Electronic Supplementary Material (ESI) for Organic Chemistry Frontiers.

Supporting Information

Copper-Catalyzed Synthesis of Cycloproyl Bis(boronates) from Aryl Olefins and Carbon Monoxide

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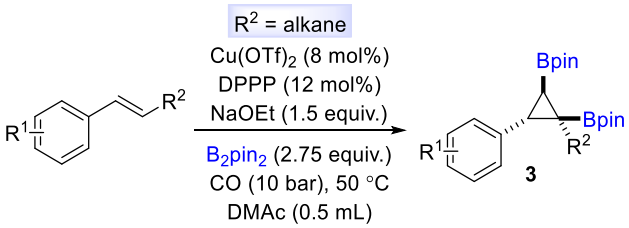
2. General information

Unless otherwise noted, all commercial reagents were ordered from Sigma-Aldrich, TCI, ABCR, or Across. All solvents (anhydrous and under inert atmosphere) were collected by M BRAUN from the solvent purification system and used under standard Schlenk techniques. Olefins were synthesized based on known literatures. Column chromatography was performed on silica gel (200-300 meshes) using *n*-pentane (bp. 36.1 °C), dichloromethane and ethyl acetate as eluents. All NMR spectra were recorded at ambient temperature using Bruker Advance 300 NMR, Bruker ARX 400 NMR spectrometers. Multiplets were assigned as follows: chemical shift (δ ppm), multiplicity (s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, br = broad), coupling constant (Hz), and integration. All ^{13}C NMR spectra were broad-band ^{1}H decoupled. Gas chromatography (GC) analyses were performed on an Agilent HP-7890A instrument with a FID detector and HP-5 capillary column (polydimethylsiloxane with 5% phenyl groups, 30 m, 0.32 mm i.d. 0.25 μm film thickness) using argon as carrier gas. High resolution mass spectra (HRMS) were recorded on an Agilent 6210 system. Because of the high toxicity of carbon monoxide, all reactions should be performed in an autoclave.
The laboratory should be well-equipped with a CO detector and alarm system.

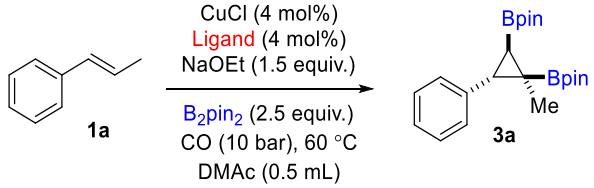
3. Experimental Procedures

3.1 Supplementary Tables



3.1.1 Optimization reaction condition for 3a.

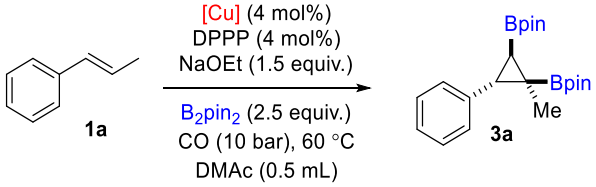
Table S1 **Screening of Ligand**[a]



Entry	Ligand	Yield of **3a** (%)
1	DPPM	11
2	DPPE	23
3	DPPP	37
4	DPPB	17
5	DPPF	19
6	DCyPE	23
7	DCyPP	20
8	DPEphos	9
9	Xantphos	14
10	(R)-Tol-BINAP	2
11	ChiraPhos	15
12	Ph-BPE	27
13	$BuPAd_2$	13
14	BDPP	19
15	DPPBz	13
6	4-OMe-dppp	32
17	4-CF_3-dppp	6

[a] Reaction conditions: *tans-β*-methylstyrene (0.2 mmol), B_2pin_2 (2.5 equiv.), CuCl (4 mol%), ligand (4 mol%), NaOEt (1.5 equiv.), CO (10 bar), DMAc (0.4 M), stirred at 60 °C for 24 h. Yields are determined by GC with hexadecane as an internal standard.

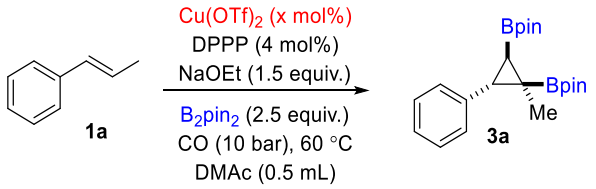
Table S2 Screening of Catalysis[a]



Entry	[Cu]	Yield of **3a** (%)
1	$CuCl_2$	34
2	CuCN	18
3	$Cu(OAc)_2$	39
4	CuI	37
5	$CuBr(Me_2S)$	37
6	$LiCuCl_4$	30
7	iPrCuCl	34
8	iMesCuCl	38
9	$CuSO_4$	28
10	$Cu(OTf)_2$	40
11	$Cu(acac)_2$	32
12	$Cu(OAc)_2$	35
13	Cu(OTf)•Toluene	34

[a] Reaction conditions: *tans-β*-methylstyrene (0.2 mmol), B_2pin_2 (2.5 equiv.), [Cu] (4 mol%), DPPP (4 mol%), NaOEt (1.5 equiv.), CO (10 bar), DMAc (0.4 M), stirred at 60 ºC for 16 h. Yields are determined by GC with hexadecane as an internal standard.

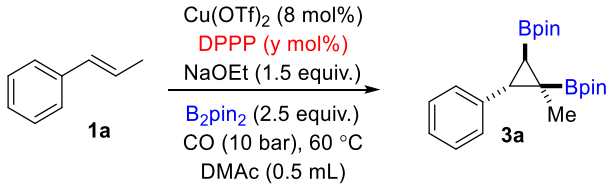
Table S3 Screening of the amount of Catalysis[a]



Entry	$Cu(OTf)_2$ (mol%)	Yield of **3a** (%)
1	4	40
2	8	51
3	10	34

[a] Reaction conditions: *tans-β*-methylstyrene (0.2 mmol), B_2pin_2 (2.5 equiv.), $Cu(OTf)_2$ (x mol%), DPPP (x mol%), NaOEt (1.5 equiv.), CO (10 bar), DMAc (0.4 M), stirred at 60 ºC for 24 h. Yields are determined by GC with hexadecane as an internal standard.

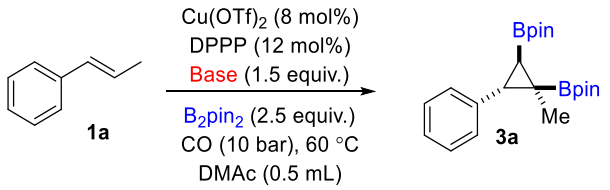
Table S4 Screening of the amount of Ligand[a]



Entry	Dppp (mol%)	Yield of **3a** (%)
1	8	51
2	12	55
3	16	47
4	20	41

[a] Reaction conditions: *tans-β*-methylstyrene (0.2 mmol), B_2pin_2 (2.5 equiv.), $Cu(OTf)_2$ (8 mol%), DPPP (y mol%), NaOEt (1.5 equiv.), CO (10 bar), DMAc (0.4 M), stirred at 60 °C for 22 h. Yields are determined by GC with hexadecane as an internal standard.

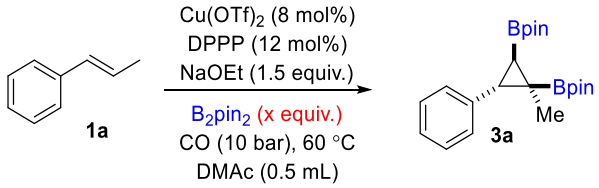
Table S5 Screening of Base[a]



Entry	Solvent	Yield of **3a** (%)
1	NaO^tBu	14
2	NaOMe	6
3	NaOPh	/
4	KO^tBu	10
5	LiO^tBu	6
6	NaO^iPr	/
7	Cs_2CO_3	50
8	Na_2CO_3	/
9	Cs(OAc)	Trace
10	K_2CO_3	5
11	K_3PO_4	25
12	KOH	9
13	NEt_3	/
14	DIPEA	/
15	NaOEt	55

[a] Reaction conditions: *tans-β*-methylstyrene (0.2 mmol), B_2pin_2 (2.5 equiv.), $Cu(OTf)_2$ (8 mol%), DPPP (12 mol%), Base (1.5 equiv.), CO (10 bar), DMAc (0.4 M), stirred at 60 °C for 22 h. Yields are determined by GC with hexadecane as an internal standard.

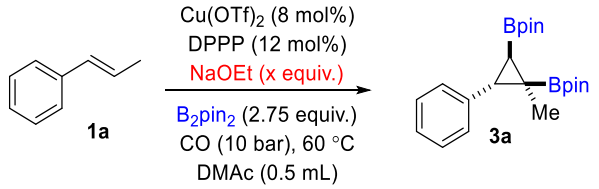
Table S6 Screening of the amount of B_2pin_2[a]



Entry	B_2pin_2	Yield of **3a** (%)
1	1.5	33
2	2.0	46
3	2.2	45
4	2.5	55
5	2.75	63
6	3.0	60
7	3.5	60

[a] Reaction conditions: *tans-β*-methylstyrene (0.2 mmol), B_2pin_2 (2.5 equiv.), $Cu(OTf)_2$ (8 mol%), DPPP (12 mol%), NaOEt (1.5 equiv.), CO (10 bar), DMAc (0.4 M), stirred at 60 ºC for 22 h. Yields are determined by GC with hexadecane as an internal standard.

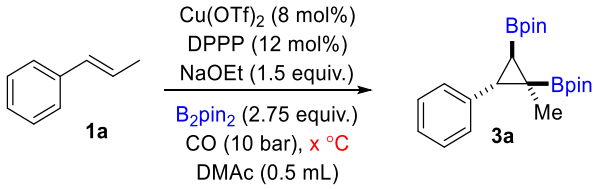
Table S7 Screening of the amount of Base[a]



Entry	NaOEt	Yield of **3a** (%)
1	1.3	60
2	1.5	63
3	1.7	58
4	2.0	56
5	2.5	53

[a] Reaction conditions: *tans-β*-methylstyrene (0.2 mmol), B_2pin_2 (2.5 equiv.), $Cu(OTf)_2$ (8 mol%), DPPP (12 mol%), NaOEt (1.5 equiv.), CO (10 bar), DMAc (0.4 M), stirred at 60 ºC for 22 h. Yields are determined by GC with hexadecane as an internal standard.

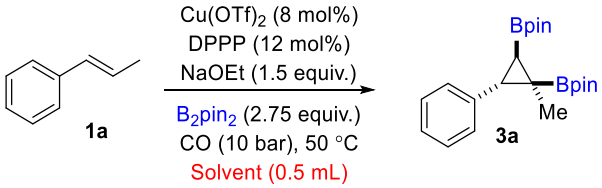
Table S8 Screening of Temperature[a]



Entry	Temperature	Yield of **3a** (%)
1	40	45
2	50	74 (61[b])
3	60	63
4	70	57

[a] Reaction conditions: *tans-β*-methylstyrene (0.2 mmol), B_2pin_2 (2.5 equiv.), $Cu(OTf)_2$ (8 mol%), DPPP (12 mol%), NaOEt (1.5 equiv.), CO (10 bar), DMAc (0.4 M), stirred at 60 ºC for 22 h. Yields are determined by GC with hexadecane as an internal standard. [b] Isolated yield.

Table S9 Screening of Solvent[a]



Entry	Solvent	Yield of **3a** (%)
1	DMF	35
2	DMSO	23
3	NMP	34
4	THF	16
5	Toluene	34
6	MeCN	29
7	Cyclohexane	25

[a] Reaction conditions: *tans-β*-methylstyrene (0.2 mmol), B_2pin_2 (2.5 equiv.), $Cu(OTf)_2$ (8 mol%), DPPP (12 mol%), NaOEt (1.5 equiv.), CO (10 bar), DMAc (0.4 M), stirred at 60 ºC for 22 h. Yields are determined by GC with hexadecane as an internal standard.

3.1.2 Optimization reaction condition for 4a.

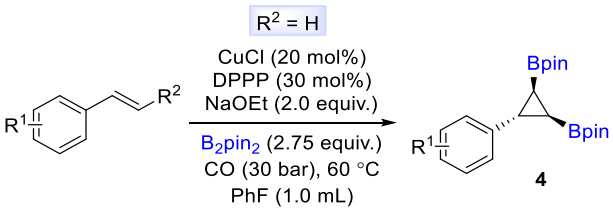
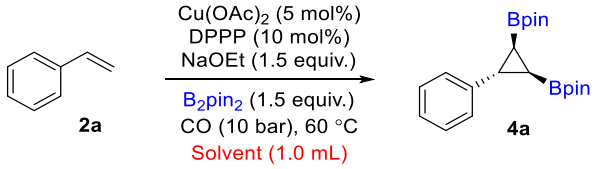


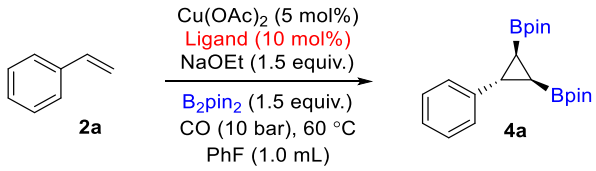
Table S10 Screening of Solvent[a]



Entry	Solvent	Yield of **4a** (%)
1	Cycloheptane	2
2	PhCl	15
3	PhF	18
4	PhOMe	4
5	MeCN	8
6	THF	8
7	1,4-Dioxane	13
8	DMAc	3
9	Toluene	7
10	Et_2O	14
11	$PhCF_3$	13
12	General procedure A	Trace

[a] Reaction conditions: styrene (0.2 mmol), B_2pin_2 (1.5 equiv.), $Cu(OAc)_2$ (5 mol%), DPPP (10 mol%), NaOEt (1.5 equiv.), CO (10 bar), solvent (1 mL), stirred at 60 ºC for 24 h. Yields are determined by GC with hexadecane as an internal standard.

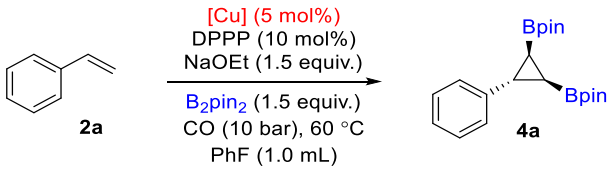
Table S11 Screening of Ligand[a]



Entry	Ligand	Yield of **4a** (%)
1	DPEphos	-
2	Xantphos	-
3	BINAP	4
4	BIPHEphos	5
5	$BuPAd_2$	3
6	DPPE	6
7	DPPB	2
8	DPPPE	3
9	DPPBz	2
10	DPPF	2
11	DPPM	-
12	2,2′-Bipyridine	2
13	DPPP	18

[a] Reaction conditions: styrene (0.2 mmol), B_2pin_2 (1.5 equiv.), $Cu(OAc)_2$ (5 mol%), Ligand (10 mol%), NaOEt (1.5 equiv.), CO (10 bar), PhF (1 mL), stirred at 60 ºC for 24 h. Yields are determined by GC with hexadecane as an internal standard.

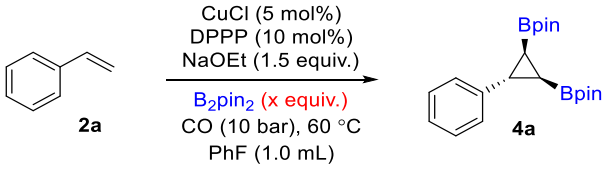
Table S12 Screening of Catalysis[a]



Entry	[Cu]	Yield of **4a** (%)
1	$Cu(OAc)_2$	18
2	$CuCl_2$	13
3	CuCl	21
4	$Cu(acac)_2$	12
5	^{i}MesCuCl	6
6	CuI	10
7	CuBr	8
8	CuCN	-
9	$Cu(OTf)_2$	4

[a] Reaction conditions: styrene (0.2 mmol), B_2pin_2 (1.5 equiv.), [Cu] (5 mol%), DPPP (10 mol%), NaOEt (1.5 equiv.), CO (10 bar), PhF (1 mL), stirred at 60 ºC for 24 h. Yields are determined by GC with hexadecane as an internal standard.

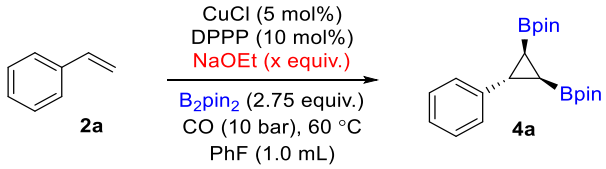
Table S13 Screening of the amount of B_2pin_2[a]



Entry	B_2pin_2 (x equiv.)	Yield of **4a** (%)
1	1.5	21
2	2.0	20
3	2.5	23
4	2.75	25
5	3.0	22

[a] Reaction conditions: styrene (0.2 mmol), B_2pin_2 (x equiv.), CuCl (5 mol%), DPPP (10 mol%), NaOEt (1.5 equiv.), CO (10 bar), PhF (1 mL), stirred at 60 ºC for 24 h. Yields are determined by GC with hexadecane as an internal standard.

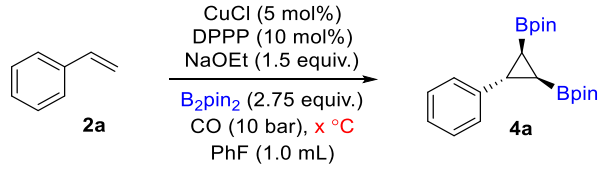
Table S14 Screening of the amount of Base[a]



Entry	Base (x equiv.)	Yield of **4a** (%)
1	1.5	25
2	2.0	29
3	2.5	27
4	3.0	24

[a] Reaction conditions: styrene (0.2 mmol), B_2pin_2 (x equiv.), CuCl (5 mol%), DPPP (10 mol%), NaOEt (1.5 equiv.), CO (10 bar), PhF (1 mL), stirred at 60 ºC for 24 h. Yields are determined by GC with hexadecane as an internal standard.

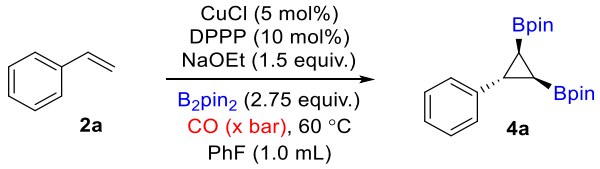
Table S15 Screening of Temperature[a]



Entry	Temperature (ºC)	Yield of **4a** (%)
1	40	13
2	50	18
3	60	29
4	80	12
5	100	6

[a] Reaction conditions: styrene (0.2 mmol), B_2pin_2 (1.5 equiv.), [Cu] (5 mol%), DPPP (10 mol%), NaOEt (1.5 equiv.), CO (10 bar), PhF (1 mL), stirred at 60 ºC for 24 h. Yields are determined by GC with hexadecane as an internal standard.

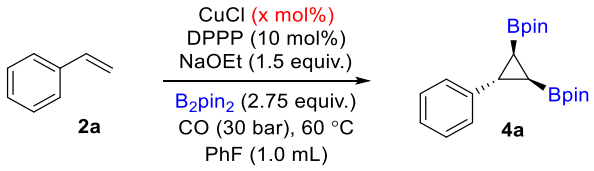
Table S16 Screening of CO pressure[a]



Entry	CO (bar)	Yield of **4a** (%)
1	10	29
2	20	38
3	30	49
4	40	44

[a] Reaction conditions: styrene (0.2 mmol), B_2pin_2 (1.5 equiv.), CuCl (10 mol%), DPPP (10 mol%), NaOEt (1.5 equiv.), CO, PhF (1 mL), stirred at 60 ºC for 16 h. Yields are determined by GC with hexadecane as an internal standard.

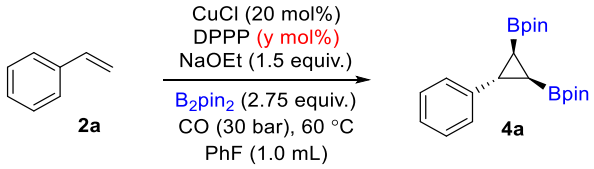
Table S17 Screening of the amount of Catalysis[a]



Entry	CuCl (x mol%)	Yield of **4a** (%)
1	10	49
2	20	53
3	30	43
4	40	25

[a] Reaction conditions: styrene (0.2 mmol), B_2pin_2 (1.5 equiv.), CuCl (x mol%), DPPP (10 mol%), NaOEt (1.5 equiv.), CO (10 bar), PhF (1 mL), stirred at 60 ºC for 24 h. Yields are determined by GC with hexadecane as an internal standard.

Table S18 Screening of the amount of Ligand[a]



Entry	DPPP (y mol%)	Yield of **4a** (%)
1	20	52
2	25	54
3	30	64 (55%[b])
4	35	57
5	40	39

[a] Reaction conditions: styrene (0.2 mmol), B_2pin_2 (1.5 equiv.), CuCl (x mol%), DPPP (10 mol%), NaOEt (1.5 equiv.), CO (10 bar), PhF (1 mL), stirred at 60 ºC for 24 h. Yields are determined by GC with hexadecane as an internal standard. [b] Isolated yield.

3.2 General Procedures for preparing alkenes.

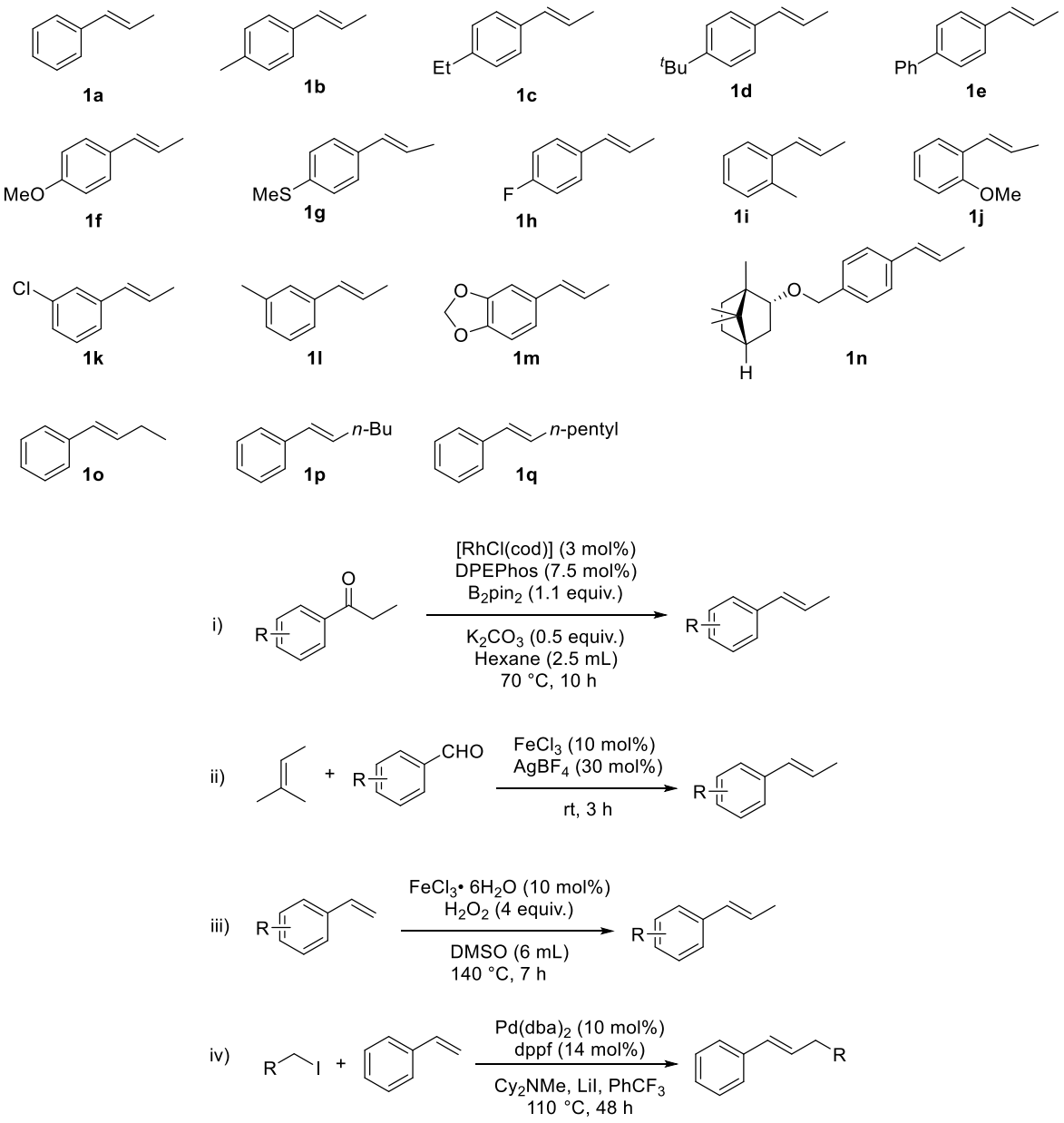


Figure 1. Preparation of substrates

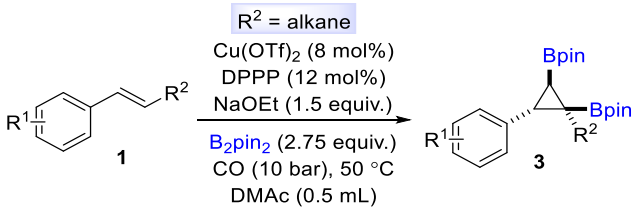
Substrates**1a-1f, 1h, 1k, 1m, 1o** were prepared according to the reported literature (Figure 1, i).[1]

Substrates **1g, 1i, 1j and 1l** were prepared according to the reported literature (Figure 1, ii).[2]

Substrate **1n** was prepared according to the known peocedure. (Figure 1, iii).[3]

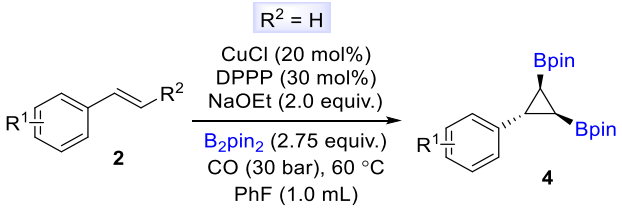
Substrates **1p** and **1q** were prepared according to the reported literature (Figure 1, iv).[4]

3.3 General Procedures A



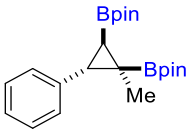
A dried 4 mL screw-cap vial equipped with a septum and a stirring bar was charged with $Cu(OTf)_2$ (5.8 mg, 8 mol%), DPPP (9.9 mg, 12 mol%), B_2pin_2 (140 mg, 2.75 equiv.) and NaOEt (20.4 mg, 1.5 equiv). The vial was sealed, connected to atmosphere with a small cannula, evacuated, and backfilled with argon three times. DMAc (0.5 mL) were added *via* syringe. To this suspension, internal olefins **1** (0.2 mmol) was added *via* Hamilton® syringe. Then the vial was placed on an alloy plate and transferred into a 300 mL stovetop autoclave (4560 series from Parr instrument company®). The autoclave was flushed one time with nitrogen (<10 bar) and three times with CO (<10 bar). The autoclave was then charged with CO (10 bar). The autoclave was then placed into an aluminum block on a magnetic stirrer. The reaction mixture was stirred (600 rpm) for 24 h at 50 °C. Then it was cooled to room temperature and the pressure was released carefully. The reaction purified by gradient column chromatography to yield product **3**.

3.4 General Procedures B



A dried 4 mL screw-cap vial equipped with a septum and a stirring bar was charged with CuCl (4.0 mg, 20 mol%), DPPP (24.7 mg, 30 mol%), B_2pin_2 (140 mg, 2.75 equiv.) and NaOEt (20.4 mg, 2.0 equiv.). The vial was sealed, connected to atmosphere with a small cannula, evacuated, and backfilled with argon three times. PhF (1.0 mL) were added *via* syringe. To this suspension, terminal olefine **2** (0.2 mmol) was added *via* Hamilton® syringe. Then the vial was placed on an alloy plate and transferred into a 300 mL stovetop autoclave (4560 series from Parr instrument company®). The autoclave was flushed one time with nitrogen (<10 bar) and three times with CO (<10 bar). The autoclave was then charged with CO (30 bar). The autoclave was then placed into an aluminum block on a magnetic stirrer. The reaction mixture was stirred (600 rpm) for 24 h at 60 °C. Then it was cooled to room temperature and the pressure was released carefully. The reaction purified by gradient column chromatography to yield product **4**.

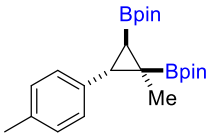
4 NMR Spectra of the Products



2,2'-(1-Methyl-3-phenylcyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (3a)

The title compound was prepared from (*E*)-prop-1-en-1-ylbenzene (23.6 mg, 0.2 mmol), according to general procedure A. The crude residue was purified by flash chromatography (pentane/EA = 50:1, Rf = 0.20) to give the product as a white solid (46.8 mg, 61%). mp: 116-118 °C.

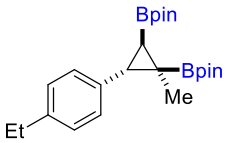
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.26 – 7.13 (m, 5H), 2.51 (d, *J* = 7.4 Hz, 1H), 1.26 (d, *J* = 3.2 Hz, 24H), 0.81 (s, 3H), 0.39 (d, *J* = 7.4 Hz, 1H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 139.2, 129.4, 127.6, 125.7, 83.2, 83.1, 31.7, 25.0, 24.9, 24.8, 24.6, 17.4. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 32.6. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{22}H_{34}{}^{10}B^{11}BO_4$ 406.2579, found: 406.2584.



2,2'-(1-Methyl-3-(*p*-tolyl)cyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (3b)

The title compound was prepared from (*E*)-1-methyl-4-(prop-1-en-1-yl)benzene (26.4 mg, 0.2 mmol), according to general procedure A. The crude residue was purified by flash chromatography (pentane/EA = 50:1, Rf = 0.20) to give the product as a colorless oil (45.4 mg, 57%).

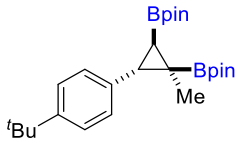
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.07 (t, *J* = 3.1 Hz, 4H), 2.47 (d, *J* = 7.4 Hz, 1H), 2.30 (s, 3H), 1.26 (d, *J* = 3.6 Hz, 24H), 0.80 (s, 3H), 0.35 (d, *J* = 7.4 Hz, 1H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 136.1, 135.1, 129.3, 128.3, 83.2, 83.1, 31.4, 25.1, 25.0, 24.8, 24.7, 21.0, 17.5. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 32.5. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{23}H_{36}{}^{10}B^{11}BO_4$ 420.2735, found: 420.2740.



2,2'-(3-(4-Ethylphenyl)-1-methylcyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (3c)

The title compound was prepared from (*E*)-1-ethyl-4-(prop-1-en-1-yl)benzene (29.2 mg, 0.2 mmol), according to general procedure A. The crude residue was purified by flash chromatography (pentane/EA = 50:1, Rf = 0.20) to give the product as a colorless oil (43 mg, 53%).

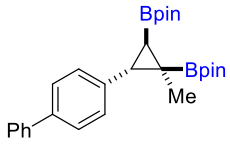
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.13 – 7.05 (m, 4H), 2.59 (t, *J* = 7.6 Hz, 2H), 2.48 (d, *J* = 7.4 Hz, 1H), 1.27 – 1.24 (m, 24H), 1.20 (d, *J* = 7.6 Hz, 3H), 0.81 (s, 3H), 0.36 (d, *J* = 7.4 Hz, 1H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 141.5, 136.3, 129.3, 127.1, 83.2, 83.1, 31.5, 28.4, 25.0, 24.9, 24.7, 24.6, 17.4, 15.6. **^{11}B NMR (128 MHz, $CDCl_3$)** δ 32.4. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{24}H_{38}{}^{10}B^{11}BO_4$ 434.2892, found: 434.2895.



2,2'-(3-(4-(*tert*-Butyl)phenyl)-1-methylcyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (3d)

The title compound was prepared from (*E*)-1-(*tert*-butyl)-4-(prop-1-en-1-yl)benzene (34.8 mg, 0.2 mmol), according to general procedure A. The crude residue was purified by flash chromatography (pentane/EA = 50:1, Rf = 0.20) to give the product as a colorless oil (40.5 mg, 46%).

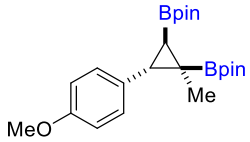
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.21 – 7.17 (m, 2H), 7.05 (d, *J* = 8.2 Hz, 2H), 2.41 (d, *J* = 7.4 Hz, 1H), 1.22 (s, 9H), 1.19 (s, 12H), 1.18 (d, *J* = 3.4 Hz, 12H), 0.77 (s, 3H), 0.30 (d, *J* = 7.4 Hz, 1H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 148.4, 136.1, 128.9, 124.5, 83.2, 83.1, 34.3, 31.5, 31.4, 25.1, 25.0, 24.8, 24.7, 17.4. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 32.4. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{26}H_{42}{}^{10}B^{11}BO_4$ 462.3205, found: 462.3209.



2,2'-(3-([1,1'-Biphenyl]-4-yl)-1-methylcyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (3e)

The title compound was prepared from (*E*)-4-(prop-1-en-1-yl)-1,1'-biphenyl (38.8 mg, 0.2 mmol), according to general procedure A. The crude residue was purified by flash chromatography (pentane/EA = 50:1, Rf = 0.20) to give the product as a colorless oil (45.1 mg, 49%).

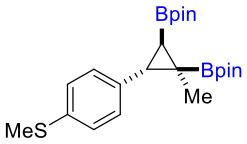
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.60 – 7.56 (m, 2H), 7.52 – 7.47 (m, 2H), 7.44 – 7.39 (m, 2H), 7.33 – 7.27 (m, 2H), 7.25 (d, *J* = 0.7 Hz, 1H), 2.55 (d, *J* = 7.4 Hz, 1H), 1.29 – 1.26 (m, 24H), 0.86 (s, 3H), 0.43 (d, *J* = 7.4 Hz, 1H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 141.1, 138.5, 138.5, 129.8, 128.6, 126.9, 126.9, 126.3, 83.3, 83.2, 31.5, 25.0, 25.0, 24.8, 24.6, 17.5. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 32.9. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{28}H_{38}{}^{10}B^{11}BO_4$ 482.2892, found: 482.2894.



2,2'-(3-(4-Methoxyphenyl)-1-methylcyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (3f)

The title compound was prepared from (*E*)-1-methoxy-4-(prop-1-en-1-yl)benzene (29.6 mg, 0.2 mmol), according to general procedure A. The crude residue was purified by flash chromatography (pentane/EA = 20:1, Rf = 0.20) to give the product as a colorless oil (40.5 mg, 49%).

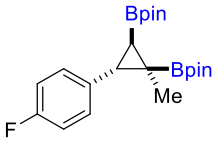
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.13 – 7.09 (m, 2H), 6.81 – 6.76 (m, 2H), 3.78 (s, 3H), 2.45 (d, *J* = 7.4 Hz, 1H), 1.26 (d, *J* = 2.4 Hz, 24H), 0.79 (s, 3H), 0.30 (d, *J* = 7.4 Hz, 1H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 157.7, 131.3, 130.4, 113.1, 83.2, 83.2, 55.2, 31.0, 25.1, 25.0, 24.8, 24.6, 17.5. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 32.5. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{23}H_{36}{}^{10}B^{11}BO_5$ 436.2684, found: 436.2691.



2,2'-(1-Methyl-3-(4-(methylthio)phenyl)cyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (3g)

The title compound was prepared from (*E*)-methyl(4-(prop-1-en-1-yl)phenyl)sulfane (32.8 mg, 0.2 mmol), according to general procedure A. The crude residue was purified by flash chromatography (pentane/EA = 30:1, Rf = 0.20) to give the product as a colorless oil (37.8 mg, 44%).

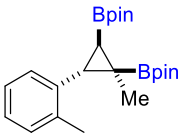
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.15 (dd, *J* = 8.7, 6.4 Hz, 4H), 2.45 (d, *J* = 7.4 Hz, 1H), 2.45 (s, 3H), 1.26 – 1.25 (m, 24H), 0.79 (s, 3H), 0.34 (d, *J* = 7.4 Hz, 1H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 136.5, 135.1, 130.0, 126.4, 83.3, 83.2, 31.3, 25.0, 25.0, 24.8, 24.6, 17.5, 16.3. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 31.26. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{23}H_{36}{}^{10}B^{11}BO_4S$ 452.2456, found: 452.2456.



2,2'-(3-(4-Fluorophenyl)-1-methylcyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2 dioxaborolane) (3h)

The title compound was prepared from (*E*)-1-fluoro-4-(prop-1-en-1-yl)benzene (27.2 mg, 0.2 mmol), according to general procedure A. The crude residue was purified by flash chromatography (pentane/EA = 50:1, Rf = 0.20) to give the product as a colorless oil (43.4 mg, 54%).

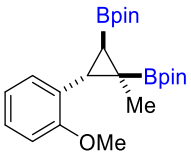
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.16 – 7.11 (m, 2H), 6.95 – 6.89 (m, 2H), 2.45 (d, *J* = 7.4 Hz, 1H), 1.26 (d, *J* = 1.4 Hz, 24H), 0.77 (s, 3H), 0.31 (d, *J* = 7.4 Hz, 1H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 161.3 (d, *J* = 243.3 Hz), 134.9 (d, *J* = 3.0 Hz), 130.8 (d, *J* = 7.8 Hz), 114.4 (d, *J* = 21.1 Hz), 83.3, 83.2, 30.9, 25.0, 25.0, 24.8, 24.6, 17.5. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 33.4. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{22}H_{33}{}^{10}B^{11}BO_4F$ 424.2485, found: 424.2483.



2,2'-(1-Methyl-3-(m-tolyl)cyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (3i)

The title compound was prepared from (*E*)-1-methyl-3-(prop-1-en-1-yl)benzene (26.4 mg, 0.2 mmol), according to general procedure A. The crude residue was purified by flash chromatography (pentane/EA = 50:1, Rf = 0.20) to give the product as a white solid (42.9 mg, 54%). mp: 88-90 °C.

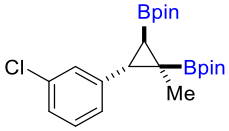
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.13 (td, *J* = 7.3, 1.1 Hz, 1H), 7.03 – 6.93 (m, 3H), 2.48 (d, *J* = 7.4 Hz, 1H), 2.31 (s, 3H), 1.28 – 1.24 (m, 24H), 0.81 (s, 3H), 0.38 (d, *J* = 7.4 Hz, 1H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 139.1, 137.1, 130.2, 127.5, 126.5, 126.5, 83.2, 83.2, 31.7, 25.1, 25.0, 24.8, 24.7, 21.4, 17.4. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 32.2. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{23}H_{36}{}^{10}B^{11}BO_4$ 420.2735, found: 420.2737.



2,2'-(3-(2-Methoxyphenyl)-1-methylcyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (3j)

The title compound was prepared from (*E*)-1-methoxy-2-(prop-1-en-1-yl)benzene (29.6 mg, 0.2 mmol), according to general procedure A. The crude residue was purified by flash chromatography (pentane/EA = 50:1, Rf = 0.20) to give the product as a colorless oil (33.1 mg, 40%).

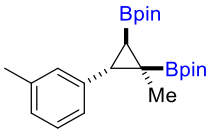
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.18 – 7.12 (m, 1H), 7.03 (dd, *J* = 7.4, 0.9 Hz, 1H), 6.86 – 6.78 (m, 2H), 3.79 (s, 3H), 2.46 (d, *J* = 7.9 Hz, 1H), 1.27 – 1.26 (m, 24H), 0.70 (s, 3H), 0.33 (d, *J* = 7.9 Hz, 1H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 159.4, 129.6, 128.3, 126.9, 119.6, 109.8, 83.5, 83.1, 55.4, 28.0, 25.0, 25.0, 24.9, 24.4, 17.3. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 30.4. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{23}H_{36}{}^{10}B^{11}BO_5$ 436.2684, found: 436.2692.



2,2'-(3-(3-Chlorophenyl)-1-methylcyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (3k)

The title compound was prepared from (*E*)-1-chloro-3-(prop-1-en-1-yl)benzene (30.4 mg, 0.2 mmol), according to general procedure A. The crude residue was purified by flash chromatography (pentane/EA = 50:1, Rf = 0.20) to give the product as a colorless oil (35.1 mg, 42%).

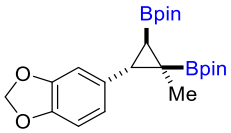
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.19 – 7.17 (m, 1H), 7.17 – 7.09 (m, 2H), 7.09 – 7.05 (m, 1H), 2.46 (d, *J* = 7.4 Hz, 1H), 1.26 (d, *J* = 2.5 Hz, 24H), 0.80 (s, 3H), 0.36 (d, *J* = 7.4 Hz, 1H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 141.6, 129.5, 128.8, 127.7, 126.0, 125.9, 83.4, 83.3, 31.3, 25.0, 25.0, 24.8, 24.6, 17.5. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 32.8. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{22}H_{33}{}^{10}B_2ClO_4$ 439.2223, found: 439.2216.



2,2'-(1-Methyl-3-(*o*-tolyl)cyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (3l)

The title compound was prepared from (*E*)-1-methyl-2-(prop-1-en-1-yl)benzene (26.4 mg, 0.2 mmol), according to general procedure A. The crude residue was purified by flash chromatography (pentane/EA = 50:1, Rf = 0.20) to give the product as a colorless oil (42.9 mg, 54%).

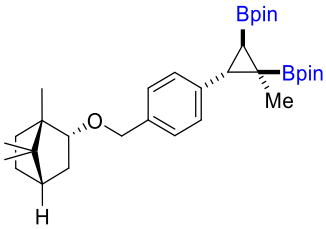
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.14 – 7.06 (m, 4H), 2.36 (d, *J* = 7.7 Hz, 1H), 2.31 (s, 3H), 1.27 (s, 12H), 1.26 (d, *J* = 3.1 Hz, 12H), 0.69 (s, 3H), 0.42 (d, *J* = 7.7 Hz, 1H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 138.6, 137.8, 129.1, 128.9, 125.9, 125.1, 83.2, 83.1, 31.0, 25.1, 25.0, 24.9, 24.5, 19.5, 17.2. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 32.8. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{23}H_{36}{}^{10}B^{11}BO_4$ 420.2735, found: 420.2733.



2,2'-(3-(Benzo[*d*][1,3]dioxol-5-yl)-1-methylcyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (3m)

The title compound was prepared from (*E*)-5-(prop-1-en-1-yl)benzo[*d*][1,3]dioxole (32.4 mg, 0.2 mmol), according to general procedure A. The crude residue was purified by flash chromatography (pentane/EA = 20:1, Rf = 0.20) to give the product as a white solid (46.2 mg, 54%). mp: 120-122 °C.

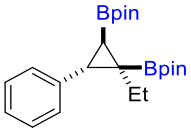
^{1}H NMR (300 MHz, $CDCl_3$) δ 6.71 – 6.67 (m, 2H), 6.64 (ddd, *J* = 8.2, 1.5, 0.7 Hz, 1H), 5.92 – 5.88 (m, 2H), 2.42 (d, *J* = 7.4 Hz, 1H), 1.26 (s, 24H), 0.80 (s, 3H), 0.27 (d, *J* = 7.4 Hz, 1H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 147.1, 145.6, 133.2, 122.4, 110.1, 107.5, 100.7, 83.2, 83.2, 31.5, 25.0, 25.0, 24.8, 24.6, 17.5. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 32.4. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{23}H_{34}{}^{10}B^{11}BO_6$ 450.2477, found: 450.2483.



2,2'-(1-Methyl-3-(4-((((1S,2R,4S)-1,7,7-trimethylbicyclo[2.2.1]heptan-2-yl)oxy)methyl)phenyl)cyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (3n)

The title compound was prepared from (1*S*,2*R*,4*S*)-1,7,7-trimethyl-2-((4-vinylbenzyl)oxy)bicyclo[2.2.1]heptane (54.0 mg, 0.2 mmol), according to general procedure A. The crude residue was purified by flash chromatography (pentane/EA = 50:1, Rf = 0.20) to give the product as a colorless oil (37.4 mg, 34%).

^{1}H NMR (300 MHz, $CDCl_3$) δ 7.23 – 7.13 (m, 4H), 4.56 – 4.38 (m, 2H), 3.66 (d, *J* = 9.4 Hz, 1H), 2.50 (d, *J* = 7.4 Hz, 1H), 2.15 – 2.04 (m, 2H), 1.66 (dt, *J* = 21.1, 3.9 Hz, 4H), 1.26 (d, *J* = 3.1 Hz, 24H), 0.87 (d, *J* = 1.0 Hz, 3H), 0.84 – 0.80 (m, 9H), 0.38 (d, *J* = 7.4 Hz, 1H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 138.1, 136.9, 129.3, 126.7, 84.1, 83.2, 83.2, 71.5, 49.3, 47.8, 45.1, 36.1, 31.6, 28.3, 26.8, 25.1, 25.0, 24.8, 24.6, 19.8, 18.9, 17.5, 14.0. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 32.7. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{33}H_{52}{}^{10}B^{11}BO_5$ 572.3937, found: 572.3947.

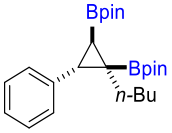


2,2'-(1-Ethyl-3-phenylcyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (3o)

The title compound was prepared from (*E*)-but-1-en-1-ylbenzene (26.4 mg, 0.2 mmol), according to general procedure A. The crude residue was purified by flash chromatography (pentane/EA = 50:1, Rf = 0.20) to give the product as a white solid (39.0 mg, 49%). mp: 85-87 °C.

^{1}H NMR (300 MHz, $CDCl_3$) δ 7.23 (d, *J* = 4.4 Hz, 4H), 7.14 (ddd, *J* = 8.1, 4.9, 3.6 Hz, 1H), 2.56 (d, *J* = 7.4 Hz, 1H), 1.28 (s, 12H), 1.25 (d, *J* = 3.9 Hz, 12H), 1.19 – 1.02 (m, 2H), 0.72 (t, *J* = 7.3 Hz, 3H), 0.43 (d, *J* = 7.4 Hz, 1H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 139.3, 129.3, 127.5, 125.6, 83.1, 83.1, 31.9, 25.6, 25.1, 25.0, 24.8, 24.6, 13.1.

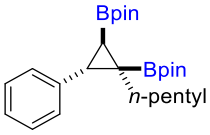
^{11}B NMR (96 MHz, $CDCl_3$) δ 32.5. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{23}H_{36}{}^{10}B^{11}BO_4$ 420.2735, found: 420.2731.



2,2'-(1-Butyl-3-phenylcyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (3p)

The title compound was prepared from (*E*)-hex-1-en-1-ylbenzene (32 mg, 0.2 mmol), according to general procedure A. The crude residue was purified by flash chromatography (pentane/EA = 50:1, Rf = 0.20) to give the product as a colorless oil (41.7 mg, 49%).

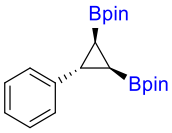
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.22 (d, *J* = 4.3 Hz, 4H), 7.17 – 7.12 (m, 1H), 2.53 (d, *J* = 7.4 Hz, 1H), 1.28 (s, 12H), 1.25 (d, *J* = 4.1 Hz, 12H), 1.06 (m, 6H), 0.65 (t, *J* = 7.2 Hz, 3H), 0.43 (d, *J* = 7.4 Hz, 1H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 139.3, 129.3, 127.5, 125.6, 83.1, 32.2, 31.8, 31.0, 25.2, 25.0, 24.9, 24.6, 22.8, 13.9. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 33.0.



2,2'-(1-Pentyl-3-phenylcyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (3q)

The title compound was prepared from (*E*)-hept-1-en-1-ylbenzene (34.8 mg, 0.2 mmol), according to general procedure A. The crude residue was purified by flash chromatography (pentane/EA = 50:1, Rf = 0.20) to give the product as a colorless oil (36.1 mg, 41%).

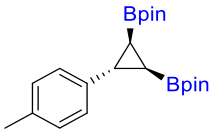
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.22 (d, *J* = 4.2 Hz, 4H), 7.17 – 7.11 (m, 1H), 2.53 (d, *J* = 7.4 Hz, 1H), 1.27 (s, 12H), 1.25 (d, *J* = 4.2 Hz, 12H), 1.13 – 0.84 (m, 8H), 0.75 – 0.66 (m, 3H), 0.43 (d, *J* = 7.4 Hz, 1H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 139.3, 129.3, 127.5, 125.5, 83.1, 83.1, 32.5, 32.0, 31.7, 28.3, 25.2, 25.0, 24.9, 24.6, 22.3, 13.9. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 33.1. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{26}H_{42}{}^{10}B^{11}BO_4$ 462.3205, found: 462.3211.



2,2'-(3-Phenylcyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (4a)

The title compound was prepared from styrene (20.8 mg, 0.2 mmol), according to general procedure B. The crude residue was purified by flash chromatography (pentane/EA = 50:1, Rf = 0.20) to give the product as a white solid (40.7 mg, 55%). mp: 124-126 °C.

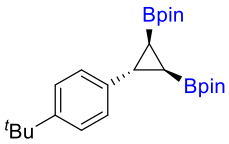
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.25 – 7.20 (m, 2H), 7.11 (td, *J* = 6.8, 1.5 Hz, 3H), 2.27 (t, *J* = 6.4 Hz, 1H), 1.26 (s, 24H), 0.58 (d, *J* = 6.4 Hz, 2H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 143.7, 128.2, 125.5, 125.5, 83.3, 25.9, 25.0, 24.8. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 31.98. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{21}H_{32}{}^{10}B^{11}BO_4$ 392.2422, found: 392.2425.



2,2'-(3-(*p*-Tolyl)cyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (4b)

The title compound was prepared from 1-methyl-4-vinylbenzene (23.6 mg, 0.2 mmol), according to general procedure B. The crude residue was purified by flash chromatography (pentane/EA = 50:1, Rf = 0.20) to give the product as a colorless oil (33.0 mg, 43%).

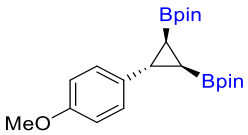
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.05 – 6.98 (m, 4H), 2.28 (s, 3H), 2.24 (t, *J* = 6.4 Hz, 1H), 1.25 (s, 24H), 0.54 (d, *J* = 6.4 Hz, 2H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 140.6, 135.0, 128.8, 125.4, 83.2, 25.6, 25.0, 24.7, 20.9. **^{11}B NMR (128 MHz, $CDCl_3$)** δ 32.3. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{22}H_{34}{}^{10}B^{11}BO_4$ 406.2579, found: 406.2576.



2,2'-(3-(4-(*tert*-Butyl)phenyl)cyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (4c)

The title compound was prepared from 1-(*tert*-butyl)-4-vinylbenzene (32 mg, 0.2 mmol), according to general procedure B. The crude residue was purified by flash chromatography (pentane/EA = 50:1, Rf = 0.20) to give the product as a colorless oil (45 mg, 53%).

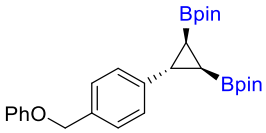
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.26 (s, 2H), 7.04 (d, *J* = 8.3 Hz, 2H), 2.26 (t, *J* = 6.4 Hz, 1H), 1.28 (s, 9H), 1.25 (s, 24H), 0.57 (d, *J* = 6.4 Hz, 2H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 148.4, 140.7, 125.1, 125.0, 83.2, 34.3, 31.4, 25.6, 25.0, 24.7. **^{11}B NMR (128 MHz, $CDCl_3$)** δ 31.9. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{25}H_{40}{}^{10}B^{11}BO_4$ 448.3048, found: 448.3053.



2,2'-(3-(4-Methoxyphenyl)cyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (4d)

The title compound was prepared from 1-methoxy-4-vinylbenzene (26.8 mg, 0.2 mmol), according to general procedure B. The crude residue was purified by flash chromatography (pentane/EA = 50:1, Rf = 0.20) to give the product as a colorless oil (40.8 mg, 51%).

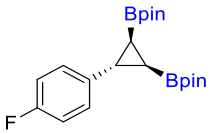
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.02 (d, *J* = 8.6 Hz, 2H), 6.78 (d, *J* = 8.8 Hz, 2H), 3.76 (s, 3H), 2.23 (t, *J* = 6.4 Hz, 1H), 1.25 (s, 24H), 0.50 (d, *J* = 6.5 Hz, 2H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 157.6, 135.7, 126.5, 113.7, 83.2, 55.3, 25.3, 25.0, 24.7. **^{11}B NMR (128 MHz, $CDCl_3$)** δ 30.3. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{22}H_{34}{}^{10}B^{11}BO_5$ 422.2527, found: 422.2532.



2,2'-(3-(4-(Phenoxymethyl)phenyl)cyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (4e)

The title compound was prepared from 1-(phenoxymethyl)-4-vinylbenzene (42 mg, 0.2 mmol), according to general procedure B. The crude residue was purified by flash chromatography (pentane/EA = 50:1, Rf = 0.20) to give the product as a white solid (44.7 mg, 47%). mp: 120-122 °C.

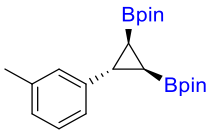
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.43 – 7.34 (m, 5H), 7.02 (d, *J* = 8.6 Hz, 2H), 6.85 (d, *J* = 8.8 Hz, 2H), 5.03 (s, 2H), 2.23 (t, *J* = 6.4 Hz, 1H), 1.25 (s, 24H), 0.50 (d, *J* = 6.4 Hz, 2H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 156.8, 137.2, 136.0, 128.5, 127.8, 127.4, 126.5, 114.7, 83.2, 70.1, 25.3, 25.0, 24.7. **^{11}B NMR (128 MHz, $CDCl_3$)** δ 30.5. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{28}H_{38}{}^{10}B^{11}BO_5$ 498.2841, found: 498.2827.



2,2'-(3-(4-Fluorophenyl)cyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (4f)

The title compound was prepared from 1-fluoro-4-vinylbenzene (24.4 mg, 0.2 mmol), according to general procedure B. The crude residue was purified by flash chromatography (pentane/EA = 50:1, Rf = 0.20) to give the product as a white solid (44.2 mg, 57%). mp: 108-110 °C.

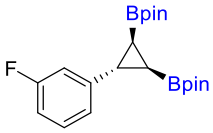
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.06 – 7.01 (m, 2H), 6.92 (d, *J* = 8.8 Hz, 2H), 2.24 (t, *J* = 6.4 Hz, 1H), 1.26 (s, 24H), 0.51 (d, *J* = 6.4 Hz, 2H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 157.8 (d, *J* = 258.1 Hz), 139.2 (d, *J* = 2.7 Hz), 126.9 (d, *J* = 7.9 Hz), 114.9 (d, *J* = 21.3 Hz), 83.3, 25.2, 25.0, 24.7. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 32.1. **^{19}F NMR (282 MHz, $CDCl_3$)** δ -118.09. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{21}H_{31}{}^{10}B_2O_4F$ 409.2362, found: 409.2366.



2,2'-(3-(*m*-Tolyl)cyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (4g)

The title compound was prepared from 1-methyl-3-vinylbenzene (23.6 mg, 0.2 mmol), according to general procedure B. The crude residue was purified by flash chromatography (pentane/EA = 50:1, Rf = 0.20) to give the product as a white solid (39.2 mg, 51%). mp: 112-114 °C.

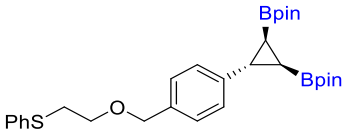
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.14 – 7.10 (m, 1H), 7.04 (s, 1H), 6.94 – 6.90 (m, 2H), 2.28 (s, 3H), 2.24 (t, *J* = 6.4 Hz, 1H), 1.25 (s, 24H), 0.57 (d, *J* = 6.4 Hz, 2H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 143.7, 137.7, 128.1, 126.5, 126.3, 122.4, 83.3, 25.9, 25.0, 24.8, 21.4. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 32.1. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{22}H_{34}{}^{10}B^{11}BO_4$ 406.2579, found: 406.2578.



2,2'-(3-(3-Fluorophenyl)cyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (4h)

The title compound was prepared from 1-fluoro-3-vinylbenzene (24.4 mg, 0.2 mmol), according to general procedure B. The crude residue was purified by flash chromatography (pentane/EA = 20:1, Rf = 0.20) to give the product as a white solid (31.1 mg, 40%). mp: 106-108 °C.

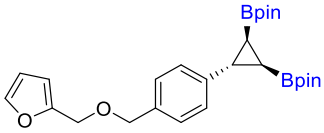
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.13 – 7.07 (m, 1H), 6.82 – 6.79 (m, 1H), 6.76 – 6.68 (m, 2H), 2.18 (t, *J* = 6.3 Hz, 1H), 1.19 (s, 24H), 0.49 (d, *J* = 6.4 Hz, 2H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 163.1 (d, *J* = 244.7 Hz), 129.5 (d, *J* = 8.5 Hz), 121.2 (d, *J* = 2.5 Hz), 112.3 (d, *J* = 23.3 Hz), 83.4, 25.6 (d, *J* = 2.0 Hz), 25.0, 24.7. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 31.9. **^{19}F NMR (282 MHz, $CDCl_3$)** δ -114.21. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{21}H_{31}{}^{10}B_2O_4F$ 409.2362, found: 409.2361.



2,2'-(3-(4-((2-(Phenylthio)ethoxy)methyl)phenyl)cyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (4i)

The title compound was prepared from phenyl(2-((4-vinylbenzyl)oxy)ethyl)sulfane (54 mg, 0.2 mmol), according to general procedure B. The crude residue was purified by flash chromatography (pentane/EA = 20:1, Rf = 0.20) to give the product as a colorless oil (60 mg, 56%).

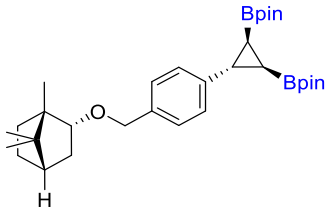
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.34 – 7.31 (m, 2H), 7.26 – 7.22 (m, 1H), 7.21 – 7.15 (m, 4H), 7.06 (d, *J* = 8.2 Hz, 2H), 4.46 (s, 2H), 3.61 (t, *J* = 6.9 Hz, 2H), 3.11 (t, *J* = 6.9 Hz, 2H), 2.27 (t, *J* = 6.4 Hz, 1H), 1.26 (s, 24H), 0.56 (d, *J* = 6.4 Hz, 2H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 143.3, 136.0, 135.1, 129.3, 128.9, 127.8, 126.1, 125.5, 83.3, 72.8, 68.3, 33.3, 25.7, 25.0, 24.7. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 32.6. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{30}H_{42}{}^{10}B_2O_5S$ 557.2908, found: 557.2911.



2,2'-(3-(4-((Furan-2-ylmethoxy)methyl)phenyl)cyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (4j)

The title compound was prepared from 2-(((4-vinylbenzyl)oxy)methyl)furan (42.8 mg, 0.2 mmol), according to general procedure B. The crude residue was purified by flash chromatography (pentane/EA = 20:1, Rf = 0.20) to give the product as a colorless oil (44.7 mg, 48%).

^{1}H NMR (300 MHz, $CDCl_3$) δ 7.41 (dd, *J* = 1.8, 0.9 Hz, 1H), 7.23 – 7.20 (m, 2H), 7.08 (d, *J* = 8.2 Hz, 2H), 6.34 (dd, *J* = 3.2, 1.8 Hz, 1H), 6.30 (dd, *J* = 3.2, 0.8 Hz, 1H), 4.49 (s, 2H), 4.41 (s, 2H), 2.27 (t, *J* = 6.4 Hz, 1H), 1.26 (s, 24H), 0.57 (d, *J* = 6.4 Hz, 2H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 151.9, 143.4, 142.8, 135.0, 128.0, 125.6, 110.2, 109.3, 83.3, 71.6, 63.3, 25.7, 25.0, 24.8. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 32.9. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{27}H_{38}{}^{10}B_2O_6$ 501.2824, found: 501.2838.

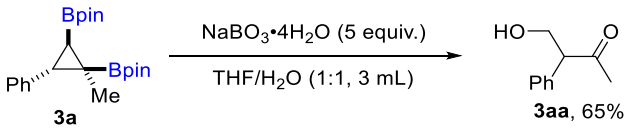


2,2'-(3-(4-((((1*S*,2*R*,4*S*)-1,7,7-Trimethylbicyclo[2.2.1]heptan-2-yl)oxy)methyl)phenyl)cyclopropane-1,2-diyl)bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolane) (4k)

The title compound was prepared from (1*S*,2*R*,4*S*)-1,7,7-trimethyl-2-((4 vinylbenzyl)oxy)bicyclo[2.2.1]heptane (54 mg, 0.2 mmol), according to general procedure B. The crude residue was purified by flash chromatography (pentane/EA = 30:1, Rf = 0.20) to give the product as a colorless oil (43.9 mg, 41%).

^{1}H NMR (300 MHz, $CDCl_3$) δ 7.19 (d, *J* = 8.1 Hz, 2H), 7.06 (d, *J* = 8.2 Hz, 2H), 4.44 (d, *J* = 28.0 Hz, 2H), 3.67 – 3.63 (m, 1H), 2.27 (t, *J* = 6.4 Hz, 1H), 2.11 – 2.05 (m, 2H), 1.66 – 1.61 (m, 2H), 1.25 (s, 24H), 1.09 (d, *J* = 1.9 Hz, 2H), 1.04 (d, *J* = 3.3 Hz, 1H), 0.87 (s, 3H), 0.84 (s, 3H), 0.81 (s, 3H), 0.57 (d, *J* = 6.4 Hz, 2H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 142.7, 136.8, 127.3, 125.4, 83.9, 83.3, 71.3, 49.3, 47.8, 45.1, 36.1, 28.3, 26.8, 25.8, 25.0, 24.8, 19.8, 18.9, 14.0. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 32.7. **HRMS (ESI-TOF):** calcd for $[M+Na]^+$ $C_{32}H_{50}{}^{10}B^{11}BO_5$ 558.3781, found: 558.3783.

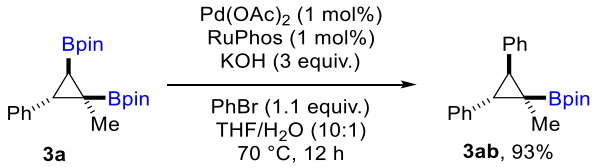
5 Derivatization of 3a



4-Hydroxy-3-phenylbutan-2-one (3aa)

The title compound was synthesized according to the following procedure[5]: To the boration product **3a** (38.4 mg, 0.1 mmol) in THF (1.5 mL) and water (1.5 mL) was added $NaBO_3 \bullet 4H_2O$ (76.5 mg. 5 equiv.). The reaction mixture was stirred vigorously for 0.5 h at room temperature. The reaction mixture was quenched with water and then extracted with EtOAc (5 mL). The combined organic layers were washed with brine (15 mL), dried over Na_2SO_4 and concentrated. The crude product was purified by column chromatography on silica gel to afford the corresponding product **3aa** as colorless oil (10.7 mg, 65%)

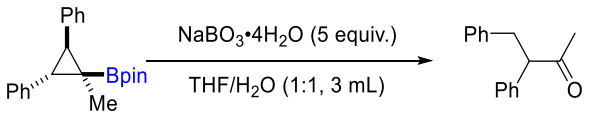
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.40 – 7.27 (m, 3H), 7.25 – 7.14 (m, 2H), 4.15 (dd, *J* = 11.3, 8.6 Hz, 1H), 3.89 (dd, *J* = 8.6, 4.7 Hz, 1H), 3.71 (dd, *J* = 11.3, 4.7 Hz, 1H), 2.09 (d, *J* = 0.24 Hz, 3H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 209.3, 135.5, 129.2, 128.6, 127.9, 64.1, 61.6, 29.5.



4,4,5,5-Tetramethyl-2-(1-methyl-2,3-diphenylcyclopropyl)-1,3,2-dioxaborolane (3ab)

The title compound was synthesized according to the following procedure[6]: A 4 mL screw-cap vial with a magnetic stir bar was charged was charged with $Pd(OAc)_2$ (0.23 mg, 1 mol%), RuPhos (0.47 mg, 1 mol %), KOH (16.8 mg, 3 equiv.), and **3a** (38.4 mg, 0.1 mmol).The vial was closed with a Teflon septum and cap and connected to the atmosphere via a needle. THF (1 mL) was added, followed by H_2O (100 µL), and bromobenzene (15.6 mg, 1 equiv.). The vial was quickly exchanged for a Teflon-lined screw cap and the reaction was stirred at 70 ºC for 12 h. At this time, the reaction was allowed to cool to room temperature and the reaction was then quenched upon addition of water (5 mL) and the mixture was extracted with EtOAc (3 mL). The combined organic was dried using Na_2SO_4 and then concentrated in vacuo. The crude product was purified by column chromatography on silica gel to afford the corresponding product **3ab** as colorless oil (31.1 mg, 93%).

^{1}H NMR (300 MHz, $CDCl_3$) δ 7.29 – 7.22 (m, 5H), 7.19 – 7.07 (m, 5H), 3.03 (d, *J* = 6.5 Hz, 1H), 2.41 (d, *J* = 6.5 Hz, 1H), 0.96 (s, 6H), 0.90 (s, 3H), 0.80 (s, 6H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 140.4, 138.9, 129.6, 129.0, 127.9, 127.8, 126.0, 125.9, 83.1, 35.9, 32.0, 24.8, 24.4, 16.8. **^{11}B NMR (96 MHz, $CDCl_3$)** δ 33.3. **HRMS (EI)** calculated for [M] $C_{22}H_{27}O_2{}^{10}B_1$ 333.2135, found: 333.2134.

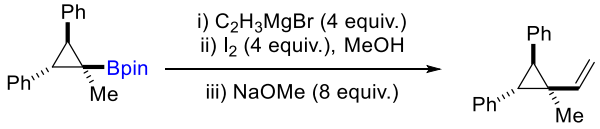


3ab **3ab-1**, 95%

3,4-Diphenylbutan-2-one (3ab-1[9])

The title compound was synthesized according to the following procedure[5]: To the boration product **3ab** (33.4 mg, 0.1 mmol) in THF (1.5 mL) and water (1.5 mL) was added $NaBO_3 \bullet 4H_2O$ (76.5 mg. 5 equiv.). The reaction mixture was stirred vigorously for 0.5 h at room temperature. The reaction mixture was quenched with water and then extracted with EtOAc (5 mL). The combined organic layers were washed with brine (15 mL), dried over Na_2SO_4 and concentrated. The crude product was purified by column chromatography on silica gel to afford the corresponding product **3ab-1** as colorless oil (21.3 mg, 95%)

^{1}H NMR (300 MHz, $CDCl_3$) δ 7.26 – 7.17 (m, 3H), 7.16 – 7.04 (m, 5H), 7.00 – 6.85 (m, 2H), 3.84 (t, *J* = 7.4 Hz, 1H), 3.35 (dd, *J* = 13.8, 7.5 Hz, 1H), 2.83 (dd, *J* = 13.8, 7.2 Hz, 1H), 1.95 (d, *J* = 0.3 Hz, 3H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 207.7, 139.7, 138.5, 129.0, 128.9, 128.4, 128.3, 127.4, 126.1, 61.6, 38.4, 29.6.

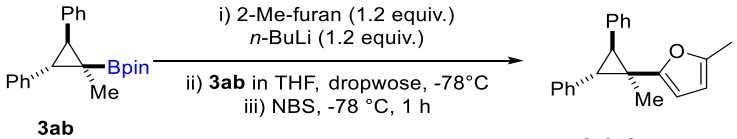


3ab **3ab-2**, 76%

(3-Methyl-3-vinylcyclopropane-1,2-diyl)dibenzene (3ab-2)

The title compound was synthesized according to the following procedure[7]: to an oven-dried round bottom flask containing a stirring bar was added a solution of **3ab** (33.4 mg, 0.1 mmol) in THF (2 mL) and subsequently vinylmagnesium bromide (1 M, 0.4 mL, 4.0 equiv.) was added dropwise. The mixture was stirred as room temperature for 30 min. To the above solution at -78 °C, I_2 (102 mg, 2.0 equiv.) in methanol (3.0 mL) was added dropwise. The reaction mixture was allowed to stir 30 min at the same temperature followed by dropwise addition of a solution of NaOMe (44 mg, 8.0 equiv.) in methanol (3 mL). After warming to room temperature, the mixture was stirred for another 1.5 h, diluted with EtOAc (10 mL) and washed sequentially with 10% aqueous solution of $Na_2S_2O_3$ (5 mL). Then, the mixture was extracted with EtOAc (10 mL), dried over Na_2SO_4, filtered and concentrated under reduced pressure. The crude product was purified by column chromatography on silica gel to afford the corresponding product **3ab-2** as colorless oil (17.8 mg, 76%).

^{1}H NMR (300 MHz, $CDCl_3$) δ 7.32 – 7.19 (m, 8H), 7.19 – 7.07 (m, 2H), 5.29 (dd, *J* = 17.2, 10.6 Hz, 1H), 4.99 (dd, *J* = 17.2, 1.5 Hz, 1H), 4.85 (dd, *J* = 10.6, 1.5 Hz, 1H), 2.70 (d, *J* = 6.9 Hz, 1H), 2.62 (d, *J* = 6.9 Hz, 1H), 1.01 (s, 3H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 142.8, 138.8, 138.3, 129.2, 129.2, 128.2, 126.3, 126.3, 111.6, 36.0, 35.5, 32.1, 17.6. **HRMS (EI)** calculated for [M] $C_{18}H_{18}$ 234.1403, found: 234.1398.



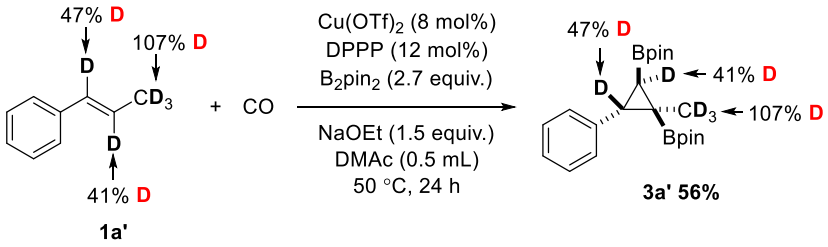
3ab **3ab-3**, 65%

2-Methyl-5-(1-methyl-2,3-diphenylcyclopropyl)furan (3ab-3)

The title compound was synthesized according to the following procedure[8]: A solution of 2-Mefuran (9.8 mg, 1.2 eq.) in THF (0.3 M) was cooled to –78 °C and treated with *n*-BuLi (1.2 eq., 2.5 M in hexanes). The cooling

bath was removed, and the mixture was stirred at room temperature for 1 h. The mixture was cooled to -78 °C and the **3ab** (33.4 mg, 0.1 mmol.) was added dropwise as a solution in THF (0.5 M). The mixture was stirred at –78 °C for 1 h. A solution of *N*-bromosuccinimide (NBS, 21.1 mg, 1.2 eq.) in MeOH (0.2 M) was added dropwise. After 1 h at –78 °C, a saturated aqueous solution of $Na_2S_2O_3$ was added and the reaction mixture was allowed to warm to room temperature. The reaction mixture was diluted with Et_2O and water. The layers were separated, and the aqueous layer was extracted with Et_2O. The combined organic layers were dried over Na_2SO_4, filtered and concentrated under vacuum. Purification by column chromatography on silica gel, gave the desired product **3ab-3** (18.7 mg, 65%).

^{1}H NMR (300 MHz, $CDCl_3$) δ 7.40 – 7.32 (m, 4H), 7.29 – 7.26 (m, 1H), 7.23 – 7.11 (m, 5H), 5.85 – 5.77 (m, 1H), 5.72 (dq, *J* = 3.0, 1.0 Hz, 1H), 3.24 (d, *J* = 6.9 Hz, 1H), 2.68 (d, *J* = 6.9 Hz, 1H), 2.09 (d, *J* = 0.8 Hz, 3H), 1.28 (s, 3H). **^{13}C NMR (75 MHz, $CDCl_3$)** δ 154.9, 150.2, 138.6, 138.0, 129.3, 128.6, 128.2, 127.6, 126.4, 125.9, 106.3, 105.6, 36.1, 33.6, 29.5, 19.8, 13.4. **HRMS (EI)** calculated for [M] $C_{21}H_{20}O$ 288.1509, found: 288.1502.



The title compound **3a'** was prepared from **1a'** (0.2 mmol), according to general procedure A. The crude residue was purified by flash chromatography (pentane/EA = 50:1, Rf = 0.20) to give the product **3a'** as a white solid (43.1 mg, 56%).

^{1}H NMR (300 MHz, $CDCl_3$) δ 7.26 – 7.05 (m, 5H), 2.62 – 2.41 (m, 1H), 1.26 (d, *J* = 3.3 Hz, 24H), 0.82 – 0.77 (m, 2H), 0.41 – 0.37 (m, 1H).

6. Reference

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[2] H. Albright, H.L. Vonesh, C.S. Schindler, *Org. Lett.* **2020**, *22*, 3155−3160.
[3] CN112299945, 2021.
[4] Y. Zou, J. S. Zhou, *Chem. Commun.* **2014**, *50*, 3725-3728.
[5] J.-E. Lee, J. Yun, *Angew. Chem. Int. Ed.* **2008**, *47*, 145-147.
[6] F.-P. Wu, X. Luo, U. Radius, T. B. Marder, X.-F. Wu, *J. Am. Chem. Soc.* **2020**, *142*, 14074-14079.
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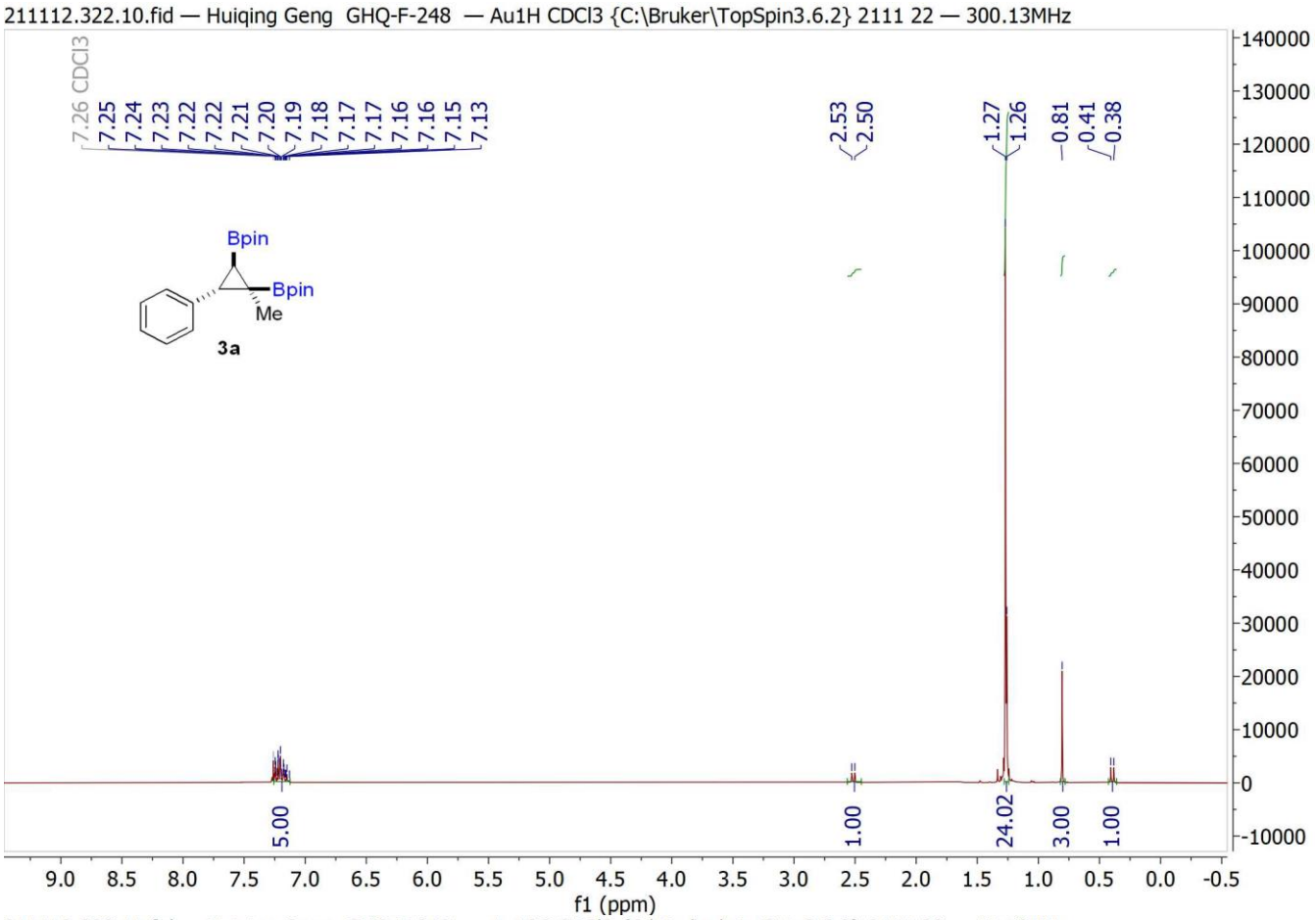
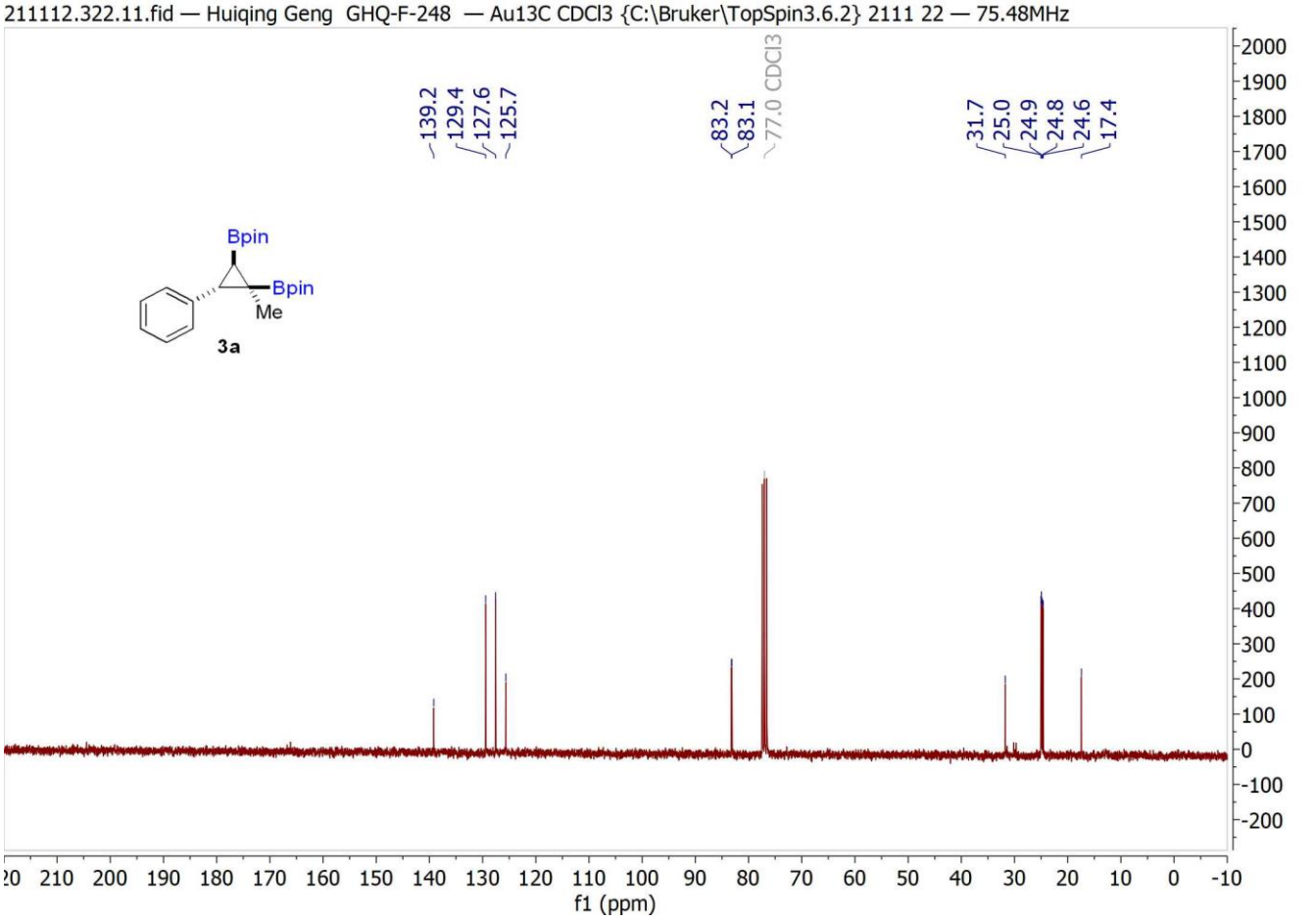
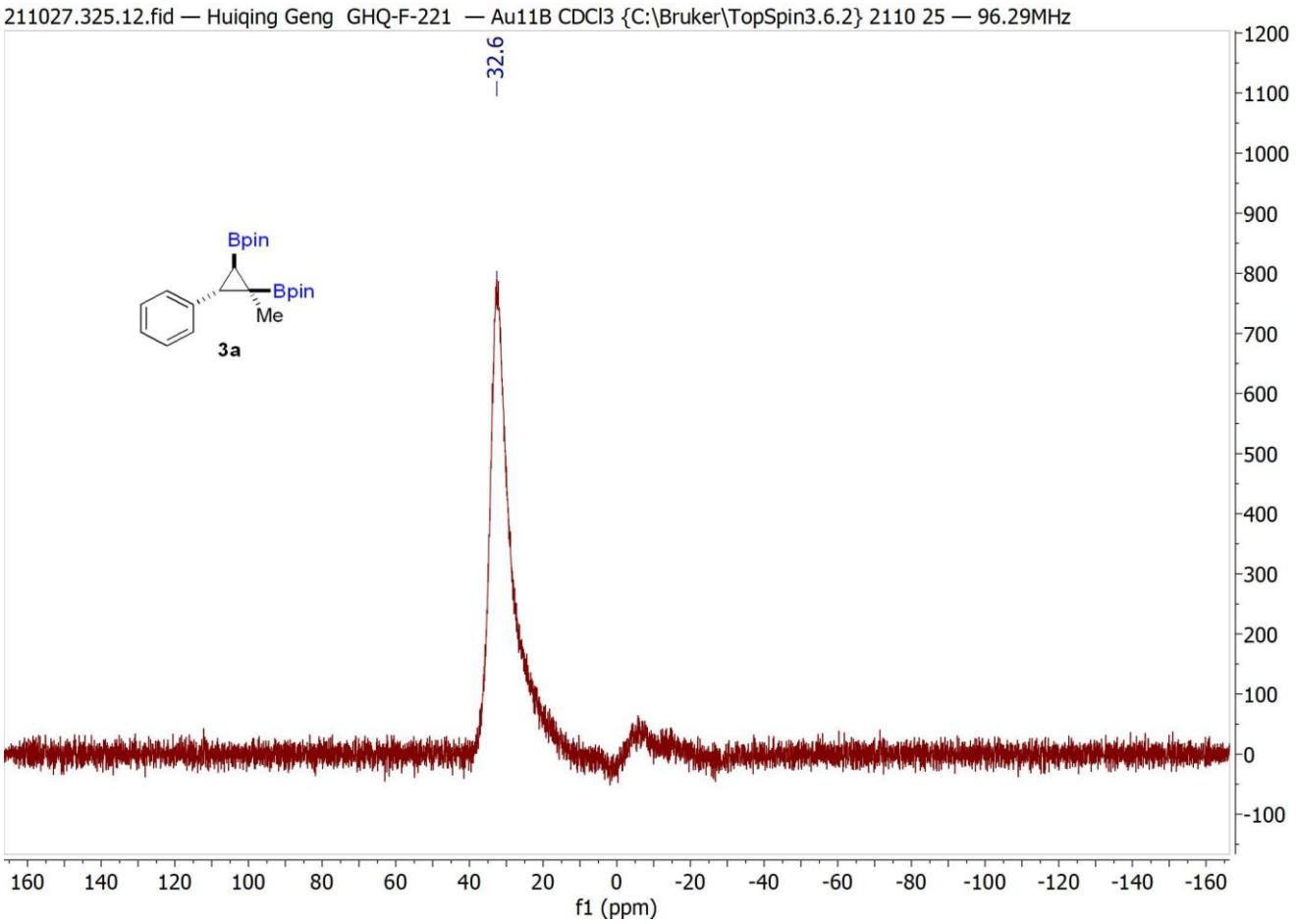
[8] A. Bonet, M. Odachowski, D. Leonori, S. Essafi, V. K. Aggarwal, *Nature Chem*. **2014**, *6*, 584-589.
[9] D. Mendez-Sanchez, J. Mangas-Sanchez, E. Busto, V. Gotor, V. Gotor-Fernandez, *Adv. Synth. Catal*. **2016**, *358*, 122-131.

7. Spectra of Products



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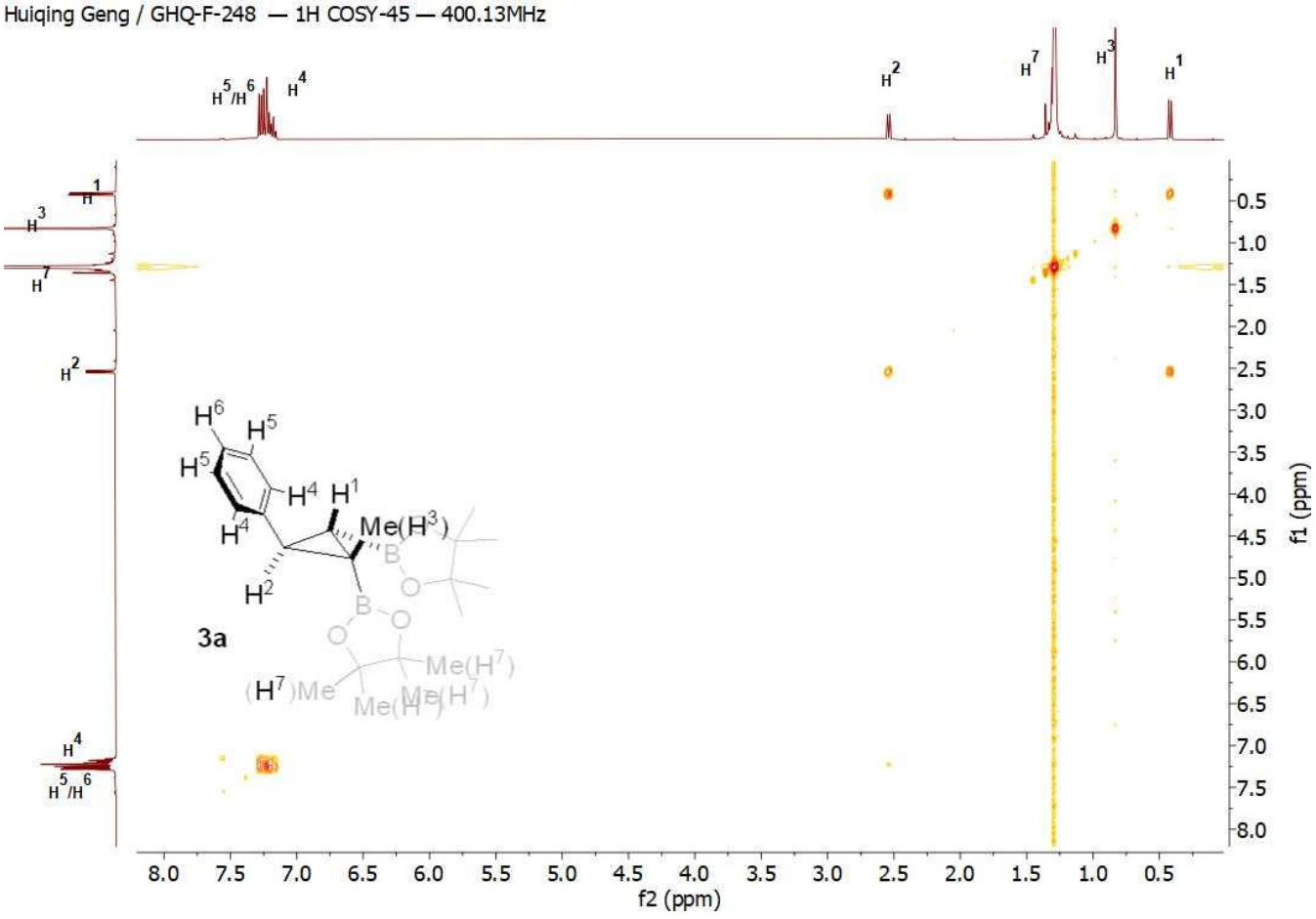
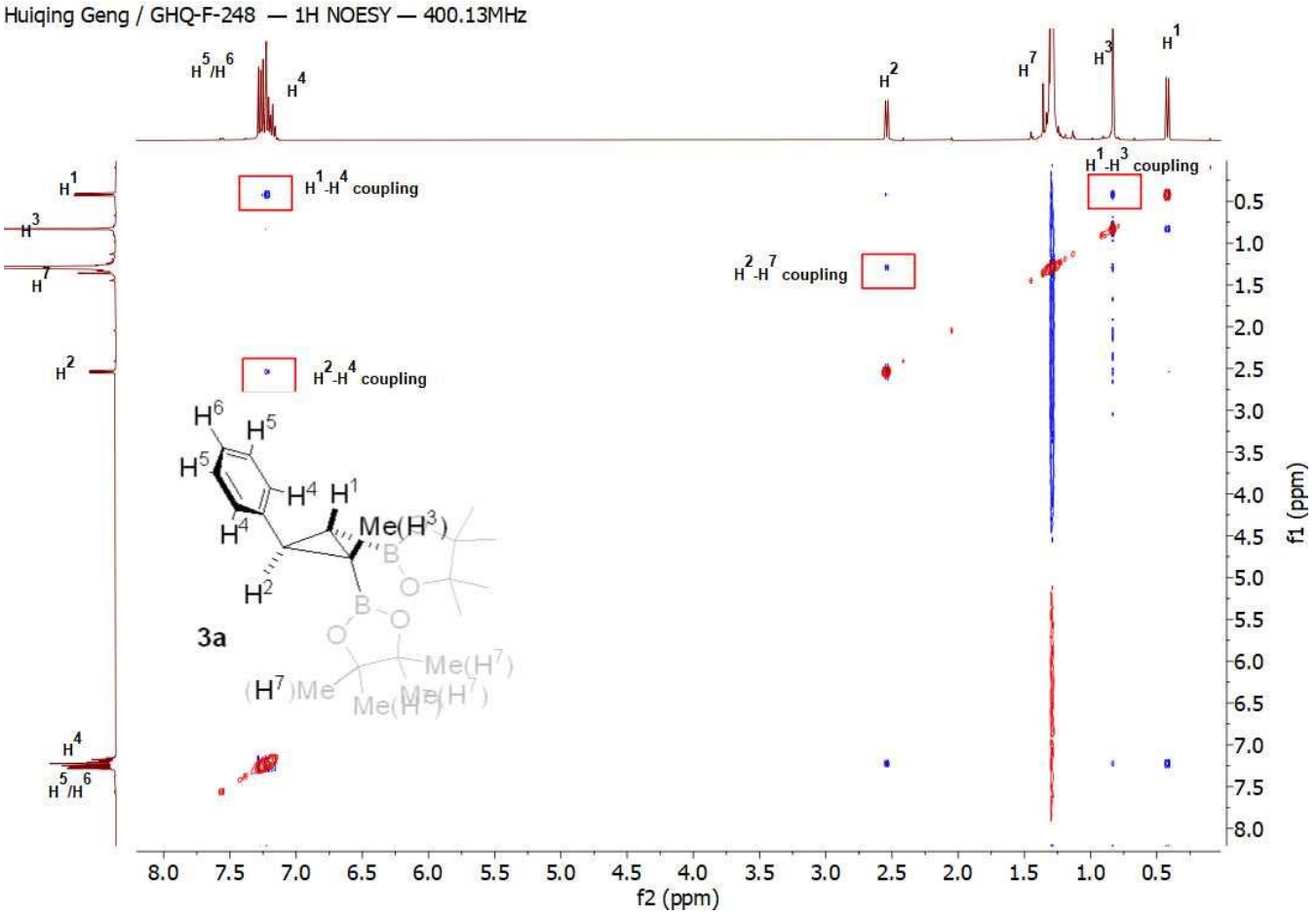
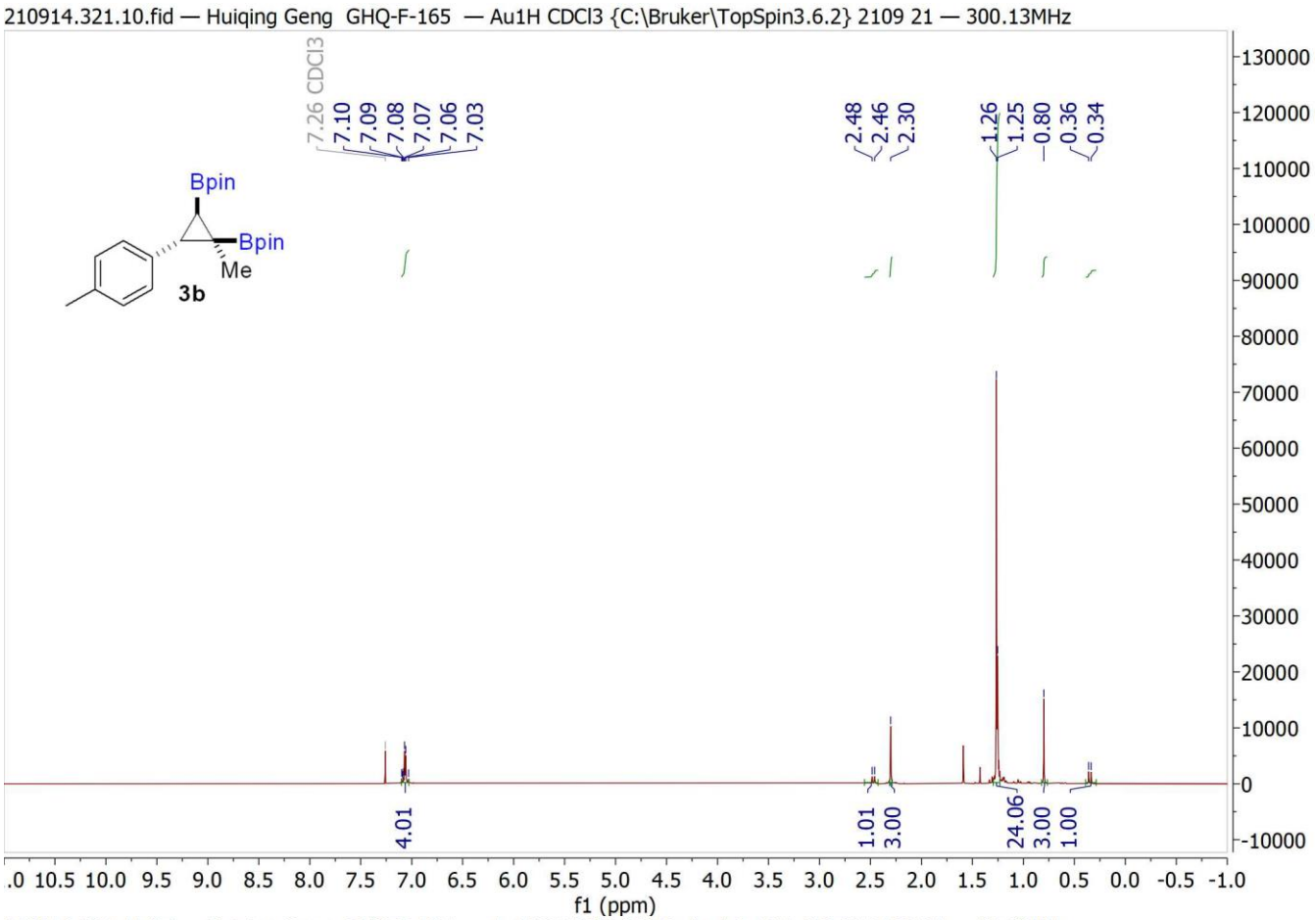
Bpin
Me
3a
f1 (ppm)


Huiqing Geng / GHQ-F-248 — 1H COSY-45 — 400.13MHz
H5/H6
H4
H2
H7
H3
H1
Me(H3)
3a
f2 (ppm)
f1 (ppm)


Huiqing Geng / GHQ-F-248 — 1H NOESY — 400.13MHz
H5/H6
H4
H2
H7
H3
H1
H1-H4 coupling
H1-H3 coupling
H2-H7 coupling
H2-H4 coupling
H6
H5
H5
H4
H1
H4
Me(H3)
H2
3a
(H7)Me
Me(H7)
Me(H7)
Me(H7)
f2 (ppm)
f1 (ppm)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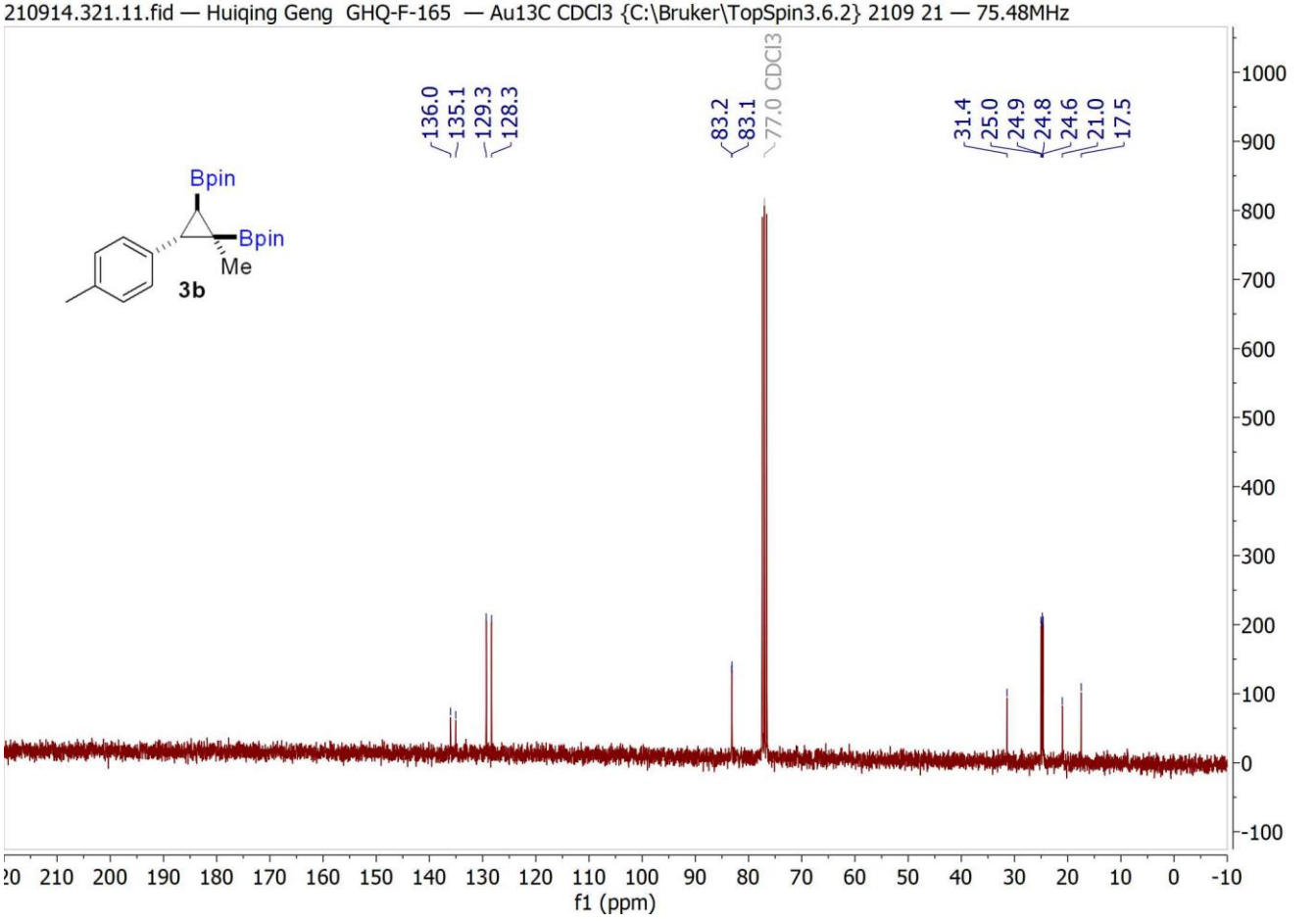
7.26 CDCl3
7.10
7.09
7.08
7.07
7.06
7.03
2.48
2.46
2.30
1.26
1.25
0.80
0.36
0.34
Bpin
Bpin
Me
3b
4.01
1.01
3.00
24.06
3.00
1.00
f1 (ppm)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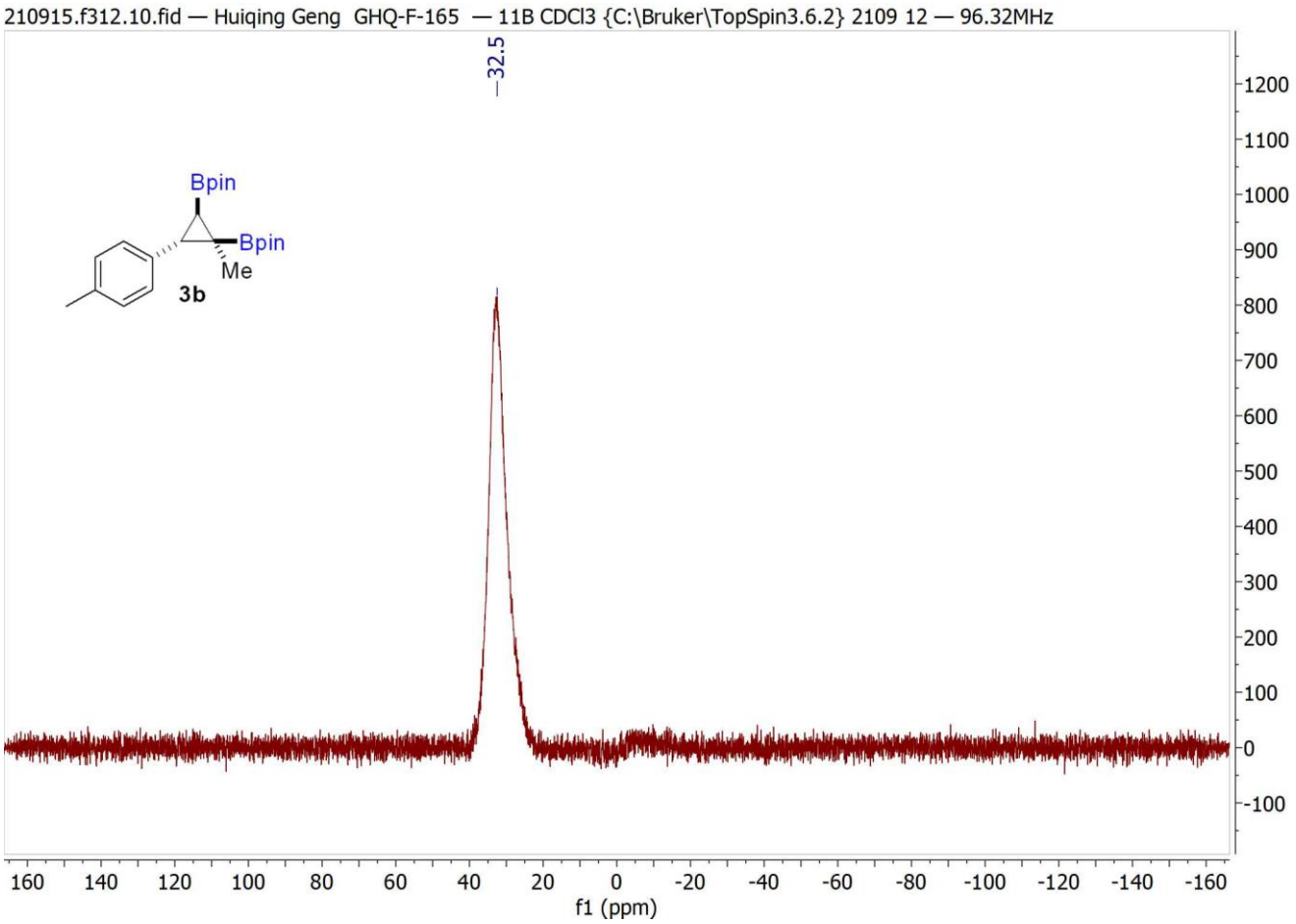
135.1
129.3
128.3
83.2
83.1
77.0 CDCl3
31.4
25.0
24.9
24.8
24.6
21.0
17.5
Bpin
Bpin
Me
3b
f1 (ppm)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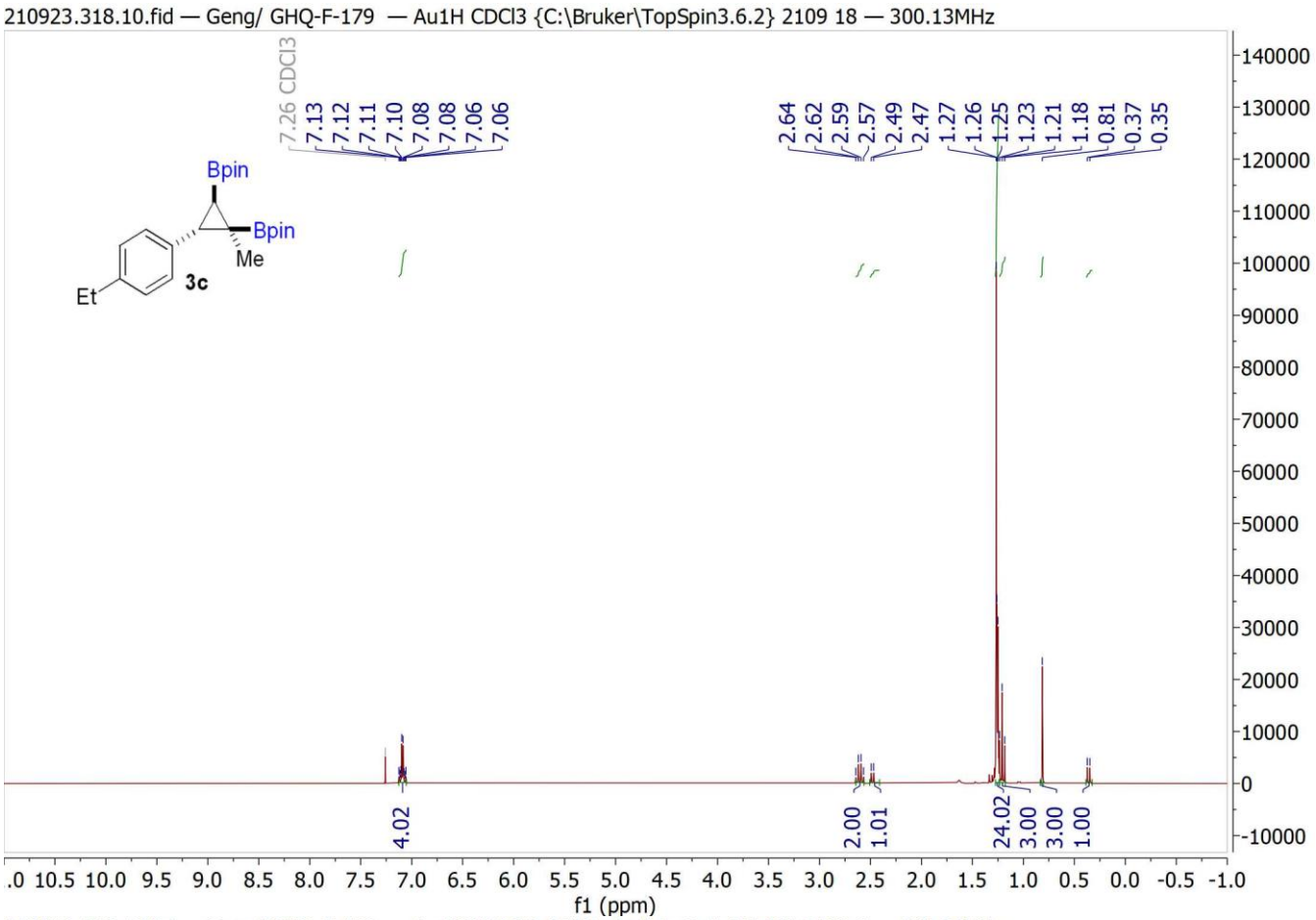
32.5
Bpin
Bpin
Me
3b
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
-100
160 140 120 100 80 60 40 20 0 -20 -40 -60 -80 -100 -120 -140 -160
f1 (ppm)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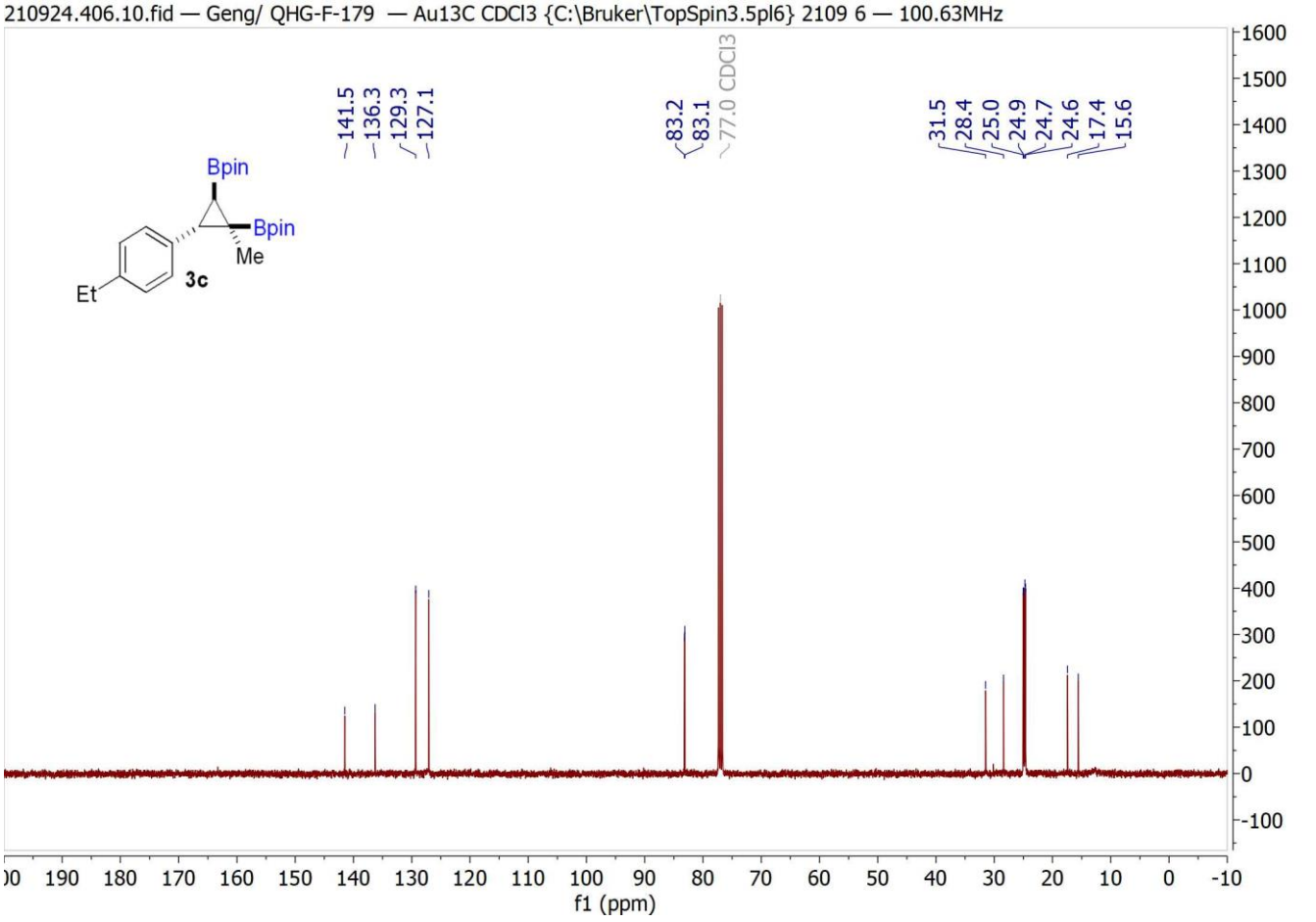
7.26 CDCl3
7.13
7.12
7.11
7.10
7.08
7.08
7.06
7.06
2.64
2.62
2.59
2.57
2.49
2.47
1.27
1.26
1.25
1.23
1.21
1.18
0.81
0.37
0.35
Bpin
Bpin
Me
Et
3c
4.02
2.00
1.01
24.02
3.00
3.00
1.00
f1 (ppm)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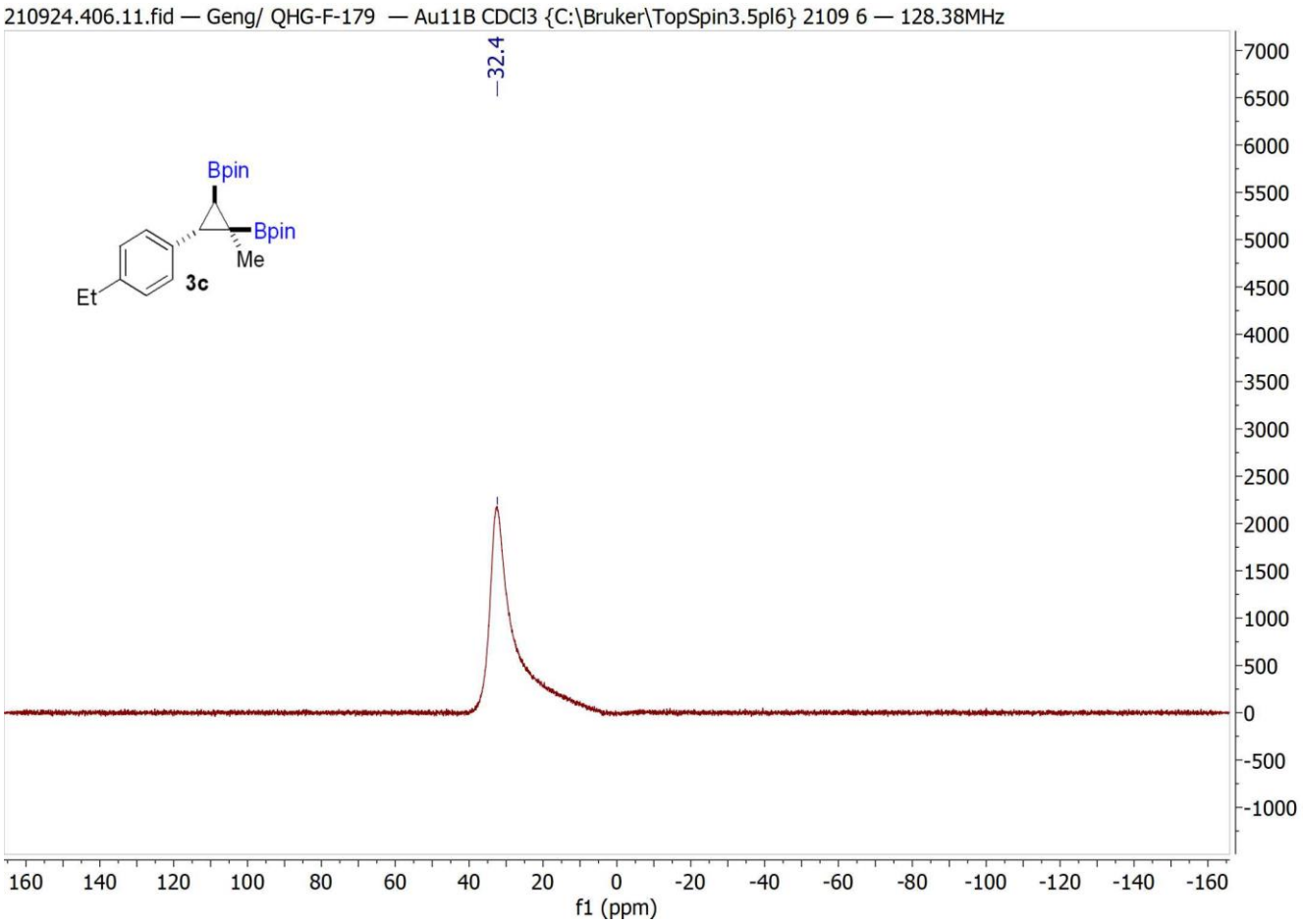
15.6
Bpin
Bpin
Me
Et
3c
f1 (ppm)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Bpin
Me
Et
3c
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6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
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-1000
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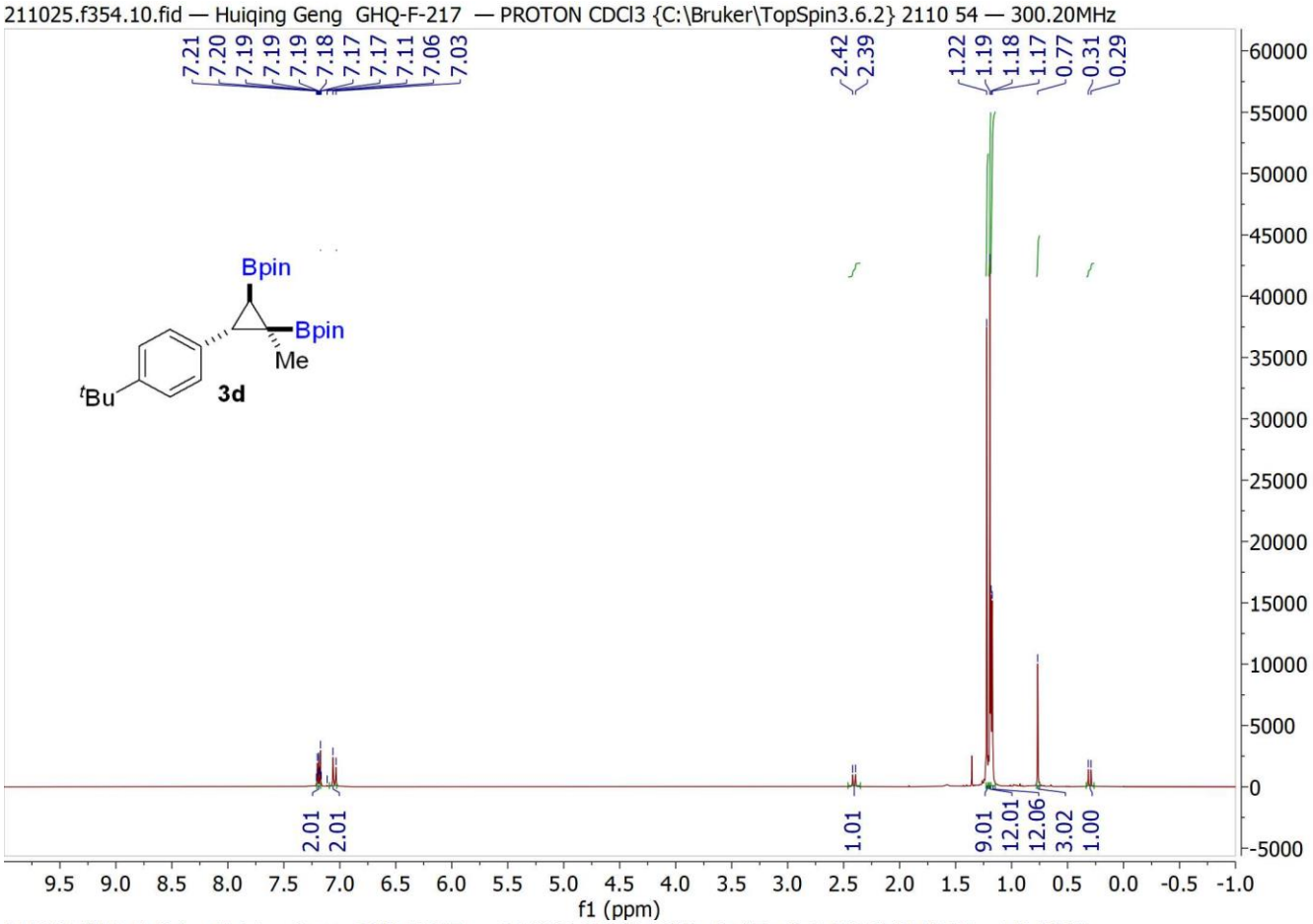
f1 (ppm)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7.20
7.19
7.19
7.19
7.18
7.17
7.17
7.11
7.06
7.03
2.42
2.39
1.22
1.19
1.18
1.17
0.77
0.31
0.29
Bpin
Bpin
Me
tBu
3d
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2.01
1.01
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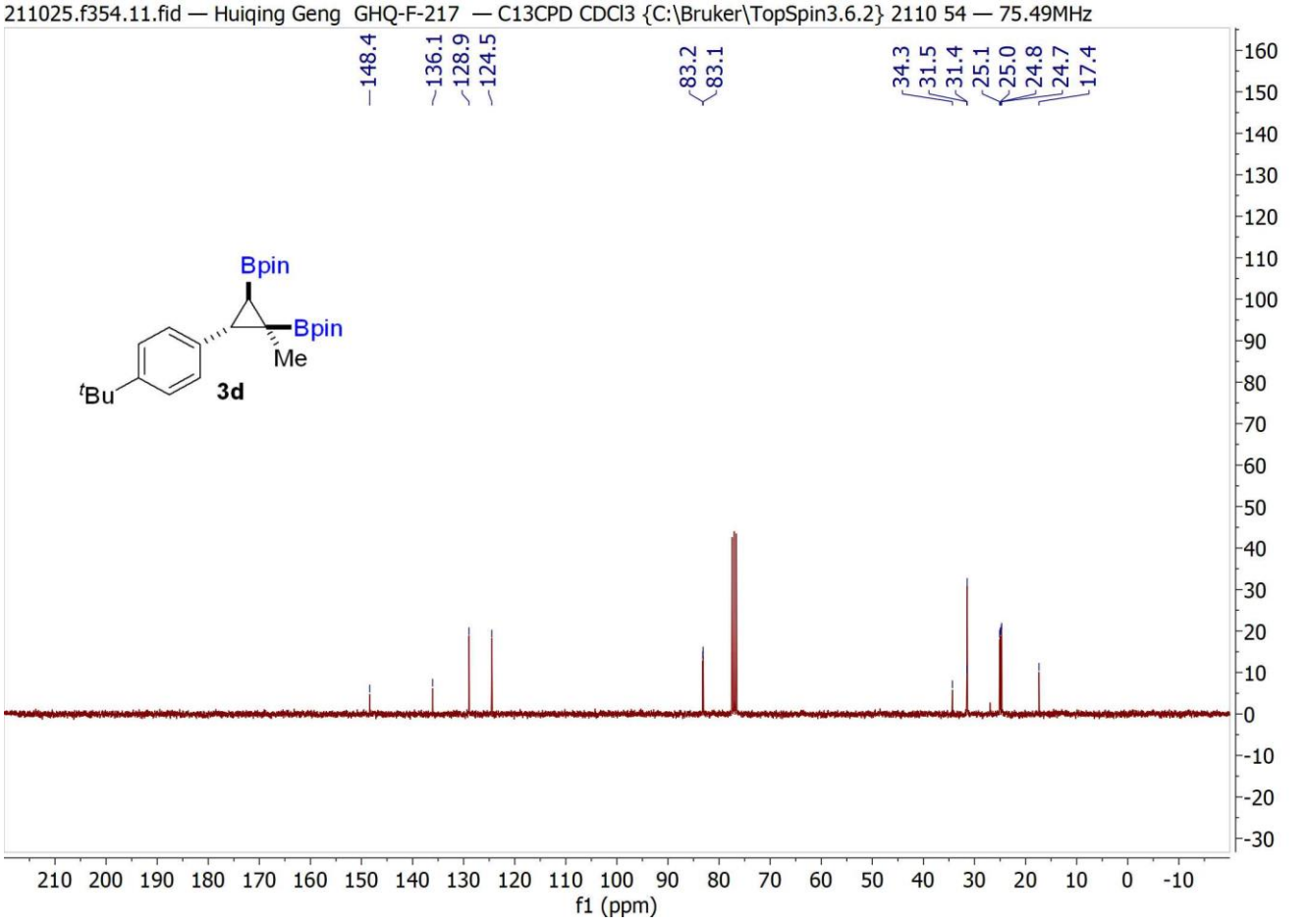
12.01
12.06
3.02
1.00
f1 (ppm)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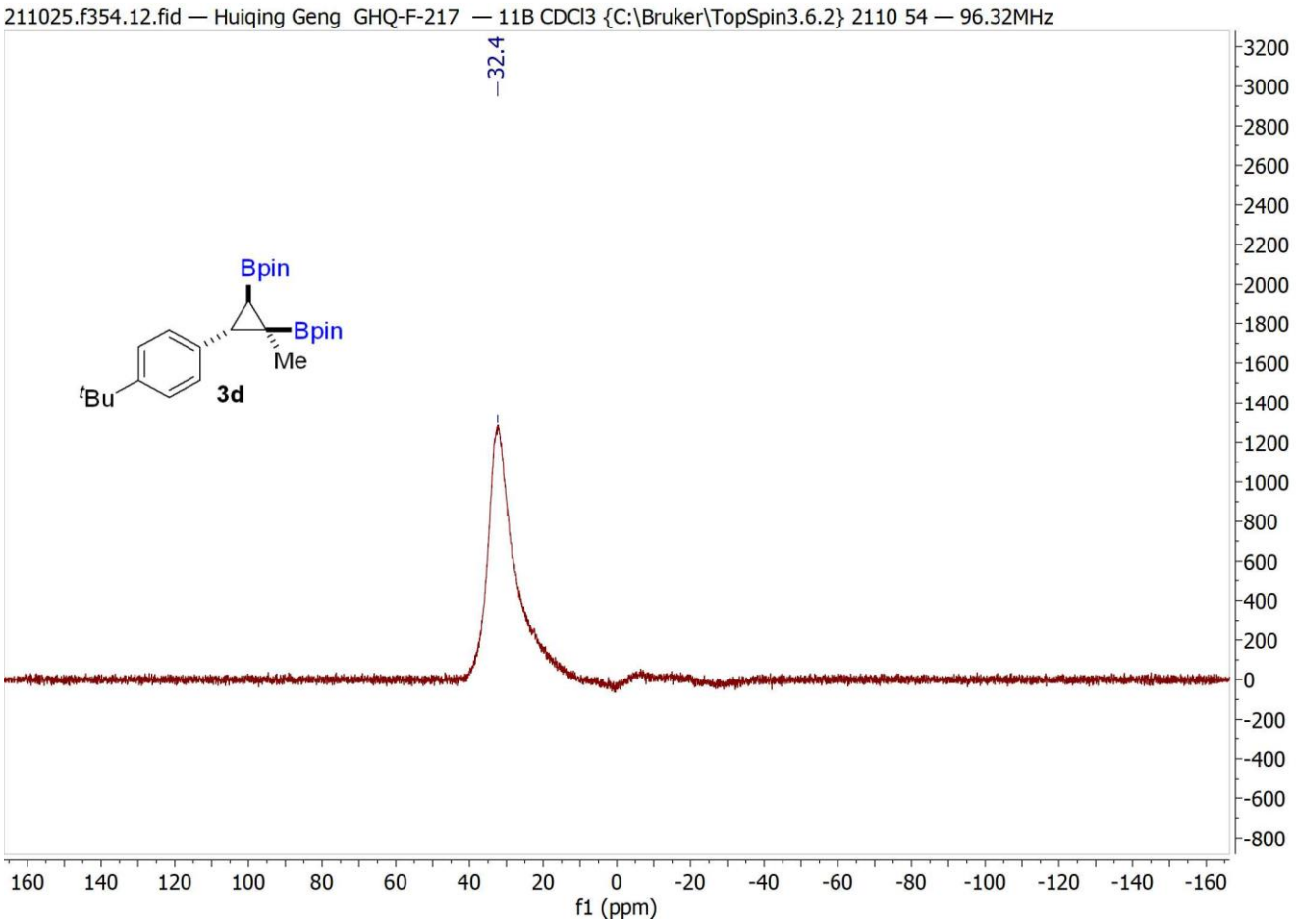
Bpin
Bpin
Me
tBu
3d
f1 (ppm)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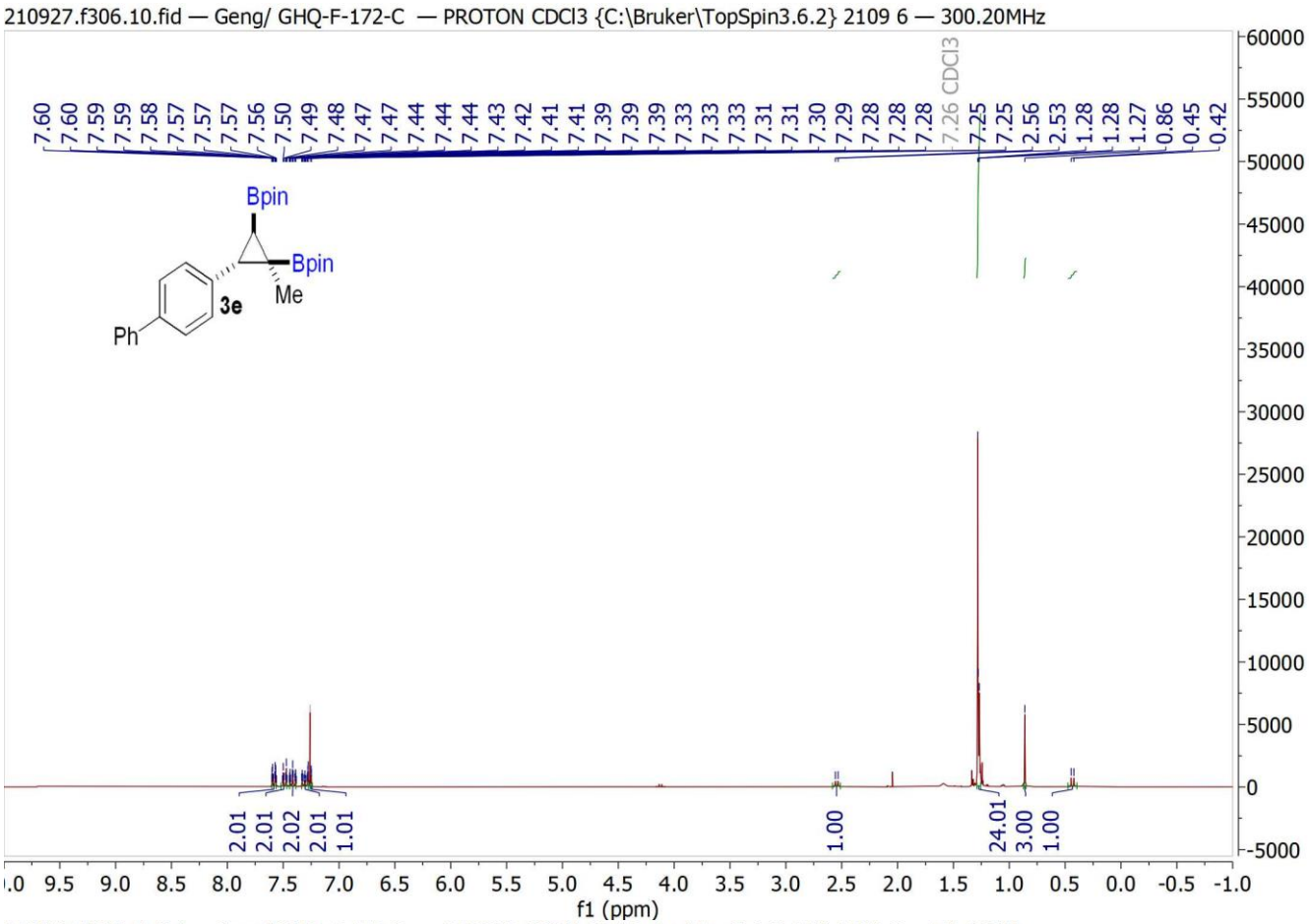
Bpin
Bpin
Me
tBu
3d
f1 (ppm)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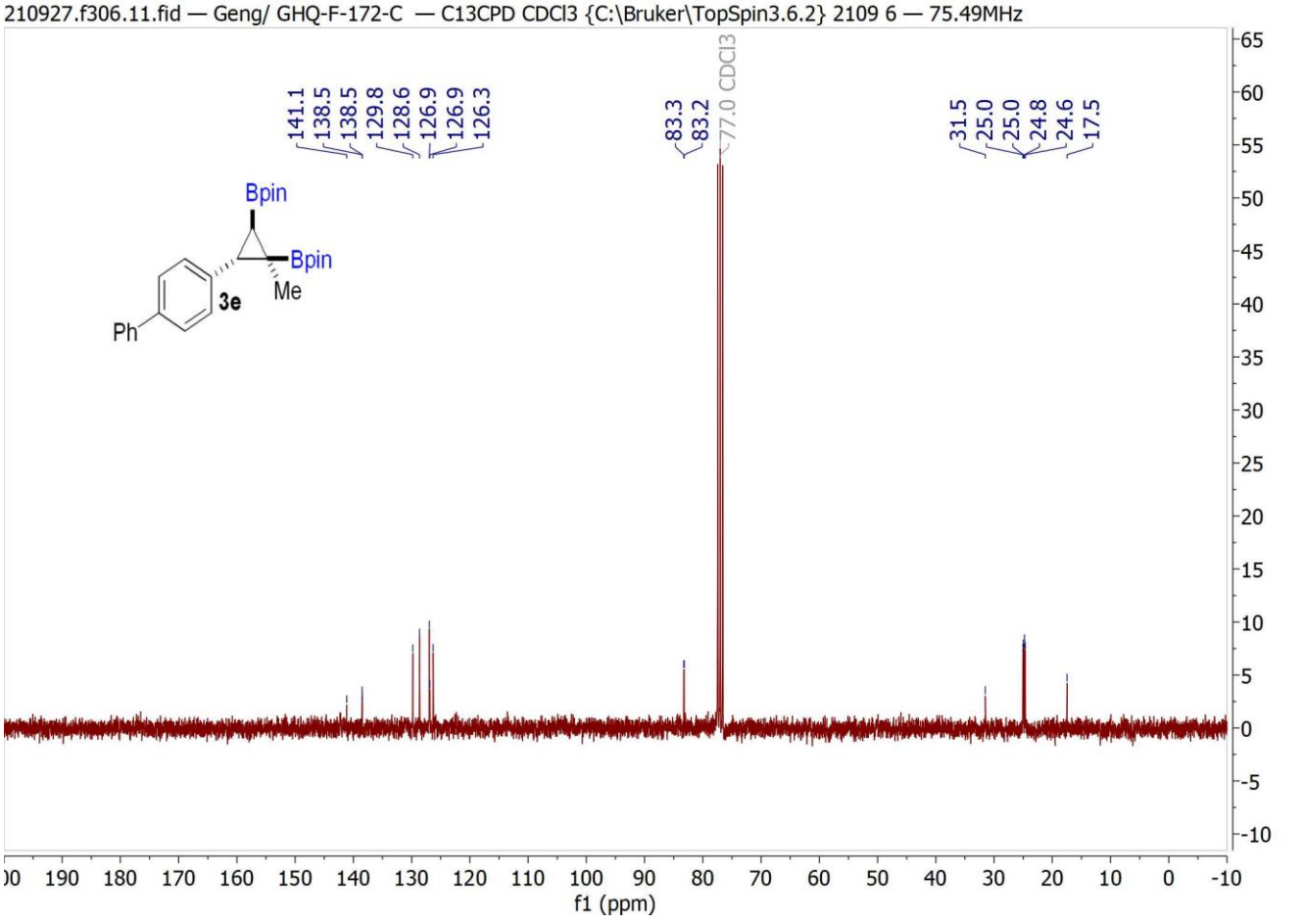
Bpin
Bpin
Me
3e
Ph
2.01 2.01 2.02 2.01 1.01 1.00 24.01 3.00 1.00
f1 (ppm)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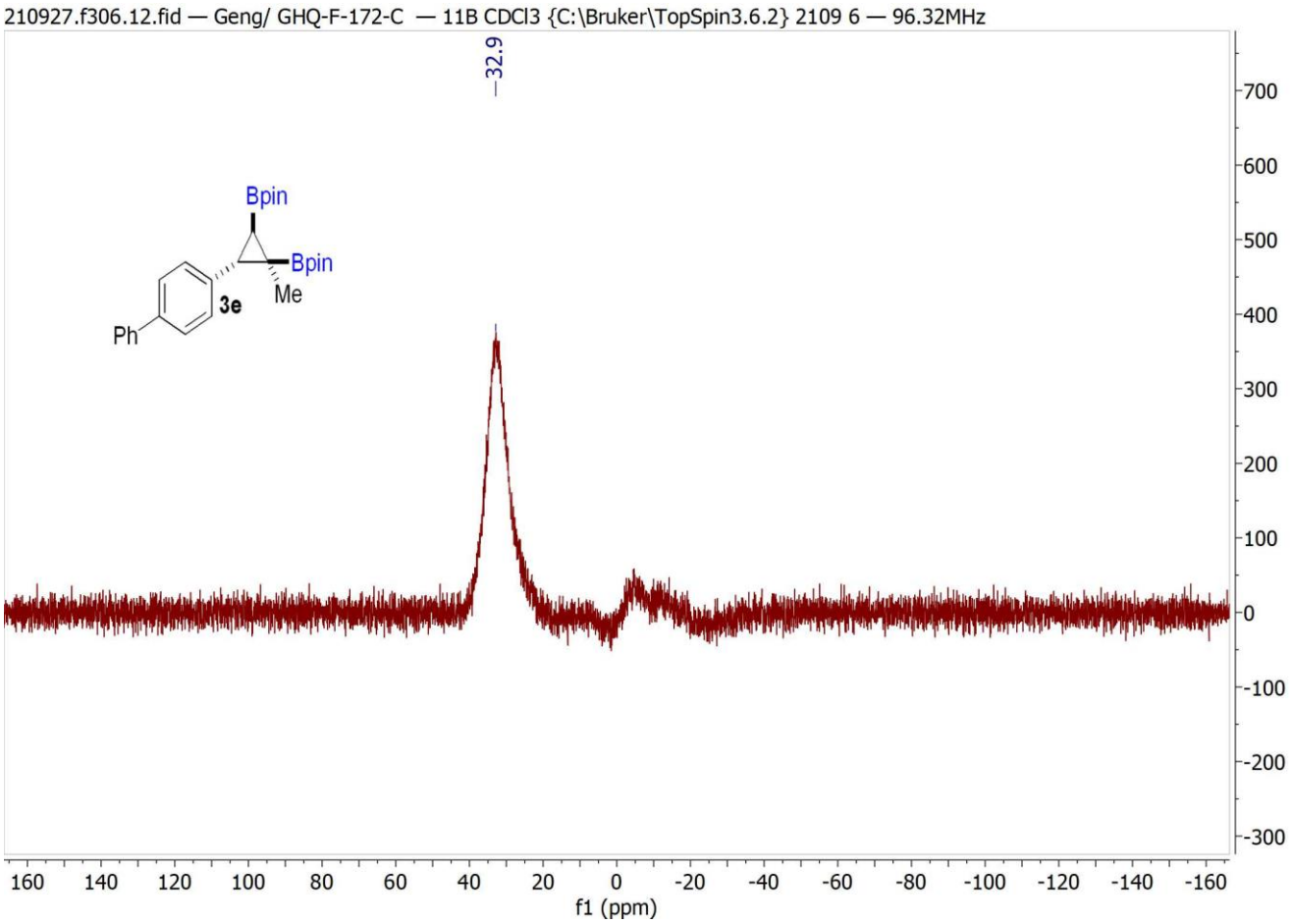
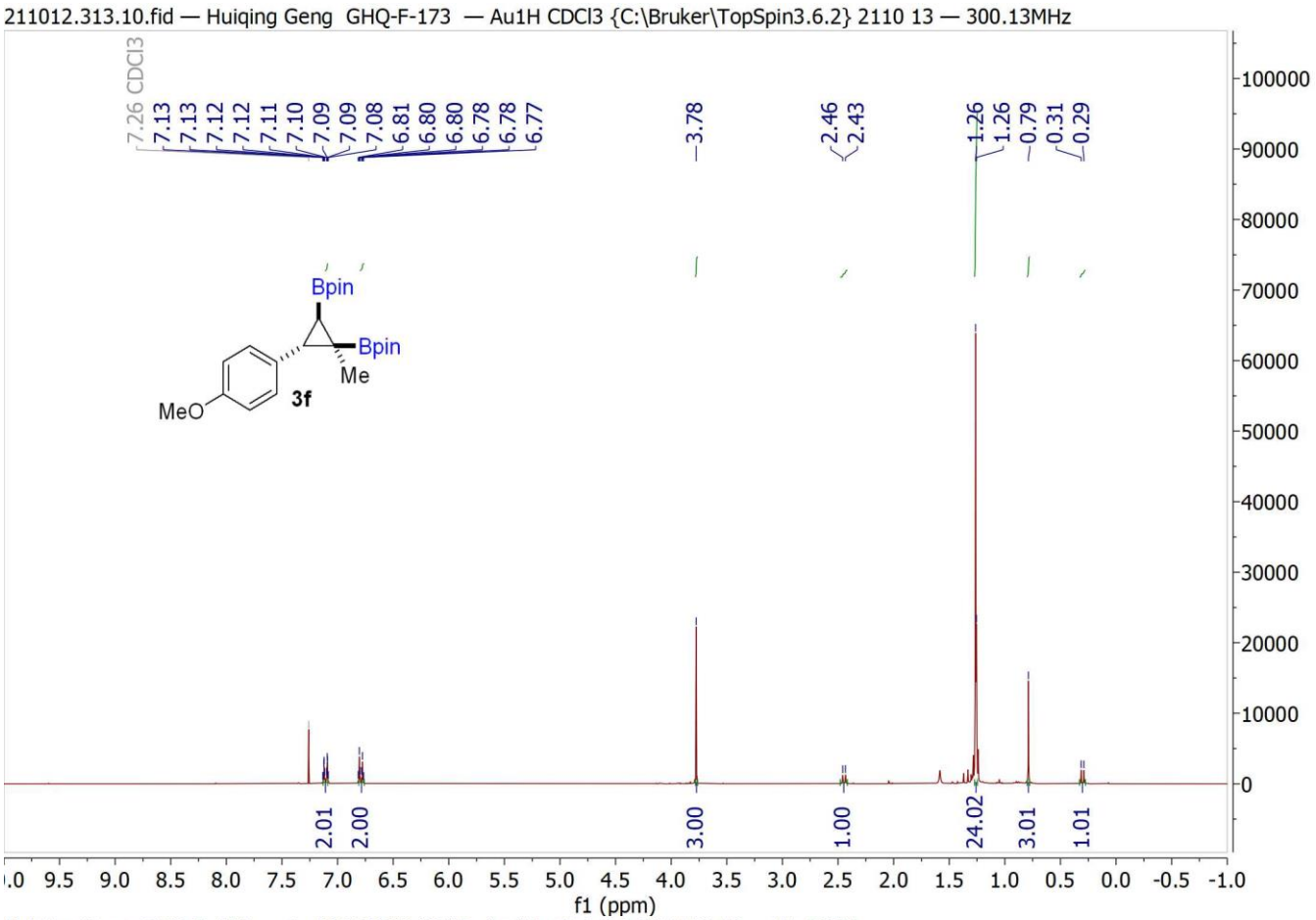
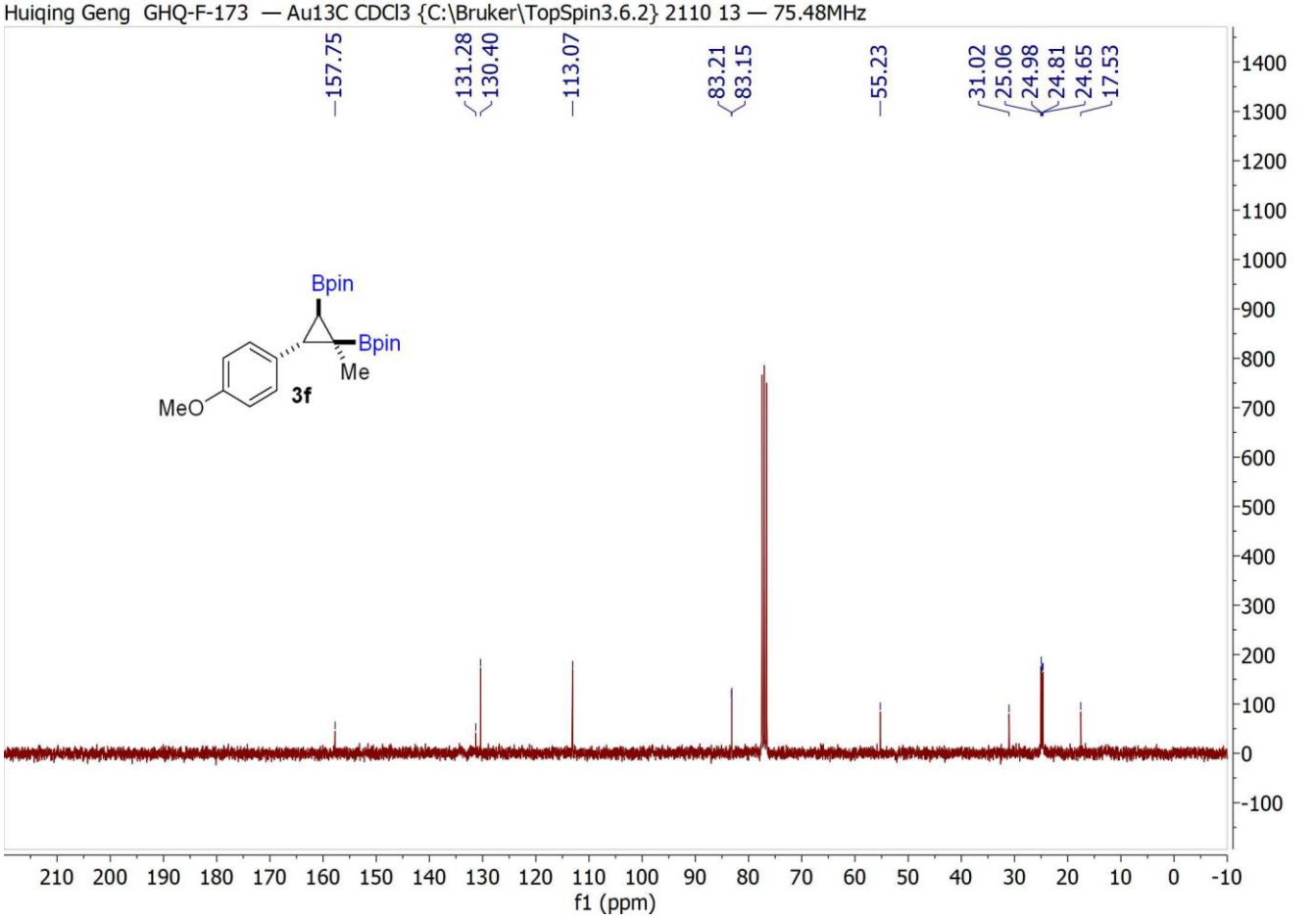
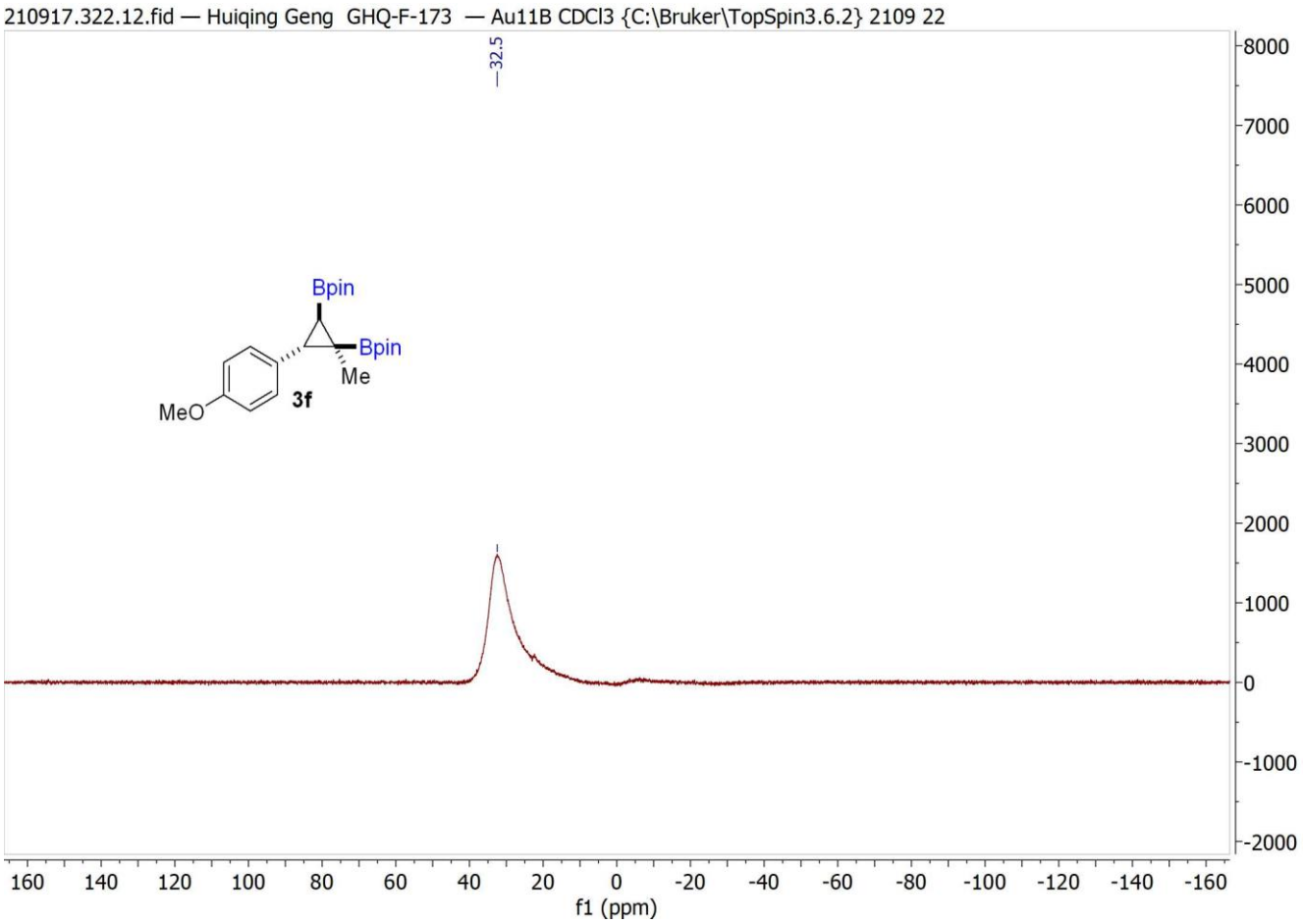
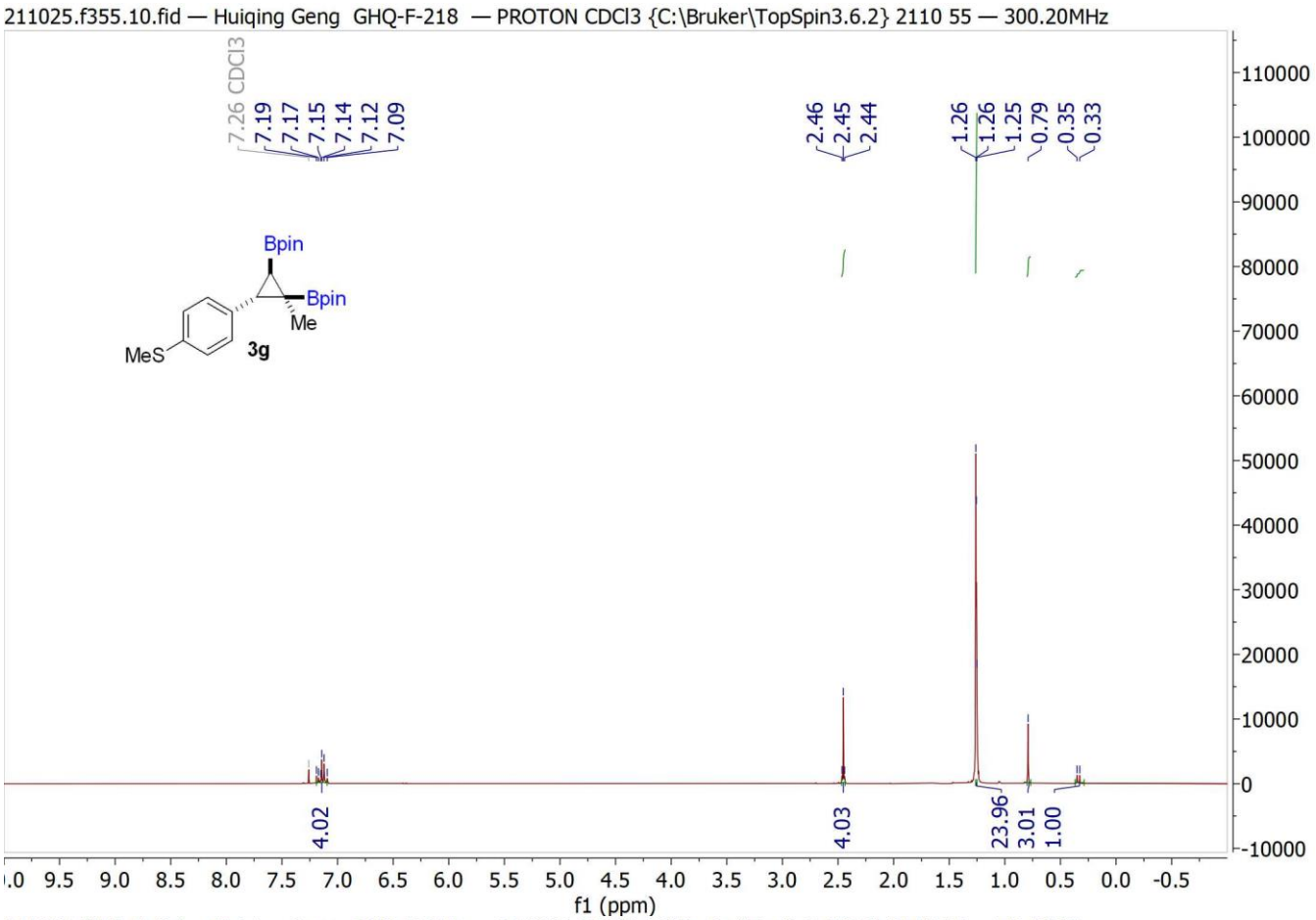
Bpin
Bpin
Me
3e
Ph
f1 (ppm)

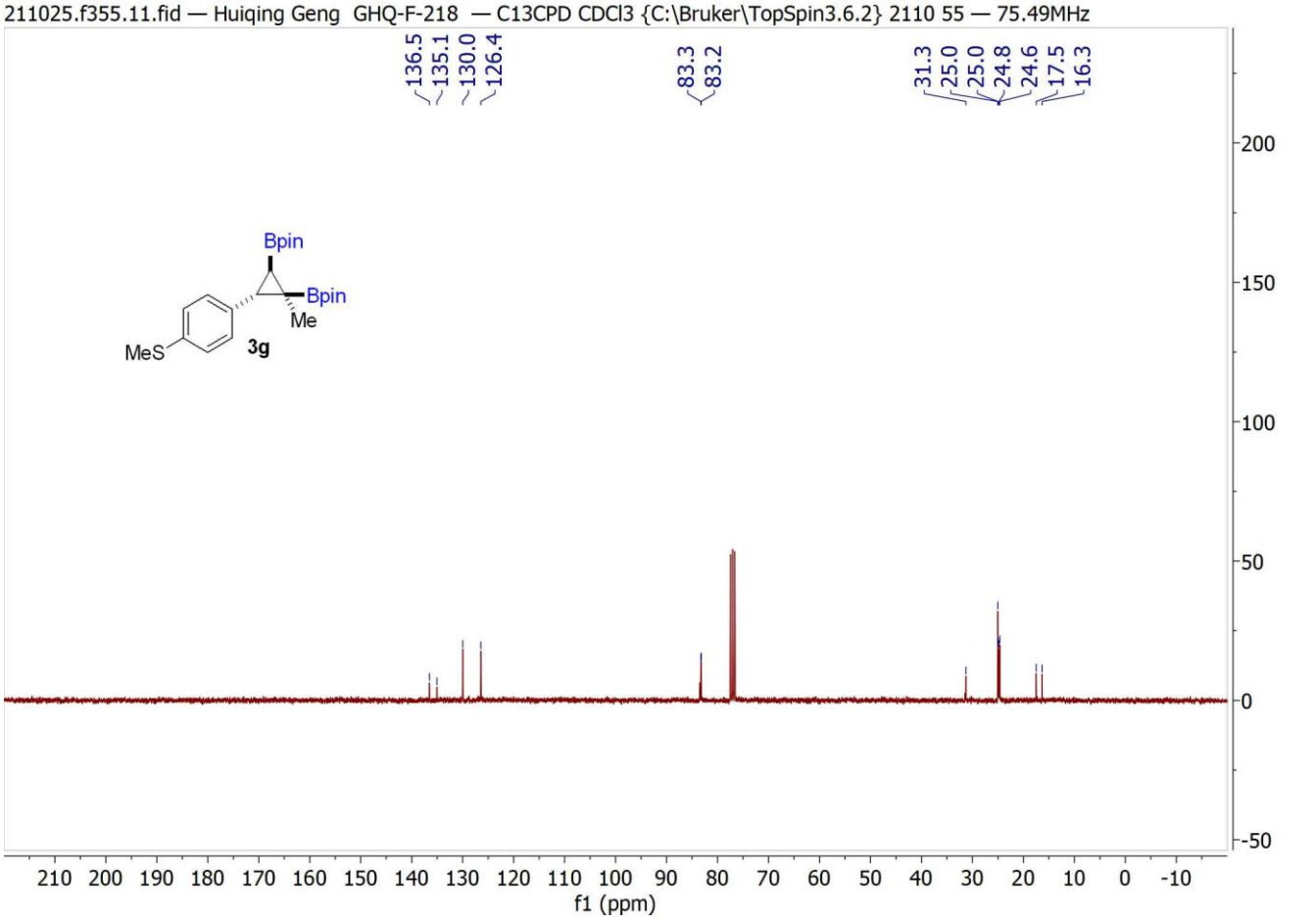

210927.f306.12.fid — Geng/ GHQ-F-172-C — 11B CDCl3 {C:\Bruker\TopSpin3.6.2} 2109 6 — 96.32MHz
32.9
Bpin
Bpin
Me
3e
Ph
700
600
500
400
300
200
100
0
-100
-200
-300
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
f1 (ppm)

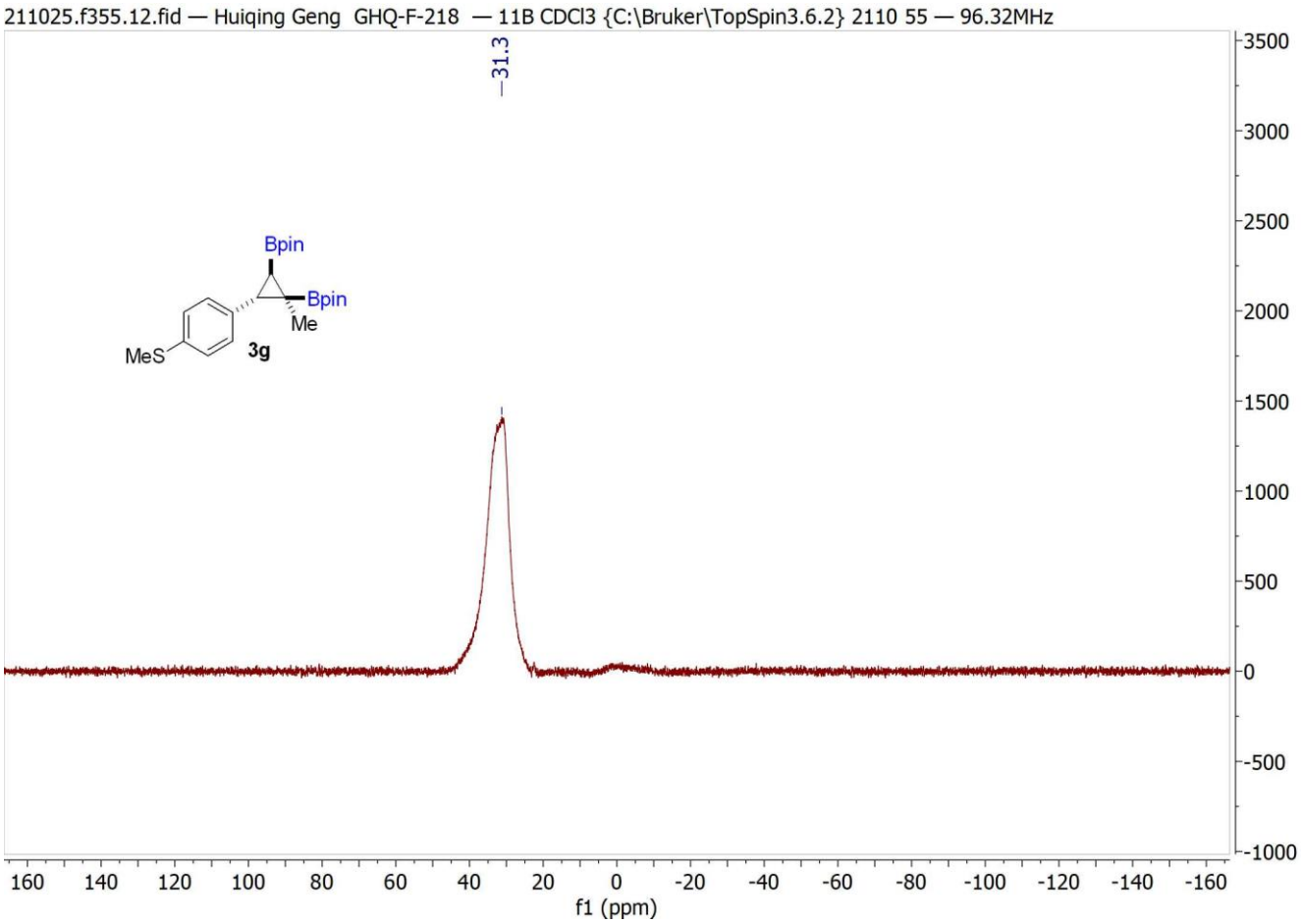

211012.313.10.fid — Huiqing Geng GHQ-F-173 — Au1H CDCl3 {C:\Bruker\TopSpin3.6.2} 2110 13 — 300.13MHz
7.26 CDCl3
7.13
7.13
7.12
7.12
7.11
7.10
7.09
7.09
7.08
6.81
6.80
6.80
6.78
6.78
6.77
3.78
2.46
2.43
1.26
1.26
0.79
0.31
0.29
Bpin
Bpin
Me
MeO
3f
2.01
2.00
3.00
1.00
24.02
3.01
1.01
f1 (ppm)

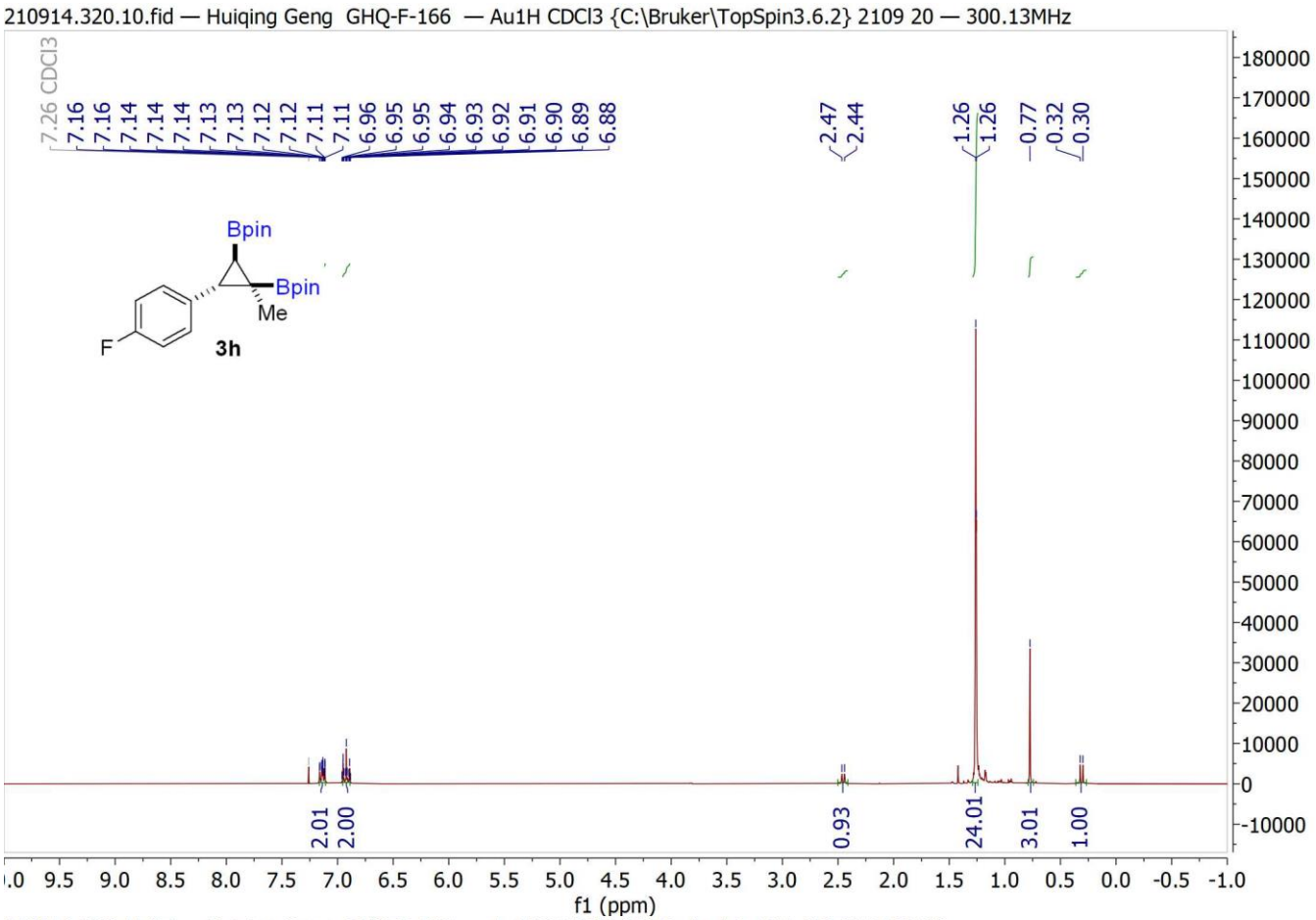

Huiqing Geng GHQ-F-173 — Au13C CDCl3 {C:\Bruker\TopSpin3.6.2} 2110 13 — 75.48MHz
157.75
131.28
130.40
113.07
83.21
83.15
55.23
31.02
25.06
24.98
24.81
24.65
17.53
Bpin
Bpin
Me
MeO
3f
f1 (ppm)

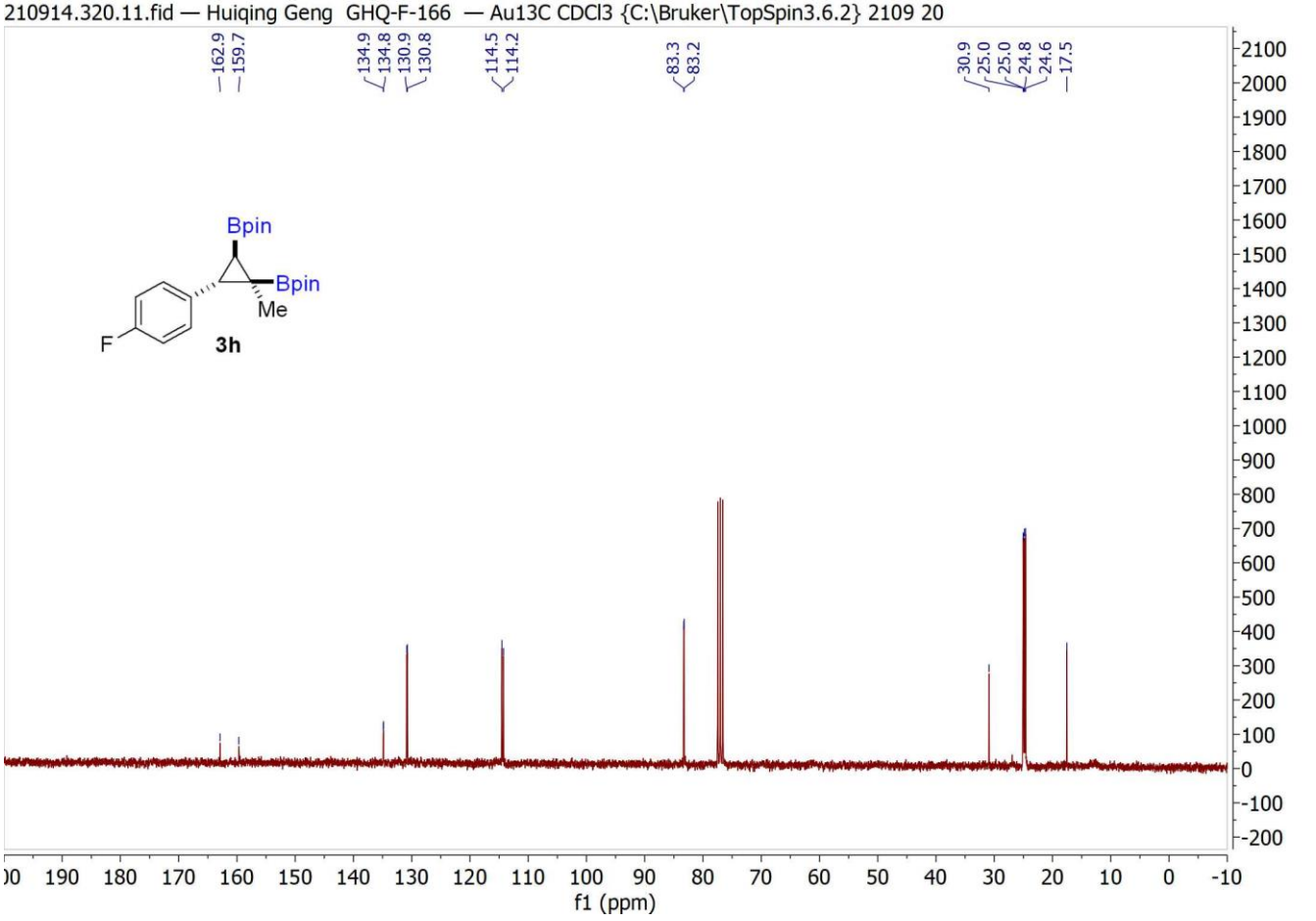

210917.322.12.fid — Huiqing Geng GHQ-F-173 — Au11B CDCl3 {C:\Bruker\TopSpin3.6.2} 2109 22
32.5
Bpin
Bpin
Me
MeO
3f
8000
7000
6000
5000
4000
3000
2000
1000
0
-1000
-2000
160 140 120 100 80 60 40 20 0 -20 -40 -60 -80 -100 -120 -140 -160
f1 (ppm)

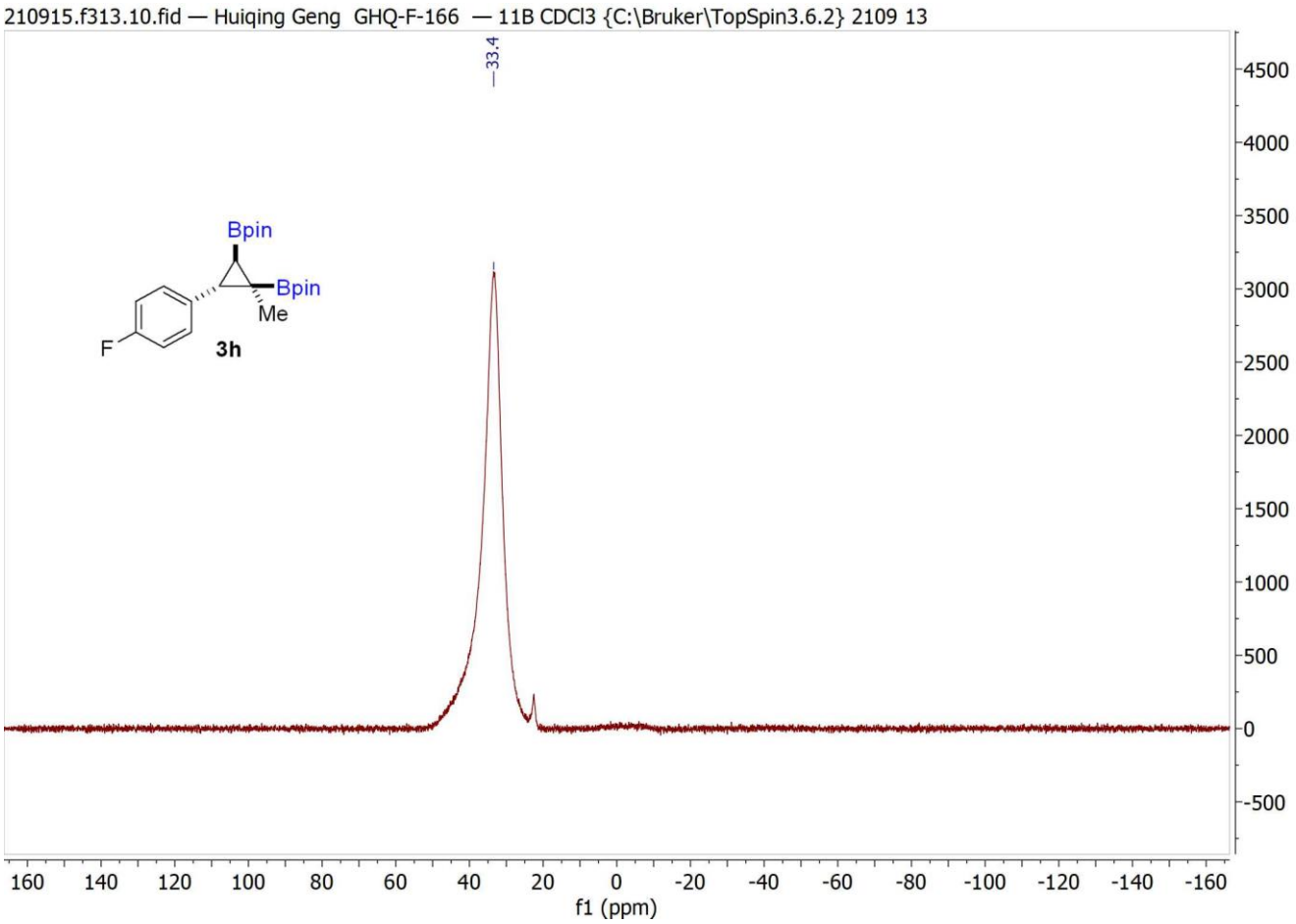

211025.f355.10.fid — Huiqing Geng GHQ-F-218 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.2} 2110 55 — 300.20MHz
7.26 CDCl3
7.19
7.17
7.15
7.14
7.12
7.09
2.46
2.45
2.44
1.26
1.26
1.25
0.79
0.35
0.33
Bpin
Bpin
Me
MeS
3g
4.02
4.03
23.96
3.01
1.00
f1 (ppm)

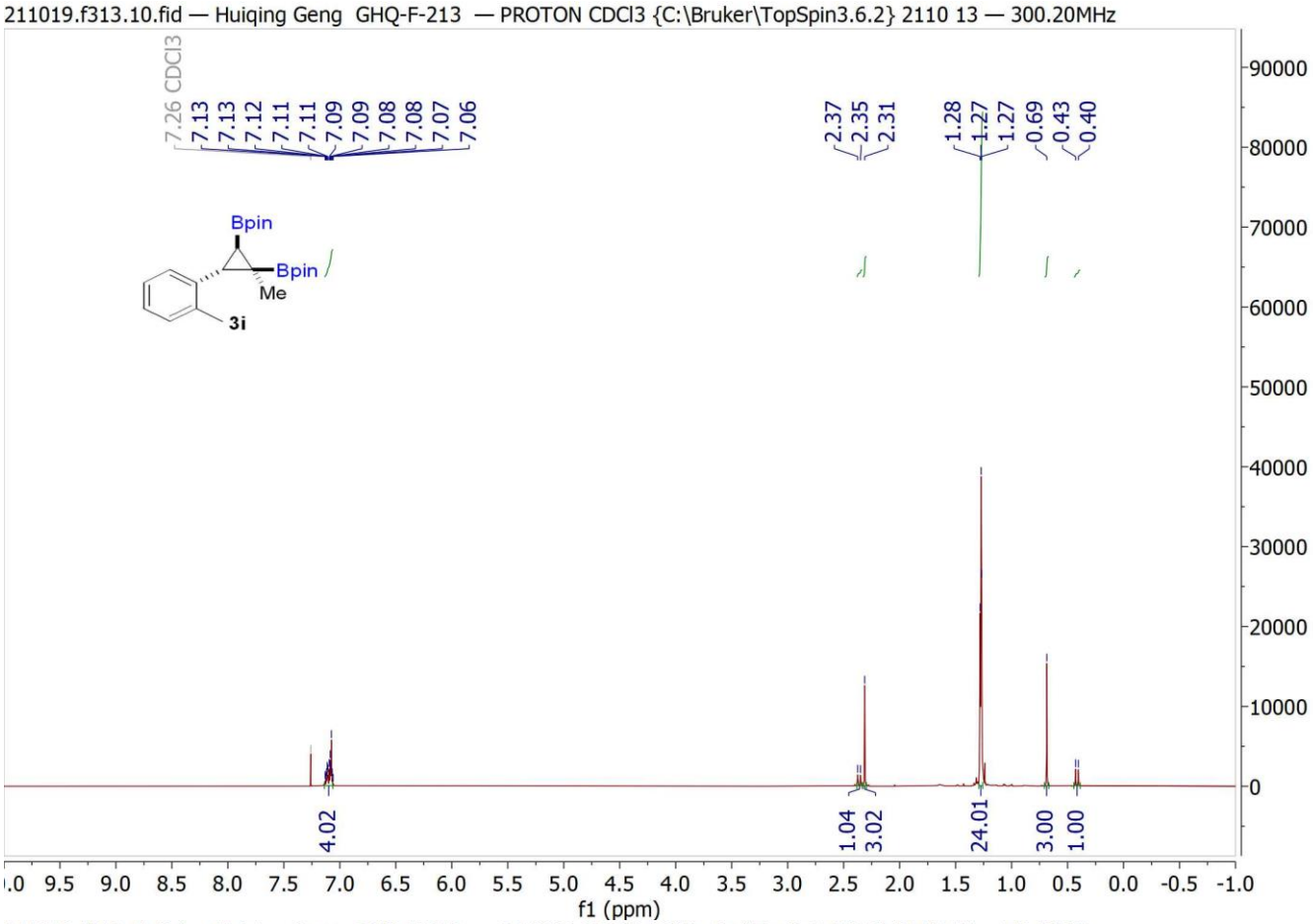

211025.f355.11.fid — Huiqing Geng GHQ-F-218 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.2} 2110 55 — 75.49MHz
136.5
135.1
130.0
126.4
83.3
83.2
31.3
25.0
25.0
24.8
24.6
17.5
16.3
Bpin
Bpin
Me
MeS
3g
f1 (ppm)

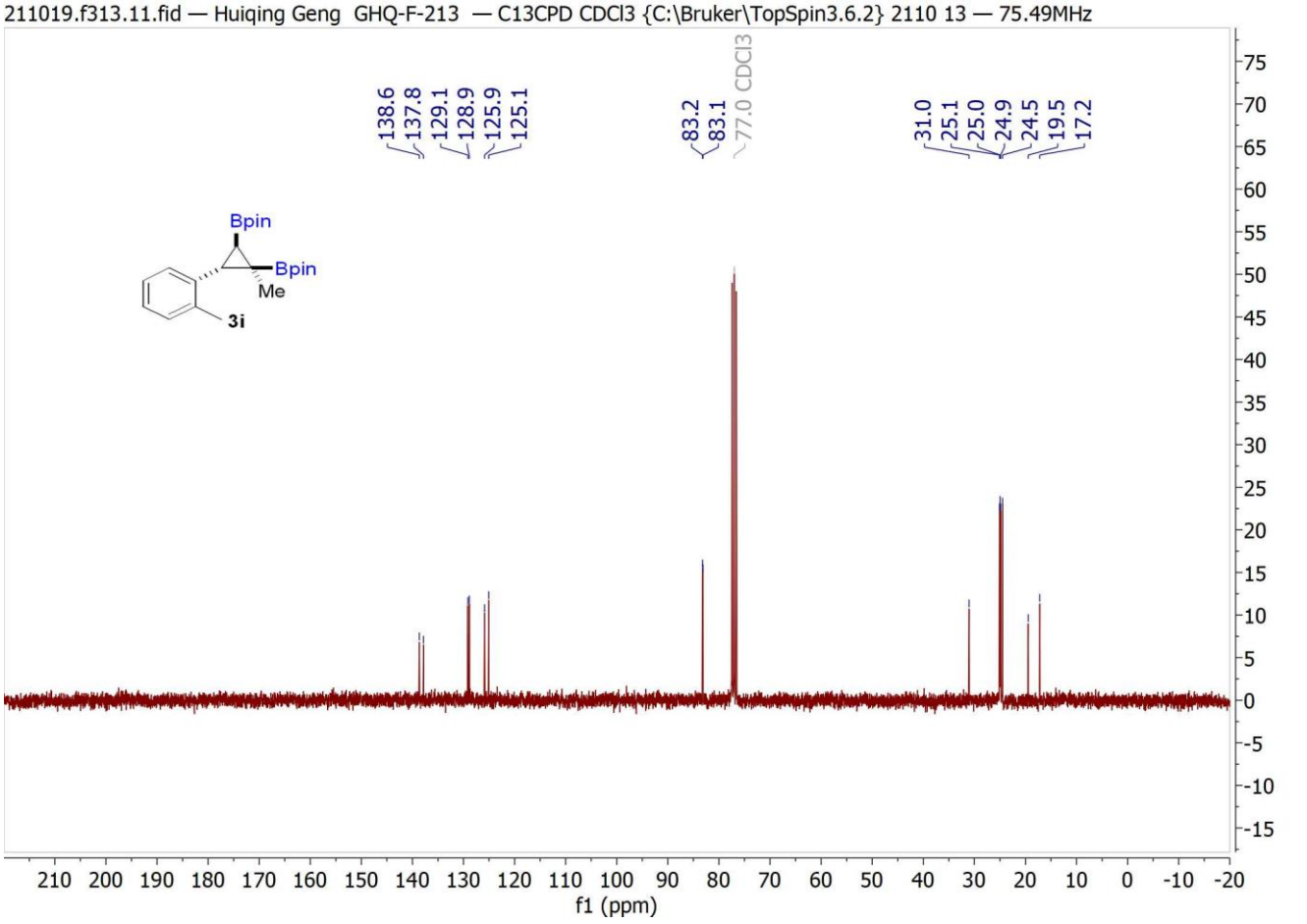

211025.f355.12.fid — Huiqing Geng GHQ-F-218 — 11B CDCl3 {C:\Bruker\TopSpin3.6.2} 2110 55 — 96.32MHz
31.3
Bpin
Bpin
Me
MeS
3g
3500
3000
2500
2000
1500
1000
500
0
-500
-1000
160 140 120 100 80 60 40 20 0 -20 -40 -60 -80 -100 -120 -140 -160
f1 (ppm)

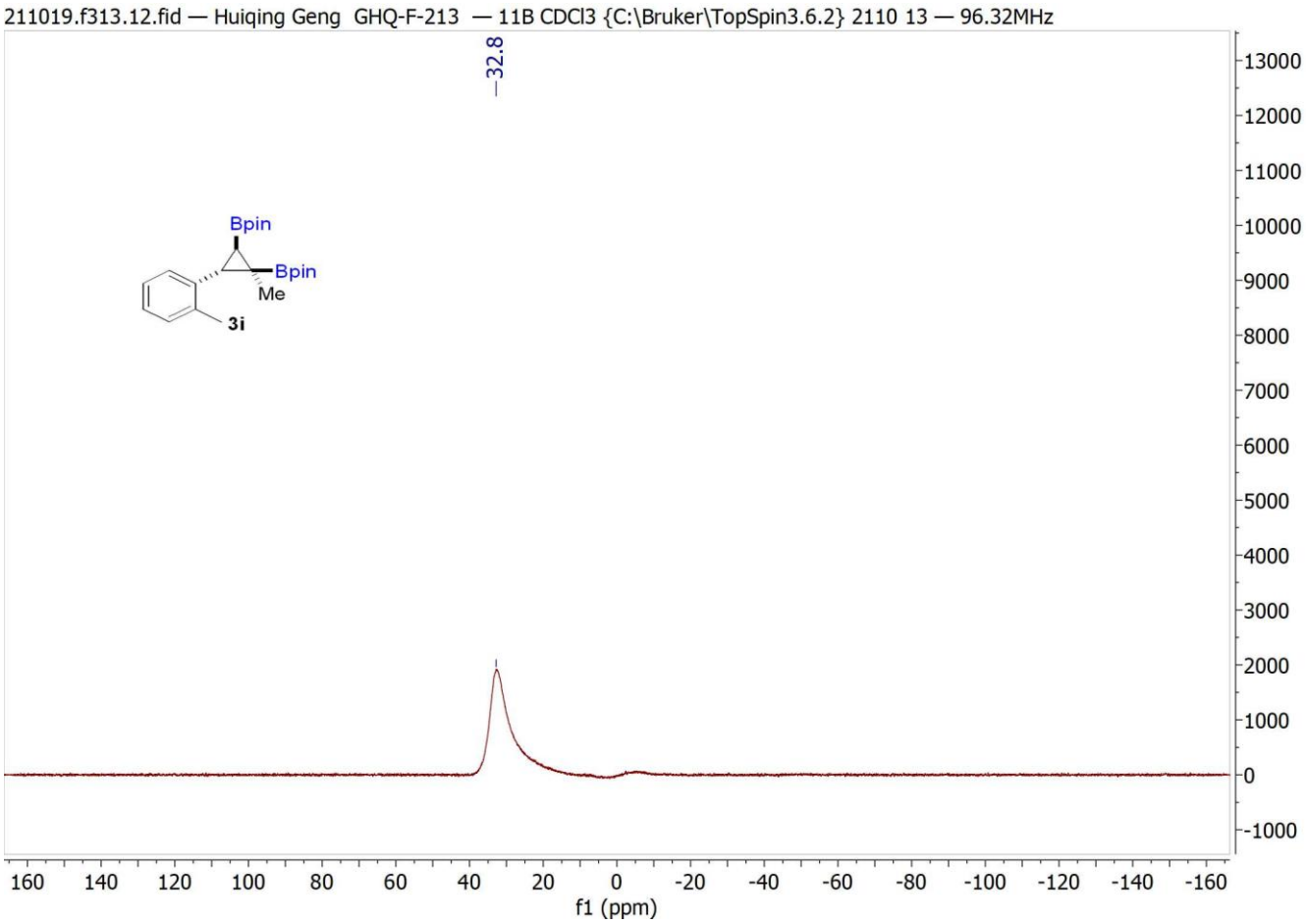

210914.320.10.fid — Huiqing Geng GHQ-F-166 — Au1H CDCl3 {C:\Bruker\TopSpin3.6.2} 2109 20 — 300.13MHz
7.26 CDCl3
7.16 7.16 7.14 7.14 7.14 7.13 7.13 7.12 7.12 7.11 7.11 6.96 6.95 6.95 6.94 6.93 6.92 6.91 6.90 6.89 6.88
2.47 2.44
1.26 1.26
0.77 0.32 0.30
Bpin
Bpin
Me
F
3h
2.01 2.00 0.93 24.01 3.01 1.00
f1 (ppm)

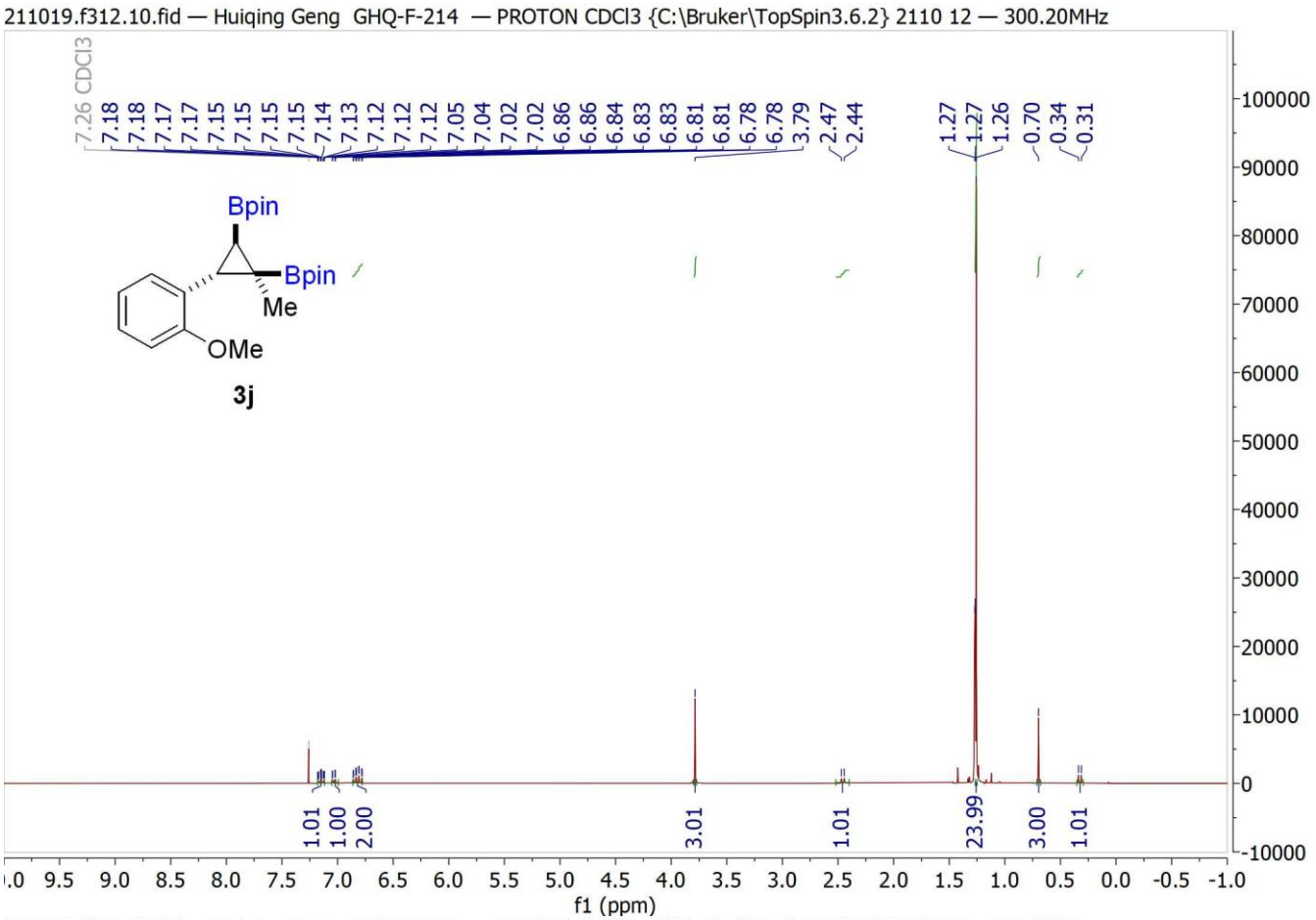

210914.320.11.fid — Huiqing Geng GHQ-F-166 — Au13C CDCl3 {C:\Bruker\TopSpin3.6.2} 2109 20
162.9 159.7
134.9 134.8 130.9 130.8
114.5 114.2
83.3 83.2
30.9 25.0 25.0 24.8 24.6 17.5
Bpin
Bpin
Me
F
3h
f1 (ppm)

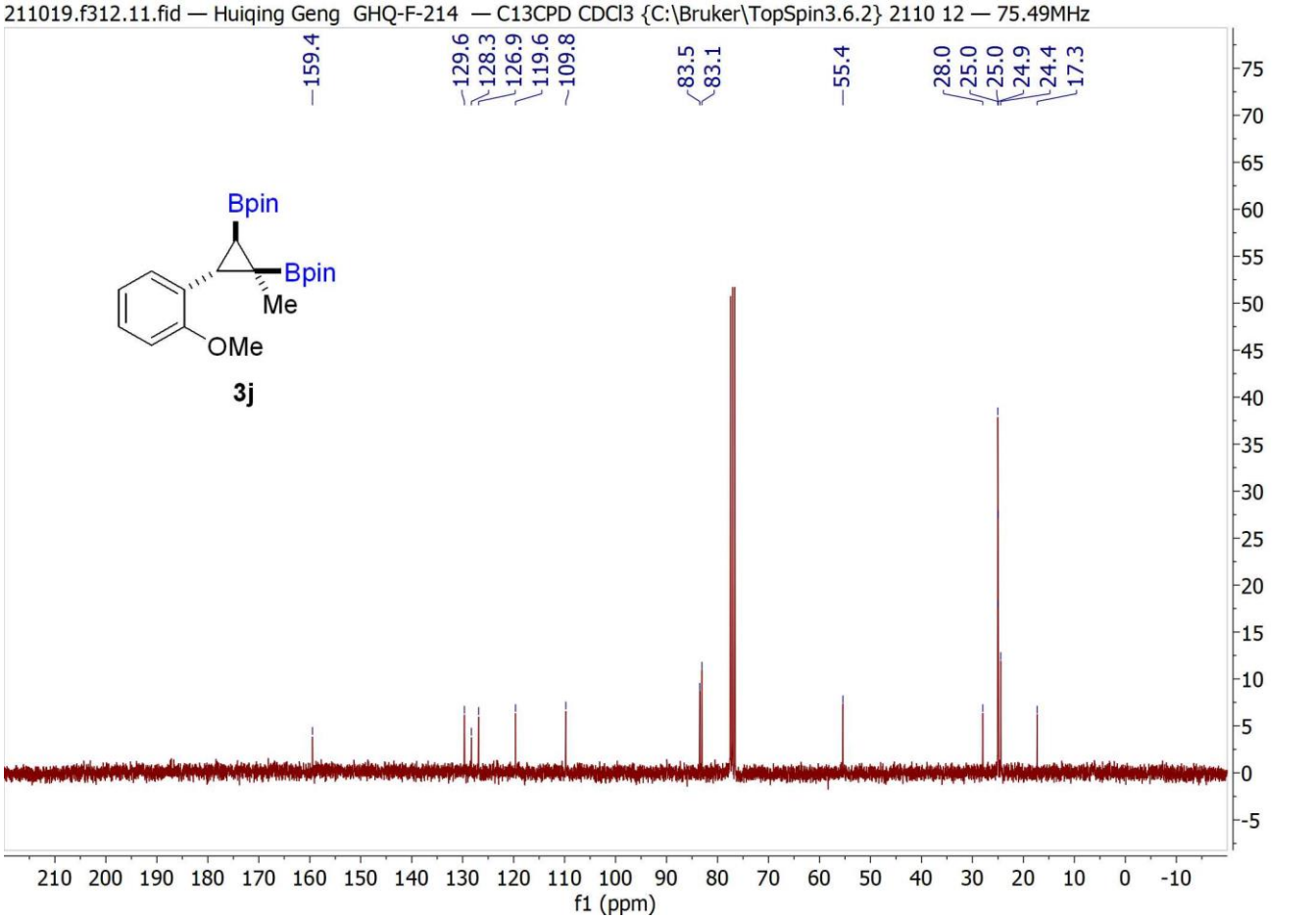

210915.f313.10.fid — Huiqing Geng GHQ-F-166 — 11B CDCl3 {C:\Bruker\TopSpin3.6.2} 2109 13
33.4
Bpin
Bpin
Me
F
3h
4500
4000
3500
3000
2500
2000
1500
1000
500
0
-500
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
f1 (ppm)

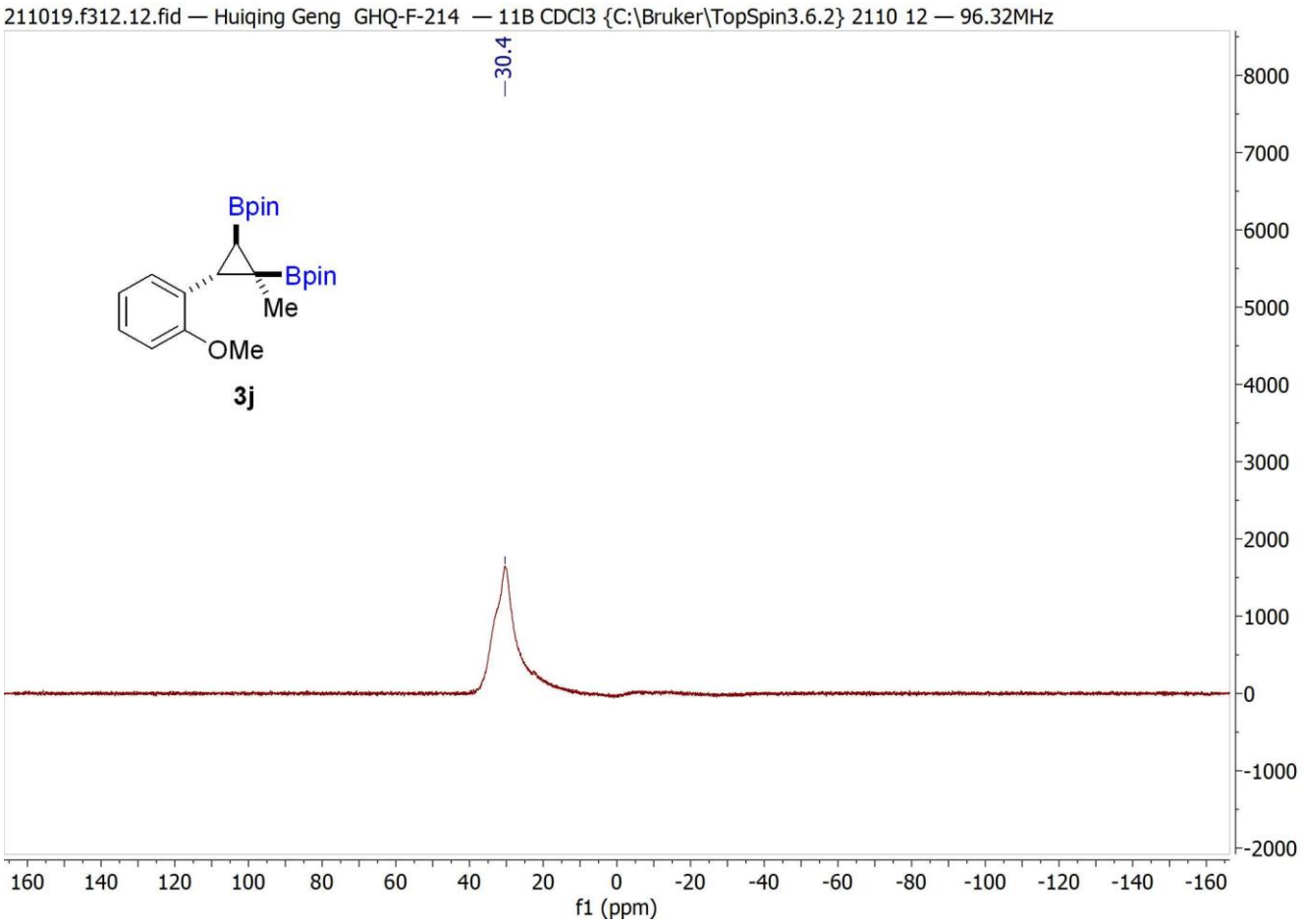

211019.f313.10.fid — Huiqing Geng GHQ-F-213 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.2} 2110 13 — 300.20MHz
7.26 CDCl3
7.13 7.13 7.12 7.11 7.11 7.09 7.09 7.08 7.08 7.07 7.06
2.37 2.35 2.31
1.28 1.27 1.27 0.69 0.43 0.40
Bpin
Bpin
Me
3i
4.02
1.04
3.02
24.01
3.00
1.00
f1 (ppm)

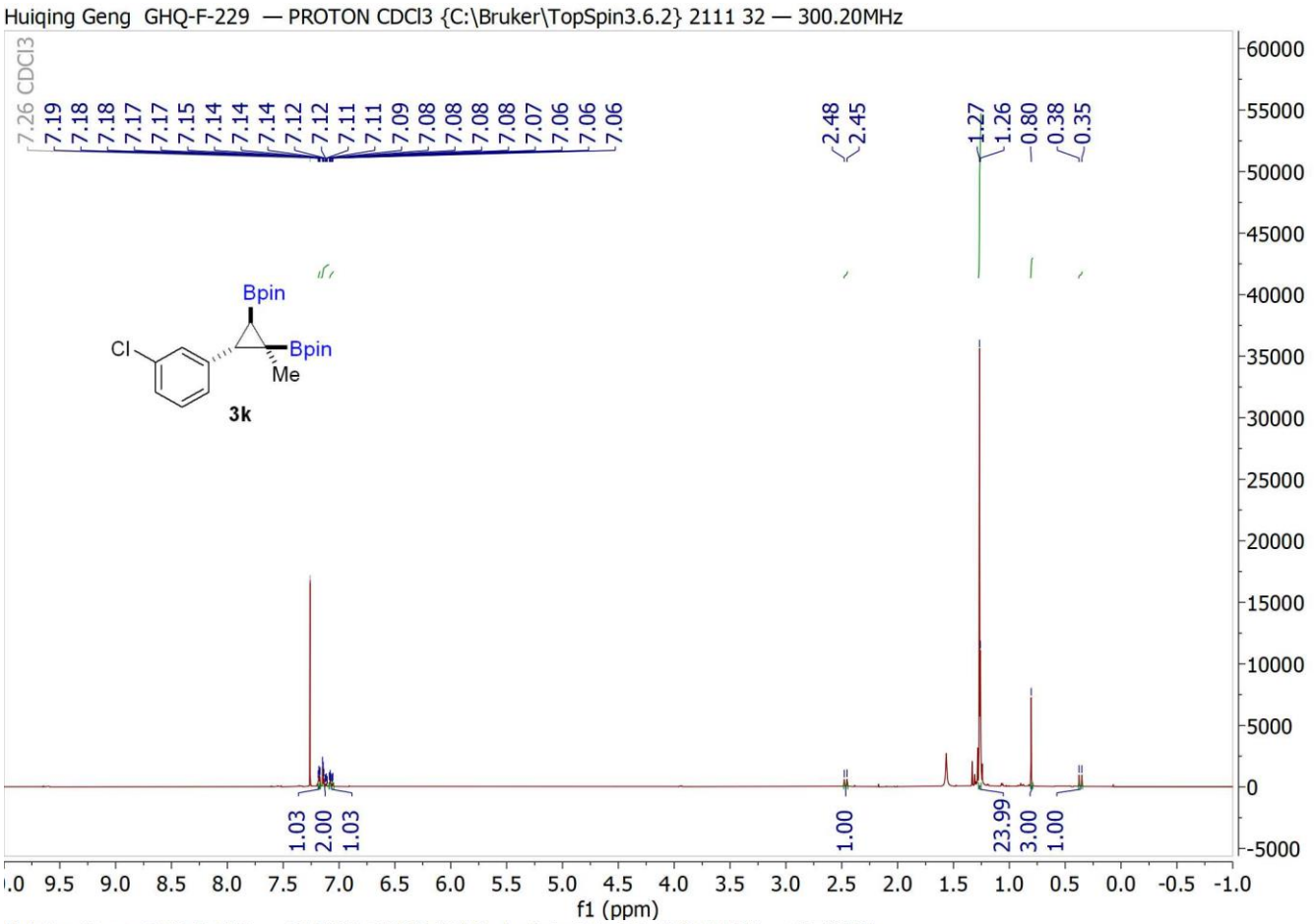

211019.f313.11.fid — Huiqing Geng GHQ-F-213 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.2} 2110 13 — 75.49MHz
138.6 137.8 129.1 128.9 125.9 125.1
83.2 83.1
77.0 CDCl3
31.0 25.1 25.0 24.9 24.5 19.5 17.2
Bpin
Bpin
Me
3i
f1 (ppm)

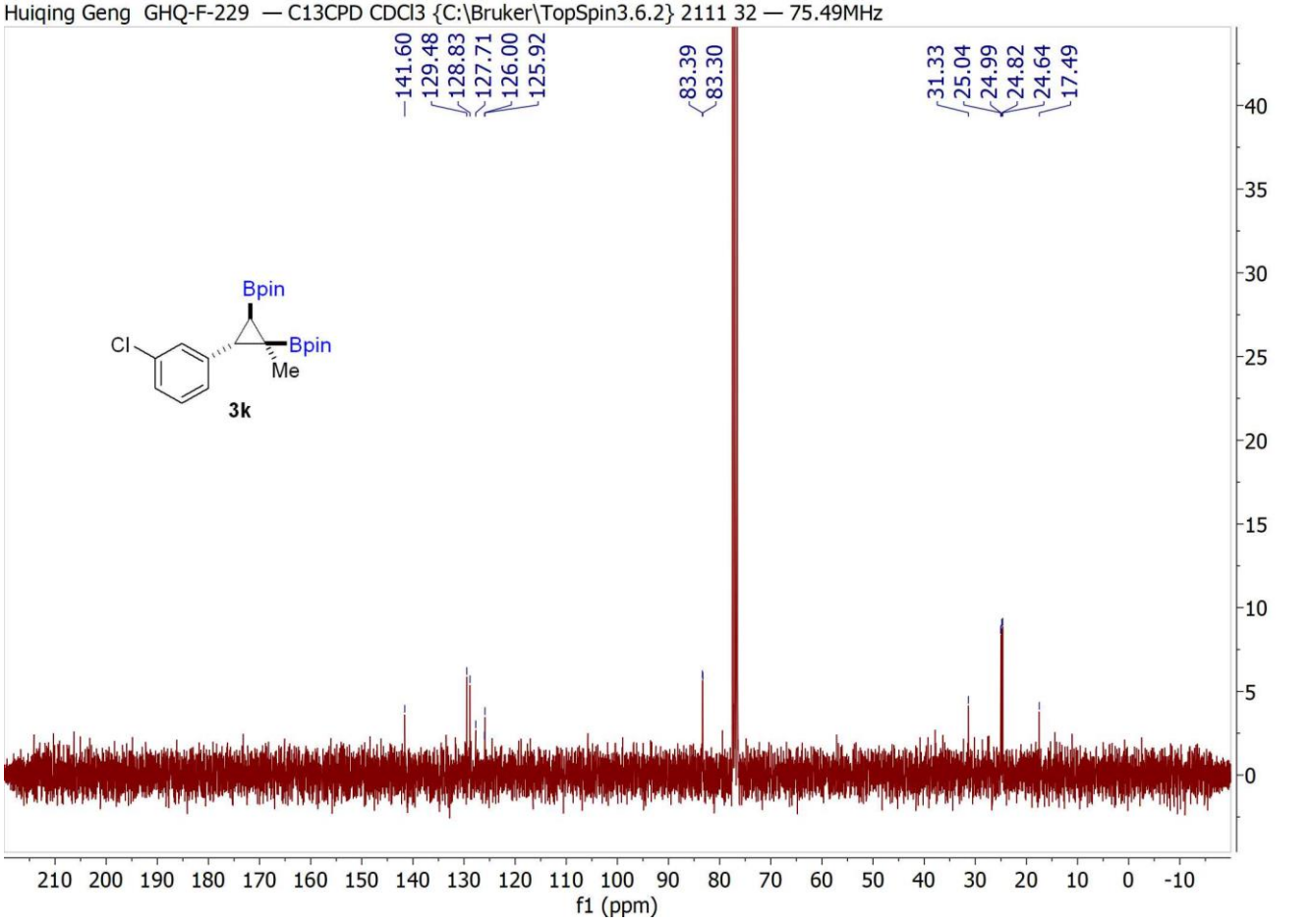

211019.f313.12.fid — Huiqing Geng GHQ-F-213 — 11B CDCl3 {C:\Bruker\TopSpin3.6.2} 2110 13 — 96.32MHz
32.8
Bpin
Bpin
Me
3i
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
-1000
160 140 120 100 80 60 40 20 0 -20 -40 -60 -80 -100 -120 -140 -160
f1 (ppm)

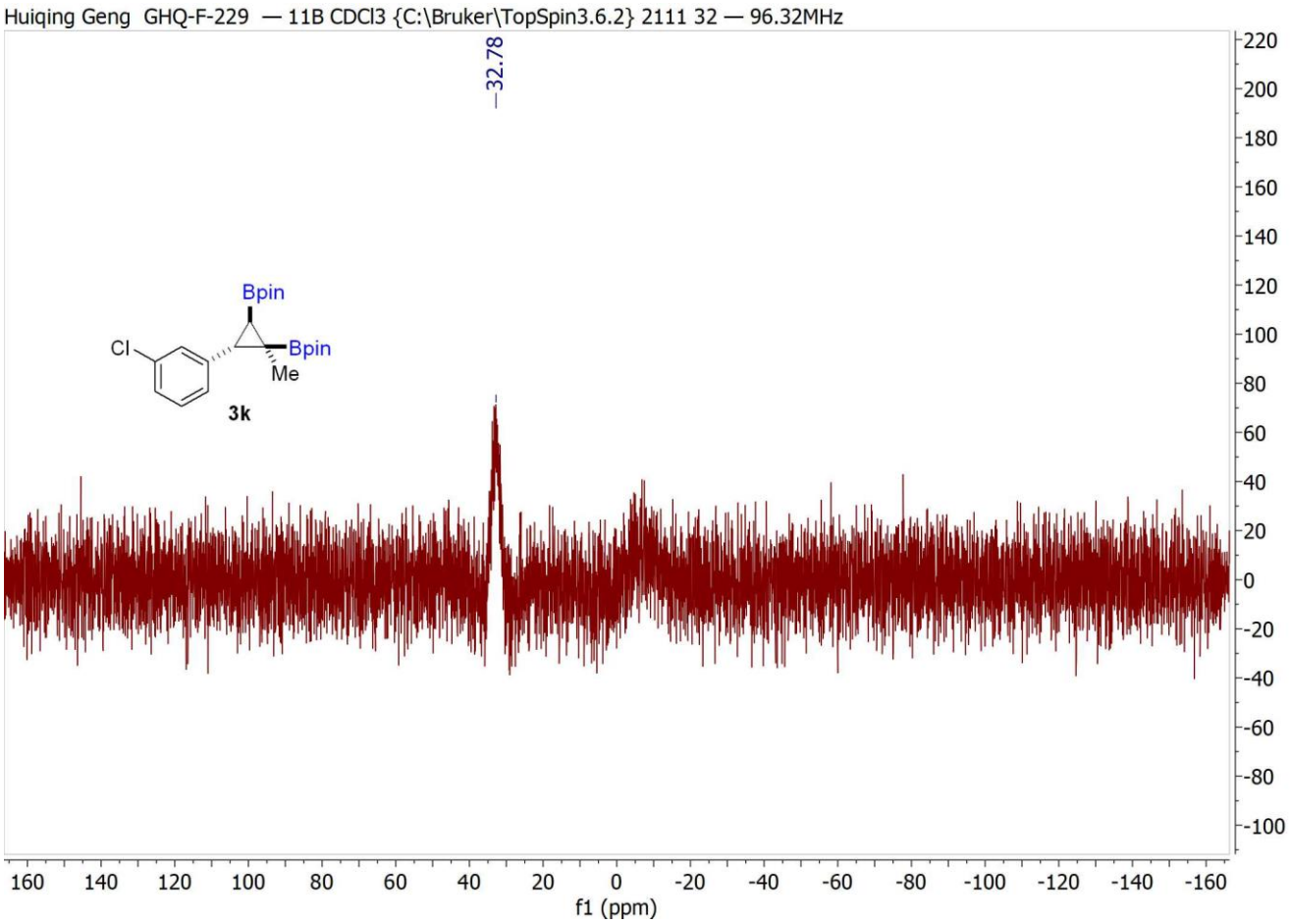

211019.f312.10.fid — Huiqing Geng GHQ-F-214 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.2} 2110 12 — 300.20MHz
7.26 CDCl3
7.18 7.18 7.17 7.17 7.15 7.15 7.15 7.15 7.14 7.13 7.12 7.12 7.12 7.05 7.04 7.02 7.02 6.86 6.86 6.84 6.83 6.83 6.81 6.81 6.78 6.78 3.79 2.47 2.44 1.27 1.27 1.26 0.70 0.34 0.31
Bpin
Bpin
Me
OMe
3j
1.01 1.00 2.00 3.01 1.01 23.99 3.00 1.01
f1 (ppm)

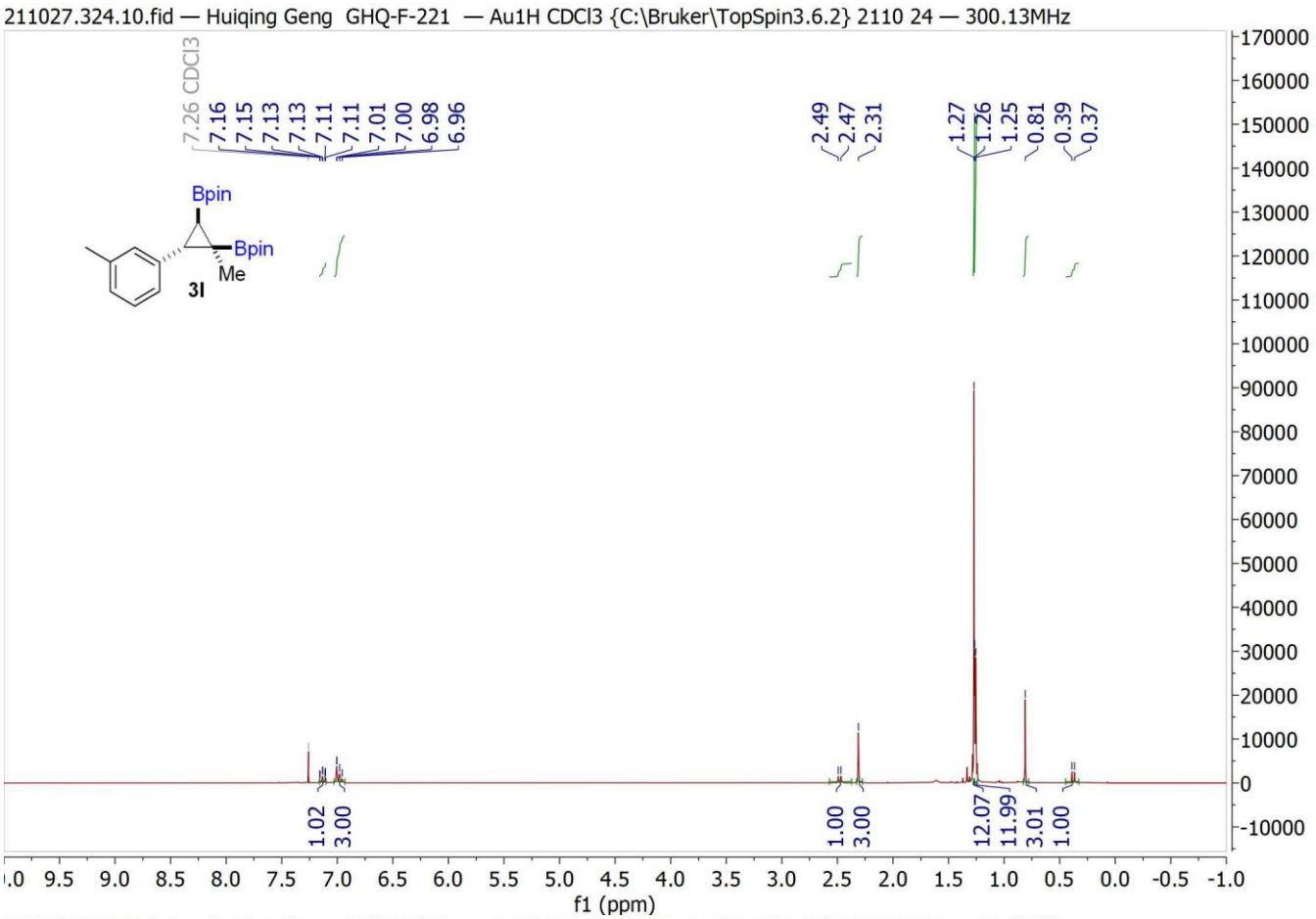

211019.f312.11.fid — Huiqing Geng GHQ-F-214 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.2} 2110 12 — 75.49MHz
159.4 129.6 128.3 126.9 119.6 109.8 83.5 83.1 55.4 28.0 25.0 25.0 24.9 24.4 17.3
Bpin
Bpin
Me
OMe
3j
f1 (ppm)

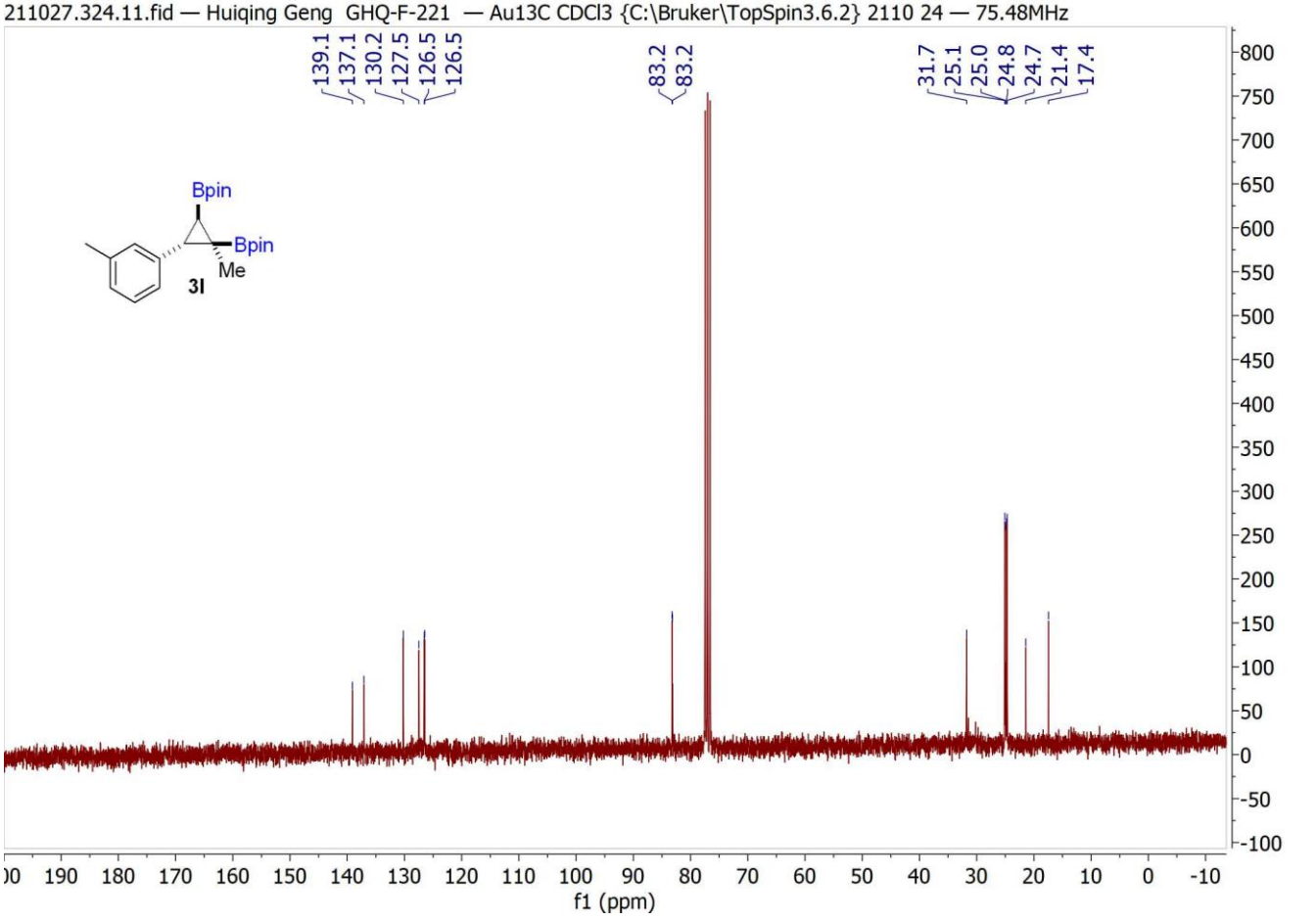

211019.f312.12.fid — Huiqing Geng GHQ-F-214 — 11B CDCl3 {C:\Bruker\TopSpin3.6.2} 2110 12 — 96.32MHz
30.4
Bpin
Bpin
Me
OMe
3j
8000
7000
6000
5000
4000
3000
2000
1000
0
-1000
-2000
160 140 120 100 80 60 40 20 0 -20 -40 -60 -80 -100 -120 -140 -160
f1 (ppm)

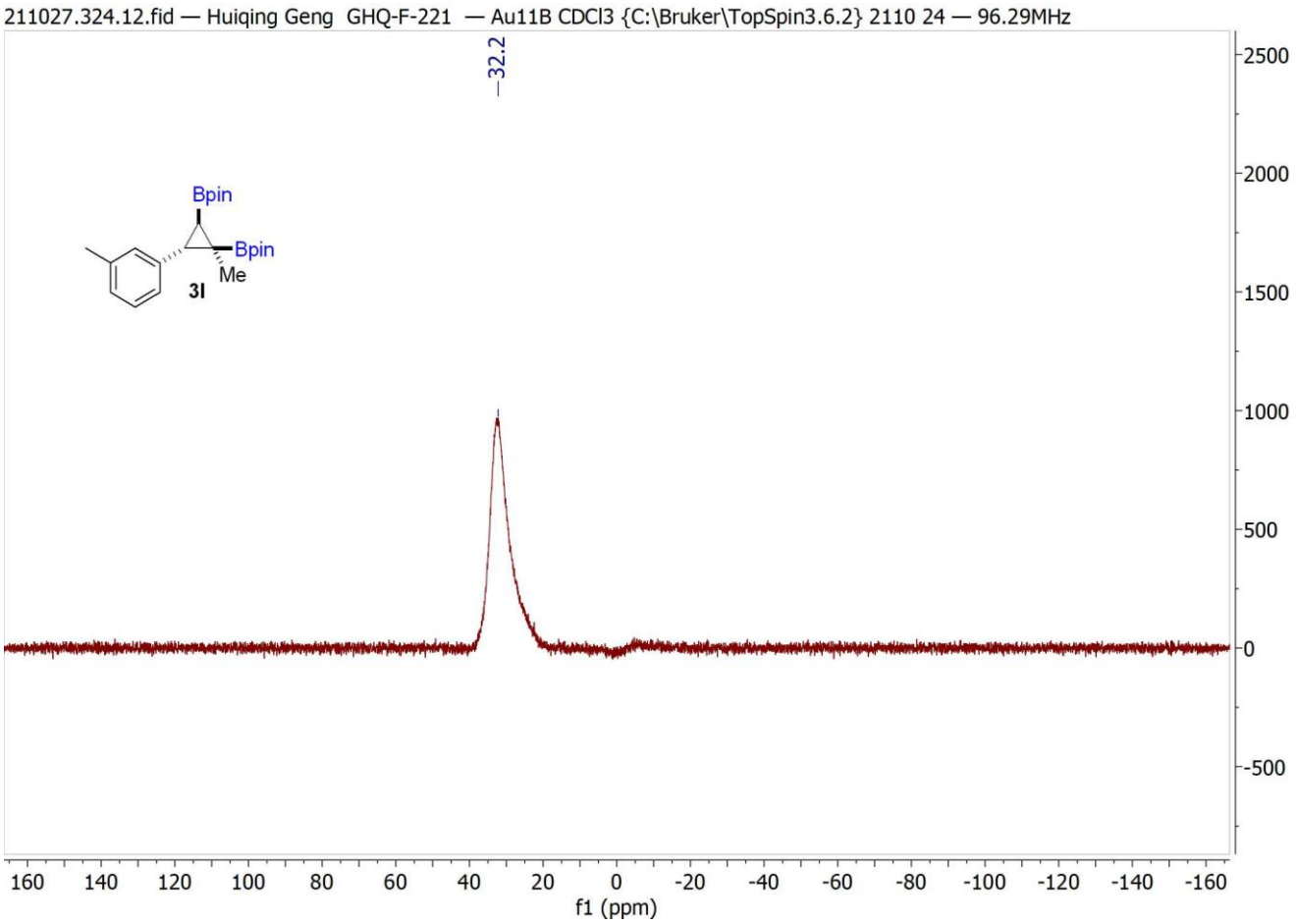

Huiqing Geng GHQ-F-229 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 32 — 300.20MHz
7.26 CDCl3
7.19 7.18 7.18 7.17 7.17 7.15 7.14 7.14 7.14 7.12 7.12 7.11 7.11 7.09 7.08 7.08 7.08 7.08 7.07 7.06 7.06 7.06
2.48 2.45
1.27 1.26 0.80 0.38 0.35
Bpin
Cl
Bpin
Me
3k
1.03 2.00 1.03 1.00 23.99 3.00 1.00
f1 (ppm)

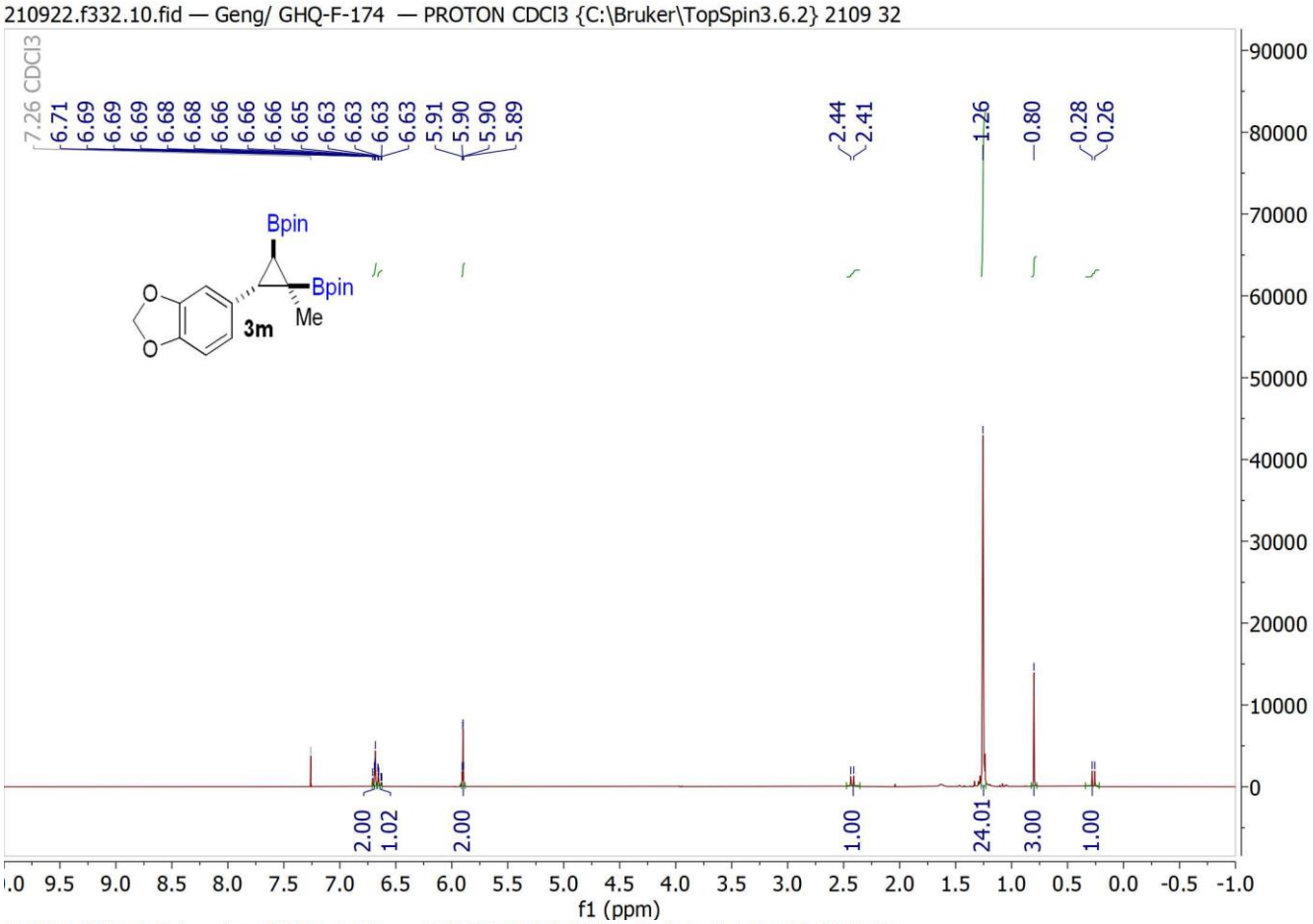

Huiqing Geng GHQ-F-229 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 32 — 75.49MHz
141.60 129.48 128.83 127.71 126.00 125.92
83.39 83.30
31.33 25.04 24.99 24.82 24.64 17.49
Bpin
Cl
Bpin
Me
3k
f1 (ppm)

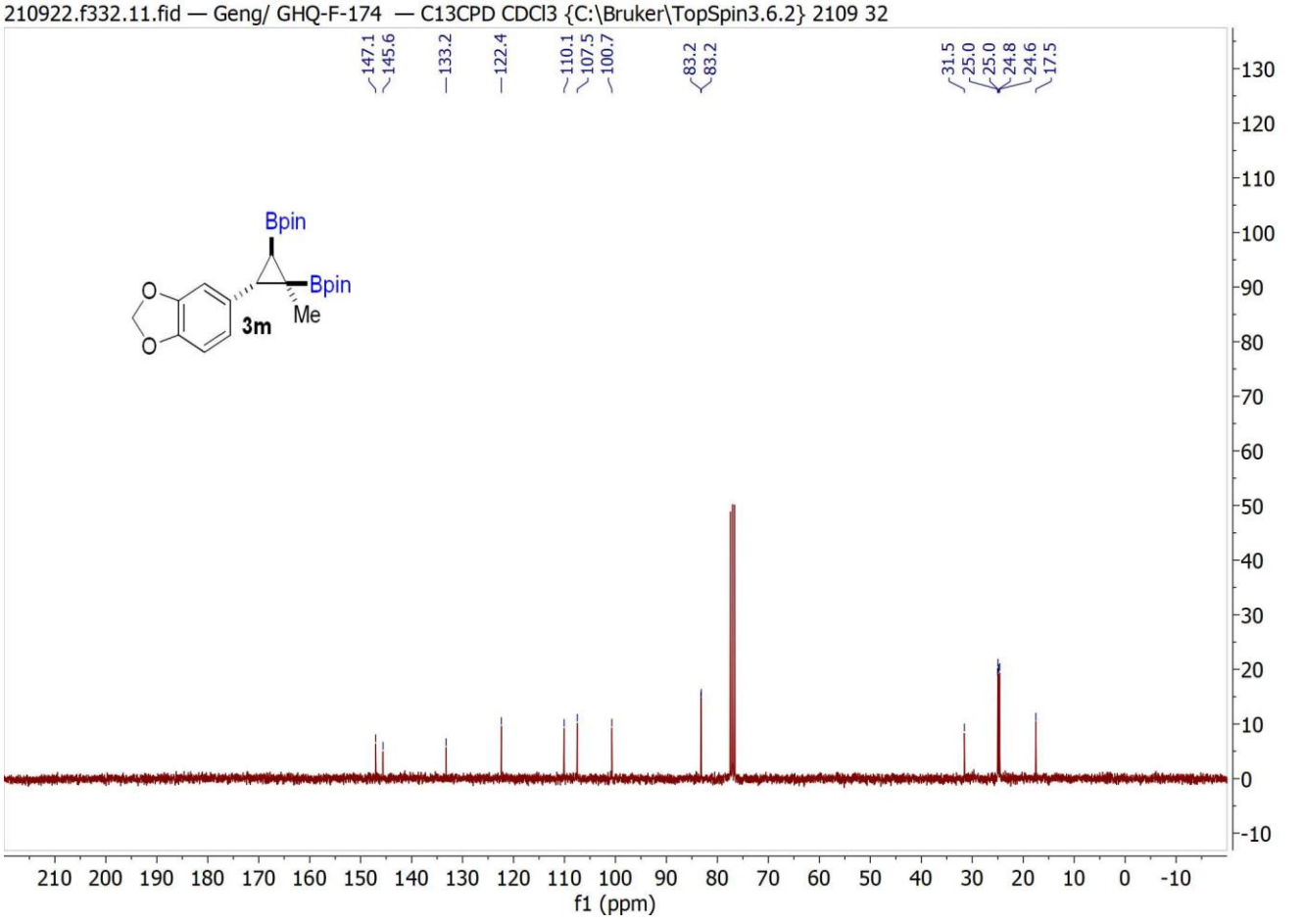

Huiqing Geng GHQ-F-229 — 11B CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 32 — 96.32MHz
32.78
Bpin
Cl
Bpin
Me
3k
f1 (ppm)

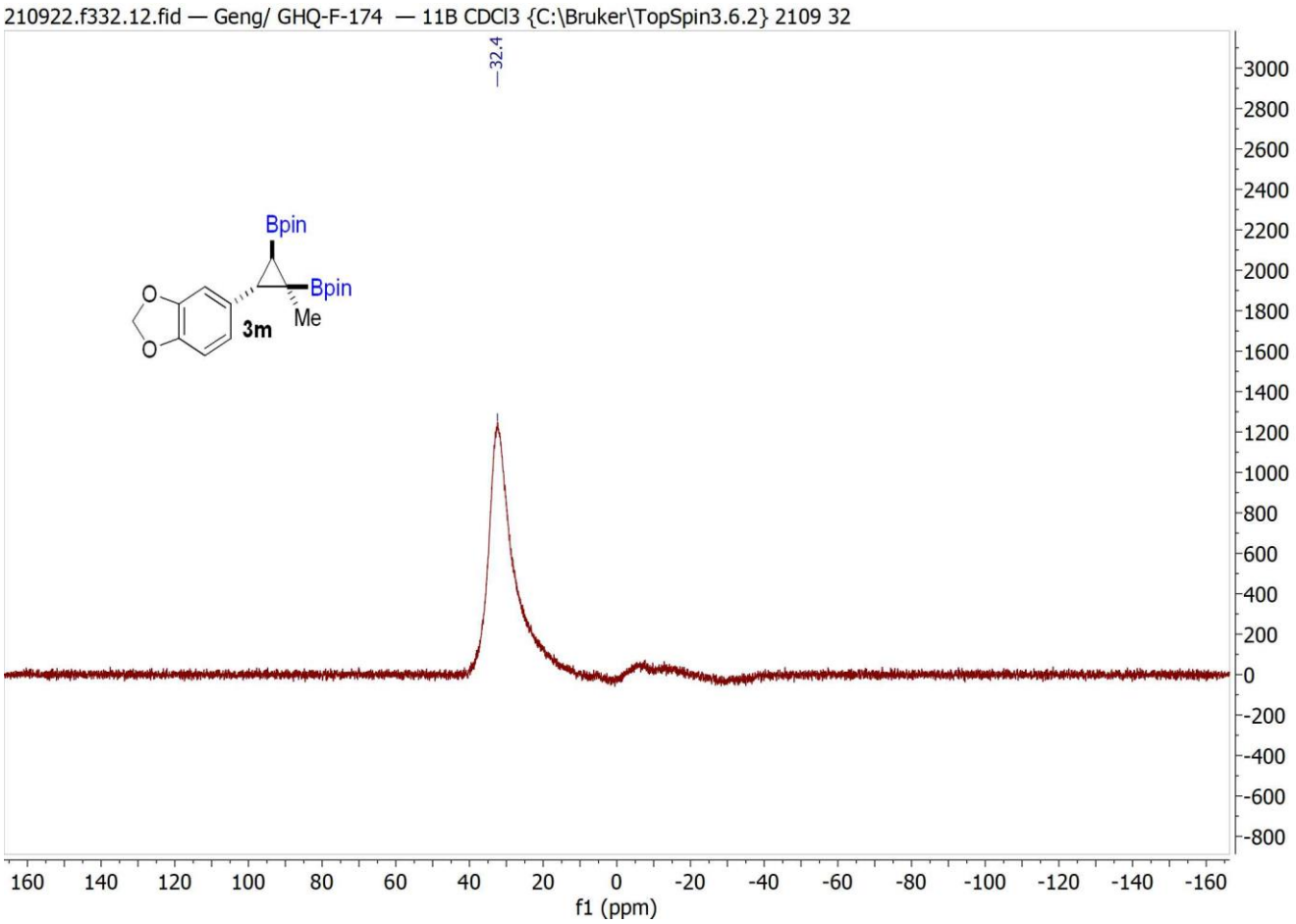

211027.324.10.fid — Huiqing Geng GHQ-F-221 — Au1H CDCl3 {C:\Bruker\TopSpin3.6.2} 2110 24 — 300.13MHz
7.26 CDCl3
7.16
7.15
7.13
7.13
7.11
7.11
7.01
7.00
6.98
6.96
2.49
2.47
2.31
1.27
1.26
1.25
0.81
0.39
0.37
Bpin
Bpin
Me
3l
1.02
3.00
1.00
3.00
12.07
11.99
3.01
1.00
f1 (ppm)

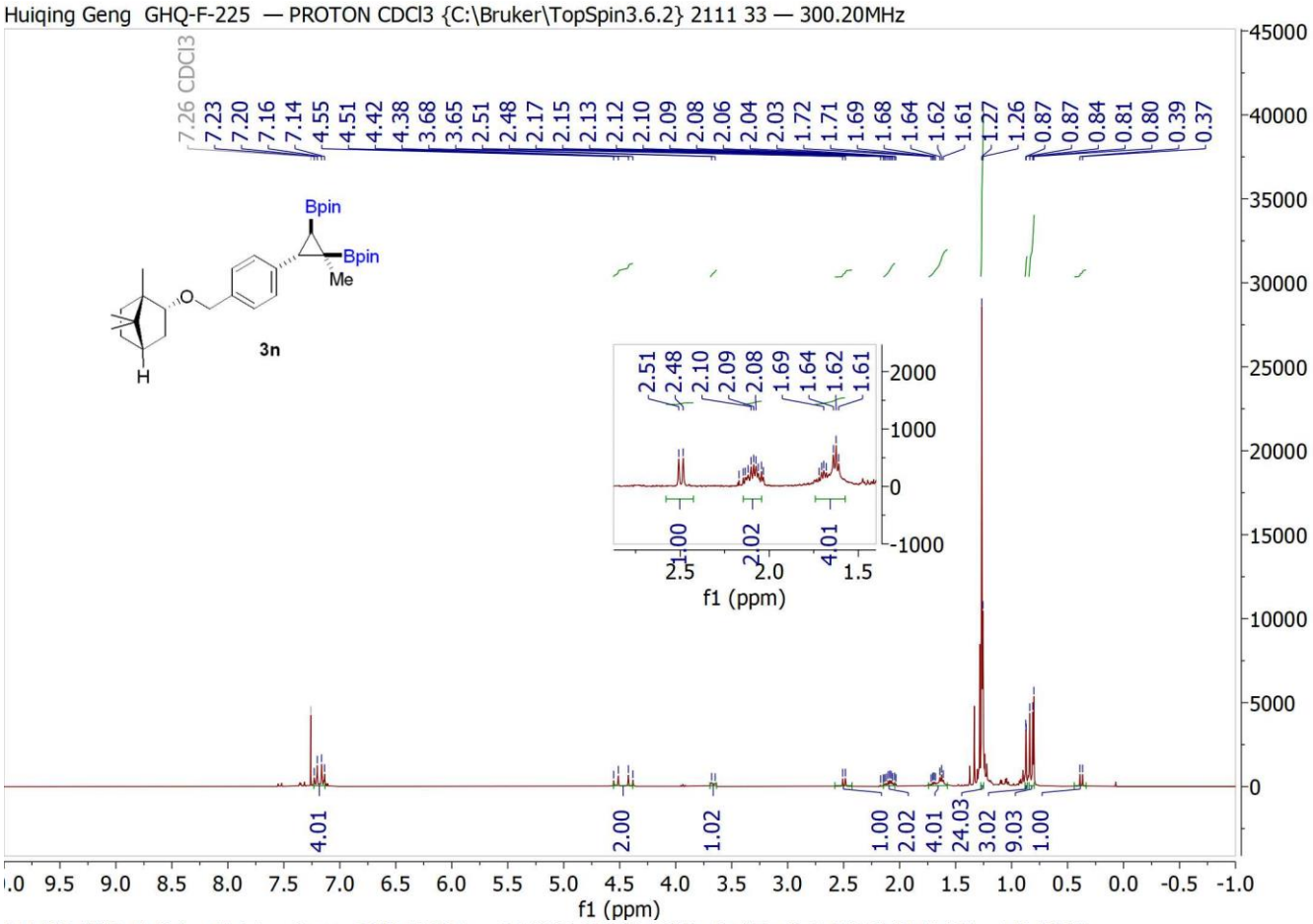

211027.324.11.fid — Huiqing Geng GHQ-F-221 — Au13C CDCl3 {C:\Bruker\TopSpin3.6.2} 2110 24 — 75.48MHz
139.1
137.1
130.2
127.5
126.5
126.5
83.2
83.2
31.7
25.1
25.0
24.8
24.7
21.4
17.4
Bpin
Bpin
Me
3l
f1 (ppm)

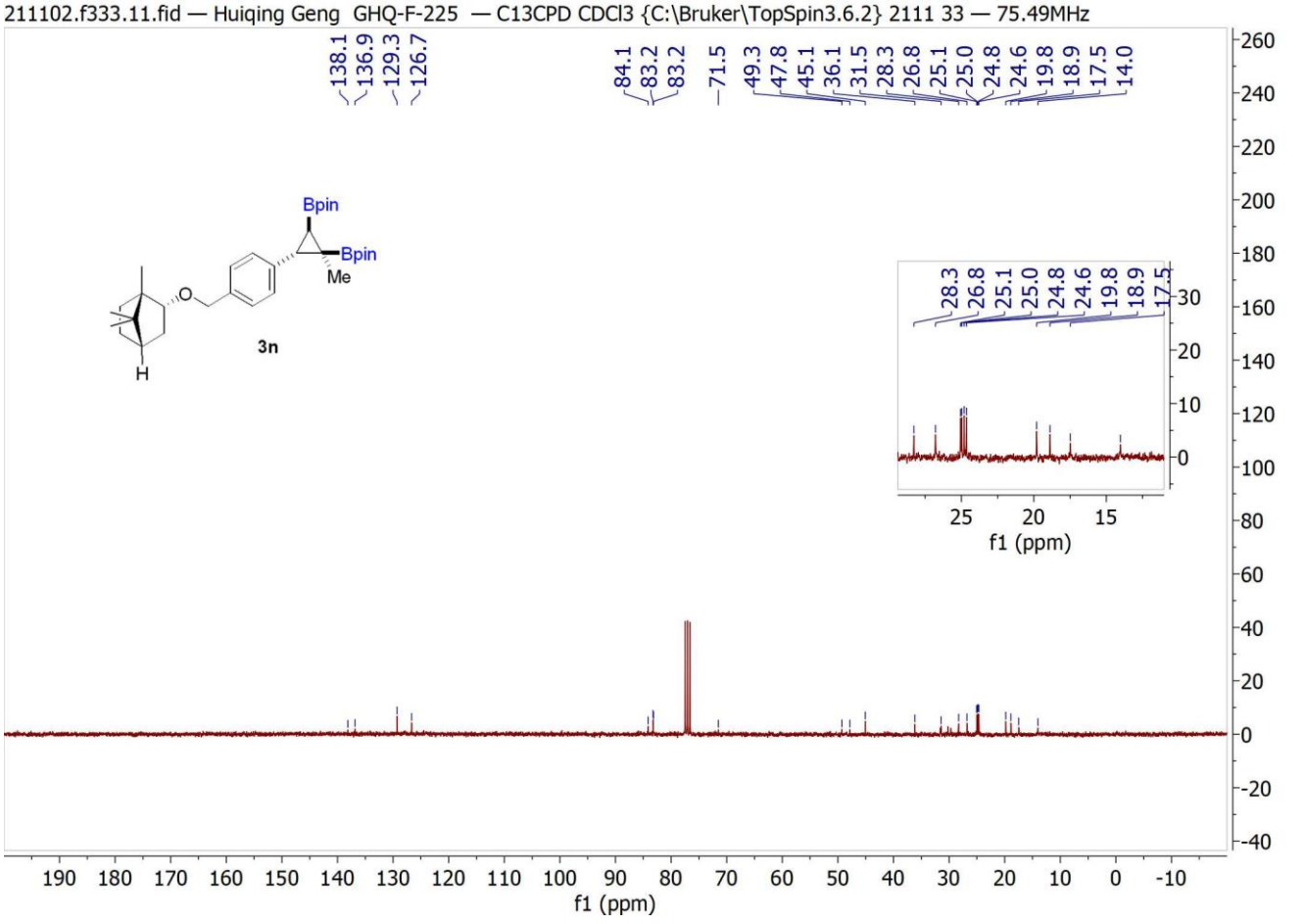

211027.324.12.fid — Huiqing Geng GHQ-F-221 — Au11B CDCl3 {C:\Bruker\TopSpin3.6.2} 2110 24 — 96.29MHz
32.2
Bpin
Bpin
Me
3l
2500
2000
1500
1000
500
0
-500
160 140 120 100 80 60 40 20 0 -20 -40 -60 -80 -100 -120 -140 -160
f1 (ppm)

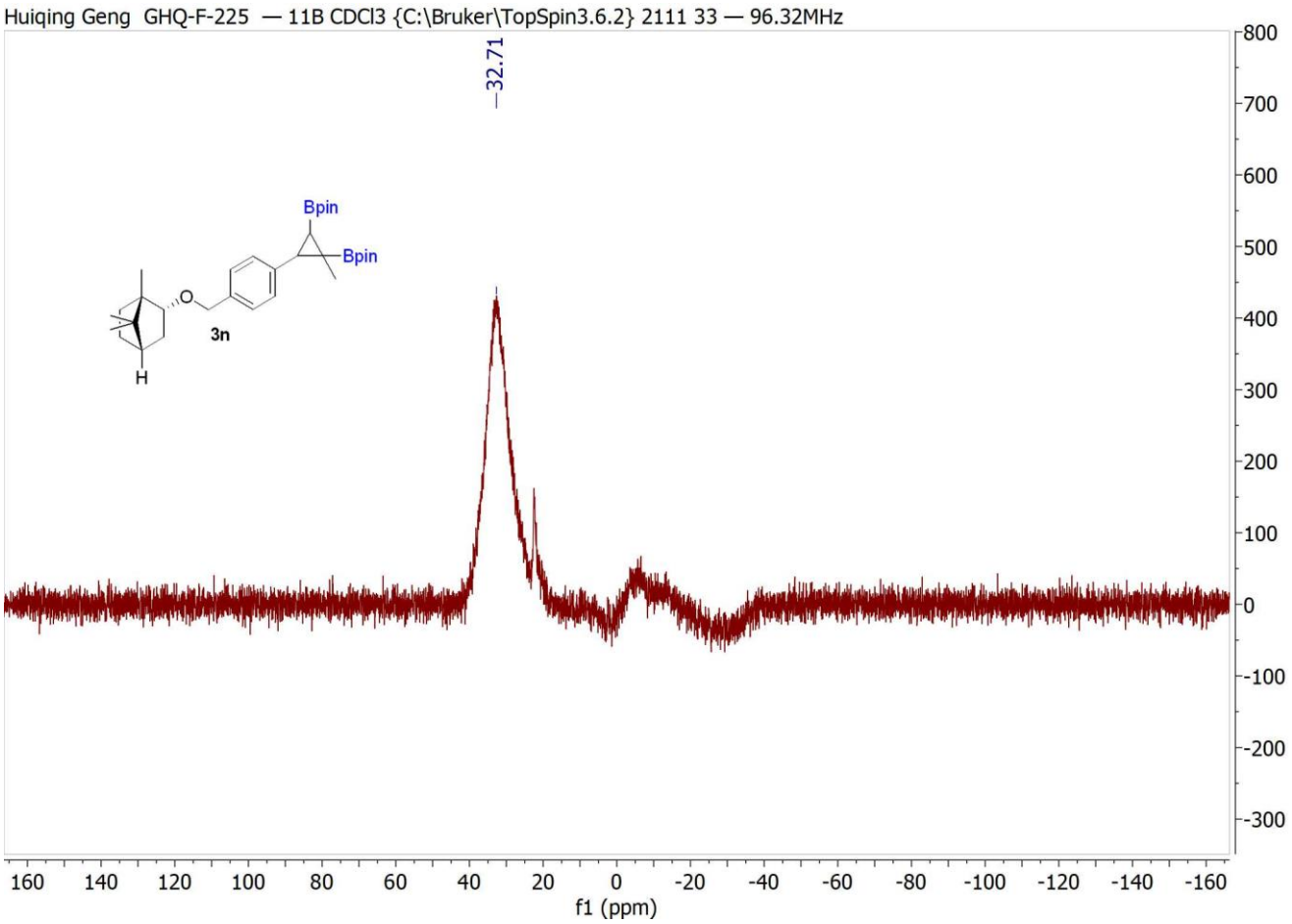

210922.f332.10.fid — Geng/ GHQ-F-174 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.2} 2109 32
7.26 CDCl3
6.71 6.69 6.69 6.69 6.68 6.68 6.66 6.66 6.66 6.65 6.63 6.63 6.63 6.63 5.91 5.90 5.90 5.89
2.44 2.41
1.26
0.80
0.28 0.26
Bpin
Bpin
Me
3m
2.00 1.02 2.00 1.00 24.01 3.00 1.00
f1 (ppm)

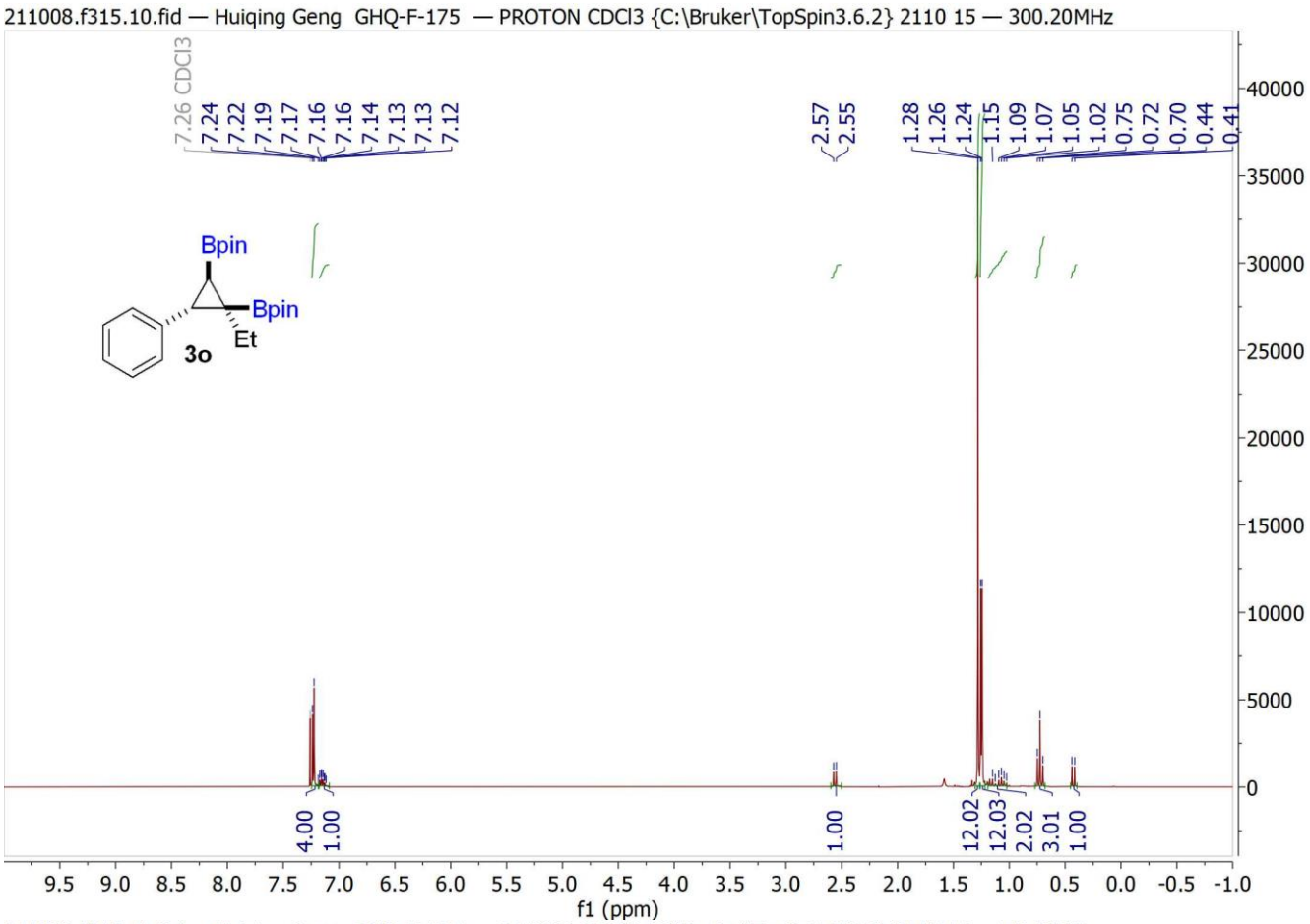

210922.f332.11.fid — Geng/ GHQ-F-174 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.2} 2109 32
147.1 145.6 133.2 122.4 110.1 107.5 100.7 83.2 83.2
31.5 25.0 25.0 24.8 24.6 17.5
Bpin
Bpin
Me
3m
f1 (ppm)

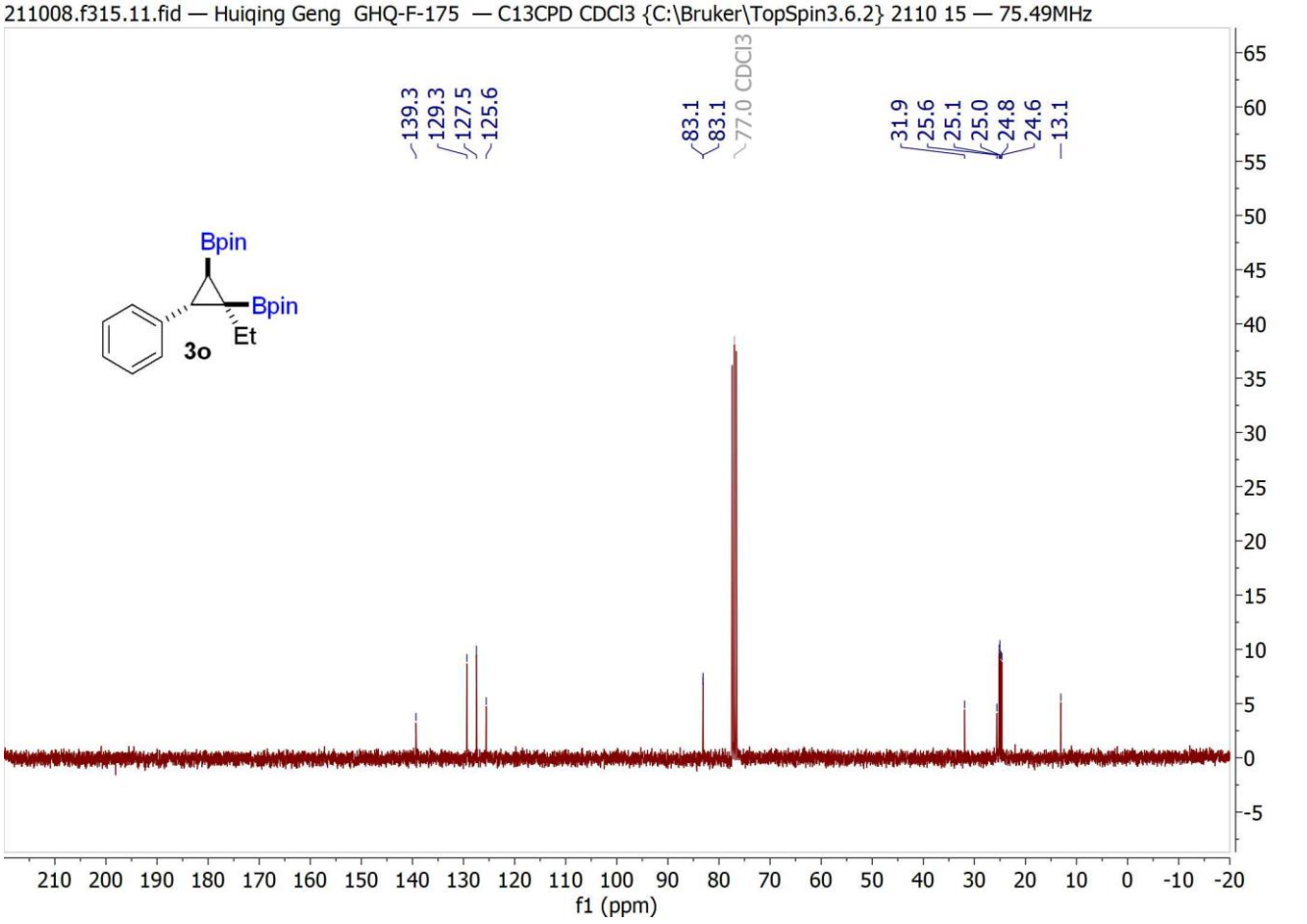

210922.f332.12.fid — Geng/ GHQ-F-174 — 11B CDCl3 {C:\Bruker\TopSpin3.6.2} 2109 32
32.4
Bpin
Bpin
Me
3m
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
-200
-400
-600
-800
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
f1 (ppm)

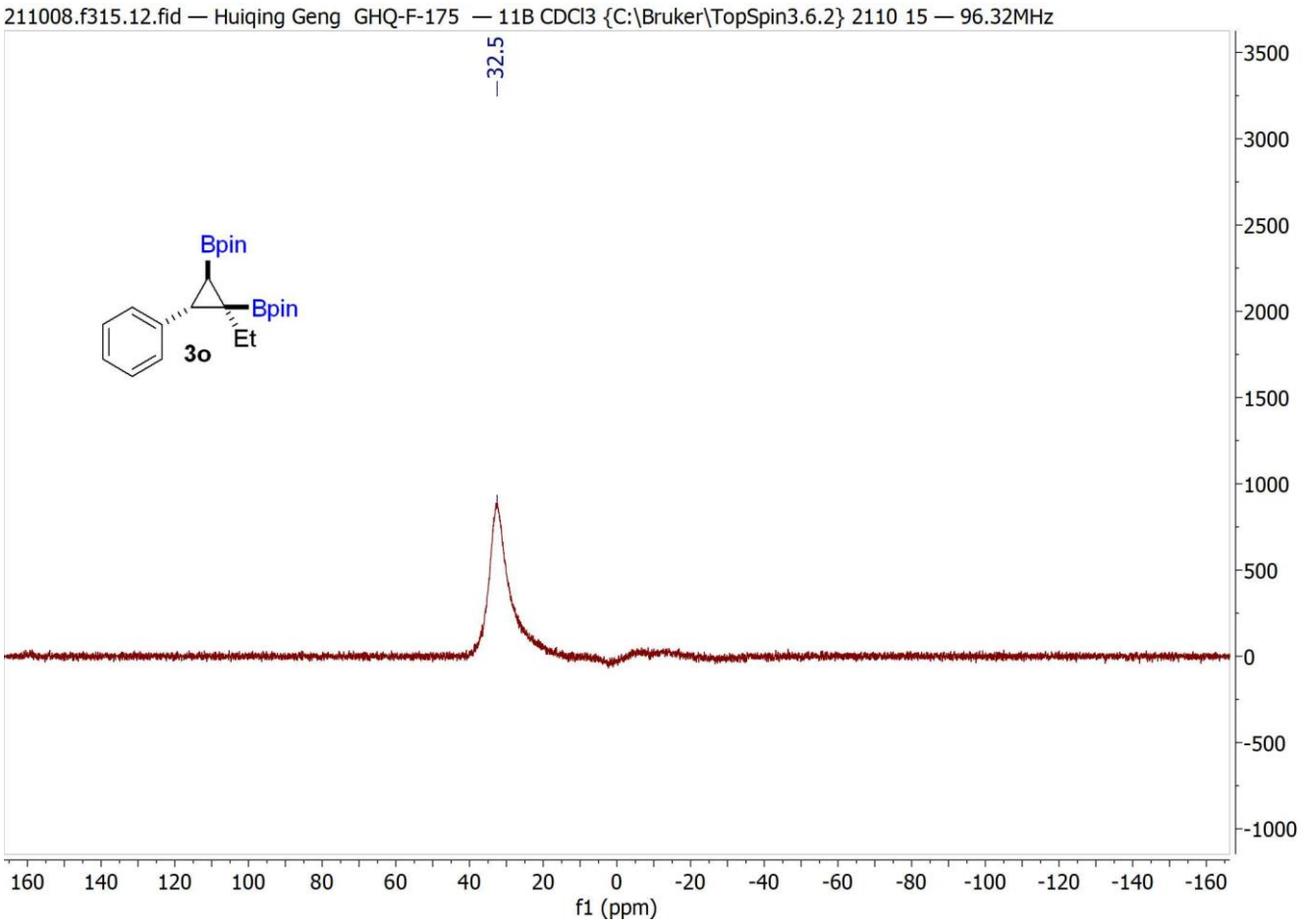

Huiqing Geng GHQ-F-225 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 33 — 300.20MHz
7.26 CDCl3
7.23 7.20 7.16 7.14 4.55 4.51 4.42 4.38 3.68 3.65 2.51 2.48 2.17 2.15 2.13 2.12 2.10 2.09 2.08 2.06 2.04 2.03 1.72 1.71 1.69 1.68 1.64 1.62 1.61 1.27 1.26 0.87 0.87 0.84 0.81 0.80 0.39 0.37
Bpin
Bpin
Me
O
H
3n
2.51 2.48 2.10 2.09 2.08 1.69 1.64 1.62 1.61
4.01 2.00 1.02 1.00 2.02 4.01 24.03 3.02 9.03 1.00
f1 (ppm)

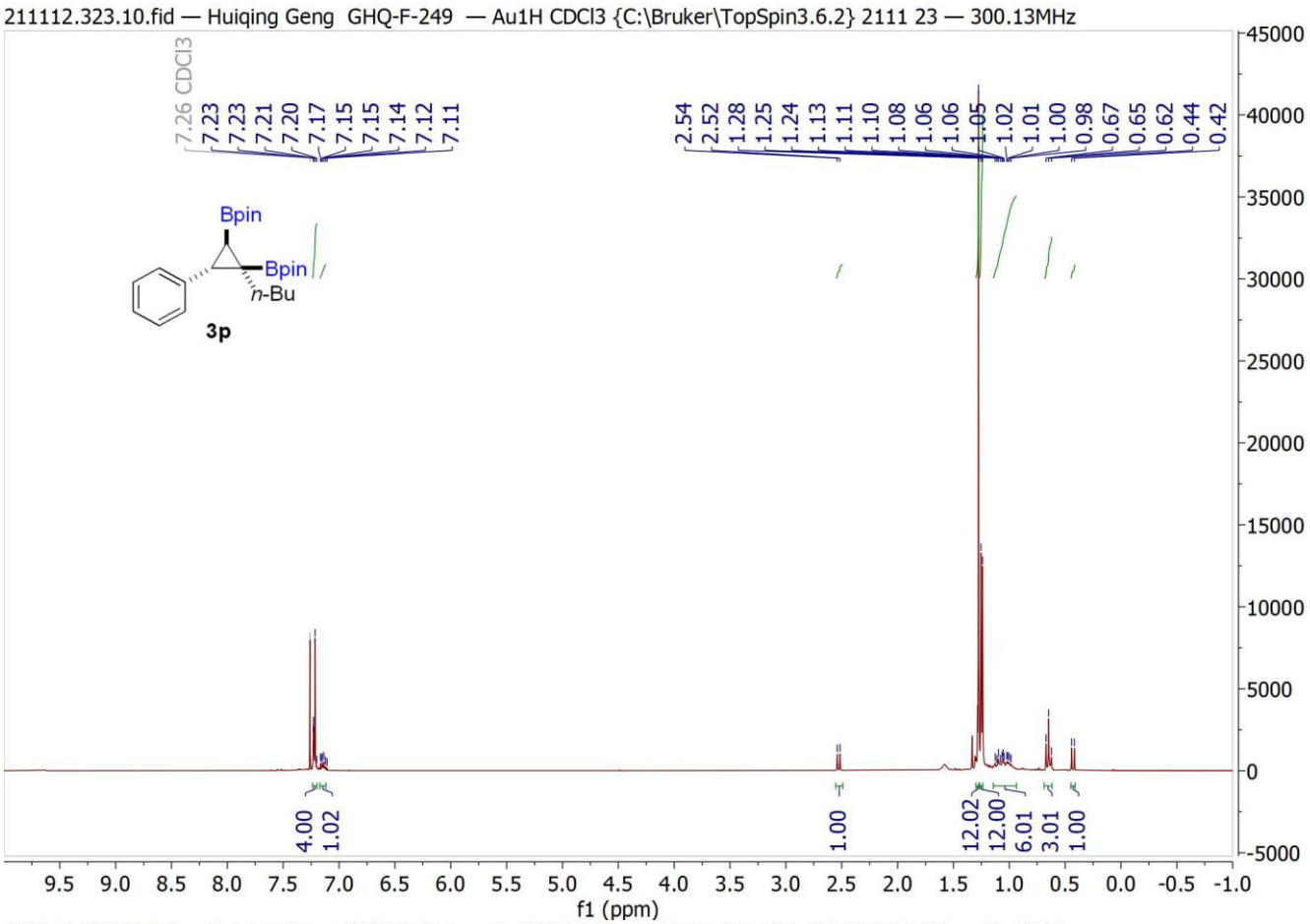

211102.f333.11.fid — Huiqing Geng GHQ-F-225 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 33 — 75.49MHz
138.1 136.9 129.3 126.7
84.1 83.2 83.2 71.5 49.3 47.8 45.1 36.1 31.5 28.3 26.8 25.1 25.0 24.8 24.6 19.8 18.9 17.5 14.0
Bpin
Bpin
Me
O
H
3n
28.3 26.8 25.1 25.0 24.8 24.6 19.8 18.9 17.5
f1 (ppm)

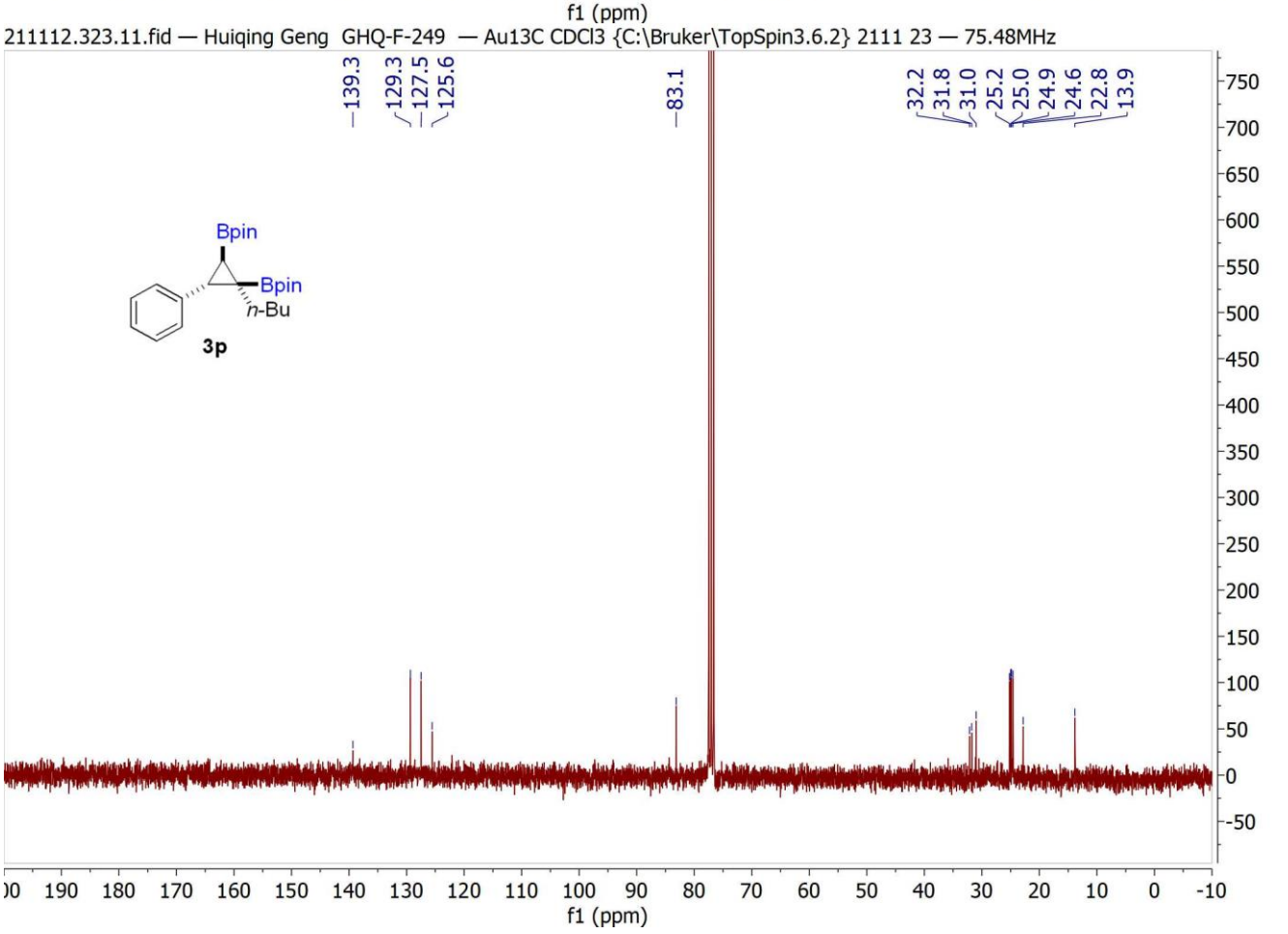

Huiqing Geng GHQ-F-225 — 11B CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 33 — 96.32MHz
32.71
Bpin
Bpin
O
H
3n
800
700
600
500
400
300
200
100
0
-100
-200
-300
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
f1 (ppm)

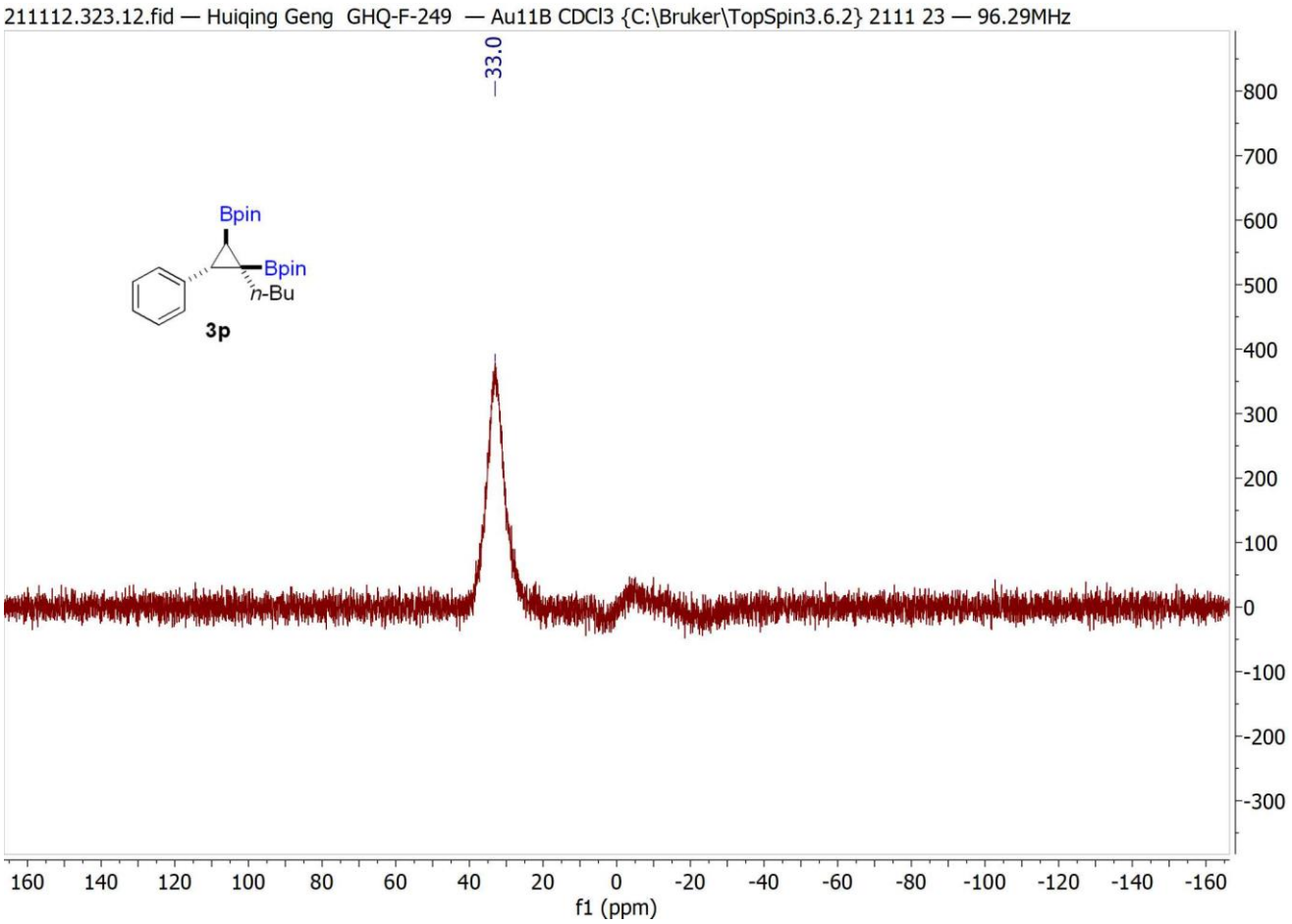

211008.f315.10.fid — Huiqing Geng GHQ-F-175 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.2} 2110 15 — 300.20MHz
7.26 CDCl3
7.24
7.22
7.19
7.17
7.16
7.16
7.14
7.13
7.13
7.12
2.57
2.55
1.28
1.26
1.24
1.15
1.09
1.07
1.05
1.02
0.75
0.72
0.70
0.44
0.41
Bpin
Bpin
Et
3o
4.00
1.00
1.00
12.02
12.03
2.02
3.01
1.00
f1 (ppm)

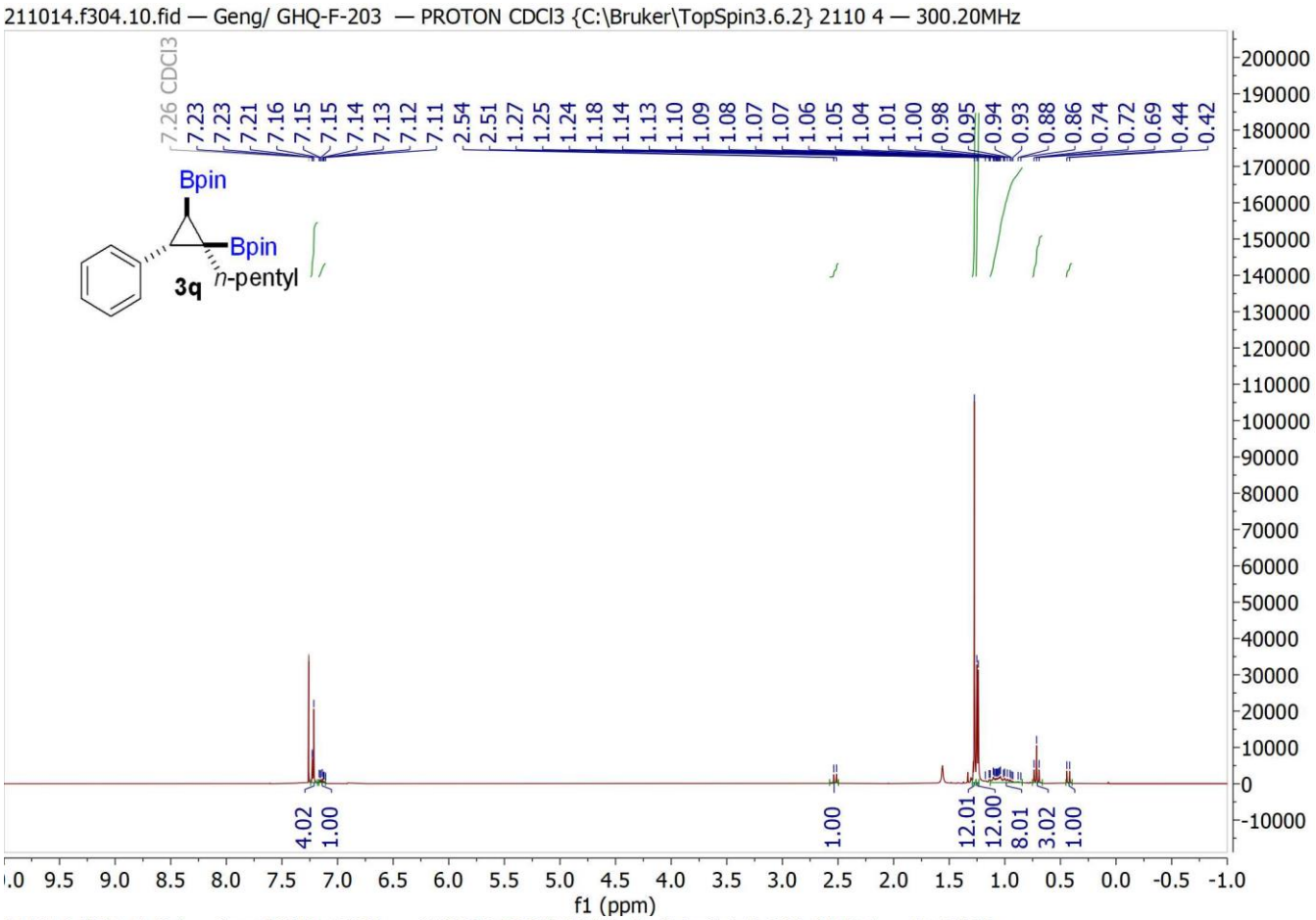

211008.f315.11.fid — Huiqing Geng GHQ-F-175 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.2} 2110 15 — 75.49MHz
139.3
129.3
127.5
125.6
83.1
83.1
77.0 CDCl3
31.9
25.6
25.1
25.0
24.8
24.6
13.1
Bpin
Bpin
Et
3o
f1 (ppm)

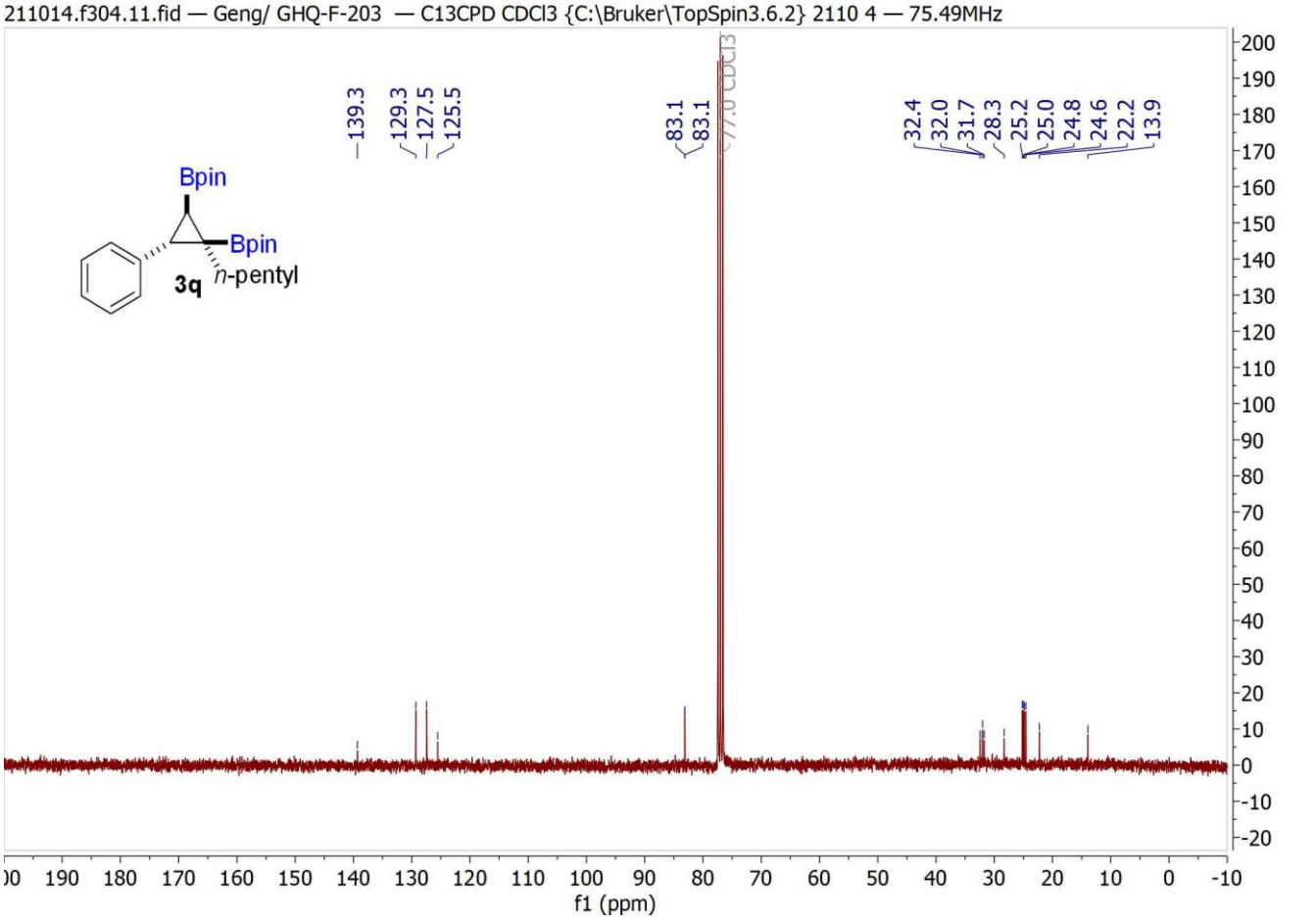

211008.f315.12.fid — Huiqing Geng GHQ-F-175 — 11B CDCl3 {C:\Bruker\TopSpin3.6.2} 2110 15 — 96.32MHz
32.5
Bpin
Bpin
Et
3o
3500
3000
2500
2000
1500
1000
500
0
-500
-1000
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
f1 (ppm)

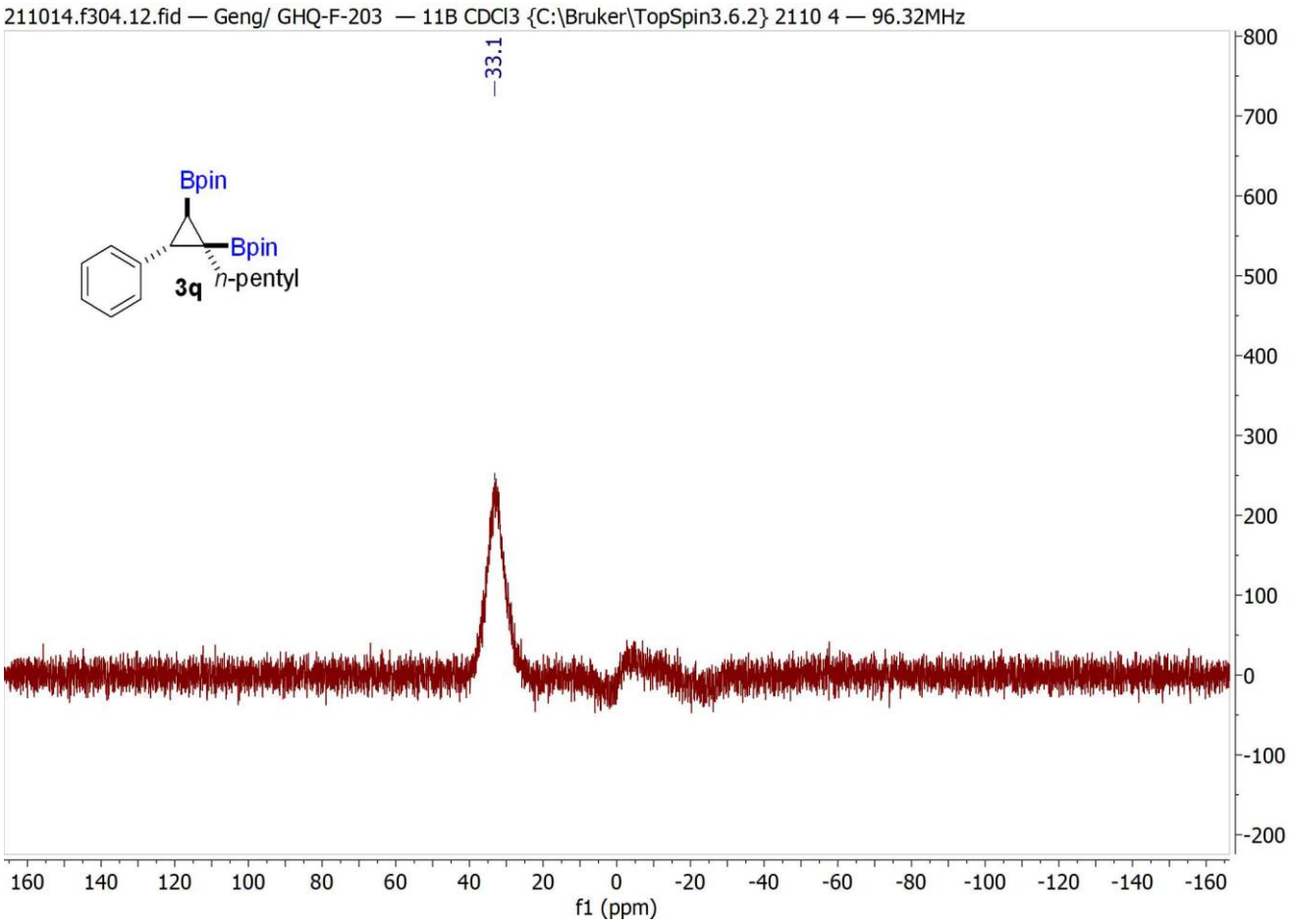

211112.323.10.fid — Huiqing Geng GHQ-F-249 — Au1H CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 23 — 300.13MHz
7.26 CDCl3
7.23
7.23
7.21
7.20
7.17
7.15
7.15
7.14
7.12
7.11
2.54
2.52
1.28
1.25
1.24
1.13
1.11
1.10
1.08
1.06
1.06
1.05
1.02
1.01
1.00
0.98
0.67
0.65
0.62
0.44
0.42
Bpin
Bpin
n-Bu
3p
4.00
1.02
1.00
12.02
12.00
6.01
3.01
1.00
f1 (ppm)

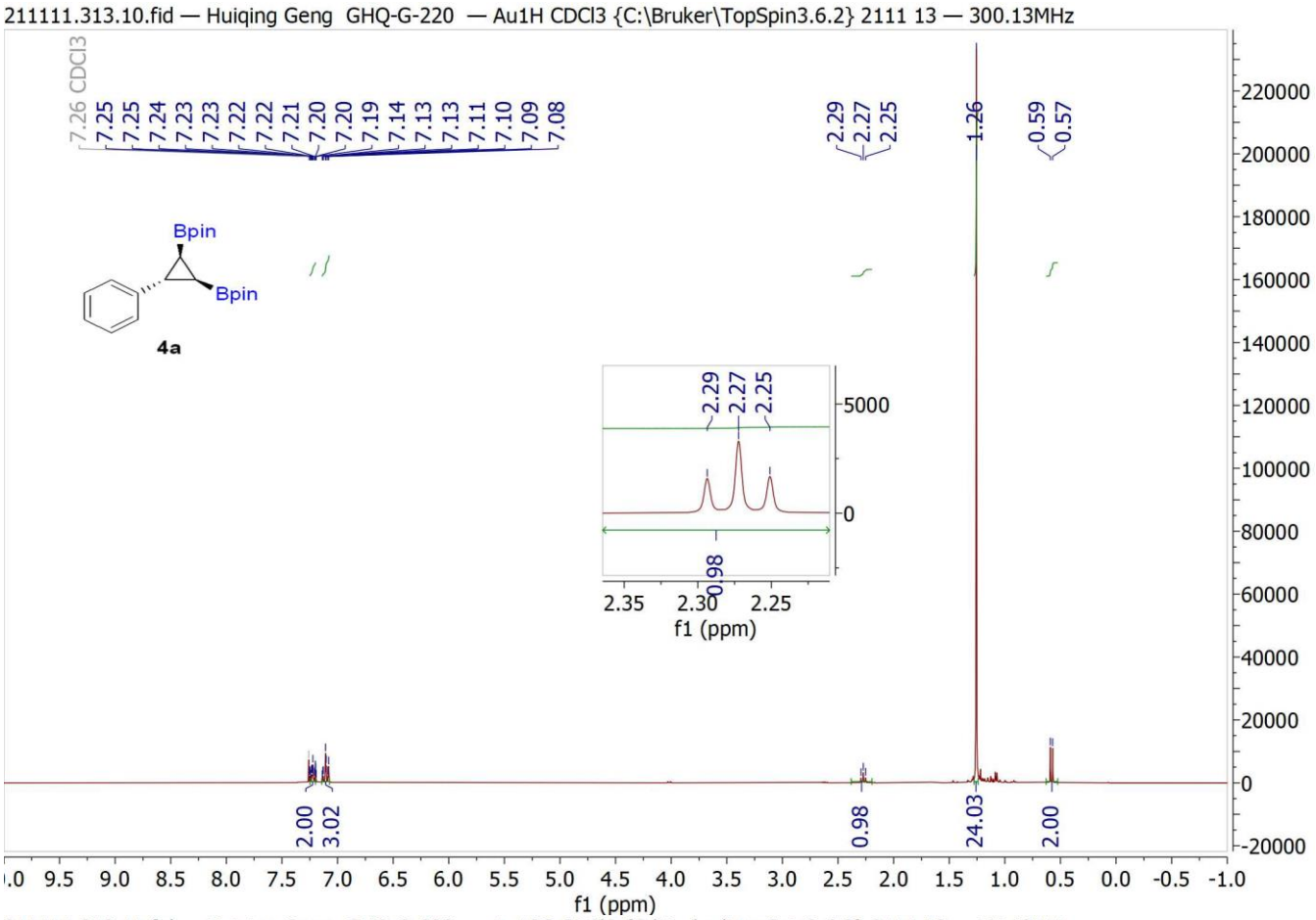

211112.323.11.fid — Huiqing Geng GHQ-F-249 — Au13C CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 23 — 75.48MHz
139.3
129.3
127.5
125.6
83.1
32.2
31.8
31.0
25.2
25.0
24.9
24.6
22.8
13.9
Bpin
Bpin
n-Bu
3p
f1 (ppm)

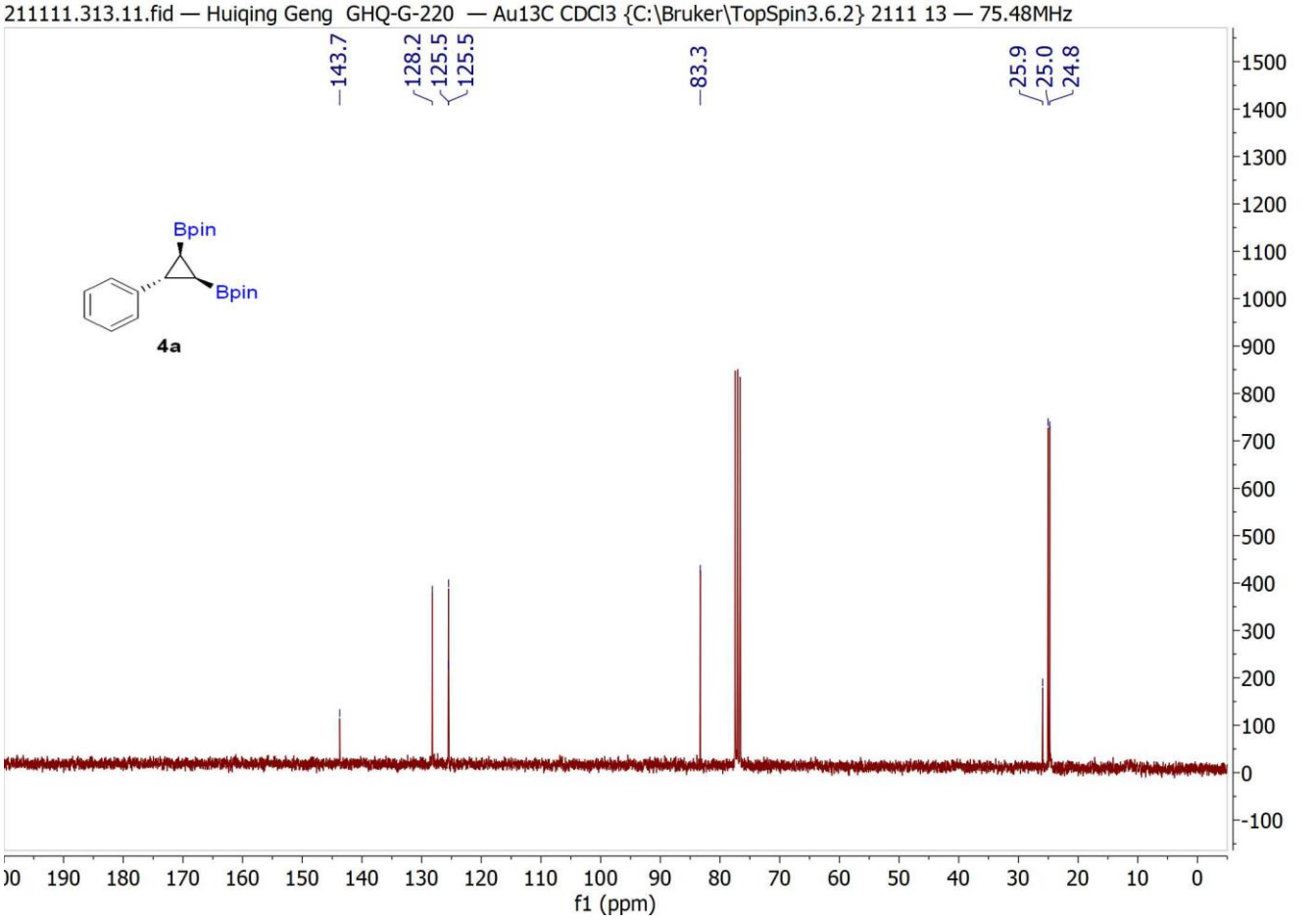

211112.323.12.fid — Huiqing Geng GHQ-F-249 — Au11B CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 23 — 96.29MHz
33.0
Bpin
Bpin
n-Bu
3p
800
700
600
500
400
300
200
100
0
-100
-200
-300
160 140 120 100 80 60 40 20 0 -20 -40 -60 -80 -100 -120 -140 -160
f1 (ppm)

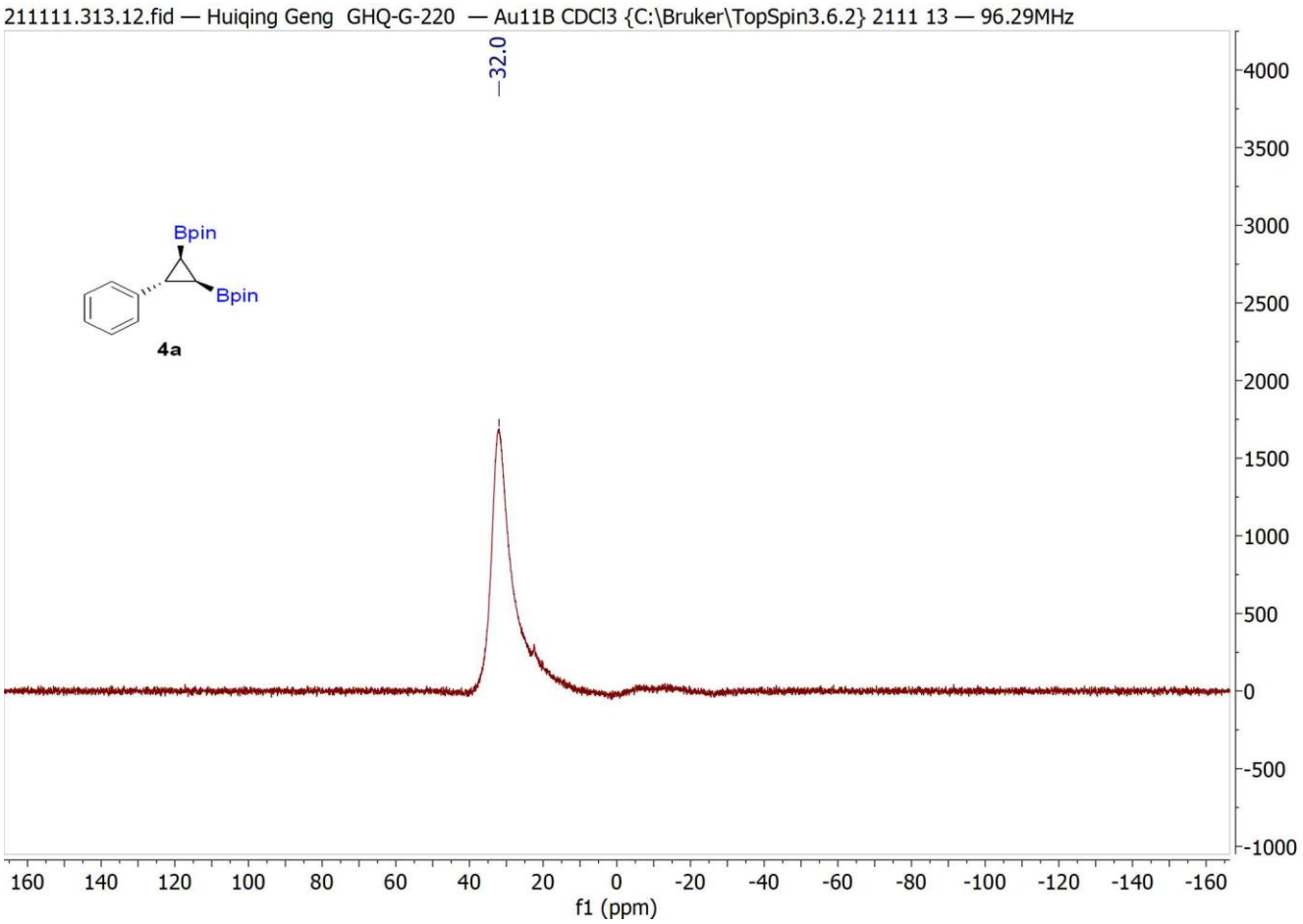

211014.f304.10.fid — Geng/ GHQ-F-203 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.2} 2110 4 — 300.20MHz
7.26 CDCl3
7.23 7.23 7.21 7.16 7.15 7.15 7.14 7.13 7.12 7.11 2.54 2.51 1.27 1.25 1.24 1.18 1.14 1.13 1.10 1.09 1.08 1.07 1.07 1.06 1.05 1.04 1.01 1.00 0.98 0.95 0.94 0.93 0.88 0.86 0.74 0.72 0.69 0.44 0.42
Bpin
Bpin
n-pentyl
3q
4.02 1.00 1.00 12.01 12.00 8.01 3.02 1.00
f1 (ppm)

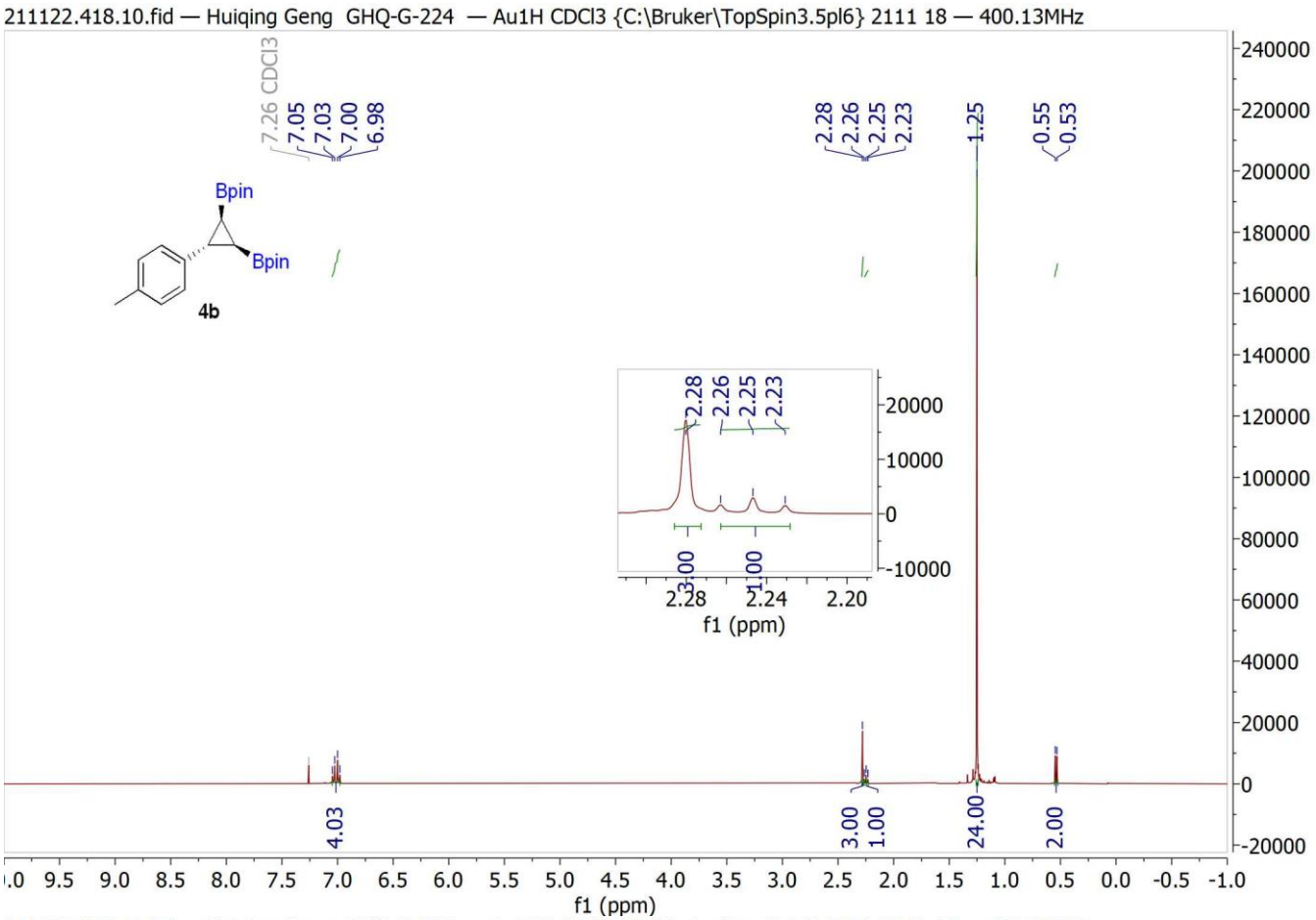

211014.f304.11.fid — Geng/ GHQ-F-203 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.2} 2110 4 — 75.49MHz
139.3 129.3 127.5 125.5 83.1 83.1 77.0 CDCl3 32.4 32.0 31.7 28.3 25.2 25.0 24.8 24.6 22.2 13.9
Bpin
Bpin
n-pentyl
3q
f1 (ppm)

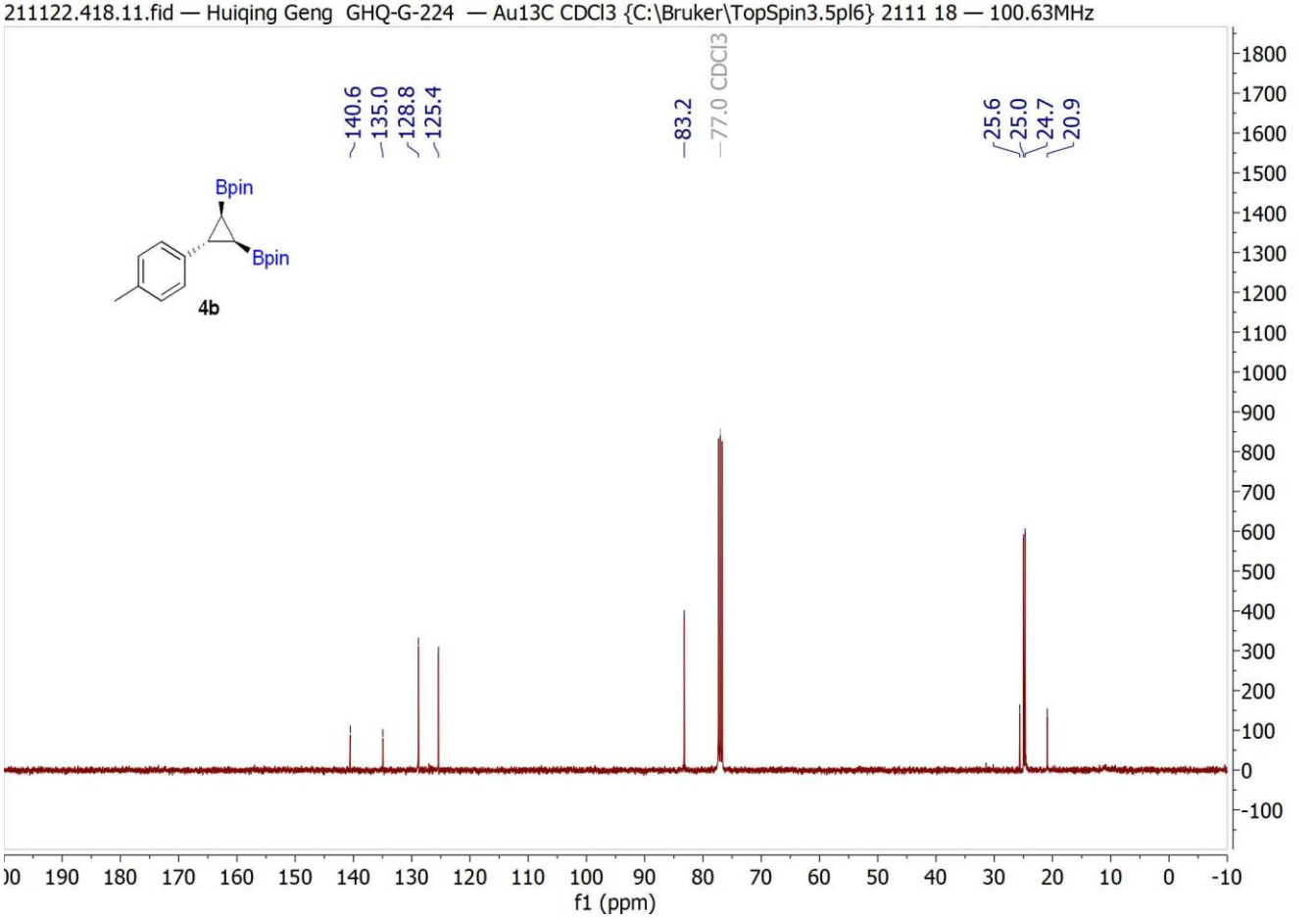

211014.f304.12.fid — Geng/ GHQ-F-203 — 11B CDCl3 {C:\Bruker\TopSpin3.6.2} 2110 4 — 96.32MHz
33.1
Bpin
Bpin
n-pentyl
3q
800
700
600
500
400
300
200
100
0
-100
-200
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
f1 (ppm)

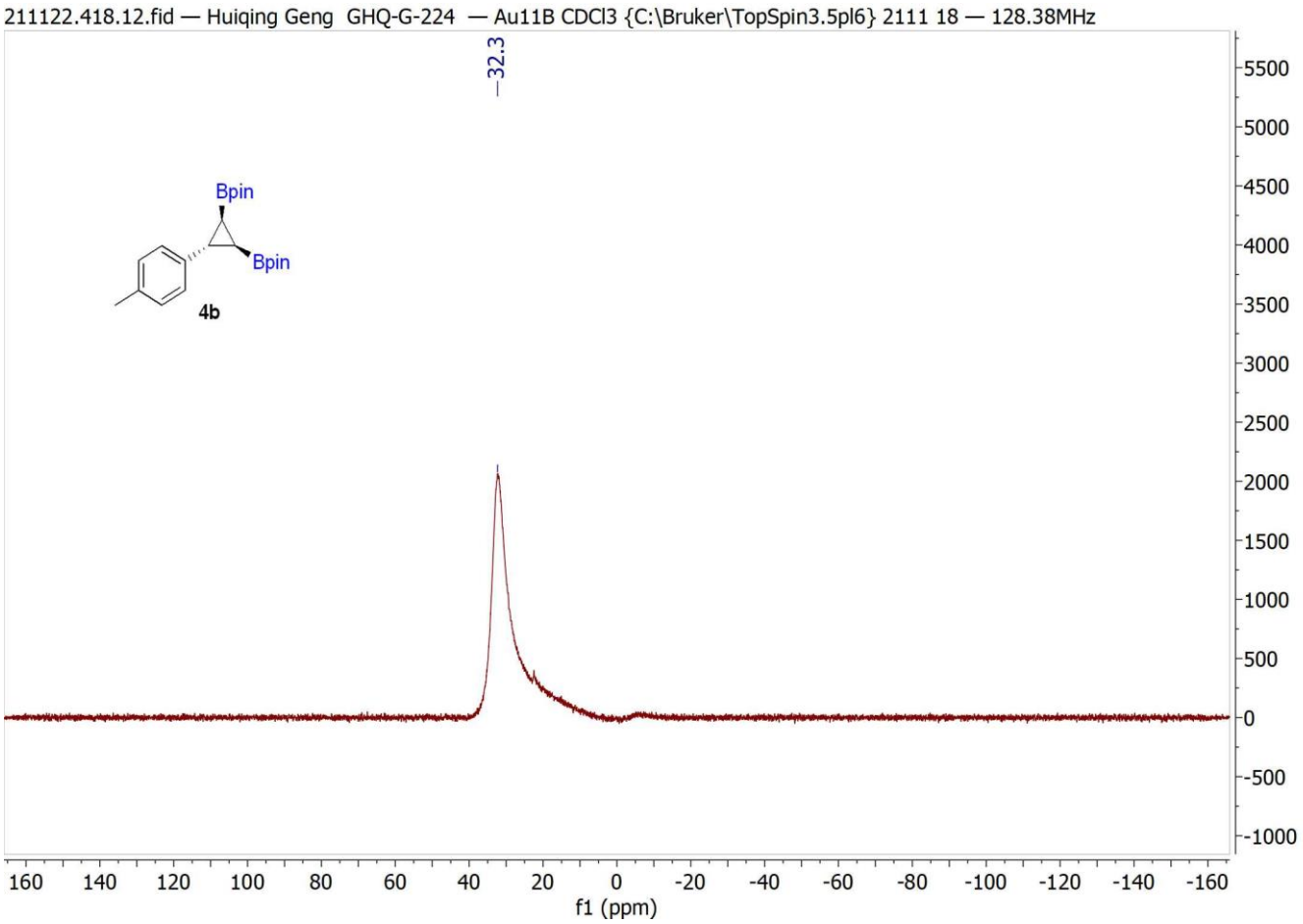

211111.313.10.fid — Huiqing Geng GHQ-G-220 — Au1H CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 13 — 300.13MHz
7.26 CDCl3
7.25 7.25 7.24 7.23 7.23 7.22 7.22 7.21 7.20 7.20 7.19 7.14 7.13 7.13 7.11 7.10 7.09 7.08
2.29 2.27 2.25
1.26
0.59 0.57
Bpin
Bpin
4a
2.29 2.27 2.25
0.98
2.35 2.30 2.25
f1 (ppm)
2.00 3.02 0.98 24.03 2.00
f1 (ppm)

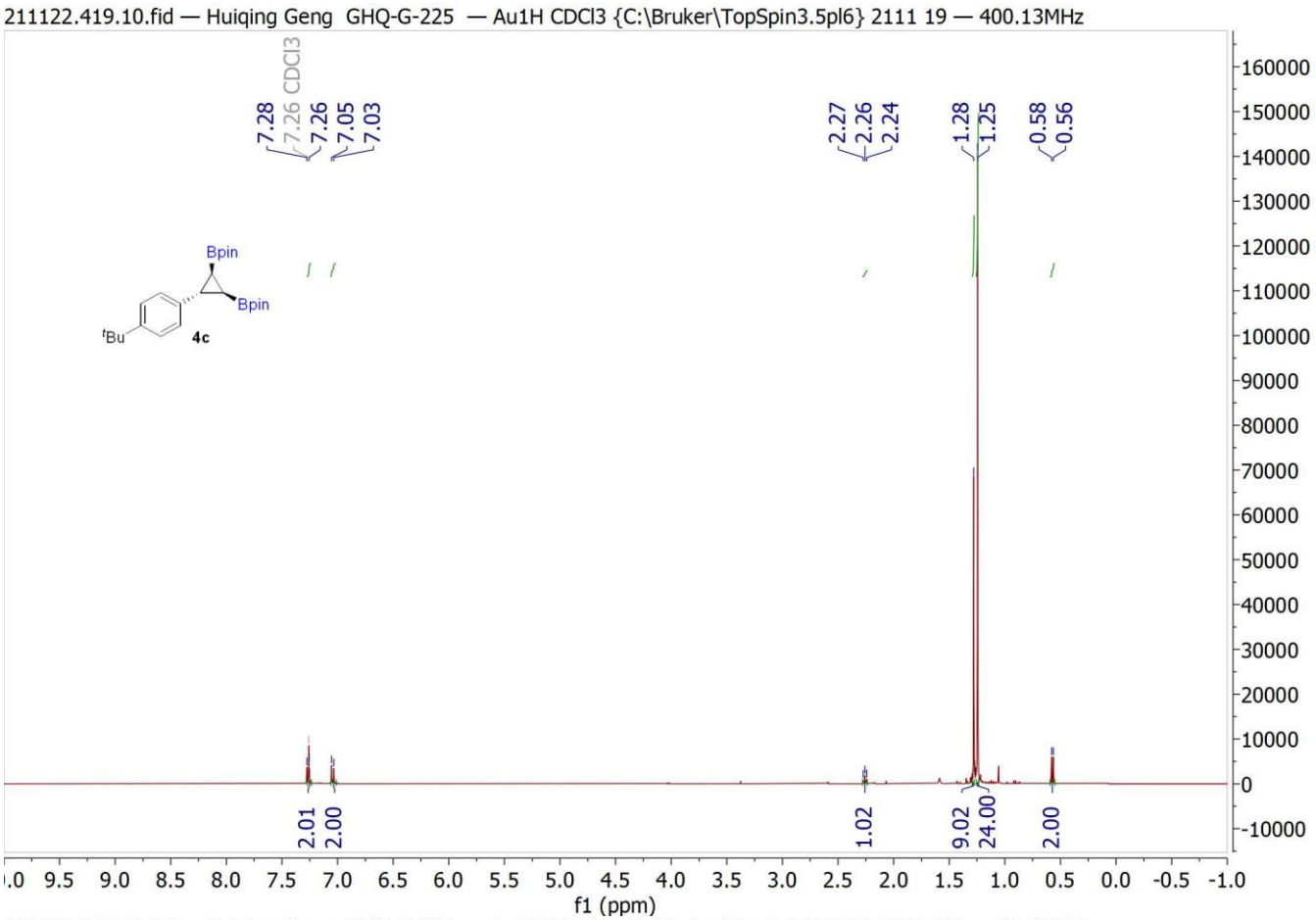

211111.313.11.fid — Huiqing Geng GHQ-G-220 — Au13C CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 13 — 75.48MHz
143.7
128.2 125.5 125.5
83.3
25.9 25.0 24.8
Bpin
Bpin
4a
f1 (ppm)

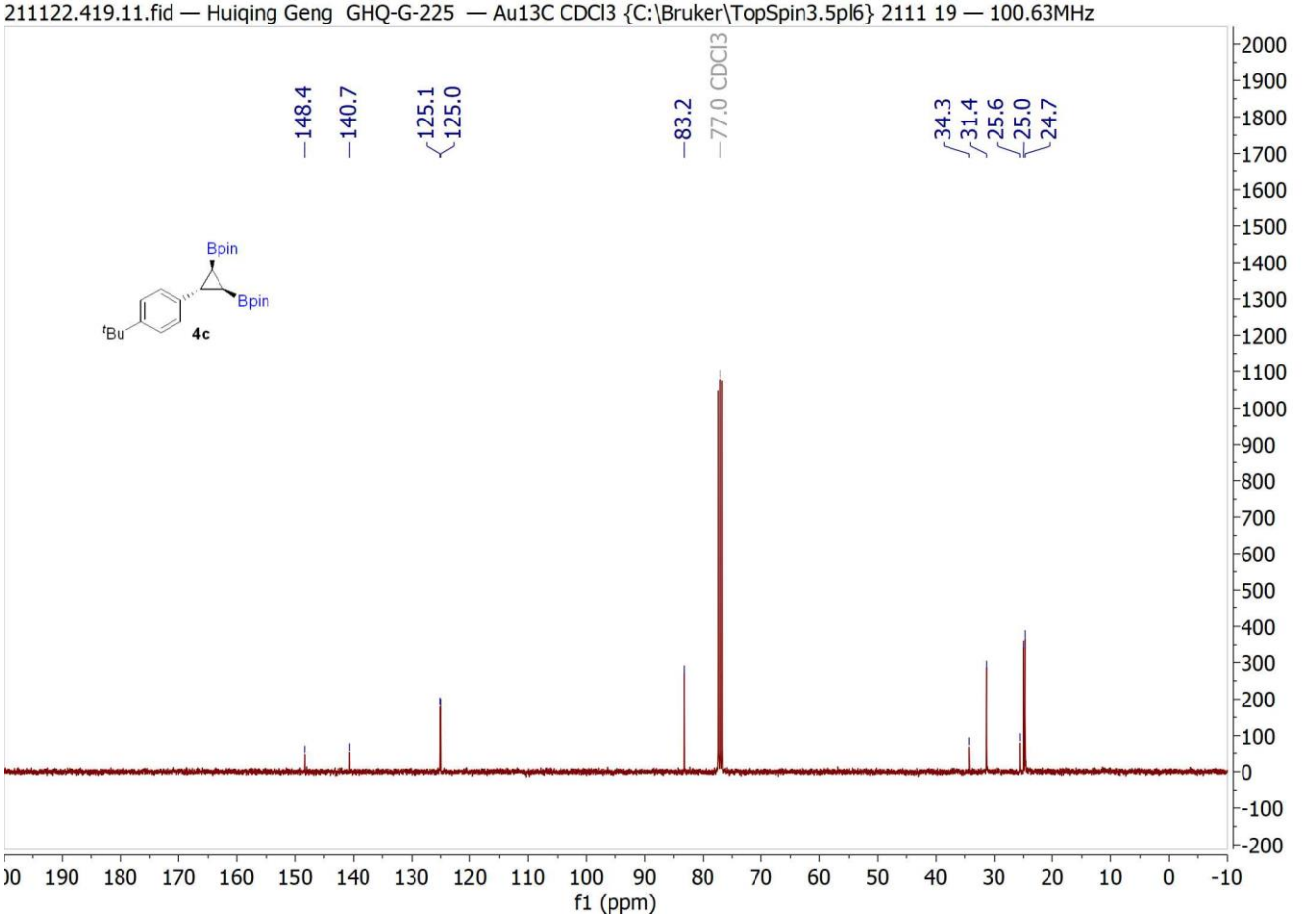

211111.313.12.fid — Huiqing Geng GHQ-G-220 — Au11B CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 13 — 96.29MHz
32.0
Bpin
Bpin
4a
4000
3500
3000
2500
2000
1500
1000
500
0
-500
-1000
160 140 120 100 80 60 40 20 0 -20 -40 -60 -80 -100 -120 -140 -160
f1 (ppm)

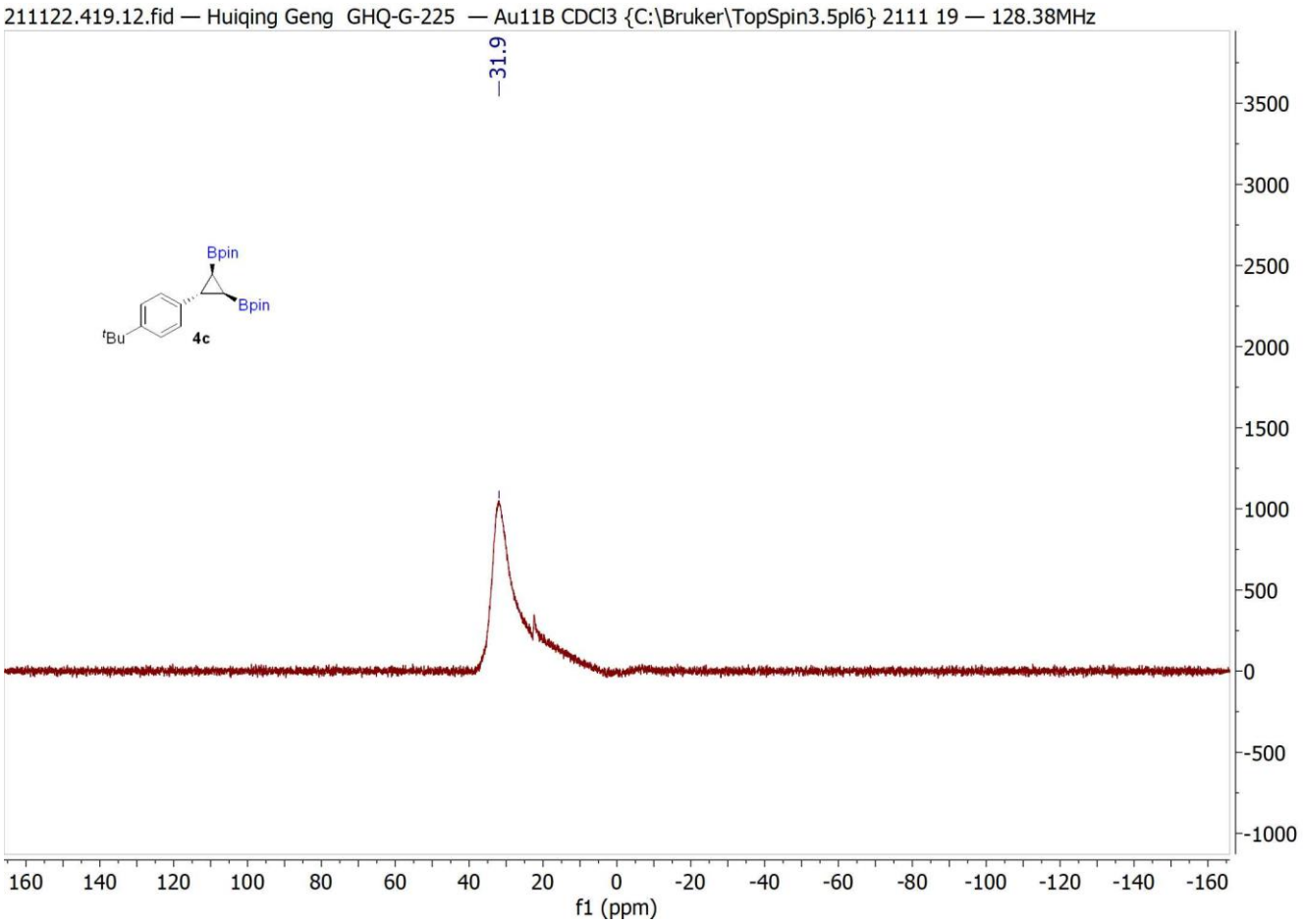

211122.418.10.fid — Huiqing Geng GHQ-G-224 — Au1H CDCl3 {C:\Bruker\TopSpin3.5pl6} 2111 18 — 400.13MHz
7.26 CDCl3
7.05
7.03
7.00
6.98
2.28
2.26
2.25
2.23
1.25
0.55
0.53
Bpin
Bpin
4b
4.03
3.00
1.00
24.00
2.00
f1 (ppm)

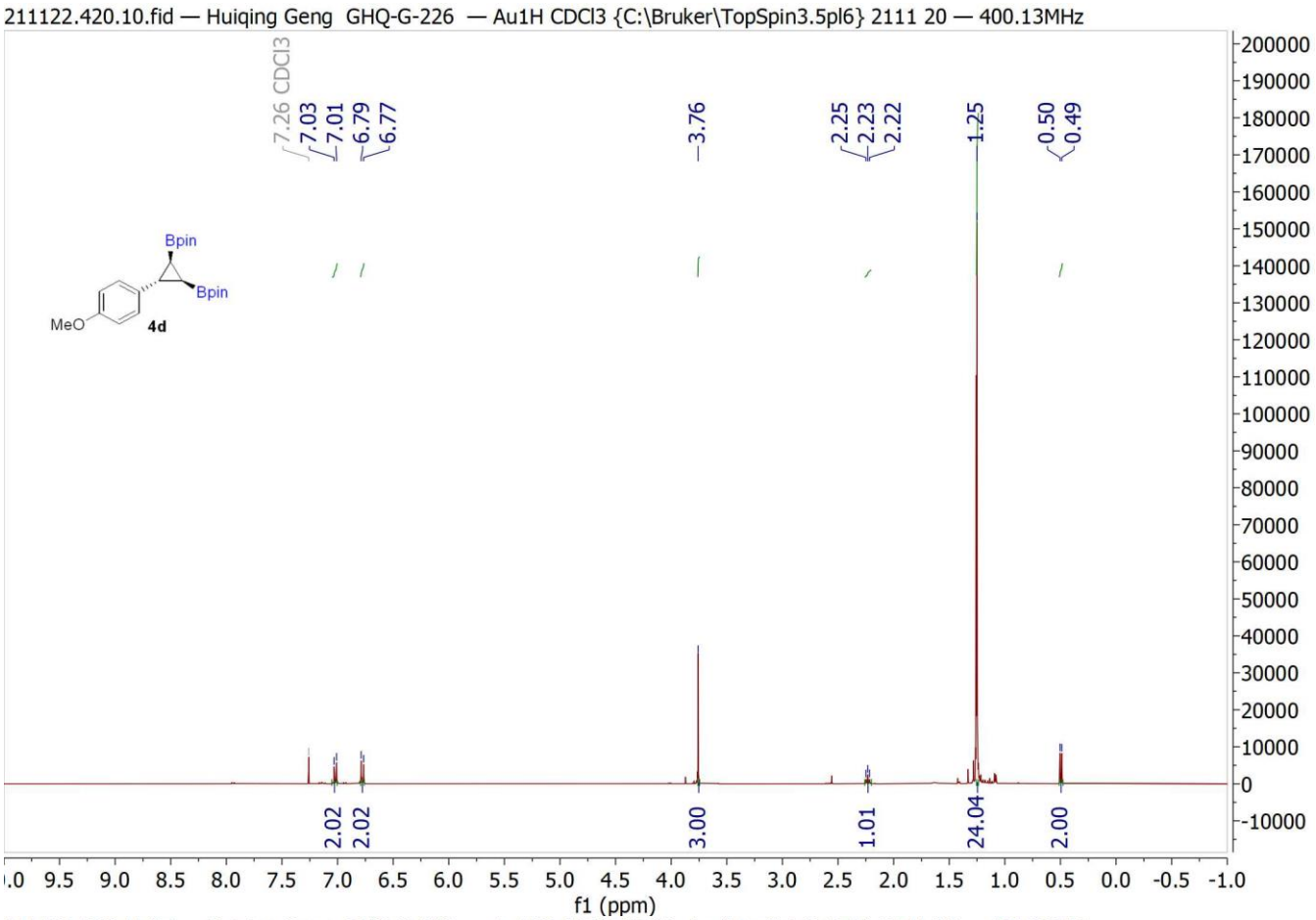

211122.418.11.fid — Huiqing Geng GHQ-G-224 — Au13C CDCl3 {C:\Bruker\TopSpin3.5pl6} 2111 18 — 100.63MHz
140.6
135.0
128.8
125.4
83.2
77.0 CDCl3
25.6
25.0
24.7
20.9
Bpin
Bpin
4b
f1 (ppm)

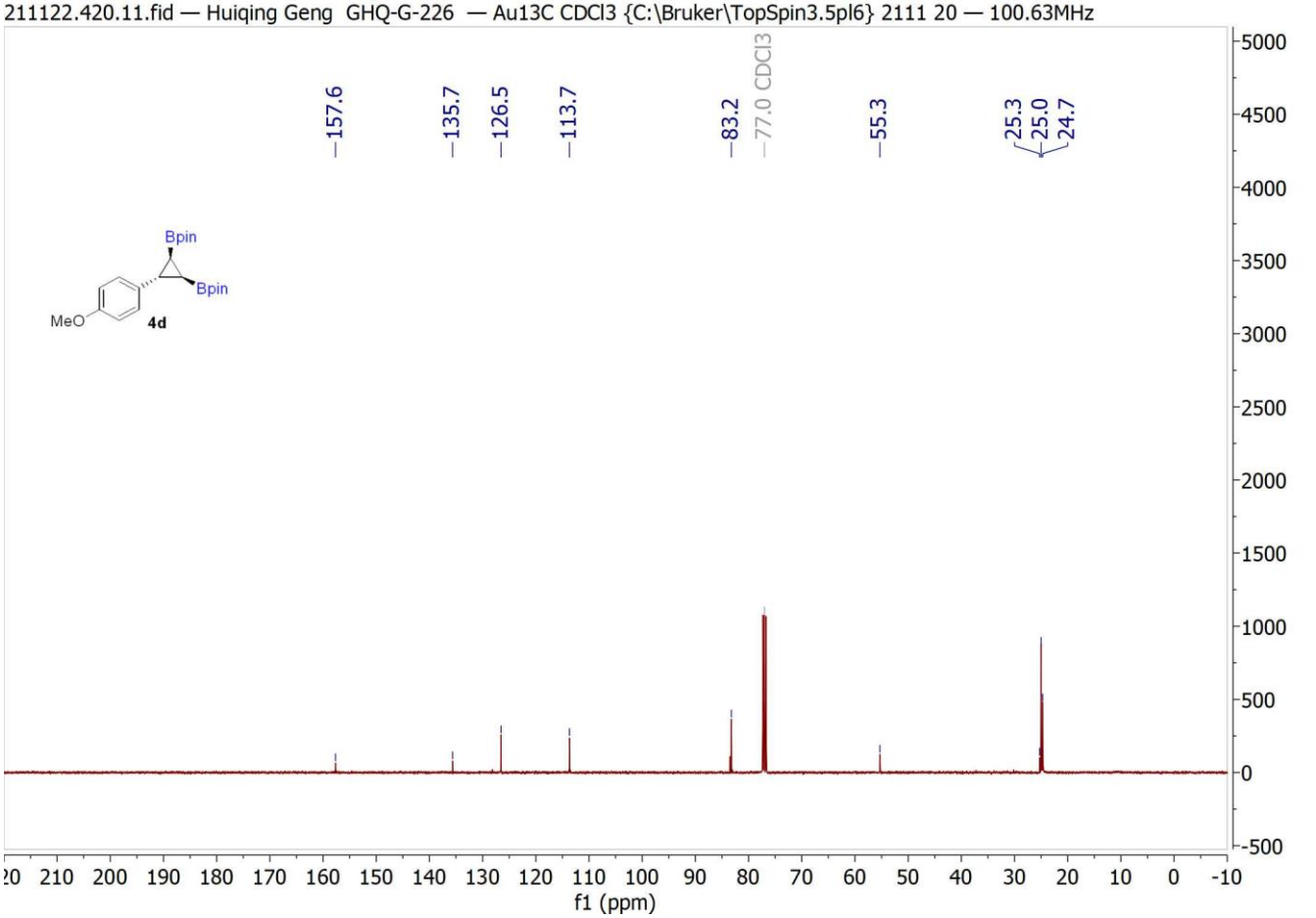

211122.418.12.fid — Huiqing Geng GHQ-G-224 — Au11B CDCl3 {C:\Bruker\TopSpin3.5pl6} 2111 18 — 128.38MHz
32.3
Bpin
Bpin
4b
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
-500
-1000
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
f1 (ppm)

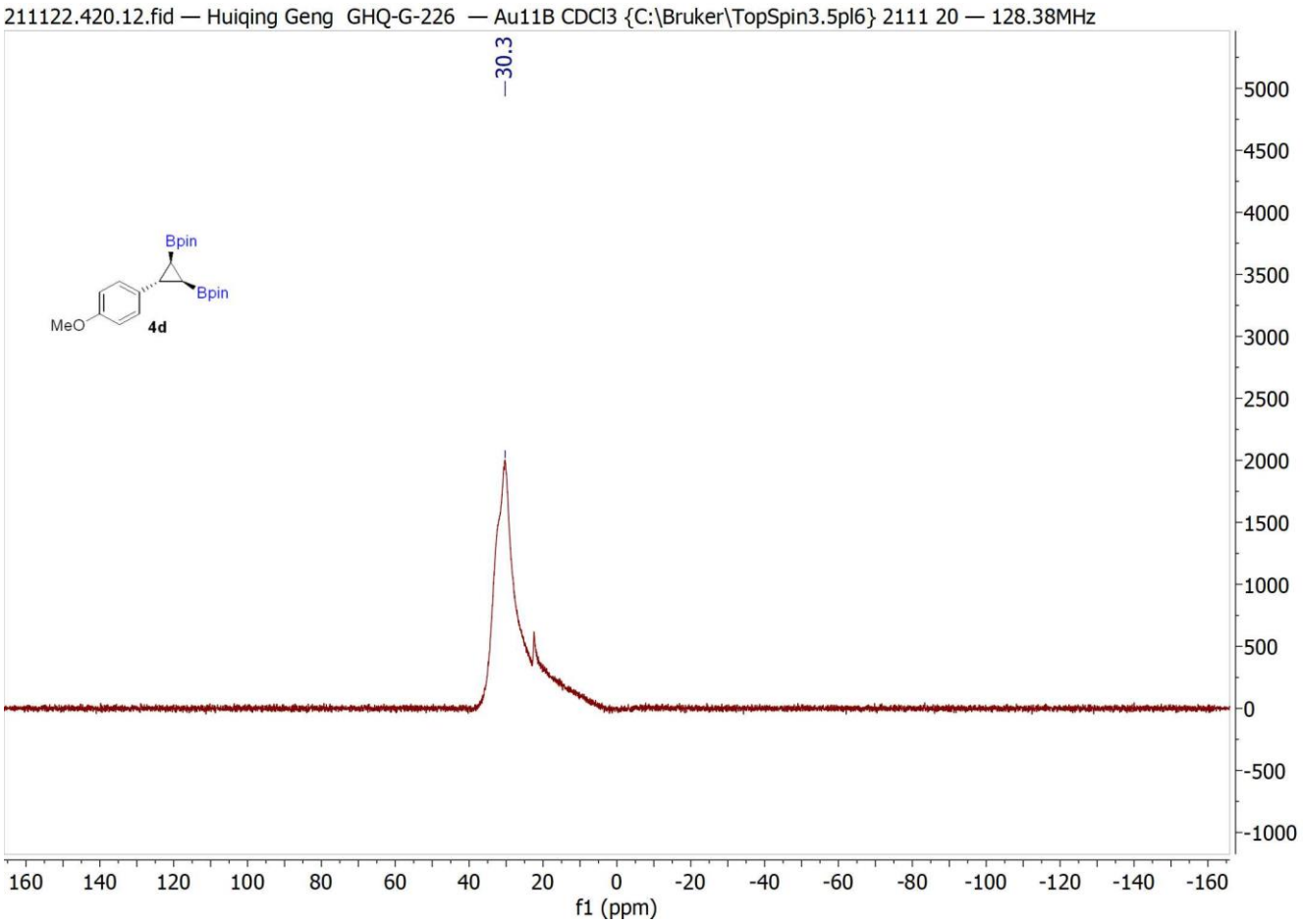

211122.419.10.fid — Huiqing Geng GHQ-G-225 — Au1H CDCl3 {C:\Bruker\TopSpin3.5pl6} 2111 19 — 400.13MHz
7.28
7.26 CDCl3
7.26
7.05
7.03
2.27
2.26
2.24
1.28
1.25
0.58
0.56
Bpin
Bpin
tBu
4c
2.01
2.00
1.02
9.02
24.00
2.00
f1 (ppm)

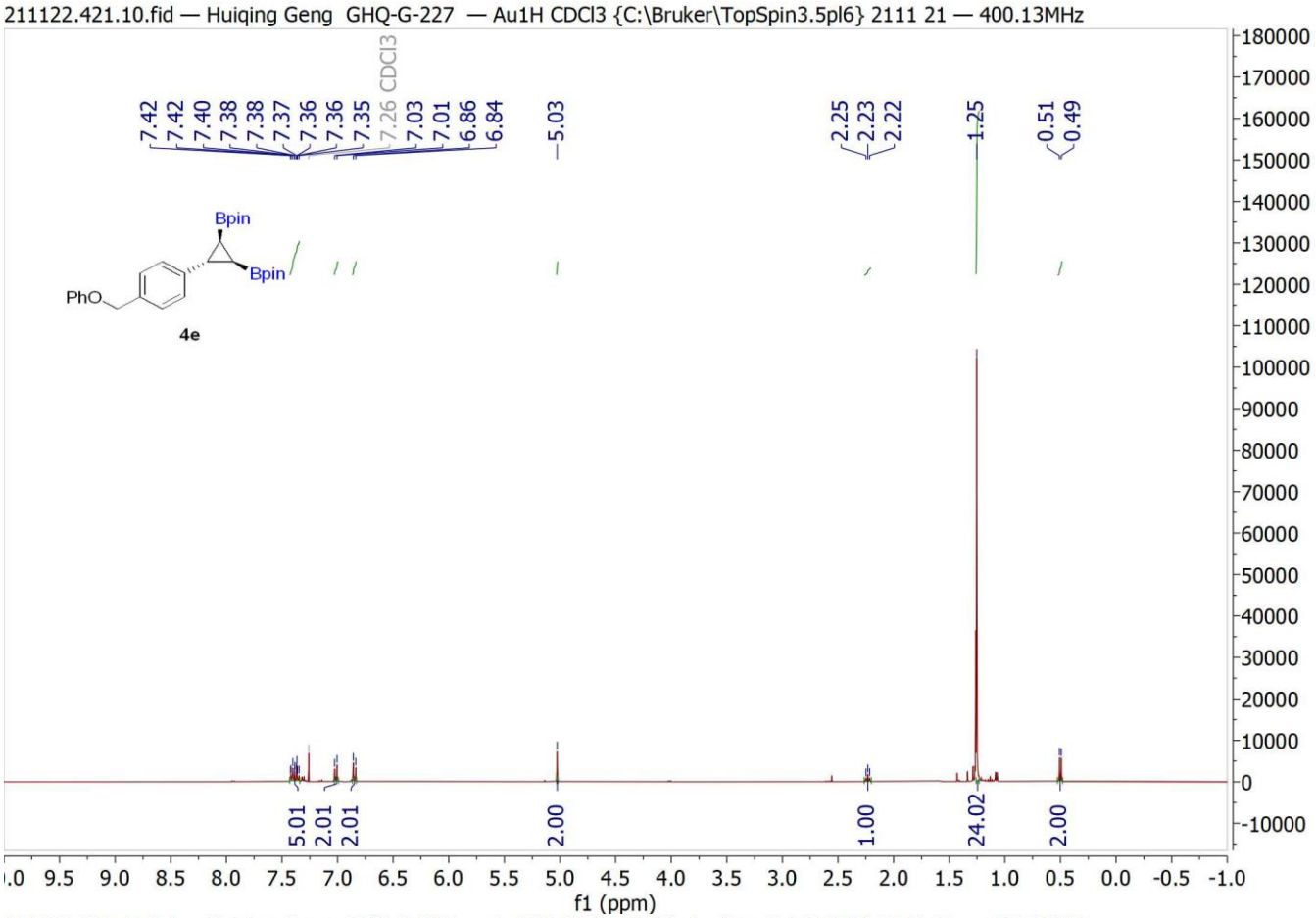

211122.419.11.fid — Huiqing Geng GHQ-G-225 — Au13C CDCl3 {C:\Bruker\TopSpin3.5pl6} 2111 19 — 100.63MHz
148.4
140.7
125.1
125.0
83.2
77.0 CDCl3
34.3
31.4
25.6
25.0
24.7
Bpin
Bpin
tBu
4c
f1 (ppm)

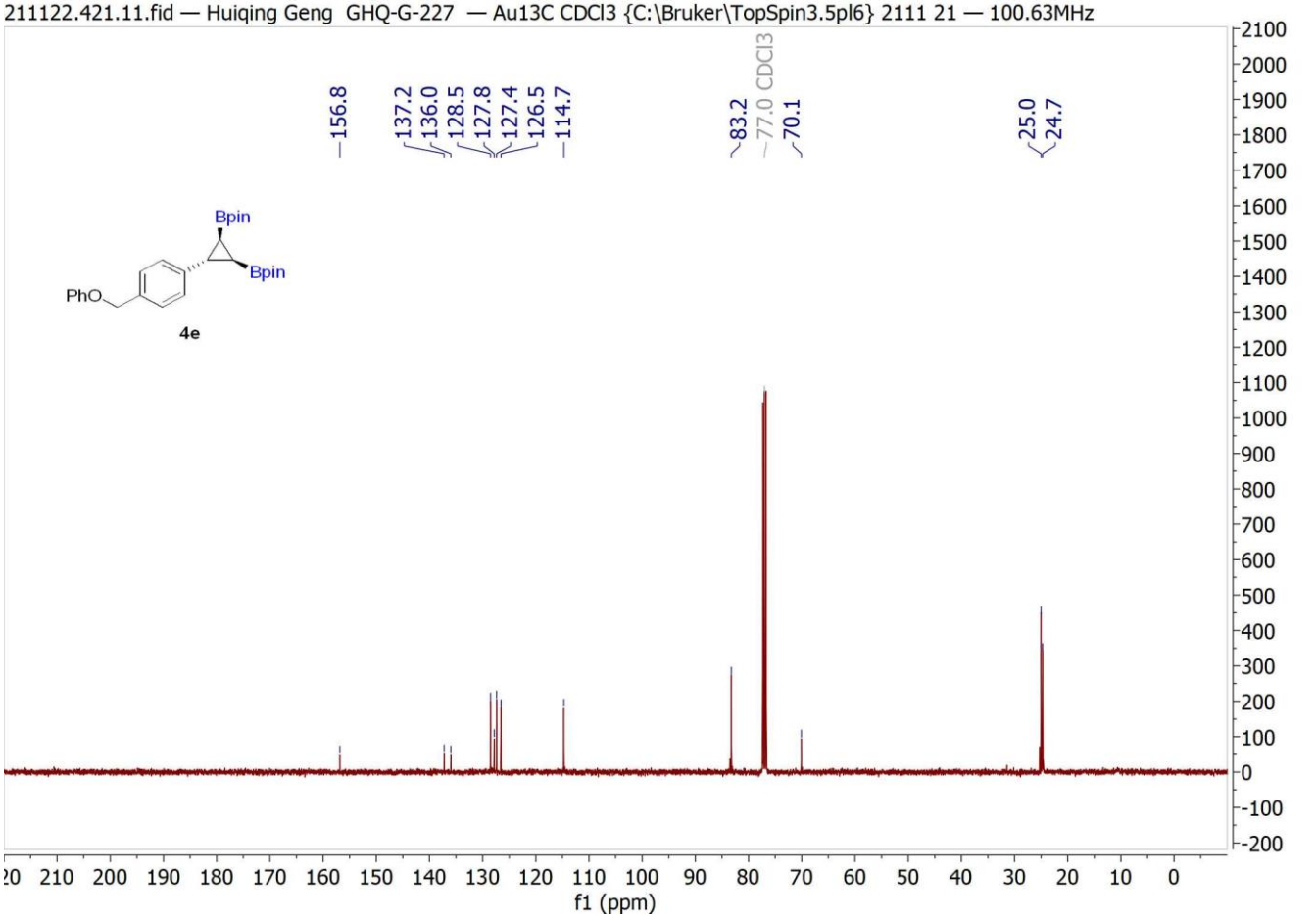

211122.419.12.fid — Huiqing Geng GHQ-G-225 — Au11B CDCl3 {C:\Bruker\TopSpin3.5pl6} 2111 19 — 128.38MHz
31.9
Bpin
Bpin
tBu
4c
3500
3000
2500
2000
1500
1000
500
0
-500
-1000
160 140 120 100 80 60 40 20 0 -20 -40 -60 -80 -100 -120 -140 -160
f1 (ppm)

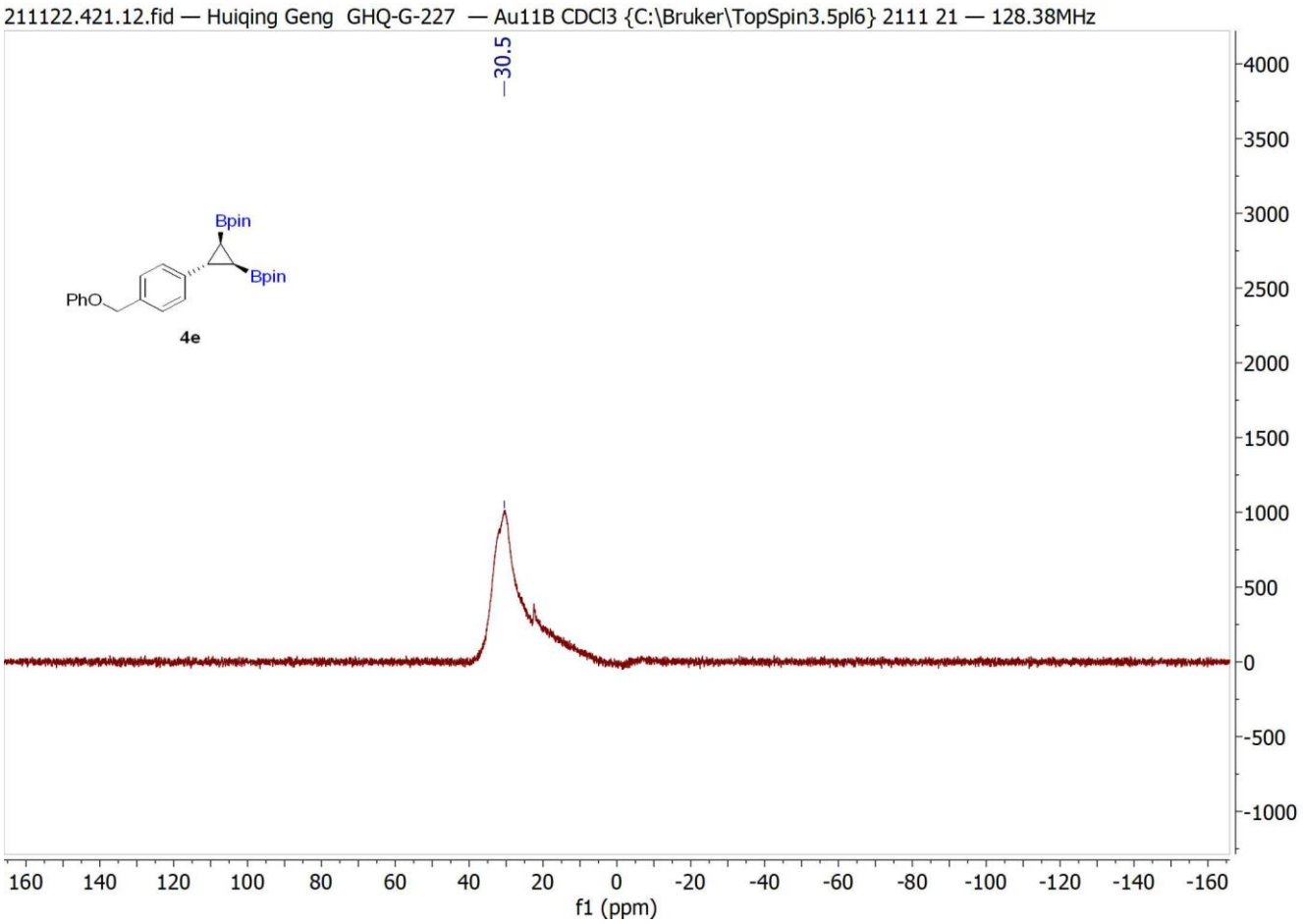

211122.420.10.fid — Huiqing Geng GHQ-G-226 — Au1H CDCl3 {C:\Bruker\TopSpin3.5pl6} 2111 20 — 400.13MHz
7.26 CDCl3
7.03
7.01
6.79
6.77
3.76
2.25
2.23
2.22
1.25
0.50
0.49
Bpin
Bpin
MeO
4d
2.02
2.02
3.00
1.01
24.04
2.00
f1 (ppm)

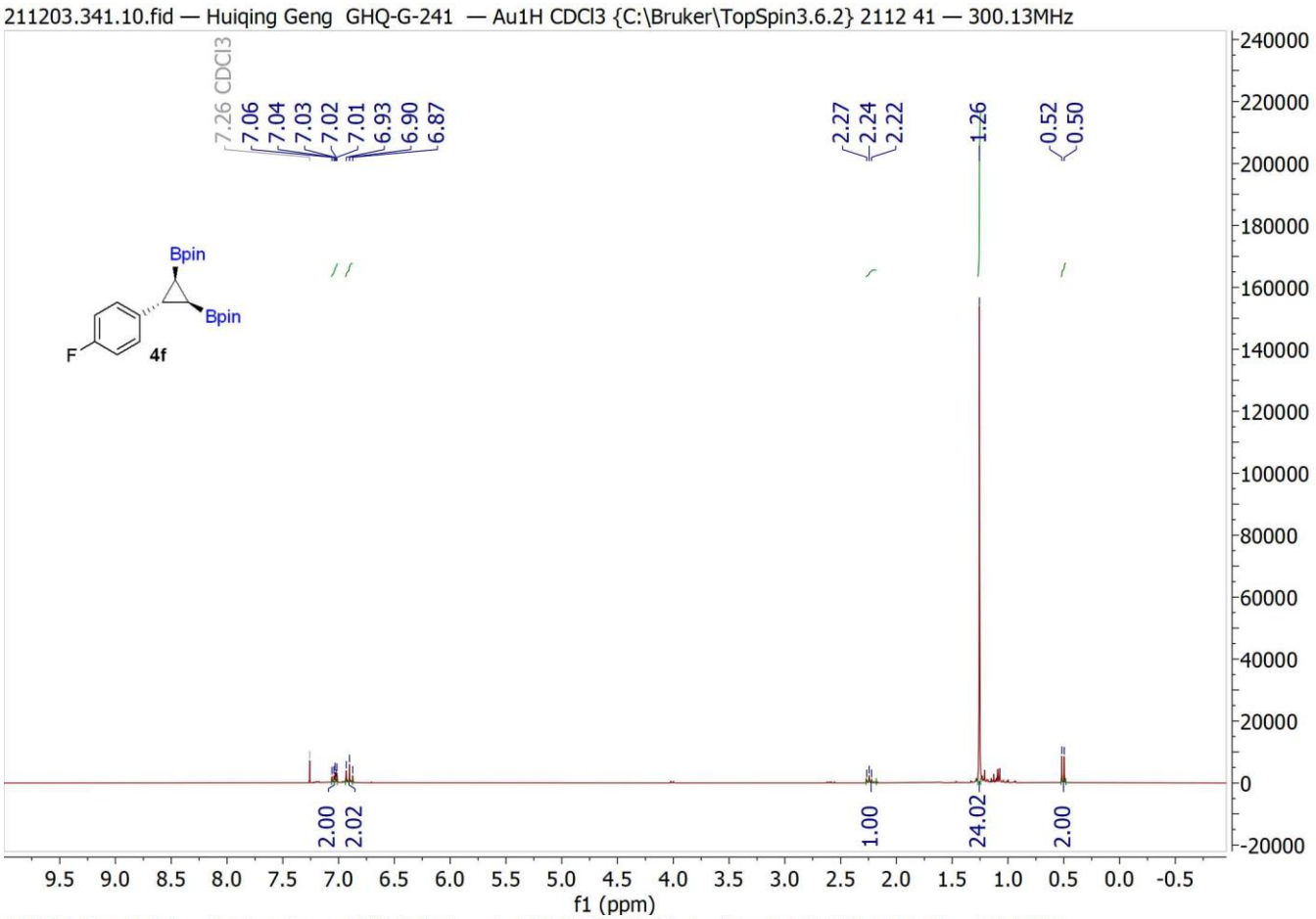

211122.420.11.fid — Huiqing Geng GHQ-G-226 — Au13C CDCl3 {C:\Bruker\TopSpin3.5pl6} 2111 20 — 100.63MHz
157.6
135.7
126.5
113.7
83.2
77.0 CDCl3
55.3
25.3
25.0
24.7
Bpin
Bpin
MeO
4d
f1 (ppm)

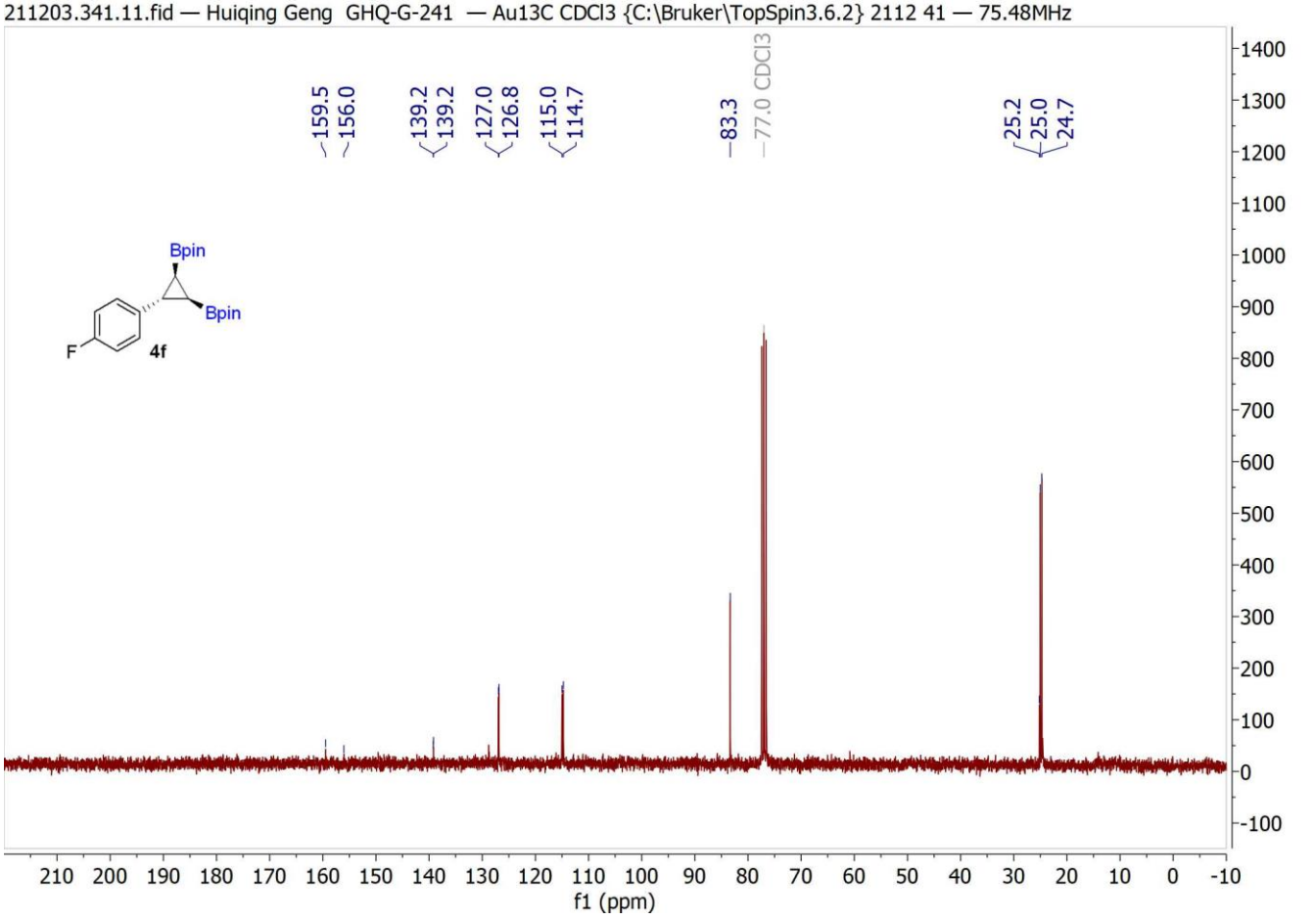

211122.420.12.fid — Huiqing Geng GHQ-G-226 — Au11B CDCl3 {C:\Bruker\TopSpin3.5pl6} 2111 20 — 128.38MHz
30.3
Bpin
Bpin
MeO
4d
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
-500
-1000
160 140 120 100 80 60 40 20 0 -20 -40 -60 -80 -100 -120 -140 -160
f1 (ppm)

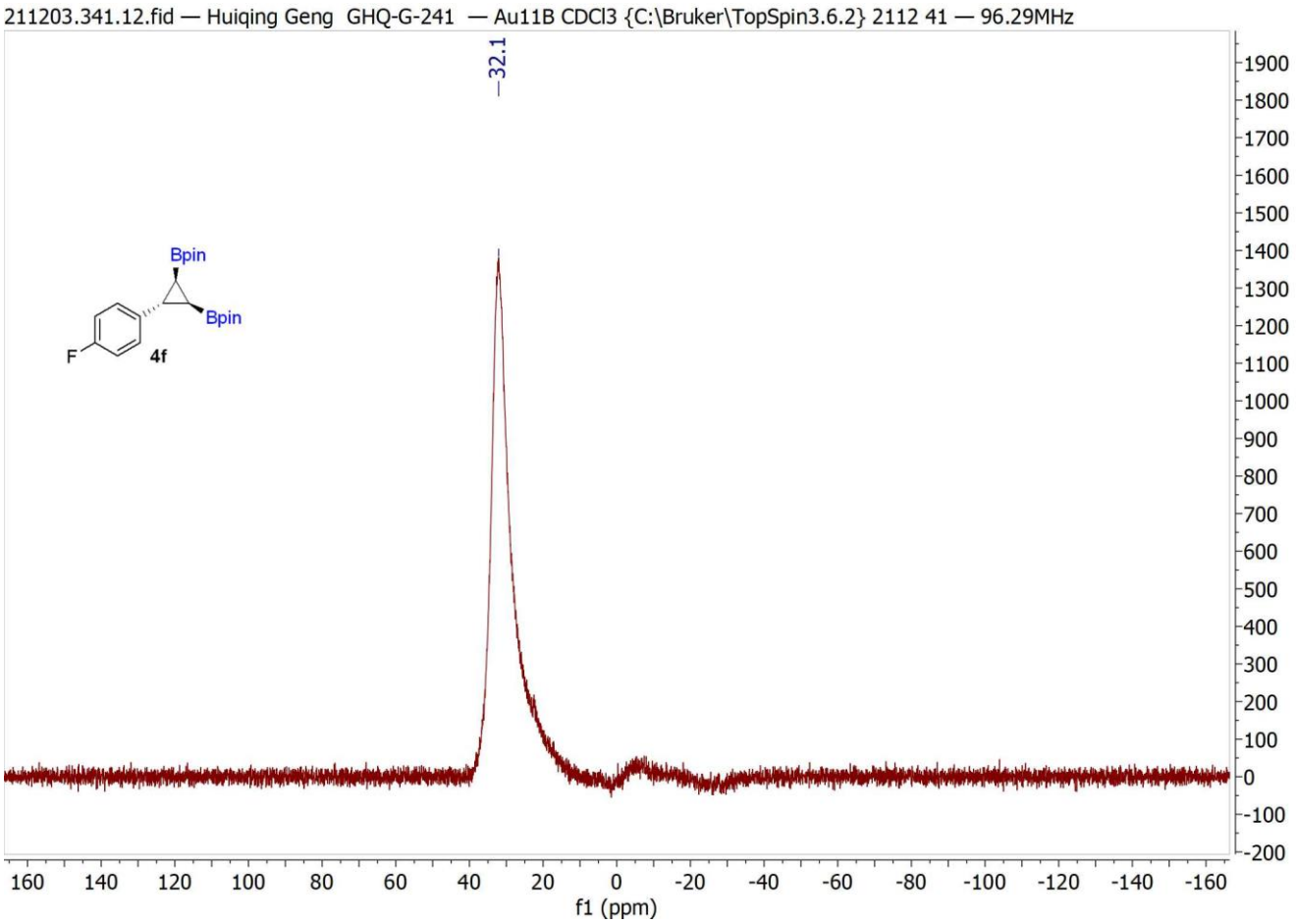

211122.421.10.fid — Huiqing Geng GHQ-G-227 — Au1H CDCl3 {C:\Bruker\TopSpin3.5pl6} 2111 21 — 400.13MHz
7.42
7.42
7.40
7.38
7.38
7.37
7.36
7.36
7.35
7.26 CDCl3
7.03
7.01
6.86
6.84
5.03
2.25
2.23
2.22
1.25
0.51
0.49
Bpin
Bpin
PhO
4e
5.01
2.01
2.01
2.00
1.00
24.02
2.00
f1 (ppm)

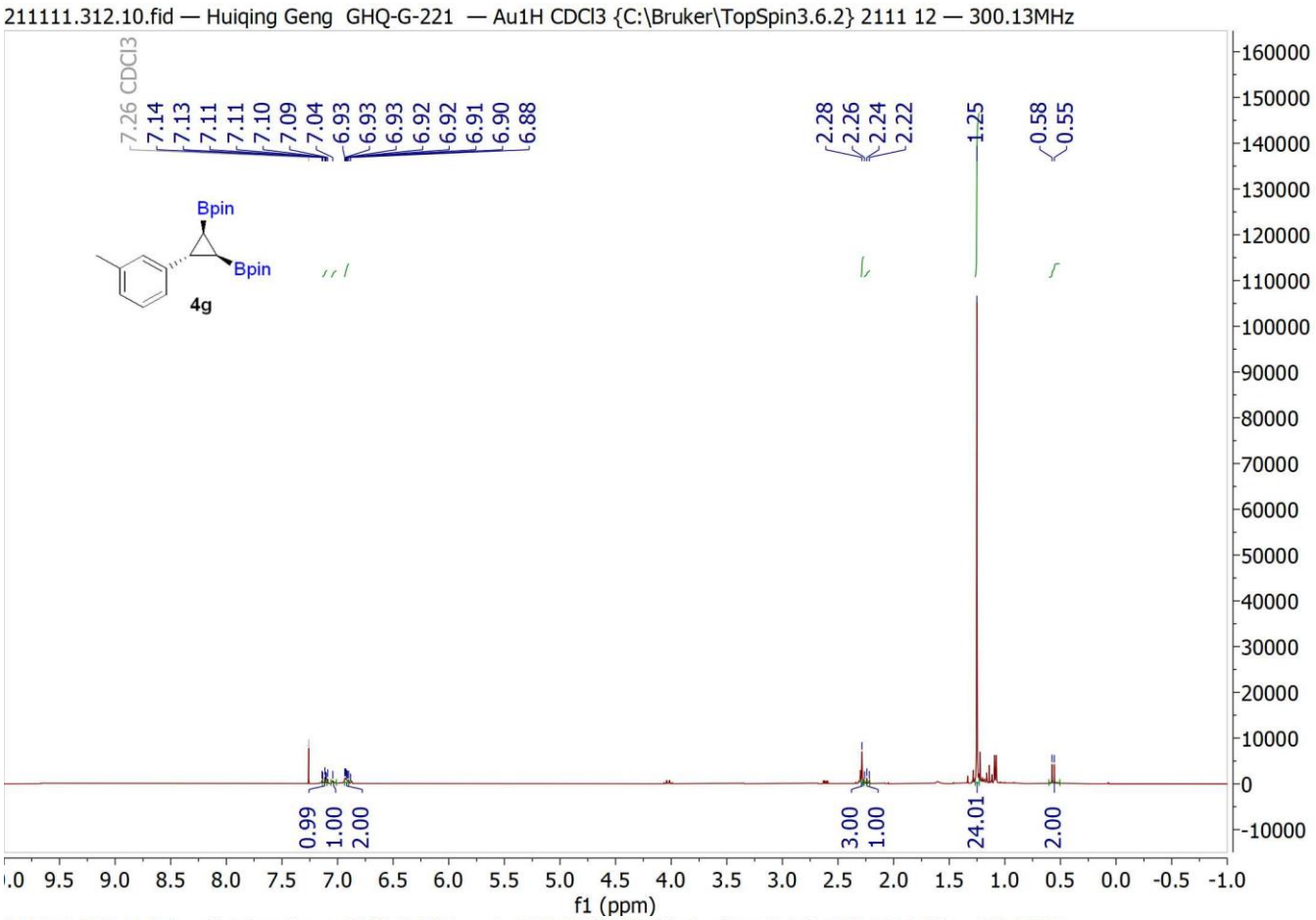

211122.421.11.fid — Huiqing Geng GHQ-G-227 — Au13C CDCl3 {C:\Bruker\TopSpin3.5pl6} 2111 21 — 100.63MHz
156.8
137.2
136.0
128.5
127.8
127.4
126.5
114.7
83.2
77.0 CDCl3
70.1
25.0
24.7
Bpin
Bpin
PhO
4e
f1 (ppm)

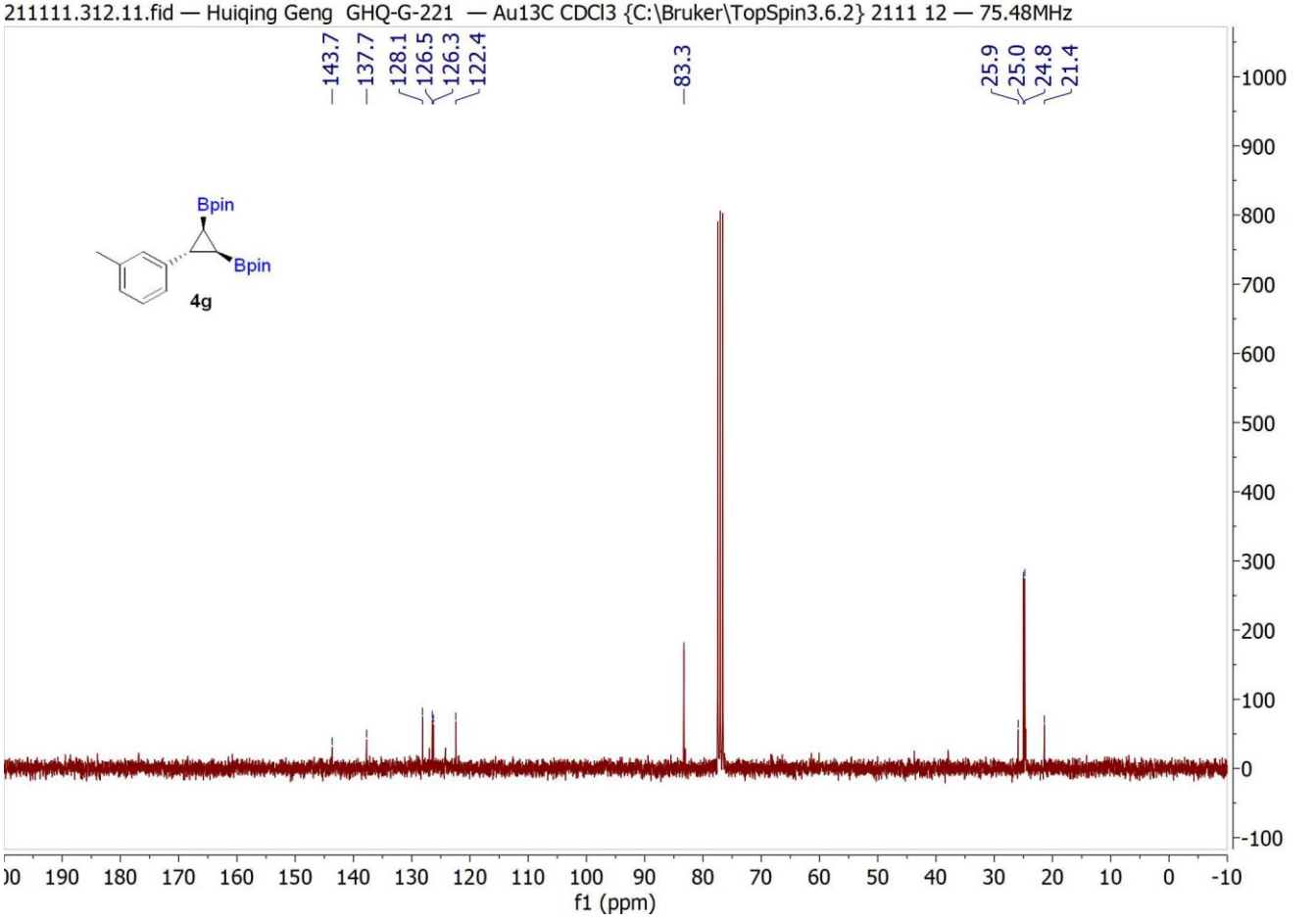

211122.421.12.fid — Huiqing Geng GHQ-G-227 — Au11B CDCl3 {C:\Bruker\TopSpin3.5pl6} 2111 21 — 128.38MHz
30.5
Bpin
Bpin
PhO
4e
4000
3500
3000
2500
2000
1500
1000
500
0
-500
-1000
160 140 120 100 80 60 40 20 0 -20 -40 -60 -80 -100 -120 -140 -160
f1 (ppm)

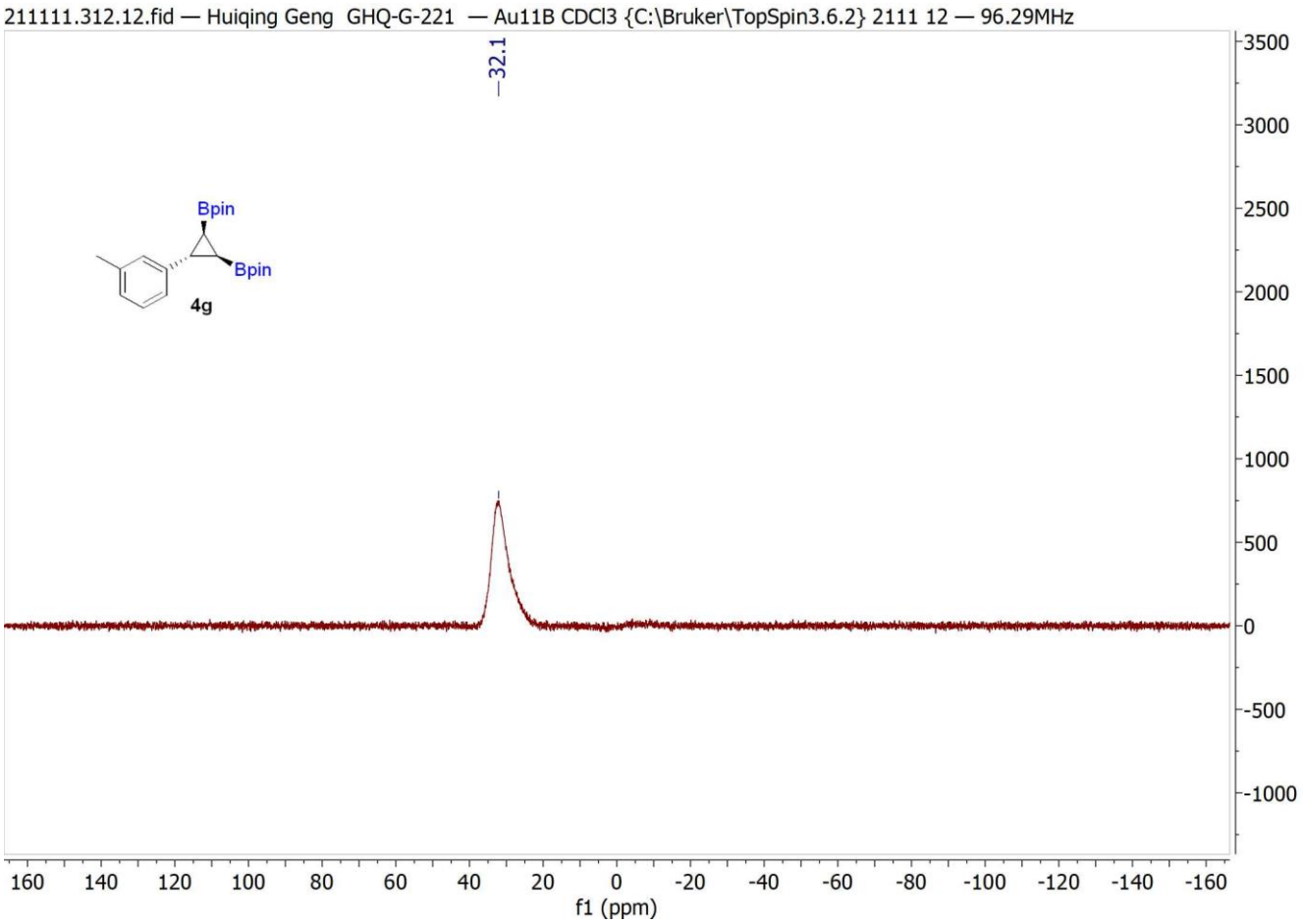

211203.341.10.fid — Huiqing Geng GHQ-G-241 — Au1H CDCl3 {C:\Bruker\TopSpin3.6.2} 2112 41 — 300.13MHz
7.26 CDCl3
7.06
7.04
7.03
7.02
7.01
6.93
6.90
6.87
2.27
2.24
2.22
1.26
0.52
0.50
Bpin
Bpin
F
4f
2.00
2.02
1.00
24.02
2.00
f1 (ppm)

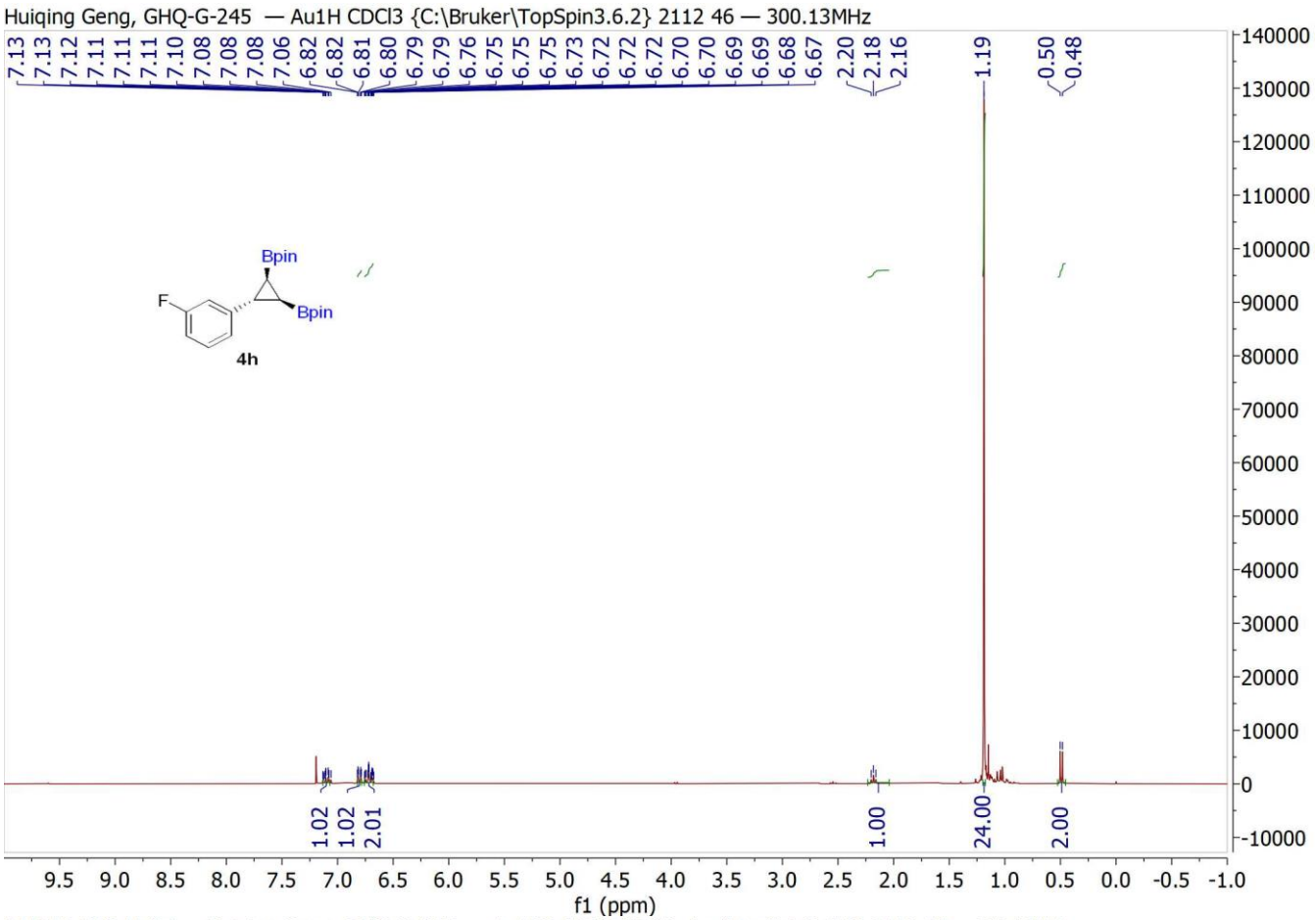

211203.341.11.fid — Huiqing Geng GHQ-G-241 — Au13C CDCl3 {C:\Bruker\TopSpin3.6.2} 2112 41 — 75.48MHz
159.5
156.0
139.2
139.2
127.0
126.8
115.0
114.7
83.3
77.0 CDCl3
25.2
25.0
24.7
Bpin
Bpin
F
4f
f1 (ppm)

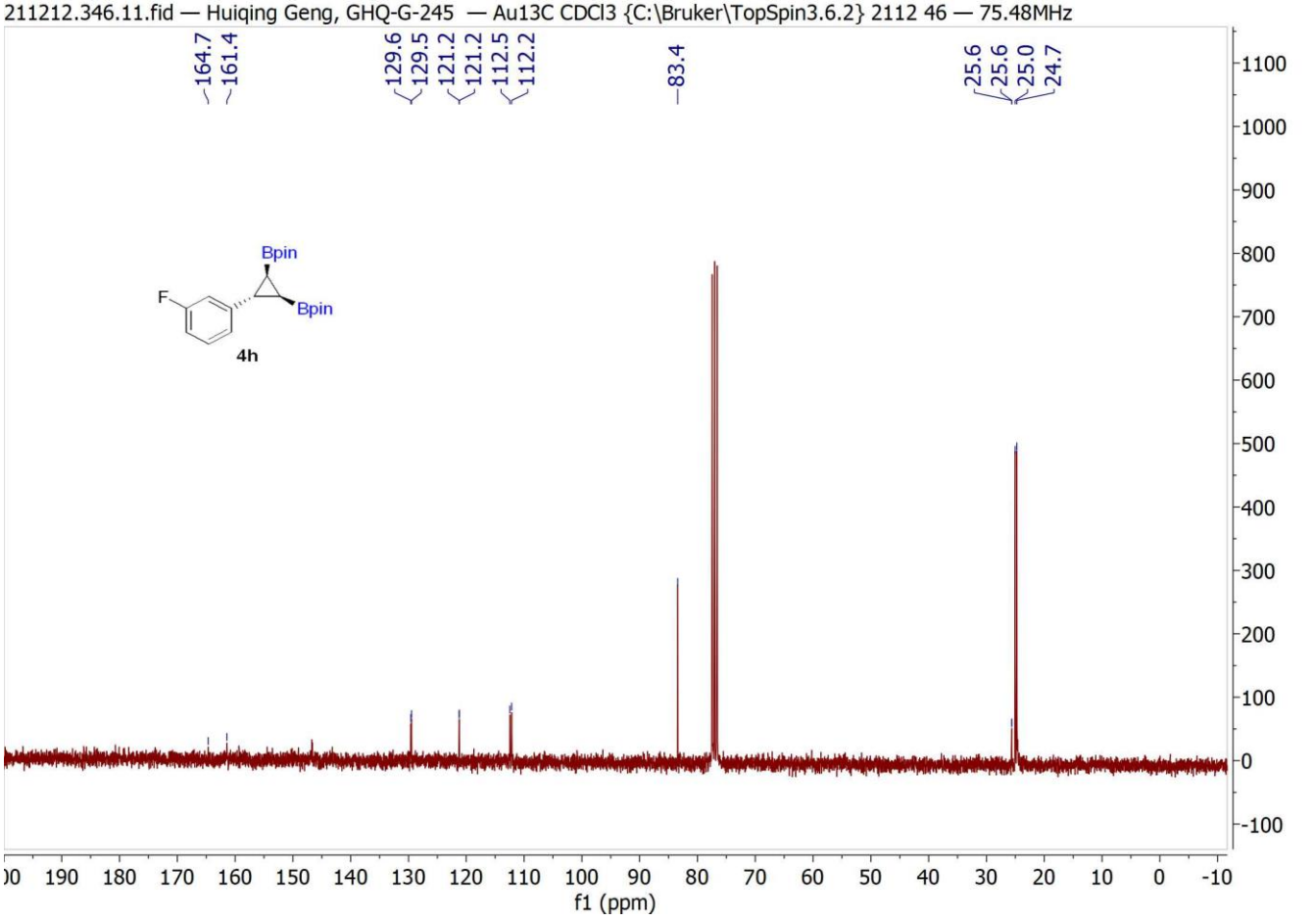

211203.341.12.fid — Huiqing Geng GHQ-G-241 — Au11B CDCl3 {C:\Bruker\TopSpin3.6.2} 2112 41 — 96.29MHz
32.1
Bpin
Bpin
F
4f
f1 (ppm)

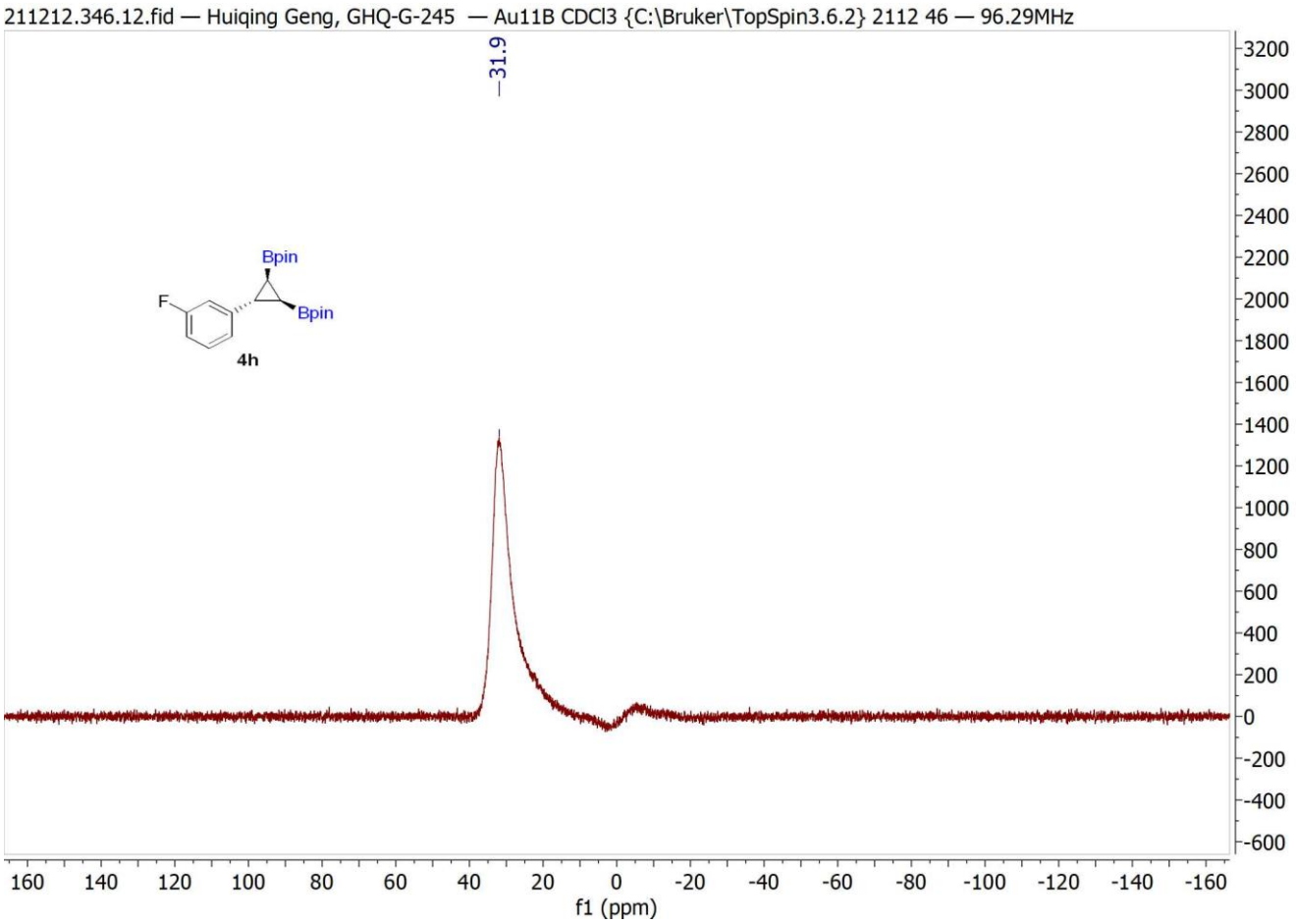

211111.312.10.fid — Huiqing Geng GHQ-G-221 — Au1H CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 12 — 300.13MHz
7.26 CDCl3
7.14
7.13
7.11
7.11
7.10
7.09
7.04
6.93
6.93
6.93
6.92
6.92
6.91
6.90
6.88
2.28
2.26
2.24
2.22
1.25
0.58
0.55
Bpin
Bpin
4g
0.99
1.00
2.00
3.00
1.00
24.01
2.00
f1 (ppm)

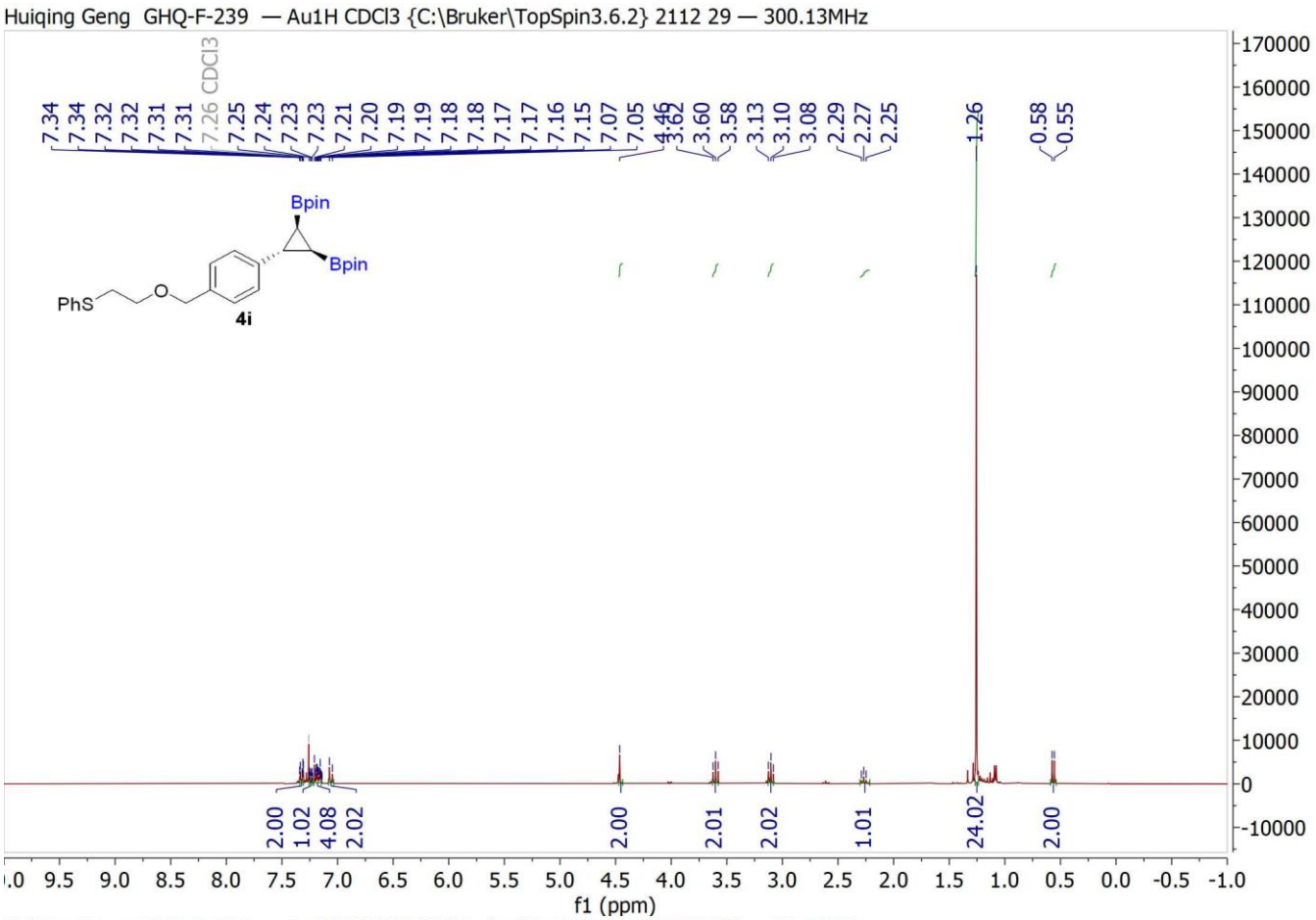

211111.312.11.fid — Huiqing Geng GHQ-G-221 — Au13C CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 12 — 75.48MHz
143.7
137.7
128.1
126.5
126.3
122.4
83.3
25.9
25.0
24.8
21.4
Bpin
Bpin
4g
f1 (ppm)

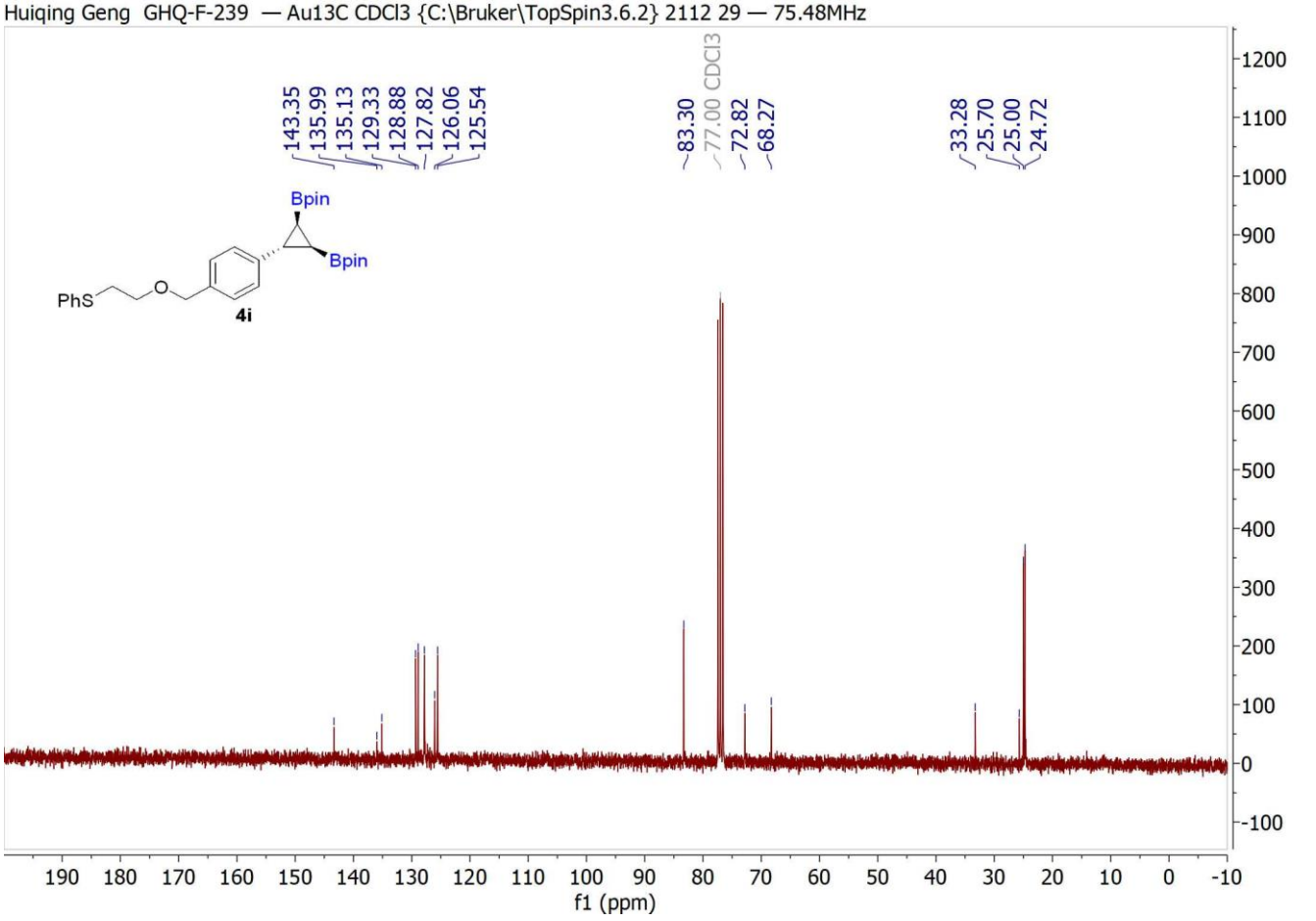

211111.312.12.fid — Huiqing Geng GHQ-G-221 — Au11B CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 12 — 96.29MHz
32.1
Bpin
Bpin
4g
3500
3000
2500
2000
1500
1000
500
0
-500
-1000
160 140 120 100 80 60 40 20 0 -20 -40 -60 -80 -100 -120 -140 -160
f1 (ppm)

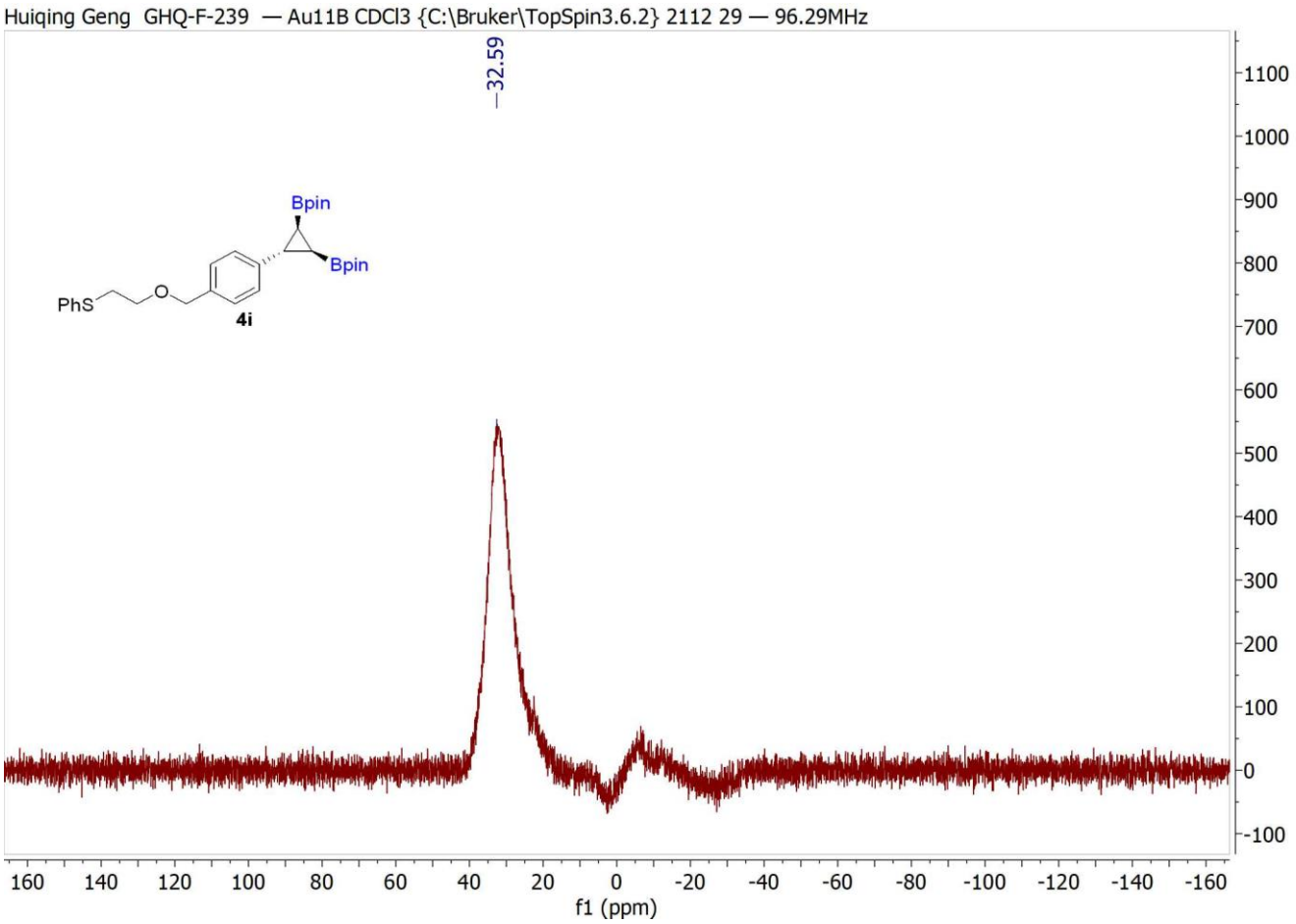

Huiqing Geng, GHQ-G-245 — Au1H CDCl3 {C:\Bruker\TopSpin3.6.2} 2112 46 — 300.13MHz
7.13 7.13 7.12 7.11 7.11 7.11 7.10 7.08 7.08 7.08 7.06 6.82 6.82 6.81 6.80 6.79 6.79 6.76 6.75 6.75 6.75 6.73 6.72 6.72 6.72 6.70 6.70 6.69 6.69 6.68 6.67 2.20 2.18 2.16 1.19 0.50 0.48
Bpin
F
Bpin
4h
1.02 1.02 2.01 1.00 24.00 2.00
f1 (ppm)

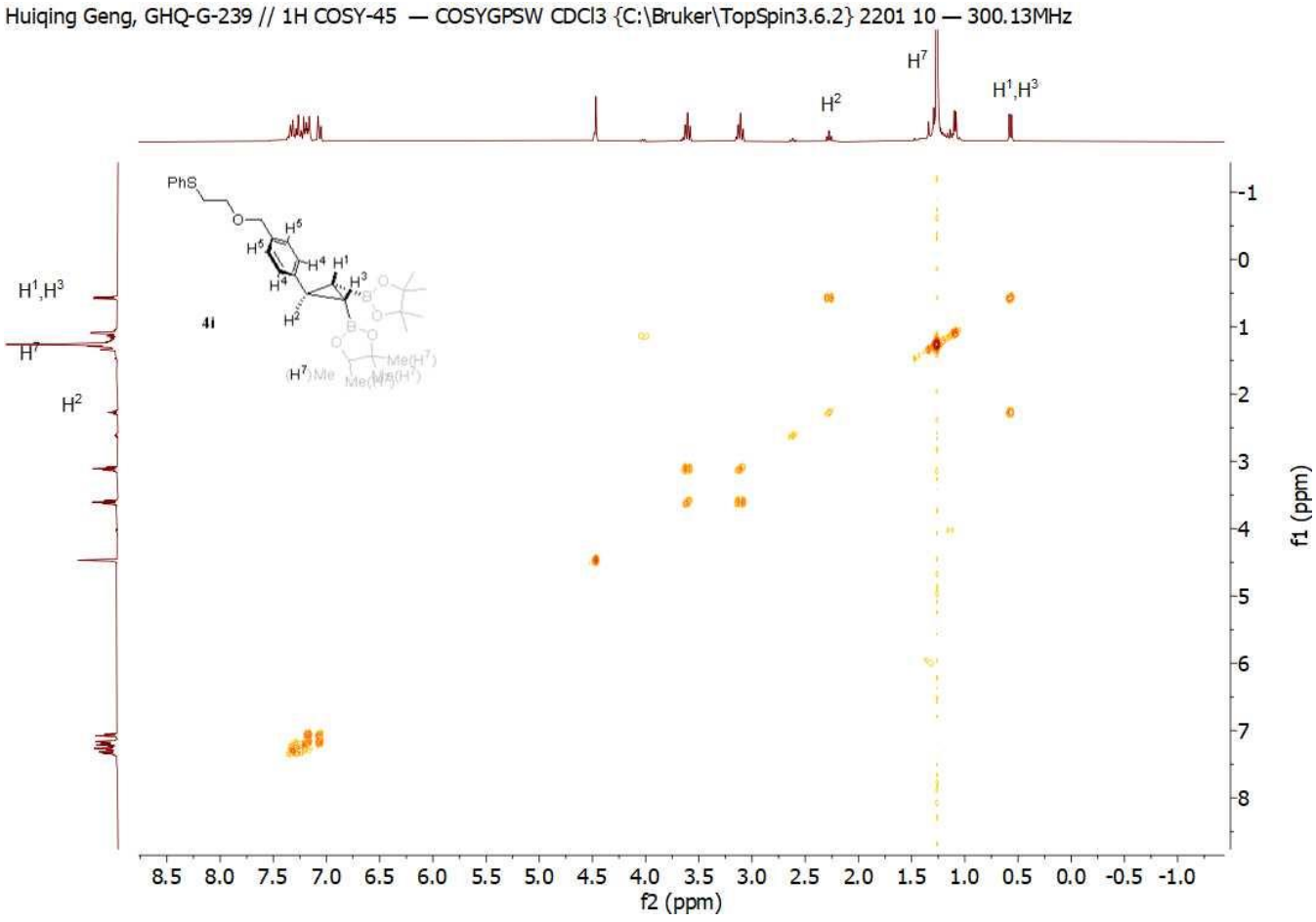

211212.346.11.fid — Huiqing Geng, GHQ-G-245 — Au13C CDCl3 {C:\Bruker\TopSpin3.6.2} 2112 46 — 75.48MHz
164.7 161.4 129.6 129.5 121.2 121.2 112.5 112.2 83.4 25.6 25.6 25.0 24.7
Bpin
F
Bpin
4h
f1 (ppm)

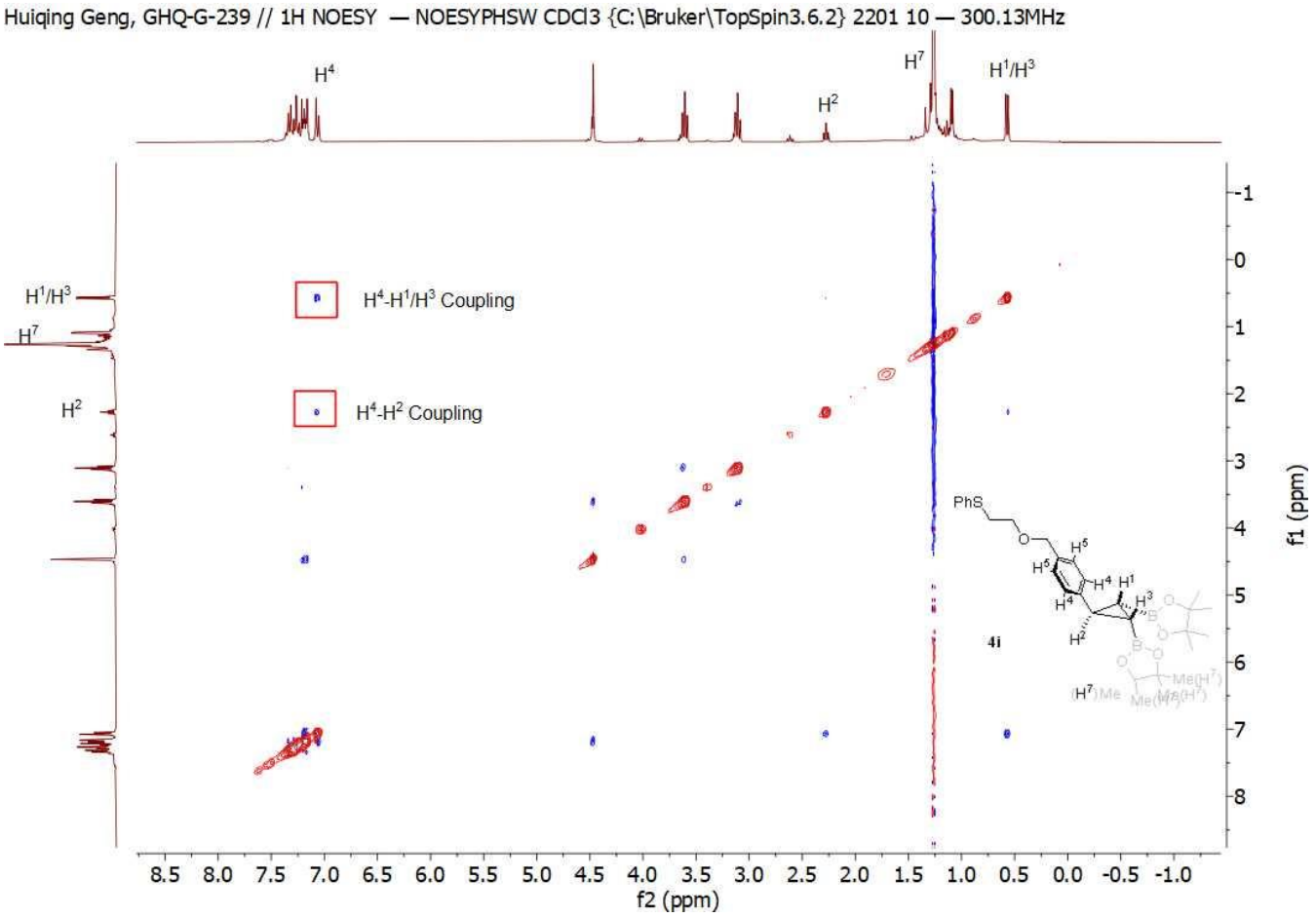

211212.346.12.fid — Huiqing Geng, GHQ-G-245 — Au11B CDCl3 {C:\Bruker\TopSpin3.6.2} 2112 46 — 96.29MHz
31.9
Bpin
F
Bpin
4h
f1 (ppm)

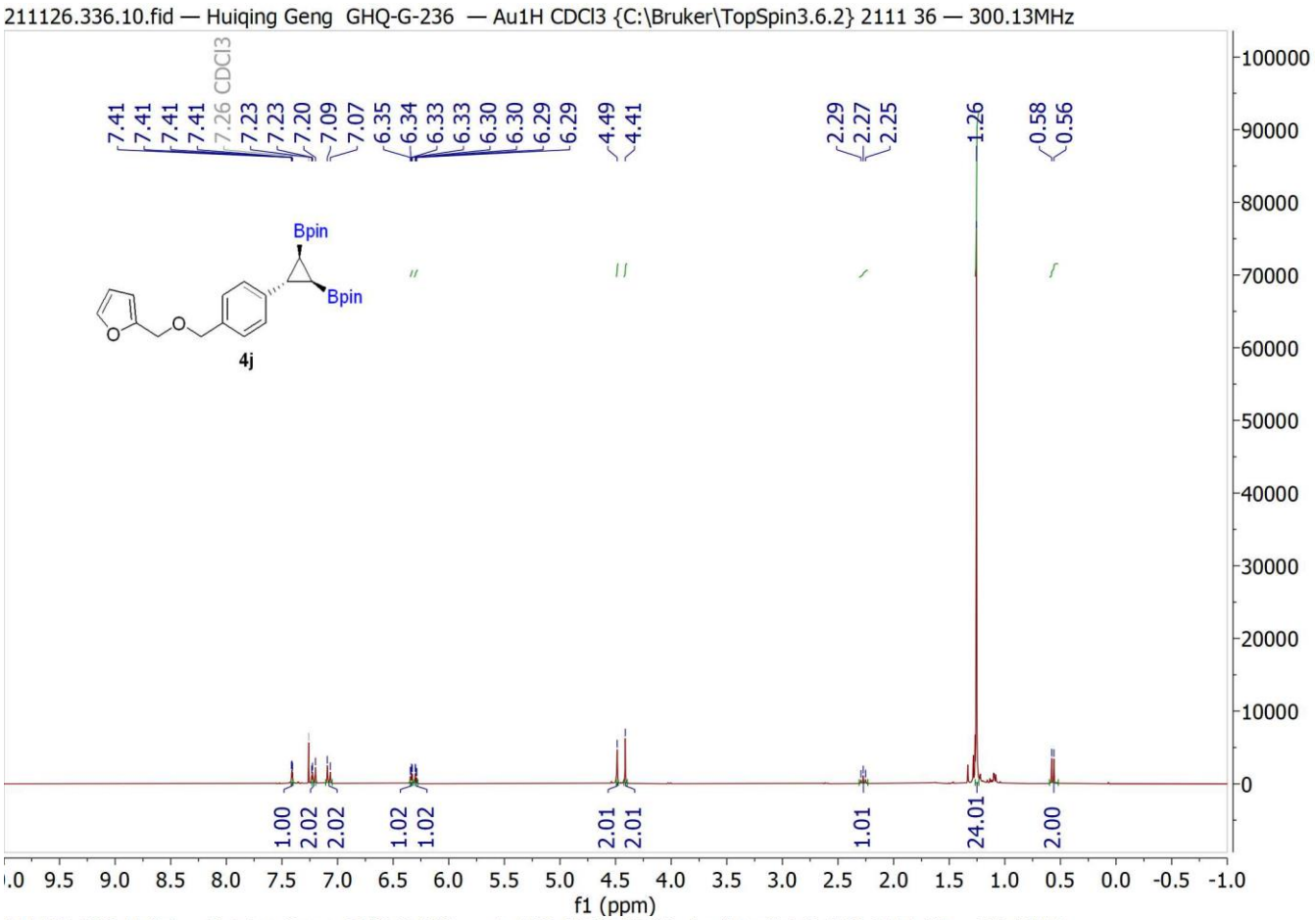

Huiqing Geng GHQ-F-239 — Au1H CDCl3 {C:\Bruker\TopSpin3.6.2} 2112 29 — 300.13MHz
7.34 7.34 7.32 7.32 7.31 7.31 7.26 CDCl3 7.25 7.24 7.23 7.23 7.21 7.20 7.19 7.19 7.18 7.18 7.17 7.17 7.16 7.15 7.07 7.05 4.46 3.62 3.60 3.58 3.13 3.10 3.08 2.29 2.27 2.25 1.26 0.58 0.55
Bpin
Bpin
PhS
O
4i
2.00 1.02 4.08 2.02 2.00 2.01 2.02 1.01 24.02 2.00
f1 (ppm)

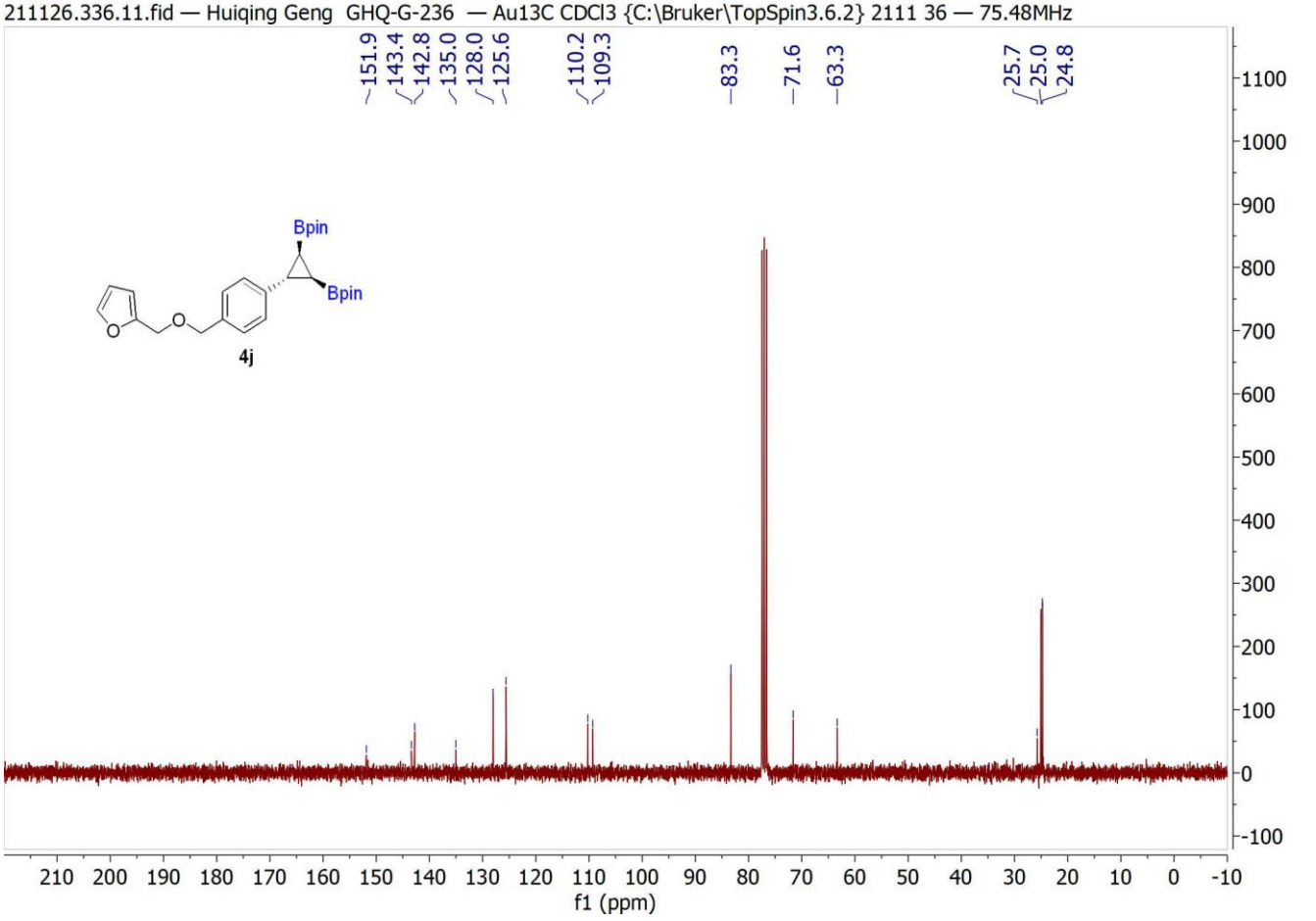

Huiqing Geng GHQ-F-239 — Au13C CDCl3 {C:\Bruker\TopSpin3.6.2} 2112 29 — 75.48MHz
143.35 135.99 135.13 129.33 128.88 127.82 126.06 125.54 83.30 77.00 CDCl3 72.82 68.27 33.28 25.70 25.00 24.72
Bpin
Bpin
PhS
O
4i
f1 (ppm)

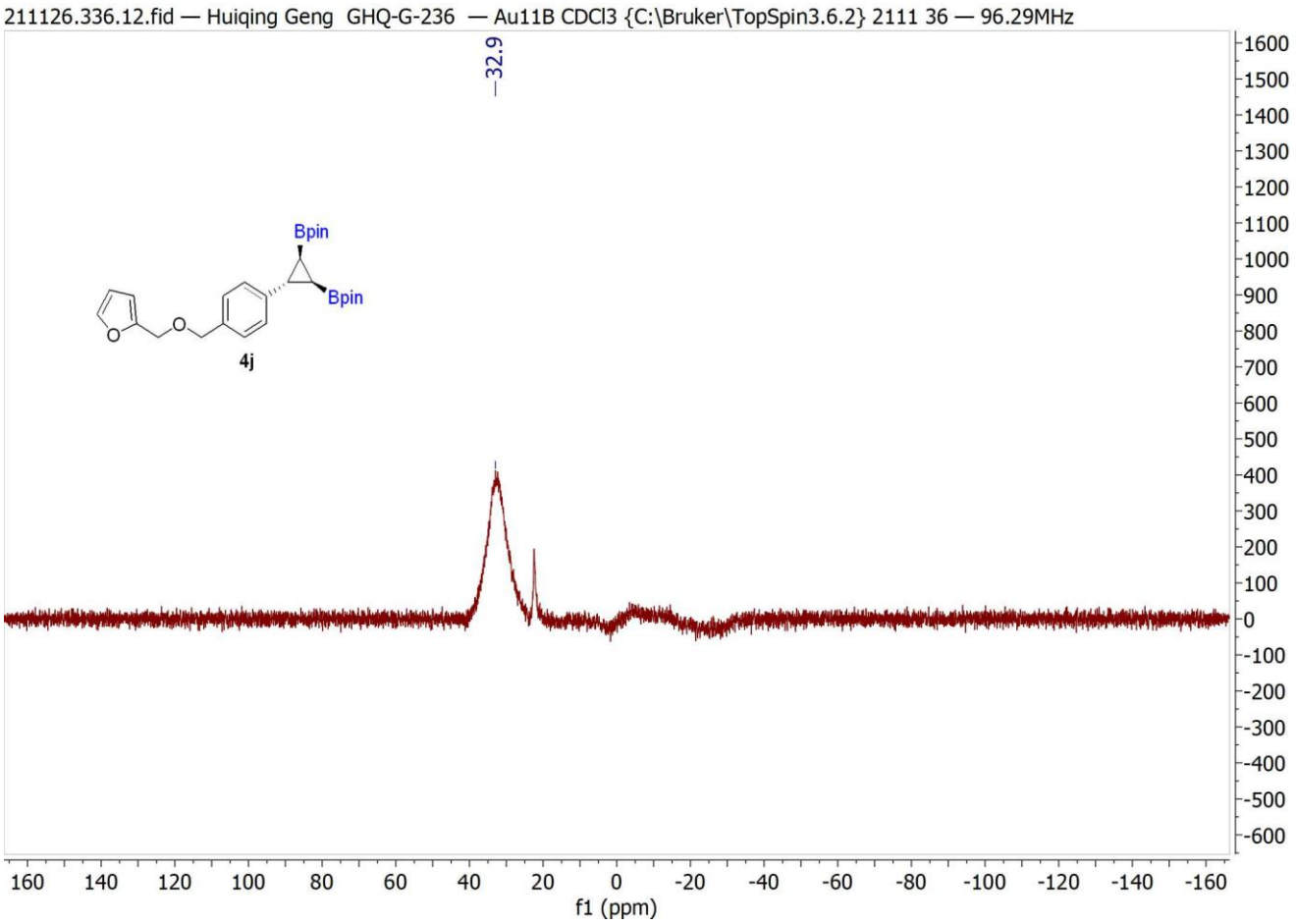

Huiqing Geng GHQ-F-239 — Au11B CDCl3 {C:\Bruker\TopSpin3.6.2} 2112 29 — 96.29MHz
32.59
Bpin
Bpin
PhS
O
4i
f1 (ppm)

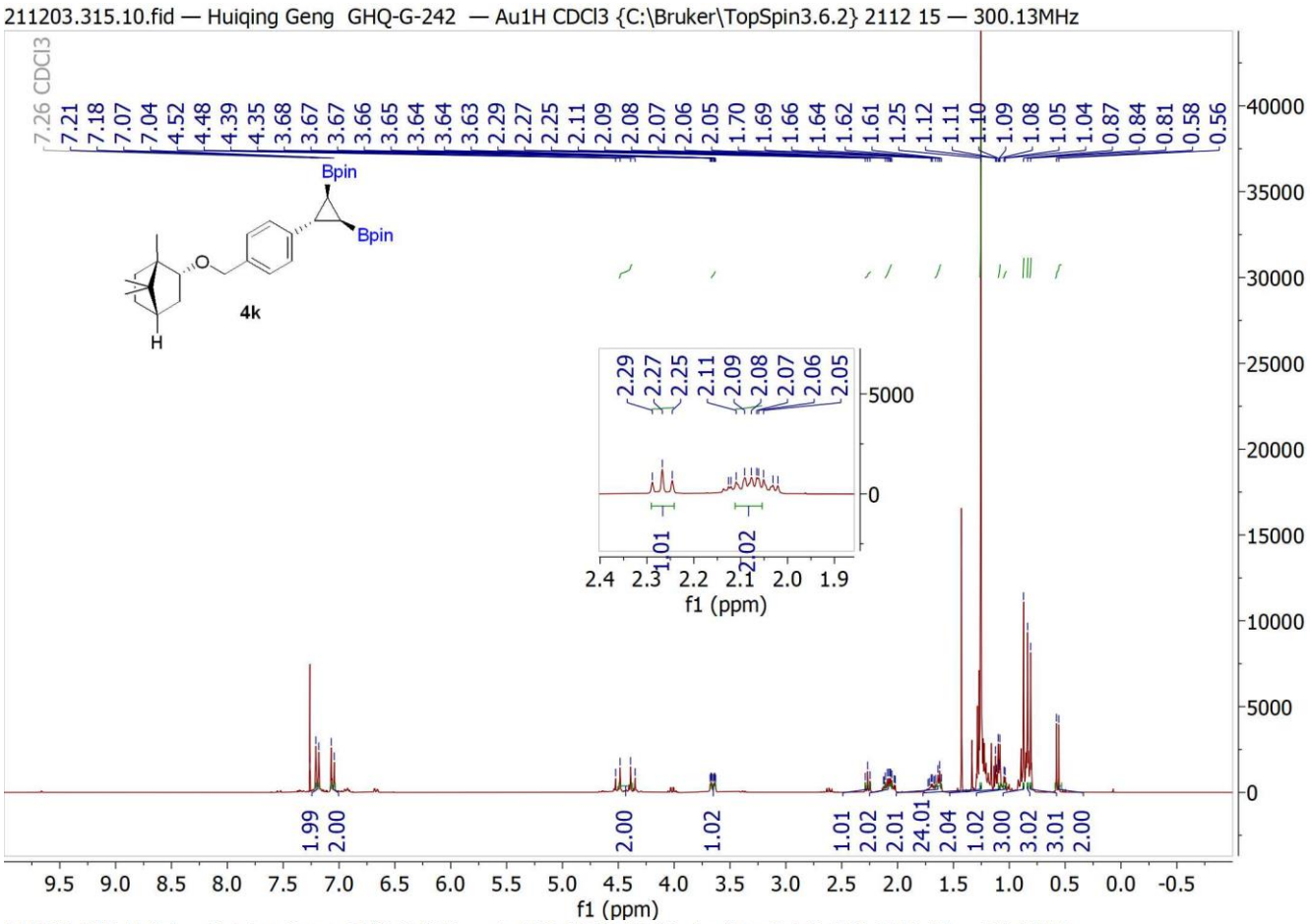

Huiqing Geng, GHQ-G-239 // 1H COSY-45 — COSYGPSW CDCl3 {C:\Bruker\TopSpin3.6.2} 2201 10 — 300.13MHz
H7
H2
H1,H3
PhS
O
4i
f2 (ppm)
f1 (ppm)

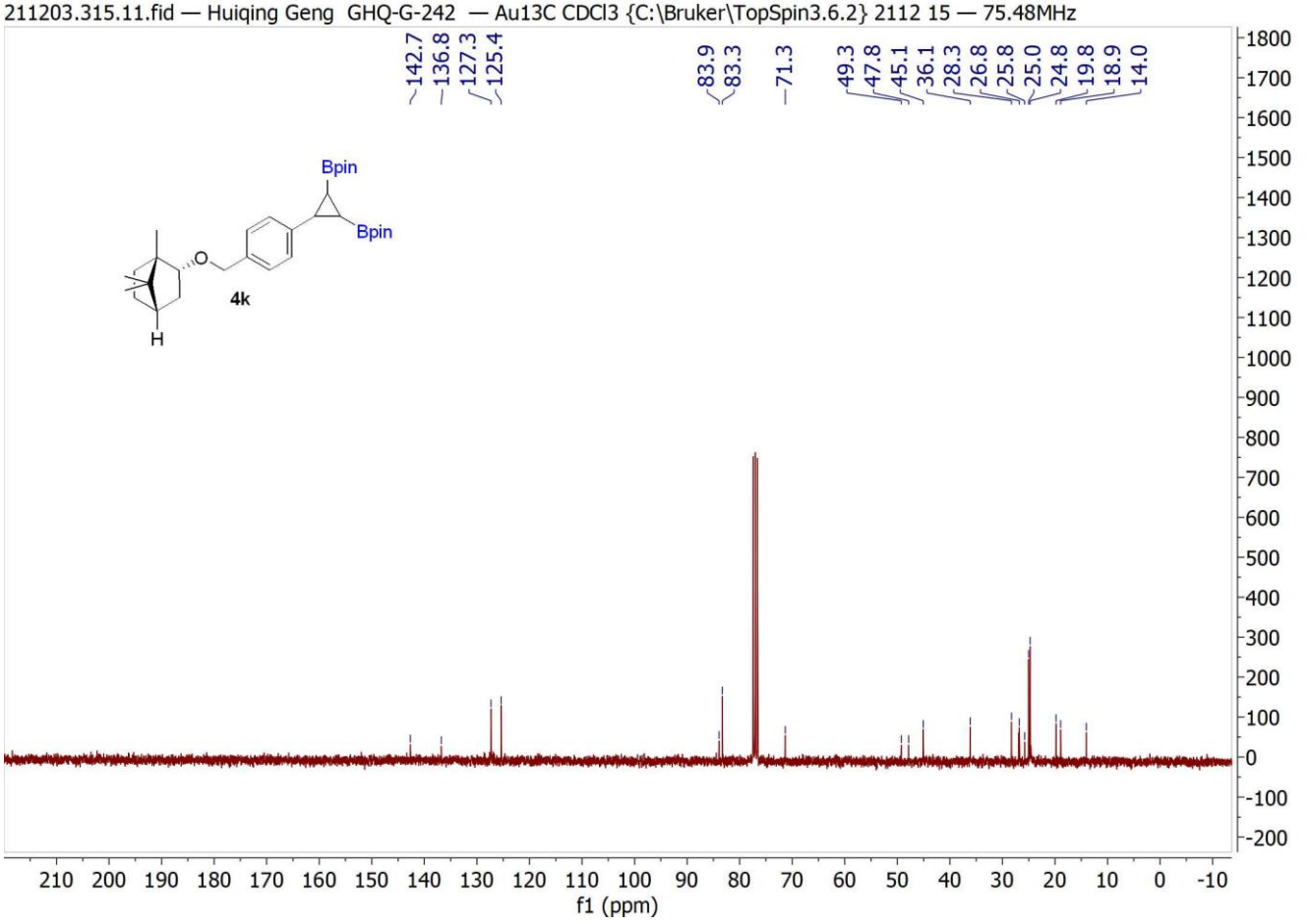

Huiqing Geng, GHQ-G-239 // 1H NOESY — NOESYPHSW CDCl3 {C:\Bruker\TopSpin3.6.2} 2201 10 — 300.13MHz
H4
H2
H7
H1/H3
H4-H1/H3 Coupling
H4-H2 Coupling
PhS
4i
f2 (ppm)
f1 (ppm)

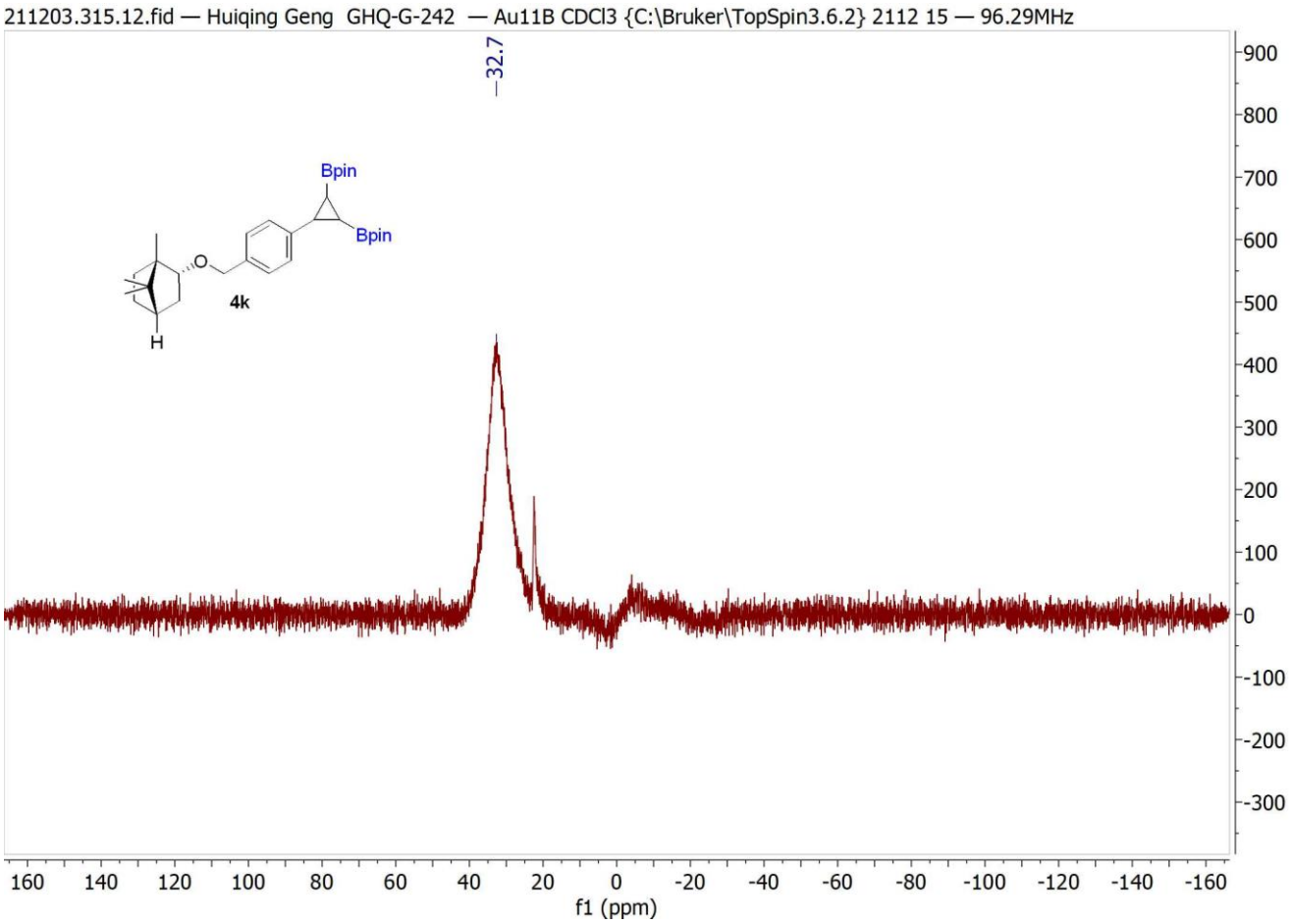

211126.336.10.fid — Huiqing Geng GHQ-G-236 — Au1H CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 36 — 300.13MHz
7.41
7.41
7.41
7.41
7.26 CDCl3
7.23
7.23
7.20
7.09
7.07
6.35
6.34
6.33
6.33
6.30
6.30
6.29
6.29
4.49
4.41
2.29
2.27
2.25
1.26
0.58
0.56
Bpin
Bpin
4j
1.00
2.02
2.02
1.02
1.02
2.01
2.01
1.01
24.01
2.00
f1 (ppm)

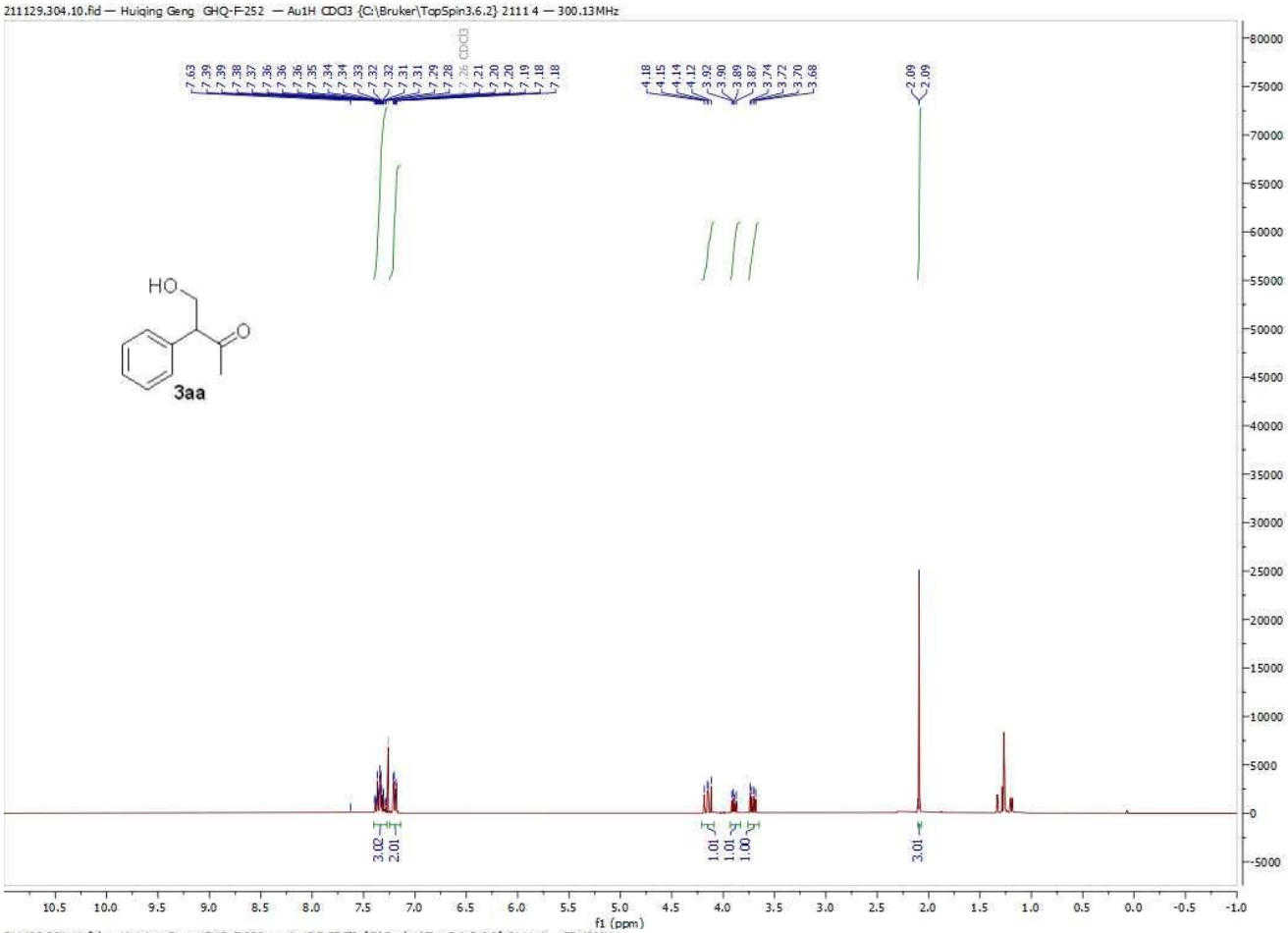

211126.336.11.fid — Huiqing Geng GHQ-G-236 — Au13C CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 36 — 75.48MHz
151.9
143.4
142.8
135.0
128.0
125.6
110.2
109.3
83.3
71.6
63.3
25.7
25.0
24.8
Bpin
Bpin
4j
f1 (ppm)

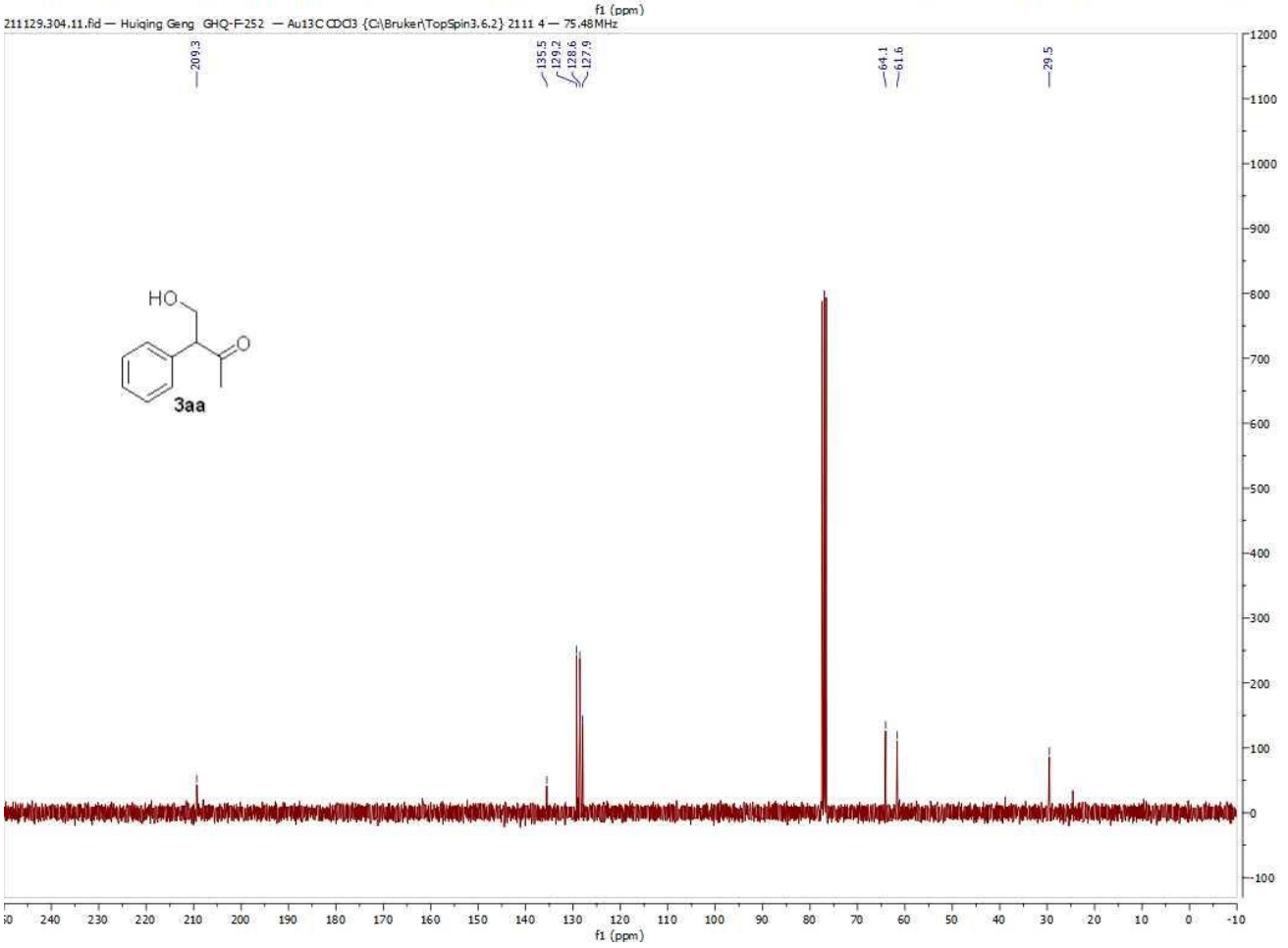

211126.336.12.fid — Huiqing Geng GHQ-G-236 — Au11B CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 36 — 96.29MHz
32.9
Bpin
Bpin
4j
f1 (ppm)

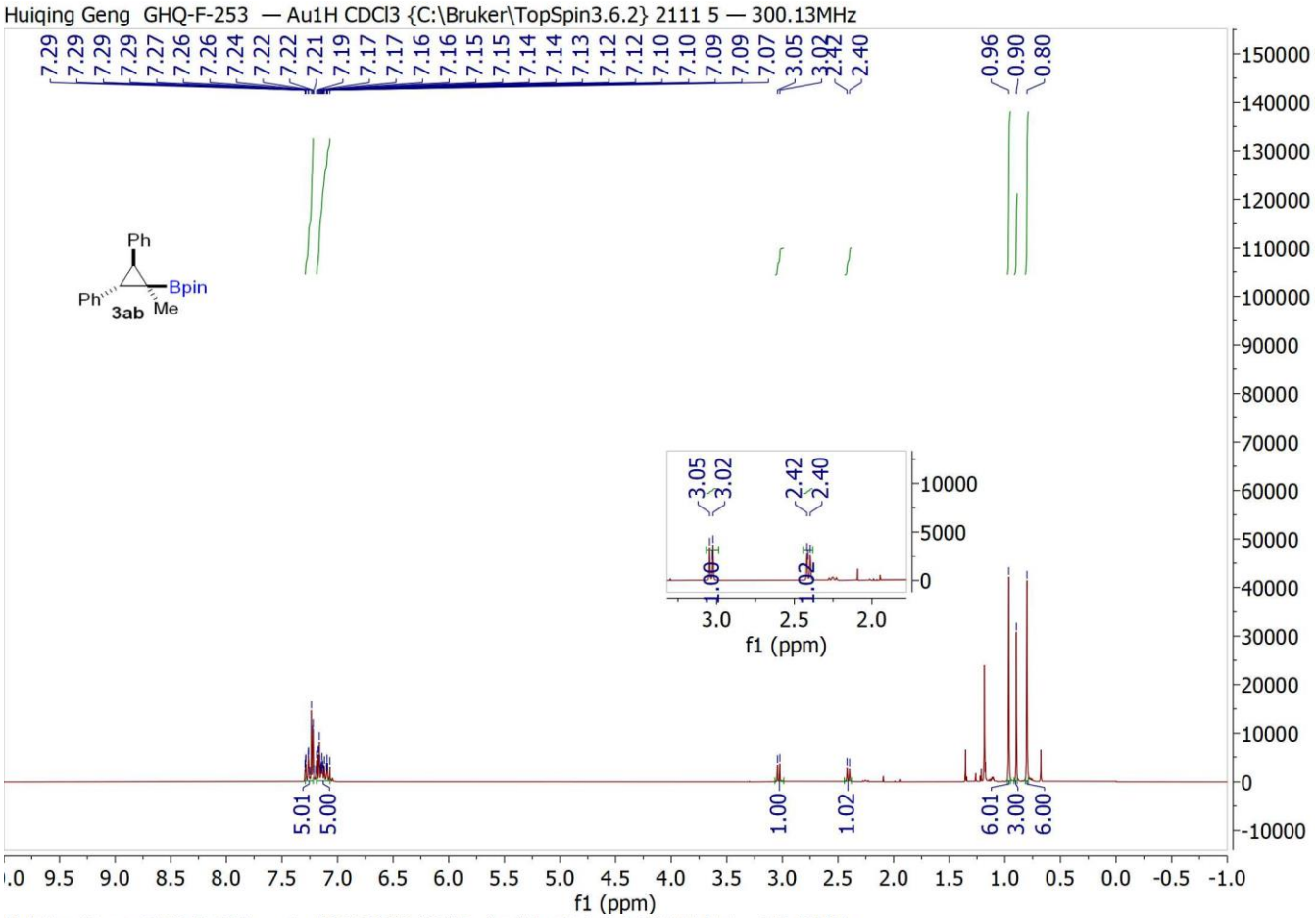

211203.315.10.fid — Huiqing Geng GHQ-G-242 — Au1H CDCl3 {C:\Bruker\TopSpin3.6.2} 2112 15 — 300.13MHz
7.26 CDCl3
Bpin
Bpin
4k
H
f1 (ppm)

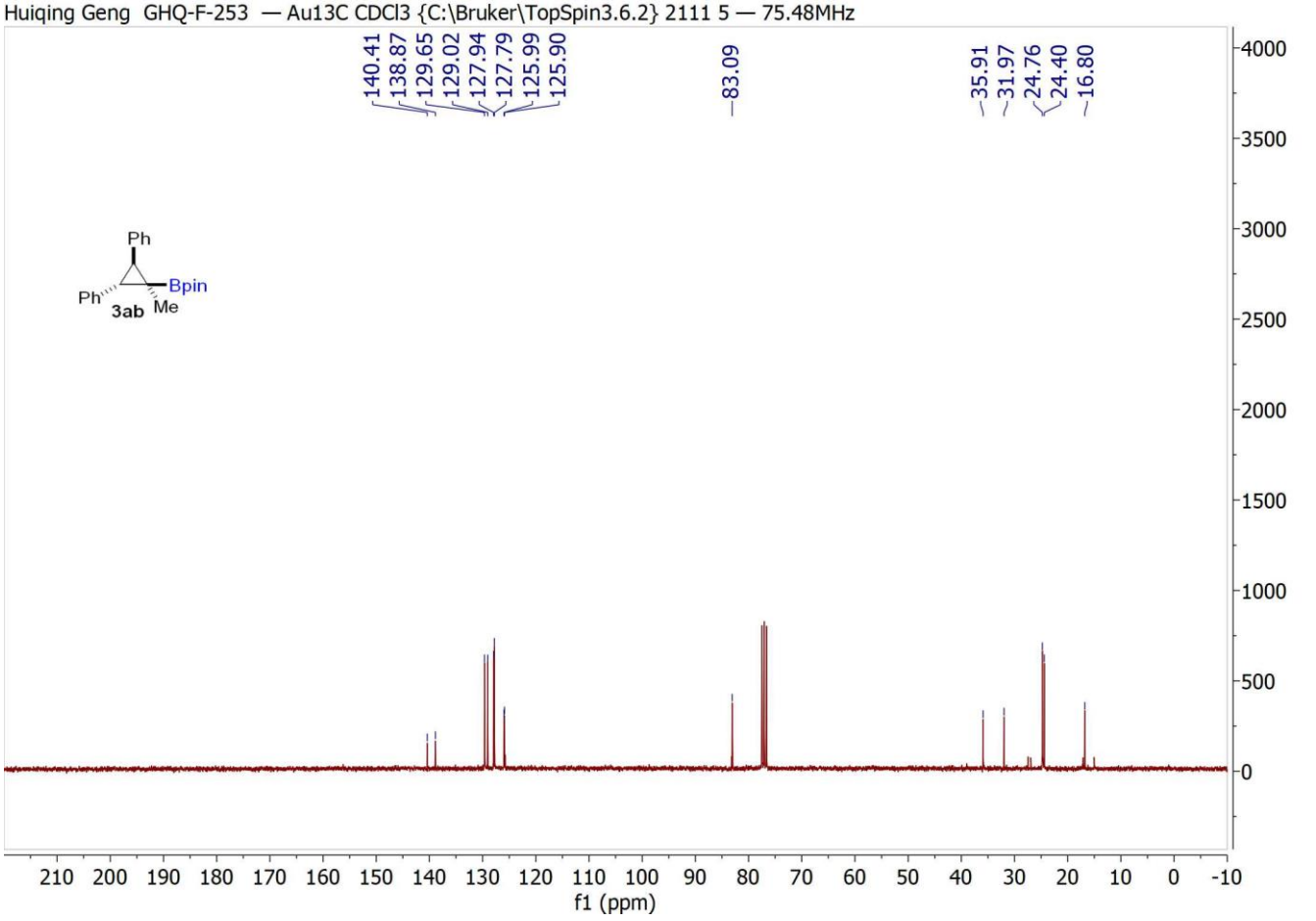

211203.315.11.fid — Huiqing Geng GHQ-G-242 — Au13C CDCl3 {C:\Bruker\TopSpin3.6.2} 2112 15 — 75.48MHz
Bpin
Bpin
4k
H
f1 (ppm)

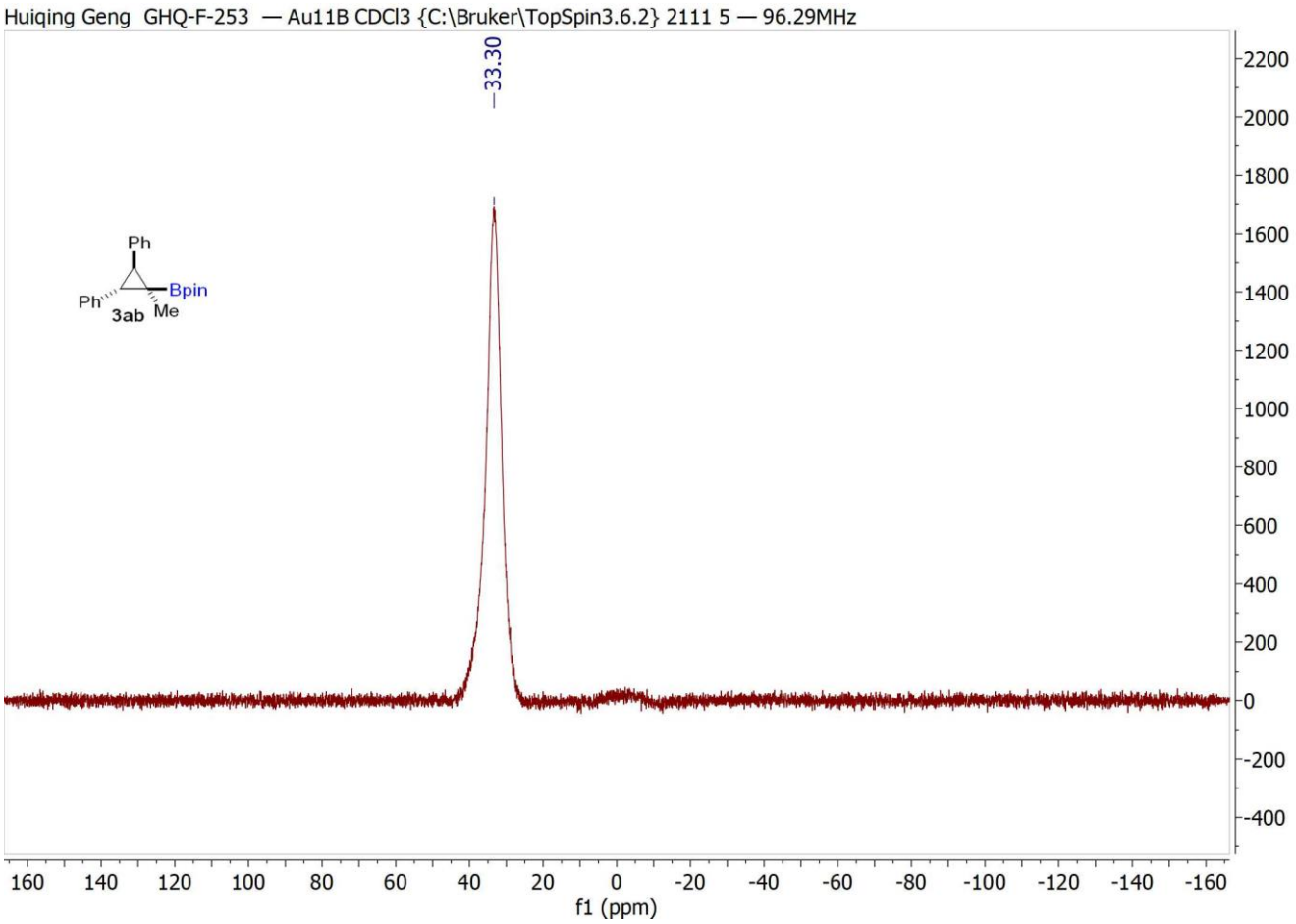

211203.315.12.fid — Huiqing Geng GHQ-G-242 — Au11B CDCl3 {C:\Bruker\TopSpin3.6.2} 2112 15 — 96.29MHz
32.7
Bpin
Bpin
O
4k
H
900
800
700
600
500
400
300
200
100
0
-100
-200
-300
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
f1 (ppm)

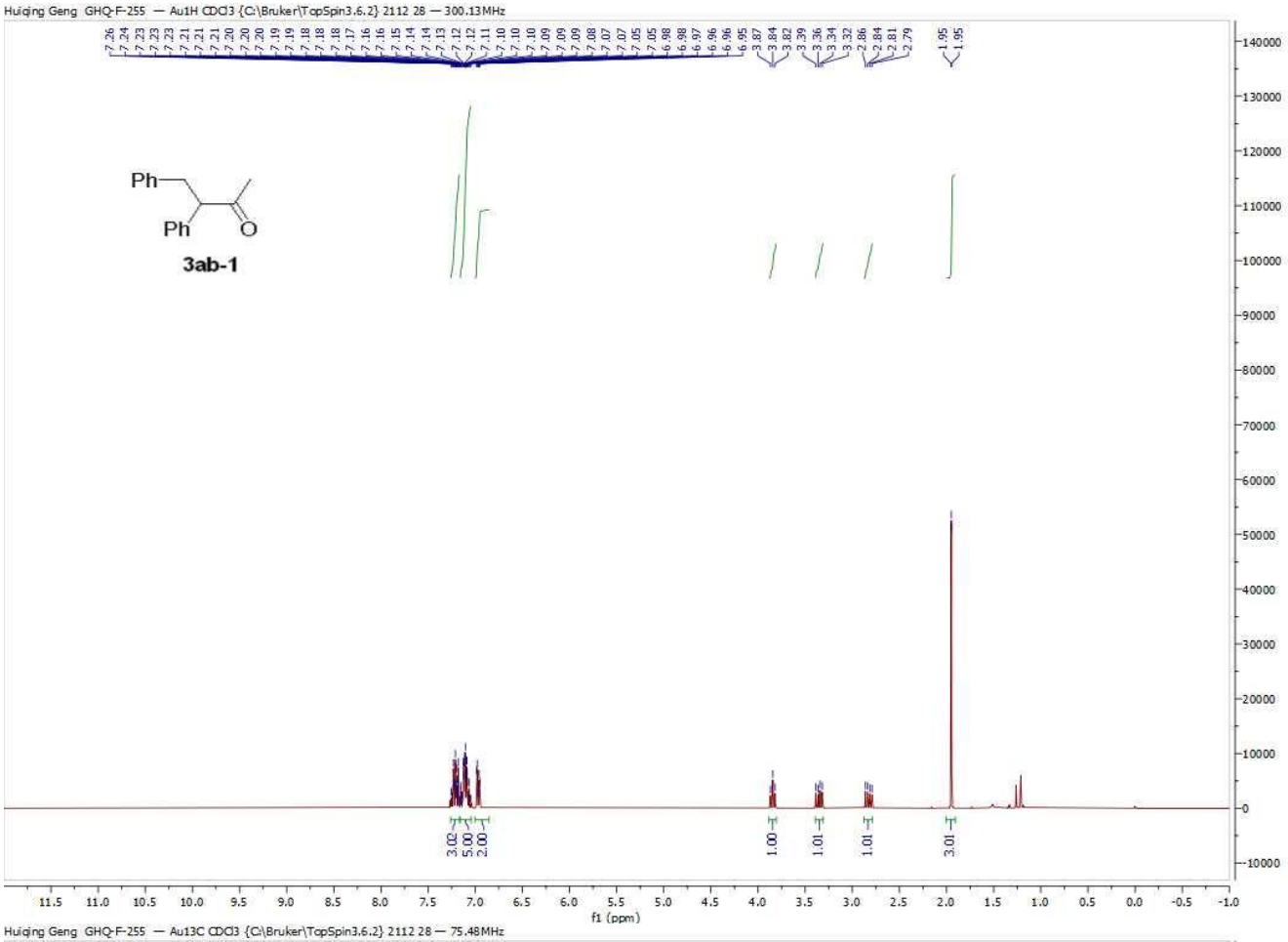

211129.304.10.fid — Huiqing Geng GHQ-F-252 — Au1H CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 4 — 300.13MHz
HO
O
3aa
f1 (ppm)

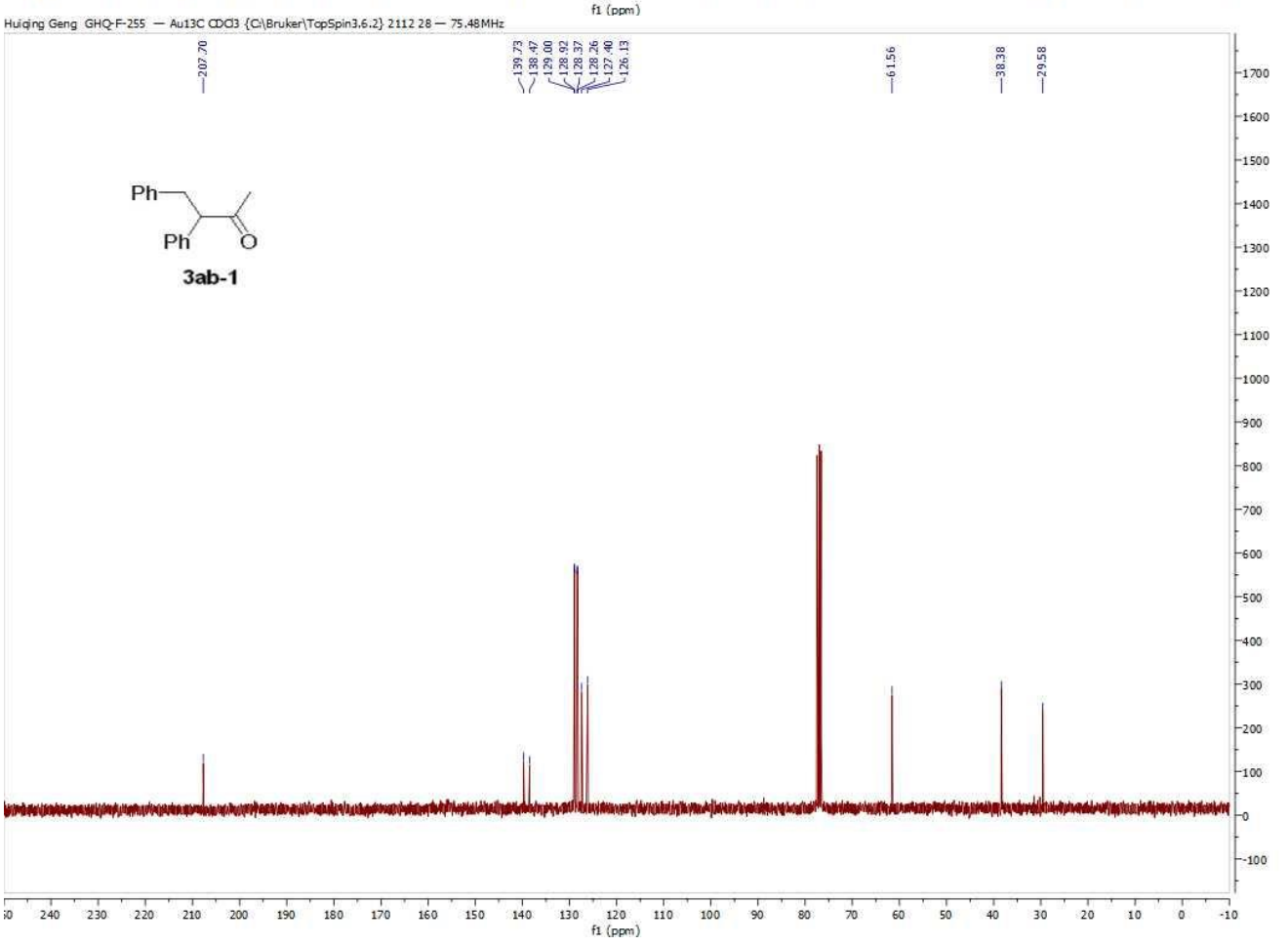

211129.304.11.fid — Huiqing Geng GHQ-F-252 — Au13C CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 4 — 75.48MHz
209.3
135.5
129.2
128.6
127.9
64.1
61.6
29.5
HO
O
3aa
f1 (ppm)

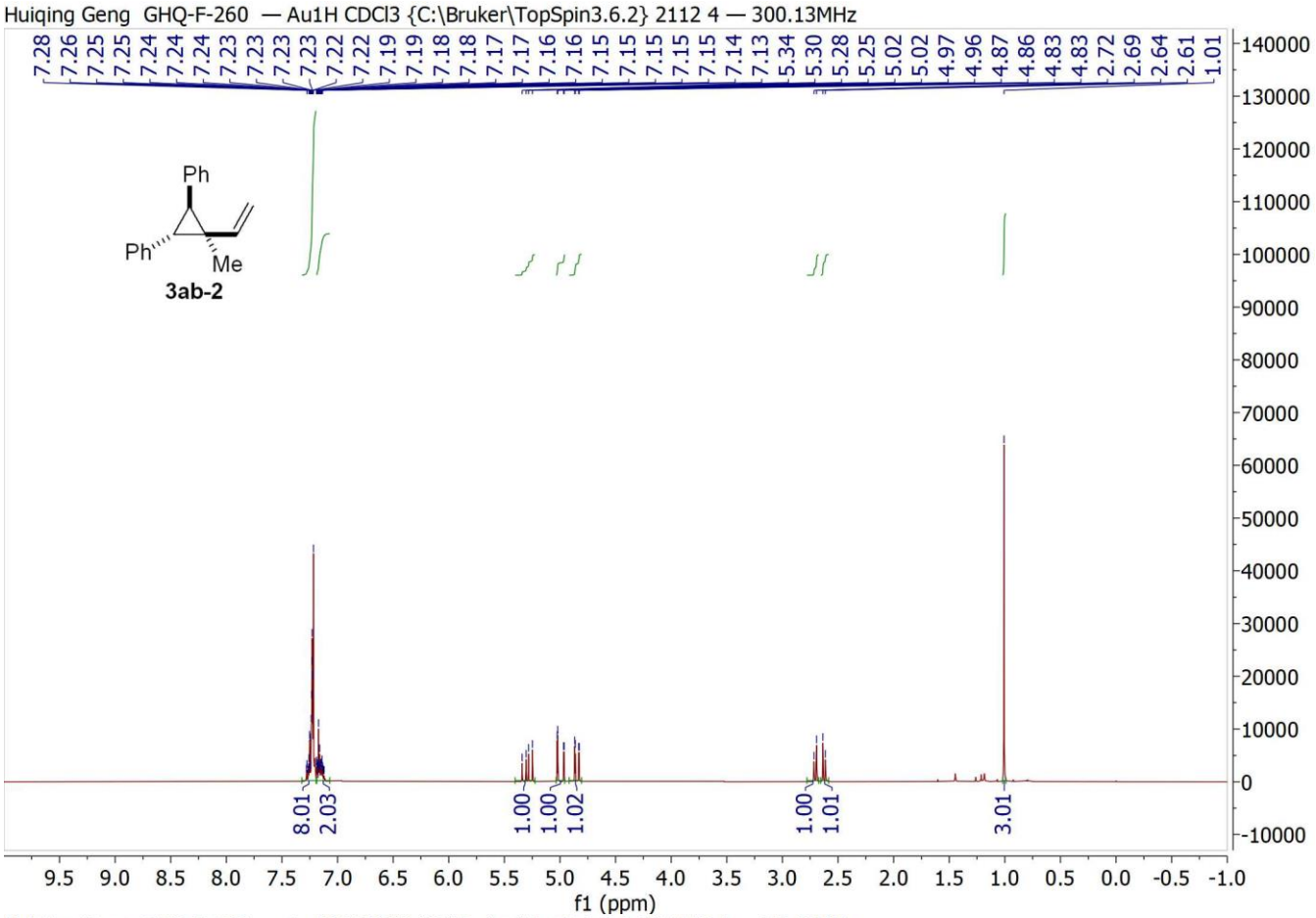

Huiqing Geng GHQ-F-253 — Au1H CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 5 — 300.13MHz
7.29 7.29 7.29 7.29 7.27 7.26 7.26 7.24 7.22 7.22 7.21 7.19 7.17 7.17 7.16 7.16 7.15 7.15 7.14 7.14 7.13 7.12 7.12 7.10 7.10 7.09 7.09 7.07 3.05 3.02 2.42 2.40 0.96 0.90 0.80
Ph
Ph
Bpin
Me
3ab
5.01 5.00 1.00 1.02 6.01 3.00 6.00
f1 (ppm)

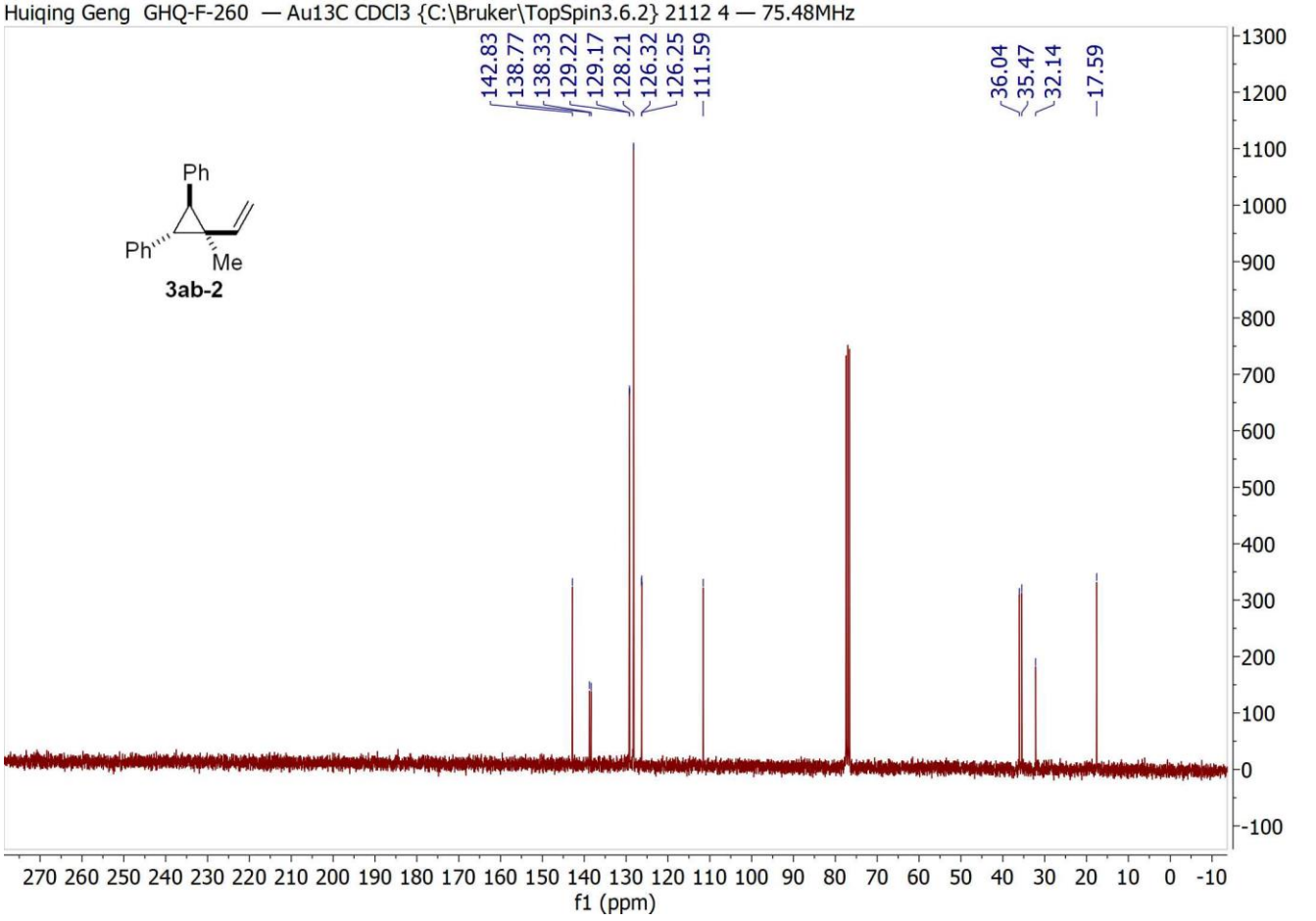

Huiqing Geng GHQ-F-253 — Au13C CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 5 — 75.48MHz
140.41 138.87 129.65 129.02 127.94 127.79 125.99 125.90 83.09 35.91 31.97 24.76 24.40 16.80
Ph
Ph
Bpin
Me
3ab
f1 (ppm)

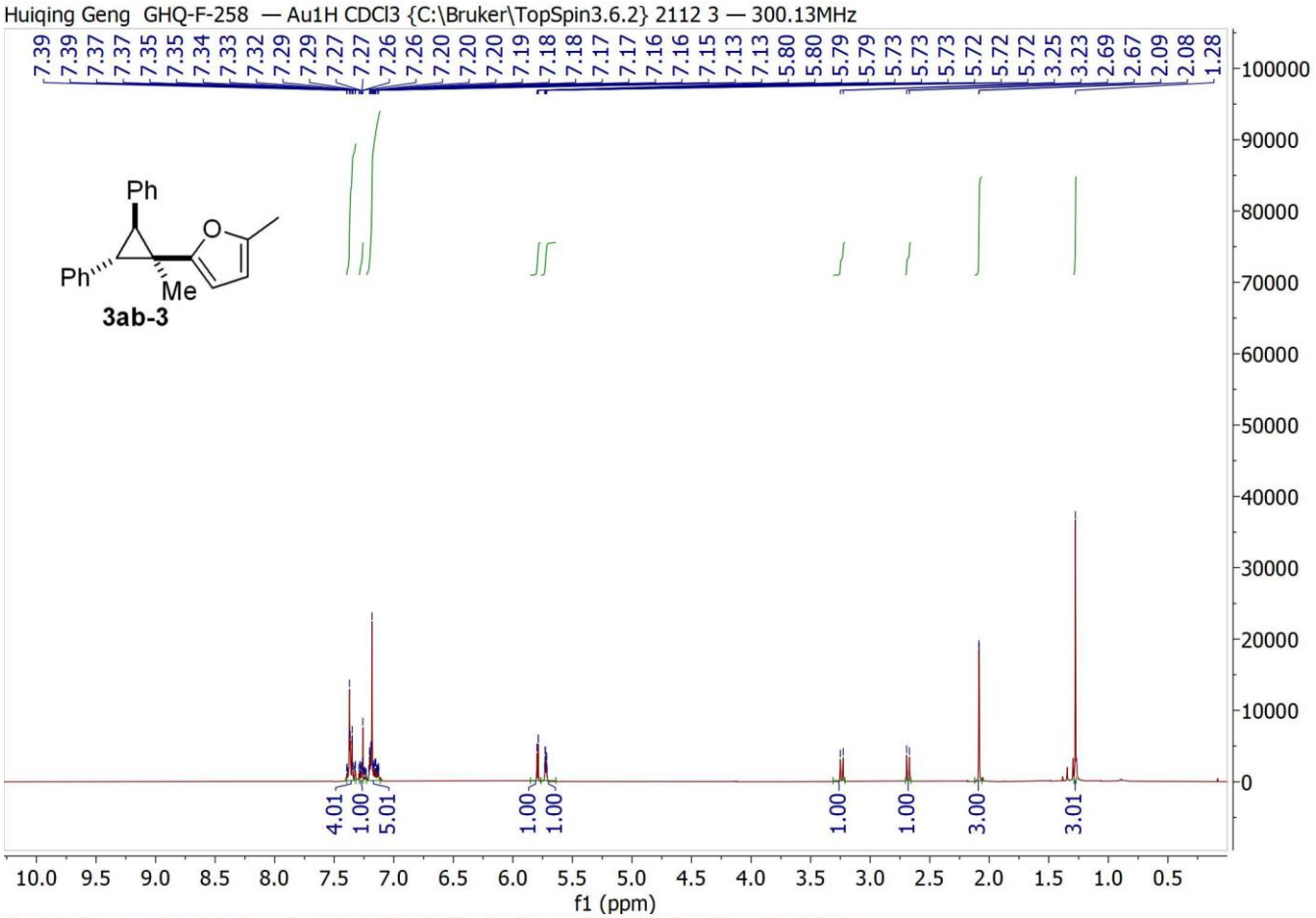

Huiqing Geng GHQ-F-253 — Au11B CDCl3 {C:\Bruker\TopSpin3.6.2} 2111 5 — 96.29MHz
33.30
Ph
Ph
Bpin
Me
3ab
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
-200
-400
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
f1 (ppm)

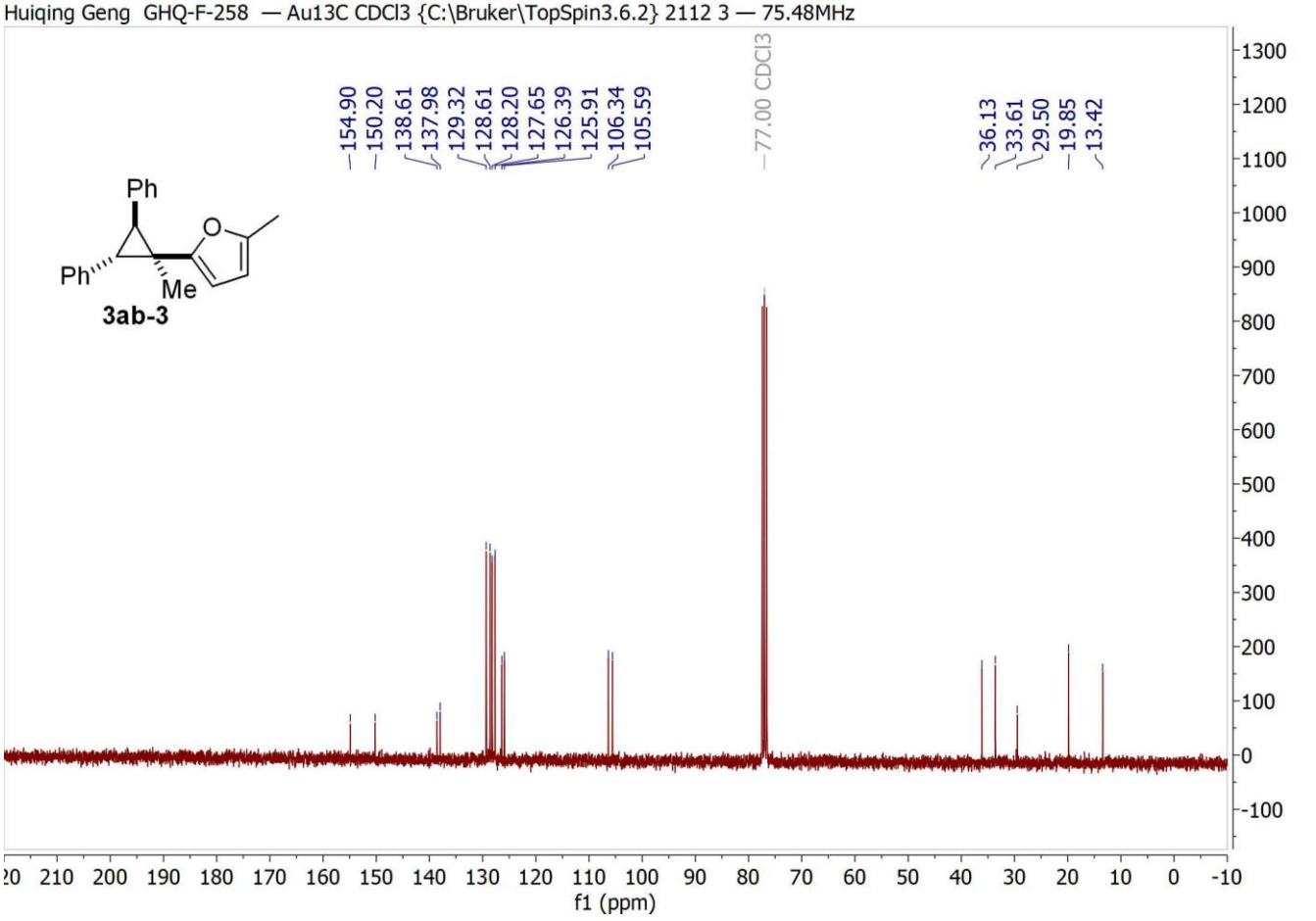

Huiqing Geng GHQ-F-255 — Au1H CDCl3 {C:\Bruker\TopSpin3.6.2} 2112 28 — 300.13MHz
Ph
Ph
O
3ab-1
f1 (ppm)

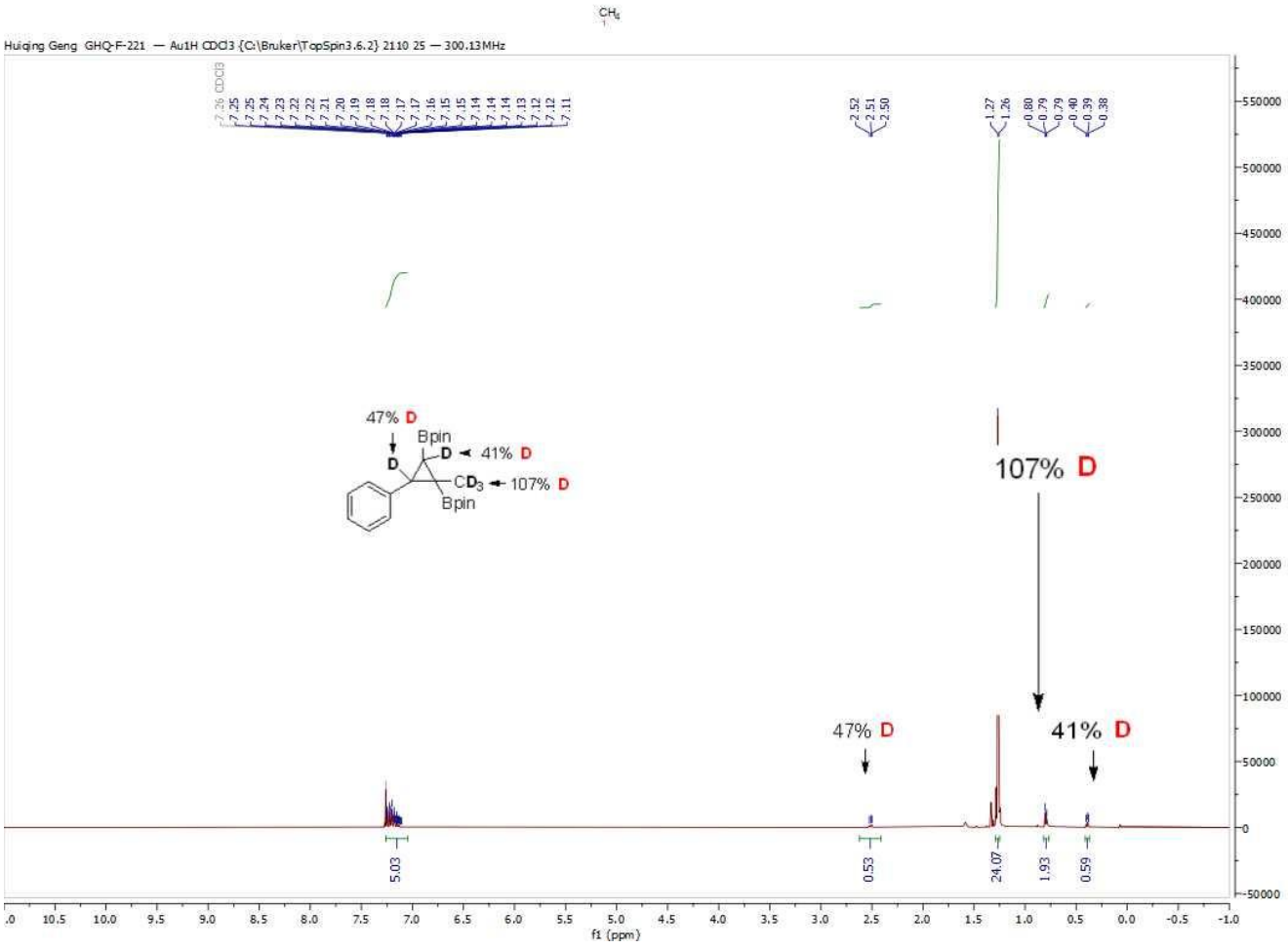

Huiqing Geng GHQ-F-255 — Au13C CDCl3 {C:\Bruker\TopSpin3.6.2} 2112 28 — 75.48MHz
207.70
139.73
138.47
129.00
128.92
128.37
128.26
127.40
126.13
61.56
38.38
29.58
Ph
Ph
O
3ab-1
f1 (ppm)


Huiqing Geng GHQ-F-260 — Au1H CDCl3 {C:\Bruker\TopSpin3.6.2} 2112 4 — 300.13MHz
7.28 7.26 7.25 7.25 7.24 7.24 7.24 7.23 7.23 7.23 7.23 7.22 7.22 7.19 7.19 7.18 7.18 7.17 7.17 7.16 7.16 7.15 7.15 7.15 7.15 7.15 7.14 7.13 5.34 5.30 5.28 5.25 5.02 5.02 4.97 4.96 4.87 4.86 4.83 4.83 2.72 2.69 2.64 2.61 1.01
Ph
Ph
Me
3ab-2
8.01 2.03 1.00 1.00 1.02 1.00 1.01 3.01
f1 (ppm)


Huiqing Geng GHQ-F-260 — Au13C CDCl3 {C:\Bruker\TopSpin3.6.2} 2112 4 — 75.48MHz
142.83 138.77 138.33 129.22 129.17 128.21 126.32 126.25 111.59 36.04 35.47 32.14 17.59
Ph
Ph
Me
3ab-2
f1 (ppm)


Huiqing Geng GHQ-F-258 — Au1H CDCl3 {C:\Bruker\TopSpin3.6.2} 2112 3 — 300.13MHz
7.39 7.39 7.37 7.37 7.35 7.35 7.34 7.33 7.32 7.29 7.29 7.27 7.27 7.26 7.26 7.20 7.20 7.20 7.19 7.18 7.18 7.17 7.17 7.16 7.16 7.15 7.13 7.13 5.80 5.80 5.79 5.79 5.73 5.73 5.73 5.72 5.72 5.72 3.25 3.23 2.69 2.67 2.09 2.08 1.28
Ph
Ph
Me
O
3ab-3
4.01 1.00 5.01 1.00 1.00 1.00 1.00 3.00 3.01
f1 (ppm)


Huiqing Geng GHQ-F-258 — Au13C CDCl3 {C:\Bruker\TopSpin3.6.2} 2112 3 — 75.48MHz
154.90 150.20 138.61 137.98 129.32 128.61 128.20 127.65 126.39 125.91 106.34 105.59
77.00 CDCl3
36.13 33.61 29.50 19.85 13.42
Ph
Ph
Me
O
3ab-3
f1 (ppm)


Huiqing Geng GHQ-F-221 — Au1H CDCl3 {C:\Bruker\TopSpin3.6.2} 2110 25 — 300.13MHz
47% D
Bpin
D
D
41% D
CD3
107% D
Bpin
107% D
47% D
41% D
5.03
0.53
24.07
1.93
0.59
f1 (ppm)

8. X-Ray data

checkCIF/PLATON report

Structure factors have been supplied for datablock(s) AX2331

THIS REPORT IS FOR GUIDANCE ONLY. IF USED AS PART OF A REVIEW PROCEDURE FOR PUBLICATION, IT SHOULD NOT REPLACE THE EXPERTISE OF AN EXPERIENCED CRYSTALLOGRAPHIC REFEREE.

No syntax errors found. CIF dictionary Interpreting this report

Datablock: AX2331

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Bond precision:   C-C = 0.0037 A          Wavelength=0.71073

Cell:               a=23.931(5)       b=9.526(2)       c=9.259(2)
                    alpha=90          beta=90          gamma=90
Temperature:        150 K

                 Calculated                Reported
Volume           2110.7(8)                 2110.6(8)
Space group      P n a 21                  P n a 21
Hall group       P 2c -2n                  P 2c -2n
Moiety formula   C21 H32 B2 O4             ?
Sum formula      C21 H32 B2 O4             C21 H32 B2 O4
Mr               370.09                    370.08
Dx,g cm-3        1.165                     1.165
Z                4                         4
Mu (mm-1)        0.077                     0.077
F000             800.0                     800.0
F000'            800.36
h,k,lmax         31,12,12                  31,12,12
Nref             5101[ 2707]               5099
Tmin,Tmax        0.963,0.986               0.960,0.990
Tmin'            0.963

Correction method= # Reported T Limits: Tmin=0.960 Tmax=0.990
AbsCorr = MULTI-SCAN

Data completeness= 1.88/1.00        Theta(max)= 27.989

R(reflections)= 0.0454( 4752)                wR2(reflections)=
                                             0.1232( 5099)
S = 1.016                  Npar= 252
```

Datablock AX2331 - ellipsoid plot