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Efficient and Stereoselective Synthesis of Sugar Fused Pyrano[3,2-*c*]Pyranones as Anticancer Agents

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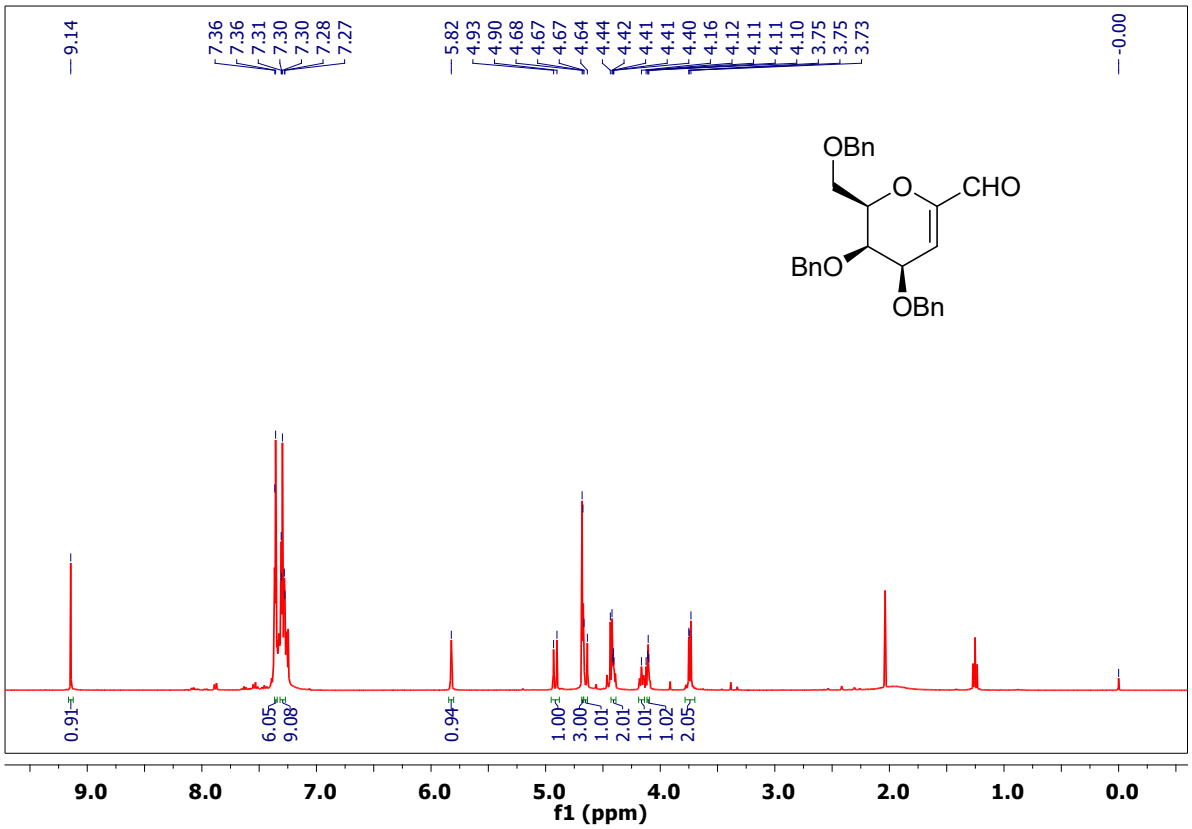


Figure 1: ^{1}H NMR spectrum of compound **2a** (400 MHz, $CDCl_3$)

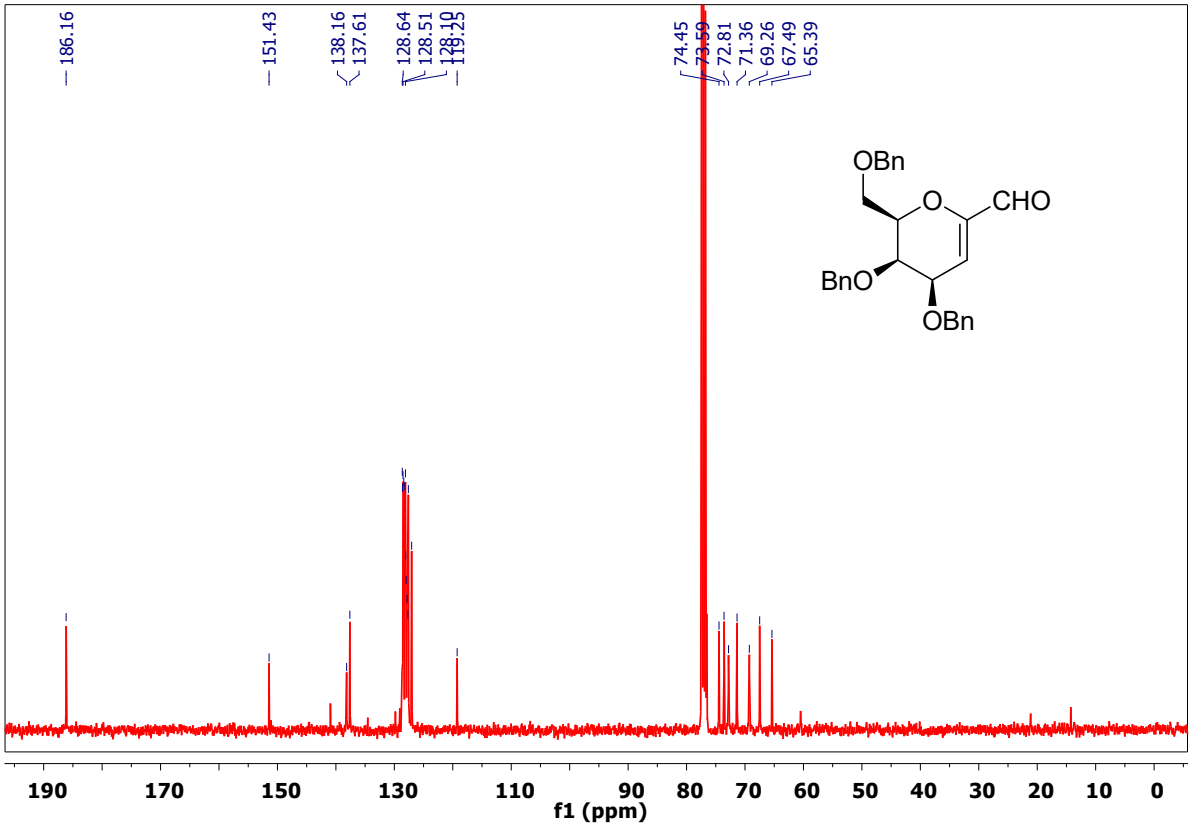


Figure 2: ^{13}C NMR spectrum of compound **2a** (100.6 MHz, $CDCl_3$)

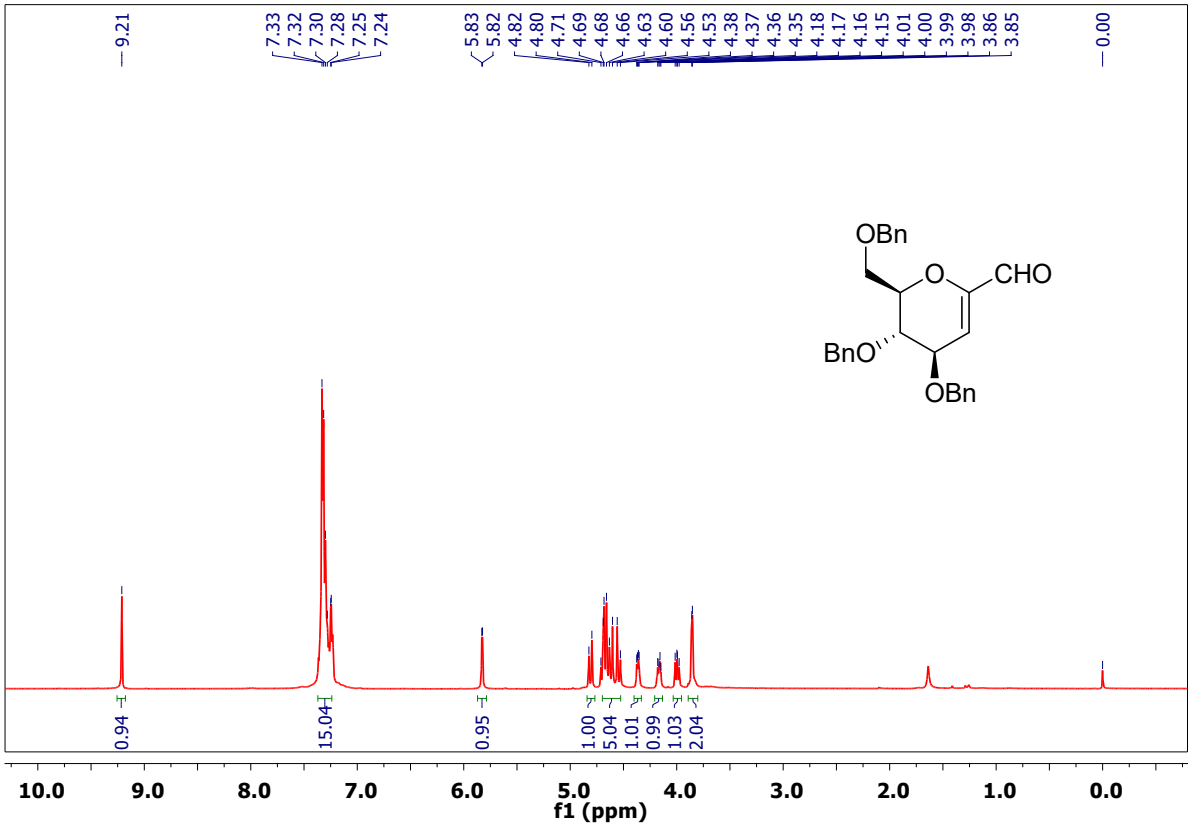


Figure 3: ^{1}H NMR spectrum of compound **2b** (400 MHz, $CDCl_3$)

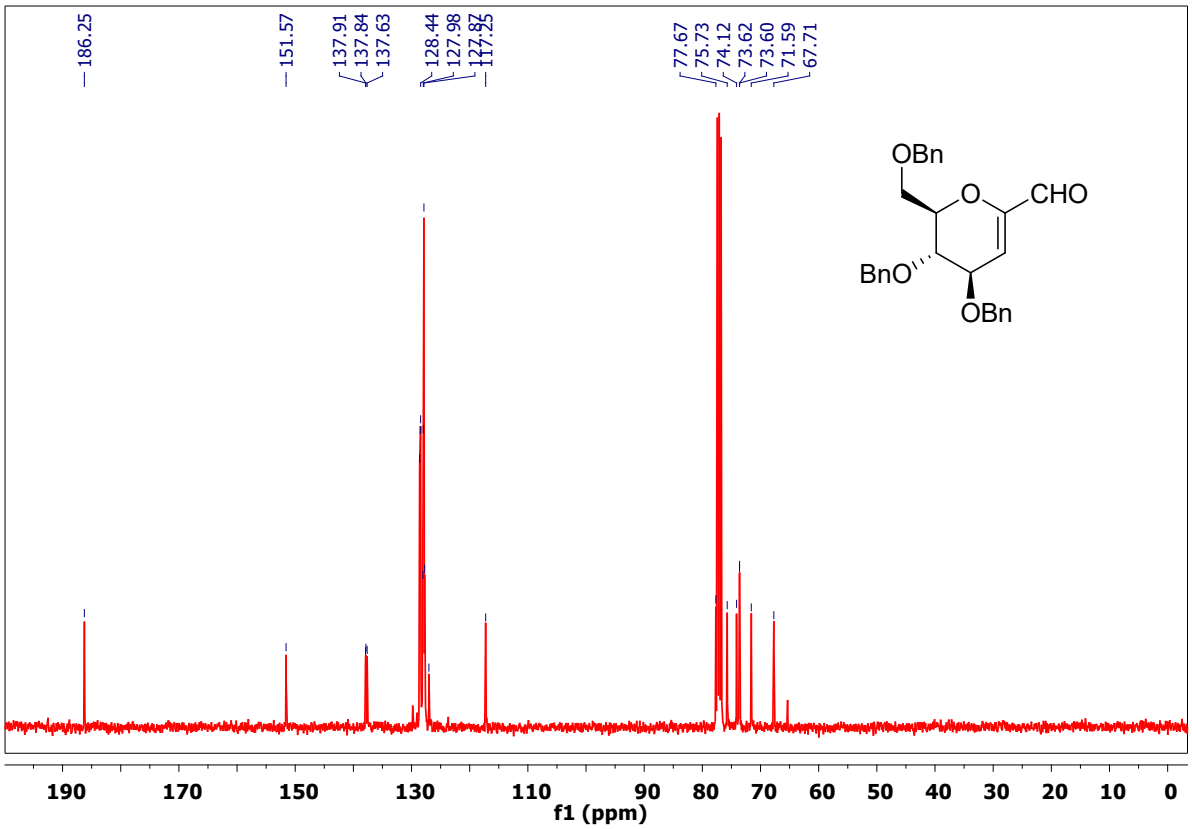


Figure 4: ^{13}C NMR spectrum of compound **2b** (100.6 MHz, $CDCl_3$)

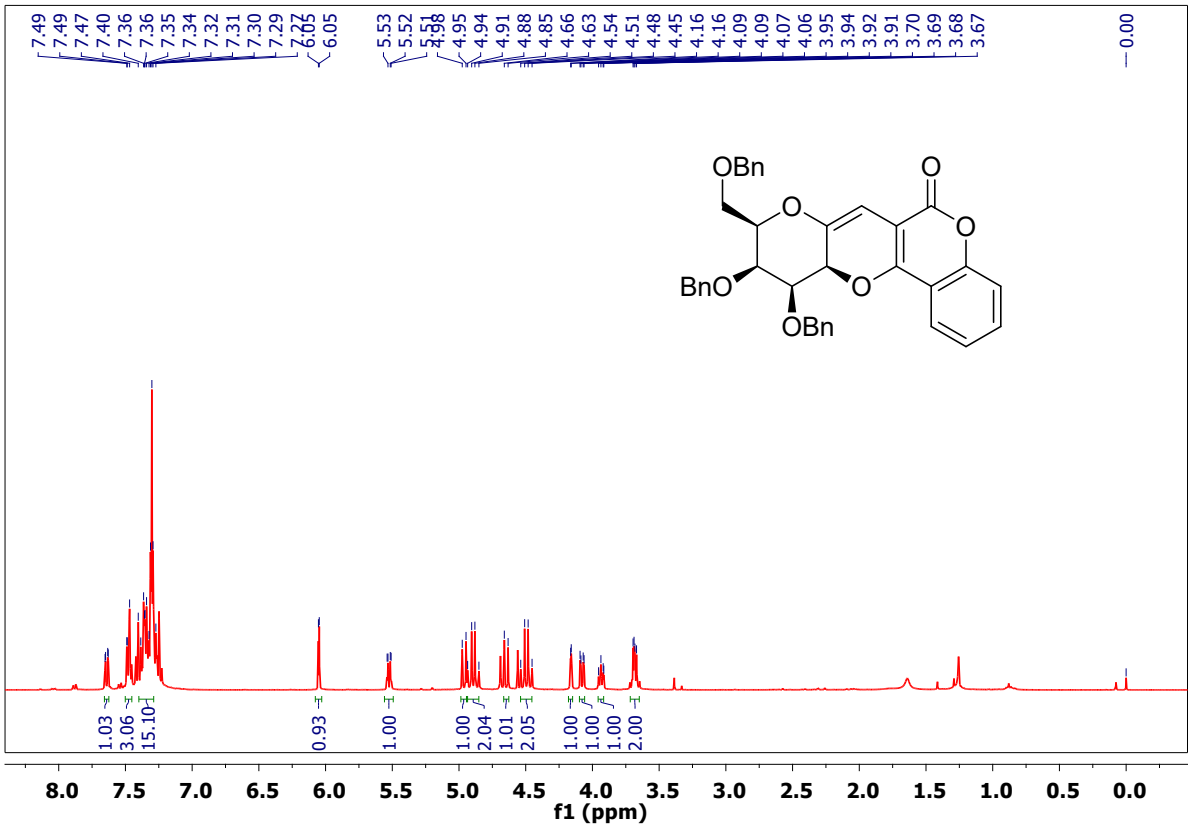


Figure 5: ^{1}H NMR spectrum of compound **4a** (400 MHz, $CDCl_3$)

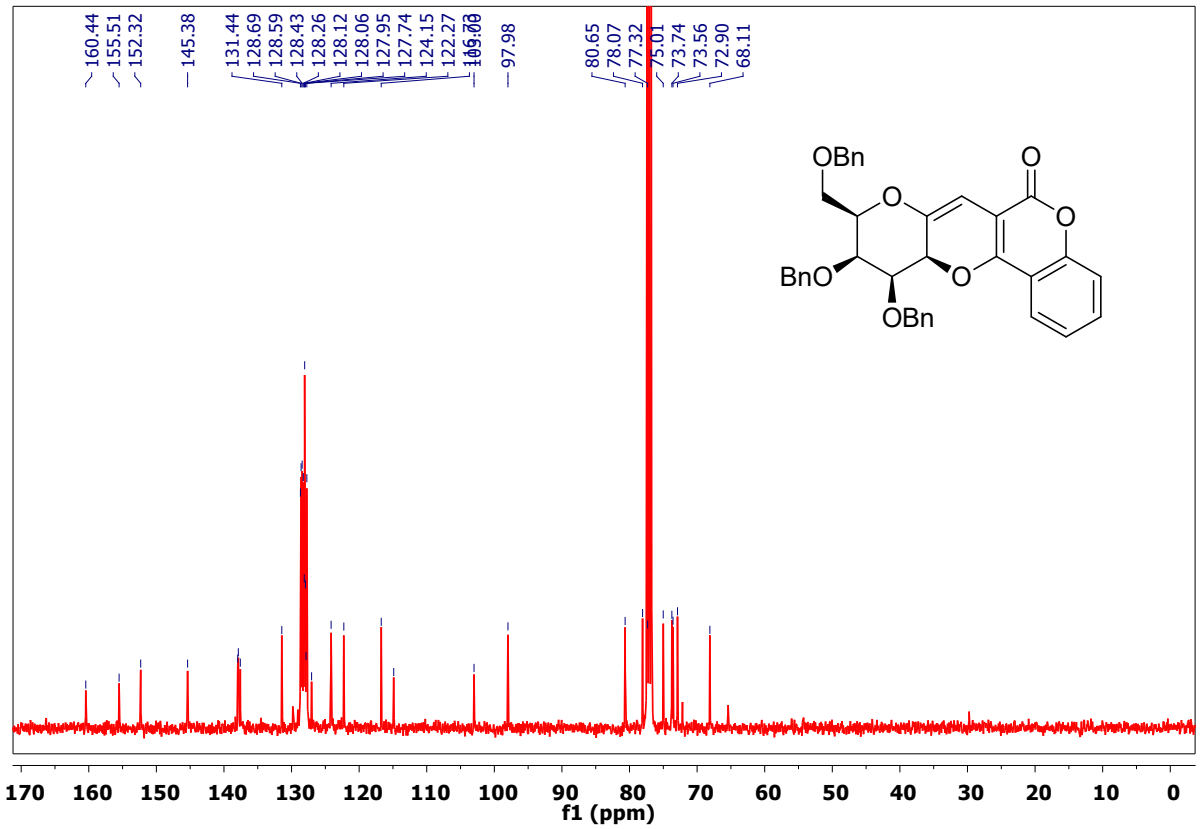


Figure 6: ^{13}C NMR spectrum of compound **4a** (100.6 MHz, $CDCl_3$)

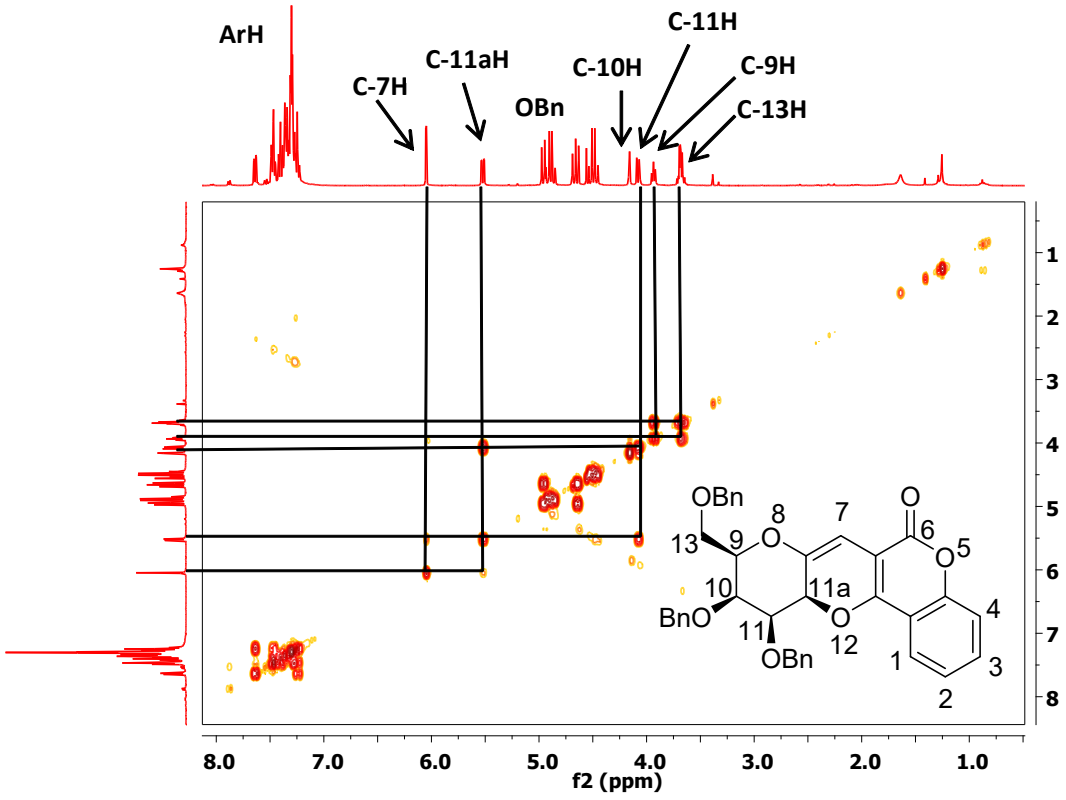


Figure 7: ^{1}H-^{1}H COSY NMR spectrum of compound **4a** (400 MHz, $CDCl_3$)

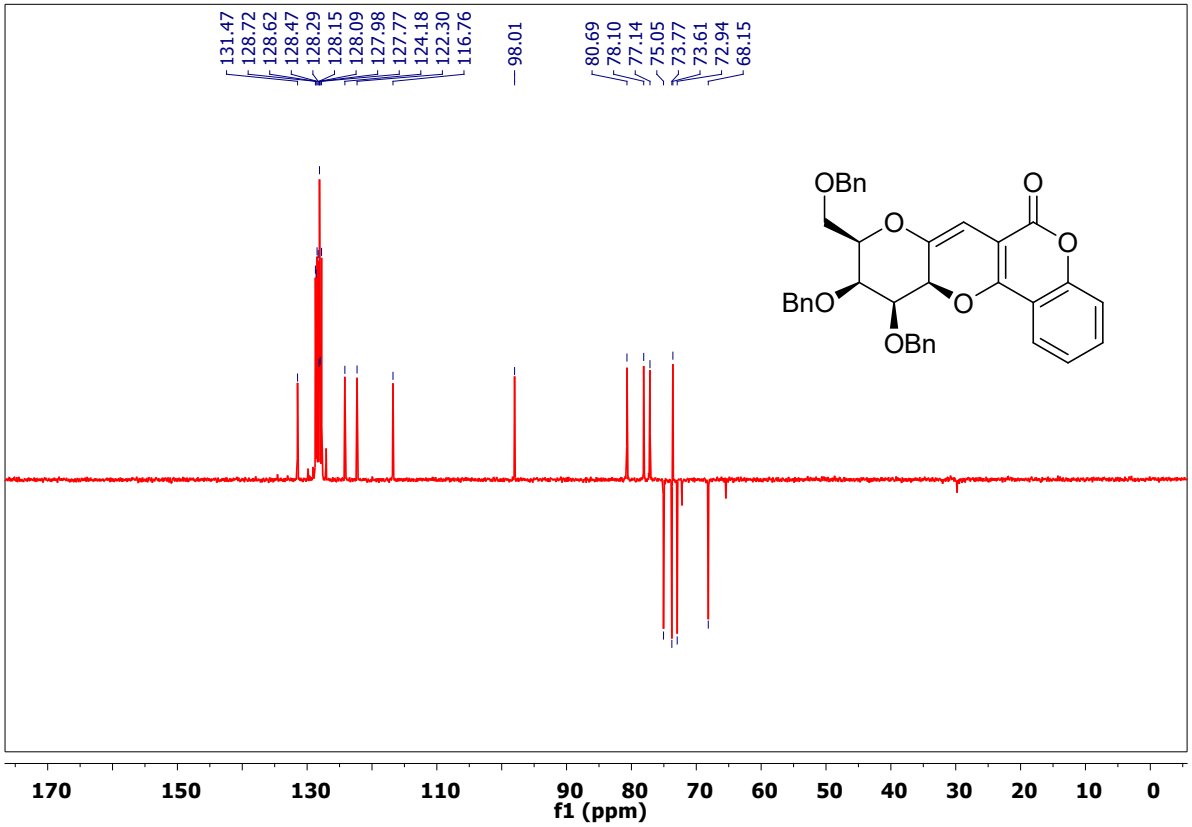


Figure 8: DEPT-135 NMR spectrum of compound **4a** (100.6 MHz, $CDCl_3$)

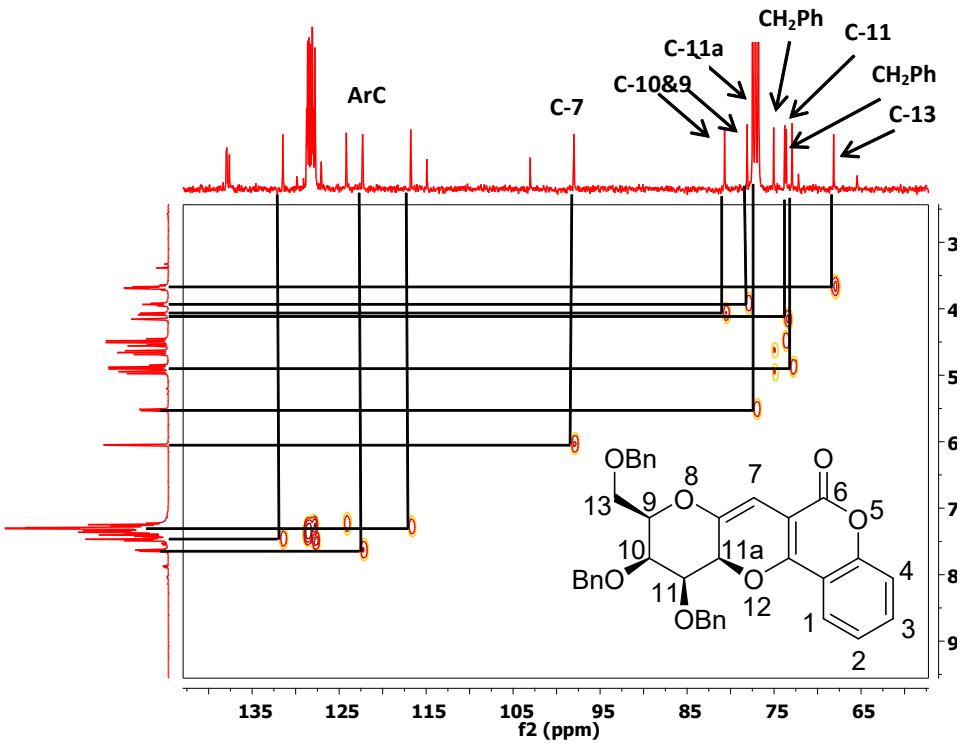


Figure 9: ^{1}H-^{13}C HETCOR NMR spectrum of compound **4a** (400 MHz, $CDCl_3$)

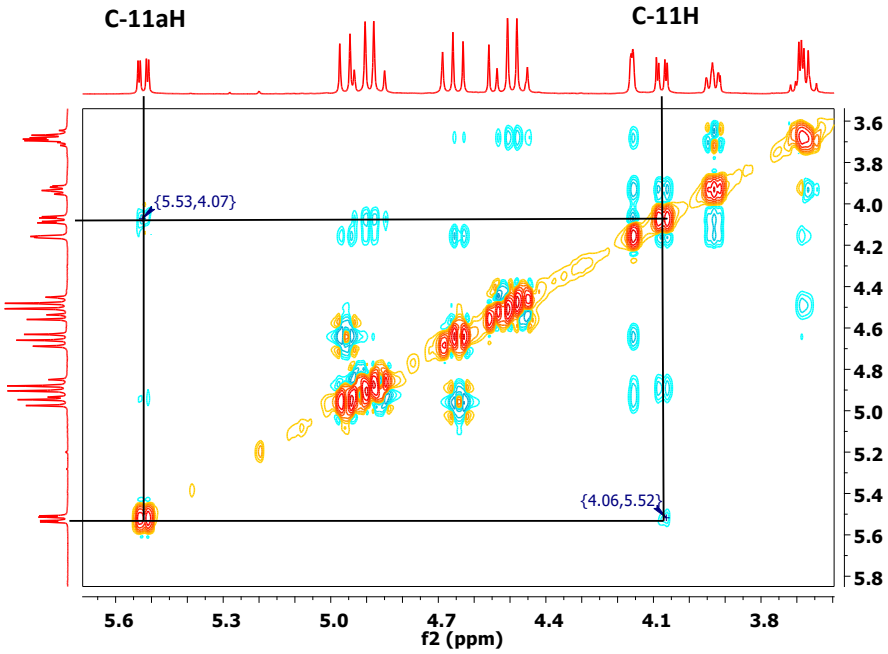


Figure 10: ^{1}H-^{1}H NOESY NMR spectrum of compound **4a** (400 MHz, $CDCl_3$)

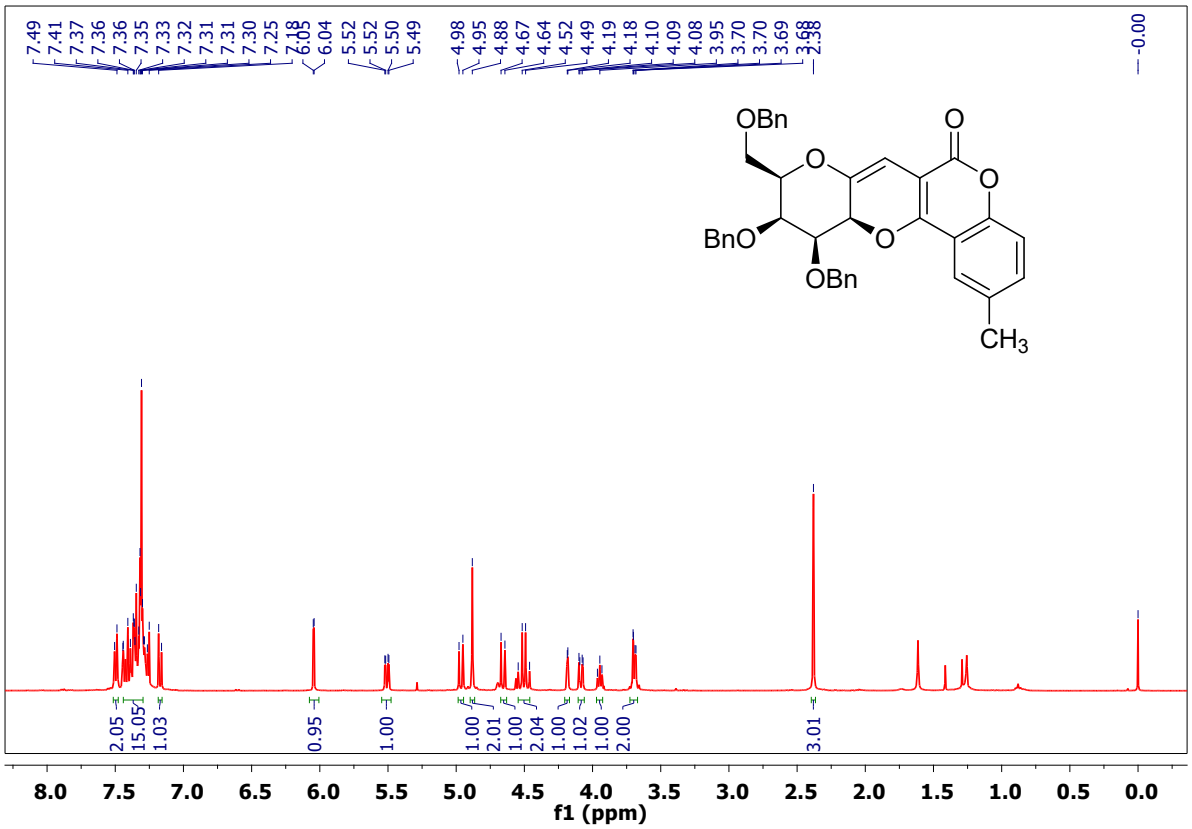


Figure 11: ^{1}H NMR spectrum of compound **4b** (400 MHz, $CDCl_3$)

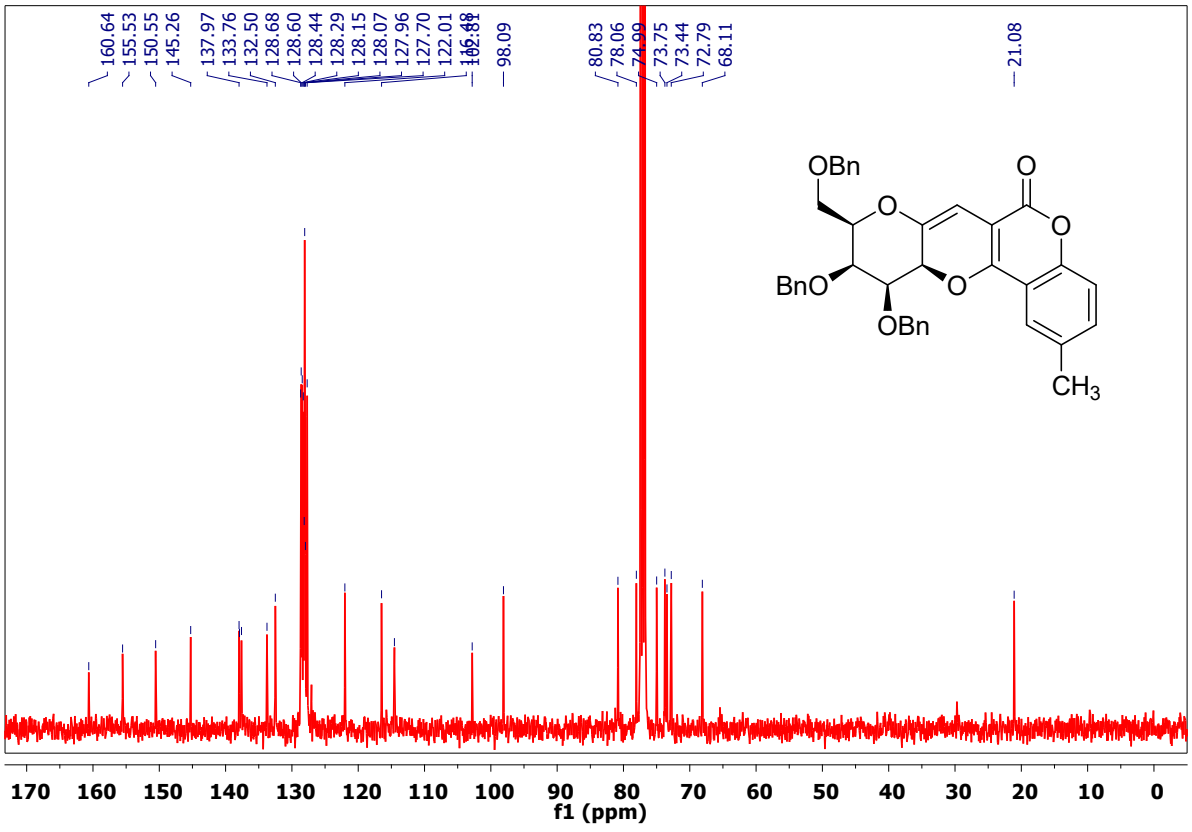


Figure 12: ^{13}C NMR spectrum of compound **4b** (100.6 MHz, $CDCl_3$)

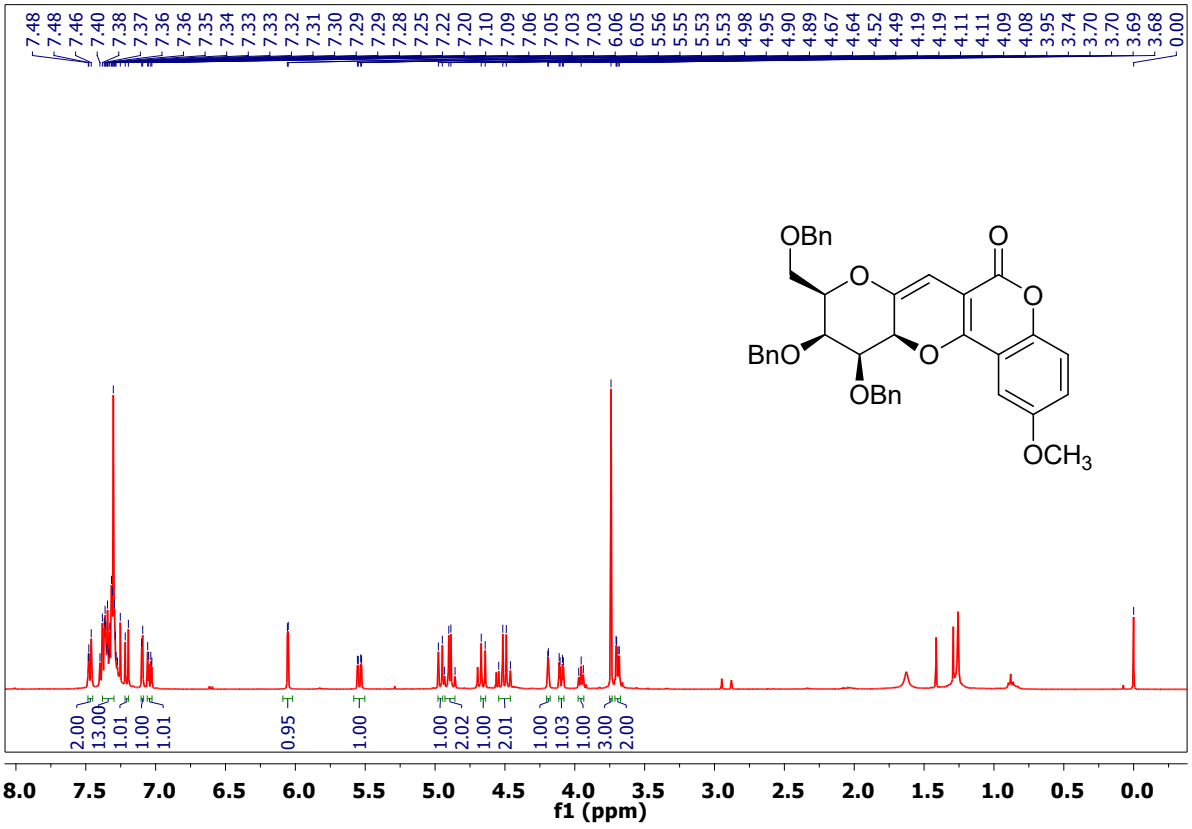


Figure 13: ^{1}H NMR spectrum of compound **4c** (400 MHz, $CDCl_3$)

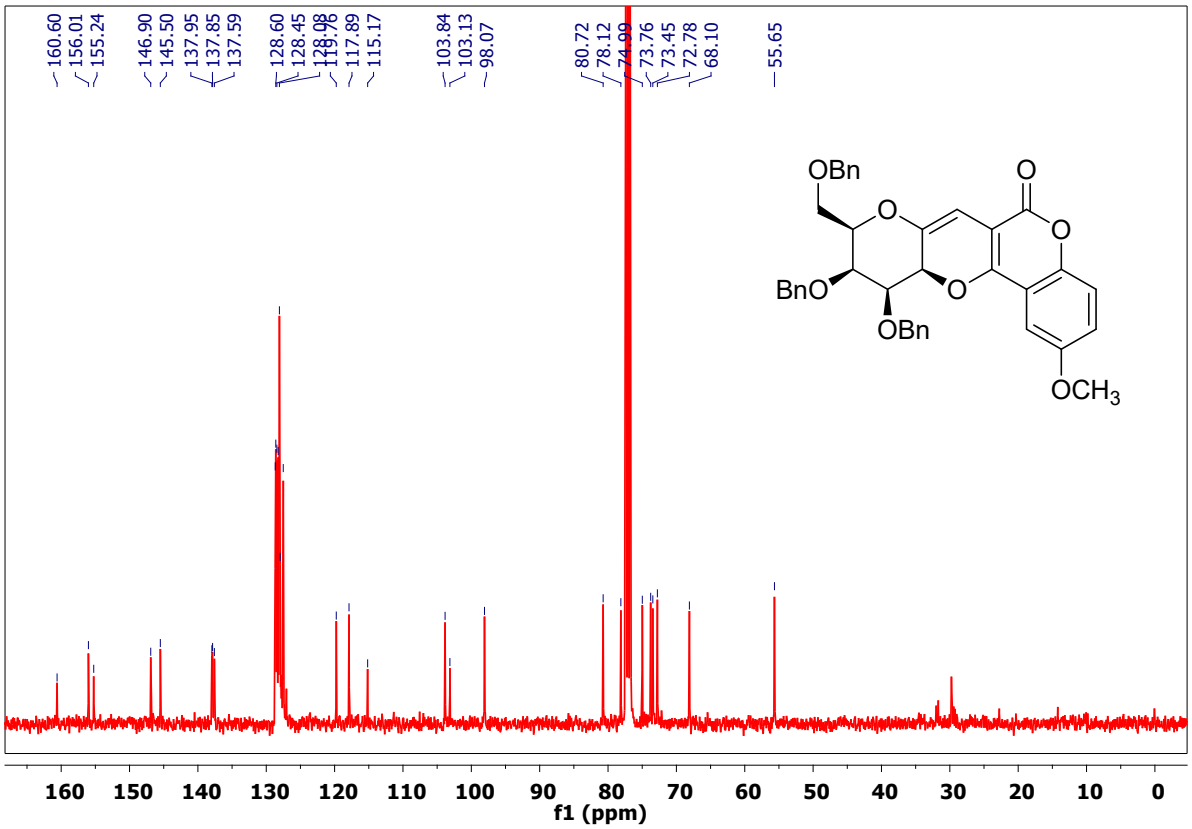


Figure 14: ^{13}C NMR spectrum of compound **4c** (100.6 MHz, $CDCl_3$)

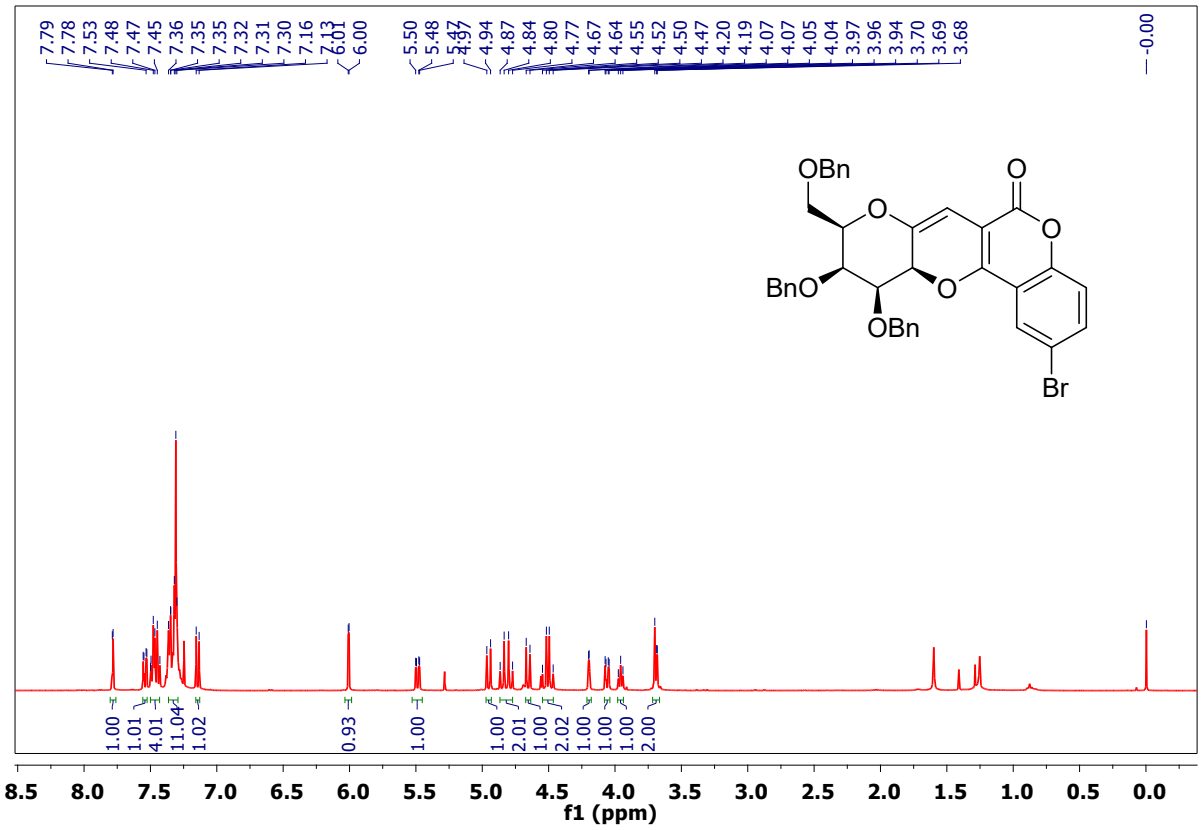


Figure 15: ^{1}H NMR spectrum of compound **4d** (400 MHz, $CDCl_3$)

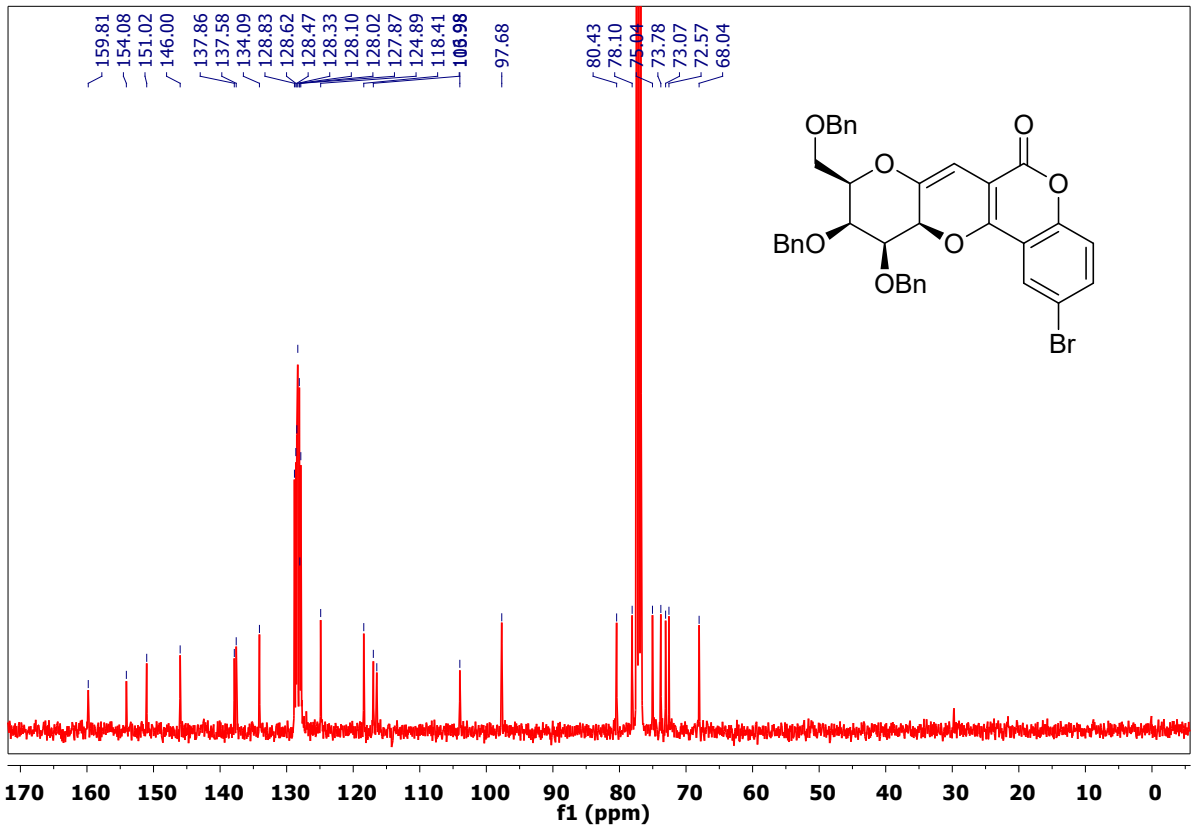


Figure 16: ^{13}C NMR spectrum of compound **4d** (100.6 MHz, $CDCl_3$)

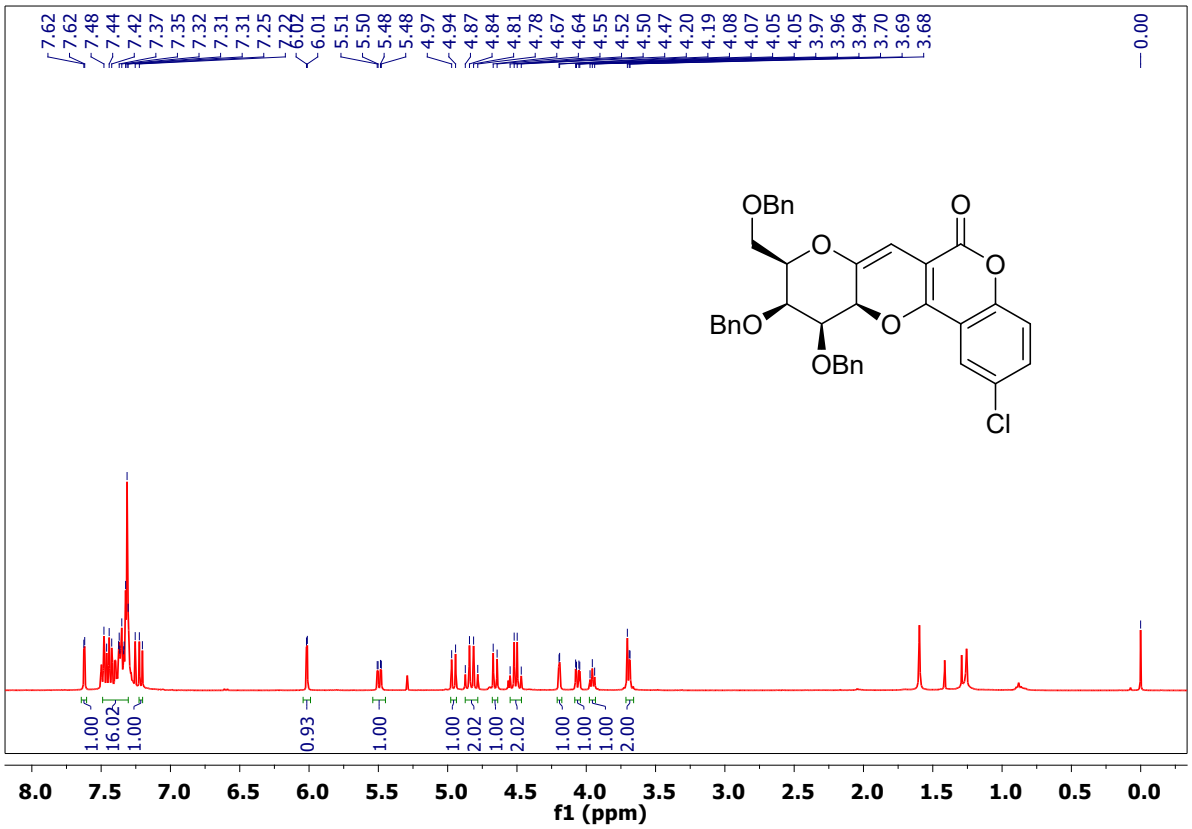


Figure 17: ^{1}H NMR spectrum of compound **4e** (400 MHz, $CDCl_3$)

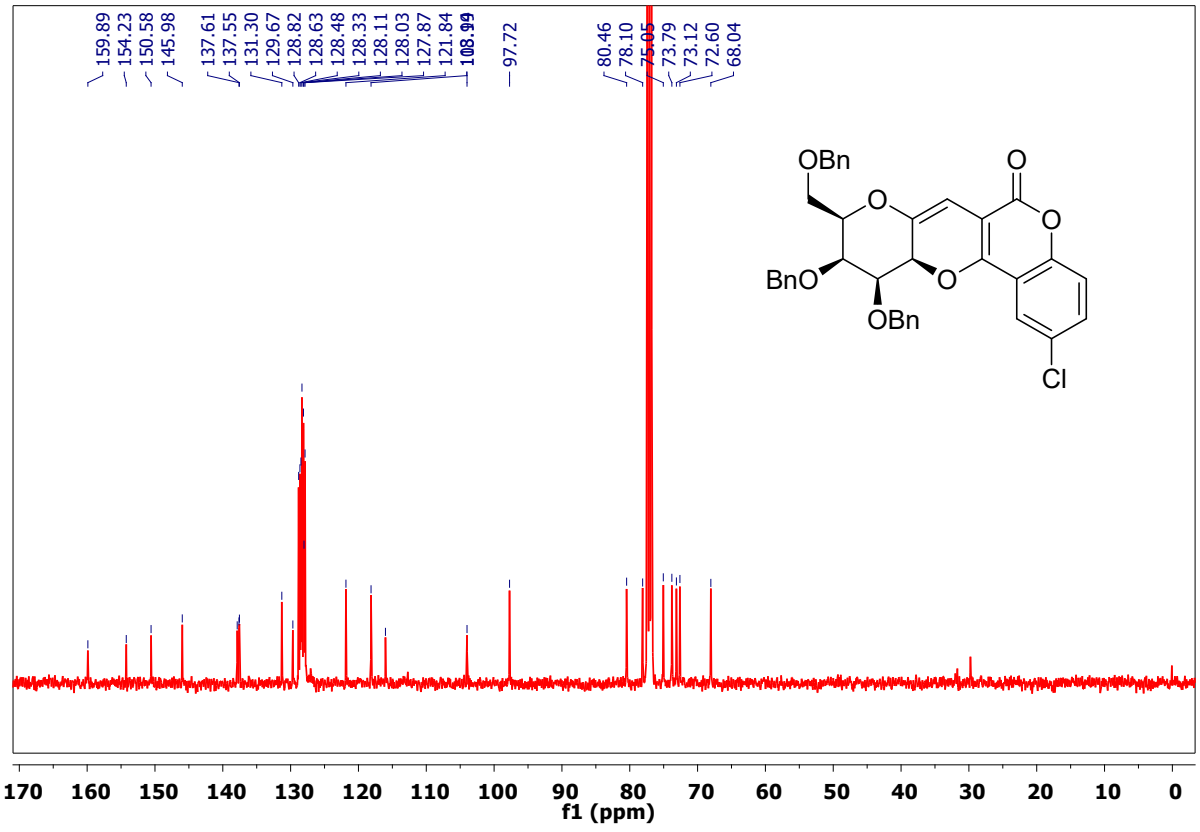
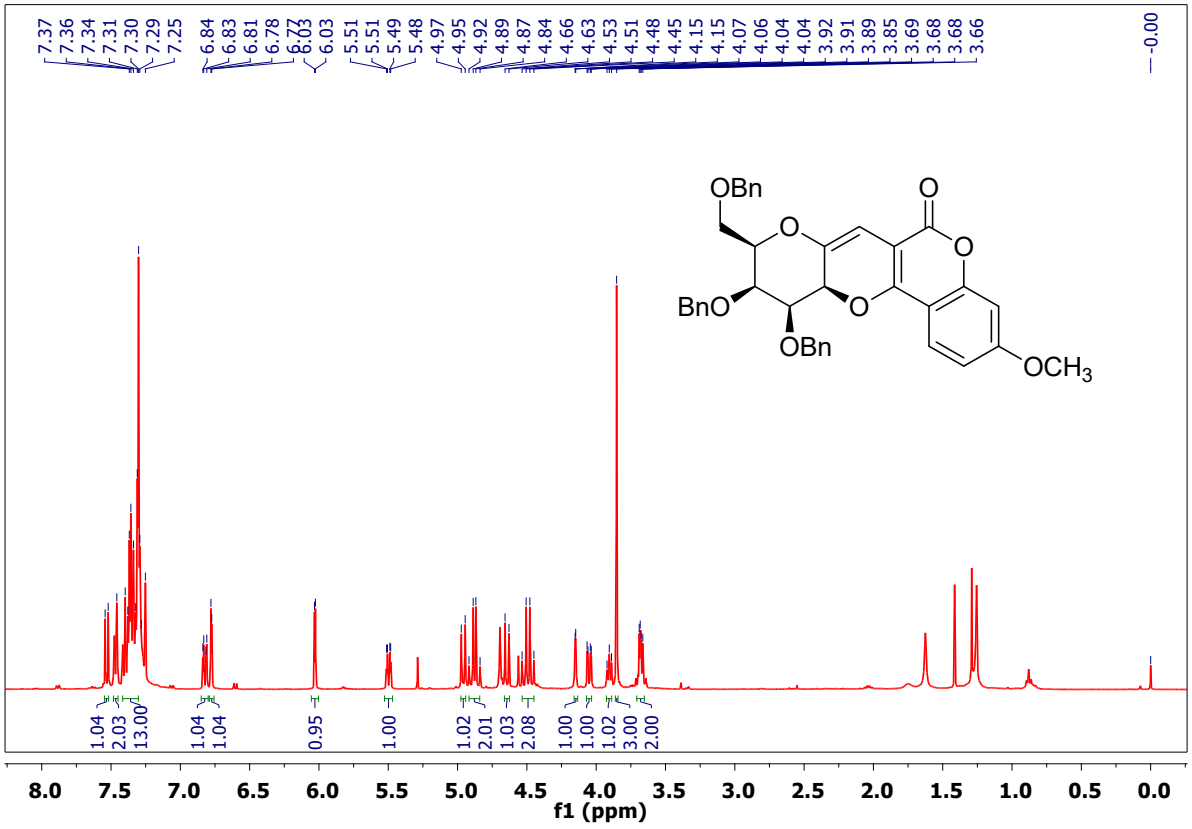


Figure 18: ^{13}C NMR spectrum of compound **4e** (100.6 MHz, $CDCl_3$)



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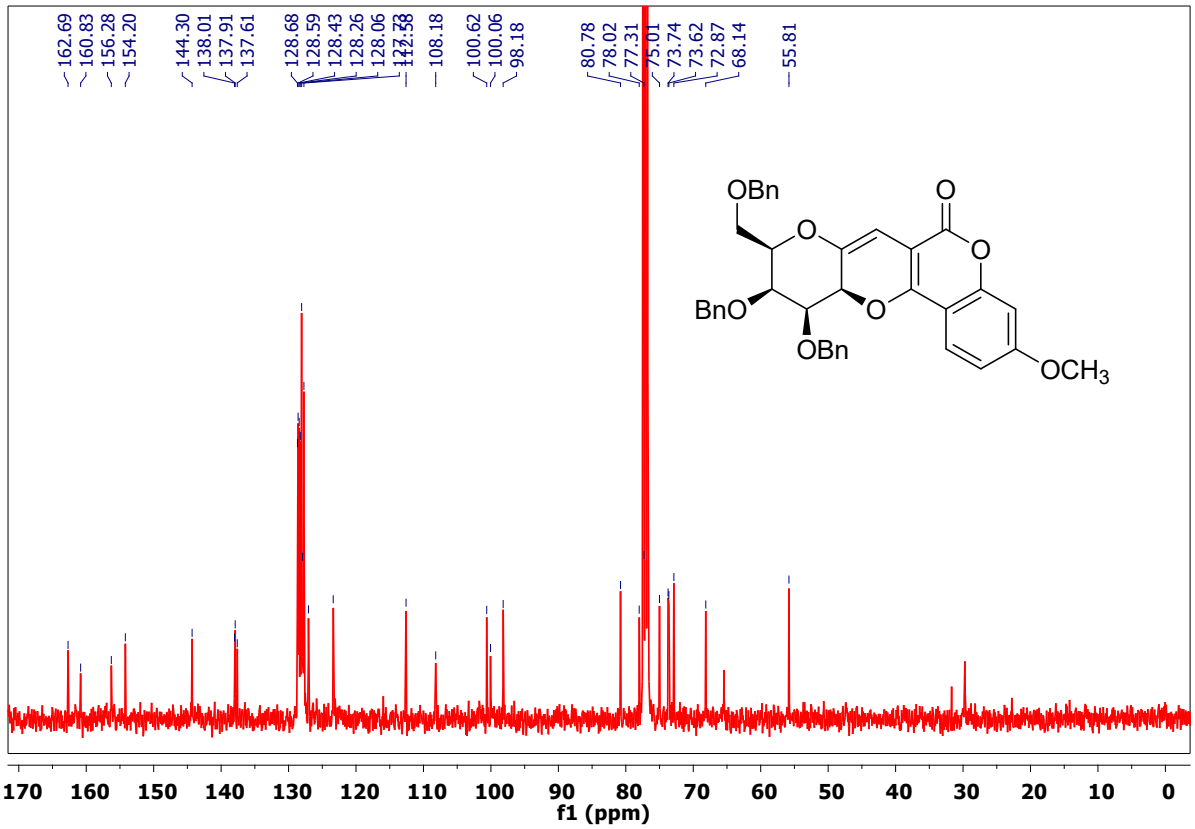


Figure 20: ^{13}C NMR spectrum of compound **4f** (100.6 MHz, $CDCl_3$)

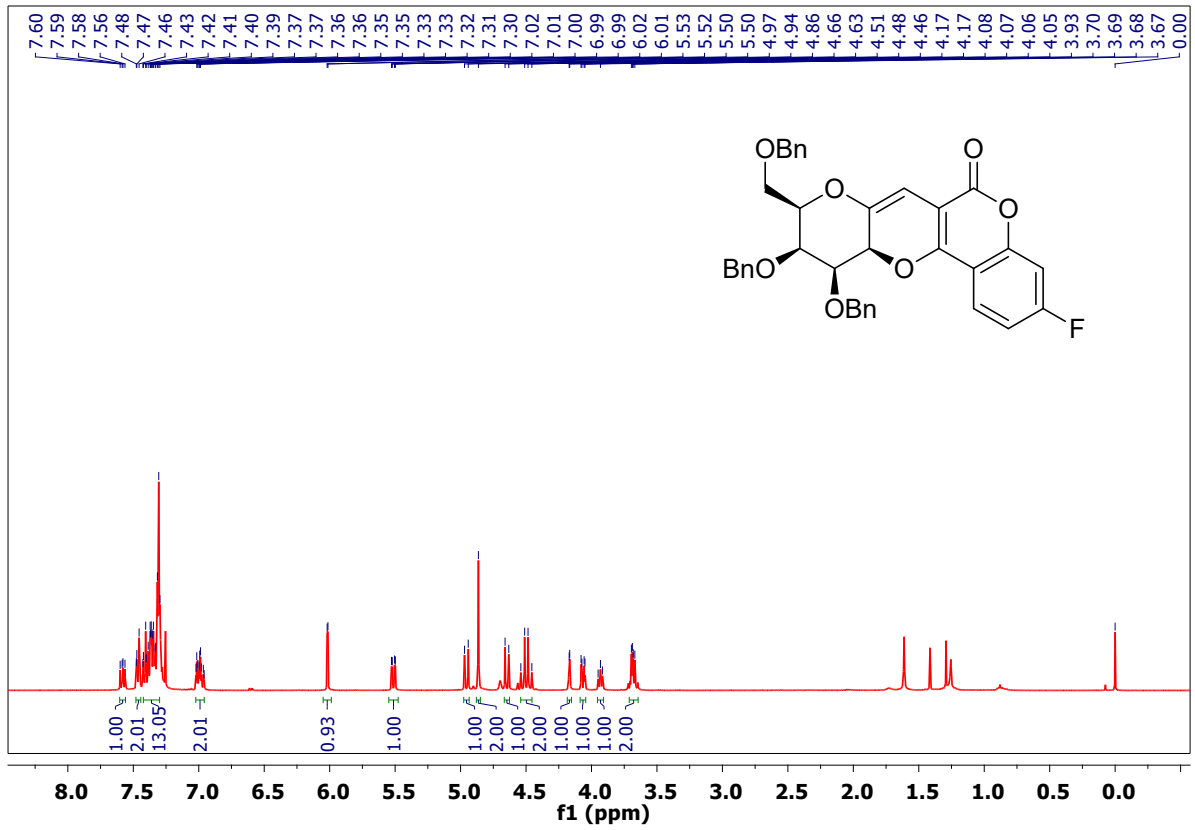


Figure 21: ^{1}H NMR spectrum of compound **4g** (400 MHz, $CDCl_3$)

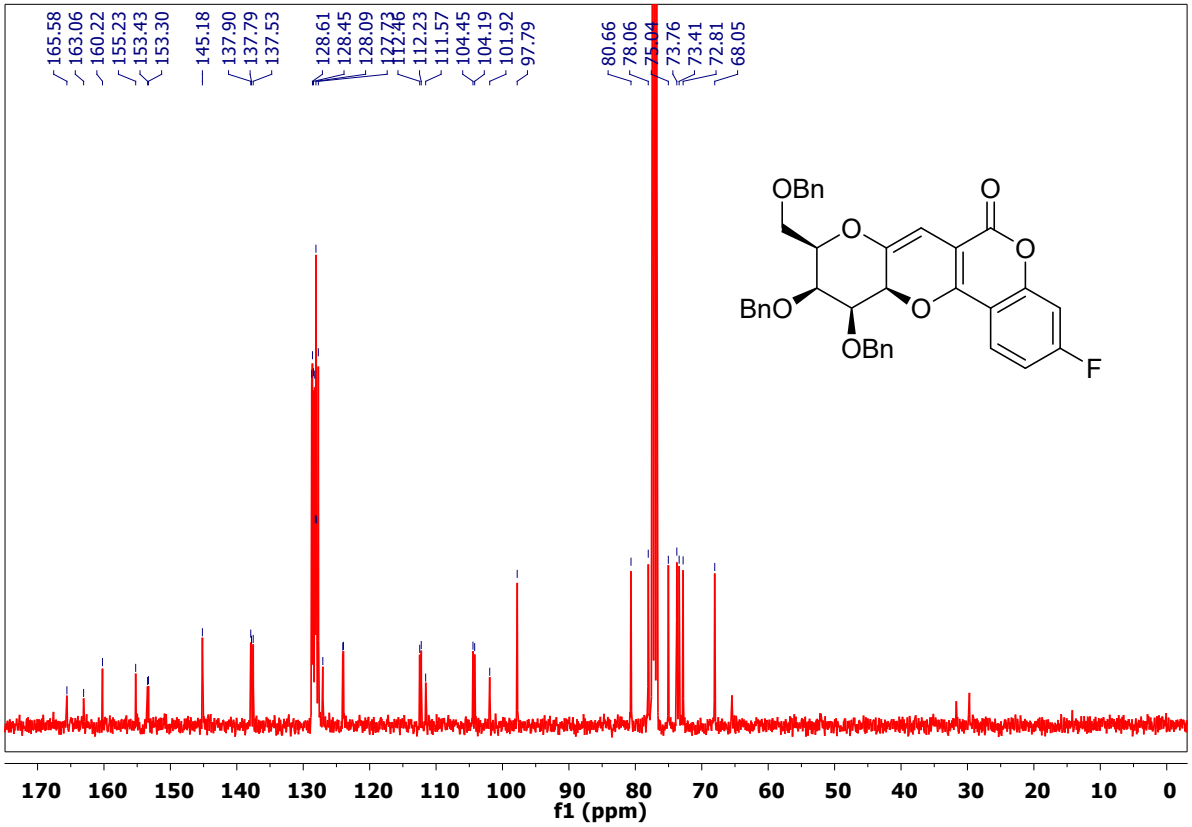


Figure 22: ^{13}C NMR spectrum of compound **4g** (100.6 MHz, $CDCl_3$)

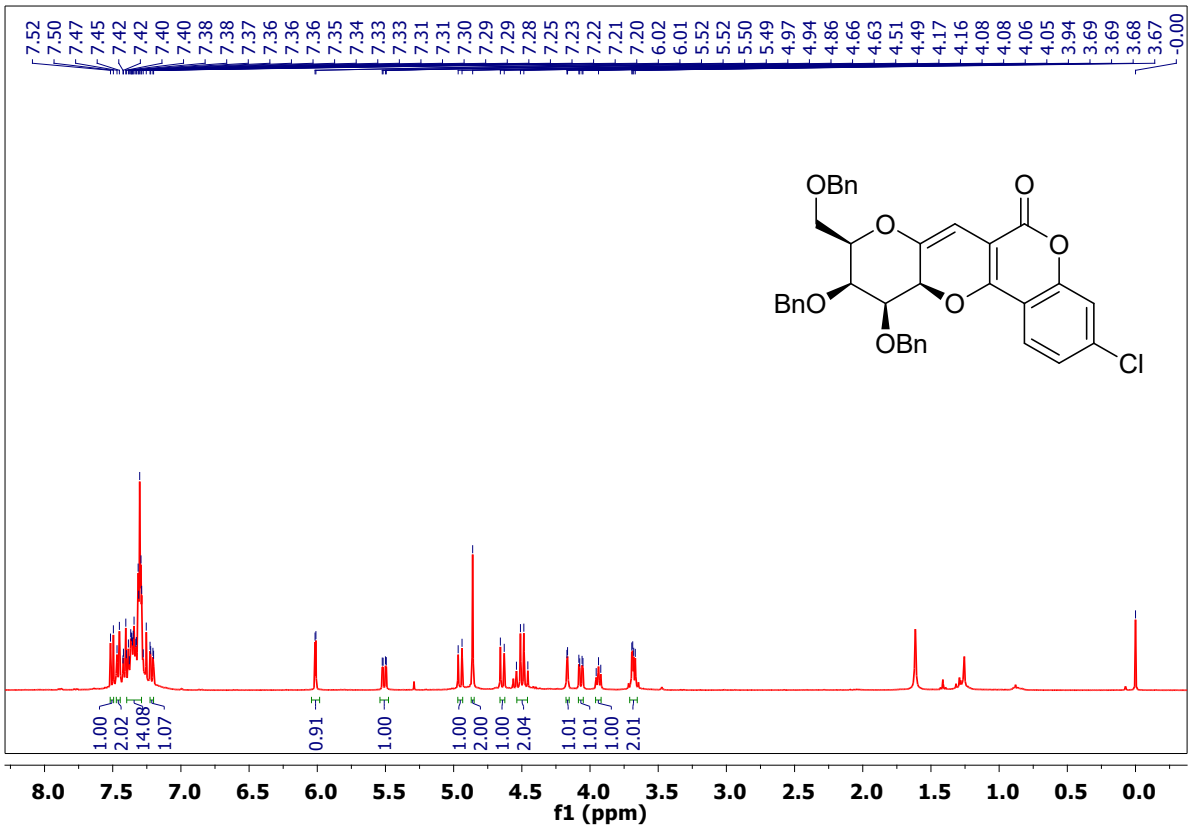


Figure 23: ^{1}H NMR spectrum of compound **4h** (400 MHz, $CDCl_3$)

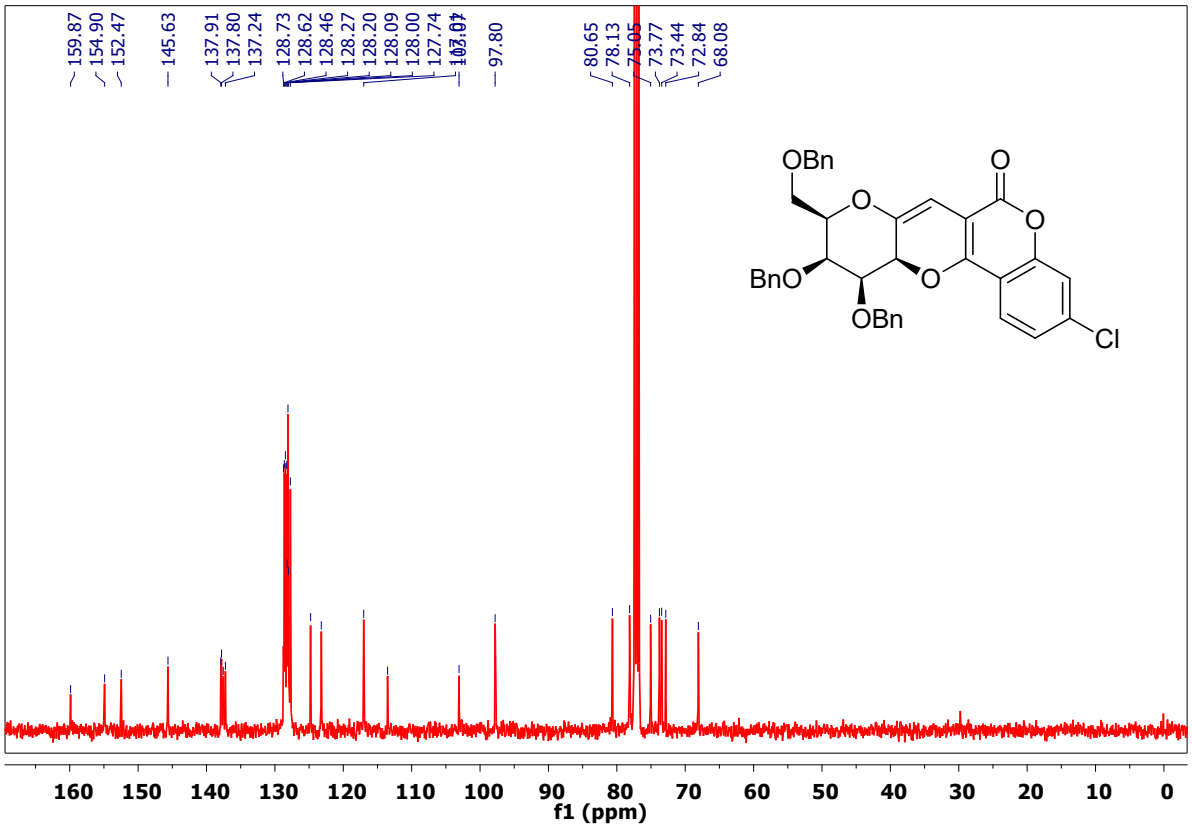


Figure 24: ^{13}C NMR spectrum of compound **4h** (100.6 MHz, $CDCl_3$)

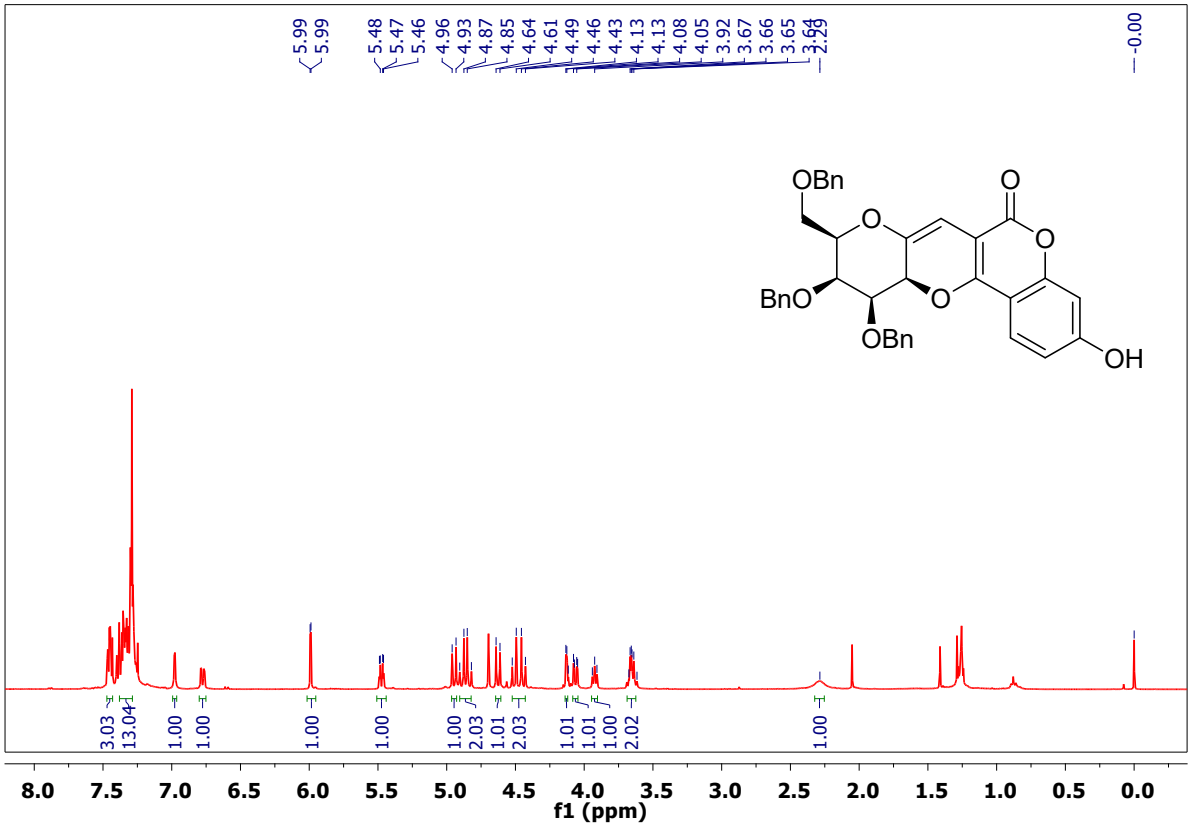


Figure 25: ^{1}H NMR spectrum of compound **4i** (400 MHz, $CDCl_3$)

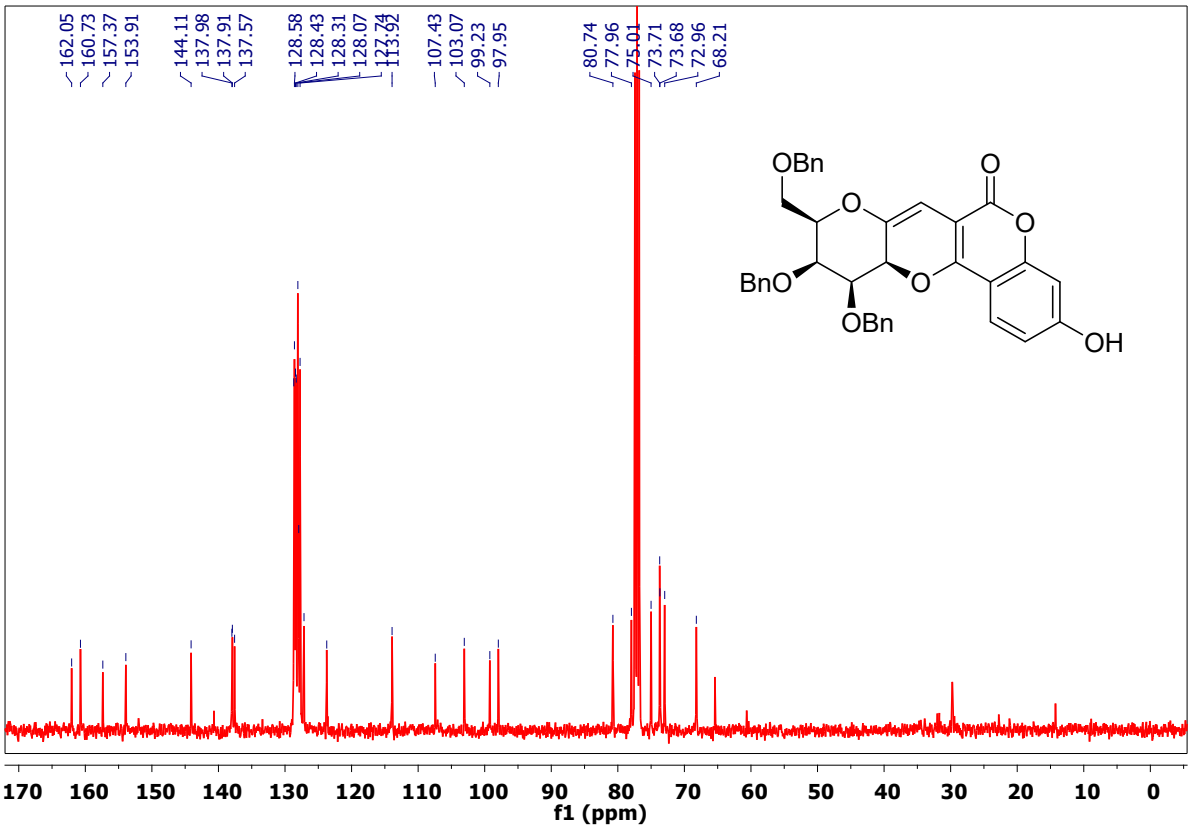


Figure 26: ^{13}C NMR spectrum of compound **4i** (100.6 MHz, $CDCl_3$)

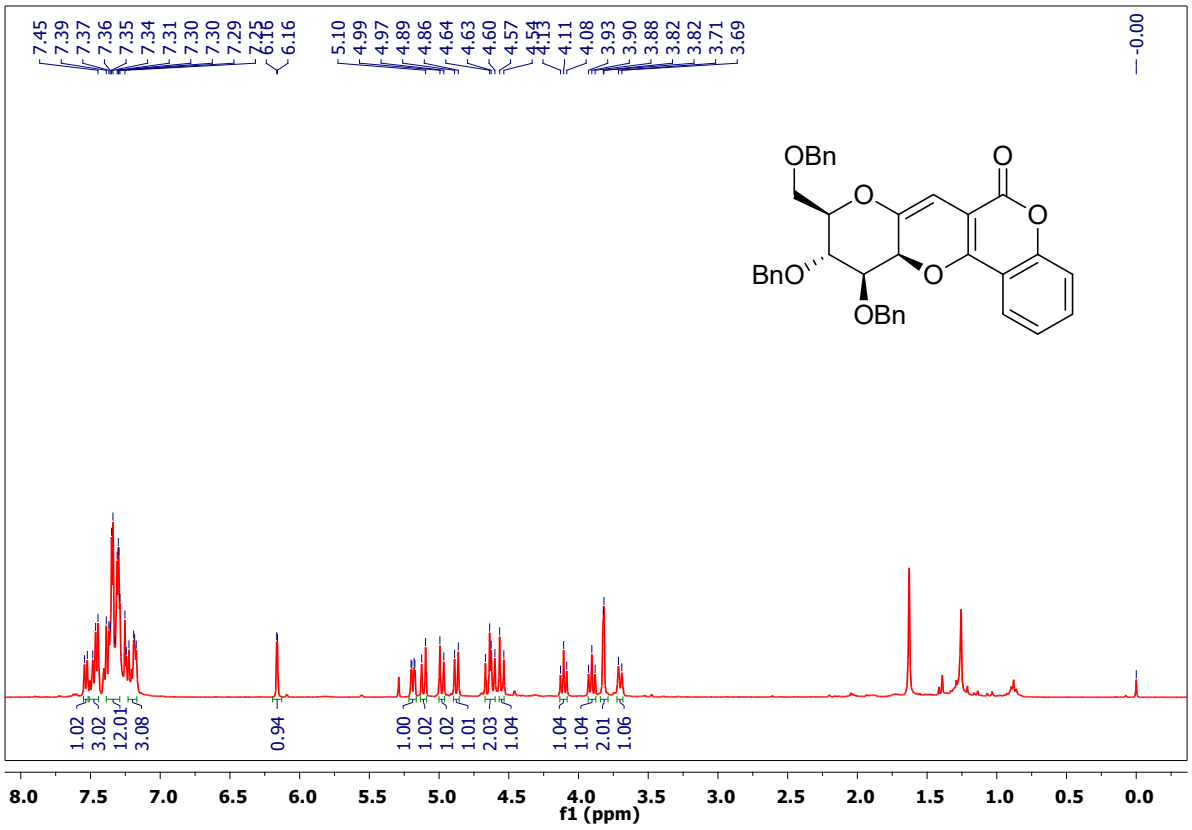


Figure 27: ^{1}H NMR spectrum of compound **5a** (400 MHz, $CDCl_3$)

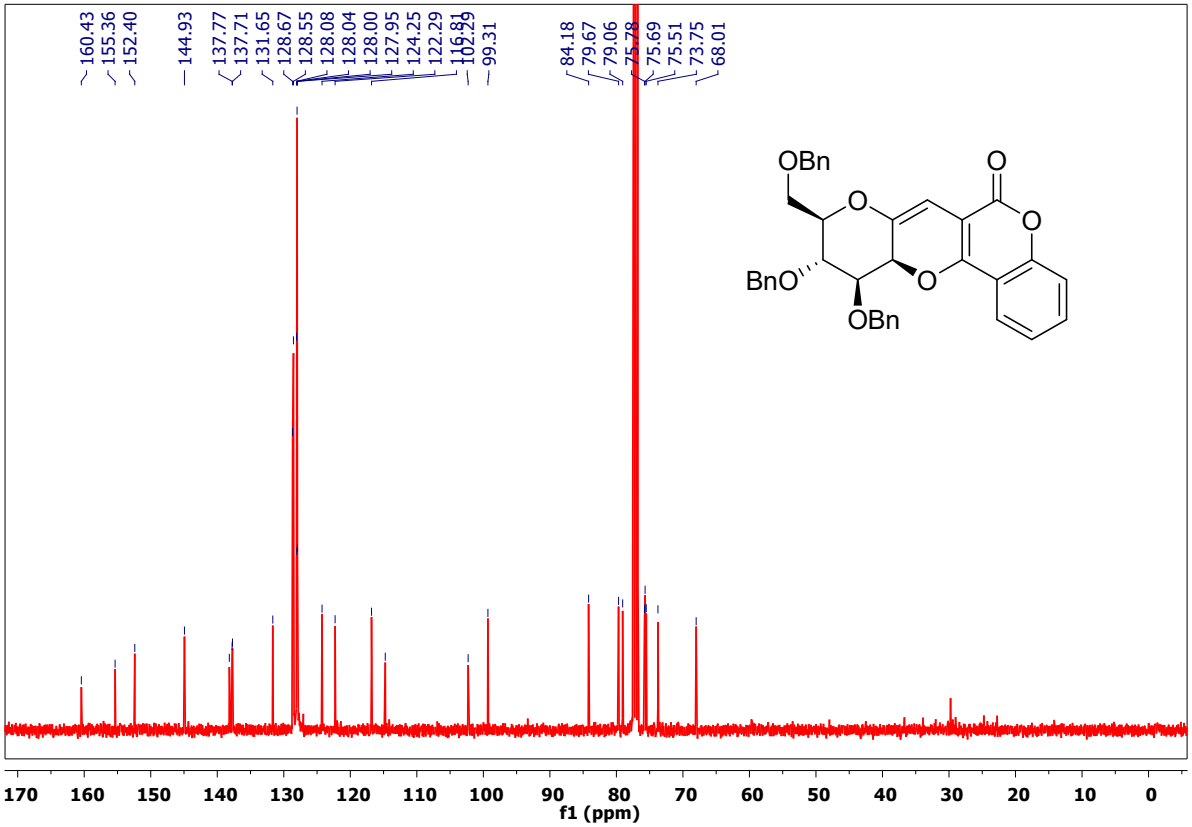


Figure 28: ^{13}C NMR spectrum of compound **5a** (100.6 MHz, $CDCl_3$)

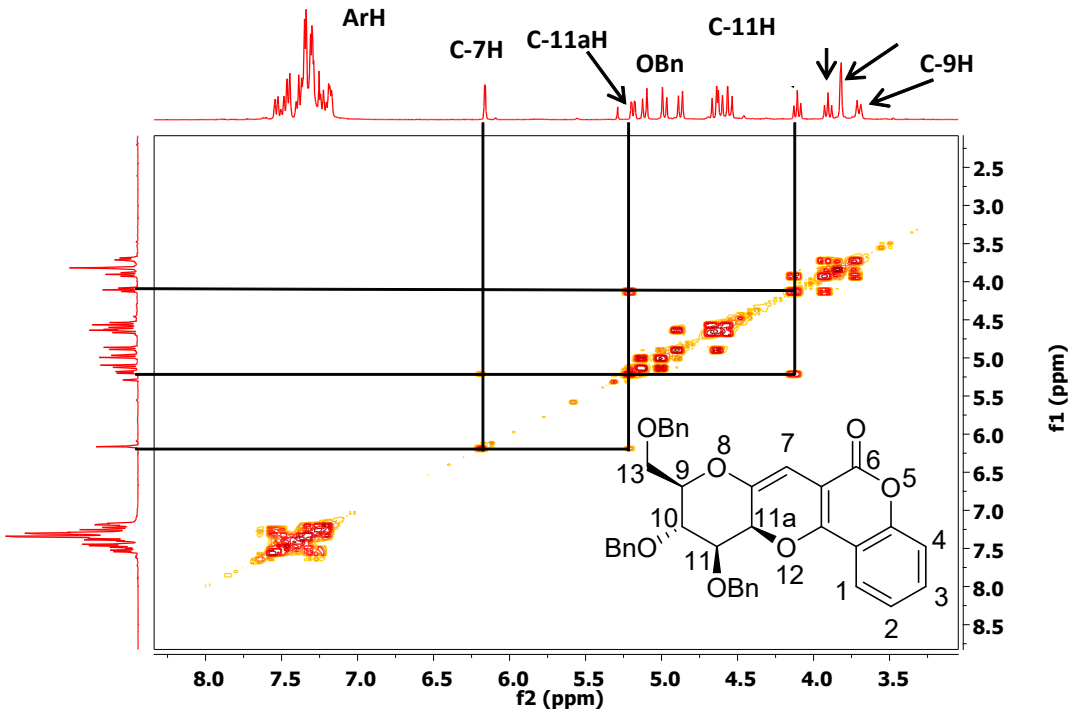


Figure 29: ^{1}H-^{1}H COSY NMR spectrum of compound **5a** (400 MHz, $CDCl_3$)

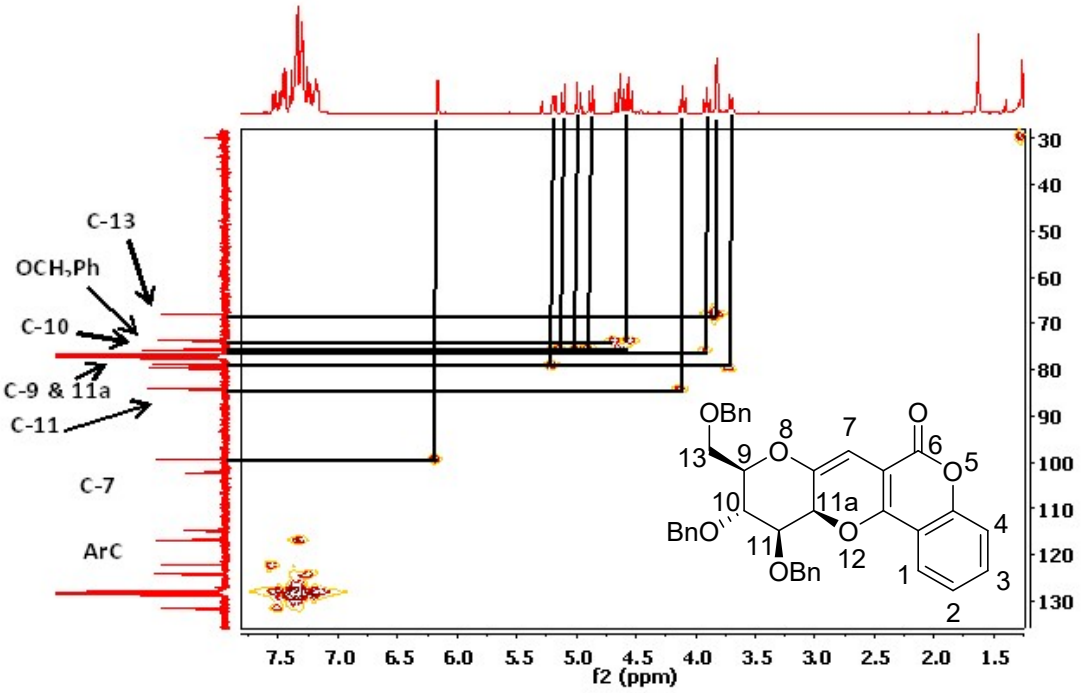


Figure 30: ^{1}H-^{13}C HETCOR NMR spectrum of compound **5a** (400 MHz, $CDCl_3$)

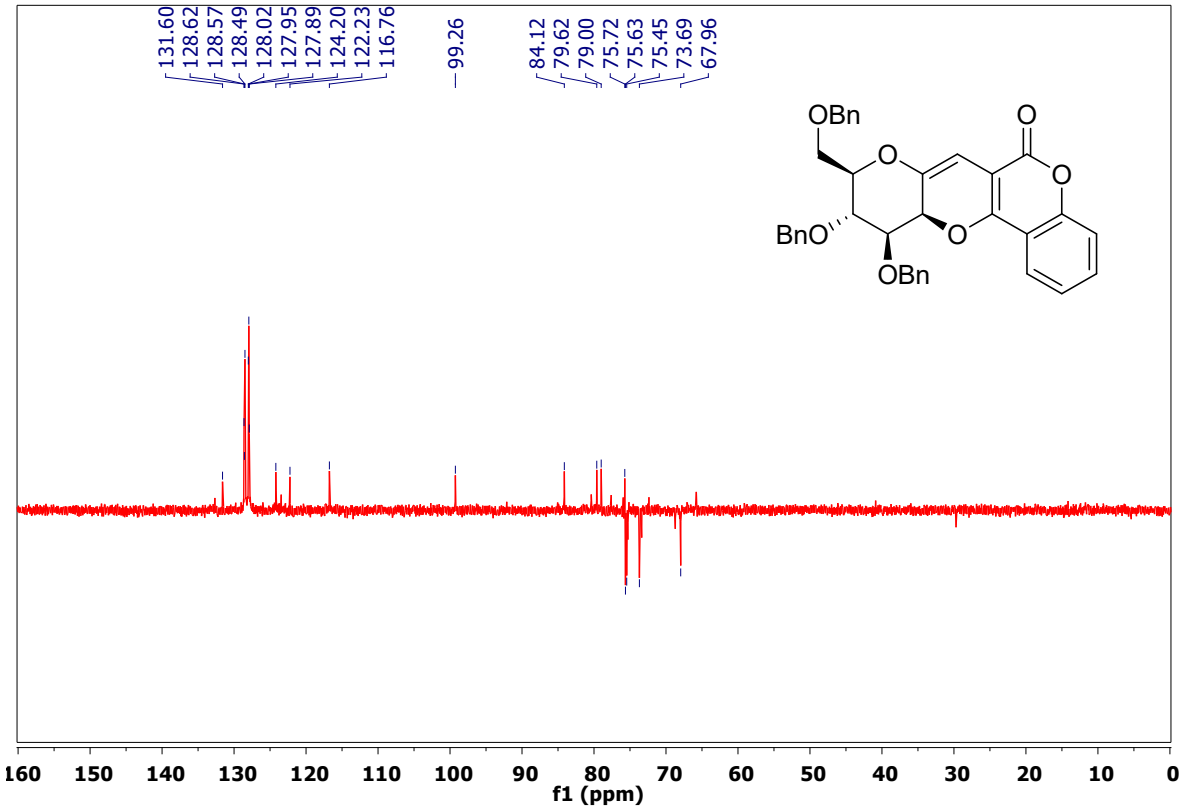


Figure 31: DEPT-135 NMR spectrum of compound **5a** (400 MHz, $CDCl_3$)

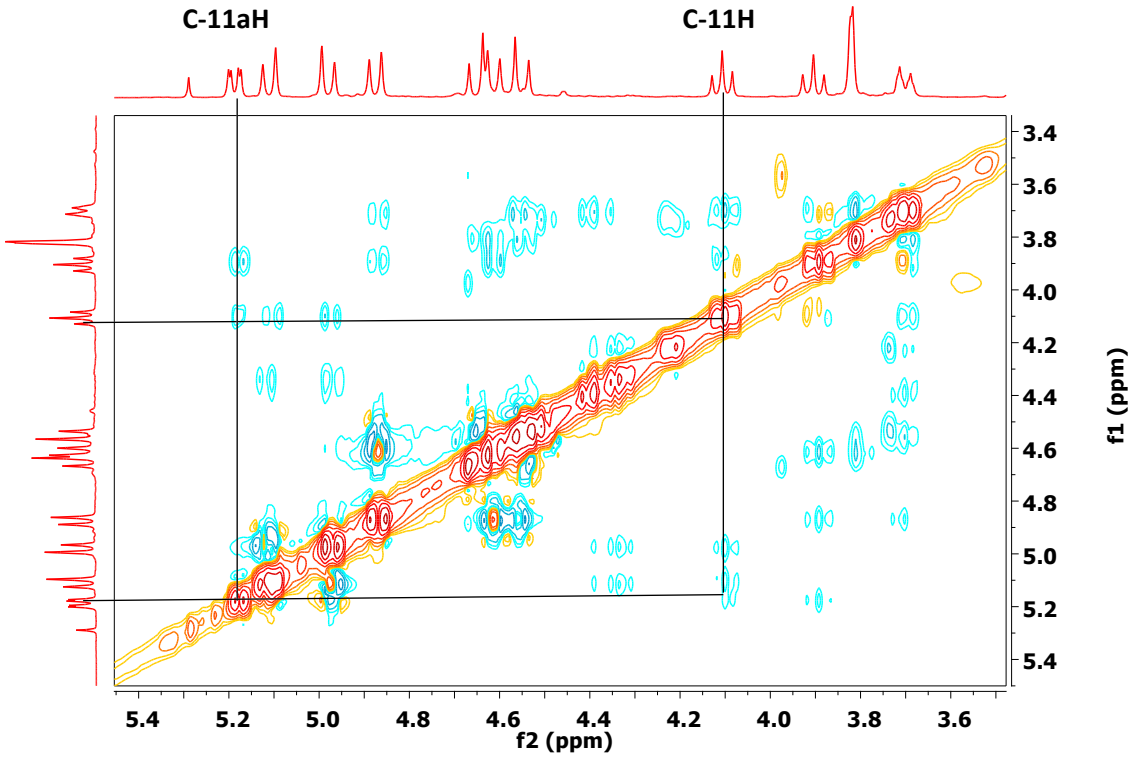


Figure 32: ^1H-^1H NOESY NMR spectrum of compound **5a** (400 MHz, $CDCl_3$)

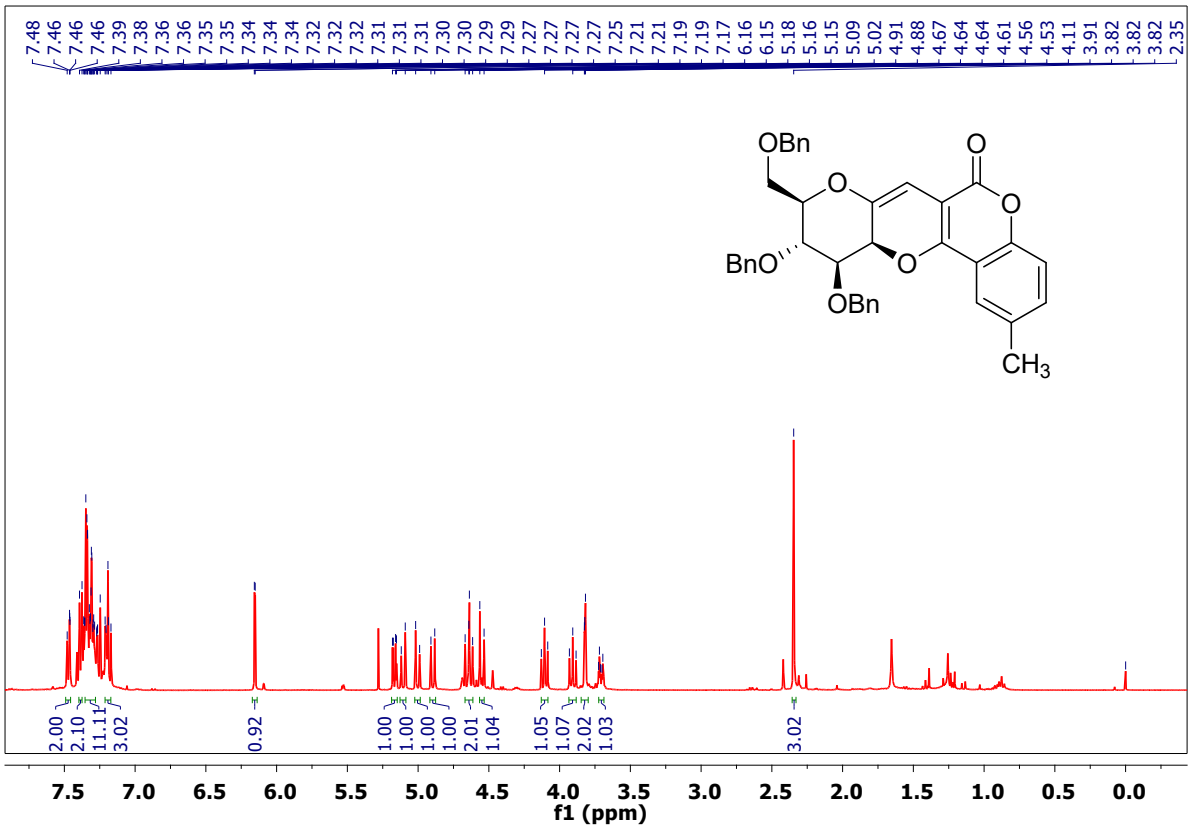


Figure 33: ^{1}H NMR spectrum of compound **5b** (400 MHz, $CDCl_3$)

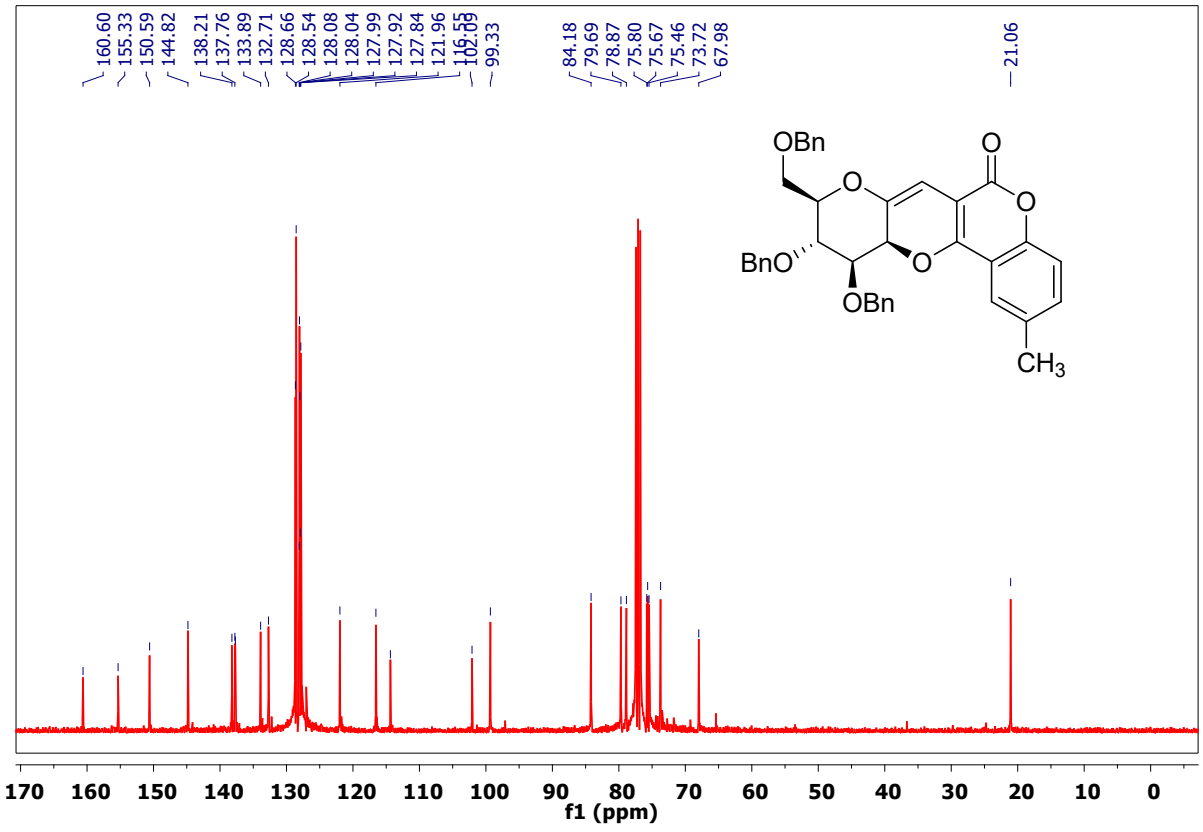


Figure 34: ^{13}C NMR spectrum of compound **5b** (100.6 MHz, $CDCl_3$)

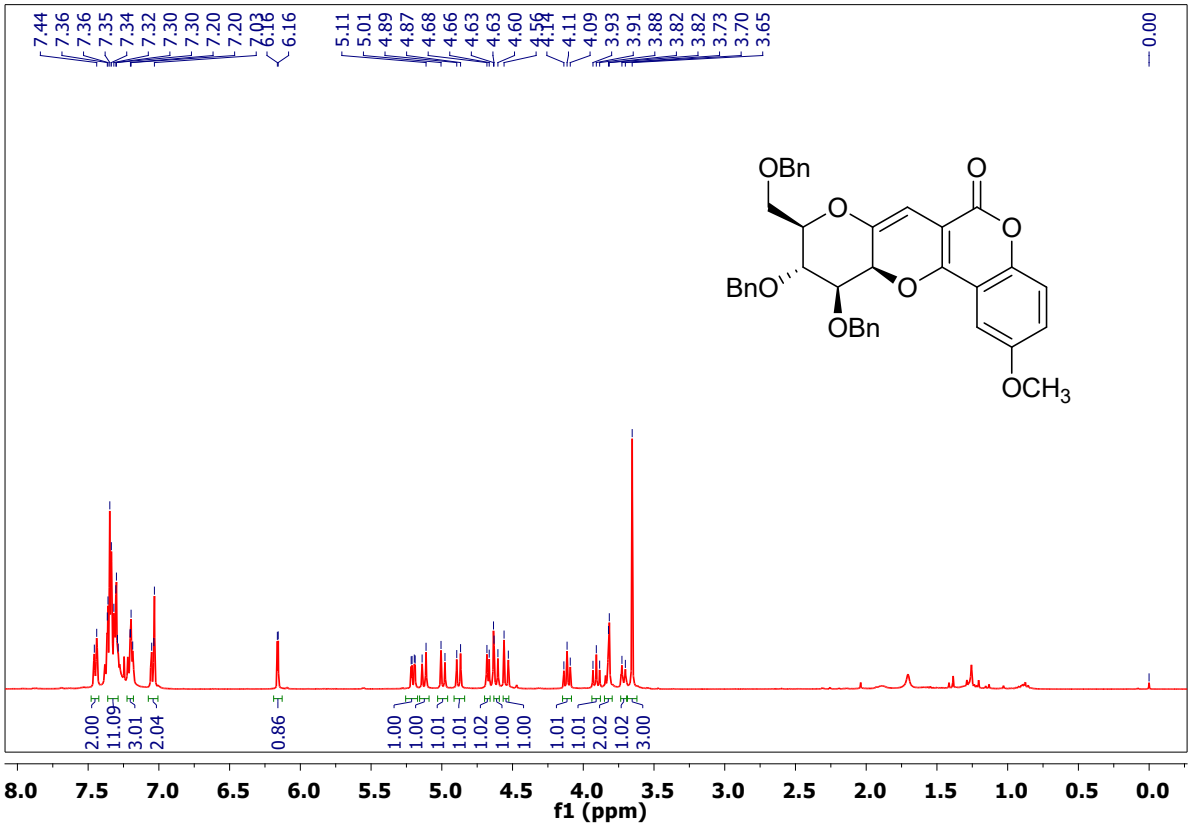


Figure 35: ^{1}H NMR spectrum of compound **5c** (400 MHz, $CDCl_3$)

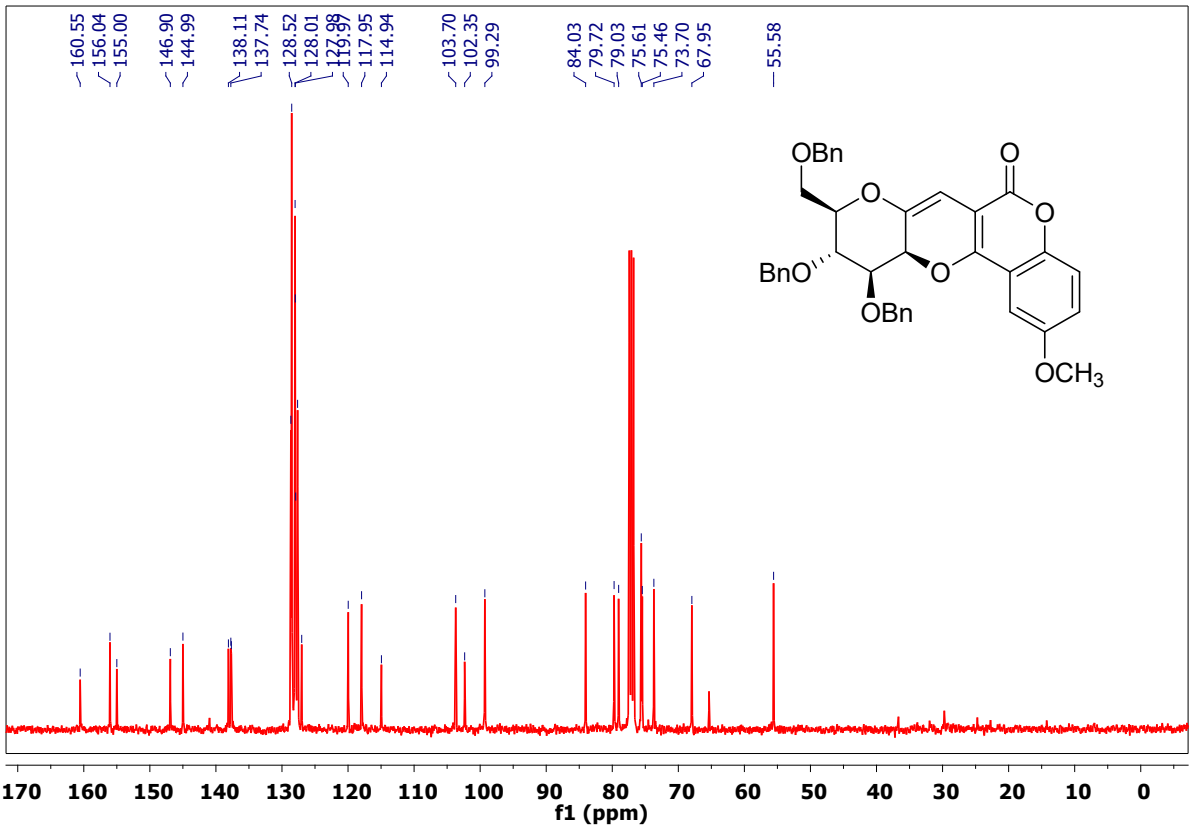


Figure 36: ^{13}C NMR spectrum of compound **5c** (100.6 MHz, $CDCl_3$)

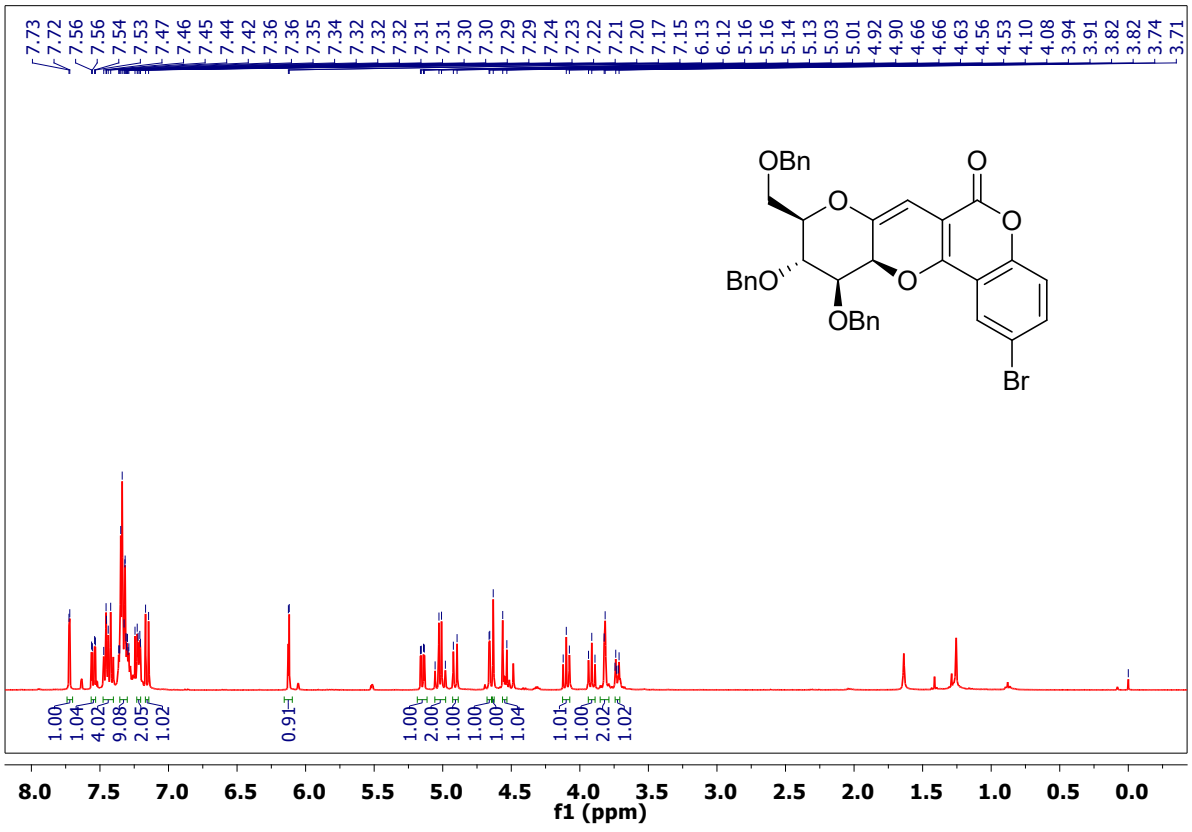


Figure 37: ^{1}H NMR spectrum of compound **5d** (400 MHz, $CDCl_3$)

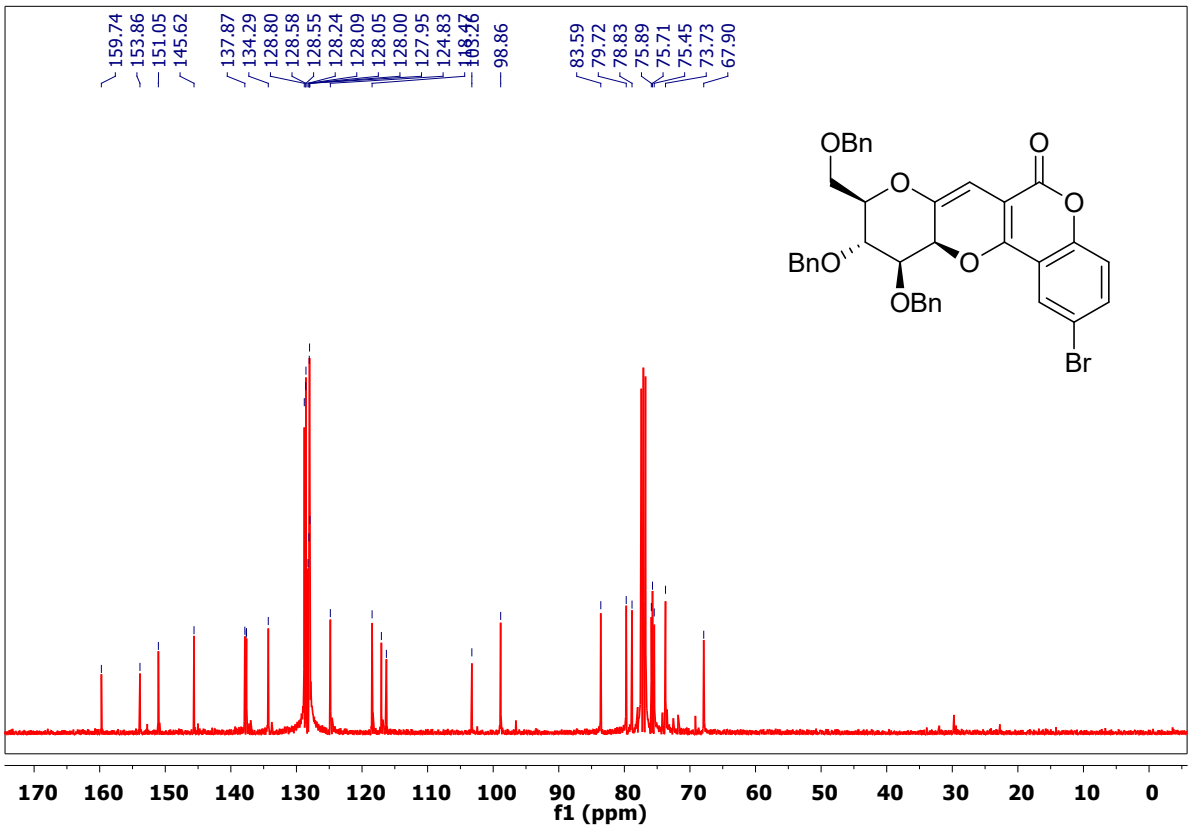


Figure 38: ^{13}C NMR spectrum of compound **5d** (100.6 MHz, $CDCl_3$)

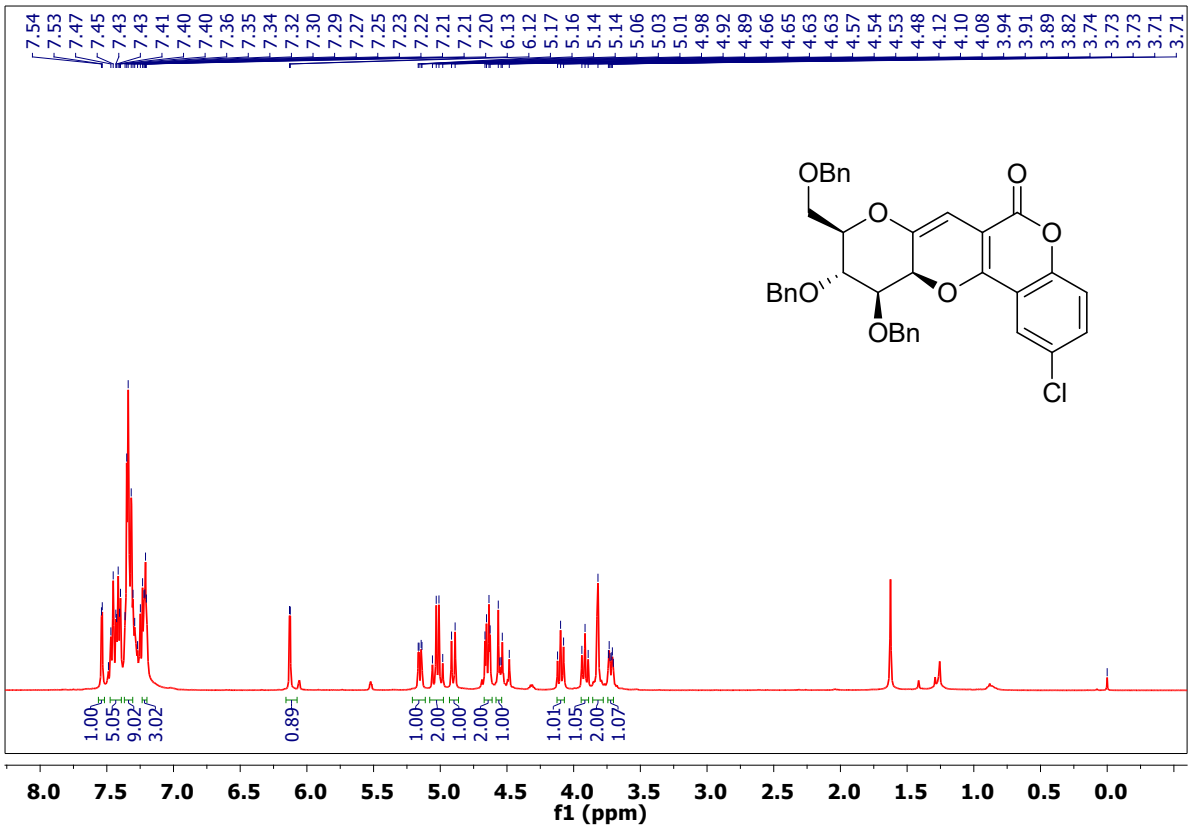


Figure 39: ^{1}H NMR spectrum of compound **5e** (400 MHz, $CDCl_3$)

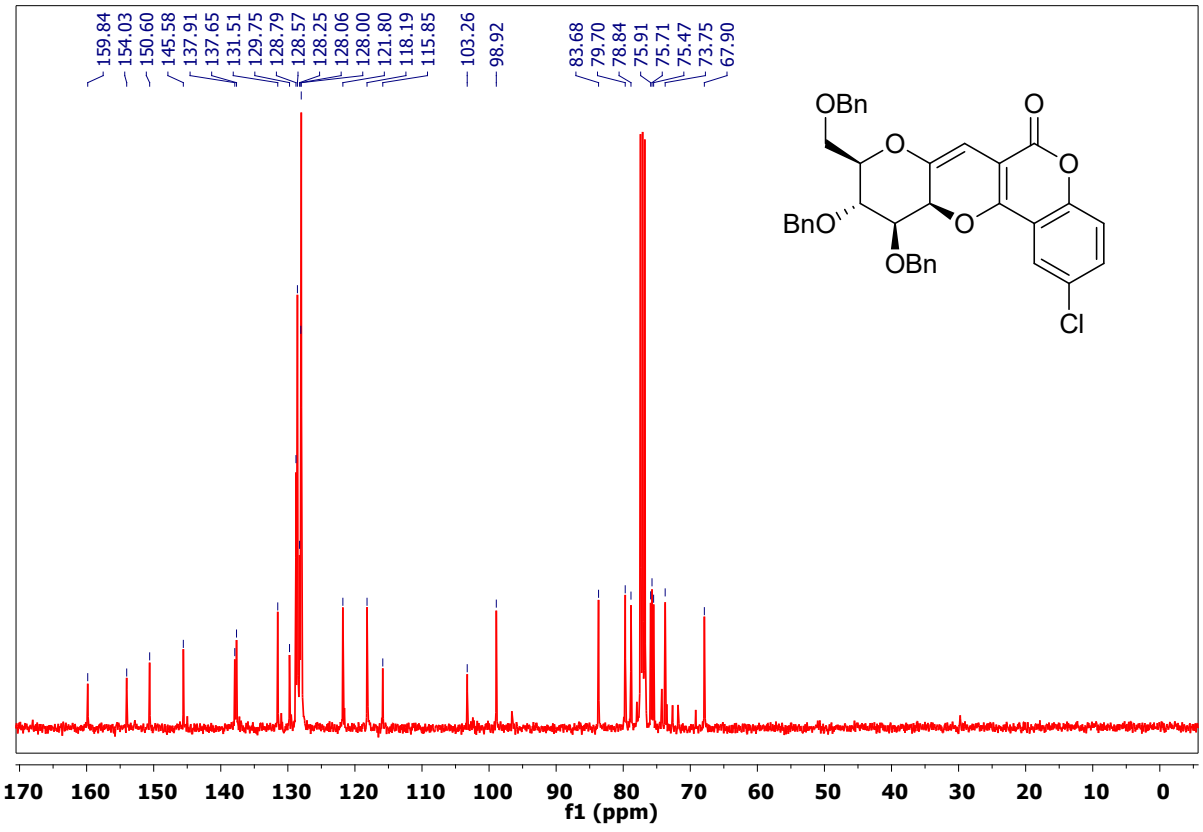


Figure 40: ^{13}C NMR spectrum of compound **5e** (100.6 MHz, $CDCl_3$)

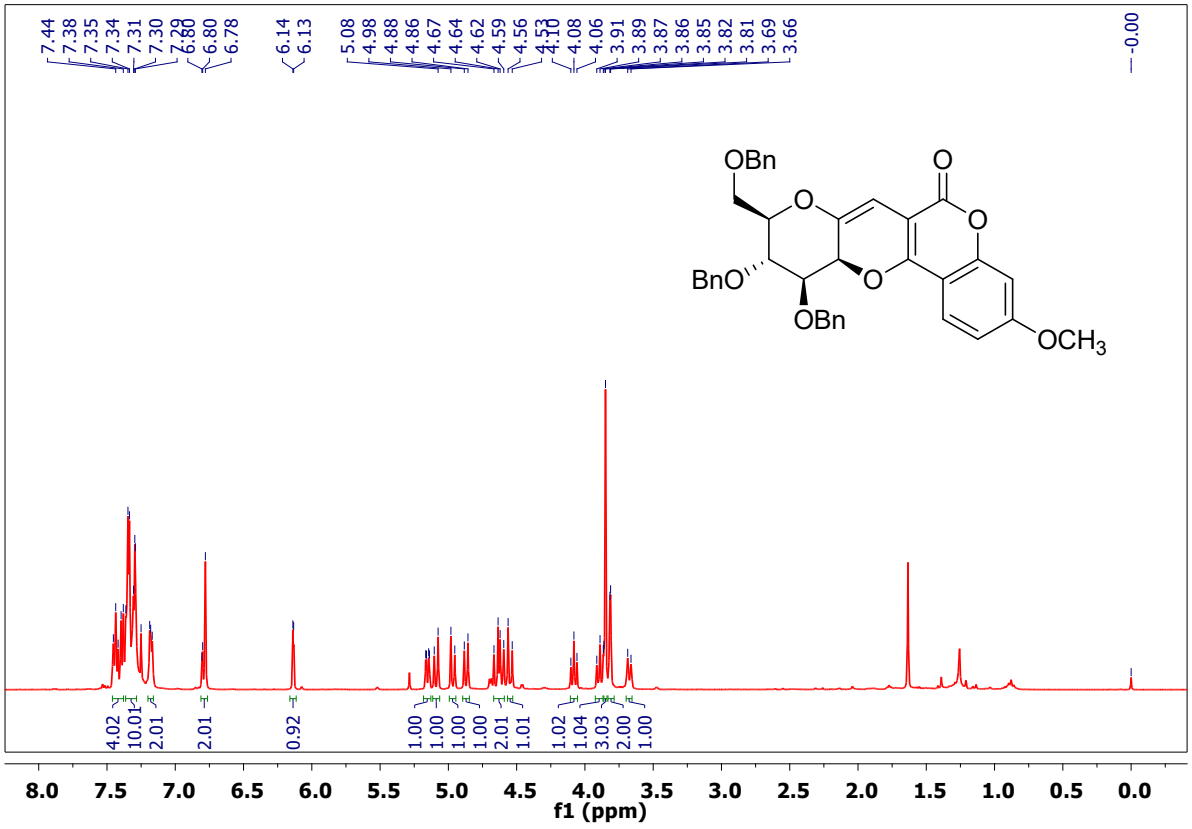


Figure 41: ^{1}H NMR spectrum of compound **5f** (400 MHz, $CDCl_3$)

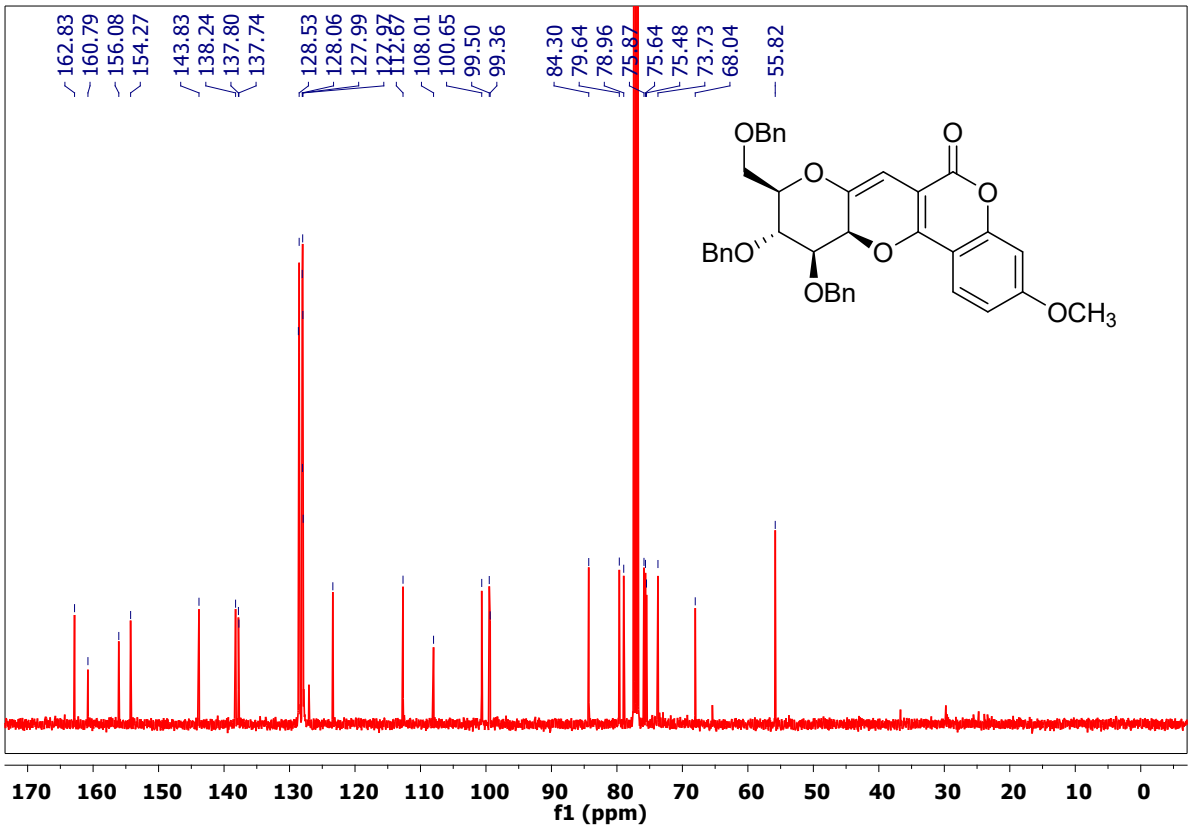


Figure 42: ^{13}C NMR spectrum of compound **5f** (100.6 MHz, $CDCl_3$)

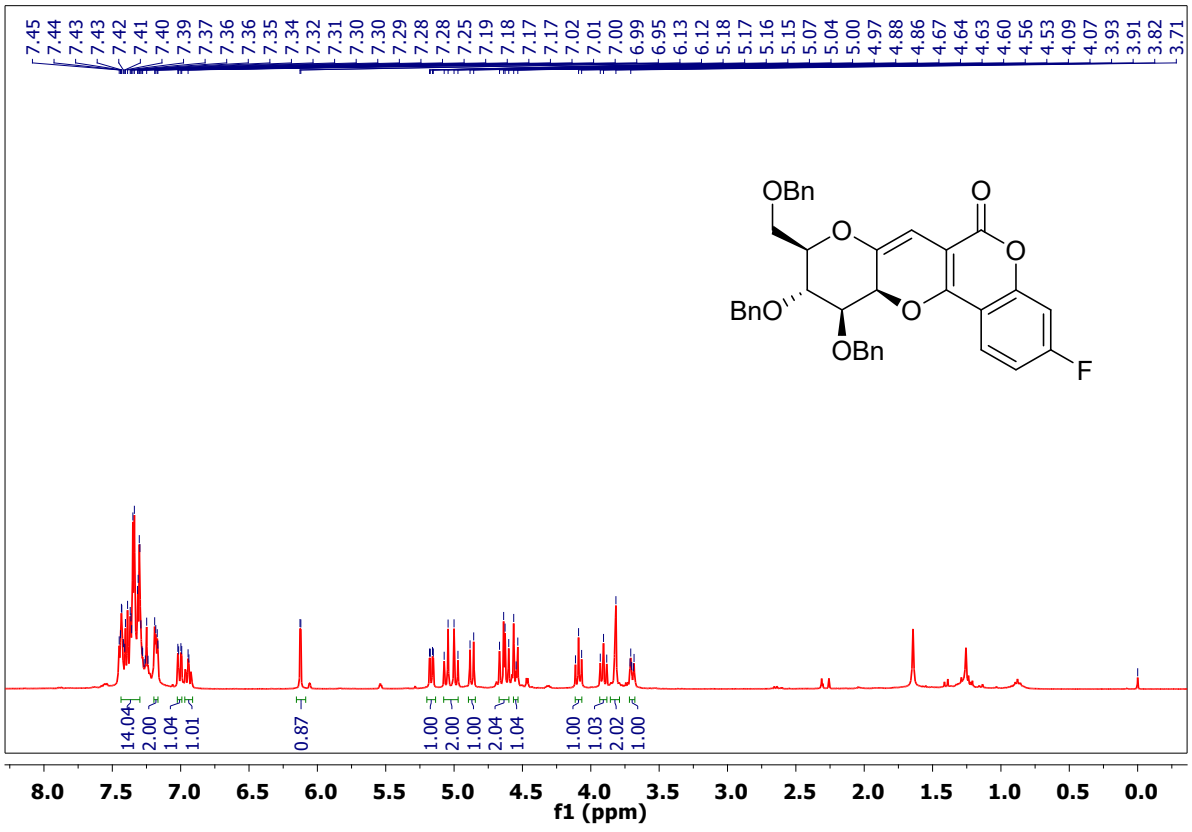


Figure 43: ^{1}H NMR spectrum of compound **5g** (400 MHz, $CDCl_3$)

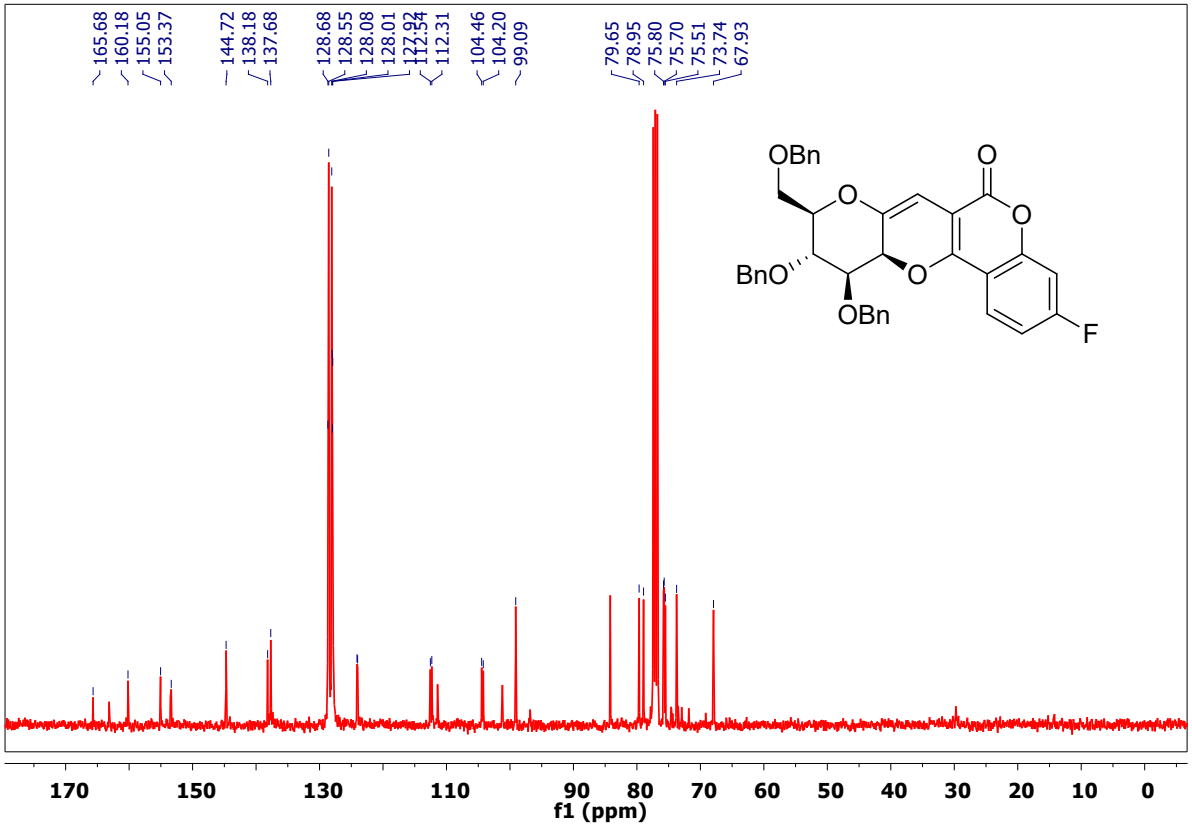


Figure 44: ^{13}C NMR spectrum of compound **5g** (100.6 MHz, $CDCl_3$)

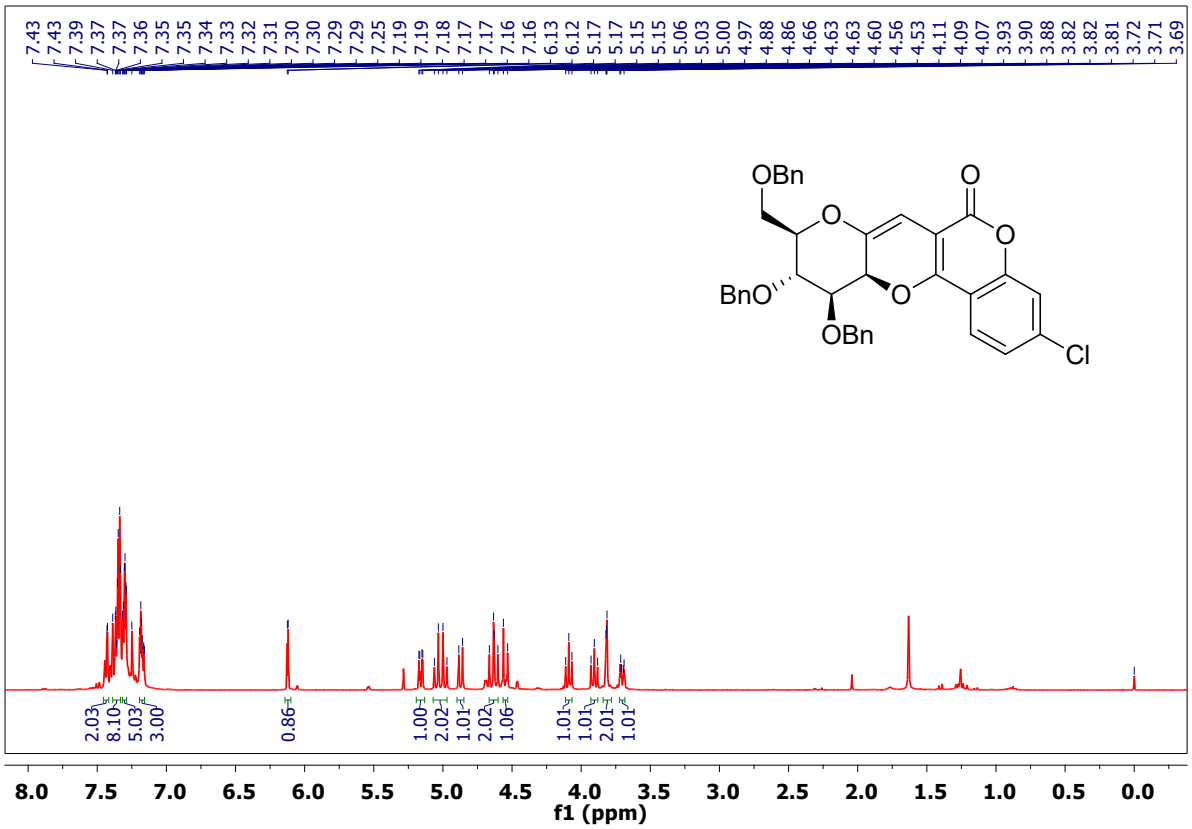


Figure 45: ^{1}H NMR spectrum of compound **5h** (400 MHz, $CDCl_3$)

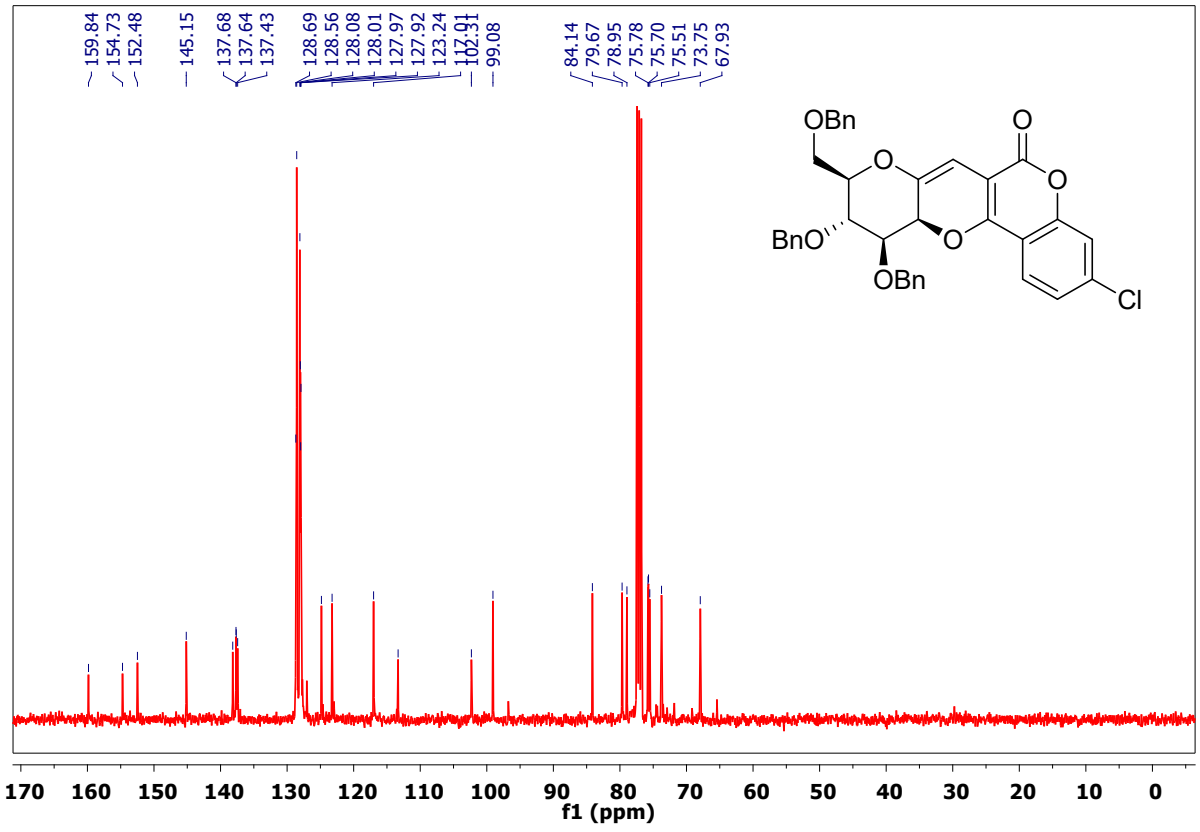


Figure 46: ^{13}C NMR spectrum of compound **5h** (100.6 MHz, $CDCl_3$)

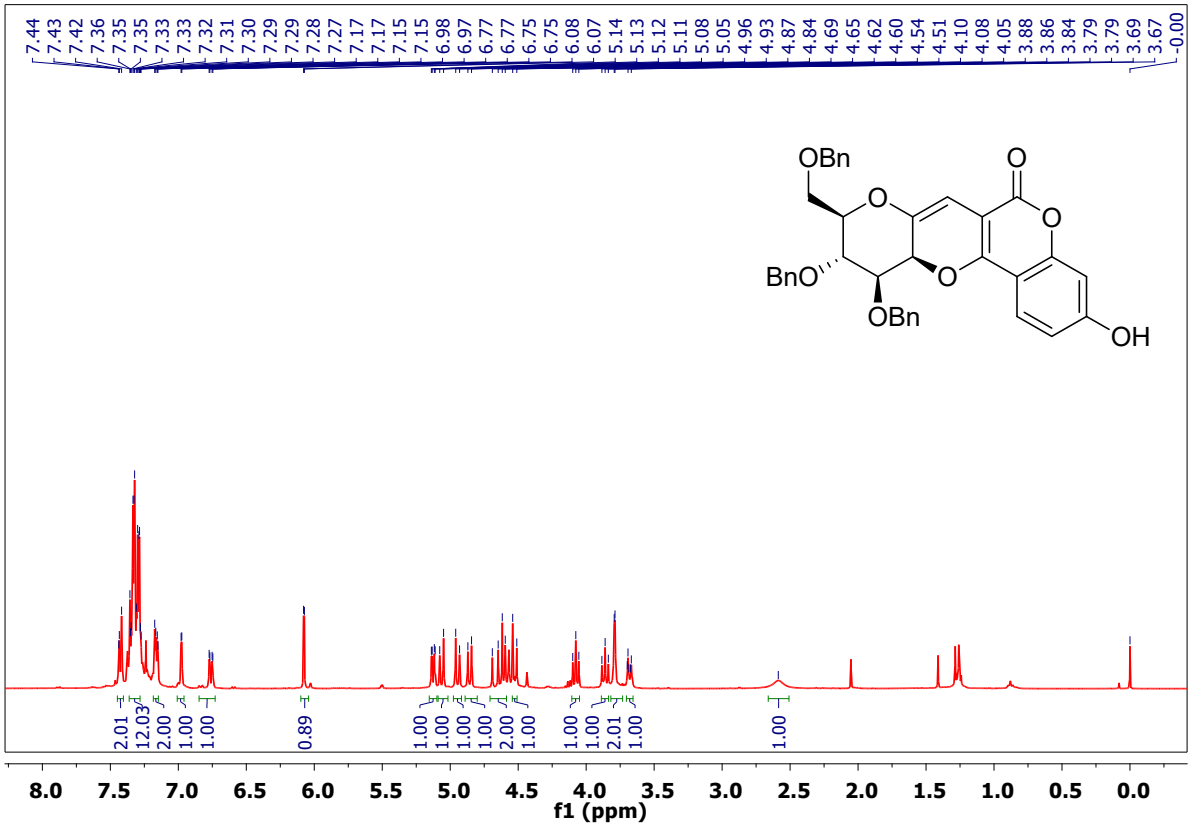


Figure 47: ^{1}H NMR spectrum of compound **5i** (400 MHz, $CDCl_3$)

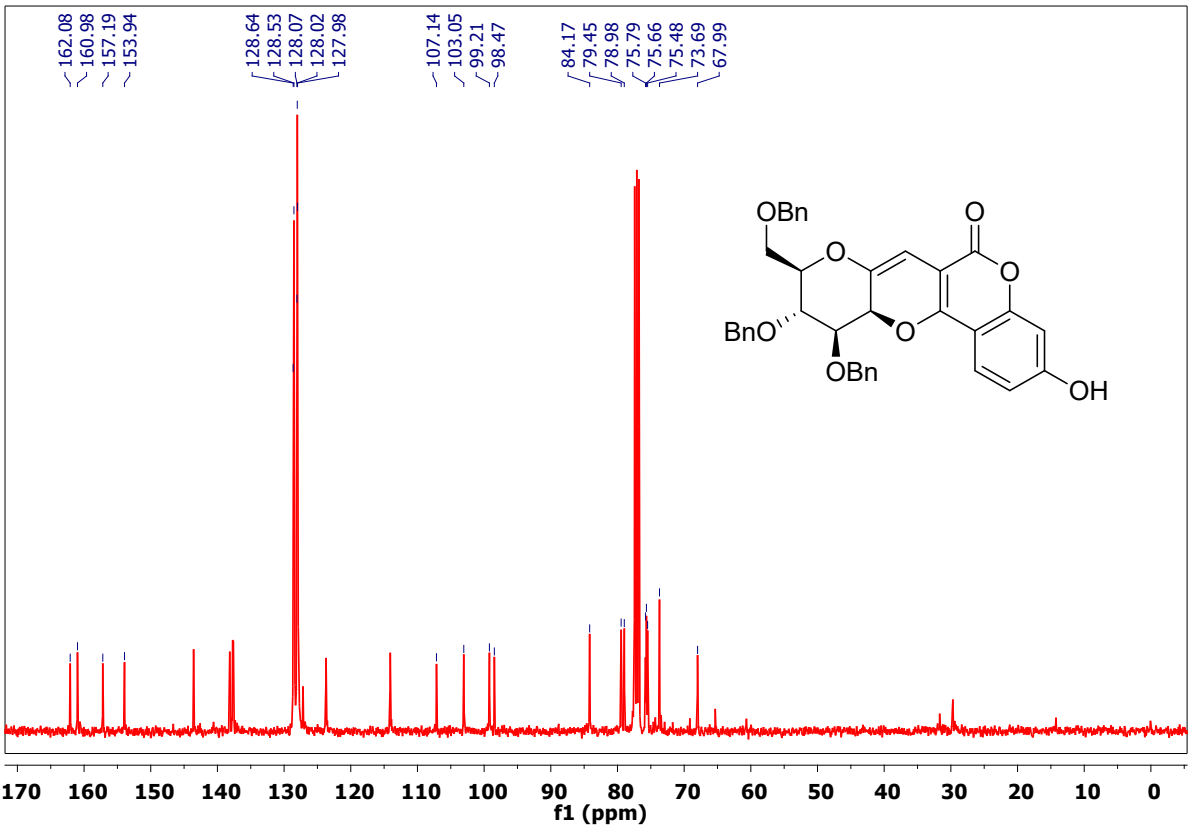


Figure 48: ^{13}C NMR spectrum of compound **5i** (100.6 MHz, $CDCl_3$)

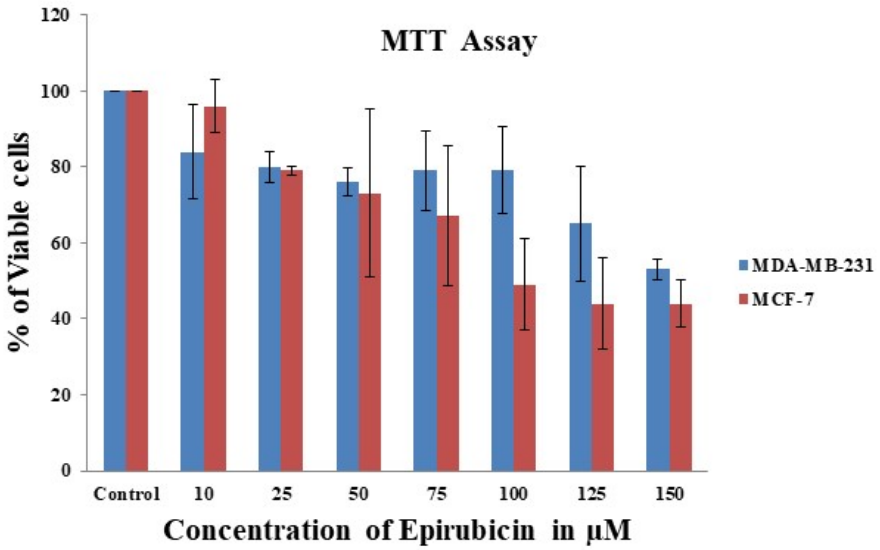


Figure 49. The MTT assay of Epirubicin at different concentration for MCF-7 and MDA-MB-231 cancer cells

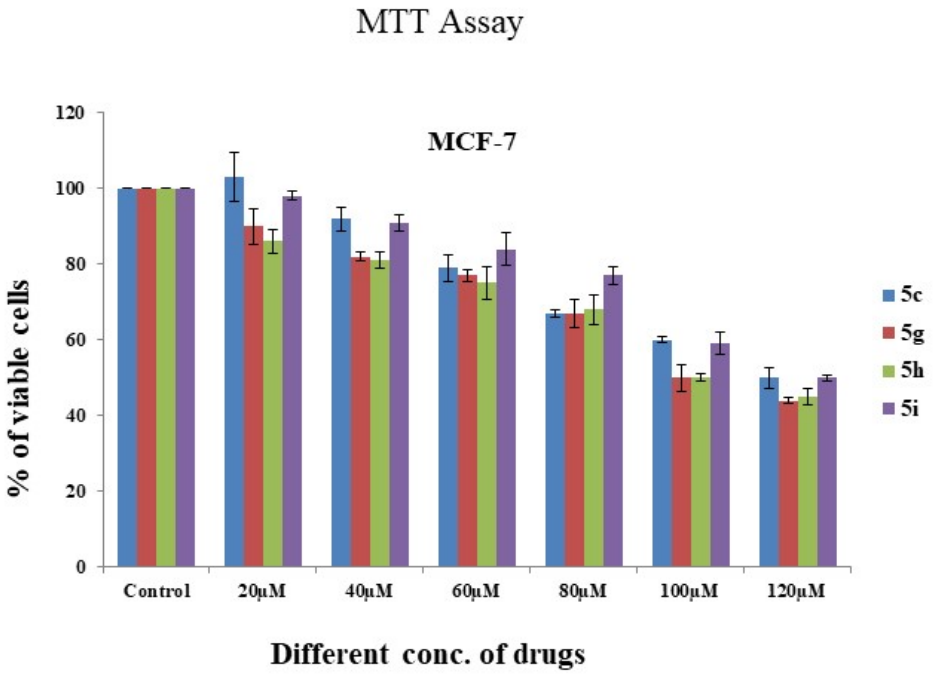
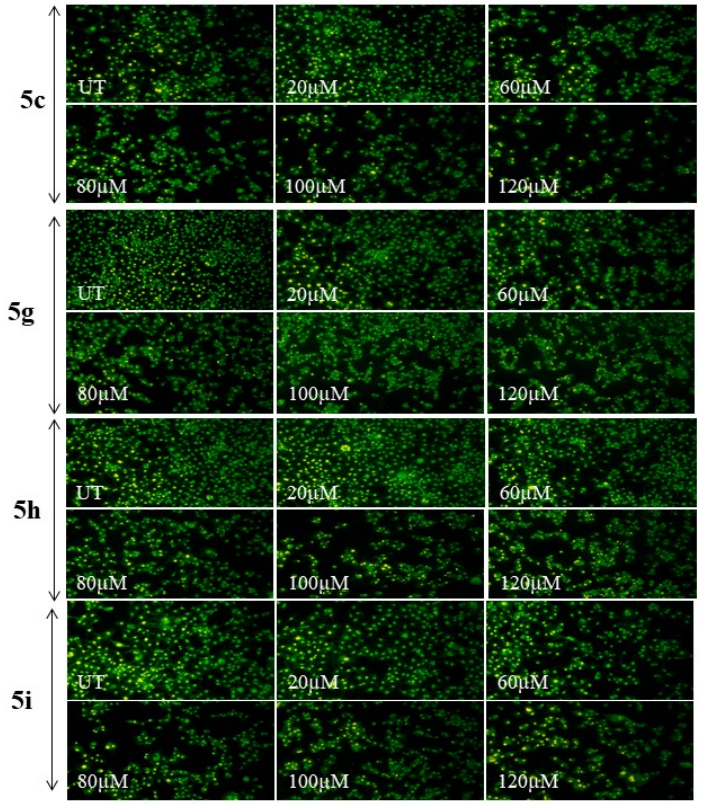


Figure 50. The MTT assay of compounds **5c**, **5g**, **5h** and **5i** at different concentration for MCF-7.



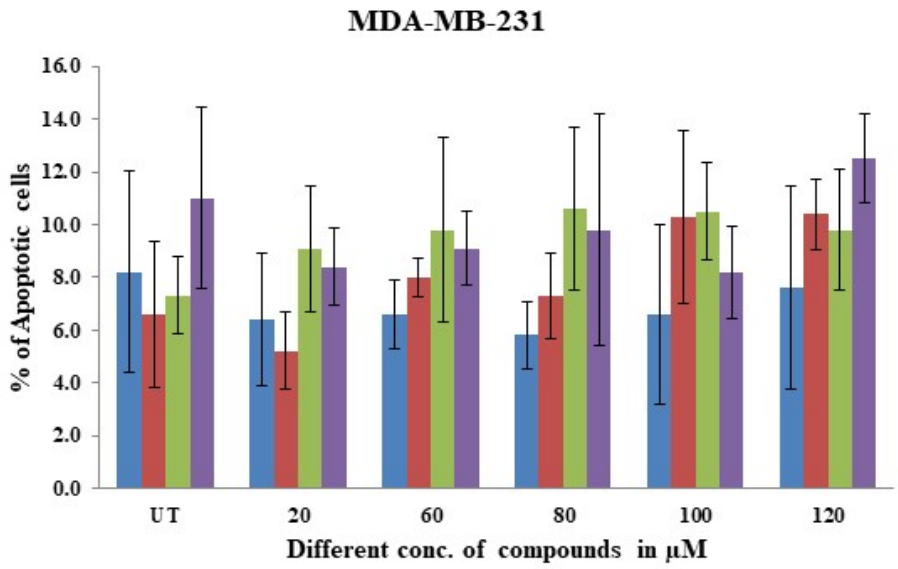


Figure 51. [A] Sugar fused pyrano[3,2-*c*]pyranones showing apoptotic changes: MDA-MB-231 cells treated with **5c**, **5g**, **5h** & **5i** compounds for 24 hours, cells stained with Acridine orange and Ethidium bromide staining, drug intake by cells indicate imitation of cell death were observed in inverted fluorescence microscope at 10X magnification. [B] Quantification of apoptotic cell no. calculated by using image J software and histogram was plotted as % of apoptotic cell vs compound concentration.

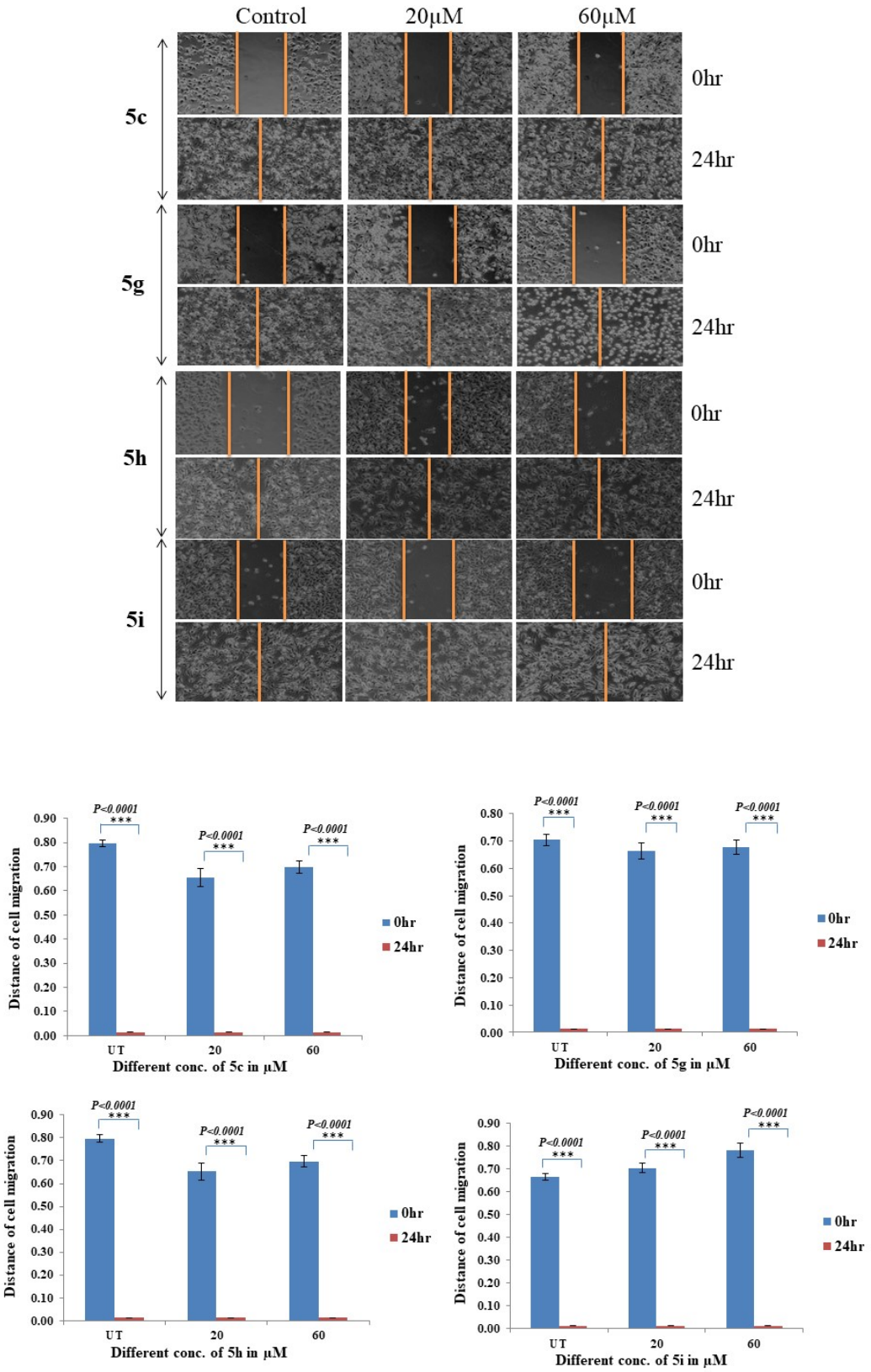


Figure 52. Compounds 5c, 5g, 5h and 5i regulation towards MDA-MB-231 breast cancer cell migration. [A] The cell migration was analysed by wound healing assay. Confluent monolayer of MDA-MB-231 cells was scratched using pipette tip and the cells were incubated with indicated concentrations of these compounds. Images were taken at 0 and 24 hours. In untreated

control gap was filled after 24 hours, whereas compounds **5c**, **5g**, **5h** and **5i** treated cells, migration was inhibited and gap is still remain. [B]The images are representative of three assays. Bar graph (down) represents not a significant cell migration inhibition by these compounds at 20 and 60 μM as compared to untreated control.