Palladium Catalyzed Ring-Opening of Diazabicylic Olefins with 4-Halo-1,3-dicarbonyl compounds: Accessing 3(2*H*)-Furanone Appended Cyclopentenes

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Supplementary Materials

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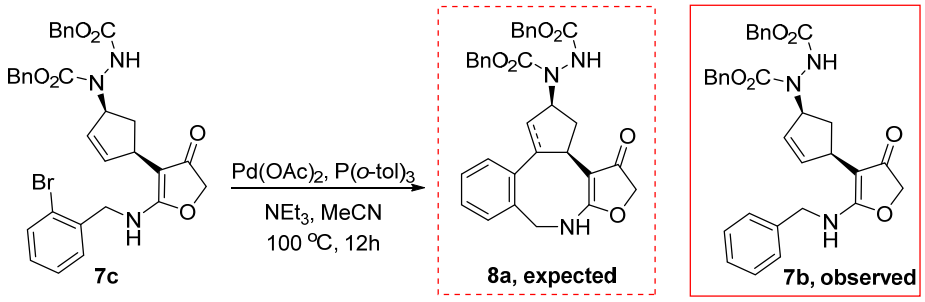
1. Optimization studies for intramolecular Heck coupling

Hydroazocines are 8-membered heterocycles with one *N*-atom.[1] These are known to exhibit interesting biological properties and there are several synthetic methodologies for accessing these molecules.[2] Owing to the importance of this eight-membered heterocycle, we chose to optimize the conditions for intramolecular Heck coupling by taking the amine functionalized 3(2*H*)-furanone **7c** as the substrate (Table S1). We tried different Heck coupling and reductive Heck coupling conditions and all of these resulted in dehalogenation affording **7b**.

Table S1. Optimization studies[a]



Entry	Catalyst	Ligand	Base	Additives	Solvent	Yield of 8a or 7b (%)
1	$Pd(OAc)_2$	P(*o*-tol)$_3$	NEt_3	-	MeCN	62
2	$Pd(OCOCF_3)_2$	P(*o*-tol)$_3$	NEt_3	-	MeCN	52
3	$Pd(PPh_3)_4$	P(*o*-tol)$_3$	NEt_3	-	MeCN	trace
4	$PdCl_2$	P(*o*-tol)$_3$	NEt_3	-	MeCN	trace
5	$PdCl_2(PPh_3)_2$	P(*o*-tol)$_3$	NEt_3	-	MeCN	NR
6	$Pd(OAc)_2$	PPh_3	NEt_3	-	MeCN	50
7	$Pd(OAc)_2$	*R*-BINAP	NEt_3	-	MeCN	50
8	$Pd(OAc)_2$	P(*o*-tol)$_3$	K_2CO_3	-	MeCN	NR
9	$Pd(OAc)_2$	P(*o*-tol)$_3$	DIEA	-	MeCN	trace
10	$Pd(OAc)_2$	P(*o*-tol)$_3$	NEt_3	-	Toluene	trace

11	$Pd(OAc)_2$	P(*o*-tol)$_3$	NEt_3	-	DMF	trace
12[b]	$Pd(OAc)_2$	P(*o*-tol)$_3$	NEt_3	-	MeCN	65
13	$Pd(OAc)_2$	-	DIEA	-	NMP	NR
14	$Pd(OAc)_2$	*R*-BINAP	TMEDA	HCOOH	MeCN	NR
15	$Pd(OAc)_2$	P(*o*-tol)$_3$	-	HCOONa	MeCN	trace
16	$Pd(OAc)_2$	P(*o*-tol)$_3$	NEt_3	HCOONa	MeCN	trace
17	$Pd(OAc)_2$	P(*o*-tol)$_3$	NEt_3	HCOONa/ TBAB	MeCN	NR
18	$Pd(OAc)_2$	P(*o*-tol)$_3$	NEt_3	Bu_4NCl	MeCN	trace

Reaction conditions: [a] **7c** (1.0 equiv., 0.05 mmol), base (1.0 equiv.), catalyst (10 mol%), ligand (10 mol%), additives (1.0 equiv.), solvent (2.0 mL), 12 h, 100 ºC, Isolated yields are reported; [b] catalyst (5 mol%).

2. References

1. M. Sutharchanadevi, R. Murugan, 9.18 - Eight-membered Rings with One Nitrogen Atom, (Editor(s): A. R. Katritzky, C. W. Rees, E. F. V. Scriven) Comprehensive Heterocyclic Chemistry II, Pergamon, **1996**, Pages 403-428.
2. A. V. Listratova, L. G. Voskressensky, *Synthesis* **2017**, *49*, 3801.

Figure S1 ^{1}H NMR (500 MHz) & ^{13}C (125 MHz) Spectra of **3a**

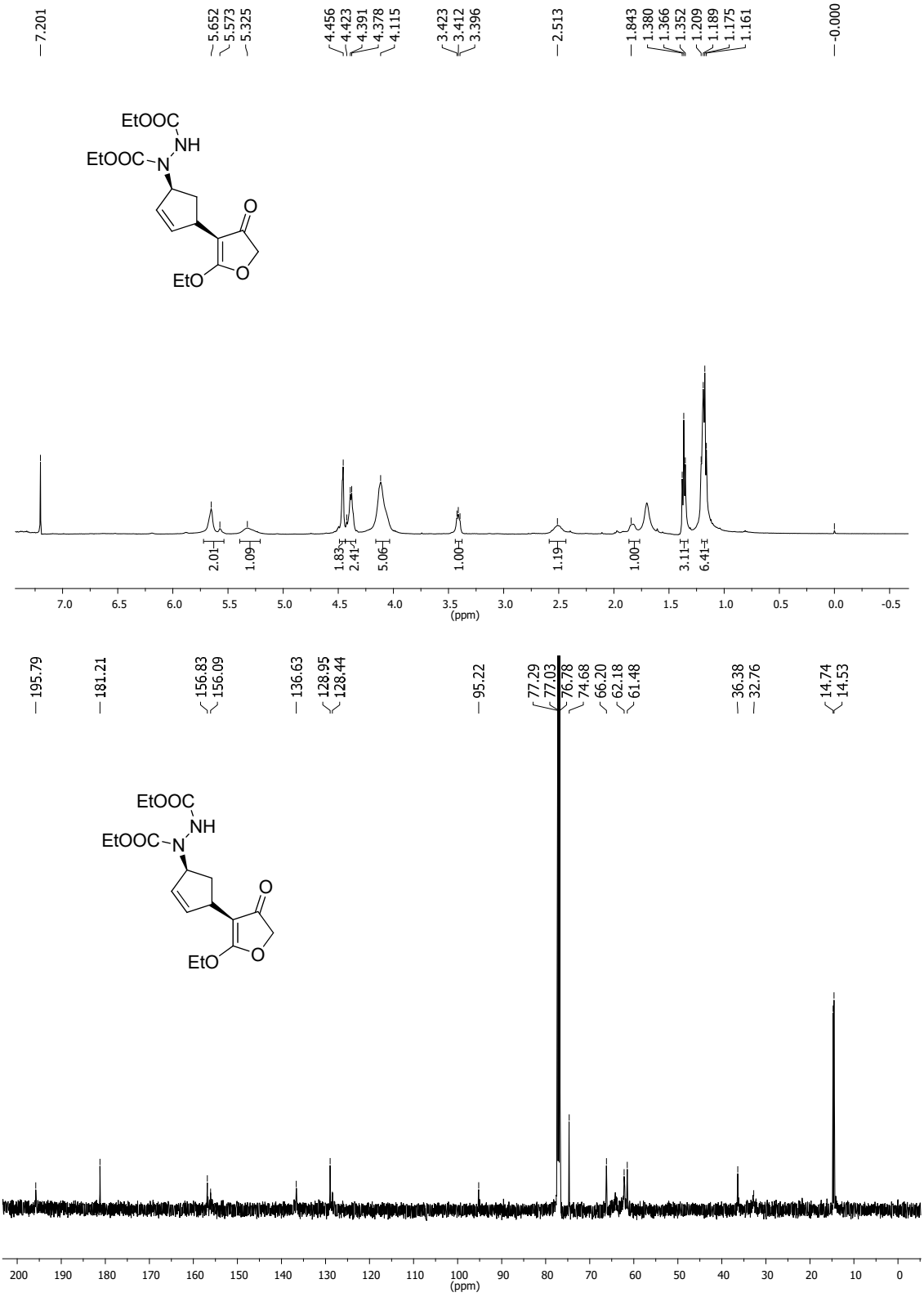


Figure S2 ^{1}H-^{1}H COSY Spectrum of **3a**

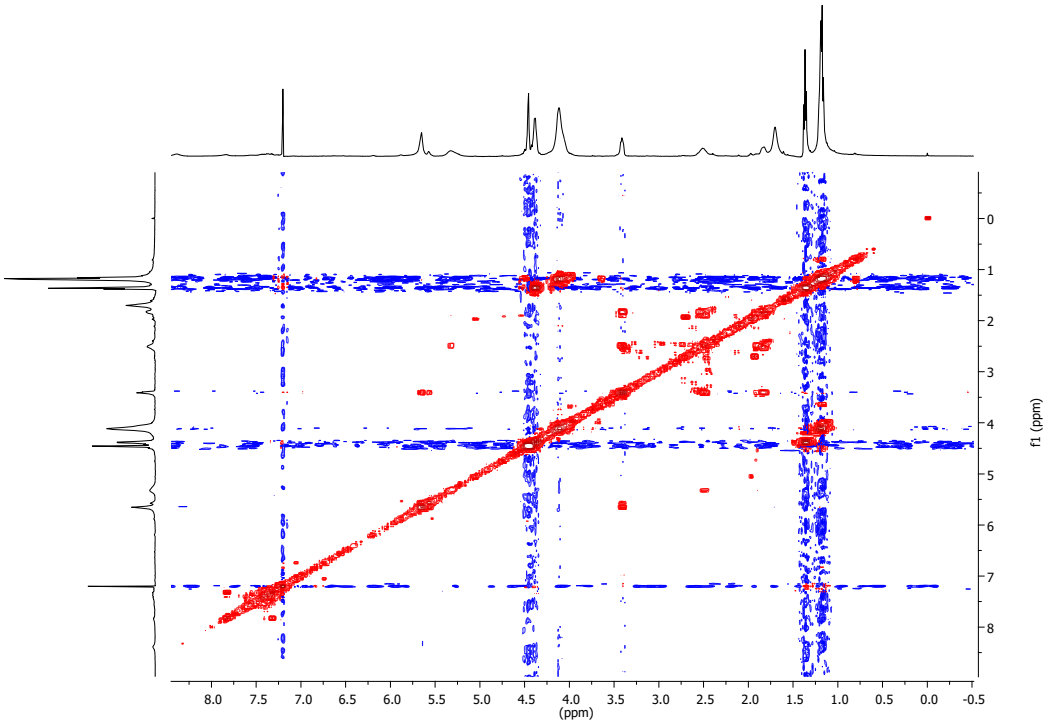


Figure S3 HMQC Spectrum of **3a**

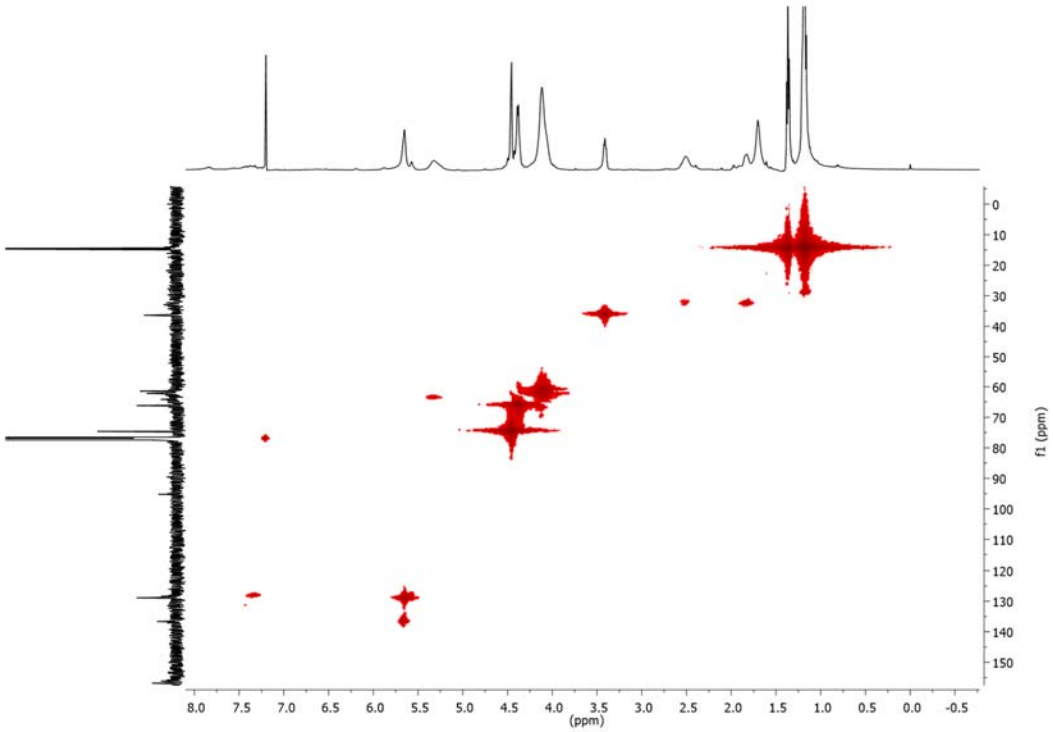


Figure S4 HMBC Spectrum of **3a**

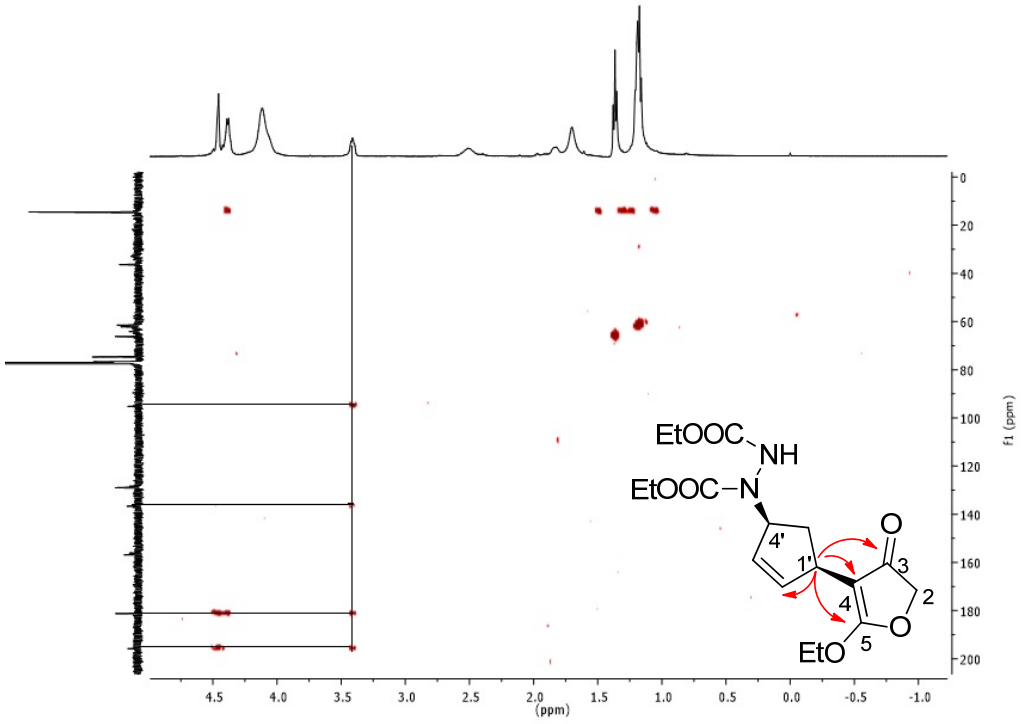


Figure S5 1D-NOE Spectrum of **3a**

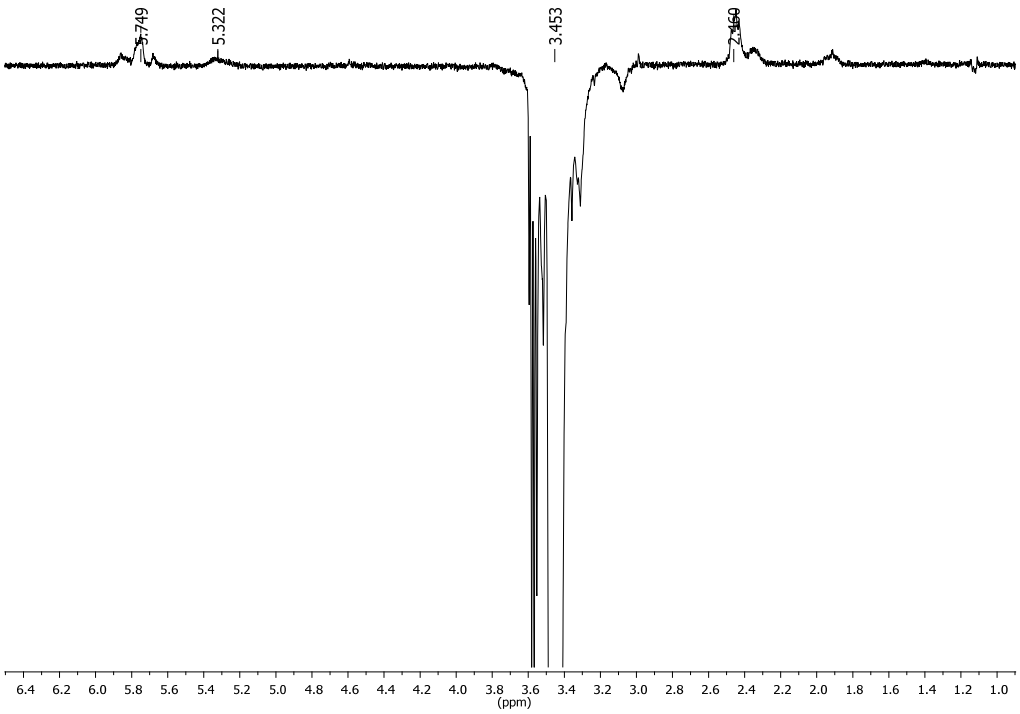


Figure S6 ^{1}H NMR (500 MHz) & ^{13}C (125 MHz) Spectra of **3b**

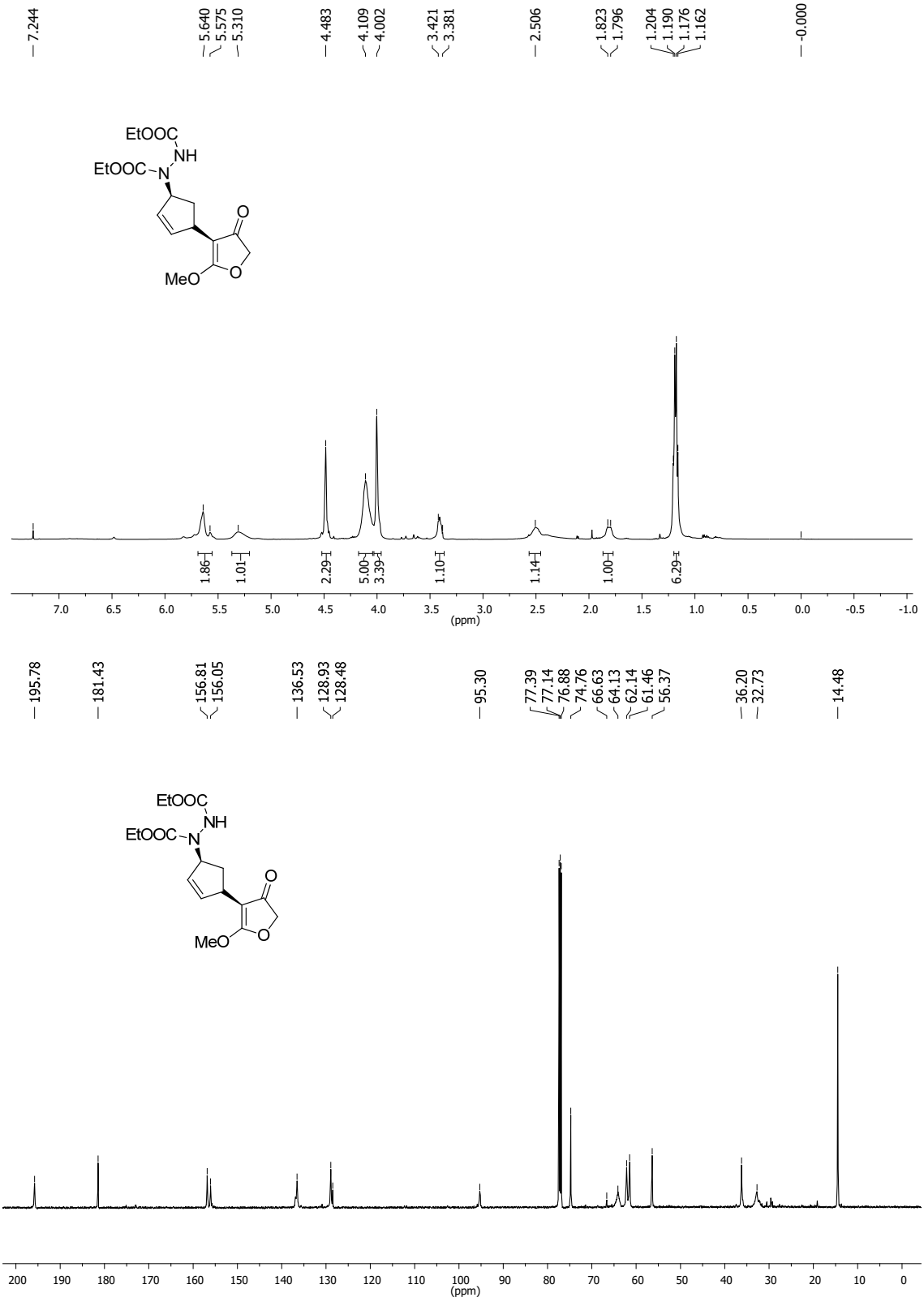


Figure S7 ^{1}H NMR (500 MHz) & ^{13}C (125 MHz) Spectra of **3c**

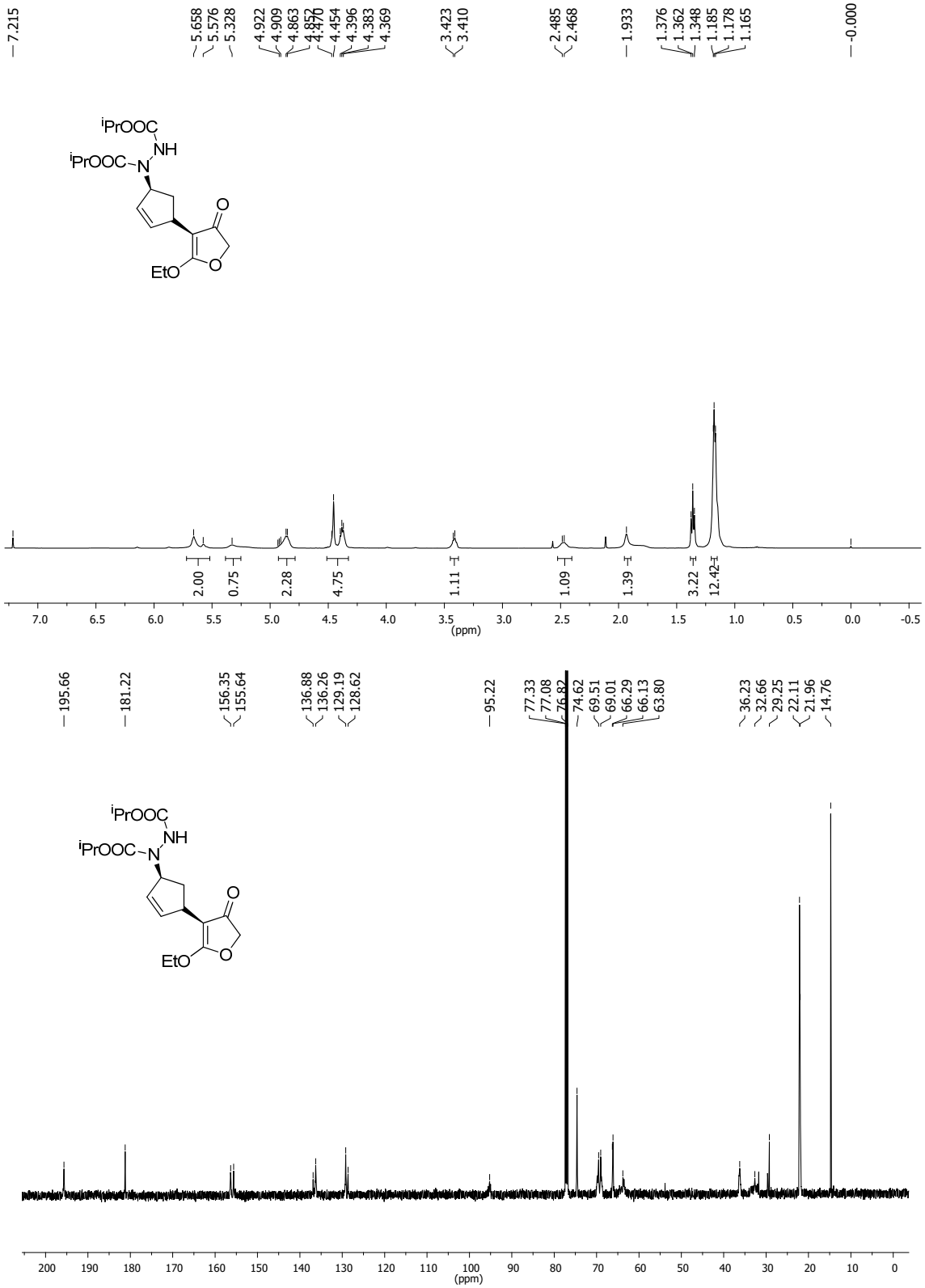


Figure S8 ^{1}H NMR (500 MHz) & ^{13}C (125 MHz) Spectra of **3d**

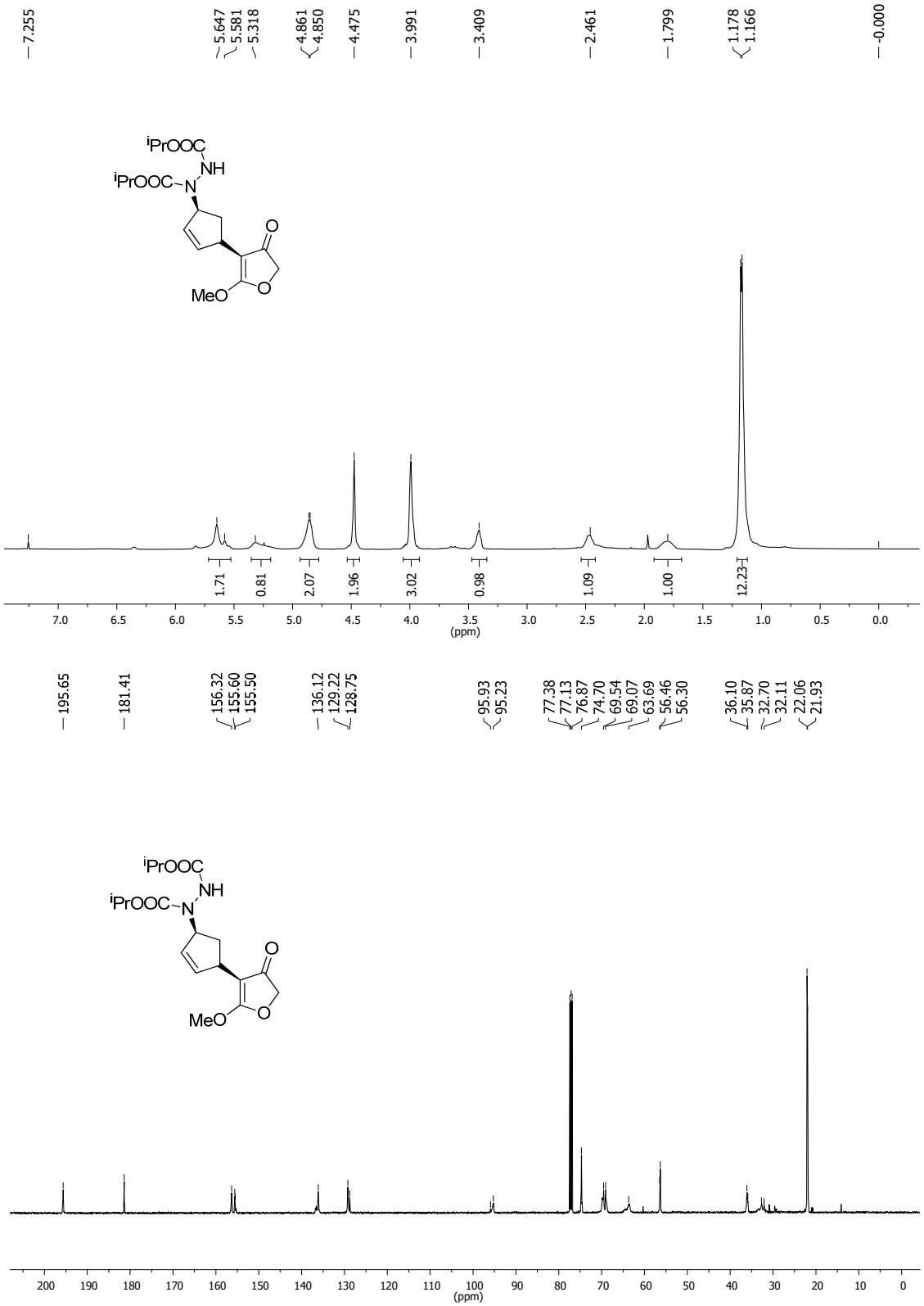


Figure S9 ^{1}H NMR (500 MHz) & ^{13}C (125 MHz) Spectra of **3e**

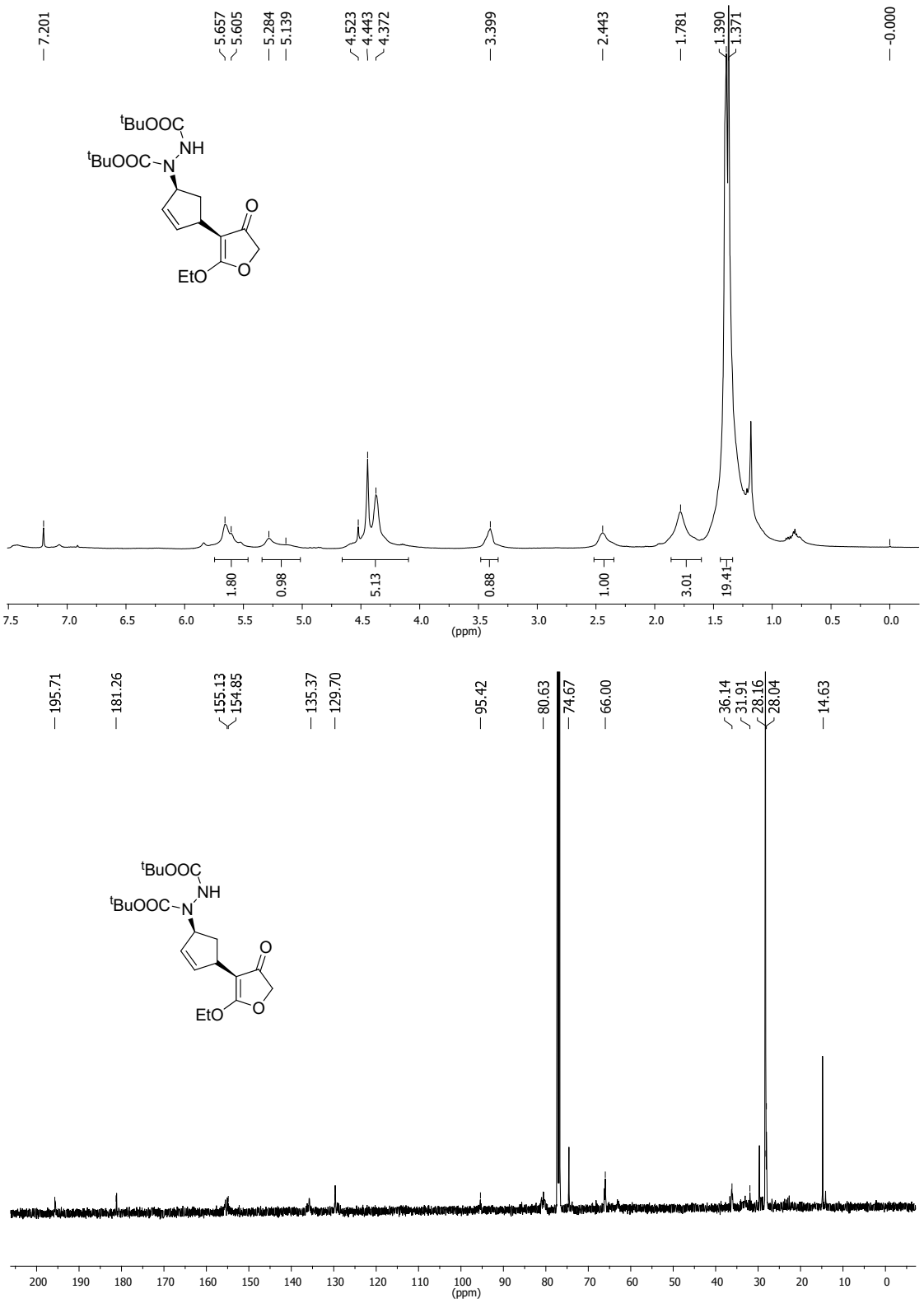
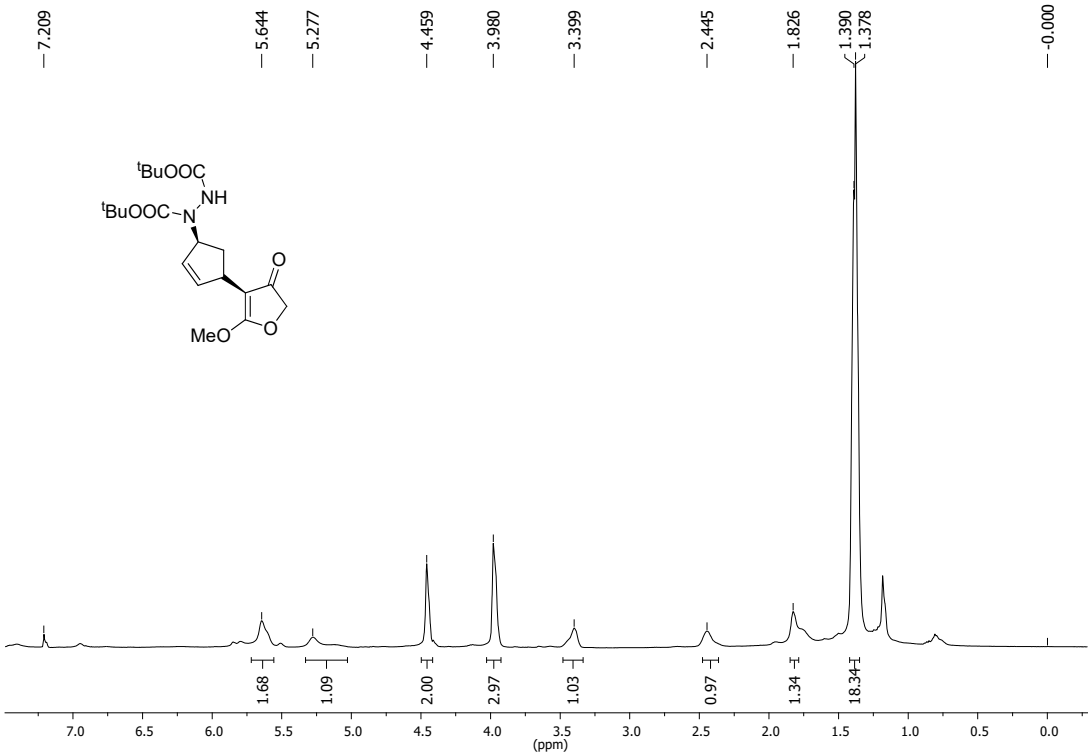


Figure S10 ^{1}H NMR (500 MHz) & ^{13}C (125 MHz) Spectra of **3f**



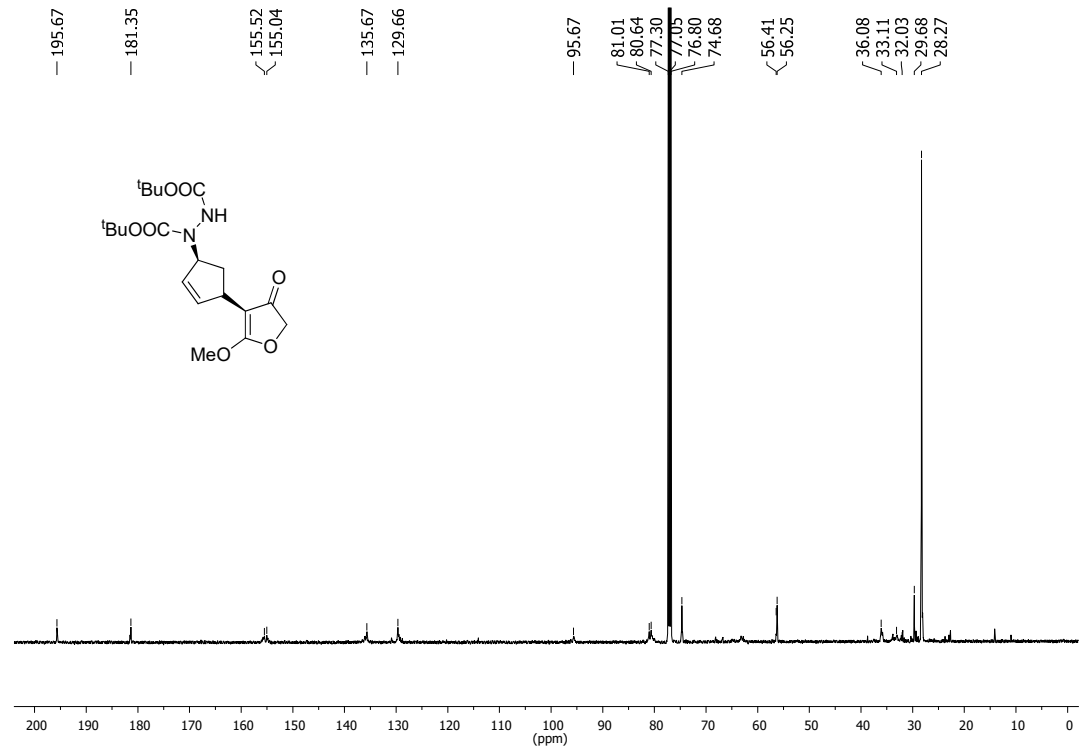


Figure S11 ^{1}H NMR (500 MHz) & ^{13}C (125 MHz) Spectra of **3g**

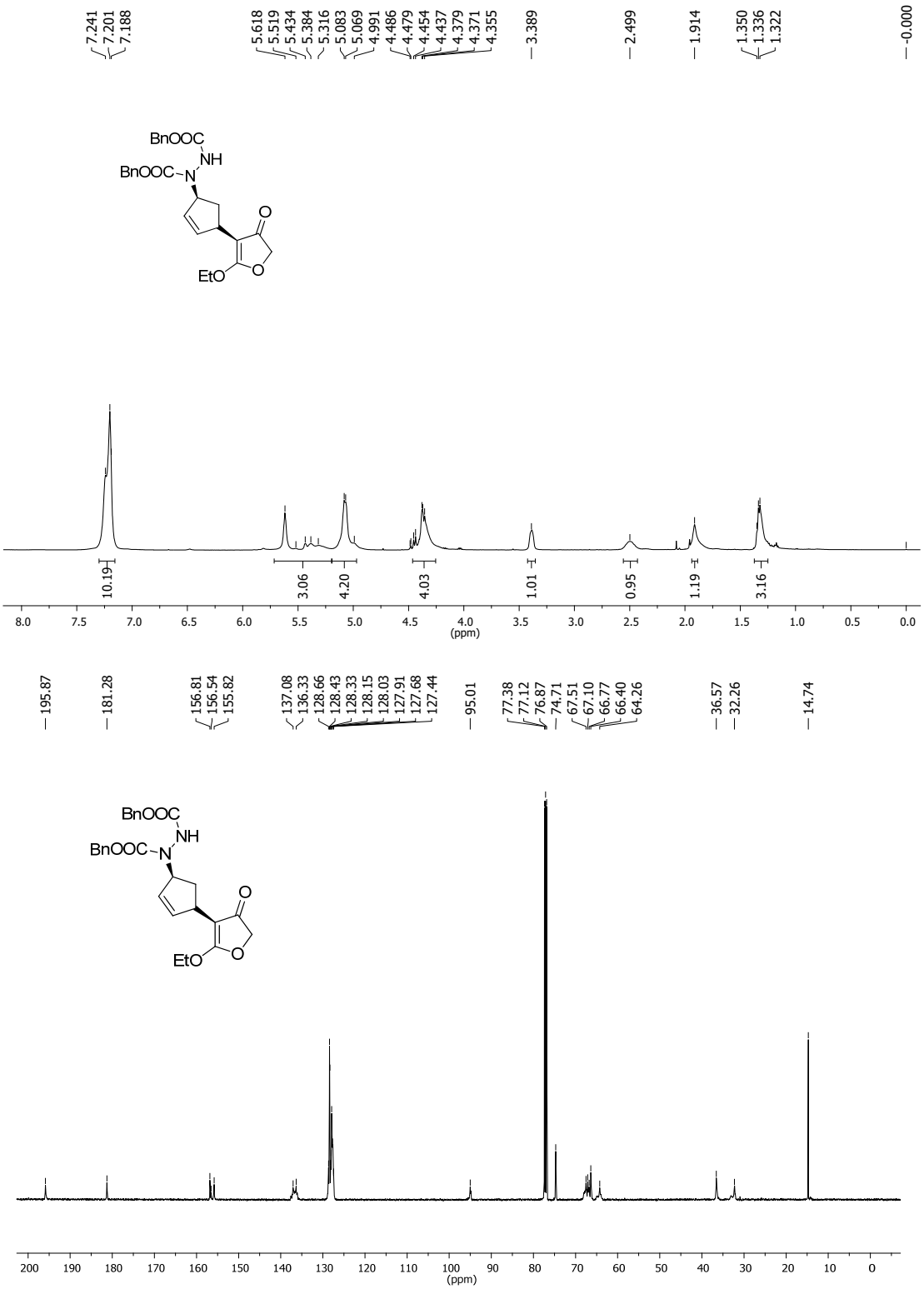


Figure S12 ^{1}H NMR (500 MHz) & ^{13}C (125 MHz) Spectra of **3h**

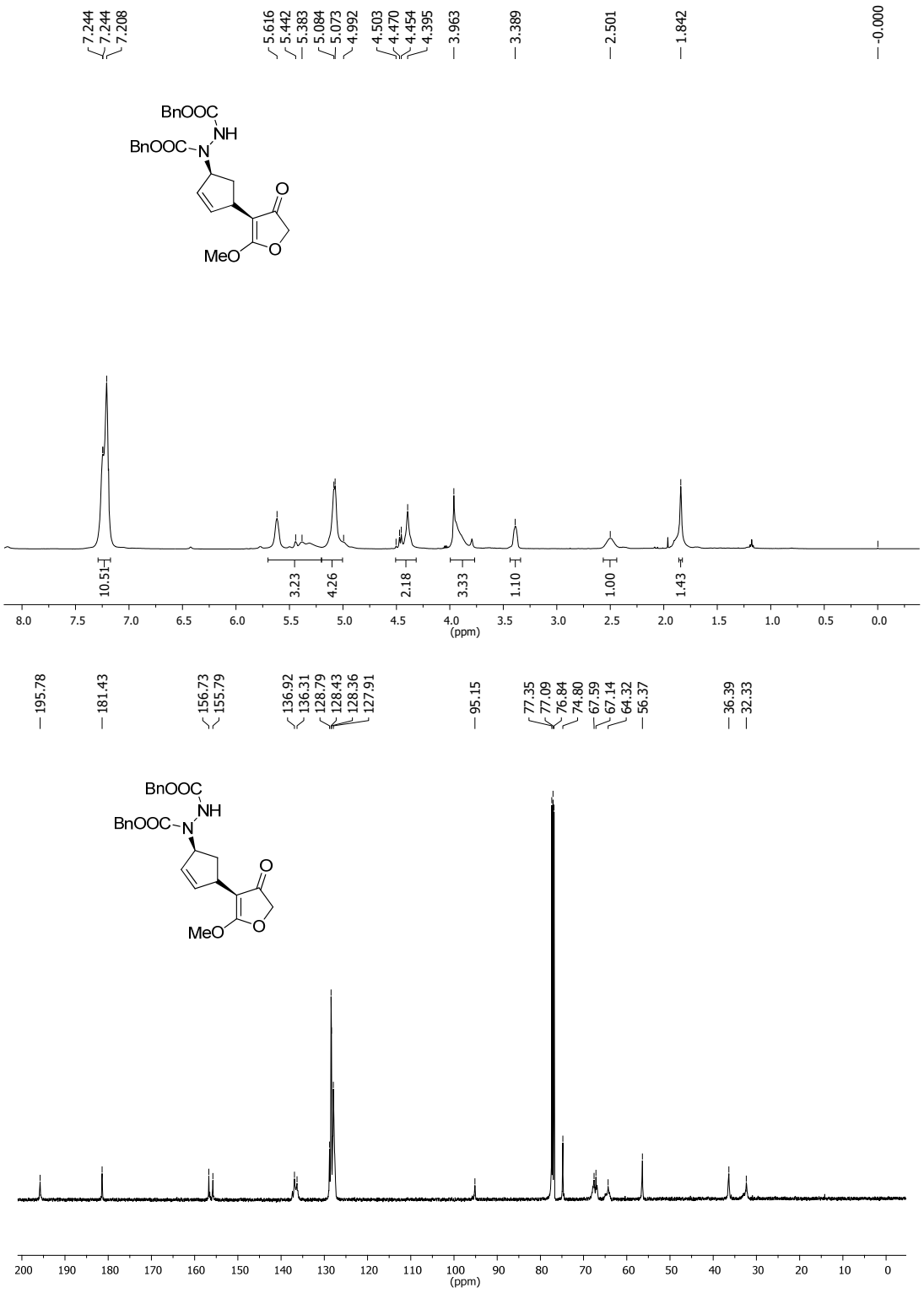


Figure S13 ^{1}H NMR (500 MHz) & ^{13}C (125 MHz) Spectra of **3i**

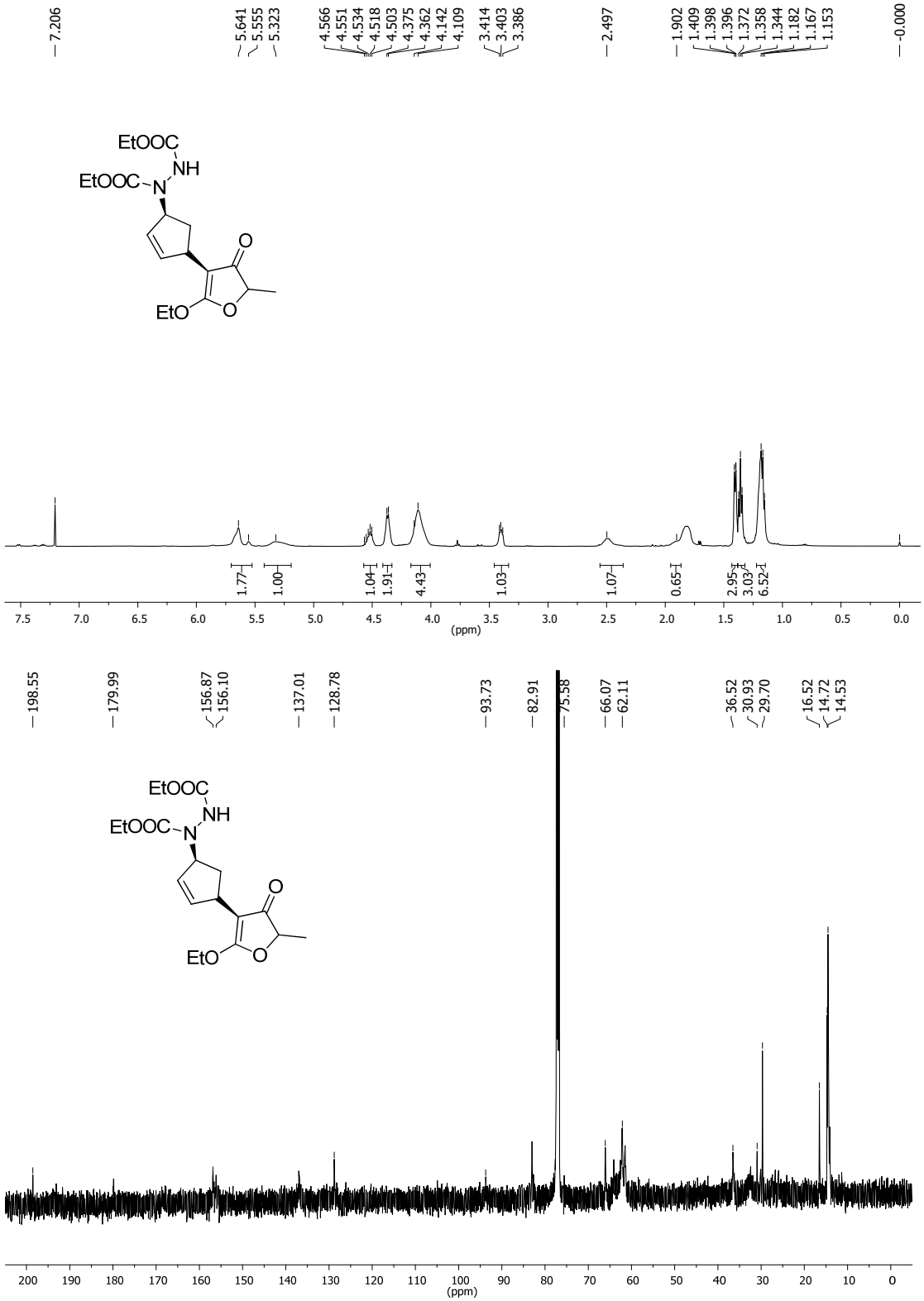


Figure S14 ^{1}H NMR (500 MHz) & ^{13}C (125 MHz) Spectra of **3j**

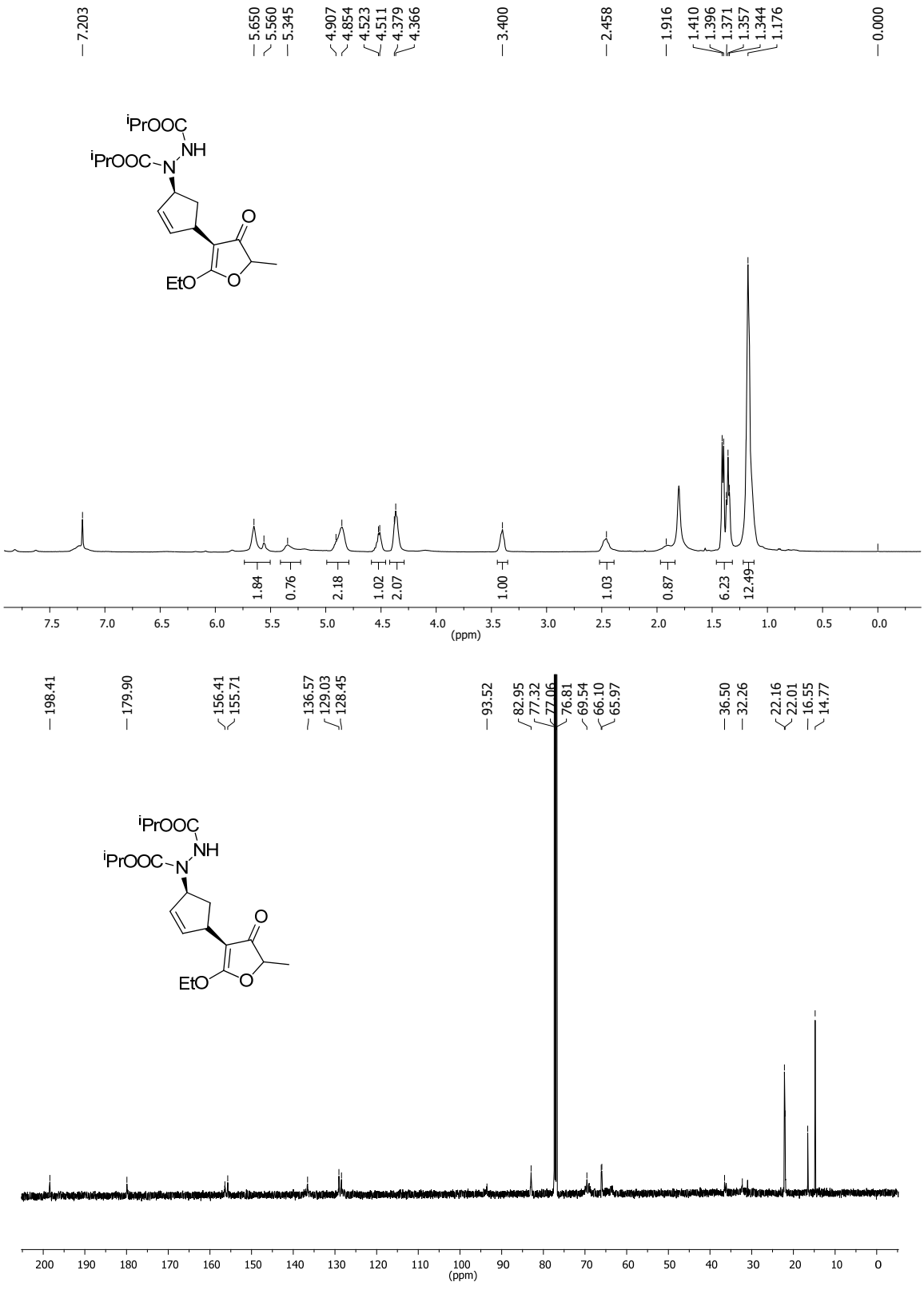


Figure S15 ^{1}H NMR (500 MHz) & ^{13}C (125 MHz) spectra of **3k**

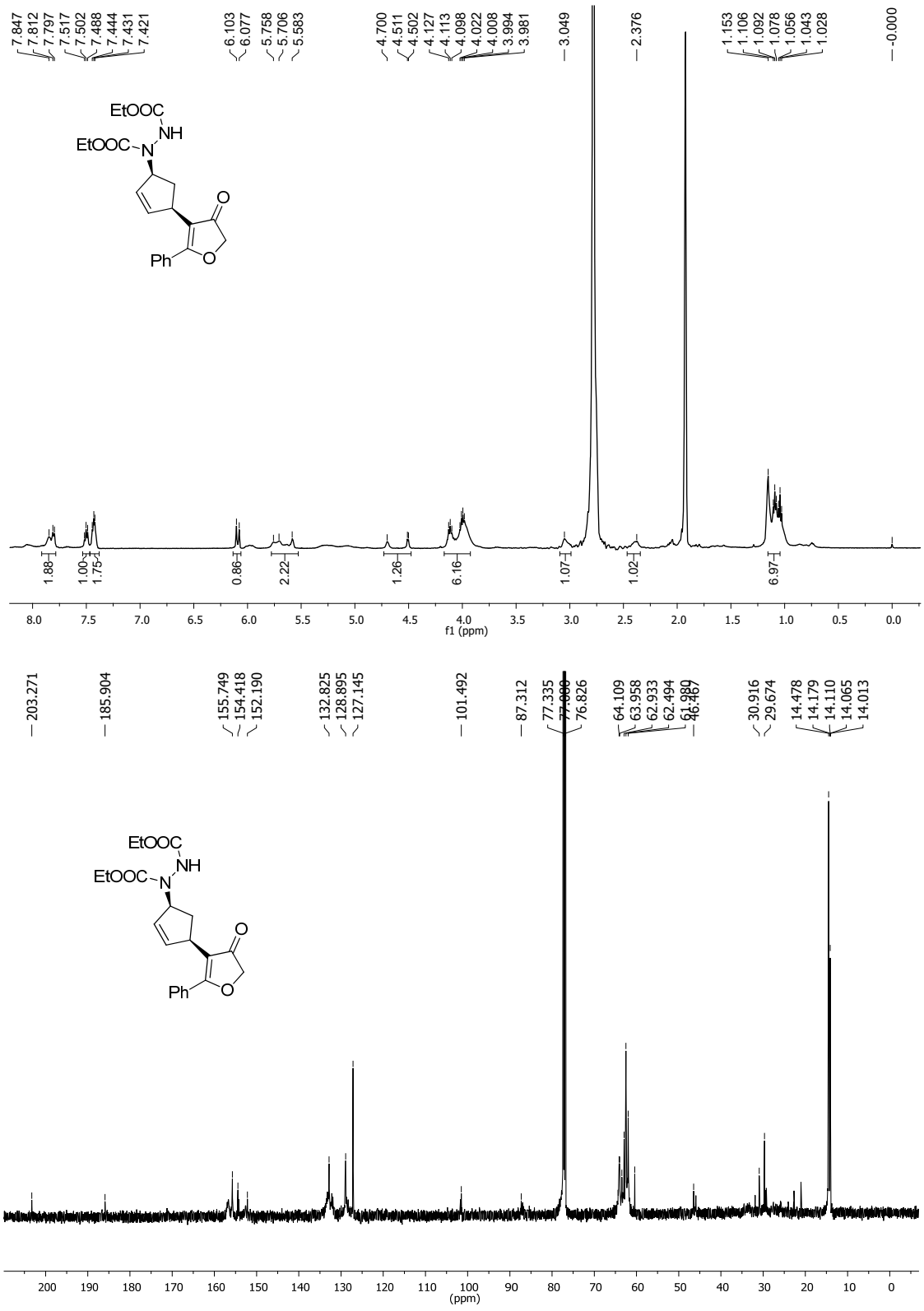


Figure S16 ^{1}H NMR (500 MHz) & ^{13}C (125 MHz) Spectra of **5a**

Figure S17 ^{1}H NMR (500 MHz) & ^{13}C (125 MHz) Spectra of **5b**

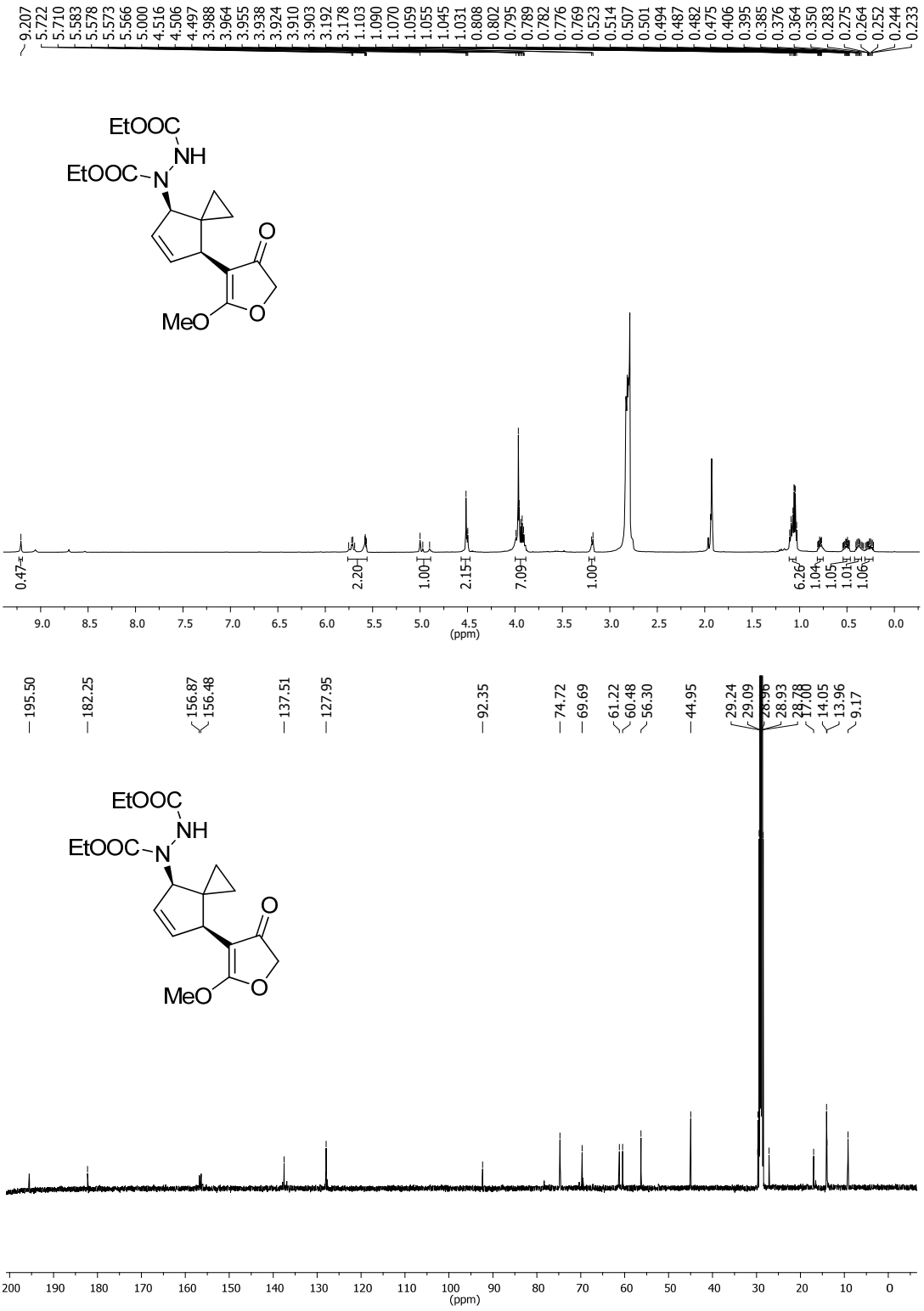


Figure S18 ^{1}H NMR (500 MHz) & ^{13}C (125 MHz) Spectra of **5c**

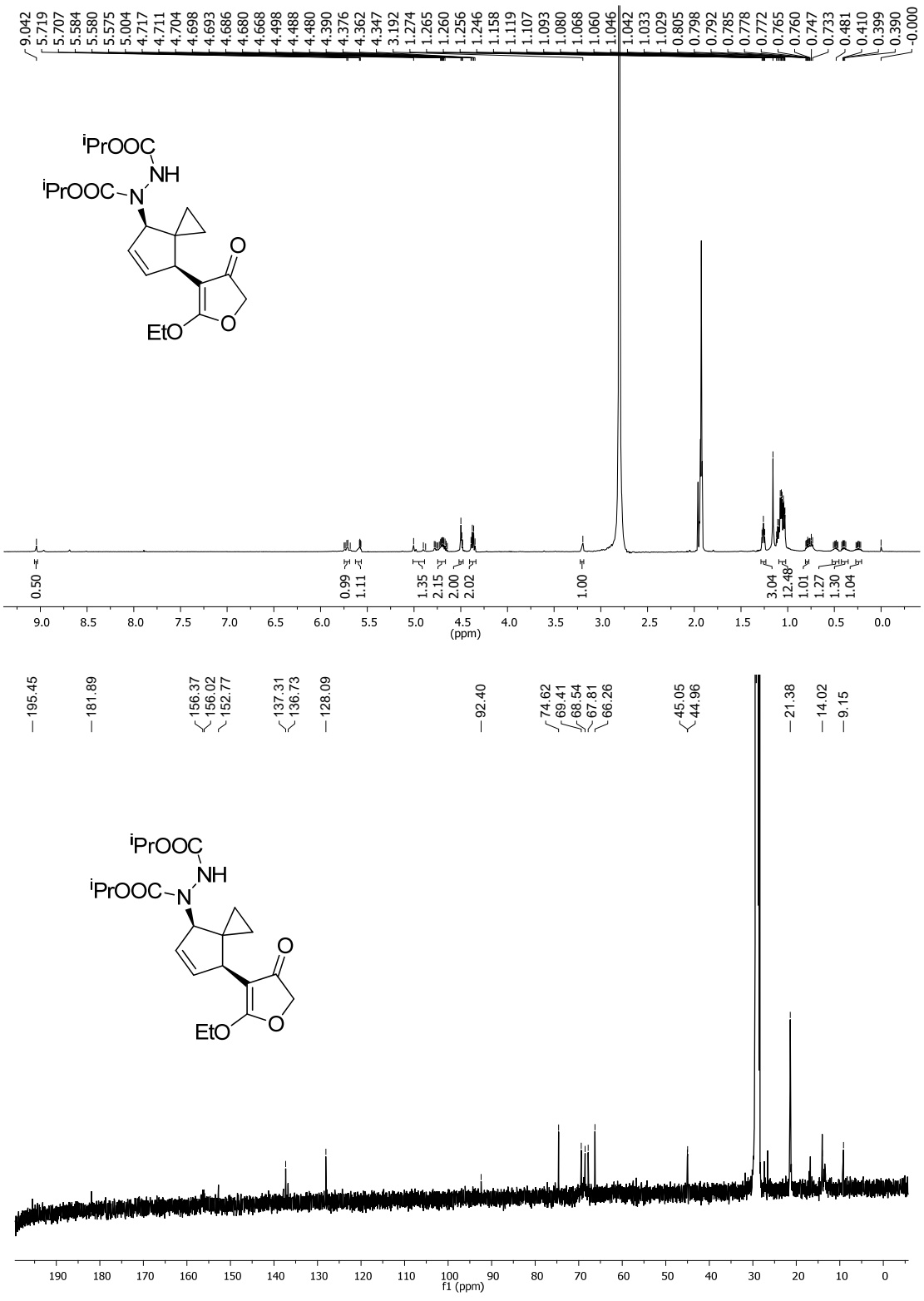


Figure S19 ^{1}H NMR (500 MHz) & ^{13}C (125 MHz) Spectra of **5d**

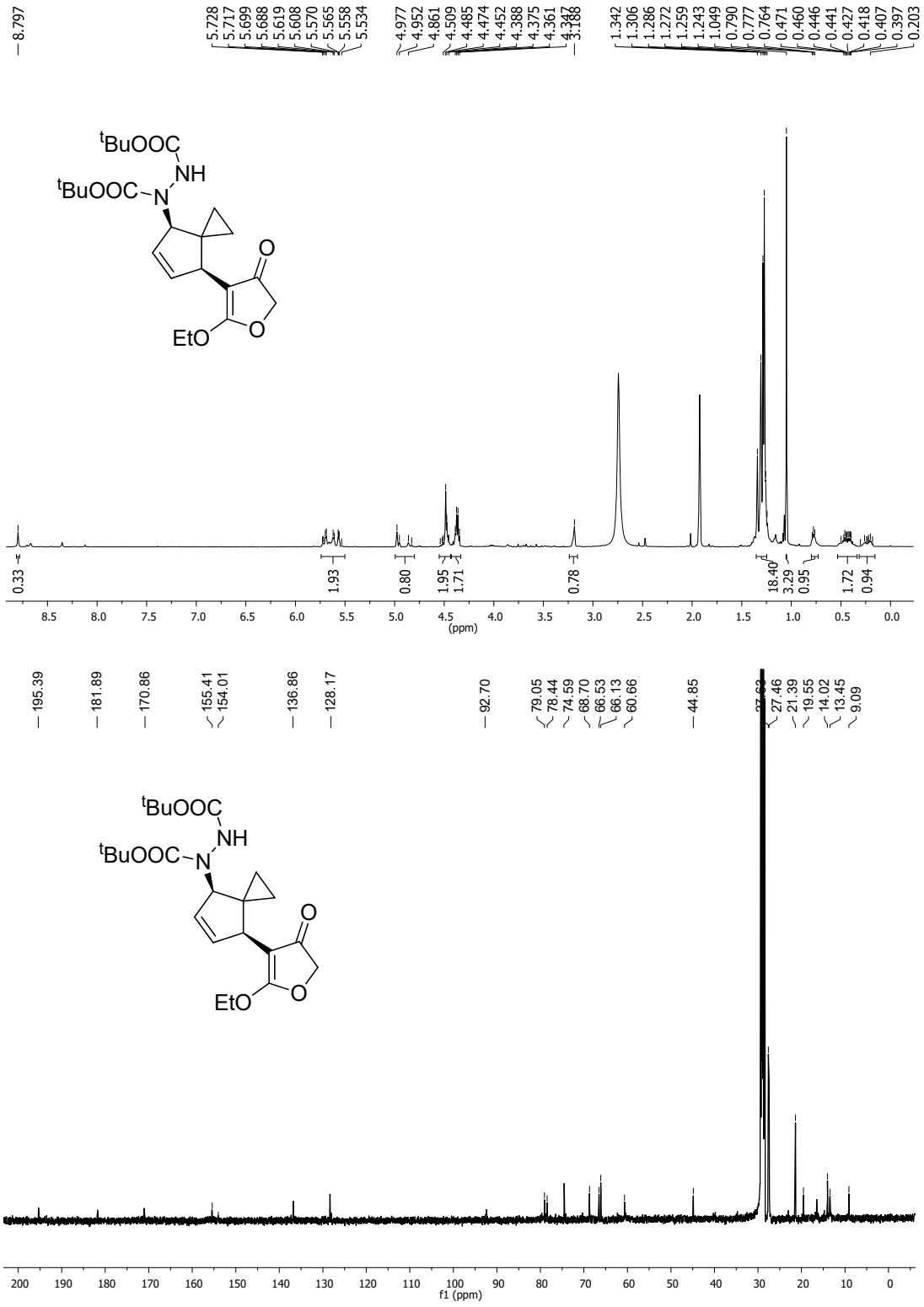


Figure S20 ^{1}H NMR (500 MHz) & ^{13}C (125 MHz) Spectra of **5e**

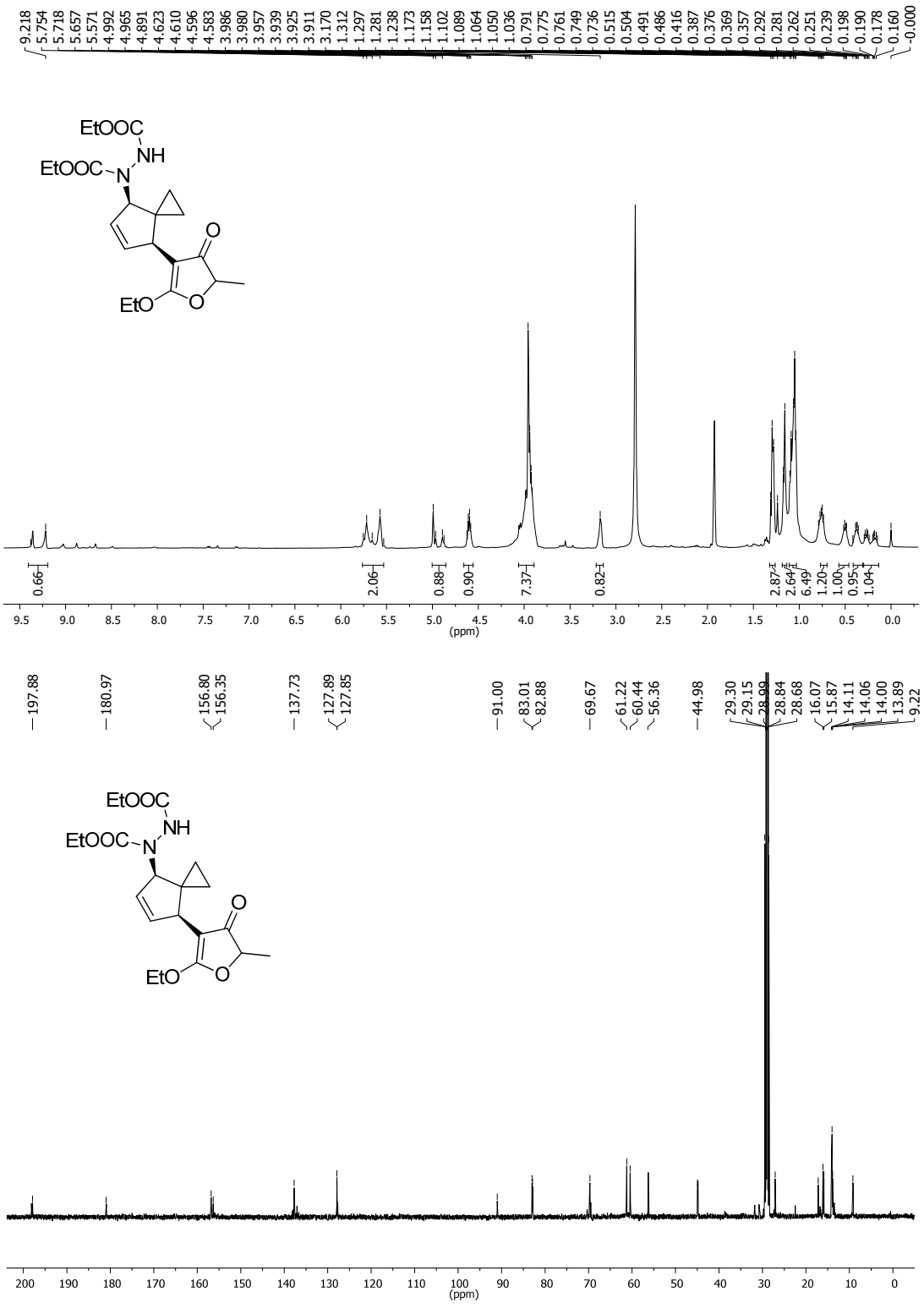


Figure S21 ^{1}H NMR (500 MHz) & ^{13}C (125 MHz) Spectra of **5f**

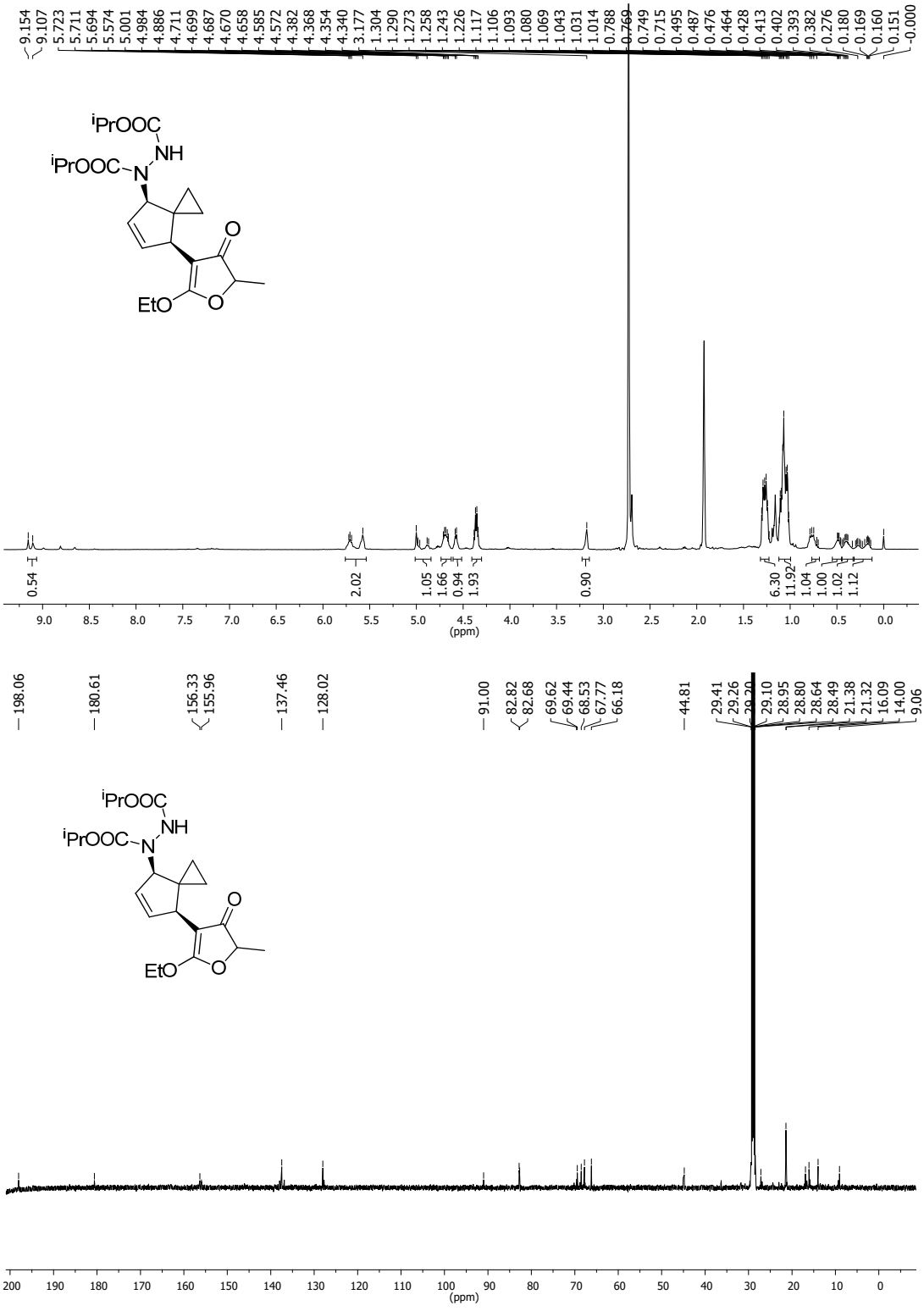


Figure S22 ^{1}H NMR (500 MHz) & ^{13}C (125 MHz) Spectra of **7a**

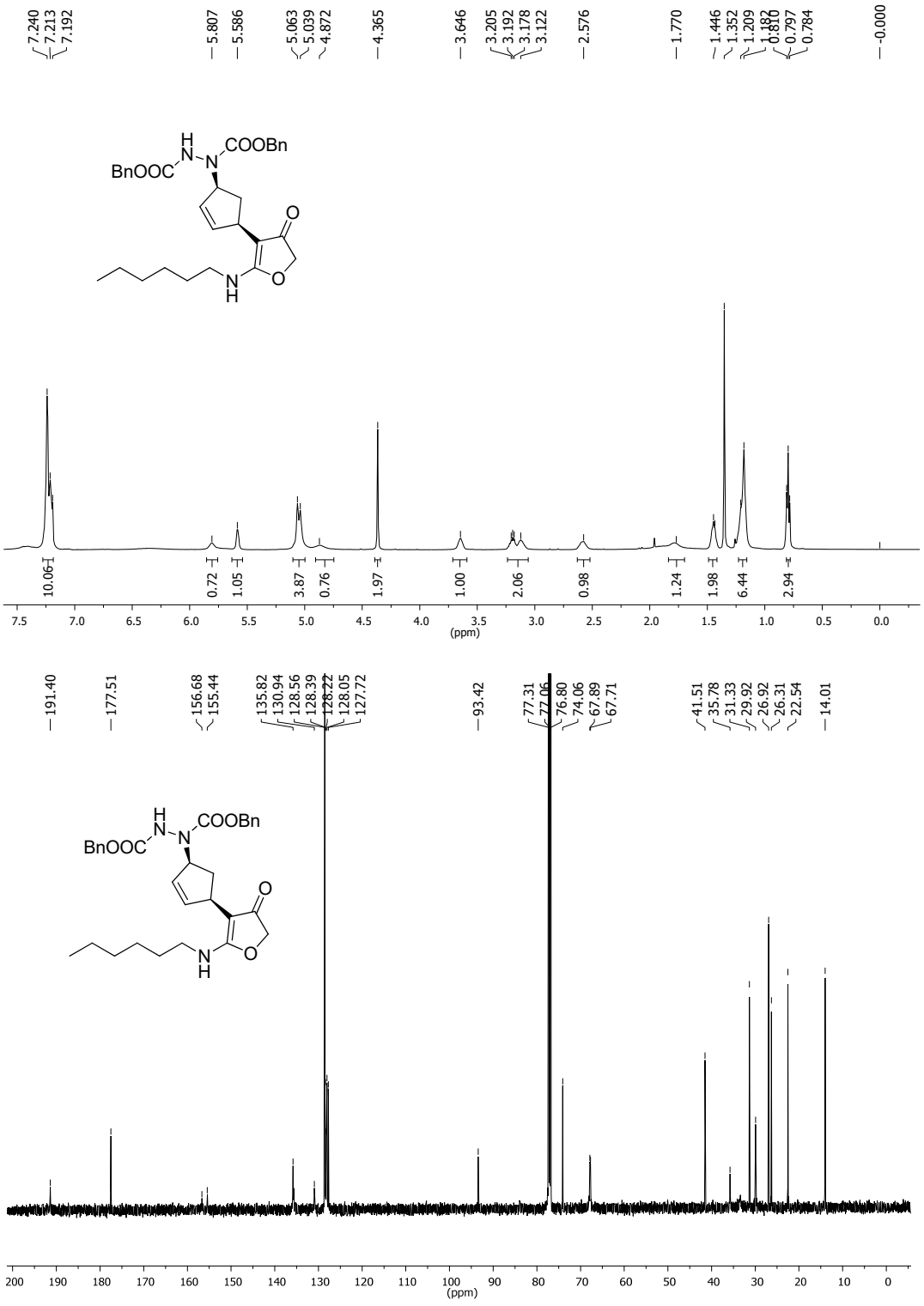


Figure S23 ^{1}H NMR (500 MHz) & ^{13}C (125 MHz) Spectra of **7b**

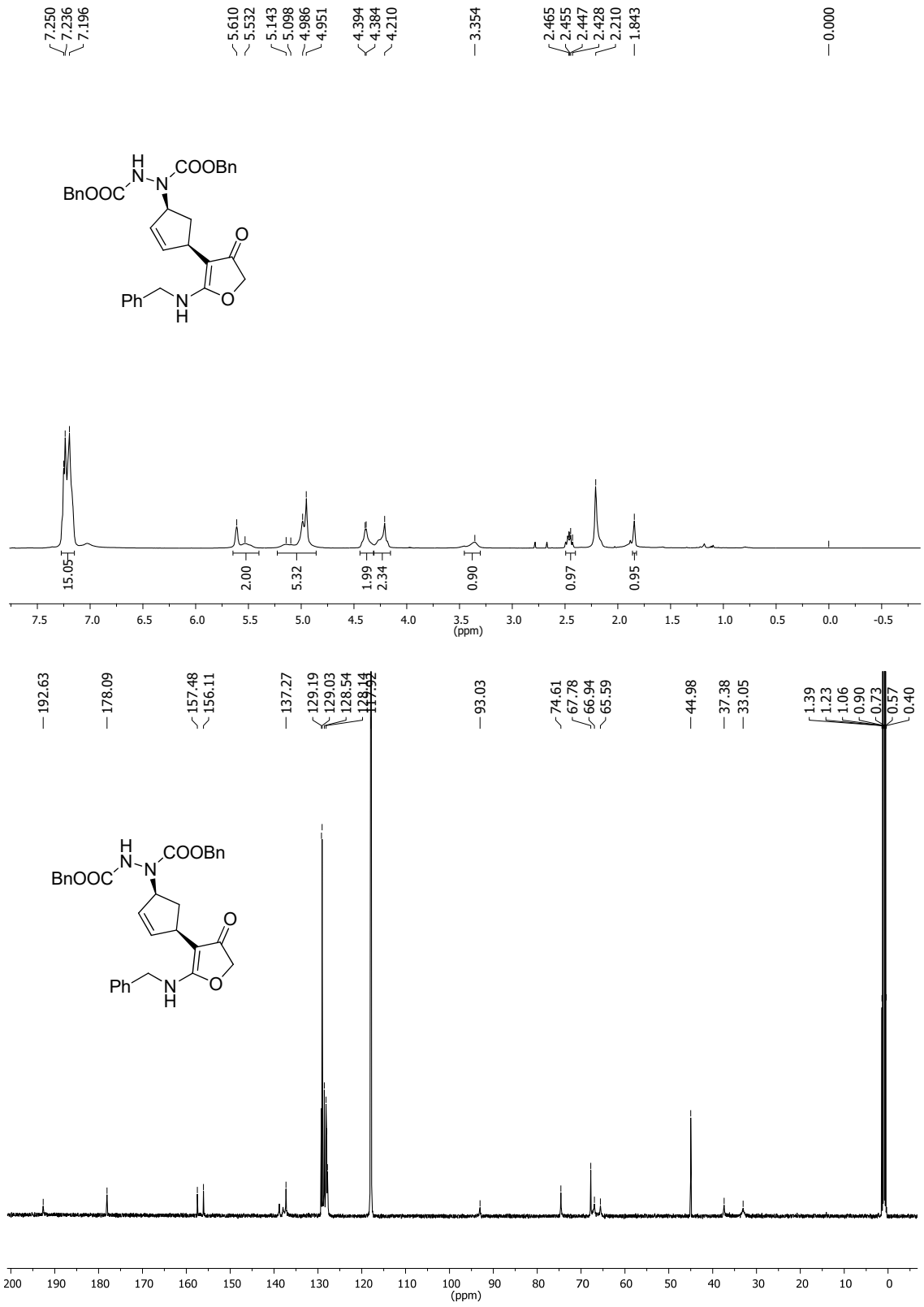


Figure S24 ^{1}H NMR (500 MHz) & ^{13}C (125 MHz) Spectra of **7c**

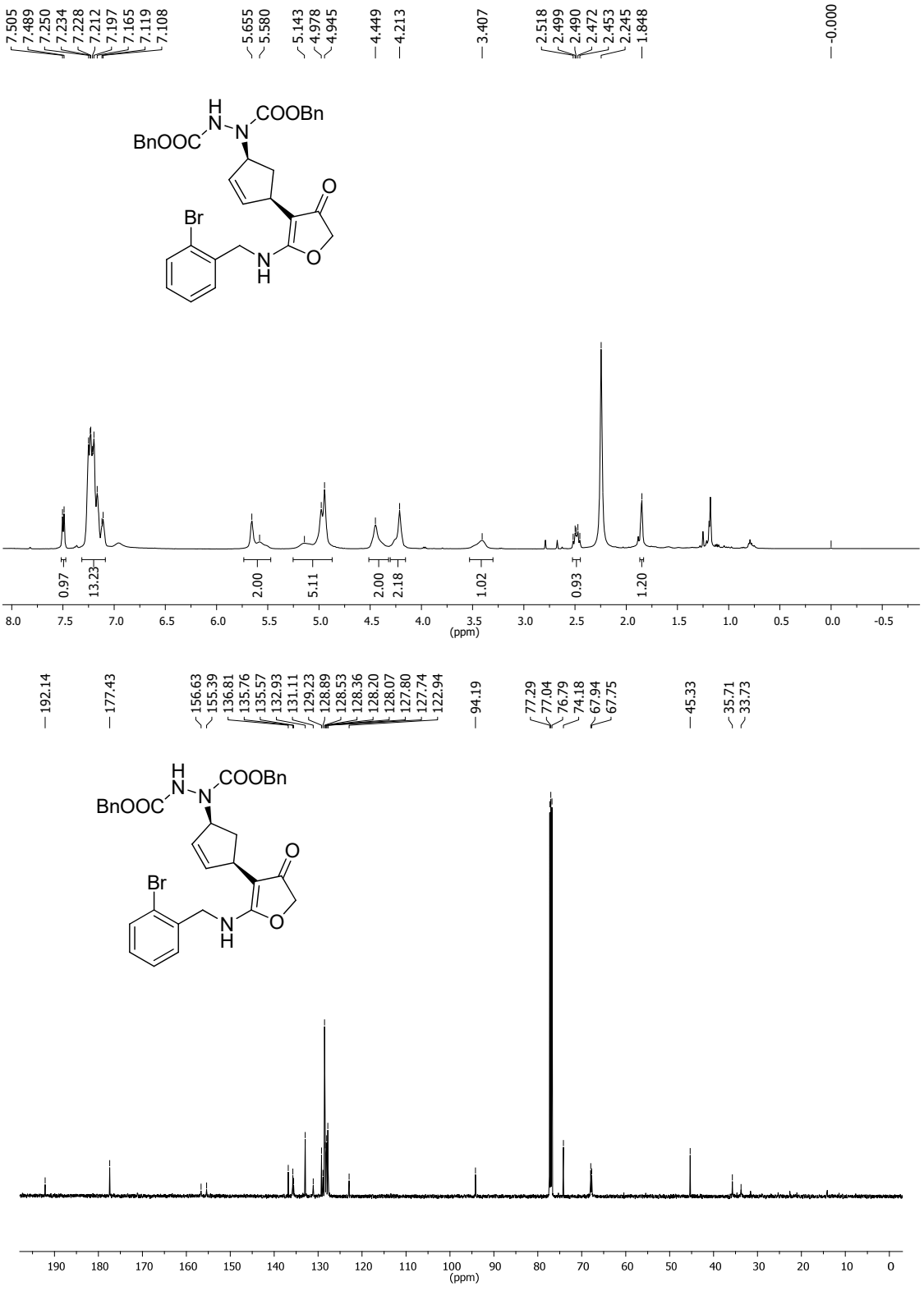


Figure S25 ^{1}H NMR (500 MHz) & ^{13}C (125 MHz) Spectra of **7d**