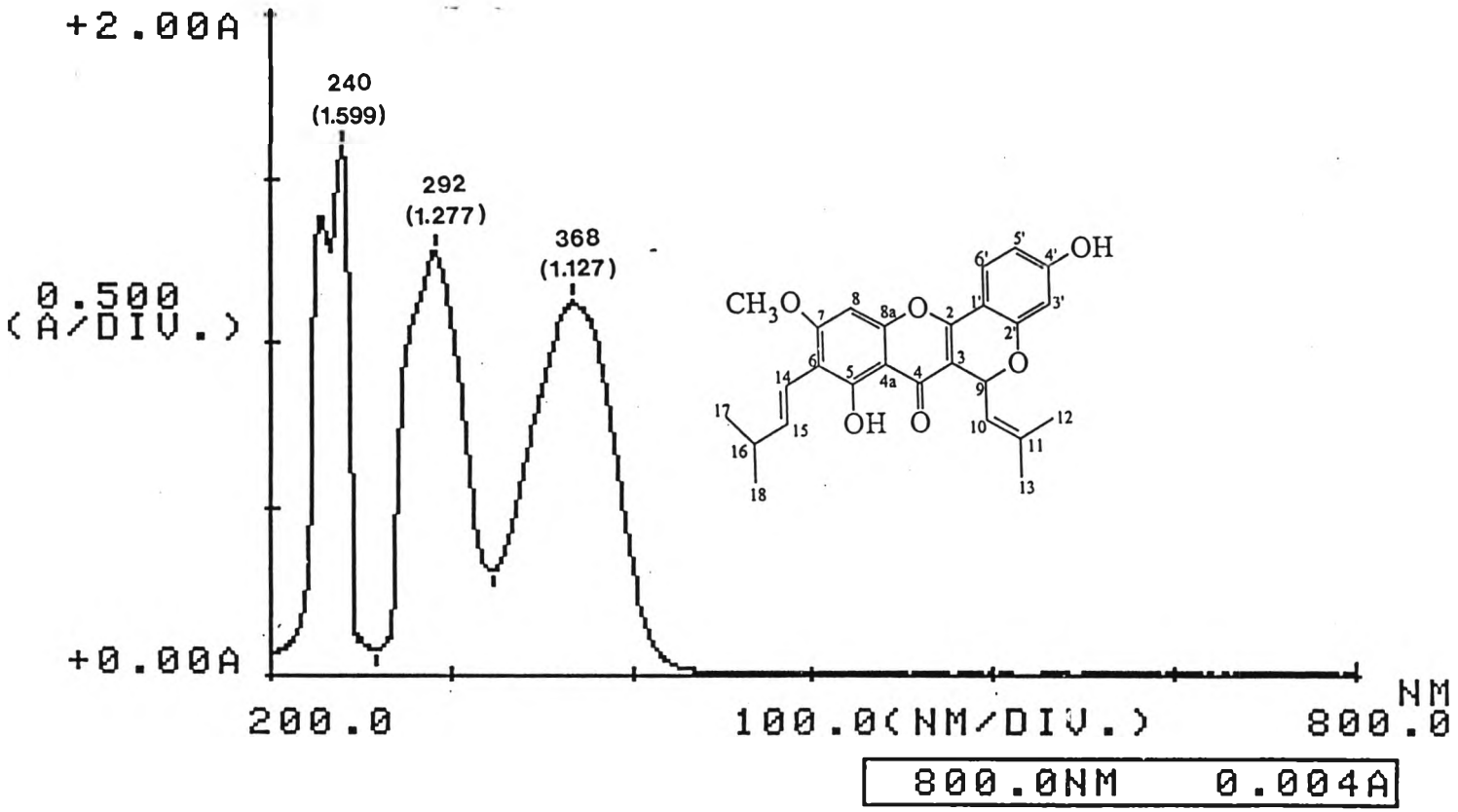


Figure 40 UV spectrum of compound AG4 (in methanol)

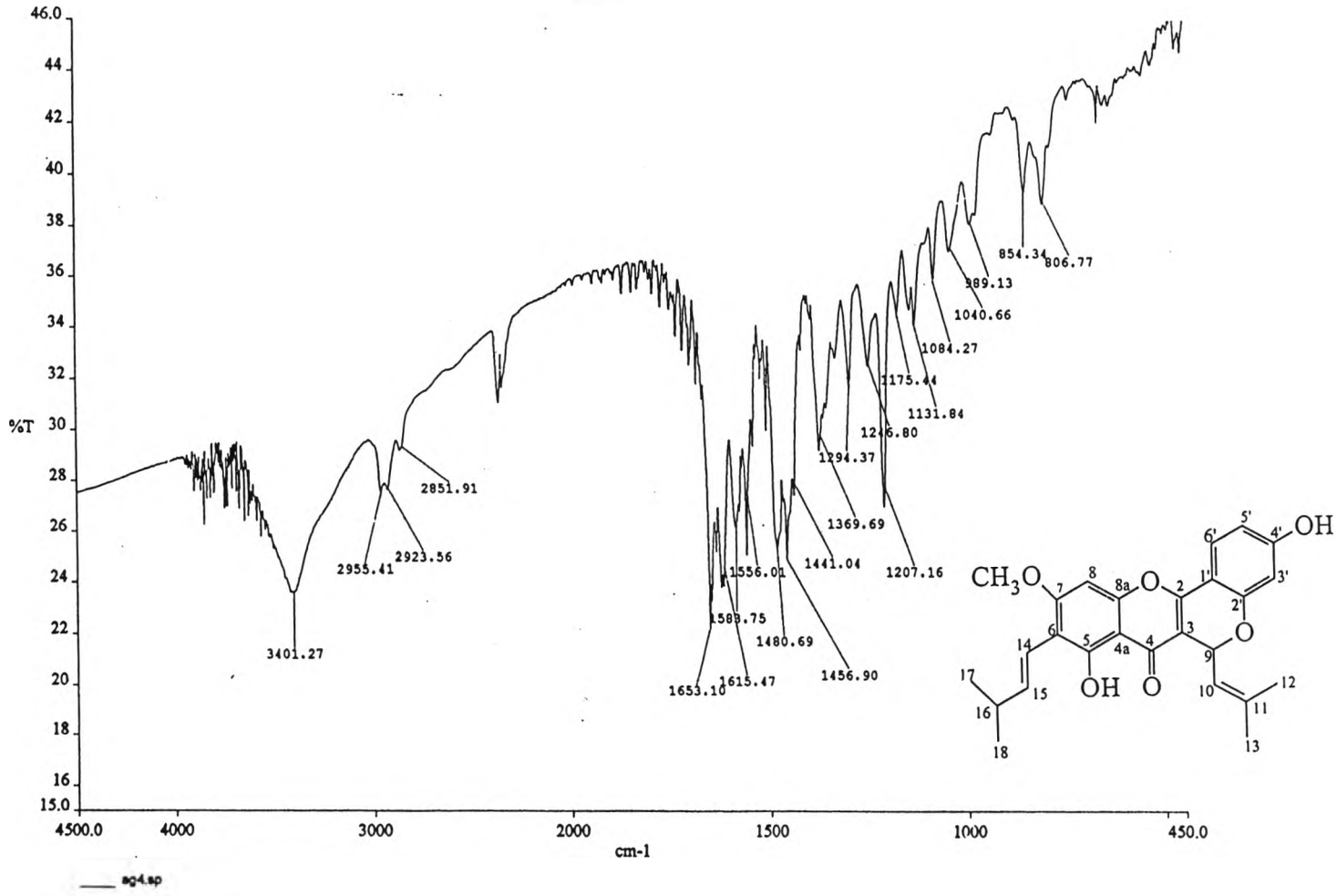


Figure 41 IR spectrum of compound AG4 (KBr)

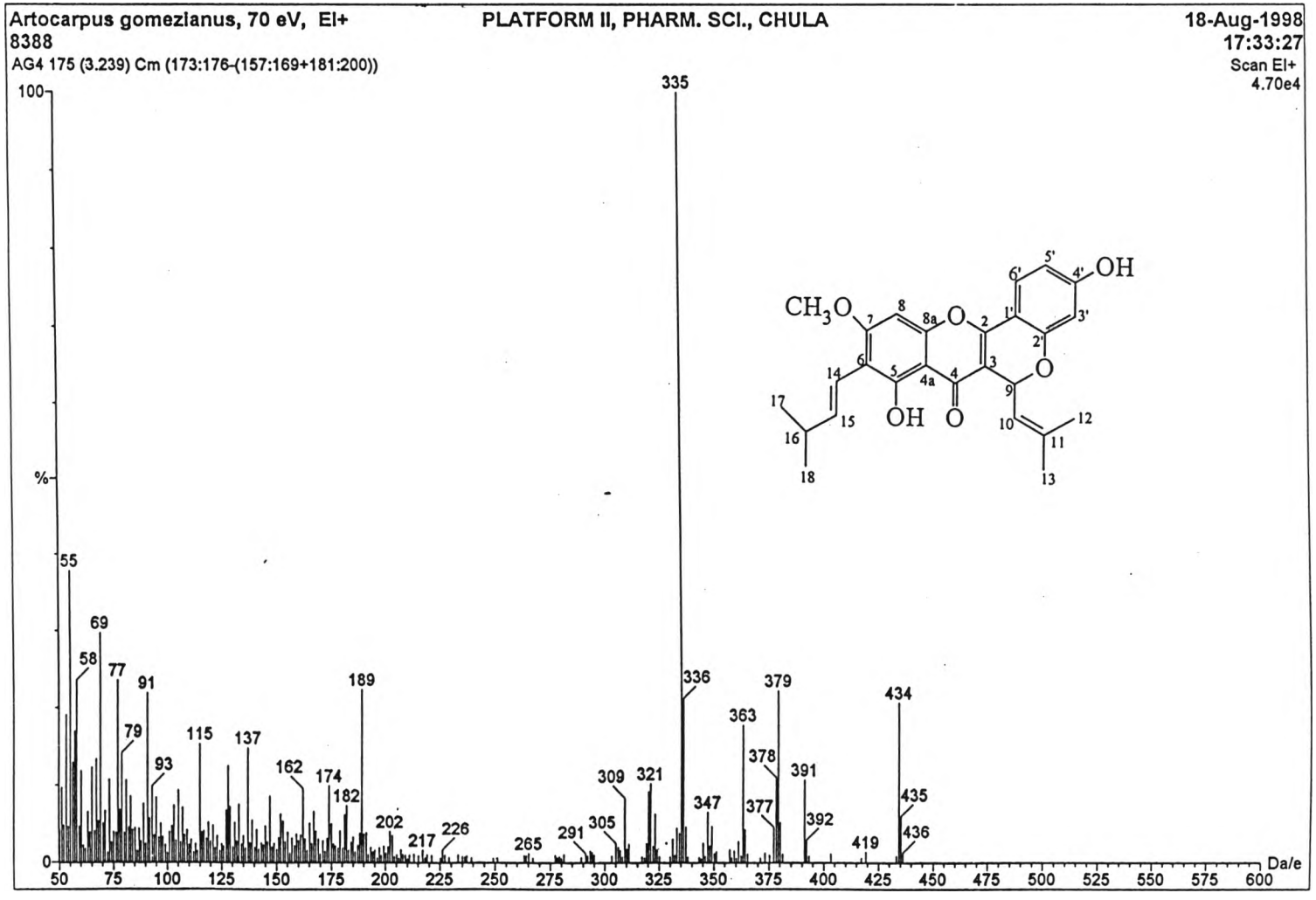


Figure 42 EI mass spectrum of compound AG4

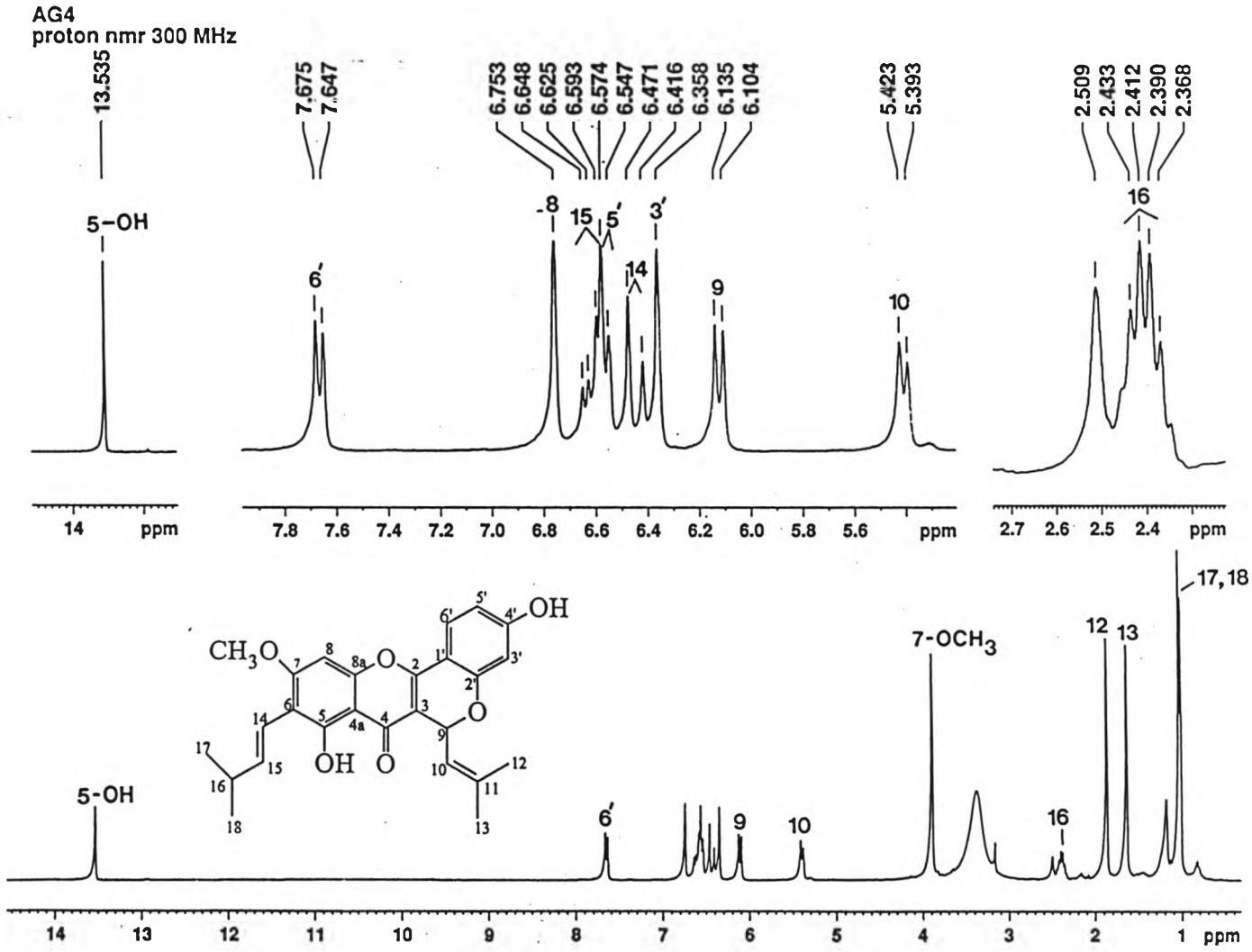


Figure 43 300 MHz ^{1}H NMR spectrum of compound. AG4 (in DMSO-d_6)

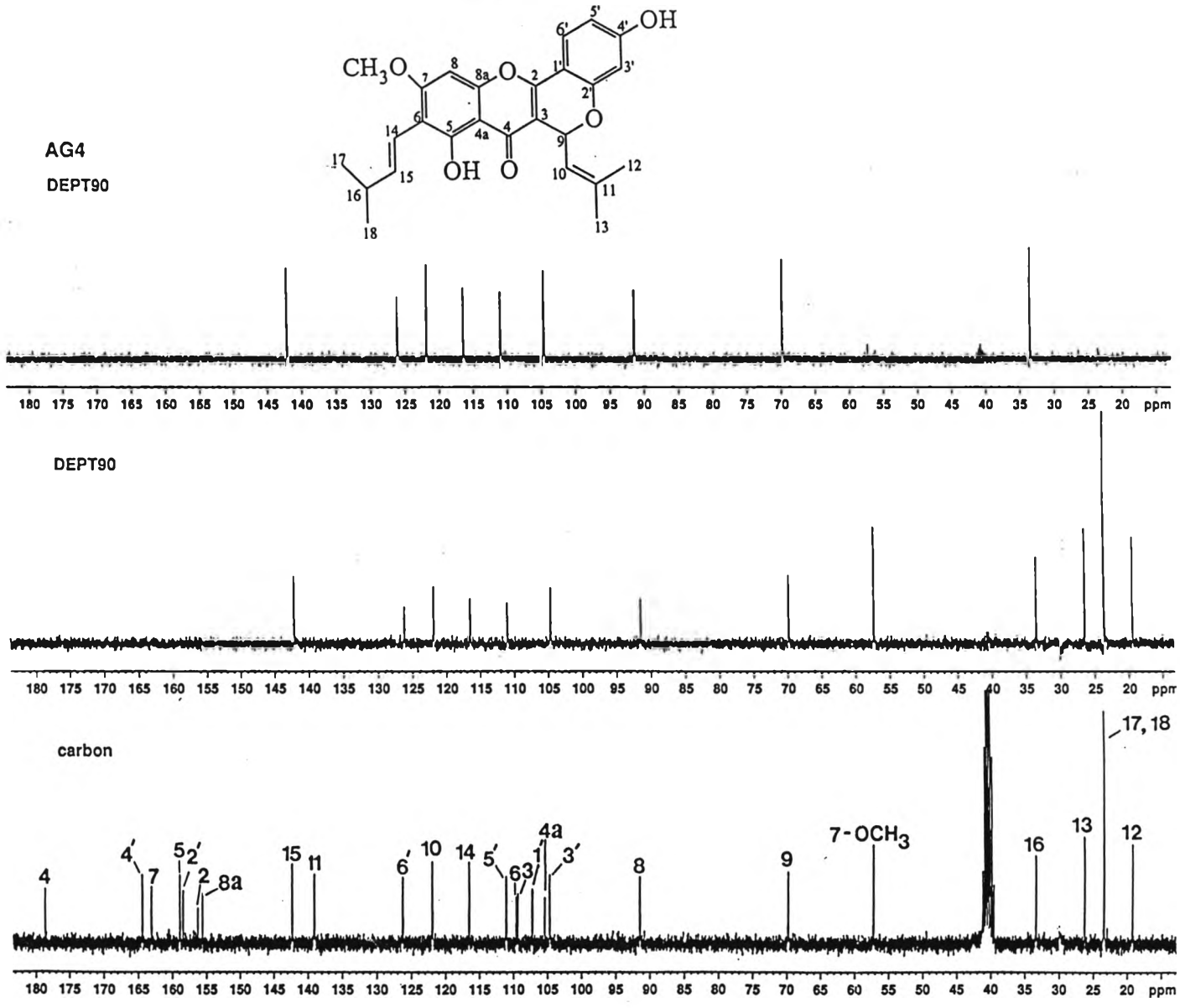


Figure 44 75 MHz ^{13}C NMR, DEPT 90 and DEPT 135 spectra of compound AG4 (in DMSO-d_6)

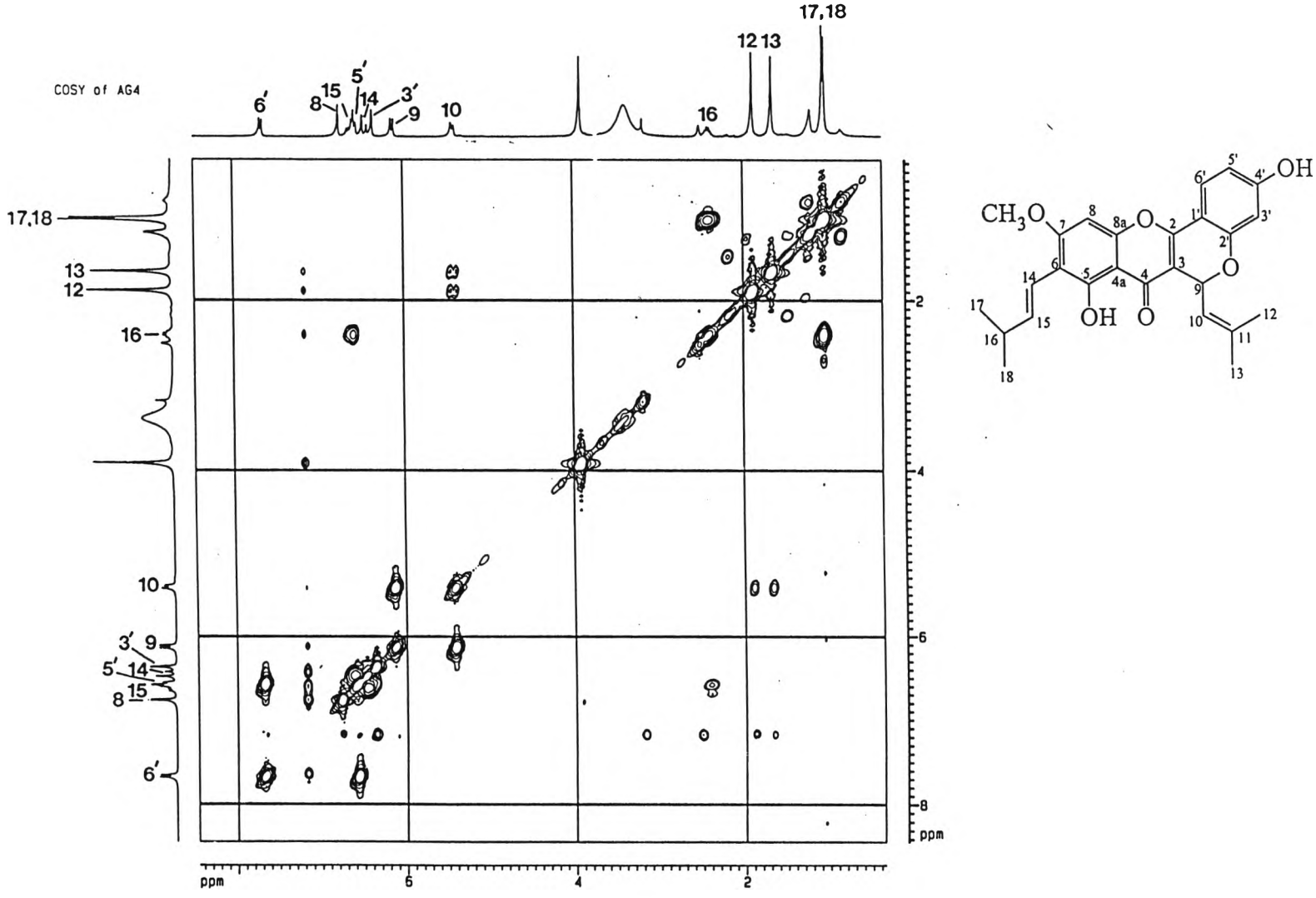


Figure 45 ^{1}H-^{1}H COSY spectrum of compound AG4 (in DMSO-d_6)

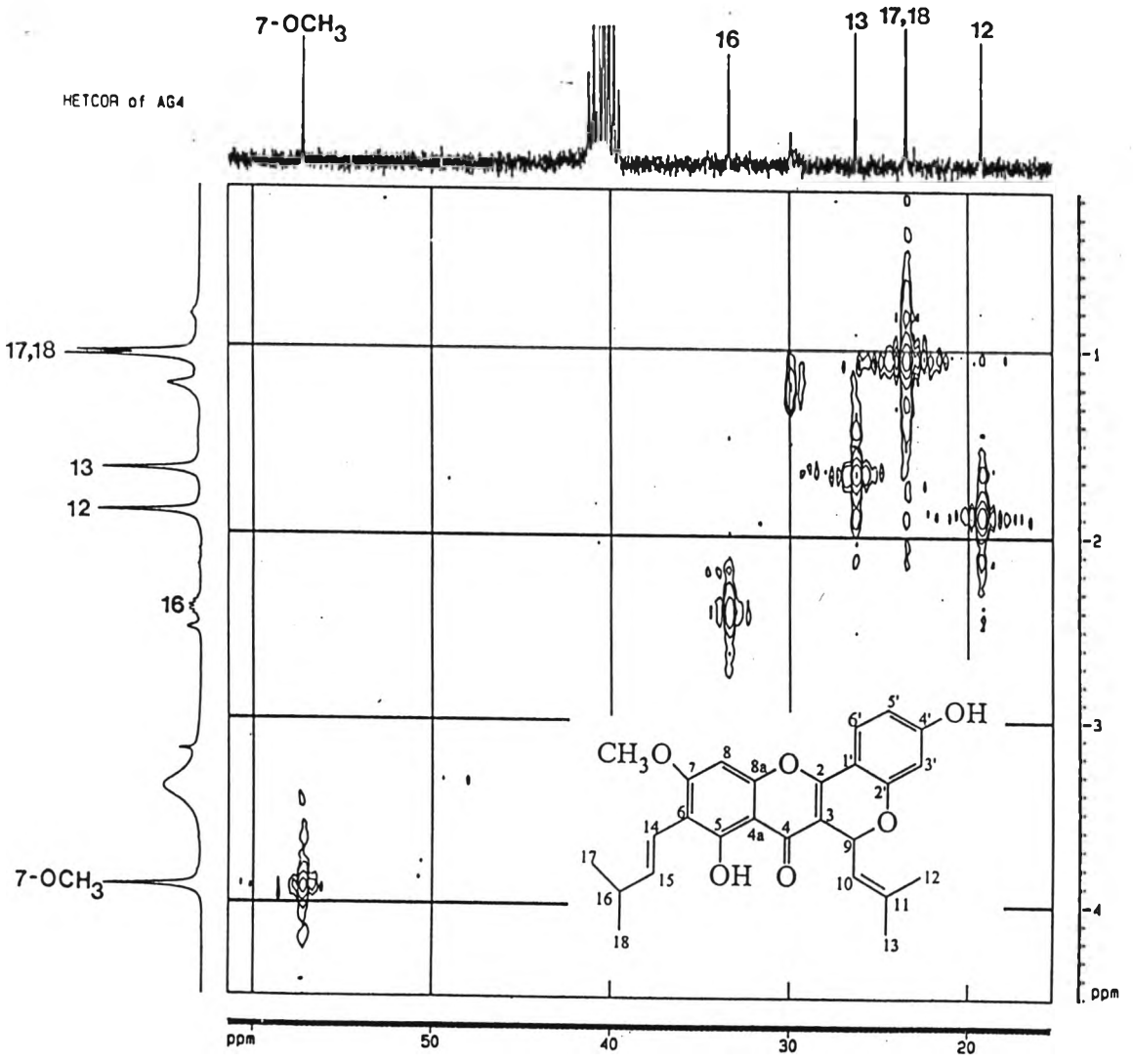


Figure 46a HETCOR spectrum of compound AG4 (in DMSO-d_6) [δ_H 0.2-4.5 ppm, δ_C 10-60 ppm]

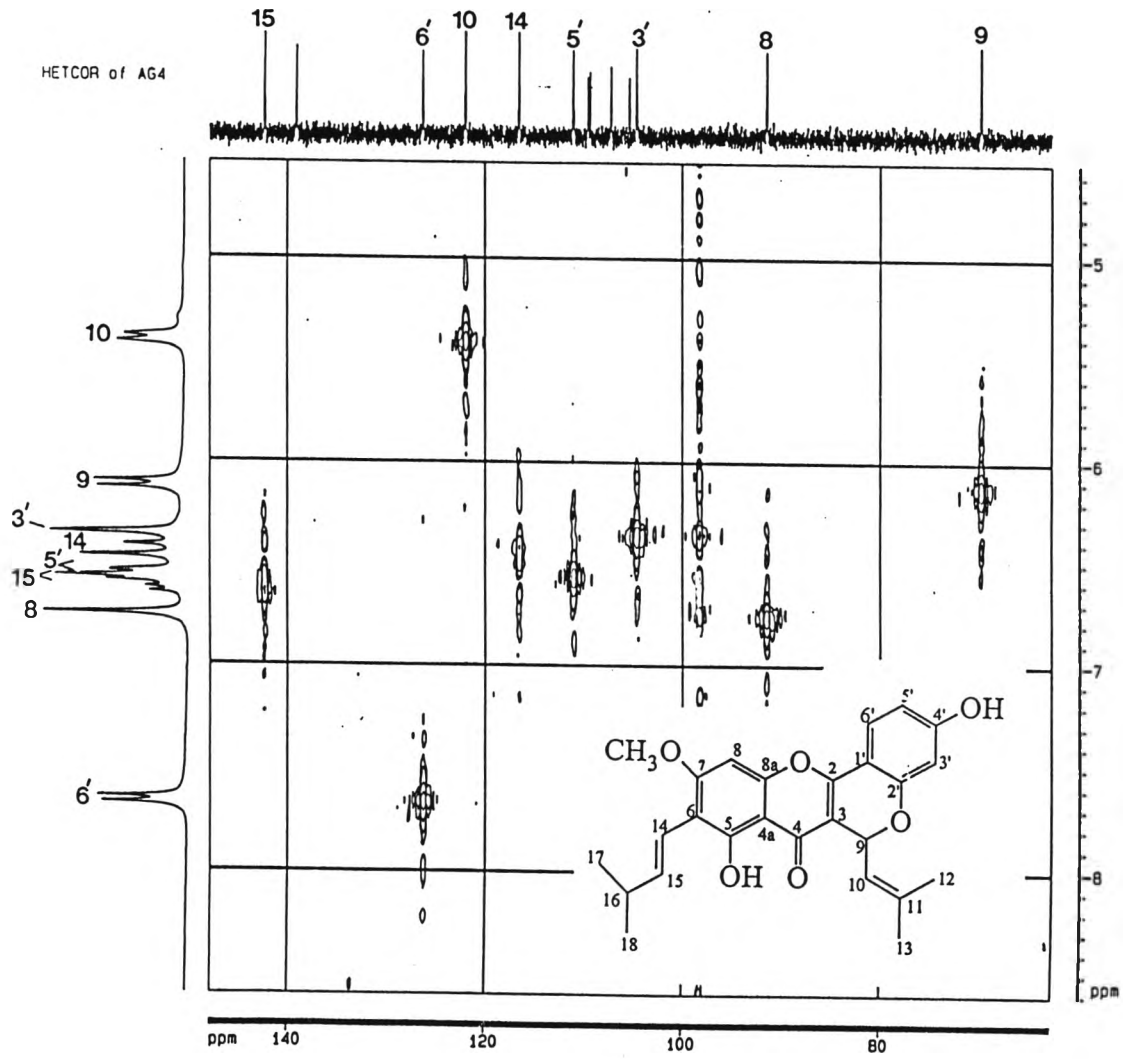


Figure 46b HETCOR spectrum of compound AG4 (in DMSO-d_6) [δ_H 4.6-8.6 ppm, δ_C 70-145 ppm]

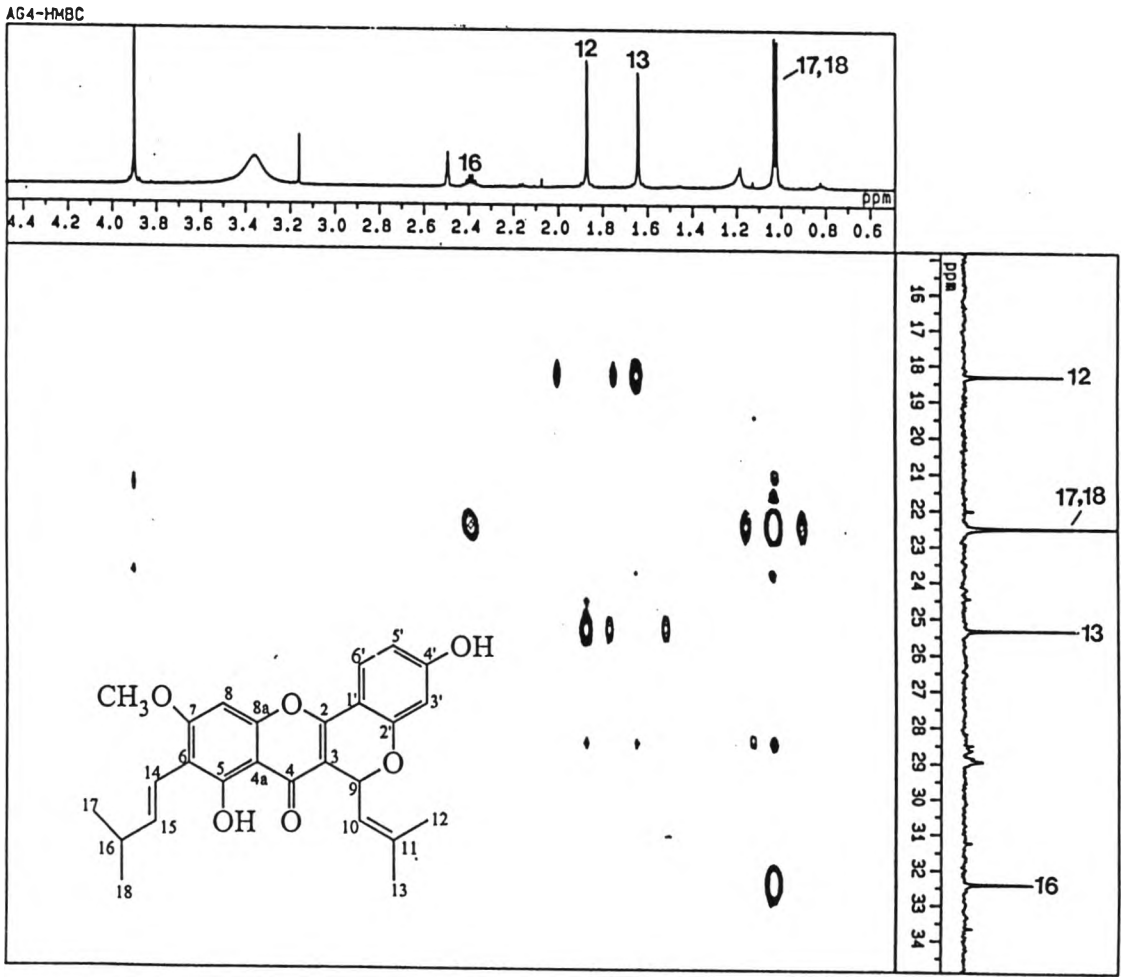


Figure 47a HMBC spectrum of compound AG4 (in DMSO-d_6) [δ_H 0.6-4.4 ppm, δ_C 15-34 ppm]

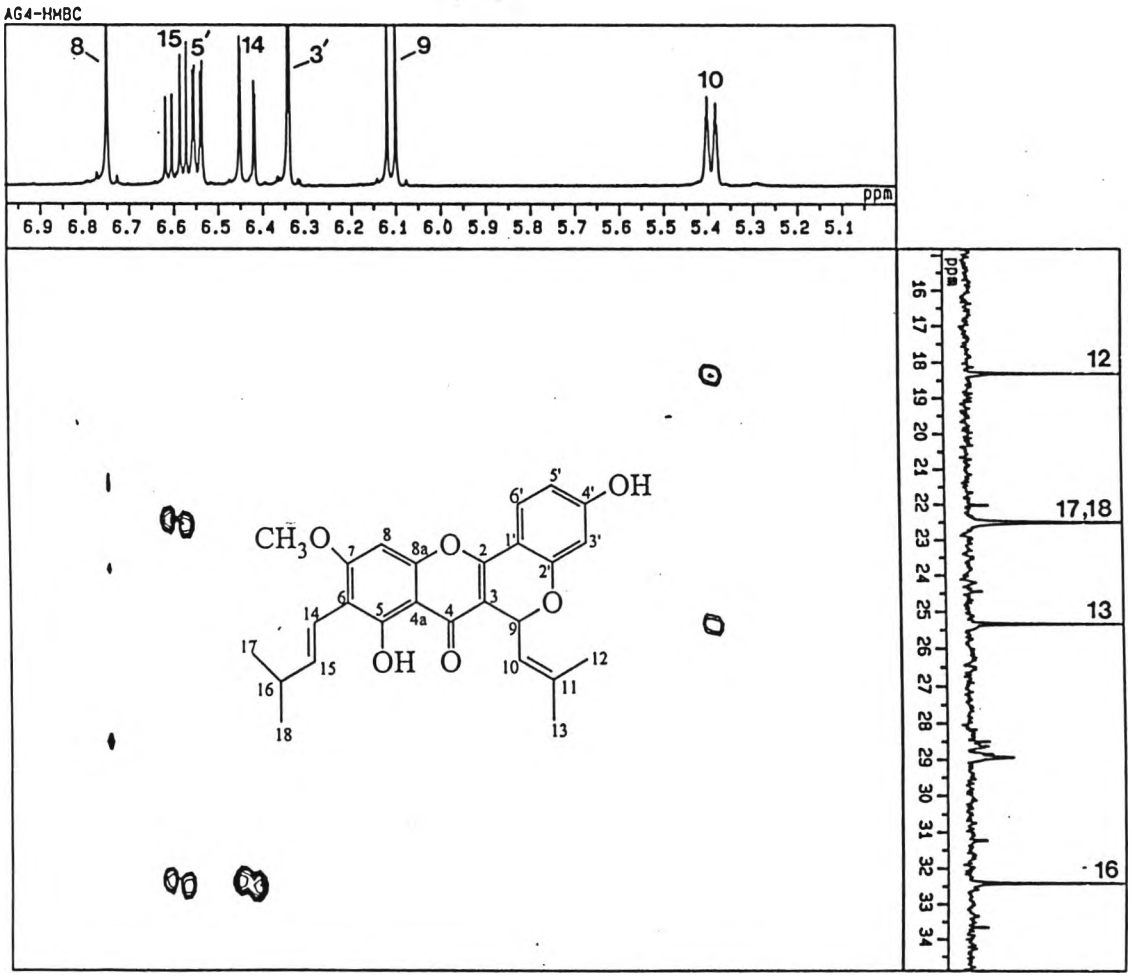


Figure 47b HMBG spectrum of compound AG4 (in DMSO-d_6) [δ_H 5.1-6.9 ppm, δ_C 15-34 ppm]

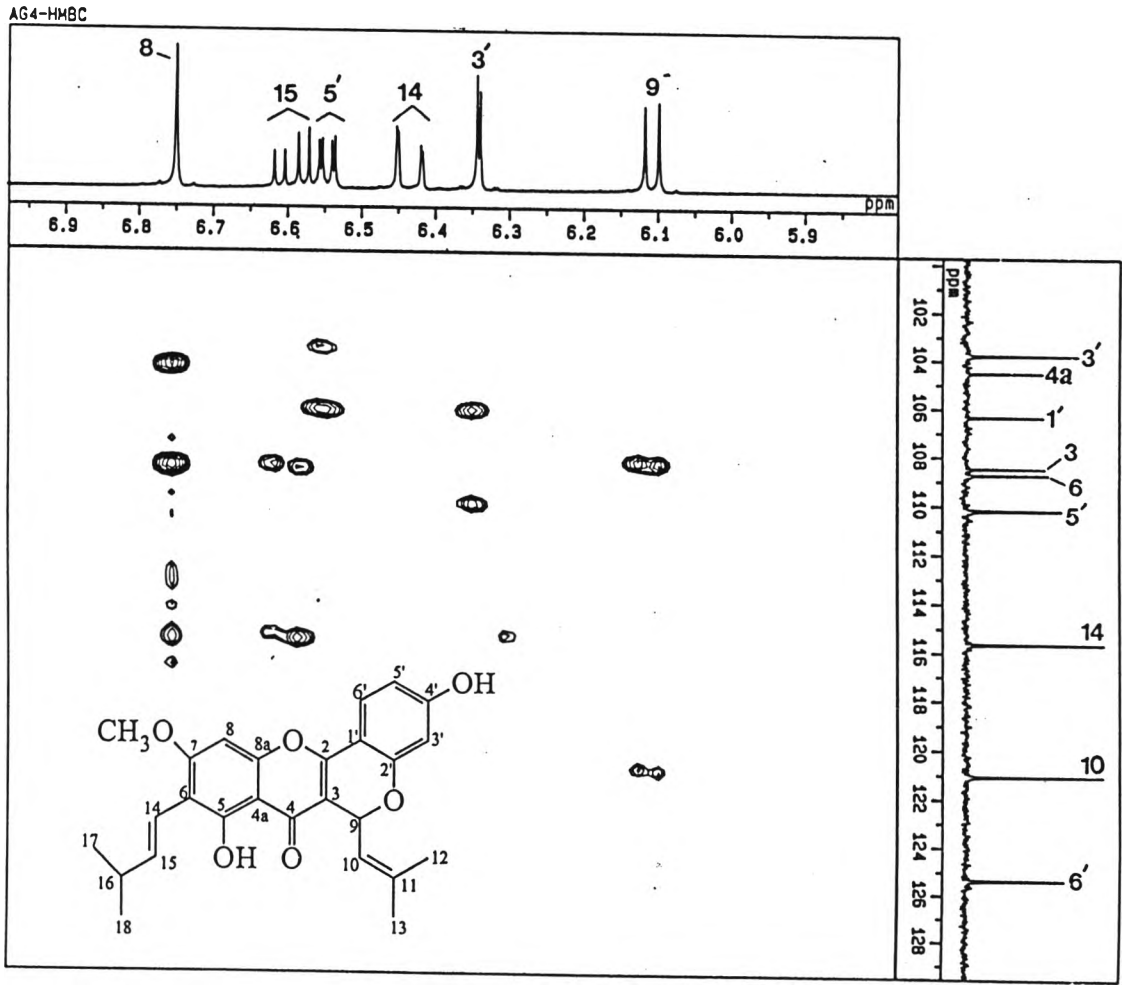


Figure 47c HMBC spectrum of compound AG4 (in DMSO-d_6) [δ_H 5.9-6.9 ppm, δ_C 101-128 ppm]

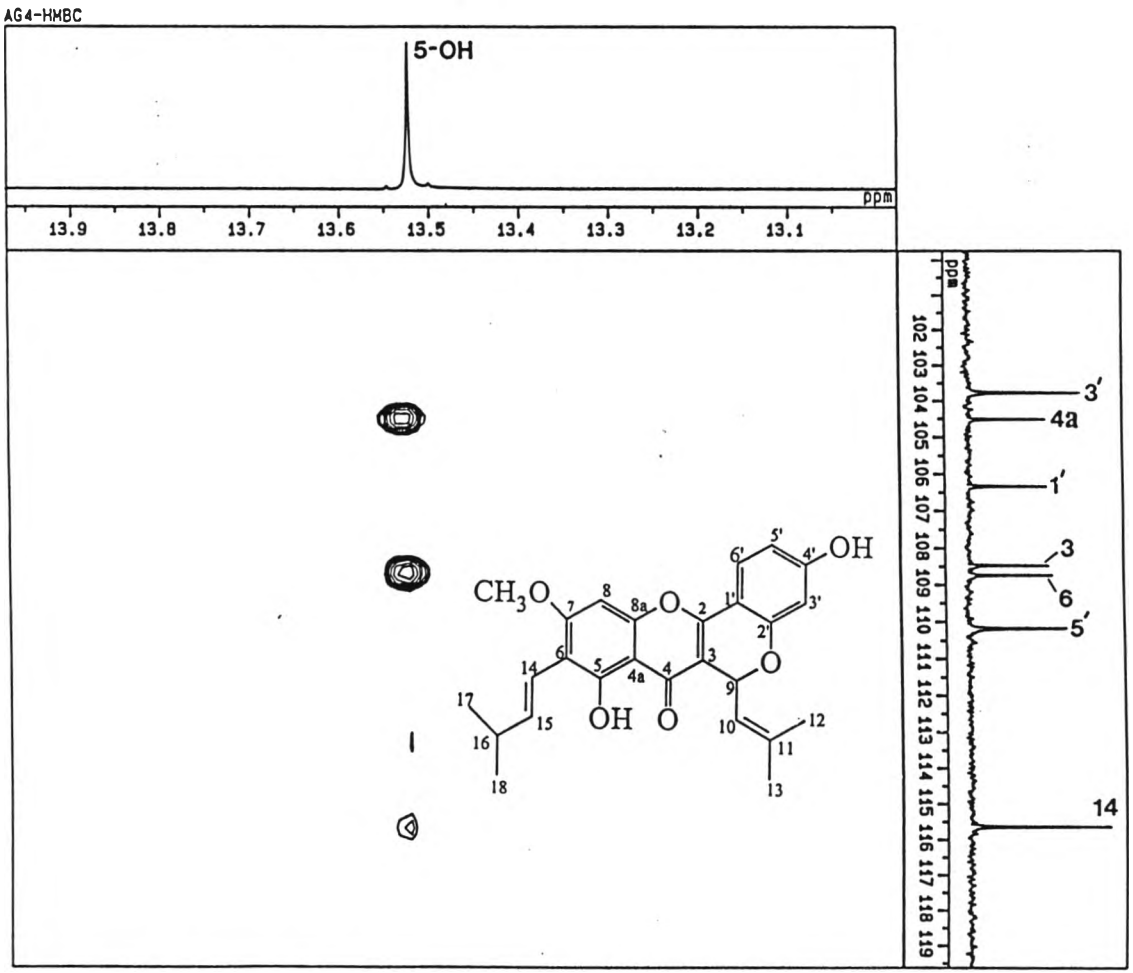


Figure 47d HMBC spectrum of compound AG4 (in DMSO-d_6) [δ_H 13.1-13.9 ppm, δ_C 100-119 ppm]

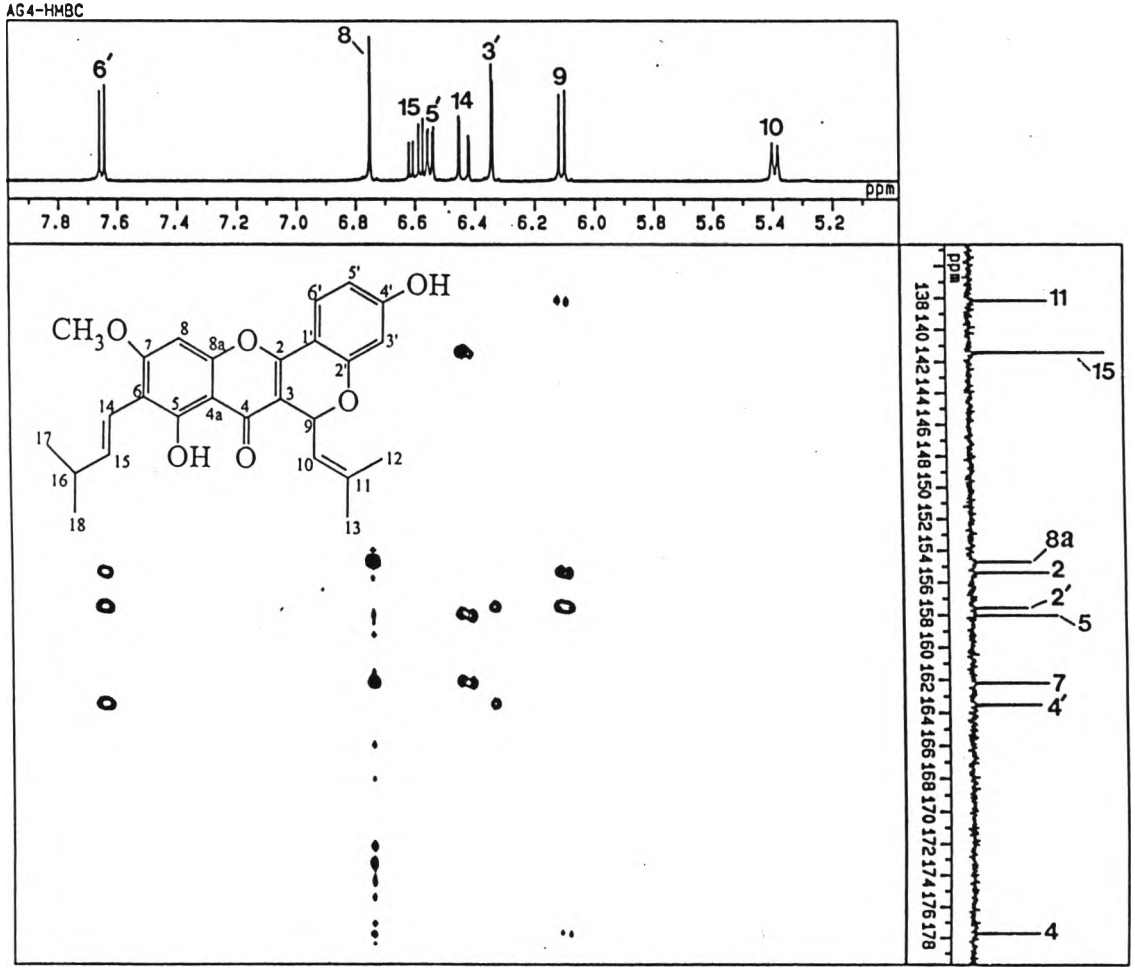


Figure 47e HMBC spectrum of compound AG4 (in DMSO-d_6) [δ_H 5.2-7.8 ppm, δ_C 137-178 ppm]

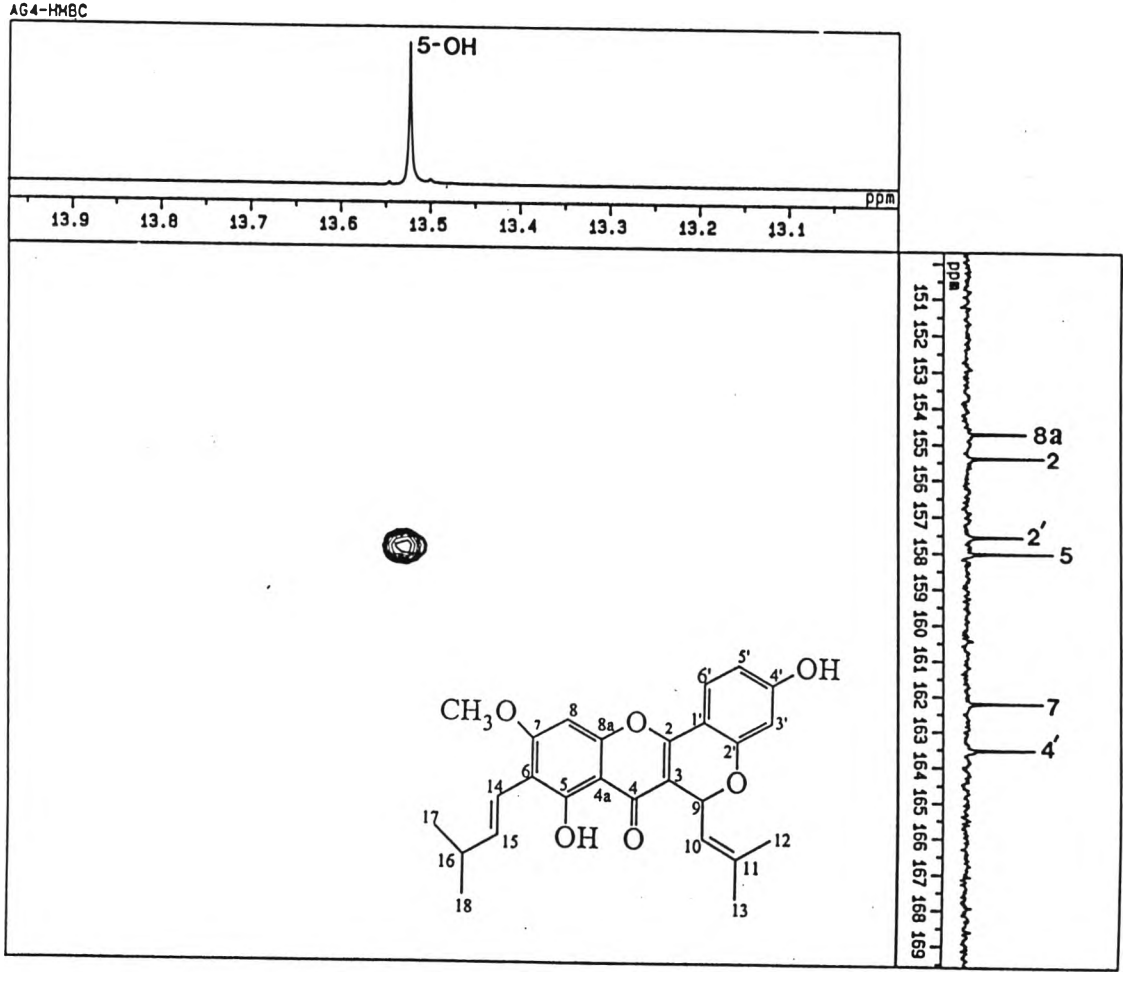


Figure 47f HMBC spectrum of compound AG4 (in DMSO-d_6) [δ_H 13.1-13.9 ppm, δ_C 151-169 ppm]

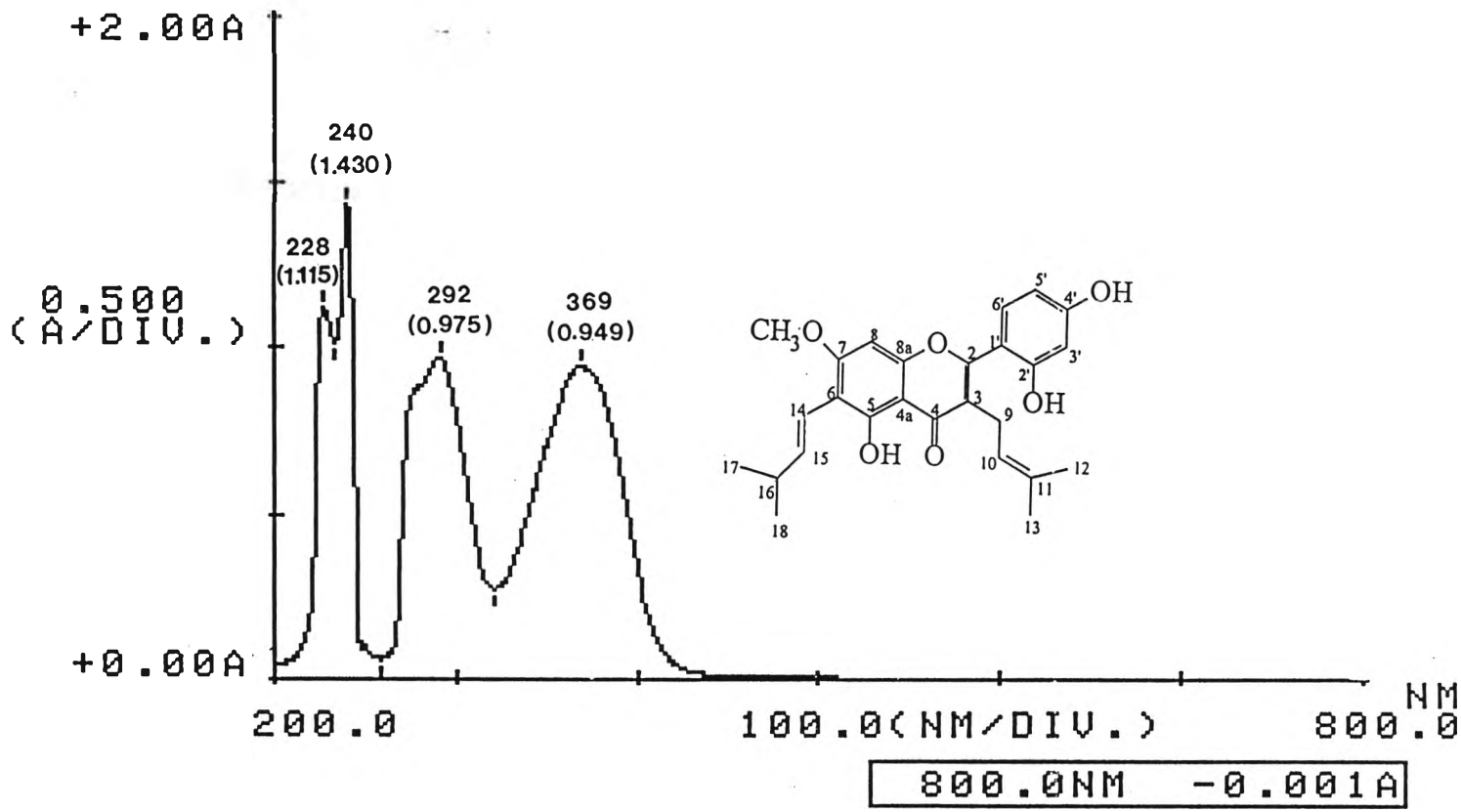


Figure 48 UV spectrum of compound AG5 (in methanol)

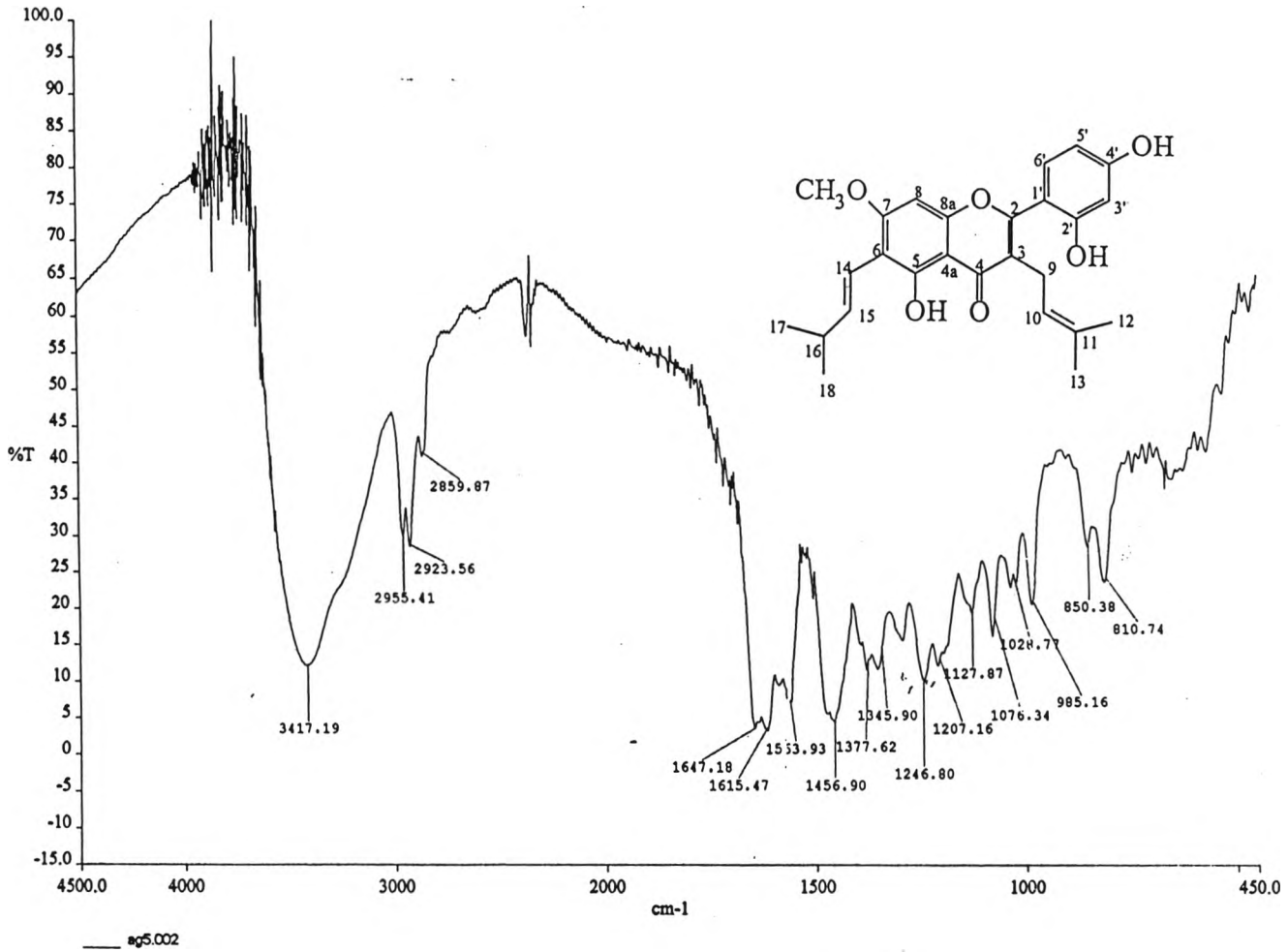


Figure 49 IR spectrum of compound AG5 (KBr disc)

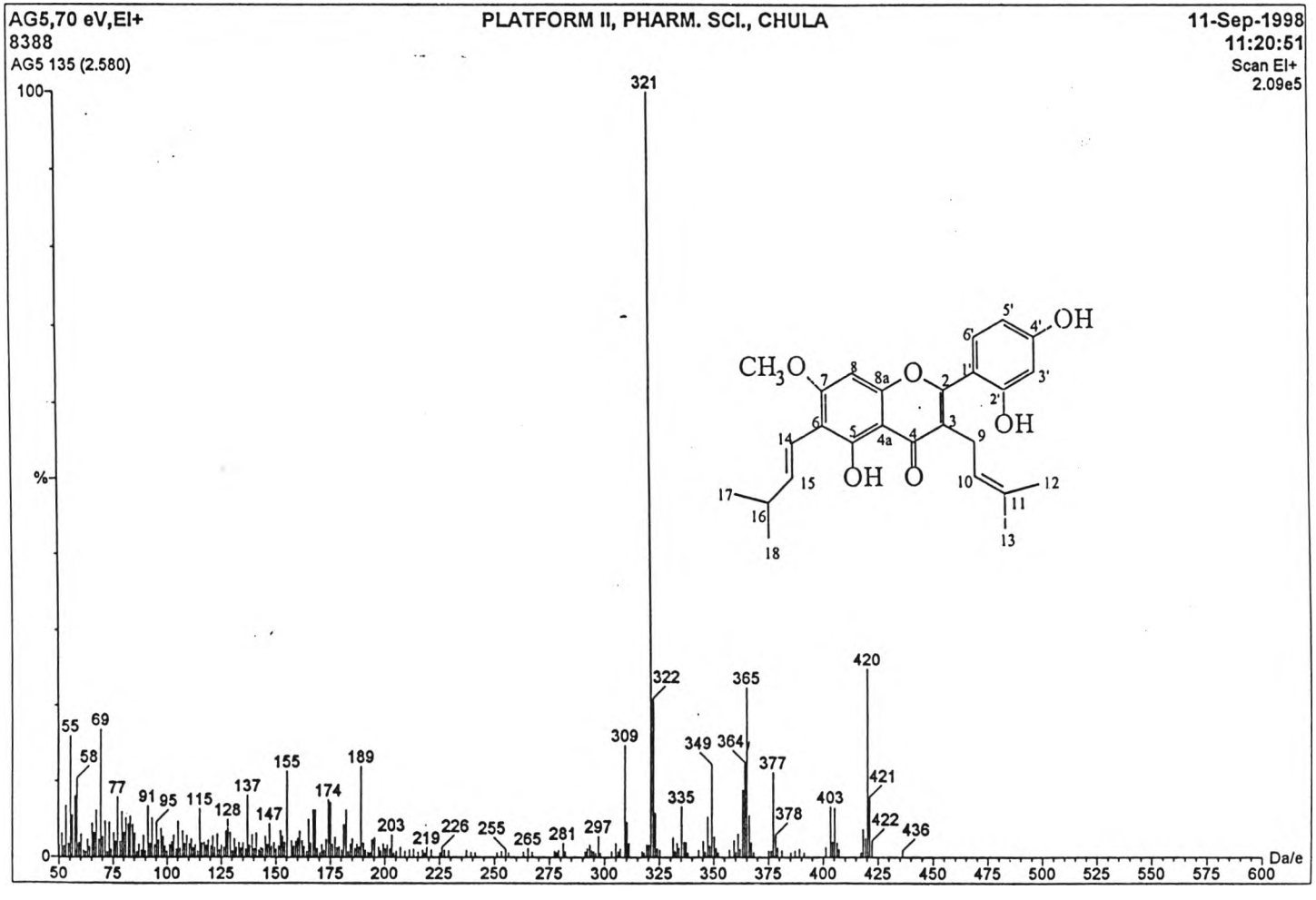


Figure 50 EI mass spectrum of compound AG5

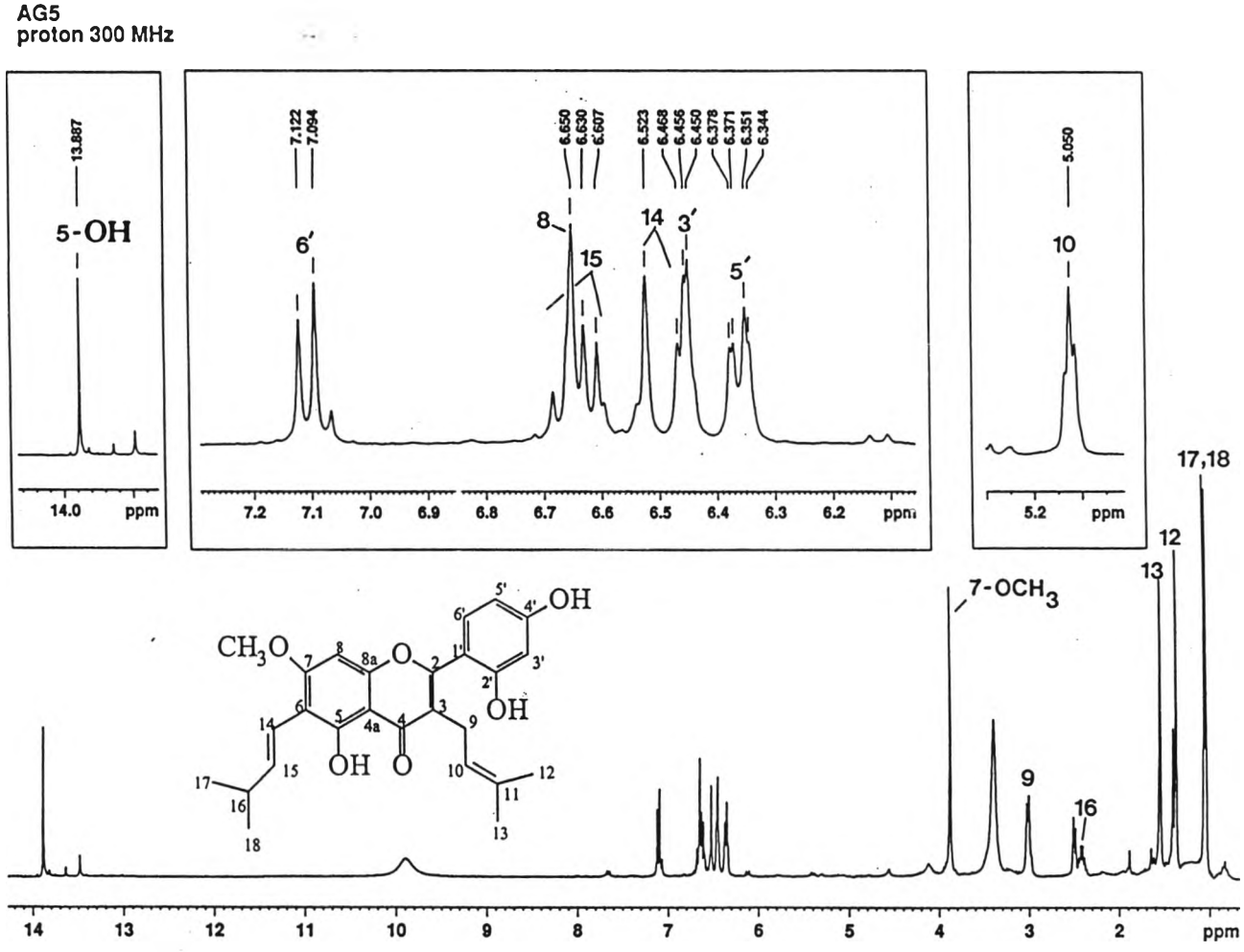


Figure 51 300 MHz ^{1}H NMR spectrum of compound AG5 (in DMSO-d_6)

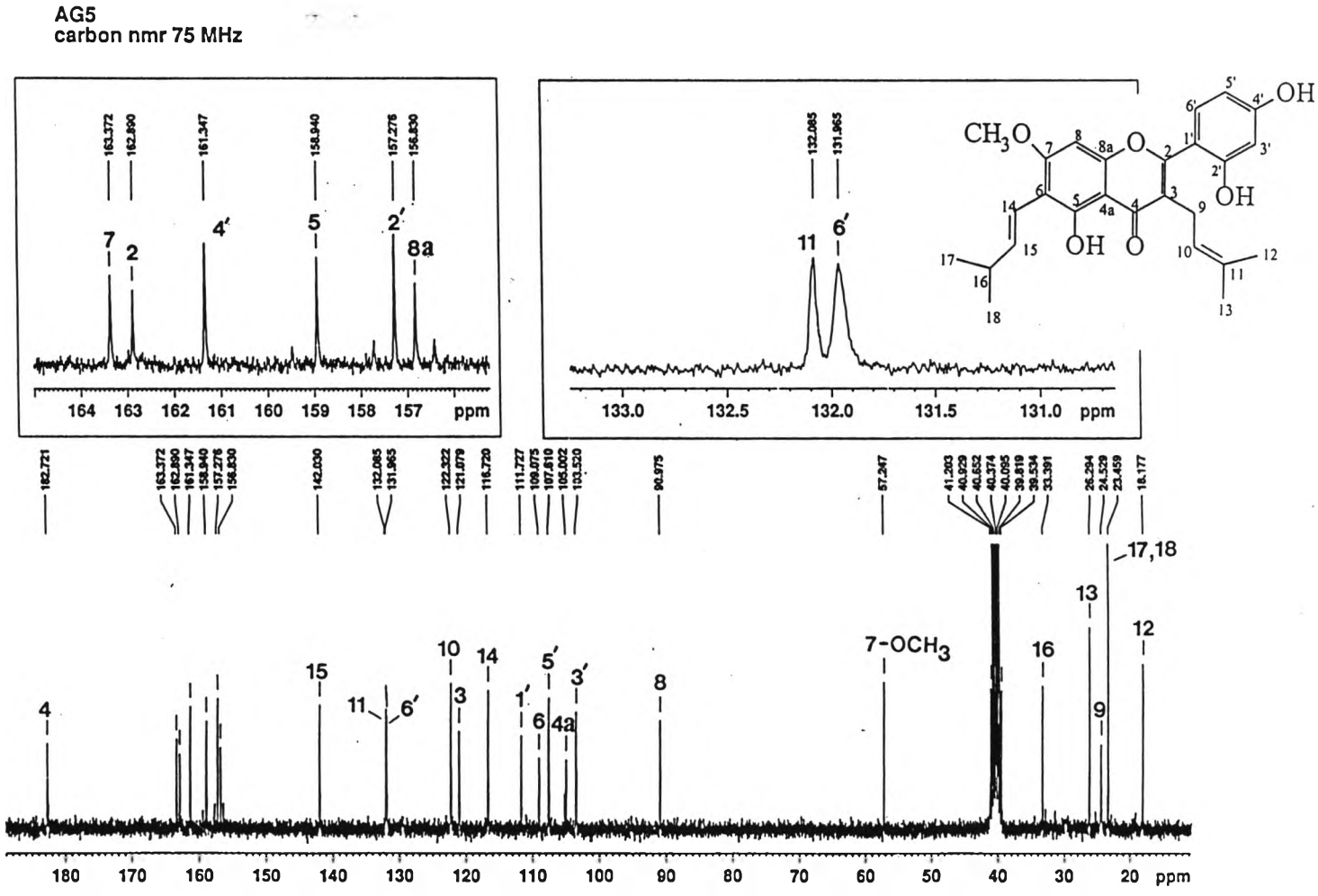


Figure 52 75 MHz ^{13}C NMR spectrum of compound AG5 (in DMSO-d_6)

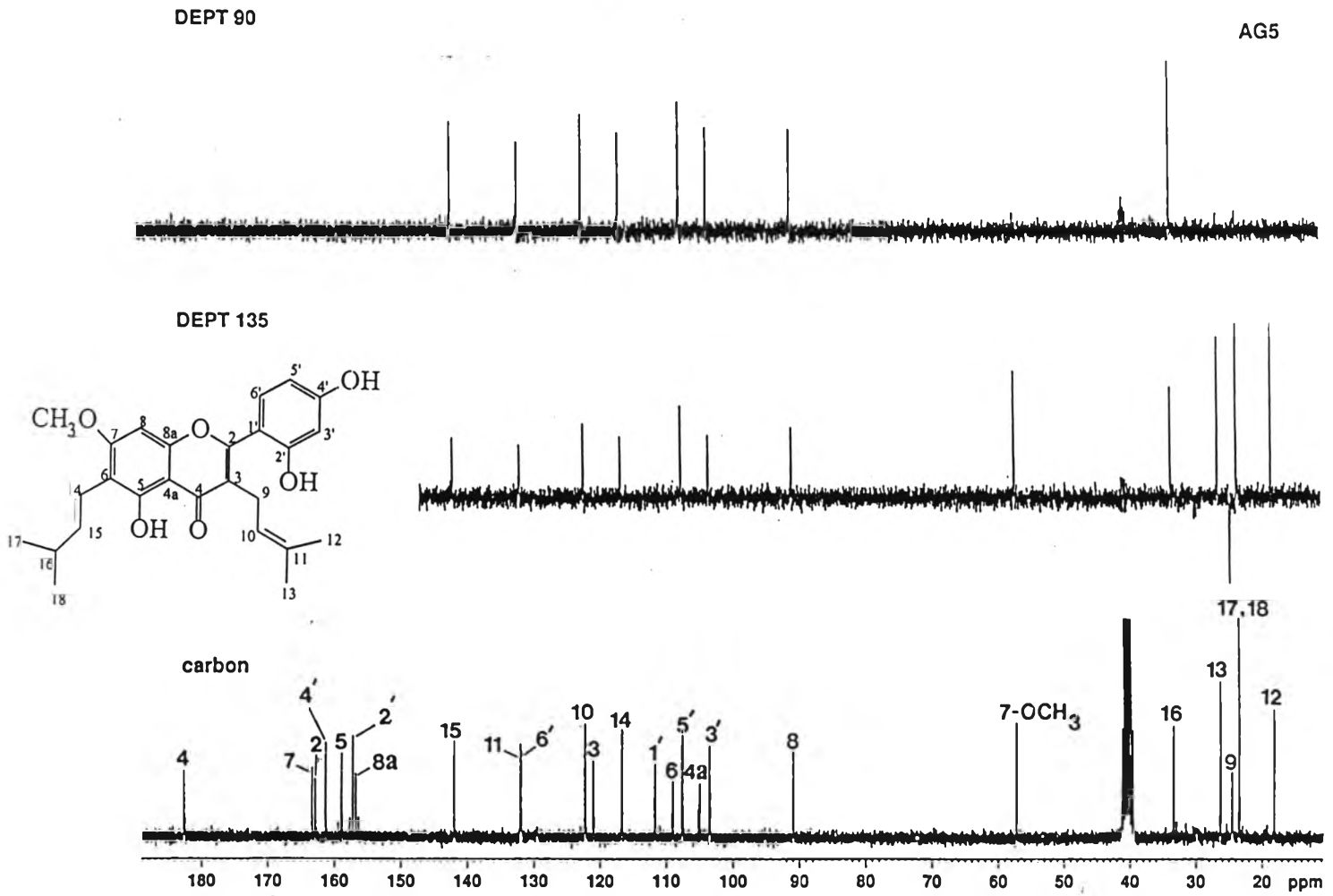


Figure 53a DEPT 90 and DEPT 135 spectra of compound AG5 (in DMSO-d_6)

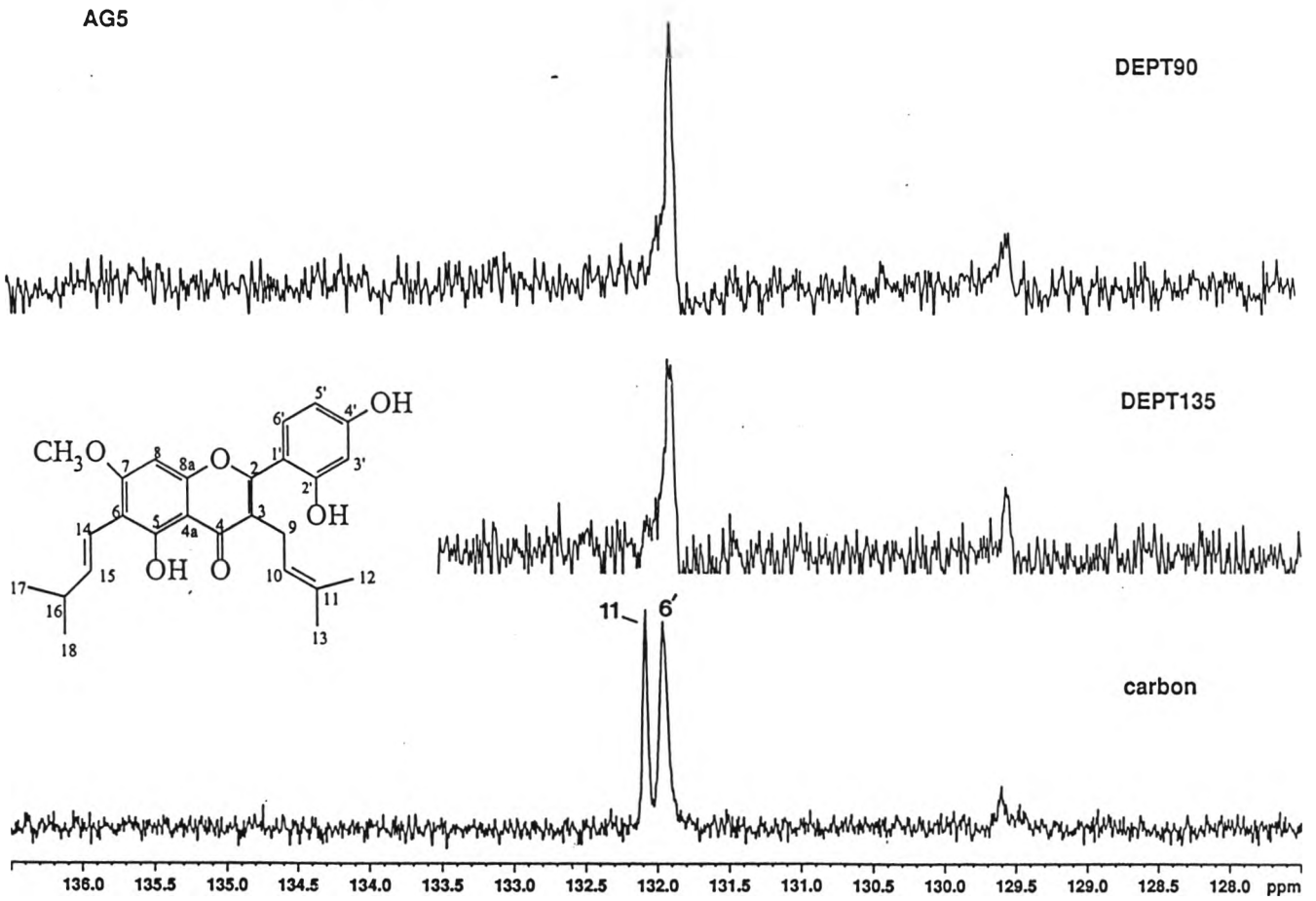


Figure 53b DEPT 90 and DEPT 135 spectra of compound AG5 (in DMSO-d_6) (expanded from 128 to 136 ppm)

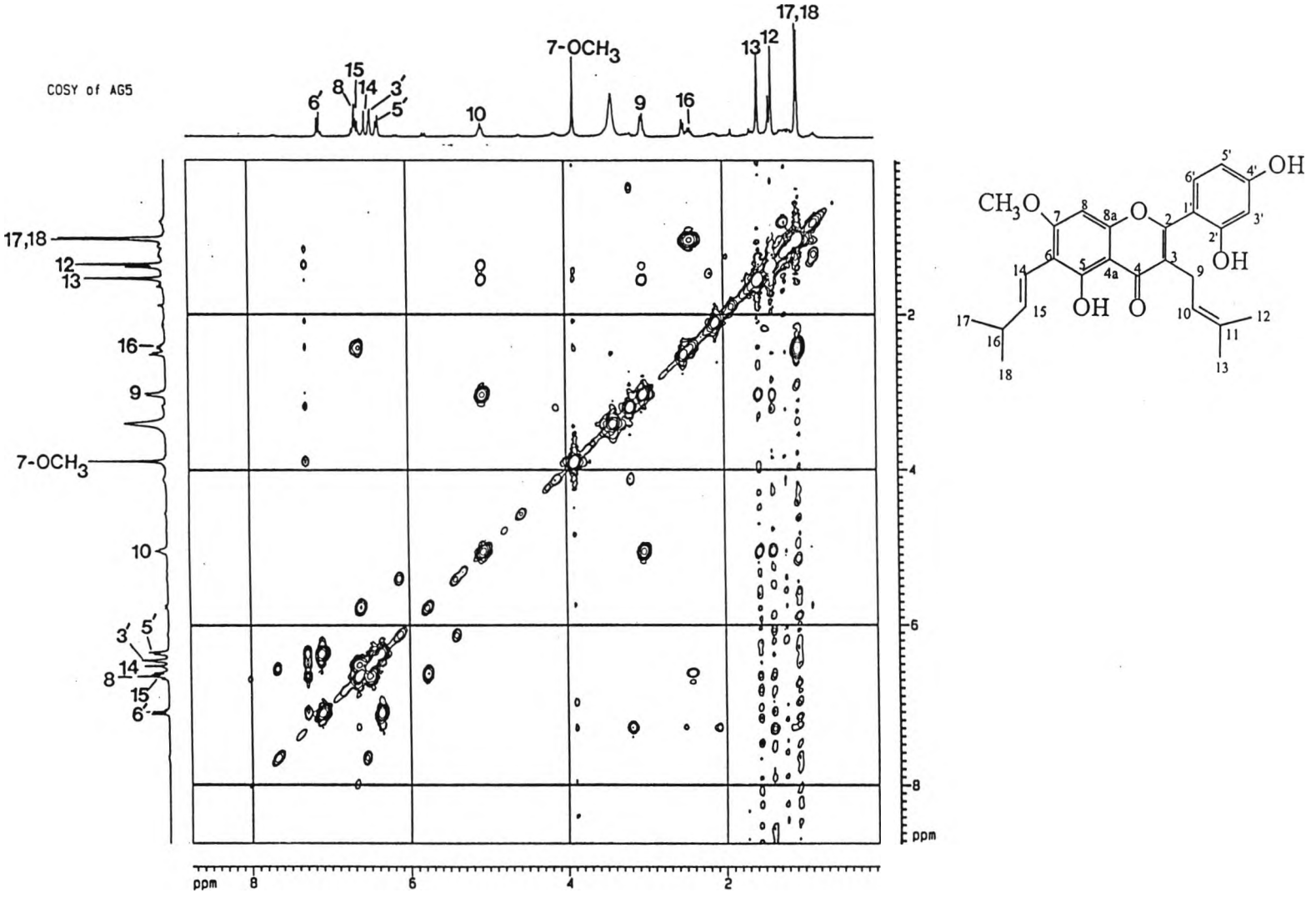


Figure 54 ^{1}H-^{1}H COSY spectrum of compound AG5 (in DMSO-d_6)

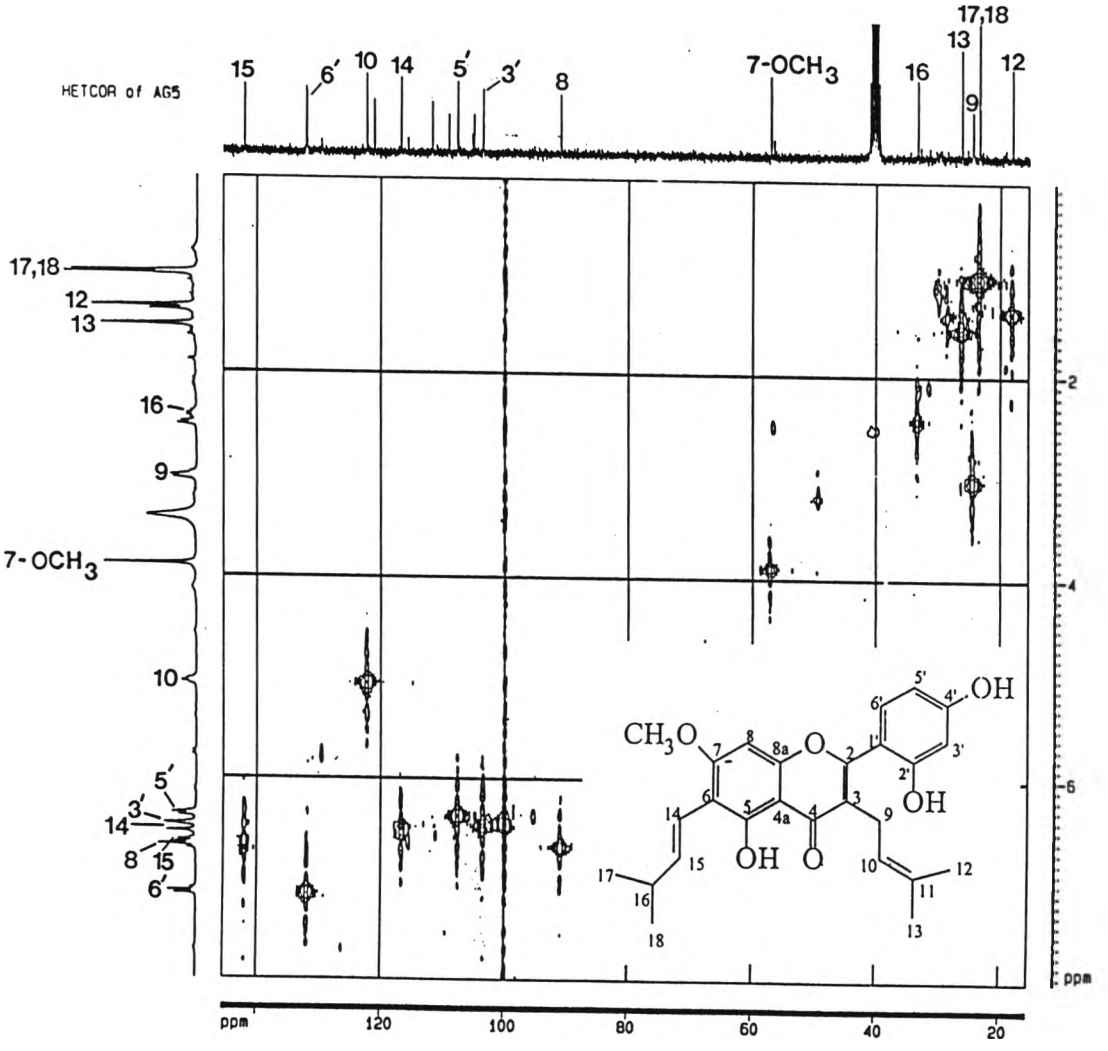


Figure 55 HETCOR spectrum of compound AG5 (in DMSO-d_6)

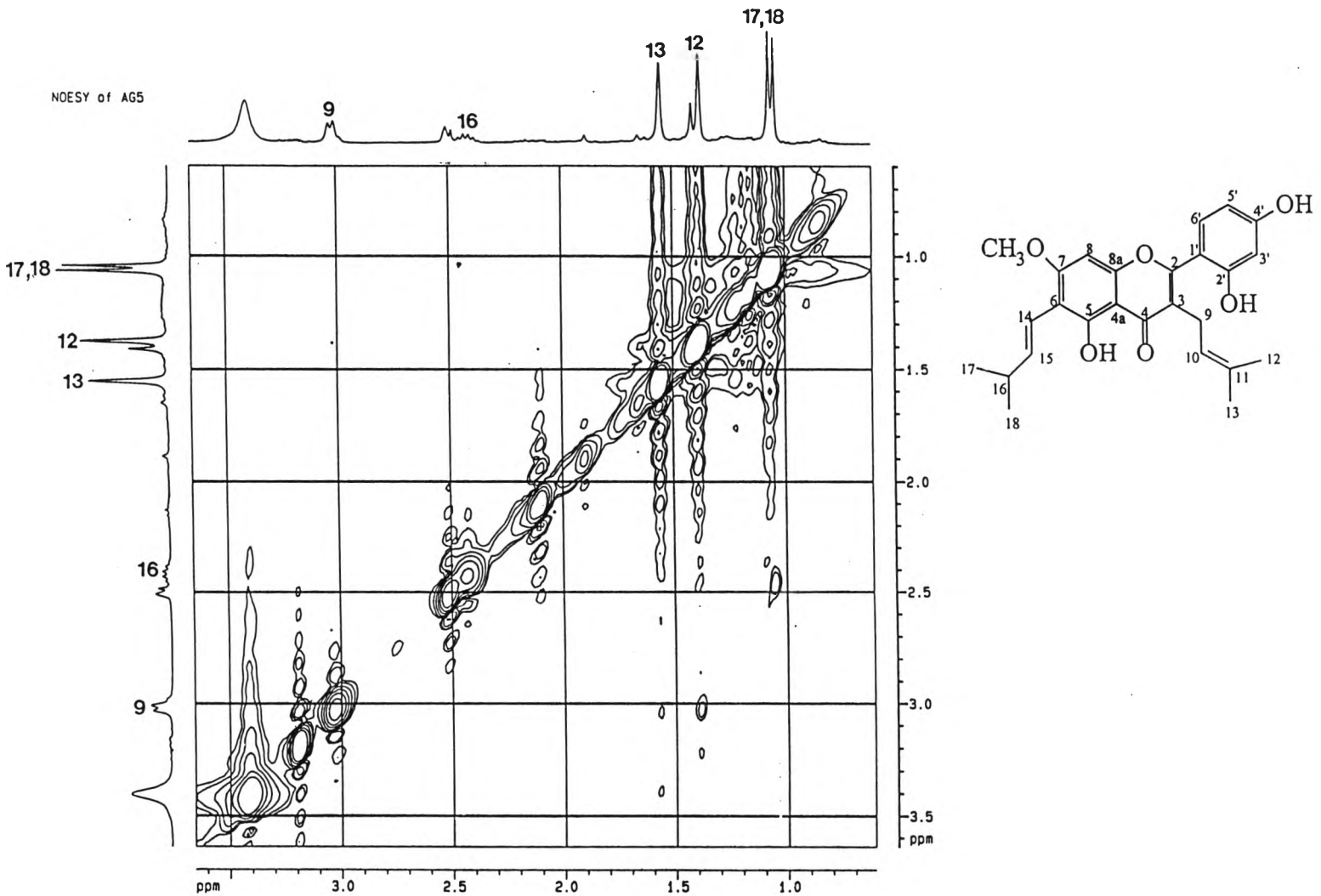


Figure 56 NOESY spectrum of compound AG5 (in DMSO-d_6)

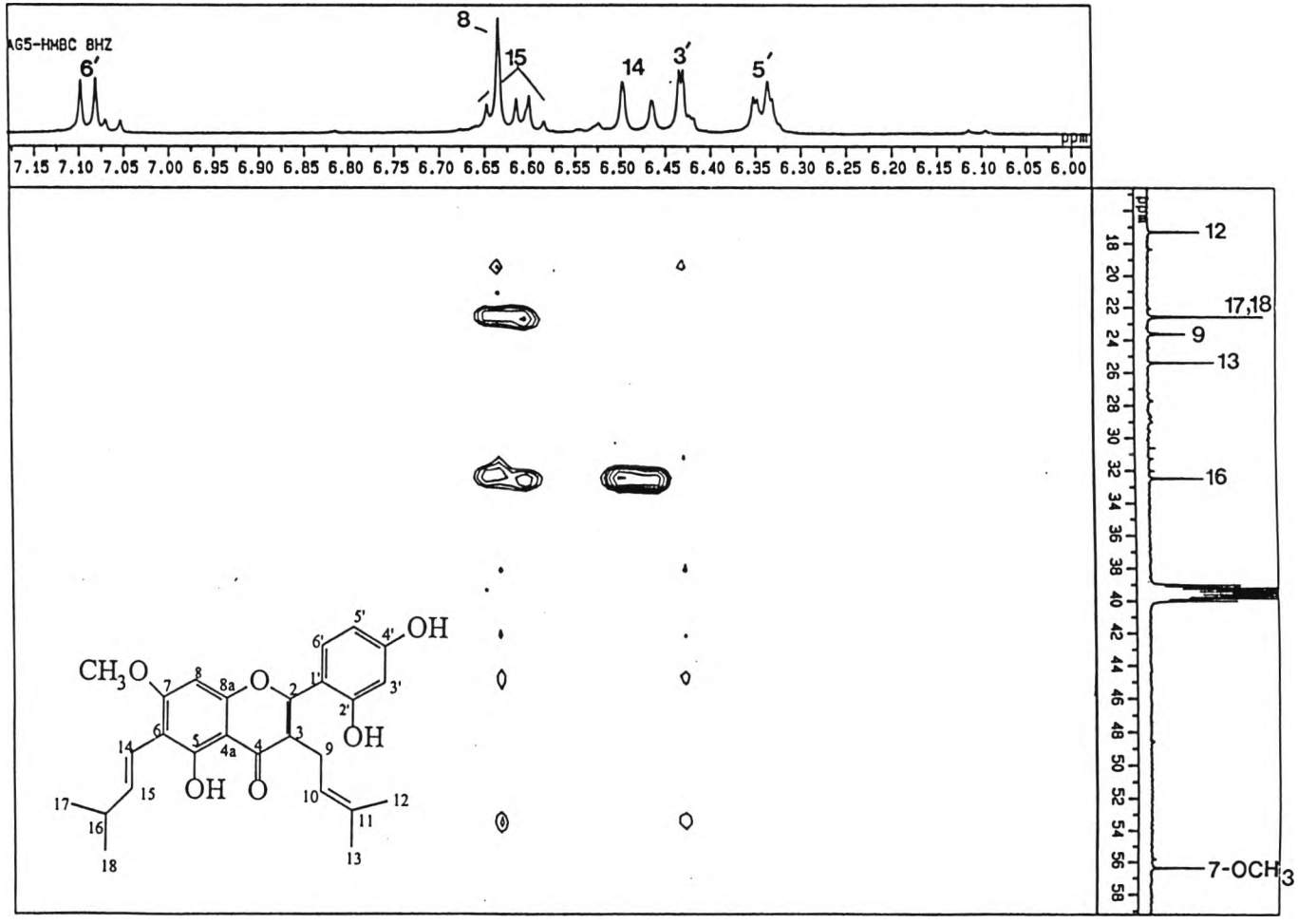


Figure 57a HMBC spectrum of compound AG5 (in DMSO-d_6) [δ_H 6.00-7.15 ppm, δ_C 17-58 ppm]

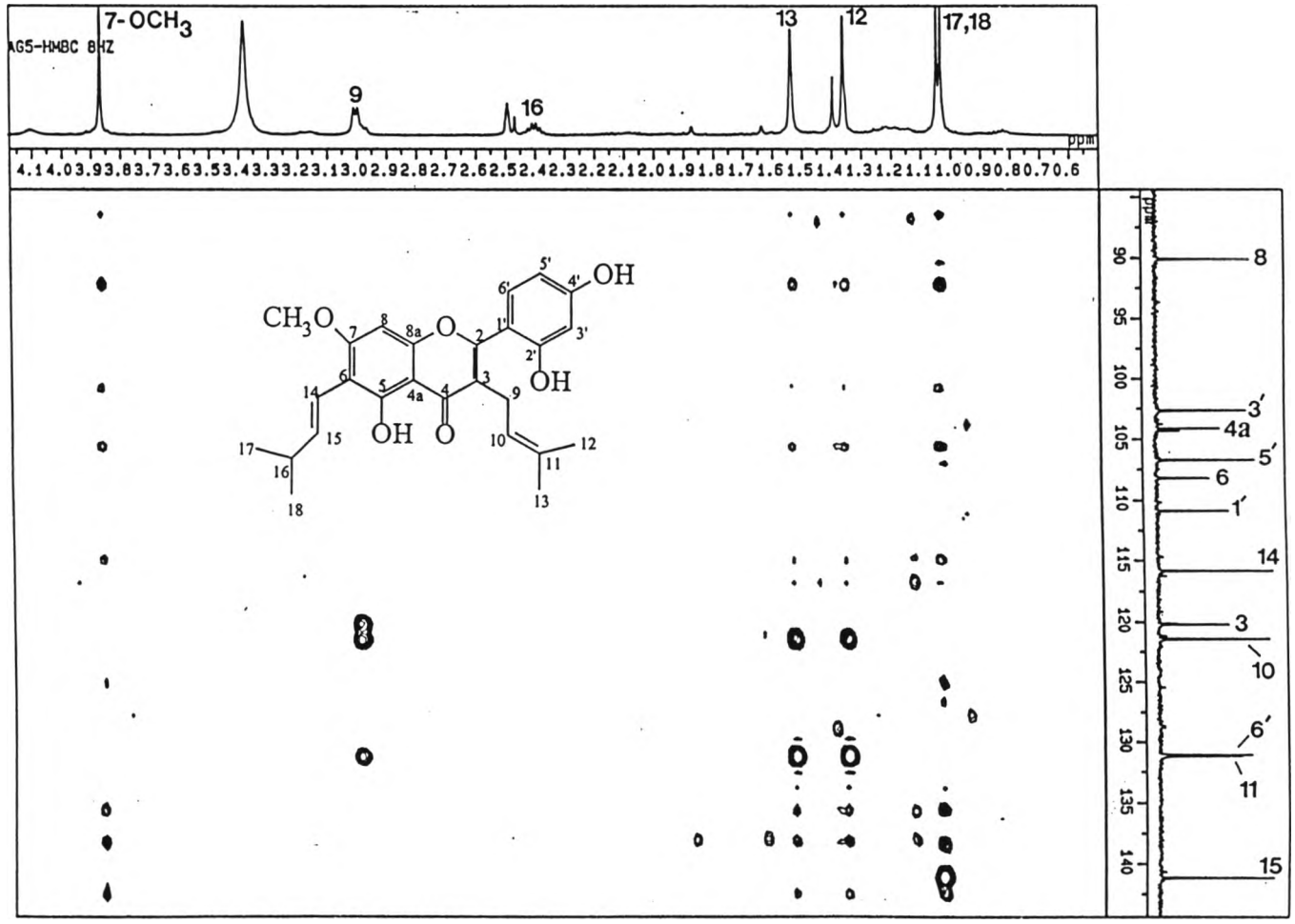


Figure 57b HMBC spectrum of compound AG5 (in DMSO-d_6) [δ_H 0.6-4.1 ppm, δ_C 85-145 ppm]

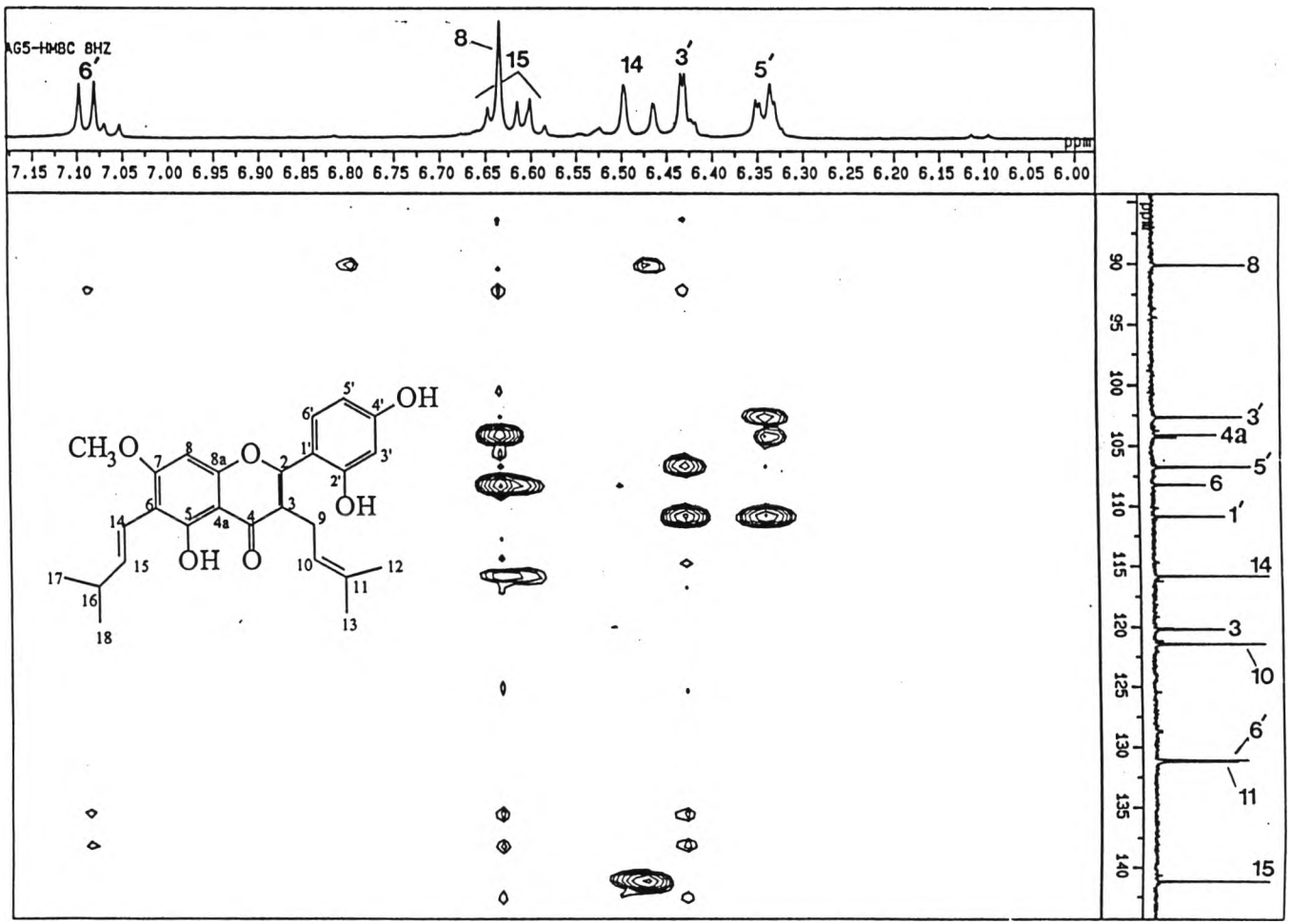


Figure 57c HMBC spectrum of compound AG5 (in DMSO-d_6) [δ_H 6.00-7.15 ppm, δ_C 80-145 ppm]

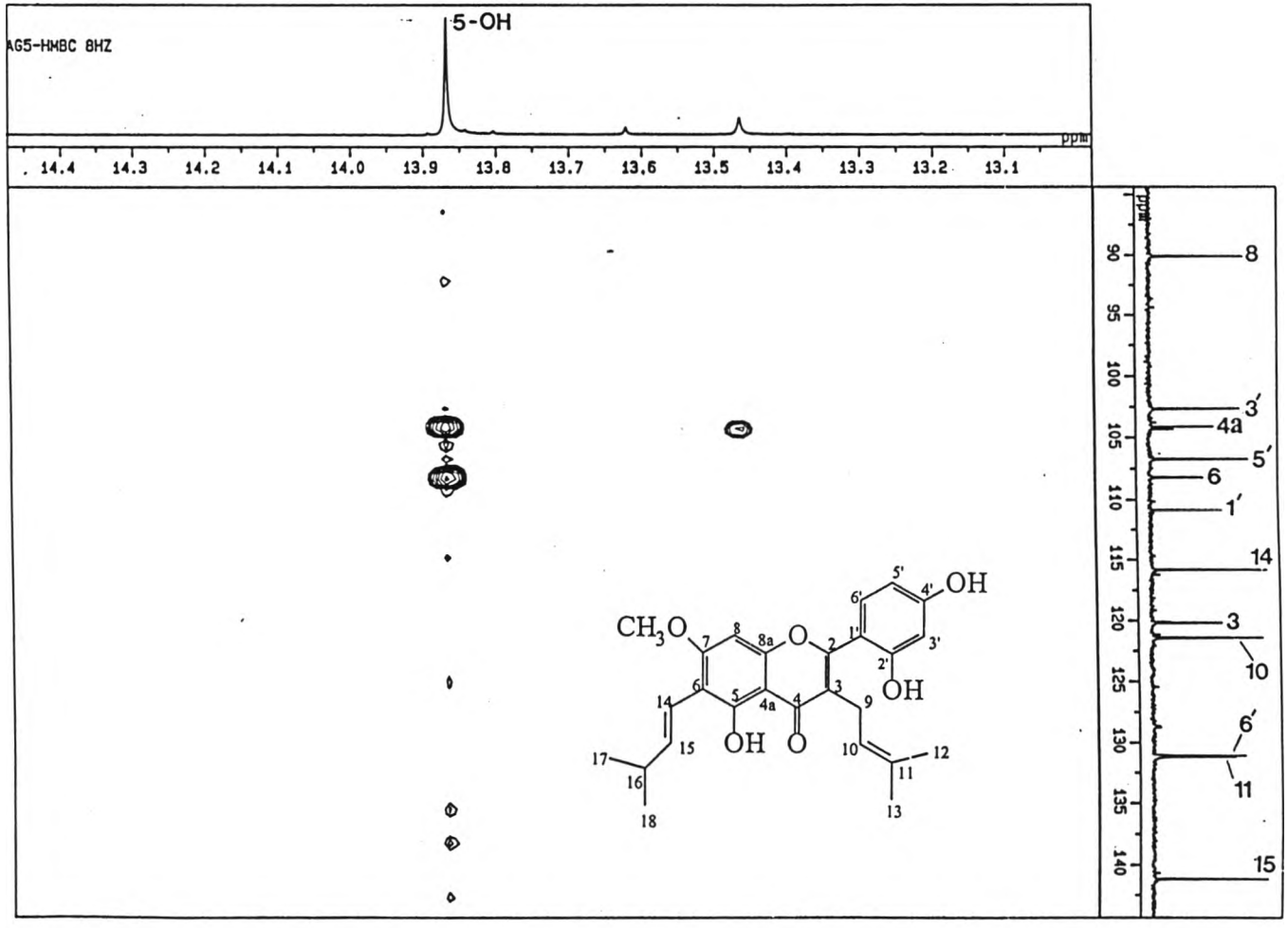


Figure 57d HMBC spectrum of compound AG5 (in DMSO-d_6) [δ_H 13.1-14.4 ppm, δ_C 80-145 ppm]

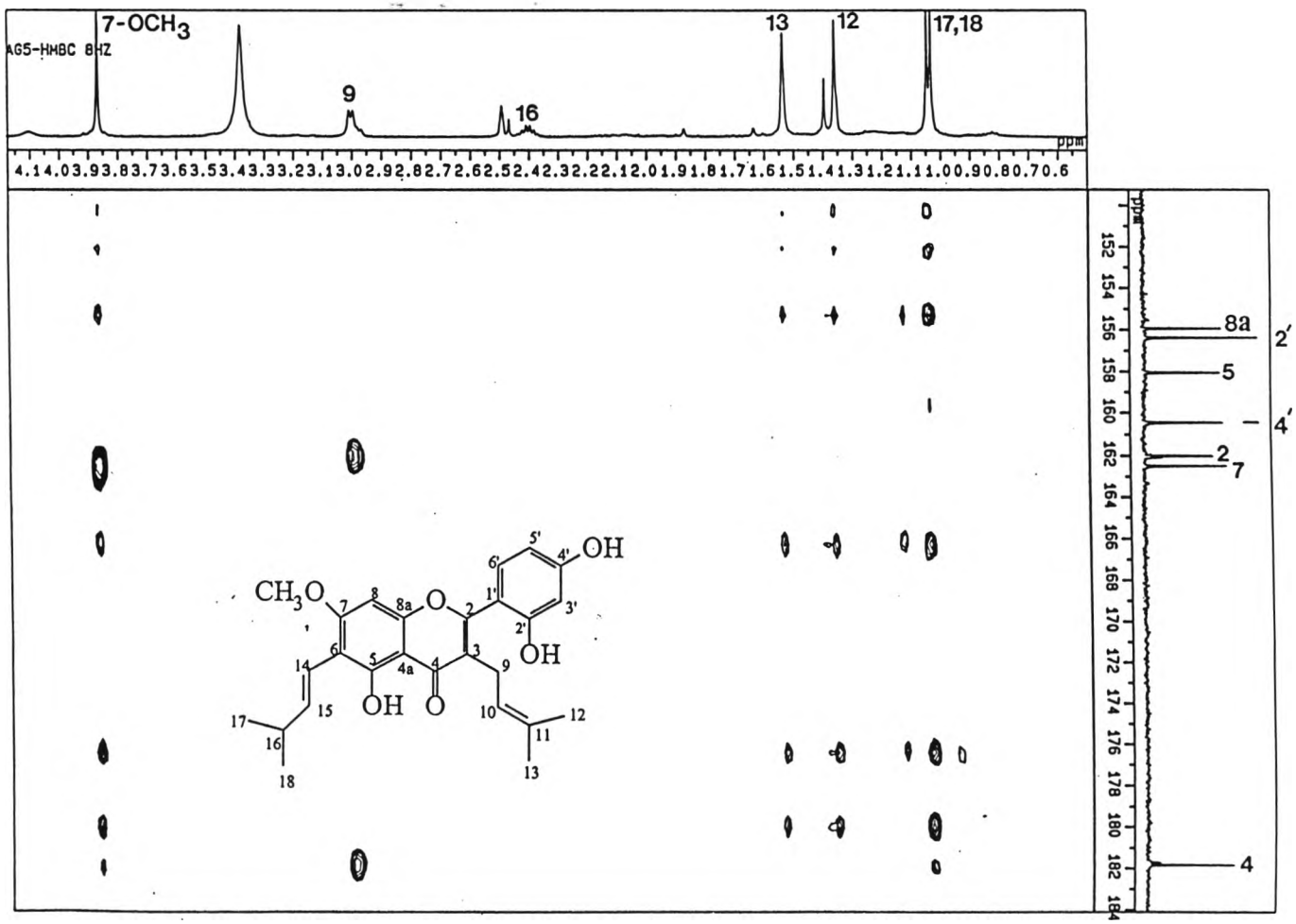


Figure 57e HMBC spectrum of compound AG5 (in DMSO-d_6) [δ_H 0.6-4.1 ppm, δ_C 151-184 ppm]

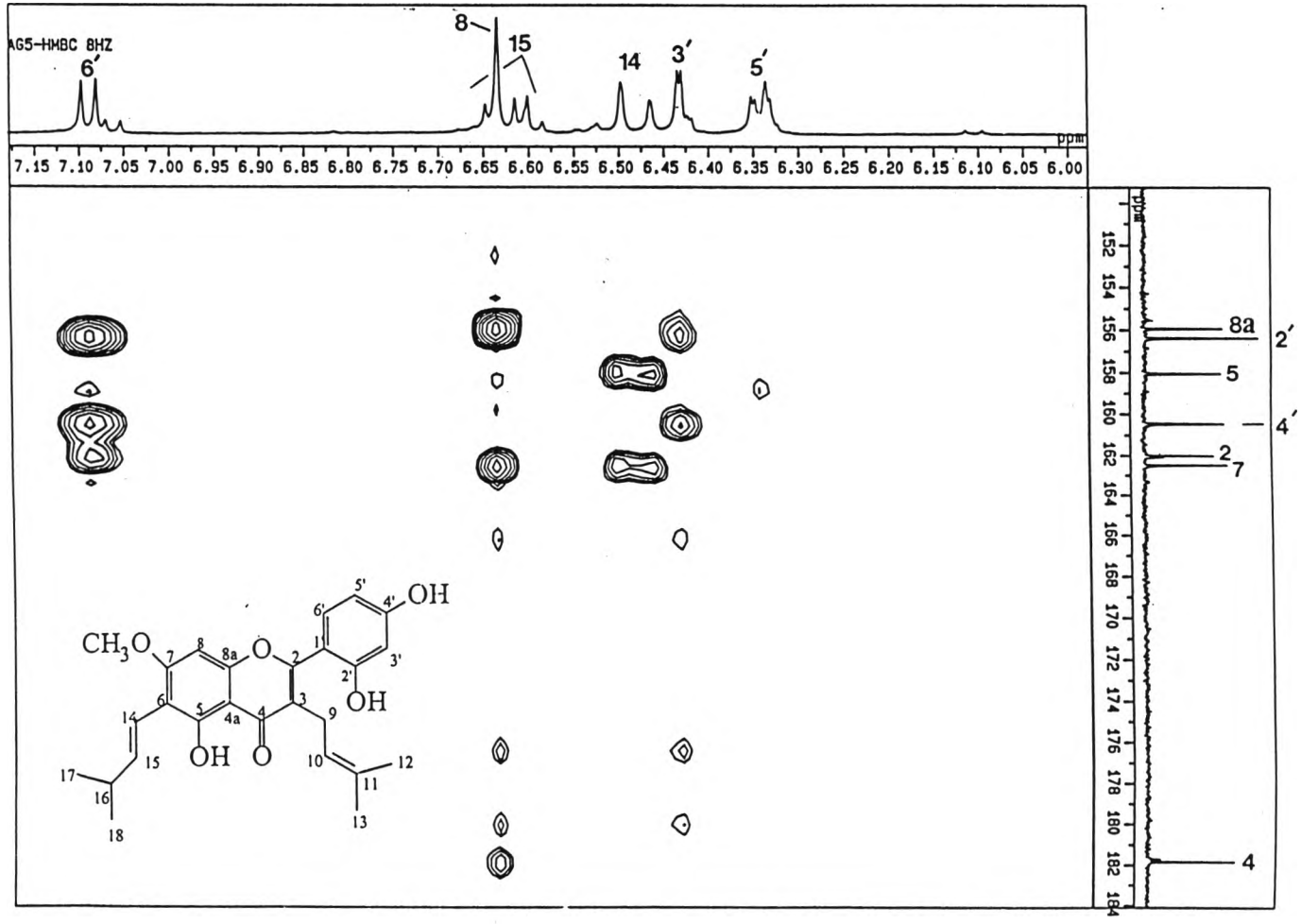


Figure 57f HMBC spectrum of compound AG5 (in DMSO-d_6) [δ_H 6.00-7.15 ppm, δ_C 151-184 ppm]

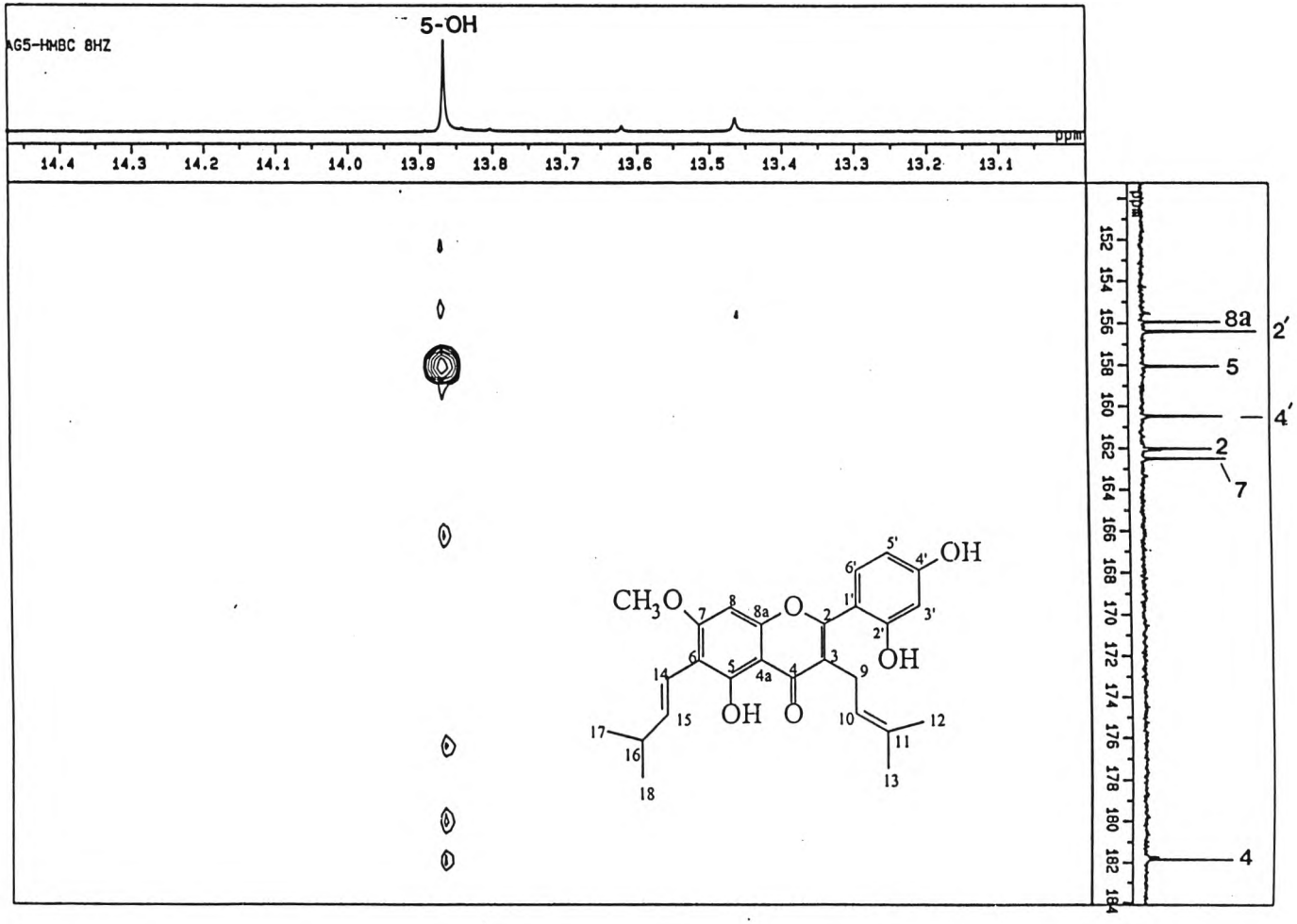


Figure 57g HMBC spectrum of compound AG5 (in DMSO-d_6) [δ_H 13.1-14.4 ppm, δ_C 151-184 ppm]

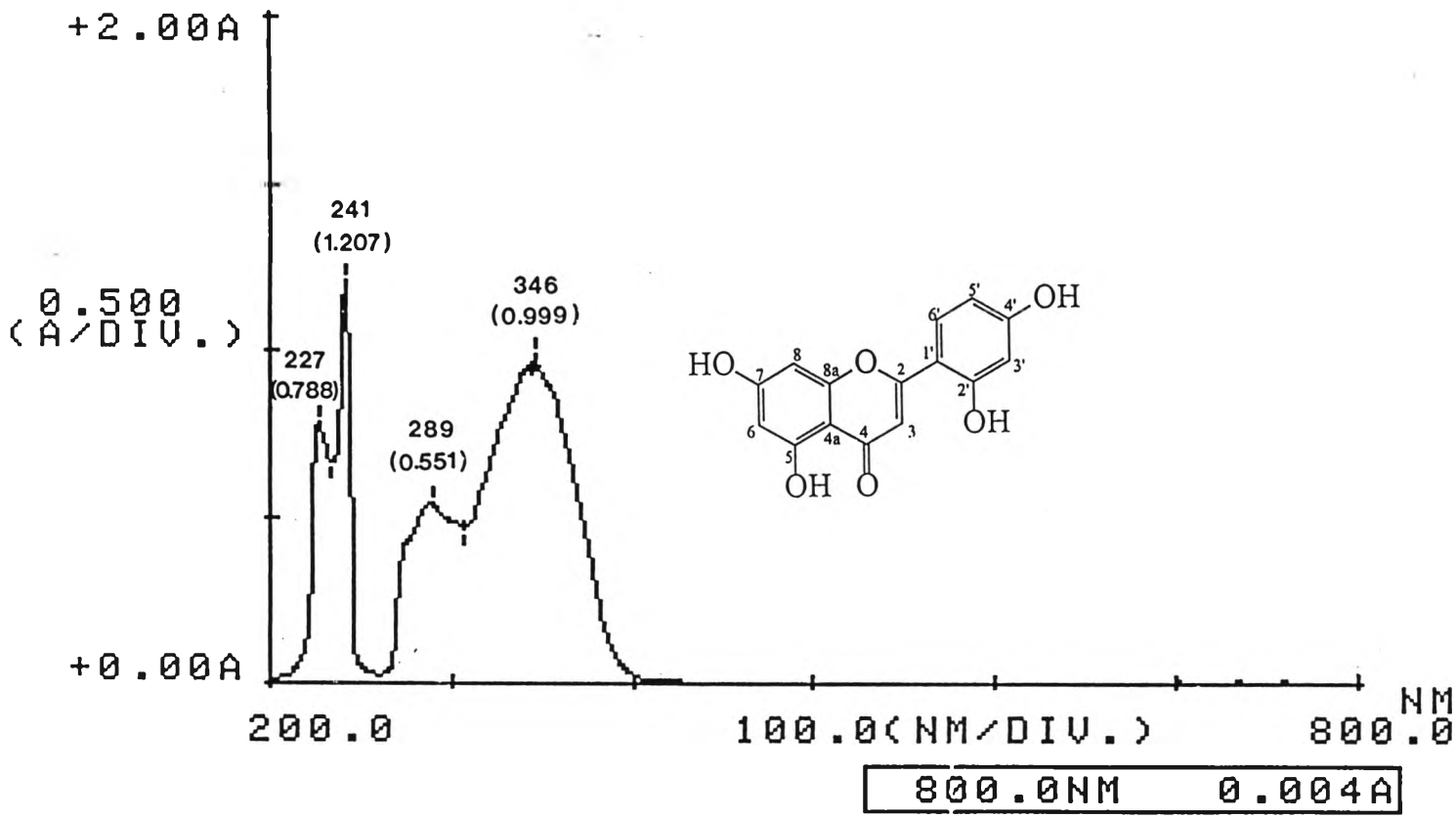


Figure 58 UV spectrum of compound AG6 (in methanol)

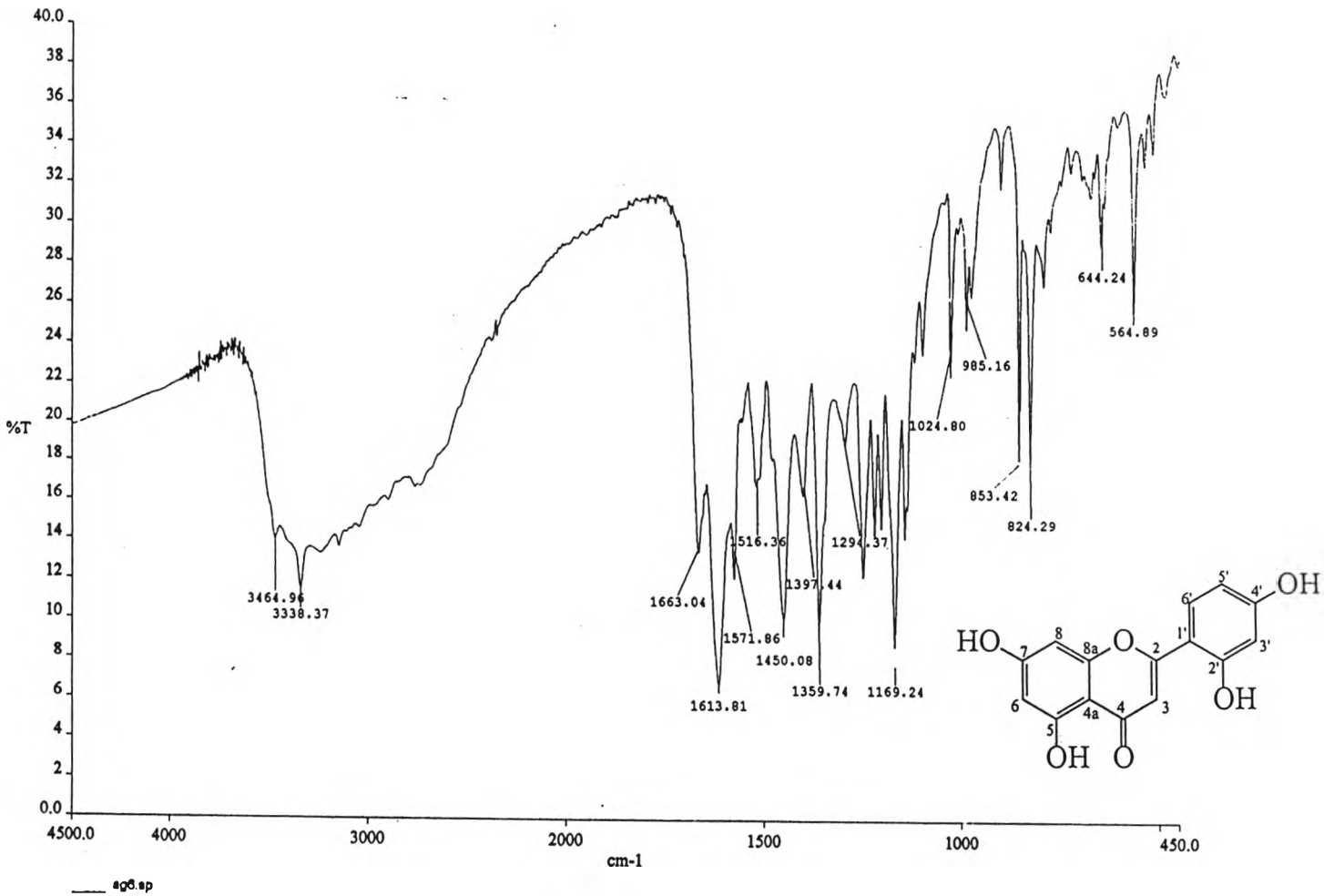


Figure 59 IR spectrum of compound AG6 (KBr disc)

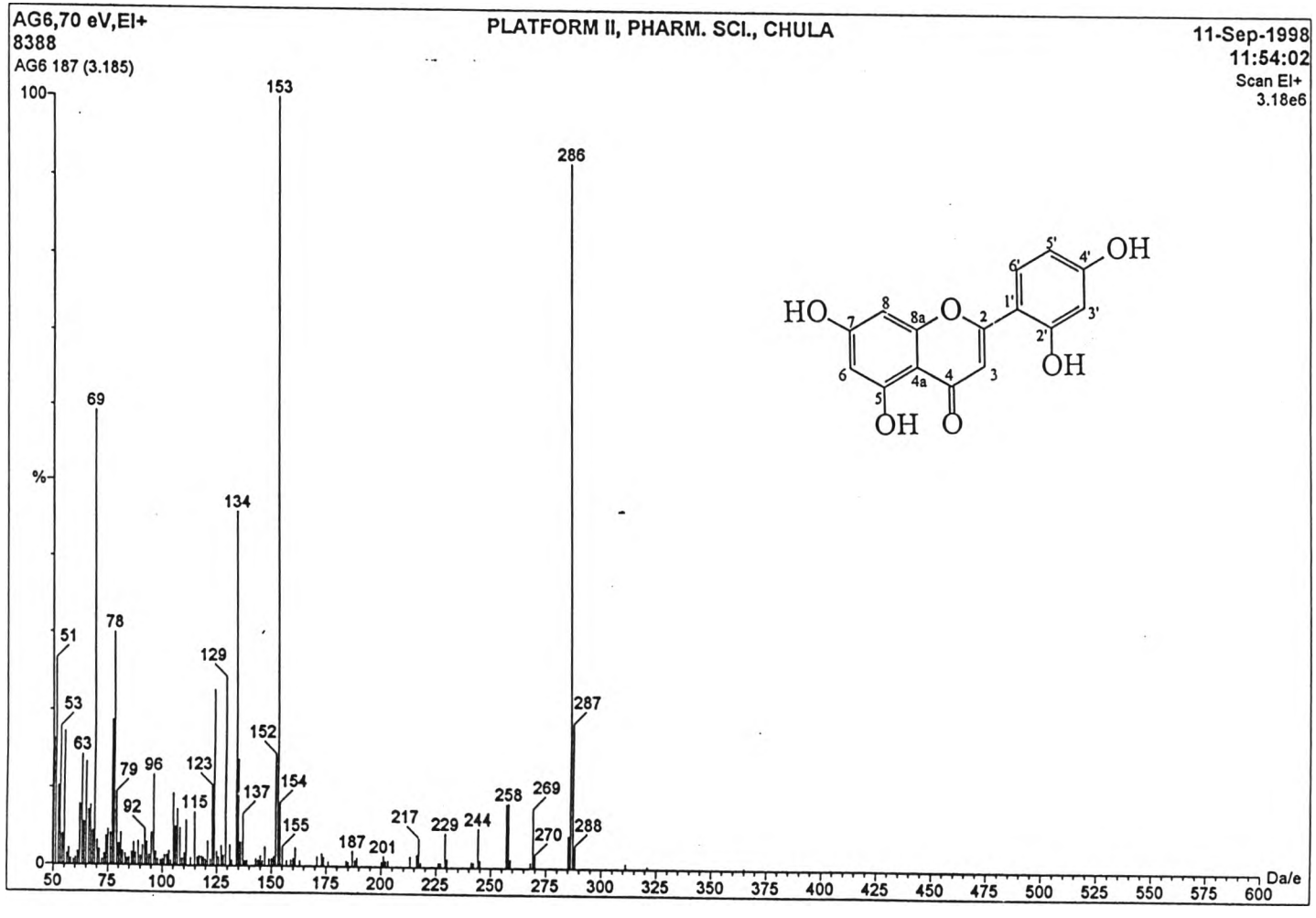


Figure 60 EI mass spectrum of compound AG6

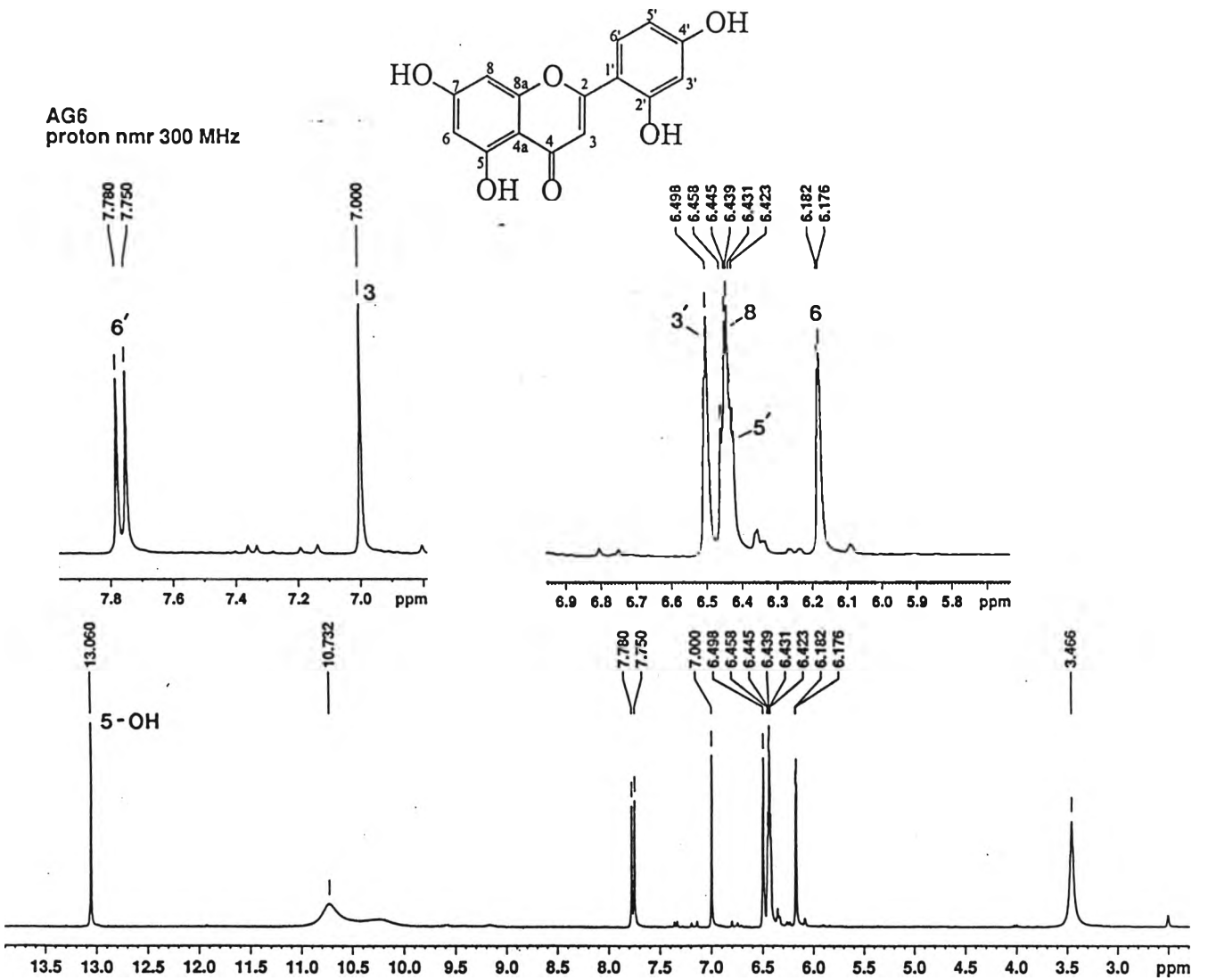


Figure 61 300 MHz ^{1}H NMR spectrum of compound AG6 (in DMSO-d_6)

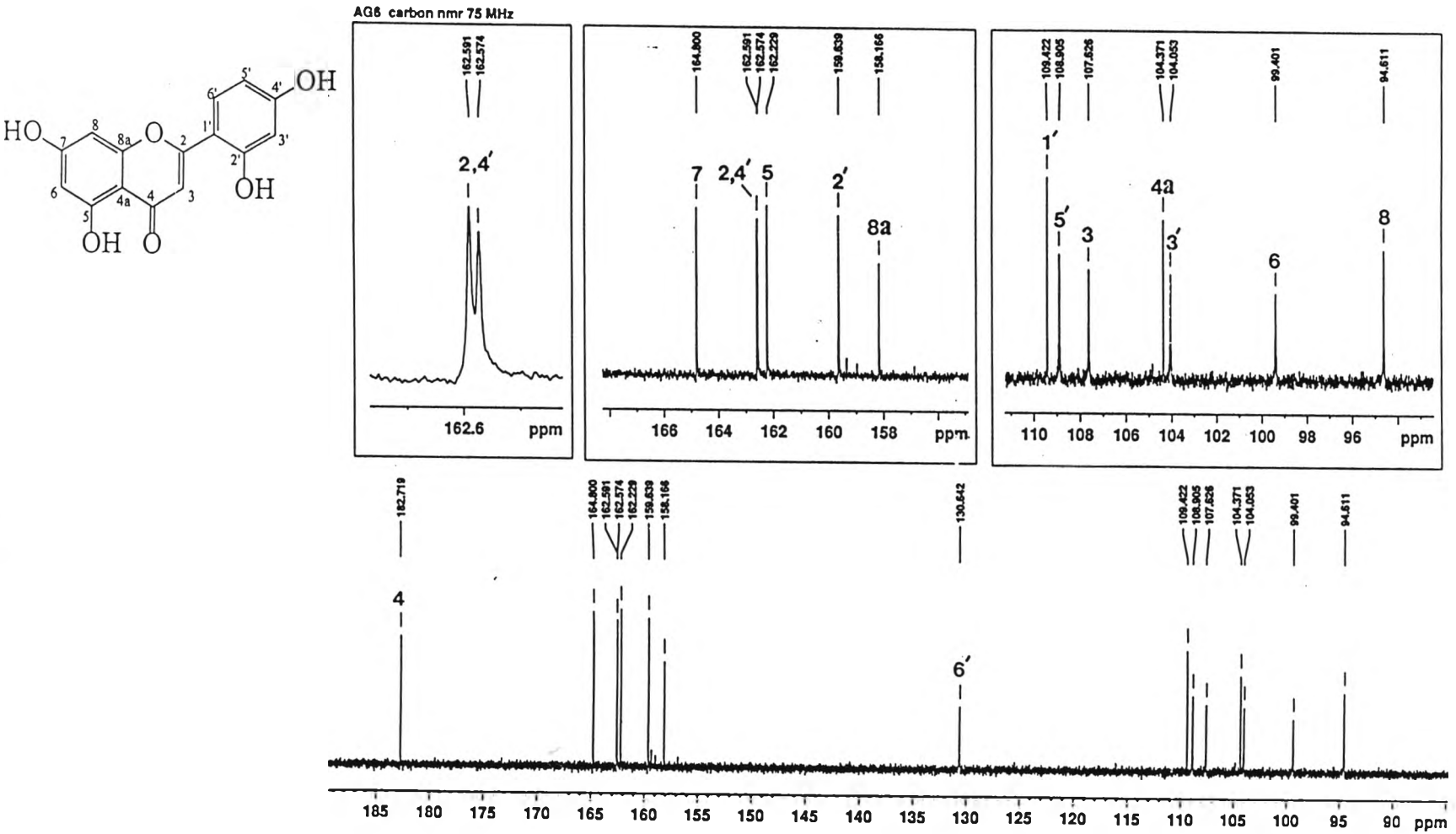


Figure 62 75 MHz ^{13}C NMR spectrum of compound AG6 (in DMSO-d_6)

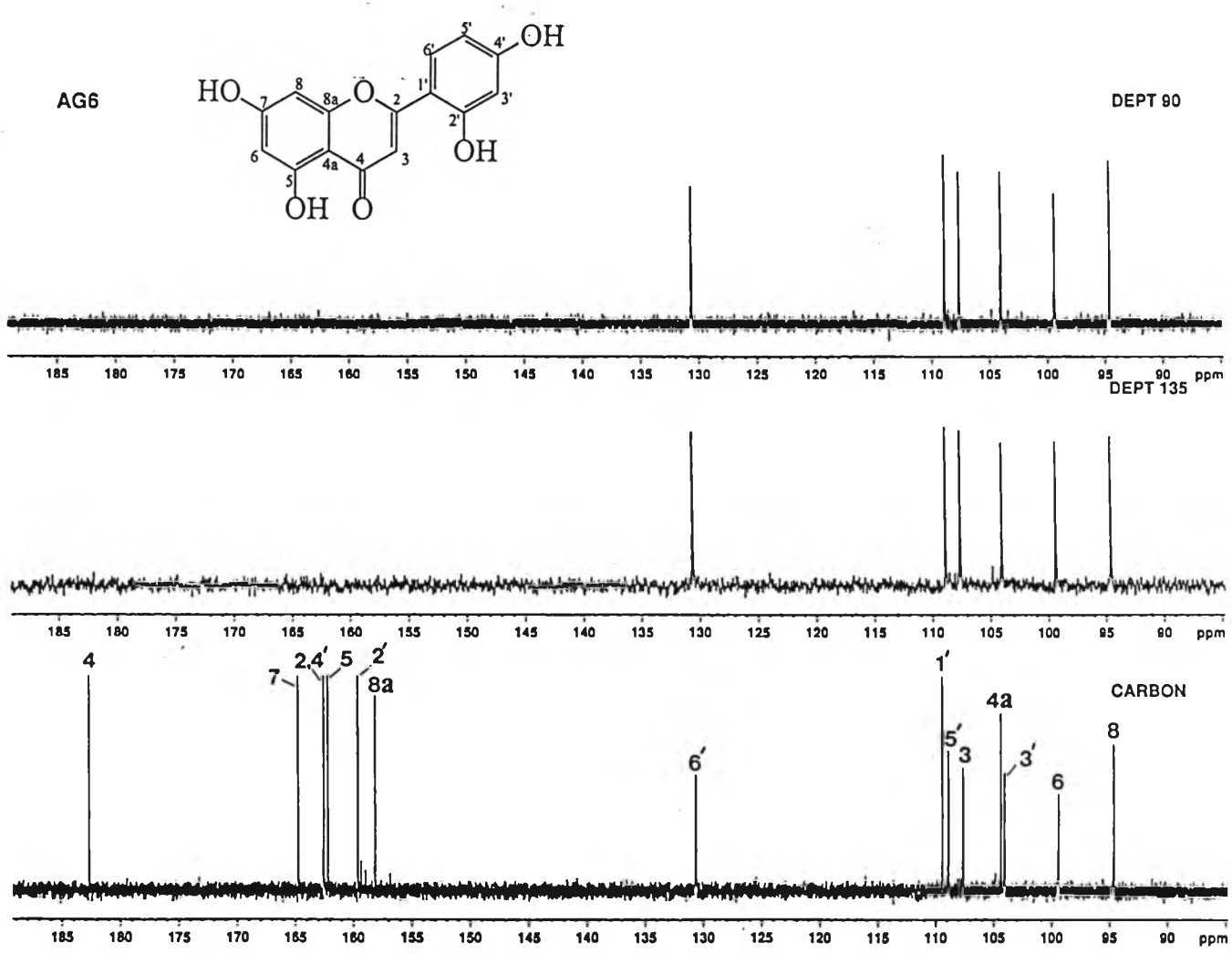


Figure 63 DEPT 90 and DEPT 135 spectra of compound AG6 (in DMSO-d_6)

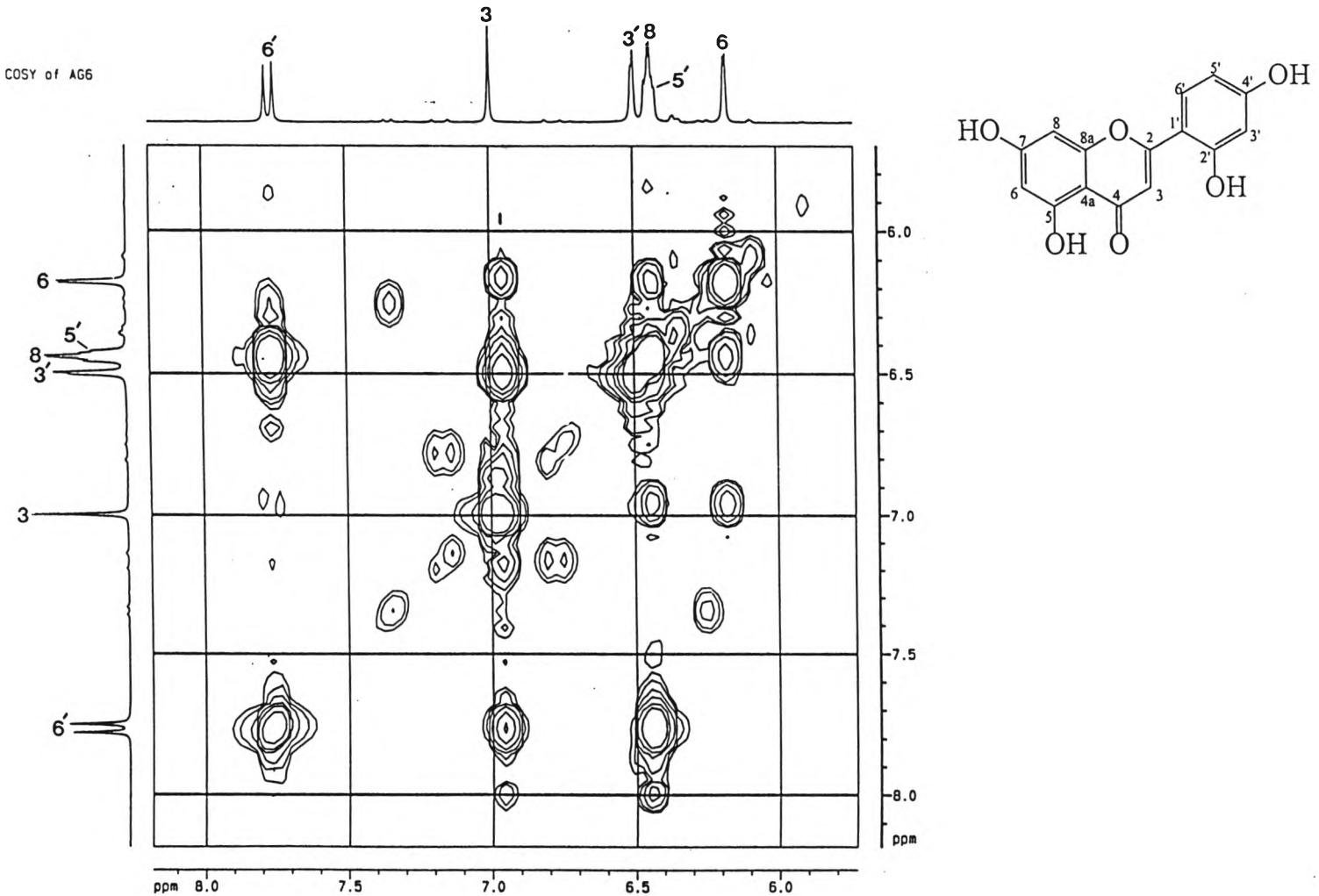


Figure 64 ^{1}H-^{1}H COSY spectrum of compound AG6 (in DMSO-d_6)

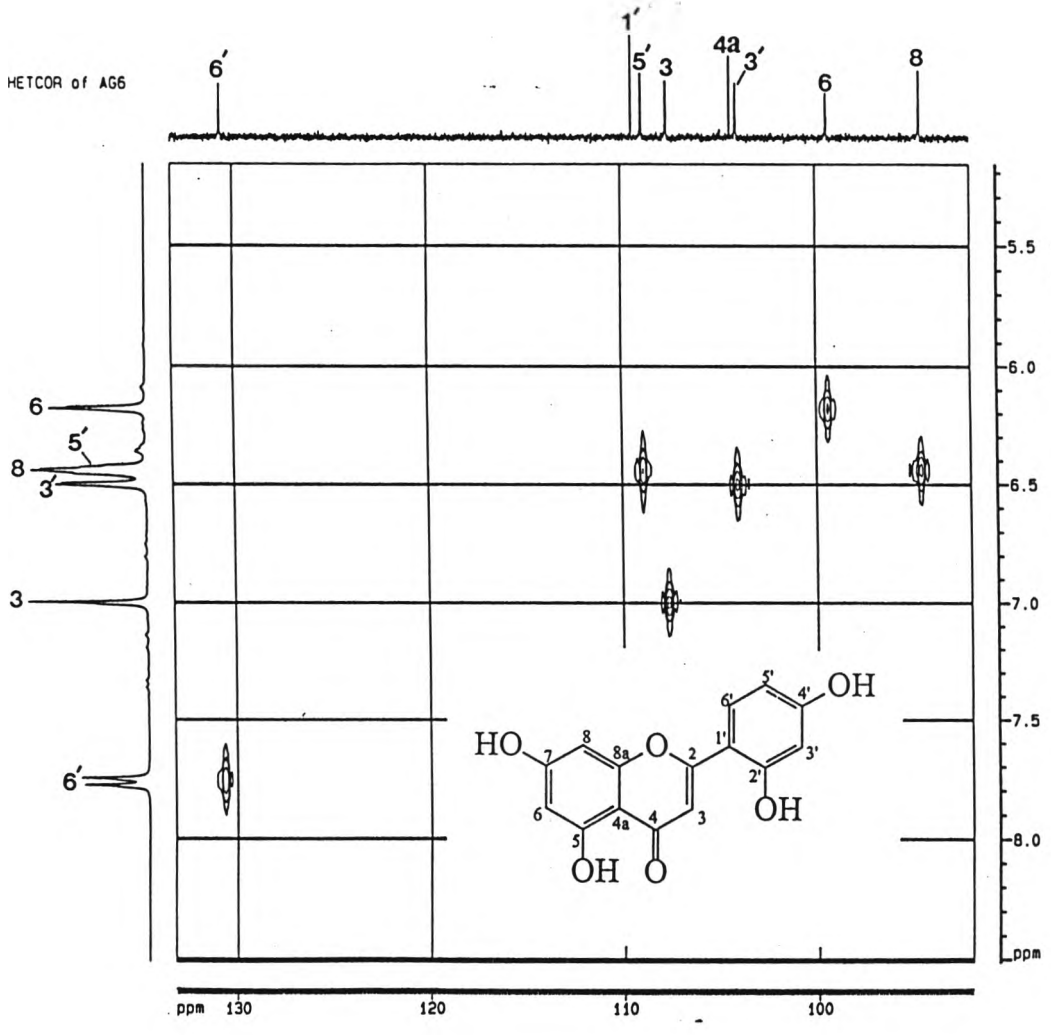


Figure 65 HETCOR spectrum of compound AG6 (in DMSO-d_6)

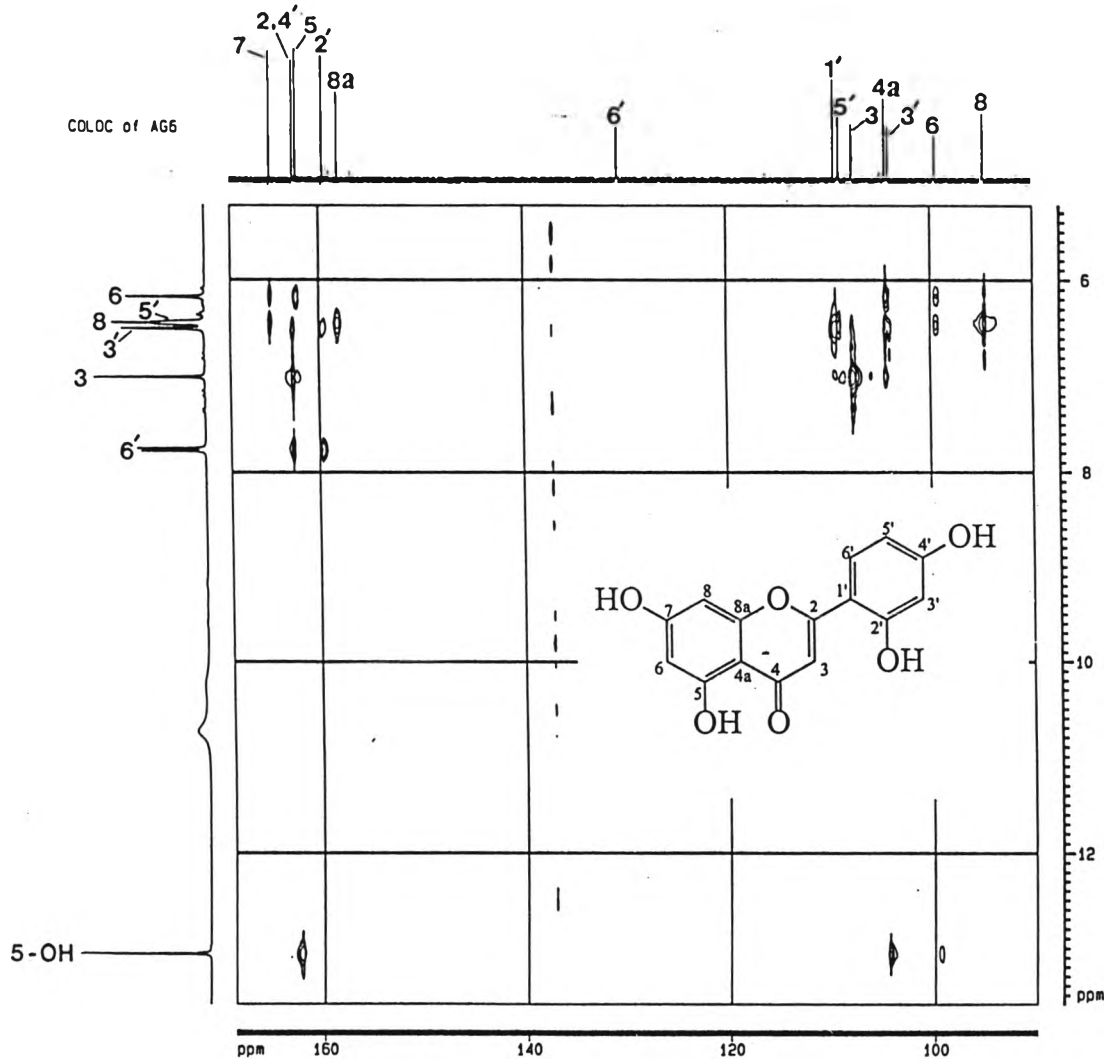


Figure 66 COLOC spectrum of compound AG6 (in DMSO-d_6)

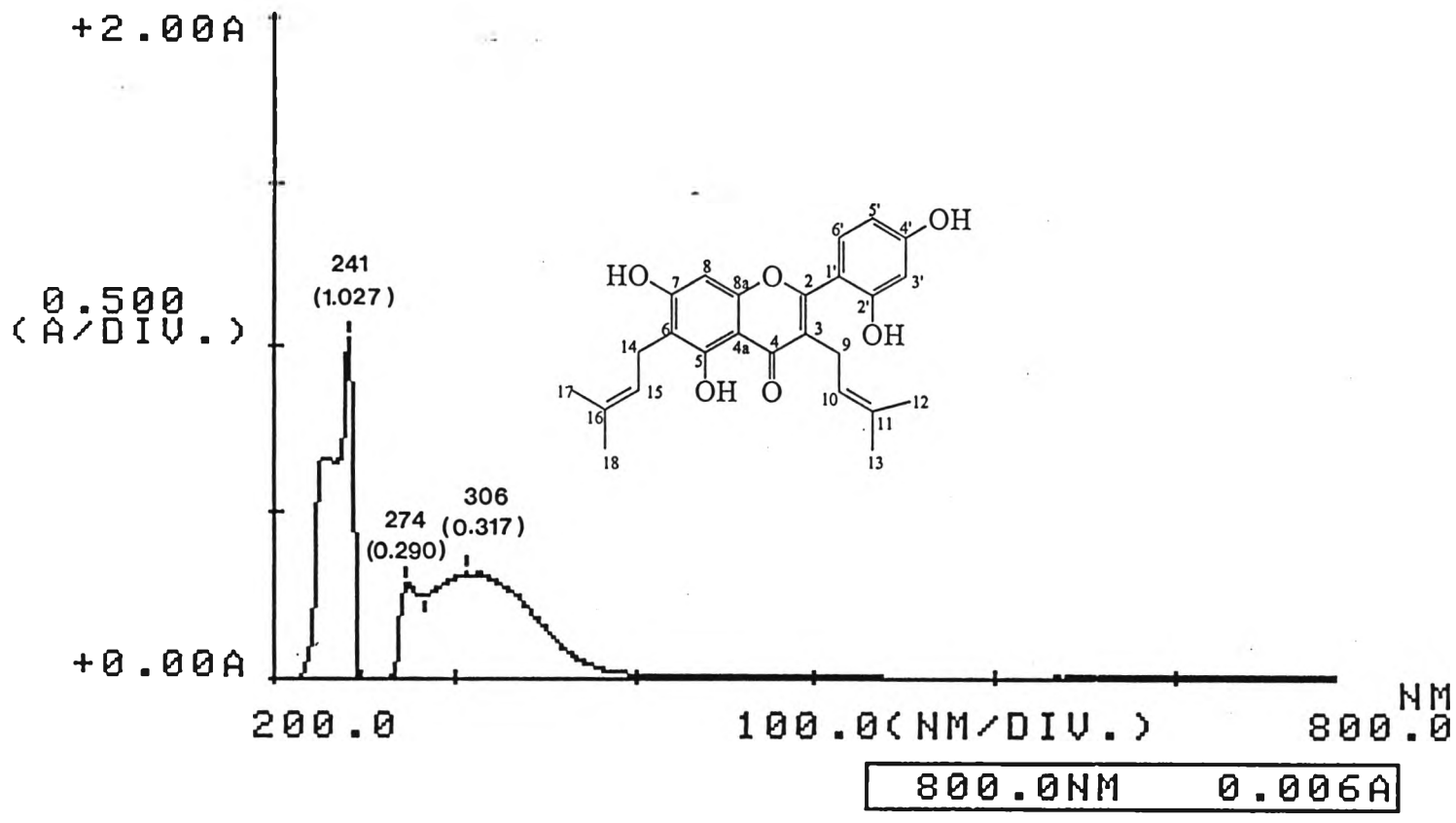


Figure 67 UV spectrum of compound AG7 (in methanol)

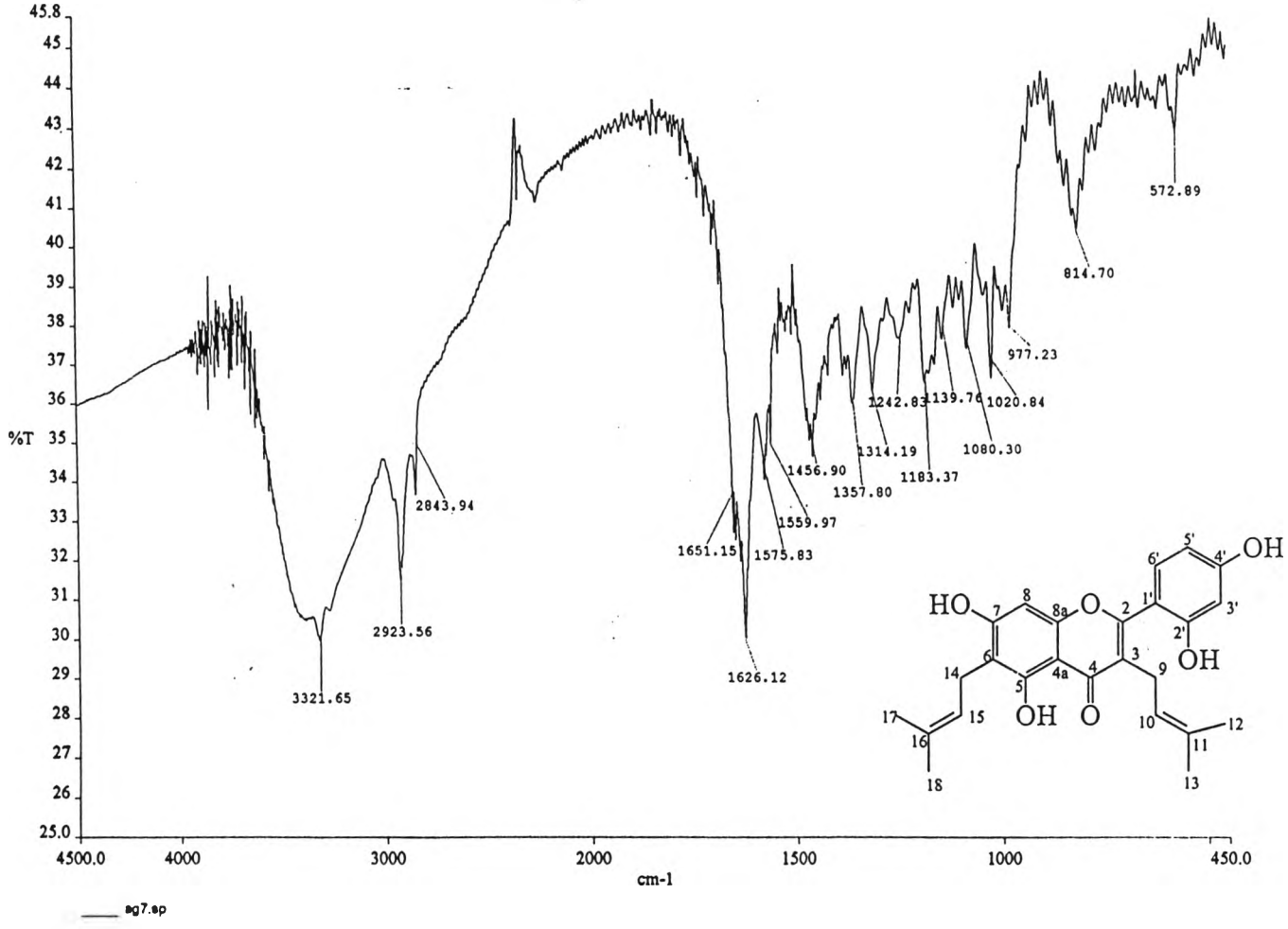


Figure 68 IR spectrum of compound AG7 (KBr disc)

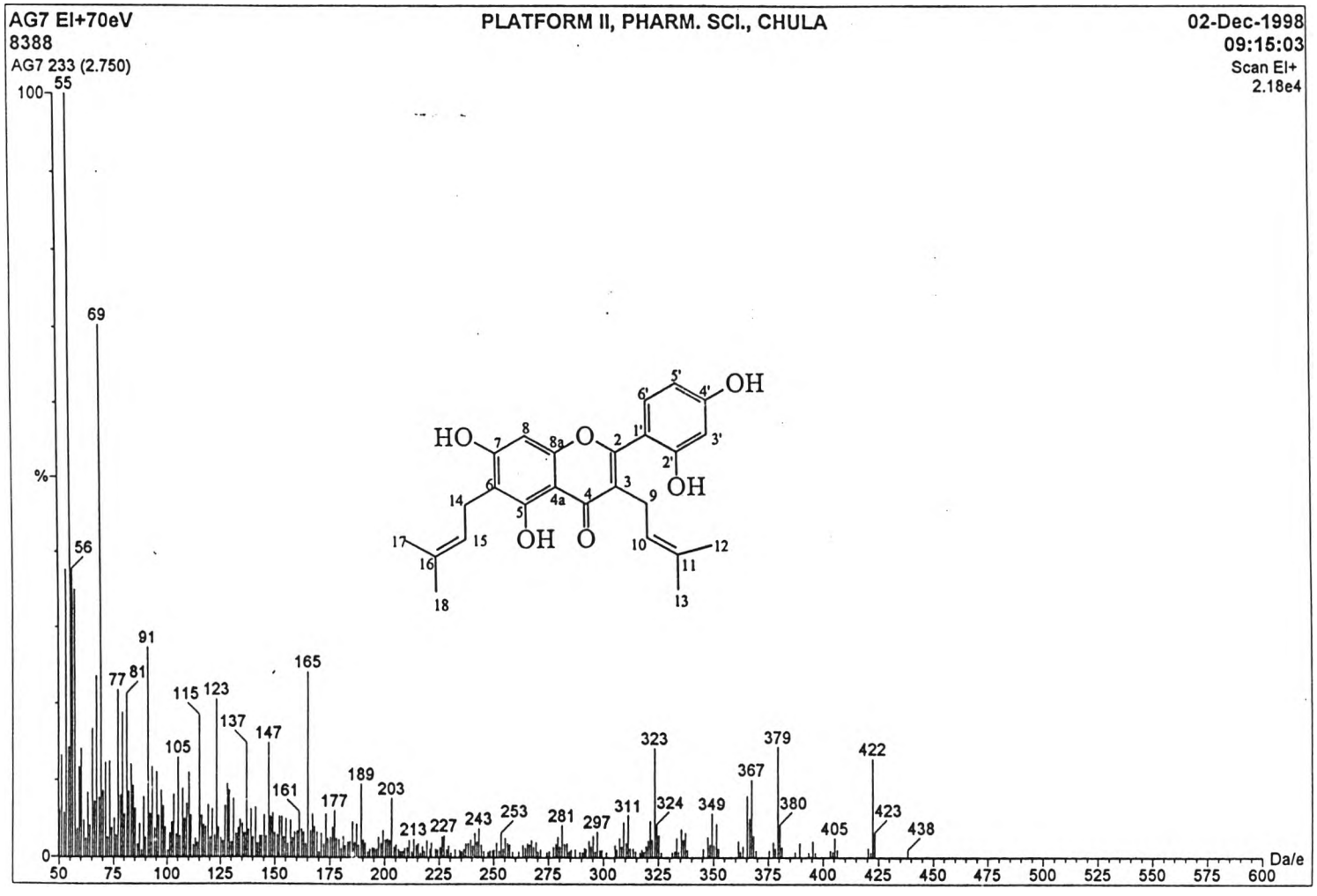


Figure 69 EI mass spectrum of compound AG7

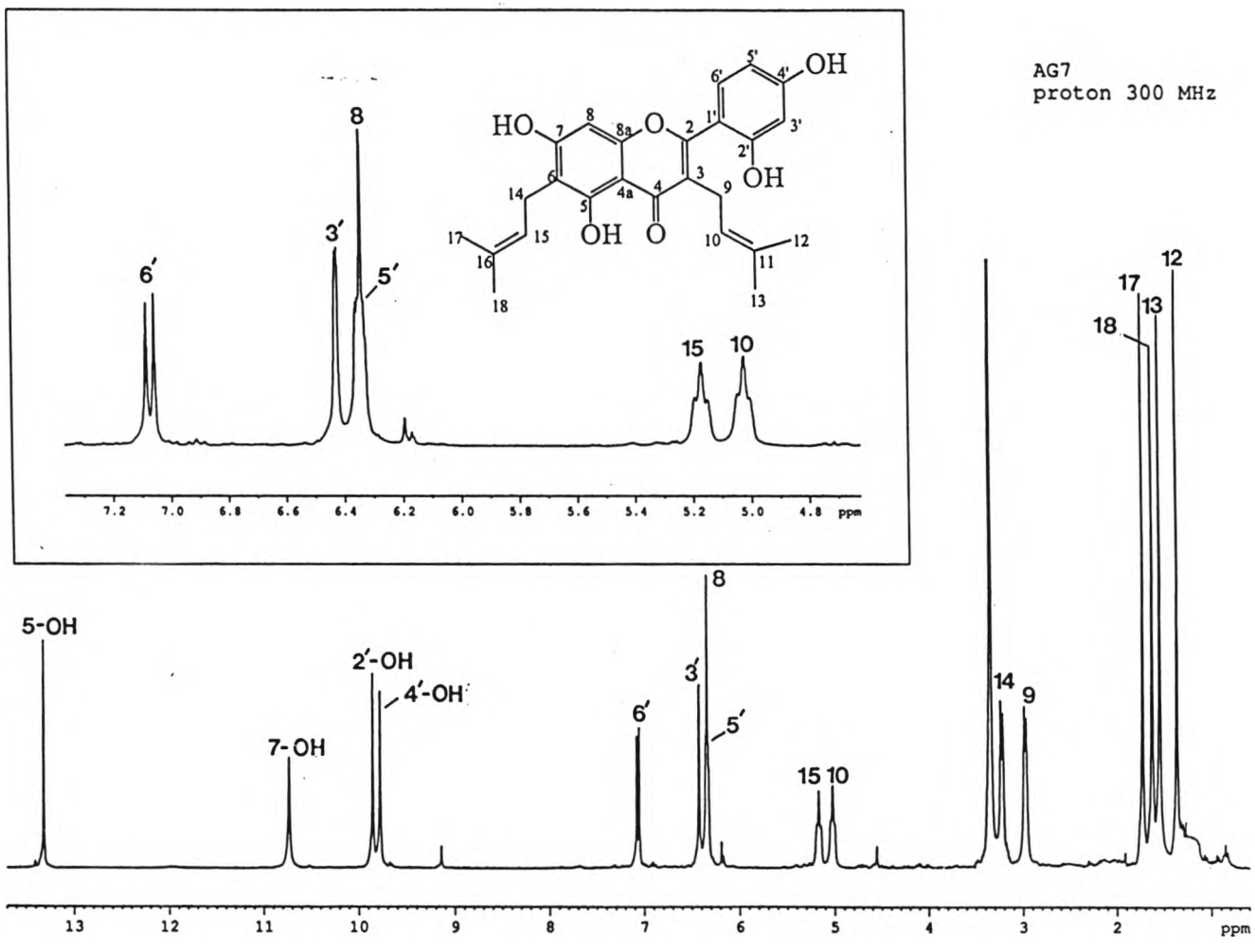


Figure 70 300 MHz ^{1}H NMR spectrum of compound AG7 (in DMSO-d_6)

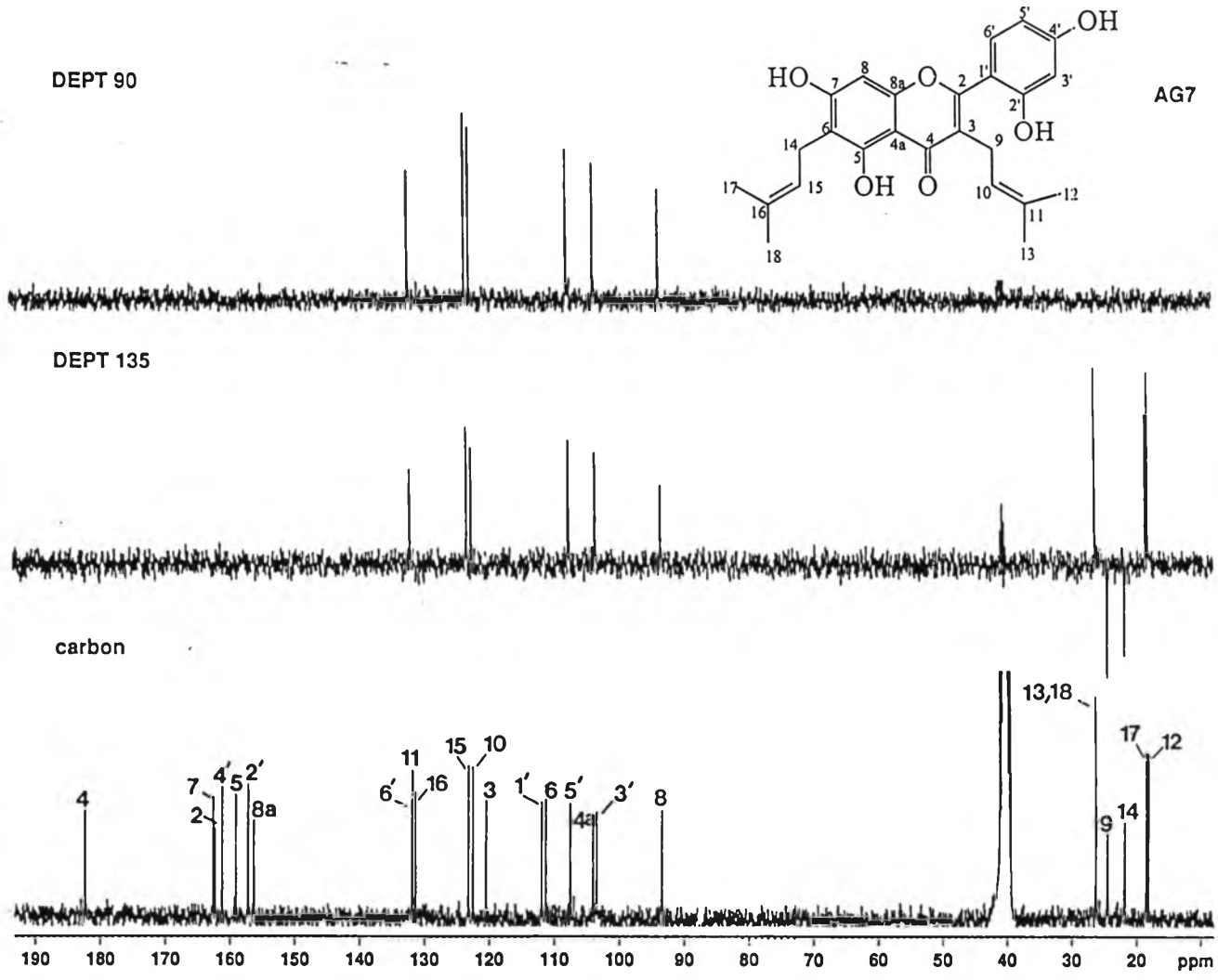


Figure 71 75 MHz ^{13}C NMR, DEPT 90 and DEPT 135 spectra of compound AG7 (in DMSO-d_6)

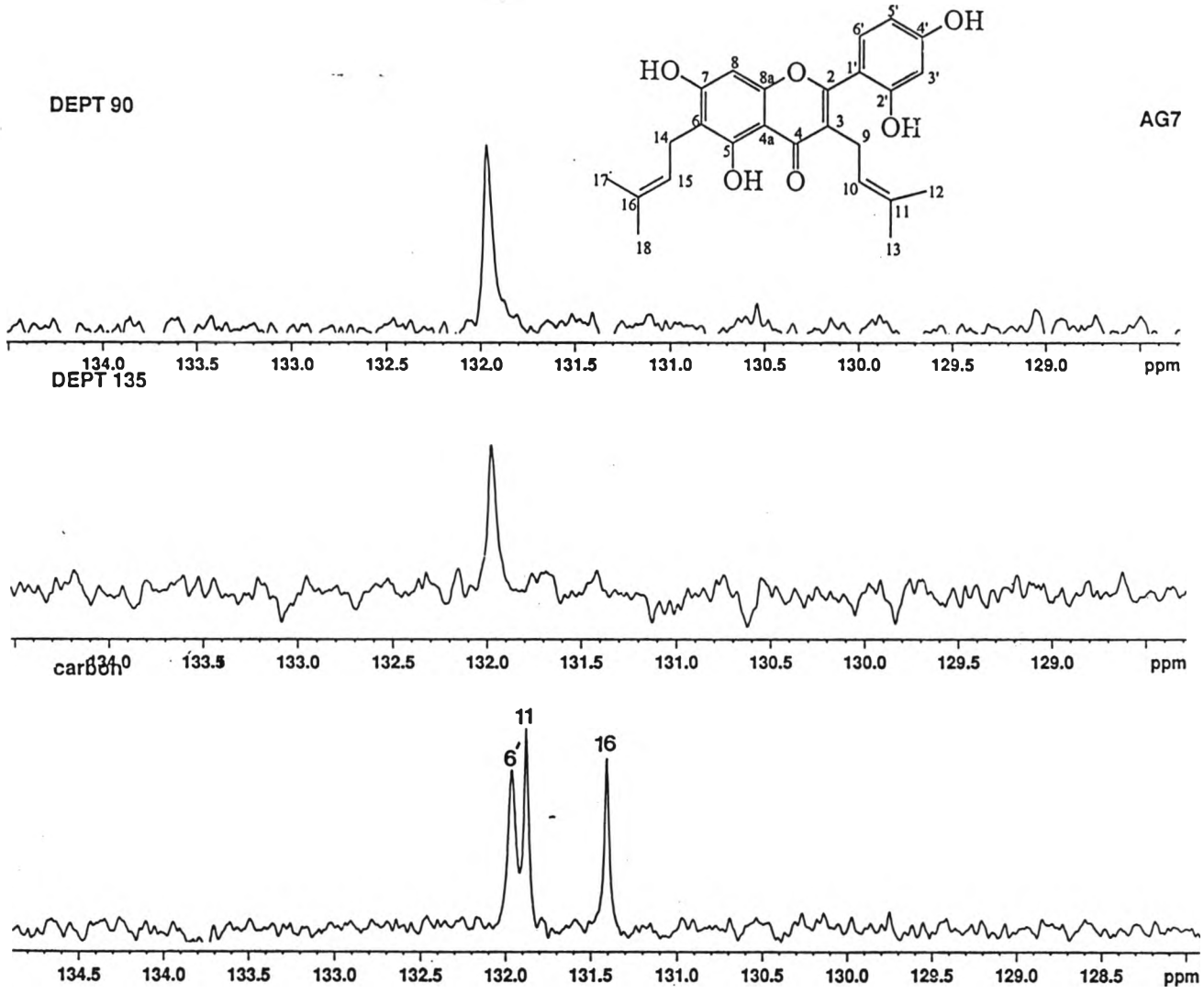


Figure 72 DEPT 90 and DEPT 135 spectra of compound AG7 (in DMSO-d_6) (expanded from 128.5 to 134.5 ppm)

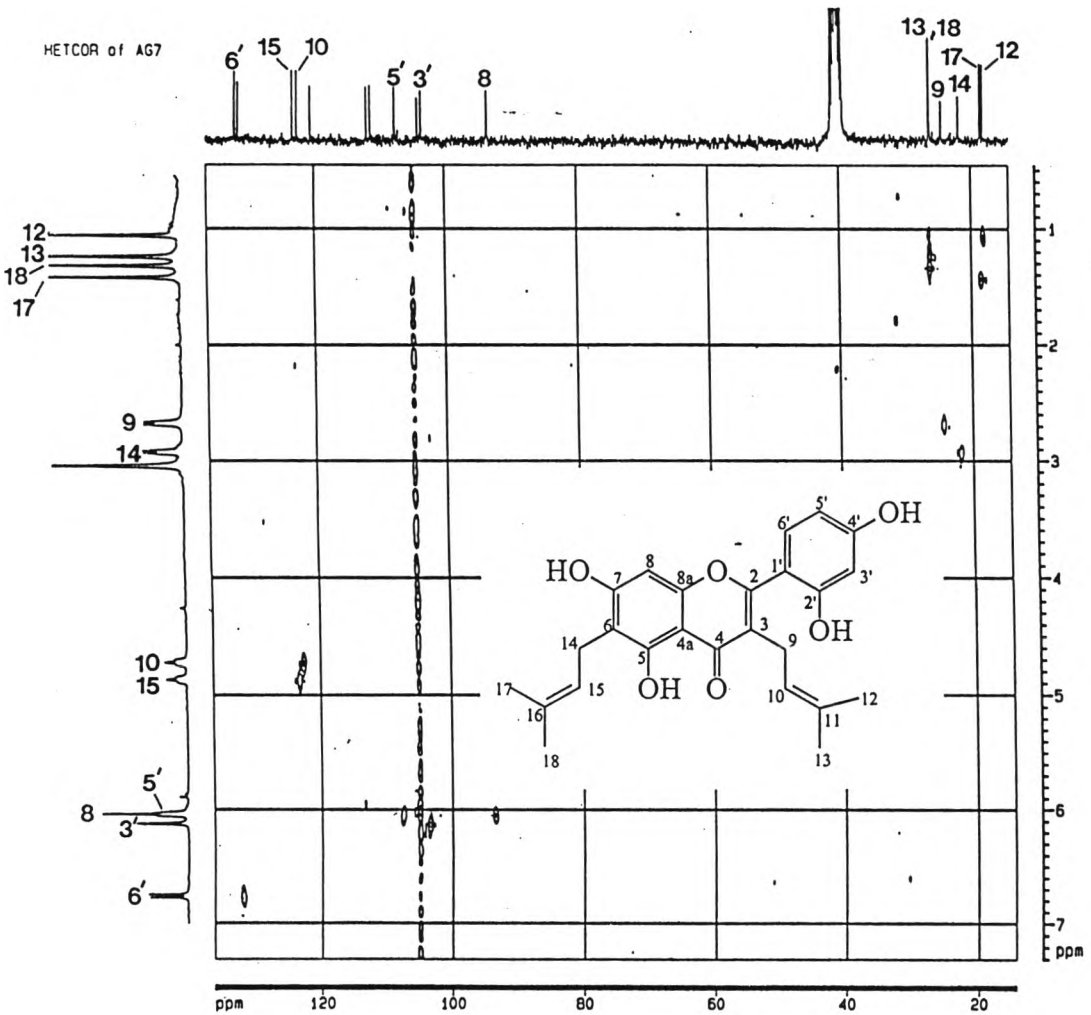


Figure 73 HETCOR spectrum of compound AG7 (in DMSO-d_6)

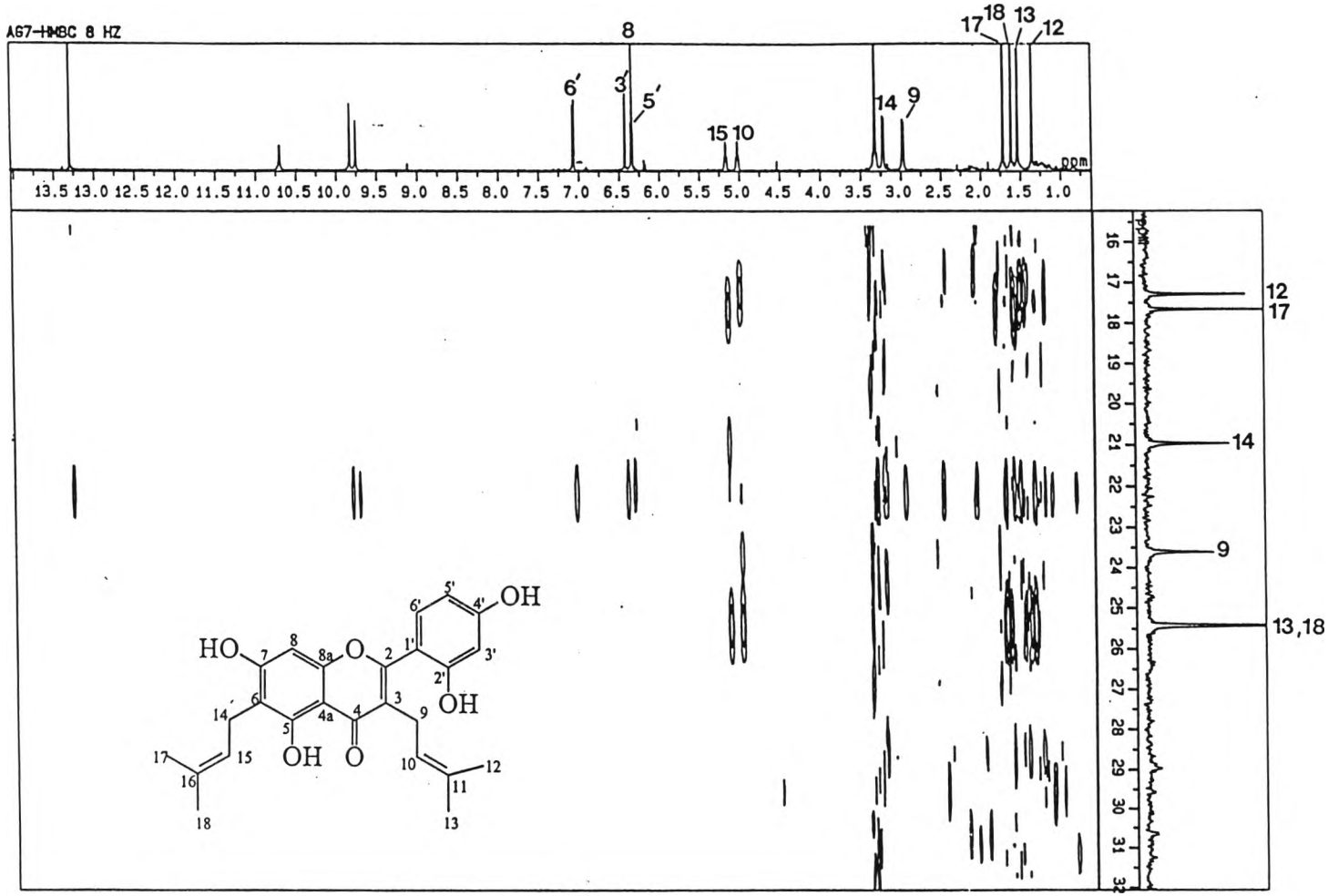


Figure 74a HMBC spectrum of compound AG7 (in DMSO-d_6) [δ_H 1.0-13.5 ppm, δ_C 16-32 ppm]

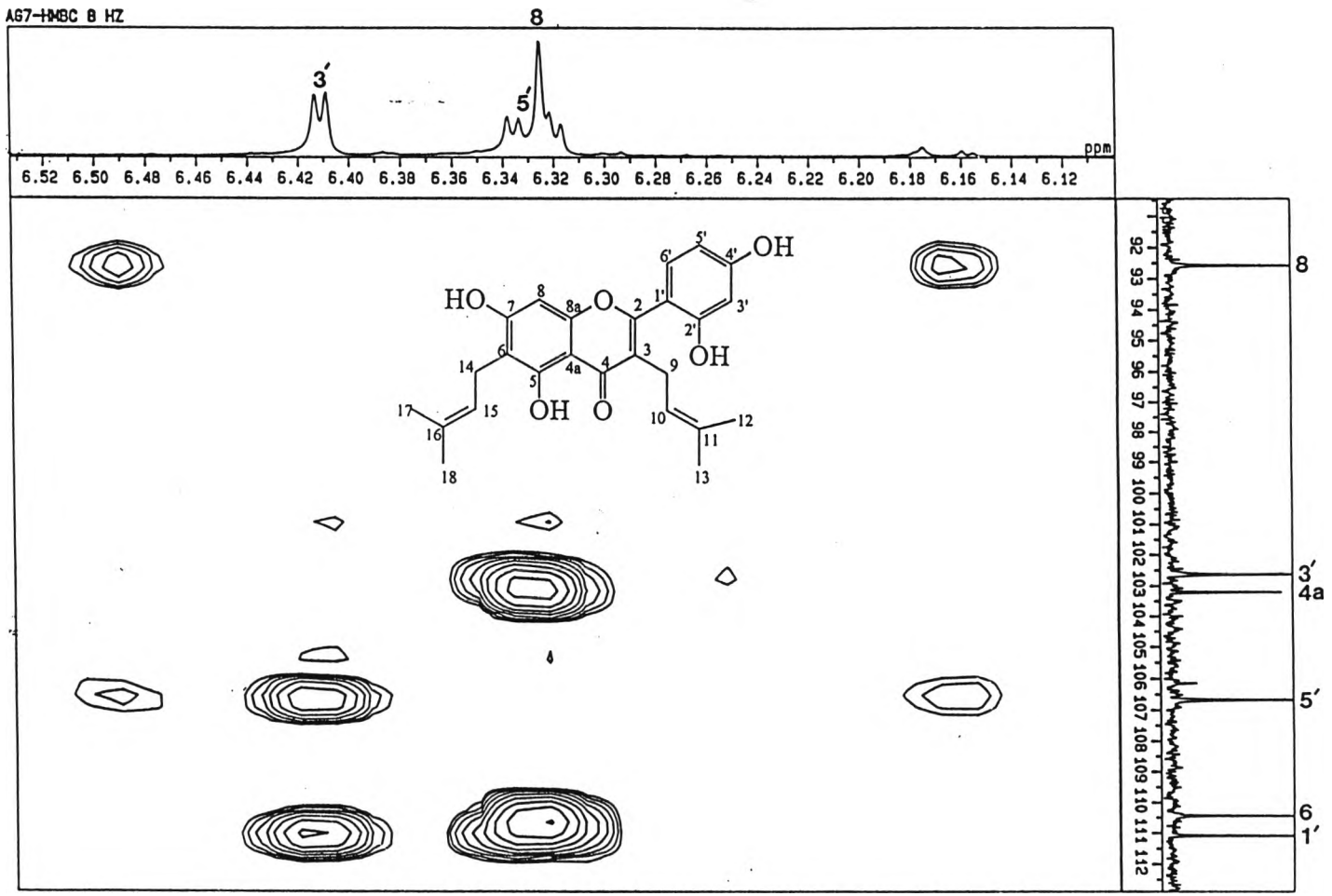


Figure 74b HMBC spectrum of compound AG7 (in DMSO-d_6) [δ_H 6.12-6.52 ppm, δ_C 91-112 ppm]

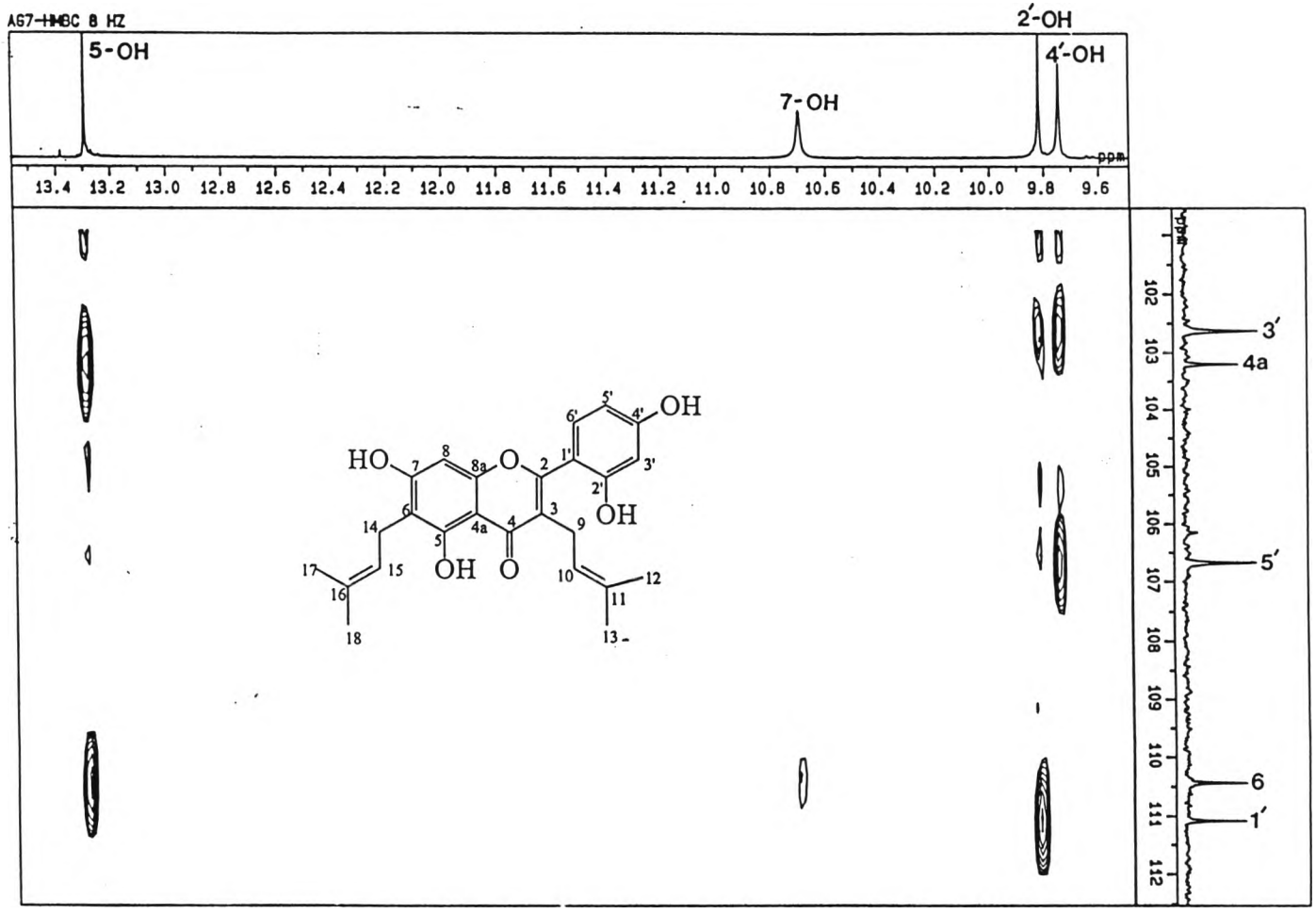


Figure 74c HMBC spectrum of compound AG7 (in DMSO-d_6) [δ_H 9.6-13.4 ppm, δ_C 101-112 ppm]

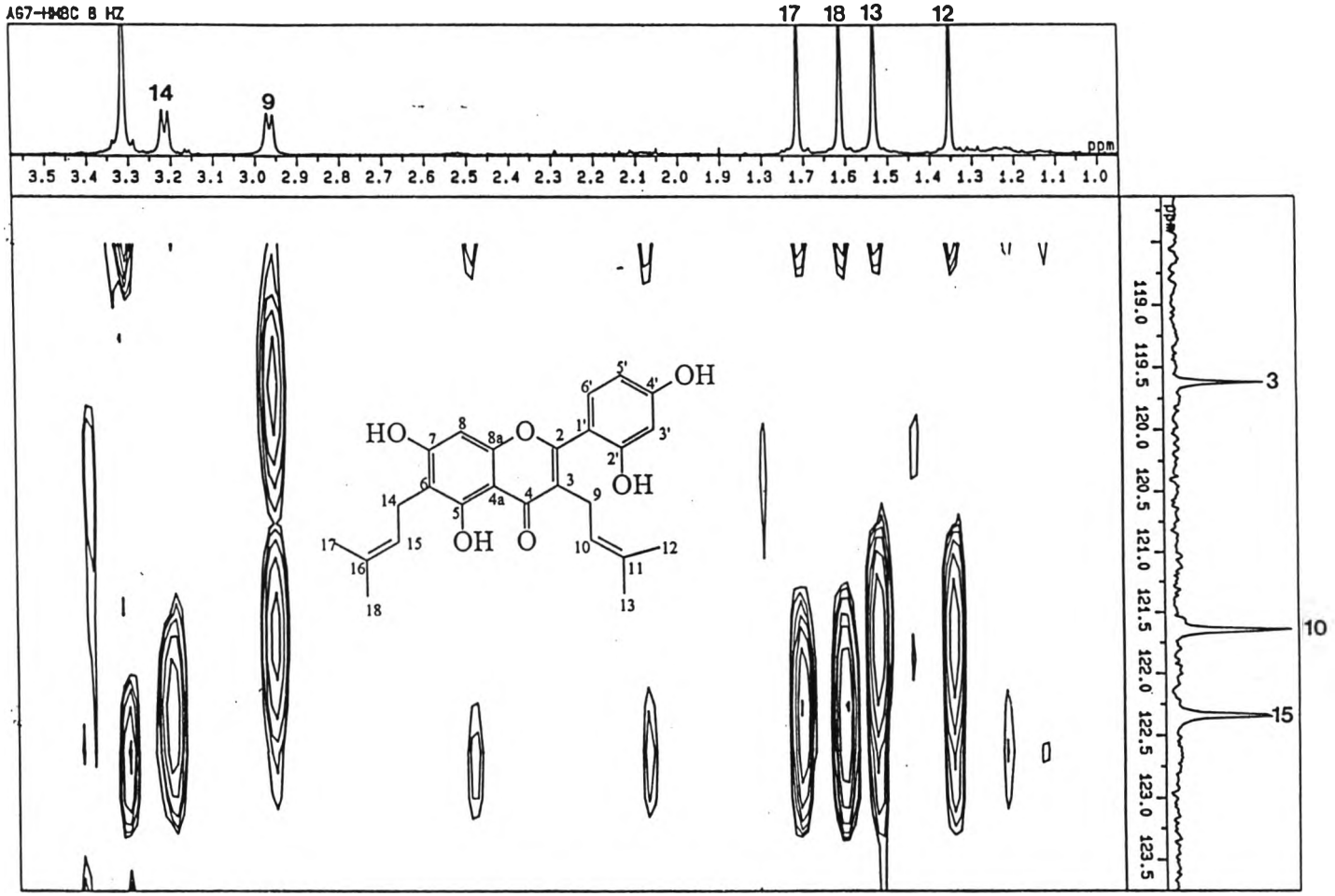


Figure 74d HMBC spectrum of compound AG7 (in DMSO-d_6) [δ_H 1.0-3.5 ppm, δ_C 119-123 ppm]

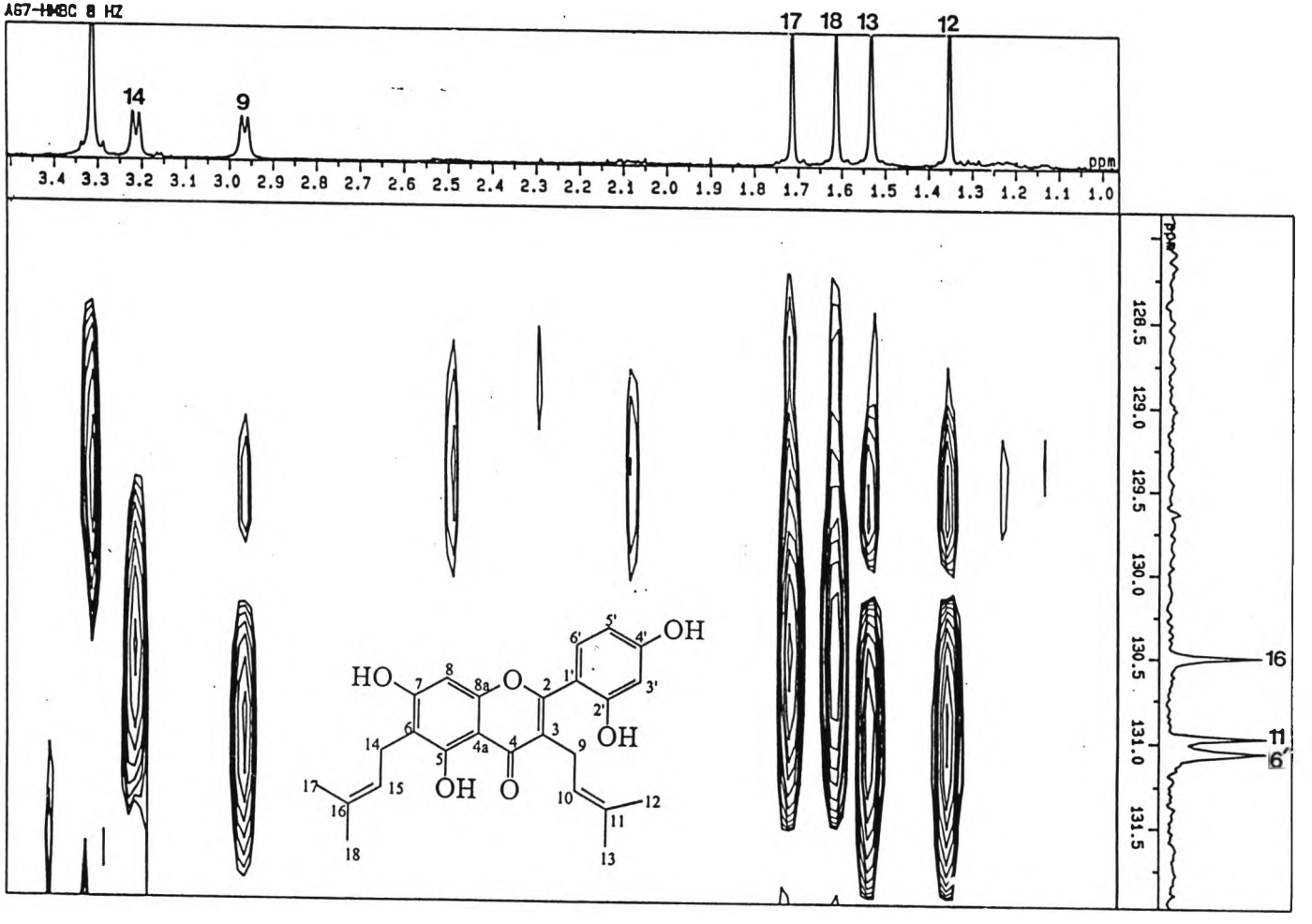


Figure 74e HMBC spectrum of compound AG7 (in DMSO-d_6) [δ_H 1.0-3.5 ppm, δ_C 128-132 ppm]

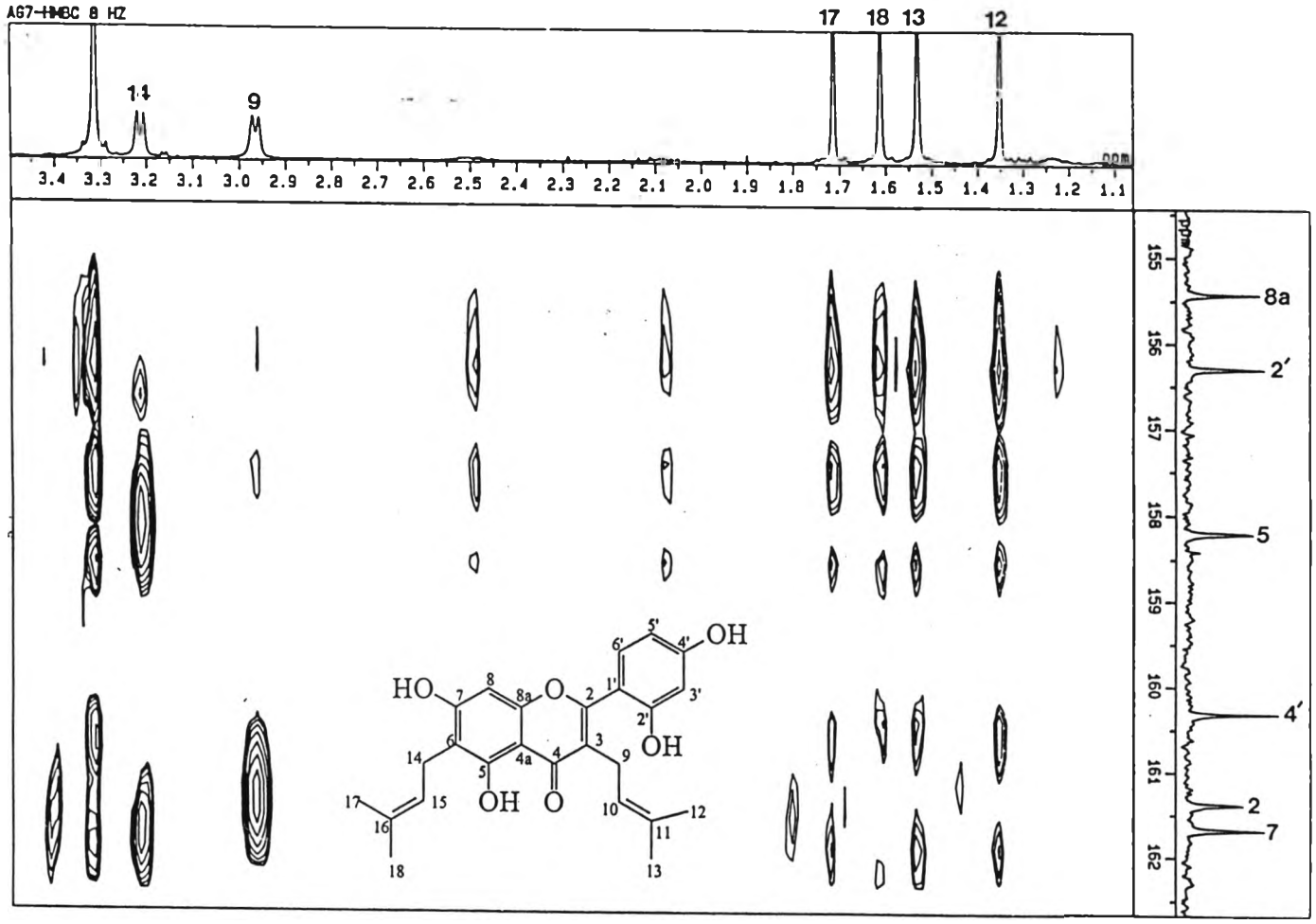


Figure 74f HMBC spectrum of compound AG7 (in DMSO-d_6) [δ_H 1.1-3.4 ppm, δ_C 155-162 ppm]

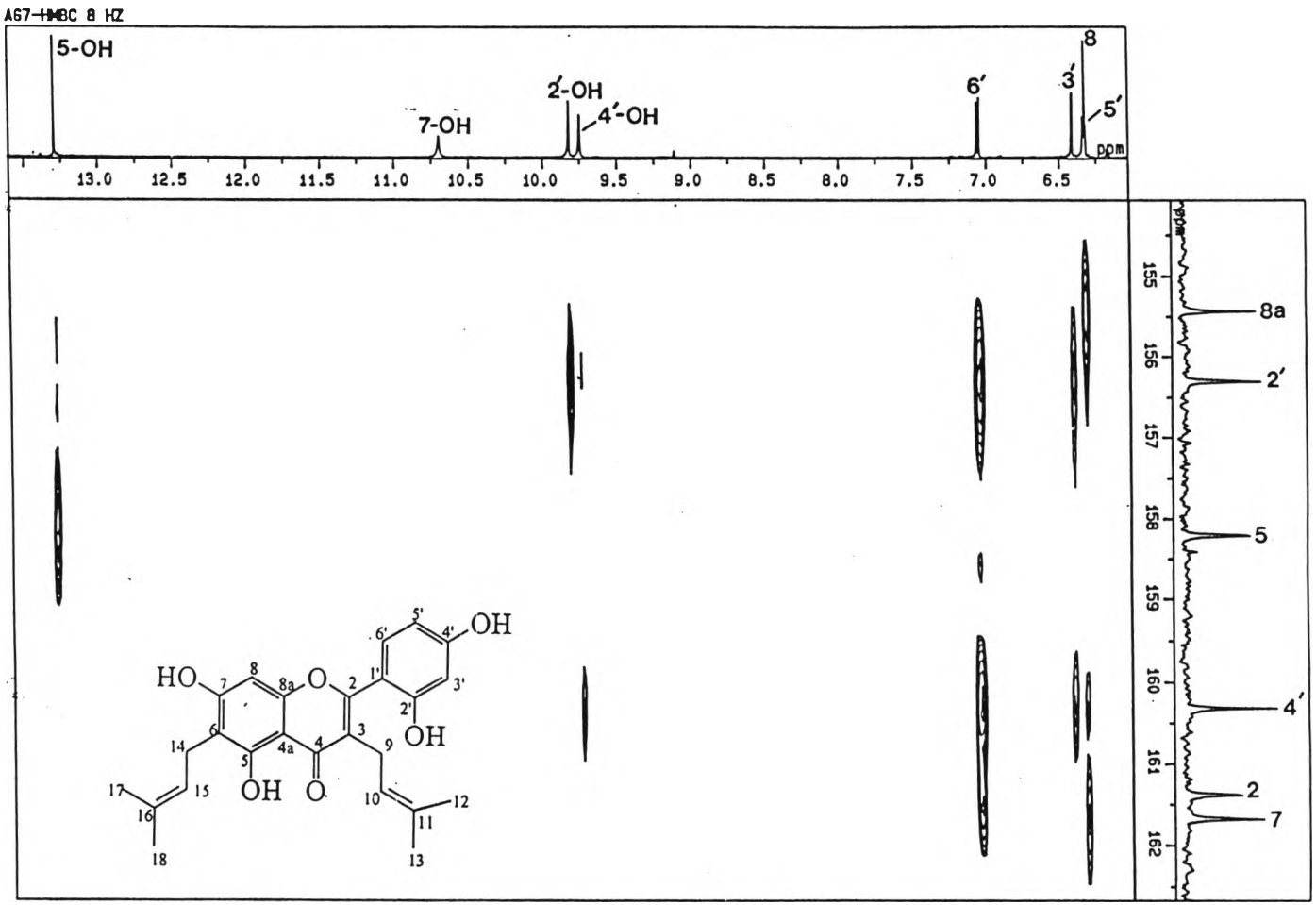


Figure 74g HMBC spectrum of compound AG7 (in DMSO-d_6) [δ_H 6.4-13.5 ppm, δ_C 155-162 ppm]

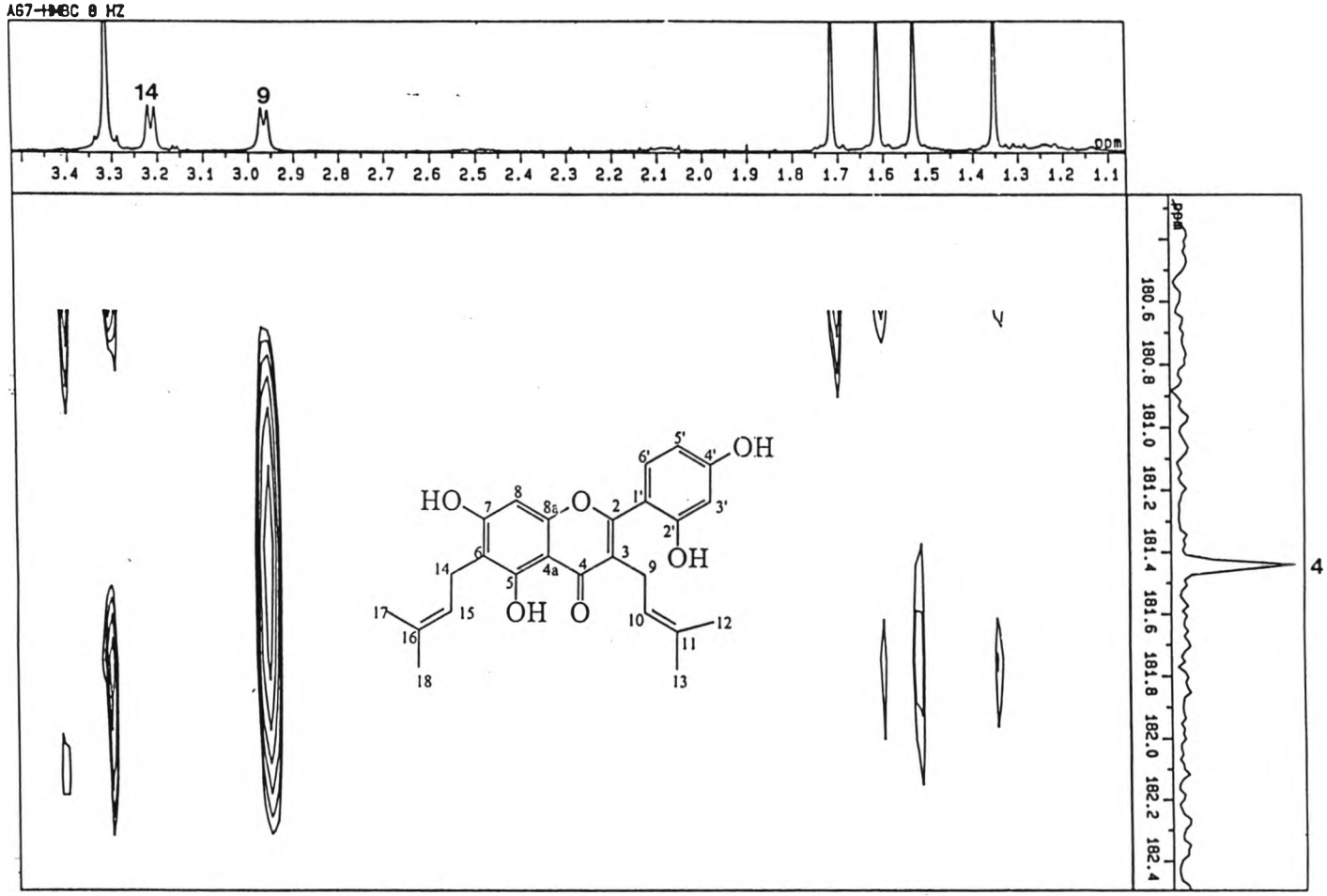


Figure 74h HMBC spectrum of compound AG7 (in DMSO-d_6) [δ_H 1.1-3.4 ppm, δ_C 180.5-182.4 ppm]

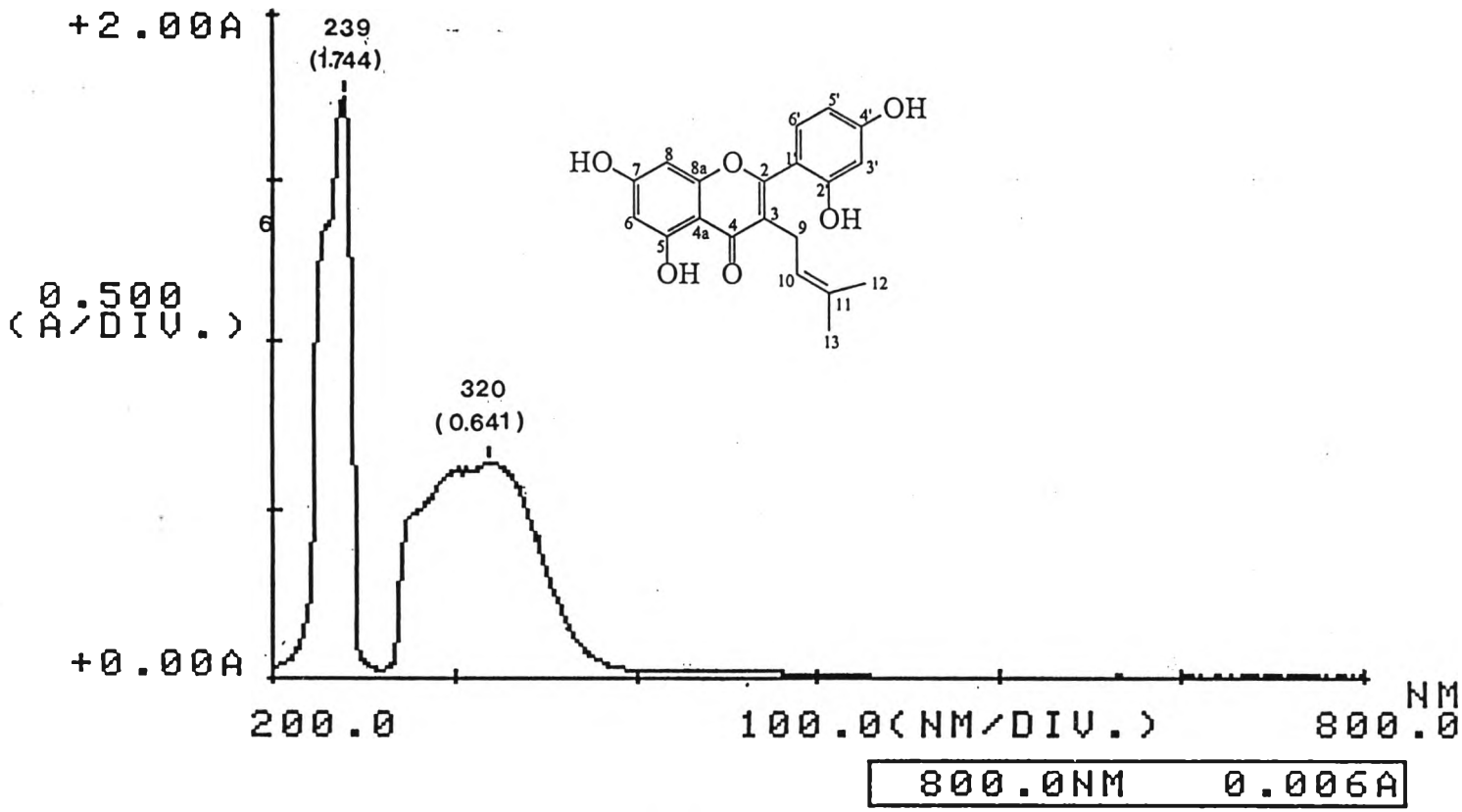


Figure 75 UV spectrum of compound AG9 (in methanol)

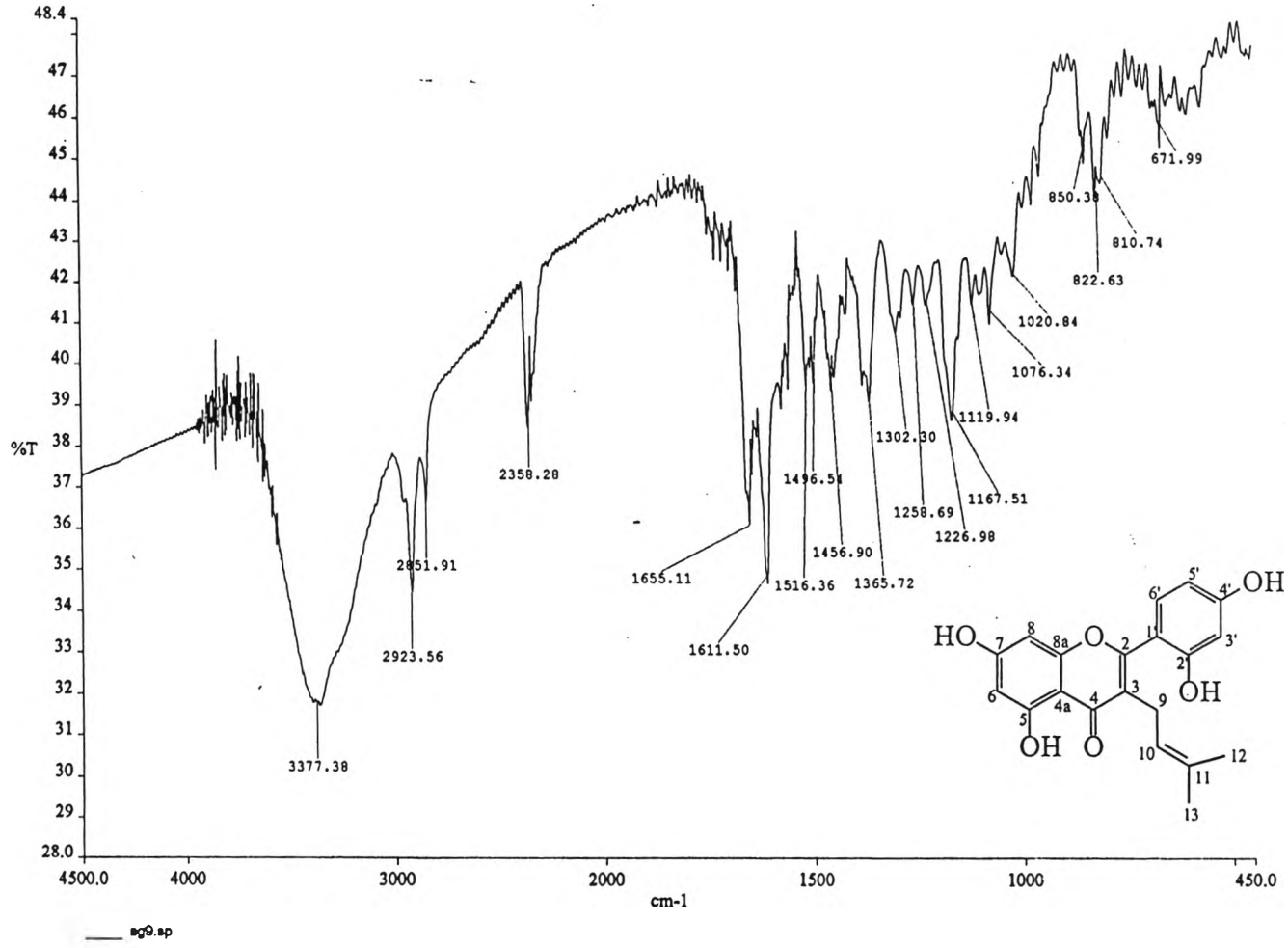


Figure 76 IR spectrum of compound AG9 (KBr disc)

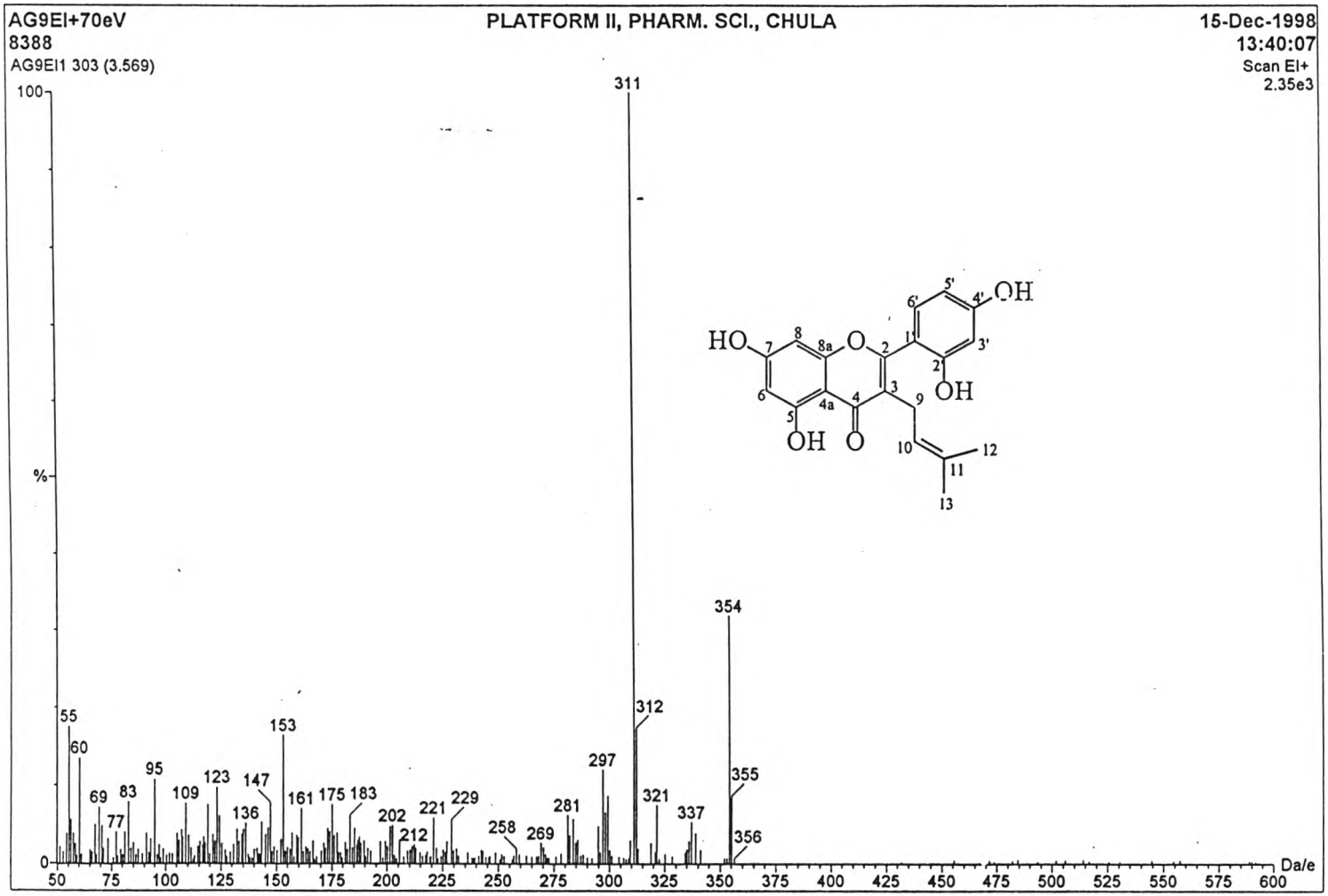


Figure 77 EI mass spectrum of compound AG9

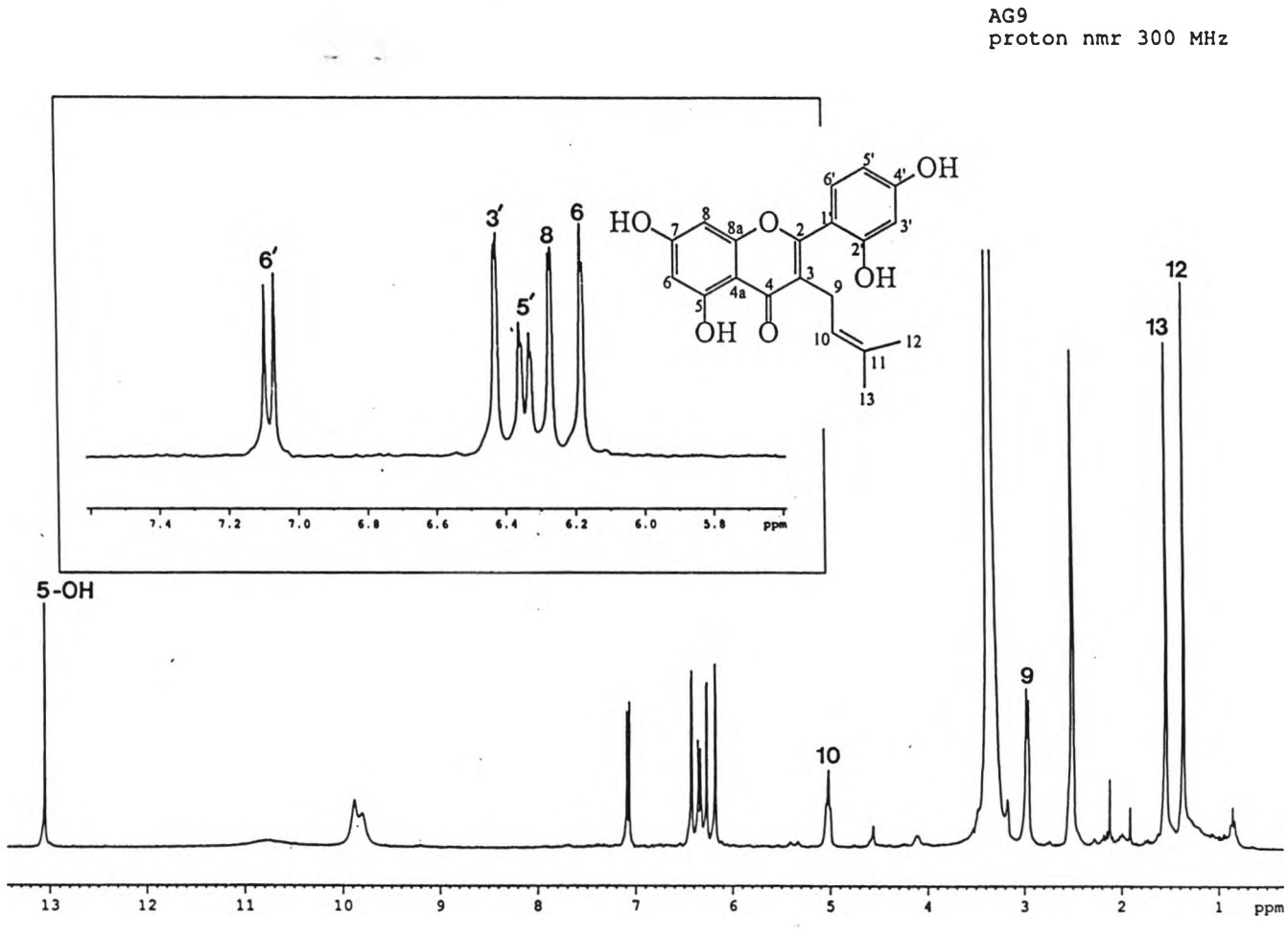


Figure 78 300 MHz ^{1}H NMR spectrum of compound AG9 (in DMSO-d_6)

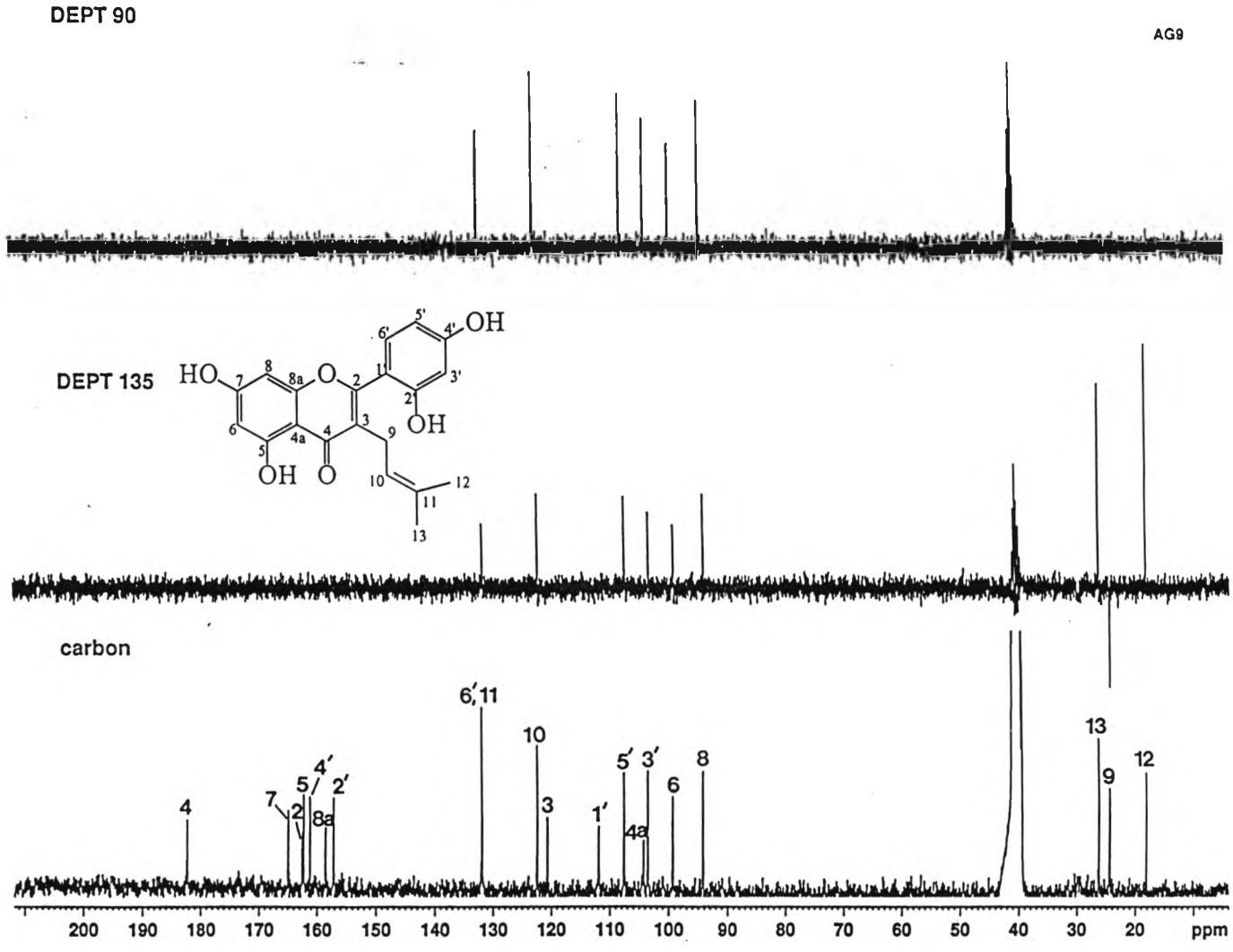


Figure 79 75 MHz ^{13}C NMR spectrum of compound AG9 (in DMSO-d_6)

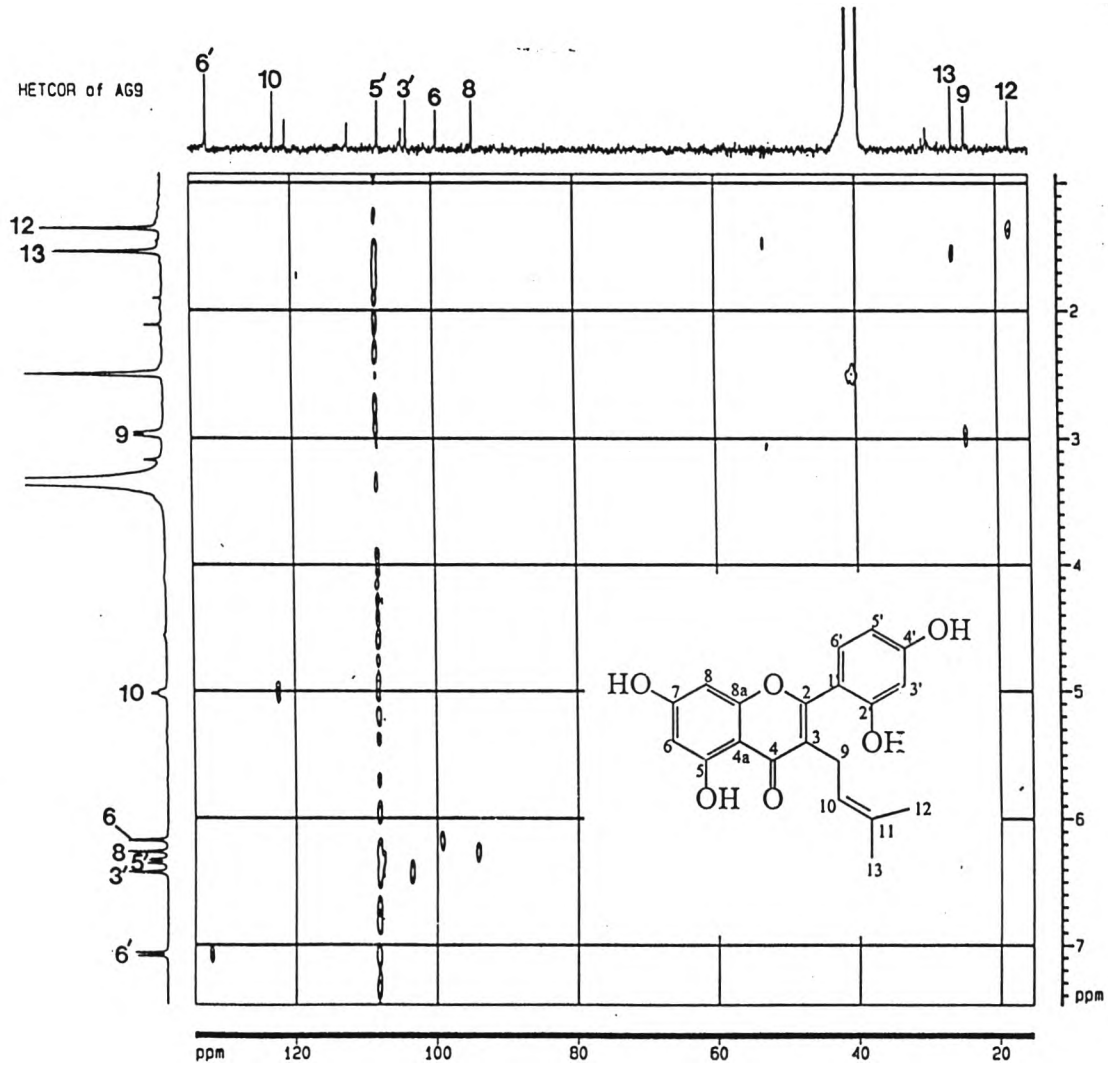


Figure 80 HETCOR spectrum of compound AG9 (in DMSO-d_6)

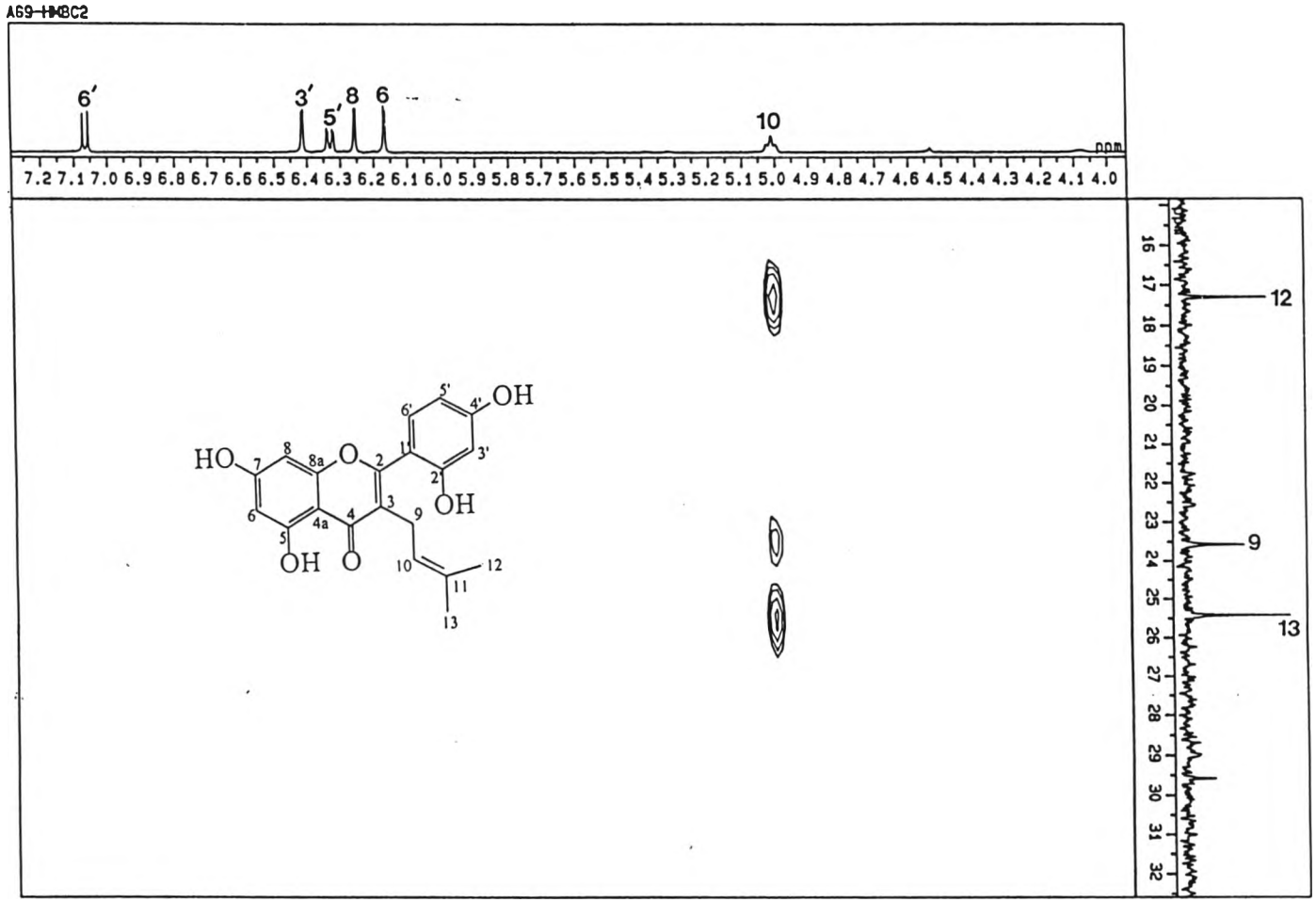


Figure 81a HMBC spectrum of compound AG9 (in DMSO-d_6) [δ_H 4.0-7.2 ppm, δ_C 16-32 ppm]

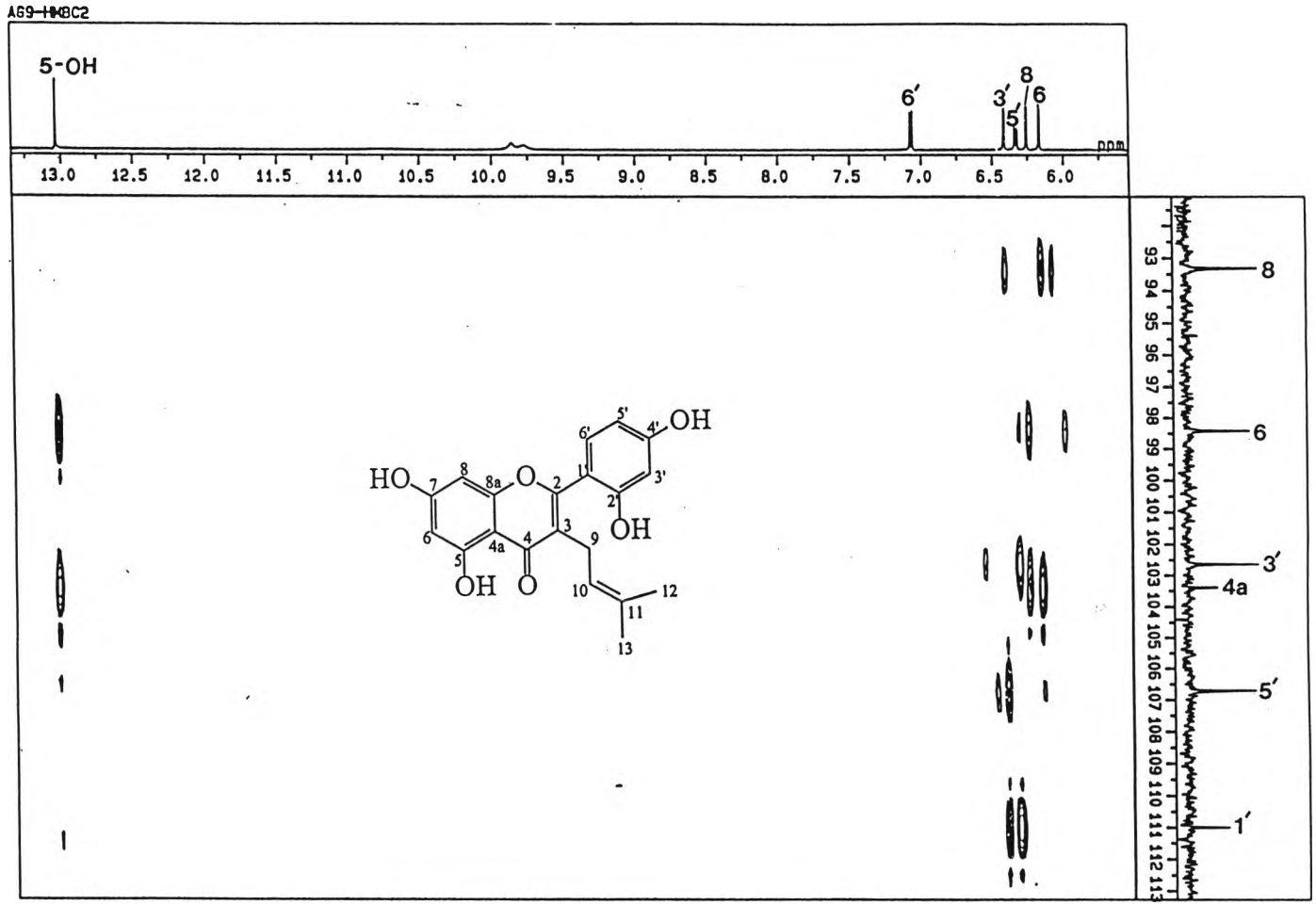


Figure 81b HMBC spectrum of compound AG9 (in DMSO-d_6) [δ_H 6.0-13.5 ppm, δ_C 92-113 ppm]

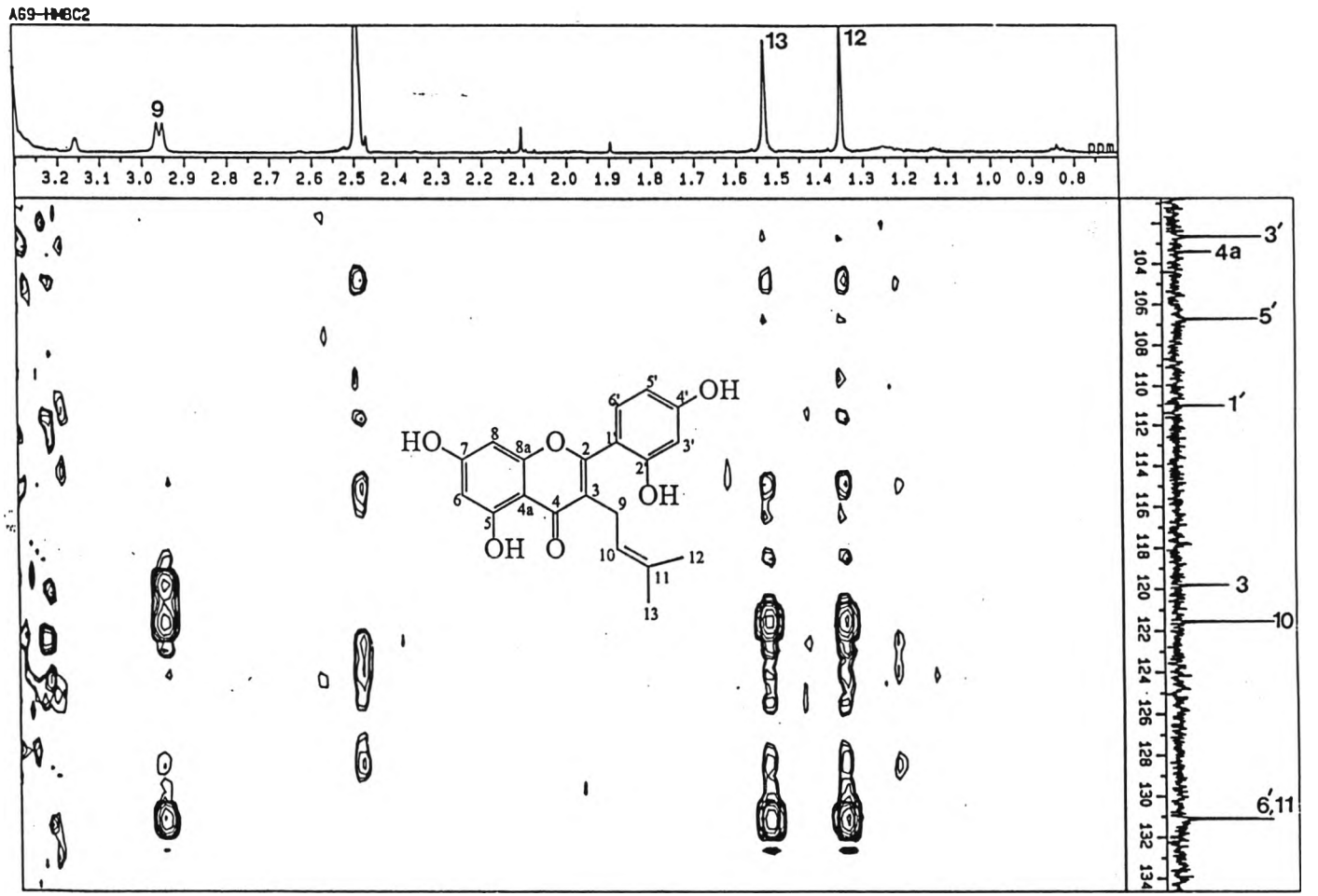


Figure 81c HMBC spectrum of compound AG9 (in DMSO-d_6) [δ_H 0.8-3.2 ppm, δ_C 103-134 ppm]

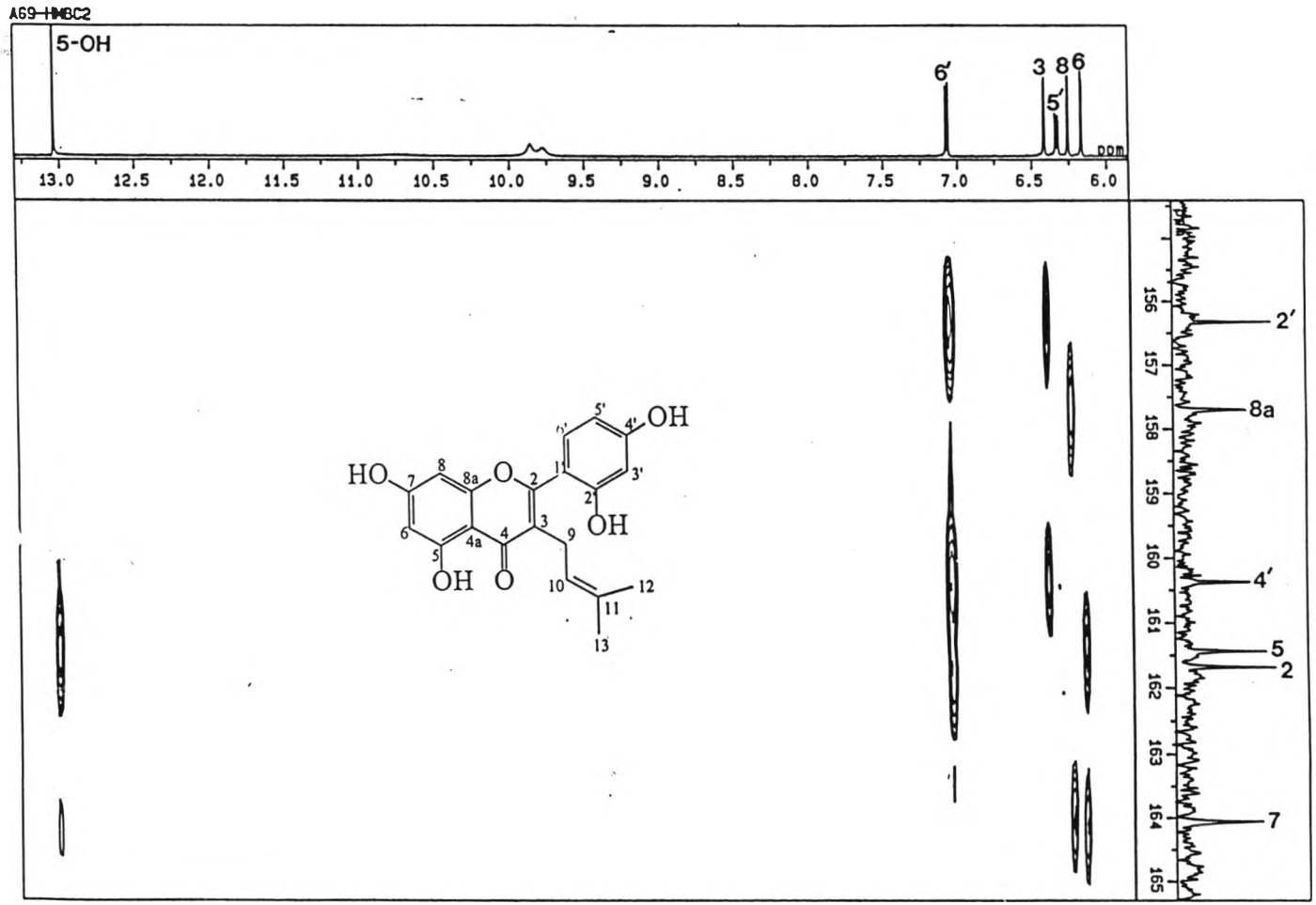


Figure 81d HMBC spectrum of compound AG9 (in DMSO-d_6) [δ_H 6.0-13.5 ppm, δ_C 155-165 ppm]

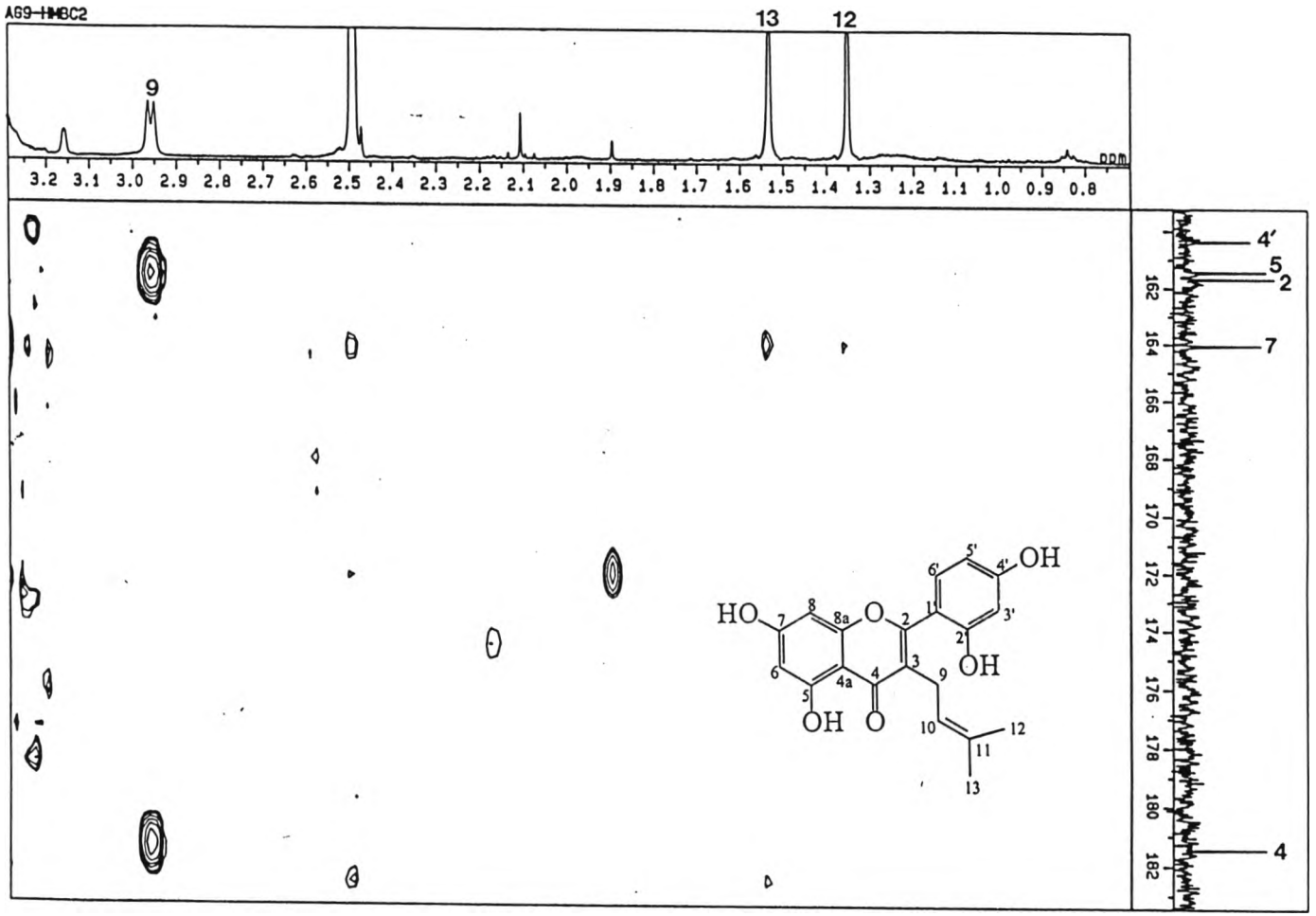


Figure 81e HMBC spectrum of compound AG9 (in DMSO-d_6) [δ_H 0.8-3.2 ppm, δ_C 161-182 ppm]

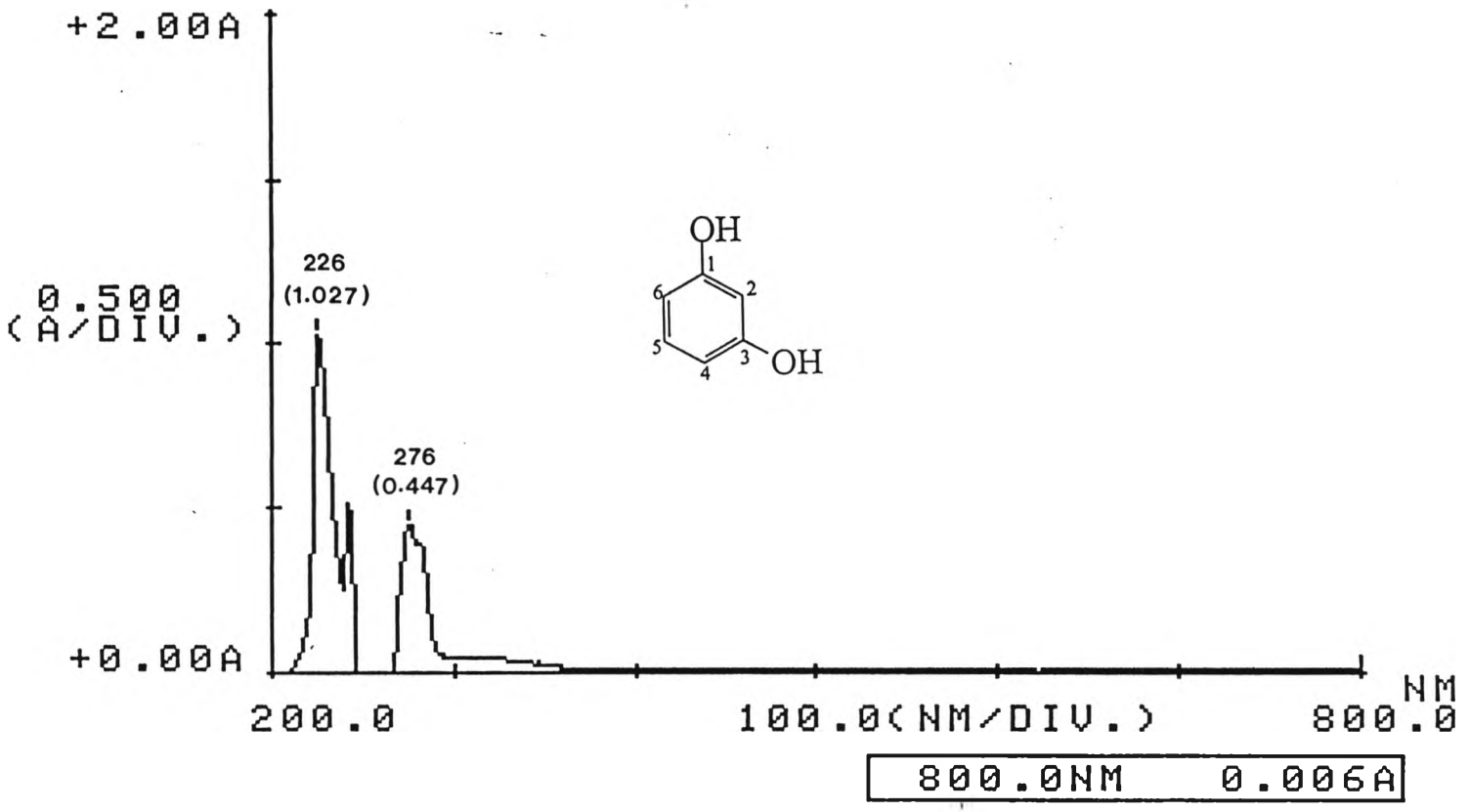


Figure 82 UV spectrum of compound AG10 (in methanol)

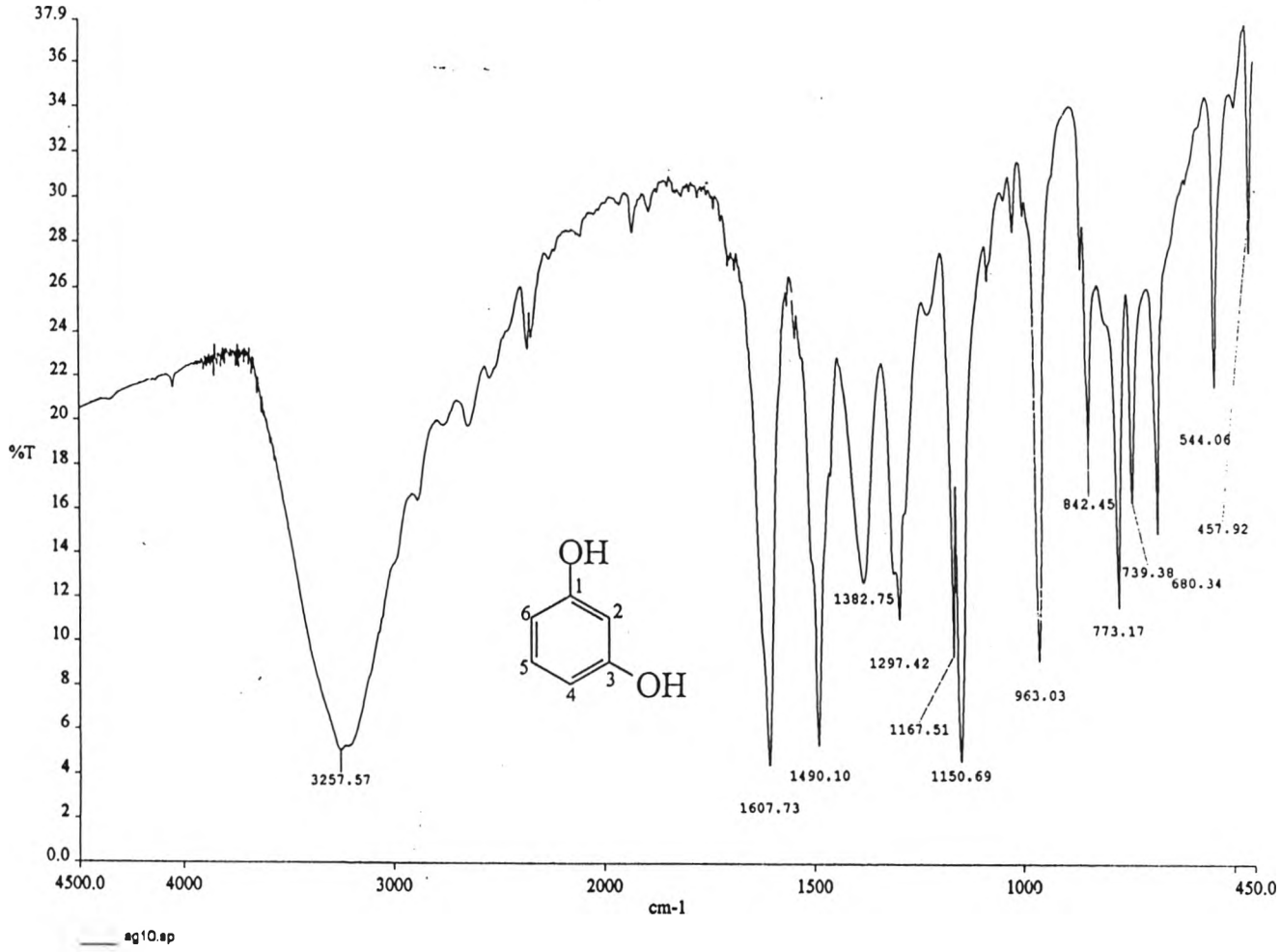


Figure 83 IR spectrum of compound AG10 (KBr disc)

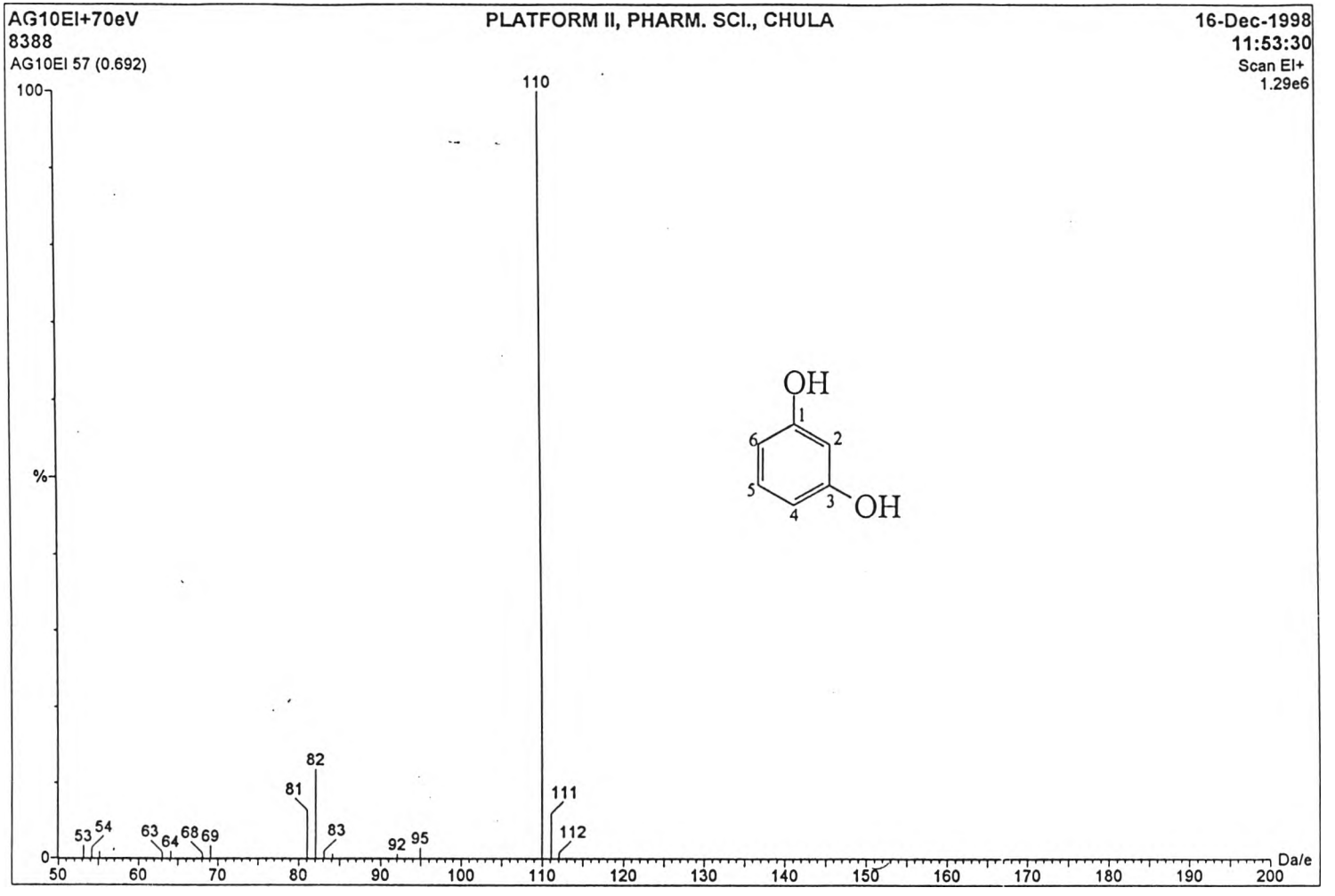


Figure 84 EI mass spectrum of compound AG10

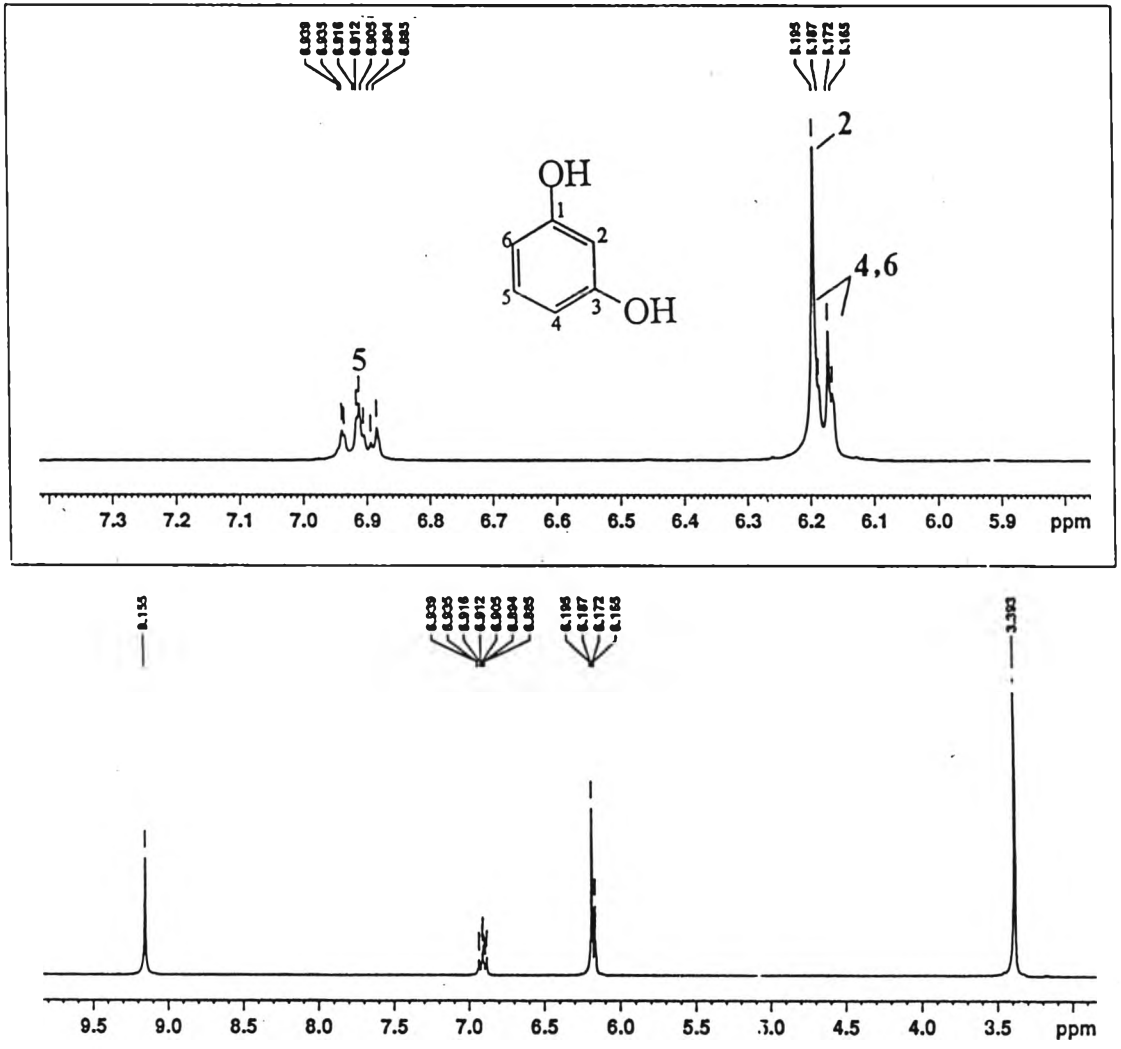


Figure 85 300 MHz ^{1}H NMR spectrum of compound AG10 (in DMSO-d_6)

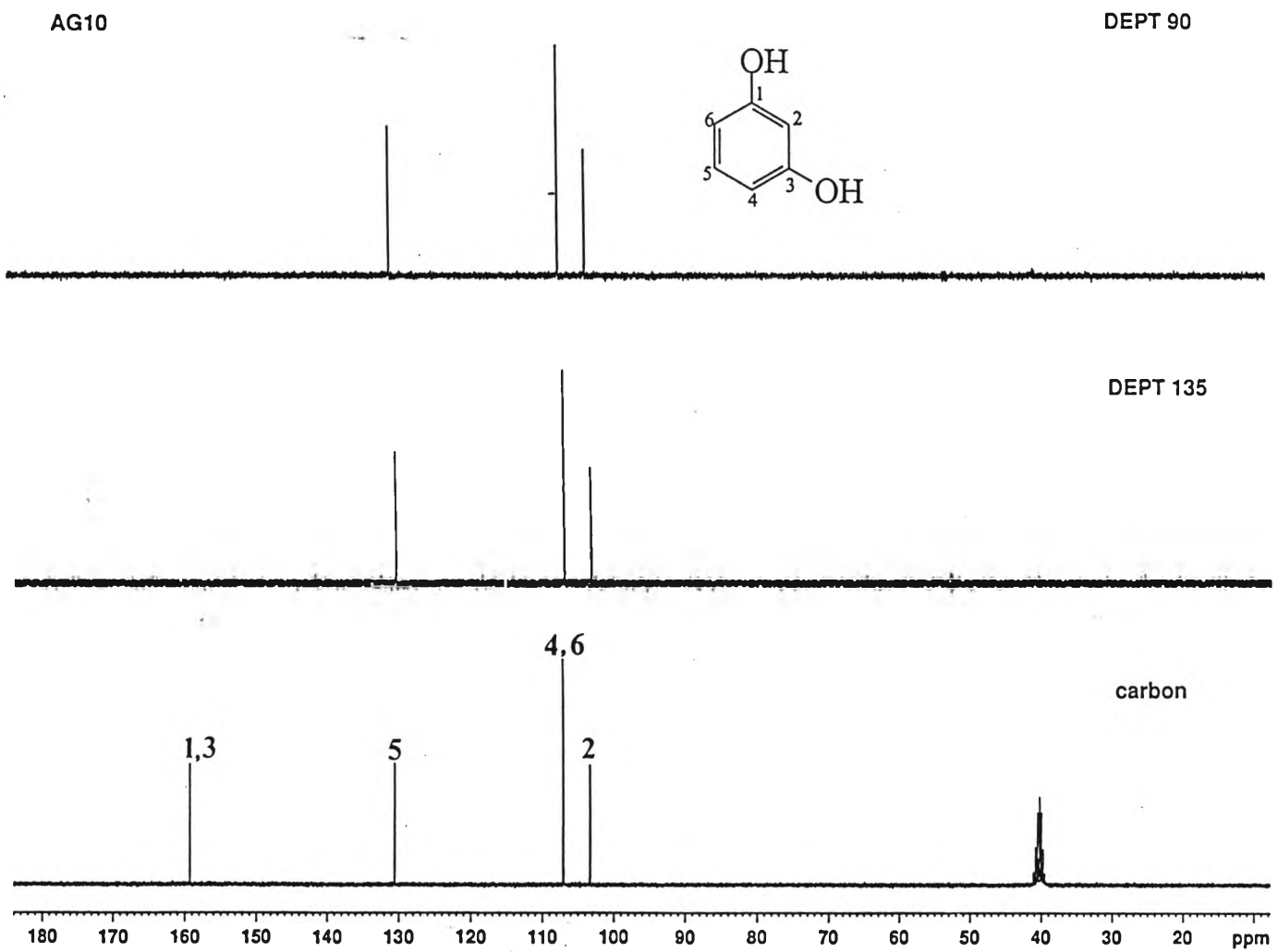


Figure 86 75 MHz ^{13}C NMR, DEPT 90 and DEPT 135 spectra.(in DMSO-d_6) of compound AG10

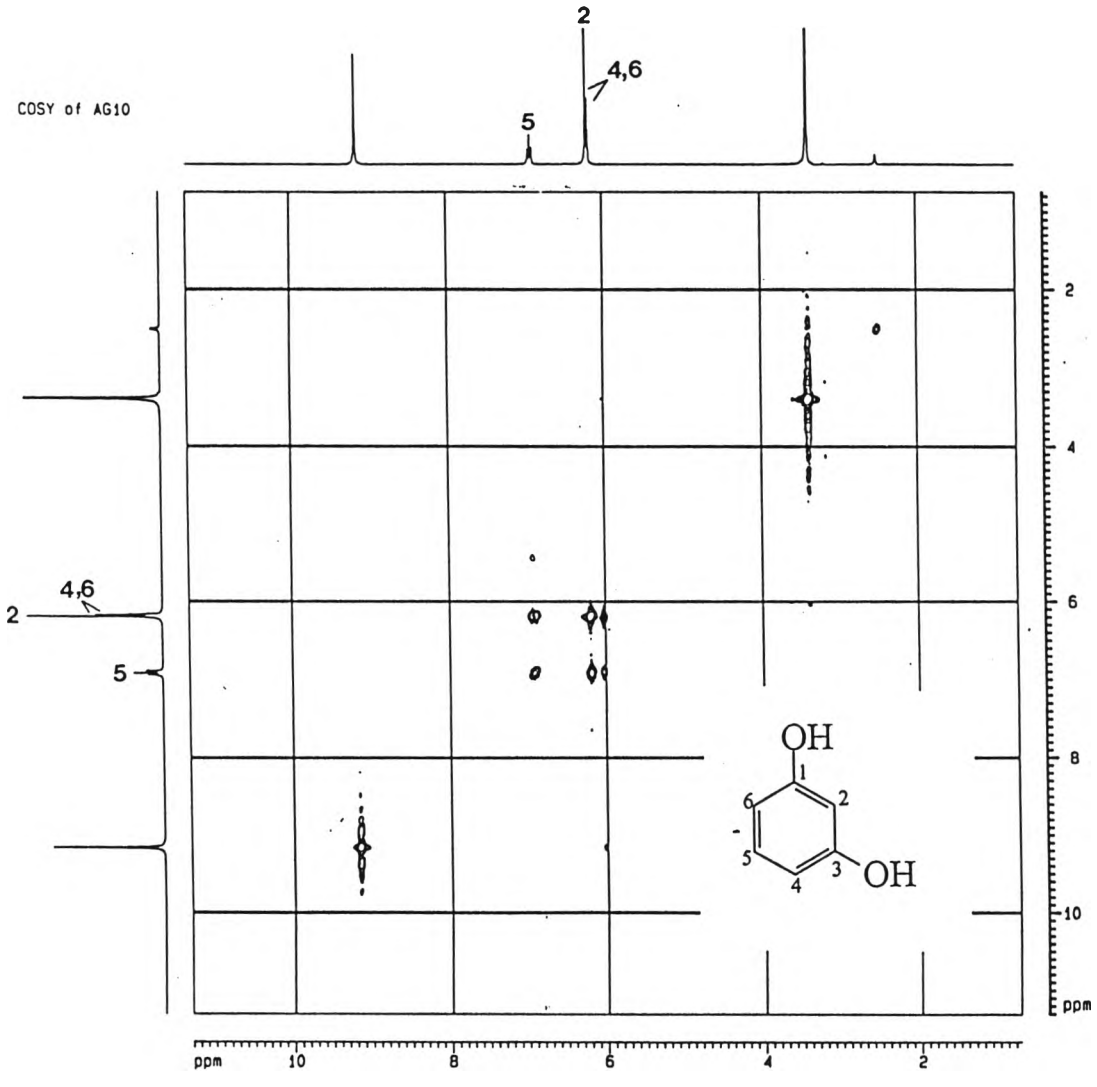


Figure 87 ^{1}H-^{1}H COSY spectrum of compound AG10 (in DMSO-d_6)

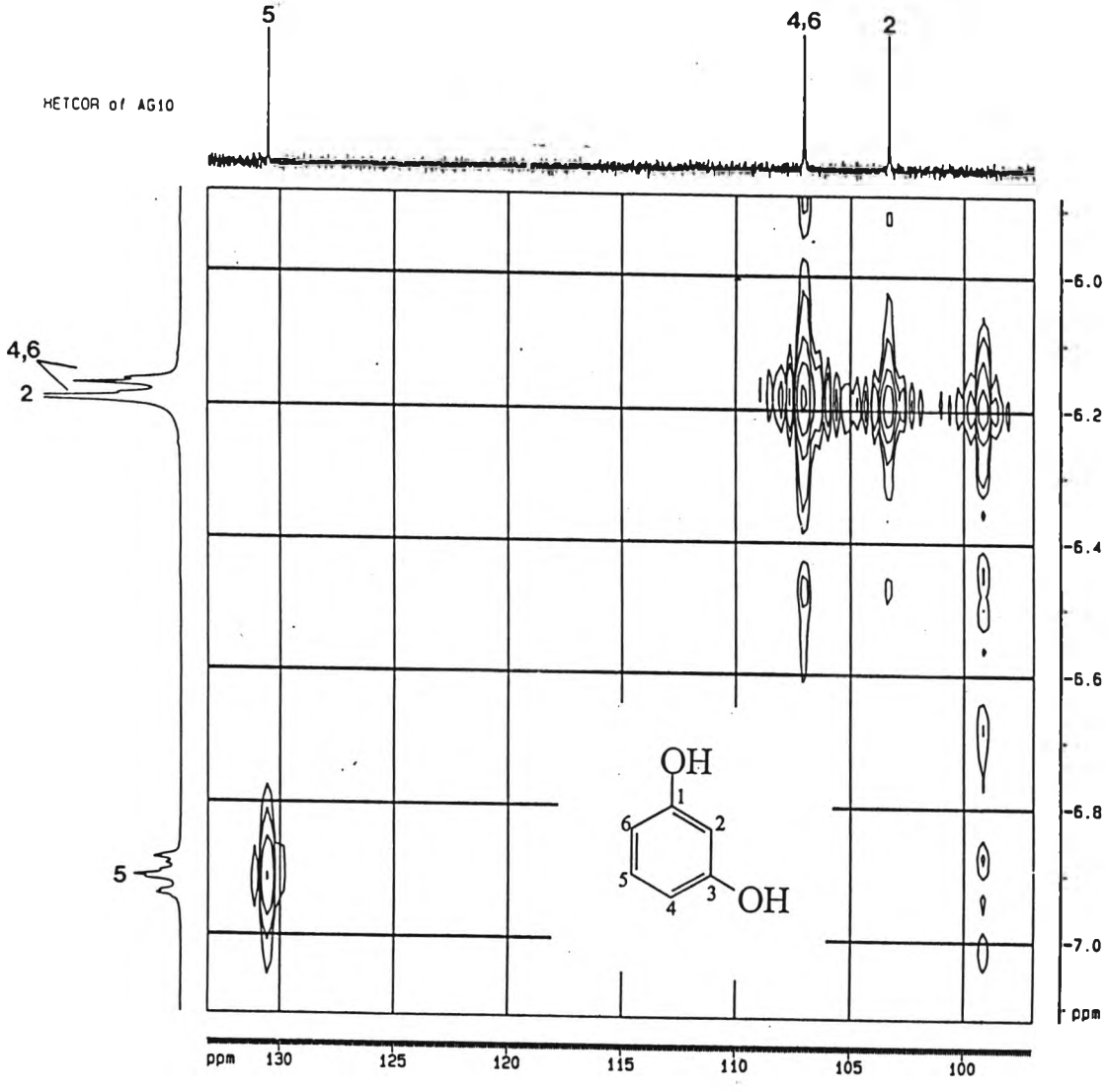


Figure 88 HETCOR spectrum of compound AG10 (in DMSO-d_6)

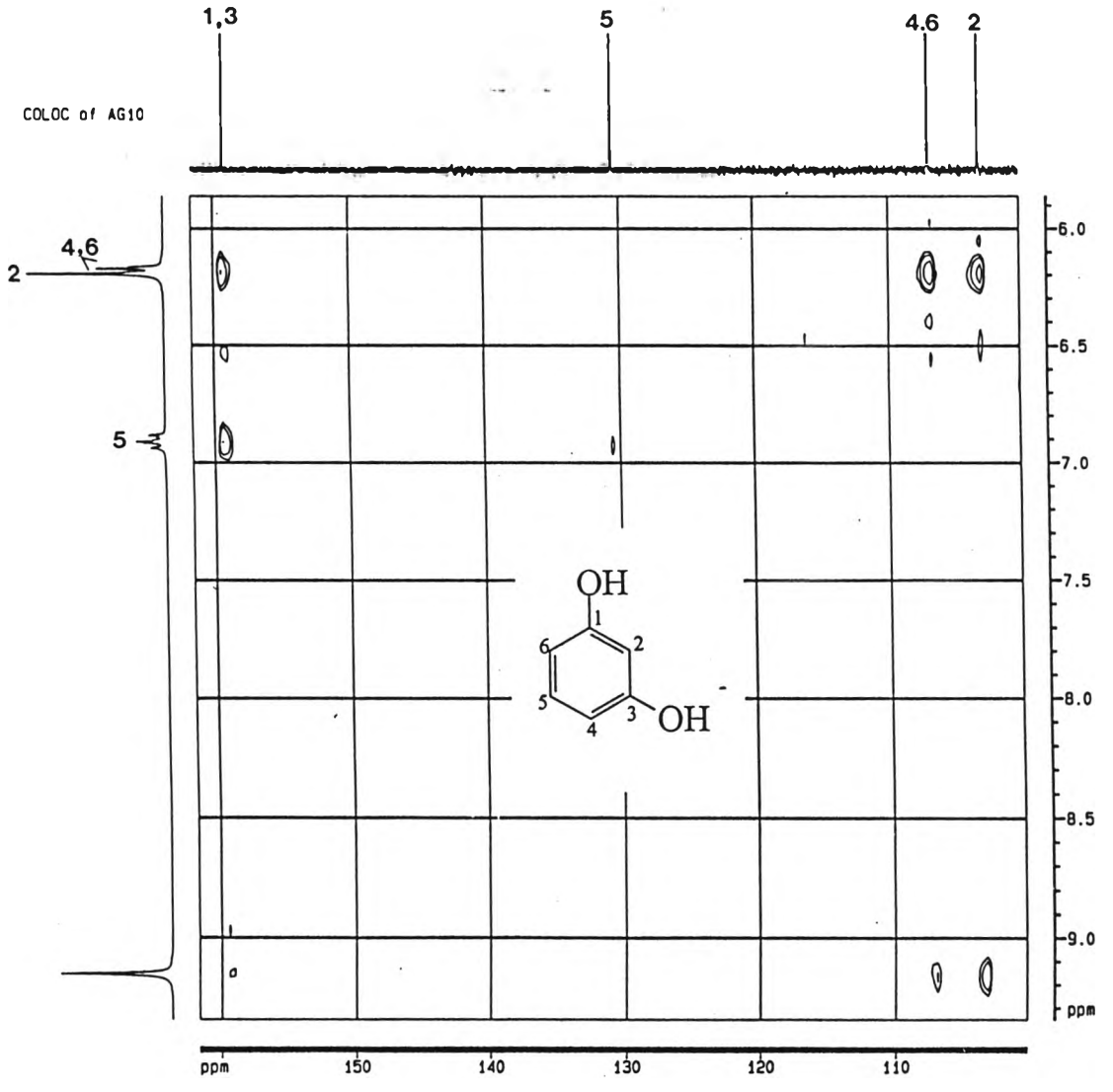


Figure 89 COLOC spectrum of compound AG 10 (in DMSO-d_6)

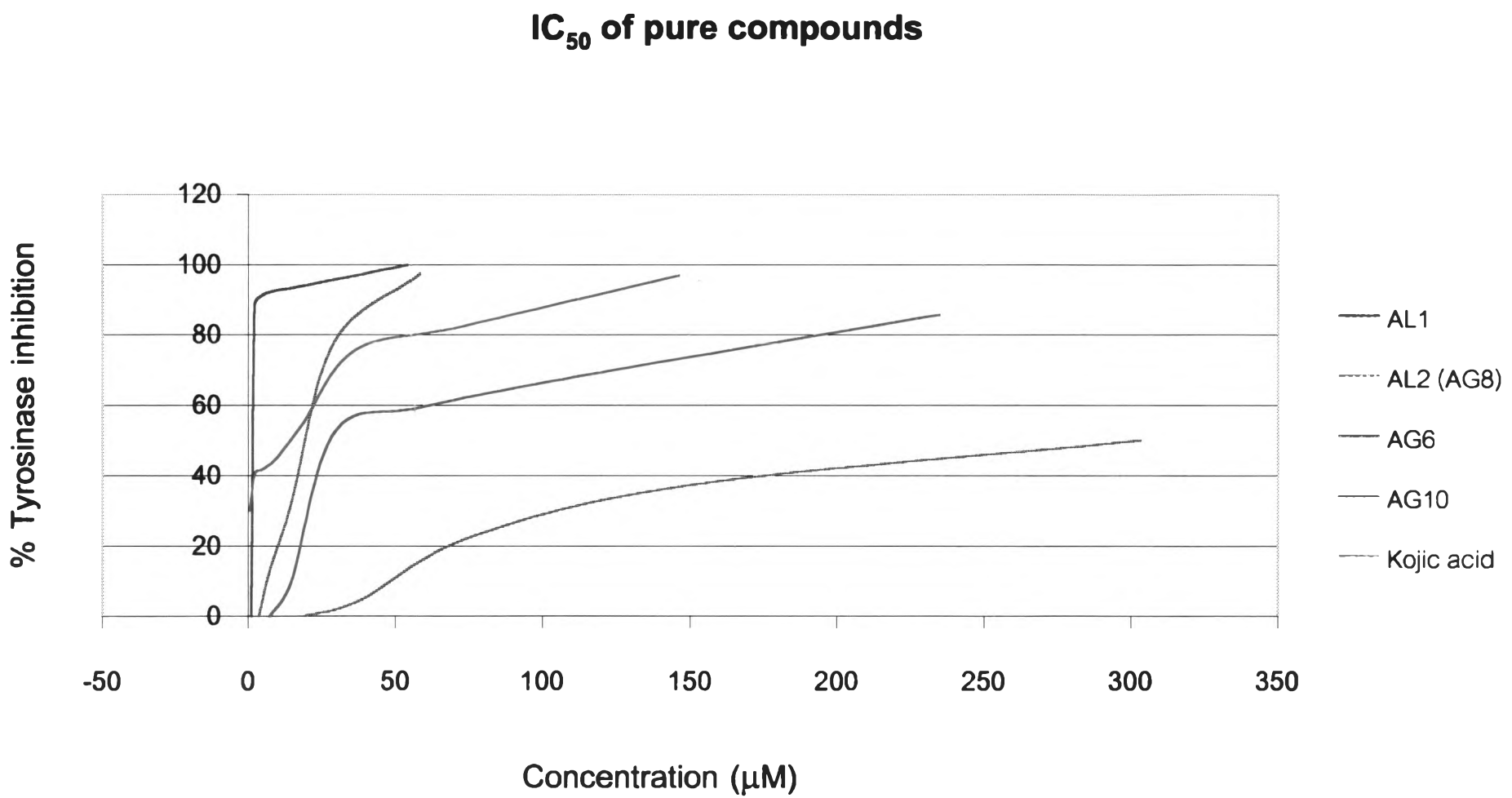


Figure 90 IC_{50} of pure compounds