Supporting Information

DABCO and Tributyl Phosphine Catalyzed [4+2] and [3+2] Cycloadditions of 3-Acyl-2H-chromen-ones and Ethyl 2,3-Butadienoate

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^{1}H, ^{13}C NMR-spectra of **1**

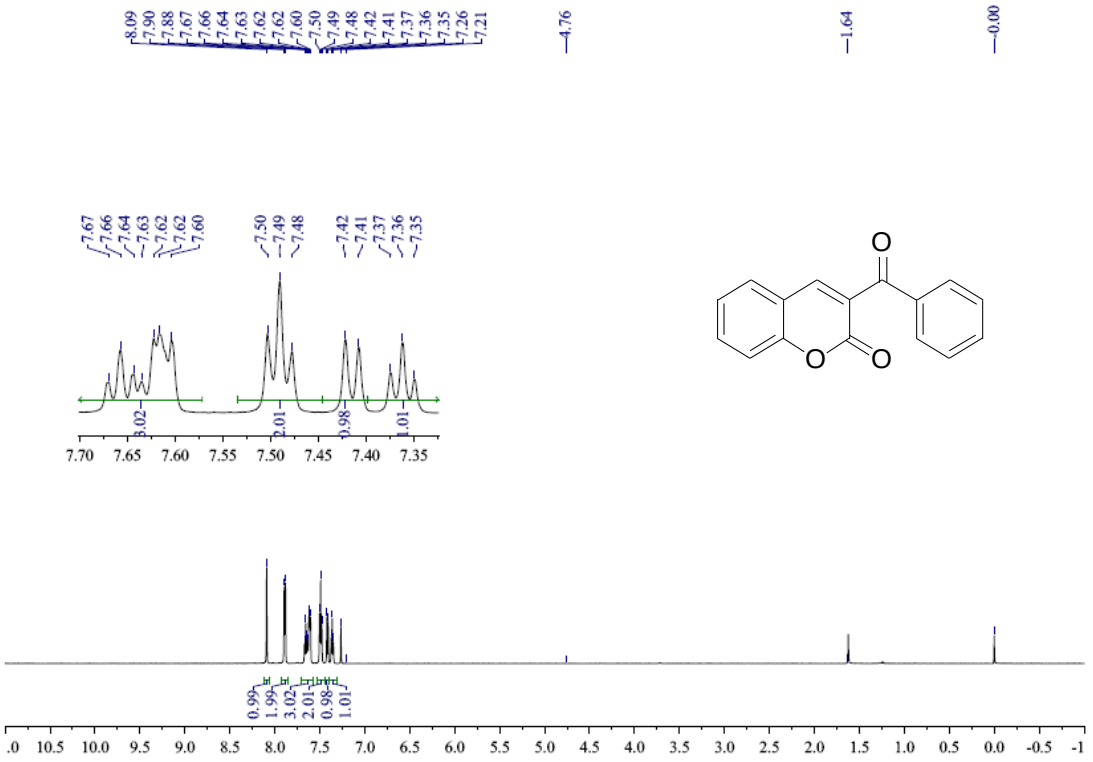

Figure S1. ^{1}H NMR spectrum (600 MHz, $CDCl_3$) of 3-benzoyl-chromen-2-one (**1a**)

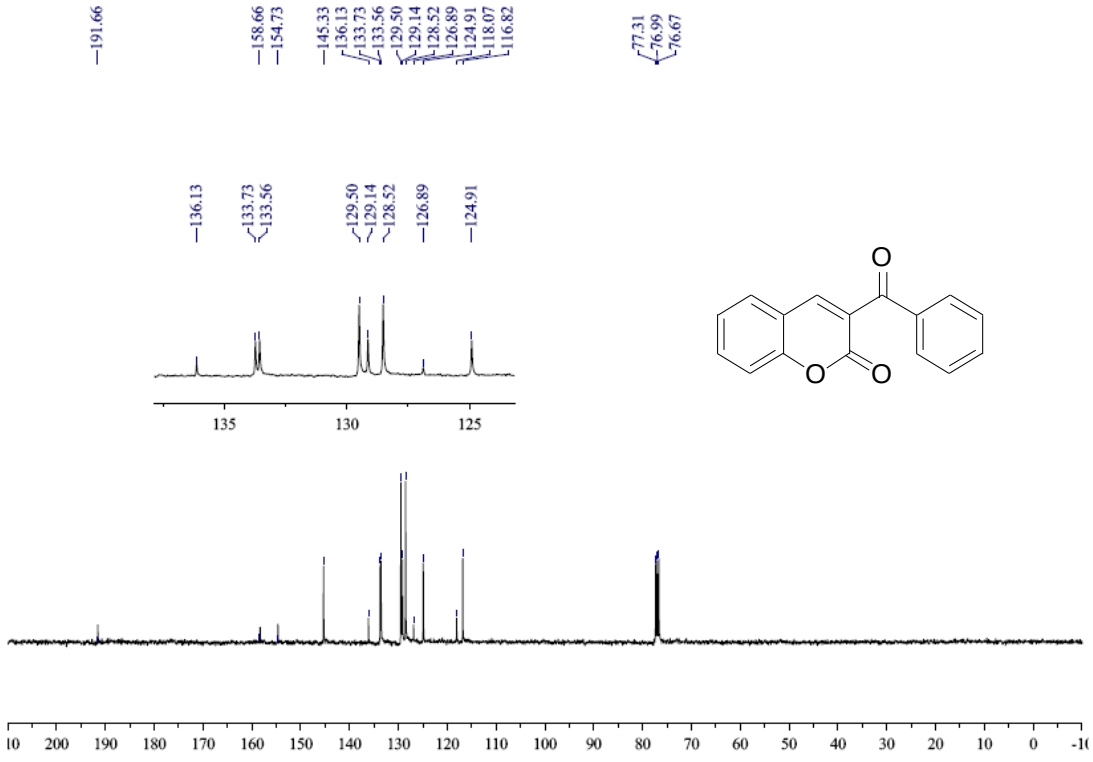

Figure S2. ^{13}C NMR spectrum (150 MHz, $CDCl_3$) of 3-benzoyl-chromen-2-one (**1a**)

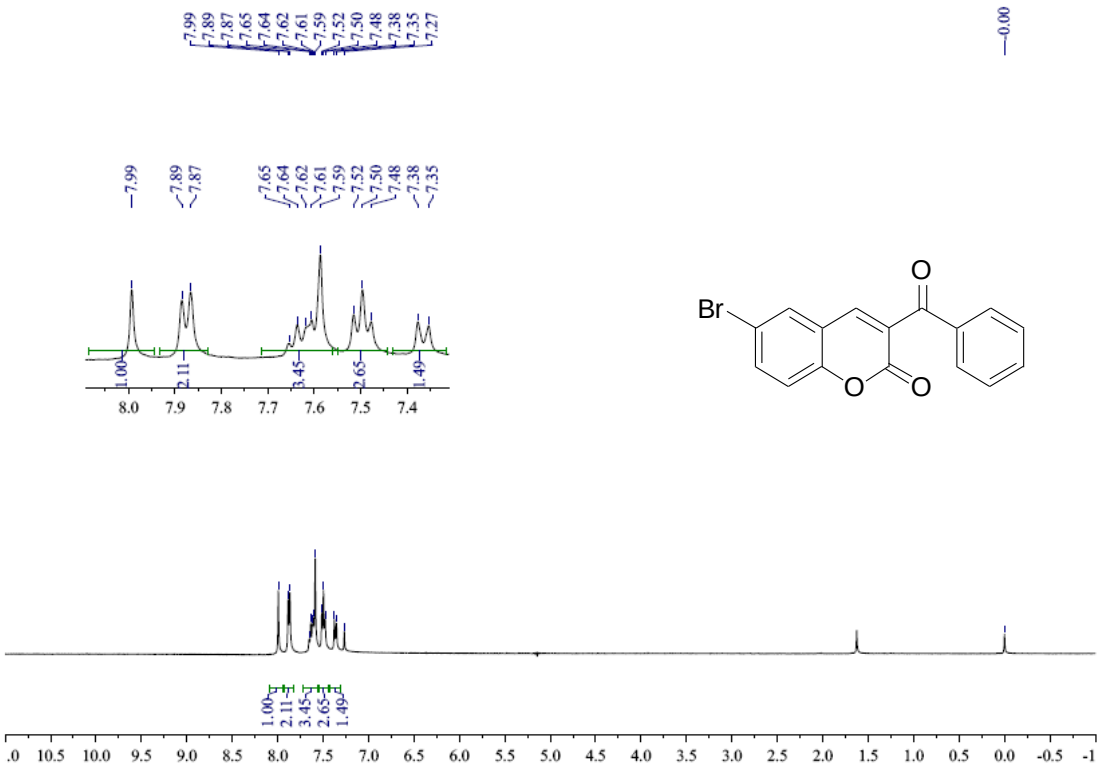

Figure S3. ^{1}H NMR spectrum (400 MHz, $CDCl_3$) of 3-benzoyl-6-bromo-chromen-2-one (**1b**)

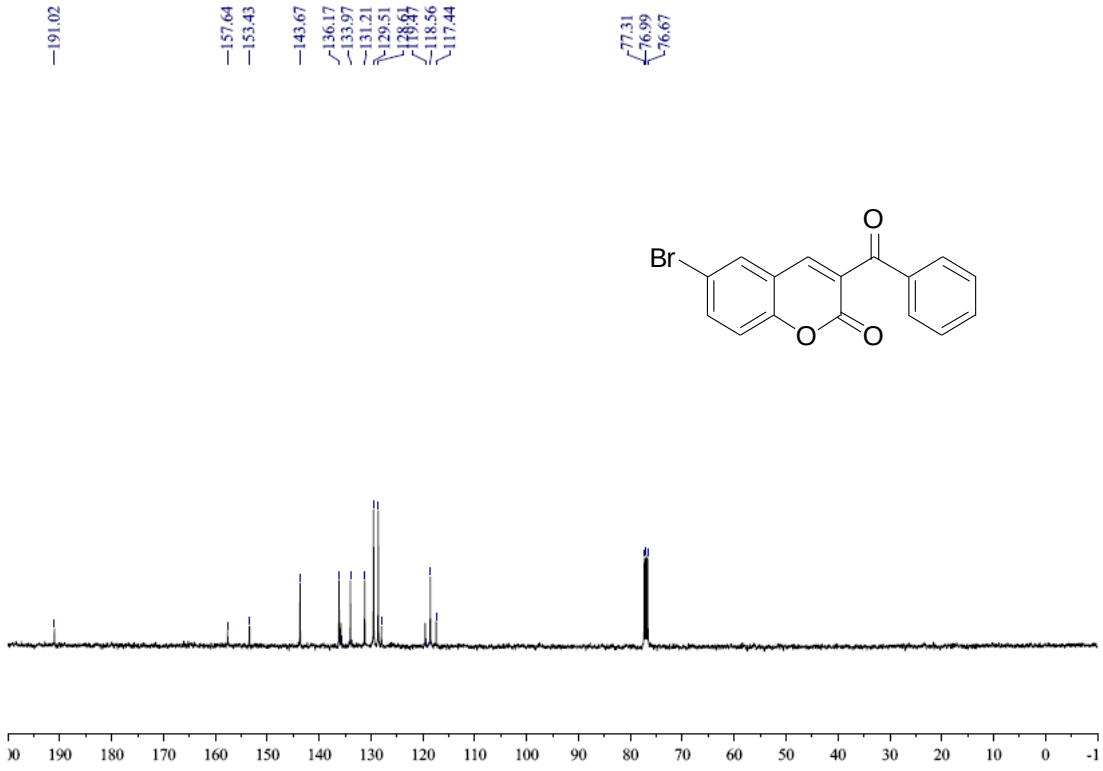

Figure S4. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of 3-benzoyl-6-bromo-chromen-2-one (**1b**)

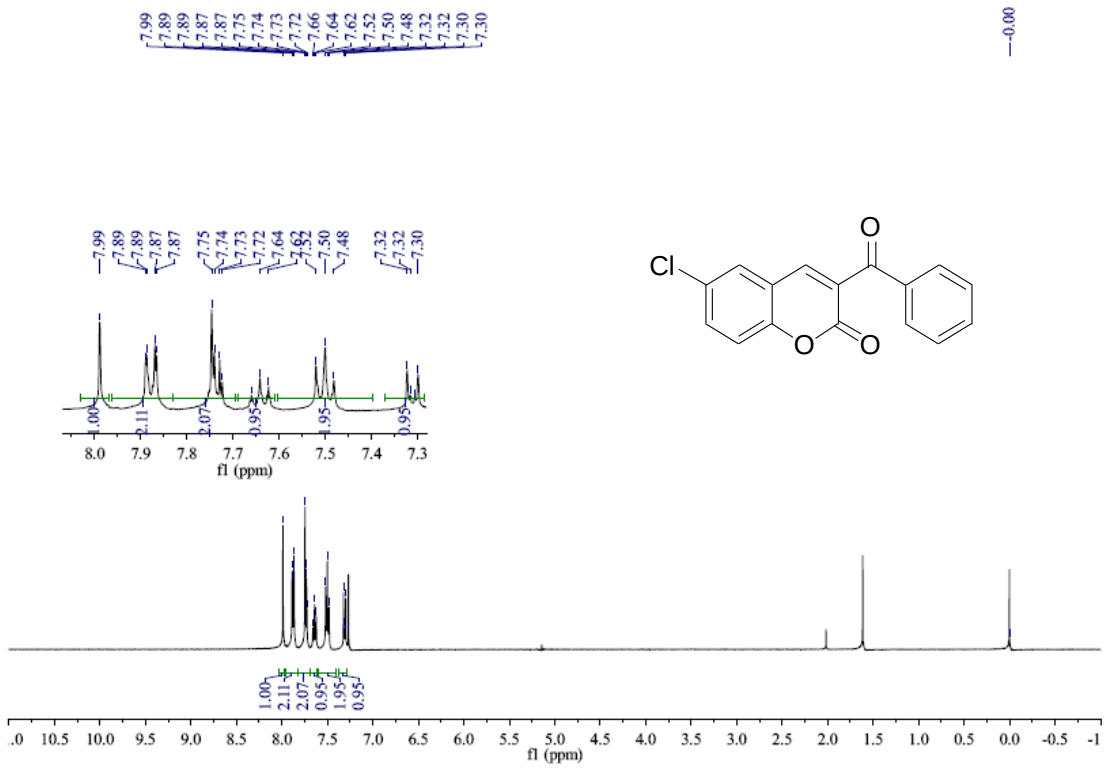

Figure S5. ^{1}H NMR spectrum (400 MHz, $CDCl_3$) of 3-benzoyl-6-chloro-chromen-2-one (**1c**)

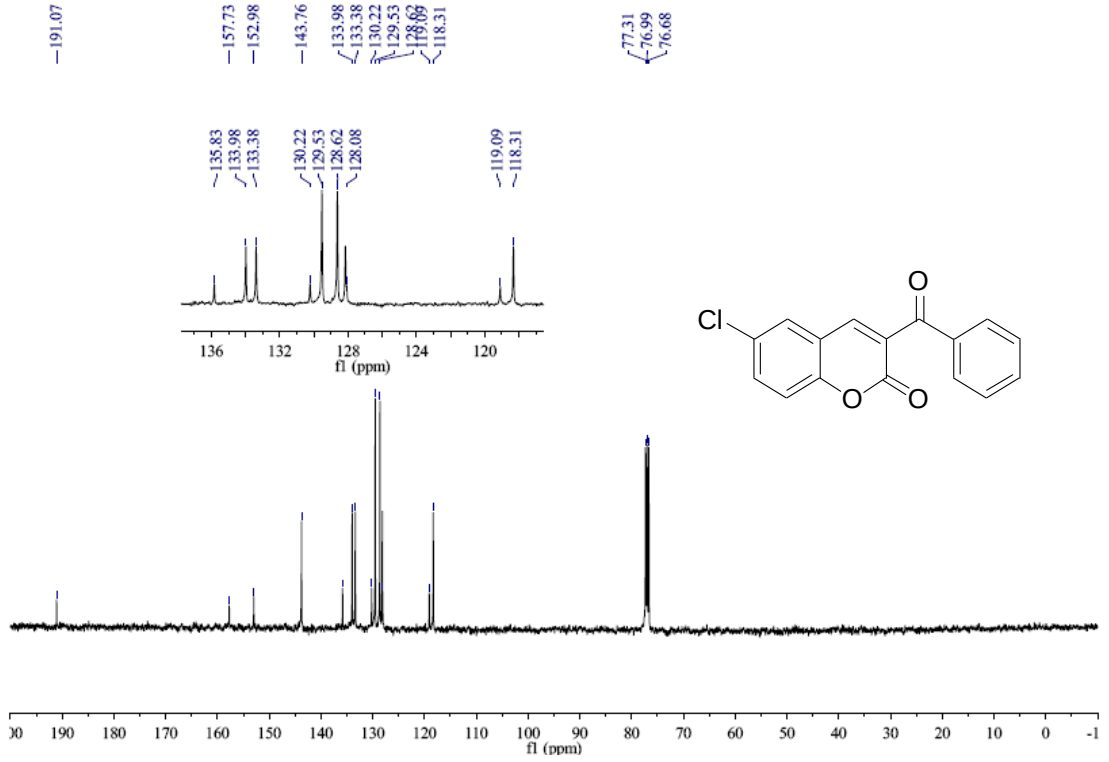

Figure S6. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of 3-benzoyl-6-chloro-chromen-2-one (**1c**)

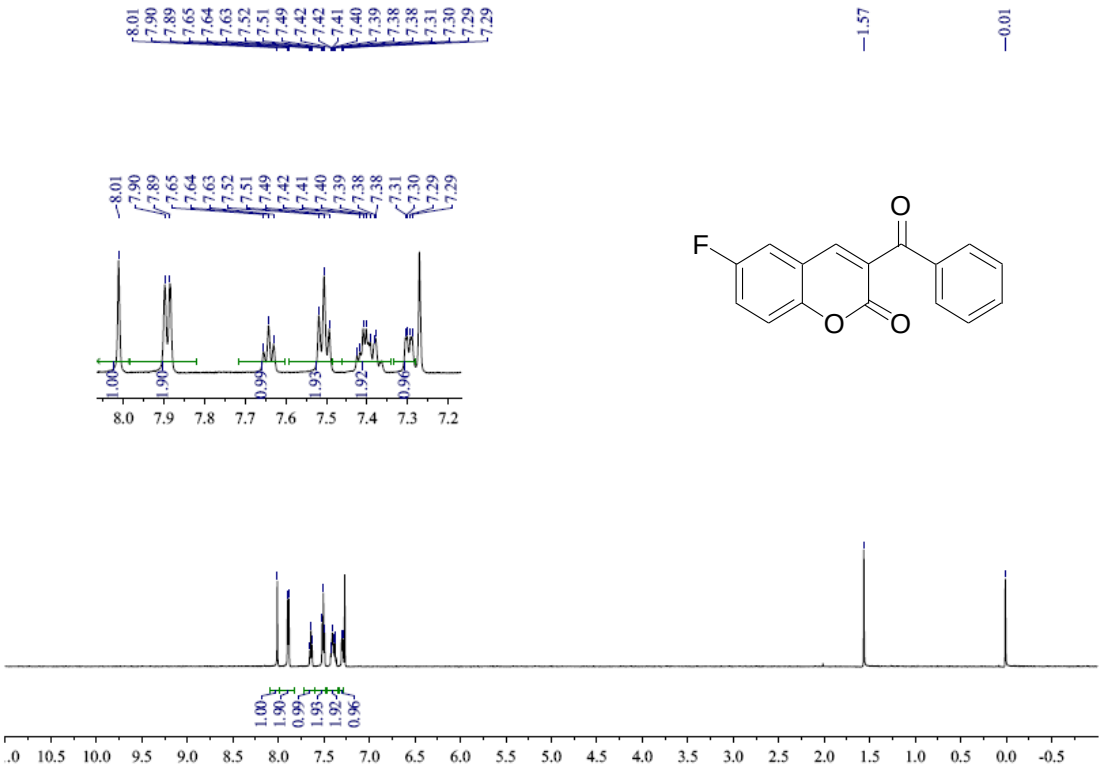

Figure S7. ^{1}H NMR spectrum (600 MHz, $CDCl_3$) of 3-benzoyl-6-fluoro-chromen-2-one (**1d**)

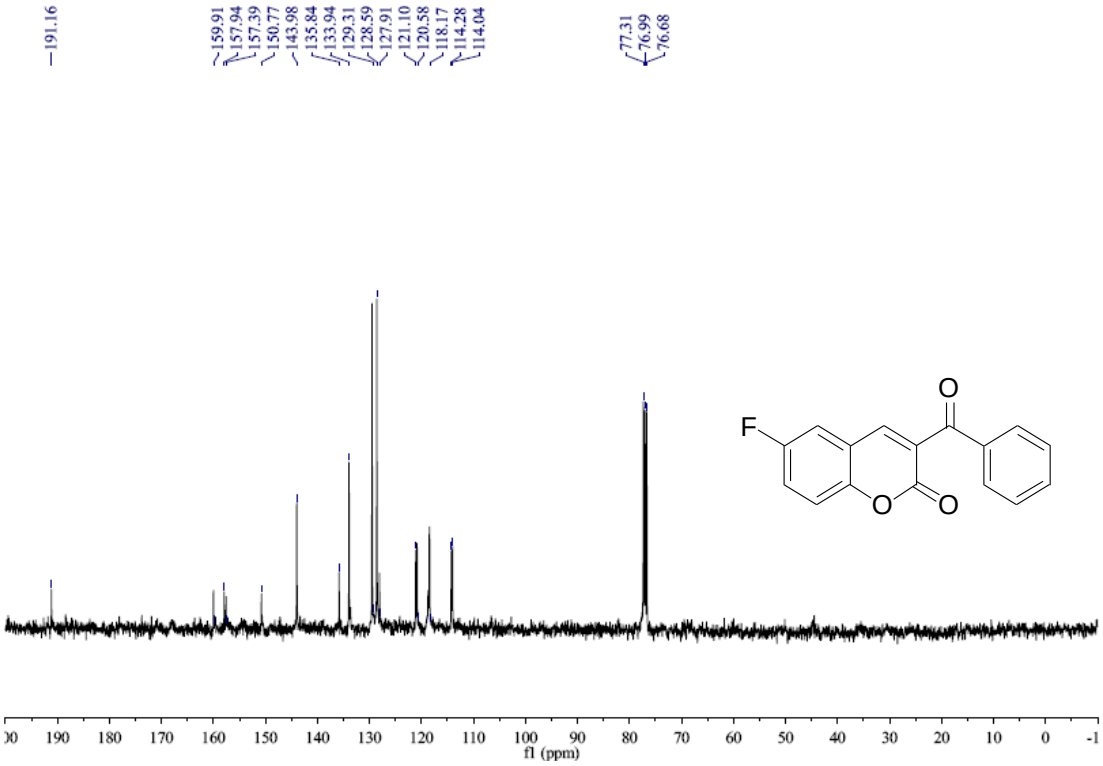

Figure S8. ^{13}C NMR spectrum (150 MHz, $CDCl_3$) of 3-benzoyl-6-fluoro-chromen-2-one (**1d**)

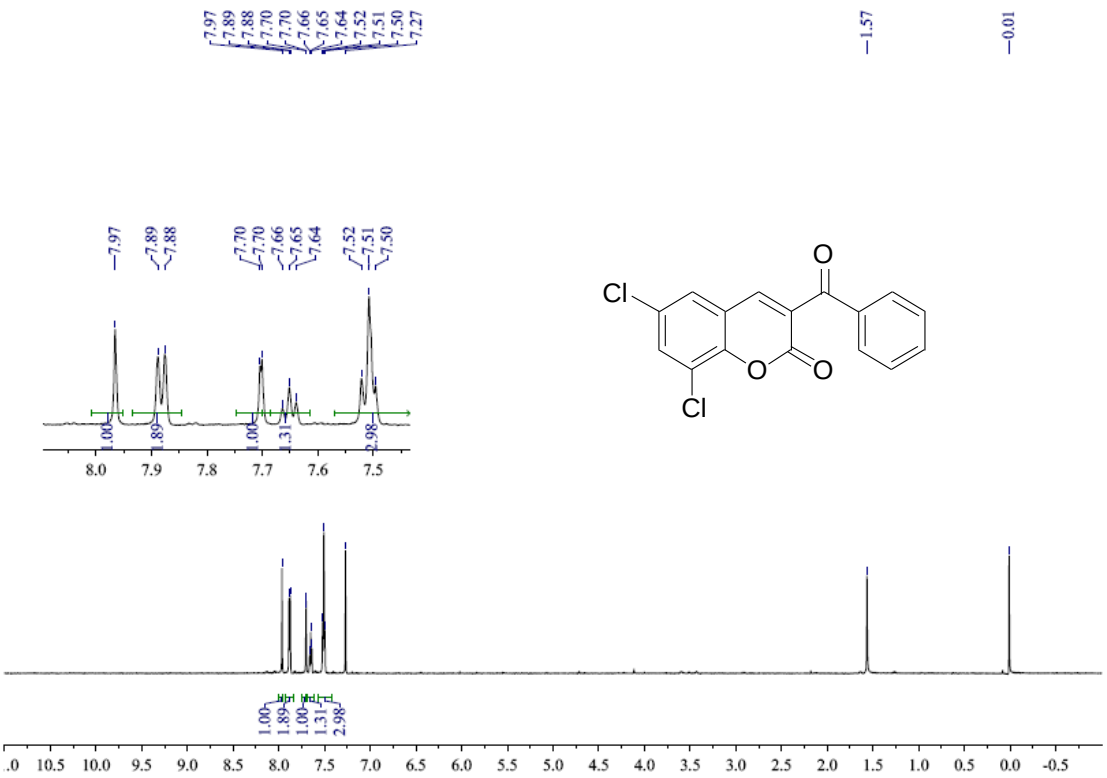

Figure S9. ^{1}H NMR spectrum (600 MHz, $CDCl_3$) of 3-benzoyl-6,8-dichloro-chromen-2-one (**1e**)

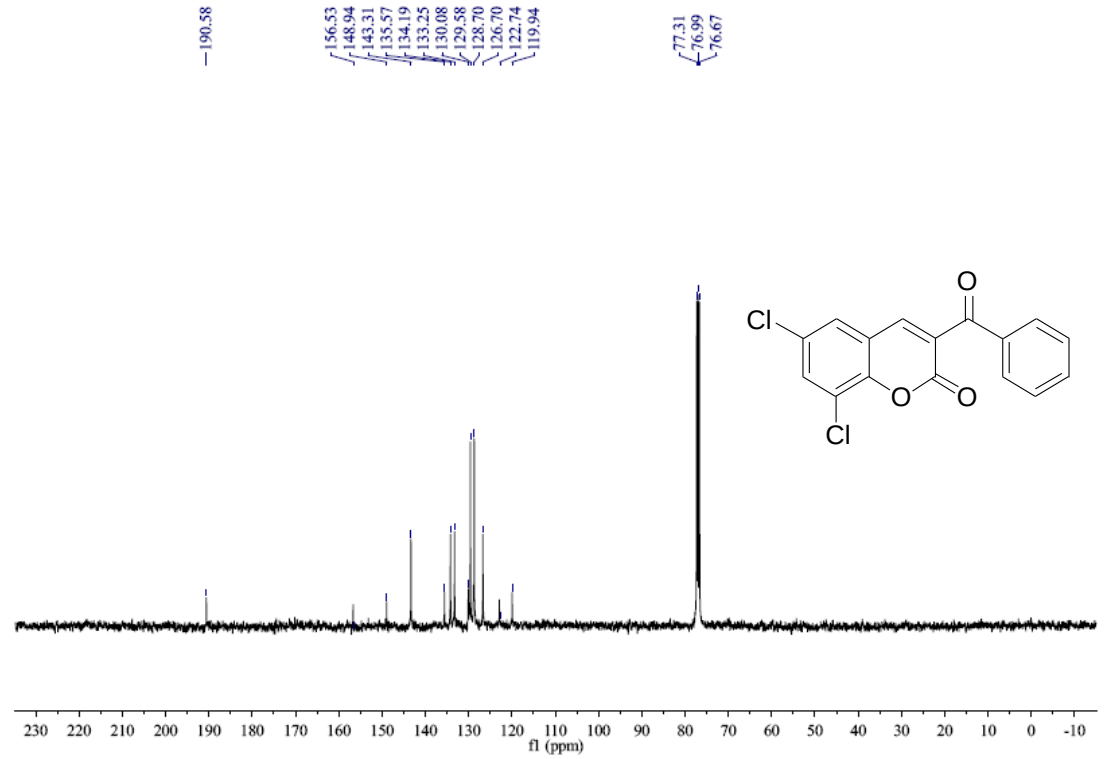

Figure S10. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of 3-benzoyl-6,8-dichloro-chromen-2-one (**1e**)

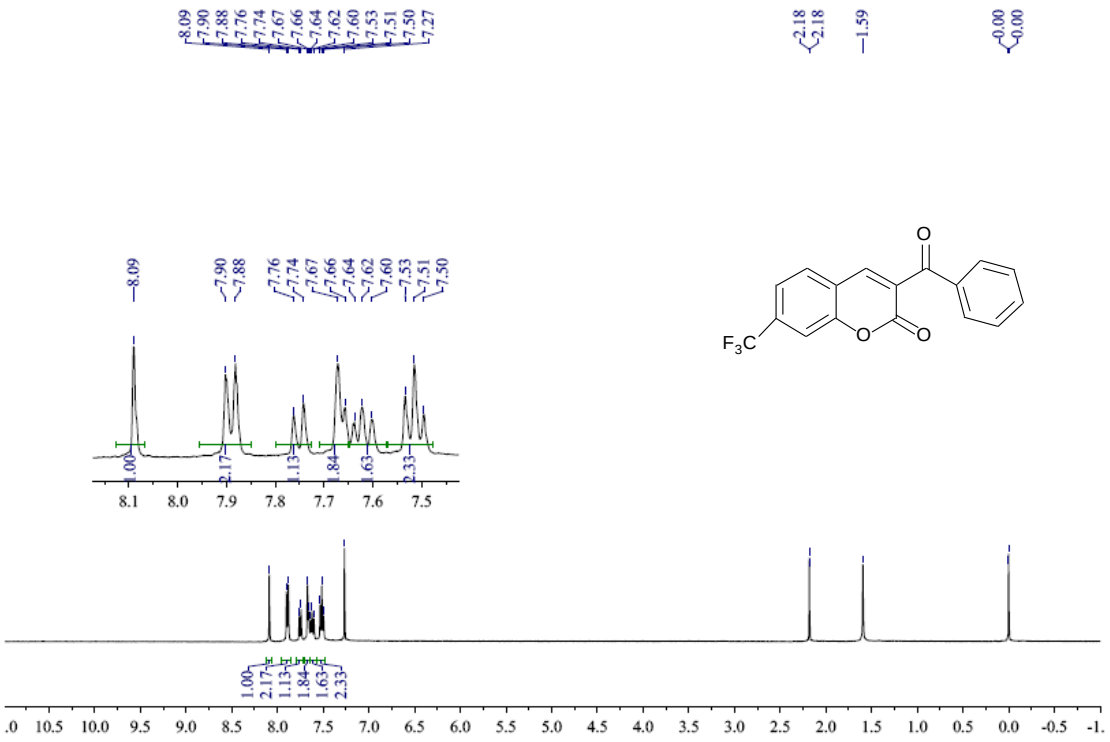

Figure S11. ^{1}H NMR spectrum (400 MHz, $CDCl_3$) of 3-benzoyl-7-(trifluoromethyl)-chromen-2-one (**1f**)

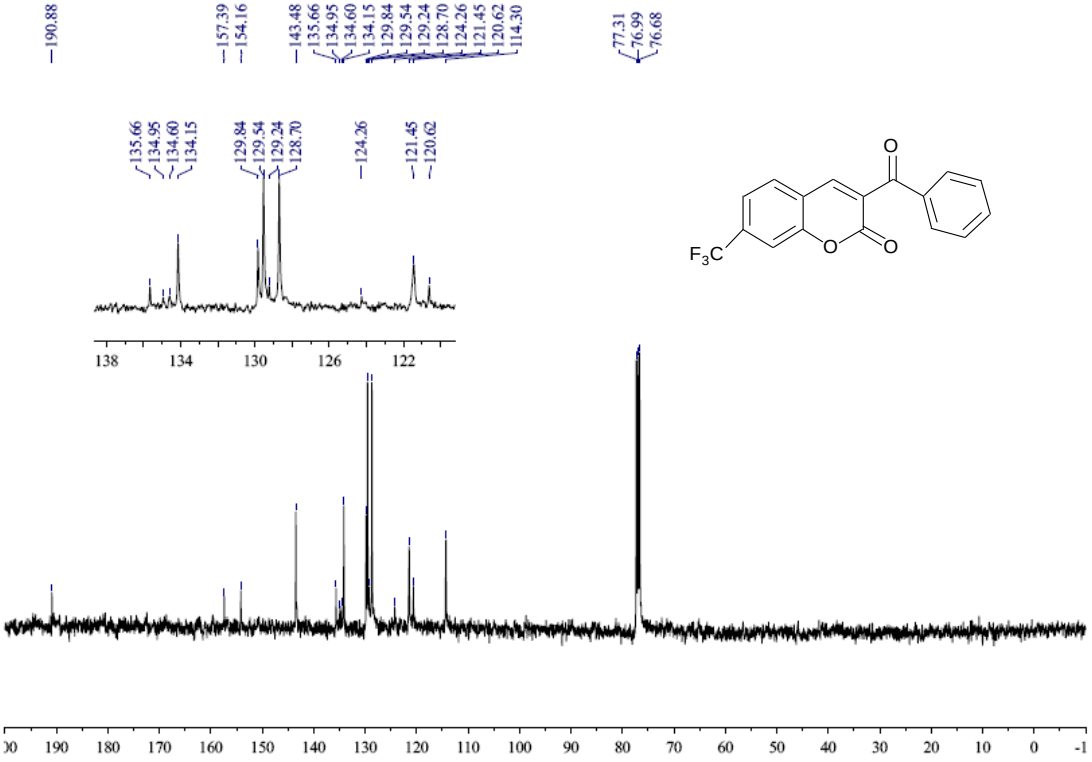

Figure S12. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of 3-benzoyl-7-(trifluoromethyl)-chromen-2-one (**1f**)

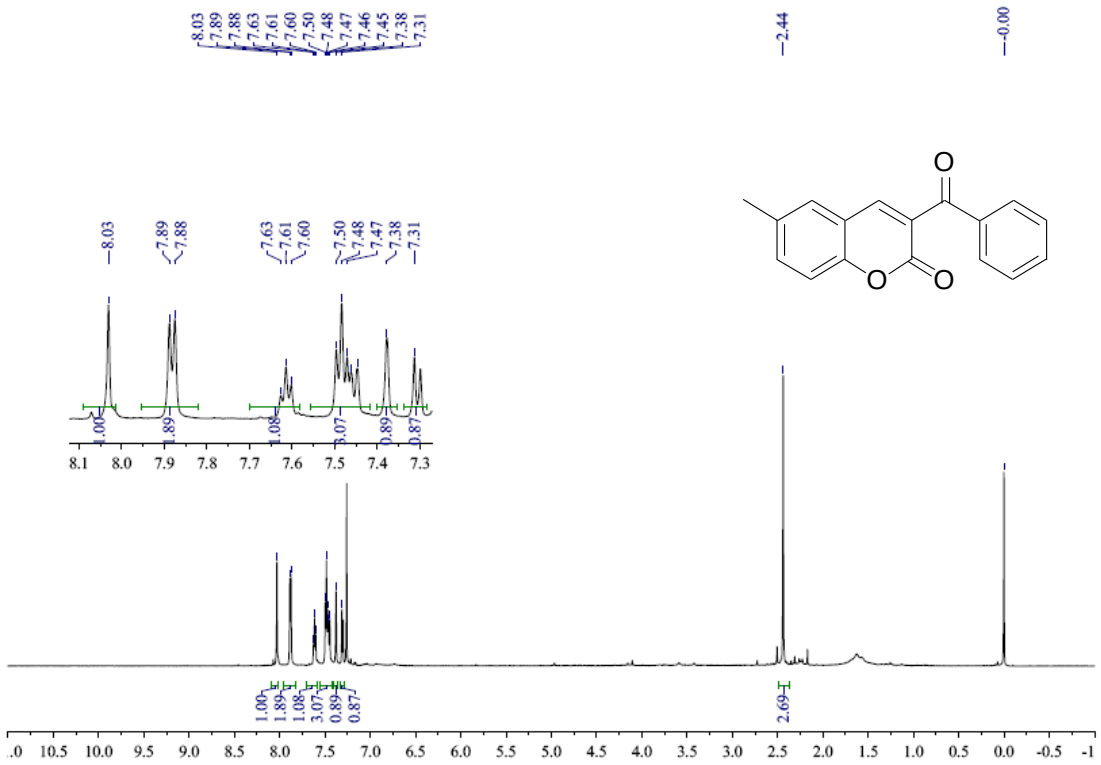

Figure S13. ^{1}H NMR spectrum (600 MHz, $CDCl_3$) of 3-benzoyl-6-methyl-chromen-2-one (**1g**)

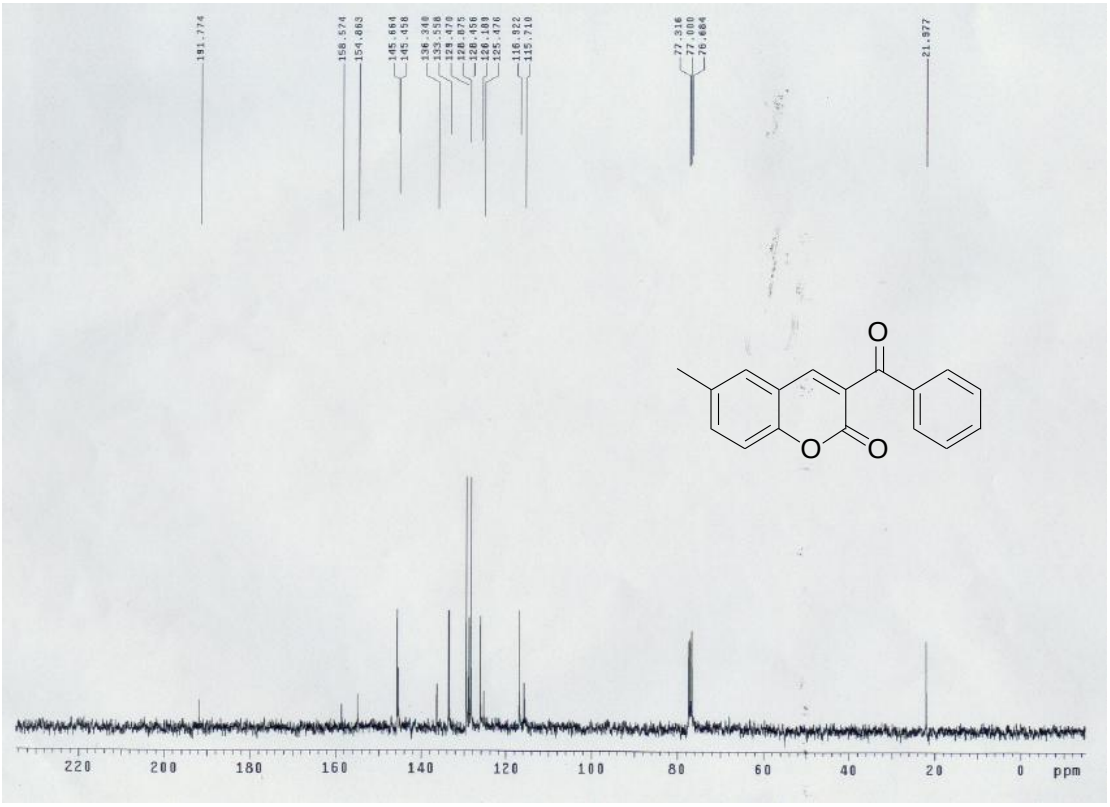

Figure S14. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of 3-benzoyl-6-methyl-chromen-2-one (**1g**)

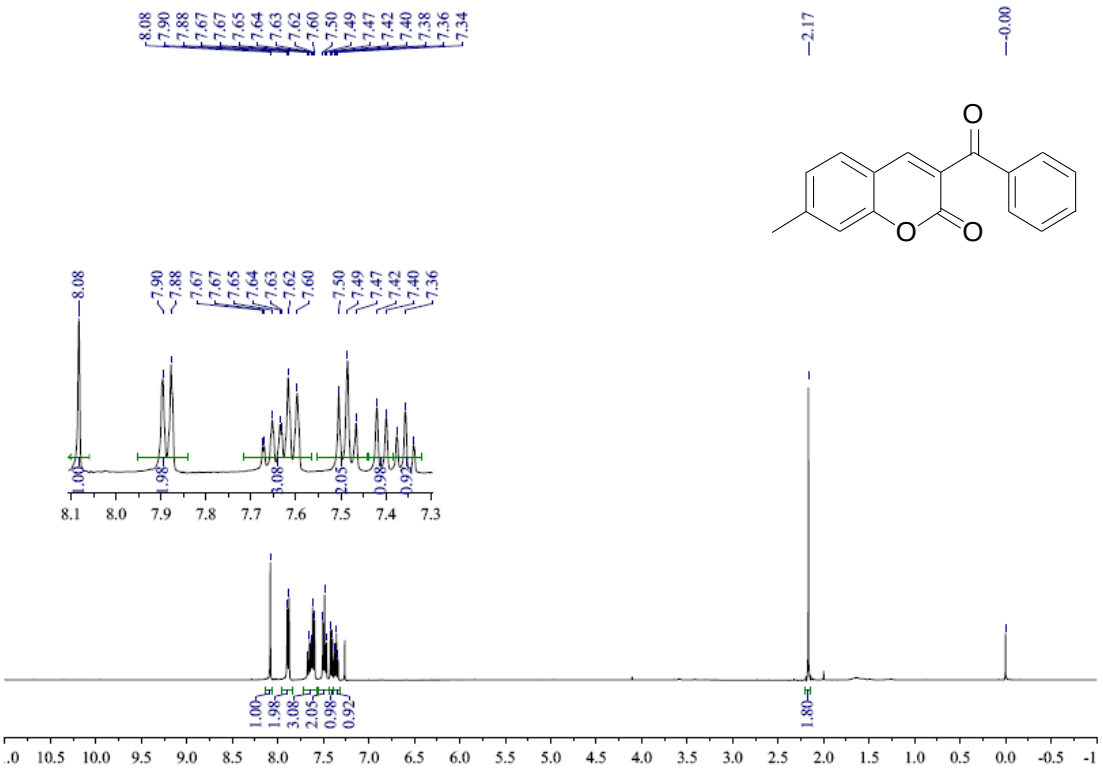

Figure S15. ^{1}H NMR spectrum (400 MHz, $CDCl_3$) of 3-benzoyl-7-methyl-chromen-2-one (**1h**)

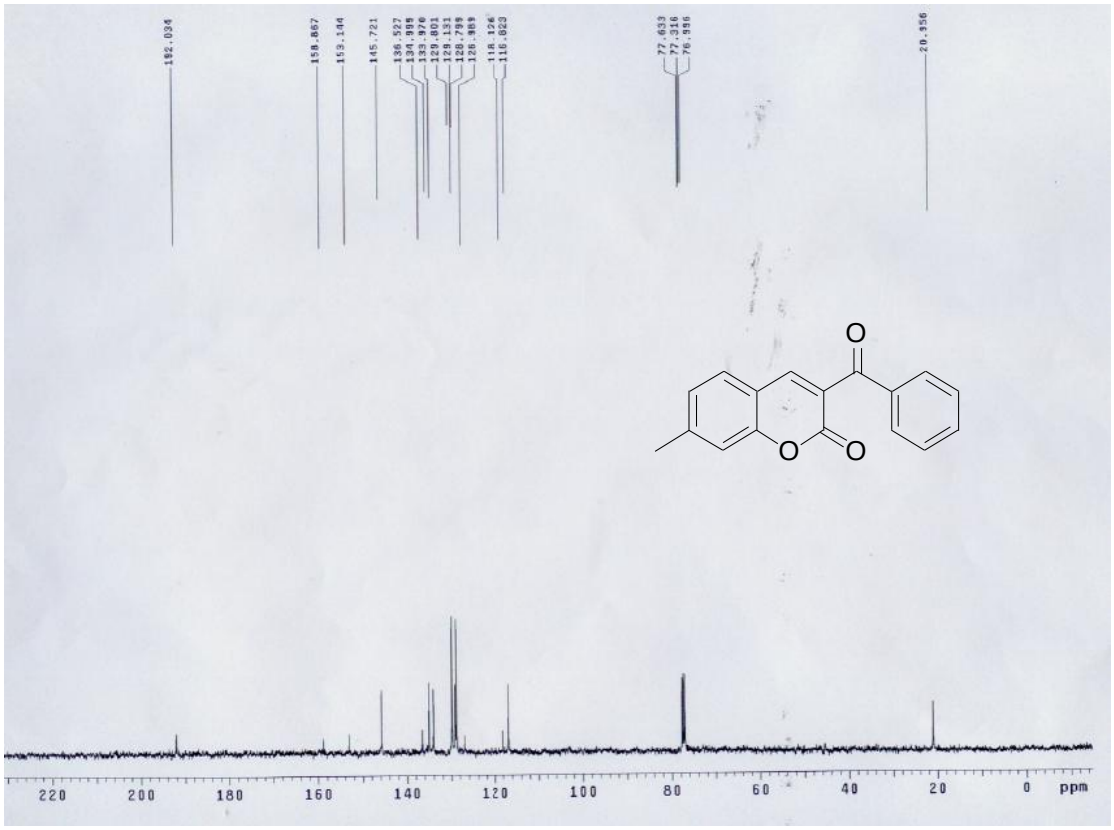

Figure S16. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of 3-benzoyl-7-methyl-chromen-2-one (**1h**)

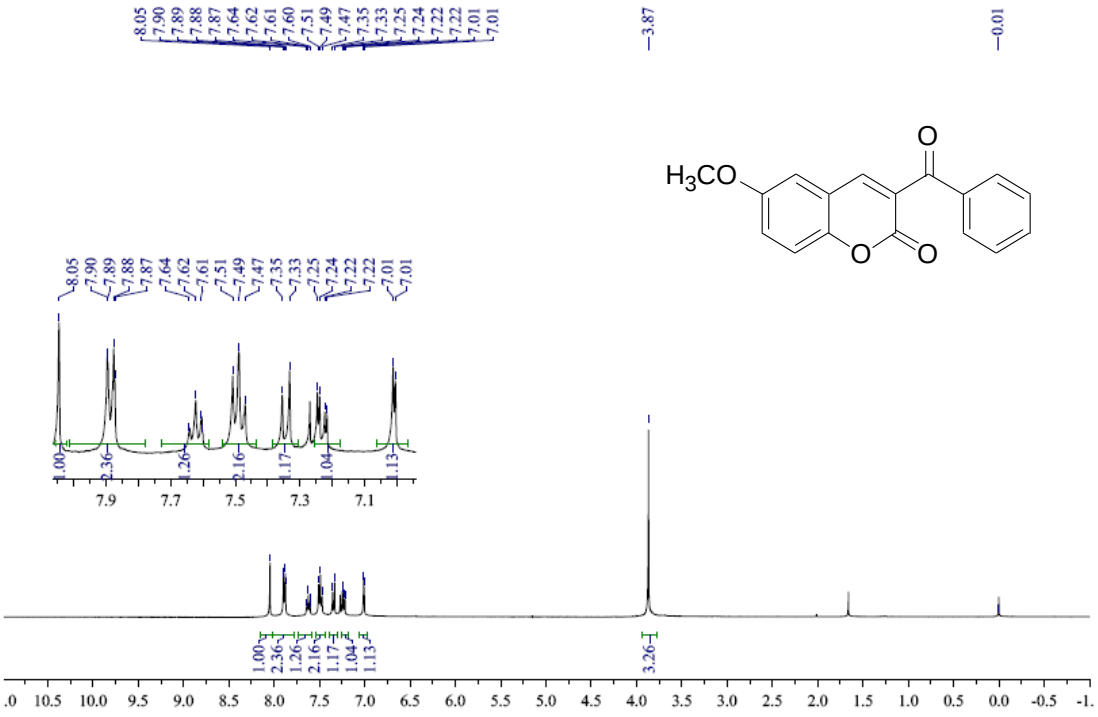

Figure S17. ^{1}H NMR spectrum (400 MHz, $CDCl_3$) of 3-benzoyl-6-methoxy-chromen-2-one (**1i**)

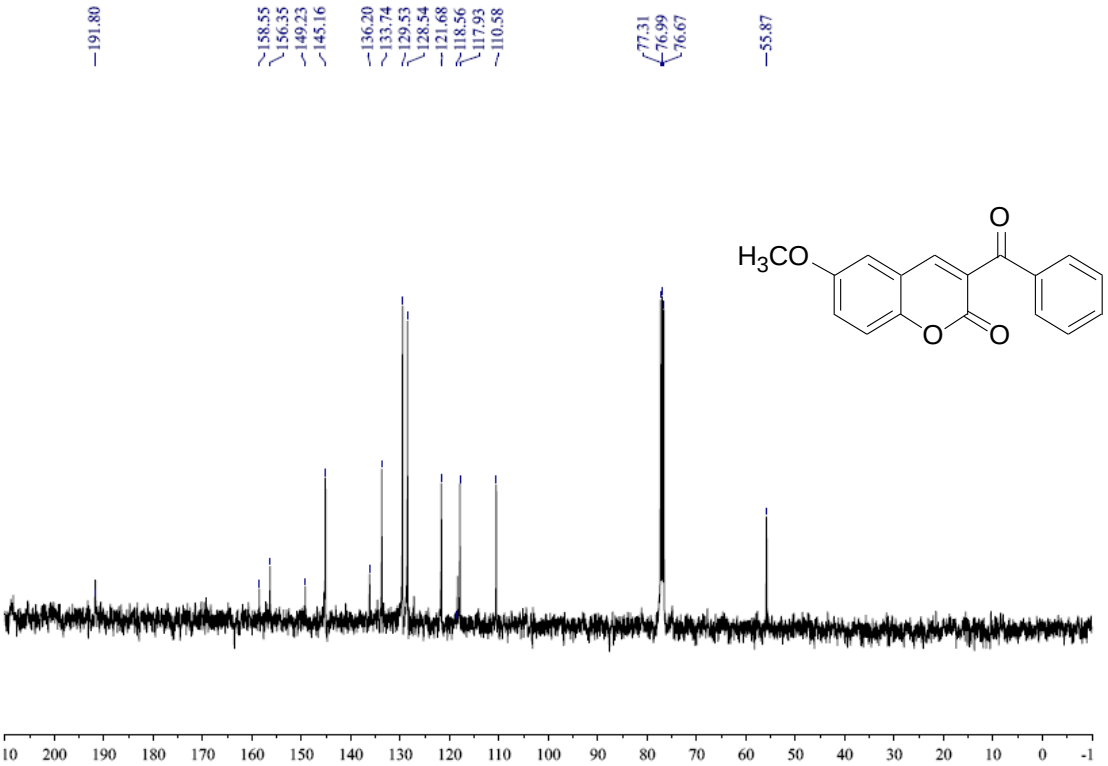

Figure S18. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of 3-benzoyl-6-methoxy-chromen-2-one (**1i**)

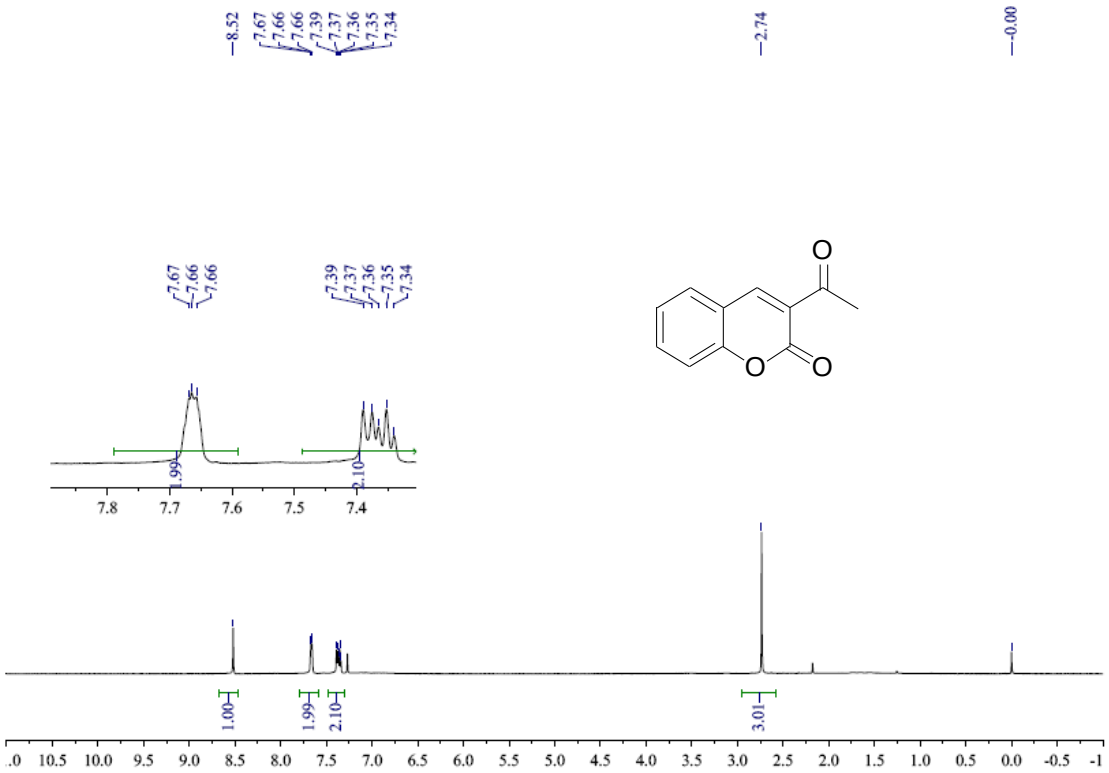

Figure S19. ^{1}H NMR spectrum (600 MHz, $CDCl_3$) of 3-acetyl-chromen-2-one (**1j**)

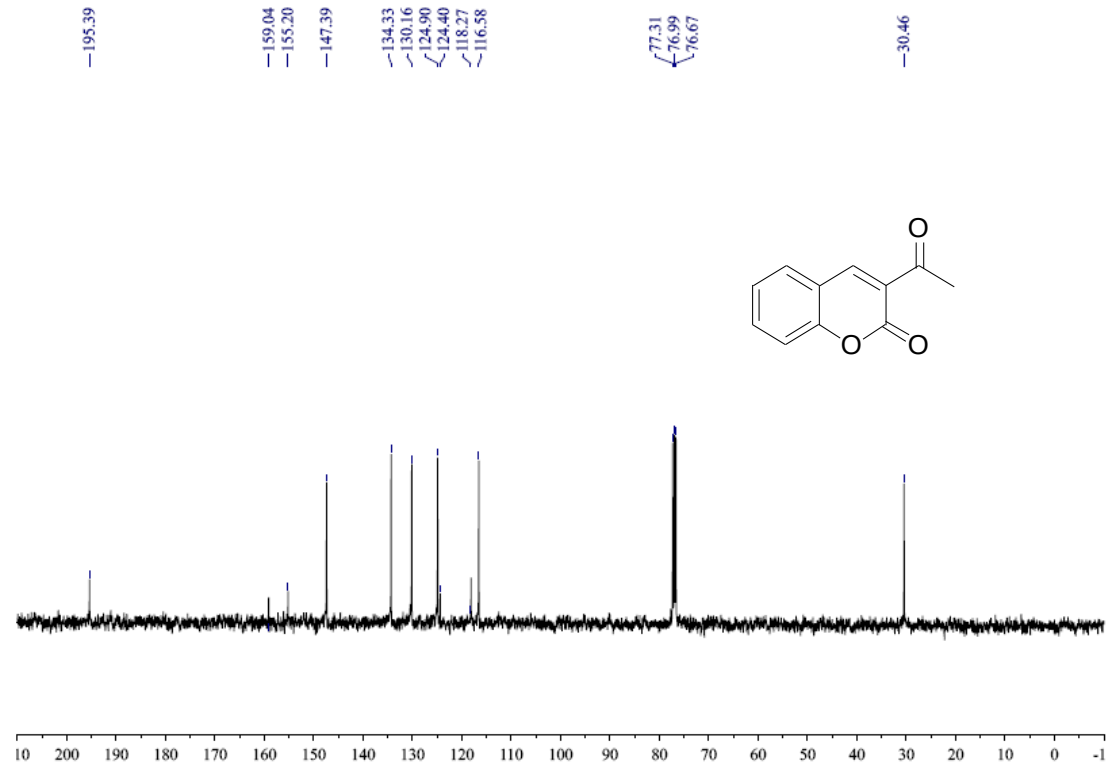

Figure S20. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of 3-acetyl-chromen-2-one (**1j**)

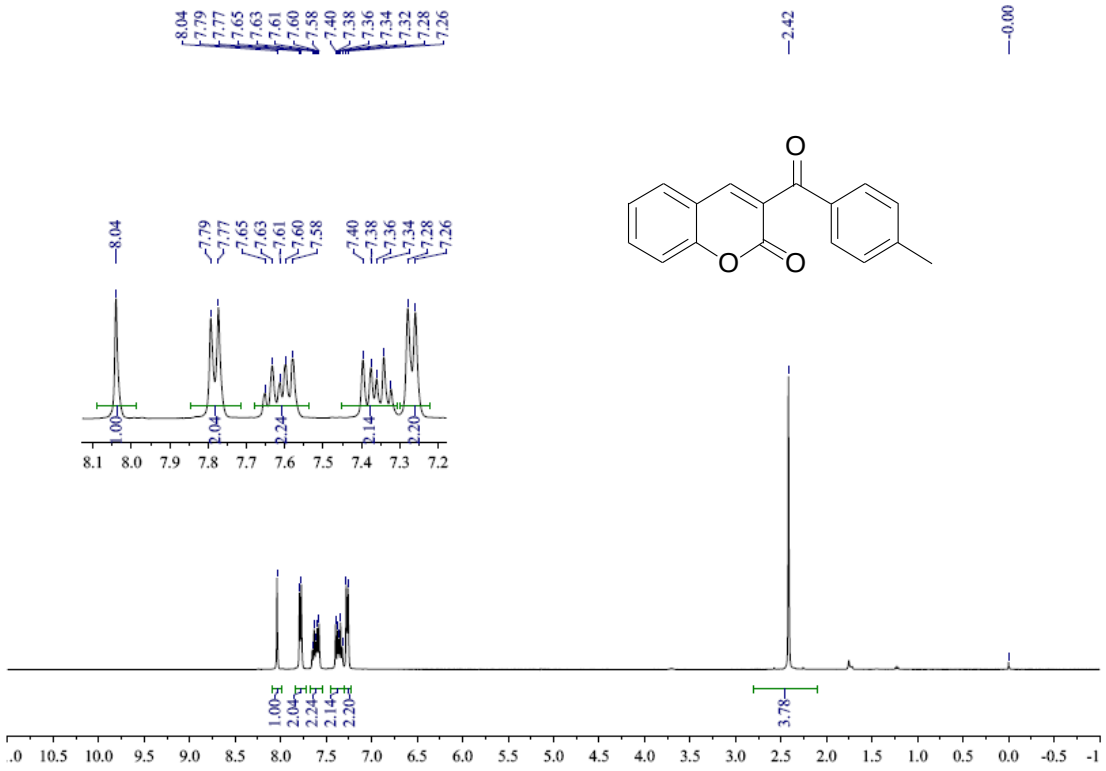

Figure S21. ^{1}H NMR spectrum (400 MHz, $CDCl_3$) of 3-(4-methylbenzoyl)-chromen-2-one (**1k**)

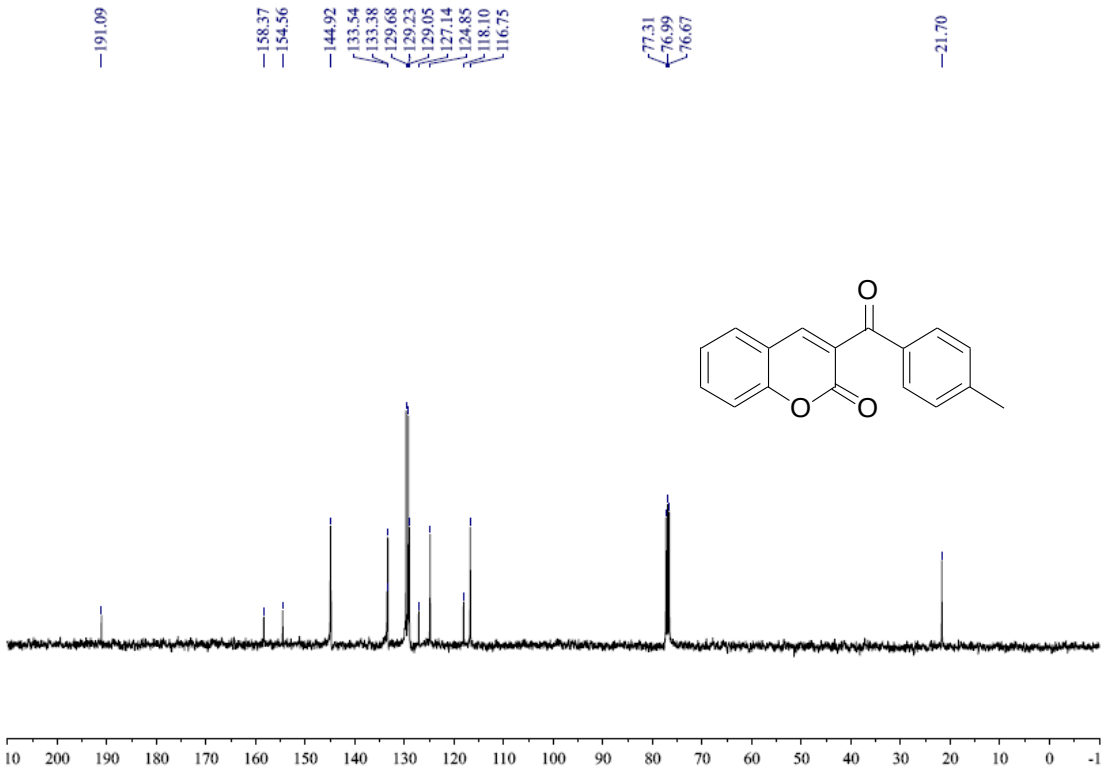

Figure S22. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of 3-(4-methylbenzoyl)-chromen-2-one (**1k**)

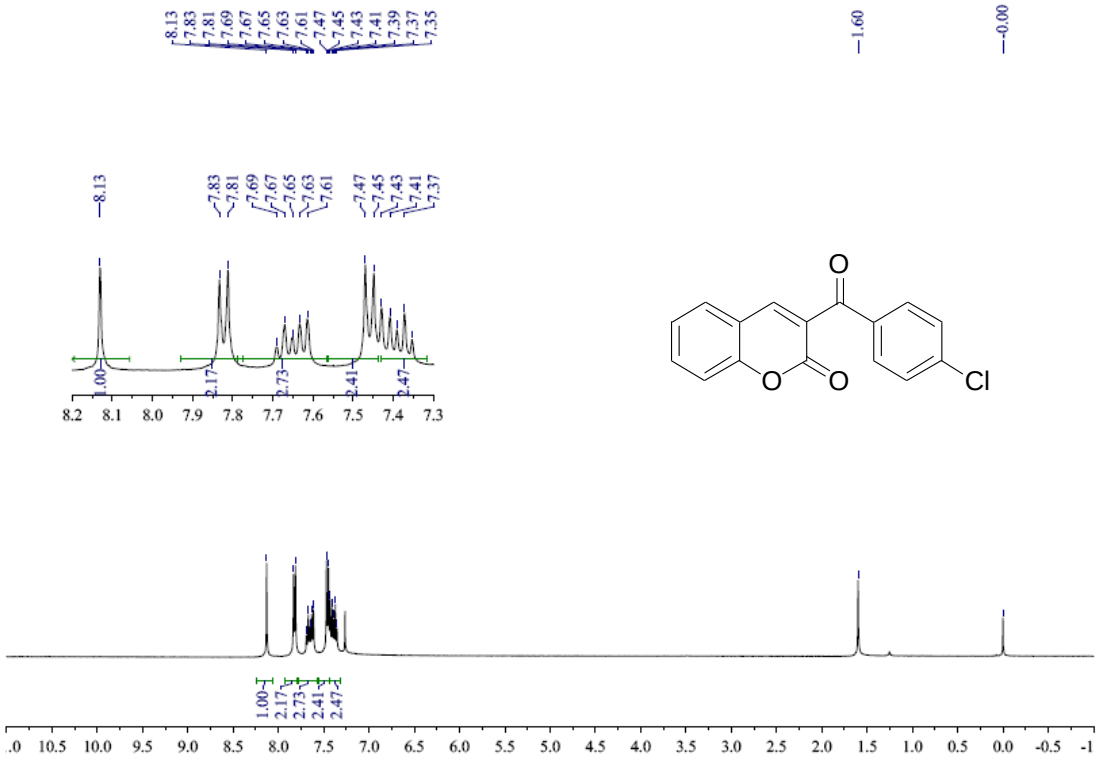

Figure S23. ^{1}H NMR spectrum (400 MHz, $CDCl_3$) of 3-(4-chlorolbenzoyl)-chromen-2-one (**1l**)

^{1}H, ^{13}C NMR-spectra of **2**

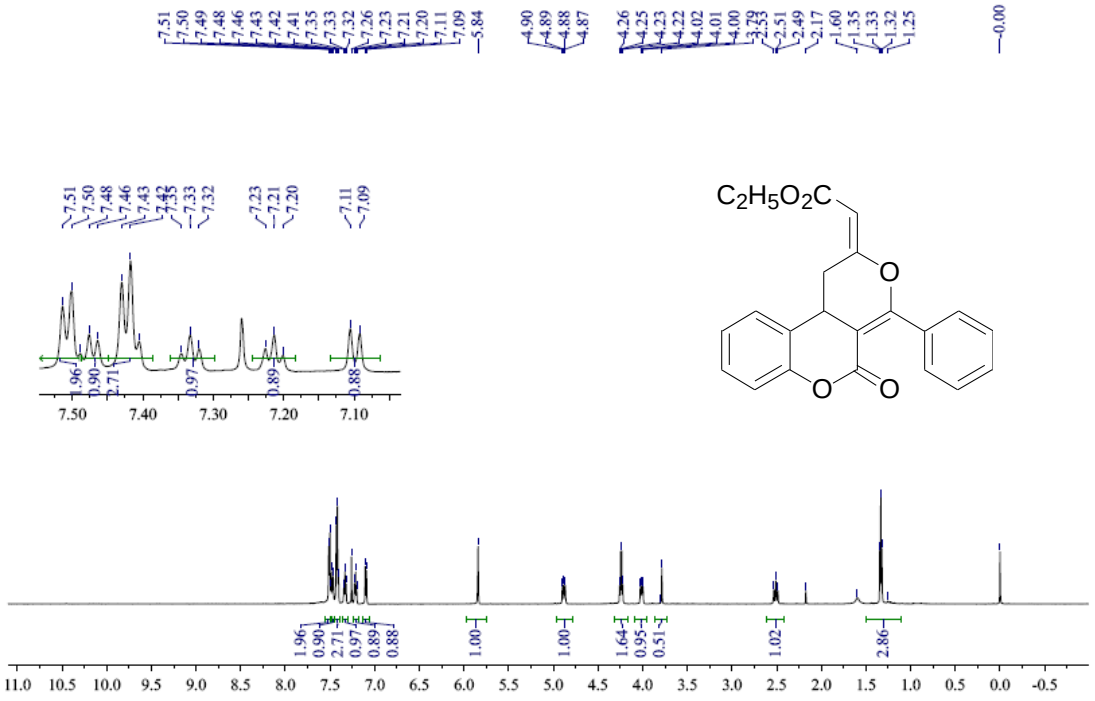

Figure S1. ^{1}H NMR spectrum (600 MHz, $CDCl_3$) of **2a**

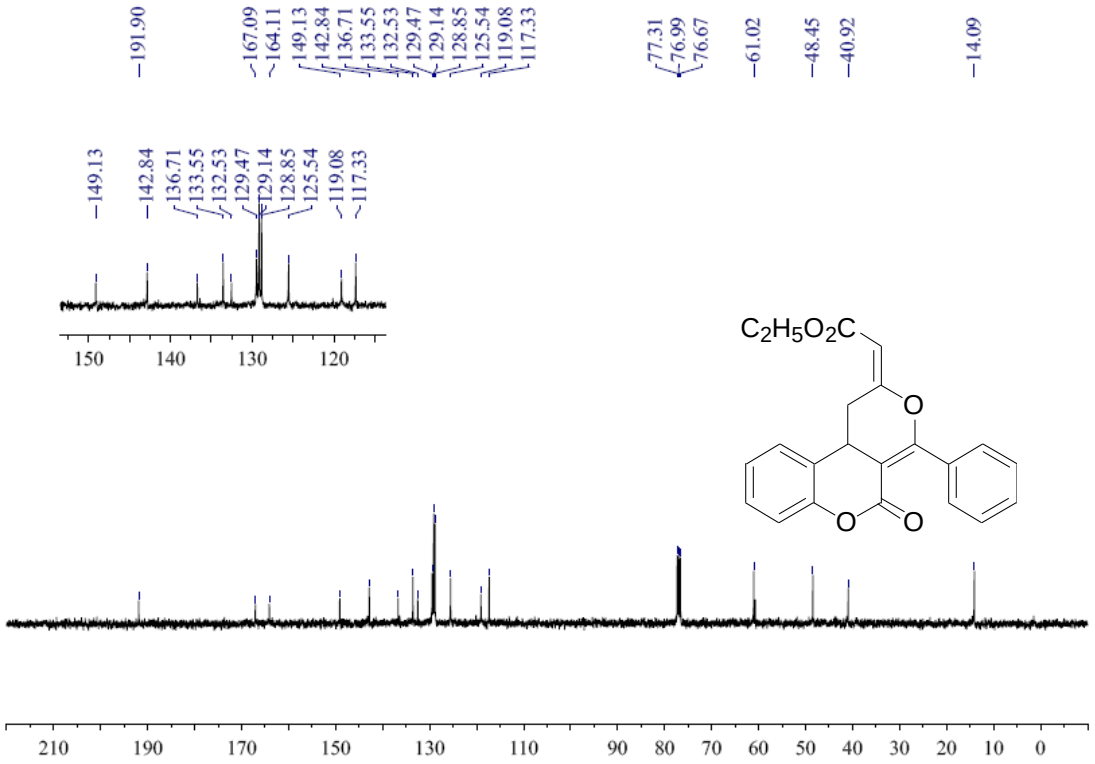

Figure S2. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of **2a**

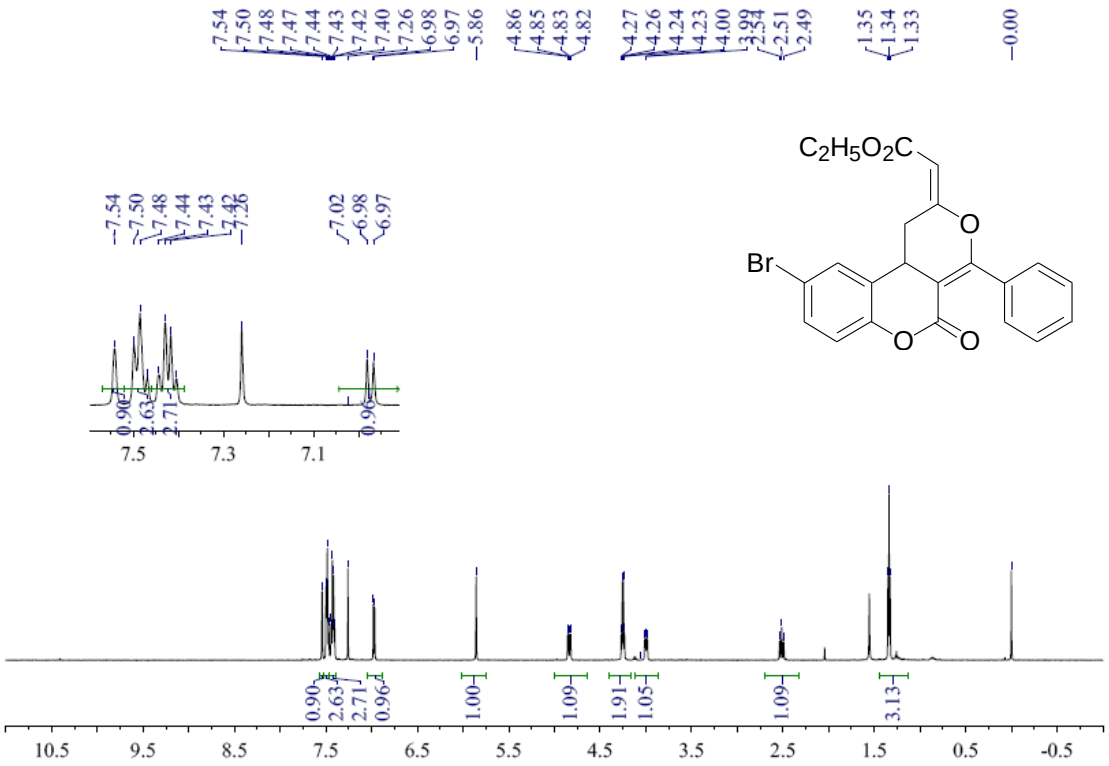

Figure S3. ^{1}H NMR spectrum (600 MHz, $CDCl_3$) of **2b**

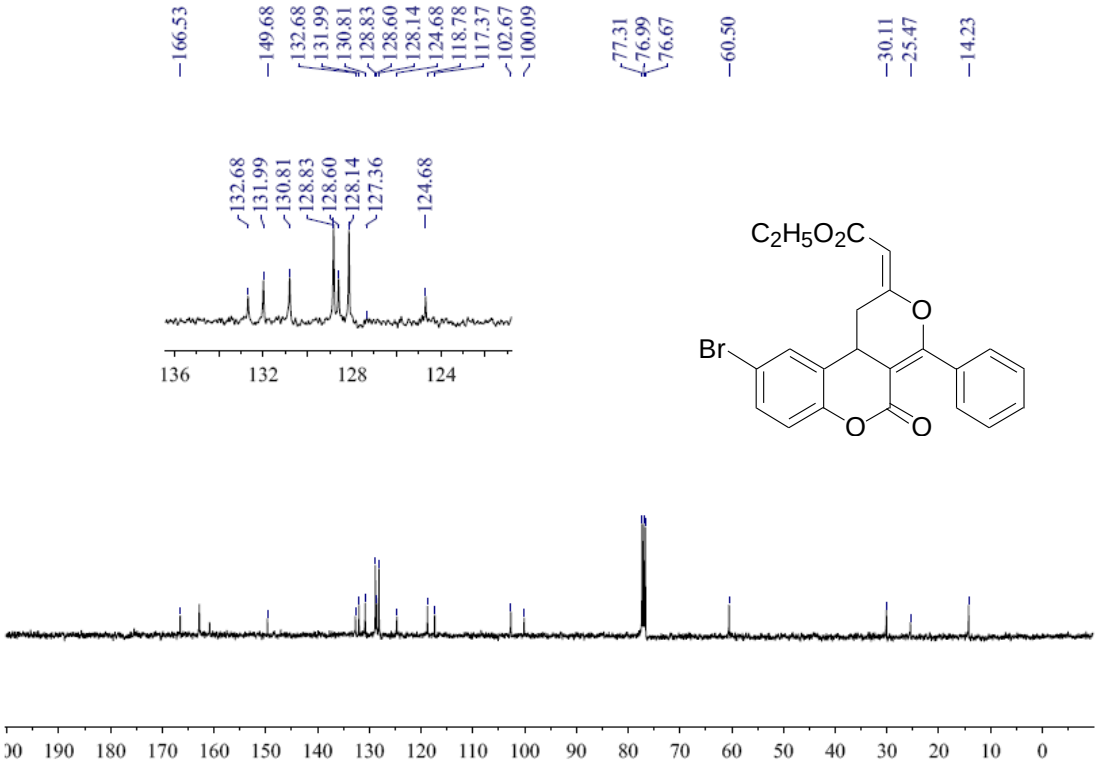

Figure S4. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of **2b**

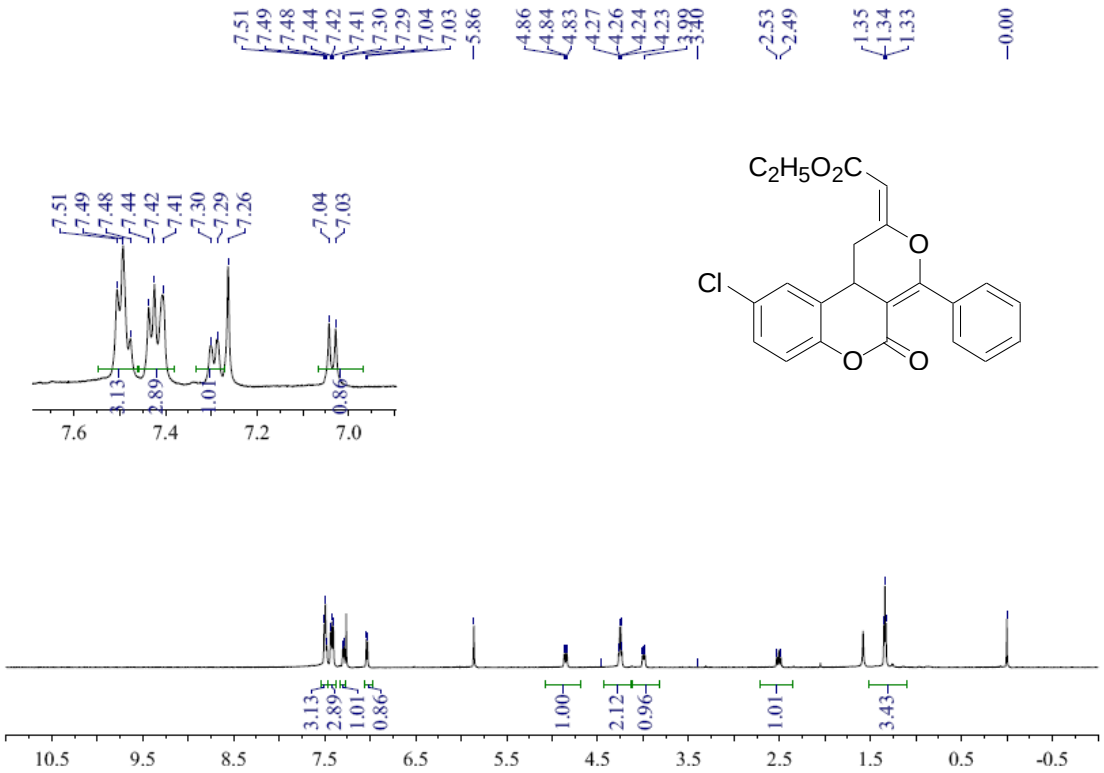

Figure S5. ^{1}H NMR spectrum (600 MHz, $CDCl_3$) of **2c**

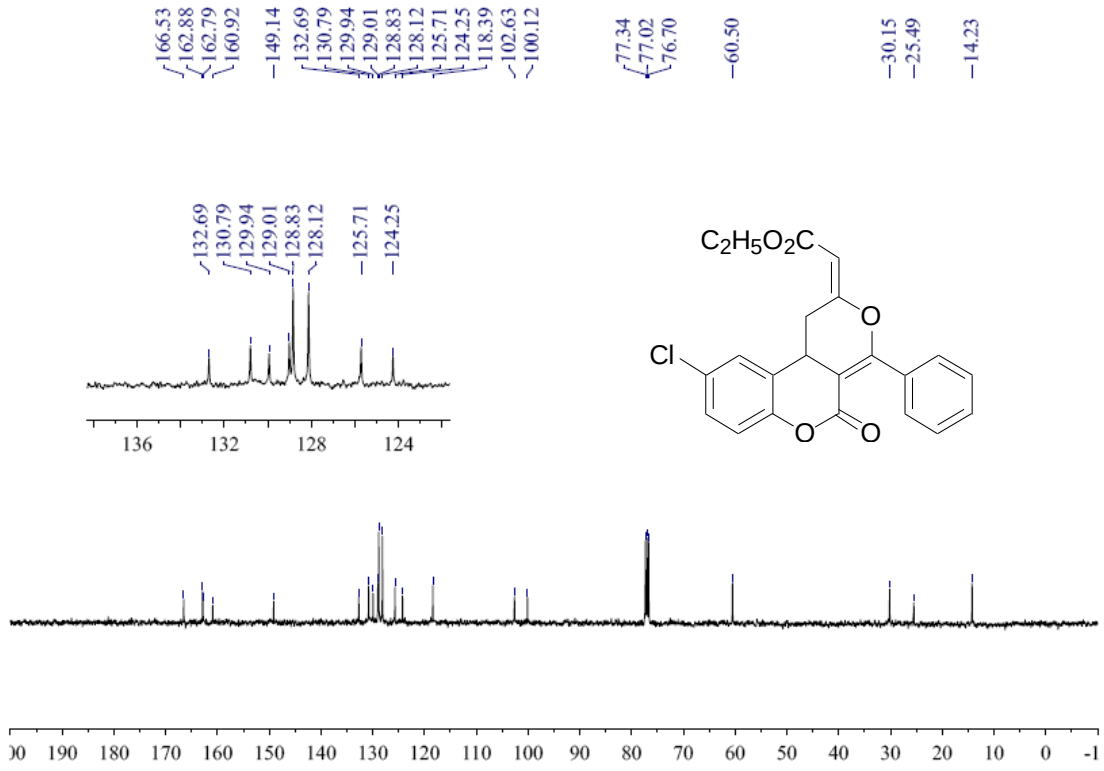

Figure S6. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of **2c**

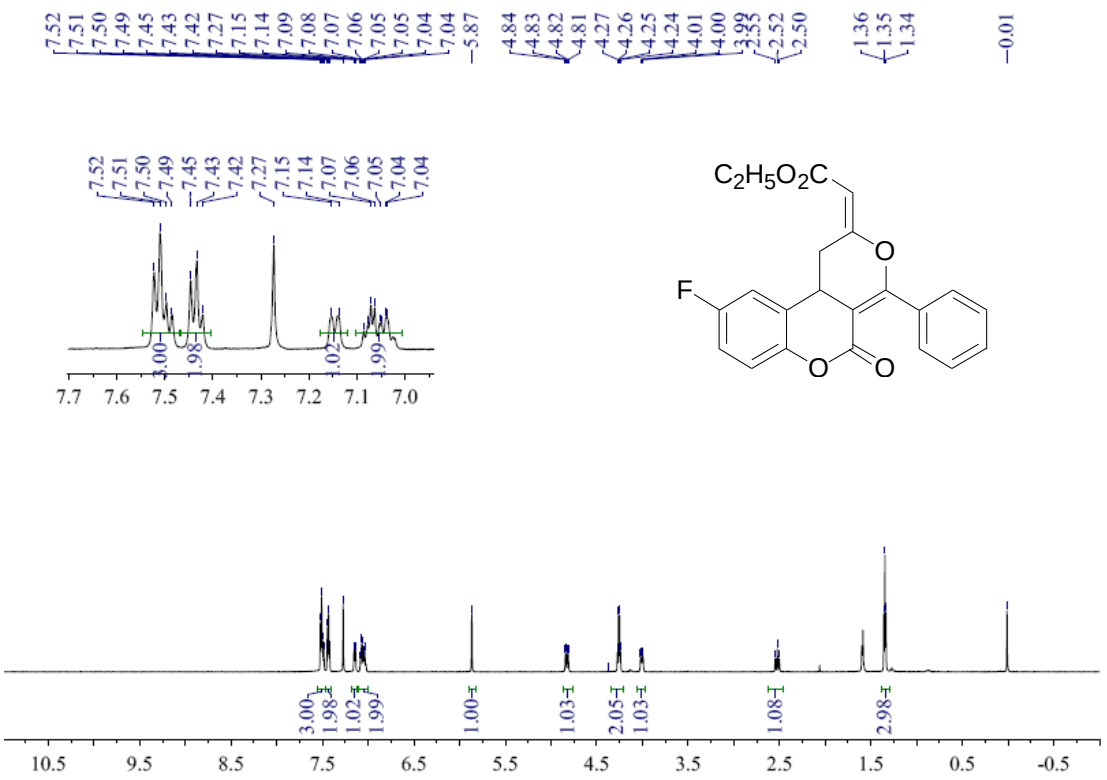

Figure S7. ^{1}H NMR spectrum (600 MHz, $CDCl_3$) of **2d**

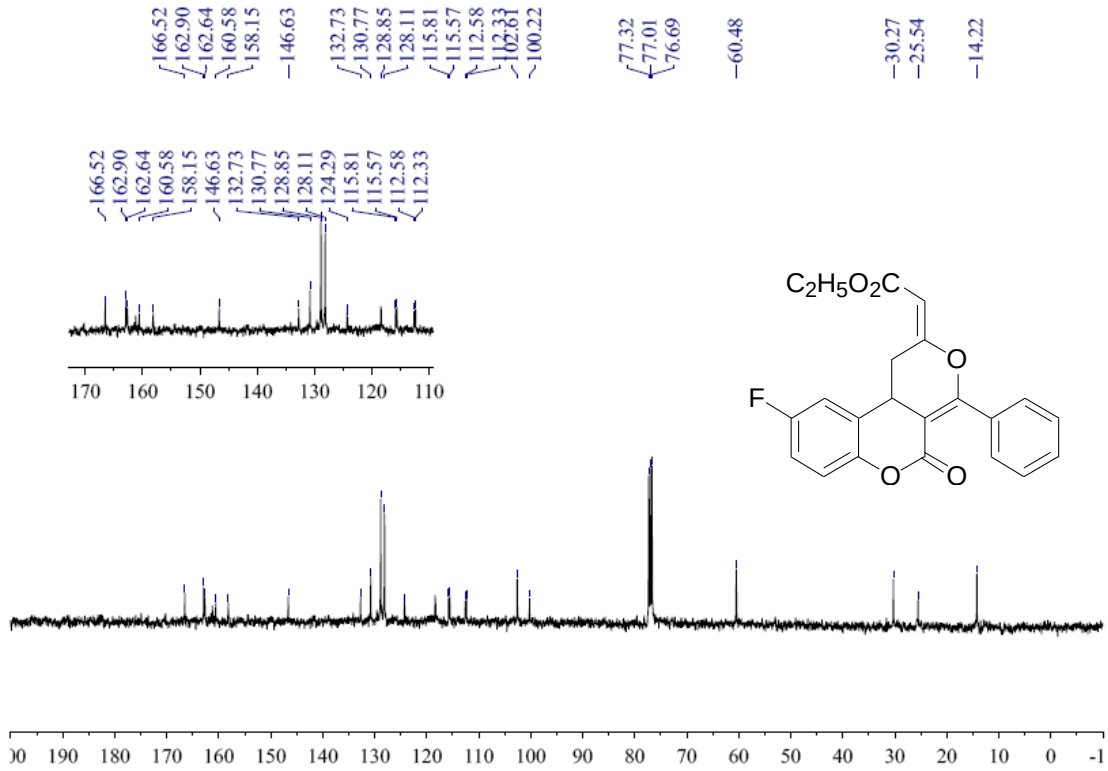

Figure S8. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of **2d**

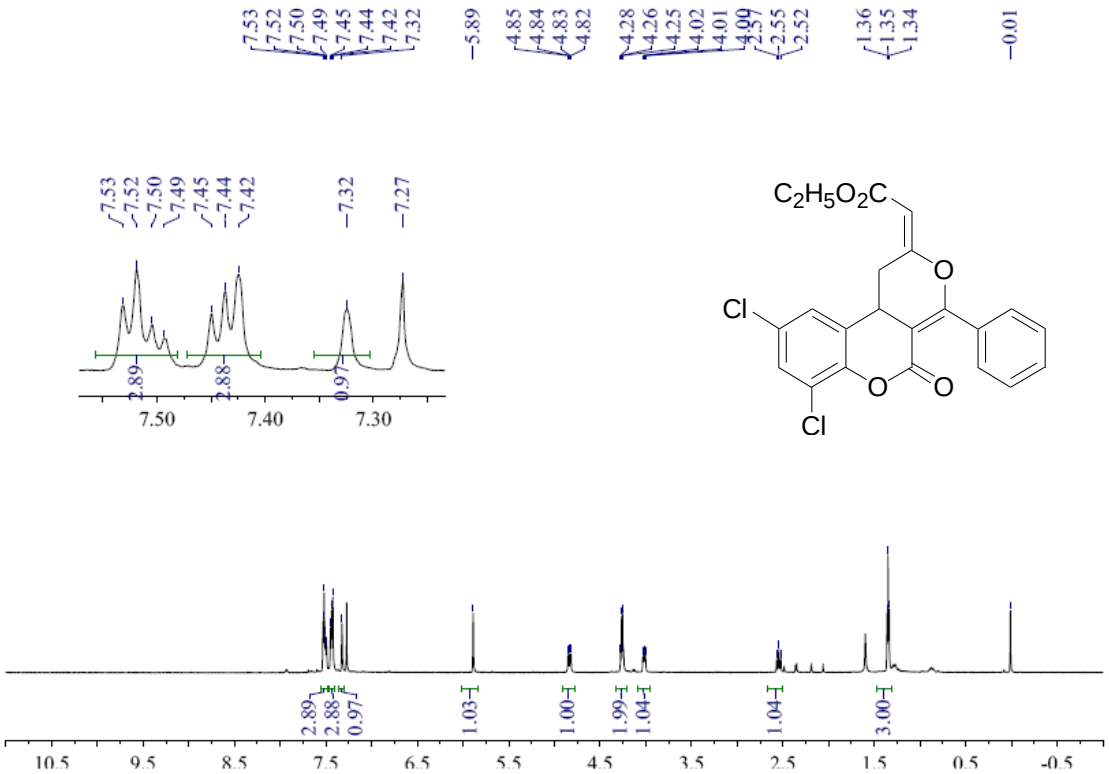

Figure S9. ^{1}H NMR spectrum (600 MHz, $CDCl_3$) of **2e**

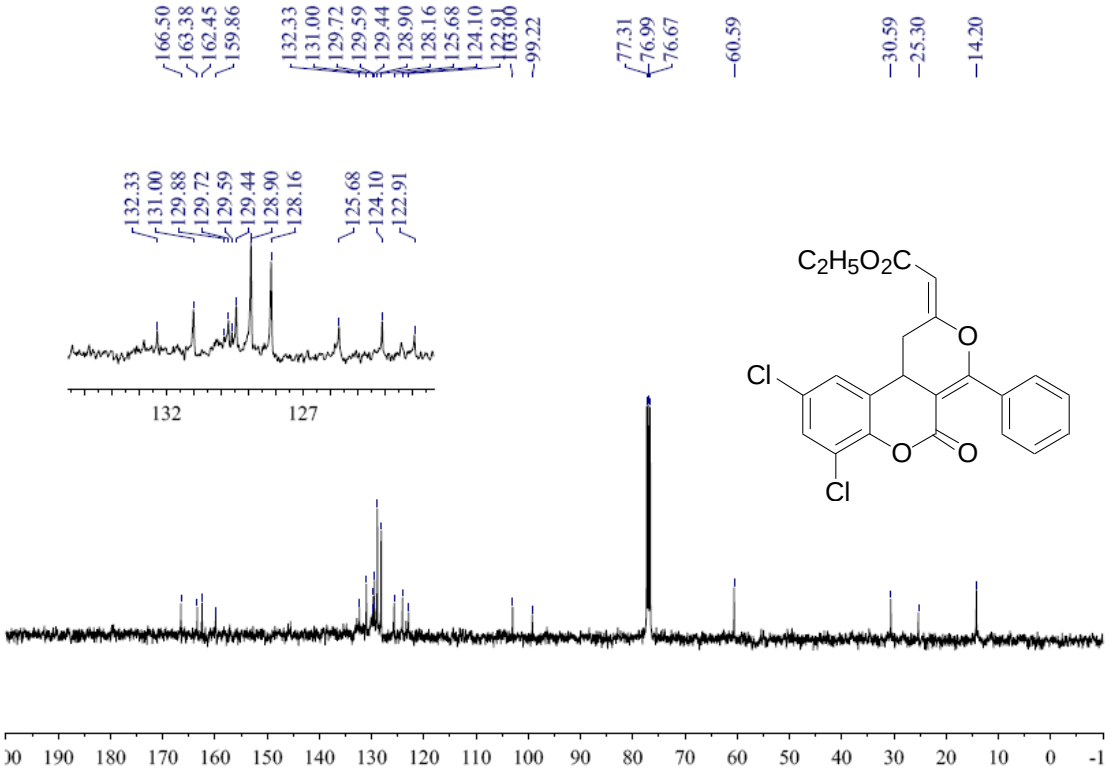

Figure S10. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of **2e**

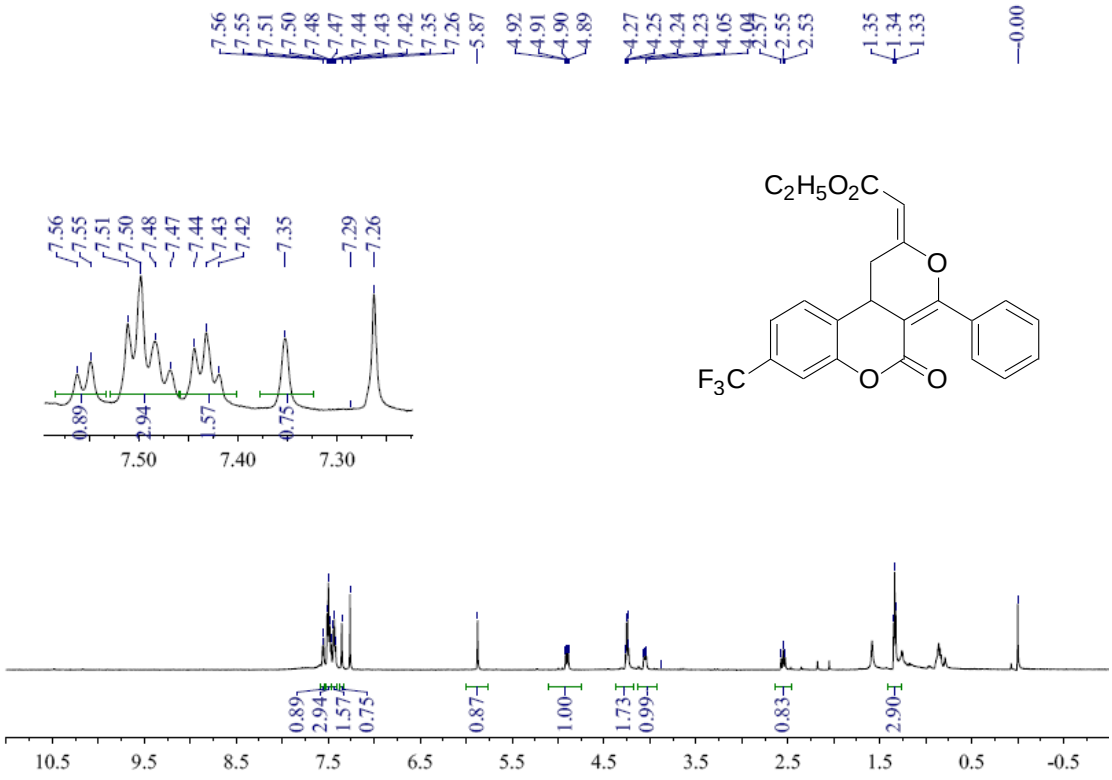

Figure S11. ^{1}H NMR spectrum (600 MHz, $CDCl_3$) of **2f**

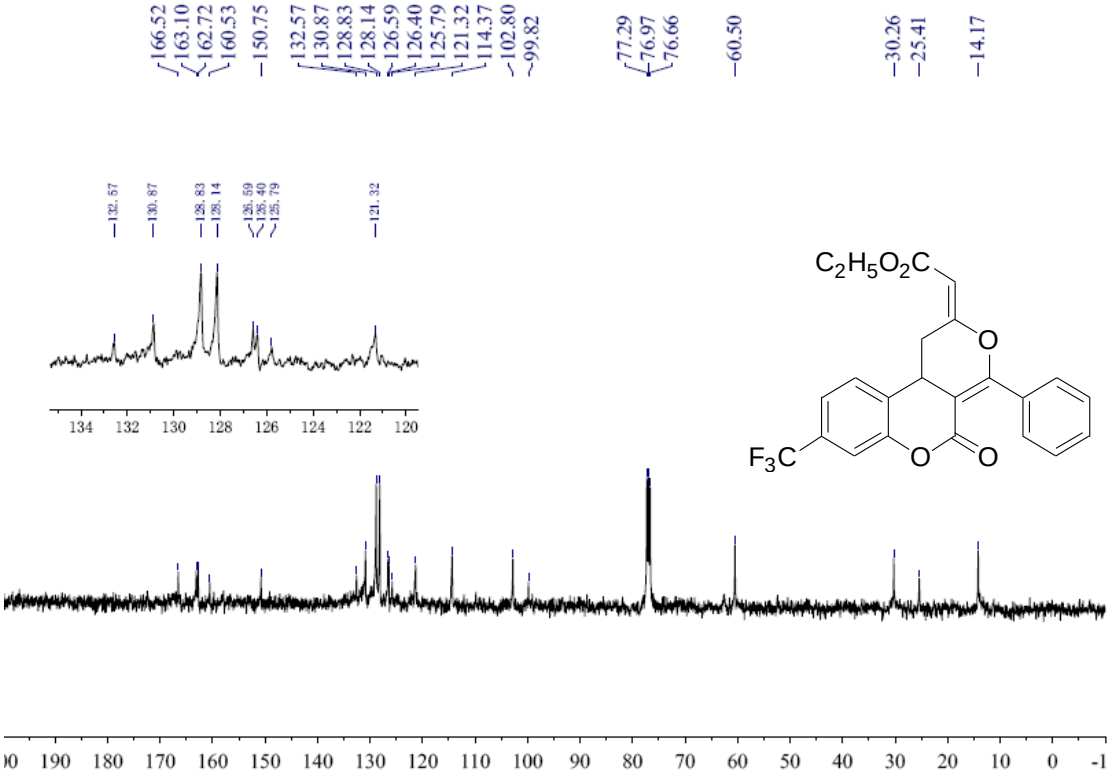

Figure S12. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of **2f**

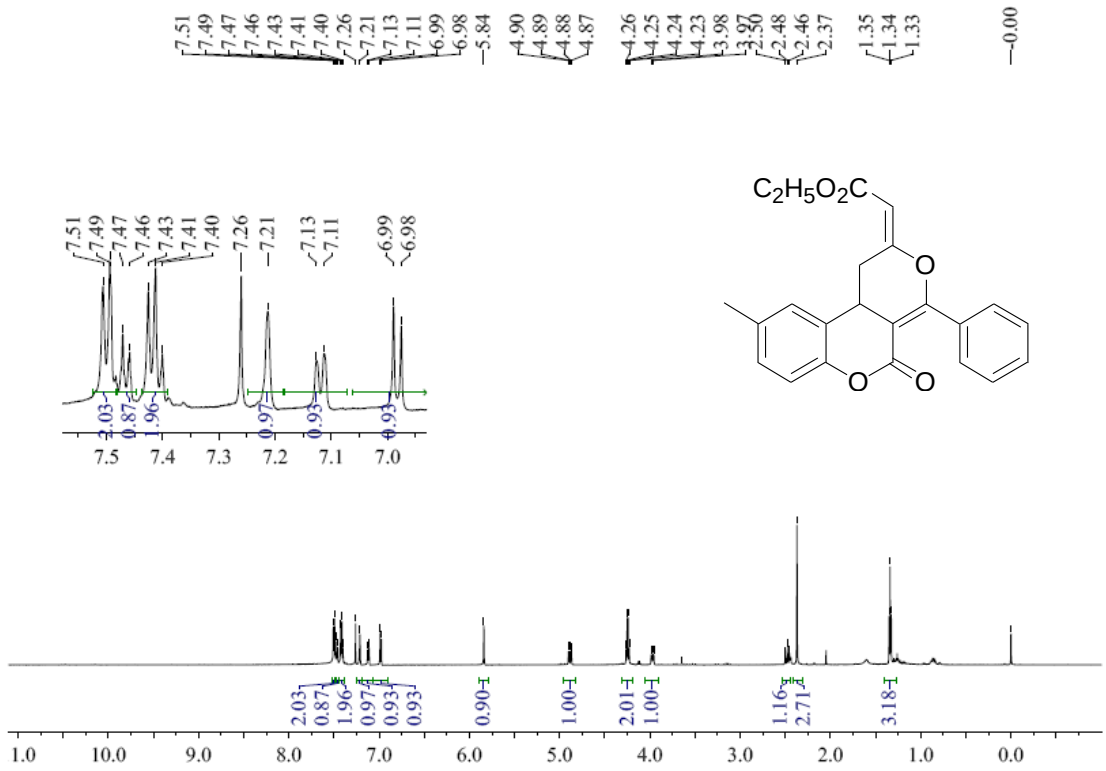

Figure S13. ^{1}H NMR spectrum (600 MHz, $CDCl_3$) of **2g**

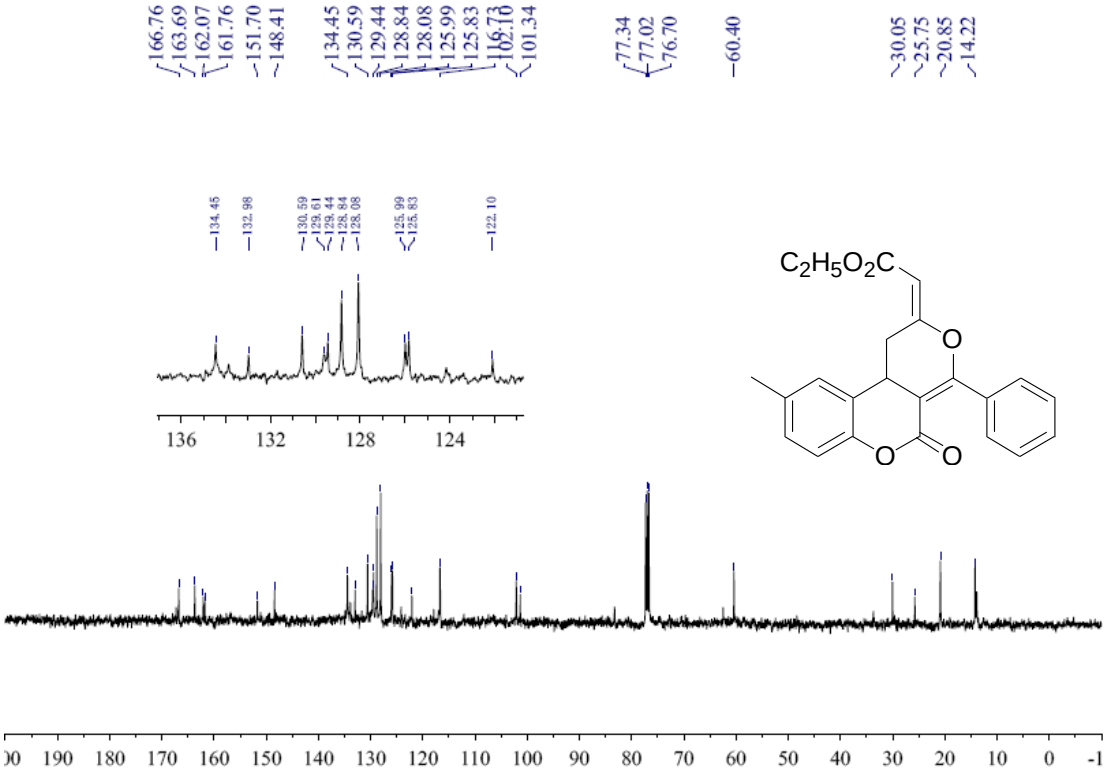

Figure S14. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of **2g**

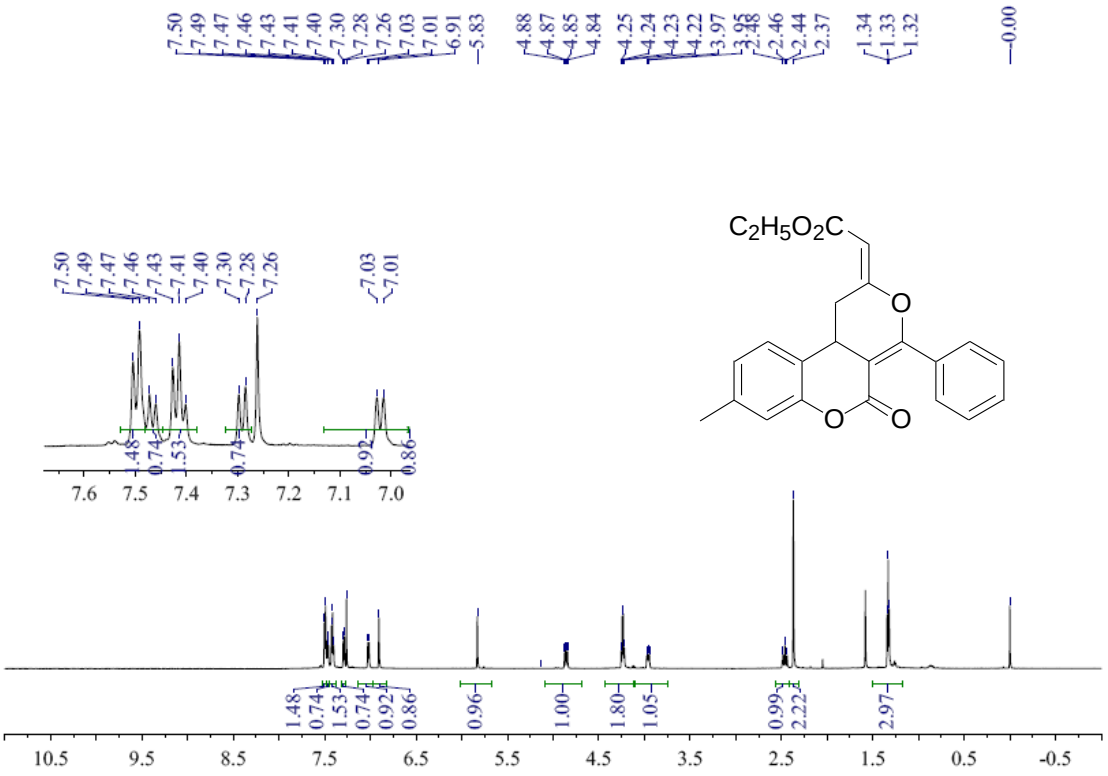

Figure S15. ^{1}H NMR spectrum (600 MHz, $CDCl_3$) of **2h**

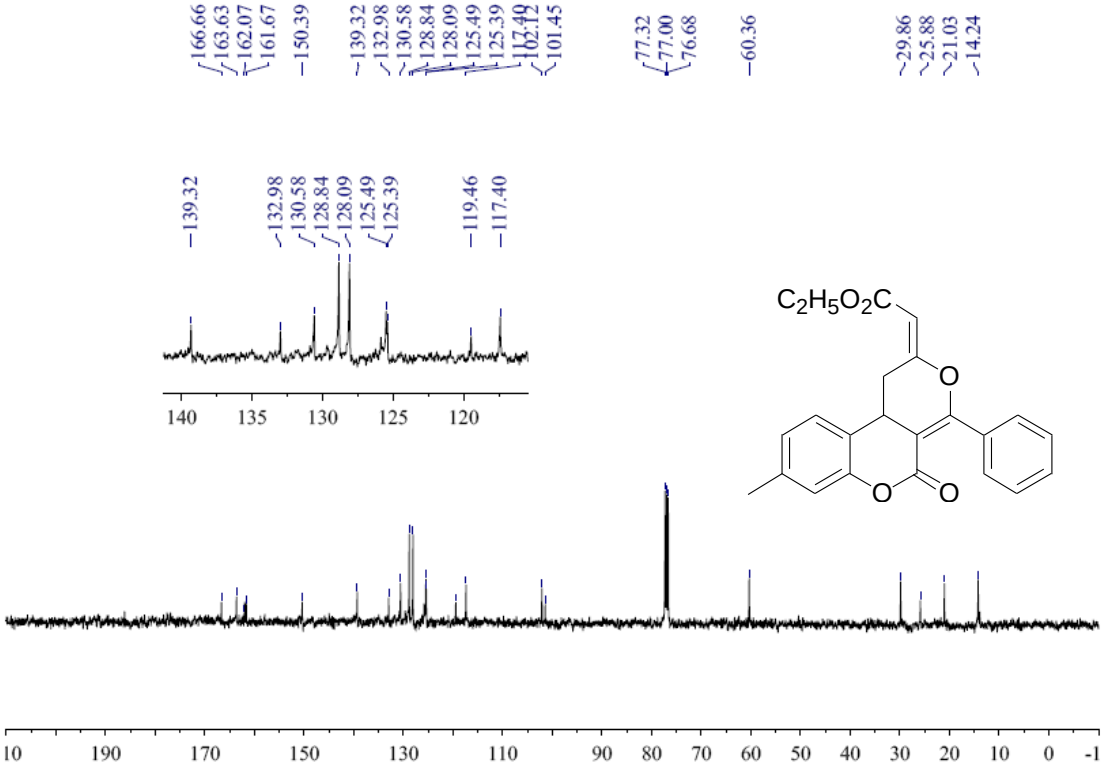

Figure S16. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of **2h**

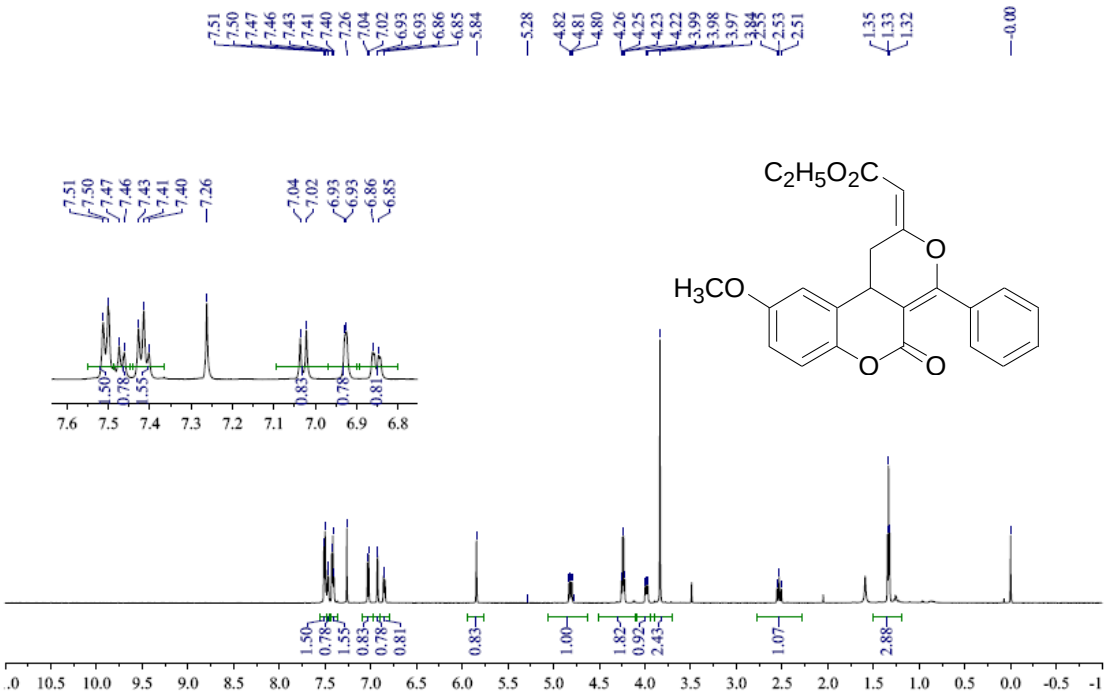

Figure S17. ^{1}H NMR spectrum (600 MHz, $CDCl_3$) of **2i**

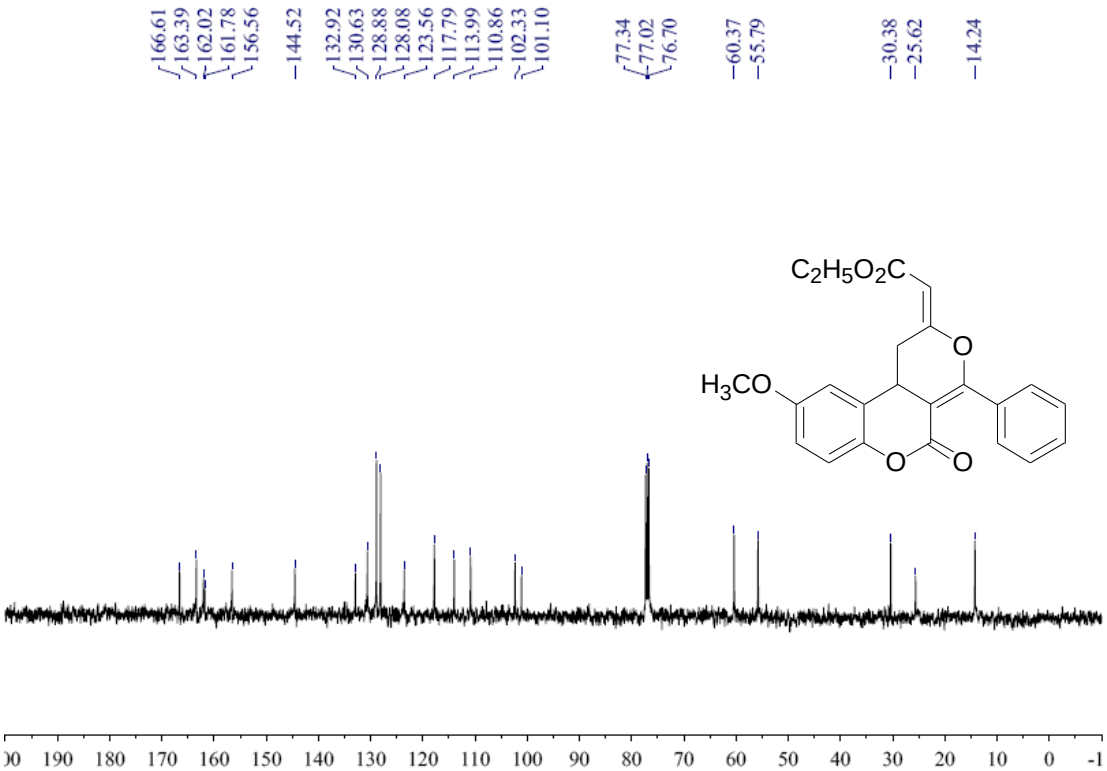

Figure S18. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of **2i**

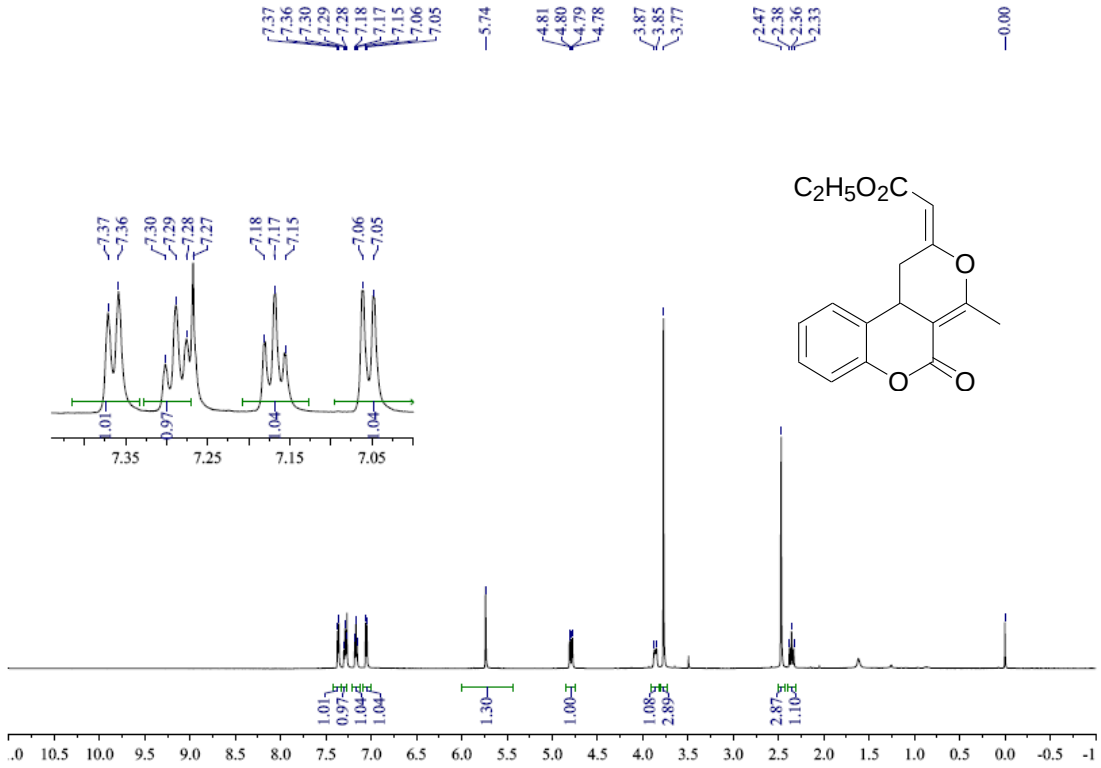

Figure S19. ^{1}H NMR spectrum (600 MHz, $CDCl_3$) of **2j**

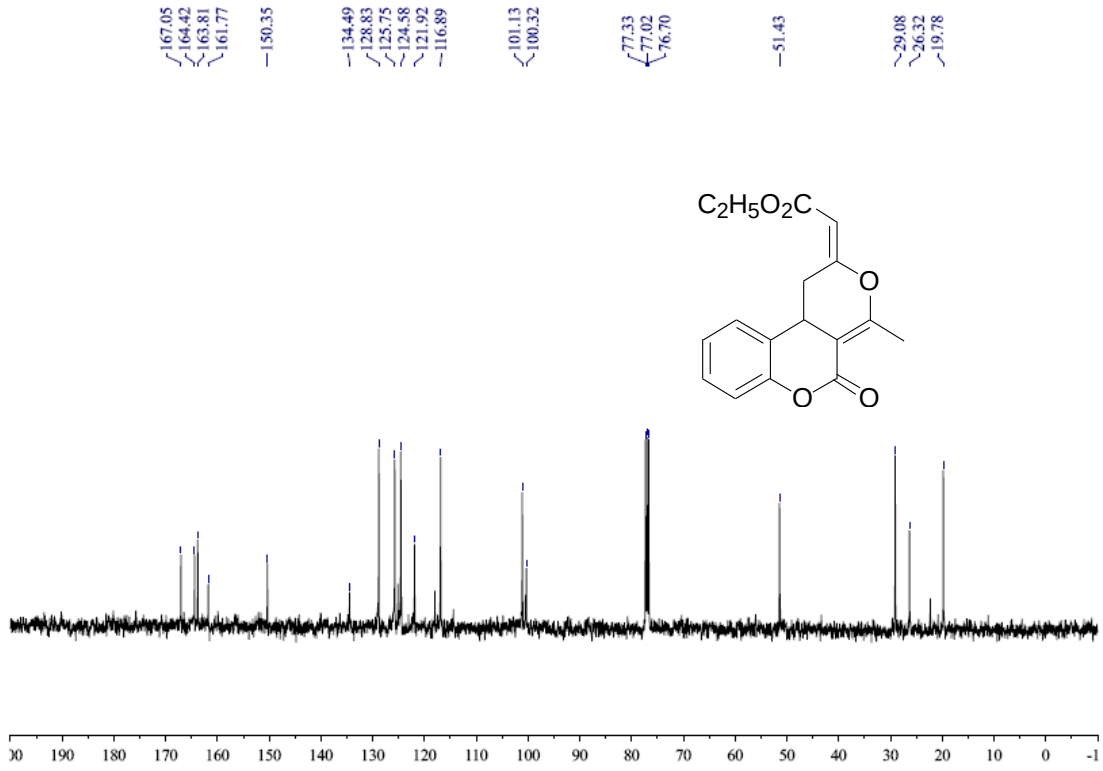

Figure S20. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of **2j**

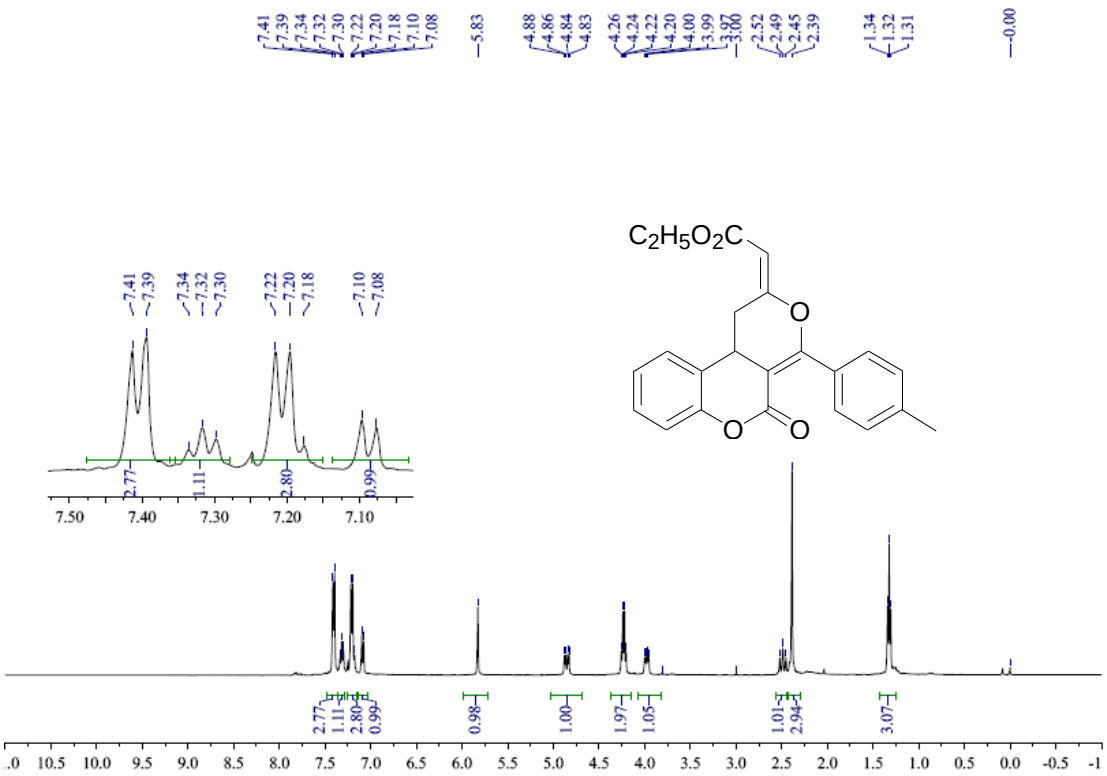

Figure S21. ^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **2k**

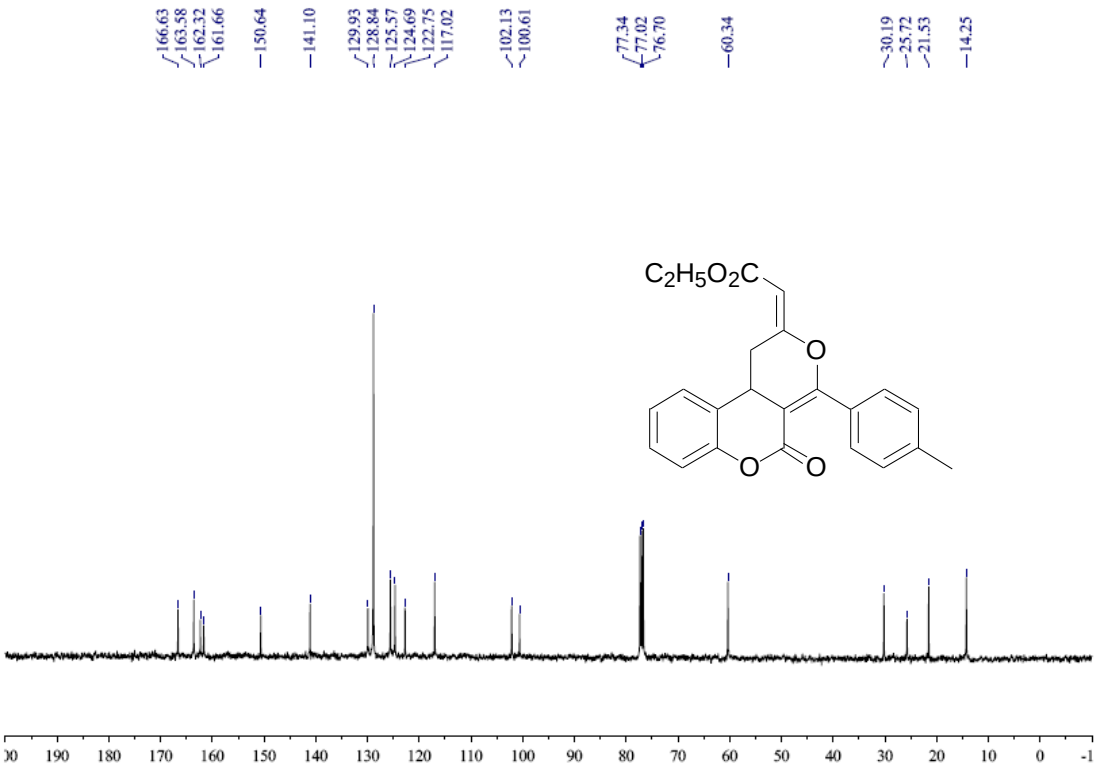

Figure S22. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of **2k**

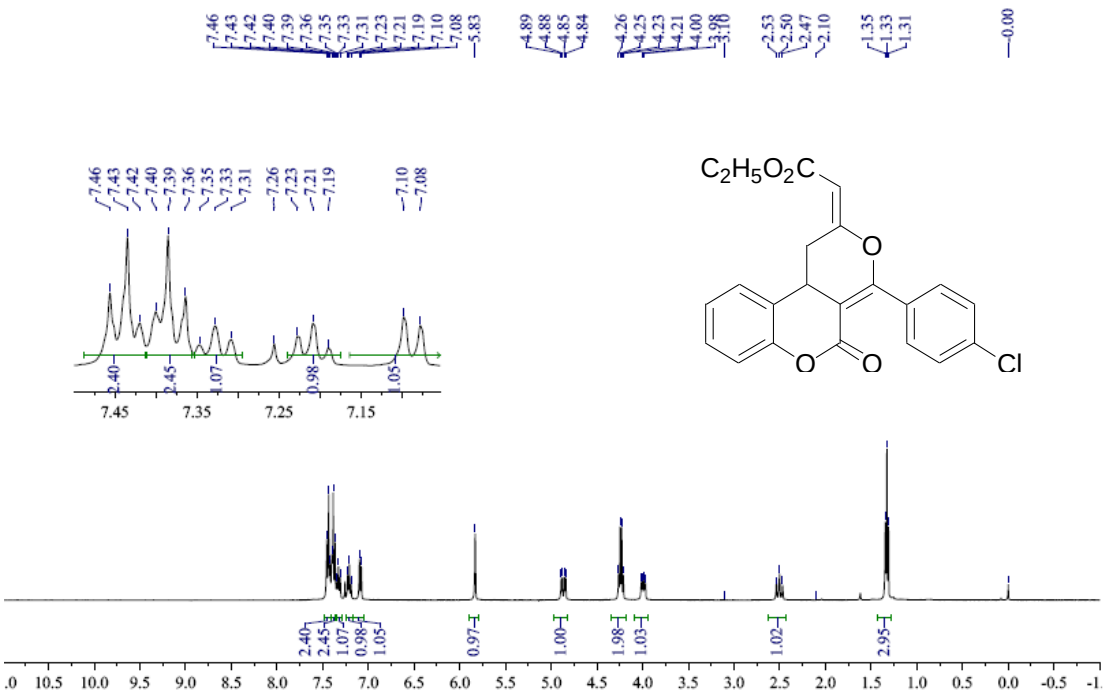

Figure S23. ^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **2l**

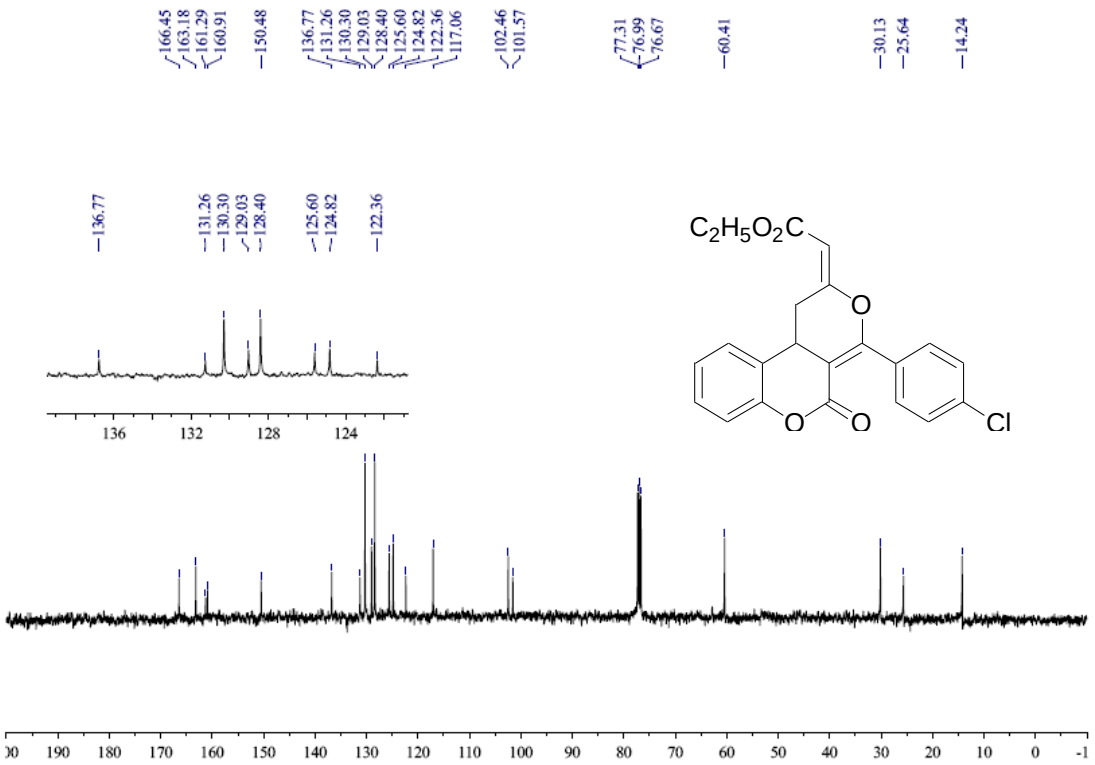

Figure S24. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of **2l**

^{1}H, ^{13}C NMR-spectra of **3**

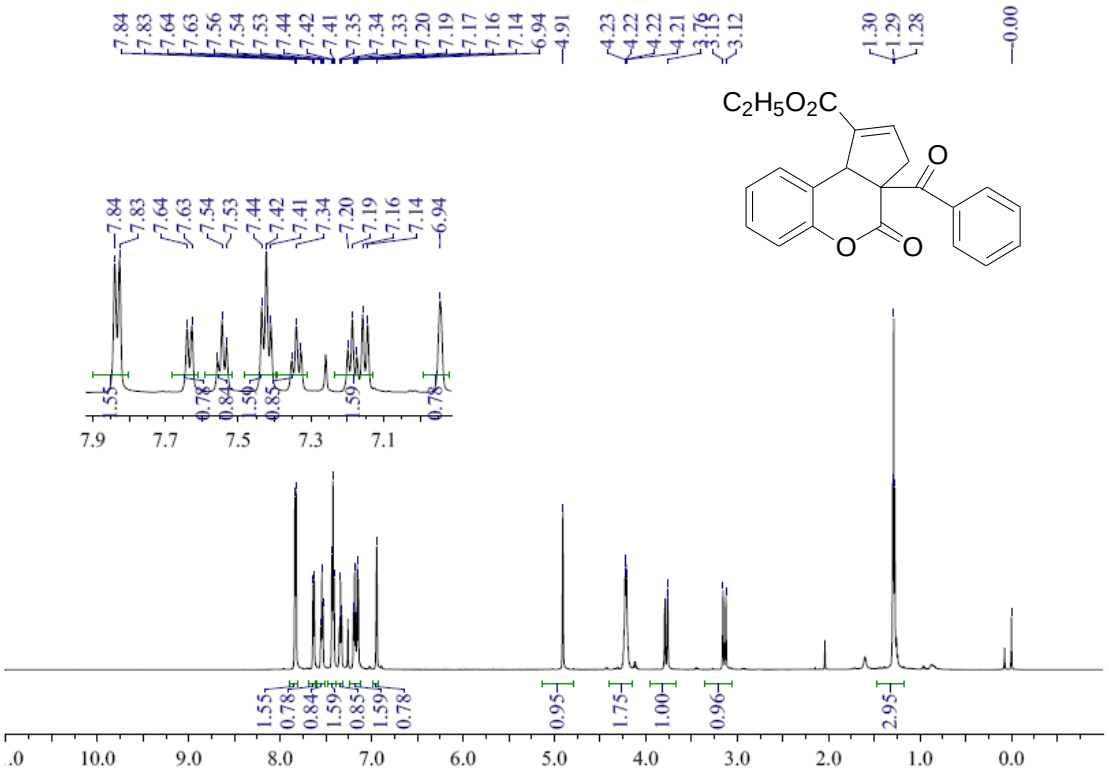

Figure S1. ^{1}H NMR spectrum (600 MHz, $CDCl_3$) of **3a**

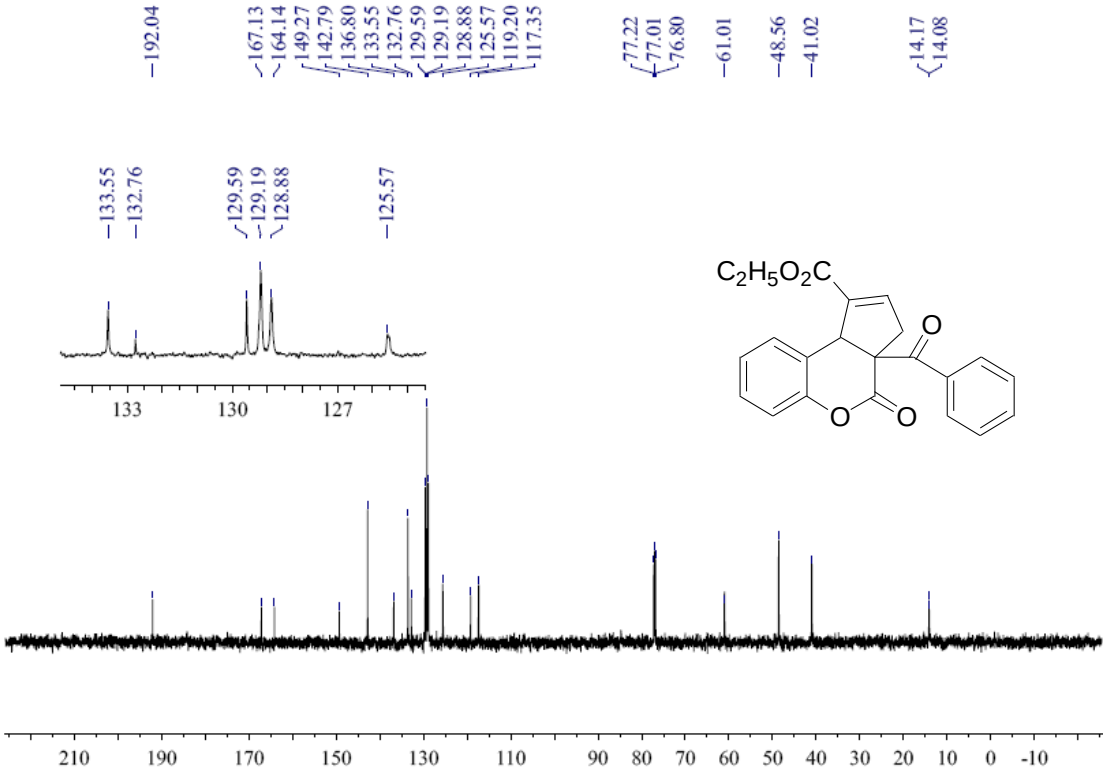

Figure S2. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of **3a**

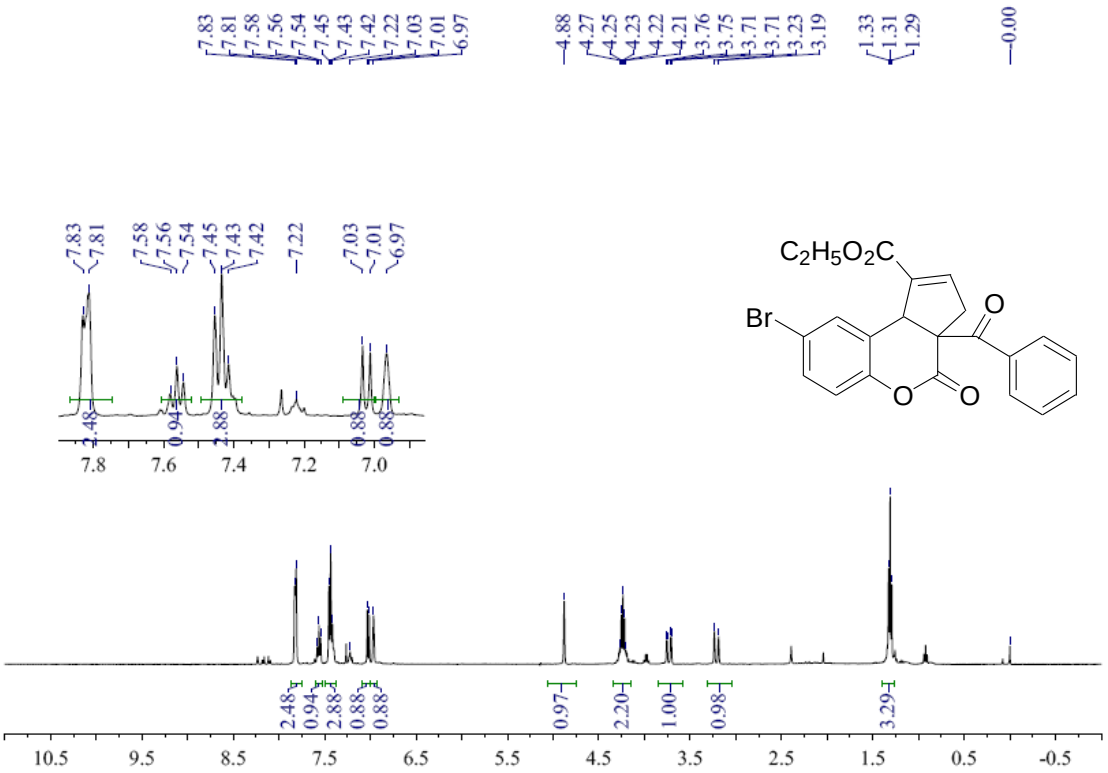

Figure S3. ^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **3b**

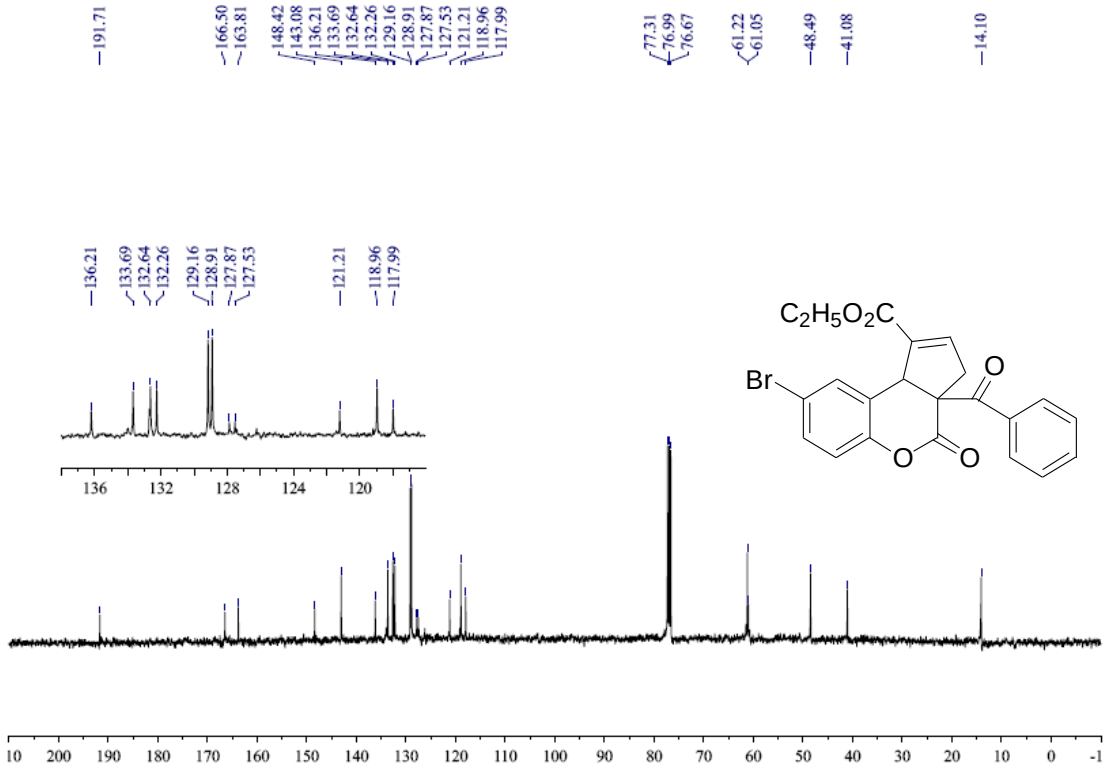

Figure S4. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of **3b**

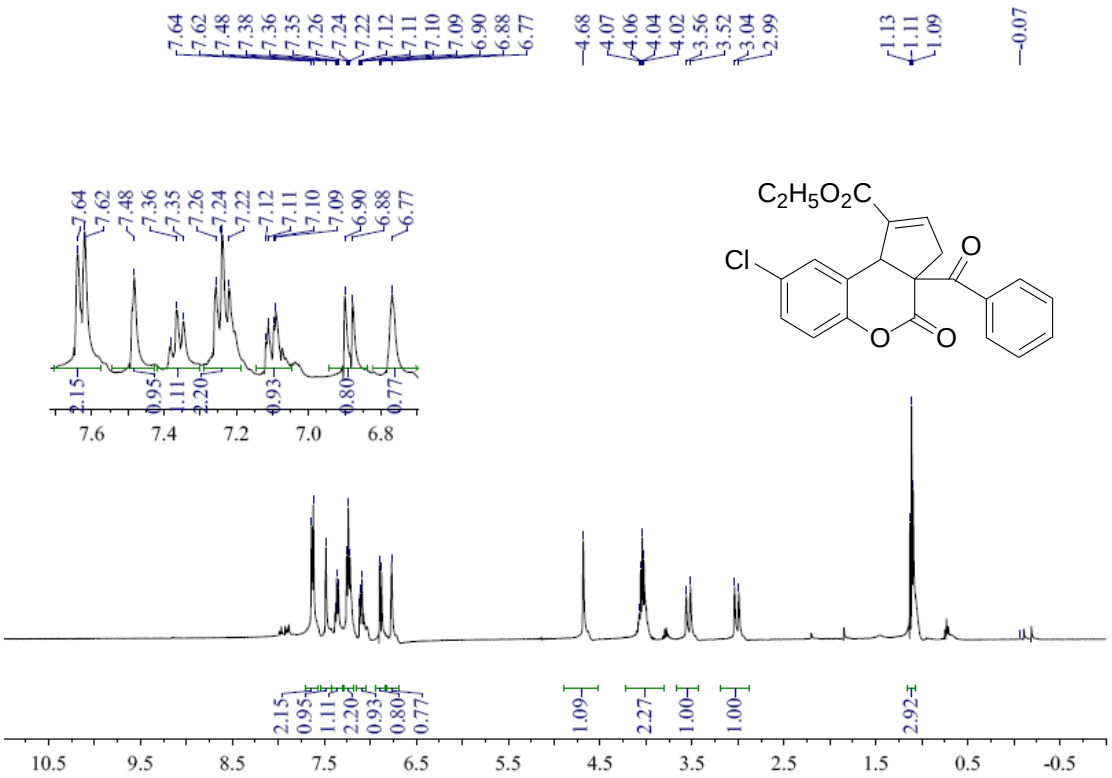

Figure S5. ^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **3c**

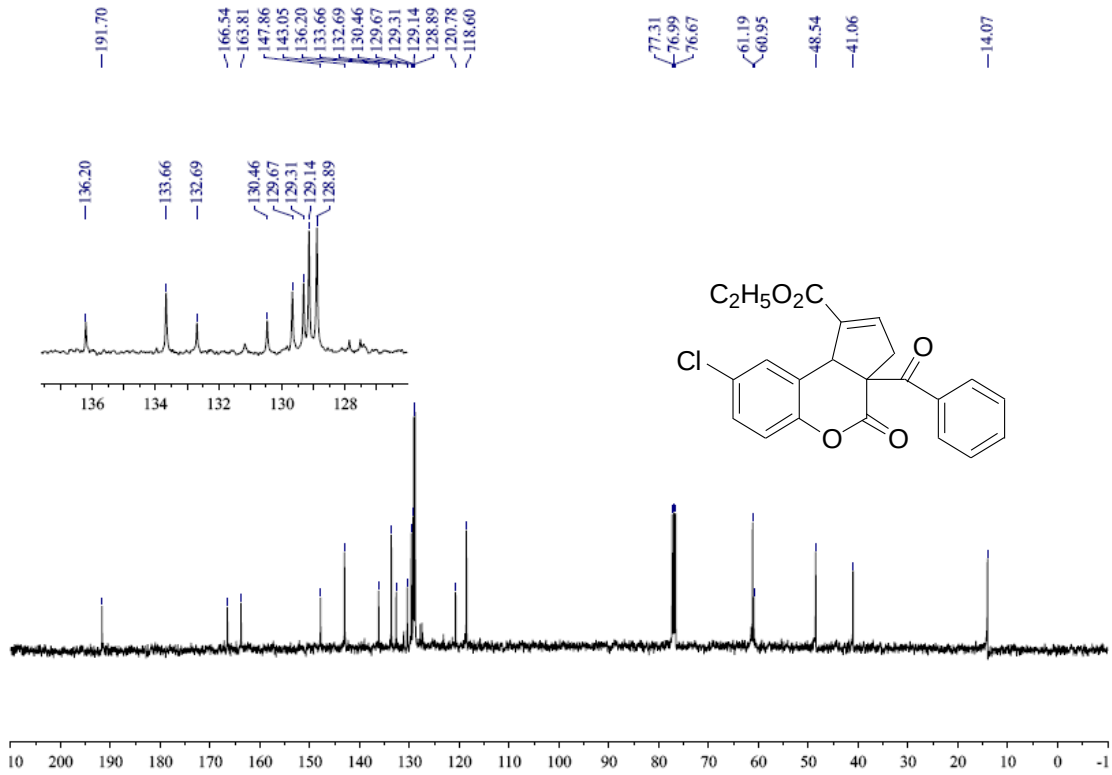

Figure S6. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of **3c**

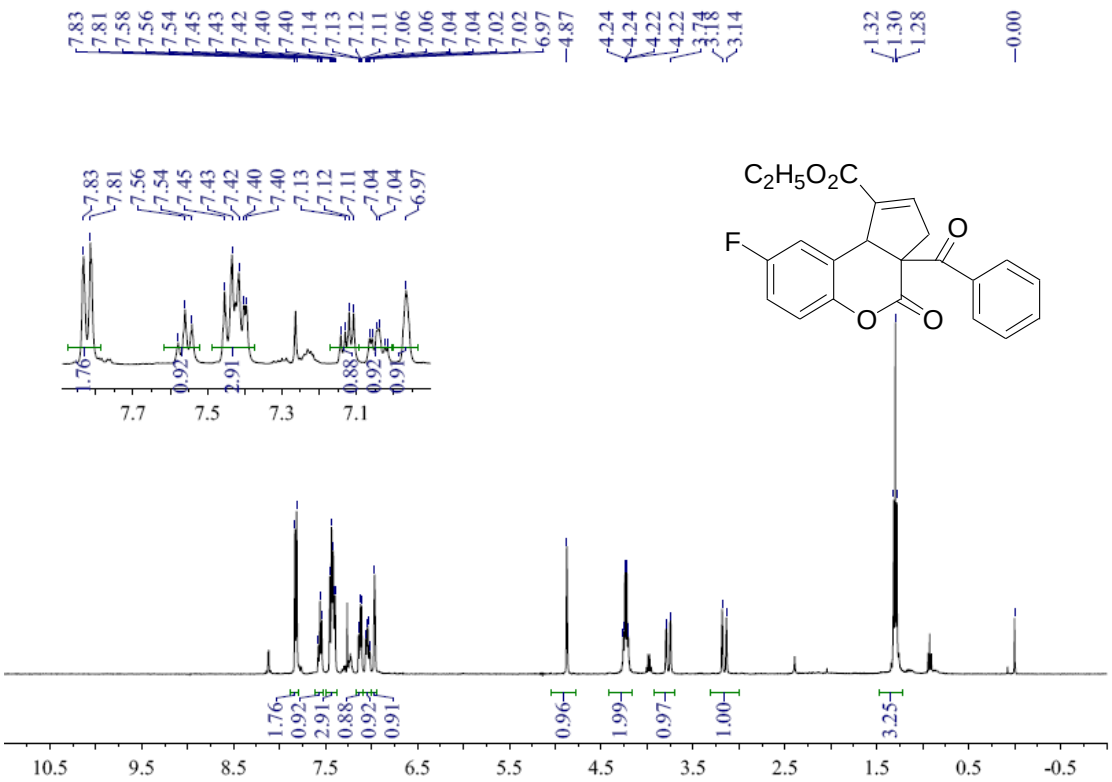

Figure S7. ^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **3d**

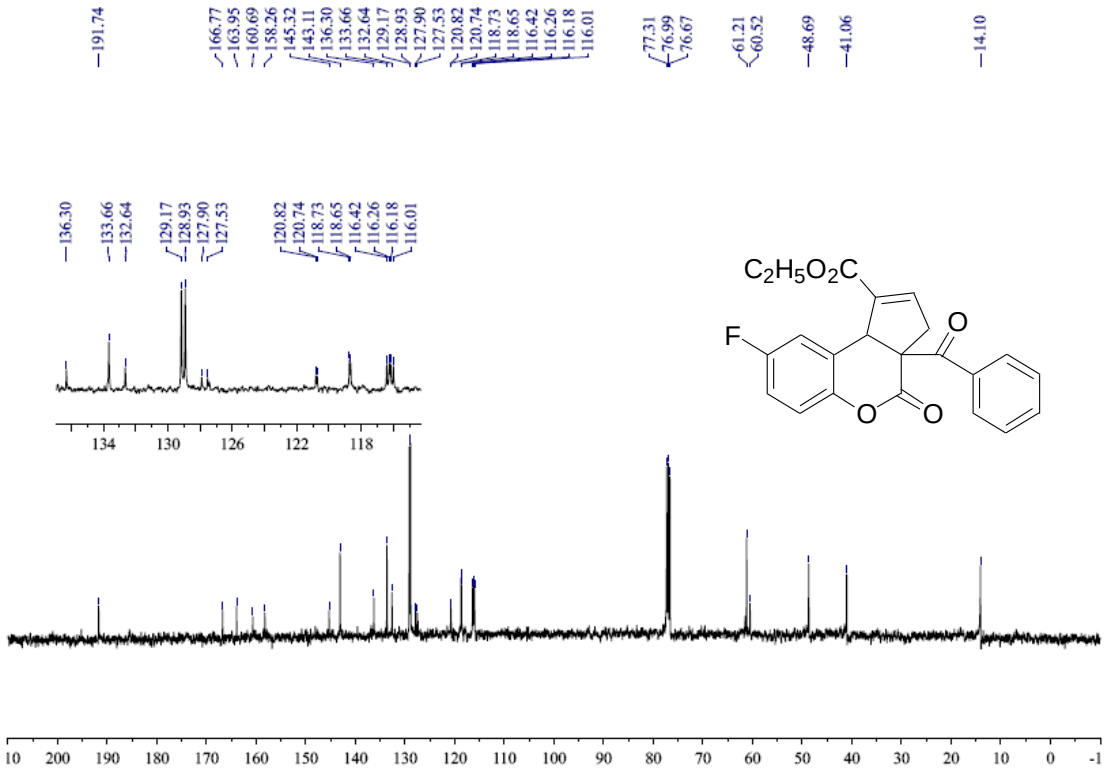

Figure S8. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of **3d**

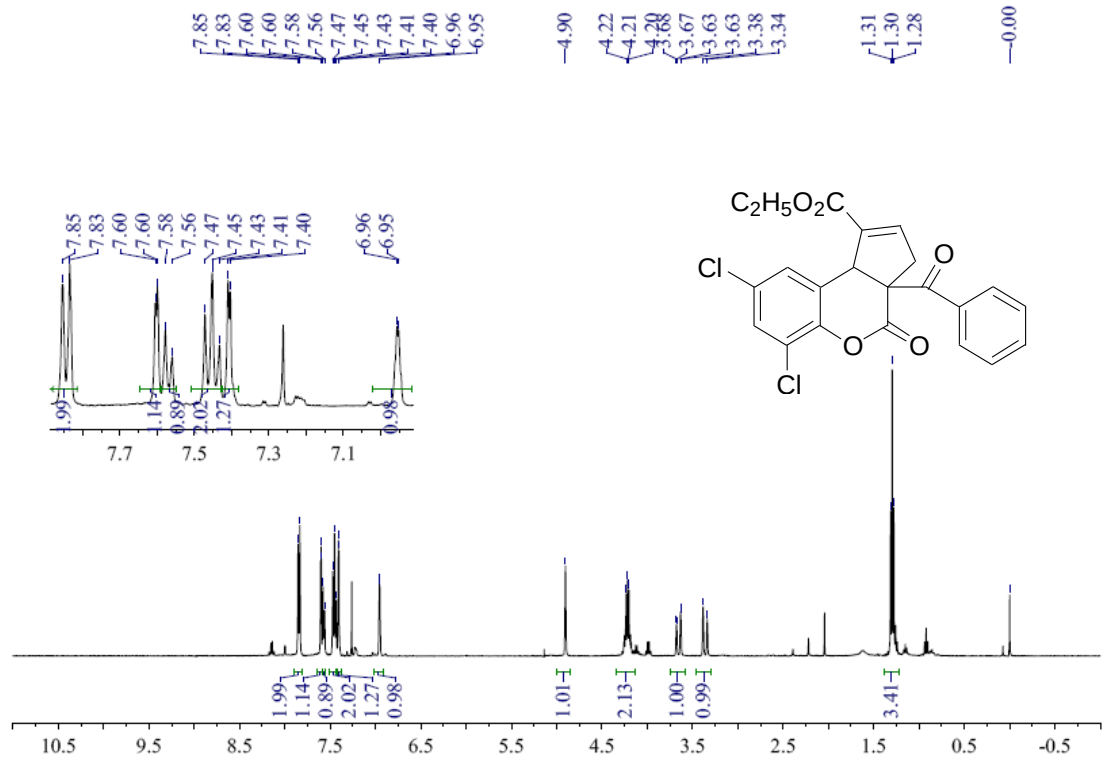

Figure S9. ^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **3e**

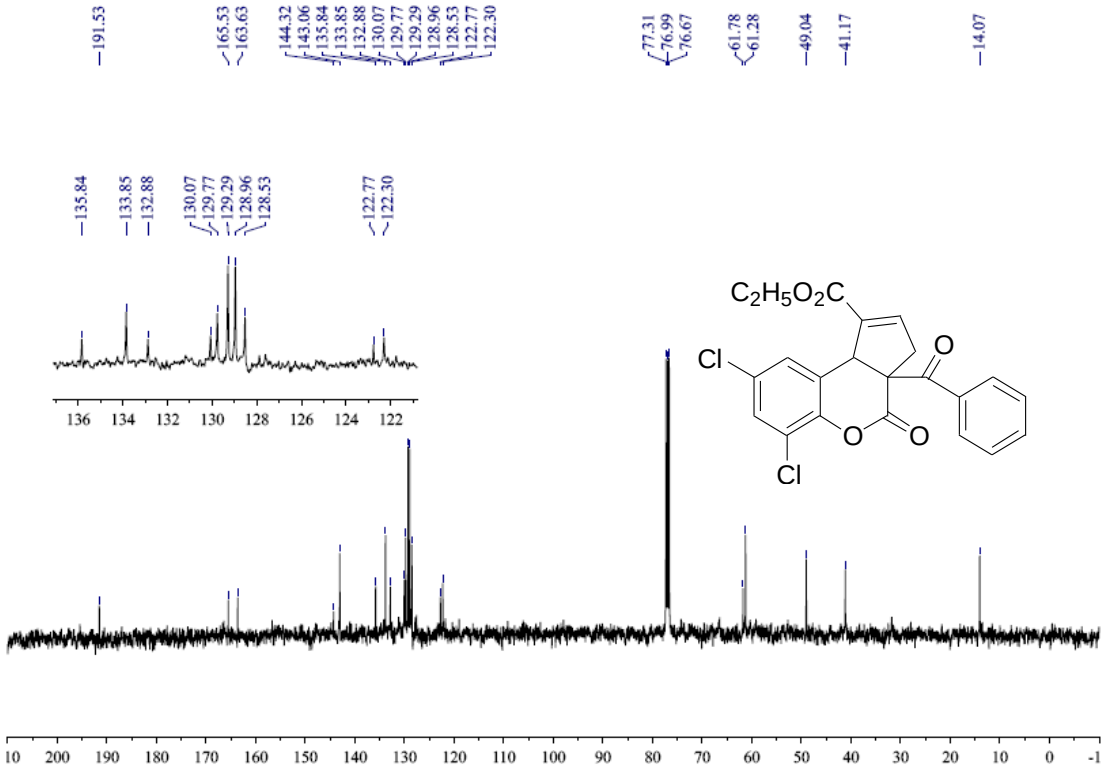

Figure S10. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of **3e**

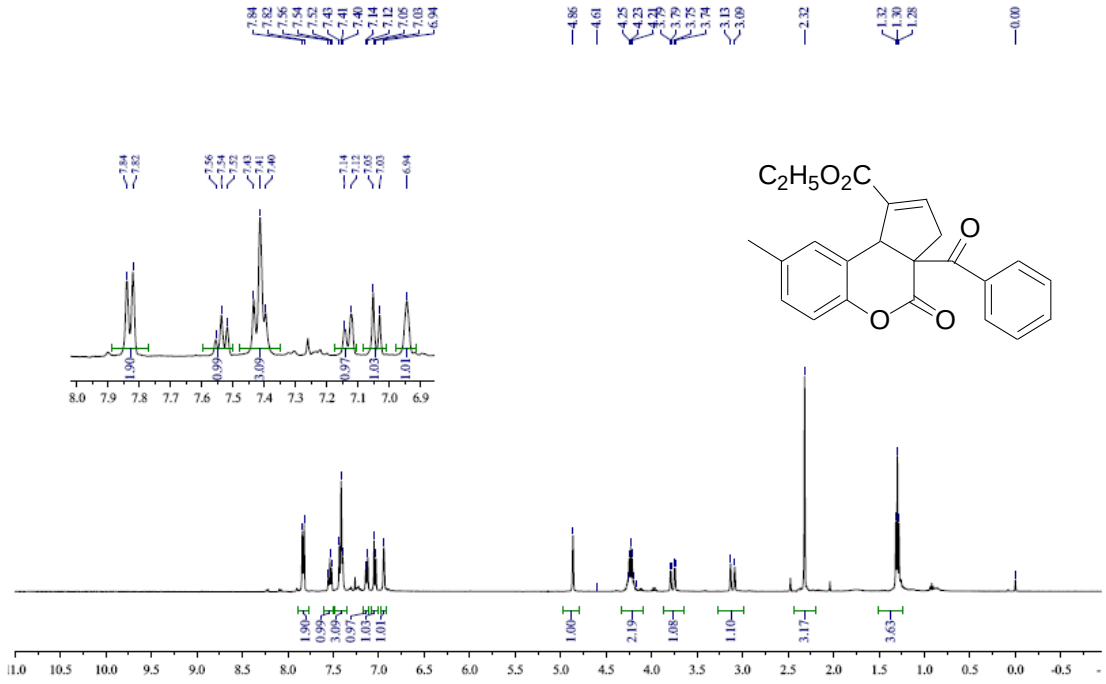

Figure S13. ^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **3f**

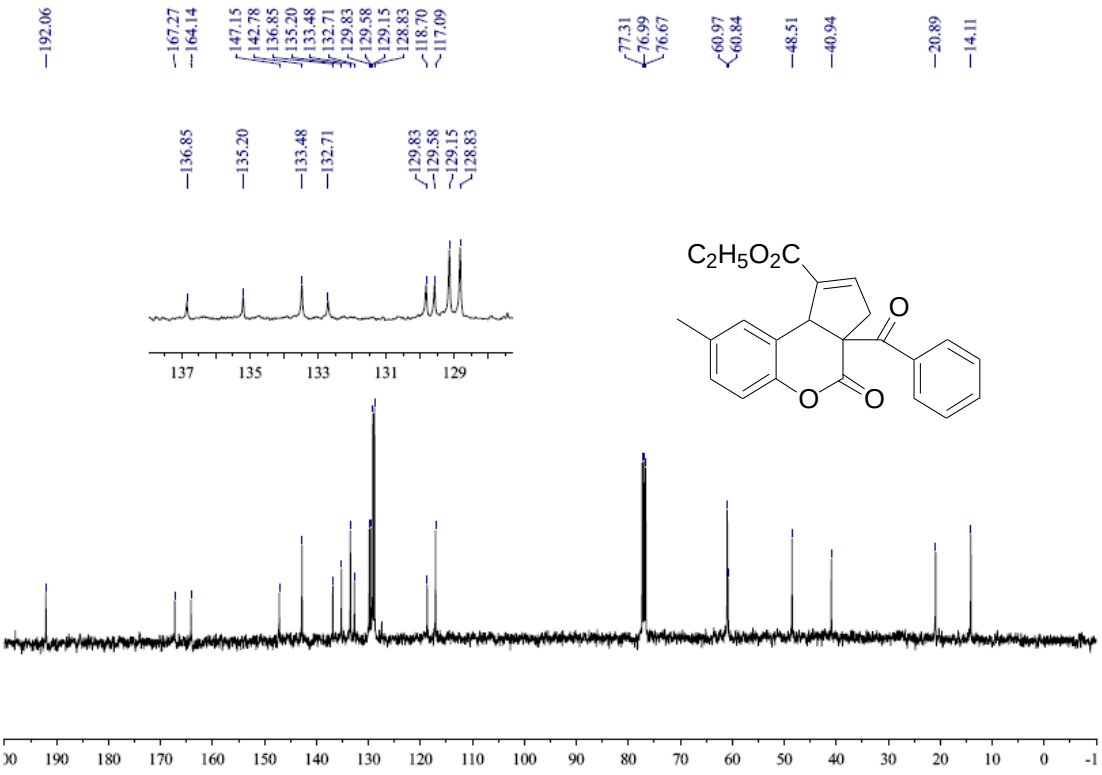

Figure S14. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of **3f**

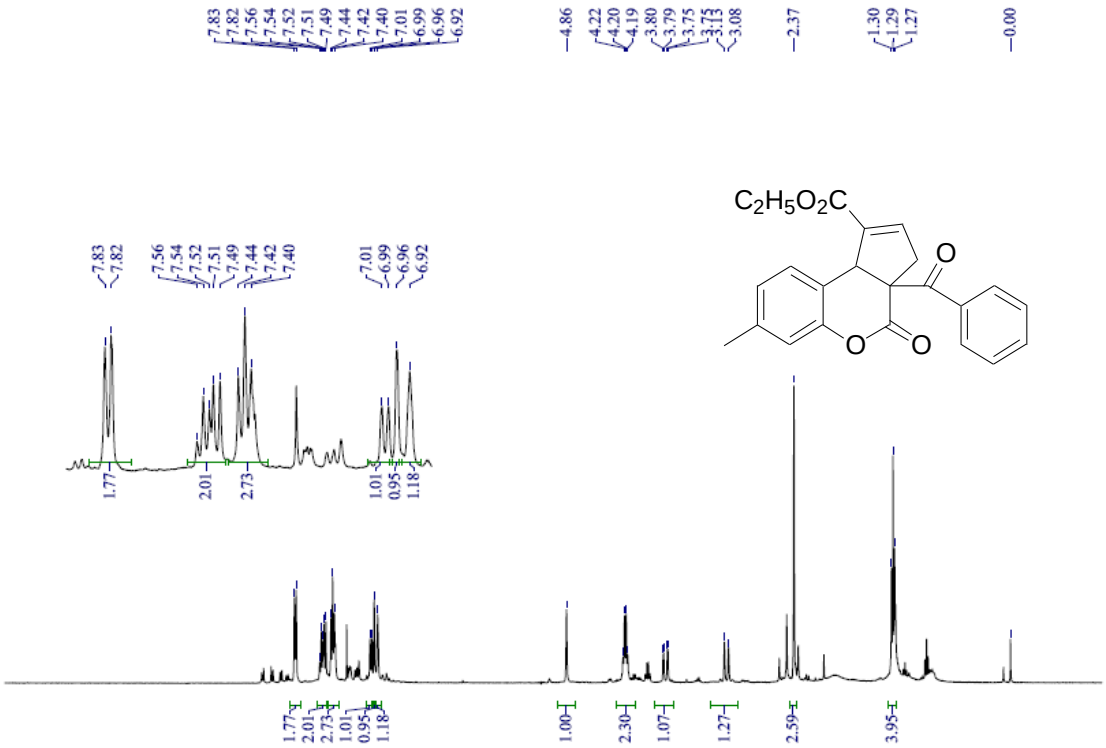

Figure S15. ^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **3g**

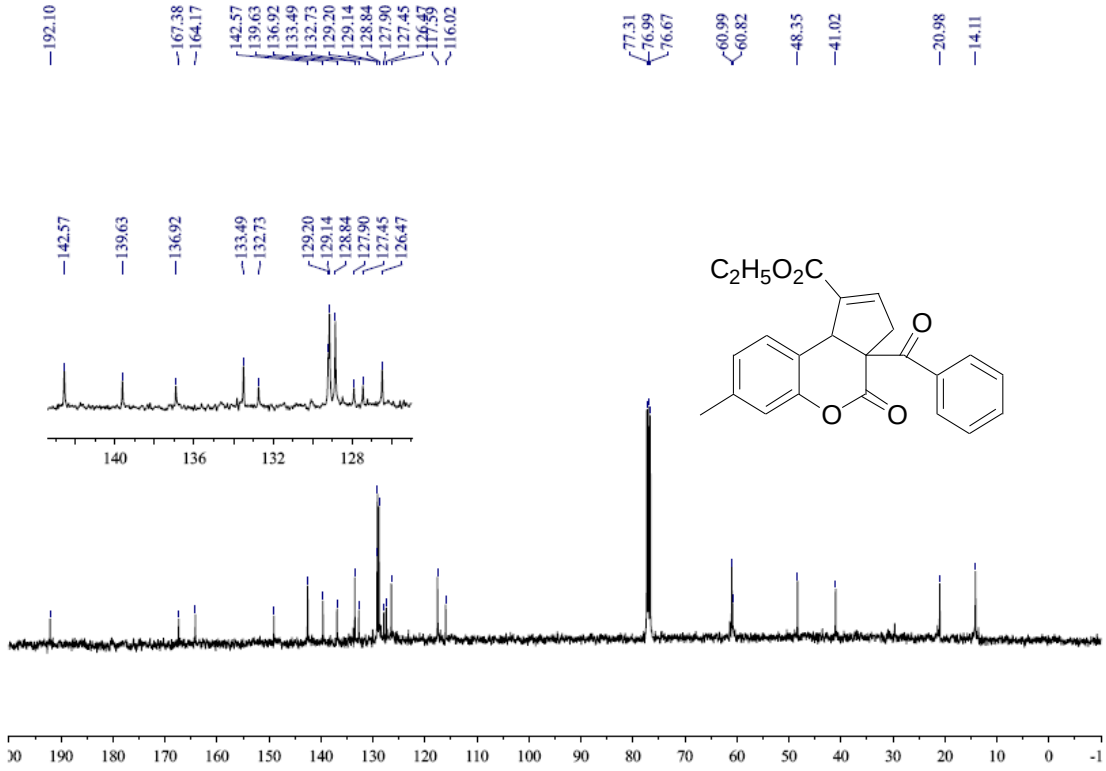

Figure S16. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of **3g**

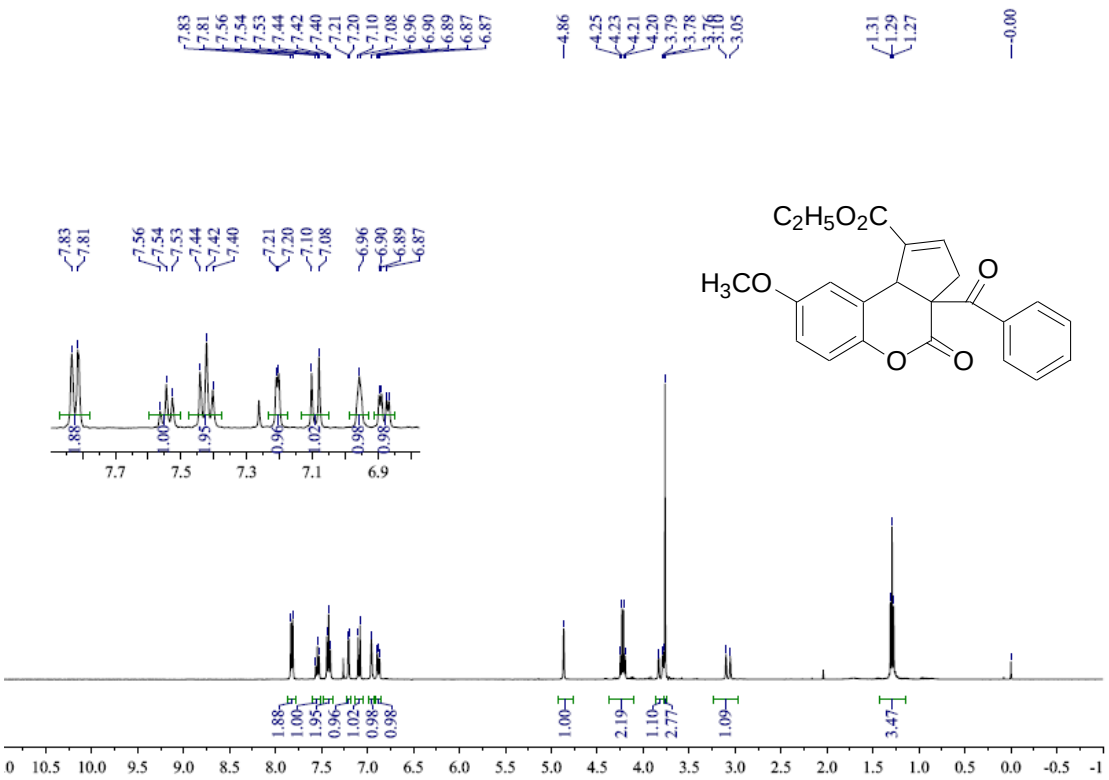

Figure S17. ^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **3h**

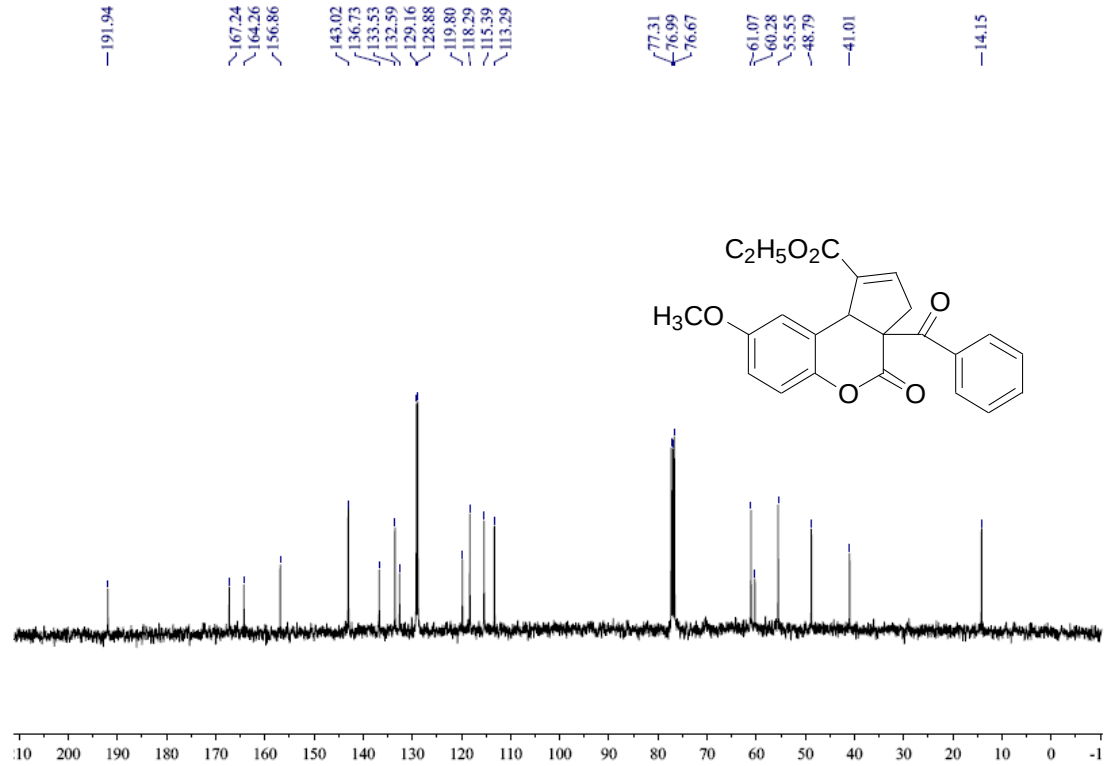

Figure S18. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of **3h**

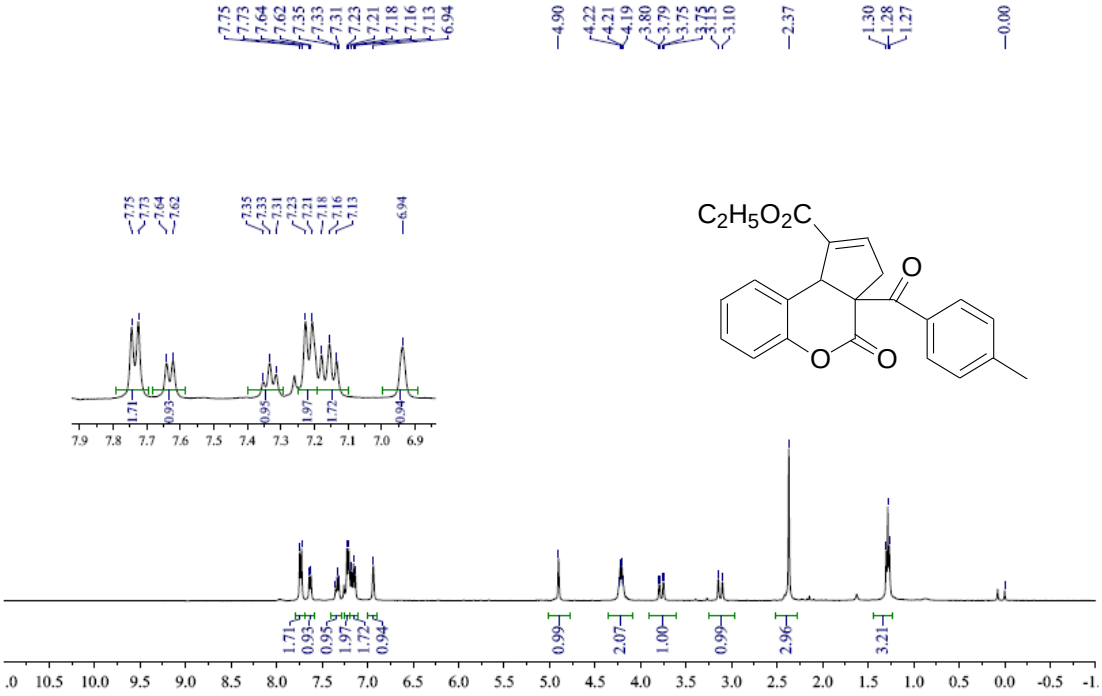

Figure S21. ^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **3i**

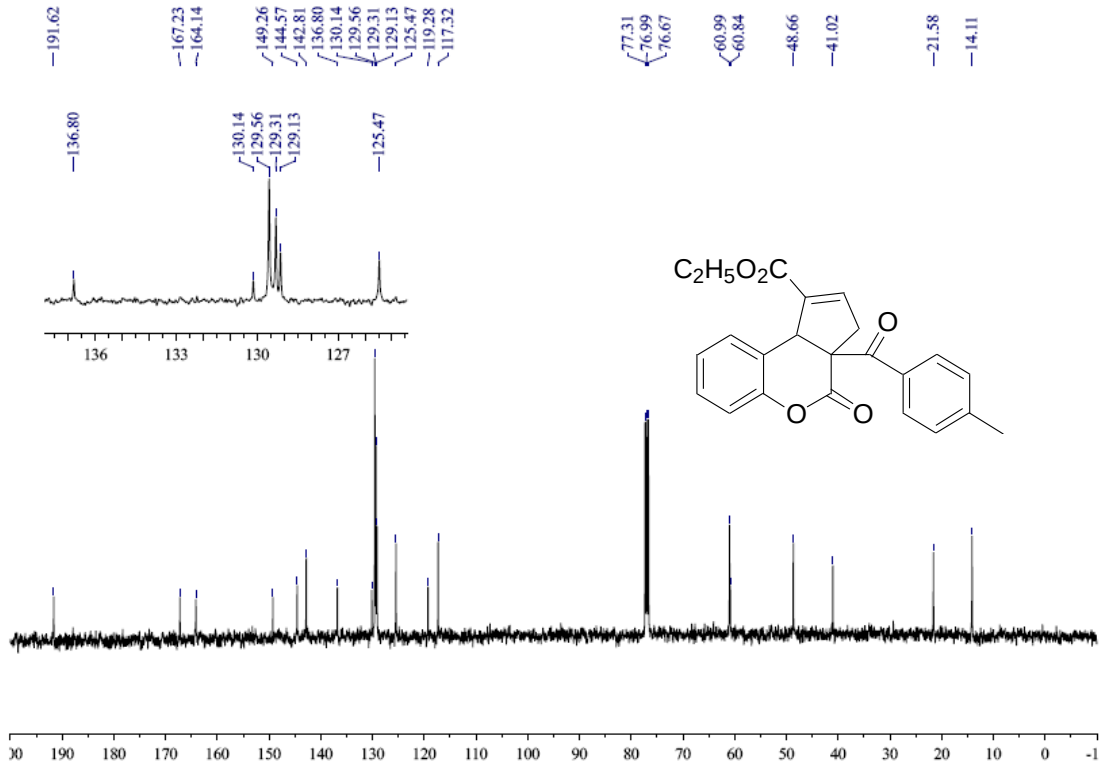

Figure S22. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of **3i**

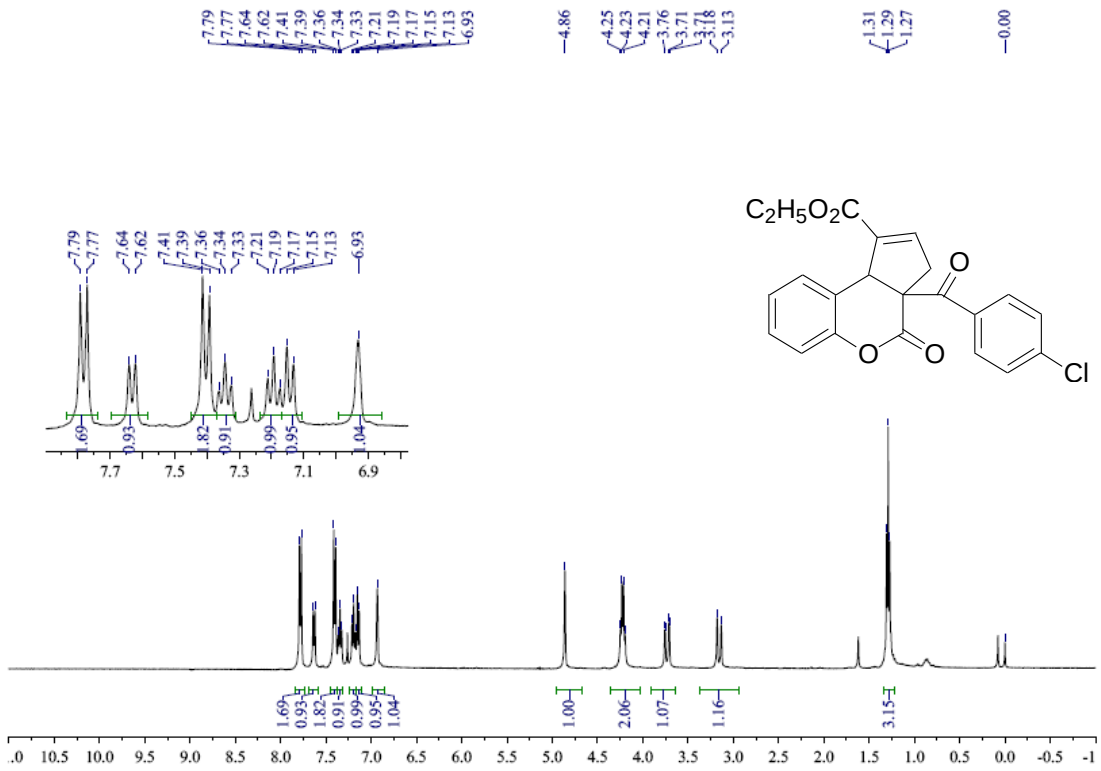

Figure S23. ^{1}H NMR spectrum (400 MHz, $CDCl_3$) of **3j**

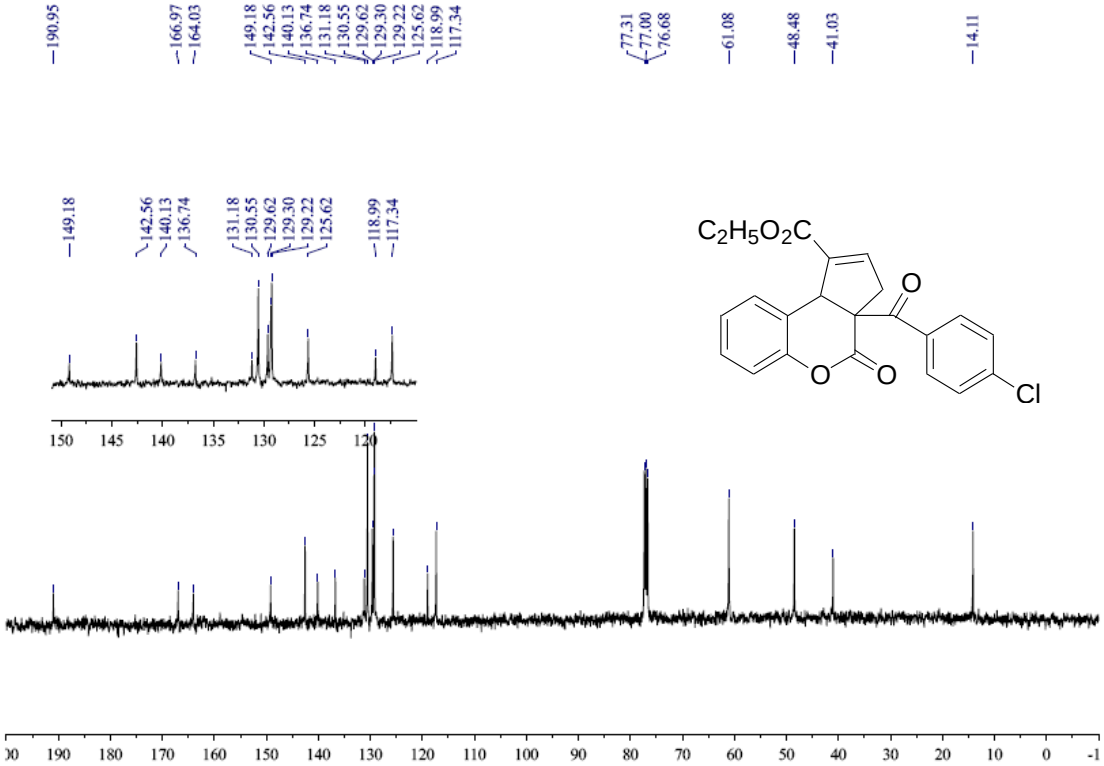

Figure S24. ^{13}C NMR spectrum (100 MHz, $CDCl_3$) of **3j**

X-ray diffraction data for **2b**

The crystal data of **2b** have been deposited in CCDC with number 889494.

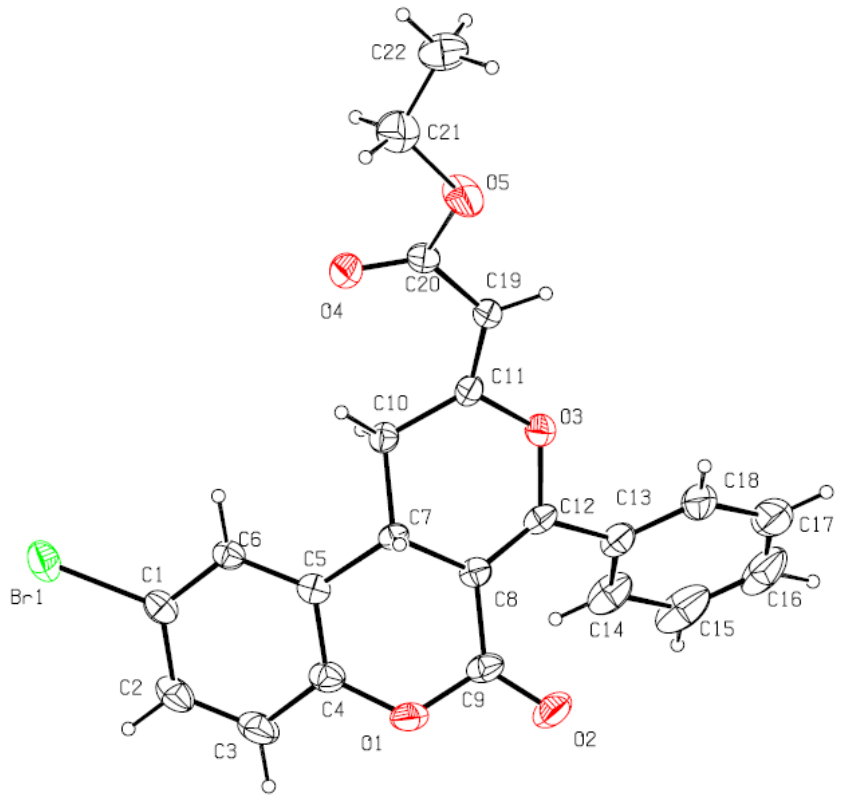

Table 1. Crystal data and structure refinement for mo_120507e.

Identification code	e:20507e	
Empirical formula	C22 H17 Br O5	
Formula weight	441.27	
Temperature	293(2) K	
Wavelength	0.71073 Å	
Crystal system	Orthorhombic	
Space group	Pna2(1)	
Unit cell dimensions	a = 11.756 Å	α= 90°.
	b = 14.575 Å	β= 90°.
	c = 11.520 Å	γ = 90°.
Volume	1973.9 $Å^3$	
Z	4	
Density (calculated)	1.485 Mg/m^3	
Absorption coefficient	2.113 mm^{-1}	
F(000)	896	
Crystal size	0.20 x 0.10 x 0.10 mm^3	

Theta range for data collection	2.23 to 26.48°.
Index ranges	-14<=h<=14, -17<=k<=18, -14<=l<=14
Reflections collected	14075
Independent reflections	3918 [R(int) = 0.0520]
Completeness to theta = 26.48°	99.6 %
Absorption correction	None
Max. and min. transmission	0.8165 and 0.6773
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	3918 / 9 / 271
Goodness-of-fit on F^2	0.986
Final R indices [I>2sigma(I)]	R1 = 0.0394, wR2 = 0.0809
R indices (all data)	R1 = 0.0920, wR2 = 0.0971
Absolute structure parameter	0.009(11)
Largest diff. peak and hole	0.220 and -0.211 e.$Å^{-3}$

X-ray diffraction data for **3j**

The crystal data of **3j** have been deposited in CCDC with number 889495.

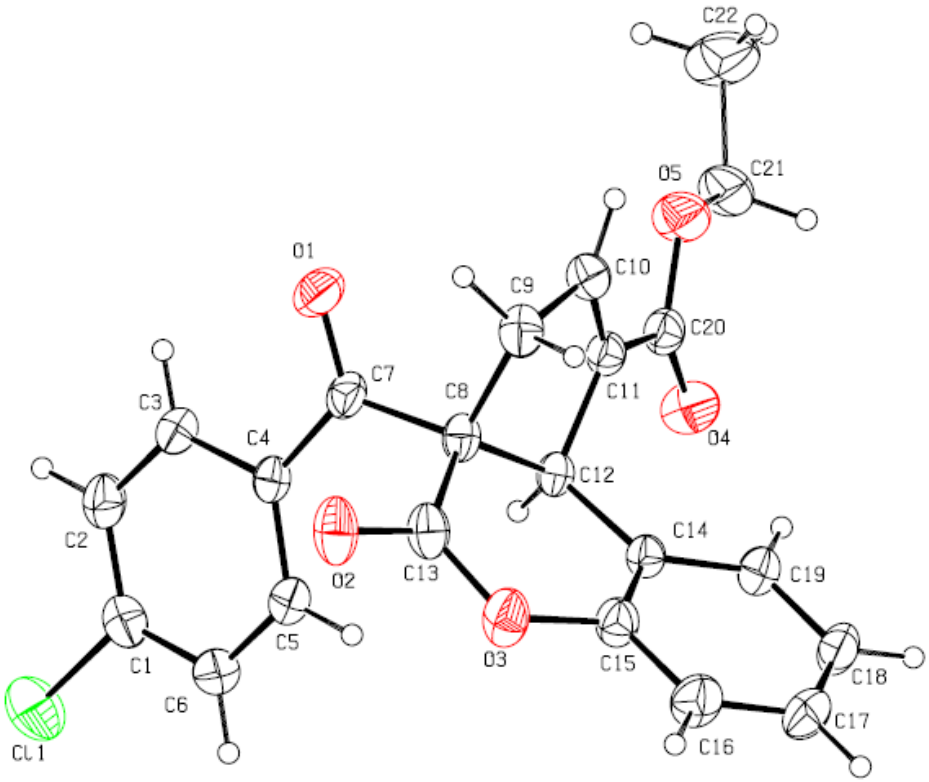

Table 1. Crystal data and structure refinement for mo_120509_0m

Identification code	120509b_0m
Empirical formula	C22 H17 Cl O5
Formula weight	396.81
Temperature	296(2) K
Wavelength	0.71073 Å
Crystal system	Triclinic
Space group	P-1
Unit cell dimensions	a = 9.7129(16) Å □ = 107.550(2)° b = 10.5113(17) Å □ = 105.744(2)° c = 10.7041(17) Å = 98.461(2)°
Volume	971.2(3) $Å^3$
Z	2
Density (calculated)	1.357 Mg/m^3
Absorption coefficient	0.227 mm^{-1}
F(000)	412
Crystal size	? x ? x ? mm^3
Theta range for data collection	2.10 to 25.50°.
Index ranges	-11<=h<=11, -11<=k<=12, -12<=l<=12

Reflections collected	7083
Independent reflections	3559 [R(int) = 0.0246]
Completeness to theta = 25.50	98.5 %
Absorption correction	None
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	3559 / 6 / 275
Goodness-of-fit on F^2	1.086
Final R indices [I>2sigma(I)]	R1 = 0.0499, wR2 = 0.1514
R indices (all data)	R1 = 0.0618, wR2 = 0.1632
Extinction coefficient	0.000(4)
Largest diff. peak and hole	0.295 and -0.413 $e.^{-3}$