Regiocontrol in the Cobalt-Catalyzed Hydrosilylation of Alkynes

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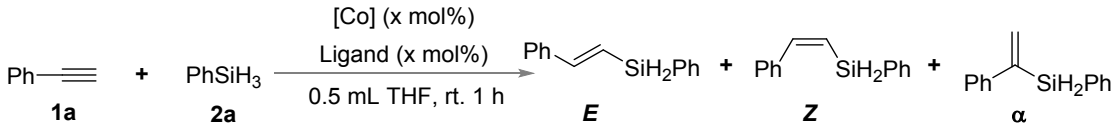
1. General experimental methods.

Reagents were purchased from commercial suppliers and used without further purification. THF, toluene, and hexane, ethyl ether were used after distillation with the sodium. Dry acetonitrile and dichloromethane were purchased from Acros Organics. Column chromatograph was performed on 35-70 mesh silica gel (Acros Organics). ^{1}H, ^{13}C, spectra were recorded on a Bruker Avance 300 Kryo spectrometer using $CDCl_3$ as solvent. Chemical shifts are reported in ppm and referenced to residual solvent signal (CDCl3: ^{1}H NMR: δ 7.26 ppm, ^{13}C NMR: δ 77.0 ppm). High Resolution Mass Spectrometry (HRMS) were recorded on Finnigan MAT 900s. GC-yields was obtained using dodecane as internal standard with Gas chromatography with FID (GC-FID, HP6890 GC-System with injector 7683B and Agilent 7820A System, carried gas: H_2).

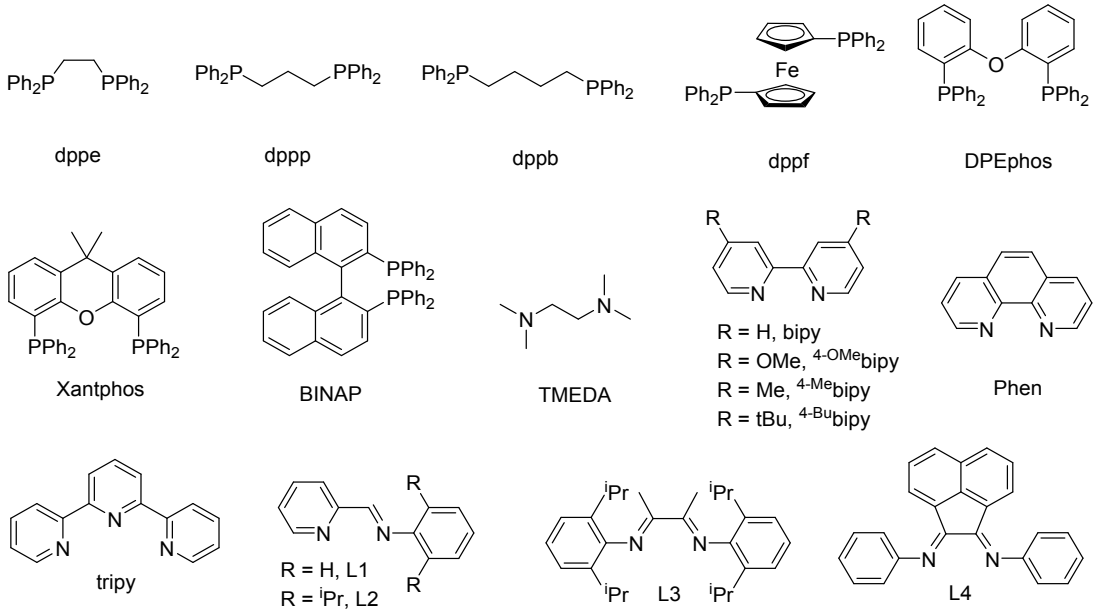
2. Method optimizations[a]

Ligand Effect



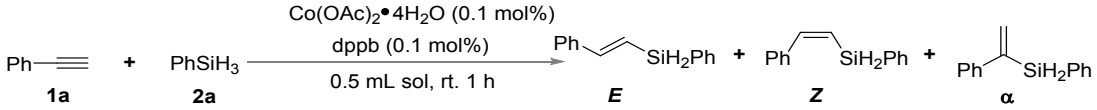
entry	**Cat. (x mol%)**	**Ligand**	**3a** (%)[b]	***E/Z/α***
1	$Co(OAc)_2•4H_2O$ (0.5)	dppe	72	87/0/13
2	$Co(OAc)_2•4H_2O$ (0.5)	dppp	81	97/0/3
3	$Co(OAc)_2•4H_2O$ (0.5)	dppb	95	98/0/2
4	$Co(OAc)_2$ (0.5)	dppb	89	98/0/2
5	$Co(acac)_2$ (0.5)	dppb	78	98/0/2
6	$CoBr_2$ (0.5)	dppb	ND	---
7	$Co(OAc)_2•4H_2O$ (0.5)	dppf	92	97/0/3
8	$Co(OAc)_2•4H_2O$ (0.5)	DPEphos	90	98/0/3
9	$Co(OAc)_2•4H_2O$ (0.5)	Xantphos	81	87/2/11
10	$Co(OAc)_2•4H_2O$ (0.5)	BINAP	<10	---
11	$Co(OAc)_2•4H_2O$ (0.5)	TMEDA	ND	---
12	$Co(OAc)_2•4H_2O$ (0.5)	bipy	75	10/0/90
13	$Co(OAc)_2•4H_2O$ (0.5)	$^{4\text{-OMe}}$bipy	66	4/0/96
14	$Co(OAc)_2•4H_2O$ (0.5)	$^{4\text{-Me}}$bipy	70	5/0/95
15	$Co(OAc)_2•4H_2O$ (0.5)	$^{4\text{-tBu}}$bipy	64	5/0/95
16	$Co(OAc)_2•4H_2O$ (0.5)	$^{2\text{-Me}}$bipy	50	20/0/80
17	$Co(OAc)_2•4H_2O$ (0.5)	$^{3\text{-Me}}$bipy	68	7/0/93
18	$Co(OAc)_2•4H_2O$ (0.5)	phen	61	10/0/90
19	$Co(OAc)_2•4H_2O$ (0.5)	tripy	ND	
20	$Co(OAc)_2•4H_2O$ (0.5)	L1	ND	---
21	$Co(OAc)_2•4H_2O$ (0.5)	L2	ND	---
22	$Co(OAc)_2•4H_2O$ (0.5)	L3	ND	---

23	$Co(OAc)_2•4H_2O$ (0.5)	L4	ND	---
24	$Ni(OAc)_2•4H_2O$ (0.5)	dppb	ND	---
25	$Fe(OAc)_2$ (0.5)	dppb	ND	---
26	$Co(OAc)_2•4H_2O$ (0.1)	dppb	94	98/0/2



[a] Reaction conditions: **1a** (0.4 mmol), **2a** (0.48 mmol), catalyst (x mol%), ligand (x mol%) in 0.5 mL THF for 1 hours. [b] GC yield using dodecane as internal standard.

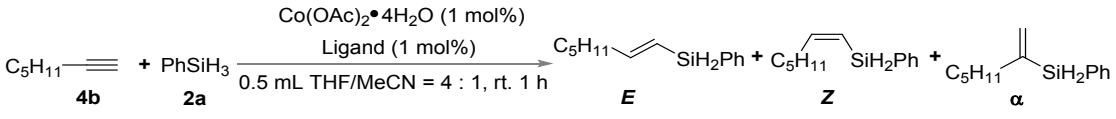
Solvent Effect



entry	Sol.	**3a** (%)[b]	***E/Z/α***
1	PhMe	77	98/0/2
2	Et_2O	94	98/0/2
3	MeCN	73	98/0/2
4	DCM	64	98/0/2

[a] Reaction conditions: **3b** (0.4 mmol), **2a** (0.48 mmol), $Co(OAc)_2•4H_2O$ (0.1 mol% in 10 μL MeOH), ligand (1 mol%) in 0.5 mL THF/MeCN = 4: 1. [b] GC yield using dodecane as internal standard.

Evaluation of Conditions for Hydrosilylation of alkyl alkynes



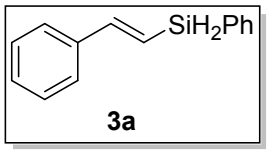
entry	**Cat. (x mol%)**	**Ligand**	**5b** (%)[b]	***E/Z/α***
1	$Co(OAc)_2•4H_2O$ (0.5)	dppb	78	90/0/10
2	$Co(OAc)_2•4H_2O$ (0.5)	DPEphos	85	97/0/3
3	$Co(OAc)_2•4H_2O$ (0.5)	dppf	86	93/0/7
4	$Co(OAc)_2$ (0.5)	Xantphos	45[c]	97/0/3

[a] Reaction conditions: **3b** (0.4 mmol), **2a** (0.48 mmol), $Co(OAc)_2•4H_2O$ (1 mol%, 10 μL MeOH), ligand (1 mol%) in 0.5 mL THF/MeCN = 4: 1. [b] GC yield using dodecane as internal standard.

3. General Procedure and characterization data

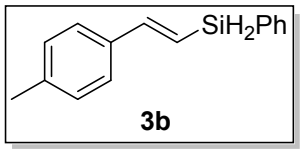
Hydrosilylation of alkynes with Co-Phosphine ligands system.

$Co(OAc)_2•4H_2O$ (0.1 mg, 0.0004 mmol, 0.001 equiv, in 10 μL MeOH), was added into 0.5 mL THF containing dppb (0.17 mg, 0.0004 mmol, 0.001 equiv). Alkyne (0.4 mmol, 1.0 equiv) was added into the system (Note: if it is solid, weigh it firstly), followed with $PhSiH_3$ (0.48 mmol, 1.2 equiv). The mixture was stirred at room temperature for 1 hours. The solvent was removed to leave a crude product, which was purified by column chromatography on silica gel to afford the product **3**. The similar procedure to afford the product **5** with 1mol% $Co(OAc)_2•4H_2O$ with DPEphos or 0.1 mol% $Co(OAc)_2•4H_2O$ with Xantphos and product **6** was obtained with 1mol% $Co(OAc)_2•4H_2O$ with $^{4\text{-Me}}$bipy ligand.



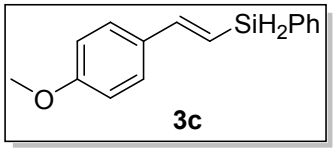
3a

The product **3a**[1] was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.66-7.63 (m, 2H), 7.49-7.46 (m, 2H), 7.43-7.32 (m, 6H), 7.18 (d, *J* = 19.0 Hz, 1H), 6.53 (dt, *J* = 19.0, 3.3 Hz, 2H), 4.71 (d, *J* = 2.9 Hz, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 149.4, 137.8, 135.5, 131.7, 129.9, 128.70, 128.66, 128.2, 126.7, 119.4.



3b

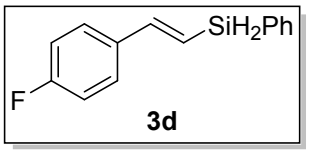
The product **3b** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.66-7.63 (m, 2H), 7.44-7.37 (m, 5H), 7.18-7.12 (m, 3H), 7.18 (d, *J* = 19.0 Hz, 1H), 6.46 (dt, *J* = 19.0, 3.3 Hz, 2H), 4.71 (d, *J* = 3.2 Hz, 2H), 2.37 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 149.3, 138.7, 135.5, 135.1, 131.9, 129.8, 129.4, 128.1, 126.7, 117.8, 21.3; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{15}H_{16}Si$: 224.1016, found: 224.1016.



3c

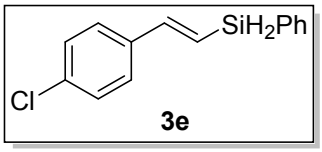
The product **3c** was purified with silica gel chromatography (Pe/EA = 50 : 1) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.64-7.61 (m, 2H), 7.42-7.38 (m, 5H), 7.11 (d, *J* = 19.0 Hz, 1H), 6.88 (d, *J* = 8.8, 2H), 6.33 (dt, *J* = 18.9, 3.3 Hz, 2H), 4.69 (d, *J* =

3.2 Hz, 2H), 3.82 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 160.1, 148.8, 135.5, 132.0, 130.9, 129.8, 128.10, 128.06, 116.3, 113.4, 55.4; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{15}H_{16}OSi$: 240.0965, found: 240.0962.



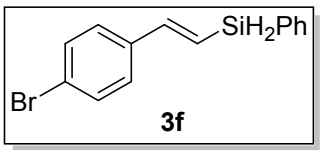
3d

The product **3d** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.65-7.61 (m, 2H), 7.46-7.36 (m, 5H), 7.11 (d, *J* = 19.0 Hz, 1H), 7.04 (t, *J* = 8.1 Hz, 2H), 6.88 (d, *J* = 8.8, 2H), 6.42 (dt, *J* = 18.9, 3.3 Hz, 2H), 4.69 (d, *J* = 3.2 Hz, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 163.0 (d, *J* = 248.3 Hz), 148.0, 135.5, 134.0 (d, *J* = 3.3 Hz), 131.6, 129.9, 128.4 (d, *J* = 8.2 Hz), 128.2, 119.2 (d, *J* = 2.2 Hz), 115.6 (d, *J* = 21.7 Hz); HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{14}H_{13}FSi$: 228.0765, found: 228.0767.



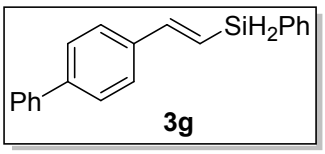
3e

The product **3e** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.64-7.61 (m, 2H), 7.49-7.39 (m, 5H), 7.34-7.30 (m, 2H), 7.10 (d, *J* = 19.0 Hz, 1H), 6.49 (dt, *J* = 19.0, 3.2 Hz, 1H), 4.70 (d, *J* = 3.2 Hz, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 147.8, 136.2, 135.5, 134.4, 131.4, 130.0, 128.8, 128.2, 127.9, 120.4; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{14}H_{13}ClSi$: 244.0470, found: 244.0474.



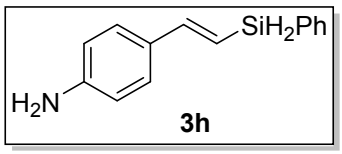
3f

The product **3f** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.64-7.61 (m, 2H), 7.44-7.37 (m, 5H), 7.32 (d, *J* = 8.5 Hz, 2H), 7.09 (d, *J* = 19.0 Hz, 1H), 6.51 (dt, *J* = 19.0, 3.2 Hz, 1H), 4.69 (d, *J* = 3.2 Hz, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 147.8, 136.6, 135.5, 131.8, 131.3, 130.0, 128.2, 122.6, 120.6; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{14}H_{13}BrSi$: 287.9964, found: 287.9957.



3g

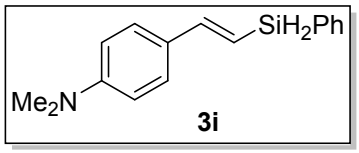
The product **3g** was purified with silica gel chromatography (Pe) as a white solid. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.66-7.52 (m, 8H), 7.47-7.35 (m, 6H), 7.20 (d, *J* = 19.0 Hz, 1H), 6.56 (dt, *J* = 19.0, 3.3 Hz, 1H), 4.72 (d, *J* = 3.2 Hz, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 148.8, 141.4, 140.6, 136.8, 135.5, 131.7, 129.9, 128.8, 128.2, 127.5, 127.3, 127.2, 127.0, 119.5; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{20}H_{18}Si$: 286.1172, found: 286.1170.



3h

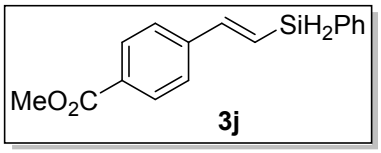
The product **3h** was purified with silica gel chromatography (Pe/EA = 5 : 1) as a pale yellow oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.64-7.61 (m, 2H), 7.41-7.38 (m, 3H), 7.29 (d, *J* = 8.4 Hz, 2H), 7.06 (d, *J* = 18.9 Hz, 1H), 6.65 (d, *J* = 8.5 Hz, 2H), 6.24 (dt, *J* = 18.9, 3.3 Hz, 1H), 4.63 (d, *J* = 3.0 Hz, 2H), 3.77 (brs, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 149.3,

147.1, 135.5, 132.3, 129.7, 128.7, 128.1, 128.05, 114.9, 114.1; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{14}H_{15}NSi$: 225.0968, found: 225.0962.



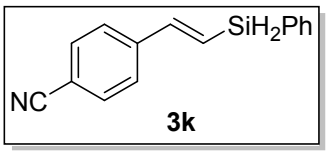
3i

The product **3i** was purified with silica gel chromatography (Pe/EA = 30 : 1) as a pale yellow oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.66-7.63 (m, 2H), 7.40-7.36 (m, 5H), 7.10 (d, *J* = 18.9 Hz, 1H), 6.69 (d, *J* = 8.8 Hz, 2H), 6.23 (dt, *J* = 18.9, 3.3 Hz, 1H), 4.70 (d, *J* = 3.0 Hz, 2H), 2.99 (s, 6H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 150.8, 149.5, 135.5, 132.6, 129.6, 128.0, 127.9, 126.4, 112.9, 112.1, 40.1; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{16}H_{19}NSi$: 253.1281, found: 253.1285.



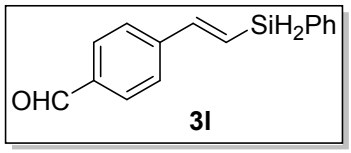
3j

The product **3j** was purified with silica gel chromatography (Pe/EA = 30 : 1) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.02 (d, *J* = 8.3 Hz, 2H), 7.65-7.62 (m, 2H), 7.51 (d, *J* = 8.4 Hz, 2H), 7.45-7.38 (m, 3H), 7.18 (d, *J* = 19.0 Hz, 1H), 6.66 (dt, *J* = 19.0, 3.2 Hz, 1H), 4.71 (d, *J* = 3.2 Hz, 2H), 3.92 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 166.8, 148.0, 141.9, 135.5, 131.1, 130.0, 129.98, 129.92, 128.2, 126.6, 123.1, 52.2; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{16}H_{16}O_2Si$: 268.0914, found: 268.0890.



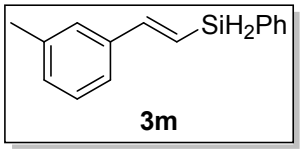
3k

The product **3k** was purified with silica gel chromatography (Pe/EA = 30 : 1) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.65-7.61 (m, 4H), 7.53 (d, *J* = 8.4 Hz, 2H), 7.45-7.43 (m, 3H), 7.14 (d, *J* = 19.0 Hz, 1H), 6.68 (dt, *J* = 19.0, 3.2 Hz, 1H), 4.71 (d, *J* = 3.1 Hz, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 146.9, 141.7, 135.5, 132.4, 130.6, 130.1, 128.2, 127.1, 124.9, 118.8, 111.7; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{15}H_{13}NSi$: 235.0812, found: 235.0813.



3l

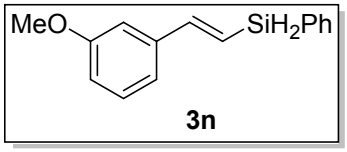
The product **3l** was purified with silica gel chromatography (Pe/EA = 30 : 1) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 10.01 (s, 1H), 7.87 (d, *J* = 8.3 Hz, 2H), 7.65-7.59 (m, 4H), 7.45-7.39 (m, 3H), 7.19 (d, *J* = 19.0 Hz, 1H), 6.72 (dt, *J* = 19.0, 3.2 Hz, 1H), 4.72 (d, *J* = 3.1 Hz, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 191.2, 147.7, 143.3, 136.1, 135.5, 130.9, 130.2, 130.1, 128.3, 127.2, 124.5; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{15}H_{14}OSi$: 238.0808, found: 238.0803.



3m

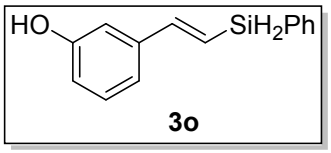
The product **3m** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.66-7.63 (m, 2H), 7.44-7.40 (m, 3H), 7.30-7.25 (m, 3H), 7.15 (d, *J* = 19.0 Hz, 1H), 6.51 (dt,

J = 19.0, 3.3 Hz, 1H), 4.71 (d, *J* = 3.2 Hz, 2H), 2.37 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 159.9, 149.2, 139.2, 135.3, 131.6, 129.9, 129.6, 128.2, 119.8, 119.5, 114.5, 111.7, 55.3; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{15}H_{16}Si$: 224.1016, found: 224.1009.



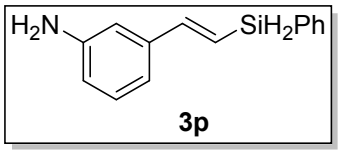
3n

The product **3n** was purified with silica gel chromatography (Pe/EA = 50 : 1) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.65-7.62 (m, 2H), 7.44-7.37 (m, 3H), 7.27 (t, *J* = 7.9 Hz, 1H), 7.14 (d, *J* = 18.9 Hz, 1H), 7.06 (d, *J* = 7.6 Hz, 1H), 7.01-7.00 (m, 1H), 6.87-6.84 (m, 1H), 6.51 (dt, *J* = 18.9, 3.3 Hz, 1H), 4.70 (d, *J* = 3.2 Hz, 2H), 2.83 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 149.5, 138.2, 137.7, 135.5, 131.8, 129.8, 129.5, 128.5, 128.1, 127.4, 123.9, 119.1, 21.4; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{15}H_{16}OSi$: 240.0965, found: 240.0964.



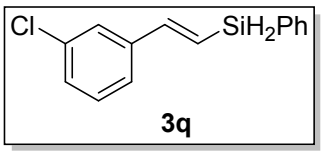
3o

The product **3o** was purified with silica gel chromatography (Pe/EA = 10 : 1) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.64-7.61 (m, 2H), 7.43-7.37 (m, 3H), 7.22 (t, *J* = 7.8 Hz, 1H), 7.10 (d, *J* = 19.0 Hz, 1H), 7.03 (d, *J* = 7.7 Hz, 1H), 7.95-7.93 (m, 1H), 6.79-6.76 (m, 1H), 6.49 (dt, *J* = 18.9, 3.3 Hz, 1H), 4.90 (brs, 1H), 4.69 (d, *J* = 3.2 Hz, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 155.8, 148.8, 139.5, 135.5, 131.6, 129.88, 129.85, 128.2, 120.0, 119.6, 115.7, 113.1.; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{14}H_{14}OSi$: 226.0808, found: 226.0812.



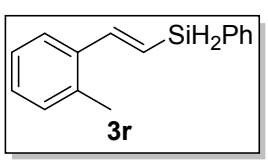
3p

The product **3p** was purified with silica gel chromatography (Pe/EA = 5 : 1) as a pale yellow oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.66-7.62 (m, 2H), 7.43-7.40 (m, 3H), 7.16 (t, *J* = 7.7 Hz, 1H), 7.09 (d, *J* = 19.3 Hz, 1H), 6.89 (d, *J* = 7.6 Hz, 1H), 6.80-6.79 (m, 1H), 6.66-6.62 (m, 1H), 6.46 (dt, *J* = 18.9, 3.3 Hz, 1H), 4.70 (d, *J* = 3.2 Hz, 2H), 3.65 (brs, 2H),; ^{13}C NMR (75 MHz, $CDCl_3$) δ 149.6, 146.7, 138.9, 135.5, 131.8, 129.8, 129.6, 128.1, 119.1, 117.5, 115.6, 113.1; HRMS (ESI) (*m/z*): $[M+H]^+$ calcd for $C_{14}H_{16}NSi$: 226.1047, found: 226.1048.



3q

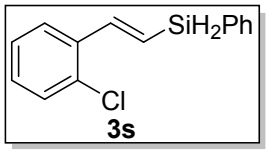
The product **3q** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.65-7.62 (m, 2H), 7.45-7.40 (m, 4H), 7.33-7.26 (m, 3H), 7.09 (d, *J* = 19.0 Hz, 1H), 6.54 (dt, *J* = 18.9, 3.2 Hz, 1H), 4.70 (d, *J* = 3.2 Hz, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 147.7, 139.6, 135.5, 134.7, 131.2, 130.0, 129.9, 128.6, 128.2, 126.6, 124.9, 121.6; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{14}H_{13}ClSi$: 244.0470, found: 244.0469.



3r

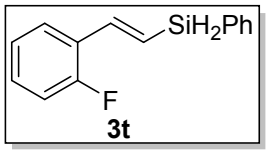
The product **3r** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.68-7.64 (m, 2H), 7.58-7.55 (m, 1H), 7.48-7.38 (m, 4H), 7.23-7.17 (m, 3H), 6.44 (dt, *J* = 18.9, 3.3 Hz,

1H), 4.73 (d, J = 2.8 Hz, 2H), 2.39 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 147.3, 137.1, 135.7, 135.5, 131.8, 130.5, 129.9, 128.4, 128.2, 126.2, 125.6, 121.1, 19.7; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{15}H_{16}Si$: 224.1016, found: 221.1016.



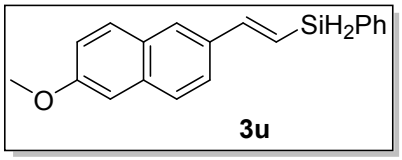
3s

The product **3s** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.66-7.56 (m, overlap, 4H), 7.44-7.35 (m, 4H), 7.26-7.22 (m, 2H), 6.53 (dt, J = 18.9, 3.3 Hz, 1H), 4.73 (d, J = 3.3 Hz, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 145.0, 135.8, 135.5, 133.4, 131.3, 129.9, 129.8, 129.5, 128.2, 126.94, 126.91, 123.2; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{10}H_{13}ClSi$: 244.0470, found: 244.0460.



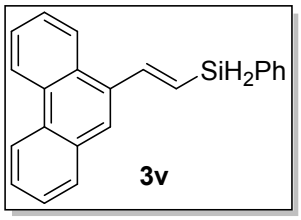
3t

The product **3t** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.66-7.63 (m, 2H), 7.57 (td, J = 7.7, 1.7 Hz, 1H), 7.44-7.36 (m, 4H), 7.31-7.23 (m, 1H), 7.16-7.02 (m, 2H), 6.60 (dt, J = 19.2, 3.3 Hz, 1H), 4.72 (d, J = 3.3 Hz, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 160.4 (d, J = 250.7 Hz), 141.1 (d, J = 4.5 Hz), 135.5, 131.4, 130.0, 129.9, 128.2, 127.2 (d, J = 3.3 Hz), 125.6 (d, J = 11.6 Hz), 124.2 (d, J = 2.6 Hz), 122.6 (d, J = 3.8 Hz), 115.6 (d, J = 22.1 Hz); HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{14}H_{13}FSi$: 228.0765, found: 228.0745.



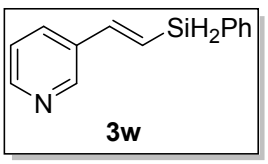
3u

The product **3u** was purified with silica gel chromatography (Pe/EA = 30 : 1) as a white solid. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.74-7.65 (m, 6H), 7.45-7.40 (m, 3H), 7.29 (d, J = 19.2 Hz, 1H), 7.17-7.13 (m, 2H), 6.57 (dt, J = 18.9, 3.2 Hz, 1H), 4.74 (d, J = 3.1 Hz, 2H), 3.93 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 158.1, 149.4, 135.6, 134.8, 133.2, 131.9, 129.9, 129.8, 128.9, 128.2, 127.2, 127.1, 123.9, 119.1, 118.3, 105.9, 55.4; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{19}H_{18}OSi$: 290.1121, found: 290.1113.



3v

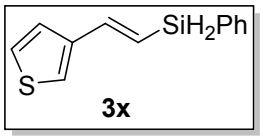
The product **3v** was purified with silica gel chromatography (Pe) as a white solid. ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.73 (d, J = 7.7 Hz, 1H), 8.67 (d, J = 8.0 Hz, 1H), 8.19-8.16 (m, 1H), 7.99-7.89 (m, 3H), 7.74-7.59 (m, 6H), 7.46-7.42 (m, 3H), 6.70 (dt, J = 18.6, 3.2 Hz, 1H), 4.82 (d, J = 2.6 Hz, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 147.3, 135.6, 135.1, 131.6, 130.5, 130..4, 130.2, 129.9, 128.9, 128.2, 126.88, 126.85, 126.8, 126.7, 125.2, 124.4, 124.1, 123.1, 122.6; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{12}H_{18}Si$: 310.1172, found: 310.1167.



3w

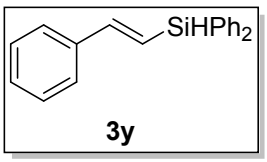
The product **3w** was purified with silica gel chromatography (Pe/EA = 5 : 1) as a pale yellow oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.66 (d, J = 2.0 Hz, 1H), 8.52 (dd, J = 4.8, 1.5 Hz, 1H), 8.78 (dt, J = 8.0, 1.9 Hz, 1H),

7.65-7.62 (m, 2H), 7.45-7.40 (m, 3H), 7.30-7.26 (m, 1H), 7.14 (d, *J* = 19.0 Hz, 1H), 6.62 (dt, *J* = 19.0, 3.2 Hz, 1H), 4.71 (d, *J* = 3.2 Hz, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 143.0, 141.6, 135.5, 131.7, 129.9, 128.1, 126.2, 124.9, 123.9, 119.0; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{13}H_{13}NSi$: 211.0812, found: 244.0799.



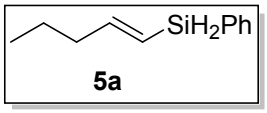
3x

The product **3x** was purified with silica gel chromatography (Pe/EA = 30 : 1) as a pale yellow oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.65-7.62 (m, 2H), 7.42-7.39 (m, 3H), 7.30-7.26 (m, 3H), 7.15 (d, *J* = 18.9 Hz, 1H), 6.29 (dt, *J* = 18.9, 3.3 Hz, 1H), 4.68 (d, *J* = 3.2 Hz, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 149.6, 148.8, 145.2, 135.5, 133.2, 133.0, 131.0, 130.1, 128.3, 123.6, 122.9; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{12}H_{12}SSi$: 216.0424, found: 216.0427.



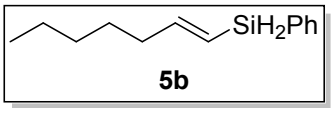
3y

The product **3y**[2] was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.65-7.62 (m, 4H), 7.50-7.32 (m, 11H), 7.11 (d, *J* = 19.0 Hz, 1H), 6.73 (dt, *J* = 19.0, 3.2 Hz, 1H), 5.26 (d, *J* = 3.2 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 149.1, 137.9, 135.6, 133.6, 129.8, 128.64, 128.62, 128.1, 126.8, 121.5.



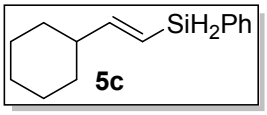
5a

The product **5a** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.61-7.57 (m, 2H), 7.44-7.35 (m, 3H), 6.37 (dt, *J* = 18.4, 6.3 Hz, 1H), 5.78-5.69 (m, 1H), 4.55 (d, *J* = 3.2 Hz, 2H), 2.18 (q, *J* = 7.1 Hz, 2H), 1.47 (dd, *J* = 14.8, 7.4 Hz, 2H), 0.93 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 154.0, 135.4, 132.4, 129.6, 128.0, 120.1, 39.0, 21.6, 13.7; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{11}H_{16}Si$: 176.1016, found: 176.1015.



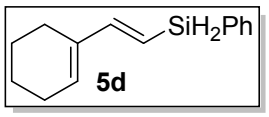
5b

The product **5b** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.60-7.57 (m, 2H), 7.41-7.35 (m, 3H), 6.38 (dt, *J* = 18.4, 6.3 Hz, 1H), 5.77-5.69 (m, 1H), 4.54 (d, *J* = 3.3 Hz, 2H), 2.19 (q, *J* = 6.7 Hz, 2H), 1.46-1.42 (m, 2H), 1.33-1.29 (m, 4H), 0.90 (t, *J* = 6.9 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 154.3, 135.4, 132.4, 129.6, 128.0, 119.8, 36.9, 31.4, 28.1, 22.6, 14.1; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{13}H_{20}Si$: 204.1329, found: 204.1311.



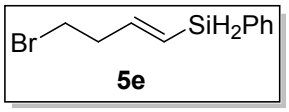
5c

The product **5c** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.59-7.56 (m, 2H), 7.40-7.35 (m, 3H), 6.33 (dd, *J* = 18.6, 6.0 Hz, 1H), 5.72-5.63 (m, 1H), 4.54 (d, *J* = 3.2 Hz, 2H), 2.11-2.02 (m, 2H), 1.80-1.72 (m, 4H), 1.36-1.05 (m, 6H), 0.90 (t, *J* = 6.9 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 159.5, 135.4, 132.5, 129.6, 128.0, 116.7, 44.2, 32.1, 26.2, 26.0; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{14}H_{20}Si$: 216.1329, found: 216.1327.



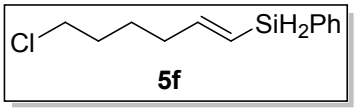
5d

The product **5d** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.61-7.58 (m, 2H), 7.41-7.35 (m, 3H), 6.79 (d, *J* = 18.8 Hz, 1H), 5.88 (s, 1H), 5.73 (dt, *J* = 18.8, 3.3 Hz, 1H), 4.61 (d, *J* = 3.2 Hz, 2H), 2.19-2.16 (m, 4H), 1.71-1.59 (m, 4H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 153.1, 137.3, 135.4, 132.9, 132.4, 129.6, 128.0, 114.1, 26.0, 23.9, 22.5, 22.4; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{14}H_{18}OSi$: 214.1172, found: 214.1168.



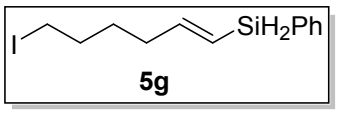
5e

The product **5e** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.61-7.58 (m, 2H), 7.43-7.38 (m, 3H), 6.31 (dt, *J* = 18.5, 6.2 Hz, 1H), 5.93-5.84 (m, 1H), 4.56 (d, *J* = 3.2 Hz, 2H), 3.46 (t, *J* = 7.0 Hz, 2H), 2.76 (q, *J* = 6.3 Hz, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 149.1, 135.4, 131.6, 129.8, 128.1, 124.1, 39.7, 31.1; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{10}H_{13}BrSi$: 239.9964, found: 239.9937.



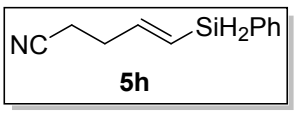
5f

The product **5f** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.61-7.58 (m, 2H), 7.43-7.38 (m, 3H), 6.35 (dt, *J* = 18.4, 6.2 Hz, 1H), 5.81-5.72 (m, 1H), 4.54 (d, *J* = 3.2 Hz, 2H), 3.55 (t, *J* = 6.6 Hz, 2H), 2.23 (q, *J* = 6.2 Hz, 2H), 1.85-1.76 (m, 2H), 1.6-1.57 (m, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 152.9, 135.4, 132.1, 129.7, 128.1, 120.9, 44.9, 36.0, 32.0, 25.6.; GC-MS (EI) (*m/z*): $[M]^+$ calcd for $C_{12}H_{17}ClSi$: 224.08, found: 224.07.



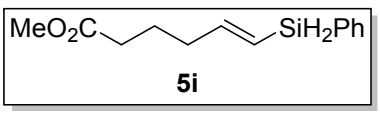
5g

The product **5g** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.59-7.56 (m, 2H), 7.42-7.36 (m, 3H), 6.34 (dt, *J* = 18.4, 6.3 Hz, 1H), 5.81-5.71 (m, 1H), 4.45 (d, *J* = 3.0 Hz, 2H), 3.20 (t, *J* = 6.9 Hz, 2H), 2.22 (q, *J* = 6.4 Hz, 2H), 1.90-1.80 (m, 2H), 1.61-1.53 (m, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 153.8, 135.4, 132.1, 129.7, 128.1, 121.0, 35.7, 32.9, 29.2, 6.8; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{12}H_{17}SiI$: 316.0139, found: 316.0132.



5h

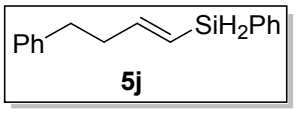
The product **5h** was purified with silica gel chromatography (Pe/EA = 10 : 1) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.59-7.56 (m, 2H), 7.41-7.38 (m, 3H), 6.32 (dt, *J* = 18.5, 5.6 Hz, 1H), 5.97-5.88 (m, 1H), 4.56 (d, *J* = 3.1 Hz, 2H), 2.54-2.44 (m, 4H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 147.7, 135.4, 131.2, 129.9, 128.2, 124.4, 119.0, 31.9, 16.4; HRMS (ESI) (*m/z*): $[M+NH_4]^+$ calcd for $C_{11}H_{17}N_2Si$: 205.1156, found: 205.1157.



5i

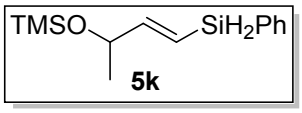
The product **5i** was purified with silica gel chromatography (Pe/EA = 50 : 1) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.58-7.55 (m, 2H), 7.39-7.36 (m, 3H), 6.32 (dt, *J* = 18.4, 6.3

Hz, 1H), 5.81-5.72 (m, 1H), 4.53 (d, *J* = 3.2 Hz, 2H), 3.67 (s, 3H), 2.33 (d, *J* = 7.5 Hz, 2H), 2.23 (q, *J* = 6.8 Hz, 2H), 1.83-1.73 (m, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 173.9, 152.4, 135.4, 132.1, 129.7, 128.0, 121.4, 51.6, 36.1, 33.4, 23.6; HRMS (ESI) (*m/z*): $[M+H]^+$ calcd for $C_{13}H_{19}O_2Si$: 235.1149, found: 235.1150.



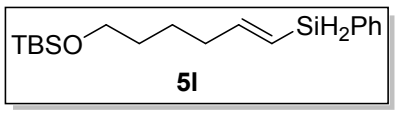
5j

The product **5j** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.57-7.54 (m, 2H), 7.42-7.35 (m, 3H), 7.33-7.28 (m, 2H), 7.24-7.19 (m, 3H), 6.42 (dt, *J* = 18.4, 6.2 Hz, 1H), 5.82-5.74 (m, 1H), 4.55 (d, *J* = 3.2 Hz, 2H), 2.77 (d, *J* = 7.8 Hz, 2H), 2.53 (q, *J* = 7.0 Hz, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 152.8, 141.6, 135.4, 132.2, 129.7, 128.5, 128.4, 128.0, 125.9, 120.9, 38.6, 34.9; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{16}H_{18}Si$: 238.1172, found: 238.1173.



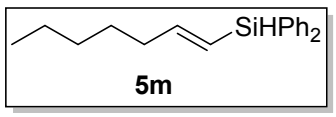
5k

The product **5k** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.59-7.55 (m, 2H), 7.41-7.36 (m, 3H), 6.35 (dd, *J* = 18.5, 4.5 Hz, 1H), 5.95-5.87 (m, 1H), 4.56 (d, *J* = 3.2 Hz, 2H), 4.36-4.29 (m, 1H), 1.24 (d, *J* = 6.5 Hz, 3H), 0.13 (s, 9H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 156.3, 135.4, 131.9, 129.7, 128.1, 117.6, 70.6, 23.8, 0.2; HRMS (ESI) (*m/z*): $[M+H]^+$ calcd for $C_{13}H_{23}OSi_2$: 251.1282, found: 251.1280.



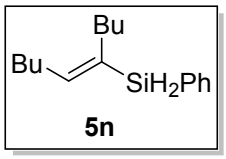
5l

The product **5l** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.59-7.56 (m, 2H), 7.41-7.36 (m, 3H), 6.37 (dd, *J* = 18.5, 6.3 Hz, 1H), 5.95-5.87 (m, 1H), 4.53 (d, *J* = 3.2 Hz, 2H), 3.62 (t, *J* = 6.4 Hz, 2H), 2.25 (q, *J* = 7.0 Hz, 2H), 1.70-1.61 (m, 2H), 0.90 (s, 9H), 0.04 (s, 6H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 153.5, 135.4, 132.3, 129.6, 128.0, 120.3, 62.5, 33.2, 31.5, 26.0, 18.4, -5.3; HRMS (ESI) (*m/z*): $[M+H]^+$ calcd for $C_{17}H_{31}OSi_2$: 307.1908, found: 307.1912.



5m

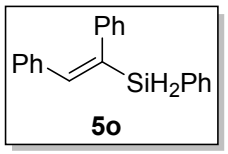
The product **5m** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.60-7.56 (m, 4H), 7.41-7.35 (m, 6H), 6.31 (dt, *J* = 18.5, 6.2 Hz, 1H), 5.97-5.89 (m, 1H), 5.09 (d, *J* = 3.2 Hz, 1H), 2.25 (q, *J* = 6.9 Hz, 2H), 1.49-1.40 (m, 2H), 1.33-1.27 (m, 4H), 0.90 (t, *J* = 6.9 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 154.1, 135.5, 134.3, 129.6, 128.0, 121.9, 37.0, 31.5, 28.1, 22.5, 14.1; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{19}H_{24}Si$: 280.1642, found: 280.1637.



5n

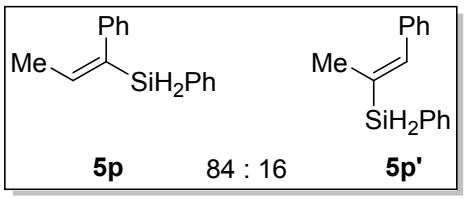
The product **5n** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.59-7.56 (m, 2H), 7.40-7.33 (m, 3H), 6.01 (t, *J* = 6.9 Hz, 1H), 4.53 (s, 2H), 2.20-2.12 (m, 4H), 1.39-1.26 (m, 8H), 0.91 (t, *J* = 7.0 Hz, 3H), 0.85 (t, *J* = 7.0 Hz, 3H); ^{13}C NMR (75

MHz, $CDCl_3$) δ 146.3, 135.6, 134.0, 132.8, 129.5, 127.9, 31.7, 31.5, 30.1, 28.6, 22.7, 22.5, 14.03, 13.97; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{16}H_{26}Si$: 246.1798, found: 246.1795.



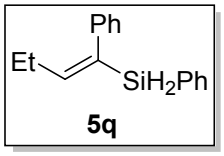
5o

The product **5o**[3] was purified with silica gel chromatography (Pe) as a white solid. ^1H NMR (300 MHz, $CDCl_3$) δ 7.61-7.58 (m, 2H), 7.43-7.35 (m, 3H), 7.28-7.22 (m, 3H), 7.15-7.02 (m, 8H), 4.81 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 142.3, 141.4, 138.6, 136.9, 135.8, 131.4, 129.9, 129.6, 128.8, 128.1, 128.0, 127.8, 127.6, 126.4



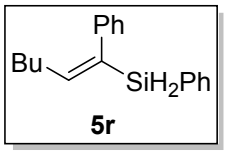
5p 84 : 16 **5p'**

The product **5p** was purified with silica gel chromatography (Pe) as a colorless oil. ^1H NMR (300 MHz, $CDCl_3$) δ 7.66-7.63 (m, 0.44H), 7.55-7.52 (m, 2H), 7.40-7.28 (m, 6.64H), 7.22-7.16 (m, 1H), 7.09-7.06 (m, 2H), 6.37 (q, *J* = 6.7 Hz, 1H), 4.69 (s, 2H), 4.67 (s, 0.35H), 2.05 (d, *J* = 1.8 Hz, 0.6H), 1.73 (d, *J* = 6.7 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 141.6, 140.8, 137.3, 135.6, 131.9, 129.7, 129.0, 128.3, 128.2, 128.2, 128.1, 128.0, 127.1, 126.0, 17.5, 16.4; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{15}H_{16}Si$: 224.1016, found: 221.1012.



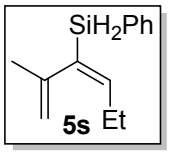
5q

The product **5q** was purified with silica gel chromatography (Pe) as a colorless oil. ^1H NMR (300 MHz, $CDCl_3$) δ 7.55-7.51 (m, 2H), 7.39-7.26 (m, 5H), 7.21-7.15 (m, 1H), 7.06-7.04 (m, 2H), 6.26 (t, *J* = 7.1 Hz, 1H), 4.69 (s, 2H), 2.12 (p, *J* = 7.5 Hz, 2H), 0.98 (t, *J* = 7.5 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 149.0, 141.1, 135.6, 135.5, 132.0, 129.7, 128.2, 128.1, 128.0, 126.0, 23.7, 14.0; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{16}H_{18}Si$: 238.1172, found: 238.1173.



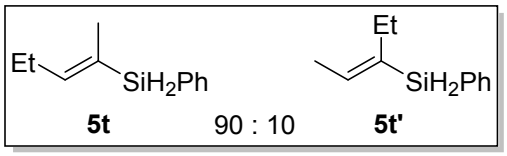
5r

The product **5r** was purified with silica gel chromatography (Pe) as a colorless oil. ^1H NMR (300 MHz, $CDCl_3$) δ 7.54-7.51 (m, 2H), 7.39-7.26 (m, 5H), 7.21-7.16 (m, 1H), 7.06-7.03 (m, 2H), 6.27 (t, *J* = 7.1 Hz, 1H), 4.69 (s, 2H), 2.11 (q, *J* = 7.2 Hz, 2H), 1.37-1.23 (m, 4H), 0.84 (t, *J* = 7.1 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 147.6, 141.1, 136.1, 135.6, 132.0, 129.7, 128.2, 128.1, 128.0, 125.9, 31.6, 30.1, 22.4, 13.9; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{18}H_{22}OSi$: 266.1485, found: 266.1483.

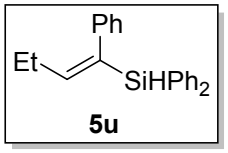


5s

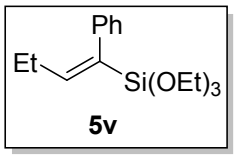
The product **5s** was purified with silica gel chromatography (Pe) as a colorless oil. ^1H NMR (300 MHz, $CDCl_3$) δ 7.60-7.57 (m, 2H), 7.40-7.35 (m, 3H), 5.96 (t, *J* = 7.1 Hz, 1H), 4.89-4.86 (m, 1H), 4.56 (s, 2H), 4.54.-4.53 (m, 1H), 2.17 (p, *J* = 7.4 Hz, 2H), 1.76-1.75 (m, 3H), 0.99 (t, *J* = 7.5 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 147.0, 144.9, 137.6, 135.6, 132.3, 129.6, 127.9, 112.0, 23.9, 23.7, 14.2; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{13}H_{18}Si$: 202.1172, found: 202.1170.



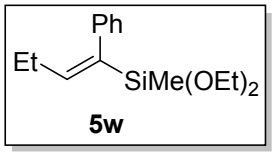
The product **5t** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.60-7.56 (m, 2H), 7.41-7.37 (m, 3H), 6.07-6.02 (m, 1H), 4.54 (s, 0.17H), 4.52 (s, 1.74H), 2.17 (p, *J* = 7.4 Hz, 2H), 1.75-1.74 (m, 3H), 1.01 (t, *J* = 7.5 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 147.7, 135.5, 135.0, 132.3, 129.6, 128.0, 22.2, 15.4, 13.6; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{11}H_{16}Si$: 176.1016, found: 176.1016.



The product **5u**[4] was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.55-7.52 (m, 4H), 7.41-7.32 (m, 6H), 7.26-7.21 (m, 2H), 7.18-7.12 (m, 1H), 7.02-6.99 (m, 2H), 6.21 (t, *J* = 7.1 Hz, 1H), 5.20 (s, 1H), 2.12 (p, *J* = 7.4 Hz, 2H), 0.97 (t, *J* = 6.9 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 149.5, 141.3, 137.2, 135.8, 133.6, 129.6, 128.4, 128.1, 127.9, 125.8, 23.7, 14.1.



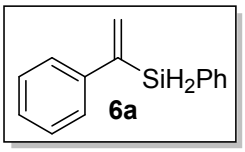
The product **5v** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.32-7.27 (m, 2H), 7.21-7.12 (m, 3H), 6.38 (t, *J* = 7.1 Hz, 1H), 3.78 (q, *J* = 7.0 Hz, 6H), 2.09 (p, *J* = 7.5 Hz, 2H), 1.17 (t, *J* = 7.0 Hz, 9H), 0.97 (t, *J* = 7.5 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 149.1, 140.4, 134.6, 128.5, 127.9, 125.8, 58.7, 23.2, 18.1, 14.0; HRMS (ESI) (*m/z*): $[M+H]^+$ calcd for $C_{16}H_{27}O_3Si$: 295.1724, found: 295.1730.



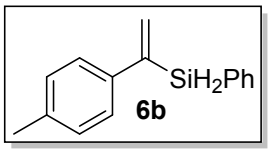
The product **5w** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.32-7.27 (m, 2H), 7.21-7.15 (m, 1H), 7.09-7.06 (m, 2H), 6.27 (t, *J* = 7.1 Hz, 1H), 3.78 (dq, *J* = 7.0, 0.9 Hz, 4H), 2.14 (p, *J* = 7.5 Hz, 2H), 1.18 (t, *J* = 7.0 Hz, 6H), 0.96 (t, *J* = 7.5 Hz, 3H), 0.15 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 147.1, 140.9, 138.6, 128.3, 128.0, 125.6, 58.4, 23.16, 18.3, 14.0, -4.6; HRMS (ESI) (*m/z*): $[M+H]^+$ calcd for $C_{15}H_{16}Si$: 265.1618, found: 265.1621.

$Co(OAc)_2$•$4H_2O$-^{4Me}bipy catalysed Hydrosilylation

$Co(OAc)_2$•$4H_2O$ (0.5 mg, 0.002 mmol, 0.005 equiv) and 4Mebipy (0.4 mg, 0.002 mmol, 0.005 equiv) were dissolved in 0.5 mL THF. Alkyne (0.4 mmol, 1.0 equiv) was added into the system (Note: if it is solid, weigh it firstly), followed with $PhSiH_3$ (0.48 mmol, 1.2 equiv). The mixture was stirred at room temperature for 3 hours. The solvent was removed to leave a crude product, which was purified by column chromatography on silica gel to afford the product **6**.

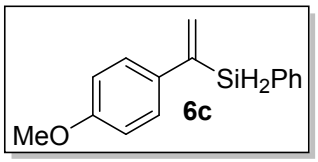


The product **6a** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.61 (dd, J = 7.7, 1.7 Hz, 2H), 7.42-7.27 (m, 8H), 6.26 (d, *J* = 2.3 Hz, 1H), 5.85 (d, *J* = 2.3 Hz, 1H), 4.86 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 144.2, 142.3, 135.6, 131.4, 131.2, 129.9, 128.5, 128.6, 127.3, 126.5; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{14}H_{14}Si$: 210.0859, found: 210.0857.



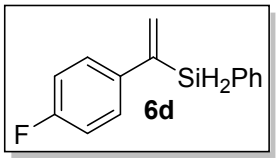
The product **6b** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.60 (dd, J = 7.7, 1.7 Hz, 2H), 7.41-7.35 (m, 3H), 7.29 (d, *J* = 8.1 Hz, 2H), 7.12 (d, *J* = 7.9 Hz, 2H), 6.23 (d, *J* = 2.3 Hz, 1H), 5.79 (d, *J* = 2.3 Hz, 1H), 4.83 (s, 2H), 2.33 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 143.7, 139.3, 137.1, 135.6, 131.3, 130.5, 129.9, 129.2, 128.1, 126.4, 21.1; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{15}H_{16}Si$: 224.1016, found: 221.1010.

The product **6c** was purified with silica gel chromatography (Pe/EA = 50 : 1) as a colorless oil. ^{1}H



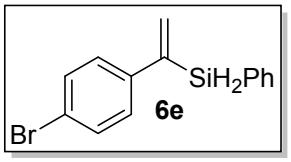
NMR (300 MHz, $CDCl_3$) δ 7.60 (dd, J = 7.7, 1.7 Hz, 2H), 7.39-7.32 (m, 5H), 6.85 (d, *J* = 8.9 Hz, 2H), 6.19 (d, *J* = 2.3 Hz, 1H), 5.75 (d, *J* = 2.3 Hz, 1H), 4.83 (s, 2H), 3.80 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 159.0, 143.1, 135.6, 134.6, 131.4, 129.9, 129.6, 128.1, 127.6, 113.9, 55.3; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{15}H_{16}OSi$: 240.0965, found: 240.0963.

The product **6d** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300



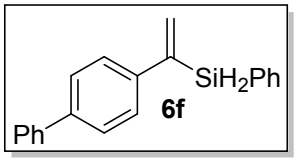
MHz, $CDCl_3$) δ 7.59 (dd, J = 7.7, 1.6 Hz, 2H), 7.42-7.31 (m, 5H), 7.03-7.69 (m, 2H), 6.19 (d, *J* = 2.1 Hz, 1H), 5.83 (d, *J* = 2.2 Hz, 1H), 4.83 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 162.2 (d, J = 246.4 Hz), 143.2, 138.3, 135.6 , 131.3, 130.9, 130.0, 128.2, 128.1 (d, J = 8.0 Hz), 115.4 (d, J = 21.4 Hz); HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{14}H_{13}FSi$: 228.0765, found: 228.0763.

The product **6e** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300



MHz, $CDCl_3$) δ 7.58-7.55 (m, 2H), 7.45-7.36 (m, 5H), 7.24-7.21 (m, 2H), 6.21 (d, *J* = 2.2 Hz, 1H), 5.85 (d, *J* = 2.2 Hz, 1H), 4.81 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 143.3, 141.2, 135.6, 133.6, 131.9, 131.6, 130.1, 128.2, 128.1, 121.3; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{14}H_{13}BrSi$: 28.9964, found: 287.9959.

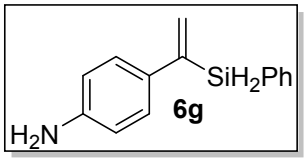
The product **6f** was purified with silica gel chromatography (Pe) as a white solid. ^{1}H NMR (300



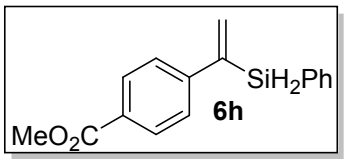
MHz, $CDCl_3$) δ 7.61-7.57 (m, 3H), 7.55-7.53 (m, 2H), 7.51-7.50 (m,

1H), 7.45-7.31 (m, 8H), 6.28 (d, J = 2.3 Hz, 1H), 5.84 (d, J = 2.3 Hz, 1H), 4.85 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 143.6, 141.2, 140.7, 140.2, 135.7, 131.3, 131.2, 130.0, 128.8, 128.2, 127.33, 127.26, 127.0, 126.9; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{20}H_{18}Si$: 286.1172, found: 286.1170.

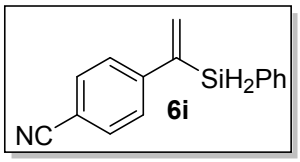
The product **6g** was purified with silica gel chromatography (Pe/EA = 5 : 1) as a pale yellow oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.61-7.58 (m, 2H), 7.40-7.35 (m, 3H), 7.23 (d, J = 8.6 Hz, 2H), 6.62 (d, J = 8.6 Hz, 2H), 6.17 (d, J = 2.3 Hz, 1H), 5.68 (d, J = 2.3 Hz, 1H), 4.82 (s, 2H), 3.67 (brs, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 145.9, 143.0, 135.6, 132.4, 131.6, 129.8, 128.2, 128.1, 127.5, 115.1; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{14}H_{15}NSi$: 225.0968, found: 225.0968.



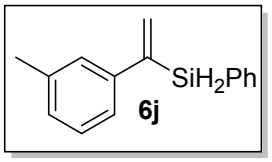
The product **6h** was purified with silica gel chromatography (Pe/EA = 30 : 1) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.97 (d, J = 8.6 Hz, 2H), 7.57 (dd, J = 7.8, 1.6 Hz, 2H), 7.42-7.35 (m, 5H), 6.28 (d, J = 2.3 Hz, 1H), 5.92 (d, J = 2.3 Hz, 1H), 4.84 (s, 2H), 3.90 (brs, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 166.9, 147.1, 143.8, 135.6, 133.0, 130.6, 130.1, 129.9, 128.9, 128.2, 126.5, 52.1; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{16}H_{16}O_2Si$: 268.0924, found: 268.0903.



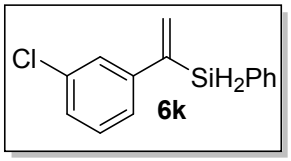
The product **6i** was purified with silica gel chromatography (Pe/EA = 30 : 1) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.61-7.54 (m, 4H), 7.44-7.37 (m, 5H), 6.27 (d, J = 2.0 Hz, 1H), 5.96 (d, J = 2.0 Hz, 1H), 4.82 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 147.2, 143.5, 135.6, 134.0, 132.4, 130.3, 128.3, 127.2, 118.9, 110.8; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{15}H_{13}NSi$: 235.0812, found: 235.0806.



The product **6j** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.61 (dd, J = 7.7, 1.8 Hz, 2H), 7.42-7.35 (m, 3H), 7.21-7.19 (m, 3H), 7.10-7.06 (m, 1H), 6.24 (d, J = 2.4 Hz, 1H), 5.82 (d, J = 2.4 Hz, 1H), 4.84 (s, 2H), 2.35 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 144.2, 142.3, 138.1, 135.6, 131.3, 131.1, 129.9, 128.4, 128.1, 128.1, 127.1, 123.7, 21.5; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{15}H_{16}Si$: 224.1016, found: 224.1019.

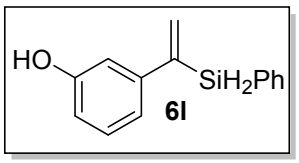


The product **6k** was purified with silica gel chromatography (Pe) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.59 (dd, J = 7.7, 1.7 Hz, 2H), 7.44-7.37 (m, 4H), 7.23 (d, J = 7.7, 1.7 Hz, 3H), 7.10-7.06 (m, 1H), 6.23 (d, J = 2.1 Hz, 1H), 5.87 (d, J = 2.2 Hz, 1H), 4.83 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ

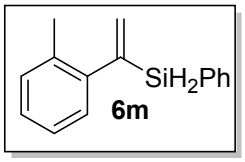


144.2, 143.3, 135.6, 134.5, 132.5, 130.6, 130.1, 129.7, 128.3, 127.3, 126.5, 124.9; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{14}H_{13}ClSi$: 244.0470, found: 224.0468.

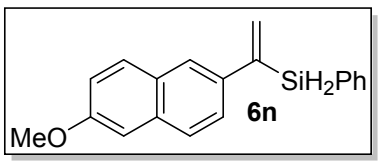
The product **6l** was purified with silica gel chromatography (Pe/EA = 10 : 1) as a colorless oil. ^1H NMR (300 MHz, $CDCl_3$) δ 7.59 (dd, *J* = 7.7, 1.7 Hz, 2H), 7.41-7.34 (m, 3H), 7.20-7.15 (m, 1H), 6.96-6.93 (m, 1H), 6.85-6.84 (m, 1H), 6.75-6.71 (m, 1H), 6.23 (d, *J* = 2.3 Hz, 1H), 5.83 (d, *J* = 2.3 Hz, 1H), 4.91 (s, 1H), 4.83 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 155.6, 144.1, 143.8, 135.6, 131.6, 131.1, 130.0, 129.8, 128.2, 119.3, 114.3, 113.3; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{14}H_{14}OSi$: 226.0808, found: 226.0804.



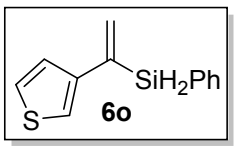
The product **6m** was purified with silica gel chromatography (Pe) as a colorless oil. ^1H NMR (300 MHz, $CDCl_3$) δ 7.54 (dd, *J* = 7.8, 1.6 Hz, 2H), 7.41-7.35 (m, 3H), 7.17-7.10 (m, 3H), 6.99-6.96 (m, 1H) , 5.92 (d, *J* = 3.1 Hz, 1H), 5.87 (d, *J* = 3.0 Hz, 1H), 4.70 (s, 2H), 2.24 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 146.5, 143.1, 135.6, 134.4, 133.0, 131.1, 130.1, 129.9, 128.0, 127.9, 126.6, 125.6, 20.3; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{15}H_{16}Si$: 224.1016, found: 224.1003.



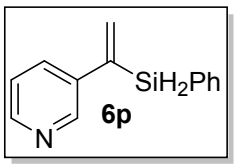
The product **6n** was purified with silica gel chromatography (Pe/EA = 30 : 1) as a white solid. ^1H NMR (300 MHz, $CDCl_3$) δ 7.74 (d, *J* = 1.7 Hz, 1H), 7.68 (d, *J* = 8.4 Hz, 2H), 7.74 (dd, *J* = 7.7, 1.7 Hz, 2H), 7.53 (dd, *J* = 8.5, 1.9 Hz, 1H), 7.40-7.33 (m, 3H), 7.14-7.10 (m, 2H) , 6.35 (d, *J* = 2.2 Hz, 1H), 5.88 (d, *J* = 2.2 Hz, 1H), 4.91 (s, 2H), 3.92 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 157.7, 143.8, 137.4, 135.6, 133.9, 131.3, 130.9, 129.9, 129.7, 128.9, 128.2, 12.0, 125.5, 125.0, 119.0, 105.6, 55.3; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{19}H_{18}OSi$: 290.1121, found: 290.1117.



The product **6o** was purified with silica gel chromatography (Pe/EA = 30 : 1) as a pale yellow oil. ^1H NMR (300 MHz, $CDCl_3$) δ 7.64-7.61 (m, 2H), 7.43-7.35 (m, 3H), 7.29-7.27 (m, 1H), 7.25-7.23 (m, 1H), 7.20-7.18 (m, 1H), 6.39 (d, *J* = 2.3 Hz, 1H), 5.78 (d, *J* = 2.3 Hz, 1H), 4.82 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 143.2, 137.6, 135.6, 131.0, 130.0, 129.7, 128.2, 125.7, 125.4, 121.8; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{12}H_{12}SSi$: 216.0424, found: 216.0432.

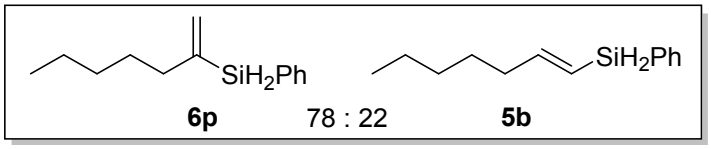


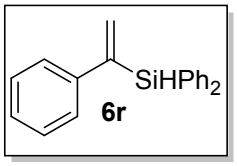
The product **6p** was purified with silica gel chromatography (Pe/EA = 5 : 1) as a pale yellow oil. ^1H NMR (300 MHz, $CDCl_3$) δ 8.6 (d, *J* = 1.7 Hz, 1H), 8.47 (dd, *J* = 4.8, 1.6 Hz, 1H), 7.64-7.56 (m, 3H), 7.42-7.33 (m, 3H), 7.23-7.19 (m, 1H), 6.26 (d, *J* = 2.1 Hz, 1H), 5.93 (d, *J* = 2.1 Hz, 1H), 4.83 (s, 2H); ^{13}C NMR (75 MHz,



$CDCl_3$) δ 148.4, 147.7, 141.4, 138.0, 135.6, 133.7, 133.2, 130.24, 130.21, 128.3, 123.3; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{13}H_{13}NSi$: 211.0812, found: 211.0807.

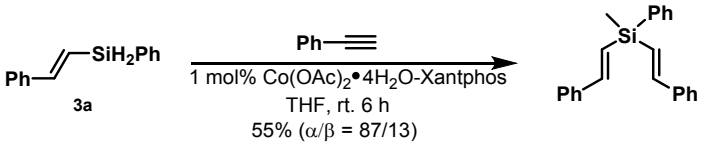
The product **6q** was purified with silica gel chromatography (Pe) as a colorless oil. ^1H NMR (300 MHz, $CDCl_3$) δ 7.60-7.56 (m, 2H), 7.42-7.35 (m, 1H), 7.58-7.57 (m, 0.78H), 5.54 (d, *J* = 2.9 Hz, 0.78H), 4.54 (s, 1.56H), 2.23-2.14 (m, 2H), 1.48-1.37 (m, 2H), 1.29-1.20 (m, 4H), 0.91-0.84 (m, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 145.4, 135.6, 131.7, 129.7, 129.4, 128.0, 37.4, 31.5, 28.5, 22.5, 14.0; HRMS (EI) (*m/z*): $[M]^+$ calcd for $C_{13}H_{20}Si$: 204.1329, found: 204.1323.



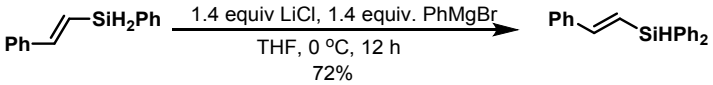


The product **6r**[4] was purified with silica gel chromatography (Pe) as a white solid. ^1H NMR (300 MHz, $CDCl_3$) δ 7.59-7.56 (m, 4H), 7.42-7.34 (m, 8H), 7.30-7.19 (m, 3H), 6.30 (dd, *J* = 2.5, 1.0 Hz, 1H), 5.69 (d, *J* = 2.5 Hz, 1H), 5.40 (d, *J* = 0.7 Hz, 1H), 4.83 (s, 2H).

Transformations of vinylsilanes[5, 6]

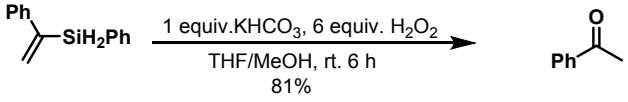


$Co(OAc)_2$•$4H_2O$ (1.0 mg, 0.004 mmol, 0.01 equiv, in 10 μL MeOH), was added into 0.5 mL THF containing Xantphos (2.3 mg, 0.004 mmol, 0.01 equiv). Phenylacetylene (0.4 mmol, 1.0 equiv) was added into the system, followed with **3a** (0.48 mmol, 1.2 equiv). The mixture was stirred at room temperature for 10 hours. The solvent was removed to leave a crude product, which was purified by column chromatography on silica gel to afford the desired product in 55% yield as a pale yellow oil. ^1H NMR (300 MHz, $CDCl_3$) δ 7.71-7.67 (m, 2H), 7.53-7.52 (m, 4H), 7.45-7.30 (m, 10H), 7.16 (d, *J* = 19.0 Hz, 2H), 6.67 (dd, *J* = 19.3, 3.1 Hz, 2H), 6.28 (d, *J* = 1.8 Hz, 0.14H), 5.83 (d, *J* = 2.5 Hz, 0.14H), 5.19 (d, *J* = 3.2 Hz, 0.13H), 5.06 (t 4.83 (s, *J* = 3.7 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 148.7, 137.9, 135.3, 133.9, 129.7, 128.6, 128.6, 128.1, 126.7, 121.8.



The Phenylmagnesium Bromide (1.0 M in THF, 0.56 mL, 0.56 mmol) and (Z) silane (0.4 mmol) was added to a suspension of LiCl (23.8 mg) in THF (0.8 mL) under N_2. The reaction was stirred for 12 hours and quenched by adding saturated NH_4Cl solution (0.5 mL). The resulting solution was

extracted with Et2O (2 x 10 mL) and dried over Na_2SO_4. The solvent was removed under reduced pressure and the crude product was purified with silica gel flash column chromatography with Pe as eluent to give **3y** a colourless oil in 72% yield. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.65-7.62 (m, 4H), 7.50-7.32 (m, 11H), 7.11 (d, *J* = 19.0 Hz, 1H), 6.73 (dt, *J* = 19.0, 3.2 Hz, 1H), 5.26 (d, *J* = 3.2 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 149.1, 137.9, 135.6, 133.6, 129.8, 128.64, 128.62, 128.1, 126.8, 121.5.

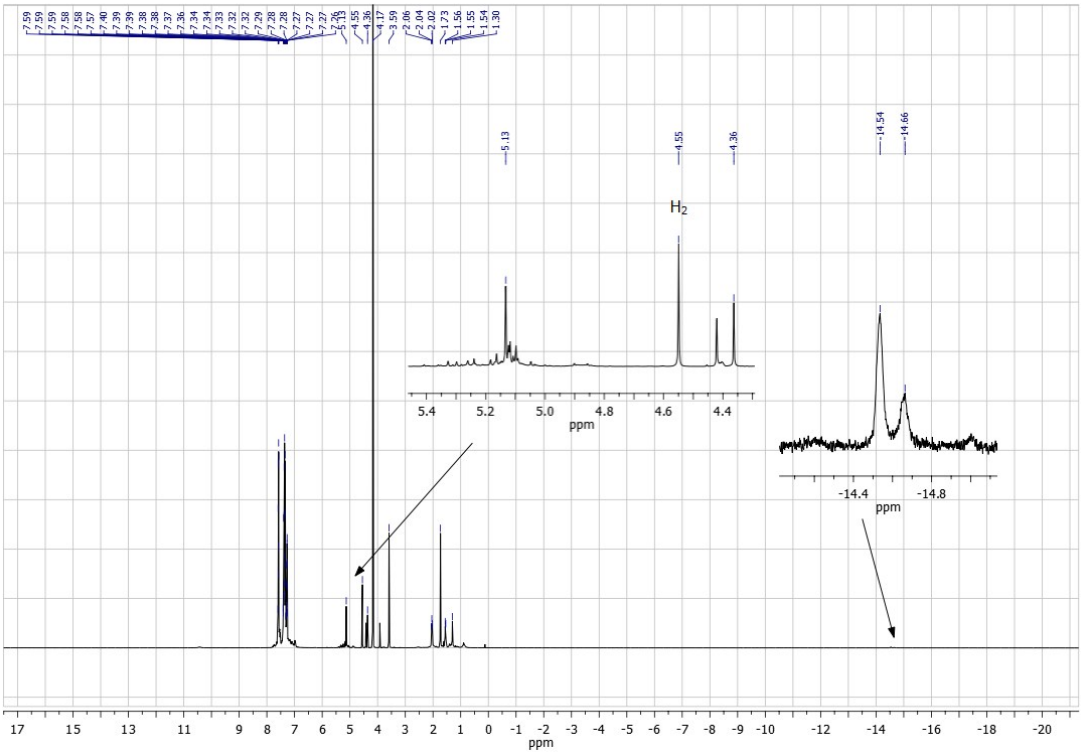


In a tube containing $KHCO_3$ (50 mg, 0.5 mmol) was added, THF (2.0 mL), MeOH (2.0 mL), 2 (0.5 mmol, 1.0 equiv.), then 30% H_2O_2 aq. (340 mg, 3.0 mmol). The resulting mixture was stirred at room temperature for 10 h before a saturated aqueous solution of $Na_2S_2O_3$ (5 mL) was added. The resulting solution was extracted with EtOAc and washed with brine (10 mL), dried over anhydrous Na_2SO_4. After filtration and evaporation of the solvent under vaccum, the residue was purified by flash column chromatography with Pe/EA (50/1) to give a colorless oil in 81% yield. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.98-7.95 (m, 2H), 7.60-7.54 (m, 1H), 7.49-7.44 (m, 2H), 2.61 (s, 3H).

4. NMR and kinetic studies

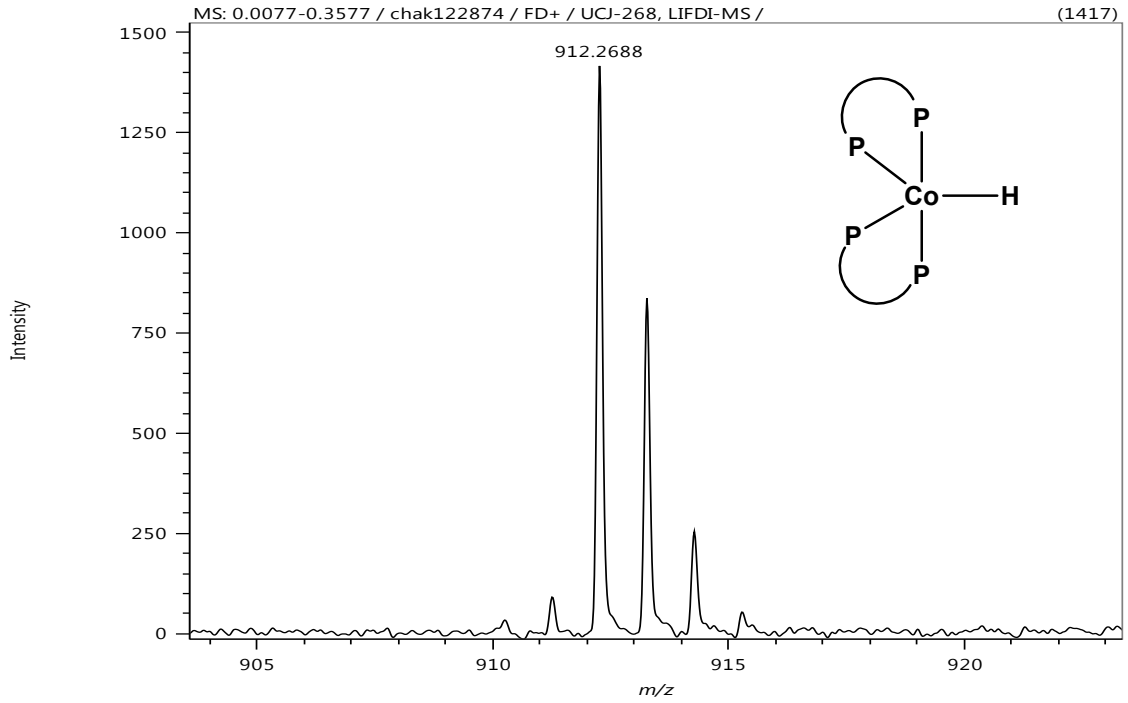
Reaction of $Co(OAc)_2$□$4H_2O$, dppb and $PhSiH_3$ (1:1:10):

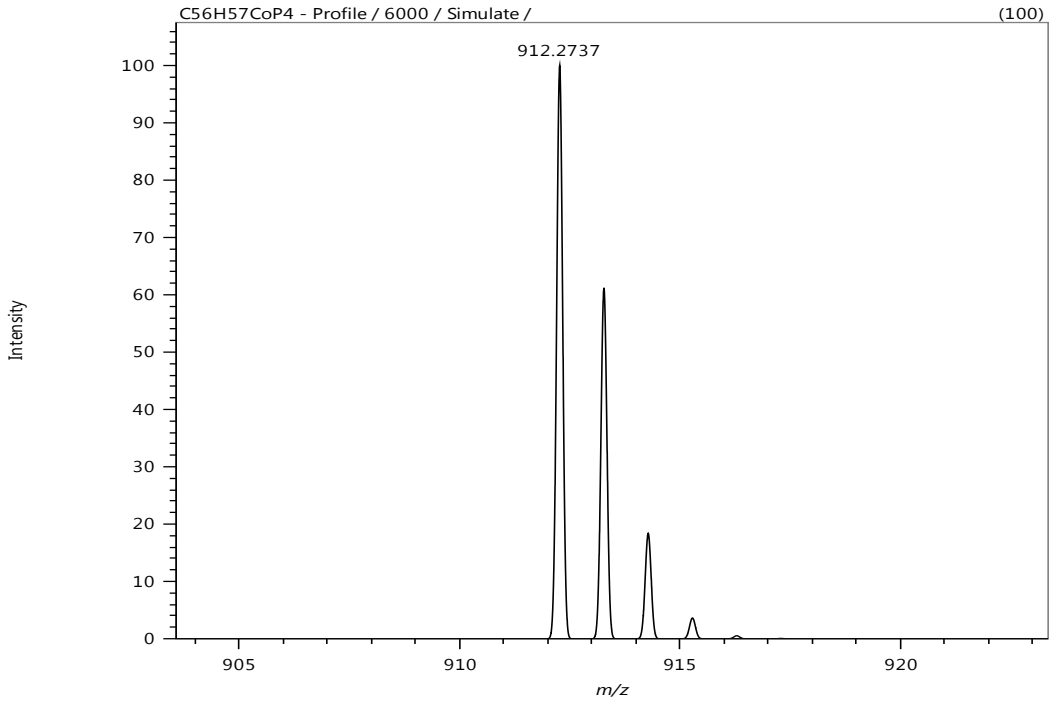
A mixture of $Co(OAc)_2$□$4H_2O$ (5 mg, 0.2 mmol) and dppb (8.8 mg, 0.021 mmol) in 0.6 mL THF-d_8 was stirred for 20 minutes and then treated with $PhSiH_3$ (25 μL, 0.20 mmol). The reaction mixture was stirred for 1h and the obtained yellowish-orange mixture was filtered and subjected to NMR spectroscopy. The NMR sample was evaporated completely and the residue was re-dissolved in toluene and subjected to LIFDI-MS.



^{1}H NMR spectrum (in THF-d_8) of the reaction mixture of $Co(OAc)_2 \square 4H_2O$, dppb and $PhSiH_3$ (1:1:10).

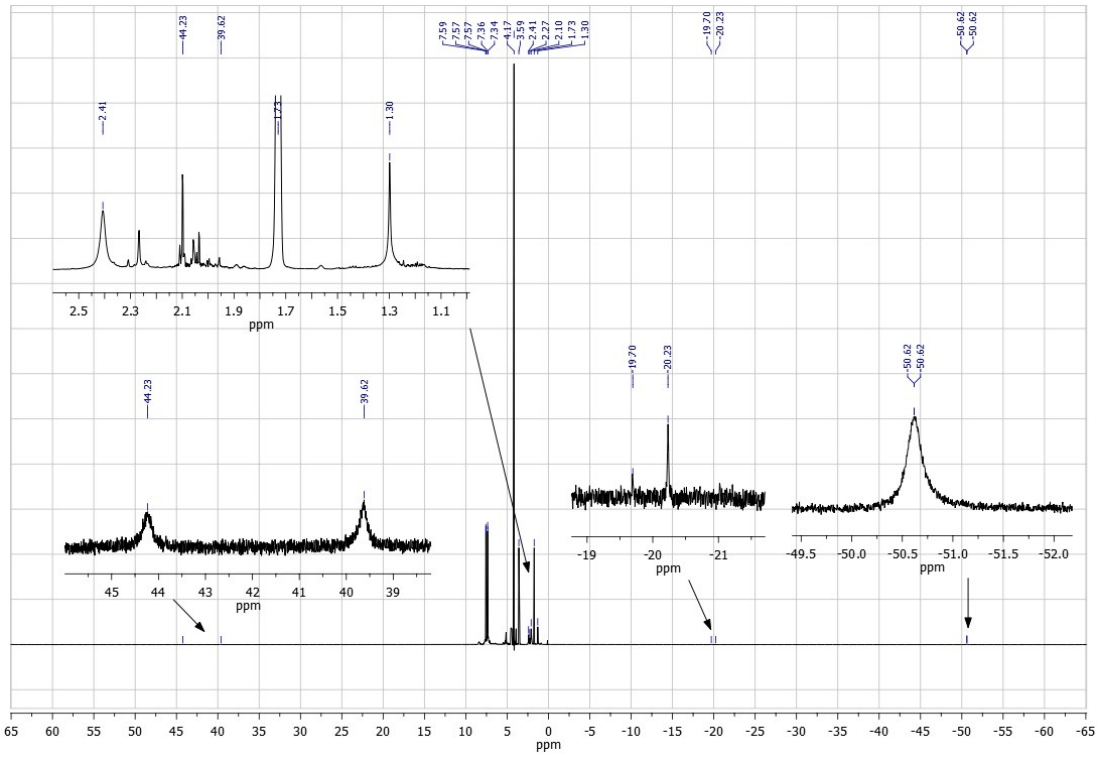
LIFDI-MS of the reaction mixture of $Co(OAc)_2 \square 4H_2O$, dppb and $PhSiH_3$ (1:1:10).in toluene:





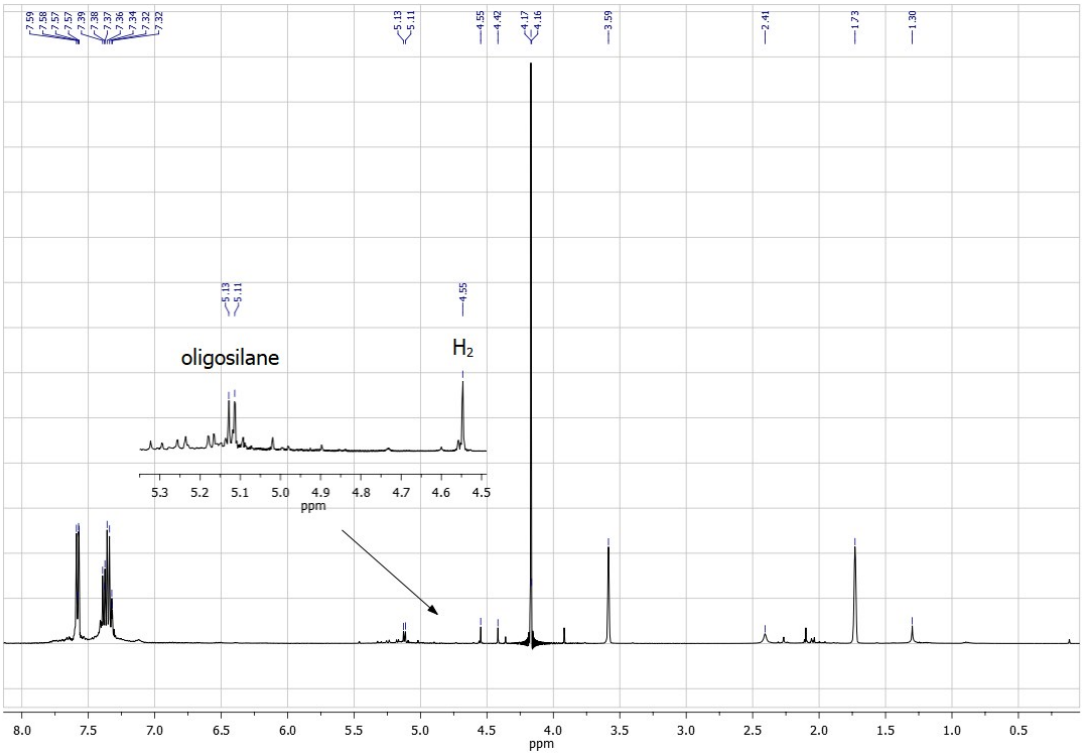
Reaction of $Co(OAc)_2$·$4H_2O$, $^{4\text{-Me}}$bipy and $PhSiH_3$ (1:1:10):

A mixture of $Co(OAc)_2$·$4H_2O$ (5 mg, 0.2 mmol) and $^{4\text{-Me}}$bipy (3.8 mg, 0.021 mmol) in 0.6 mL THF-d_8 was stirred for 20 minutes and then treated with $PhSiH_3$ (25 µL, 0.20 mmol). The reaction mixture was stirred for 1h and the obtained black brown mixture



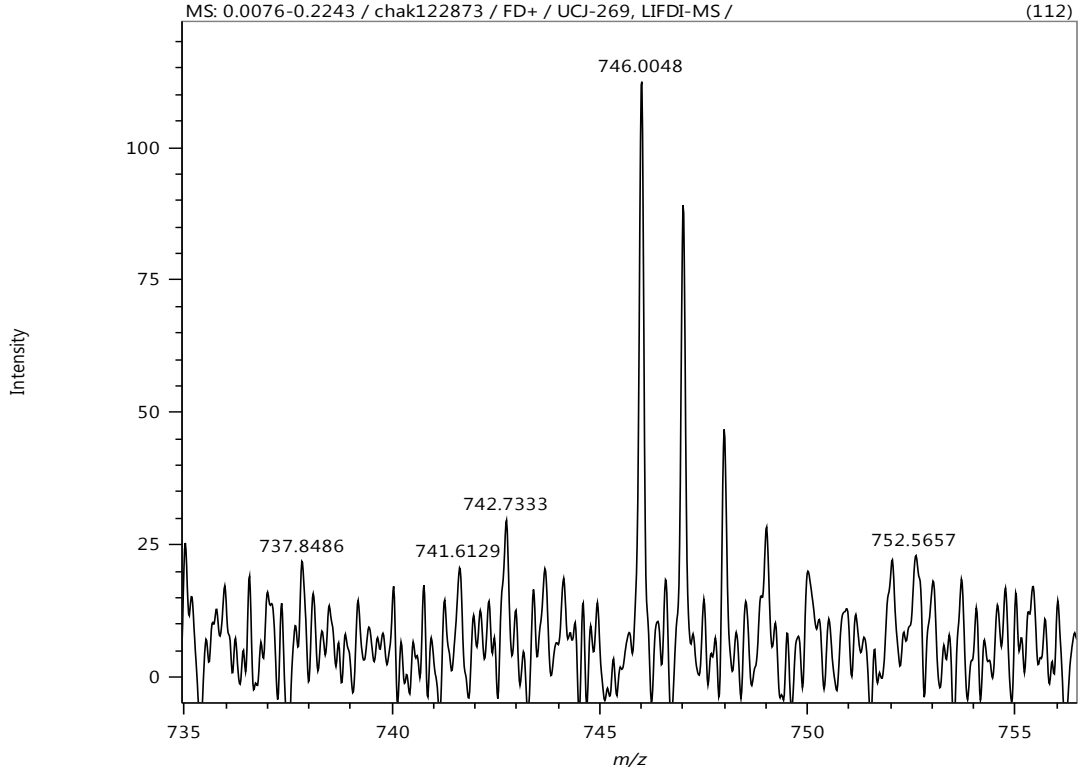
^{1}H NMR spectrum (in THF-d_8) of the reaction mixture of $Co(OAc)_2$·$4H_2O$, $^{4\text{-Me}}$bipy and $PhSiH_3$ (1:1:10).

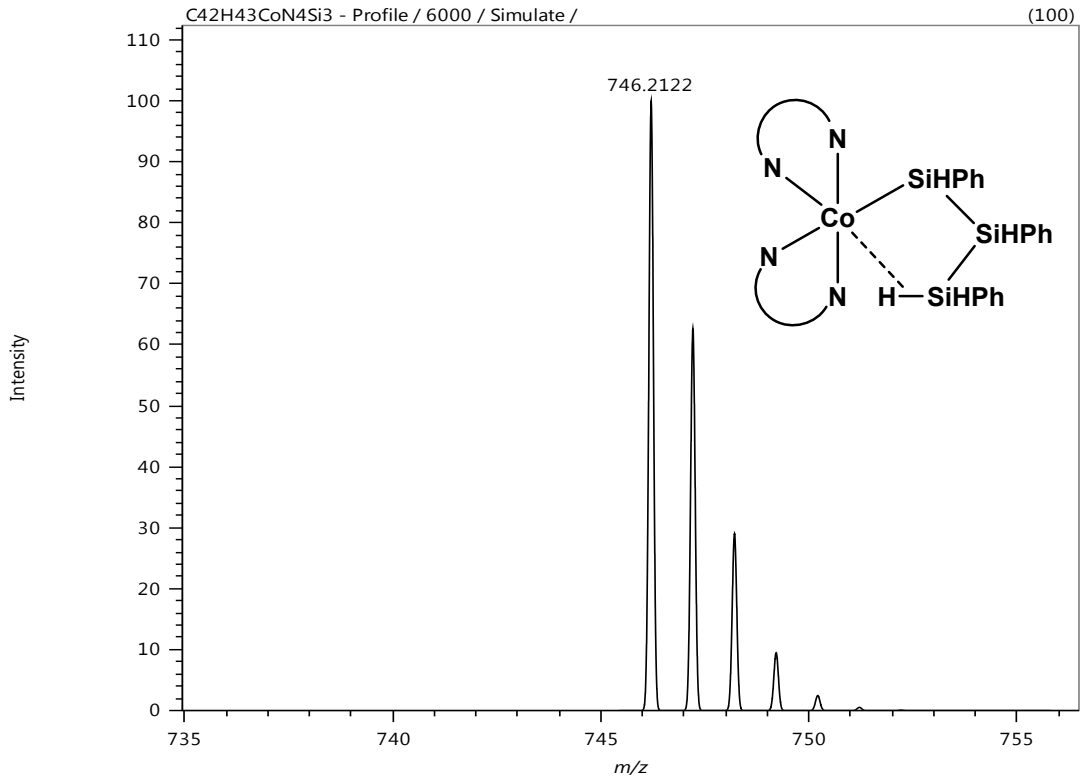
was filtered and subjected to NMR spectroscopy. The NMR sample was evaporated completely and the residue was re-dissolved in toluene and subjected to LIFDI-MS.



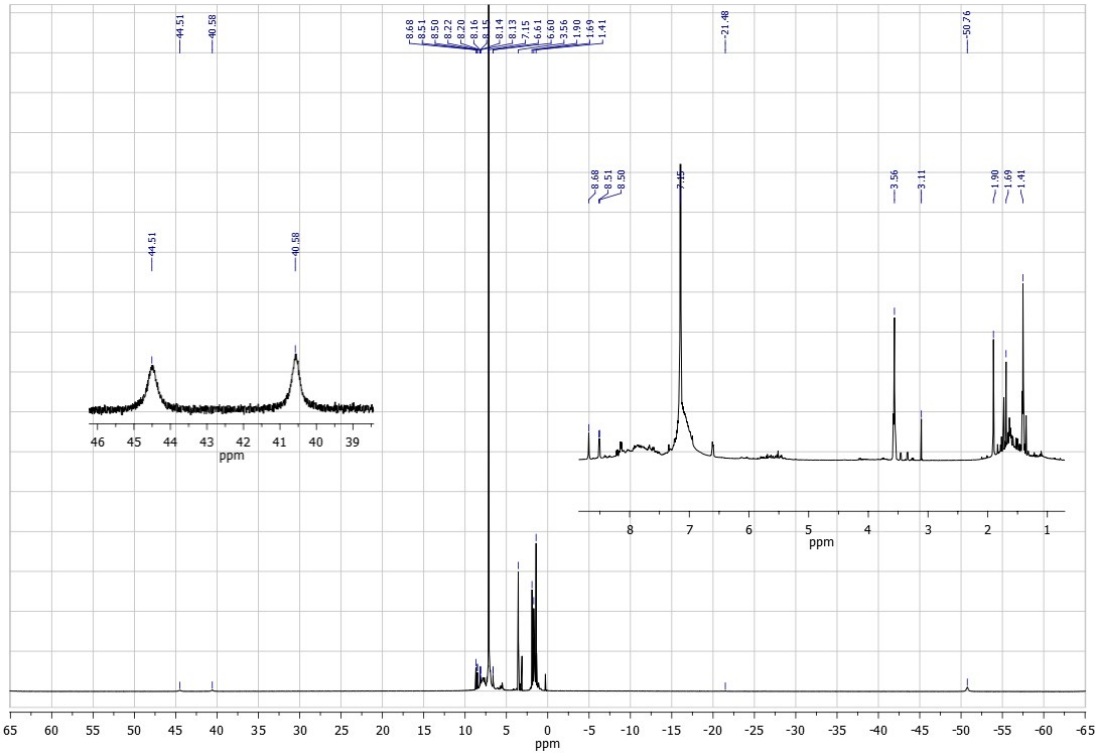
Expanded region (0.5 – 8 ppm) of the ^{1}H NMR spectrum (in THF-d_8) of the reaction mixture of $Co(OAc)_2 \cdot 4H_2O$, $^{4\text{-Me}}$bipy and $PhSiH_3$ (1:1:10).

LIFDI-MS of the reaction mixture of $Co(OAc)_2 \cdot 4H_2O$, $^{4\text{-Me}}$bipy and $PhSiH_3$ (1:1:10) in toluene:





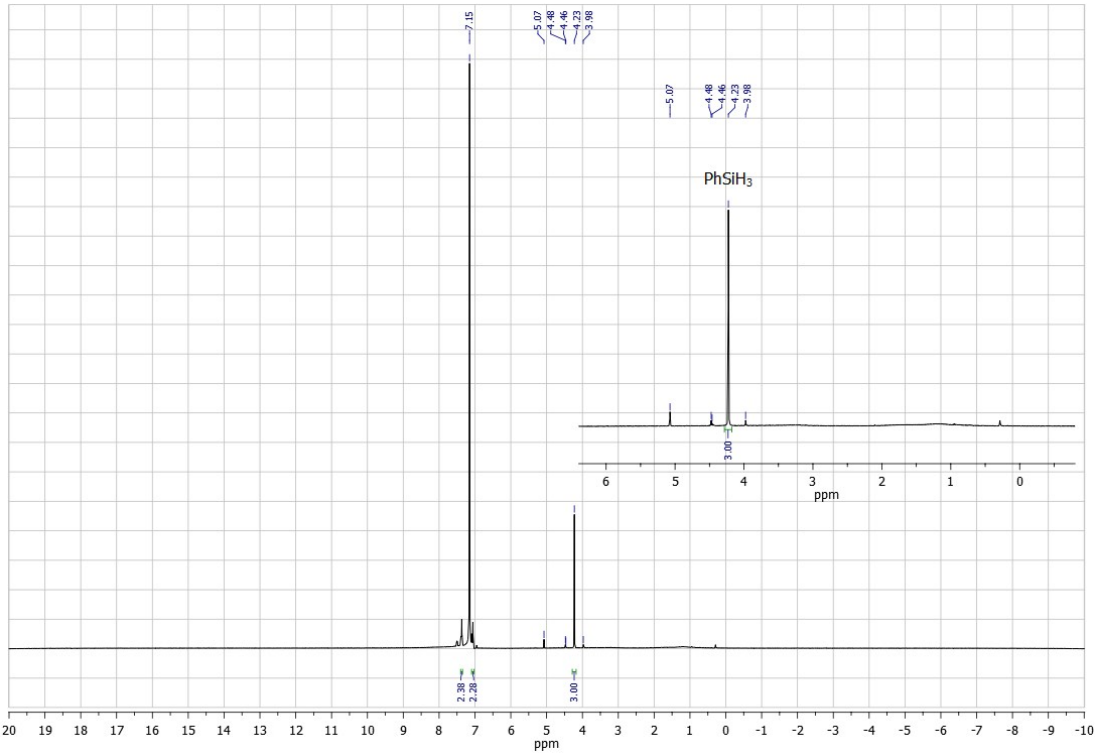
Reaction of $Co(OAc)_2$□$4H_2O$, $^{4\text{-Me}}$bipy and $PhSiH_3$ (1:1:5):



^{1}H NMR spectrum of the reaction mixture of $Co(OAc)_2$□$4H_2O$, $^{4\text{-Me}}$bipy and $PhSiH_3$ (1:1:5).

A mixture of $Co(OAc)_2$□$4H_2O$ (5 mg, 0.2 mmol) and $^{4\text{-Me}}$bipy (3.8 mg, 0.021 mmol) in 0.6 mL C_6D_6 was stirred for 10 minutes and then treated with $PhSiH_3$ (12,5 µL, 0.20

mmol). The reaction mixture was stirred for 1h and the obtained black brown mixture was filtered and subjected to NMR spectroscopy. The NMR sample was treated with $LiAlH_4$ (2 mg, 0.053 mmol) and stirred overnight. Color of the solution changed to red then to dark purple and a NMR was recorded.

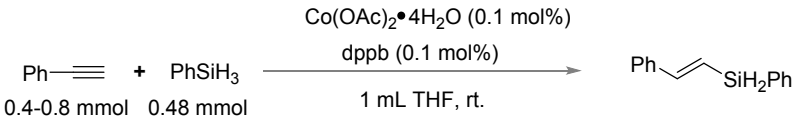


^{1}H NMR spectrum of the reaction mixture of $Co(OAc)_2 \cdot 4H_2O$, $^{4\text{-Me}}$bipy and $PhSiH_3$ (1:1:5) upon treatment with $LiAlH_4$.

Kinetic studies

General procedure to acquire kinetic data: In an Ar-filled glovebox, a 5 mL screw-capped vial was charged with $Co(OAc)_2 \cdot 4H_2O$ (dissolved in 10 μL MeOH), ligand, phenylacetylene, dodecane (internal standard, 0.2 mmol), THF (1.0 mL) and a magnetic stirring bar. The timing was started upon addition of $PhSiH_3$, and 1 μL of the solution was drawn at intervals and diluted immediately with ethyl acetate to quench the reaction. The yield of the product was measured based on GC analysis.

Figure S1. Kinetic profile with varying phenylacetylene concentrations



Phenylacetylene (mmol)	Rate (M/s)
0.4	3.31×10^{-3}
0.6	3.18×10^{-3}
0.8	3.04×10^{-3}

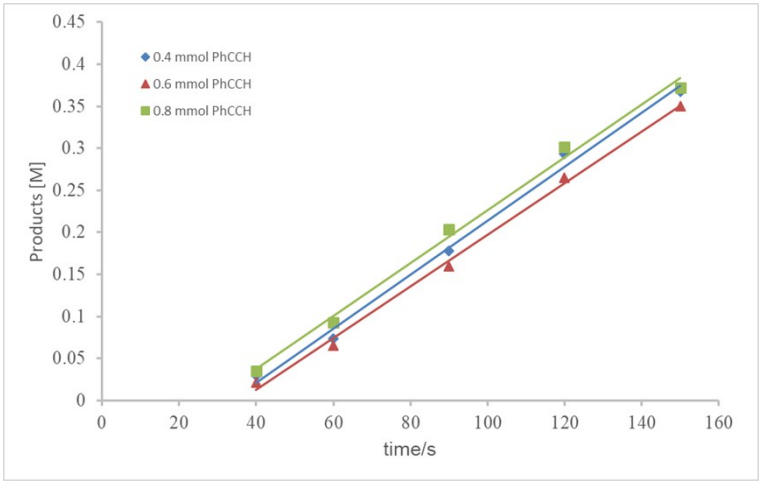
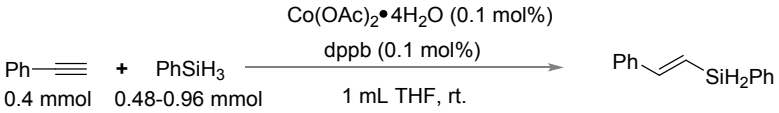


Figure S2. Kinetic profile with varying phenylsilane concentrations



$PhSiH_3$ (mmol)	Rate (M/s)
0.48	3.21×10^{-3}
0.72	3.00×10^{-3}
0.96	3.09×10^{-3}

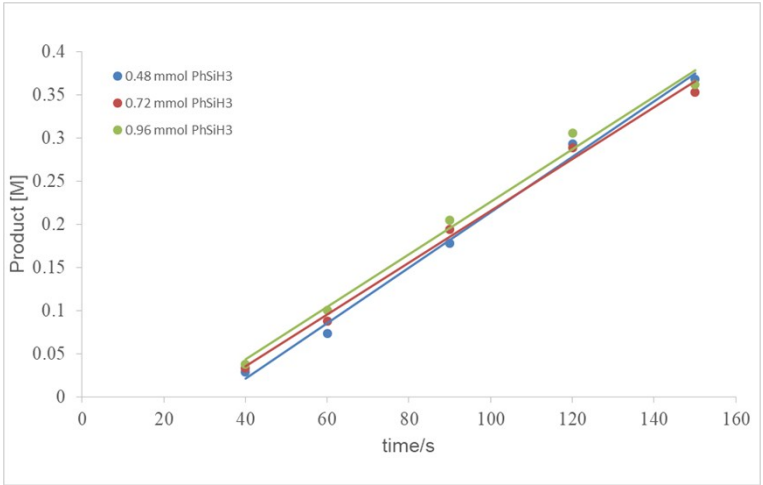
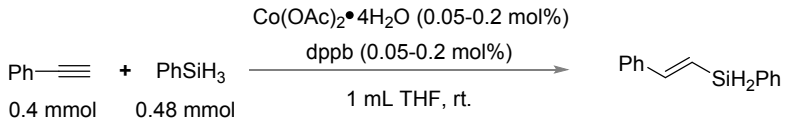


Figure S3. Kinetic profile with varying cobalt concentrations



$Co(OAc)_2•4H_2O$	Rate (M/s)
0.05 mol%	1.54×10^{-3}
0.1 mol%	3.20×10^{-3}
0.2 mol%	5.30×10^{-3}

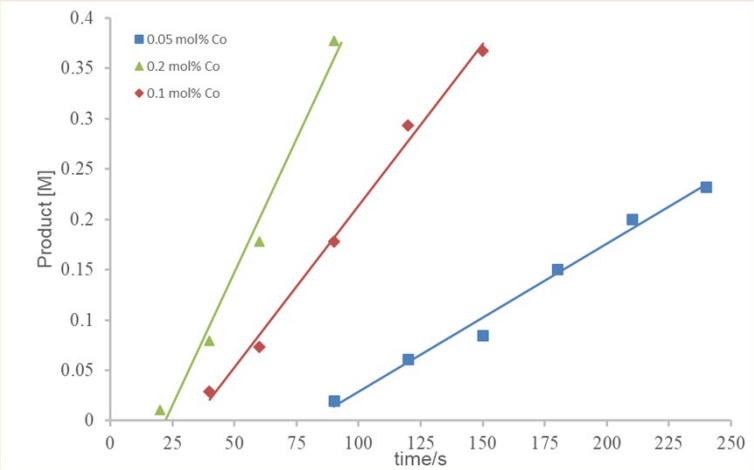
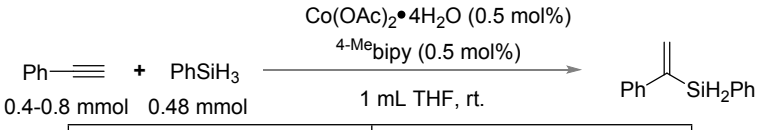


Figure S4. Kinetic profile with varying phenylacetylene concentrations



Phenylacetylene (mmol)	Rate (M/s)
0.4	7.90×10^{-4}
0.6	8.37×10^{-4}
0.8	7.38×10^{-4}

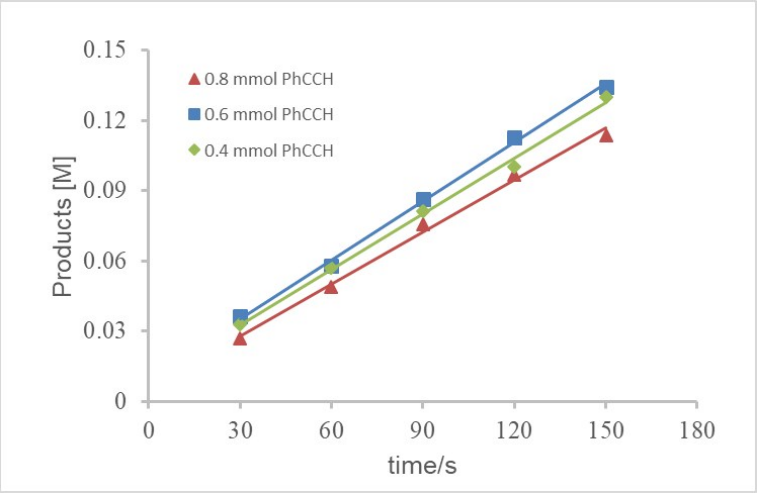
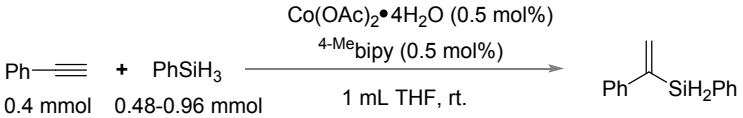


Figure S5. Kinetic profile with varying phenylsilane concentrations



$PhSiH_3$ (mmol)	Rate (M/s)
0.48	8.58×10^{-4}
0.72	1.18×10^{-3}
0.96	1.47×10^{-3}

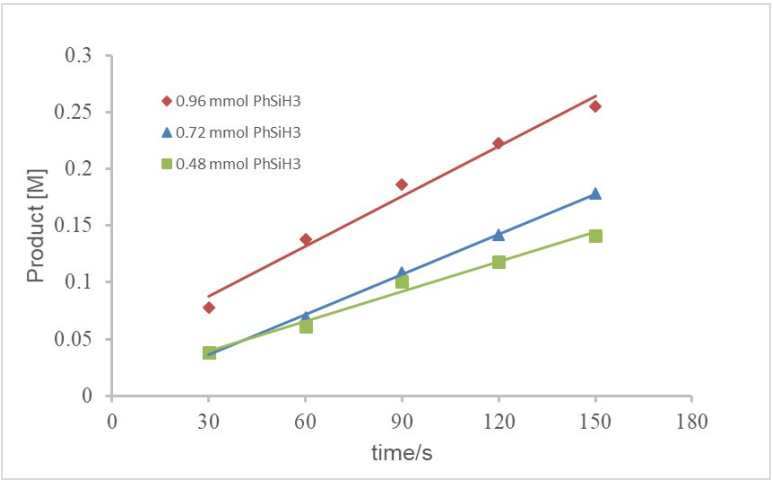
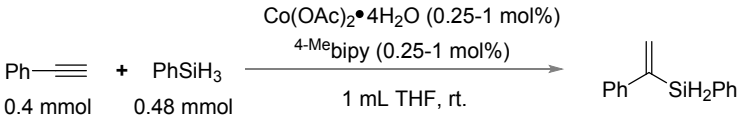
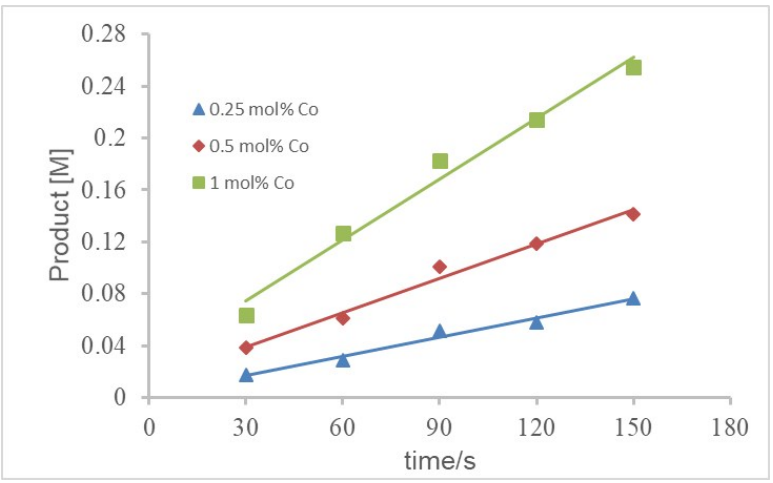


Figure S6. Kinetic profile with varying phenylsilane concentrations



$Co(OAc)_2$•$4H_2O$	Rate (M/s)
0.25 mol%	4.73×10^{-4}
0.5 mol%	8.79×10^{-4}
1 mol%	1.57×10^{-3}



5. Reference

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3. W. J. Teo, C. Wang, Y. W. Tan, S. Ge. *Angew. Chem. Int. Ed*. **2017**, *56*, 4328.
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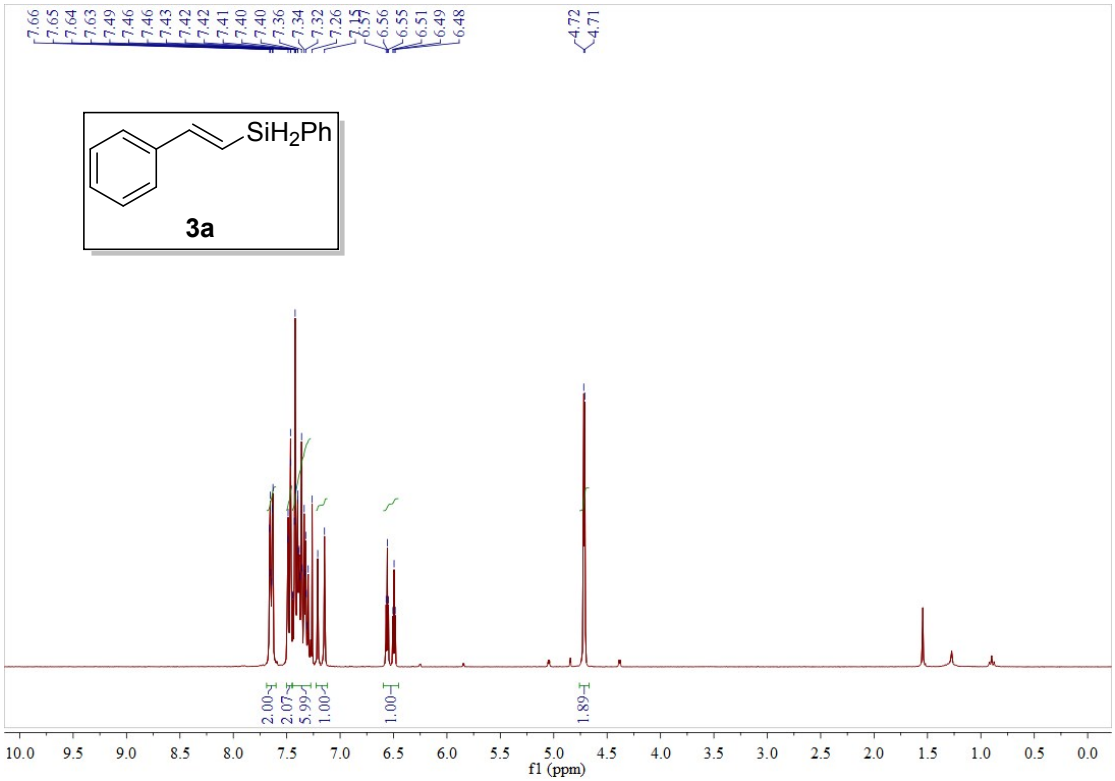
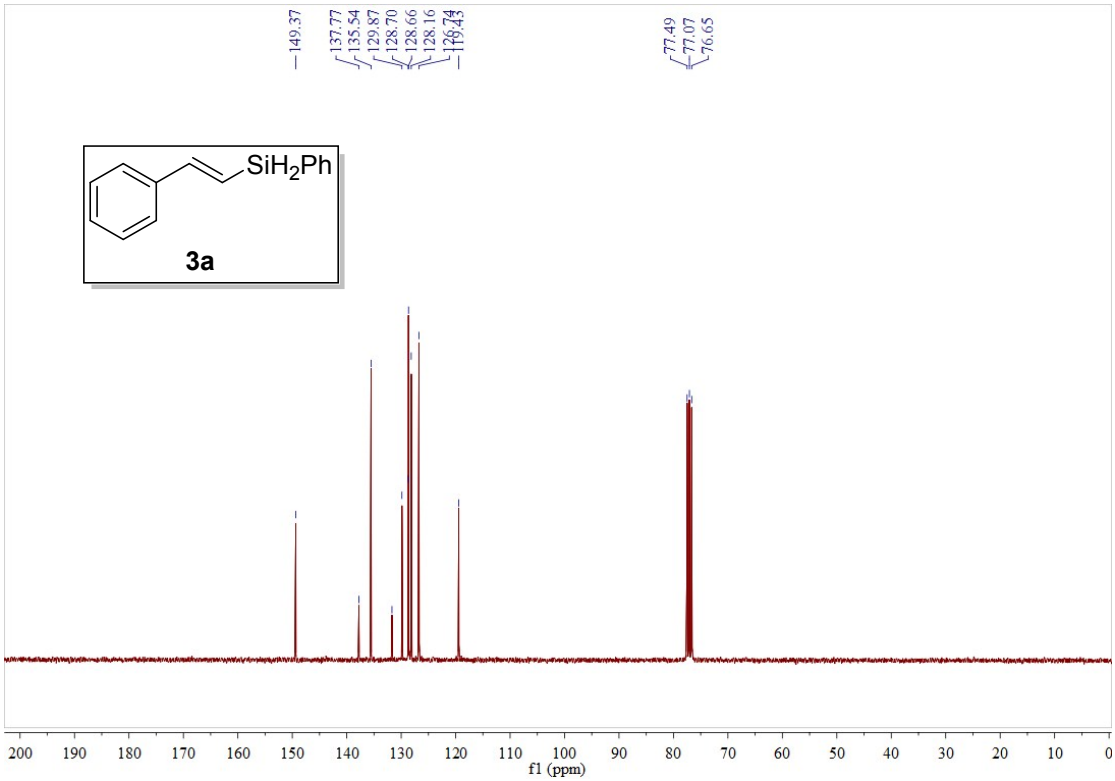
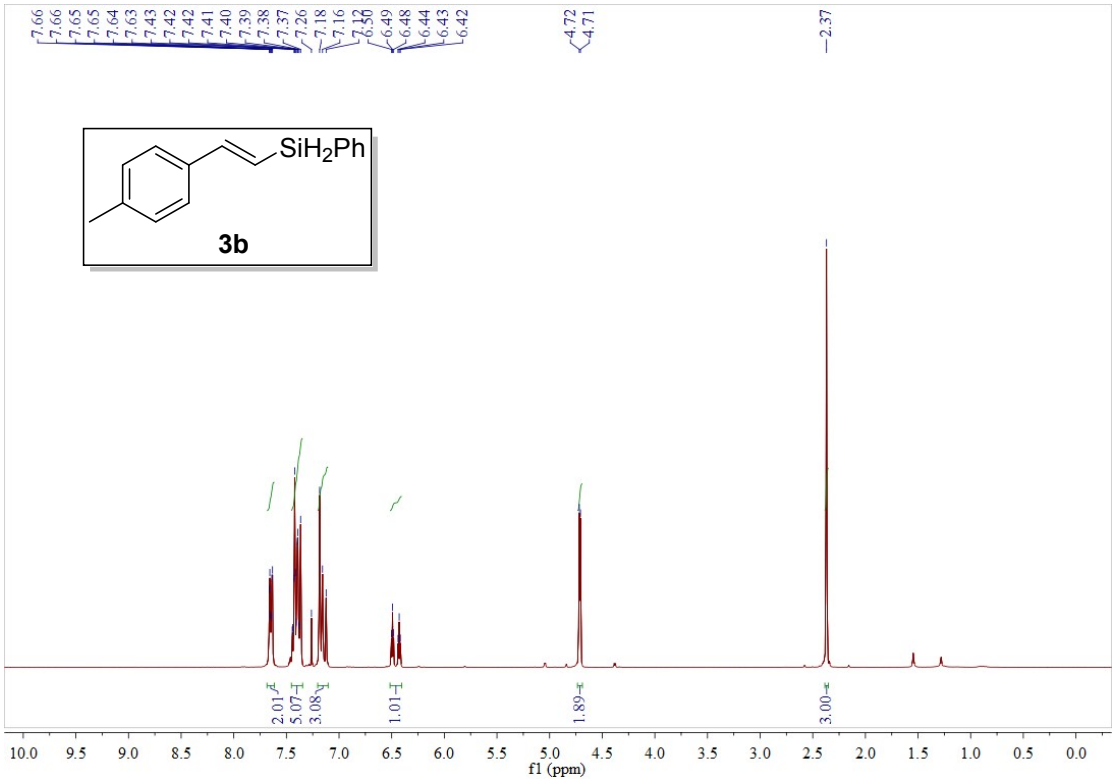
6. ^{1}H, ^{13}C NMR spectrum



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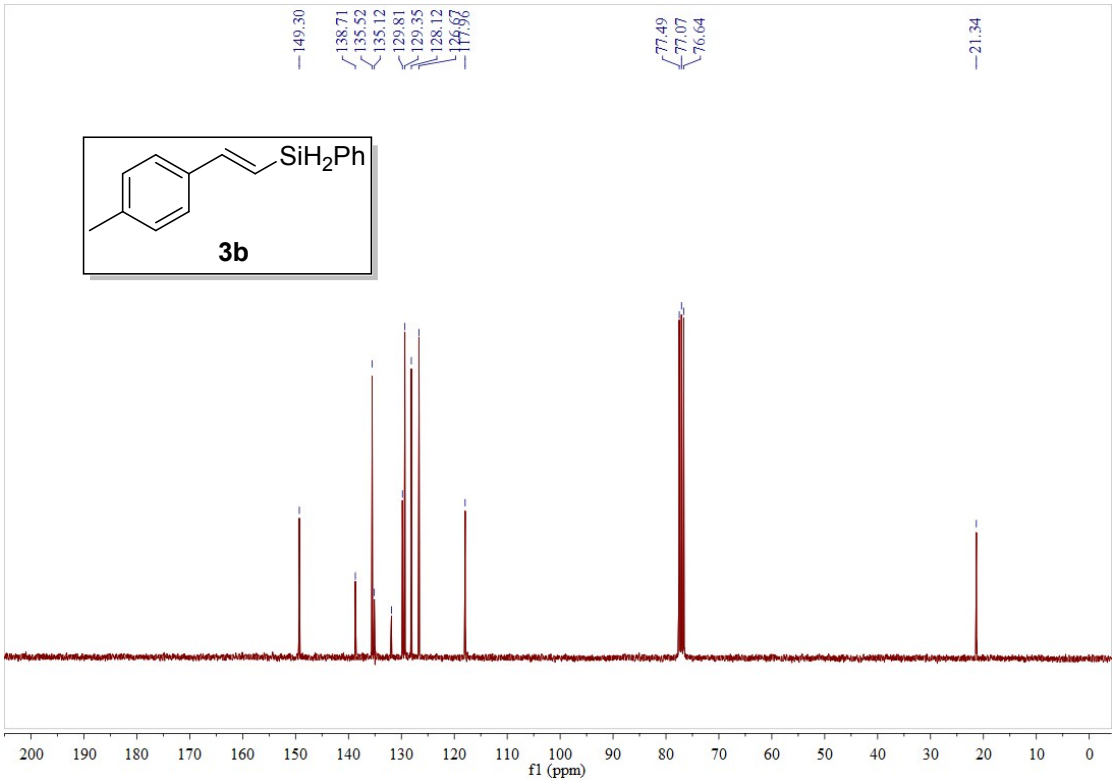
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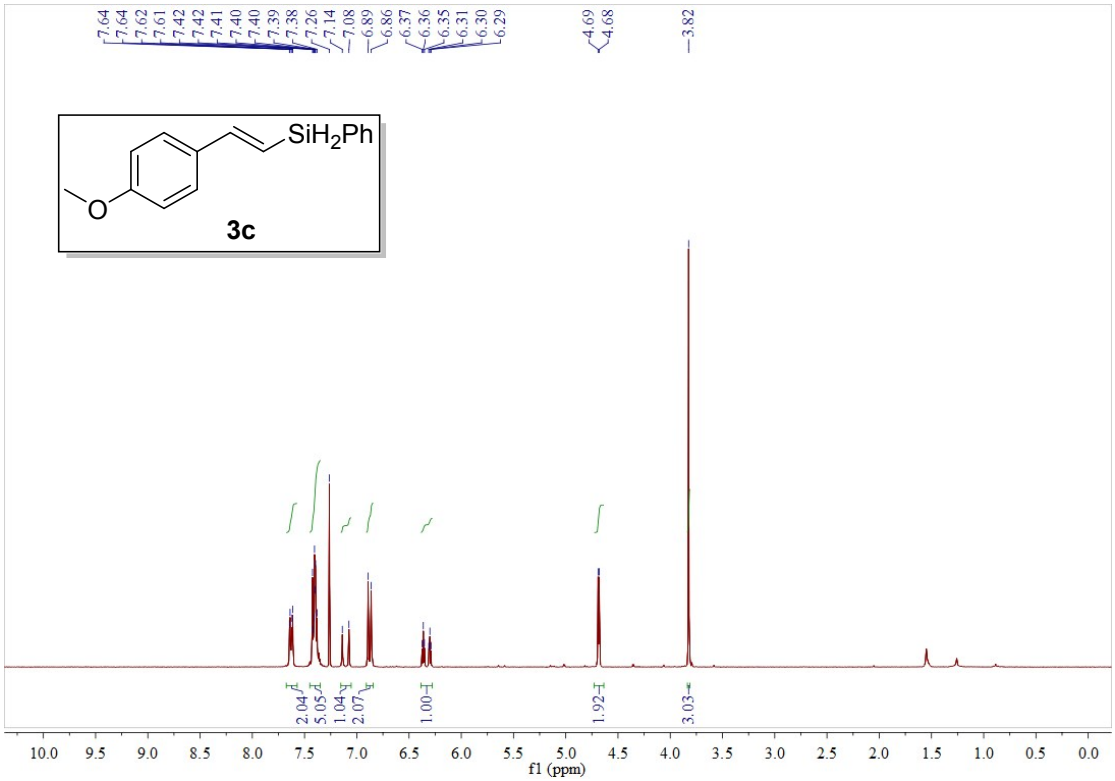
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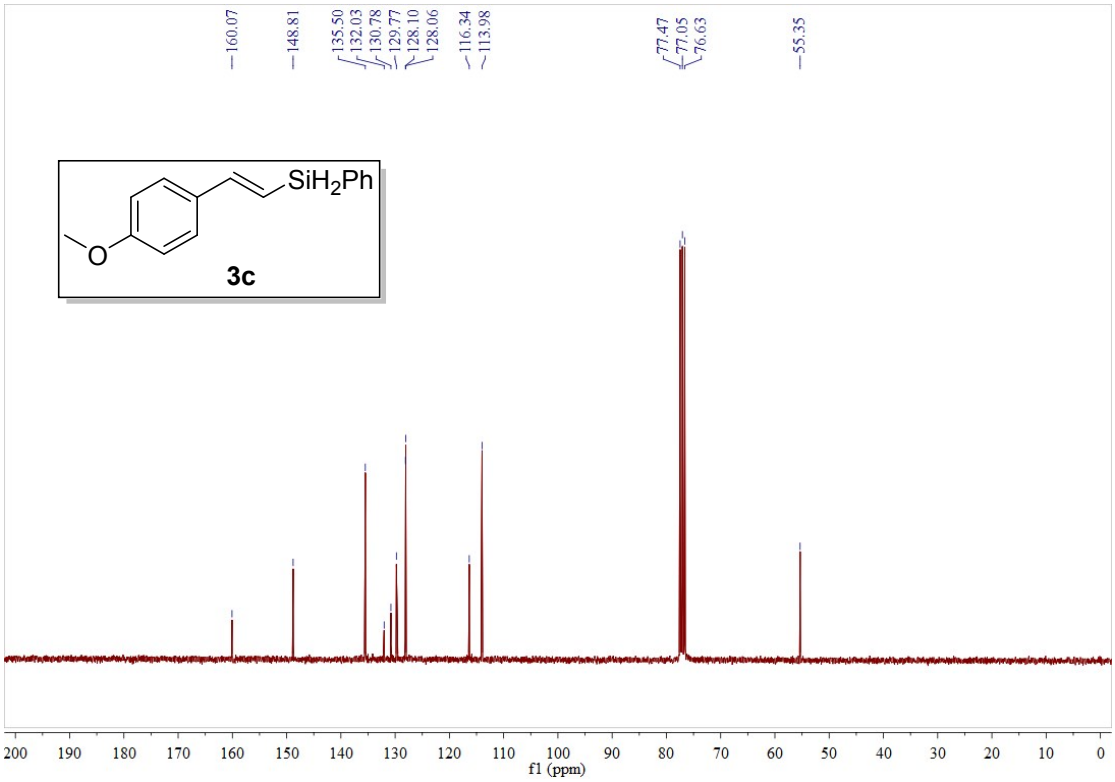
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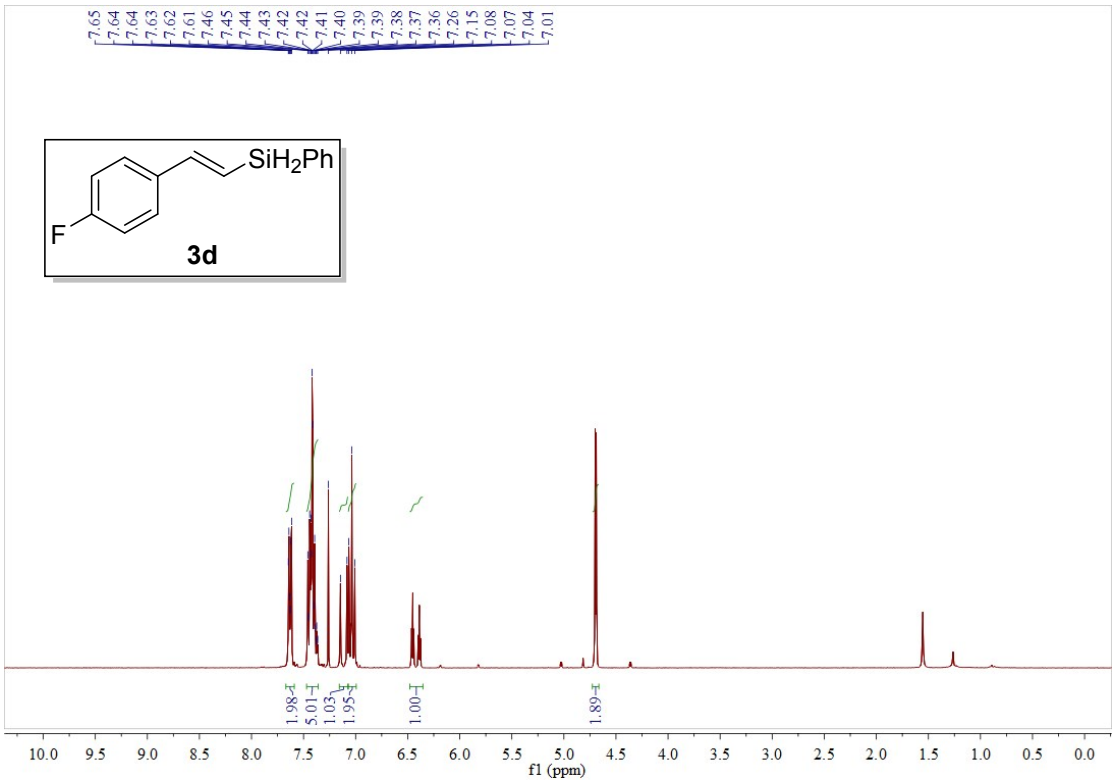
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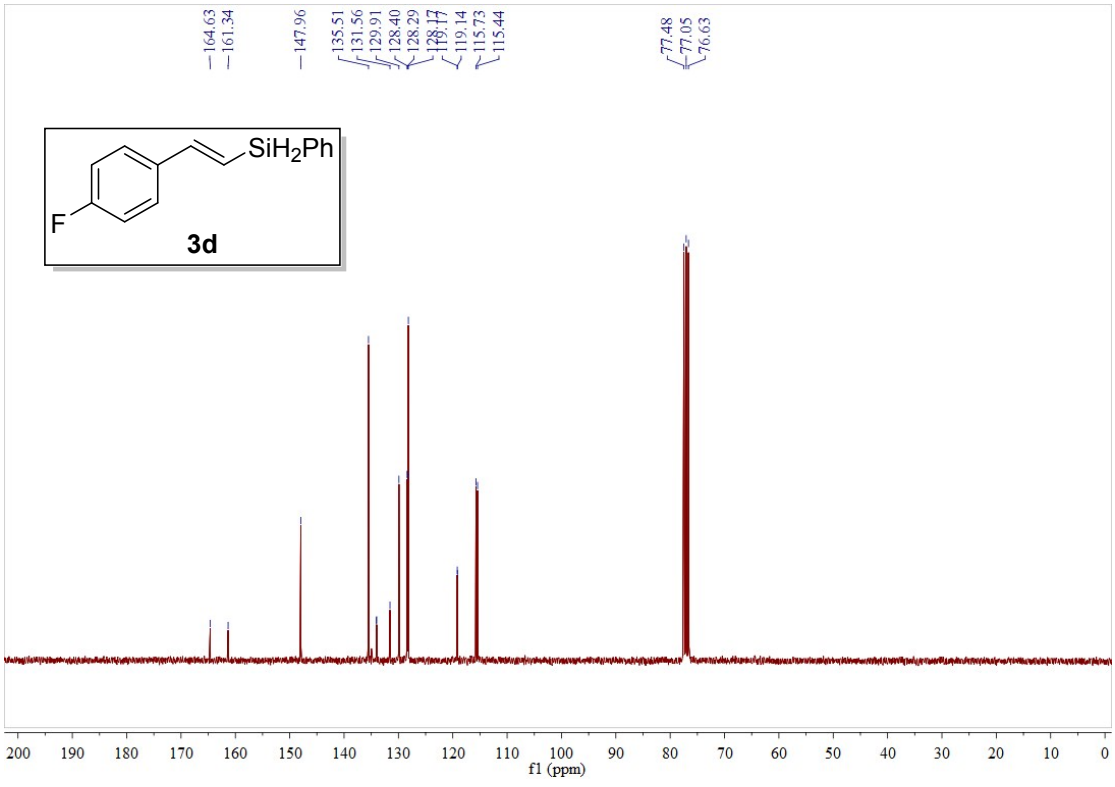
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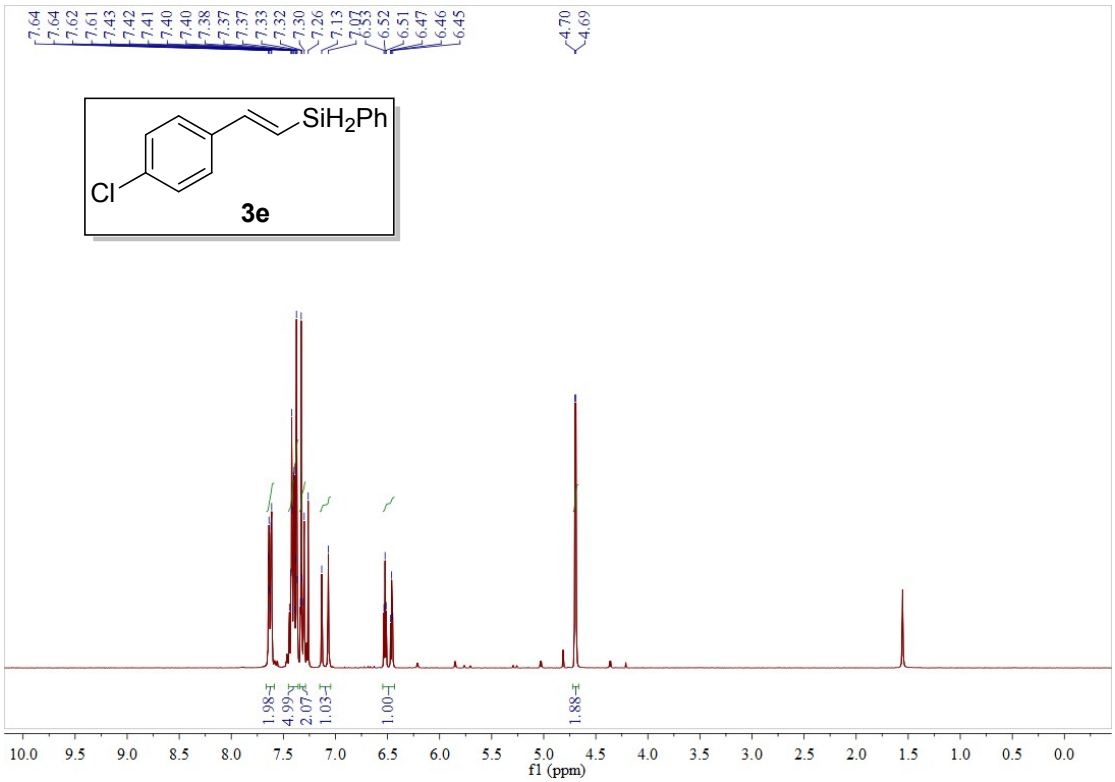
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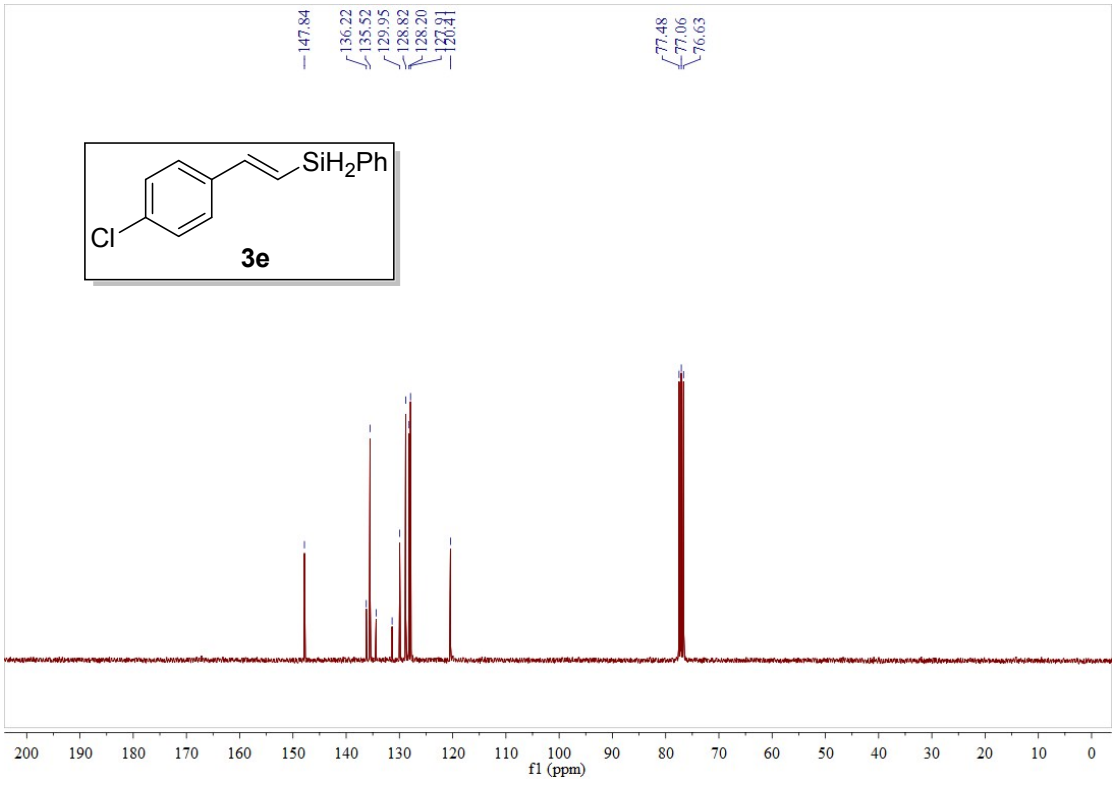
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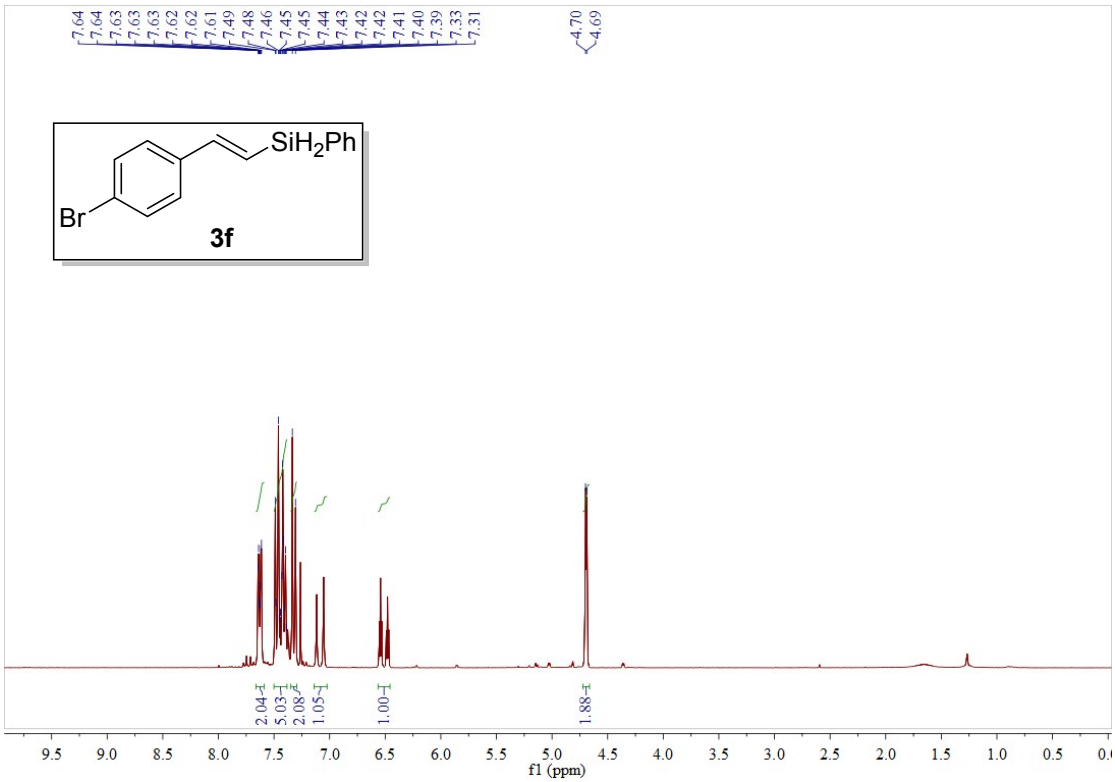
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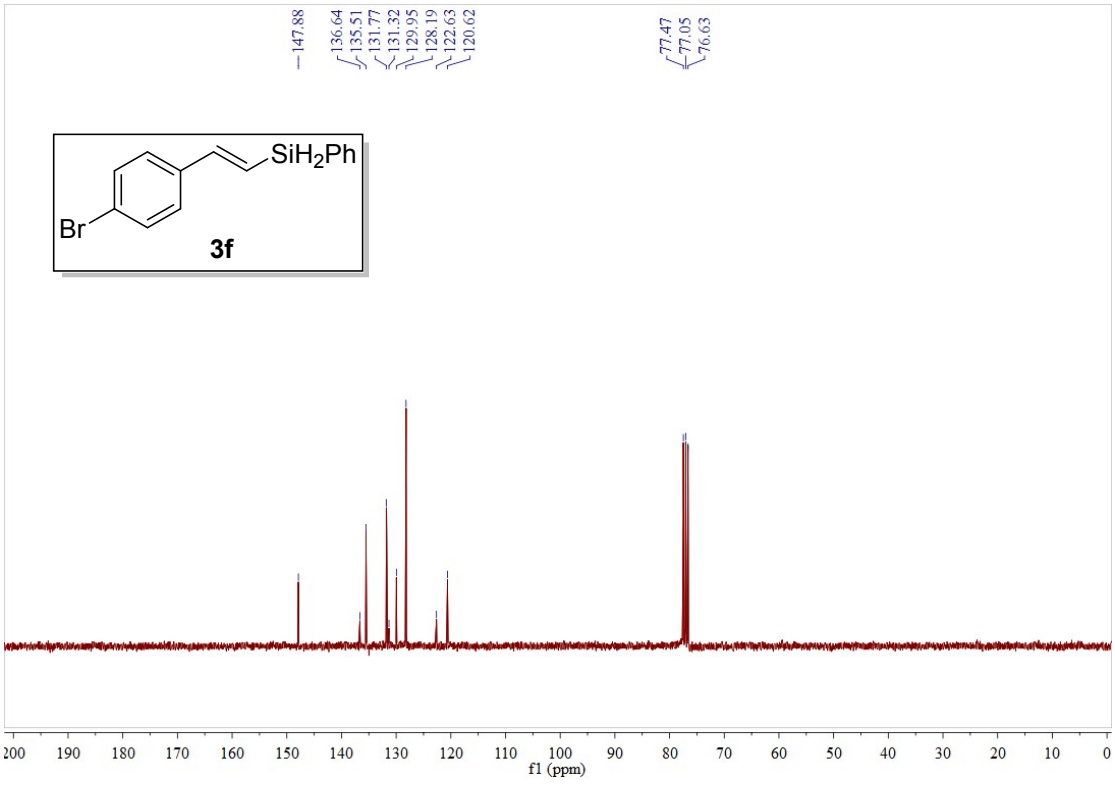
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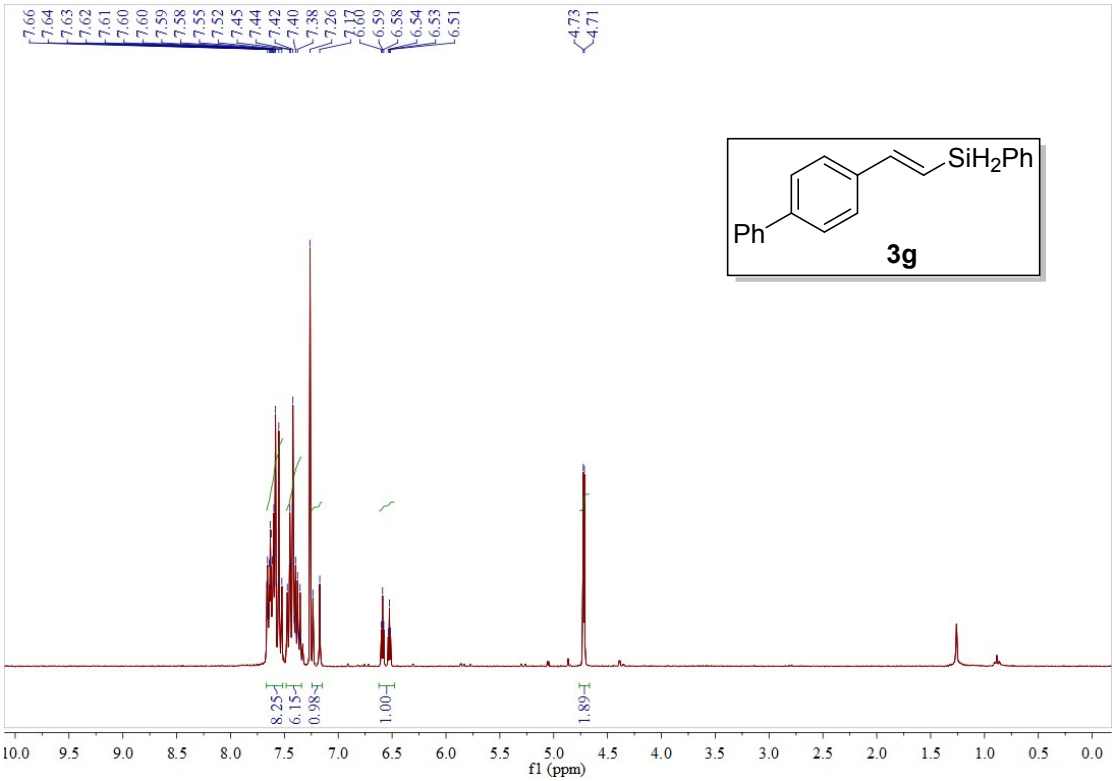
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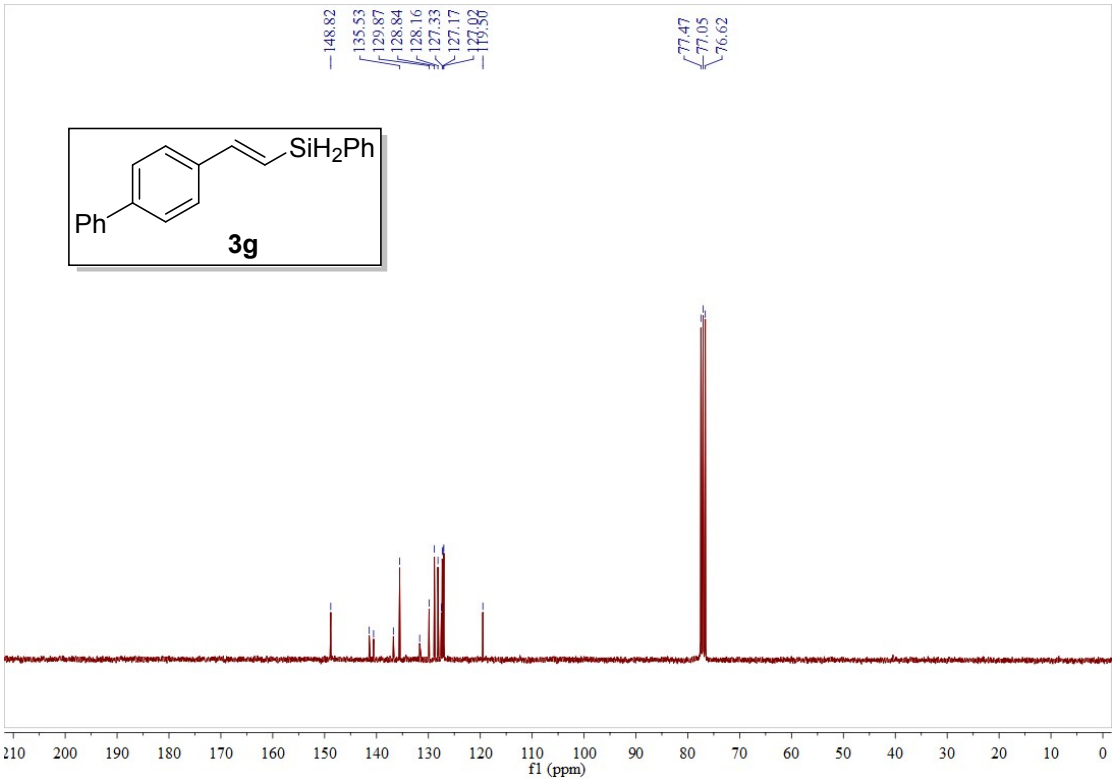
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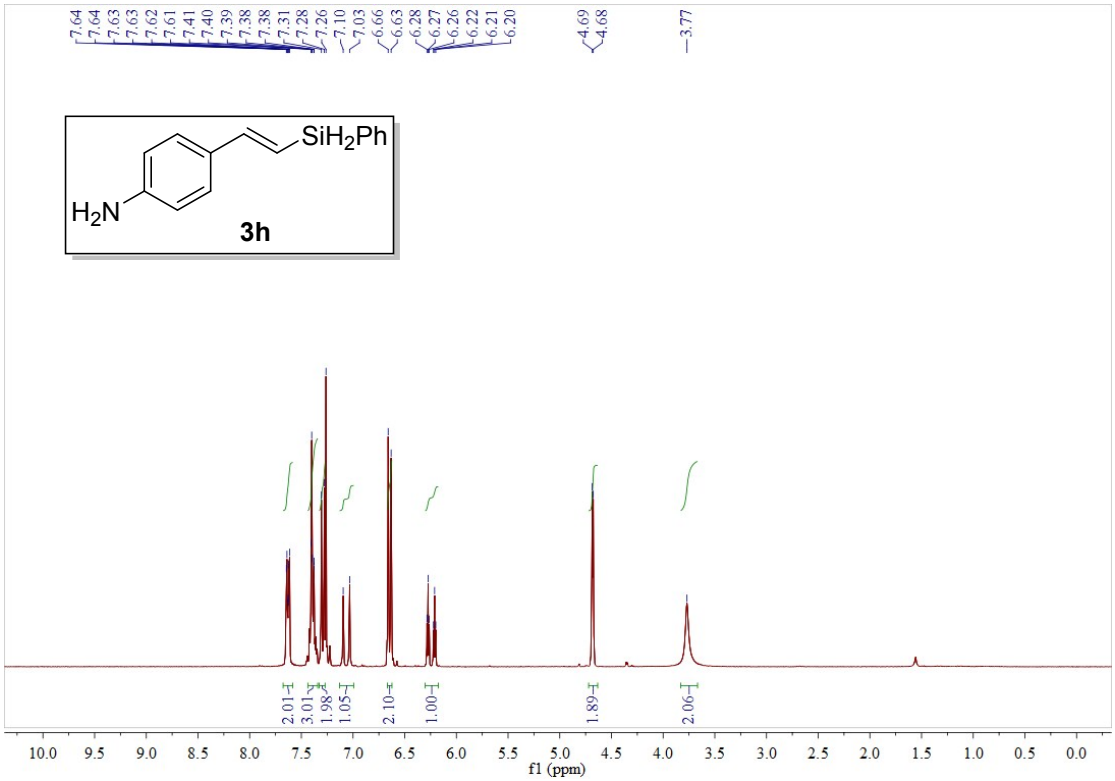
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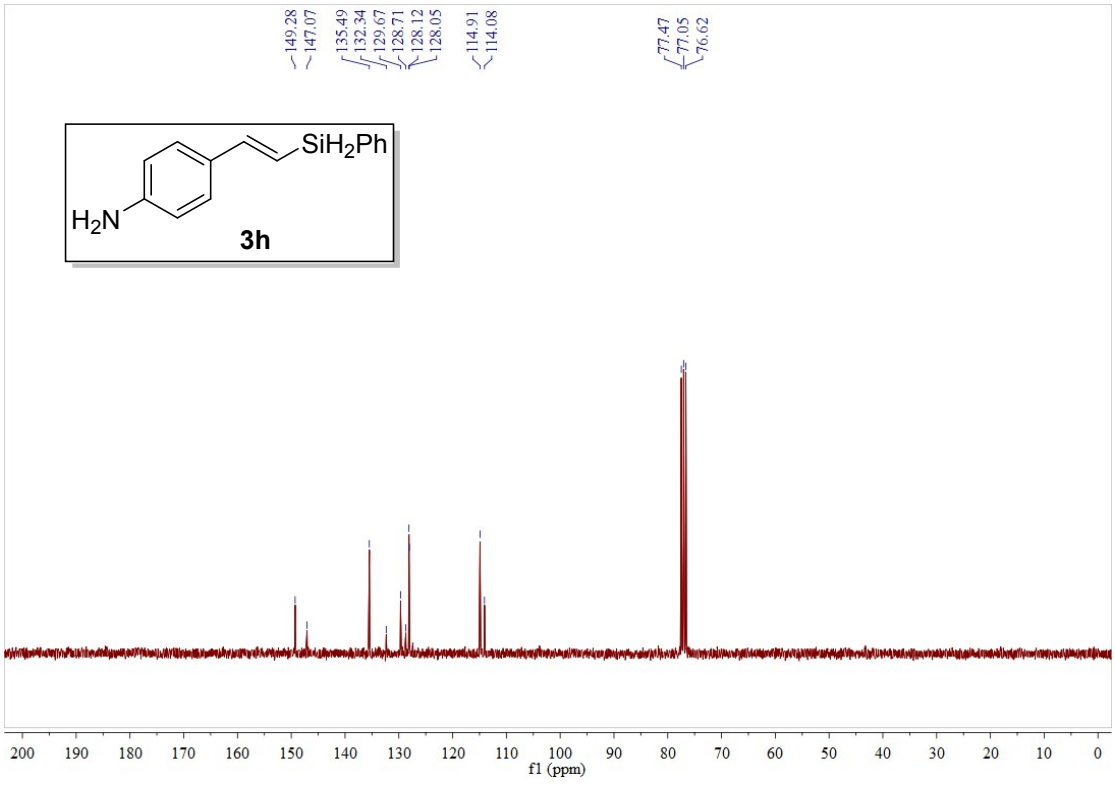
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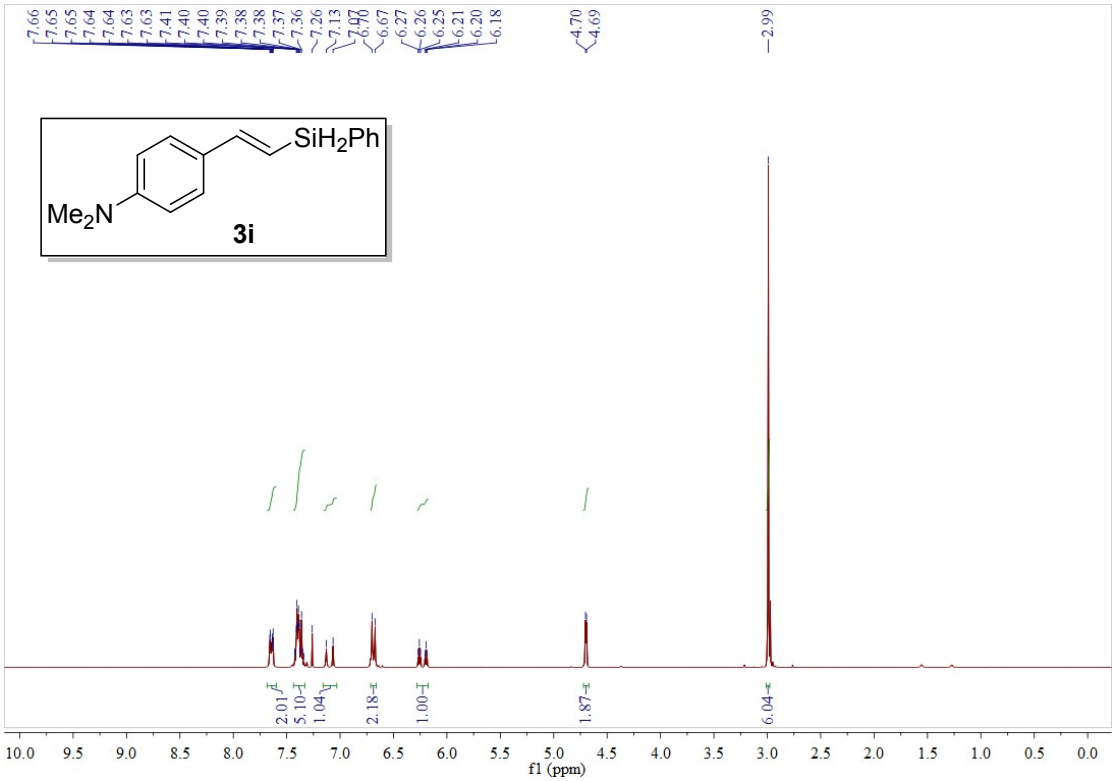
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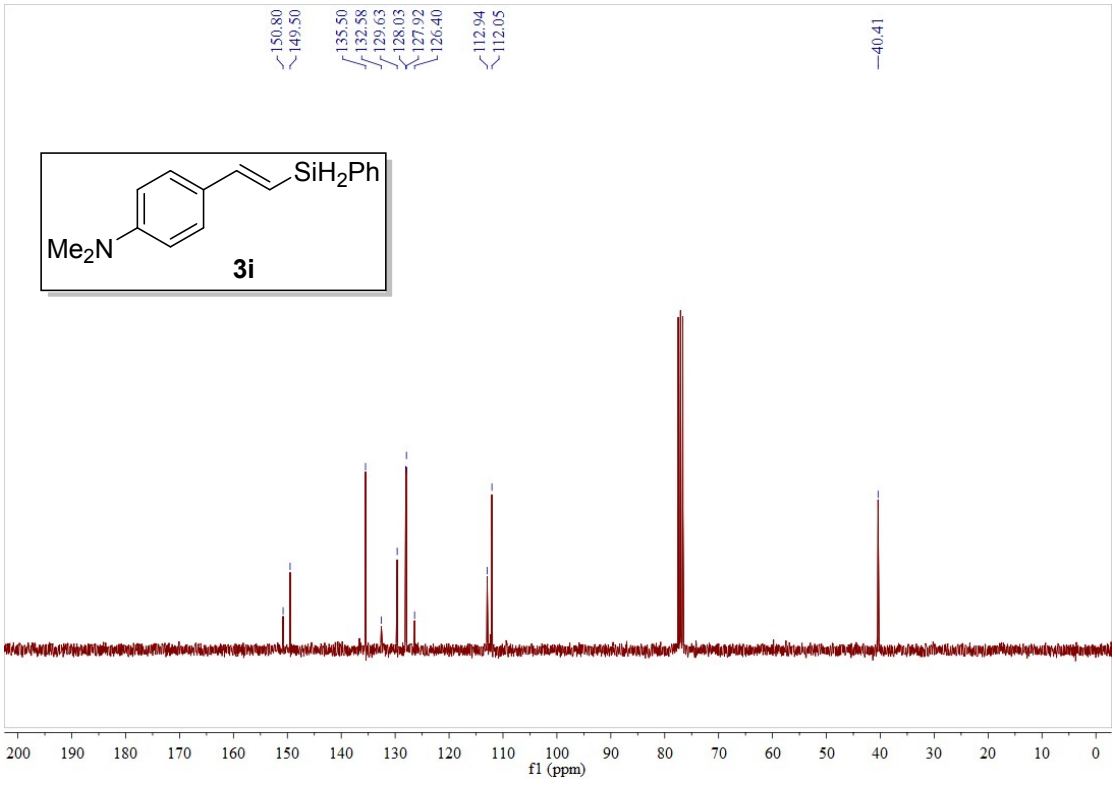
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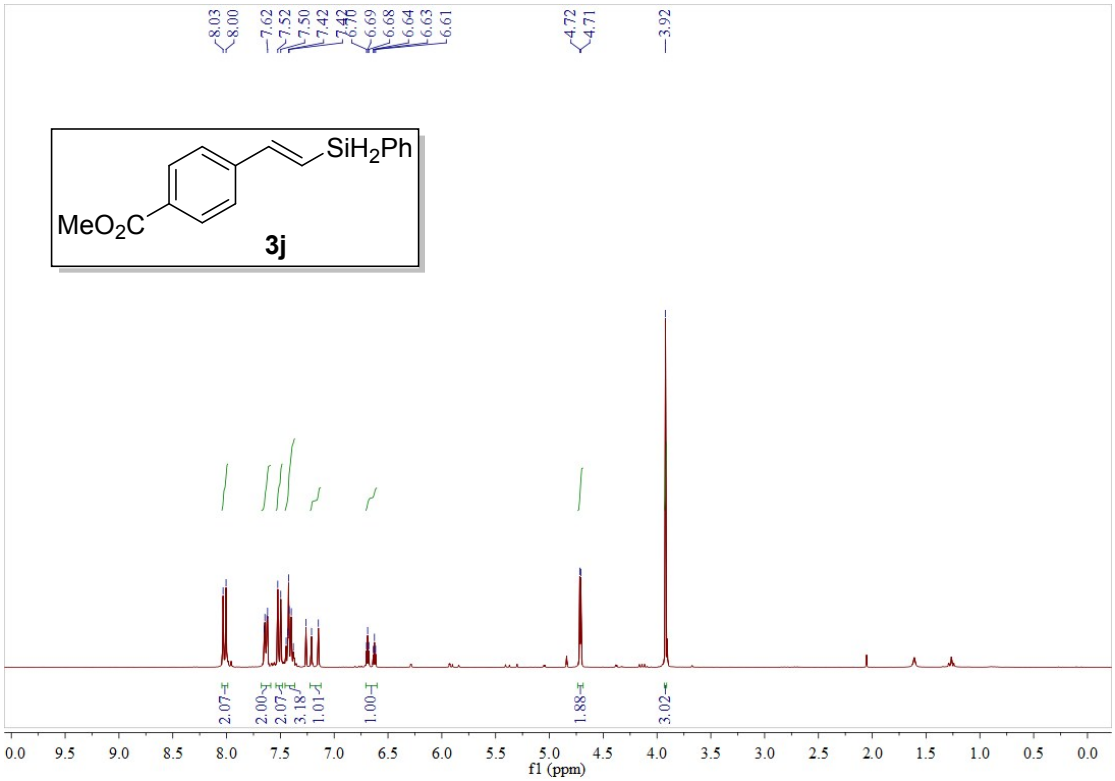
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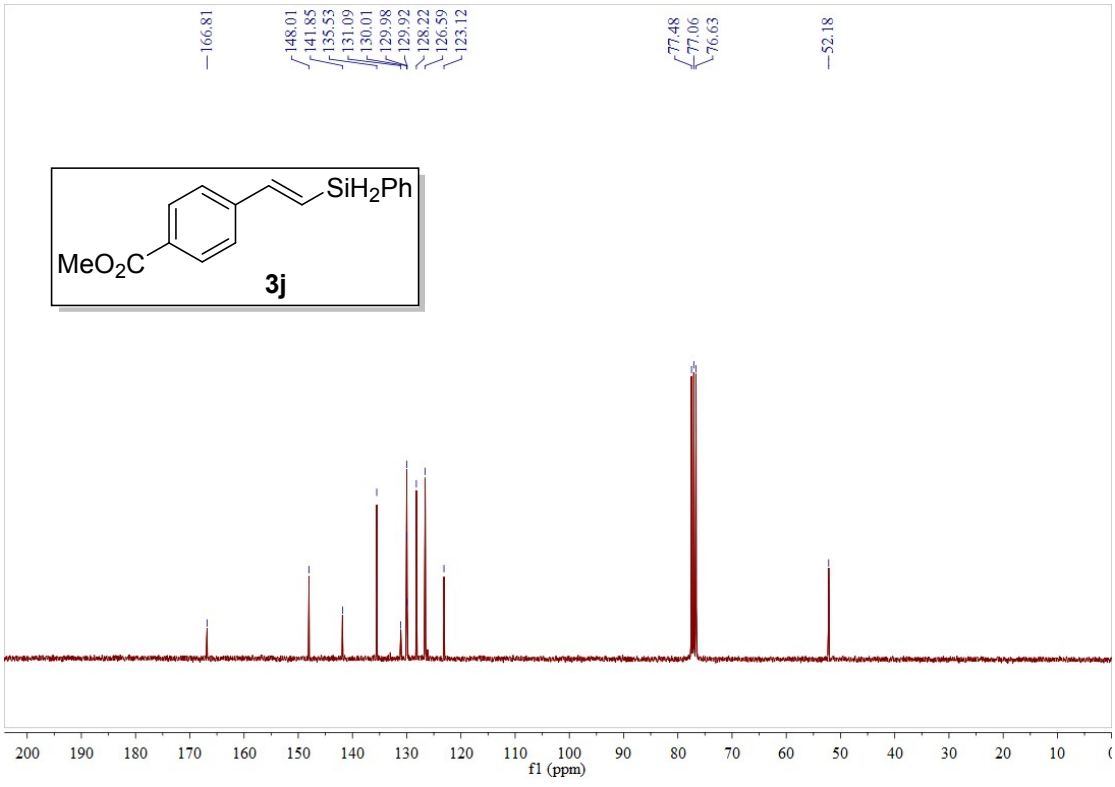
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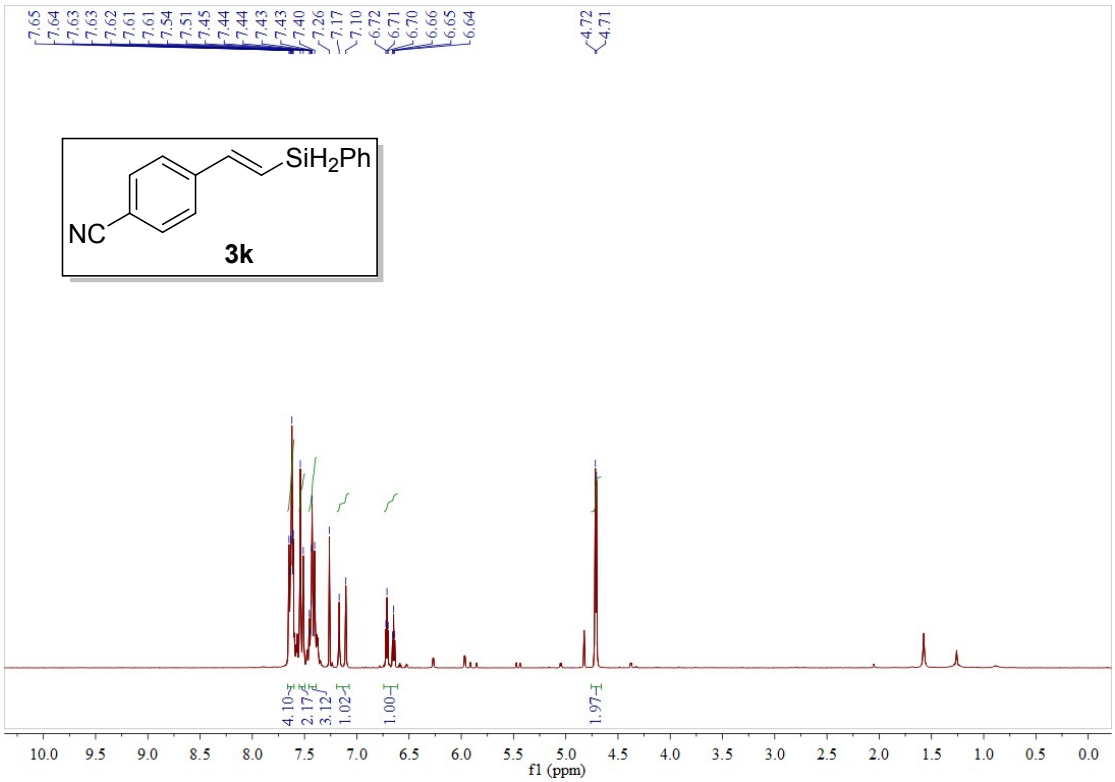
SiH2Ph
MeO2C
3j
f1 (ppm)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7.54
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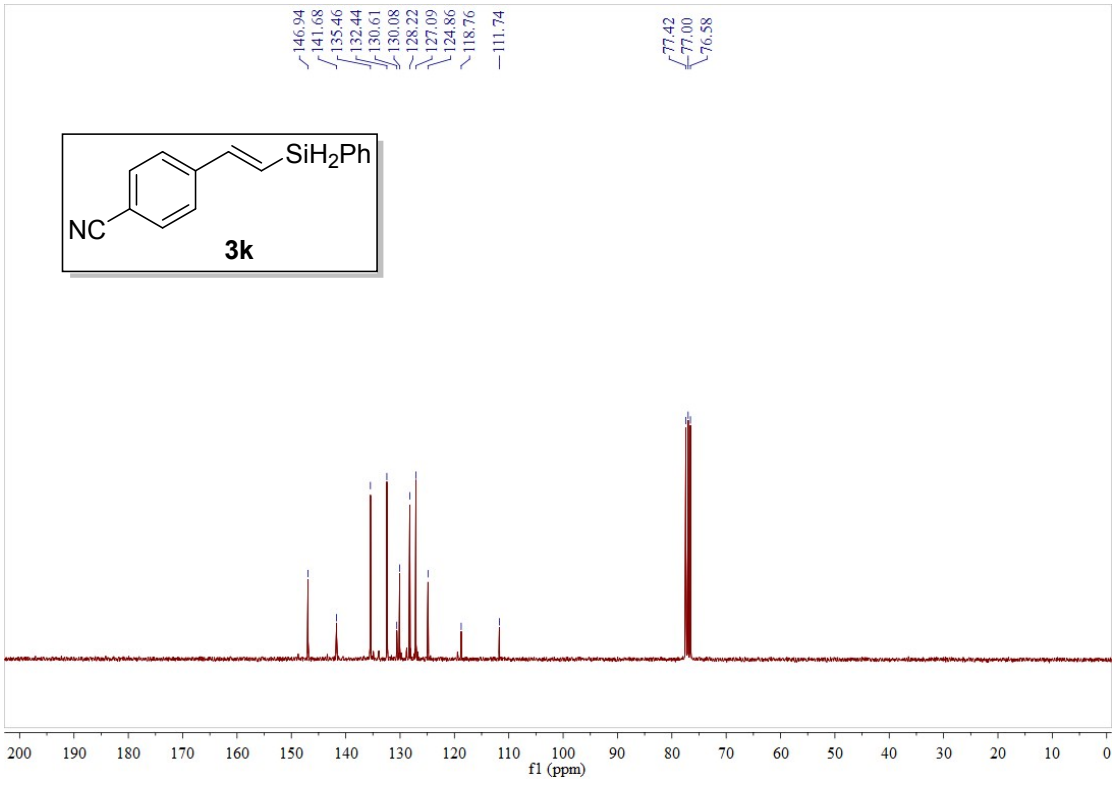
7.45
7.44
7.44
7.43
7.43
7.40
7.26
7.17
7.10
6.72
6.71
6.70
6.66
6.65
6.64
4.72
4.71
SiH2Ph
NC
3k
4.10
2.17
3.12
1.02
1.00
1.97
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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127.09
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118.76
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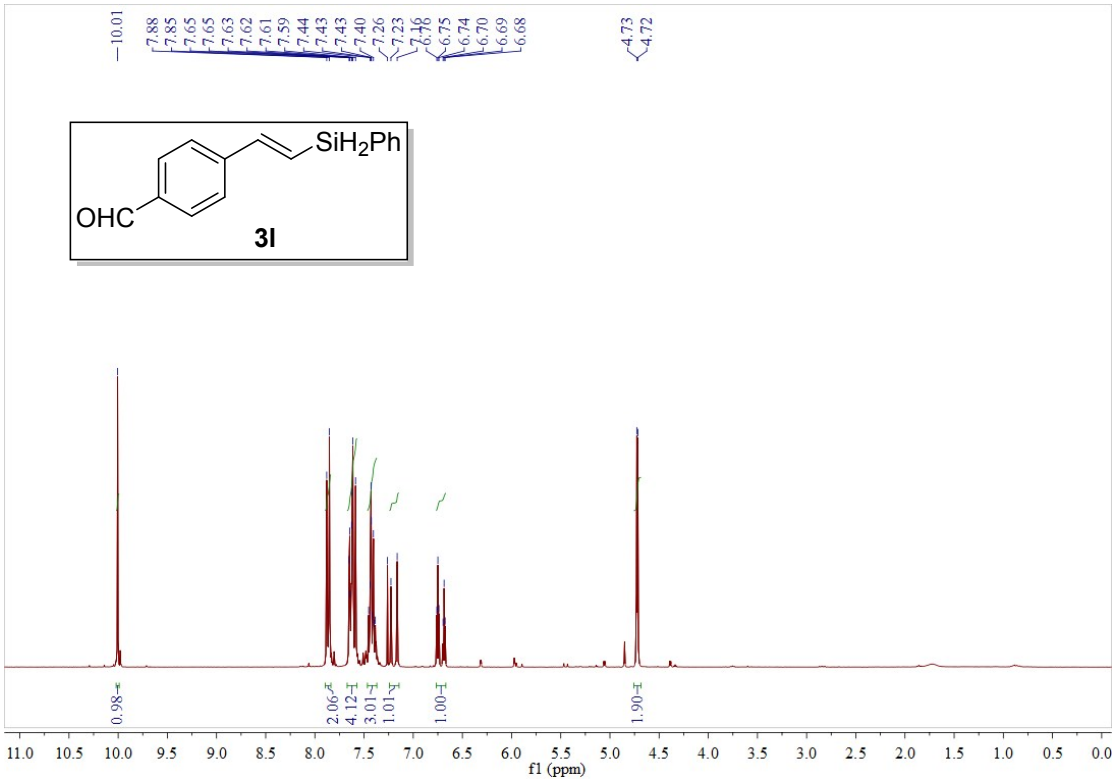
76.58
SiH2Ph
NC
3k
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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7.61
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7.44
7.43
7.43
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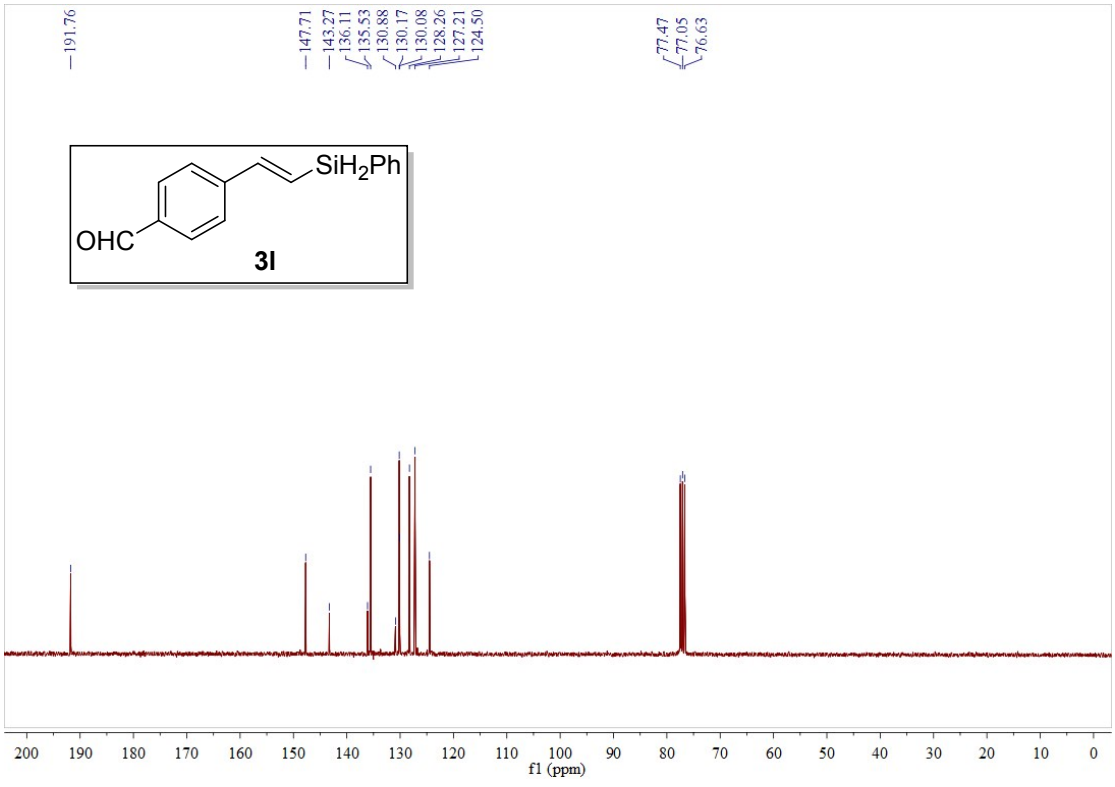
7.26
7.23
7.16
6.76
6.75
6.74
6.70
6.69
6.68
4.73
4.72
SiH2Ph
OHC
3l
0.98
2.06
4.12
3.01
1.01
1.00
1.90
f1 (ppm)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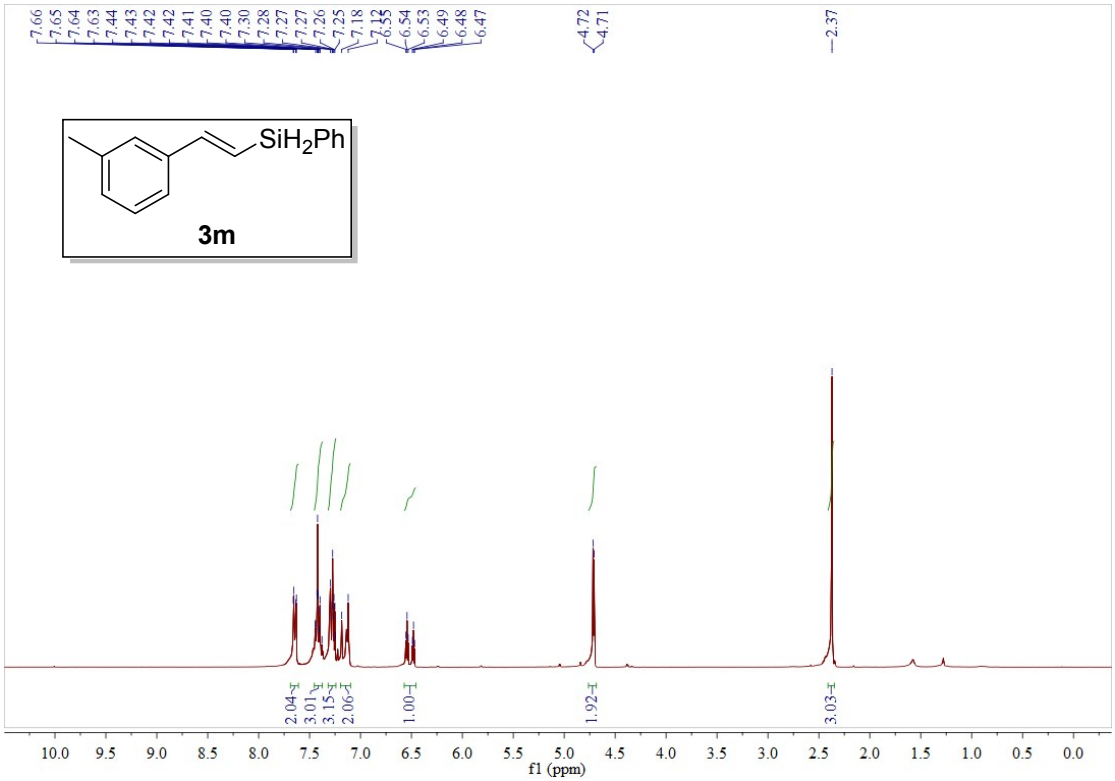
77.05
76.63
SiH2Ph
OHC
3l
f1 (ppm)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7.27
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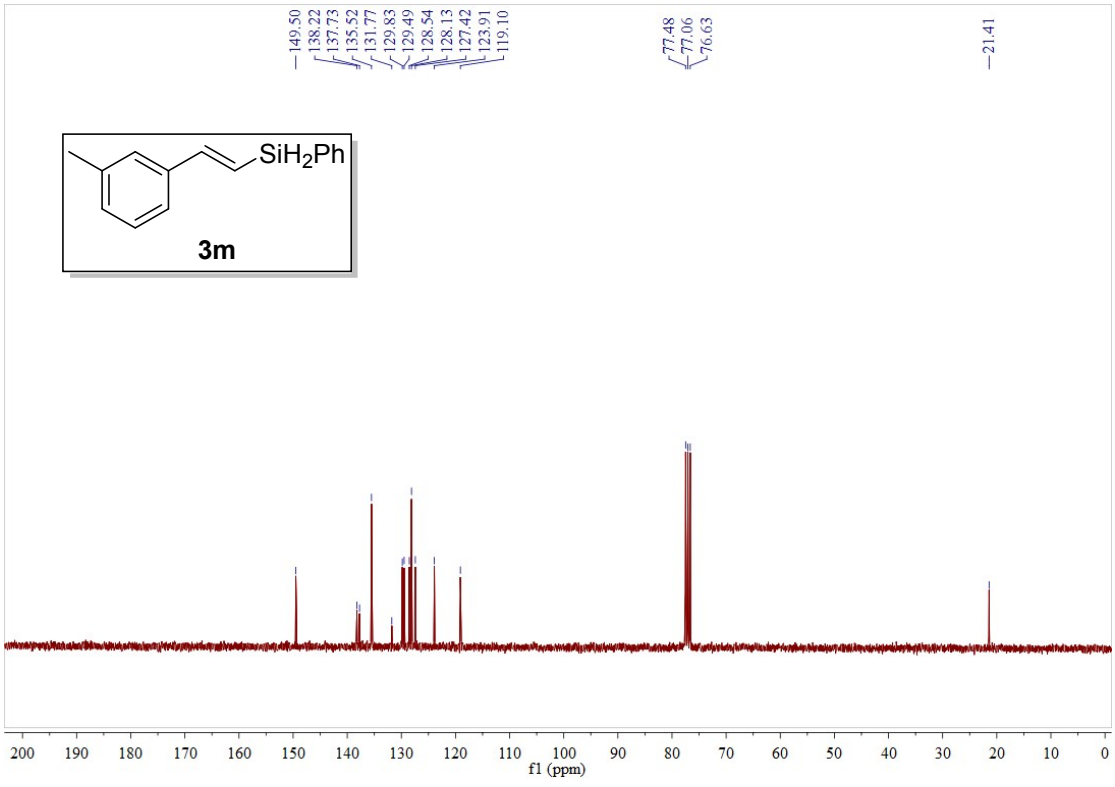
7.26
7.25
7.18
7.12
6.55
6.54
6.53
6.49
6.48
6.47
4.72
4.71
2.37
SiH2Ph
3m
2.04
3.01
3.15
2.06
1.00
1.92
3.03
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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129.49
128.54
128.13
127.42
123.91
119.10
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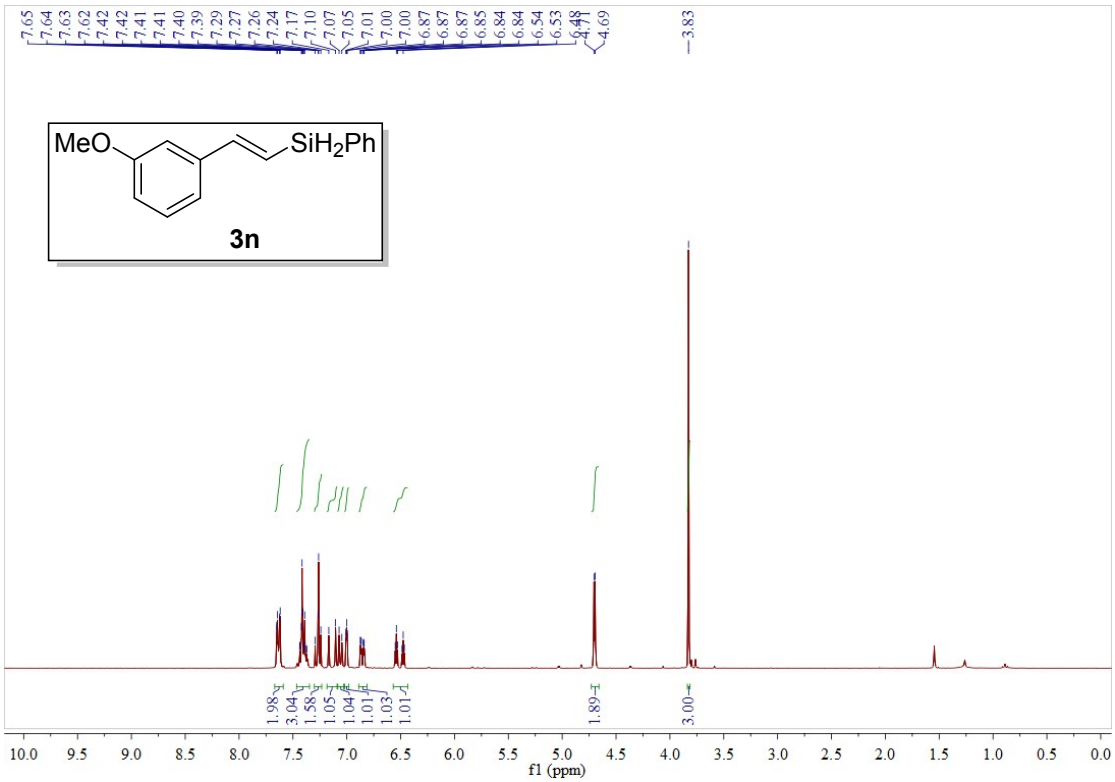
76.63
21.41
SiH2Ph
3m
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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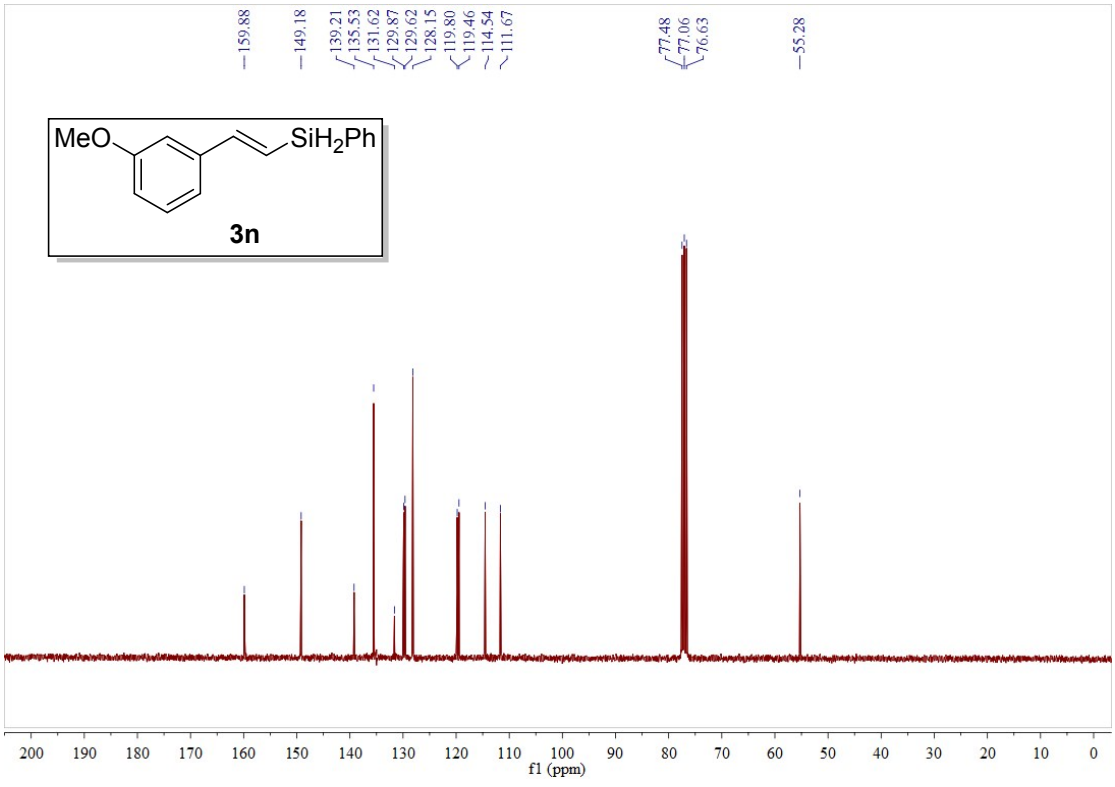
7.26
7.24
7.17
7.10
7.07
7.05
7.01
7.00
7.00
6.87
6.87
6.87
6.85
6.84
6.84
6.54
6.53
6.48
4.71
4.69
3.83
MeO
SiH2Ph
3n
1.98
3.04
1.58
1.05
1.04
1.01
1.03
1.01
1.89
3.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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119.46
114.54
111.67
77.48
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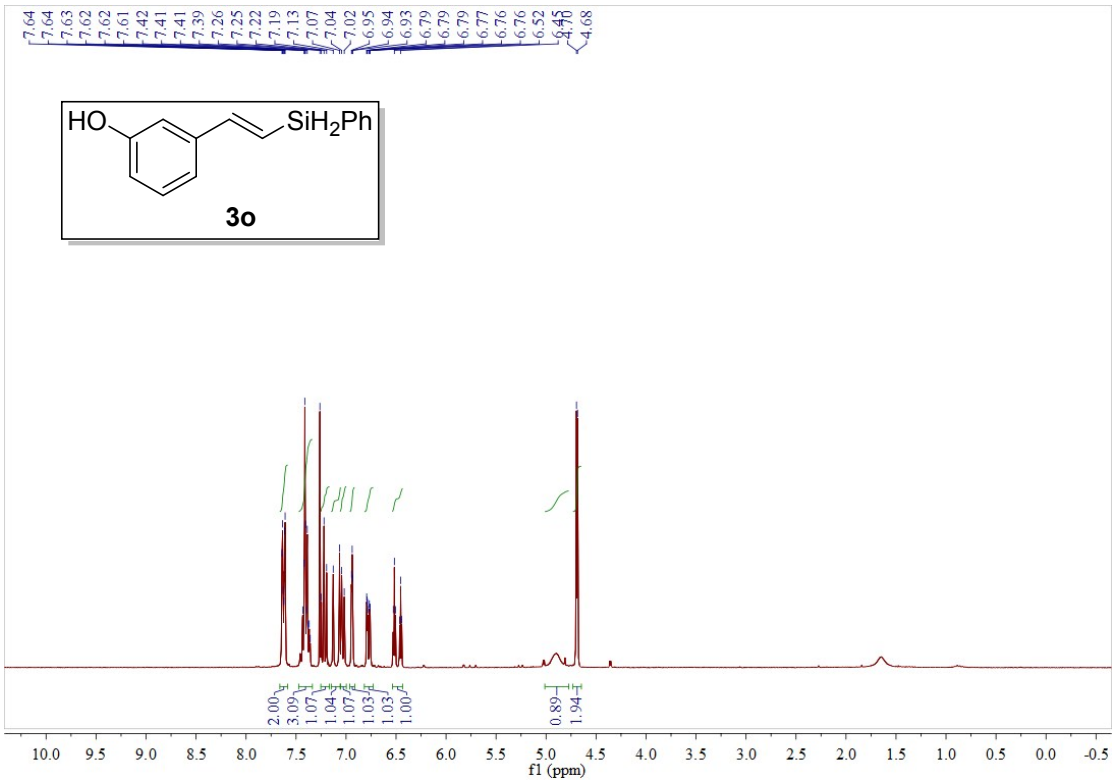
55.28
MeO
SiH2Ph
3n
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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7.22
7.19
7.13
7.07
7.04
7.02
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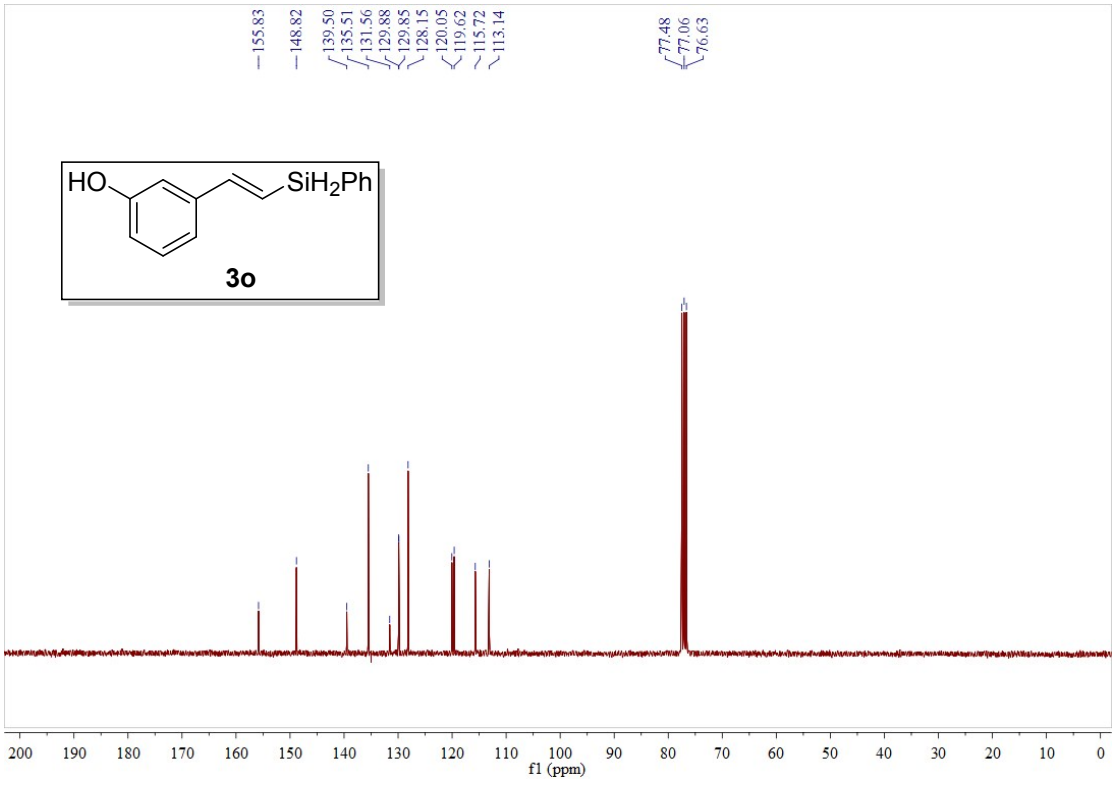
6.94
6.93
6.79
6.79
6.79
6.77
6.76
6.76
6.52
6.45
4.70
4.68
HO
SiH2Ph
3o
2.00
3.09
1.07
1.04
1.07
1.03
1.03
1.00
0.89
1.94
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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119.62
115.72
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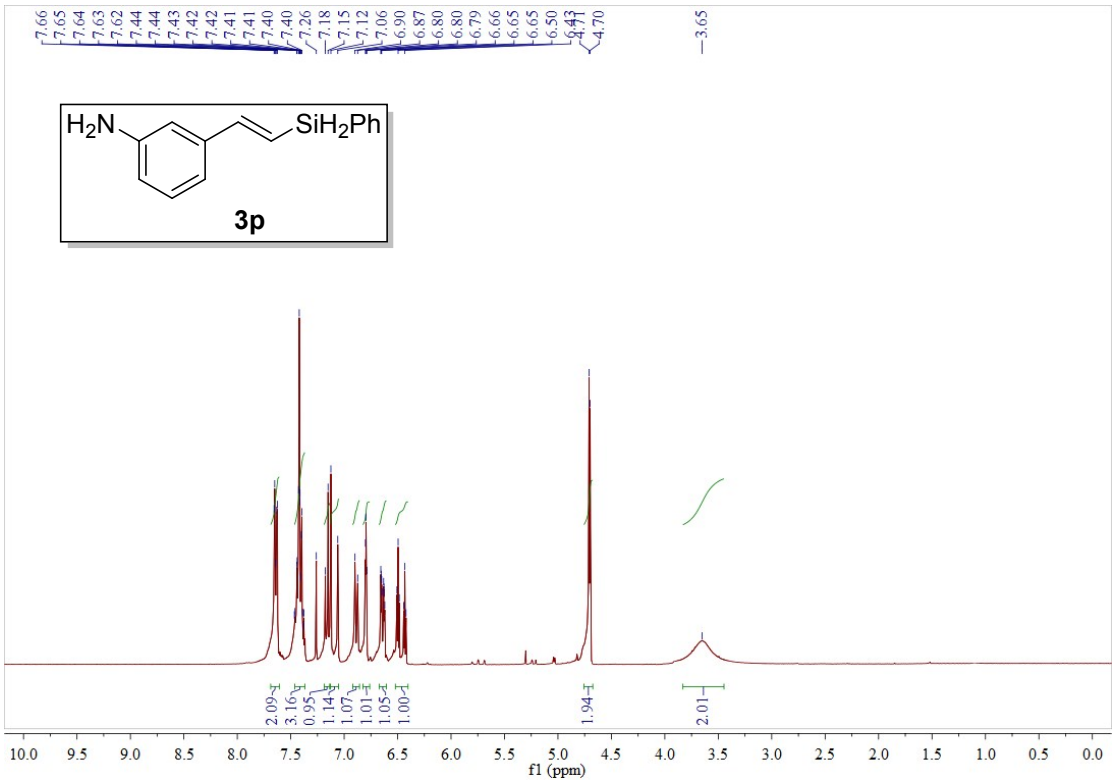
76.63
HO
SiH2Ph
3o
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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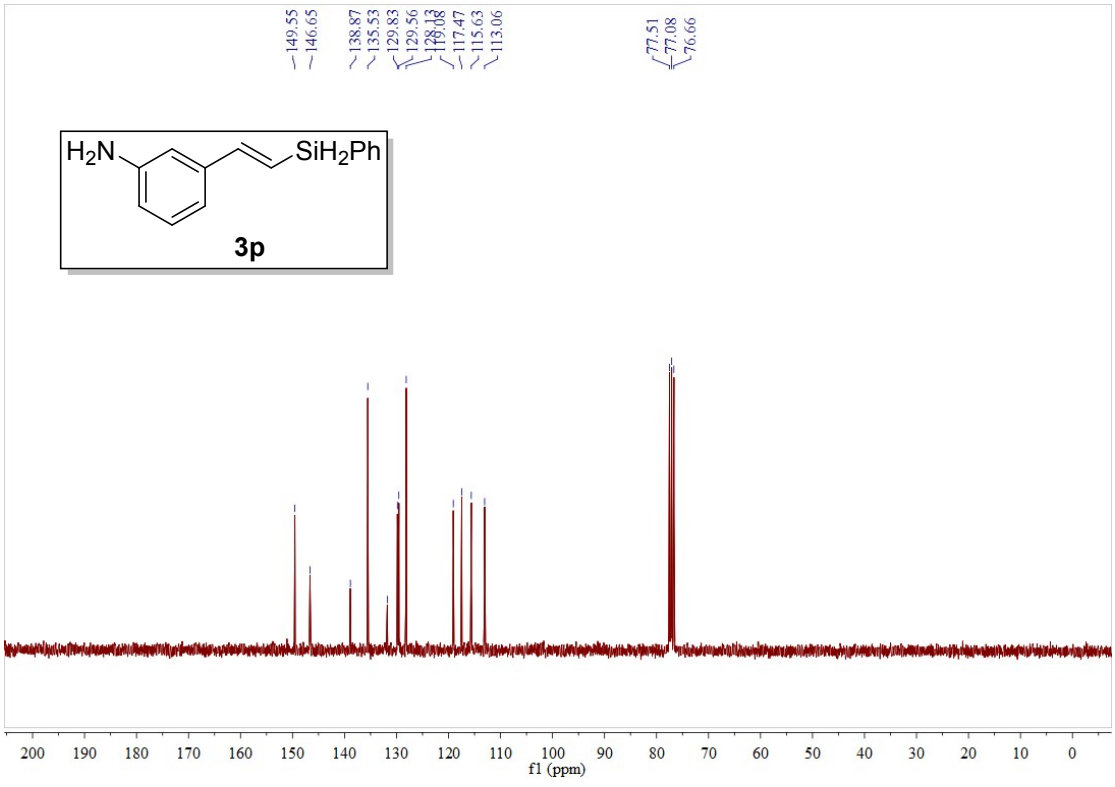
6.65
6.65
6.50
6.43
4.71
4.70
3.65
H2N
SiH2Ph
3p
2.09
3.16
0.95
1.14
1.07
1.01
1.05
1.00
1.94
2.01
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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115.63
113.06
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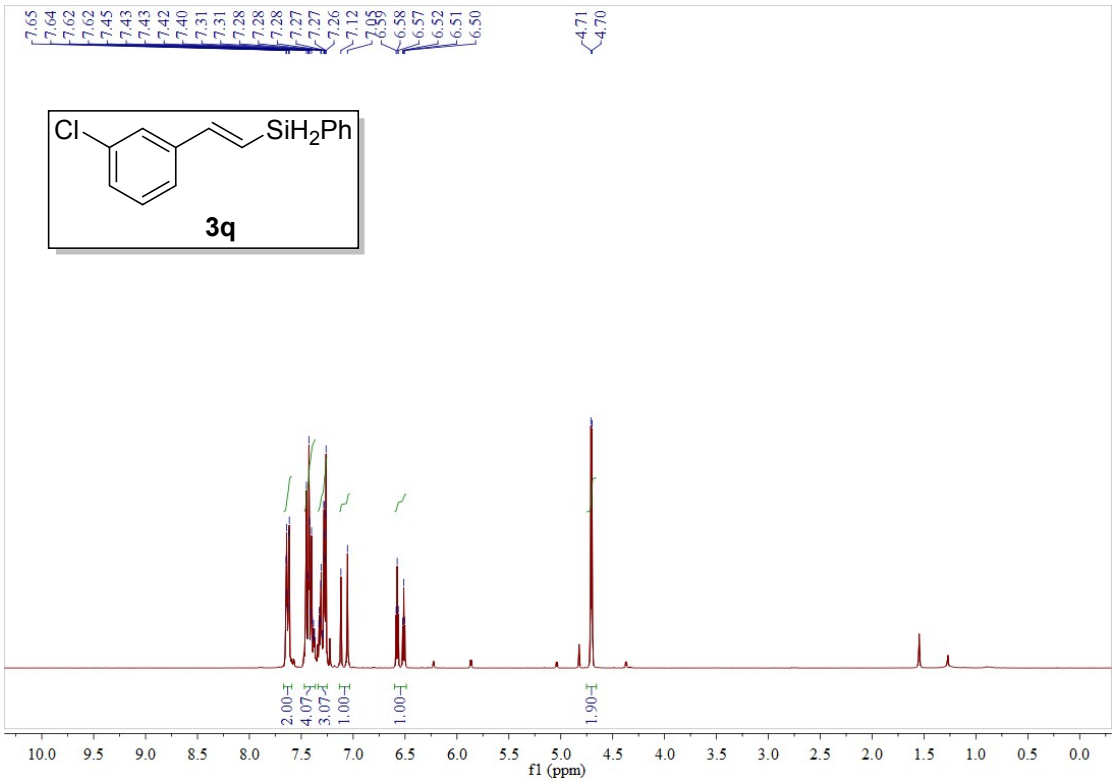
76.66
H2N
SiH2Ph
3p
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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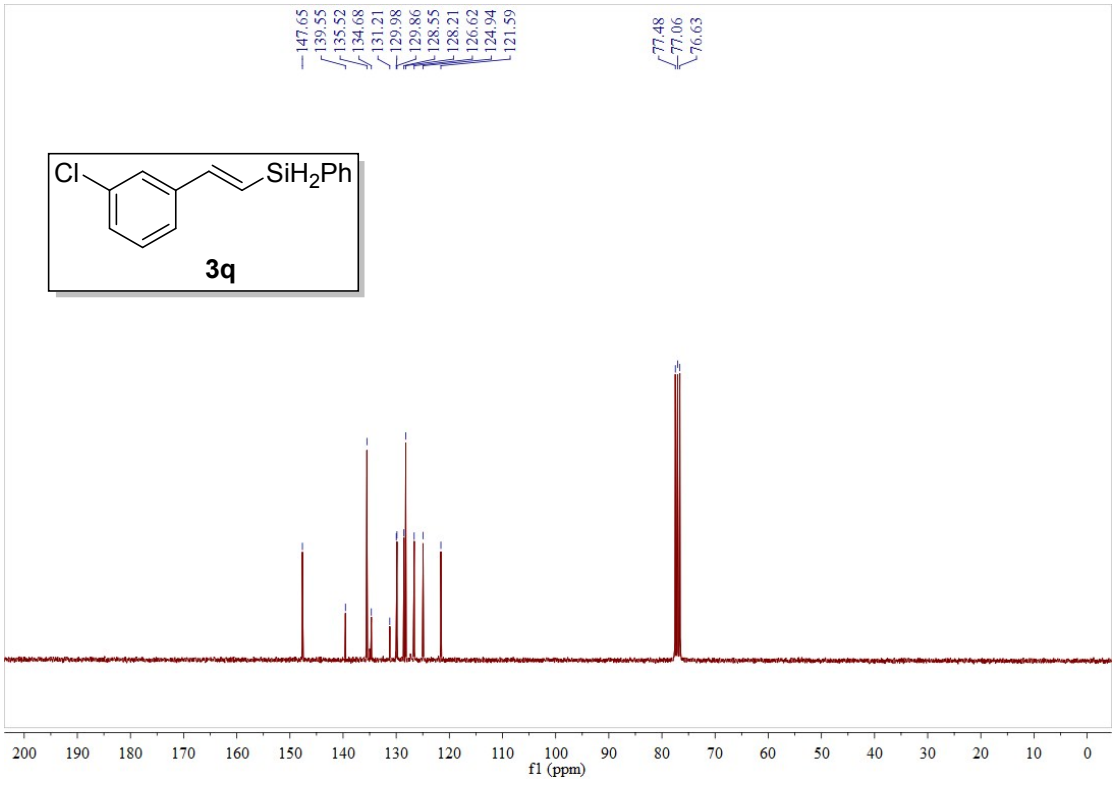
7.28
7.27
7.27
7.26
7.12
6.59
6.58
6.57
6.52
6.51
6.50
4.71
4.70
Cl
SiH2Ph
3q
2.00
4.07
3.07
1.00
1.00
1.90
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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124.94
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76.63
Cl
SiH2Ph
3q
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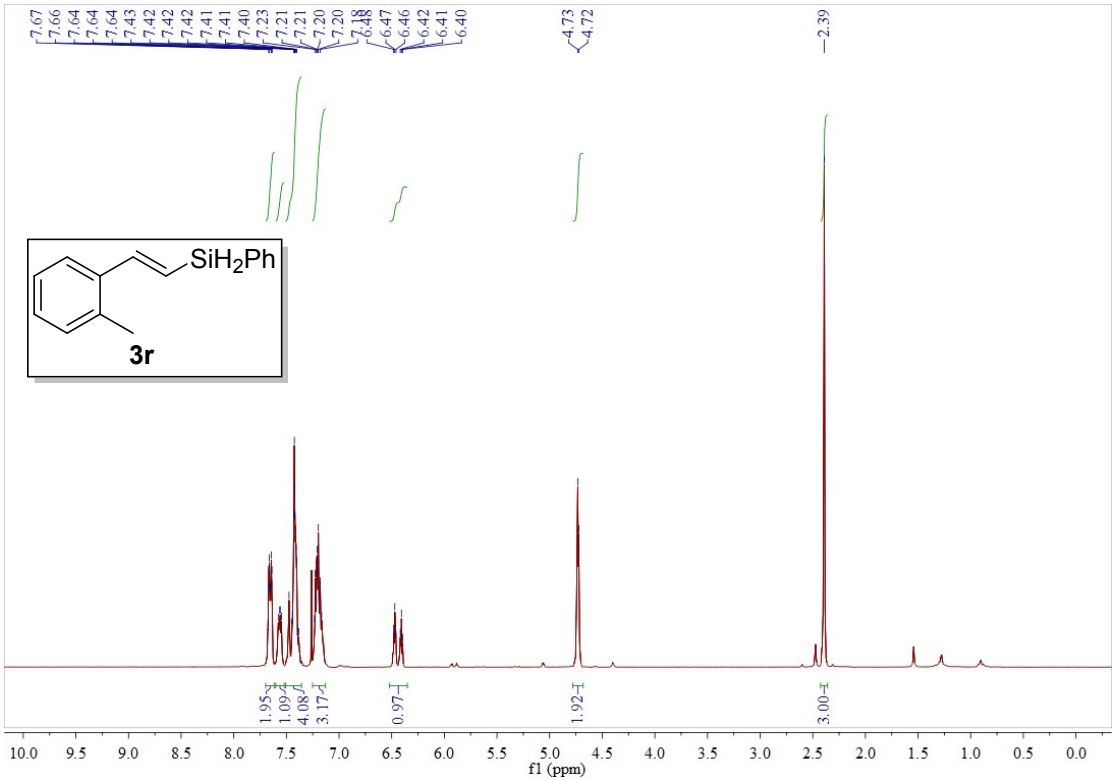
f1 (ppm)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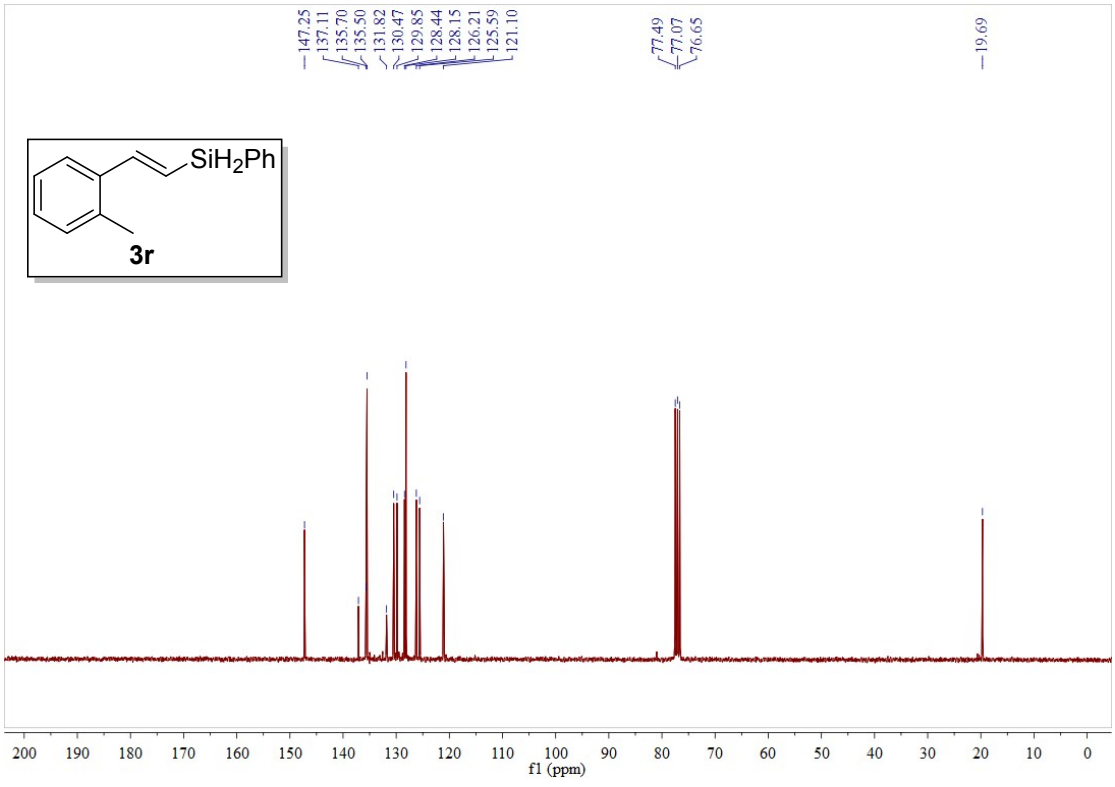
7.41
7.41
7.40
7.23
7.21
7.21
7.20
7.20
6.47
6.46
6.42
6.41
6.40
4.73
4.72
2.39
SiH2Ph
3r
1.95
1.09
4.08
3.17
0.97
1.92
3.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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126.21
125.59
121.10
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19.69
SiH2Ph
3r
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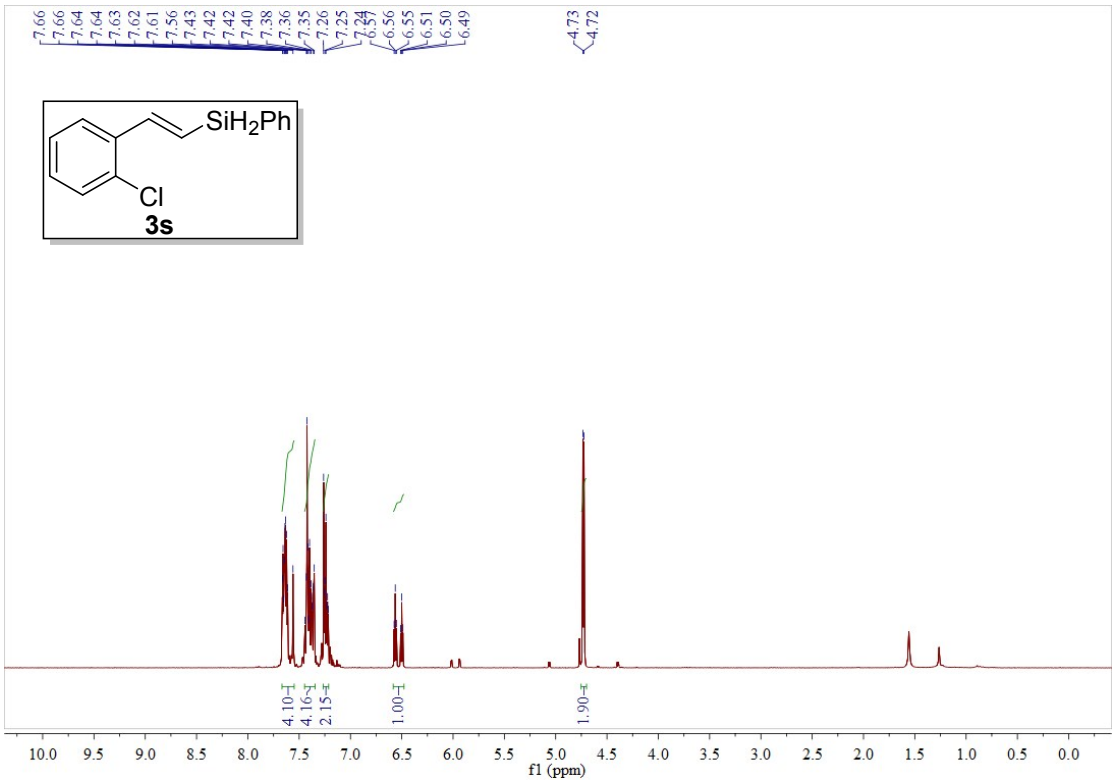
f1 (ppm)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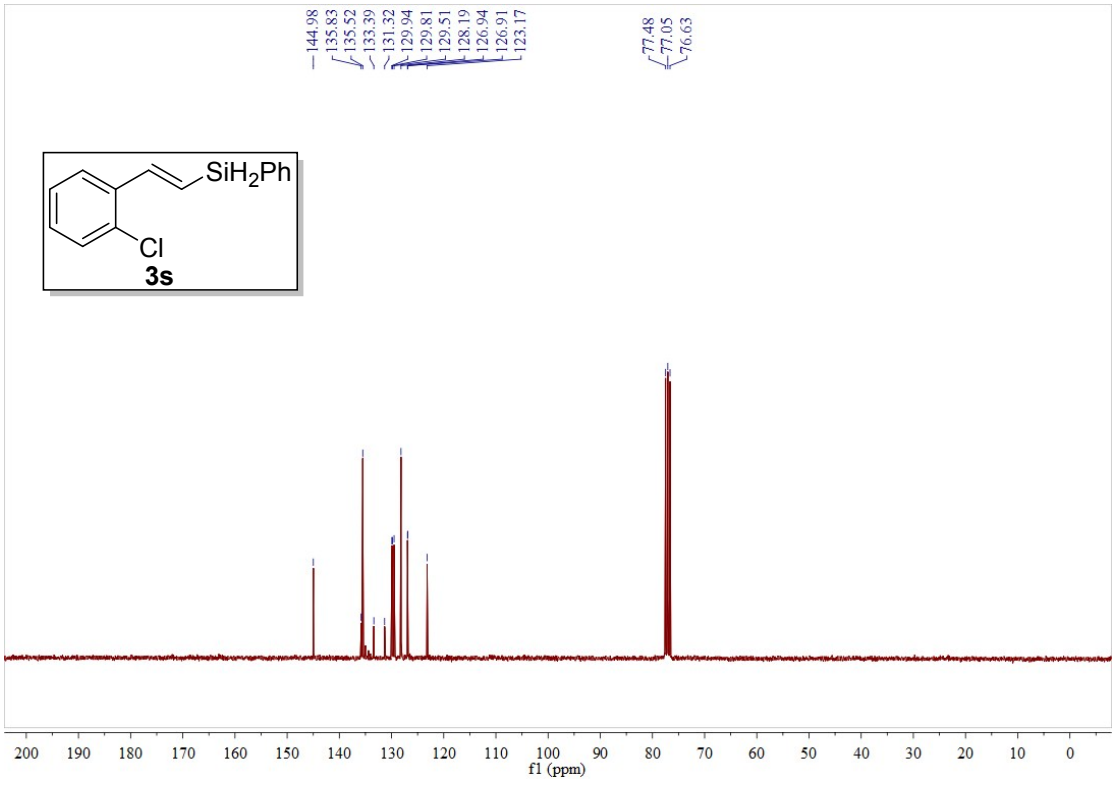
7.25
7.24
6.57
6.56
6.55
6.51
6.50
6.49
4.73
4.72
SiH2Ph
Cl
3s
4.10
4.16
2.15
1.00
1.90
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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126.91
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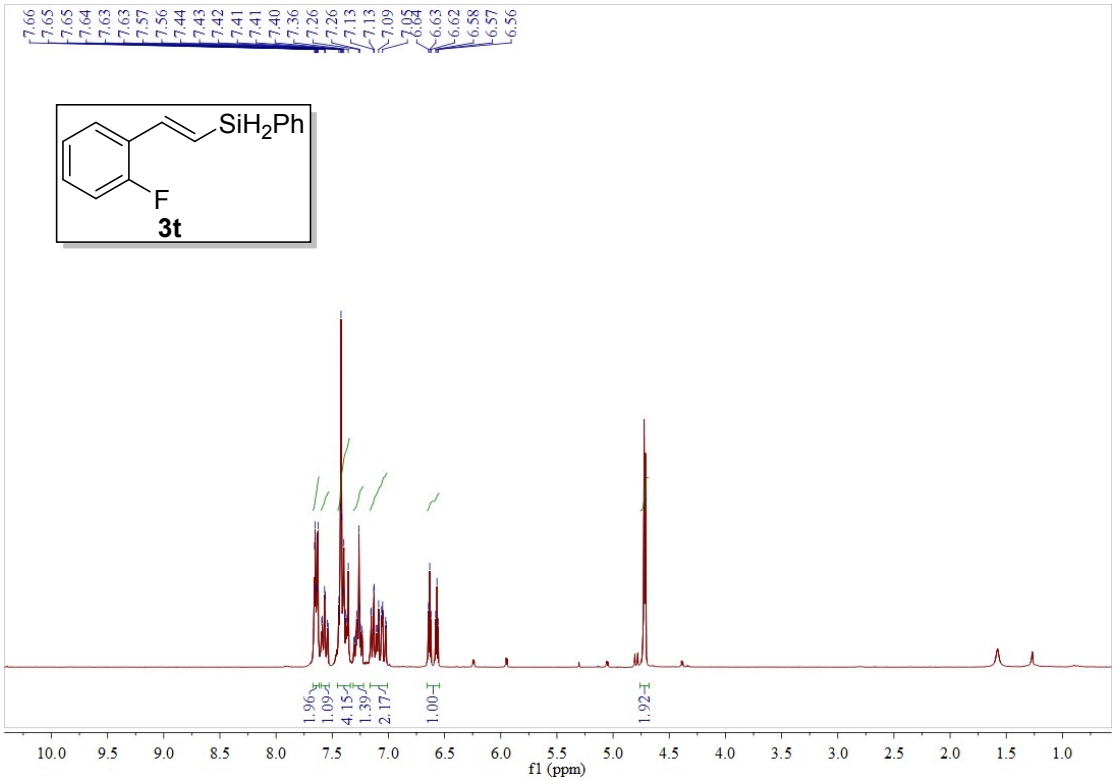
77.05
76.63
SiH2Ph
Cl
3s
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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7.41
7.40
7.36
7.26
7.26
7.13
7.13
7.09
7.05
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6.63
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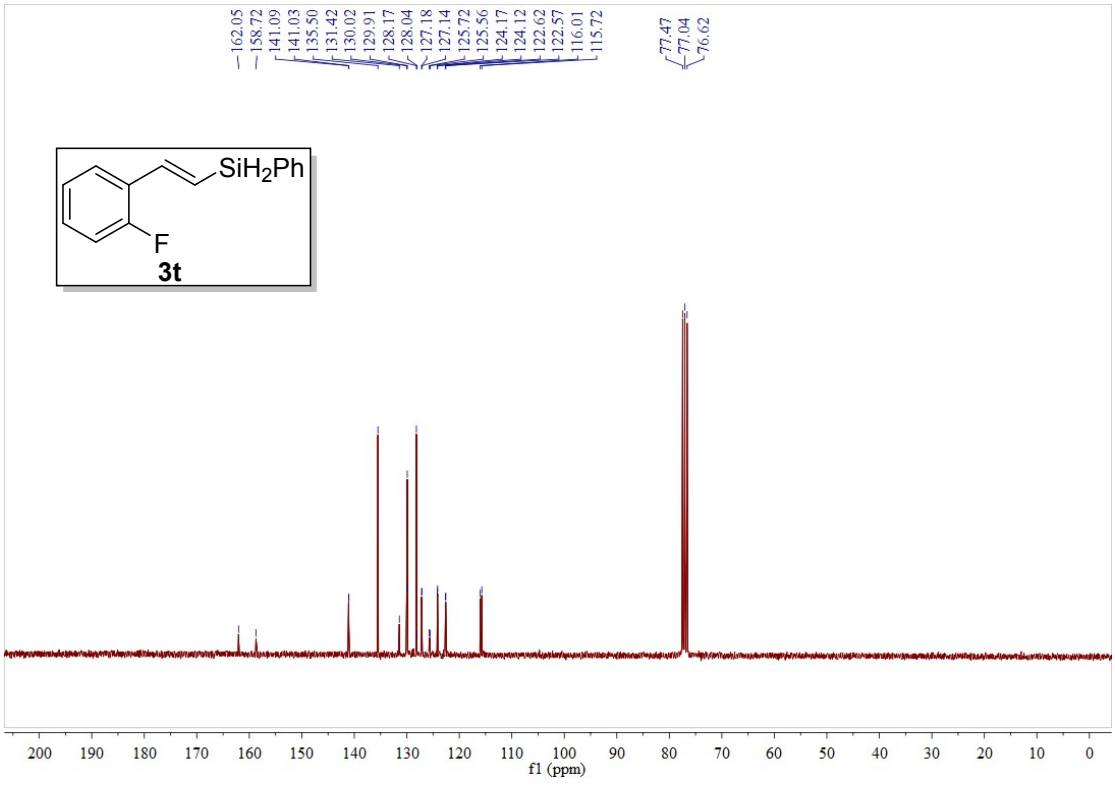
6.58
6.57
6.56
SiH2Ph
F
3t
1.96
1.09
4.15
1.39
2.17
1.00
1.92
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0
f1 (ppm)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125.56
124.17
124.12
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122.57
116.01
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76.62
SiH2Ph
F
3t
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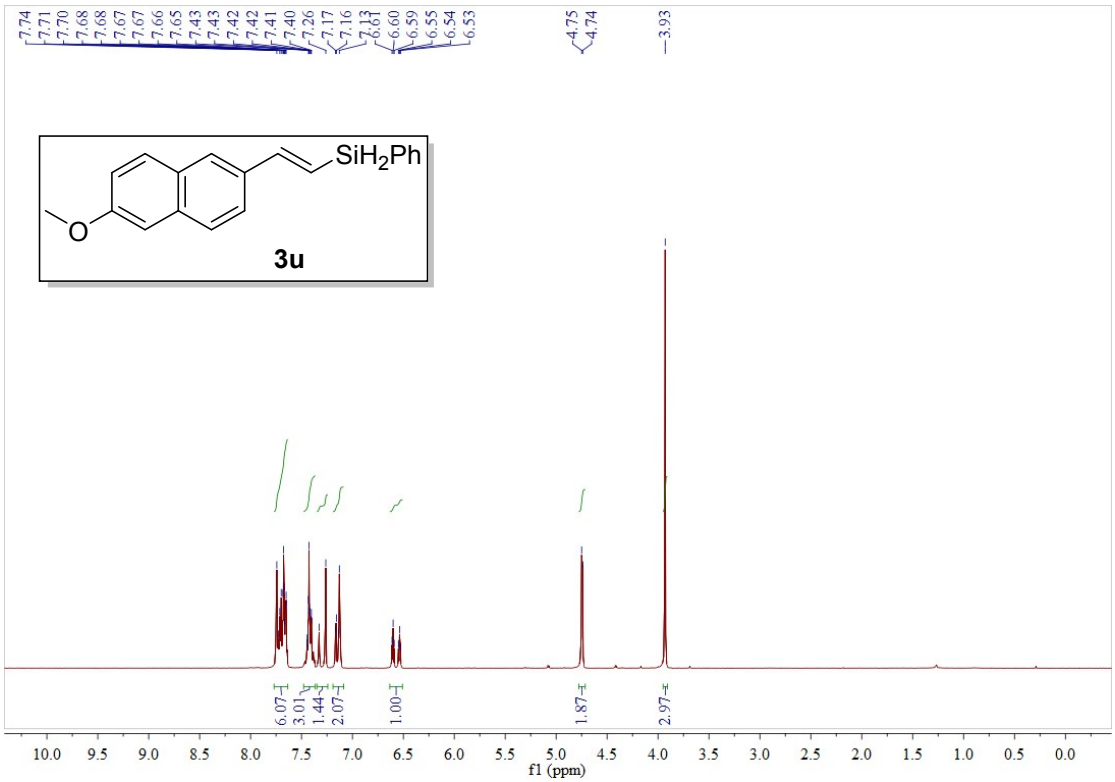
f1 (ppm)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7.17
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7.13
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6.54
6.53
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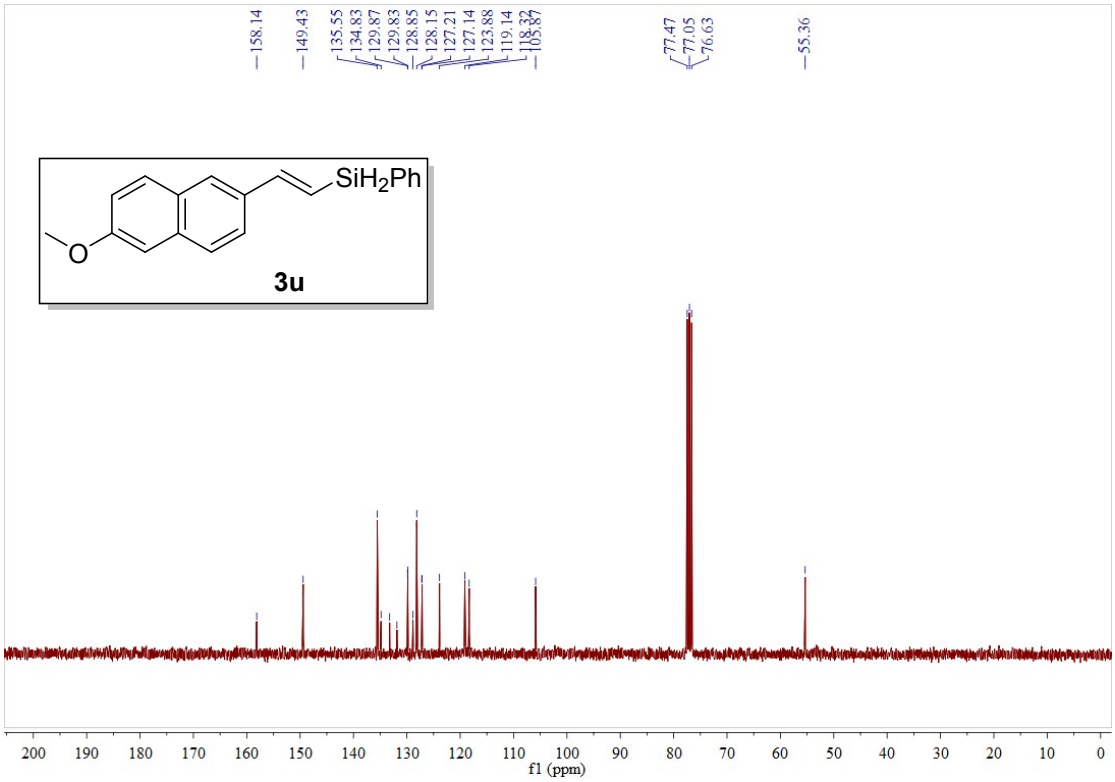
4.74
3.93
SiH2Ph
O
3u
6.07
3.01
1.44
2.07
1.00
1.87
2.97
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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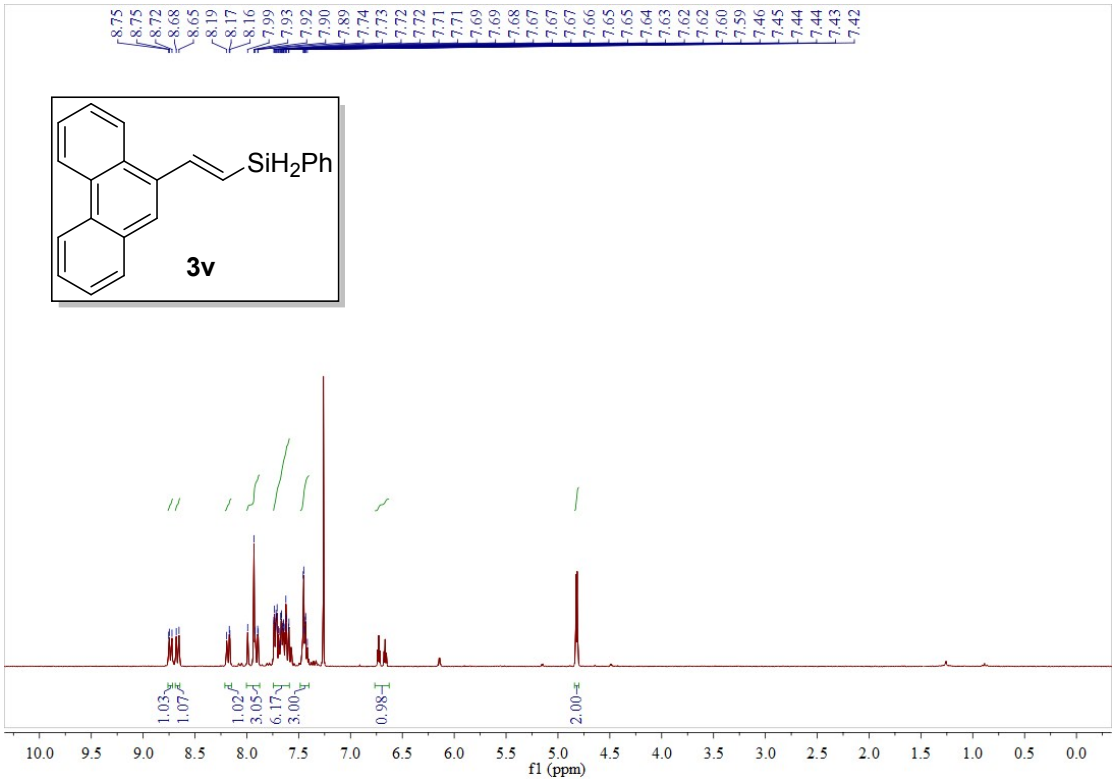
77.05
76.63
55.36
SiH2Ph
O
3u
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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7.68
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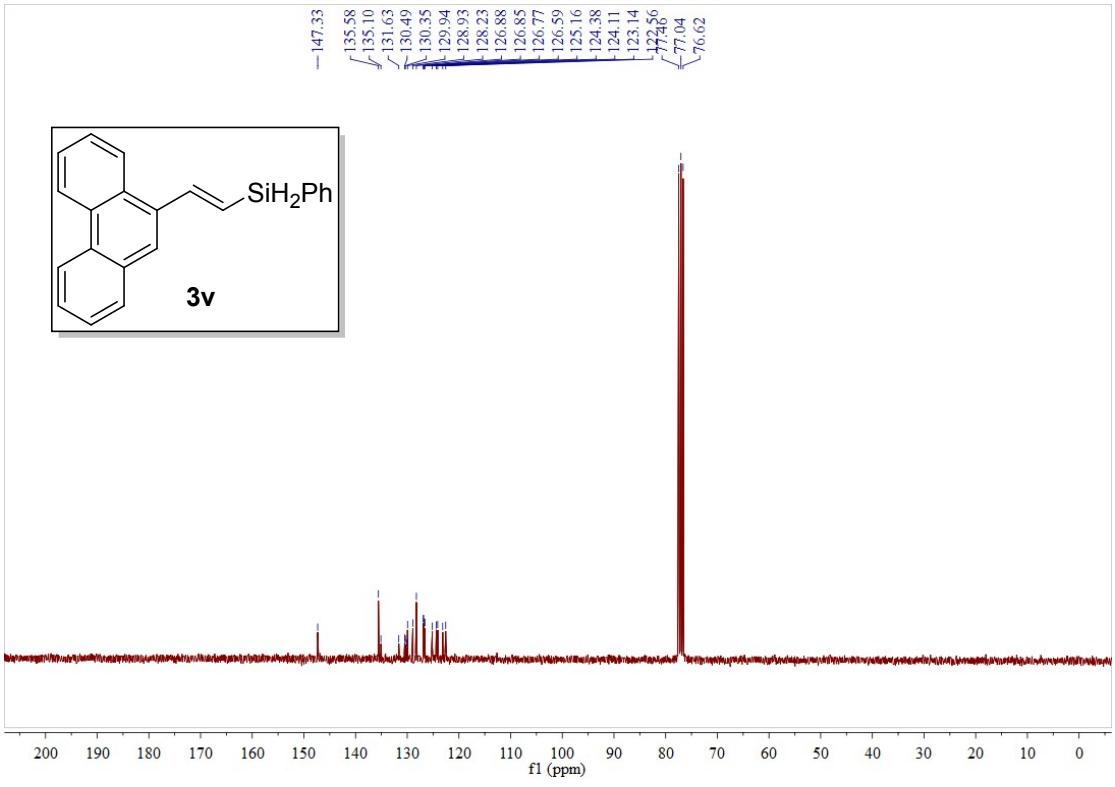
7.44
7.43
7.42
SiH2Ph
3v
1.03
1.07
1.02
3.05
6.17
3.00
0.98
2.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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126.59
125.16
124.38
124.11
123.14
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77.04
76.62
SiH2Ph
3v
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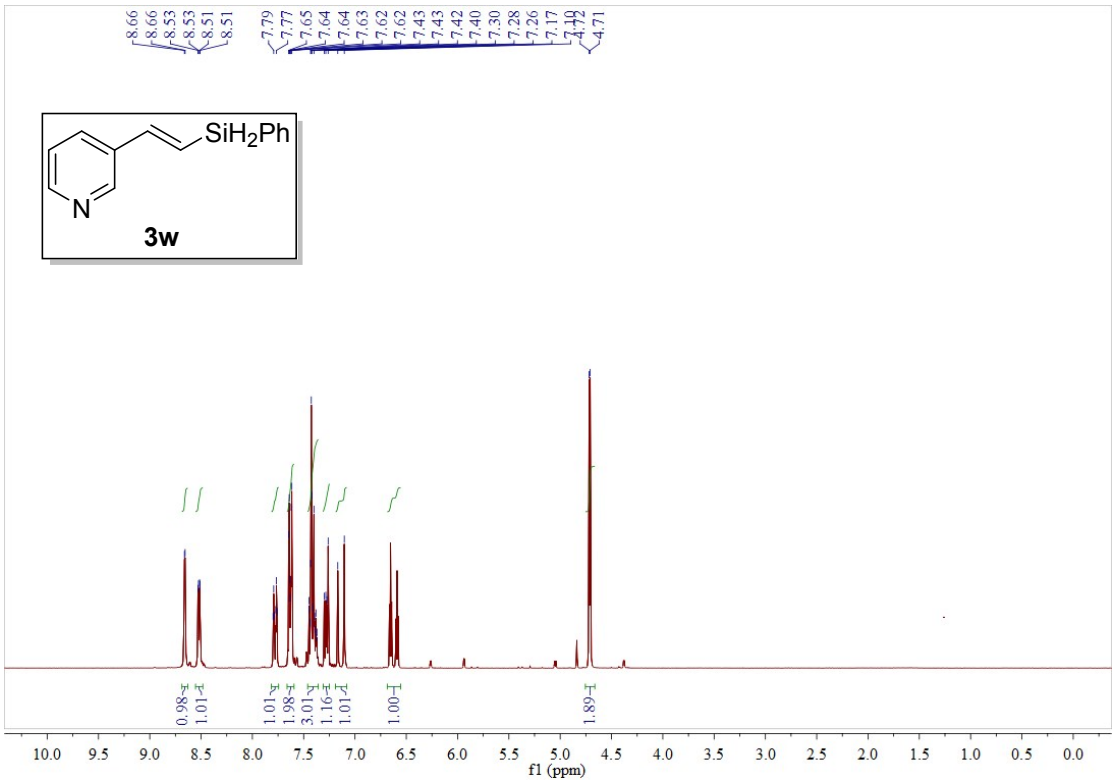
f1 (ppm)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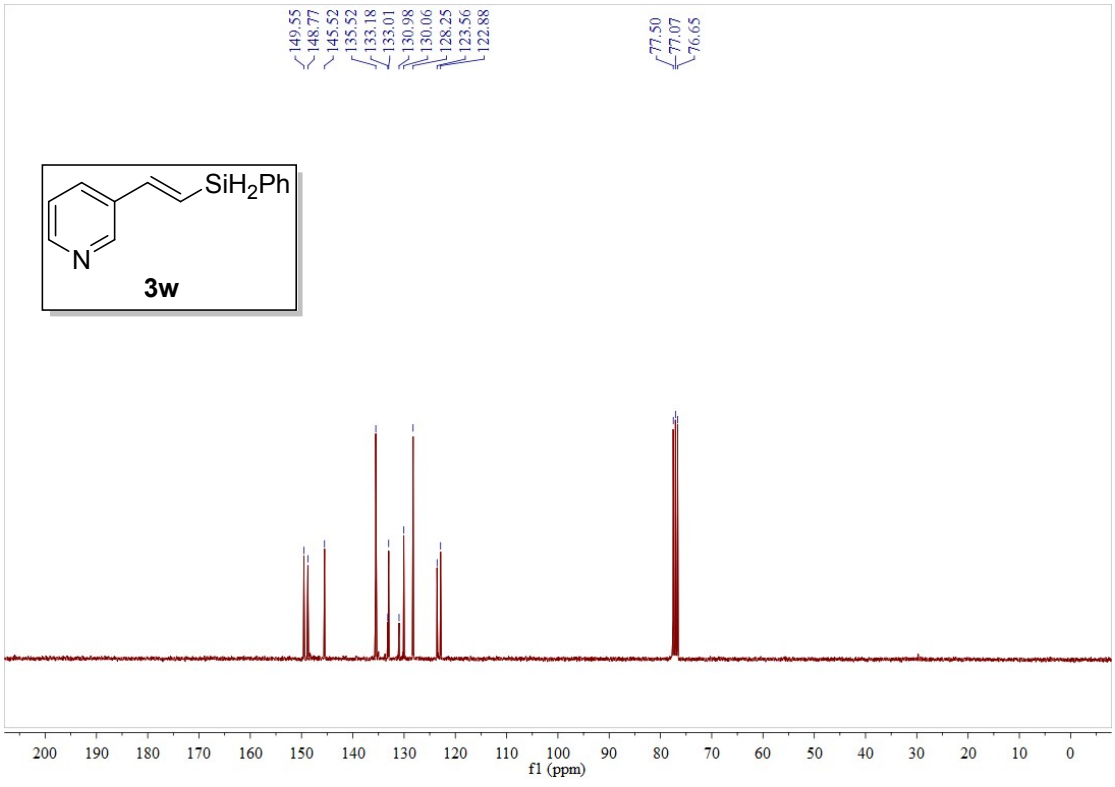
7.28
7.26
7.17
4.72
4.71
SiH2Ph
N
3w
0.98
1.01
1.01
1.98
3.01
1.16
1.01
1.00
1.89
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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76.65
SiH2Ph
N
3w
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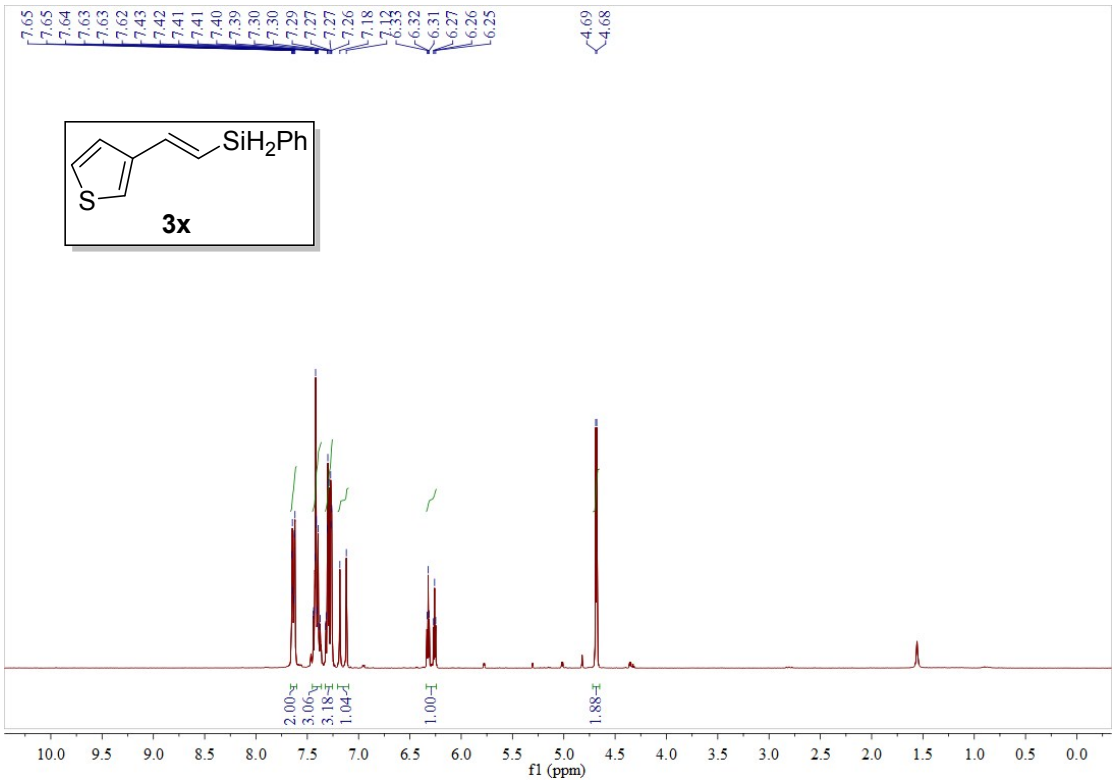
f1 (ppm)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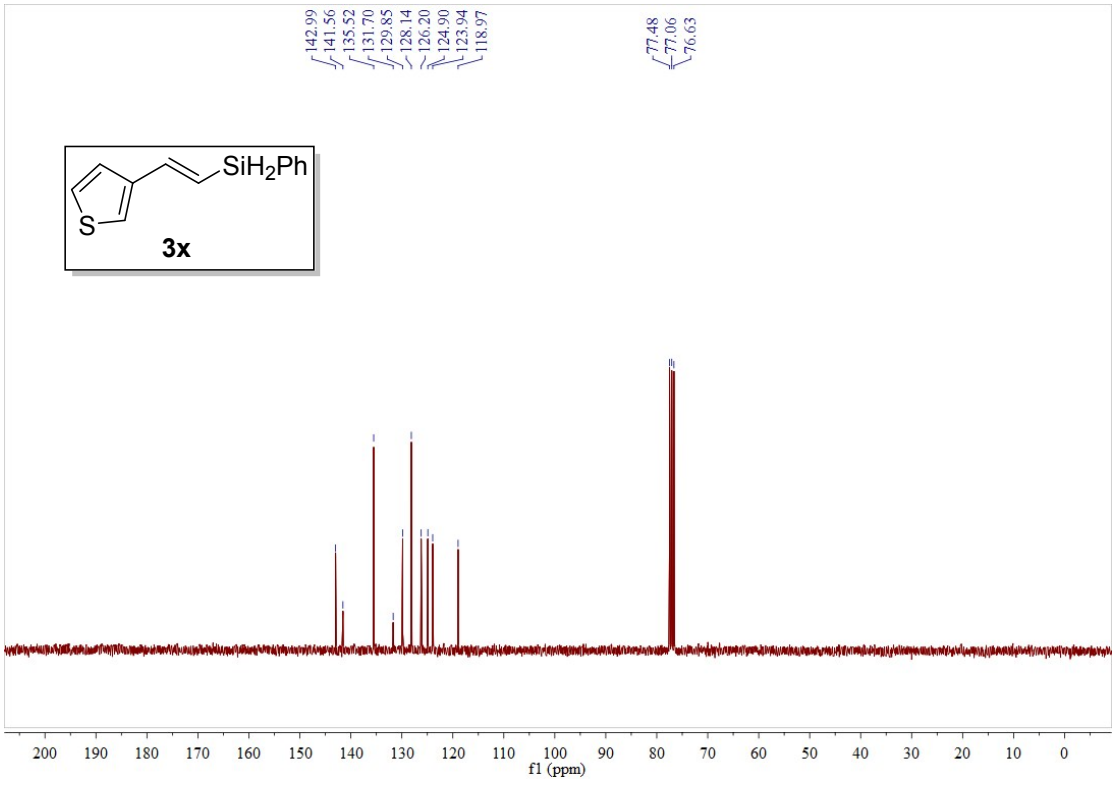
7.29
7.27
7.27
7.26
7.18
7.12
6.33
6.32
6.31
6.27
6.26
6.25
4.69
4.68
SiH2Ph
S
3x
2.00
3.06
3.18
1.04
1.00
1.88
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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76.63
SiH2Ph
S
3x
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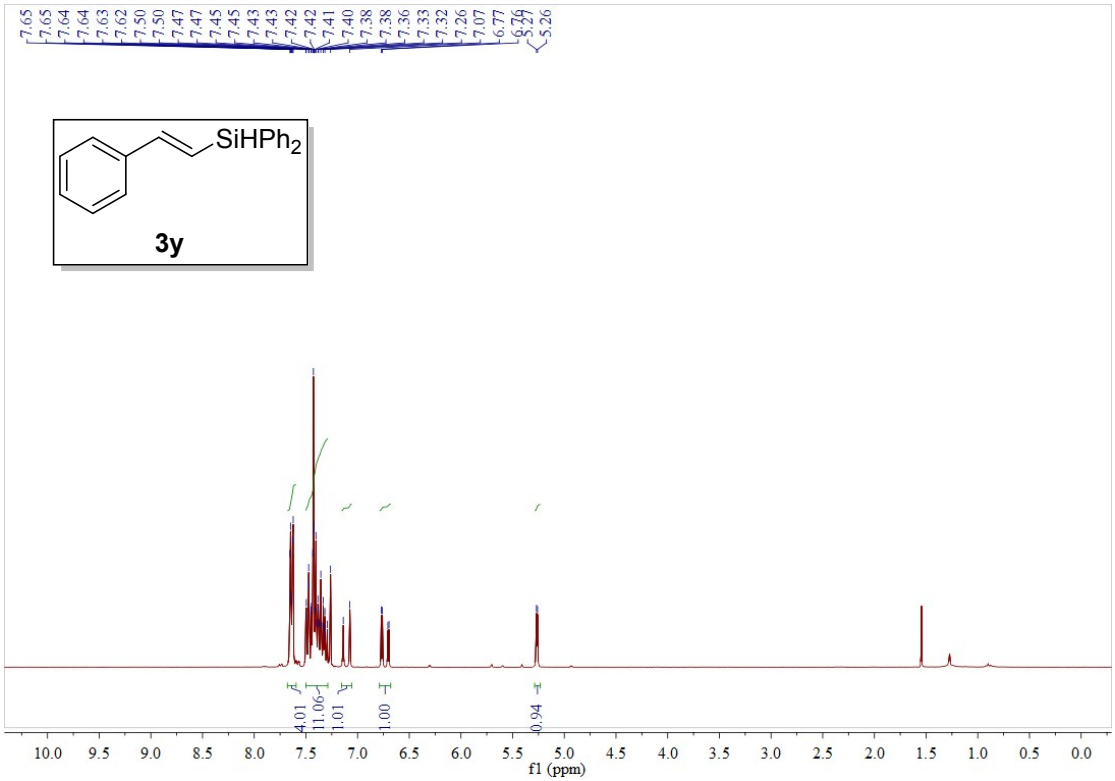
f1 (ppm)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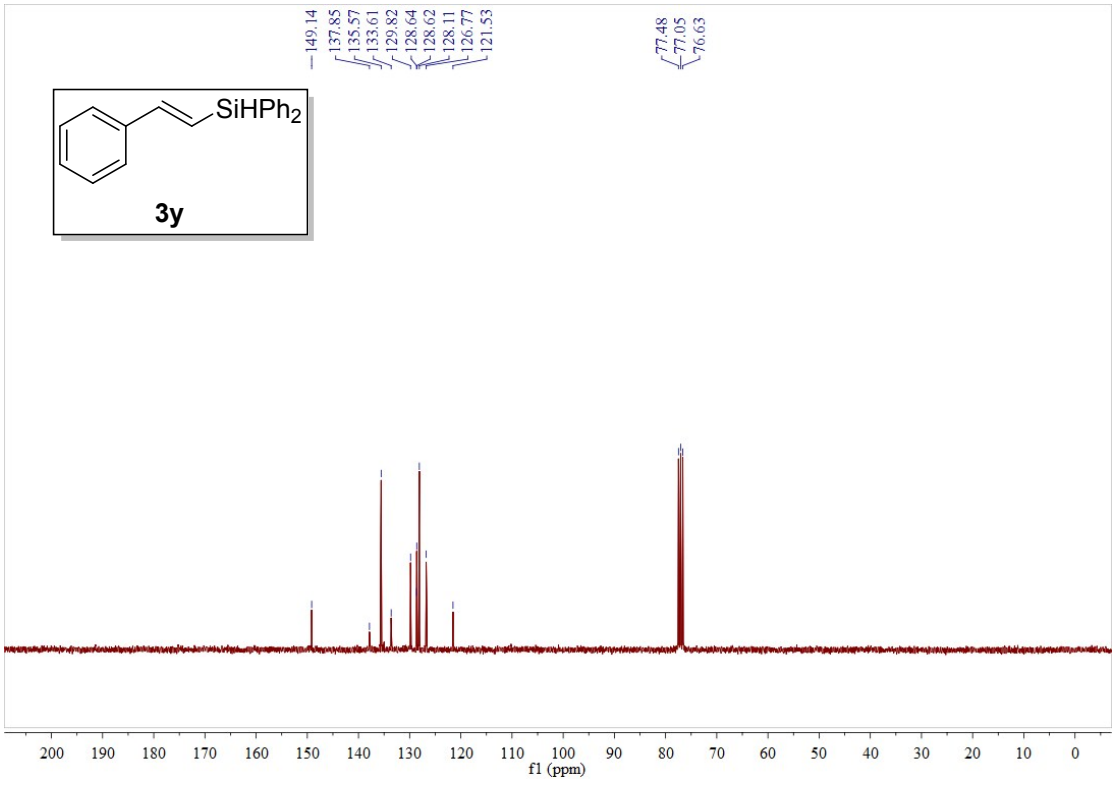
7.42
7.41
7.40
7.38
7.36
7.33
7.32
7.26
7.07
6.77
6.76
5.27
5.26
SiHPh2
3y
4.01
11.06
1.01
1.00
0.94
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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76.63
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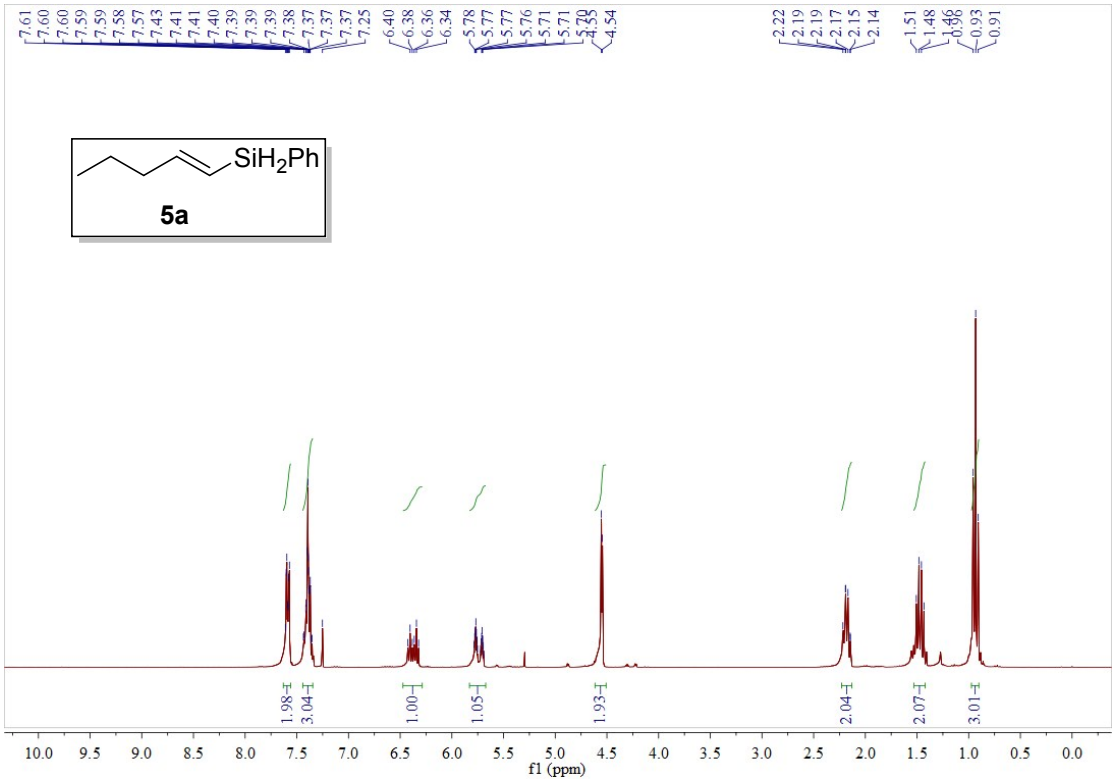
f1 (ppm)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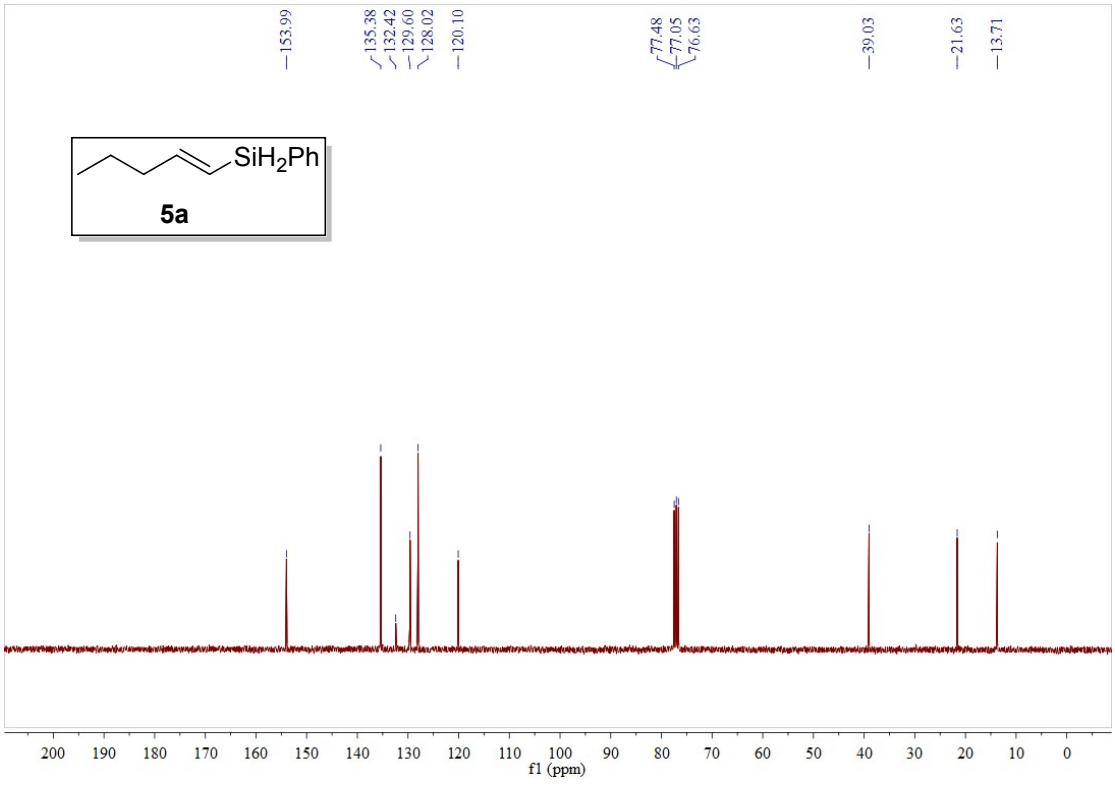
4.55
4.54
2.22
2.19
2.19
2.17
2.15
2.14
1.51
1.48
1.46
0.96
0.93
0.91
SiH2Ph
5a
1.98
3.04
1.00
1.05
1.93
2.04
2.07
3.01
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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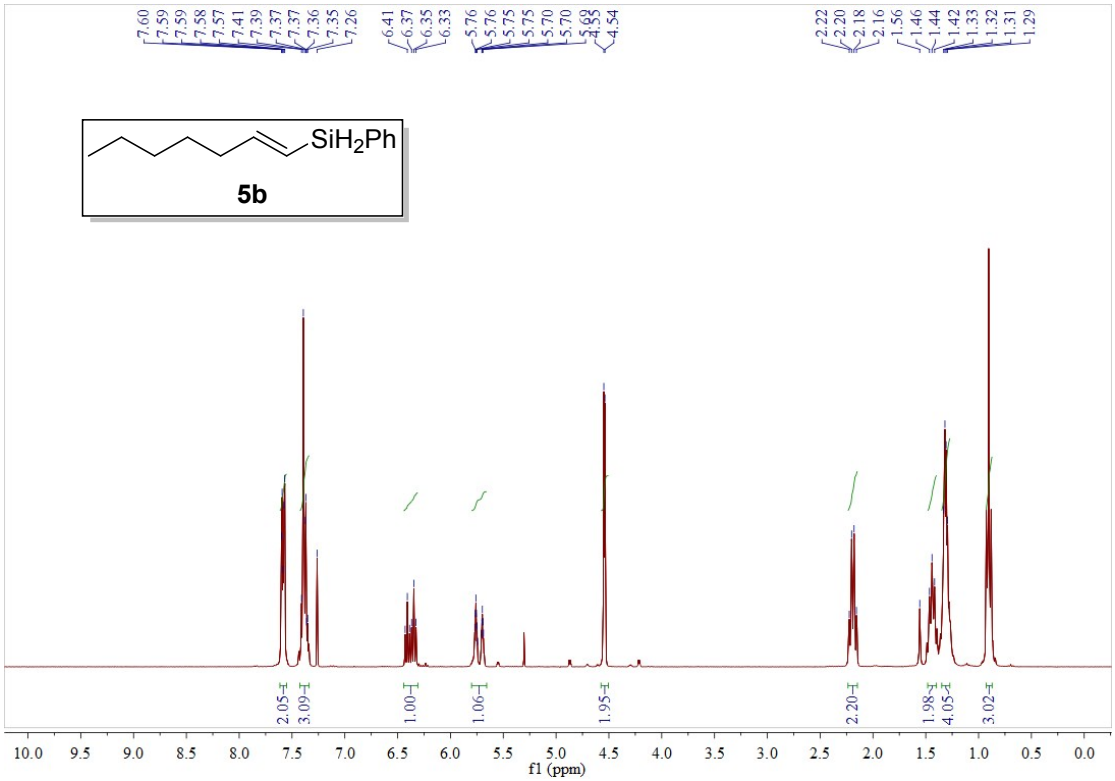
f1 (ppm)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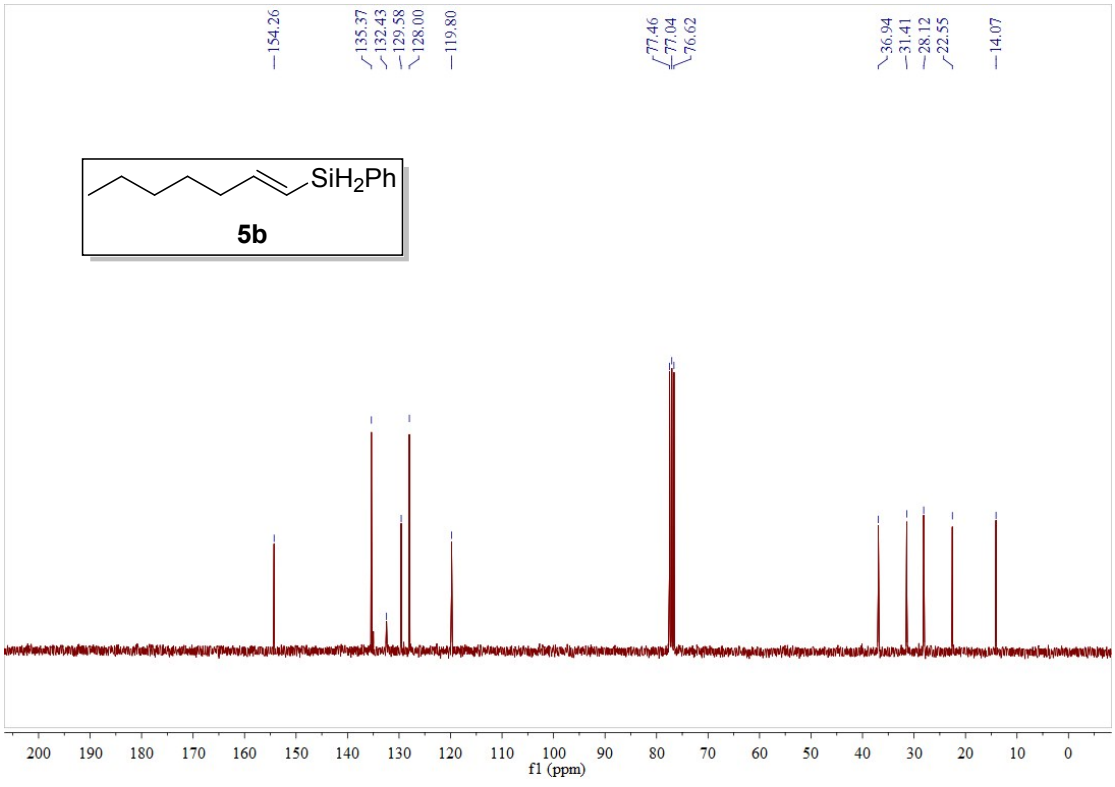
6.35
6.33
5.76
5.76
5.75
5.75
5.70
5.70
4.55
4.54
2.22
2.20
2.18
2.16
1.56
1.46
1.44
1.42
1.33
1.32
1.31
1.29
SiH2Ph
5b
2.05
3.09
1.00
1.06
1.95
2.20
1.98
4.05
3.02
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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77.04
76.62
36.94
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22.55
14.07
SiH2Ph
5b
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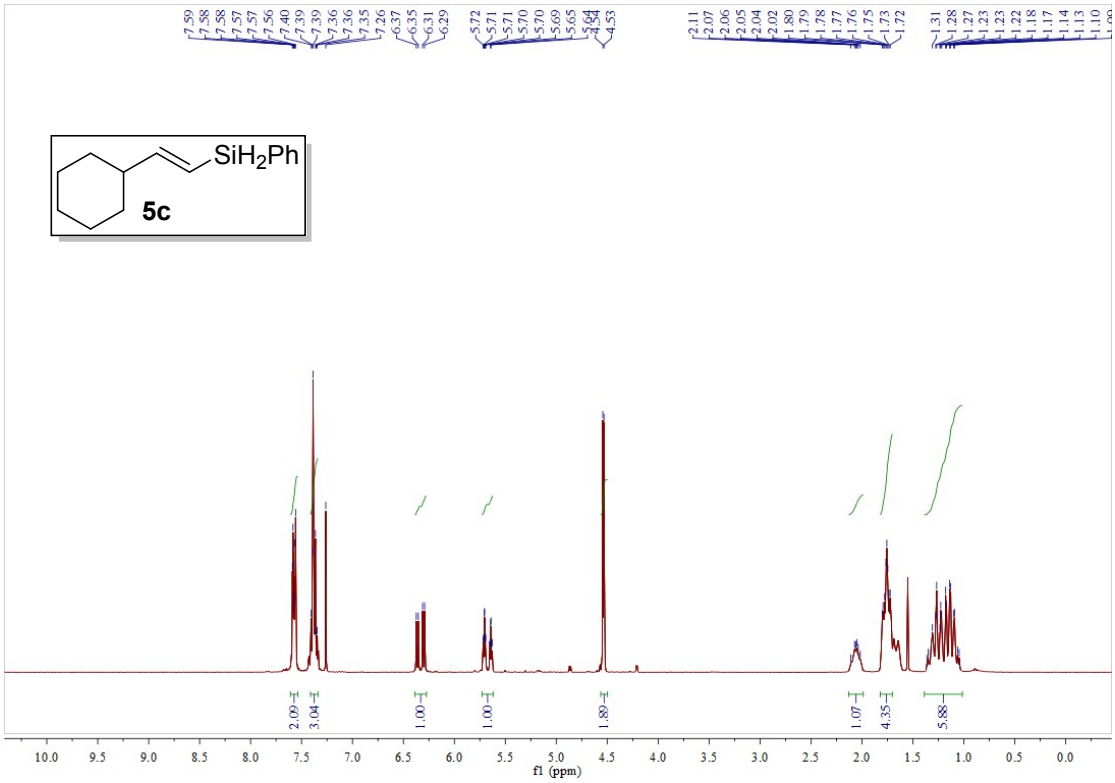
f1 (ppm)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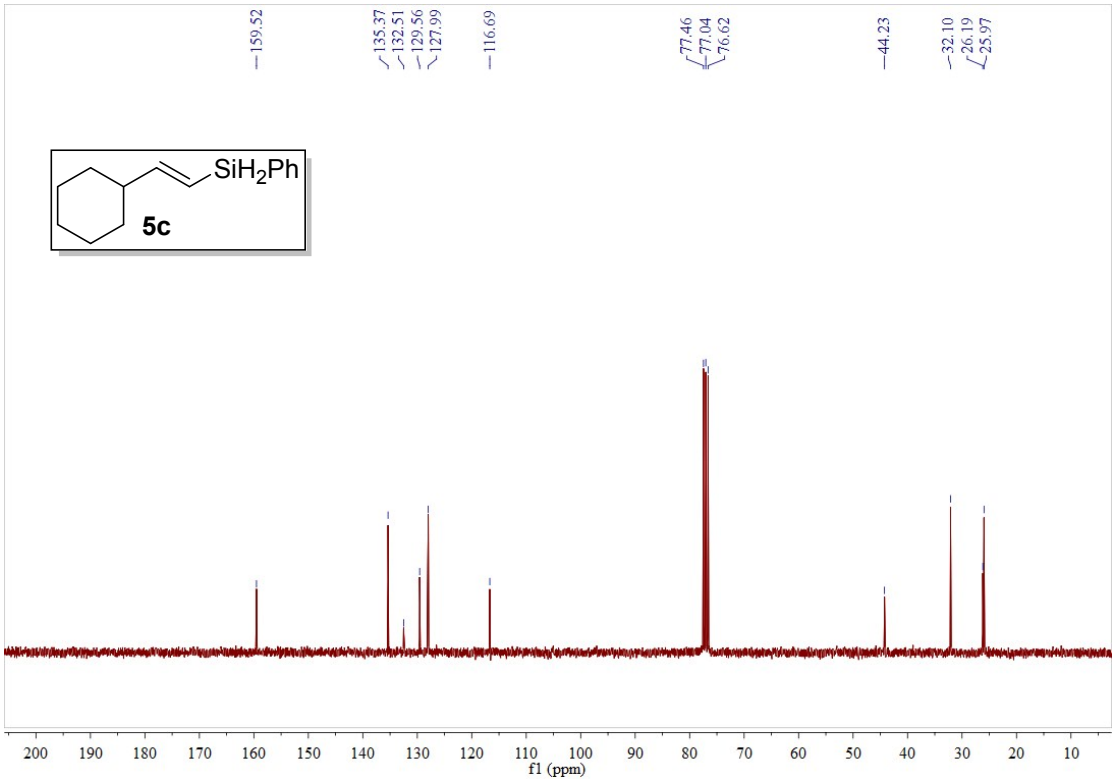
5c
f1 (ppm)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5c
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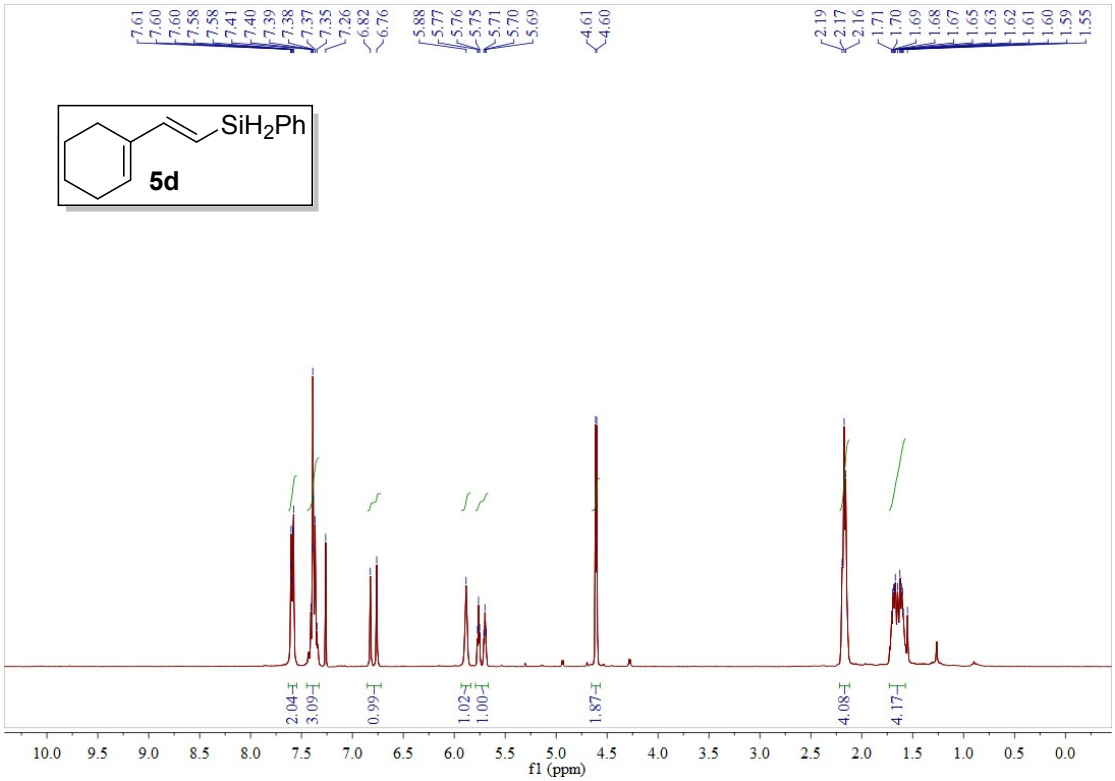
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1.67
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1.63
1.62
1.61
1.60
1.59
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SiH2Ph
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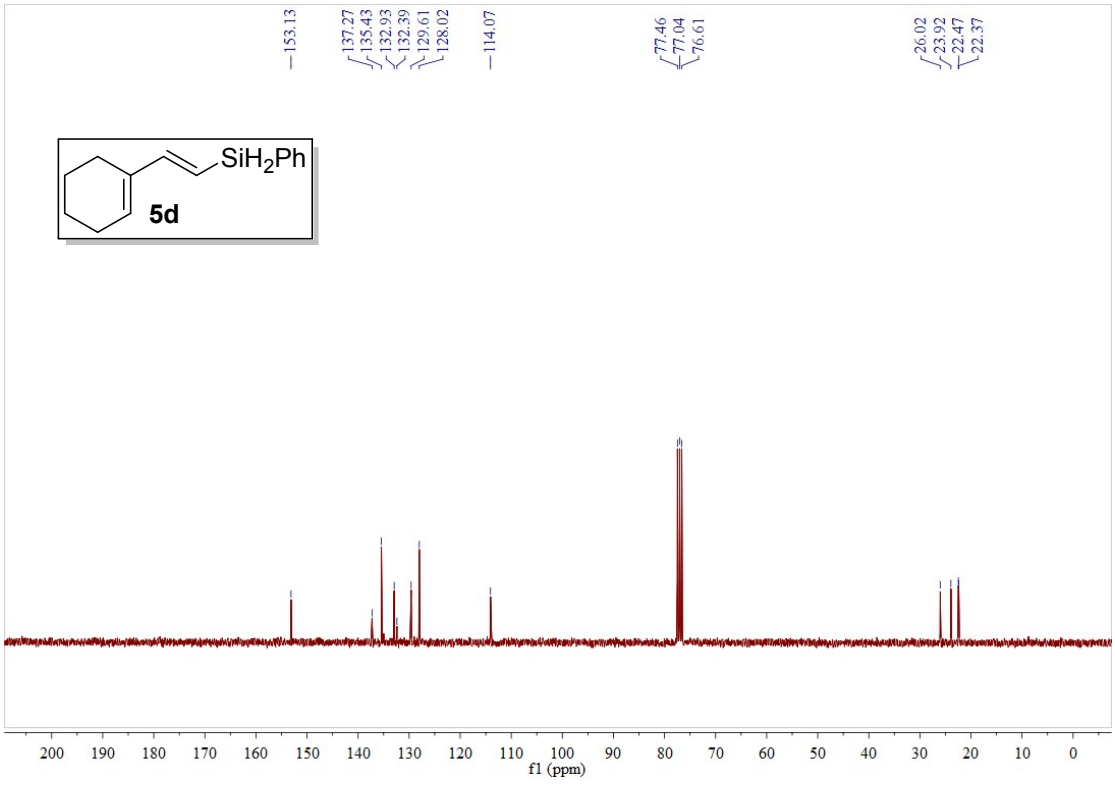
1.00
1.87
4.08
4.17
f1 (ppm)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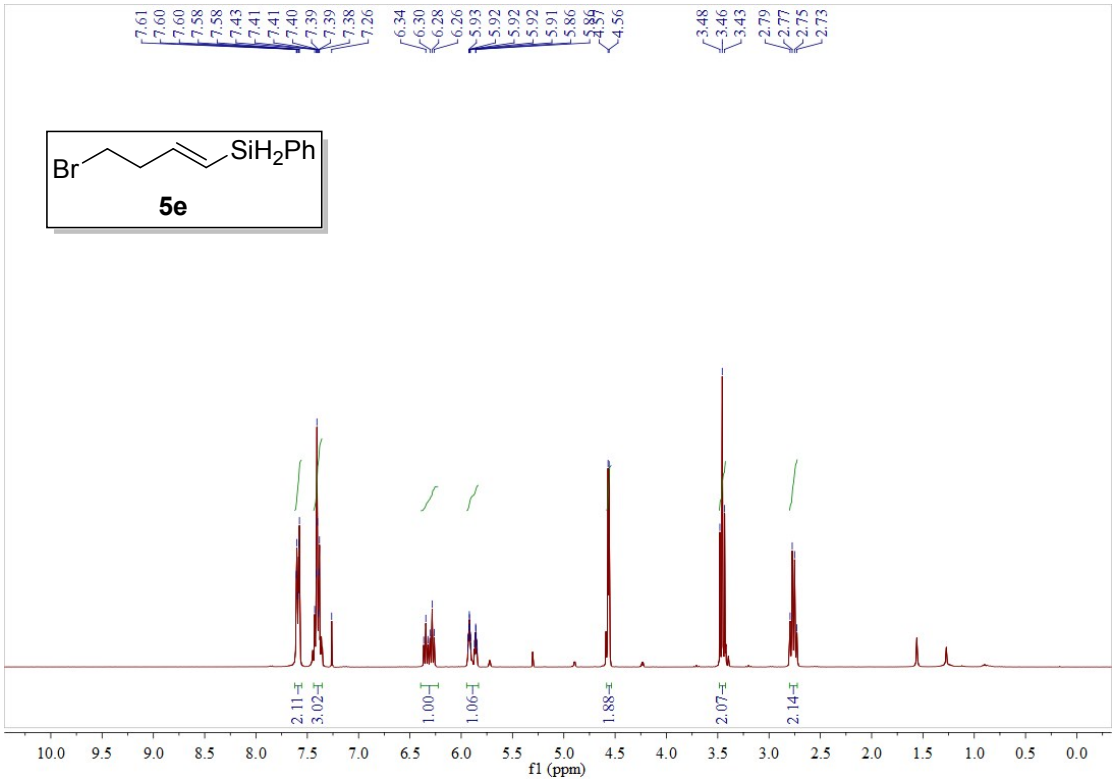
22.47
22.37
SiH2Ph
5d
f1 (ppm)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5.92
5.91
5.86
5.86
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4.56
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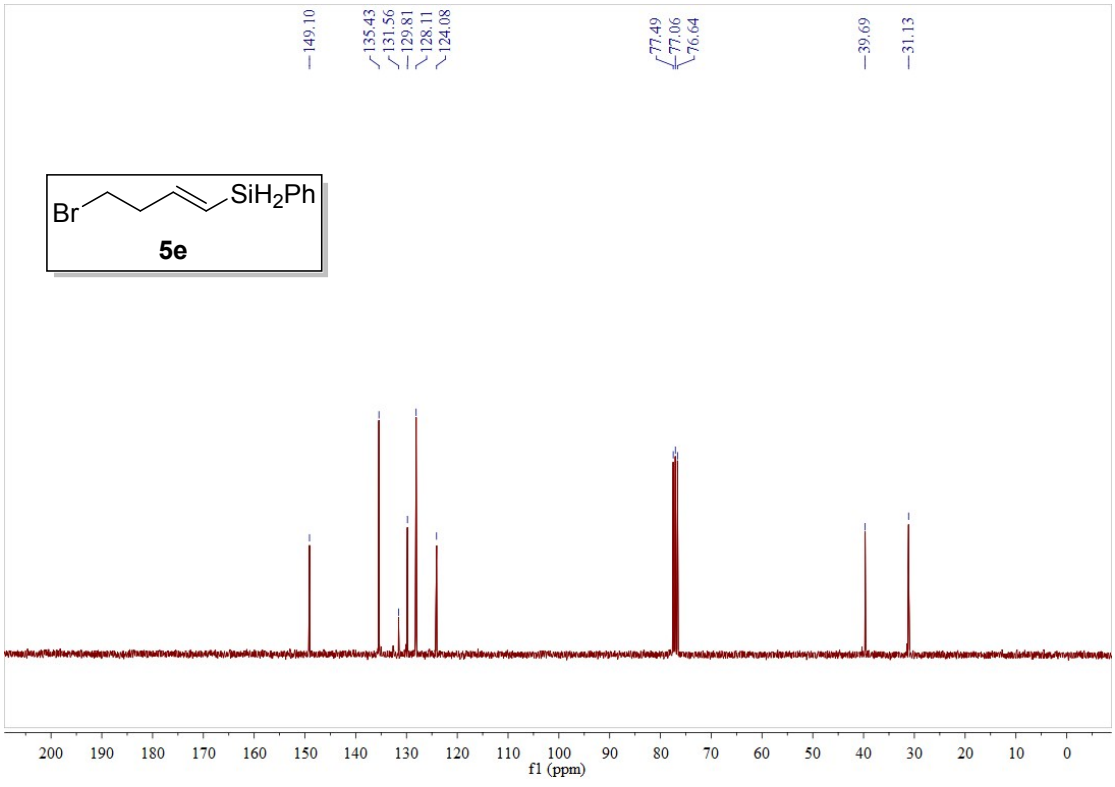
3.46
3.43
2.79
2.77
2.75
2.73
Br
SiH2Ph
5e
2.11
3.02
1.00
1.06
1.88
2.07
2.14
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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31.13
Br
SiH2Ph
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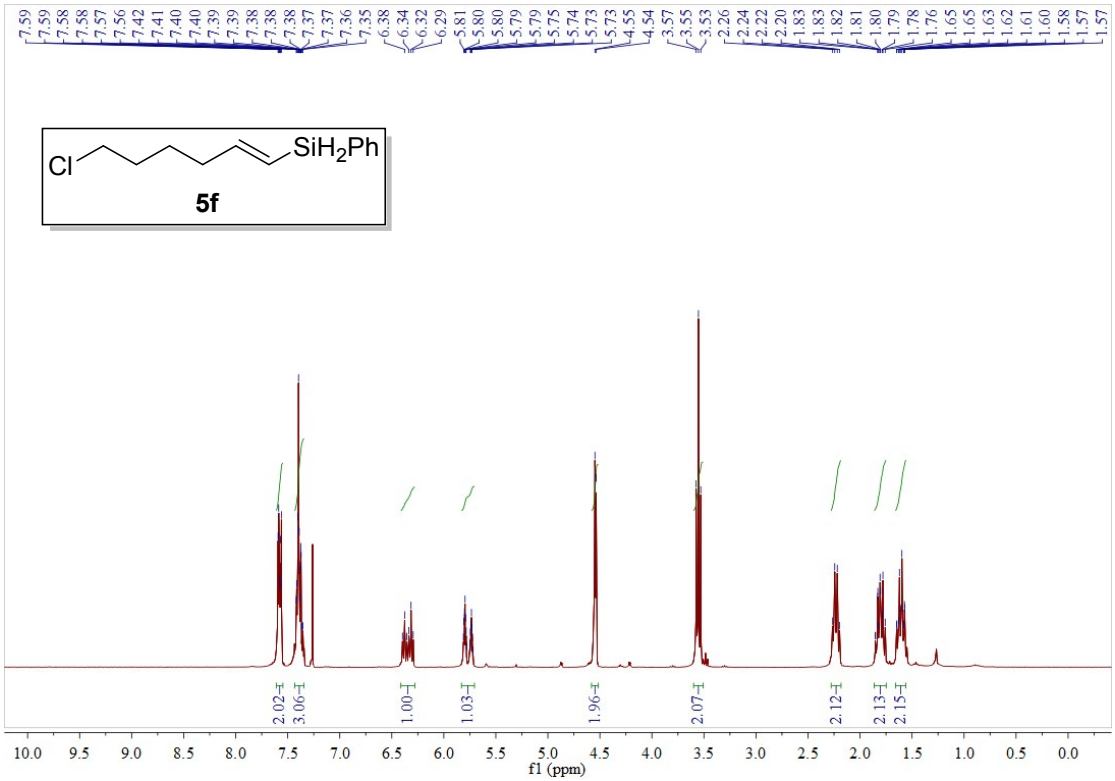
f1 (ppm)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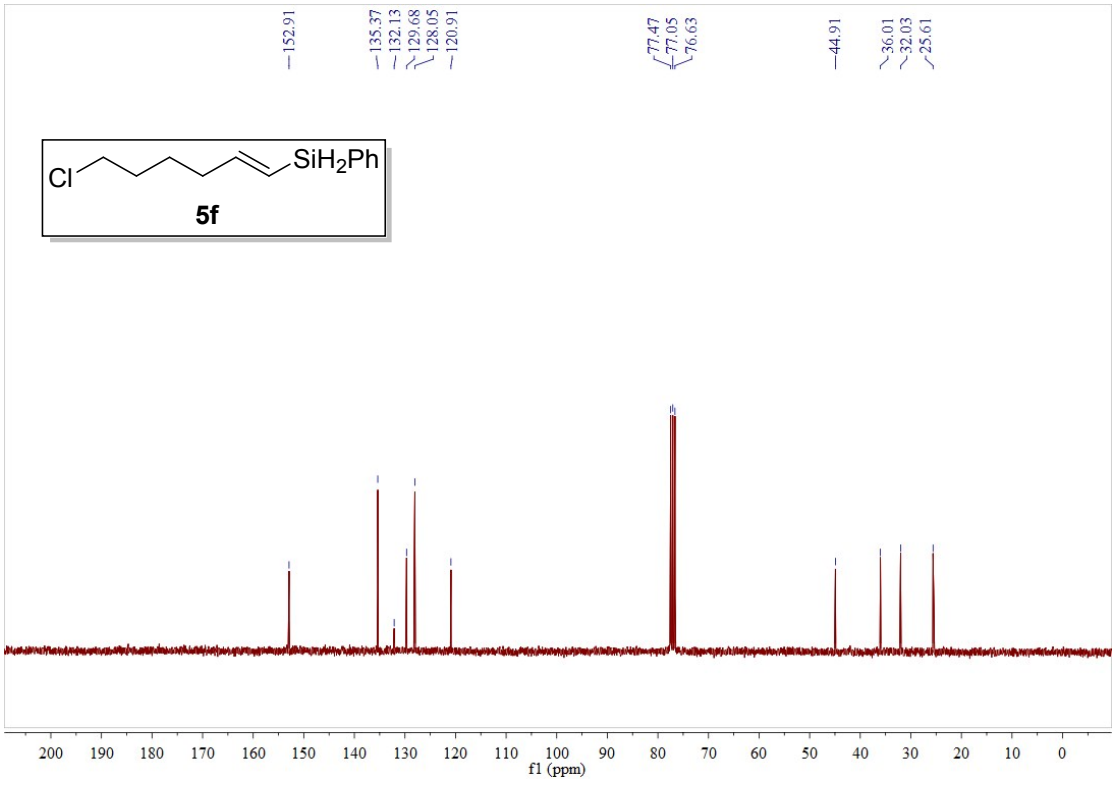
Cl
SiH2Ph
5f
2.02 3.06 1.00 1.03 1.96 2.07 2.12 2.13 2.15
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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SiH2Ph
5f
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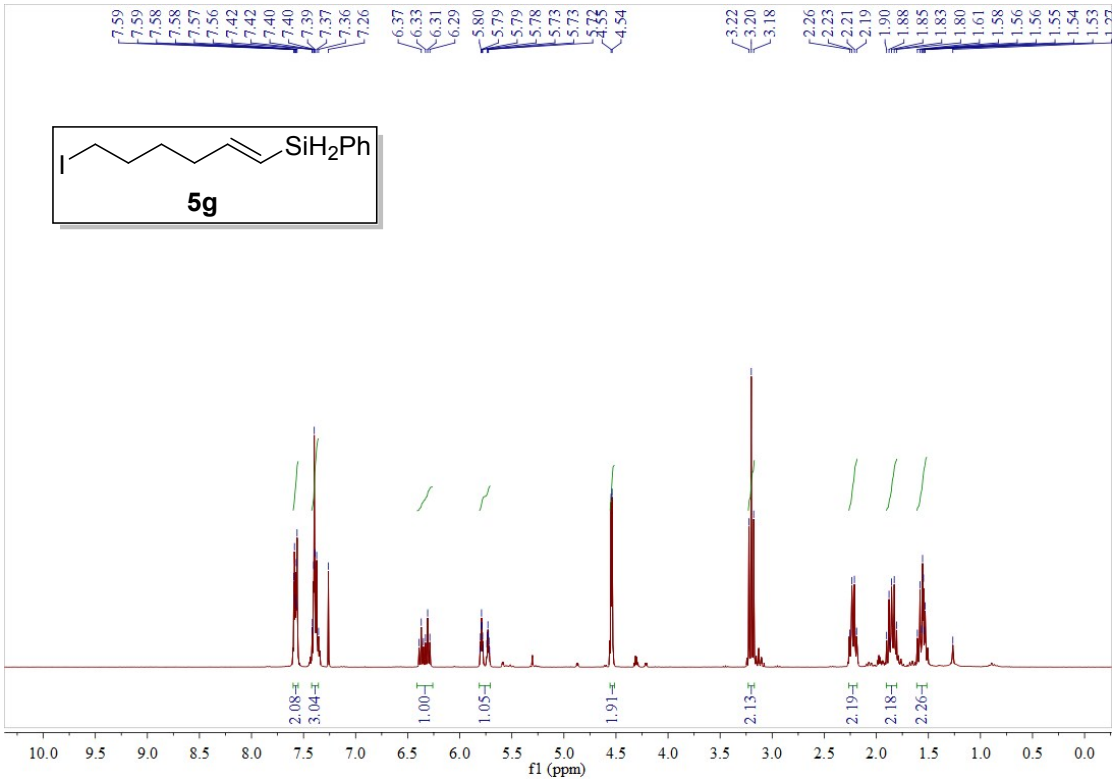
f1 (ppm)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1.85
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1.80
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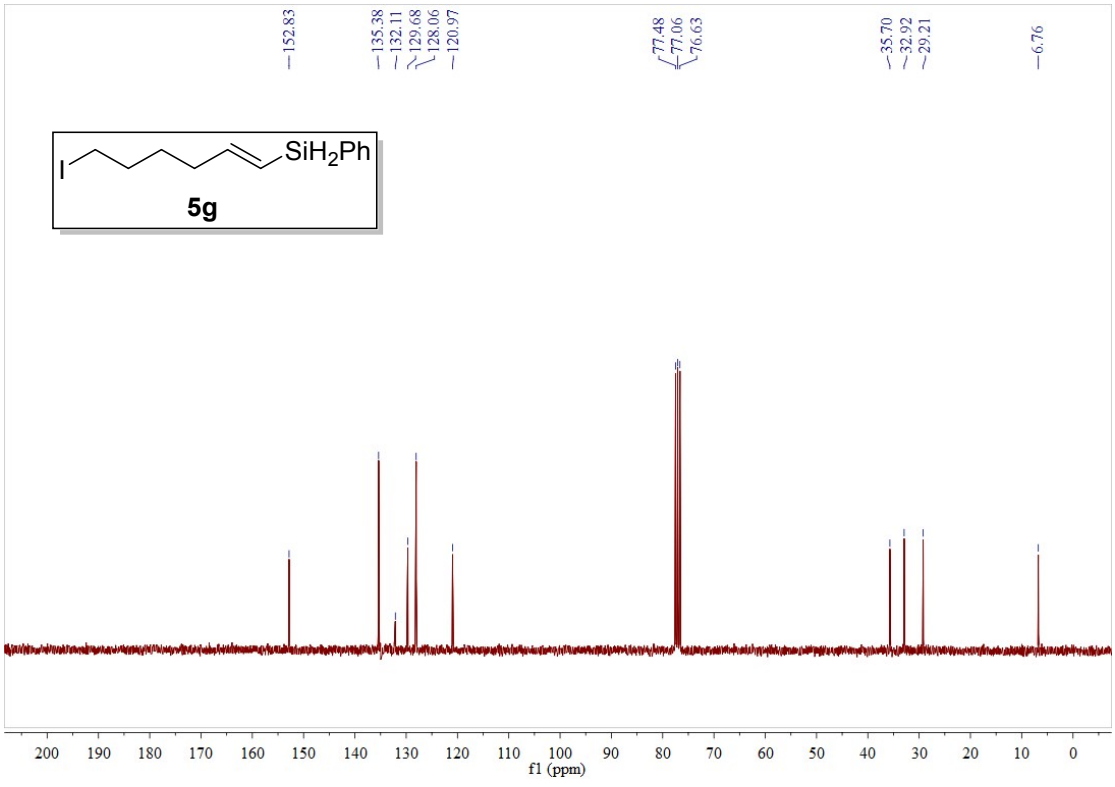
1.58
1.56
1.56
1.55
1.54
1.53
SiH2Ph
5g
2.08
3.04
1.00
1.05
1.91
2.13
2.19
2.18
2.26
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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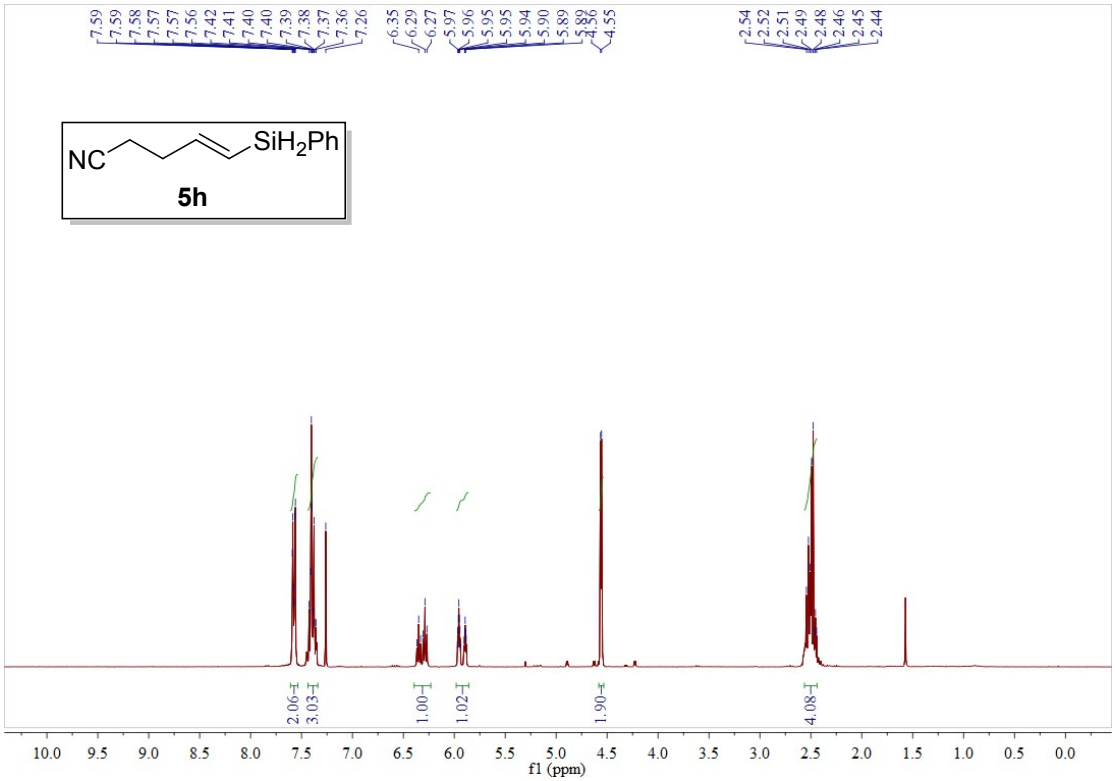
6.76
SiH2Ph
5g
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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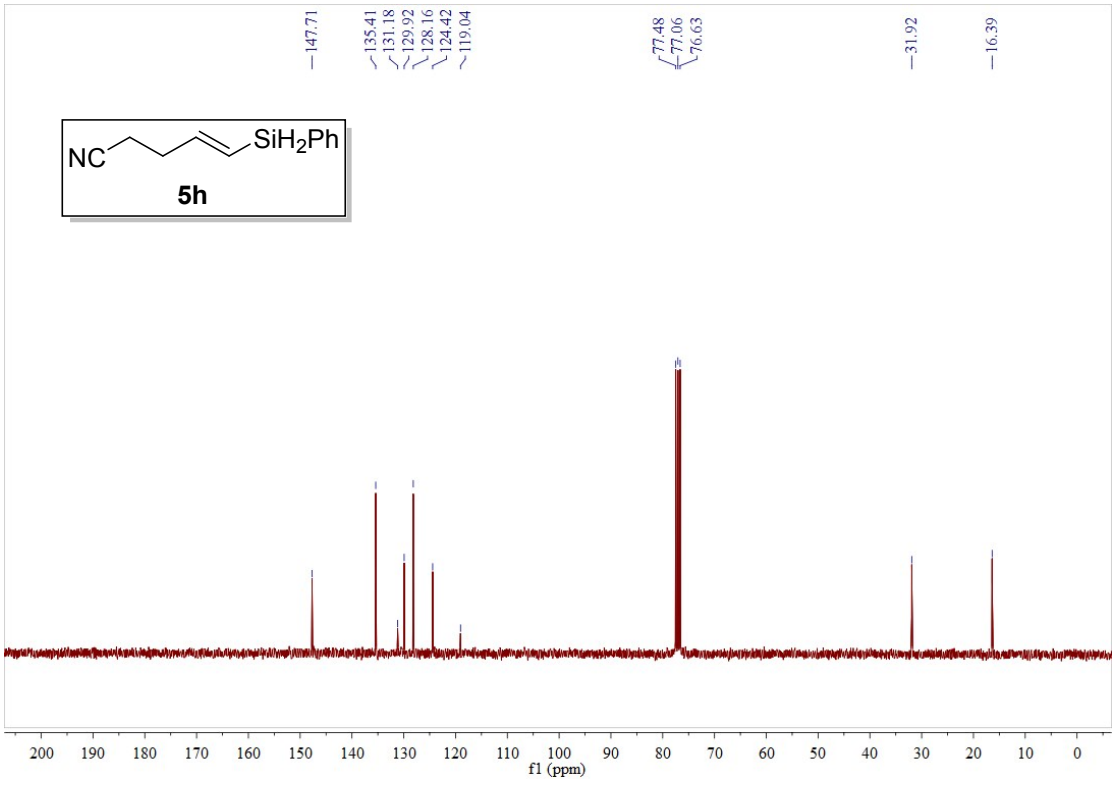
NC
SiH2Ph
5h
2.06
3.03
1.00
1.02
1.90
4.08
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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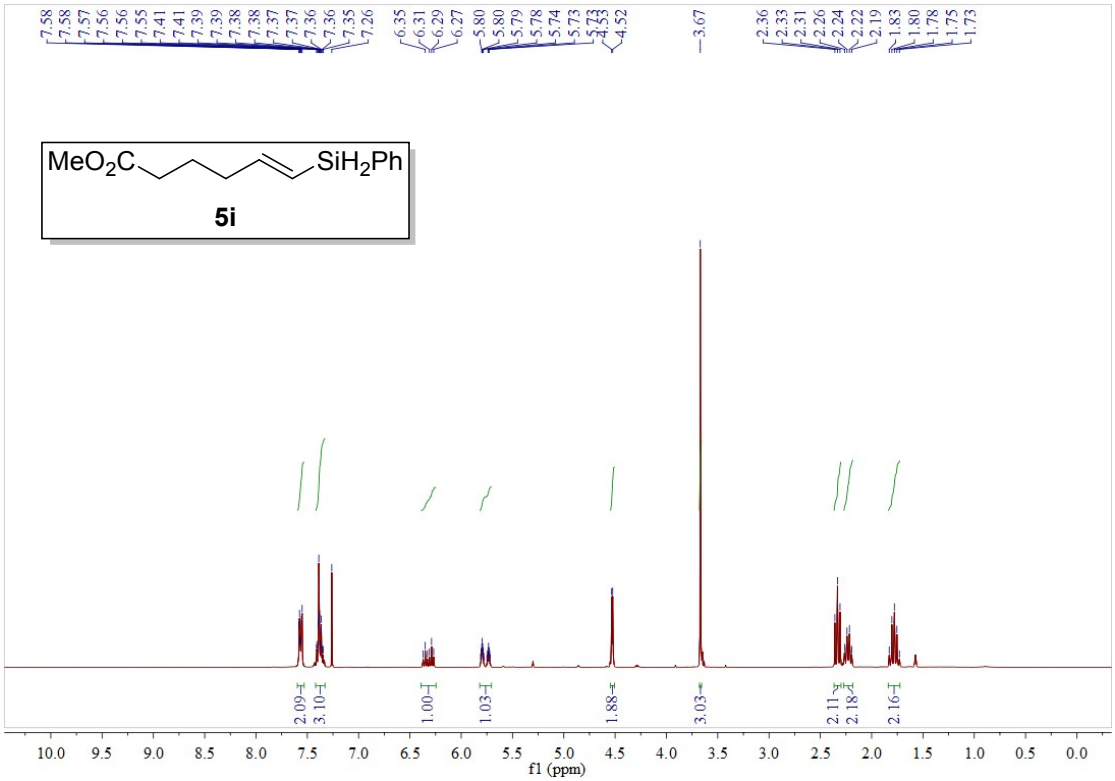
f1 (ppm)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1.80
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MeO2C
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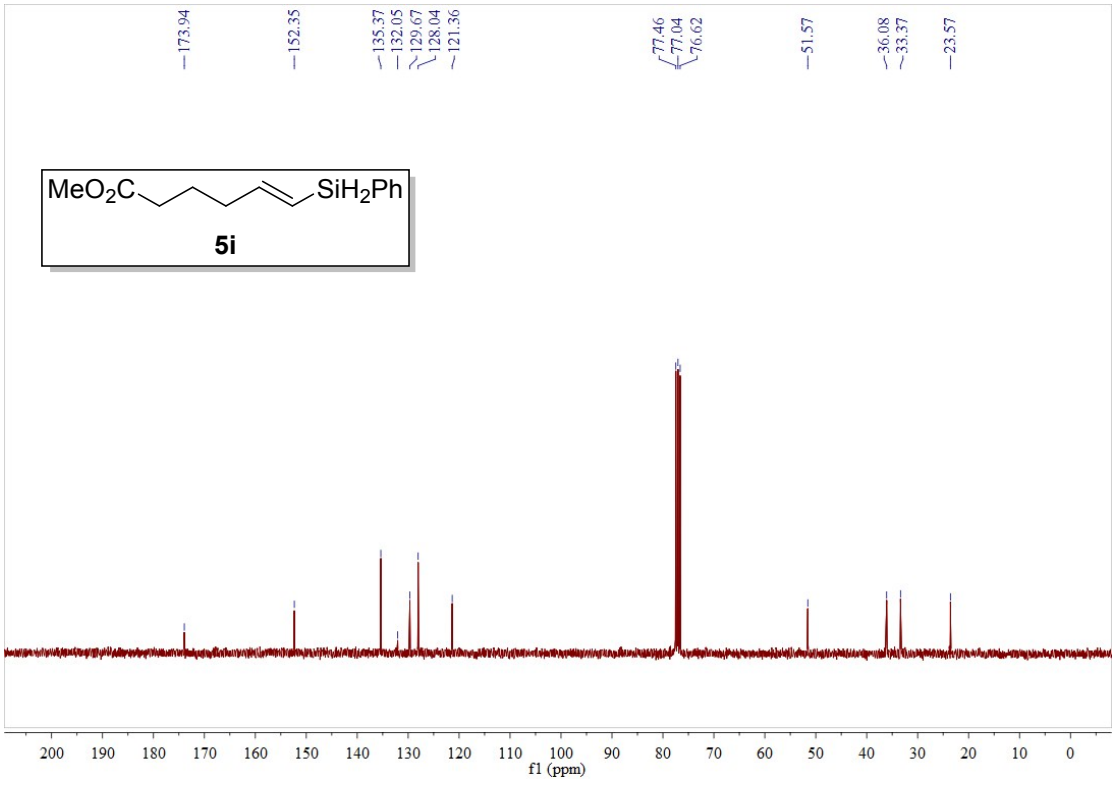
2.16
f1 (ppm)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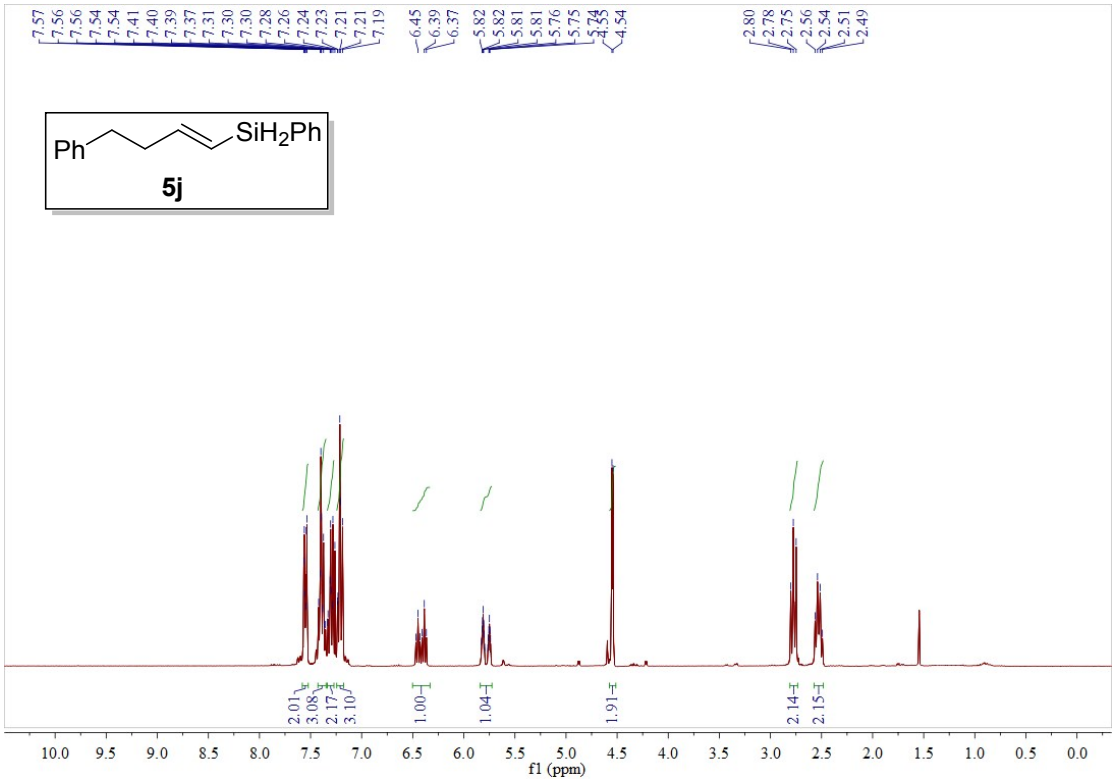
MeO2C
SiH2Ph
5i
f1 (ppm)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2.51
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Ph
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5j
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1.00
1.04
1.91
2.14
2.15
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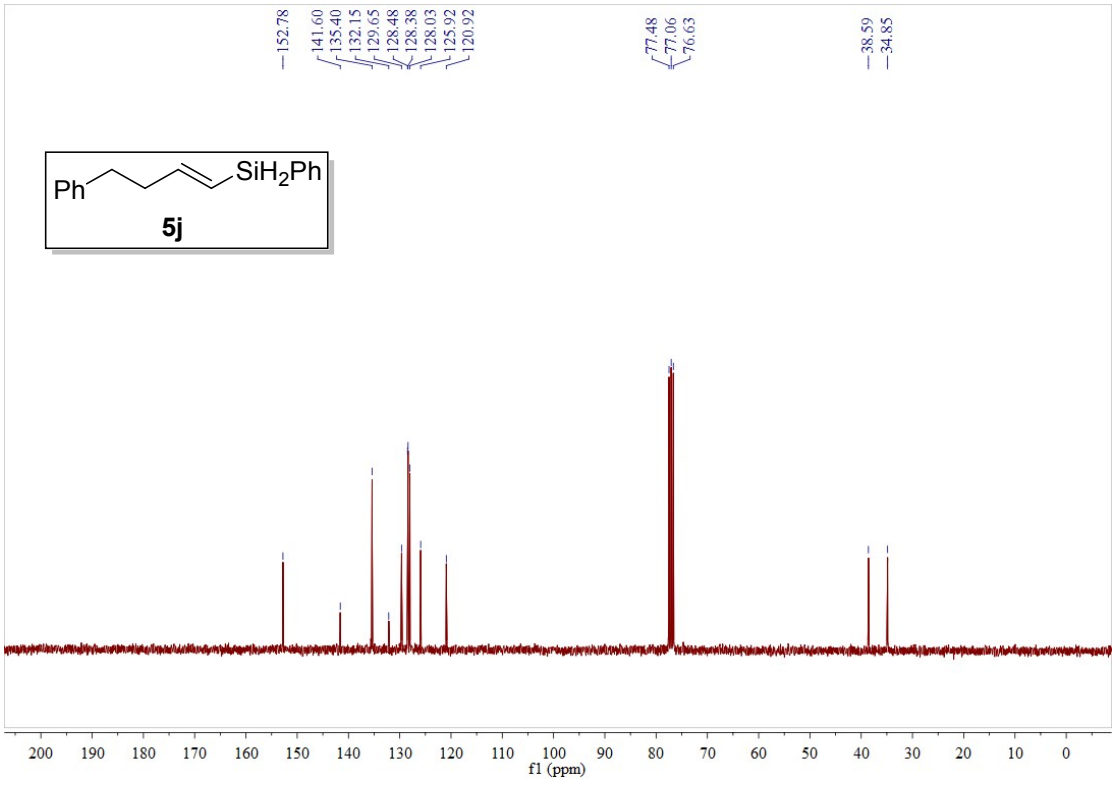
f1 (ppm)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77.48
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34.85
Ph
SiH2Ph
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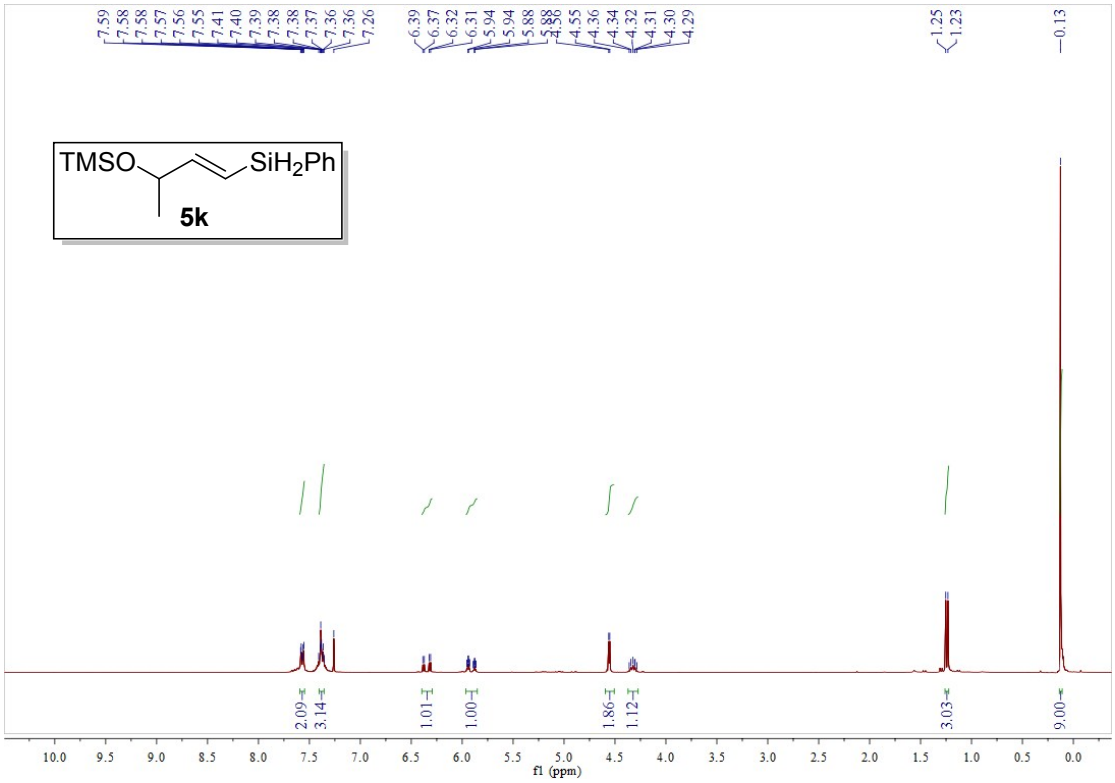
f1 (ppm)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6.32
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4.29
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1.23
0.13
TMSO
SiH2Ph
5k
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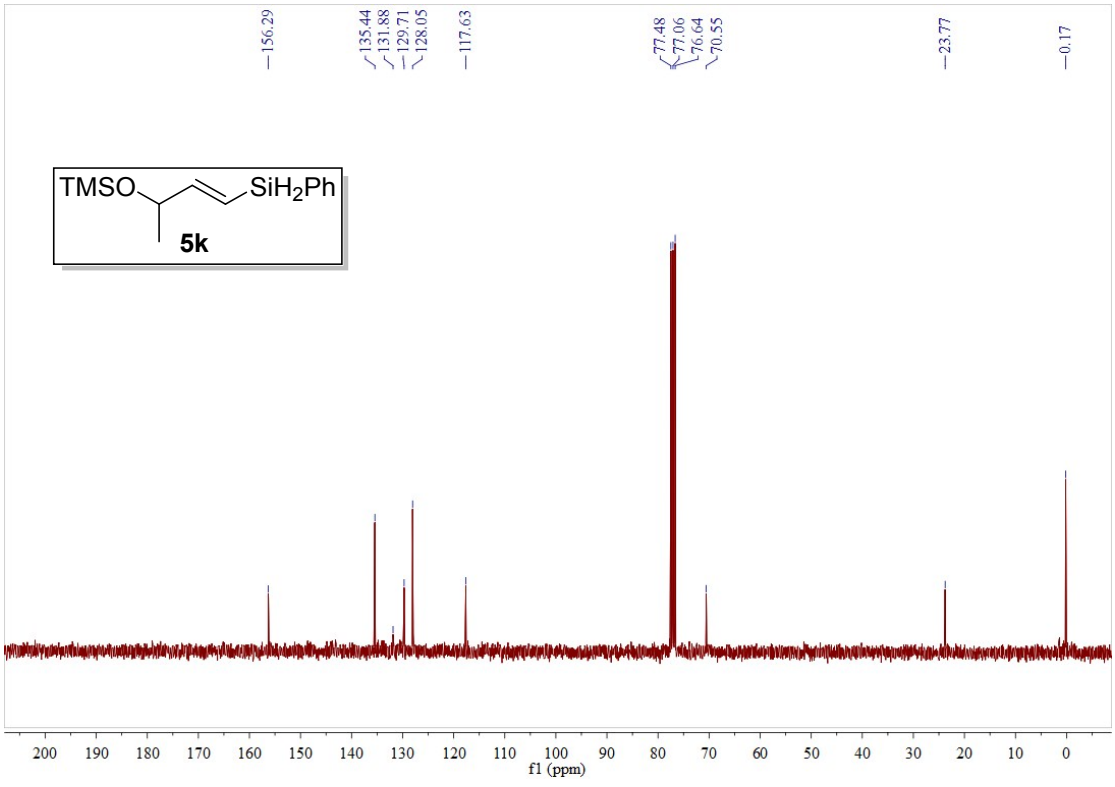
3.14
1.01
1.00
1.86
1.12
3.03
9.00
f1 (ppm)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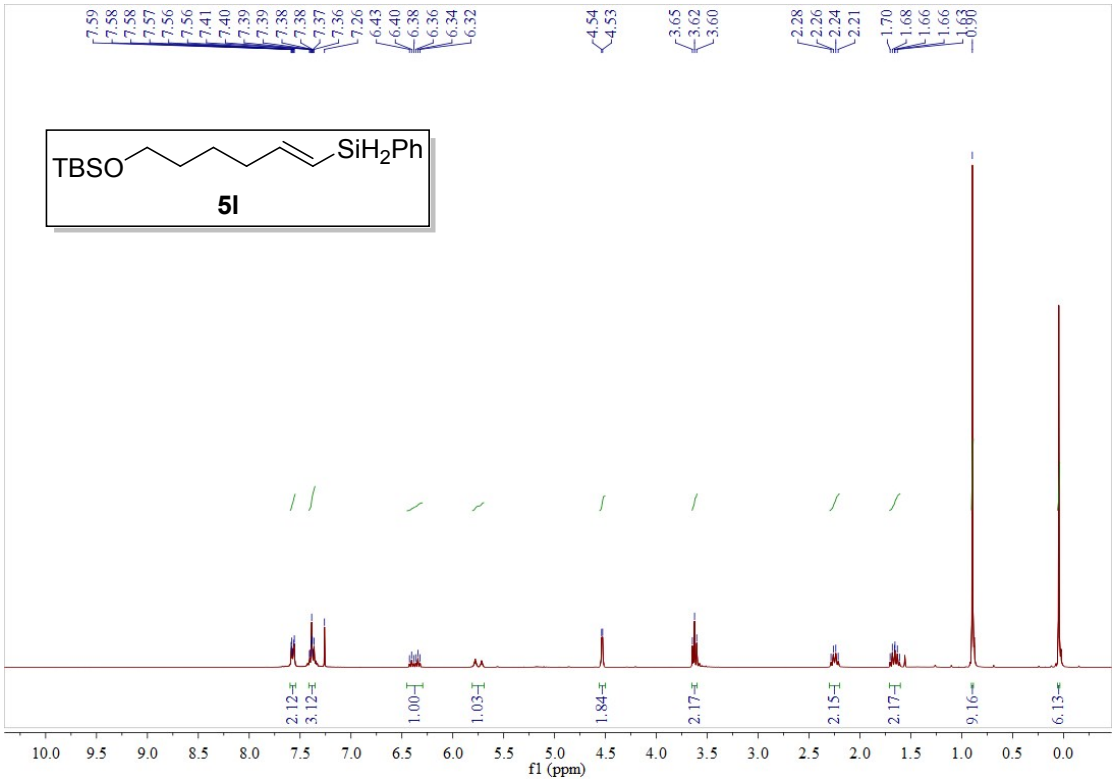
SiH2Ph
5k
f1 (ppm)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7.26
6.43
6.40
6.38
6.36
6.34
6.32
4.54
4.53
3.65
3.62
3.60
2.28
2.26
2.24
2.21
1.70
1.68
1.66
1.66
1.63
0.90
TBSO
SiH2Ph
5l
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1.00
1.03
1.84
2.17
2.15
2.17
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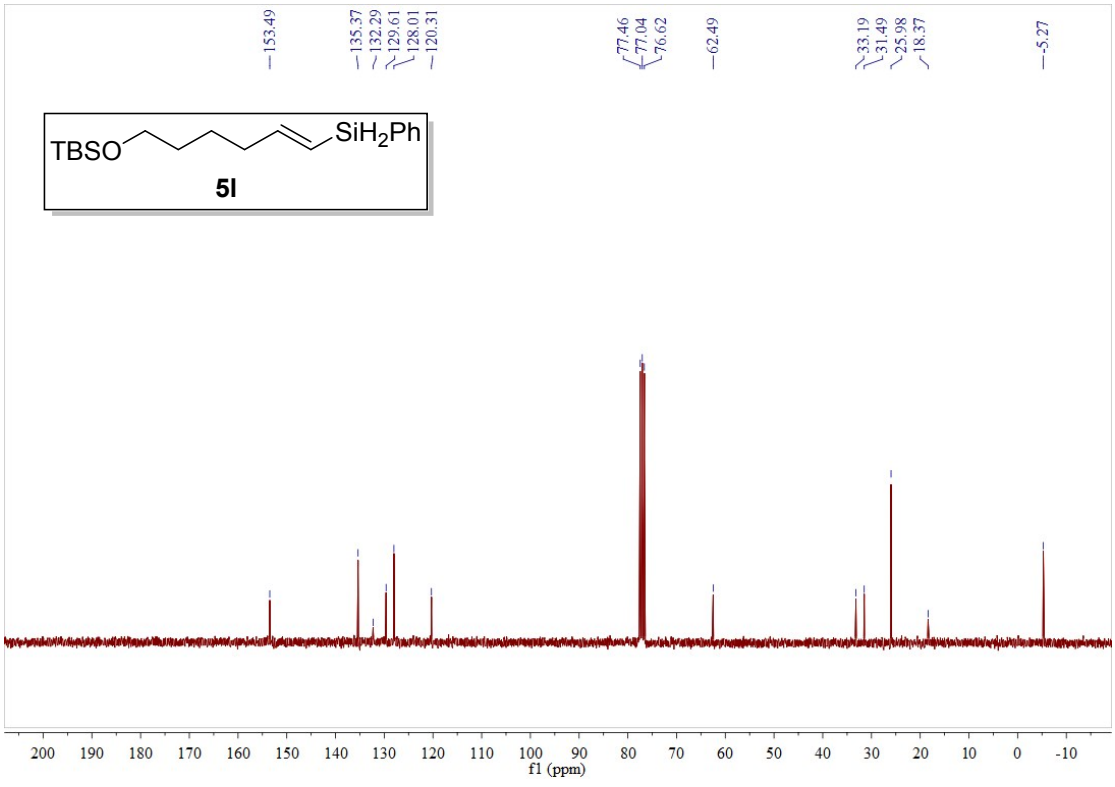
6.13
f1 (ppm)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18.37
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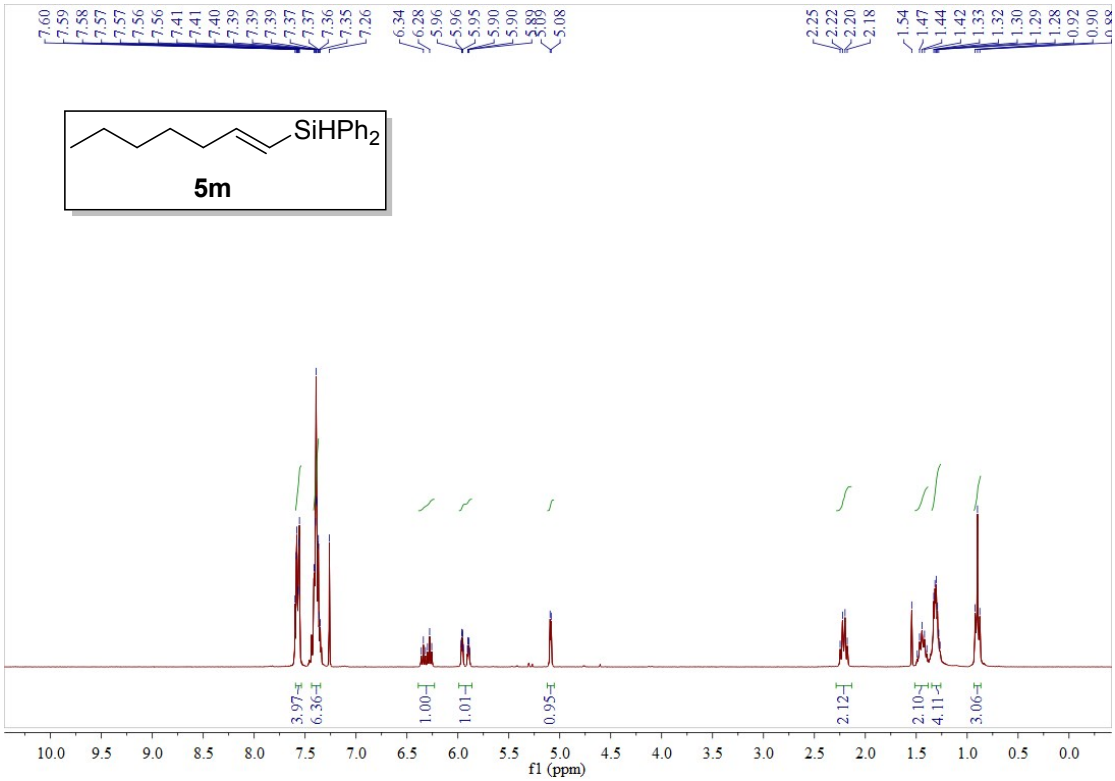
TBSO
SiH2Ph
5l
f1 (ppm)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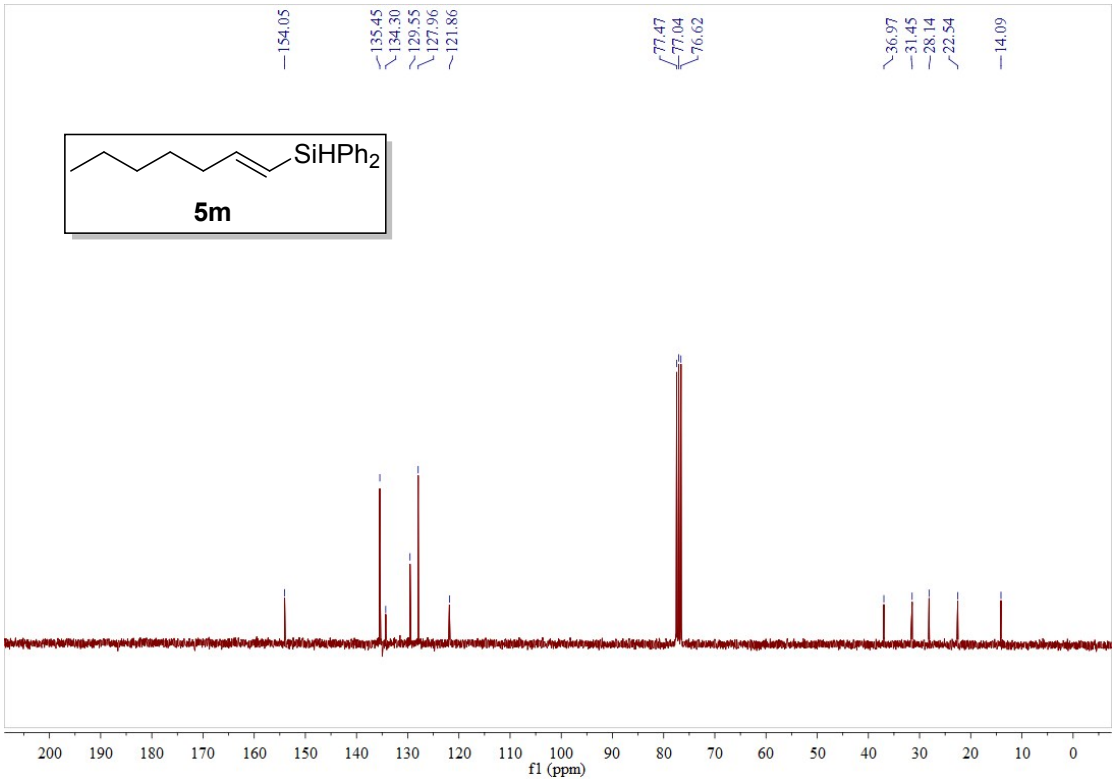
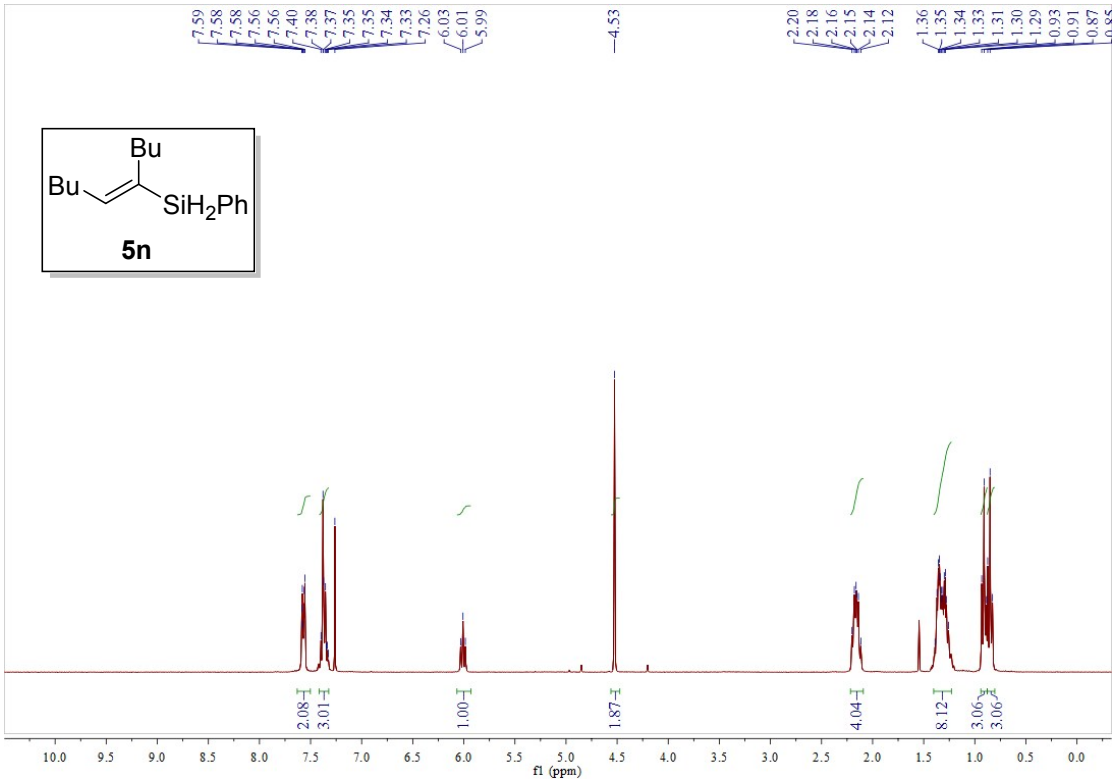
f1 (ppm)


SiHPh2
5m
f1 (ppm)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6.03
6.01
5.99
4.53
2.20
2.18
2.16
2.15
2.14
2.12
1.36
1.35
1.34
1.33
1.31
1.30
1.29
0.93
0.91
0.87
Bu
Bu
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1.00
1.87
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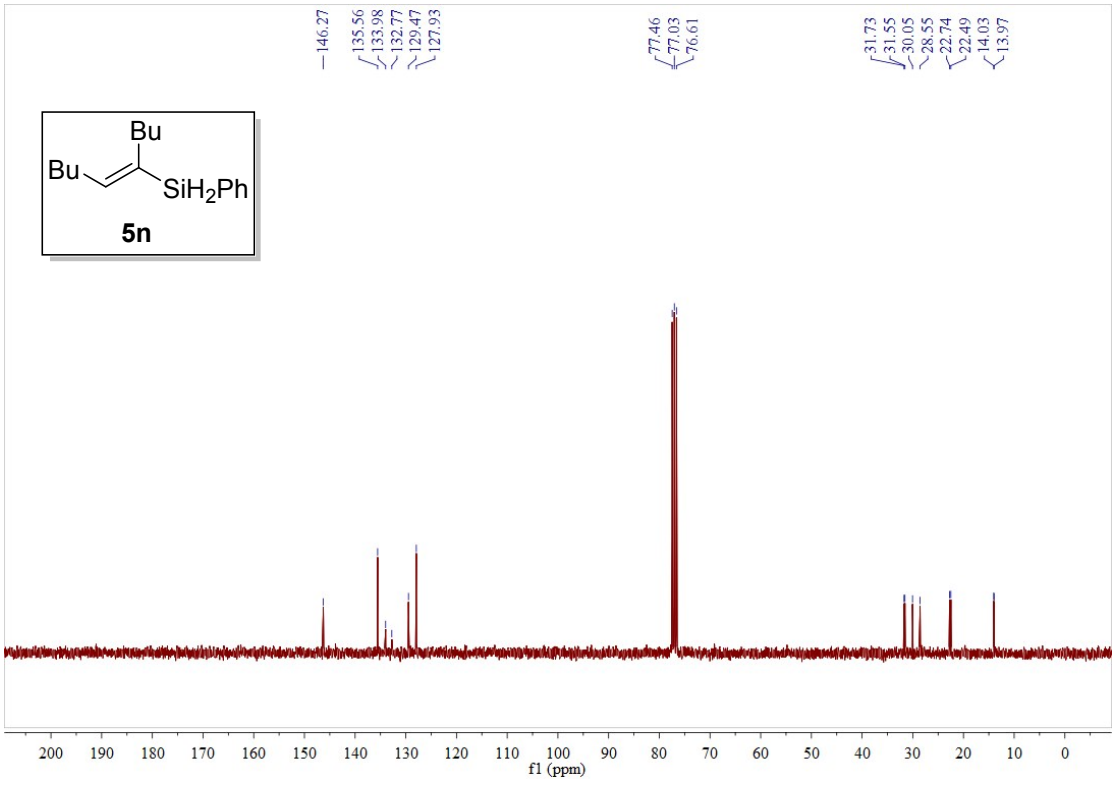
3.06
f1 (ppm)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22.49
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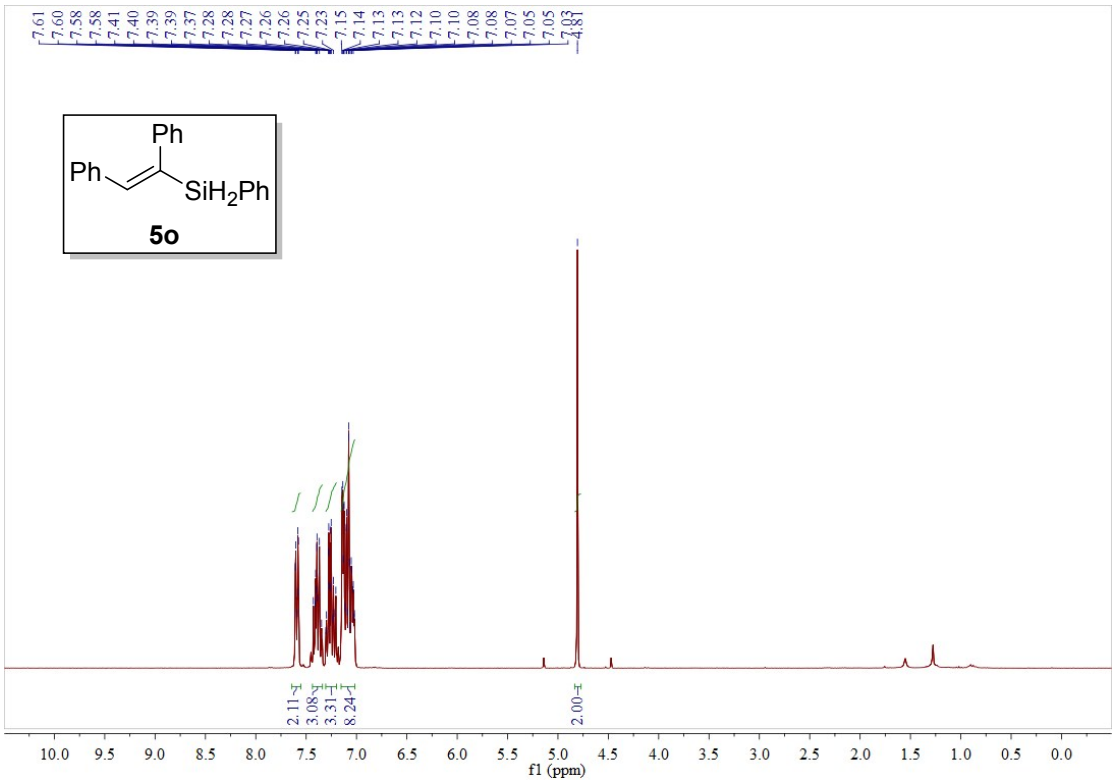
Bu
Bu
SiH2Ph
5n
f1 (ppm)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7.23
7.15
7.14
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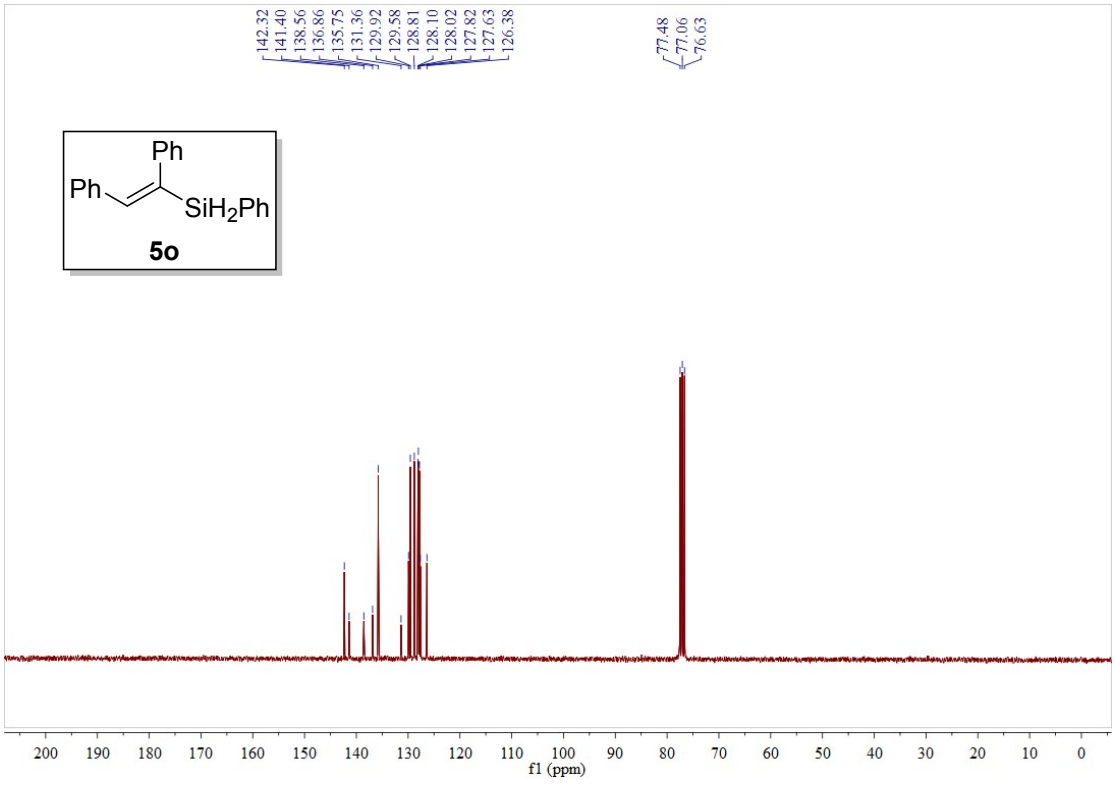
7.13
7.12
7.10
7.10
7.08
7.08
7.07
7.05
7.05
7.03
4.81
Ph
Ph
SiH2Ph
5o
2.11
3.08
3.31
8.24
2.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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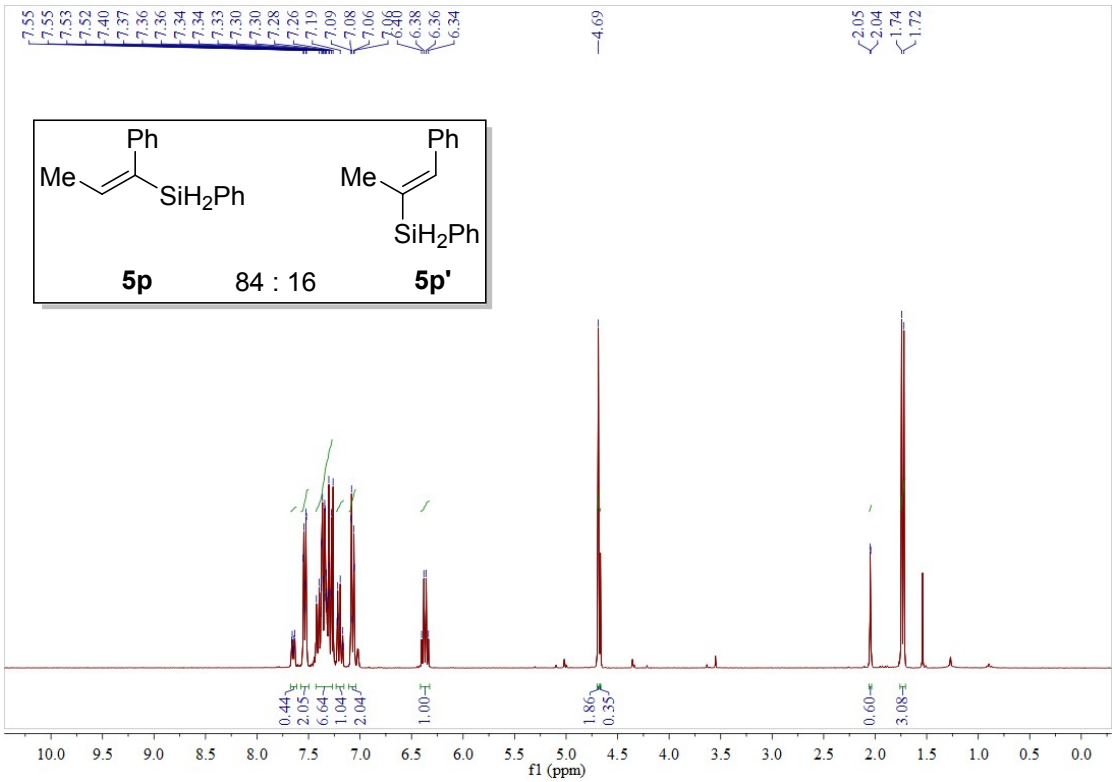
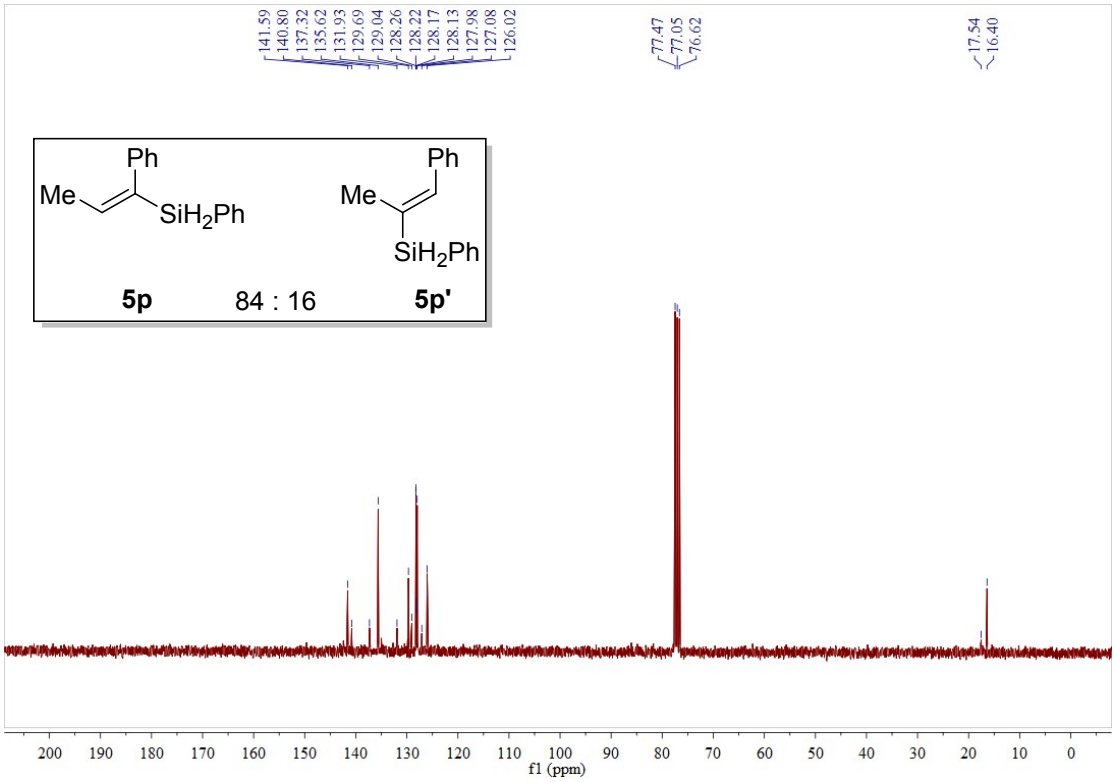
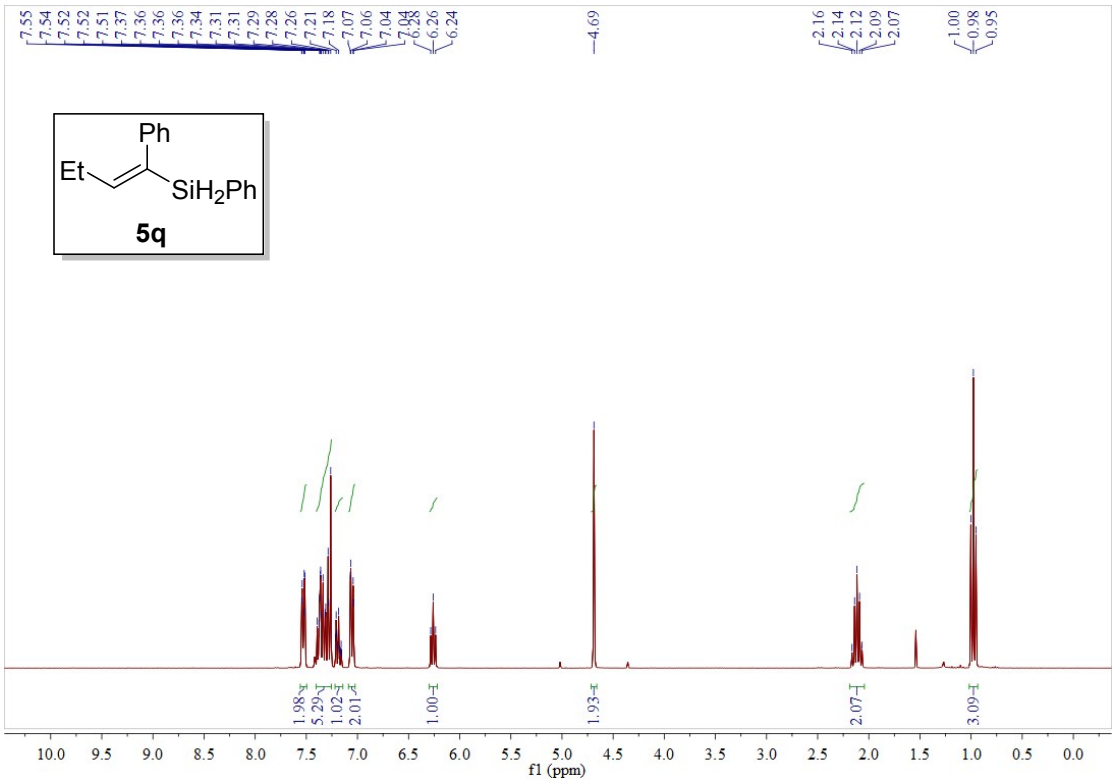
128.81
128.10
128.02
127.82
127.63
126.38
77.48
77.06
76.63
Ph
Ph
SiH2Ph
5o
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


Ph
Me
SiH2Ph
Ph
Me
SiH2Ph
5p
84 : 16
5p'
f1 (ppm)


Ph
Me
SiH2Ph
Ph
Me
SiH2Ph
5p
84 : 16
5p'
f1 (ppm)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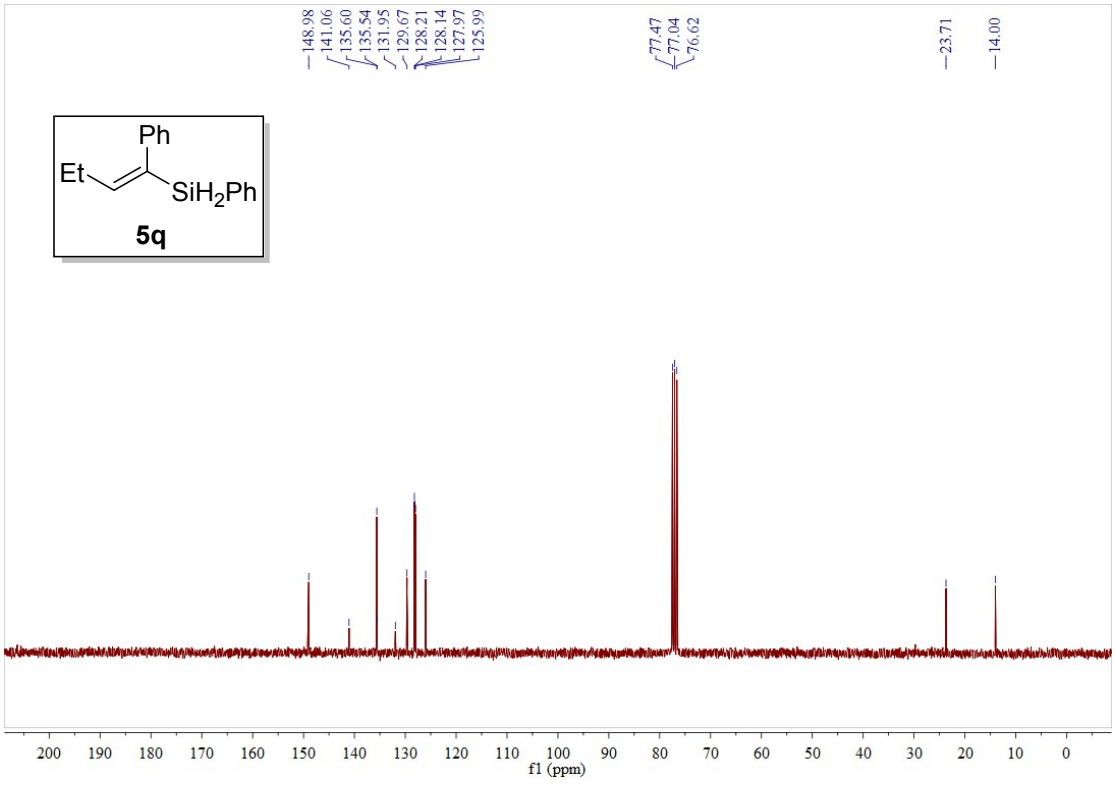
7.26
7.21
7.18
7.07
7.06
7.04
7.04
6.28
6.26
6.24
4.69
2.16
2.14
2.12
2.09
2.07
1.00
0.98
0.95
Ph
Et
SiH2Ph
5q
1.98
5.29
1.02
2.01
1.00
1.93
2.07
3.09
f1 (ppm)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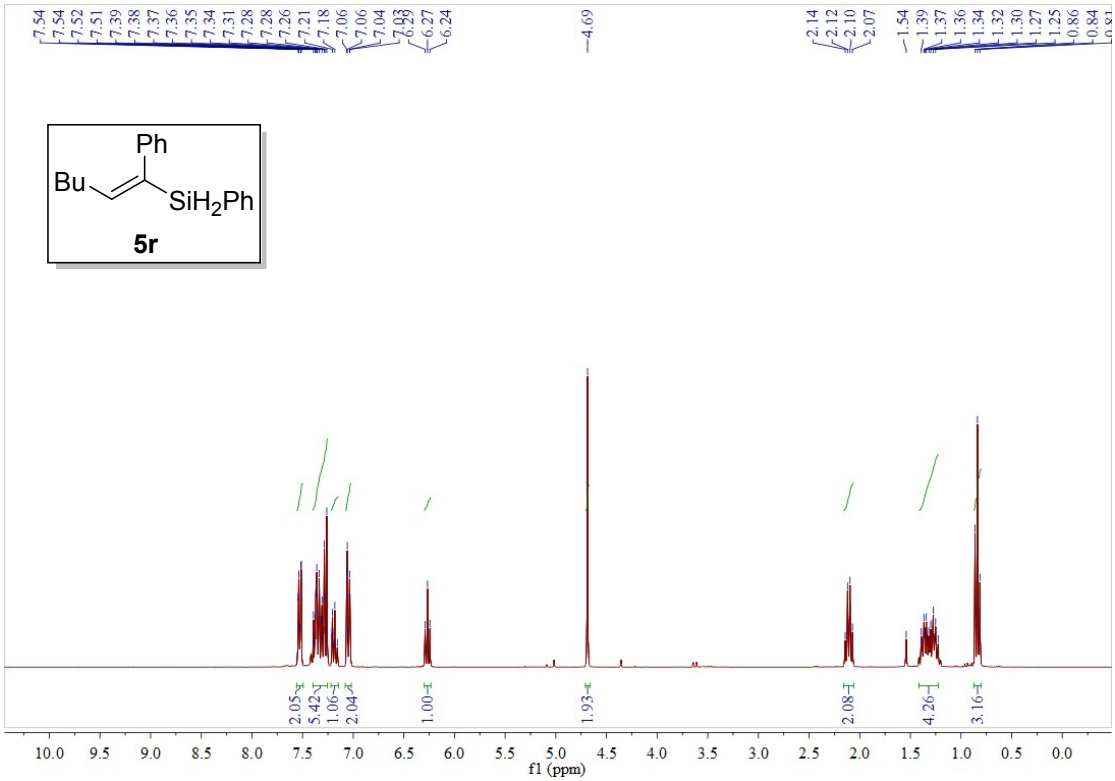
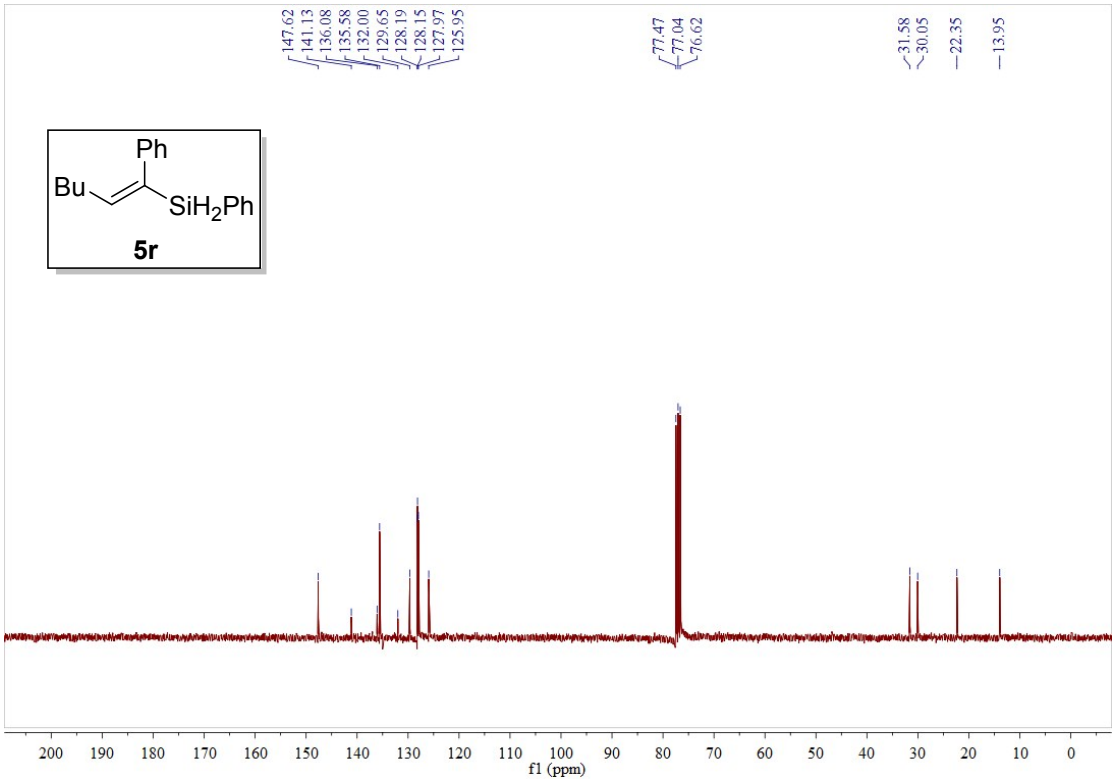
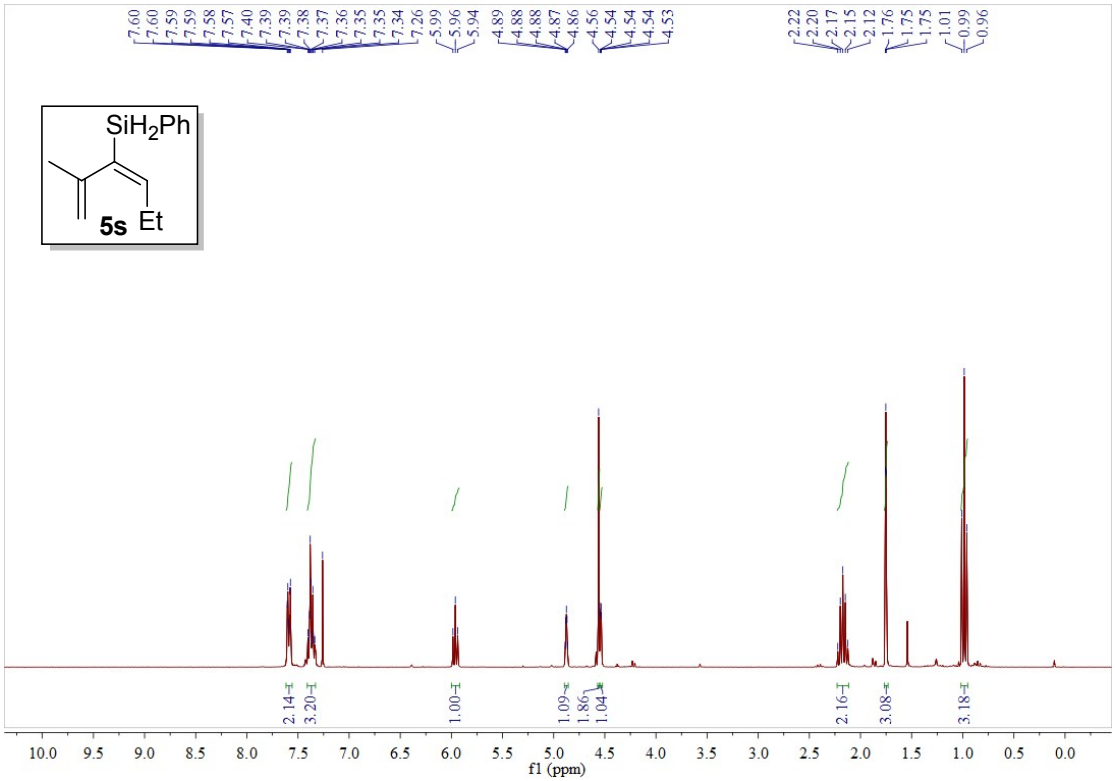
14.00
Ph
Et
SiH2Ph
5q
f1 (ppm)


Ph
Bu
SiH2Ph
5r
f1 (ppm)


Ph
Bu
SiH2Ph
5r
f1 (ppm)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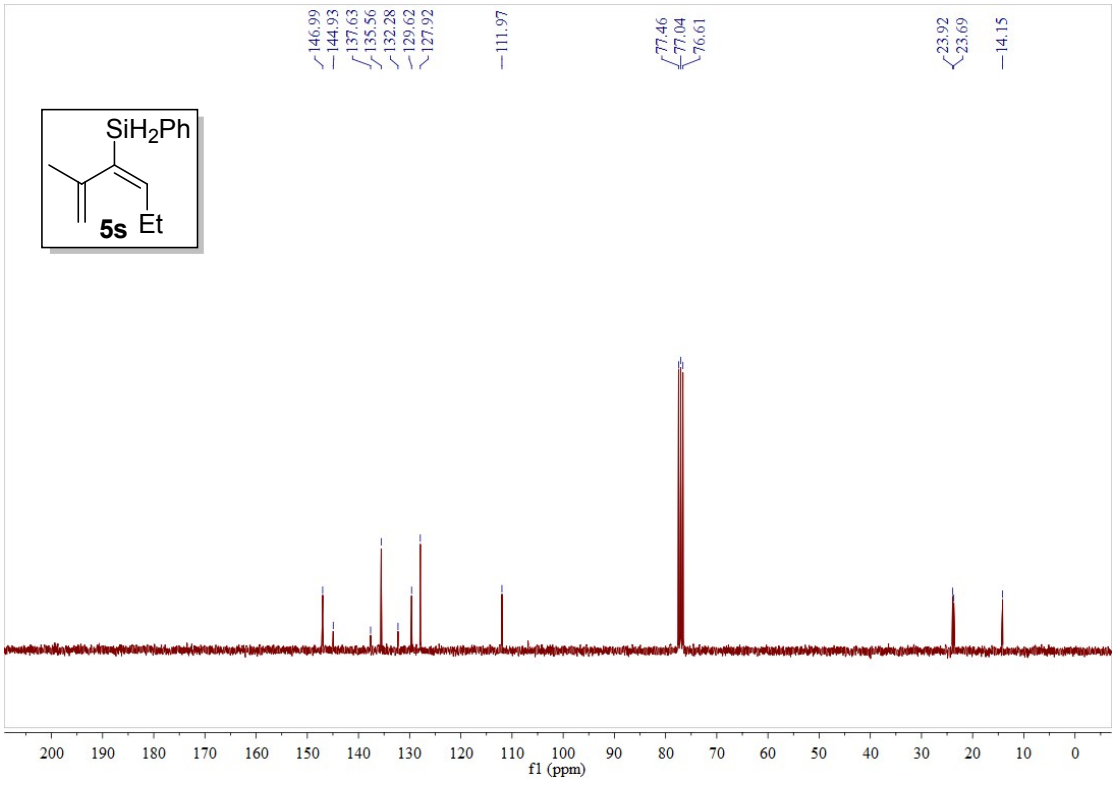
4.54
4.54
4.54
4.53
2.22
2.20
2.17
2.15
2.12
1.76
1.75
1.75
1.01
0.99
0.96
SiH2Ph
5s Et
2.14
3.20
1.00
1.09
1.86
1.04
2.16
3.08
3.18
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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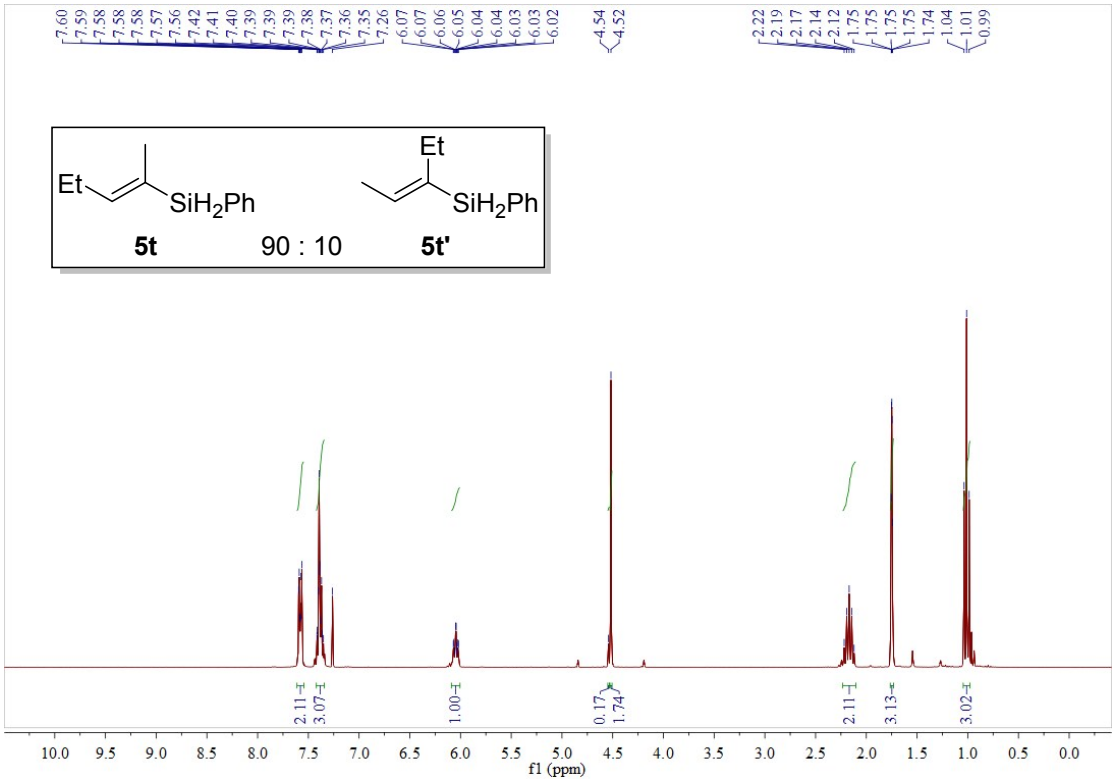
127.92
111.97
77.46
77.04
76.61
23.92
23.69
14.15
SiH2Ph
5s Et
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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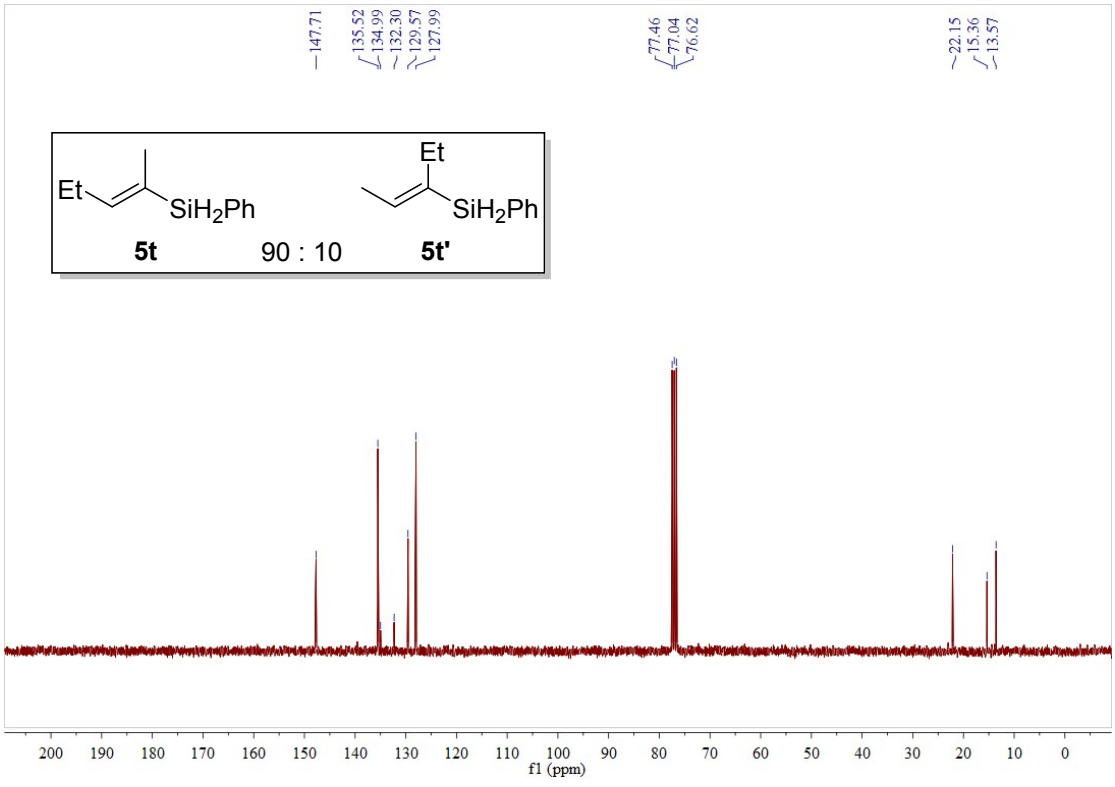
Et
SiH2Ph
5t
90 : 10
Et
SiH2Ph
5t'
2.11 3.07 1.00 0.17 1.74 2.11 3.13 3.02
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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Et
SiH2Ph
5t
90 : 10
Et
SiH2Ph
5t'
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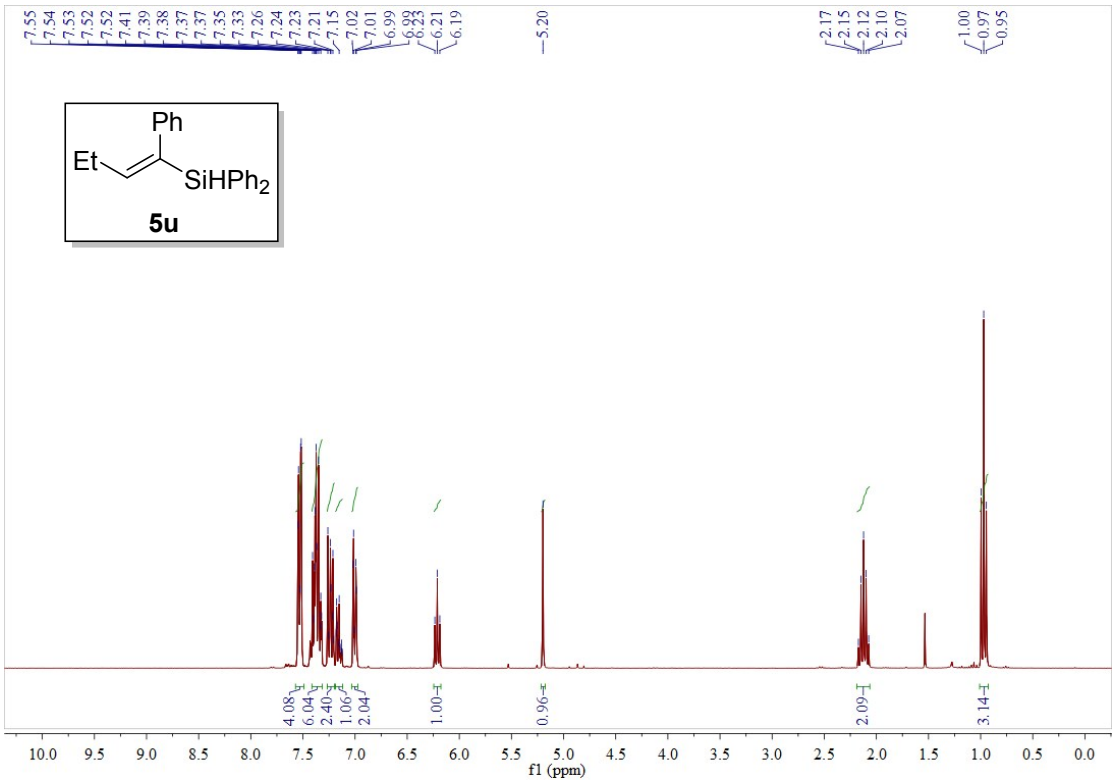
f1 (ppm)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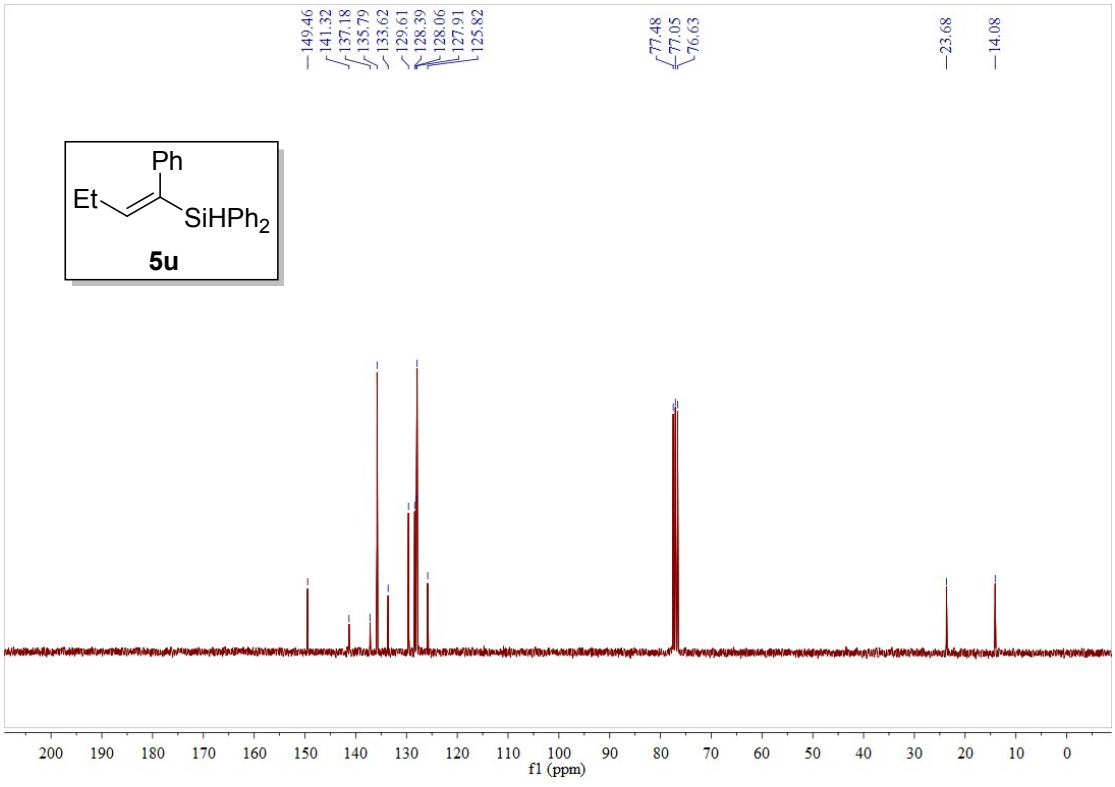
7.23
7.21
7.15
7.02
7.01
6.99
6.23
6.21
6.19
5.20
2.17
2.15
2.12
2.10
2.07
1.00
0.97
0.95
Ph
Et
SiHPh2
5u
4.08
6.04
2.40
1.06
2.04
1.00
0.96
2.09
3.14
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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77.05
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Ph
Et
SiHPh2
5u
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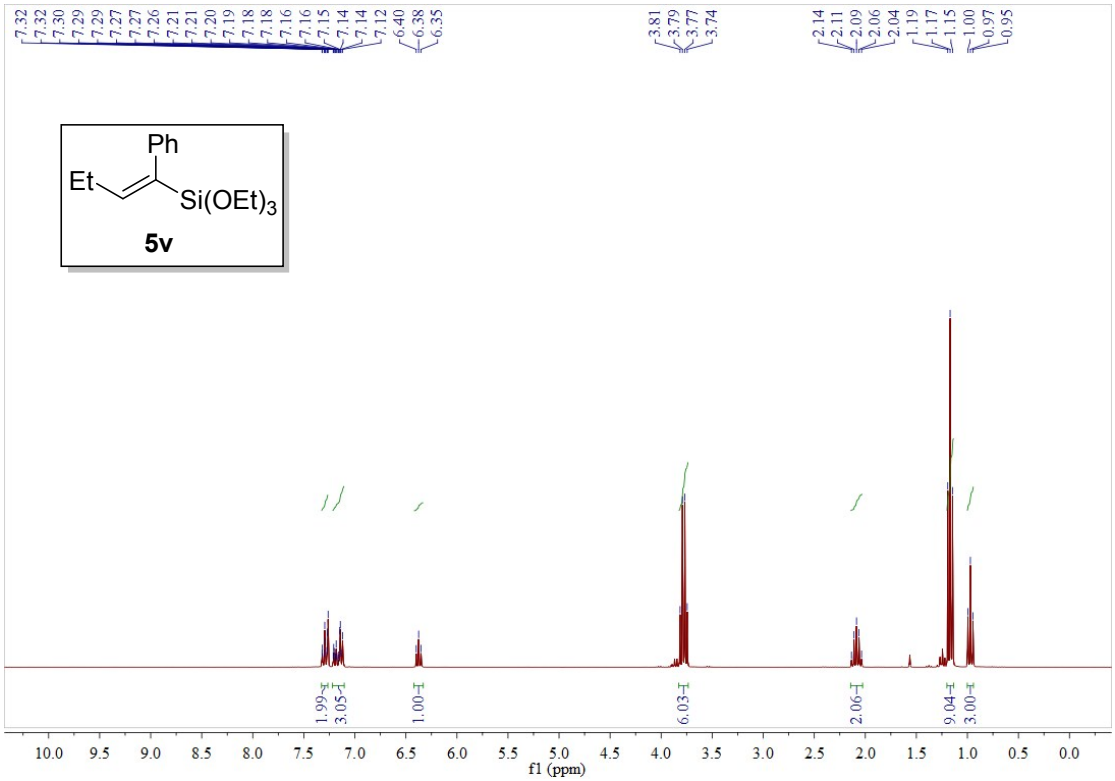
f1 (ppm)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7.18
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7.16
7.15
7.14
7.14
7.12
6.40
6.38
6.35
3.81
3.79
3.77
3.74
2.14
2.11
2.09
2.06
2.04
1.19
1.17
1.15
1.00
0.97
0.95
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Et
Si(OEt)3
5v
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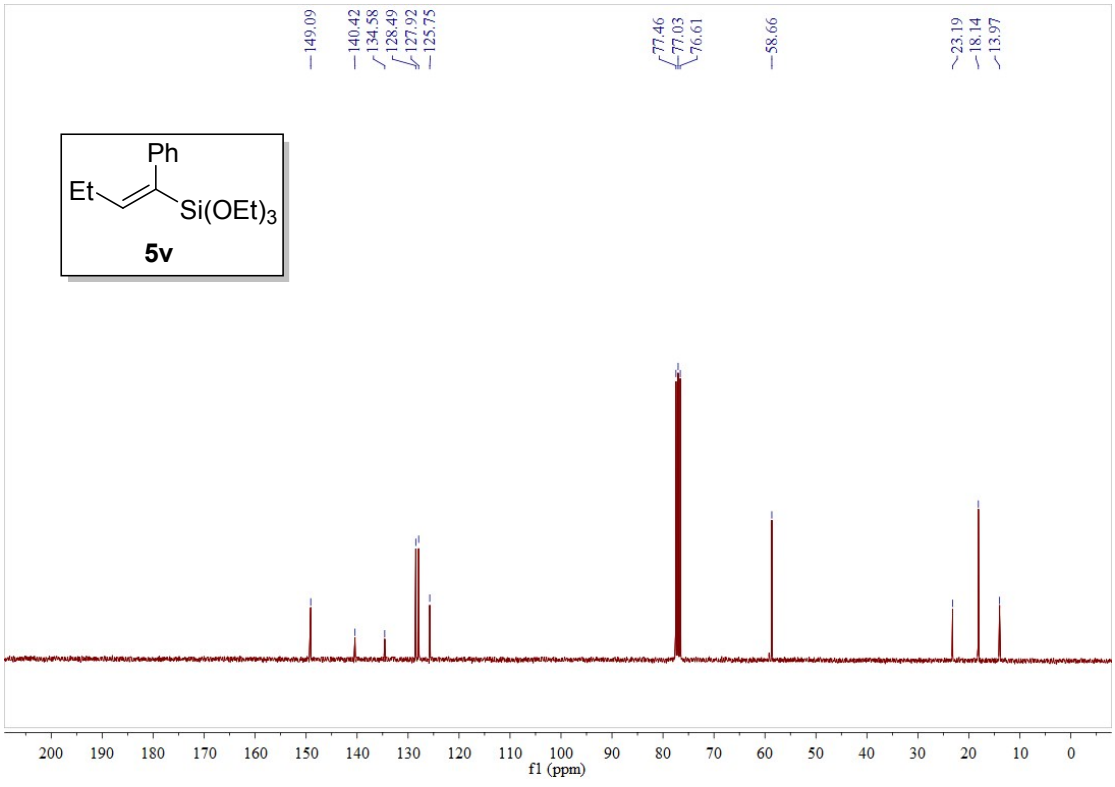
1.00
6.03
2.06
9.04
3.00
f1 (ppm)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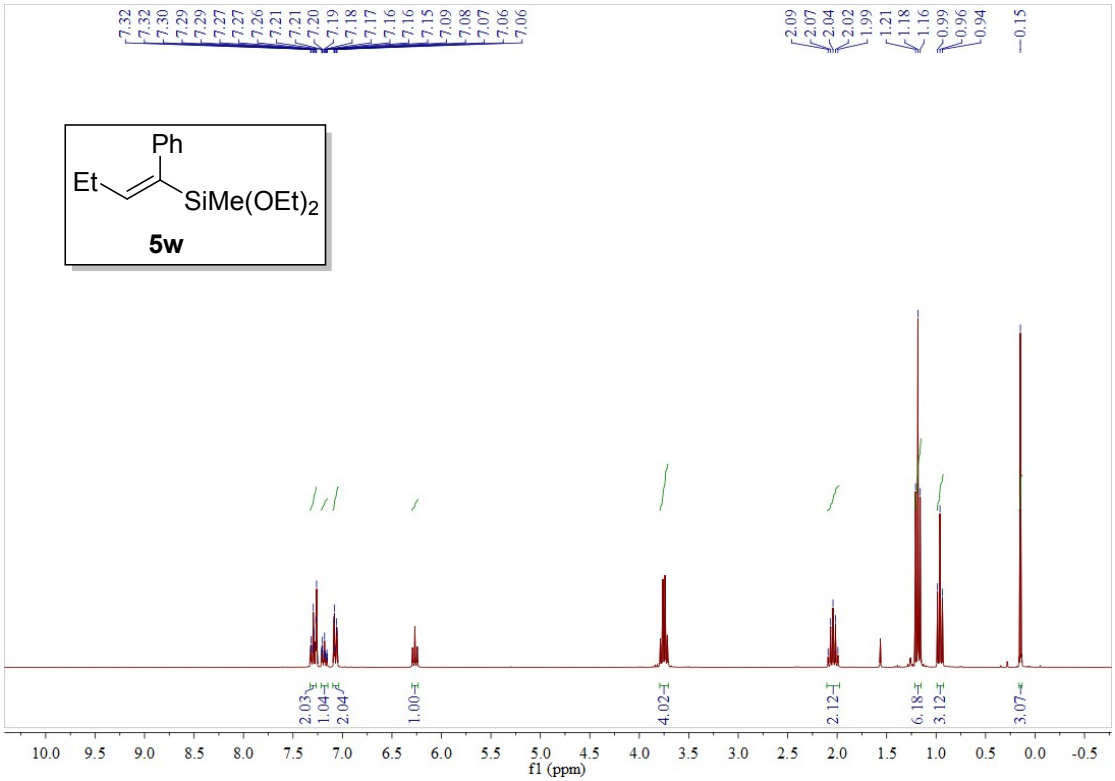
Et
Si(OEt)3
5v
f1 (ppm)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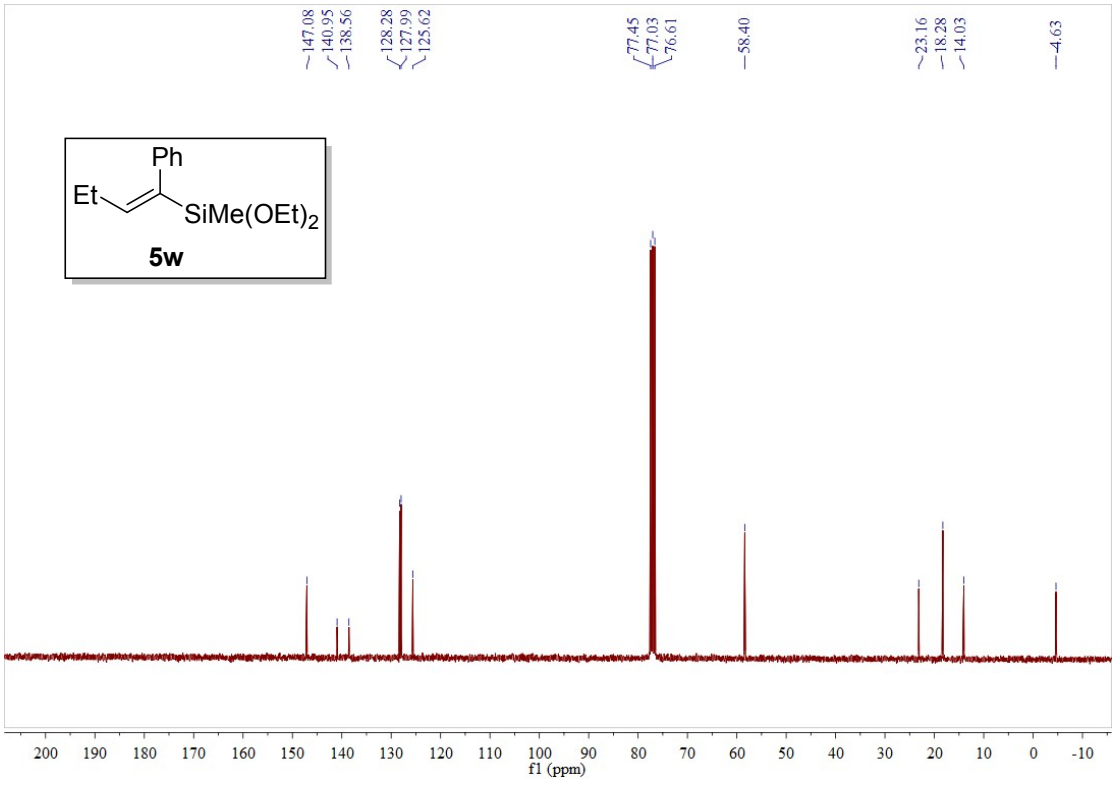
7.08
7.07
7.06
7.06
2.09
2.07
2.04
2.02
1.99
1.21
1.18
1.16
0.99
0.96
0.94
0.15
Ph
Et
SiMe(OEt)2
5w
2.03
1.04
2.04
1.00
4.02
2.12
6.18
3.12
3.07
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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58.40
23.16
18.28
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4.63
Ph
Et
SiMe(OEt)2
5w
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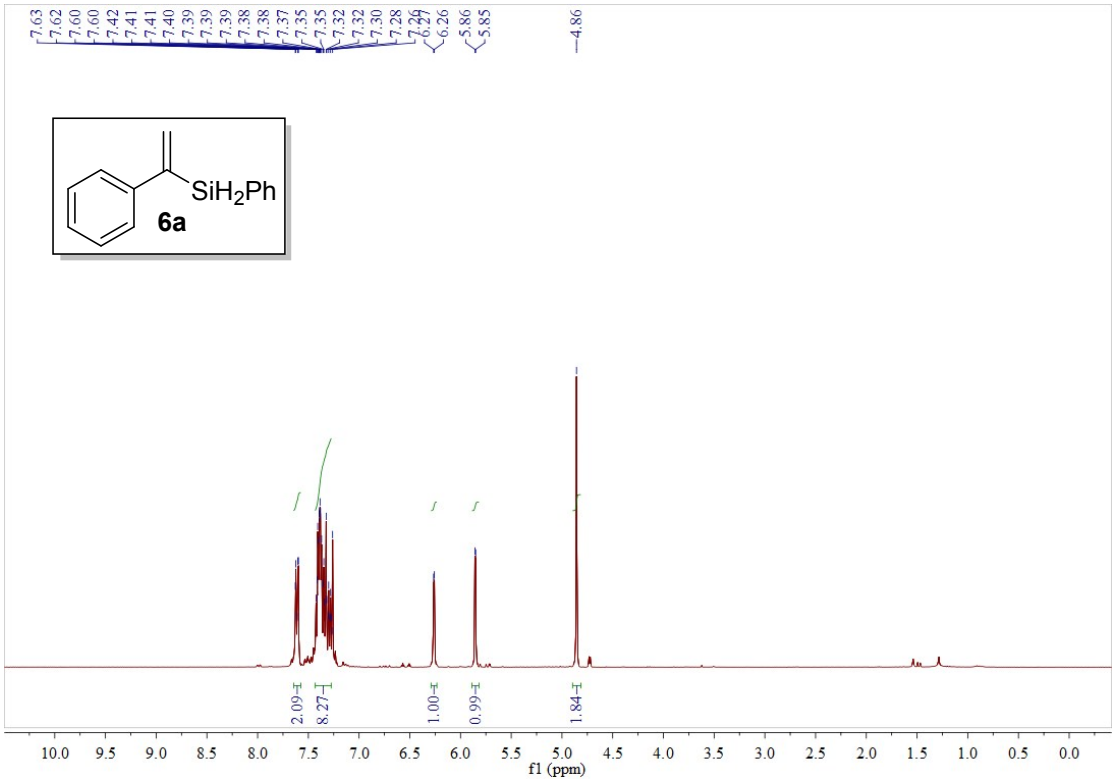
f1 (ppm)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7.28
6.27
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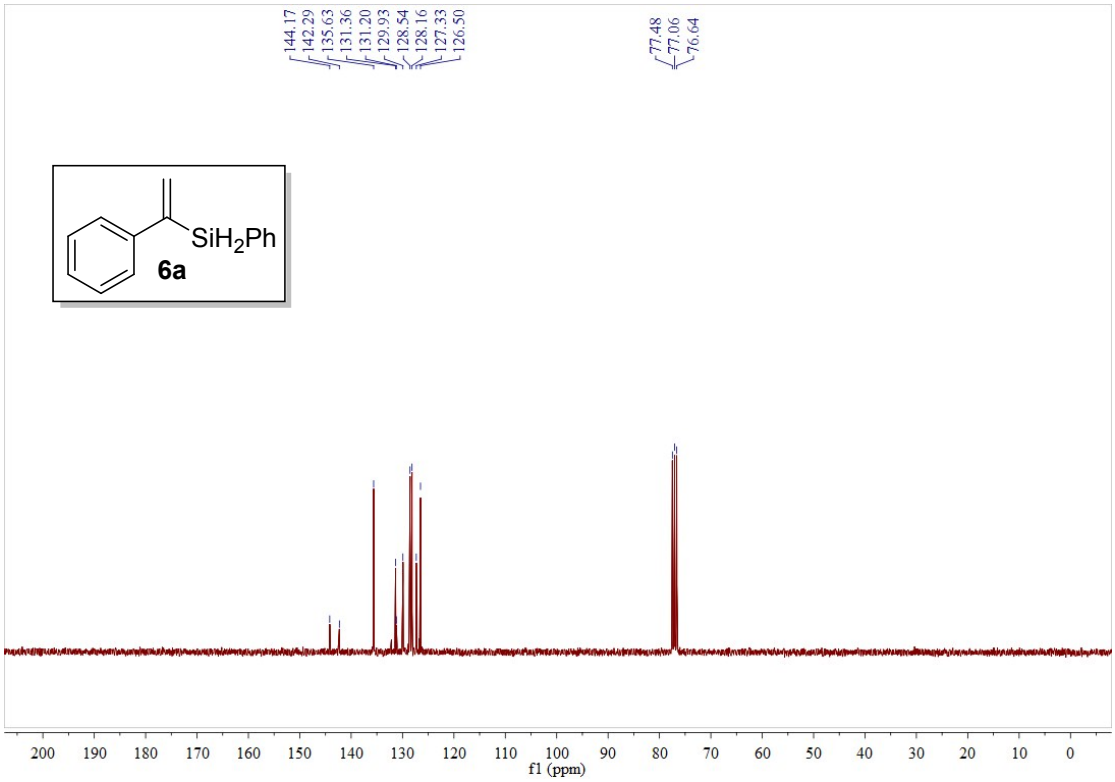
1.84
f1 (ppm)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77.48
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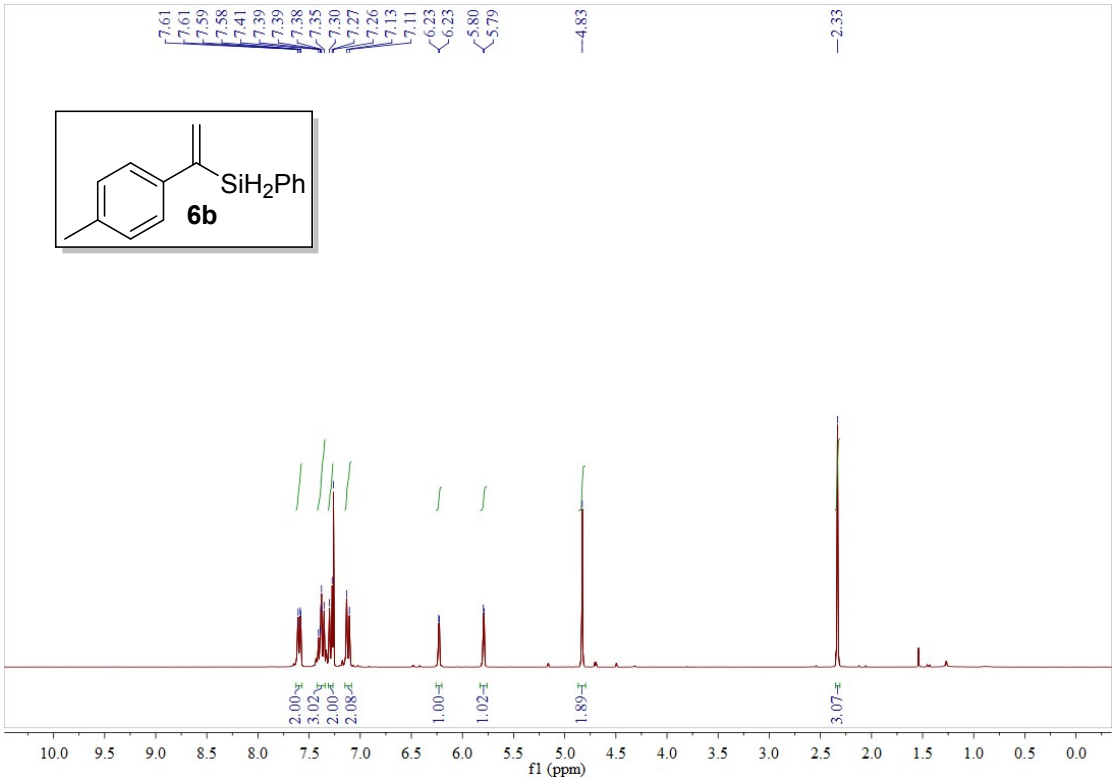
76.64
SiH2Ph
6a
f1 (ppm)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7.13
7.11
6.23
6.23
5.80
5.79
4.83
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SiH2Ph
6b
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2.08
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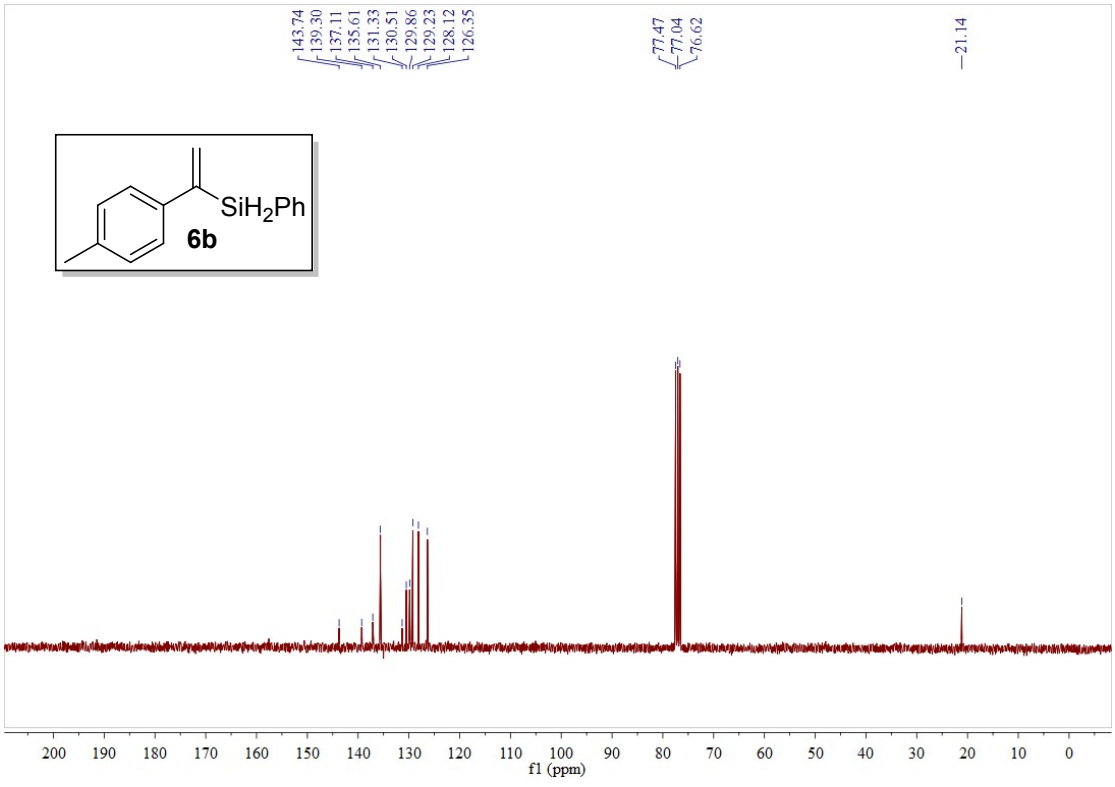
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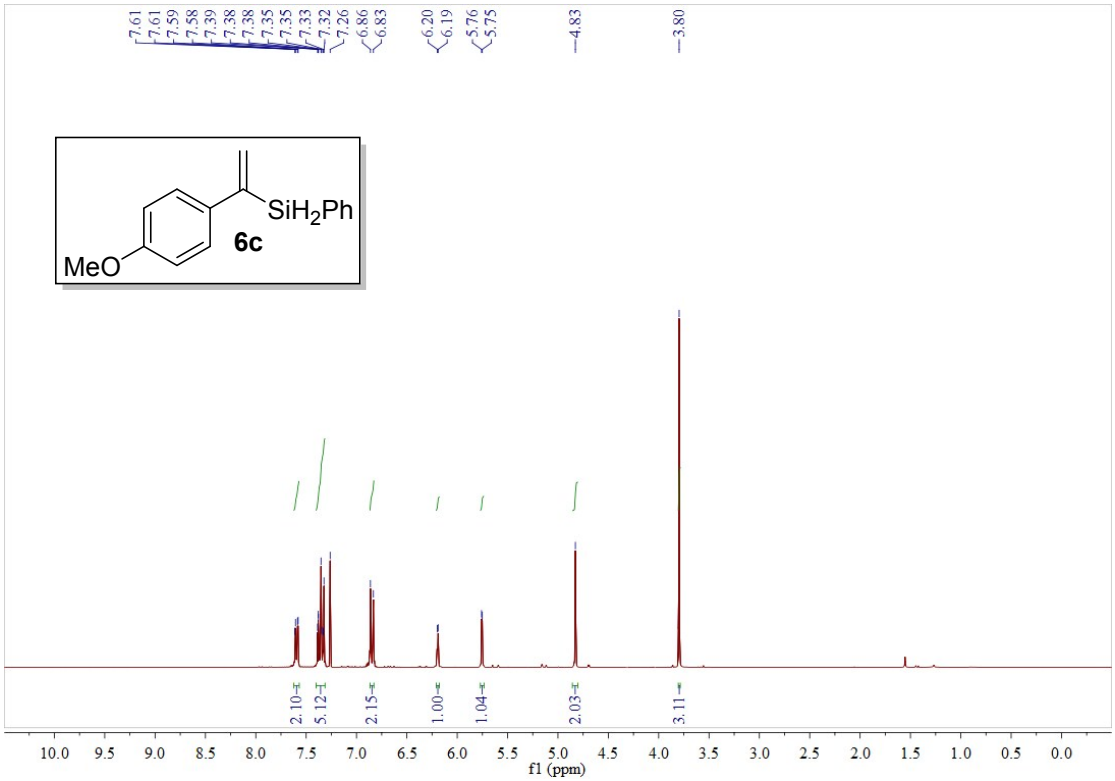
21.14
SiH2Ph
6b
f1 (ppm)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5.75
4.83
3.80
SiH2Ph
6c
MeO
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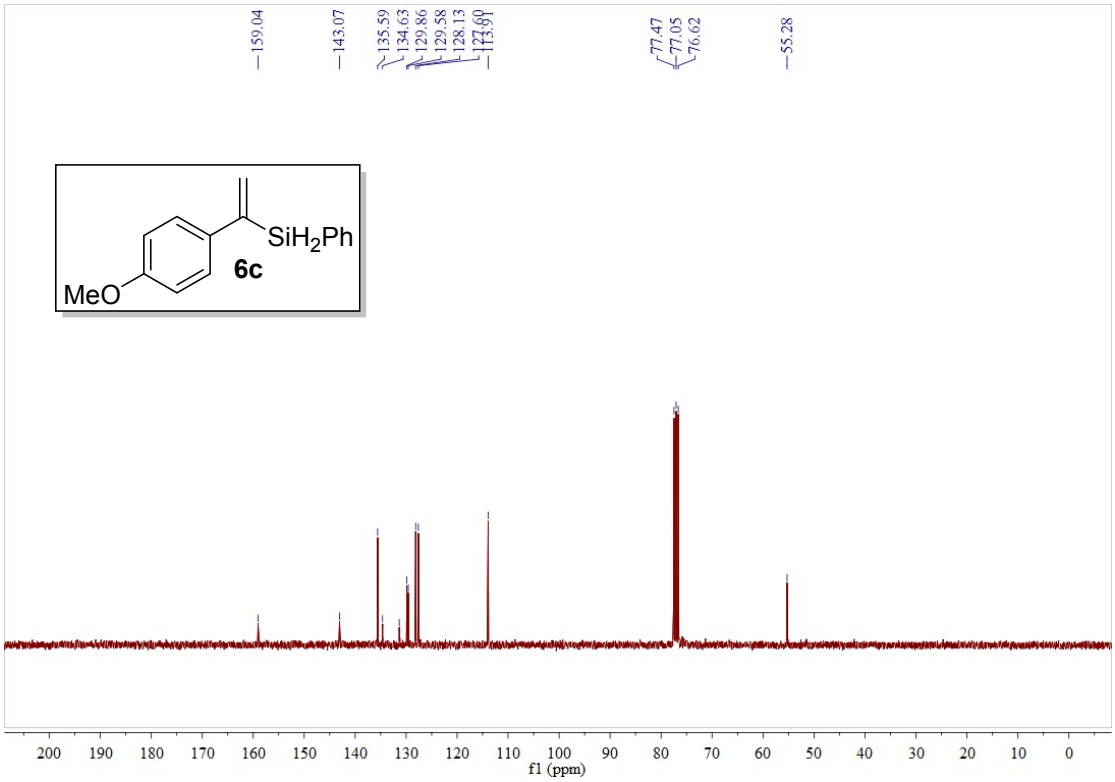
5.12
2.15
1.00
1.04
2.03
3.11
f1 (ppm)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76.62
55.28
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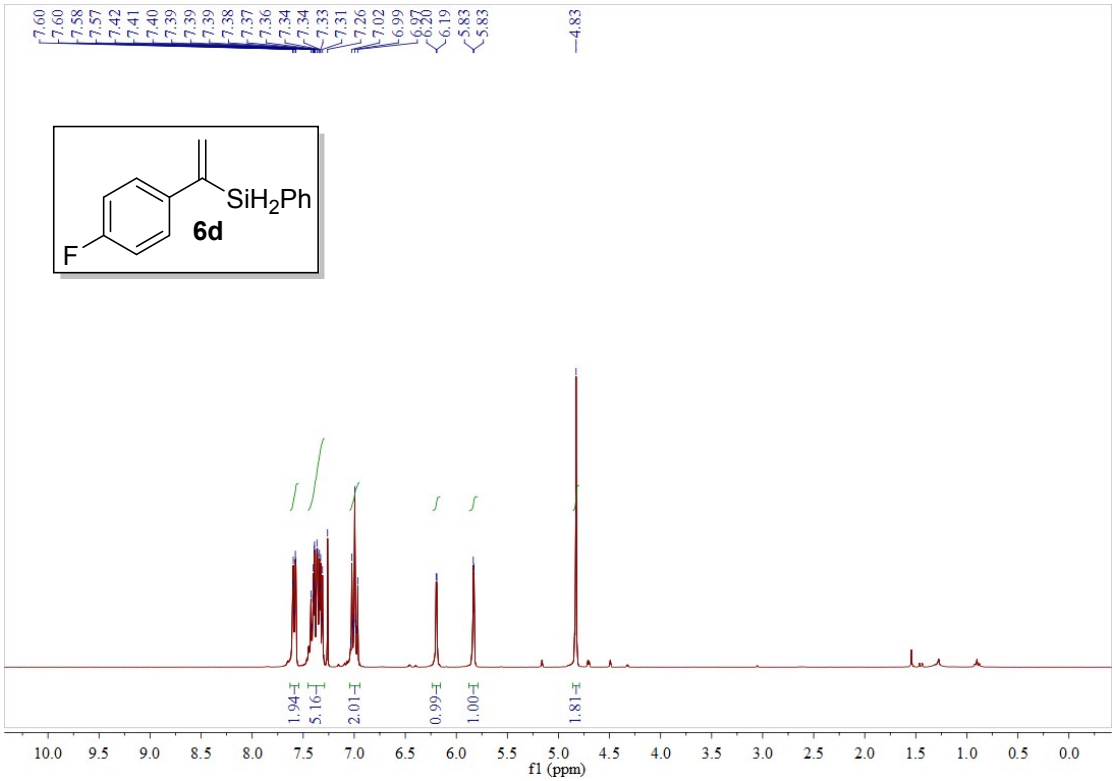
6c
MeO
f1 (ppm)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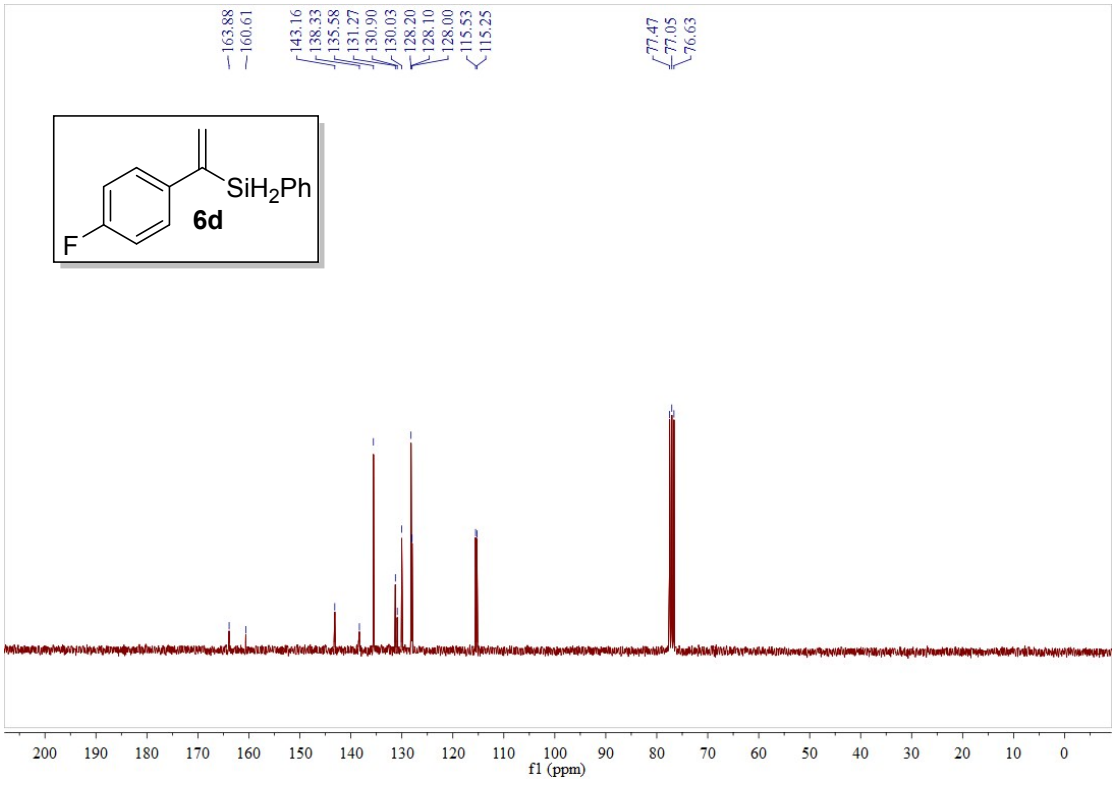
7.39
7.38
7.37
7.36
7.34
7.34
7.33
7.31
7.26
7.02
6.99
6.97
6.20
6.19
5.83
5.83
4.83
SiH2Ph
6d
F
1.94
5.16
2.01
0.99
1.00
1.81
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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130.03
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128.10
128.00
115.53
115.25
77.47
77.05
76.63
SiH2Ph
6d
F
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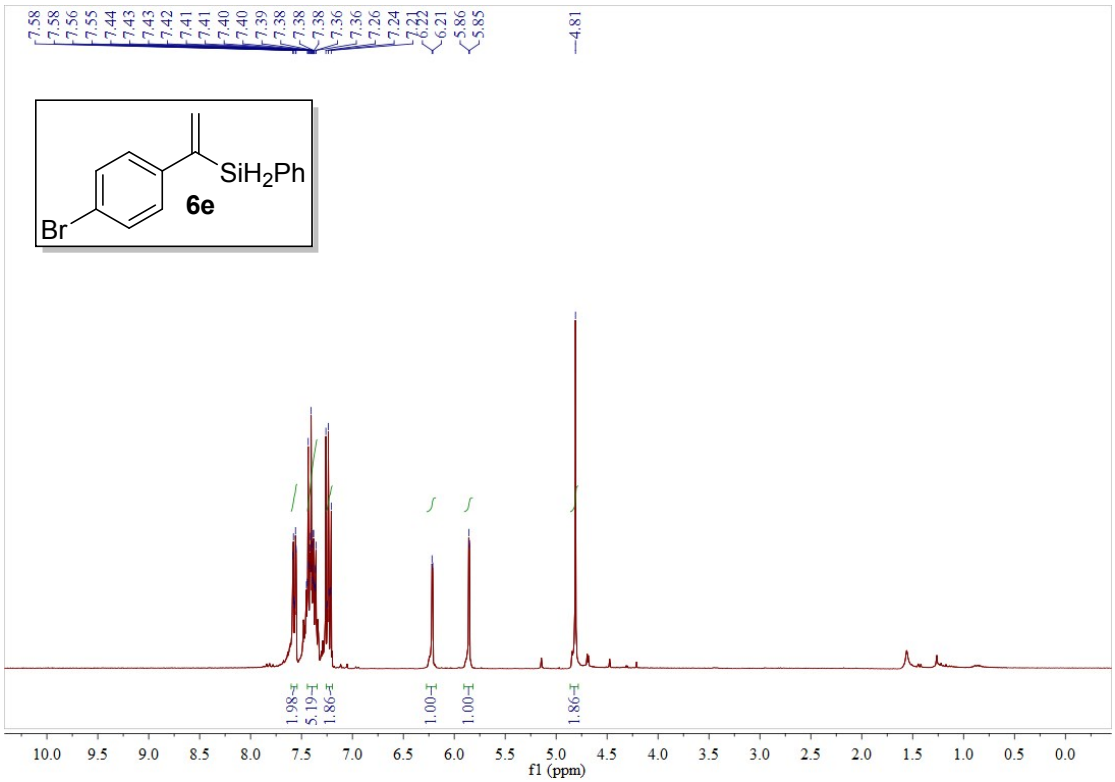
f1 (ppm)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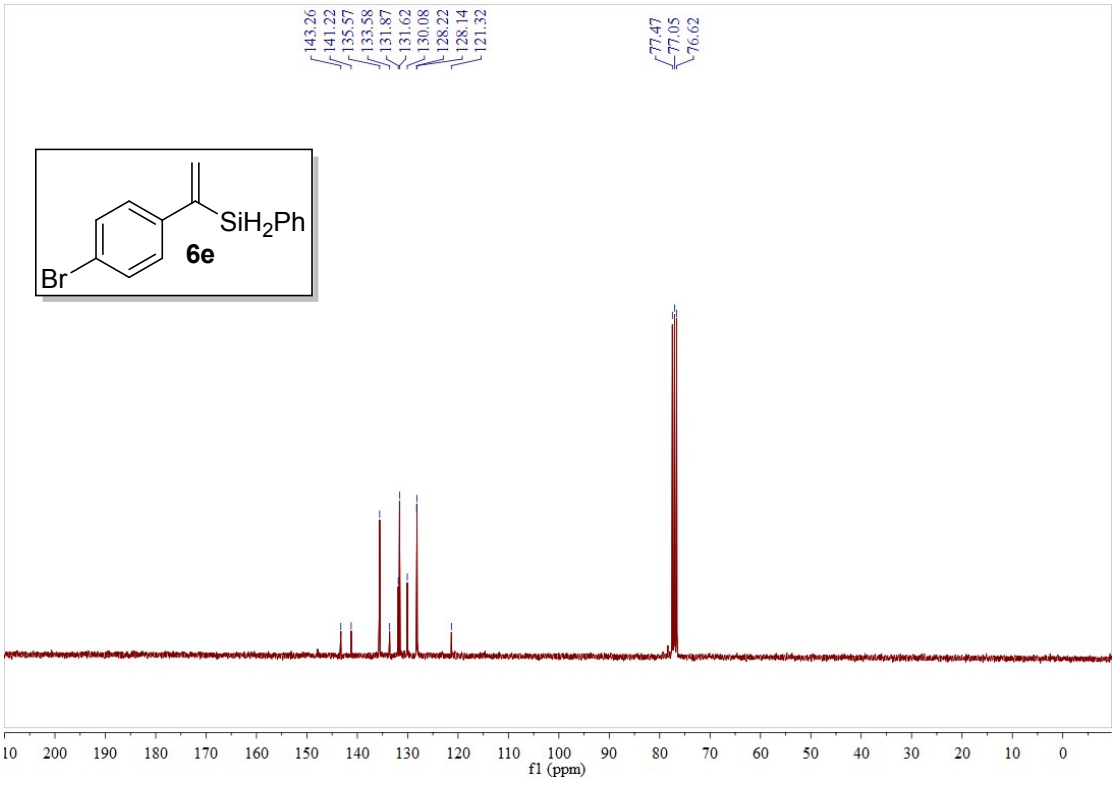
7.41
7.40
7.40
7.39
7.38
7.38
7.38
7.36
7.36
7.26
7.24
7.21
6.22
6.21
5.86
5.85
4.81
SiH2Ph
6e
Br
1.98
5.19
1.86
1.00
1.00
1.86
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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131.87
131.62
130.08
128.22
128.14
121.32
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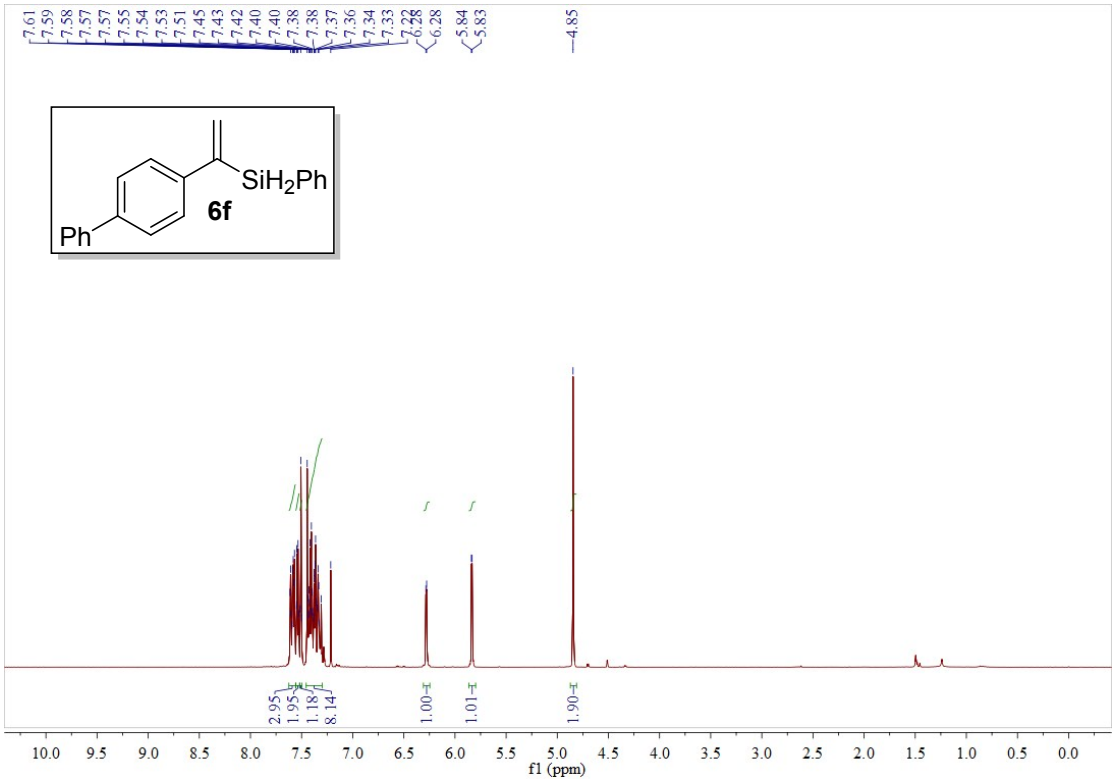
77.05
76.62
SiH2Ph
6e
Br
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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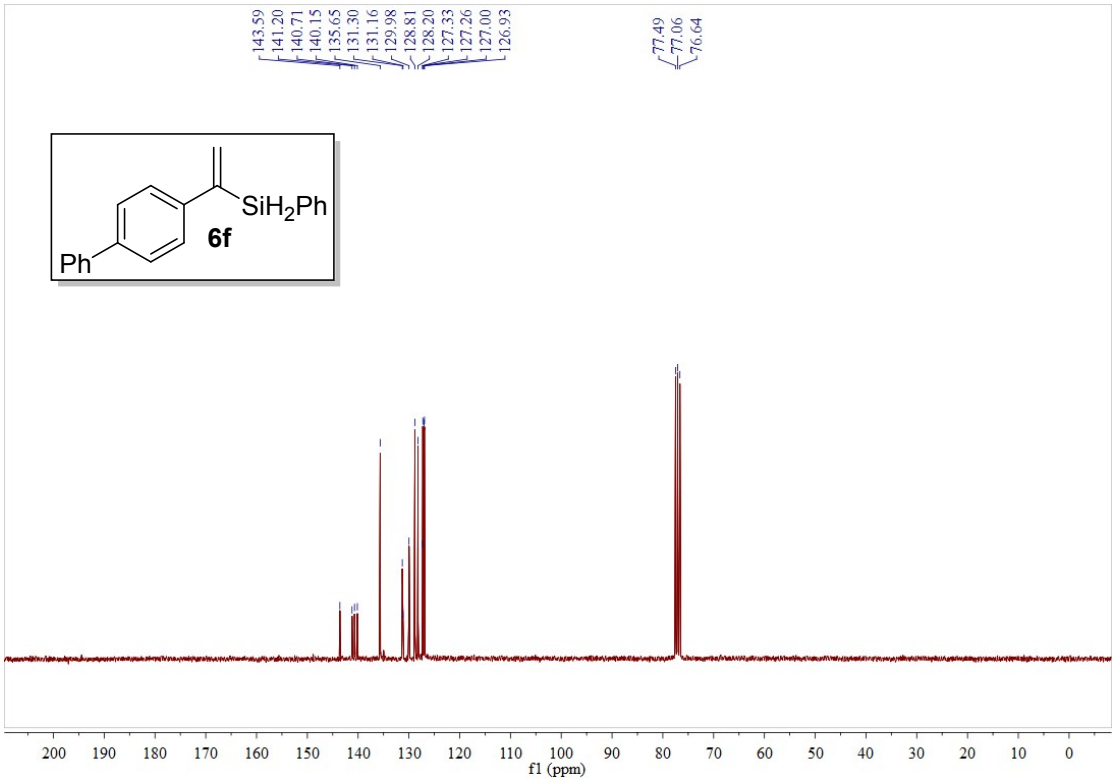
7.40
7.40
7.38
7.38
7.37
7.36
7.34
7.33
7.22
6.28
6.28
5.84
5.83
4.85
SiH2Ph
6f
Ph
2.95
1.95
1.18
8.14
1.00
1.01
1.90
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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129.98
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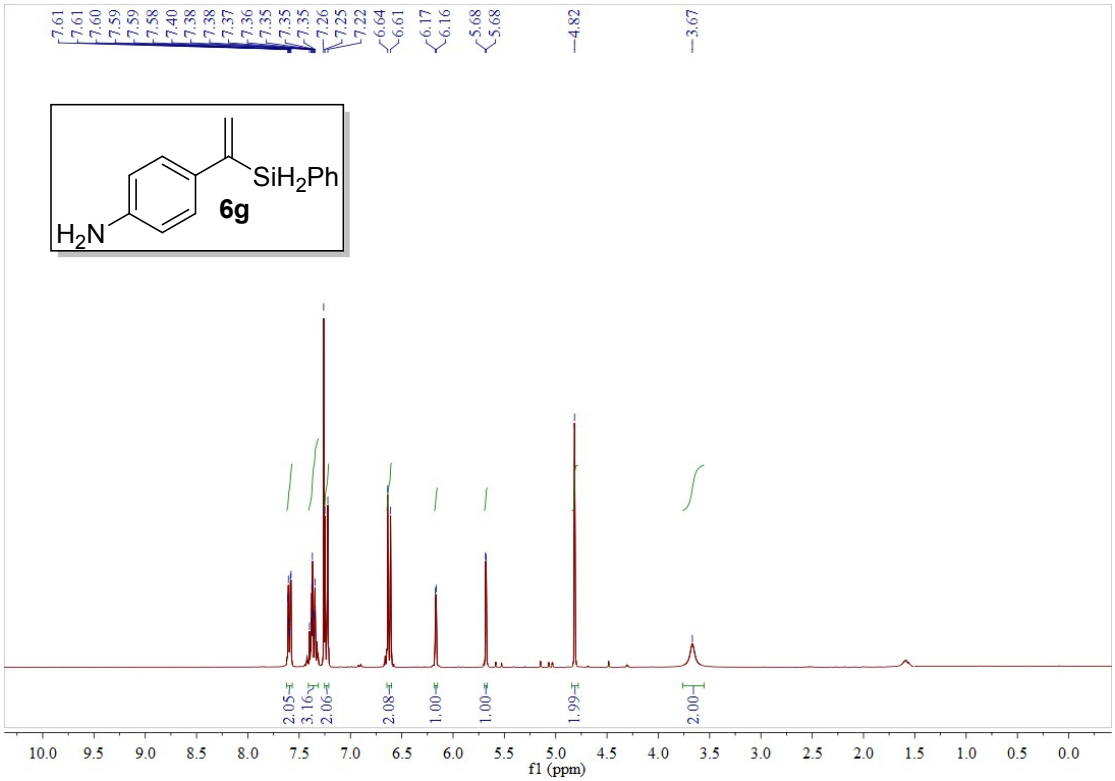
128.20
127.33
127.26
127.00
126.93
77.49
77.06
76.64
SiH2Ph
6f
Ph
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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7.59
7.58
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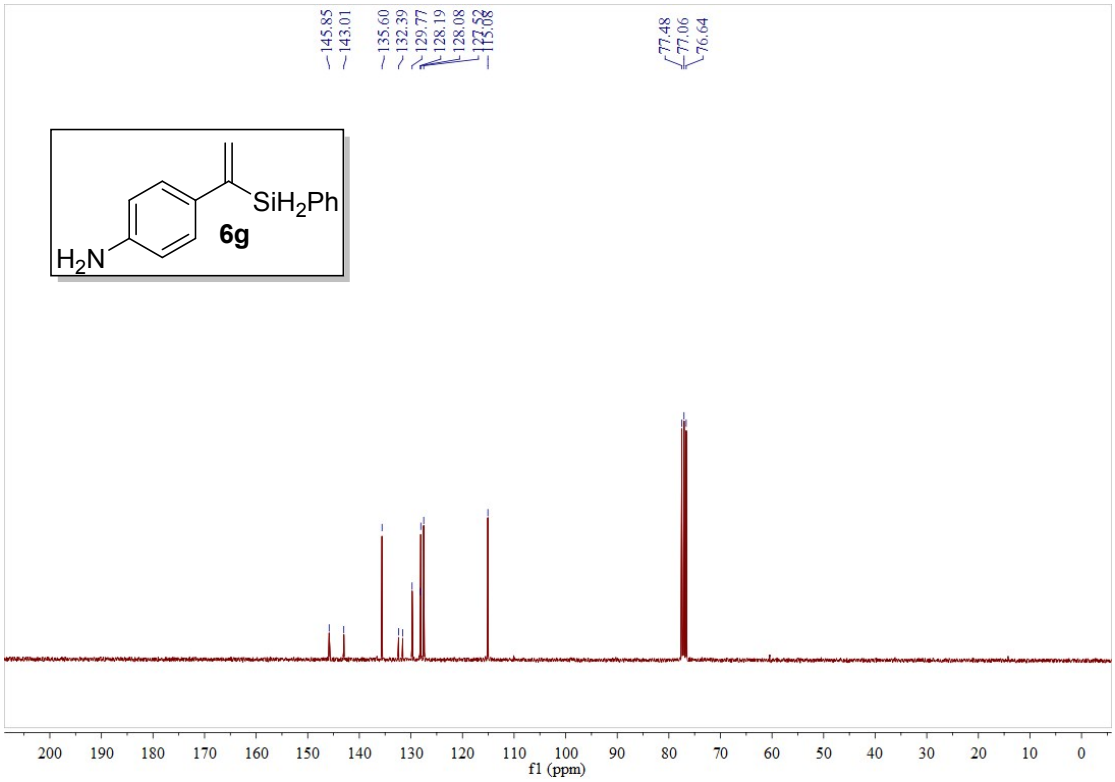
7.38
7.38
7.37
7.36
7.35
7.35
7.35
7.26
7.25
7.22
6.64
6.61
6.17
6.16
5.68
5.68
4.82
3.67
SiH2Ph
6g
H2N
2.05
3.16
2.06
2.08
1.00
1.00
1.99
2.00
f1 (ppm)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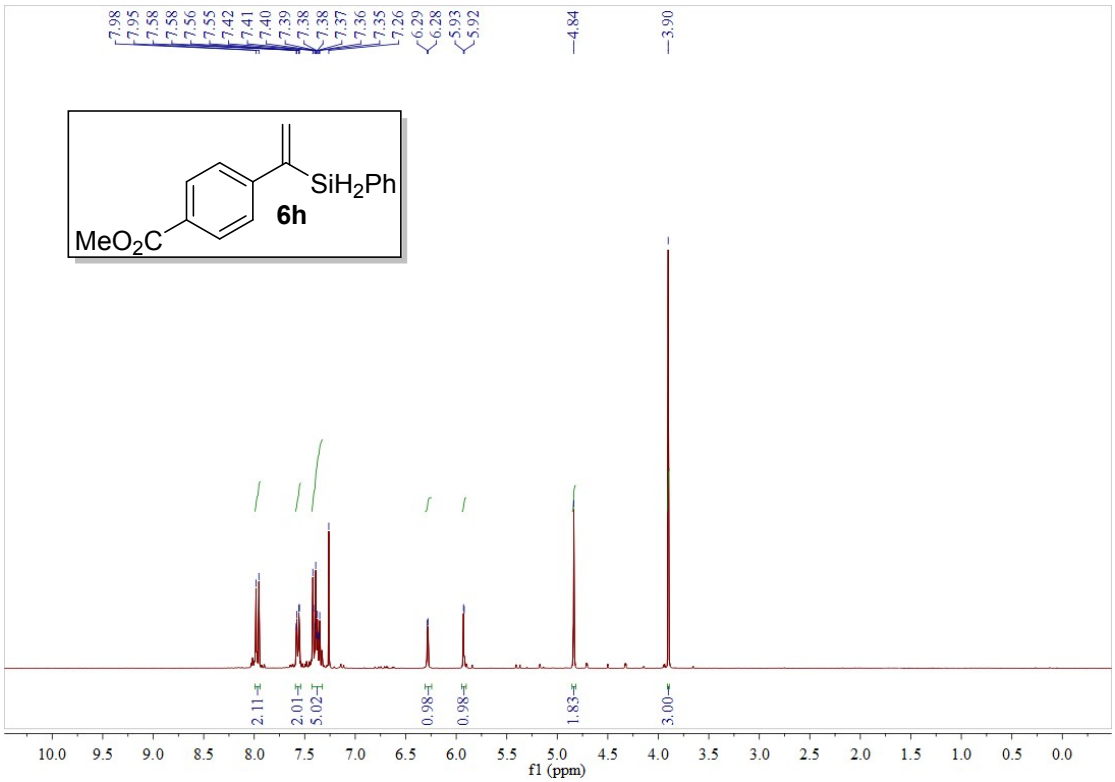
127.52
125.08
77.48
77.06
76.64
SiH2Ph
6g
H2N
f1 (ppm)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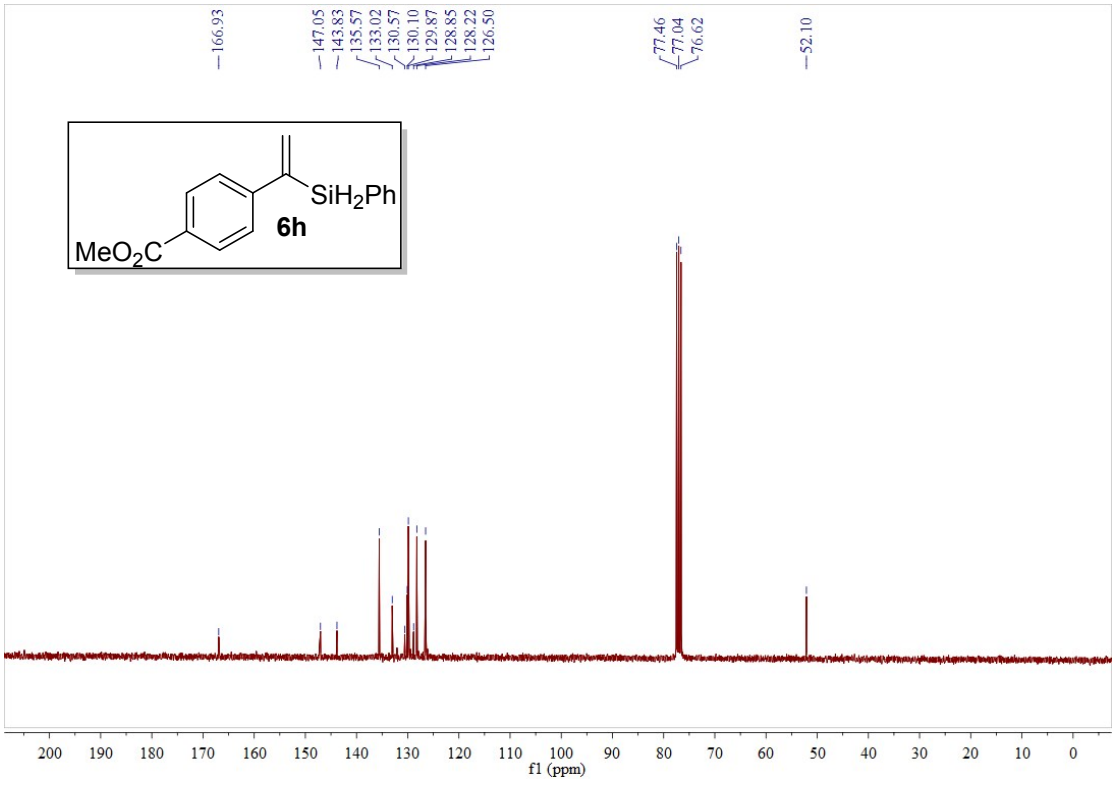
7.40
7.39
7.38
7.38
7.37
7.36
7.35
7.26
6.29
6.28
5.93
5.92
4.84
3.90
SiH2Ph
6h
MeO2C
2.11
2.01
5.02
0.98
0.98
1.83
3.00
f1 (ppm)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143.83
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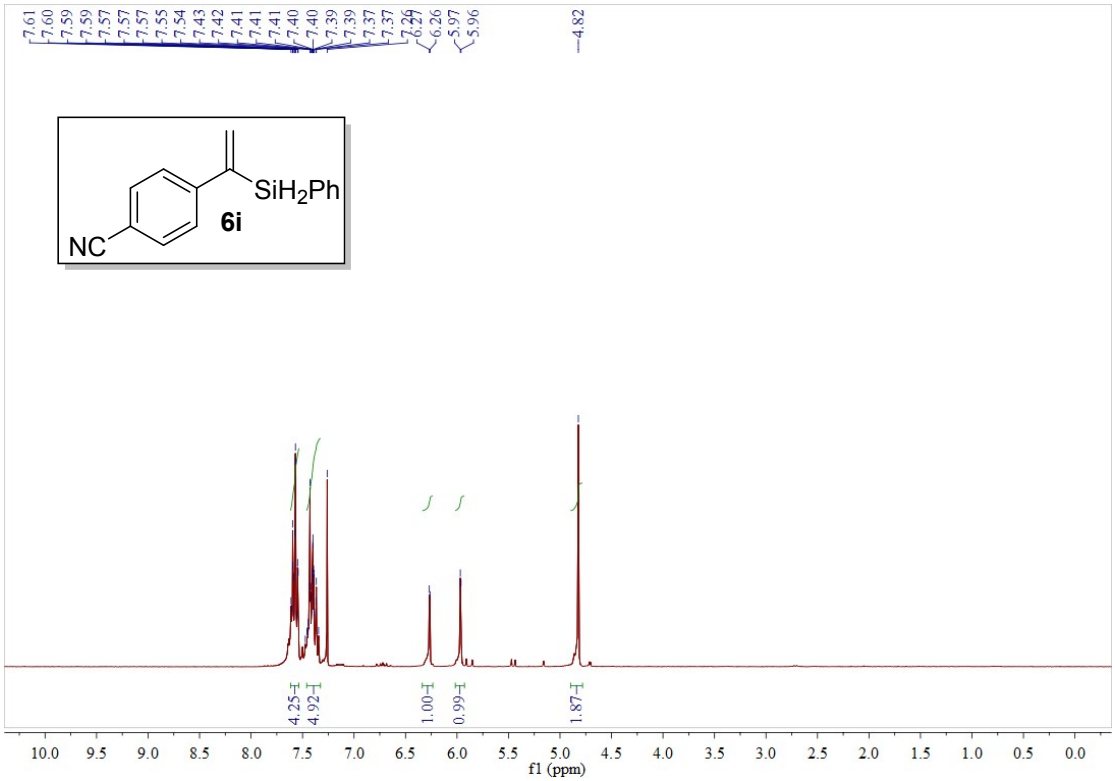
126.50
77.46
77.04
76.62
52.10
SiH2Ph
6h
MeO2C
f1 (ppm)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7.43
7.42
7.41
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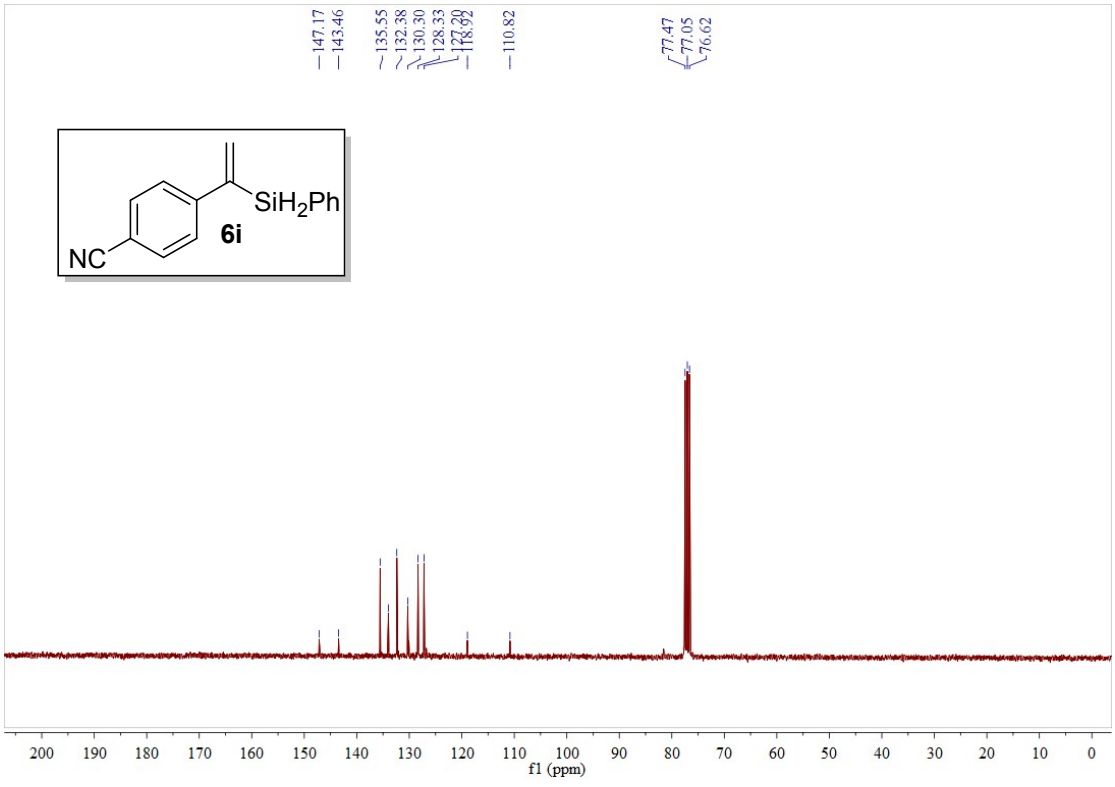
7.41
7.40
7.40
7.39
7.39
7.37
7.37
7.26
6.26
5.97
5.96
4.82
SiH2Ph
6i
NC
4.25
4.92
1.00
0.99
1.87
f1 (ppm)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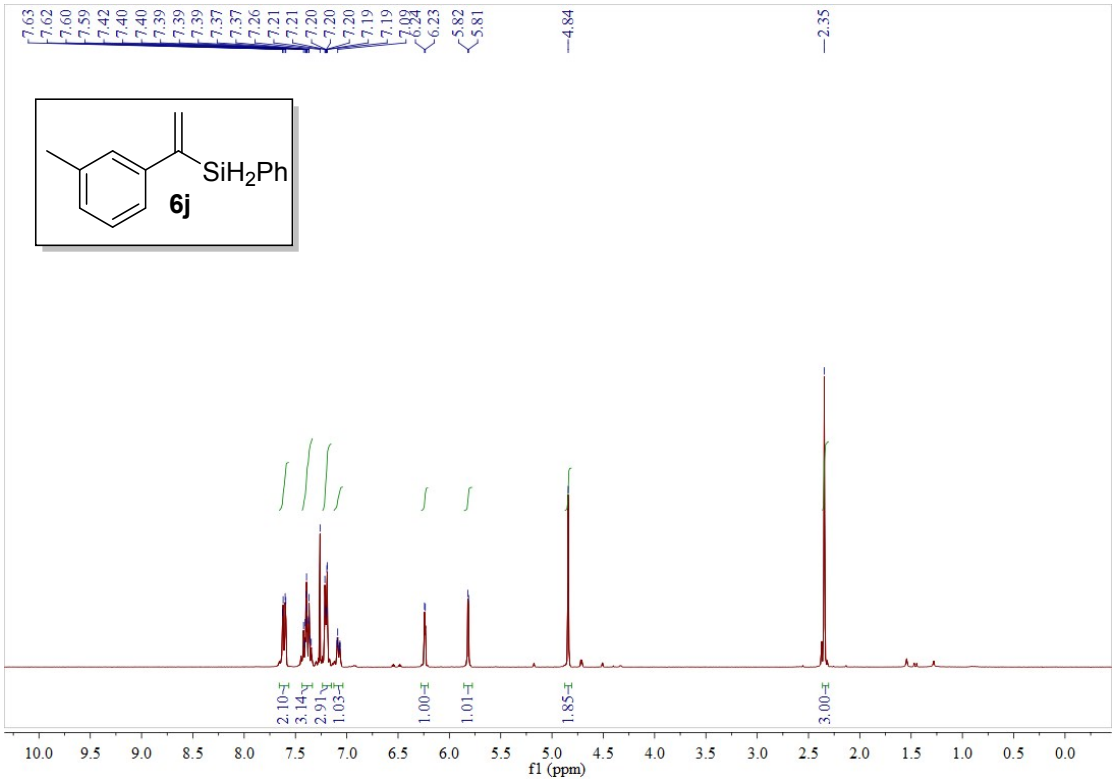
127.20
118.92
110.82
77.47
77.05
76.62
SiH2Ph
6i
NC
f1 (ppm)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7.62
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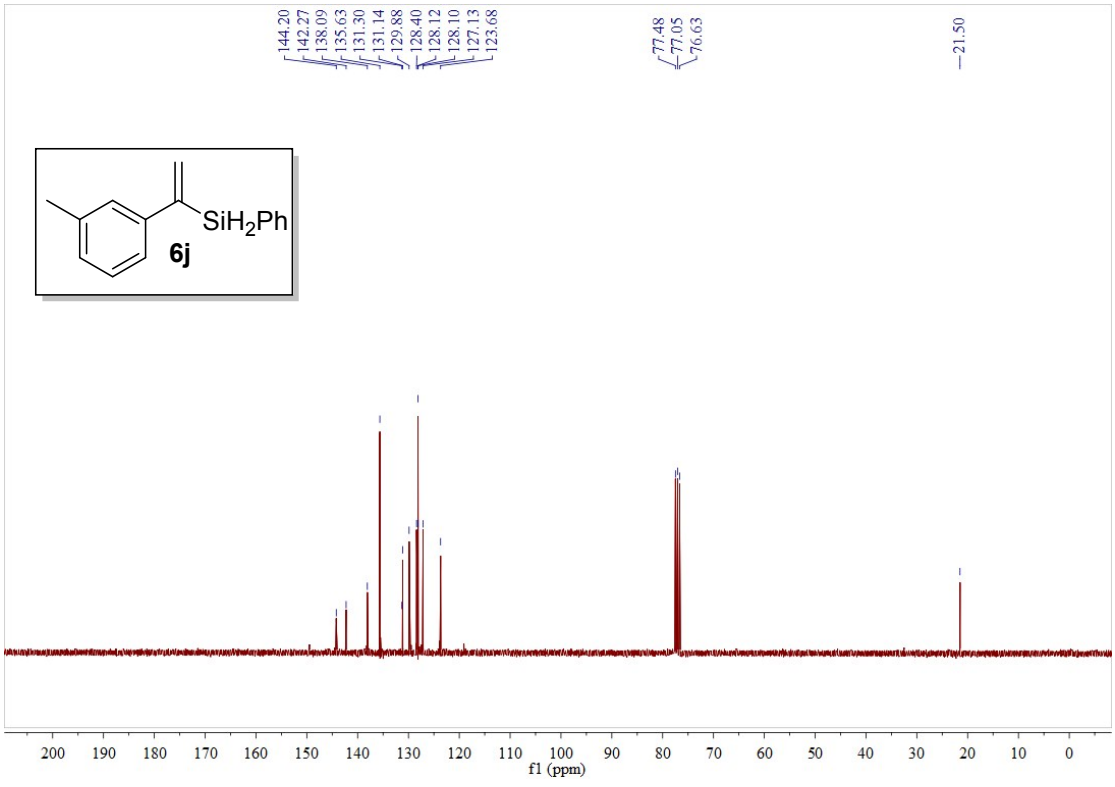
7.39
7.37
7.37
7.26
7.21
7.21
7.20
7.20
7.20
7.19
7.19
7.09
6.24
6.23
5.82
5.81
4.84
2.35
SiH2Ph
6j
2.10
3.14
2.91
1.03
1.00
1.01
1.85
3.00
f1 (ppm)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127.13
123.68
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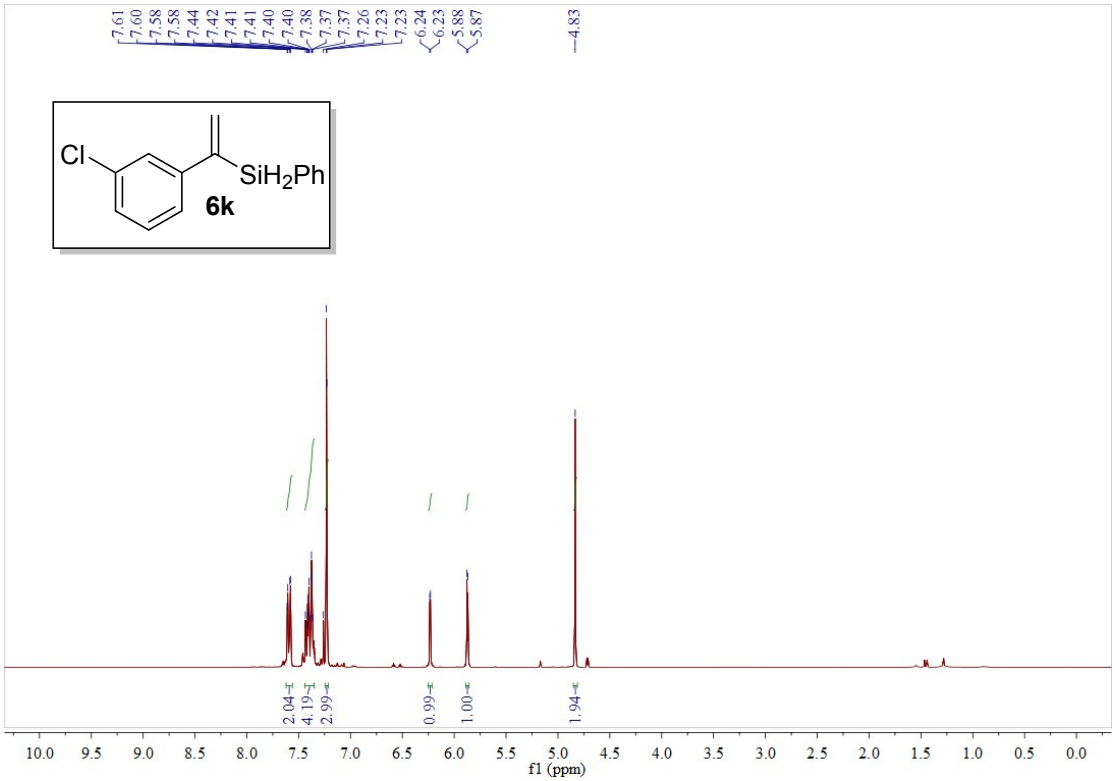
77.05
76.63
21.50
SiH2Ph
6j
f1 (ppm)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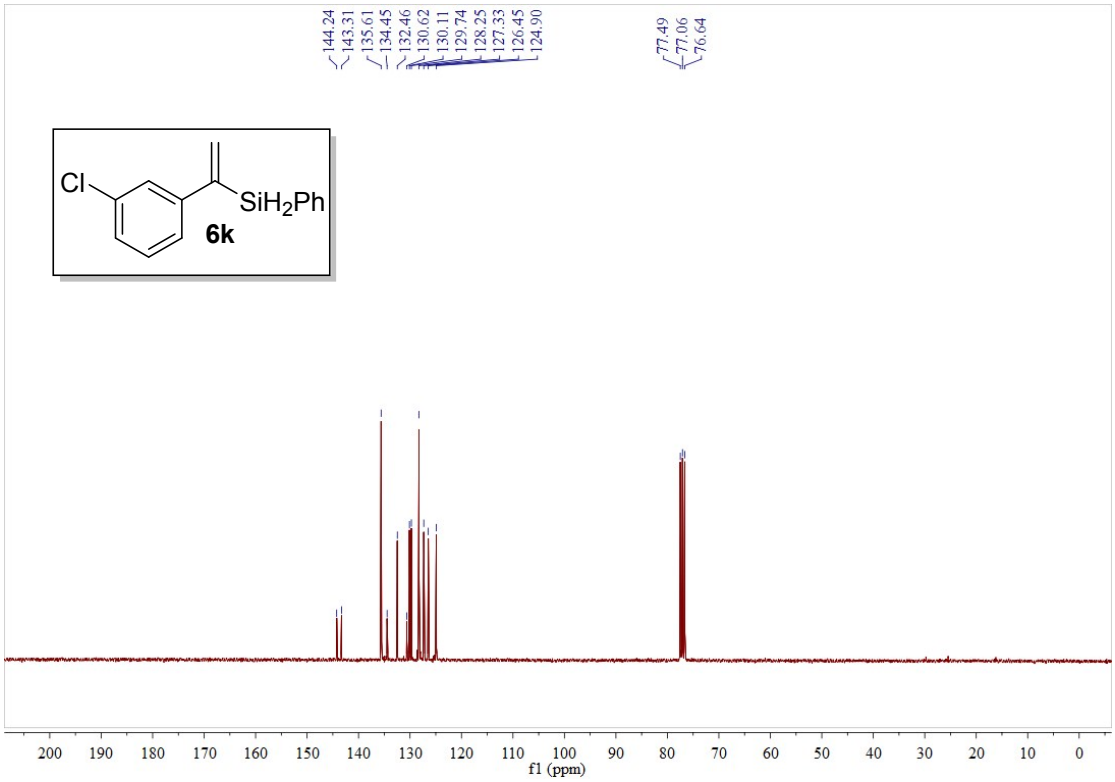
7.40
7.40
7.38
7.37
7.37
7.26
7.23
7.23
6.24
6.23
5.88
5.87
4.83
Cl
SiH2Ph
6k
2.04
4.19
2.99
0.99
1.00
1.94
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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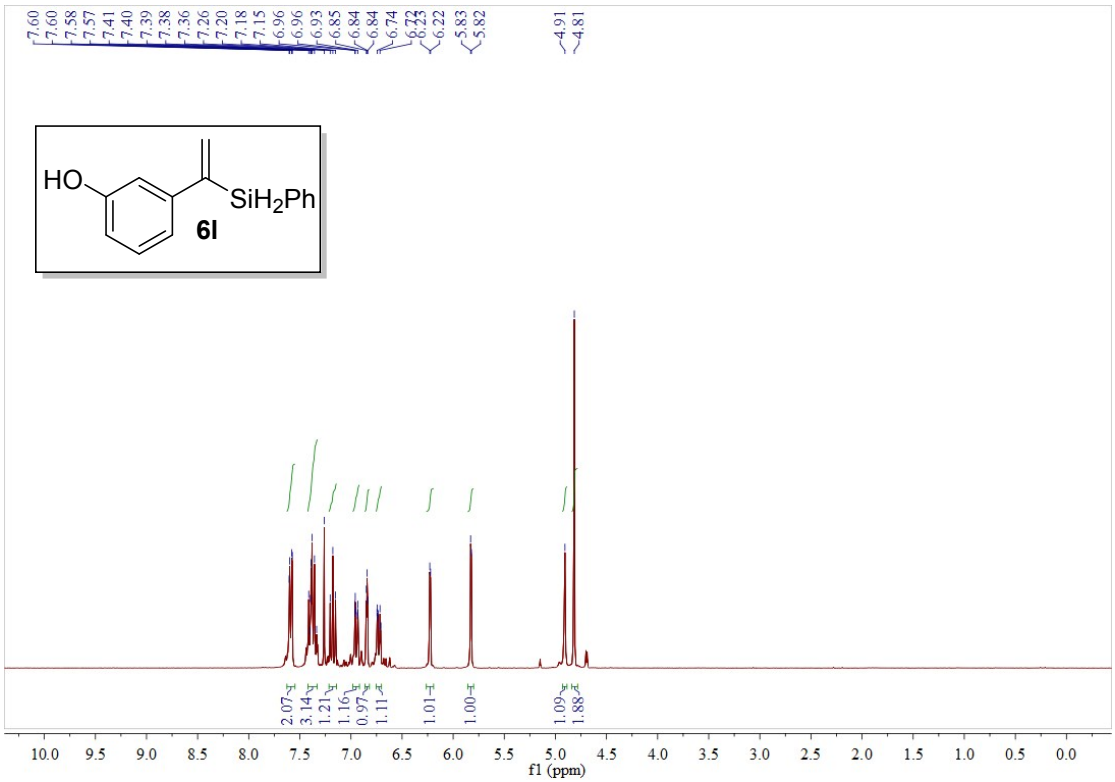
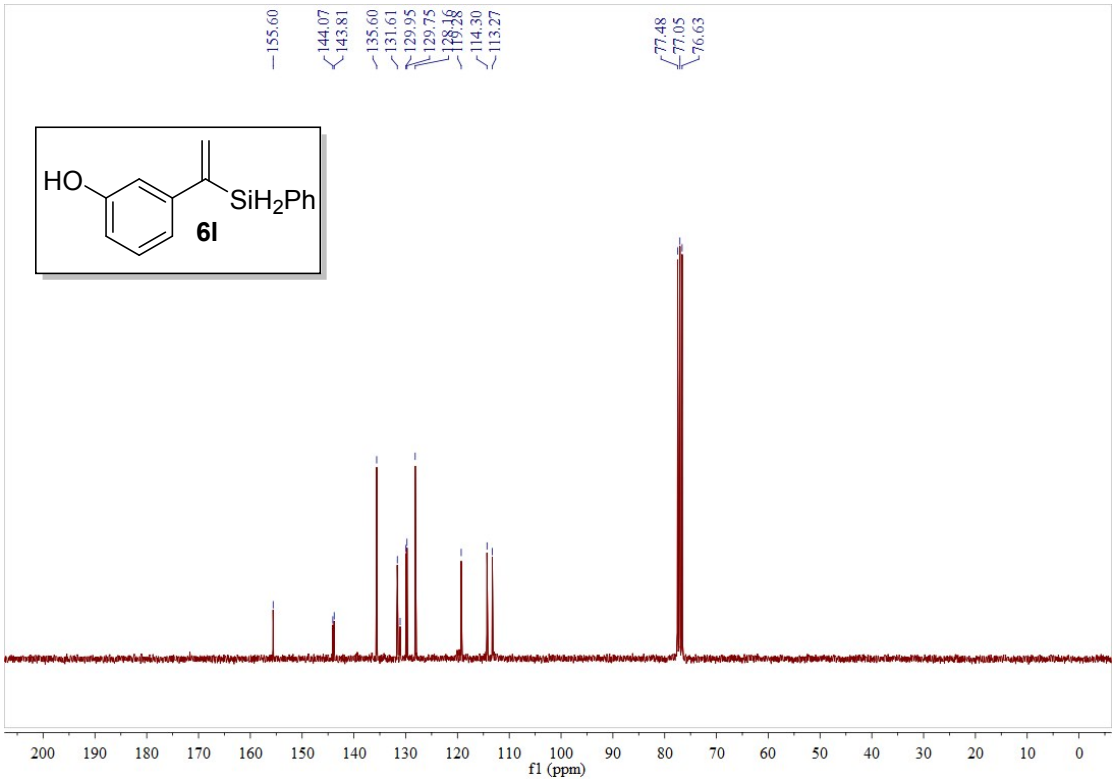
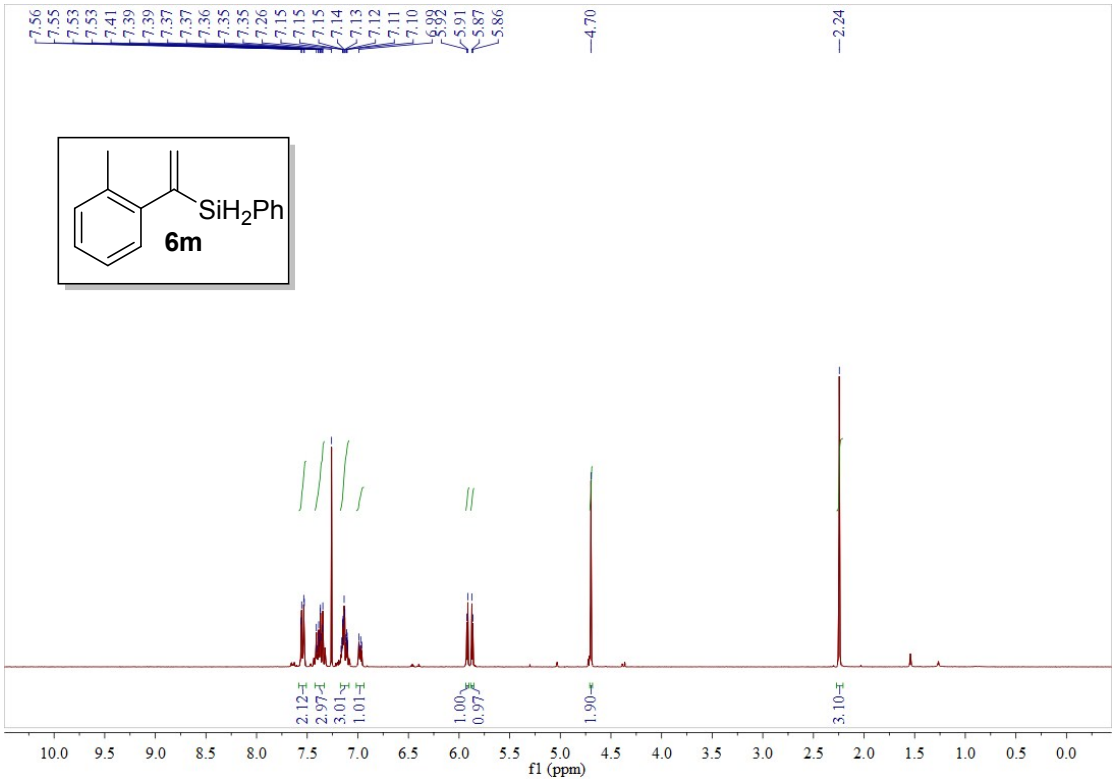
130.62
130.11
129.74
128.25
127.33
126.45
124.90
77.49
77.06
76.64
Cl
SiH2Ph
6k
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


HO
SiH2Ph
6l
f1 (ppm)


HO
SiH2Ph
6l
f1 (ppm)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7.15
7.15
7.15
7.14
7.13
7.12
7.11
7.10
6.98
5.92
5.91
5.87
5.86
4.70
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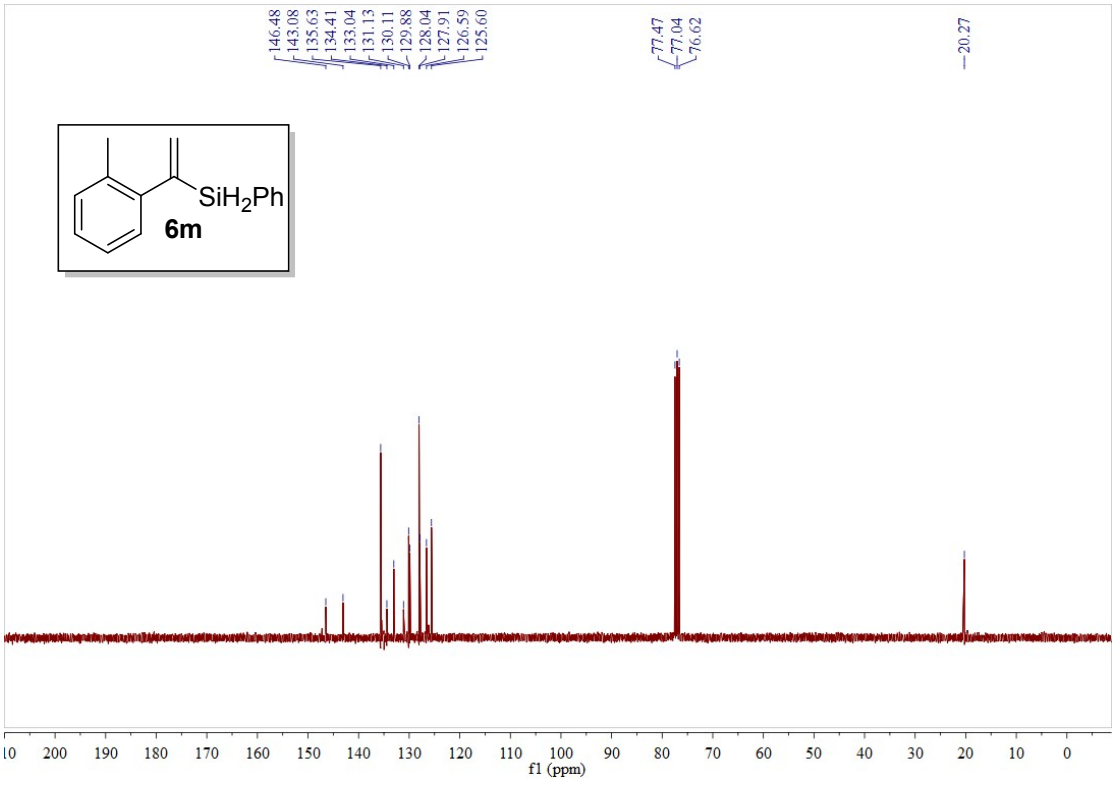
SiH2Ph
6m
2.12
2.97
3.01
1.01
1.00
0.97
1.90
3.10
f1 (ppm)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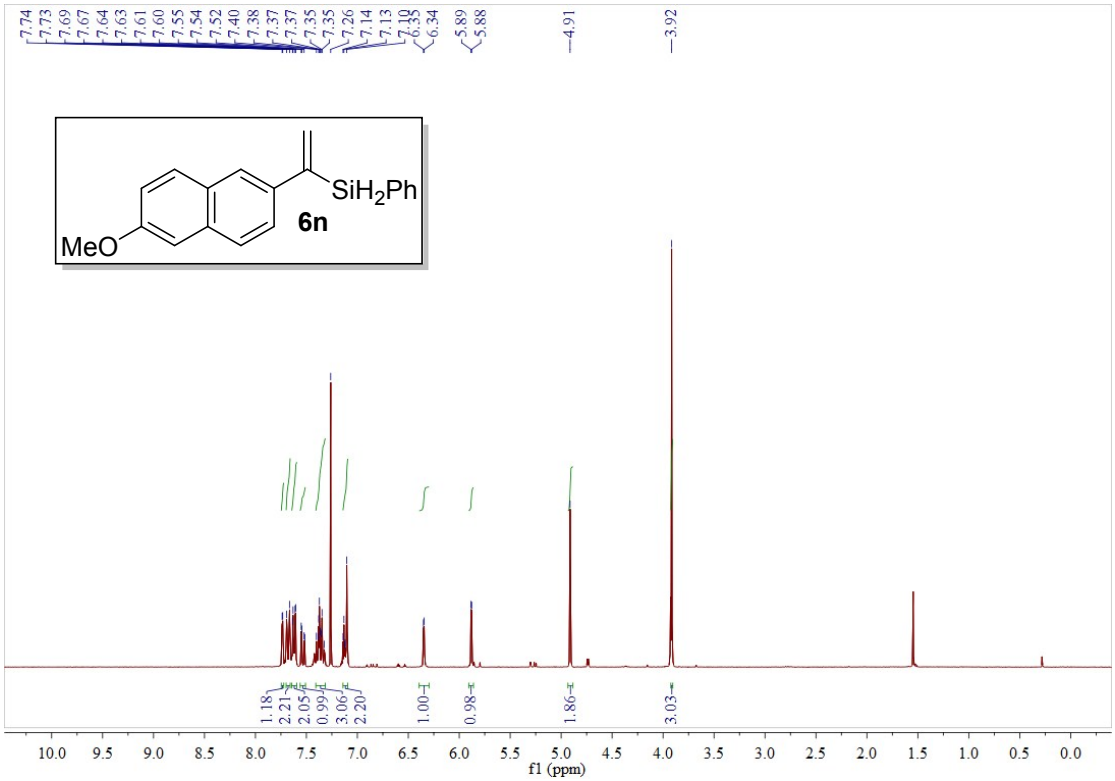
131.13
130.11
129.88
128.04
127.91
126.59
125.60
77.47
77.04
76.62
20.27
SiH2Ph
6m
f1 (ppm)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7.63
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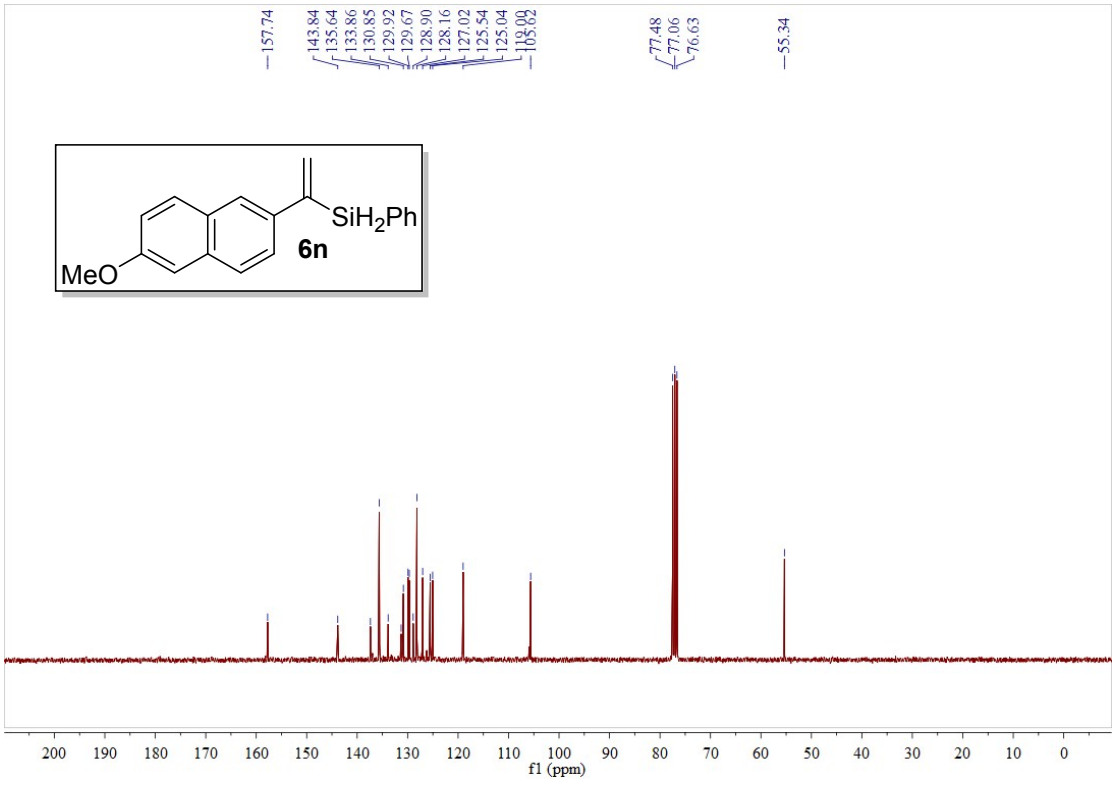
7.54
7.52
7.40
7.38
7.37
7.37
7.35
7.35
7.26
7.14
7.13
7.10
6.35
6.34
5.89
5.88
4.91
3.92
SiH2Ph
6n
MeO
1.18
2.21
2.05
0.99
3.06
2.20
1.00
0.98
1.86
3.03
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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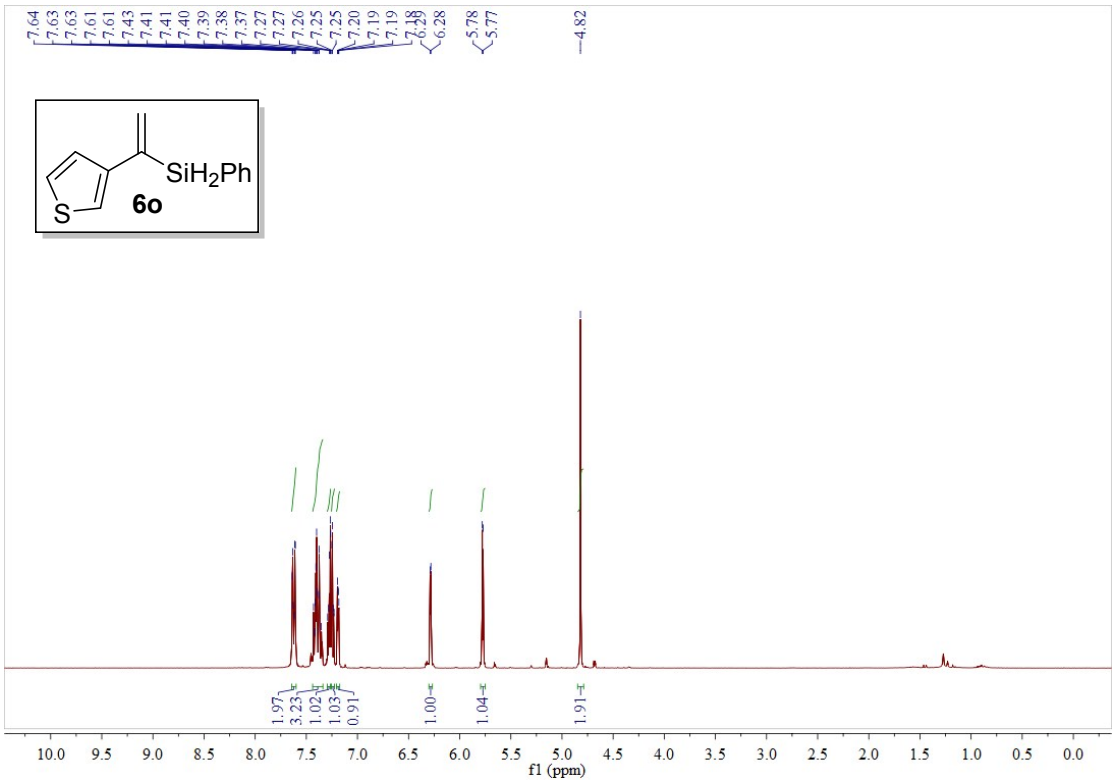
129.92
129.67
128.90
128.16
127.02
125.54
125.04
119.00
105.02
77.48
77.06
76.63
55.34
SiH2Ph
6n
MeO
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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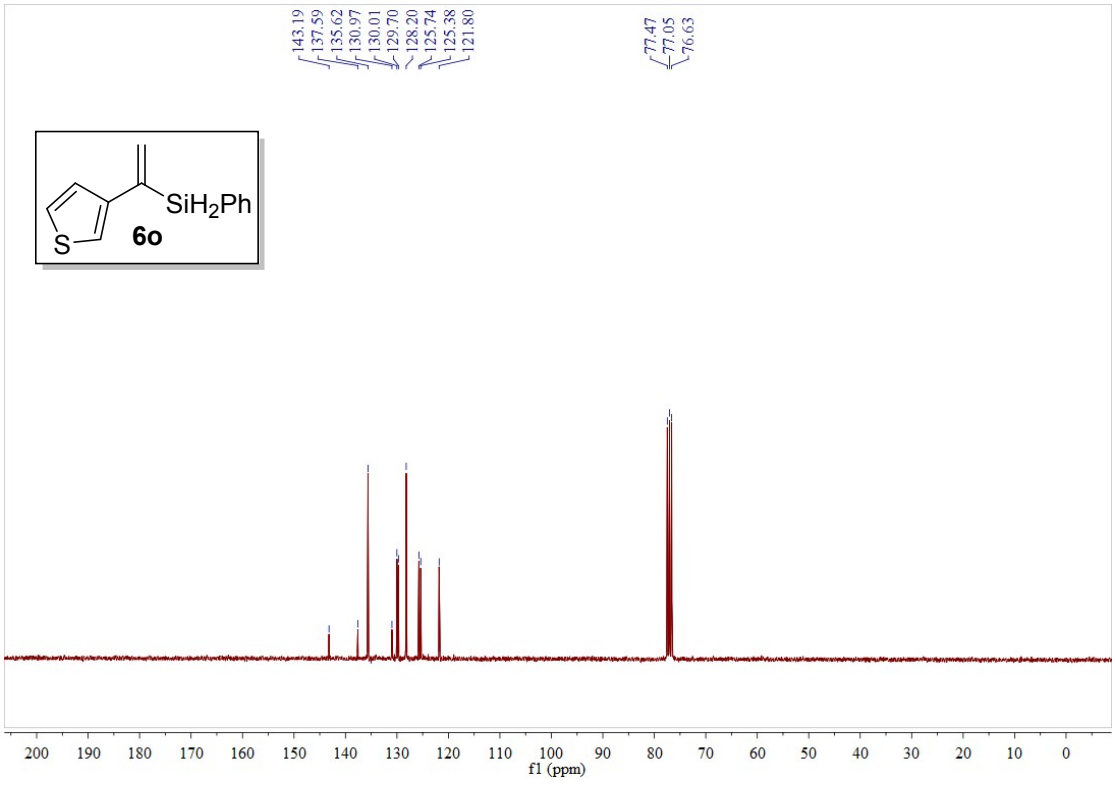
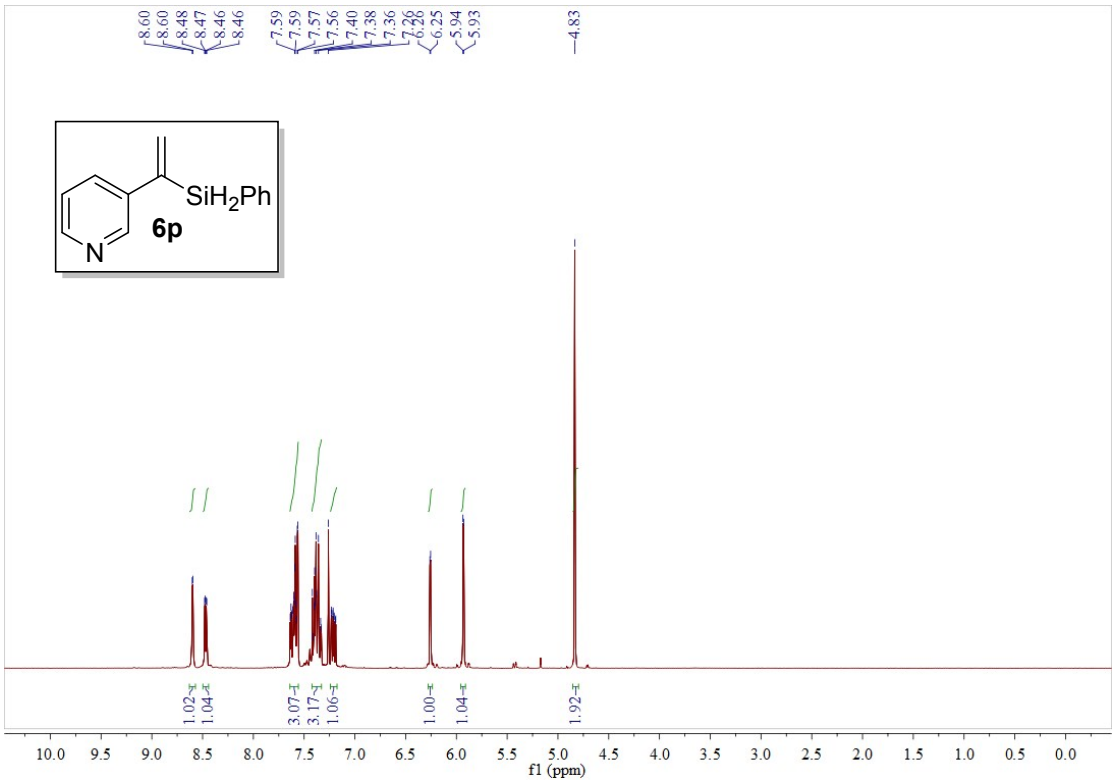
7.41
7.40
7.39
7.38
7.37
7.27
7.27
7.26
7.25
7.25
7.20
7.19
7.19
6.29
6.28
5.78
5.77
4.82
SiH2Ph
S
6o
1.97
3.23
1.02
1.03
0.91
1.00
1.04
1.91
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


143.19
137.59
135.62
130.97
130.01
129.70
128.20
125.74
125.38
121.80
77.47
77.05
76.63
SiH2Ph
S
6o
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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8.60
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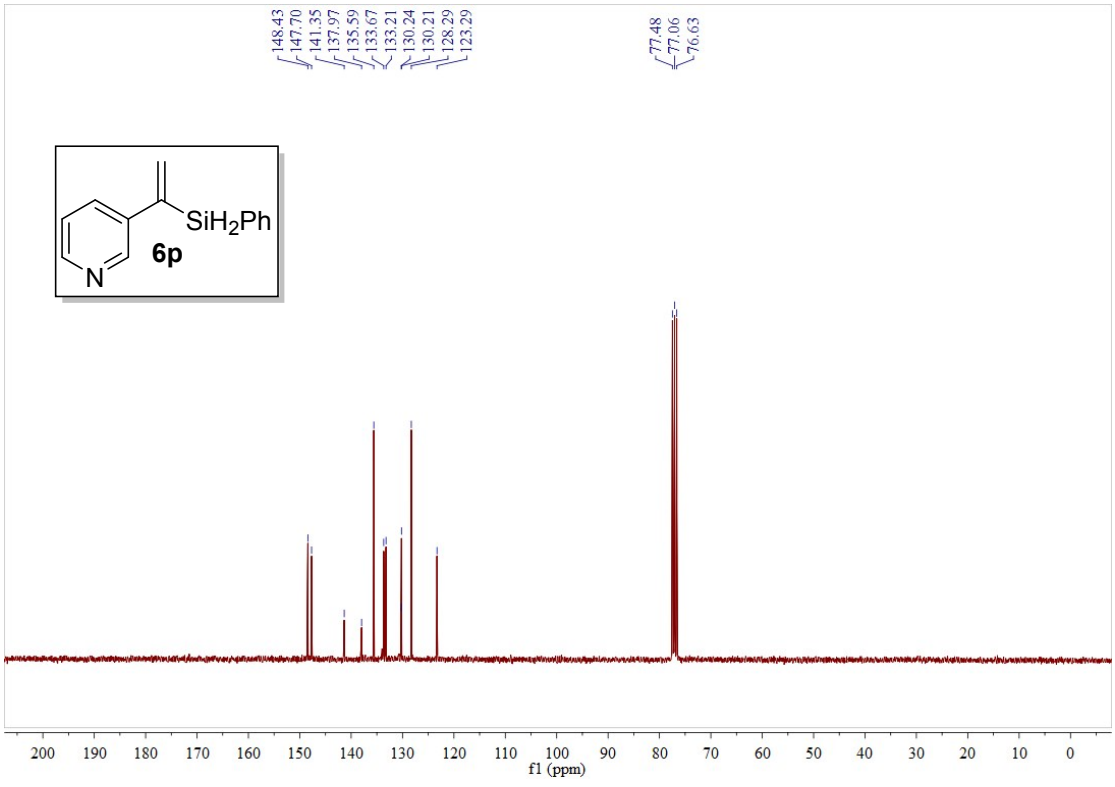
8.46
8.46
7.59
7.59
7.57
7.56
7.40
7.38
7.36
7.26
6.25
5.94
5.93
4.83
SiH2Ph
6p
N
1.02
1.04
3.07
3.17
1.06
1.00
1.04
1.92
f1 (ppm)


148.43
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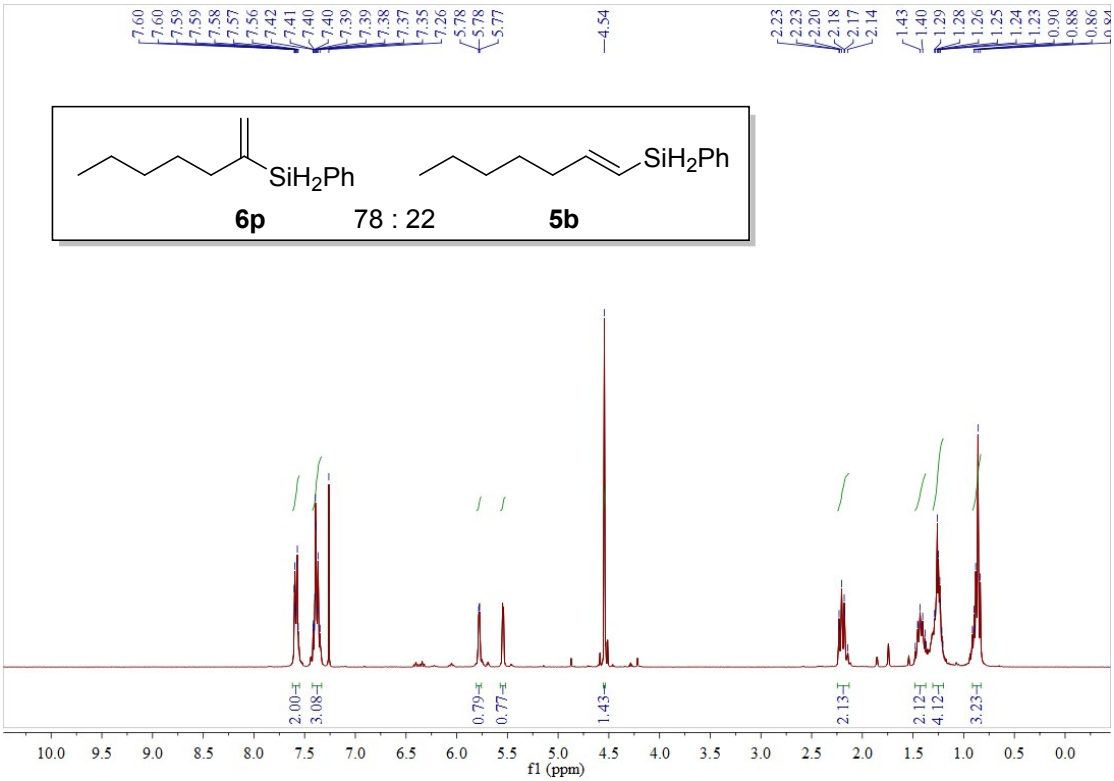
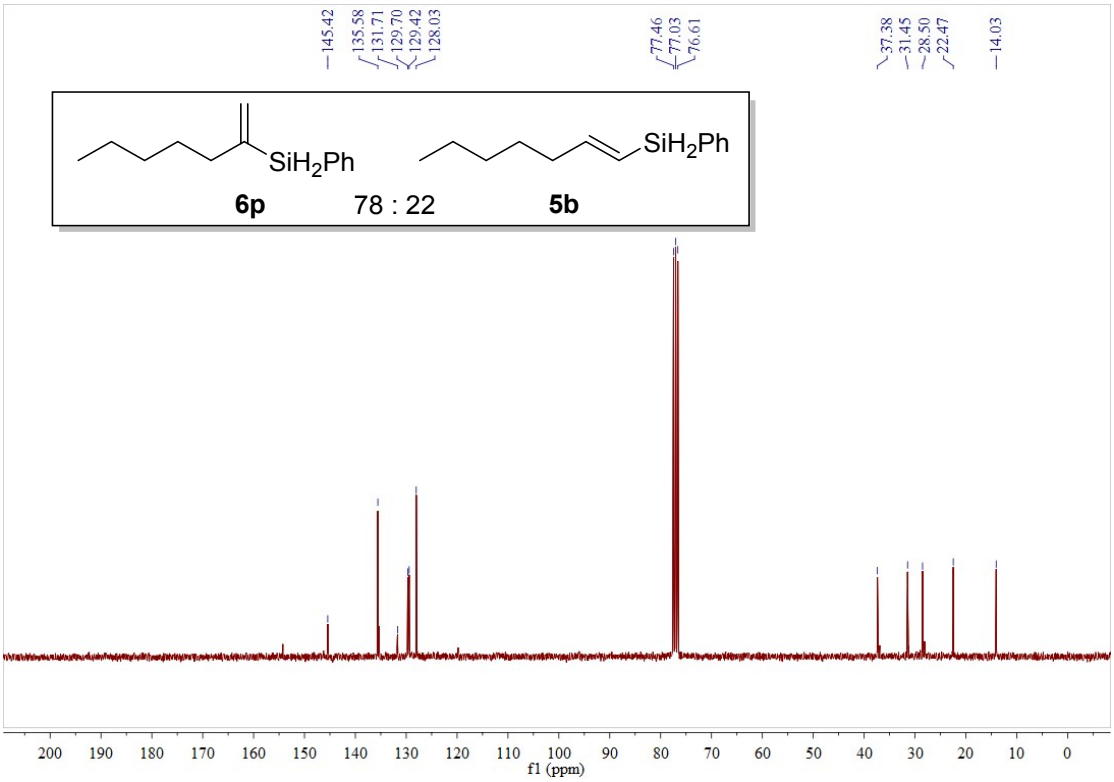
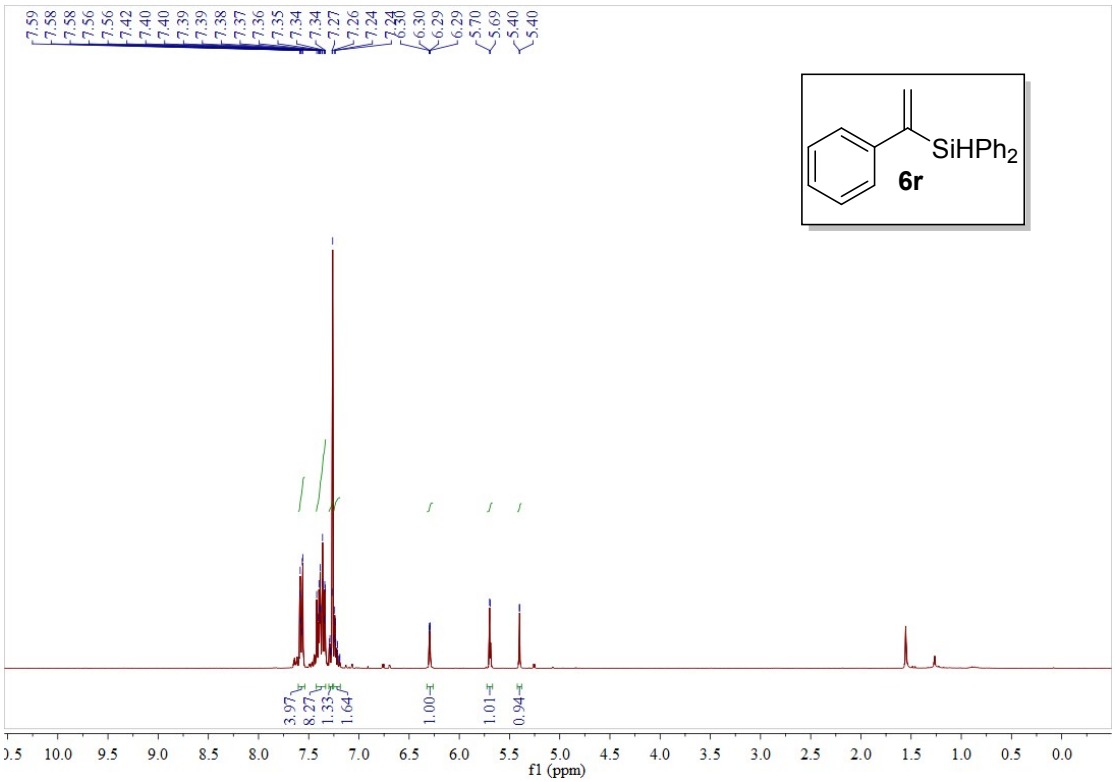
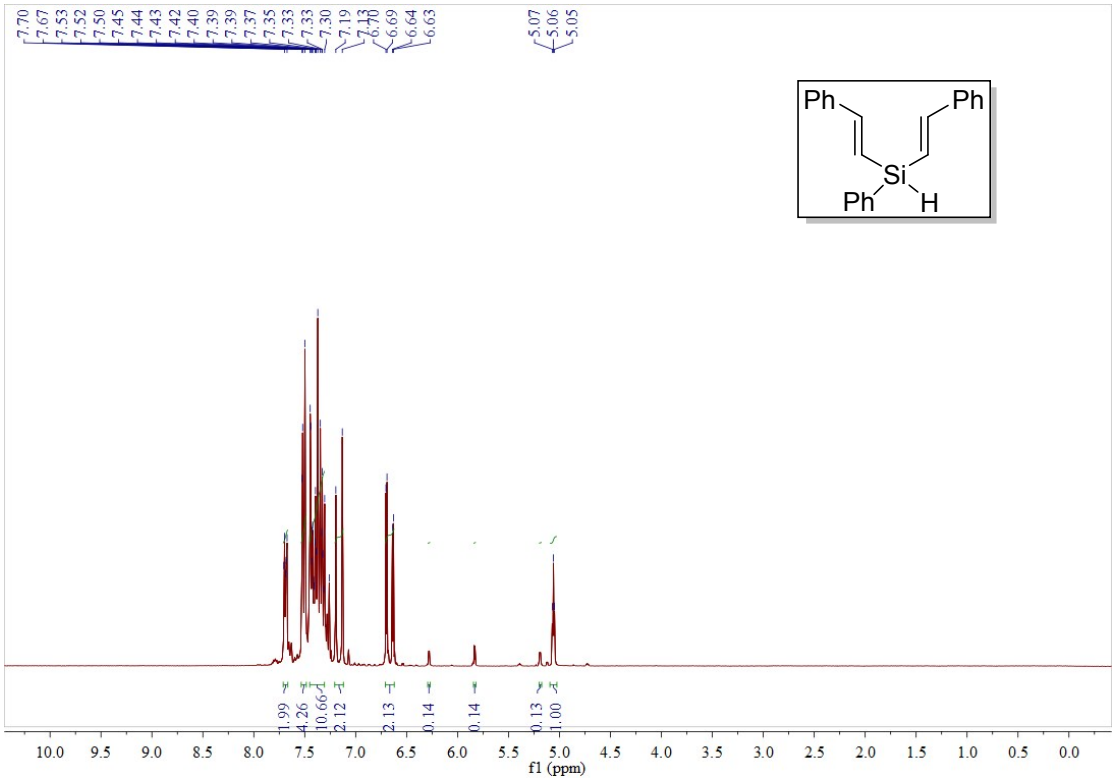
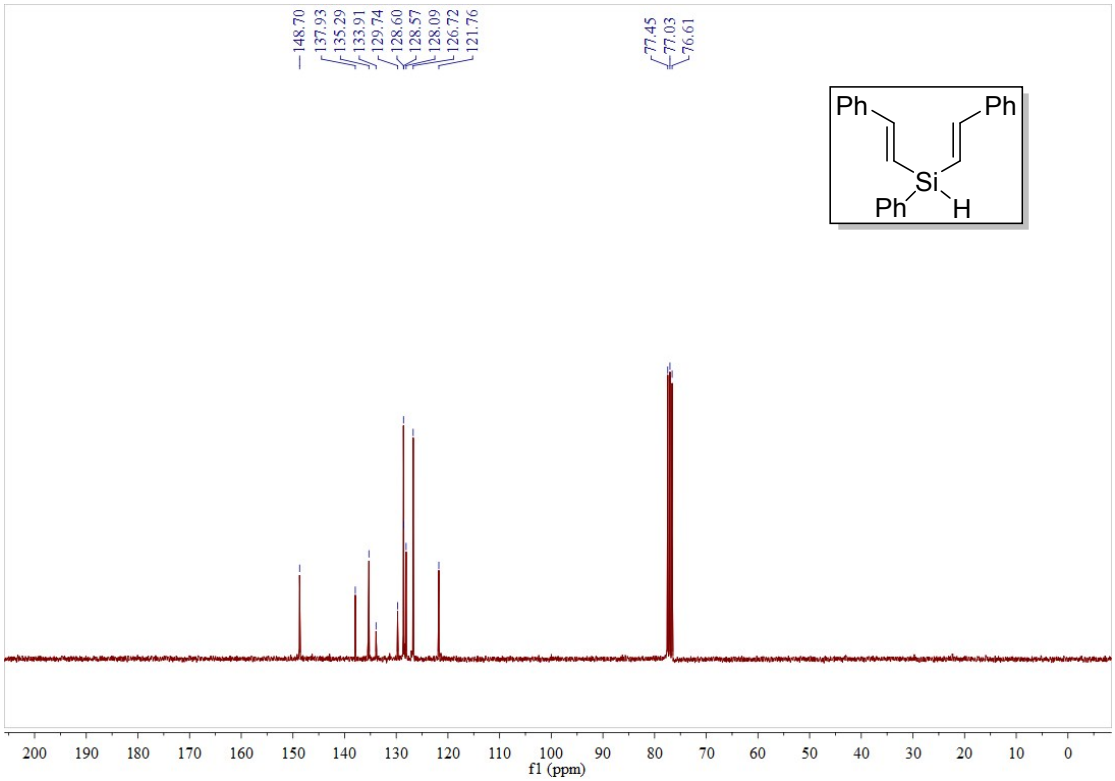
135.59
133.67
133.21
130.24
130.21
128.29
123.29
77.48
77.06
76.63
SiH2Ph
6p
N
f1 (ppm)

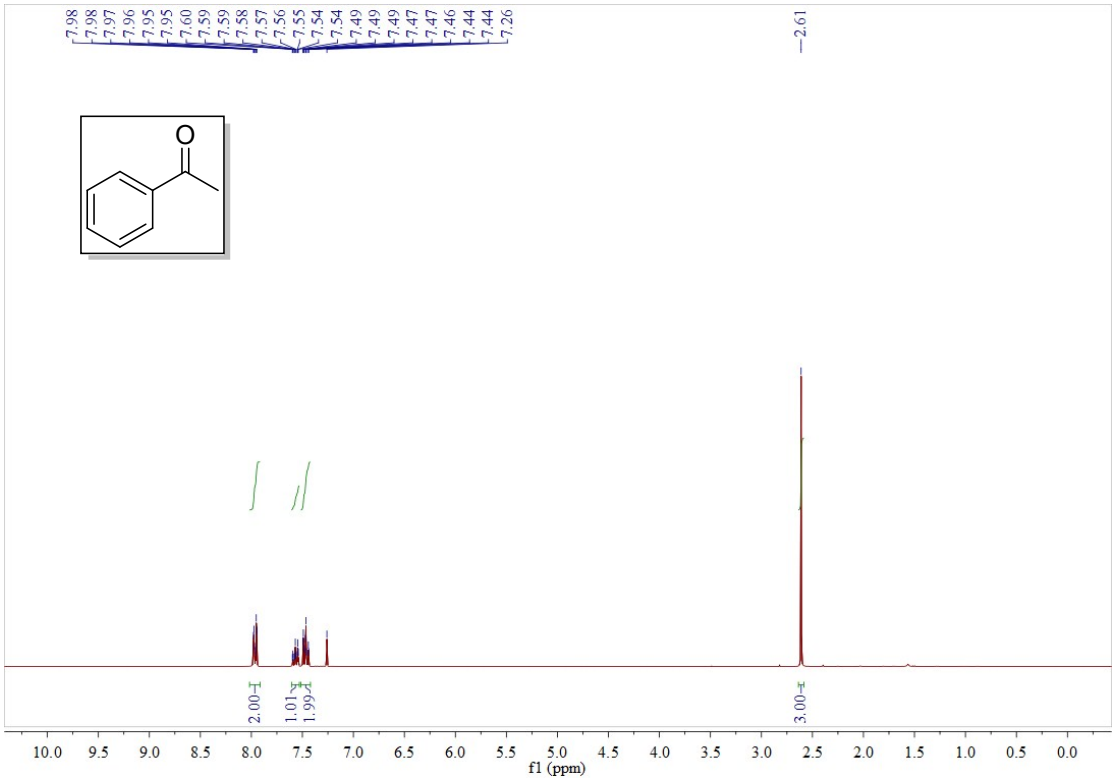

SiH2Ph
6p
78 : 22
5b
SiH2Ph
f1 (ppm)


SiH2Ph
6p
78 : 22
5b
SiH2Ph
f1 (ppm)


SiHPh2
6r
f1 (ppm)


Ph
Ph
Si
Ph
H
f1 (ppm)


148.70
137.93
135.29
133.91
129.74
128.60
128.57
128.09
126.72
121.76
77.45
77.03
76.61
Ph
Ph
Si
Ph
H
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


7.98
7.98
7.97
7.96
7.95
7.95
7.60
7.59
7.59
7.58
7.57
7.56
7.55
7.54
7.54
7.49
7.49
7.49
7.47
7.47
7.46
7.44
7.44
7.26
2.61
O
2.00
1.01
1.99
3.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)