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Supplementary information

Iridium(I)-catalyzed enantioselective five- and six-membered C−H silylation of ferrocenes

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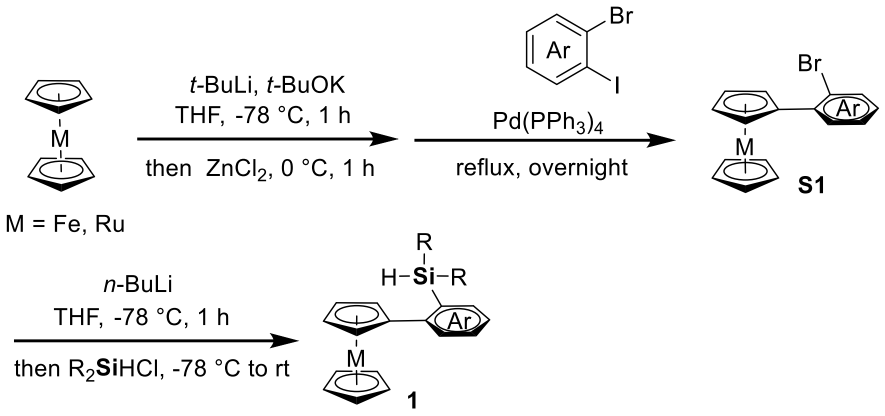
1. General Information

All reactions were carried out under a nitrogen atmosphere in oven-dried glassware. Unless otherwise mentioned, all other reagents were purchased from commercial sources and were used without further purification. Solvent was purified according to the procedure from the book named "Purification of Laboratory Chemicals". Flash column chromatography was performed on silica gel (particle size 200-300 mesh). NMR spectra were recorded on a Bruker 400MHz spectrometer and were calibrated using residual solvent as an internal reference ($CDCl_3$: 7.26 ppm for ^1H NMR and 77 ppm for ^{13}C NMR; CD_3COCD_3: 2.05 ppm for ^1H NMR and 29.84 ppm for ^{13}C NMR). The following abbreviations were used to explain the multiplicities: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, b = broad. Enantiomeric excesses (ee values) of the products were determined by chiral HPLC analysis using a Thermo U3000 instrument (n-hexane/iPrOH as eluent) with a Daicel chiracel® OD-H or OD-3 or IA-3 or IC-3 Column (column temperature 25 °C). Optical rotation was measured on IP-digi300/2 apparatus with a sodium lamp (589 nm) at 25 °C. Melting points were determined on a X-4B melting point apparatus. High-resolution mass spectra were recorded on an IonSpec FT-ICR mass spectrometer or Agilent 6520 Q-TOF LC-MS with ESI resource. Absolute configurations were determined by comparison of specific rotations with literature data. Racemic compounds were prepared by use of (*rac*)-4-phenyl-2-(pyridin-2-yl)-4,5-dihydrooxazole as the ligand under the same reaction condition.

2. Iridium-Catalyzed 5-Membered Enantioselective C−H Silylation of Ferrocenes

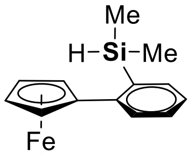
2.1 General procedures for the synthesis of substrate 1[1-3]



The stirred solution of metallocene (20 mmol) in THF (60 mL) was cooled to -78 °C under N_2, *t*-BuOK (10 mol%, 224 mg) was added followed by dropwise addition of *t*-BuLi (42 mmol. 1.6 M, 26 mL). After being stirred at this temperature for 1 h, $ZnCl_2$ (42 mmol, 5.7 g) was added in one portion and the system was gradually warmed to room temperature in 1 h. $Pd(PPh_3)_4$ (1.0 mmol, 1.15 g) and 2-bromoiodobenzene derivatives (20 mmol) were added sequentially. The stirring was continued for additional 4 h after being heated to 60 °C. The reaction was quenched with 2N HCl aq. (50 mL), the organic phase was separated, sequentially washed with water (50 mL), brine (50 mL) and dried with $MgSO_4$. The mixture was filtered and concentrated under reduced pressure. Column chromatography on silica gel by using hexane as eluent provided the aryl bromide **S1**.

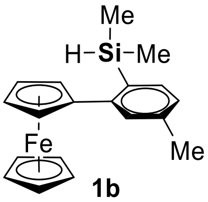
The aryl bromide **S1** (5 mmol) was dissolved in THF (25 mL) and cooled to -78 °C under N_2. *n*-BuLi (5.5 mmol, 2.5 M, 2.2 mL) was added dropwise and the mixture was stirred for additional 10 min. The reaction system was allowed to warm to room temperature after the addition of silane chloride (6 mmol) and stirred overnight. After the reaction was finished, the reaction mixture was quenched with water (5 mL) and the volatile compound was removed under reduced pressure. The residue was extracted with DCM for three times (30 mL × 3). The combined organic layer was separated, washed with brine (30 mL), dried with Na_2SO_4. The mixture was filtered and concentrated under reduced pressure. Column chromatography on silica gel by using hexane as eluent provided the substrate **1**.

2.2 Characterization of substrates 1



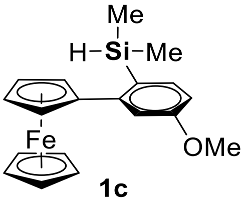
1a

According to general procedure, **1a** was obtained in 42% yield as dark orange solid. R*f* = 0.5 (Hexane). **^{1}H NMR (400 MHz, CD$_3$COCD$_3$)** δ 7.98 (d, *J* = 7.7 Hz, 1H), 7.47 – 7.39 (m, 2H), 7.24 (t, *J* = 7.4 Hz, 1H), 4.53 – 4.49 (m, 3H), 4.31 (t, *J* = 1.9 Hz, 2H), 4.18 (s, 5H), 0.09 (d, *J* = 3.8 Hz, 6H). **^{13}C NMR (101 MHz, CD$_3$COCD$_3$)** δ 145.88, 136.72, 135.28, 132.08, 129.84, 126.54, 92.24, 71.14, 70.20, 68.53, -2.78.



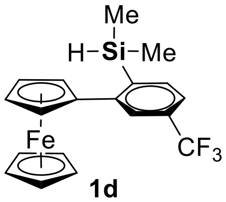
1b

According to general procedure, **1b** was obtained in 47% yield as dark orange solid. R*f* = 0.5 (Hexane). **^{1}H NMR (400 MHz, CD$_3$COCD$_3$)** δ 7.80 (s, 1H), 7.33 (d, *J* = 7.5 Hz, 1H), 7.07 (ddd, *J* = 7.6, 1.8, 0.8 Hz, 1H), 4.49 – 4.45 (m, 3H), 4.29 (t, *J* = 1.9 Hz, 2H), 4.17 (s, 5H), 2.40 (s, 3H), 0.07 (d, *J* = 3.7 Hz, 6H). **^{13}C NMR (101 MHz, CD$_3$COCD$_3$)** δ145.84, 139.44, 135.47, 133.21, 132.79, 127.43, 92.30, 71.07, 70.20, 68.43, -2.72.



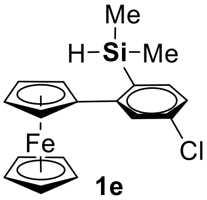
1c

According to general procedure, **1c** was obtained in 36% yield as dark orange solid. R*f* = 0.5 (Hexane/Ethyl acetate = 20:1). **^{1}H NMR (400 MHz, CD$_3$COCD$_3$)** δ 7.54 (d, *J* = 2.6 Hz, 1H), 7.36 (d, *J* = 8.3 Hz, 1H), 6.84 (dd, *J* = 8.3, 2.6 Hz, 1H), 4.51 (t, *J* = 1.8 Hz, 2H), δ 4.48 – 4.45 (m, 1H), 4.30 (t, *J* = 1.8 Hz, 2H), 4.20 (s, 5H), 3.90 (s, 3H), 0.06 (d, *J* = 3.7 Hz, 6H). **^{13}C NMR (101 MHz, CD$_3$COCD$_3$)** δ 161.26, 147.72, 136.86, 127.71, 117.66, 112.59, 92.35, 71.18, 70.20, 70.19, 68.49, 55.33, -2.61.



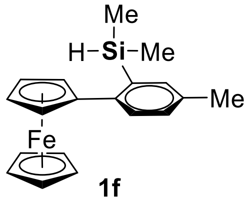
1d

According to general procedure, **1d** was obtained in 22% yield as dark orange solid. R*f* = 0.5 (Hexane). **^{1}H NMR (400 MHz, CD$_3$COCD$_3$)** δ 8.25 (s, 1H), 7.68 (d, *J* = 7.8 Hz, 1H), 7.56 (d, *J* = 8.9 Hz, 1H), 4.59 (t, *J* = 1.9 Hz, 2H), 4.53 – 4.50 (m, 1H), 4.39 (t, *J* = 1.8 Hz, 2H), 4.20 (s, 5H), 0.14 (d, *J* = 3.8 Hz, 6H). **^{13}C NMR (101 MHz, CD$_3$COCD$_3$)** δ 147.46, 142.22, 136.23, 131.13 (q, *J* = 31.8 Hz), 128.32 (q, *J* = 3.8 Hz), 125.38 (q, *J* = 272.7 Hz), 122.63 (q, *J* = 3.8 Hz), 71.41, 70.36, 69.15, 69.13, -3.14.



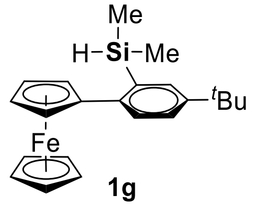
1e

According to general procedure, **1e** was obtained in 25% yield as dark orange oil. R*f* = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD$_3$COCD$_3$)** δ 7.96 (d, *J* = 2.2 Hz, 1H), 7.45 (d, *J* = 8.1 Hz, 1H), 7.28 (dd, *J* = 8.0, 2.2 Hz, 1H), 4.55 (t, *J* = 1.9 Hz, 2H),4.50 – 4.44 (m, 1H), 4.36 (t, *J* = 1.8 Hz, 2H), 4.20 (s, 5H), 0.10 (d, *J* = 3.7 Hz, 6H). **^{13}C NMR (101 MHz, CD$_3$COCD$_3$)** δ148.57, 137.12, 135.67, 135.41, 131.69, 126.55, 90.73, 71.27, 70.37, 68.97, -2.97.



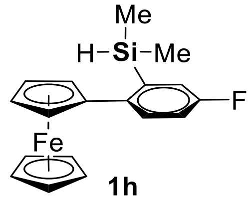
1f

According to general procedure, **1f** was obtained in 42% yield as dark orange solid. R*f* = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD$_3$COCD$_3$)** δ 7.86 (d, *J* = 7.8 Hz, 1H), 7.27 – 7.21 (m, 2H), 4.50 – 4.45 (m, 3H), 4.28 (t, *J* = 1.8 Hz, 2H), 4.16 (s, 4H), 2.32 (s, 3H), 0.08 (d, *J* = 3.7 Hz, 6H). **^{13}C NMR (101 MHz, CD$_3$COCD$_3$)** δ 142.77, 136.50, 135.91, 135.66, 132.06, 130.58, 92.22, 71.07, 70.14, 68.37, 21.13, -2.73.



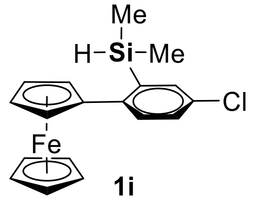
1g

According to general procedure, **1g** was obtained in 34% yield as dark orange solid. R$_f$ = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD$_3$COCD$_3$)** δ 7.90 (d, *J* = 8.1 Hz, 1H), 7.51 – 7.46 (m, 2H), 4.53-4.48 (m, 1H), 4.46 (t, *J* = 1.8 Hz, 2H), 4.29 (t, *J* = 1.9 Hz, 2H), 4.17 (s, 5H), 1.35 (s, 9H), 0.10 (d, *J* = 3.8 Hz, 6H). **^{13}C NMR (101 MHz, CD$_3$COCD$_3$)** δ 148.71, 142.82, 136.13, 131.93, 131.90, 126.92, 92.20, 71.09, 70.13, 68.38, -2.69.



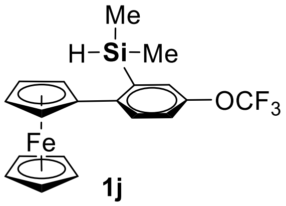
1h

According to general procedure, **1h** was obtained in 30% yield as dark orange solid. R$_f$ = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD$_3$COCD$_3$)** δ 8.08 – 8.01 (m, 1H), 7.18 – 7.13 (m, 2H), 4.50-4.43 (m, 3H), 4.31 (t, *J* = 1.9 Hz, 2H), 4.19 (s, 5H), 0.11 (d, *J* = 3.7 Hz, 6H). **^{13}C NMR (101 MHz, CD$_3$COCD$_3$)** δ 161.88 (d, *J* = 246.1 Hz), 141.90 (d, *J* = 3.2 Hz), 139.81 (d, *J* = 3.9 Hz), 134.26 (d, *J* = 7.0 Hz), 121.02 (d, *J* = 19.1 Hz), 116.49 (d, *J* = 21.1 Hz), 91.32, 71.23, 70.20, 68.58, -3.08.



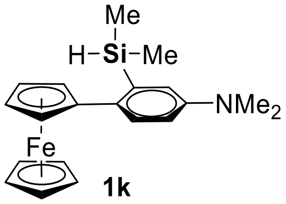
1i

According to general procedure, **1i** was obtained in 42% yield as dark orange solid. R$_f$ = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD$_3$COCD$_3$)** δ 7.99 (d, *J* = 8.2 Hz, 1H), 7.43 – 7.39 (m, 2H), 4.50 – 4.46 (m, 3H), 4.33 (t, *J* = 1.8 Hz, 2H), 4.19 (s, 5H), 0.12 (d, *J* = 3.7 Hz, 6H). **^{13}C NMR (101 MHz, CD$_3$COCD$_3$)** δ 144.84, 139.61, 134.55, 133.99, 132.23, 129.71, 90.85, 71.20, 70.32, 68.83, -3.07.



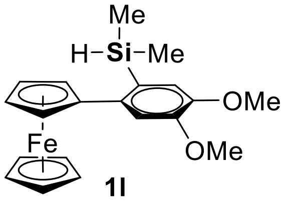
1j

According to general procedure, **1j** was obtained in 26% yield as dark orange oil. R_f = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 8.11 (d, *J* = 8.5 Hz, 1H), 7.37 – 7.31 (m, 2H), 4.52 (t, *J* = 1.8 Hz, 2H), 4.49 (p, *J* = 3.8 Hz, 1H), 4.35 (t, *J* = 1.8 Hz, 2H), 4.21 (s, 5H), 0.12 (d, *J* = 3.7 Hz, 6H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 147.92, 145.36, 139.81, 134.05, 127.16, 122.27, 121.48 (q, *J* = 255.2 Hz), 90.81, 71.30, 70.32, 68.86, -3.12.



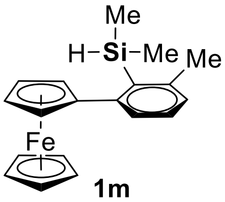
1k

According to general procedure, **1k** was obtained in 20% yield as dark orange solid. R_f = 0.3 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.80 (dt, *J* = 8.6, 1.2 Hz, 1H), 6.85 – 6.82 (m, 2H), 4.48 (p, *J* = 3.7 Hz, 1H), 4.40 (t, *J* = 1.9 Hz, 2H), 4.23 (t, *J* = 1.8 Hz, 2H), 4.15 (s, 5H), 2.95 (s, 6H), 0.09 (d, *J* = 3.8 Hz, 6H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 149.48, 136.68, 133.06, 132.82, 119.14, 114.37, 92.74, 70.81, 69.93, 67.98, 40.68, -2.66.



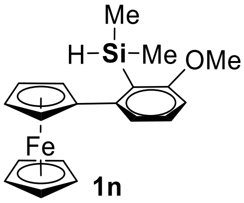
1l

According to general procedure, **1l** was obtained in 26% yield as dark orange solid. R_f = 0.4 (Hexane/Ethyl acetate = 10:1). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.57 (s, 1H), 6.95 (s, 1H), 4.48 – 4.44 (m, 3H), 4.27 (t, *J* = 1.8 Hz, 2H), 4.20 (s, 5H), 3.95 (s, 3H), 3.83 (s, 3H), 0.08 (d, *J* = 3.7 Hz, 6H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 150.66, 148.39, 139.15, 127.45, 118.64, 116.30, 92.68, 71.08, 70.09, 68.31, 56.22, 55.86, -2.60.



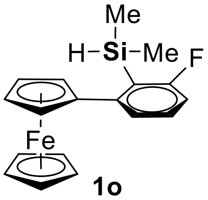
1m

According to general procedure, **1m** was obtained in 28% yield as dark orange solid. R$_f$ = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD$_3$COCD$_3$)** δ 7.85 (d, *J* = 7.6 Hz, 1H), 7.27 (t, *J* = 7.6 Hz, 1H), 7.06 (d, *J* = 7.4 Hz, 1H), 4.41 (t, *J* = 1.8 Hz, 2H), 4.32 – 4.27 (m, 3H), 4.15 (s, 5H), 2.45 (s, 3H), 0.11 (d, *J* = 4.0 Hz, 6H). **^{13}C NMR (101 MHz, CD$_3$COCD$_3$)** δ 146.31, 144.32, 136.28, 130.63, 129.23, 128.80, 94.48, 71.66, 70.15, 68.21, 23.62, -1.66.



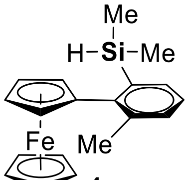
1n

According to general procedure, **1n** was obtained in 21% yield as dark orange solid. R$_f$ = 0.3 (Hexane/Ethyl acetate = 20:1). **^{1}H NMR (400 MHz, CD$_3$COCD$_3$)** δ 7.58 (dd, *J* = 7.8, 0.9 Hz, 1H), 7.34 (t, *J* = 8.0 Hz, 1H), 6.82 (d, *J* = 8.0 Hz, 1H), 4.40 (t, *J* = 1.8 Hz, 2H), 4.24 (t, *J* = 1.8 Hz, 2H), 4.19 (p, *J* = 3.8 Hz, 1H), 4.12 (s, 5H), 3.82 (s, 3H), 0.20 (d, *J* = 3.7 Hz, 6H). **^{13}C NMR (101 MHz, CD$_3$COCD$_3$)** δ165.50, 147.37, 130.76, 125.58, 125.21, 108.47, 92.00, 71.65, 70.17, 68.01, 55.69, -2.22.



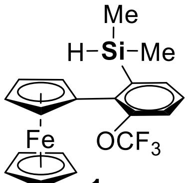
1o

According to general procedure, **1o** was obtained in 36% yield as dark orange oil. R$_f$ = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD$_3$COCD$_3$)** δ 7.83 (dd, *J* = 7.8, 1.0 Hz, 1H), 7.42 – 7.40 (m, 1H), 6.95 (t, *J* = 8.7 Hz, 1H), 4.45 (t, *J* = 1.9 Hz, 2H), 4.31 – 4.30 (m, 3H), 4.16 (s, 5H), 0.24 (d, *J* = 2.1 Hz, 6H). **^{13}C NMR (101 MHz, CD$_3$COCD$_3$)** δ 168.35 (d, *J* = 237.9 Hz), 148.36 (d, *J* = 10.5 Hz), 131.59 (d, *J* = 9.9 Hz), 128.83 (d, *J* = 2.5 Hz), 123.53 (d, *J* = 28.9 Hz), 113.03 (d, *J* = 26.8 Hz), 91.23, 71.62, 70.33, 68.48, -2.35.



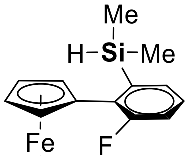
1p

According to general procedure, **1p** was obtained in 29% yield as dark orange oil. R$_f$ = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.35 – 7.33 (m, 1H), 7.29 – 7.24 (m, 1H), 7.17 (t, *J* = 7.4 Hz, 1H), 4.52 – 4.48 (m, 3H), 4.42 (t, *J* = 1.9 Hz, 2H), 4.18 (s, 5H), 2.93 (s, 3H), 0.02 (d, *J* = 3.7 Hz, 6H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 142.13, 138.54, 136.48, 133.20, 132.23, 125.71, 90.61, 70.80, 69.27, 67.67, 21.07, -2.61.



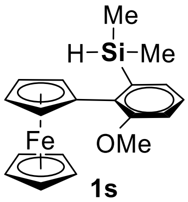
1q

According to general procedure, **1q** was obtained in 15% yield as dark orange solid. R$_f$ = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.51 – 7.49 (m, 1H), 7.43 (d, *J* = 6.2 Hz, 2H), 4.58 – 4.49 (m, 3H), 4.47 – 4.40 (m, 2H), 4.18 (s, 5H), 0.10 (d, *J* = 3.7 Hz, 6H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 147.67, 142.20, 137.55, 134.55, 128.14, 122.0 (q, *J* = 256.5 Hz), 121.30 (d, *J* = 1.7 Hz), 84.83, 71.28, 70.21, 69.13, -2.34.



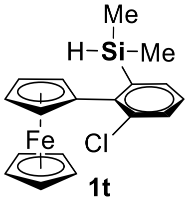
1r

According to general procedure, **1r** was obtained in 12% yield as dark orange oil. R$_f$ = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.34-7.32 (m, 2H), 7.26 – 7.16 (m, 1H), 4.60 – 4.55 (m, 3H), 4.38 (t, *J* = 1.9 Hz, 2H), 4.15 (s, 5H), 0.12 (d, *J* = 3.7 Hz, 6H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 161.17 (d, *J* = 249.6 Hz), 140.74, 132.53 (d, *J* = 10.8 Hz), 131.92 (d, *J* = 3.5 Hz), 128.44 (d, *J* = 7.7 Hz), 117.65 (d, *J* = 23.9 Hz), 83.55 70.98 (d, *J* = 1.8 Hz), 70.25, 68.93, -2.52.



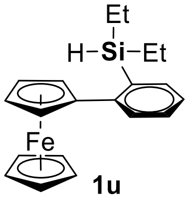
1s

According to general procedure, **1s** was obtained in 22% yield as dark orange solid. R$_f$ = 0.3 (Hexane/Ethyl acetate = 20:1). **^{1}H NMR (400 MHz, CD$_3$COCD$_3$)** δ 7.28 (t, *J* = 7.8 Hz, 1H), 7.11 – 7.08 (m, 2H), 4.59 – 4.51 (m, 3H), 4.30 (t, *J* = 1.9 Hz, 2H), 4.09 (s, 5H), 4.01 (s, 3H), 0.07 (d, *J* = 3.6 Hz, 6H). **^{13}C NMR (101 MHz, CD$_3$COCD$_3$)** δ 157.85, 139.22, 133.02, 128.15, 127.78, 112.53, 87.13, 71.29, 69.98, 68.15, 55.43, -2.11.



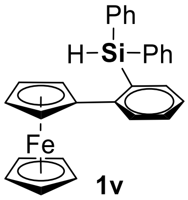
1t

According to general procedure, **1t** was obtained in 14% yield as dark orange oil. R$_f$= 0.4 (Hexane). **^{1}H NMR (400 MHz, CD$_3$COCD$_3$)** δ 7.51 – 7.46 (m, 2H), 7.27 (t, *J* = 7.6 Hz, 1H), 4.64 (t, *J* = 1.9 Hz, 2H), 4.55 – 4.51 (m, 1H), 4.44 (t, *J* = 1.9 Hz, 2H), 4.21 (s, 5H), 0.06 (d, *J* = 3.7 Hz, 6H). **^{13}C NMR (101 MHz, CD$_3$COCD$_3$)** δ142.62, 142.22, 135.12, 134.73, 132.54, 127.80, 88.77, 71.62, 70.44, 68.81, -2.08.



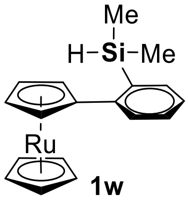
1u

According to general procedure, **1u** was obtained in 40% yield as dark orange oil. R$_f$ = 0.5 (Hexane). **^{1}H NMR (400 MHz, CD$_3$COCD$_3$)** δ 7.99 (d, *J* = 7.7 Hz, 1H), 7.46 – 7.39 (m, 2H), 7.24 (td, *J* = 7.4, 1.2 Hz, 1H), 4.47 (t, *J* = 1.9 Hz, 2H), 4.30 (t, *J* = 1.8 Hz, 2H), 4.24 (p, *J* = 3.3 Hz, 1H), 4.18 (s, 5H), 0.86 (t, *J* = 7.8 Hz, 6H), 0.64 – 0.60 (m, 4H). **^{13}C NMR (101 MHz, CD$_3$COCD$_3$)** δ 146.12, 136.14, 134.75, 132.22, 129.80, 126.42, 92.24, 71.18, 70.19, 68.45, 8.66, 4.50.



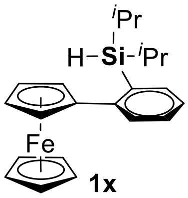
1v

According to general procedure, **1v** was obtained in 40% yield as dark orange solid. R_f = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 8.06 (dd, *J* = 7.9, 1.2 Hz, 1H), 7.49 – 7.34 (m, 11H), 7.29 – 7.26 (m, 1H), 7.21 – 7.19 (m, 1H), 5.40 (s, 1H), 4.41 (t, *J* = 1.9 Hz, 2H), 4.14 (t, *J* = 1.8 Hz, 2H), 4.08 (s, 5H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 147.27, 137.61, 136.44, 136.42, 135.28, 132.25, 132.04, 130.49, 130.44, 128.84, 126.32, 90.78, 71.12, 70.20, 68.62.



1w

According to general procedure, **1w** was obtained in 22% yield as colorless oil. R_f = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.63 (dd, *J* = 7.5, 1.3 Hz, 1H), 7.46 (dd, *J* = 7.1, 1.5 Hz, 1H), 7.30 (td, *J* = 7.5, 1.6 Hz, 1H), 7.23 (td, *J* = 7.4, 1.4 Hz, 1H), 4.81 (t, *J* = 1.7 Hz, 2H), 4.63 (t, *J* = 1.7 Hz, 2H), 4.61 (s, 5H), 4.55 – 4.50 (m, 1H), 0.19 (d, *J* = 3.8 Hz, 7H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 144.45, 137.14, 134.90, 134.15, 129.72, 126.90, 97.88, 74.21, 72.08, 70.35, -2.75.

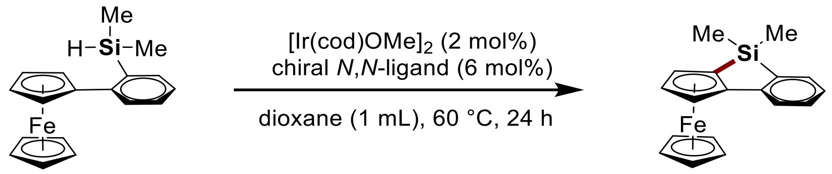


1x

According to general procedure, **1x** was obtained in 38% yield as dark orange oil. R_f = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ8.02 (dd, *J* = 7.8, 0.7 Hz, 1H), 7.46 – 7.39 (m, 2H), 7.25 (td, *J* = 7.4, 1.3 Hz, 1H), 4.45 (t, *J* = 1.8 Hz, 2H), 4.29 (t, *J* = 1.8 Hz, 2H), 4.17 (s, 5H), 3.93 (t, *J* = 3.9 Hz, 1H), 1.14 – 1.05 (m, 2H), 0.98 (d, *J* = 7.1 Hz, 6H), 0.87 (d, *J* = 7.2 Hz, 6H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 146.18, 136.61, 134.56, 132.44, 129.61, 126.21, 92.30, 71.55, 70.17, 68.32, 19.71, 19.55, 12.40.

2.3 Reaction condition optimization

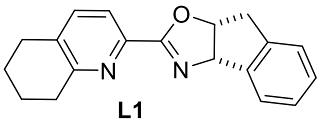
Table S1 Chiral ligands screening for the enantioselective C−H silylation of **1a**[a]



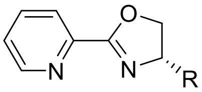
1a **2a**

entry	ligand	yield (%)[b]	ee (%)[c]	entry	ligand	yield (%)[b]	ee (%)[c]
1	**L1**	96	95	8	**L8**	93	88
2	**L2**	99	98	9	**L9**	94	97
3	**L3**	93	73	10	**L10**	95	91
4	**L4**	93	80	11	**L11**	96	81
5	**L5**	96	61	12	**L12**	92	79
6	**L6**	90	96	13	**L13**	N.R	N.R
7	**L7**	97	66	14	**L14**	N.R	N.R

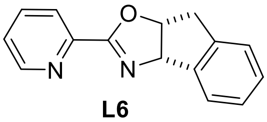
[a] The reaction was conducted with **1a** (0.2 mmol), $[Ir(cod)OMe]_2$ (2 mol%), chiral *N*,*N*-ligand (6 mol%) in dioxane (1 mL) at 60 °C under N_2 for 24 h. [b] Yields were determined by NMR using TCE as internal standard. [c] Ee values were determined by chiral HPLC.



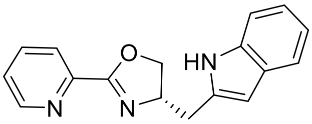
L1



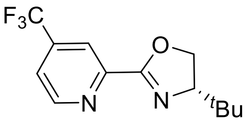
L2, R = Ph
L3, R = ^{i}Pr
L4, R = ^{t}Bu
L5, R = Bn



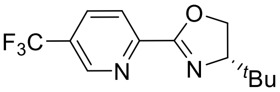
L6



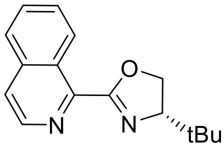
L7



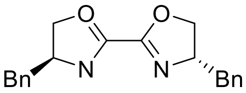
L8



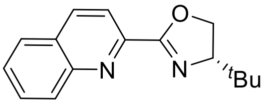
L9



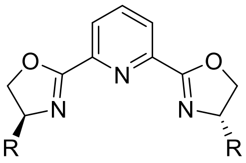
L10



L11



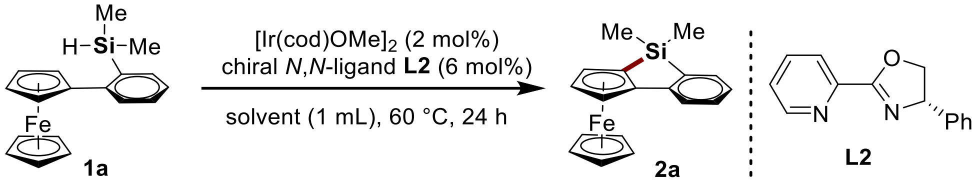
L12



L13

L13, R = ^{t}Bu
L14, R = Ph

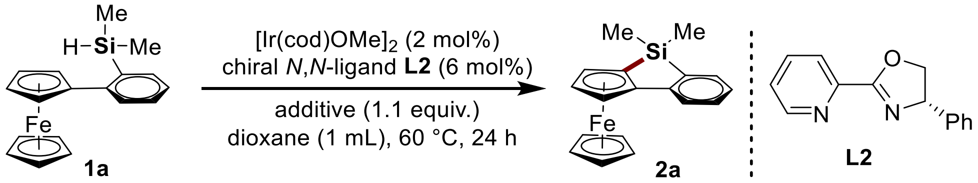
Table S2 Solvent screening for the enantioselective C–H silylation of **1a**[a]



entry	solvent	yield (%)[b]	ee (%)[c]
1	THF	95	93
2	toluene	92	91
3	benzene	93	95
4	DCE	83	82
5	DME	85	89
6	DMA	38	71
7	DMSO	N.R.	N.R.
8	$PhCF_3$	85	90
9	cyclohexane	91	91
10	MTBE	90	91
11	CH_3CN	82	81

[a] The reaction was conducted with **1a** (0.2 mmol), $[Ir(cod)OMe]_2$ (2 mol%), chiral *N*,*N*-ligand **L2** (6 mol%) in solvent (1 mL) at 60 °C under N_2 for 24 h. [b] Yields were determined by NMR using TCE as internal standard. [c] Ee values were determined by chiral HPLC. N.R.: no reaction.

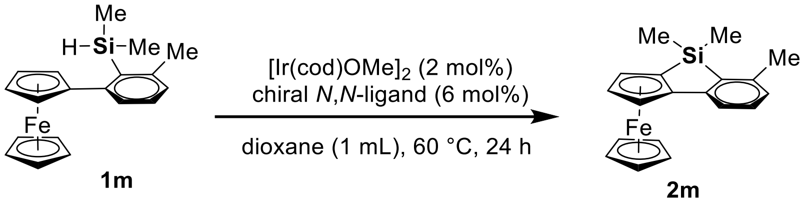
Table S3 Additive screening for the enantioselective C–H silylation of **1a** [a]



entry	additive	yield (%)[b]	ee (%)[c]
1	cyclohexene	96	88
2	cod	96	92
3	styrene	95	92
4	cyclooctene	96	83
5	tbe	97	90
6	nbe	96	90
7	none	99	98

[a] The reaction was conducted with **1a** (0.2 mmol), $[Ir(cod)OMe]_2$ (2 mol%), chiral *N*,*N*-ligand **L2** (6 mol%), additive (1.1 equiv.) in dioxane (1 mL) at 60 °C under N_2 for 24 h. [b] Yields were determined by NMR using TCE as internal standard. [c] Ee values were determined by chiral HPLC.

Table S4 Optimization for the enantioselective C−H silylation of C3-substituted substrate **1m**[a]



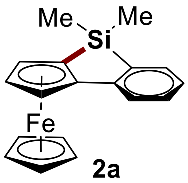
entry	ligand	yield (%)[b]	ee (%)[c]	entry	ligand	yield (%)[b]	ee (%)[c]
1	**L1**	90	85	8	**L8**	90	87
2	**L2**	85	92	9	**L9**	91	88
3	**L3**	90	76	10	**L10**	94	90
4	**L4**	92	80	11	**L11**	85	77
5	**L5**	88	57	12	**L12**	92	83
6	**L6**	98	95	13	**L13**	N.R	N.R
7	**L7**	82	65	14	**L14**	N.R	N.R

[a]The recation was conducted with **1a** (0.2 mmol), $[Ir(cod)OMe]_2$ (2 mol%), chiral *N*,*N*-ligand (6 mol%)in dioxane (1 mL) at 60 °C under N_2 for 24 h. [b] Yields were determined by NMR using TCE as internal standard. [c] Ee values were determined by chiral HPLC.

2.4 General procedure for the Ir-catalyzed asymmetric C−H silylation of Ferrocenes 1

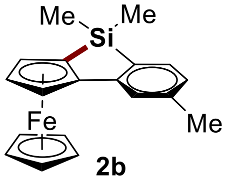
In a N_2 flushed glovebox, an oven-dried 8 mL tube equipped with a Teflon-coated magnetic stir bar was charged with $[Ir(cod)OMe]_2$ (2.6 mg， 0.004 mmol, 2 mol%), chiral *N*, *N*-ligand (0.012 mmol, 6 mol%) and anhydrous 1,4-dioxane (0.5 mL). The resulting mixture was stirred in the glovebox at room temperature for 1 hour, followed by addition of the starting material **1** (0.2 mmol, 1 equiv) in 1,4-dioxane (0.5 mL). The reaction tube was capped, removed from the glove box and the reaction mixture was stirred at 60 °C for 24 h. Then, the reaction mixture was cooled to room temperature, concentrated under vacuum and subjected to silica gel column chromatography to deliver the planar chiral ferrocene sioles **2**. The ee value of the product was determined by chiral HPLC analysis. Chiral *N*,*N*-ligand **L2** was used for the synthesis of planar chiral ferrocene sioles **2a**−**l** and **2u**−**w** under the reaction. On the other hand, chiral *N*,*N*-ligand **L6** was used for the Ir-catalyzed enantioselective C−H silylation of C3 or C6-substituted substrates **1m**−**t**. Product **2u** was synthesized at 90 °C for 48h. Product **2v** was synthesized at 100 °C for 24 h.

2.5 Characterization of products 2



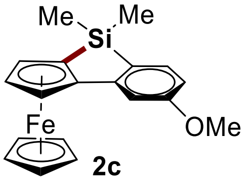
2a

According to general procedure, **2a** was obtained in 99% yield and 98% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.49 (d, *J* = 7.2 Hz, 1H), 7.41 (d, *J* = 7.6 Hz, 1H), 7.27 (td, *J* = 7.5, 1.3 Hz, 1H), 7.11 (td, *J* = 7.3, 1.1 Hz, 1H), 4.88 (dd, *J* = 2.2, 0.9 Hz, 1H), 4.54 (t, *J* = 2.3 Hz, 1H), 4.39 (d, *J* = 2.1 Hz , 1H), 3.97 (s, 5H), 0.69 (s, 3H), 0.28 (s, 3H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 148.72, 142.75, 133.28, 130.31, 126.06, 121.69, 97.82, 74.04, 72.29, 71.32, 70.35, 64.97, -0.62, -1.58. **HPLC analysis** (IA-3): Hexane/Isopropanol = 100:0, 0.5 mL/min, 254 nm UV detector, 98% ee, t_R =10.4 min (major) and t_R = 13.2 min (minor). **$[\alpha]_D^{25}$** = 349 (c = 0.538, acetone).



2b

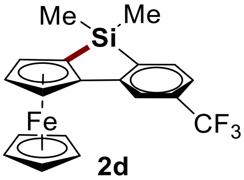
According to general procedure, **2b** was obtained in 99% yield and 98% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.37 (d, *J* = 7.3 Hz, 1H), 7.25 (s, 1H), 6.94 (d, *J* = 7.2 Hz, 1H), 4.86 (dd, *J* = 2.3, 0.9 Hz, 1H), 4.52 (t, *J* = 2.3 Hz, 1H), 4.37 (dd, *J* = 2.2, 0.8 Hz, 1H), 3.96 (s, 5H), 2.32 (s, 3H), 0.67 (s, 3H), 0.26 (s, 3H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 148.91, 139.89, 139.21, 133.19, 126.99, 122.49, 97.88, 73.90, 72.65, 71.24, 70.31, 64.82, 21.69, -0.51, -1.49. **HPLC analysis** (OD-3): Hexane/Isopropanol = 99:1, 1 mL/min, 254 nm UV detector, 98% ee, t_R = 8.4 min (major) and t_R = 10.6 min (minor). **$[\alpha]_D^{25}$** = 169.5 (c = 0.56, acetone).



2c

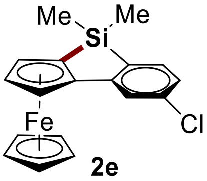
According to general procedure, **2c** was obtained in 83% yield and 97% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.3 (Hexane/Ethyl acetate = 20:1). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.39 (d, *J* = 7.9 Hz, 1H), 7.04

(d, *J* = 2.3 Hz, 1H), 6.71 (dd, *J* = 7.9, 2.4 Hz, 1H), 4.90 (dd, *J* = 2.3, 0.9 Hz, 1H), 4.53 (t, *J* = 2.3 Hz, 1H), 4.38 (dd, *J* = 2.3, 0.9 Hz, 1H), 3.99 (s, 5H), 3.83 (s, 3H), 0.67 (s, 3H), 0.27 (s, 3H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 162.49, 150.73, 134.27, 133.36, 111.66, 107.97, 97.52, 73.94, 73.31, 71.35, 70.38, 65.00, 55.34, -0.39, -1.36. **HPLC analysis** (OD-3): Hexane/Isopropanol = 90:10, 1 mL/min, 254 nm UV detector, 97% ee, t_R = 7.9 min (major) and t_R = 12.4 min (minor). **$[\alpha]_D^{25}$** = 98.6 (c = 0.46, acetone).



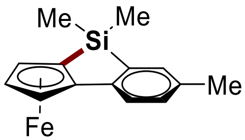
2d

According to general procedure, **2d** was obtained in 94% yield and 99% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.70 – 7.68 (m, 2H), 7.42 (d, *J* = 7.7 Hz, 1H), 5.07 (d, *J* = 2.3 Hz, 1H), 4.62 (t, *J* = 2.3 Hz, 1H), 4.48 (d, *J* = 2.2 Hz, 1H), 4.01 (s, 5H), 0.73 (s, 3H), 0.32 (s, 3H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 150.42, 148.21 (d, *J* = 1.4 Hz), 133.85, 131.98 (q, *J* = 31.5 Hz), 125.62 (q, *J* = 271.6 Hz), 122.28 (q, *J* = 3.9 Hz), 117.60 (q, *J* = 3.7 Hz), 96.09, 74.84, 72.62, 71.99, 70.57, 65.68, -0.90, -1.86. **HRMS (ESI)** calcd for C19H17F3FeSi $[M]^+$ 386.0401, found 386.0393. **HPLC analysis** (IA-3): Hexane/Isopropanol = 100:0, 0.5 mL/min, 254 nm UV detector, 99% ee, t_R =11.3 min (major) and t_R = 9.6 min (minor). **$[\alpha]_D^{25}$** = 393.9 (c = 0.595, acetone).



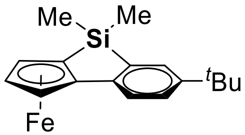
2e

According to general procedure, **2e** was obtained in 92% yield and 98% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.3 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.47 (d, *J* = 7.7 Hz, 1H), 7.44 (d, *J* = 2.0 Hz, 1H), 7.13 (dd, *J* = 7.7, 1.9 Hz, 1H), 4.96 (dd, *J* = 2.3, 0.8 Hz, 1H), 4.57 (t, *J* = 2.3 Hz, 1H), 4.43 (dd, *J* = 2.3, 0.8 Hz, 1H), 4.00 (s, 5H), 0.69 (s, 3H), 0.29 (s, 3H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 151.50, 141.36, 136.26, 134.62, 125.73, 121.57, 96.17, 74.54, 72.87, 71.81, 70.49, 65.43, -0.71, -1.66. **HPLC analysis** (OD-3): Hexane/Isopropanol = 99:1, 0.5 mL/min, 254 nm UV detector, 98% ee, t_R =8.3 min (major) and t_R = 9.0 min (minor). **$[\alpha]_D^{25}$** = 111.7 (c = 0.68, acetone).



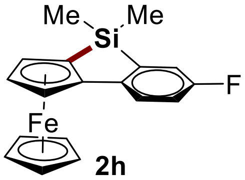
2f

According to general procedure, **2f** was obtained in 97% yield and 98% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.31 – 7.29 (m, 2H), 7.08 (d, *J* = 7.8 Hz, 1H), 4.83 (dd, *J* = 2.3, 0.8 Hz, 1H), 4.50 (t, *J* = 2.2 Hz, 1H), 4.36 (dd, *J* = 2.2, 0.8 Hz, 1H), 3.96 (s, 5H), 2.27 (s, 3H), 0.68 (s, 3H), 0.27 (s, 3H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 145.67, 142.91, 135.14, 134.08, 131.03, 121.53, 98.13, 73.78, 72.13, 71.09, 70.30, 64.67, 21.34, -0.59, -1.54. **HPLC analysis** (OD-H): Hexsane/Isopropanol = 99.5:0.5, 0.5 mL/min, 254 nm UV detector, 98% ee, t_R = 12.3 min (major) and t_R = 11.7 min (minor). **$[\alpha]_D^{25}$** = 359.9 (c = 0.515, acetone).



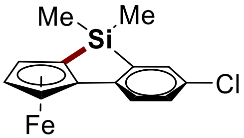
2g

According to general procedure, **2g** was obtained in 97% yield and 98% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.58 (dd, *J* = 1.6, 0.8 Hz, 1H), 7.35 – 7.31 (m, 2H), 4.83 (dd, *J* = 2.2, 0.8 Hz, 1H), 4.51 (t, *J* = 2.3 Hz, 1H), 4.36 (dd, *J* = 2.3, 0.8 Hz, 1H), 3.96 (s, 5H), 1.32 (s, 9H), 0.69 (s, 3H), 0.27 (s, 3H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 148.44, 145.64, 142.53, 129.98, 127.33, 121.30, 98.01, 73.75, 72.35, 71.07, 70.23, 70.13, 64.67, 35.11, 31.78, -0.49, -1.38. **HPLC analysis** (OD-H): Hexane/Isopropanol = 99.5:0.5, 0.5 mL/min, 254 nm UV detector, 98% ee, t_R = 8.5 min (major) and t_R = 7.9 min (minor). **$[\alpha]_D^{25}$** = 353.2 (c = 0.6, acetone).



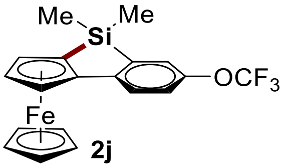
2h

According to general procedure, **2h** was obtained in 92% yield and 98% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.42 (dd, *J* = 8.3, 4.9 Hz, 1H), 7.26 (dd, *J* = 8.3, 2.6 Hz, 1H), 7.03 – 6.98 (m, 1H), 4.87 (dd, *J* = 2.3, 0.9 Hz, 1H), 4.53 (t, *J* = 2.3 Hz, 1H), 4.39 (dd, *J* = 2.2, 0.8 Hz, 1H), 3.98 (s, 5H), 0.70 (s, 3H), 0.29 (s, 3H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 162.20 (d, *J* = 243.8 Hz), 145.92 (d, *J* = 4.8 Hz), 144.58 (d, *J* = 2.5 Hz), 122.89 (d, *J* = 7.4 Hz), 119.80 (d, *J* = 19.8 Hz), 116.79 (d, *J* = 22.4 Hz), 97.05, 74.08, 72.13, 71.43, 70.36, 64.91, -0.78, -1.70. **HPLC analysis** (OD-H): Hexane/Isopropanol = 99.5:0.5, 0.5 mL/min, 254 nm UV detector, 98% ee, t_R = 10.5 min (major) and t_R = 9.9 min (minor). **$[\alpha]_D^{25}$** = 263.9 (c = 0.57, acetone).



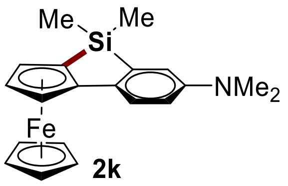
2i

According to general procedure, **2i** was obtained in 90% yield and 96% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.49 (d, *J* = 2.2 Hz, 1H), 7.40 (d, *J* = 8.1 Hz, 1H), 7.27 (dd, *J* = 8.1, 2.2 Hz, 1H), 4.90 (dd, *J* = 2.3, 0.8 Hz, 1H), 4.56 (t, *J* = 2.3 Hz, 1H), 4.42 (dd, *J* = 2.2, 0.8 Hz, 1H), 3.99 (s, 5H), 0.71 (s, 3H), 0.31 (s, 3H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 147.63, 145.77, 133.07, 131.45, 130.14, 123.02, 96.50, 74.46, 72.34, 71.70, 70.50, 65.29, -0.79, -1.73. **HPLC analysis** (OD-H): Hexane/Isopropanol = 99.7:0.3, 1 mL/min, 254 nm UV detector, 96% ee, t_R = 6.6 min (major) and t_R = 6.2 min (minor). **$[\alpha]_D^{25}$** = 423.5 (c = 0.48, acetone).



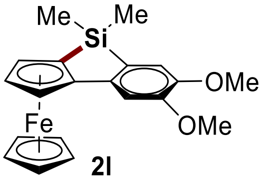
2j

According to general procedure, **2j** was obtained in 97% yield and 97% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.3 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.49 (d, *J* = 8.3 Hz, 1H), 7.44 (d, *J* = 1.2 Hz, 1H), 7.21 – 7.18 (m, 1H), 4.93 (dd, *J* = 2.3, 0.8 Hz, 1H), 4.58 (t, *J* = 2.3 Hz, 1H), 4.44 (dd, *J* = 2.3, 0.8 Hz, 1H), 4.00 (s, 5H), 0.72 (s, 3H), 0.32 (s, 3H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 148.18, 147.85 (d, *J* = 2 Hz), 145.77, 125.85, 123.07, 122.73, 121.50 (q, *J* = 255.53 Hz), 96.27, 74.55, 72.61, 71.83, 70.50, 65.41, -0.84, -1.75. **HRMS (ESI)** calcd for C19H17F3FeOSi $[M]^+$ 402.0350, found 402.0349. **HPLC analysis** (OD-3): Hexane/Isopropanol = 99.7:0.3, 0.5 mL/min, 254 nm UV detector, 97% ee, t_R = 10.2 min (major) and t_R = 9.5 min (minor). **$[\alpha]_D^{25}$** = 290.3 (c = 0.495, acetone).



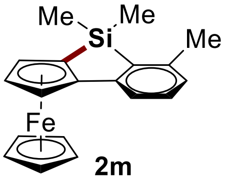
2k

According to general procedure, **2k** was obtained in 96% yield and 97% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.3 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.26 (dd, *J* = 8.3, 0.5 Hz, 1H), 6.98 (d, *J* = 2.6 Hz, 1H), 6.68 (dd, *J* = 8.4, 2.7 Hz, 1H), 4.73 (dd, *J* = 2.2, 0.8 Hz, 1H), 4.44 (t, *J* = 2.2 Hz, 1H), 4.29 (dd, *J* = 2.2, 0.8 Hz, 1H), 3.95 (s, 5H), 2.94 (s, 6H), 0.68 (s, 3H), 0.27 (s, 3H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 149.96, 143.80, 136.16, 122.24, 117.91, 114.69, 99.65, 73.08, 71.22, 70.47, 70.08, 63.64, 40.93, -0.42, -1.32. **HRMS (ESI)** calcd for C20H24FeNSi $[M+H]^+$ 362.1022, found 362.1025. **HPLC analysis** (IA-3): Hexane/Isopropanol = 99:1, 0.5 mL/min, 254 nm UV detector, 97% ee, t_R = 9.3 min (major) and t_R = 9.6 min (minor). **$[\alpha]_D^{25}$** = 388.3 (c = 0.062, acetone).



2l

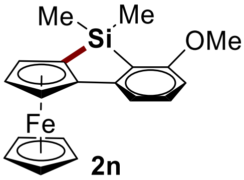
According to general procedure, **2l** was obtained in 80% yield and 98% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.3 (Hexane/Ethyl acetate = 10:1). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.11 (s, 1H), 7.10 (s, 1H), 4.82 (d, *J* = 2.2 Hz, 1H), 4.46 (t, *J* = 2.2 Hz, 1H), 4.32 (d, *J* = 2.1 Hz, 1H), 3.97 (s, 5H), 3.85 (s, 3H), 3.81 (s, 3H), 0.66 (s, 3H), 0.26 (s, 3H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ152.19, 148.79, 141.93, 133.45, 117.12, 106.52, 98.66, 73.34, 72.18, 71.01, 70.27, 69.20, 64.42, 56.31, 56.03, 30.42, -0.48, -1.36. **HPLC analysis** (ID): Hexane/Isopropanol = 95:5, 1 mL/min, 254 nm UV detector, 98% ee, t_R = 6.7 min (major) and t_R = 11.1 min (minor). **$[\alpha]_D^{25}$** = 208.2 (c = 0.37, acetone).



2m

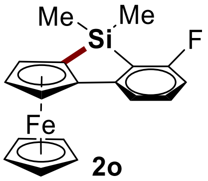
According to general procedure, **2m** was obtained in 98% yield and 95% ee as dark orange oil under the optimized condition by use of **L6** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane).

^{1}H NMR (400 MHz, CD_3COCD_3) δ 7.28 – 7.21 (m, 1H), 7.17 (t, *J* = 7.5 Hz, 1H), 6.91 (d, *J* = 7.4 Hz, 1H), 4.85 (dd, *J* = 2.3, 0.9 Hz, 1H), 4.51 (t, *J* = 2.2 Hz, 1H), 4.38 (dd, *J* = 2.3, 0.8 Hz, 1H), 3.97 (s, 5H), 2.39 (s, 3H), 0.75 (s, 3H), 0.33 (s, 3H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 148.71, 143.38, 141.31, 130.76, 127.06, 119.30, 97.87, 73.84, 72.17, 71.14, 70.31, 64.96, 22.21, -1.08, -1.25. **HRMS (ESI)** calcd for C19H20FeSi $[M]^+$ 332.0684, found 332.0682. **HPLC analysis** (IA-3): Hexane/Isopropanol = 100:0, 0.5 mL/min, 254 nm UV detector, 95% ee, t_R = 11.6 min (major) and t_R = 14.6 min (minor). **$[\alpha]_D^{25}$** = 428.4 (c = 0.24, acetone).



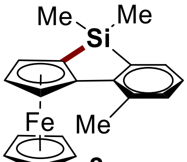
2n

According to general procedure, **2n** was obtained in 98% yield and 97% ee as dark orange oil under the optimized condition by use of **L6** as the chiral ligand at 60 °C for 24 h. R_f = 0.3 ((Hexane/DCM = 5:1). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.28 (t, *J* = 7.8 Hz, 1H), 7.03 (d, *J* = 7.8 Hz, 1H), 6.70 (d, *J* = 8.1 Hz, 1H), 4.83 (dd, *J* = 2.3, 0.8 Hz, 1H), 4.50 (t, *J* = 2.3 Hz, 1H), 4.35 (dd, *J* = 2.2, 0.8 Hz, 1H), 3.97 (s, 5H), 3.81 (s, 3H), 0.68 (s, 3H), 0.27 (s, 3H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ164.40, 150.33, 132.69, 128.28, 115.14, 108.16, 97.53, 73.87, 72.97, 71.27, 70.32, 65.11, 55.45, -1.12, -1.48. **HRMS (ESI)** calcd for C19H20FeOSi $[M]^+$ 348.0633, found 348.0630. **HPLC analysis** (IA-3): Hexane/Isopropanol = 99.7:0.3, 0.5 mL/min, 254 nm UV detector, 97% ee, t_R = 9.4 min (major) and t_R = 10.0 min (minor). **$[\alpha]_D^{25}$** = 658.1 (c = 0.63, acetone).



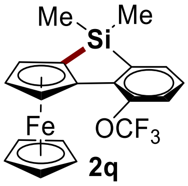
2o

According to general procedure, **2o** was obtained in 93% yield and 97% ee as dark orange oil under the optimized condition by use of **L6** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.34 – 7.29 (m, 1H), 7.25 – 7.23 (m, 1H), 6.82 – 6.77 (m, 1H), 4.91 (dd, *J* = 2.3, 0.9 Hz, 1H), 4.56 (t, *J* = 2.3 Hz, 1H), 4.43 (dd, *J* = 2.2, 0.9 Hz, 1H), 4.00 (s, 5H), 0.75 (s, 3H), 0.35 (s, 3H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 167.02 (d, *J* = 239.4 Hz), 151.78 (d, *J* = 12.7 Hz), 133.36 (d, *J* = 8.1 Hz), 126.80 (d, *J* = 35.0 Hz), 118.16 (d, *J* = 2.7 Hz), 112.43 (d, *J* = 25.1 Hz), 96.67 (d, *J* = 1.9 Hz), 74.59, 72.36, 71.67, 70.51, 65.50, -0.94, -1.50. **HRMS (ESI)** calcd for C18H17FFeSi $[M]^+$ 336.0433, found 336.0431. **HPLC analysis** (OD-3): Hexane/Isopropanol = 99:1, 0.5 mL/min, 254 nm UV detector, 97% ee, t_R = 10.4 min (major) and t_R = 8.9 min (minor). **$[\alpha]_D^{25}$** = 507.3 (c = 0.54, acetone).



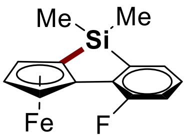
2p

According to general procedure, **2p** was obtained in 97% yield and 84% ee as dark orange oil under the optimized condition by use of **L6** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.33 (dd, *J* = 6.9, 1.5, 0.7 Hz, 1H), 7.14 – 6.97 (m, 2H), 4.88 (dd, *J* = 2.3, 0.8 Hz, 1H), 4.56 (t, *J* = 2.3 Hz, 1H), 4.41 (dd, *J* = 2.3, 0.8 Hz, 1H), 3.99 (s, 5H), 2.50 (s, 3H), 0.66 (s, 3H), 0.26 (s, 3H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 146.97, 143.20, 132.66, 132.54, 130.86, 126.05, 97.65, 74.52, 72.74, 71.28, 70.08, 68.90, 21.49, -0.71, -1.57. **HPLC analysis** (IA-3): Hexane/Isopropanol = 99.9:0.1, 0.5 mL/min, 254 nm UV detector, 84% ee, t_R = 11.0 min (major) and t_R = 12.4 min (minor). **$[\alpha]_D^{25}$** = 114.6 (c = 0.70, acetone).



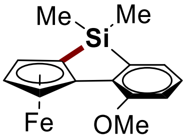
2q

According to general procedure, **2q** was obtained in 97% yield and 99% ee as dark orange oil under the optimized condition by use of **L6** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.51 – 7.46 (m, 1H), 7.25 – 7.24 (m, 2H), 4.93 (d, *J* = 2.2 Hz, 1H), 4.63 (t, *J* = 2.3 Hz, 1H), 4.48 (dd, *J* = 2.3, 0.9 Hz, 1H), 4.03 (s, 5H), 0.72 (s, 3H), 0.31 (s, 3H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 147.02, 144.77 (q, *J* = 1.3 Hz), 140.70, 132.07, 127.61, 122.07 (q, *J* = 1.3 Hz), 121.08 (q, *J* = 128.3 Hz), 93.08, 75.11, 72.59, 72.57, 71.73, 70.38, 68.66, -0.83, -1.69. **HRMS (ESI)** calcd for C19H17F3FeOSi $[M]^+$ 402.0345, found 402.0340. **HPLC analysis** (OD-H): Hexane/Isopropanol=100:0, 0.5 mL/min, 254 nm UV detector, 99% ee, t_R = 10.3 min (major) and t_R = 11.7 min (minor). **$[\alpha]_D^{25}$** = 343.4 (c = 0.41, acetone).



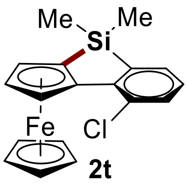
2r

According to general procedure, **2r** was obtained in 97% yield and 95% ee as dark orange oil under the optimized condition by use of **L6** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.32 – 7.31 (m, 1H), 7.19 – 7.14 (ddd, *J* = 8.2, 6.9, 4.7 Hz, 1H), 7.06 – 7.01 (ddd, *J* = 10.6, 8.2, 1.0 Hz, 1H), 4.92 (td, *J* = 2.5, 0.9 Hz, 1H), 4.58 (t, *J* = 2.3 Hz, 1H), 4.43 (dd, *J* = 2.3, 0.9 Hz, 1H), 4.01 (s, 5H), 0.71 (s, 3H), 0.30 (s, 3H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 158.76 (d, *J* = 248.6 Hz), 146.61 (d, *J* = 1.5 Hz), 134.84 (d, *J* = 12.3 Hz), 129.26 (d, *J* = 3.3 Hz), 127.95 (d, *J* = 5.9 Hz), 117.19 (d, *J* = 20.5 Hz), 93.00 (d, *J* = 2.2 Hz), 74.69 (d, *J* = 1.0 Hz), 72.06, 71.47, 70.35, 68.26 (d, *J* = 5.0 Hz), -0.78, -1.63. **HRMS (ESI)** calcd for C18H17FFeSi $[M]^+$ 336.0433, found 336.0430. **HPLC analysis** (OD-H): Hexane/Isopropanol = 99.5:0.5, 0.5 mL/min, 254 nm UV detector, 95% ee, t_R =9.2 min (major) and t_R =8.7 min (minor). **$[\alpha]_D^{25}$** = 452.8 (c = 0.57, acetone).

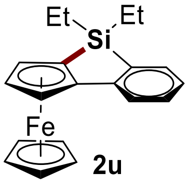


2s

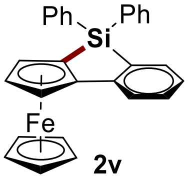
According to general procedure, **2s** was obtained in 97% yield and 96% ee as dark orange oil under the optimized condition by use of **L6** as the chiral ligand at 60 °C for 24 h. R_f = 0.3 ((Hexane/DCM = 5:1). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.16 – 7.08 (m, 2H), 6.95 (dd, *J* = 8.0, 1.2 Hz, 1H), 5.06 (dd, *J* = 2.2, 0.9 Hz, 1H), 4.49 (t, *J* = 2.2 Hz, 1H), 4.34 (dd, *J* = 2.3, 0.9 Hz, 1H), 3.95 (s, 5H), 3.95 (s, 3H), 0.67 (s, 3H), 0.27 (s, 3H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 155.81, 144.51, 136.18, 127.52, 125.48, 113.09, 95.99, 73.97, 71.37, 70.81, 70.12, 69.51, 55.68, -0.67, -1.53. **HRMS (ESI)** calcd for C19H20FeOSi $[M]^+$ 348.0633, found 348.0631. **HPLC analysis** (OD-H): Hexane/Isopropanol = 99.5:0.5, 0.5 mL/min, 254 nm UV detector, 96% ee, t_R =6.0 min (major) and t_R =5.8 min (minor). **$[\alpha]_D^{25}$** = -6.2 (c = 0.53, acetone).


2t

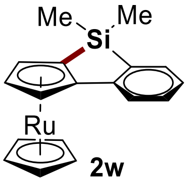
According to general procedure, **2t** was obtained in 95% yield and 81% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.44 (dd, *J* = 6.9, 1.1 Hz, 1H), 7.31 (dd, *J* = 8.0, 1.1 Hz, 1H), 7.13 (t, *J* = 7.4 Hz, 1H), 5.31 (dd, *J* = 2.3, 0.9 Hz, 1H), 4.61 (t, *J* = 2.4 Hz, 1H), 4.46 (dd, *J* = 2.4, 0.9 Hz, 1H), 4.03 (s, 5H), 0.69 (s, 3H), 0.30 (s, 3H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 146.51, 146.01, 131.78, 131.64, 129.27, 127.37, 95.07, 75.01, 72.88, 71.84, 70.36, 69.75, -0.85, -1.69. **HRMS (ESI)** calcd for C18H17ClFeSi $[M]^+$ 352.0132, found 352.0130. **HPLC analysis** (OD-H): Hexane/Isopropanol = 99.5:0.5, 0.5 mL/min, 254 nm UV detector, 81% ee, t_R =10.6 min (major) and t_R =8.8 min (minor). **$[\alpha]_D^{25}$** = 3.9 (c = 0.543, acetone).


2u

According to general procedure, **2u** was obtained in 59% yield and 86% ee as dark orange oil under the modified optimized condition by use of **L2** as the chiral ligand at 90 °C for 48 h. R_f = 0.3 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.47 – 7.41 (m, 1H), 7.27 (td, *J* = 7.5, 1.3 Hz, 1H), 7.10 (td, *J* = 7.3, 1.1 Hz, 1H), 4.90 (d, *J* = 2.3 Hz, 1H), 4.55 (t, *J* = 2.3 Hz, 1H), 4.37 (d, *J* = 2.3 Hz, 1H), 3.97 (s, 5H), 1.36 (t, *J* = 7.8 Hz, 3H), 1.25 – 1.11 (m, 2H), 0.86 – 0.78 (m, 5H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 149.31, 141.12, 133.89, 130.36, 125.99, 121.85, 98.10, 74.10, 71.65, 70.97, 70.40, 64.95, 8.22, 7.85, 5.91, 5.58. **HPLC analysis** (OD-3): Hexane/Isopropanol = 99:1, 1 mL/min, 254 nm UV detector, 86% ee, t_R = 14.8 min (major) and t_R = 10.7 min (minor). **$[\alpha]_D^{25}$** = 290.2 (c = 0.37, acetone).


2v

According to general procedure, **2v** was obtained in 98% yield and 86% ee as dark orange oil under the modified optimized condition by use of **L2** as the chiral ligand at 100 °C for 24 h. R_f = 0.3 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 8.00 – 7.97 (m, 2H), 7.79 (d, *J* = 7.3, 1H), 7.56 – 7.48 (m, 6H), 7.39 – 7.21 (m, 5H), 5.01 (dd, *J* = 2.2, 1.0 Hz, 1H), 4.66 (dd, *J* = 2.6, 1.6 Hz, 2H), 3.66 (s, 5H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 149.81, 138.82, 136.50, 135.96, 135.61, 134.91, 131.03, 130.77, 130.39, 128.94, 128.68, 126.46, 122.21, 98.08, 74.69, 71.72, 70.84, 69.74, 65.38. **HPLC analysis** (OD-H): Hexane/Isopropanol = 99:1, 1 mL/min, 254 nm UV detector, 86% ee, t_R = 12.7 min (major) and t_R = 8.0 min (minor). **$[\alpha]_D^{25}$** = 296.2 (c = 0.67, acetone).

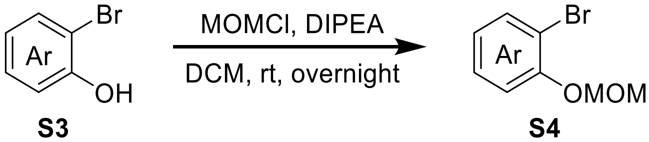


2w

According to general procedure, **2w** was obtained in 92% yield and 98% ee as colorless oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.3 (Hexane). **^{1}H NMR (400 MHz, CD_3COCD_3)** δ 7.42 (dt, *J* = 7.0, 1.0 Hz, 1H), 7.29 (dt, *J* = 7.6, 0.9 Hz, 1H), 7.19 (td, *J* = 7.5, 1.3 Hz, 1H), 7.05 (td, *J* = 7.2, 1.1 Hz, 1H), 5.24 (dd, *J* = 2.2, 0.7 Hz, 1H), 4.77 (t, *J* = 2.2 Hz, 1H), 4.72 (dd, *J* = 2.1, 0.7 Hz, 1H), 4.38 (s, 5H), 0.50 (s, 3H), 0.36 (s, 3H). **^{13}C NMR (101 MHz, CD_3COCD_3)** δ 147.86, 141.99, 133.32, 130.15, 126.22, 121.28, 101.24, 77.21, 75.11, 72.72, 72.10, 66.86, -0.03, -1.40. **HPLC analysis** (OD-3): Hexane/Isopropanol = 99:1, 0.5 mL/min, 254 nm UV detector, 98% ee, t_R = 6.0 min (major) and t_R = 4.3 min (minor). **$[\alpha]_D^{25}$** = 178.1 (c = 0.524, acetone).

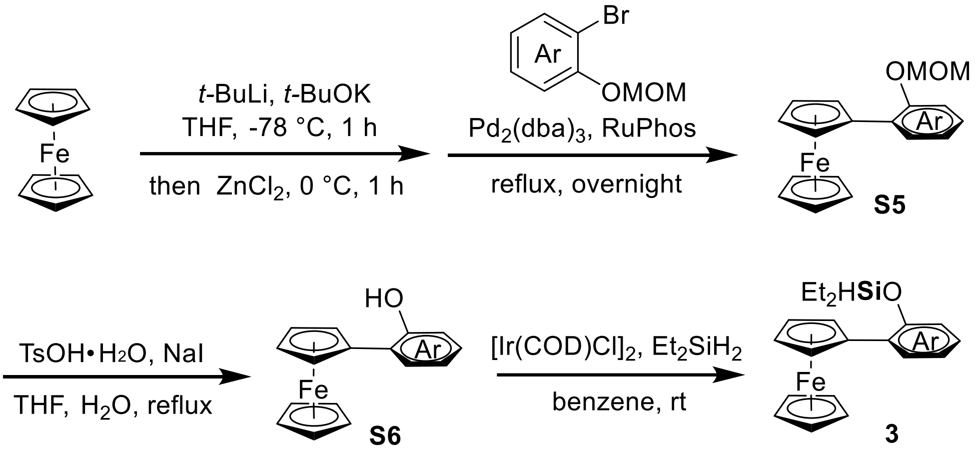
3. Iridium-Catalyzed 6-Membered Enantioselective C−H Silylation of Ferrocenes

3.1 General procedures for the synthesis of starting materials 3[1, 2, 4, 5]



To a solution of substituted phenol **S3** (20 mmol, 1 equiv) and DIPEA (6.6 mL, 40 mmol, 2 equiv) in DCM (50 mL), MOMCl (2.3 mL, 2.4g, 30 mmol, 1.5 equiv) was added dropwise at 0 °C.

After addition, the solution was allowed to warm to room temperature and stirred overnight. The reaction mixture was then diluted with DCM (100 mL) and washed with sat NH_4Cl aq solution (30 mL × 3). The organic layer was separated, washed with brine (50 mL), dried with Na_2SO_4, filtered and concentrated under reduced pressure to yield the crude product **S4**. The crude product **S4** was directly used for next step without any further purification.

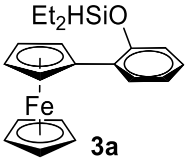


The stirred solution of ferrocene (20 mmol) in THF (60 mL) was cooled to -78 °C under N_2, *t*-BuOK (10 mol%, 224 mg) was added followed by dropwise addition of *t*-BuLi (42 mmol. 1.6 M, 26 mL). After being stirred at this temperature for 1 h, $ZnCl_2$ (42 mmol, 5.7 g) was added in one portion and the system was gradually warmed to room temperature in 1 h. Then, the aryl bromide **S4** (20 mmol, 1 equiv), $Pd_2(dba)_3$ (0.183g, 0.02 mmol, 1 mol%) and RuPhos (0.38g, 0.08 mmol, 4 mol%) were added sequentially and the mixture is refluxed overnight (If the aryl bromide S4 contains a chloro-group on phenyl ring, $Pd(PPh_3)_4$ (1.15 g, 1 mmol, 0.05 equiv) was used as the catalyst instead of $Pd_2(dba)_3$/RuPhos system during the coupling reaction). The solution was cooled and quenched with sat NH_4Cl aq solution (10 mL) and extracted with DCM for three times (100 mL × 3). The combined organic layer was separated, washed with brine (50 mL), dried with Na_2SO_4, filtered and concentrated under reduced pressure.The crude product **S5** was purified by column chromatography on silica gel using hexane/DCM as eluent.

A two-necked flask equipped with a magnetic stir bar and a reflux condenser was charged with **S5** (10 mmol, 1 equiv), NaI (14.9 g, 100 mmol, 10 equiv), $TsOH•H_2O$ (3.8 g, 20 mmol, 2 equiv) and evacuated and backfilled with N_2 for three times. Degassed THF (80 mL) and water (20 mL) was added to the flask via syringe. The mixture was refluxed until the starting material **S5** had been completely consumed as judged by TLC analysis. The volatiles were removed under vacuum, and the residue was extracted with DCM for three times (50 mL × 3). The combined organic layer was separated, washed with brine (50 mL), dried with Na_2SO_4, filtered and concentrated under reduced pressure. The crude product was purified by column chromatography on silica gel using hexane/DCM as eluent to deliver the product **S6**.

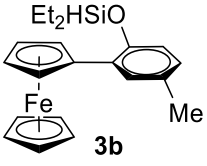
Following the literature procedure,[6,7] a flame-dried flask was charged with $[Ir(cod)Cl]_2$ (33.6 mg, 0.05 mmol, 0.5 mol%) and Et_2SiH_2 (15 mmol, 1.5 equiv) under N_2 and stirred at room temperature until the brown solid was completely dissolved. **S6** (10 mmol, 1 equiv) in benzene (20 mL) was added dropwise to the flask under N_2. The mixture was stirred at room temperature until the starting material **S6** had been completely consumed as judged by NMR analysis (typically 10-72 h). The volatiles were removed under vacuum to afford the hydrosilane product **3** with almost quantitative yield, which was directly used for next step without any further purification.

3.2 Characterization of starting materials 3



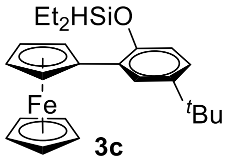
3a

According to the general procedure, **3a** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.60 (d, *J* = 7.7 Hz, 1H), 7.12 (t, *J* = 7.7 Hz, 1H), 6.97 (t, *J* = 7.5 Hz, 1H), 6.90 (d, *J* = 8.0 Hz, 1H), 4.81 – 4.80 (m, 1H), 4.76 (s, 2H), 4.29 (s, 2H), 4.08 (s, 5H), 1.06 – 0.97 (m, 6H), 0.87 – 0.81 (m, 4H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 152.74, 129.75, 129.18, 126.70, 121.32, 118.57, 82.65, 69.37, 68.94, 68.15, 6.62, 5.15.



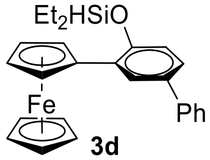
3b

According to general procedure, **3b** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.33 (s, 1H), 6.88 (d, *J* = 8.2 Hz, 1H), 6.76 (d, *J* = 8.2 Hz, 1H), 4.77 –4.75 (m, 3H), 4.31 (s, 2H), 4.10 (s, 5H), 2.32 (s, 3H), 1.01 (t, *J* = 7.7 Hz, 6H), 0.83 – 0.80 (m, 4H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 150.56, 130.28, 130.13, 128.63, 127.31, 118.31, 82.82, 69.34, 68.82, 68.09, 20.72, 6.64, 5.15.



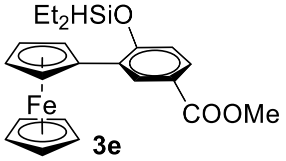
3c

According to general procedure, **3c** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.63 (d, *J* = 2.6 Hz, 1H), 7.11 (dd, *J* = 8.5, 2.6 Hz, 1H), 6.80 (d, *J* = 8.4 Hz, 1H), 4.76 – 4.74 (m, 1H), 4.72 (t, *J* = 1.9 Hz, 2H), 4.27 (s, 2H), 4.07 (s, 5H), 1.36 (s, 9H), 1.02 (t, *J* = 7.9 Hz, 6H), 0.86 – 0.77 (m, 4H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 150.44, 143.59, 128.09, 127.18, 123.64, 117.86, 83.61, 69.34, 69.12, 67.94, 34.09, 31.57, 6.63, 5.19.



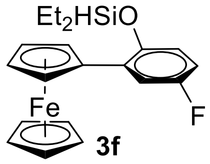
3d

According to general procedure, **3d** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.82 (d, *J* = 2.4 Hz, 1H), 7.62 (d, *J* = 7.6 Hz, 2H), 7.47 (t, *J* = 7.6 Hz, 2H), 7.37 – 7.32 (m, 2H), 6.96 (d, *J* = 8.3 Hz, 1H), 4.85 – 4.79 (m, 3H), 4.31 (s, 2H), 4.10 (s, 5H), 1.06 (t, *J* = 7.8 Hz, 6H), 0.90 – 0.84 (m, 4H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 152.35, 140.91, 134.26, 129.44, 128.68, 128.37, 126.68, 125.42, 118.77, 82.60, 69.38, 68.94, 68.25, 6.63, 5.16.



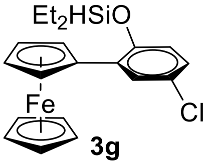
3e

According to general procedure, **3e** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 8.27 (d, *J* = 2.3 Hz, 1H), 7.79 (dd, *J* = 8.5, 2.3 Hz, 1H), 6.91 (d, *J* = 8.5 Hz, 1H), 4.87 – 4.85(m, 1H), 4.79 (t, *J* = 1.9 Hz, 2H), 4.31 (t, *J* = 1.9 Hz, 2H), 4.06 (s, 5H), 3.92 (s, 3H), 1.06 –0.99 (m, 6H), 0.90 – 0.84 (m, 4H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 166.95, 156.73, 131.35, 129.51, 128.37, 123.17, 118.11, 81.50, 69.45, 68.85, 68.53, 51.95, 6.56, 5.07.



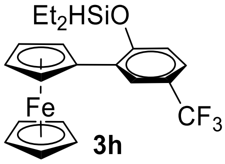
3f

According to general procedure, **3f** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.26 – 7.23 (m, 1H), 7.82 – 7.65 (m, 2H), 4.74 –4.73 (m, 3H), 4.31 (s, 2H), 4.08 (s, 5H), 1.03 – 0.95 (m, 6H), 0.83 – 0.76 (m, 4H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 157.39 (d, *J* = 238.1 Hz), 148.74 (d, *J* = 1.6 Hz), 131.04 (d, *J* = 8.0 Hz), 119.33 (d, *J* = 8.6 Hz), 115.52 (d, *J* = 23.5 Hz), 112.89 (d, *J* = 23.0 Hz), 81.48, 69.49, 68.99, 68.53, 6.57, 5.07.



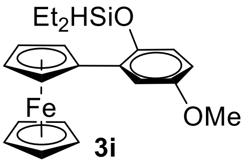
3g

According to general procedure, **3g** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.50 (s, 1H), 7.04 (d, *J* = 9.3 Hz, 1H), 6.80 (d, *J* = 8.6 Hz, 1H), 4.76 – 4.75 (m, 3H), 4.32 (s, 2H), 4.09 (s, 5H), 1.01 (t, *J* = 7.9 Hz, 6H), 0.84 – 0.78 (m, 4H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 151.33, 131.31, 129.05, 126.30, 126.13, 119.63, 81.20, 69.47, 68.87, 68.56, 6.57, 5.04.



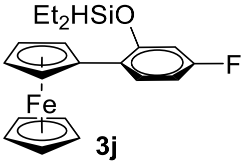
3h

According to general procedure, **3h** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.81 (s, 1H), 7.34 (d, *J* = 8.4 Hz, 1H), 6.94 (d, *J* = 8.5 Hz, 1H), 4.84 – 4.76(m, 3H), 4.33 (s, 2H), 4.07 (s, 5H), 1.04 (t, *J* = 8.0 Hz, 6H), 0.89 – 0.83 (m, 4H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 155.37, 130.35, 126.80 (q, *J* = 3.5 Hz), 124.5 (q, *J* = 272.4 Hz), 123.68 (q, *J* = 3.9, 3.5 Hz), 123.58 (q, *J* = 32.3 Hz), 118.53, 81.24, 69.55, 68.99, 68.73, 6.59, 5.12.

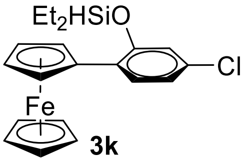


3i

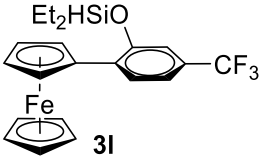
According to general procedure, **3i** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.14 (d, *J* = 3.1 Hz, 1H), 6.80 (d, *J* = 8.7 Hz, 1H), 6.66 (dd, *J* = 8.8, 3.1 Hz, 1H), 4.74 – 4.70 (m, 3H), 4.27 (t, *J* = 1.9 Hz, 2H), 4.07 (s, 5H), 3.82 (s, 3H), 1.00 (t, *J* = 7.9 Hz, 6H), 0.87 – 0.73 (m, 4H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 153.78, 146.82, 130.12, 119.12, 115.17, 111.48, 82.52, 69.41, 69.04, 68.24, 55.59, 6.62, 5.12.


3j

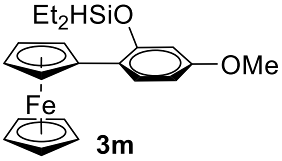
According to general procedure, **3j** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.53 (t, *J* = 7.8 Hz, 1H), 6.72 – 6.62 (m, 2H), 4.80 – 4.79 (m, 1H), 4.69 (t, *J* = 1.9 Hz, 2H), 4.27 (t, *J* = 1.9 Hz, 2H), 4.07 (s, 5H), 1.04 (t, *J* = 7.7 Hz, 6H), 0.87 – 0.81 (m, 4H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 161.31 (d, *J* = 245.6 Hz), 153.51 (d, *J* = 10.4 Hz), 130.32 (d, *J* = 9.6 Hz), 125.23 (d, *J* = 3.5 Hz), 108.29 (d, *J* = 21.0 Hz), 105.92 (d, *J* = 22.9 Hz), 82.18, 69.34, 68.67, 68.09, 6.54, 5.01.


3k

According to general procedure, **3k** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.52 (d, *J* = 2.7 Hz, 1H), 7.04 (dd, *J* = 8.7, 2.7 Hz, 1H), 6.80 (d, *J* = 8.6 Hz, 1H), 4.77 (s, 1H), 4.73 (s, 2H), 4.30 (s, 2H), 4.08 (s, 5H), 1.04 – 0.95 (m, 6H), 0.85 – 0.79 (m, 4H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 151.35, 131.32, 129.08, 126.33, 126.13, 119.65, 81.26, 69.51, 68.90, 68.59, 6.58, 5.05.

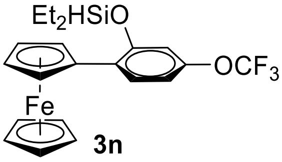

3l

According to general procedure, **3l** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.66 (d, *J* = 8.1 Hz, 1H), 7.19 (dd, *J* = 8.2, 1.8 Hz, 1H), 7.10 (d, *J* = 1.9 Hz, 1H), 4.84 – 4.81 (m, 1H), 4.78 (t, *J* = 1.8 Hz, 3H), 4.34 (t, *J* = 1.9 Hz, 2H), 4.07 (s, 4H), 1.02 – 0.97 (m, 6H), 0.88 – 0.81 (m, 4H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 152.69, 133.79, 129.85, 128.46 (q, *J* = 32.6 Hz), 124.08 (q, *J* = 272.7 Hz), 117.98 (q, *J* = 3.8 Hz), 115.34 (q, *J* = 3.8 Hz), 80.77, 69.55, 69.18, 68.86, 6.52, 5.05.



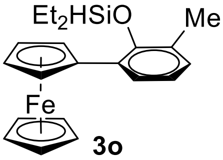
3m

According to general procedure, **3m** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.49 (d, *J* = 8.6 Hz, 1H), 6.55 (dd, *J* = 8.6, 2.6 Hz, 1H), 6.48 (d, *J* = 2.5 Hz, 1H), 4.81 – 4.78 (m, 1H), 4.68 (t, *J* = 1.8 Hz, 2H), 4.24 (t, *J* = 1.8 Hz, 2H), 4.07 (s, 5H), 3.81 (s, 3H), 1.05 – 1.02 (m, 6H), 0.86 – 0.80 (m, 4H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 158.59, 153.54, 130.18, 121.53, 106.75, 104.81, 83.21, 69.28, 68.42, 67.80, 55.26, 6.61, 5.10.



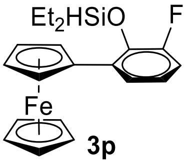
3n

According to general procedure, **3n** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.57 (dd, *J* = 8.5, 1.6 Hz, 1H), 6.84 (d, *J* = 8.6 Hz, 1H), 6.76 (s, 1H), 4.80 – 4.79 (m, 1H), 4.71 (s, 2H), 4.30 (s, 2H), 4.08 (s, 5H), 1.05 – 0.96 (m, 6H), 0.87 – 0.81 (m, 4H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 153.28, 147.38 (q, *J* = 1.9 Hz), 130.18, 128.34, 120.45 (q, *J* = 257.0 Hz), 113.63, 111.43, 81.50, 69.43, 68.86, 68.38, 6.52, 5.02.



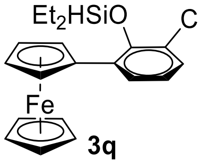
3o

According to general procedure, **3o** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.54 (dd, *J* = 7.7, 1.9 Hz, 1H), 7.02 – 6.99 (m, 1H), 6.93 (t, *J* = 7.5 Hz, 1H), 4.62 (t, *J* = 1.9 Hz, 2H), 4.42 – 4.41 (m, 1H), 4.27 (t, *J* = 1.9 Hz, 2H), 4.09 (s, 5H), 2.28(s, 3H), 0.87 – 0.83 (m, 6H), 0.56 – 0.47 (m, 4H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 151.17, 129.83, 129.11, 128.80, 128.61, 121.49, 84.21, 70.20, 69.47, 69.44, 67.73, 17.33, 6.48, 5.26.



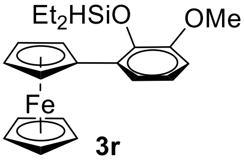
3p

According to general procedure, **3p** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.35 (d, *J* = 7.6 Hz, 1H), 6.94 – 6.86 (m, 2H), 4.73 – 4.68 (m, 3H), 4.30 (s, 2H), 4.07 (s, 5H), 0.99 – 0.95 (m, 6H), 0.89 – 0.76 (m, 4H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 154.32 (d, *J* = 241.0 Hz), 140.51 (d, *J* = 13.4 Hz), 132.22, 124.76, 121.02 (d, *J* = 8.3 Hz), 113.16 (d, *J* = 19.7 Hz), 81.63 (d, *J* = 2.6 Hz), 69.47, 69.15, 68.38, 6.45, 5.52.



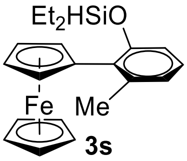
3q

According to general procedure, **3q** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.56 (dd, *J* = 7.8, 1.7 Hz, 1H), 7.19 (dd, *J* = 7.9, 1.7 Hz, 1H), 6.92 (t, *J* = 7.8 Hz, 1H), 4.65 (t, *J* = 1.8 Hz, 2H), 4.52 – 4.50 (m, 1H), 4.29 (t, *J* = 1.8 Hz, 2H), 4.07 (s, 5H), 0.86 (t, *J* = 7.9 Hz, 6H), 0.64 – 0.59 (m, 4H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 148.82, 132.30, 129.12, 129.10, 127.41, 127.38, 126.09, 122.07, 82.63, 69.99, 69.55, 68.17, 6.44, 5.36.



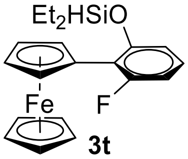
3r

According to general procedure, **3r** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.19 (d, *J* = 7.9 Hz, 1H), 6.88 (t, *J* = 7.9 Hz, 1H), 6.72 (d, *J* = 7.9 Hz, 1H), 4.77 (s, 2H), 4.70 – 4.68 (m, 1H), 4.28 (s, 2H), 4.07 (s, 5H), 3.84 (s, 3H), 0.96 (t, *J* = 7.9 Hz, 6H), 0.80 – 0.69 (m, 4H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 150.33, 142.15, 129.84, 121.77, 120.73, 108.92, 82.48, 69.36, 69.13, 68.10, 55.27, 6.72, 6.01.



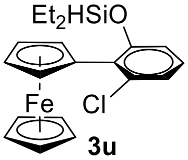
3s

According to general procedure, **3s** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.04 (t, *J* = 7.8 Hz, 1H), 6.85 (d, *J* = 7.2 Hz, 1H), 6.76 (d, *J* = 8.1 Hz, 1H), 4.71 – 4.68 (m, 1H), 4.59 (t, *J* = 1.9 Hz, 2H), 4.30 (t, *J* = 1.9 Hz, 2H), 4.13 (s, 5H), 2.94 (s, 3H), 1.0 – 0.96 (m, 6H), 0.81 – 0.74 (m, 4H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 153.93, 138.29, 127.42, 126.32, 124.59, 116.40, 81.92, 71.18, 69.25, 67.08, 22.42, 6.69, 5.21.



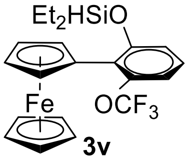
3t

According to general procedure, **3t** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.08 –7.03 (m, 1H), 6.77 – 6.69 (m, 2H), 4.81 (s, 2H), 4.72 (s, 1H), 4.30 (s, 2H), 4.11 (s, 5H), 1.00 – 0.96 (m, 6H), 0.80 – 0.74 (m, 4H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 161.17 (d, *J* = 248.0 Hz), 154.34 (d, *J* = 7.6 Hz), 126.37 (d, *J* = 11.3 Hz), 118.15 (d, *J* = 14.1 Hz), 114.51, 109.18 (d, *J* = 24.0 Hz), 75.96, 70.26 (d, *J* = 4.9 Hz), 69.38, 67.95, 6.53, 5.01.



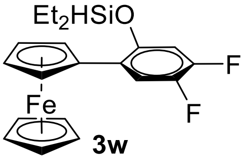
3u

According to general procedure, **3u** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.09 – 6.98 (m, 2H), 6.81 (dd, *J* = 7.8, 1.6 Hz, 1H), 4.81 (t, *J* = 1.9 Hz, 1H), 4.64 – 4.62 (m, 1H), 4.32 (t, *J* = 1.9 Hz, 1H), 4.16 (s, 5H), 1.06 – 0.94 (m, 6H), 0.75 – 0.69 (m, 4H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 154.82, 134.12, 127.87, 126.72, 124.38, 117.66, 79.49, 71.32, 69.51, 67.43, 6.53, 5.00.



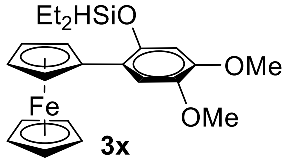
3v

According to general procedure, **3v** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.14 (t, *J* = 8.2 Hz, 1H), 6.99 – 6.95 (m, 1H), 6.85 (dd, *J* = 8.1, 1.2 Hz, 1H), 4.77 – 4.74 (m, 3H), 4.33 (t, *J* = 1.9 Hz, 2H), 4.13 (s, 5H), 1.04 – 0.99 (m, 6H), 0.88 – 0.74 (m, 4H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 154.79, 147.77, 126.41, 120.77(q, *J* =258.6 Hz), 116.78, 112.74 (q, *J* = 2.2 Hz), 76.46, 70.67, 69.35, 67.96, 6.52, 5.07.



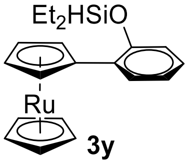
3w

According to general procedure, **3w** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.36 (dd, *J* = 11.8, 9.2 Hz, 1H), 6.71 (dd, *J* = 11.6, 7.1 Hz, 1H), 4.75 – 4.73 (m, 1H), 4.67 (t, *J* = 1.9 Hz, 2H), 4.29 (t, *J* = 1.9 Hz, 2H), 4.08 (s, 5H), 1.04 – 0.94 (m, 6H), 0.86 – 0.76 (m, 4H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 148.45 (dd, *J* = 7.5, 2.3 Hz), 147.96 (dd, *J* = 248.5, 14.0 Hz), 145.09 (dd, *J* = 240.1, 12.8 Hz), 126.03 (d, *J* = 9.3 Hz), 116.94 (d, *J* = 18.8 Hz), 107.62 (d, *J* = 18.5 Hz), 81.08, 69.46, 68.83, 68.45, 6.49, 4.96.



3x

According to general procedure, **3x** was obtained in almost quantitative yield as dark orange oil. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 6.99 (s, 1H), 6.36 (s, 1H), 4.61 – 4.56 (m, 1H), 4.56 (t, *J* = 1.9 Hz, 2H), 4.14 (t, *J* = 1.8 Hz, 2H), 3.96 (s, 5H), 3.81 (s, 3H), 3.76 (s, 3H), 0.91 – 0.86 (m, 6H), 0.71 – 0.59 (m, 4H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 147.74, 146.54, 143.49, 120.29, 113.10, 103.68, 83.32, 69.29, 68.66, 67.87, 56.50, 55.92, 6.62, 5.16.



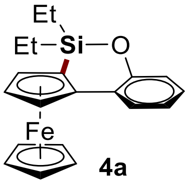
3y

Compound **3y** was synthesized by a modified literature's procedure,[8] which has been described in our previous report. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.43 (dd, *J* = 7.7, 1.8 Hz, 10H), 7.07 (ddd, *J* = 8.1, 7.3, 1.8 Hz, 1H), 6.89 – 6.82 (m, 2H), 5.07 (t, *J* = 1.7 Hz, 2H), 4.75 (p, *J* = 2.4 Hz, 1H), 4.63 (t, *J* = 1.7 Hz, 2H), 4.49 (s, 5H), 1.03 – 0.95 (m, 6H), 0.86 – 0.73 (m, 4H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 152.56, 130.78, 128.42, 127.14, 121.12, 118.49, 87.53, 72.01, 71.23, 70.11, 6.59, 5.15.

3.3 General procedure for the Ir-catalyzed asymmetric 6-membered C−H silylation

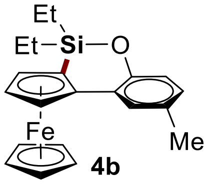
In a N$_2$ flushed glovebox, an oven-dried 8 mL tube equipped with a Teflon-coated magnetic stir bar was charged with [Ir(cod)OMe]$_2$ (2.6 mg，0.004 mmol, 2 mol%), chiral *N*, *N*-ligand **L2** or **L6** (0.012 mmol, 6 mol%) and anhydrous 1,4-dioxane (0.5 mL). The resulting mixture was stirred in the glovebox at room temperature for 1 hour, followed by addition of the starting material **3** (0.2 mmol, 1 equiv) in 1,4-dioxane (0.5 mL). The reaction tube was capped, removed from the glove box and the reaction mixture was stirred at 60 °C for 24 h. Then, the reaction mixture was cooled to room temperature, concentrated under vacuum and subjected to silica gel column chromatography to deliver the planar chiral ferrocene sioles **2**. The ee value of the product was determined by chiral HPLC analysis. **L2** was employed as the chiral ligand for the enantioselective 6-membered C−H silylation of substrates **3a-n** as well as **3w-y**. On the other hand, **L6** was utilized as the chiral ligand for the enantioselective 6-membered C−H silylation of C3 or C6-substituted substrates **3o-v**.

3.4 Characterization of products 4



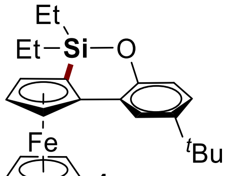
4a

According to general procedure, **4a** was obtained in 93% yield and 98% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane/DCM = 5:1). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.41 (dd, *J* = 7.7, 1.8 Hz, 1H), 7.11 – 7.09 (m, 1H), 6.94 – 6.87 (m, 2H), 4.96 (dd, *J* = 2.4, 1.1 Hz, 1H), 4.53 (t, *J* = 2.4 Hz, 1H), 4.28 (dd, *J* = 2.3, 1.0 Hz, 1H), 4.04 (s, 5H), 1.31 – 1.18 (m, 5H), 0.86 – 0.72 (m, 5H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 152.42, 127.10, 125.57, 124.89, 120.70, 119.58, 86.80, 71.70, 71.53, 69.82, 65.40, 64.33, 7.75, 7.48, 6.31, 6.26. **HPLC analysis** (IC-3): Hexane/Isopropanol = 99.5:0.5, 0.5 mL/min, 254 nm UV detector, 98% ee, t_R = 8.0 min (major) and t_R = 9.7 min (minor). **$[\alpha]_D^{25}$** = 304 (c = 0.867, DCM).



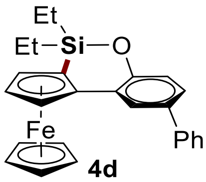
4b

According to general procedure, **4b** was obtained in 93% yield and 96% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane/DCM = 5:1). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.21 (d, *J* = 2.2 Hz, 1H), 6.94 – 6.91 (m, 1H), 6.84 (d, *J* = 8.2 Hz, 1H), 4.96 (d, *J* = 1.6 Hz, 1H), 4.53 (t, *J* = 2.3 Hz, 1H), 4.29 (d, *J* = 1.6 Hz, 1H), 4.06 (s, 5H), 2.33 (s, 3H), 1.33 – 1.15 (m, 5H), 0.87 – 0.69 (m, 5H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 150.26, 129.65, 127.82, 125.26, 125.09, 119.24, 87.09, 71.67, 71.47, 69.83, 65.27, 64.46, 20.73, 7.67, 7.39, 6.32, 6.30. **HPLC analysis** (OD-3): Hexane/Isopropanol = 99.7:0.3, 0.5 mL/min, 254 nm UV detector, 96% ee, t_R = 10.4 min (major) and t_R = 12.3 min (minor). **$[\alpha]_D^{25}$** = 111.6 (c = 0.645, DCM).



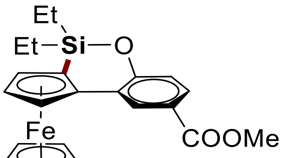
4c

According to general procedure, **4c** was obtained in 82% yield and 97% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R$_f$ = 0.3 (Hexane/DCM = 5:1). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.41 (d, J = 2.5 Hz, 1H), 7.13 (dd, J = 8.5, 2.5 Hz, 1H), 6.85 (d, J = 8.5 Hz, 1H), 4.98 (dd, J = 2.4, 1.1 Hz, 1H), 4.52 (t, J = 2.4 Hz, 1H), 4.27 (dd, J = 2.3, 1.1 Hz, 1H), 4.04 (s, 5H), 1.35 (s, 9H), 1.32 – 1.16 (m, 5H), 0.87 – 0.69 (m, 5H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 150.08, 143.18, 124.45, 124.08, 121.60, 118.87, 87.38, 71.68, 71.39, 69.81, 65.26, 64.37, 34.08, 31.61, 7.66, 7.52, 6.32, 6.31. **HPLC analysis** (IA-3): Hexane/Isopropanol = 99.9:0.1, 0.5 mL/min, 254 nm UV detector, 97% ee, t$_R$ = 11.5 min (major) and t$_R$ = 9.1 min (minor). **[α]$_D^{25}$** = -29.7 (c = 0.72, DCM).



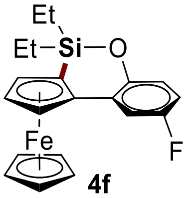
4d

According to general procedure, **4d** was obtained in 87% yield and 96% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R$_f$ = 0.4 (Hexane/DCM = 3:1). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.62 – 7.60 (m, 3H), 7.45 (t, J = 7.5 Hz, 2H), 7.35 – 7.31 (m, 2H), 6.99 (d, J = 8.3 Hz, 1H), 5.04 (s, 1H), 4.57 (s, 1H), 4.33 (s, 1H), 4.07 (s, 5H), 1.33 – 1.18 (m, 5H), 0.89 – 0.74 (m, 5H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 152.13, 141.16, 133.75, 128.65, 126.74, 126.57, 125.89, 125.84, 123.48, 119.90, 86.71, 71.84, 71.68, 69.90, 65.43, 64.41, 7.76, 7.47, 6.31, 6.29. **HRMS (ESI)** calcd for C26H26FeOSi [M]$^+$ 438.1102, found 438.1103.**HPLC analysis** (OD-3): Hexane/Isopropanol = 99.5:0.5, 0.5 mL/min, 254 nm UV detector, 96% ee, t$_R$ = 11.9 min (major) and t$_R$ = 10.6 min (minor). **[α]$_D^{25}$** = 36.2 (c = 0.46, DCM).



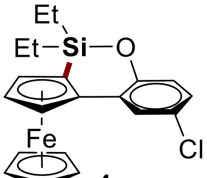
4e

According to general procedure, 4e was obtained in 84% yield and 95% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane/ Ethyl acetate = 20:1). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.11 (d, *J* = 2.2 Hz, 1H), 7.79 (dd, *J* = 8.5, 2.2 Hz, 1H), 6.94 (d, *J* = 8.5 Hz, 1H), 5.07 (dd, *J* = 2.4, 1.1 Hz, 1H), 4.57 (t, *J* = 2.4 Hz, 1H), 4.30 (dd, *J* = 2.4, 1.0 Hz, 1H), 4.03 (s, 5H), 3.91 (s, 3H), 1.30 – 1.16 (m, 5H), 0.82 – 0.70 (m, 5H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 167.12, 156.58, 128.80, 126.81, 125.91, 122.64, 119.60, 85.64, 71.99, 71.94, 69.92, 65.83, 63.89, 51.88, 7.81, 7.48, 6.23, 6.14. **HPLC analysis** (OD-3) Hexane/Isopropanol=99:1, 0.5 mL/min, 254 nm UV detector, 95% ee, t_R = 13.6 min (major) and t_R = 18.2 min (minor). **$[\alpha]_D^{25}$** = -72.1 (c = 0.65, DCM).



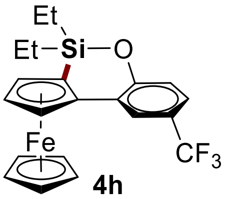
4f

According to general procedure, **4f** was obtained in 92% yield and 95% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane/DCM = 5:1). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.07 (dd, *J* = 9.6, 3.0 Hz, 1H), 6.86 – 6.75 (m, 2H), 4.89 (d, *J* = 2.2 Hz, 1H), 4.55 (t, *J* = 2.3 Hz, 1H), 4.30 (d, *J* = 2.1 Hz, 1H), 4.05 (s, 5H), 1.30 – 1.12 (m, 5H), 0.84 – 0.68 (m, 5H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 157.17 (d, *J* = 236.6 Hz), 148.35, 126.99 (d, *J* = 7.9 Hz), 120.18 (d, *J* = 8.5 Hz), 113.26 (d, *J* = 23.4 Hz), 110.79 (d, *J* = 24.0 Hz), 85.77 (d, *J* = 0.7 Hz), 72.06, 71.86, 69.92, 65.64, 64.50, 7.70, 7.40, 6.27, 6.23. **HPLC analysis** (IC-3): Hexane/Isopropanol = 99.8:0.2, 0.5 mL/min, 254 nm UV detector, 95% ee, t_R = 9.1 min (major) and t_R = 10.5 min (minor). **$[\alpha]_D^{25}$** = 257.3 (c = 0.225, DCM).



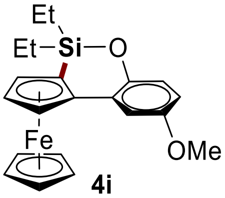
4g

According to general procedure, **4g** was obtained in 92% yield and 96% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane/DCM = 4:1). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.36 (d, *J* = 2.7 Hz, 1H), 7.06 (dd, *J* = 8.6, 2.7 Hz, 1H), 6.86 (d, *J* = 8.6 Hz, 1H), 4.92 (dd, *J* = 2.5, 1.0 Hz, 1H), 4.56 (t, *J* = 2.4 Hz, 1H), 4.30 (dd, *J* = 2.5, 1.1 Hz, 1H), 4.06 (s, 5H), 1.32 – 1.16 (m, 5H), 0.84 – 0.69 (m, 5H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 151.00, 127.57, 126.71, 125.44, 124.33, 120.78, 85.46, 72.06, 71.94, 69.94, 65.55, 64.37, 7.72, 7.40, 6.25, 6.20. **HPLC analysis** (IA-3): Hexane/Isopropanol = 99.9:0.1, 0.5 mL/min, 254 nm UV detector, 96% ee, t_R = 14.7 min (major) and t_R = 11.8 min (minor). **$[\alpha]_D^{25}$** = -11.4 (c = 0.47, DCM).



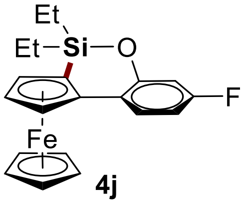
4h

According to general procedure, **4h** was obtained in 89% yield and 95% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane/DCM = 5:1). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.66 (d, *J* = 2.3 Hz, 1H), 7.37 (dd, *J* = 8.6, 2.3 Hz, 1H), 7.01 (d, *J* = 8.5 Hz, 1H), 5.01 (dd, *J* = 2.5, 1.0 Hz, 1H), 4.60 (t, *J* = 2.4 Hz, 1H), 4.34 (dd, *J* = 2.4, 1.0 Hz, 1H), 4.07 (s, 5H), 1.33 – 1.21 (m, 5H), 0.86 – 0.72 (m, 5H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 154.98, 126.49, 124.58 (q, *J* = 272.7 Hz), 123.97 (q, *J* = 4.1 Hz), 122.97 (q, *J* = 32.7 Hz), 121.91 (q, *J* = 3.4 Hz), 119.86, 85.21, 72.14 (d, *J* = 4.3 Hz), 69.97, 65.66, 64.23, 7.77, 7.46, 6.21, 6.15. **HPLC analysis** (IA-3): Hexane/Isopropanol = 99.9:0.1, 0.5 mL/min, 254 nm UV detector, 95% ee, t_R = 10.9 min (major) and t_R = 9.3 min (minor). **$[\alpha]_D^{25}$** = 221.2 (c = 0.64, DCM).



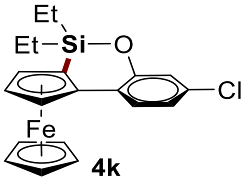
4i

According to general procedure, **4i** was obtained in 93% yield and 96% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane/Ethyl acetate = 20:1). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 6.93 (d, *J* = 3.1 Hz, 1H), 6.84 (d, *J* = 8.7 Hz, 1H), 6.66 (dd, *J* = 8.8, 2.9 Hz, 1H), 4.93 (s, 1H), 4.55 (s, 1H), 4.31 (s, 1H), 4.06 (s, 5H), 3.81 (s, 3H), 1.29 – 1.13 (m, 5H), 0.84 – 0.67 (m, 5H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 153.46, 146.54, 126.30, 119.77, 111.95, 110.33, 86.69, 71.86, 71.58, 69.86, 65.44, 64.69, 55.64, 7.63, 7.34, 6.31, 6.28. **HPLC analysis** (IC-3): Hexane/Isopropanol = 99.5:0.5, 0.5 mL/min, 254 nm UV detector, 96% ee, t_R = 11.6 min (major) and t_R = 12.8 min (minor). **$[\alpha]_D^{25}$** = 67.7 (c = 0.55, DCM).



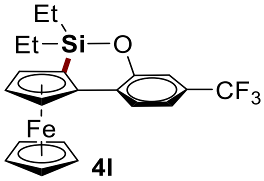
4j

According to general procedure, **4j** was obtained in 88% yield and 96% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.3 (Hexane/DCM = 5:1). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.34 (dd, *J* = 8.6, 6.7 Hz, 1H), 6.69 – 6.59 (m, 2H), 4.90 (dd, *J* = 2.4, 1.1 Hz, 1H), 4.52 (t, *J* = 2.4 Hz, 1H), 4.27 (dd, *J* = 2.4, 1.0 Hz, 1H), 4.04 (s, 5H), 1.31 – 1.16 (m, 5H), 0.85 – 0.72 (m, 5H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 161.94 (d, *J* = 243.9 Hz), 153.48 (d, *J* = 12.2 Hz), 125.41 (d, *J* = 9.8 Hz), 121.68 (d, *J* = 3.1 Hz), 107.75 (d, *J* = 21.3 Hz), 106.93 (d, *J* = 23.3 Hz), 86.43, 71.54, 71.46, 69.82, 65.23, 63.46, 7.72, 7.42, 6.23, 6.18. **HPLC analysis** (IA-3): Hexane/Isopropanol = 99.9:0.1, 0.5 mL/min, 254 nm UV detector, 96% ee, t_R = 14.0 min (major) and t_R = 12.9 min (minor). **$[\alpha]_D^{25}$** = 231.4 (c = 0.38, DCM).



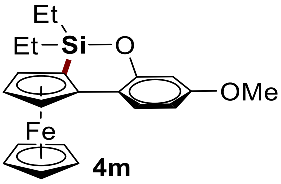
4k

According to general procedure, **4k** was obtained in 90% yield and 96% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.3 (Hexane/DCM = 5:1). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.35 (s, 1H), 7.05 (d, *J* = 8.5 Hz, 1H), 6.85 (d, *J* = 8.6 Hz, 1H), 4.92 (s, 1H), 4.56 (s, 1H), 4.31 (s, 1H), 4.06 (s, 5H), 1.29 – 1.12 (m, 5H), 0.83 – 0.65 (m, 5H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 151.00, 127.56, 126.72, 125.42, 124.33, 120.76, 85.57, 72.12, 72.01, 70.01, 65.57, 64.40, 7.69, 7.38, 6.25, 6.20. **HPLC analysis** (IA-3): Hexane/Isopropanol = 99.9:0.1, 0.5 mL/min, 254 nm UV detector, 96% ee, t_R = 12.4 min (major) and t_R = 10.6 min (minor). **$[\alpha]_D^{25}$** = -10.6 (c = 0.63, DCM).



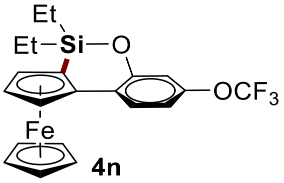
4l

According to general procedure, **4l** was obtained in 81% yield and 92% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane/DCM = 5:1). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.47 (dd, *J* = 8.1, 1.0 Hz, 1H), 7.17 (s, 1H), 7.12 – 7.10 (m, 1H), 4.98 (dd, *J* = 2.5, 1.1 Hz, 1H), 4.59 (t, *J* = 2.4 Hz, 1H), 4.33 (dd, *J* = 2.4, 1.0 Hz, 1H), 4.04 (s, 5H), 1.32 – 1.16 (m, 5H), 0.84 – 0.71 (m, 5H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 152.26, 129.86, 128.77 (q, *J* = 33.7 Hz), 125.04, 124.22 (q, *J* = 272.7 Hz), 122.87, 117.32 (q, *J* = 3.8 Hz), 116.61 (q, *J* = 3.9 Hz), 84.85, 72.33 (d, *J* = 9.8 Hz), 70.02, 65.94, 64.75, 7.76, 7.47, 6.22, 6.17. **HPLC analysis** (IC-3): Hexane/Isopropanol = 99.9:0.1, 0.5 mL/min, 254 nm UV detector, 92% ee, t_R = 9.5 min (major) and t_R = 10.3 min (minor). $[\alpha]_D^{25}$ = 292.2 (c = 0.64, DCM).



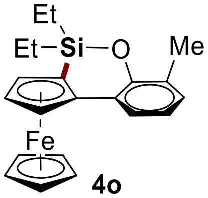
4m

According to general procedure, **4m** was obtained in 90% yield and 97% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.3 (Hexane/Ethyl acetate = 20:1). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.30 (d, *J* = 8.5 Hz, 1H), 6.53 (d, *J* = 2.5 Hz, 1H), 6.49 (dd, *J* = 8.5, 2.6 Hz, 1H), 4.93 (s, 1H), 4.53 (s, 1H), 4.30 (s, 1H), 4.07 (s, 5H), 3.81 (s, 3H), 1.31 – 1.13 (m, 5H), 0.91 – 0.69 (m, 5H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 159.21, 153.49, 125.44, 117.90, 107.26, 104.63, 88.09, 71.30, 71.27, 69.89, 64.81, 63.01, 55.16, 7.61, 7.39, 6.27, 6.24. **HPLC analysis** (IC-3): Hexane/Isopropanol = 99.5:0.5, 0.5 mL/min, 254 nm UV detector, 97% ee, t_R = 11.5 min (major) and t_R = 15 min (minor). $[\alpha]_D^{25}$ = 255.8 (c = 0.44, DCM).



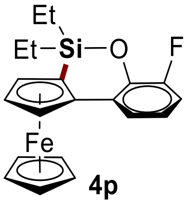
4n

According to general procedure, **4n** was obtained in 86% yield and 96% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane/DCM = 5:1). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.38 (d, *J* = 8.5 Hz, 1H), 6.81 (s, 1H), 6.75 (d, *J* = 7.6 Hz, 1H), 4.93 (dd, *J* = 2.4, 1.1 Hz, 1H), 4.55 (t, *J* = 2.4 Hz, 1H), 4.29 (dd, *J* = 2.4, 1.1 Hz, 1H), 4.05 (s, 5H), 1.32 – 1.14 (m, 5H), 0.89 – 0.68 (m, 5H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 153.09, 147.95, 125.28, 124.60, 120.46 (q, *J* = 256.6 Hz), 113.06, 112.30, 85.64, 71.86, 71.78, 69.90, 65.50, 63.89, 7.74, 7.46, 6.22, 6.17. **HPLC analysis** (IA-3): Hexane/Isopropanol = 99.5:0.5, 0.5 mL/min, 254 nm UV detector, 96% ee, t_R = 11.5 min (major) and t_R = 10.5 min (minor). $[\alpha]_D^{25}$ = 307.8 (c = 0.26, DCM).



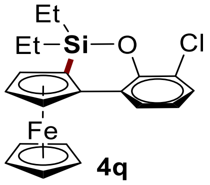
4o

According to general procedure, **4o** was obtained in 90% yield and 92% ee as dark orange oil under the optimized condition by use of **L6** as the chiral ligand at 60 °C for 24 h. R_f = 0.5 (Hexane/DCM = 5:1). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.26 – 7.18 (m, 1H), 6.98 (d, *J* = 7.2 Hz, 1H), 6.78 (t, *J* = 7.4 Hz, 1H), 5.01 (s, 1H), 4.58 (s, 1H), 4.36 (s, 1H), 4.09 (s, 5H), 2.27 (s, 3H), 1.29 – 1.08 (m, 5H), 0.90 – 0.69 (m, 5H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 150.69, 128.54, 127.85, 124.82, 122.76, 119.93, 88.28, 71.90, 71.89, 70.22, 65.73, 64.67, 16.58, 7.60, 7.32, 6.31, 6.27. **HRMS (ESI)** calcd for C21H24FeOSi $[M]^+$ 376.0945, found 376.0942. **HPLC analysis** (IC-3): Hexane/Isopropanol = 99.5:0.5, 0.5 mL/min, 254 nm UV detector, 92% ee, t_R = 7.7 min (major) and t_R = 8.2 min (minor). $[\alpha]_D^{25}$ = 348.9 (c = 0.45, DCM).



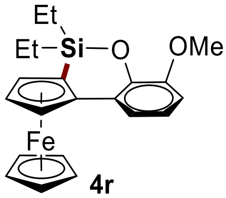
4p

According to general procedure, **4p** was obtained in 85% yield and 96% ee as dark orange oil under the optimized condition by use of **L6** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane/DCM=5:1). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.14 (d, *J* = 7.8 Hz, 1H), 6.93 – 6.88 (m, 1H), 6.80 – 6.75 (m, 1H), 4.97 (s, 1H), 4.58 (s, 1H), 4.35 (s, 1H), 4.07 (s, 5H), 1.31 – 1.14 (m, 5H), 0.87 – 0.71 (m, 5H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 153.59 (d, *J* = 243.1 Hz), 140.58 (d, *J* = 12.3 Hz), 128.32 (d, *J* = 2.0 Hz), 120.09 (d, *J* = 7.7 Hz), 119.89 (d, *J* = 3.2 Hz), 113.71 (d, *J* = 19.1 Hz), 85.83 (d, *J* = 3.2 Hz), 72.10, 71.84, 69.98, 65.87, 64.39, 7.80, 7.51, 6.27, 6.20. **HRMS (ESI)** calcd for C20H21FFeOSi $[M]^+$ 380.0695, found 380.0693 **HPLC analysis** (OD-3): Hexane/Isopropanol = 99.5:0.5, 0.5 mL/min, 254 nm UV detector, 96% ee, t_R = 11.8 min (major) and t_R = 11.1 min (minor). **$[\alpha]_D^{25}$** = 282.8 (c = 0.78, DCM).



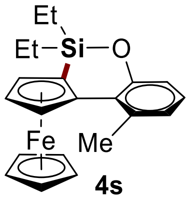
4q

According to general procedure, **4q** was obtained in 94% yield and 90% ee as dark orange oil under the optimized condition by use of **L6** as the chiral ligand at 60 °C for 24 h. R*f* = 0.4 (Hexane/DCM = 5:1). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.30 (dd, *J* = 7.8, 1.6 Hz, 1H), 7.20 (dd, *J* = 7.9, 1.5 Hz, 1H), 6.79 (t, *J* = 7.8 Hz, 1H), 4.95 (s, 1H), 4.56 (t, *J* = 2.0 Hz, 1H), 4.32 (s, 1H), 4.06 (s, 5H), 1.33 – 1.17 (m, 5H), 0.87 – 0.68 (m, 5H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 148.13, 127.52, 124.44, 123.27, 120.74, 86.10, 71.96, 71.93, 69.93, 65.77, 64.53, 7.71, 7.32, 6.18, 6.16. **HRMS (ESI)** calcd for C20H21ClFeOSi $[M]^+$ 396.0400, found 396.0398. **HPLC analysis** (OD-3): Hexane/Isopropanol = 99.5:0.5, 0.5 mL/min, 254 nm UV detector, 90% ee, t_R = 12.5 min (major) and t_R = 11.3 min (minor). **$[\alpha]_D^{25}$** = 416.6 (c = 0.57, DCM).



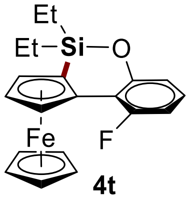
4r

According to general procedure, **4r** was obtained in 98% yield and 96% ee as dark orange oil under the optimized condition by use of **L6** as the chiral ligand at 60 °C for 24 h. R*f* = 0.3 (Hexane/Ethyl acetate = 20:1). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.03 (dd, *J* = 7.7, 1.7 Hz, 1H), 6.84 – 6.75 (m, 2H), 4.94 (s, 1H), 4.53 (s, 1H), 4.31 (s, 1H), 4.06 (s, 5H), 3.89 (s, 3H), 1.35 – 1.17 (m, 5H), 0.88 – 0.67 (m, 5H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 150.17, 141.95, 126.34, 120.13, 117.35, 110.26, 86.80, 71.76, 71.45, 69.78, 65.72, 64.45, 56.22, 7.64, 7.42, 6.32, 6.27. **HRMS (ESI)** calcd for C21H25FeO2Si $[M]^+$ 393.0968, found 393.0962. **HPLC analysis** (IA-3): Hexane/Isopropanol = 90:10, 0.5 mL/min, 254 nm UV detector, 96% ee, t_R = 7.7 min (major) and t_R = 8.0 min (minor). **$[\alpha]_D^{25}$** = 431.1 (c = 0.34, DCM).



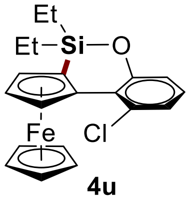
4s

According to general procedure, **4s** was obtained in 89% yield and 98% ee as dark orange oil under the optimized condition by use of **L6** as the chiral ligand at 60 °C for 24 h. R$_f$ = 0.4 (Hexane/DCM = 5:1). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.02 (t, *J* = 7.7 Hz, 1H), 6.85 (d, *J* = 8.0 Hz, 1H), 6.78 (d, *J* = 7.4 Hz, 1H), 5.13 (s, 1H), 4.58 (s, 1H), 4.32 (s, 1H), 4.08 (s, 5H), 2.61 (s, 3H), 1.31 – 1.08 (m, 5H), 0.86 – 0.67 (m, 5H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 153.63, 135.70, 126.33, 125.27, 124.32, 118.12, 86.86, 71.62, 71.38, 70.19, 69.93, 66.77, 24.00, 6.90, 6.85, 6.40, 6.36. **HRMS (ESI)** calcd for C21H24FeOSi [M]$^{+}$ 376.0945, found 376.0940. **HPLC analysis** (IA-3): Hexane/Isopropanol = 99.5:0.5, 0.5 mL/min, 254 nm UV detector, 98% ee, t$_R$ = 8.0 min (major) and t$_R$ = 8.6 min (minor). **$[\alpha]_D^{25}$** = 154.5 (c = 0.326, DCM).



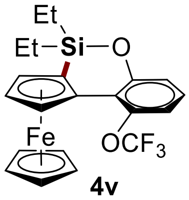
4t

According to general procedure, **4t** was obtained in 84% yield and 96% ee as dark orange oil under the optimized condition by use of **L6** as the chiral ligand at 60 °C for 24 h. R$_f$ = 0.4 (Hexane/DCM = 5:1). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.01 (q, *J* = 8.1 Hz, 1H), 6.73 (d, *J* = 8.1 Hz, 1H), 6.68 – 6.63 (m, 1H), 5.32 (s, 1H), 4.59 (s, 1H), 4.32 (s, 1H), 4.09 (s, 5H), 1.28 – 1.12 (m, 5H), 0.86 – 0.71 (m, 5H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 160.39 (d, *J* = 246.6 Hz), 153.96 (d, *J* = 7.4 Hz), 126.29 (d, *J* = 11.4 Hz), 115.45 (d, *J* = 3.0 Hz), 114.99 (d, *J* = 15.0 Hz), 108.07 (d, *J* = 23.6 Hz), 81.52 (d, *J* = 1.7 Hz), 72.20 (d, *J* = 3.1 Hz), 71.25 (d, *J* = 1.3 Hz), 70.22, 70.06, 69.86, 7.54, 7.50, 6.30, 6.20. **HRMS (ESI)** calcd for C20H21FFeOSi [M]$^{+}$ 380.0690, found 380.0688. **HPLC analysis** (OD-3): Hexane/Isopropanol = 99.5:0.5, 0.5 mL/min, 254 nm UV detector, 96% ee, t$_R$ = 11.8 min (major) and t$_R$ = 11.1 min (minor). **$[\alpha]_D^{25}$** = 287.9 (c = 0.616, DCM).



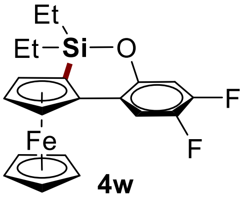
4u

According to general procedure, **4u** was obtained in 92% yield and 98% ee as dark orange oil under the optimized condition by use of **L6** as the chiral ligand at 60 °C for 24 h. R$_f$ = 0.4 (Hexane/DCM = 5:1). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.04 –7.00 (m, 2H), 6.92 – 6.88 (m, 1H), 5.79 (dd, *J* = 2.5, 1.0 Hz, 1H), 4.59 (t, *J* = 2.5 Hz, 1H), 4.32 (dd, *J* = 2.4, 1.0 Hz, 1H), 4.09 (s, 5H), 1.31 – 1.15 (m, 5H), 0.88 – 0.70 (m, 5H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 154.40, 131.41, 126.60, 125.24, 123.90, 118.89, 83.97, 71.97, 71.59, 71.05, 69.98, 66.31, 7.08, 6.91, 6.33, 6.27. **HRMS (ESI)** calcd for C20H21ClFeOSi [M]$^+$ 396.0400, found 396.0399. **HPLC analysis** (OD-3): Hexane/Isopropanol = 99.9:0.1, 0.5 mL/min, 254 nm UV detector, 98% ee, t$_R$ = 10.1 min (major) and t$_R$ = 11 min (minor). **$[\alpha]_D^{25}$** = 14.7 (c = 0.29, DCM).



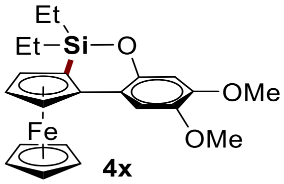
4v

According to general procedure, **4v** was obtained in 93% yield and 98% ee as dark orange oil under the optimized condition by use of **L6** as the chiral ligand at 60 °C for 24 h. R$_f$ = 0.4 (Hexane/DCM = 5:1). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.09 (t, *J* = 8.1 Hz, 1H), 6.92 – 6.87 (m, 2H), 5.34 (s, 1H), 4.59 (t, *J* = 2.3 Hz, 1H), 4.31 (s, 1H), 4.07 (s, 5H), 1.38 – 1.09 (m, 5H), 0.84 – 0.65 (m, 5H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 154.28, 146.38 (q, *J* = 1.4 Hz), 126.26, 120.73 (d, *J* = 258.2 Hz), 120.47, 118.51, 113.35 (q, *J* = 1.6 Hz), 81.62, 72.50, 71.56, 70.19, 69.94, 65.47, 7.48, 7.16, 6.29, 6.17. **HRMS (ESI)** calcd for C21H21F3FeO2Si [M]$^+$ 446.0612, found 446.0610. **HPLC analysis** (OD-3): Hexane/Isopropanol = 100:0, 0.5 mL/min, 254 nm UV detector, 98% ee, t$_R$ = 9.9 min (major) and t$_R$ = 10.7 min (minor). **$[\alpha]_D^{25}$** = 201.5 (c = 0.423, DCM).



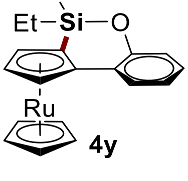
4w

According to general procedure, **4w** was obtained in 80% yield and 91% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.3 (Hexane/DCM = 5:1). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.15 (dd, *J* = 11.4, 9.0 Hz, 1H), 6.73 (dd, *J* = 11.7, 7.2 Hz, 1H), 4.83 (dd, *J* = 2.5, 1.0 Hz, 1H), 4.53 (t, *J* = 2.4 Hz, 1H), 4.28 (dd, *J* = 2.4, 1.0 Hz, 1H), 4.05 (s, 5H), 1.30 – 1.14 (m, 5H), 0.84 – 0.68 (m, 5H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ148.57 (dd, *J* = 247.5, 14.0 Hz), 148.36 (d, *J* = 9.8 Hz), 144.99 (dd, *J* = 239.0, 13.0 Hz), 122.02 (dd, *J* = 5.5, 1.6 Hz), 112.16 (d, *J* = 19.2 Hz), 108.49 (d, *J* = 19.1 Hz), 85.42, 71.92, 71.76, 69.93, 65.48, 63.84, 7.69, 7.38, 6.19, 6.15. **HPLC analysis** (IA-3): Hexane/Isopropanol = 99.9:0.1, 0.5 mL/min, 254 nm UV detector, 91% ee, t_R = 14.7 min (major) and t_R = 14.3 min (minor). **$[\alpha]_D^{25}$** = 237.2 (c = 0.135, DCM).



4x

According to general procedure, **4x** was obtained in 91% yield and 94% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.3 (Hexane/Ethyl acetate = 10:1). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 6.87 (s, 1H), 6.54 (s, 1H), 4.85 (s, 1H), 4.49 (s, 1H), 4.24 (s, 1H), 4.04 (s, 5H), 3.90 (s, 3H), 3.87 (s, 3H), 1.30 – 1.12 (m, 5H), 0.65 – 0.66 (m, 5H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 148.43, 146.79, 143.16, 116.29, 108.34, 103.89, 87.76, 71.33, 71.04, 69.74, 64.76, 63.33, 56.69, 55.75, 7.60, 7.39, 6.27, 6.24. **HPLC analysis** (IA-3): Hexane/Isopropanol = 98:2, 0.5 mL/min, 254 nm UV detector, 94% ee, t_R = 13.7 min (major) and t_R = 11.3 min (minor). **$[\alpha]_D^{25}$** = 203.4 (c = 0.59, DCM).



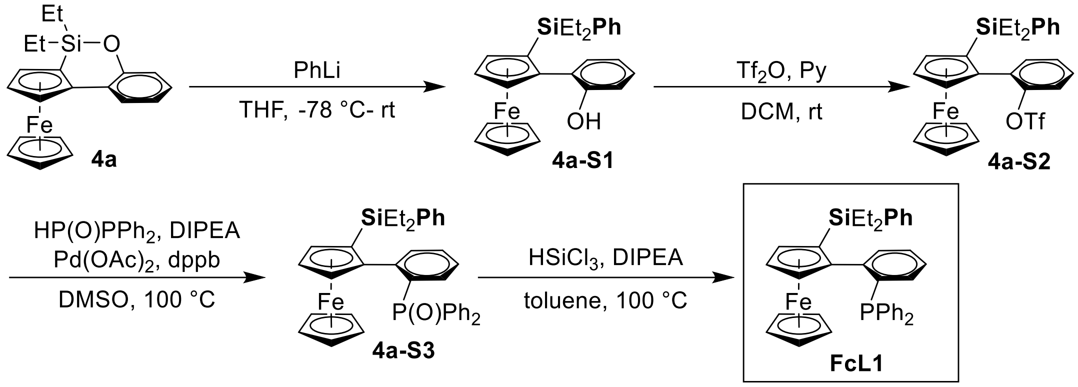
4y

According to general procedure, **4y** was obtained in 90% yield and 97% ee as dark orange oil under the optimized condition by use of **L2** as the chiral ligand at 60 °C for 24 h. R_f = 0.4 (Hexane/DCM = 5:1). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.37 (dd, *J* = 7.7, 1.7 Hz, 1H), 7.08 – 7.05 (m, 1H), 6.90 – 6.83 (m, 2H), 5.34 (dd, *J* = 2.3, 0.9 Hz, 1H), 4.85 (t, *J* = 2.3 Hz, 1H), 4.64 (dd, *J* = 2.3, 0.9 Hz, 1H), 4.48 (s, 5H), 1.21 – 1.09 (m, 4H), 0.97 – 0.81 (m, 6H). **^{13}C NMR (101 MHz,**

$CDCl_3$) δ 152.14, 127.02, 124.71, 124.63, 120.54, 119.41, 89.80, 73.36, 72.81, 71.73, 68.16, 67.58, 8.84, 7.59, 6.38, 6.15. **HPLC analysis** (IA-3): Hexane/Isopropanol = 99.9:0.1, 0.5 mL/min, 254 nm UV detector, 97% ee, t_R = 11.2 min (major) and t_R = 13.2 min (minor). **$[\alpha]_D^{25}$** = 213.9 (c = 0.75, DCM).

4. Applications of Product 4a

4.1 Ligand synthesis[9]

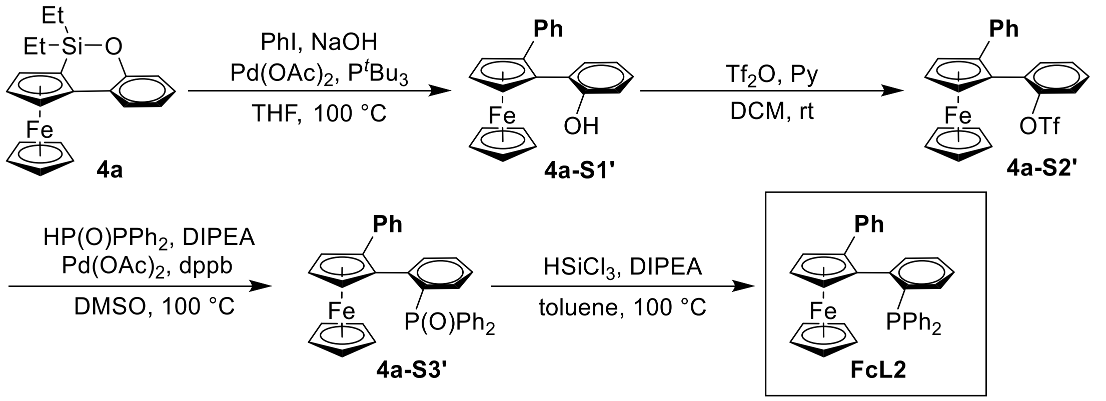


A flame-dried Schlenk tube containing a stir bar was charged with **4a** (1.86 g, 5 mmol, 1 equiv). The tube was then evacuated and backfilled with N_2 for three times, followed by addition of 25 mL of THF. The solution was cooled to -78 °C and PhLi (10 mL, 1 mol/L in Et_2O, 2 equiv) was added dropwise. The reaction mixture was stirred for 30 min at -78 °C and then allowed to warm to room temperature for additional 30 min. After completion of the reaction, the reaction mixture was quenched with NH_4Cl solution (3 mL), extracted with Et_2O (30mL× 3), washed with brine (30 mL), dried over Na_2SO_4, filtered and concentrated in vacuum. The crude residue was purified by flash column chromatography on silica gel (Hexane/DCM, 90/10), affording the product **4a-S1**.

To a solution of ferrocenyl-phenol **4a-S1** (10 mmol, 1 equiv) and pyridine (3.3 mL, 20 mmol, 2 equiv) in DCM (25 mL), Tf_2O (1.2 mL, 15 mmol, 1.5 equiv) was added dropwise at 0 °C and the mixture was stirred at room temperature overnight. After the reaction was finished, the reaction mixture was diluted with DCM (100 mL) and washed with 1N HCl solution (30 mL × 3). The organic layer was separated, washed with brine (50 mL), dried over Na_2SO_4, filtered and concentrated under reduced pressure. The crude residue was purified by flash column chromatography on silica gel to deliver the product **4a-S2**.

A flame-dried Schlenk tube equipped with a magnetic stir bar was charged with $Pd(OAc)_2$ (112.5 mg, 0.5 mmol, 0.1 equiv), dppb (213.3 mg, 0.5 mmol, 0.1 equiv), $HP(O)Ph_2$ (2.02 g, 10 mmol, equiv) and ArOTf (5 mmol, 1 equiv). The tube was evacuated and backfilled with N_2 for three times, followed by addition of the DIPEA (3.3 mL, 20 mmol, 4 equiv) and DMSO (25 mL). The reaction mixture was heated to 100 °C with continuously stirring for 18 h. After the reaction was finished, the reaction mixture was cooled to room temperature, diluted with EtOAc (50 mL) and washed with 1N HCl solution (15 mL × 3) and brine (30 mL × 3). The combined organic layers were dried over Na_2SO_4, filtered and concentrated under reduced pressure. The crude residue was purified by flash column chromatography on silica gel to yield the product **4a-S3**.

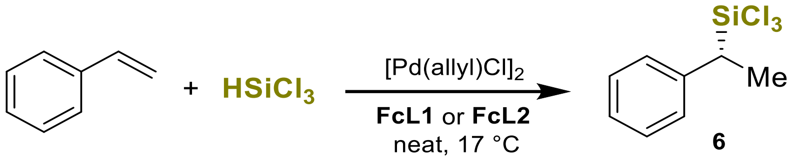
A flame-dried Schlenk tube equipped with a magnetic stir bar was charged with $ArP(O)Ph_2$ **4a-S3** (5 mmol, 1 equiv). The tube was evacuated and backfilled with N_2 for three times, followed by addition of DIPEA (8.3 mL, 50 mmol, 10 equiv) and toluene (25 mL). The reaction mixture was cooled to 0 °C and $HSiCl_3$ (2.6 mL, 25 mmol, 5 equiv) was added dropwise to the stirred solution. After addition, the reaction mixture was heated to 90 °C with continuously stirring for 24 h. After the reaction was finished, an aqueous solution of NaOH was added dropwise to the stirred solution at 0 °C. Then, the reaction mixture was extracted with Et_2O (30 mL× 3), washed with brine, dried over Na_2SO_4, filtered and concentrated in vacuum. The crude residue was purified by flash column chromatography on silica gel (Hexane/DCM, 90/10), affording the phosphine ligand **FcL1**. **FcL1** was obtained in 56 % yield over 4steps as orange solid. R_f = 0.4 (Hexane/DCM = 4:1). **^{1}H NMR (400 MHz, $CDCl_3$)** δ7.74 – 7.71 (m, 1H), 7.45 – 7.36 (m, 2H), 7.29 – 7.21 (m, 6H), 7.18 – 7.06 (m, 7H), 6.92 – 6.88 (m, 2H), 6.83 – 6.80 (m, 1H), 4.20 (t, *J* = 2.4 Hz, 1H), 4.09 (s, 1H), 3.93 (s, 5H), 3.83 (t, *J* = 1.9 Hz, 1H), 1.03 – 0.61 (m, 10H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 138.85 (d, *J* = 13.9 Hz), 138.25 (d, *J* = 12.4 Hz), 137.91 (d, *J* = 13.7 Hz), 137.22, 134.83, 134.04, 133.99, 133.94, 133.74, 133.68, 133.49, 133.42, 128.66, 128.36, 128.30, 128.17, 128.11, 127.95, 127.73, 127.42, 126.92, 96.32, 96.22, 74.94, 74.70, 74.61, 71.57, 69.26, 7.77, 7.66, 4.53, 4.46. (The complicate C-P splittings were observed from 134.04 ppm to 126.92 ppm). **^{31}P NMR (162 MHz, $CDCl_3$)** δ -15.64. **HRMS (ESI)** calcd for C38H37FePSi $[M]^+$ 608.1746, found 608.1750. **$[\alpha]_D^{25}$** = 42.0 (c = 0.12, $CHCl_3$).



A flame-dried Schlenk tube containing a stirbar was charged with Pd(OAc)$_2$ (112.5 mg, 0.5 mmol, 0.1equiv), P^{t}Bu$_3$ (202 mg, 1 mmol, 0.2 equiv), NaOH (0.6 g, 15 mmol, 3 equiv) and **4a** (1.86 g, 5 mmol, 1 equiv) in glovebox, followed by addition of PhI (3.06 g, 15 mmol, 3 equiv) and THF (25 mL). The reaction tube was capped, removed from the glove box and the reaction mixture was stirred at 100 °C for 24 h. Then, the reaction mixture was cooled to room temperature and then quenched with 1N HCl solution (30 mL), extracted with Et$_2$O (30 mL× 3), washed with brine (30 mL), dried over Na$_2$SO$_4$, filtered and concentrated in vacuum. The crude residue was purified by flash column chromatography on silica gel (Hexane/DCM, 90/10) to deliver the ferrocenyl-phenol **4a-S1′**.

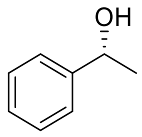
As described in the synthesis of **FcL1**, the ferrocenyl-phenol **4a-S1′** was transformed to the phosphine ligand **FcL2** by 3-steps. Notably, to ensure the ee value of the **FcL2**, **4a-S3′** underwent recrystallization (in CH$_3$OH) before reduction. **FcL2** was obtained in 38% yield over 4 steps as orange solid. R$_f$ = 0.4 (Hexane/DCM = 3:1). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.94 – 7.91 (m, 1H), 7.28– 7.18 (m, 4H), 7.14 – 7.01 (m, 11H), 6.95 – 6.74 (m, 3H), 4.51 (t, *J* = 1.5 Hz, 1H), 4.20 (d, *J* = 2.4 Hz, 1H), 4.17 (s, 1H), 4.09 (s, 5H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 143.09, 142.80, 138.58, 138.52, 138.38, 137.80, 137.77, 137.67, 137.63, 133.72, 133.65, 133.63, 133.55, 133.50, 133.46, 133.43, 128.95, 128.22, 128.15, 128.13, 128.05, 127.99, 127.50, 126.97, 125.63, 89.23 (d, *J* = 9.9 Hz), 87.89 (d, *J* = 2.3 Hz), 72.71 (d, *J* = 8.0 Hz), 70.46, 68.66, 66.54. (The complicate C-P splittings were observed from 143.09 ppm to 89.23 ppm). **^{31}P NMR (162 MHz, CDCl$_3$)** δ -13.58. **HRMS (ESI)** calcd for C34H27FeP [M]$^+$ 522.1194, found 522.1186. **$[\alpha]_D^{25}$** = 159.0 (c = 0.18, CHCl$_3$).

4.2 Applications of chiral ligands FcL1 and FcL2

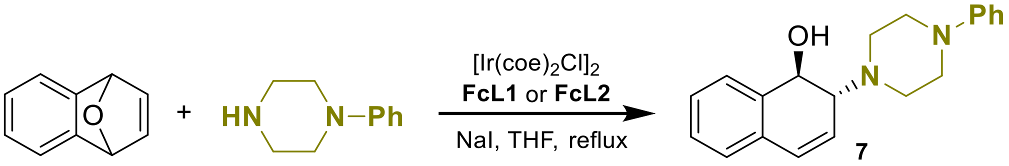


L	FcL1	FcL2
yield	90%	92%
ee	34%	66%

Following the literature's procedure,[10] a flame-dried Schlenk tube containing a stirbar was charged with allylpalladium chloride dimer (1.5 mg, 0.00625 mmol, 0.125 mol %), the chiral ligand **FcL1** or **FcL2** (0.025 mmol, 0.5 mol %) and styrene (520 mg, 5 mmol, 1 equiv) in glovebox. The resulting mixture was stirred in the glovebox at room temperature for 1 hour, followed by the dropwise addition of the trichlorosilane (1.6 mL, 10 mmol, 2 equiv) at 0 °C. After addition, the reaction mixture was allowed to warm to room temperature and the tube was capped, removed from the glove box. The reaction mixture was stirred at room temperature (17 °C) for 24 h and then was subjected to bulb-to-bulb distillation, giving 1-(trichlorosilyl)-1-phenylethane **6** as colorless oil. To determine the ee value of product **6**, the Fleming-Tamao oxidation was carried out: To a mixture of the hydrosilylation product **6** (177 mg, 0.741 mmol, 1 equiv), KF (258 mg, 4.446 mmol, 6 equiv), $KHCO_3$ (445 mg, 4.446 mmol, 6 equiv) in THF (15 mL) and MeOH (15 mL) was added H_2O_2 (0.89 mL, 30%) at room temperature. The mixture was stirred at room temperature for 17 h. To the mixture was added sat. $Na_2S_2O_3$ aq. Organic materials were extracted with ether, washed with water and brine, and dried over Na_2SO_4. After evaporation of the solvent, the residue was subjected to bulb-to-bulb distillation, giving enantioenriched 1-arylethanol. The enantiomeric excesses of the alcohol was determined by HPLC on a chiral stationary phase. The absolute configurations were assigned on the basis of the optical rotation.



R_f = 0.4 (Hexane/ Ethyl acetate = 9:1).**^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.42 – 7.32 (m, 4H), 7.30 – 7.24 (m, 1H), 4.90 (q, J = 6.4 Hz, 1H), 1.50 (d, J = 6.4 Hz, 3H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 145.78, 128.49, 127.46, 125.36, 70.41, 25.13. **HPLC analysis** (OD-3): Hexane/Isopropanol = 90:10, 1 mL/min, 254 nm UV detector, 34% ee obtained by employment of **FcL1** as the ligand and 66% ee obtained by use of **FcL2** as the ligand, t_R = 5.7 min (major) and t_R = 6.4 min (minor). **$[\alpha]_D^{25}$** = 22.6 (c = 0.34, DCM, 66% ee).



7

FcL1: 45% yield, 67% ee

FcL2: 57% yield, 70% ee

Following a modified literature's procedure,[11] a flame-dried Schlenk tube containing a stirbar was charged with [Ir(coe)$_2$Cl]$_2$ (3.8 mg, 0.004 mmol, 2 mol%), the chiral ligand **FcL1** or **FcL2** (0.01 mmol, 5 mol%) and THF (0.6 mL) in glovebox. After 1 h stirring at room temperature, oxabenzonorbornadiene (28.8 mg, 0.2 mmol, 1 equiv), 1-phenylpiperazine (97.3 mg, 0.6 mmol, 3 equiv), NaI (6 mg, 0.04 mmol, 0.2 equiv) and THF (0.6 mL) was added to the Schlenk tube and the reaction mixture was allowed to stirred at reflux for 18 h. After the reaction was finished, the crude residue was purified by flash column chromatography on silica gel to afford the product **7** in 45% yield for **FcL1** and in 57% yield for **FcL2** as white solid. R_f = 0.3 (Hexane/ Ethyl acetate = 7:3). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.59 (d, *J* = 7.2 Hz, 1H), 7.30 – 7.22 (m, 5H), 7.09 (d, *J* = 7.1 Hz, 1H), 6.95 (d, *J* = 8.2 Hz, 2H), 6.88 (t, *J* = 7.3 Hz, 1H), 6.56 (dd, *J* = 9.9, 2.6 Hz, 1H), 6.14 (dd, *J* = 10.0, 2.5 Hz, 1H), 4.93 (d, *J* = 11.7 Hz, 1H), 3.53 (dt, *J* = 11.8, 2.7 Hz, 1H), 3.33 – 3.19 (m, 4H), 3.02 – 2.97 (m, 2H), 2.76 – 2.70 (m, 2H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 151.16, 136.89, 131.66, 129.63, 129.14, 127.97, 127.51, 126.26, 124.84, 124.57, 123.96, 120.03, 116.29, 67.66, 67.60, 49.71, 48.97. **HPLC analysis** (OD-3): Hexane/Isopropanol = 90:10, 1 mL/min, 254 nm UV detector, 67% ee for **FcL1** and 70% ee for **FcL2**, t_R = 11.6 min (major) and t_R = 13.5 min (minor). **$[\alpha]_D^{25}$** = -49.5 (c = 0.13, CHCl$_3$, 70% ee).

5. References

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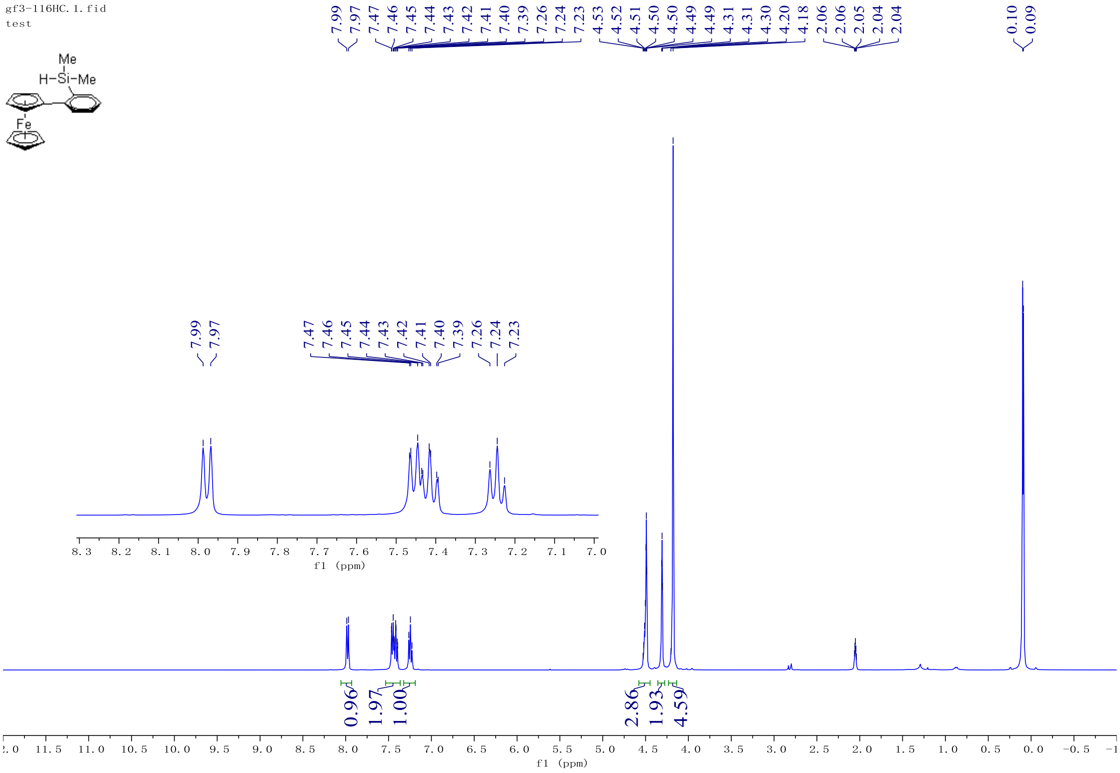
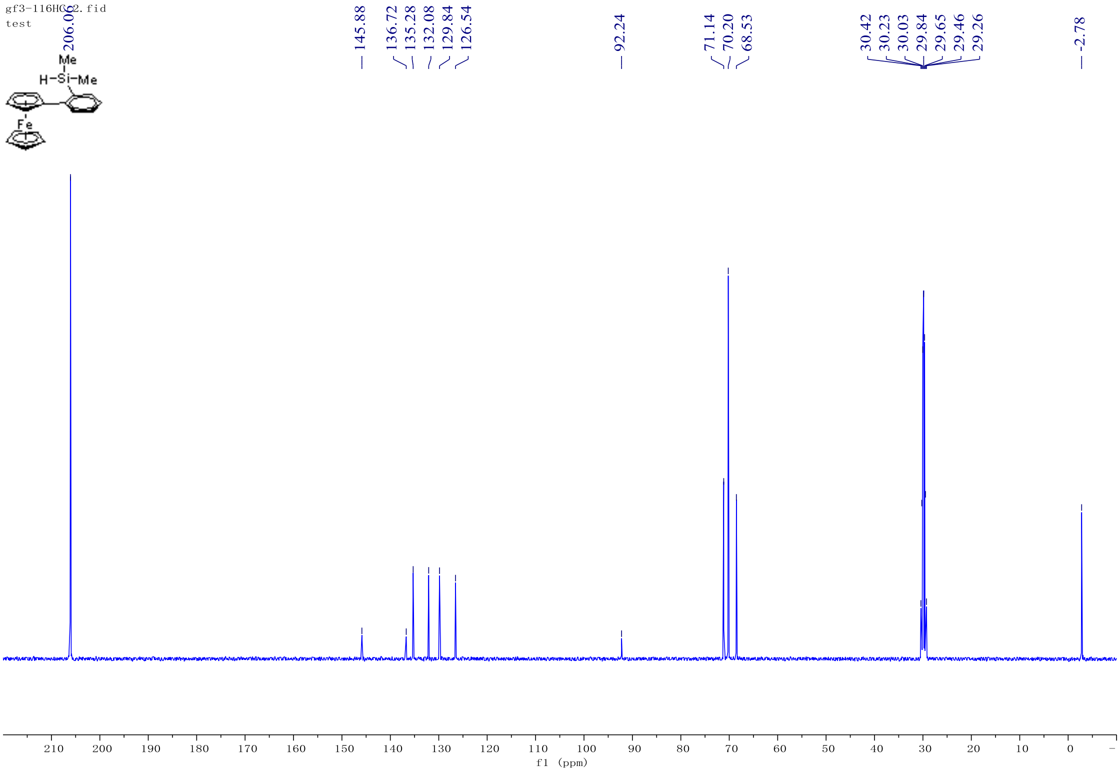
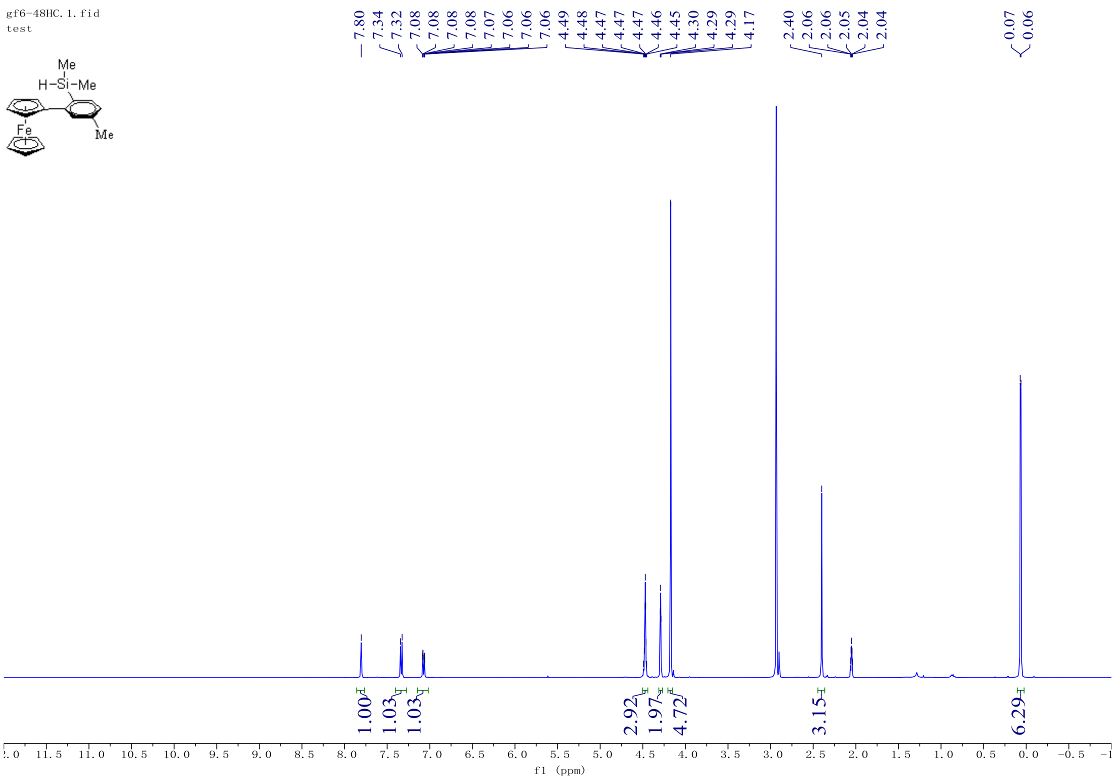
6. NMR Spectra

Compound 1a





Compound 1b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7.07
7.06
7.06
7.06
4.49
4.48
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4.46
4.45
4.30
4.29
4.29
4.17
2.40
2.06
2.06
2.05
2.04
2.04
0.07
0.06
1.00
1.03
1.03
2.92
1.97
4.72
3.15
6.29
12.0
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6.0
5.5
5.0
4.5
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0.0
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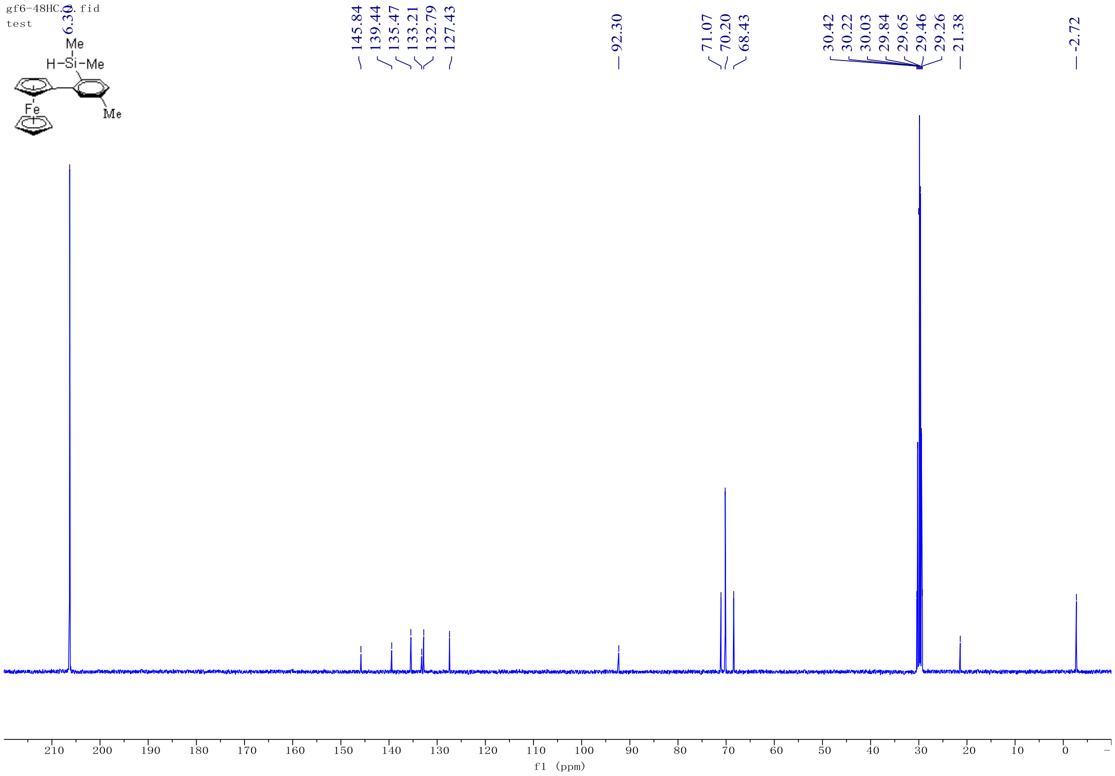
−1
f1 (ppm)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68.43
30.42
30.22
30.03
29.84
29.65
29.46
29.26
21.38
-2.72
210
200
190
180
170
160
150
140
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110
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90
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70
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50
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30
20
10
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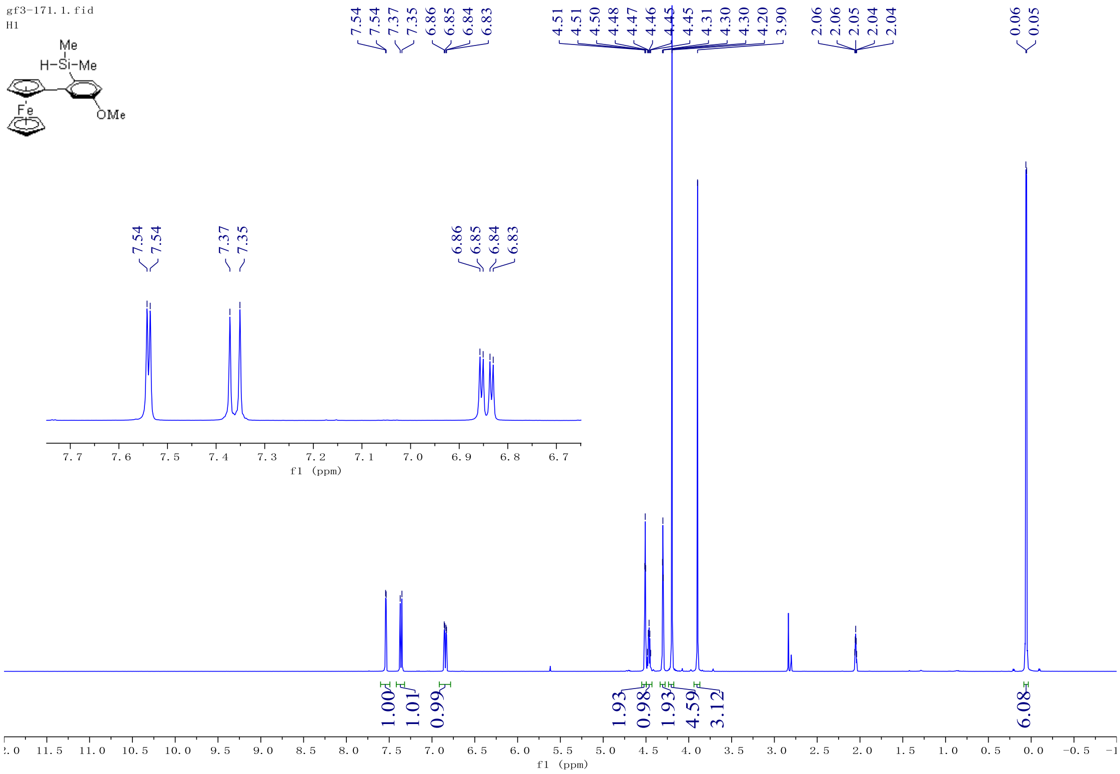
f1 (ppm)

Compound 1c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4.20
3.90
2.06
2.06
2.05
2.04
2.04
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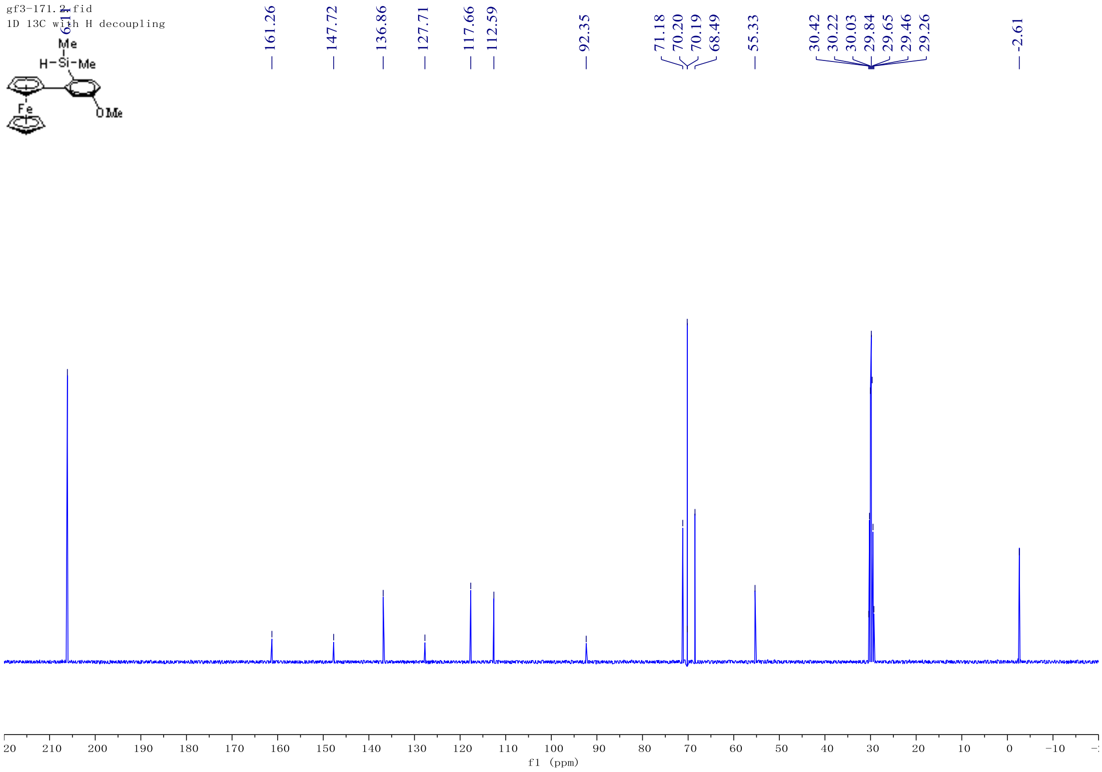
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30.03
29.84
29.65
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29.26
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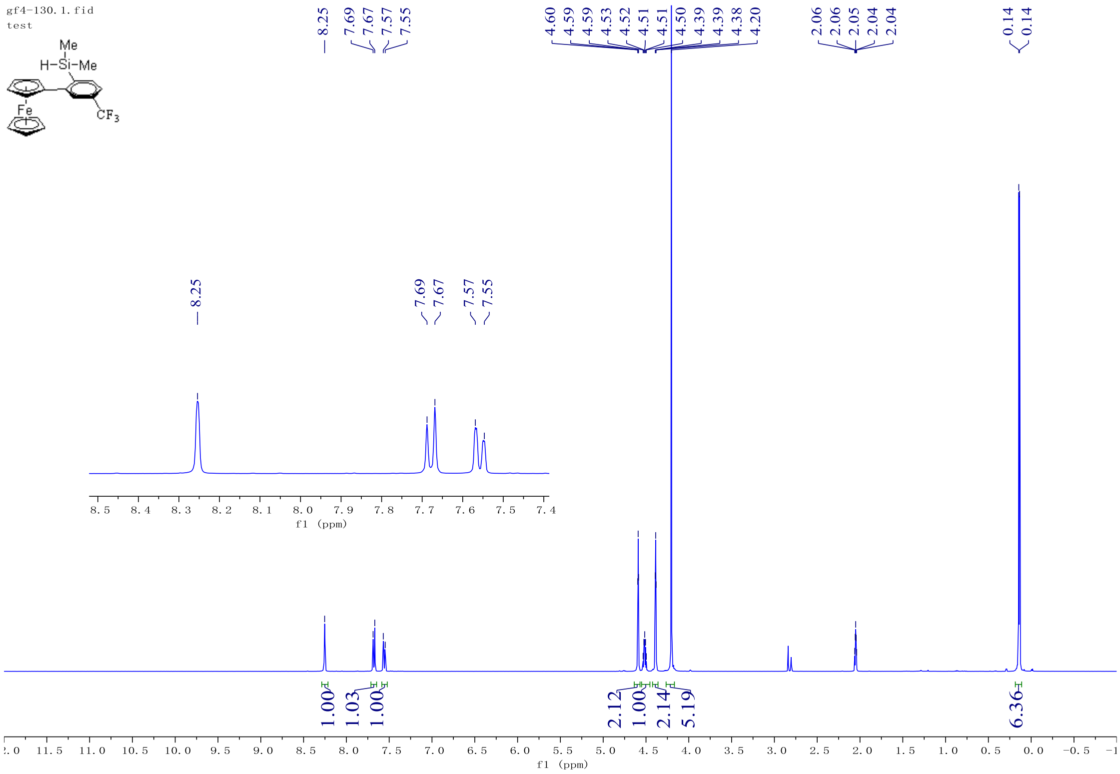
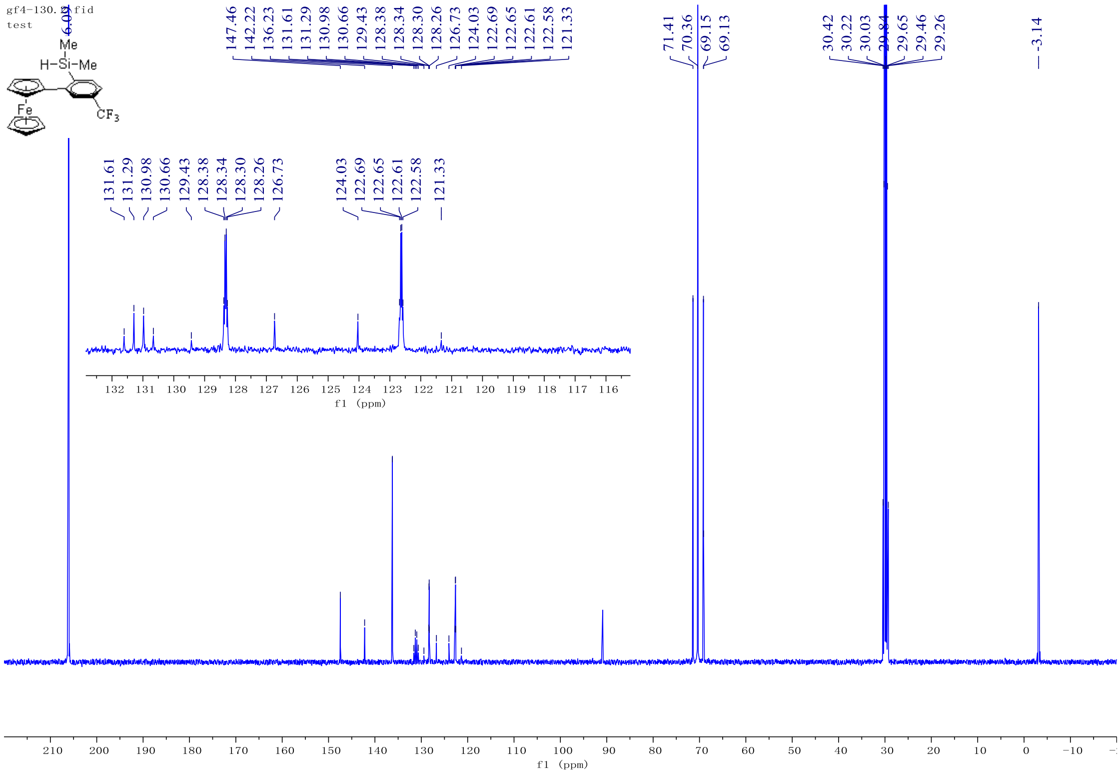
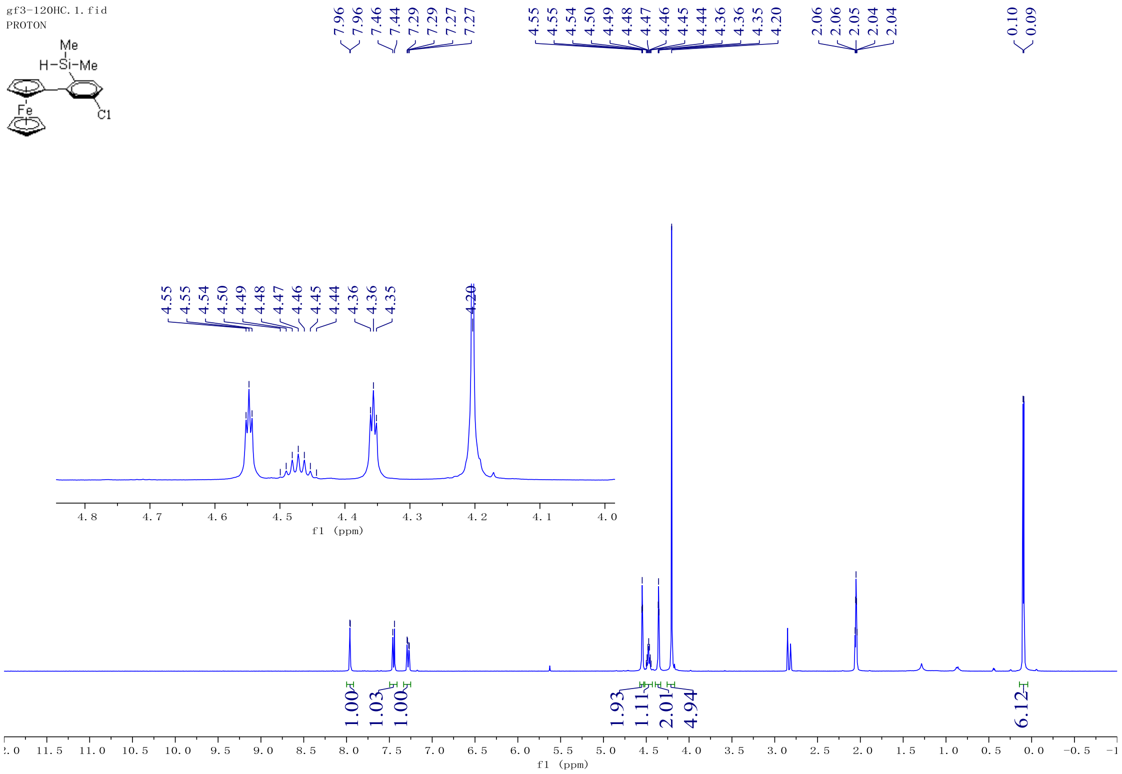
f1 (ppm)

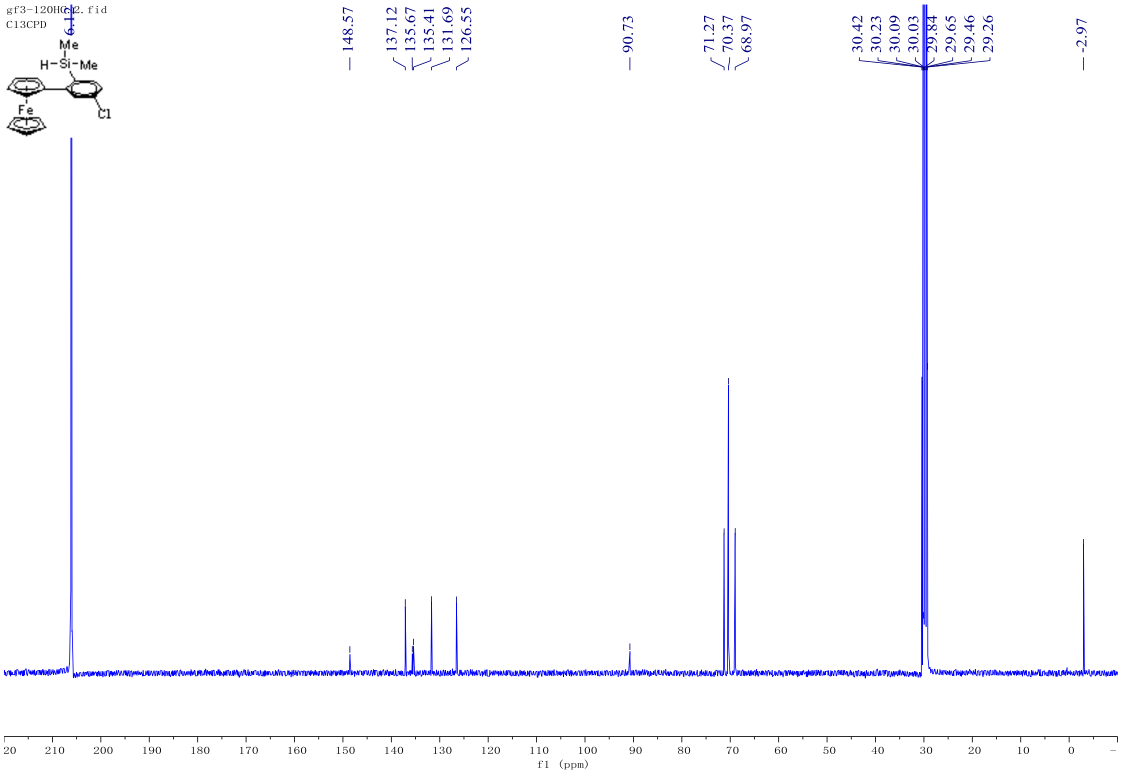
Compound 1d


gf4-130.1.fid
test
Me
H-Si-Me
Fe
CF3
8.25
7.69
7.67
7.57
7.55
4.60
4.59
4.59
4.53
4.52
4.51
4.51
4.50
4.39
4.39
4.38
4.20
2.06
2.06
2.05
2.04
2.04
0.14
0.14
8.5 8.4 8.3 8.2 8.1 8.0 7.9 7.8 7.7 7.6 7.5 7.4
f1 (ppm)
1.00
1.03
1.00
2.12
1.00
2.14
5.19
6.36
12.0 11.5 11.0 10.5 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 -1
f1 (ppm)

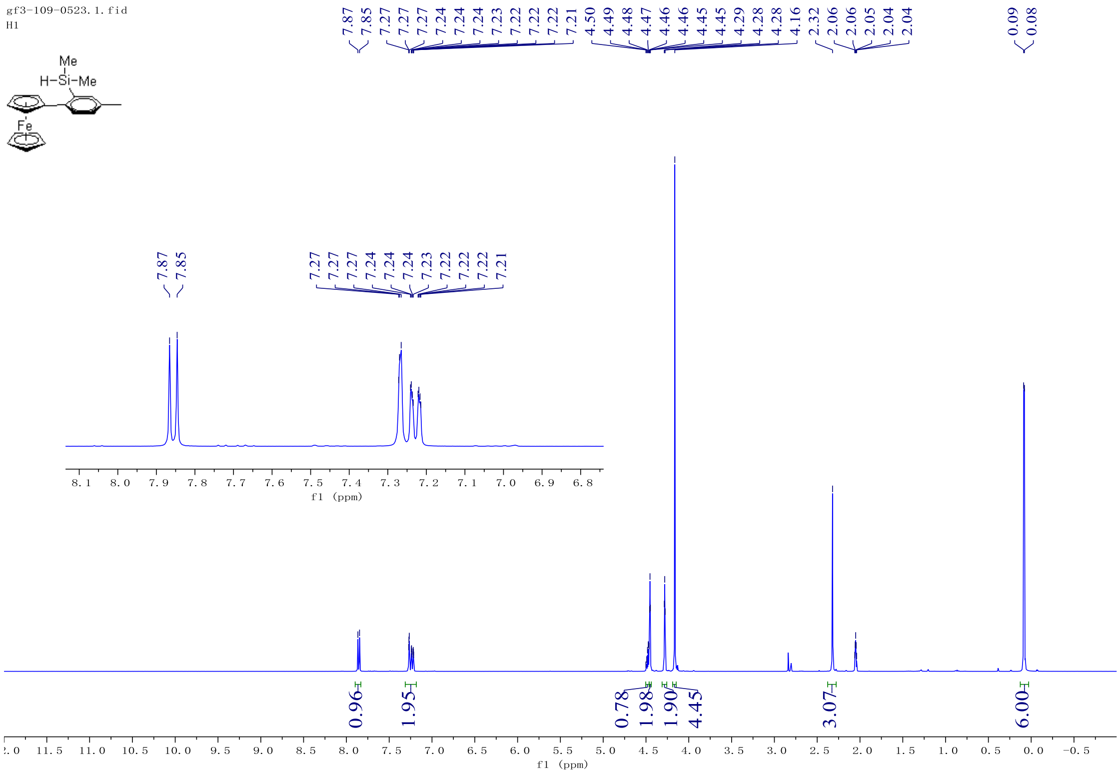

gf4-130.2.fid
test
206.03
Me
H-Si-Me
Fe
CF3
147.46
142.22
136.23
131.61
131.29
130.98
130.66
129.43
128.38
128.34
128.30
128.26
126.73
124.03
122.69
122.65
122.61
122.58
121.33
71.41
70.36
69.15
69.13
30.42
30.22
30.03
29.84
29.65
29.46
29.26
-3.14
131.61
131.29
130.98
130.66
129.43
128.38
128.34
128.30
128.26
126.73
124.03
122.69
122.65
122.61
122.58
121.33
132 131 130 129 128 127 126 125 124 123 122 121 120 119 118 117 116
f1 (ppm)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

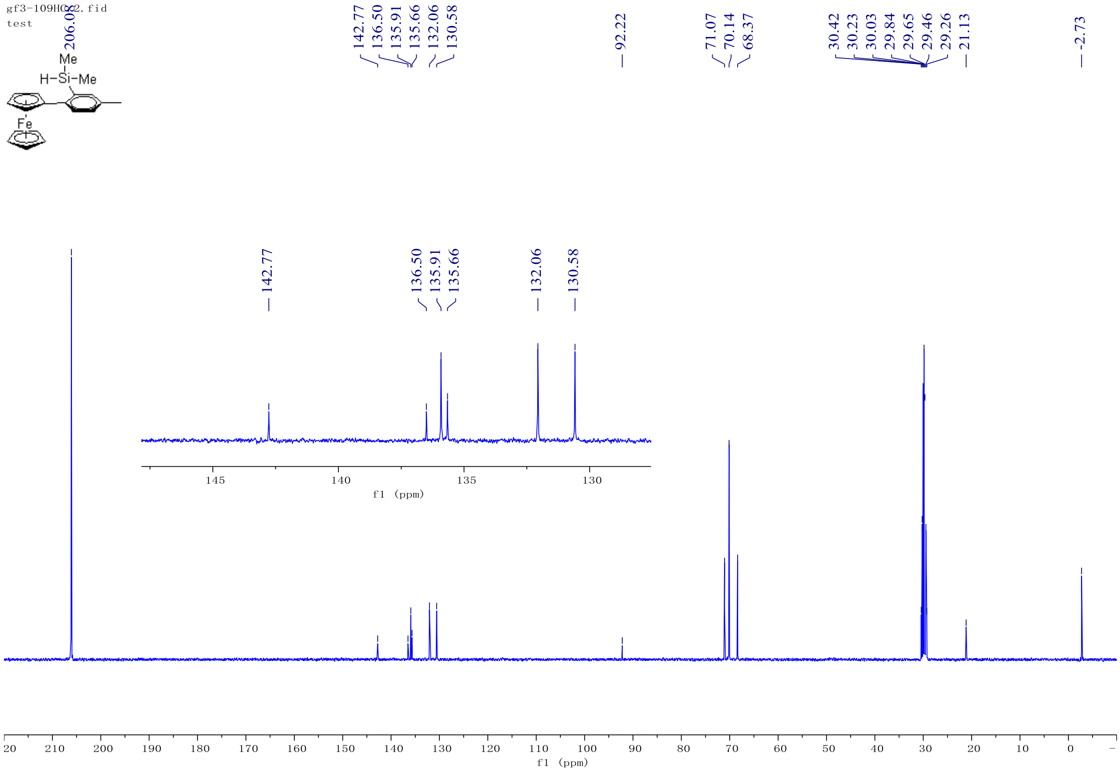
Compound 1e


gf3-120HC.1.fid
PROTON
Me
H−Si−Me
Fe
Cl
7.96 7.96 7.46 7.44 7.29 7.29 7.27 7.27
4.55 4.55 4.54 4.50 4.49 4.48 4.47 4.46 4.45 4.44 4.36 4.36 4.35 4.20
2.06 2.06 2.05 2.04 2.04
0.10 0.09
1.00 1.03 1.00 1.93 1.11 2.01 4.94 6.12
f1 (ppm)

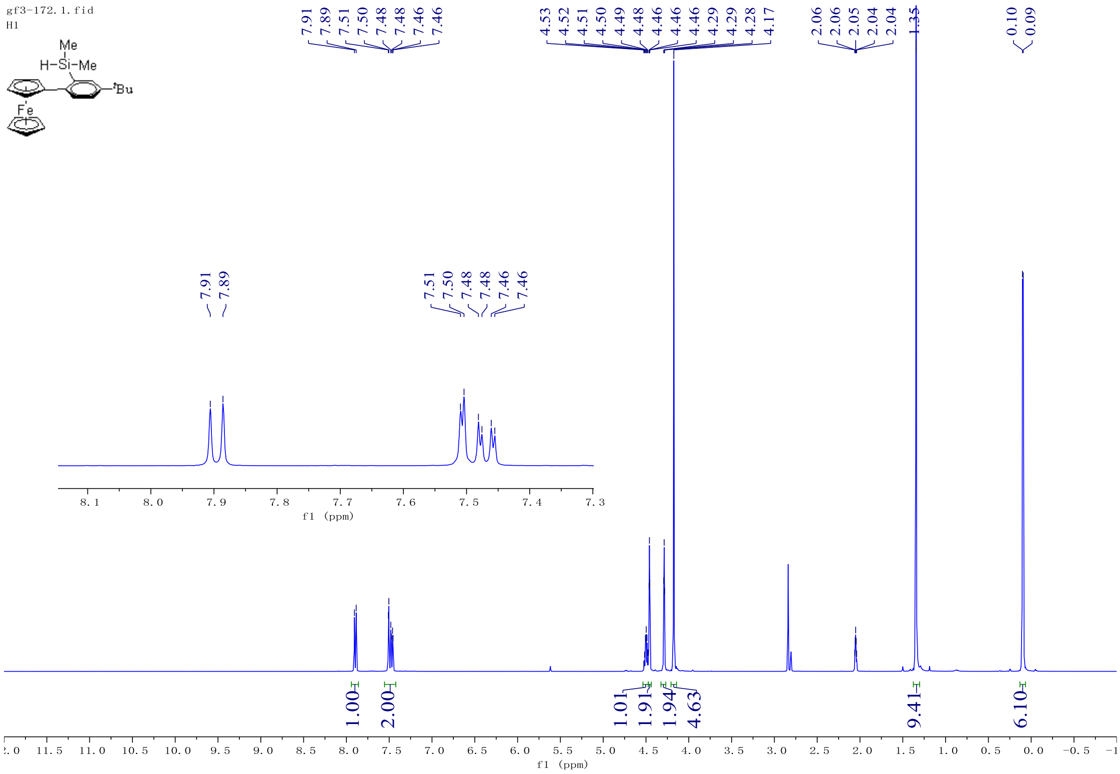

gf3-120HC.2.fid
C13CPD
Me
H−Si−Me
Fe
Cl
148.57
137.12 135.67 135.41 131.69 126.55
90.73
71.27 70.37 68.97
30.42 30.23 30.09 30.03 29.84 29.65 29.46 29.26
-2.97
f1 (ppm)

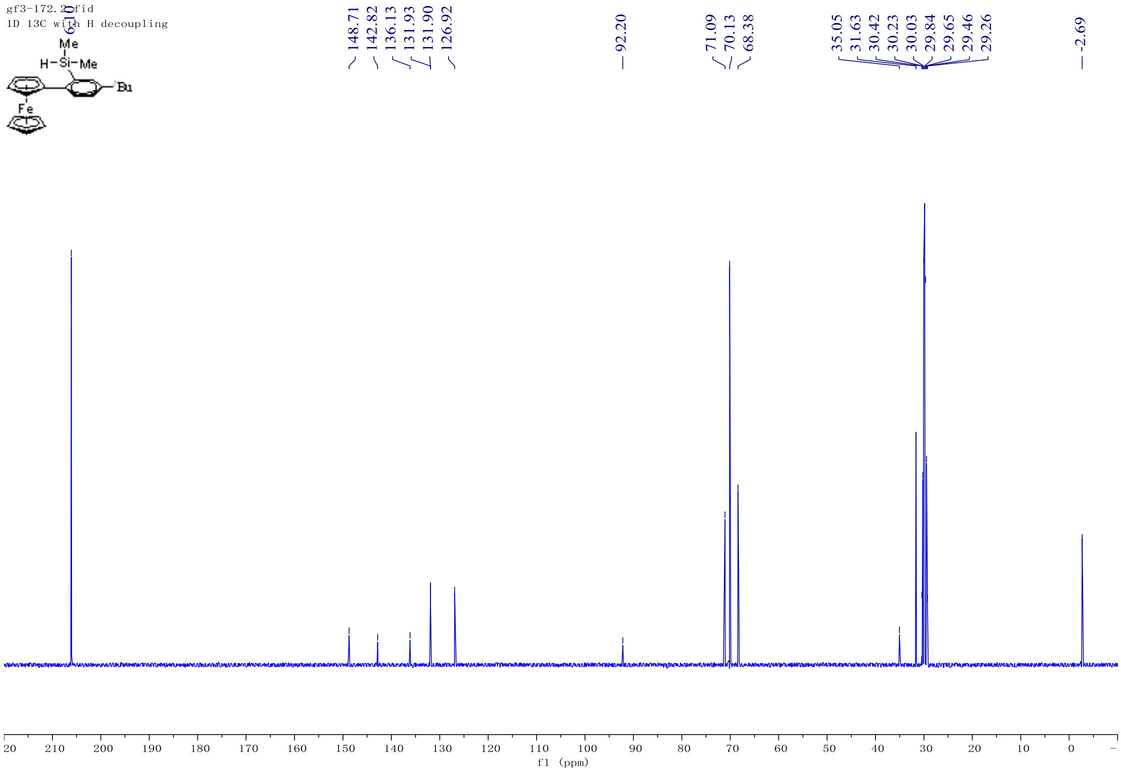
Compound 1f


gf3-109-0523.1.fid
H1
Me
H-Si-Me
Fe
7.87
7.85
7.27
7.27
7.27
7.24
7.24
7.24
7.23
7.22
7.22
7.22
7.21
4.50
4.49
4.48
4.47
4.46
4.46
4.45
4.45
4.29
4.28
4.28
4.16
2.32
2.06
2.06
2.05
2.04
2.04
0.09
0.08
0.96
1.95
0.78
1.98
1.90
4.45
3.07
6.00
f1 (ppm)

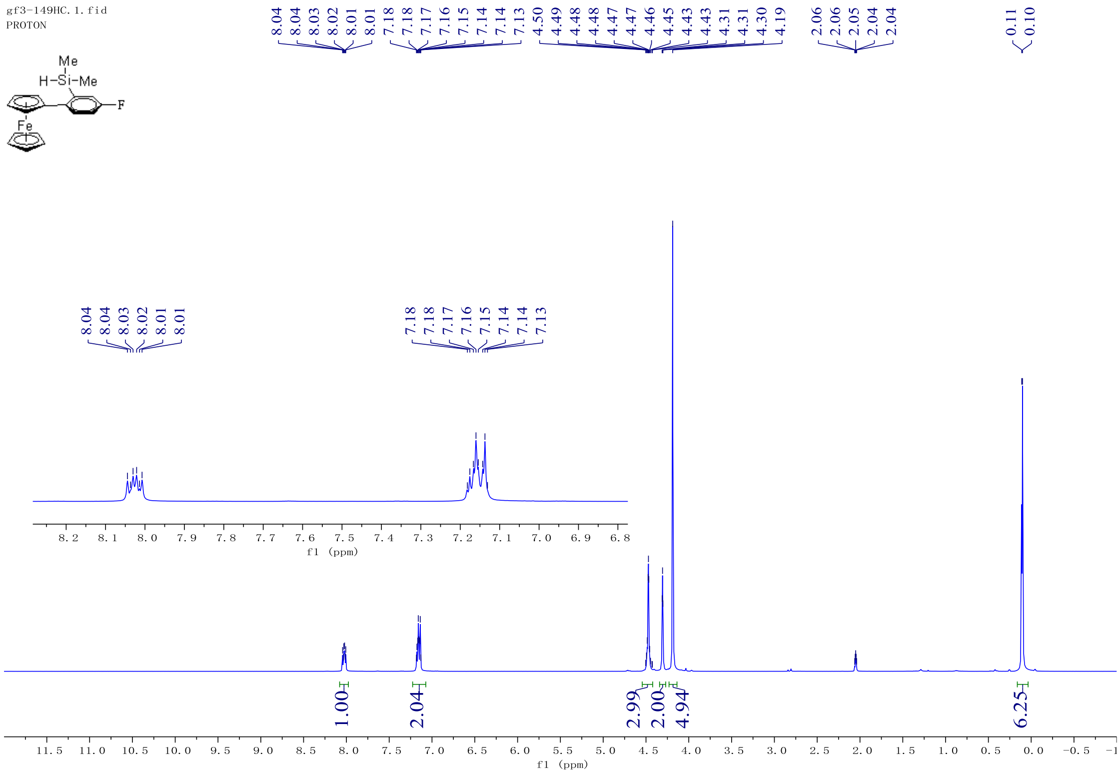

gf3-109HC2.fid
test
Me
H-Si-Me
Fe
206.08
142.77
136.50
135.91
135.66
132.06
130.58
92.22
71.07
70.14
68.37
30.42
30.23
30.03
29.84
29.65
29.46
29.26
21.13
-2.73
f1 (ppm)

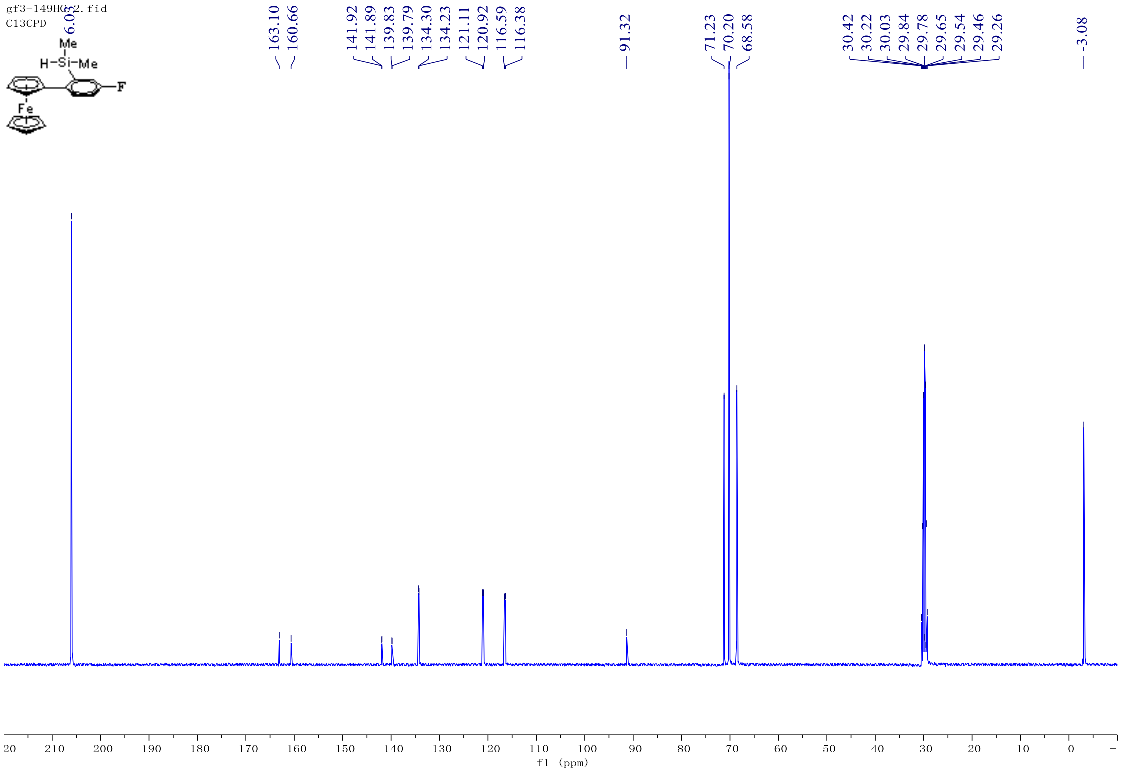
Compound 1g


gf3-172.1.fid
H1
Me
H-Si-Me
tBu
Fe
7.91
7.89
7.51
7.50
7.48
7.48
7.46
7.46
4.53
4.52
4.51
4.50
4.49
4.48
4.46
4.46
4.46
4.29
4.29
4.28
4.17
2.06
2.06
2.05
2.04
2.04
1.35
0.10
0.09
7.91
7.89
7.51
7.50
7.48
7.48
7.46
7.46
8.1
8.0
7.9
7.8
7.7
7.6
7.5
7.4
7.3
f1 (ppm)
1.00
2.00
1.01
1.91
1.94
4.63
9.41
6.10
12.0
11.5
11.0
10.5
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
-1
f1 (ppm)

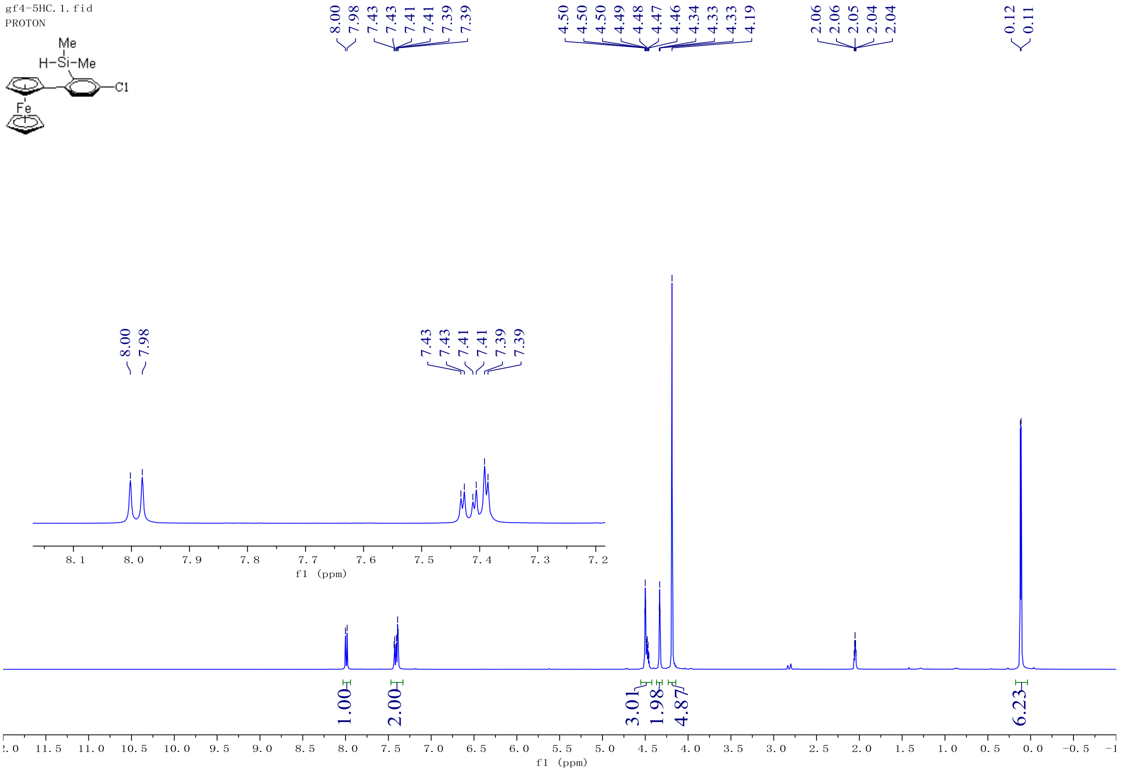

gf3-172.2.fid
1D 13C with H decoupling
6.10
Me
H-Si-Me
tBu
Fe
148.71
142.82
136.13
131.93
131.90
126.92
92.20
71.09
70.13
68.38
35.05
31.63
30.42
30.23
30.03
29.84
29.65
29.46
29.26
-2.69
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

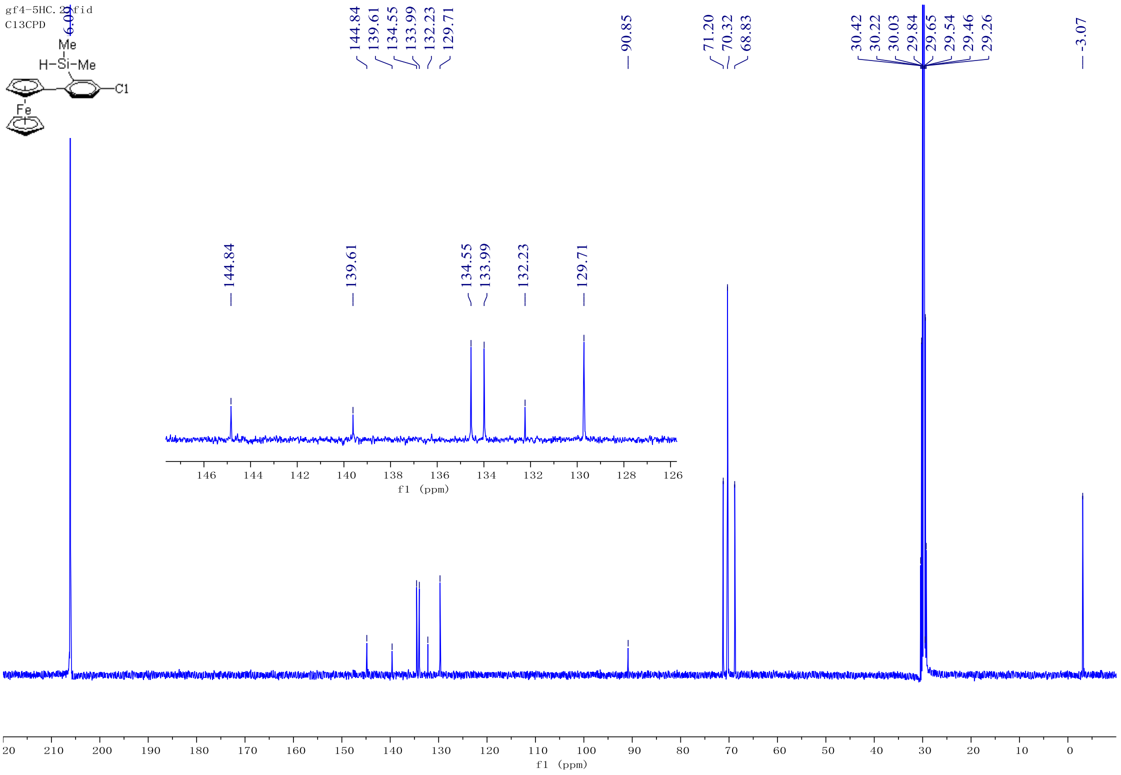
Compound 1h


gf3-149HC.1.fid
PROTON
Me
H-Si-Me
F
Fe
8.04 8.04 8.03 8.02 8.01 8.01 7.18 7.18 7.17 7.16 7.15 7.14 7.14 7.13 4.50 4.49 4.48 4.48 4.47 4.47 4.46 4.45 4.43 4.43 4.31 4.31 4.30 4.19 2.06 2.06 2.05 2.04 2.04 0.11 0.10
8.04 8.04 8.03 8.02 8.01 8.01
7.18 7.18 7.17 7.16 7.15 7.14 7.14 7.13
8.2 8.1 8.0 7.9 7.8 7.7 7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8
f1 (ppm)
1.00
2.04
2.99
2.00
4.94
6.25
11.5 11.0 10.5 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 -1
f1 (ppm)

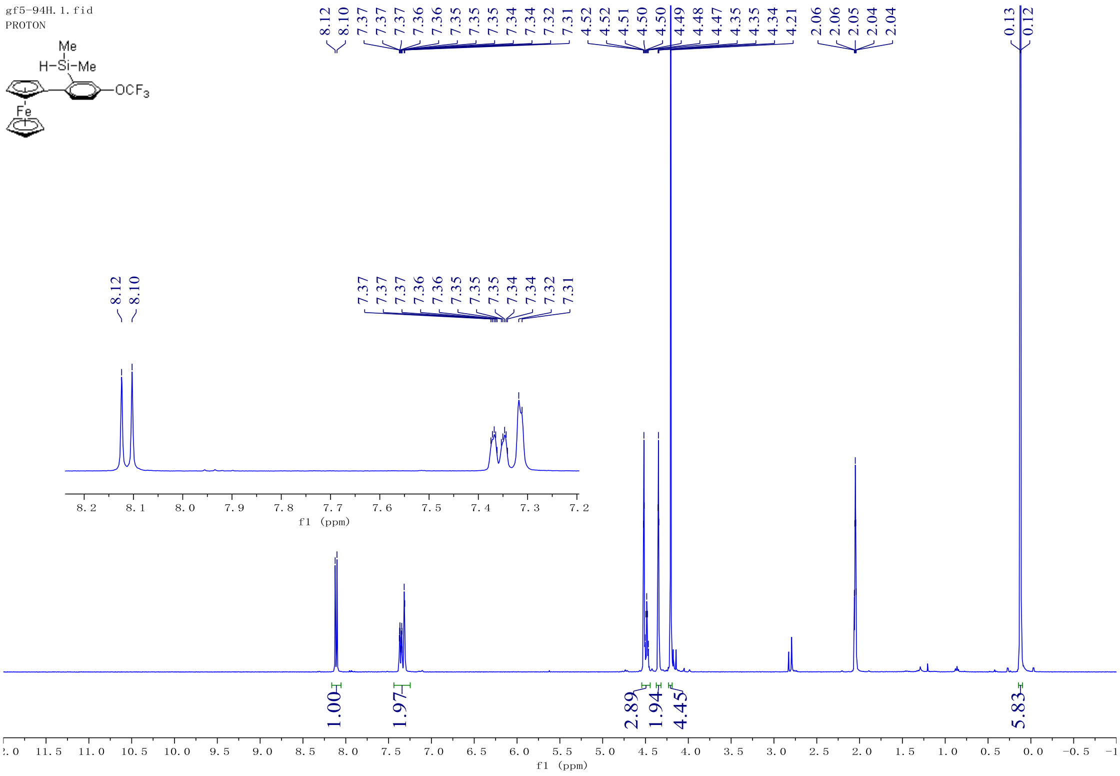

gf3-149HC.2.fid
C13CPD
6.03
Me
H-Si-Me
F
Fe
163.10 160.66 141.92 141.89 139.83 139.79 134.30 134.23 121.11 120.92 116.59 116.38 91.32 71.23 70.20 68.58 30.42 30.22 30.03 29.84 29.78 29.65 29.54 29.46 29.26 -3.08
20 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

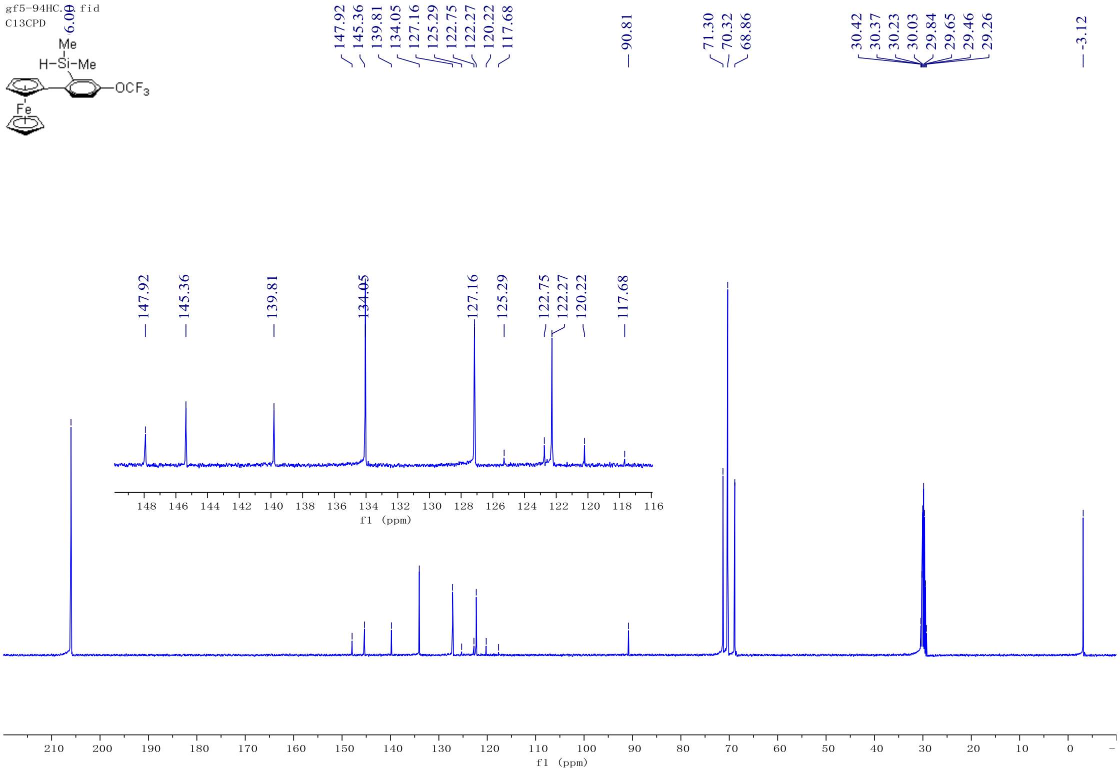
Compound 1i


gf4-5HC.1.fid
PROTON
Me
H-Si-Me
Cl
Fe
8.00
7.98
7.43
7.43
7.41
7.41
7.39
7.39
4.50
4.50
4.50
4.49
4.48
4.47
4.46
4.34
4.33
4.33
4.19
2.06
2.06
2.05
2.04
2.04
0.12
0.11
1.00
2.00
3.01
1.98
4.87
6.23
f1 (ppm)

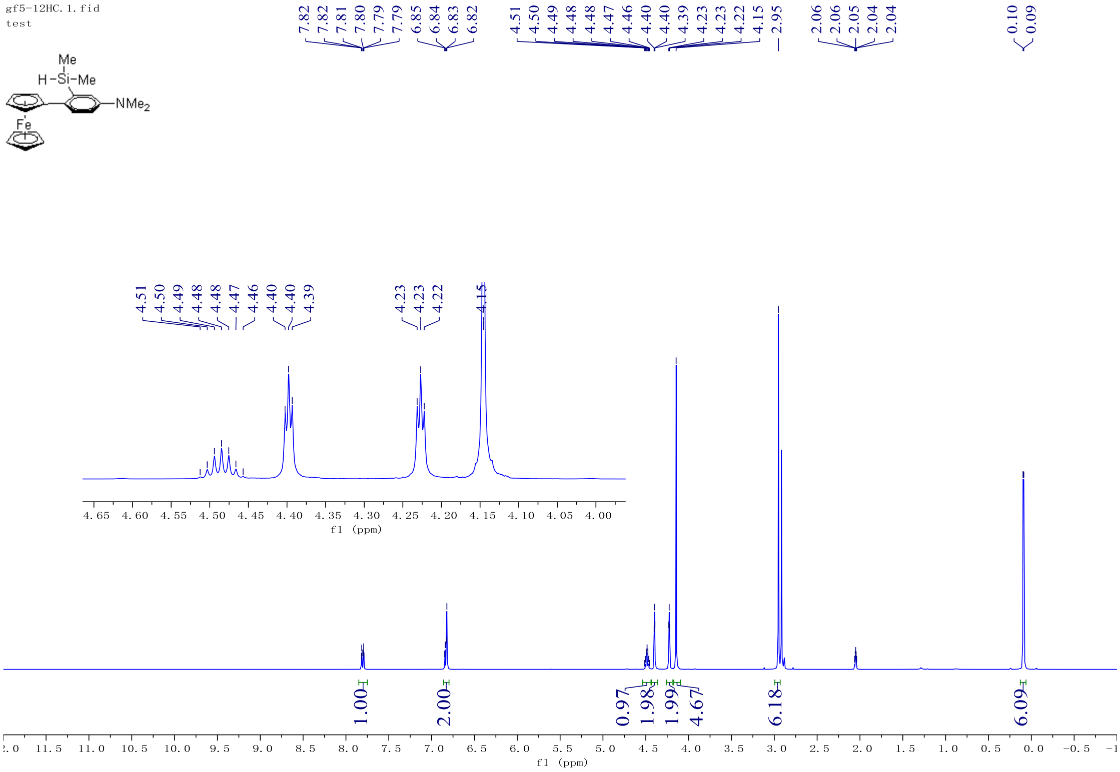

gf4-5HC.2.fid
C13CPD
Me
H-Si-Me
Cl
Fe
6.01
144.84
139.61
134.55
133.99
132.23
129.71
90.85
71.20
70.32
68.83
30.42
30.22
30.03
29.84
29.65
29.54
29.46
29.26
-3.07
f1 (ppm)

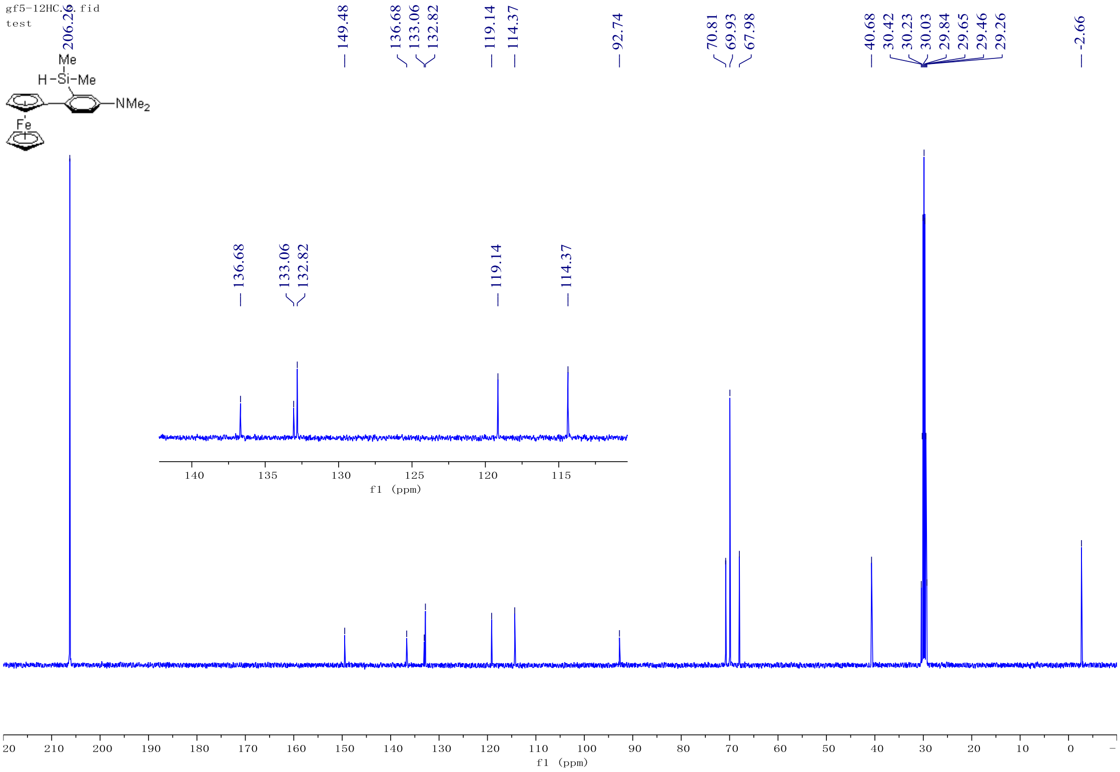
Compound 1j


gf5-94H.1.fid
PROTON
Me
H-Si-Me
OCF3
Fe
8.12
8.10
7.37
7.37
7.37
7.36
7.36
7.35
7.35
7.35
7.34
7.34
7.32
7.31
4.52
4.52
4.51
4.50
4.50
4.49
4.48
4.47
4.35
4.35
4.34
4.21
2.06
2.06
2.05
2.04
2.04
0.13
0.12
1.00
1.97
2.89
1.94
4.45
5.83
f1 (ppm)

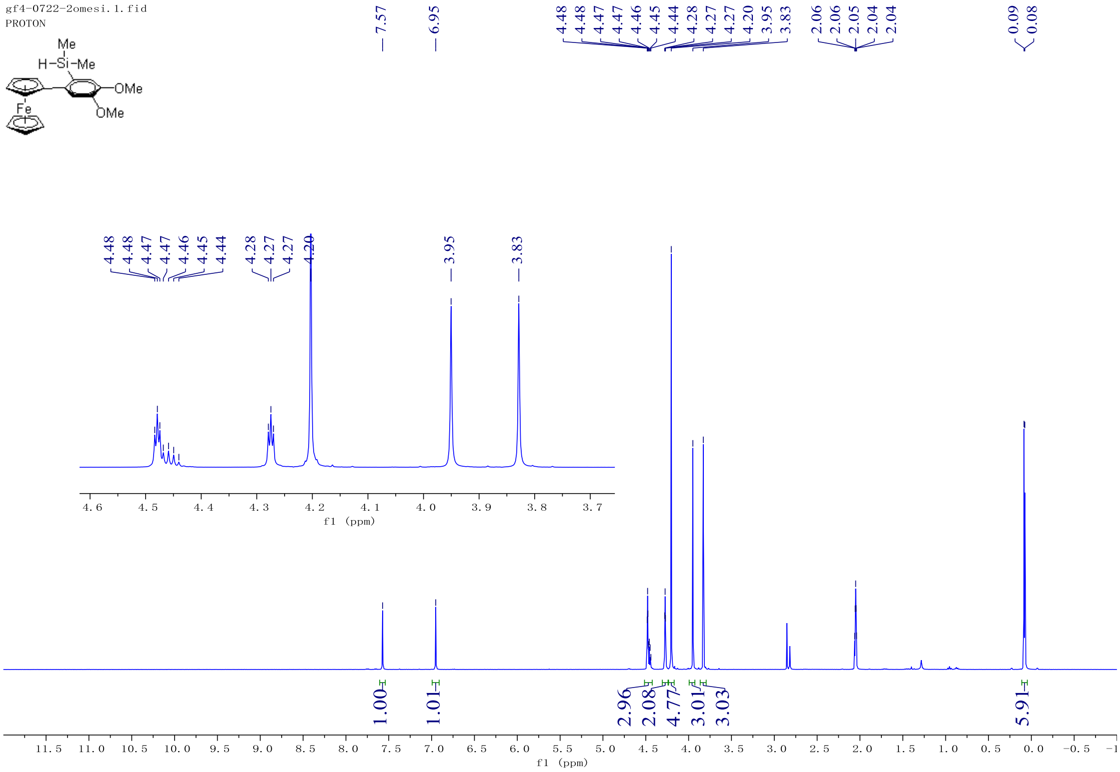

gf5-94HC.9.fid
C13CPD
6.09
Me
H-Si-Me
OCF3
Fe
147.92
145.36
139.81
134.05
127.16
125.29
122.75
122.27
120.22
117.68
90.81
71.30
70.32
68.86
30.42
30.37
30.23
30.03
29.84
29.65
29.46
29.26
-3.12
f1 (ppm)

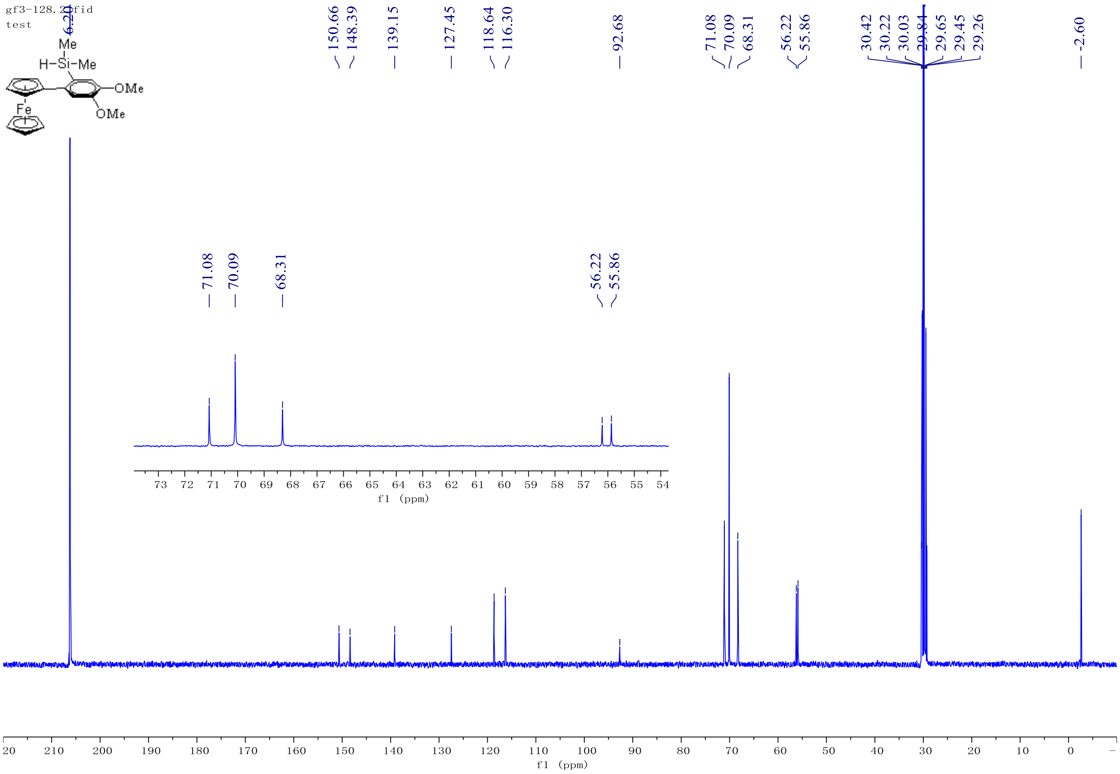
Compound 1k


gf5-12HC.1.fid
test
Me
H-Si-Me
NMe2
Fe
7.82
7.82
7.81
7.80
7.79
7.79
6.85
6.84
6.83
6.82
4.51
4.50
4.49
4.48
4.48
4.47
4.46
4.40
4.40
4.39
4.23
4.23
4.22
4.15
2.95
2.06
2.06
2.05
2.04
2.04
0.10
0.09
1.00
2.00
0.97
1.98
1.99
4.67
6.18
6.09
f1 (ppm)

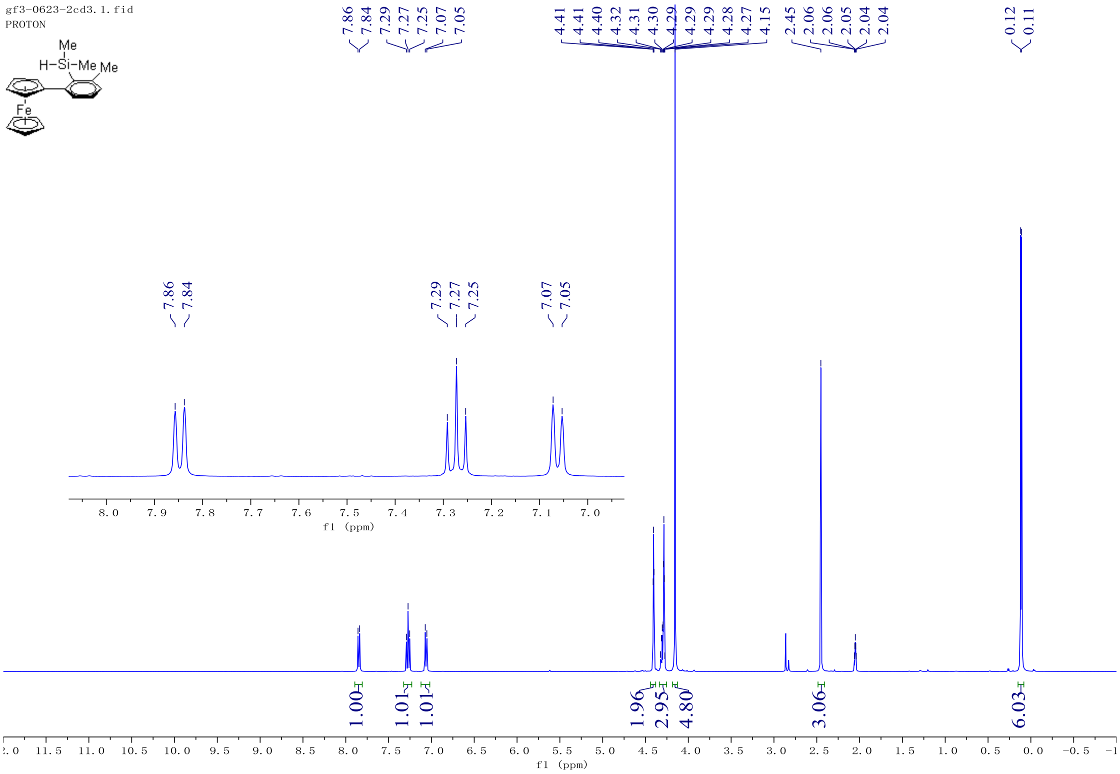

test
206.26
Me
H-Si-Me
NMe2
Fe
149.48
136.68
133.06
132.82
119.14
114.37
92.74
70.81
69.93
67.98
40.68
30.42
30.23
30.03
29.84
29.65
29.46
29.26
-2.66
f1 (ppm)

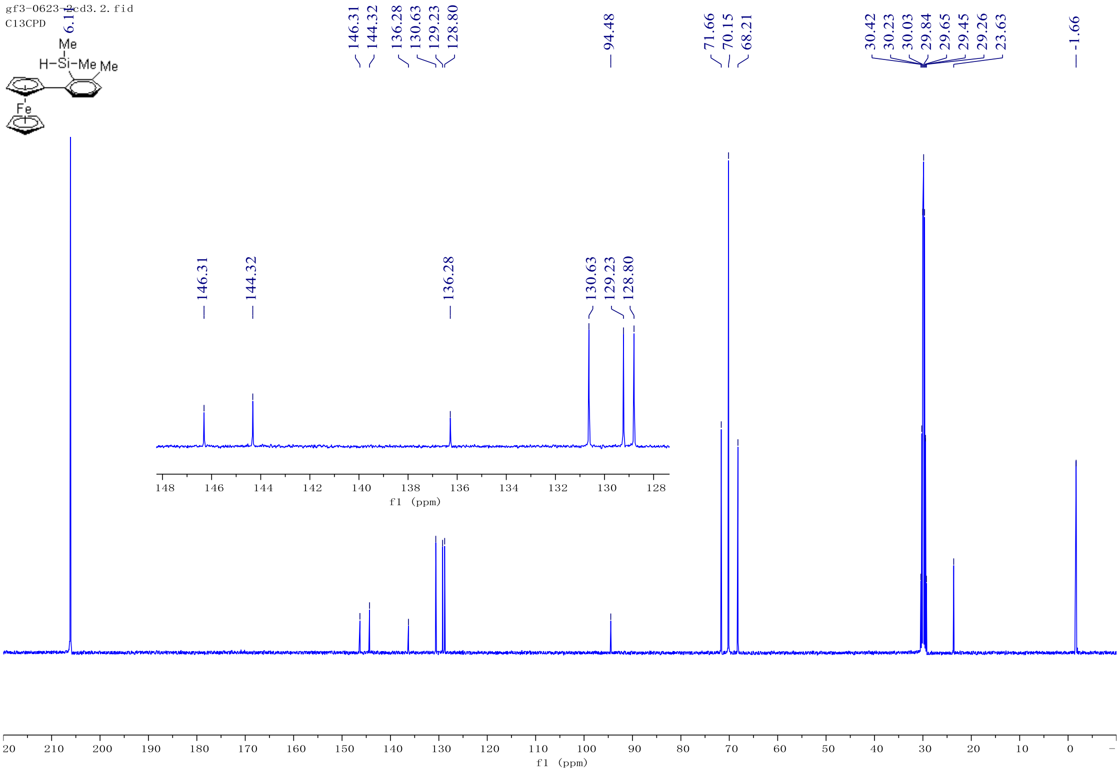
Compound 1l


gf4-0722-2omesi.1.fid
PROTON
Me
H–Si–Me
OMe
Fe
OMe
7.57
6.95
4.48
4.48
4.47
4.47
4.46
4.45
4.44
4.28
4.27
4.27
4.20
3.95
3.83
2.06
2.06
2.05
2.04
2.04
0.09
0.08
1.00
1.01
2.96
2.08
4.77
3.01
3.03
5.91
4.6 4.5 4.4 4.3 4.2 4.1 4.0 3.9 3.8 3.7
f1 (ppm)
11.5 11.0 10.5 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 -1
f1 (ppm)

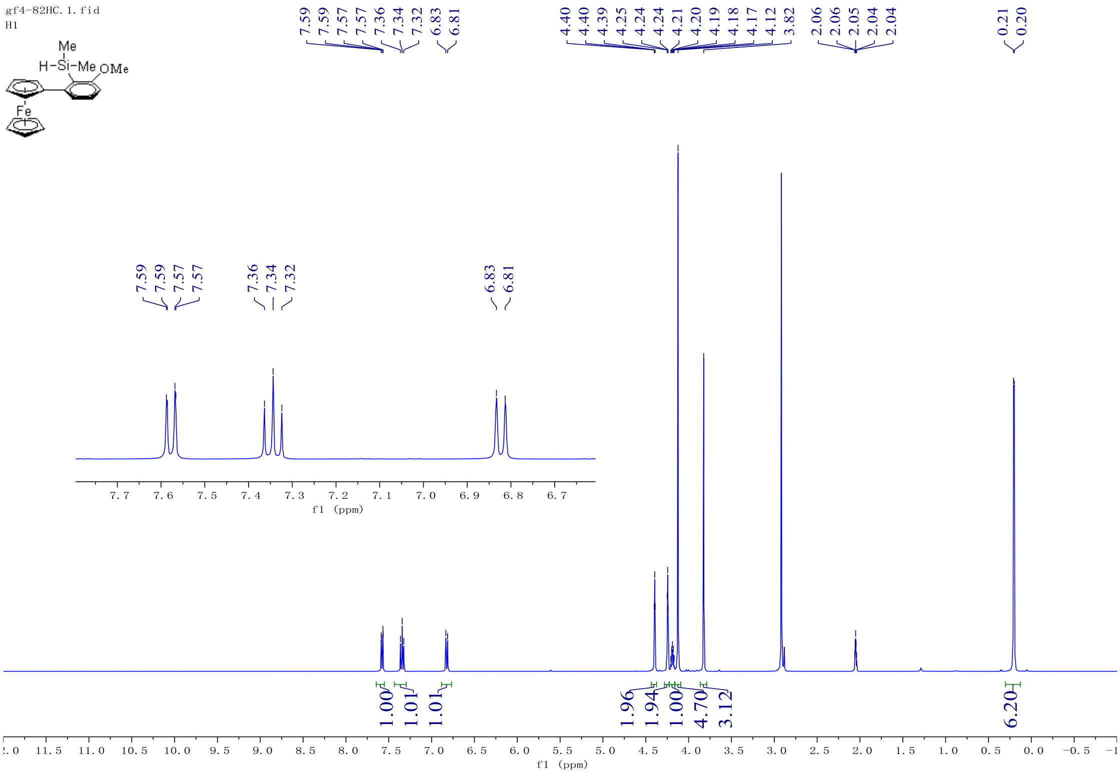

gf3-128.2 fid
test
6.20
Me
H–Si–Me
OMe
Fe
OMe
150.66
148.39
139.15
127.45
118.64
116.30
92.68
71.08
70.09
68.31
56.22
55.86
30.42
30.22
30.03
29.84
29.65
29.45
29.26
-2.60
73 72 71 70 69 68 67 66 65 64 63 62 61 60 59 58 57 56 55 54
f1 (ppm)
20 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

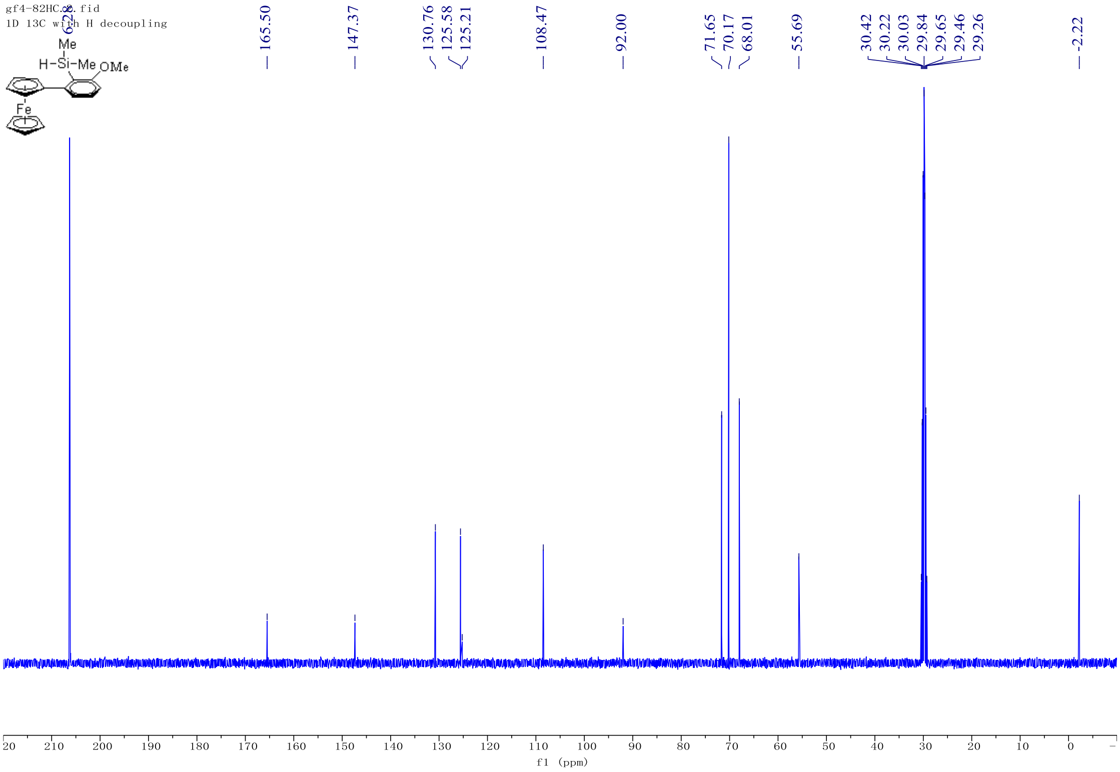
Compound 1m


gf3-0623-2cd3.1.fid
PROTON
Me
H–Si–Me Me
Fe
7.86
7.84
7.29
7.27
7.25
7.07
7.05
4.41
4.41
4.40
4.32
4.31
4.30
4.29
4.29
4.29
4.28
4.27
4.15
2.45
2.06
2.06
2.05
2.04
2.04
0.12
0.11
1.00
1.01
1.01
1.96
2.95
4.80
3.06
6.03
f1 (ppm)

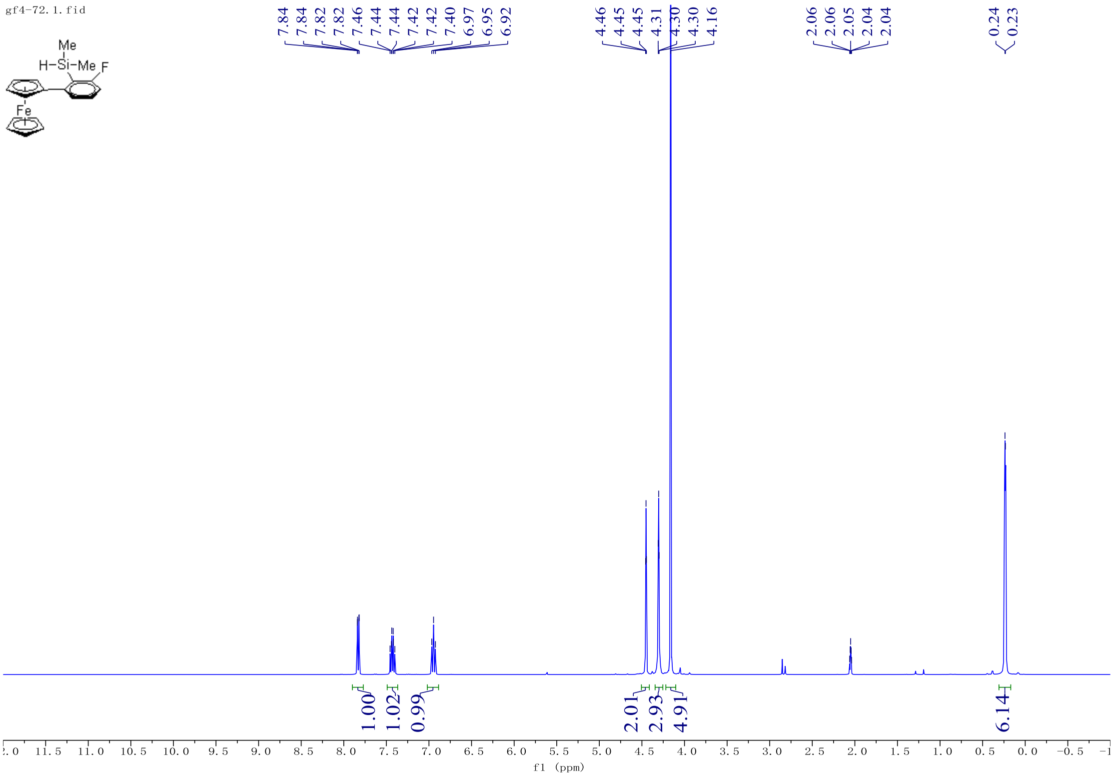

gf3-0623-2cd3.2.fid
C13CPD
6.1
Me
H–Si–Me Me
Fe
146.31
144.32
136.28
130.63
129.23
128.80
94.48
71.66
70.15
68.21
30.42
30.23
30.03
29.84
29.65
29.45
29.26
23.63
-1.66
f1 (ppm)

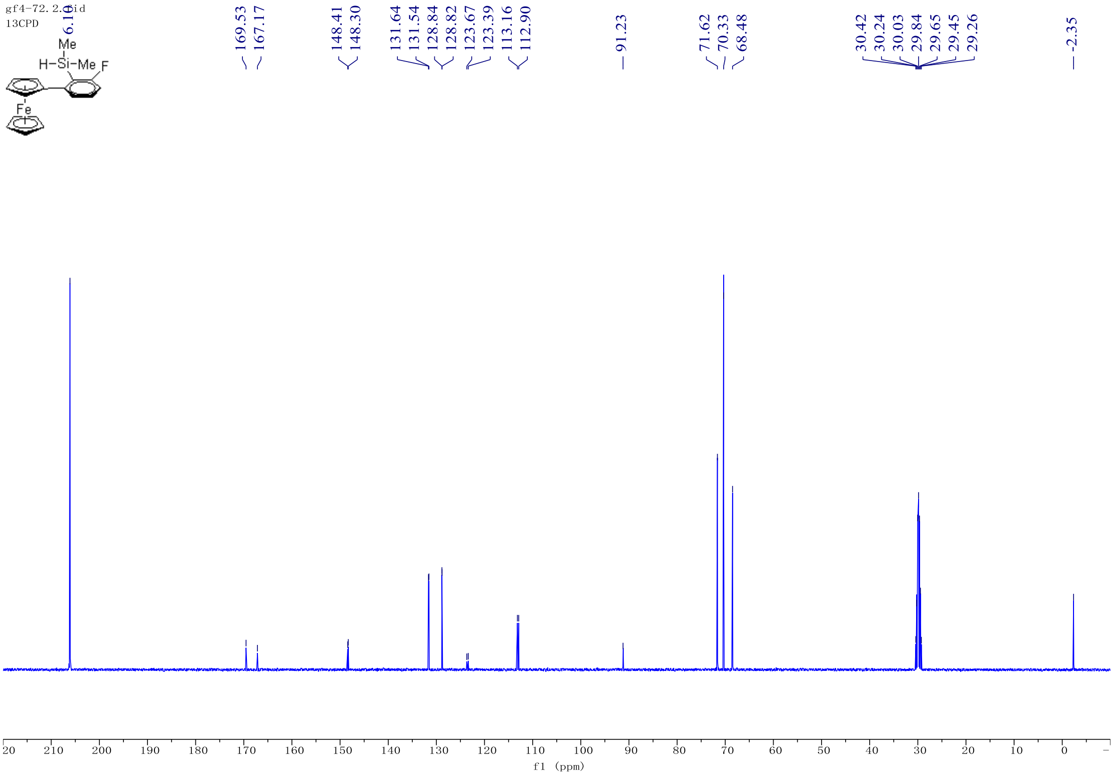
Compound 1n


gf4-82HC.1.fid
H1
Me
H–Si–Me
OMe
Fe
7.59
7.59
7.57
7.57
7.36
7.34
7.32
6.83
6.81
4.40
4.40
4.39
4.25
4.24
4.24
4.21
4.20
4.19
4.18
4.17
4.12
3.82
2.06
2.06
2.05
2.04
2.04
0.21
0.20
7.7
7.6
7.5
7.4
7.3
7.2
7.1
7.0
6.9
6.8
6.7
f1 (ppm)
1.00
1.01
1.01
1.96
1.94
1.00
4.70
3.12
6.20
11.5
11.0
10.5
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)

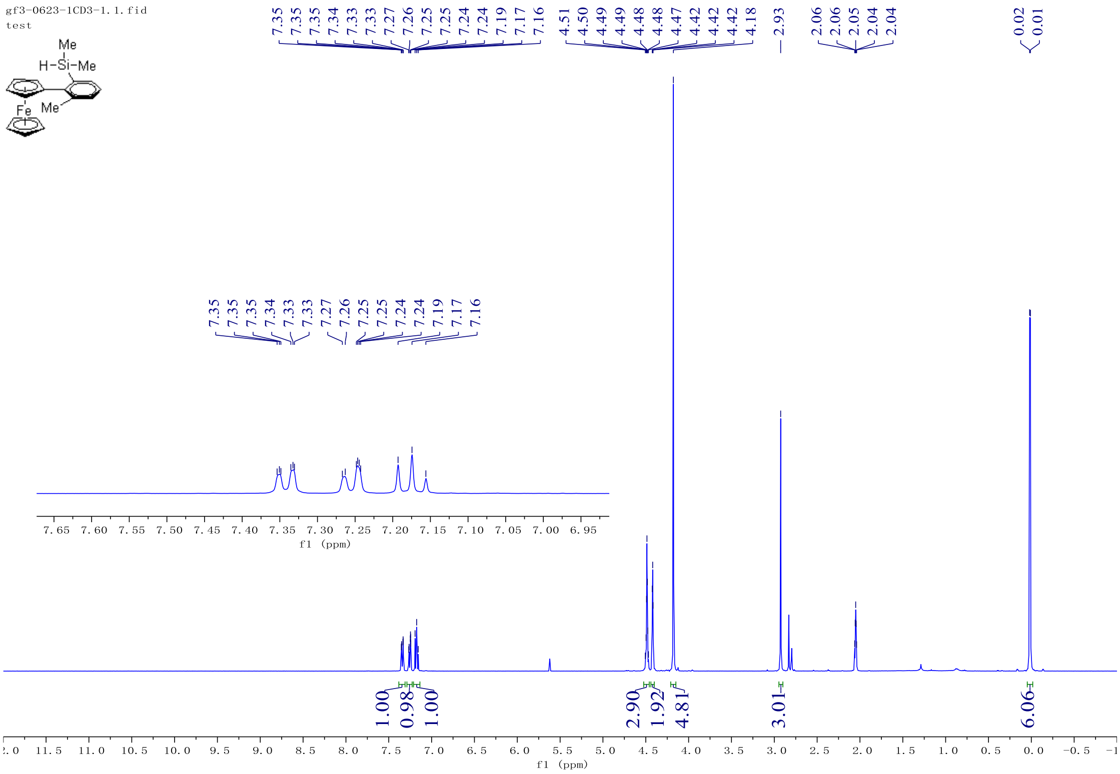

gf4-82HC.2.fid
1D 13C with H decoupling
Me
H–Si–Me
OMe
Fe
165.50
147.37
130.76
125.58
125.21
108.47
92.00
71.65
70.17
68.01
55.69
30.42
30.22
30.03
29.84
29.65
29.46
29.26
-2.22
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

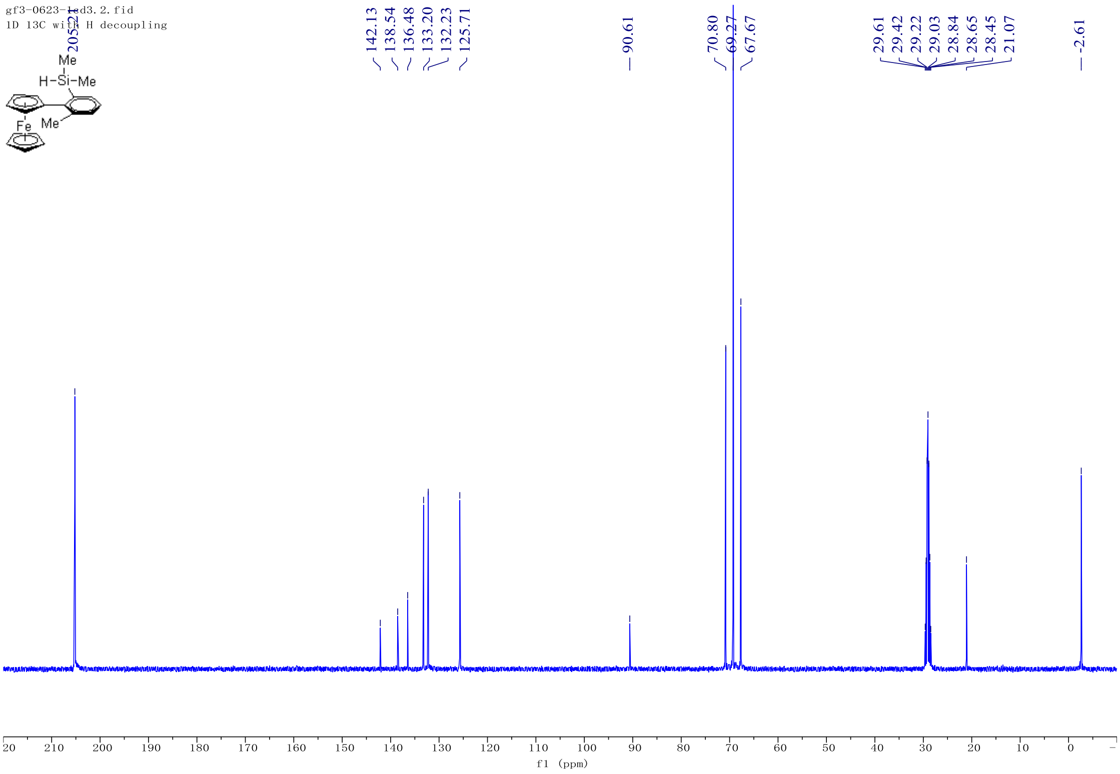
Compound 1o


gf4-72.1.fid
Me
H–Si–Me
F
Fe
7.84
7.84
7.82
7.82
7.46
7.44
7.44
7.42
7.42
7.40
6.97
6.95
6.92
4.46
4.45
4.45
4.31
4.30
4.30
4.16
2.06
2.06
2.05
2.04
2.04
0.24
0.23
1.00
1.02
0.99
2.01
2.93
4.91
6.14
2.0
11.5
11.0
10.5
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
-1
f1 (ppm)

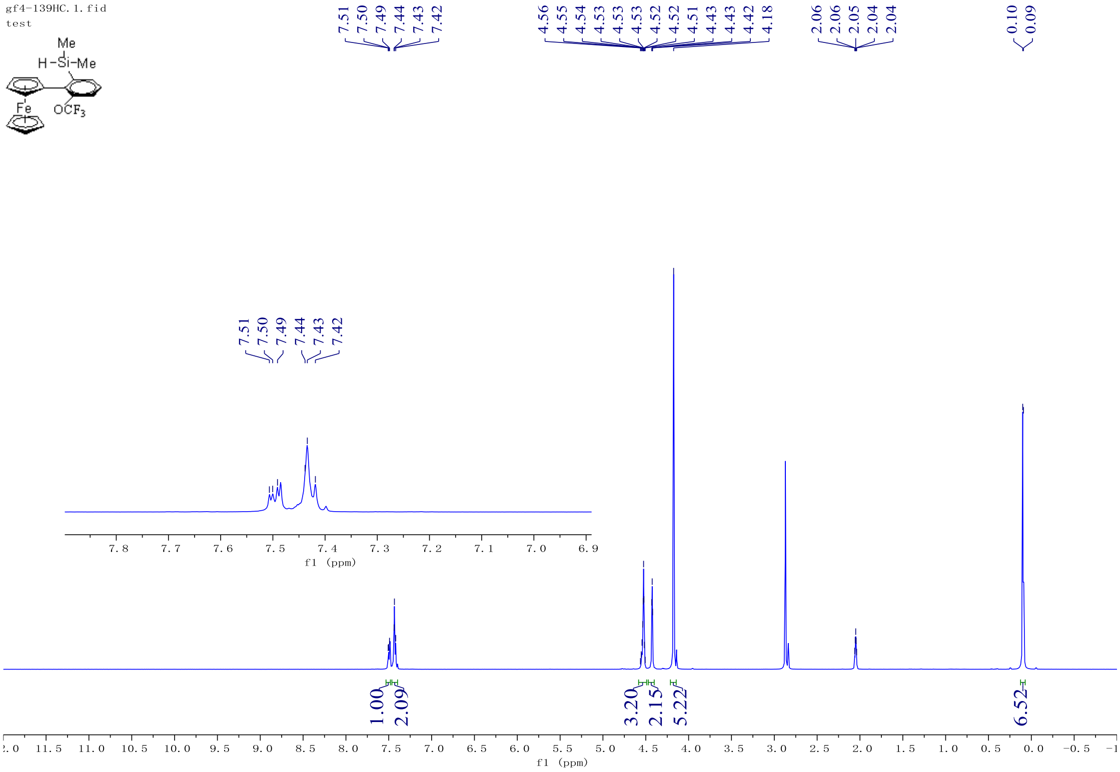

gf4-72.2.fid
13CPD
6.10
Me
H–Si–Me
F
Fe
169.53
167.17
148.41
148.30
131.64
131.54
128.84
128.82
123.67
123.39
113.16
112.90
91.23
71.62
70.33
68.48
30.42
30.24
30.03
29.84
29.65
29.45
29.26
-2.35
20
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-
f1 (ppm)

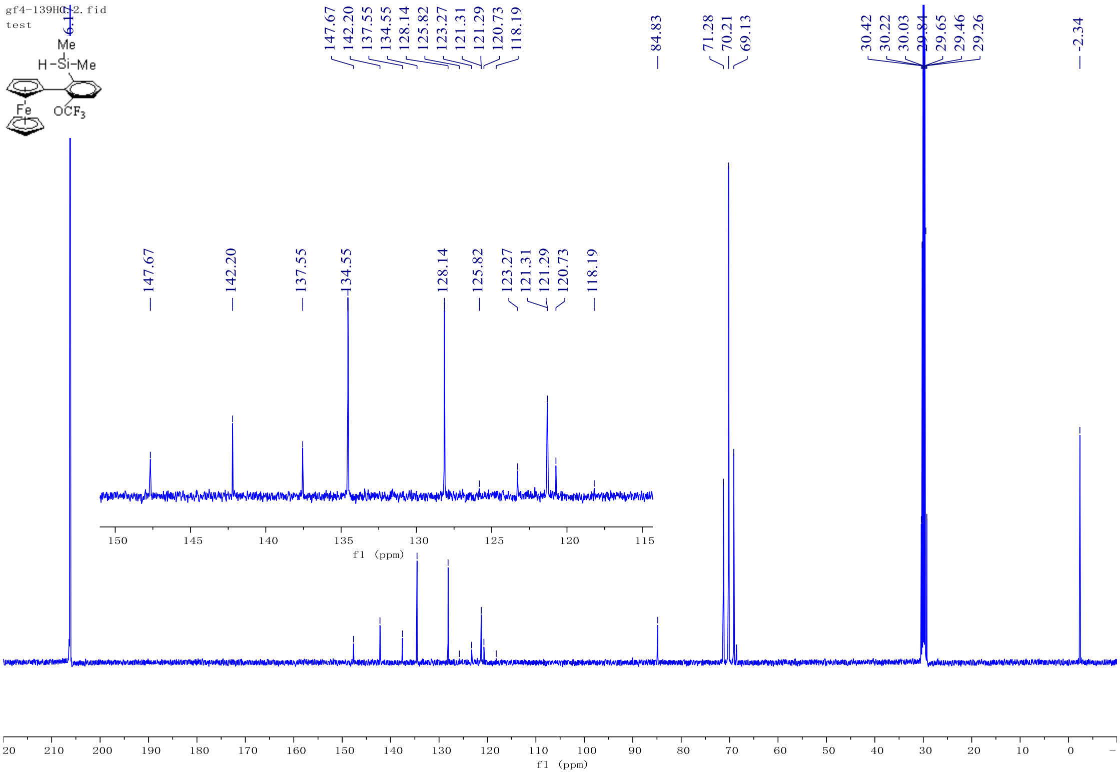
Compound 1p


gf3-0623-1CD3-1.1.fid
test
Me
H−Si−Me
Fe
Me
7.35 7.35 7.35 7.34 7.33 7.33 7.27 7.26 7.25 7.25 7.24 7.24 7.19 7.17 7.16
4.51 4.50 4.49 4.49 4.48 4.48 4.47 4.42 4.42 4.42 4.18
2.93
2.06 2.06 2.05 2.04 2.04
0.02 0.01
1.00 0.98 1.00
2.90 1.92 4.81
3.01
6.06
7.65 7.60 7.55 7.50 7.45 7.40 7.35 7.30 7.25 7.20 7.15 7.10 7.05 7.00 6.95
f1 (ppm)
12.0 11.5 11.0 10.5 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 −1
f1 (ppm)

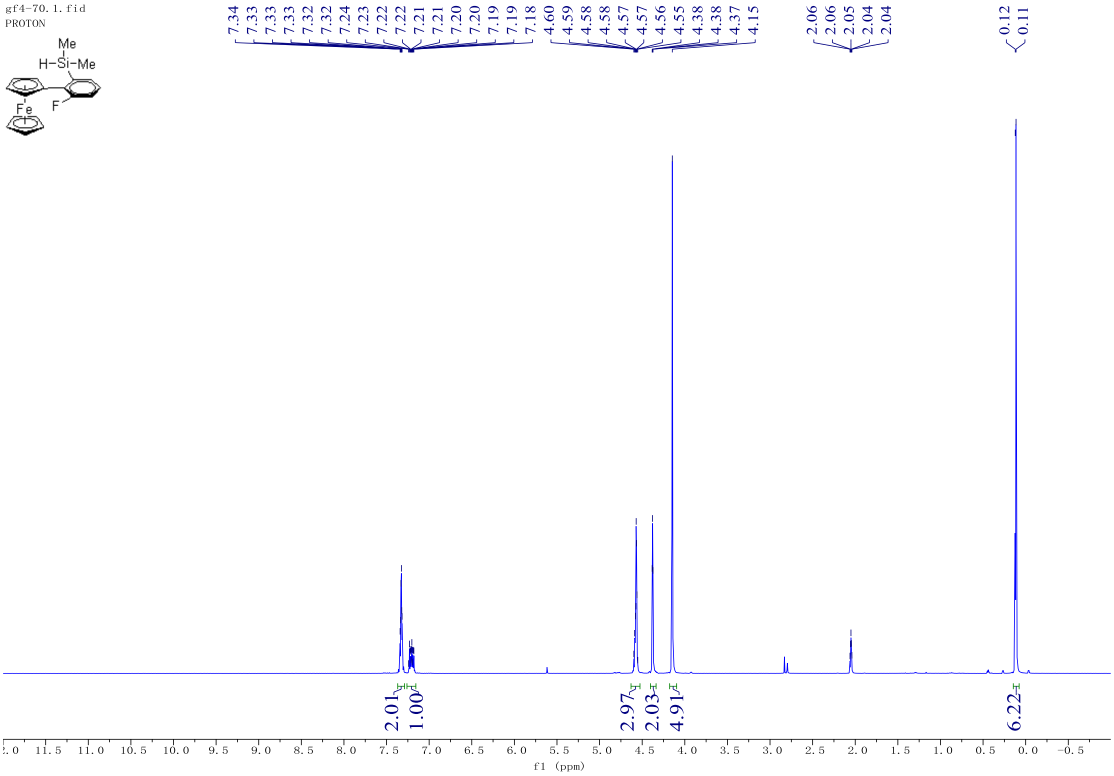

gf3-0623-1cd3.2.fid
1D 13C with H decoupling
205.21
Me
H−Si−Me
Fe
Me
142.13 138.54 136.48 133.20 132.23 125.71
90.61
70.80 69.27 67.67
29.61 29.42 29.22 29.03 28.84 28.65 28.45 21.07
-2.61
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

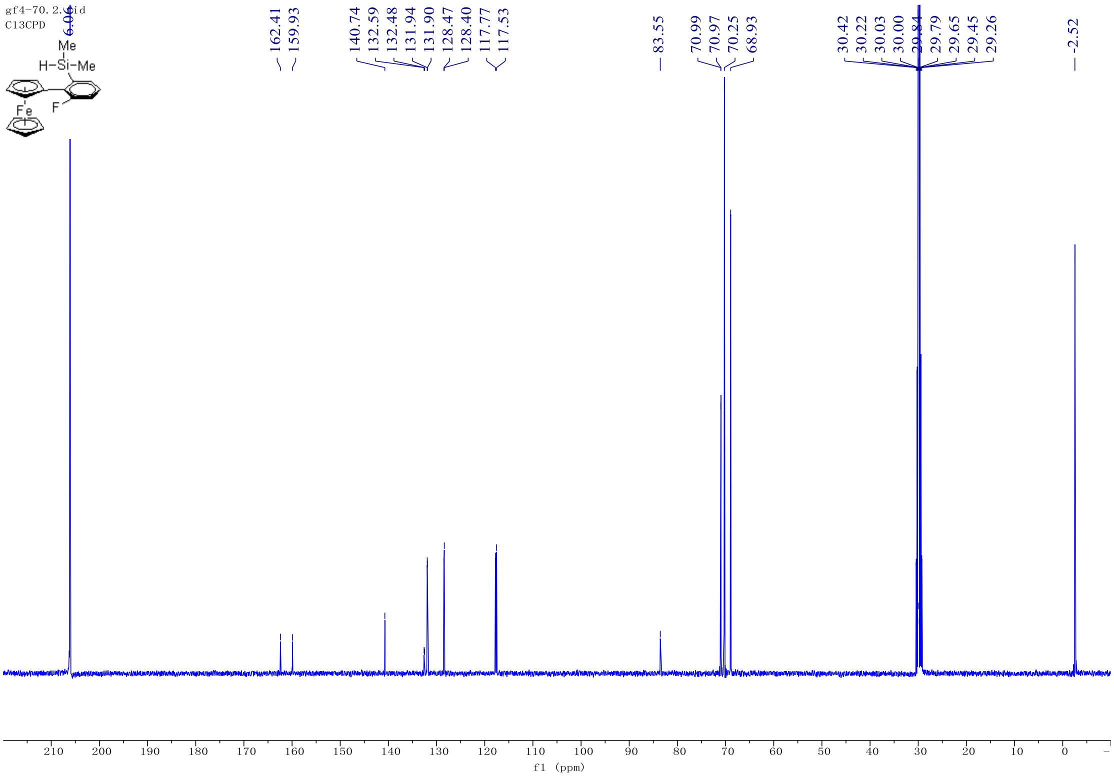
Compound 1q


gf4-139HC.1.fid
test
Me
H-Si-Me
Fe
OCF3
7.51
7.50
7.49
7.44
7.43
7.42
4.56
4.55
4.54
4.53
4.53
4.53
4.52
4.52
4.51
4.43
4.43
4.42
4.18
2.06
2.06
2.05
2.04
2.04
0.10
0.09
7.8
7.7
7.6
7.5
7.4
7.3
7.2
7.1
7.0
6.9
f1 (ppm)
1.00
2.09
3.20
2.15
5.22
6.52
11.5
11.0
10.5
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)

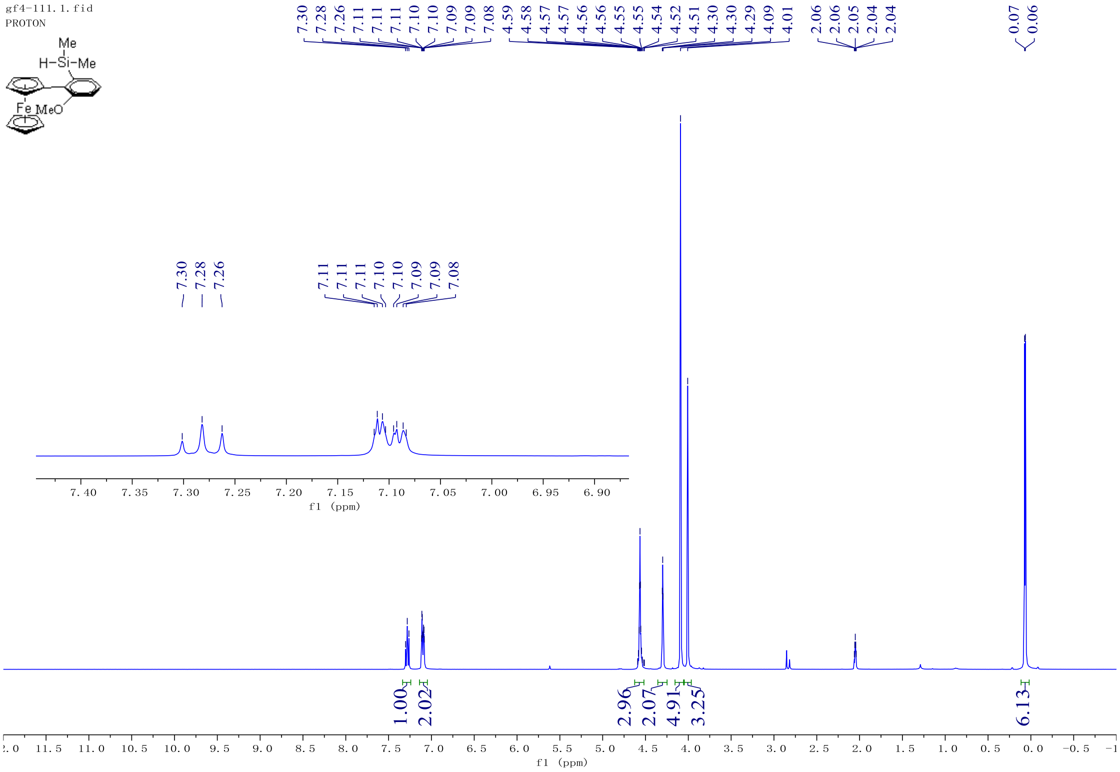

gf4-139HC.2.fid
test
Me
H-Si-Me
Fe
OCF3
147.67
142.20
137.55
134.55
128.14
125.82
123.27
121.31
121.29
120.73
118.19
84.83
71.28
70.21
69.13
30.42
30.22
30.03
29.84
29.65
29.46
29.26
-2.34
150
145
140
135
130
125
120
115
f1 (ppm)
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

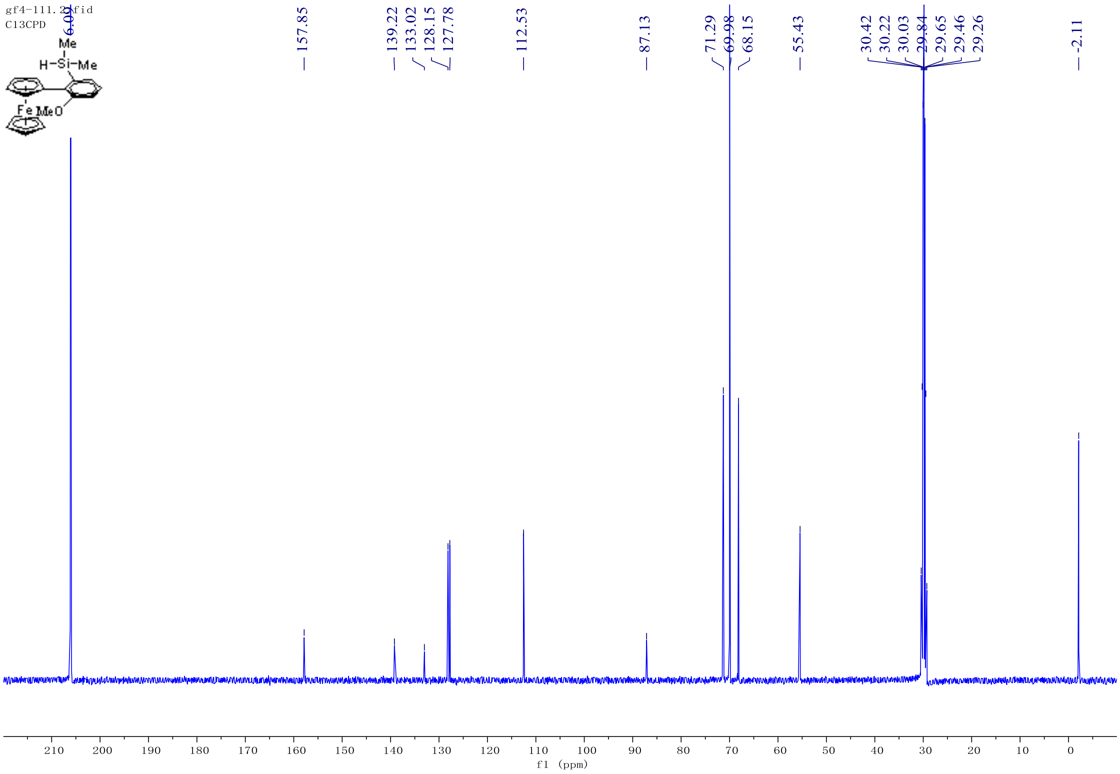
Compound 1r


gf4-70.1.fid
PROTON
Me
H–Si–Me
Fe
F
7.34
7.33
7.33
7.33
7.32
7.32
7.24
7.23
7.22
7.22
7.21
7.21
7.20
7.20
7.19
7.19
7.18
4.60
4.59
4.58
4.58
4.57
4.57
4.56
4.55
4.38
4.38
4.37
4.15
2.06
2.06
2.05
2.04
2.04
0.12
0.11
2.01
1.00
2.97
2.03
4.91
6.22
12.0
11.5
11.0
10.5
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)

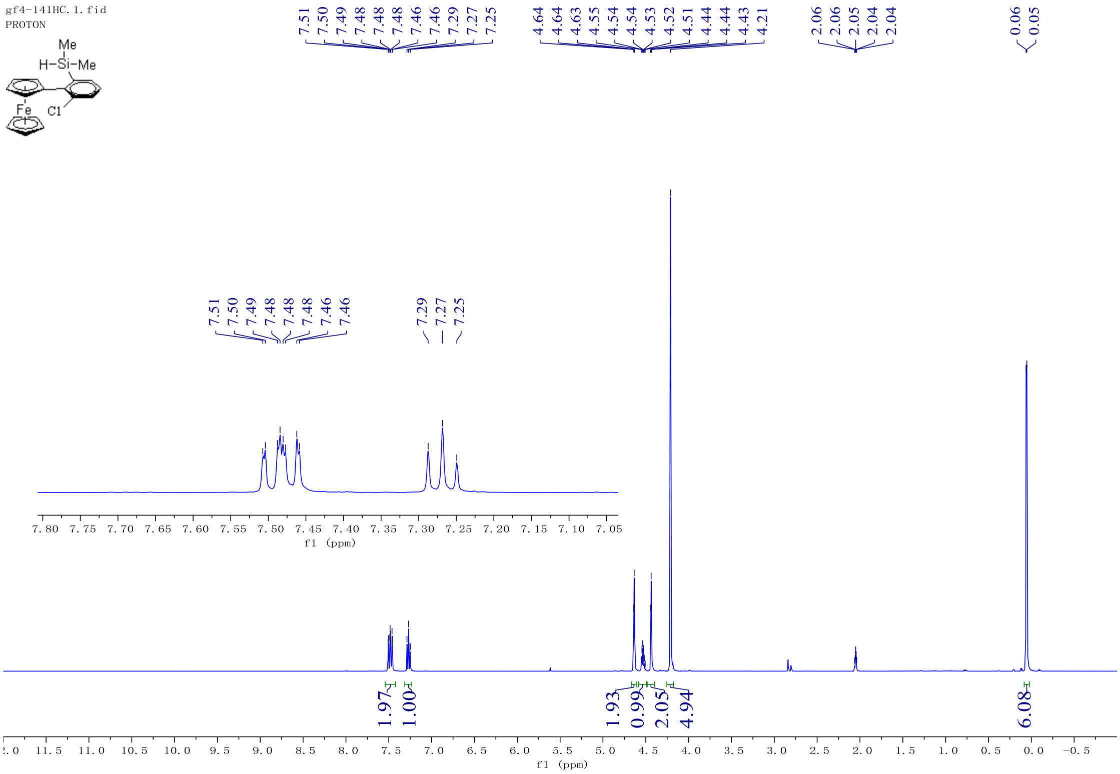

gf4-70.2.fid
C13CPD
6.06
Me
H–Si–Me
Fe
F
162.41
159.93
140.74
132.59
132.48
131.94
131.90
128.47
128.40
117.77
117.53
83.55
70.99
70.97
70.25
68.93
30.42
30.22
30.03
30.00
29.84
29.79
29.65
29.45
29.26
-2.52
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

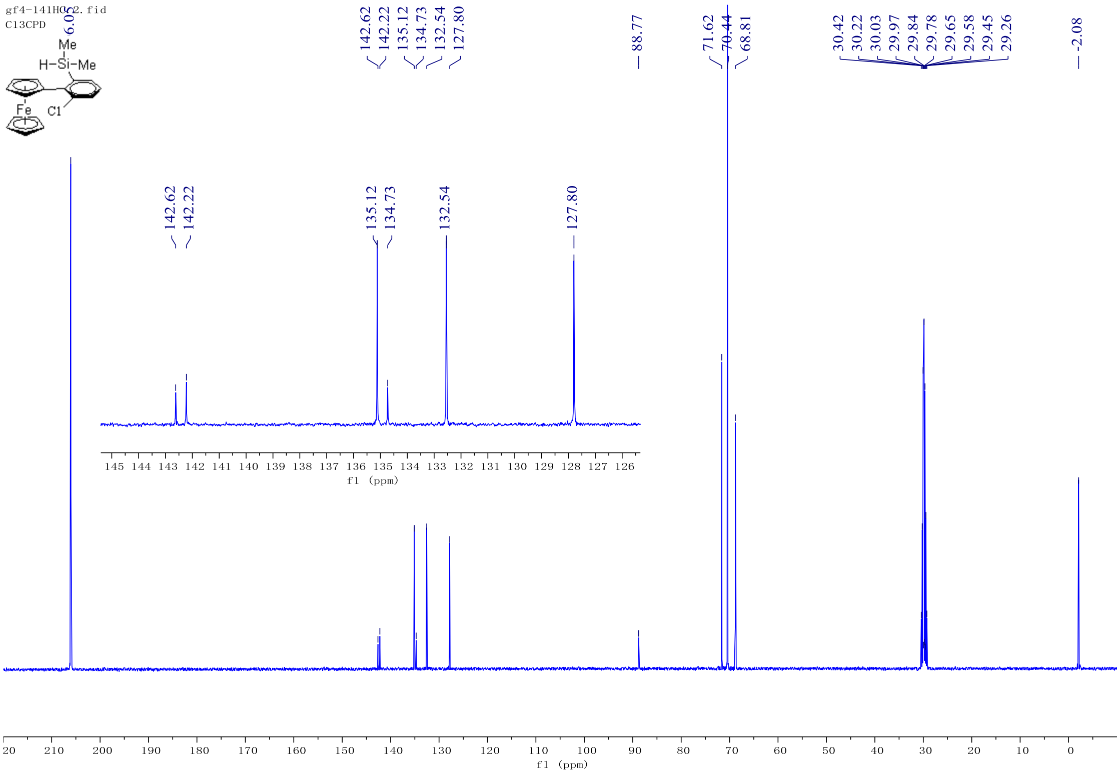
Compound 1s


gf4-111.1.fid
PROTON
Me
H–Si–Me
Fe MeO
7.30
7.28
7.26
7.11
7.11
7.11
7.10
7.10
7.09
7.09
7.08
4.59
4.58
4.57
4.56
4.56
4.55
4.55
4.54
4.52
4.51
4.30
4.30
4.29
4.09
4.01
2.06
2.06
2.05
2.04
2.04
0.07
0.06
1.00
2.02
2.96
2.07
4.91
3.25
6.13
7.40 7.35 7.30 7.25 7.20 7.15 7.10 7.05 7.00 6.95 6.90
f1 (ppm)
11.5 11.0 10.5 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)

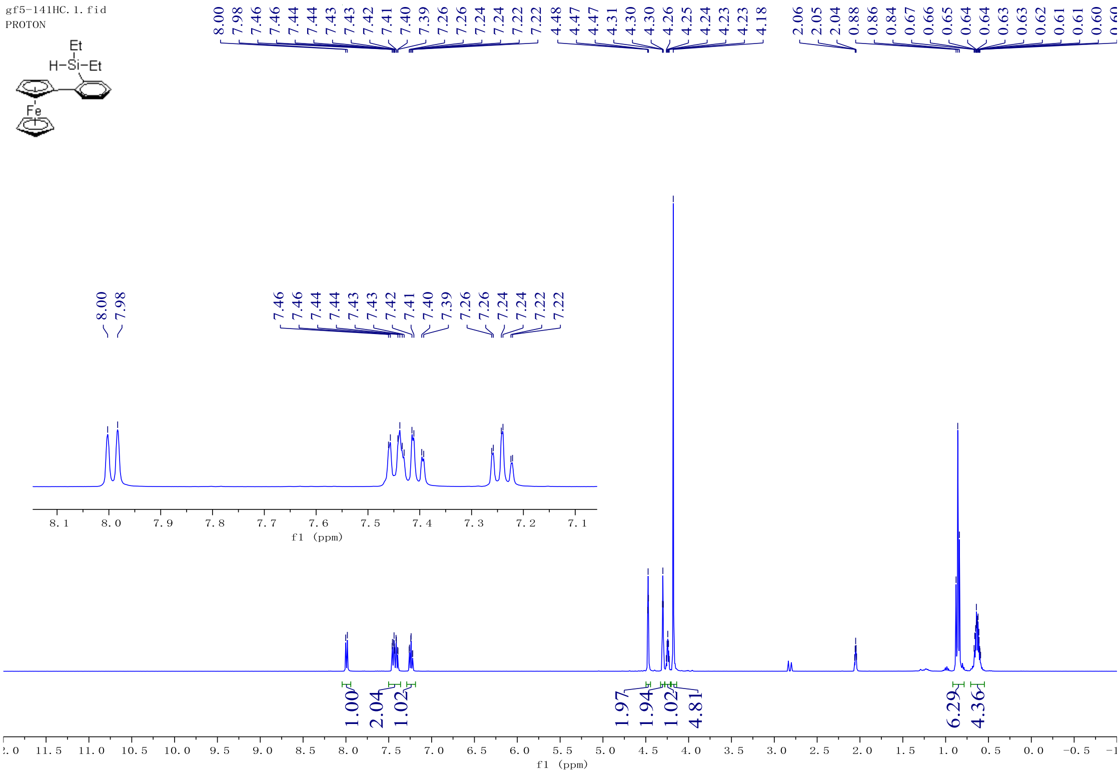

gf4-111.2.fid
C13CPD
6.00
Me
H–Si–Me
Fe MeO
157.85
139.22
133.02
128.15
127.78
112.53
87.13
71.29
69.98
68.15
55.43
30.42
30.22
30.03
29.84
29.65
29.46
29.26
-2.11
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

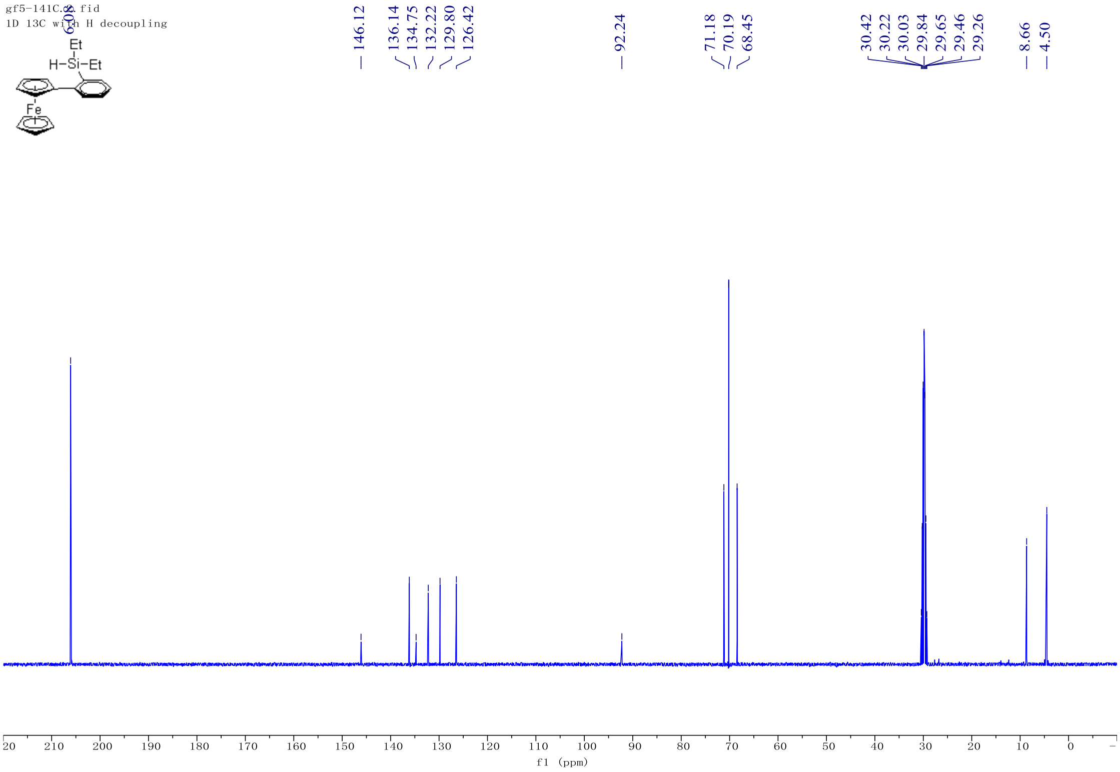
Compound 1t


gf4-141HC.1.fid
PROTON
Me
H–Si–Me
Fe
Cl
7.51 7.50 7.49 7.48 7.48 7.48 7.46 7.46 7.29 7.27 7.25
4.64 4.64 4.63 4.55 4.54 4.54 4.53 4.52 4.51 4.44 4.44 4.43 4.21
2.06 2.06 2.05 2.04 2.04
0.06 0.05
1.97 1.00 1.93 0.99 2.05 4.94 6.08
7.80 7.75 7.70 7.65 7.60 7.55 7.50 7.45 7.40 7.35 7.30 7.25 7.20 7.15 7.10 7.05
f1 (ppm)
11.5 11.0 10.5 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)

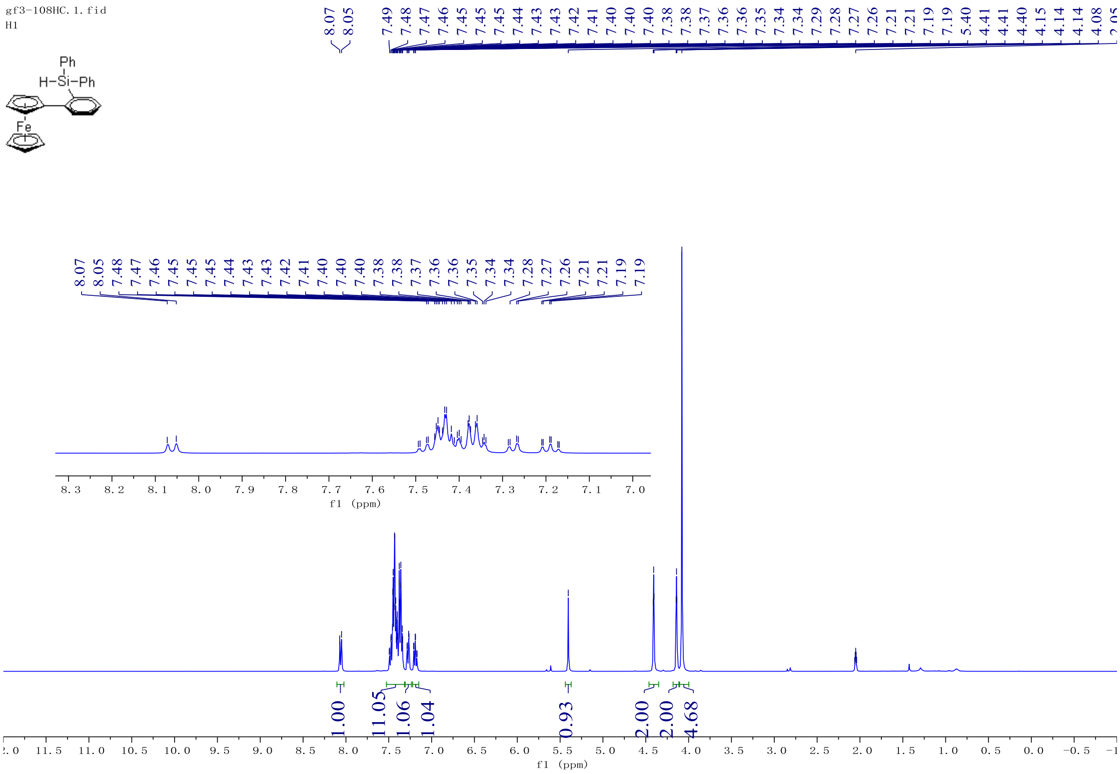

gf4-141HC.2.fid
C13CPD
Me
H–Si–Me
Fe
Cl
142.62 142.22 135.12 134.73 132.54 127.80
88.77
71.62 70.44 68.81
30.42 30.22 30.03 29.97 29.84 29.78 29.65 29.58 29.45 29.26
-2.08
145 144 143 142 141 140 139 138 137 136 135 134 133 132 131 130 129 128 127 126
f1 (ppm)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

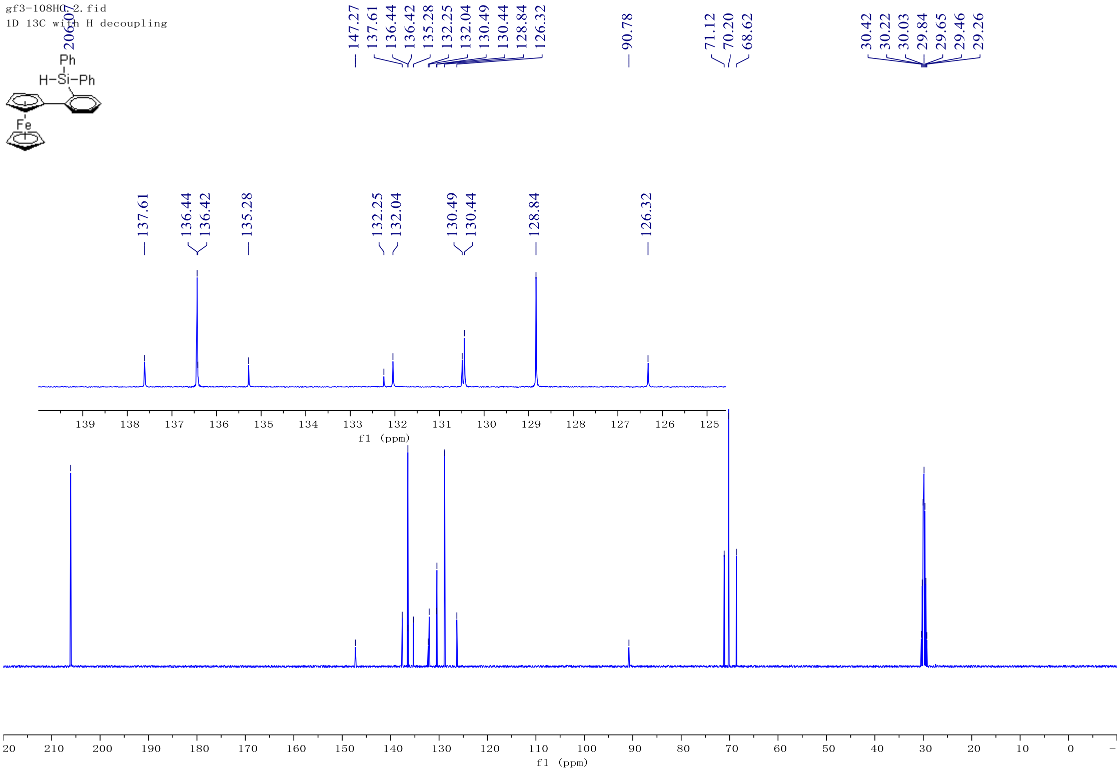
Compound 1u


gf5-141HC.1.fid
PROTON
Et
H–Si–Et
Fe
8.00
7.98
7.46
7.46
7.44
7.44
7.43
7.43
7.42
7.41
7.40
7.39
7.26
7.26
7.24
7.24
7.22
7.22
4.48
4.47
4.47
4.31
4.30
4.30
4.26
4.25
4.24
4.23
4.23
4.18
2.06
2.05
2.04
0.88
0.86
0.84
0.67
0.66
0.65
0.64
0.64
0.63
0.63
0.62
0.61
0.61
0.60
8.1
8.0
7.9
7.8
7.7
7.6
7.5
7.4
7.3
7.2
7.1
f1 (ppm)
1.00
2.04
1.02
1.97
1.94
1.02
4.81
6.29
4.36
11.5
11.0
10.5
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)

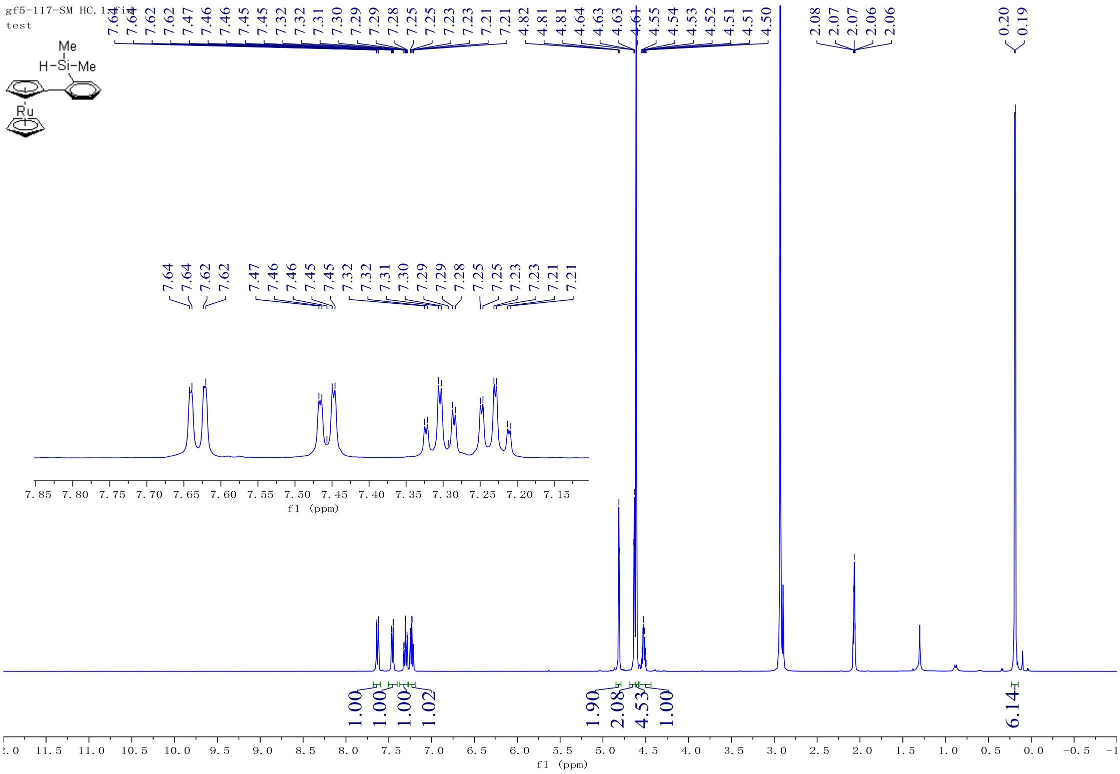

gf5-141C.2.fid
1D 13C with H decoupling
6.08
Et
H–Si–Et
Fe
146.12
136.14
134.75
132.22
129.80
126.42
92.24
71.18
70.19
68.45
30.42
30.22
30.03
29.84
29.65
29.46
29.26
8.66
4.50
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

Compound 1v

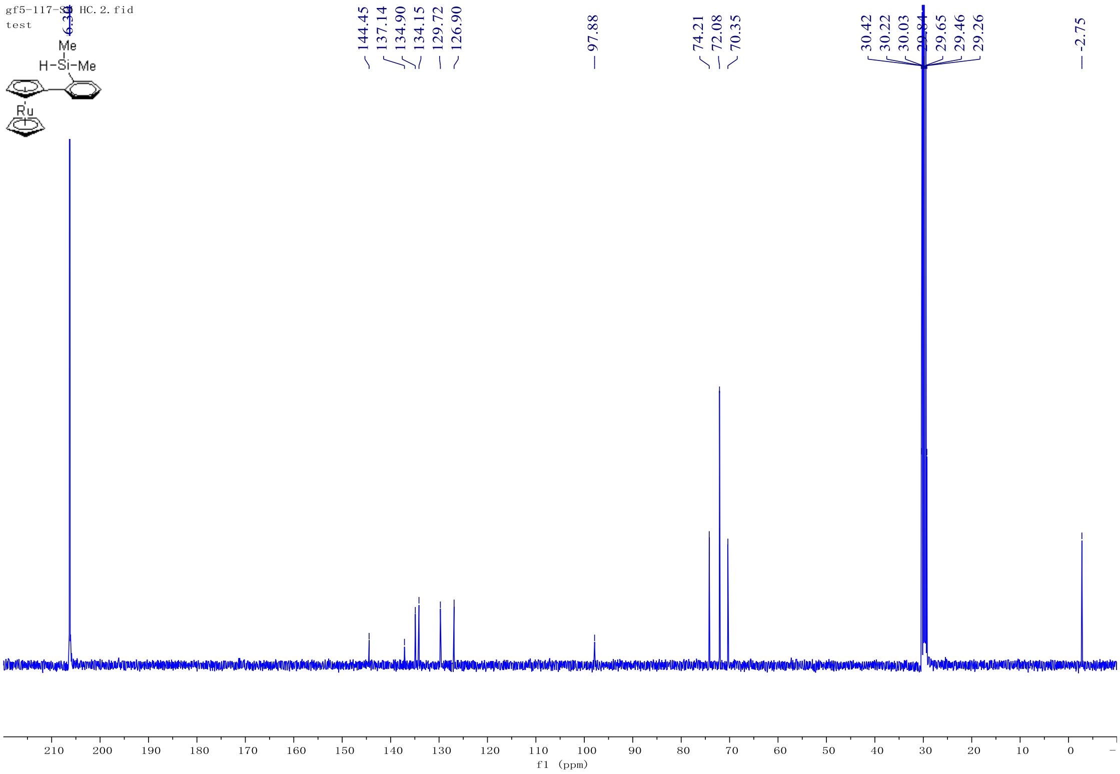

gf3-108HC.1.fid
H1
Ph
H–Si–Ph
Fe
8.07
8.05
7.49
7.48
7.47
7.46
7.45
7.45
7.45
7.44
7.43
7.43
7.42
7.41
7.40
7.40
7.40
7.38
7.38
7.37
7.36
7.36
7.35
7.34
7.34
7.29
7.28
7.27
7.26
7.21
7.21
7.19
7.19
5.40
4.41
4.41
4.40
4.15
4.14
4.14
4.08
1.00
11.05
1.06
1.04
0.93
2.00
2.00
4.68
f1 (ppm)


gf3-108HC.2.fid
1D 13C with H decoupling
206.01
147.27
137.61
136.44
136.42
135.28
132.25
132.04
130.49
130.44
128.84
126.32
90.78
71.12
70.20
68.62
30.42
30.22
30.03
29.84
29.65
29.46
29.26
Ph
H–Si–Ph
Fe
f1 (ppm)

Compound 1w

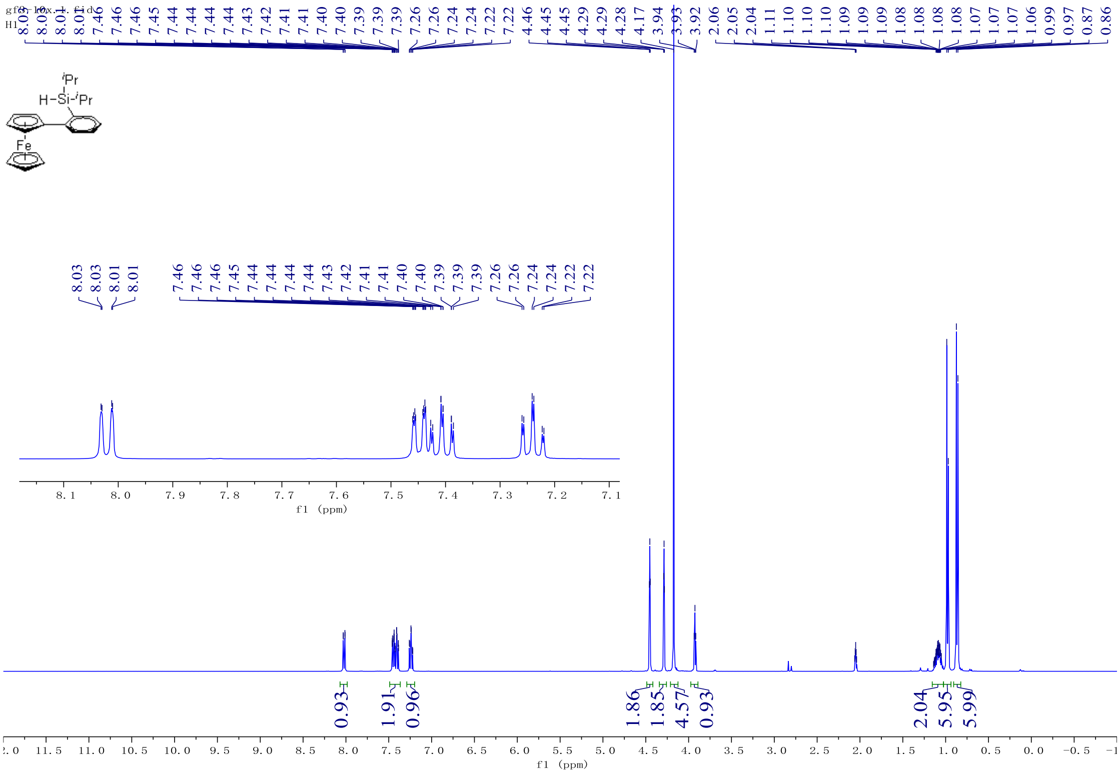


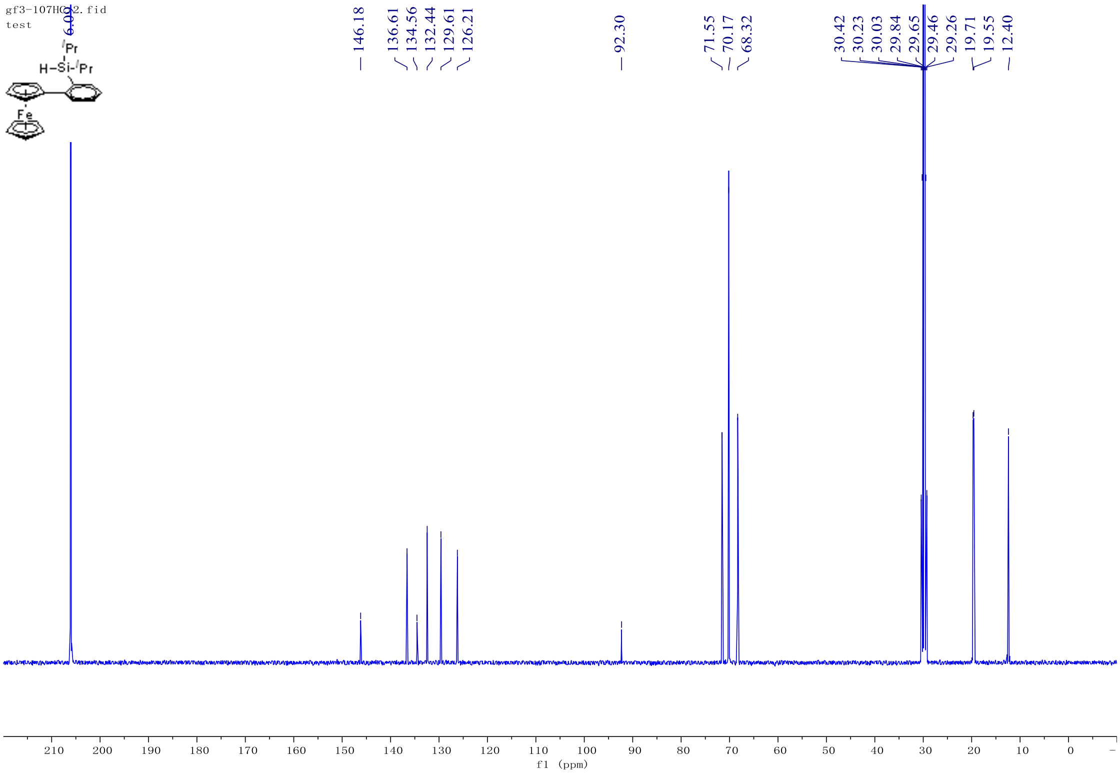
gf5-117-SM HC.1.fid
test
Me
H-Si-Me
Ru
7.64
7.64
7.62
7.47
7.46
7.45
7.45
7.32
7.32
7.31
7.30
7.29
7.29
7.28
7.25
7.25
7.23
7.23
7.21
7.21
4.82
4.81
4.81
4.64
4.63
4.63
4.61
4.55
4.54
4.53
4.52
4.51
4.51
4.50
2.08
2.07
2.07
2.06
2.06
0.20
0.19
7.64
7.64
7.62
7.62
7.47
7.46
7.46
7.45
7.45
7.32
7.32
7.31
7.30
7.29
7.29
7.28
7.25
7.25
7.23
7.23
7.21
7.21
7.85 7.80 7.75 7.70 7.65 7.60 7.55 7.50 7.45 7.40 7.35 7.30 7.25 7.20 7.15
f1 (ppm)
1.00
1.00
1.00
1.02
1.90
2.08
4.53
1.00
6.14
12.0 11.5 11.0 10.5 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 -1
f1 (ppm)



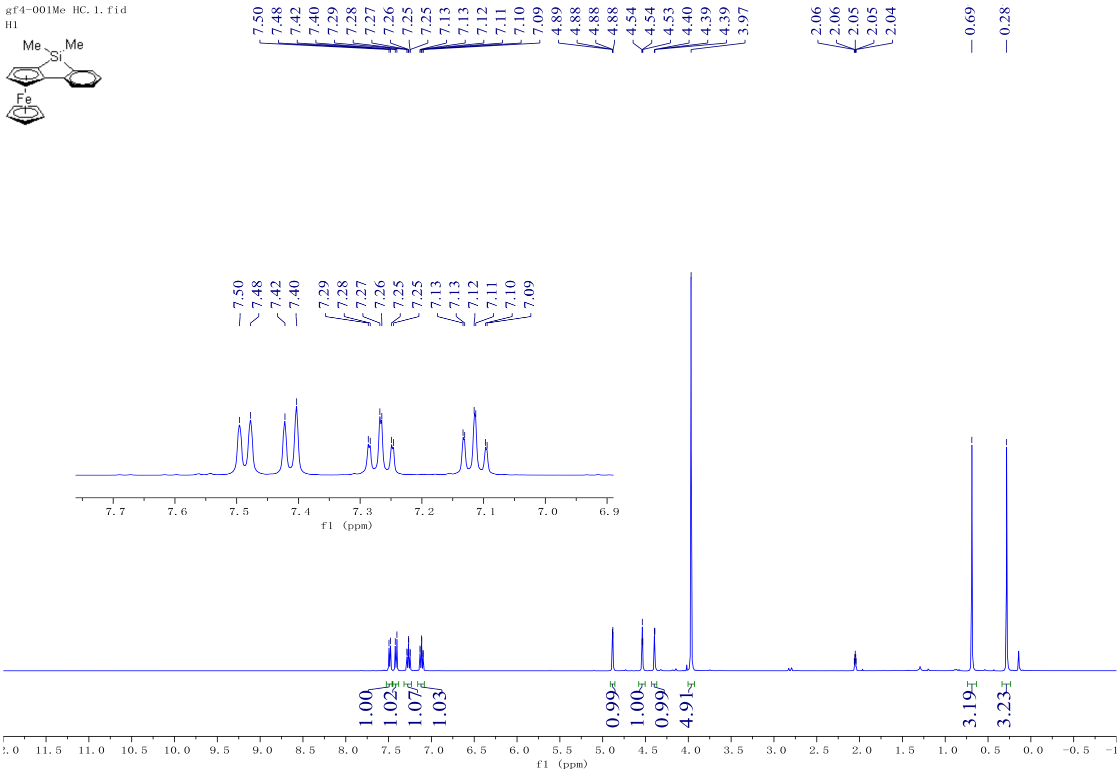
gf5-117-SM HC.2.fid
test
6.30
Me
H-Si-Me
Ru
144.45
137.14
134.90
134.15
129.72
126.90
97.88
74.21
72.08
70.35
30.42
30.22
30.03
29.84
29.65
29.46
29.26
-2.75
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

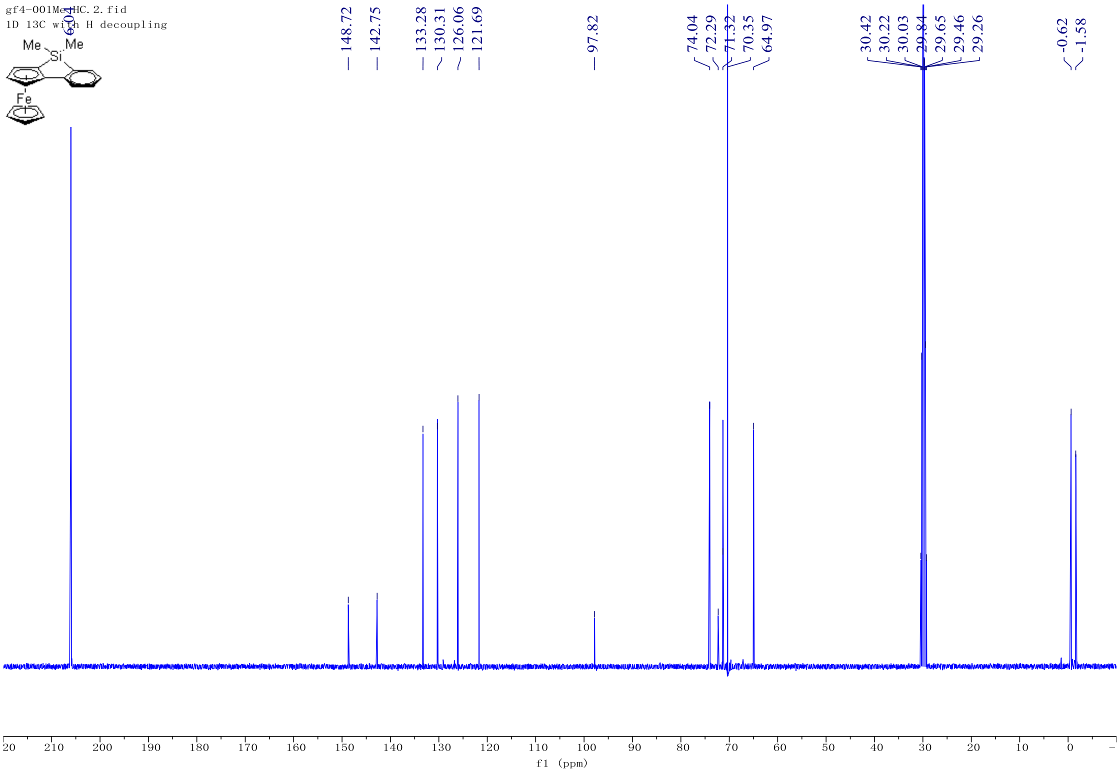
Compound 1x


gf3-1x.1.fid
H1
8.03 8.03 8.01 8.01 7.46 7.46 7.45 7.44 7.44 7.44 7.44 7.43 7.42 7.41 7.41 7.40 7.40 7.39 7.39 7.39 7.26 7.26 7.24 7.24 7.22 7.22 4.46 4.45 4.45 4.29 4.29 4.28 4.17 3.94 3.93 3.92 2.06 2.05 2.04 1.11 1.10 1.10 1.09 1.09 1.09 1.08 1.08 1.08 1.08 1.07 1.07 1.07 1.06 0.99 0.97 0.87 0.86
^{i}Pr
H–Si–^{i}Pr
Fe
8.03 8.03 8.01 8.01
7.46 7.46 7.46 7.45 7.44 7.44 7.44 7.44 7.43 7.42 7.41 7.41 7.40 7.40 7.39 7.39 7.39
7.26 7.26 7.24 7.24 7.22 7.22
8.1 8.0 7.9 7.8 7.7 7.6 7.5 7.4 7.3 7.2 7.1
f1 (ppm)
0.93 1.91 0.96 1.86 1.85 4.57 0.93 2.04 5.95 5.99
12.0 11.5 11.0 10.5 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 -1
f1 (ppm)

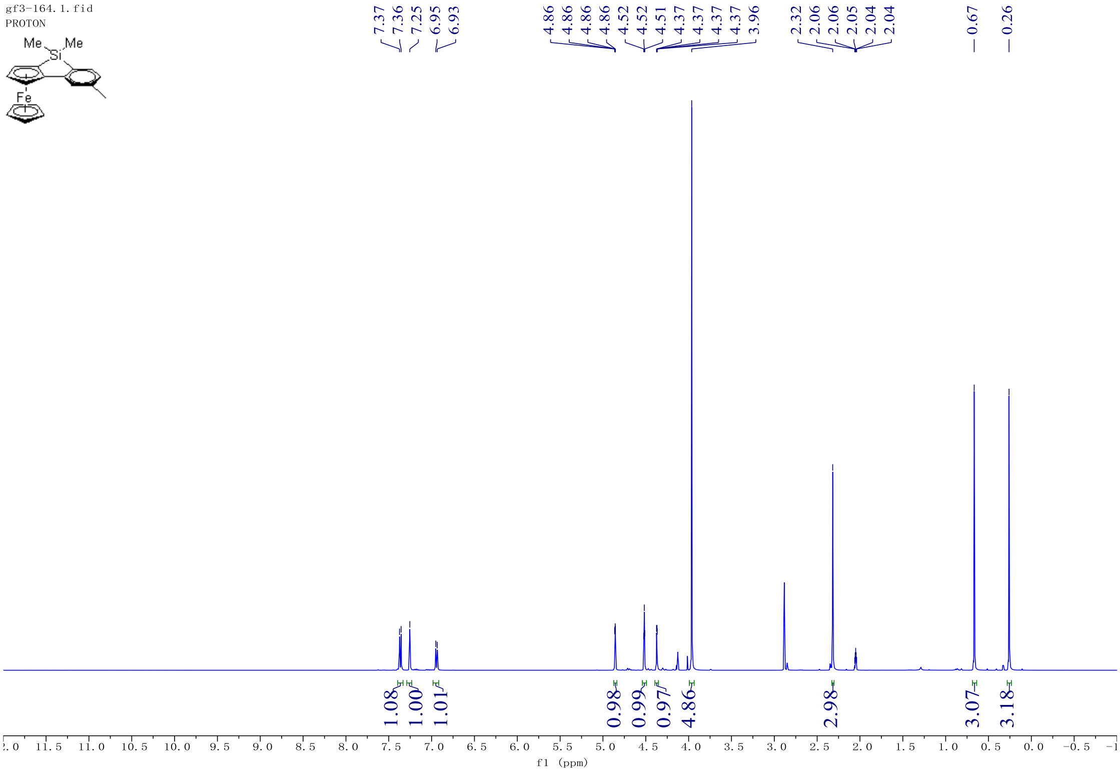

gf3-107HC.2.fid
test
206.92
146.18
136.61 134.56 132.44 129.61 126.21
92.30
71.55 70.17 68.32
30.42 30.23 30.03 29.84 29.65 29.46 29.26 19.71 19.55 12.40
^{i}Pr
H–Si–^{i}Pr
Fe
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

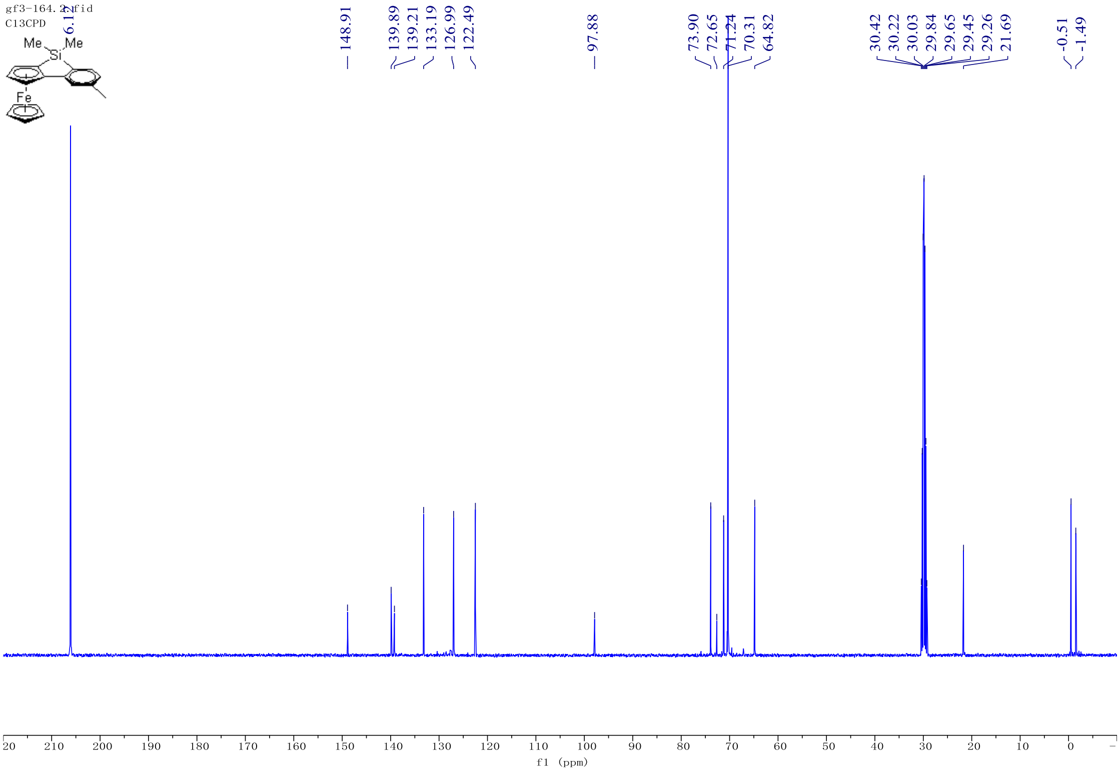
Compound 2a


gf4-001Me HC.1.fid
H1
Me
Si
Me
Fe
7.50
7.48
7.42
7.40
7.29
7.28
7.27
7.26
7.25
7.25
7.13
7.13
7.12
7.11
7.10
7.09
4.89
4.88
4.88
4.88
4.54
4.54
4.53
4.40
4.39
4.39
3.97
2.06
2.06
2.05
2.05
2.04
0.69
0.28
7.7
7.6
7.5
7.4
7.3
7.2
7.1
7.0
6.9
f1 (ppm)
1.00
1.02
1.07
1.03
0.99
1.00
0.99
4.91
3.19
3.23
12.0
11.5
11.0
10.5
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
−1
f1 (ppm)

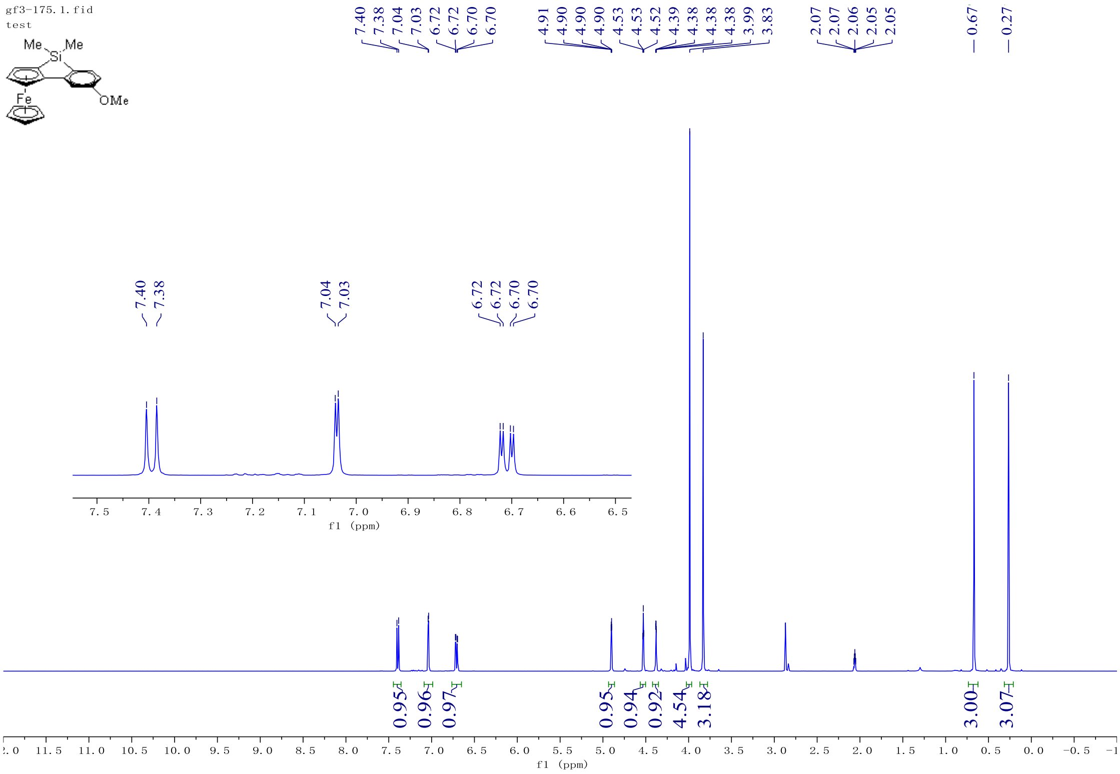

gf4-001Me HC.2.fid
1D 13C with H decoupling
6.04
Me
Si
Me
Fe
148.72
142.75
133.28
130.31
126.06
121.69
97.82
74.04
72.29
71.32
70.35
64.97
30.42
30.22
30.03
29.84
29.65
29.46
29.26
-0.62
-1.58
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

Compound 2b

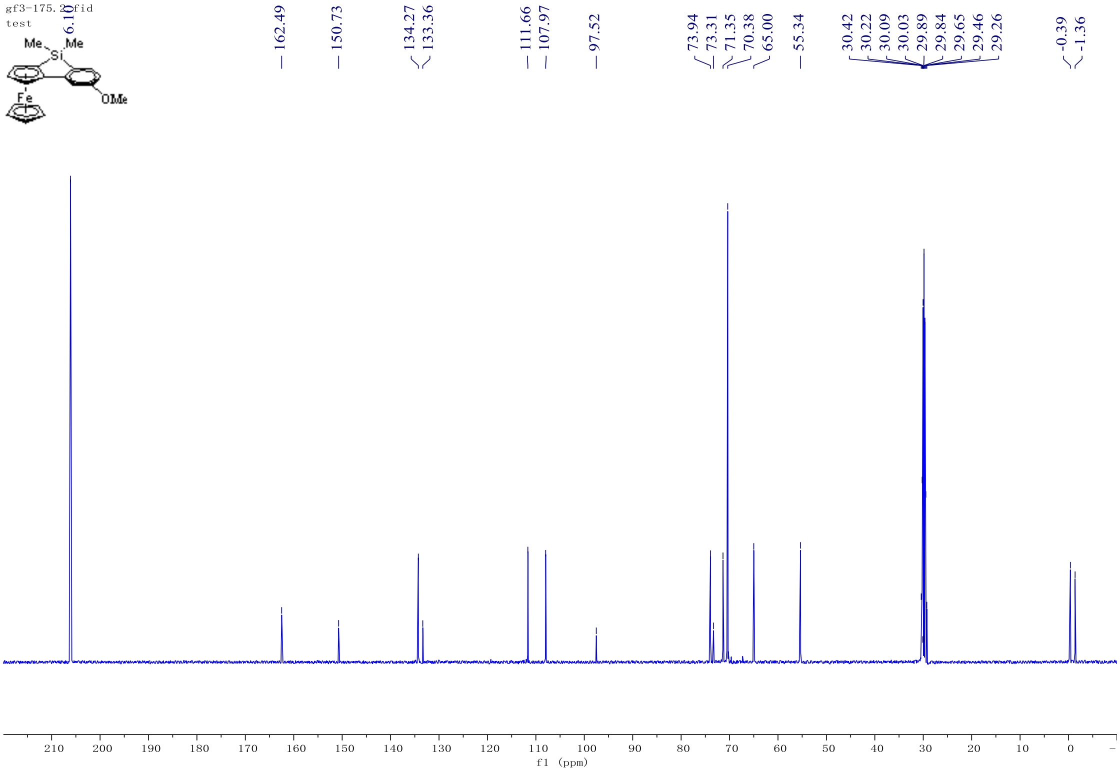

gf3-164.1.fid
PROTON
Me
Me
Si
Fe
7.37
7.36
7.25
6.95
6.93
4.86
4.86
4.86
4.86
4.52
4.52
4.51
4.37
4.37
4.37
4.37
3.96
2.32
2.06
2.06
2.05
2.04
2.04
0.67
0.26
1.08
1.00
1.01
0.98
0.99
0.97
4.86
2.98
3.07
3.18
2.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


gf3-164.2.fid
C13CPD
6.12
Me
Me
Si
Fe
148.91
139.89
139.21
133.19
126.99
122.49
97.88
73.90
72.65
71.24
70.31
64.82
30.42
30.22
30.03
29.84
29.65
29.45
29.26
21.69
-0.51
-1.49
20
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

Compound 2c

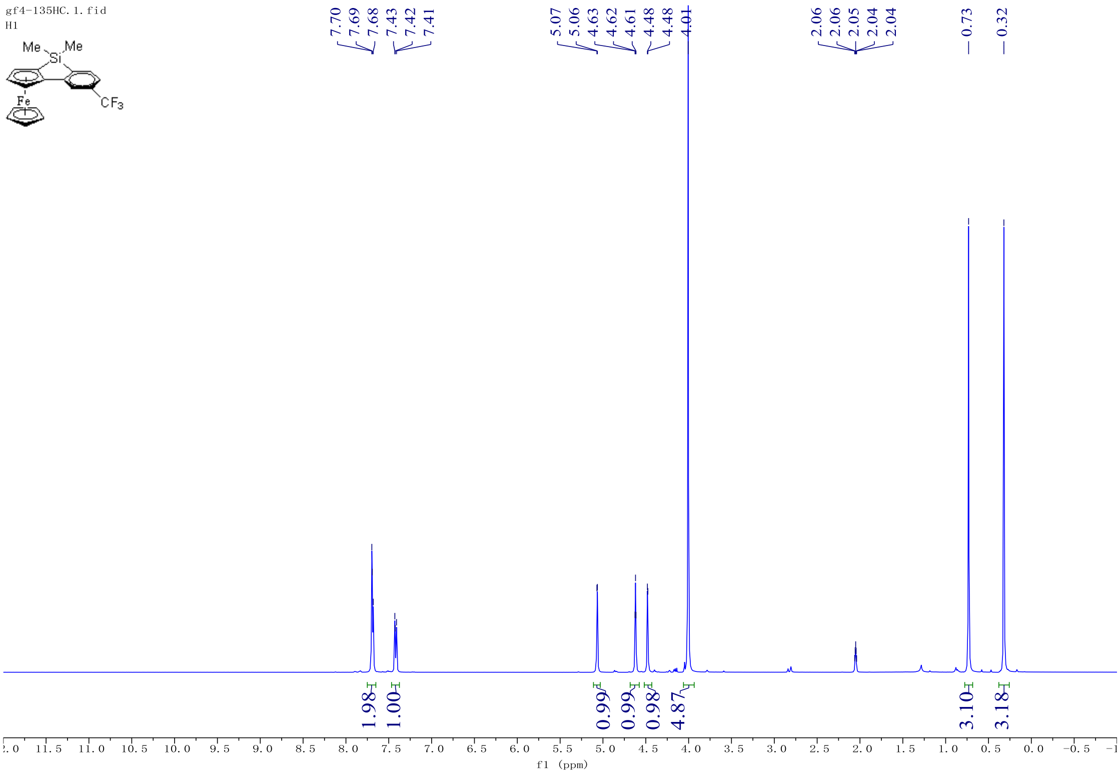


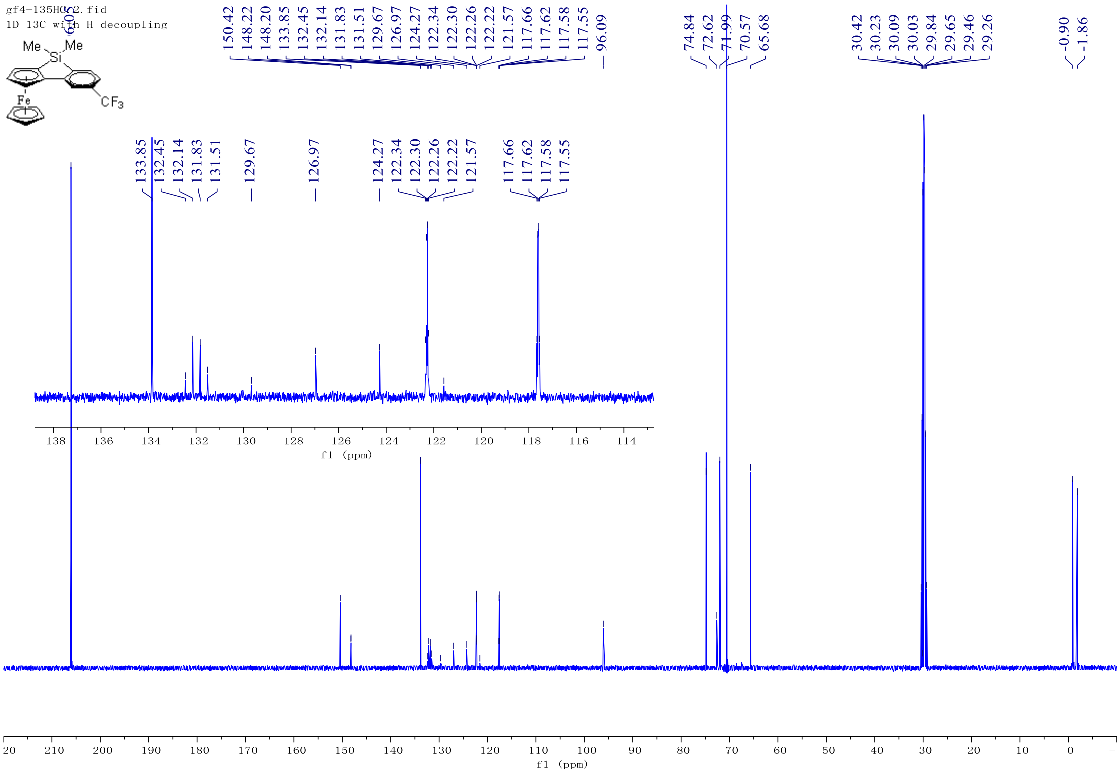
gf3-175.1.fid
test
Me
Me
Si
Fe
OMe
7.40
7.38
7.04
7.03
6.72
6.72
6.70
6.70
4.91
4.90
4.90
4.90
4.53
4.53
4.52
4.39
4.38
4.38
4.38
3.99
3.83
2.07
2.07
2.06
2.05
2.05
0.67
0.27
7.5
7.4
7.3
7.2
7.1
7.0
6.9
6.8
6.7
6.6
6.5
f1 (ppm)
0.95
0.96
0.97
0.95
0.94
0.92
4.54
3.18
3.00
3.07
11.5
11.0
10.5
10.0
9.5
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)



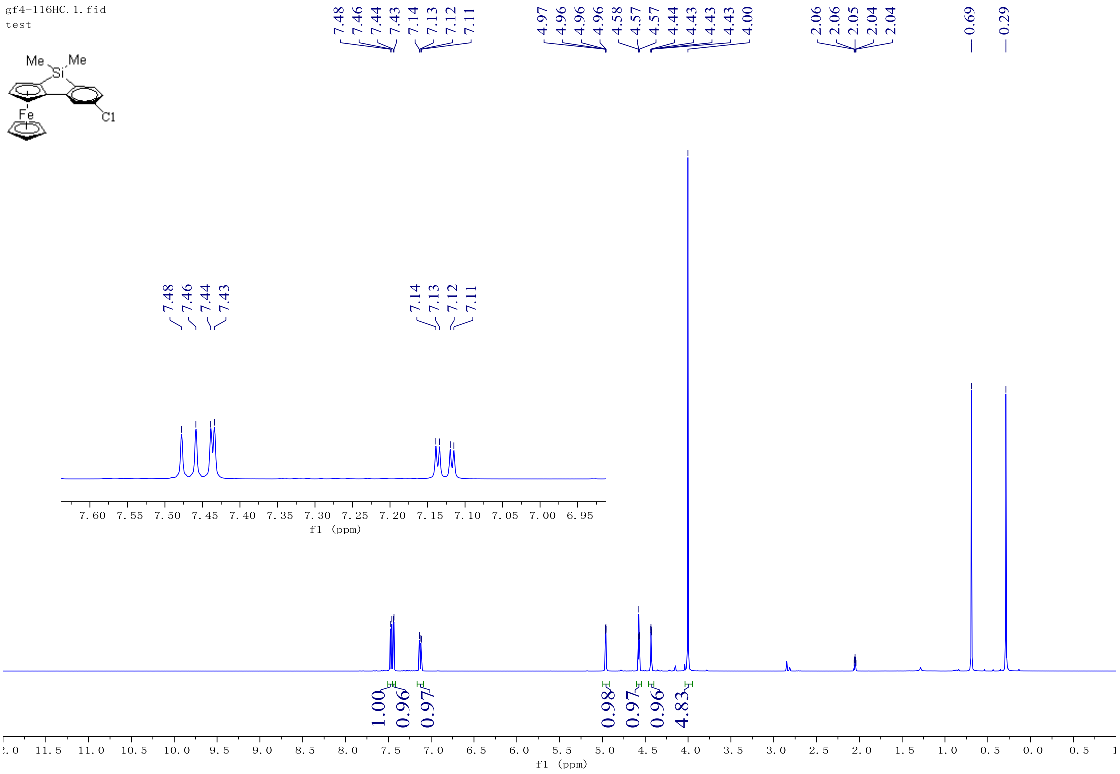
gf3-175.2.fid
6.10
test
Me
Me
Si
Fe
OMe
162.49
150.73
134.27
133.36
111.66
107.97
97.52
73.94
73.31
71.35
70.38
65.00
55.34
30.42
30.22
30.09
30.03
29.89
29.84
29.65
29.46
29.26
-0.39
-1.36
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

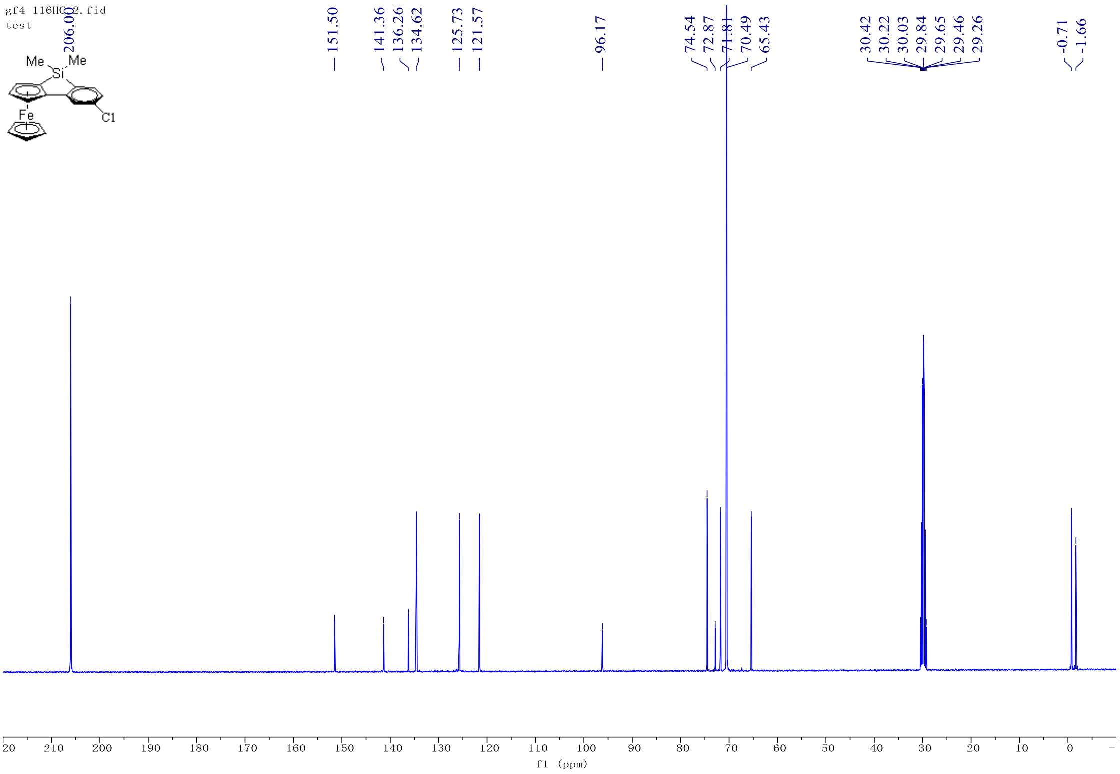
Compound 2d


gf4-135HC.1.fid
H1
Me
Si
Me
Fe
CF3
7.70
7.69
7.68
7.43
7.42
7.41
5.07
5.06
4.63
4.62
4.61
4.48
4.48
4.01
2.06
2.06
2.05
2.04
2.04
0.73
0.32
1.98
1.00
0.99
0.99
0.98
4.87
3.10
3.18
2.0 11.5 11.0 10.5 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 -1
f1 (ppm)

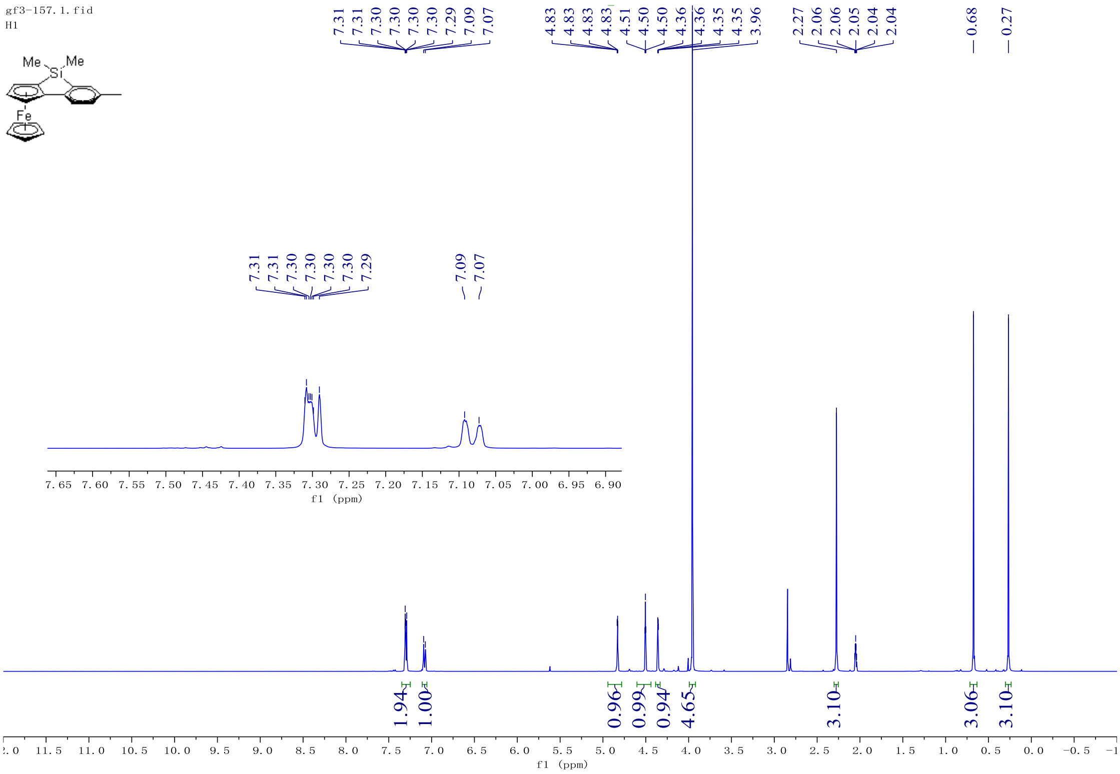

gf4-135HC.2.fid
1D 13C with H decoupling
Me
Si
Me
Fe
CF3
6.05
150.42
148.22
148.20
133.85
132.45
132.14
131.83
131.51
129.67
126.97
124.27
122.34
122.30
122.26
122.22
121.57
117.66
117.62
117.58
117.55
96.09
74.84
72.62
71.99
70.57
65.68
30.42
30.23
30.09
30.03
29.84
29.65
29.46
29.26
-0.90
-1.86
133.85
132.45
132.14
131.83
131.51
129.67
126.97
124.27
122.34
122.30
122.26
122.22
121.57
117.66
117.62
117.58
117.55
138 136 134 132 130 128 126 124 122 120 118 116 114
f1 (ppm)
20 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

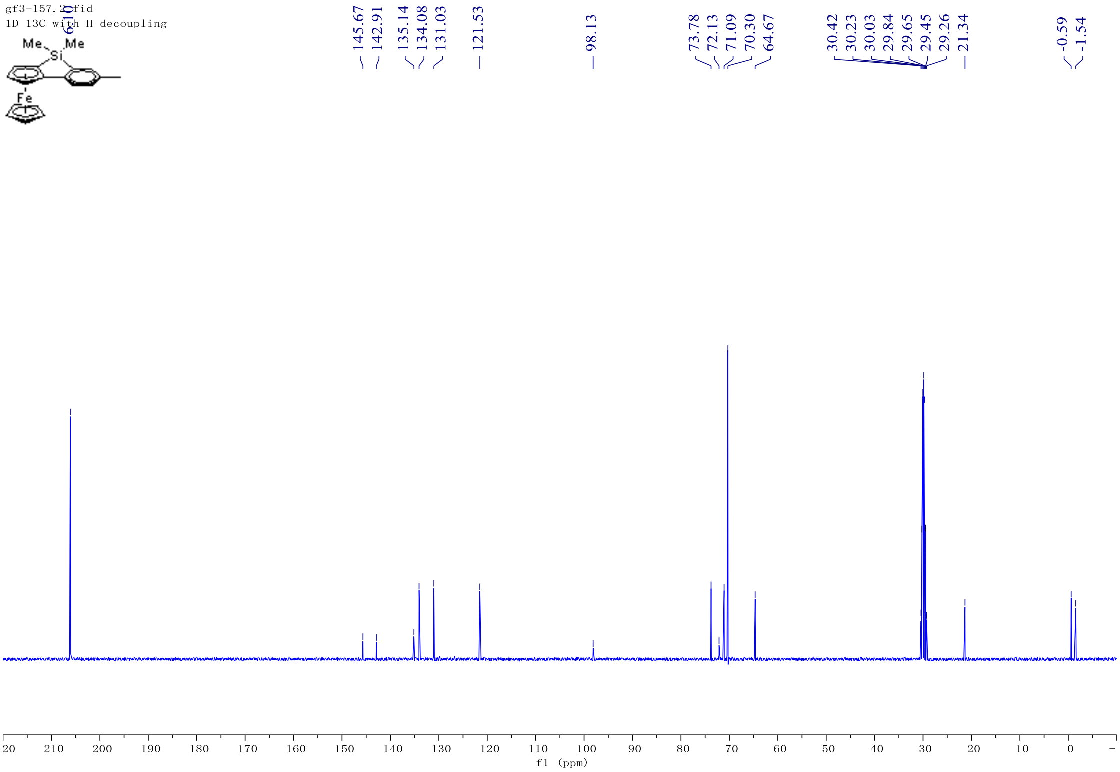
Compound 2e


gf4-116HC.1.fid
test
Me
Me
Si
Fe
Cl
7.48
7.46
7.44
7.43
7.14
7.13
7.12
7.11
4.97
4.96
4.96
4.96
4.58
4.57
4.57
4.44
4.43
4.43
4.43
4.00
2.06
2.06
2.05
2.04
2.04
0.69
0.29
7.60 7.55 7.50 7.45 7.40 7.35 7.30 7.25 7.20 7.15 7.10 7.05 7.00 6.95
f1 (ppm)
1.00
0.96
0.97
0.98
0.97
0.96
4.83
12.0 11.5 11.0 10.5 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 -1
f1 (ppm)

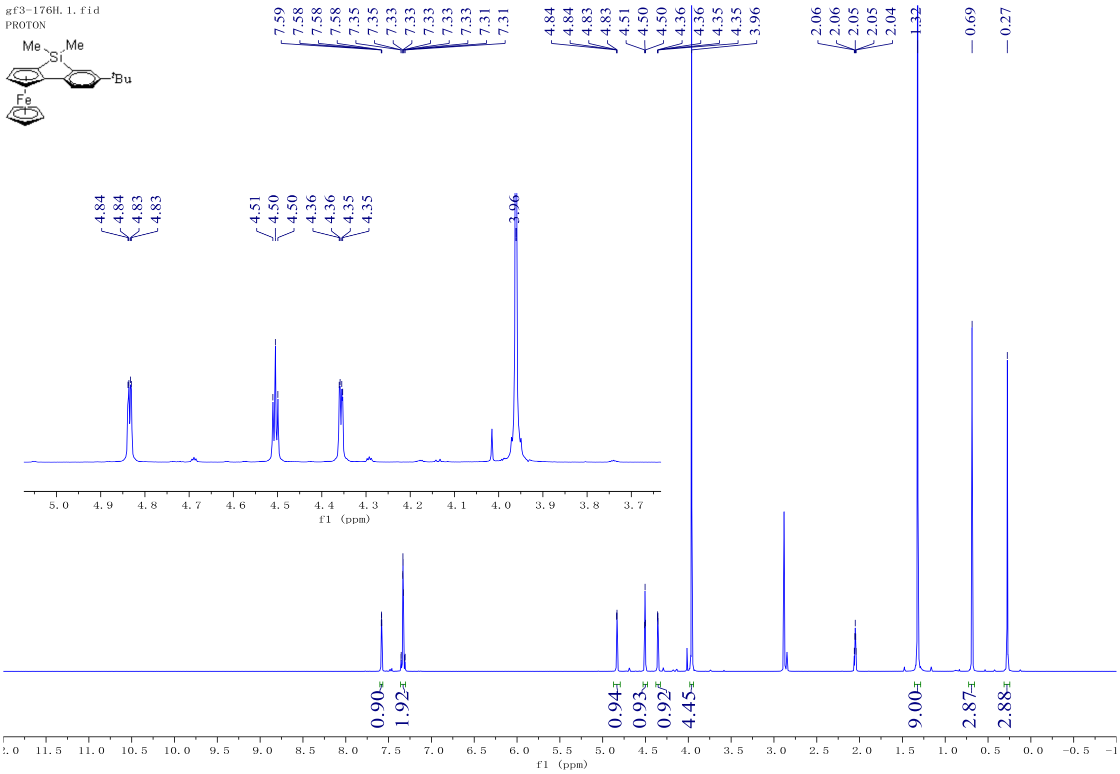

gf4-116HC.2.fid
test
Me
Me
Si
Fe
Cl
206.00
151.50
141.36
136.26
134.62
125.73
121.57
96.17
74.54
72.87
71.81
70.49
65.43
30.42
30.22
30.03
29.84
29.65
29.46
29.26
-0.71
-1.66
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

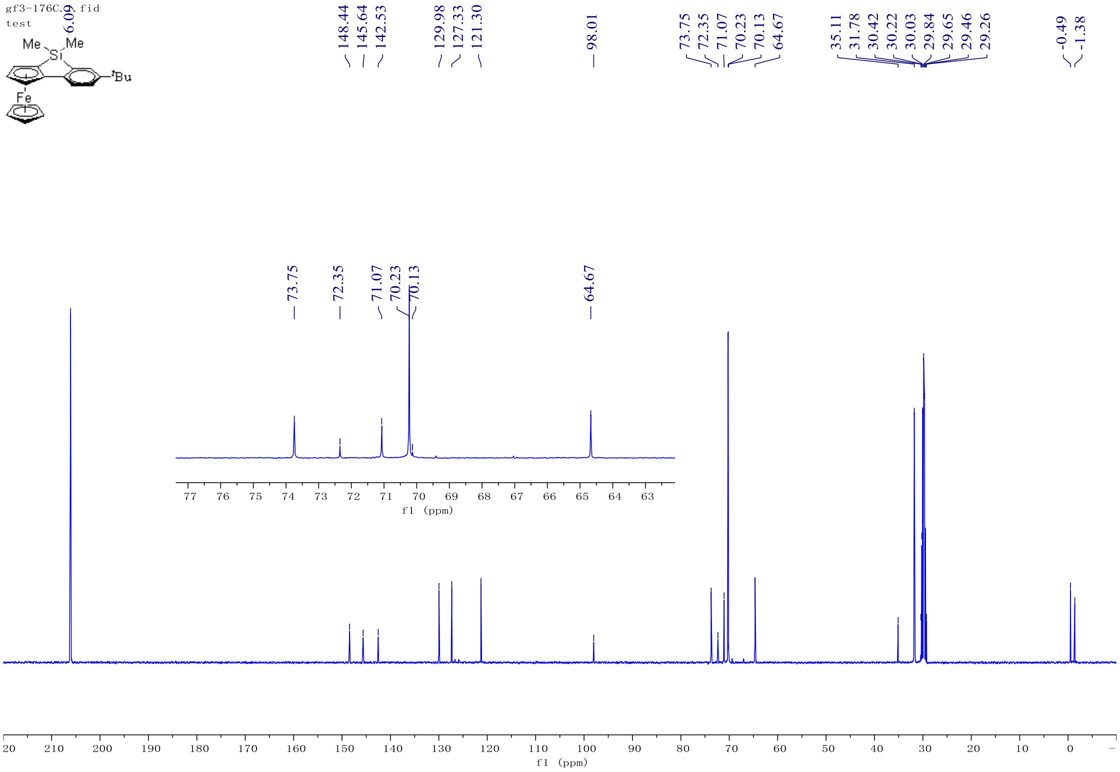
Compound 2f


gf3-157.1.fid
H1
Me
Si
Me
Fe
7.31
7.31
7.30
7.30
7.30
7.30
7.29
7.09
7.07
4.83
4.83
4.83
4.83
4.51
4.50
4.50
4.36
4.36
4.35
4.35
3.96
2.27
2.06
2.06
2.05
2.04
2.04
0.68
0.27
7.31
7.31
7.30
7.30
7.30
7.30
7.29
7.09
7.07
7.65 7.60 7.55 7.50 7.45 7.40 7.35 7.30 7.25 7.20 7.15 7.10 7.05 7.00 6.95 6.90
f1 (ppm)
1.94
1.00
0.96
0.99
0.94
4.65
3.10
3.06
3.10
2.0 11.5 11.0 10.5 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 -1
f1 (ppm)

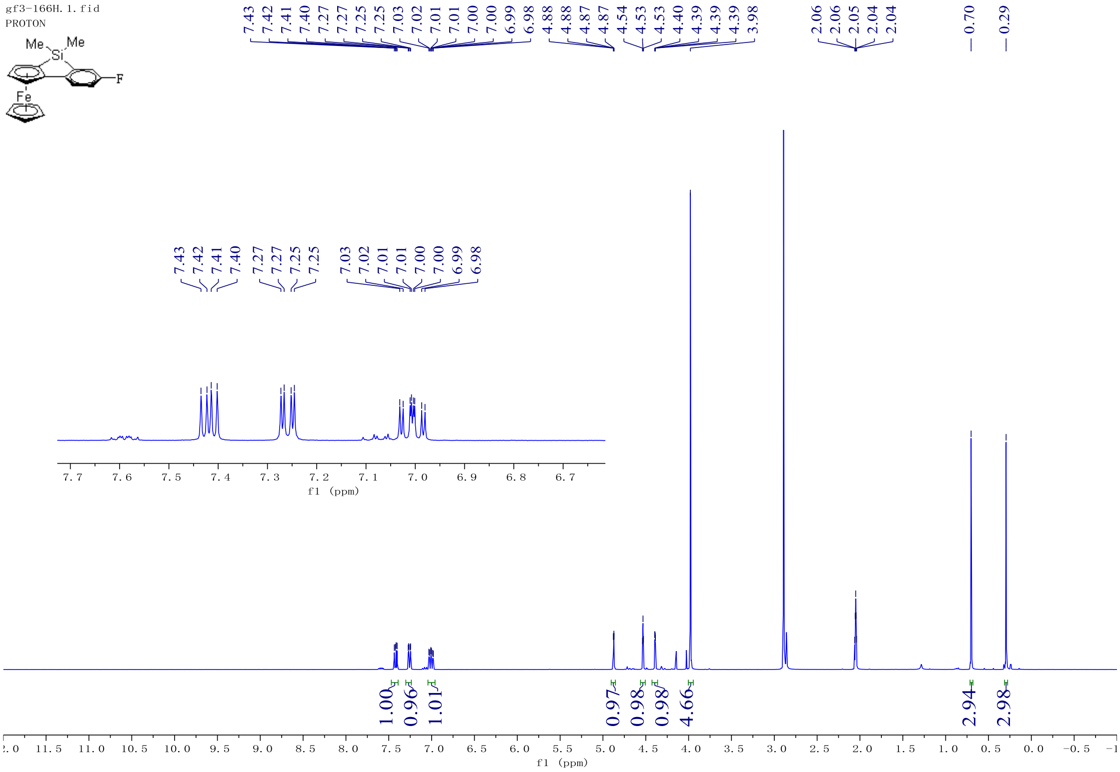

gf3-157.2.fid
1D 13C with H decoupling
6.10
Me
Si
Me
Fe
145.67
142.91
135.14
134.08
131.03
121.53
98.13
73.78
72.13
71.09
70.30
64.67
30.42
30.23
30.03
29.84
29.65
29.45
29.26
21.34
-0.59
-1.54
20 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

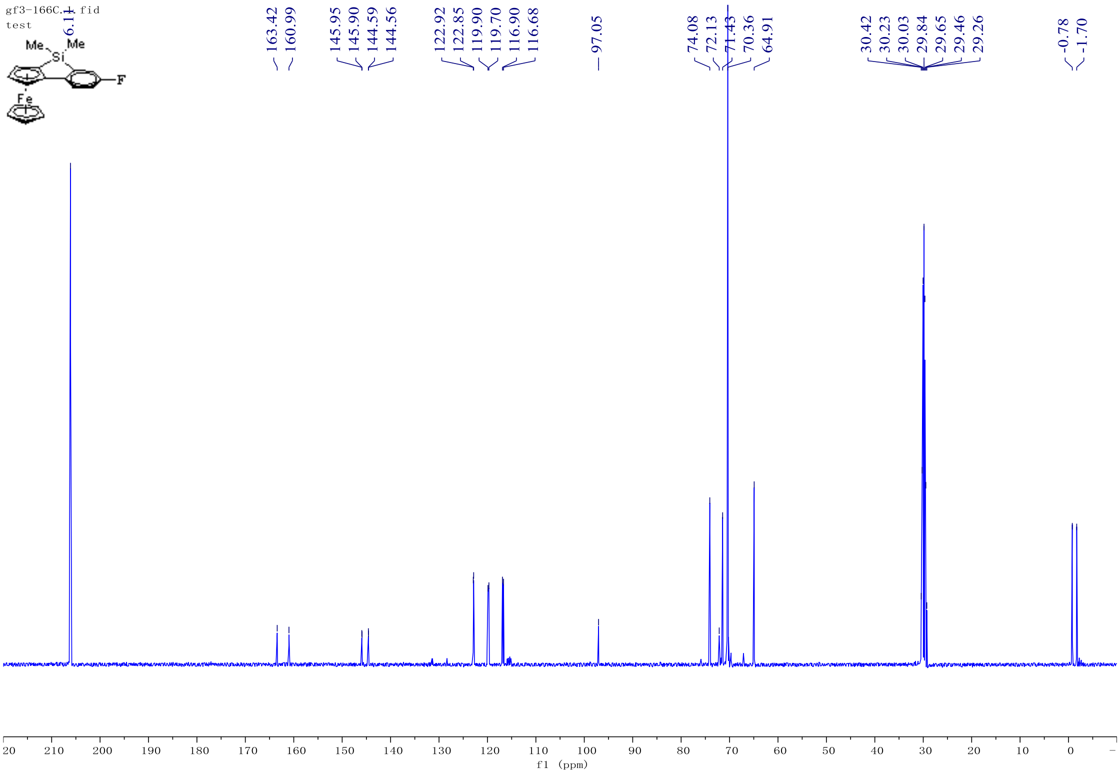
Compound 2g


gf3-176H.1.fid
PROTON
Me
Si
Me
Fe
tBu
7.59
7.58
7.58
7.58
7.35
7.35
7.33
7.33
7.33
7.33
7.33
7.31
7.31
4.84
4.84
4.83
4.83
4.51
4.50
4.50
4.36
4.36
4.35
4.35
3.96
2.06
2.06
2.05
2.05
2.04
1.32
0.69
0.27
4.84
4.84
4.83
4.83
4.51
4.50
4.50
4.36
4.36
4.35
4.35
3.96
5.0
4.9
4.8
4.7
4.6
4.5
4.4
4.3
4.2
4.1
4.0
3.9
3.8
3.7
f1 (ppm)
0.90
1.92
0.94
0.93
0.92
4.45
9.00
2.87
2.88
12.0
11.5
11.0
10.5
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
-1
f1 (ppm)

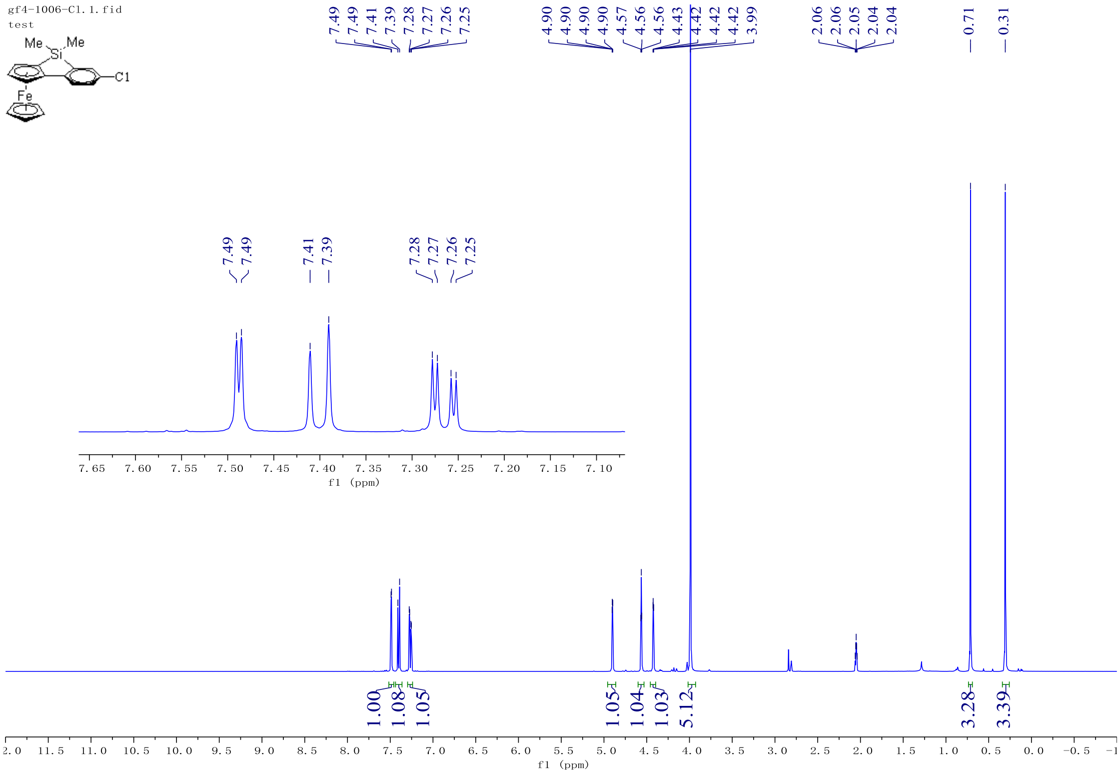

gf3-176C.2.fid
test
206.09
Me
Si
Me
Fe
tBu
148.44
145.64
142.53
129.98
127.33
121.30
98.01
73.75
72.35
71.07
70.23
70.13
64.67
35.11
31.78
30.42
30.22
30.03
29.84
29.65
29.46
29.26
-0.49
-1.38
73.75
72.35
71.07
70.23
70.13
64.67
77
76
75
74
73
72
71
70
69
68
67
66
65
64
63
f1 (ppm)
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

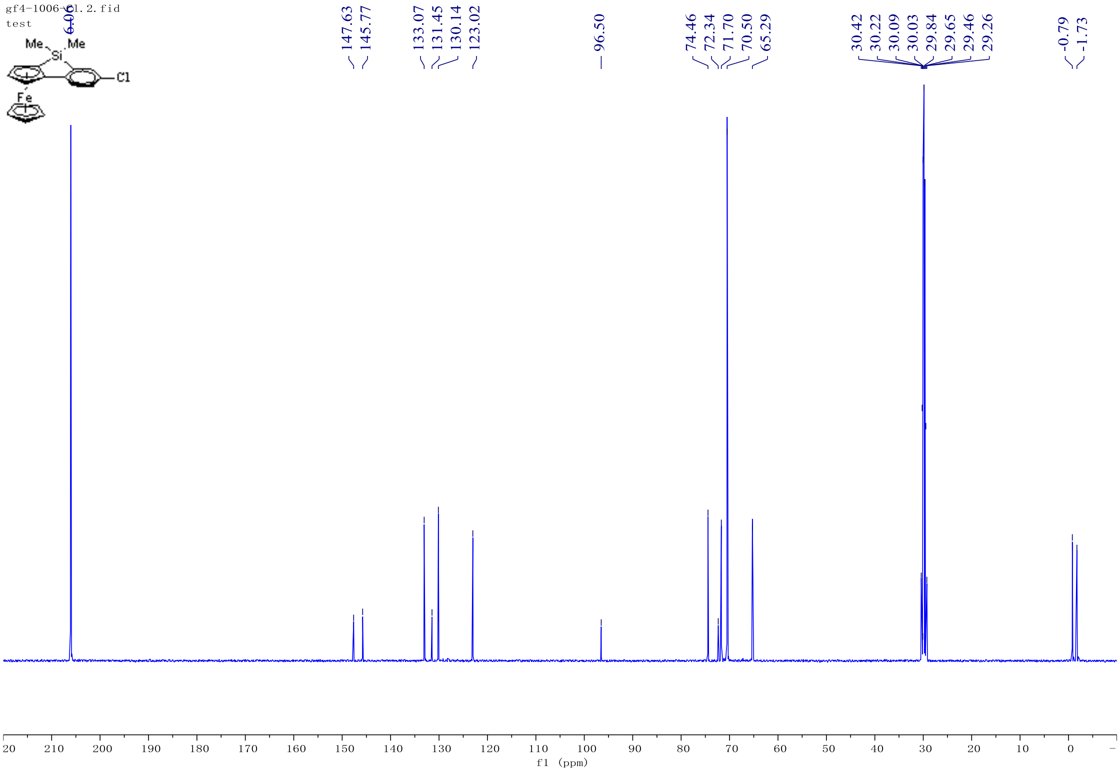
Compound 2h


gf3-166H.1.fid
PROTON
Me
Me
Si
Fe
F
7.43
7.42
7.41
7.40
7.27
7.27
7.25
7.25
7.03
7.02
7.01
7.01
7.00
7.00
6.99
6.98
4.88
4.88
4.87
4.87
4.54
4.53
4.53
4.40
4.39
4.39
4.39
3.98
2.06
2.06
2.05
2.04
2.04
0.70
0.29
1.00
0.96
1.01
0.97
0.98
0.98
4.66
2.94
2.98
f1 (ppm)

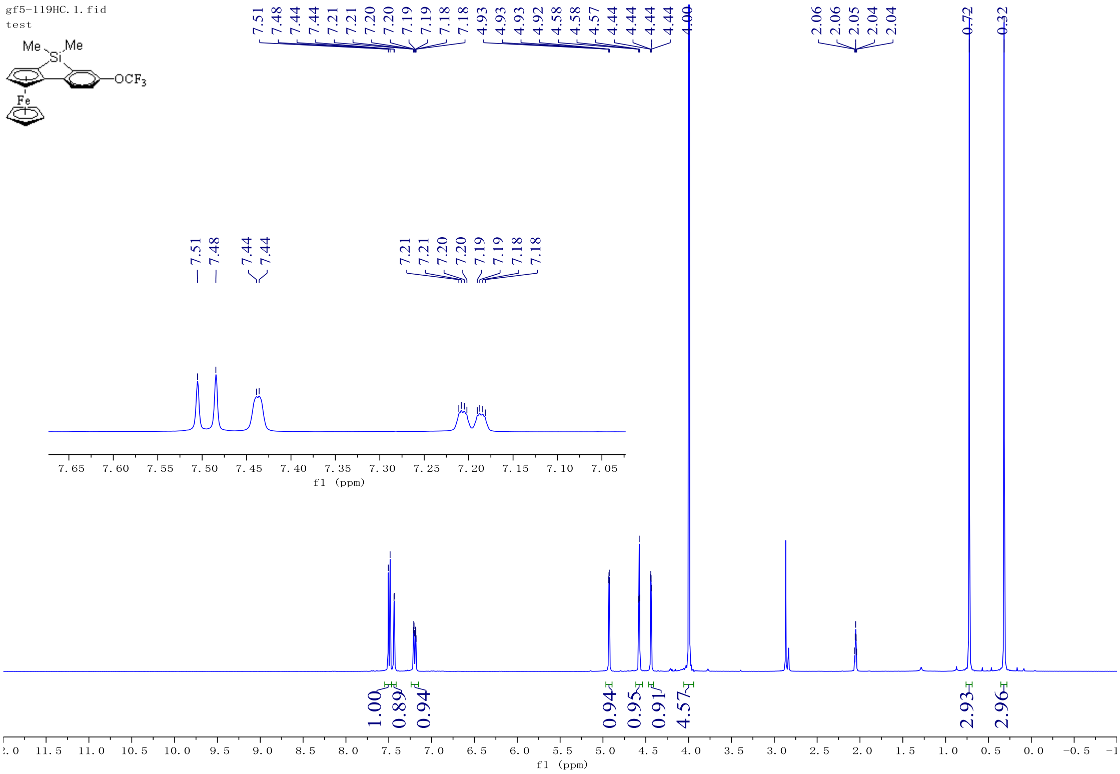

gf3-166C.1.fid
test
Me
Me
Si
Fe
F
6.1
163.42
160.99
145.95
145.90
144.59
144.56
122.92
122.85
119.90
119.70
116.90
116.68
97.05
74.08
72.13
71.43
70.36
64.91
30.42
30.23
30.03
29.84
29.65
29.46
29.26
-0.78
-1.70
f1 (ppm)

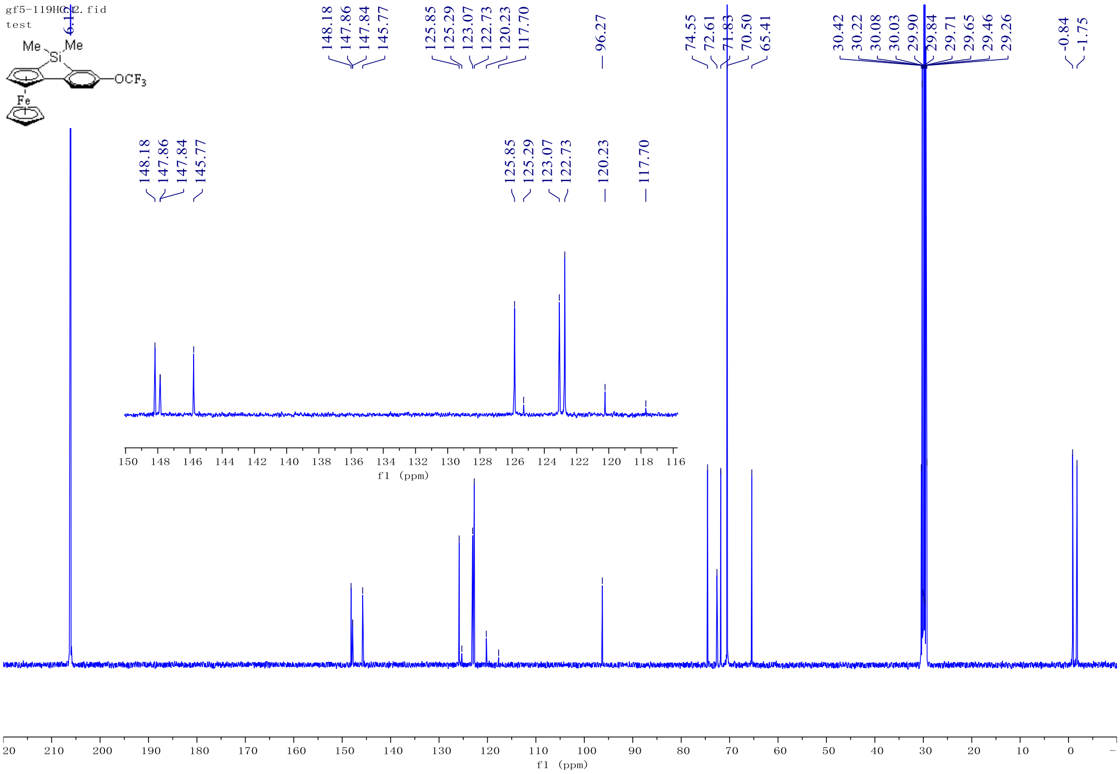
Compound 2i


gf4-1006-Cl.1.fid
test
Me
Si
Me
Fe
Cl
7.49 7.49 7.41 7.39 7.28 7.27 7.26 7.25
4.90 4.90 4.90 4.90 4.57 4.56 4.56 4.43 4.42 4.42 4.42 3.99
2.06 2.06 2.05 2.04 2.04
0.71
0.31
7.65 7.60 7.55 7.50 7.45 7.40 7.35 7.30 7.25 7.20 7.15 7.10
f1 (ppm)
1.00 1.08 1.05 1.05 1.04 1.03 5.12 3.28 3.39
12.0 11.5 11.0 10.5 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 -1
f1 (ppm)

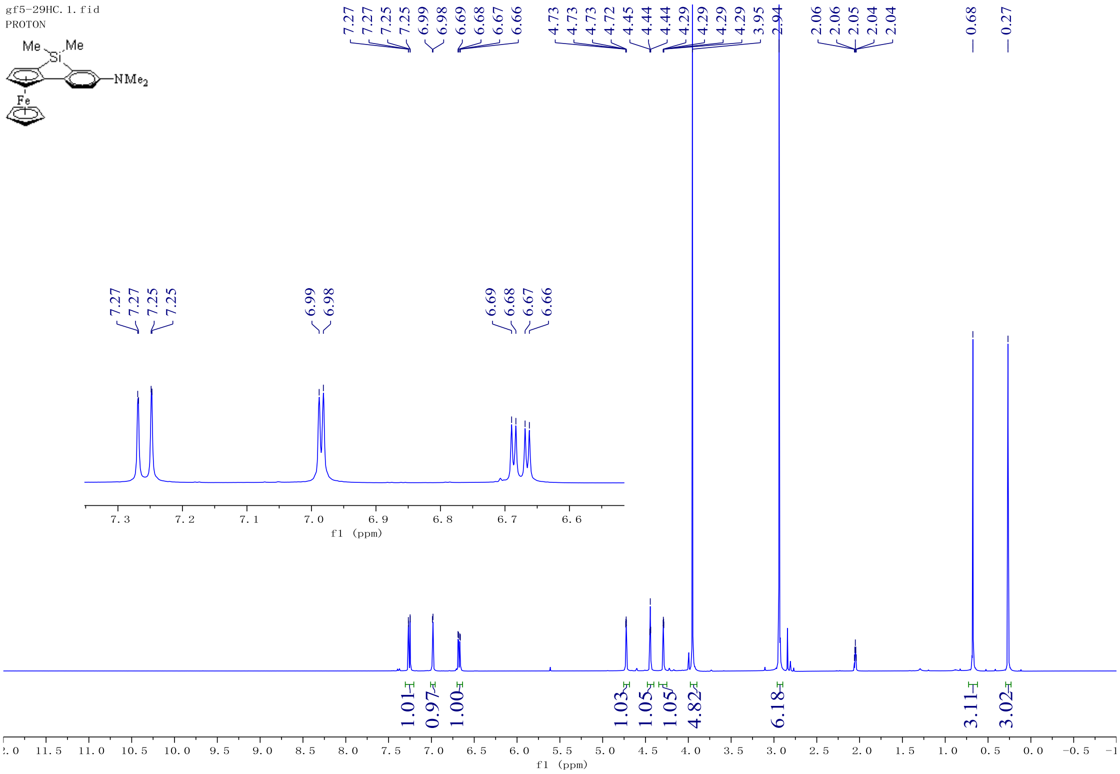

gf4-1006-Cl.2.fid
test
Me
Si
Me
Fe
Cl
206.06
147.63 145.77
133.07 131.45 130.14 123.02
96.50
74.46 72.34 71.70 70.50 65.29
30.42 30.22 30.09 30.03 29.84 29.65 29.46 29.26
-0.79 -1.73
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

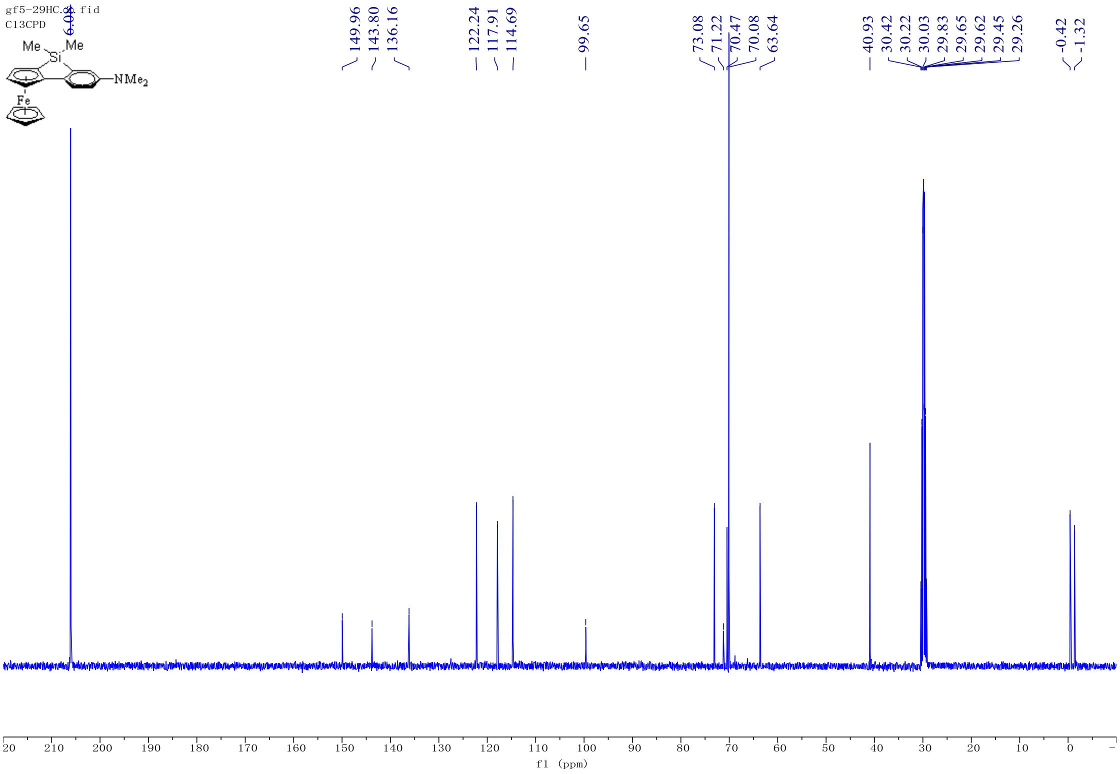
Compound 2j


gf5-119HC.1.fid
test
Me
Me
Si
OCF3
Fe
7.51 7.48 7.44 7.44 7.21 7.21 7.20 7.20 7.19 7.19 7.18 7.18 4.93 4.93 4.93 4.92 4.58 4.58 4.57 4.44 4.44 4.44 4.44 4.00
2.06 2.06 2.05 2.04 2.04
0.72
0.32
7.51
7.48
7.44 7.44
7.21 7.21 7.20 7.20 7.19 7.19 7.18 7.18
7.65 7.60 7.55 7.50 7.45 7.40 7.35 7.30 7.25 7.20 7.15 7.10 7.05
f1 (ppm)
1.00
0.89
0.94
0.94
0.95
0.91
4.57
2.93
2.96
12.0 11.5 11.0 10.5 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 -1
f1 (ppm)

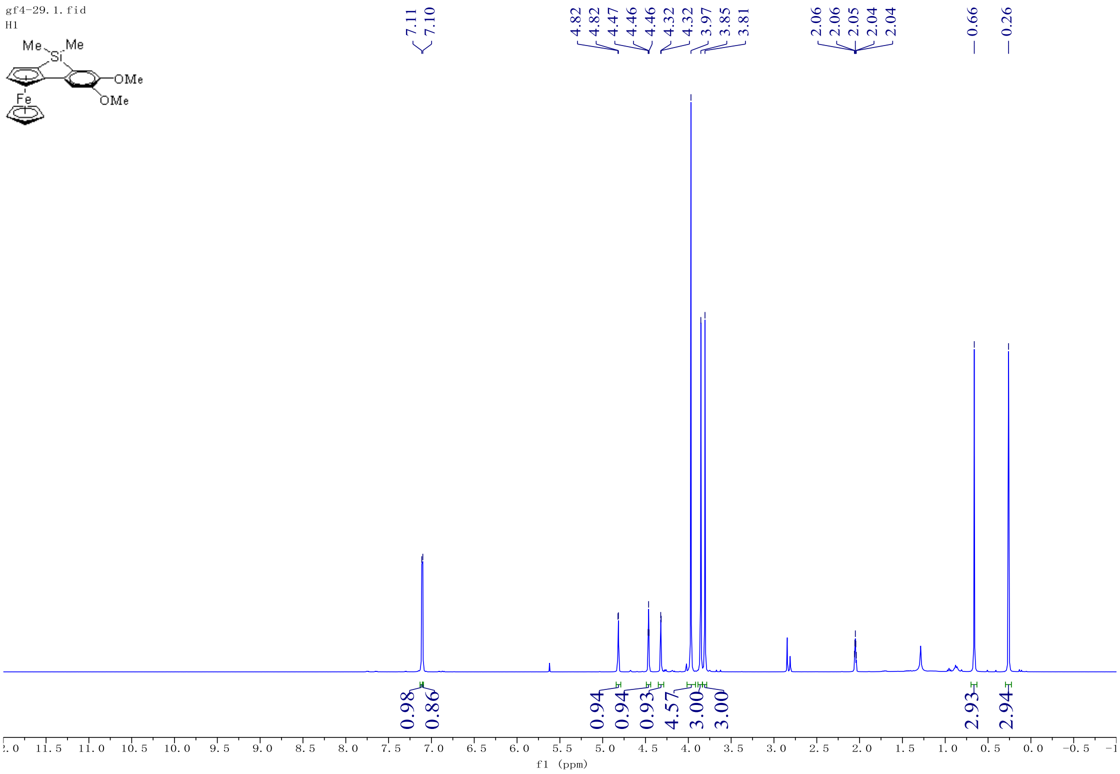

gf5-119HC.2.fid
test
206.12
Me
Me
Si
OCF3
Fe
148.18 147.86 147.84 145.77
125.85 125.29 123.07 122.73 120.23 117.70
96.27
74.55 72.61 71.83 70.50 65.41
30.42 30.22 30.08 30.03 29.90 29.84 29.71 29.65 29.46 29.26
-0.84 -1.75
148.18 147.86 147.84 145.77
125.85 125.29 123.07 122.73
120.23
117.70
150 148 146 144 142 140 138 136 134 132 130 128 126 124 122 120 118 116
f1 (ppm)
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

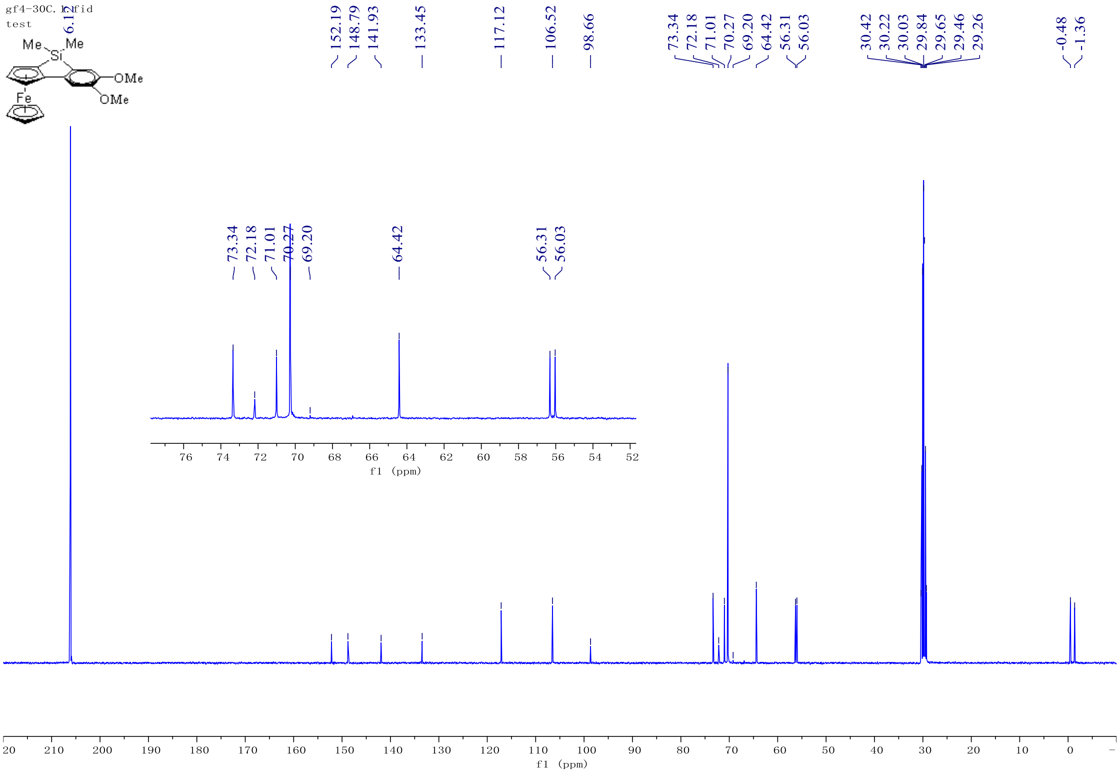
Compound 2k


gf5-29HC.1.fid
PROTON
Me
Me
Si
NMe2
Fe
7.27
7.27
7.25
7.25
6.99
6.98
6.69
6.68
6.67
6.66
4.73
4.73
4.73
4.72
4.45
4.44
4.44
4.29
4.29
4.29
4.29
3.95
2.94
2.06
2.06
2.05
2.04
2.04
0.68
0.27
1.01
0.97
1.00
1.03
1.05
1.05
4.82
6.18
3.11
3.02
7.3
7.2
7.1
7.0
6.9
6.8
6.7
6.6
f1 (ppm)
2.0
11.5
11.0
10.5
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
-1
f1 (ppm)

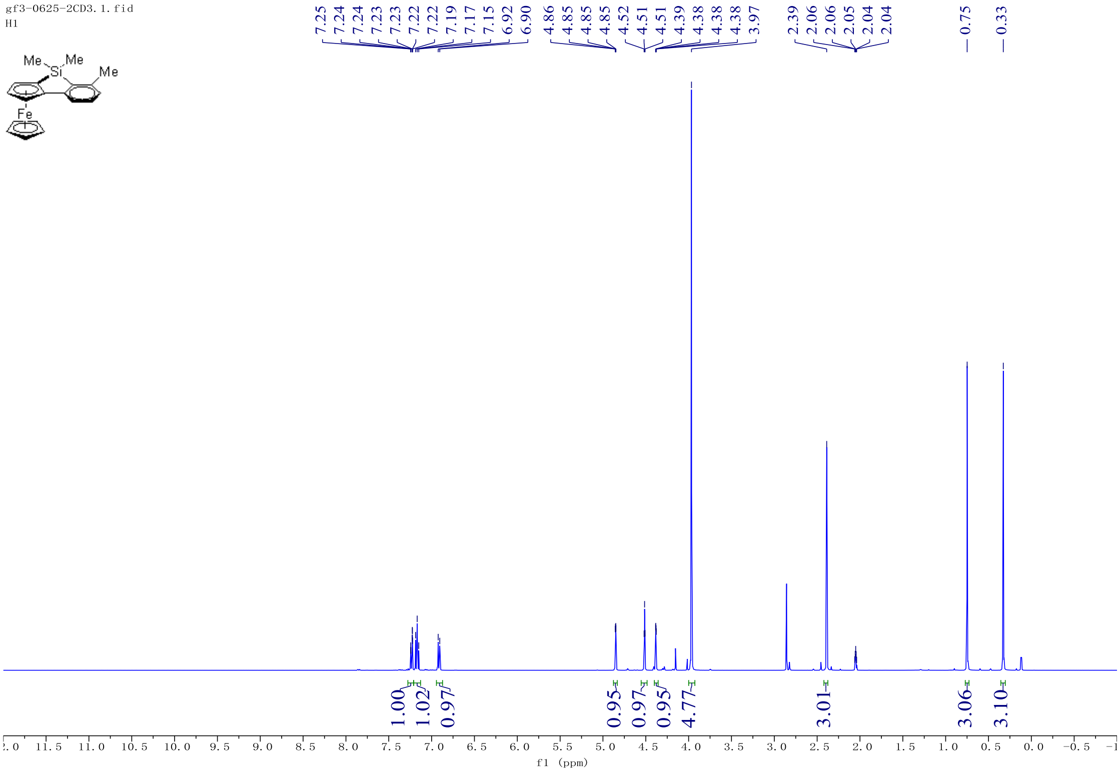

gf5-29HC.2.fid
C13CPD
6.08
Me
Me
Si
NMe2
Fe
149.96
143.80
136.16
122.24
117.91
114.69
99.65
73.08
71.22
70.47
70.08
63.64
40.93
30.42
30.22
30.03
29.83
29.65
29.62
29.45
29.26
-0.42
-1.32
20
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

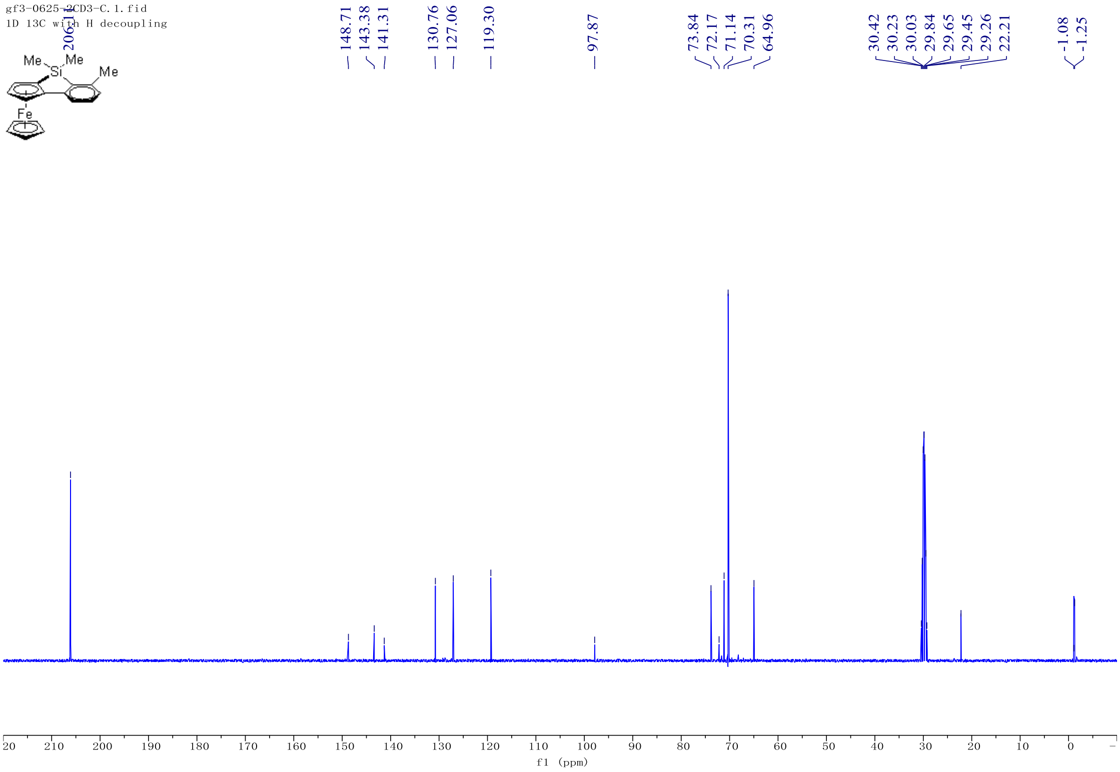
Compound 2l


gf4-29.1.fid
H1
Me
Me
Si
OMe
OMe
Fe
7.11
7.10
4.82
4.82
4.47
4.46
4.46
4.32
4.32
3.97
3.85
3.81
2.06
2.06
2.05
2.04
2.04
0.66
0.26
0.98
0.86
0.94
0.94
0.93
4.57
3.00
3.00
2.93
2.94
.0
11.5
11.0
10.5
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
-1
f1 (ppm)

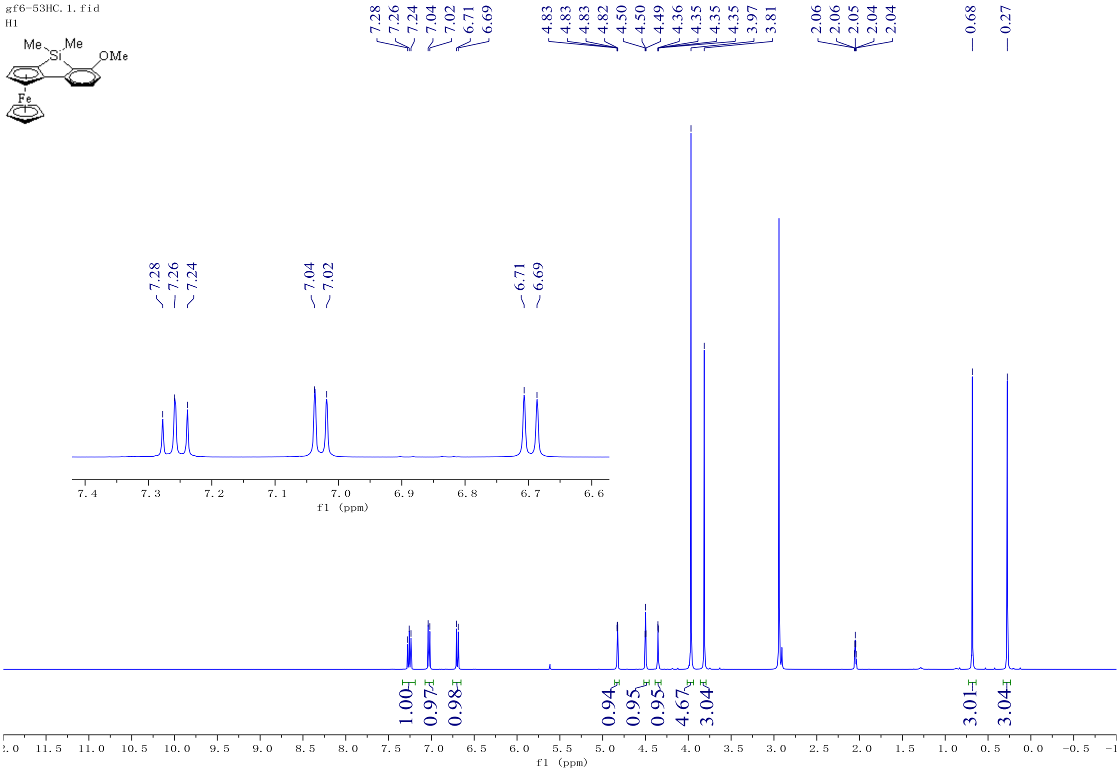

gf4-30C.1.fid
test
6.12
Me
Me
Si
OMe
OMe
Fe
152.19
148.79
141.93
133.45
117.12
106.52
98.66
73.34
72.18
71.01
70.27
69.20
64.42
56.31
56.03
30.42
30.22
30.03
29.84
29.65
29.46
29.26
-0.48
-1.36
73.34
72.18
71.01
70.27
69.20
64.42
56.31
56.03
76
74
72
70
68
66
64
62
60
58
56
54
52
f1 (ppm)
20
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

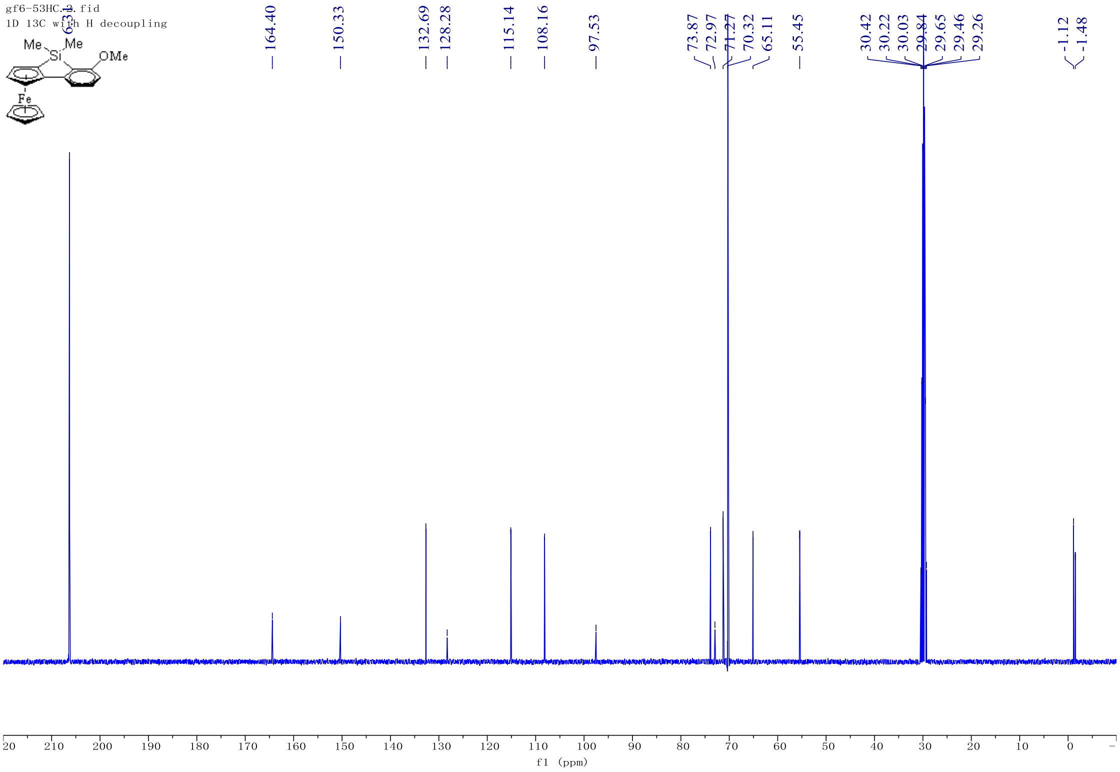
Compound 2m


gf3-0625-2CD3.1.fid
H1
Me
Me
Si
Me
Fe
7.25
7.24
7.24
7.23
7.23
7.22
7.22
7.19
7.17
7.15
6.92
6.90
4.86
4.85
4.85
4.85
4.52
4.51
4.51
4.39
4.38
4.38
4.38
3.97
2.39
2.06
2.06
2.05
2.04
2.04
0.75
0.33
1.00
1.02
0.97
0.95
0.97
0.95
4.77
3.01
3.06
3.10
12.0
11.5
11.0
10.5
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
-1
f1 (ppm)

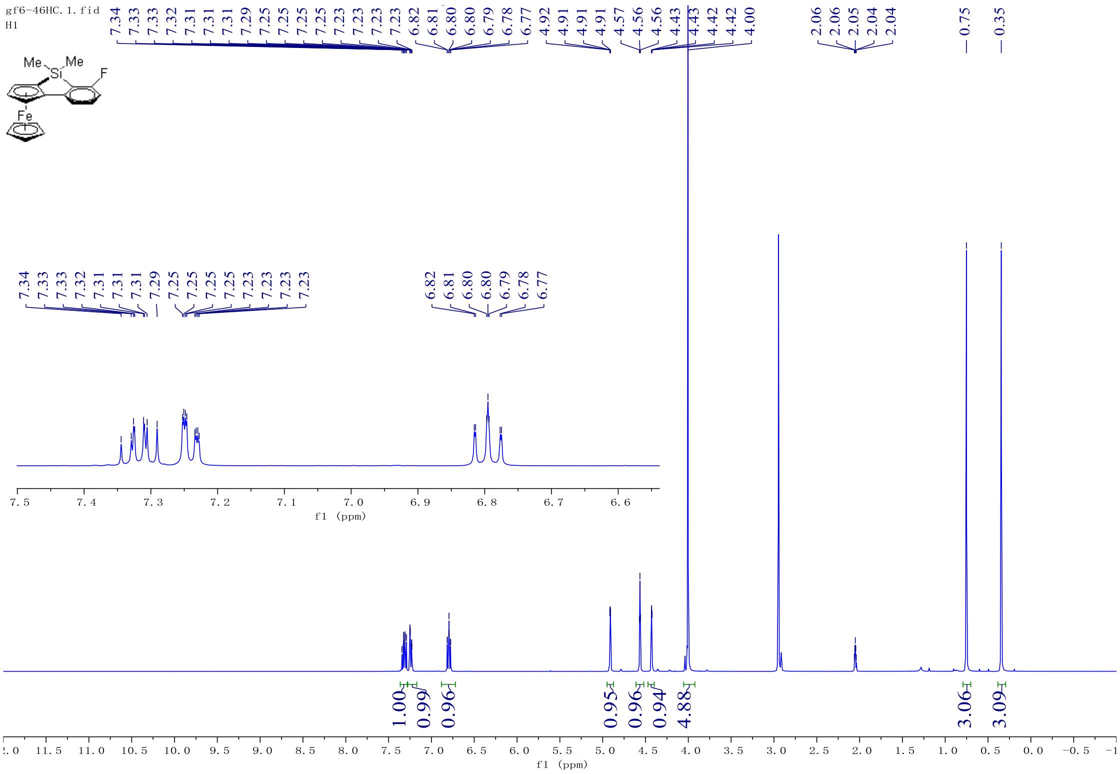

gf3-0625-2CD3-C.1.fid
1D 13C with H decoupling
Me
Me
Si
Me
Fe
206.11
148.71
143.38
141.31
130.76
127.06
119.30
97.87
73.84
72.17
71.14
70.31
64.96
30.42
30.23
30.03
29.84
29.65
29.45
29.26
22.21
-1.08
-1.25
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

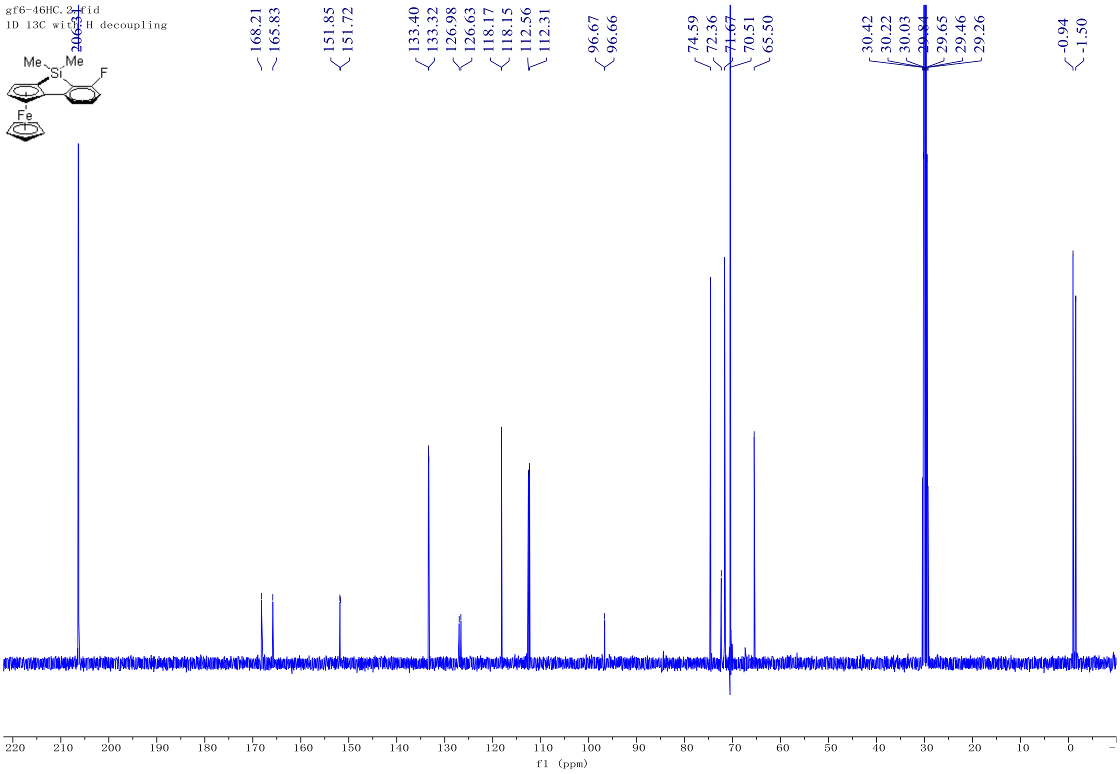
Compound 2n


gf6-53HC.1.fid
H1
Me
Si
Me
OMe
Fe
7.28
7.26
7.24
7.04
7.02
6.71
6.69
4.83
4.83
4.83
4.82
4.50
4.50
4.49
4.36
4.35
4.35
4.35
3.97
3.81
2.06
2.06
2.05
2.04
2.04
0.68
0.27
1.00
0.97
0.98
0.94
0.95
0.95
4.67
3.04
3.01
3.04
f1 (ppm)

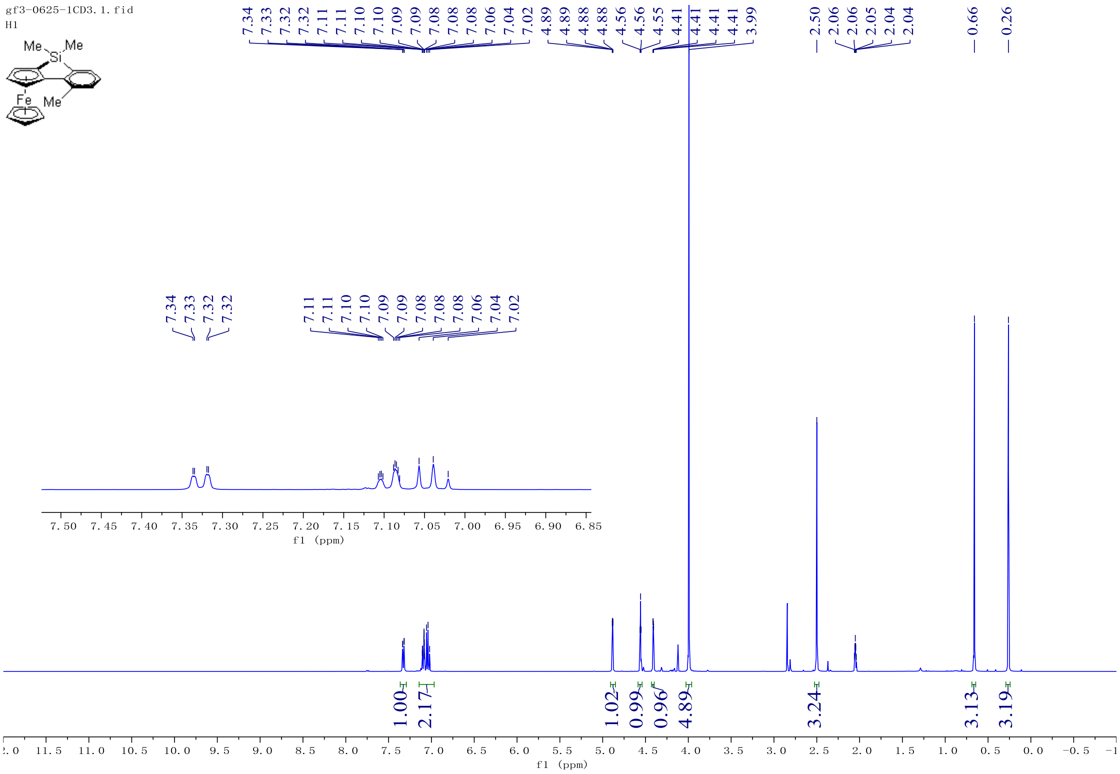

gf6-53HC.2.fid
1D 13C with H decoupling
Me
Si
Me
OMe
Fe
164.40
150.33
132.69
128.28
115.14
108.16
97.53
73.87
72.97
71.27
70.32
65.11
55.45
30.42
30.22
30.03
29.84
29.65
29.46
29.26
-1.12
-1.48
f1 (ppm)

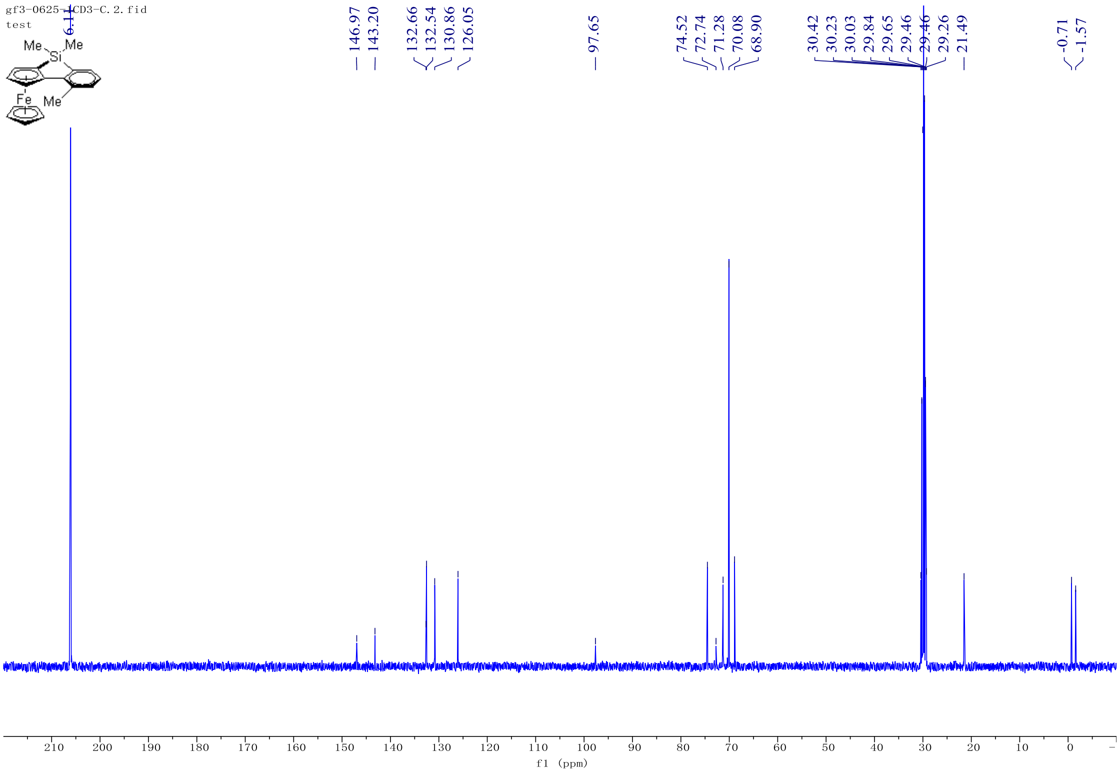
Compound 2o


gf6-46HC.1.fid
H1
7.34 7.33 7.33 7.32 7.31 7.31 7.31 7.29 7.25 7.25 7.25 7.25 7.23 7.23 7.23 7.23 6.82 6.81 6.80 6.80 6.79 6.78 6.77 4.92 4.91 4.91 4.91 4.57 4.56 4.56 4.43 4.43 4.42 4.42 4.00 2.06 2.06 2.05 2.04 2.04 0.75 0.35
Me
Me
Si
F
Fe
1.00
0.99
0.96
0.95
0.96
0.94
4.88
3.06
3.09
f1 (ppm)

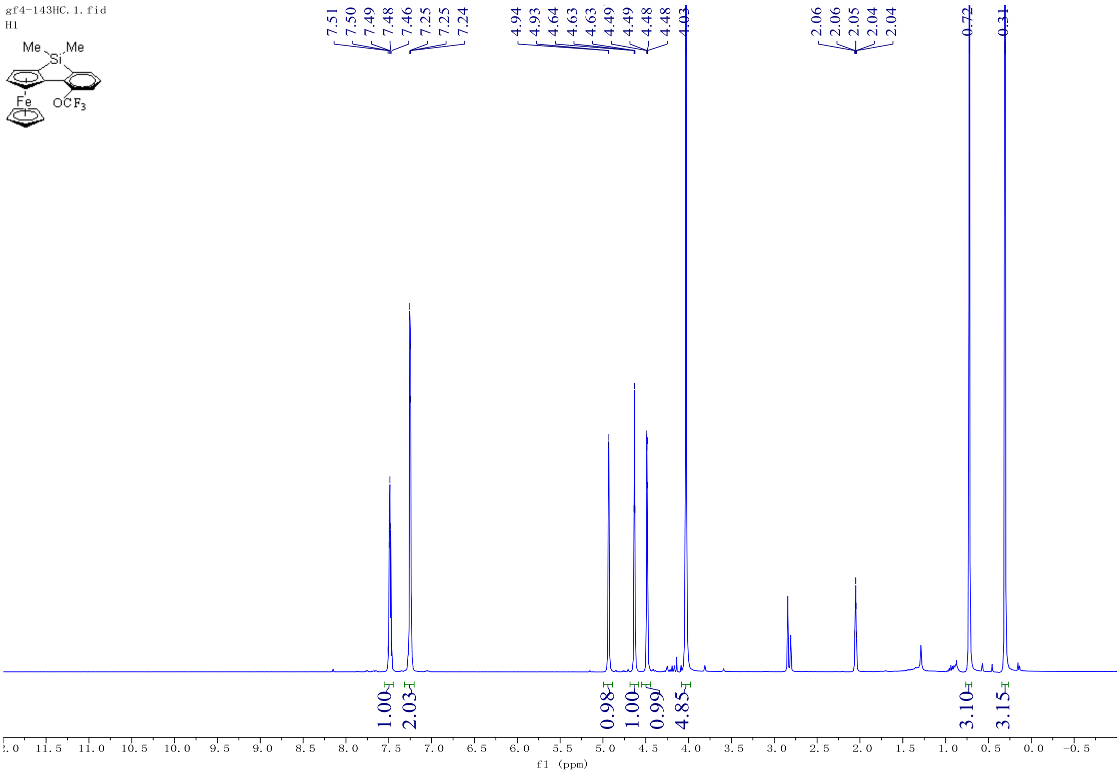

gf6-46HC.2.fid
1D 13C with H decoupling
206.31 168.21 165.83 151.85 151.72 133.40 133.32 126.98 126.63 118.17 118.15 112.56 112.31 96.67 96.66 74.59 72.36 71.67 70.51 65.50 30.42 30.22 30.03 29.84 29.65 29.46 29.26 -0.94 -1.50
Me
Me
Si
F
Fe
f1 (ppm)

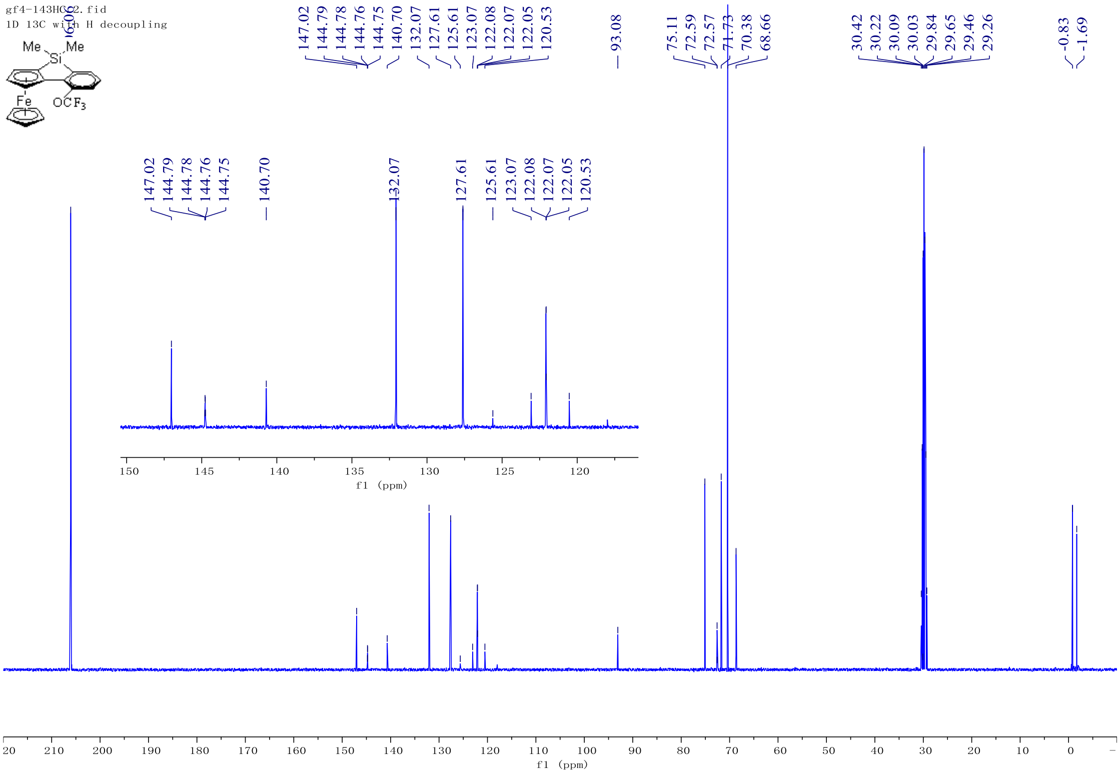
Compound 2p


gf3-0625-1CD3.1.fid
H1
Me
Si
Me
Fe
Me
7.34
7.33
7.32
7.32
7.11
7.11
7.10
7.10
7.09
7.09
7.08
7.08
7.08
7.06
7.04
7.02
4.89
4.89
4.88
4.88
4.56
4.56
4.55
4.41
4.41
4.41
4.41
3.99
2.50
2.06
2.06
2.05
2.04
2.04
0.66
0.26
7.50 7.45 7.40 7.35 7.30 7.25 7.20 7.15 7.10 7.05 7.00 6.95 6.90 6.85
f1 (ppm)
1.00
2.17
1.02
0.99
0.96
4.89
3.24
3.13
3.19
2.0 11.5 11.0 10.5 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 -1
f1 (ppm)

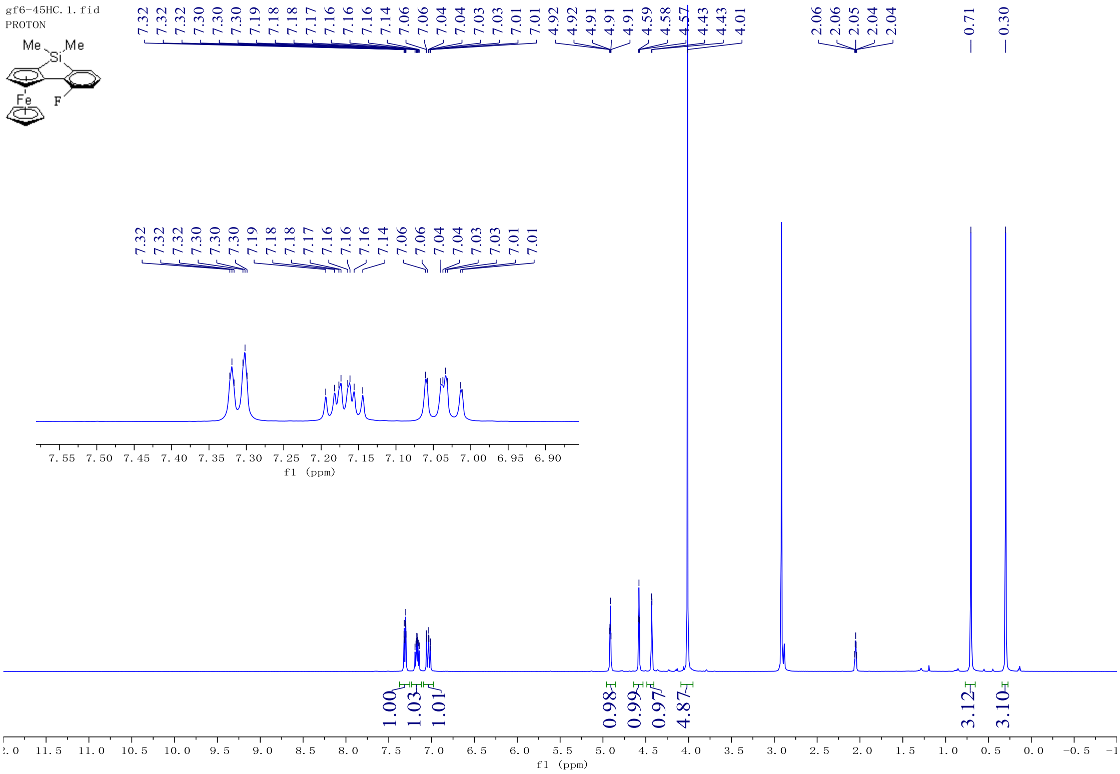

gf3-0625-1CD3-C.2.fid
test
Me
Si
Me
Fe
Me
6.11
146.97
143.20
132.66
132.54
130.86
126.05
97.65
74.52
72.74
71.28
70.08
68.90
30.42
30.23
30.03
29.84
29.65
29.46
29.46
29.26
21.49
-0.71
-1.57
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

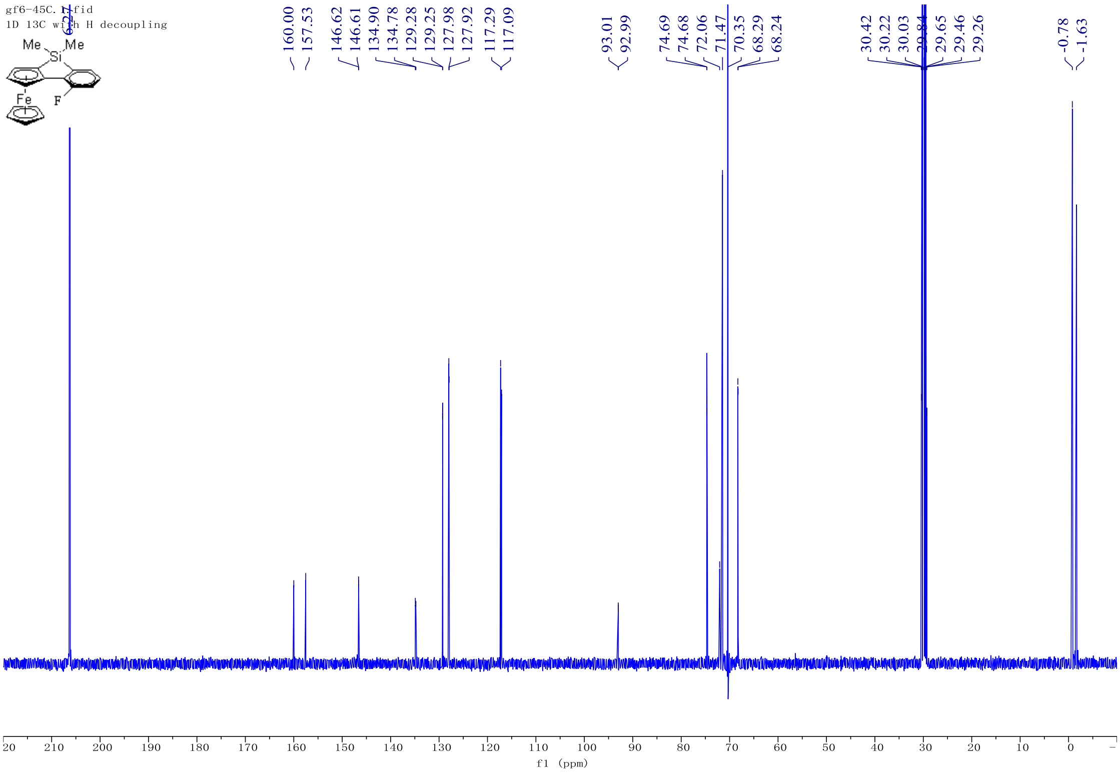
Compound 2q


gf4-143HC.1.fid
H1
Me
Si
Me
Fe
OCF3
7.51
7.50
7.49
7.48
7.46
7.25
7.25
7.24
4.94
4.93
4.64
4.63
4.63
4.49
4.49
4.48
4.48
4.03
2.06
2.06
2.05
2.04
2.04
0.72
0.31
1.00
2.03
0.98
1.00
0.99
4.85
3.10
3.15
2.0
11.5
11.0
10.5
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)

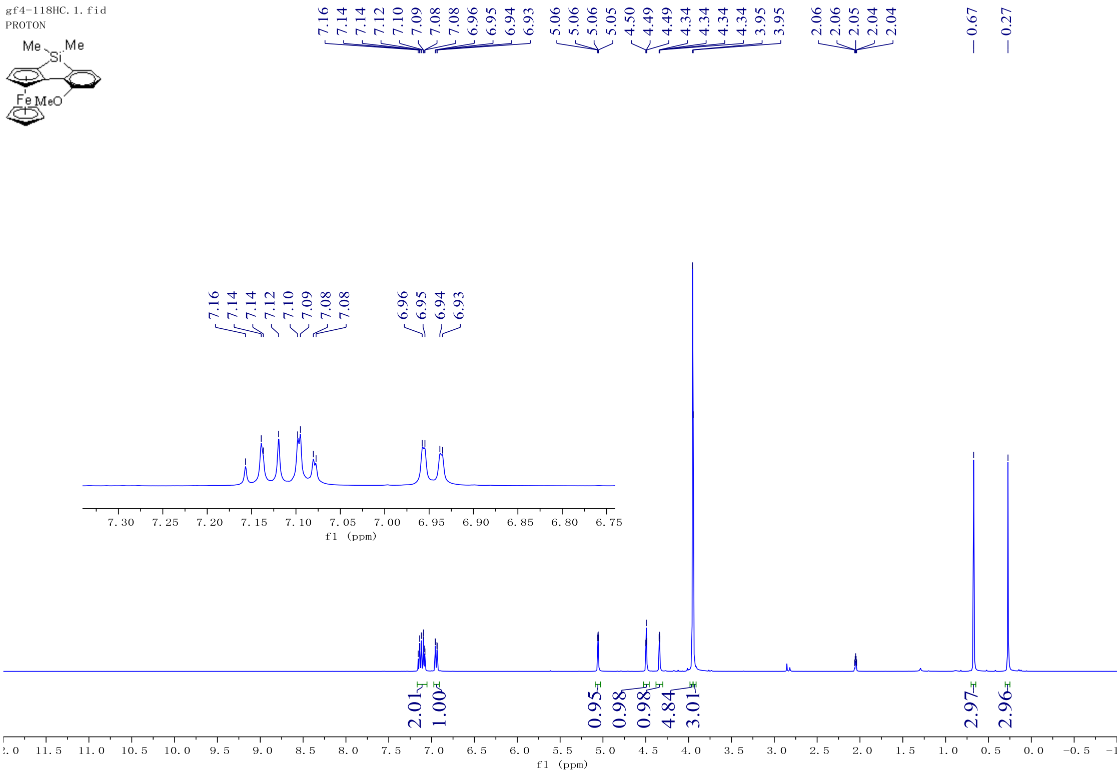

gf4-143HC.2.fid
1D 13C with H decoupling
6.06
Me
Si
Me
Fe
OCF3
147.02
144.79
144.78
144.76
144.75
140.70
132.07
127.61
125.61
123.07
122.08
122.07
122.05
120.53
93.08
75.11
72.59
72.57
71.73
70.38
68.66
30.42
30.22
30.09
30.03
29.84
29.65
29.46
29.26
-0.83
-1.69
147.02
144.79
144.78
144.76
144.75
140.70
132.07
127.61
125.61
123.07
122.08
122.07
122.05
120.53
150
145
140
135
130
125
120
f1 (ppm)
20
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

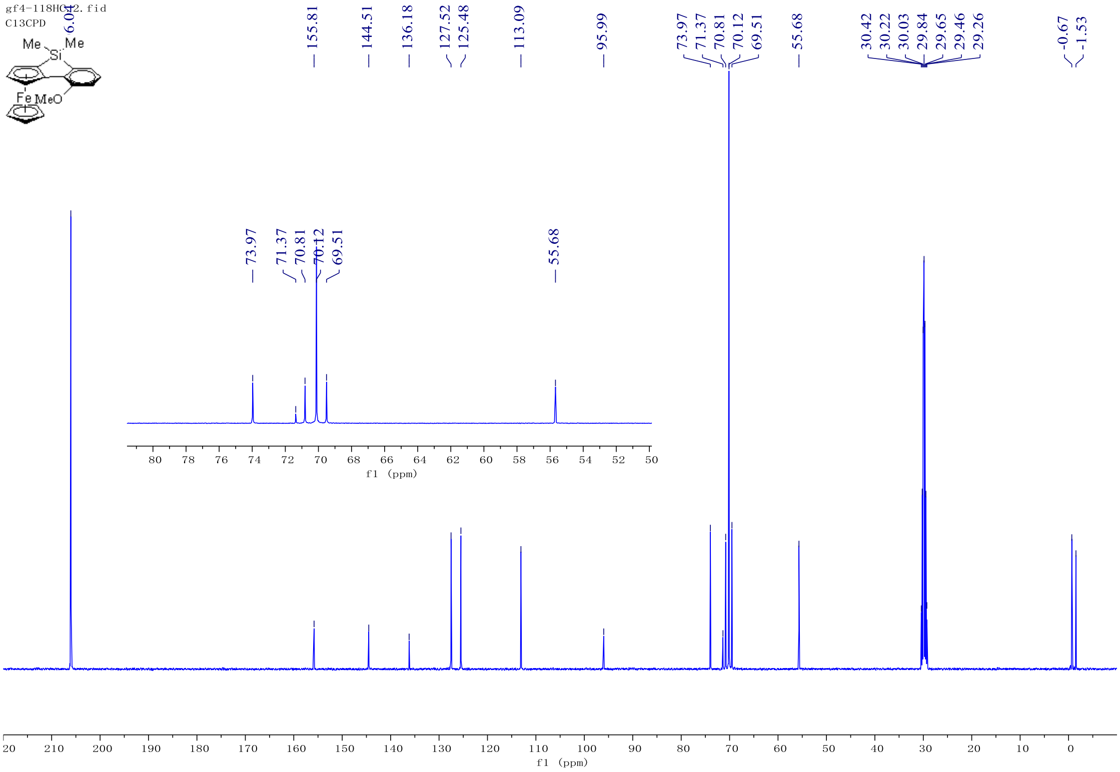
Compound 2r


gf6-45HC.1.fid
PROTON
Me
Me
Si
Fe
F
7.32 7.32 7.32 7.30 7.30 7.30 7.19 7.18 7.18 7.17 7.16 7.16 7.16 7.14 7.06 7.06 7.04 7.04 7.03 7.03 7.01 7.01
4.92 4.92 4.91 4.91 4.91 4.59 4.58 4.57 4.43 4.43 4.01
2.06 2.06 2.05 2.04 2.04
0.71
0.30
1.00 1.03 1.01 0.98 0.99 0.97 4.87 3.12 3.10
7.55 7.50 7.45 7.40 7.35 7.30 7.25 7.20 7.15 7.10 7.05 7.00 6.95 6.90
f1 (ppm)

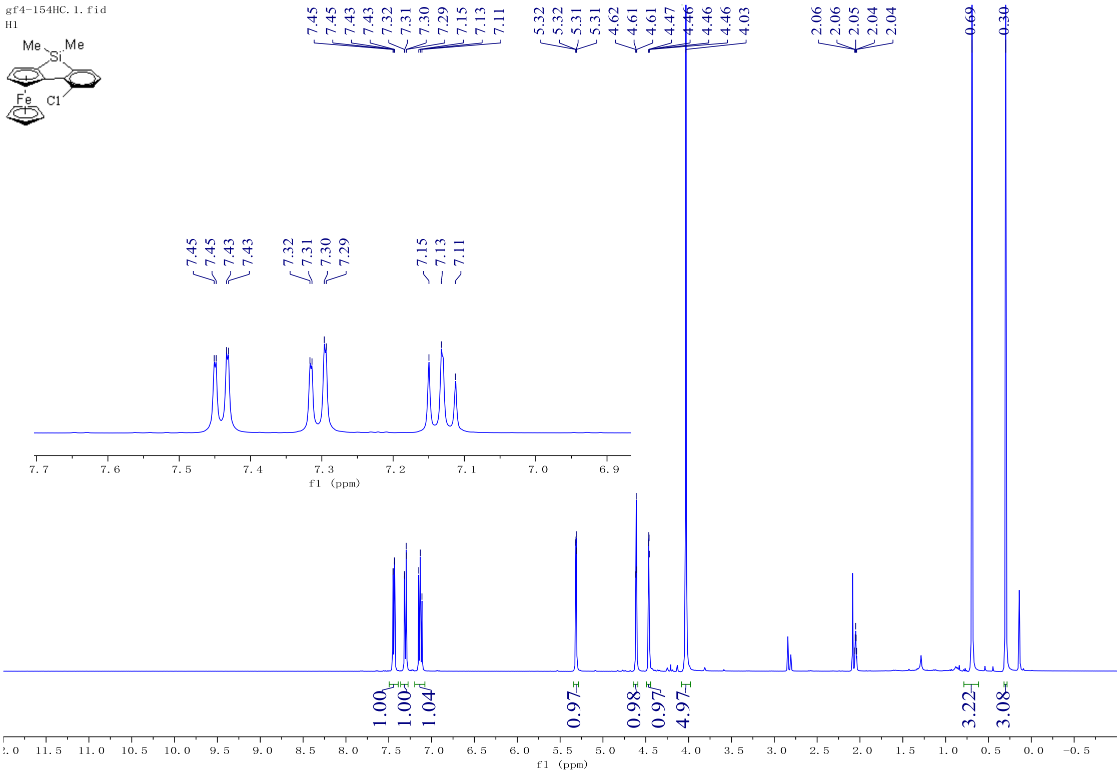

gf6-45C.1.fid
1D 13C with H decoupling
Me
Me
Si
Fe
F
160.00 157.53 146.62 146.61 134.90 134.78 129.28 129.25 127.98 127.92 117.29 117.09
93.01 92.99
74.69 74.68 72.06 71.47 70.35 68.29 68.24
30.42 30.22 30.03 29.84 29.65 29.46 29.26
-0.78 -1.63
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

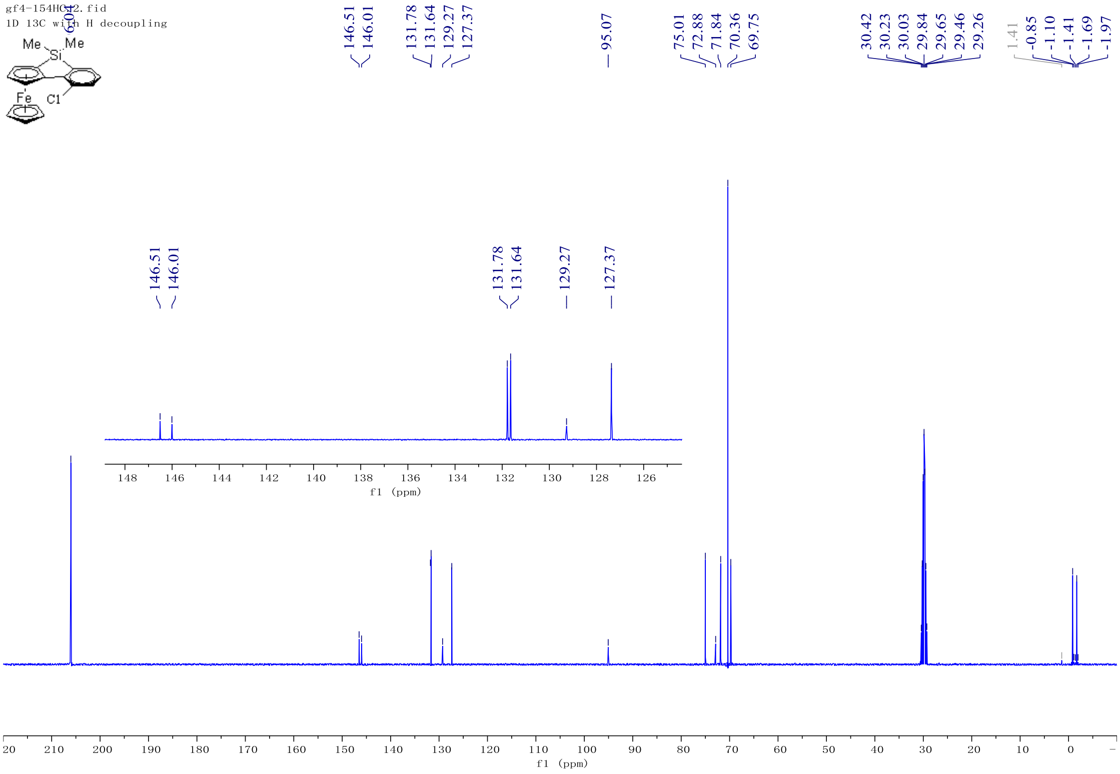
Compound 2s


gf4-118HC.1.fid
PROTON
Me
Si
Me
Fe
MeO
7.16
7.14
7.14
7.12
7.10
7.09
7.08
7.08
6.96
6.95
6.94
6.93
5.06
5.06
5.06
5.05
4.50
4.49
4.49
4.34
4.34
4.34
4.34
3.95
3.95
2.06
2.06
2.05
2.04
2.04
0.67
0.27
7.30
7.25
7.20
7.15
7.10
7.05
7.00
6.95
6.90
6.85
6.80
6.75
f1 (ppm)
2.01
1.00
0.95
0.98
0.98
4.84
3.01
2.97
2.96
12.0
11.5
11.0
10.5
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
-1
f1 (ppm)

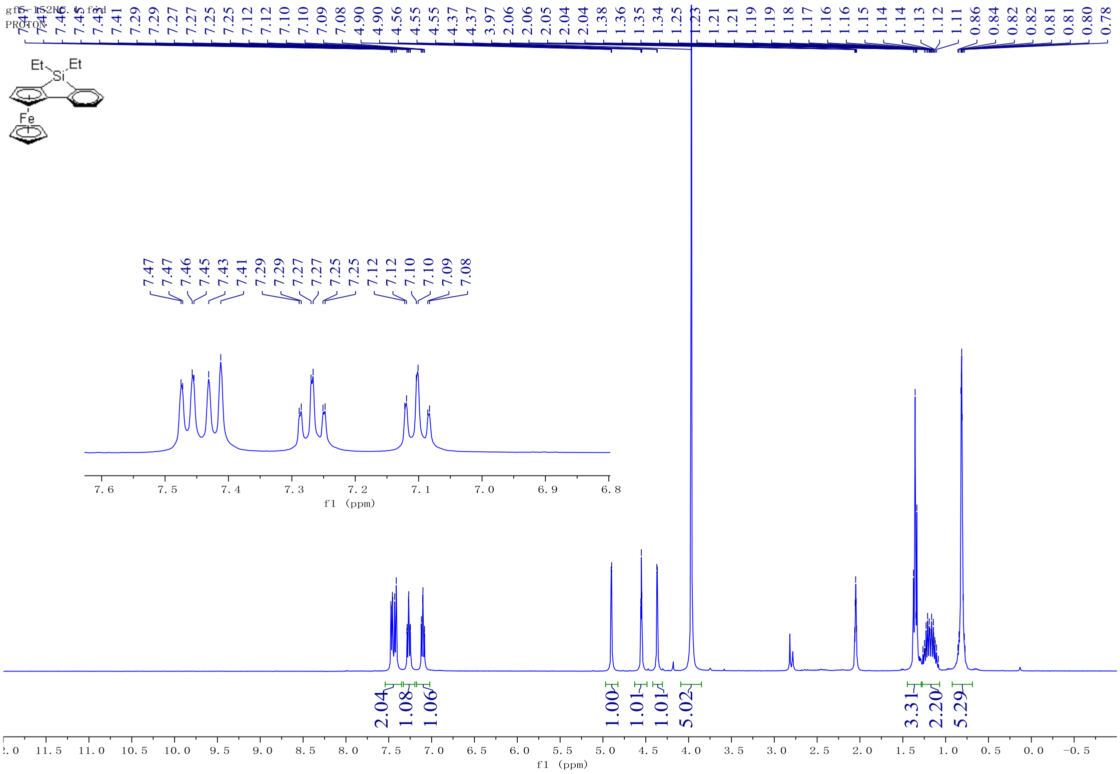

gf4-118HC.2.fid
C13CPD
6.04
Me
Si
Me
Fe
MeO
155.81
144.51
136.18
127.52
125.48
113.09
95.99
73.97
71.37
70.81
70.12
69.51
55.68
30.42
30.22
30.03
29.84
29.65
29.46
29.26
-0.67
-1.53
73.97
71.37
70.81
70.12
69.51
55.68
80
78
76
74
72
70
68
66
64
62
60
58
56
54
52
50
f1 (ppm)
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

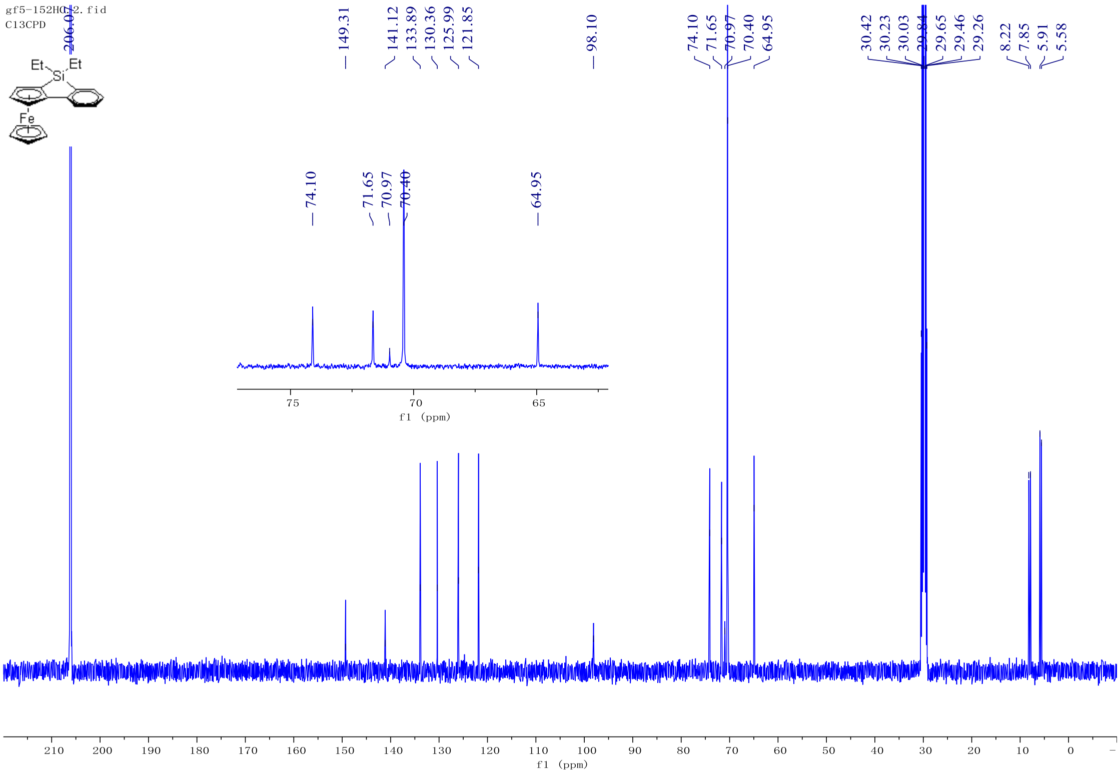
Compound 2t


gf4-154HC.1.fid
H1
Me
Si
Me
Fe
Cl
7.45 7.45 7.43 7.43 7.32 7.31 7.30 7.29 7.15 7.13 7.11 5.32 5.32 5.31 5.31 4.62 4.61 4.61 4.47 4.46 4.46 4.46 4.03 2.06 2.06 2.05 2.04 2.04 0.69 0.30
1.00 1.00 1.04 0.97 0.98 0.97 4.97 3.22 3.08
7.7 7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9
f1 (ppm)
12.0 11.5 11.0 10.5 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)

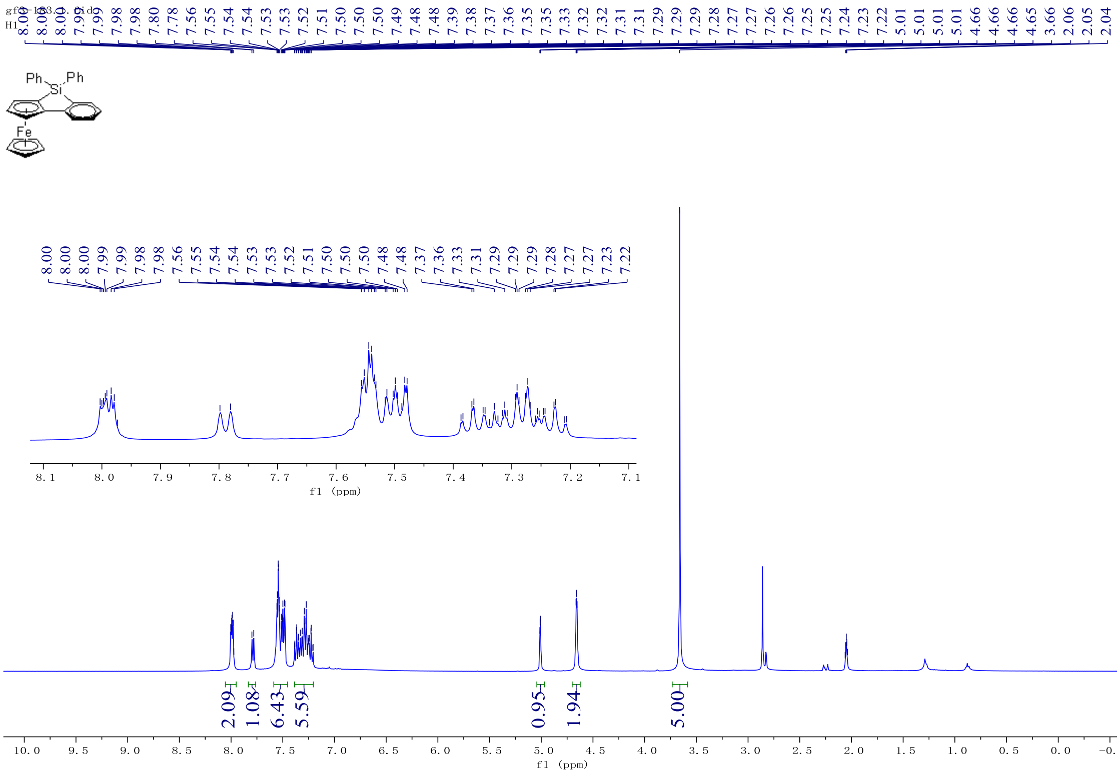

gf4-154HC.2.fid
1D 13C with H decoupling
Me
Si
Me
Fe
Cl
206.04
146.51 146.01 131.78 131.64 129.27 127.37 95.07 75.01 72.88 71.84 70.36 69.75 30.42 30.23 30.03 29.84 29.65 29.46 29.26 1.41 -0.85 -1.10 -1.41 -1.69 -1.97
148 146 144 142 140 138 136 134 132 130 128 126
f1 (ppm)
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

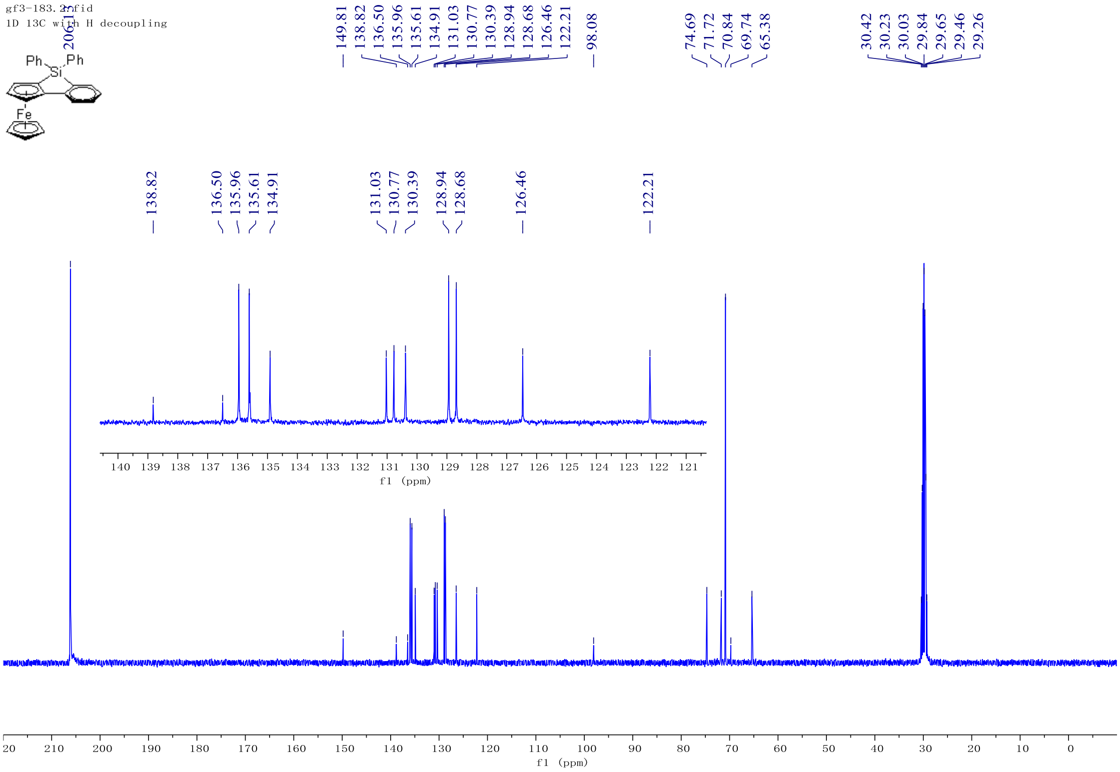
Compound 2u


gf5-152HG.1.fid
PROTON
Et
Si
Et
Fe
7.47 7.47 7.46 7.45 7.43 7.41 7.29 7.29 7.27 7.27 7.25 7.25 7.12 7.12 7.10 7.10 7.09 7.08 4.90 4.90 4.56 4.55 4.55 4.37 4.37 3.97 2.06 2.05 2.05 2.04 2.04 1.38 1.36 1.35 1.34 1.25 1.23 1.21 1.21 1.19 1.19 1.18 1.17 1.16 1.16 1.15 1.14 1.14 1.13 1.12 1.11 0.86 0.84 0.82 0.82 0.81 0.81 0.80 0.78
7.47 7.47 7.46 7.45 7.43 7.41 7.29 7.29 7.27 7.27 7.25 7.25 7.12 7.12 7.10 7.10 7.09 7.08
7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8
f1 (ppm)
2.04 1.08 1.06 1.00 1.01 1.01 5.02 3.31 2.20 5.29
12.0 11.5 11.0 10.5 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)

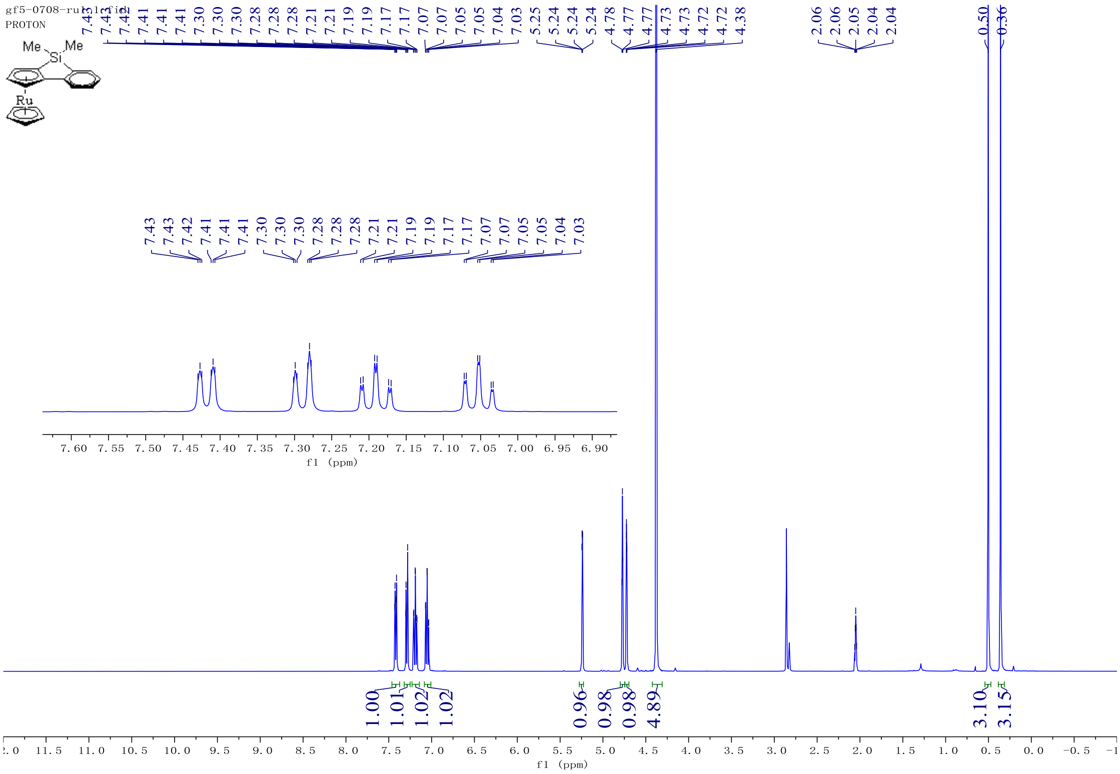

gf5-152HC12.fid
C13CPD
206.07
Et
Si
Et
Fe
149.31 141.12 133.89 130.36 125.99 121.85 98.10 74.10 71.65 70.97 70.40 64.95 30.42 30.23 30.03 29.84 29.65 29.46 29.26 8.22 7.85 5.91 5.58
74.10 71.65 70.97 70.40 64.95
75 70 65
f1 (ppm)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

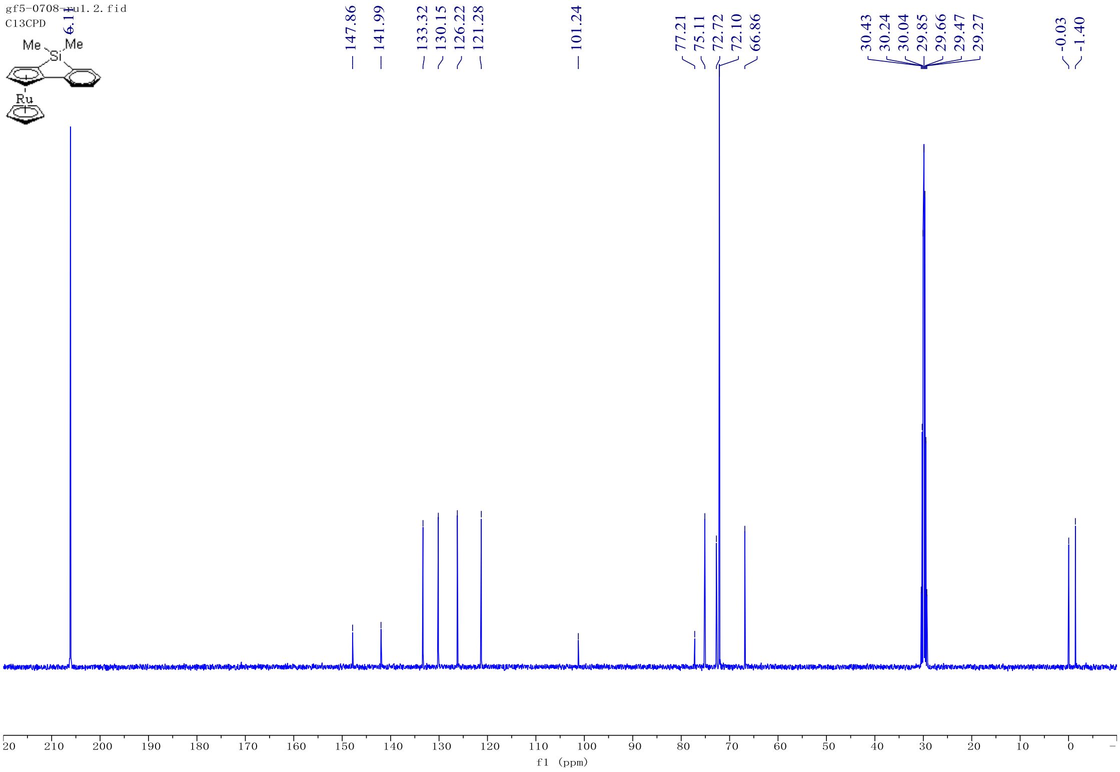
Compound 2v


H1
8.00 8.00 8.00 7.99 7.99 7.98 7.98 7.80 7.78 7.56 7.55 7.54 7.54 7.53 7.53 7.52 7.51 7.50 7.50 7.50 7.49 7.48 7.48 7.39 7.38 7.37 7.36 7.35 7.35 7.33 7.32 7.31 7.31 7.29 7.29 7.29 7.28 7.27 7.27 7.26 7.26 7.25 7.25 7.24 7.23 7.22 5.01 5.01 5.01 5.01 4.66 4.66 4.66 4.65 3.66 2.06 2.05 2.04
Ph
Ph
Si
Fe
8.00 8.00 8.00 7.99 7.99 7.98 7.98 7.56 7.55 7.54 7.54 7.53 7.53 7.52 7.51 7.50 7.50 7.50 7.48 7.48 7.37 7.36 7.33 7.31 7.29 7.29 7.29 7.28 7.27 7.27 7.23 7.22
8.1 8.0 7.9 7.8 7.7 7.6 7.5 7.4 7.3 7.2 7.1
f1 (ppm)
2.09 1.08 6.43 5.59 0.95 1.94 5.00
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 -0.
f1 (ppm)

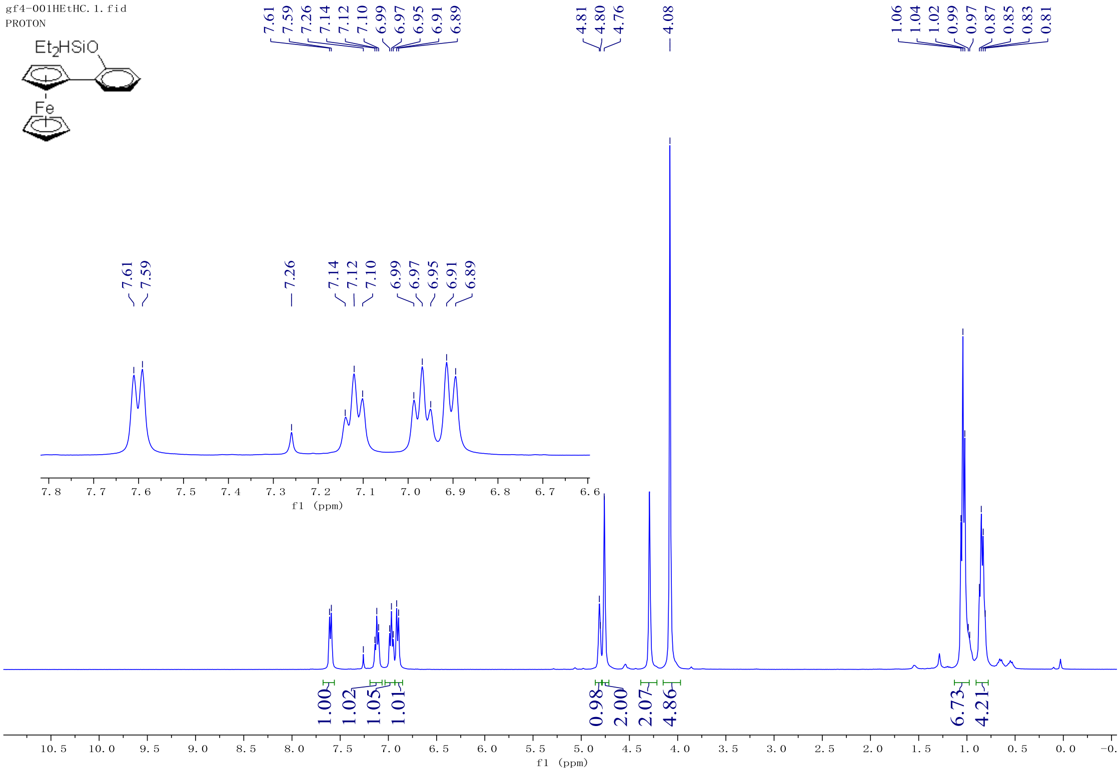

gf3-183.2.fid
1D 13C with H decoupling
149.81 138.82 136.50 135.96 135.61 134.91 131.03 130.77 130.39 128.94 128.68 126.46 122.21
98.08
74.69 71.72 70.84 69.74 65.38
30.42 30.23 30.03 29.84 29.65 29.46 29.26
Ph
Ph
Si
Fe
138.82 136.50 135.96 135.61 134.91 131.03 130.77 130.39 128.94 128.68 126.46 122.21
140 139 138 137 136 135 134 133 132 131 130 129 128 127 126 125 124 123 122 121
f1 (ppm)
20 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

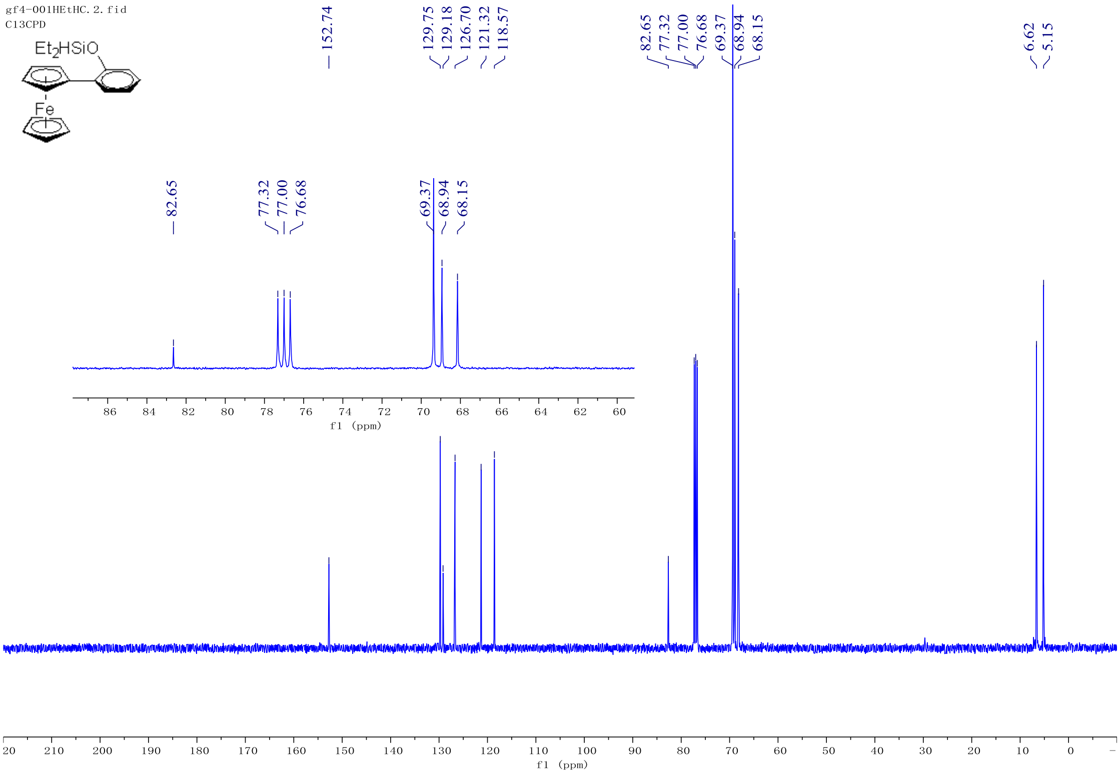
Compound 2w


gf5-0708-ru1.1.fid
PROTON
Me
Si
Me
Ru
7.43 7.43 7.42 7.41 7.41 7.41 7.30 7.30 7.30 7.28 7.28 7.28 7.21 7.21 7.19 7.19 7.17 7.17 7.07 7.07 7.05 7.05 7.04 7.03 5.25 5.24 5.24 5.24 4.78 4.77 4.77 4.73 4.73 4.72 4.72 4.38 2.06 2.06 2.05 2.04 2.04 0.50 0.36
7.60 7.55 7.50 7.45 7.40 7.35 7.30 7.25 7.20 7.15 7.10 7.05 7.00 6.95 6.90
f1 (ppm)
1.00 1.01 1.02 1.02 0.96 0.98 0.98 4.89 3.10 3.15
12.0 11.5 11.0 10.5 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 −1
f1 (ppm)

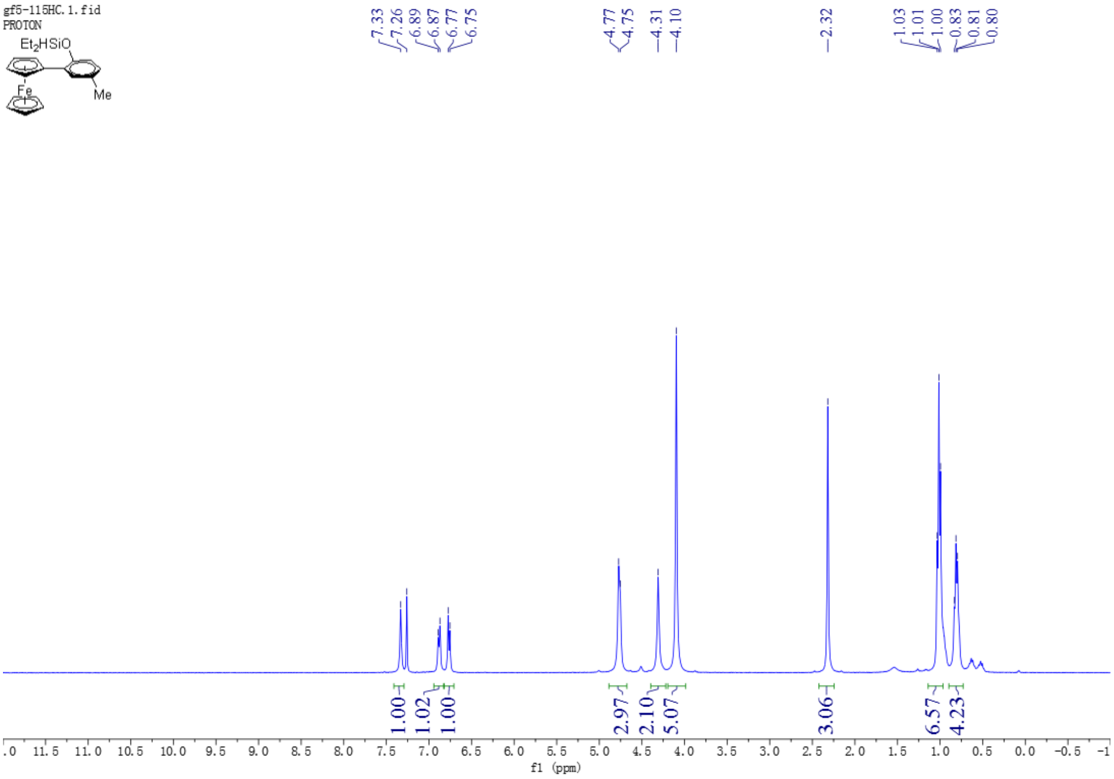

gf5-0708-ru1.2.fid
C13CPD
Me
Si
Me
Ru
206.1
147.86 141.99 133.32 130.15 126.22 121.28 101.24 77.21 75.11 72.72 72.10 66.86 30.43 30.24 30.04 29.85 29.66 29.47 29.27 -0.03 -1.40
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

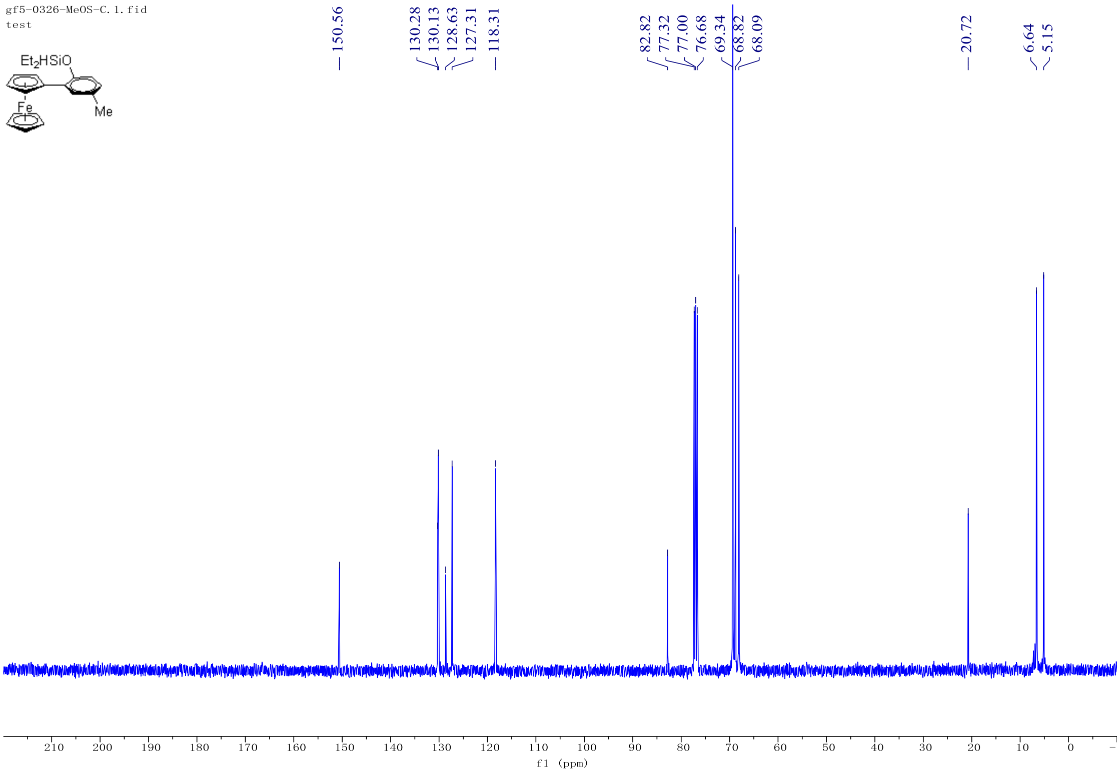
Compound 3a


gf4-001HEtHC.1.fid
PROTON
Et2HSiO
Fe
7.61
7.59
7.26
7.14
7.12
7.10
6.99
6.97
6.95
6.91
6.89
4.81
4.80
4.76
4.08
1.06
1.04
1.02
0.99
0.97
0.87
0.85
0.83
0.81
1.00
1.02
1.05
1.01
0.98
2.00
2.07
4.86
6.73
4.21
7.8 7.7 7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8 6.7 6.6
f1 (ppm)
10.5 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.
f1 (ppm)

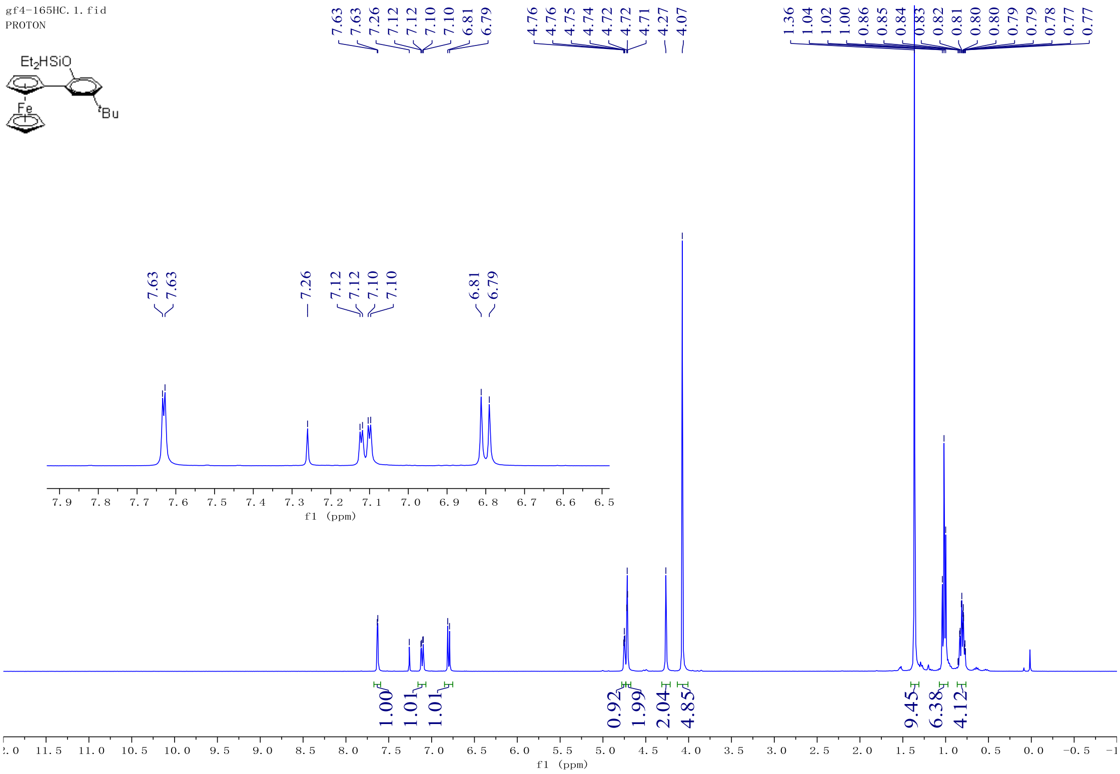

gf4-001HEtHC.2.fid
C13CPD
Et2HSiO
Fe
152.74
129.75
129.18
126.70
121.32
118.57
82.65
77.32
77.00
76.68
69.37
68.94
68.15
6.62
5.15
86 84 82 80 78 76 74 72 70 68 66 64 62 60
f1 (ppm)
20 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

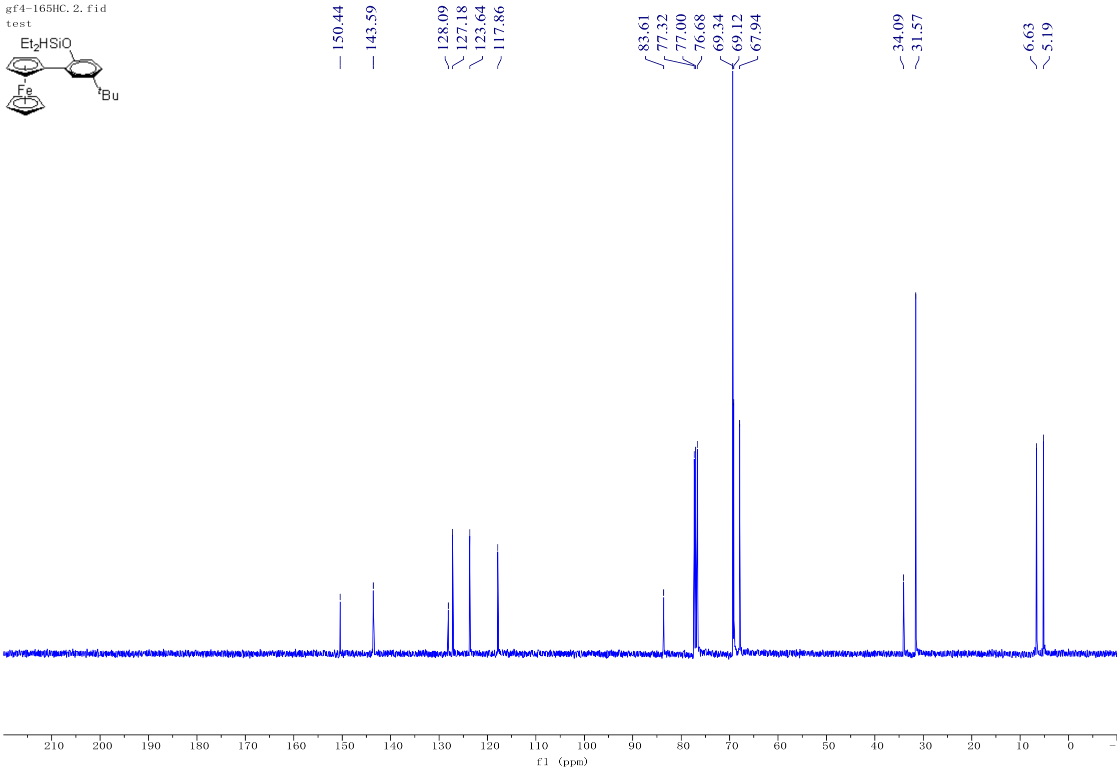
Compound 3b


gf5-115HC.1.fid
PROTON
Et$_2$HSiO
Fe
Me
7.33
7.26
6.89
6.87
6.77
6.75
4.77
4.75
4.31
4.10
2.32
1.03
1.01
1.00
0.83
0.81
0.80
1.00
1.02
1.00
2.97
2.10
5.07
3.06
6.57
4.23
f1 (ppm)

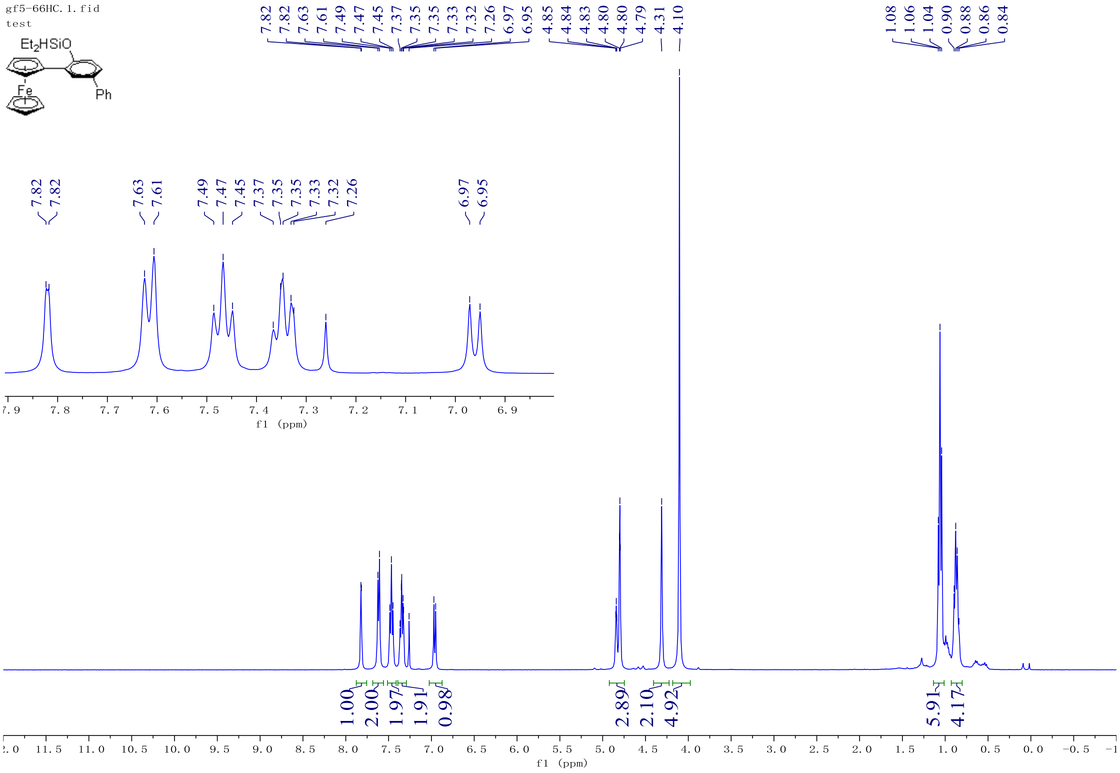

gf5-0326-MeOS-C.1.fid
test
Et$_2$HSiO
Fe
Me
150.56
130.28
130.13
128.63
127.31
118.31
82.82
77.32
77.00
76.68
69.34
68.82
68.09
20.72
6.64
5.15
f1 (ppm)

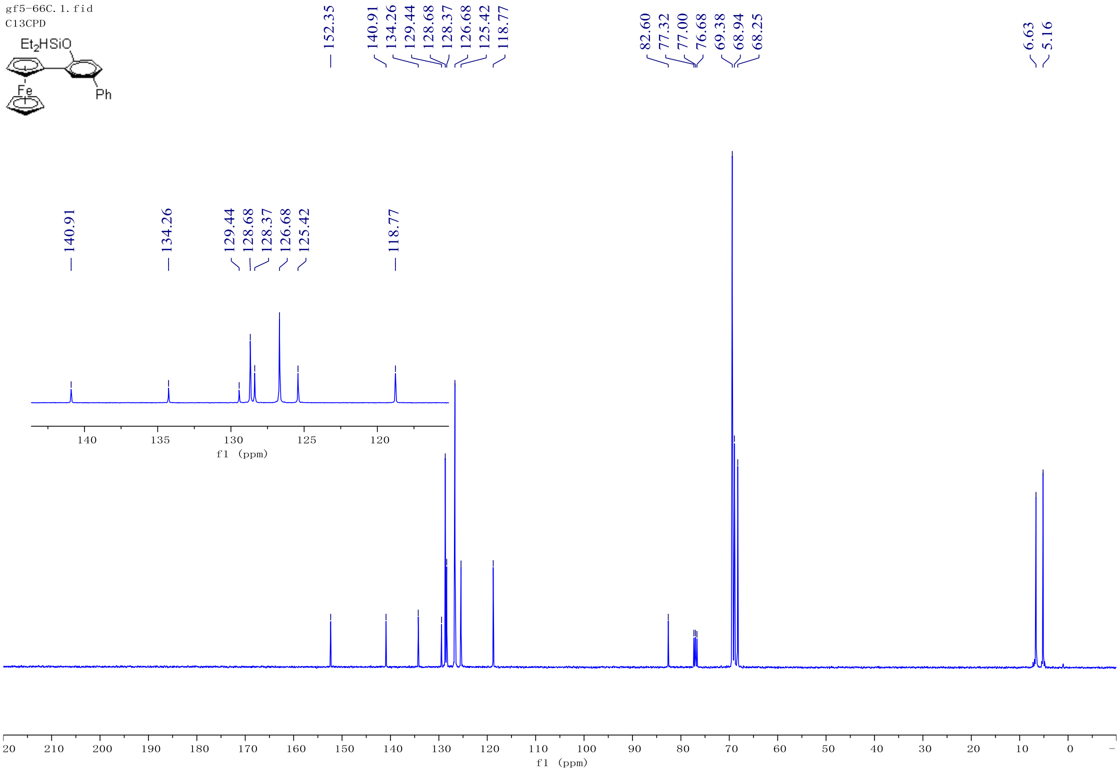
Compound 3c


gf4-165HC.1.fid
PROTON
Et2HSiO
Fe
tBu
7.63
7.63
7.26
7.12
7.12
7.10
7.10
6.81
6.79
4.76
4.76
4.75
4.74
4.72
4.72
4.71
4.27
4.07
1.36
1.04
1.02
1.00
0.86
0.85
0.84
0.83
0.82
0.81
0.80
0.80
0.79
0.79
0.78
0.77
0.77
7.9
7.8
7.7
7.6
7.5
7.4
7.3
7.2
7.1
7.0
6.9
6.8
6.7
6.6
6.5
f1 (ppm)
1.00
1.01
1.01
0.92
1.99
2.04
4.85
9.45
6.38
4.12
11.5
11.0
10.5
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)

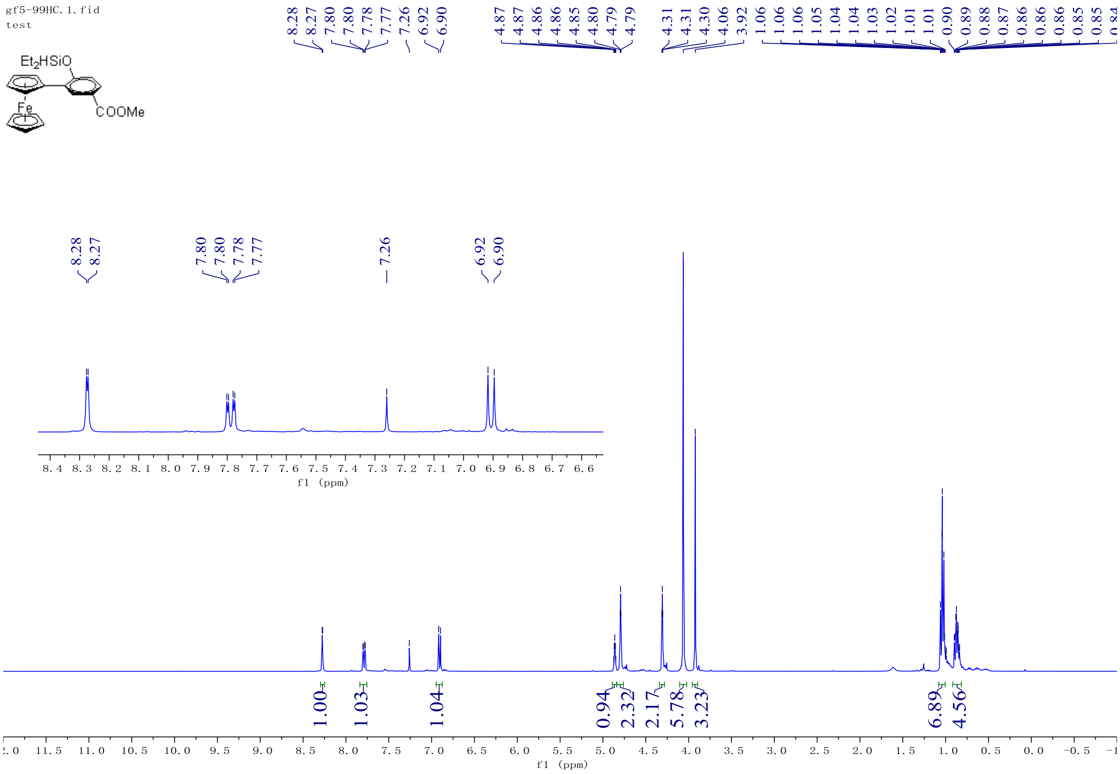

gf4-165HC.2.fid
test
Et2HSiO
Fe
tBu
150.44
143.59
128.09
127.18
123.64
117.86
83.61
77.32
77.00
76.68
69.34
69.12
67.94
34.09
31.57
6.63
5.19
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

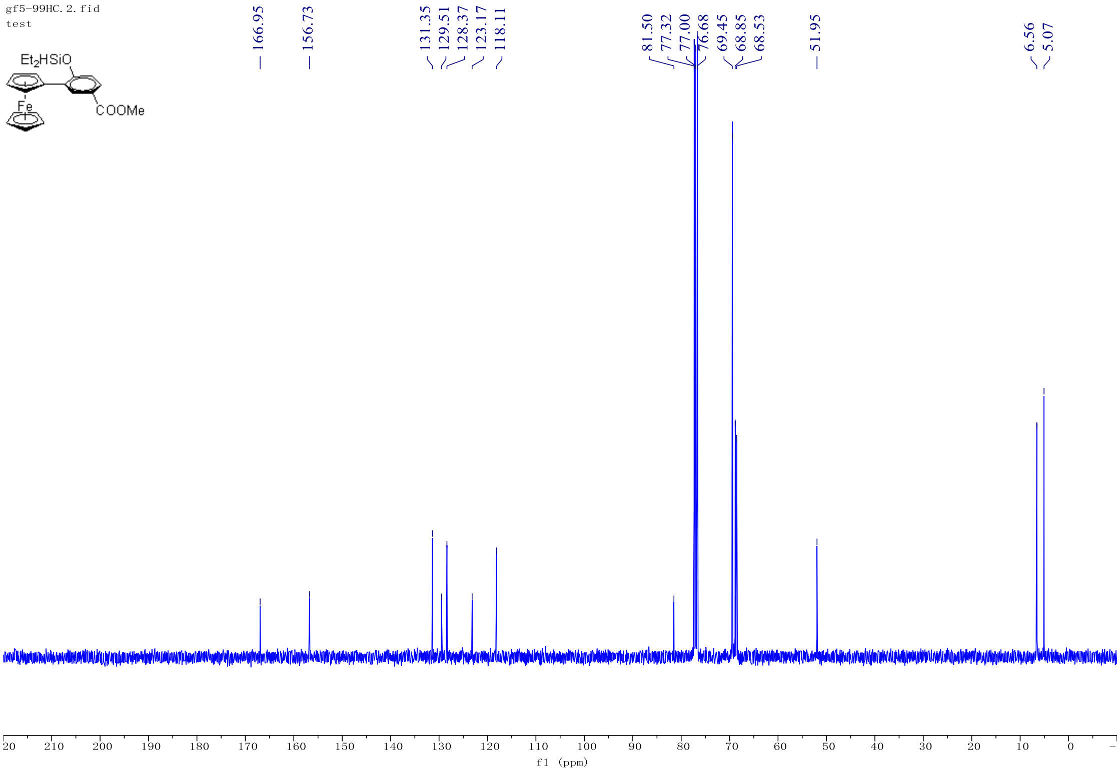
Compound 3d


gf5-66HC.1.fid
test
Et$_2$HSiO
Fe
Ph
7.82 7.82 7.63 7.61 7.49 7.47 7.45 7.37 7.35 7.35 7.33 7.32 7.26 6.97 6.95 4.85 4.84 4.83 4.80 4.80 4.79 4.31 4.10
1.08 1.06 1.04 0.90 0.88 0.86 0.84
1.00 2.00 1.97 1.91 0.98 2.89 2.10 4.92 5.91 4.17
f1 (ppm)

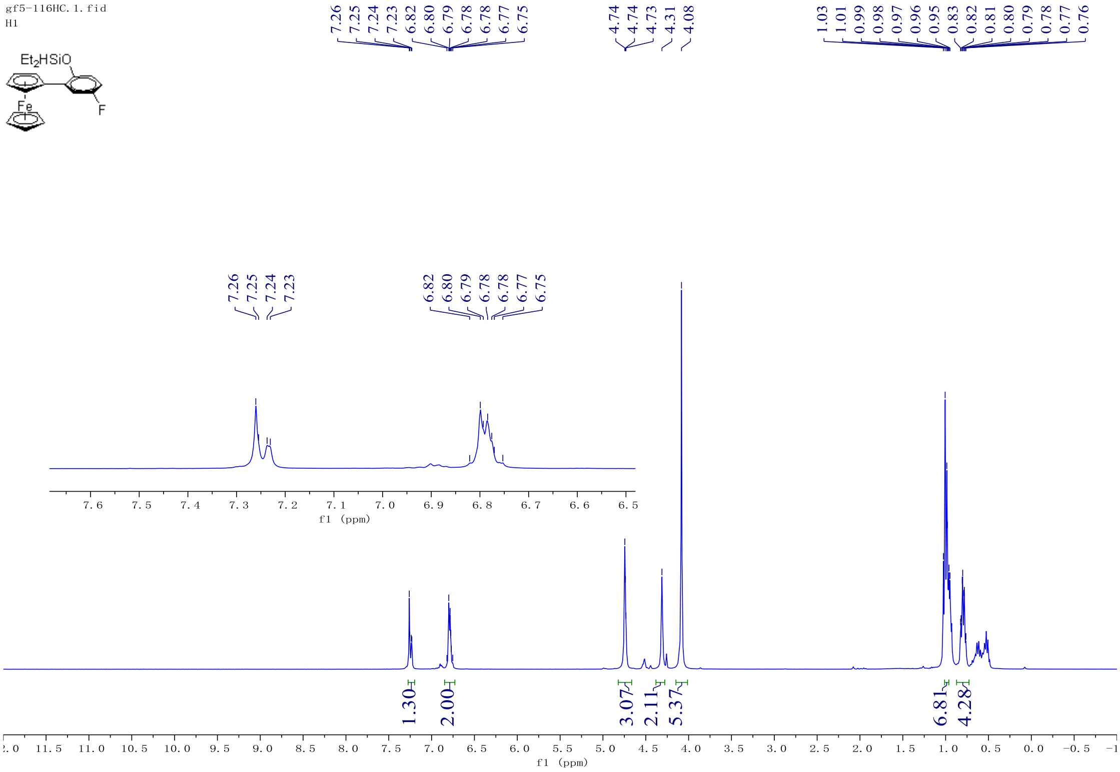

gf5-66C.1.fid
C13CPD
Et$_2$HSiO
Fe
Ph
152.35 140.91 134.26 129.44 128.68 128.37 126.68 125.42 118.77 82.60 77.32 77.00 76.68 69.38 68.94 68.25 6.63 5.16
f1 (ppm)

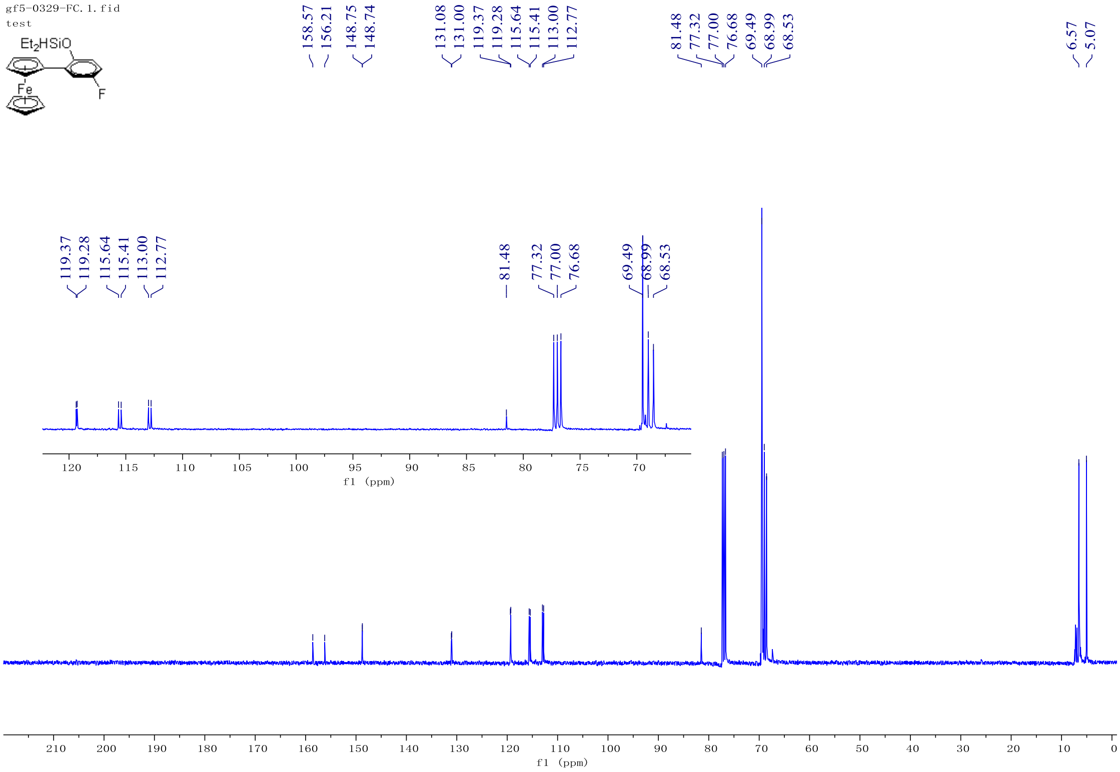
Compound 3e


gf5-99HC.1.fid
test
Et$_2$HSiO
Fe
COOMe
8.28
8.27
7.80
7.80
7.78
7.77
7.26
6.92
6.90
4.87
4.87
4.86
4.86
4.85
4.80
4.79
4.79
4.31
4.31
4.30
4.06
3.92
1.06
1.06
1.05
1.04
1.04
1.03
1.02
1.01
1.01
0.90
0.89
0.88
0.87
0.86
0.86
0.86
0.85
8.4 8.3 8.2 8.1 8.0 7.9 7.8 7.7 7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8 6.7 6.6
f1 (ppm)
1.00
1.03
1.04
0.94
2.32
2.17
5.78
3.23
6.89
4.56
11.5 11.0 10.5 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)

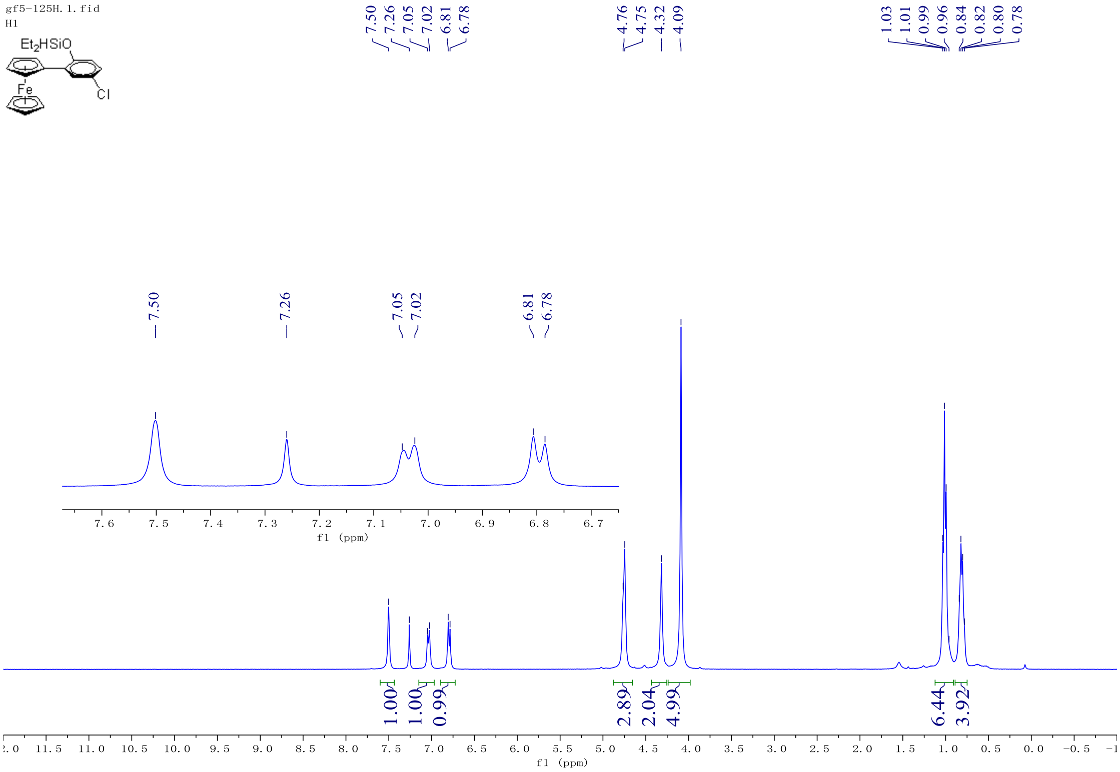

gf5-99HC.2.fid
test
Et$_2$HSiO
Fe
COOMe
166.95
156.73
131.35
129.51
128.37
123.17
118.11
81.50
77.32
77.00
76.68
69.45
68.85
68.53
51.95
6.56
5.07
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

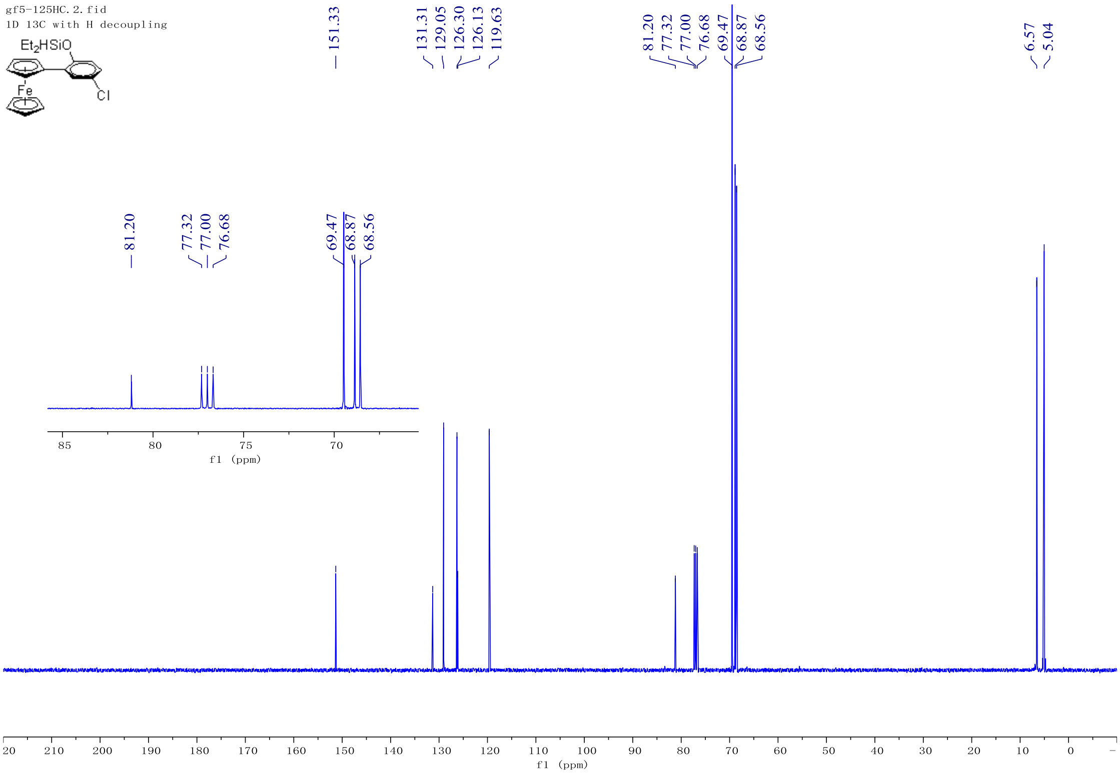
Compound 3f


gf5-116HC.1.fid
H1
Et2HSiO
Fe
F
7.26
7.25
7.24
7.23
6.82
6.80
6.79
6.78
6.78
6.77
6.75
4.74
4.74
4.73
4.31
4.08
1.03
1.01
0.99
0.98
0.97
0.96
0.95
0.83
0.82
0.81
0.80
0.79
0.78
0.77
0.76
1.30
2.00
3.07
2.11
5.37
6.81
4.28
7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8 6.7 6.6 6.5
f1 (ppm)
12.0 11.5 11.0 10.5 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 -1
f1 (ppm)

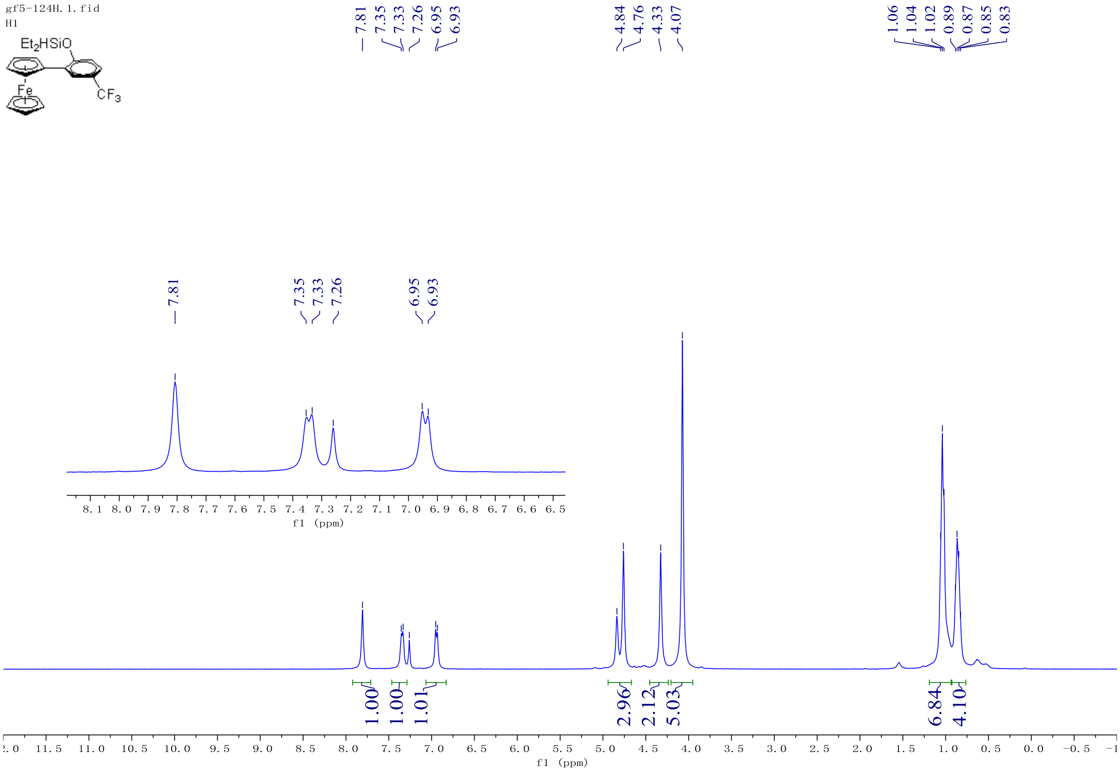

gf5-0329-FC.1.fid
test
Et2HSiO
Fe
F
158.57
156.21
148.75
148.74
131.08
131.00
119.37
119.28
115.64
115.41
113.00
112.77
81.48
77.32
77.00
76.68
69.49
68.99
68.53
6.57
5.07
120 115 110 105 100 95 90 85 80 75 70
f1 (ppm)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

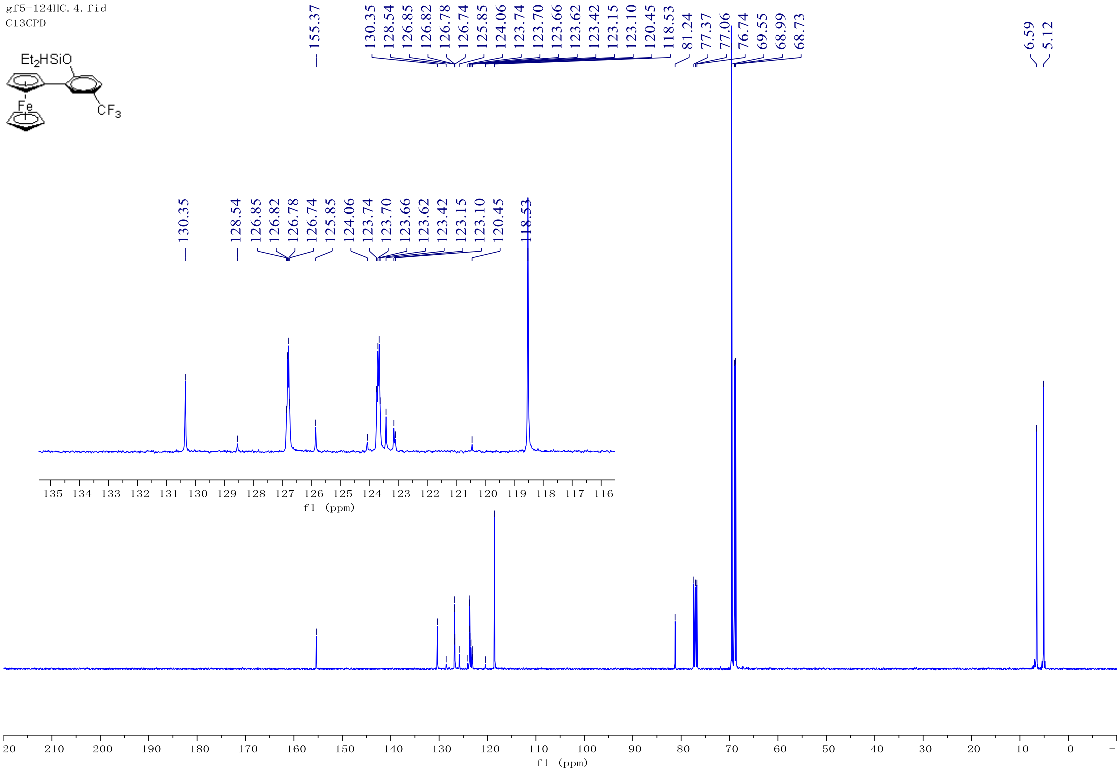
Compound 3g


gf5-125H.1.fid
H1
Et2HSiO
Fe
Cl
7.50
7.26
7.05
7.02
6.81
6.78
4.76
4.75
4.32
4.09
1.03
1.01
0.99
0.96
0.84
0.82
0.80
0.78
1.00
1.00
0.99
2.89
2.04
4.99
6.44
3.92
7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8 6.7
f1 (ppm)
12.0 11.5 11.0 10.5 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 -1
f1 (ppm)

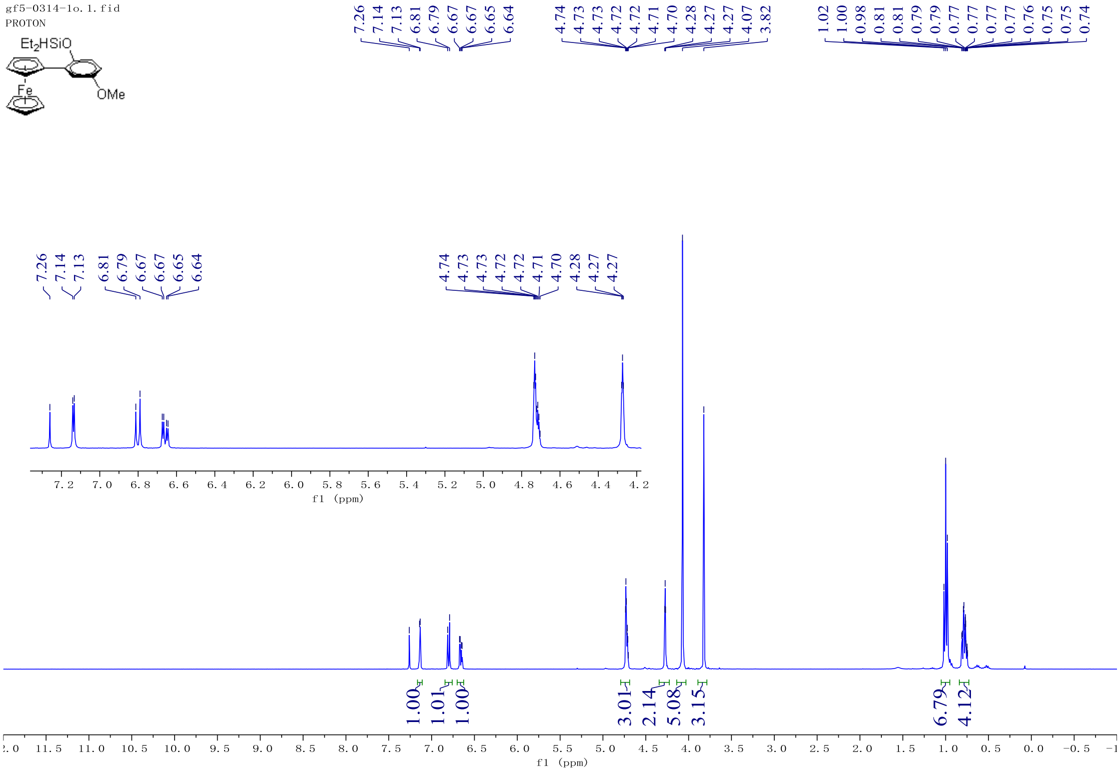

gf5-125HC.2.fid
1D 13C with H decoupling
Et2HSiO
Fe
Cl
151.33
131.31
129.05
126.30
126.13
119.63
81.20
77.32
77.00
76.68
69.47
68.87
68.56
6.57
5.04
85 80 75 70
f1 (ppm)
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

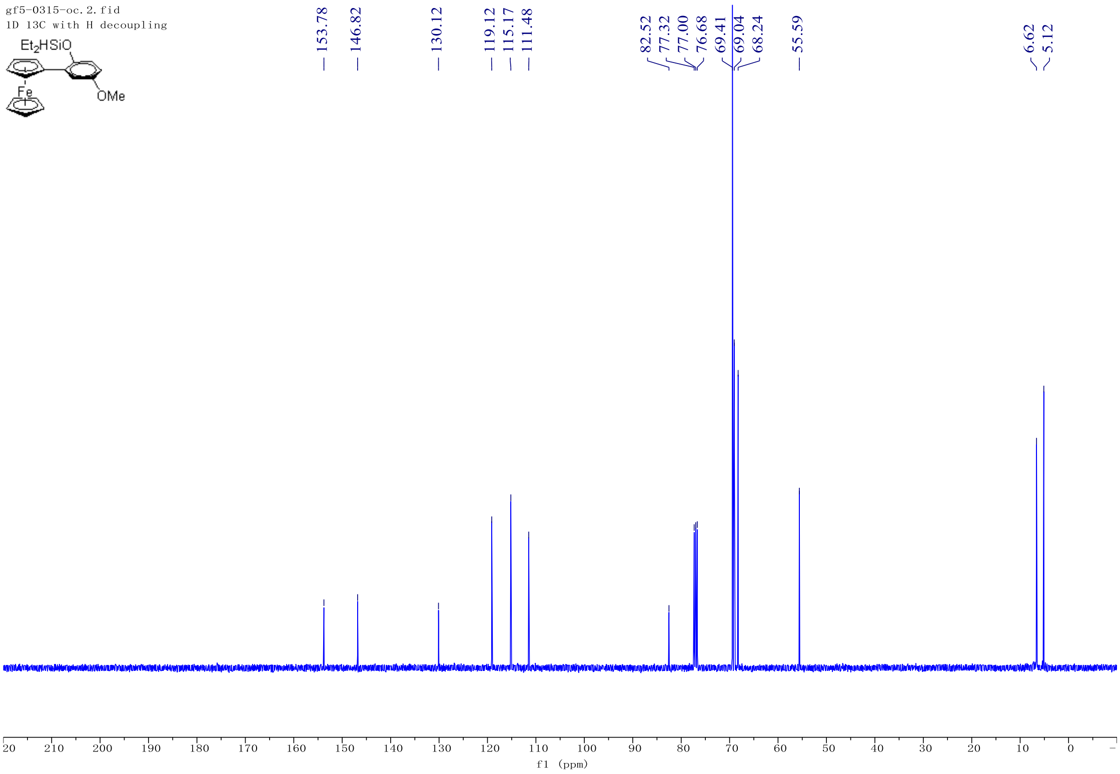
Compound 3h


gf5-124H.1.fid
H1
Et2HSiO
Fe
CF3
7.81
7.35
7.33
7.26
6.95
6.93
4.84
4.76
4.33
4.07
1.06
1.04
1.02
0.89
0.87
0.85
0.83
1.00
1.00
1.01
2.96
2.12
5.03
6.84
4.10
f1 (ppm)

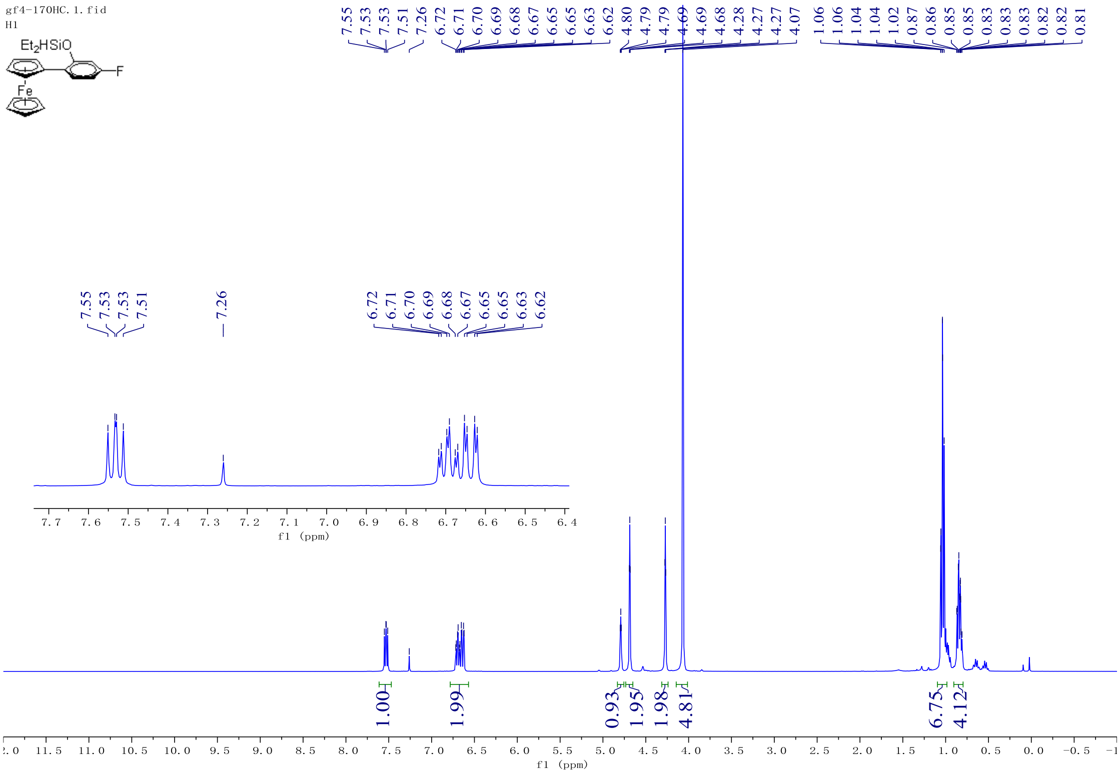

gf5-124HC.4.fid
C13CPD
Et2HSiO
Fe
CF3
155.37
130.35
128.54
126.85
126.82
126.78
126.74
125.85
124.06
123.74
123.70
123.66
123.62
123.42
123.15
123.10
120.45
118.53
81.24
77.37
77.06
76.74
69.55
68.99
68.73
6.59
5.12
f1 (ppm)

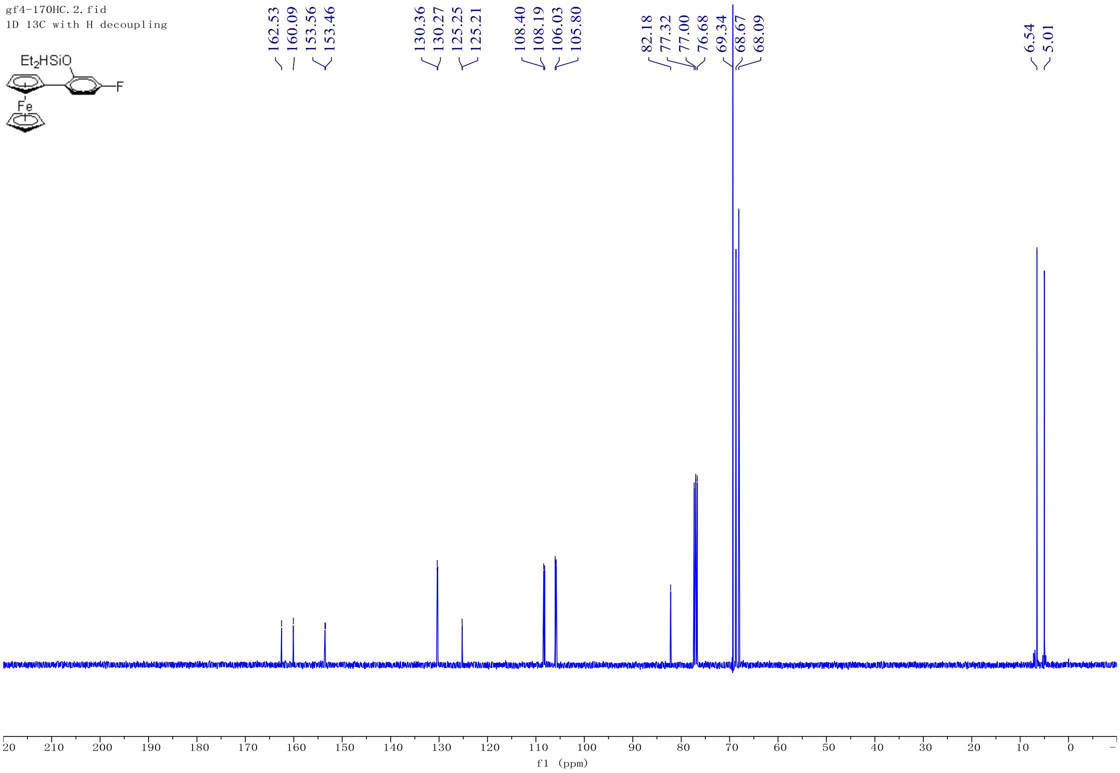
Compound 3i


gf5-0314-1o.1.fid
PROTON
Et2HSiO
Fe
OMe
7.26
7.14
7.13
6.81
6.79
6.67
6.67
6.65
6.64
4.74
4.73
4.73
4.72
4.72
4.71
4.70
4.28
4.27
4.27
4.07
3.82
1.02
1.00
0.98
0.81
0.81
0.79
0.79
0.77
0.77
0.77
0.77
0.76
0.75
0.75
0.74
1.00
1.01
1.00
3.01
2.14
5.08
3.15
6.79
4.12
f1 (ppm)

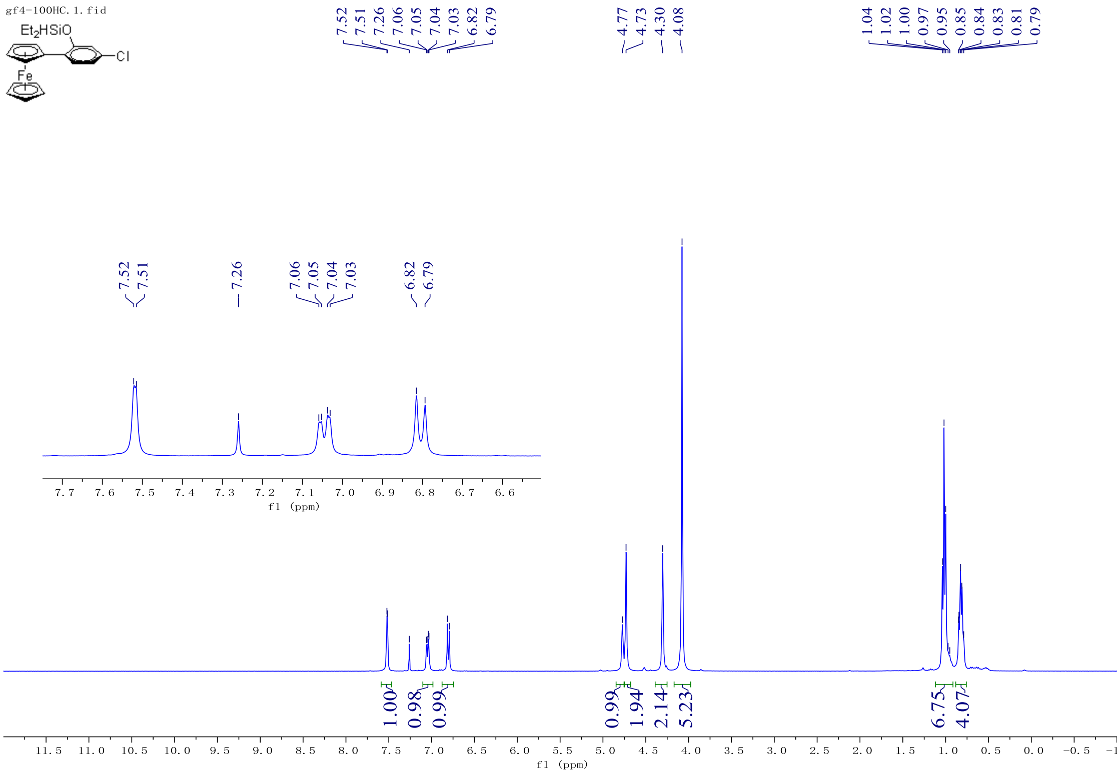

gf5-0315-oc.2.fid
1D 13C with H decoupling
Et2HSiO
Fe
OMe
153.78
146.82
130.12
119.12
115.17
111.48
82.52
77.32
77.00
76.68
69.41
69.04
68.24
55.59
6.62
5.12
f1 (ppm)

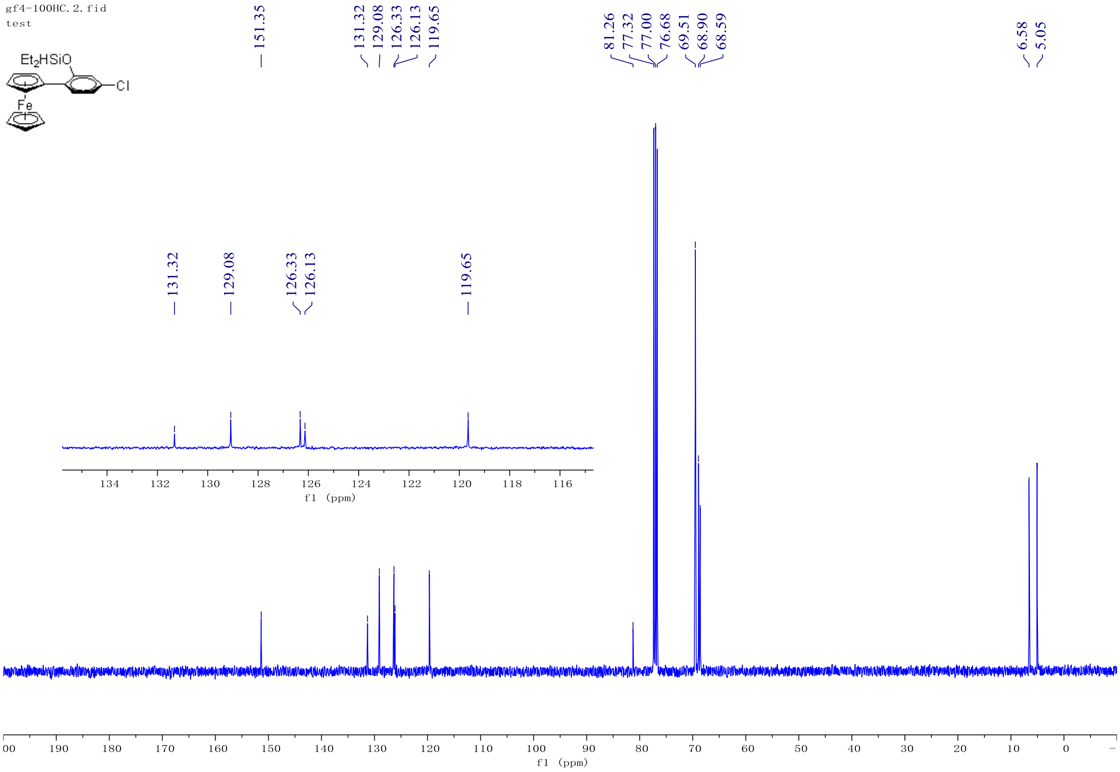
Compound 3j


gf4-170HC.1.fid
H1
Et2HSiO
F
Fe
7.55
7.53
7.53
7.51
7.26
6.72
6.71
6.70
6.69
6.68
6.67
6.65
6.65
6.63
6.62
4.80
4.79
4.79
4.69
4.69
4.68
4.28
4.27
4.27
4.07
1.06
1.06
1.04
1.04
1.02
0.87
0.86
0.85
0.85
0.83
0.83
0.83
0.82
0.82
0.81
1.00
1.99
0.93
1.95
1.98
4.81
6.75
4.12
f1 (ppm)

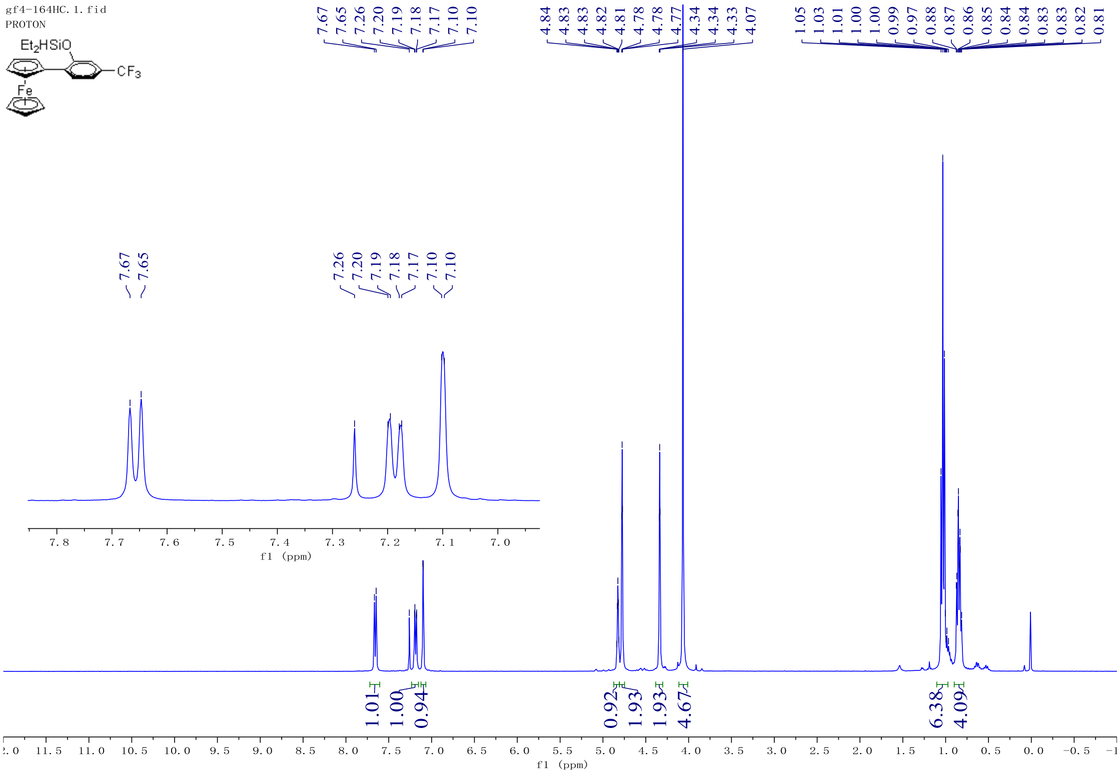

gf4-170HC.2.fid
1D 13C with H decoupling
Et2HSiO
F
Fe
162.53
160.09
153.56
153.46
130.36
130.27
125.25
125.21
108.40
108.19
106.03
105.80
82.18
77.32
77.00
76.68
69.34
68.67
68.09
6.54
5.01
f1 (ppm)

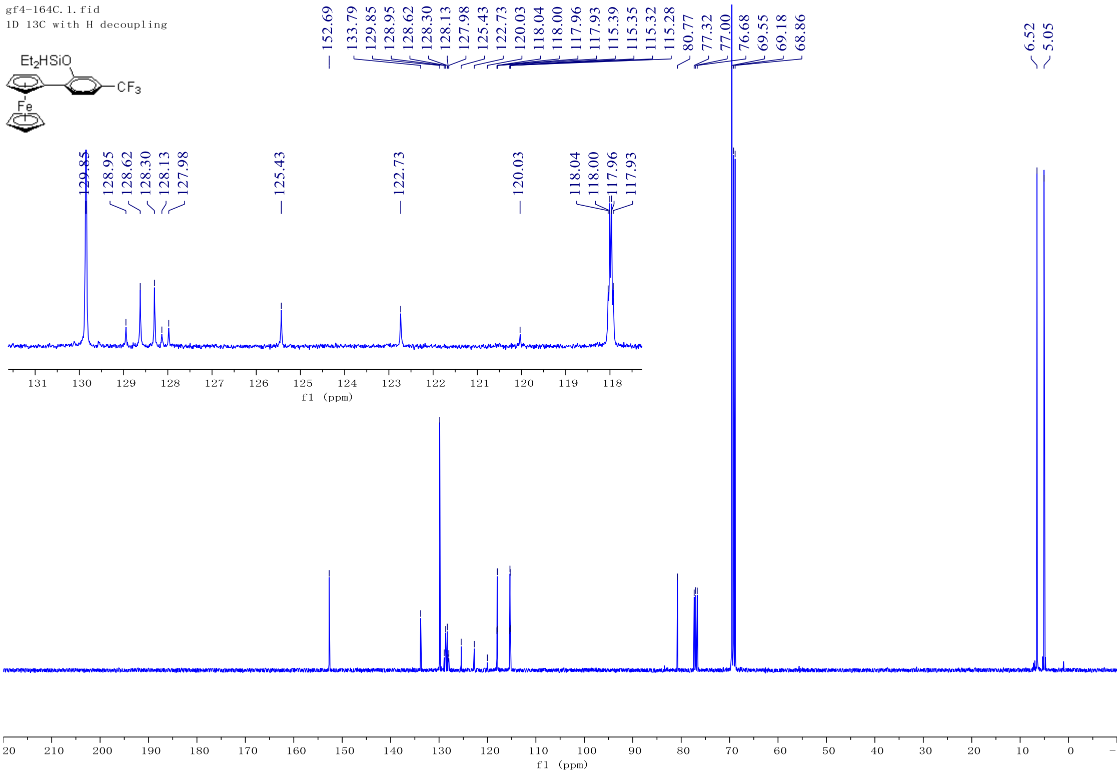
Compound 3k


gf4-100HC.1.fid
Et2HSiO
Fe
Cl
7.52
7.51
7.26
7.06
7.05
7.04
7.03
6.82
6.79
4.77
4.73
4.30
4.08
1.04
1.02
1.00
0.97
0.95
0.85
0.84
0.83
0.81
0.79
1.00
0.98
0.99
0.99
1.94
2.14
5.23
6.75
4.07
f1 (ppm)

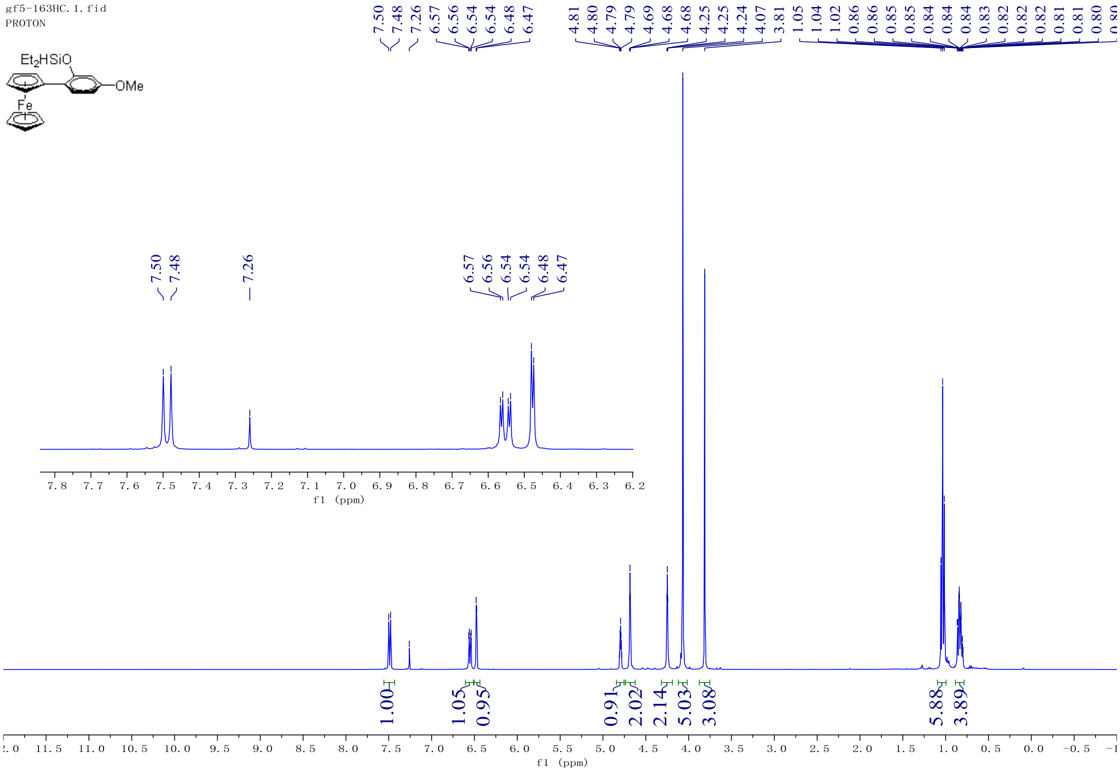

gf4-100HC.2.fid
test
Et2HSiO
Fe
Cl
151.35
131.32
129.08
126.33
126.13
119.65
81.26
77.32
77.00
76.68
69.51
68.90
68.59
6.58
5.05
f1 (ppm)

Compound 3l

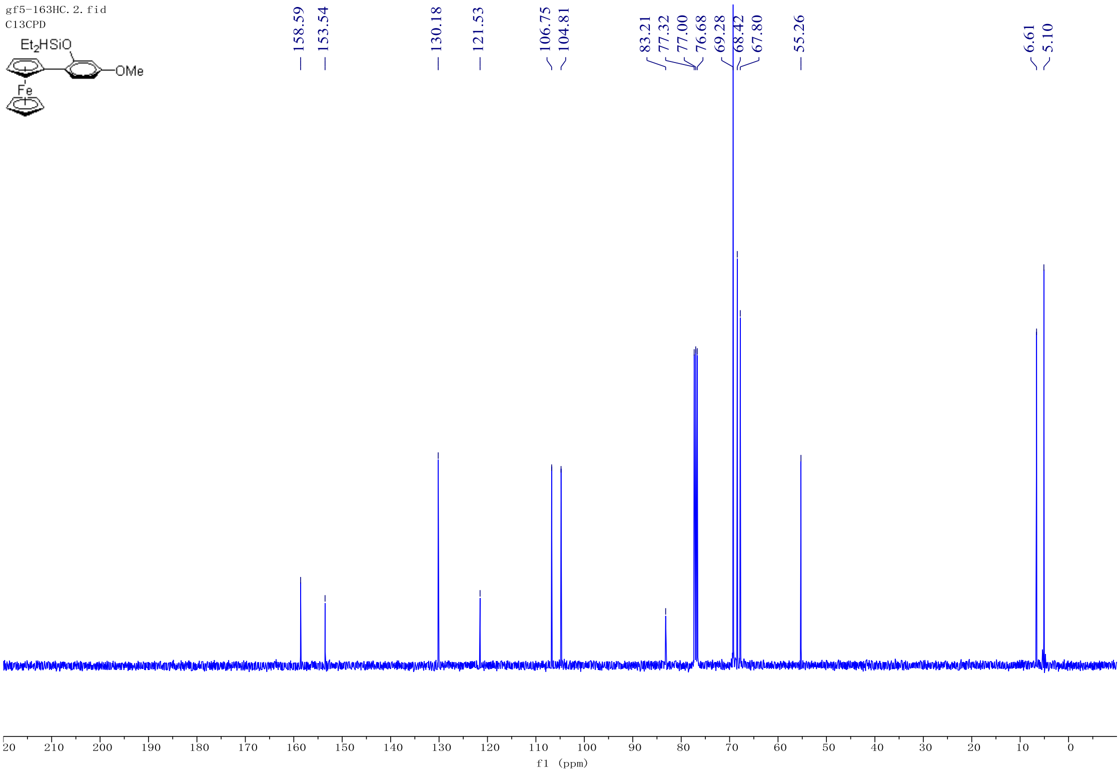

gf4-164HC.1.fid
PROTON
Et2HSiO
CF3
Fe
7.67 7.65 7.26 7.20 7.19 7.18 7.17 7.10 7.10
4.84 4.83 4.83 4.82 4.81 4.78 4.78 4.77 4.34 4.34 4.33 4.07
1.05 1.03 1.01 1.00 1.00 0.99 0.97 0.88 0.87 0.86 0.85 0.84 0.84 0.83 0.83 0.82 0.81
7.67 7.65
7.26 7.20 7.19 7.18 7.17 7.10 7.10
7.8 7.7 7.6 7.5 7.4 7.3 7.2 7.1 7.0
f1 (ppm)
1.01 1.00 0.94
0.92 1.93 1.93 4.67
6.38 4.09
12.0 11.5 11.0 10.5 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 -1
f1 (ppm)


gf4-164C.1.fid
1D 13C with H decoupling
Et2HSiO
CF3
Fe
152.69 133.79 129.85 128.95 128.62 128.30 128.13 127.98 125.43 122.73 120.03 118.04 118.00 117.96 117.93 115.39 115.35 115.32 115.28 80.77 77.32 77.00 76.68 69.55 69.18 68.86
6.52 5.05
129.85 128.95 128.62 128.30 128.13 127.98 125.43 122.73 120.03 118.04 118.00 117.96 117.93
131 130 129 128 127 126 125 124 123 122 121 120 119 118
f1 (ppm)
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

Compound 3m

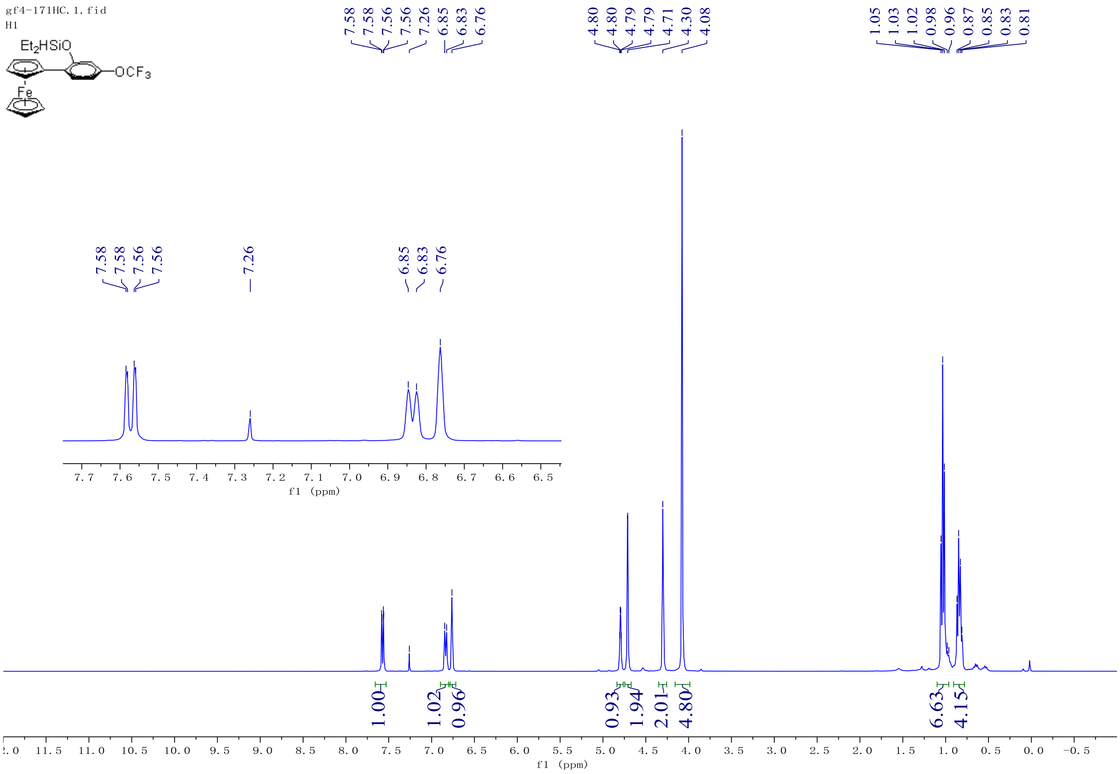


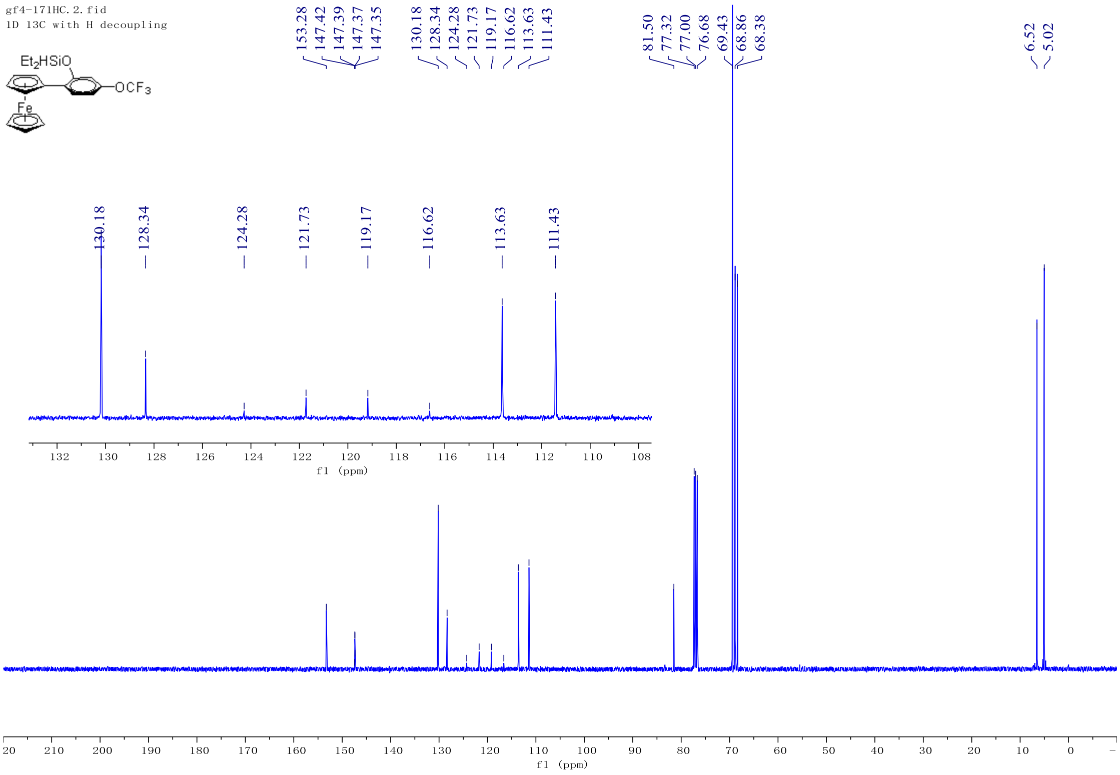
gf5-163HC.1.fid
PROTON
Et2HSiO
OMe
Fe
7.50
7.48
7.26
6.57
6.56
6.54
6.54
6.48
6.47
4.81
4.80
4.79
4.79
4.69
4.68
4.68
4.25
4.25
4.24
4.07
3.81
1.05
1.04
1.02
0.86
0.86
0.85
0.84
0.84
0.84
0.83
0.82
0.82
0.82
0.81
0.81
0.80
1.00
1.05
0.95
0.91
2.02
2.14
5.03
3.08
5.88
3.89
7.8 7.7 7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8 6.7 6.6 6.5 6.4 6.3 6.2
f1 (ppm)
11.5 11.0 10.5 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)



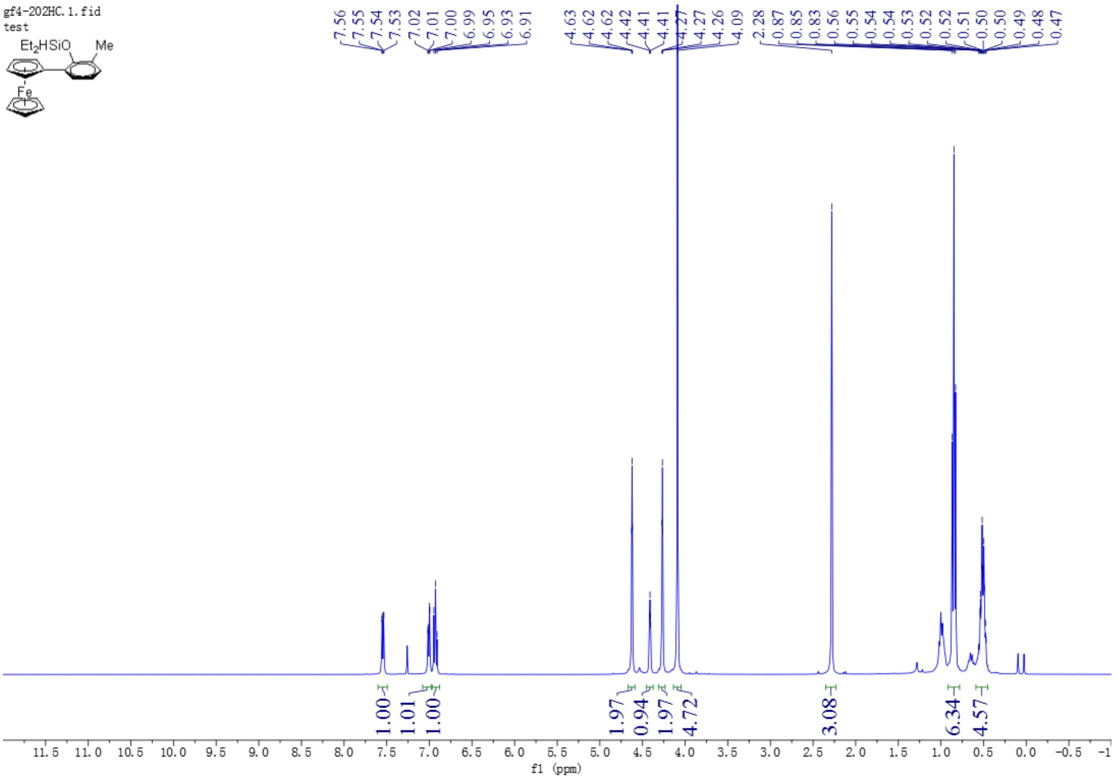
gf5-163HC.2.fid
C13CPD
Et2HSiO
OMe
Fe
158.59
153.54
130.18
121.53
106.75
104.81
83.21
77.32
77.00
76.68
69.28
68.42
67.80
55.26
6.61
5.10
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

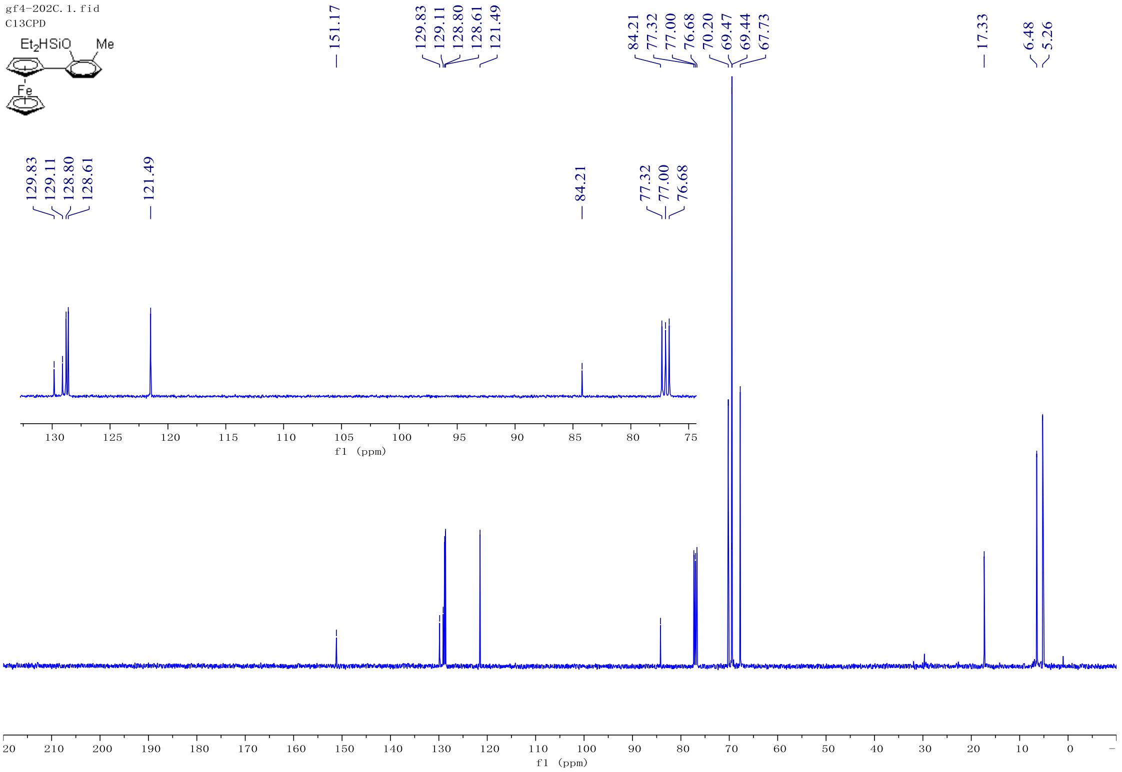
Compound 3n


gf4-171HC.1.fid
H1
Et2HSiO
OCF3
Fe
7.58 7.58 7.56 7.56 7.26 6.85 6.83 6.76
4.80 4.80 4.79 4.79 4.71 4.30 4.08
1.05 1.03 1.02 0.98 0.96 0.87 0.85 0.83 0.81
7.58 7.58 7.56 7.56
7.26
6.85 6.83 6.76
7.7 7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8 6.7 6.6 6.5
f1 (ppm)
1.00
1.02
0.96
0.93
1.94
2.01
4.80
6.63
4.15
12.0 11.5 11.0 10.5 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)

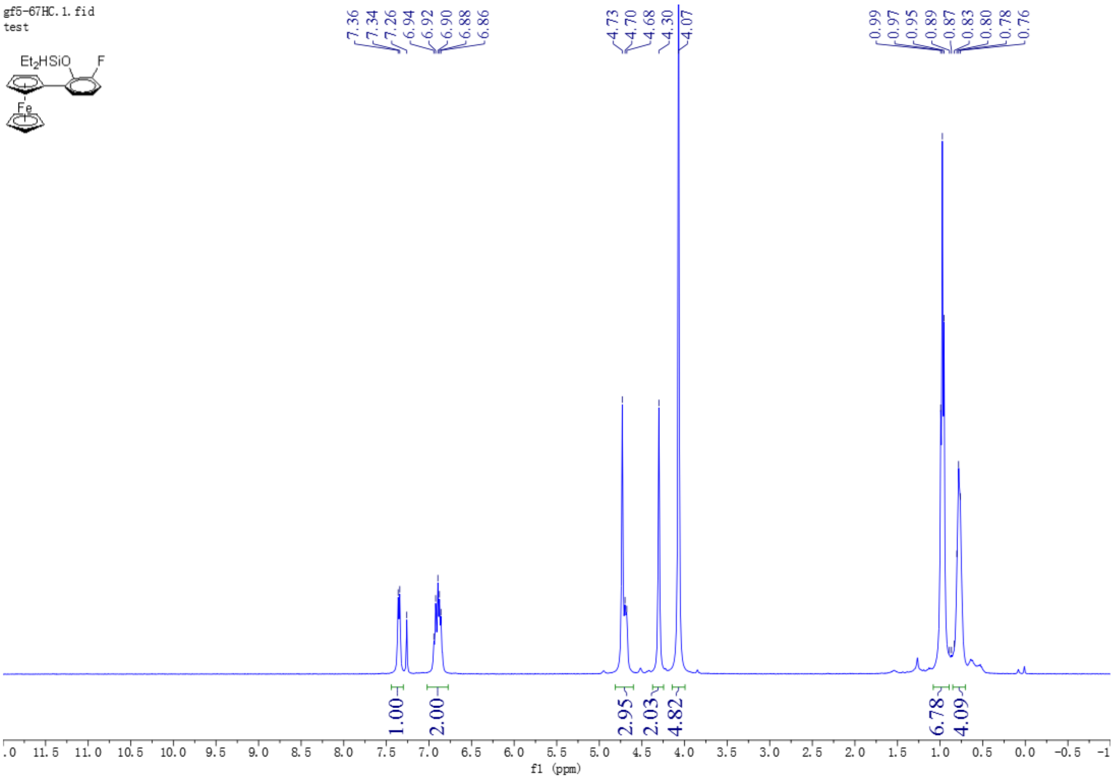

gf4-171HC.2.fid
1D 13C with H decoupling
Et2HSiO
OCF3
Fe
153.28 147.42 147.39 147.37 147.35
130.18 128.34 124.28 121.73 119.17 116.62 113.63 111.43
81.50 77.32 77.00 76.68 69.43 68.86 68.38
6.52 5.02
130.18
128.34
124.28
121.73
119.17
116.62
113.63
111.43
132 130 128 126 124 122 120 118 116 114 112 110 108
f1 (ppm)
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

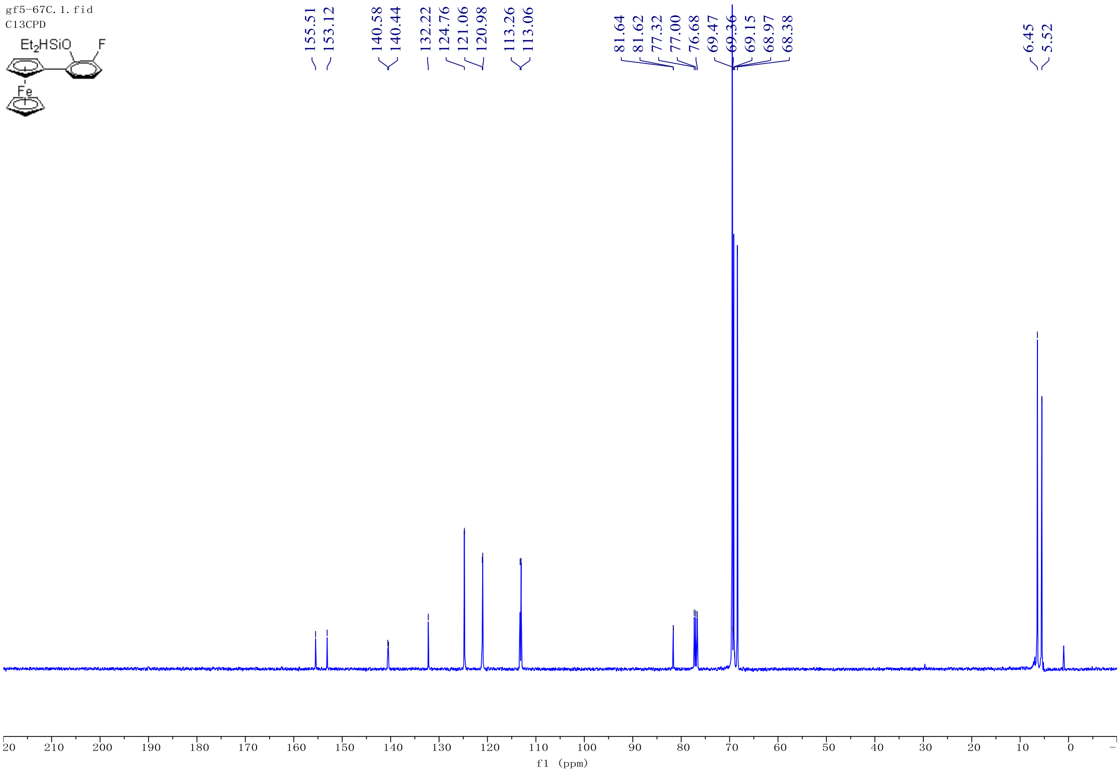
Compound 3o


gf4-202HC.1.fid
test
Et2HSiO
Me
Fe
7.56
7.55
7.54
7.53
7.02
7.01
7.00
6.99
6.95
6.93
6.91
4.63
4.62
4.62
4.42
4.41
4.41
4.27
4.27
4.26
4.09
2.28
0.87
0.85
0.83
0.56
0.55
0.54
0.54
0.53
0.52
0.52
0.51
0.50
0.50
0.49
0.48
0.47
1.00
1.01
1.00
1.97
0.94
1.97
4.72
3.08
6.34
4.57
11.5 11.0 10.5 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 -1
f1 (ppm)

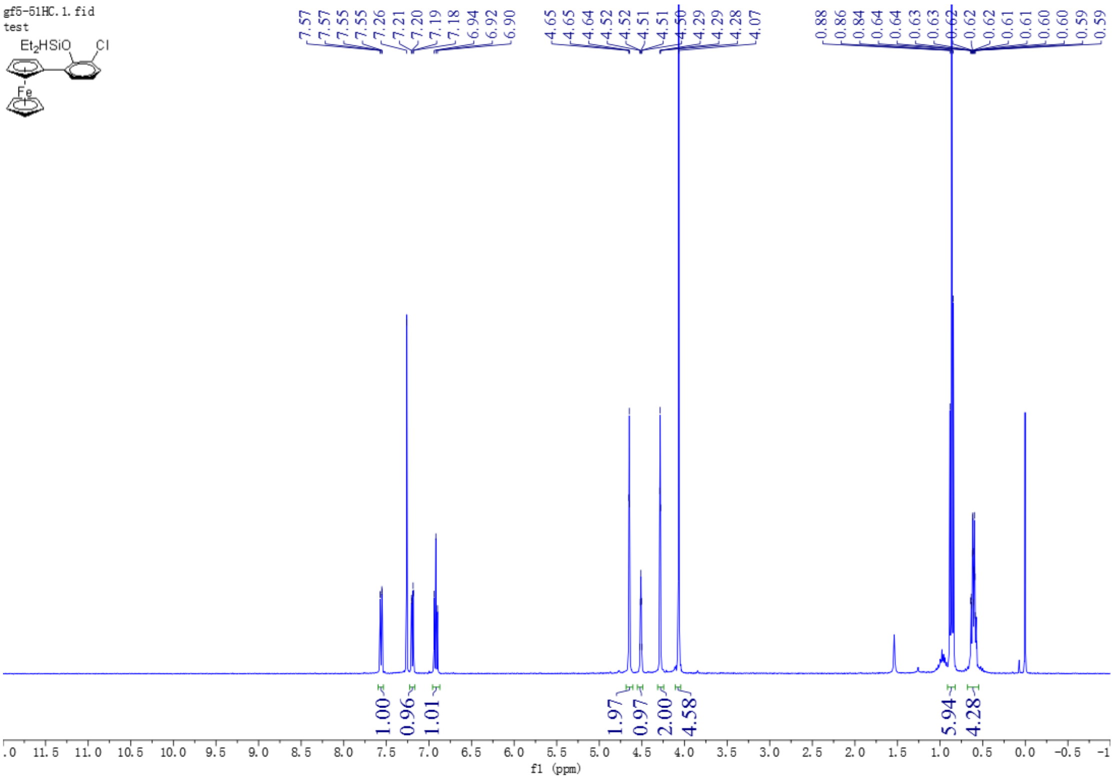

gf4-202C.1.fid
C13CPD
Et2HSiO
Me
Fe
151.17
129.83
129.11
128.80
128.61
121.49
84.21
77.32
77.00
76.68
70.20
69.47
69.44
67.73
17.33
6.48
5.26
129.83
129.11
128.80
128.61
121.49
84.21
77.32
77.00
76.68
130 125 120 115 110 105 100 95 90 85 80 75
f1 (ppm)
20 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

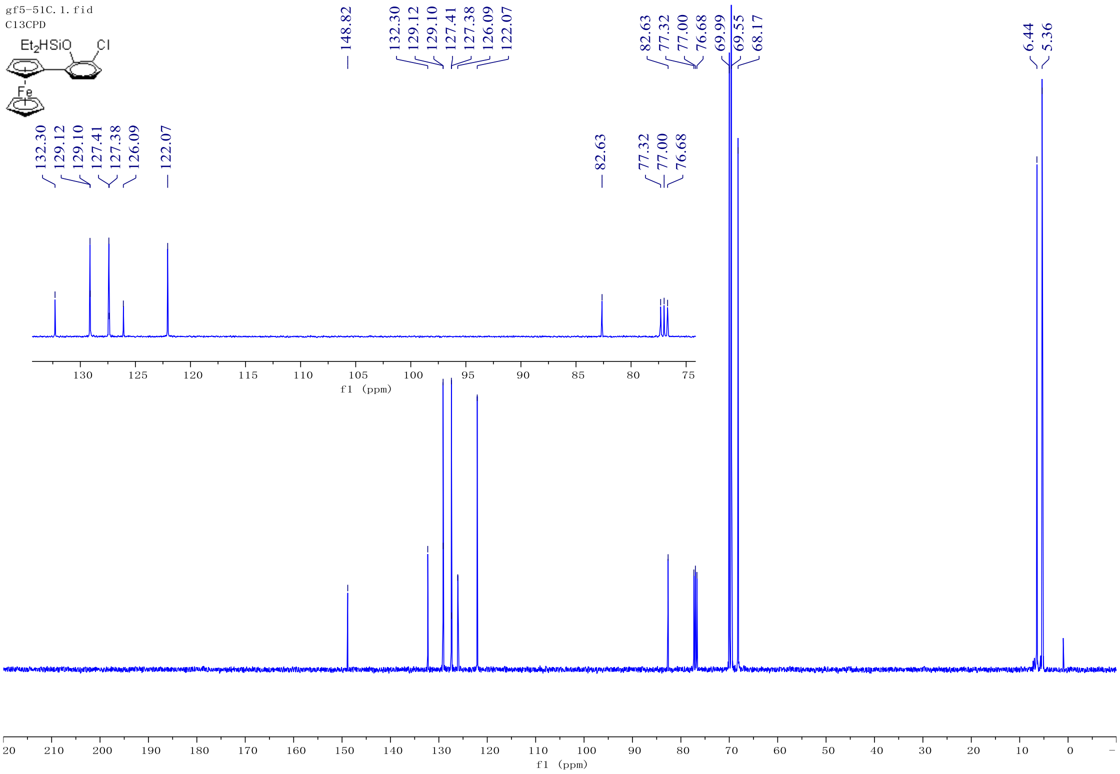
Compound 3p


gf5-67HC.1.fid
test
Et2HSiO
F
Fe
7.36
7.34
7.26
6.94
6.92
6.90
6.88
6.86
4.73
4.70
4.68
4.30
4.07
0.99
0.97
0.95
0.89
0.87
0.83
0.80
0.78
0.76
1.00
2.00
2.95
2.03
4.82
6.78
4.09
f1 (ppm)

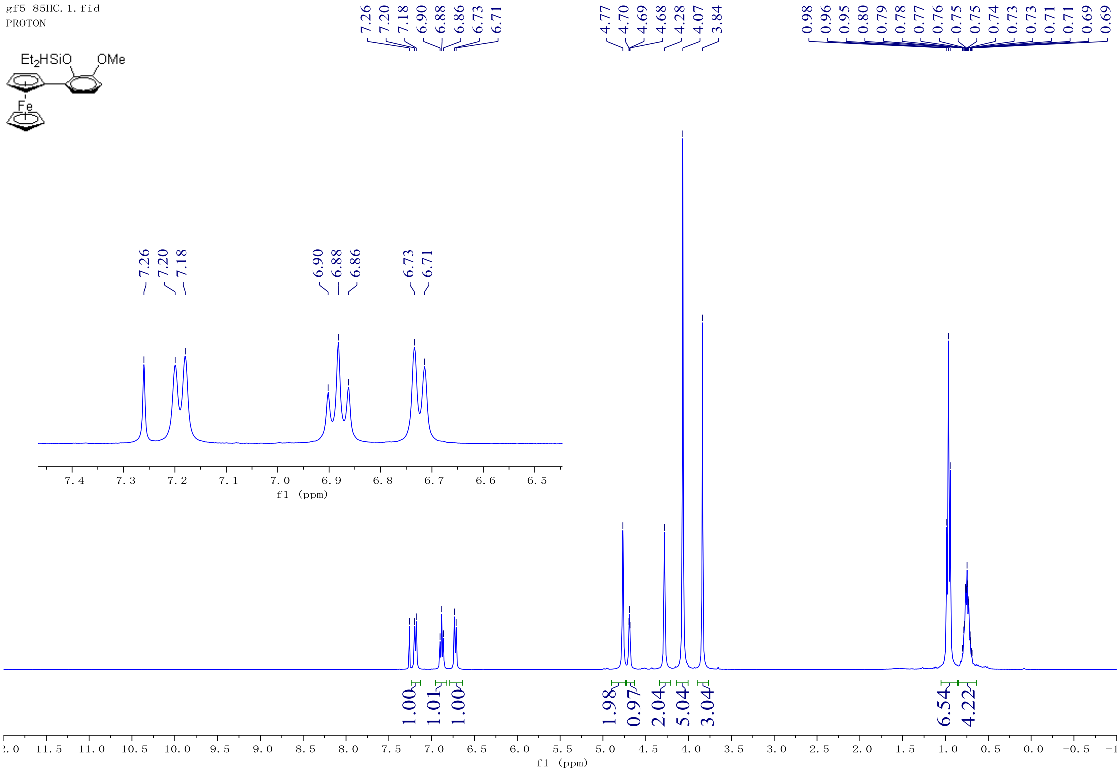

gf5-67C.1.fid
C13CPD
Et2HSiO
F
Fe
155.51
153.12
140.58
140.44
132.22
124.76
121.06
120.98
113.26
113.06
81.64
81.62
77.32
77.00
76.68
69.47
69.36
69.15
68.97
68.38
6.45
5.52
f1 (ppm)

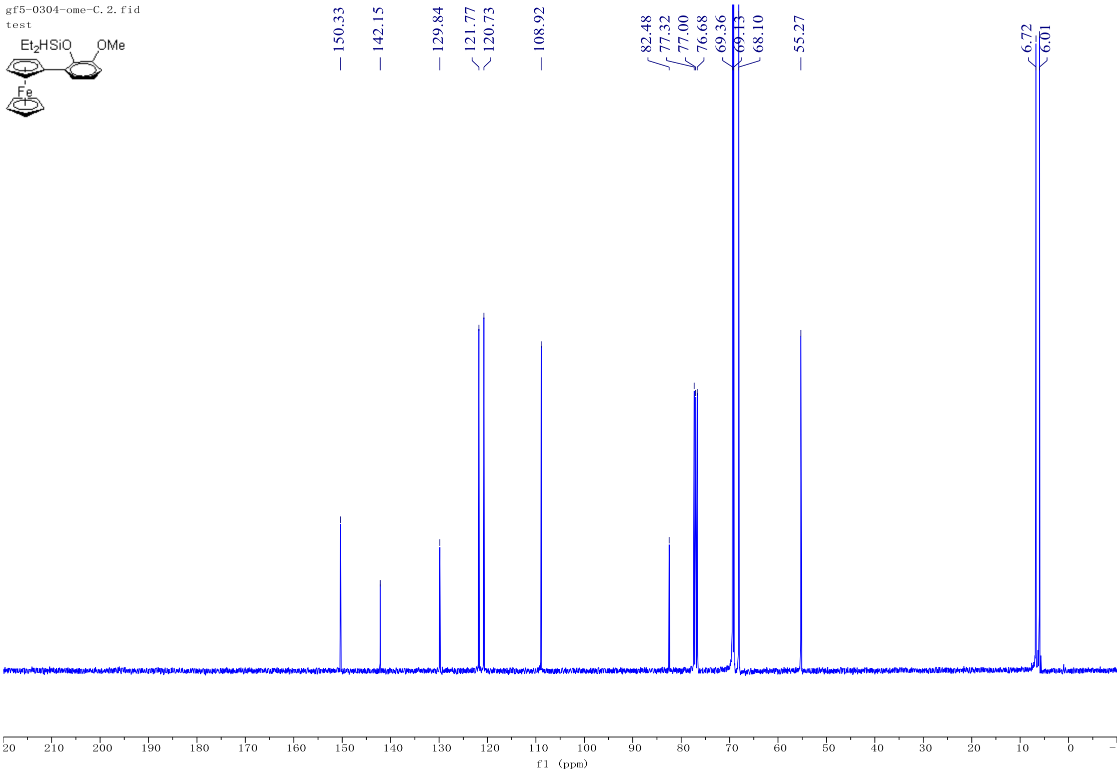
Compound 3q


gf5-51HC.1.fid
test
Et2HSiO
Cl
Fe
7.57
7.57
7.55
7.55
7.26
7.21
7.20
7.19
7.18
6.94
6.92
6.90
4.65
4.65
4.64
4.52
4.52
4.51
4.51
4.50
4.29
4.29
4.28
4.07
0.88
0.86
0.84
0.64
0.64
0.63
0.63
0.62
0.62
0.61
0.61
0.60
0.60
0.59
0.59
1.00
0.96
1.01
1.97
0.97
2.00
4.58
5.94
4.28
f1 (ppm)

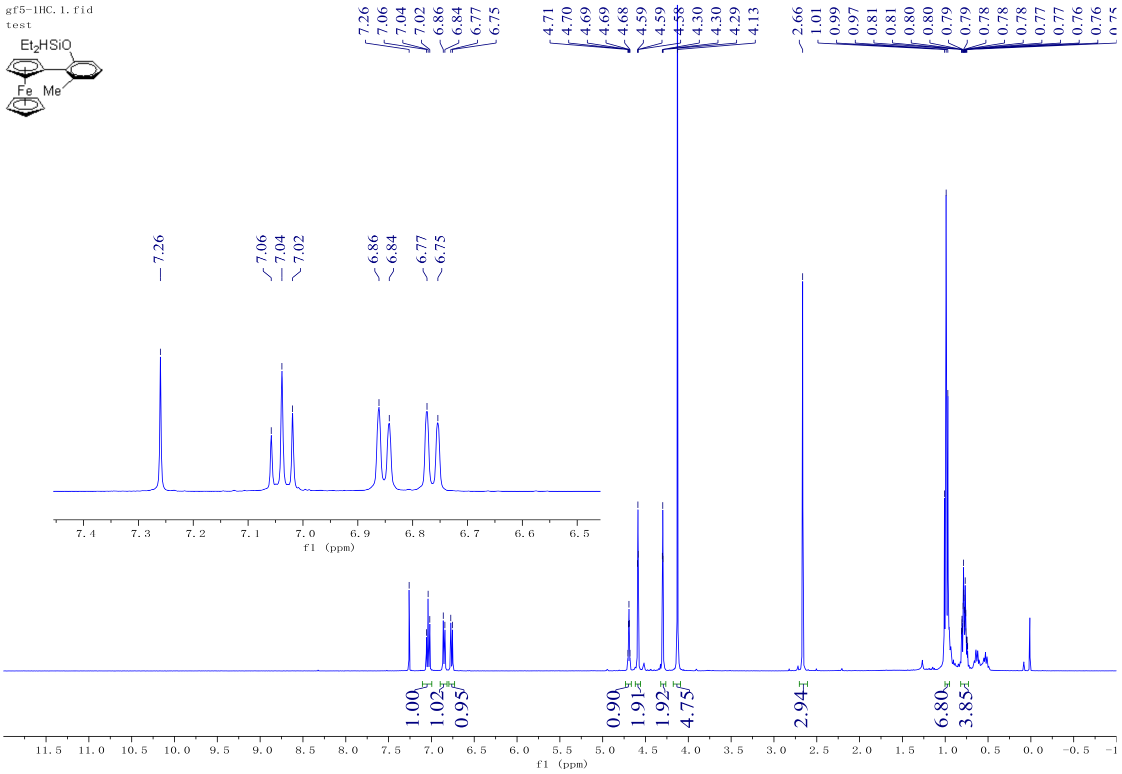

gf5-51C.1.fid
C13CPD
Et2HSiO
Cl
Fe
148.82
132.30
129.12
129.10
127.41
127.38
126.09
122.07
82.63
77.32
77.00
76.68
69.99
69.55
68.17
6.44
5.36
82.63
77.32
77.00
76.68
f1 (ppm)
f1 (ppm)

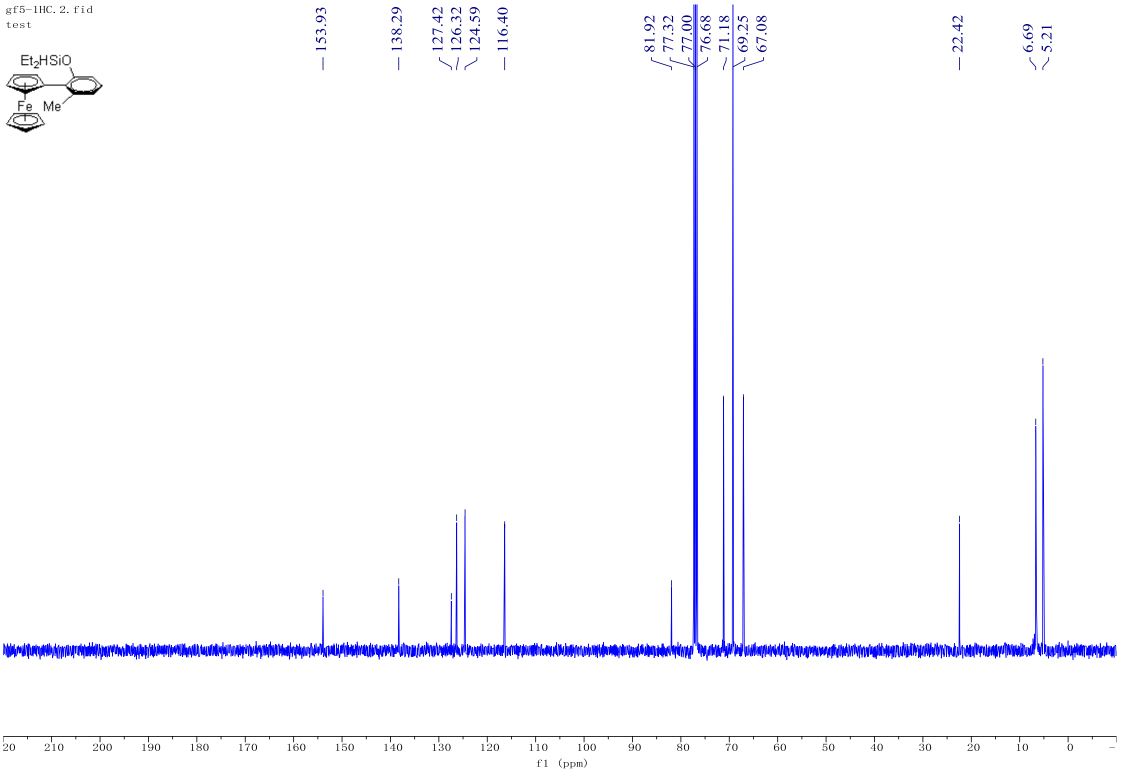
Compound 3r


gf5-85HC.1.fid
PROTON
Et2HSiO
OMe
Fe
7.26
7.20
7.18
6.90
6.88
6.86
6.73
6.71
4.77
4.70
4.69
4.68
4.28
4.07
3.84
0.98
0.96
0.95
0.80
0.79
0.78
0.77
0.76
0.75
0.75
0.74
0.73
0.73
0.71
0.69
0.69
7.4
7.3
7.2
7.1
7.0
6.9
6.8
6.7
6.6
6.5
f1 (ppm)
1.00
1.01
1.00
1.98
0.97
2.04
5.04
3.04
6.54
4.22
11.5
11.0
10.5
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)

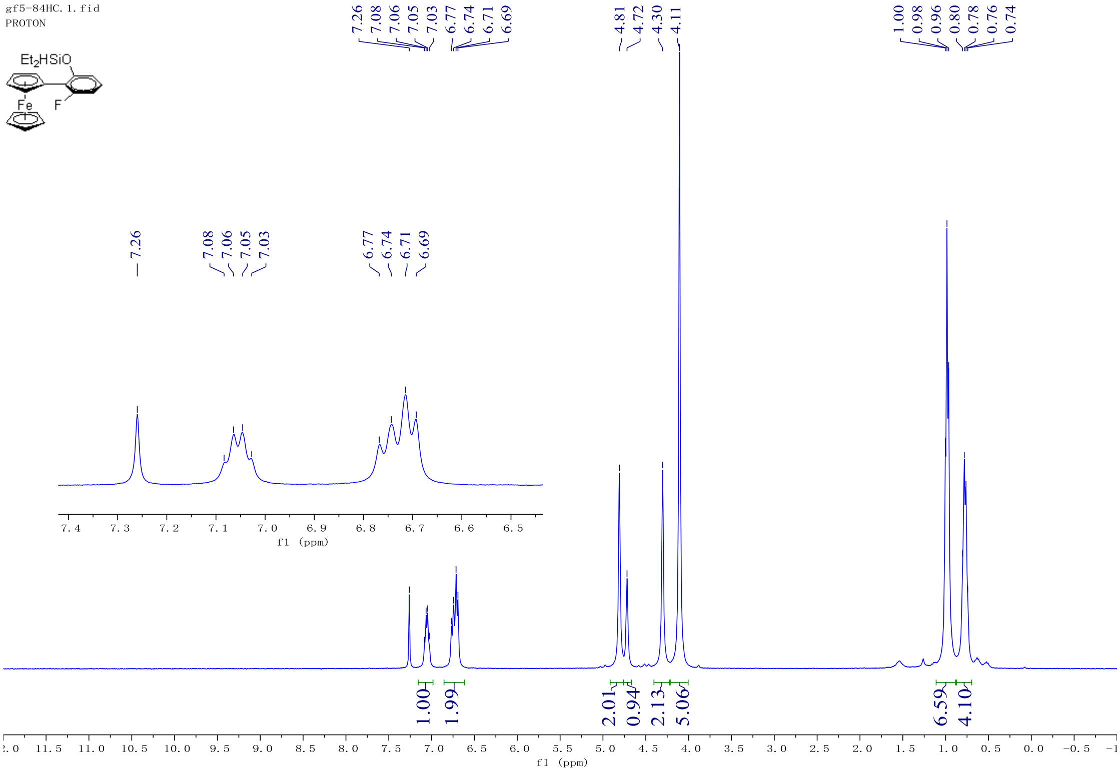

gf5-0304-ome-C.2.fid
test
Et2HSiO
OMe
Fe
150.33
142.15
129.84
121.77
120.73
108.92
82.48
77.32
77.00
76.68
69.36
69.13
68.10
55.27
6.72
6.01
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

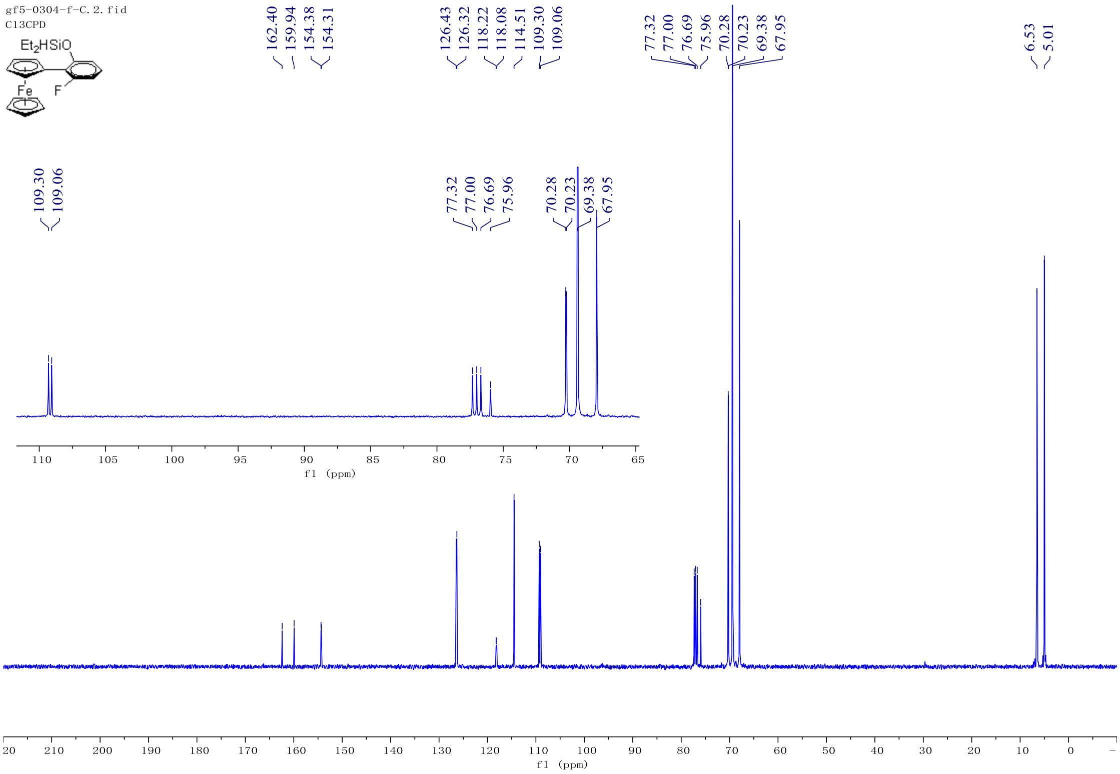
Compound 3s


gf5-1HC.1.fid
test
Et$_2$HSiO
Fe
Me
7.26
7.06
7.04
7.02
6.86
6.84
6.77
6.75
4.71
4.70
4.69
4.69
4.68
4.59
4.59
4.58
4.30
4.30
4.29
4.13
2.66
1.01
0.99
0.97
0.81
0.81
0.80
0.80
0.79
0.79
0.78
0.78
0.78
0.77
0.77
0.76
0.76
1.00
1.02
0.95
0.90
1.91
1.92
4.75
2.94
6.80
3.85
f1 (ppm)

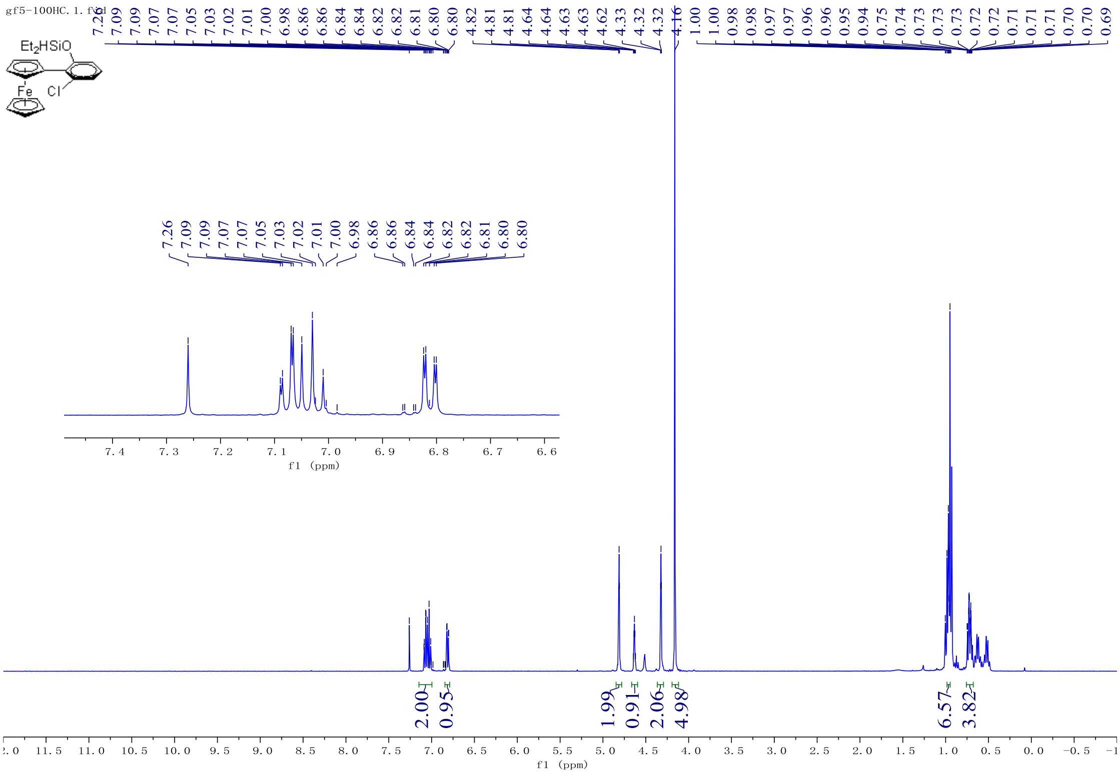

gf5-1HC.2.fid
test
Et$_2$HSiO
Fe
Me
153.93
138.29
127.42
126.32
124.59
116.40
81.92
77.32
77.00
76.68
71.18
69.25
67.08
22.42
6.69
5.21
f1 (ppm)

Compound 3t

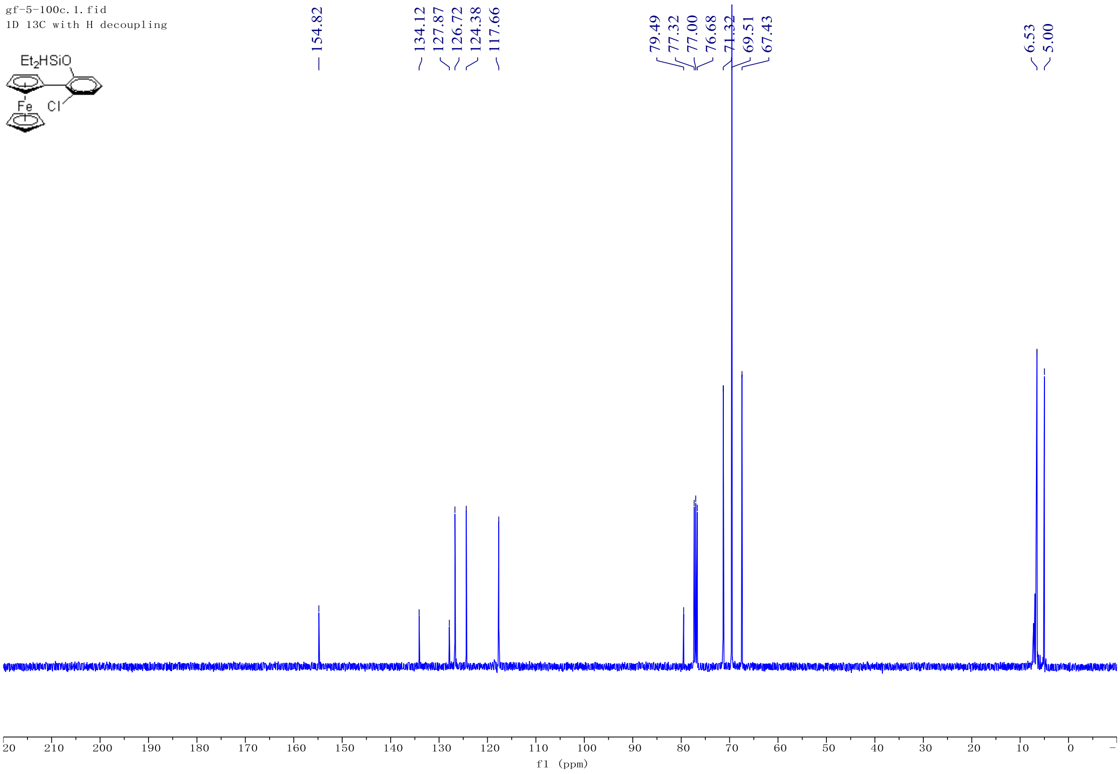

gf5-84HC.1.fid
PROTON
Et2HSiO
Fe
F
7.26
7.08
7.06
7.05
7.03
6.77
6.74
6.71
6.69
4.81
4.72
4.30
4.11
1.00
0.98
0.96
0.80
0.78
0.76
0.74
1.00
1.99
2.01
0.94
2.13
5.06
6.59
4.10
7.4 7.3 7.2 7.1 7.0 6.9 6.8 6.7 6.6 6.5
f1 (ppm)
12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1
f1 (ppm)


gf5-0304-f-C.2.fid
C13CPD
Et2HSiO
Fe
F
162.40
159.94
154.38
154.31
126.43
126.32
118.22
118.08
114.51
109.30
109.06
77.32
77.00
76.69
75.96
70.28
70.23
69.38
67.95
6.53
5.01
110 105 100 95 90 85 80 75 70 65
f1 (ppm)
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

Compound 3u

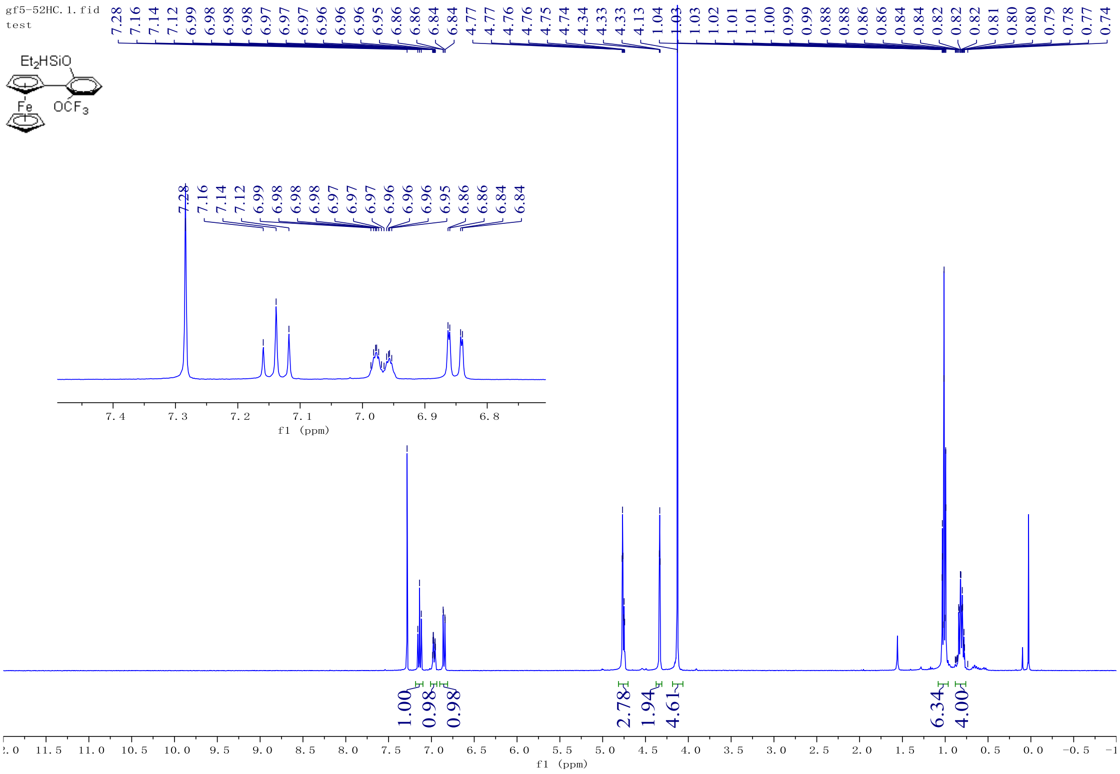


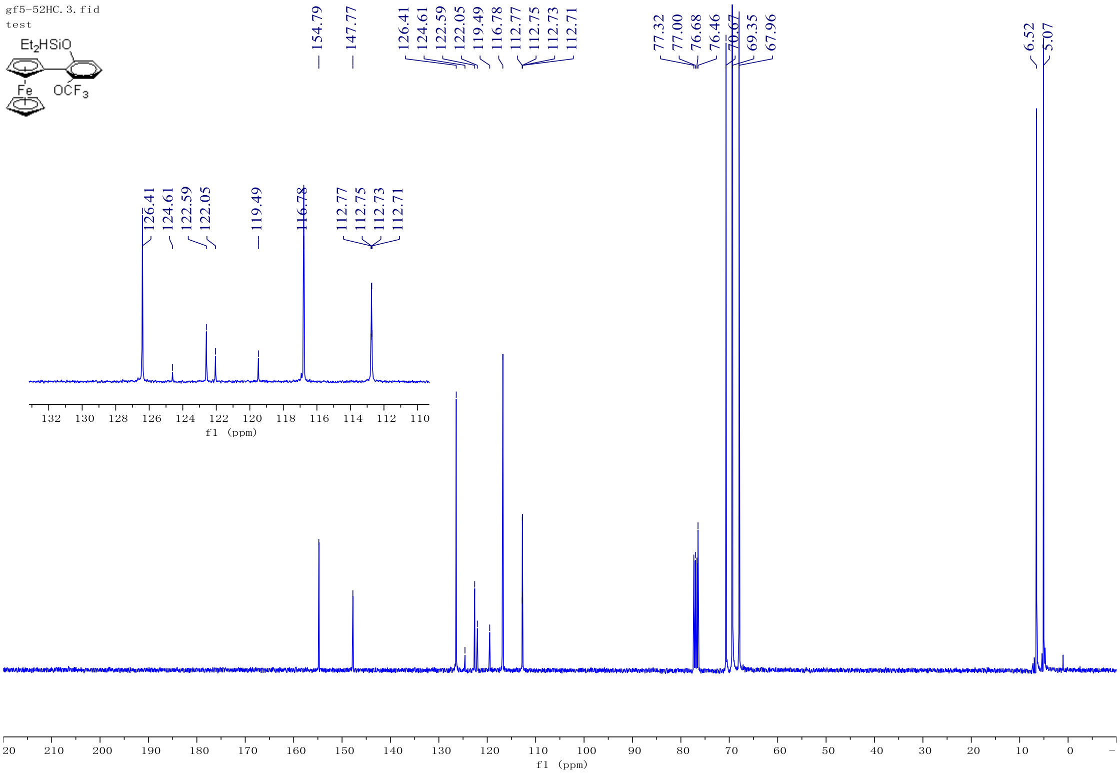
gf5-100HC.1.fid
Et2HSiO
Fe
Cl
7.26 7.09 7.09 7.07 7.07 7.05 7.03 7.02 7.01 7.00 6.98 6.86 6.86 6.84 6.84 6.82 6.82 6.81 6.80 6.80 4.82 4.81 4.81 4.64 4.64 4.63 4.63 4.62 4.33 4.32 4.32 4.16 1.00 0.98 0.98 0.97 0.97 0.96 0.96 0.95 0.94 0.75 0.74 0.73 0.73 0.73 0.72 0.72 0.71 0.71 0.71 0.70 0.69
2.00 0.95 1.99 0.91 2.06 4.98 6.57 3.82
f1 (ppm)



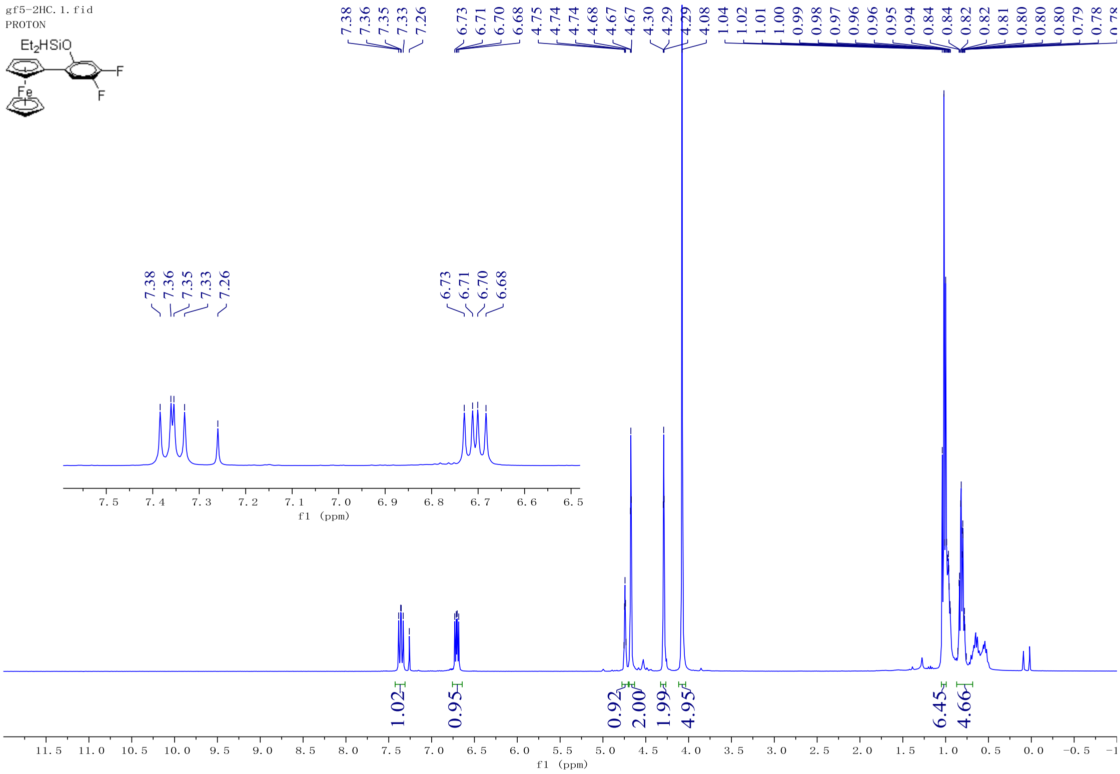
gf-5-100c.1.fid
1D 13C with H decoupling
Et2HSiO
Fe
Cl
154.82 134.12 127.87 126.72 124.38 117.66 79.49 77.32 77.00 76.68 71.32 69.51 67.43 6.53 5.00
f1 (ppm)

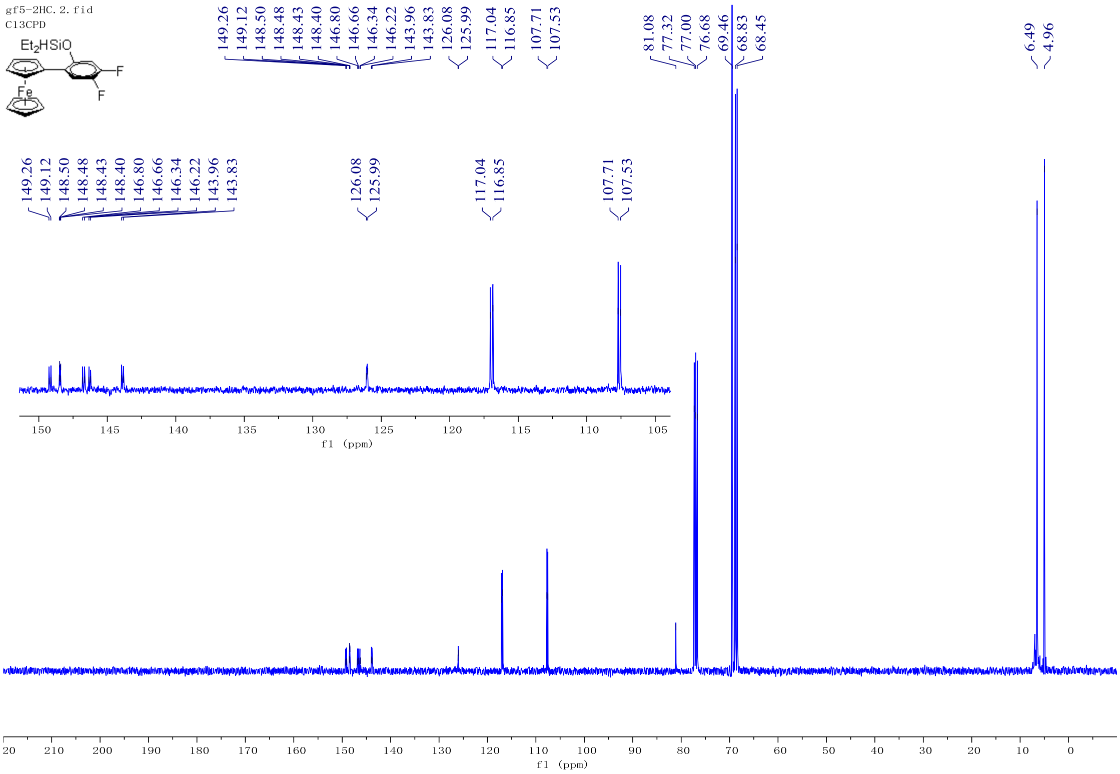
Compound 3v


gf5-52HC.1.fid
test
Et$_2$HSiO
Fe
OCF$_3$
7.28
7.16
7.14
7.12
6.99
6.98
6.98
6.98
6.97
6.97
6.97
6.96
6.96
6.96
6.95
6.86
6.84
6.84
4.77
4.77
4.76
4.76
4.75
4.74
4.34
4.33
4.13
1.04
1.03
1.03
1.02
1.01
1.01
1.00
0.99
0.99
0.88
0.88
0.86
0.86
0.84
0.84
0.82
0.82
0.82
0.81
0.80
0.79
0.78
0.77
0.74
7.28
7.16
7.14
7.12
6.99
6.98
6.98
6.98
6.97
6.97
6.97
6.96
6.96
6.96
6.95
6.86
6.86
6.84
6.84
7.4
7.3
7.2
7.1
7.0
6.9
6.8
f1 (ppm)
1.00
0.98
0.98
2.78
1.94
4.61
6.34
4.00
11.5
11.0
10.5
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)

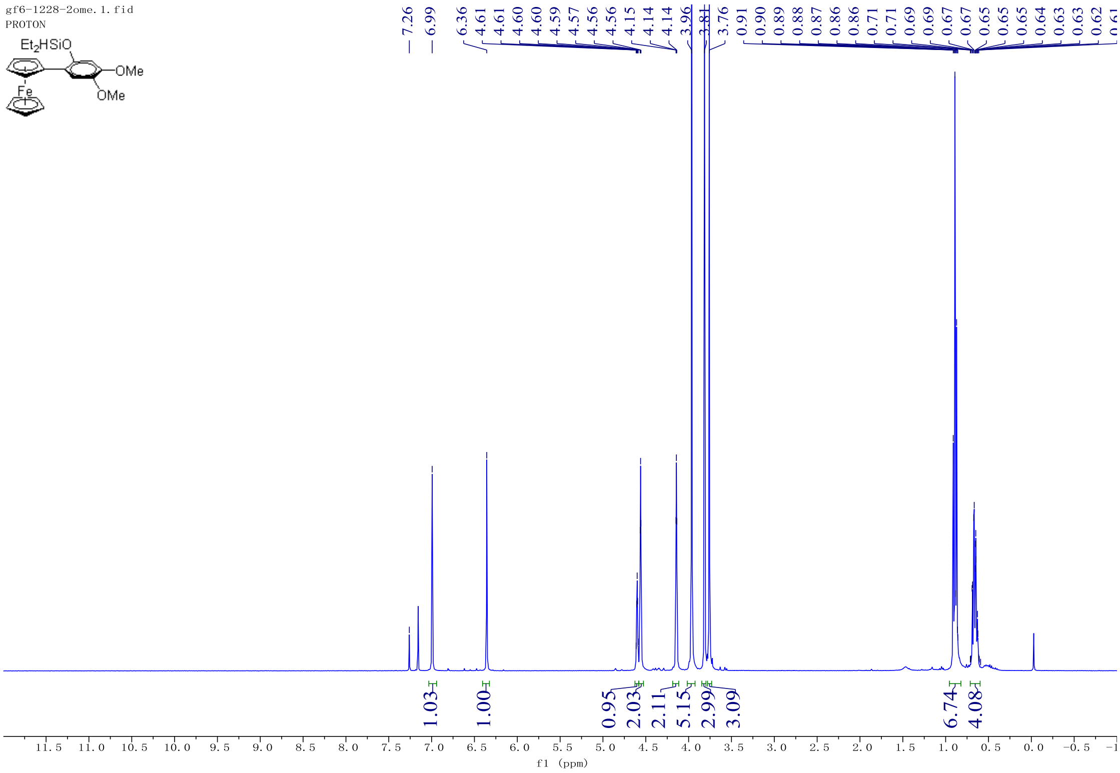

gf5-52HC.3.fid
test
Et$_2$HSiO
Fe
OCF$_3$
154.79
147.77
126.41
124.61
122.59
122.05
119.49
116.78
112.77
112.75
112.73
112.71
77.32
77.00
76.68
76.46
70.67
69.35
67.96
6.52
5.07
126.41
124.61
122.59
122.05
119.49
116.78
112.77
112.75
112.73
112.71
132
130
128
126
124
122
120
118
116
114
112
110
f1 (ppm)
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

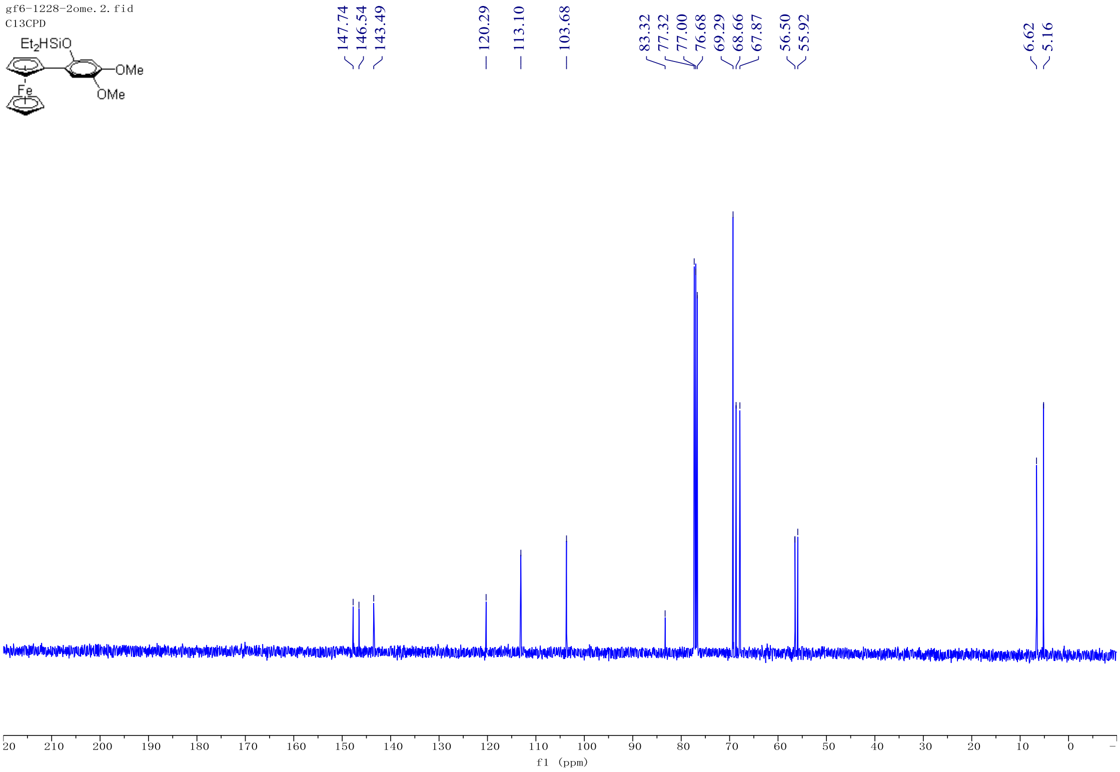
Compound 3w


gf5-2HC.1.fid
PROTON
Et_2HSiO
F
F
Fe
7.38
7.36
7.35
7.33
7.26
6.73
6.71
6.70
6.68
4.75
4.74
4.74
4.68
4.67
4.67
4.30
4.29
4.29
4.08
1.04
1.02
1.01
1.00
0.99
0.98
0.97
0.96
0.96
0.95
0.94
0.84
0.84
0.82
0.82
0.81
0.80
0.80
0.80
0.79
0.78
1.02
0.95
0.92
2.00
1.99
4.95
6.45
4.66
f1 (ppm)

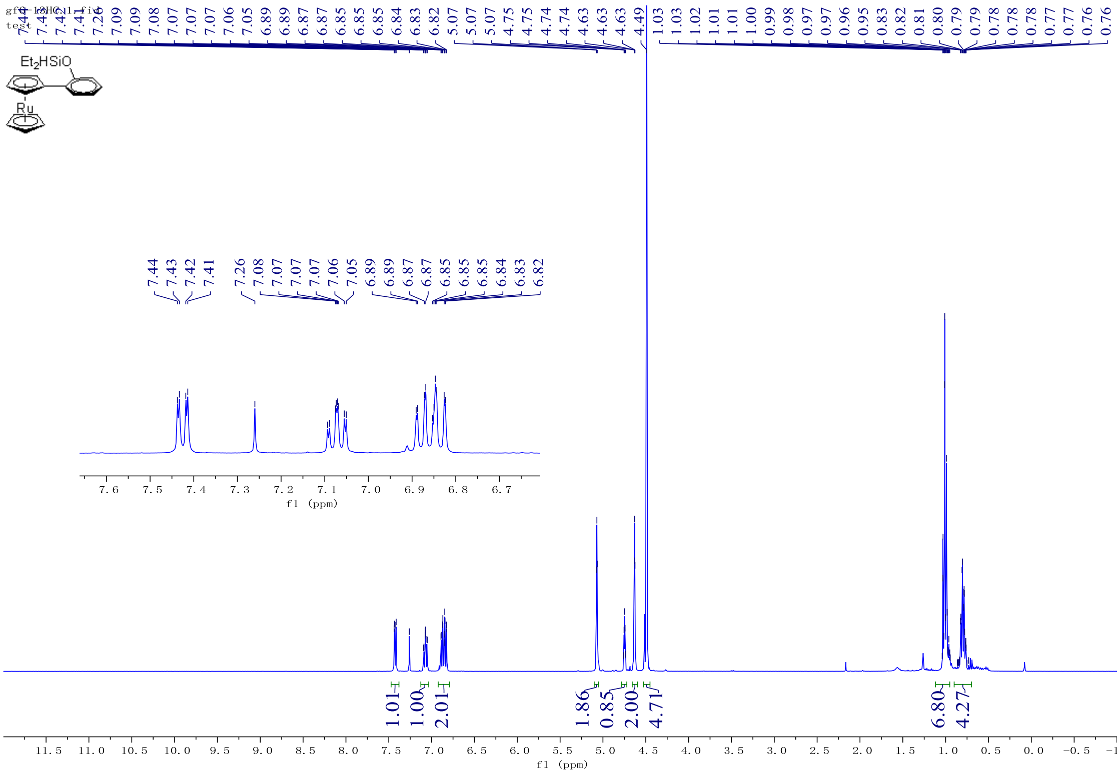

gf5-2HC.2.fid
C13CPD
Et_2HSiO
F
F
Fe
149.26
149.12
148.50
148.48
148.43
148.40
146.80
146.66
146.34
146.22
143.96
143.83
126.08
125.99
117.04
116.85
107.71
107.53
81.08
77.32
77.00
76.68
69.46
68.83
68.45
6.49
4.96
f1 (ppm)

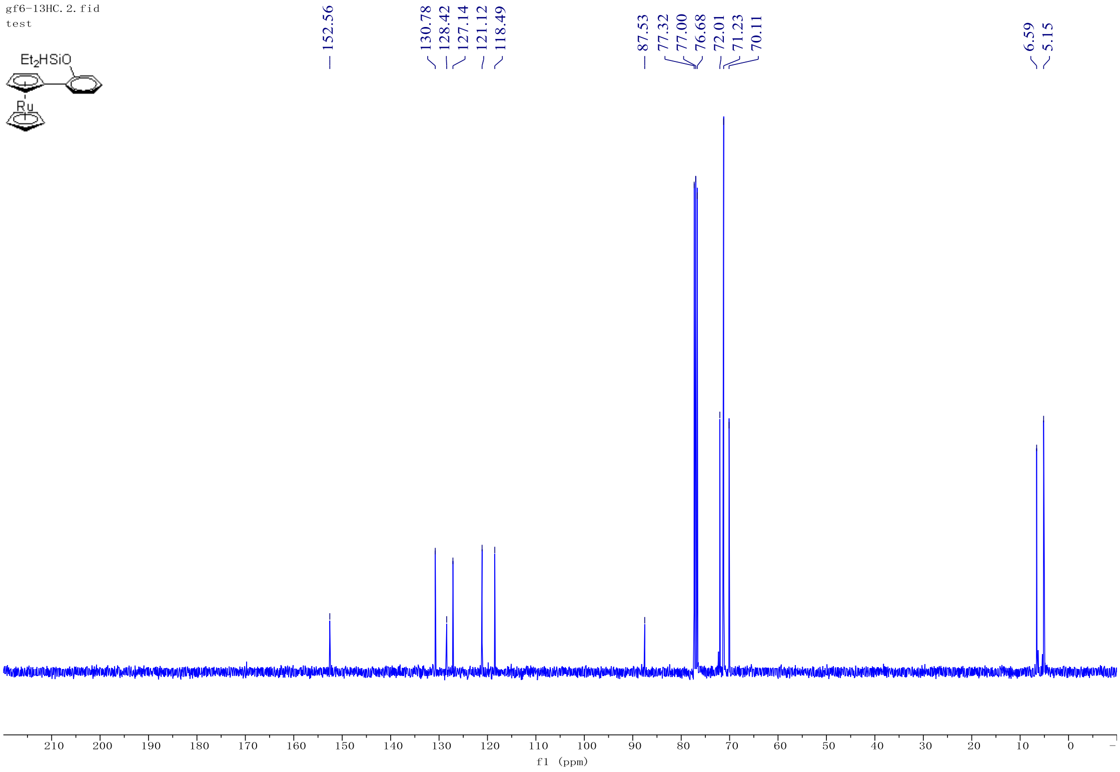
Compound 3x


gf6-1228-2ome.1.fid
PROTON
Et$_2$HSiO
OMe
OMe
Fe
7.26
6.99
6.36
4.61
4.61
4.60
4.60
4.59
4.57
4.56
4.56
4.15
4.14
4.14
3.96
3.81
3.76
0.91
0.90
0.89
0.88
0.87
0.86
0.86
0.71
0.71
0.69
0.69
0.67
0.67
0.65
0.65
0.65
0.64
0.63
0.63
0.62
1.03
1.00
0.95
2.03
2.11
5.15
2.99
3.09
6.74
4.08
11.5
11.0
10.5
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)

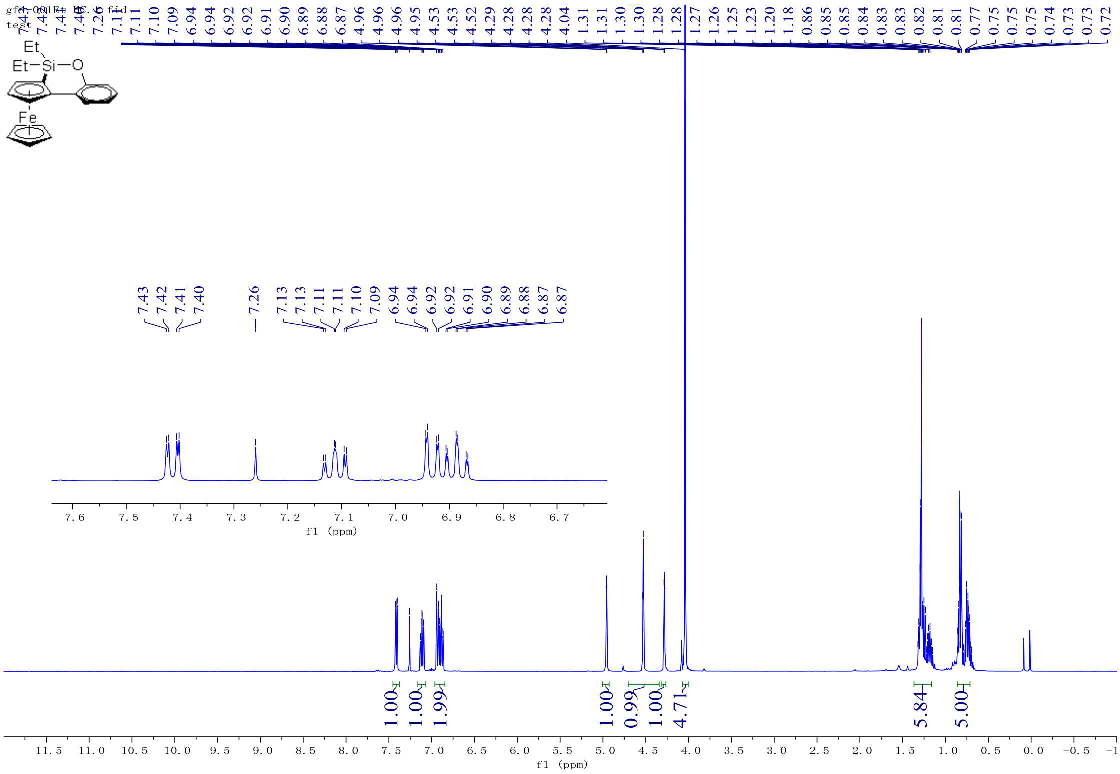

gf6-1228-2ome.2.fid
C13CPD
Et$_2$HSiO
OMe
OMe
Fe
147.74
146.54
143.49
120.29
113.10
103.68
83.32
77.32
77.00
76.68
69.29
68.66
67.87
56.50
55.92
6.62
5.16
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

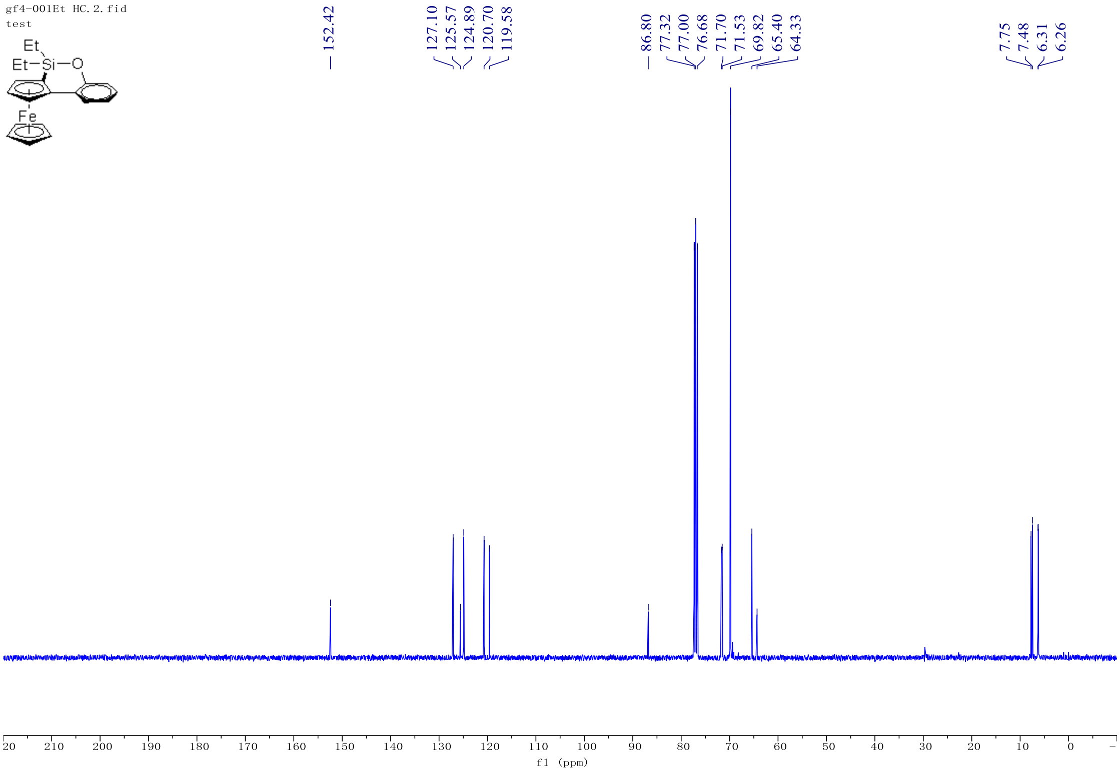
Compound 3y


gf6-13HC.1.fid
test
Et2HSiO
Ru
7.44 7.43 7.42 7.41 7.26 7.09 7.09 7.08 7.07 7.07 7.07 7.06 7.05 6.89 6.89 6.87 6.87 6.85 6.85 6.85 6.84 6.83 6.82 5.07 5.07 5.07 4.75 4.75 4.74 4.74 4.63 4.63 4.63 4.49 1.03 1.03 1.02 1.01 1.01 1.00 0.99 0.98 0.97 0.97 0.96 0.95 0.83 0.82 0.81 0.80 0.79 0.79 0.78 0.78 0.78 0.77 0.76 0.76
7.44 7.43 7.42 7.41 7.26 7.08 7.07 7.07 7.07 7.06 7.05 6.89 6.89 6.87 6.87 6.85 6.85 6.85 6.84 6.83 6.82
7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8 6.7
f1 (ppm)
1.01 1.00 2.01 1.86 0.85 2.00 4.71 6.80 4.27
11.5 11.0 10.5 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 -1
f1 (ppm)

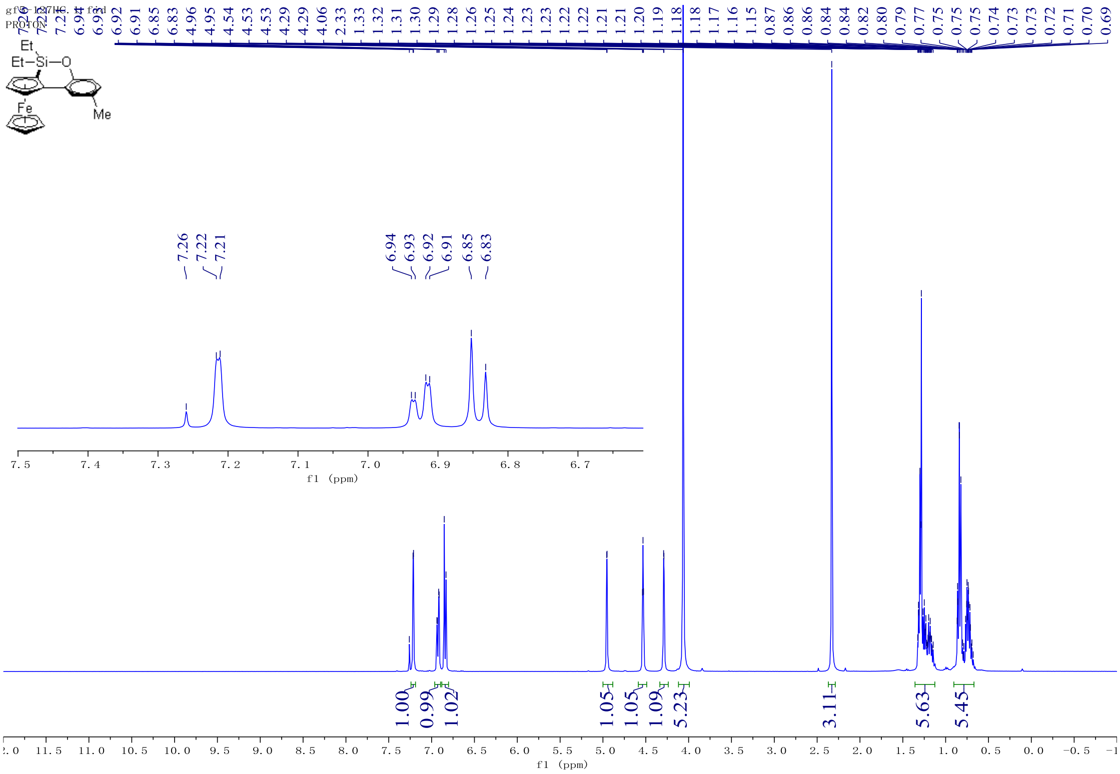

gf6-13HC.2.fid
test
Et2HSiO
Ru
152.56
130.78 128.42 127.14 121.12 118.49
87.53 77.32 77.00 76.68 72.01 71.23 70.11
6.59 5.15
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

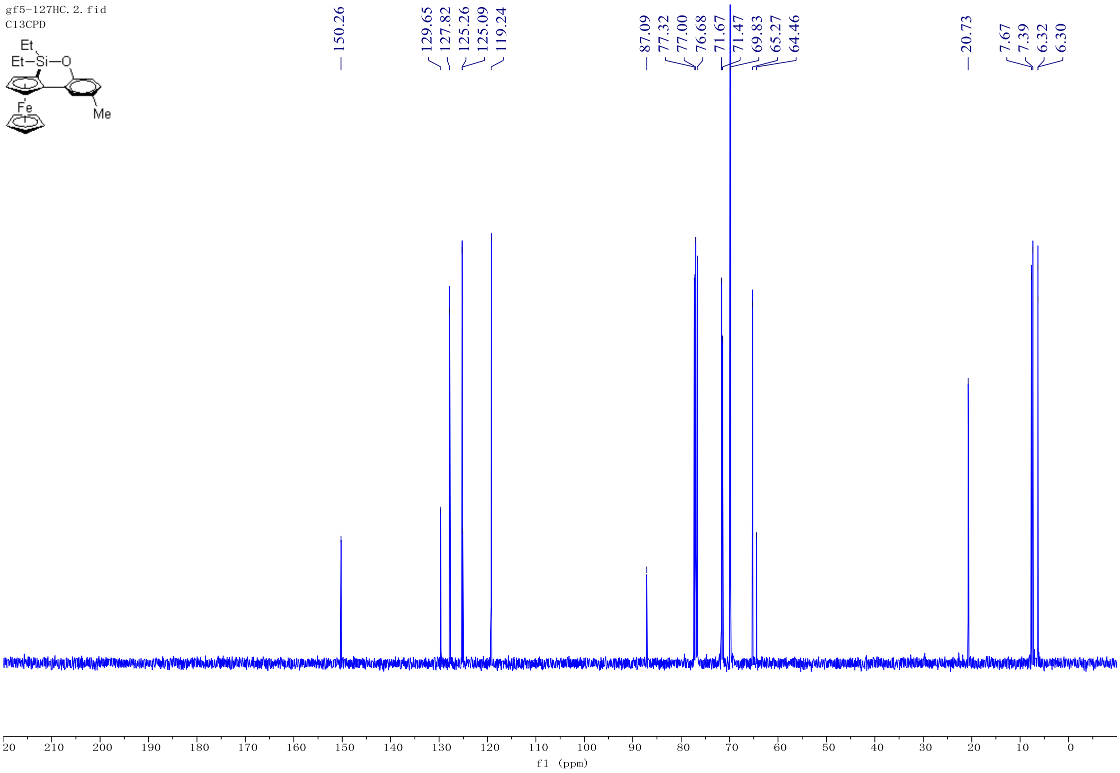
Compound 4a


test
Et
Et−Si−O
Fe
7.43
7.42
7.41
7.40
7.26
7.11
7.10
7.09
6.94
6.94
6.92
6.91
6.90
6.89
6.88
6.87
4.96
4.96
4.95
4.53
4.53
4.52
4.29
4.28
4.28
4.28
4.04
1.31
1.31
1.30
1.30
1.28
1.28
1.27
1.26
1.25
1.23
1.20
1.18
0.86
0.85
0.85
0.84
0.83
0.83
0.82
0.81
0.81
0.77
0.75
0.75
0.75
0.74
0.73
0.73
0.72
7.43
7.42
7.41
7.40
7.26
7.13
7.13
7.11
7.11
7.10
7.09
6.94
6.94
6.92
6.92
6.91
6.90
6.89
6.88
6.87
6.87
7.6
7.5
7.4
7.3
7.2
7.1
7.0
6.9
6.8
6.7
f1 (ppm)
1.00
1.00
1.99
1.00
0.99
1.00
4.71
5.84
5.00
11.5
11.0
10.5
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
-1
f1 (ppm)

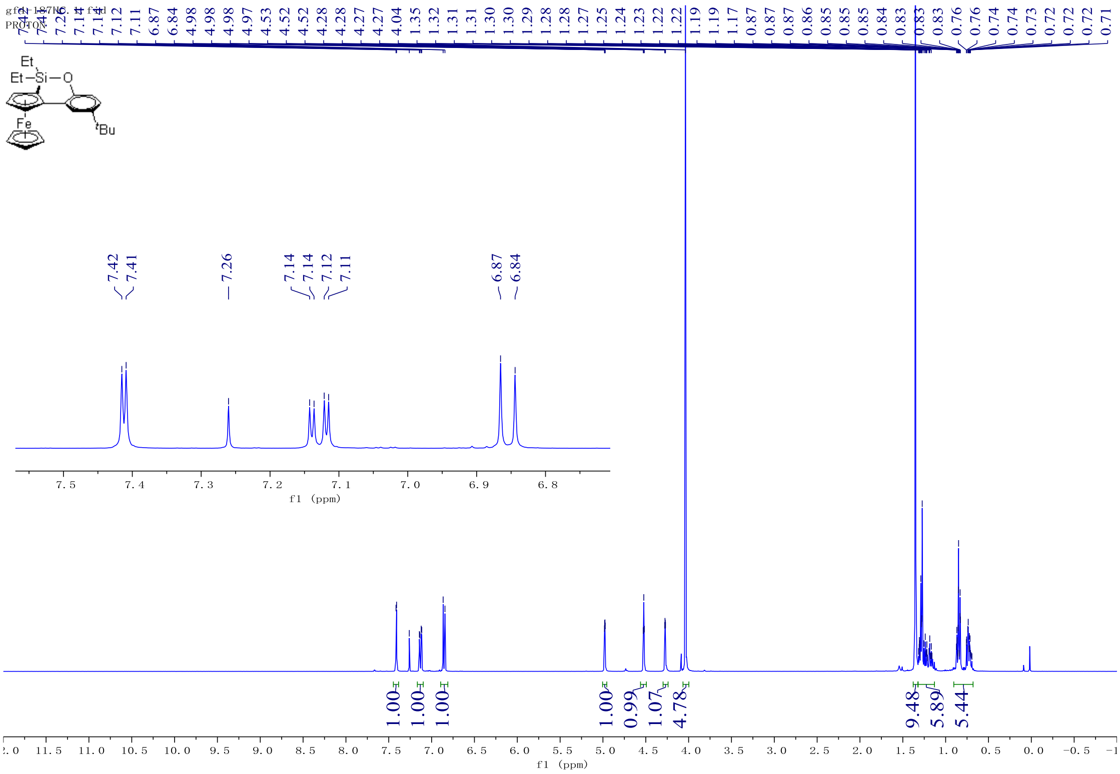

gf4-001Et HC.2.fid
test
Et
Et−Si−O
Fe
152.42
127.10
125.57
124.89
120.70
119.58
86.80
77.32
77.00
76.68
71.70
71.53
69.82
65.40
64.33
7.75
7.48
6.31
6.26
20
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

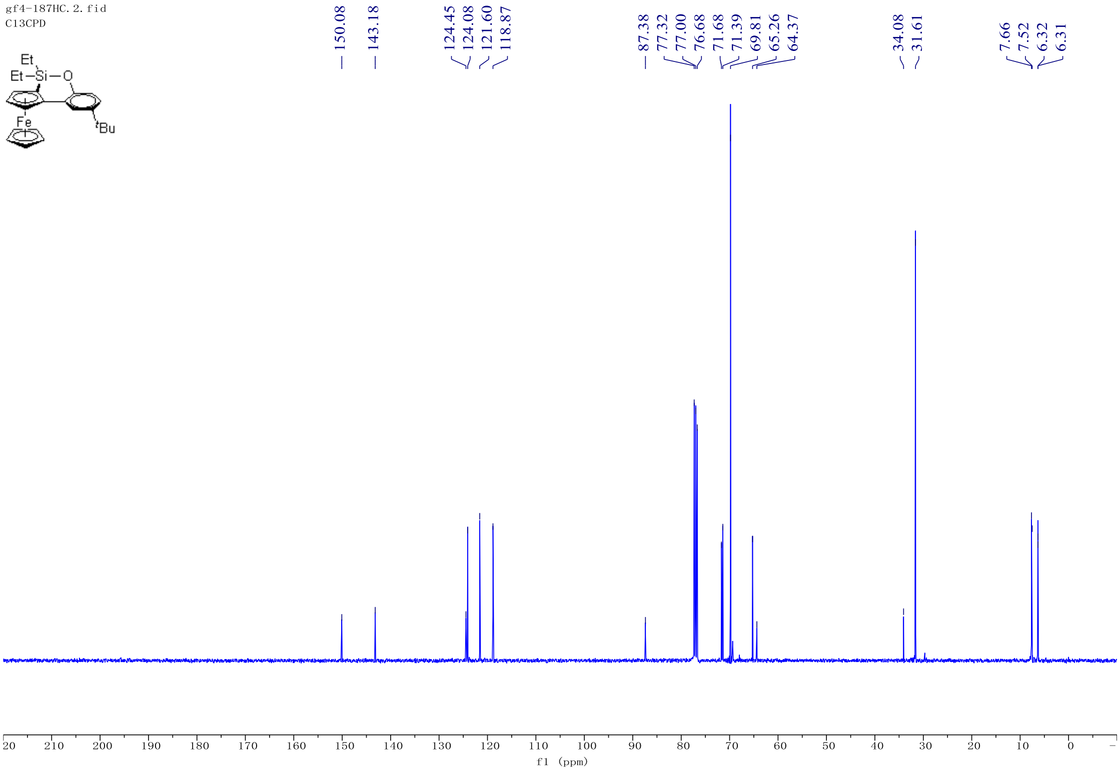
Compound 4b


gf5-127HC.1.fid
PROTON
Et
Et–Si–O
Fe
Me
7.26 7.22 7.21 6.94 6.93 6.92 6.91 6.85 6.83 4.96 4.95 4.54 4.53 4.53 4.29 4.29 4.06 2.33 1.33 1.32 1.31 1.30 1.29 1.28 1.26 1.25 1.24 1.23 1.23 1.22 1.22 1.21 1.21 1.20 1.19 1.18 1.18 1.17 1.16 1.15 0.87 0.86 0.86 0.84 0.84 0.82 0.80 0.79 0.77 0.75 0.75 0.75 0.74 0.73 0.73 0.72 0.71 0.70 0.69
7.26 7.22 7.21 6.94 6.93 6.92 6.91 6.85 6.83
7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8 6.7
f1 (ppm)
1.00 0.99 1.02 1.05 1.05 1.09 5.23 3.11 5.63 5.45
12.0 11.5 11.0 10.5 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 -1
f1 (ppm)

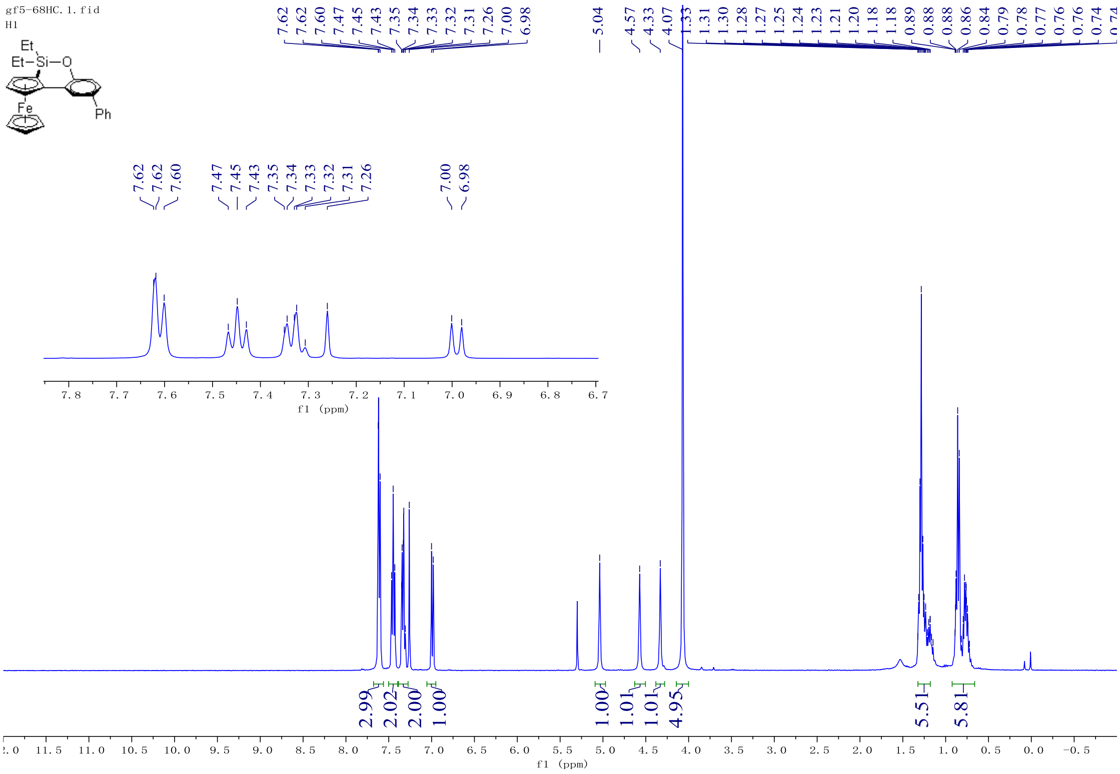

gf5-127HC.2.fid
C13CPD
Et
Et–Si–O
Fe
Me
150.26 129.65 127.82 125.26 125.09 119.24 87.09 77.32 77.00 76.68 71.67 71.47 69.83 65.27 64.46 20.73 7.67 7.39 6.32 6.30
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

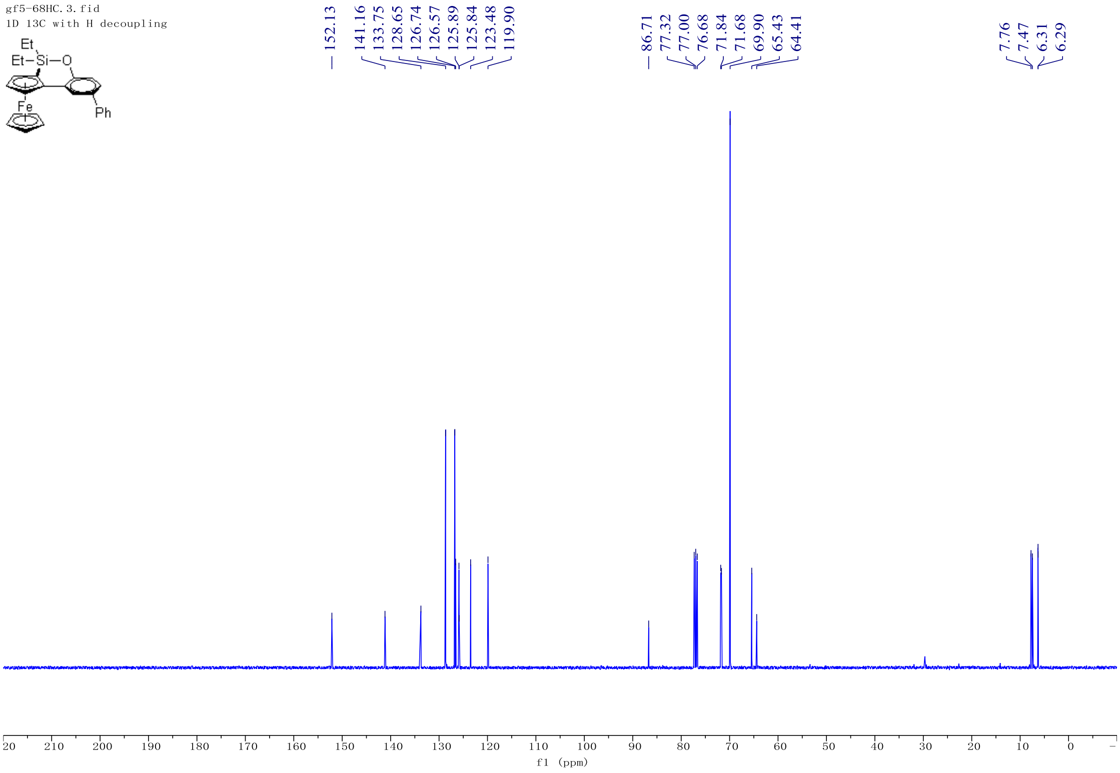
Compound 4c


PROTON
7.42
7.41
7.26
7.14
7.14
7.12
7.11
6.87
6.84
4.98
4.98
4.98
4.97
4.53
4.52
4.52
4.28
4.28
4.27
4.27
4.04
1.35
1.32
1.31
1.31
1.30
1.30
1.29
1.28
1.28
1.27
1.25
1.24
1.23
1.22
1.22
1.19
1.19
1.17
0.87
0.87
0.87
0.86
0.85
0.85
0.85
0.84
0.83
0.83
0.83
0.76
0.76
0.74
0.74
0.73
0.72
0.72
0.71
Et
Et
Si
O
Fe
tBu
1.00
1.00
1.00
1.00
0.99
1.07
4.78
9.48
5.89
5.44
7.5
7.4
7.3
7.2
7.1
7.0
6.9
6.8
f1 (ppm)
11.5
11.0
10.5
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)

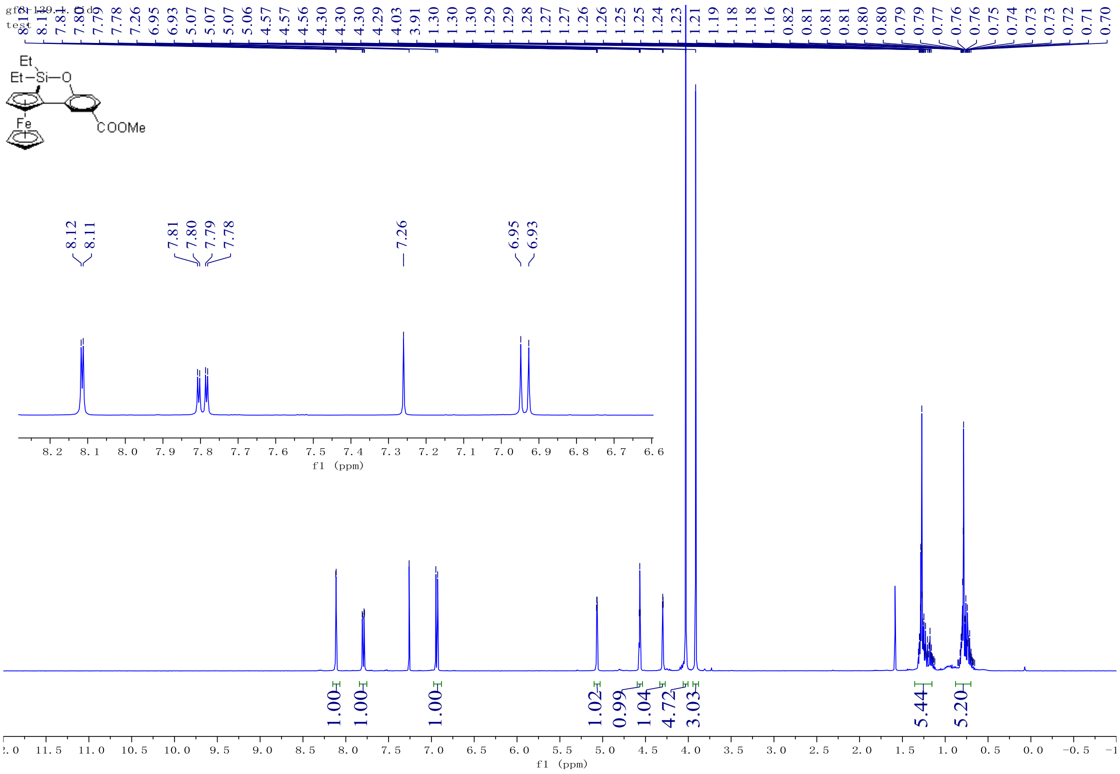

gf4-187HC.2.fid
C13CPD
150.08
143.18
124.45
124.08
121.60
118.87
87.38
77.32
77.00
76.68
71.68
71.39
69.81
65.26
64.37
34.08
31.61
7.66
7.52
6.32
6.31
Et
Et
Si
O
Fe
tBu
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

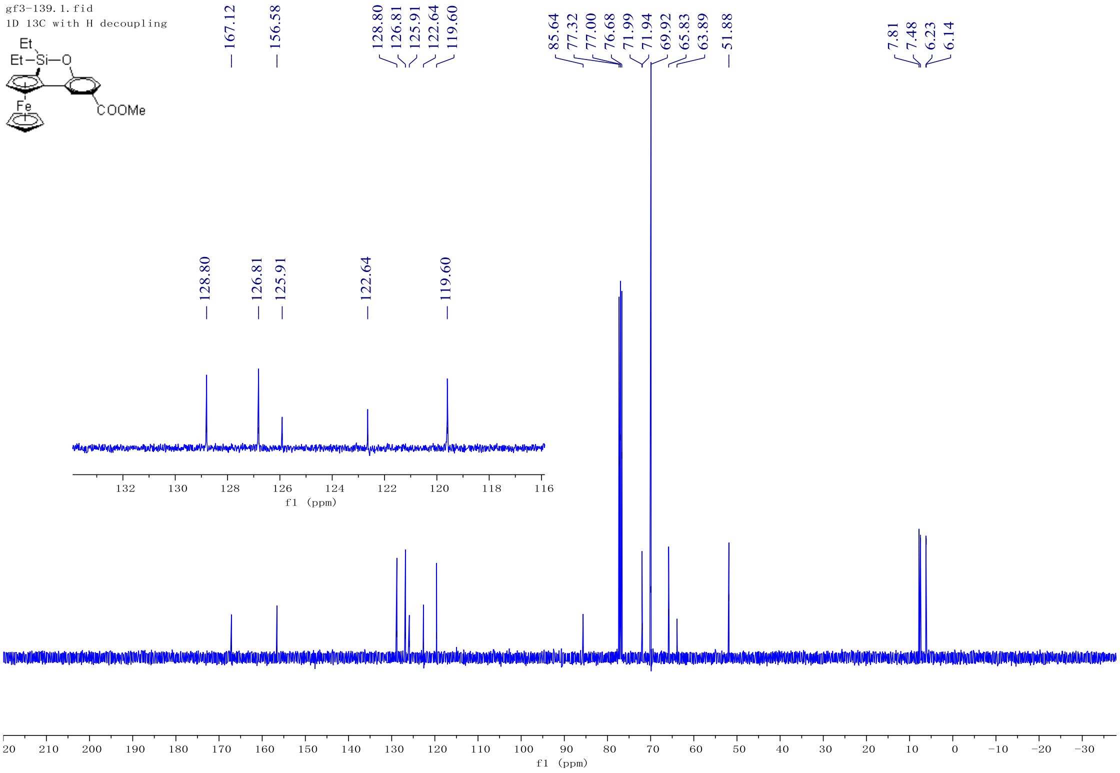
Compound 4d


gf5-68HC.1.fid
H1
Et
Et–Si–O
Fe
Ph
7.62
7.62
7.60
7.47
7.45
7.43
7.35
7.34
7.33
7.32
7.31
7.26
7.00
6.98
5.04
4.57
4.33
4.07
1.33
1.31
1.30
1.28
1.27
1.25
1.24
1.23
1.21
1.20
1.18
1.18
0.89
0.88
0.88
0.86
0.84
0.79
0.78
0.77
0.76
0.76
0.74
2.99
2.02
2.00
1.00
1.00
1.01
1.01
4.95
5.51
5.81
f1 (ppm)

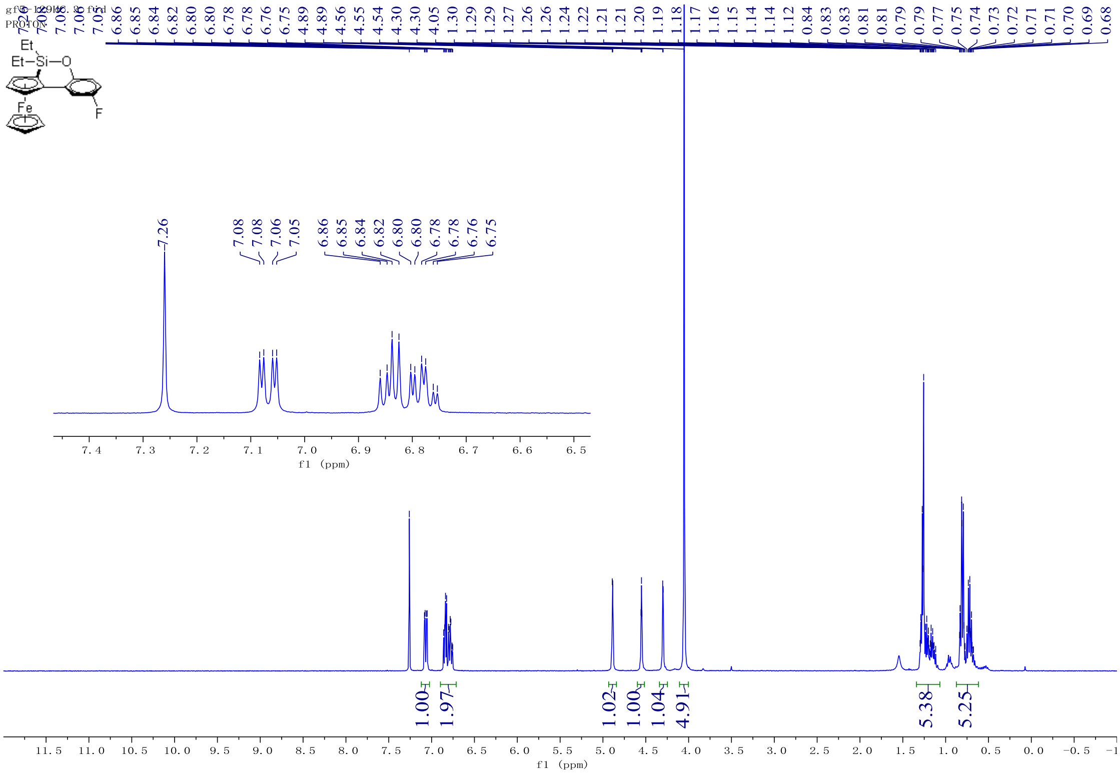

gf5-68HC.3.fid
1D 13C with H decoupling
Et
Et–Si–O
Fe
Ph
152.13
141.16
133.75
128.65
126.74
126.57
125.89
125.84
123.48
119.90
86.71
77.32
77.00
76.68
71.84
71.68
69.90
65.43
64.41
7.76
7.47
6.31
6.29
f1 (ppm)

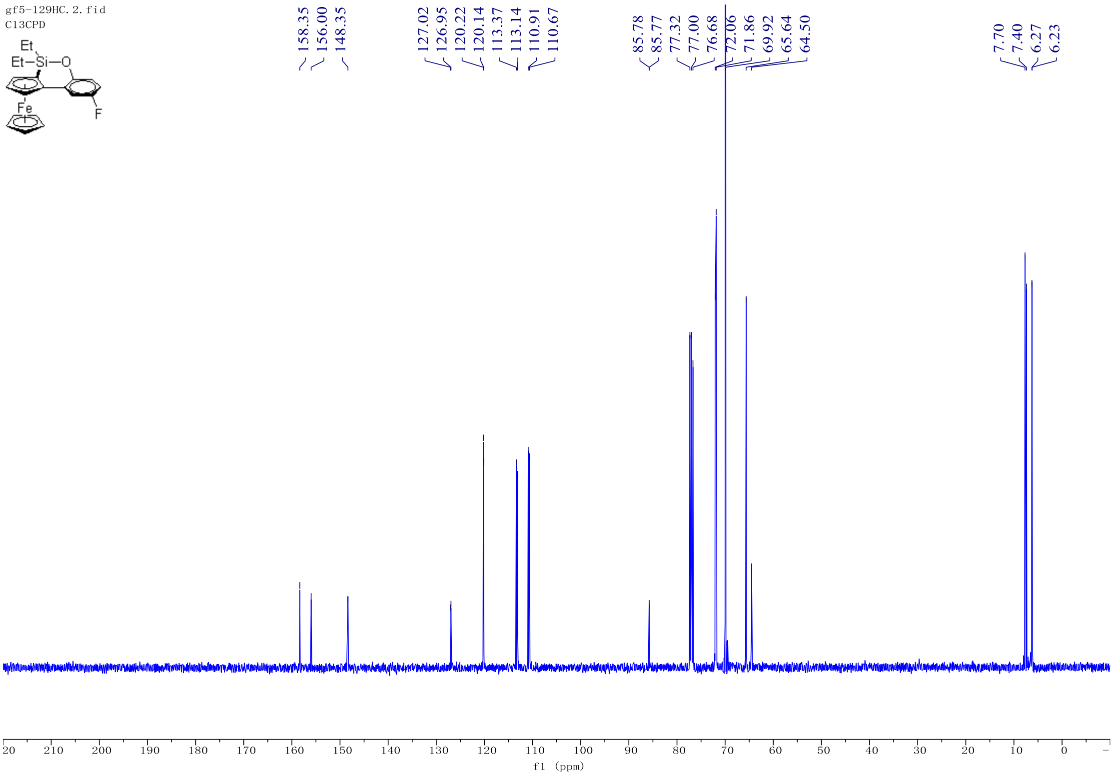
Compound 4e


gf3-139
test
8.12
8.11
7.81
7.80
7.79
7.78
7.26
6.95
6.93
5.07
5.07
5.07
5.06
4.57
4.57
4.56
4.30
4.30
4.29
4.03
3.91
1.30
1.30
1.30
1.29
1.29
1.28
1.27
1.27
1.26
1.26
1.25
1.25
1.24
1.23
1.21
1.19
1.18
1.18
1.16
0.82
0.81
0.81
0.81
0.80
0.80
0.79
0.79
0.77
0.76
0.76
0.75
0.74
0.73
0.73
0.72
0.71
0.70
Et
Et–Si–O
Fe
COOMe
1.00
1.00
1.00
1.02
0.99
1.04
4.72
3.03
5.44
5.20
f1 (ppm)

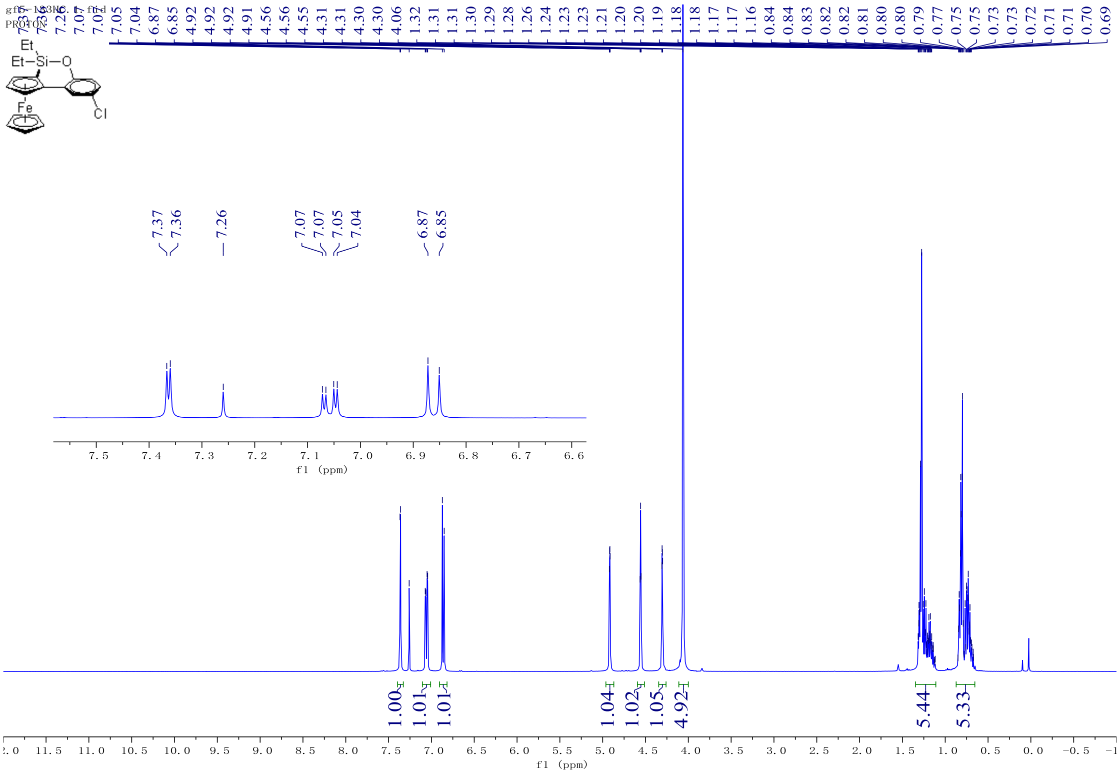

gf3-139.1.fid
1D 13C with H decoupling
167.12
156.58
128.80
126.81
125.91
122.64
119.60
85.64
77.32
77.00
76.68
71.99
71.94
69.92
65.83
63.89
51.88
7.81
7.48
6.23
6.14
Et
Et–Si–O
Fe
COOMe
f1 (ppm)

Compound 4f

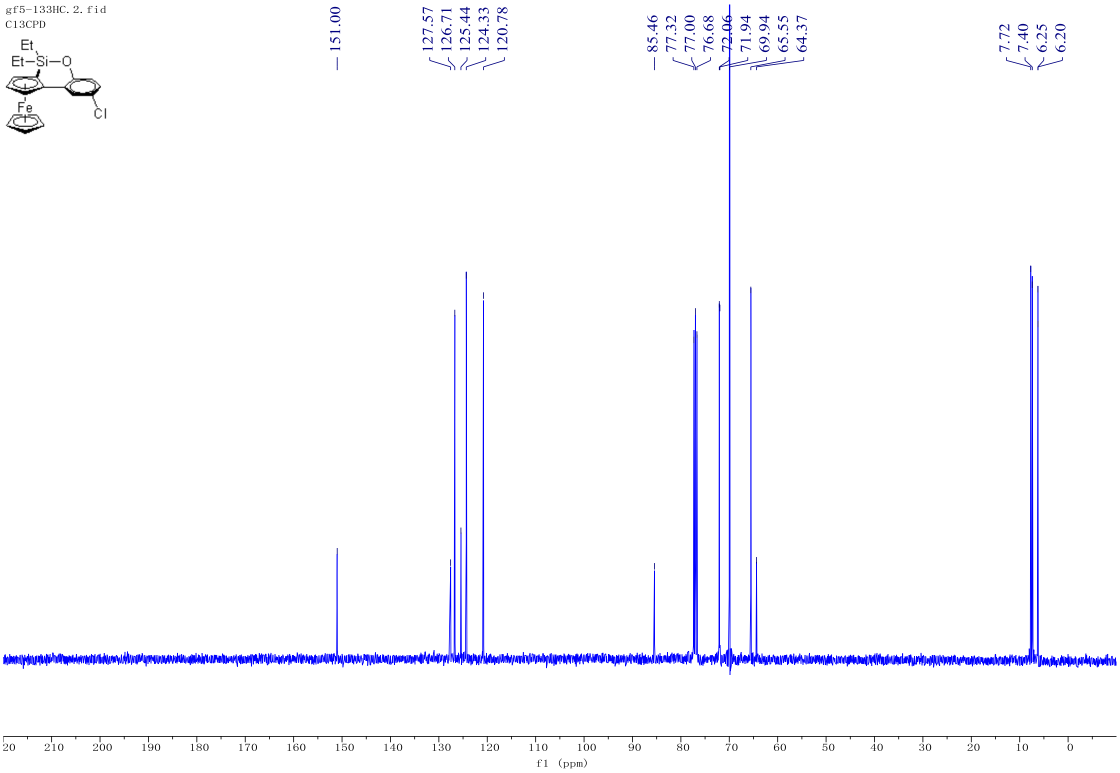

PROTON
Et
Et–Si–O
Fe
F
7.26
7.08
7.08
7.06
7.05
6.86
6.85
6.84
6.82
6.80
6.80
6.78
6.78
6.76
6.75
4.89
4.89
4.56
4.55
4.54
4.30
4.30
4.05
1.30
1.29
1.29
1.27
1.26
1.26
1.24
1.22
1.21
1.21
1.20
1.19
1.18
1.17
1.16
1.15
1.14
1.14
1.12
0.84
0.83
0.83
0.81
0.81
0.79
0.79
0.77
0.75
0.74
0.73
0.72
0.71
0.71
0.70
0.69
0.68
1.00
1.97
1.02
1.00
1.04
4.91
5.38
5.25
f1 (ppm)


gf5-129HC.2.fid
C13CPD
Et
Et–Si–O
Fe
F
158.35
156.00
148.35
127.02
126.95
120.22
120.14
113.37
113.14
110.91
110.67
85.78
85.77
77.32
77.00
76.68
72.06
71.86
69.92
65.64
64.50
7.70
7.40
6.27
6.23
f1 (ppm)

Compound 4g

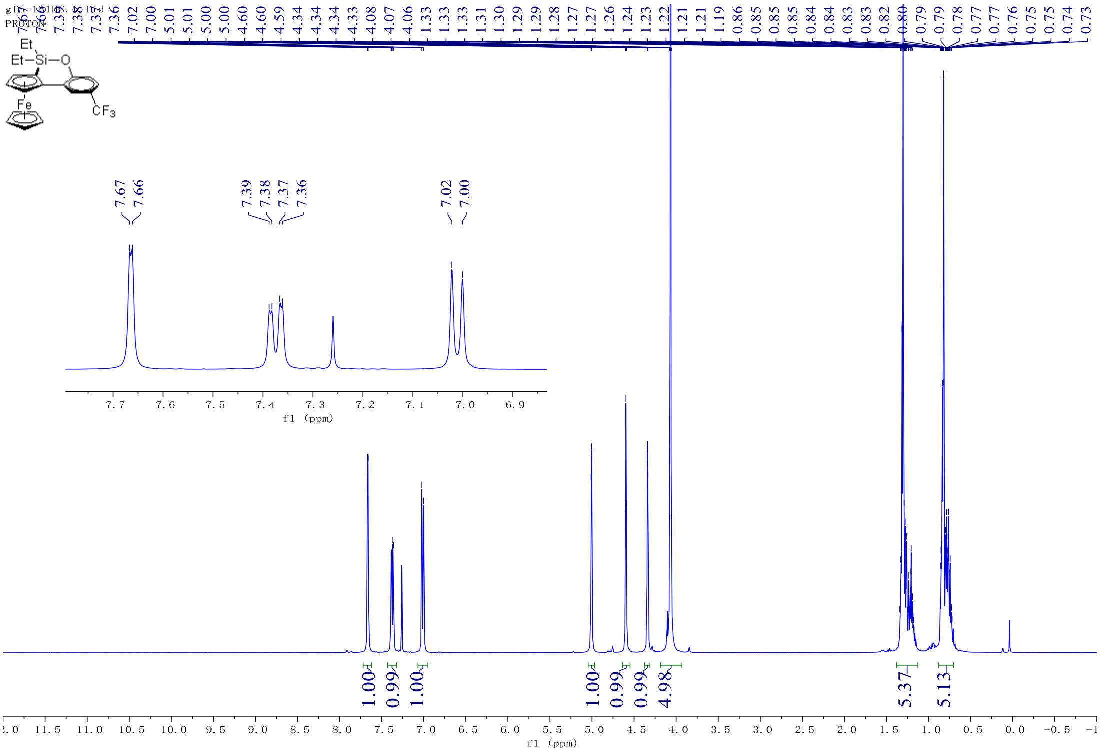


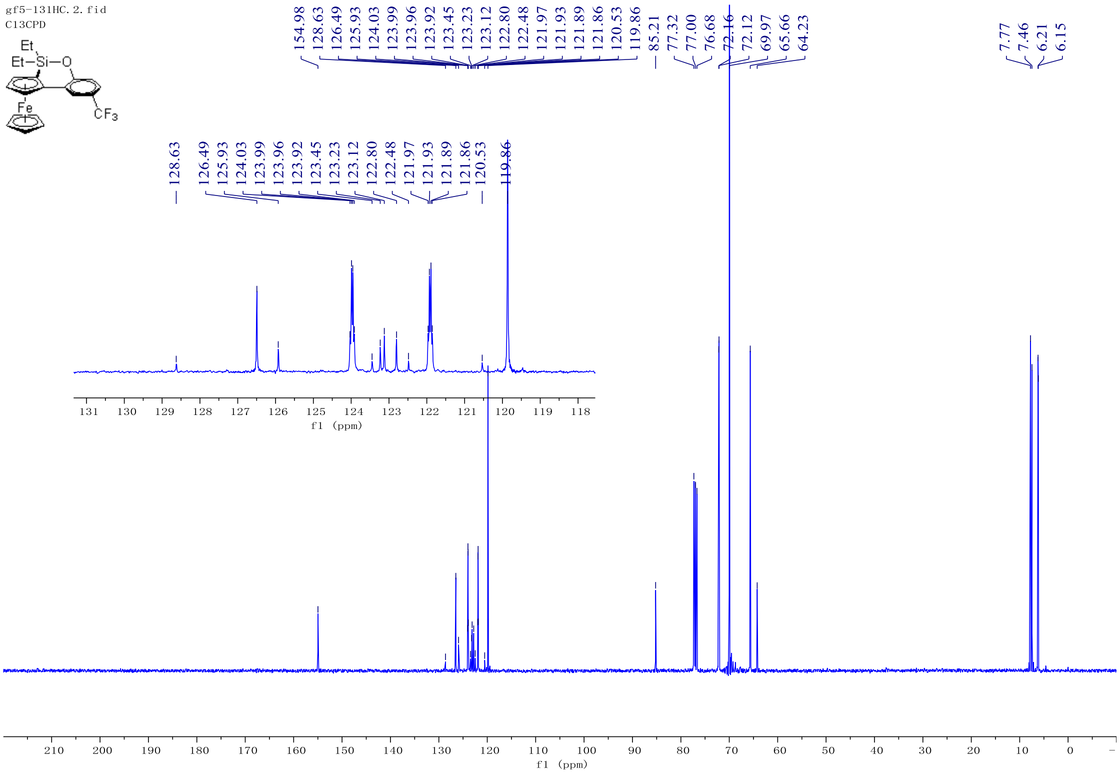
PROTON
Et
Et–Si–O
Fe
Cl
7.37
7.36
7.26
7.07
7.07
7.05
7.04
6.87
6.85
4.92
4.92
4.92
4.91
4.56
4.56
4.55
4.31
4.31
4.30
4.30
4.06
1.32
1.31
1.31
1.30
1.29
1.28
1.26
1.24
1.23
1.23
1.21
1.20
1.20
1.19
1.18
1.18
1.17
1.17
1.16
0.84
0.84
0.83
0.82
0.82
0.81
0.80
0.80
0.79
0.77
0.75
0.75
0.73
0.73
0.72
0.71
0.70
0.69
7.5
7.4
7.3
7.2
7.1
7.0
6.9
6.8
6.7
6.6
f1 (ppm)
1.00
1.01
1.01
1.04
1.02
1.05
4.92
5.44
5.33
11.5
11.0
10.5
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)



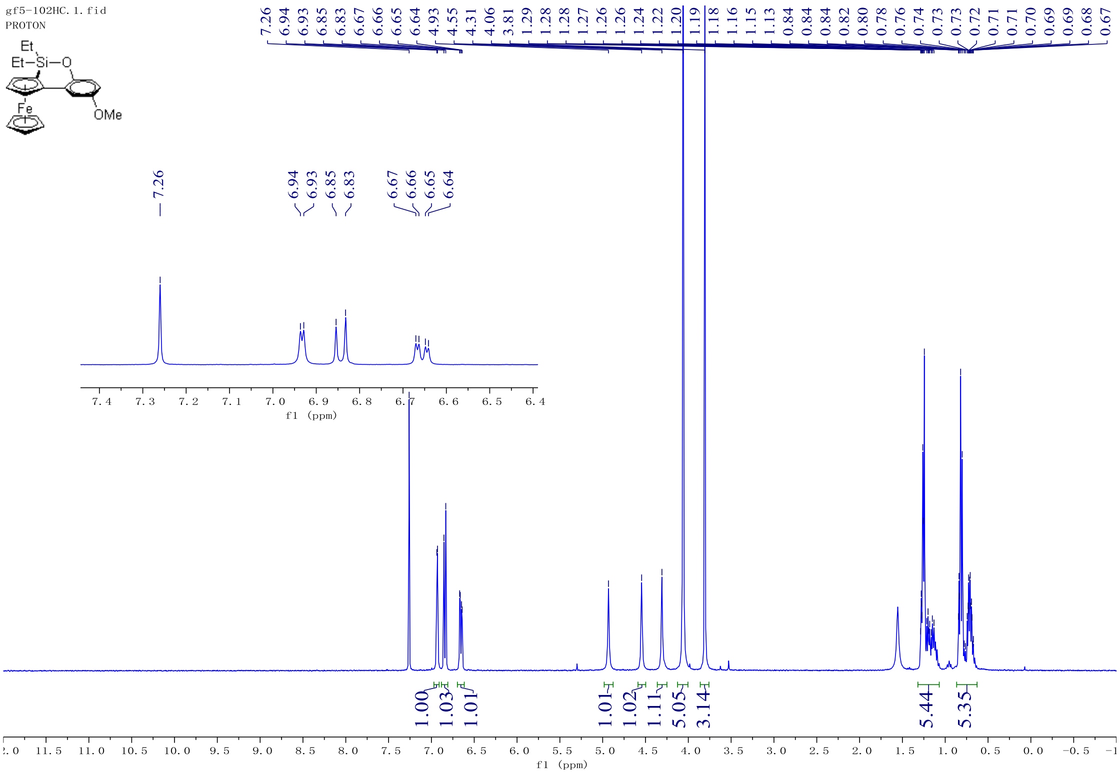
gf5-133HC.2.fid
C13CPD
Et
Et–Si–O
Fe
Cl
151.00
127.57
126.71
125.44
124.33
120.78
85.46
77.32
77.00
76.68
72.06
71.94
69.94
65.55
64.37
7.72
7.40
6.25
6.20
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

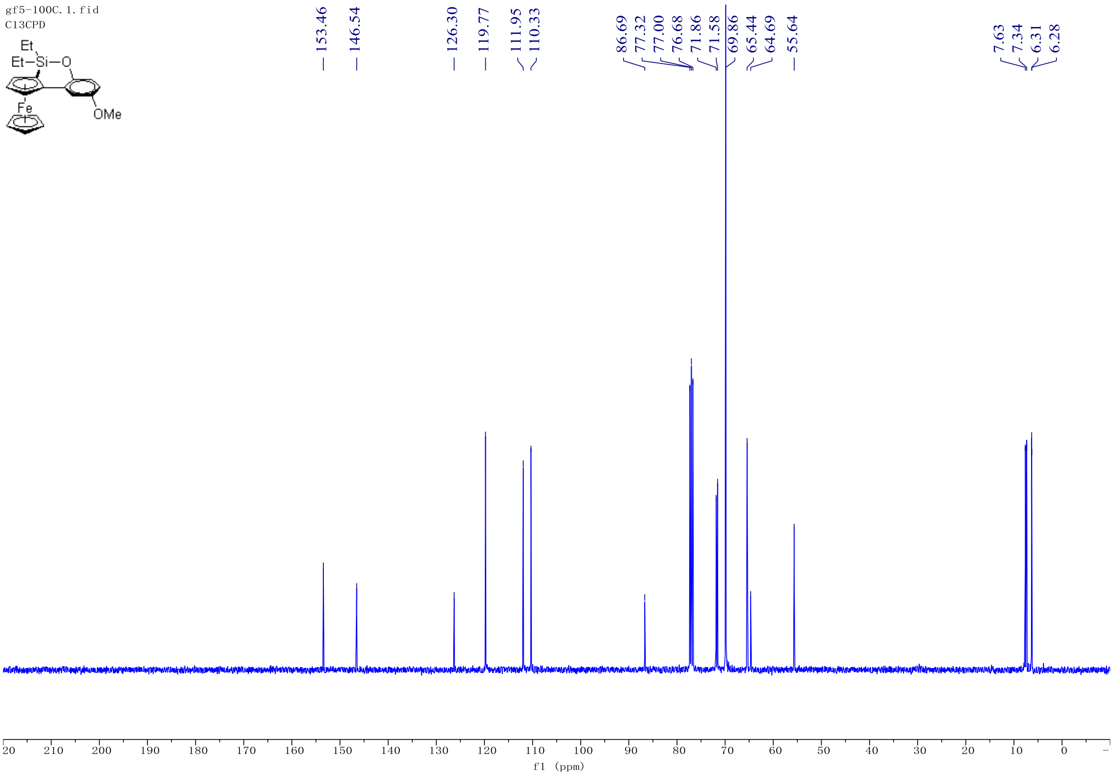
Compound 4h


gf5-131H.1.fid
PROTON
Et
Et–Si–O
Fe
CF3
7.67
7.66
7.39
7.38
7.37
7.36
7.02
7.00
5.01
5.01
5.00
5.00
4.60
4.60
4.59
4.34
4.34
4.34
4.33
4.08
4.07
4.06
1.33
1.33
1.33
1.31
1.30
1.29
1.29
1.28
1.27
1.27
1.26
1.24
1.23
1.22
1.21
1.21
1.19
0.86
0.85
0.85
0.85
0.84
0.84
0.83
0.83
0.82
0.80
0.79
0.79
0.78
0.77
0.77
0.76
0.75
0.75
0.74
0.73
7.67
7.66
7.39
7.38
7.37
7.36
7.02
7.00
7.7 7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9
f1 (ppm)
1.00
0.99
1.00
1.00
0.99
0.99
4.98
5.37
5.13
12.0 11.5 11.0 10.5 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 −1
f1 (ppm)

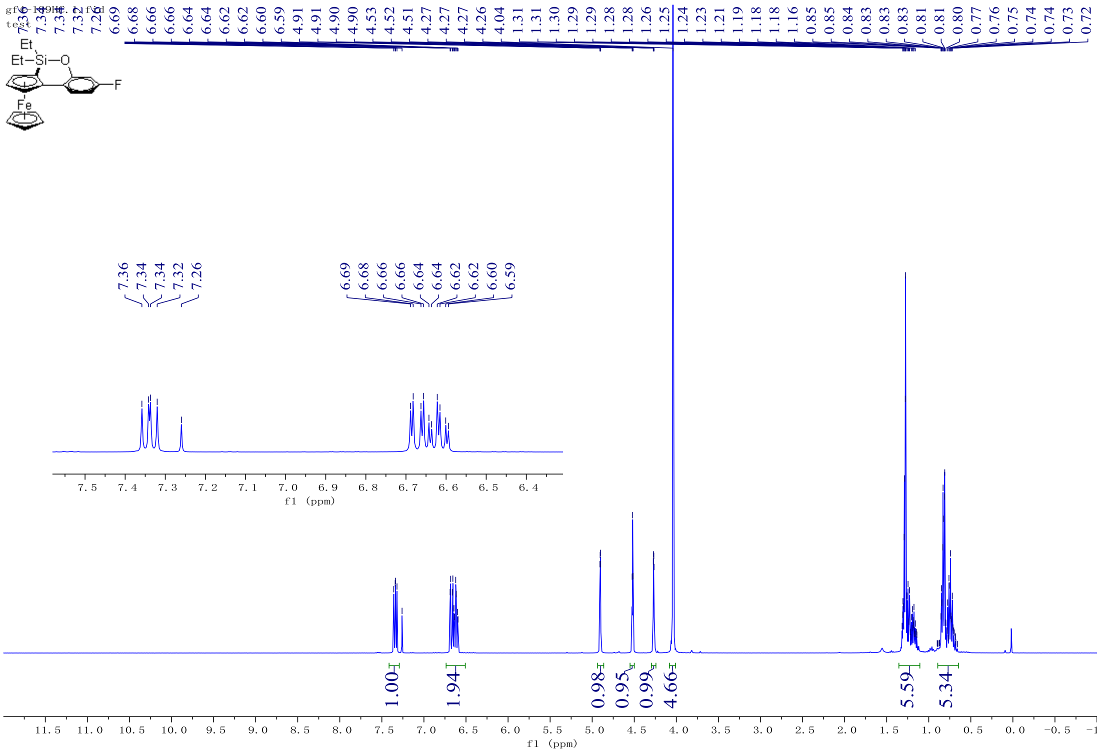

gf5-131HC.2.fid
C13CPD
Et
Et–Si–O
Fe
CF3
154.98
128.63
126.49
125.93
124.03
123.99
123.96
123.92
123.45
123.23
123.12
122.80
122.48
121.97
121.93
121.89
121.86
120.53
119.86
85.21
77.32
77.00
76.68
72.16
72.12
69.97
65.66
64.23
7.77
7.46
6.21
6.15
128.63
126.49
125.93
124.03
123.99
123.96
123.92
123.45
123.23
123.12
122.80
122.48
121.97
121.93
121.89
121.86
120.53
119.86
131 130 129 128 127 126 125 124 123 122 121 120 119 118
f1 (ppm)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

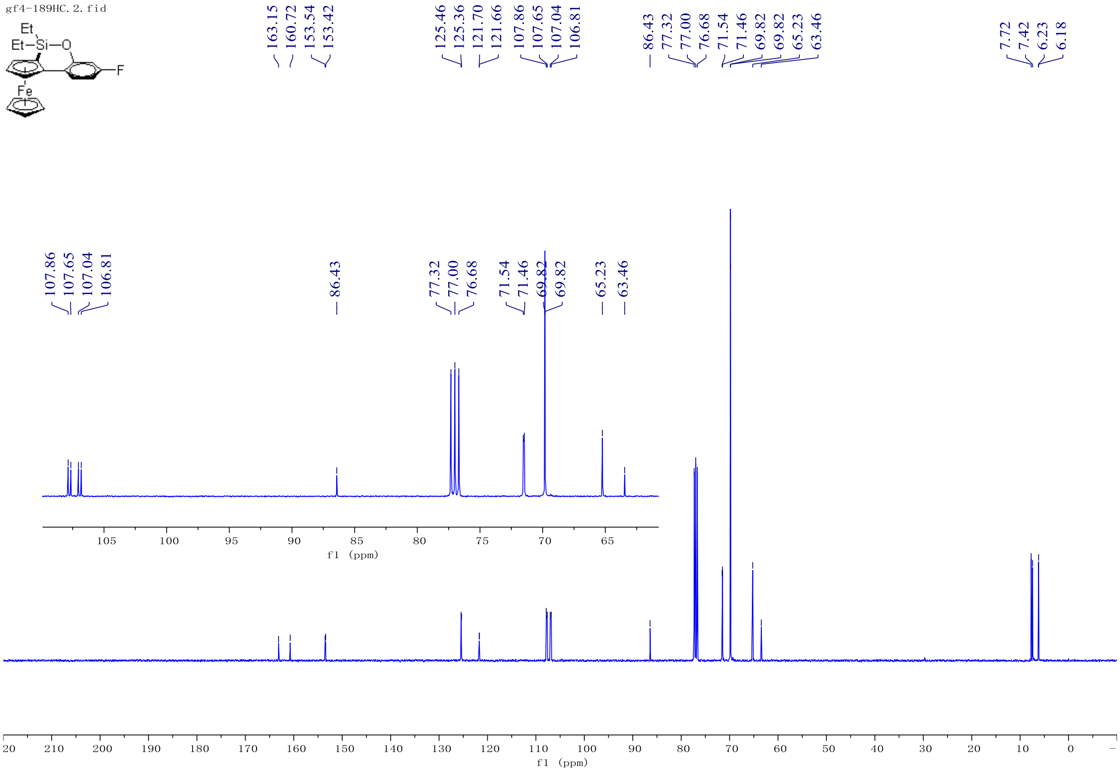
Compound 4i


gf5-102HC.1.fid
PROTON
Et
Et–Si–O
Fe
OMe
7.26
6.94
6.93
6.85
6.83
6.67
6.66
6.65
6.64
4.93
4.55
4.31
4.06
3.81
1.29
1.28
1.28
1.27
1.26
1.26
1.24
1.22
1.20
1.19
1.18
1.16
1.15
1.13
0.84
0.84
0.84
0.82
0.80
0.78
0.76
0.74
0.73
0.73
0.72
0.71
0.71
0.70
0.69
0.69
0.68
0.67
7.4
7.3
7.2
7.1
7.0
6.9
6.8
6.7
6.6
6.5
6.4
f1 (ppm)
1.00
1.03
1.01
1.01
1.02
1.11
5.05
3.14
5.44
5.35
12.0
11.5
11.0
10.5
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
-1
f1 (ppm)

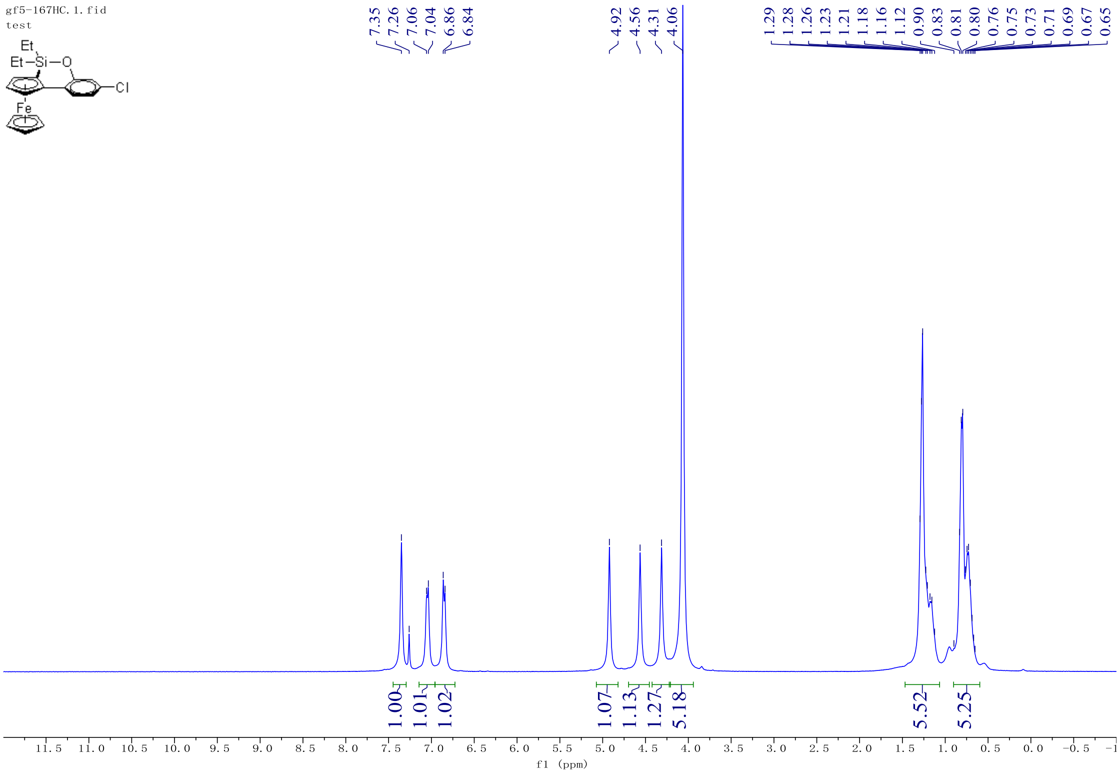

gf5-100C.1.fid
C13CPD
Et
Et–Si–O
Fe
OMe
153.46
146.54
126.30
119.77
111.95
110.33
86.69
77.32
77.00
76.68
71.86
71.58
69.86
65.44
64.69
55.64
7.63
7.34
6.31
6.28
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

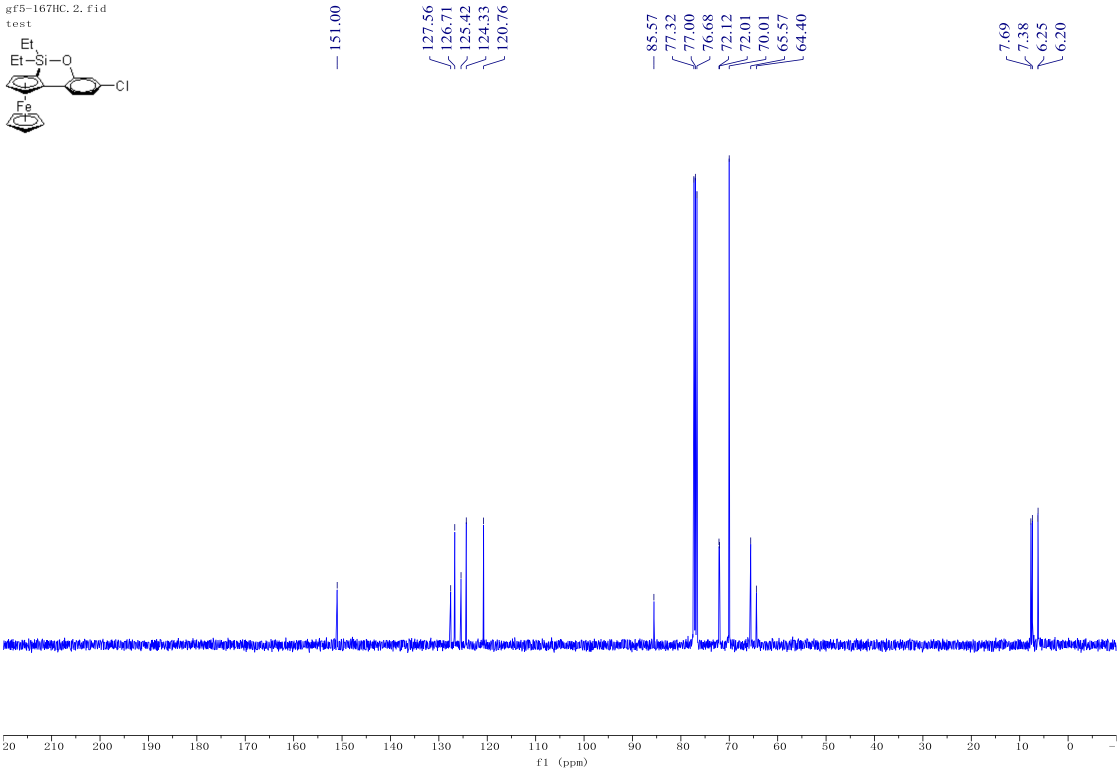
Compound 4j


gf4-189HC.1.fid
test
7.36 7.34 7.34 7.32 7.26 6.69 6.68 6.66 6.66 6.64 6.64 6.62 6.62 6.60 6.59 4.91 4.91 4.90 4.53 4.52 4.51 4.27 4.27 4.26 4.04 1.31 1.31 1.30 1.29 1.29 1.28 1.28 1.26 1.25 1.24 1.23 1.21 1.19 1.18 1.18 1.16 0.85 0.85 0.84 0.83 0.83 0.83 0.81 0.81 0.80 0.77 0.76 0.75 0.74 0.74 0.73 0.72
Et
Et–Si–O
F
Fe
7.36 7.34 7.34 7.32 7.26
6.69 6.68 6.66 6.66 6.64 6.64 6.62 6.62 6.60 6.59
7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8 6.7 6.6 6.5 6.4
f1 (ppm)
1.00 1.94 0.98 0.95 0.99 4.66 5.59 5.34
11.5 11.0 10.5 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 -1
f1 (ppm)

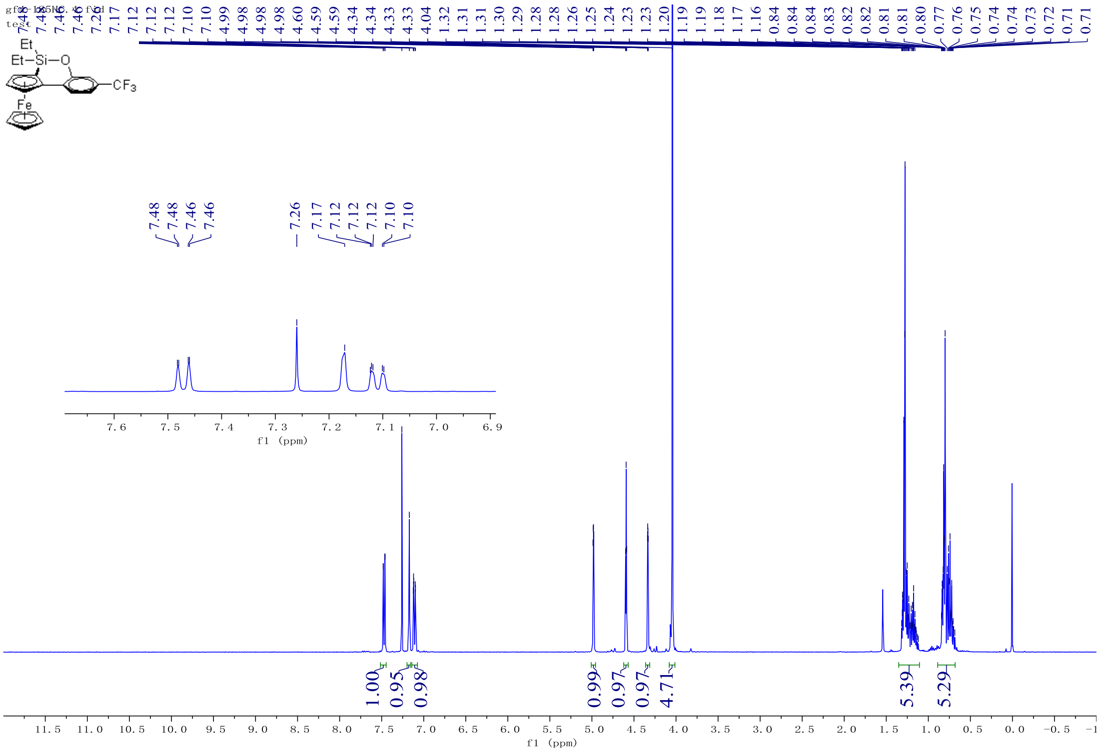

gf4-189HC.2.fid
163.15 160.72 153.54 153.42 125.46 125.36 121.70 121.66 107.86 107.65 107.04 106.81 86.43 77.32 77.00 76.68 71.54 71.46 69.82 69.82 65.23 63.46 7.72 7.42 6.23 6.18
Et
Et–Si–O
F
Fe
107.86 107.65 107.04 106.81 86.43 77.32 77.00 76.68 71.54 71.46 69.82 69.82 65.23 63.46
105 100 95 90 85 80 75 70 65
f1 (ppm)
20 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

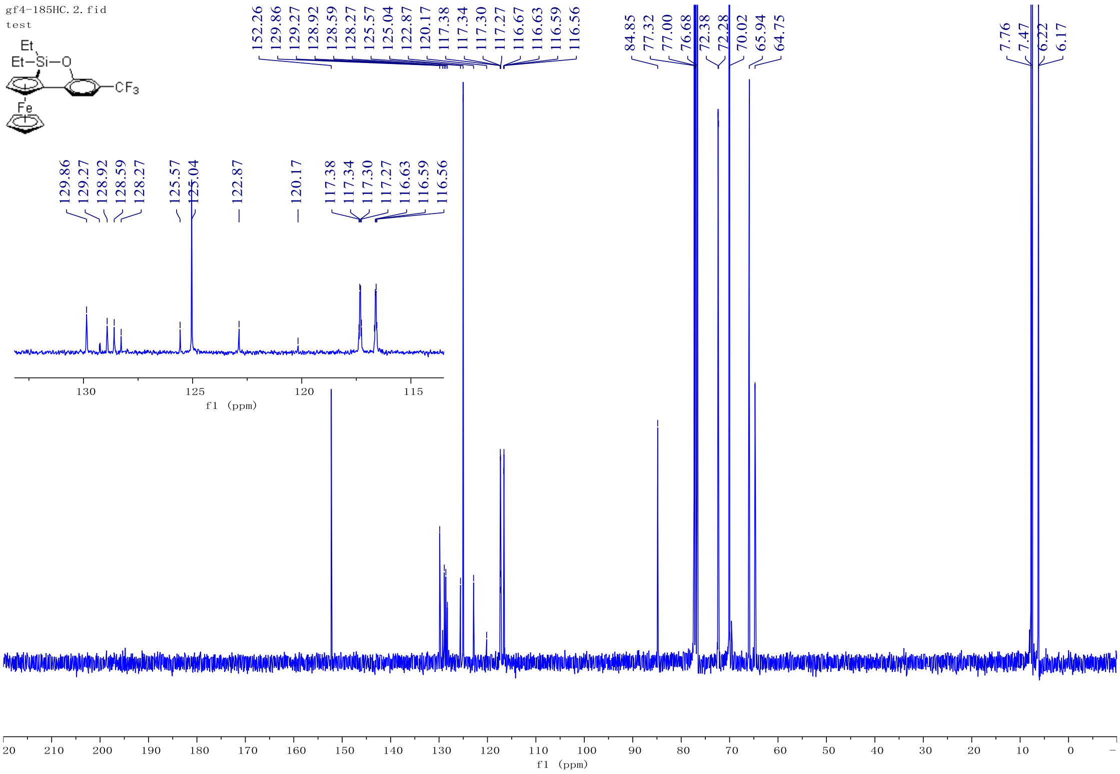
Compound 4k


gf5-167HC.1.fid
test
Et
Et–Si–O
Fe
Cl
7.35
7.26
7.06
7.04
6.86
6.84
4.92
4.56
4.31
4.06
1.29
1.28
1.26
1.23
1.21
1.18
1.16
1.12
0.90
0.83
0.81
0.80
0.76
0.75
0.73
0.71
0.69
0.67
0.65
1.00
1.01
1.02
1.07
1.13
1.27
5.18
5.52
5.25
11.5 11.0 10.5 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 −1
f1 (ppm)

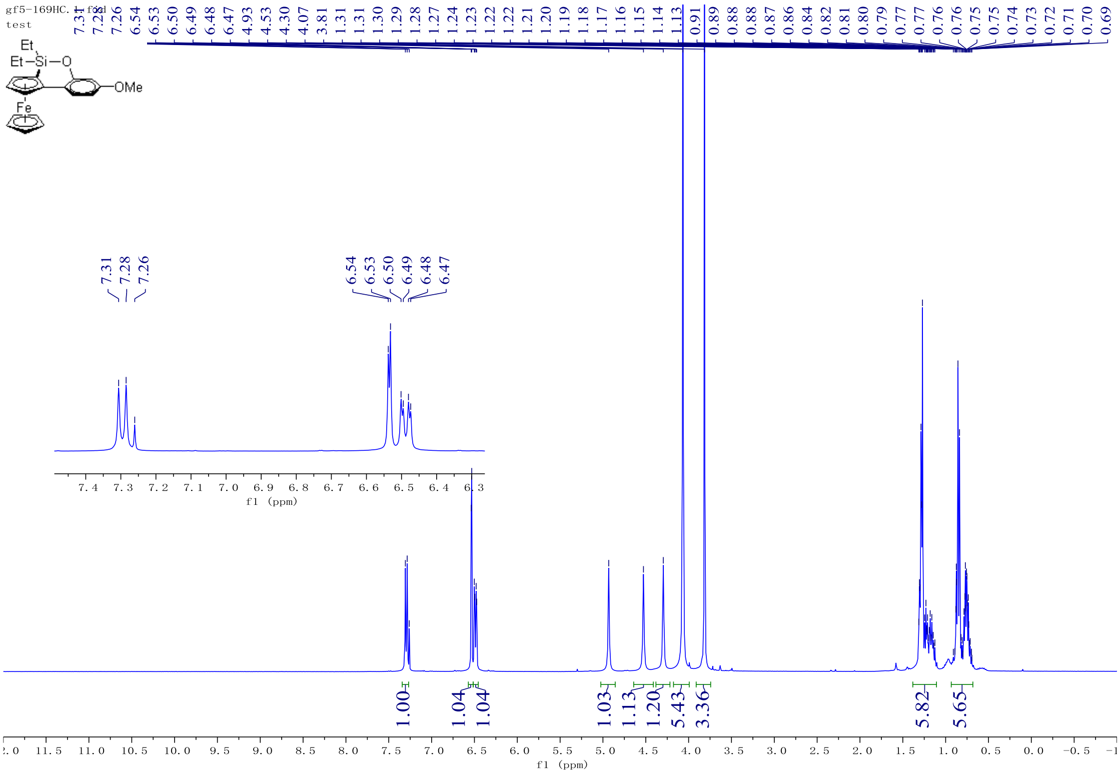

gf5-167HC.2.fid
test
Et
Et–Si–O
Fe
Cl
151.00
127.56
126.71
125.42
124.33
120.76
85.57
77.32
77.00
76.68
72.12
72.01
70.01
65.57
64.40
7.69
7.38
6.25
6.20
20 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

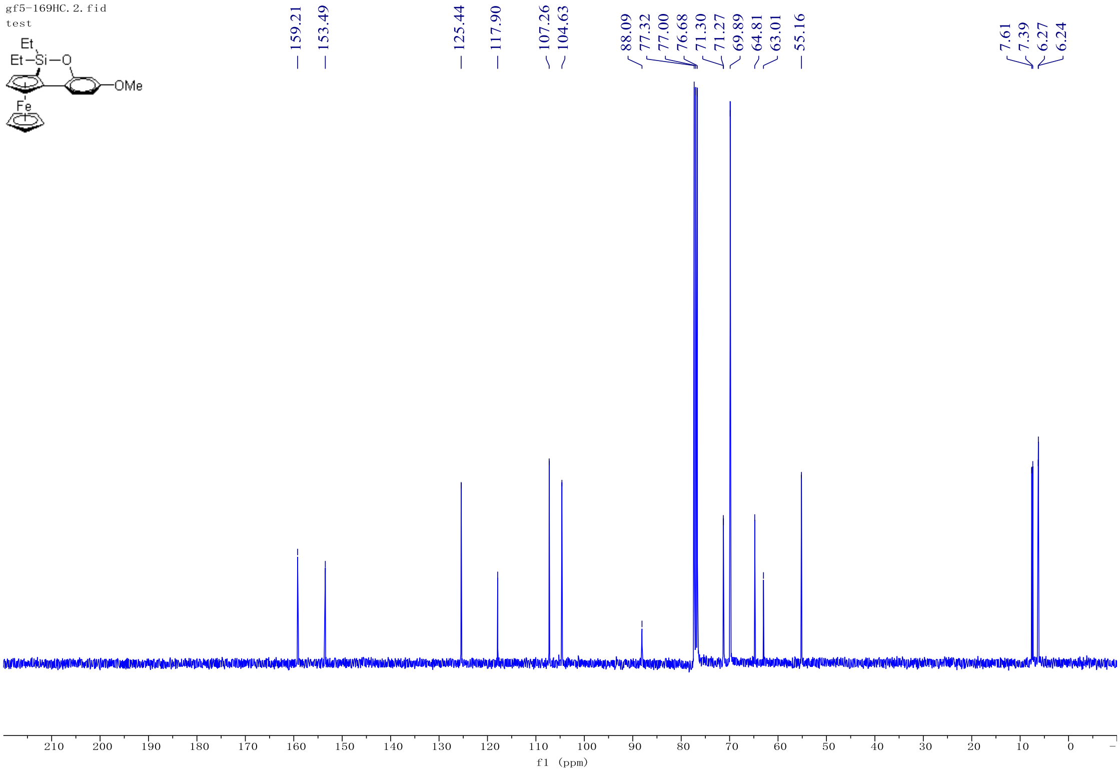
Compound 4l


gf4-185HC.1.fid
test
Et
Et–Si–O
CF3
Fe
7.48 7.48 7.46 7.46 7.26 7.17 7.12 7.12 7.10 7.10 4.99 4.98 4.98 4.98 4.60 4.59 4.59 4.34 4.34 4.33 4.33 4.04 1.32 1.31 1.31 1.30 1.29 1.28 1.28 1.26 1.25 1.24 1.23 1.23 1.20 1.19 1.19 1.18 1.17 1.16 0.84 0.84 0.84 0.83 0.82 0.82 0.81 0.81 0.80 0.77 0.76 0.75 0.74 0.74 0.73 0.72 0.71 0.71
7.48 7.48 7.46 7.46 7.26 7.17 7.12 7.12 7.12 7.10 7.10
7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9
f1 (ppm)
1.00 0.95 0.98 0.99 0.97 0.97 4.71 5.39 5.29
11.5 11.0 10.5 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 -1
f1 (ppm)

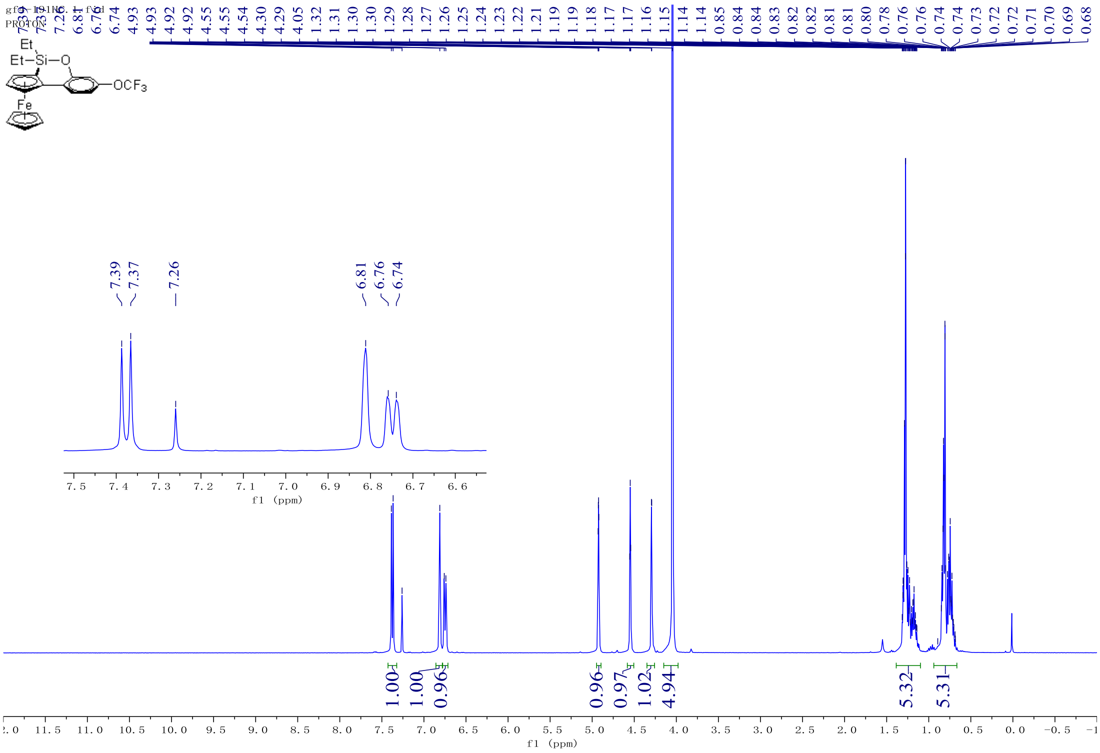

gf4-185HC.2.fid
test
Et
Et–Si–O
CF3
Fe
152.26 129.86 129.27 128.92 128.59 128.27 125.57 125.04 122.87 120.17 117.38 117.34 117.30 117.27 116.67 116.63 116.59 116.56
84.85 77.32 77.00 76.68 72.38 72.28 70.02 65.94 64.75
7.76 7.47 6.22 6.17
129.86 129.27 128.92 128.59 128.27 125.57 125.04 122.87 120.17 117.38 117.34 117.30 117.27 116.63 116.59 116.56
130 125 120 115
f1 (ppm)
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

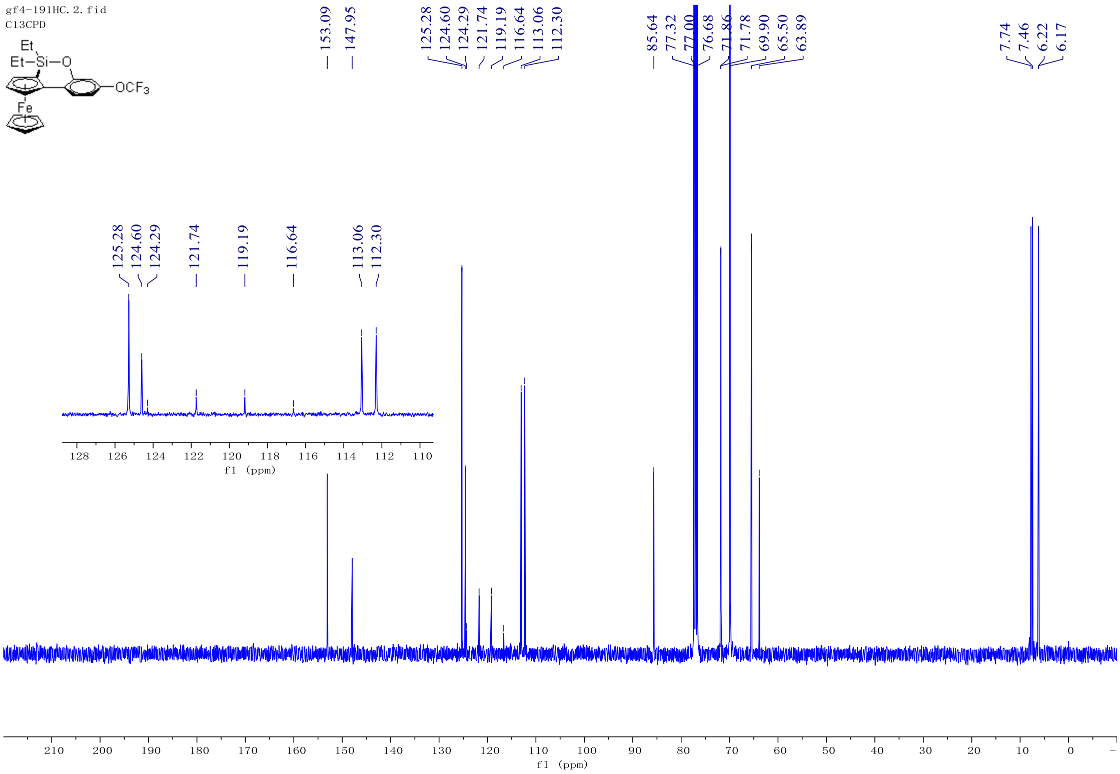
Compound 4m


gf5-169HC.1.fid
test
Et
Et–Si–O
Fe
OMe
7.31
7.28
7.26
6.54
6.53
6.50
6.49
6.48
6.47
4.93
4.53
4.30
4.07
3.81
1.31
1.31
1.30
1.29
1.28
1.27
1.24
1.23
1.22
1.22
1.21
1.20
1.19
1.18
1.17
1.16
1.15
1.14
1.13
0.91
0.89
0.88
0.88
0.87
0.86
0.84
0.82
0.81
0.80
0.79
0.77
0.77
0.76
0.76
0.75
0.75
0.74
0.73
0.72
0.71
0.70
0.69
1.00
1.04
1.04
1.03
1.13
1.20
5.43
3.36
5.82
5.65
f1 (ppm)

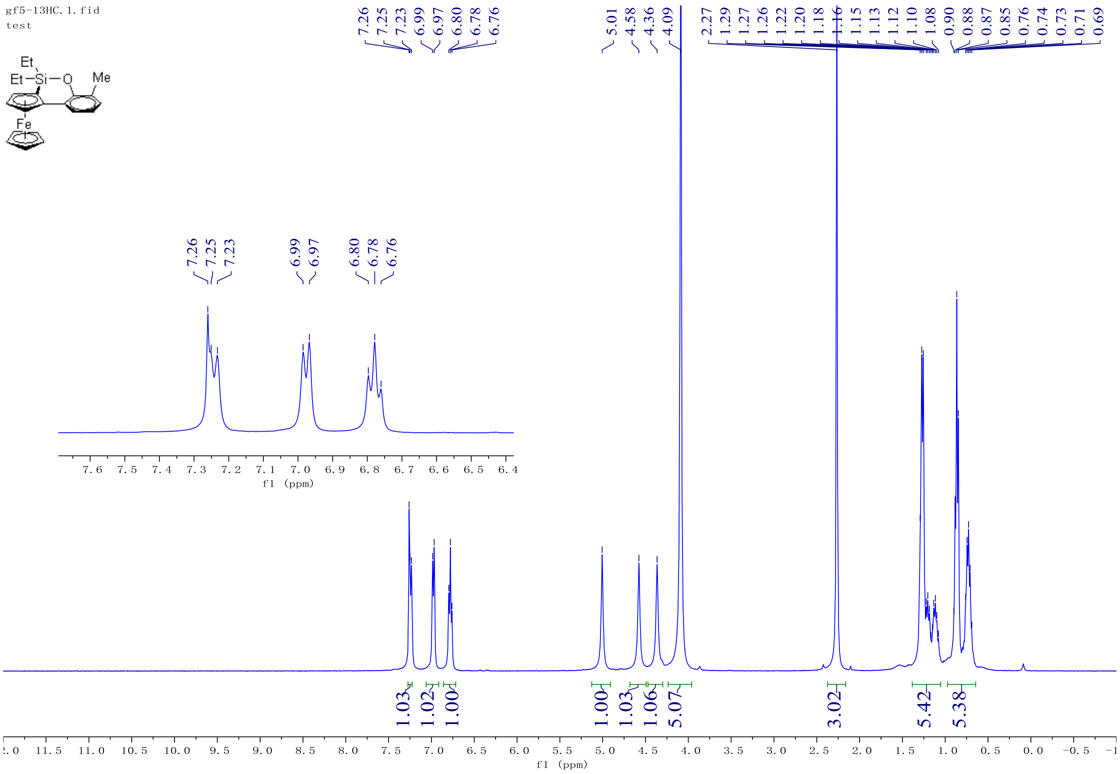

gf5-169HC.2.fid
test
Et
Et–Si–O
Fe
OMe
159.21
153.49
125.44
117.90
107.26
104.63
88.09
77.32
77.00
76.68
71.30
71.27
69.89
64.81
63.01
55.16
7.61
7.39
6.27
6.24
f1 (ppm)

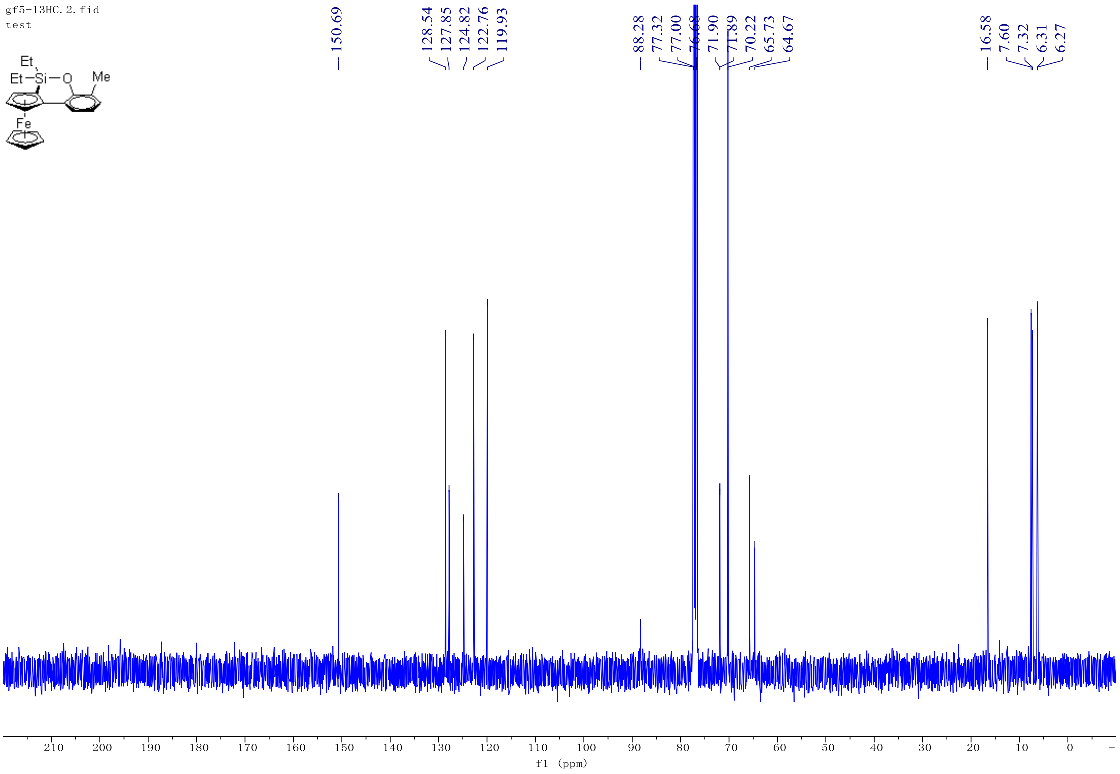
Compound 4n


gf4-191HC.1.fid
PROTON
Et
Et–Si–O
OCF3
Fe
7.39
7.37
7.26
6.81
6.76
6.74
4.93
4.93
4.92
4.92
4.55
4.55
4.54
4.30
4.29
4.05
1.32
1.31
1.30
1.30
1.29
1.28
1.27
1.26
1.25
1.24
1.23
1.22
1.21
1.19
1.19
1.18
1.17
1.17
1.16
1.15
1.14
1.14
0.85
0.84
0.84
0.83
0.82
0.82
0.81
0.81
0.80
0.78
0.76
0.76
0.74
0.74
0.73
0.72
0.72
0.71
0.70
0.69
0.68
1.00
1.00
0.96
0.96
0.97
1.02
4.94
5.32
5.31
f1 (ppm)

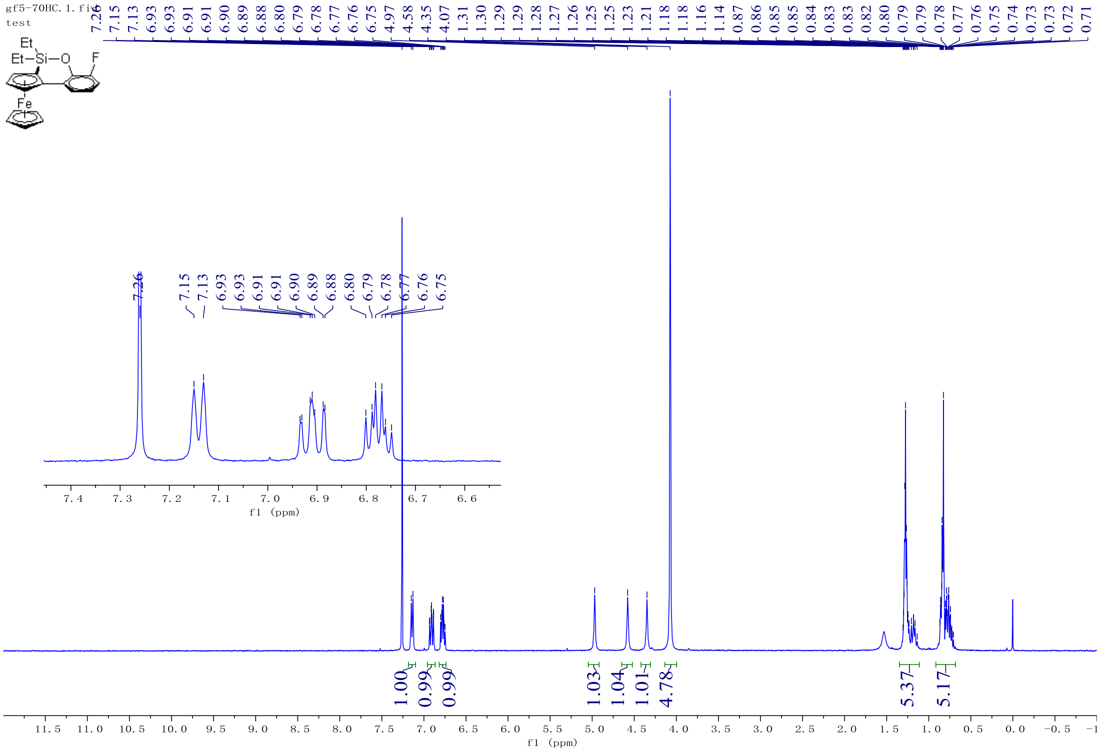

gf4-191HC.2.fid
C13CPD
Et
Et–Si–O
OCF3
Fe
153.09
147.95
125.28
124.60
124.29
121.74
119.19
116.64
113.06
112.30
85.64
77.32
77.00
76.68
71.86
71.78
69.90
65.50
63.89
7.74
7.46
6.22
6.17
f1 (ppm)

Compound 4o

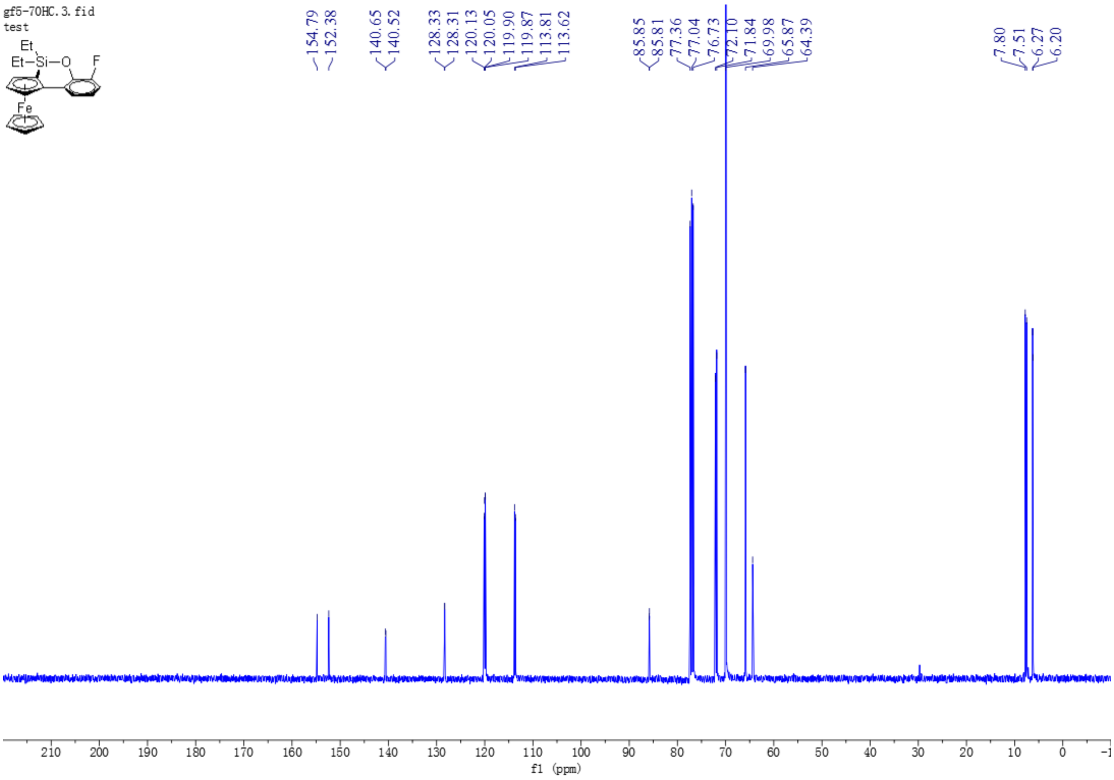

gf5-13HC.1.fid
test
Et
Et–Si–O
Me
Fe
7.26
7.25
7.23
6.99
6.97
6.80
6.78
6.76
5.01
4.58
4.36
4.09
2.27
1.29
1.27
1.26
1.22
1.20
1.18
1.16
1.15
1.13
1.12
1.10
1.08
0.90
0.88
0.87
0.85
0.76
0.74
0.73
0.71
0.69
7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8 6.7 6.6 6.5 6.4
f1 (ppm)
1.03
1.02
1.00
1.00
1.03
1.06
5.07
3.02
5.42
5.38
12.0 11.5 11.0 10.5 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 -1
f1 (ppm)


gf5-13HC.2.fid
test
Et
Et–Si–O
Me
Fe
150.69
128.54
127.85
124.82
122.76
119.93
88.28
77.32
77.00
76.68
71.90
71.89
70.22
65.73
64.67
16.58
7.60
7.32
6.31
6.27
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

Compound 4p

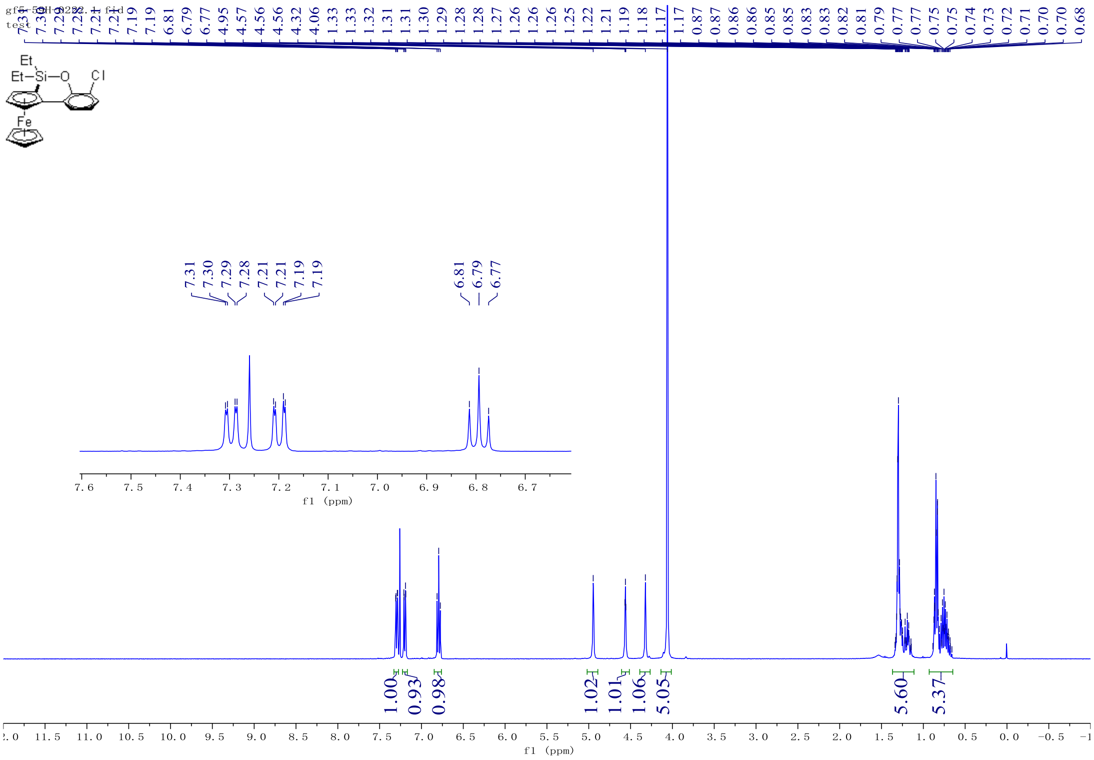


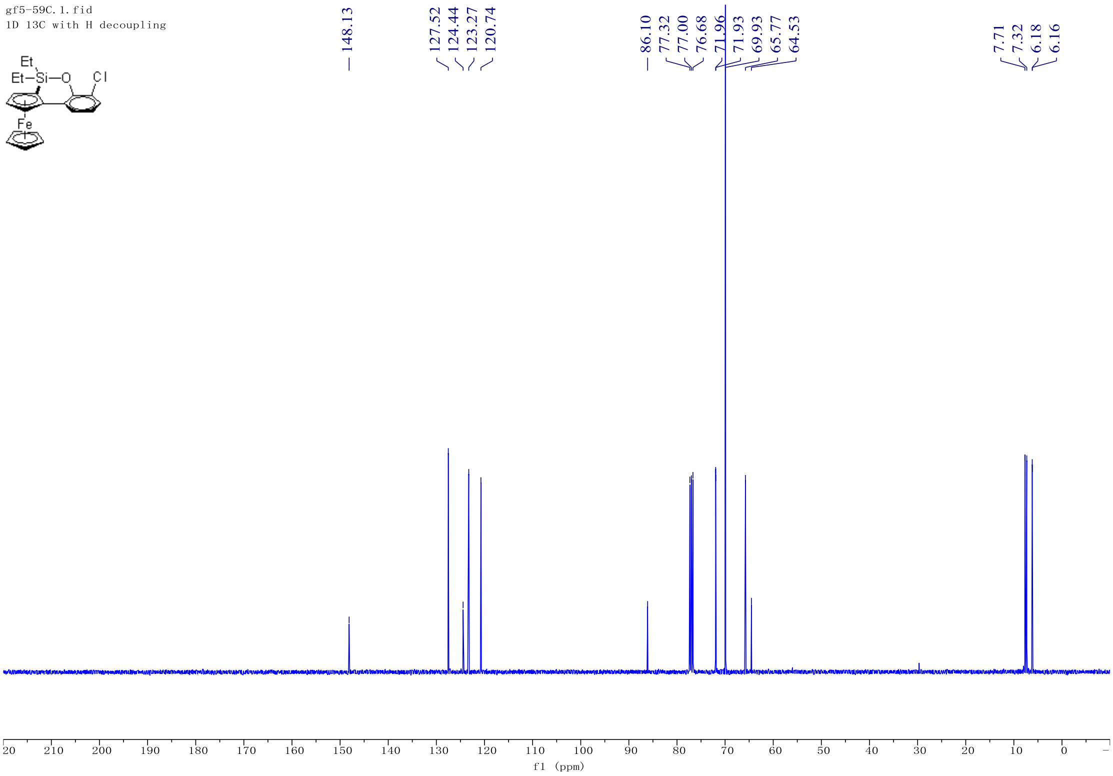
gf5-70HC.1.fid
test
Et
Et–Si–O
F
Fe
7.26
7.15
7.13
6.93
6.93
6.91
6.91
6.90
6.89
6.88
6.80
6.79
6.78
6.77
6.76
6.75
4.97
4.58
4.35
4.07
1.31
1.30
1.29
1.29
1.28
1.27
1.26
1.25
1.25
1.23
1.21
1.18
1.18
1.16
1.14
0.87
0.86
0.85
0.85
0.84
0.83
0.83
0.82
0.80
0.79
0.79
0.78
0.77
0.76
0.75
0.74
0.73
0.73
0.72
0.71
7.4
7.3
7.2
7.1
7.0
6.9
6.8
6.7
6.6
f1 (ppm)
1.00
0.99
0.99
1.03
1.04
1.01
4.78
5.37
5.17
11.5
11.0
10.5
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
-1
f1 (ppm)



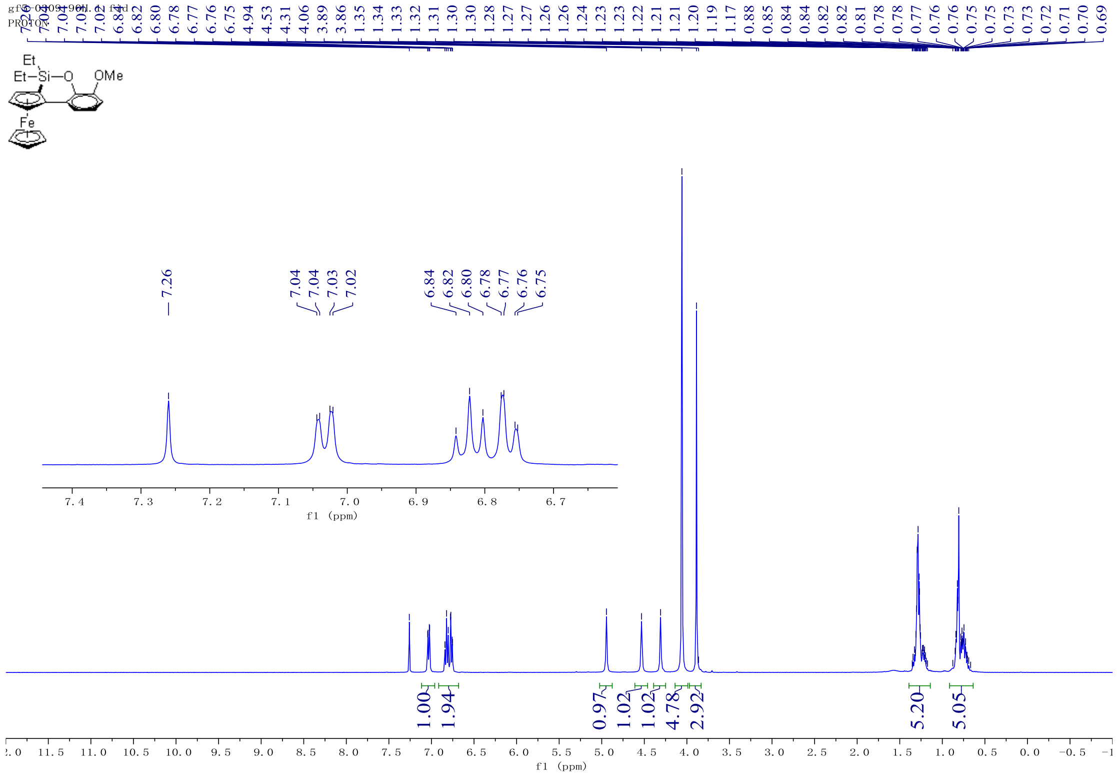
gf5-70HC.3.fid
test
Et
Et–Si–O
F
Fe
154.79
152.38
140.65
140.52
128.33
128.31
120.13
120.05
119.90
119.87
113.81
113.62
85.85
85.81
77.36
77.04
76.73
72.10
71.84
69.98
65.87
64.39
7.80
7.51
6.27
6.20
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-1
f1 (ppm)

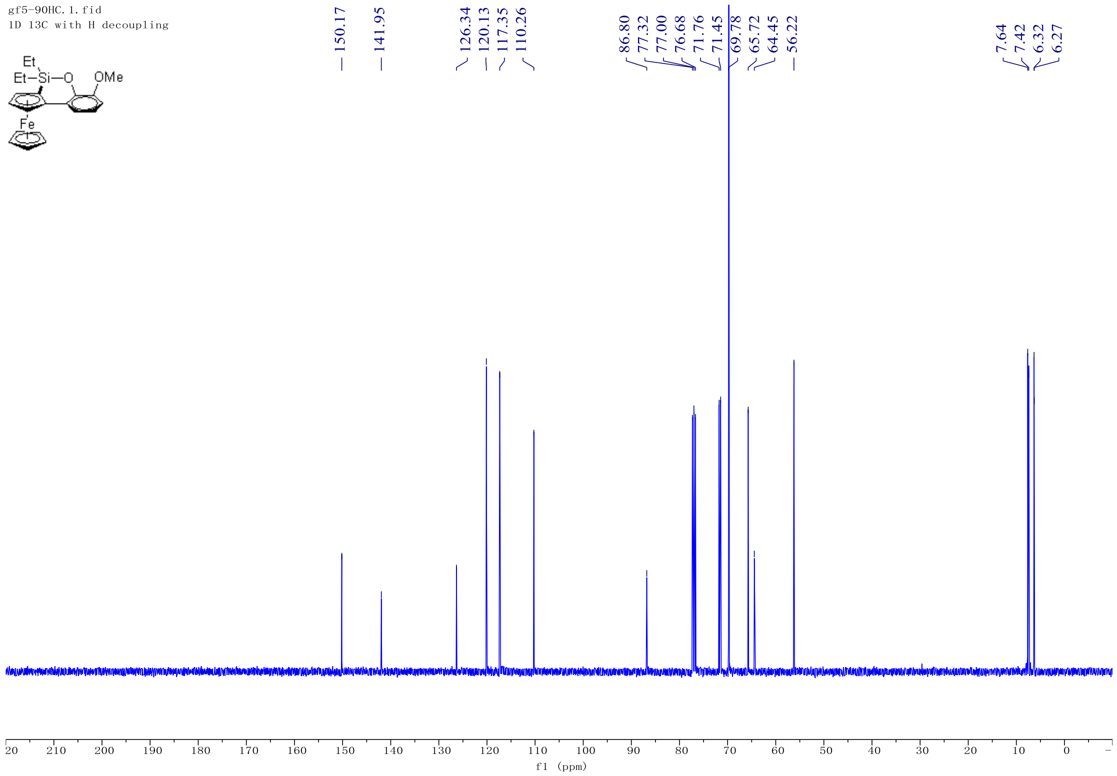
Compound 4q


7.31
7.30
7.29
7.28
7.21
7.21
7.19
7.19
6.81
6.79
6.77
4.95
4.57
4.56
4.56
4.32
4.06
1.33
1.33
1.32
1.31
1.31
1.30
1.29
1.28
1.28
1.27
1.26
1.26
1.25
1.22
1.21
1.19
1.18
1.17
1.17
0.87
0.87
0.86
0.86
0.85
0.85
0.83
0.83
0.82
0.81
0.79
0.77
0.77
0.75
0.75
0.74
0.73
0.72
0.71
0.70
0.70
0.68
Et
Et–Si–O
Cl
Fe
1.00
0.93
0.98
1.02
1.01
1.06
5.05
5.60
5.37
f1 (ppm)

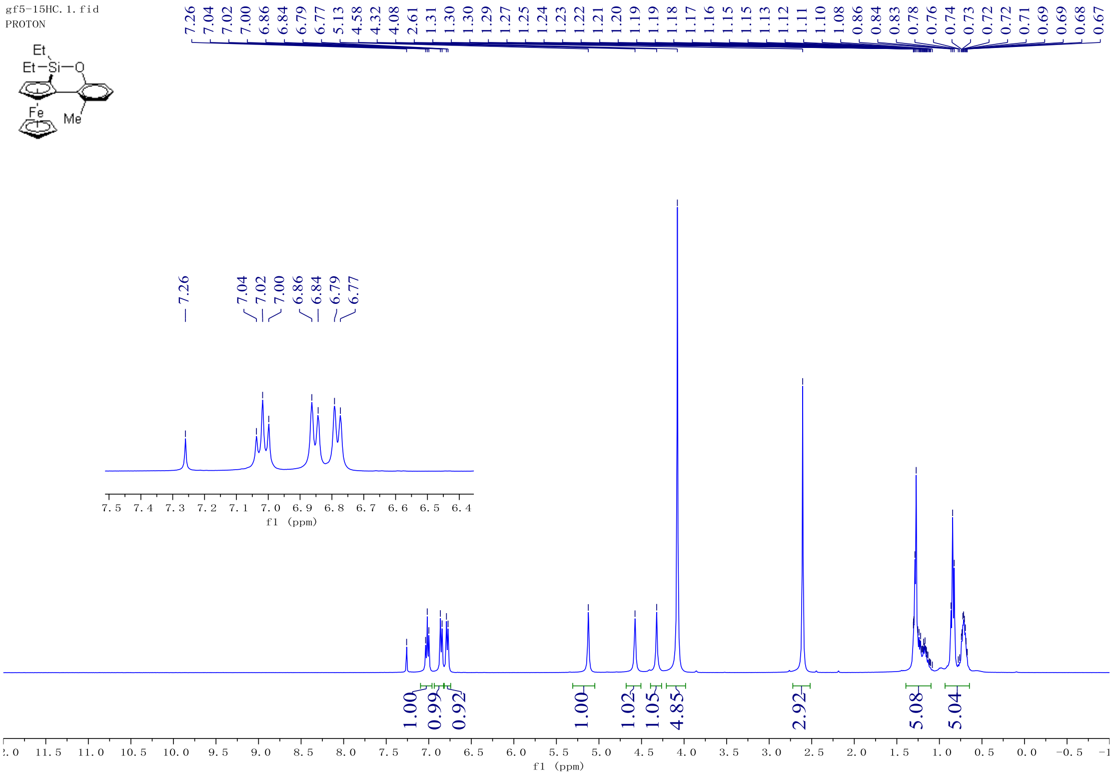

gf5-59C.1.fid
1D 13C with H decoupling
148.13
127.52
124.44
123.27
120.74
86.10
77.32
77.00
76.68
71.96
71.93
69.93
65.77
64.53
7.71
7.32
6.18
6.16
Et
Et–Si–O
Cl
Fe
f1 (ppm)

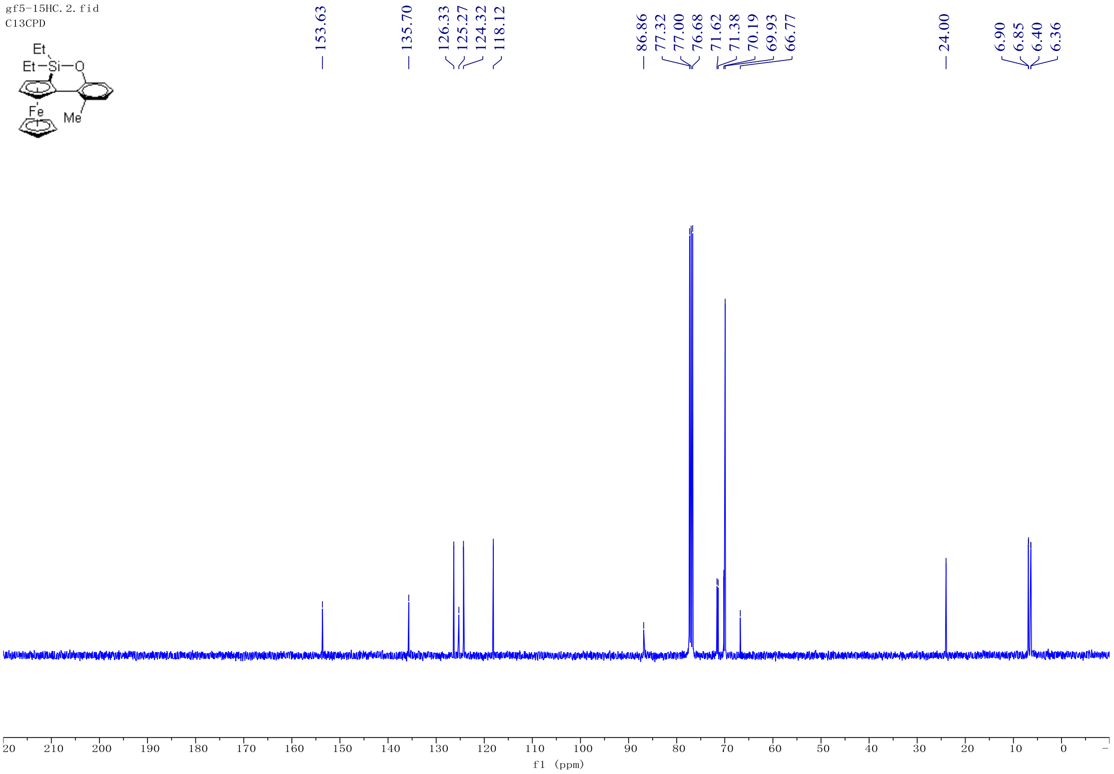
Compound 4r


gf5-0309-90H.1.fid
PROTON
7.26
7.04
7.04
7.03
7.02
6.84
6.82
6.80
6.78
6.77
6.76
6.75
4.94
4.53
4.31
4.06
3.89
3.86
1.35
1.34
1.33
1.32
1.31
1.30
1.30
1.28
1.27
1.27
1.26
1.26
1.24
1.23
1.23
1.22
1.21
1.21
1.20
1.19
1.17
0.88
0.85
0.84
0.84
0.82
0.82
0.81
0.78
0.78
0.77
0.76
0.76
0.75
0.75
0.73
0.73
0.72
0.71
0.70
0.69
Et
Et–Si–O
OMe
Fe
1.00
1.94
0.97
1.02
1.02
4.78
2.92
5.20
5.05
f1 (ppm)

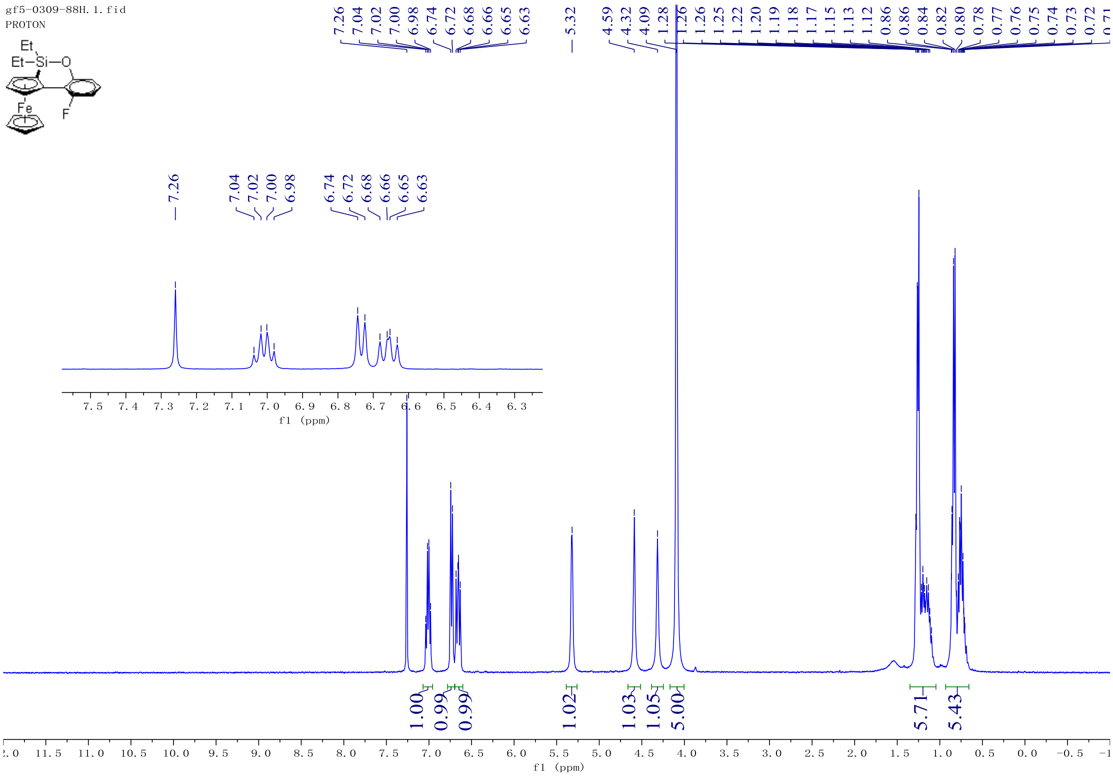

gf5-90HC.1.fid
1D 13C with H decoupling
150.17
141.95
126.34
120.13
117.35
110.26
86.80
77.32
77.00
76.68
71.76
71.45
69.78
65.72
64.45
56.22
7.64
7.42
6.32
6.27
Et
Et–Si–O
OMe
Fe
f1 (ppm)

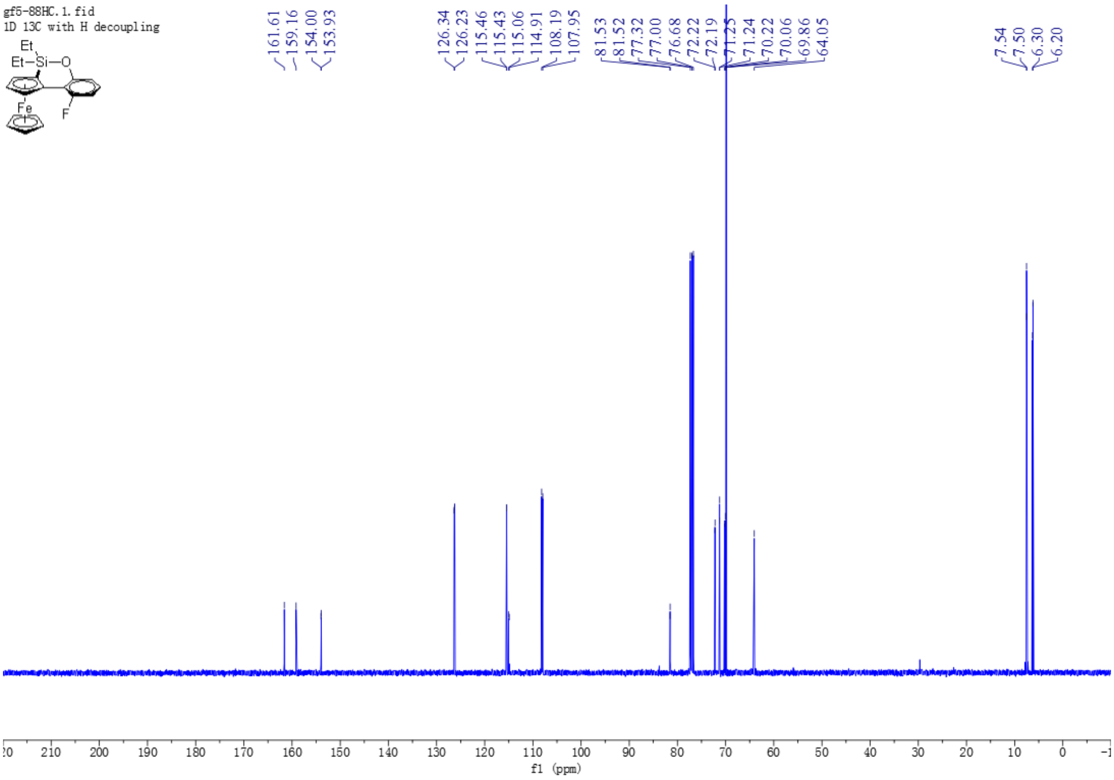
Compound 4s


gf5-15HC.1.fid
PROTON
Et
Et
Si
O
Fe
Me
7.26 7.04 7.02 7.00 6.86 6.84 6.79 6.77 5.13 4.58 4.32 4.08 2.61 1.31 1.30 1.29 1.27 1.25 1.24 1.23 1.22 1.21 1.20 1.19 1.19 1.18 1.17 1.16 1.15 1.15 1.13 1.12 1.11 1.10 1.08 0.86 0.84 0.83 0.78 0.76 0.74 0.73 0.72 0.72 0.71 0.69 0.69 0.68 0.67
7.26 7.04 7.02 7.00 6.86 6.84 6.79 6.77
7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8 6.7 6.6 6.5 6.4
f1 (ppm)
1.00 0.99 0.92 1.00 1.02 1.05 4.85 2.92 5.08 5.04
11.5 11.0 10.5 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)

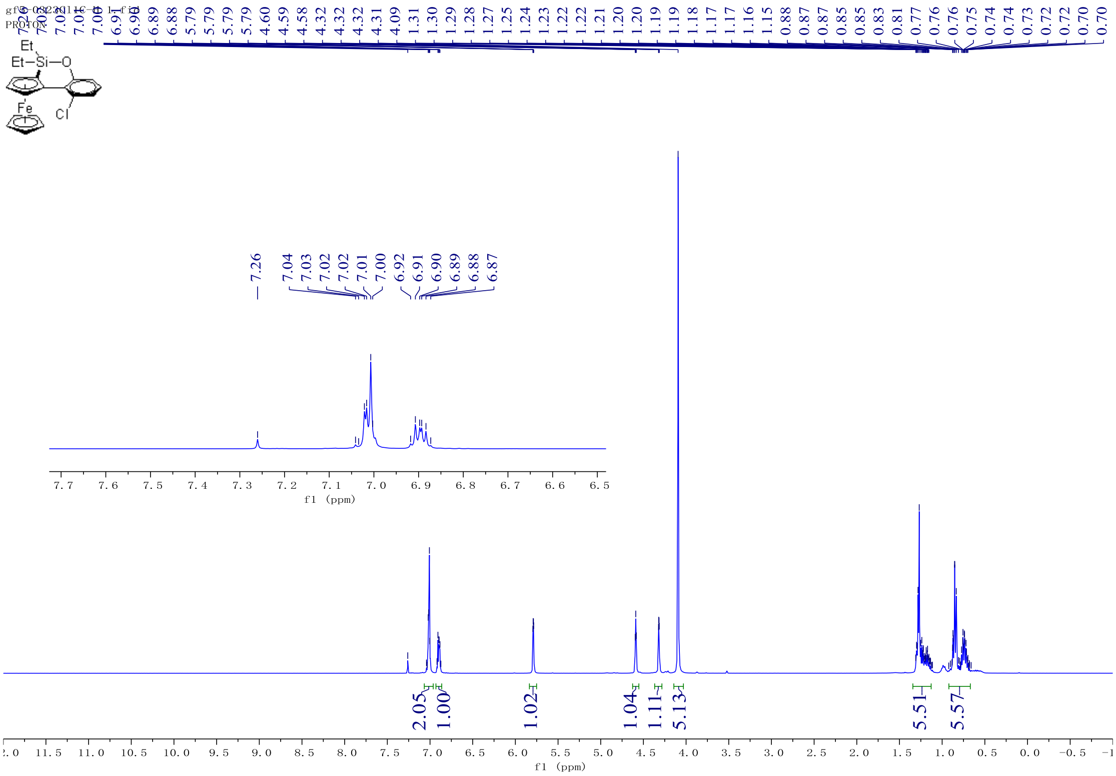

gf5-15HC.2.fid
C13CPD
Et
Et
Si
O
Fe
Me
153.63 135.70 126.33 125.27 124.32 118.12 86.86 77.32 77.00 76.68 71.62 71.38 70.19 69.93 66.77 24.00 6.90 6.85 6.40 6.36
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

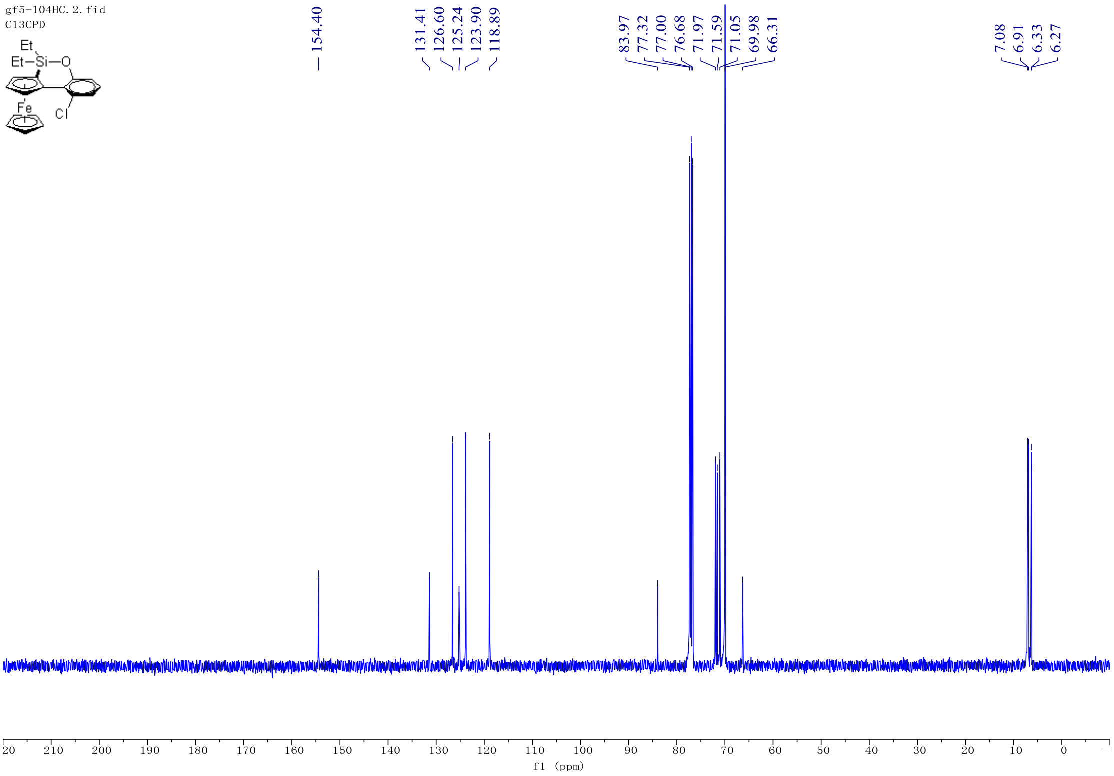
Compound 4t


gf5-0309-88H.1.fid
PROTON
Et
Et–Si–O
Fe
F
7.26
7.04
7.02
7.00
6.98
6.74
6.72
6.68
6.66
6.65
6.63
5.32
4.59
4.32
4.09
1.28
1.26
1.26
1.25
1.22
1.20
1.19
1.18
1.17
1.15
1.13
1.12
0.86
0.84
0.82
0.80
0.78
0.77
0.76
0.75
0.74
0.73
0.72
7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8 6.7 6.6 6.5 6.4 6.3
f1 (ppm)
1.00
0.99
0.99
1.02
1.03
1.05
5.00
5.71
5.43
11.5 11.0 10.5 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)

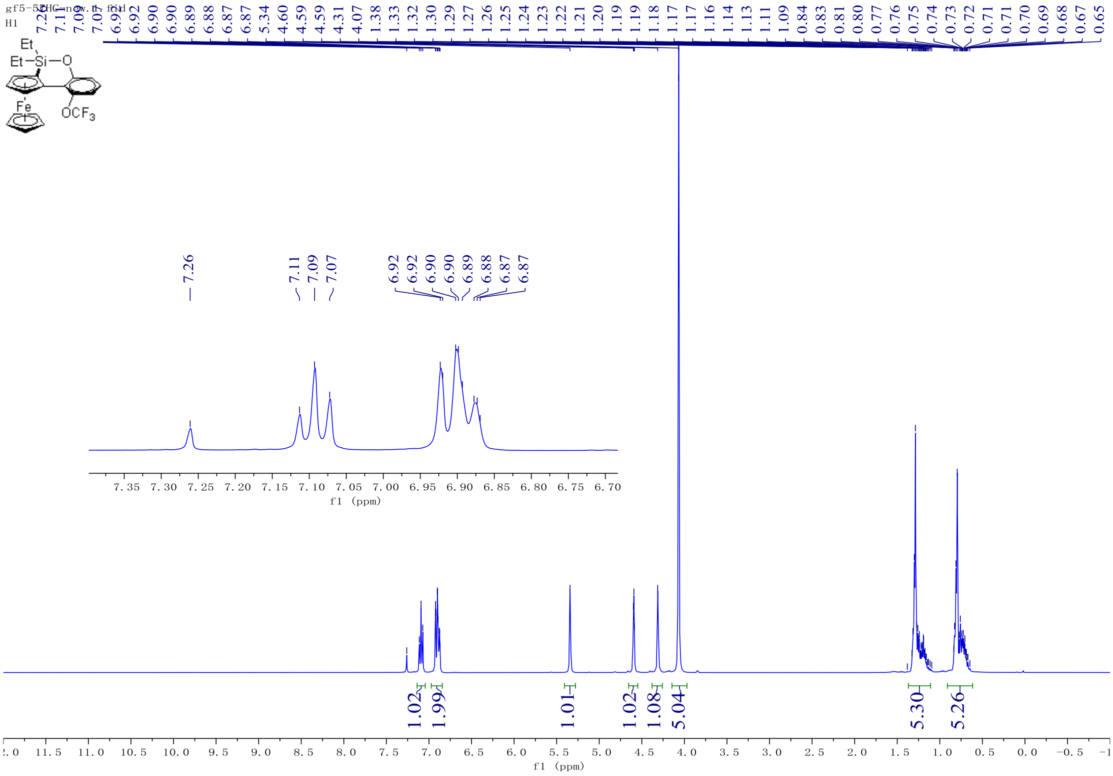

gf5-88HC.1.fid
1D 13C with H decoupling
Et
Et–Si–O
Fe
F
161.61
159.16
154.00
153.93
126.34
126.23
115.46
115.43
115.06
114.91
108.19
107.95
81.53
81.52
77.32
77.00
76.68
72.22
72.19
71.25
71.24
70.22
70.06
69.86
64.05
7.54
7.50
6.30
6.20
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

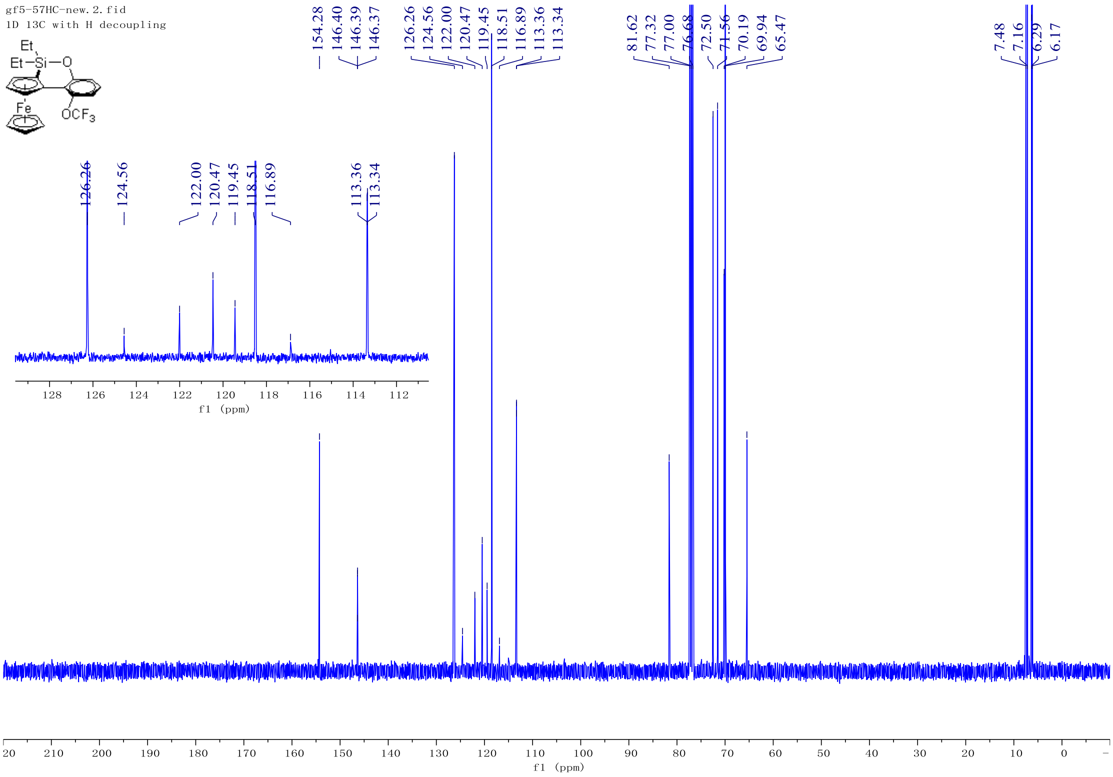
Compound 4u


gf5-0323Cl-C-H.1.fid
PROTON
Et
Et–Si–O
Fe
Cl
7.26 7.03 7.02 7.01 7.00 6.91 6.90 6.89 6.88 5.79 5.79 5.79 5.79 4.60 4.59 4.58 4.32 4.32 4.32 4.31 4.09 1.31 1.30 1.29 1.28 1.27 1.25 1.24 1.23 1.22 1.22 1.21 1.20 1.20 1.19 1.19 1.18 1.17 1.17 1.16 1.15 0.88 0.87 0.87 0.85 0.85 0.83 0.81 0.77 0.76 0.76 0.75 0.74 0.74 0.73 0.72 0.72 0.70 0.70
7.26 7.04 7.03 7.02 7.02 7.01 7.00 6.92 6.91 6.90 6.89 6.88 6.87
7.7 7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8 6.7 6.6 6.5
f1 (ppm)
2.05 1.00 1.02 1.04 1.11 5.13 5.51 5.57
12.0 11.5 11.0 10.5 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 -1
f1 (ppm)

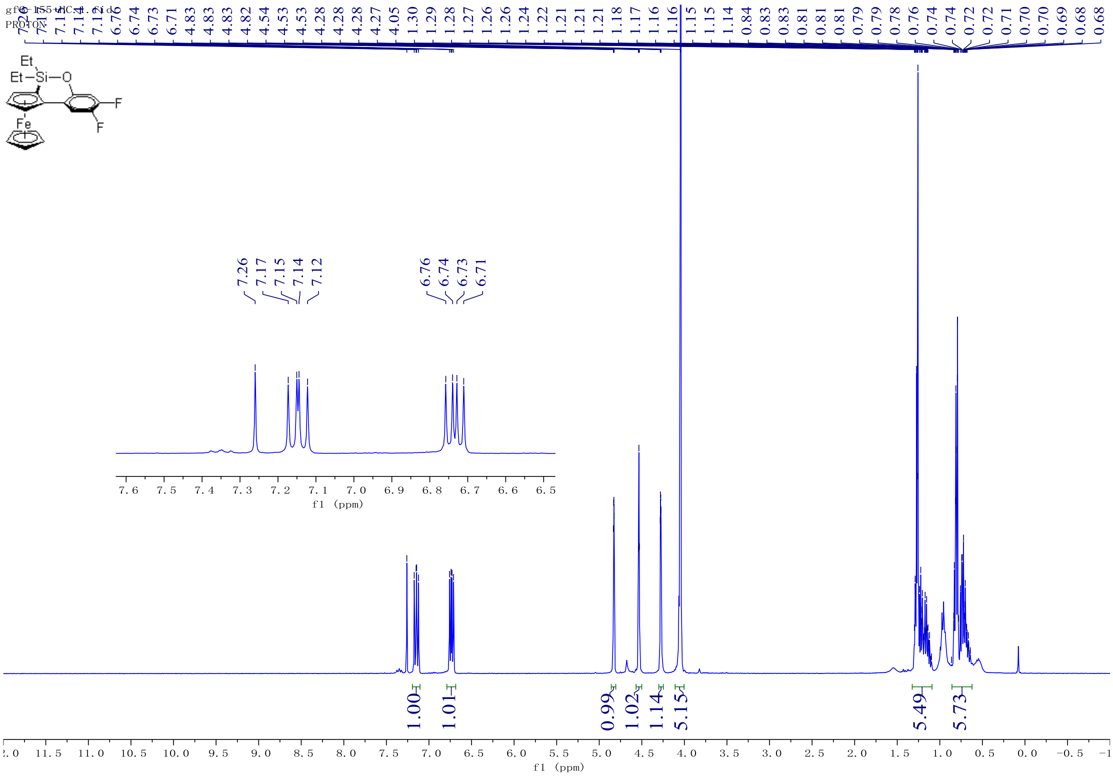

gf5-104HC.2.fid
C13CPD
Et
Et–Si–O
Fe
Cl
154.40
131.41 126.60 125.24 123.90 118.89
83.97 77.32 77.00 76.68 71.97 71.59 71.05 69.98 66.31
7.08 6.91 6.33 6.27
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

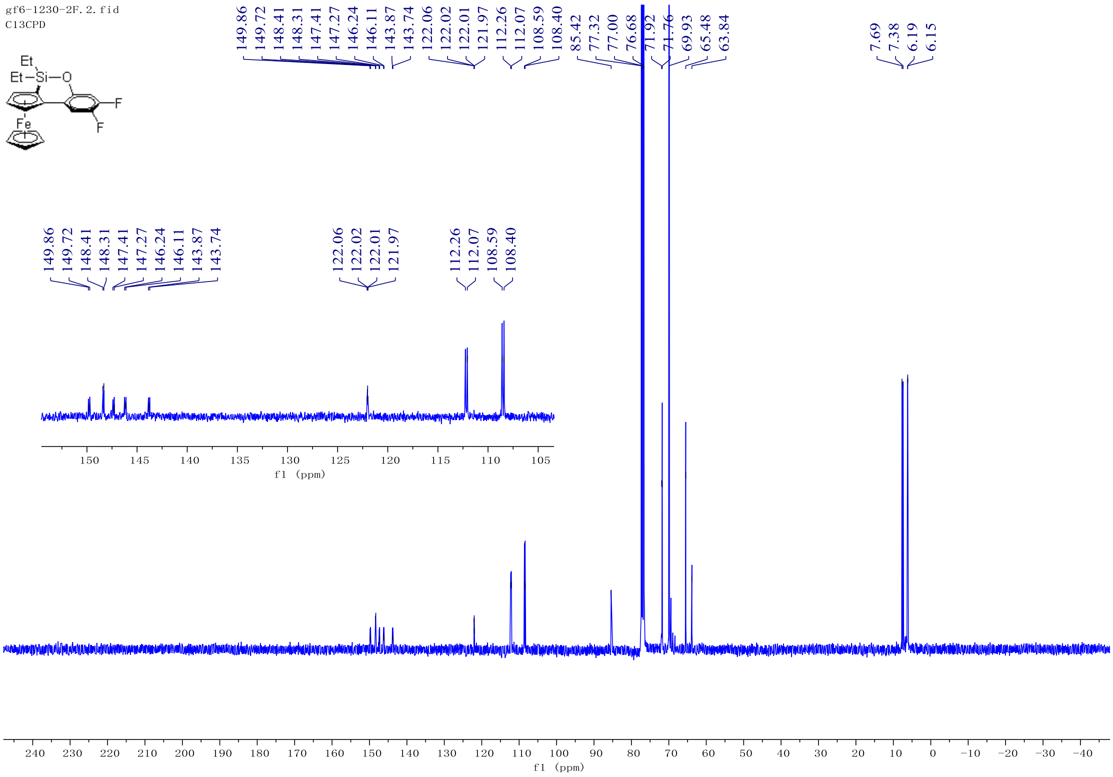
Compound 4v


gf5-57HC-new.1.fid
H1
7.26
7.11
7.09
7.07
6.92
6.92
6.90
6.90
6.89
6.88
6.87
6.87
5.34
4.60
4.59
4.59
4.31
4.07
1.38
1.33
1.32
1.30
1.29
1.27
1.26
1.25
1.24
1.23
1.22
1.21
1.20
1.19
1.19
1.18
1.17
1.17
1.16
1.14
1.13
1.11
1.09
0.84
0.83
0.81
0.80
0.77
0.76
0.75
0.74
0.73
0.72
0.71
0.71
0.70
0.69
0.68
0.67
0.65
Et
Et–Si–O
Fe
OCF3
7.35 7.30 7.25 7.20 7.15 7.10 7.05 7.00 6.95 6.90 6.85 6.80 6.75 6.70
f1 (ppm)
1.02
1.99
1.01
1.02
1.08
5.04
5.30
5.26
12.0 11.5 11.0 10.5 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 -1
f1 (ppm)

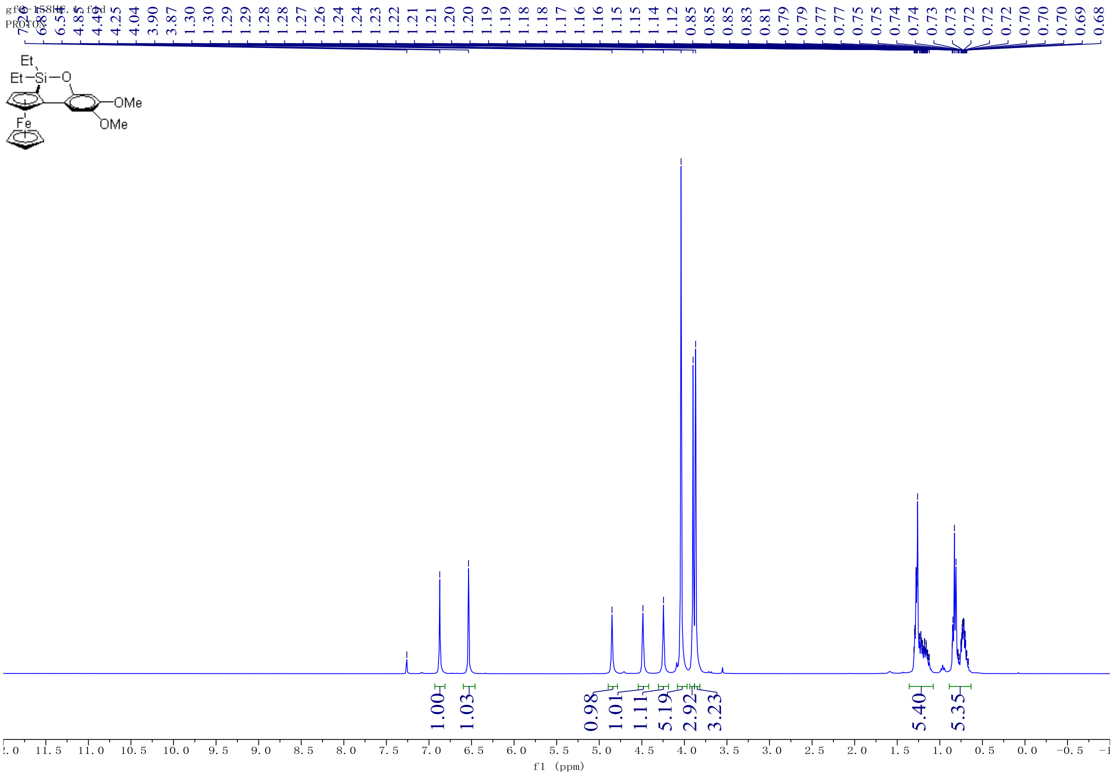

gf5-57HC-new.2.fid
1D 13C with H decoupling
154.28
146.40
146.39
146.37
126.26
124.56
122.00
120.47
119.45
118.51
116.89
113.36
113.34
81.62
77.32
77.00
76.68
72.50
71.56
70.19
69.94
65.47
7.48
7.16
6.29
6.17
Et
Et–Si–O
Fe
OCF3
128 126 124 122 120 118 116 114 112
f1 (ppm)
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

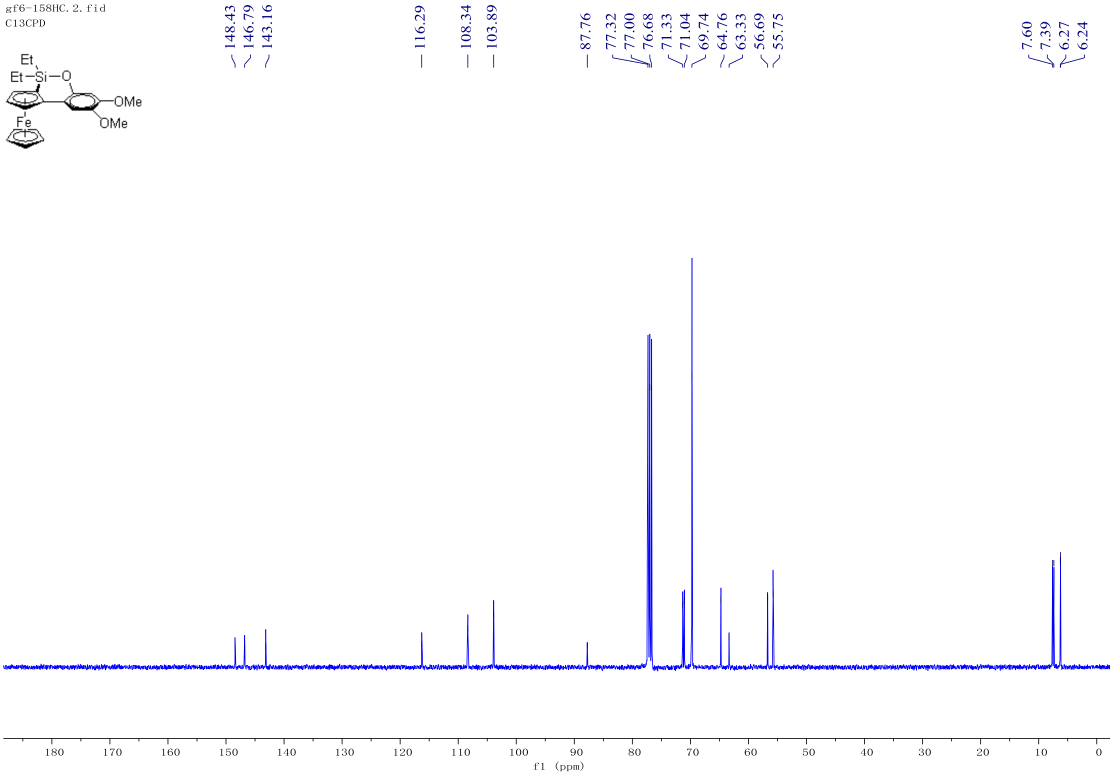
Compound 4w


gf6-155-4C.1.fid
PROTON
7.26 7.17 7.15 7.14 7.12 6.76 6.74 6.73 6.71 4.83 4.83 4.83 4.82 4.54 4.53 4.53 4.28 4.28 4.28 4.27 4.05 1.30 1.29 1.28 1.27 1.26 1.24 1.22 1.21 1.21 1.21 1.18 1.17 1.16 1.16 1.15 1.15 1.14 0.84 0.83 0.83 0.81 0.81 0.81 0.79 0.78 0.76 0.74 0.74 0.72 0.71 0.70 0.69 0.68
Et
Et–Si–O
F
F
Fe
7.26 7.17 7.15 7.14 7.12
6.76 6.74 6.73 6.71
7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8 6.7 6.6 6.5
f1 (ppm)
1.00 1.01 0.99 1.02 1.14 5.15 5.49 5.73
12.0 11.5 11.0 10.5 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 −1
f1 (ppm)

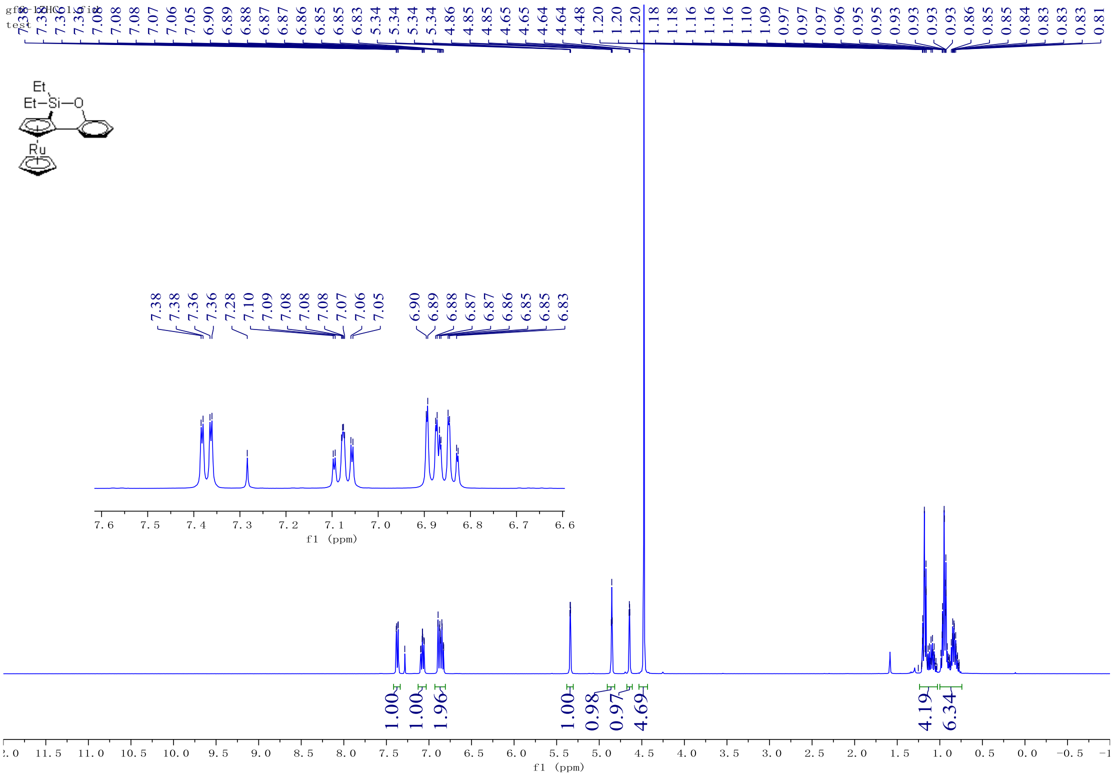

gf6-1230-2F.2.fid
C13CPD
149.86 149.72 148.41 148.31 147.41 147.27 146.24 146.11 143.87 143.74 122.06 122.02 122.01 121.97 112.26 112.07 108.59 108.40 85.42 77.32 77.00 76.68 71.92 71.76 69.93 65.48 63.84
7.69 7.38 6.19 6.15
Et
Et–Si–O
F
F
Fe
149.86 149.72 148.41 148.31 147.41 147.27 146.24 146.11 143.87 143.74
122.06 122.02 122.01 121.97
112.26 112.07 108.59 108.40
150 145 140 135 130 125 120 115 110 105
f1 (ppm)
240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 −10 −20 −30 −40
f1 (ppm)

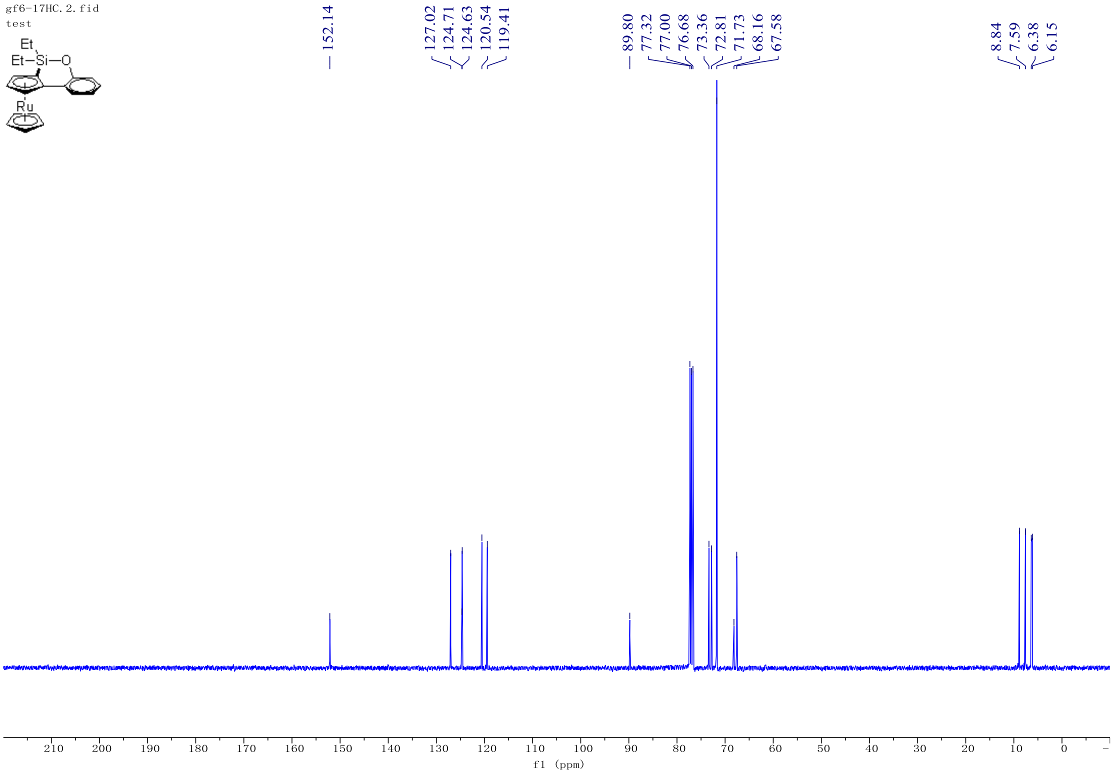
Compound 4x


gf6-158HC.1.fid
PROTON
7.26
6.87
6.54
4.85
4.49
4.25
4.04
3.90
3.87
1.30
1.30
1.29
1.29
1.28
1.28
1.27
1.26
1.24
1.24
1.23
1.22
1.21
1.21
1.20
1.20
1.19
1.19
1.18
1.18
1.17
1.16
1.16
1.15
1.15
1.14
1.12
0.85
0.85
0.85
0.83
0.81
0.79
0.79
0.77
0.77
0.75
0.75
0.74
0.74
0.73
0.73
0.72
0.72
0.72
0.70
0.70
0.70
0.69
0.68
Et
Et
Si
O
OMe
OMe
Fe
1.00
1.03
0.98
1.01
1.11
5.19
2.92
3.23
5.40
5.35
.0
11.5
11.0
10.5
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
-1
f1 (ppm)

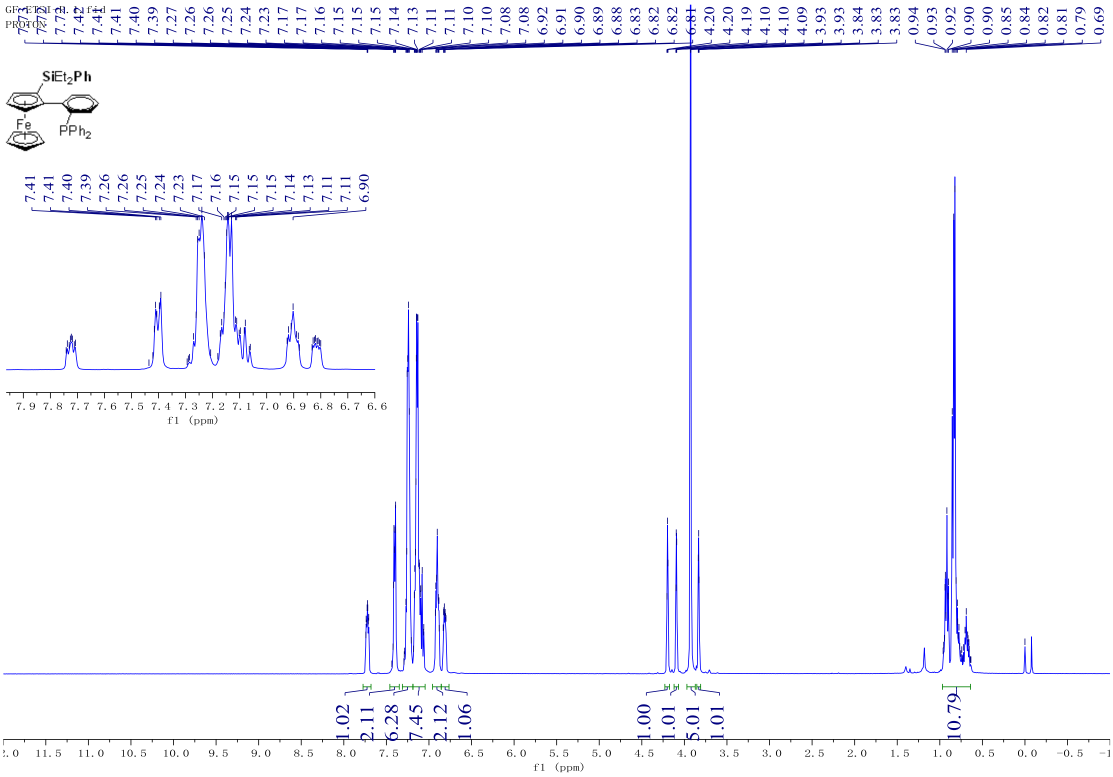

gf6-158HC.2.fid
C13CPD
148.43
146.79
143.16
116.29
108.34
103.89
87.76
77.32
77.00
76.68
71.33
71.04
69.74
64.76
63.33
56.69
55.75
7.60
7.39
6.27
6.24
Et
Et
Si
O
OMe
OMe
Fe
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

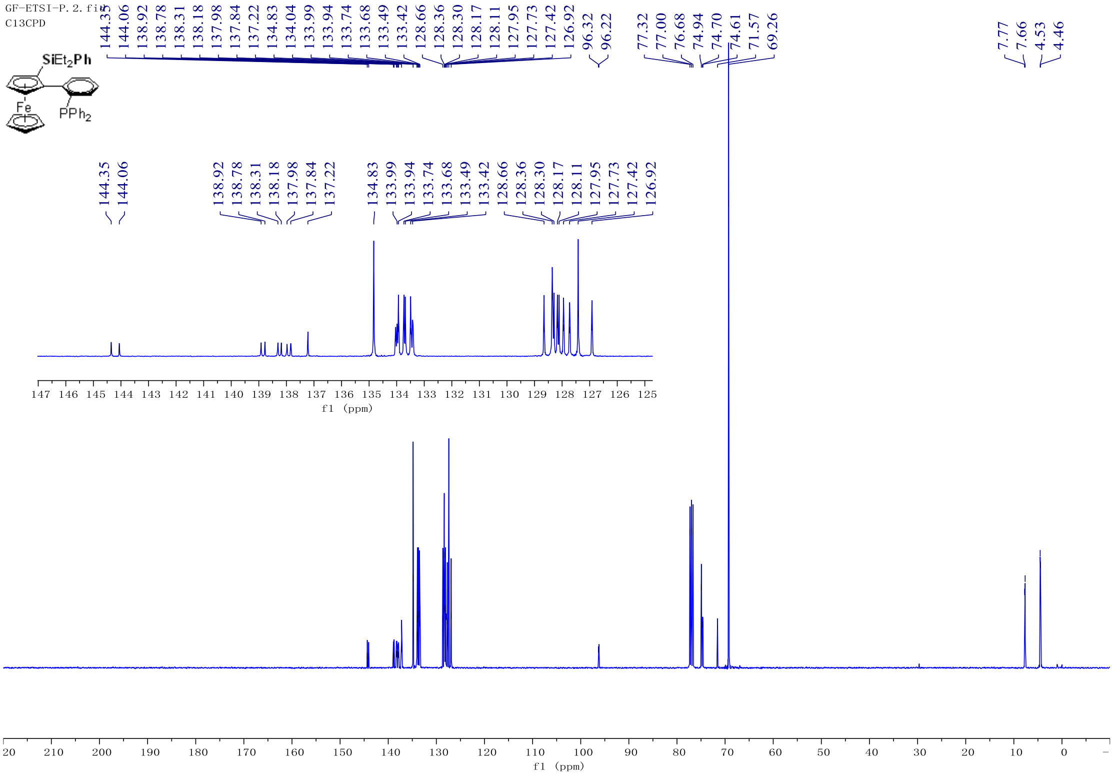
Compound 4y

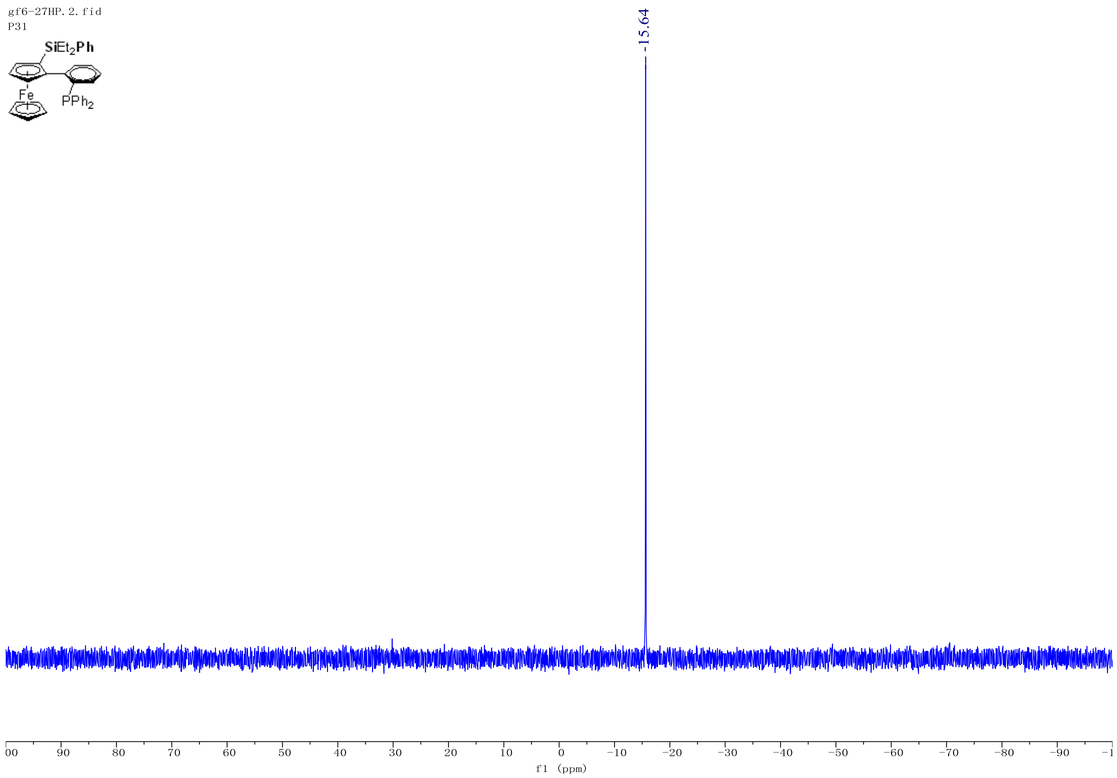

gf6-17HC.1.fid
test
7.38 7.38 7.36 7.36 7.08 7.08 7.08 7.07 7.06 7.05 6.90 6.89 6.88 6.87 6.87 6.86 6.85 6.85 6.83 5.34 5.34 5.34 5.34 4.86 4.85 4.85 4.65 4.65 4.64 4.64 4.48 1.20 1.20 1.20 1.18 1.18 1.16 1.16 1.16 1.10 1.09 0.97 0.97 0.97 0.96 0.95 0.95 0.93 0.93 0.93 0.93 0.86 0.85 0.85 0.84 0.83 0.83 0.83 0.81
Et
Et–Si–O
Ru
7.38 7.38 7.36 7.36 7.28 7.10 7.09 7.08 7.08 7.08 7.07 7.06 7.05 6.90 6.89 6.88 6.87 6.87 6.86 6.85 6.85 6.83
7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9 6.8 6.7 6.6
f1 (ppm)
1.00 1.00 1.96 1.00 0.98 0.97 4.69 4.19 6.34
12.0 11.5 11.0 10.5 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 -1
f1 (ppm)


gf6-17HC.2.fid
test
Et
Et–Si–O
Ru
152.14
127.02 124.71 124.63 120.54 119.41
89.80 77.32 77.00 76.68 73.36 72.81 71.73 68.16 67.58
8.84 7.59 6.38 6.15
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

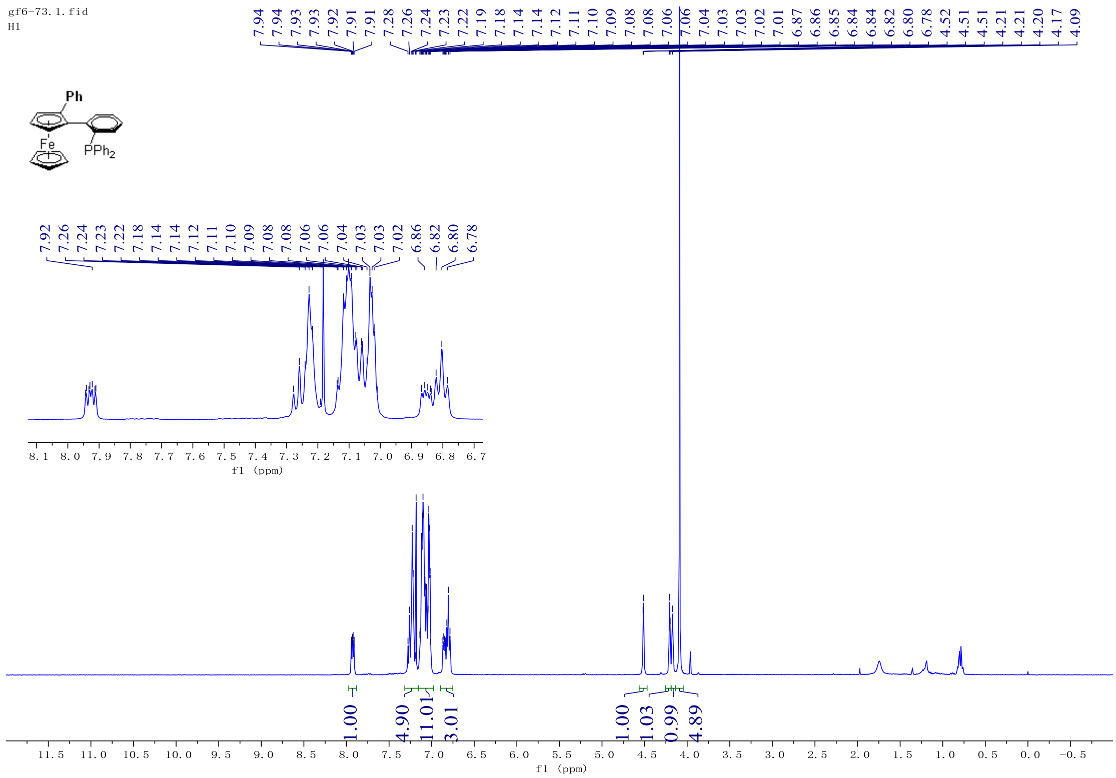
Compound FcL1

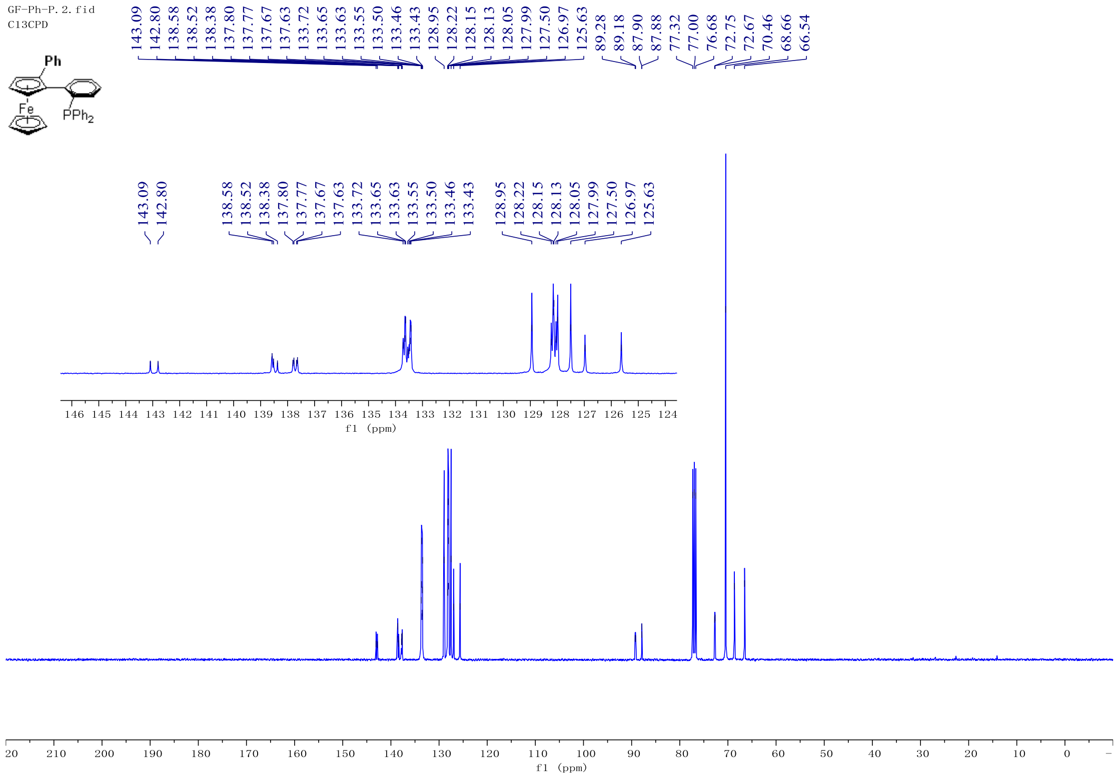


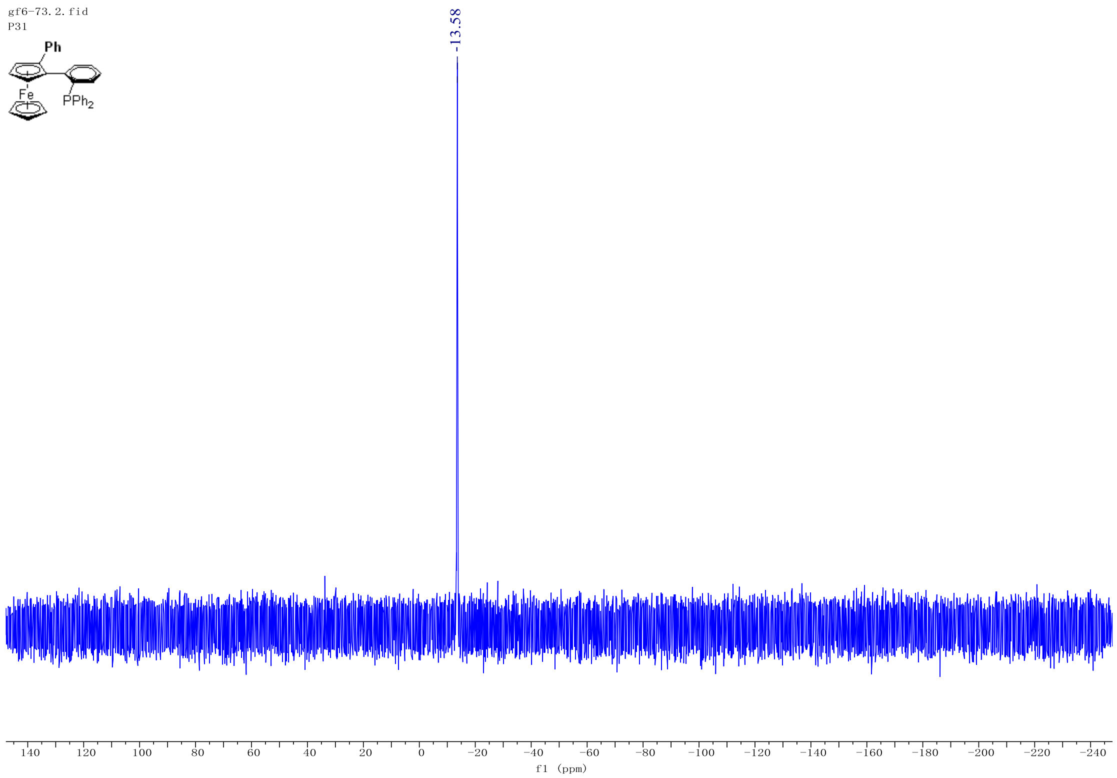



gf6-27HP.2.fid
P31
SiEt2Ph
Fe
PPh2
-15.64
00
90
80
70
60
50
40
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−1
f1 (ppm)

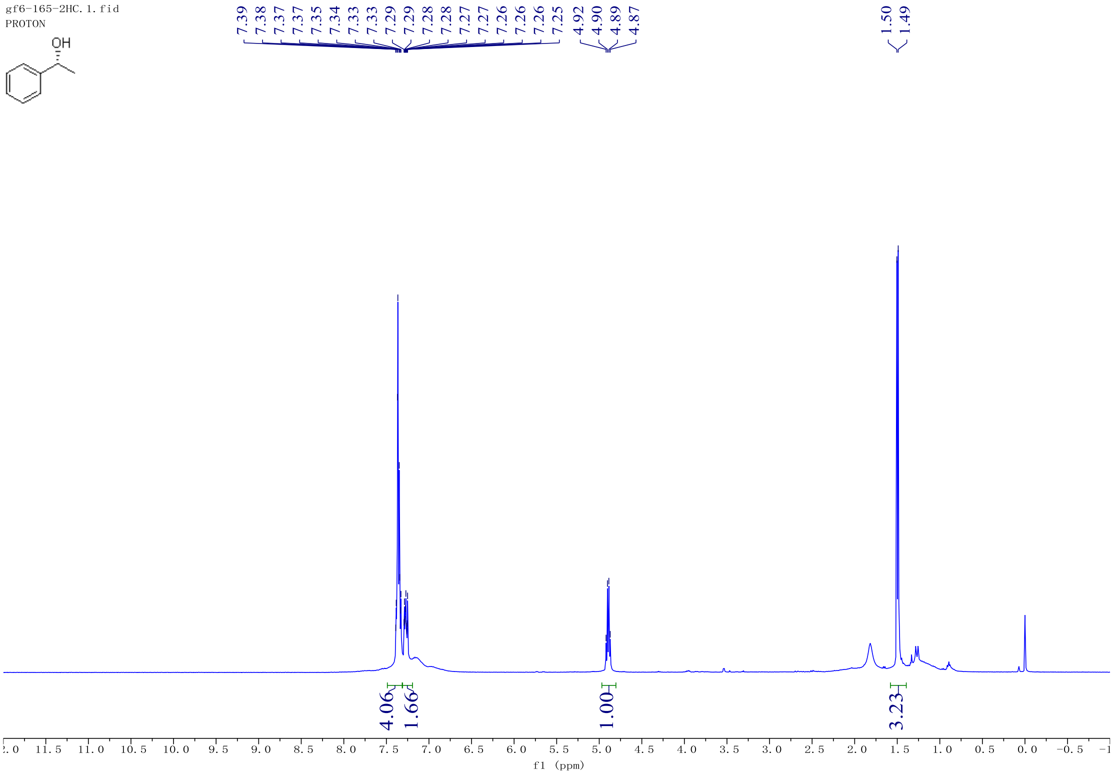
Compound FcL2

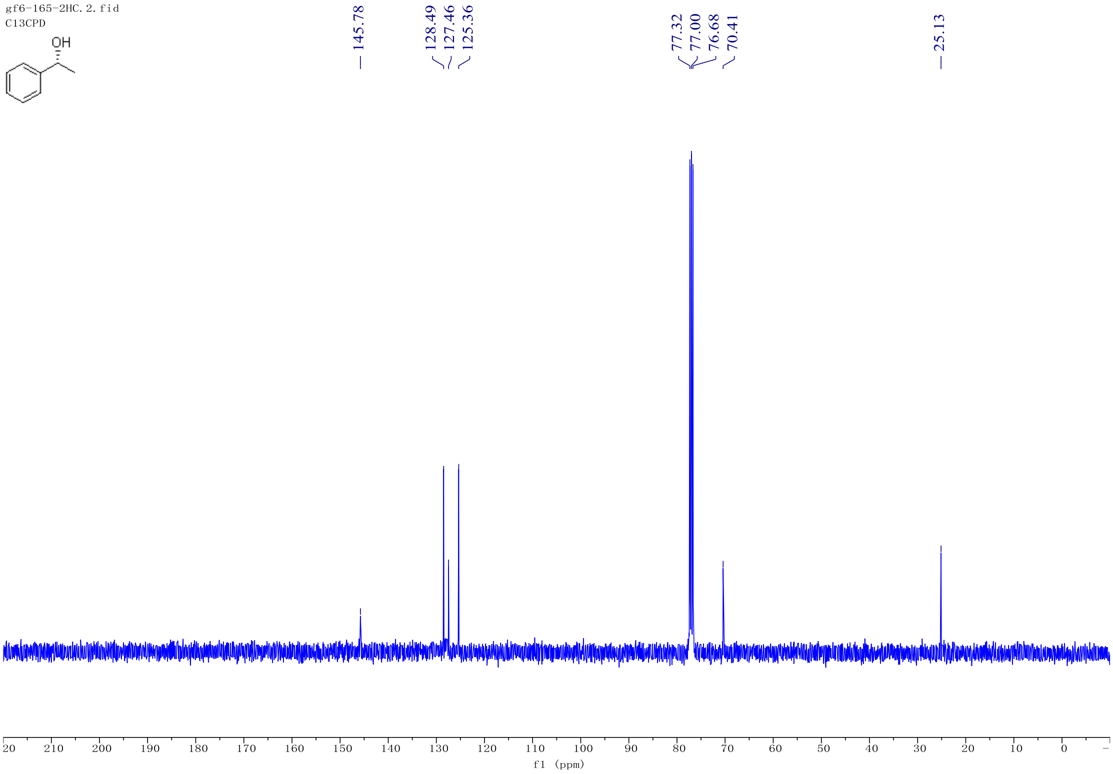




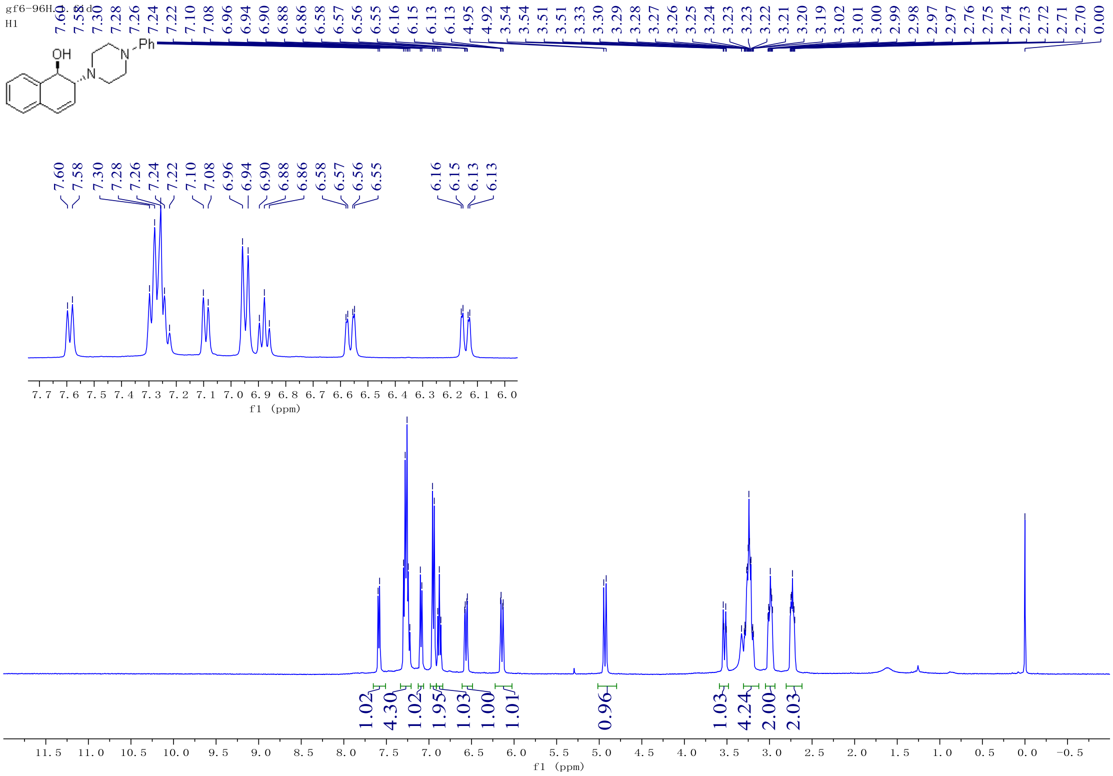

gf6-73.2.fid
P31
Ph
Fe
PPh2
-13.58
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
-220
-240
f1 (ppm)

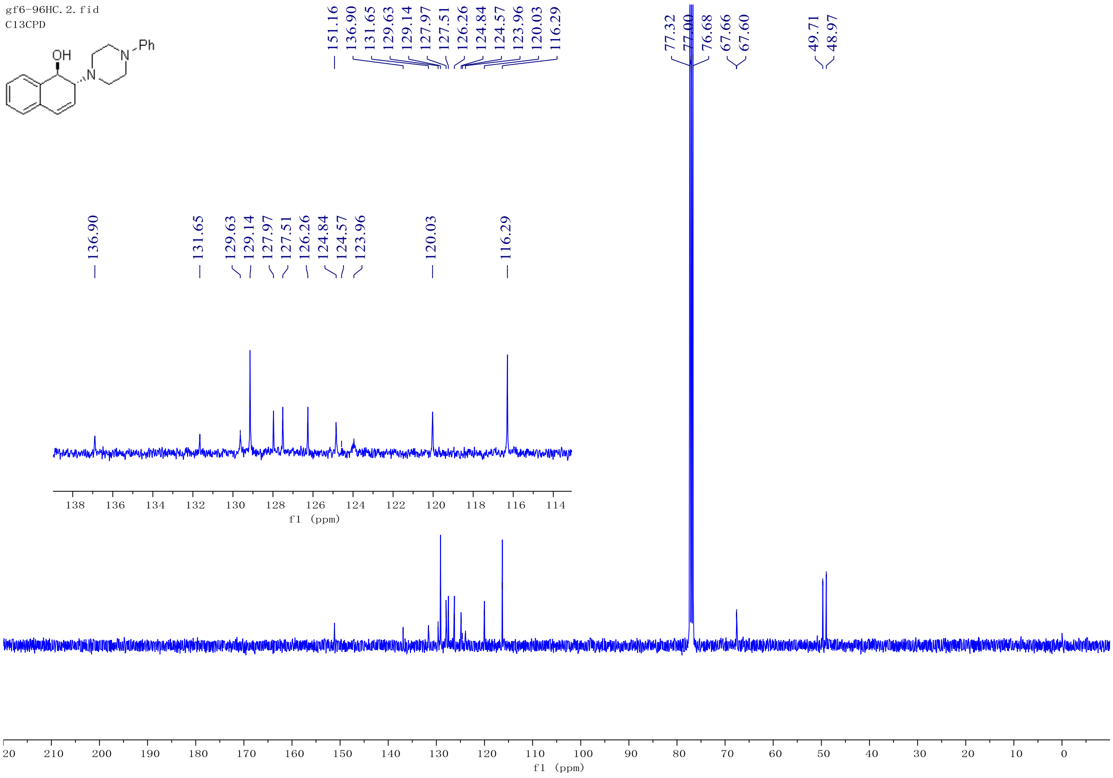
Compound 6-1


gf6-165-2HC.1.fid
PROTON
OH
7.39
7.38
7.37
7.37
7.35
7.34
7.33
7.33
7.29
7.29
7.28
7.28
7.27
7.27
7.26
7.26
7.26
7.25
4.92
4.90
4.89
4.87
1.50
1.49
4.06
1.66
1.00
3.23
12.0 11.5 11.0 10.5 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 -1
f1 (ppm)


gf6-165-2HC.2.fid
C13CPD
OH
145.78
128.49
127.46
125.36
77.32
77.00
76.68
70.41
25.13
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

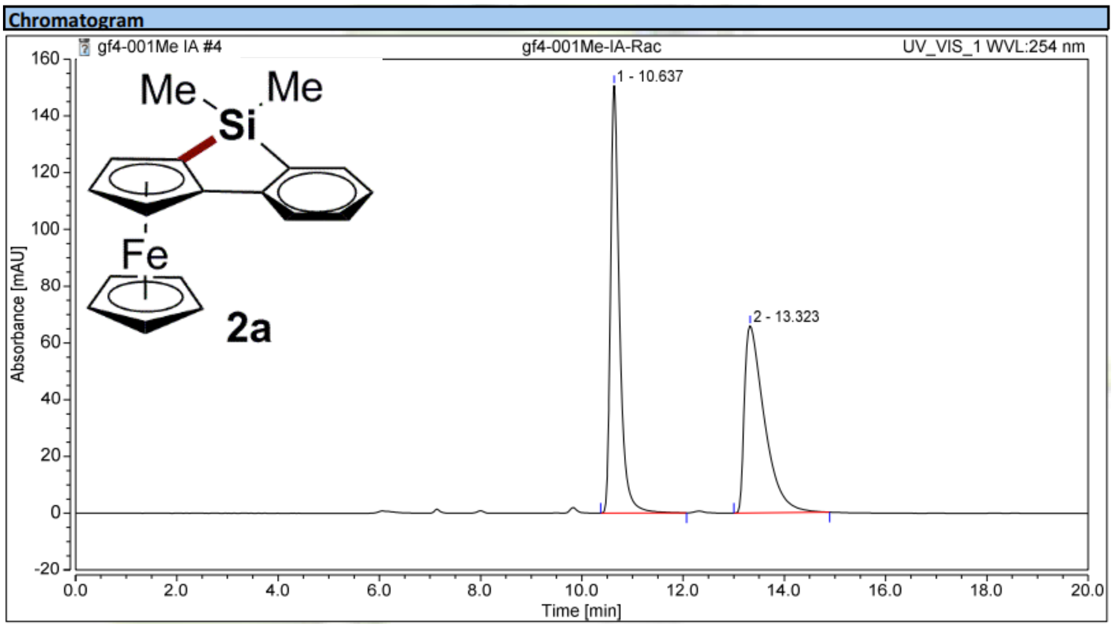
Compound 7


gf6-96H.2.fid
H1
OH
N
N
Ph
7.60 7.58 7.30 7.28 7.26 7.24 7.22 7.10 7.08 6.96 6.94 6.90 6.88 6.86 6.58 6.57 6.56 6.55 6.16 6.15 6.13 6.13 4.95 4.92 3.54 3.51 3.51 3.33 3.30 3.29 3.28 3.27 3.26 3.25 3.24 3.23 3.23 3.22 3.21 3.20 3.19 3.02 3.01 3.00 2.99 2.98 2.97 2.97 2.76 2.75 2.74 2.73 2.72 2.71 2.70 0.00
1.02 4.30 1.02 1.95 1.03 1.00 1.01 0.96 1.03 4.24 2.00 2.03
f1 (ppm)


gf6-96HC.2.fid
C13CPD
OH
N
N
Ph
151.16 136.90 131.65 129.63 129.14 127.97 127.51 126.26 124.84 124.57 123.96 120.03 116.29 77.32 77.00 76.68 67.66 67.60 49.71 48.97
f1 (ppm)

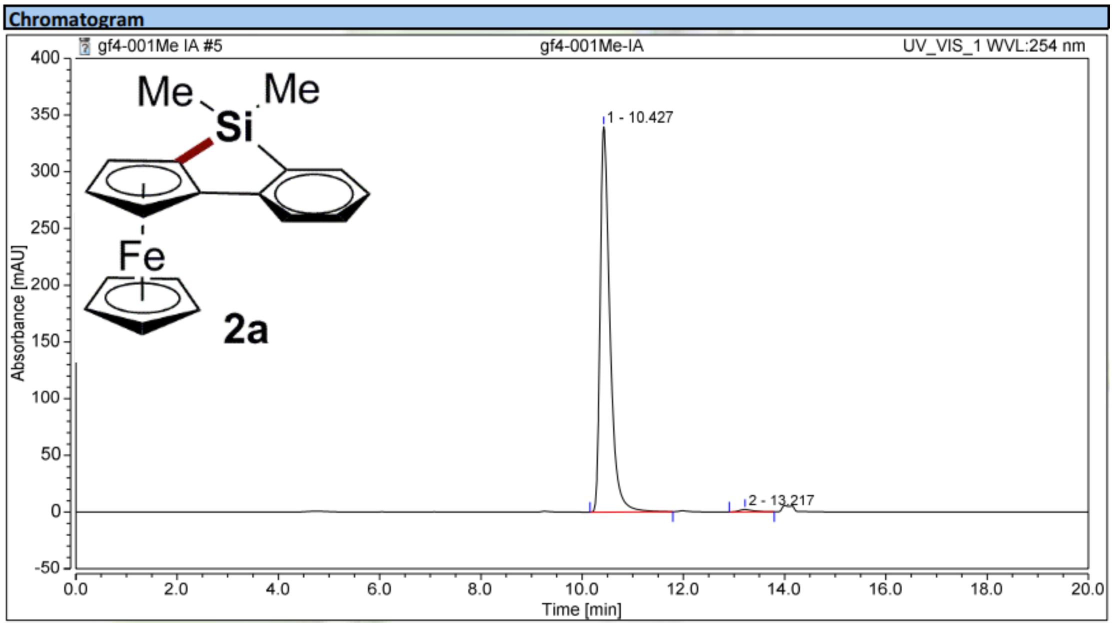
7. HPLC Traces

Compound 2a



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	10.637	31.391	150.698	50.97	69.55
2	13.323	30.202	65.992	49.03	30.45
Totals:		**61.593**	**216.690**	**100.00**	**100.00**

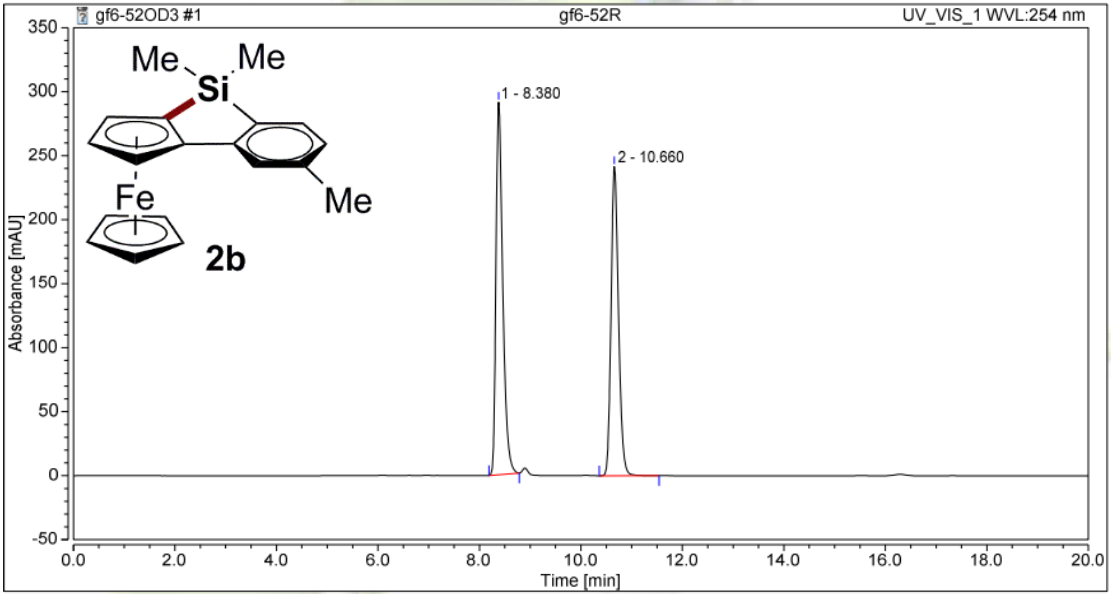


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	10.427	75.550	339.730	99.06	99.37
2	13.217	0.715	2.167	0.94	0.63
Totals:		**76.265**	**341.897**	**100.00**	**100.00**

Compound 2b

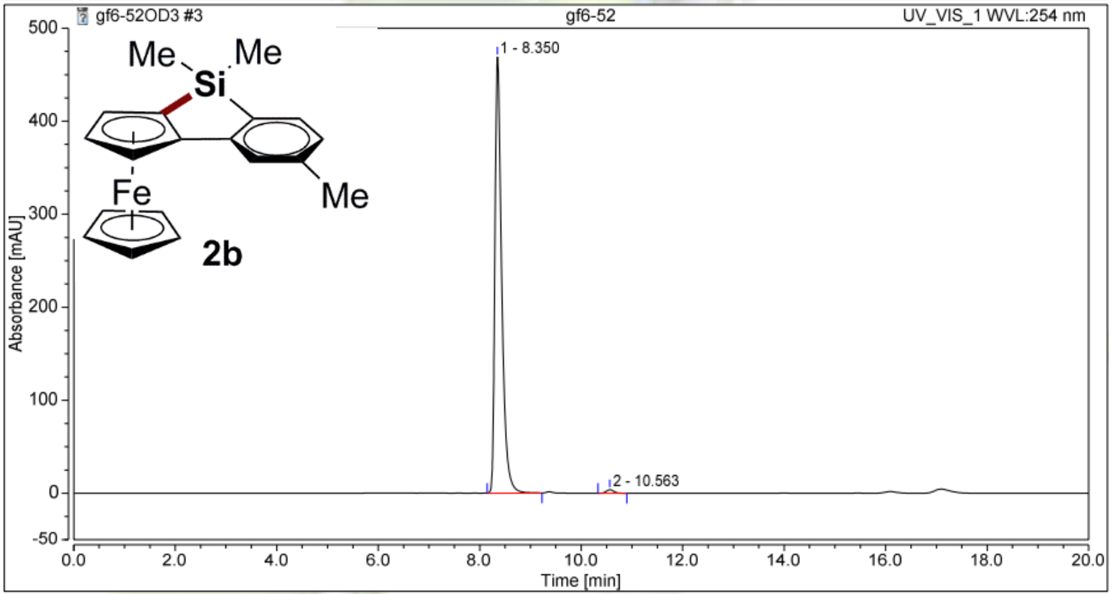
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	8.380	45.265	291.110	52.15	54.65
2	10.660	41.537	241.542	47.85	45.35
Totals:		**86.802**	**532.652**	**100.00**	**100.00**

Chromatogram

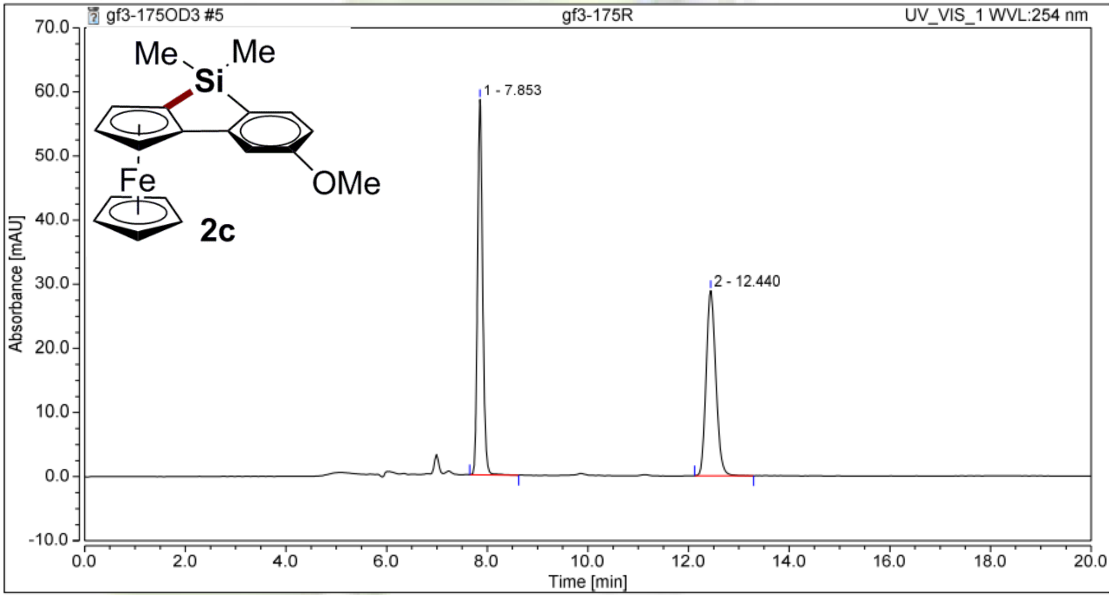


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	8.350	72.810	468.889	99.12	99.19
2	10.563	0.644	3.832	0.88	0.81
Totals:		**73.454**	**472.721**	**100.00**	**100.00**

Compound 2c

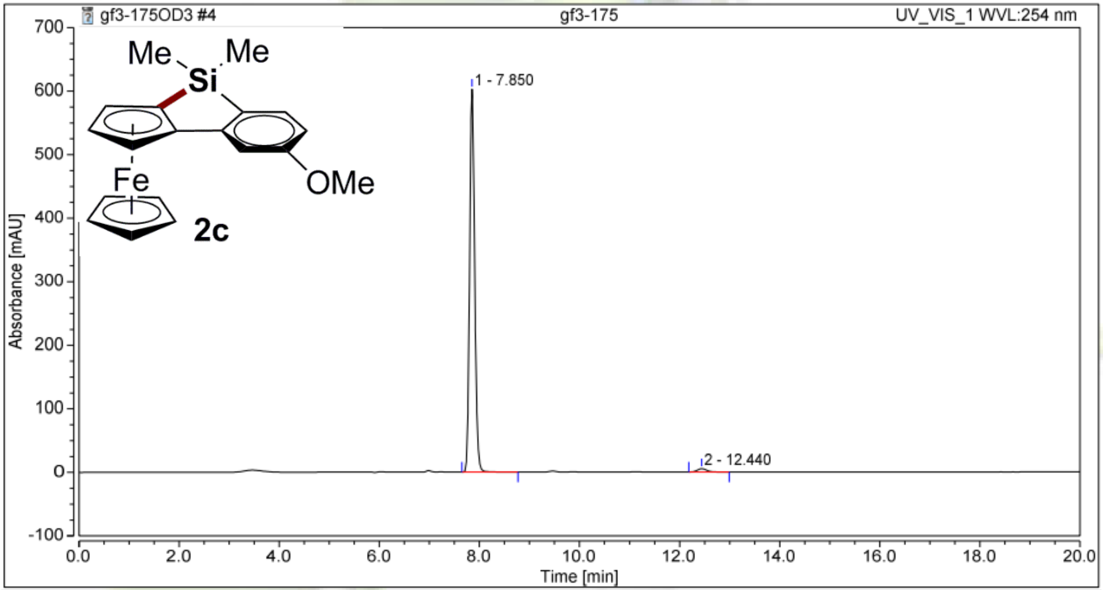
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	7.853	6.889	58.510	51.89	66.96
2	12.440	6.387	28.869	48.11	33.04
Totals:		**13.276**	**87.379**	**100.00**	**100.00**

Chromatogram

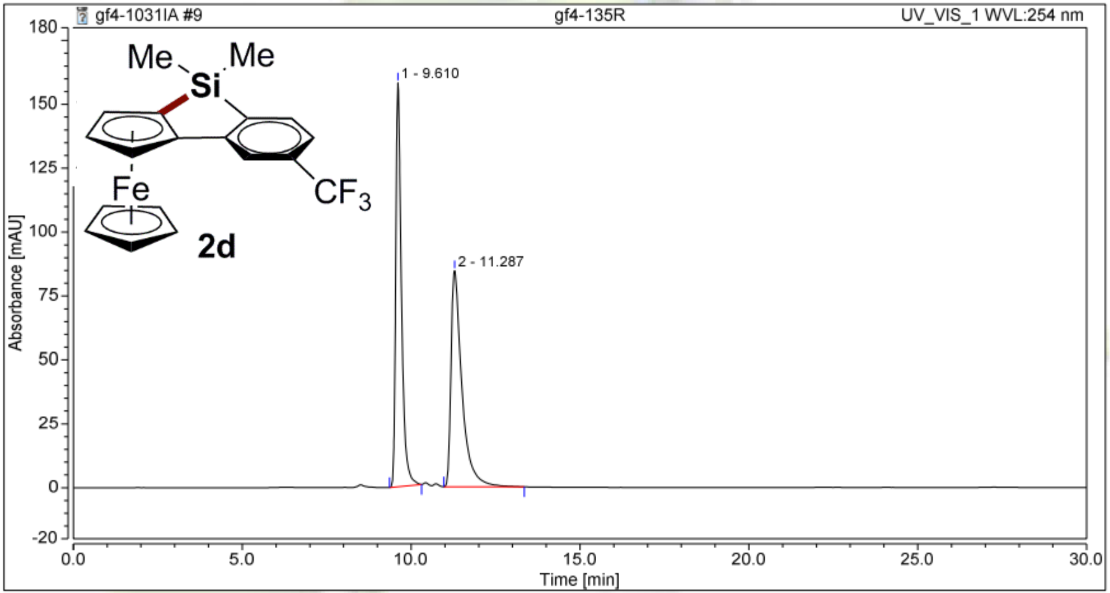


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	7.850	70.294	602.668	98.36	99.13
2	12.440	1.175	5.313	1.64	0.87
Totals:		**71.469**	**607.981**	**100.00**	**100.00**

Compound 2d

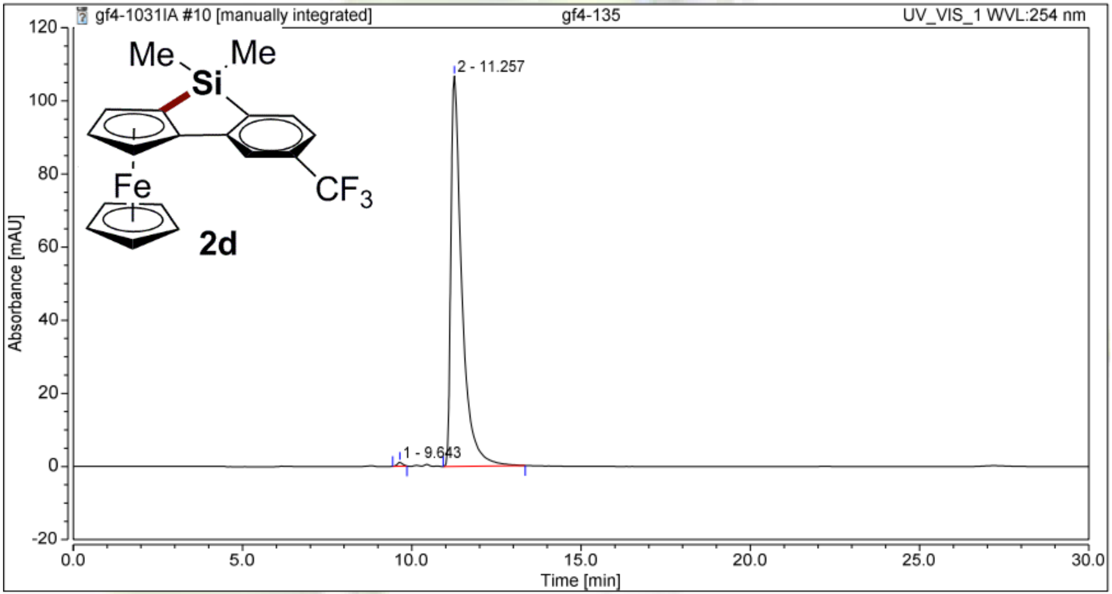
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	9.610	30.783	158.048	49.28	65.16
2	11.287	31.685	84.514	50.72	34.84
Totals:		**62.468**	**242.562**	**100.00**	**100.00**

Chromatogram

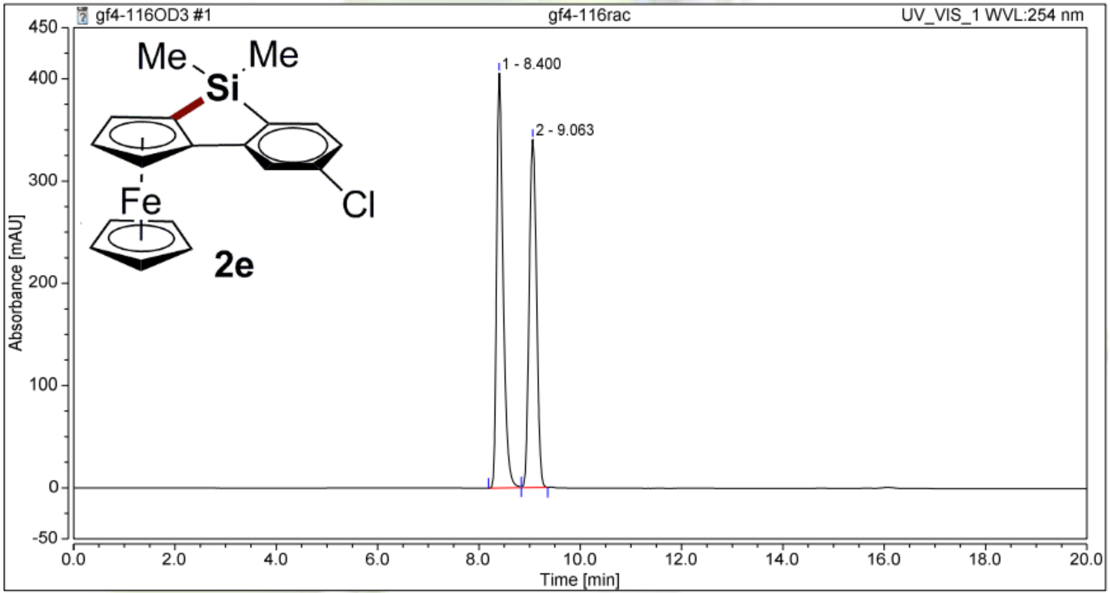


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	9.643	0.185	1.062	0.46	0.98
2	11.257	40.229	106.729	99.54	99.02
Totals:		**40.414**	**107.791**	**100.00**	**100.00**

Compound 2e

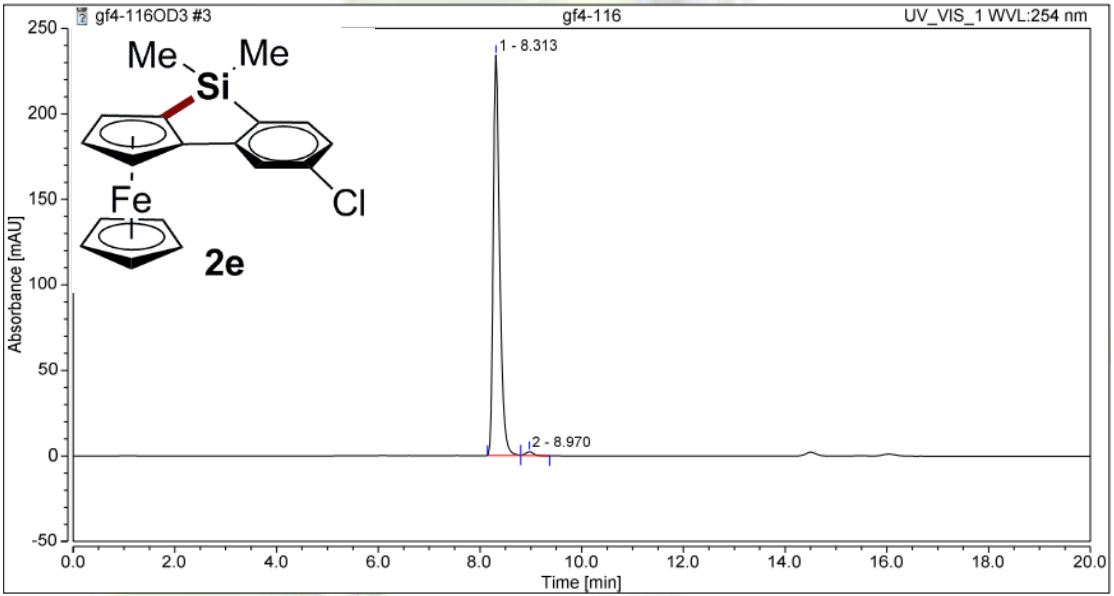
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	8.400	60.620	405.758	51.69	54.38
2	9.063	56.662	340.381	48.31	45.62
Totals:		**117.282**	**746.139**	**100.00**	**100.00**

Chromatogram

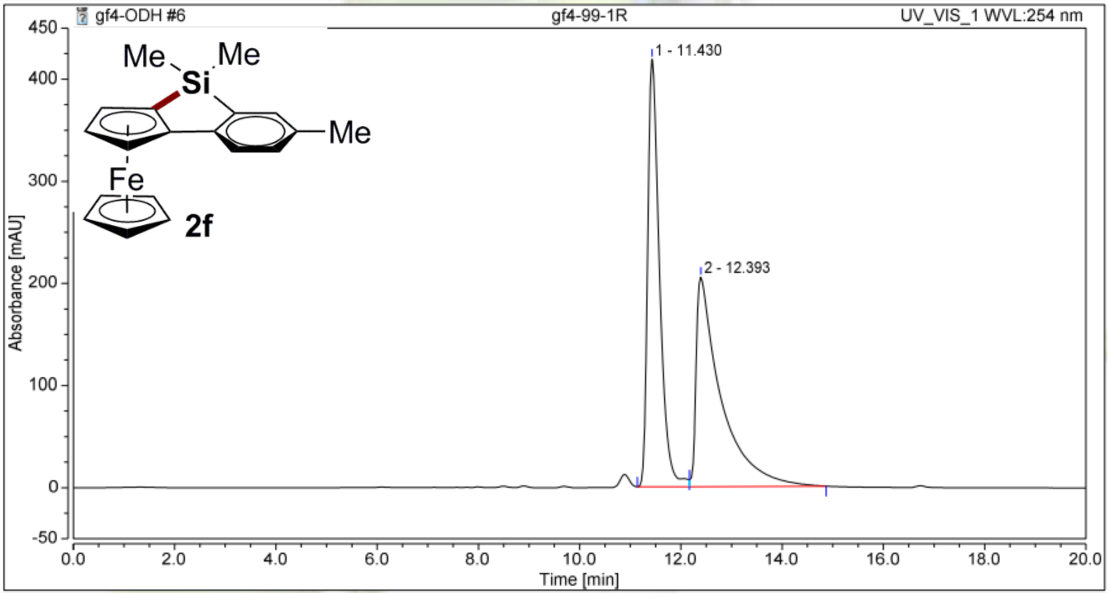


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	8.313	34.412	233.925	98.81	99.01
2	8.970	0.415	2.342	1.19	0.99
Totals:		**34.828**	**236.266**	**100.00**	**100.00**

Compound 2f

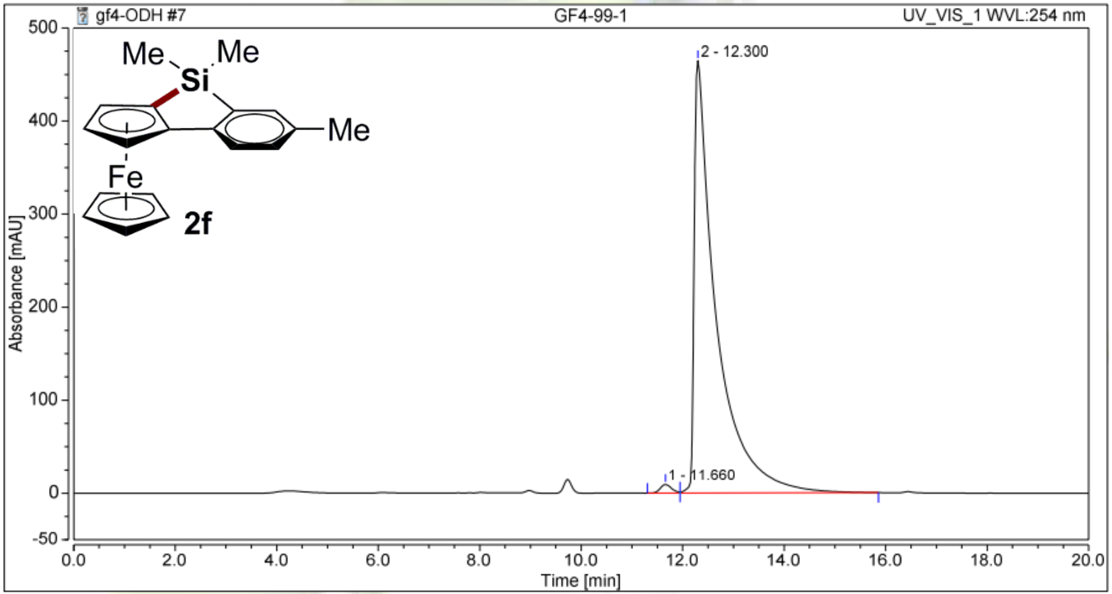
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	11.430	112.981	418.718	49.37	67.13
2	12.393	115.858	205.048	50.63	32.87
Totals:		**228.839**	**623.765**	**100.00**	**100.00**

Chromatogram

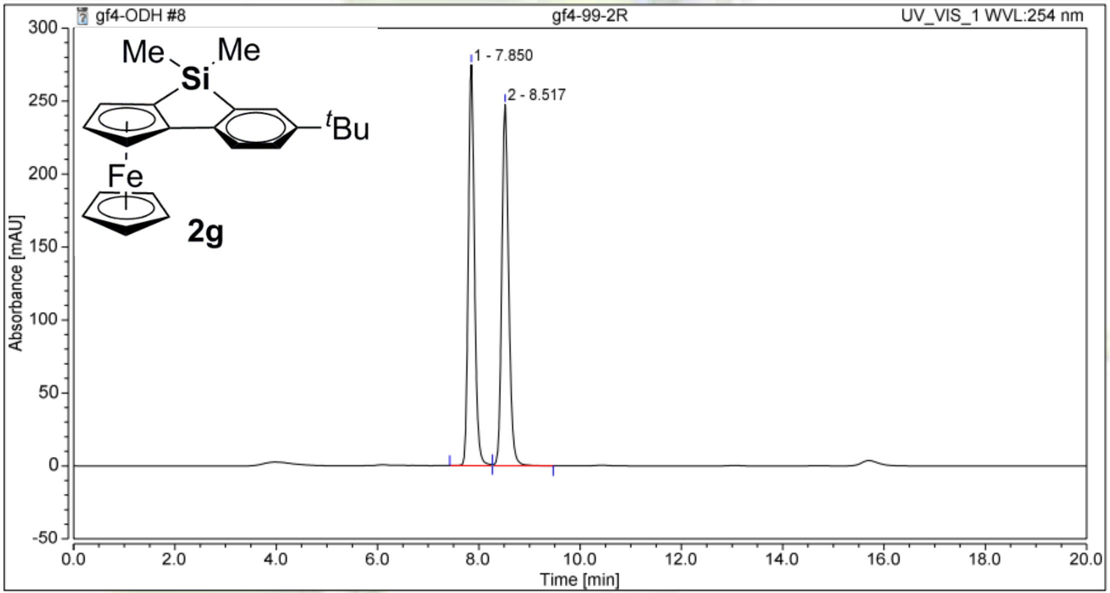


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	11.660	2.425	9.317	1.04	1.97
2	12.300	231.627	464.629	98.96	98.03
Totals:		**234.052**	**473.945**	**100.00**	**100.00**

Compound 2g

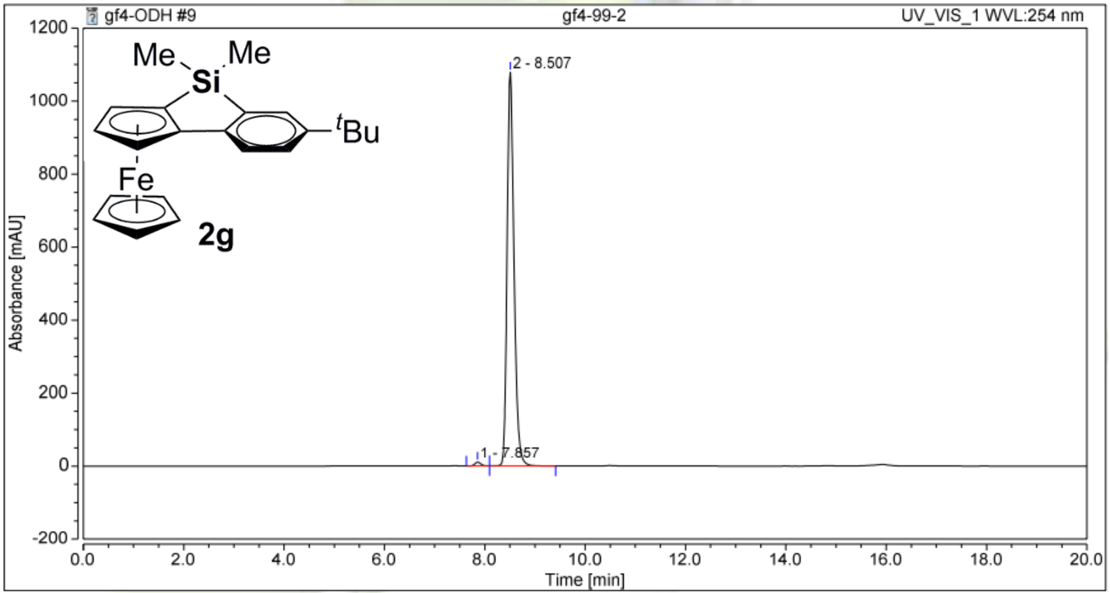
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	7.850	38.290	274.719	49.47	52.59
2	8.517	39.110	247.651	50.53	47.41
Totals:		**77.400**	**522.370**	**100.00**	**100.00**

Chromatogram

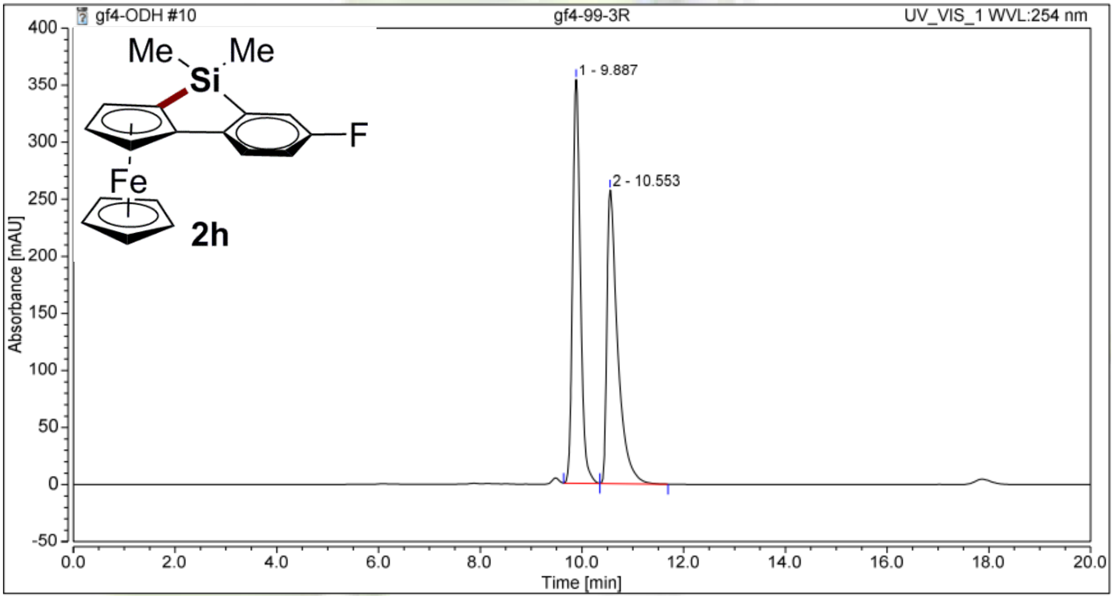


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	7.857	1.584	10.860	0.92	1.00
2	8.507	170.952	1078.877	99.08	99.00
Totals:		**172.536**	**1089.737**	**100.00**	**100.00**

Compound 2h

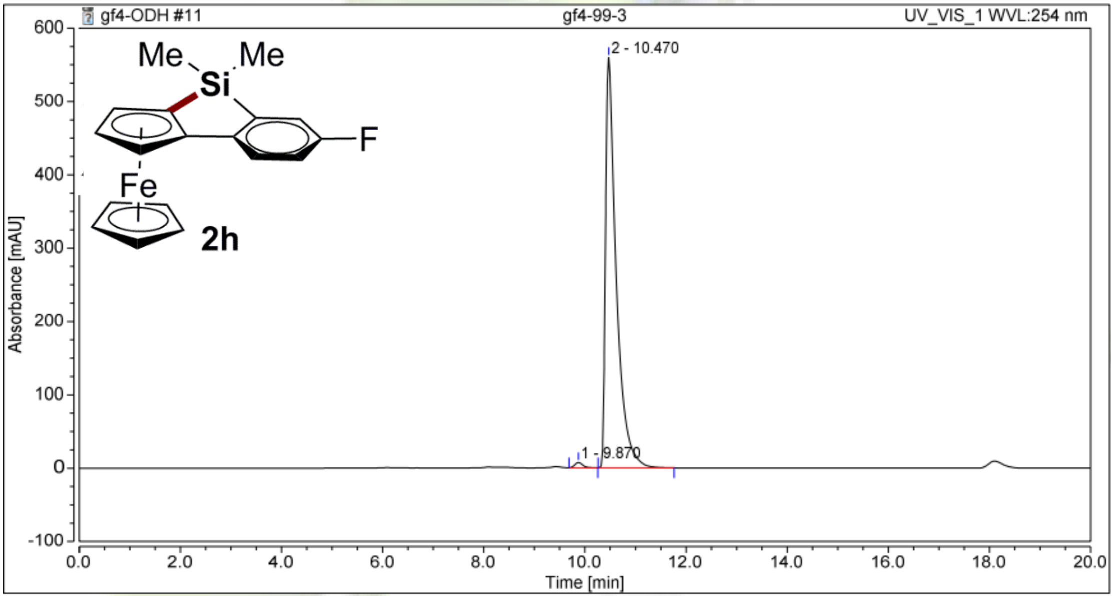
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	9.887	62.287	353.820	49.55	57.89
2	10.553	63.422	257.361	50.45	42.11
Totals:		**125.709**	**611.182**	**100.00**	**100.00**

Chromatogram

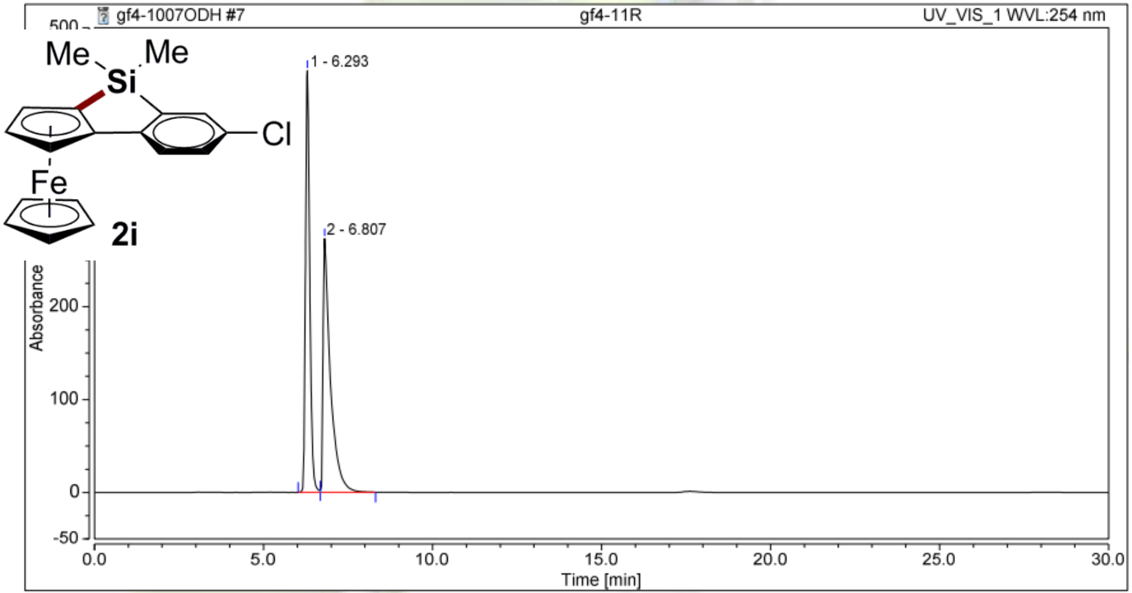


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	9.870	1.309	7.126	0.94	1.26
2	10.470	137.692	559.538	99.06	98.74
Totals:		**139.001**	**566.664**	**100.00**	**100.00**

Compound 2i

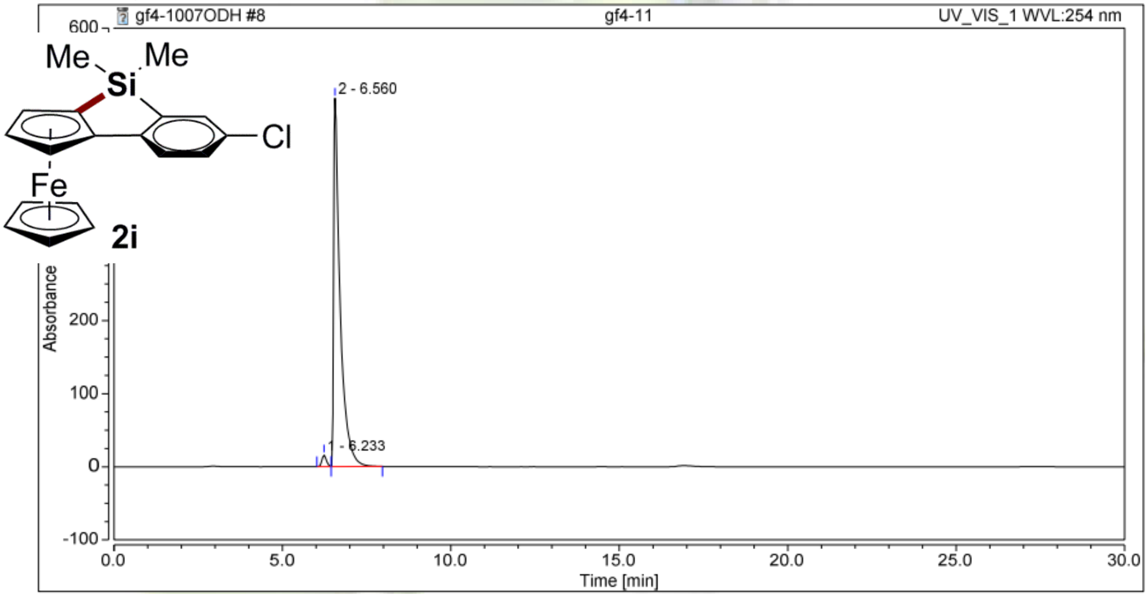
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	6.293	66.252	453.828	49.09	62.45
2	6.807	68.707	272.919	50.91	37.55
Totals:		**134.959**	**726.747**	**100.00**	**100.00**

Chromatogram

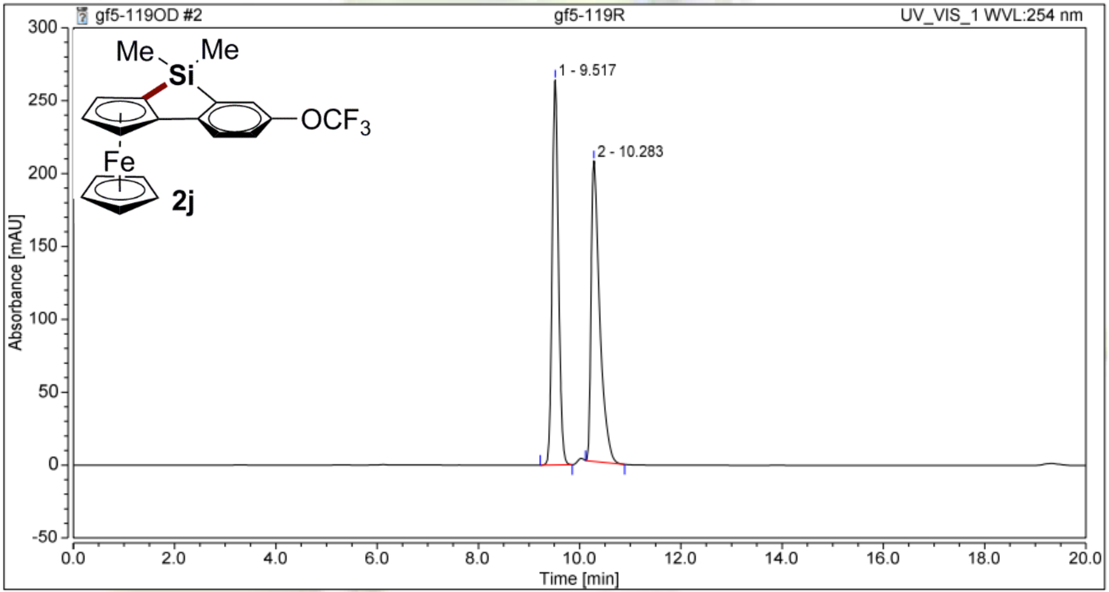


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	6.233	2.433	15.889	2.13	3.06
2	6.560	111.621	503.825	97.87	96.94
Totals:		**114.055**	**519.715**	**100.00**	**100.00**

Compound 2j

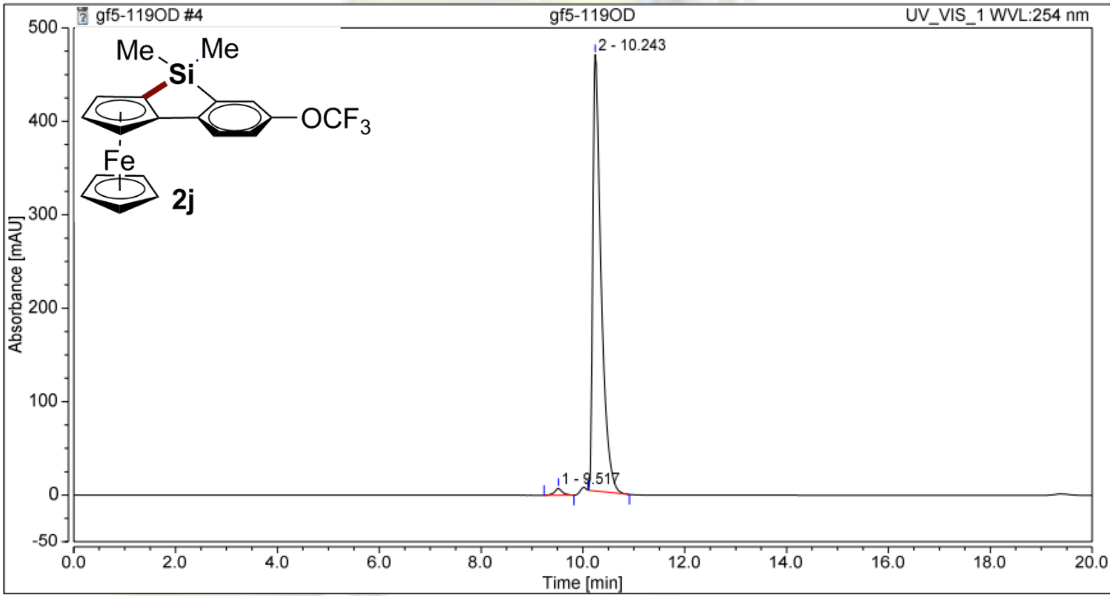
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	9.517	38.016	264.060	48.52	56.15
2	10.283	40.332	206.206	51.48	43.85
Totals:		**78.348**	**470.265**	**100.00**	**100.00**

Chromatogram

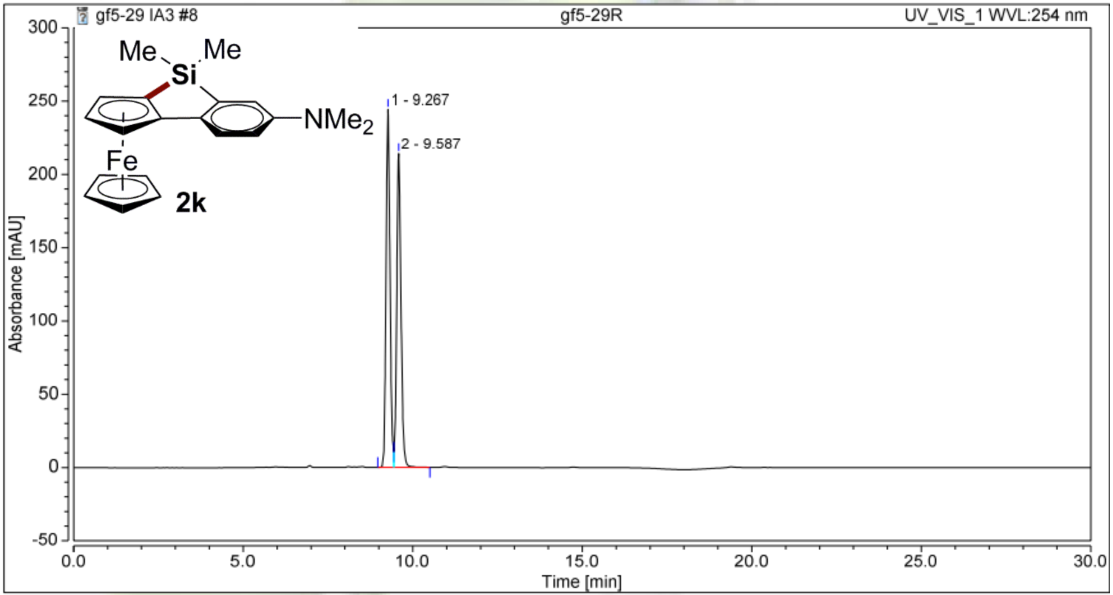


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	9.517	1.253	7.179	1.40	1.51
2	10.243	88.041	466.918	98.60	98.49
Totals:		**89.293**	**474.096**	**100.00**	**100.00**

Compound 2k

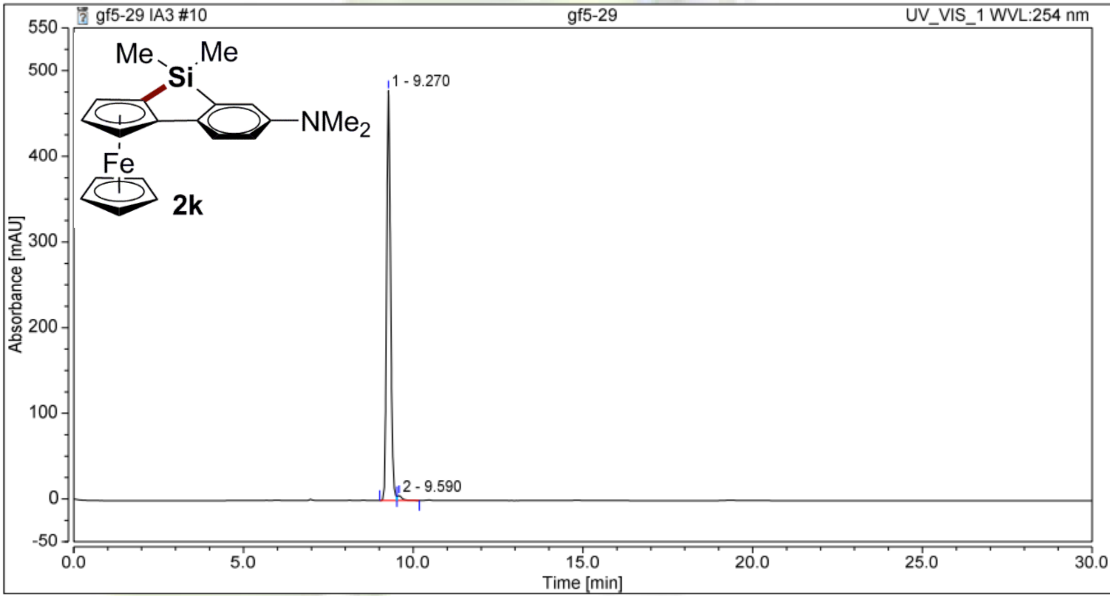
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	9.267	32.463	244.337	50.90	53.29
2	9.587	31.309	214.173	49.10	46.71
Totals:		**63.772**	**458.510**	**100.00**	**100.00**

Chromatogram

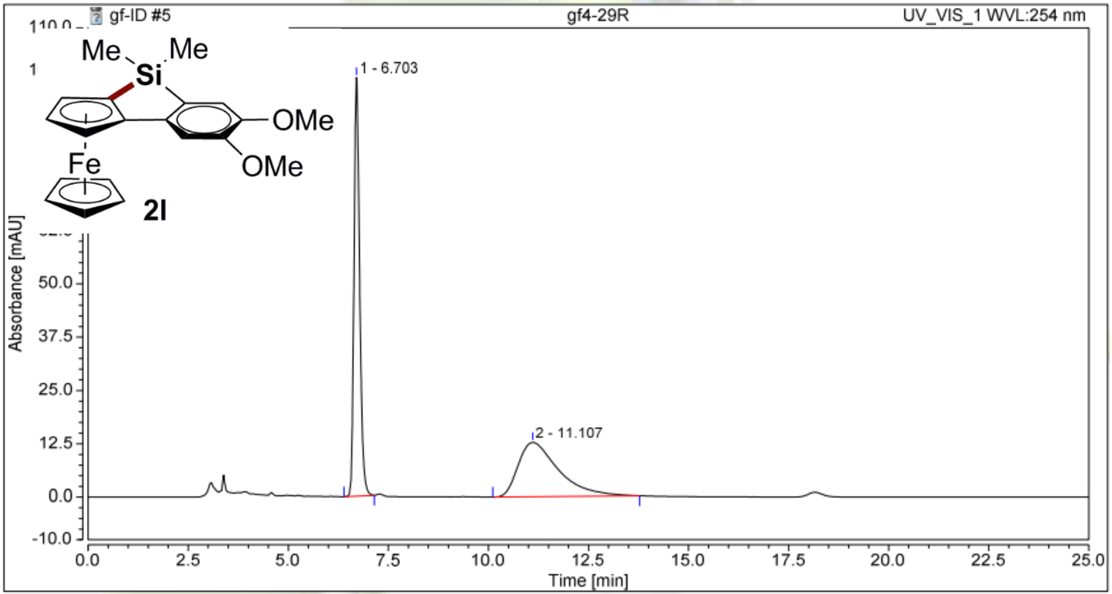


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	9.270	64.108	478.248	98.60	98.83
2	9.590	0.913	5.684	1.40	1.17
Totals:		**65.021**	**483.932**	**100.00**	**100.00**

Compound 2l

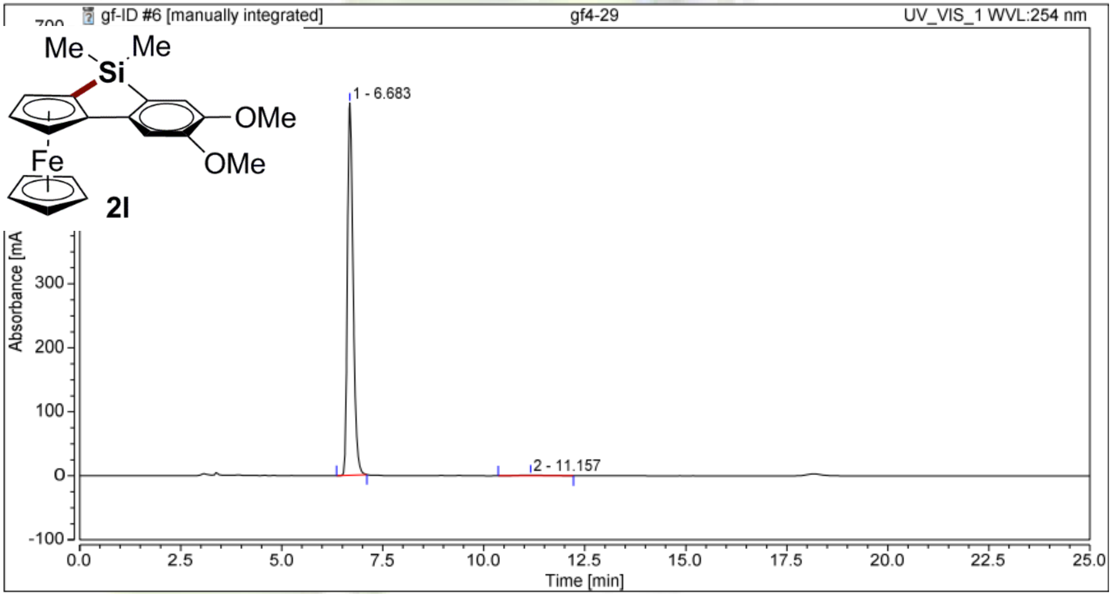
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	6.703	15.983	98.136	51.81	88.54
2	11.107	14.867	12.707	48.19	11.46
Totals:		**30.850**	**110.843**	**100.00**	**100.00**

Chromatogram

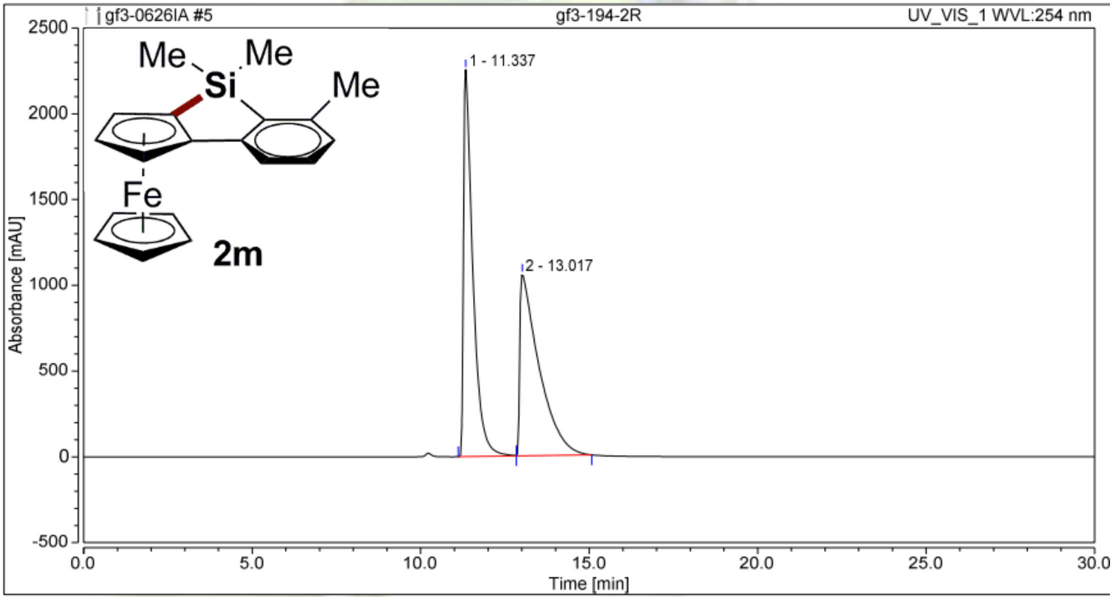


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	6.683	94.114	581.349	99.06	99.84
2	11.157	0.897	0.912	0.94	0.16
Totals:		**95.011**	**582.261**	**100.00**	**100.00**

Compound 2m

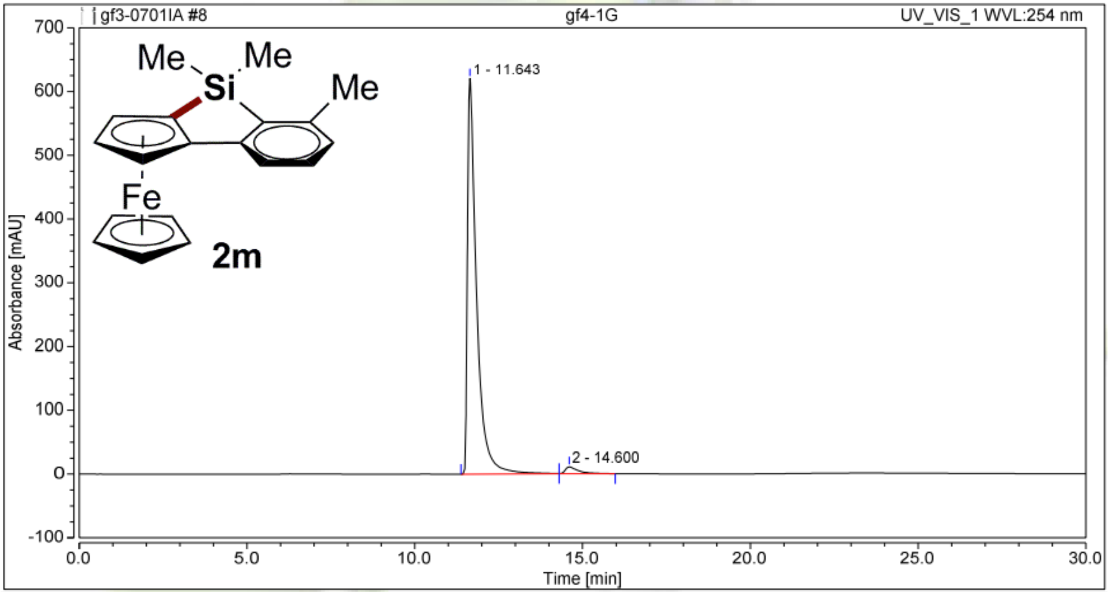
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	11.337	725.427	2256.142	50.93	68.07
2	13.017	698.865	1058.354	49.07	31.93
Totals:		**1424.292**	**3314.497**	**100.00**	**100.00**

Chromatogram

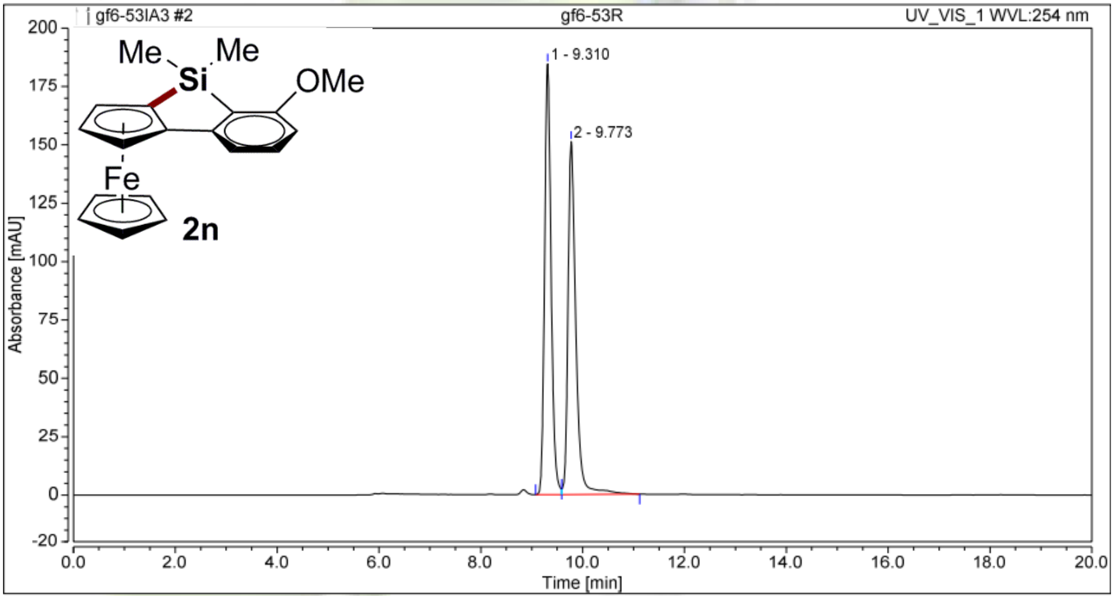


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	11.643	196.111	620.169	97.55	98.30
2	14.600	4.925	10.757	2.45	1.70
Totals:		**201.035**	**630.926**	**100.00**	**100.00**

Compound 2n

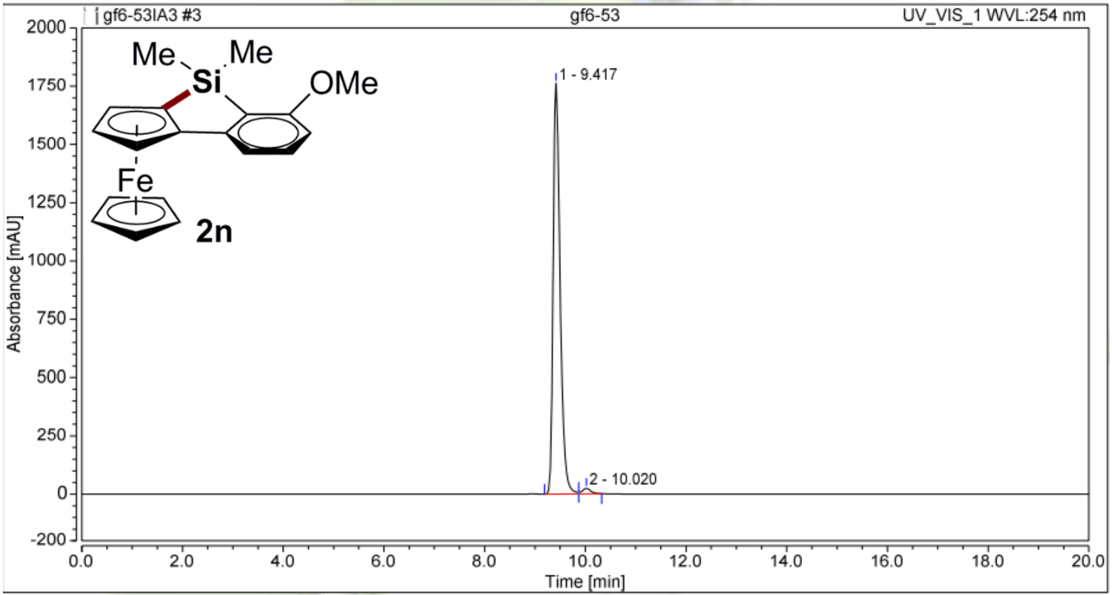
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	9.310	27.481	184.483	50.34	54.95
2	9.773	27.107	151.231	49.66	45.05
Totals:		**54.588**	**335.714**	**100.00**	**100.00**

Chromatogram

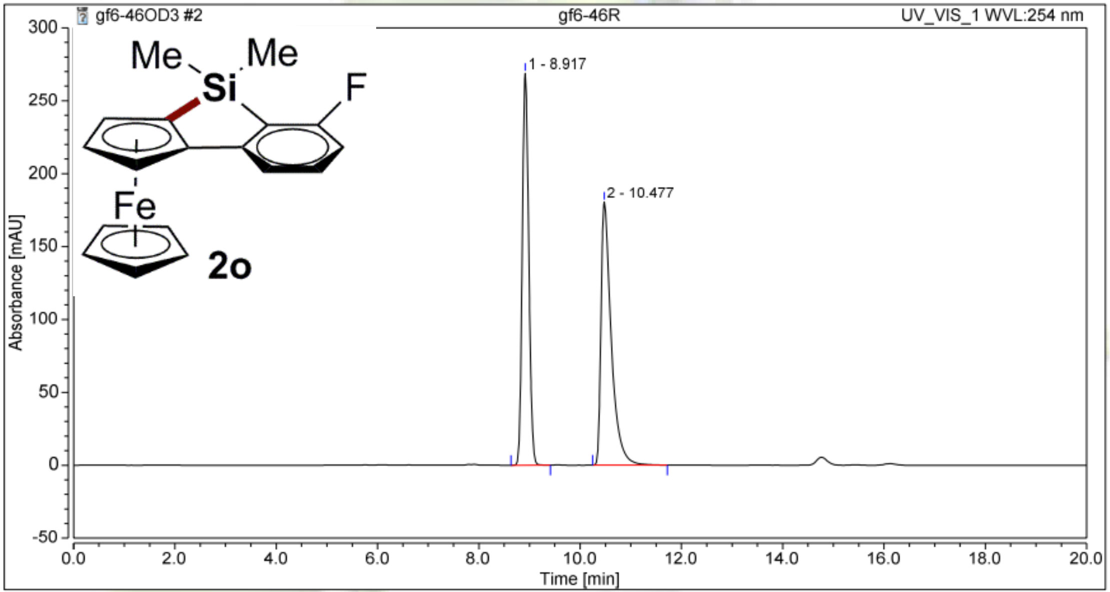


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	9.417	282.290	1761.602	98.45	98.68
2	10.020	4.446	23.600	1.55	1.32
Totals:		**286.736**	**1785.202**	**100.00**	**100.00**

Compound 2o

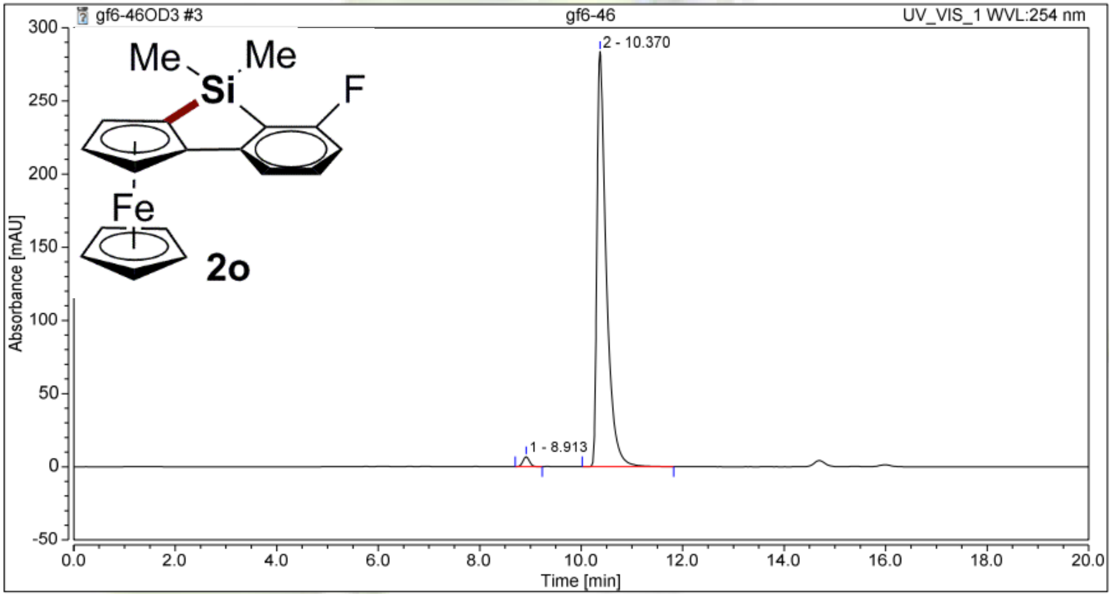
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	8.917	39.874	268.835	48.59	59.84
2	10.477	42.182	180.418	51.41	40.16
Totals:		**82.057**	**449.253**	**100.00**	**100.00**

Chromatogram

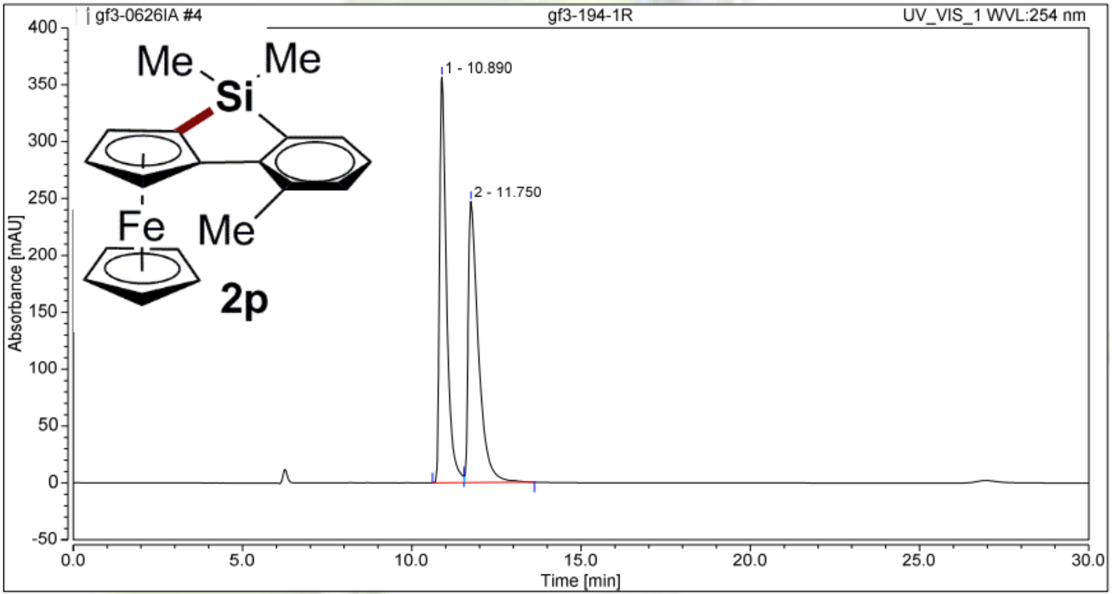


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	8.913	1.020	6.853	1.68	2.36
2	10.370	59.781	283.776	98.32	97.64
Totals:		**60.801**	**290.629**	**100.00**	**100.00**

Compound 2p

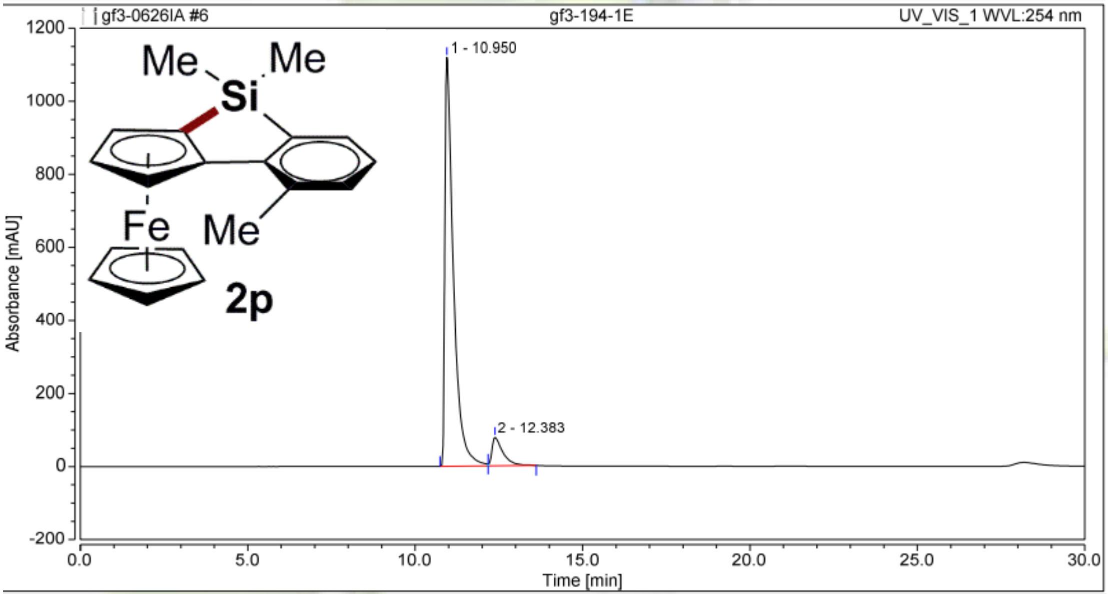
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	10.890	85.956	356.661	49.80	59.06
2	11.750	86.646	247.202	50.20	40.94
Totals:		**172.601**	**603.862**	**100.00**	**100.00**

Chromatogram

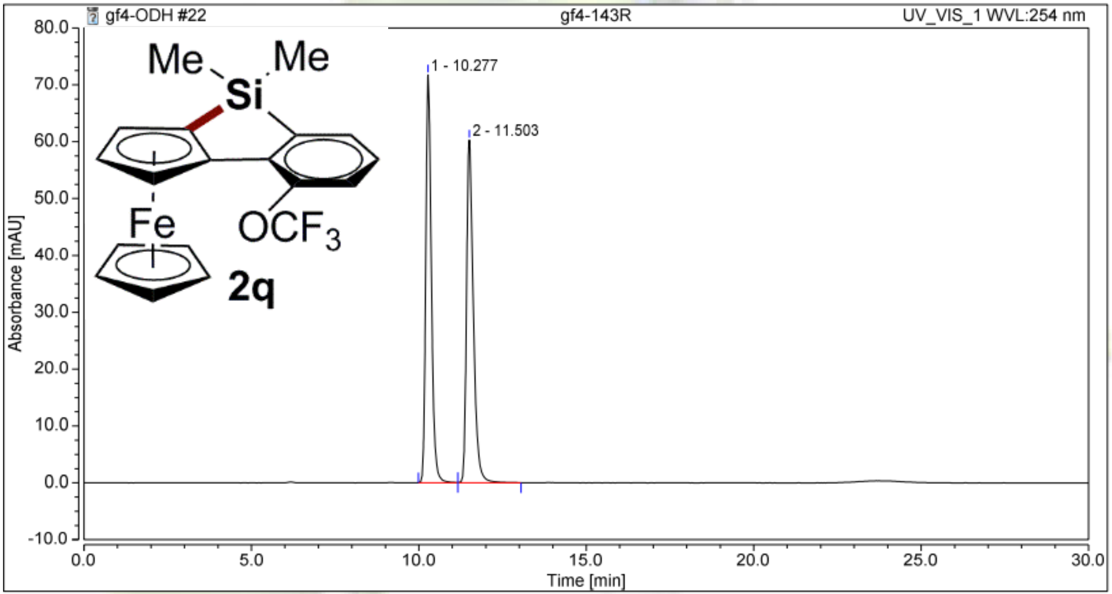


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	10.950	332.174	1119.197	91.81	93.48
2	12.383	29.625	78.071	8.19	6.52
Totals:		**361.799**	**1197.268**	**100.00**	**100.00**

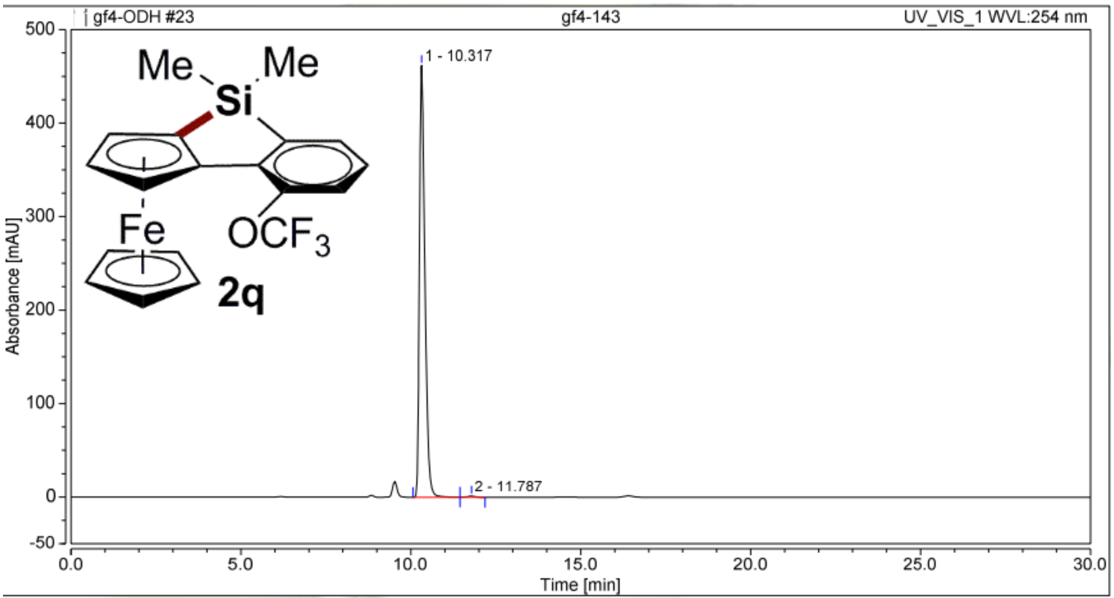
Compound 2q

Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	10.277	13.874	71.718	49.38	54.34
2	11.503	14.220	60.274	50.62	45.66
Totals:		**28.094**	**131.991**	**100.00**	**100.00**

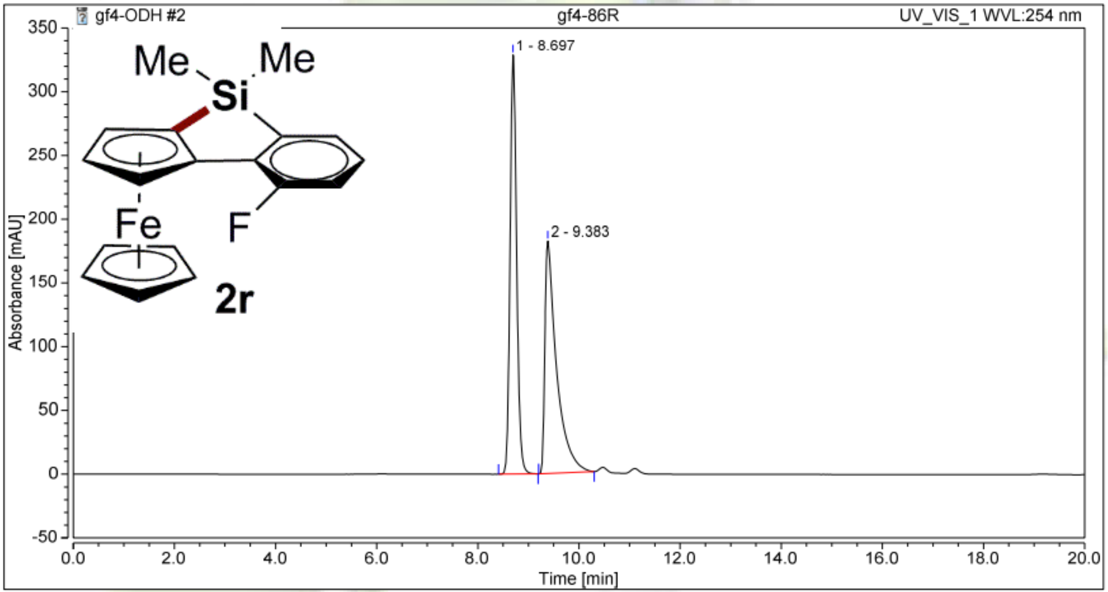


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	10.317	85.854	461.930	99.63	99.72
2	11.787	0.316	1.297	0.37	0.28
Totals:		**86.170**	**463.227**	**100.00**	**100.00**

Compound 2r

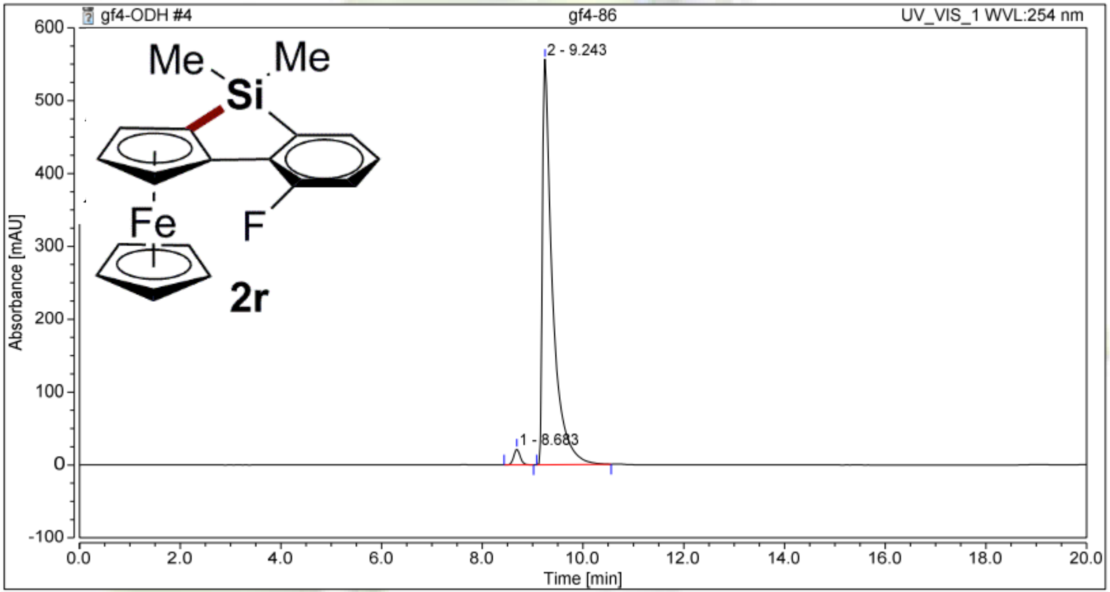
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	8.697	49.267	328.724	50.09	64.31
2	9.383	49.087	182.444	49.91	35.69
Totals:		**98.354**	**511.168**	**100.00**	**100.00**

Chromatogram

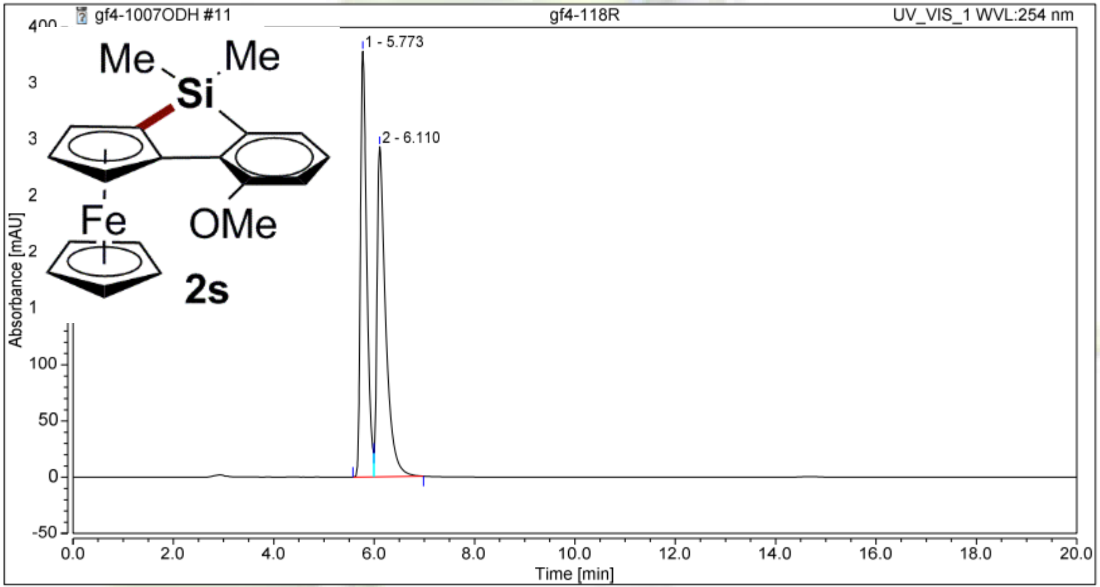


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	8.683	3.179	21.564	2.42	3.73
2	9.243	127.932	556.614	97.58	96.27
Totals:		**131.111**	**578.178**	**100.00**	**100.00**

Compound 2s

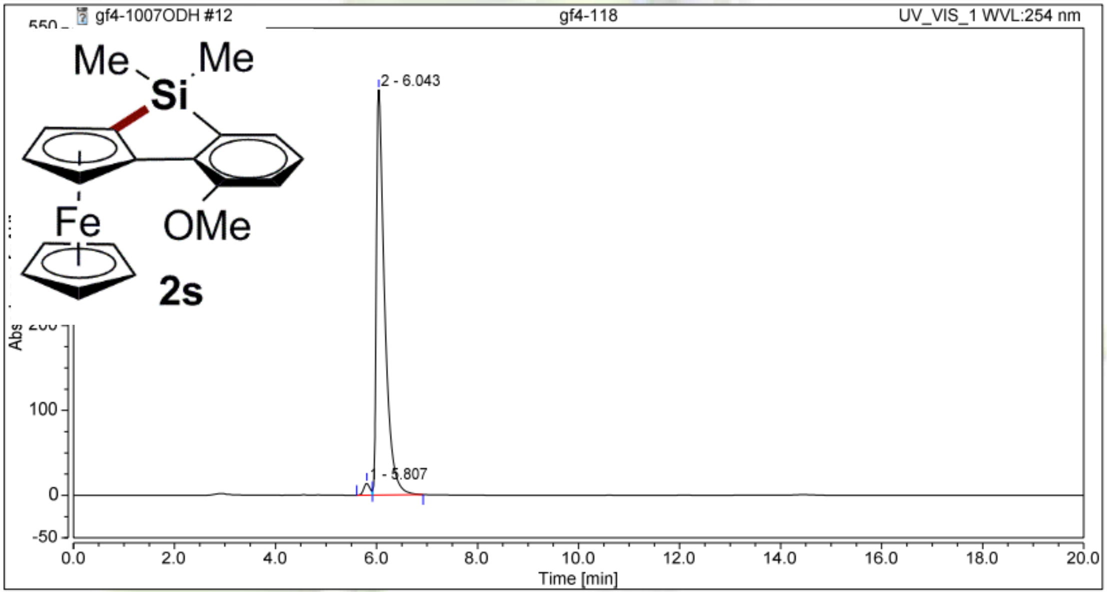
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	5.773	55.188	378.402	48.44	56.32
2	6.110	58.738	293.515	51.56	43.68
Totals:		**113.926**	**671.917**	**100.00**	**100.00**

Chromatogram

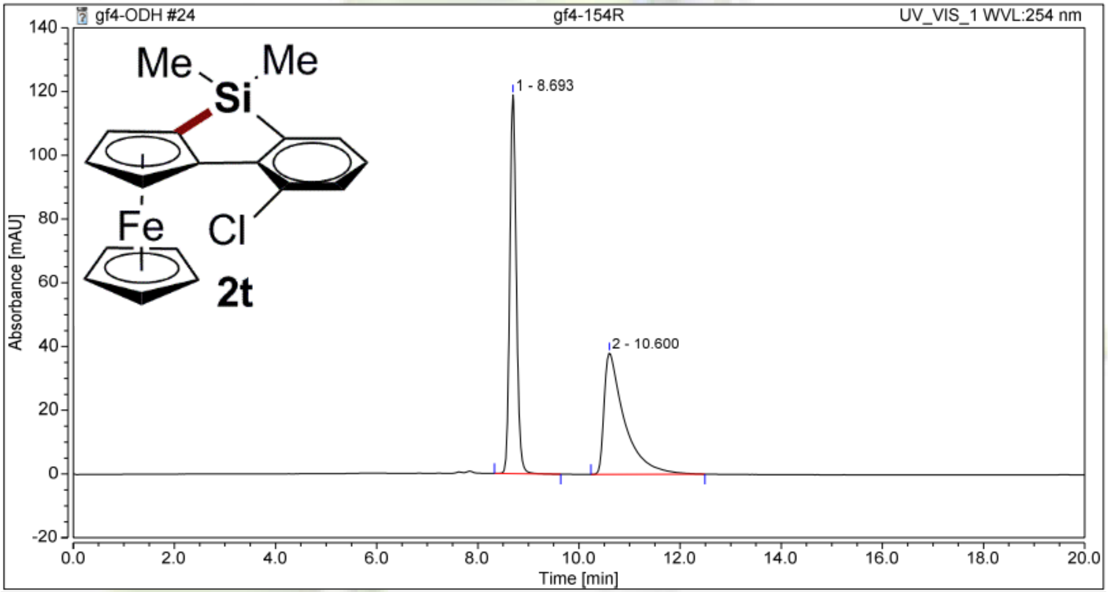


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	5.807	1.941	14.014	2.09	2.85
2	6.043	90.762	476.902	97.91	97.15
Totals:		**92.703**	**490.916**	**100.00**	**100.00**

Compound 2t

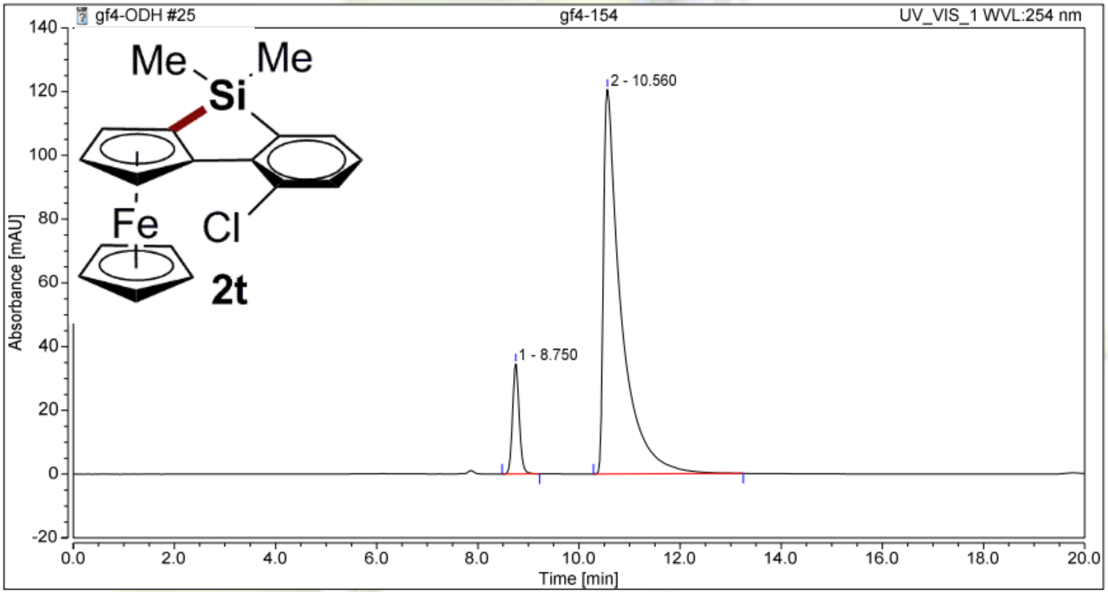
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	8.693	17.845	118.870	50.03	75.72
2	10.600	17.825	38.110	49.97	24.28
Totals:		**35.670**	**156.980**	**100.00**	**100.00**

Chromatogram

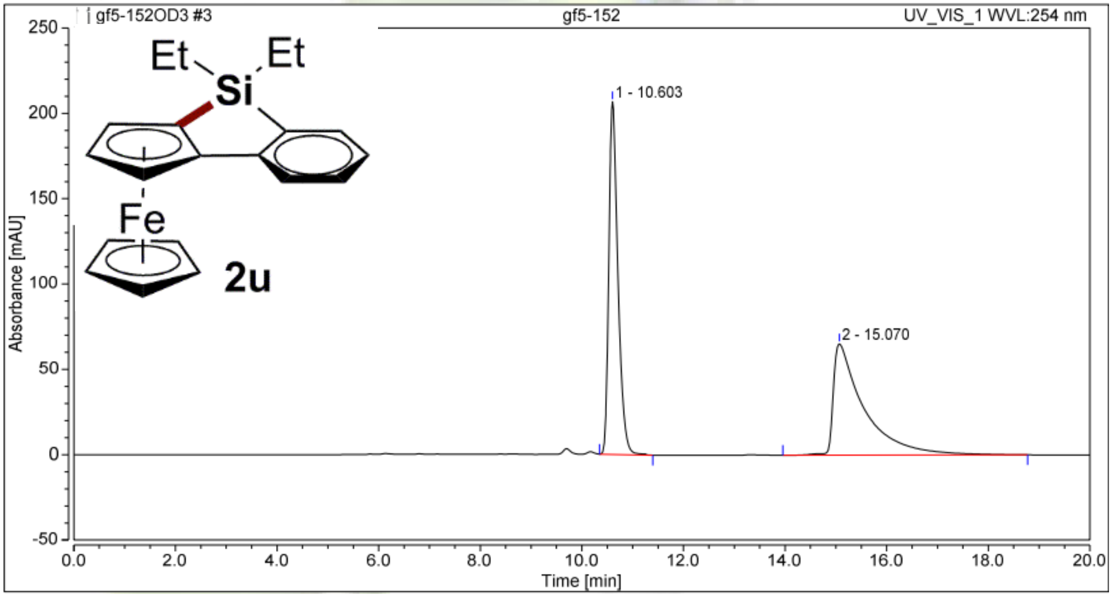


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	8.750	5.251	34.532	9.72	22.25
2	10.560	48.754	120.637	90.28	77.75
Totals:		**54.005**	**155.169**	**100.00**	**100.00**

Compound 2u

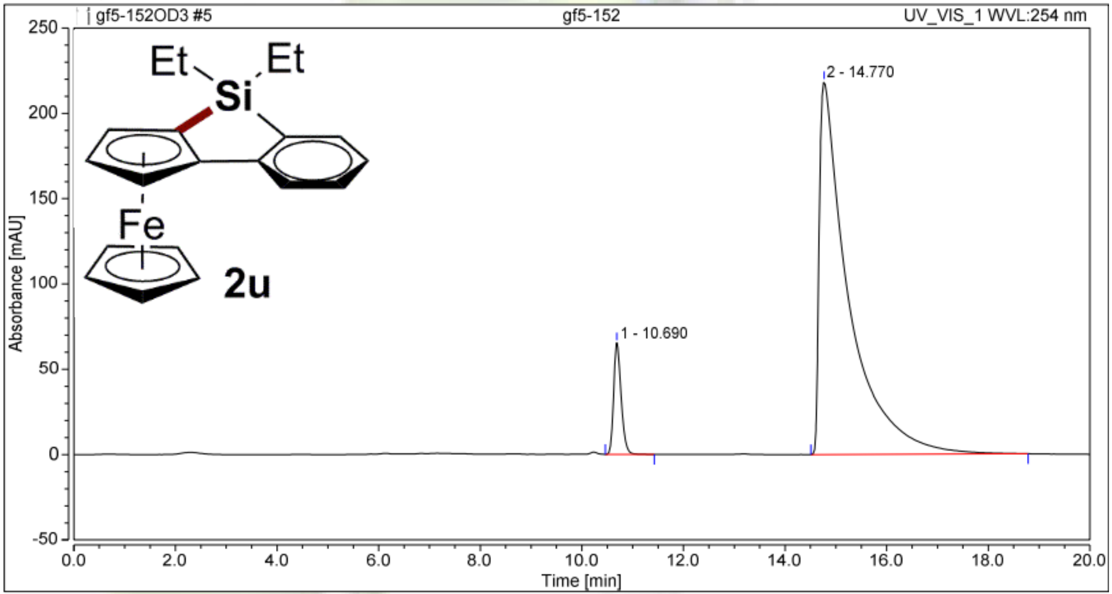
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	10.603	43.402	206.657	48.83	76.00
2	15.070	45.477	65.259	51.17	24.00
Totals:		**88.879**	**271.916**	**100.00**	**100.00**

Chromatogram

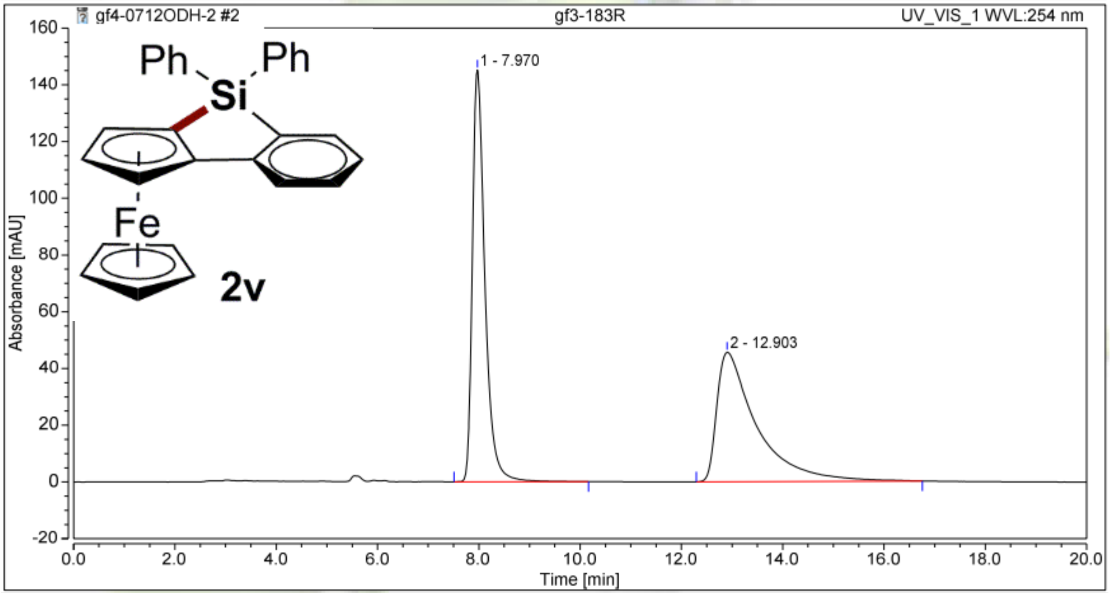


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	10.690	11.324	65.423	7.24	23.04
2	14.770	145.076	218.513	92.76	76.96
Totals:		**156.401**	**283.936**	**100.00**	**100.00**

Compound 2v

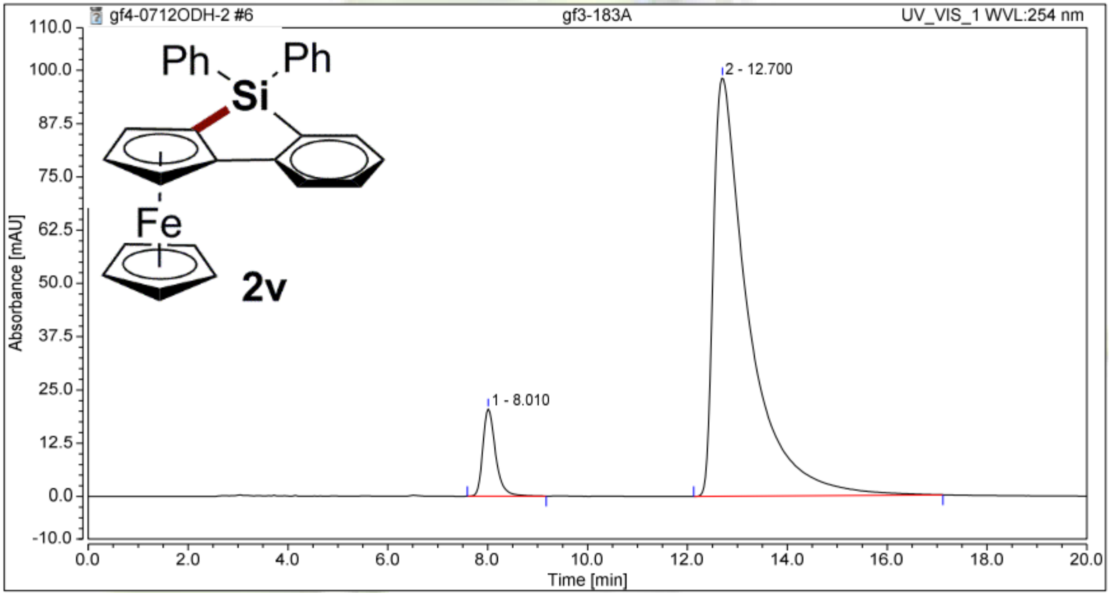
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	7.970	41.864	145.113	50.22	76.06
2	12.903	41.497	45.674	49.78	23.94
Totals:		**83.361**	**190.787**	**100.00**	**100.00**

Chromatogram

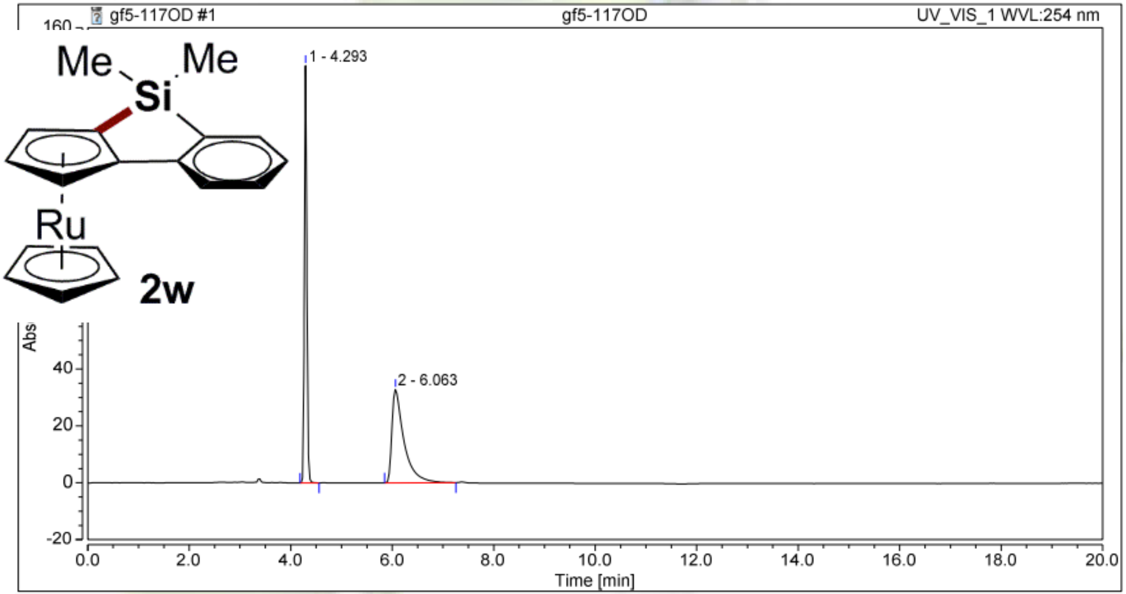


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	8.010	6.085	20.502	7.10	17.27
2	12.700	79.594	98.210	92.90	82.73
Totals:		**85.679**	**118.712**	**100.00**	**100.00**

Compound 2w

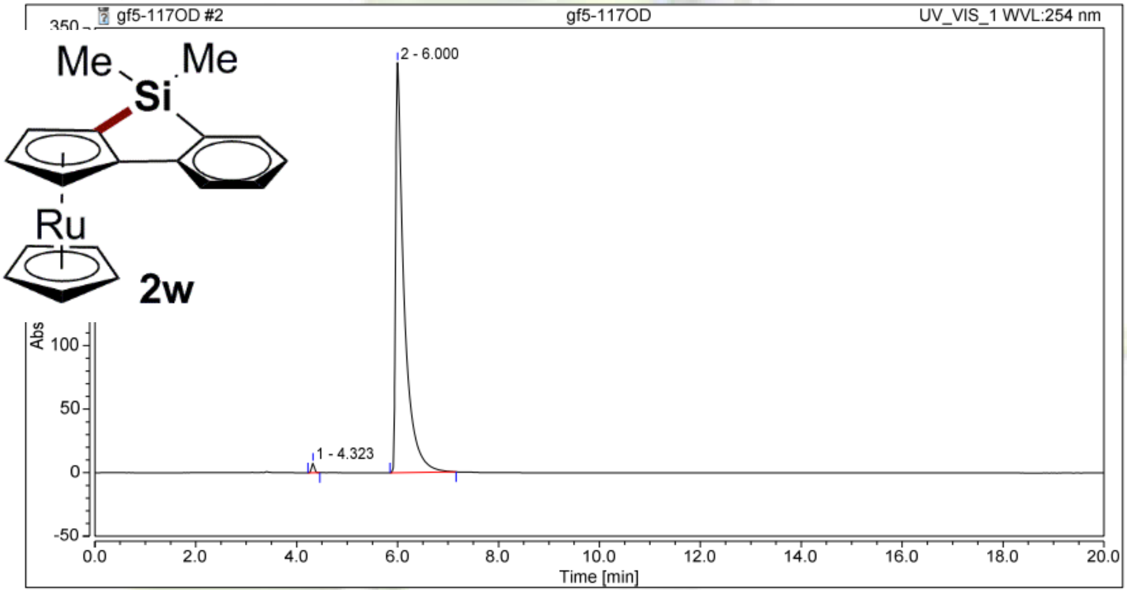
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	4.293	8.357	146.842	47.98	81.70
2	6.063	9.061	32.900	52.02	18.30
Totals:		**17.418**	**179.742**	**100.00**	**100.00**

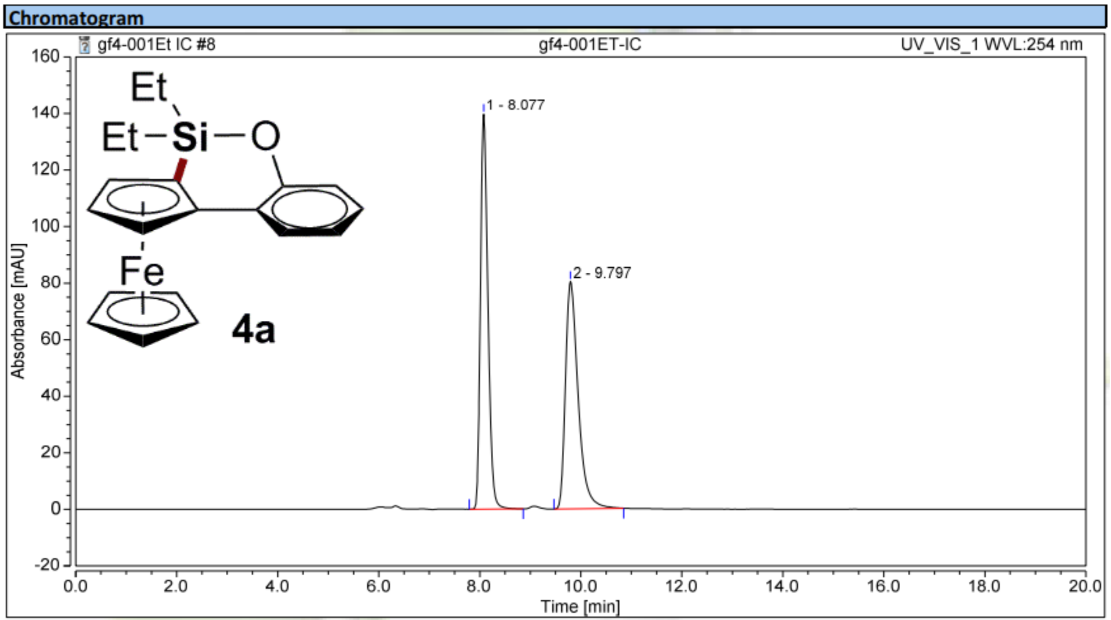
Chromatogram



Result

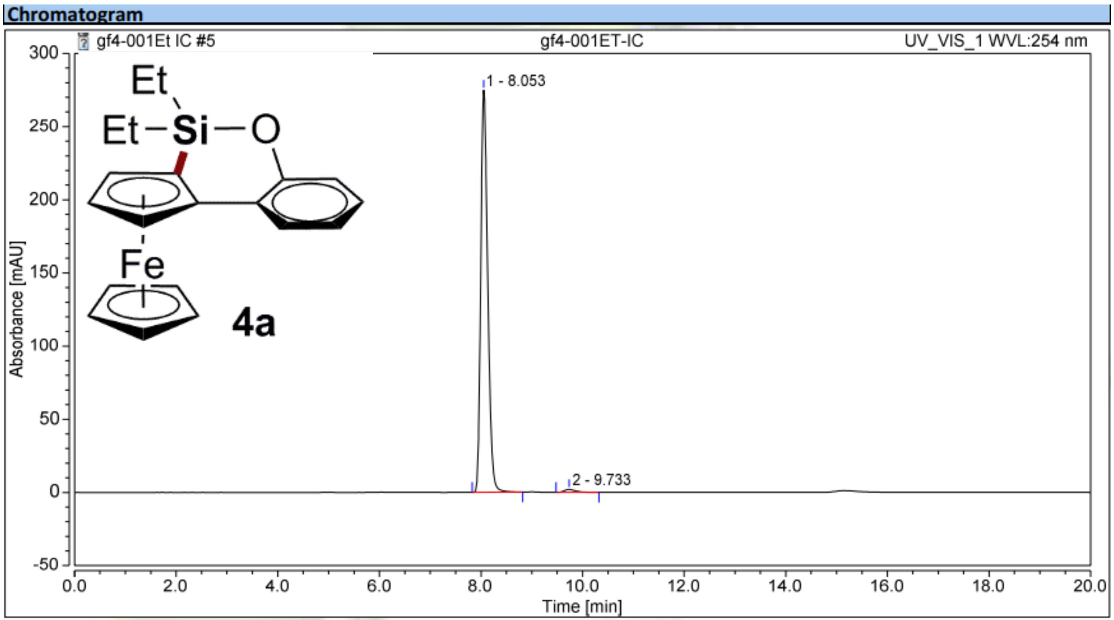
Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	4.323	0.486	7.430	0.76	2.25
2	6.000	63.448	322.750	99.24	97.75
Totals:		**63.934**	**330.180**	**100.00**	**100.00**

Compound 4a



Result

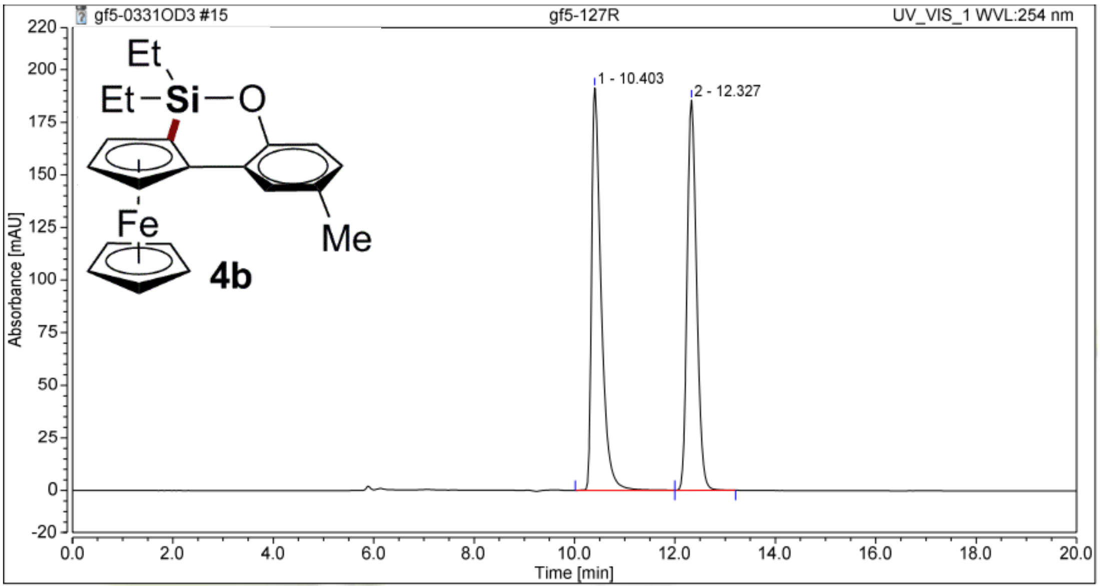
Peak \#	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	8.077	24.282	139.624	51.06	63.46
2	9.797	23.275	80.385	48.94	36.54
Totals:		**47.556**	**220.008**	**100.00**	**100.00**



Result

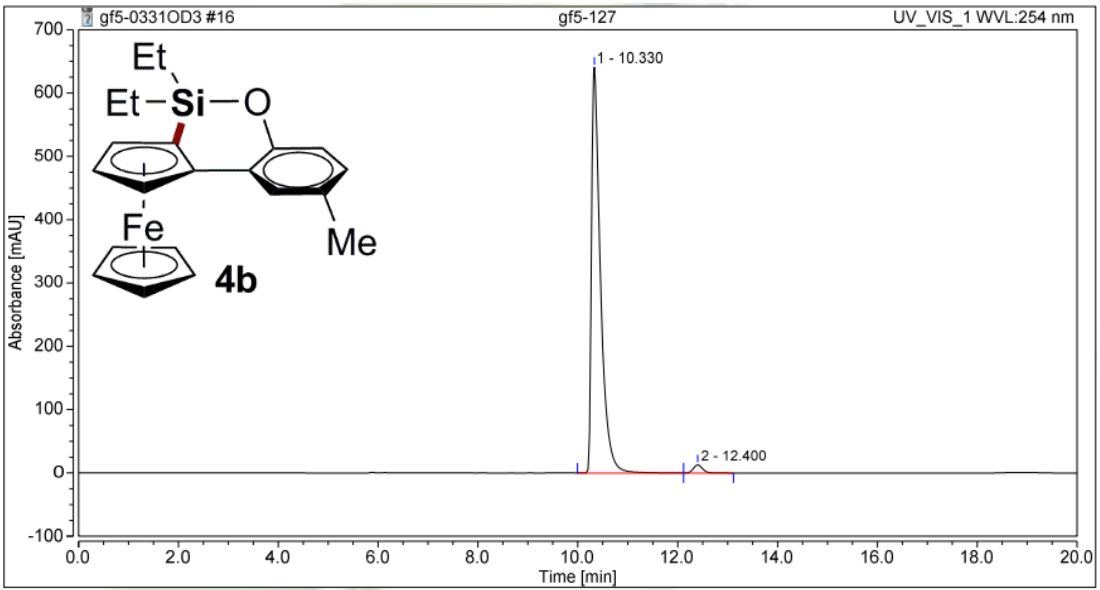
Peak \#	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	8.053	44.258	274.833	98.90	99.29
2	9.733	0.493	1.971	1.10	0.71
Totals:		**44.751**	**276.805**	**100.00**	**100.00**

Compound 4b



Result

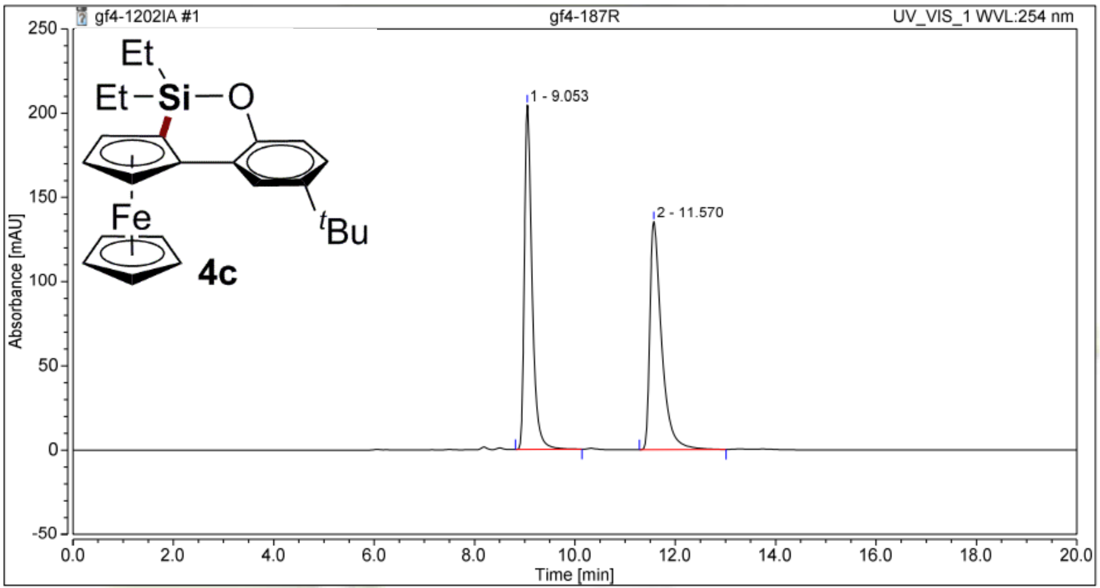
Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	10.403	41.802	191.318	50.67	50.77
2	12.327	40.697	185.531	49.33	49.23
Totals:		**82.499**	**376.850**	**100.00**	**100.00**



Result

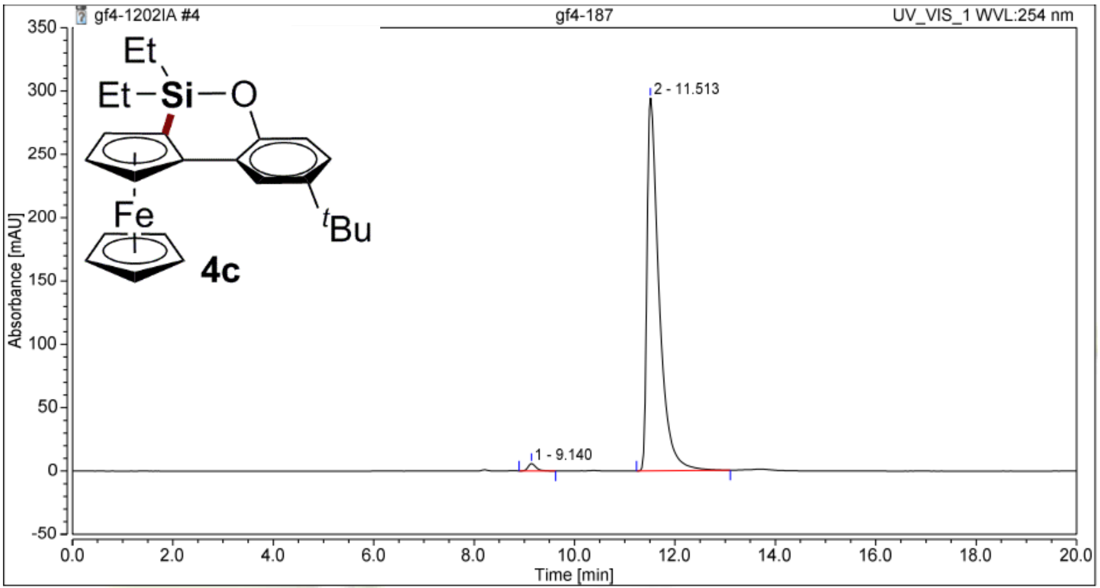
Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	10.330	132.968	640.831	97.99	98.04
2	12.400	2.722	12.798	2.01	1.96
Totals:		**135.690**	**653.629**	**100.00**	**100.00**

Compound 4c



Result

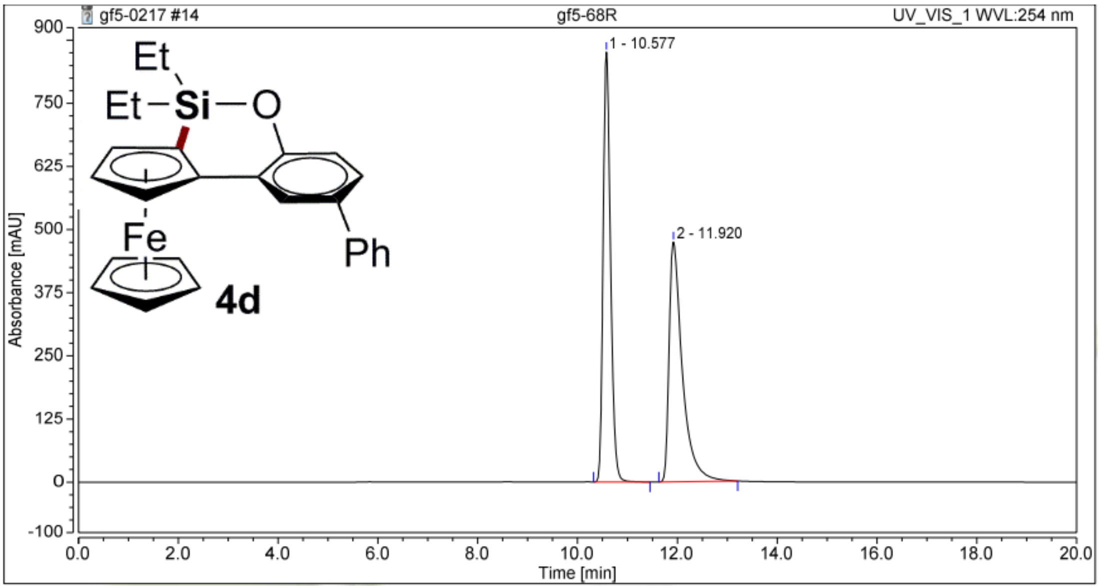
Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	9.053	35.756	204.501	49.48	60.17
2	11.570	36.509	135.353	50.52	39.83
Totals:		**72.266**	**339.854**	**100.00**	**100.00**



Result

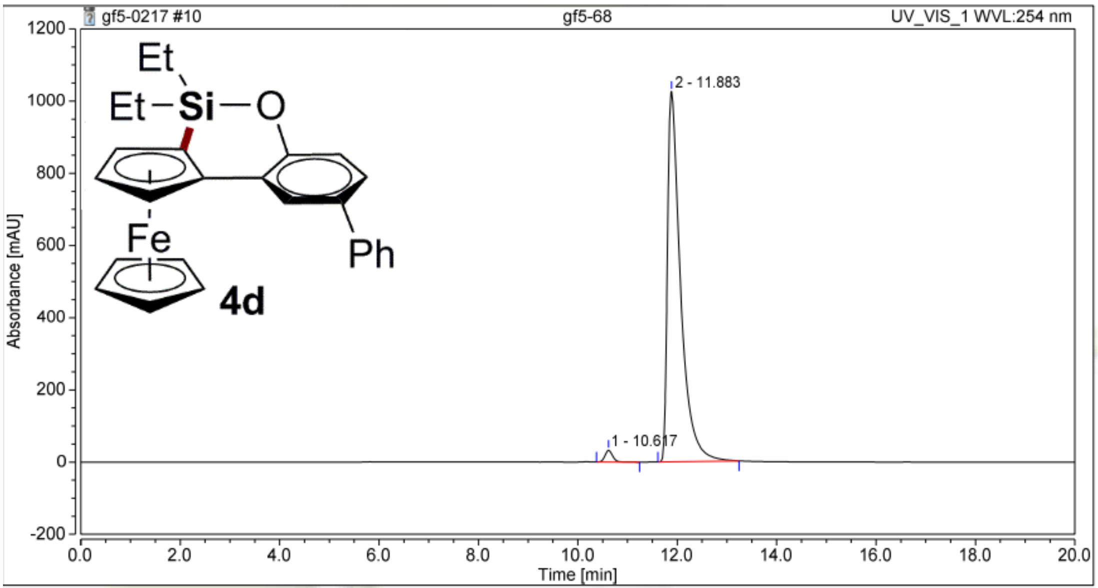
Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	9.140	1.043	5.844	1.26	1.95
2	11.513	81.816	294.328	98.74	98.05
Totals:		**82.858**	**300.172**	**100.00**	**100.00**

Compound 4d



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	10.577	145.660	851.121	49.94	64.17
2	11.920	145.995	475.281	50.06	35.83
Totals:		**291.655**	**1326.402**	**100.00**	**100.00**

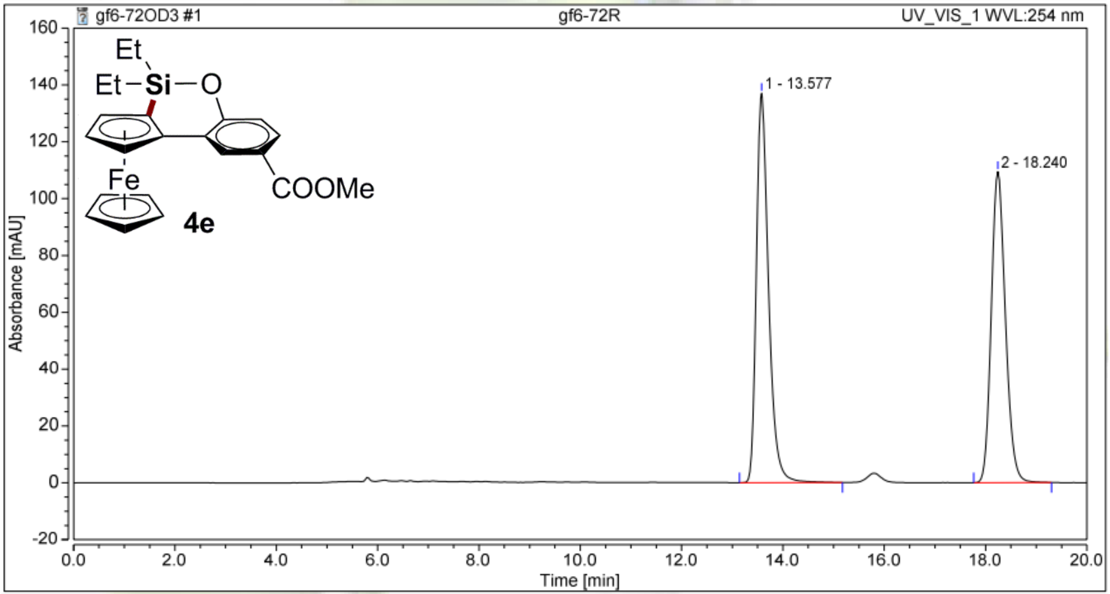


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	10.617	5.866	32.861	1.84	3.10
2	11.883	312.288	1026.186	98.16	96.90
Totals:		**318.154**	**1059.047**	**100.00**	**100.00**

Compound 4e

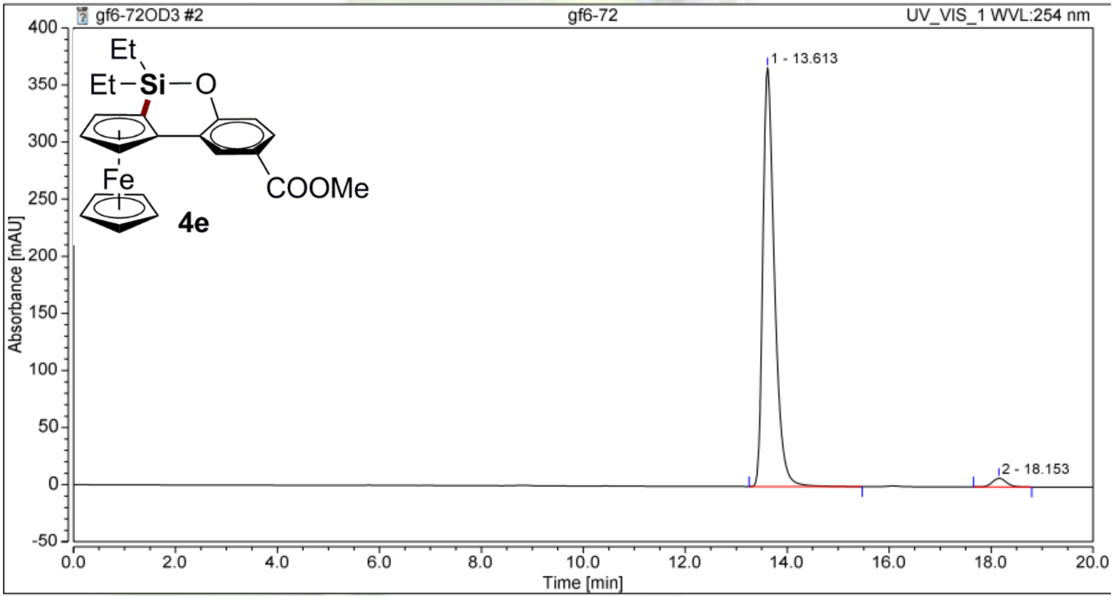
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	13.577	37.990	136.990	51.52	55.57
2	18.240	35.746	109.521	48.48	44.43
Totals:		**73.735**	**246.510**	**100.00**	**100.00**

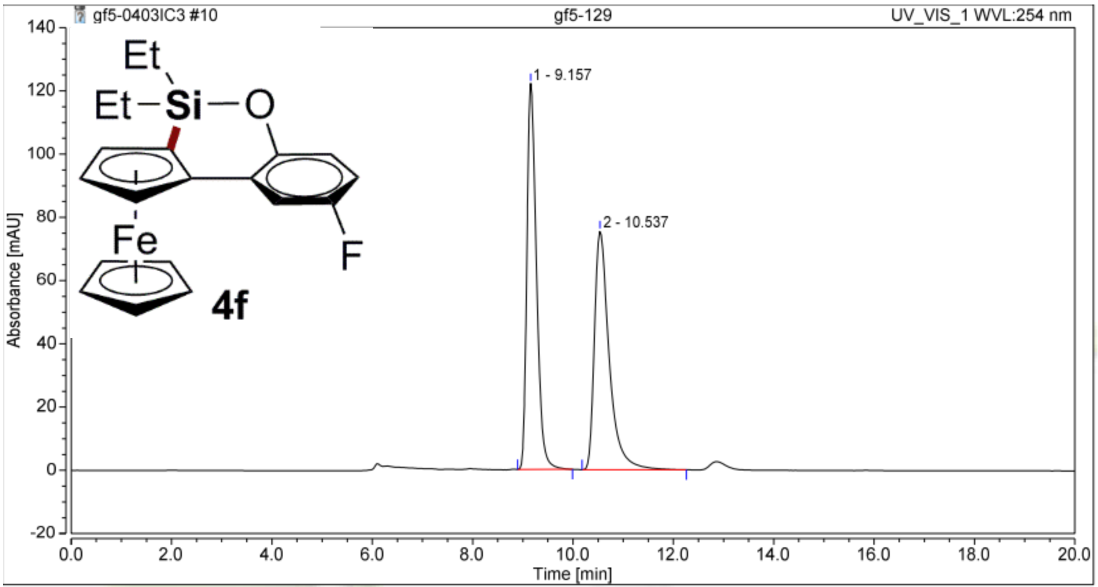
Chromatogram



Result

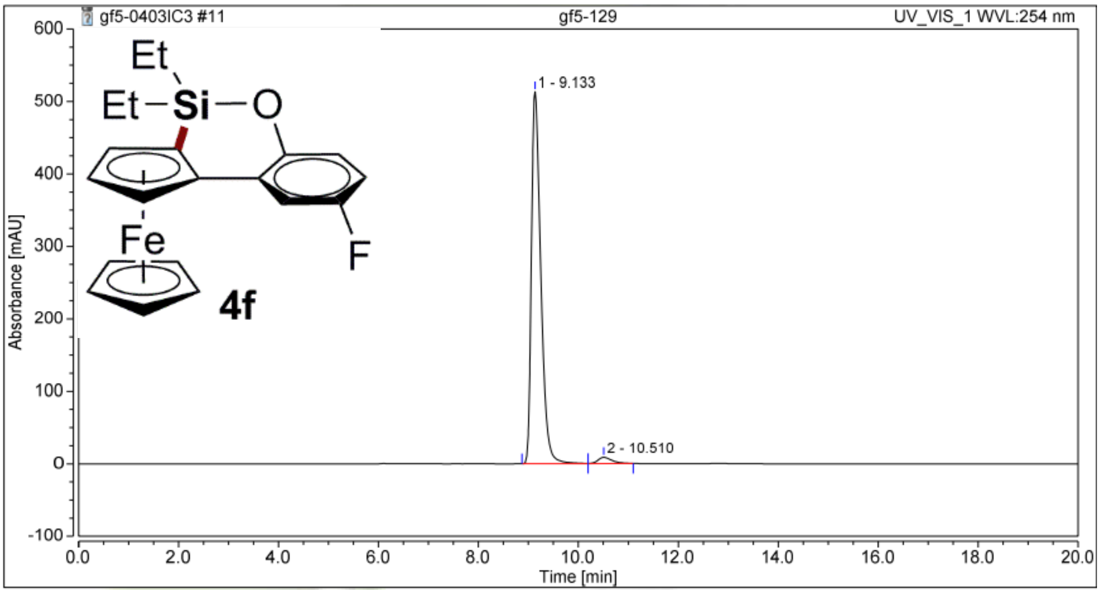
Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	13.613	96.751	366.601	97.52	97.98
2	18.153	2.463	7.546	2.48	2.02
Totals:		**99.214**	**374.148**	**100.00**	**100.00**

Compound 4f



Result

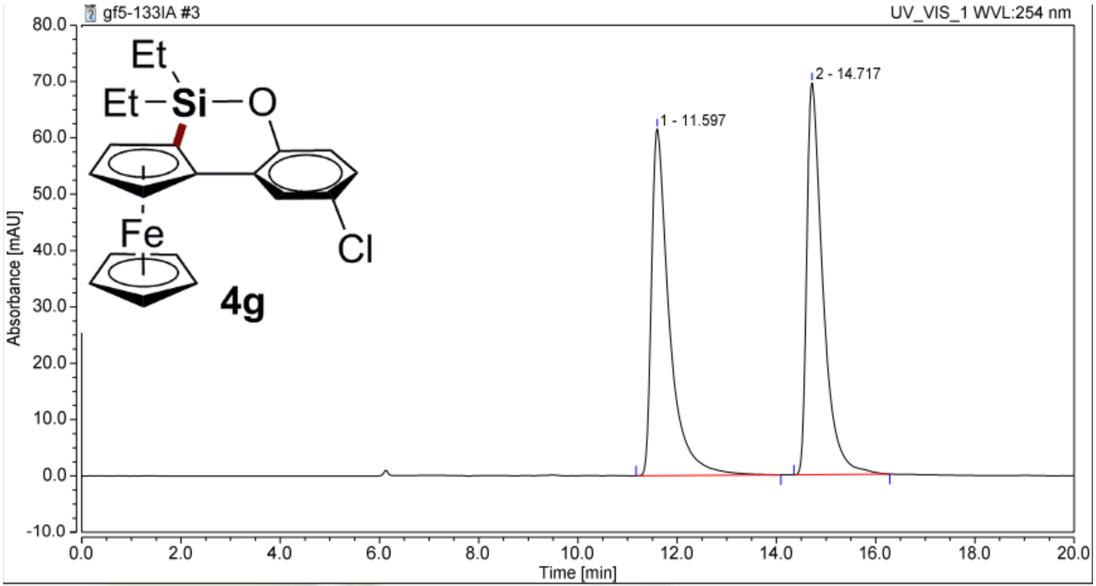
Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	9.157	26.718	122.051	50.77	61.79
2	10.537	25.909	75.481	49.23	38.21
Totals:		**52.627**	**197.532**	**100.00**	**100.00**



Result

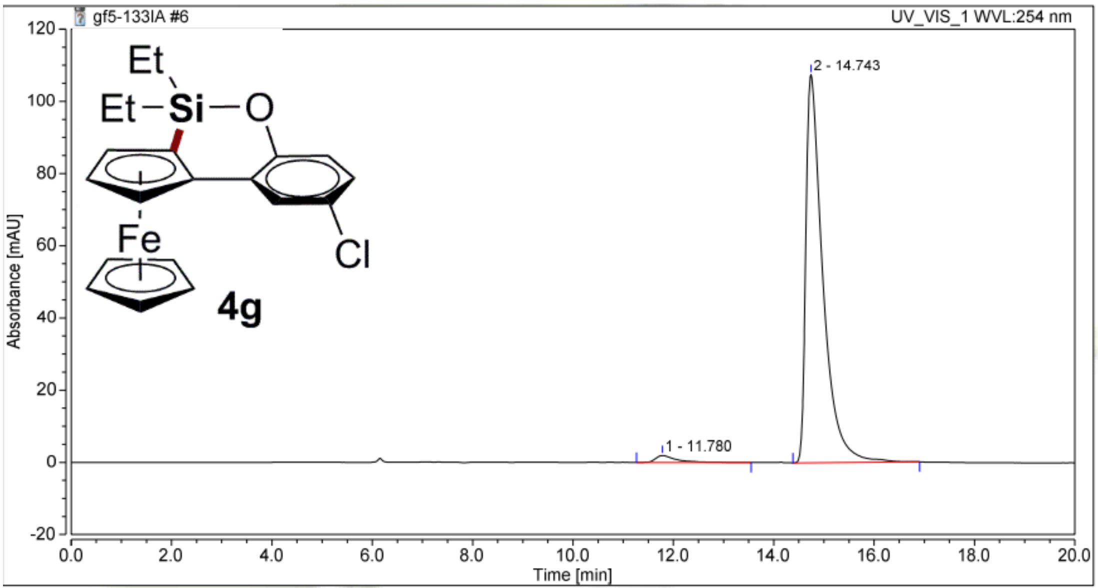
Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	9.133	110.906	513.400	97.56	98.36
2	10.510	2.779	8.567	2.44	1.64
Totals:		**113.684**	**521.967**	**100.00**	**100.00**

Compound 4g



Result

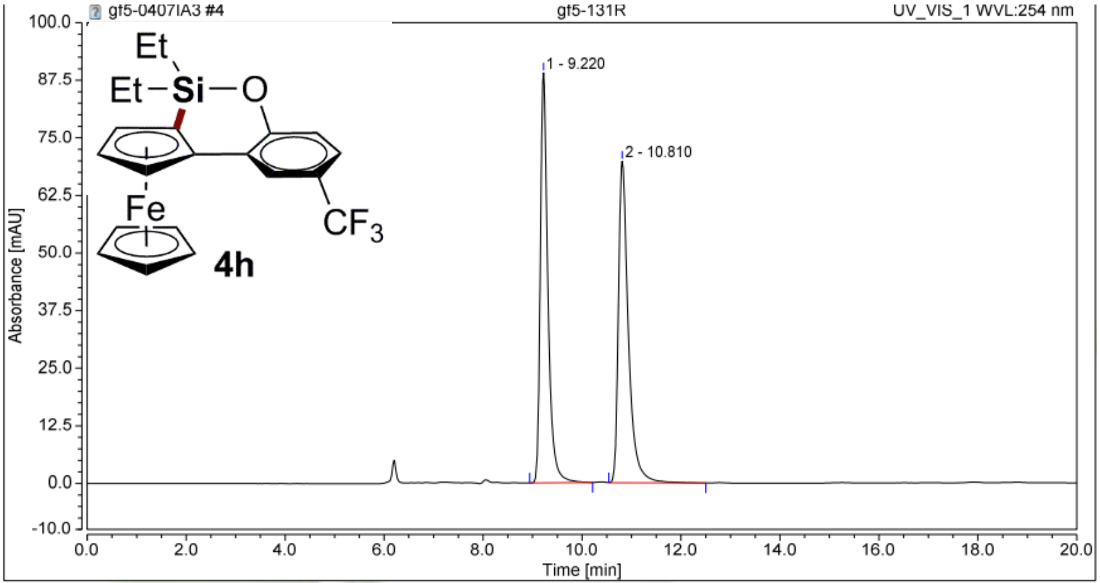
Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	11.597	25.692	61.535	49.40	46.94
2	14.717	26.317	69.570	50.60	53.06
Totals:		**52.009**	**131.104**	**100.00**	**100.00**



Result

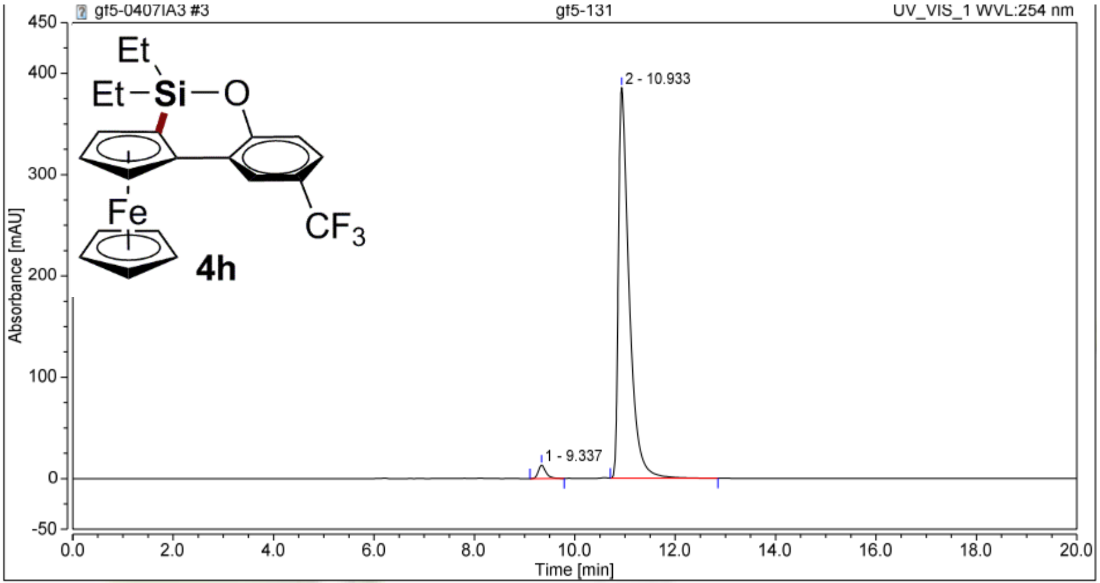
Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	11.780	0.924	1.914	2.15	1.75
2	14.743	42.153	107.454	97.85	98.25
Totals:		**43.077**	**109.368**	**100.00**	**100.00**

Compound 4h



Result

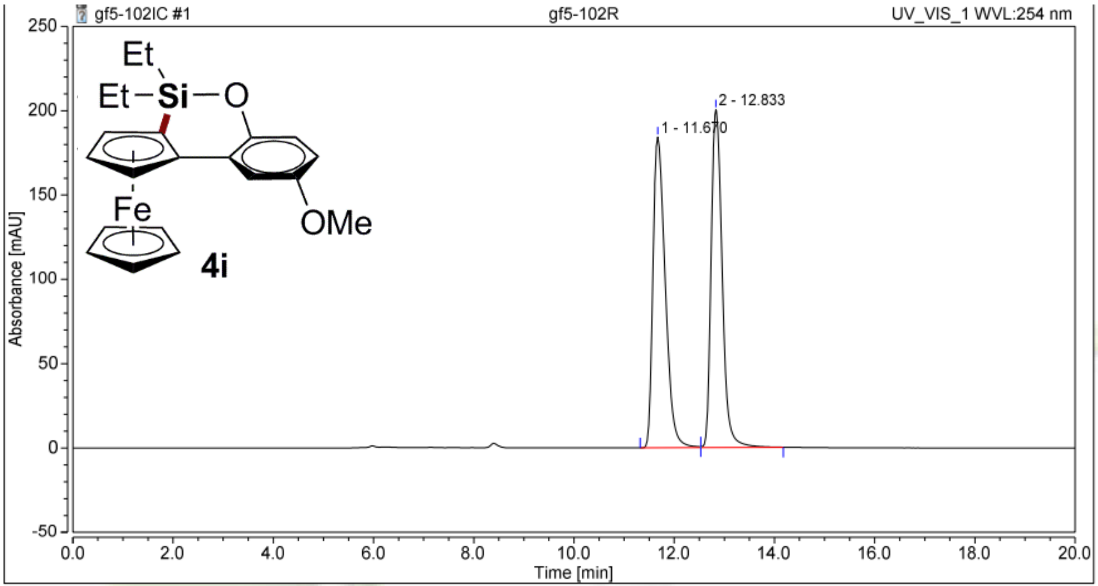
Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	9.220	15.906	89.002	49.47	56.06
2	10.810	16.244	69.761	50.53	43.94
Totals:		**32.150**	**158.763**	**100.00**	**100.00**



Result

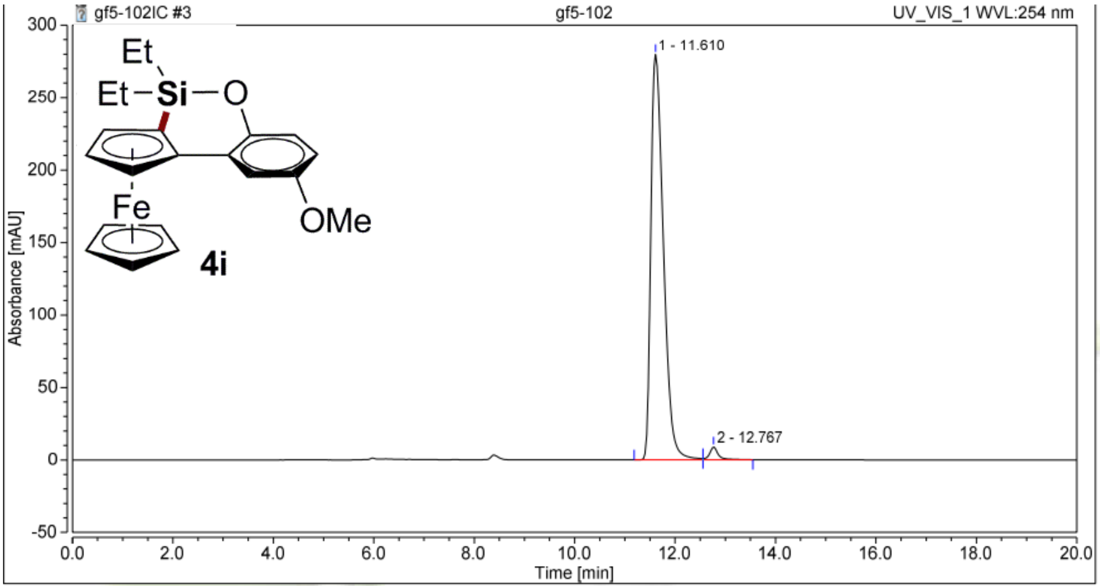
Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	9.337	2.328	13.225	2.37	3.32
2	10.933	95.782	385.452	97.63	96.68
Totals:		**98.110**	**398.677**	**100.00**	**100.00**

Compound 4i



Result

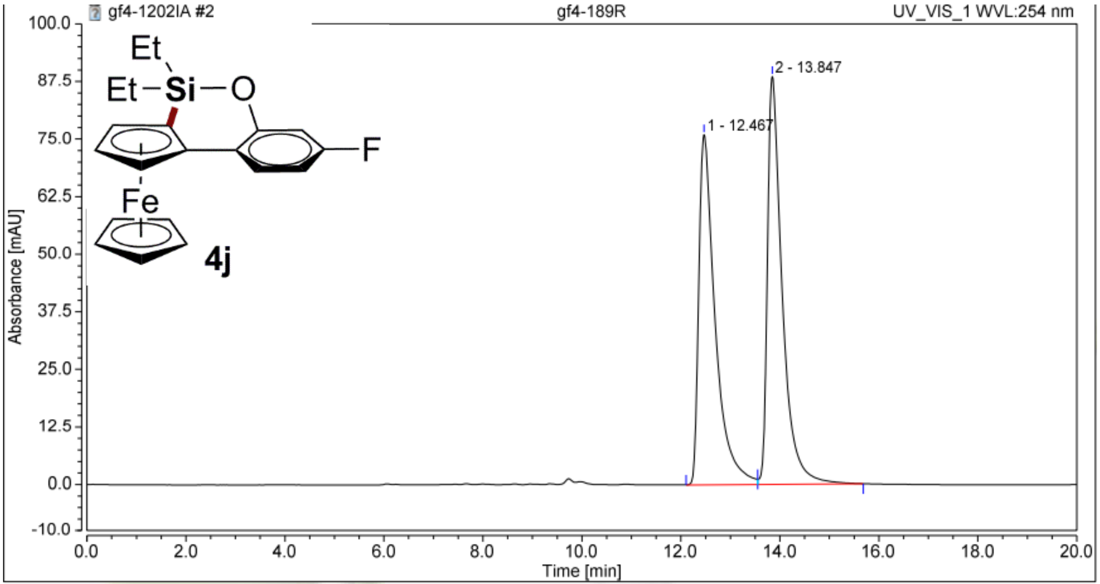
Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	11.670	52.256	184.295	50.69	47.92
2	12.833	50.828	200.255	49.31	52.08
Totals:		**103.084**	**384.550**	**100.00**	**100.00**



Result

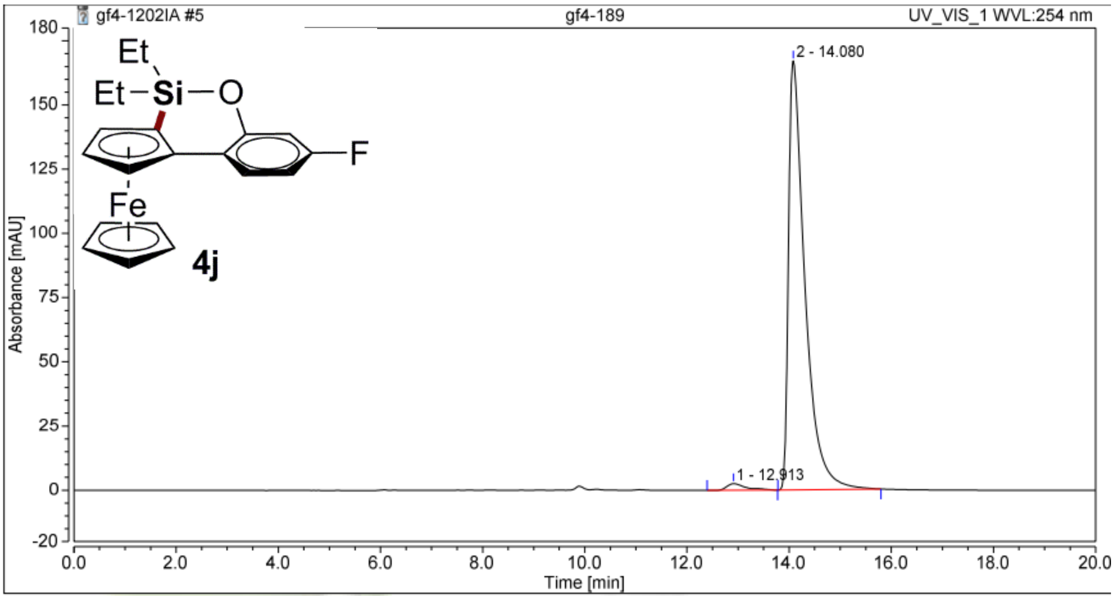
Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	11.610	80.432	279.776	97.84	96.93
2	12.767	1.778	8.857	2.16	3.07
Totals:		**82.210**	**288.634**	**100.00**	**100.00**

Compound 4j



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	12.467	29.112	76.005	48.76	46.18
2	13.847	30.597	88.569	51.24	53.82
Totals:		**59.709**	**164.575**	**100.00**	**100.00**

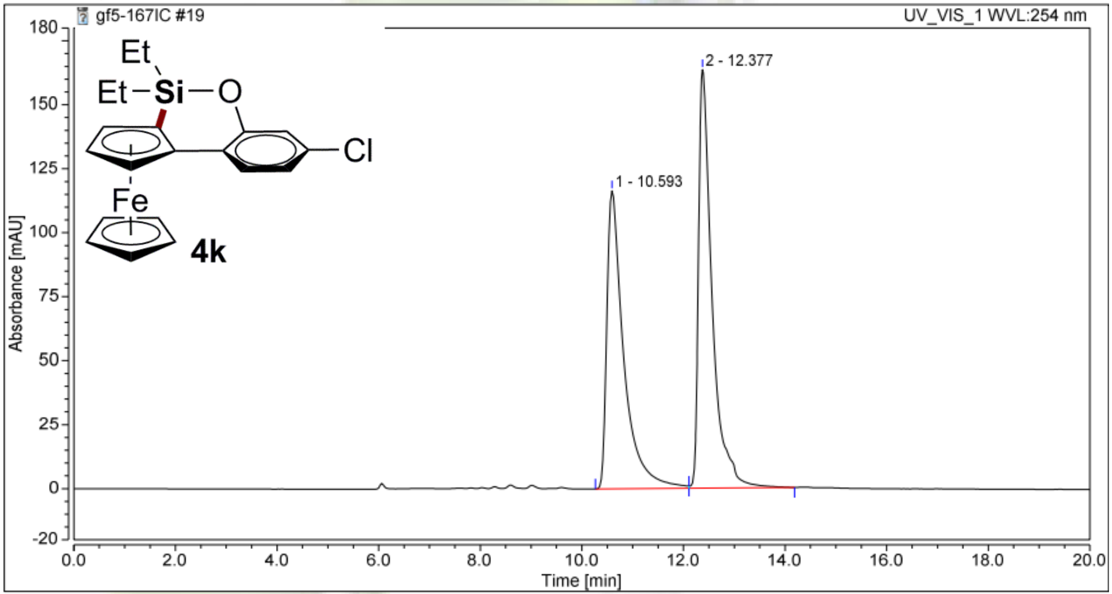


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	12.913	1.143	2.576	1.81	1.52
2	14.080	61.929	167.063	98.19	98.48
Totals:		**63.071**	**169.639**	**100.00**	**100.00**

Compound 4k

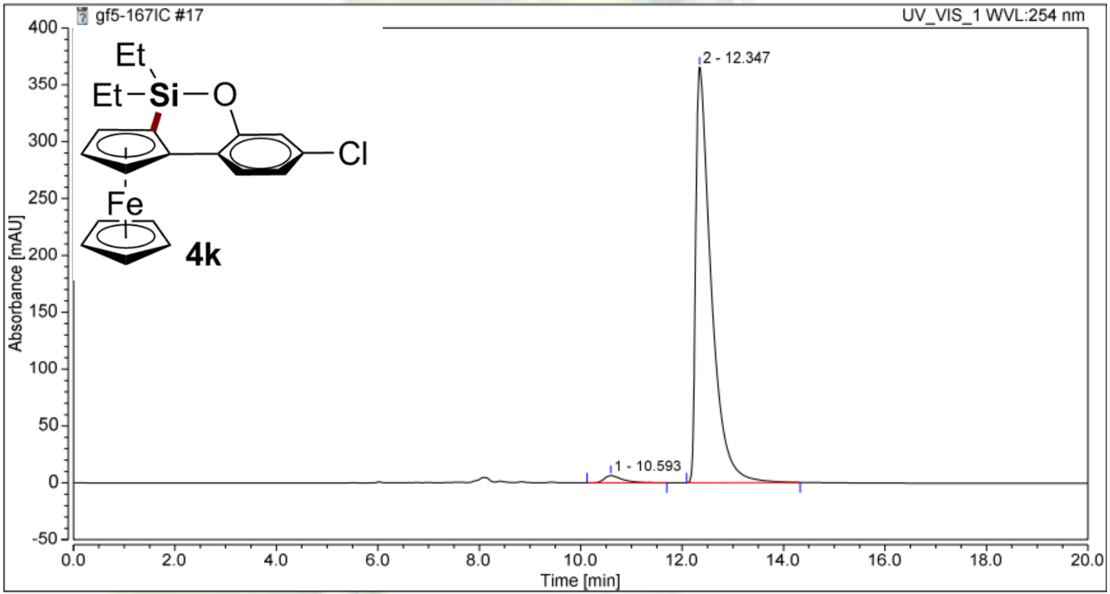
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	10.593	45.370	116.474	47.27	41.59
2	12.377	50.607	163.551	52.73	58.41
Totals:		**95.977**	**280.025**	**100.00**	**100.00**

Chromatogram

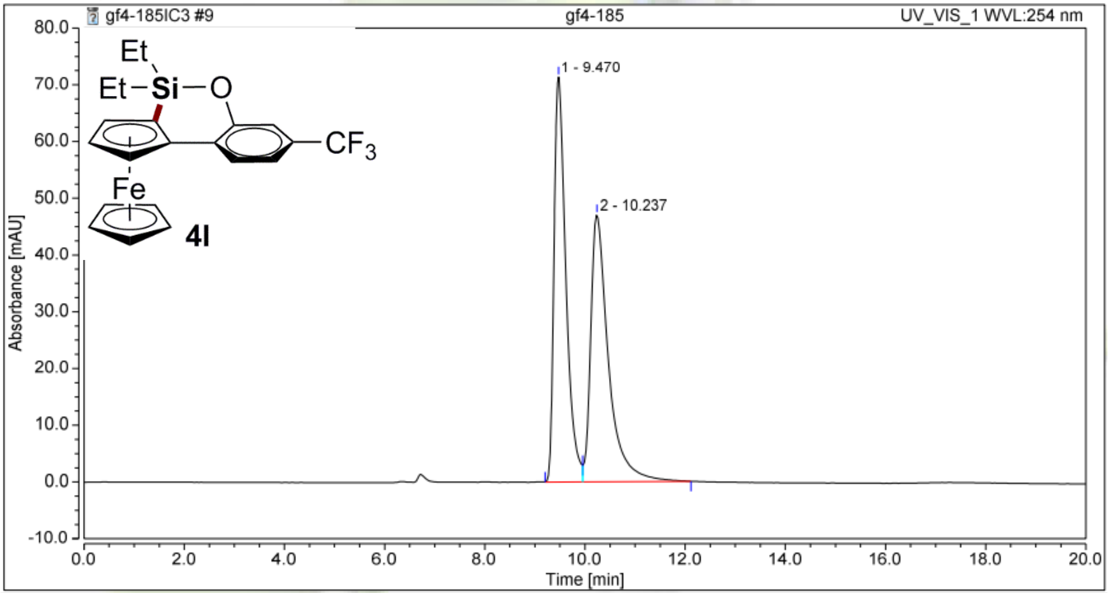


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	10.593	2.735	6.440	2.08	1.73
2	12.347	128.739	365.562	97.92	98.27
Totals:		**131.474**	**372.002**	**100.00**	**100.00**

Compound 4l

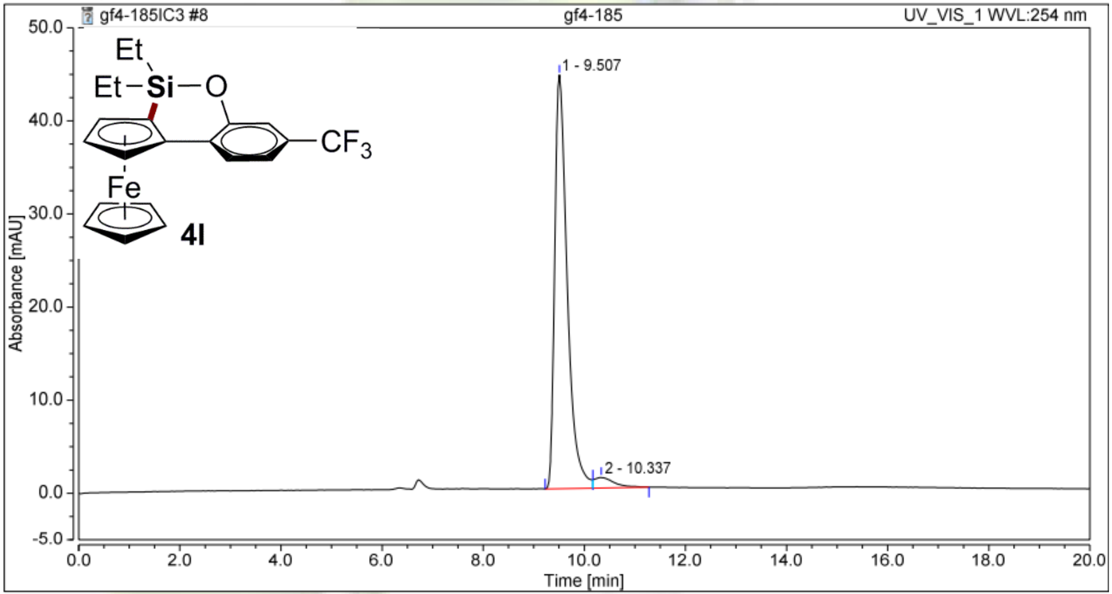
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	9.470	19.593	71.389	50.44	60.27
2	10.237	19.252	47.056	49.56	39.73
Totals:		**38.845**	**118.445**	**100.00**	**100.00**

Chromatogram

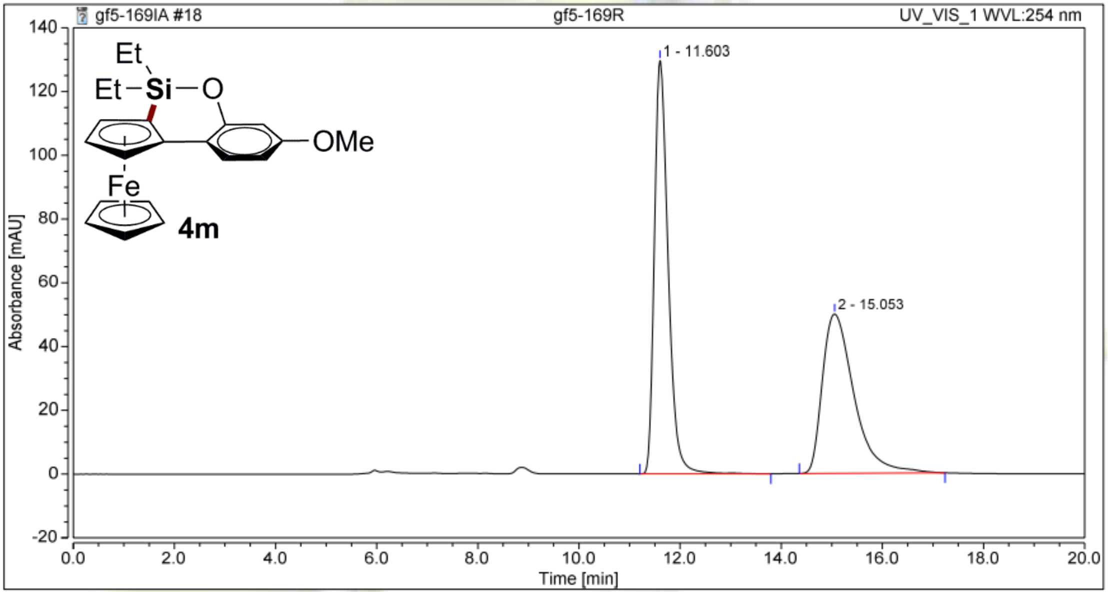


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	9.507	12.752	44.424	96.13	97.56
2	10.337	0.513	1.113	3.87	2.44
Totals:		**13.265**	**45.537**	**100.00**	**100.00**

Compound 4m

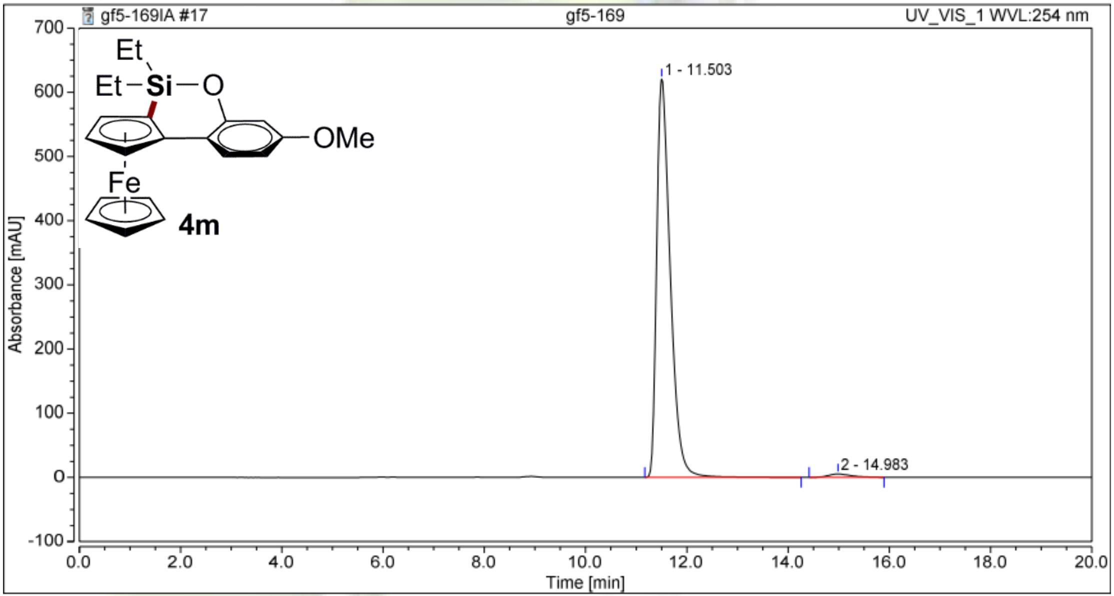
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	11.603	40.762	129.617	53.06	72.18
2	15.053	36.056	49.957	46.94	27.82
Totals:		**76.819**	**179.574**	**100.00**	**100.00**

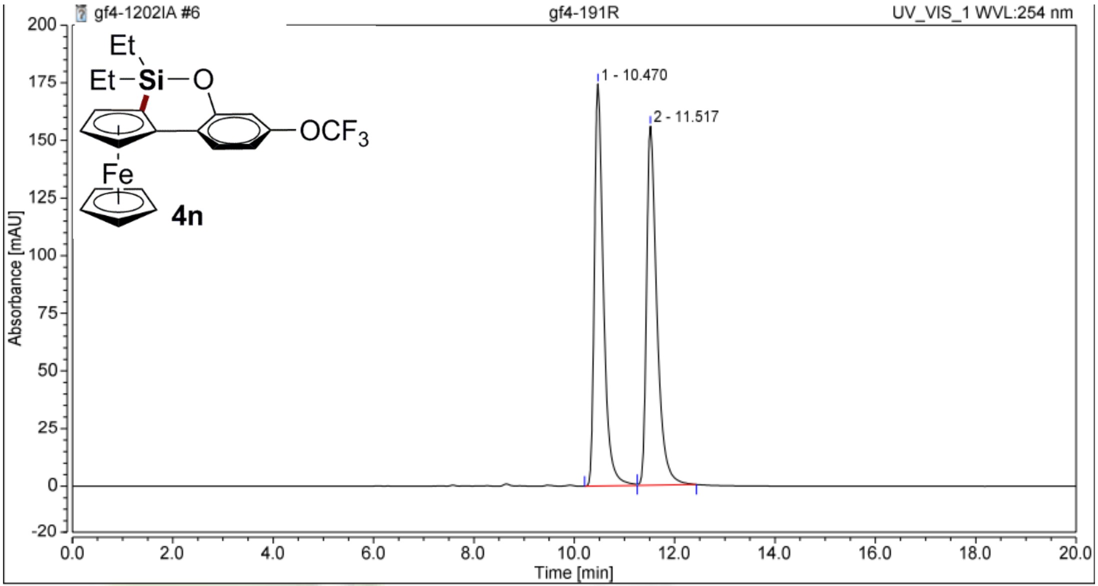
Chromatogram



Result

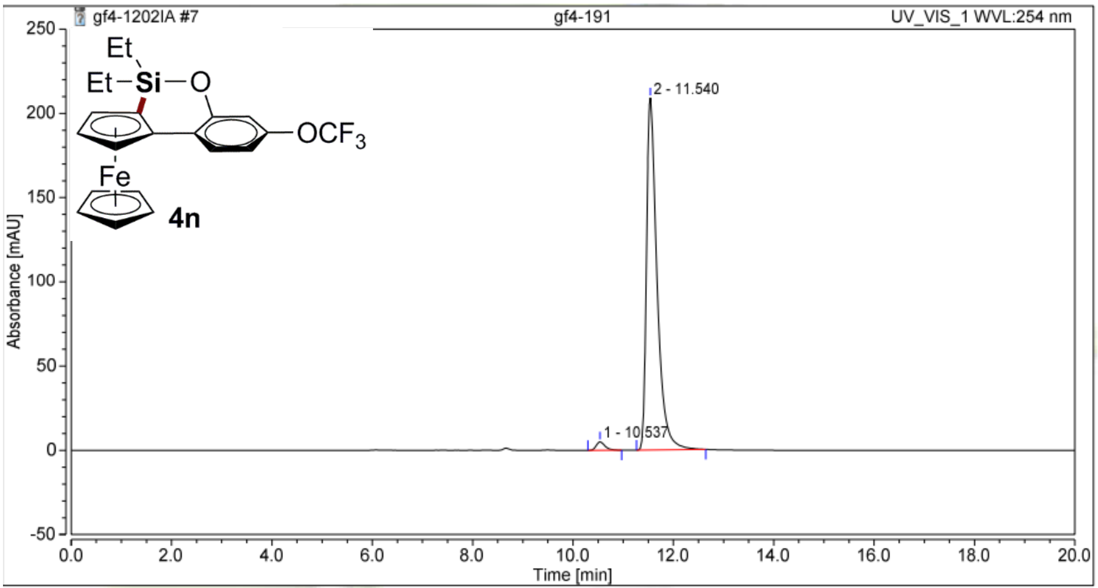
Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	11.503	193.038	620.397	98.67	99.19
2	14.983	2.611	5.081	1.33	0.81
Totals:		**195.649**	**625.478**	**100.00**	**100.00**

Compound 4n



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	10.470	36.316	174.508	49.52	52.83
2	11.517	37.019	155.813	50.48	47.17
Totals:		**73.335**	**330.322**	**100.00**	**100.00**

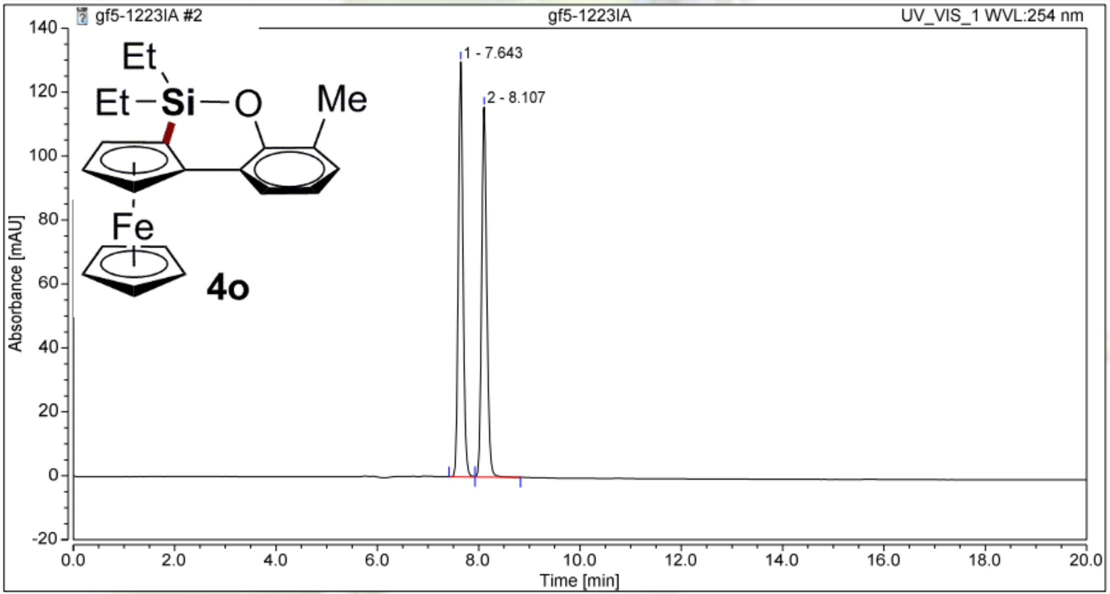


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	10.537	1.031	5.005	2.00	2.34
2	11.540	50.509	209.091	98.00	97.66
Totals:		**51.540**	**214.096**	**100.00**	**100.00**

Compound 4o

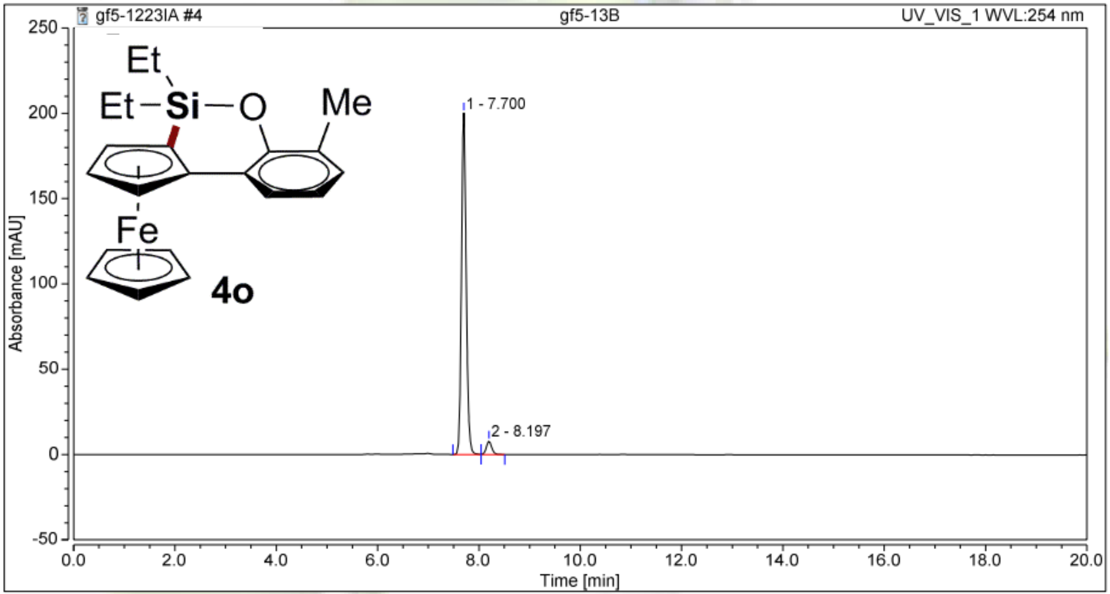
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	7.643	13.978	129.788	50.56	52.87
2	8.107	13.666	115.677	49.44	47.13
Totals:		**27.644**	**245.465**	**100.00**	**100.00**

Chromatogram

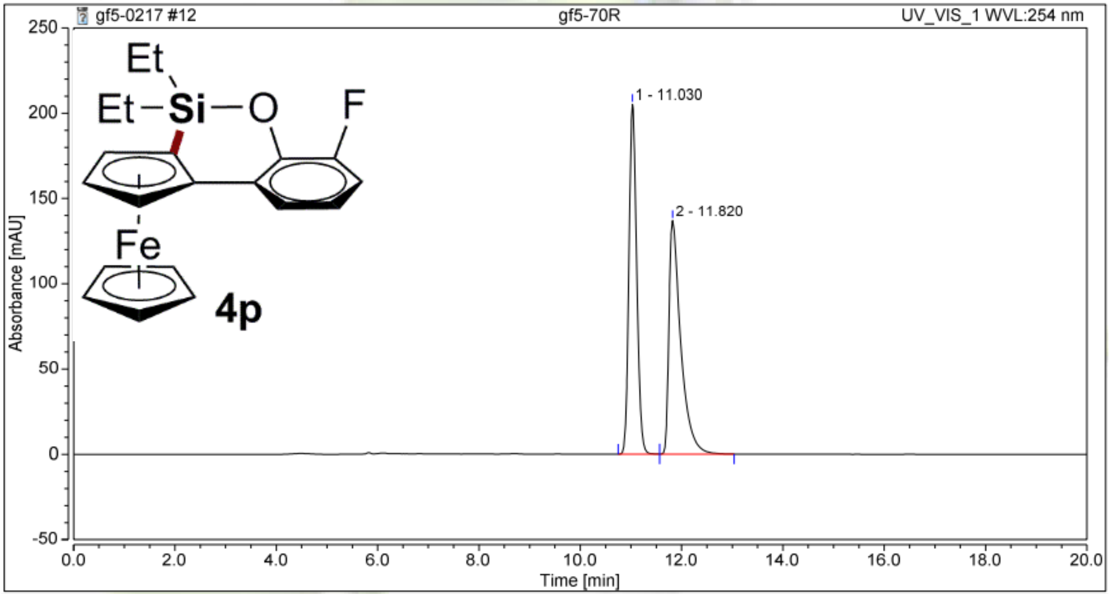


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	7.700	21.907	200.297	95.77	96.21
2	8.197	0.967	7.896	4.23	3.79
Totals:		**22.874**	**208.193**	**100.00**	**100.00**

Compound 4p

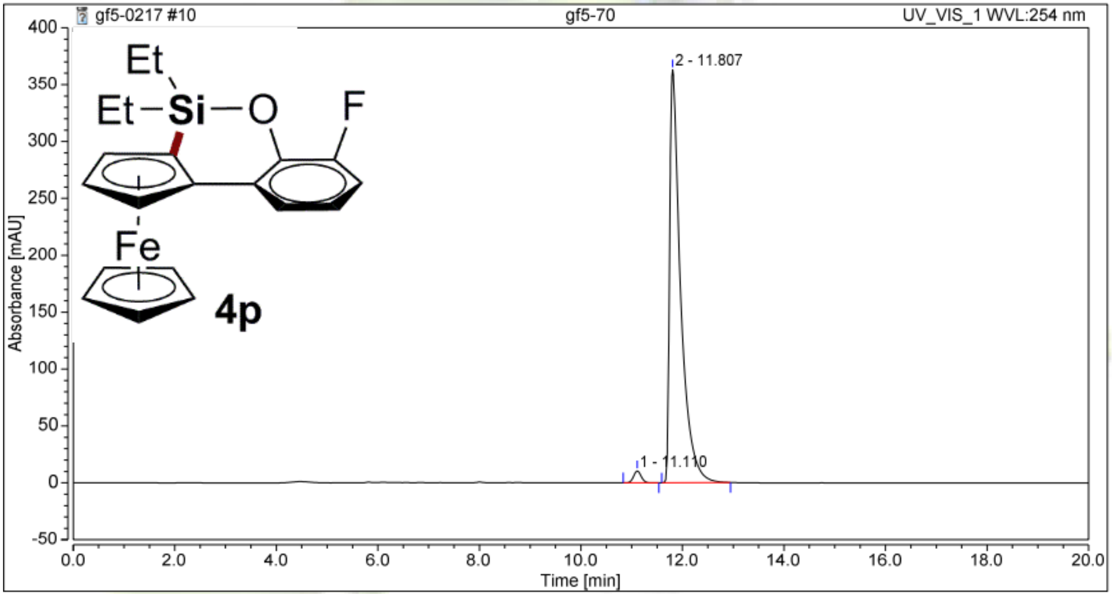
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	11.030	36.217	205.127	49.38	59.97
2	11.820	37.120	136.897	50.62	40.03
Totals:		**73.336**	**342.023**	**100.00**	**100.00**

Chromatogram

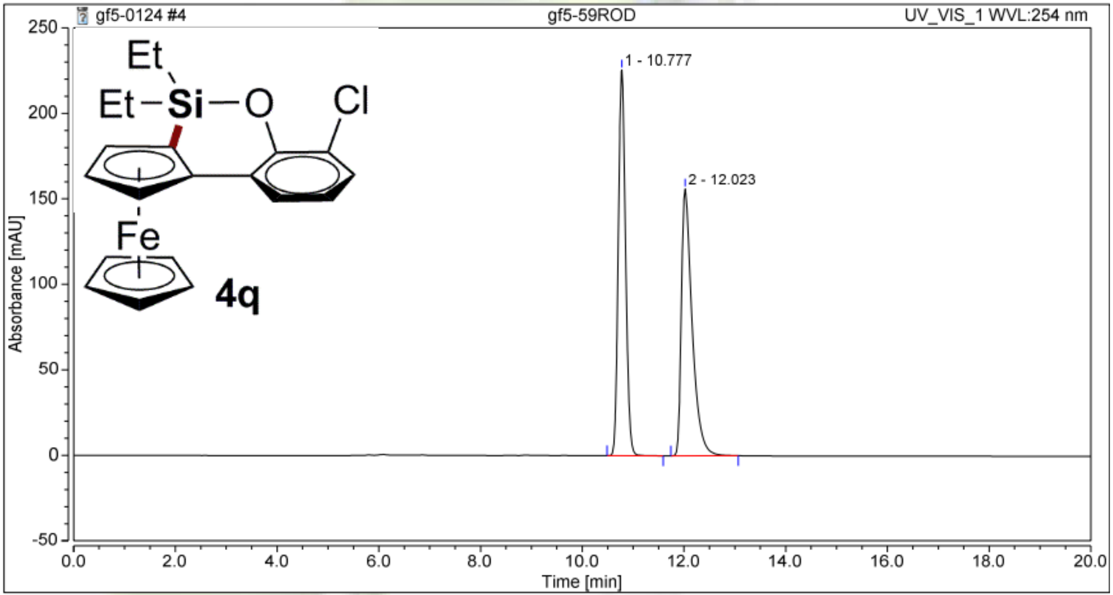


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	11.110	1.806	10.529	1.95	2.82
2	11.807	90.876	362.907	98.05	97.18
Totals:		**92.682**	**373.436**	**100.00**	**100.00**

Compound 4q

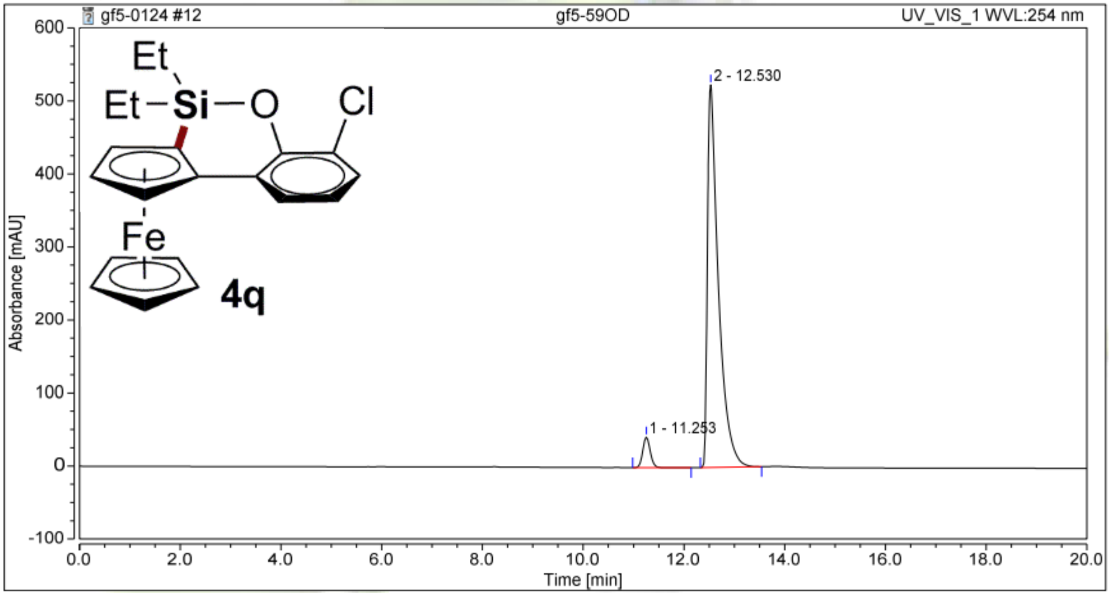
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	10.777	37.353	225.551	49.41	59.10
2	12.023	38.249	156.099	50.59	40.90
Totals:		**75.603**	**381.650**	**100.00**	**100.00**

Chromatogram

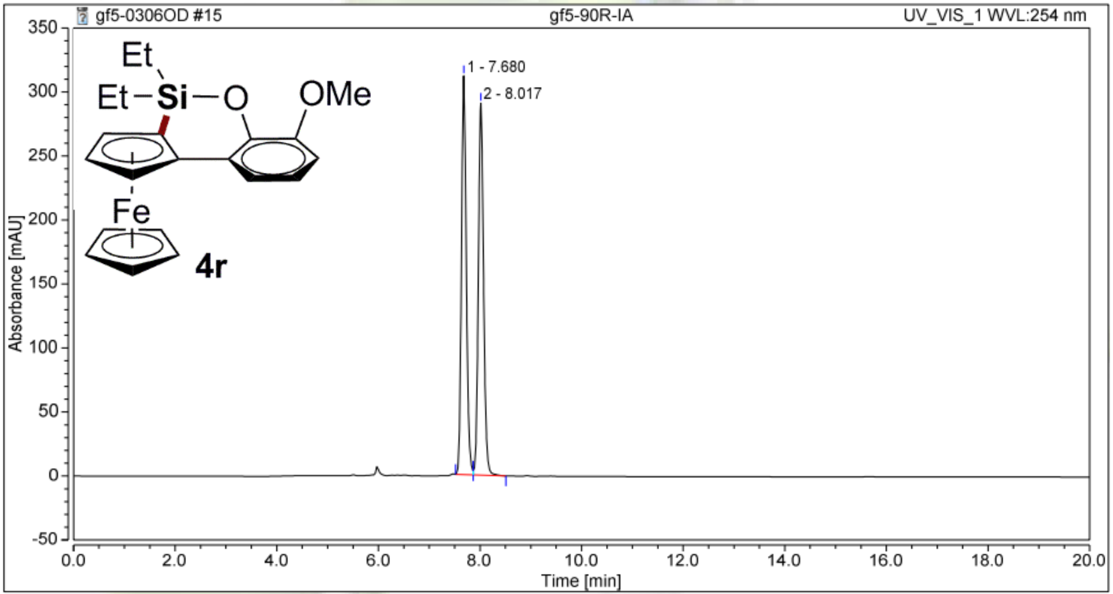


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	11.253	7.087	42.014	5.07	7.42
2	12.530	132.628	524.036	94.93	92.58
Totals:		**139.715**	**566.050**	**100.00**	**100.00**

Compound 4r

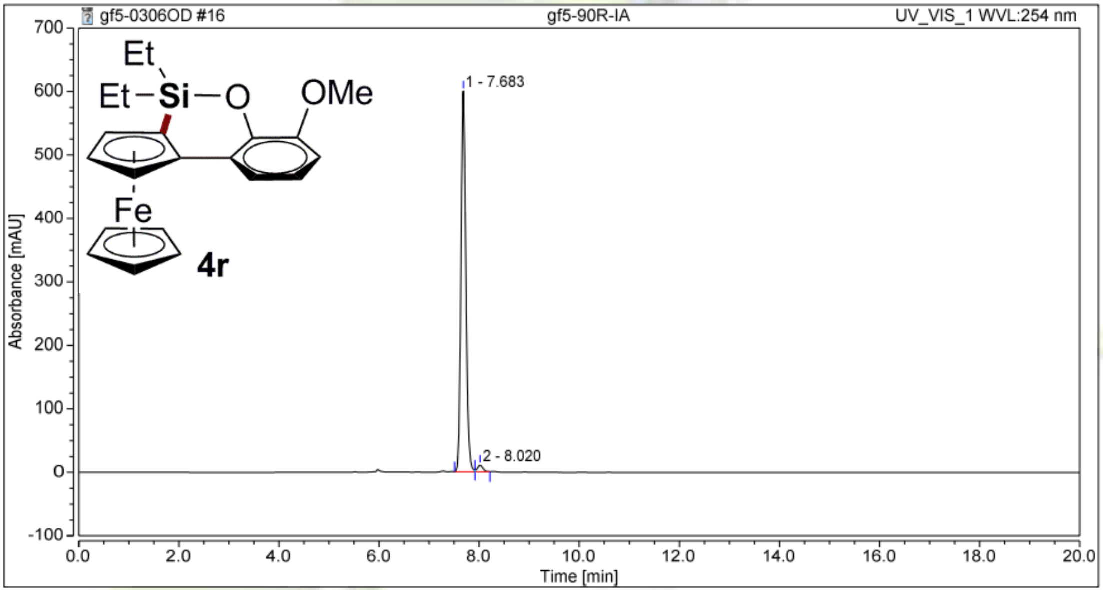
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	7.680	34.955	311.690	50.27	51.76
2	8.017	34.574	290.548	49.73	48.24
Totals:		**69.530**	**602.238**	**100.00**	**100.00**

Chromatogram

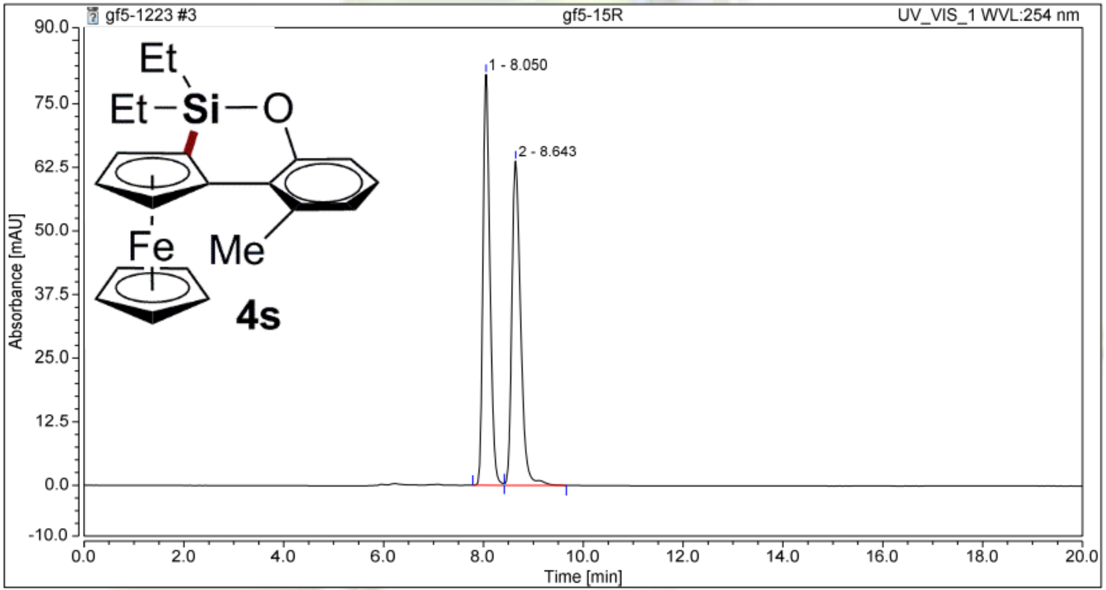


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	7.683	67.879	599.923	98.17	98.29
2	8.020	1.265	10.439	1.83	1.71
Totals:		**69.144**	**610.362**	**100.00**	**100.00**

Compound 4s

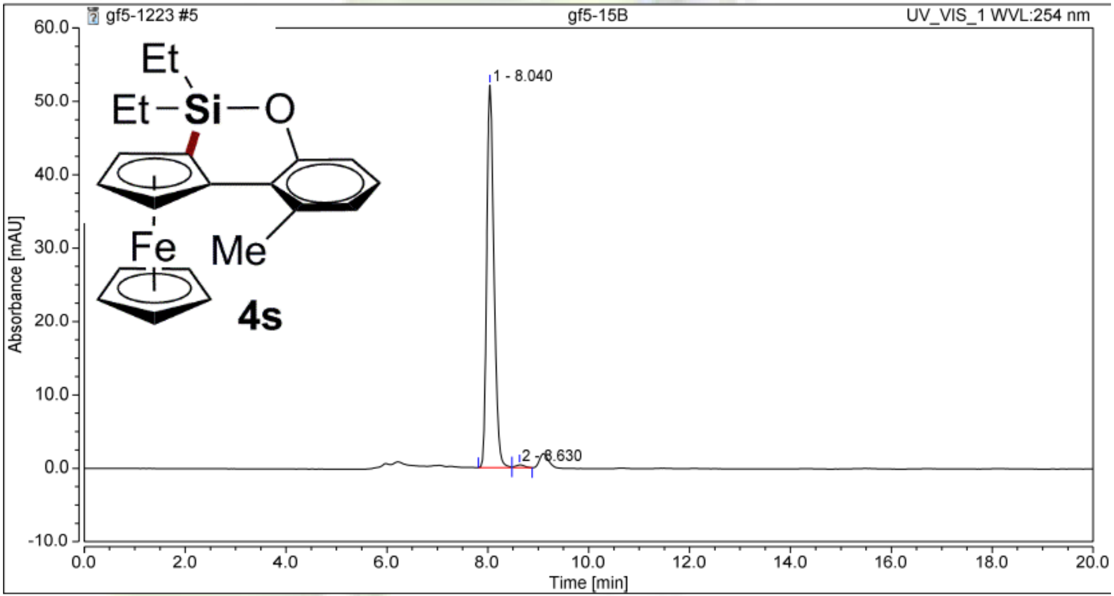
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	8.050	13.126	80.771	50.35	55.88
2	8.643	12.942	63.772	49.65	44.12
Totals:		**26.069**	**144.542**	**100.00**	**100.00**

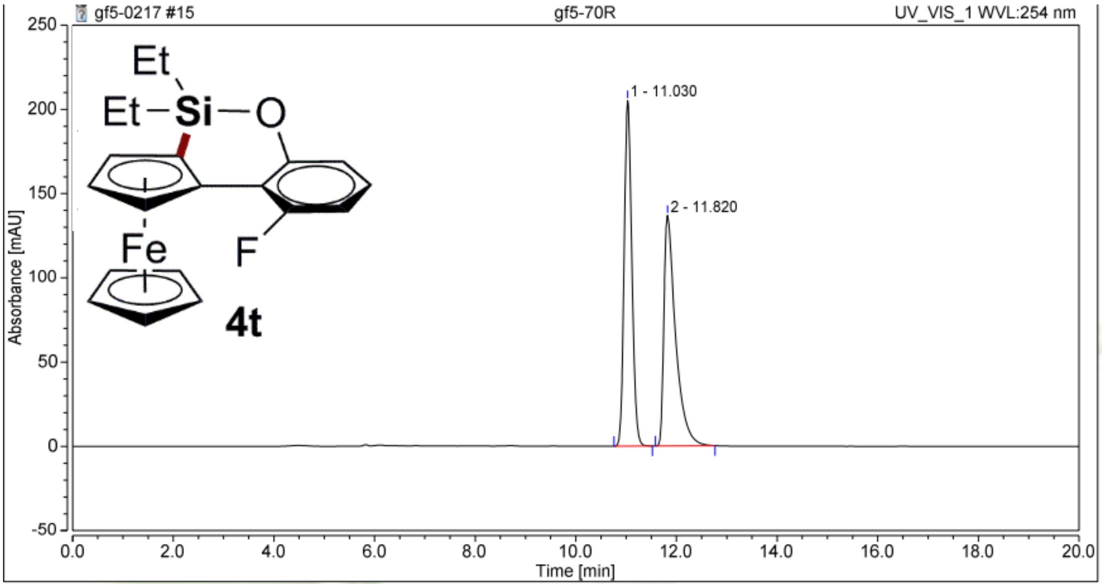
Chromatogram



Result

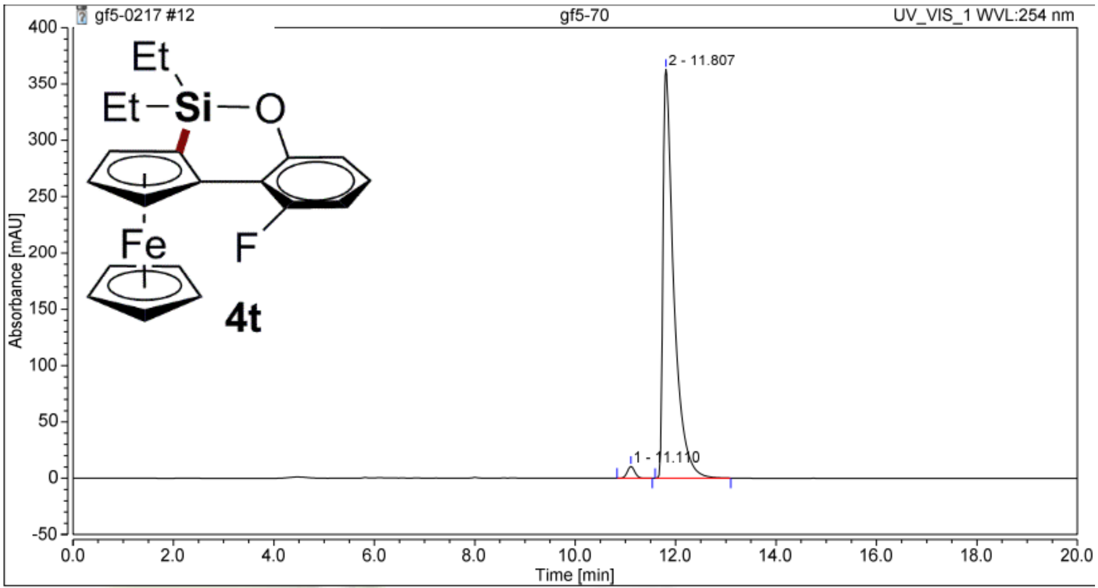
Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	8.040	8.674	52.142	99.12	99.27
2	8.630	0.077	0.386	0.88	0.73
Totals:		**8.751**	**52.528**	**100.00**	**100.00**

Compound 4t



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	11.030	36.170	205.086	49.51	59.99
2	11.820	36.888	136.780	50.49	40.01
Totals:		**73.058**	**341.866**	**100.00**	**100.00**

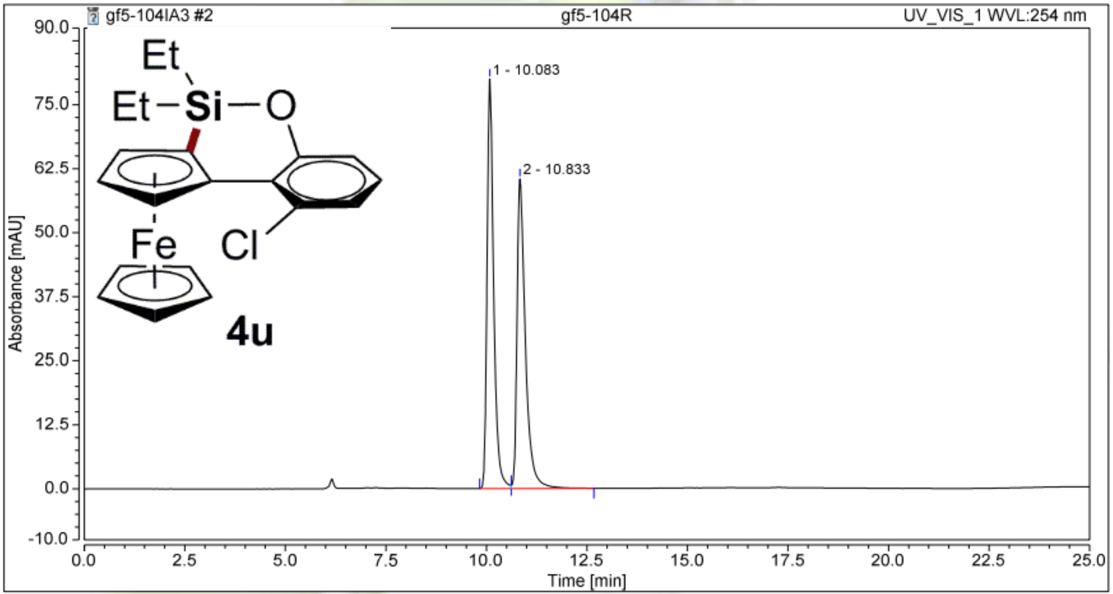


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	11.110	1.806	10.529	1.95	2.82
2	11.807	91.013	362.936	98.05	97.18
Totals:		**92.819**	**373.465**	**100.00**	**100.00**

Compound 4u

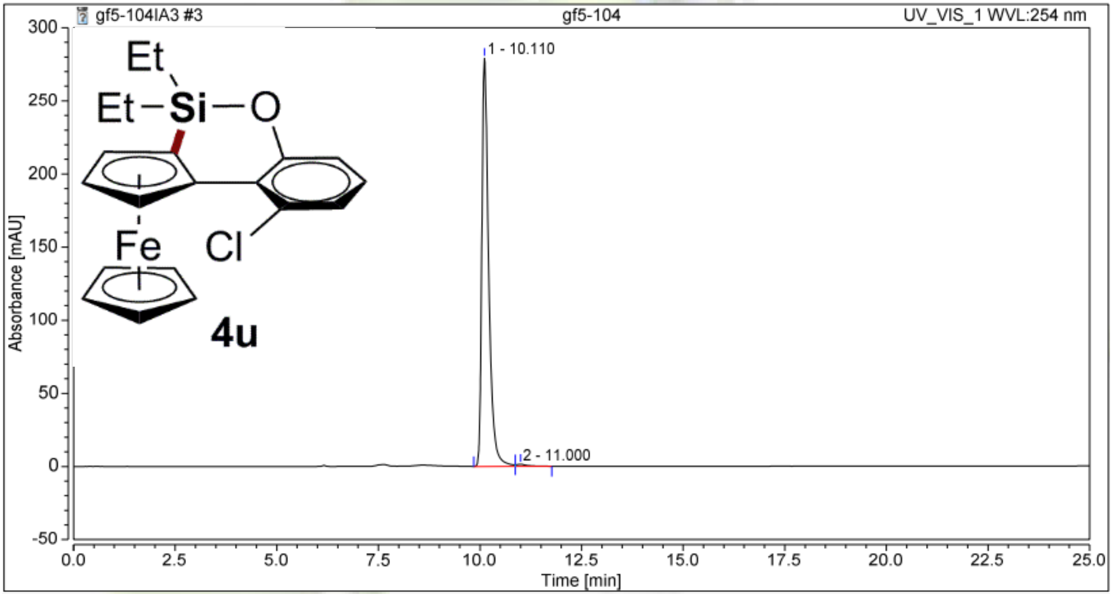
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	10.083	15.249	79.991	51.08	56.94
2	10.833	14.603	60.494	48.92	43.06
Totals:		**29.851**	**140.485**	**100.00**	**100.00**

Chromatogram

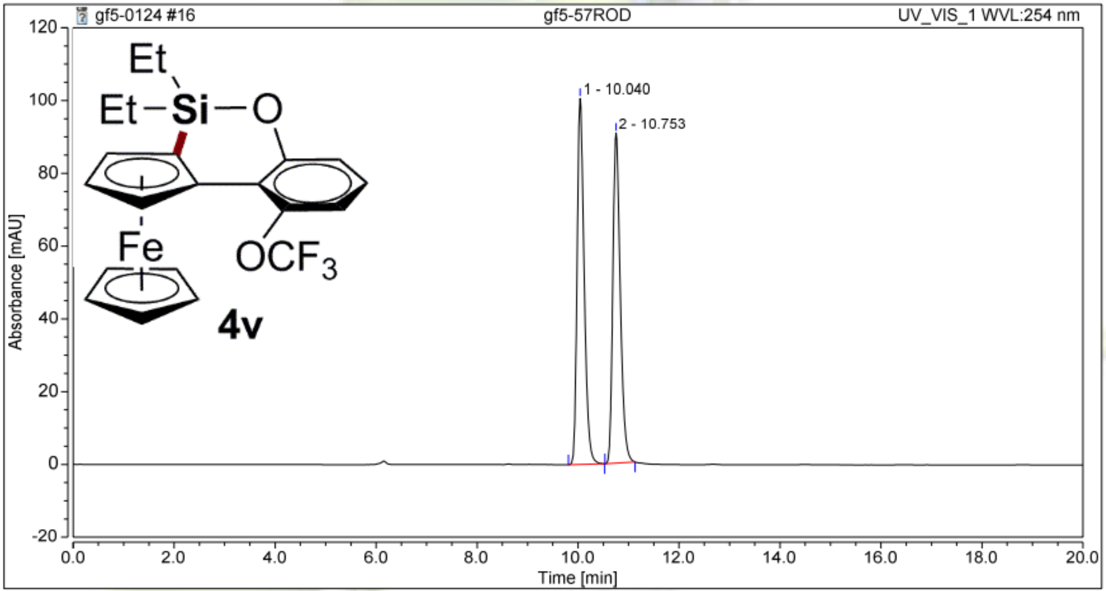


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	10.110	54.705	279.003	99.19	99.50
2	11.000	0.446	1.398	0.81	0.50
Totals:		**55.151**	**280.400**	**100.00**	**100.00**

Compound 4v

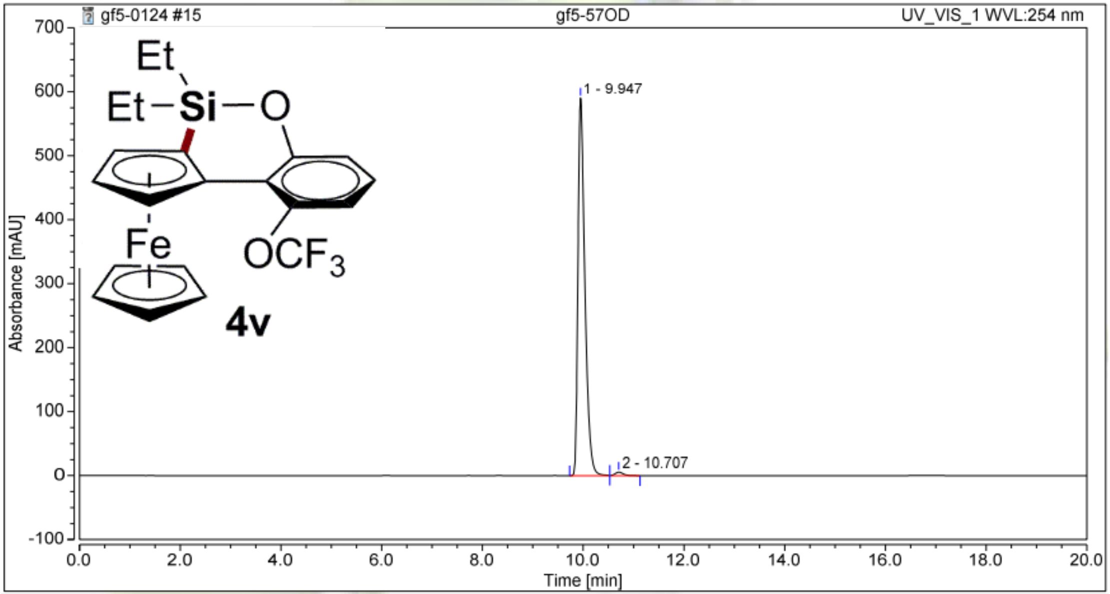
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	10.040	16.141	100.539	51.07	52.59
2	10.753	15.465	90.650	48.93	47.41
Totals:		**31.606**	**191.188**	**100.00**	**100.00**

Chromatogram

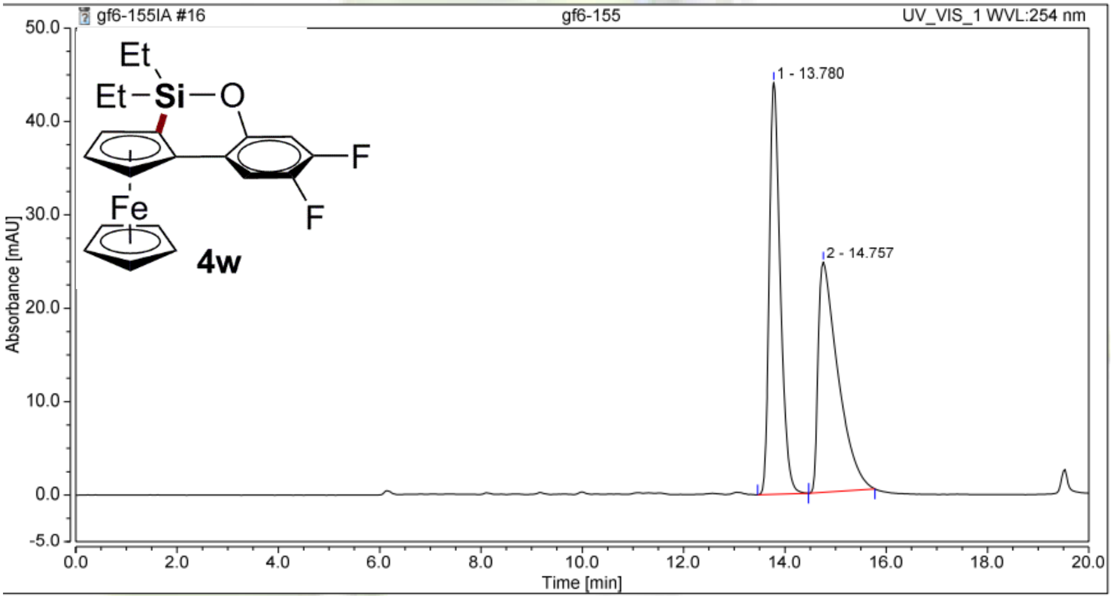


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	9.947	94.330	590.143	98.92	99.08
2	10.707	1.027	5.492	1.08	0.92
Totals:		**95.357**	**595.636**	**100.00**	**100.00**

Compound 4w

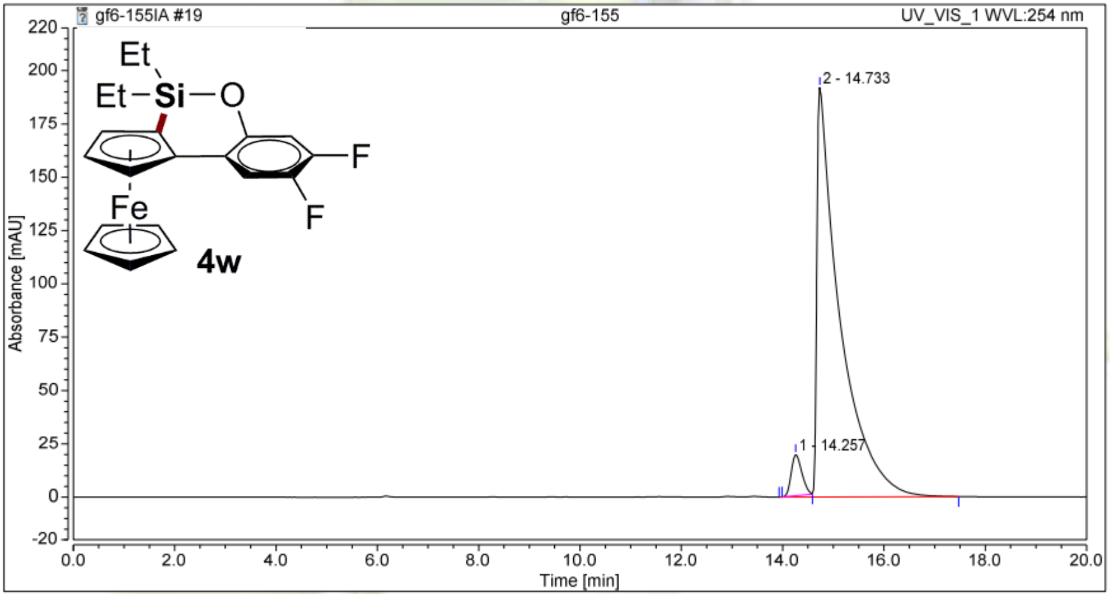
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	13.780	11.055	44.111	49.68	64.16
2	14.757	11.199	24.642	50.32	35.84
Totals:		**22.254**	**68.753**	**100.00**	**100.00**

Chromatogram

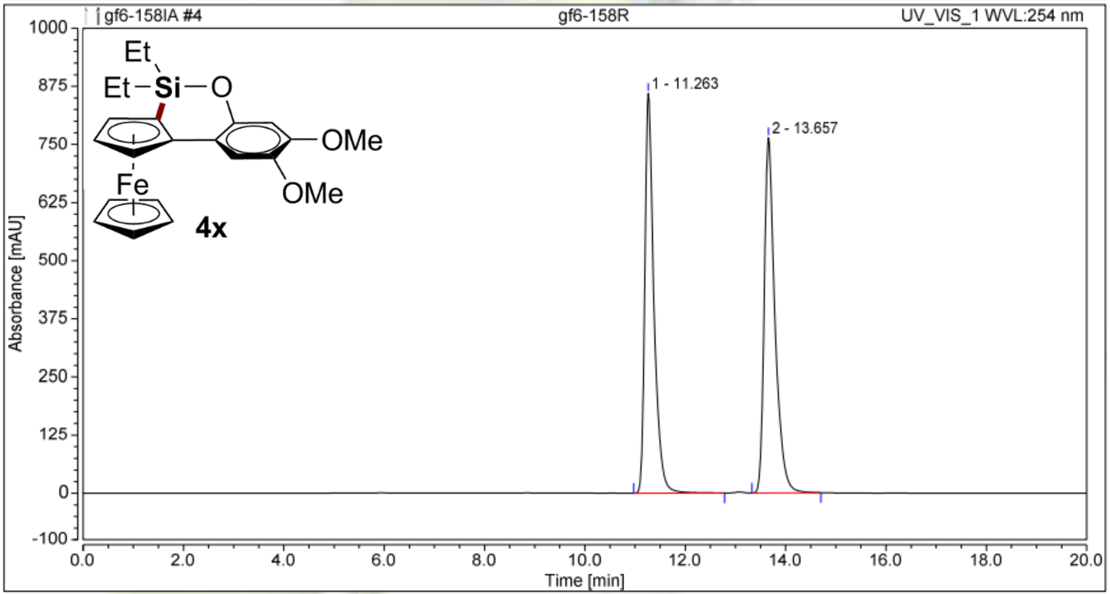


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	14.257	4.657	19.272	4.44	9.12
2	14.733	100.252	192.093	95.56	90.88
Totals:		**104.908**	**211.365**	**100.00**	**100.00**

Compound 4x

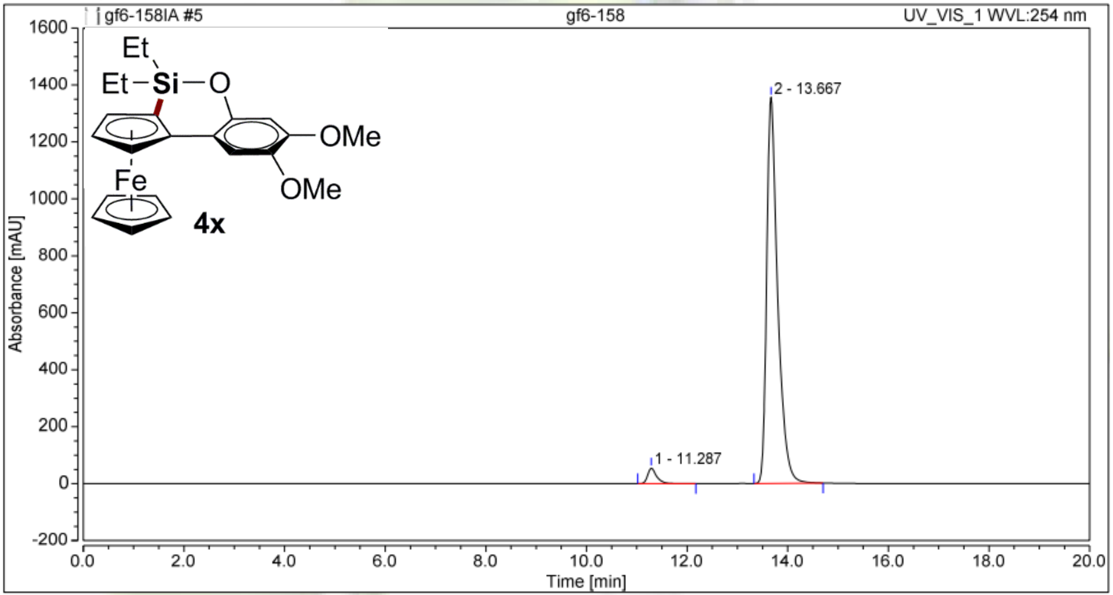
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	11.263	179.740	859.643	48.63	52.96
2	13.657	189.904	763.634	51.37	47.04
Totals:		**369.644**	**1623.277**	**100.00**	**100.00**

Chromatogram

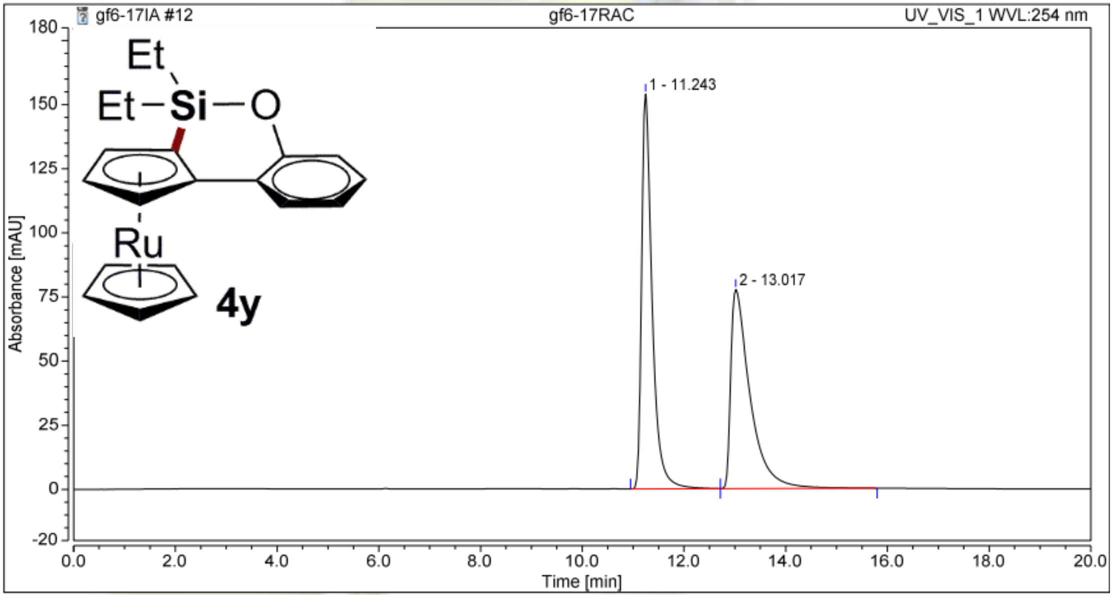


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	11.287	11.325	54.735	3.20	3.88
2	13.667	342.102	1356.062	96.80	96.12
Totals:		**353.427**	**1410.797**	**100.00**	**100.00**

Compound 4y

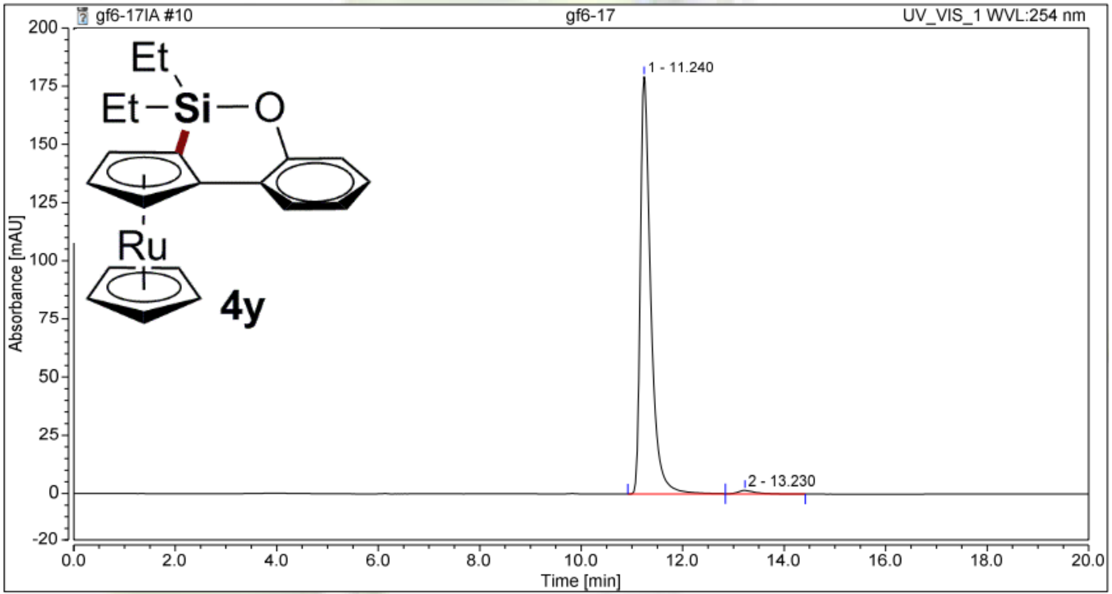
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	11.243	36.828	153.965	51.75	66.46
2	13.017	34.340	77.698	48.25	33.54
Totals:		**71.168**	**231.663**	**100.00**	**100.00**

Chromatogram

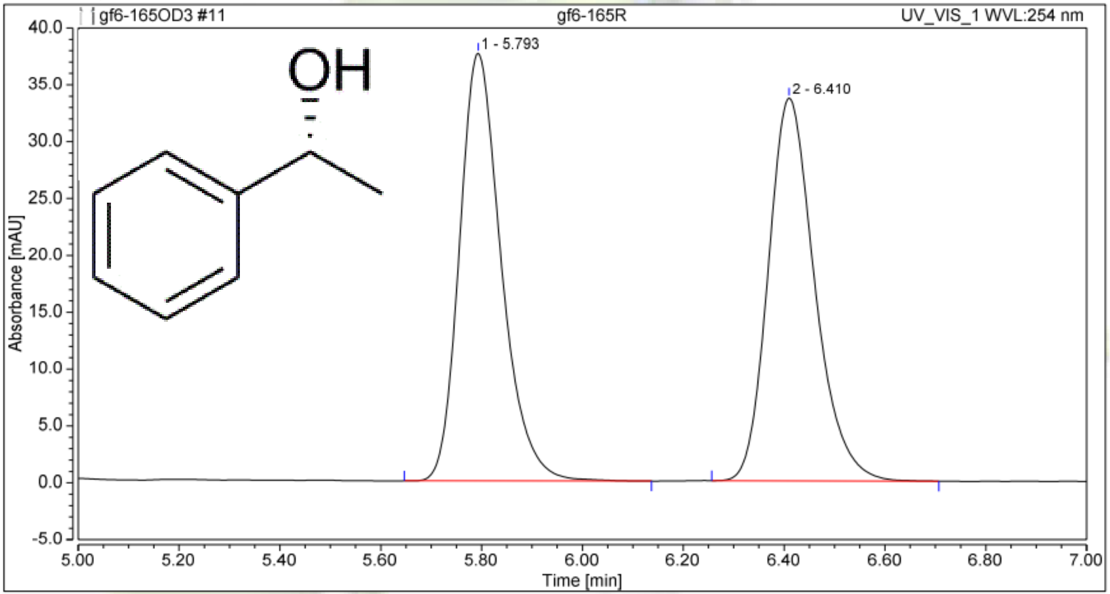


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	11.240	42.687	179.316	98.45	99.16
2	13.230	0.671	1.527	1.55	0.84
Totals:		**43.357**	**180.842**	**100.00**	**100.00**

Compound 6-1

Chromatogram

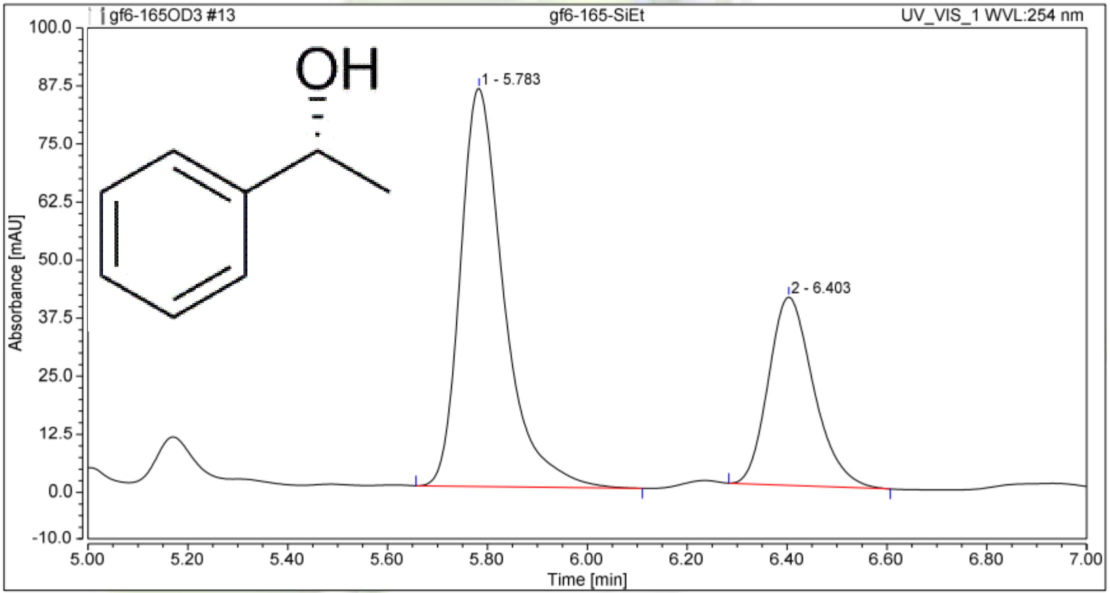


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	5.793	3.611	37.618	50.10	52.78
2	6.410	3.597	33.654	49.90	47.22
Totals:		**7.208**	**71.273**	**100.00**	**100.00**

Using FcL1 as ligand

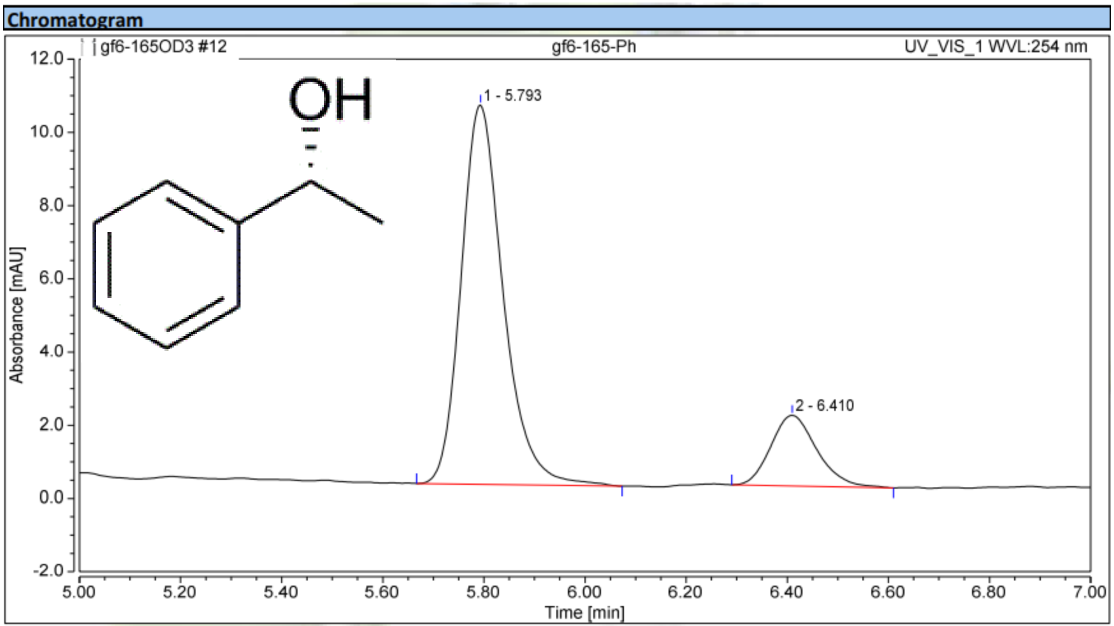
Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	5.783	8.637	85.689	66.99	67.89
2	6.403	4.255	40.522	33.01	32.11
Totals:		**12.892**	**126.211**	**100.00**	**100.00**

Using FcL2 as ligand

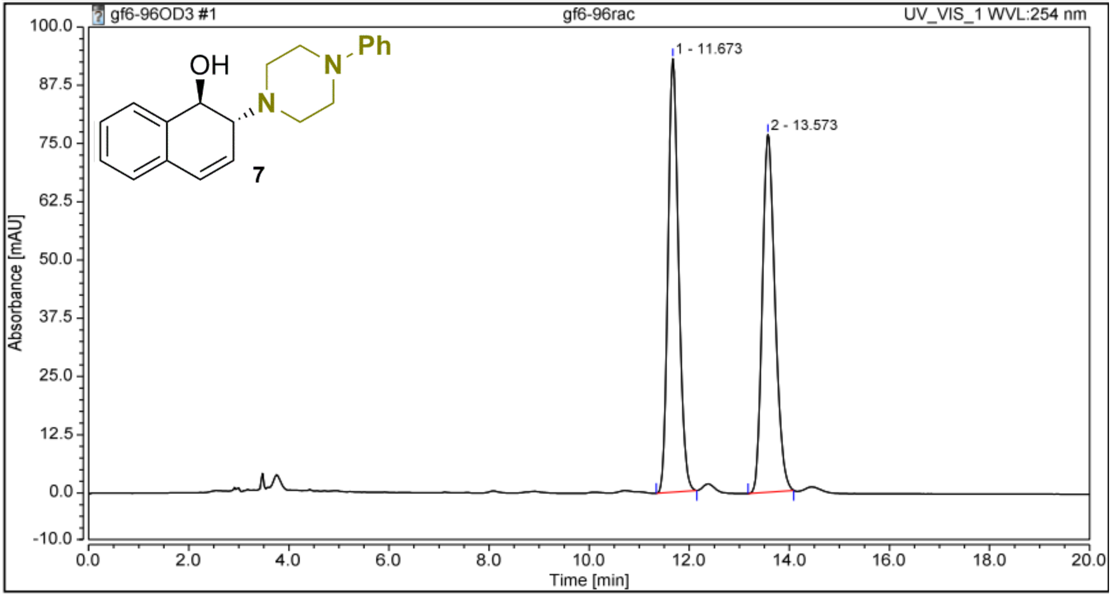


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	5.793	0.999	10.355	83.08	84.31
2	6.410	0.203	1.927	16.92	15.69
Totals:		**1.202**	**12.282**	**100.00**	**100.00**

Compound 7

Chromatogram

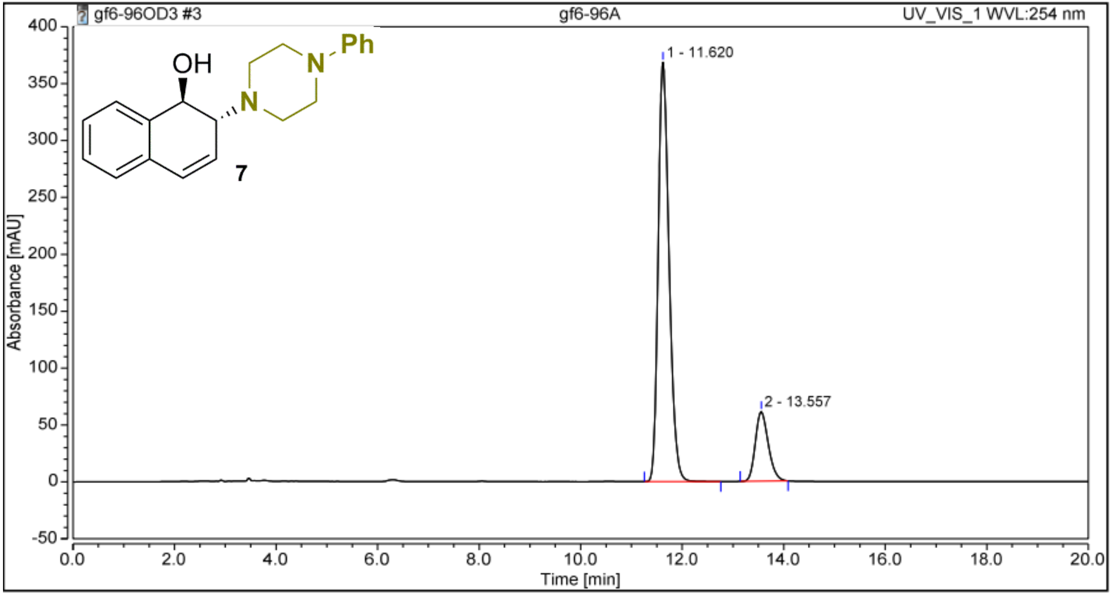


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	11.673	22.699	92.989	50.12	54.78
2	13.573	22.592	76.756	49.88	45.22
Totals:		**45.292**	**169.745**	**100.00**	**100.00**

Using FcL1 as ligand

Chromatogram

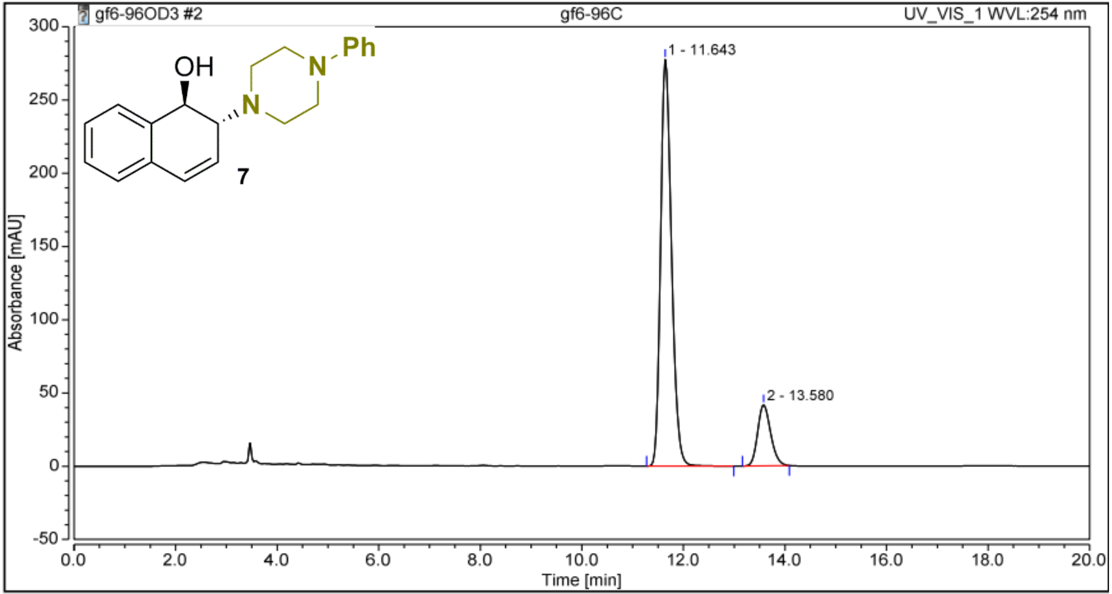


Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	11.620	91.171	368.583	83.47	85.76
2	13.557	18.055	61.186	16.53	14.24
Totals:		**109.226**	**429.768**	**100.00**	**100.00**

Using FcL2 as ligand

Chromatogram



Result

Peak #	Run time [min][	Area [mAU*min]	Height [mAU]	Area %	Height %
1	11.643	68.625	277.553	84.78	86.92
2	13.580	12.322	41.755	15.22	13.08
Totals:		**80.948**	**319.308**	**100.00**	**100.00**