Transition Metal–Free Stereospecific Access to (*E*)-(1-fluoro-2-arylvinyl)phosphine Borane Complexes

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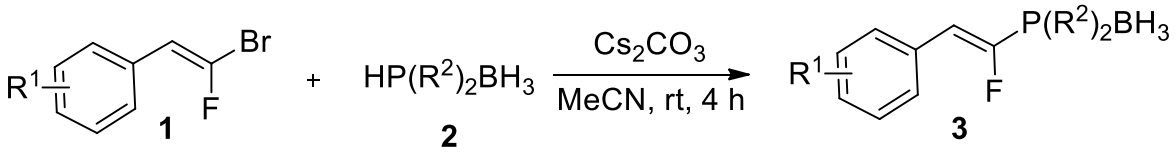
1. General information

Commercially available reagents were used without further purification. Anhydrous solvents were purchased from Sigma-Aldrich. Chromatography was carried out using neutral alumina 90 (70-230 mesh); the following solvents were used: DCM = dichloromethane, MeCN = acetonitrile. Melting points (mp) were determined on a Fisher Scientific hot stage melting point apparatus and are uncorrected. ^{1}H, ^{11}B, ^{13}C, ^{19}F and ^{31}P NMR spectra were recorded using a Bruker AC 400 spectrometer operating at 400 MHz (^{1}H), 160 MHz (^{11}B), 100 MHz (^{13}C), 376 MHz (^{19}F), 162 MHz (^{31}P), or a Bruker AC 300 spectrometer operating at 300 MHz (^{1}H), 120 MHz (^{11}B), 75 MHz (^{13}C), 282 MHz (^{19}F), 122 MHz (^{31}P), respectively. The chemical shifts (δ) were calibrated on residual proton and carbon resonances of $CDCl_3$ (^{1}H, 7.26 ppm and ^{13}C, 77.2 ppm), on boron resonance of BF_3-Et_2O (^{11}B, 0.0 ppm), on fluorine resonance of $CFCl_3$ (^{19}F, 0.0 ppm) and on phosphorus resonance of PPh_3 (^{31}P, 0.0 ppm). In the ^{13}C NMR spectra, signals corresponding to CH, CH_2, or CH_3 groups were assigned from DEPT-135. The multiplicity signals were indicated with the following abbreviations: s (singlet), d (doublet), t (triplet), q (quartet), m (multiplet), and b (broad) and the combinations thereof. Proton decoupled ^{13}C NMR spectra were indicated with the $\{^{1}H\}$ label. IR spectra were recorded on Perkin Elmer Spectrum 100 FT IR spectrometer. High Resolution Mass Spectra (HRMS) were recorded on a JEOL AccuTof 4G spectrometer coupled to a GC HP Agilent 7890 in ElectroSpray Ionisation mode (ESI) or Field Desorption (FD). EPR-ST experiments were carried out using an X-Band spectrometer (MS 400 Magnettech). The ESR spectra simulations were carried out using the WINSIM software. *Gem*-Bromofluoroalkenes were prepared according to our previous report (X. Lei, G. Dutheuil, X. Pannecoucke, J.-C. Quirion *Org. Lett.* **2004**, *6*, 2101).

2. General procedure for the coupling reaction

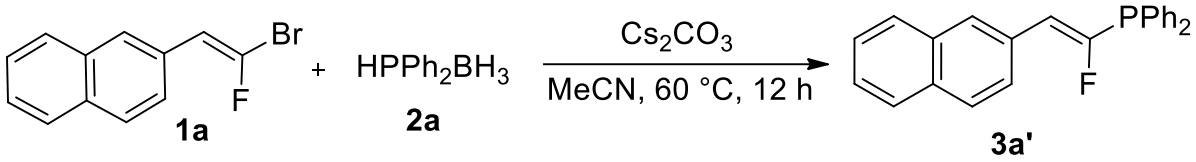
A. General coupling reaction



In a dry vial under argon atmospher was added *gem*-bromofluoroalkene **1** (1 equiv), phosphine borane **2** (1.1 equiv), and Cs_2CO_3 (1.2 equiv). The vial was then filled with dry and degassed

MeCN (5 mL/mmol), then was stirred for 4 h at room temperature. The crude was then chromatographed on neutral alumina to afford the pure product **3**.

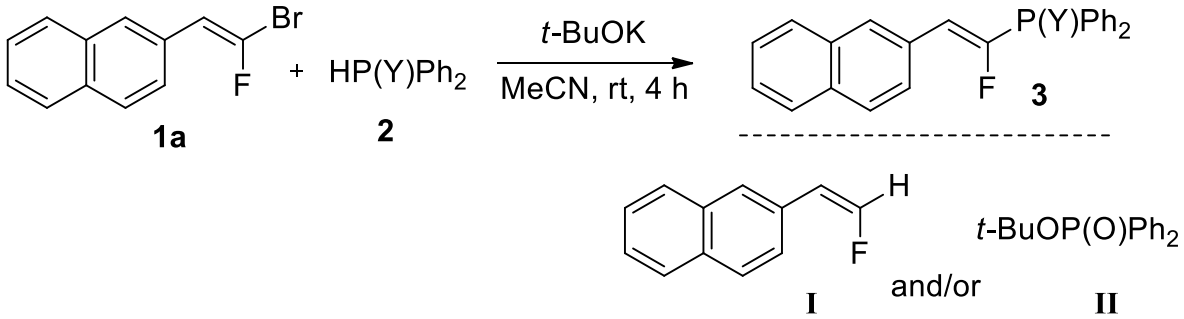
B. *One pot* coupling/deboration sequence



In a dry vial under argon atmosphere was added *gem*-bromofluoroalkene **1a** (0.20 mmol, 50 mg, 1 equiv), phosphine borane **2a** (0.22 mmol, 44 mg, 1.1 equiv), and Cs_2CO_3 (0.24 mmol, 78 mg, 1.2 equiv). The vial was then filled with dry and degassed MeCN (1 mL, 5 mL/mmol), then was stirred for 12 h at 60 °C. The crude was then chromatographed on silica gel to afford the pure product **3a'** (30 mg, 43%).

3. Optimization of the reaction and control experiments

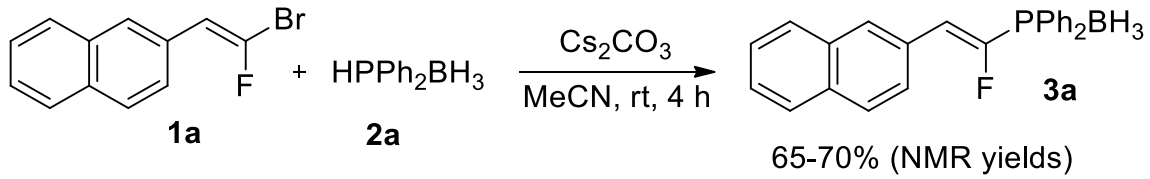
A. Variation of the phosphine



Entry	Y	Yield[a]	Notes
1	BH_3	21% (**3a**)	-
2	O	0%	Products **I** and **II**
3	-	0%	Product **I**

[a] Isolated yields.

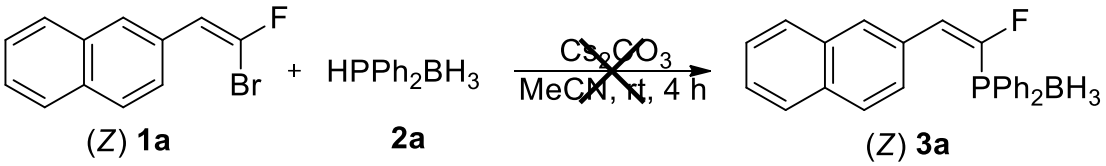
B. Optimization of the purification conditions for the phosphine borane



Entry	Purification method	Yield[a]	Notes
1	Filtration[b]	n.d.	No separation of **3a** and $HPPh_2BH_3$
2	Silica gel pad[b]	n.d.	-
3	Silica gel column[b]	25%	-
4	Dehydrated silica gel column[b]	14%	-
5	Basic alumina column[b]	32%	-
6	Basic alumina pad[b]	45%	-
7	Neutral alumina pad[b]	49%	Few by-products
8	Neutral alumina column[c]	63%	-
9	Neutral alumina column[c]	n.d.	Degradation

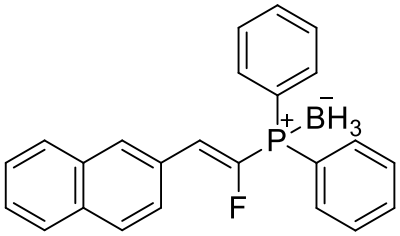
[a] Isolated yields. [b] With CH_2Cl_2 stabilized with amylene. [c] With CH_2Cl_2 stabilized with ethanol. n.d.: not determined.

C. Reaction with (*Z*) *gem*-bromofluoroalcènes

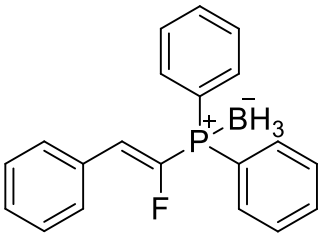


In a dry vial under argon atmosphere was added *gem*-bromofluoroalkene (*Z*) **1a** (1 equiv), phosphine borane **2** (1.1 equiv), and Cs_2CO_3 (1.2 equiv). The vial was then filled with dry and degassed MeCN (5 mL/mmol), then was stirred for 4 h at room temperature. Degradation of starting material (*Z*) **1a** was observed by ^{19}F NMR, probably because of the basic conditions, according to previous report: X. Lei, G. Dutheuil, X. Pannecoucke, J.-C. Quirion *Org. Lett.* **2004**, *6*, 2101.

4. Experimental data for compounds 3a-3m

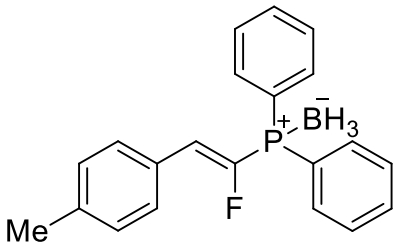


(*E*)-((1-Fluoro-2-(naphth-2-yl)vinyl)diphenylphosphonio)trihydroborate 3a: (*E*)-2-(2-bromo-2-fluorovinyl)naphthalene (0.2 mmol, 50 mg), diphenylphosphine borane (0.22 mmol, 44 mg), Cs_2CO_3 (0.24 mmol, 78 mg) in MeCN (1 mL) were reacted according to the general procedure. The crude product was chromatographed on neutral alumina eluting with pure pentane to pentane/DCM 8/2 to afford the desired compound in 63% yield (46 mg) as a colourless solid. mp 173-175 °C. IR: 3058, 2923, 2849, 2392, 2348, 1435, 1054, 910, 821 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$): δ 8.11 (s, 1H), 7.86-7.74 (m, 6H), 7.66-7.40 (m, 10H), 7.04 (dd, $^3J_{H-F}$ = 42.7, $^3J_{H-P}$ = 8.9 Hz, 1H), 1.7-0.7 (bm, 3H). ^{13}C NMR {^1H} (100 MHz, $CDCl_3$): δ 153.1 (dd, $^1J_{C-F}$ = 295.4, $^1J_{C-P}$ = 62.9 Hz, Cq), 133.6 (d, *J* = 1.7 Hz, Cq), 133.3 (s, Cq), 133.2 (d, $^2J_{C-P}$ = 10.0 Hz, 4xCH), 132.0 (d, $^4J_{C-P}$ = 2.4 Hz, 2xCH), 130.4 (d, *J* = 7.7 Hz, CH), 129.3 (dd, ^3J = 10.9, 2.4 Hz, Cq), 129.1 (d, $^3J_{C-P}$ = 10.6 Hz, 4xCH), 128.7 (s, CH), 128.5 (s, CH), 127.8 (s, CH), 127.3 (s, CH), 126.9 (d, *J* = 7.9 Hz, CH), 126.72 (d, $^1J_{C-P}$ = 60.9 Hz, 2xCq), 126.68 (s, CH), 125.3 (d, ^2J = 26.6 Hz, CH). ^{11}B NMR (160 MHz, $CDCl_3$): δ -38.3 (m). ^{19}F NMR (376 MHz, $CDCl_3$): δ -114.6 (dd, $^3J_{F-H}$ = 42.7, $^2J_{F-P}$ = 17.5 Hz). ^{31}P NMR (162 MHz, $CDCl_3$): δ 21.1 (m). HRMS (ESI-TOF): calcd for $C_{24}H_{21}BFNaP$ *m/z* 393.1356 $[M+Na]^+$, found 393.1345.

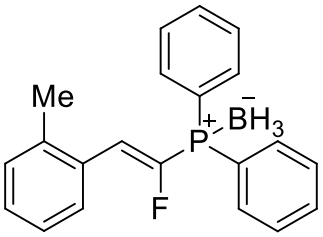


(*E*)-((1-Fluoro-2-phenylvinyl)diphenylphosphonio)trihydroborate 3b: (*E*)-2-(2-bromo-2-fluorovinyl)benzene (0.2 mmol, 40 mg), diphenylphosphine borane (0.22 mmol, 44 mg), Cs_2CO_3 (0.24 mmol, 78 mg) in MeCN (1 mL) were reacted according to the general procedure. The crude product was chromatographed on neutral alumina eluting with pure pentane to pentane/DCM 7/3 to afford the desired compound in 40% yield (25 mg) as a colourless solid.

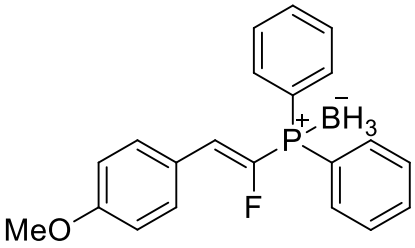
mp 113-115 °C. IR: 3054, 2387, 1485, 1435, 1052, 875, 829 cm^{-1}. ^{1}H NMR (300 MHz, $CDCl_3$): δ 7.77 (dd, *J* = 11.1, 7.6 Hz, 4H), 7.68-7.62 (m, 2H), 7.58-7.45 (m, 6H), 7.43- 7.34 (m, 3H), 6.89 (dd, $^{3}J_{H-F}$ = 42.7, $^{3}J_{H-P}$ = 8.9 Hz, 1H), 1.5-0.7 (bm, 3H). ^{13}C NMR {^{1}H} (75 MHz, $CDCl_3$): δ 152.9 (dd, $^{1}J_{C-F}$ = 295.1, $^{1}J_{C-P}$ = 62.9 Hz, Cq), 133.1 (d, $^{2}J_{C-P}$ = 10.1 Hz, 4xCH), 131.9 (d, $^{4}J_{C-P}$ = 2.5 Hz, 2xCH), 131.8 (dd, ^{3}J = 11.4, 1.7 Hz, Cq), 130.1 (d, *J* = 7.7 Hz, 2xCH), 129.6 (d, *J* = 2.4 Hz, CH), 129.1 (d, $^{3}J_{C-P}$ = 10.6 Hz, 4xCH), 128.9 (s, 2xCH), 126.7 (d, $^{1}J_{C-P}$ = 60.9 Hz, 2xCq), 125.2 (d, ^{2}J = 26.5 Hz, CH). ^{11}B NMR (120 MHz, $CDCl_3$): δ -38.2 (m). ^{19}F NMR (282 MHz, $CDCl_3$): δ -114.7 (dd, $^{3}J_{F-H}$ = 42.7, $^{2}J_{F-P}$ = 17.8 Hz). ^{31}P NMR (122 MHz, $CDCl_3$): δ 21.1 (m). HRMS (FD-TOF): calcd for $C_{20}H_{16}FP$ *m/z* 306.0973 $[M\text{-}BH_3]^+$, found 306.0974.



(*E*)-((1-Fluoro-2-(p-tolyl)vinyl)diphenylphosphonio)trihydroborate 3c: (*E*)-1-(2-bromo-2-fluorovinyl)-4-methylbenzene (0.20 mmol, 43 mg), diphenylphosphine borane (0.22 mmol, 44 mg), Cs_2CO_3 (0.24 mmol, 78 mg) in MeCN (1 mL) were reacted according to the general procedure. The crude product was chromatographed on neutral alumina eluting with pure pentane to pentane/DCM 8/2 to afford the desired compound in 22% yield (15 mg) as a sticky colourless solid. IR: 2930, 2838, 2388, 1593, 1500, 1291, 1254, 1179, 1107, 1057, 1025, 825, 801 cm^{-1}. ^{1}H NMR (300 MHz, $CDCl_3$): δ 7.74 (dd, *J* = 11.1, 7.4 Hz, 4H), 7.61-7.33 (m, 8H), 7.18 (d, *J* = 8.0 Hz, 2H), 6.84 (dd, $^{3}J_{H-F}$ = 42.9, $^{3}J_{H-P}$ = 8.9 Hz, 1H), 2.36 (s, 3H), 1.4-1.1 (bm, 3H). Selected ^{13}C NMR {^{1}H} (75 MHz, $CDCl_3$): δ 139.8 (d, *J* = 2.5 Hz, Cq), 133.2 (d, *J* = 10.1 Hz, Cq), 133.0 (d, $^{2}J_{C-P}$ = 10.0 Hz, 4xCH), 131.7 (d, $^{4}J_{C-P}$ = 2.5 Hz, 2xCH), 130.0 (d, *J* = 7.6 Hz, 2xCH), 129.4 (s, 2xCH), 128.9 (d, $^{3}J_{C-P}$ = 10.6 Hz, 4xCH), 126.7 (d, $^{1}J_{C-P}$ = 61.0 Hz, 2xCq), 125.1 (d, ^{2}J = 26.7 Hz, CH), 21.5 (s, CH_3). ^{11}B NMR (120 MHz, $CDCl_3$): δ -37.8 (m). ^{19}F NMR (282 MHz, $CDCl_3$): δ -116.1 (dd, $^{3}J_{F-H}$ = 43.0, $^{2}J_{F-P}$ = 17.5 Hz). ^{31}P NMR (122 MHz, $CDCl_3$): δ 21.1 (m). HRMS (ESI-TOF): calcd for $C_{21}H_{19}FP$ *m/z* 321.1208 $[M\text{-}BH_3+H]^+$, found 321.1212.

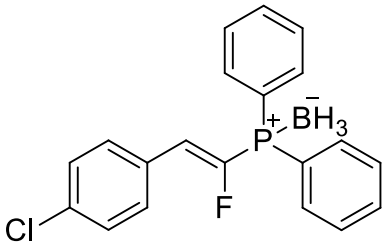


(*E*)-((1-Fluoro-2-(o-tolyl)vinyl)diphenylphosphonio)trihydroborate 3d: (*E*)-1-(2-bromo-2-fluorovinyl)-2-methylbenzene (0.20 mmol, 43 mg), diphenylphosphine borane (0.22 mmol, 44 mg), Cs_2CO_3 (0.24 mmol, 78 mg) in MeCN (1 mL) were reacted according to the general procedure. The crude product was chromatographed on neutral alumina eluting with pure pentane to pentane/DCM 8/2 to afford the desired compound in 84% yield (56 mg) as a sticky colourless solid. IR: 3058, 2924, 2387, 2340, 1482, 1436, 1107, 1053, 830 cm^{-1}. ^1H NMR (300 MHz, $CDCl_3$): δ 7.84-7.75 (m, 5H), 7.64-7.56 (m, 2H), 7.55-7.48 (m, 4H), 7.31-7.25 (m, 3H), 7.17 (dd, $^3J_{H-F}$ = 42.2, $^3J_{H-P}$ = 9.3 Hz, 1H), 2.41 (s, 3H), 1.6-1.2 (bm, 3H). ^{11}B NMR (120 MHz, $CDCl_3$): δ -38.5 (m). ^{19}F NMR (282 MHz, $CDCl_3$): δ -116.4 (dd, $^3J_{F-H}$ = 42.2, $^2J_{F-P}$ = 18.5 Hz). ^{31}P NMR (122 MHz, $CDCl_3$): δ 21.6 (m). HRMS (ESI-TOF): calcd for $C_{21}H_{19}FP$ *m/z* 321.1208 $[M-BH_3+H]^+$, found 321.1209.

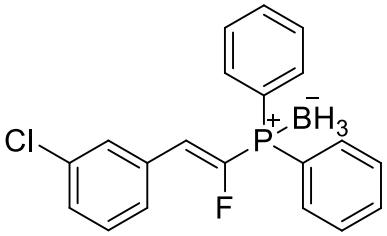


(*E*)-((2-(4-Methoxyphenyl)-1-fluorovinyl)diphenylphosphonio)trihydroborate 3e: (*E*)-1-(2-bromo-2-fluorovinyl)-4-methoxybenzene (0.2 mmol, 46 mg), diphenylphosphine borane (0.22 mmol, 44 mg), Cs_2CO_3 (0.24 mmol, 78 mg) in MeCN (1 mL) were reacted according to the general procedure. The crude product was chromatographed on neutral alumina eluting with pentane/DCM 8/2 to afford the desired compound in 63% yield (46 mg) as a colourless solid. mp 85-87 °C. IR: 3056, 2933, 2837, 2386, 2355, 2342, 1605, 1509, 1436, 1251, 1178, 1055, 1028, 828 cm^{-1}. ^1H NMR (300 MHz, $CDCl_3$): δ 7.70-7.54 (m, 4H), 7.53-7.29 (m, 8H), 6.78 (d, *J* = 8.0 Hz, 2H), 6.71 (dd, $^3J_{H-F}$ = 42.3, $^3J_{H-P}$ = 8.5 Hz, 1H), 3.70 (s, 3H), 1.3-0.8 (bm, 3H). ^{13}C NMR {^1H} (75 MHz, $CDCl_3$): δ 160.4 (d, *J* = 3.1 Hz, Cq), 150.9 (dd, $^1J_{C-F}$ = 291.5, $^1J_{C-P}$ 64.9 Hz, Cq), 133.0 (d, $^2J_{C-P}$ = 10.0 Hz, 4xCH), 131.7 (m, 4xCH), 128.9 (d, $^3J_{C-P}$ = 10.6 Hz, 4xCH), 126.9 (d, $^1J_{C-P}$ = 61.2 Hz, 2xCq), 124.8 (d, *J* = 27.1 Hz, CH), 124.5 (dd, *J* = 11.8, 1.5 Hz, Cq), 114.2 (s, 2xCH), 55.3 (s, CH_3). ^{11}B NMR (160 MHz, $CDCl_3$): δ -38.2 (m). ^{19}F NMR (376 MHz,

$CDCl_3$): δ -118.9 (dd, $^3J_{F-H}$ = 43.3, $^2J_{F-P}$ = 18.8 Hz). ^{31}P NMR (162 MHz, $CDCl_3$): δ 20.4 (m). HRMS (ESI-TOF): calcd for $C_{21}H_{19}FOP$ *m/z* 337.1158 $[M-BH_3+H]^+$, found 337.1161.

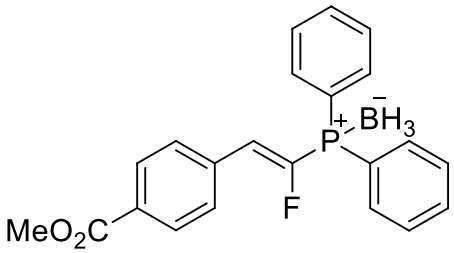


(*E*)-((2-(4-Chlorophenyl)-1-fluorovinyl)diphenylphosphonio)trihydroborate 3f: (*E*)-1-(2-bromo-2-fluorovinyl)-4-chlorobenzene (0.2 mmol, 47 mg), diphenylphosphine borane (0.22 mmol, 44 mg), Cs_2CO_3 (0.24 mmol, 78 mg) in MeCN (1 mL) were reacted according to the general procedure. The crude product was chromatographed on neutral alumina eluting with pentane/DCM 9/1 to pentane/DCM 8/2 to afford the desired compound in 64% yield (45 mg) as a colourless solid. mp 119-121 °C. IR: 2376, 1492, 1434, 1108, 1091, 1055, 814 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.75 (dd, *J* = 11.3, 7.5 Hz, 4H), 7.59-7.55 (m, 4H), 7.53-7.45 (m, 4H), 7.35 (d, *J* = 8.5 Hz, 2H), 6.84 (dd, $^3J_{H-F}$ = 42.1 Hz, $^3J_{H-P}$ = 8.8 Hz, 1H), 1.6-0.9 (bm, 3H). ^{13}C NMR {^{1}H} (100 MHz, $CDCl_3$): δ 153.6 (dd, $^1J_{C-F}$ = 296.2, $^1J_{C-P}$ = 61.8 Hz, Cq), 135.4 (d, *J* = 3.6 Hz, Cq), 133.1 (d, $^2J_{C-P}$ = 10.1 Hz, 4xCH), 132.0 (d, $^4J_{C-P}$ = 2.4 Hz, 2xCH), 131.3 (d, *J* = 7.9 Hz, 2xCH), 130.2 (dd, ^3J = 11.5, 1.5 Hz, Cq), 129.4-128.7 (m, 6xCH), 126.4 (d, $^1J_{C-P}$ = 61.0 Hz, 2xCq), 123.9 (d, ^2J = 26.6 Hz, CH). ^{11}B NMR (160 MHz, $CDCl_3$): δ -38.3 (m). ^{19}F NMR (376 MHz, $CDCl_3$): δ -113.9 (dd, $^3J_{F-H}$ = 42.1, $^2J_{F-P}$ = 17.0 Hz). ^{31}P NMR (162 MHz, $CDCl_3$): δ 21.3 (m). HRMS (ESI-TOF): calcd for $C_{20}H_{16}{}^{35}ClFP$ *m/z* 341.0662 $[M-BH_3+H]^+$, found 341.0668.



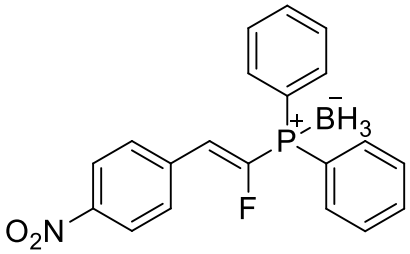
(*E*)-((2-(3-Chlorophenyl)-1-fluorovinyl)diphenylphosphonio)trihydroborate 3g: (*E*)-1-(2-bromo-2-fluorovinyl)-3-chlorobenzene (0.2 mmol, 47 mg), diphenylphosphine borane (0.22 mmol, 44 mg), Cs_2CO_3 (0.24 mmol, 78 mg) in MeCN (1 mL) were reacted according to the general procedure. The crude product was chromatographed on neutral alumina eluting with pure pentane to pentane/DCM 8/2 to afford the desired compound in 49% yield (34 mg) as a

colourless solid. mp 99-101 °C. IR: 3057, 2924, 2388, 1561, 1472, 1435, 1053, 888, 820 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.75 (dd, *J* = 11.2, 7.6 Hz, 4H), 7.68 (s, 1H), 7.59-7.54 (m, 2H), 7.53-7.46 (m, 5H), 7.35-7.28 (m, 2H), 6.83 (dd, $^{3}J_{H-F}$ = 41.7, $^{3}J_{H-P}$ = 8.7 Hz, 1H), 1.6-0.9 (bm, 3H). ^{13}C NMR {^{1}H} (100 MHz, $CDCl_3$): δ 154.3 (dd, $^{1}J_{C-F}$ = 297.5, $^{1}J_{C-P}$ = 61.0 Hz, Cq), 134.8 (s, Cq), 133.3 (dd, ^{3}J = 11.4, 1.3 Hz, Cq), 133.1 (d, $^{2}J_{C-P}$ = 10.0 Hz, 4xCH), 132.1 (d, $^{4}J_{C-P}$ = 2.5 Hz, 2xCH), 130.1 (s, CH), 129.8 (d, *J* = 9.1 Hz, CH), 129.6 (d, *J* = 2.1 Hz, CH), 129.2 (d, $^{3}J_{C-P}$ = 10.6 Hz, 4xCH), 128.2 (d, *J* = 6.9 Hz, CH), 126.3 (d, $^{1}J_{C-P}$ = 60.9 Hz, 2xCq), 123.7 (d, *J* = 26.4 Hz, CH). ^{11}B NMR (160 MHz, $CDCl_3$): δ -38.3 (m). ^{19}F NMR (376 MHz, $CDCl_3$): δ -112.3 (dd, $^{3}J_{F-H}$ = 41.7, $^{2}J_{F-P}$ = 17.2 Hz). ^{31}P NMR (162 MHz, $CDCl_3$): δ 21.6 (m). HRMS (ESI-TOF): calcd for $C_{20}H_{16}{}^{35}ClFP$ *m/z* 341.0662 $[M\text{-}BH_3+H]^+$, found 341.0659.

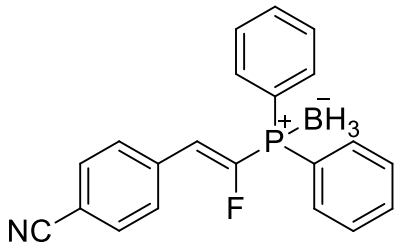


(*E*)-((2-(4-(Methoxycarbonyl)phenyl)-1-fluorovinyl)diphenylphosphonio)trihydroborate

3h: (*E*)-methyl 4-(2-bromo-2-fluorovinyl)benzoate (0.2 mmol, 52 mg), diphenylphosphine borane (0.22 mmol, 44 mg), Cs_2CO_3 (0.24 mmol, 78 mg) in MeCN (1 mL) were reacted according to the general procedure. The crude product was chromatographed on neutral alumina eluting with pentane/DCM 9/1 to pentane/DCM 8/2 to afford the desired compound in 85% yield (64 mg) as a colourless solid. mp 147-149 °C. IR: 2924, 2849, 2384, 1717, 1436, 1412, 1280, 1185, 1107, 1053, 894, 828 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.04 (d, $^{3}J_{H-H}$ = 8.4 Hz, 2H), 7.79-7.72 (m, 4H), 7.69 (d, $^{3}J_{H-H}$ = 8.4 Hz, 2H), 7.59-7.54 (m, 2H), 7.53-7.46 (m, 4H), 6.91 (dd, $^{3}J_{H-F}$ = 41.9, $^{3}J_{H-P}$ = 8.7 Hz, 1H), 3.92 (s, 3H), 1.6-0.8 (bm, 3H). ^{13}C NMR {^{1}H} (100 MHz, $CDCl_3$): δ 166.6 (s, Cq), 155.0 (dd, $^{1}J_{C-F}$ = 299.1, $^{1}J_{C-P}$ = 60.4 Hz, Cq), 135.9 (d, ^{3}J = 11.2 Hz, Cq), 133.1 (d, $^{2}J_{C-P}$ = 10.1 Hz, 4xCH), 132.1 (d, $^{4}J_{C-P}$ = 2.5 Hz, 2xCH), 130.6 (d, *J* = 2.4 Hz, Cq), 130.0 (s, 2xCH), 129.9 (d, *J* = 7.9 Hz, 2xCH), 129.2 (d, $^{3}J_{C-P}$ = 10.7 Hz, 4xCH), 126.2 (d, $^{1}J_{C-P}$ = 60.8 Hz, 2xCq), 123.9 (d, ^{2}J = 26.2 Hz, CH), 52.4 (s, OCH_3). ^{11}B NMR (160 MHz, $CDCl_3$): δ -38.5 (m). ^{19}F NMR (376 MHz, $CDCl_3$): δ -111.0 (dd, $^{3}J_{F-H}$ = 41.9, $^{2}J_{F-P}$ = 17.5 Hz). ^{31}P NMR (122 MHz, $CDCl_3$): δ 21.7 (m). HRMS (ESI-TOF): calcd for $C_{22}H_{19}FO_2P$ *m/z* 365.1107 $[M\text{-}BH_3+H]^+$, found 365.1106.

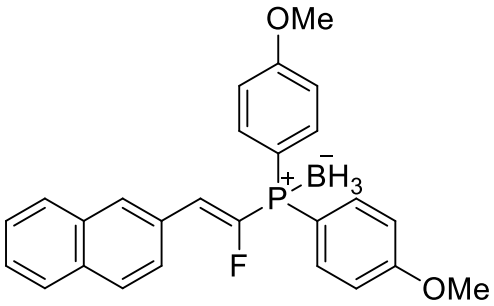


(*E*)-((2-(4-Nitrophenyl)-1-fluorovinyl)diphenylphosphonio)trihydroborate 3i: (*E*)-1-(2-bromo-2-fluorovinyl)-4-nitrobenzene (0.20 mmol, 49 mg), diphenylphosphine borane (0.22 mmol, 44 mg), Cs_2CO_3 (0.24 mmol, 78 mg) in MeCN (1 mL) were reacted according to the general procedure. The crude product was chromatographed on neutral alumina eluting with pure pentane to pentane/DCM 1/1 to afford the desired compound in 53% yield (39 mg) as a colourless solid. mp 153-155 °C. IR: 3061, 2418, 1644, 1594, 1511, 1436, 1344, 1289, 1107, 1056, 885, 859, 843, 827 cm^{-1}. ^1H NMR (300 MHz, $CDCl_3$): δ 8.23 (d, J = 8.8 Hz, 2H), 7.89-7.67 (m, 6H), 7.65-7.38 (m, 6H), 6.94 (dd, $^3J_{H-F}$ = 41.0, $^3J_{H-P}$ = 8.6 Hz, 1H), 1.4-0.7 (bm, 3H). ^{13}C NMR {^1H} (75 MHz, $CDCl_3$): δ 156.7 (dd, $^1J_{C-F}$ = 302.4, $^1J_{C-P}$ = 58.1 Hz, Cq), 147.8 (s, Cq), 137.8 (d, ^3J = 11.3 Hz, Cq), 133.1 (d, $^2J_{C-P}$ = 10.1 Hz, 4xCH), 132.3 (s, 2xCH), 130.7 (d, J = 8.0 Hz, 2xCH), 129.3 (d, $^3J_{C-P}$ = 10.7 Hz, 4xCH), 125.8 (d, ^1J = 60.7 Hz, 2xCq), 124.1 (s, 2xCH), 122.6 (d, ^2J = 26.1 Hz, CH). ^{11}B NMR (120 MHz, $CDCl_3$): δ -38.5 (m). ^{19}F NMR (282 MHz, $CDCl_3$): δ -108.6 (dd, $^3J_{F-H}$ = 41.0, $^3J_{F-P}$ = 16.5 Hz). ^{31}P NMR (122 MHz, $CDCl_3$): δ 22.2 (m). HRMS (FD-TOF): calcd for $C_{20}H_{15}FNO_2P$ *m/z* 351.0824 $[M-BH_3]^+$, found 351.0826.



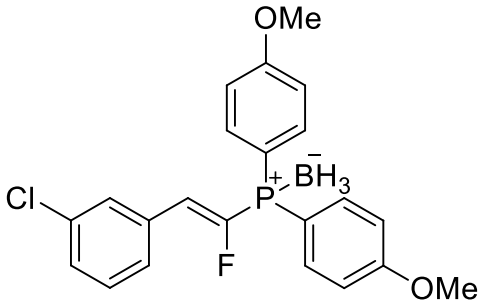
(*E*)-((2-(4-Cyanophenyl)-1-fluorovinyl)diphenylphosphonio)trihydroborate 3j: (*E*)-4-(2-bromo-2-fluorovinyl)benzonitrile (0.2 mmol, 45 mg), diphenylphosphine borane (0.22 mmol, 44 mg), Cs_2CO_3 (0.24 mmol, 78 mg) in MeCN (1 mL) were reacted according to the general procedure. The crude product was chromatographed on neutral alumina eluting with pentane/DCM 8/2 to afford the desired compound in 82% yield (51 mg) as a colourless solid. mp 131-133 °C. IR: 3053, 2401, 2350, 2230, 1435, 1050, 887, 839, 828 cm^{-1}. ^1H NMR (300 MHz, $CDCl_3$): δ 7.98- 7.37 (m, 14H), 6.89 (dd, $^3J_{H-F}$ = 41.2, $^3J_{H-P}$ = 8.2 Hz, 1H), 1.5-0.8 (bm, 3H). ^{13}C NMR {^1H} (75 MHz, $CDCl_3$): δ 156.1 (dd, $^1J_{C-F}$ = 301.3, $^1J_{C-P}$ = 58.6 Hz, Cq), 135.9 (d, J = 11.3 Hz, Cq), 133.0 (d, $^2J_{C-P}$ = 10.1 Hz, 4xCH), 132.5 (s, 2xCH), 132.2 (d, $^4J_{C-P}$ = 2.4

Hz, 2xCH), 130.4 (d, J = 8.0 Hz, 2xCH), 129.2 (d, $^{3}J_{C\text{-}P}$ = 10.7 Hz, 4xCH), 125.8 (d, $^{1}J_{C\text{-}P}$ = 60.8 Hz, 2xCq), 123.0 (d, J = 26.1 Hz, CH), 118.5 (s, Cq), 112.7 (d, J = 3.0 Hz, Cq). ^{11}B NMR (160 MHz, $CDCl_3$): δ -38.4 (m). ^{19}F NMR (376 MHz, $CDCl_3$): δ -109.7 (dd, $^{3}J_{F\text{-}H}$ = 41.2, $^{2}J_{F\text{-}P}$ = 19.2 Hz). ^{31}P NMR (162 MHz, $CDCl_3$): δ -21.9 (m). HRMS (ESI-TOF): calcd for $C_{21}H_{16}FNP$ *m/z* 332.1004 $[M\text{-}BH_3+H]^+$, found 332.1002.

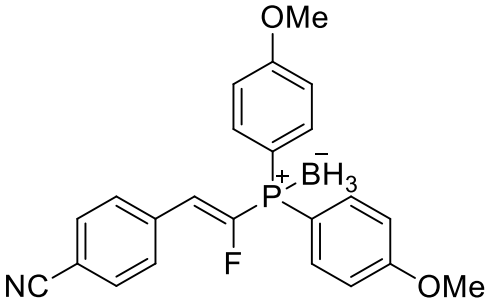


(*E*)-((1-Fluoro-2-(naphth-2-yl)vinyl)-bis(4-methoxyphenyl)phosphonio)trihydroborate

3k: (*E*)-2-(2-bromo-2-fluorovinyl)naphthalene (0.20 mmol, 50 mg), bis(4-methoxy-phenyl)phosphine borane (0.22 mmol, 57 mg), Cs_2CO_3 (0.24 mmol, 78 mg) in MeCN (1 mL) were reacted according to the general procedure. The crude product was chromatographed on neutral alumina eluting with pure pentane to pentane/DCM 1/1 to afford the desired compound in 38% yield (30 mg) as a sticky colourless solid. IR: 2923, 2355, 1593, 1569, 1500, 1455, 1300, 1257, 1177, 1108, 1054, 1028, 903, 826 cm^{-1}. ^{1}H NMR (300 MHz, $CDCl_3$): δ 8.08 (s, 1H), 7.84-7.68 (m, 8H), 7.54-7.44 (m, 2H), 7.05-6.83 (m, 5H), 3.85 (s, 6H), 1.4-0.9 (bm, 3H). ^{13}C NMR {^{1}H} (75 MHz, $CDCl_3$): δ 162.6 (d, $^{4}J_{C\text{-}P}$ = 2.4 Hz, 2xCq), 154.1 (dd, $^{1}J_{C\text{-}F}$ = 295.0, $^{1}J_{C\text{-}P}$ = 63.3 Hz, Cq), 134.8 (d, $J_{C\text{-}P}$ = 11.3 Hz, 4xCH), 133.5 (d, J = 1.8 Hz, Cq), 133.3 (s, Cq), 130.2 (d, J = 7.6 Hz, CH), 129.5 (dd, J = 11.2, 1.7 Hz, Cq), 128.6 (s, J = 16.2 Hz, CH), 128.4 (s, CH), 127.7 (s, CH), 127.2 (s, CH), 126.9 (d, J = 7.9 Hz, CH), 126.6 (s, CH), 124.2 (d, ^{2}J = 26.0 Hz, CH), 117.5 (d, $^{1}J_{C\text{-}P}$ = 66.4 Hz, 2xCq), 114.8 (d, $J_{C\text{-}P}$ = 11.6 Hz, 4xCH), 55.5 (s, 2xOCH_3). ^{11}B NMR (120 MHz, $CDCl_3$): δ -38.0 (m). ^{19}F NMR (282 MHz, $CDCl_3$): δ -114.8 (dd, $^{3}J_{F\text{-}H}$ = 42.8, $^{2}J_{F\text{-}P}$ = 20.6 Hz). ^{31}P NMR (122 MHz, $CDCl_3$): δ 18.4 (m). HRMS (FD-TOF): calcd for $C_{26}H_{22}FO_2P$ *m/z* 416.1341 $[M\text{-}BH_3]^+$, found 416.1349.

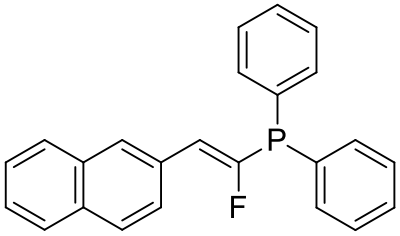


***(E)*-((2-(3-Chlorophenyl)-1-fluorovinyl)-bis(4-methoxyphenyl)phosphonio)trihydroborate 3l:** (*E*)-1-(2-bromo-2-fluorovinyl)-3-chlorobenzene (0.20 mmol, 47 mg), bis(4-methoxyphenyl)phosphine borane (0.22 mmol, 57 mg), Cs_2CO_3 (0.24 mmol, 78 mg) in MeCN (1 mL) were reacted according to the general procedure. The crude product was chromatographed on neutral alumina eluting with pure pentane to pentane/DCM 7/3 to afford the desired compound in 18% yield (12 mg) as a sticky colourless solid. IR: 2924, 2389, 1725, 1436, 1107, 1054, 812 cm^{-1}. ^1H NMR (300 MHz, $CDCl_3$): δ 7.66 (m, 5H), 7.44 (m, 1H), 7.30 (m, 2H), 6.98 (m, 4H), 6.72 (dd, $^3J_{H-F}$ = 41.9, $^3J_{H-P}$ = 8.5 Hz, 1H), 3.85 (s, 6H), 1.4-0.8 (bm, 3H). Selected ^{13}C NMR {^1H} (75 MHz, $CDCl_3$): δ 162.7 (d, $^4J_{C-P}$ = 2.4 Hz, 2xCq), 134.8 (m, 4xCH+Cq), 133.5 (dd, *J* = 11.1, 1.3 Hz, Cq), 130.0 (s, CH), 129.8 (d, *J* = 9.0 Hz, CH), 129.4 (d, *J* = 2.1 Hz, CH), 128.2 (d, *J* = 7.0 Hz, CH), 122.6 (d, ^2J = 25.9 Hz, CH), 117.1 (d, $^1J_{C-P}$ = 66.4 Hz, 2xCq), 114.8 (d, $^3J_{C-P}$ = 11.6 Hz, 4xCH), 55.5 (s, CH_3). ^{11}B NMR (120 MHz, $CDCl_3$): δ -38.7 (m). ^{19}F NMR (282 MHz, $CDCl_3$): δ -112.6 (dd, $^3J_{F-H}$ = 41.9, $^2J_{F-P}$ = 20.2 Hz). ^{31}P NMR (122 MHz, $CDCl_3$): δ 18.7 (m). HRMS (ESI-TOF): calcd for $C_{22}H_{20}{}^{35}ClFO_2P$ *m/z* 401.0873 $[M\text{-}BH_3+H]^+$, found 401.0867.



(*E*)-((2-(4-Cyanophenyl)-1-fluorovinyl) bis(4-methoxyphenyl)phosphonio)trihydroborate 3m: (*E*)-4-(2-bromo-2-fluorovinyl)benzonitrile (0.20 mmol, 45 mg), bis(4-methoxyphenyl)phosphine borane (0.22 mmol, 57 mg), Cs_2CO_3 (0.24 mmol, 78 mg) in MeCN (1 mL) were reacted according to the general procedure. The crude product was chromatographed on neutral alumina eluting with pure pentane to pentane/DCM 1/1 to afford the desired compound in 47% yield (42 mg) as a sticky colourless solid. IR: 2932, 2839, 2388, 2228, 1594, 1500, 1292, 1254, 1179, 1107, 826, 800 cm^{-1}. ^1H NMR (300 MHz, $CDCl_3$): δ 7.71-

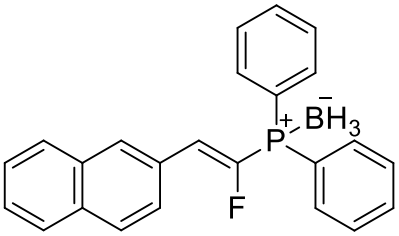
7.61 (m, 8H), 7.00 (dd, J = 8.3, 1.7 Hz, 4H), 6.79 (dd, $^{3}J_{H\text{-}F}$ = 41.4, $^{3}J_{H\text{-}P}$ = 8.3 Hz, 1H), 3.85 (s, 6H), 1.4-0.9 (bm, 3H). ^{13}C NMR {^{1}H} (75 MHz, $CDCl_3$): δ 162.7 (d, $^{4}J_{C\text{-}P}$ = 2.4 Hz, 2xCq), 157.1 (dd, $^{1}J_{C\text{-}F}$ = 301.0, $^{1}J_{C\text{-}P}$ = 59.2 Hz, Cq), 136.1 (d, J = 11.0 Hz, Cq), 134.8 (d, $^{2}J_{C\text{-}P}$ = 11.5 Hz, 4xCH), 132.5 (s, 2xCH), 130.3 (d, J = 8.1 Hz, 2xCH), 121.9 (d, ^{2}J = 25.5 Hz, CH), 118.6 (s, Cq), 116.5 (d, $^{1}J_{C\text{-}P}$ = 66.3 Hz, 2xCq), 114.9 (d, $^{3}J_{C\text{-}P}$ = 11.6 Hz, 4xCH), 112.5 (d, J = 3.0 Hz, Cq), 55.5 (s, 2xOCH_3). ^{11}B NMR (120 MHz, $CDCl_3$): δ -38.1 (m). ^{19}F NMR (282 MHz, $CDCl_3$): δ -109.4 (dd, $^{3}J_{F\text{-}H}$ = 41.4, $^{2}J_{F\text{-}P}$ = 19.8 Hz). ^{31}P NMR (122 MHz, $CDCl_3$): δ 19.1 (m). HRMS (FD-TOF): calcd for $C_{23}H_{19}FNO_2P$ *m/z* 391.1137 $[M\text{-}BH_3]^+$, found 391.1148.

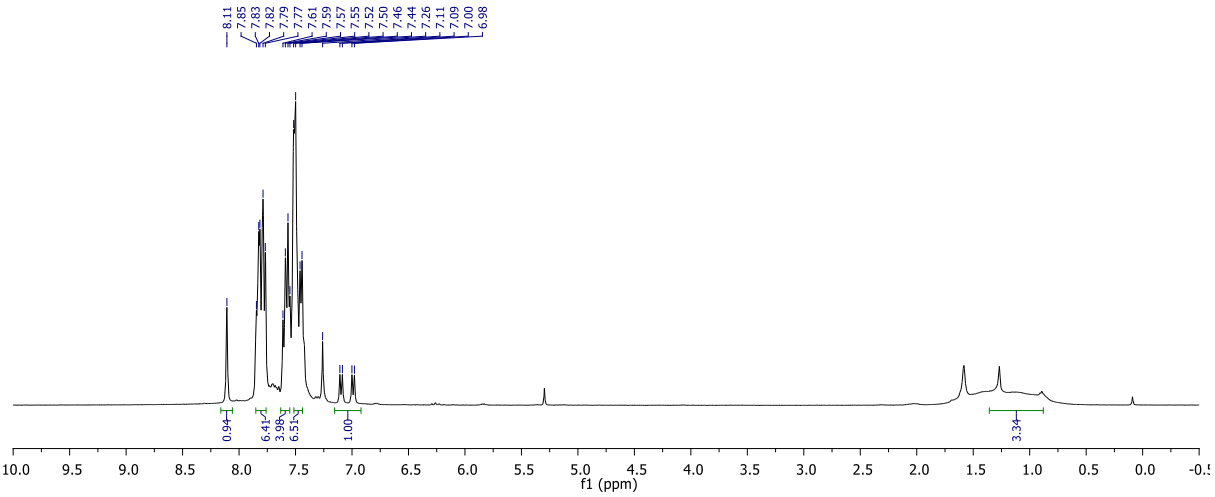


***(E)*-(1-Fluoro-2-(naphth-2-yl)vinyl)diphenylphosphine 3a':** (*E*)-2-(2-bromo-2-fluorovinyl)naphthalene (0.20 mmol, 50 mg), diphenylphosphine borane (0.22 mmol, 44 mg), Cs_2CO_3 (0.24 mmol, 78 mg) in MeCN (1 mL) were reacted according to the general procedure, at 60 °C overnight. The crude product was chromatographed on silica gel eluting with pentane/toluene 9/1 to 5/5 to afford the desired compound in 43% yield (31 mg) as a colourless solid. mp 139-141 °C. IR: 3058, 2924, 2852, 1727, 1584, 1479, 1430, 1273, 1042, 906, 828 cm^{-1}. ^{1}H NMR (300 MHz, $CDCl_3$): δ 8.04 (s, 1H), 7.9-7.7 (m, 4H), 7.7-7.6 (m, 4H), 7.5-7.3 (m, 8H), 6.51 (dd, $^{3}J_{H\text{-}F}$ = 41.0, $^{3}J_{H\text{-}P}$ = 9.4 Hz, 1H). ^{13}C NMR {^{1}H} (75 MHz, $CDCl_3$): δ 161.6 (dd, $^{1}J_{C\text{-}F}$ = 313.6, $^{1}J_{C\text{-}P}$ = 28.9 Hz, Cq), 134.4 (dd, J = 6.4, 2.8 Hz, 2xCq), 133.6 (d, $^{2}J_{C\text{-}P}$ = 19.3 Hz, 4xCH), 133.4 (s, Cq), 133.1 (d, J = 1.9 Hz, Cq), 130.7 (dd, ^{3}J = 11.9, 2.1 Hz, Cq), 129.4 (s, 2xCH), 129.0 (d, J = 8.1 Hz, CH), 128.8 (d, $^{3}J_{C\text{-}P}$ = 7.1 Hz, 4xCH), 128.4 (s, CH), 128.2 (s, CH), 127.7 (s, CH), 126.9 (d, J = 8.0 Hz, CH), 126.6 (s, CH), 126.4 (s, CH), 123.8 (dd, $^{2}J_{C\text{-}F}$ = 39.3, $^{2}J_{C\text{-}P}$ = 4.3 Hz, CH). ^{19}F NMR (282 MHz, $CDCl_3$): δ -104.4 (dd, $^{3}J_{F\text{-}H}$ = 41.1, $^{2}J_{F\text{-}P}$ = 14.5 Hz). ^{31}P NMR (122 MHz, $CDCl_3$): δ -5.4 (m). HRMS (ESI-TOF): calcd for $C_{24}H_{19}OFP$ *m/z* 373.1158 $[M(O)+H]^+$, found 373.1163.

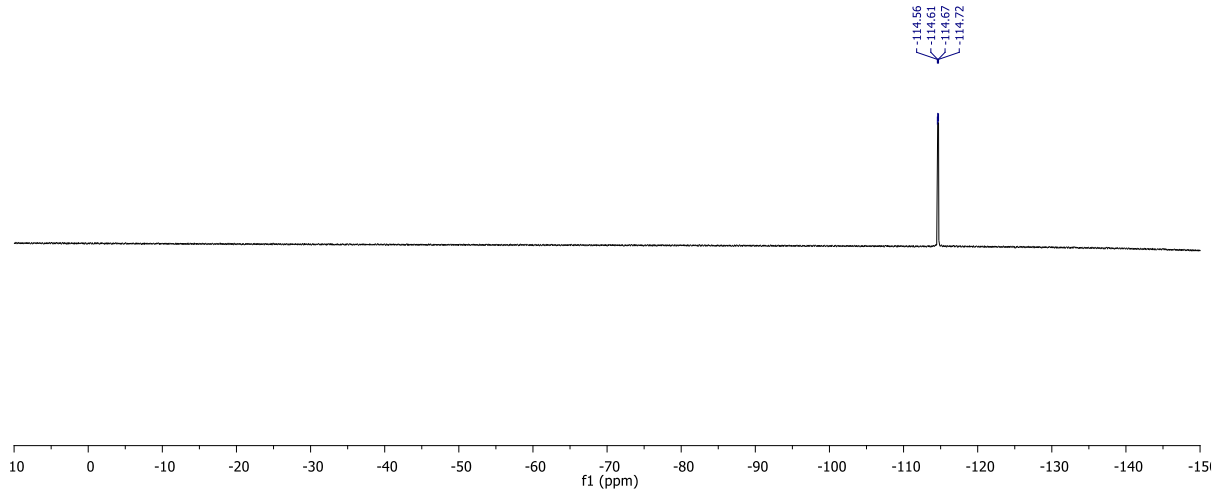
5. NMR spectra for compounds 3a-3m

(*E*)-((1-Fluoro-2-(naphth-2-yl)vinyl)diphenylphosphonio)trihydroborate 3a

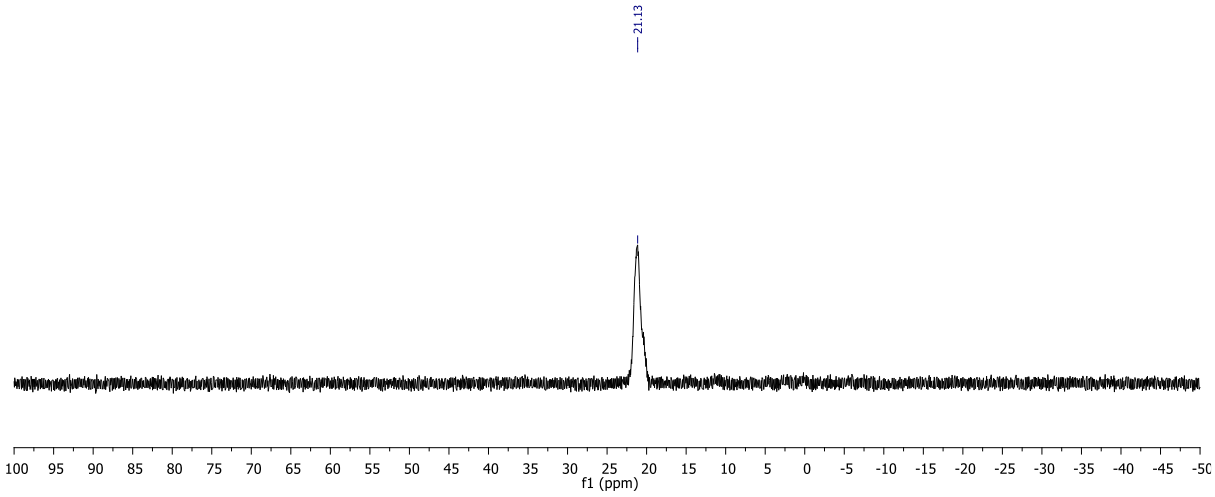




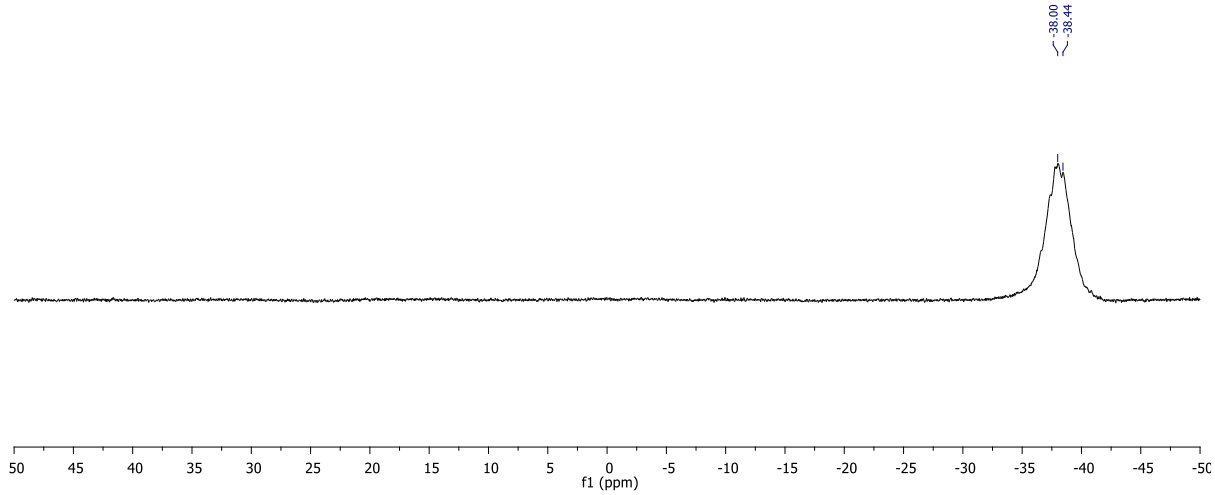
^{1}H NMR in $CDCl_3$



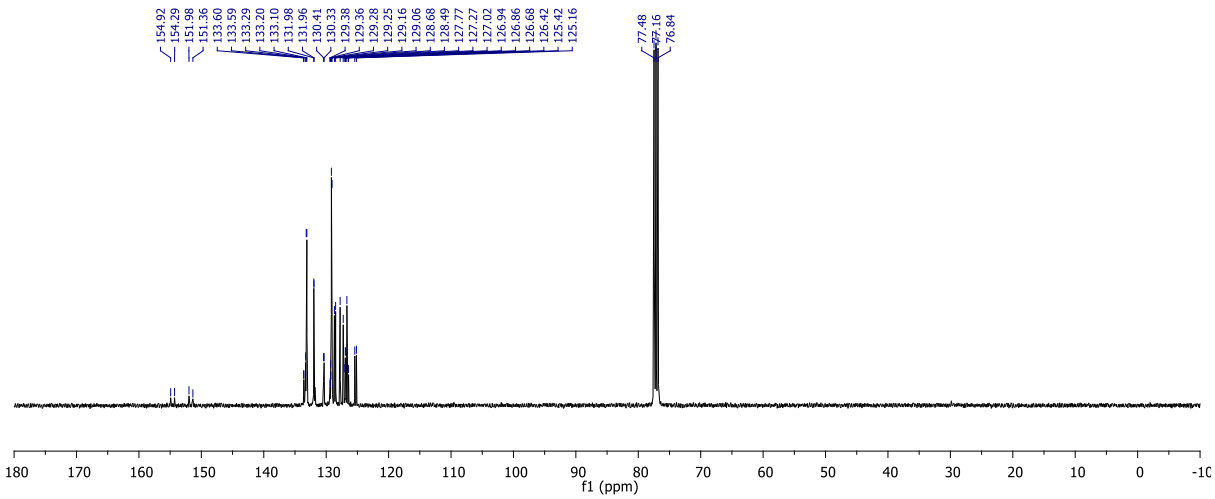
^{19}F NMR in $CDCl_3$



^{31}P NMR in $CDCl_3$

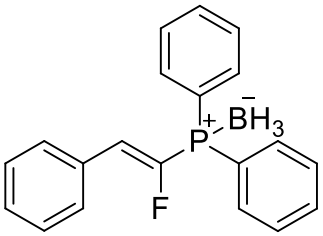


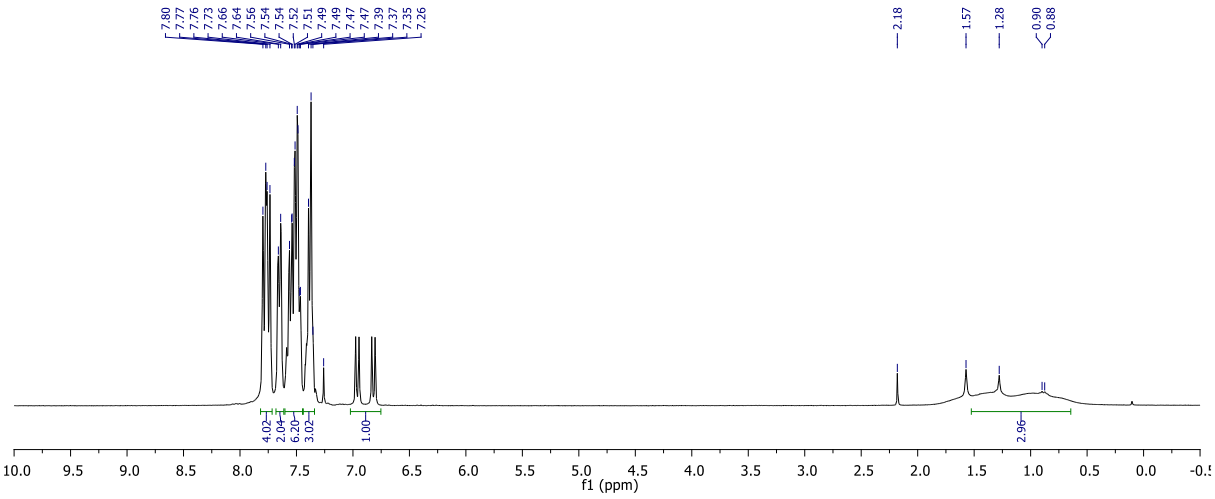
^{11}B NMR in $CDCl_3$



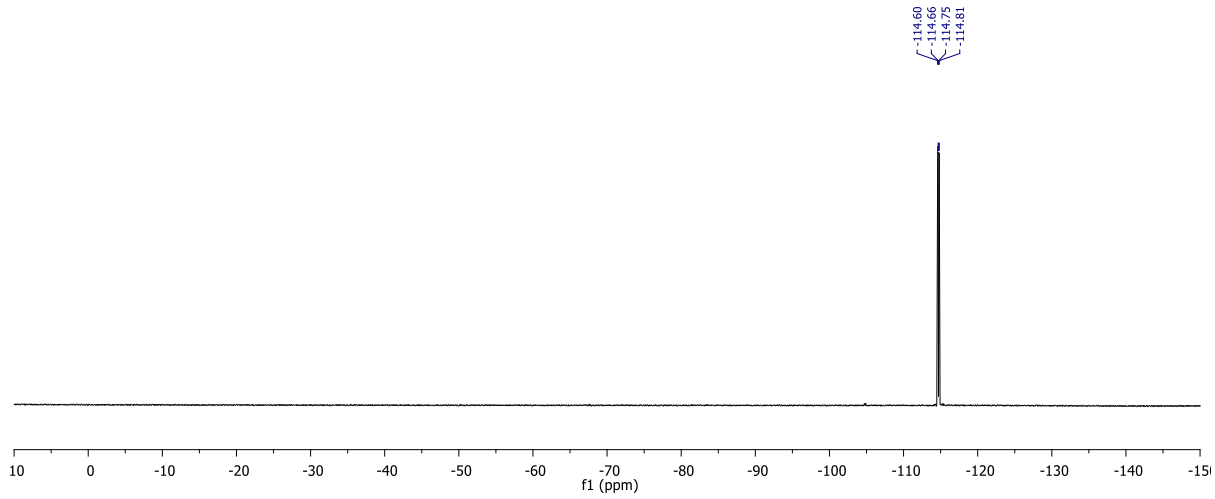
^{13}C NMR {^{1}H} in $CDCl_3$

(*E*)-((1-Fluoro-2-phenylvinyl)diphenylphosphonio)trihydroborate 3b

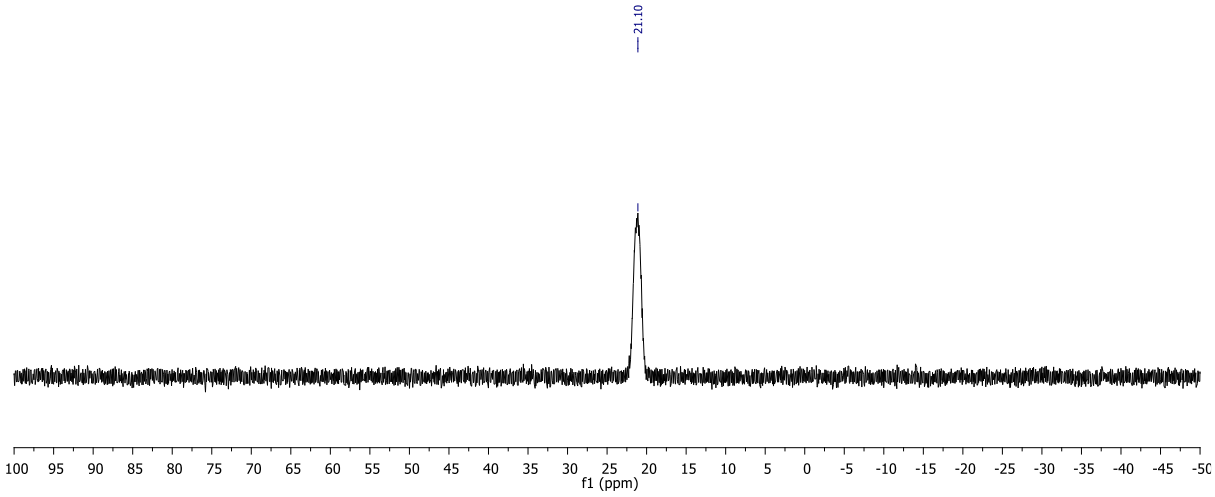




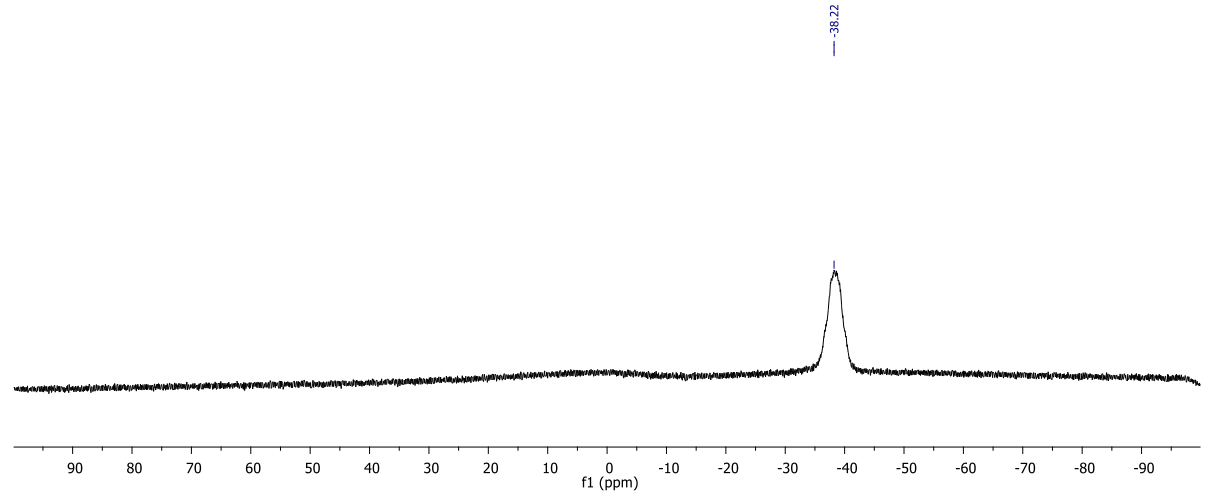
^{1}H NMR in $CDCl_3$



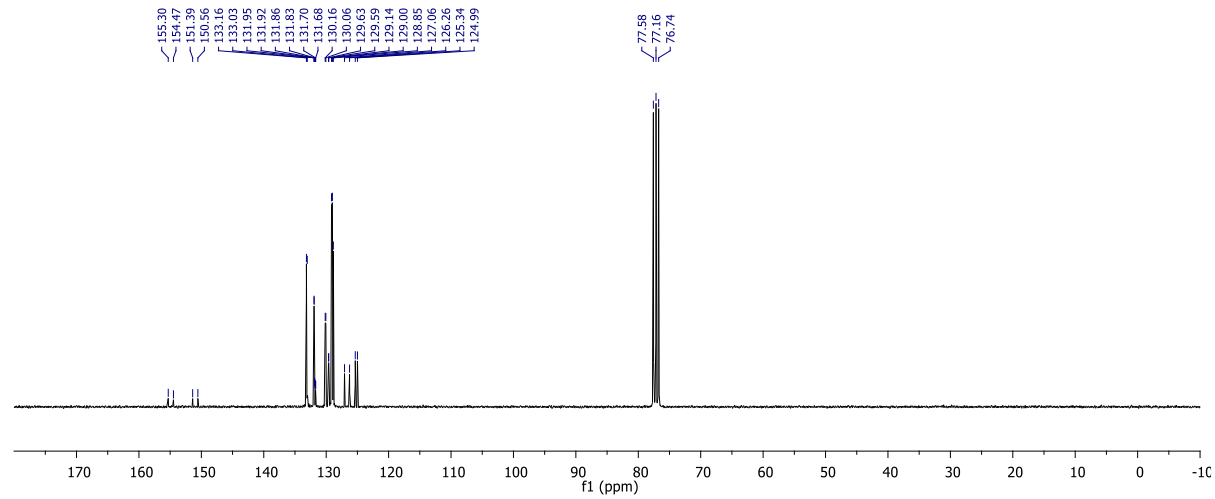
^{19}F NMR in $CDCl_3$



^{31}P NMR in $CDCl_3$

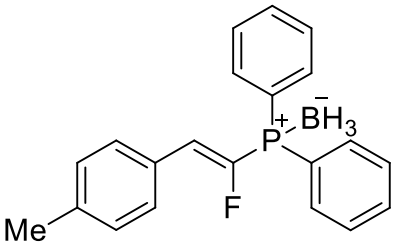


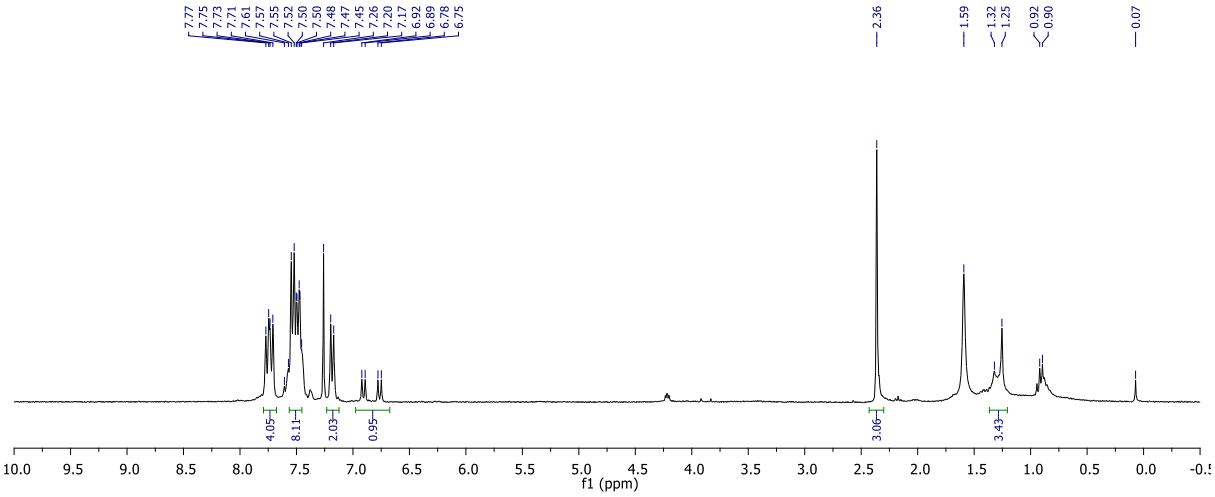
^{11}B NMR in $CDCl_3$



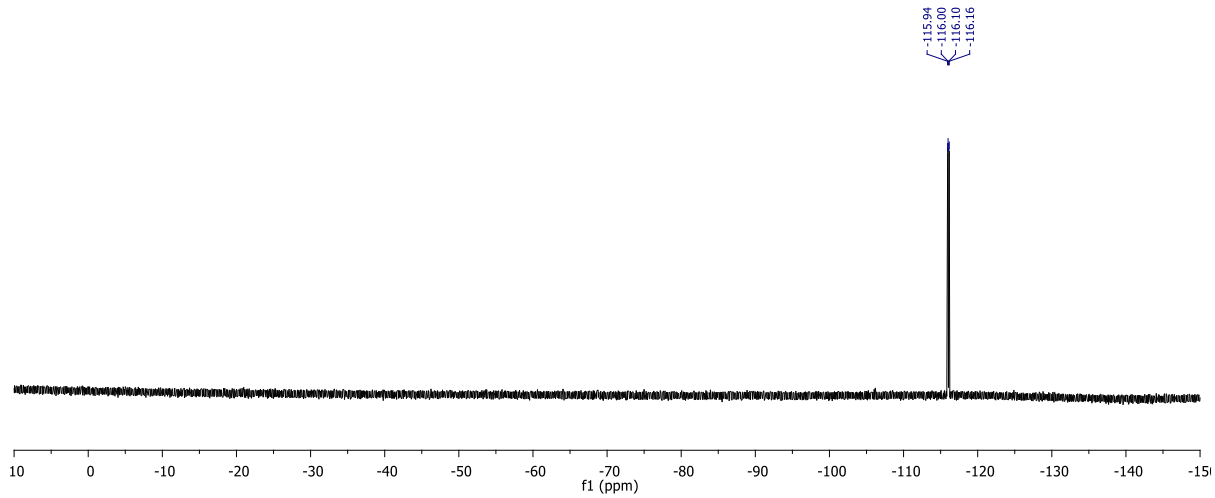
^{13}C NMR {^{1}H} in $CDCl_3$

(*E*)-((1-Fluoro-2-(*p*-tolyl)vinyl)diphenylphosphonio)trihydroborate 3c

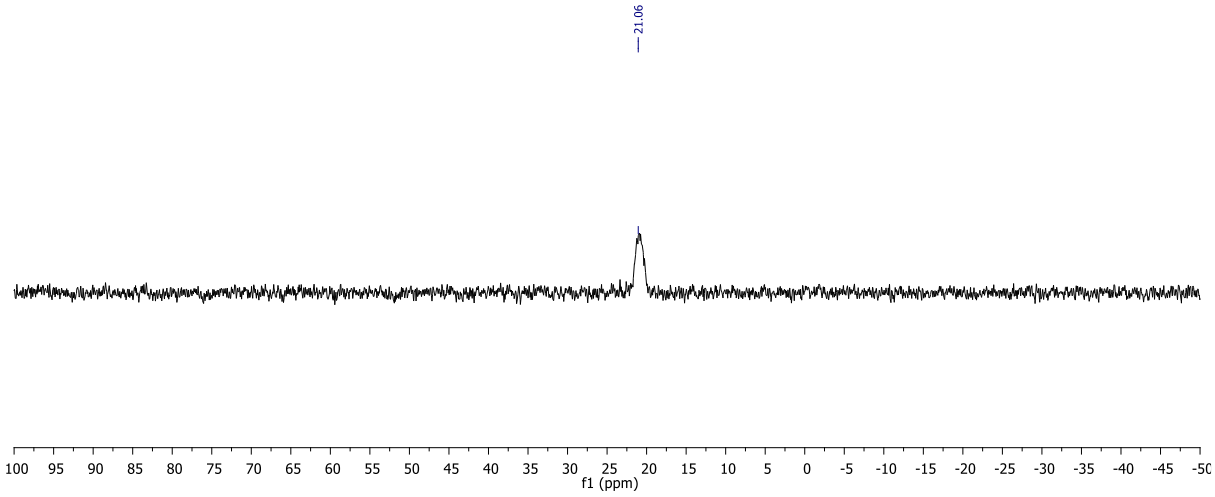




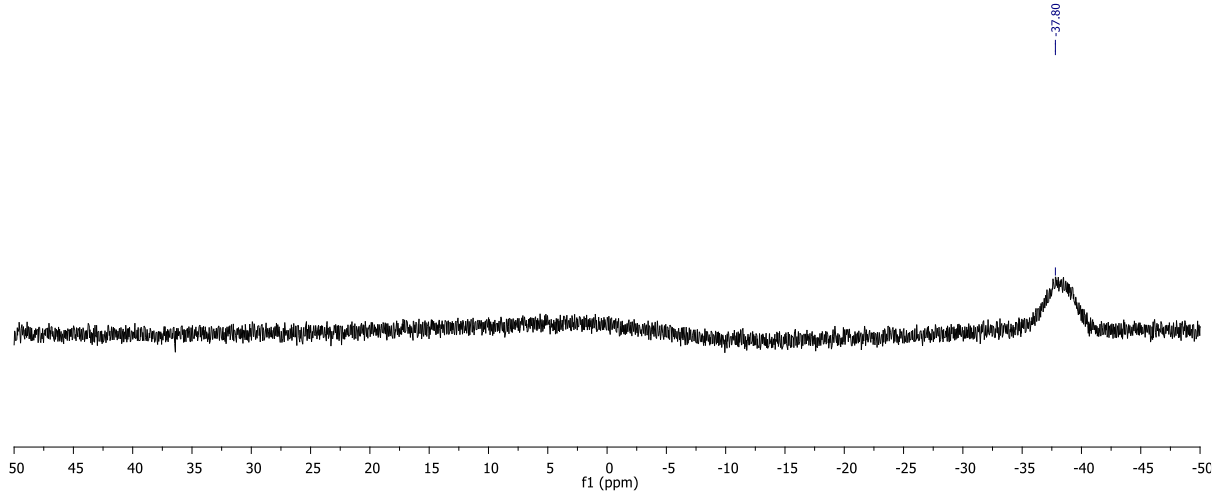
^{1}H NMR in $CDCl_3$



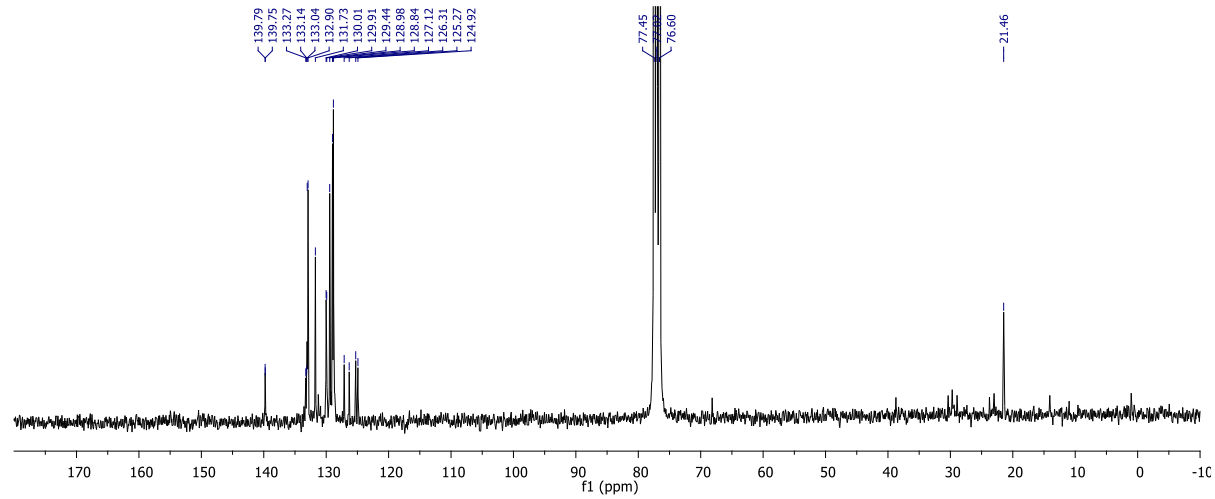
^{19}F NMR in $CDCl_3$



^{31}P NMR in $CDCl_3$

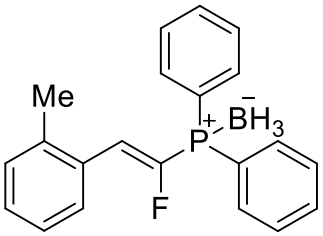


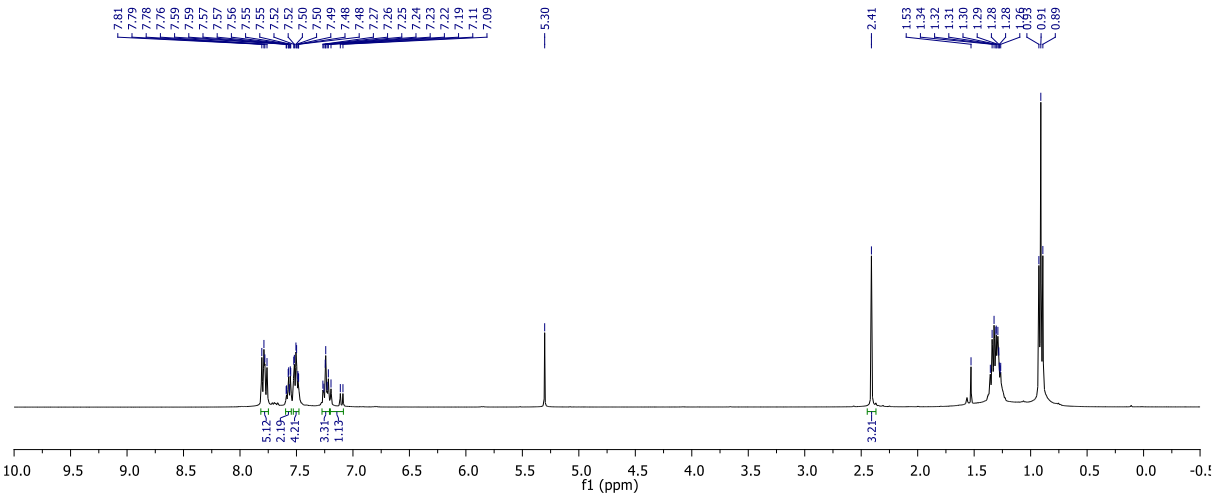
^{11}B NMR in $CDCl_3$



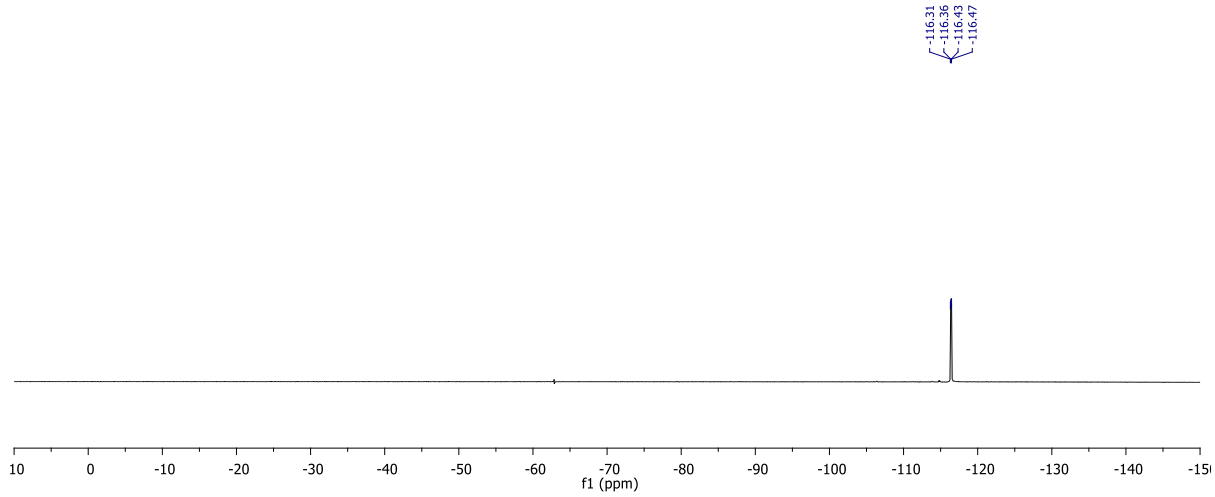
^{13}C NMR {^{1}H} in $CDCl_3$

(*E*)-((1-Fluoro-2-(*o*-tolyl)vinyl)diphenylphosphonio)trihydroborate 3d

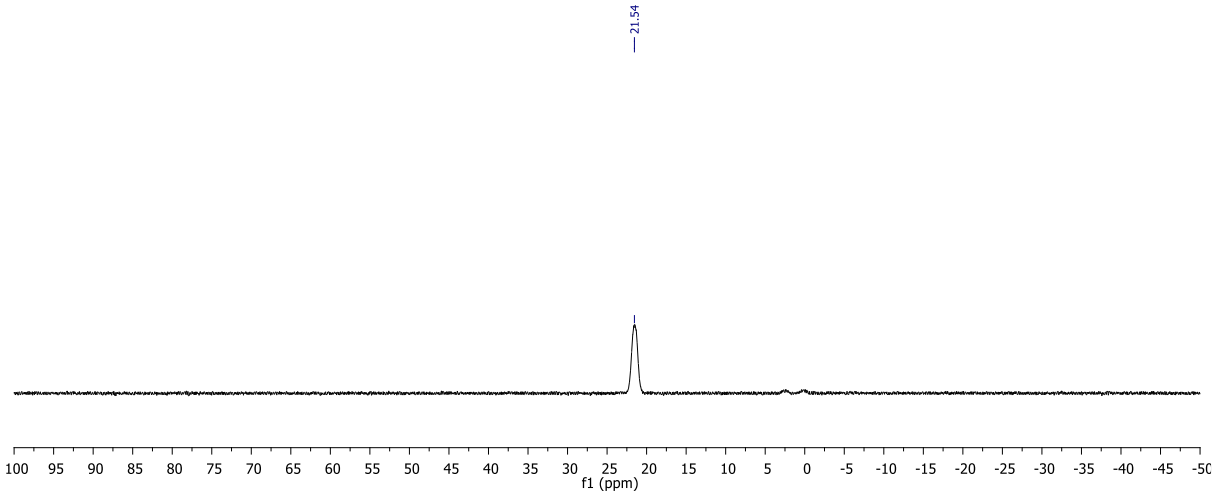




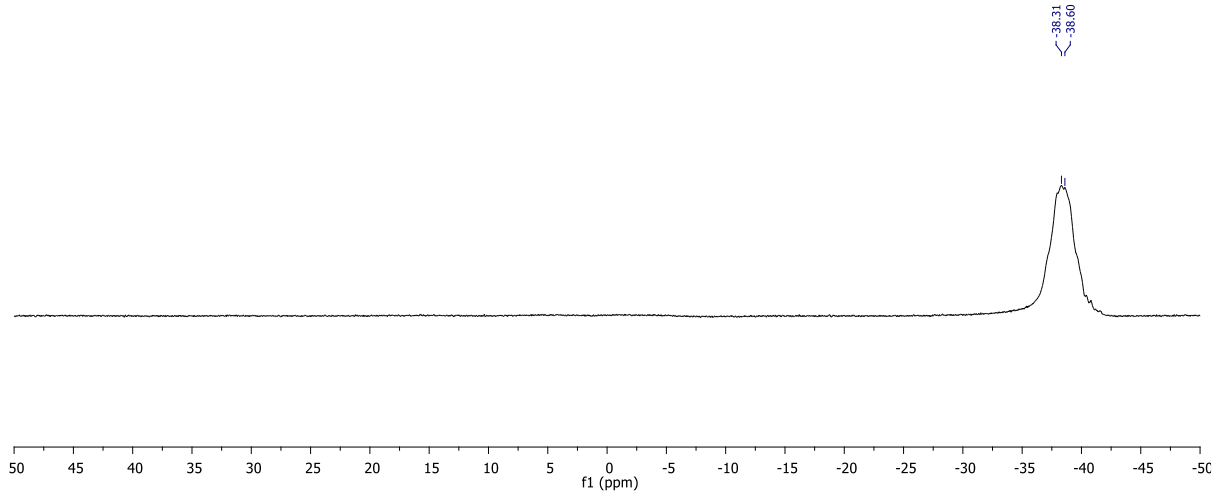
^{1}H NMR in $CDCl_3$



^{19}F NMR in $CDCl_3$

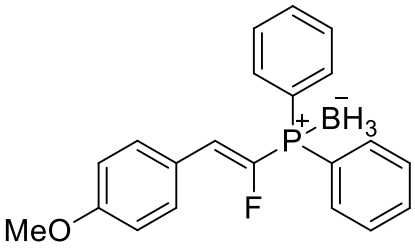


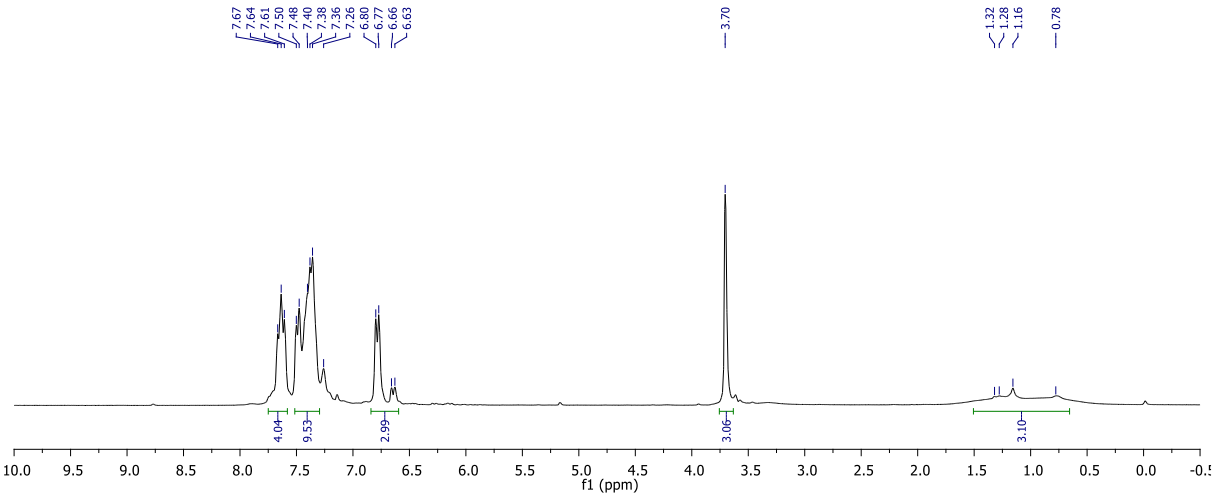
^{31}P NMR in $CDCl_3$



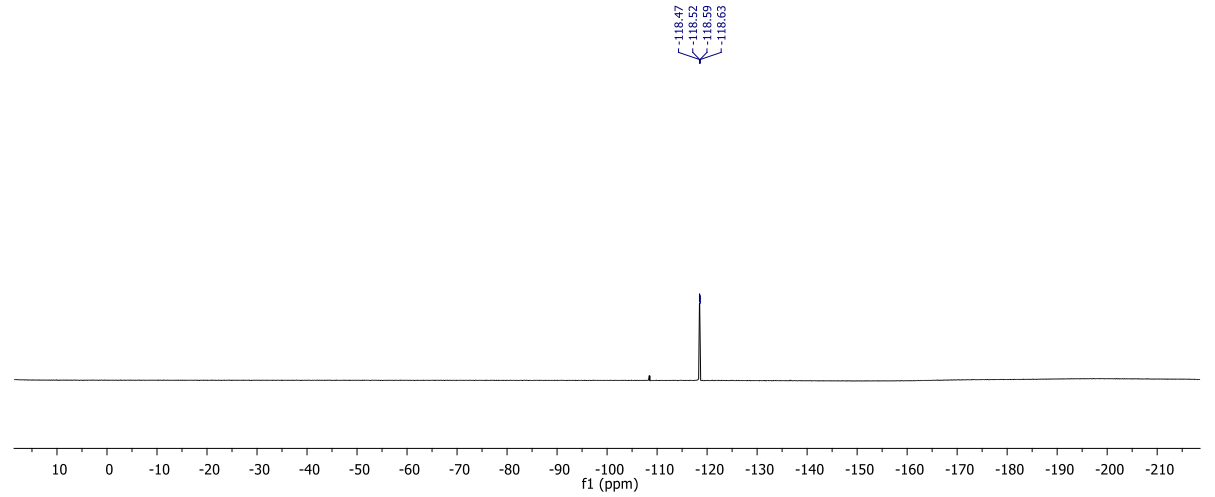
^{11}B NMR in $CDCl_3$

(*E*)-((2-(4-Methoxyphenyl)-1-fluorovinyl)diphenylphosphonio)trihydroborate 3e

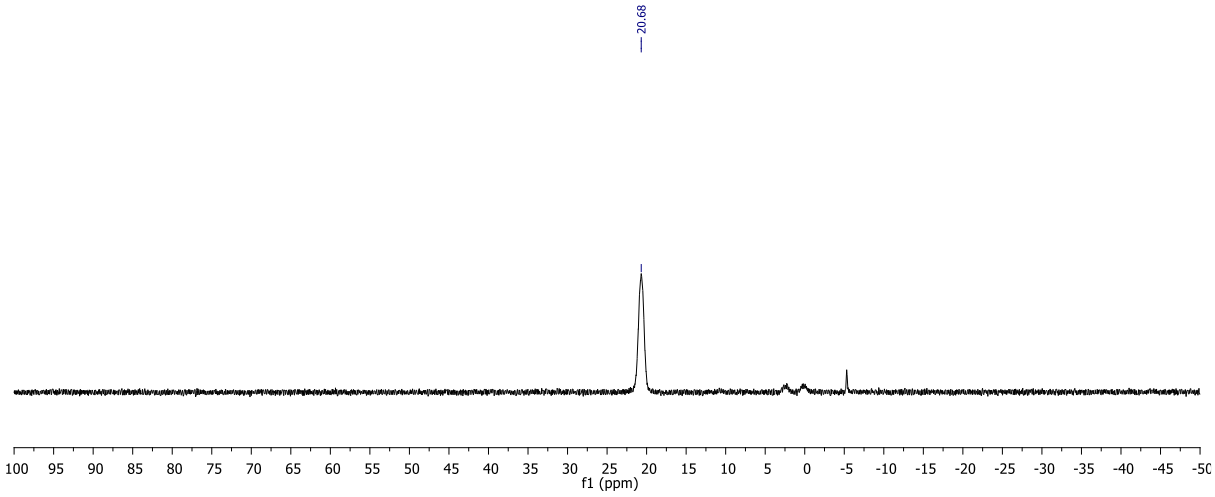




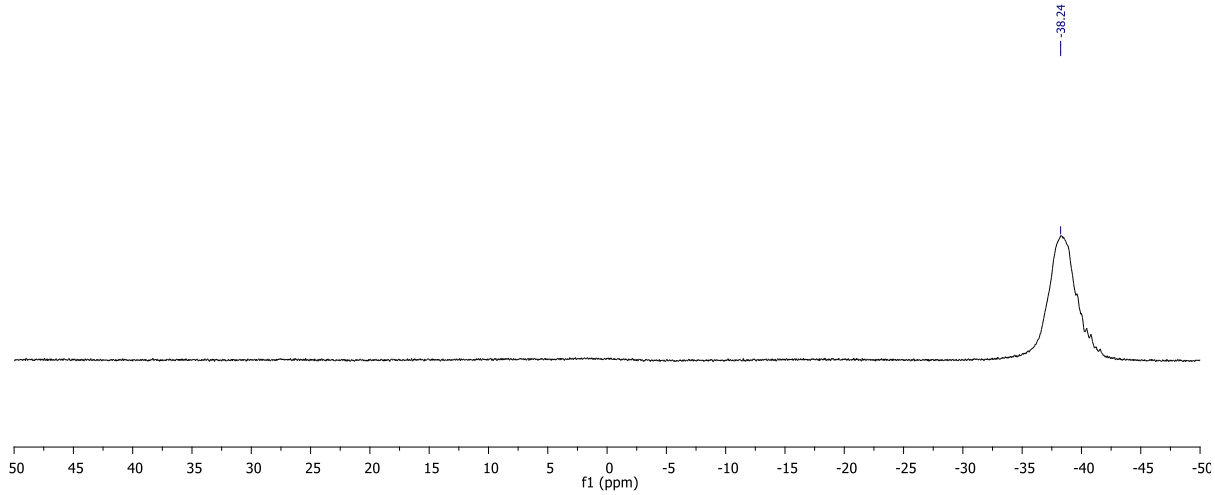
^{1}H NMR in $CDCl_3$



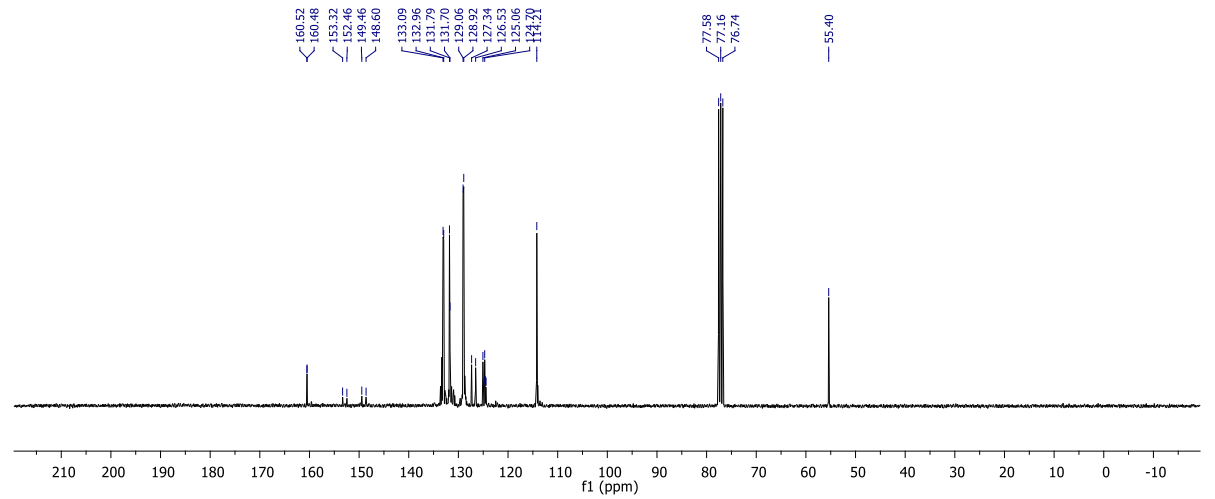
^{19}F NMR in $CDCl_3$



^{31}P NMR in $CDCl_3$

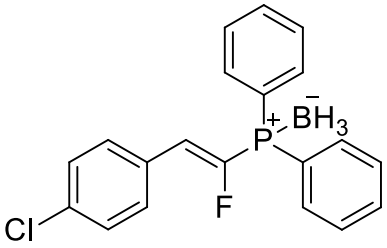


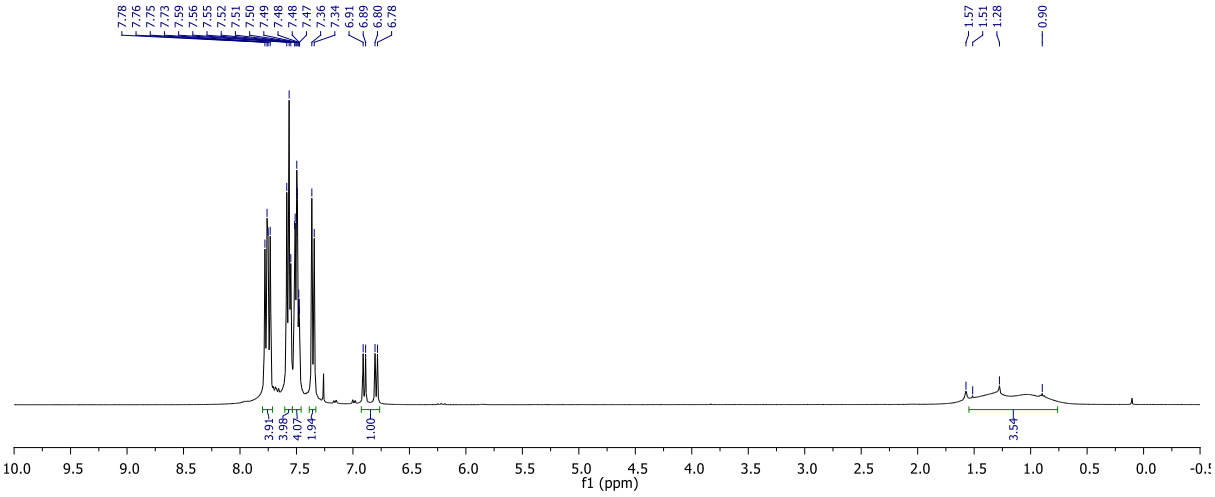
^{11}B NMR in $CDCl_3$



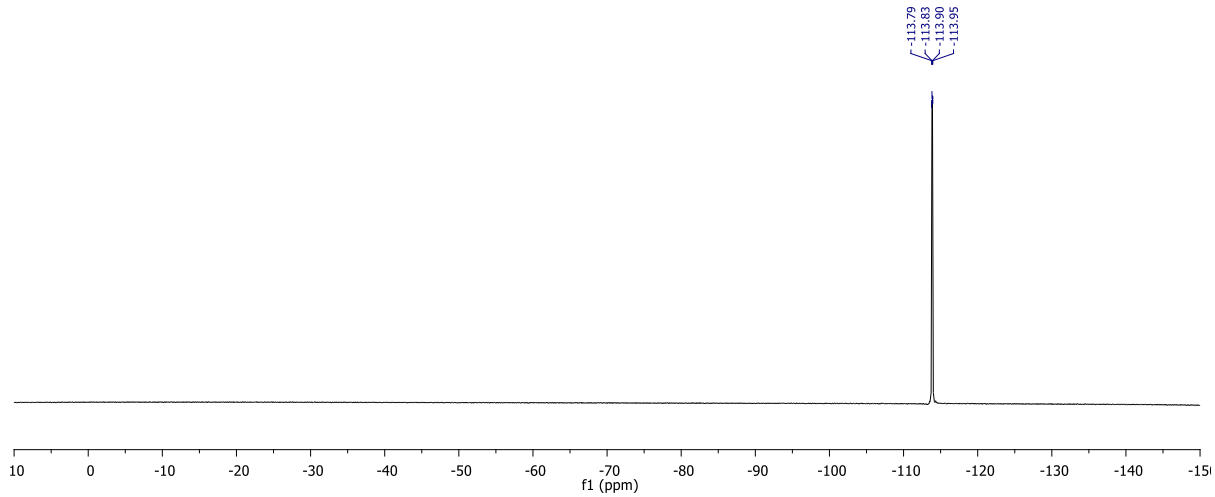
^{13}C NMR {^{1}H} in $CDCl_3$

(*E*)-((2-(4-Chlorophenyl)-1-fluorovinyl)diphenylphosphonio)trihydroborate 3f

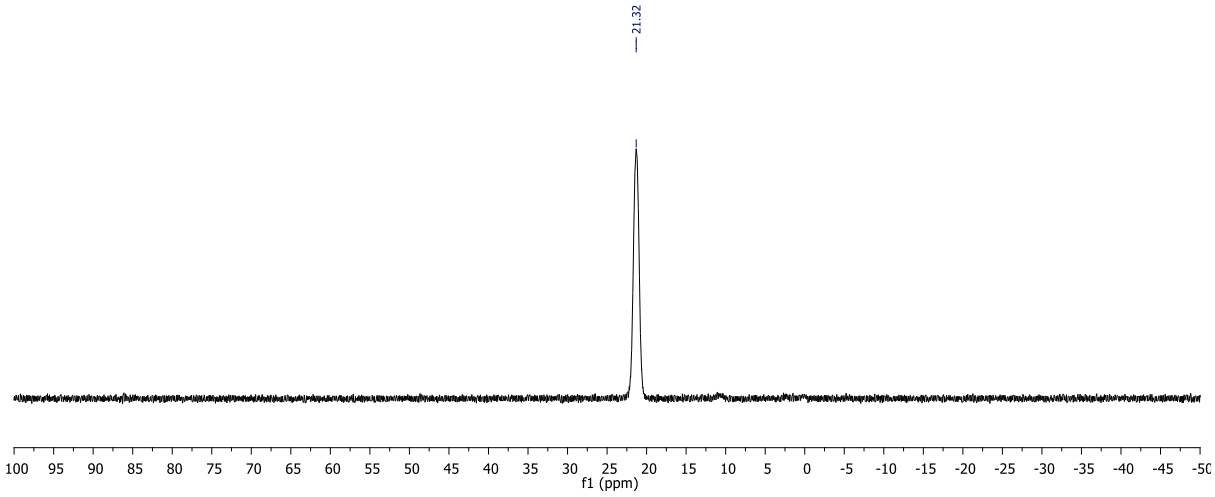




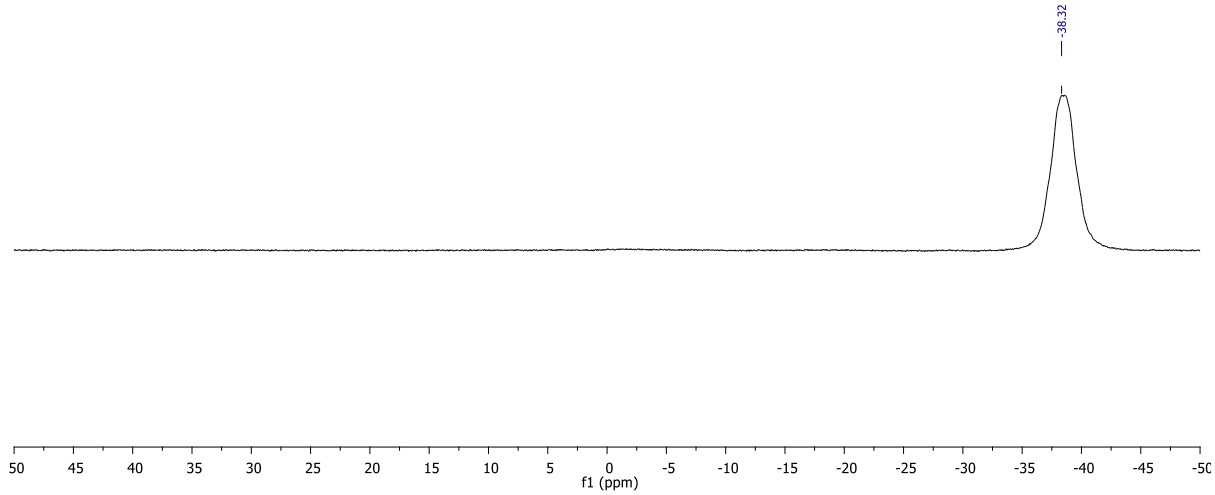
^{1}H NMR in $CDCl_3$



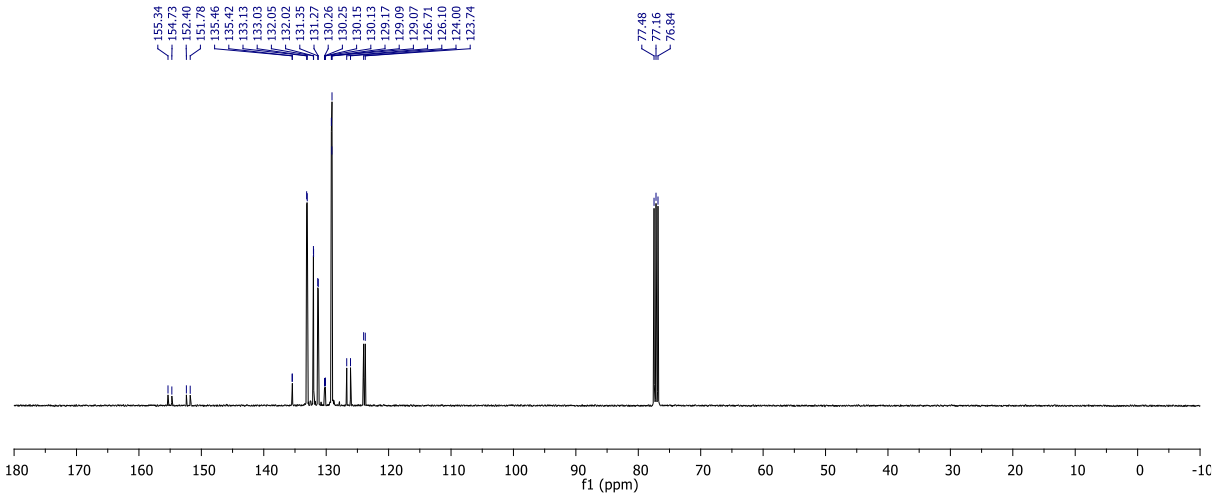
^{19}F NMR in $CDCl_3$



^{31}P NMR in $CDCl_3$

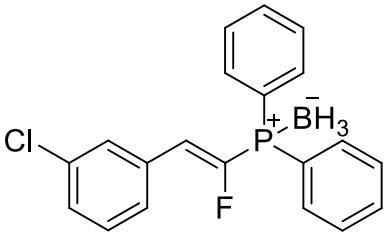


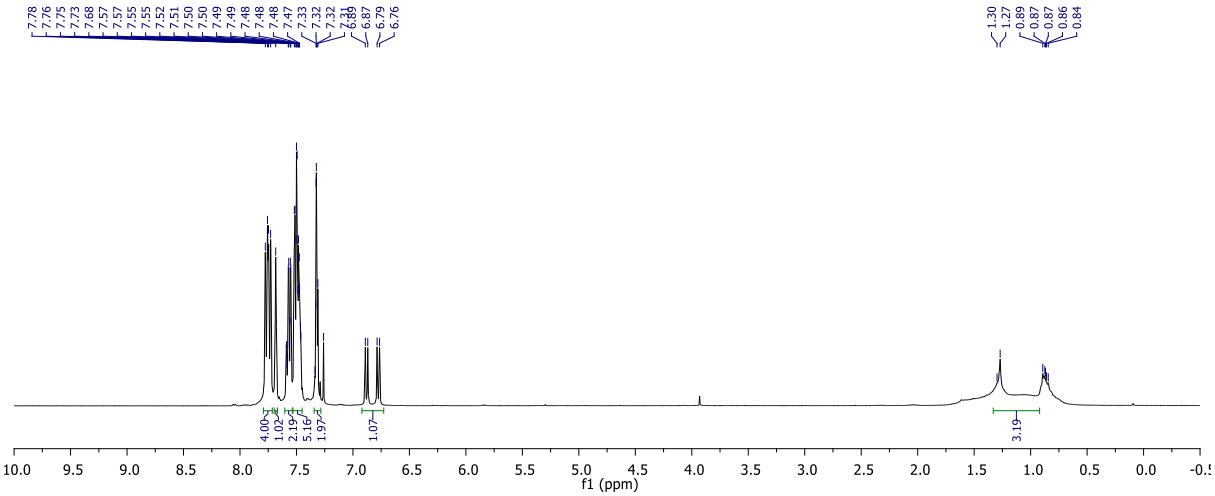
^{11}B NMR in $CDCl_3$



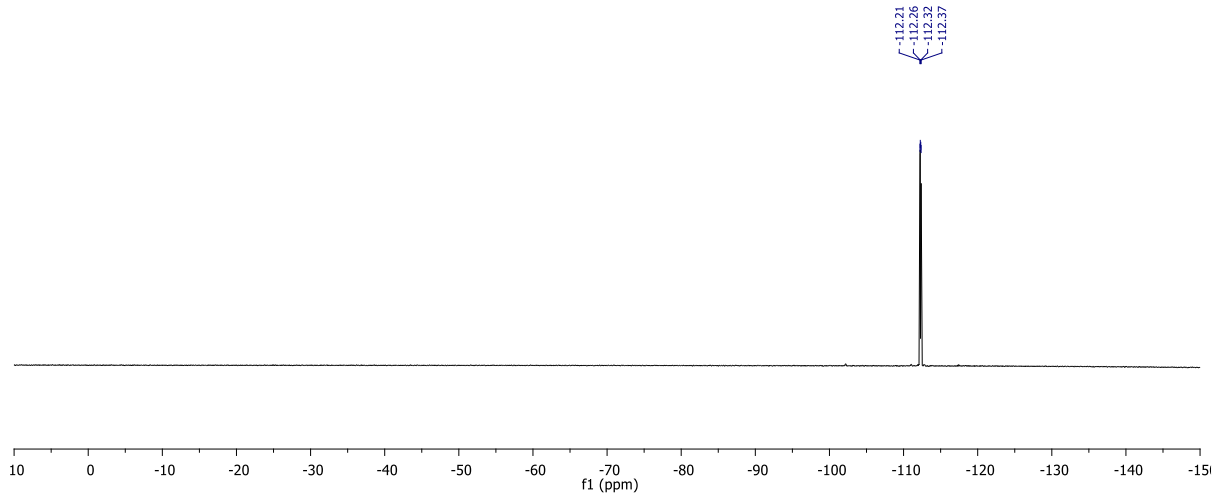
^{13}C NMR {^{1}H} in $CDCl_3$

(*E*)-((2-(3-Chlorophenyl)-1-fluorovinyl)diphenylphosphonio)trihydroborate 3g

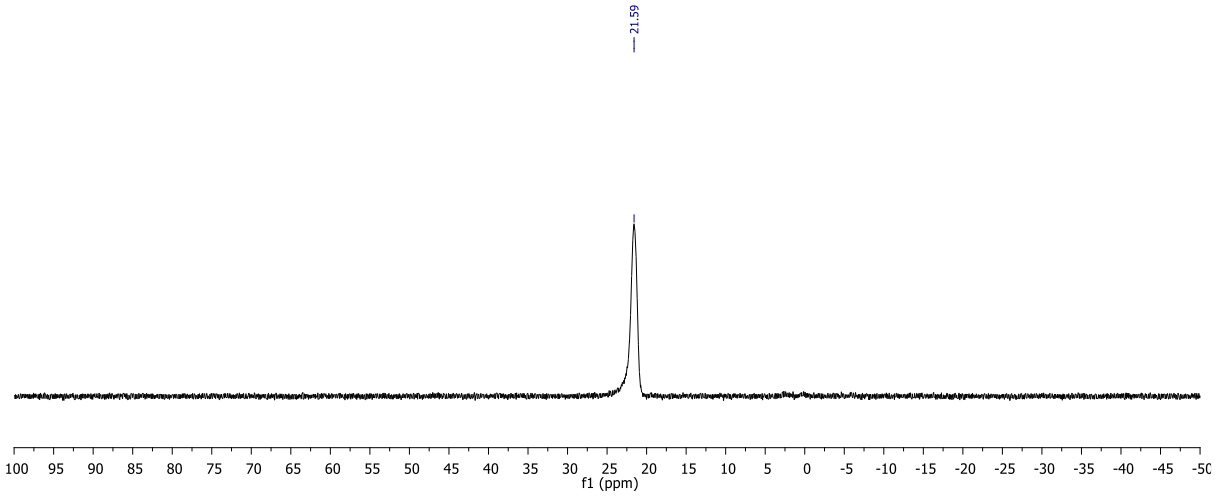




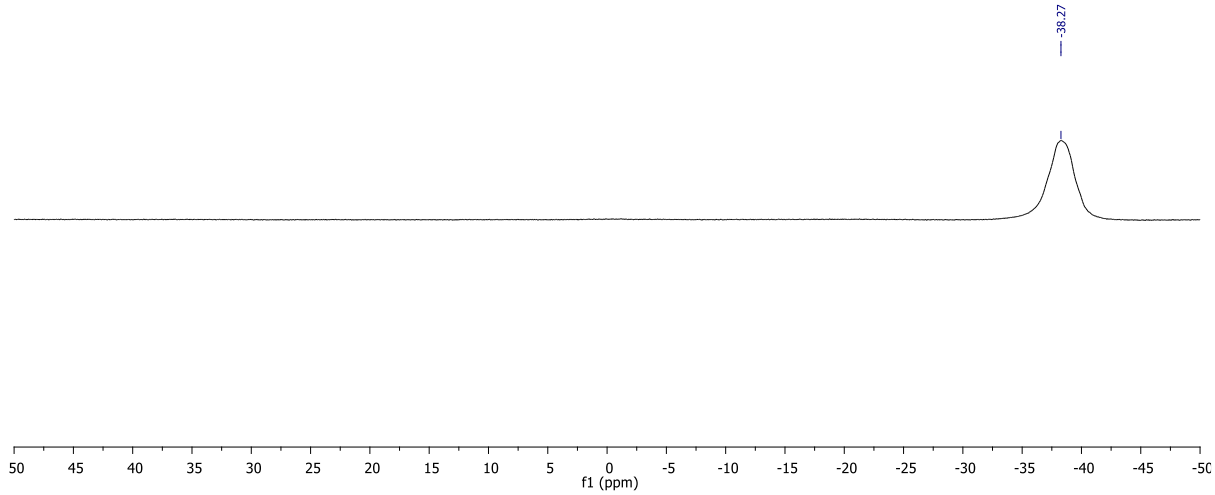
^{1}H NMR in $CDCl_3$



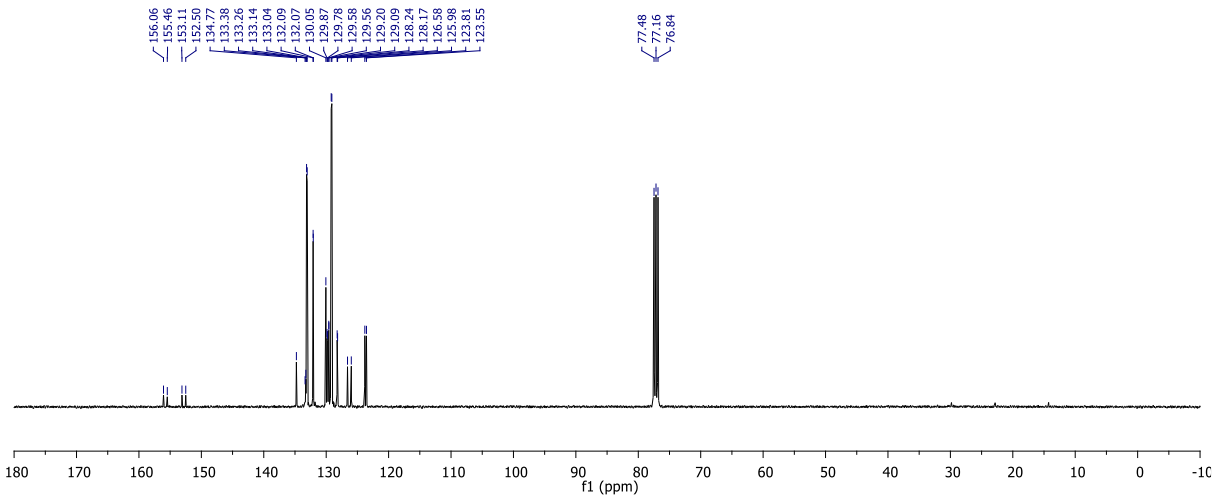
^{19}F NMR in $CDCl_3$



^{31}P NMR in $CDCl_3$



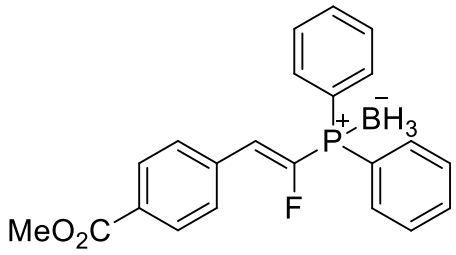
^{11}B NMR in $CDCl_3$

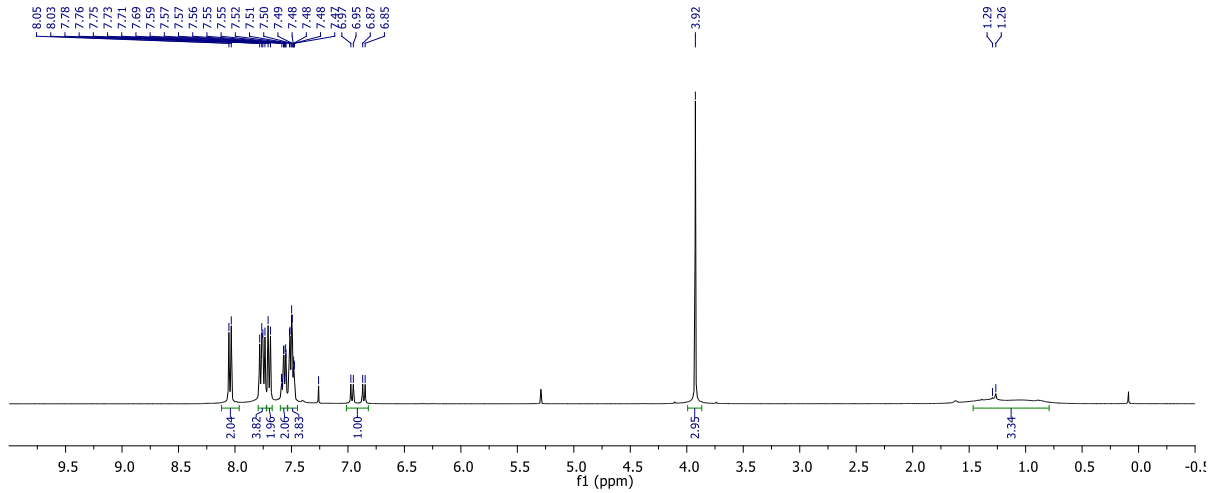


^{13}C NMR {^{1}H} in $CDCl_3$

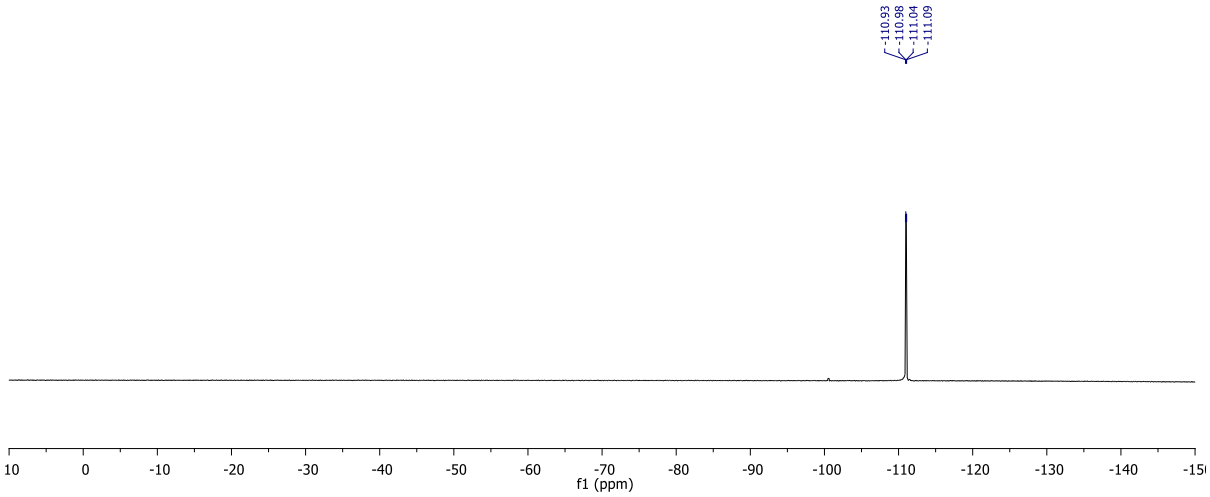
(*E*)-((2-(4-(Methoxycarbonyl)phenyl)-1-fluorovinyl)diphenylphosphonio)trihydroborate

3h

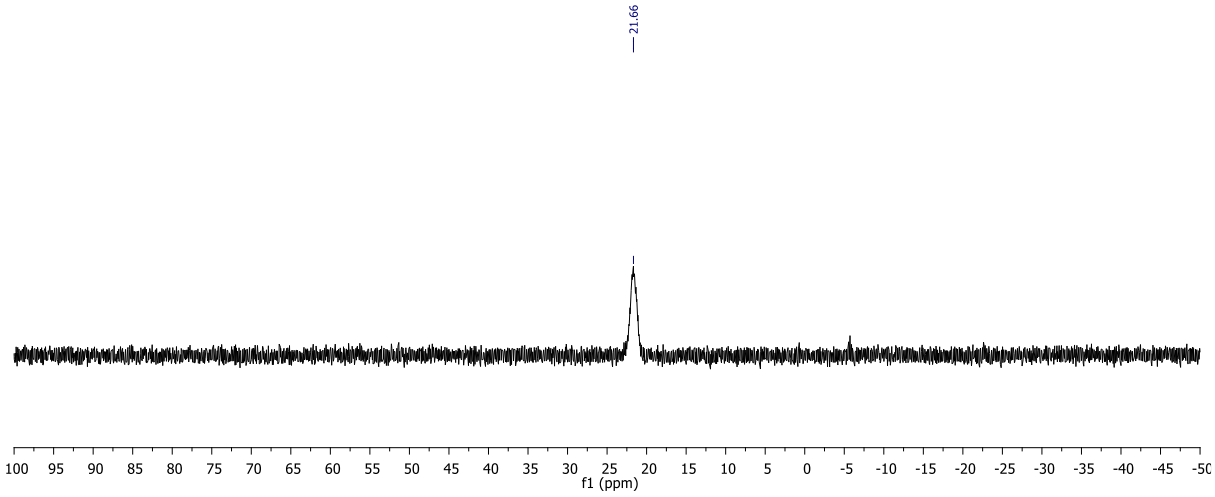




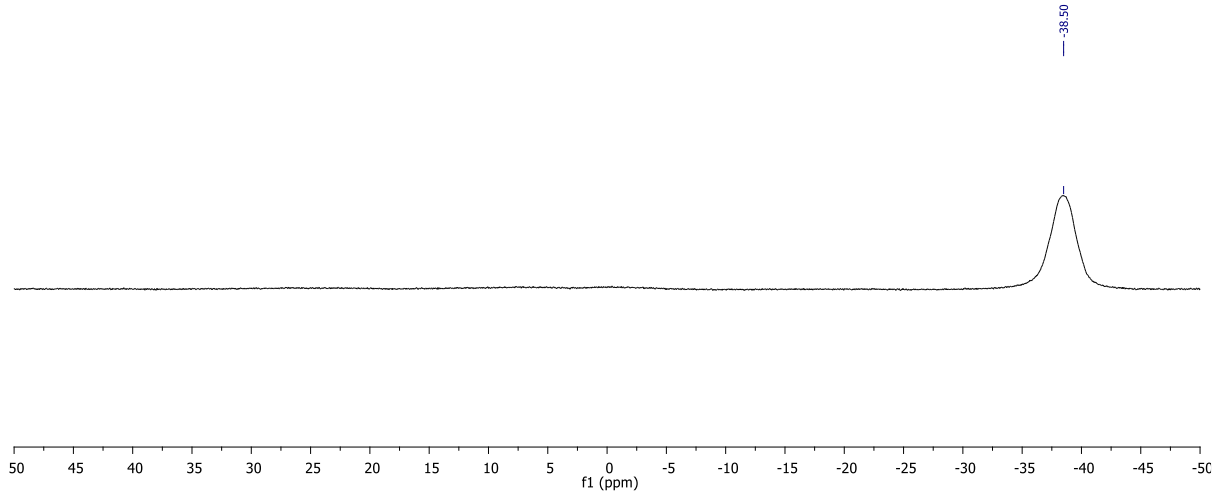
^{1}H NMR in $CDCl_3$



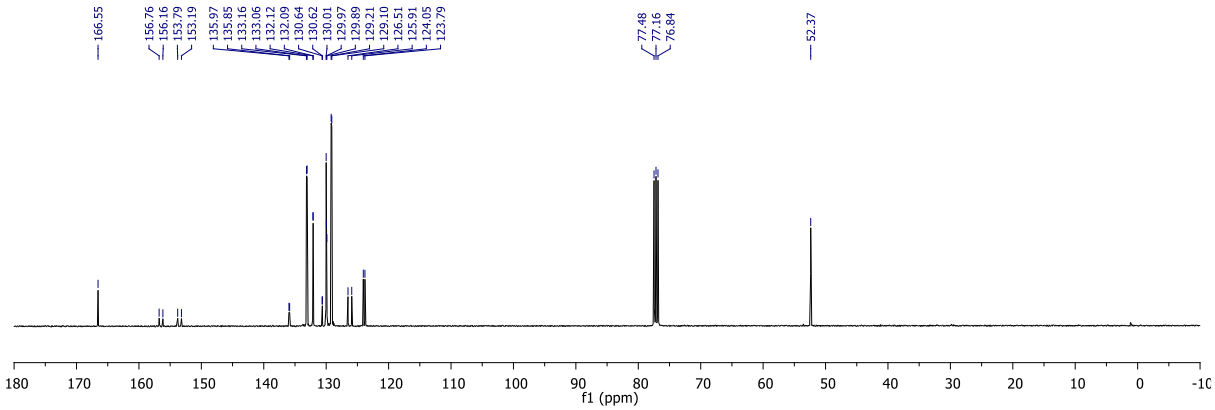
^{19}F NMR in $CDCl_3$



^{31}P NMR in $CDCl_3$

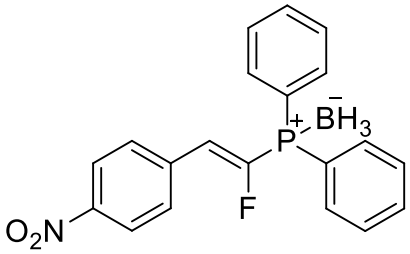


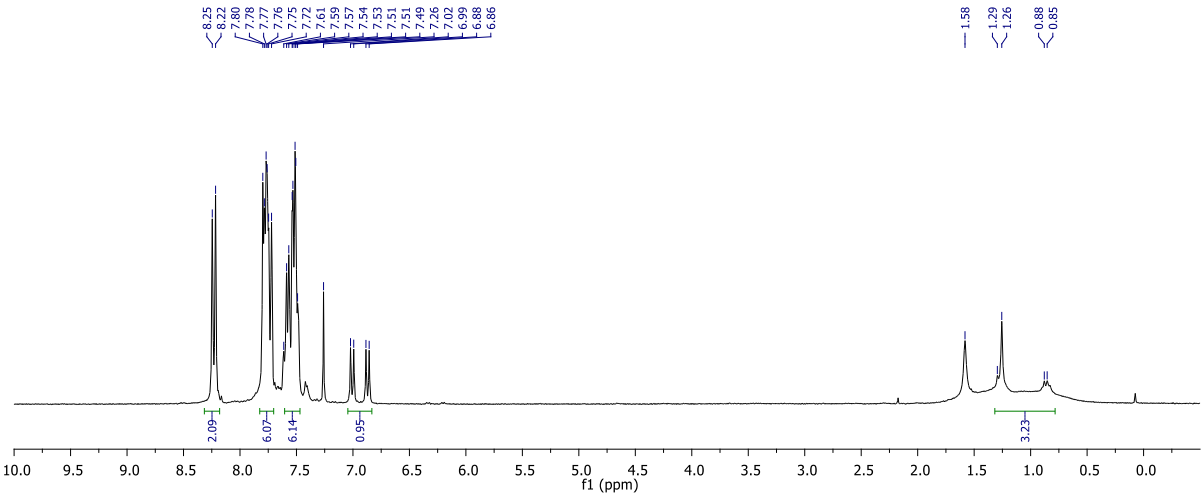
^{11}B NMR in $CDCl_3$



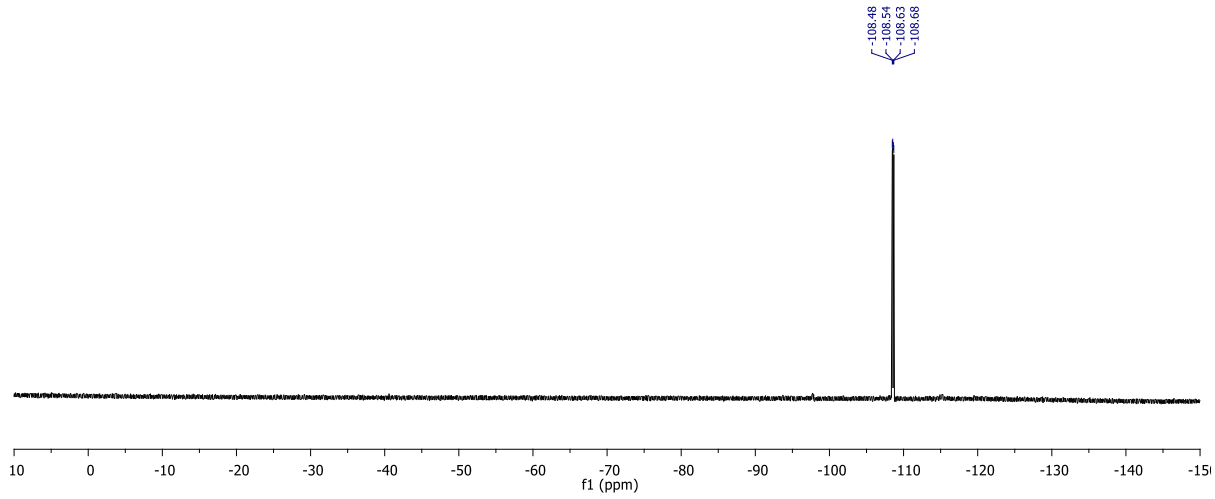
^{13}C NMR {^{1}H} in $CDCl_3$

(*E*)-((2-(4-Nitrophenyl)-1-fluorovinyl)diphenylphosphonio)trihydroborate 3i

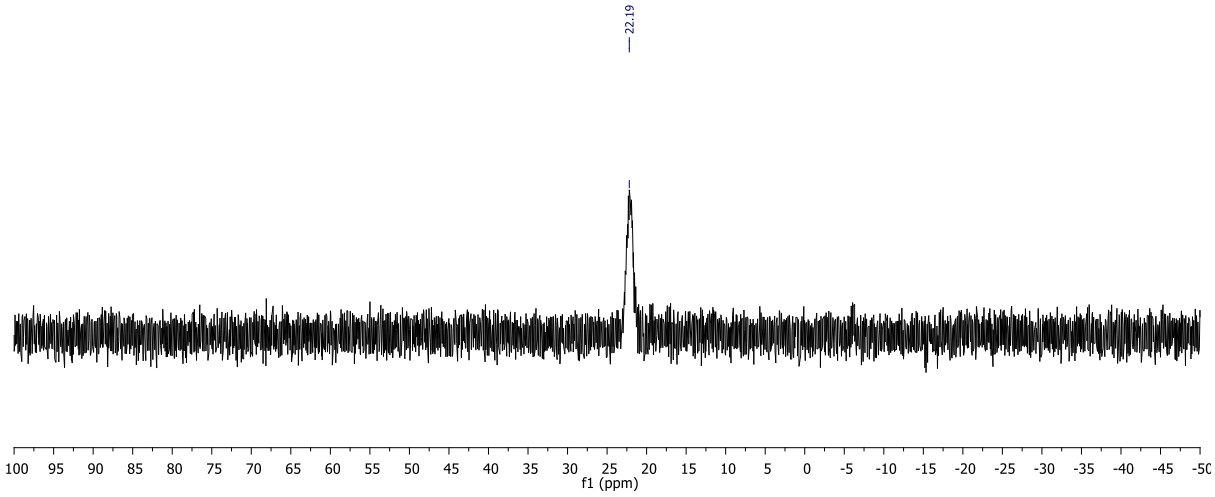




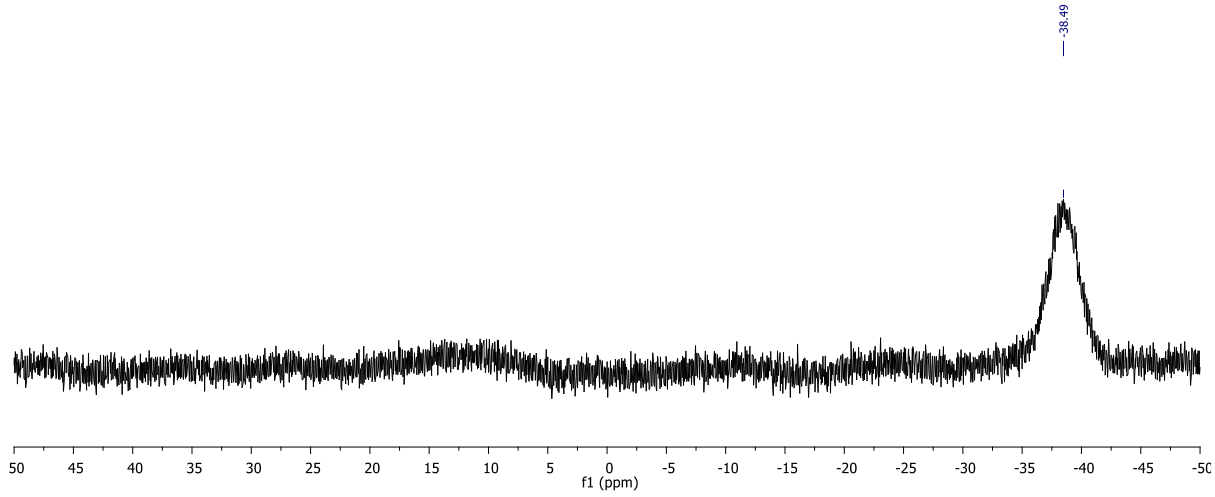
^{1}H NMR in $CDCl_3$



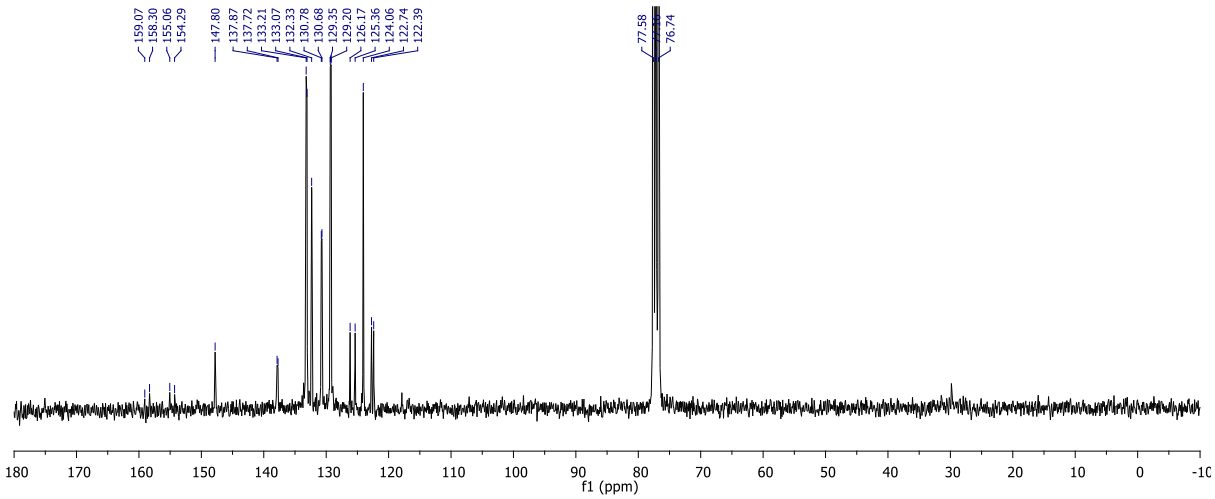
^{19}F NMR in $CDCl_3$



^{31}P NMR in $CDCl_3$

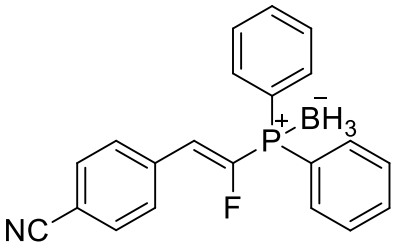


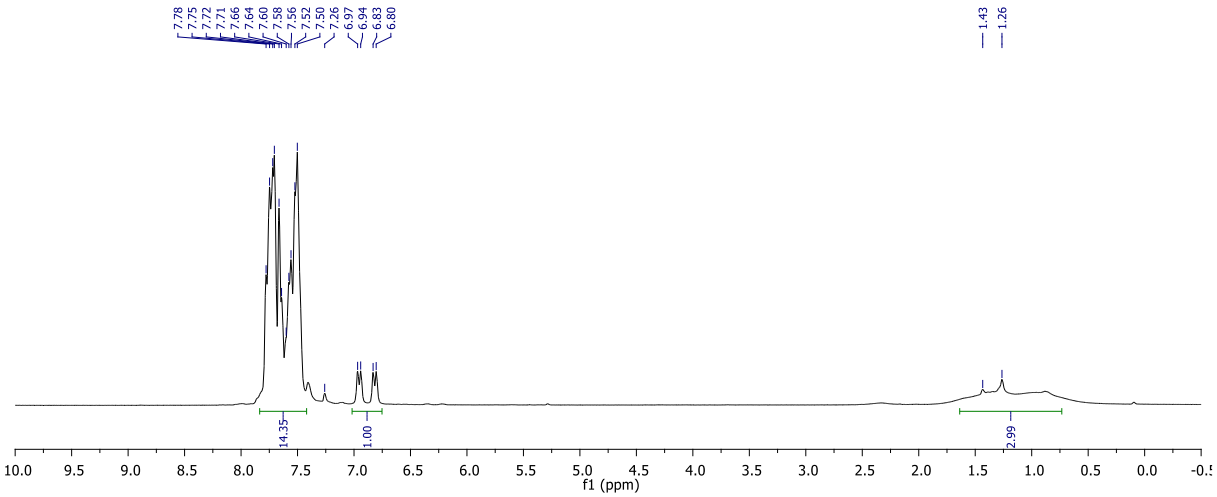
^{11}B NMR in $CDCl_3$



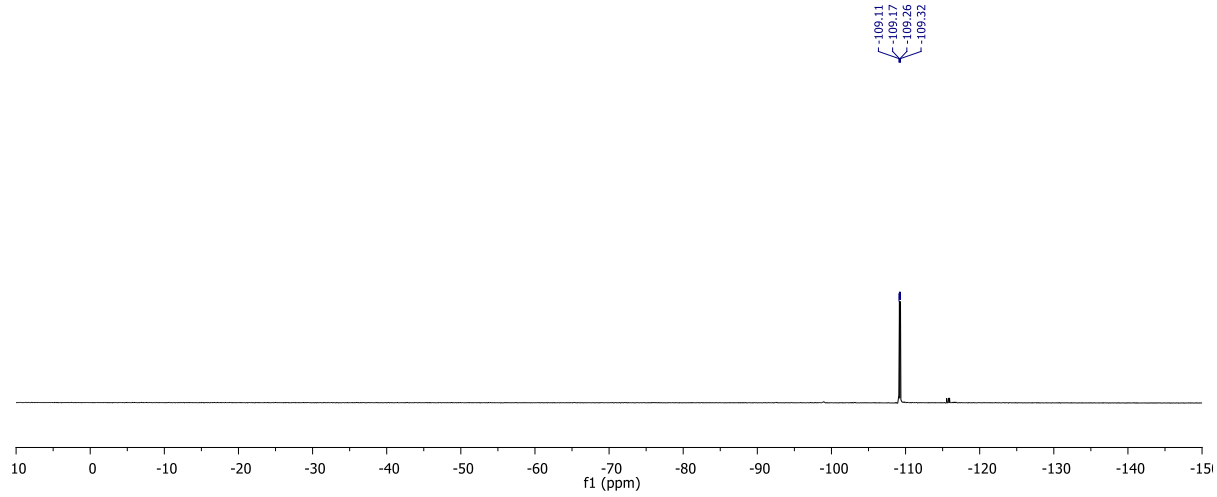
^{13}C NMR {^{1}H} in $CDCl_3$

(*E*)-((2-(4-Cyanophenyl)-1-fluorovinyl)diphenylphosphonio)trihydroborate 3j

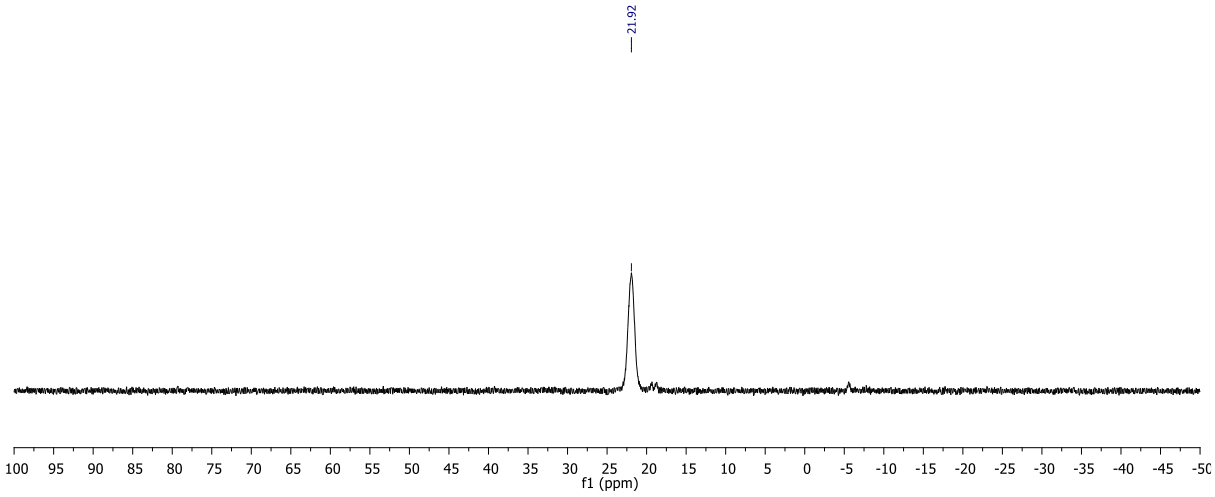




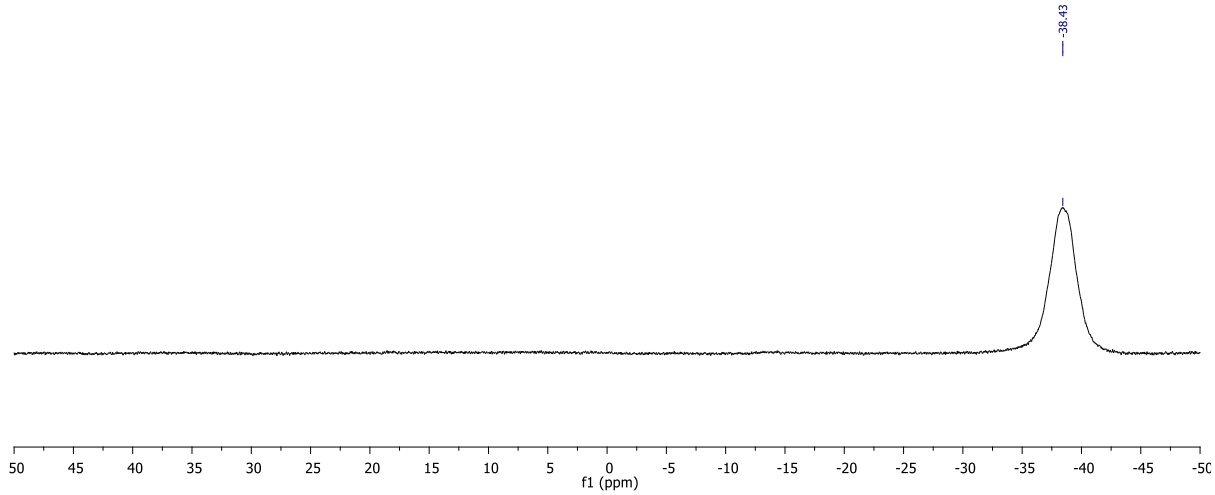
^{1}H NMR in $CDCl_3$



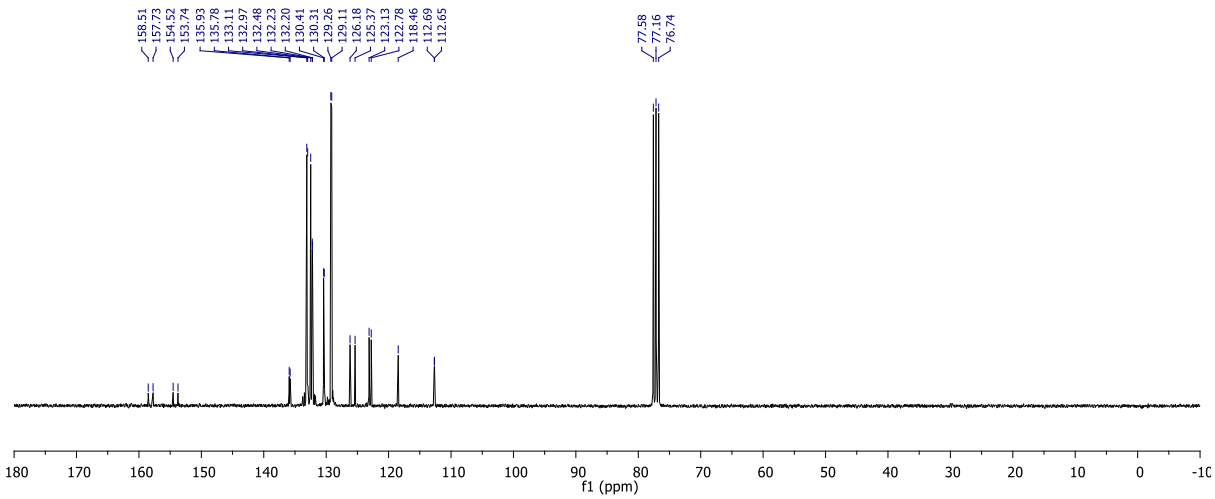
^{19}F NMR in $CDCl_3$



^{31}P NMR in $CDCl_3$



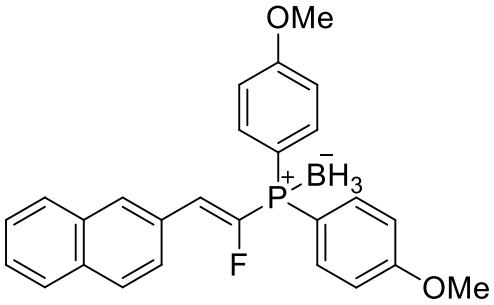
^{11}B NMR in $CDCl_3$

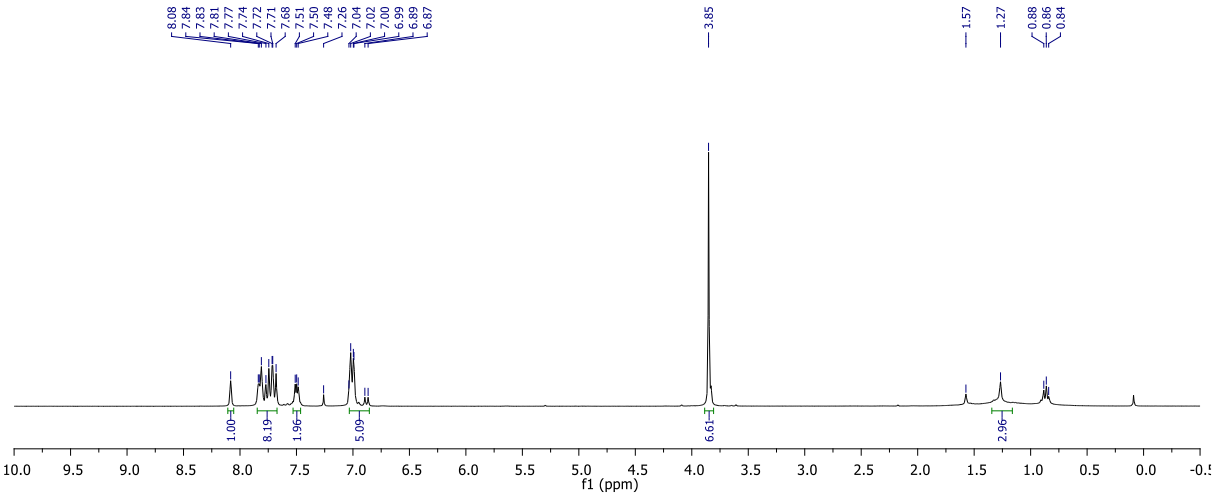


^{13}C NMR {^{1}H} in $CDCl_3$

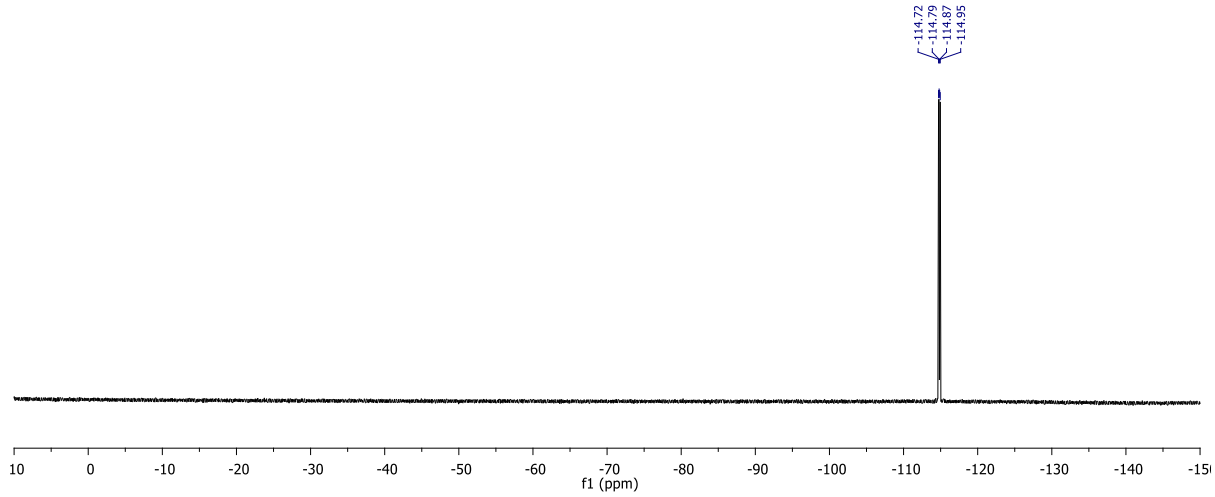
(*E*)-((1-Fluoro-2-(naphth-2-yl)vinyl)-bis(4-methoxyphenyl)phosphonio)trihydroborate

3k

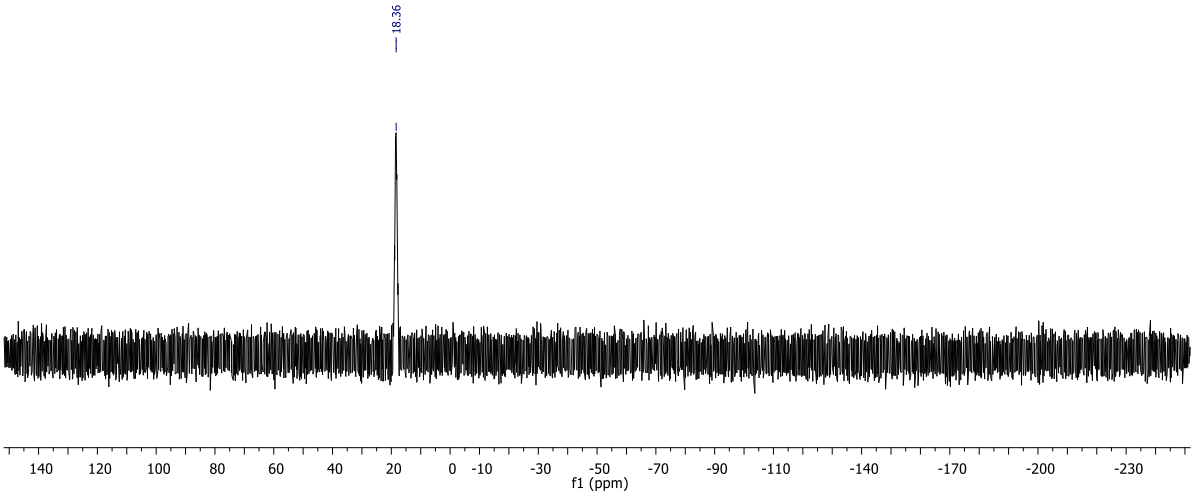




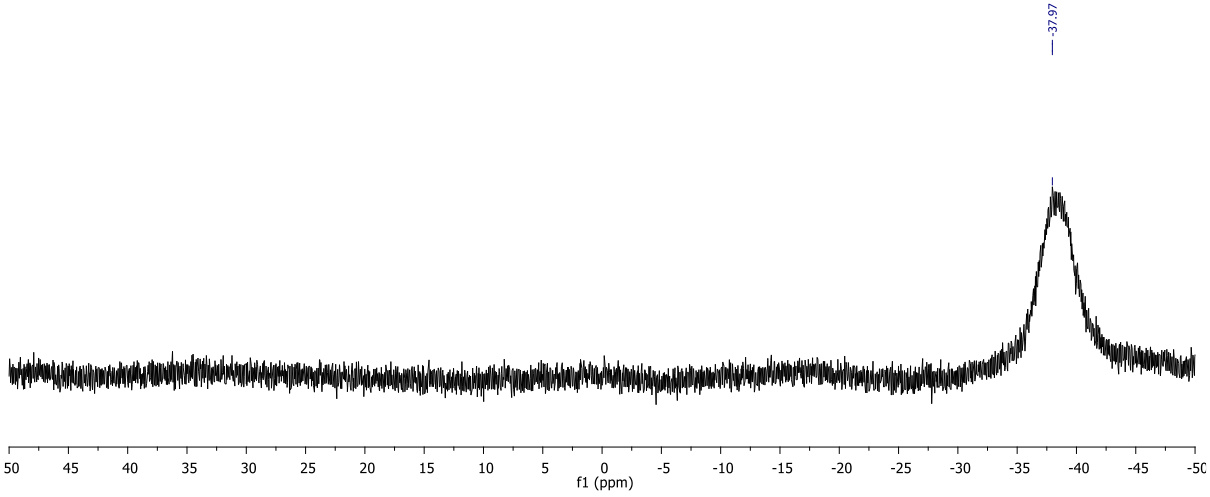
^{1}H NMR in $CDCl_3$



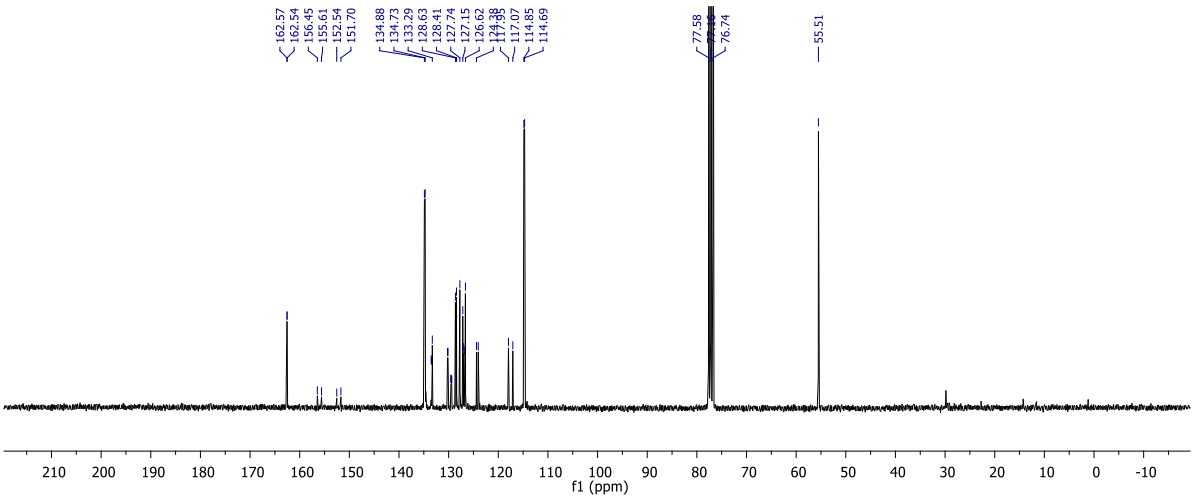
^{19}F NMR in $CDCl_3$



^{31}P NMR in $CDCl_3$

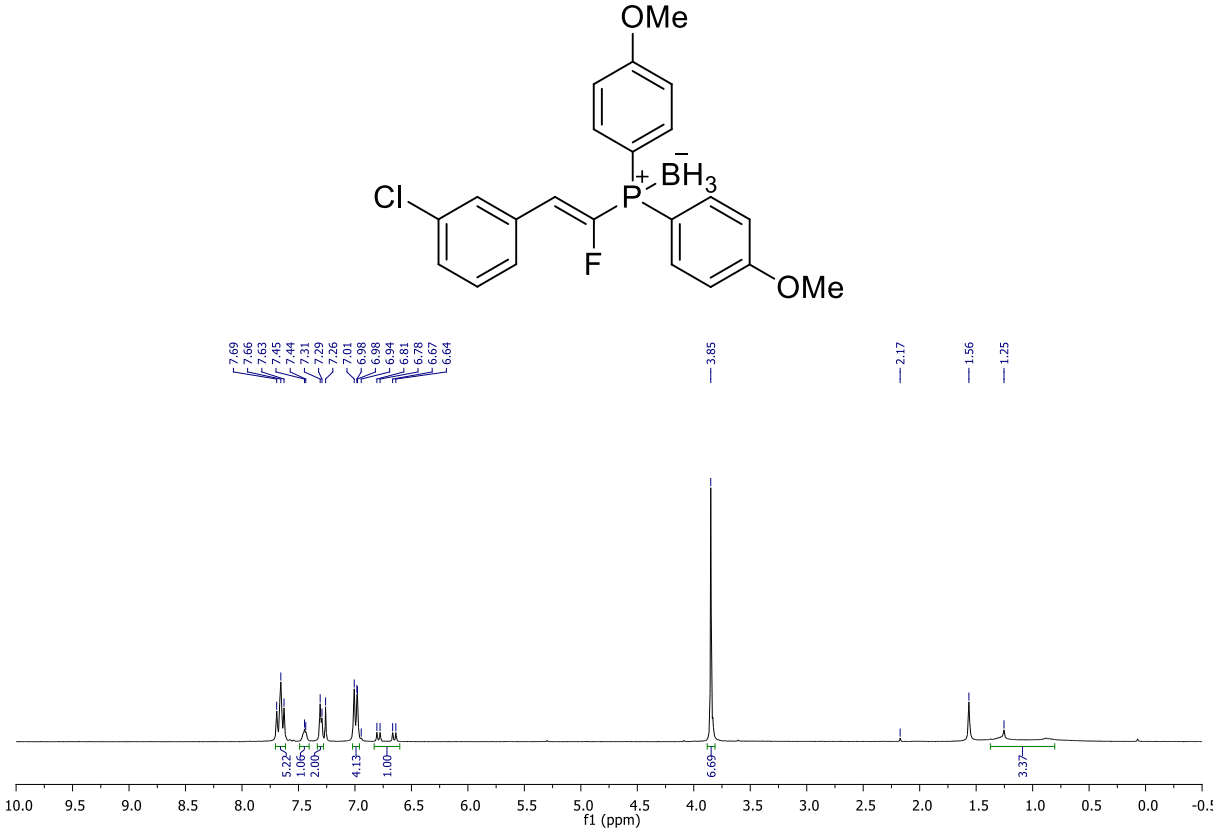


^{11}B NMR in $CDCl_3$

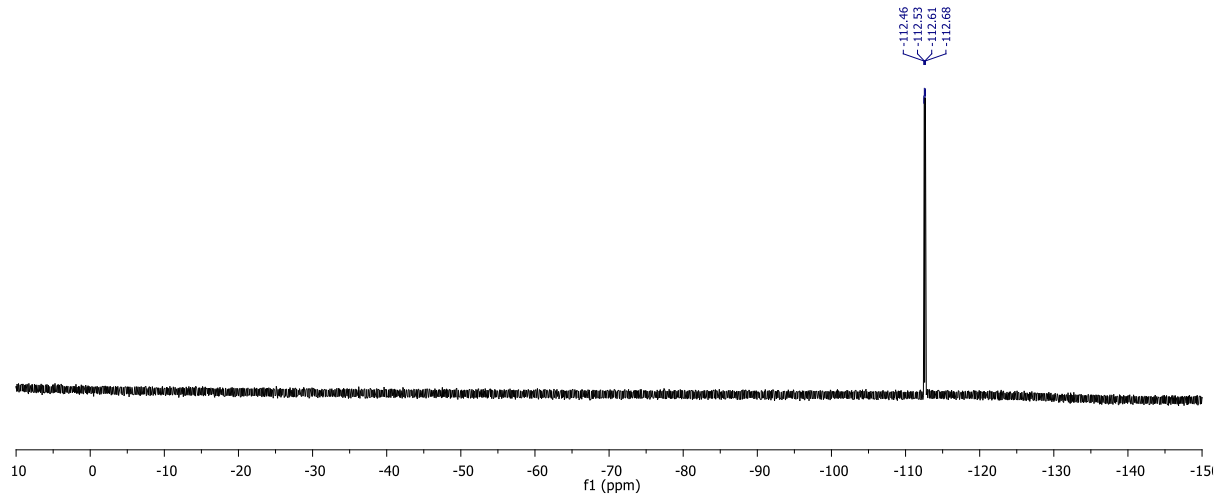


^{13}C NMR {^{1}H} in $CDCl_3$

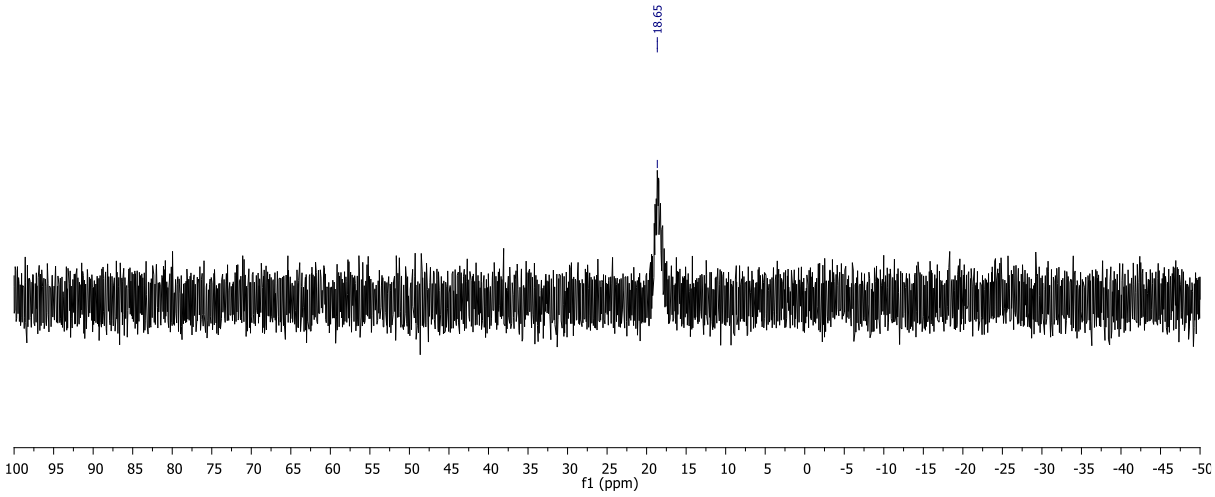
***(E)*-((2-(3-Chlorophenyl)-1-fluorovinyl)-bis(4-methoxyphenyl)phosphonio)trihydroborate 3l**



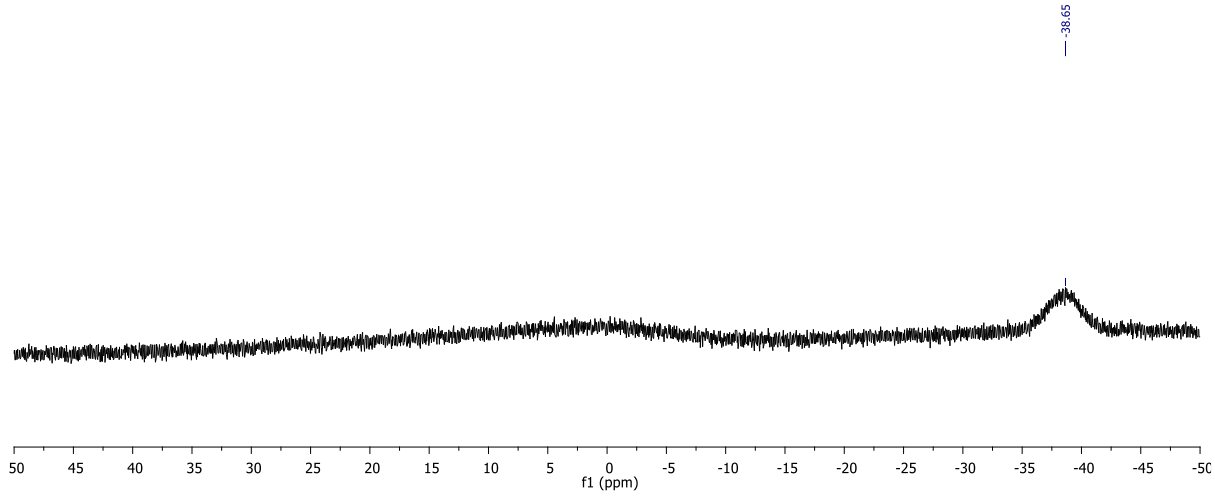
^{1}H NMR in $CDCl_3$



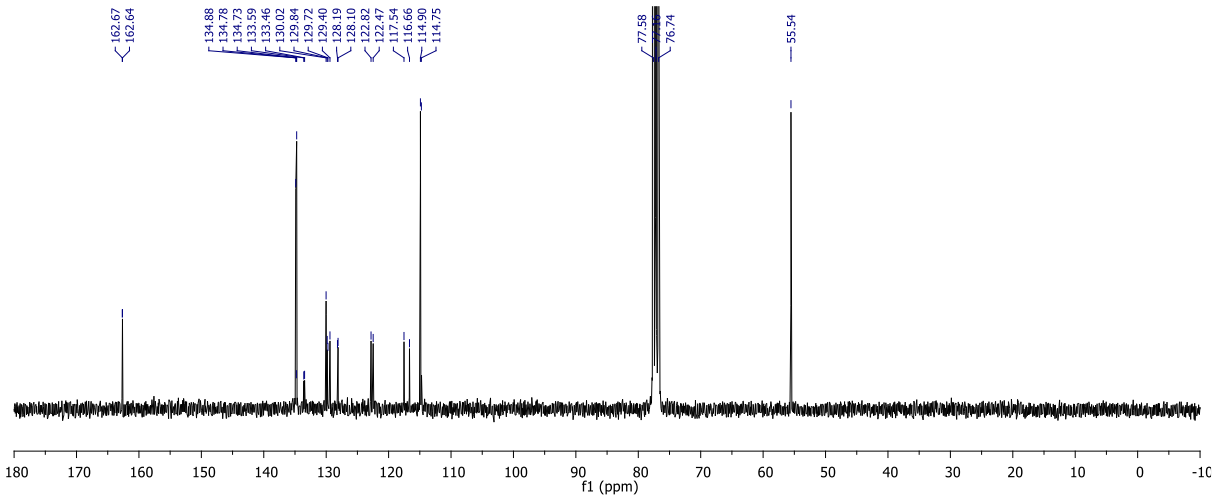
^{19}F NMR in $CDCl_3$



^{31}P NMR in $CDCl_3$

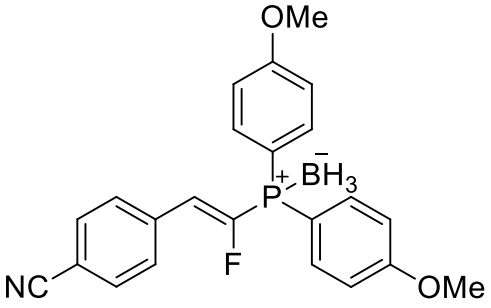


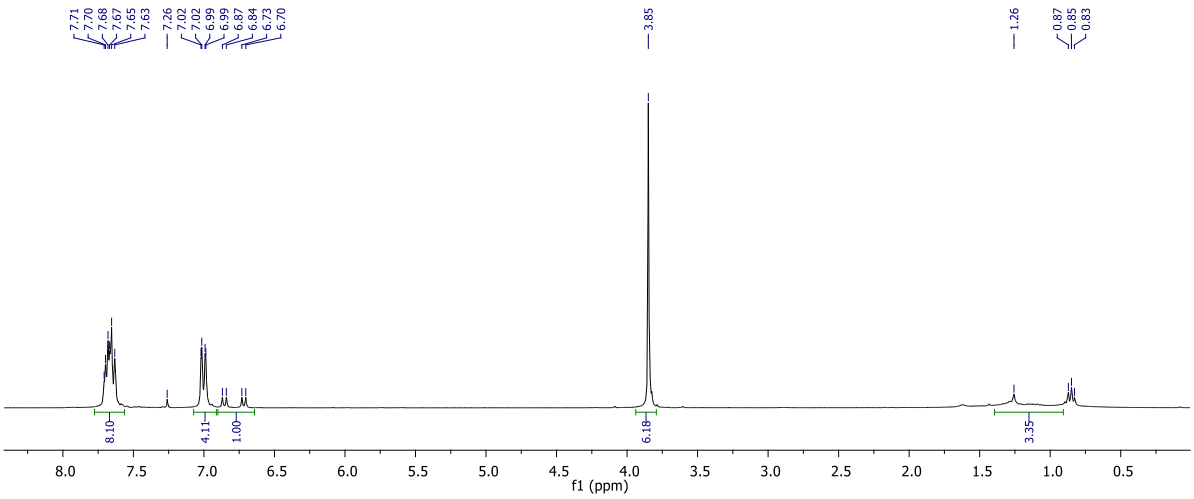
^{11}B NMR in $CDCl_3$



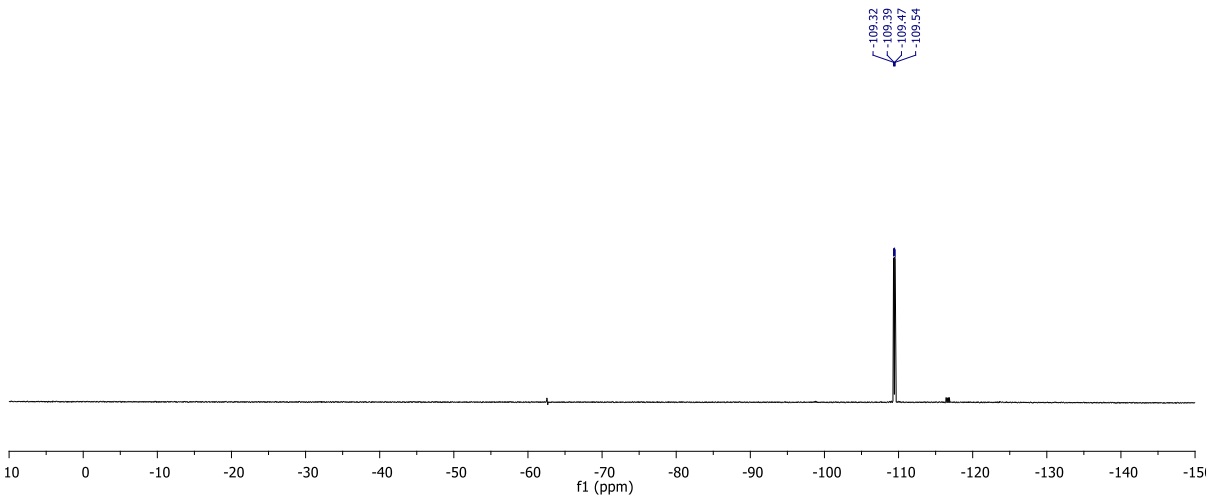
^{13}C NMR {^{1}H} in $CDCl_3$

(*E*)-((2-(4-Cyanophenyl)-1-fluorovinyl) bis(4-methoxyphenyl)phosphonio)trihydroborate 3m

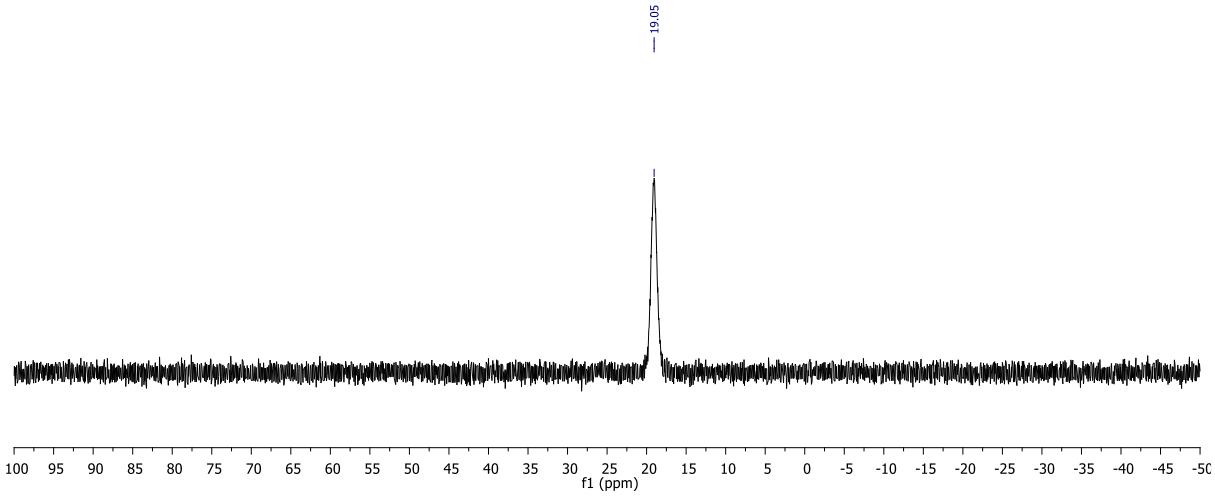




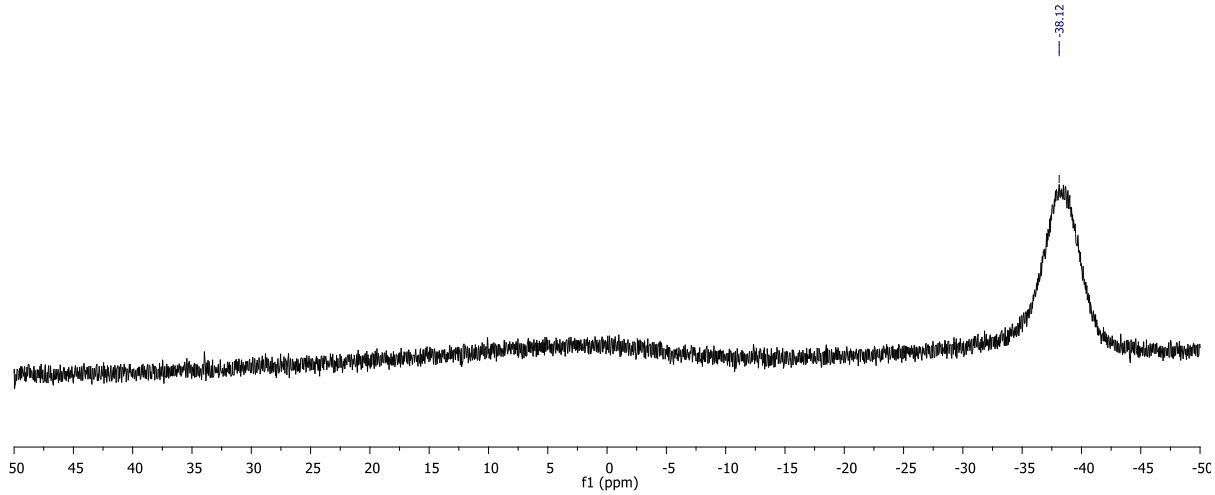
^{1}H NMR in $CDCl_3$



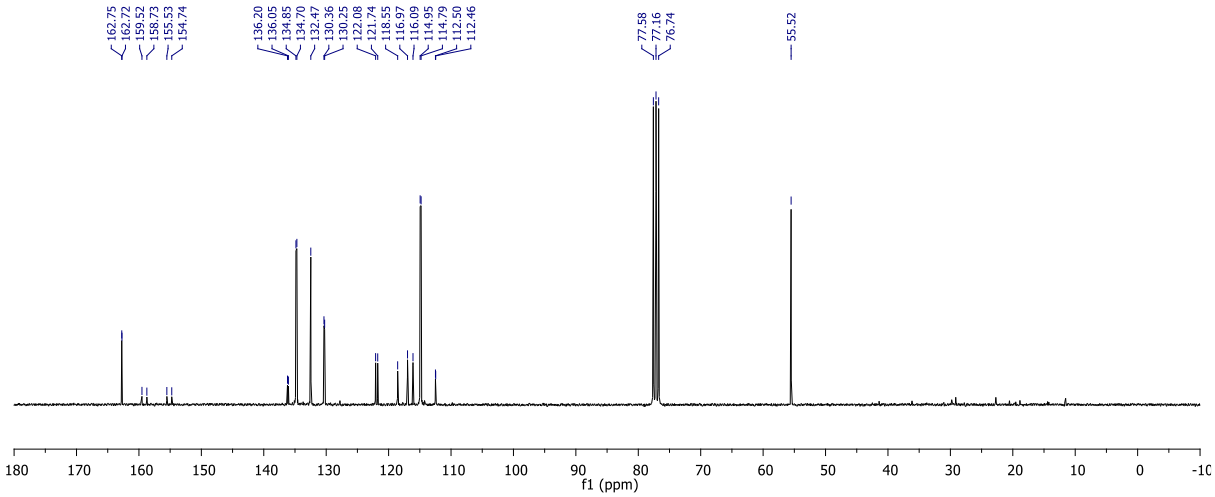
^{19}F NMR in $CDCl_3$



^{31}P NMR in $CDCl_3$

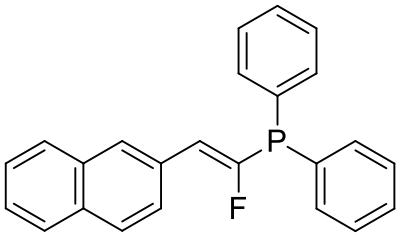


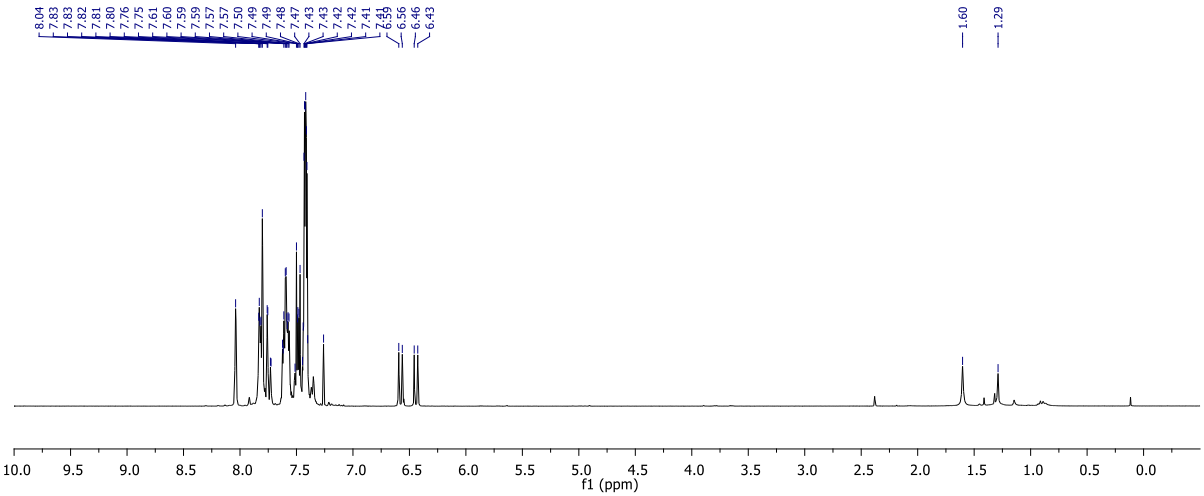
^{11}B NMR in $CDCl_3$



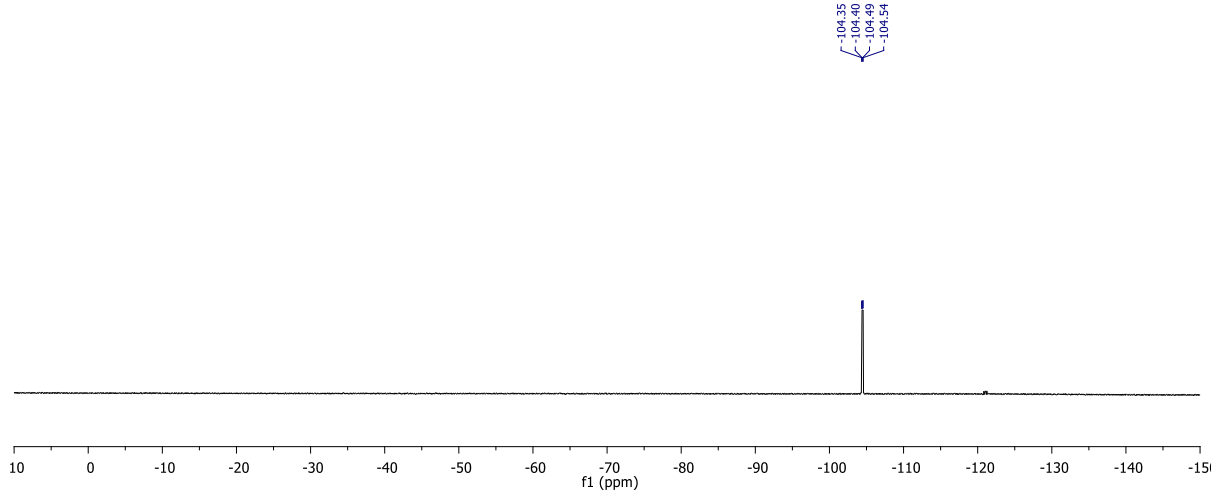
^{13}C NMR {^{1}H} in $CDCl_3$

***(E)*-(1-Fluoro-2-(naphth-2-yl)vinyl)diphenylphosphine 3a'**

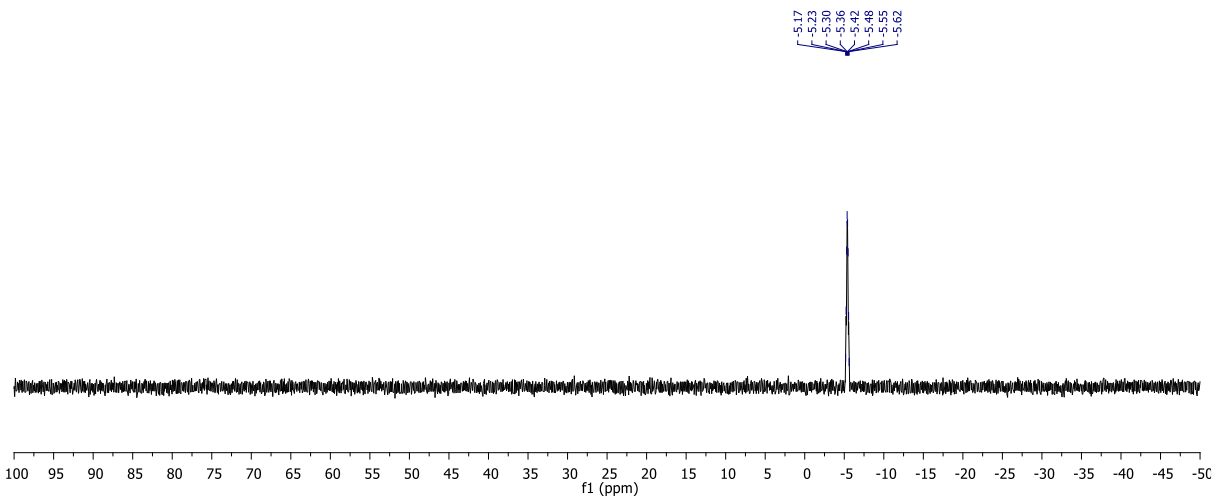




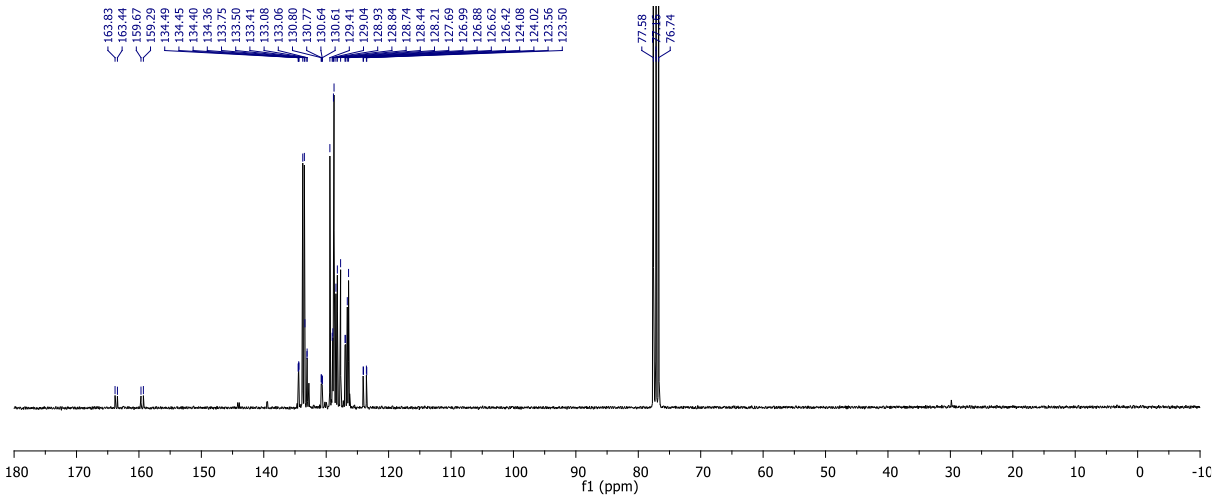
^{1}H NMR in $CDCl_3$



^{19}F NMR in $CDCl_3$

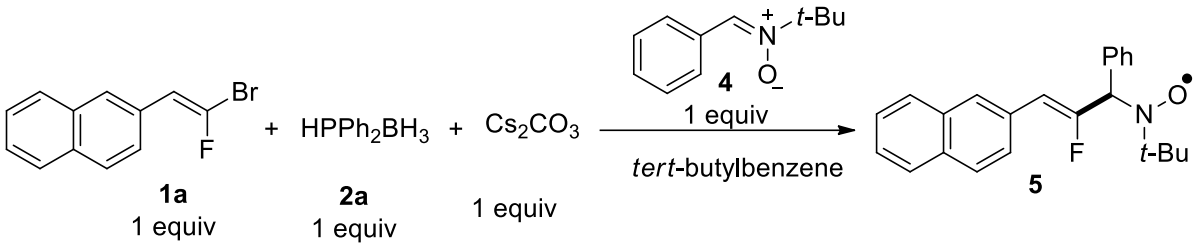


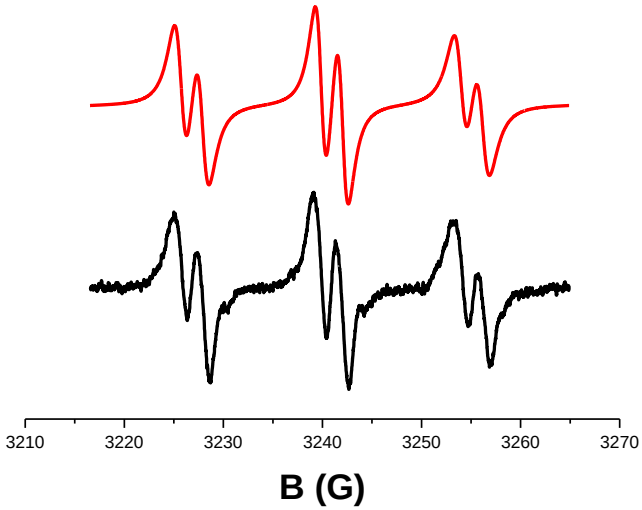
^{31}P NMR in $CDCl_3$



^{13}C NMR {^{1}H} in $CDCl_3$

6. Electron paramagnetic resonance (EPR) experiment



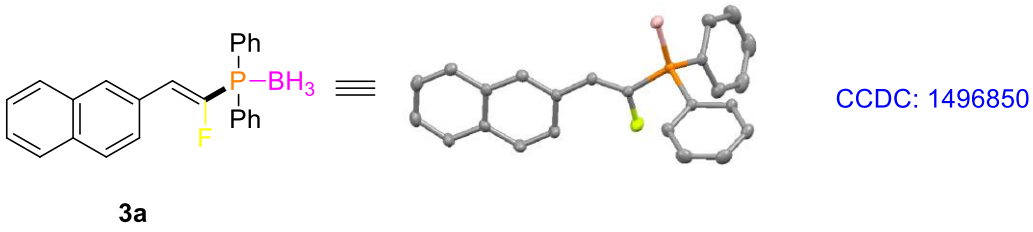


a_N = 14.5; a_H= 2.3 G

7. X-Ray structures

(*E*)-((1-Fluoro-2-(naphth-2-yl)vinyl)diphenylphosphonio)trihydroborate 3a

Hydrogen atoms are omitted for clarity.

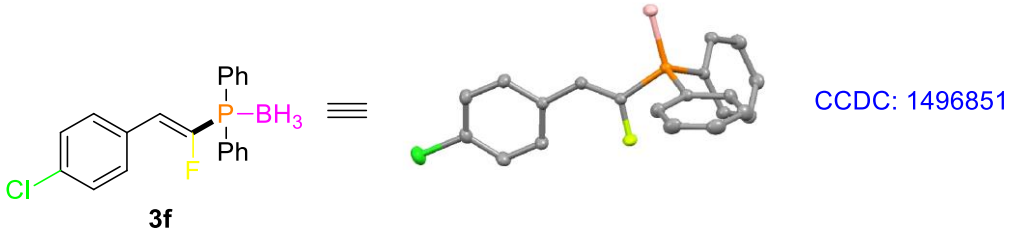


3a

Figure 1 : X-Ray Structure of **3a**

(*E*)-((2-(4-Chlorophenyl)-1-fluorovinyl)diphenylphosphonio)trihydroborate 3f

Hydrogen atoms are omitted for clarity.

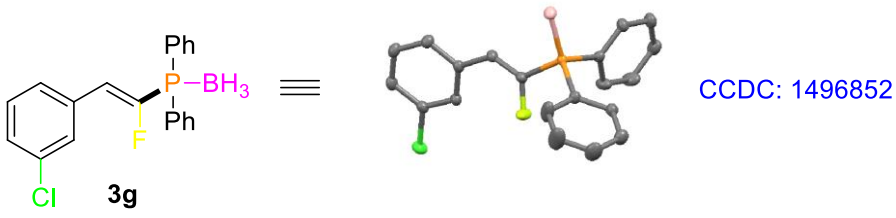


3f

Figure 2 : X-Ray Structure of **3f**

(*E*)-((2-(3-Chlorophenyl)-1-fluorovinyl)diphenylphosphonio)trihydroborate 3g

Hydrogen atoms are omitted for clarity.



3g

Figure 3 : X-Ray Structure of **3g**