Supporting Information

Metal- and additive-free ipso-benzylation of arylsilanes to access diarylmethanes

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Content

1. General information

Unless mentioned otherwise, all air and moisture-insensitive reactions were carried out under an ambient atmosphere and monitored by thin-layer chromatography (TLC). High-resolution mass spectra were obtained using Q Exactive Plus from Thermo Concentration under reduced pressure was performed by rotary evaporation at 25 - 40 °C at an appropriate pressure. Purified compounds were further dried under vacuum (10^{-6} - 10^{-3} bar). Yields refer to purified and spectroscopically pure compounds, unless otherwise stated.

1.1 Solvents

All reagents were purchased from Adamas, Kermel and DAMAO, and used without further purification.

1.2 Chromatography

All reagents were commercial and were used without further purification. Column chromatography was performed on silica gel (200-300 mesh) and reactions were monitored by thin-layer chromatography (TLC) using 254 nm UV light for visualization.

1.3 Instrument characterization

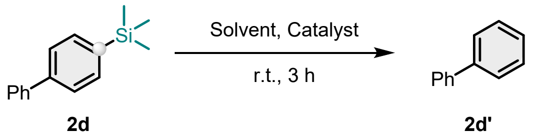
^{1}H NMR, ^{13}C NMR (400 MHz, 101 MHz, respectively) spectra were measured in $CDCl_3$ recorded on Bruker Avance DPX 400 MHz spectrometer. ^{1}H NMR, ^{13}C NMR ^{19}F NMR (600 MHz, 151 MHz, 565 MHz respectively) spectra were measured in $CDCl_3$ recorded on Bruker Avance DPX 600 MHz spectrometer. All chemical shifts (δ) were reported in ppm and coupling constants (J) in Hz. NMR Spectra recorded in $CDCl_3$ were referenced to tetramethylsilane at 0 ppm for ^{1}H or referenced to residual $CHCl_3$ at 77.16 ppm for ^{13}C. The following abbreviations are used: m (multiplet), s (singlet), d (doublet), t (triplet), q (quartet), dd (doublet of doublets), etc. The high resolution mass spectra (HRMS) were measured on a Bruker Daltonics APEX II 47e spectrometer using electron spray ionization (APCI), the mass analyzer is a Fourier transform ion cyclotron resonance. GC-MS test in Agilent 7890B-5977B model gas chromatography mass spectrometry instrument using 16-1050 amu, El source, direct injection, mass analyzer for four bar mass analyzer.

1.4 Starting materials

All substrates were used as received from commercial suppliers, unless otherwise stated. Chemicals were purchased from Adamas Energy Chemical, Macklin and Aladdin.

2. Optimization of reaction conditionsa

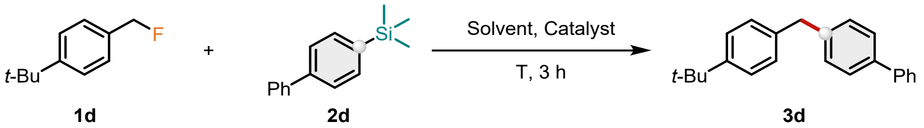
Table S1: Optimization of catalyst[a]:



Entry	Solvent	Additive (10 mol%)	Yield (%)[b]
1	HFIP	--	0
2	HFIP	$FeCl_3$	99
3	HFIP	$Fe_2(SO_4)_3$	0
4	HFIP	$Cu(OTf)_2$	98
5	HFIP	HCl (aq.)	97
6	HFIP	AcOH	0

[a] Reaction conditions: **2d** (0.5 mmol) and catalyst (0.05 mmol) were reacted in solvent (2 mL) at room temperature for 3 h. [b] Yield was isolated yield.

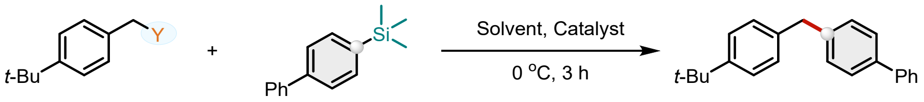
Table S2: Optimization of feed ratio; solvent and temperature[a]:



Entry	**2d** (equiv.)	Solvent	Catalyst[b]	T (°C)	Yield (%)[c]
1	5	HFIP	--	-10	0
2	5	HFIP	--	0	73
3	5	HFIP	--	23	Mixture
4	1	HFIP	--	0	38
5	2	HFIP	--	0	42
6	3	HFIP	--	0	50
7	4	HFIP	--	0	64
8	5	HFIP	--	0	73
9	6	HFIP	--	0	75
10	5	HFIP:DCM=1:1	--	0	78
11	5	HFIP:DCM=2:1	--	0	98
12	5	DCM	--	0	n.r.
13	5	DCM	$Fe_2(SO_4)_3$	0	n.r.
14	5	THF	--	0	n.r.
15	5	TFE	--	0	n.r.
16	5	n-hexane	--	0	n.r.
17	5	n-hexane	$Fe_2(SO_4)_3$	0	n.r.
18	5	MeCN	--	0	n.r.
19	5	MeCN	$Fe_2(SO_4)_3$	0	n.r.

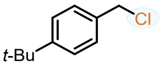
[a] Reaction conditions: **1d** (0.3 mmol) and **2d** (1.5 mmol) were reacted in the mixture solvent of HFIP (2 mL) and DCM (1 mL) at 0 °C for 3 h. [b] $Fe_2(SO_4)_3$ (0.015 mmol) as Catalyst. [c] Yield was isolated yield.

Table S3: Optimization of leaving group[a]:

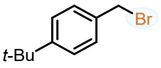


1 **2d** **3d**

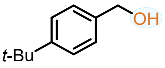
Entry	Y	**2d** (equiv.)	Solvent	Yield (%)[b]
1	OH	5	HFIP	0
2	N_3[1]	5	HFIP	0
3	F	5	HFIP	78
4	Cl	5	HFIP	Mixture
5	Br	5	HFIP	Mixture
6	OTf	5	HFIP	0



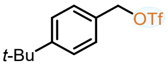
1d-1



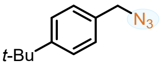
1d-2



1d-3



1d-4



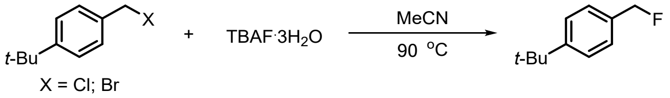
1d-5

[a] Reaction conditions: **1** (0.3 mmol) and **2d** (1.5 mmol) were reacted in the mixture solvent of HFIP (2 mL) at 0 ºC for 3 h. [b] Yield was isolated yield.

3. Experimental procedures

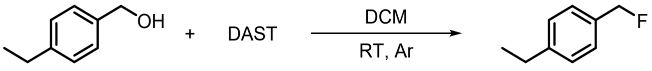
3.1 General synthesis method of raw material preparation

General A synthesis method for preparation of fluorine raw materials:



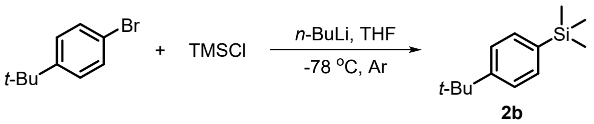
According to the literature report made,[2] a solution of benzylic bromide or benzyl chloride and tetrabutylammonium fluoride (either as trihydrate or tetrakis *tert*-butanol coordinated) in acetonitrile (0.1 M substrate concentration) was heated at reflux for 2 h, then cooled to room temperature. The solvent was removed in vacuo and the residue redissolved in DCM and filtered through a plug of silica eluting with diethyl ether. The solvent was removed in vacuo to give the benzylic fluoride product.

General B synthesis method for preparation of fluorine raw materials:



According to the literature report made,[3] in an Ar atmosphere, DAST (2.0 equiv.) was added dropwise to a stirring solution containing anhydrous CH_2Cl_2 containing benzyl alcohol (1.0 equiv.) at 0 °C, and the reaction was transferred to room temperature overnight. After the reaction was completed, the crude mixture was quenched with saturated $NaHCO_3$ aqueous solution at 0 °C and extracted with Et_2O. The merged organic layer is dried on Na_2SO_4 and concentrated in vacuum. The crude product was purified by column chromatography.

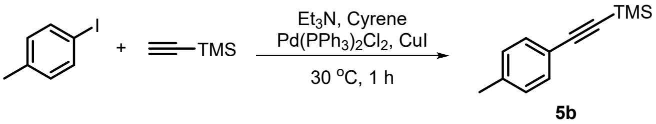
General C synthesis method of preparing aryl silane raw materials:



2b

According to the literature report made,[4] an oven-dried Schlenk flask under Ar was charged with 1-bromo-4-*tert*-butylbenzene (1.00 equiv.) and anhydrous THF (0.50 M). The solution was cooled to -78 °C and after 10 min, *n*-butyllithium (1.60 M in hexanes; 1.20 equiv.) was added dropwise. Immediately or after 30 min at -78 °C, trimethylsilyl chloride (1.50 equiv.) was added dropwise. The solution was stirred overnight, gradually warming up to rt. Water was added, the organic layer was separated, and the aqueous phase was extracted three times with Et_2O. Combined organic phases were washed with brine, dried over $MgSO_4$, filtered, and concentrated under reduced pressure. The crude product was purified by silica gel (eluent-n-hexane) column chromatography to obtain raw material **2b**.

General D synthesis method for the preparation of alkynylsilane raw materials:



According to the literature report made,[5] using $Pd(PPh_3)_2Cl_2$ (2 mol %), CuI (4 mol%), Cyrene (0.5 mL, 0.5 M), Et_3N (1.1 equiv), 4-iodotoluene (1 equiv.), and ethynyltrimethylsilane (1.05 equiv.). After 1 h, the reaction mixture was purified by the general procedure (silica gel, petroleum ether 0 - 1% Et_2O) to obtain raw material **5b**.

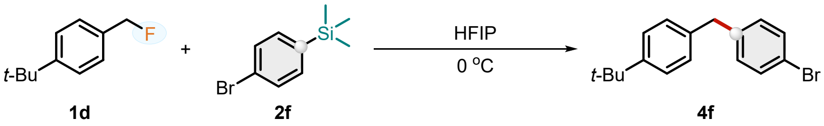
3.2 Preparation of new products

Synthesis of substrates **3a-3u**, **4a-4d**, **4i-4v**, **6a-6j**:

Under an ambient atmosphere, **2d** (0.34 g, 1.5 mmol) was added to a Schlenk tube equipped with a polytetrafluoroethylene-coated magnetic stir bar, and the reaction system was placed in an ice-water bath. Then 3 mL reaction solvent (HFIP, 2 mL and DCM, 1 mL) was added to the system until it was completely dissolved, followed by the addition of **1d** (0.05 g, 0.3 mmol). The reaction system was stirred at 0 °C for 3 hours, after the reaction was completed, and then $Cu(OTf)_2$ (0.01 g, 0.03 mmol) was added to the system to continue the reaction for 15 minutes. Then 20 mL of CH_2Cl_2 was added to the reaction mixture. The organic layer was extracted with saturated aqueous $NaHCO_3$ solution (3 × 20 mL). The combined organic layers were dried with anhydrous Na_2SO_4 and filtered and solvent was removed under reduced pressure. The resulting crude product was purified by column chromatography on silica gel using petroleum ether : ethyl acetate = 80 : 1 as eluent to afford the product **3d** in the yield of

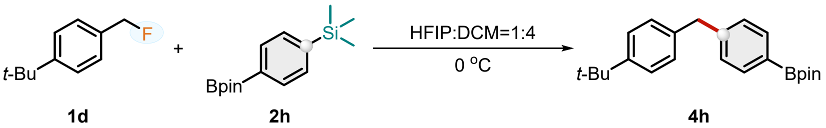
98% as a colorless oil.

Synthesis of substrates **4e-4g**:



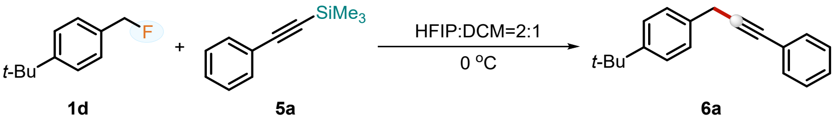
In the atmosphere, **2f** (0.34 g, 1.5 mmol) was added to a Schrenk tube containing a polytetrafluoroethylene coated magnetic stirrer, and the reaction system was placed in an ice water bath. Then 3 mL reaction solvent (HFIP, 3 mL) was added to the system until completely dissolved, and then **1d** (0.05 g, 0.3 mmol) was added. The reaction system was stirred at 0 °C for 3 hours, after the reaction was completed, and then $Cu(OTf)_2$ (0.01 g, 0.03 mmol) was added to the system to continue the reaction for 15 minutes. Then 20 mL of CH_2Cl_2 was added to the reaction mixture. The organic layer was extracted with saturated $NaHCO_3$ aqueous solution (3 × 20 mL). The merged organic layer was dried with anhydrous Na_2SO_4, filtered, and decompressed to remove the solvent. The resulting crude product was purified by column chromatography on silica gel using petroleum ether : ethyl acetate = 80 : 1 as eluent to afford the product **4f** in the yield of 93% as a colorless oil.

Synthesis of substrates **4h**:



In the atmosphere, **2h** (0.41 g, 1.5 mmol) was added to a Schrenk tube containing a polytetrafluoroethylene coated magnetic stirrer, and the reaction system was placed in an ice water bath. Then 3 mL reaction solvent (HFIP, 0.6 mL and DCM, 2.4 mL) was added to the system until completely dissolved, and then **1d** (0.05 g, 0.3 mmol) was added. The reaction system was stirred at 0 °C for 3 hours, after the reaction was completed, and then $Cu(OTf)_2$ (0.01 g, 0.03 mmol) was added to the system to continue the reaction for 15 minutes. Then 20 mL of CH_2Cl_2 was added to the reaction mixture. The organic layer was extracted with saturated $NaHCO_3$ aqueous solution (3 × 20 mL). The merged organic layer was dried with anhydrous Na_2SO_4, filtered, and decompressed to remove the solvent. The resulting crude product was purified by column chromatography on silica gel using petroleum ether : ethyl acetate = 20 : 1 as eluent to afford the product **4h** in the yield of 46% as a white solid.

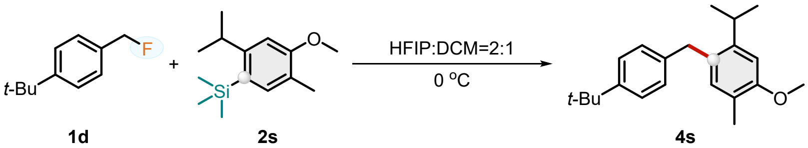
Synthesis of substrates **5a**:



In the atmosphere, **5a** (0.26 g, 1.5 mmol) was added to a Schrenk tube containing a polytetrafluoroethylene coated magnetic stirrer, and the reaction system was placed in an ice water bath. Then 3 mL reaction solvent (HFIP, 2 mL and DCM, 1 mL) was added to the system until completely dissolved, and then **1d** (0.05 g, 0.3 mmol) was added. The reaction system was stirred at 0 °C for 3 hours, after the reaction was completed, and then Cu(OTf)$_2$ (0.01 g, 0.03 mmol) was added to the system to continue the reaction for 15 minutes. Then 20 mL of CH_2Cl_2 was added to the reaction mixture. The organic layer was extracted with saturated $NaHCO_3$ aqueous solution (3 × 20 mL). The merged organic layer was dried with anhydrous Na_2SO_4, filtered, and decompressed to remove the solvent. The resulting crude product was purified by column chromatography on silica gel using petroleum ether : ethyl acetate = 80 : 1 as eluent to afford the product **6a** in the yield of 85% as a yellow oil.

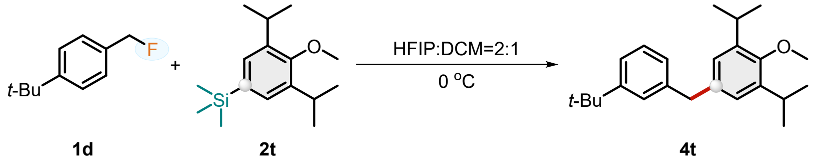
3.3 Pharmaceutical application

Carvacrol:



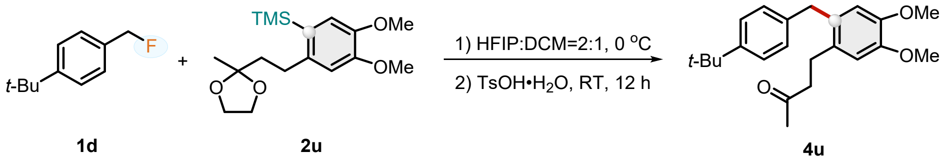
In the atmosphere, carvacrol derivatives 2s^6 (0.35 g, 1.5 mmol) was added to a Schrenk tube containing a polytetrafluoroethylene coated magnetic stirrer, and the reaction system was placed in an ice water bath. Then 3 mL reaction solvent (HFIP, 2 mL and DCM, 1 mL) was added to the system until completely dissolved, and then **1d** (0.05 g, 0.3 mmol) was added. The reaction system was stirred at 0 °C for 3 hours, after the reaction was completed, and then Cu(OTf)$_2$ (0.01 g, 0.03 mmol) was added to the system to continue the reaction for 15 minutes. Then 20 mL of CH_2Cl_2 was added to the reaction mixture. The organic layer was extracted with saturated $NaHCO_3$ aqueous solution (3 × 20 mL). The merged organic layer was dried with anhydrous Na_2SO_4, filtered, and decompressed to remove the solvent. The resulting crude product was purified by column chromatography on silica gel using petroleum ether : ethyl acetate = 80 : 1 as eluent to afford the product **4s** in the yield of 71% as a white solid.

Propofol:



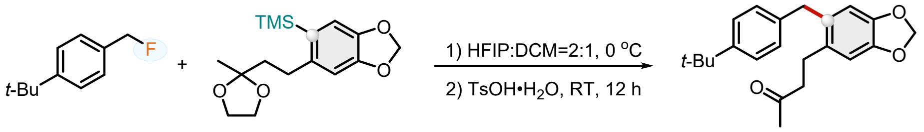
In the atmosphere, propofol derivative **2t**[6] (0.40 g, 1.5 mmol) was added to a Schrenk tube containing a polytetrafluoroethylene coated magnetic stirrer, and the reaction system was placed in an ice water bath. Then 3 mL reaction solvent (HFIP, 2 mL and DCM, 1 mL) was added to the system until completely dissolved, and then **1d** (0.05 g, 0.3 mmol) was added. The reaction system was stirred at 0 °C for 3 hours, after the reaction was completed, and then $Cu(OTf)_2$ (0.01 g, 0.03 mmol) was added to the system to continue the reaction for 15 minutes. Then 20 mL of CH_2Cl_2 was added to the reaction mixture. The organic layer was extracted with saturated $NaHCO_3$ aqueous solution (3 × 20 mL). The merged organic layer was dried with anhydrous Na_2SO_4, filtered, and decompressed to remove the solvent. The resulting crude product was purified by column chromatography on silica gel using petroleum ether : ethyl acetate = 80 : 1 as eluent to afford the product **4t** in the yield of 61% as a white solid.

Vanillylacetone acetone:



In the atmosphere, piperonyl acetone derivatives **2u**[6] (0.46 g, 1.5 mmol) was added to a Schrenk tube containing a polytetrafluoroethylene coated magnetic stirrer, and the reaction system was placed in an ice water bath. Then 3 mL reaction solvent (HFIP 2 mL and DCM 1 mL) was added to the system until completely dissolved, and then p-tert-butylbenzyl fluoride (0.05 g, 0.3 mmol) was added. The reaction system was stirred at 0 °C for 3 hours, after the reaction was completed, and then TsOH • H_2O (0.01 g, 0.03 mmol) was added to the system to continue the reaction for 12 h. Then 20 mL of CH_2Cl_2 was added to the reaction mixture. The organic layer was extracted with saturated $NaHCO_3$ aqueous solution (3 × 20 mL). The merged organic layer was dried with anhydrous Na_2SO_4, filtered, and decompressed to remove the solvent. The resulting crude product was purified by column chromatography on silica gel using petroleum ether : ethyl acetate = 80 : 1 as eluent to afford the product **4u** in the yield of 62% as a white solid.

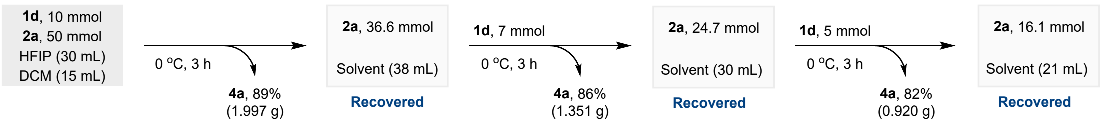
Piperonyl acetone:



1d **2v** **4v**

In the atmosphere, piperonyl acetone derivatives **2v**^{6} (0.46 g, 1.5 mmol) was added to a Schrenk tube containing a polytetrafluoroethylene coated magnetic stirrer, and the reaction system was placed in an ice water bath. Then 3 mL reaction solvent (HFIP 2 mL and DCM 1 mL) was added to the system until completely dissolved, and then p-tert-butylbenzyl fluoride (0.05 g, 0.3 mmol) was added. The reaction system was stirred at 0 °C for 3 hours, after the reaction was completed, and then TsOH • H_2O (0.01 g, 0.03 mmol) was added to the system to continue the reaction for 12 h. Then 20 mL of CH_2Cl_2 was added to the reaction mixture. The organic layer was extracted with saturated $NaHCO_3$ aqueous solution (3 × 20 mL). The merged organic layer was dried with anhydrous Na_2SO_4, filtered, and decompressed to remove the solvent. The resulting crude product was purified by column chromatography on silica gel using petroleum ether : ethyl acetate = 80 : 1 as eluent to afford the product **4v** in the yield of 64% as a white solid.

3.4 Enlargement reaction



Under an ambient atmosphere, 2a (7.52 g, 50 mmol) was added to a round-bottom flask containing a polytetrafluoroethylene-coated magnetic stir bar, and the reaction system was placed in an ice water bath. Then, 45 mL of reaction solvent (HFIP, 30 mL, DCM, 15 mL) was added to the system. After it was completely dissolved, it was added for 1 d (1.66 g, 10 mmol). The reaction system was stirred at 0 °C for 3 hours, after the reaction was completed, The mixture of 2a and solvent (38 mL) was distilled by vacuum distillation, and the remaining mixture was separated and purified by column chromatography. The product 4a was obtained by using petroleum ether : ethyl acetate = 80 : 1 as eluent. After three consecutive reactions, the reaction efficiency was affected. Finally, the product 4a was obtained in an average yield of 86 %.

4. Determination of reaction mechanism

4.1 Necessity of benzyl fluoride in this reaction

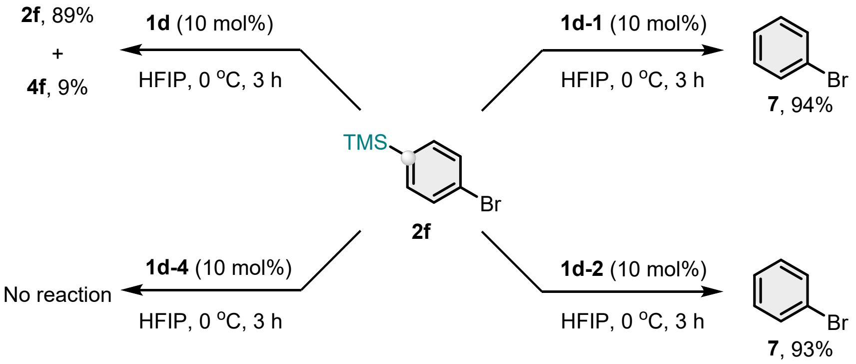
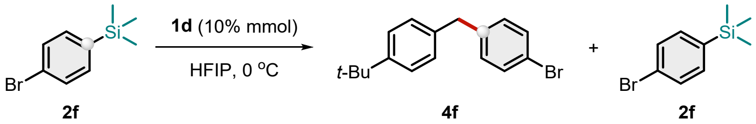
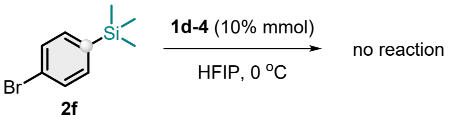


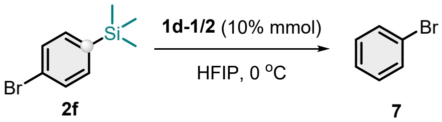
Figure S1. Necessity of benzyl fluoride in this reaction



In the atmosphere, **2f** (0.23 g, 1 mmol) was added to a Schrenk tube containing a polytetrafluoroethylene coated magnetic stirrer, and the reaction system was placed in an ice water bath. Then 3 mL reaction solvent (HFIP, 3 mL) was added to the system until completely dissolved, and then **1d** (0.02 g, 0.1 mmol) was added. The reaction system was stirred at 0 °C for 3 hours, after the reaction was completed, the solvent was evaporated by rotary evaporation at low temperature, and then the system was separated by column chromatography. The target product **4f** was obtained in a yield of 9%, and the remaining **2f** was not involved in the reaction and successfully recovered.



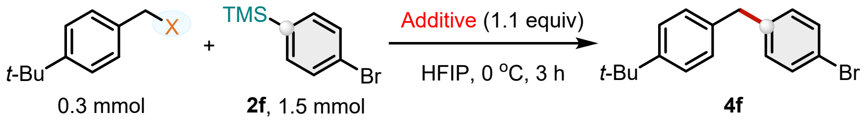
In the atmosphere, **2f** (0.23 g, 1 mmol) was added to a Schrenk tube containing a polytetrafluoroethylene coated magnetic stirrer, and the reaction system was placed in an ice water bath. Then 3 mL reaction solvent (HFIP, 3 mL) was added to the system until completely dissolved, and then **1d-4**[7] (0.03 g, 0.1 mmol) was added. The reaction system was stirred at 0 °C for 3 hours, the reaction system was stirred at 0 °C for 3 hours, after the reaction was completed, the solvent was evaporated by rotary evaporation at low temperature, and then the system was separated by column chromatography, the reactants were completely recovered.



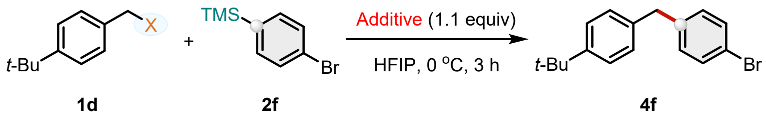
In the atmosphere, **2f** (0.23 g, 1 mmol) was added to a Schrenk tube containing a polytetrafluoroethylene coated magnetic stirrer, and the reaction system was placed in an ice water bath. Then 3 mL reaction solvent (HFIP, 3 mL) was added to the system until completely dissolved, and then **1d-1** or **1d-2** (0.1 mmol) was added. The reaction system was stirred at 0 °C for 3 hours, after the reaction was completed, the solvent was evaporated by rotary evaporation at low temperature, and then the system was separated by column chromatography, product **7** was collected and **2f** was not found.

4.2 Applicability of other leaving groups in this reaction

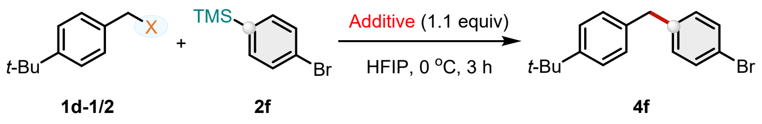
Table S4: Applicability of other leaving groups in this reaction



	X	Additive	
		AgOAc	Et$_3$N
1d	F	**4f**, 93%; **2f**, 81%	**4f**, 80%; **2f**, 83%
1d-1	Cl	**4f**, 87%; **2f**, 82%	**4f**, 61%; **2f**, 87%
1d-2	Br	**4f**, 84%; **2f**, 83%	**4f**, 59%; **2f**, 88%

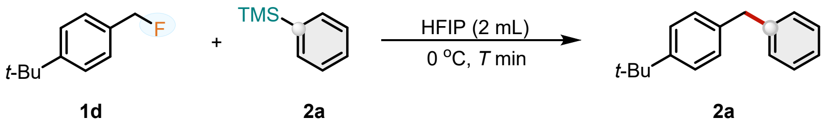


In the atmosphere, additive (Et$_3$N or AgOAc, 0.33 mmol) and 1-bromo-4-trimethylsilylbenzene (0.34 g, 1.5 mmol) was added to a Schrenk tube containing a polytetrafluoroethylene coated magnetic stirrer, and the reaction system was placed in an ice water bath. Then 3 mL reaction solvent (HFIP, 3 mL) was added to the system until completely dissolved, and then **1d** (0.05 g, 0.3 mmol) was added. The reaction system was stirred at 0 °C for 3 hours. After the reaction was completed, 20 mL of CH_2Cl_2 was added to the reaction mixture. The organic layer was extracted with saturated $NaHCO_3$ aqueous solution (3 × 20 mL). The merged organic layer was dried with anhydrous Na_2SO_4, filtered, and decompressed to remove the solvent. The obtained crude product was purified by silica gel column chromatography, and the product **4f** was obtained, and the **2f** were all recovered.



In the atmosphere, additive (Et_3N or AgOAc, 0.33 mmol) and 1-bromo-4-trimethylsilylbenzene (0.34 g, 1.5 mmol) was added to a Schrenk tube containing a polytetrafluoroethylene coated magnetic stirrer, and the reaction system was placed in an ice water bath. Then 3 mL reaction solvent (HFIP, 3 mL) was added to the system until completely dissolved, and then **1d-1** or **1d-2** (0.3 mmol) was added. The reaction system was stirred at 0 °C for 3 hours. After the reaction was completed, 20 mL of CH_2Cl_2 was added to the reaction mixture. The organic layer was extracted with saturated $NaHCO_3$ aqueous solution (3 × 20 mL). The merged organic layer was dried with anhydrous Na_2SO_4, filtered, and decompressed to remove the solvent. The resulting crude product was purified by column chromatography on silica gel using petroleum ether : ethyl acetate = 80 : 1 as eluent to afford the product **4f** in the yield of as a colorless oil, the other **2f** are largely recovered.

4.3 Effect of different raw material concentrations on reaction rate



Under atmospheric conditions, **1d** was introduced into the **2a** system containing HFIP (2 mL) at 0 °C, dodecane was employed as an internal standard for quantification. Three sets of parallel experiments, each consisting of five replicates, were performed under varying molar numbers of **1d** : **2a** = 0. 5 : 1, 1 : 1, and 1 : 2. See Appendix for specific data.

Table S5: Effect of different raw material concentrations on reaction rate

T/ min	n_1(**1d**:**2a** = 0.5:1)/ mmol	n_2(**1d**:**2a** = 1:1) / mmol	n_3(**1d**:**2a** = 1:2) / mmol

0	0	0	0
3	0	0.0095	0.00803
6	0.005	0.0335	0.03326
9	0.01581	0.0339	0.05499
12	0.01934	0.0482	0.07583
15	0.02389	0.0550	0.0936

All samples were analyzed by gas chromatography-mass spectrometry (GC-MS).

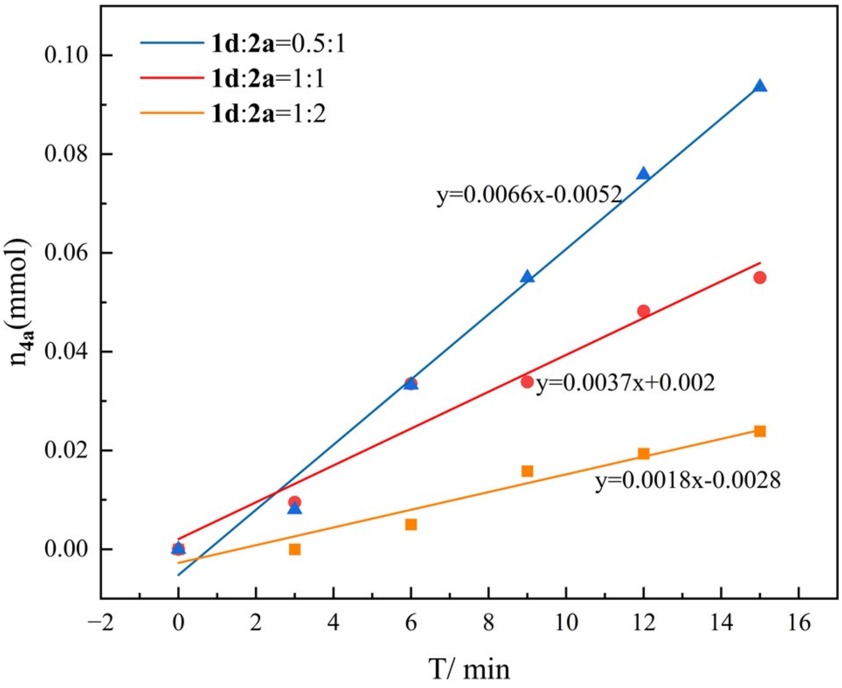
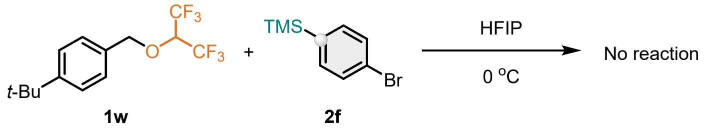
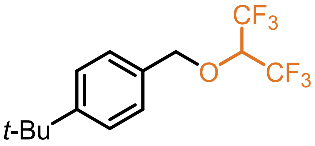


Figure S2. Effect of different raw material concentrations on reaction rate

4.4 Reaction process study



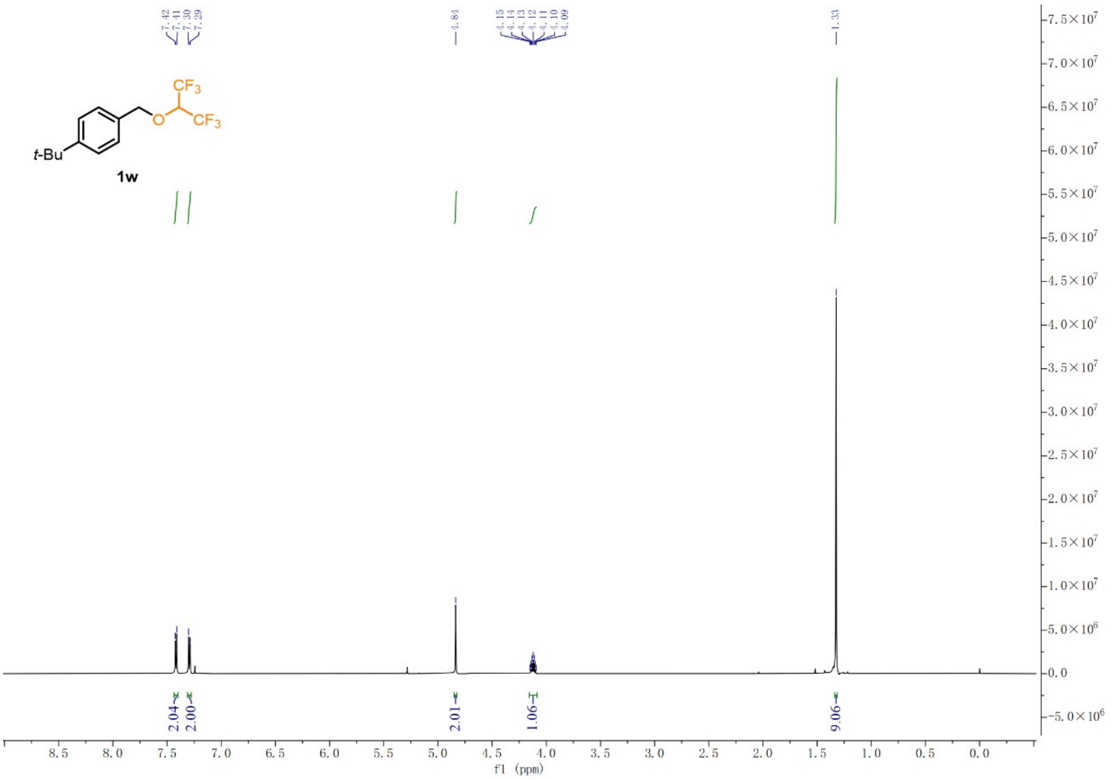
In the atmosphere, **2f** (0.34 g, 1.5 mmol) was added to a Schrenk tube containing a polytetrafluoroethylene coated magnetic stirrer, and the reaction system was placed in an ice water bath. Then 3 mL reaction solvent (HFIP, 3 mL) was added to the system until completely dissolved, and then **1w**[8] (0.09 g, 0.3 mmol) was added. The reaction system was stirred at 0 °C for 3 hours, the reaction system was stirred at 0 °C for 3 hours, after the reaction was completed, the solvent was evaporated by rotary evaporation at low temperature, and then the system was separated by column chromatography, the reactants were completely recovered.



1w

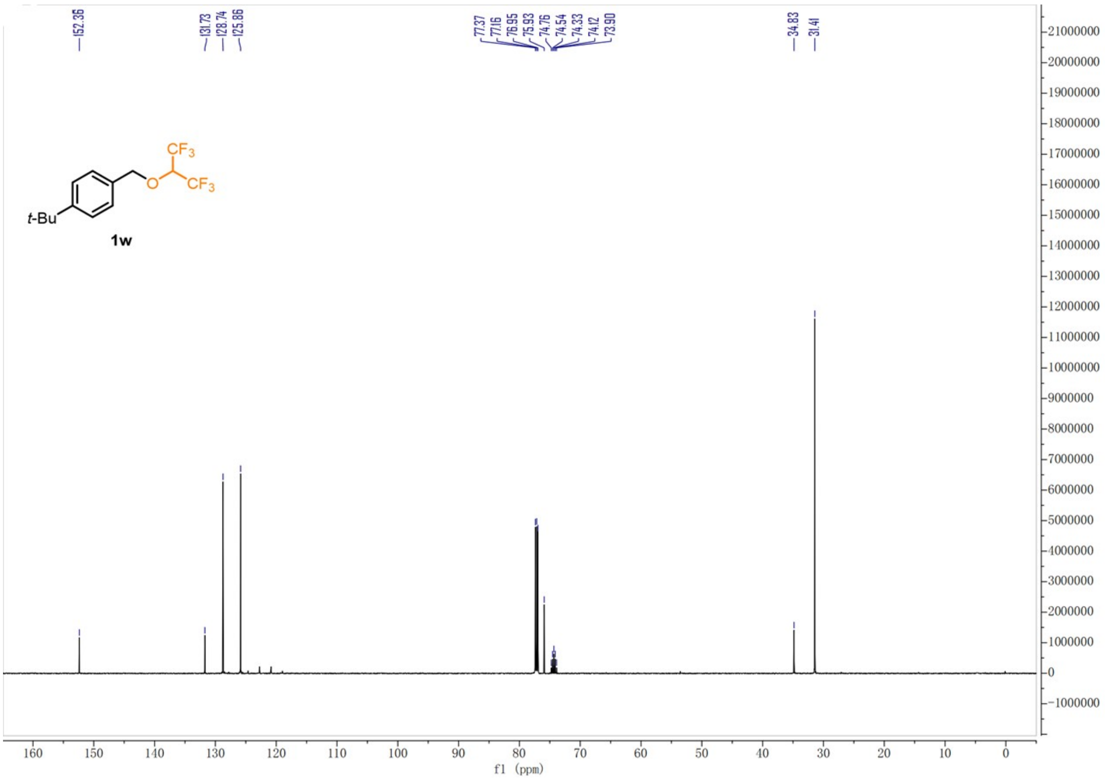
1-(tert-butyl)-4-(((1,1,1,3,3,3-hexafluoropropan-2-yl)oxy)methyl)benzene (1w); ^{1}H NMR (600 MHz, CDCl$_3$) δ 7.42 (d, J = 8.4 Hz, 2H), 7.29 (d, J = 8.4 Hz, 2H), 4.84 (s, 2H), 4.15-4.09 (m, 1H), 1.33 (s, 9H); **^{13}C NMR** (151 MHz, CDCl$_3$) δ 152.36, 131.73, 128.74, 125.86, 77.37, 77.16, 76.95, 75.93, 74.76, 74.54, 74.33, 74.12, 73.90, 34.83, 31.41; **^{19}F NMR** (565 MHz, CDCl$_3$) δ -73.50.

^{1}H NMR of **1w**
CDCl$_3$, 600 MHz, 298 K



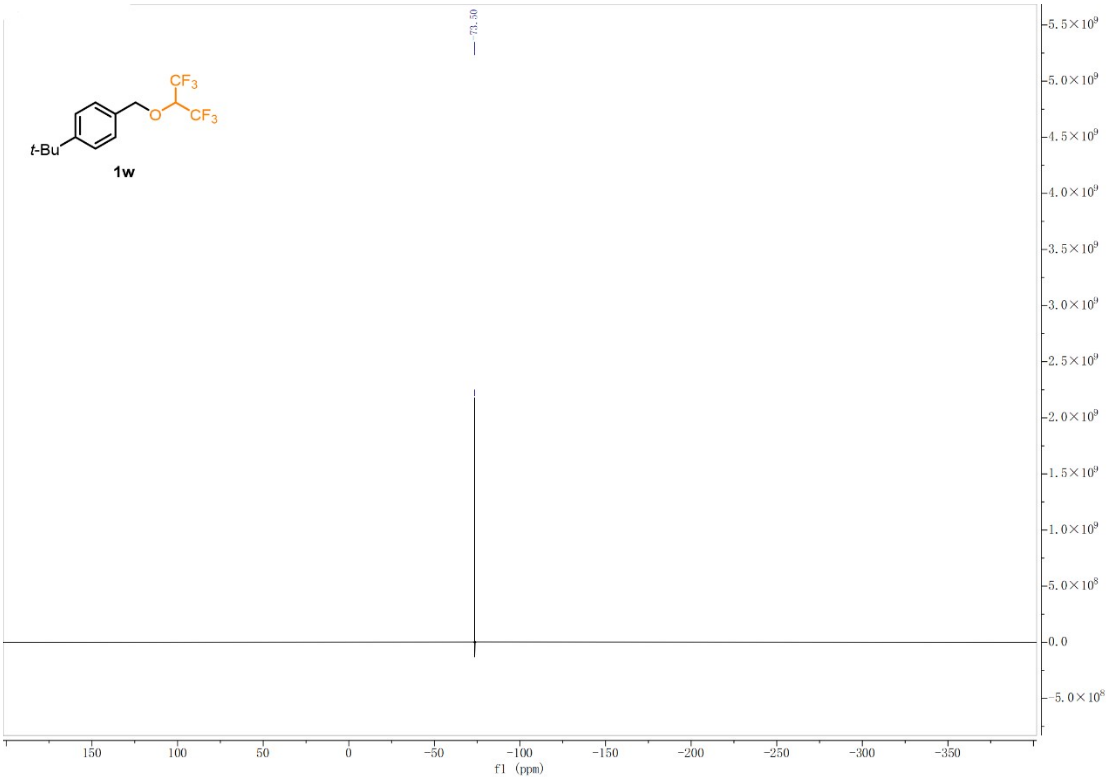
^{13}C NMR of **1w**

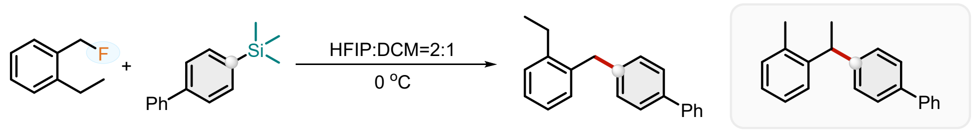
CDCl$_3$, 151 MHz, 298 K



^{19}F NMR of **1w**

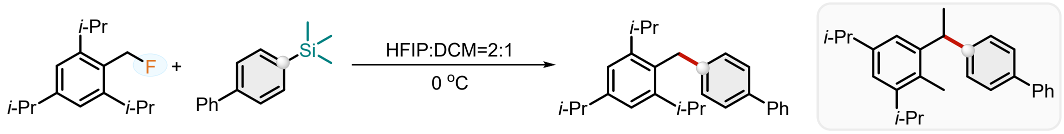
CDCl$_3$, 565 MHz, 298 K





1i **2d** **3i**, 68% **3i'** was not observed

Under an ambient atmosphere, **2d** (0.34 g, 1.5 mmol) was added to a Schlenk tube equipped with a polytetrafluoroethylene-coated magnetic stir bar, and the reaction system was placed in an ice-water bath. Then 3 mL reaction solvent (HFIP, 2 mL and DCM, 1 mL) was added to the system until it was completely dissolved, followed by the addition of **1i** (0.05 g, 0.3 mmol). The reaction system was stirred at 0 °C for 3 hours, and then Cu(OTf)$_2$ (0.01 g, 0.03 mmol) was added to the system to continue the reaction for 15 minutes. After the reaction was completed, 20 mL of CH$_2$Cl$_2$ was added to the reaction mixture. The organic layer was extracted with saturated aqueous NaHCO$_3$ solution (3 × 20 mL). The combined organic layers were dried with anhydrous Na$_2$SO$_4$ and filtered and solvent was removed under reduced pressure. The resulting crude product was purified by column chromatography on silica gel using petroleum ether : ethyl acetate = 80 : 1 as eluent to afford the product **3i** in the yield of 68% as a colorless oil, and product **3i'** was not detected.



1r **2d** **3r**, 96% **3r'** was not observed

Under an ambient atmosphere, **2d** (0.34 g, 1.5 mmol) was added to a Schlenk tube equipped with a polytetrafluoroethylene-coated magnetic stir bar, and the reaction system was placed in an ice-water bath. Then 3 mL reaction solvent (HFIP, 2 mL and DCM, 1 mL) was added to the system until it was completely dissolved, followed by the addition of **1r** (0.05 g, 0.3 mmol). The reaction system was stirred at 0 °C for 3 hours, and then Cu(OTf)$_2$ (0.01 g, 0.03 mmol) was added to the system to continue the reaction for 15 minutes. After the reaction was completed, 20 mL of CH$_2$Cl$_2$ was added to the reaction mixture. The organic layer was extracted with saturated aqueous NaHCO$_3$ solution (3 × 20 mL). The combined organic layers were dried with anhydrous Na$_2$SO$_4$ and filtered and solvent was removed under reduced pressure. The resulting crude product was purified by column chromatography on silica gel using petroleum ether : ethyl acetate = 80 : 1 as eluent to afford the product **3r** in the yield of 96% as a colorless oil, and product **3r'** was not detected.

NMR monitoring of product **8**:

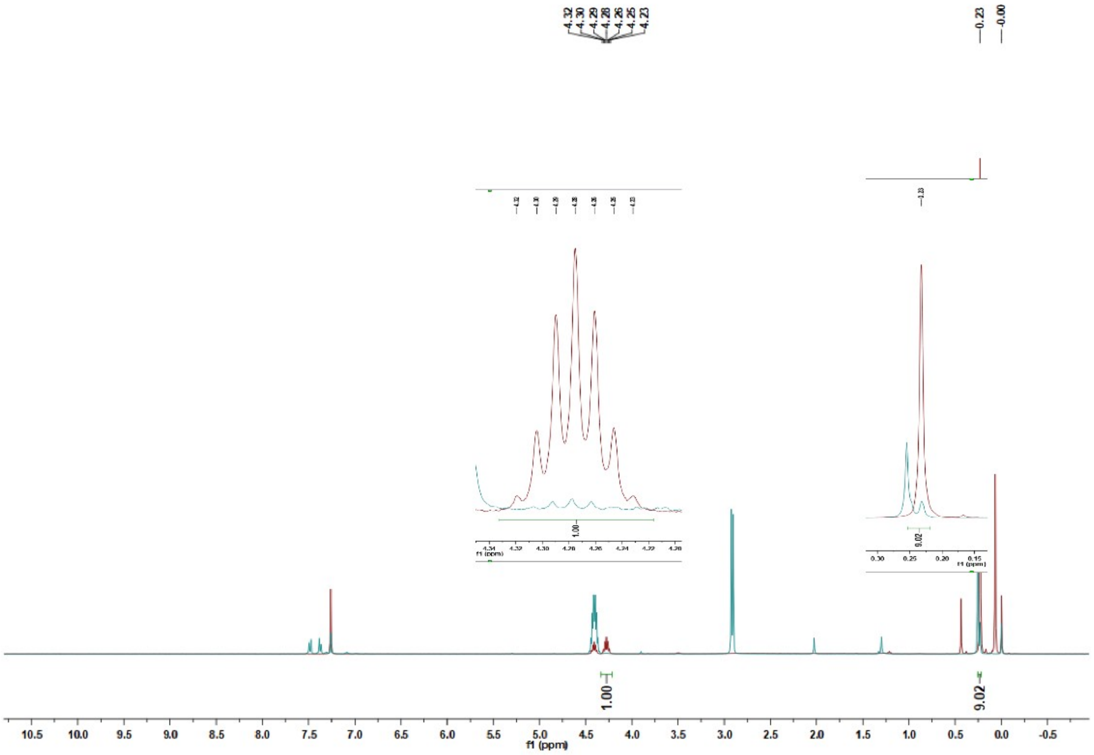
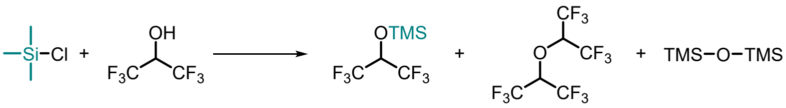


Figure S3. The NMR comparison diagram of product **8**



8

Under an ambient atmosphere, HFIP (0.17 g, 1 mmol) was added to a Schlenk tube equipped with a polytetrafluoroethylene-coated magnetic stir bar. Then add trimethylchlorosilane (0.11 g, 1 mmol). The reaction system was stirred at room temperature for 6 hours. After the reaction was completed, the solvent was dried and evaporated at low temperature, and the product **8** was generated by nuclear magnetic monitoring.

NMR data of ptoduct **8**:

((1,1,1,3,3,3-hexafluoropropan-2-yl)oxy)trimethylsilane (8)[9], **^{1}H NMR** (400 MHz, $CDCl_3$) δ 4.32 - 4.23 (m, 1H), 0.23 (s, 9H).

4.5 Interaction between hexafluoroisopropanol and benzyl fluoride

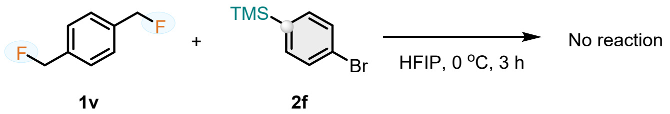


Table S6: NMR titration of **1v** and HFIP:

	$V_{(\mathbf{1v}\ (\mu L))}$	$V_{(HFIP(\mu L))}$
1v	10	0
HFIP	0	10
1v : HFIP	0.0121	0.0105
1v : HFIP	0.0121	0.0211

HFIP and $CDCl_3$ were purchased commercially, **1v** was prepared according to the literature report. Four ^1H NMR samples of 1 M stock solutions of HFIP and **1v** were prepared in 0.50 mL of $CDCl_3$, where the ratios of HFIP and **1v** are 1:1 and 2:1.

In order to evaluate the interaction between HFIP and **1v** (Table S6), HFIP was titrated with **1v** and the process was monitored by ^1H NMR (Figure S4). An obviously downfield shift of the hydrogen of the OH moiety in HFIP was observed when HFIP was mixed with **1v**, indicating that the existence of hydrogen bonding interaction between HFIP and benzyl fluoride.

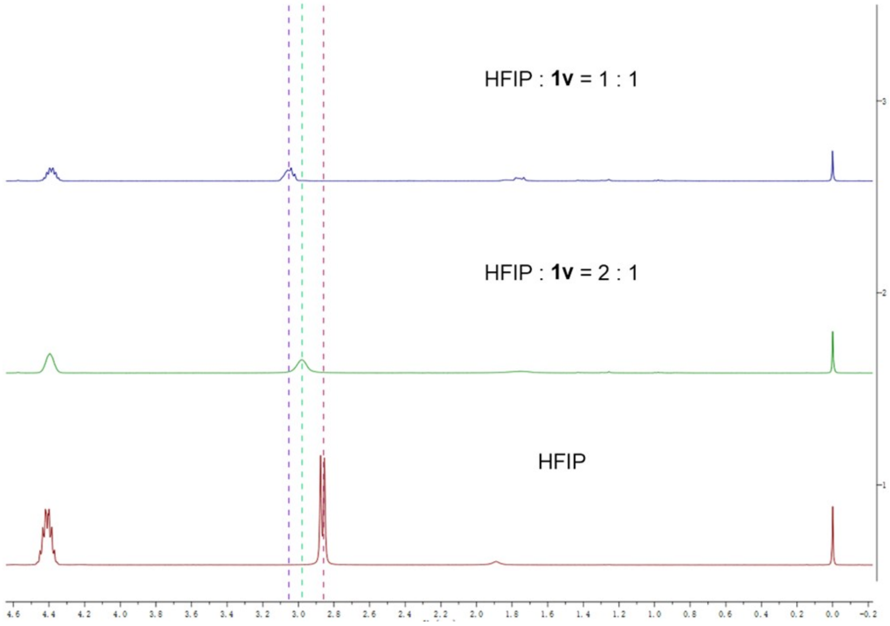


Figure S4. Comparison of **1v** and HFIP NMR titration spectra

In the atmospheric atmosphere, mix HFIP (0.5 mmol) and **1v** (0.5 mmol) in a molar ratio of 1:1 to the sample. After mixing evenly, 13 μL of the mixed sample was taken with a pipette and transferred to a nuclear magnetic tube, and 0.6 mL of $CDCl_3$ was added for later use. The nuclear magnetic tubes were placed in a low-temperature nuclear magnetic field, and nuclear magnetic monitoring was performed at different temperatures of -10 °C, 0 °C, 10 °C, 20 °C, 30 °C and 40 °C. It is evident that the chemical shift of the H proton at the benzyl position of **1v** (the rightmost peak in **Figure S5**.) exhibits a continuous variation with changing temperature, indicating that an intermolecular interaction between the benzyl fluoride and the HFIP mediated by F–H bonding.

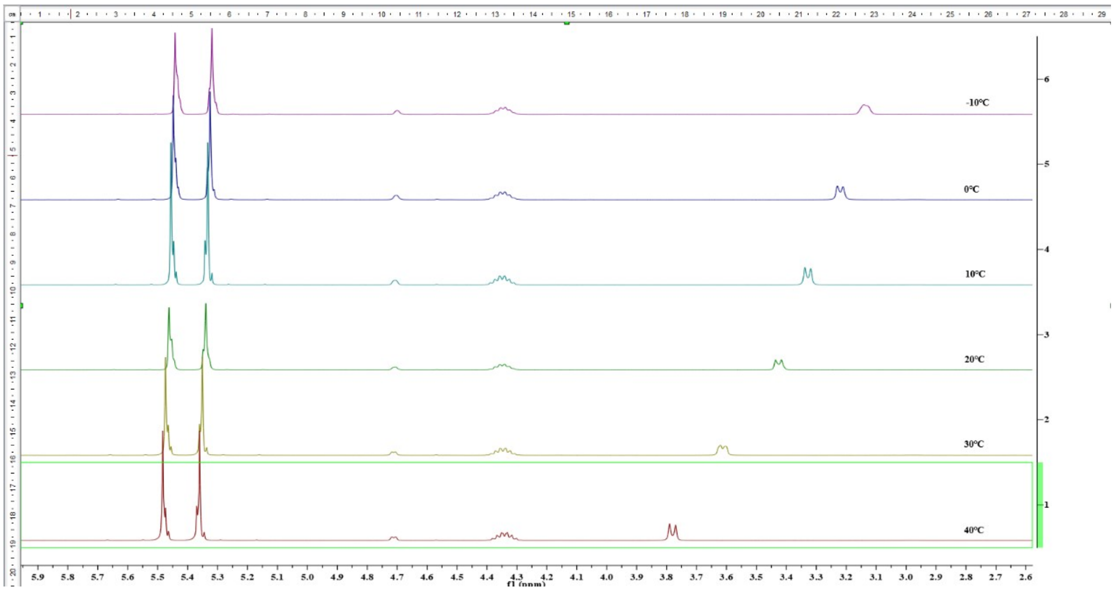
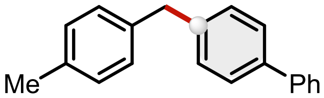
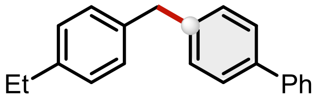


Figure S5. ^{1}H-NMR experiments of the interaction between HFIP and **1v** at different temperatures.

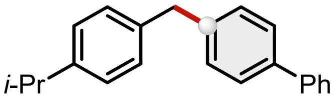
5. Characterization data of the products



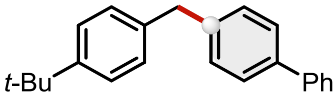
4-(4-methylbenzyl)-1,1'-biphenyl (3a)[10], white solid; 99% yield; **^{1}H NMR** (400 MHz, CDCl$_3$) δ 7.54 (d, *J* = 7.6 Hz, 2H), 7.49 (d, *J* = 6.8 Hz, 2H), 7.39 (t, *J* = 7.0 Hz, 2H), 7.29 (t, *J* = 7.2 Hz, 1H), 7.23 (d, *J* = 7.4 Hz, 2H), 7.09 (s, 4H), 3.96 (s, 2H), 2.30 (s, 3H); **^{13}C NMR** (101 MHz, CDCl$_3$) δ 141.00, 140.53, 138.91, 137.93, 135.58, 129.22, 129.18, 128.81, 128.68, 127.15, 127.01, 126.97, 41.13, 21.00; **HRMS** (APCI) m/z calculated $C_{20}H_{17}^-$ [M-H]$^-$ 257.1325, found 257.1338.



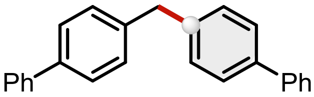
4-(4-ethylbenzyl)-1,1'-biphenyl (3b), white solid; 87% yield; **^{1}H NMR** (400 MHz, CDCl$_3$) δ 7.54 (d, *J* = 7.6 Hz, 2H), 7.49 (d, *J* = 7.8 Hz, 2H), 7.38 (t, *J* = 6.8 Hz, 2H), 7.29 (d, *J* = 6.4 Hz, 1H), 7.23 (d, *J* = 6.6 Hz, 2H), 7.12 (s, 4H), 3.96 (s, 2H), 2.60 (q, *J* = 7.6 Hz, 2H), 1.21 (t, *J* = 7.6 Hz, 3H); **^{13}C NMR** (101 MHz, CDCl$_3$) δ 141.99, 141.01, 140.49, 138.92, 138.18, 129.26, 128.84, 128.68, 127.97, 127.15, 127.01, 126.97, 41.17, 28.43, 15.60; **HRMS** (APCI) m/z calculated $C_{21}H_{19}^-$ [M-H]$^-$ 271.1481, found 271.1496.



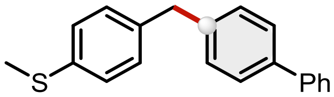
4-(4-isopropylbenzyl)-1,1'-biphenyl (3c), colorless oil; 98% yield; **^{1}H NMR** (400 MHz, CDCl$_3$) δ 7.55 (d, *J* = 7.6 Hz, 2H), 7.50 (d, *J* = 7.8 Hz, 2H), 7.39 (t, *J* = 6.8 Hz, 2H), 7.30 (d, *J* = 6.4 Hz, 1H), 7.25 (d, *J* = 6.6 Hz, 2H), 7.14 (s, 4H), 3.97 (s, 2H), 2.90 - 2.83 (m, 1H), 1.22 (d, *J* = 6.8 Hz, 6H); **^{13}C NMR** (101 MHz, CDCl$_3$) δ 146.63, 141.03, 140.46, 138.94, 138.31, 129.30, 128.80, 128.68, 127.16, 127.01, 126.98, 126.53, 41.17, 33.68, 24.03; **HRMS** (APCI) m/z calculated $C_{22}H_{21}^-$ [M-H]$^-$ 285.1638, found 285.1654.



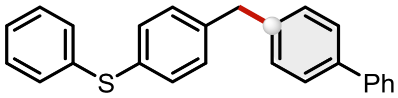
4-(4-(*tert*-butyl)benzyl)-1,1'-biphenyl (3d)[10], colorless oil; 98% yield; **^{1}H NMR** (400 MHz, CDCl$_3$) δ 7.56 (d, *J* = 7.4 Hz, 2H), 7.50 (d, *J* = 8.2 Hz, 2H), 7.40 (t, *J* = 7.6 Hz, 2H), 7.33 - 7.25 (m, 5H), 7.15 (d, *J* = 8.2 Hz, 2H), 3.98 (s, 2H), 1.30 (d, *J* = 2.6 Hz, 9H); **^{13}C NMR** (101 MHz, CDCl$_3$) δ 148.88, 141.01, 140.39, 138.93, 137.94, 129.32, 128.69, 128.51, 127.16, 127.02, 126.98, 125.39, 41.05, 34.35, 31.38; **HRMS** (APCI) m/z calculated $C_{23}H_{23}^-$ [M-H]$^-$ 299.1794, found 299.1810.



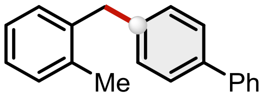
di([1,1'-biphenyl]-4-yl)methane (3e)[10], brown solid; 97% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.57 (d, *J* = 6.4 Hz, 4H), 7.53 (d, *J* = 7.6 Hz, 4H), 7.41 (t, *J* = 7.2 Hz, 4H), 7.30 (t, *J* = 9.6 Hz, 6H), 4.05 (s, 2H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 140.96, 140.11, 139.11, 133.78, 129.33, 129.02, 128.71, 127.26, 127.08, 127.00, 126.34, 41.22; **HRMS** (APCI) m/z calculated $C_{25}H_{19}^-$ $[M-H]^-$ 319.1481, found 319.1498.



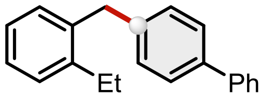
(4-([1,1'-biphenyl]-4-ylmethyl)phenyl)(methyl)sulfane (3f), white solid; 53% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.55 (d, *J* = 7.8 Hz, 2H), 7.49 (d, *J* = 6.8 Hz, 2H), 7.39 (t, *J* = 7.2 Hz, 2H), 7.30 (t, *J* = 7.2 Hz, 1H), 7.23 - 7.18 (m, 4H), 7.13 (d, *J* = 7.8 Hz, 2H), 3.95 (s, 2H), 2.43 (s, 3H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 140.87, 140.05, 139.03, 138.00, 135.81, 129.42, 129.20, 128.68, 127.17, 127.07, 126.94, 40.95, 16.11; **HRMS** (APCI) m/z calculated $C_{20}H_{17}S^-$ $[M-H]^-$ 289.1045, found 289.1061.



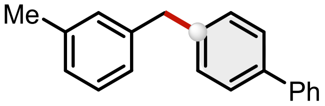
(4-([1,1'-biphenyl]-4-ylmethyl)phenyl)(phenyl)sulfane (3g), white solid; 42% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.56 (d, *J* = 7.6 Hz, 2H), 7.52 (d, *J* = 6.4 Hz, 2H), 7.42 (t, *J* = 6.8 Hz, 2H), 7.35 - 7.20 (m, 10H), 7.17 (d, *J* = 8.0 Hz, 2H), 3.99 (s, 2H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 140.90, 140.34, 139.73,139.21, 136.29, 132.87, 131.71, 130.52, 129.82, 129.31, 129.11, 128.72, 127.27, 127.12, 127.00, 126.77, 41.14; **HRMS** (APCI) m/z calculated $C_{25}H_{19}S^-$ $[M-H]^-$ 351.1202, found 351.1217.



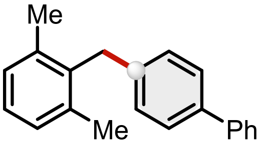
4-(2-methylbenzyl)-1,1'-biphenyl (3h)[11], colorless oil; 70% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.56 (d, *J* = 7.6 Hz, 2H), 7.49 (d, *J* = 6.4 Hz, 2H), 7.41 (t, *J* = 7.6 Hz, 2H), 7.31 (t, *J* = 7.4 Hz, 1H), 7.19 - 7.15 (m, 6H), 4.02 (s, 2H), 2.27 (s, 3H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 140.99, 139.51, 138.86, 138.80, 136.63, 130.32, 129.95, 129.11, 128.70, 127.10, 127.03, 126.97, 126.51, 126.03, 39.08, 19.70; **HRMS** (APCI) m/z calculated $C_{20}H_{17}^-$ $[M-H]^-$ 257.1325, found 257.1338.



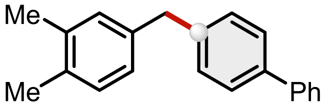
4-(2-ethylbenzyl)-1,1'-biphenyl (3i), colorless oil; 68% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.56 (d, *J* = 7.2 Hz, 2H), 7.49 (d, *J* = 7.6 Hz, 2H), 7.41 (t, *J* = 7.2 Hz, 2H), 7.34 - 7.29 (m, 1H), 7.22 - 7.14 (m, 6H), 4.06 (s, 2H), 2.64 (q, *J* = 7.6 Hz, 2H), 1.17 (t, *J* = 7.4 Hz, 3H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 142.42, 140.97, 140.04, 138.82, 138.04, 130.31, 129.09, 128.69, 128.45, 127.07, 127.03, 126.96, 126.70, 125.92, 38.37, 25.74, 14.83; **HRMS** (APCI) m/z calculated $C_{21}H_{19}^-$ [M-H]$^-$ 271.1481, found 271.1496.



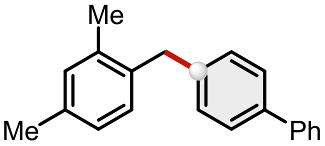
4-(3-methylbenzyl)-1,1'-biphenyl (3j)[12], colorless oil; 48% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.57 (d, *J* = 7.6 Hz, 2H), 7.51 (d, *J* = 7.2 Hz, 2H), 7.41 (t, *J* = 7.4 Hz, 2H), 7.32 (d, *J* = 7.2 Hz, 1H), 7.25 (d, *J* = 8.0 Hz, 2H), 7.19 (t, *J* = 7.4 Hz, 1H), 7.03 (d, *J* = 8.6 Hz, 3H), 3.98 (s, 2H), 2.32 (s, 3H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 141.01, 140.90, 140.37, 138.96, 138.10, 129.72, 129.28, 128.70, 128.39, 127.18, 127.04, 126.99, 126.89, 125.98, 41.52, 21.41; **HRMS** (APCI) m/z calculated $C_{20}H_{17}^-$ [M-H]$^-$ 257.1325, found 257.1338. **HRMS** (APCI) m/z calculated $C_{20}H_{17}^-$ [M-H]$^-$ 257.1325, found 257.1338.



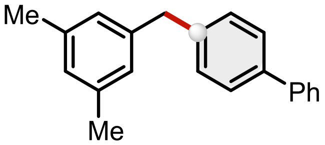
4-(2,6-dimethylbenzyl)-1,1'-biphenyl (3k)[13], white solid; 90% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.55 (d, *J* = 7.6 Hz, 2H), 7.46 (d, *J* = 6.8 Hz, 2H), 7.41 (t, *J* = 6.8 Hz, 2H), 7.31 (t, *J* = 7.2 Hz, 1H), 7.08 (d, *J* = 7.2 Hz, 5H), 4.10 (s, 2H), 2.28 (s, 6H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 141.00, 138.91, 138.70, 137.16, 136.77, 128.68, 128.25, 128.14, 127.09, 126.99, 126.94, 126.36, 34.70, 20.26; **HRMS** (APCI) m/z calculated $C_{21}H_{19}^-$ [M-H]$^-$ 271.1481, found 271.1495.



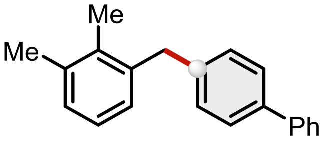
4-(3,4-dimethylbenzyl)-1,1'-biphenyl (3l), white solid; 77% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.56 (d, *J* = 7.8 Hz, 2H), 7.50 (d, *J* = 7.8 Hz, 2H), 7.41 (t, *J* = 7.6 Hz, 2H), 7.31 (d, *J* = 6.2 Hz, 1H), 7.26 - 7.22 (m, 2H), 7.06 (d, *J* = 6.6 Hz, 1H), 7.00 (s, 1H), 6.96 (s, 1H), 3.94 (s, 2H), 2.23 (s, 6H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 141.06, 140.66, 138.89, 138.41, 136.62, 134.26, 130.25, 129.74, 129.22, 128.68, 127.16, 126.99, 126.29, 41.16, 19.76, 19.31; **HRMS** (APCI) m/z calculated $C_{21}H_{19}^-$ [M-H]$^-$ 271.1481, found 271.1495.



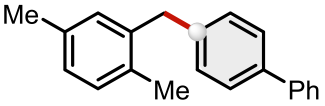
4-(2,4-dimethylbenzyl)-1,1'-biphenyl (3m)[14], white solid; 72% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.55 (d, *J* = 7.8 Hz, 2H), 7.48 (d, *J* = 7.2 Hz, 2H), 7.39 (t, *J* = 7.4 Hz, 2H), 7.29 (t, *J* = 7.2 Hz, 1H), 7.17 (d, *J* = 7.2 Hz, 2H), 7.03 - 6.96 (m, 3H), 3.97 (s, 2H), 2.30 (s, 3H), 2.22 (s, 3H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 141.02, 139.82, 138.76, 136.39, 135.95, 135.74, 131.15, 129.90, 129.04, 128.68, 127.07, 126.99, 126.95, 126.64, 38.67, 20.94, 19.61; **HRMS** (APCI) m/z calculated $C_{21}H_{19}^-$ [M-H]$^-$ 271.1481, found 271.1495.



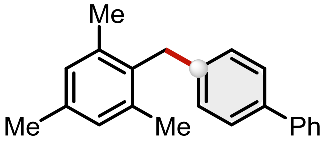
4-(3,5-dimethylbenzyl)-1,1'-biphenyl (3n)[14], white solid; 71% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.56 (d, *J* = 7.8 Hz, 2H), 7.50 (d, *J* = 7.2 Hz, 2H), 7.40 (t, *J* = 7.6 Hz, 2H), 7.31 (d, *J* = 7.4 Hz, 1H), 7.25 (d, *J* = 7.2 Hz, 2H), 6.84 (s, 3H), 3.93 (s, 2H), 2.28 (s, 6H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 141.03, 140.84, 140.49, 138.90, 137.98, 129.26, 128.69, 127.79, 127.15, 127.01, 126.98, 126.78, 41.46, 21.27; **HRMS** (APCI) m/z calculated $C_{21}H_{19}^-$ [M-H]$^-$ 271.1481, found 271.1495.



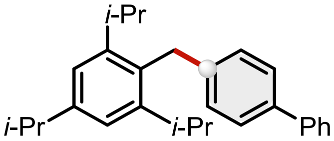
4-(2,3-dimethylbenzyl)-1,1'-biphenyl (3o)[14], white solid; 88% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.55 (d, *J* = 7.8 Hz, 2H), 7.48 (d, *J* = 6.8 Hz, 2H), 7.40 (t, *J* = 7.0 Hz, 2H), 7.30 (t, *J* = 7.2 Hz, 1H), 7.17 (d, *J* = 7.2 Hz, 2H), 7.07 - 7.02 (m, 3H), 4.04 (s, 2H), 2.29 (s, 3H), 2.16 (s, 3H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 141.01, 139.91, 138.77, 138.58, 137.04, 135.21, 129.00, 128.68, 128.30, 128.08, 127.07, 127.00, 126.96, 125.45, 39.68, 20.69, 15.44; **HRMS** (APCI) m/z calculated $C_{21}H_{19}^-$ [M-H]$^-$ 271.1481, found 271.1495.



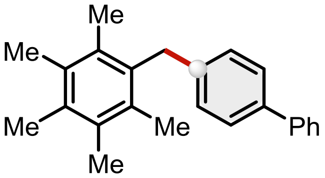
4-(2,5-dimethylbenzyl)-1,1'-biphenyl (3p), white solid; 99% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.56 (d, *J* = 7.6 Hz, 2H), 7.49 (d, *J* = 6.6 Hz, 2H), 7.41 (t, *J* = 7.2 Hz, 2H), 7.31 (t, *J* = 7.2 Hz, 1H), 7.18 (d, *J* = 7.2 Hz, 2H), 7.06 (d, *J* = 7.2 Hz, 1H), 6.97 (d, *J* = 6.6 Hz, 2H), 3.98 (s, 2H), 2.30 (s, 3H), 2.22 (s, 3H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 141.01, 139.67, 138.78, 138.55, 135.43, 133.44, 130.76, 130.22, 129.07, 128.69, 127.15, 127.08, 127.02, 126.97, 39.05, 20.98, 19.23; **HRMS** (APCI) m/z calculated $C_{21}H_{19}^-$ [M-H]$^-$ 271.1481, found 271.1495.



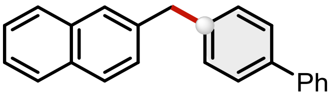
4-(2,4,6-trimethylbenzyl)-1,1'-biphenyl (3q)[11], white solid; 97% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.53 (d, *J* = 7.8 Hz, 2H), 7.44 (d, *J* = 7.2 Hz, 2H), 7.38 (t, *J* = 7.4 Hz, 2H), 7.28 (t, *J* = 7.0 Hz, 1H), 7.06 (d, *J* = 7.6 Hz, 2H), 6.89 (s, 2H), 4.04 (s, 2H), 2.29 (s, 3H), 2.22 (s, 6H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 141.03, 139.22, 138.61, 136.98, 135.69, 133.67, 128.91, 128.66, 128.23, 127.05, 126.92, 34.35, 20.90, 20.15; **HRMS** (APCI) m/z calculated $C_{22}H_{21}^-$ [M-H]$^-$ 285.1649, found 285.1651.



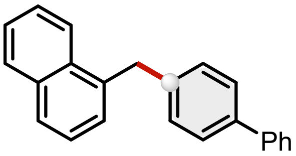
4-(2,4,6-triisopropylbenzyl)-1,1'-biphenyl (3r), colorless oil; 96% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.55 (d, *J* = 7.2 Hz, 2H), 7.47 (d, *J* = 7.6 Hz, 2H), 7.38 (t, *J* = 7.2 Hz, 2H), 7.28 (d, *J* = 6.8 Hz, 1H), 7.09 - 7.06 (m, 4H), 4.15 (s, 2H), 3.13 - 3.02 (m, 2H), 2.95 - 2.90 (m, 1H), 1.29 (d, *J* = 6.6 Hz, 6H), 1.16 (d, *J* = 6.2 Hz, 12H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 147.40, 147.03, 141.01, 140.64, 138.46, 130.58, 128.67, 128.32, 126.92, 126.90, 121.04, 34.17, 32.69, 29.65, 24.11, 24.22; **HRMS** (APCI) m/z calculated $C_{28}H_{33}^-$ [M-H]$^-$ 369.2588, found 369.2593.



4-(2,3,4,5,6-pentamethylbenzyl)-1,1'-biphenyl (3s), white solid; 95% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.54 (d, *J* = 7.6 Hz, 2H), 7.45 (d, *J* = 7.8 Hz, 2H), 7.39 (t, *J* = 7.4 Hz, 2H), 7.29 (t, *J* = 6.8 Hz, 1H), 7.10 (d, *J* = 7.6 Hz, 2H), 4.14 (s, 2H), 2.28 (s, 3H), 2.25 (s, 6H), 2.20 (s, 6H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 141.08, 139.75, 138.52, 133.69, 133.17, 132.77, 132.52, 128.65, 128.33, 127.04, 126.93, 35.80, 16.96, 16.88; **HRMS** (APCI) m/z calculated $C_{24}H_{25}^-$ [M-H]$^-$ 313.1962, found 313.1963.

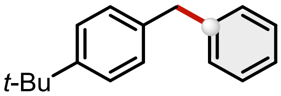


2-([1,1'-biphenyl]-4-ylmethyl)naphthalene (3t)[11], white solid; 69% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.78 (t, *J* = 8.6 Hz, 3H), 7.66 (s, 1H), 7.56 (d, *J* = 7.6 Hz, 2H), 7.52 (d, *J* = 6.8 Hz, 2H), 7.46 - 7.39 (m, 4H), 7.35 - 7.28 (m, 4H), 4.17 (s, 2H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 140.95, 140.09, 139.10, 138.46, 133.61, 132.10, 129.40, 128.71, 128.14, 127.62, 127.55, 127.22, 127.13, 127.08, 127.00, 126.00, 125.38, 41.73; **HRMS** (APCI) m/z calculated $C_{23}H_{17}^-$ [M-H]$^-$ 293.1336, found 293.1339.

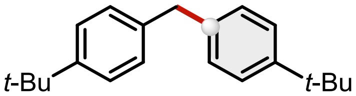


1-([1,1'-biphenyl]-4-ylmethyl)naphthalene (3u)[11], white solid; 64% yield; **^{1}H NMR**

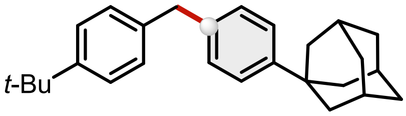
(400 MHz, $CDCl_3$) δ 8.05 - 7.99 (m, 1H), 7.90 - 7.82 (m, 1H), 7.77 (d, *J* = 8.2 Hz, 1H), 7.54 (d, *J* = 7.6 Hz, 2H), 7.49 - 7.37 (m, 7H), 7.34 - 7.29 (m, 2H), 7.25 (d, *J* = 7.2 Hz, 2H), 4.48 (s, 2H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 140.94, 139.74, 138.97, 136.49, 133.94, 132.12, 129.09, 128.69, 127.36, 127.21, 127.16, 127.04, 126.96, 126.00, 125.57, 124.27, 38.68; **HRMS** (APCI) m/z calculated $C_{23}H_{17}^-$ [M-H]$^-$ 293.1336, found 293.1339.



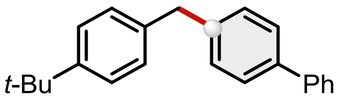
1-benzyl-4-(*tert*-butyl)benzene (4a)[15], colorless oil; 94% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.31 - 7.26 (m, 4H), 7.23 - 7.16 (m, 3H), 7.12 (d, *J* = 8.2 Hz, 2H), 3.95 (s, 2H), 1.30 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 148.79, 141.25, 138.05, 128.94, 128.47, 128.40, 125.97, 125.32, 41.40, 34.34, 31.37; **HRMS** (APCI) m/z calculated $C_{17}H_{19}^-$ [M-H]$^-$ 223.1481, found 223.1482.



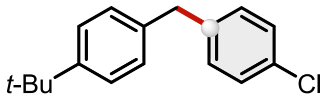
bis(4-(*tert*-butyl)phenyl)methane (4b)[11], white solid; 78% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.30 (d, *J* = 8.2 Hz, 4H), 7.13 (d, *J* = 8.2 Hz, 4H), 3.92 (s, 2H), 1.30 (s, 18H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 148.70, 138.23, 128.51, 125.30, 40.89, 34.34, 31.39; **HRMS** (APCI) m/z calculated $C_{21}H_{27}^-$ [M-H]$^-$ 279.2118, found 279.2122.



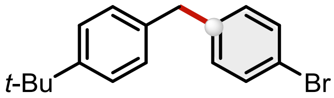
1-(4-(4-(*tert*-butyl)benzyl)phenyl)adamantane (4c), white solid; 66% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.28 (t, *J* = 9.4 Hz, 4H), 7.14 (d, *J* = 6.6 Hz, 4H), 3.91 (s, 2H), 2.07 (s, 3H), 1.89 (s, 6H), 1.75 (s, 6H), 1.29 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 149.00, 148.68, 138.29, 138.26, 128.56, 128.52, 125.28, 124.86, 43.22, 40.95, 36.81, 35.86, 34.33, 31.39, 28.96; **HRMS** (APCI) m/z calculated $C_{27}H_{33}^-$ [M-H]$^-$ 357.2588, found 357.2589.



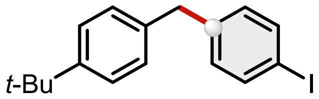
4-(4-(tert-butyl)benzyl)-1,1'-biphenyl (4d)[10], colorless oil; 98% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.56 (d, *J* = 7.4 Hz, 2H), 7.50 (d, *J* = 8.2 Hz, 2H), 7.40 (t, *J* = 7.6 Hz, 2H), 7.33 - 7.25 (m, 5H), 7.15 (d, *J* = 8.2 Hz, 2H), 3.98 (s, 2H), 1.30 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 148.88, 141.01, 140.39, 138.93, 137.94, 129.32, 128.69, 128.51, 127.16, 127.02, 126.98, 125.39, 41.05, 34.35, 31.38; **HRMS** (APCI) m/z calculated $C_{23}H_{23}^-$ [M-H]$^-$ 299.1794, found 299.1810.



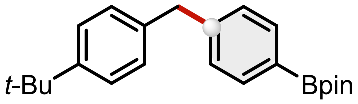
1-(*tert*-butyl)-4-(4-chlorobenzyl)benzene (4e)[16], colorless oil; 84% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.30 (d, *J* = 8.2 Hz, 2H), 7.23 (d, *J* = 8.2 Hz, 2H), 7.14 - 7.05 (m, 4H), 3.90 (s, 2H), 1.29 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 149.06, 139.72, 137.48, 131.76, 130.26, 128.49, 128.41, 125.43, 40.70, 34.36, 31.35; **HRMS** (APCI) m/z calculated $C_{17}H_{18}Cl^-$ $[M-H]^-$ 257.1102, found 257.1106.



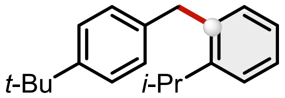
1-bromo-4-(4-(*tert*-butyl)benzyl)benzene (4f)[16], colorless oil; 92% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.38 (d, *J* = 6.8 Hz, 2H), 7.30 (d, *J* = 6.4 Hz, 2H), 7.06 (t, *J* = 8.8 Hz, 4H), 3.88 (s, 2H), 1.30 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 149.05, 140.22, 137.36, 131.43, 130.66, 128.41, 125.42, 119.81, 40.75, 34.34, 31.35; **HRMS** (APCI) m/z calculated $C_{17}H_{18}Br^-$ $[M-H]^-$ 301.0597, found 301.0601.



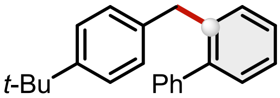
1-(*tert*-butyl)-4-(4-iodobenzyl)benzene (4g)[16], yellow oil; 61% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.59 (d, *J* = 8.2 Hz, 2H), 7.30 (d, *J* = 8.2 Hz, 2H), 7.08 (d, *J* = 8.2 Hz, 2H), 6.95 (d, *J* = 8.2 Hz, 2H), 3.88 (s, 2H), 1.30 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 149.11, 140.95, 137.44, 137.34, 131.03, 128.42, 125.44, 91.19, 40.88, 34.37, 31.35; **HRMS** (APCI) m/z calculated $C_{17}H_{18}I^-$ $[M-H]^-$ 349.0459, found 349.0449.



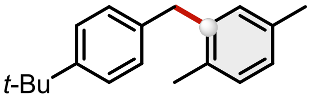
2-(4-(4-(*tert*-butyl)benzyl)phenyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane (4h), white solid; 46% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.74 (d, *J* = 7.8 Hz, 2H), 7.28 (d, *J* = 8.2 Hz, 2H), 7.22 (d, *J* = 7.8 Hz, 2H), 7.09 (d, *J* = 8.2 Hz, 2H), 3.95 (s, 2H), 1.32 (s, 12H), 1.29 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 148.83, 144.57, 137.84, 134.98, 128.44, 125.32, 83.62, 41.63, 34.33, 31.36, 24.83; **HRMS** (APCI) m/z calculated $C_{23}H_{32}BO_2^+$ $[M+H]^+$ 350.2526, found 350.2523.



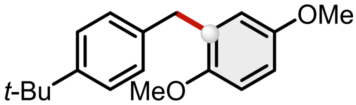
1-(4-(*tert*-butyl)benzyl)-2-isopropylbenzene (4i)[16], colorless oil; 91% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.29 (d, *J* = 7.4 Hz, 2H), 7.13 (s, 6H), 3.91 (s, 2H), 2.96 - 2.77 (m, 1H), 1.29 (s, 9H), 1.22 (d, *J* = 6.2 Hz, 6H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 148.70, 146.45, 138.61, 138.30, 128.80, 128.49, 126.44, 125.29, 41.02, 34.34, 33.68, 31.40, 24.05; **HRMS** (APCI) m/z calculated $C_{20}H_{27}^+$ [M+H]$^+$ 267.2107, found 267.2109.



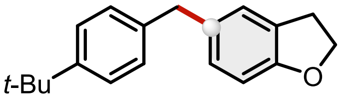
2-(4-(*tert*-butyl)benzyl)-1,1'-biphenyl (4j)[16], yellow solid; 93% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.57 (d, *J* = 7.4 Hz, 2H), 7.51 (d, *J* = 8.0 Hz, 2H), 7.41 (t, *J* = 7.6 Hz, 2H), 7.33 - 7.24 (m, 5H), 7.16 (d, *J* = 8.2 Hz, 2H), 3.99 (s, 2H), 1.31 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 148.91, 141.03, 140.41, 138.95, 137.95, 129.33, 128.69, 128.51, 127.17, 127.02, 126.99, 125.40, 41.06, 34.37, 31.38; **HRMS** (APCI) m/z calculated $C_{23}H_{23}^-$ [M-H]$^-$ 299.1794, found 299.1810.



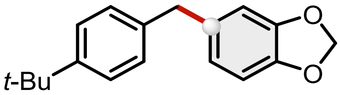
2-(4-(*tert*-butyl)benzyl)-1,4-dimethylbenzene (4k)[17], colorless oil; 79% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.28 (d, *J* = 7.4 Hz, 2H), 7.04 (d, *J* = 7.4 Hz, 3H), 6.95 (s, 2H), 3.91 (s, 2H), 2.28 (s, 3H), 2.20 (s, 3H), 1.29 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 148.56, 138.84, 137.42, 135.31, 133.39, 130.75, 130.13, 128.24, 126.99, 125.21, 38.82, 34.31, 31.38, 20.98, 19.23; **HRMS** (APCI) m/z calculated $C_{19}H_{23}^-$ [M-H]$^-$ 251.1805, found 251.1806.



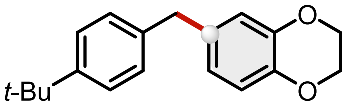
2-(4-(*tert*-butyl)benzyl)-1,4-dimethoxybenzene (4l)[18], colorless oil; 82% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.28 (d, *J* = 7.6 Hz, 2H), 7.14 (d, *J* = 7.8 Hz, 2H), 6.79 (d, *J* = 8.6 Hz, 1H), 6.71 - 6.67 (m, 2H), 3.91 (s, 2H), 3.78 (s, 3H), 3.72 (s, 3H), 1.29 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 153.48, 151.68, 148.54, 137.60, 131.15, 128.54, 125.19, 116.91, 111.34, 111.02, 56.04, 55.61, 35.33, 34.32, 31.40; **HRMS** (APCI) m/z calculated $C_{19}H_{23}O_2^-$ [M-H]$^-$ 283.1693, found 283.1693.



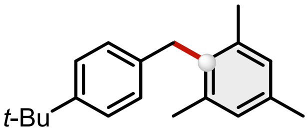
5-(4-(*tert*-butyl)benzyl)-2,3-dihydrobenzofuran (4m), colorless oil; 47% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.30 (d, *J* = 7.2 Hz, 2H), 7.11 (d, *J* = 7.6 Hz, 2H), 7.02 (s, 1H), 6.94 (d, *J* = 8.2 Hz, 1H), 6.70 (d, *J* = 8.0 Hz, 1H), 4.53 (t, *J* = 8.2 Hz, 2H), 3.87 (s, 2H), 3.16 (t, *J* = 8.6 Hz, 2H), 1.30 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 158.40, 148.71, 138.76, 133.30, 128.37, 128.32, 127.12, 125.41, 125.31, 108.96, 71.15, 40.81, 34.34, 31.39, 29.80; **HRMS** (APCI) m/z calculated $C_{19}H_{21}O^-$ [M-H]$^-$ 265.1587, found 265.1587.



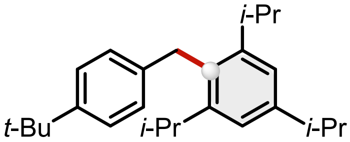
5-(4-(*tert*-butyl)benzyl)benzo-[1,3]dioxole (4n), colorless oil; 63% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.30 (d, J = 6.8 Hz, 2H), 7.10 (d, J = 7.2 Hz, 2H), 6.73 (d, J = 8.2 Hz, 1H), 6.66 (s, 2H), 5.89 (s, 2H), 3.85 (s, 2H), 1.29 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 148.87, 147.63, 145.77, 138.19, 135.17, 128.35, 125.35, 121.69, 109.43, 108.11, 100.77, 41.08, 34.35, 31.37; **HRMS** (APCI) m/z calculated $C_{18}H_{19}O_2^-$ [M-H]$^-$ 267.1390, found 267.1393.



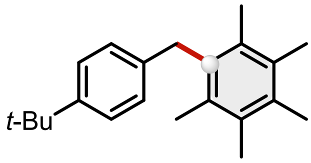
6-(4-(*tert*-butyl)benzyl)-2,3-dihydrobenzo-[1,4]dioxine (4o), colorless oil; 42% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.29 (d, J = 6.8 Hz, 2H), 7.11 (d, J = 6.8 Hz, 2H), 6.77 (d, J = 8.0 Hz, 1H), 6.67 (d, J = 10.2 Hz, 2H), 4.22 (s, 4H), 3.83 (s, 2H), 1.29 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 148.76, 143.29, 141.76, 138.19, 134.71, 128.40, 125.32, 121.80, 117.55, 117.07, 64.38, 64.29, 40.66, 34.34, 31.38; **HRMS** (APCI) m/z calculated $C_{19}H_{21}O_2^-$ [M-H]$^-$ 281.2486, found 281.2487.



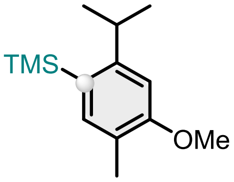
2-(4-(tert-butyl)benzyl)-1,3,5-trimethylbenzene (4p)[19], colorless oil; 74% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.23 (d, J = 7.2 Hz, 2H), 6.94 (d, J = 7.6 Hz, 2H), 6.87 (s, 2H), 3.97 (s, 2H), 2.28 (s, 3H), 2.20 (s, 6H), 1.27 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 148.36, 136.94, 135.49, 134.11, 128.83, 127.48, 125.18, 34.27, 34.19, 31.39, 20.89, 20.19; **HRMS** (APCI) m/z calculated $C_{20}H_{27}^+$ [M+H]$^+$ 267.2107, found 267.2107.



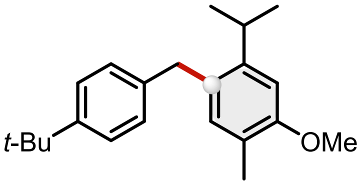
2-(4-(*tert*-butyl)benzyl)-1,3,5-triisopropylbenzene (4q), colorless oil; 87% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.25 (d, J = 7.2 Hz, 2H), 7.03 (s, 2H), 6.95 (d, J = 7.4 Hz, 2H), 4.08 (s, 2H), 3.11 - 3.02 (m, 2H), 2.94 - 2.87 (m, 1H), 1.29 (s, 15H), 1.14 (d, J = 6.2 Hz, 12H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 148.28, 147.34, 146.81, 138.29, 131.05, 127.55, 125.06, 120.93, 34.29, 34.16, 32.51, 31.41, 29.57, 24.19, 24.11; **HRMS** (APCI) m/z calculated $C_{26}H_{37}^-$ [M-H]$^-$ 349.2890, found 349.2890.



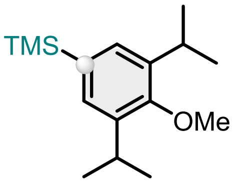
1-(4-(*tert*-butyl)benzyl)-2,3,4,5,6-pentamethylbenzene (4r), white solid; 93% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.23 (d, *J* = 7.8 Hz, 2H), 6.96 (d, *J* = 7.6 Hz, 2H), 4.06 (s, 2H), 2.23 (s, 9H), 2.17 (s, 6H), 1.28 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 148.23, 137.44, 134.10, 132.71, 132.39, 128.93, 127.55, 125.14, 35.61, 34.25, 31.39, 20.52, 16.93, 16.88, 16.85, 15.87; **HRMS** (APCI) m/z calculated $C_{22}H_{29}^-$ $[M-H]^-$ 293.2264, found 293.2264.



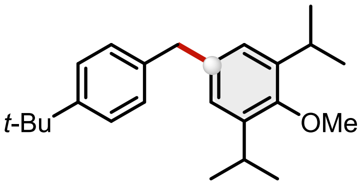
Carvacrol derivatives ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.18 (s, 1H), 6.77 (s, 1H), 3.85 (s, 3H), 3.17 - 3.11 (m, 1H), 2.19 (s, 3H), 1.27 (d, *J* = 6.8 Hz, 6H), 0.30 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ ^{13}C NMR (101 MHz, $CDCl_3$) δ 159.03, 154.54, 136.57, 127.58, 123.38, 106.85, 55.04, 33.75, 24.74, 15.88, 0.61; **HRMS** (APCI) m/z calculated $C_{14}H_{25}OSi^+$ $[M+H]^+$ 238.1747, found 238.1748.



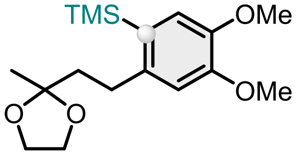
1-(4-(*tert*-butyl)benzyl)-2-isopropyl-4-methoxy-5-methylbenzene (4s), white solid; 71% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.27 (d, *J* = 8.2 Hz, 2H), 7.03 (d, *J* = 8.2 Hz, 2H), 6.89 (s, 1H), 6.75 (s, 1H), 3.93 (s, 2H), 3.83 (s, 3H), 3.15 - 3.08 (m, 1H), 2.15 (s, 3H), 1.29 (s, 9H), 1.14 (d, *J* = 6.8 Hz, 6H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 156.55, 148.44, 145.51, 138.68, 132.84, 128.96, 128.02, 125.14, 123.70, 107.10, 55.31, 37.28, 34.30, 31.39, 29.16, 23.88, 15.73; **HRMS** (APCI) m/z calculated $C_{22}H_{31}O^+$ $[M+H]^+$ 311.2369, found 311.2370.



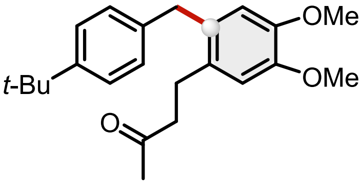
Propofol derivatives ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.25 (s, 2H), 3.75 (s, 3H), 3.37 - 3.30 (m, 2H), 1.25 (d, *J* = 6.8 Hz, 12H), 0.26 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ ^{13}C NMR (101 MHz, $CDCl_3$) δ 155.34, 140.66, 135.62, 129.13, 62.14, 26.47, 24.08, -0.87; **HRMS** (APCI) m/z calculated $C_{16}H_{29}OSi^+$ $[M+H]^+$ 265.1982, found 265.1986.



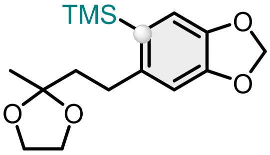
5-(4-(*tert*-butyl)benzyl)-1,3-diisopropyl-2-methoxybenzene (4t), white solid; 61% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.31 (d, *J* = 8.2 Hz, 2H), 7.12 (d, *J* = 8.2 Hz, 2H), 6.92 (s, 2H), 3.90 (s, 2H), 3.72 (s, 3H), 3.35 - 3.27 (m, 2H), 1.30 (s, 9H), 1.20 (d, *J* = 6.8 Hz, 12H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 152.75, 148.61, 141.41, 136.66, 129.13, 128.28, 125.23, 124.67, 62.21, 41.29, 34.34, 31.39, 26.48, 24.06; **HRMS** (APCI) m/z calculated $C_{24}H_{35}O^+$ $[M+H]^+$ 339.2682, found 339.2685.



(4,5-dimethoxy-2-(2-(2-methyl-1,3-dioxolan-2-yl)ethyl)phenyl)trimethylsilane (2u); **^{1}H NMR** (400 MHz, $CDCl_3$) δ 6.94 (s, 1H), 6.74 (s, 1H), 4.00 (d, *J* = 4.2 Hz, 4H), 3.87 (d, *J* = 1.6 Hz, 6H), 2.85 - 2.73 (m, 2H), 1.99 - 1.92 (m, 2H), 1.39 (s, 3H), 0.33 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 149.85, 146.30, 141.15, 128.88, 117.14, 112.10, 109.62, 64.84, 55.88, 55.65, 42.19, 29.93, 24.16, 0.40; **HRMS** (APCI) m/z calculated $C_{17}H_{29}O_4Si^+$ $[M+H]^+$ 325.1829, found 325.1830.

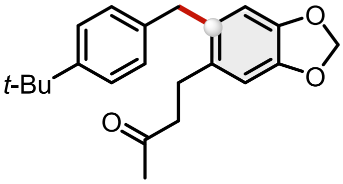


4-(2-(4-(*tert*-butyl)benzyl)-4,5-dimethoxyphenyl)butan-2-one (4u), white solid; 62% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.30 (d, *J* = 12.6 Hz, 2H), 7.03 (d, *J* = 8.2 Hz, 2H), 6.68 (d, *J* = 6.2 Hz, 2H), 3.92 (s, 2H), 3.85 (s, 6H), 2.85 - 2.76 (m, 4H), 1.99 (s, 3H), 1.29 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 207.93, 148.90, 146.10, 145.85, 137.80, 132.47, 131.78, 128.19, 125.33, 110.74, 109.37, 56.04, 55.61, 44.70, 38.33, 34.34, 31.37, 29.89, 26.64; **HRMS** (APCI) m/z calculated $C_{23}H_{31}O_3^+$ $[M+H]^+$ 355.2268, found 355.2263.

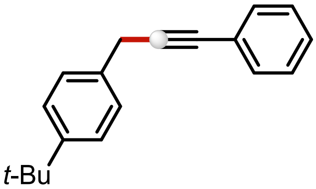


trimethyl(6-(2-(2-methyl-1,3-dioxolan-2-yl)ethyl)benzo-[1,3]dioxol-5-yl)silane (2v); **^{1}H NMR** (400 MHz, $CDCl_3$) δ 6.91 (s, 1H), 6.73 (s, 1H), 5.90 (s, 2H), 3.97 (t, *J* = 8.8 Hz, 4H), 2.80 - 2.72 (m, 2H), 1.95 - 1.87 (m, 2H), 1.38 (s, 3H), 0.31 (s, 9H); **^{13}C**

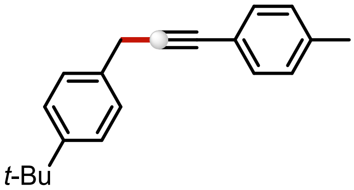
NMR (101 MHz, CDCl$_3$) δ 148.55, 145.25, 142.32, 130.22, 113.37, 109.58, 109.41, 100.57, 64.82, 42.01, 30.03, 24.14, 0.41; **HRMS** (APCI) m/z calculated $C_{16}H_{25}O_4Si^+$ $[M+H]^+$ 309.1517, found 309.1515.



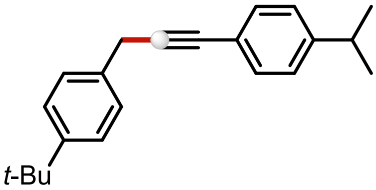
4-(6-(4-(*tert*-butyl)benzyl)benzo-[1,3]dioxol-5-yl)butan-2-one (4v), white solid; 62% yield; **^{1}H NMR** (400 MHz, CDCl$_3$) δ 7.28 (d, *J* = 9.2 Hz, 2H), 7.03 (d, *J* = 7.8 Hz, 2H), 6.64 (s, 2H), 5.90 (s, 2H), 3.88 (s, 2H), 2.80 - 2.74 (m, 2H), 2.41 (t, *J* = 7.8 Hz, 2H), 2.01 (s, 3H), 1.29 (s, 9H); **^{13}C NMR** (101 MHz, CDCl$_3$) δ 207.93, 148.90, 146.10, 145.85, 137.80, 132.47, 131.78, 128.19, 125.33, 110.74, 109.37, 100.79, 44.70, 38.33, 34.34, 31.37, 29.89, 26.64; **HRMS** (APCI) m/z calculated $C_{22}H_{27}O_3^+$ $[M+H]^+$ 339.1955, found 339.1961.



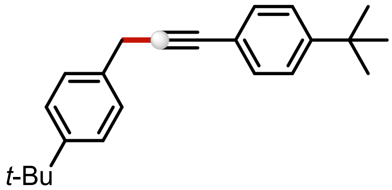
1-(*tert*-butyl)-4-(3-phenylprop-2-yn-1-yl)benzene (6a)[20], yellow oil; 85% yield; **^{1}H NMR** (400 MHz, CDCl$_3$) δ 7.46 - 7.43 (m, 2H), 7.37 (s, 4H), 7.31 - 7.27 (m, 3H), 3.81 (s, 2H), 1.32 (s, 9H); **^{13}C NMR** (101 MHz, CDCl$_3$) δ 149.53, 133.71, 131.61, 128.19, 127.73, 127.63, 125.46, 123.72, 87.80, 82.38, 34.43, 31.37, 25.22; **HRMS** (APCI) m/z calculated $C_{19}H_{19}^-$ $[M-H]^-$ 247.1492, found 247.1495.



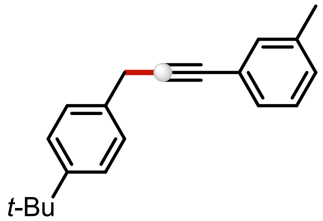
1-(*tert*-butyl)-4-(3-(p-tolyl)prop-2-yn-1-yl)benzene (6b), yellow oil; 62% yield; **^{1}H NMR** (400 MHz, CDCl$_3$) δ 7.34 (d, *J* = 11.8 Hz, 5H), 7.25 (s, 1H), 7.10 (d, *J* = 7.4 Hz, 2H), 3.79 (s, 2H), 2.33 (s, 3H), 1.32 (s, 9H); **^{13}C NMR** (101 MHz, CDCl$_3$) δ 149.48, 137.72, 133.87, 131.49, 128.95, 127.63, 125.44, 120.66, 86.98, 82.44, 34.42, 31.38, 25.24, 21.41; **HRMS** (APCI) m/z calculated $C_{20}H_{21}^-$ $[M-H]^-$ 261.1649, found 261.1652.



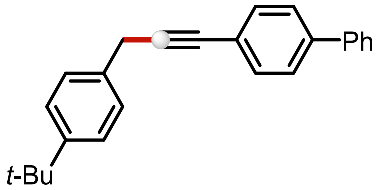
1-(*tert*-butyl)-4-(3-(4-isopropylphenyl)prop-2-yn-1-yl)benzene (6c), yellow oil; 59% yield; **^{1}H NMR** (400 MHz, CDCl$_3$) δ 7.36 (d, *J* = 9.6 Hz, 6H), 7.15 (d, *J* = 6.8 Hz, 2H), 3.79 (s, 2H), 2.92 - 2.85 (m, 1H), 1.32 (s, 9H), 1.23 (d, *J* = 6.8 Hz, 6H); **^{13}C NMR** (101 MHz, CDCl$_3$) δ 149.46, 148.66, 133.89, 131.59, 127.62, 126.32, 125.42, 121.05, 86.91, 82.51, 34.42, 34.00, 31.38, 25.24, 23.81; **HRMS** (APCI) m/z calculated C$_{22}$H$_{25}^-$ [M-H]$^-$ 289.1962, found 289.1967.



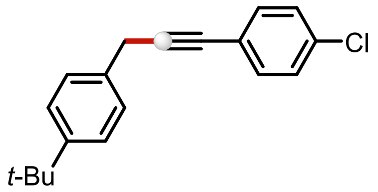
4,4'-(prop-1-yne-1,3-diyl)bis(*tert*-butylbenzene) (6d), yellow oil; 55% yield; **^{1}H NMR** (400 MHz, CDCl$_3$) δ 7.40 - 7.34 (m, 6H), 7.31 (d, *J* = 6.8 Hz, 2H), 3.79 (s, 2H), 1.31 (d, *J* = 6.6 Hz, 18H); **^{13}C NMR** (101 MHz, CDCl$_3$) δ 150.90, 149.46, 133.89, 131.32, 127.63, 125.42, 125.18, 120.74, 86.99, 82.46, 34.68, 34.42, 31.38, 31.18, 25.24; **HRMS** (APCI) m/z calculated C$_{23}$H$_{27}^-$ [M-H]$^-$ 303.2118, found 303.2123.



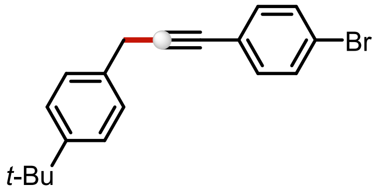
1-(3-(4-(*tert*-butyl)phenyl)prop-1-yn-1-yl)-3-methylbenzene (6e), yellow oil; 58% yield; **^{1}H NMR** (400 MHz, CDCl$_3$) δ 7.36 (m, 4H), 7.25 (t, *J* = 6.6 Hz, 2H), 7.18 (t, *J* = 7.6 Hz, 1H), 7.09 (d, *J* = 7.4 Hz, 1H), 3.79 (s, 2H), 2.32 (s, 3H), 1.32 (s, 9H); **^{13}C NMR** (101 MHz, CDCl$_3$) δ 149.51, 137.84, 133.79, 132.24, 128.66, 128.62, 128.10, 127.63, 125.45, 123.54, 87.39, 82.54, 34.43, 31.38, 25.22, 21.20; **HRMS** (APCI) m/z calculated C$_{20}$H$_{23}^+$ [M+H]$^+$ 263.1794, found 263.1793.



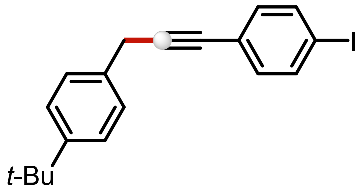
4-(3-(4-(*tert*-butyl)phenyl)prop-1-yn-1-yl)-1,1'-biphenyl (6f), white solid; 68% yield; **^{1}H NMR** (400 MHz, CDCl$_3$) δ 7.58 (d, *J* = 7.8 Hz, 2H), 7.55 - 7.49 (m, 5H), 7.43 (t, *J* = 6.8 Hz, 2H), 7.37 (s, 4H), 3.83 (s, 2H), 1.33 (s, 9H); **^{13}C NMR** (101 MHz, CDCl$_3$) δ 149.57, 140.47, 133.71, 132.04, 128.81, 127.66, 127.49, 126.99, 126.89, 126.66, 125.49, 122.70, 88.52, 82.26, 34.44, 31.38, 25.32; **HRMS** (APCI) m/z calculated C$_{25}$H$_{23}^-$ [M-H]$^-$ 323.1805, found 323.1810.



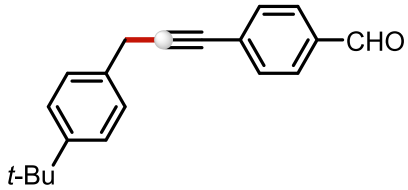
1-(*tert*-butyl)-4-(3-(4-chlorophenyl)prop-2-yn-1-yl)benzene (6g), yellow oil; 91% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.36 - 7.31 (m, 6H), 7.26 (d, *J* = 8.8 Hz, 2H), 3.78 (s, 2H), 1.32 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 149.65, 133.69, 133.45, 132.85, 128.51, 127.62, 125.51, 122.25, 88.93, 81.29, 34.44, 31.36, 25.22; **HRMS** (APCI) m/z calculated $C_{19}H_{18}Cl^-$ $[M-H]^-$ 281.1102, found 281.1107.



1-bromo-4-(3-(4-(*tert*-butyl)phenyl)prop-1-yn-1-yl)benzene (6h), colorless oil; 89% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.42 (d, *J* = 6.2 Hz, 2H), 7.37 (d, *J* = 6.4 Hz, 2H), 7.35 - 7.27 (m, 4H), 3.78 (s, 2H), 1.33 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 149.66, 133.40, 133.09, 131.43, 127.62, 125.52, 122.70, 121.86, 89.14, 81.35, 34.44, 31.36, 25.25; **HRMS** (APCI) m/z calculated $C_{19}H_{18}Br^-$ $[M-H]^-$ 325.0597, found 325.0603.



1-(*tert*-butyl)-4-(3-(4-iodophenyl)prop-2-yn-1-yl)benzene (6i), colorless oil; 78% yield; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.63 (d, *J* = 8.2 Hz, 2H), 7.37 (d, *J* = 6.4 Hz, 2H), 7.33 (d, *J* = 8.2 Hz, 2H), 7.16 (d, *J* = 8.2 Hz, 2H), 3.78 (s, 2H), 1.33 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 149.66, 137.34, 133.38, 133.20, 127.62, 125.52, 123.28, 93.42, 89.45, 81.47, 34.44, 31.36, 25.27; **HRMS** (APCI) m/z calculated $C_{19}H_{20}I^+$ $[M+H]^+$ 375.0604, found 375.0603.

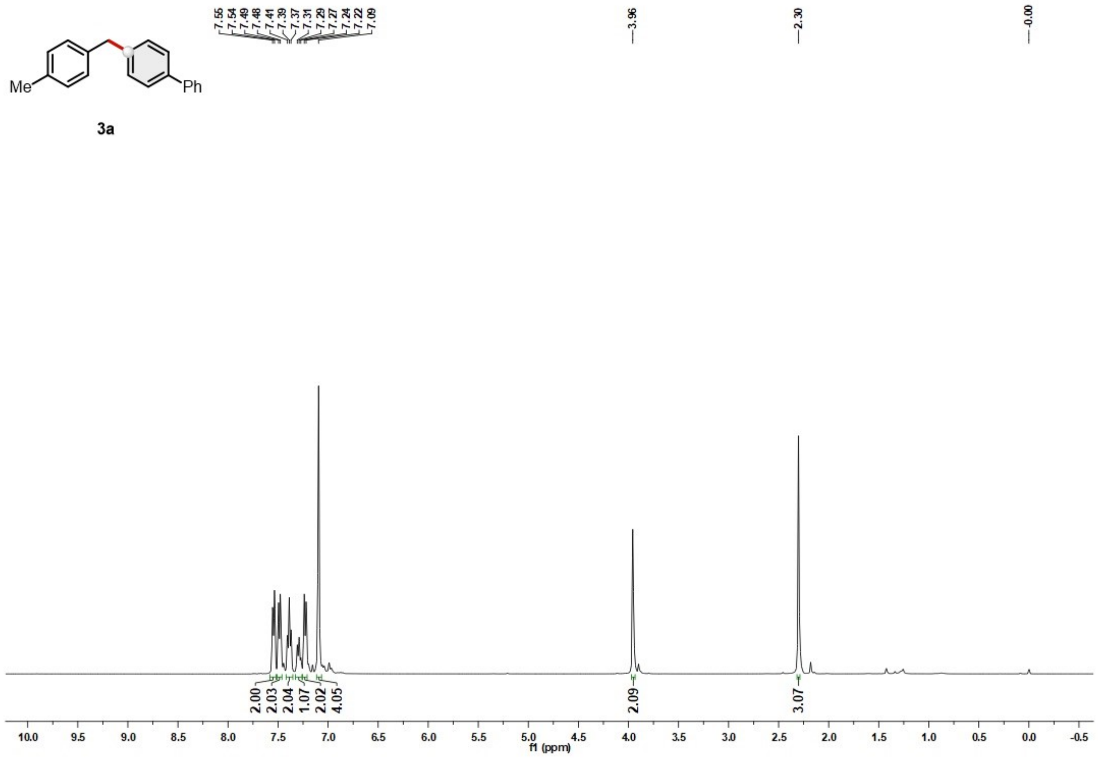


4-(3-(4-(*tert*-butyl)phenyl)prop-1-yn-1-yl)benzaldehyde (6j), colorless oil; 72% yield; **^{1}H NMR** (400 MHz, CDCl3) δ 9.99 (s, 1H), 7.81 (d, *J* = 7.0 Hz, 2H), 7.58 (d, *J* = 7.2 Hz, 2H), 7.38 (d, *J* = 6.8 Hz, 2H), 7.33 (d, *J* = 7.2 Hz, 2H), 3.83 (s, 2H), 1.33 (s, 9H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 191.48, 149.81, 135.13, 133.05, 132.17, 130.17, 129.49, 127.64, 125.59, 92.56, 81.76, 34.46, 31.36, 25.37; **HRMS** (APCI) m/z calculated $C_{20}H_{21}^{+}$ $[M+H]^{+}$ 277.1587, found 277.158.

6. Copies of NMR spectra

^{1}H NMR of **3a**

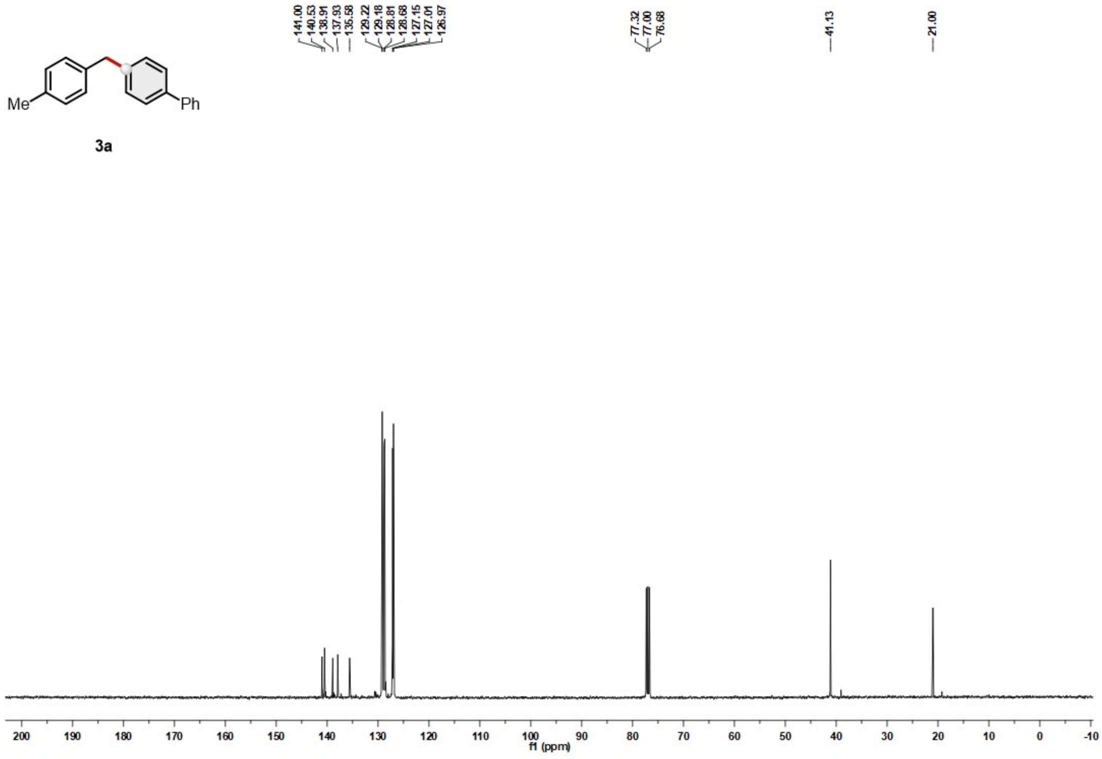
CDCl$_3$, 400 MHz, 298 K



3a

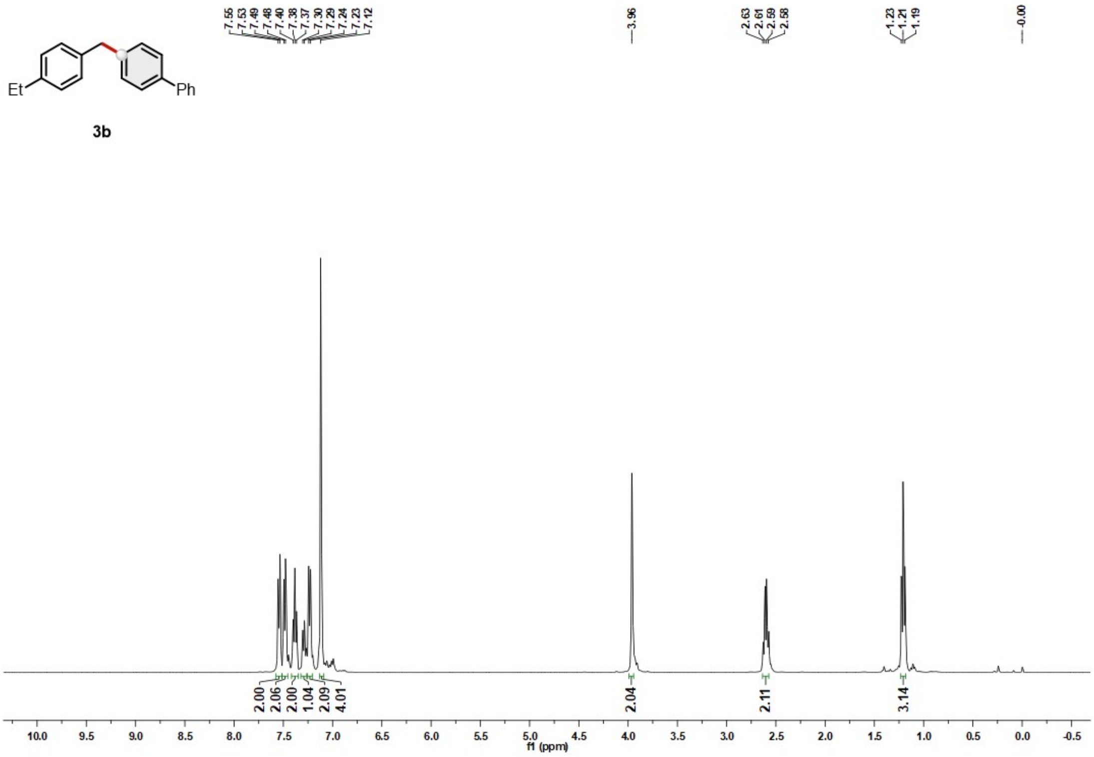
^{13}C NMR of **3a**

CDCl$_3$, 101 MHz, 298 K

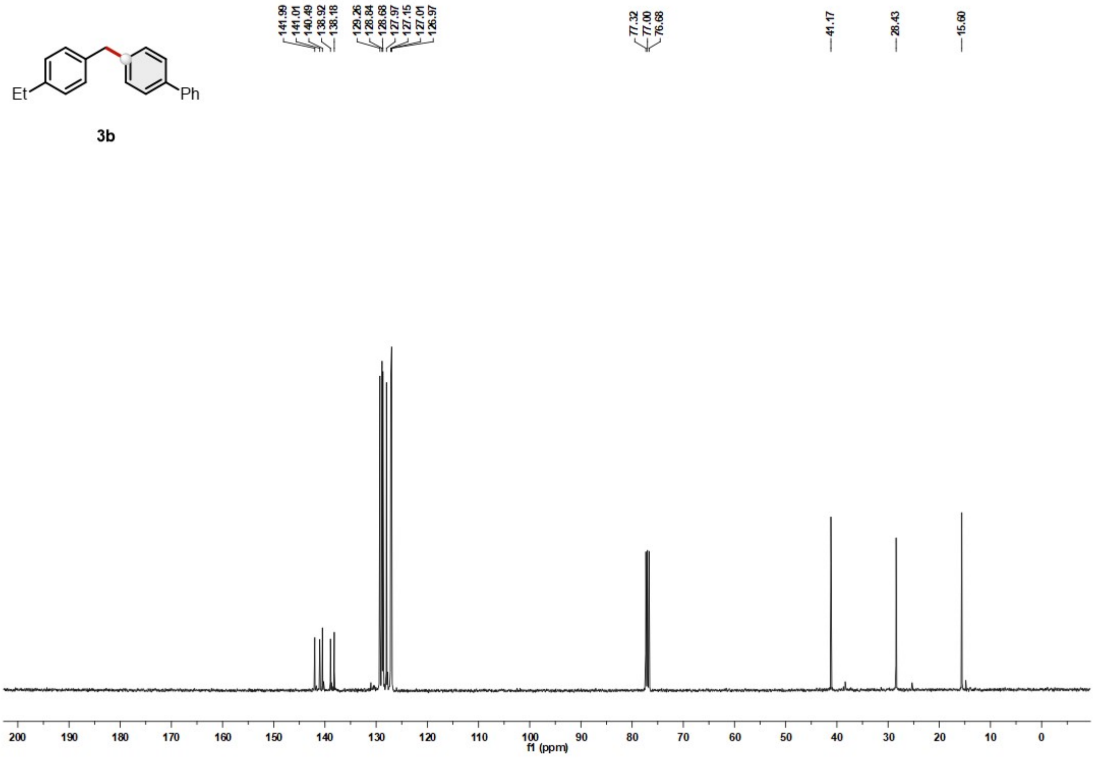


3a

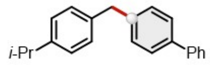
^{1}H NMR of **3b**
CDCl$_3$, 400 MHz, 298 K



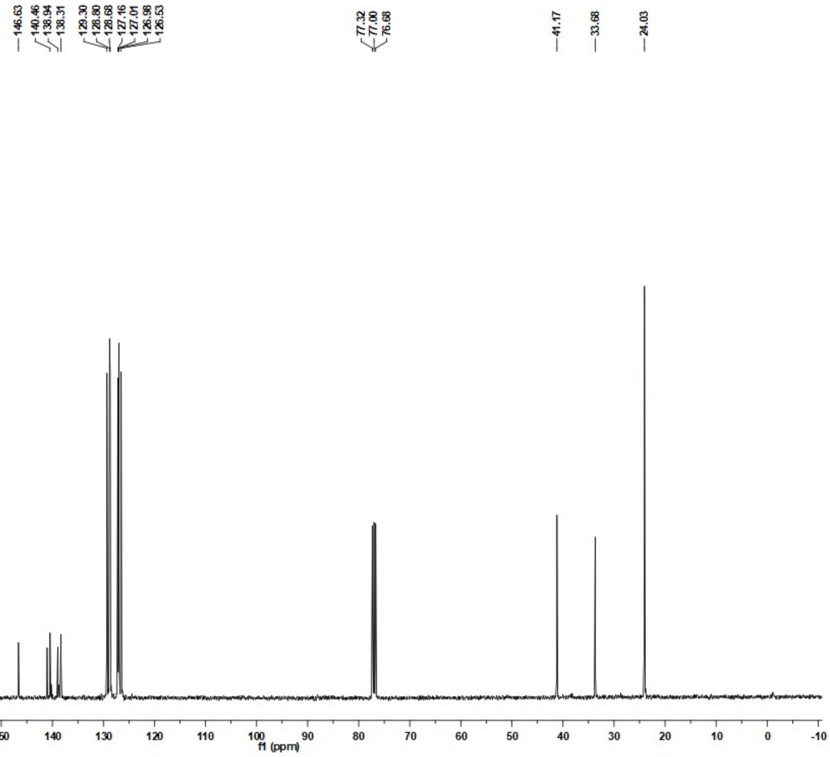
^{13}C NMR of **3b**
CDCl$_3$, 101 MHz, 298 K



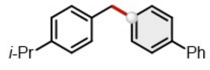
^{1}H NMR of **3c**
$CDCl_3$, 400 MHz, 298 K



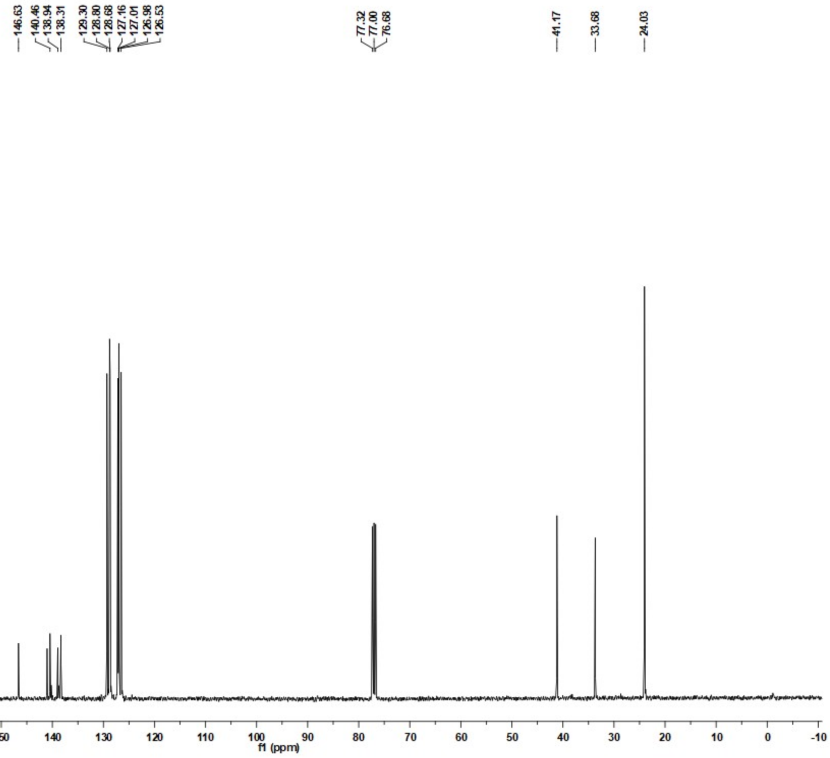
3c



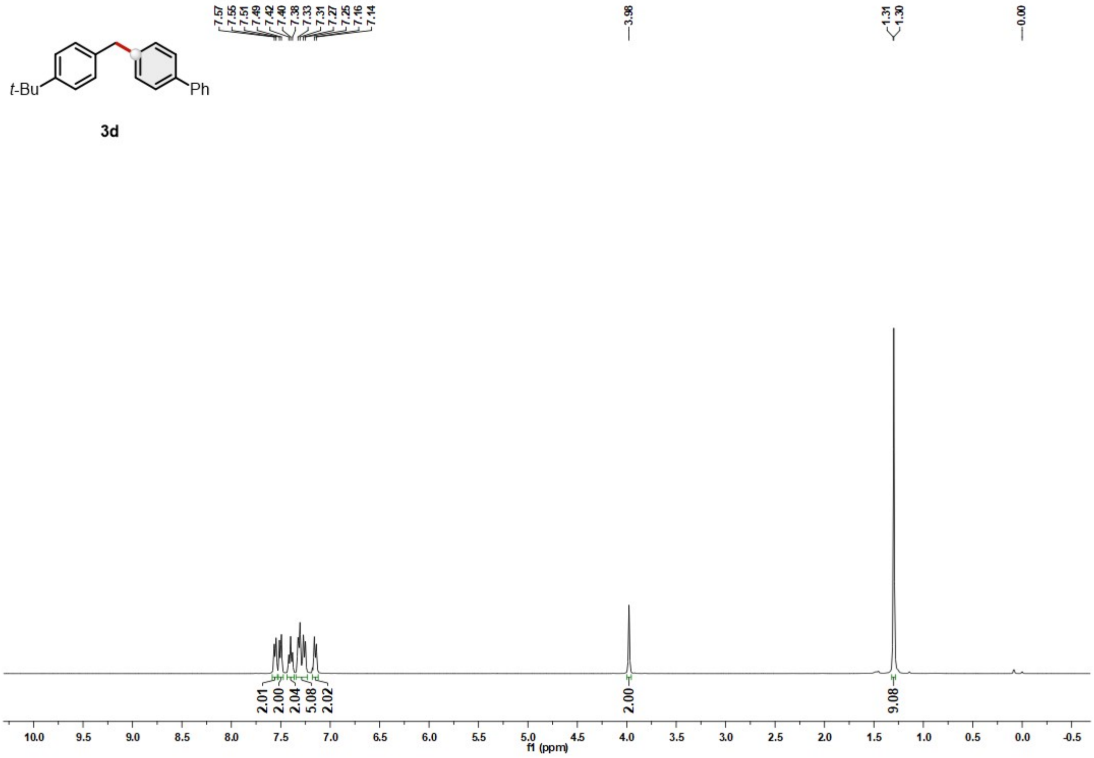
^{13}C NMR of **3c**
$CDCl_3$, 101 MHz, 298 K



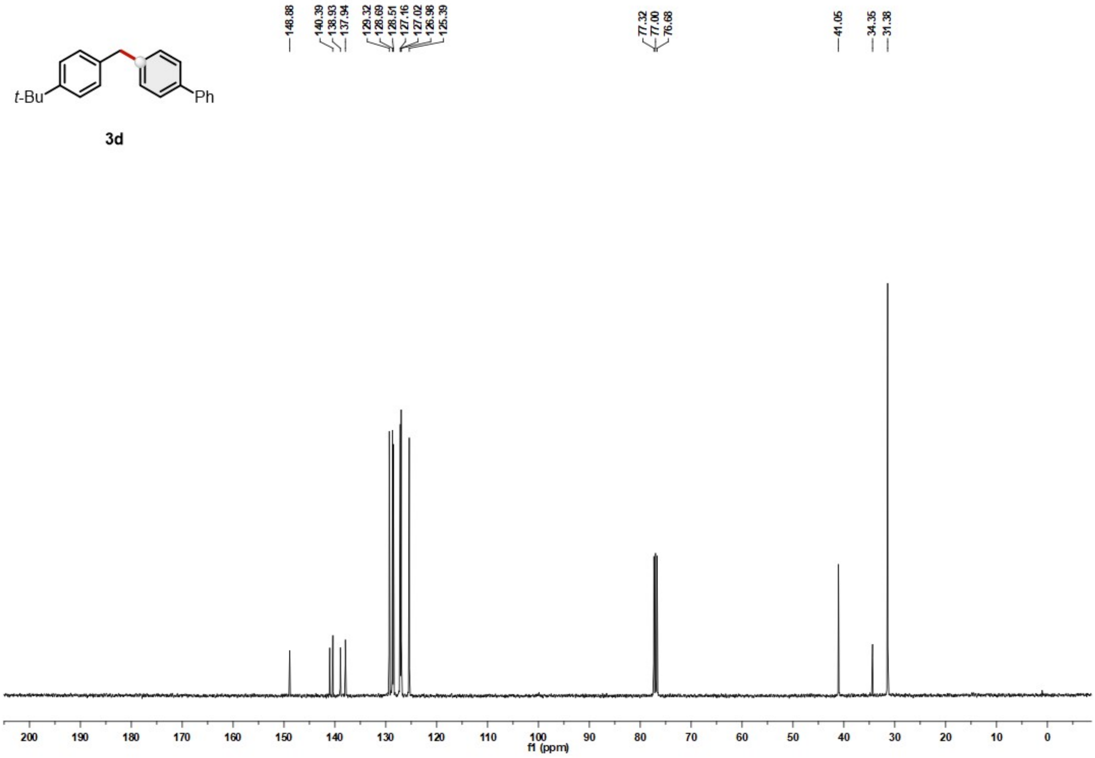
3c



^{1}H NMR of **3d**
CDCl$_3$, 400 MHz, 298 K

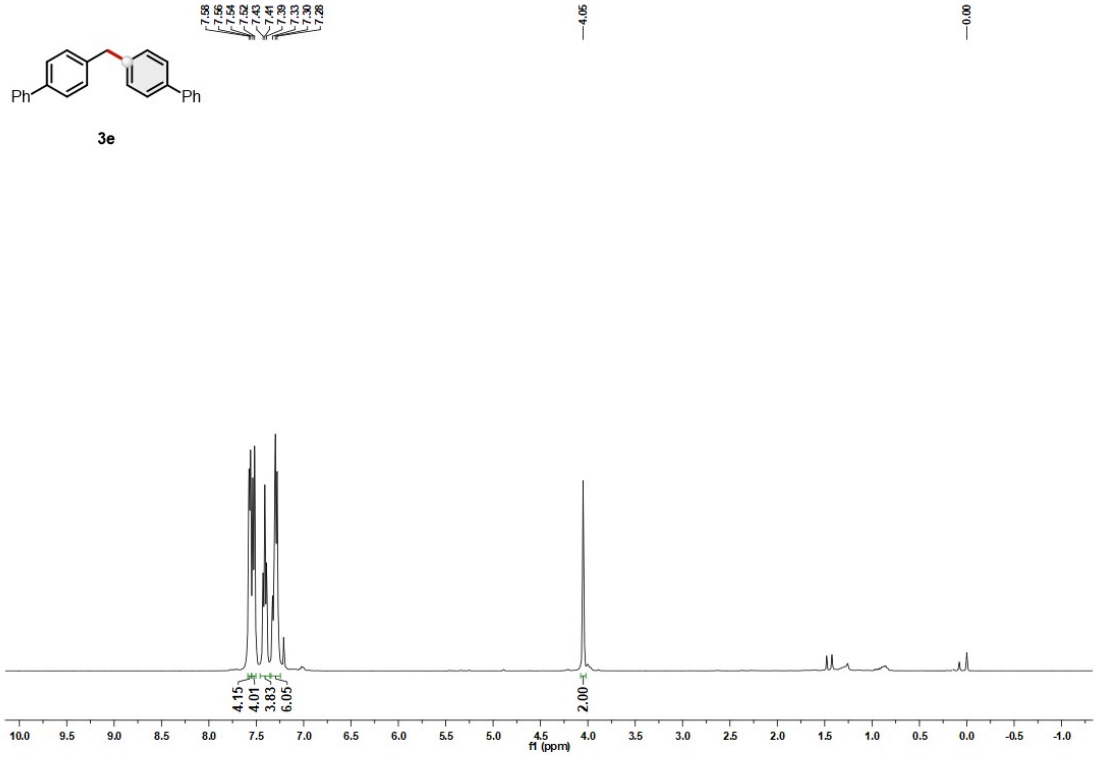


^{13}C NMR of **3d**
CDCl$_3$, 101 MHz, 298 K



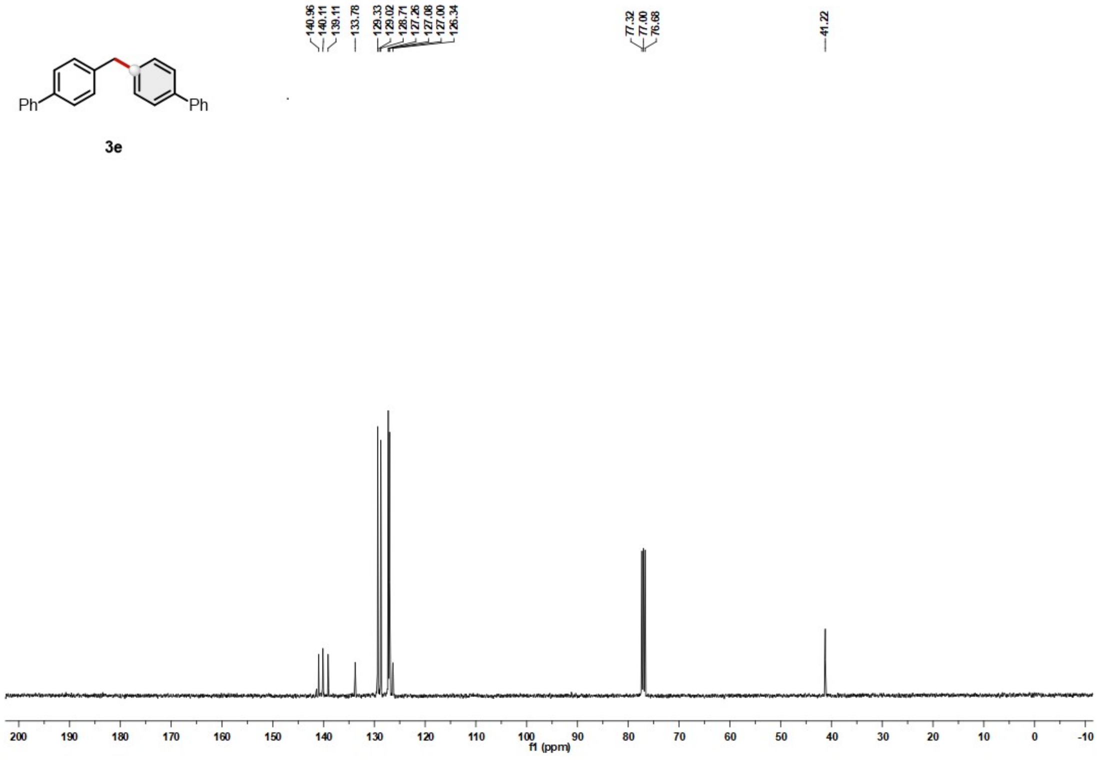
^{1}H NMR of **3e**

CDCl$_3$, 400 MHz, 298 K



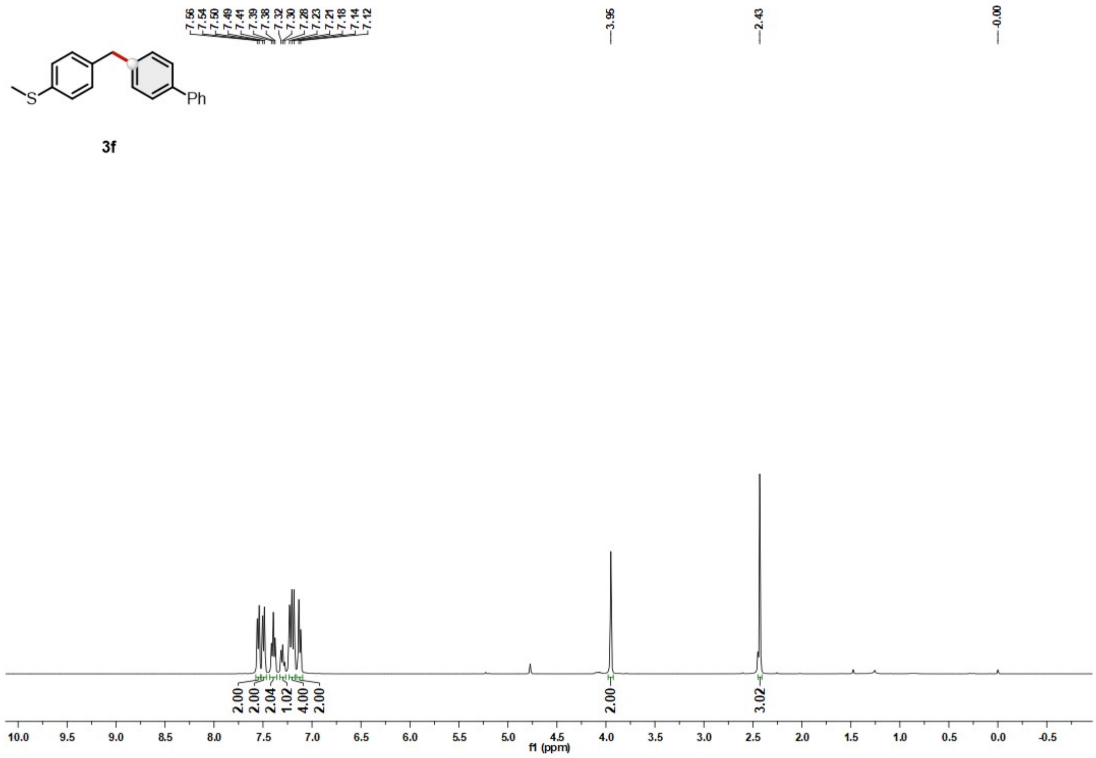
^{13}C NMR of **3e**

CDCl$_3$, 101 MHz, 298 K



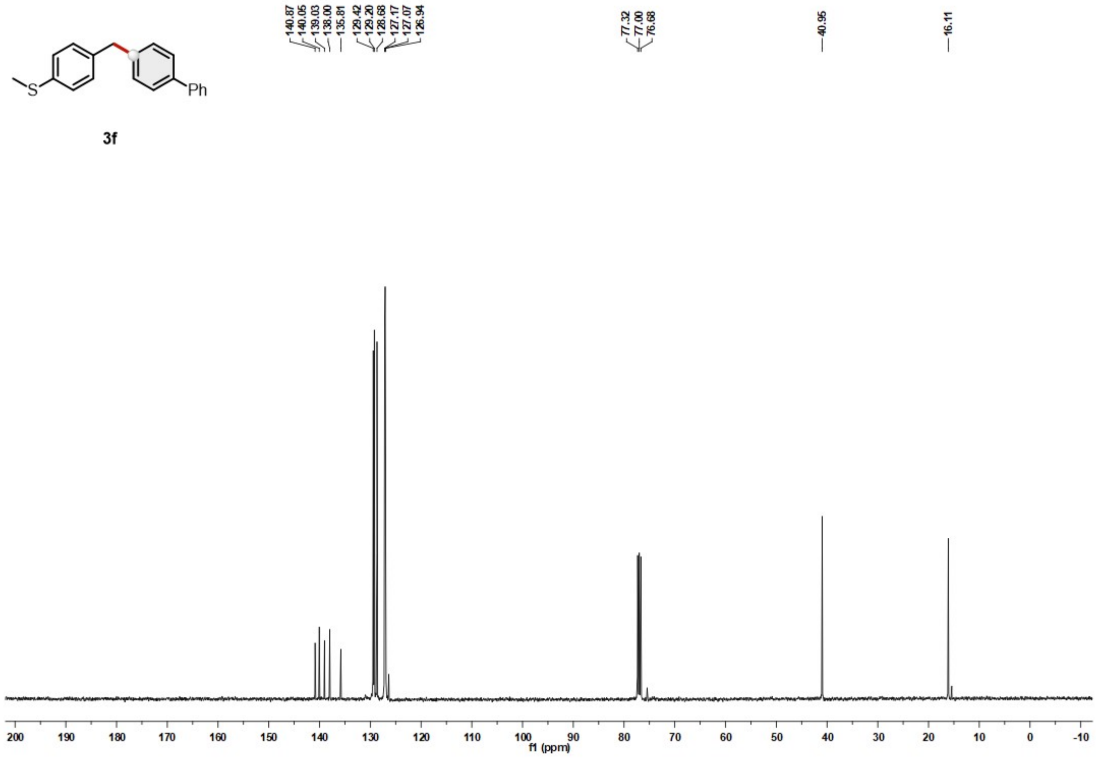
^{1}H NMR of **3f**

CDCl$_3$, 400 MHz, 298 K

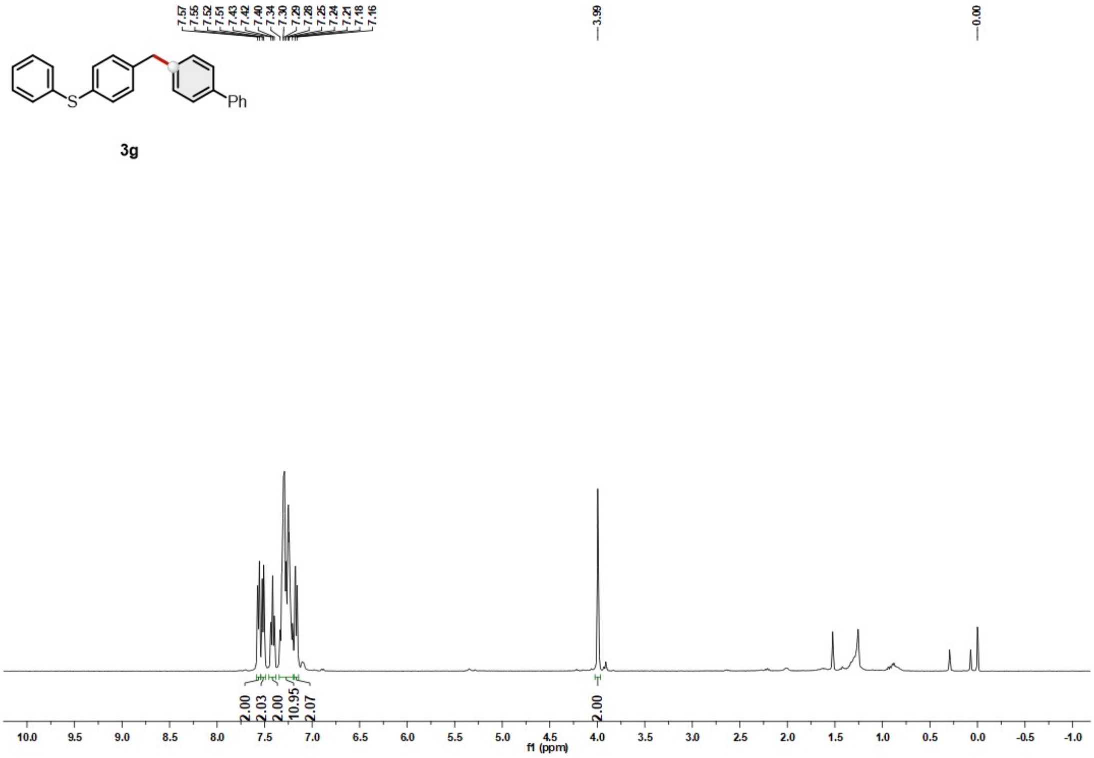


^{13}C NMR of **3f**

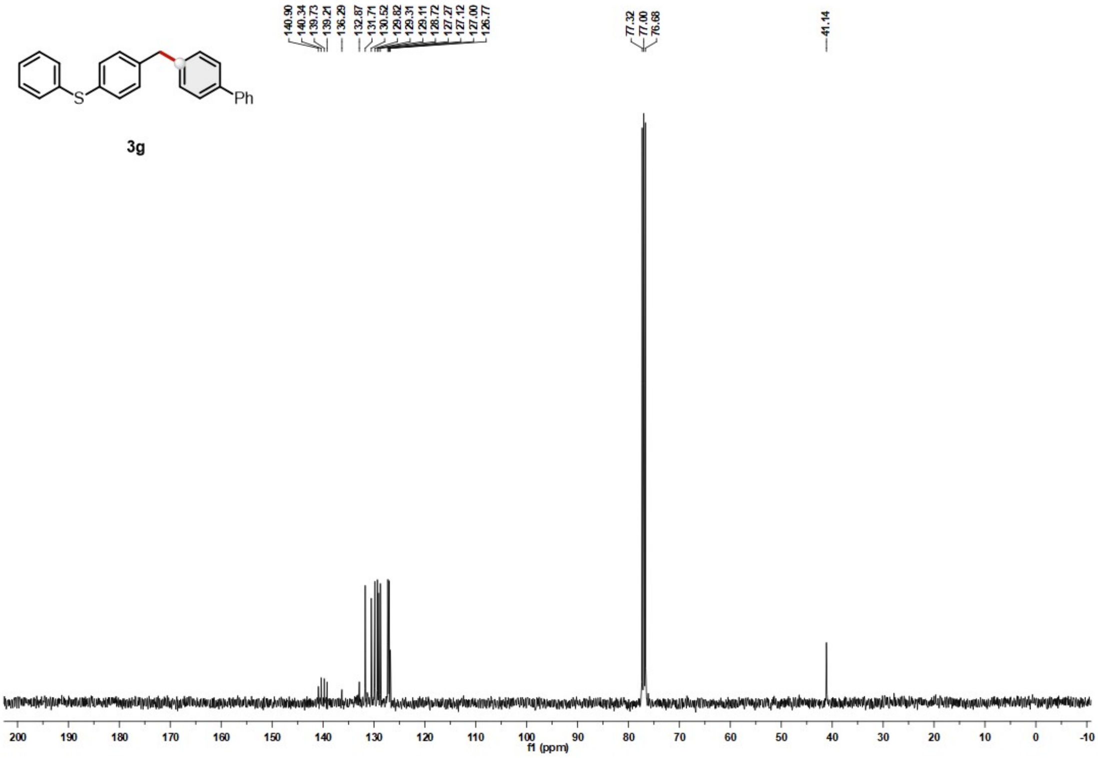
CDCl$_3$, 101 MHz, 298 K



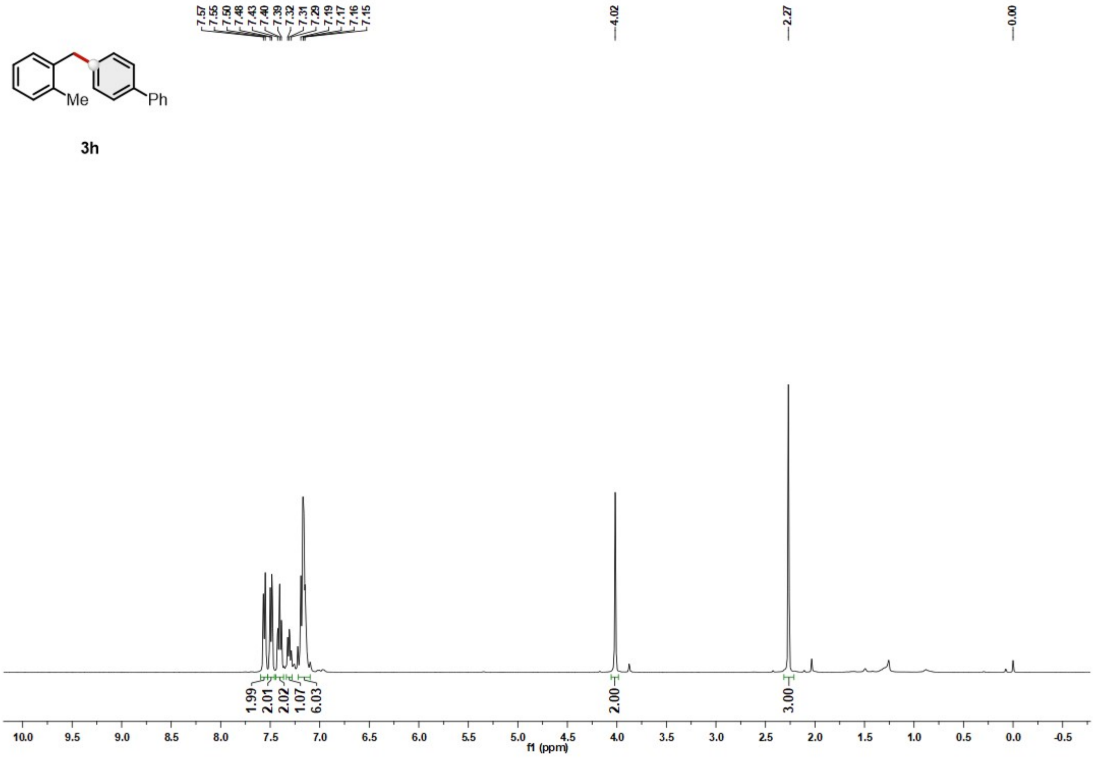
^{1}H NMR of **3g**
CDCl$_3$, 400 MHz, 298 K



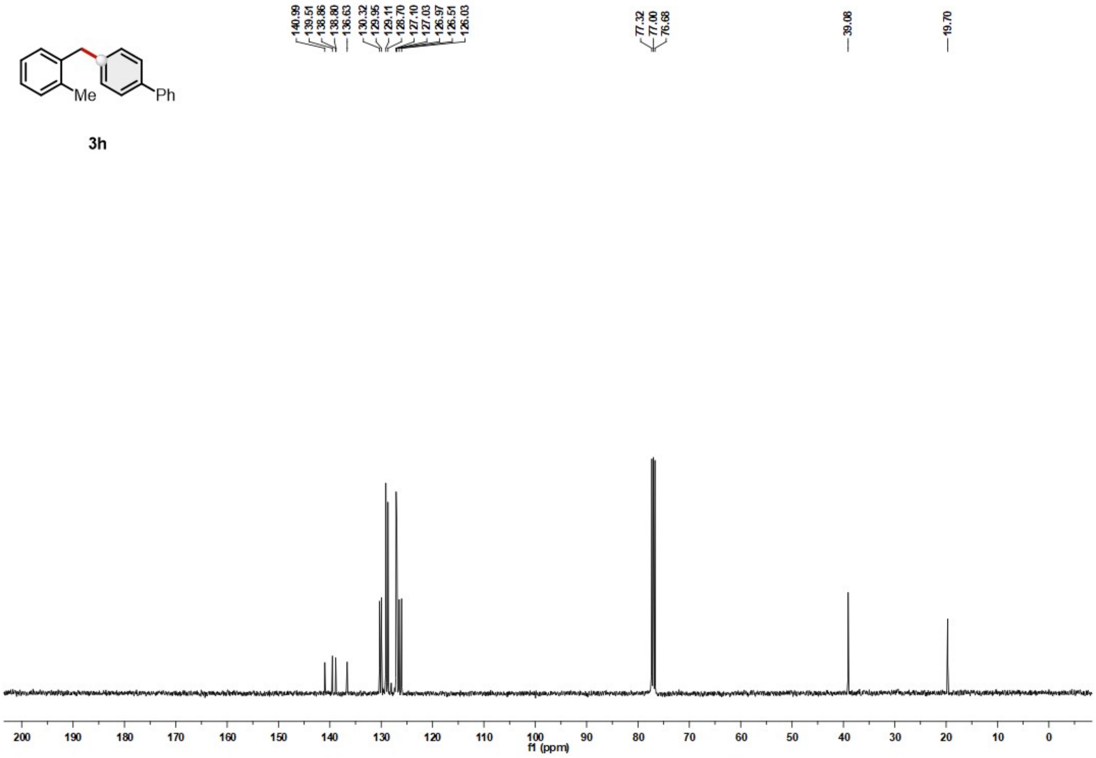
^{13}C NMR of **3g**
CDCl$_3$, 101 MHz, 298 K



^{1}H NMR of **3h**
CDCl$_3$, 400 MHz, 298 K

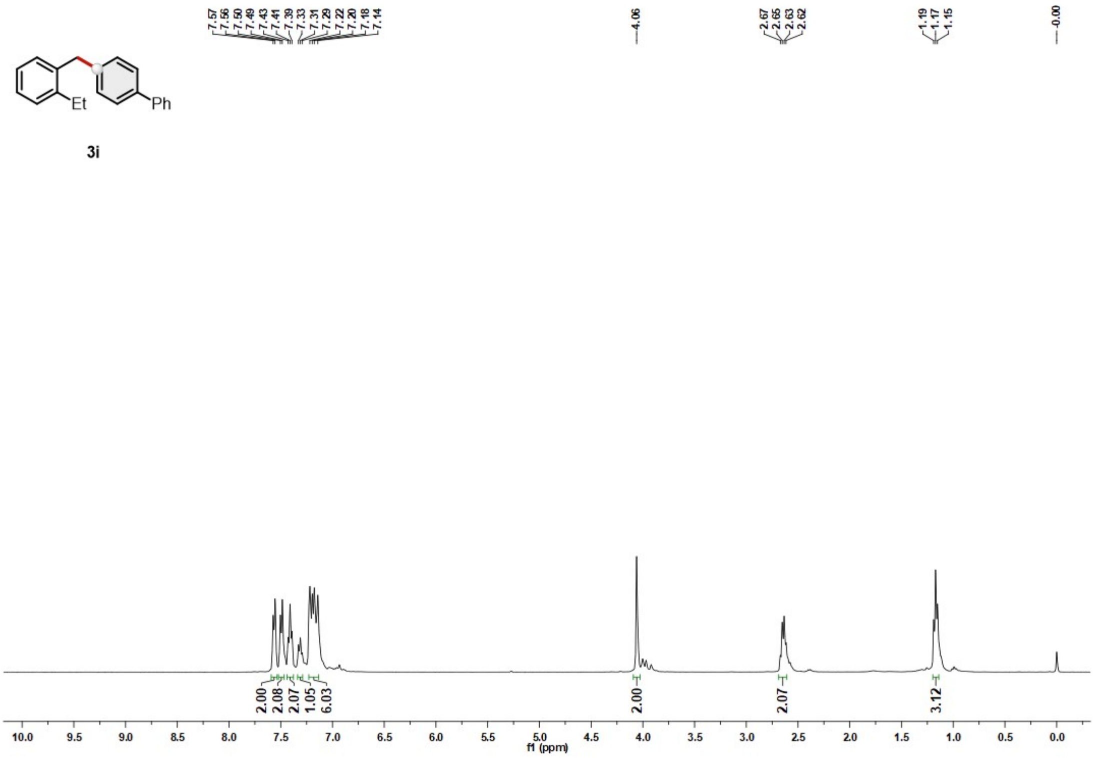


^{13}C NMR of **3h**
CDCl$_3$, 101 MHz, 298 K



^{1}H NMR of **3i**

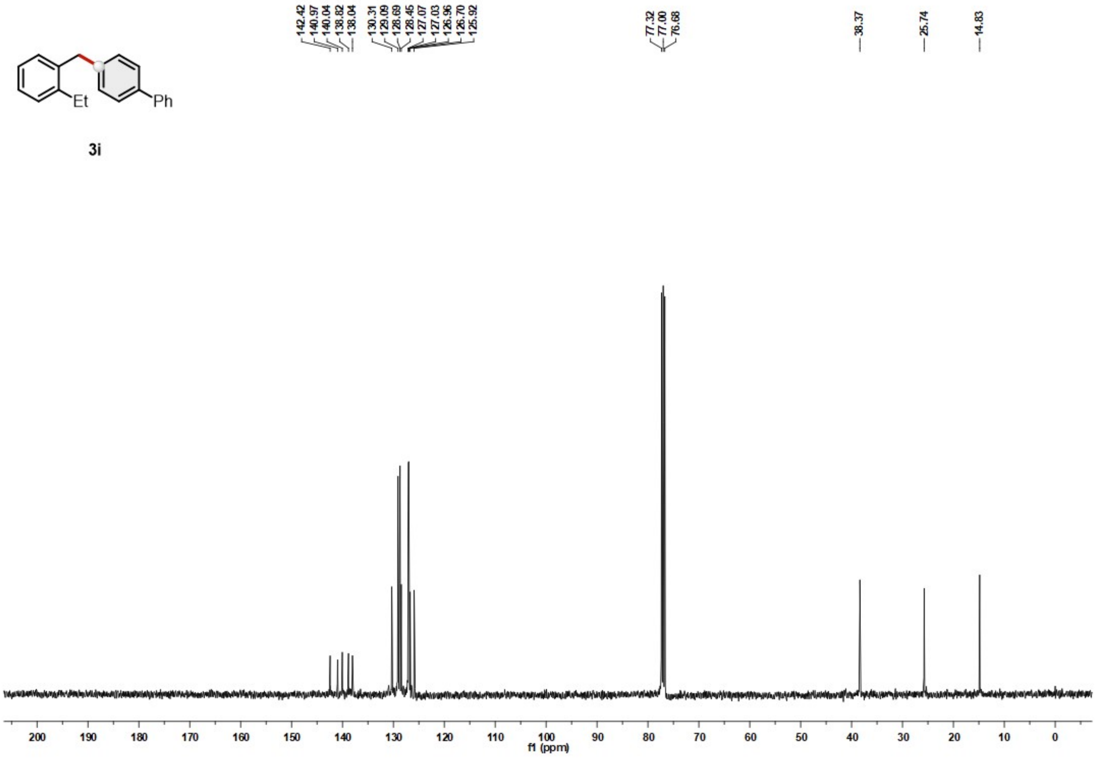
CDCl$_3$, 400 MHz, 298 K



3i

^{13}C NMR of **3i**

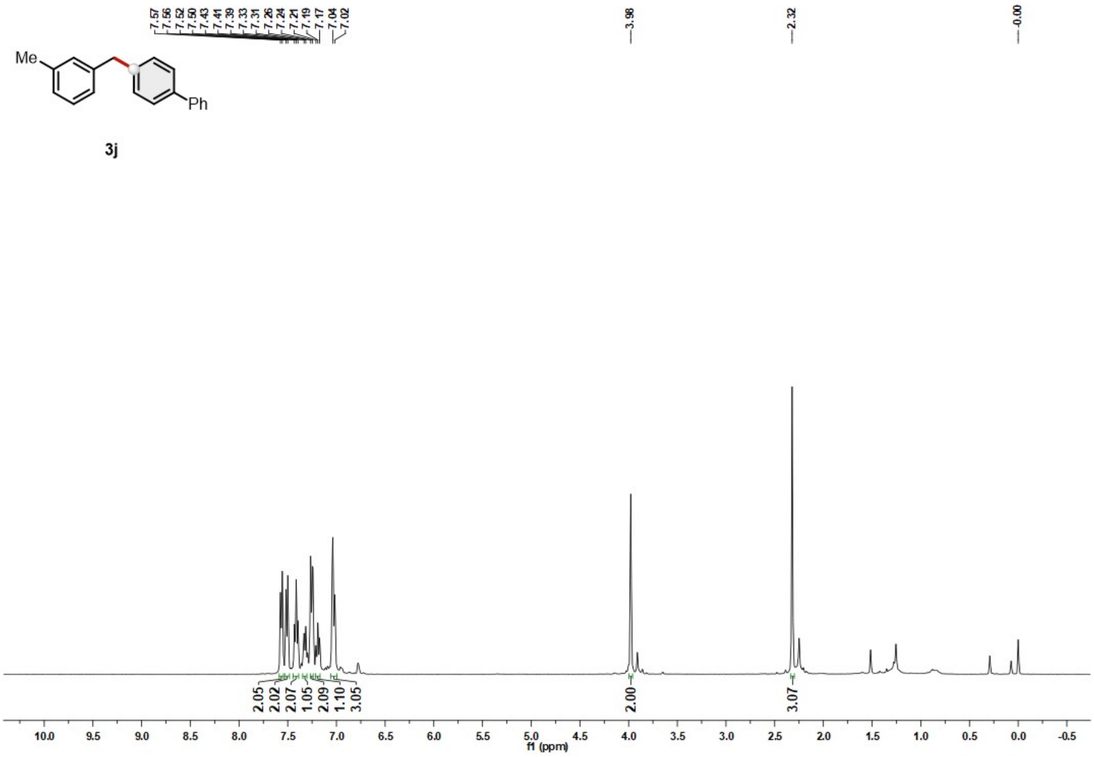
CDCl$_3$, 101 MHz, 298 K



3i

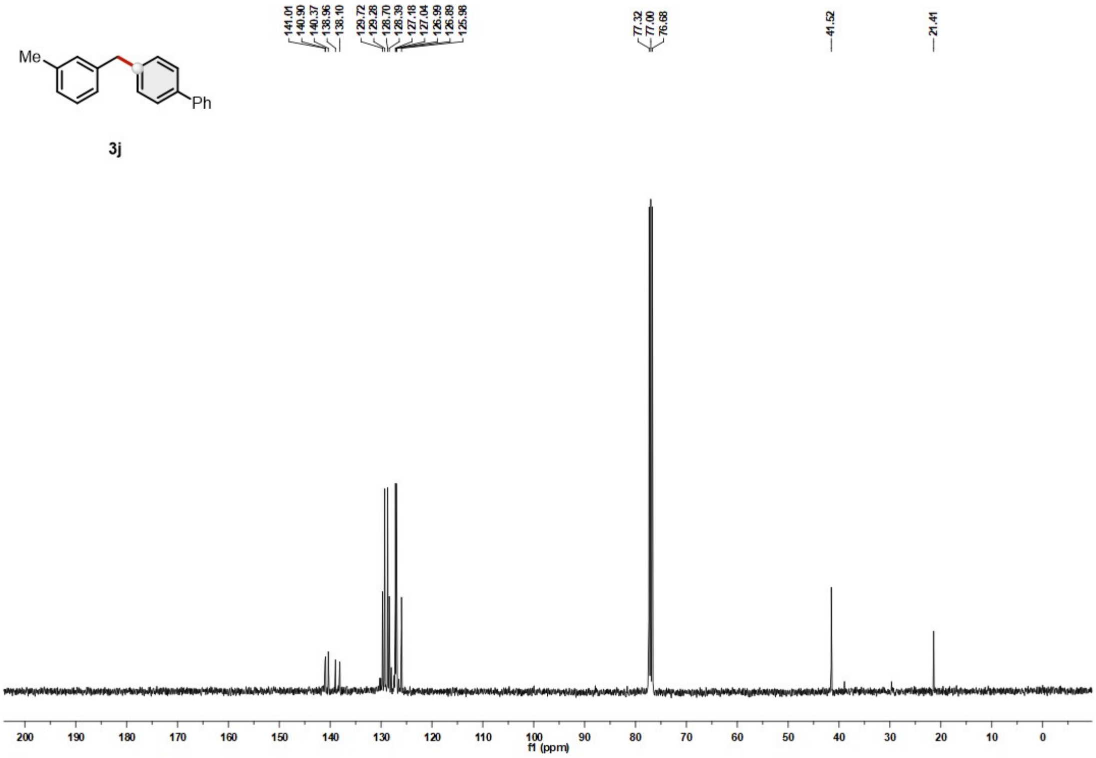
^{1}H NMR of **3j**

CDCl$_3$, 400 MHz, 298 K



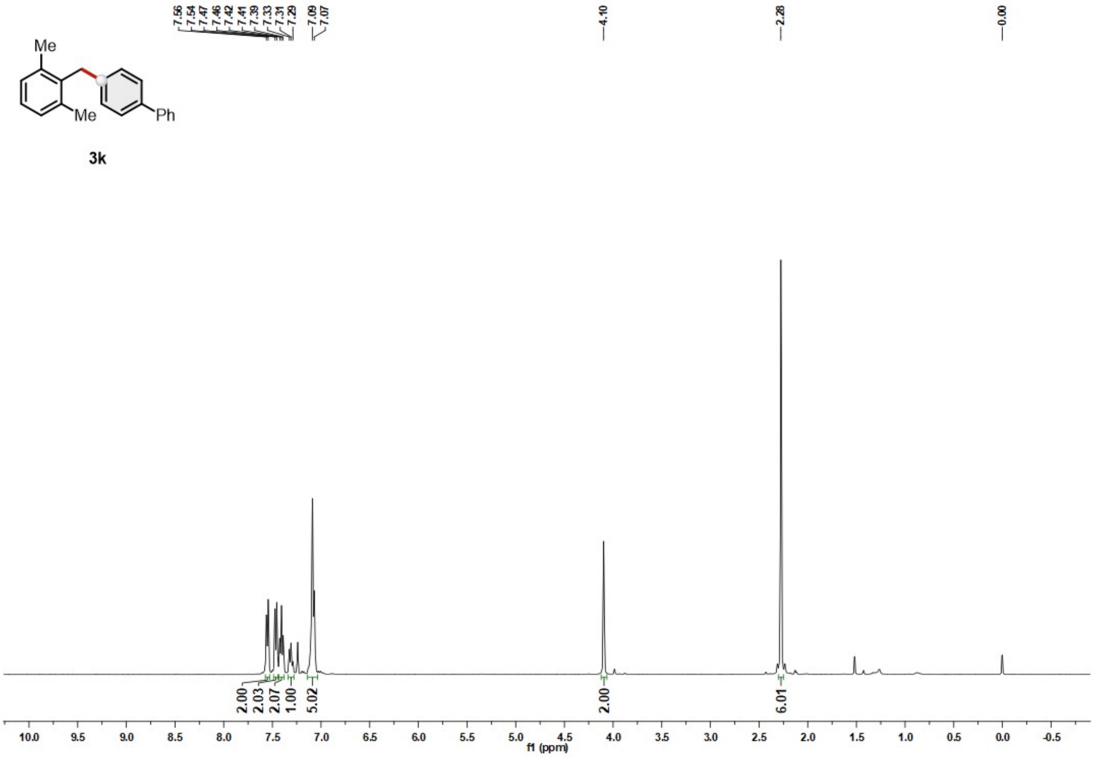
^{13}C NMR of **3j**

CDCl$_3$, 101 MHz, 298 K



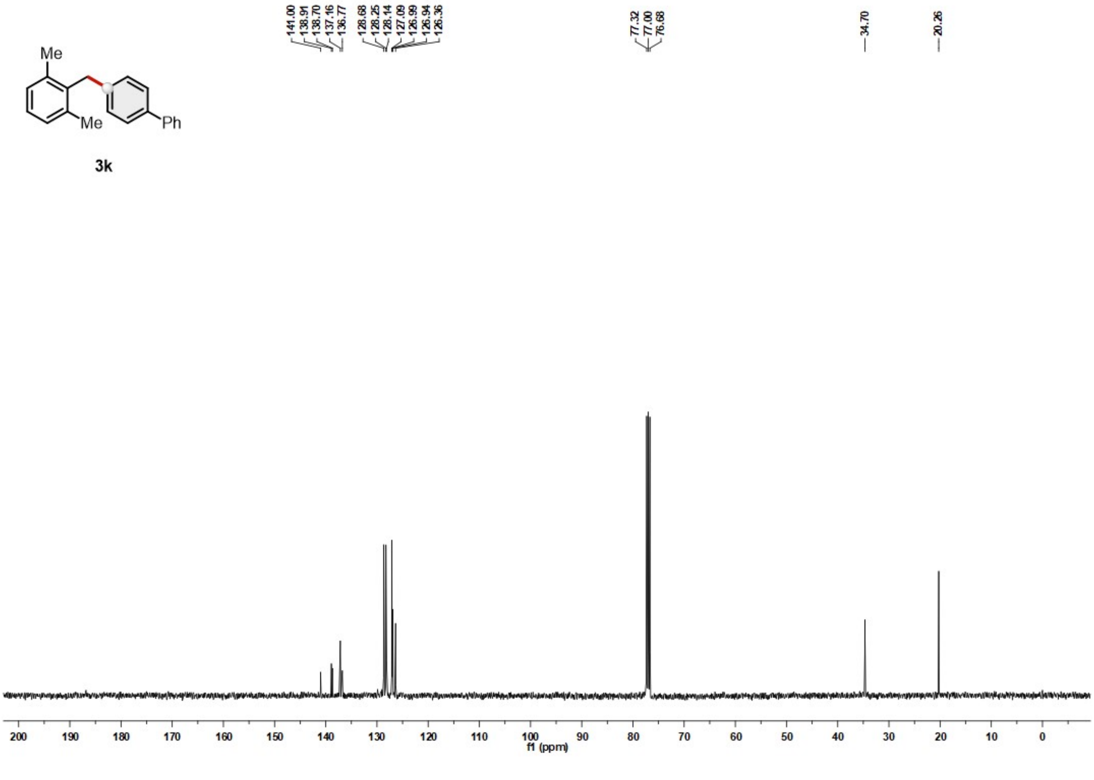
^{1}H NMR of **3k**

CDCl$_3$, 400 MHz, 298 K

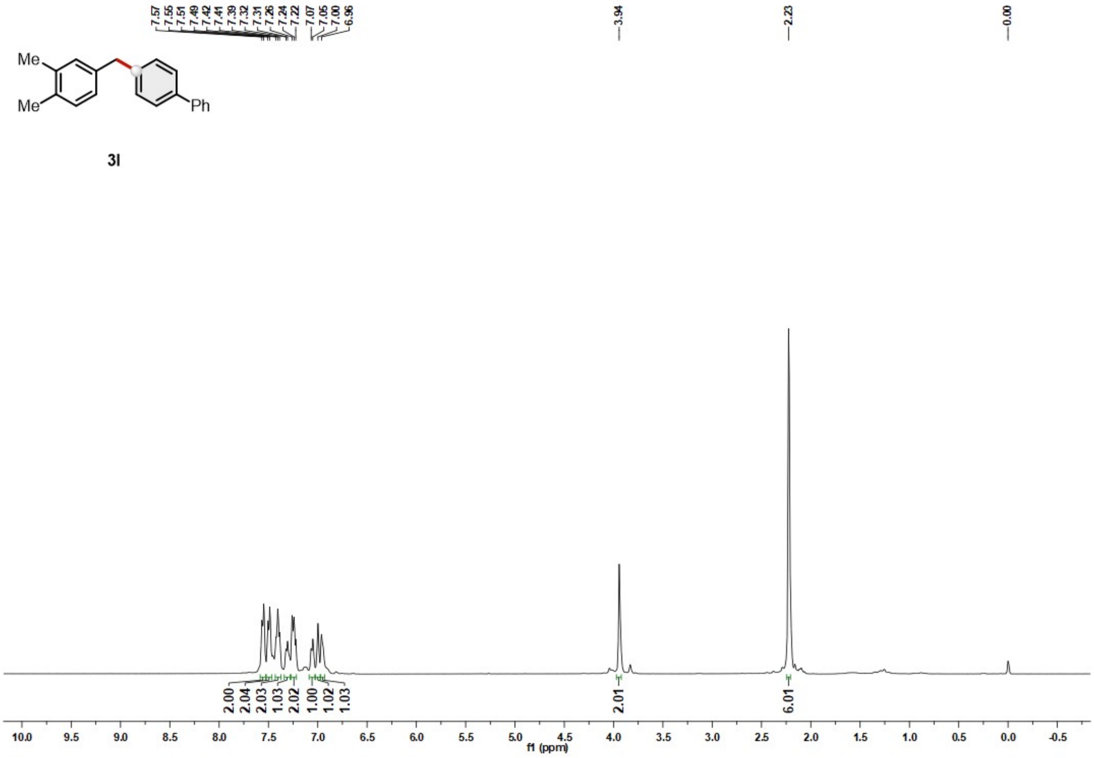


^{13}C NMR of **3k**

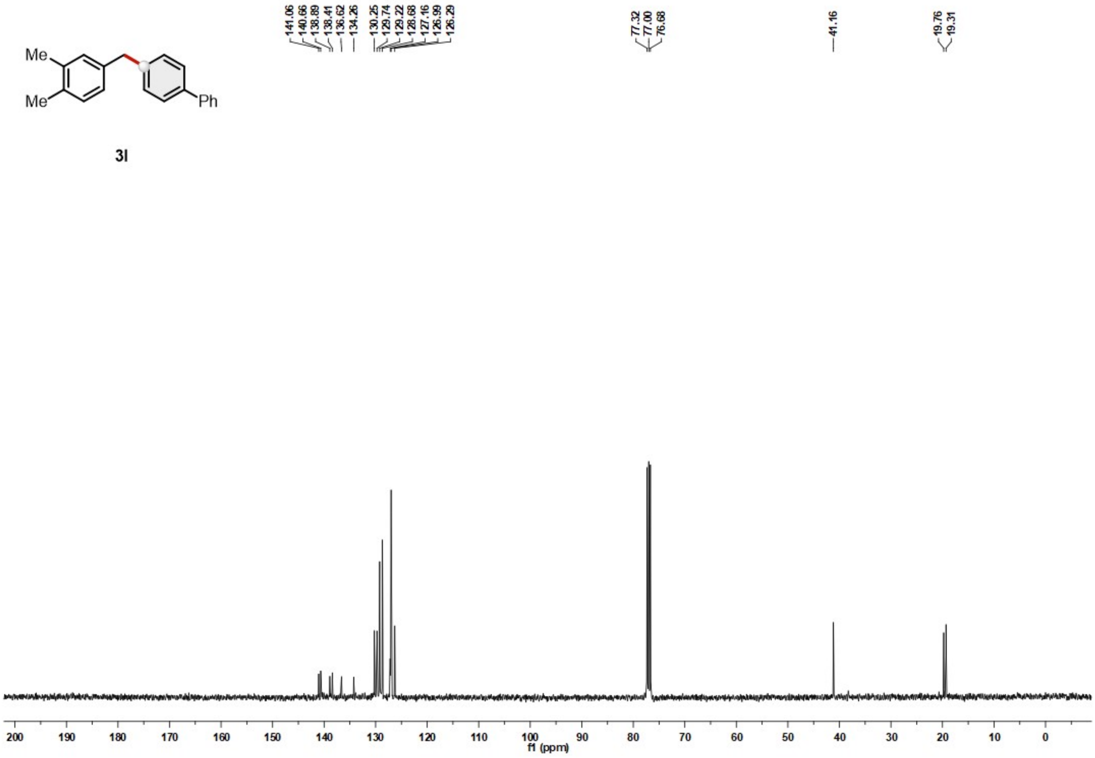
CDCl$_3$, 101 MHz, 298 K



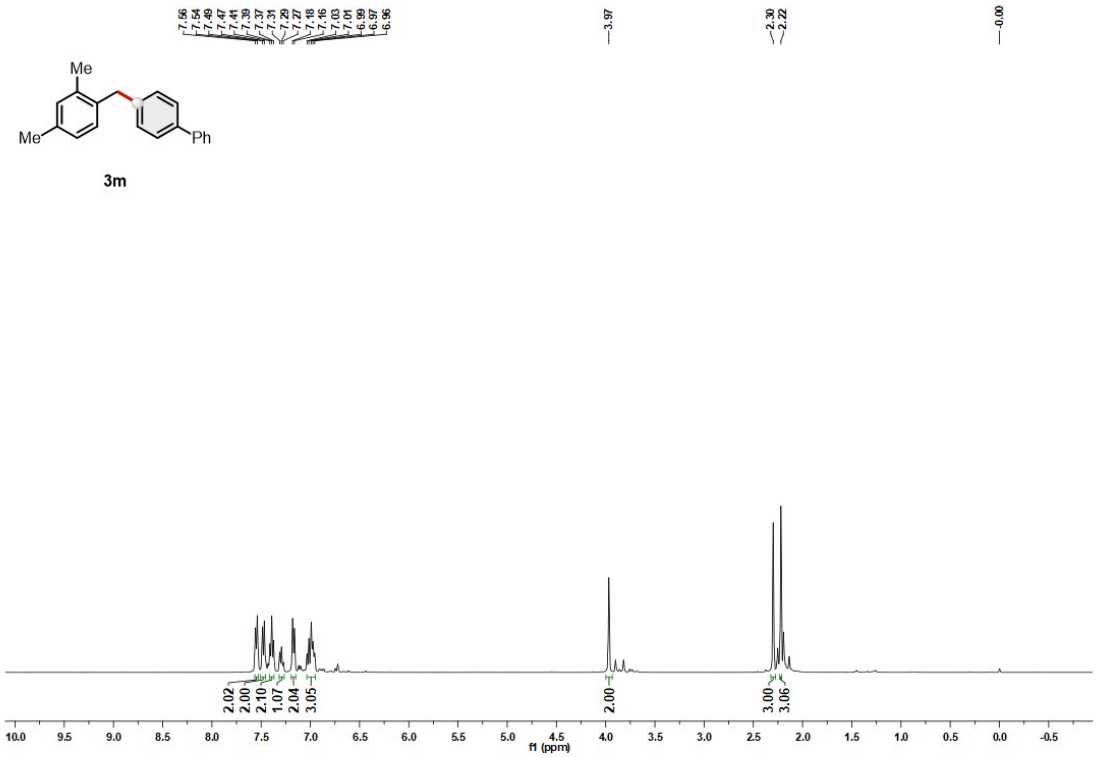
^{1}H NMR of **3l**
CDCl$_3$, 400 MHz, 298 K



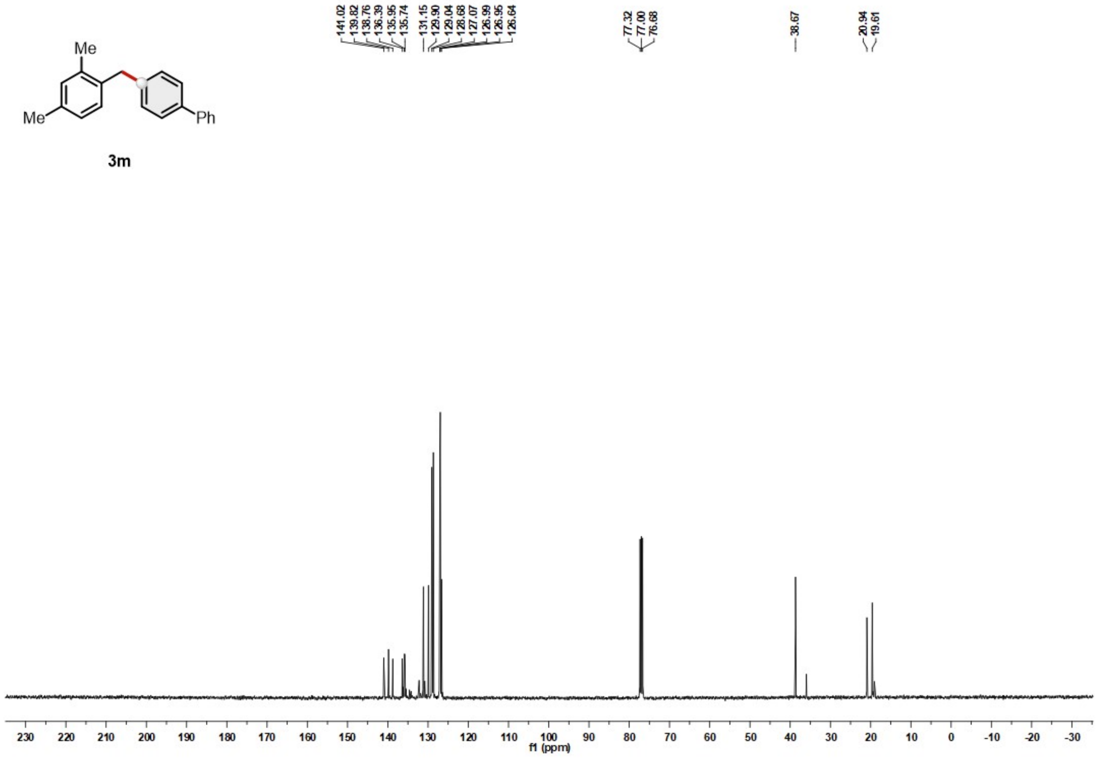
^{13}C NMR of **3l**
CDCl$_3$, 101 MHz, 298 K



^{1}H NMR of **3m**
CDCl$_3$, 400 MHz, 298 K

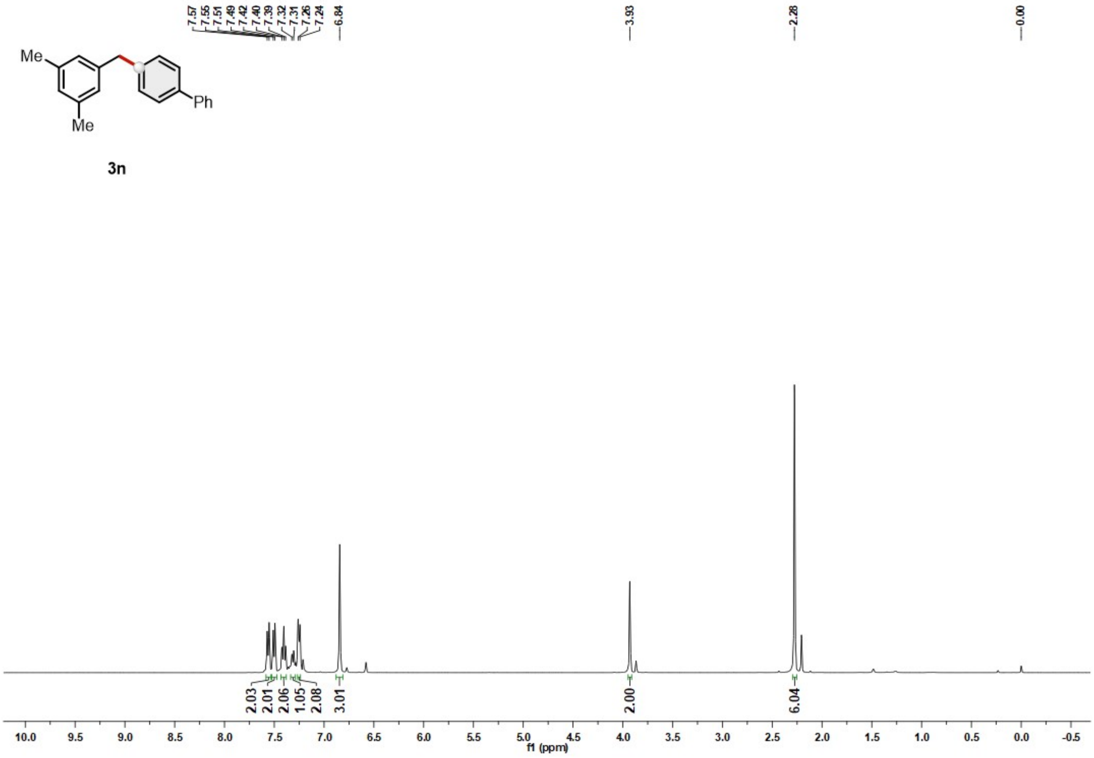


^{13}C NMR of **3m**
CDCl$_3$, 101 MHz, 298 K



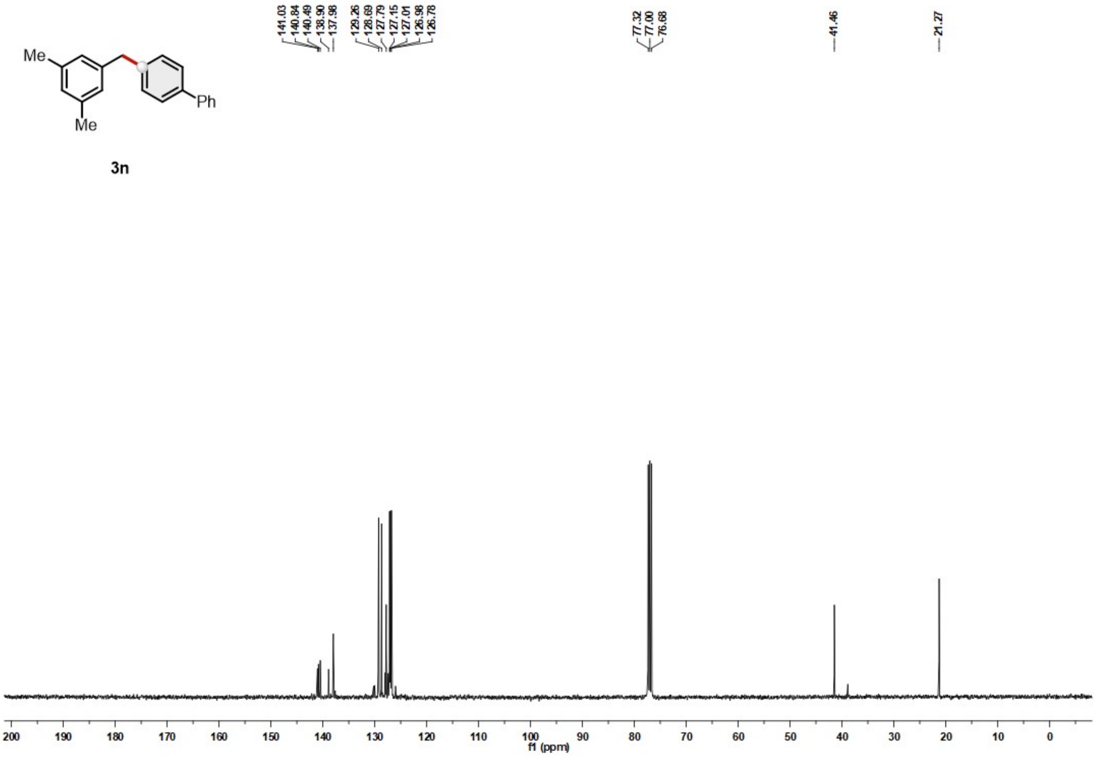
^{1}H NMR of **3n**

CDCl$_3$, 400 MHz, 298 K

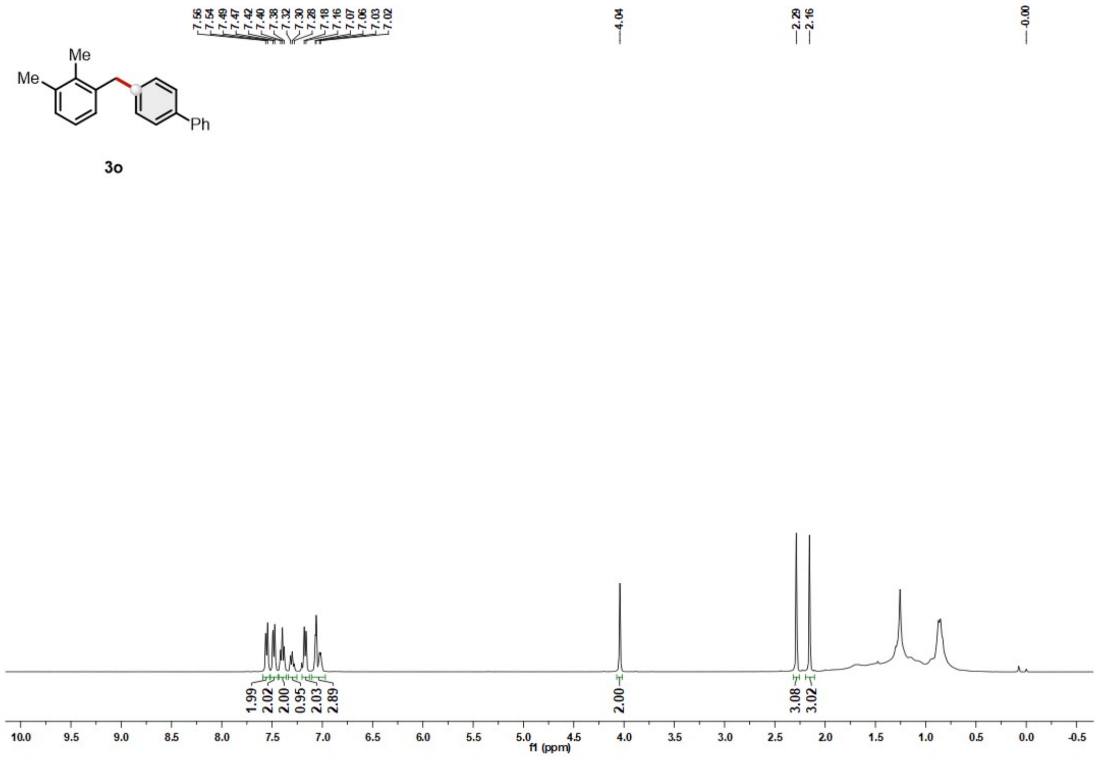


^{13}C NMR of **3n**

CDCl$_3$, 101 MHz, 298 K

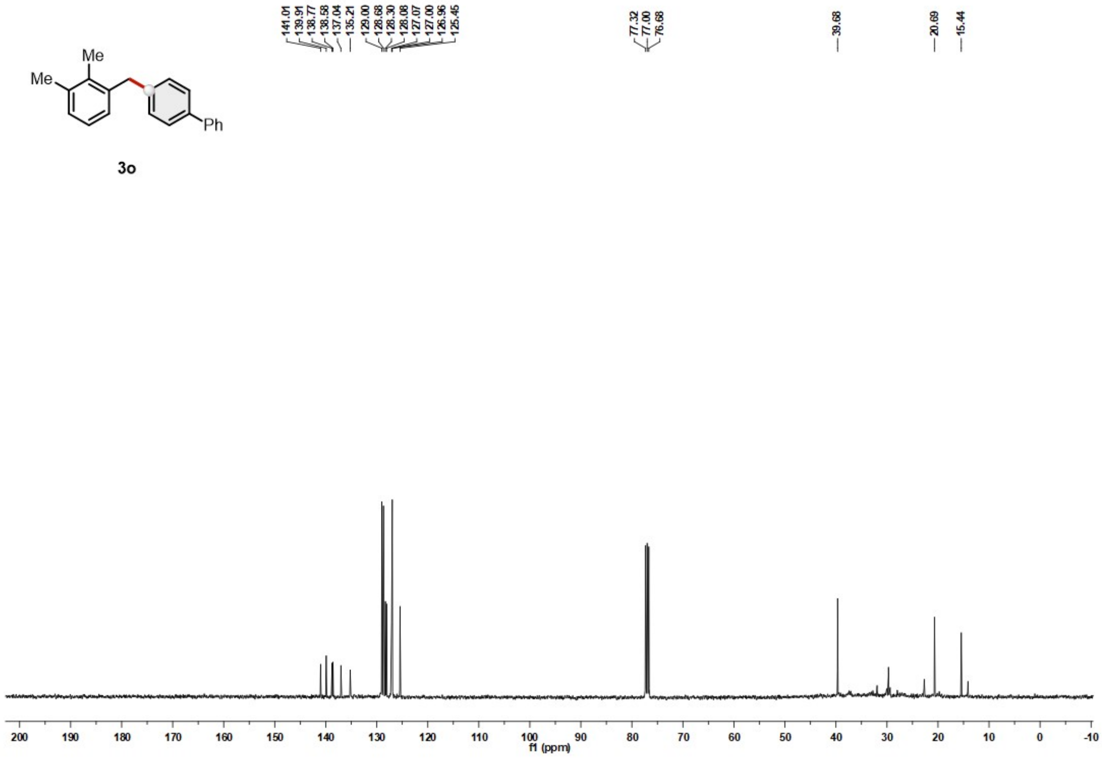


^{1}H NMR of **3o**
CDCl$_3$, 400 MHz, 298 K



3o

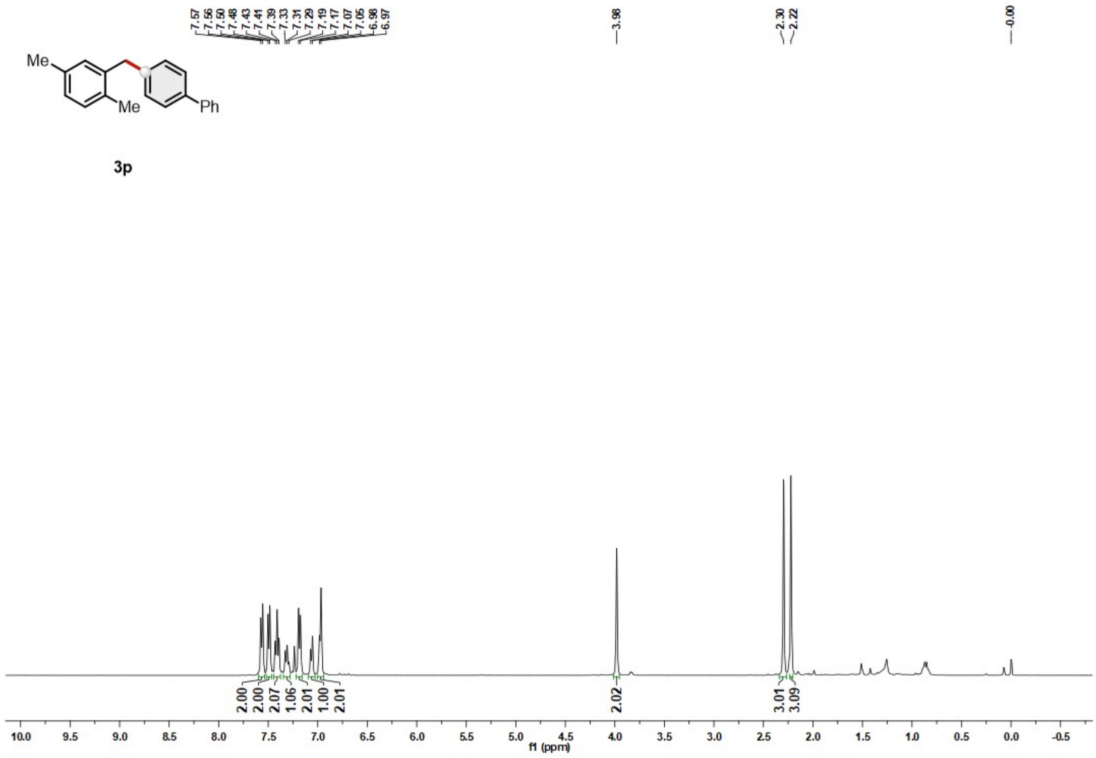
^{13}C NMR of **3o**
CDCl$_3$, 101 MHz, 298 K



3o

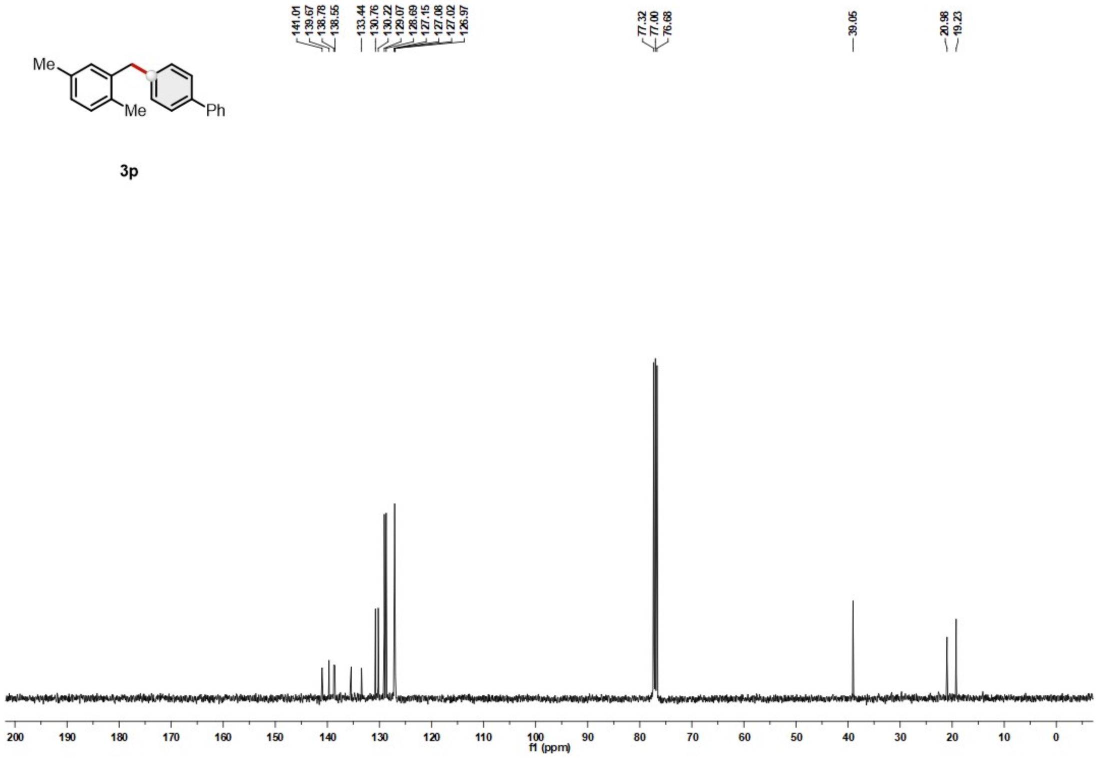
^{1}H NMR of **3p**

CDCl$_3$, 400 MHz, 298 K



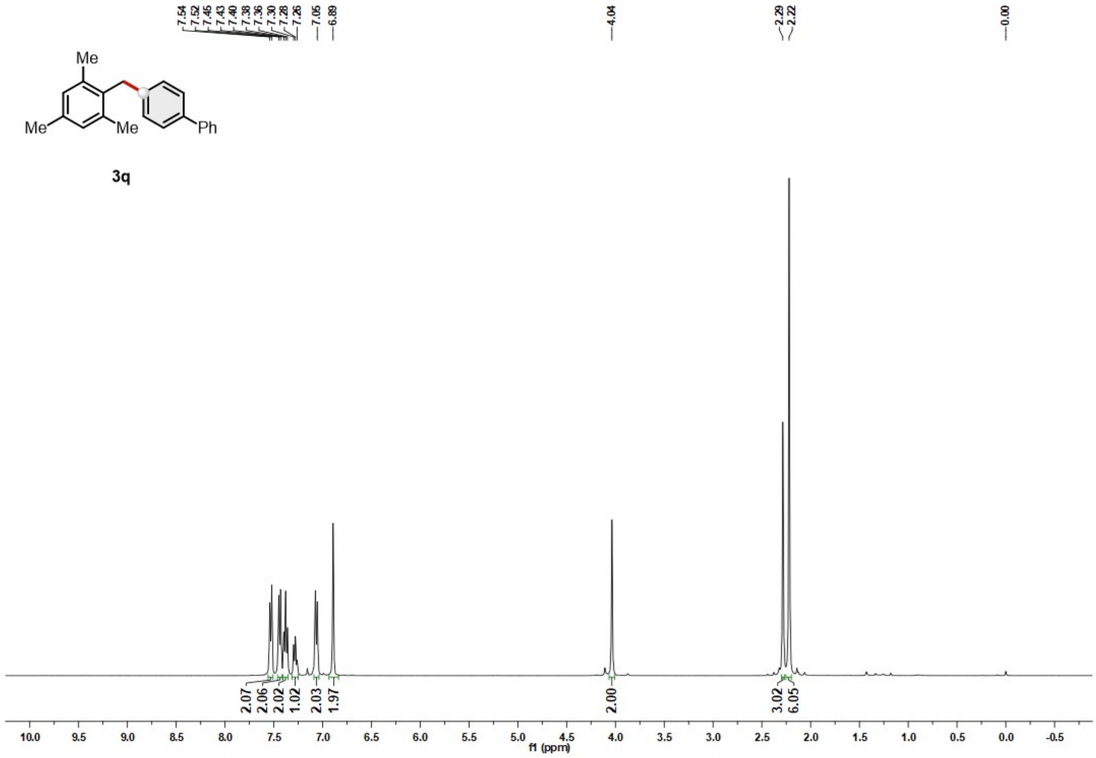
^{13}C NMR of **3p**

CDCl$_3$, 101 MHz, 298 K



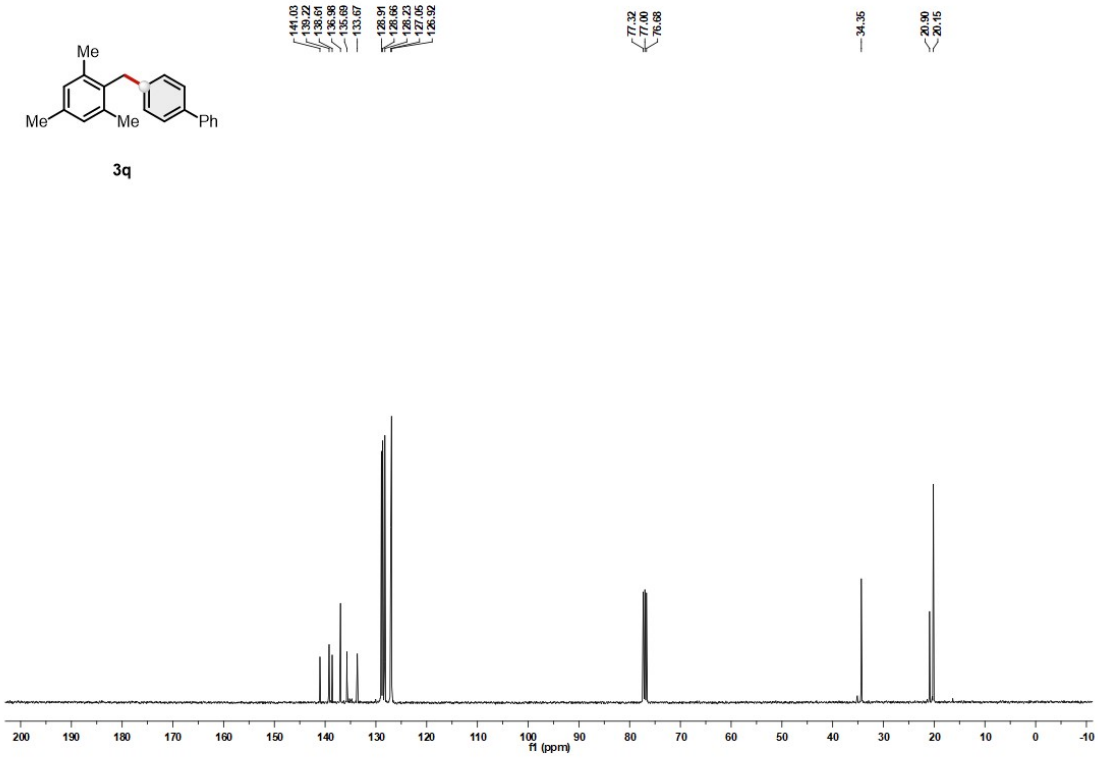
^{1}H NMR of **3q**

CDCl$_3$, 400 MHz, 298 K



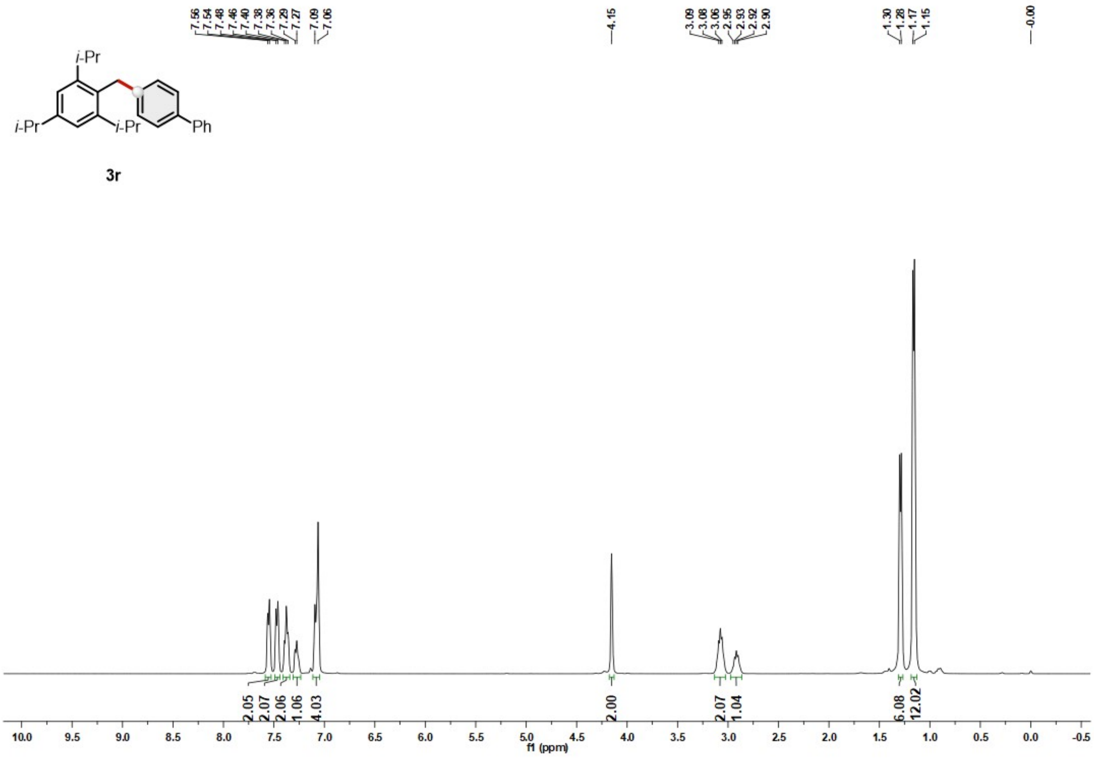
^{13}C NMR of **3q**

CDCl$_3$, 101 MHz, 298 K



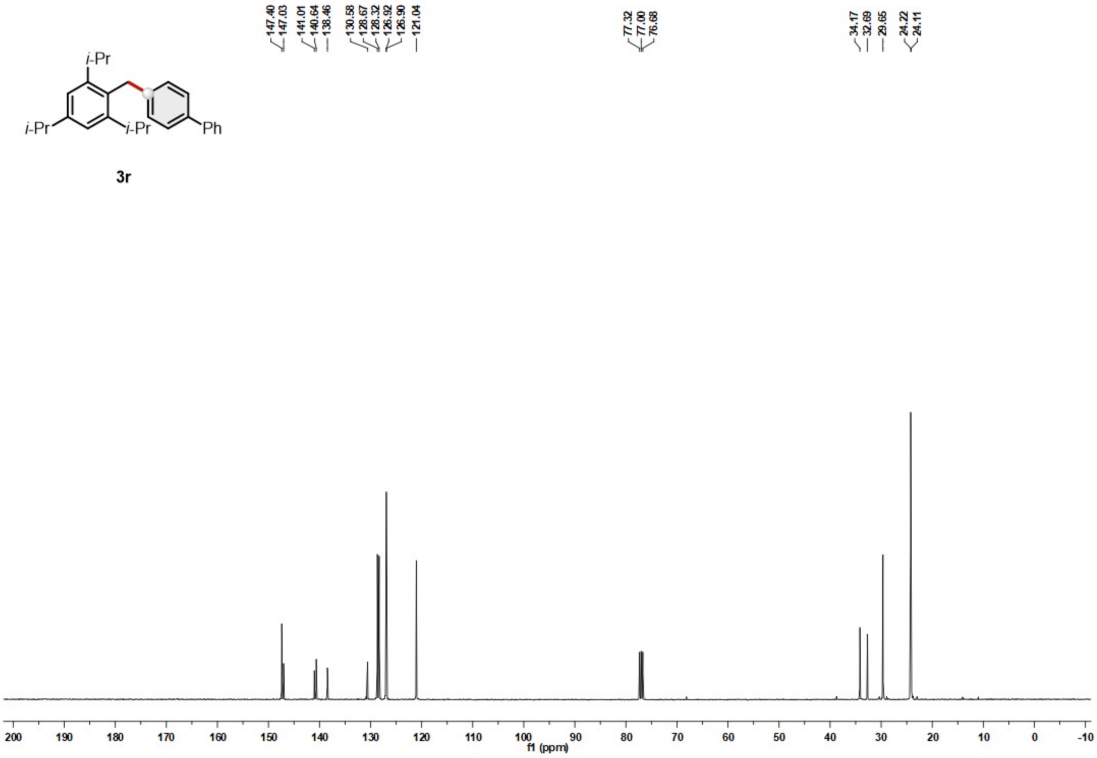
^{1}H NMR of **3r**

CDCl$_3$, 400 MHz, 298 K

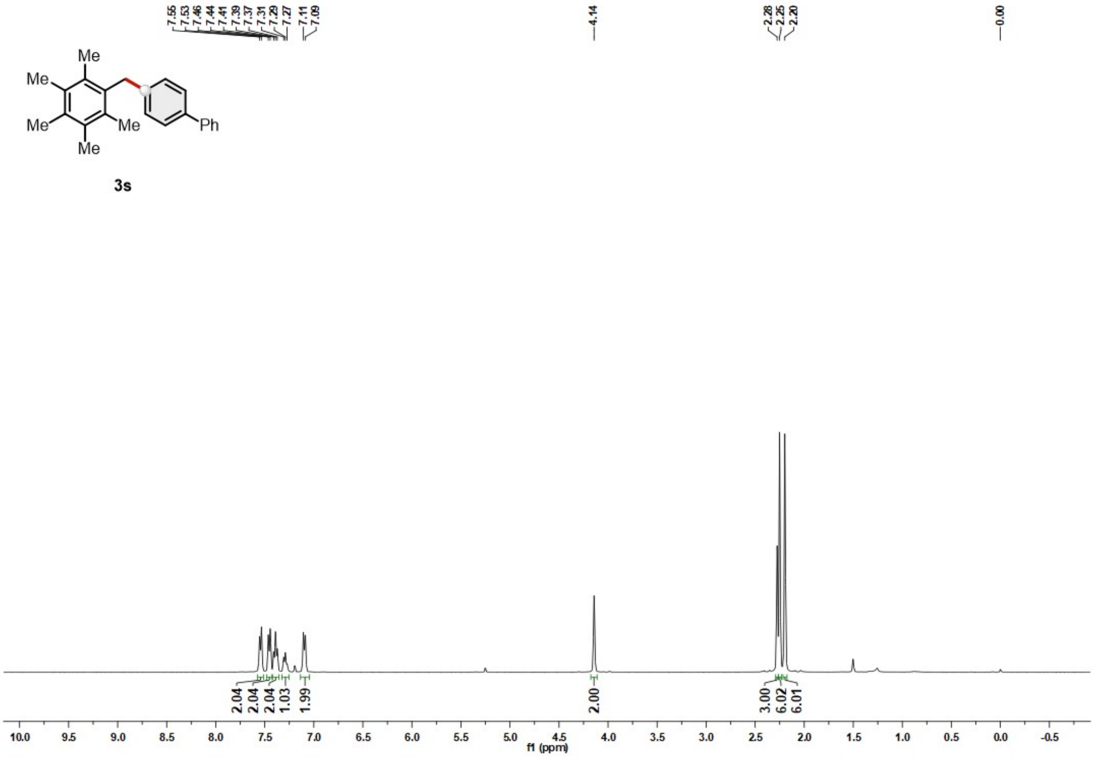


^{13}C NMR of **3r**

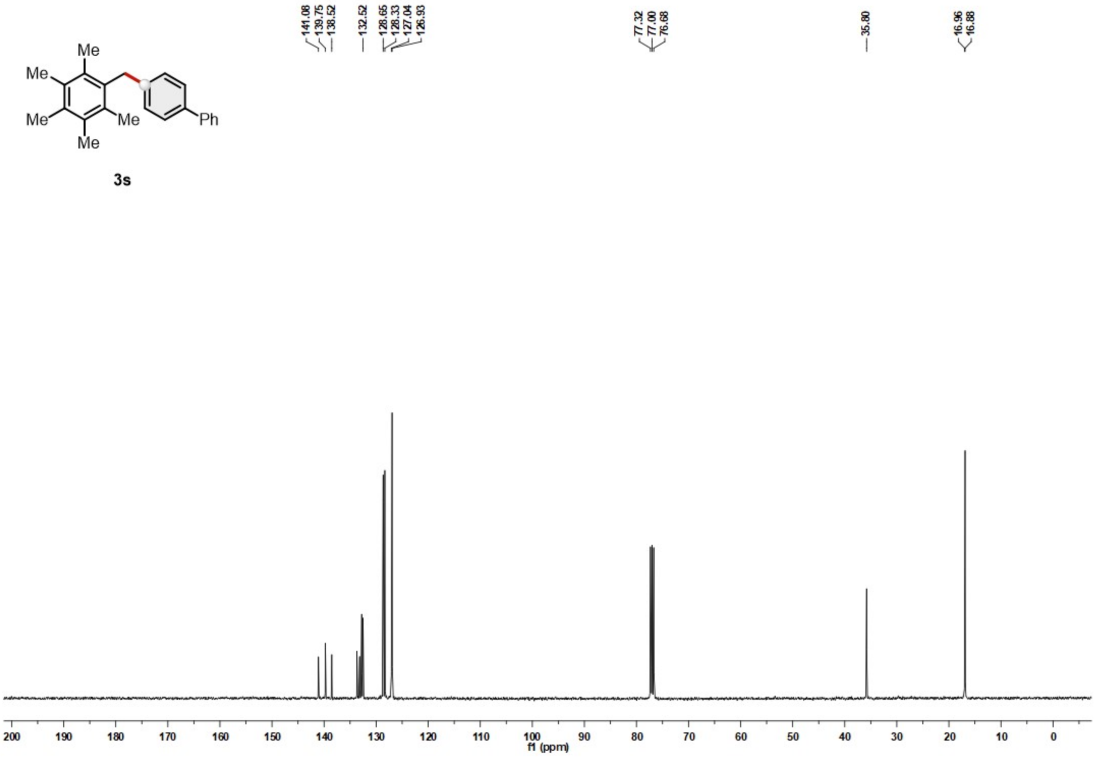
CDCl$_3$, 101 MHz, 298 K



^{1}H NMR of **3s**
CDCl$_3$, 400 MHz, 298 K



^{13}C NMR of **3s**
CDCl$_3$, 101 MHz, 298 K



^{1}H NMR of **3t**
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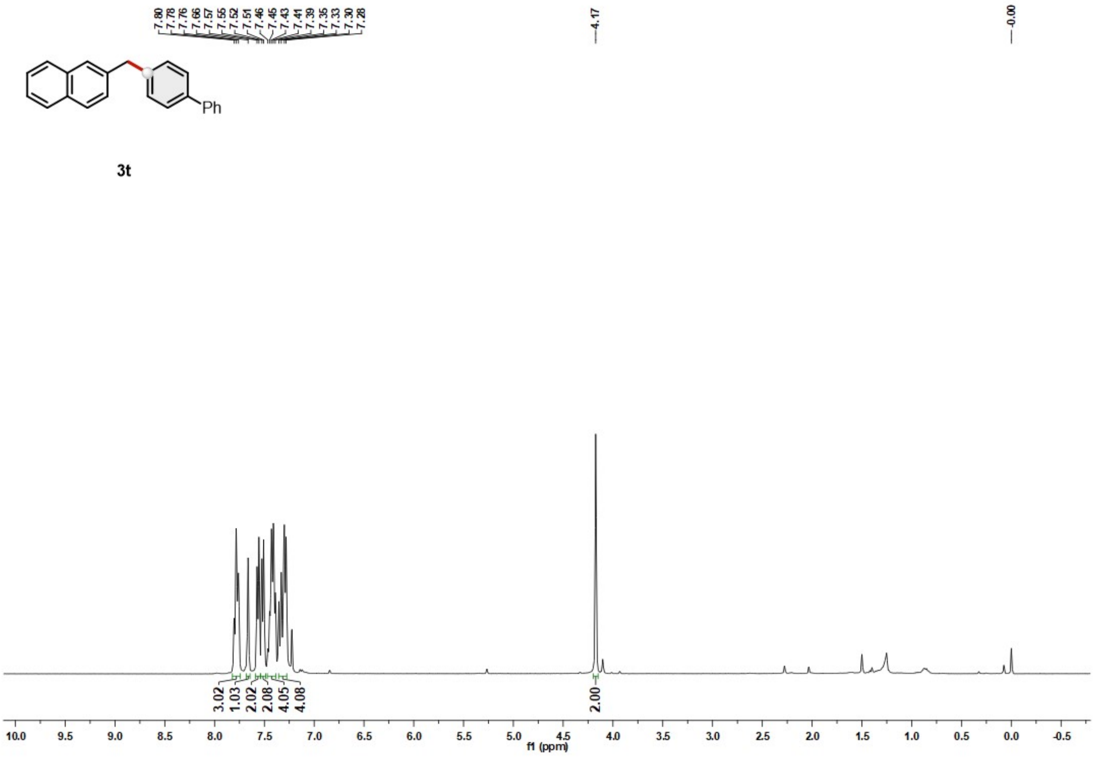
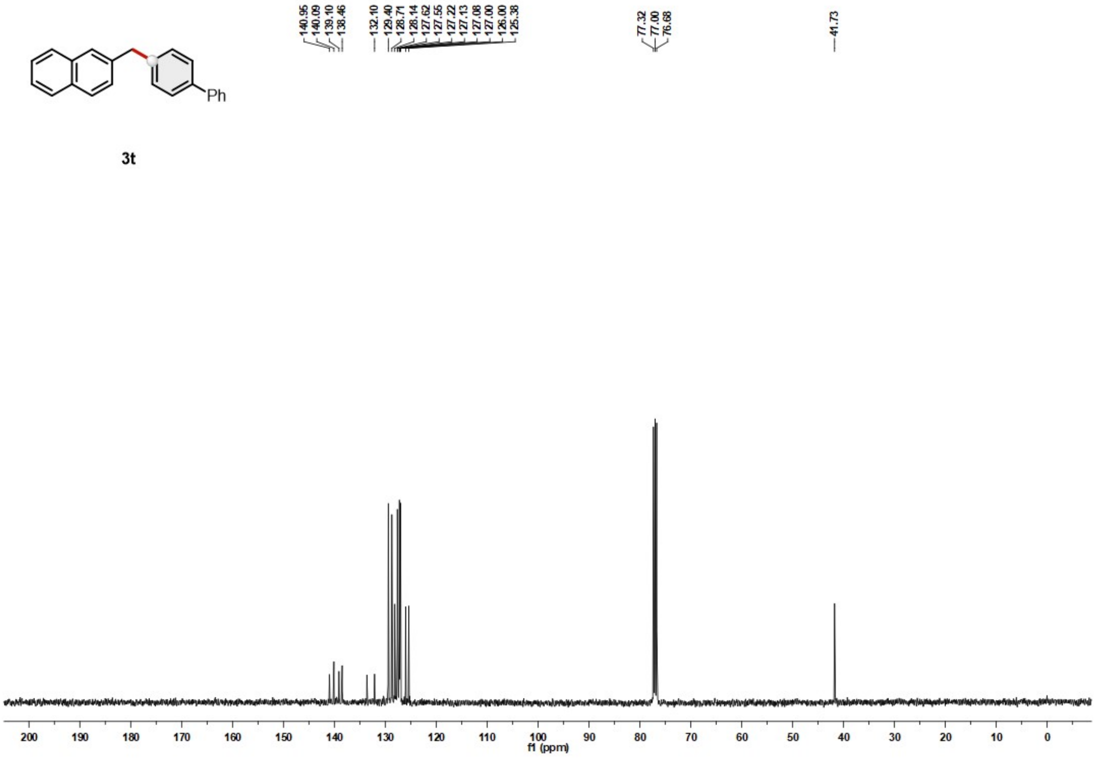
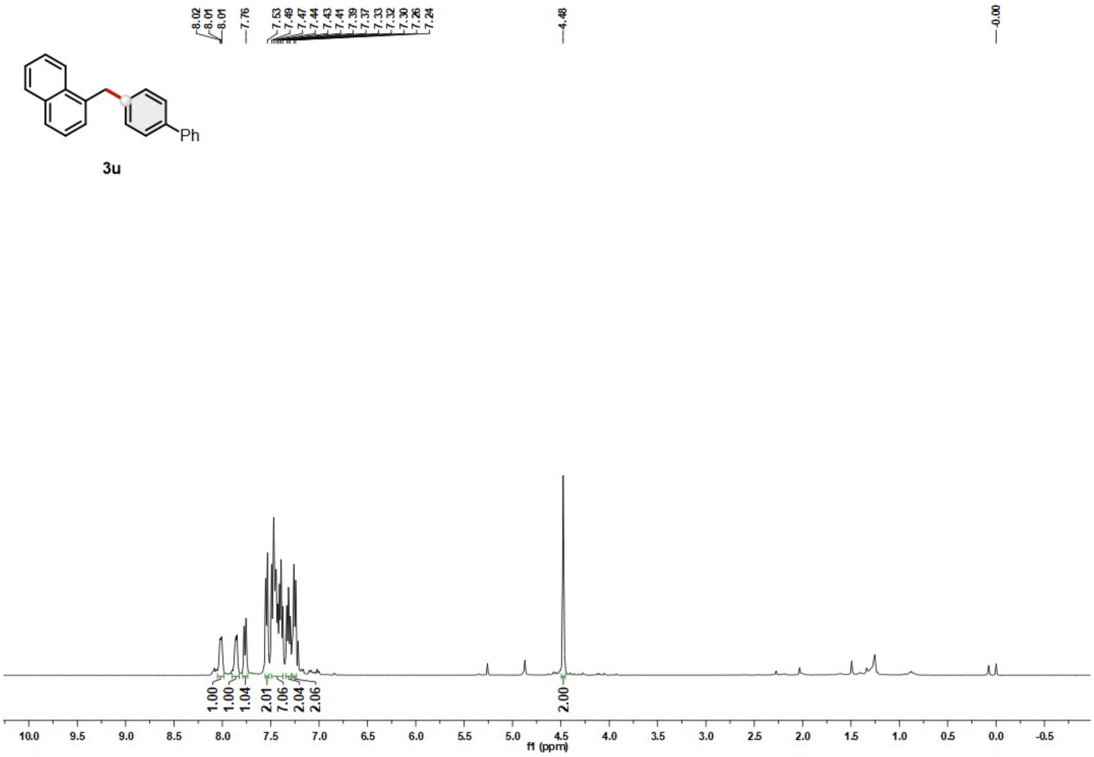


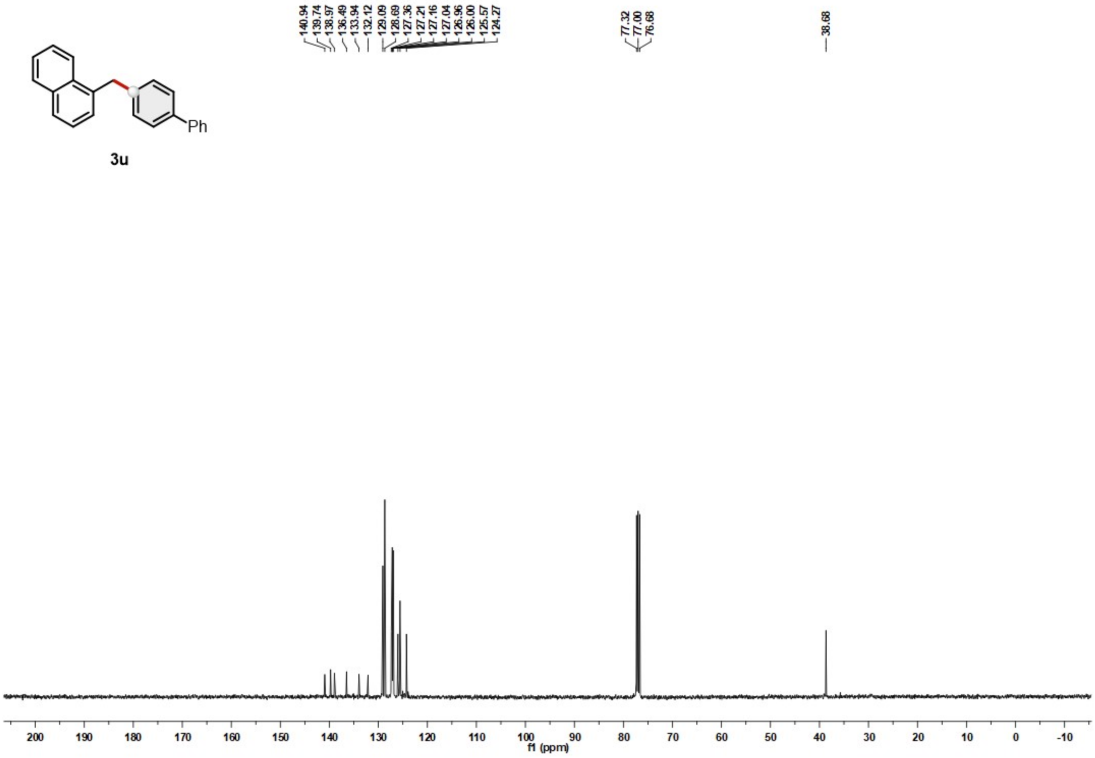
^{13}C NMR of **3t**
CDCl$_3$, 101 MHz, 298 K



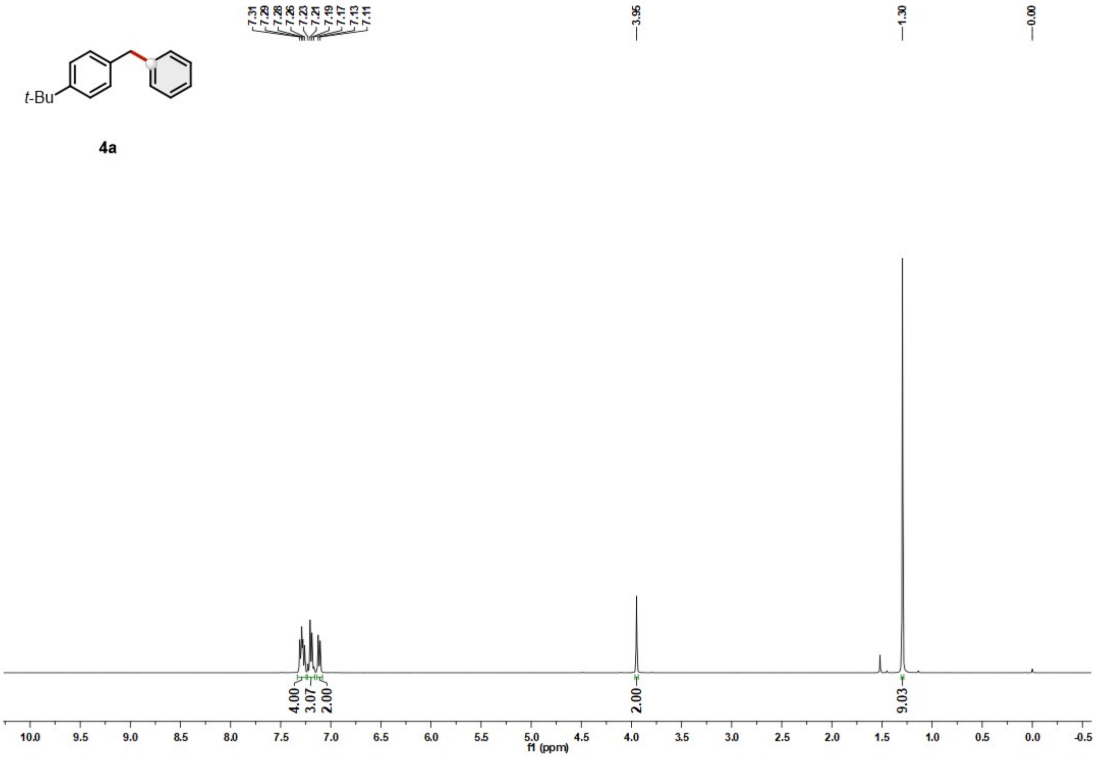
^{1}H NMR of **3u**
CDCl$_3$, 400 MHz, 298 K



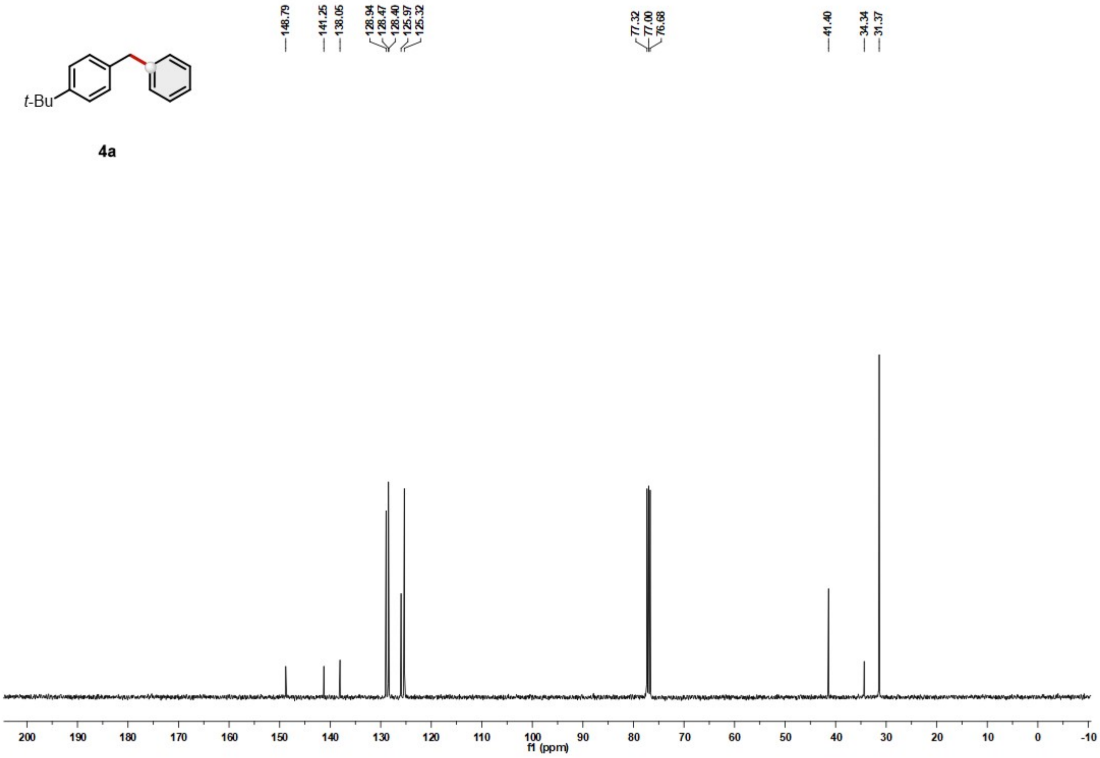
^{13}C NMR of **3u**
CDCl$_3$, 101 MHz, 298 K



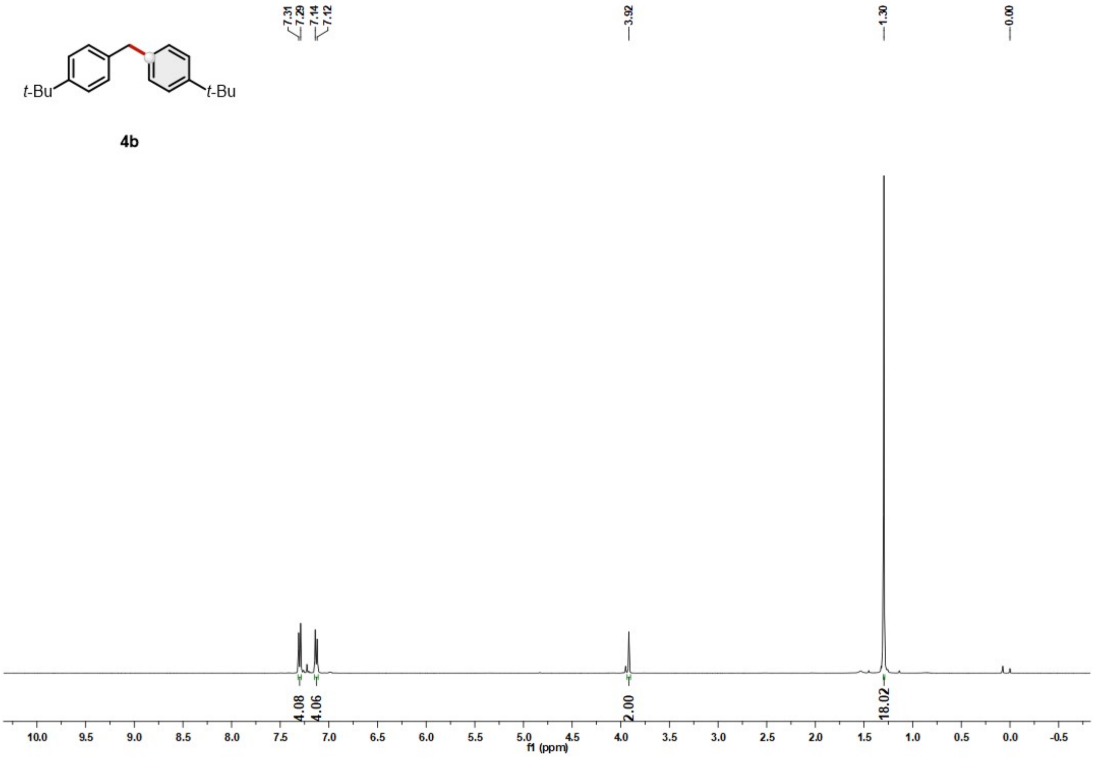
^{1}H NMR of **4a**
$CDCl_3$, 400 MHz, 298 K



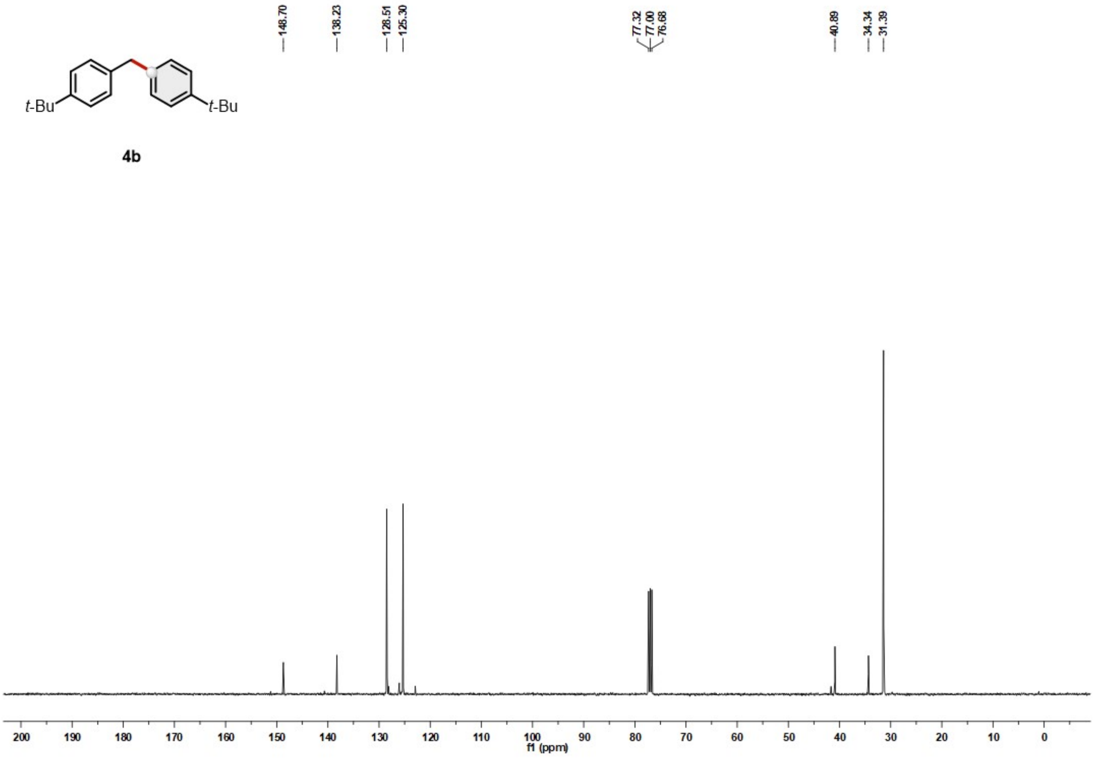
^{13}C NMR of **4a**
$CDCl_3$, 101 MHz, 298 K



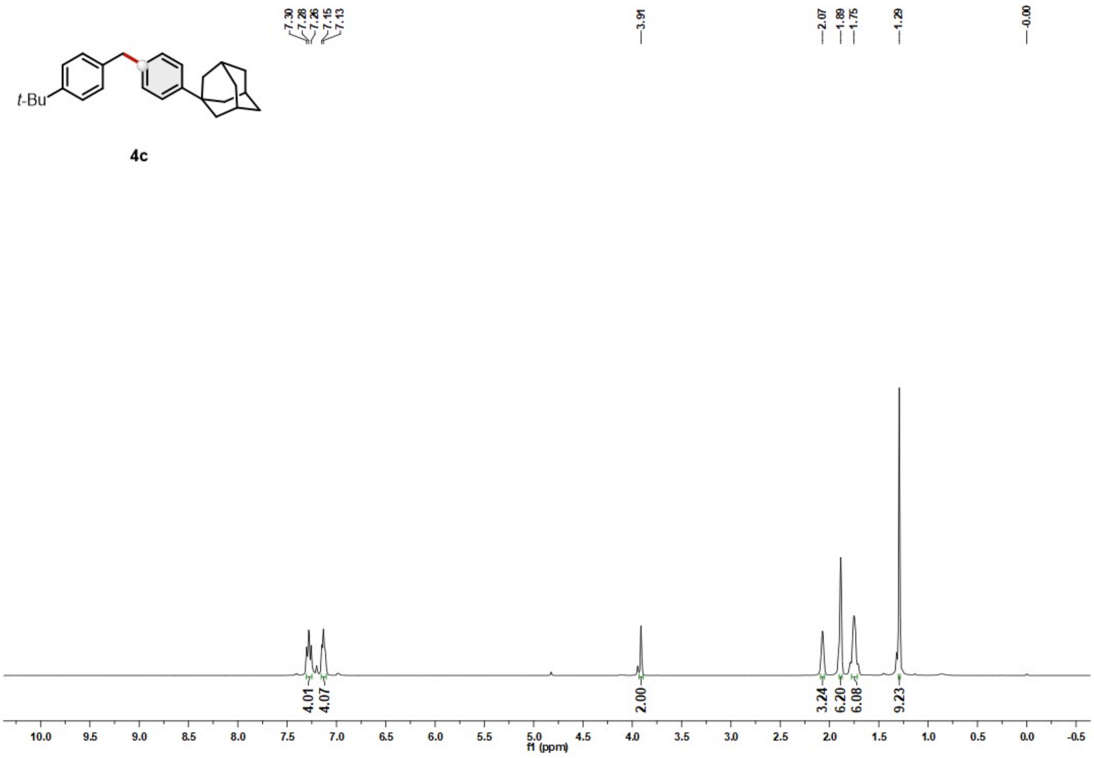
^{1}H NMR of **4b**
CDCl$_3$, 400 MHz, 298 K



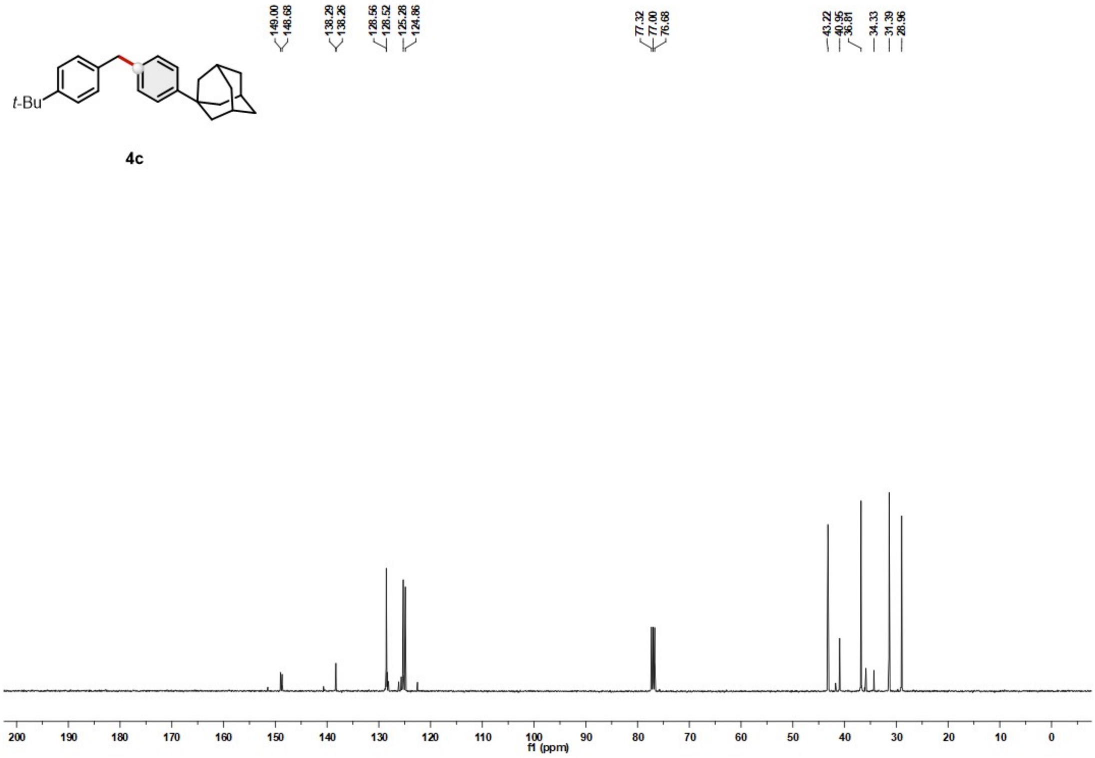
^{13}C NMR of **4b**
CDCl$_3$, 101 MHz, 298 K



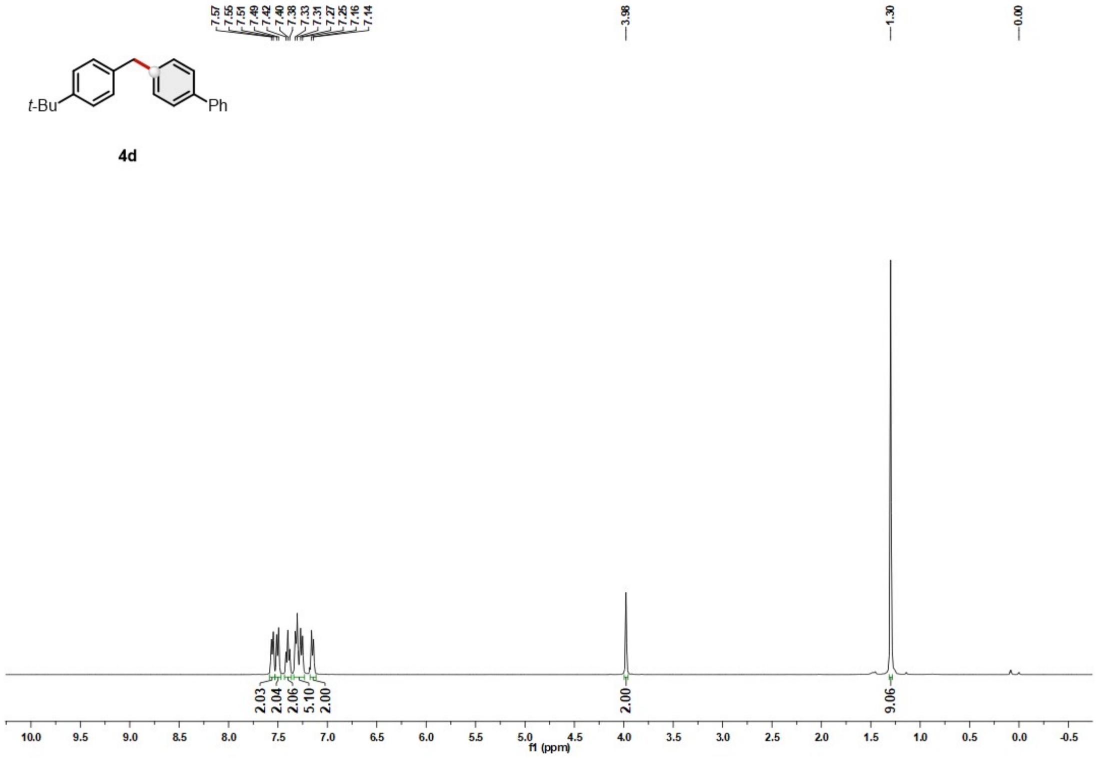
^{1}H NMR of **4c**
CDCl$_3$, 400 MHz, 298 K



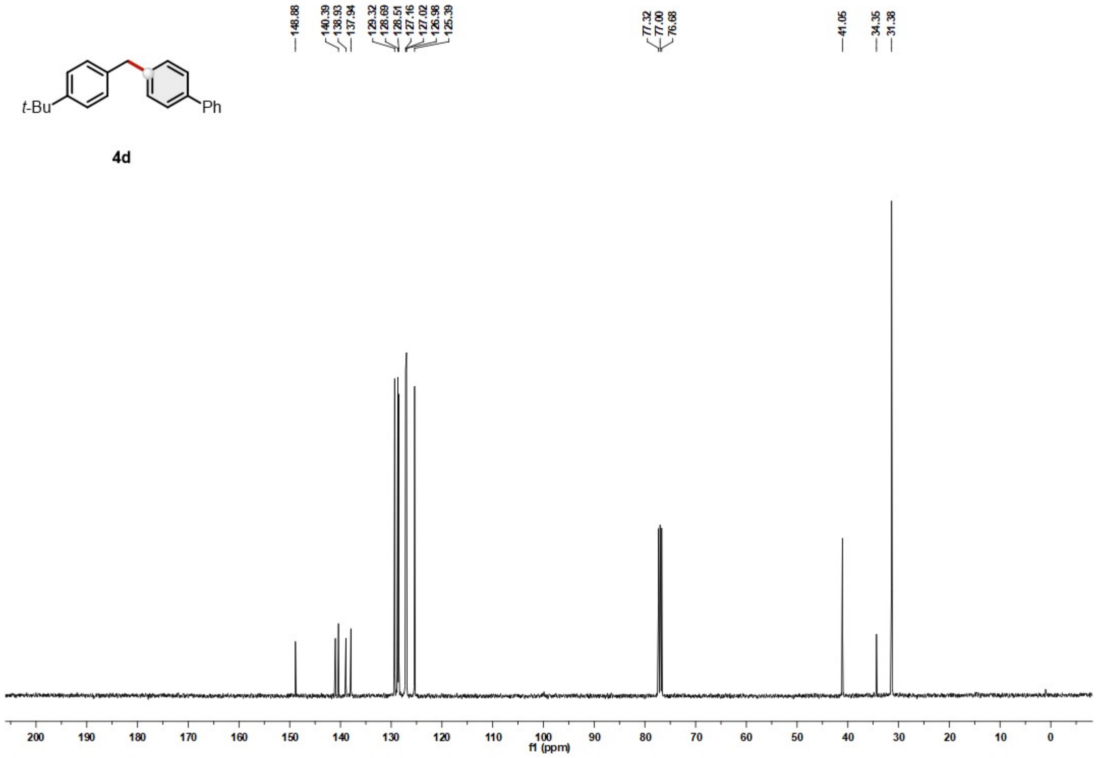
^{13}C NMR of **4c**
CDCl$_3$, 101 MHz, 298 K



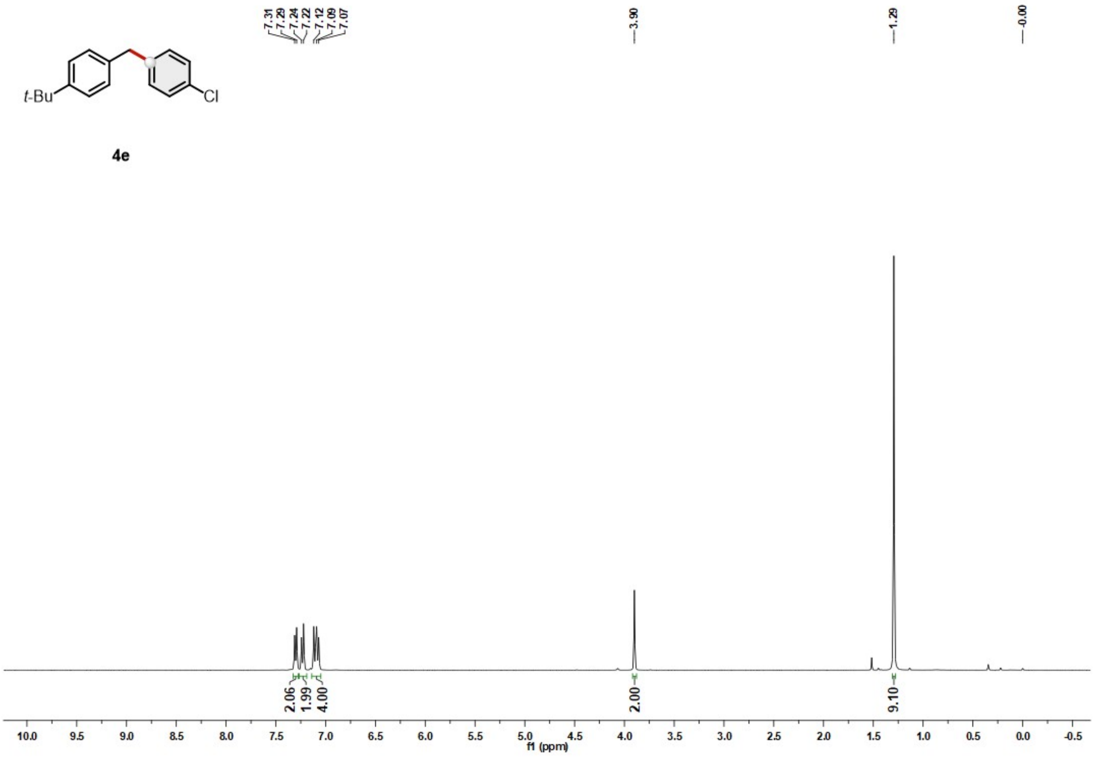
^{1}H NMR of **4d**
CDCl$_3$, 400 MHz, 298 K



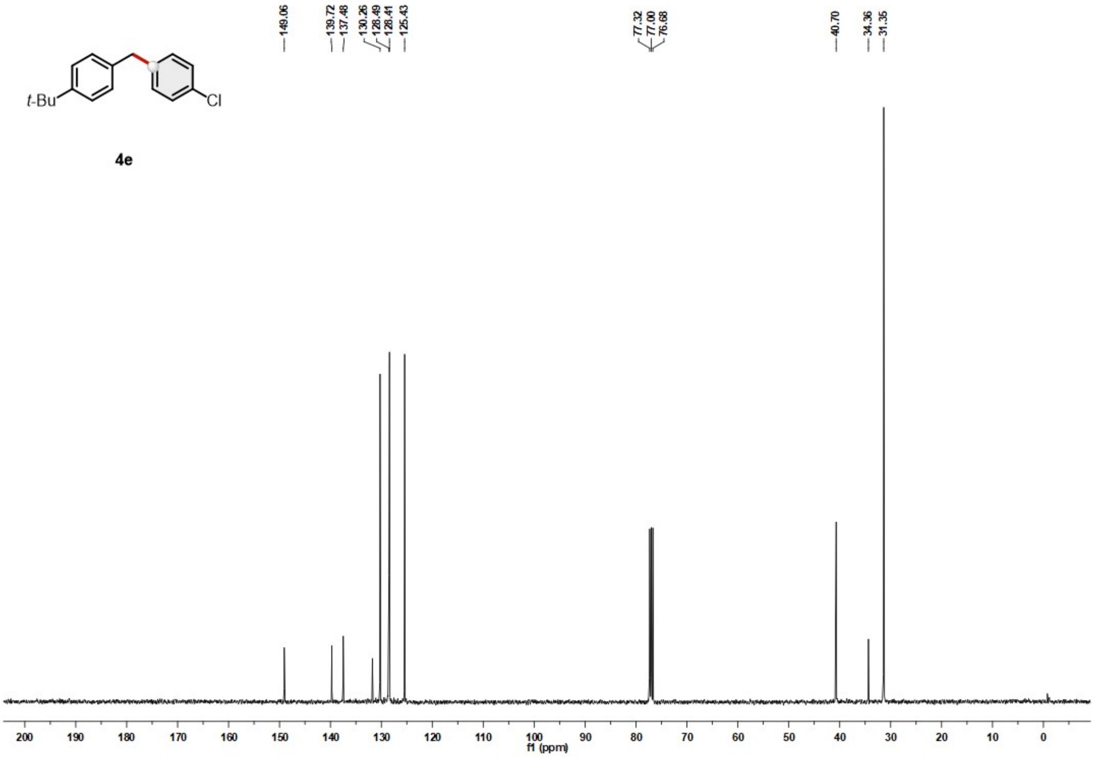
^{13}C NMR of **4d**
CDCl$_3$, 101 MHz, 298 K



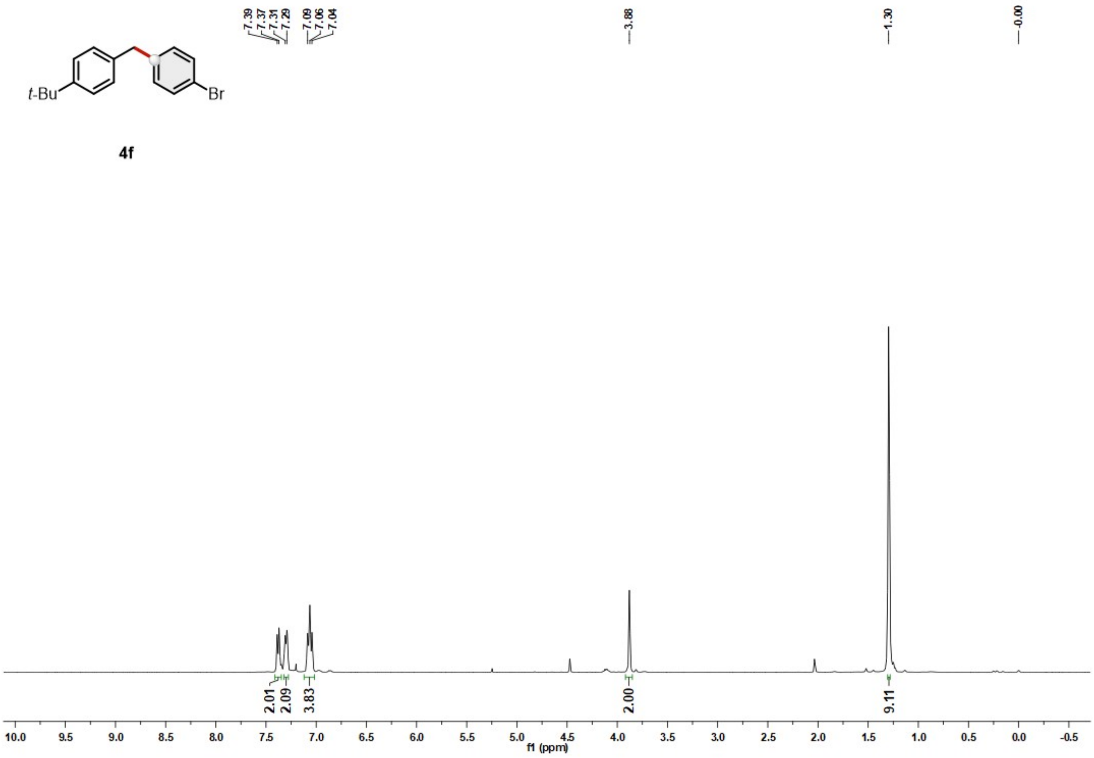
^{1}H NMR of **4e**
CDCl$_3$, 400 MHz, 298 K



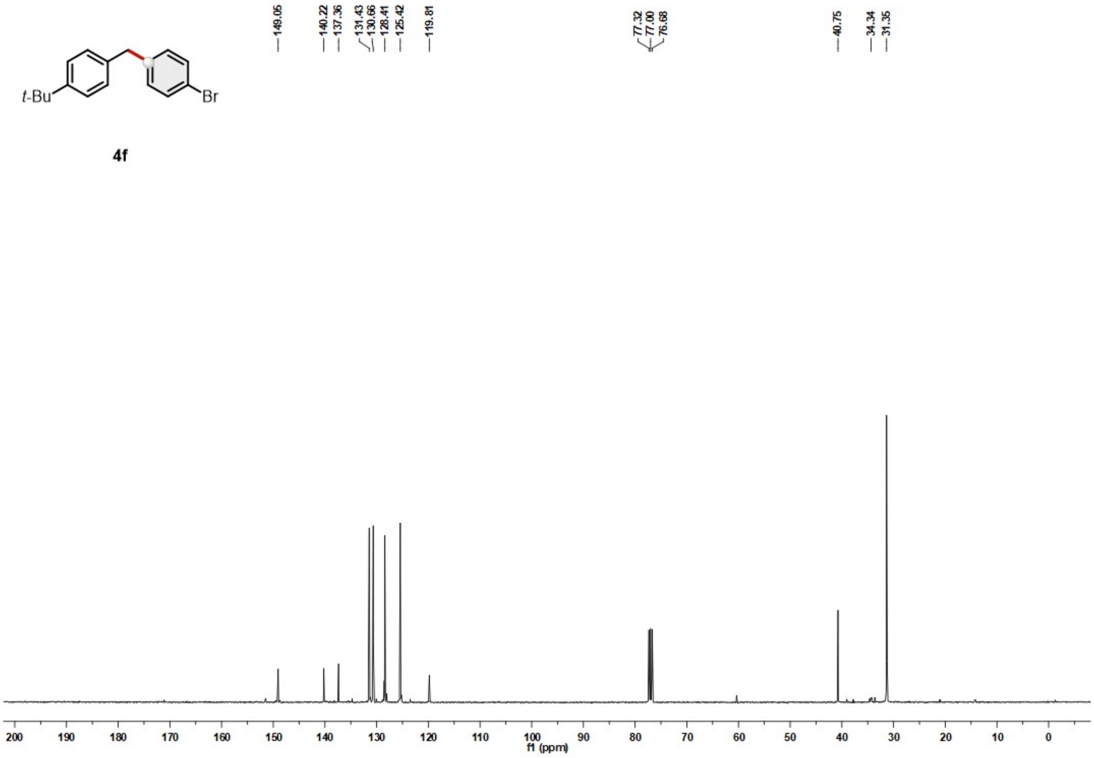
^{13}C NMR of **4e**
CDCl$_3$, 101 MHz, 298 K



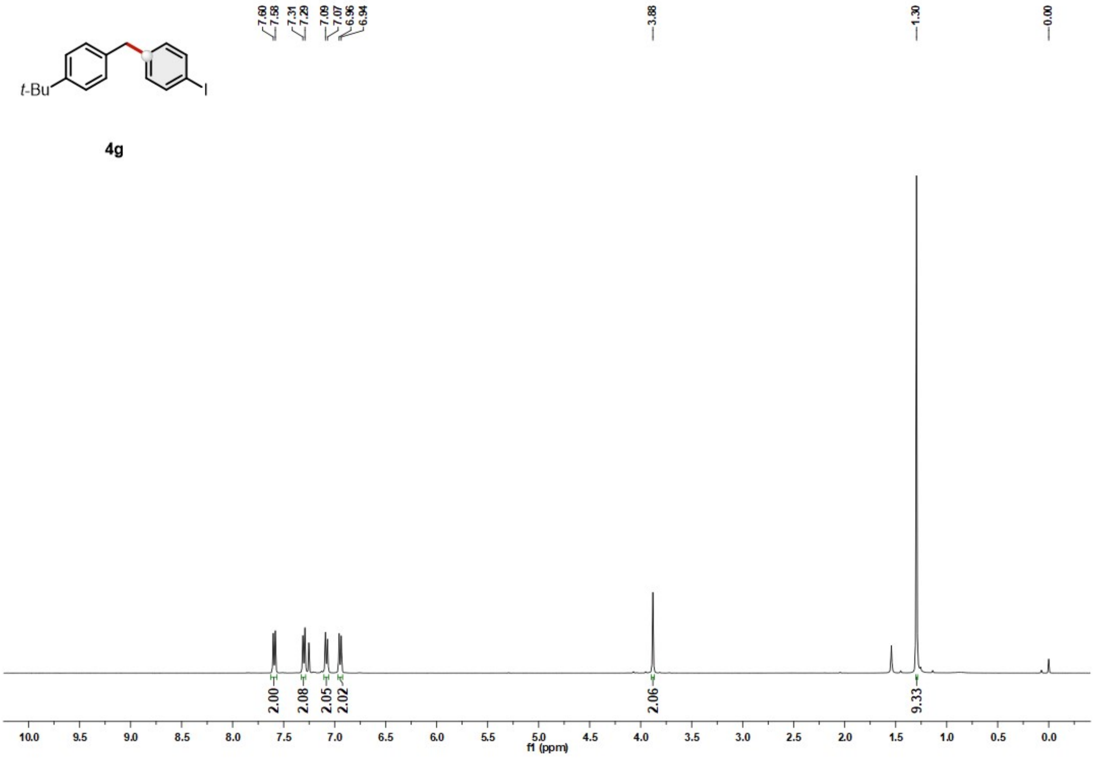
^{1}H NMR of **4f**
CDCl$_3$, 400 MHz, 298 K



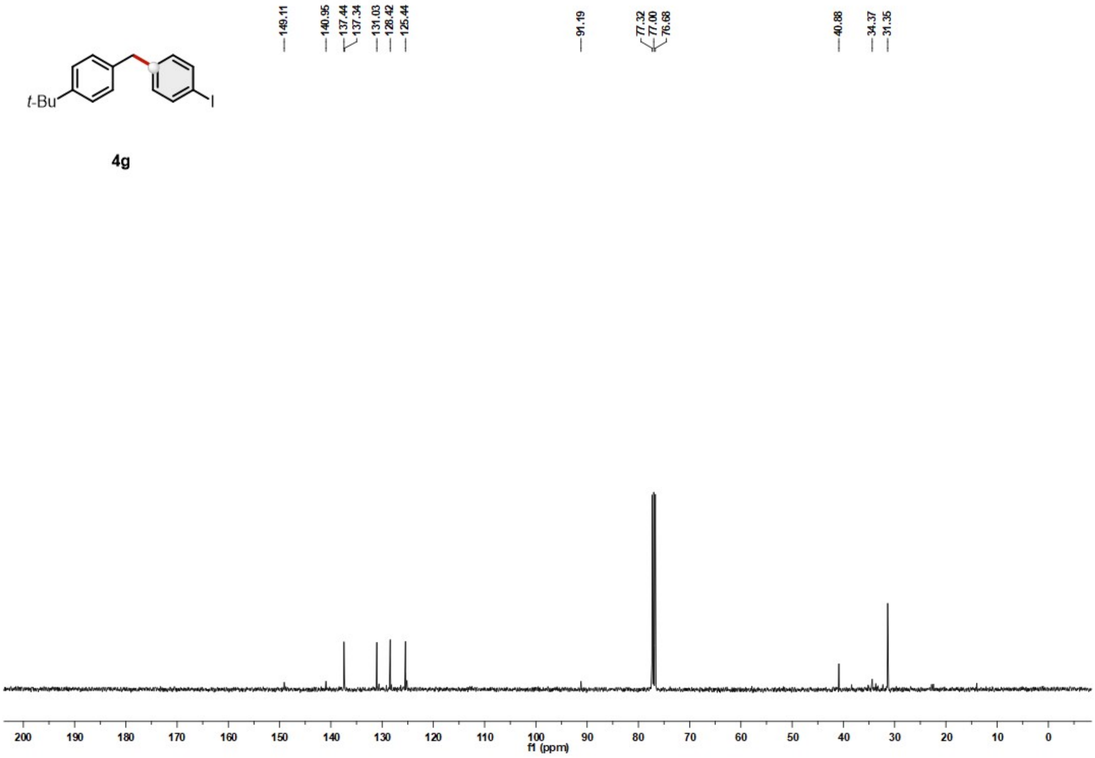
^{13}C NMR of **4f**
CDCl$_3$, 101 MHz, 298 K



^{1}H NMR of **4g**
$CDCl_3$, 400 MHz, 298 K

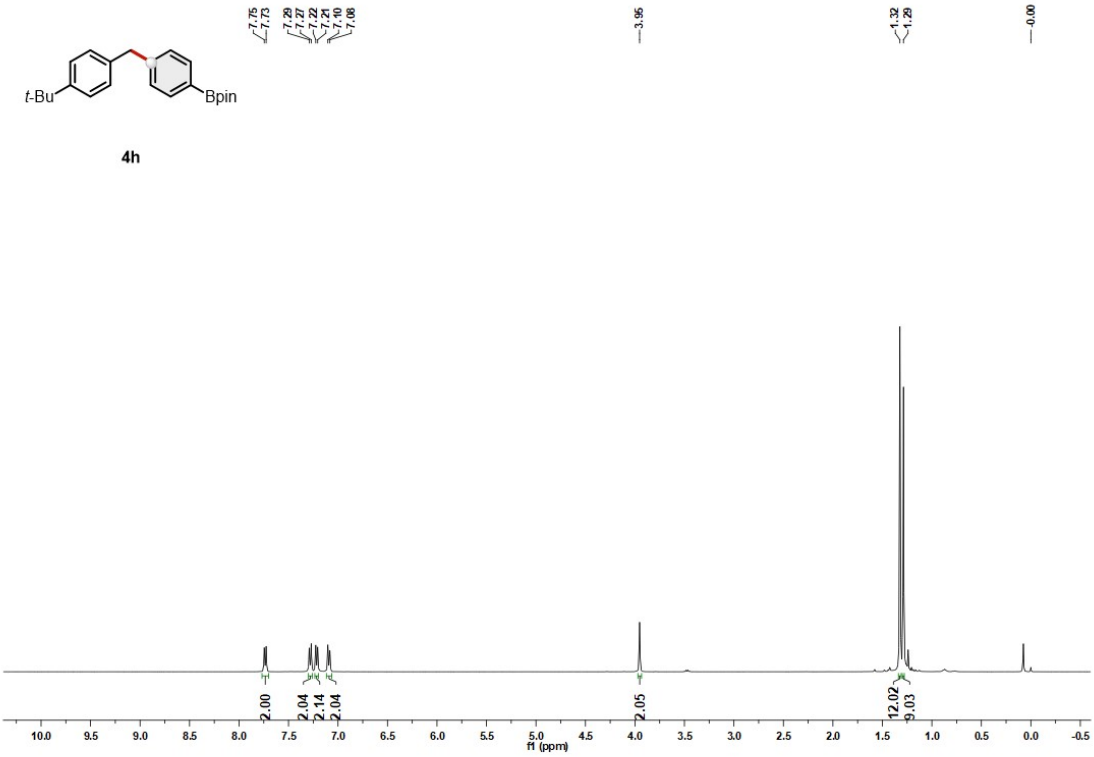


^{13}C NMR of **4g**
$CDCl_3$, 101 MHz, 298 K



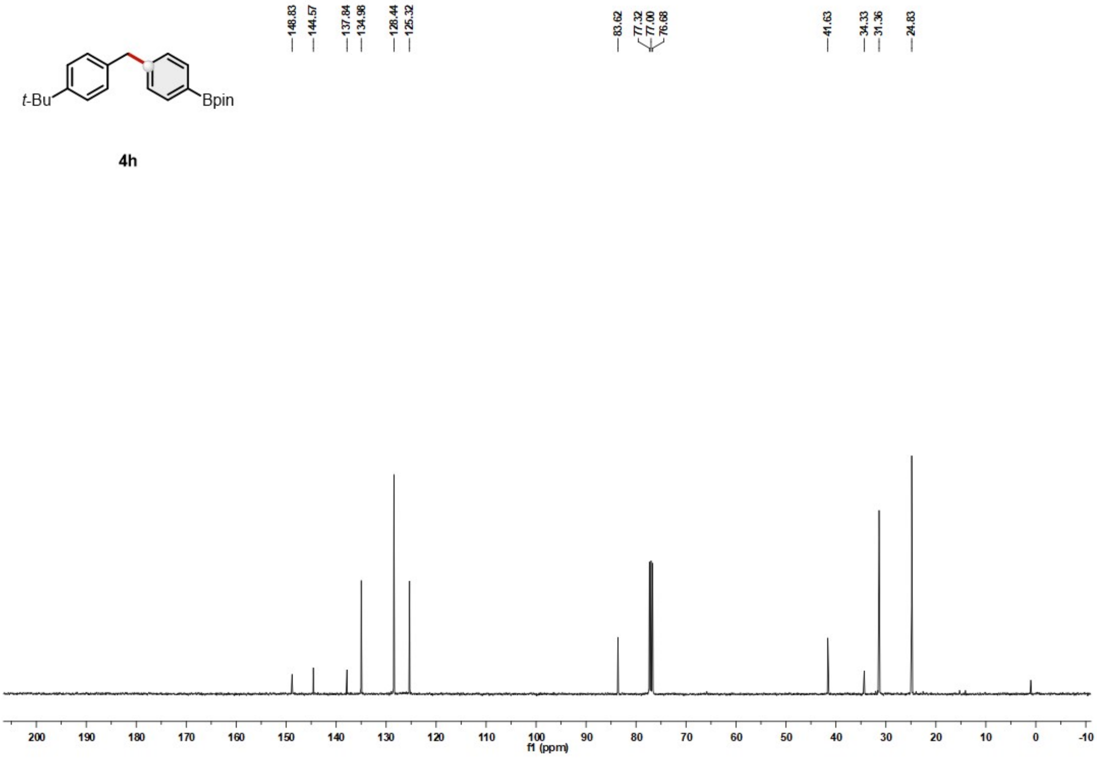
^{1}H NMR of **4h**

CDCl$_3$, 400 MHz, 298 K



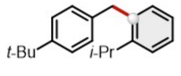
^{13}C NMR of **4h**

CDCl$_3$, 101 MHz, 298 K

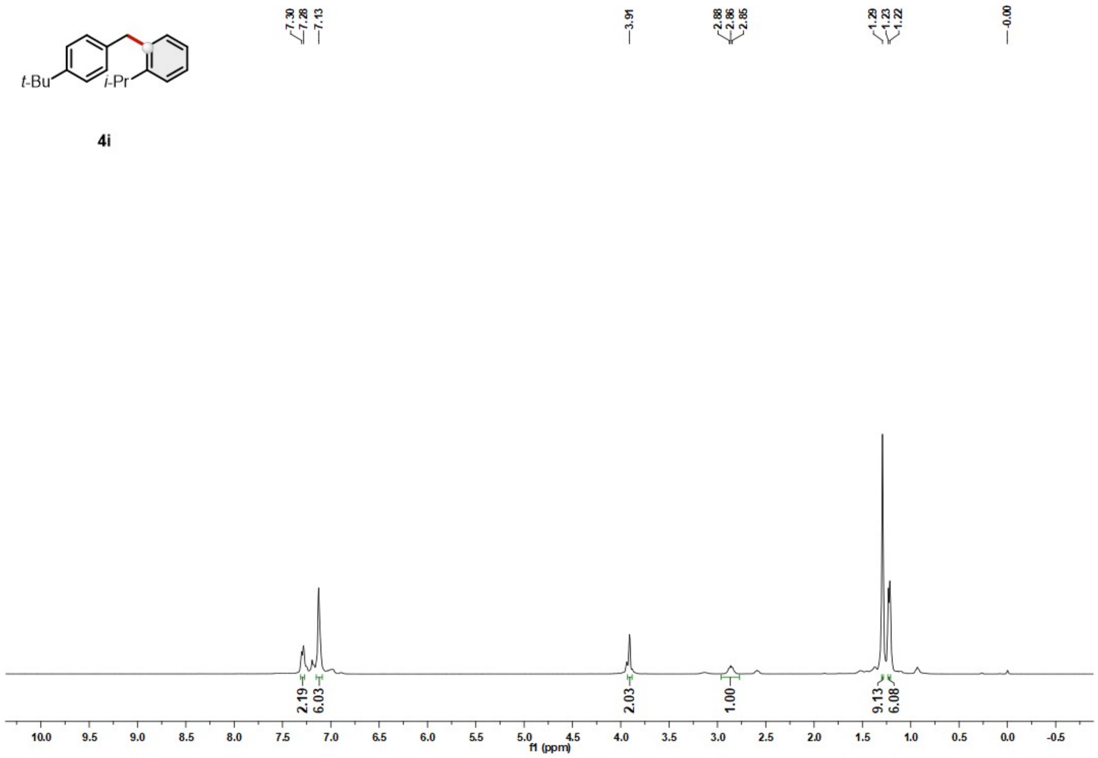


^{1}H NMR of **4i**

CDCl$_3$, 400 MHz, 298 K

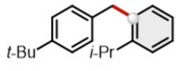


4i

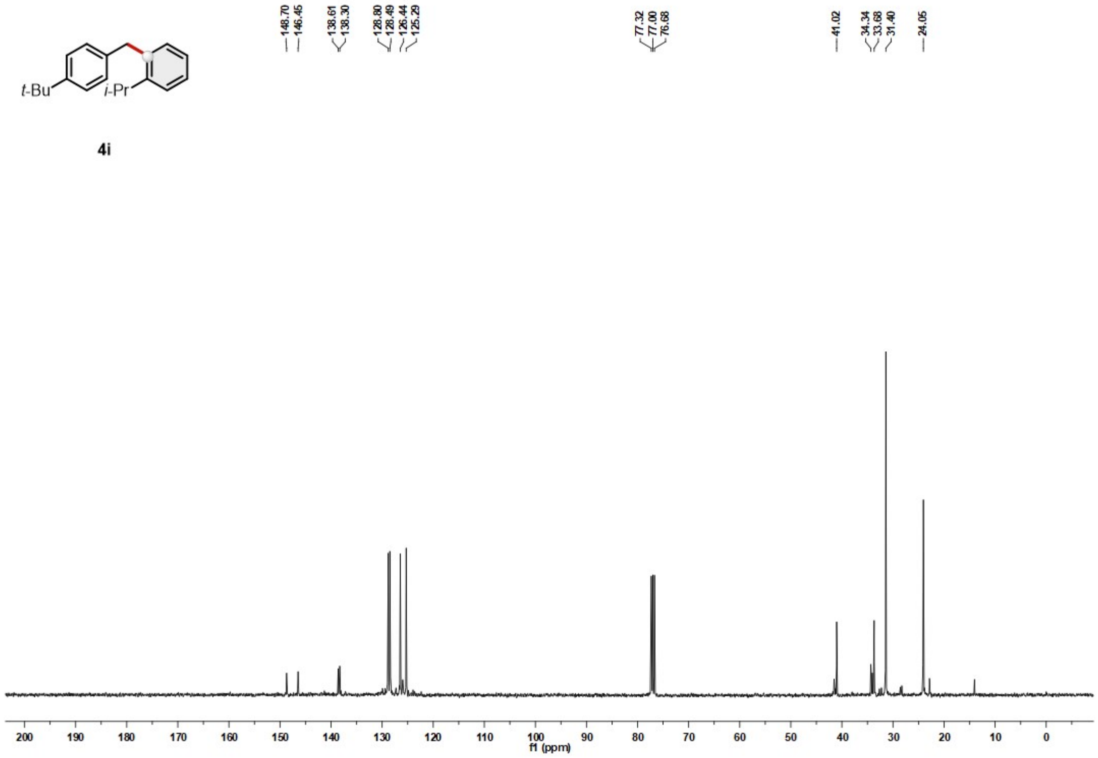


^{13}C NMR of **4i**

CDCl$_3$, 101 MHz, 298 K

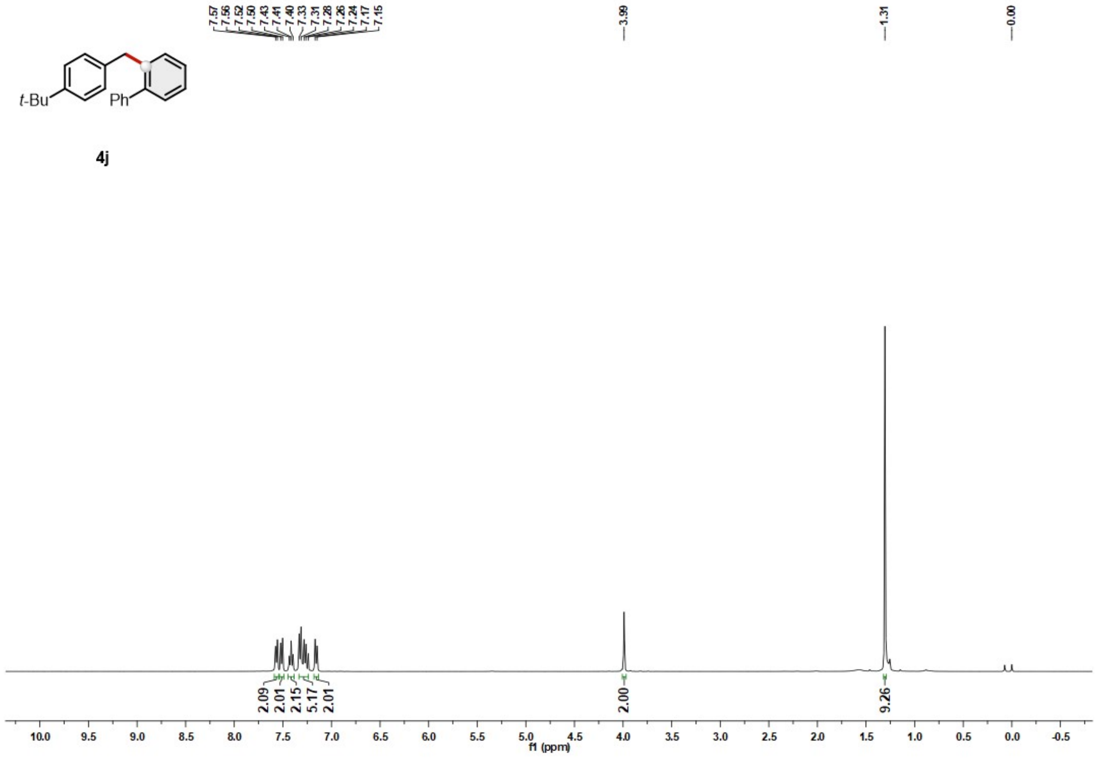


4i



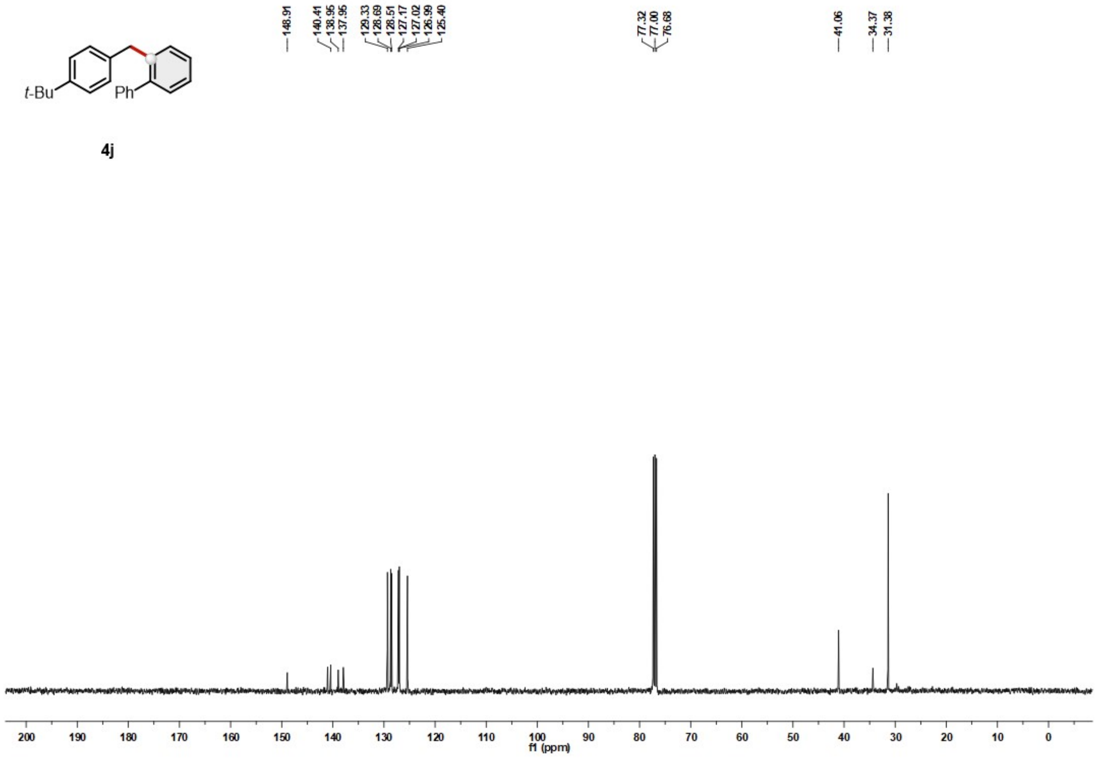
^{1}H NMR of **4j**

CDCl$_3$, 400 MHz, 298 K

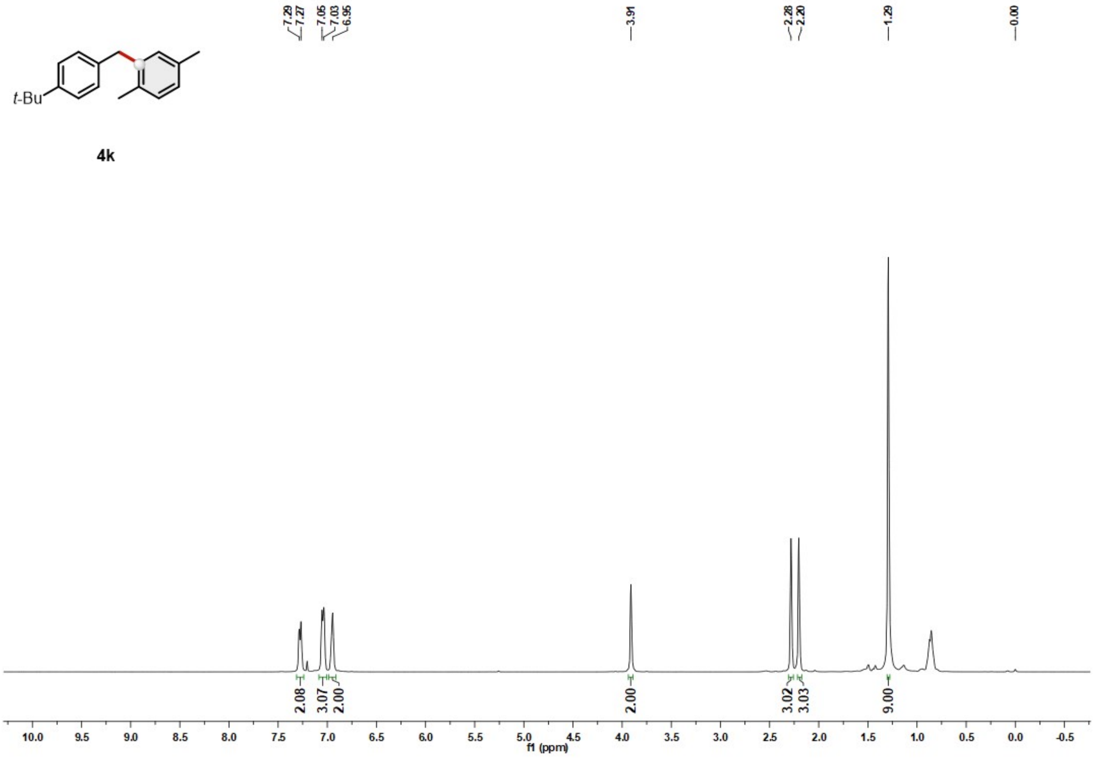


^{13}C NMR of **4j**

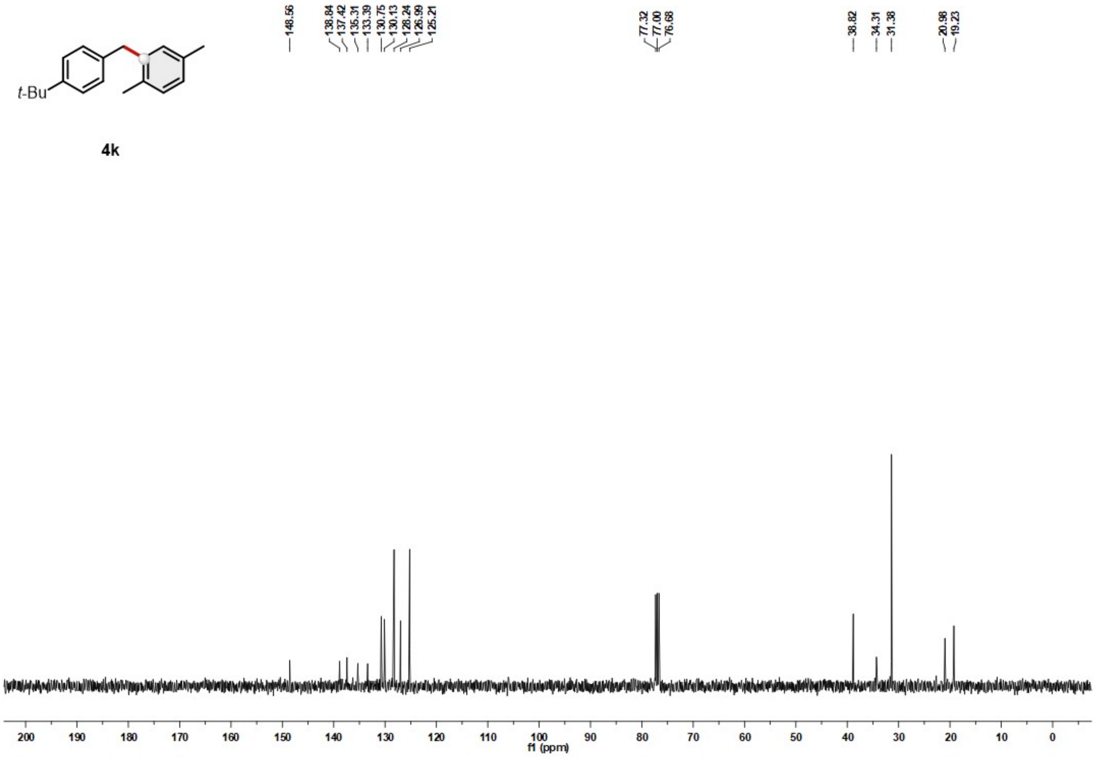
CDCl$_3$, 101 MHz, 298 K



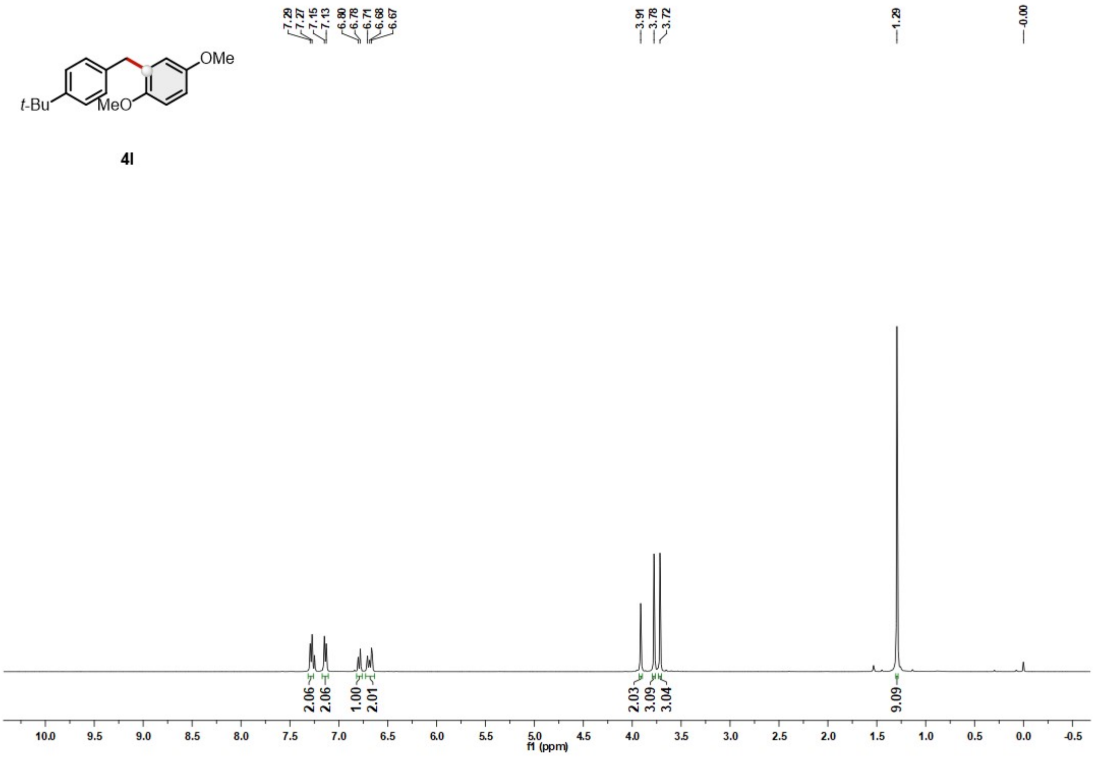
^{1}H NMR of **4k**
CDCl$_3$, 400 MHz, 298 K



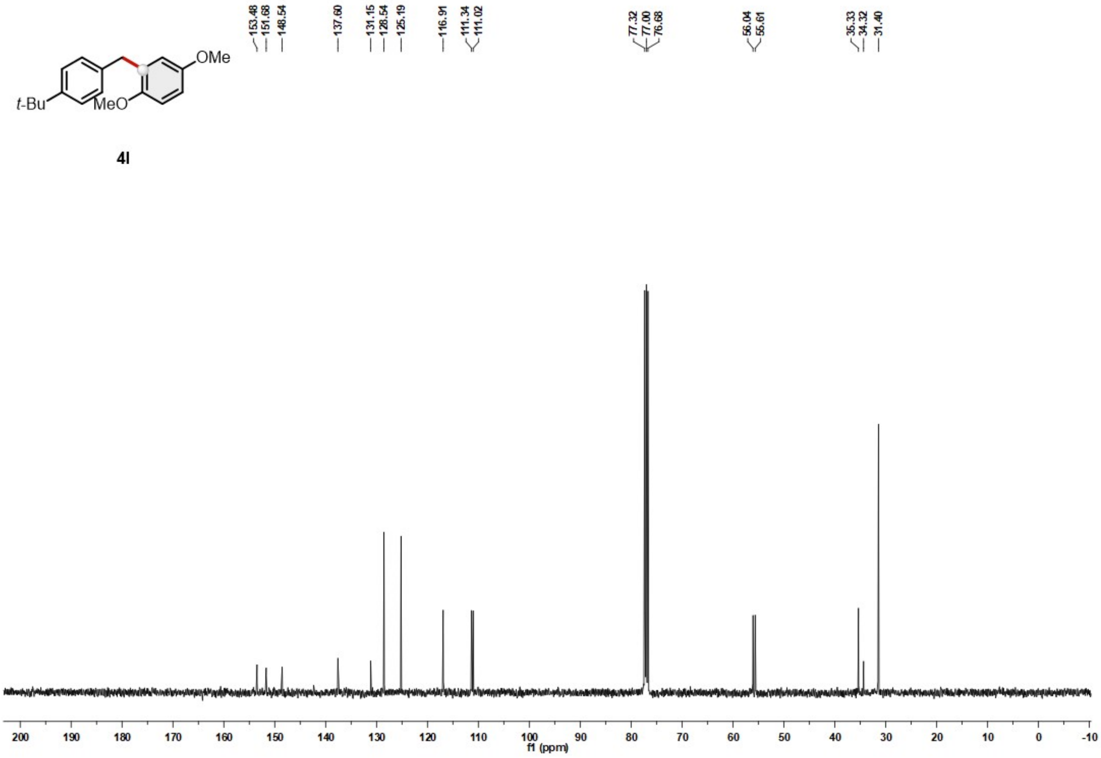
^{13}C NMR of **4k**
CDCl$_3$, 101 MHz, 298 K



^{1}H NMR of **4l**
CDCl$_3$, 400 MHz, 298 K

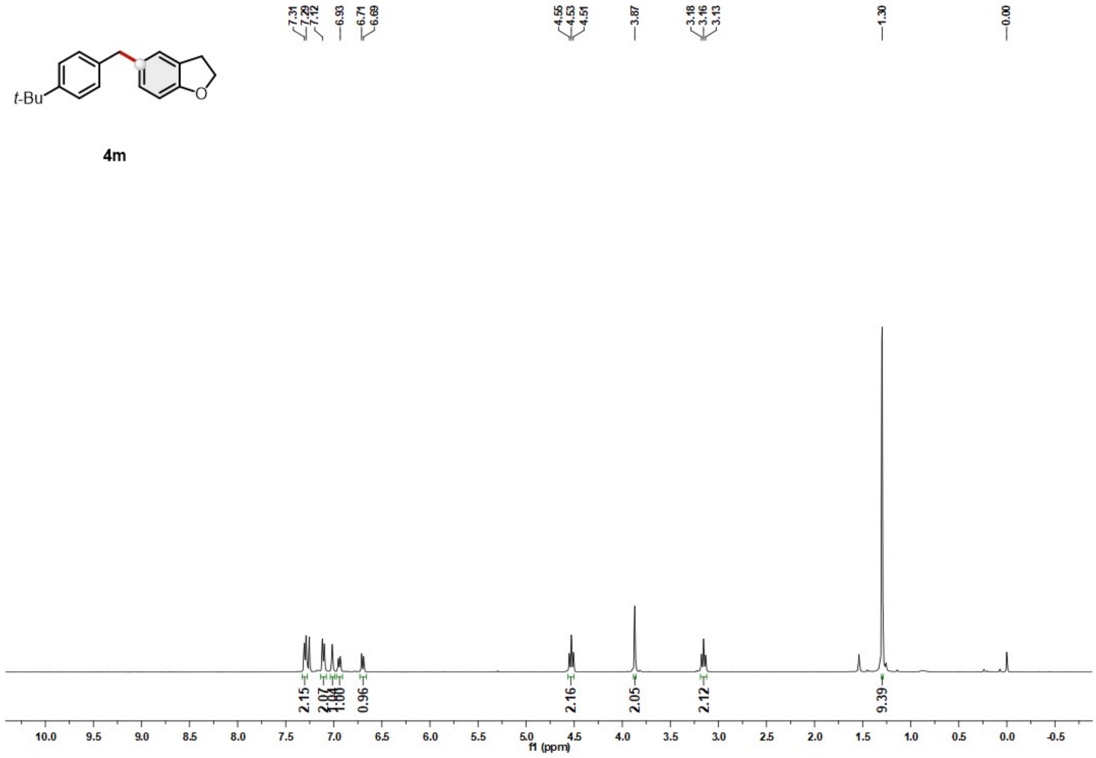


^{13}C NMR of **4l**
CDCl$_3$, 101 MHz, 298 K



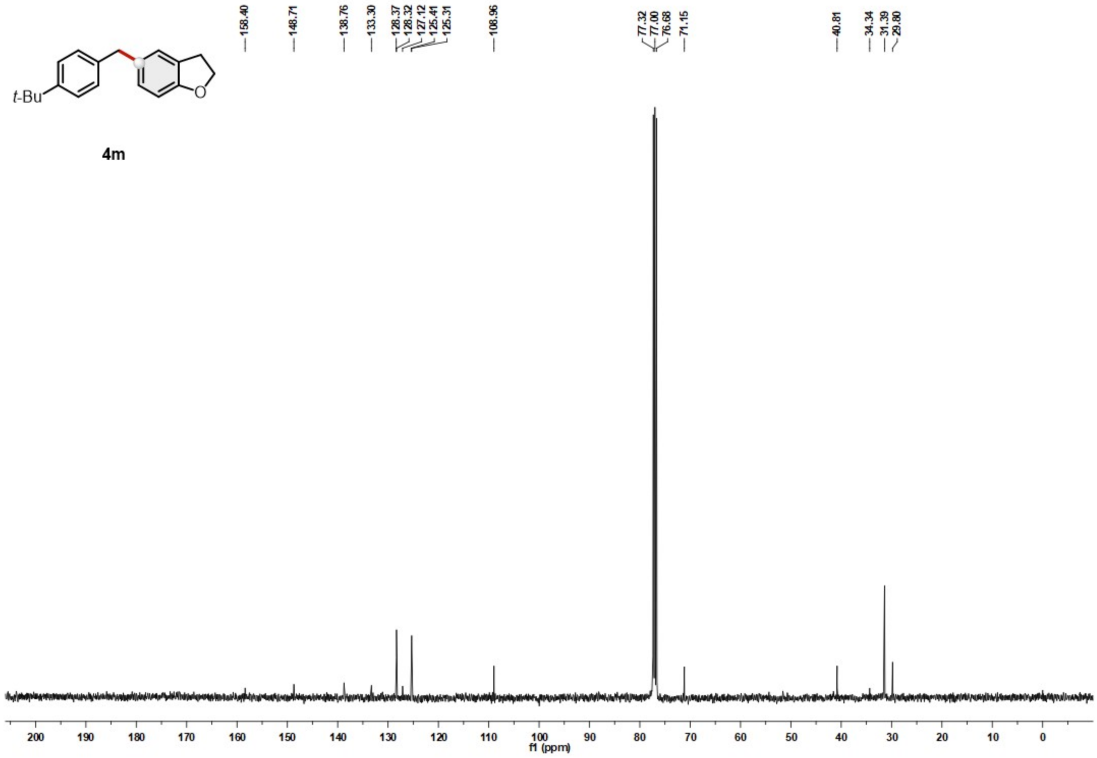
^{1}H NMR of **4m**

CDCl$_3$, 400 MHz, 298 K



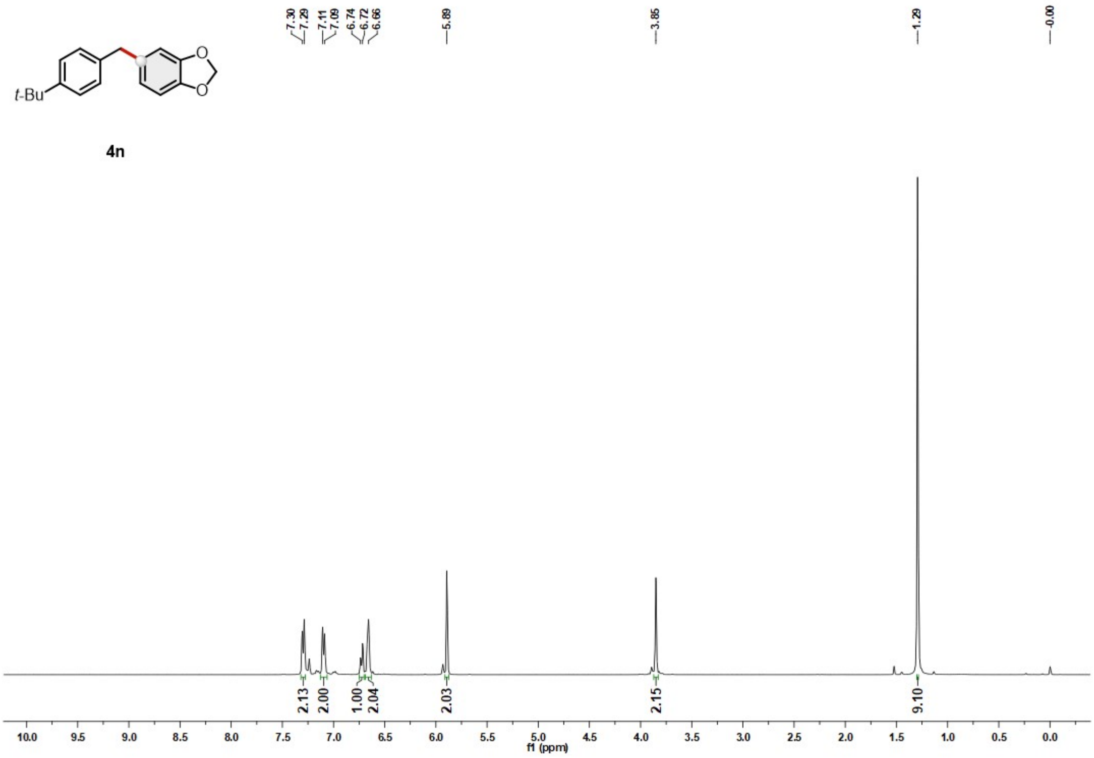
^{13}C NMR of **4m**

CDCl$_3$, 101 MHz, 298 K



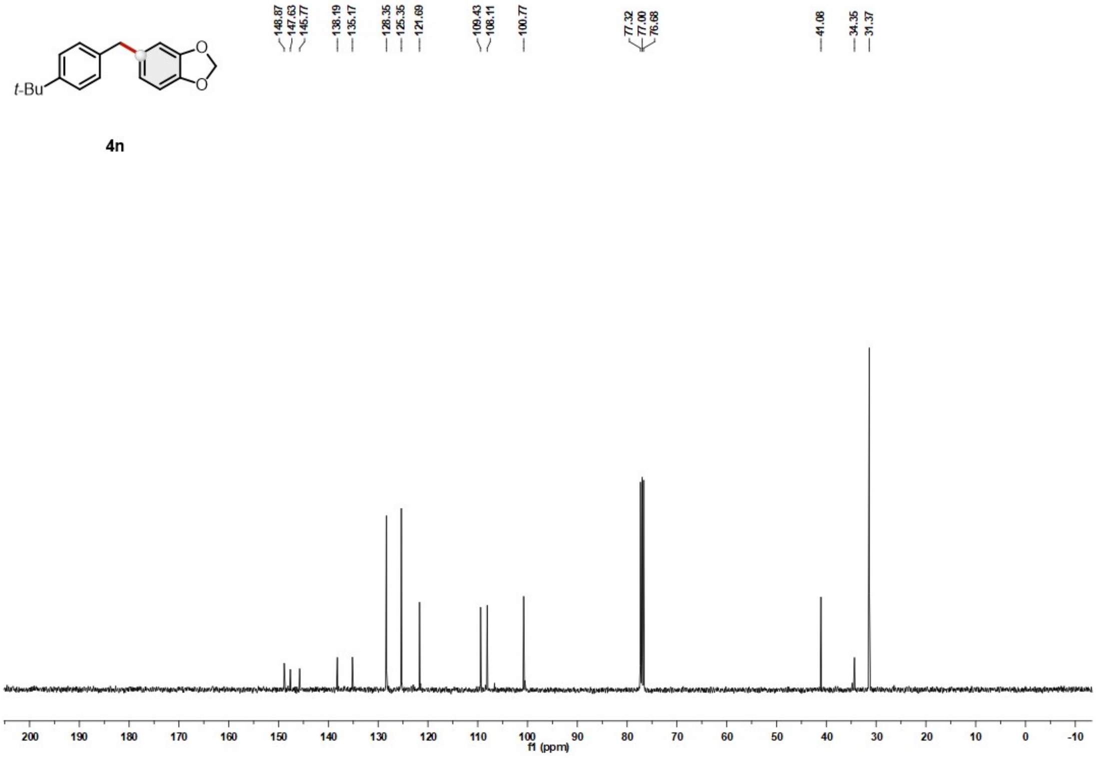
^{1}H NMR of **4n**

CDCl$_3$, 400 MHz, 298 K



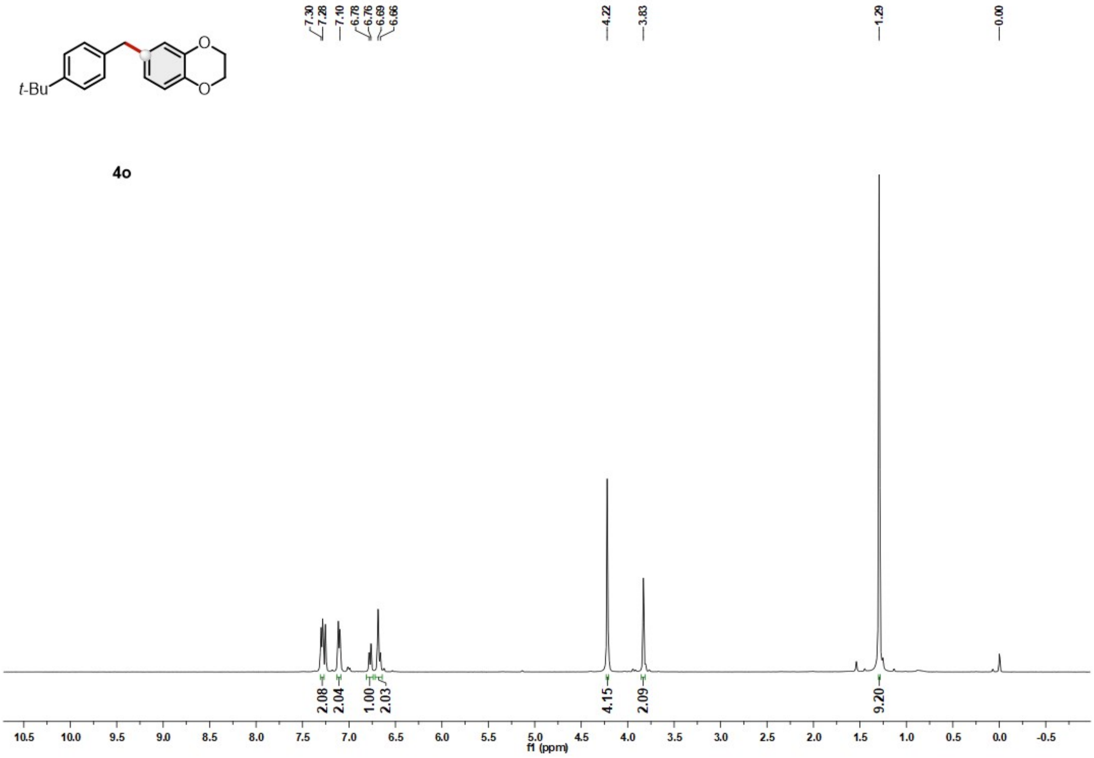
^{13}C NMR of **4n**

CDCl$_3$, 101 MHz, 298 K



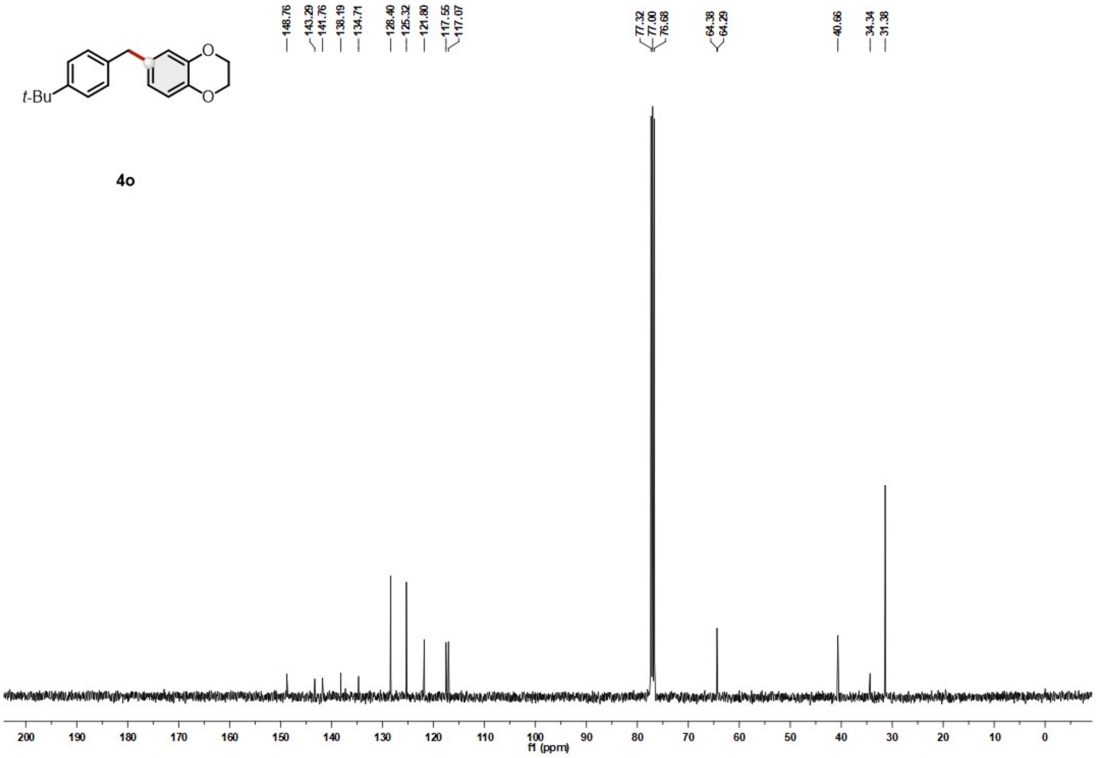
^{1}H NMR of **4o**

CDCl$_3$, 400 MHz, 298 K



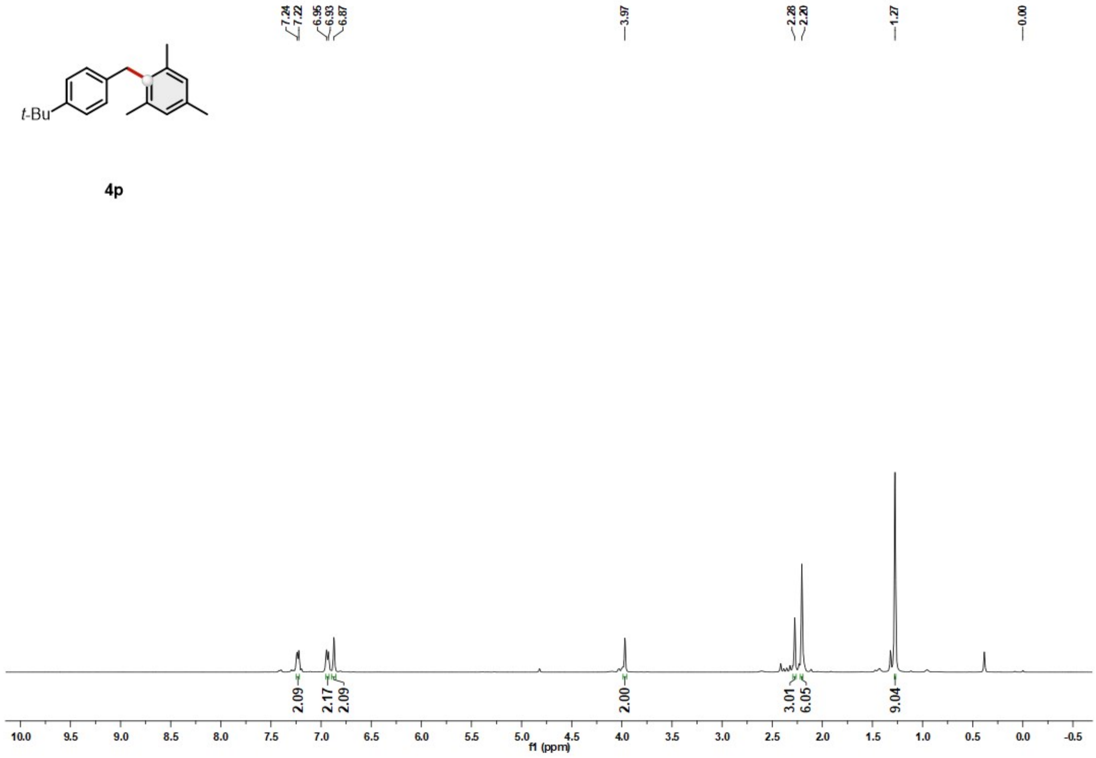
^{13}C NMR of **4o**

CDCl$_3$, 101 MHz, 298 K



^{1}H NMR of **4p**

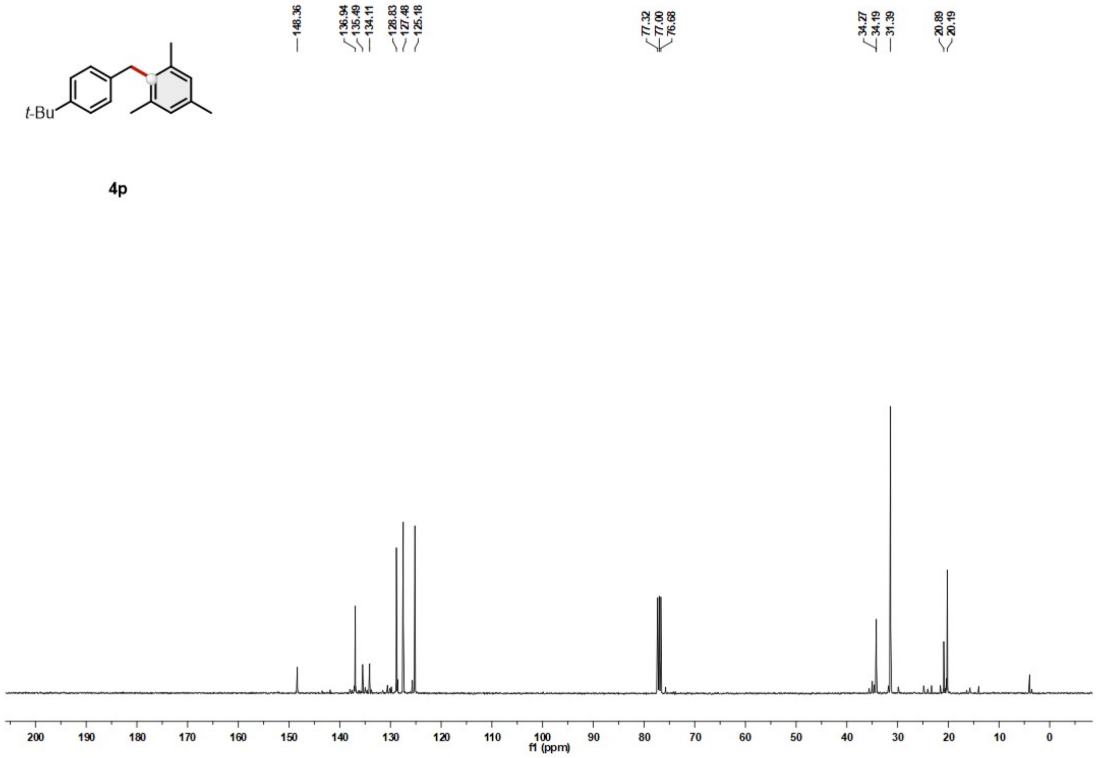
CDCl$_3$, 400 MHz, 298 K



4p

^{13}C NMR of **4p**

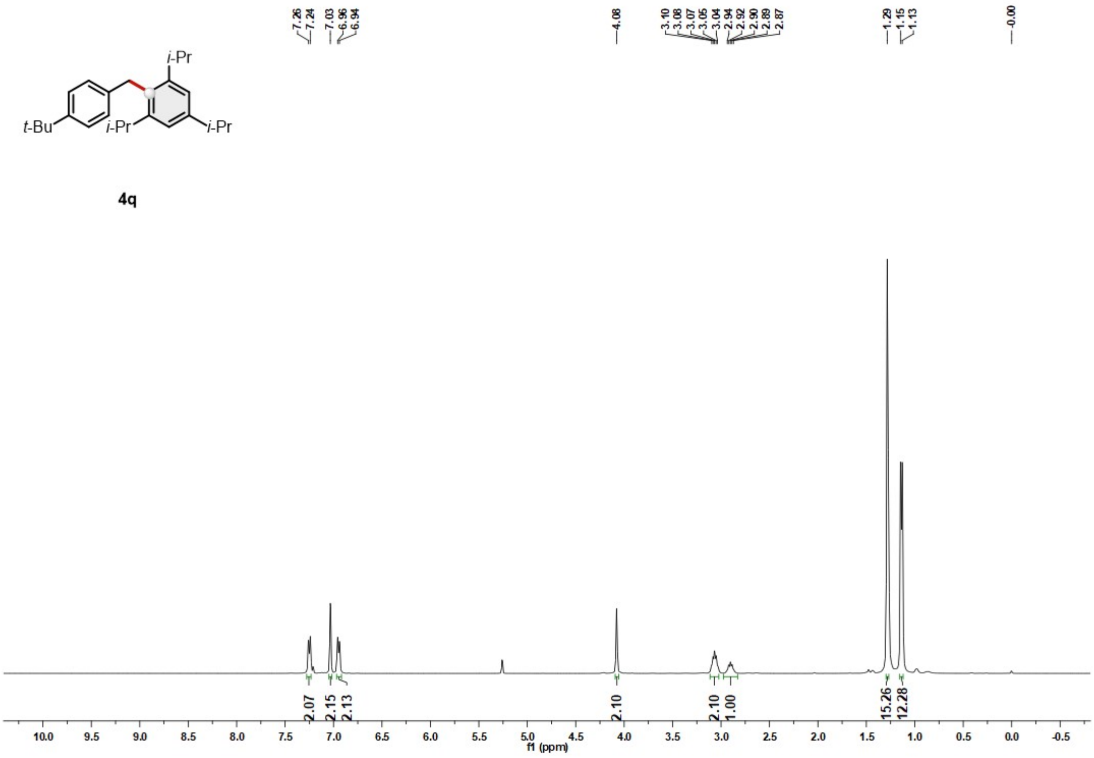
CDCl$_3$, 101 MHz, 298 K



4p

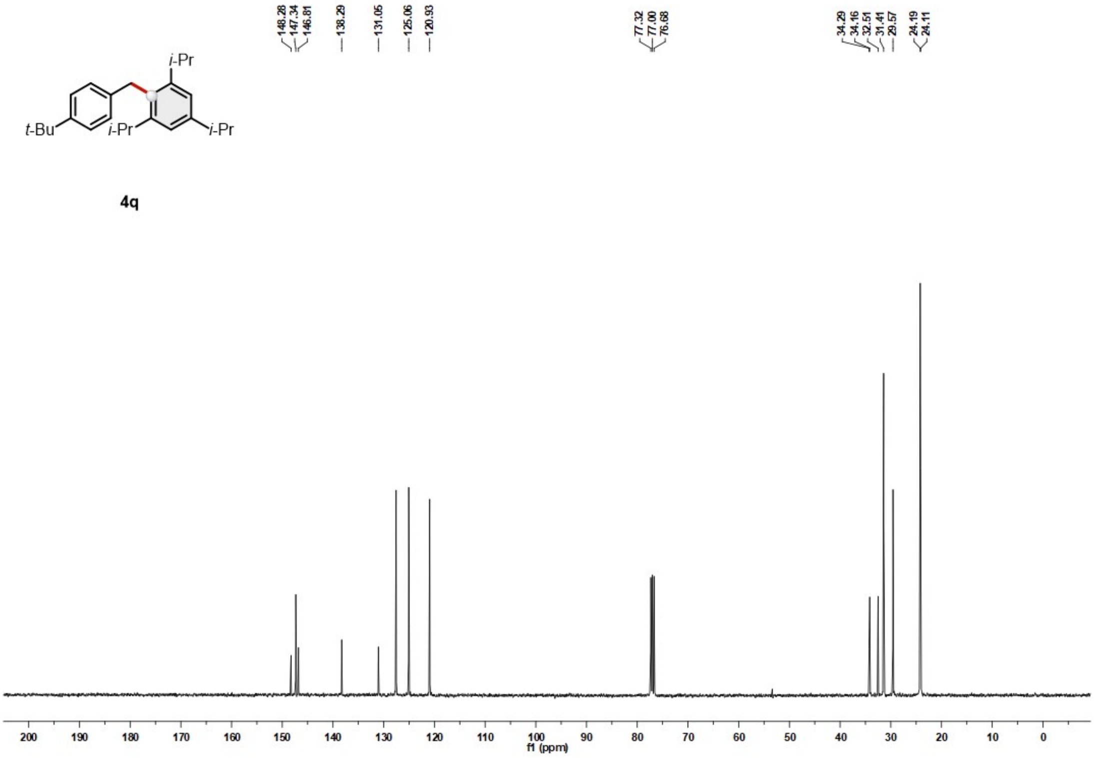
^{1}H NMR of **4q**

CDCl$_3$, 400 MHz, 298 K



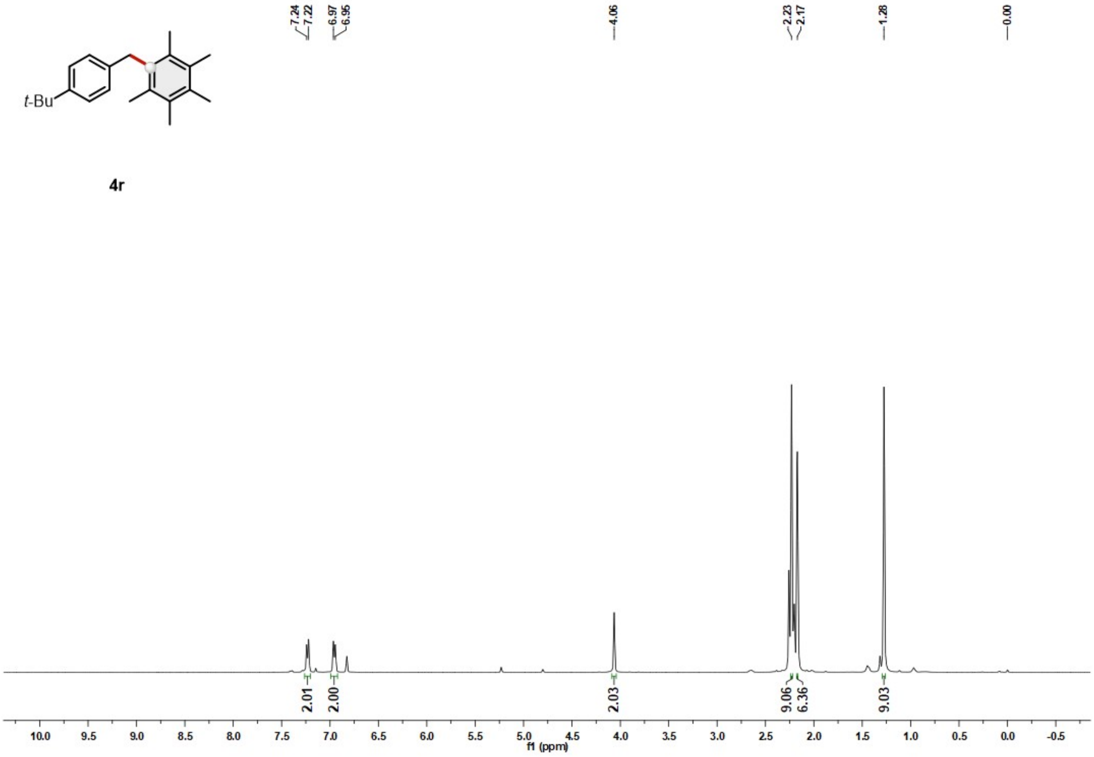
^{13}C NMR of **4q**

CDCl$_3$, 101 MHz, 298 K



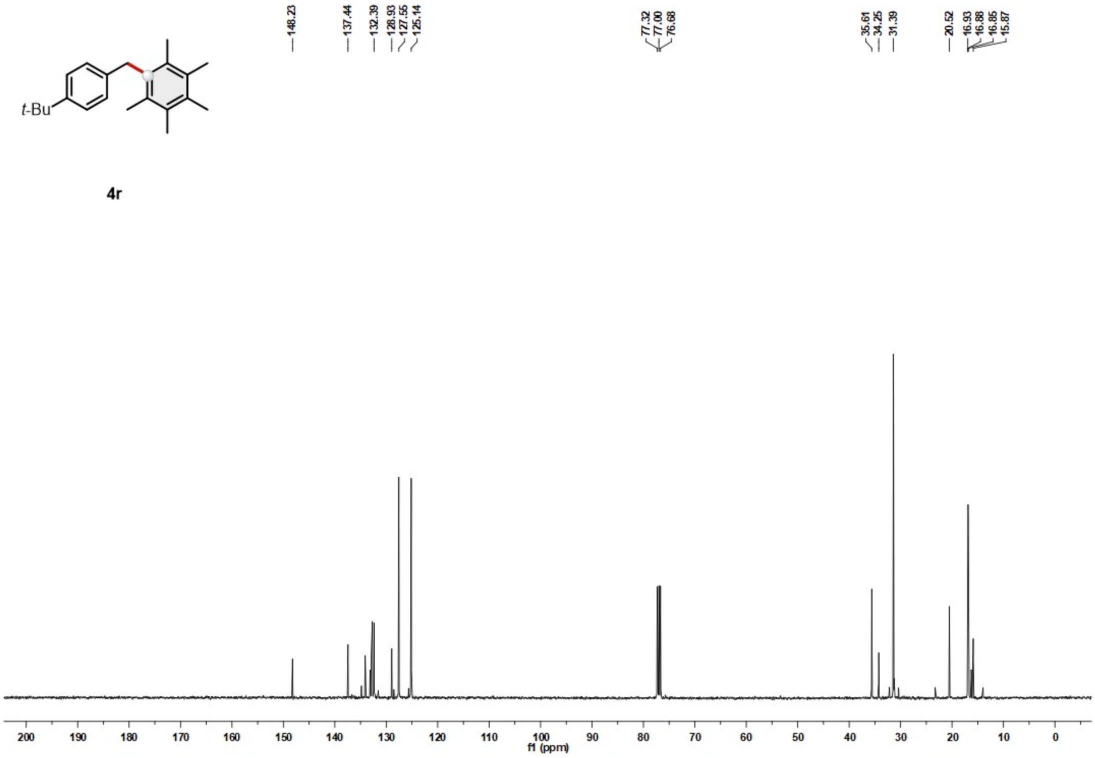
^{1}H NMR of **4r**

CDCl$_3$, 400 MHz, 298 K

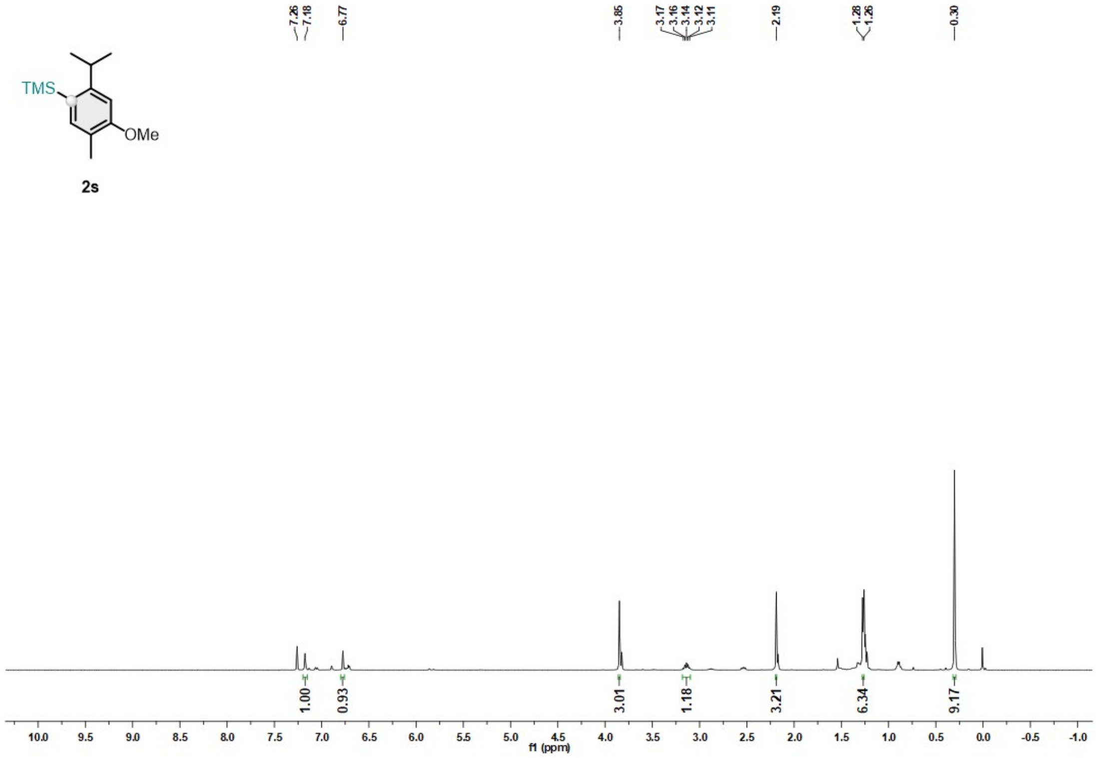


^{13}C NMR of **4r**

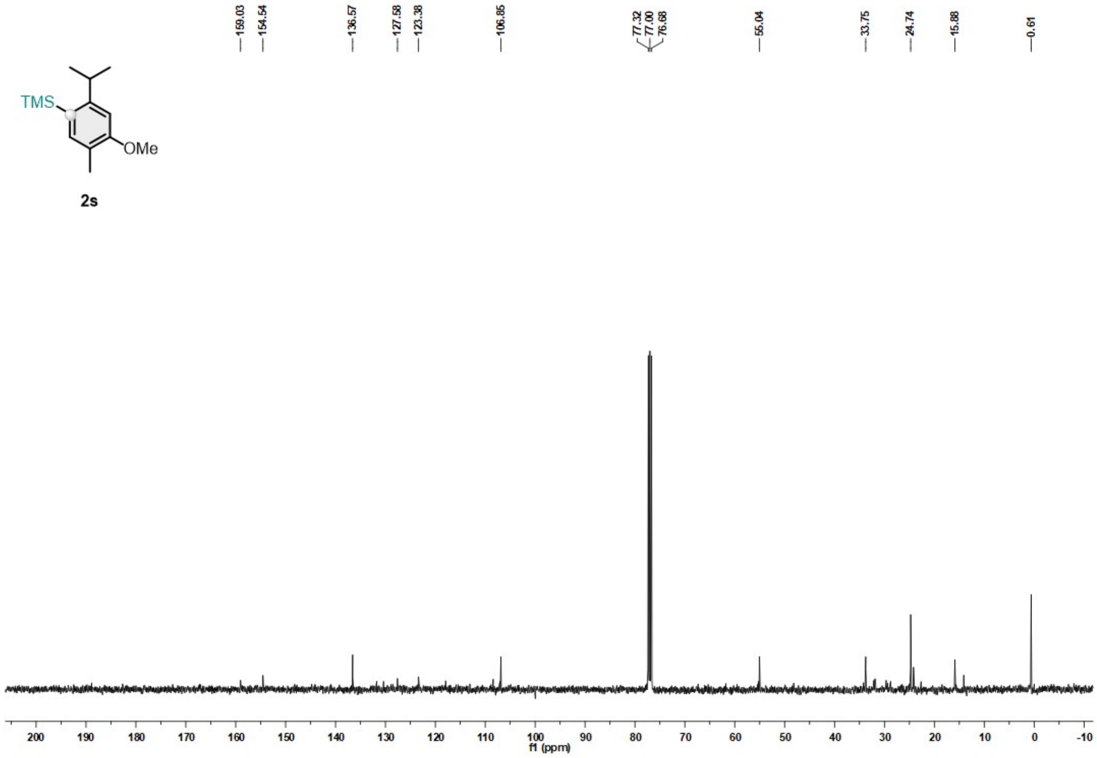
CDCl$_3$, 101 MHz, 298 K



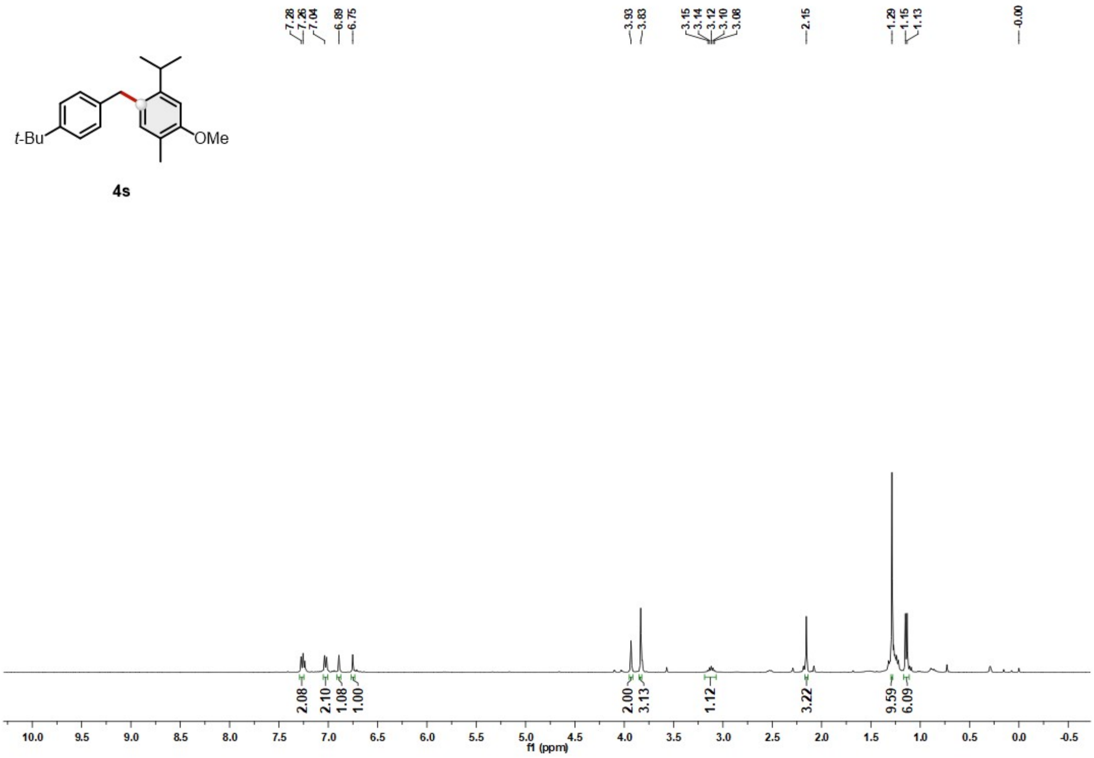
^{1}H NMR of **2s**
CDCl$_3$, 400 MHz, 298 K



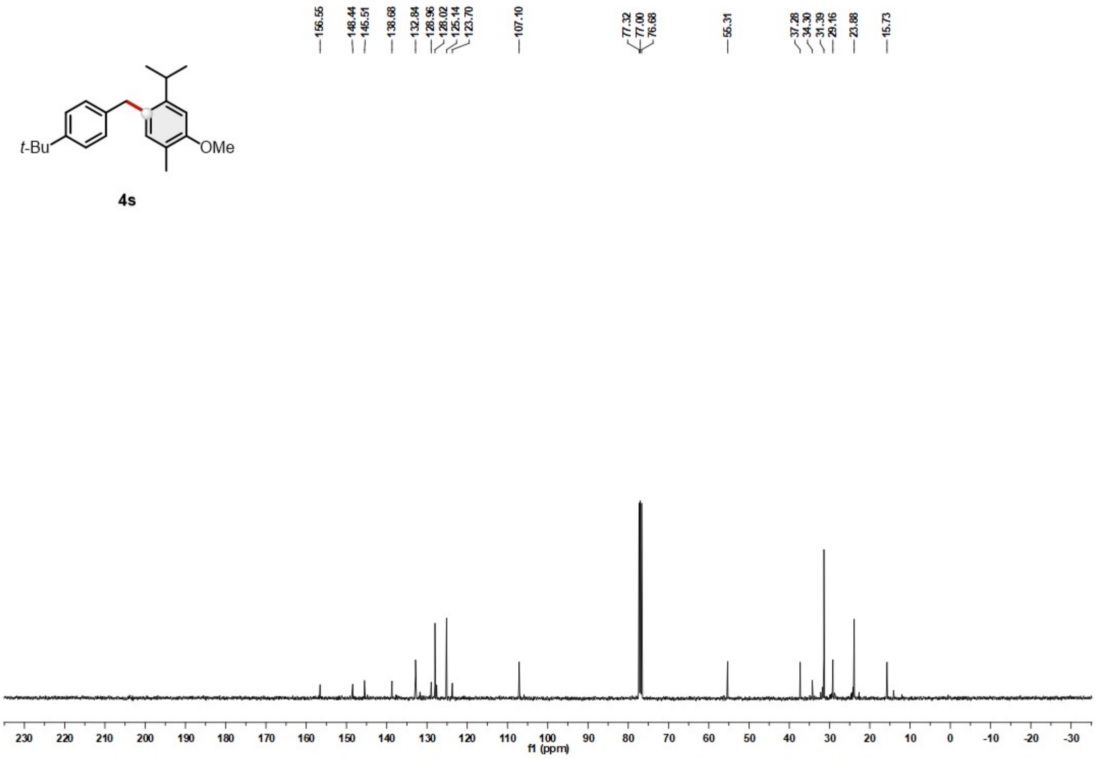
^{13}C NMR of **2s**
CDCl$_3$, 101 MHz, 298 K



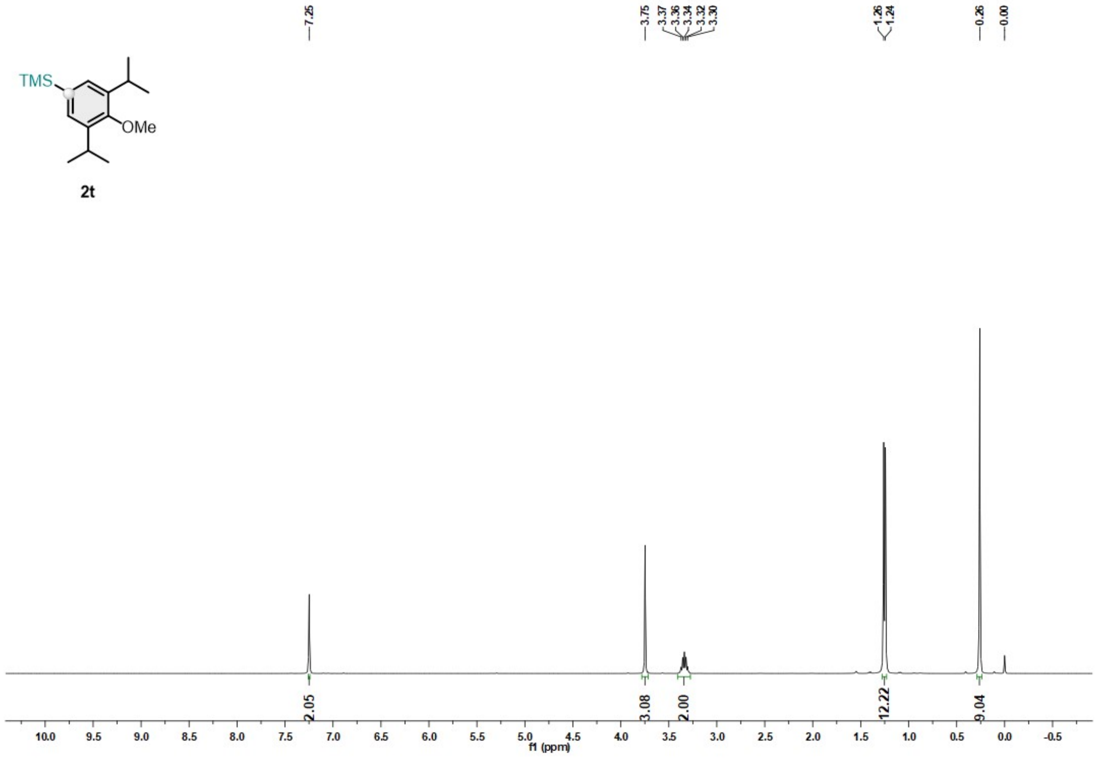
^{1}H NMR of **4s**
CDCl$_3$, 400 MHz, 298 K



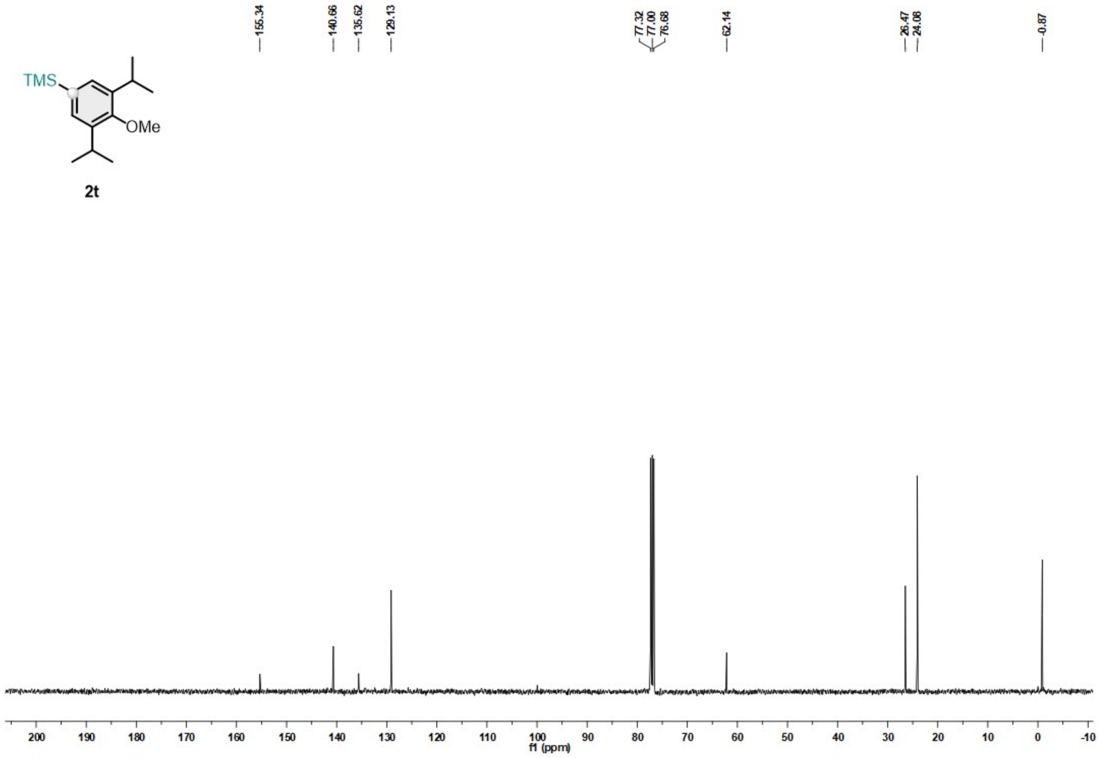
^{13}C NMR of 4**s**
CDCl$_3$, 101 MHz, 298 K



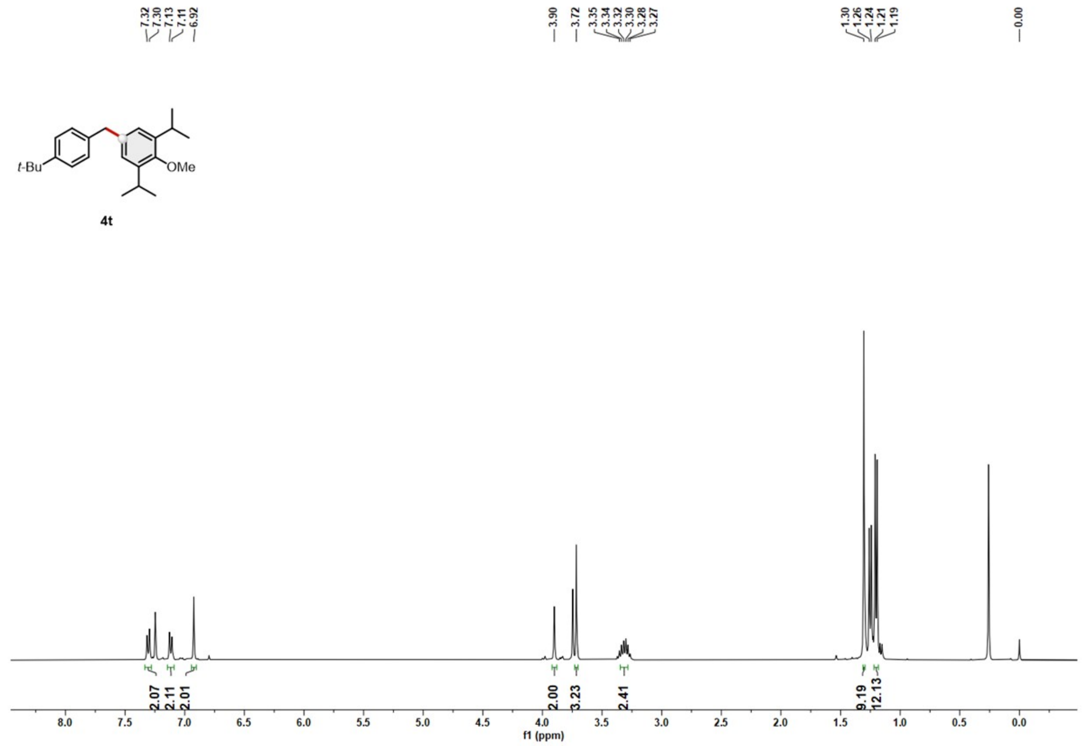
^{1}H NMR of **2t**
$CDCl_3$, 400 MHz, 298 K



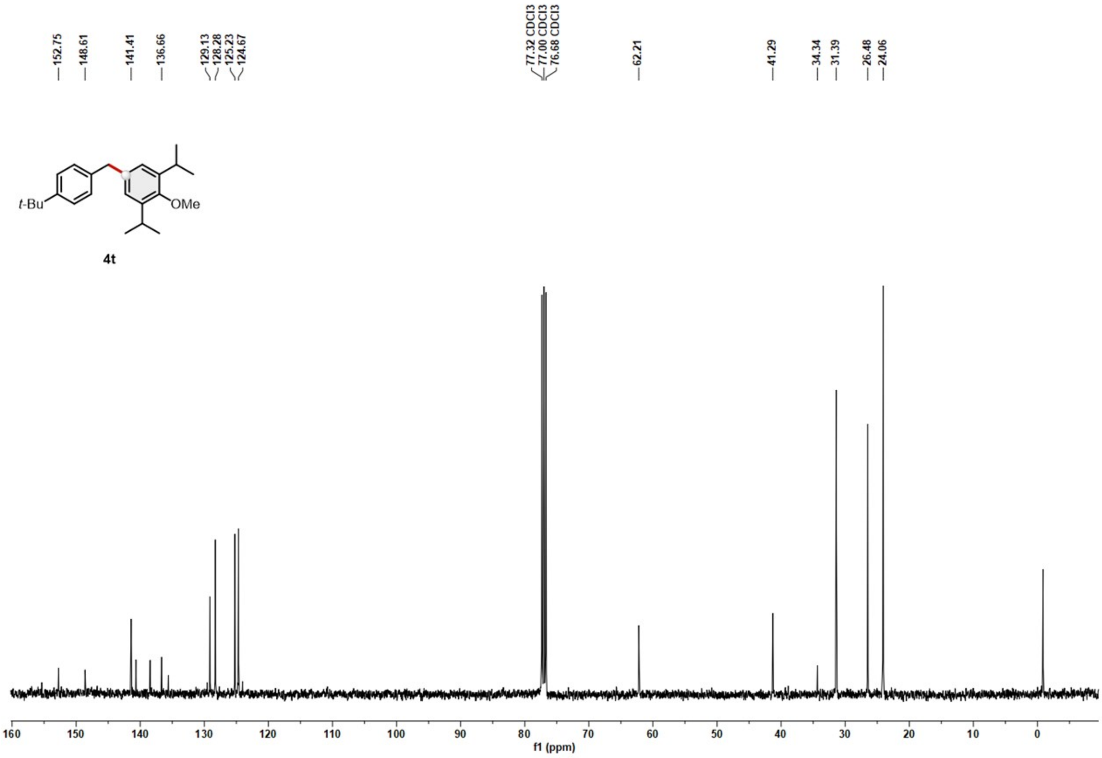
^{13}C NMR of **2t**
$CDCl_3$, 101 MHz, 298 K



^{1}H NMR of **4t**
CDCl$_3$, 400 MHz, 298 K

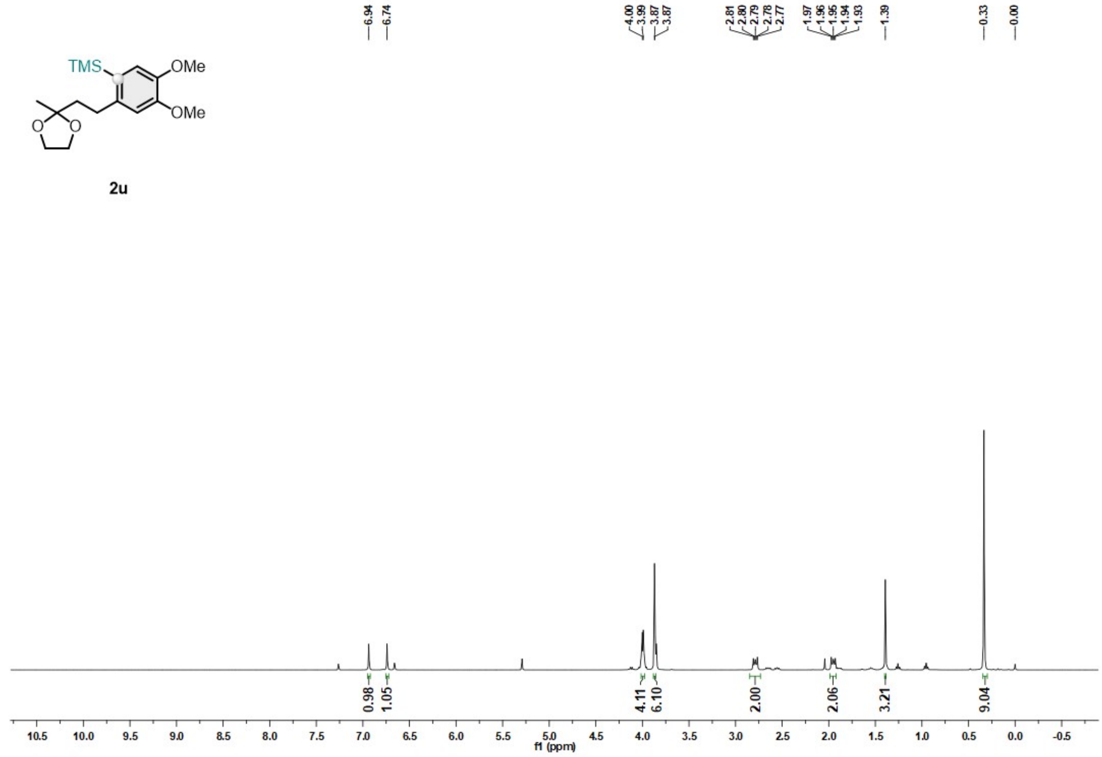


^{13}C NMR of **4t**
CDCl$_3$, 101 MHz, 298 K



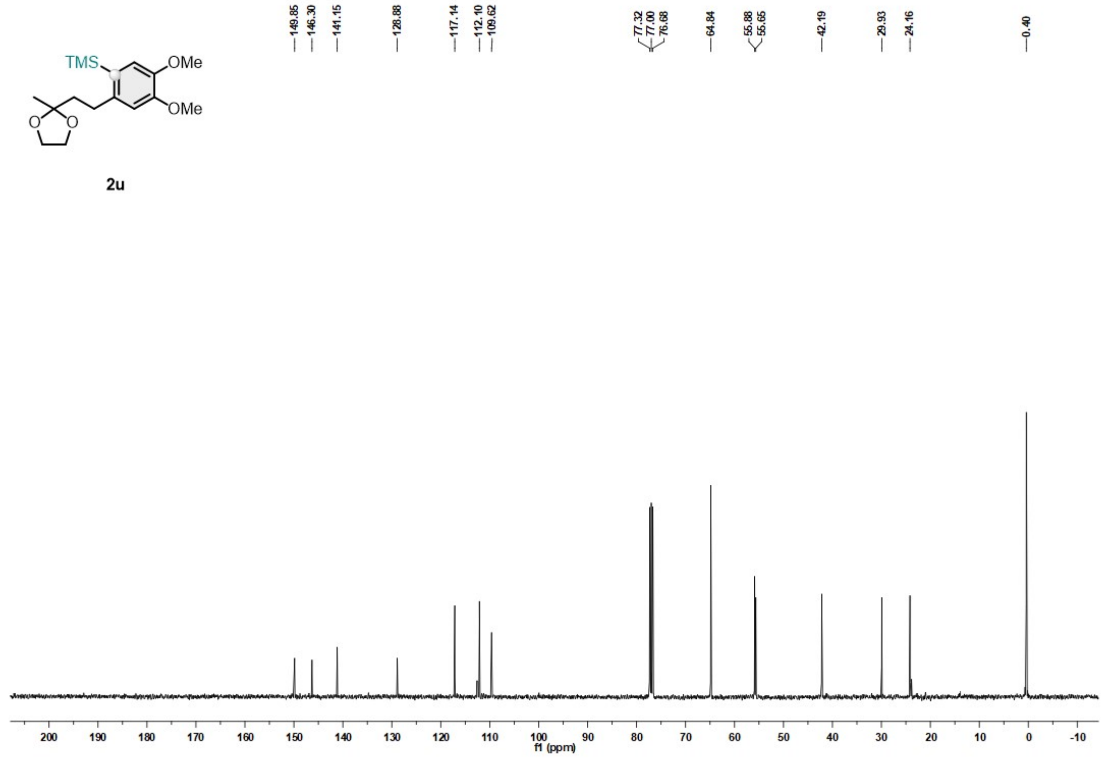
^{1}H NMR of **2u**

CDCl$_3$, 400 MHz, 298 K



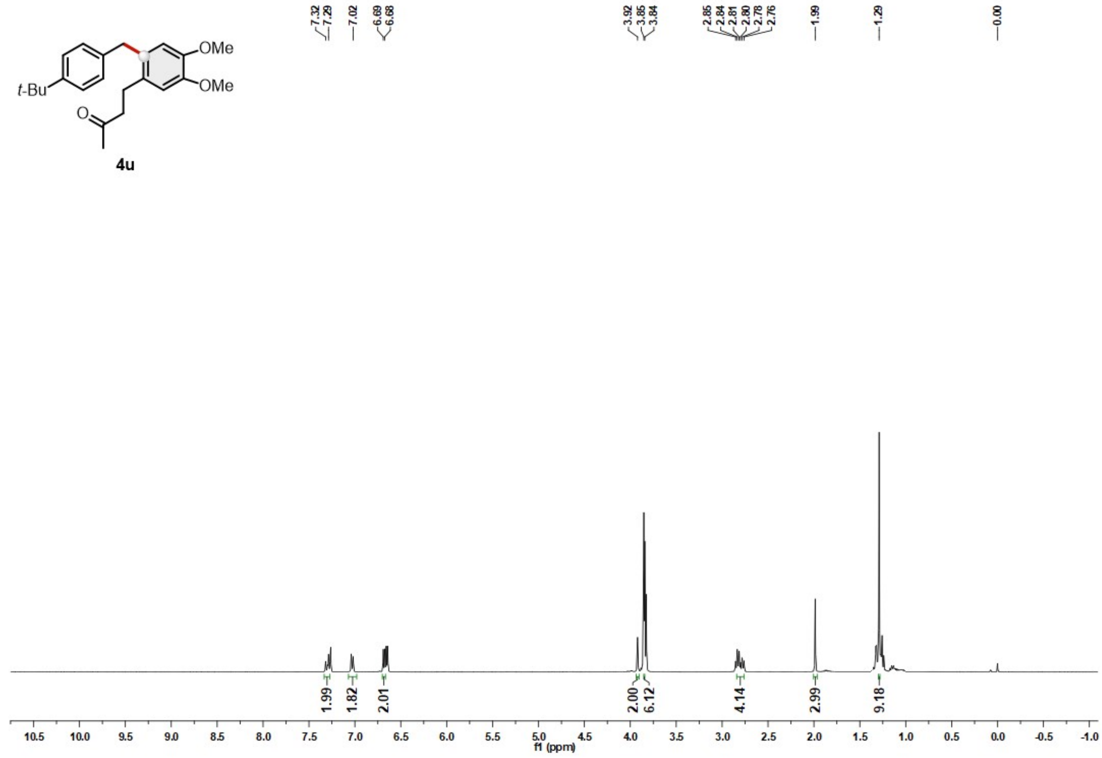
^{13}C NMR of **2u**

CDCl$_3$, 101 MHz, 298 K



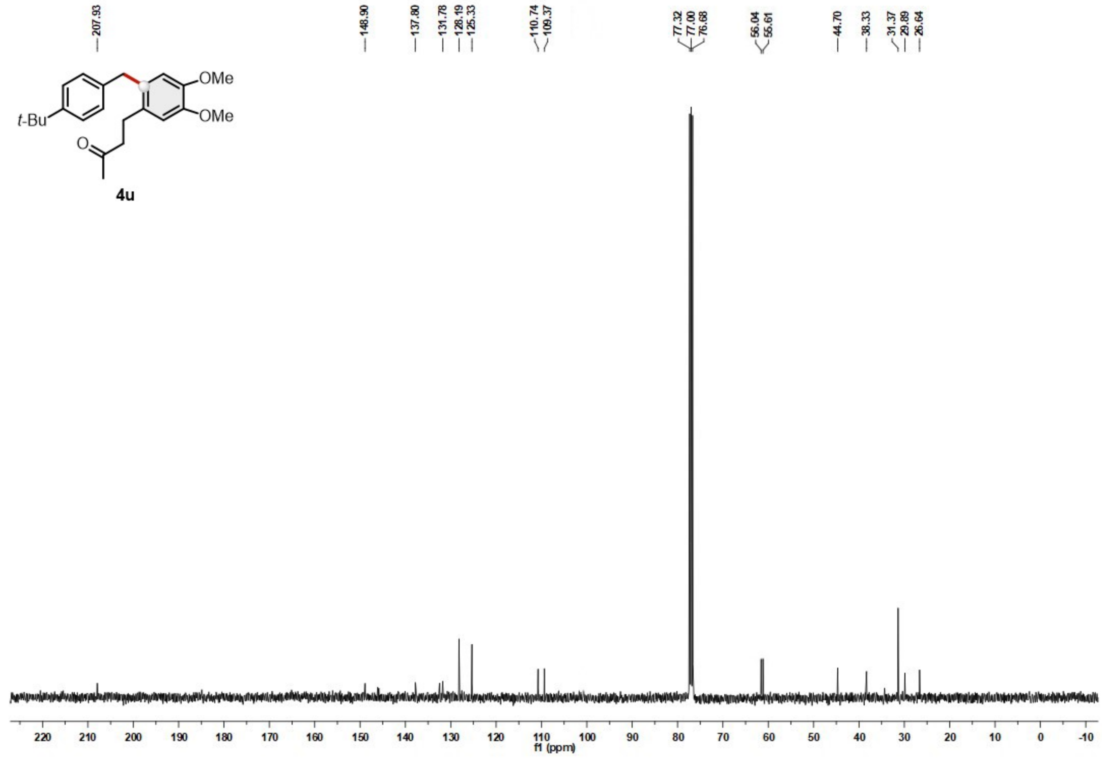
^{1}H NMR of **4u**

CDCl$_3$, 400 MHz, 298 K

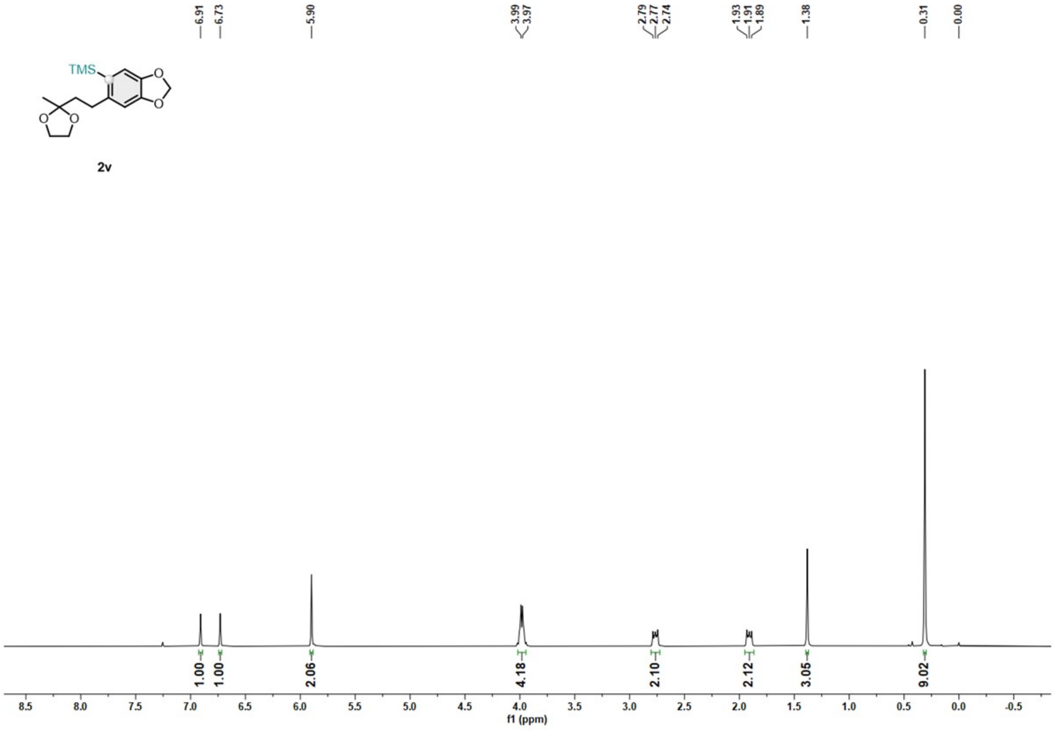


^{13}C NMR of **4u**

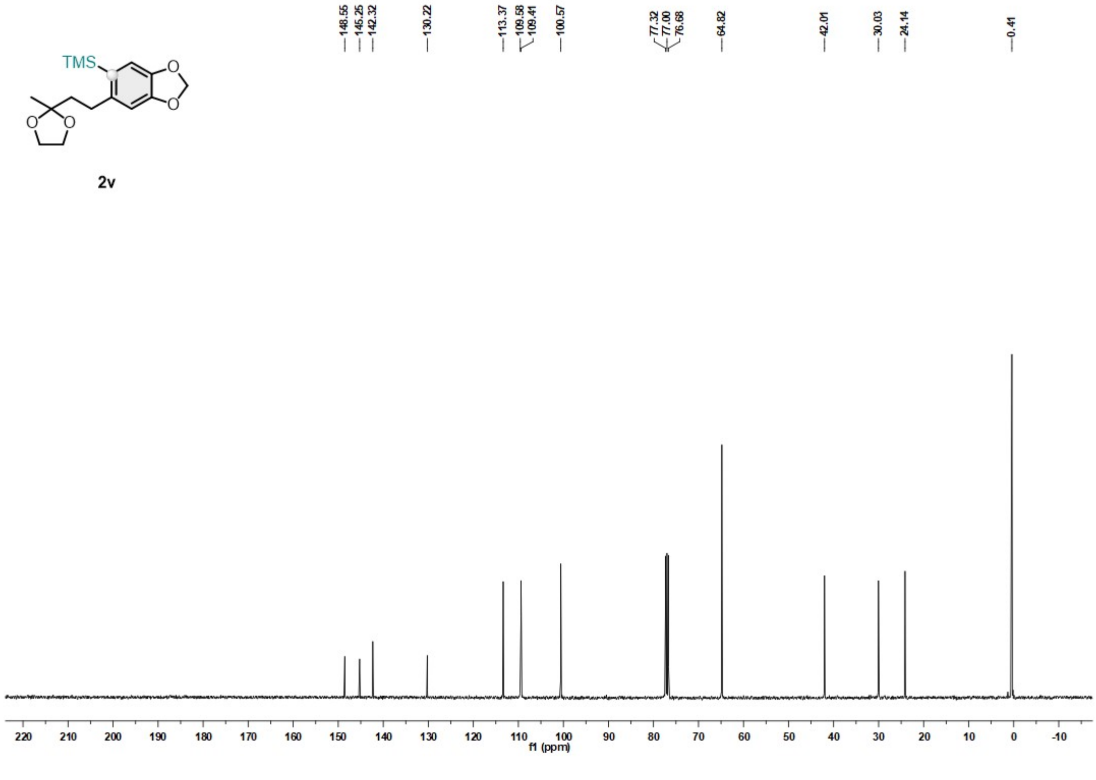
CDCl$_3$, 101 MHz, 298 K



^{1}H NMR of **2v**
$CDCl_3$, 400 MHz, 298 K

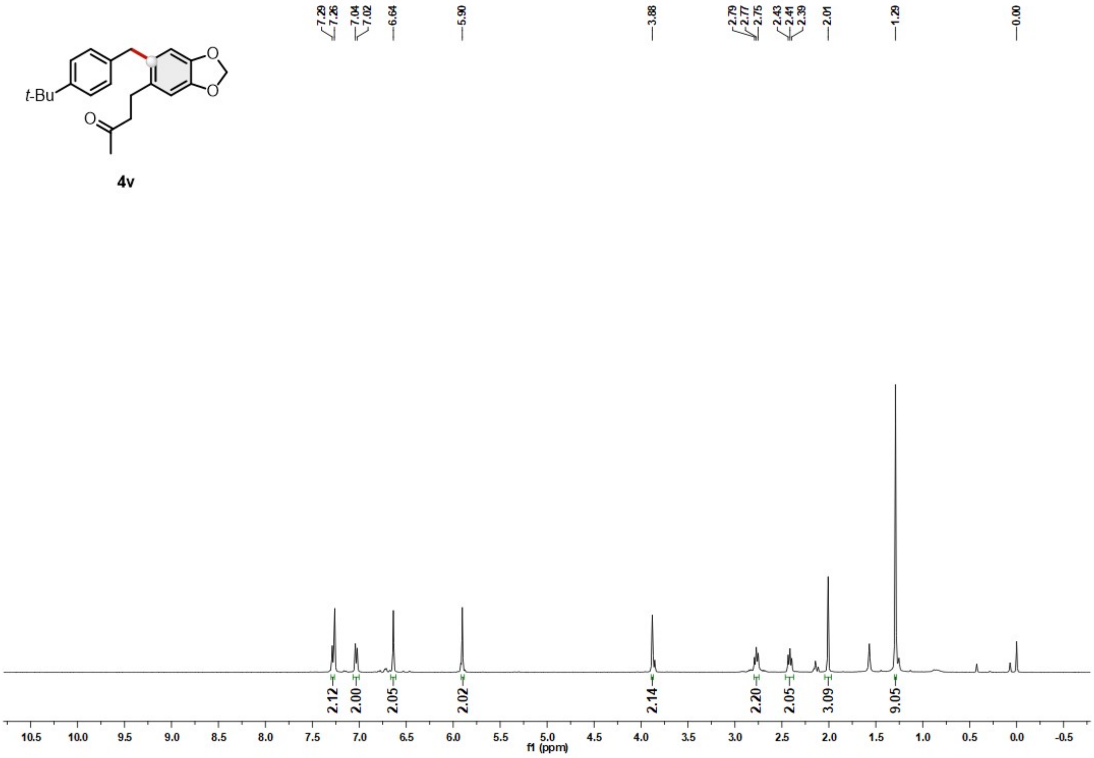


^{13}C NMR of **2v**
$CDCl_3$, 101 MHz, 298 K



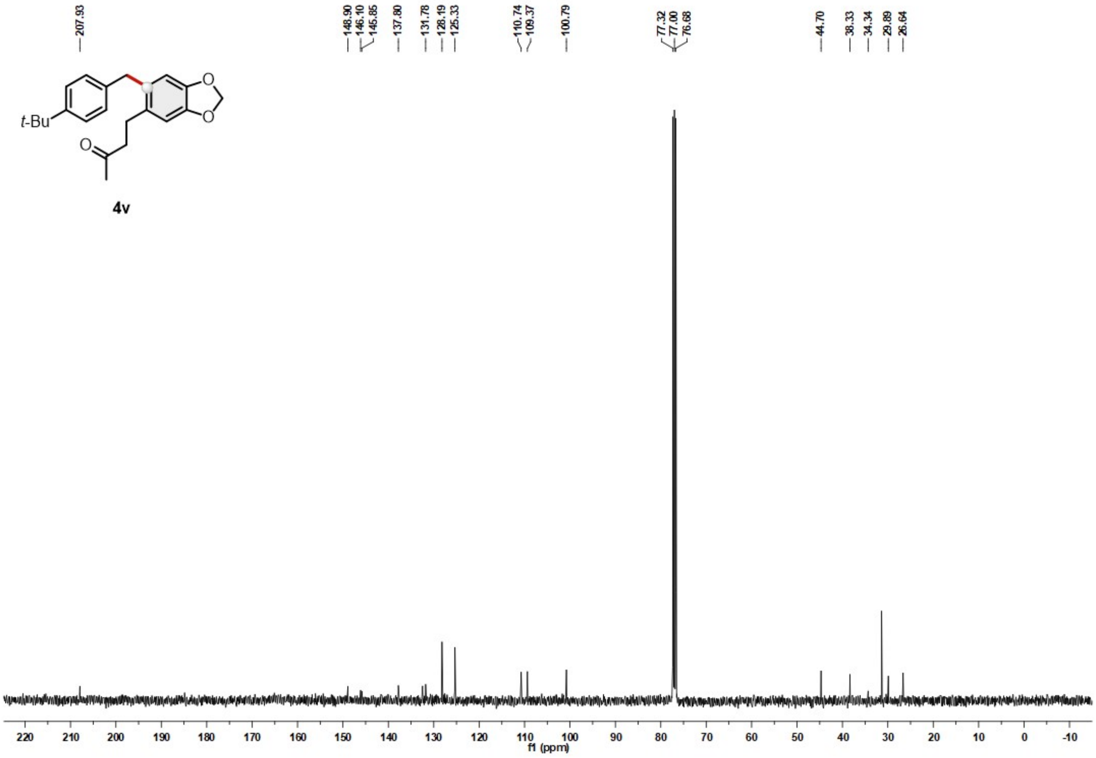
^{1}H NMR of **4v**

CDCl$_3$, 400 MHz, 298 K



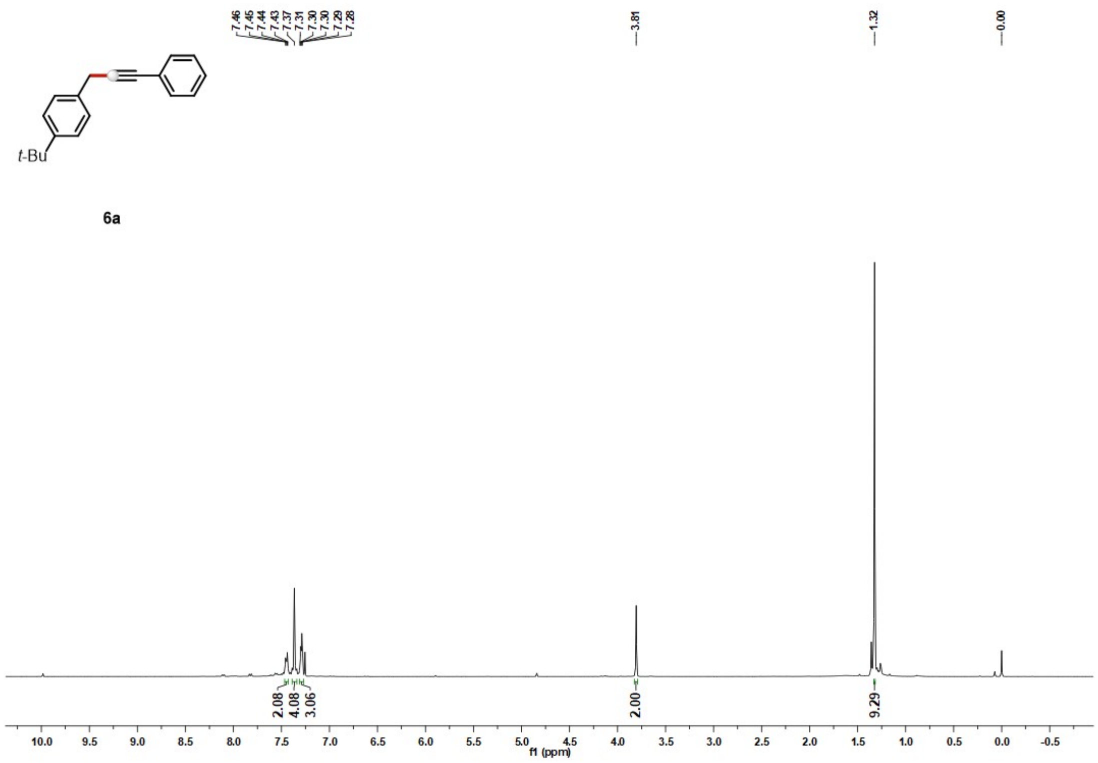
^{13}C NMR of **4v**

CDCl$_3$, 101 MHz, 298 K



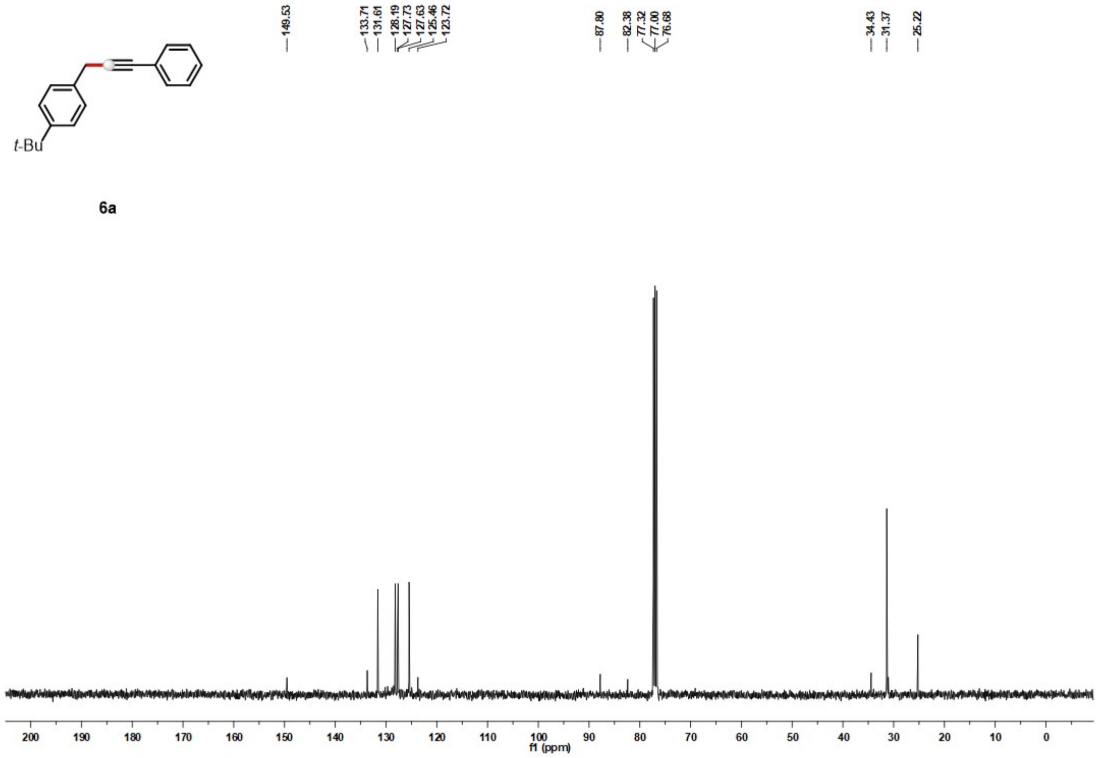
^{1}H NMR of **6a**

CDCl$_3$, 400 MHz, 298 K



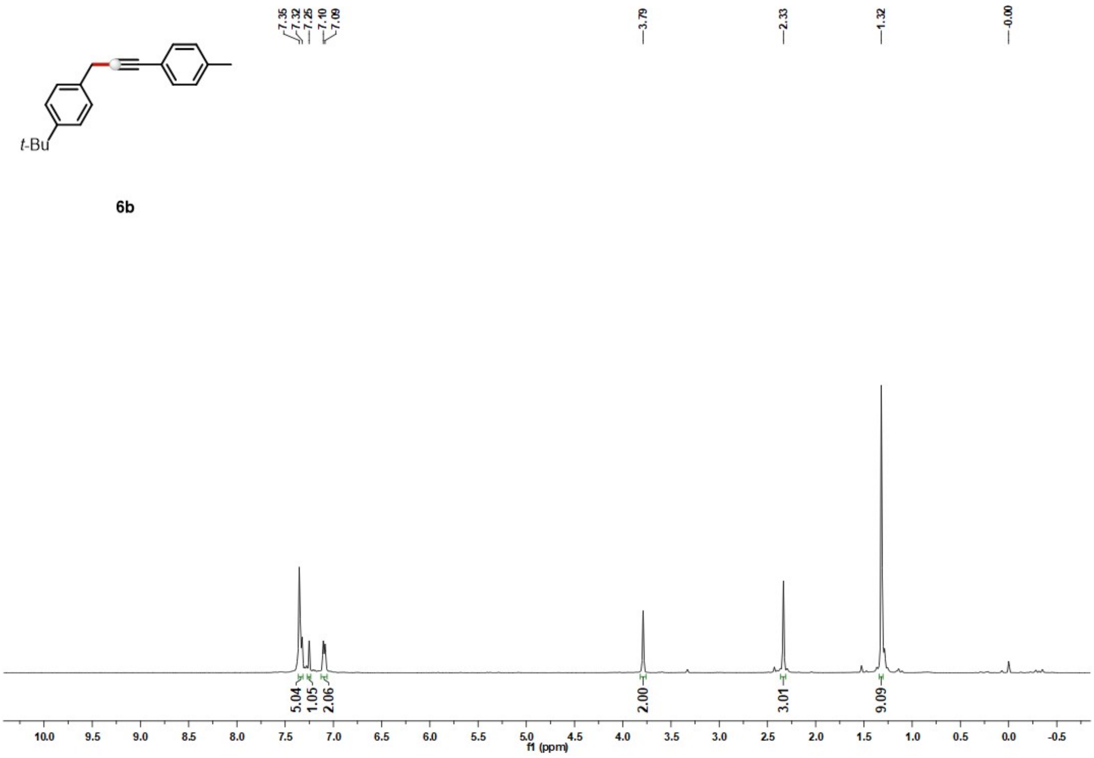
^{13}C NMR of **6a**

CDCl$_3$, 101 MHz, 298 K



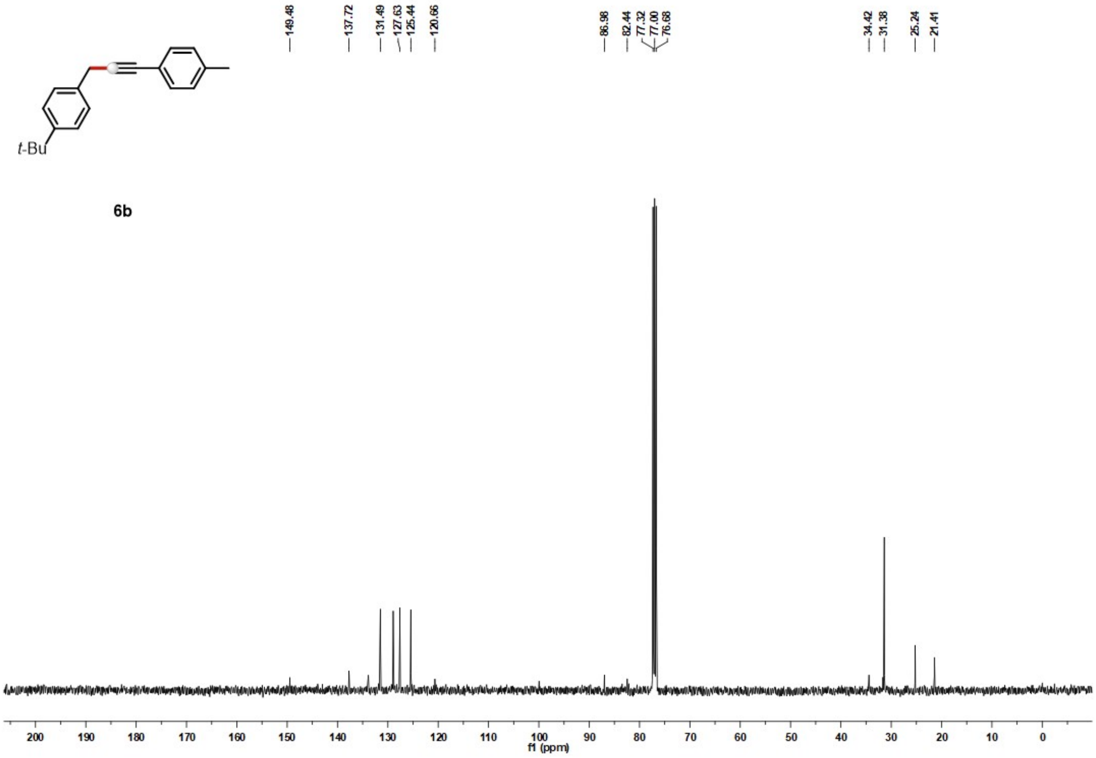
^{1}H NMR of **6b**

CDCl$_3$, 400 MHz, 298 K

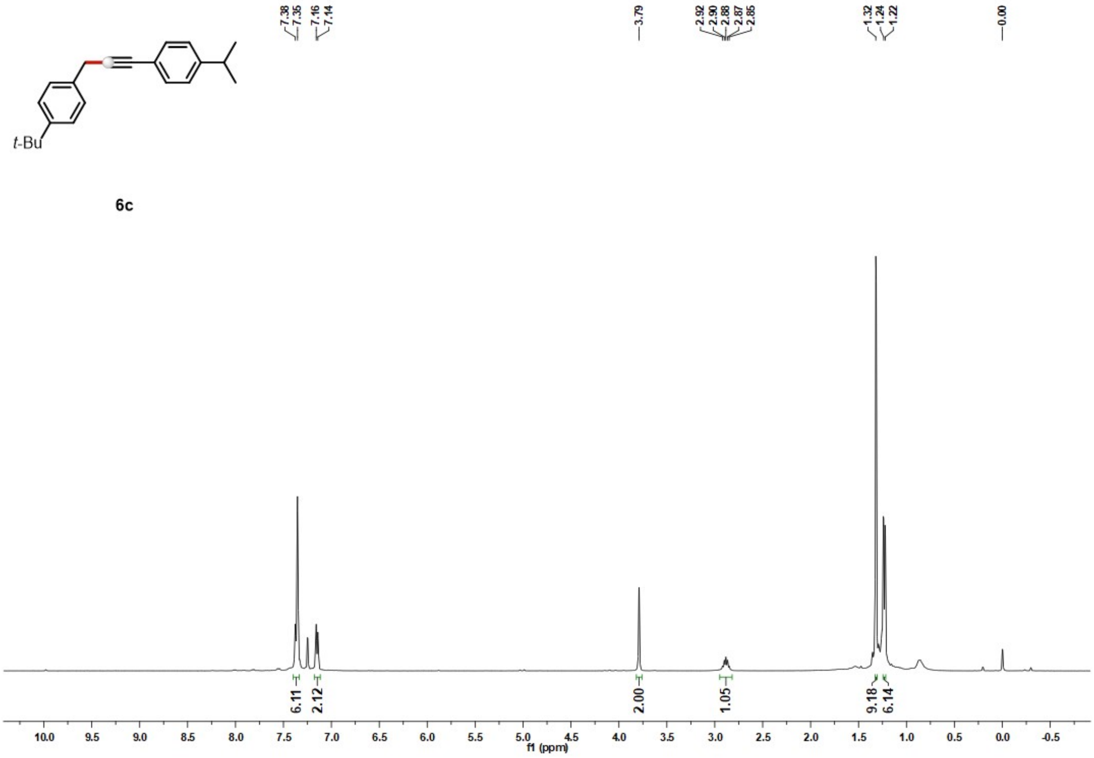


^{13}C NMR of **6b**

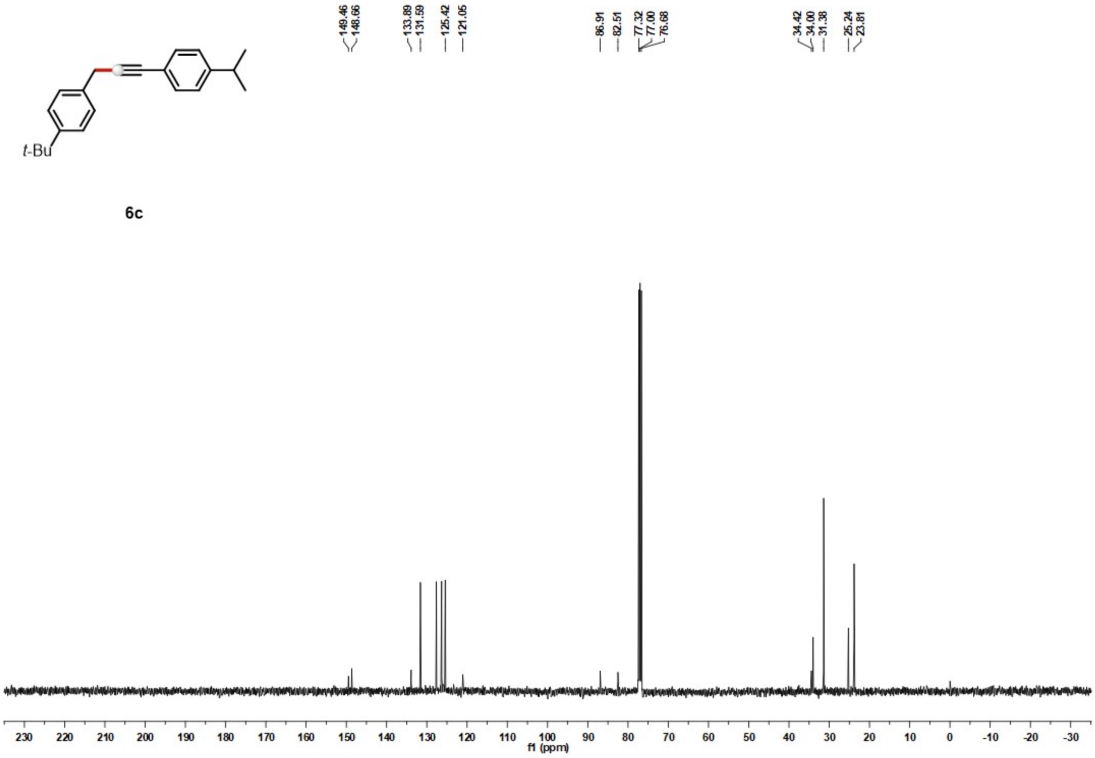
CDCl$_3$, 101 MHz, 298 K



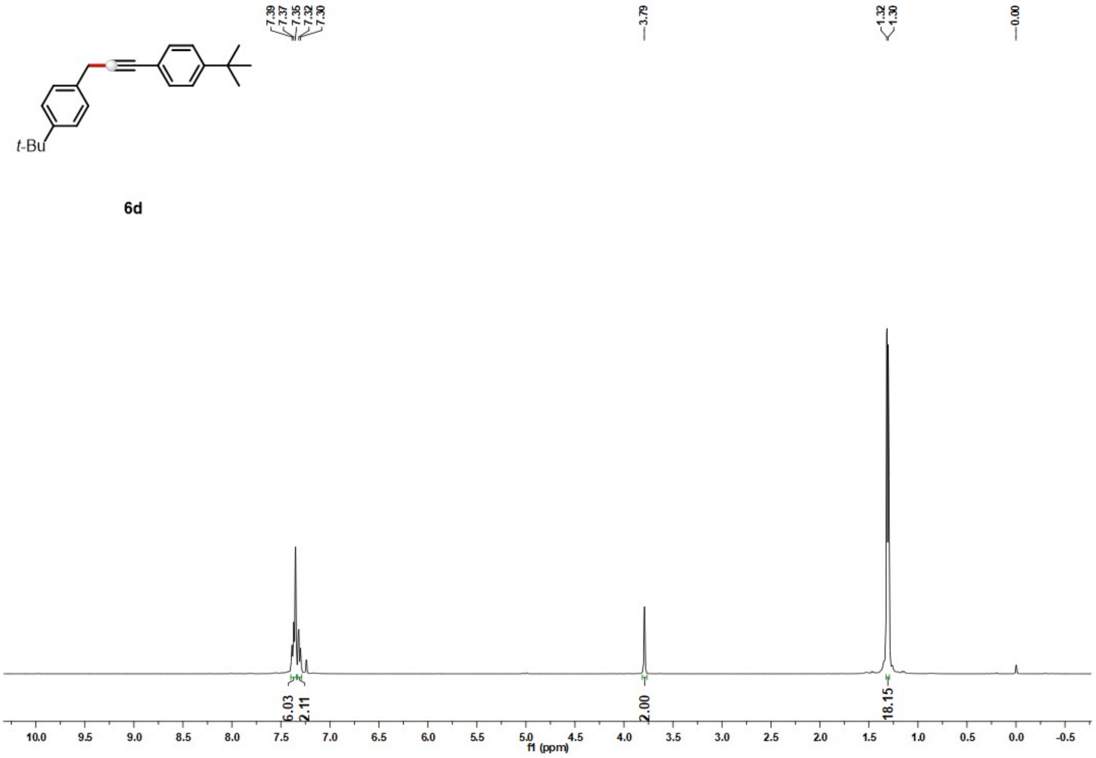
^{1}H NMR of **6c**
CDCl$_3$, 400 MHz, 298 K


6c

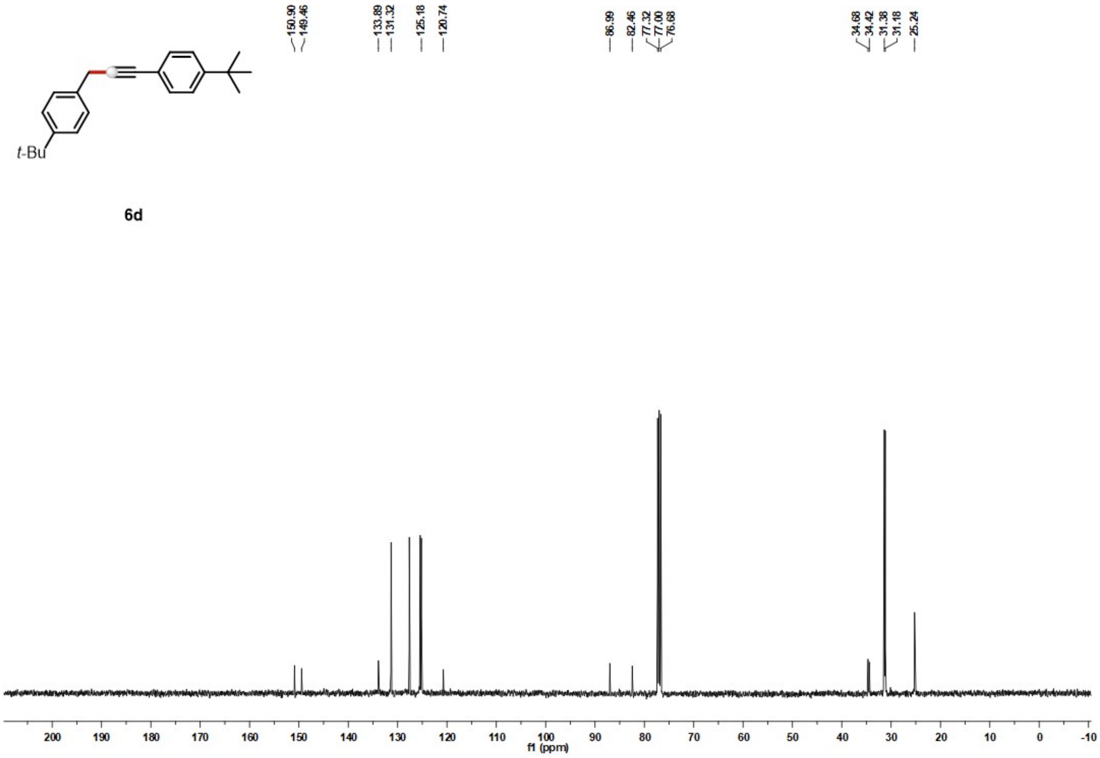
^{13}C NMR of **6c**
CDCl$_3$, 101 MHz, 298 K


6c

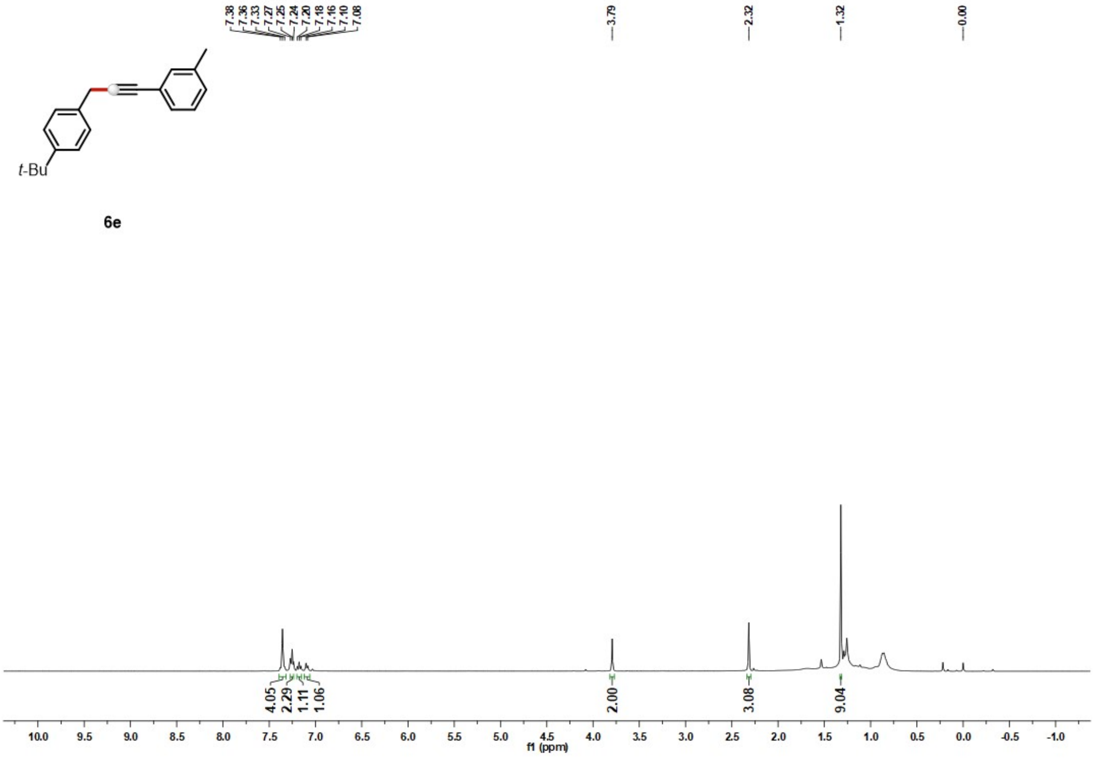
^{1}H NMR of **6d**
CDCl$_3$, 400 MHz, 298 K



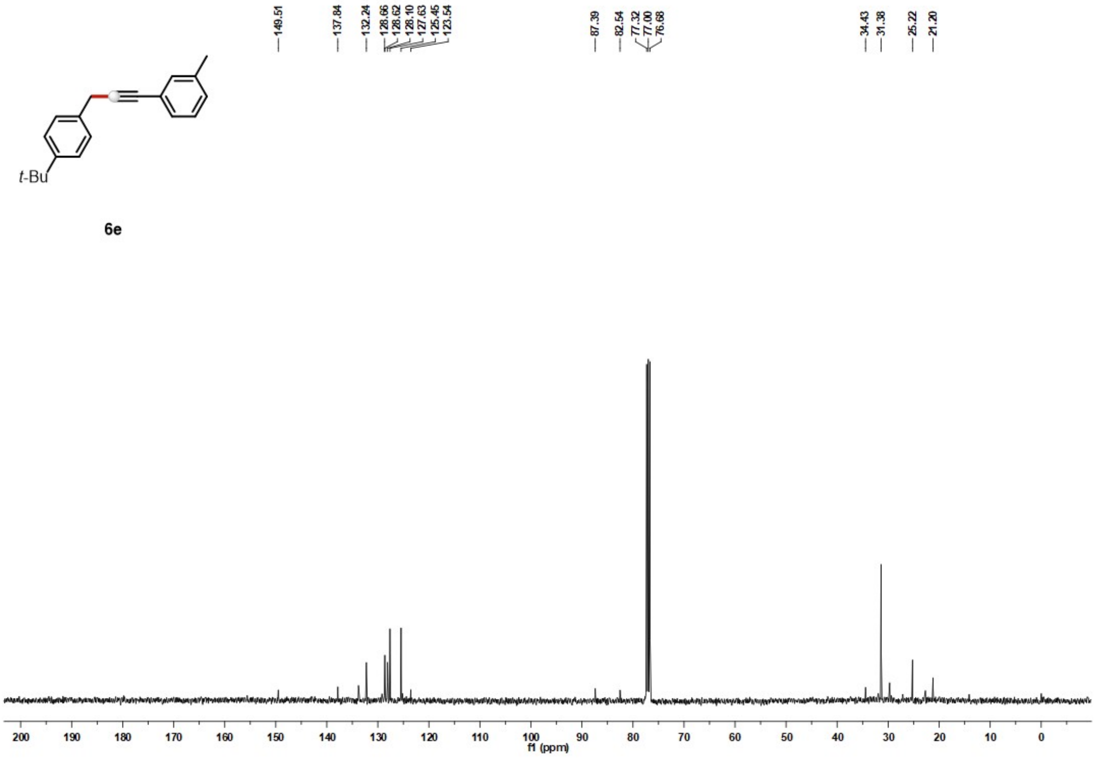
^{13}C NMR of **6d**
CDCl$_3$, 101 MHz, 298 K



^{1}H NMR of **6e**
CDCl$_3$, 400 MHz, 298 K

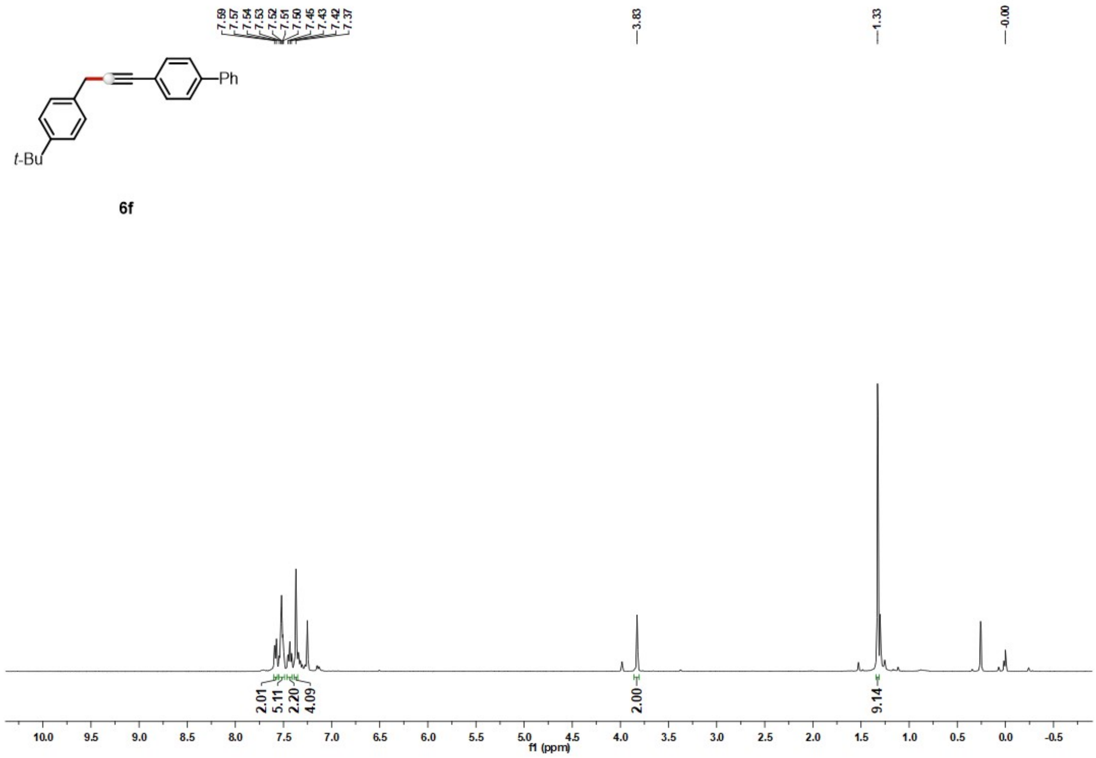


^{13}C NMR of **6e**
CDCl$_3$, 101 MHz, 298 K



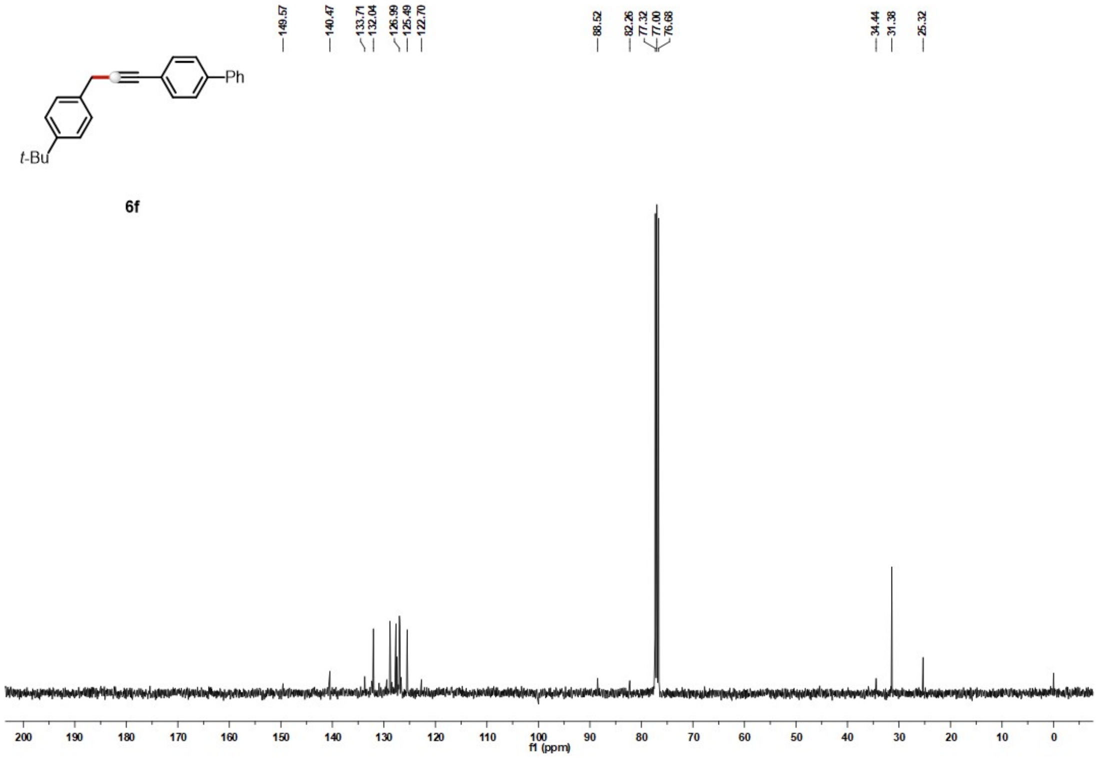
^{1}H NMR of **6f**

CDCl$_3$, 400 MHz, 298 K

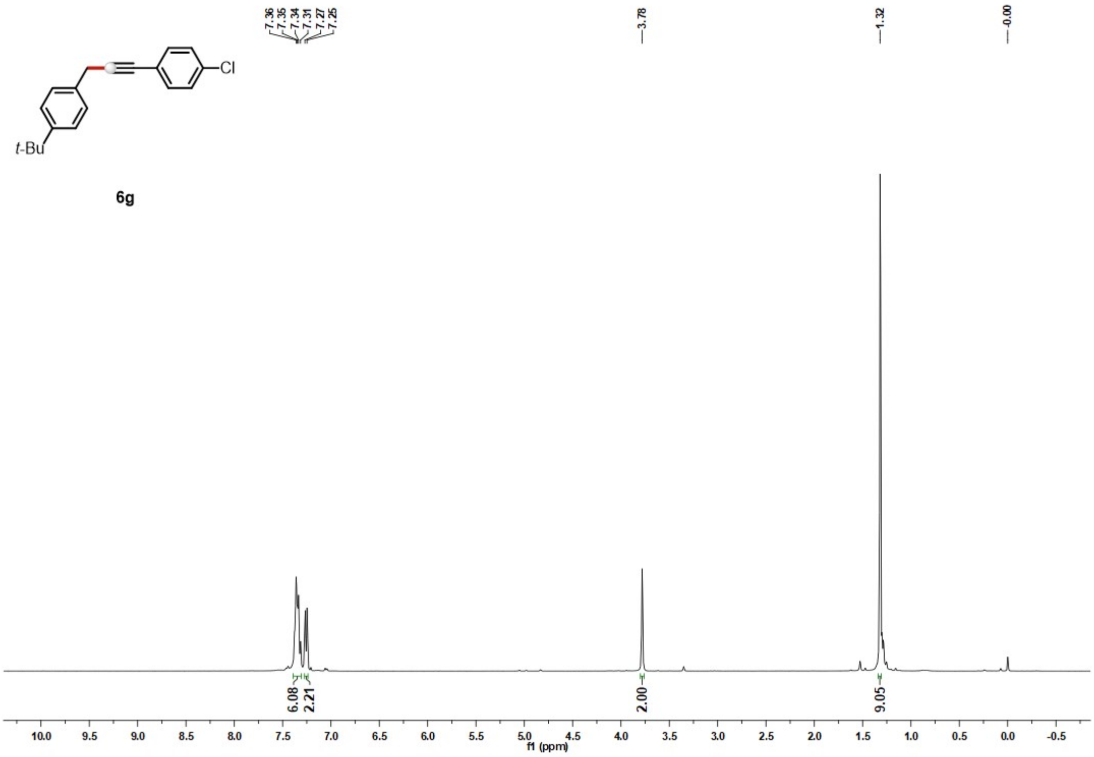


^{13}C NMR of **6f**

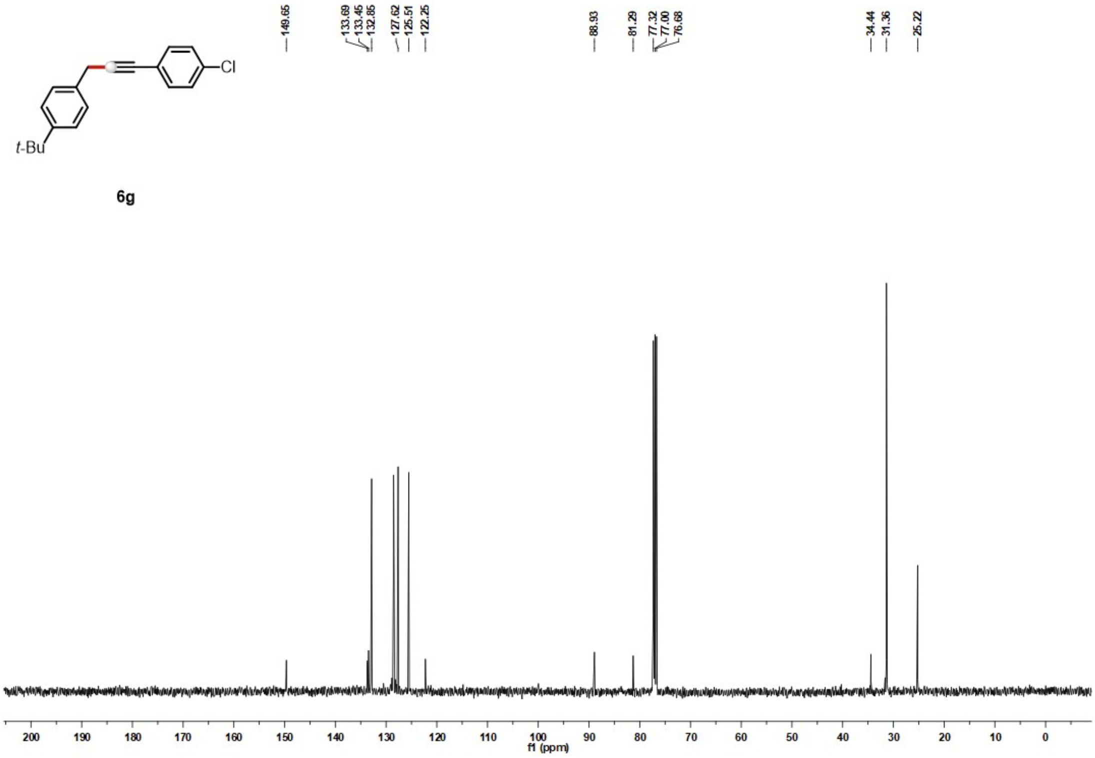
CDCl$_3$, 101 MHz, 298 K



^{1}H NMR of **6g**
CDCl$_3$, 400 MHz, 298 K

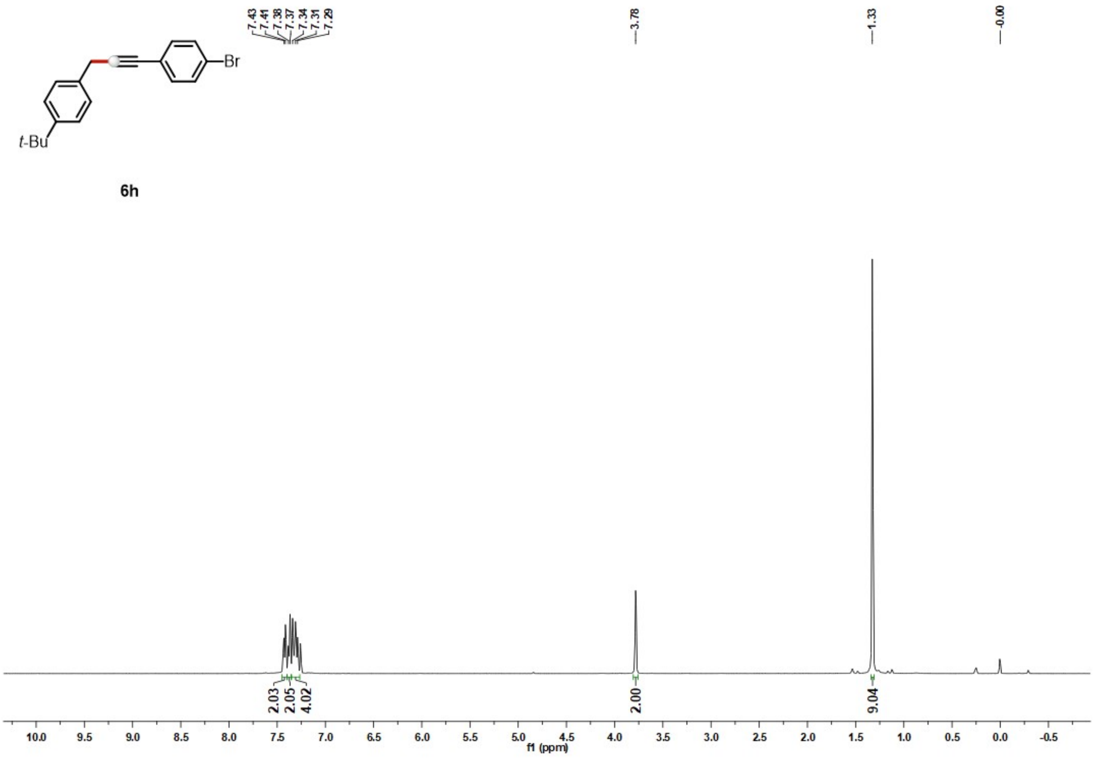


^{13}C NMR of **6g**
CDCl$_3$, 101 MHz, 298 K



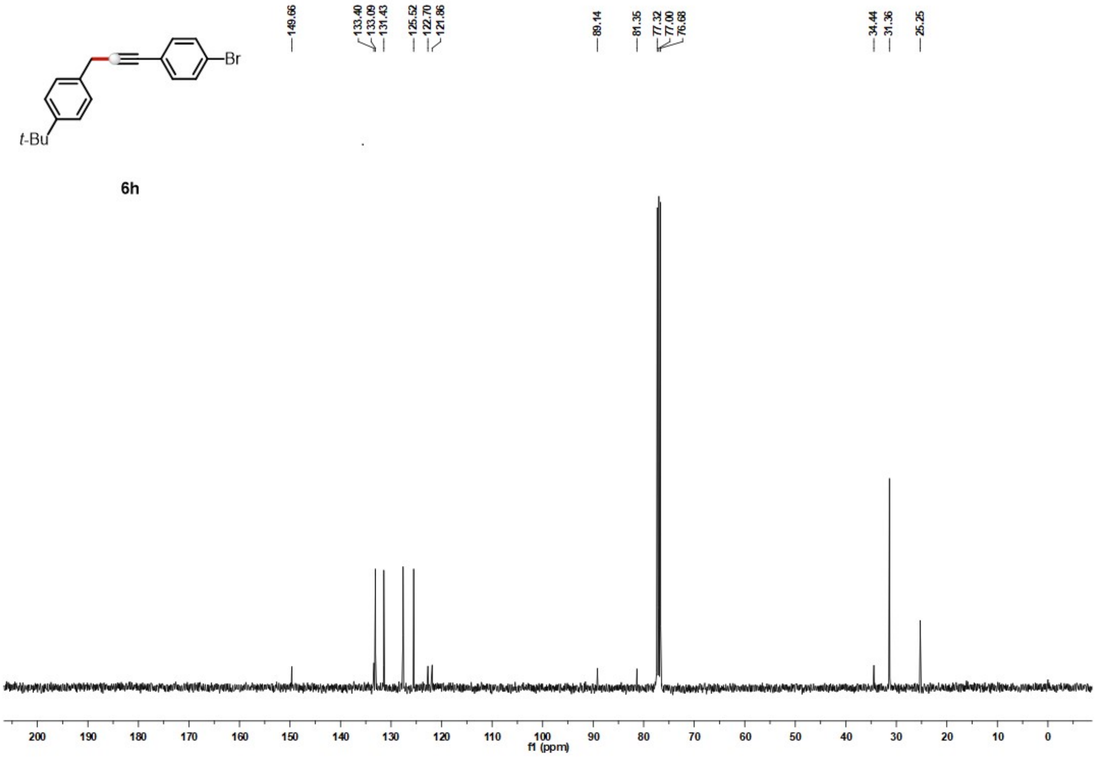
^{1}H NMR of **6h**

CDCl$_3$, 400 MHz, 298 K



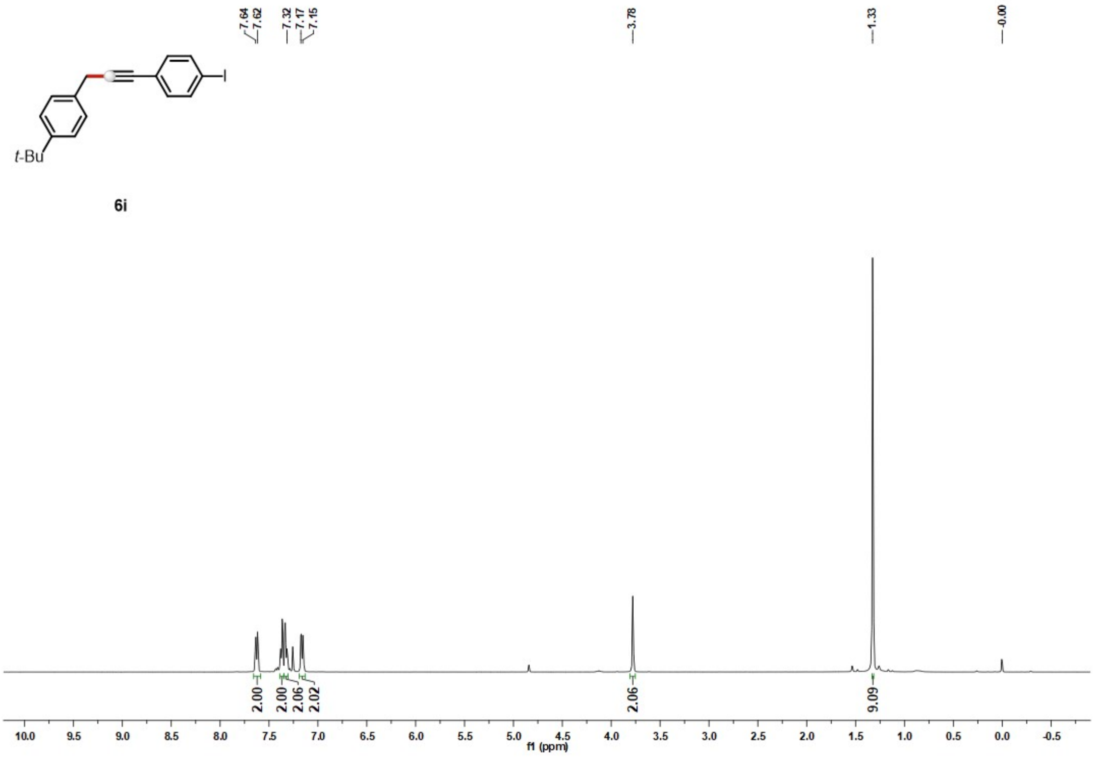
^{13}C NMR of **6h**

CDCl$_3$, 101 MHz, 298 K



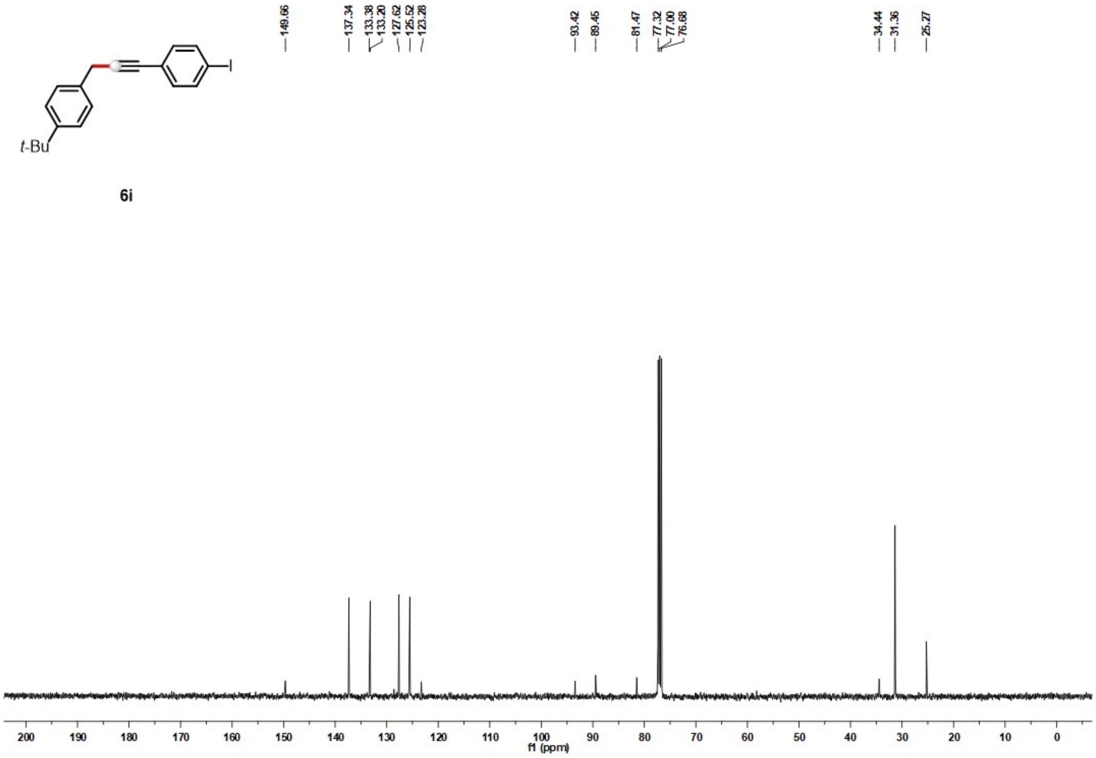
^{1}H NMR of **6i**

CDCl$_3$, 400 MHz, 298 K

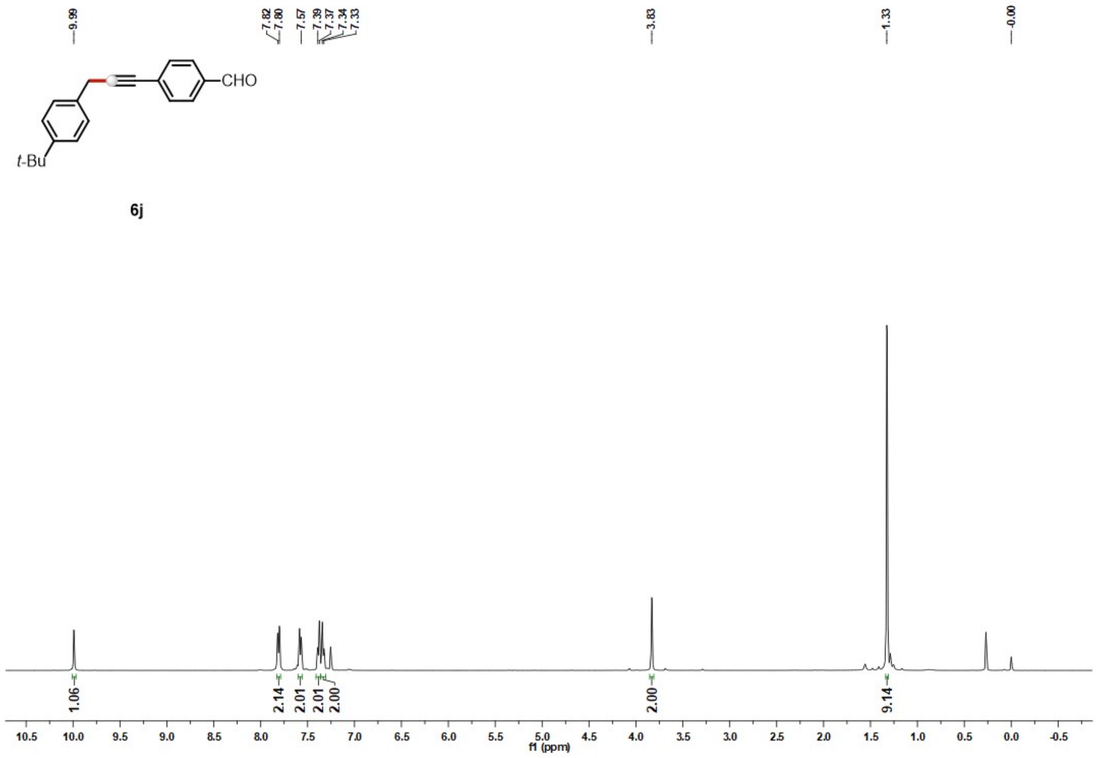


^{13}C NMR of **6i**

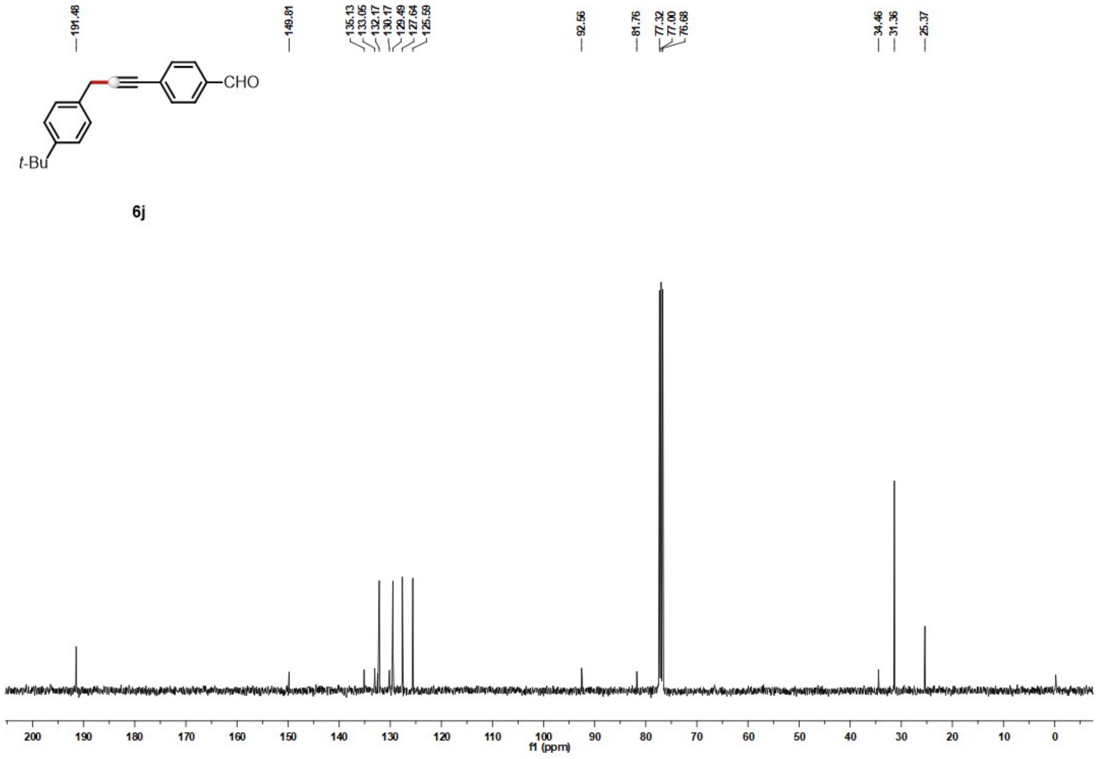
CDCl$_3$, 101 MHz, 298 K



^{1}H NMR of **6j**
CDCl$_3$, 400 MHz, 298 K



^{13}C NMR of **6j**
CDCl$_3$, 101 MHz, 298 K



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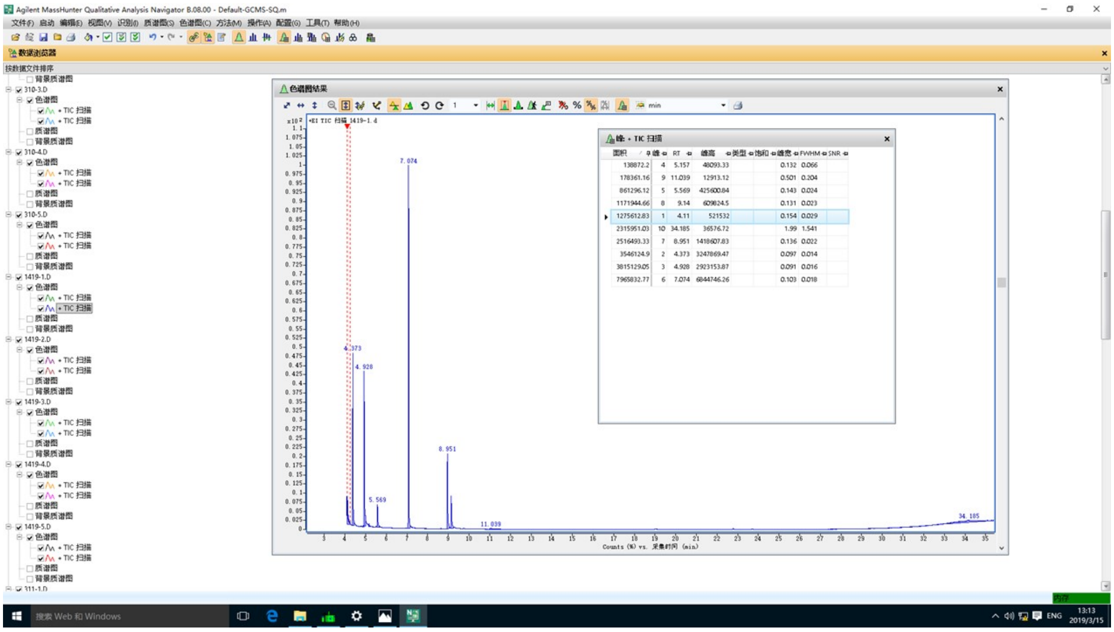
Appendix

The following is the GC-MS raw data

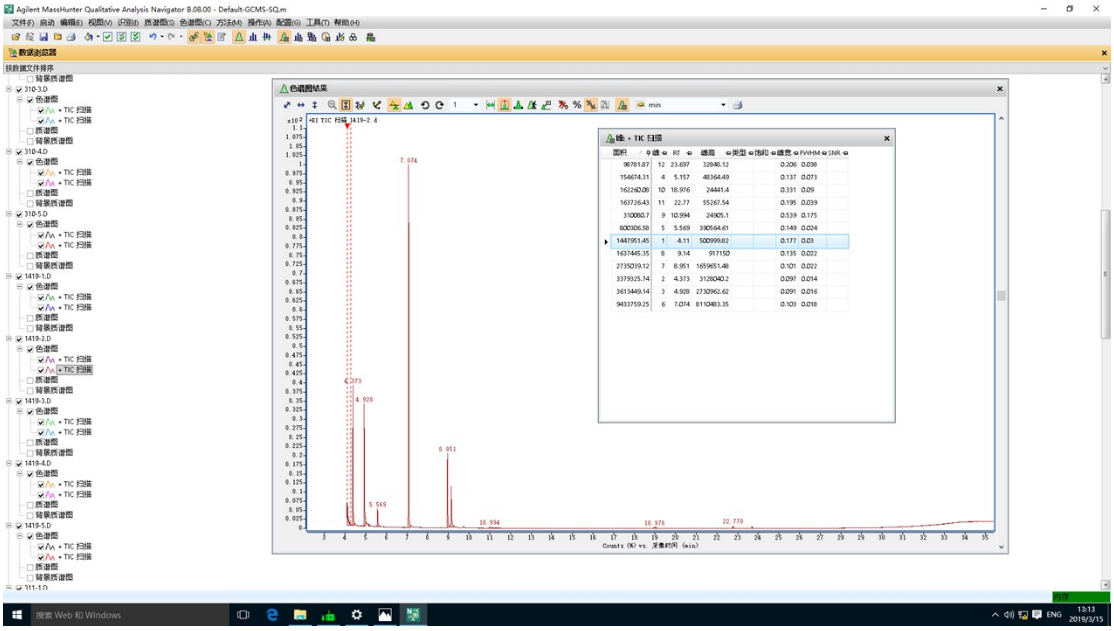
1d : **2a** = 0.5 : 1

T=3 min



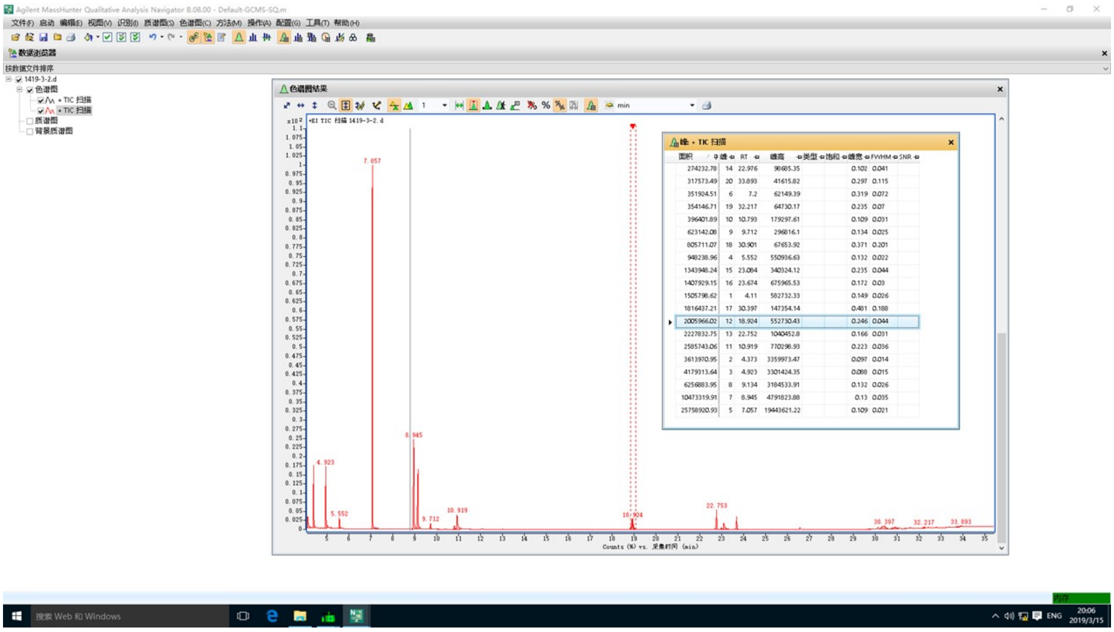
面积	峰	RT	峰高	类型	饱和	峰宽	FWHM	SNR
138872.2	4	5.157	48093.33			0.132	0.066	
178361.16	9	11.039	12913.12			0.501	0.204	
861296.12	5	5.569	425600.84			0.143	0.024	
1171944.66	8	9.14	609824.5			0.131	0.023	
1275612.83	1	4.11	521532			0.154	0.029	
2315951.03	10	34.185	36576.72			1.99	1.541	
2516493.33	7	8.951	1418607.83			0.136	0.022	
3546124.9	2	4.373	3247869.47			0.097	0.014	
3815129.05	3	4.928	2923153.87			0.091	0.016	
7965832.77	6	7.074	6844746.26			0.103	0.018	

T=6 min



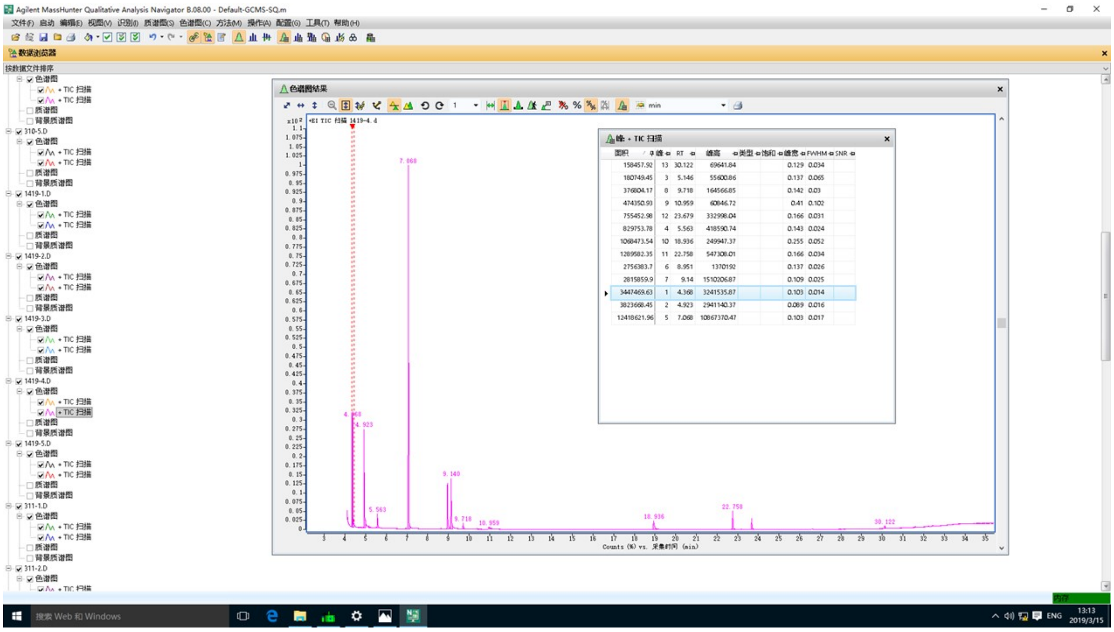
面积	峰	RT	峰高	类型	饱和	峰宽	FWHM	SNR
98781.87	12	23.697	32848.12			0.206	0.038	
154674.31	4	5.157	48364.49			0.137	0.073	
162260.08	10	18.976	24441.4			0.331	0.09	
163726.43	11	22.77	55267.54			0.195	0.039	
310080.7	9	10.994	24905.1			0.539	0.175	
800306.58	5	5.569	390564.61			0.149	0.024	
1447951.45	1	4.11	500999.82			0.177	0.03	
1637445.35	8	9.14	917150			0.135	0.022	
2735039.12	7	8.951	1659651.48			0.101	0.022	
3379325.74	2	4.373	3128040.2			0.097	0.014	
3613449.14	3	4.928	2730962.62			0.091	0.016	
9433759.25	6	7.074	8110483.35			0.103	0.018	

T=9 min



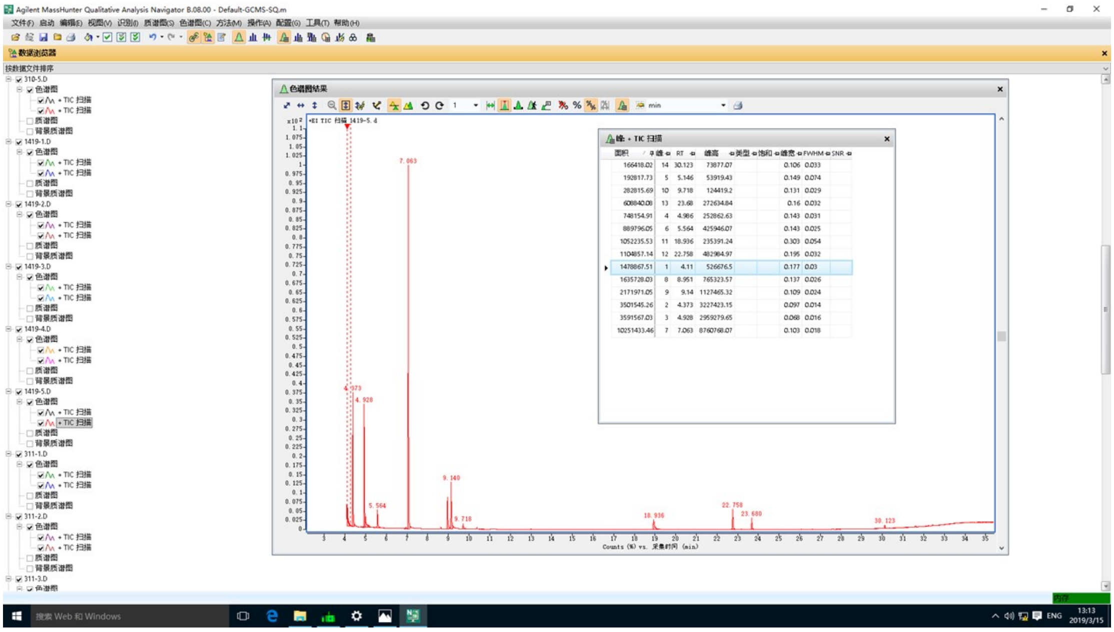
面积	峰	RT	峰高	类型	饱和	峰宽	FWHM	SNR
274232.78	14	22.976	98685.35			0.102	0.041	
317573.49	20	33.893	41615.82			0.297	0.115	
351924.51	6	7.2	62149.39			0.319	0.072	
354146.71	19	32.217	64730.17			0.235	0.07	
396401.89	10	10.793	179297.61			0.109	0.031	
623142.08	9	9.712	296816.1			0.134	0.025	
805711.07	18	30.901	67653.92			0.371	0.201	
948238.96	4	5.552	550936.63			0.132	0.022	
1343948.24	15	23.084	340324.12			0.235	0.044	
1407929.15	16	23.674	675965.53			0.172	0.03	
1505798.62	1	4.11	582732.33			0.149	0.026	
1816437.21	17	30.397	147354.14			0.481	0.188	
2005966.02	12	18.924	552730.43			0.246	0.044	
2227832.75	13	22.752	1040452.8			0.166	0.031	
2585743.06	11	10.919	770298.93			0.223	0.036	
3613970.95	2	4.373	3359973.47			0.097	0.014	
4179313.64	3	4.923	3301424.35			0.088	0.015	
6256883.95	8	9.134	3184533.91			0.132	0.026	
10473319.91	7	8.945	4791823.88			0.13	0.035	
25758920.93	5	7.057	19443621.22			0.109	0.021	

T=12 min



面积	峰	RT	峰高	类型	饱和	峰宽	FWHM	SNR
158457.92	13	30.122	69641.84			0.129	0.034	
180749.45	3	5.146	55600.86			0.137	0.065	
376804.17	8	9.718	164566.85			0.142	0.03	
474350.93	9	10.959	60846.72			0.41	0.102	
755452.98	12	23.679	332998.04			0.166	0.031	
829753.78	4	5.563	418590.74			0.143	0.024	
1068473.54	10	18.936	249947.37			0.255	0.052	
1289582.35	11	22.758	547308.01			0.166	0.034	
2756383.7	6	8.951	1370192			0.137	0.026	
2815859.9	7	9.14	1510206.87			0.109	0.025	
3447469.63	1	4.368	3241535.87			0.103	0.014	
3823668.45	2	4.923	2941140.37			0.089	0.016	
12418621.96	5	7.068	10867370.47			0.103	0.017	

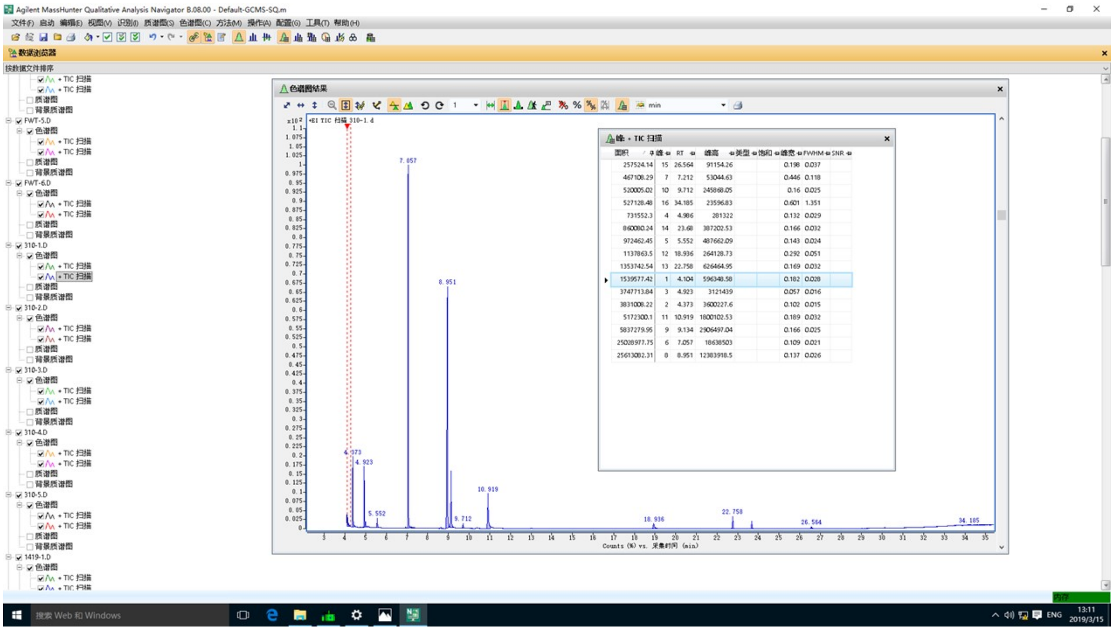
T=15 min



面积	峰	RT	峰高	类型	饱和	峰宽	FWHM	SNR
166418.02	14	30.123	73877.07			0.106	0.033	
192817.73	5	5.146	53919.43			0.149	0.074	
282815.69	10	9.718	124419.2			0.131	0.029	
608840.08	13	23.68	272634.84			0.16	0.032	
748154.91	4	4.986	252862.63			0.143	0.031	
889796.05	6	5.564	425946.07			0.143	0.025	
1052235.53	11	18.936	235391.24			0.303	0.054	
1104857.14	12	22.758	482984.97			0.195	0.032	
1478867.51	1	4.11	526676.5			0.177	0.03	
1635728.03	8	8.951	765323.57			0.137	0.026	
2171971.05	9	9.14	1127465.32			0.109	0.024	
3501545.26	2	4.373	3227423.15			0.097	0.014	
3591567.03	3	4.928	2959279.65			0.068	0.016	
10251433.46	7	7.063	8760768.07			0.103	0.018	

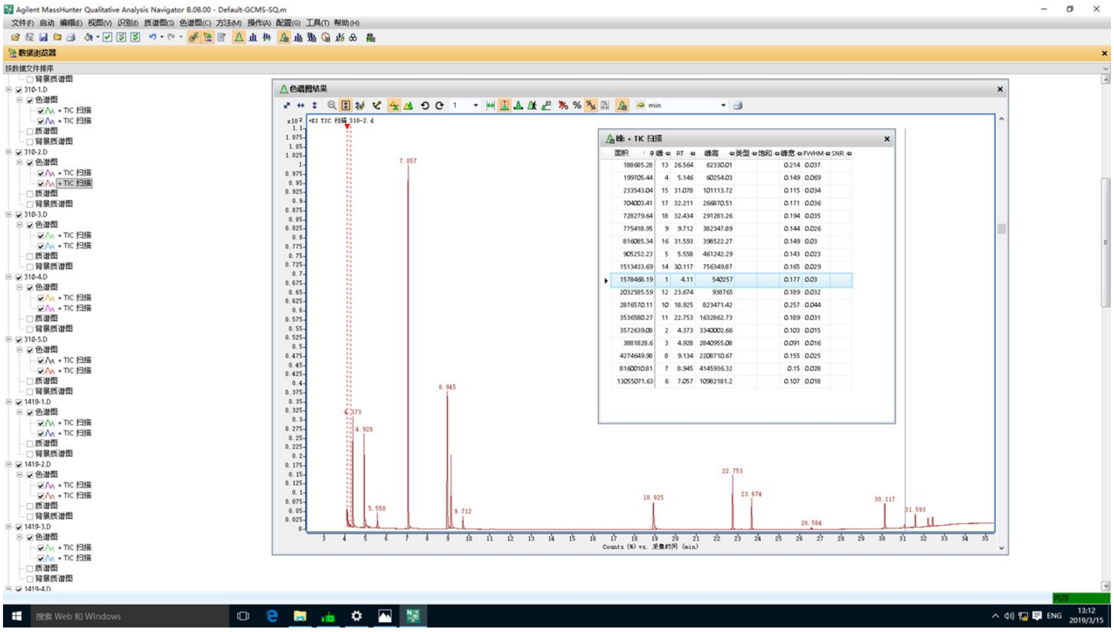
1d : **2a** = 1 : 1

T=3 min



面积	峰	RT	峰高	类型	饱和	峰宽	FWHM	SNR
257524.14	15	26.564	91154.26			0.198	0.037	
467108.29	7	7.212	53044.63			0.446	0.118	
520005.02	10	9.712	245868.05			0.16	0.025	
527128.48	16	34.185	23596.83			0.601	1.351	
731552.3	4	4.986	281322			0.132	0.029	
860080.24	14	23.68	387202.53			0.166	0.032	
972462.45	5	5.552	487662.09			0.143	0.024	
1137863.5	12	18.936	264128.73			0.292	0.051	
1353742.54	13	22.758	626464.95			0.169	0.032	
1539577.42	1	4.104	596348.58			0.182	0.028	
3747713.84	3	4.923	3121439			0.057	0.016	
3831008.22	2	4.373	3600227.6			0.102	0.015	
5172300.1	11	10.919	1800102.53			0.189	0.032	
5837279.95	9	9.134	2906497.04			0.166	0.025	
25028977.75	6	7.057	18638503			0.109	0.021	
25613082.31	8	8.951	12383918.5			0.137	0.026	

T=6 min



面积	峰	RT	峰高	类型	饱和	峰宽	FWHM	SNR
188685.28	13	26.564	62330.01			0.214	0.037	
199705.44	4	5.146	60254.03			0.149	0.069	
233543.04	15	31.078	101113.72			0.115	0.034	
704003.41	17	32.211	266870.51			0.171	0.036	
728279.64	18	32.434	291281.26			0.194	0.035	
775418.95	9	9.712	382347.89			0.144	0.026	
816085.34	16	31.593	398522.27			0.149	0.03	
905252.23	5	5.558	461242.29			0.143	0.023	
1513433.69	14	30.117	756349.87			0.165	0.029	
1578468.19	1	4.11	540257			0.177	0.03	
2032585.59	12	23.674	938765			0.189	0.032	
2876570.11	10	18.925	823471.42			0.257	0.044	
3536580.27	11	22.753	1632862.73			0.189	0.031	
3572639.08	2	4.373	3340002.66			0.103	0.015	
3881828.6	3	4.928	2840955.08			0.091	0.016	
4274649.98	8	9.134	2208710.67			0.155	0.025	
8160010.81	7	8.945	4145936.32			0.15	0.028	
13055071.63	6	7.057	10982181.2			0.107	0.018	

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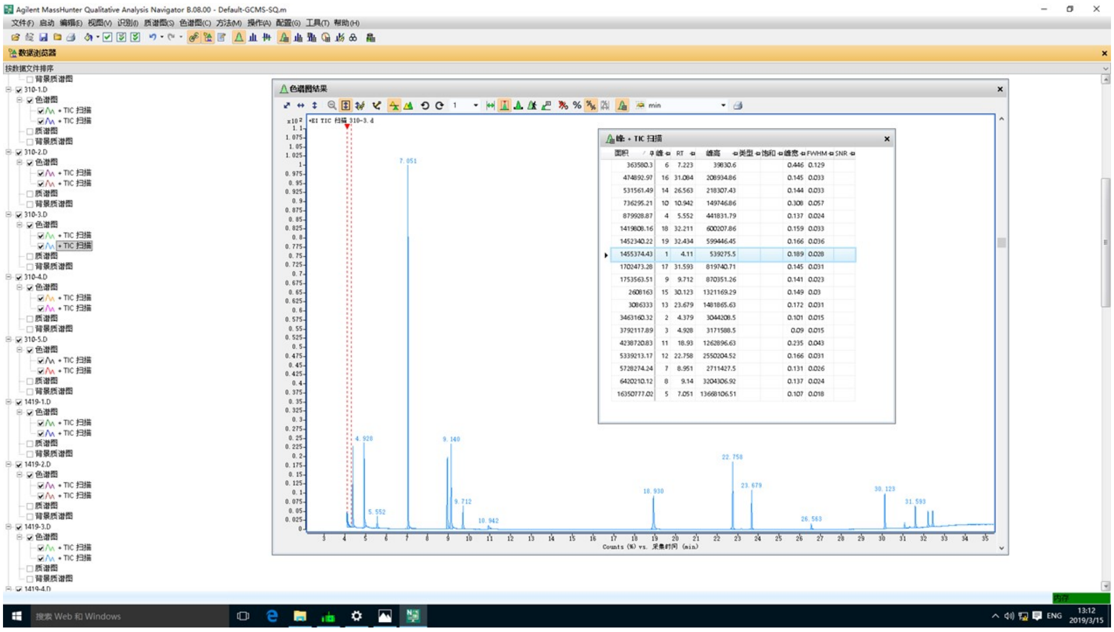
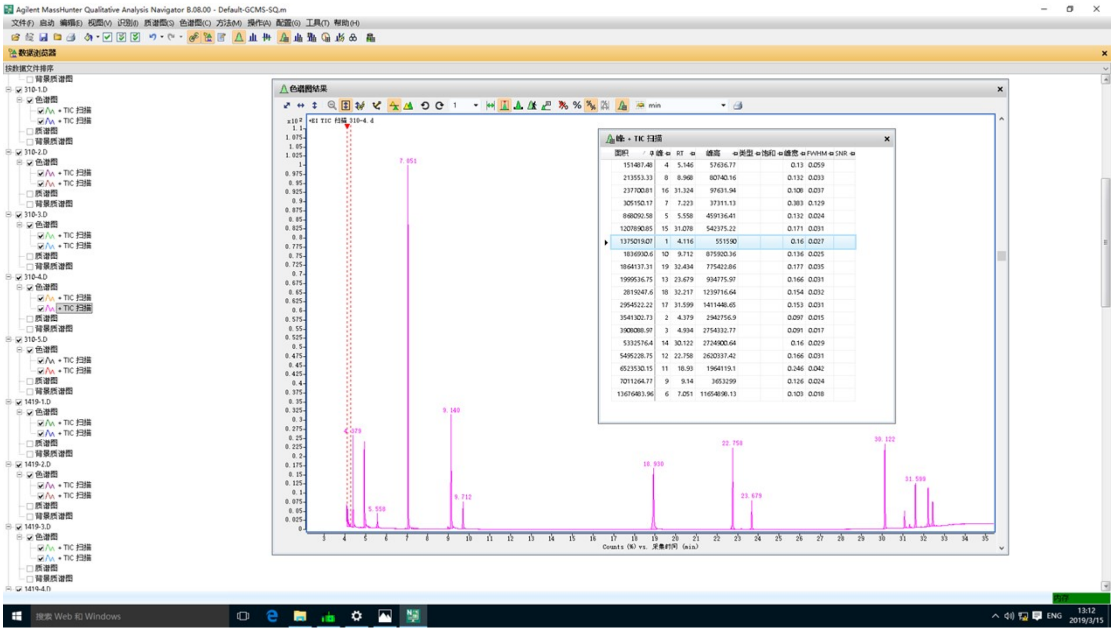


面积	峰	RT	峰高	类型	饱和	峰宽	FWHM	SNR
363580.3	6	7.223	39830.6			0.446	0.129	
474892.97	16	31.084	208934.86			0.145	0.033	
531561.49	14	26.563	218307.43			0.144	0.033	
736295.21	10	10.942	149746.86			0.308	0.057	
879928.87	4	5.552	441831.79			0.137	0.024	
1419808.16	18	32.211	600207.86			0.159	0.033	
1452340.22	19	32.434	599446.45			0.166	0.036	
1455374.43	1	4.11	539275.5			0.189	0.028	
1702473.28	17	31.593	819740.71			0.145	0.031	
1753563.51	9	9.712	870351.26			0.141	0.023	
2608163	15	30.123	1321169.29			0.149	0.03	
3086333	13	23.679	1481865.63			0.172	0.031	
3463160.32	2	4.379	3044208.5			0.101	0.015	
3792117.89	3	4.928	3171588.5			0.09	0.015	
4238720.83	11	18.93	1262896.63			0.235	0.043	
5339213.17	12	22.758	2550204.52			0.166	0.031	
5728274.24	7	8.951	2711427.5			0.131	0.026	
6420210.12	8	9.14	3204306.92			0.137	0.024	
16350777.02	5	7.051	13668106.51			0.107	0.018	

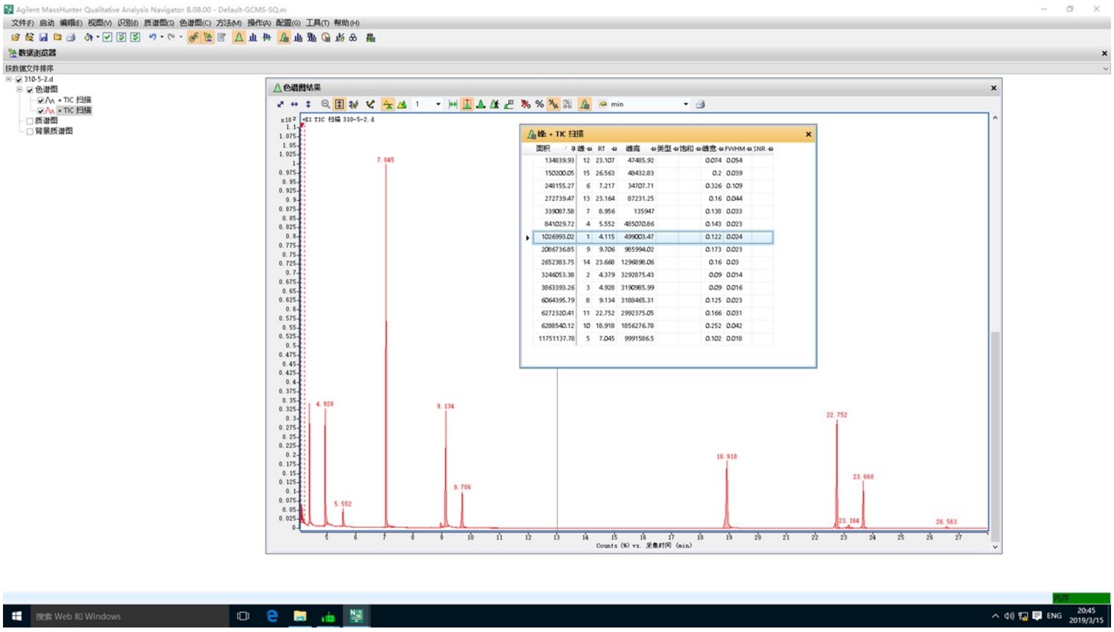
T=12 min



峰 + TIC 扫描

面积	峰	RT	峰高	类型	饱和	峰宽	FWHM	SNR
151487.48	4	5.146	57636.77			0.13	0.059	
213553.33	8	8.968	80740.16			0.132	0.033	
237700.81	16	31.324	97631.94			0.108	0.037	
305150.17	7	7.223	37311.13			0.383	0.129	
868092.58	5	5.558	459136.41			0.132	0.024	
1207890.85	15	31.078	542375.22			0.171	0.031	
1375019.07	1	4.116	551590			0.16	0.027	
1836930.6	10	9.712	875920.36			0.136	0.025	
1864137.31	19	32.434	775422.86			0.177	0.035	
1999536.75	13	23.679	934775.97			0.166	0.031	
2819247.6	18	32.217	1239716.64			0.154	0.032	
2954522.22	17	31.599	1411448.65			0.153	0.031	
3541302.73	2	4.379	2942756.9			0.097	0.015	
3908088.97	3	4.934	2754332.77			0.091	0.017	
5332576.4	14	30.122	2724900.64			0.16	0.029	
5495228.75	12	22.758	2620337.42			0.166	0.031	
6523530.15	11	18.93	1964119.1			0.246	0.042	
7011264.77	9	9.14	3653299			0.126	0.024	
13676483.96	6	7.051	11654898.13			0.103	0.018	

T=15 min

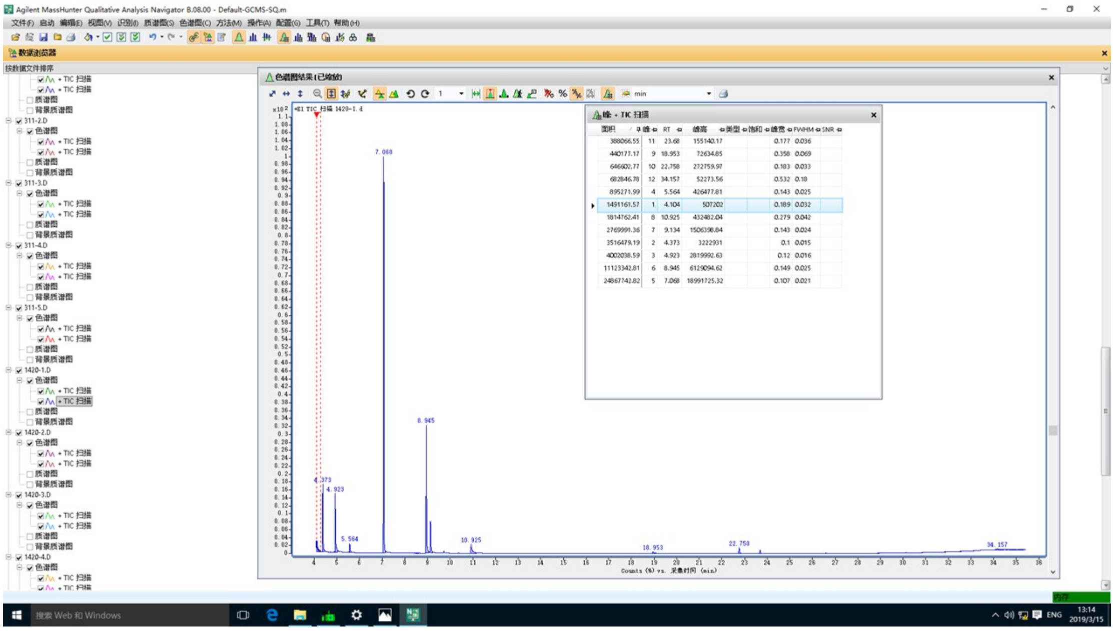


峰 + TIC 扫描

面积	峰	RT	峰高	类型	饱和	峰宽	FWHM	SNR
134839.93	12	23.107	47485.92			0.074	0.054	
150200.05	15	26.563	48432.83			0.2	0.039	
248155.27	6	7.217	34707.71			0.326	0.109	
272739.47	13	23.164	87231.25			0.16	0.044	
339087.58	7	8.956	135947			0.138	0.033	
841029.72	4	5.552	485070.86			0.143	0.023	
1026993.02	1	4.115	499003.47			0.122	0.024	
2086736.85	9	9.706	985994.02			0.173	0.023	
2652383.75	14	23.668	1296898.06			0.16	0.03	
3246053.38	2	4.379	3292875.43			0.09	0.014	
3863393.26	3	4.928	3190985.99			0.09	0.016	
6064395.79	8	9.134	3188465.31			0.125	0.023	
6272320.41	11	22.752	2992375.05			0.166	0.031	
6288540.12	10	18.918	1856276.78			0.252	0.042	
11751137.78	5	7.045	9991586.5			0.102	0.018	

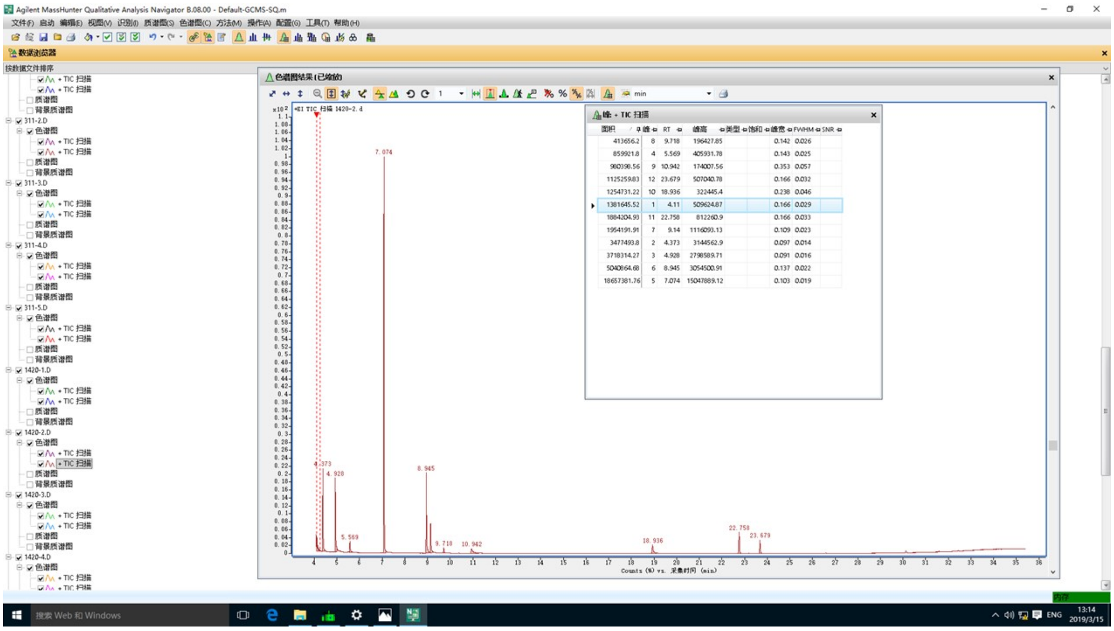
1d : **2a** = 1 : 2

T=3 min



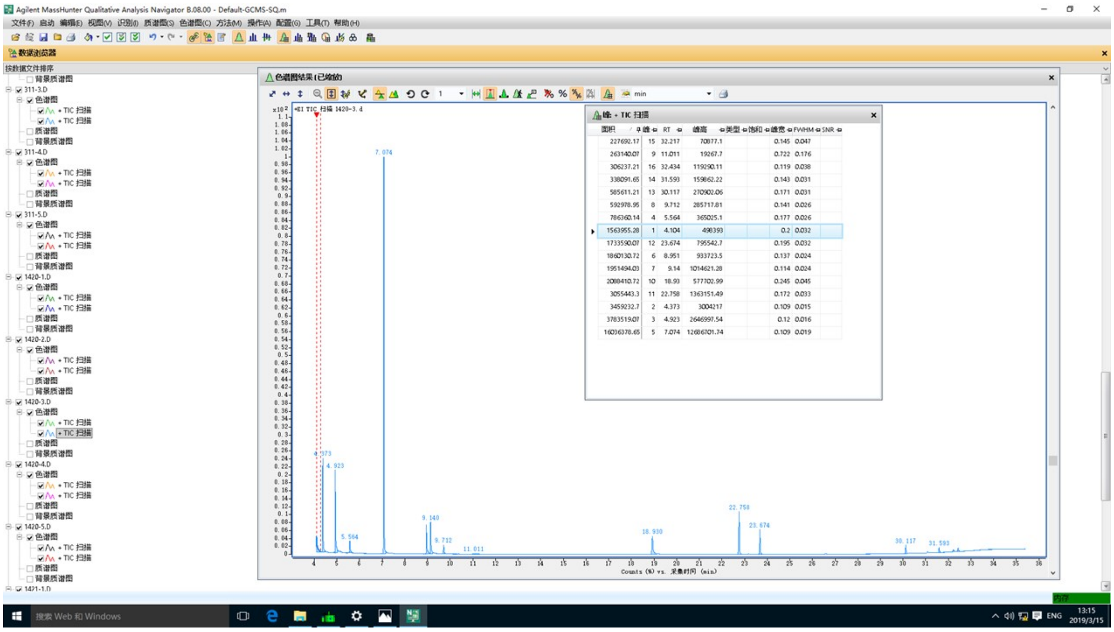
面积	峰	RT	峰高	类型	饱和	峰宽	FWHM	SNR
388066.55	11	23.68	155140.17			0.177	0.036	
440177.17	9	18.953	72634.85			0.358	0.069	
646602.77	10	22.758	272759.97			0.183	0.033	
682846.78	12	34.157	52273.56			0.532	0.18	
895271.99	4	5.564	426477.81			0.143	0.025	
1491161.57	1	4.104	507202			0.189	0.032	
1814762.41	8	10.925	432482.04			0.279	0.042	
2769991.36	7	9.134	1506398.84			0.143	0.024	
3516479.19	2	4.373	3222931			0.1	0.015	
4002038.59	3	4.923	2819992.63			0.12	0.016	
11123342.81	6	8.945	6129094.62			0.149	0.025	
24867742.82	5	7.068	18991725.32			0.107	0.021	

T=6 min



面积	峰	RT	峰高	类型	饱和	峰宽	FWHM	SNR
413656.2	8	9.718	196427.85			0.142	0.026	
859921.8	4	5.569	405931.78			0.143	0.025	
980398.56	9	10.942	174007.56			0.353	0.057	
1125259.83	12	23.679	507040.78			0.166	0.032	
1254731.22	10	18.936	322445.4			0.238	0.046	
1381645.52	1	4.11	509624.87			0.166	0.029	
1884204.93	11	22.758	812260.9			0.166	0.033	
1954191.91	7	9.14	1116093.13			0.109	0.023	
3477493.8	2	4.373	3144562.9			0.097	0.014	
3718314.27	3	4.928	2798589.71			0.091	0.016	
5040864.68	6	8.945	3054500.91			0.137	0.022	
18657381.76	5	7.074	15047889.12			0.103	0.019	

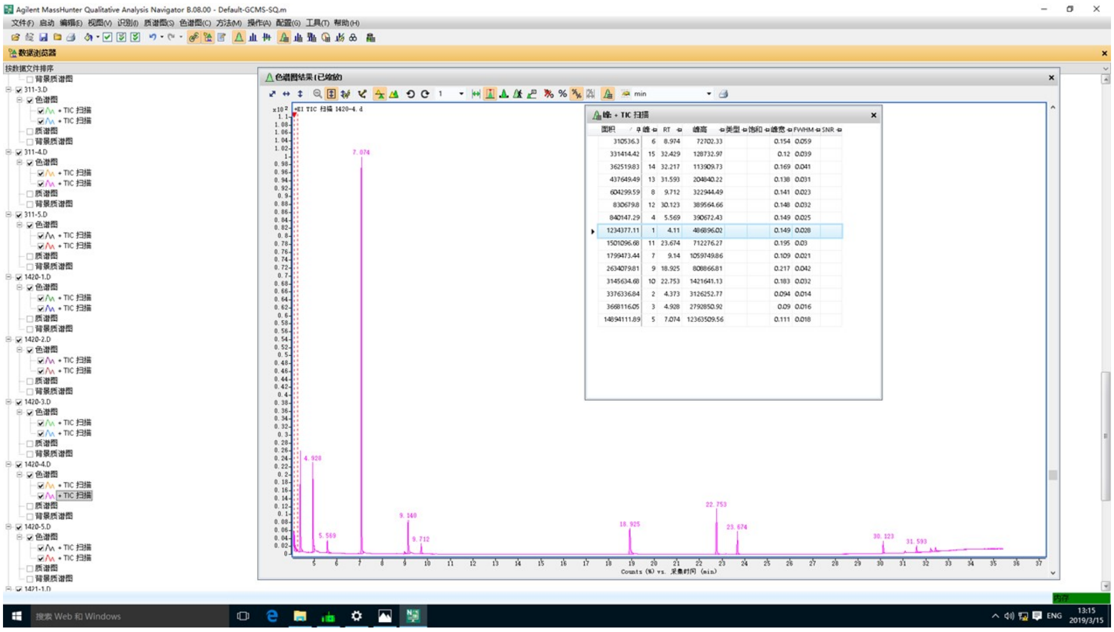
T=9 min



峰: + TIC 扫描

面积	峰	RT	峰高	类型	饱和	峰宽	FWHM	SNR
227692.17	15	32.217	70877.1			0.145	0.047	
263140.07	9	11.011	19267.7			0.722	0.176	
306237.21	16	32.434	119290.11			0.119	0.038	
338091.65	14	31.593	159862.22			0.143	0.031	
585611.21	13	30.117	270902.06			0.171	0.031	
592978.95	8	9.712	285717.81			0.141	0.026	
786360.14	4	5.564	365025.1			0.177	0.026	
1563955.28	1	4.104	498393			0.2	0.032	
1733590.07	12	23.674	795542.7			0.195	0.032	
1860130.72	6	8.951	933723.5			0.137	0.024	
1951494.03	7	9.14	1014621.28			0.114	0.024	
2088410.72	10	18.93	577702.99			0.245	0.045	
3055443.3	11	22.758	1363151.49			0.172	0.033	
3459232.7	2	4.373	3004217			0.109	0.015	
3783519.07	3	4.923	2646997.54			0.12	0.016	
16036378.65	5	7.074	12686701.74			0.109	0.019	

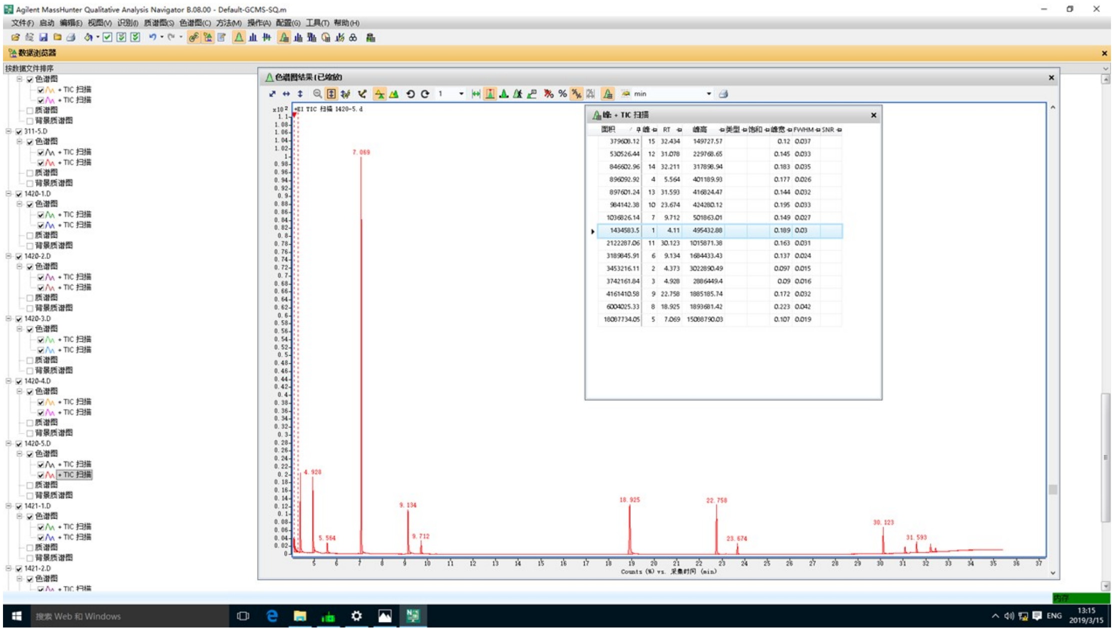
T=12 min



峰: + TIC 扫描

面积	峰	RT	峰高	类型	饱和	峰宽	FWHM	SNR
310536.3	6	8.974	72702.33			0.154	0.059	
331414.42	15	32.429	128732.97			0.12	0.039	
362519.83	14	32.217	113909.73			0.169	0.041	
437649.49	13	31.593	204840.22			0.138	0.031	
604299.59	8	9.712	322944.49			0.141	0.023	
830679.8	12	30.123	389564.66			0.148	0.032	
840147.29	4	5.569	390672.43			0.149	0.025	
1234377.11	1	4.11	486896.02			0.149	0.028	
1501096.68	11	23.674	712276.27			0.195	0.03	
1799473.44	7	9.14	1059749.86			0.109	0.021	
2634079.81	9	18.925	808866.81			0.217	0.042	
3145634.68	10	22.753	1421641.13			0.183	0.032	
3376336.84	2	4.373	3126252.77			0.094	0.014	
3668116.05	3	4.928	2792850.92			0.09	0.016	
14894111.89	5	7.074	12363509.56			0.111	0.018	

T=15 min



峰: + TIC 扫描

面积	峰	RT	峰高	类型	饱和	峰宽	FWHM	SNR
379608.12	15	32.434	149727.57			0.12	0.037	
530526.44	12	31.078	229768.65			0.145	0.033	
846602.96	14	32.211	317898.94			0.183	0.035	
896092.92	4	5.564	401189.93			0.177	0.026	
897601.24	13	31.593	416824.47			0.144	0.032	
984142.38	10	23.674	424280.12			0.195	0.033	
1036826.14	7	9.712	501863.01			0.149	0.027	
1434583.5	1	4.11	495432.88			0.189	0.03	
2122287.06	11	30.123	1015871.38			0.163	0.031	
3189845.91	6	9.134	1684433.43			0.137	0.024	
3453216.11	2	4.373	3022890.49			0.097	0.015	
3742161.84	3	4.928	2886449.4			0.09	0.016	
4161410.58	9	22.758	1885185.74			0.172	0.032	
6004025.33	8	18.925	1893681.42			0.223	0.042	
18087734.05	5	7.069	15088790.03			0.107	0.019	