

Convenient Synthesis of Functionalized Cyclopropa[c]coumarin-1a-carboxylates

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¹ Department of Chemistry, M. V. Lomonosov Moscow State University, Leninskie gory 1-3, Moscow 119991, Russian Federation

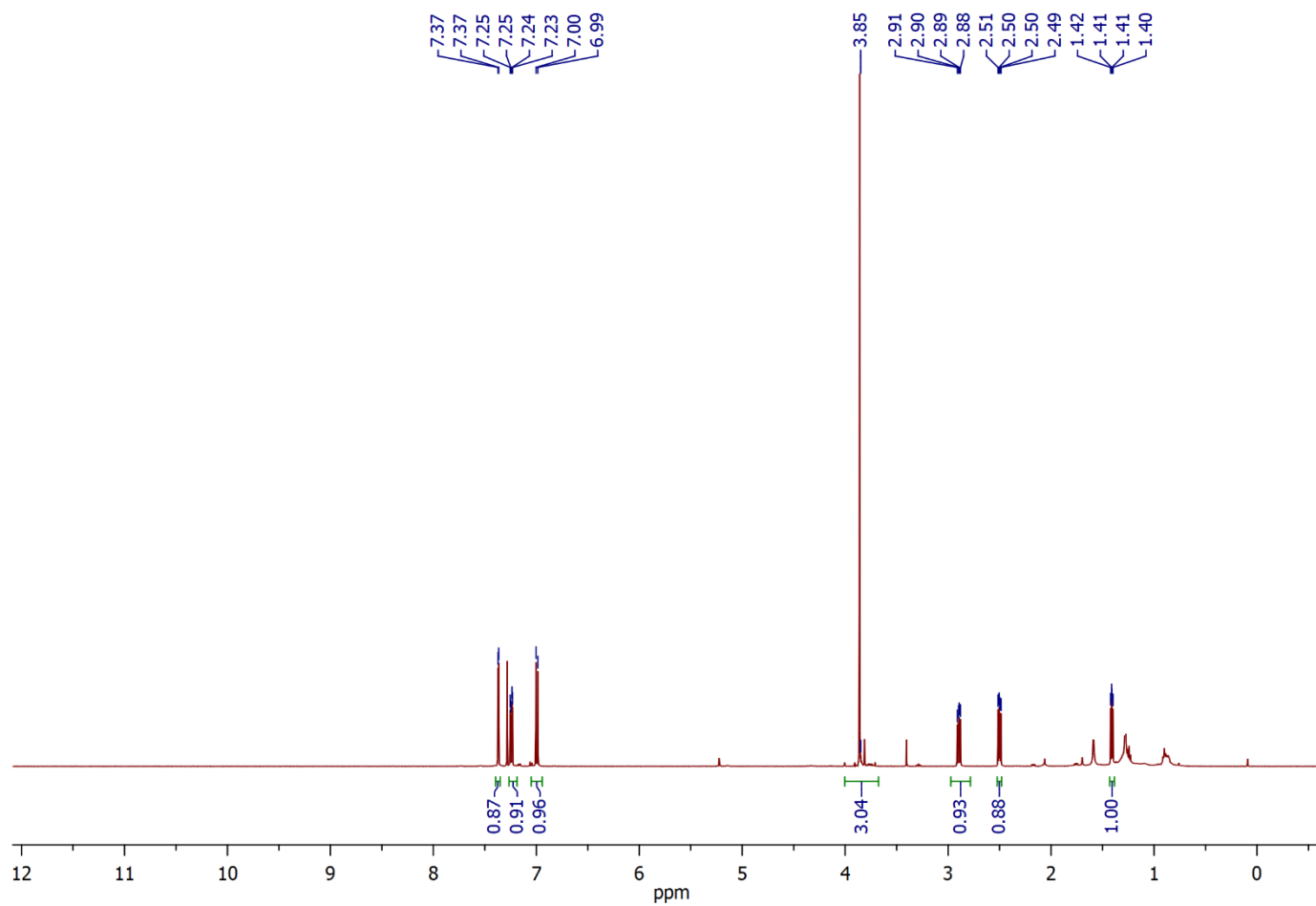
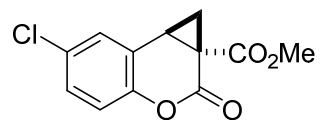
² N. M. Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, Kosygina 4, Moscow 119334, Russian Federation

³ Laboratory of Chemical Synthesis, Dmitry Rogachev National Research Center of Pediatric Hematology, Oncology and Immunology, Samory Mashela 1, Moscow 117997, Russian Federation

⁴ Faculty of Science, RUDN University, Miklukho-Maklaya 6, Moscow 117198, Russian Federation

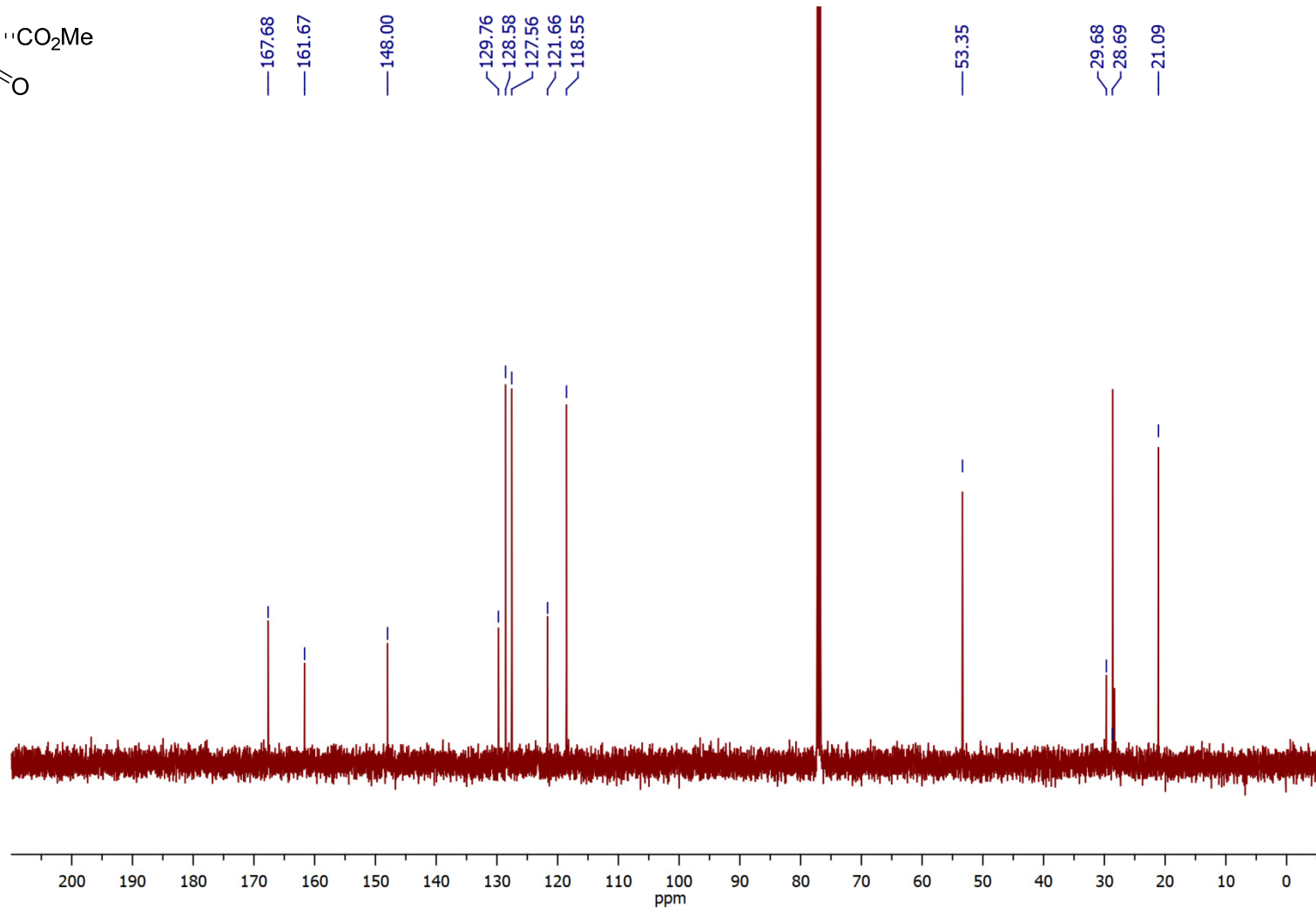
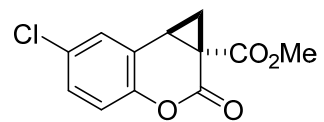
Methyl (1a*RS*,7b*RS*)-6-chloro-2-oxo-1,7b-dihydrocyclopropa[*c*]chromene-1a(2*H*)-carboxylate (2b)

¹H NMR (CDCl₃, 500 MHz)



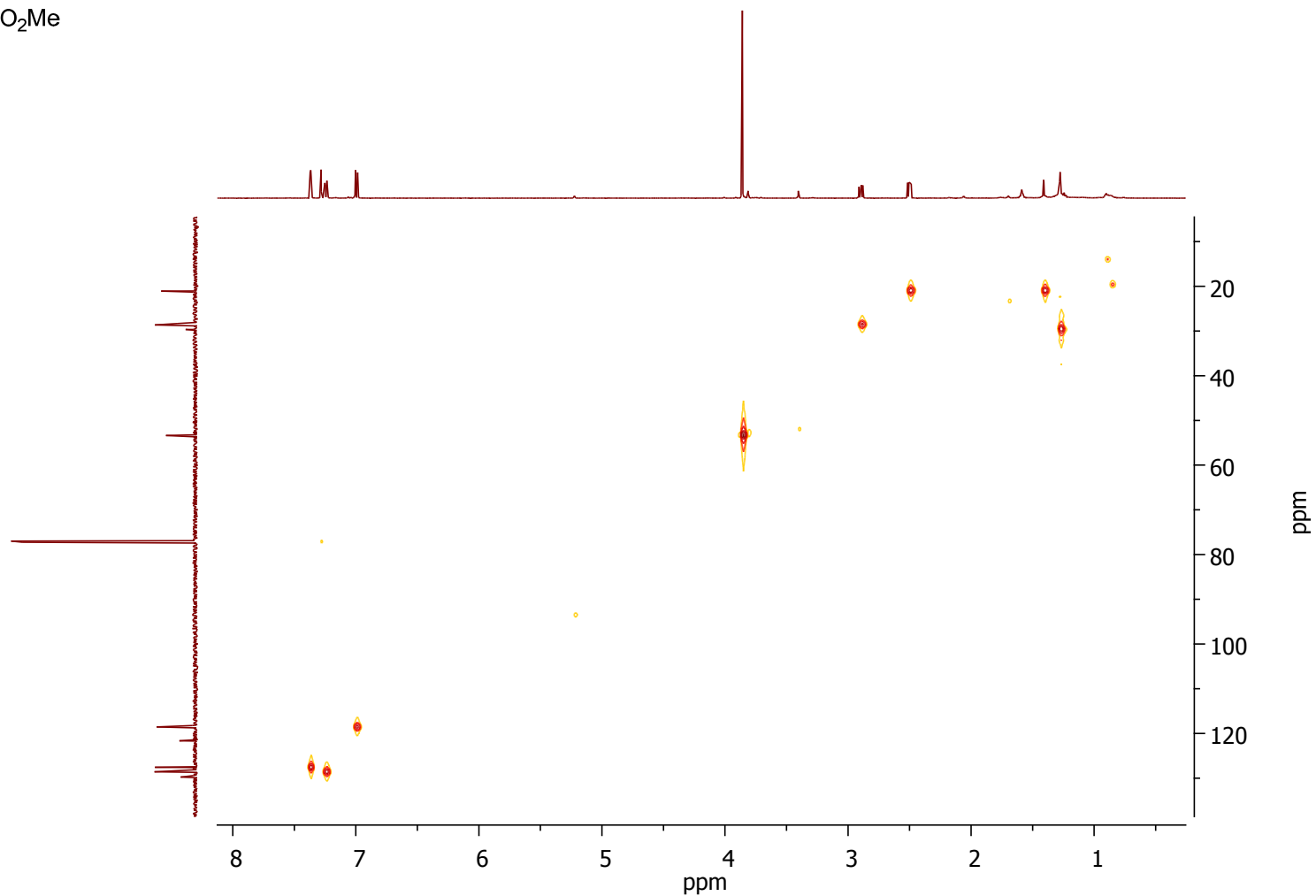
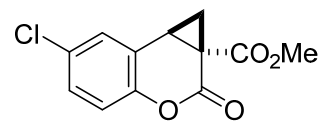
Methyl (1a*RS*,7b*RS*)-6-chloro-2-oxo-1,7b-dihydrocyclopropa[*c*]chromene-1a(2*H*)-carboxylate (2b)

^{13}C NMR (CDCl_3 , 125 MHz)



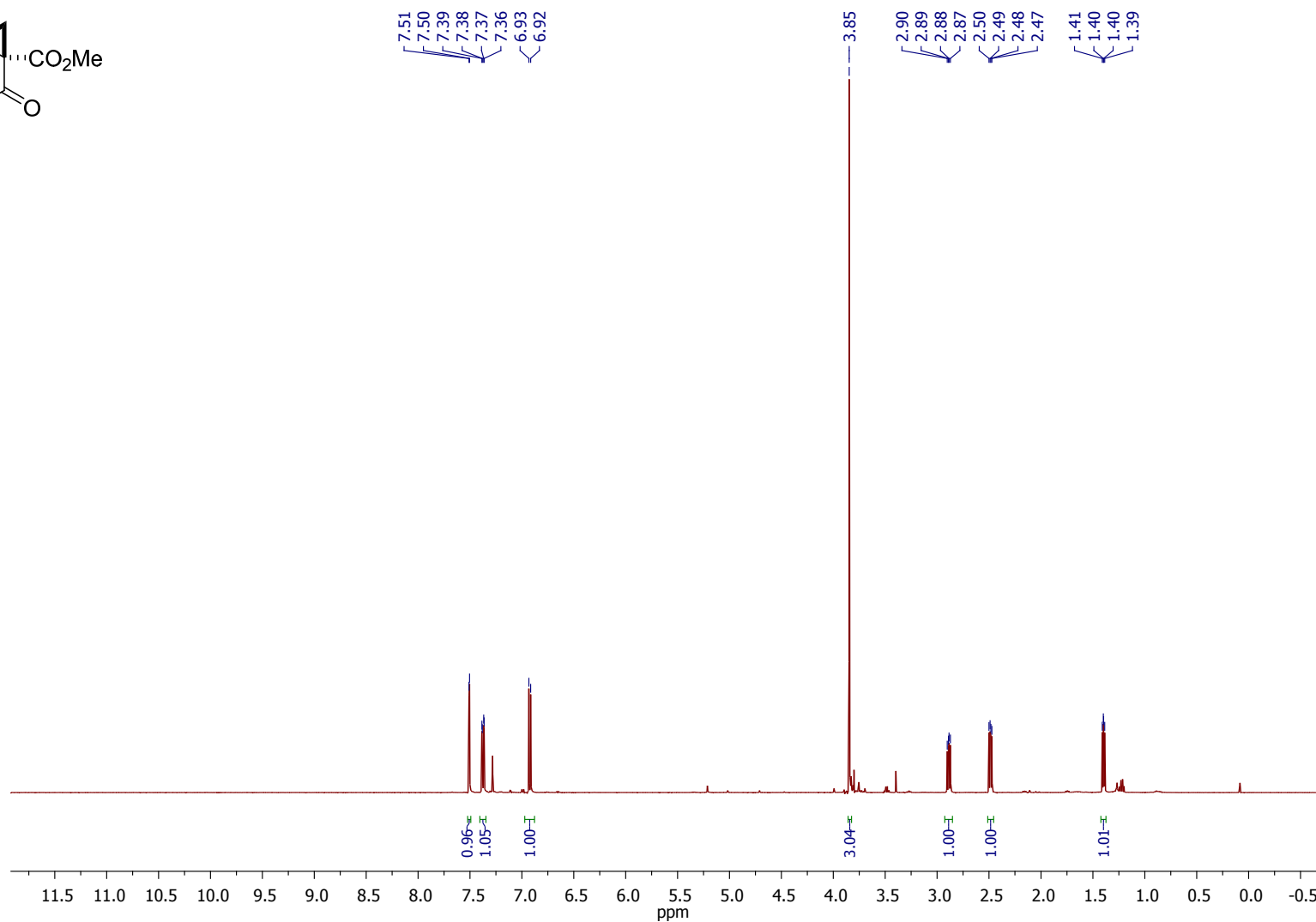
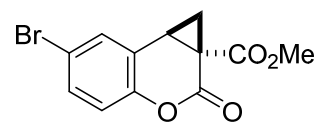
Methyl (1a*RS*,7b*RS*)-6-chloro-2-oxo-1,7b-dihydrocyclopropa[*c*]chromene-1a(2*H*)-carboxylate (2b)

HSQC ^1H - ^{13}C (CDCl_3)



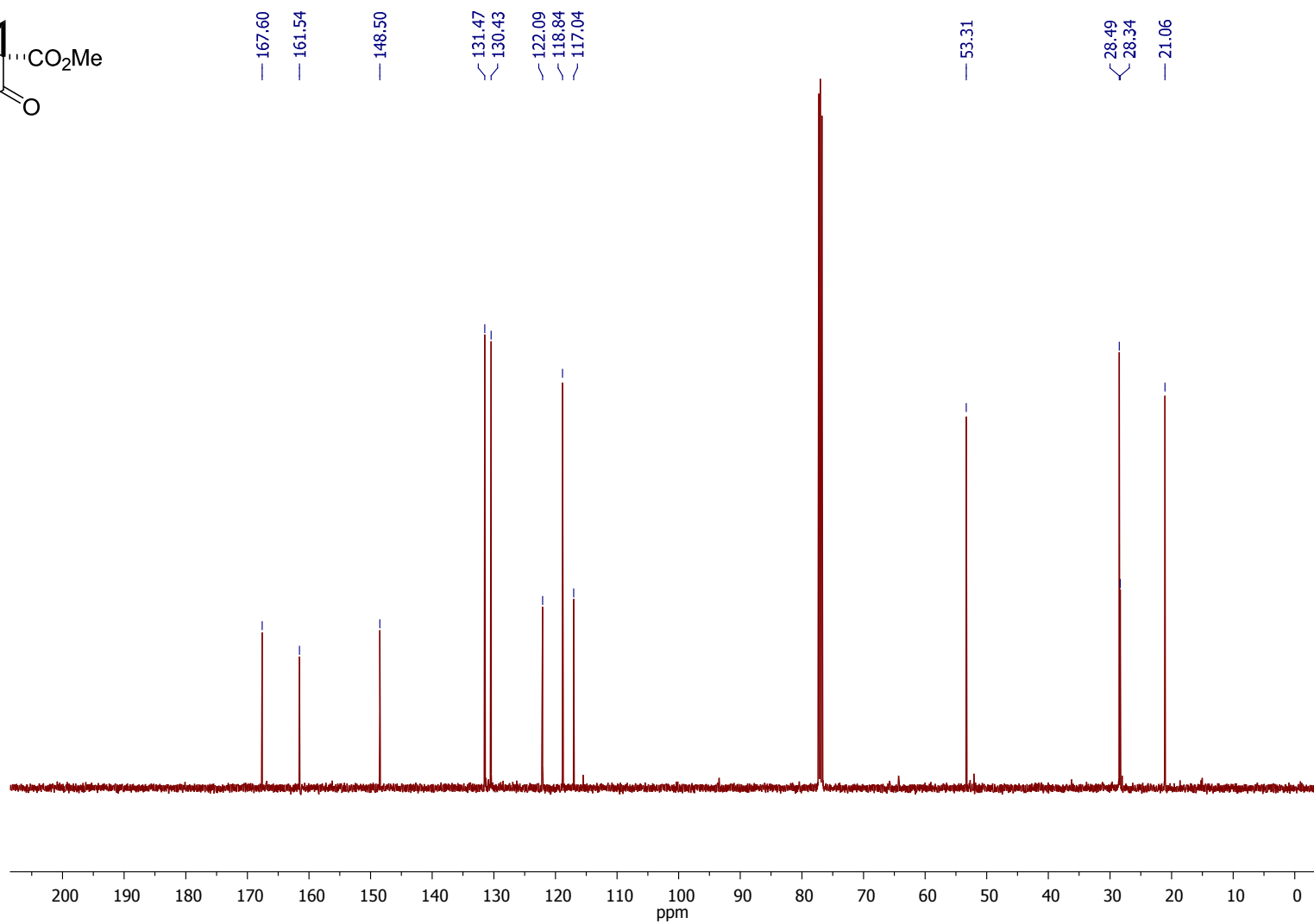
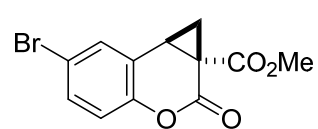
Methyl (1a*RS*,7b*RS*)-6-bromo-2-oxo-1,7b-dihydrocyclopropa[*c*]chromene-1a(2*H*)-carboxylate (2c)

¹H NMR (CDCl₃, 500 MHz)



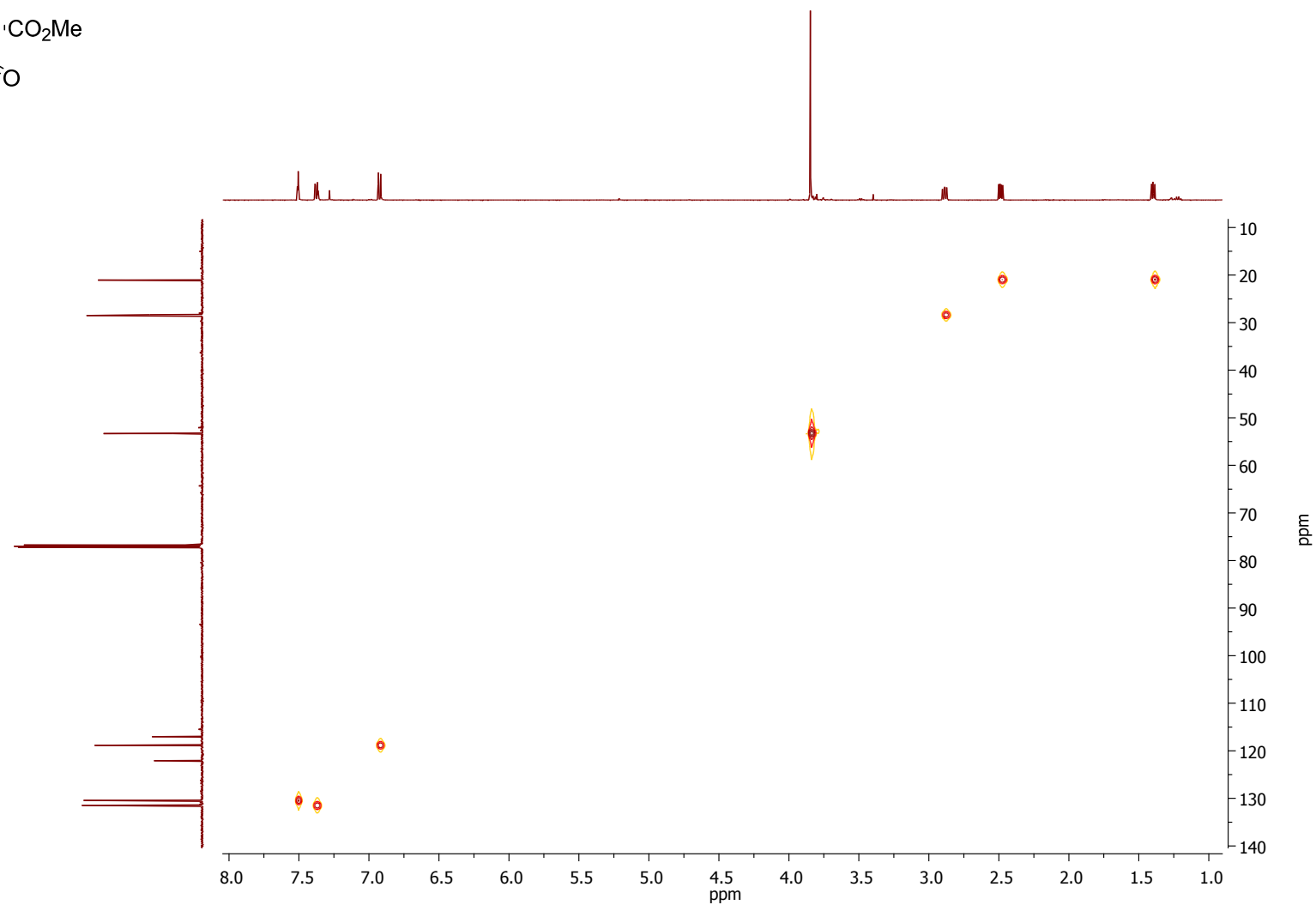
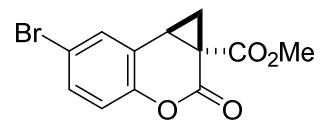
Methyl (1a*RS*,7b*RS*)-6-bromo-2-oxo-1,7b-dihydrocyclopropa[*c*]chromene-1a(2*H*)-carboxylate (2c)

^{13}C NMR (CDCl_3 , 125 MHz)

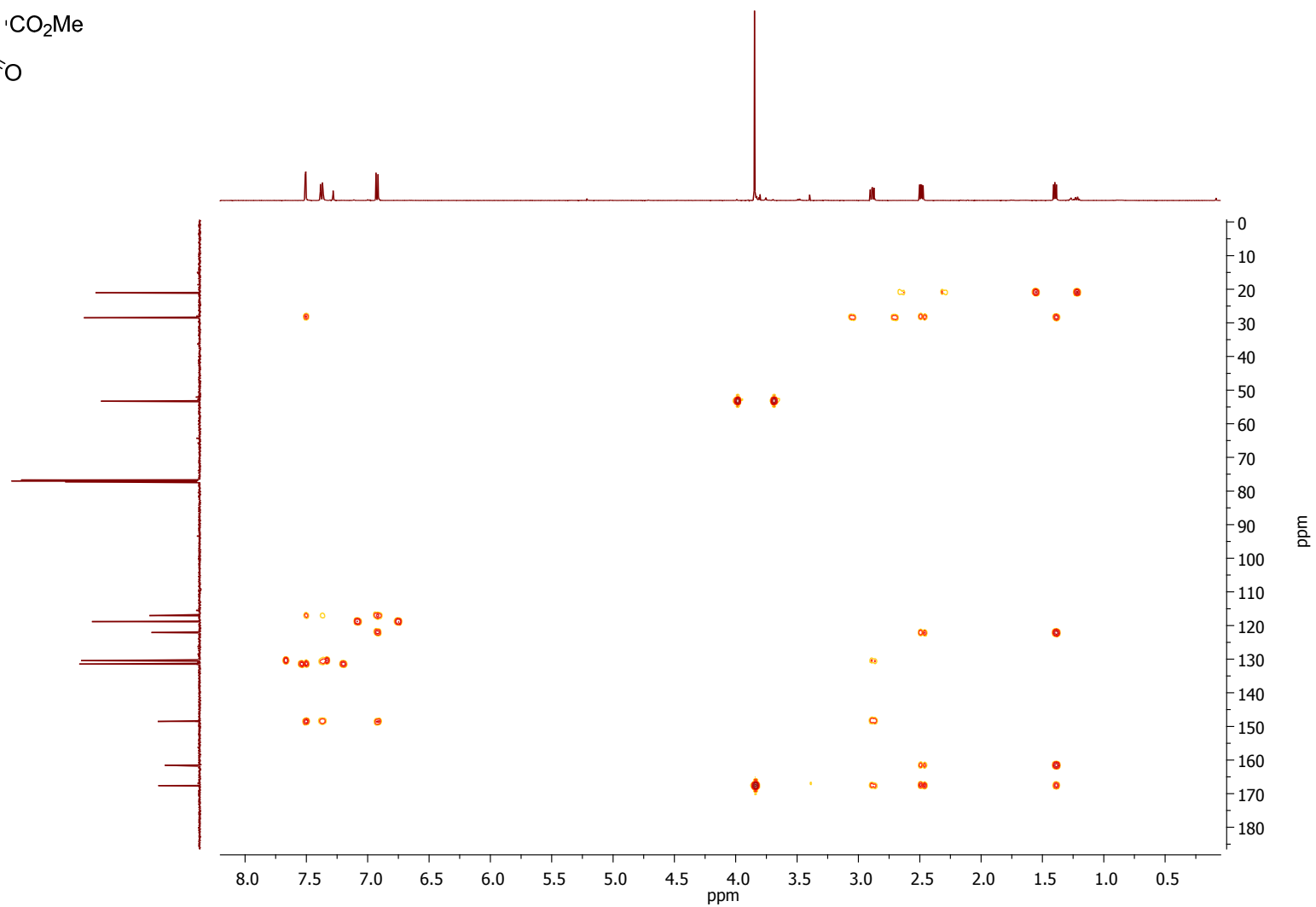
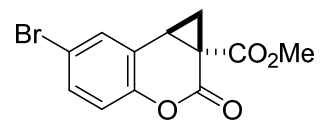


Methyl (1a*RS*,7b*RS*)-6-bromo-2-oxo-1,7b-dihydrocyclopropa[*c*]chromene-1a(2*H*)-carboxylate (2c)

HSQC ^1H - ^{13}C (CDCl_3)

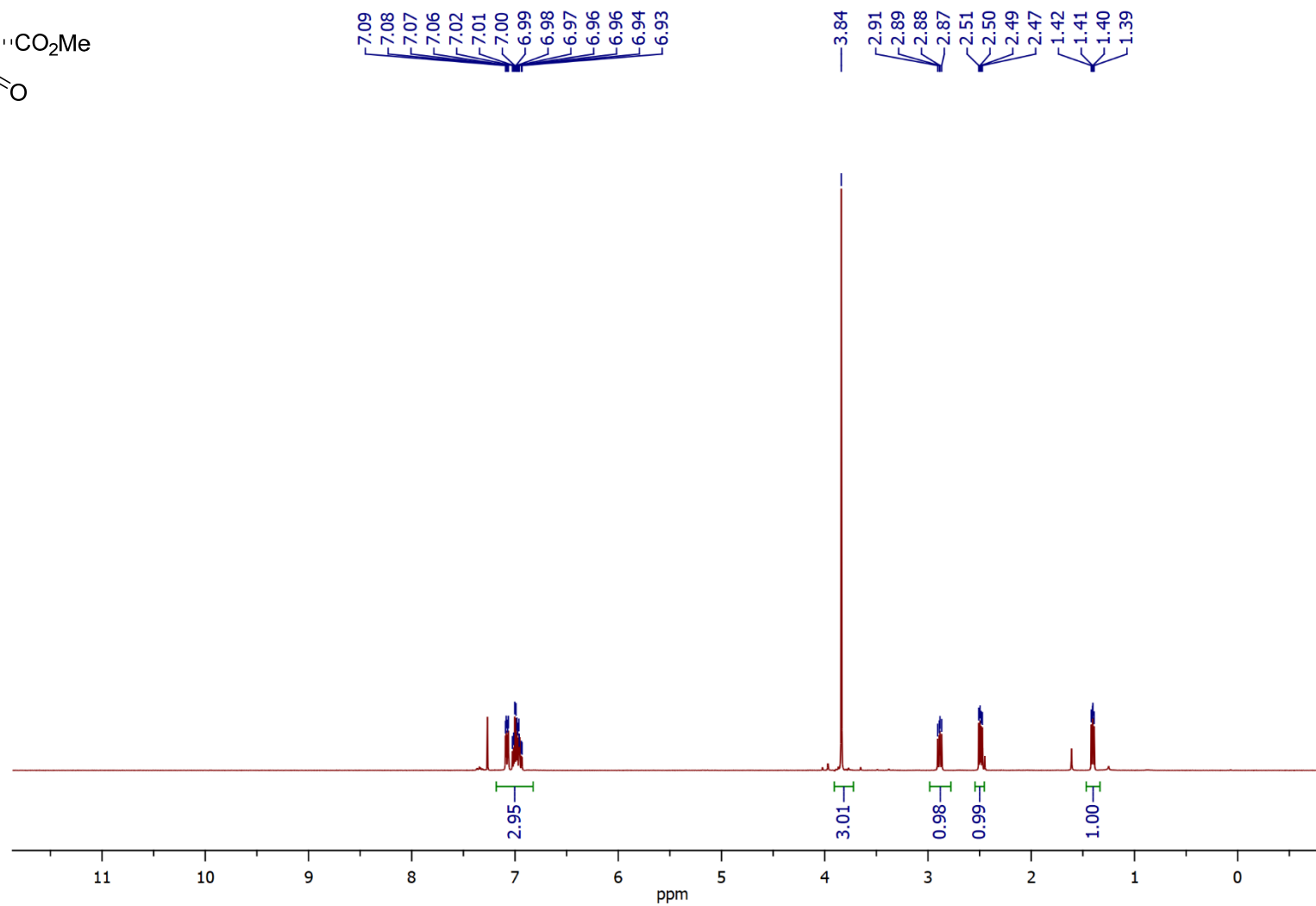
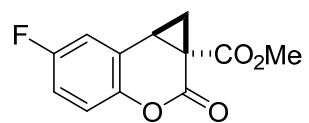


Methyl 6-bromo-2-oxo-1,7b-dihydrocyclopropa[*c*]chromene-1a(2*H*)-carboxylate (2c)

HMBC ^1H - ^{13}C (CDCl_3)

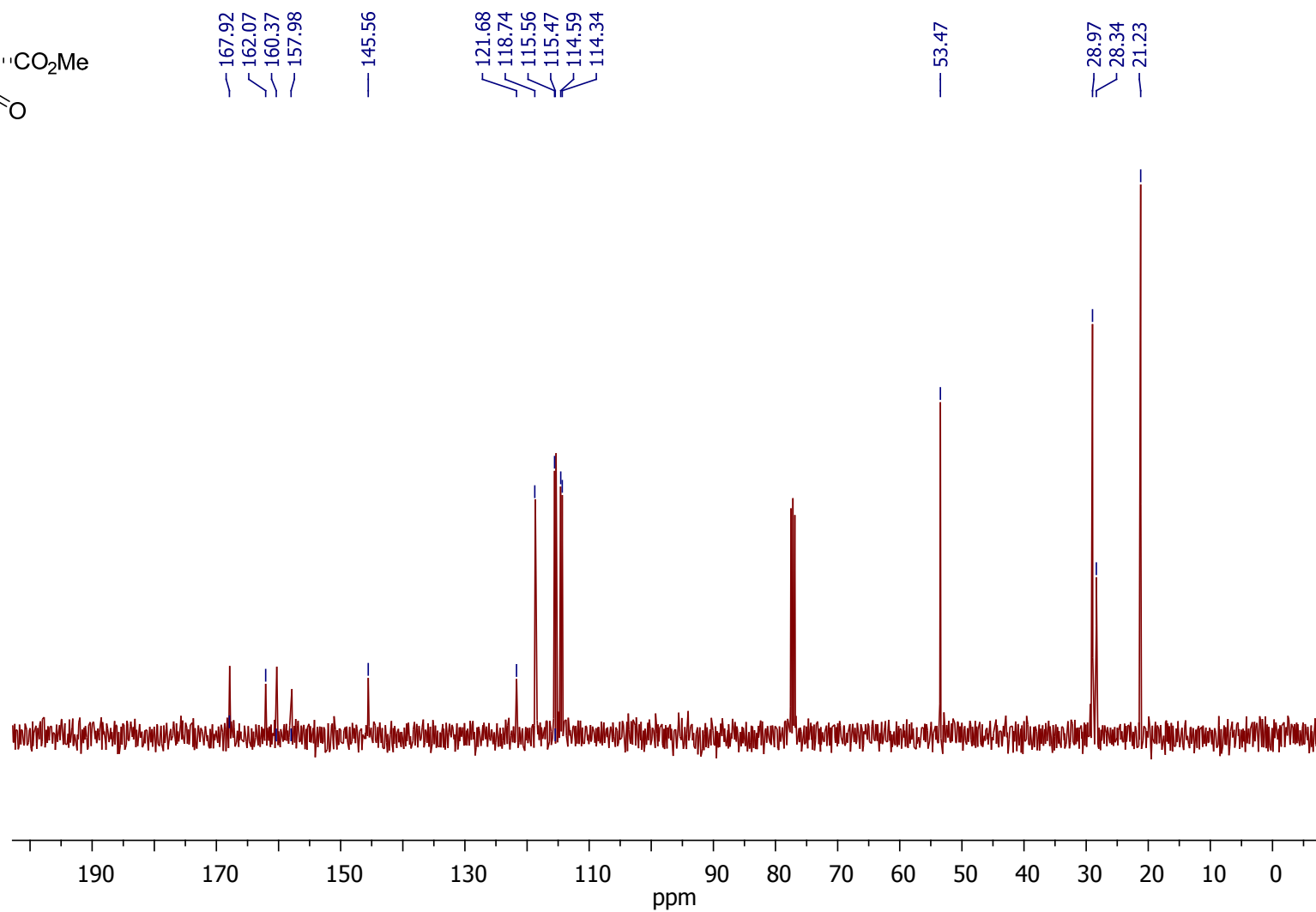
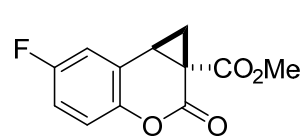
Methyl (1a*RS*,7b*RS*)-6-fluoro-2-oxo-1,7b-dihydrocyclopropa[*c*]chromene-1a(2*H*)-carboxylate (2d)

¹H NMR (CDCl₃, 400 MHz)



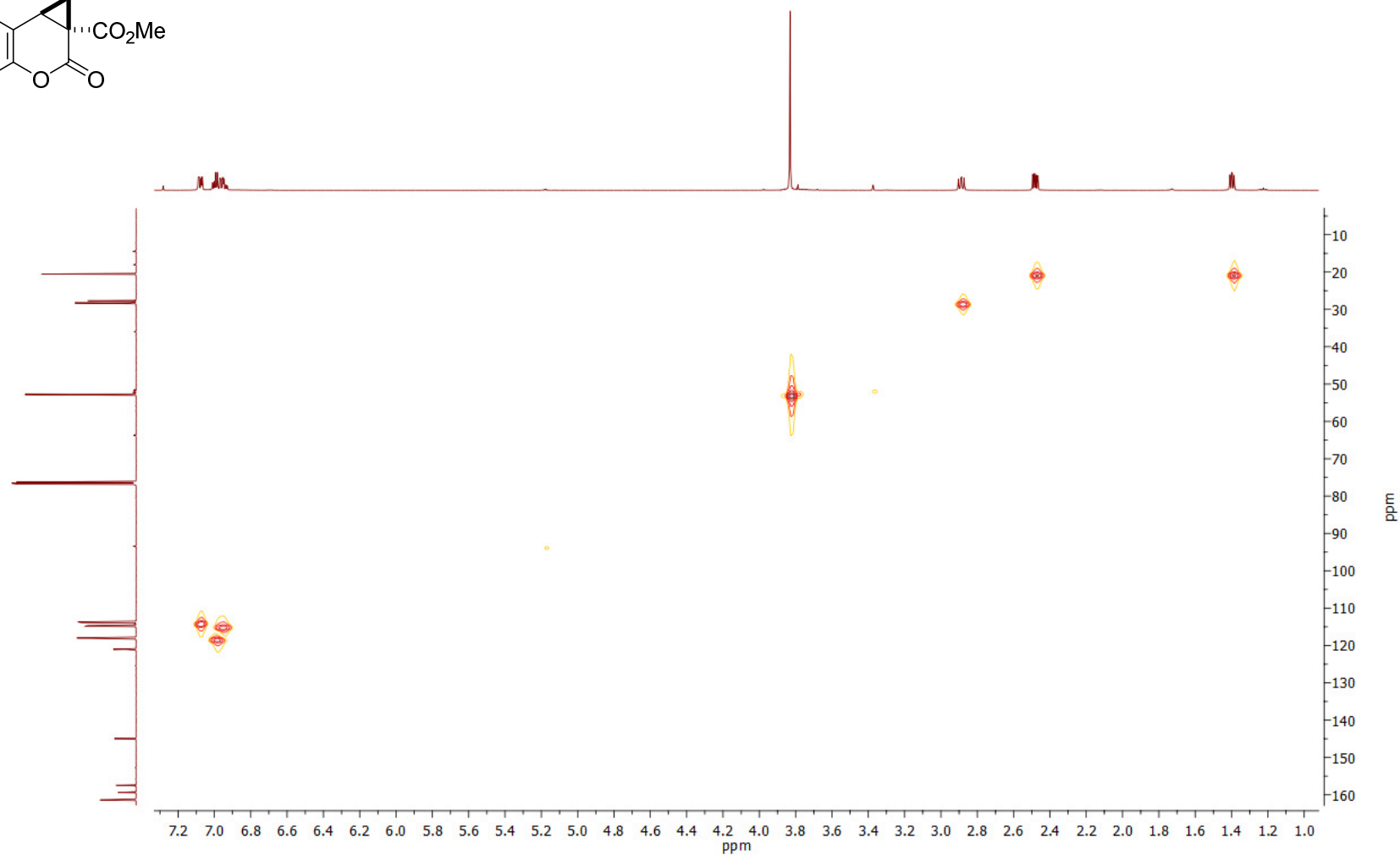
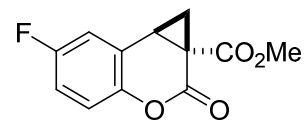
Methyl (1a*RS*,7b*RS*)-6-fluoro-2-oxo-1,7b-dihydrocyclopropa[*c*]chromene-1a(2*H*)-carboxylate (2d)

^{13}C NMR (CDCl_3 , 100 MHz)



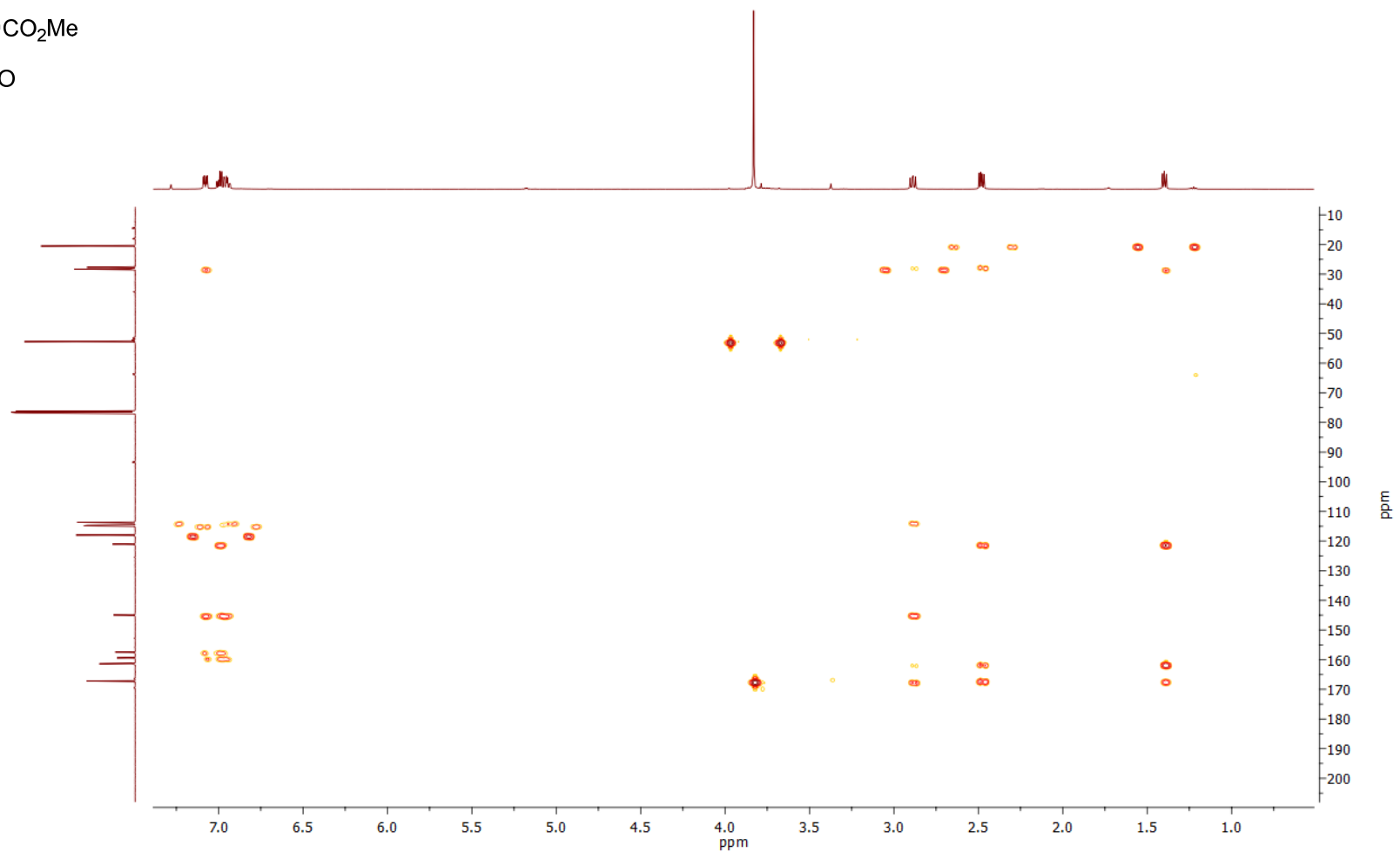
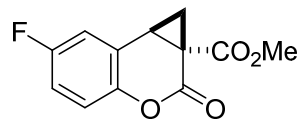
Methyl (1a*RS*,7b*RS*)-6-fluoro-2-oxo-1,7b-dihydrocyclopropa[*c*]chromene-1a(2*H*)-carboxylate (2d)

HSQC ^1H - ^{13}C (CDCl_3)



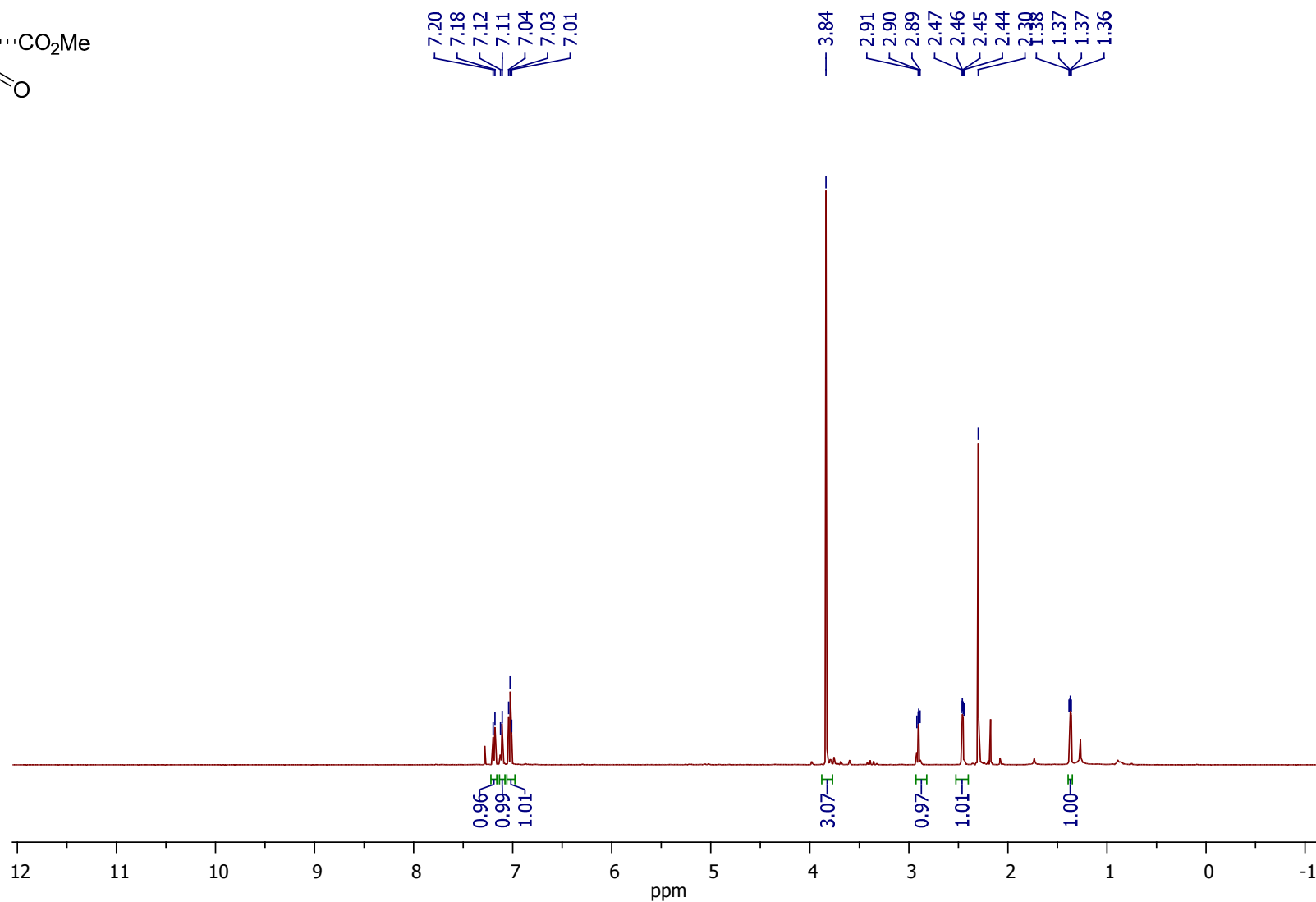
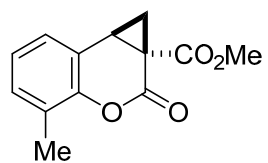
Methyl (1a*RS*,7b*RS*)-6-fluoro-2-oxo-1,7b-dihydrocyclopropa[c]chromene-1a(2*H*)-carboxylate (2d)

HMBC ^1H - ^{13}C (CDCl_3)



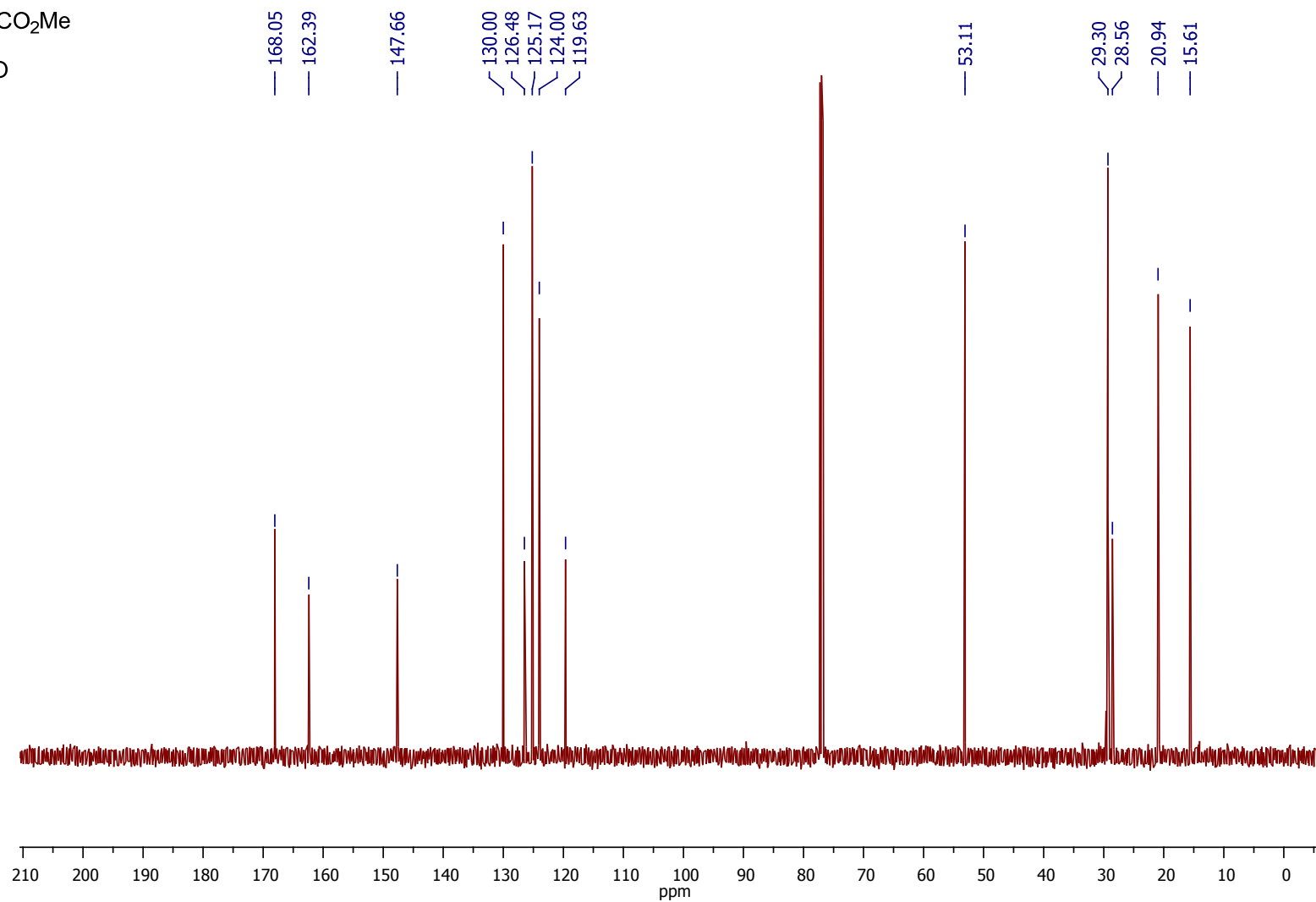
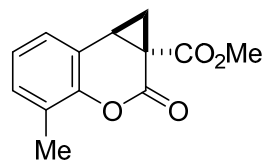
Methyl (1a*RS*,7b*RS*)-6-bromo-2-oxo-1,7b-dihydrocyclopropa[*c*]chromene-1a(2*H*)-carboxylate (2e)

¹H NMR (CDCl₃, 500 MHz)



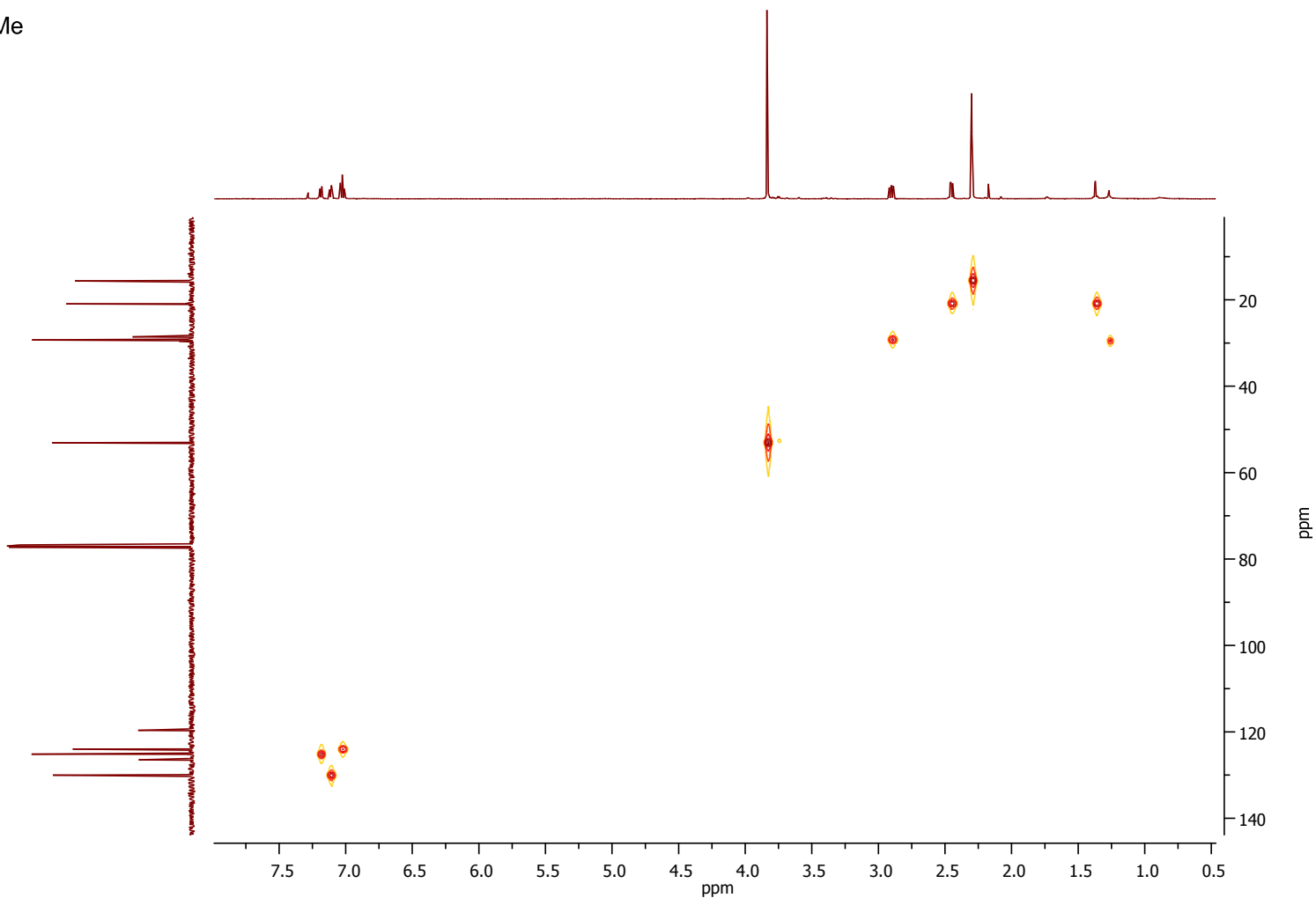
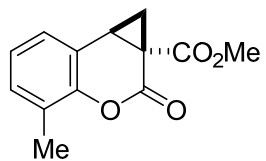
Methyl (1a*RS*,7b*RS*)-6-bromo-2-oxo-1,7b-dihydrocyclopropa[*c*]chromene-1a(2*H*)-carboxylate (2e)

^{13}C NMR (CDCl_3 , 125 MHz)



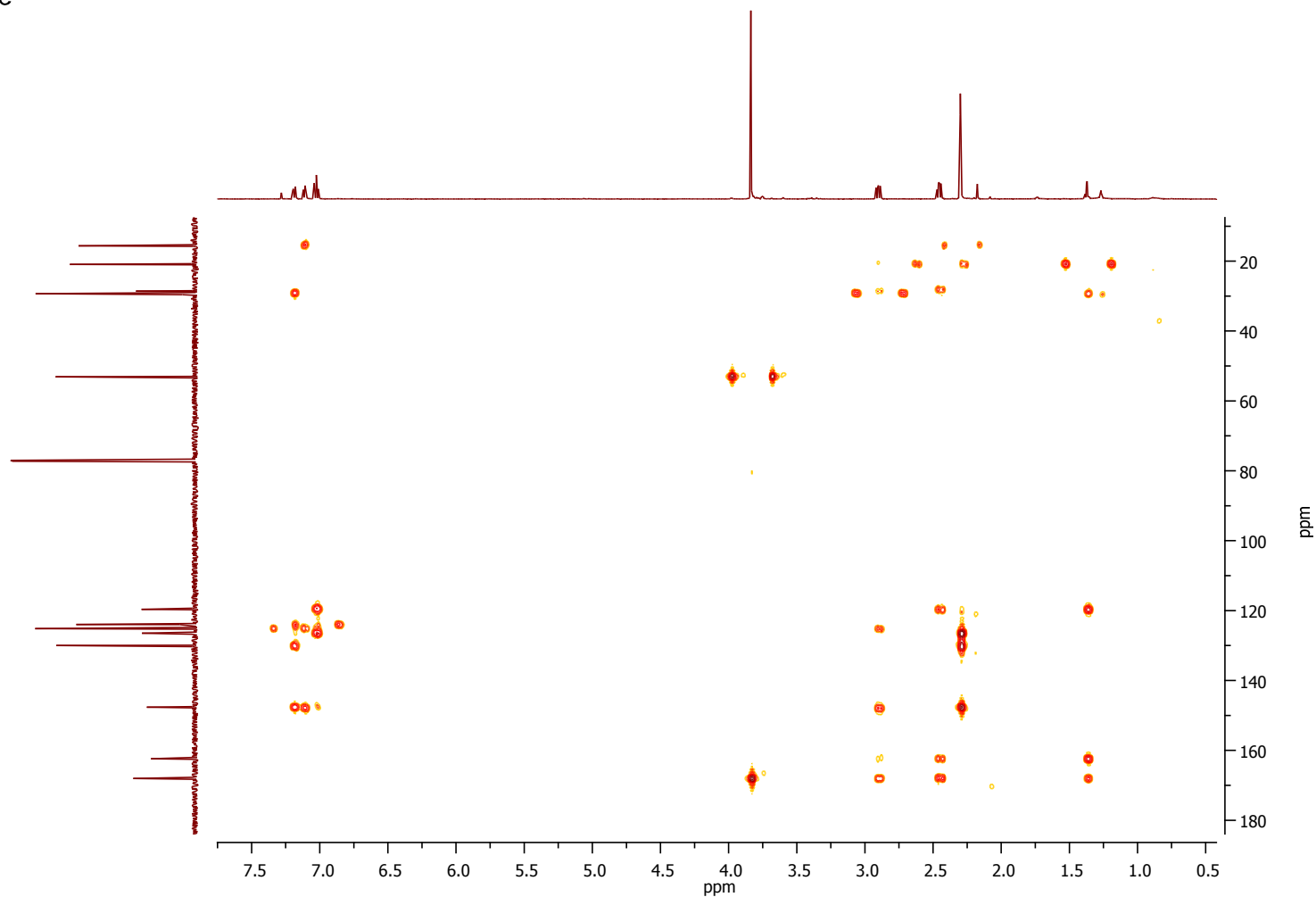
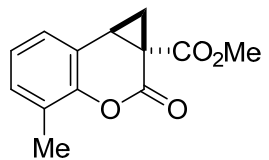
Methyl (1a*RS*,7b*RS*)-6-bromo-2-oxo-1,7b-dihydrocyclopropa[*c*]chromene-1a(2*H*)-carboxylate (2e)

HSQC ^1H - ^{13}C (CDCl_3)



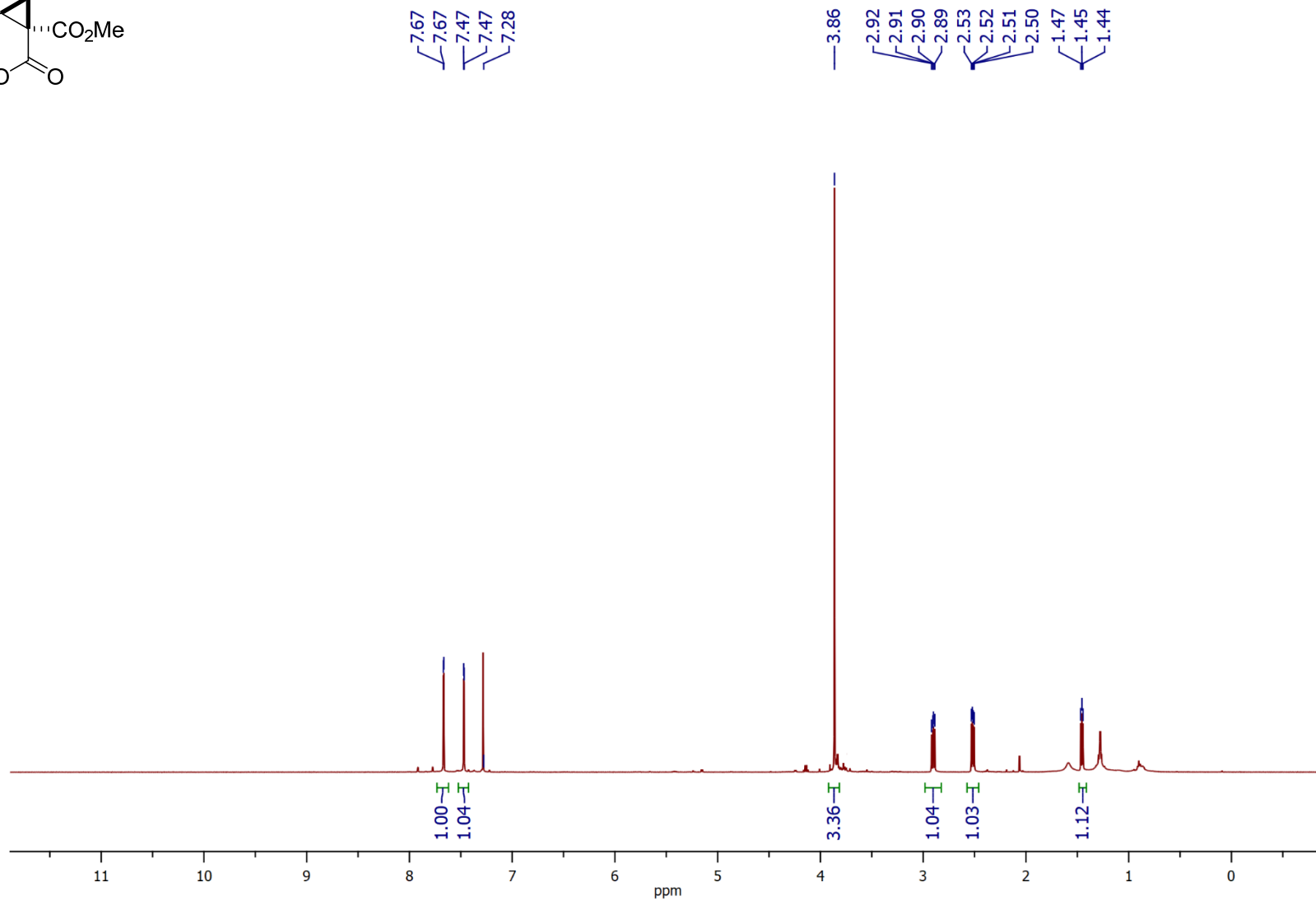
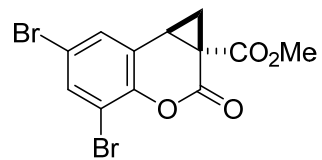
Methyl (1a*RS*,7b*RS*)-6-bromo-2-oxo-1,7b-dihydrocyclopropa[*c*]chromene-1a(2*H*)-carboxylate (2e)

HMBC ^1H - ^{13}C (CDCl_3)



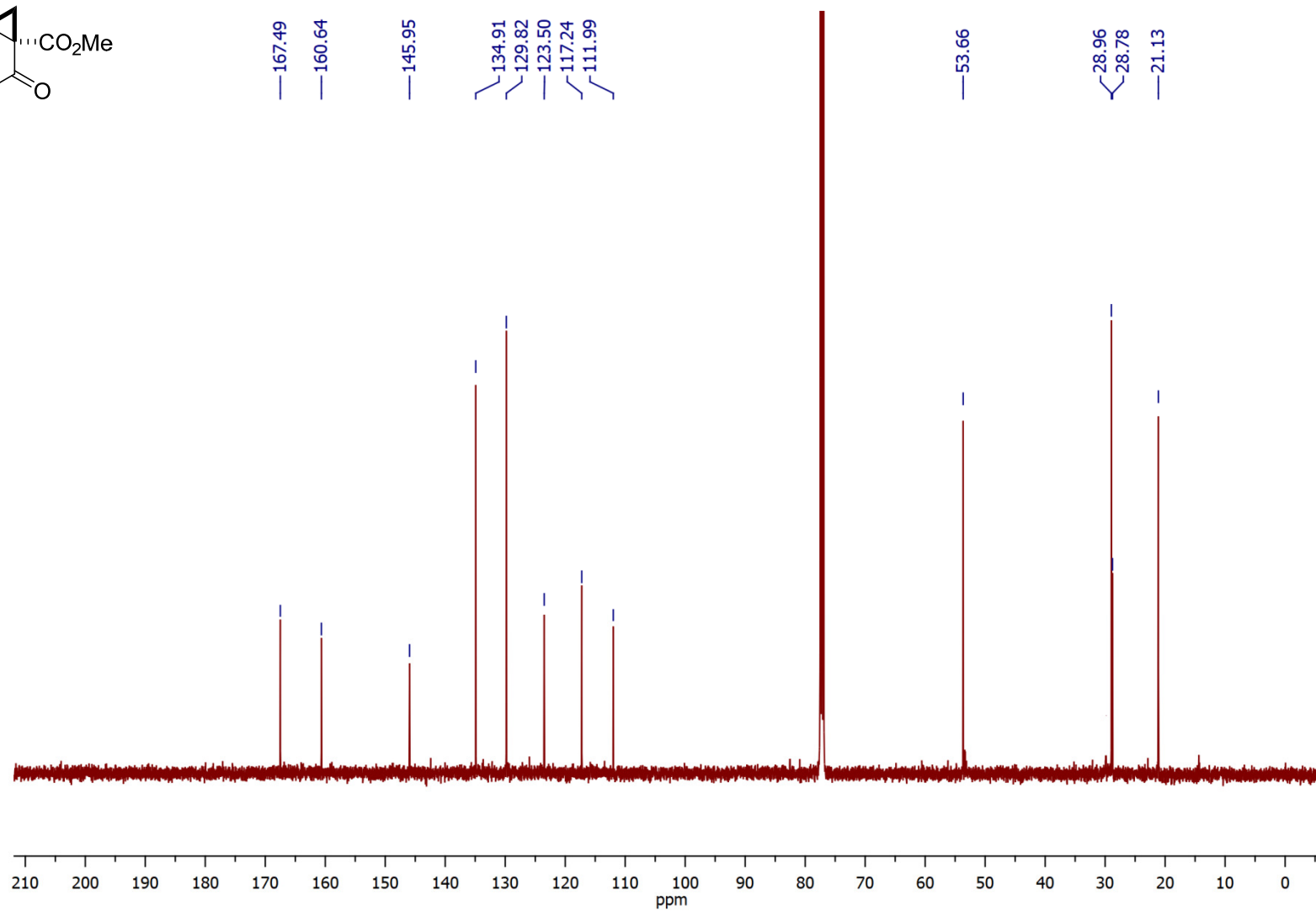
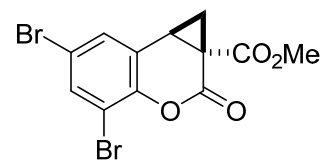
Methyl (1a*RS*,7b*RS*)-4,6-dibromo-2-oxo-1,7b-dihydrocyclopropa[*c*]chromene-1a(2*H*)-carboxylate (2f)

¹H NMR (CDCl₃, 500 MHz)



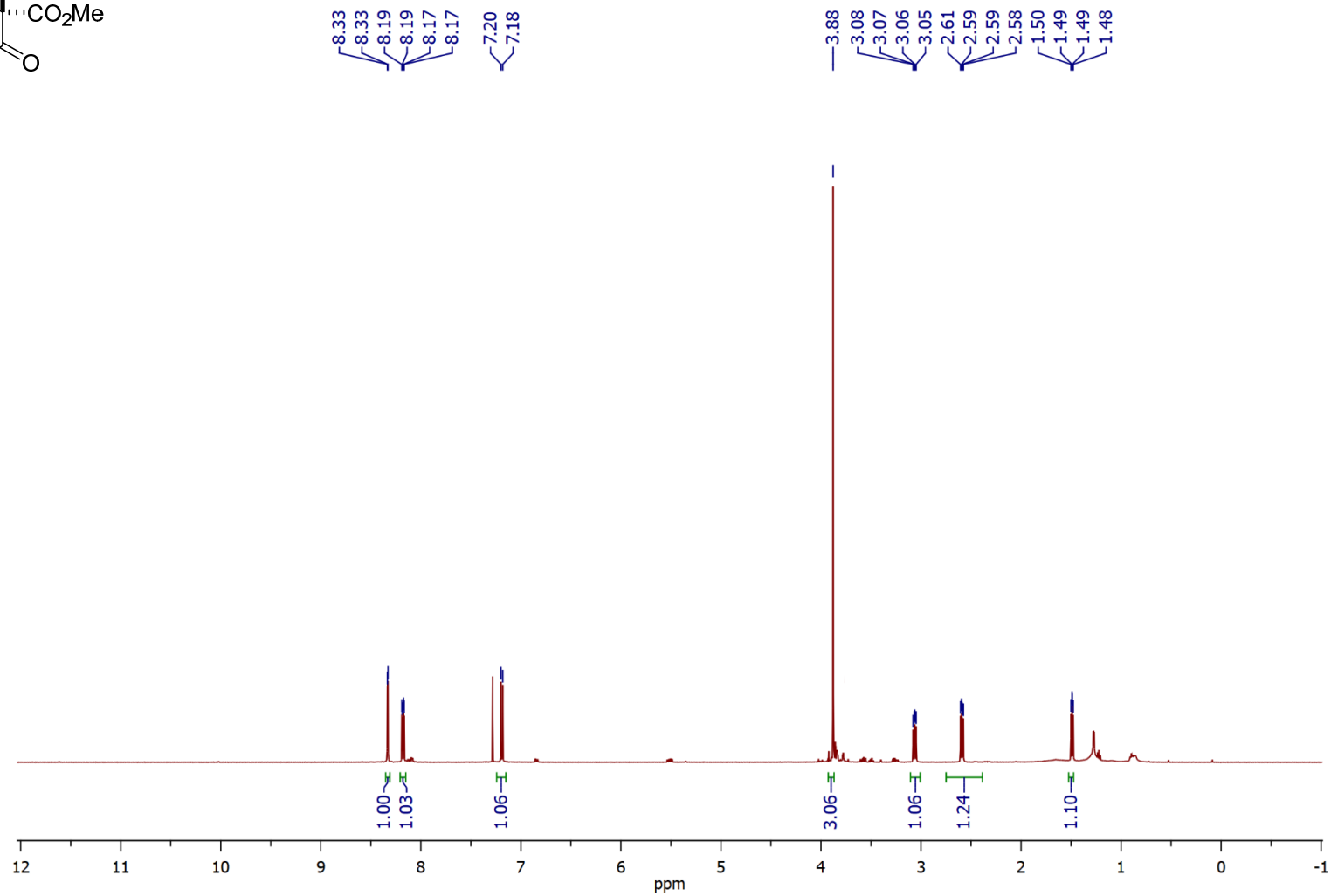
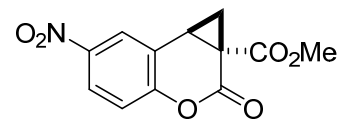
Methyl (1a*RS*,7b*RS*)-4,6-dibromo-2-oxo-1,7b-dihydrocyclopropa[*c*]chromene-1a(2*H*)-carboxylate (2f)

^{13}C NMR (CDCl_3 , 125 MHz)



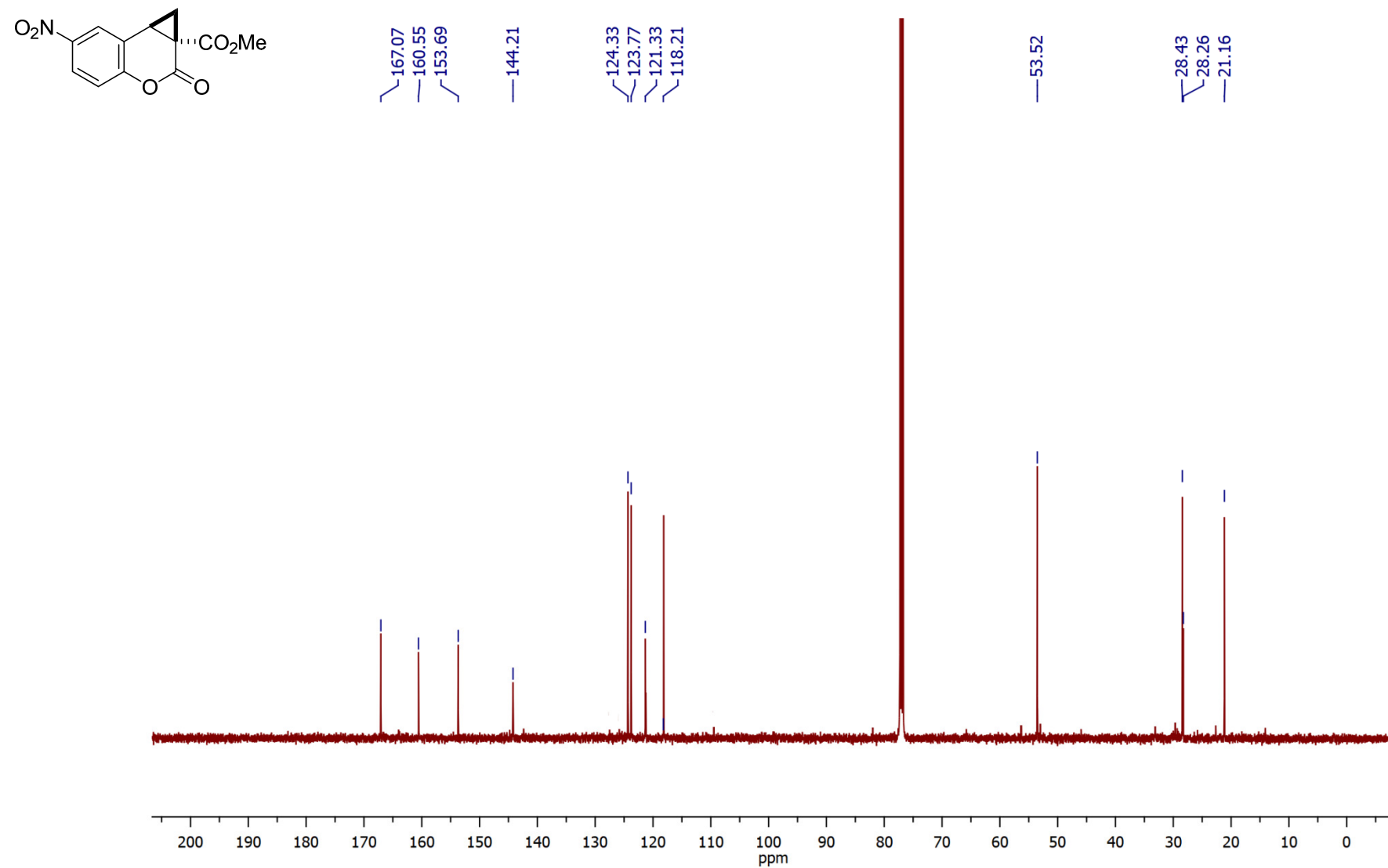
Methyl (1a*RS*,7b*RS*)-6-nitro-2-oxo-1,7b-dihydrocyclopropa[*c*]chromene-1a(2*H*)-carboxylate (2h)

¹H NMR (CDCl₃, 500 MHz)



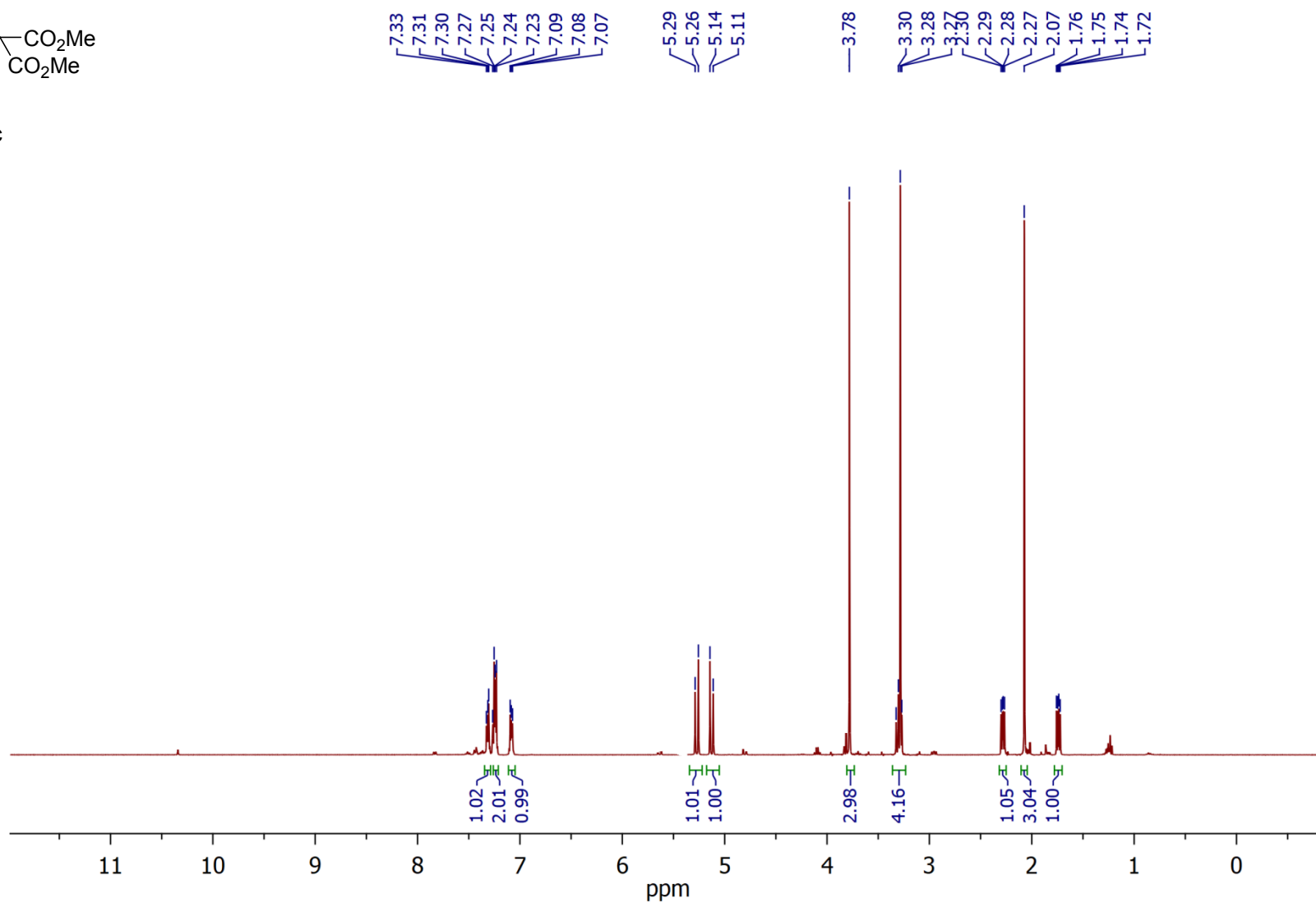
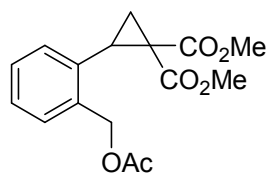
Methyl (1a*RS*,7b*RS*)-6-nitro-2-oxo-1,7b-dihydrocyclopropa[*c*]chromene-1a(2*H*)-carboxylate (2h)

^{13}C NMR (CDCl_3 , 125 MHz)



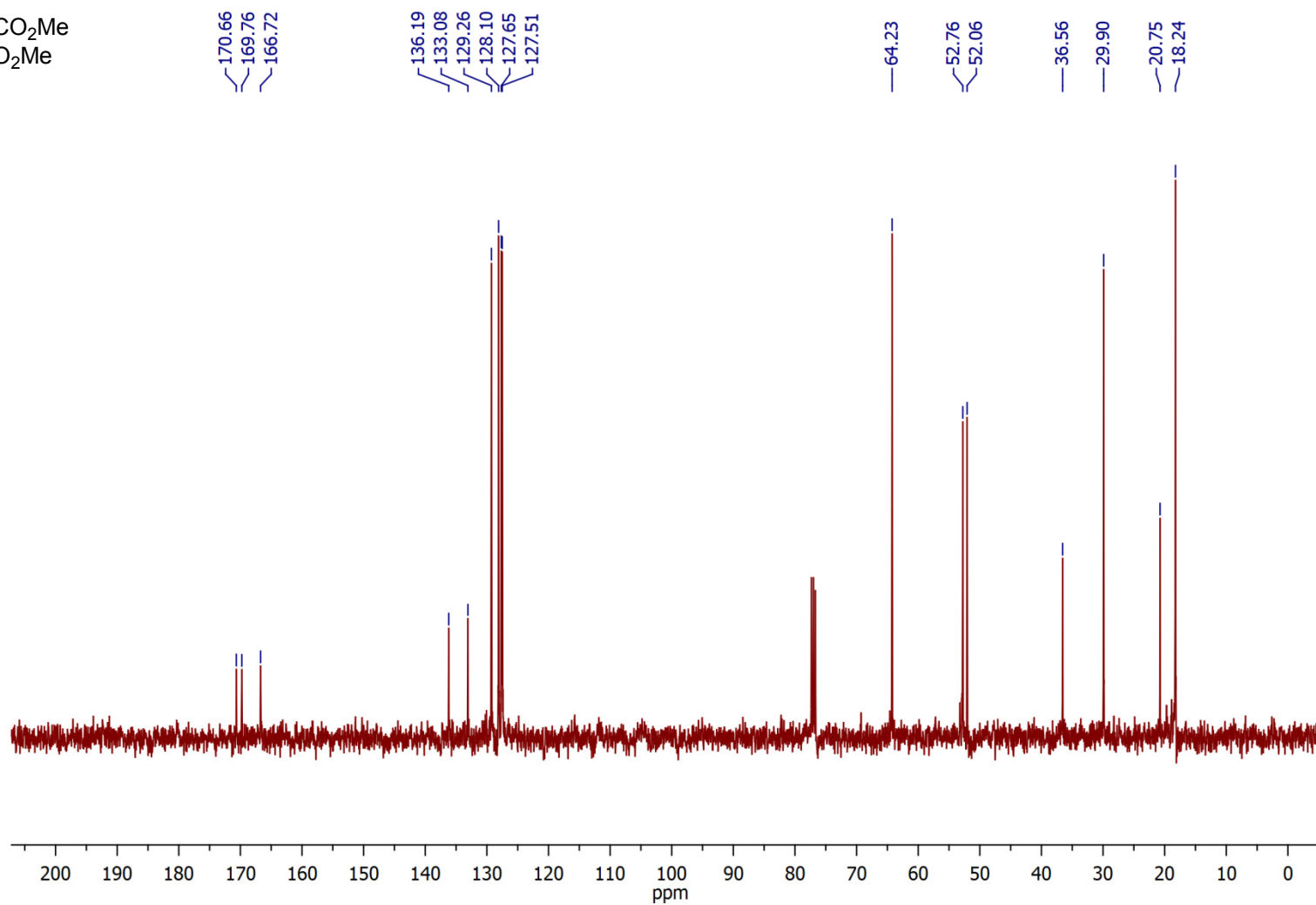
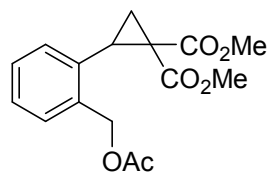
Dimethyl 2-[2-(acetoxymethyl)phenyl]cyclopropane-1,1-dicarboxylate (5)

^1H NMR (CDCl_3 , 400 MHz)



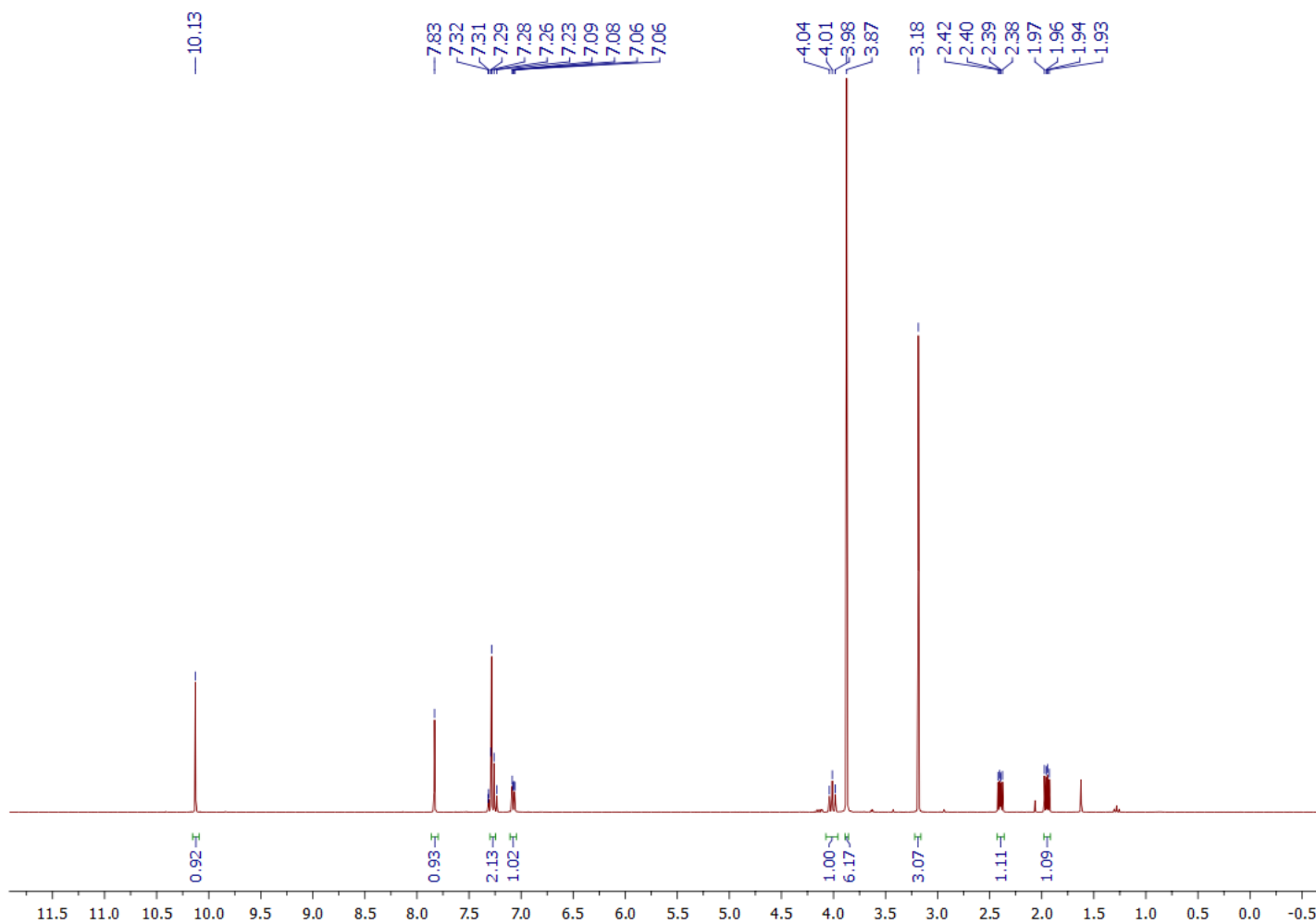
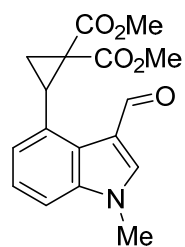
Dimethyl 2-[2-(acetoxymethyl)phenyl]cyclopropane-1,1-dicarboxylate (5)

^{13}C NMR (CDCl_3 , 100 MHz)



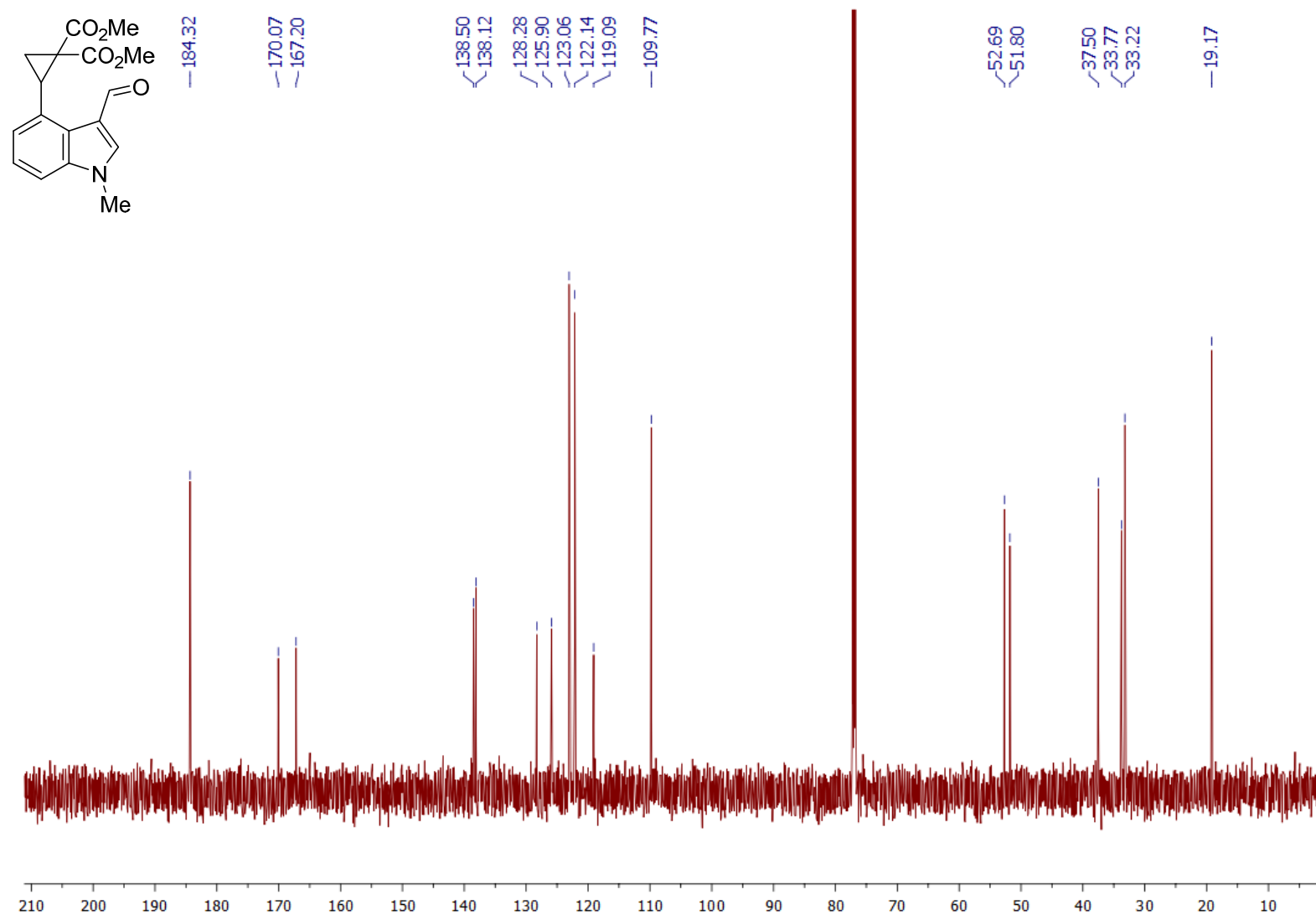
Dimethyl 2-(3-formyl-1-methyl-1*H*-indol-4-yl)cyclopropane-1,1-dicarboxylate (7)

¹H NMR (CDCl₃, 500 MHz)



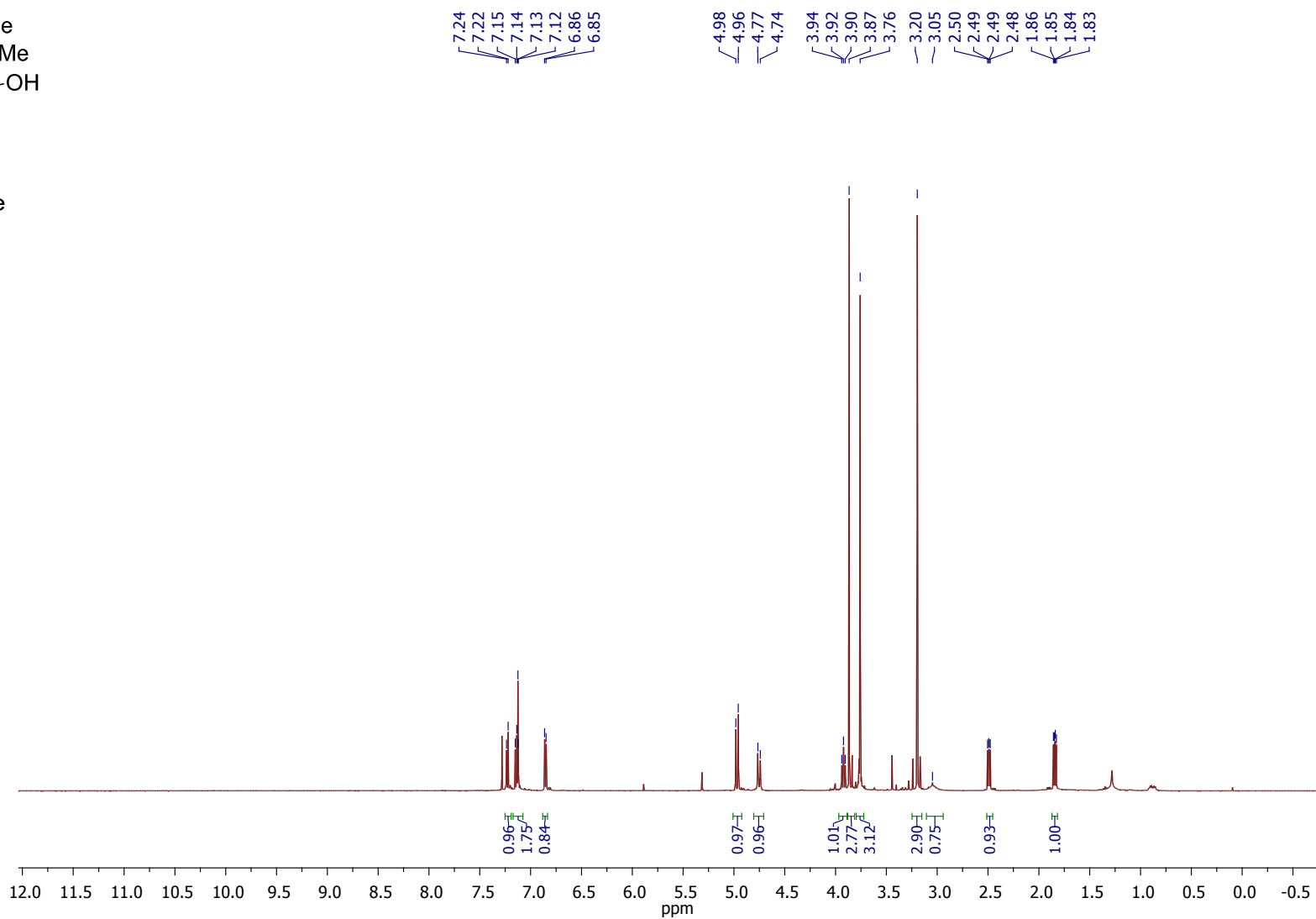
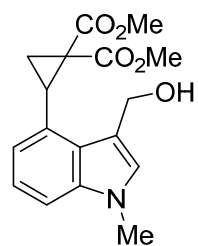
Dimethyl 2-(3-formyl-1-methyl-1*H*-indol-4-yl)cyclopropane-1,1-dicarboxylate (7)

^{13}C NMR (CDCl_3 , 125 MHz)



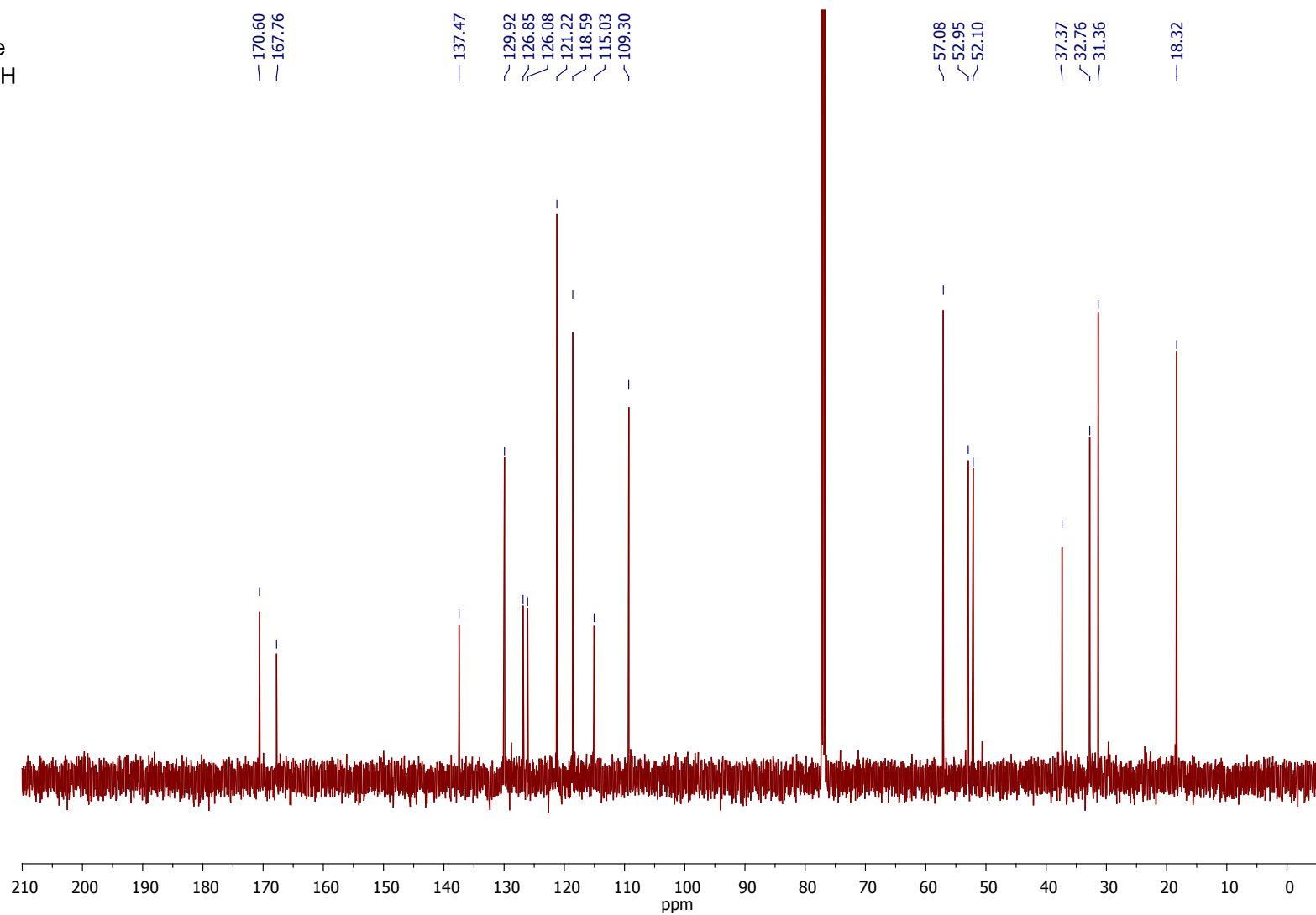
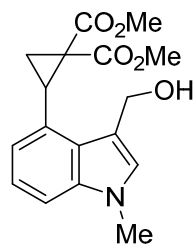
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¹H NMR (CDCl₃, 500 MHz)



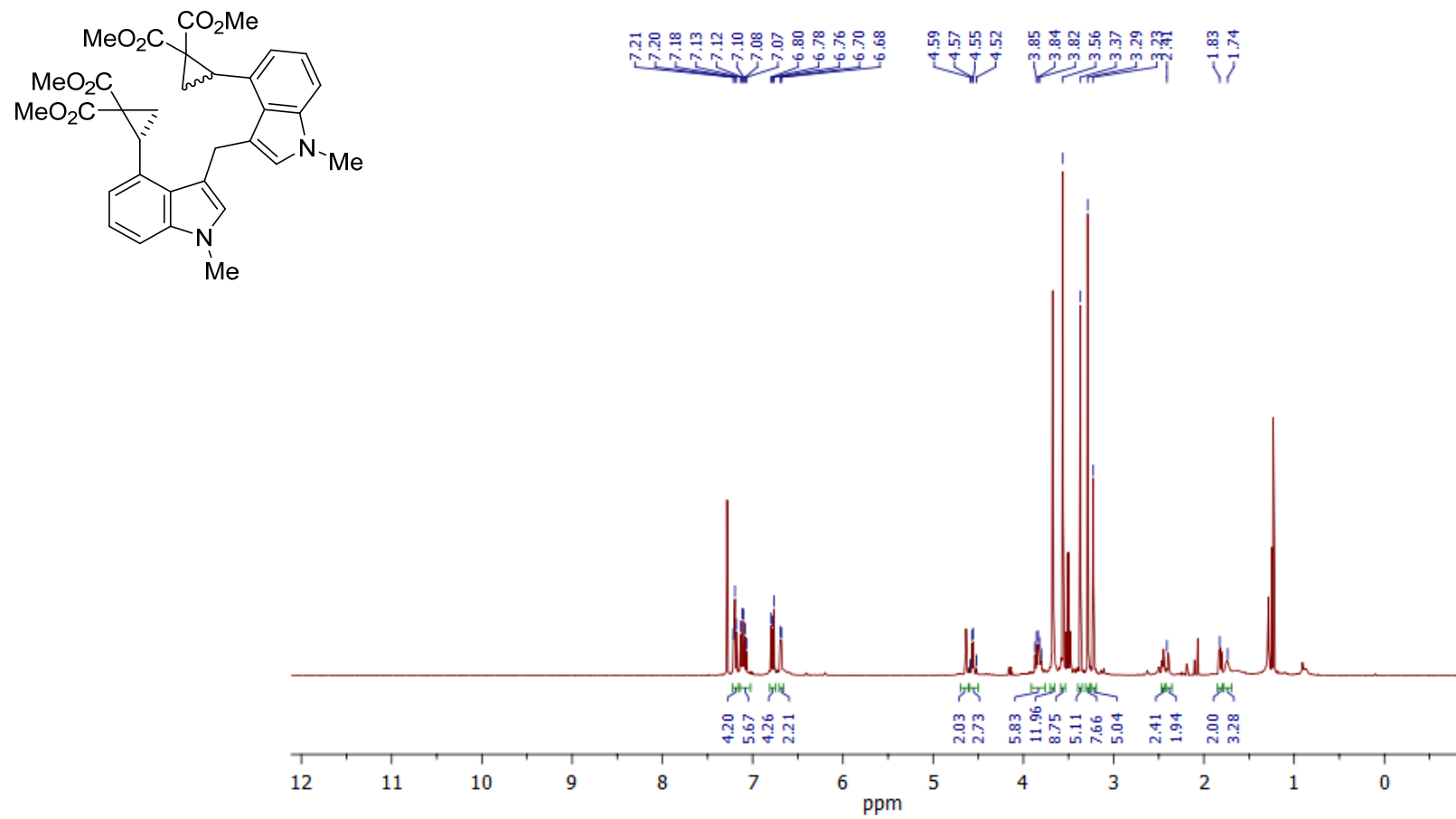
Dimethyl 2-(3-hydroxymethyl-1-methyl-1*H*-indol-4-yl)cyclopropane-1,1-dicarboxylate (8)

^{13}C NMR (CDCl_3 , 125 MHz)



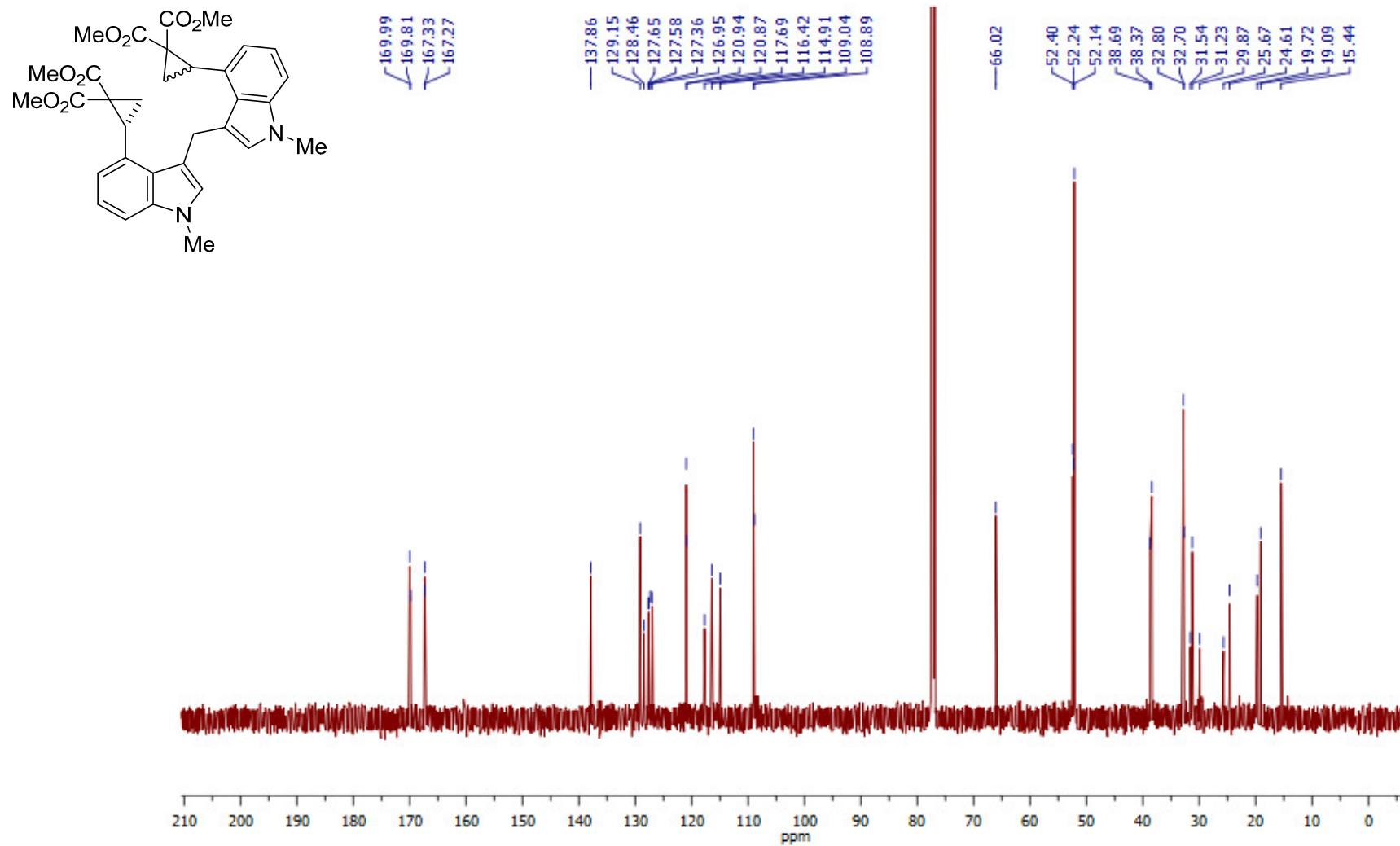
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¹H NMR (CDCl₃, 500 MHz)



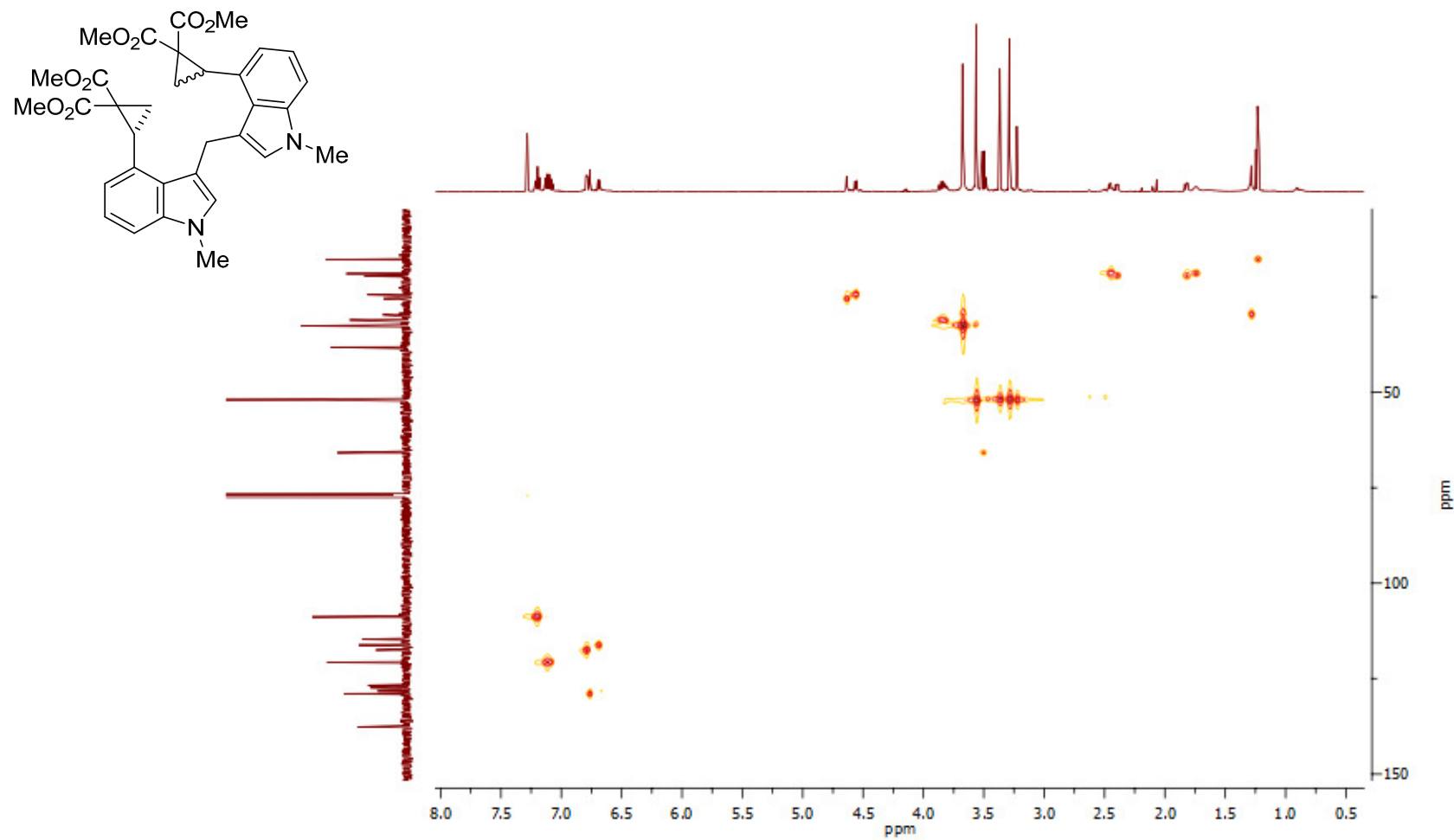
Dimethyl 2-[3-({4-[2,2-bis(methoxycarbonyl)cyclopropyl]-1-methyl-1*H*-indol-3-yl}methyl)-1-methyl-1*H*-indol-4-yl]cyclopropane-1,1-dicarboxylate (9)

^{13}C NMR (CDCl_3 , 125 MHz)



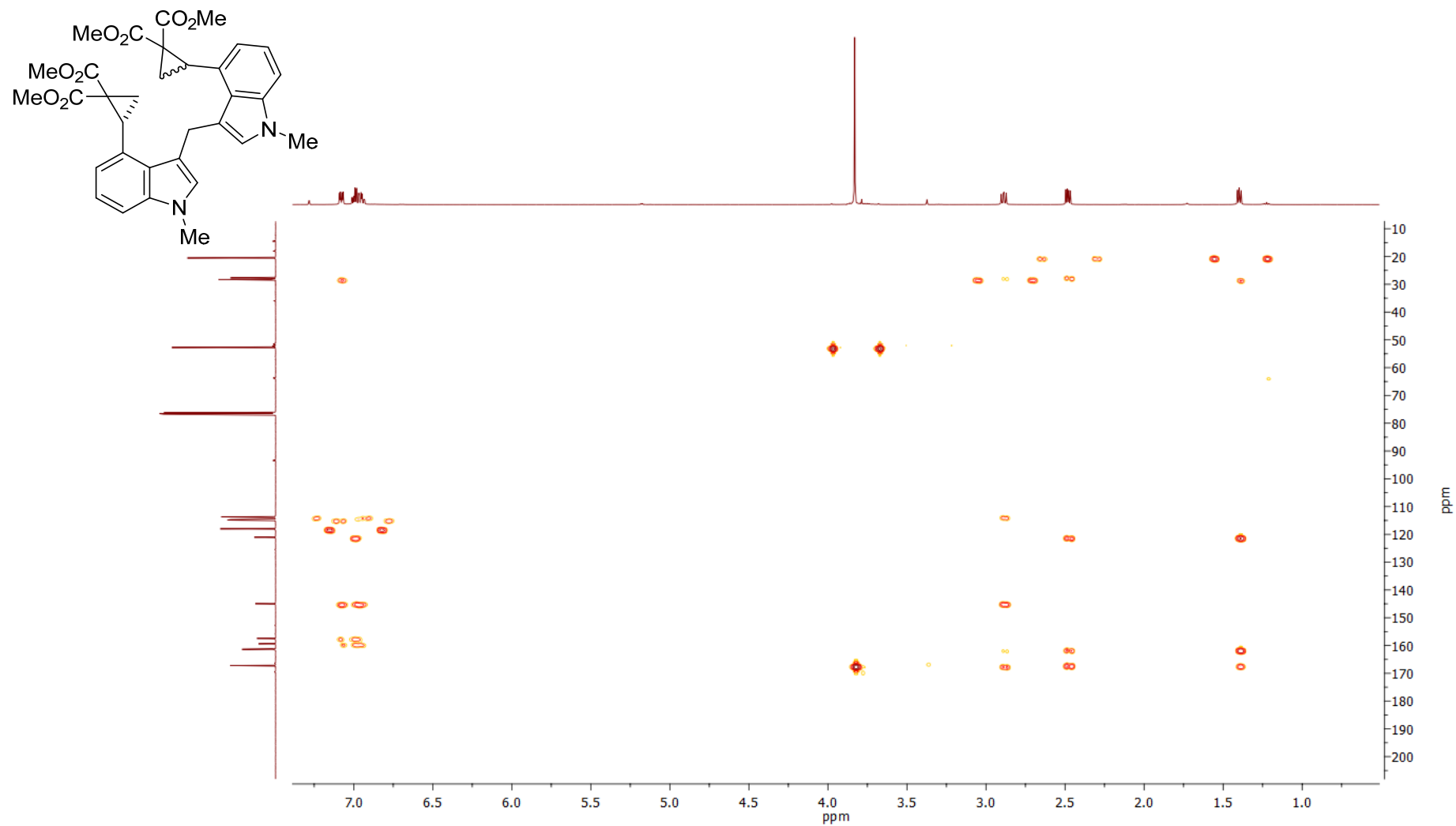
Dimethyl 2-[3-({4-[2,2-bis(methoxycarbonyl)cyclopropyl]-1-methyl-1*H*-indol-3-yl}methyl)-1-methyl-1*H*-indol-4-yl]cyclopropane-1,1-dicarboxylate (9)

HSQC ^1H - ^{13}C (CDCl_3)



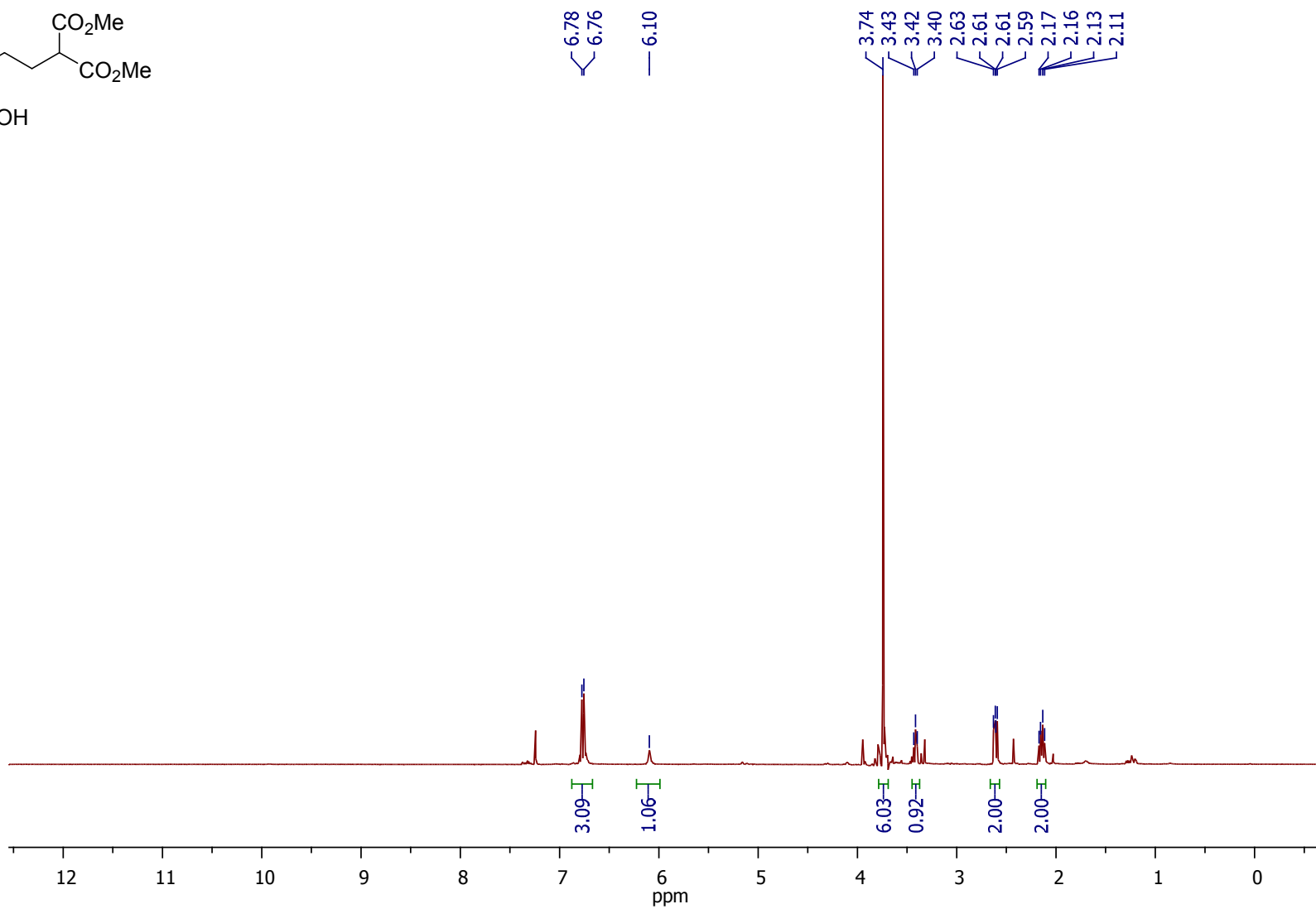
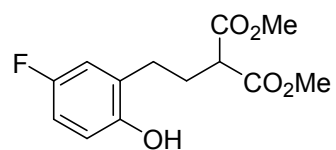
Dimethyl 2-[3-({4-[2,2-bis(methoxycarbonyl)cyclopropyl]-1-methyl-1*H*-indol-3-yl}methyl)-1-methyl-1*H*-indol-4-yl]cyclopropane-1,1-dicarboxylate (9)

HMBC ^1H - ^{13}C (CDCl_3)



Dimethyl 2-[2-(5-fluoro-2-hydroxyphenyl)ethyl]malonate (10)

^1H NMR (CDCl_3 , 400 MHz)



Dimethyl 2-[2-(5-fluoro-2-hydroxyphenyl)ethyl]malonate (10)

^{13}C NMR (CDCl_3 , 100 MHz)

