Supporting Information for

Transition-metal-free, visible-light-induced multicomponent synthesis of allylic amines and tetrahydroquinolines

*Jian Wang**

Antibiotics Research and Re-evaluation Key Laboratory of Sichuan Province, Sichuan Industrial Institute of Antibiotics, School of Pharmacy, Chengdu University, Chengdu, 610106, P. R. China

Table of Contents

1. General Experimental Details

Unless otherwise noted, reagents were purchased from Aldrich Chemical Co. (Darmstadt, Germany), Adamas-beta (Shanghai, China), and Energy Chemical (Shanghai, China) and used without further purification. Commercially available activated powdered 4Å MS, anhydrous dichloromethane (DCM) and acetonitrile (MeCN) were used directly. All known compounds are prepared according to the literature. All reactions were run under an inert atmosphere (N_2) unless otherwise stated, with oven-dried glassware, using standard techniques. Irradiation of the reaction mixture was achieved using a 40 W Kessil A160WE LED – Tuna blue aquarium light (setup: max blue, max intensity). Clear glass vials (3 mL) with PTFE/silicon septum lined screw caps were used as the standard reaction vessel. Proton nuclear magnetic resonance (^{1}H NMR, 600 MHz) and carbon-13 nuclear magnetic resonance (^{13}C NMR, 150 MHz) spectra were measured on a JNM-ECZ600R/S1 (JEOL, Tokyo, Japan) with $CDCl_3$ as solvent and recorded in ppm relative to an internal tetramethylsilane standard. High-resolution mass spectra (HRMS) were recorded on a 6520 Q-TOF MS system (Agilent, Santa Clara, CA, USA) using an electrospray (ESI) ionization source. Low-resolution mass spectra were obtained on an Agilent 1260-6120 ESI-LC/MS. Cyclic voltammetry measurements were performed in dry DCM or CH_3CN on a CHI 610E electrochemical analyzer with a three-electrode cell, using 0.1 M Bu_4NPF_6 as supporting electrolyte, AgCl/Ag as reference electrode, platinum disk as working electrode, Pt wire as counter electrode, and a scan rate at 100 mV/s. Stern-Volmer quenching was performed using a Techcomp FL970 spectrofluorometer with a 150W xenon lamp.

2. Setup for Photocatalytic Reactions

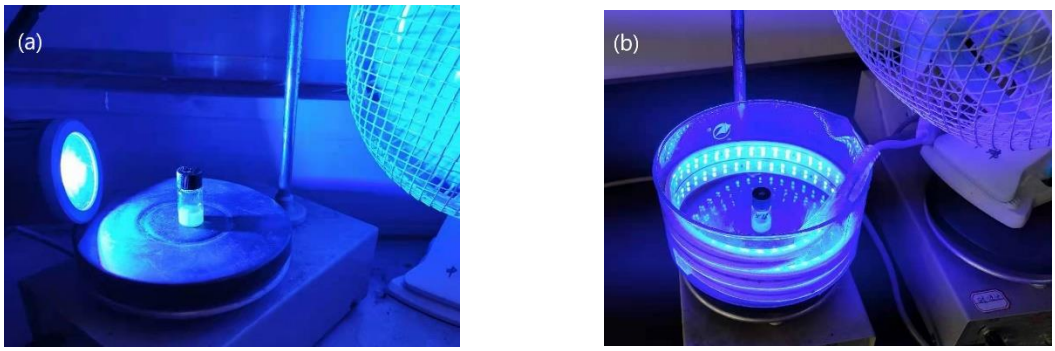


Figure S1. (a) General reaction setup using Kessil lamp as light sources, (b) General reaction setup using strips of blue LEDs as light sources.

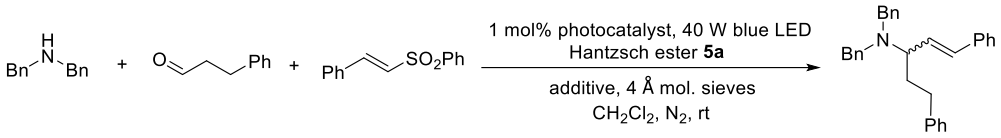
3. Reaction Optimizations

3.1 Photocatalytic Radical Alkenylation to Synthesize Tertiary Allylic Amines

A 3 mL PTFE/Silicone-lined septa screw cap (PP) clear glass vial equipped with a magnetic stir bar was charged with dibenzylamine (**1aa**), 3-phenylpropanal (**2ab**), (*E*)-(2-

(phenylsulfonyl)vinyl)benzene (**3ac**), Hantzsch ester **5a**, 4Å MS and the respective photocatalyst. The vial was sealed and a needle was inserted through the septa and the contents evacuated/backfilled with N_2 (3 cycles), followed by the addition of the anhydrous dichloromethane via syringe. Acid additive was then added using a micro-syringe in some cases. Then it was irradiated for indicated time with the respective light source. Upon completion, the reaction mixture was analyzed by TLC and directly loaded onto the prepared TLC glass plate using EtOAc/P.E. as an eluent to afford product **4aa**.

Table S1. Reaction Optimizations of Photocatalytic Radical Alkenylation to Synthesize Tertiary Allylic Amines



1aa **2ab** **3ac** **4aa** (*E*/*Z*)

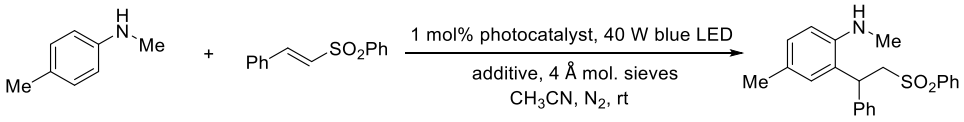
Entry	**1a**, **2a**, **3a** (mmol)	Photocatalyst	Additive	Time	Yield[a]	*E*:*Z*[b]
1	0.2, 0.2, 0.1	$Ir(ppy)_3$	propionic acid (20 mol%)	24 h	82%	41:52
2	0.2, 0.2, 0.1	$Ir(ppy)_3$	propionic acid (20 mol%)	48 h	78%	21:79
3	0.2, 0.2, 0.1	CzIPN	propionic acid (20 mol%)	2 h	93%	>99:1
4	**0.2, 0.2, 0.1**	**CzIPN**	**none**	**2 h**	**94%**	**>99:1**
5	0.12, 0.12, 0.1	CzIPN	none	2 h	73%	>99:1
6	0.1, 0.1, 0.2	CzIPN	none	2 h	67%	>99:1
7	0.2, 0.2, 0.1	none	none	2 h	0%	-
8[c]	0.2, 0.2, 0.1	CzIPN	none	2 h	11%	>99:1
9[d]	0.2, 0.2, 0.1	CzIPN	none	2 h	80%	>99:1
10[e]	0.2, 0.2, 0.1	CzIPN	none	2 h	65%	>99:1
11[f]	0.2, 0.2, 0.1	CzIPN	none	2 h	86%	>99:1
12	0.2, 0.2, 0.1	None	none	2 h	0%	-
13[g]	0.2, 0.2, 0.1	CzIPN	none	2 h	8%	>99:1

(a) Isolated yields; (b) the isomer could be isolated from each other by prepared TLC glass plate (PE:EA = 100:1) (c) reaction run without **5a**; (d) reaction run without 4Å mol. sieves; (e) reaction run without nitrogen protection; (f) using strips of blue LEDs as light sources, (g) reaction run without **5a**.

3.2 Photocatalytic Addition of Aniline to Vinyl Sulfone

A 3 mL PTFE/Silicone-lined septa screw cap (PP) clear glass vial equipped with a magnetic stir bar was charged with *N*-Methyl-*p*-toluidin (**6b**), (*E*)-(2-(phenylsulfonyl)vinyl)benzene (**3ac**), and the respective photocatalyst and base. The vial was sealed and a needle was inserted through the septa and the contents evacuated/backfilled with N_2 (3 cycles), followed by the addition of the anhydrous CH_3CN via syringe. Then it was irradiated for indicated time with the respective light source. Upon completion, the reaction mixture was analyzed by TLC and the solvent was removed in vacuo. The residue was purified by the prepared TLC glass plate (EtOAc/P.E.) to afford the product **9b**.

Table S2. Reaction Optimizations of Photocatalytic Addition of Aniline to Vinyl Sulfone



6b **3ac** **9b**

Entry	**11a**, **3a** (mmol)	Photocatalyst	Additive	Time	Yield[a]
1	0.2, 0.1	$Ir(dMeppy)_3$	NaOAc (2.0 equiv)	2 h	45%
2	0.1, 0.2	$Ir(dMeppy)_3$	NaOAc (2.0 equiv)	2 h	35%
3	0.2, 0.1	$Ir(dMeppy)_3$	DABCO (2.0 equiv)	2 h	49%
4	0.2, 0.1	$Ir(dMeppy)_3$	quinuclidine (2.0 equiv)	2 h	37%
5	0.2, 0.1	$Ir(dMeppy)_3$	Et_3N (2.0 equiv)	2 h	31%
6	0.2, 0.1	$Ir(dMeppy)_3$	piperidine (2.0 equiv)	2 h	20%
7	0.2, 0.1	$Ir(dMeppy)_3$	K_3PO_4 (2.0 equiv)	2 h	9%
8	0.2, 0.1	$Ir(dMeppy)_3$	Cs_2CO_3 (2.0 equiv)	2 h	0%
9	0.5, 0.1	$Ir(dMeppy)_3$	DABCO (5.0 equiv)	2 h	53%
10	0.5, 0.1	$Ir(ppy)_3$	DABCO (5.0 equiv)	2 h	55%
11	0.5, 0.1	$Ir(dtbbpy)(ppy)_2PF_6$	DABCO (5.0 equiv)	15 h	48%
12	0.5, 0.1	$Ir(dF(CF_3)ppy)_2(dtbbpy)PF_6$	DABCO (5.0 equiv)	2 h	0%
13	0.5, 0.1	$Ir(dF(Me)ppy)_2(dtbbpy)PF_6$	DABCO (5.0 equiv)	2 h	0%

14	0.5, 0.1	CzIPN	DABCO (5.0 equiv)	2 h	trace
15[b]	0.5, 0.1	$Ir(ppy)_3$	DABCO (5.0 equiv)	2 h	16%
16[c]	**0.5, 0.1**	**$Ir(ppy)_3$**	**DABCO (5.0 equiv)**	**2 h**	**58%**
17[c]	0.5, 0.1	$Ir(ppy)_3$	DABCO (1.0 equiv)	2 h	57%
18[c]	0.2, 0.1	$Ir(ppy)_3$	DABCO (1.0 equiv)	2 h	53%
19[d]	0.5, 0.1	$Ir(ppy)_3$	DABCO (5.0 equiv)	2 h	46%
(a) Isolated yields; (b) reaction run without nitrogen protection; (c) reaction run without 4Å mol. sieves; (d) using strips of blue LEDs as light sources.					

4. Synthetic Procedures

4.1 General Procedure A: Photocatalytic Radical Alkenylation to Synthesize Tertiary Allylic Amines

A 3 mL PTFE/Silicone-lined septa screw cap (PP) clear glass vial equipped with a magnetic stir bar was charged with all solid reagents such as vinyl sulfone (**3**), Hantzsch ester **5a**, 4Å MS and 4CzIPN. The vial was sealed and a needle was inserted through the septa and the contents evacuated/backfilled with N_2 (3 cycles), followed by the addition of the anhydrous dichloromethane via syringe. The liquid amine (**1**) and aldehyde (**2**) were added using a micro-syringe. Then it was irradiated for 2 hours with the Kessil lamp with vigorous stirring. Upon completion, the reaction mixture was analyzed by TLC and directly loaded onto the column or prepared TLC glass plate using EtOAc/P.E. as an eluent to afford the desired product.

4.2 General Procedure B: Photocatalytic Addition of Aniline to Vinyl Sulfone

A 3 mL PTFE/Silicone-lined septa screw cap (PP) clear glass vial equipped with a magnetic stir bar was charged with aniline (**6**), vinyl sulfone (**3**), DABCO, and $Ir(ppy)_3$. The vial was sealed and a needle was inserted through the septa and the contents evacuated/backfilled with N_2 (3 cycles), followed by the addition of the anhydrous CH_3CN via syringe. Then it was irradiated for 2 hours with the Kessil lamp with vigorous stirring. Upon completion, the reaction mixture was analyzed by TLC and the solvent was removed in vacuo. The residue was purified by flash chromatography on silica gel or prepared TLC glass plate (EtOAc/P.E.) to afford the desired product.

4.3 General Procedure C: Elimination of Arenesulfinate from 9 to 2-Vinylanilines

A 3 mL dry and clear glass vial equipped with a magnetic stir bar was charged with **9** and DMF. The vial was purged with N_2, and KO*t*Bu was added slowly. Then the mixture was stirred

vigorously for 1 hours at room temperature. Upon completion, the reaction mixture was analyzed by TLC and poured into water. The mixture was extracted with EA. The combined organic layer was dried over $NaSO_4$. After removal of solvent, the residue was purified by flash chromatography on silica gel or prepared TLC glass plate (EtOAc/P.E.) to afford the desired product.

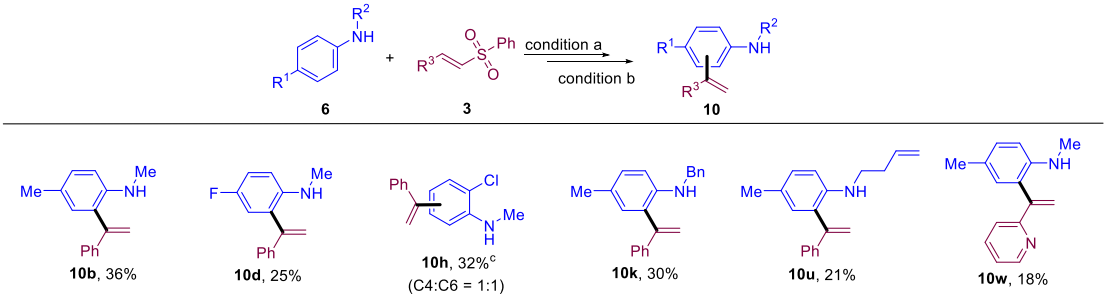
4.4 General Procedure D: The One-Pot Two-Step Method to Synthesize 2-Vinylanilines from Aniline and Vinyl Sulfone

A 3 mL PTFE/Silicone-lined septa screw cap (PP) clear glass vial equipped with a magnetic stir bar was charged with aniline (**6**), vinyl sulfone (**3**), DABCO, and $Ir(ppy)_3$. The vial was sealed and a needle was inserted through the septa and the contents evacuated/backfilled with N_2 (3 cycles), followed by the addition of the anhydrous CH_3CN via syringe. Then it was irradiated for 2 hours with the Kessil lamp with vigorous stirring. Upon completion, the reaction mixture was analyzed by TLC and KO*t*Bu was added under the protection of N_2 flow. Then the reaction mixture was stirred vigorously for another 1 hours at room temperature. After that, the reaction mixture was poured into water and extracted with EA. The combined organic layer was dried over $NaSO_4$. After removal of solvent, the residue was purified by flash chromatography on silica gel or prepared TLC glass plate (EtOAc/P.E.) to afford the desired product.

4.5 General Procedure E: Cyclization Reaction between 2-Vinylaniline and Aldehyde to Synthesize Tetrahydroquinolines

A 3 mL PTFE/Silicone-lined septa screw cap (PP) clear glass vial equipped with a magnetic stir bar was charged with 2-Vinylaniline (**10**), Hantzsch ester **5a**, 4Å MS and 4CzIPN. The vial was sealed and a needle was inserted through the septa and the contents evacuated/backfilled with N_2 (3 cycles), followed by the addition of the anhydrous dichloromethane via syringe. The liquid aldehyde (**2**) was added using a micro-syringe. Then it was irradiated for 24 hours with the Kessil lamp with vigorous stirring. Upon completion, the reaction mixture was analyzed by TLC and directly loaded onto the column or prepared TLC glass plate using EtOAc/P.E. as an eluent to afford the desired product.

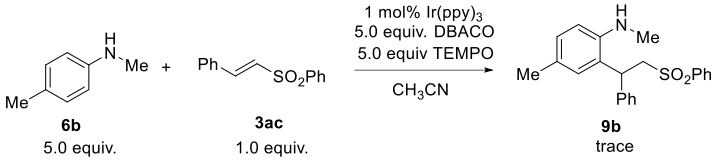
5. Sope of the one-pot two-step reaction to obtain the 2-vinylaniline



[a]Reaction conditions: **6** (2.5 mmol), **3** (0.5 mmol), DABCO (2.5 mmol), $Ir(ppy)_3$ (1mol%), CH_3CN (10 mL), rt, N_2, 40 W blue LED, 2 h. [b]KO*t*Bu (1.0 mmol), rt, N_2, 1 h. [c]the regioisomers were isolated after the first step, then the eliminations were done separately under condition a.

6. Mechanism of the addition of *N*-monoalkylated anilines to vinyl sulfone

6.1 Mass Spectrometry for Detection of Reaction Intermediates



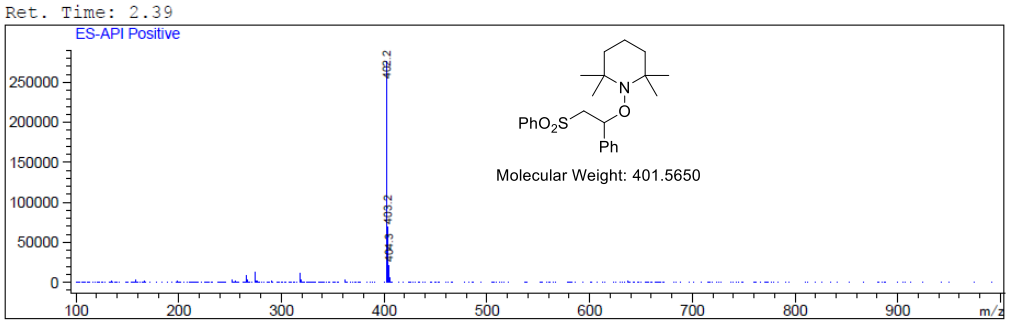


Figure S2. Mass Spectrometry for Detection of Reaction Intermediates

6.2 Stern-Volmer Quenching Experiments

Stern-Volmer fluorescence quenching experiments were run with freshly prepared solutions of 0.1 mM $Ir(ppy)_3$ in degassed dry CH_3CN at room temperature. The solutions were irradiated at 395 nm and fluorescence was measured from 450 nm to 700 nm. Control experiments showed that the excited state $Ir(ppy)_3^*$ was mainly quenched by vinyl sulfone **3ac**.

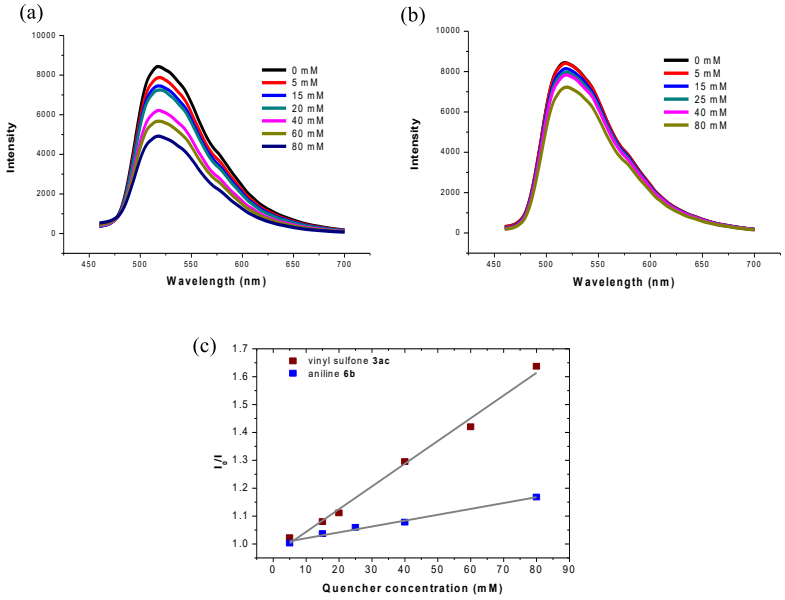


Figure S3. Fluorescence quenching spectra of $Ir(ppy)_3$ with variable (a) vinyl sulfone **3ac** and (b) *N*-Methyl-*p*-toluidine **6b**.(c) Stern−Volmer plots for **3ac** and **6b** using $Ir(ppy)_3$.

6.3 Mechanism proposal

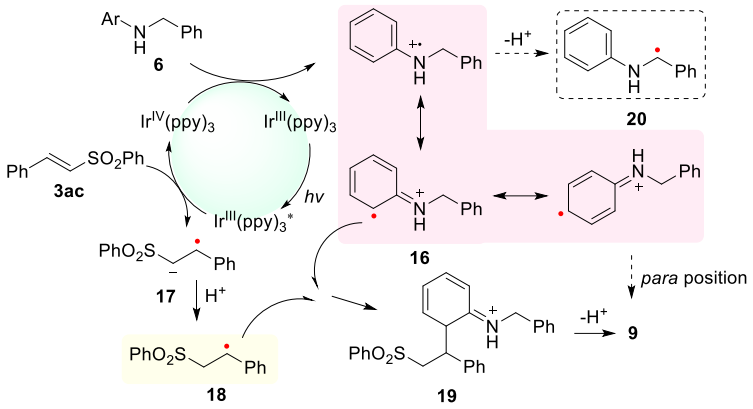
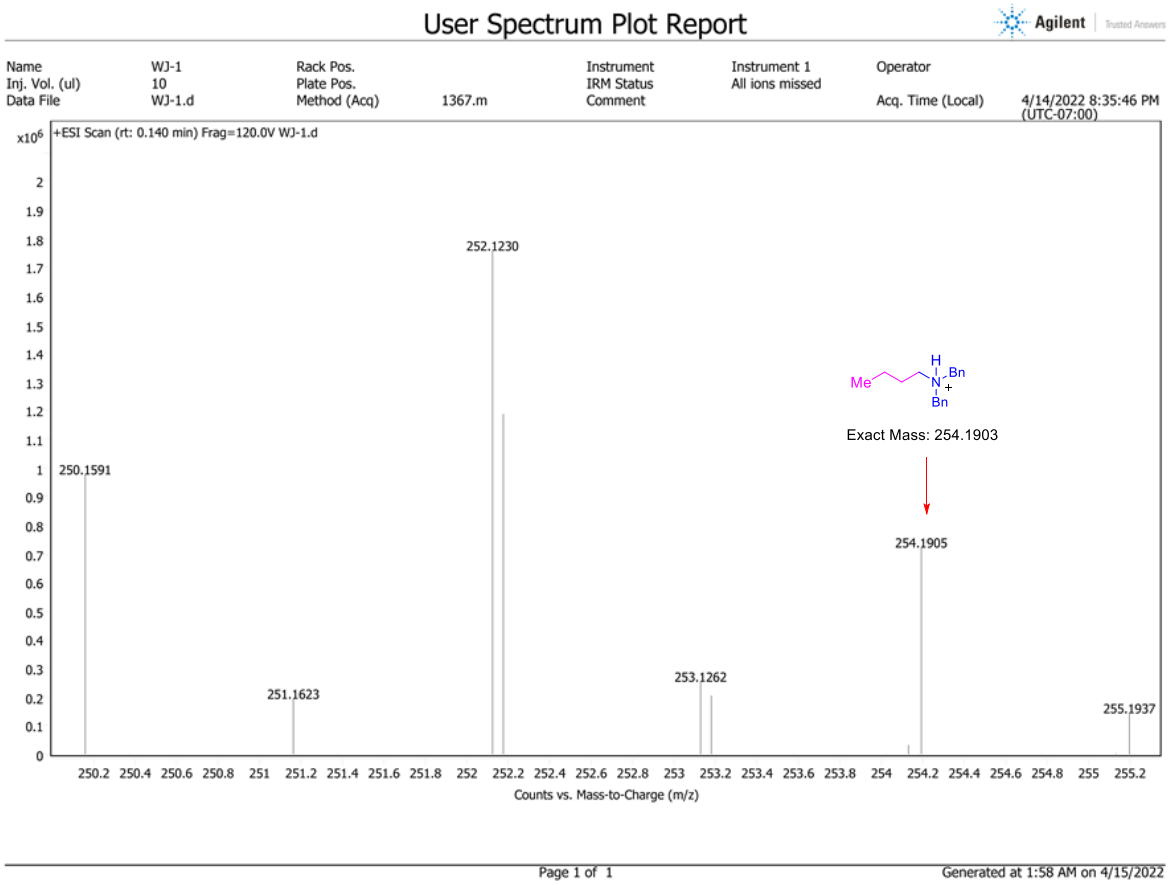


Figure S4. Mechanism of the photocatlyic synthesis of 2-(1-phenyl-2-(phenylsulfonyl)ethyl)anilines

7. Detection of Ring-Opening Product in Radical Clock Experiment



8. Cyclic Voltammetry Measurements of 3ac

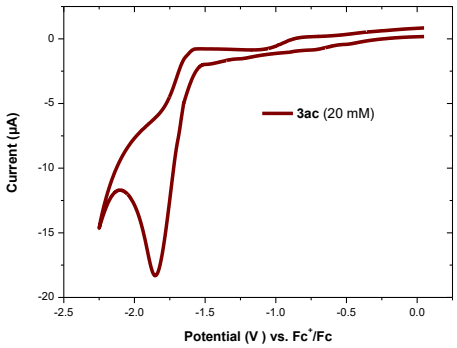


Figure S5. Cyclic Voltammetry Measurements of **3ac** in CH_3CN

9. Stern-Volmer Quenching Experiments

Stern-Volmer fluorescence quenching experiments were run with freshly prepared solutions of 0.05 mM 4CzIPN in degassed dry DCM or CH_3CN at room temperature. The solutions were irradiated at 435 nm and fluorescence was measured from 450 nm to 700 nm. Control experiments showed that the excited state $Ir(ppy)_3^*$ was mainly quenched by vinyl sulfone **3ac**.

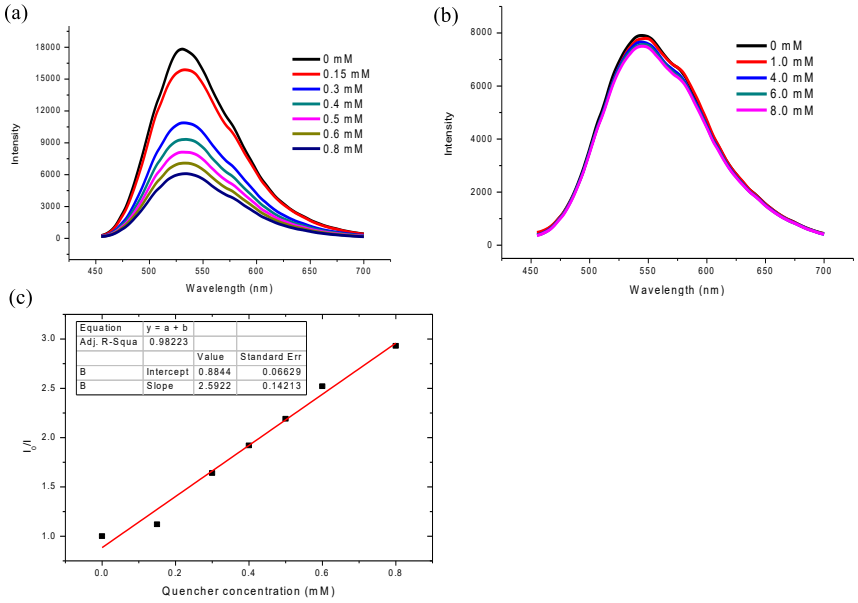


Figure S6. Fluorescence quenching spectra of 4CzIPN with variable (a) Hantzscher **5a** in DCM and (b) **IM-1** in CH_3CN. (c) Stern−Volmer plots for **5b** using 4CzIPN.

10. X-ray crystallographic data of 4ab

Single crystals of $C_{30}H_{29}N$ [mo- wj-0320-0m] (CCDC 2132946) were obtained by slow solvent evaporation from ethyl acetate solution. A suitable crystal was selected and measured on a Bruker APEX-II CCD diffractometer. The crystal was kept at 296.0 K during data collection. Using Olex2[1], the structure was solved with the ShelXT[2] structure solution program using Intrinsic Phasing and refined with the ShelXL[3] refinement package using Least

Squares minimisation.

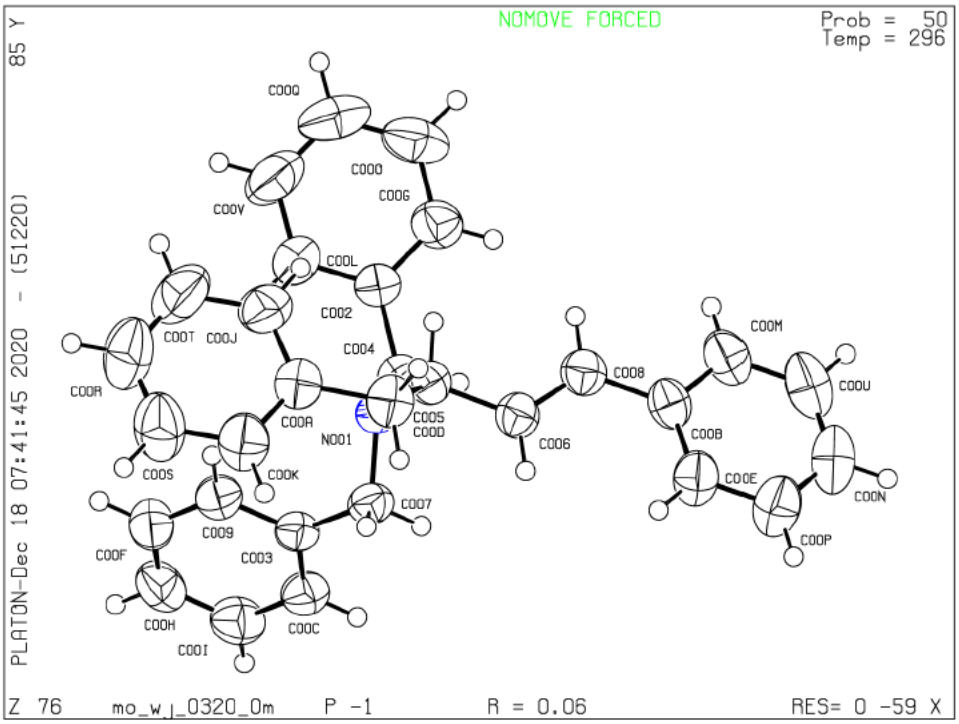


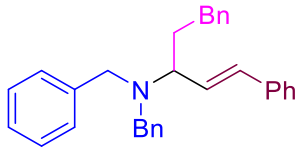
Table S3. Crystal data and structure refinement for **4ab**.

Identification code	mo_WJ_0320_0m
Empirical formula	$C_{30}H_{29}N$
Formula weight	403.54
Temperature/K	296.0
Crystal system	triclinic
Space group	P-1
a/Å	7.5023(9)
b/Å	12.0636(15)
c/Å	13.0703(12)
α/°	95.483(4)
β/°	97.326(4)
γ/°	94.209(5)
Volume/Å^3	1163.5(2)
Z	2
ρ_{calc}g/cm^3	1.152
μ/mm^{-1}	0.066
F(000)	432.0
Crystal size/mm^3	0.3 × 0.2 × 0.2
Radiation	MoKα (λ = 0.71073)

2Θ range for data collection/°	4.392 to 55.202
Index ranges	$-9 \leq h \leq 9, -15 \leq k \leq 15, -17 \leq l \leq 16$
Reflections collected	52107
Independent reflections	5384 [R_{int} = 0.1058, R_{sigma} = 0.0594]
Data/restraints/parameters	5384/0/280
Goodness-of-fit on F^2	1.007
Final R indexes [I>=2σ (I)]	R_1 = 0.0570, wR_2 = 0.1212
Final R indexes [all data]	R_1 = 0.1270, wR_2 = 0.1506
Largest diff. peak/hole / e $Å^{-3}$	0.12/-0.21

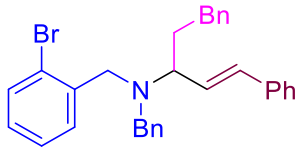
11. Characteristic of the Obtained New Compounds

(*E*)-*N*,*N*-dibenzyl-1,5-diphenylpent-1-en-3-amine (**4aa**)



The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (39 mg, 94%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.46-7.43 (m, 6H), 7.39-7.33 (m, 6H), 7.30-7.24 (m, 5H), 7.17 (t, *J* = 7.2 Hz, 1H), 7.13 (d, *J* = 7.2 Hz, 2H), 6.43 (d, *J* = 15.6 Hz, 1H), 6.30 (dd, *J* = 16.2, 9.0 Hz, 1H), 3.93 (d, *J* = 13.8 Hz, 2H), 3.49 (d, *J* = 13.2 Hz, 2H), 3.31 (q, *J* = 7.4 Hz, 1H), 2.87-2.82 (m, 1H), 2.62-2.57 (m, 1H), 2.17-2.11 (m, 1H), 1.92-1.86 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 142.7, 140.5, 137.3, 133.4, 128.9, 128.8, 128.5, 128.4, 128.4, 128.3, 127.6, 126.9, 126.5, 125.8, 60.4, 54.0, 34.8, 33.1; HRMS (ESI): $[M+H]^+$ calcd. for $C_{31}H_{32}N$: m/z = 418.2532; found, 418.2529.

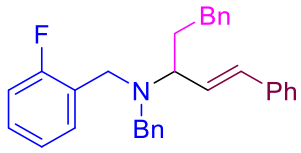
(*E*)-*N*-benzyl-*N*-(2-bromobenzyl)-1,5-diphenylpent-1-en-3-amine (**4ba**)



The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (37 mg, 75%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.73 (d, *J* = 7.8 Hz, 1H), 7.53 (d, *J* = 8.0 Hz, 1H), 7.47 (d, *J* = 7.8 Hz, 2H), 7.43 (d, *J* = 7.5 Hz, 2H), 7.38 (t, *J* = 7.6, 2H), 7.34 (t, *J* = 7.8, 2H), 7.32-7.28 (m, 2H), 7.27-7.25 (m, 3H), 7.18 (t, *J* = 6.6 Hz, 1H), 7.14 (d, *J* = 7.5 Hz, 2H), 7.11 (t, *J* = 7.8 Hz, 1H), 6.47 (d, *J* = 15.9 Hz, 1H), 6.33 (dd, *J* = 15.9, 8.8 Hz, 1H), 3.93 (d, *J* = 13.8 Hz, 1H), 3.84 (s, 2H), 3.58 (d, *J* = 13.9 Hz, 1H), 3.30 (q, *J* = 7.5 Hz, 1H), 2.82-2.77 (m, 1H), 2.67-2.59 (m, 1H), 2.21-2.13 (m, 1H), 1.99-1.89 (m, 1H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 142.5, 140.1, 139.3, 137.2, 133.8, 132.7, 130.5, 128.9, 128.7, 128.5, 128.5, 128.4, 128.2, 128.1, 127.7, 127.5, 127.0, 126.6, 125.8, 124.3, 61.2, 54.4, 53.5, 34.7, 33.3;

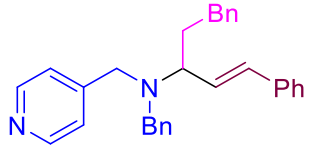
HRMS (ESI): $[M+H]^+$ calcd. for $C_{31}H_{31}BrN$: m/z = 496.1634; found, 496.1636.

(*E*)-*N*-benzyl-*N*-(2-fluorobenzyl)-1,5-diphenylpent-1-en-3-amine (**4ca**)



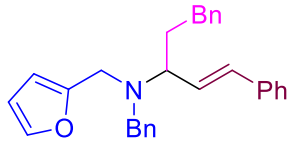
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (41 mg, 94%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.44 (d, J = 7.4 Hz, 2H), 7.42-7.32 (m, 8H), 7.29 (t, J = 7.2 Hz, 1H), 7.27-7.24 (m 3H), 7.18 (t, J = 7.5, 1H), 7.12 (d, J = 7.2, 2H), 7.02-6.99 (m, 2H), 6.41 (d, J = 15.9 Hz, 1H), 6.28 (dd, J = 15.9, 8.7 Hz, 1H), 3.90 (d, J = 13.7 Hz, 1H), 3.83 (d, J = 13.7 Hz, 1H), 3.46 (t, J = 14.3 Hz, 2H), 3.26 (q, J = 7.8 Hz, 1H), 2.82-2.77 (m, 1H), 2.62-2.57 (m, 1H), 2.15-2.08 (m, 1H), 1.93-1.87 (m, 1H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 162.0 (d, J = 243.2 Hz), 142.5, 140.3, 137.2, 136.0 (d, J = 2.9 Hz), 133.5, 130.3, 130.2 (d, J = 7.5 Hz), 128.8, 128.8, 128.5, 128.5, 128.4, 128.2, 127.7, 127.0, 126.5, 125.8, 115.2 (d, J = 21.0 Hz), 60.3, 53.9, 53.3, 34.7, 33.1; HRMS (ESI): $[M+H]^+$ calcd. for $C_{31}H_{31}FN$: m/z = 436.2435; found, 436.2428.

(*E*)-*N*-benzyl-1,5-diphenyl-*N*-(pyridin-4-ylmethyl)pent-1-en-3-amine (**4da**)



The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:20); colorless oil (36 mg, 86%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.51 (dd, J = 4.3, 1.4 Hz, 2H), 7.43-7.27 (m, 12H), 7.24 (t, J = 7.8 Hz, 2H), 7.19-7.16 (m 1H), 7.11 (d, J = 7.2, 2H), 6.39 (d, J = 15.9 Hz, 1H), 6.24 (dd, J = 15.9, 8.8 Hz, 1H), 3.89 (d, J = 13.8 Hz, 1H), 3.83 (d, J = 14.4 Hz, 1H), 3.59-3.48 (m, 2 H), 3.23 (q, J = 7.8 Hz, 1H), 2.79-2.72 (m, 1H), 2.64-2.58 (m, 1H), 2.14-2.08 (m, 1H), 1.95-1.89 (m, 1H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 150.0, 149.8, 142.2, 139.7, 137.0, 133.9, 128.9, 128.8, 128.8, 128.5, 128.5, 128.5, 127.8, 127.6, 127.2, 126.5, 126.0, 123.8, 123.8, 60.9, 54.3, 53.3, 34.7, 33.0; HRMS (ESI): $[M+H]^+$ calcd. for $C_{30}H_{31}N_2$: m/z = 419.2482; found, 419.2477.

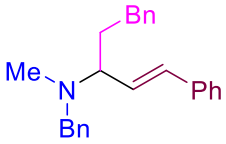
(*E*)-*N*-benzyl-*N*-(furan-2-ylmethyl)-1,5-diphenylpent-1-en-3-amine (**4ea**)



The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:20); colorless oil (29 mg, 71%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.43-7.41 (m, 5H), 7.37-7.33 (m, 4H), 7.28-7.26 (m, 4H), 7.19-7.16 (m 3H), 6.46 (d, J = 15.9 Hz, 1H), 6.34 (t, J = 1.2 Hz, 1H), 6.21-6.17 (m, 2H), 3.96 (d, J = 14.0 Hz, 1H), 3.83 (d, J = 14.7 Hz, 1H), 3.64 (d, J =

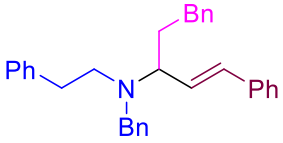
14.7 Hz, 1H), 3.57 (d, *J* = 14.0 Hz, 1H), 3.34 (q, *J* = 7.5 Hz, 1H), 2.87-2.81 (m, 1H), 2.67-2.60 (m, 1H), 2.17-2.09 (m, 1H), 1.93-1.85 (m, 1H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 153.9, 142.7, 141.8, 140.3, 137.2, 133.2, 128.8, 128.7, 128.6, 128.6, 128.4, 128.4, 127.6, 126.9, 126.5, 125.8, 110.3, 108.1, 61.4, 54.2, 46.7, 34.8, 32.9; HRMS (ESI): $[M+H]^+$ calcd. for $C_{29}H_{30}NO$: m/z = 408.2322; found, 408.2323.

(*E*)-*N*-benzyl-*N*-methyl-1,5-diphenylpent-1-en-3-amine (**4fa**)



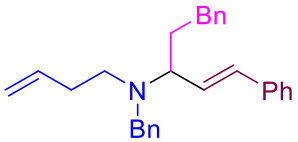
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (26 mg, 76%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.44 (d, *J* = 7.7 Hz, 2H), 7.38-7.33 (m, 6H), 7.32-7.27 (m, 4H), 7.24-7.20 (m 3H), 6.49 (d, *J* = 15.9 Hz, 1H), 6.30 (dd, *J* = 15.9, 8.8 Hz, 1H), 3.76 (d, *J* = 13.4 Hz, 1H), 3.52 (d, *J* = 13.4 Hz, 1H), 3.21 (q, *J* = 7.8 Hz, 1H), 2.79-2.73 (m, 2H), 2.27 (s, 3H), 2.16-2.13 (m, 1H), 1.93-1.89 (m, 1H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 142.6, 140.0, 137.2, 133.1, 128.9, 128.7, 128.7, 128.6, 128.5, 128.4, 127.6, 127.0, 126.5, 125.8, 65.2, 58.3, 37.7, 34.8, 32.9; HRMS (ESI): $[M+H]^+$ calcd. for $C_{25}H_{28}N$: m/z = 342.2216; found, 342.2212.

(*E*)-*N*-benzyl-*N*-phenethyl-1,5-diphenylpent-1-en-3-amine (**4ga**)



The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (39 mg, 90%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.44-7.35 (m, 8H), 7.32-7.29 (m, 6H), 7.24-7.20 (m, 2H), 7.18-7.17 (m, 4H), 6.46 (d, *J* = 15.9 Hz, 1H), 6.26 (ddd, *J* = 15.9, 8.5, 2.6 Hz, 1H), 4.00 (d, *J* = 14.0 Hz, 1H), 3.61 (d, *J* = 14.0 Hz, 1H), 3.33 (q, *J* = 7.7 Hz, 1H), 2.97-2.94 (m, 1H), 2.83-2.73 (m, 4H), 2.65-2.60 (m, 1H), 2.07-2.03 (m, 1H), 1.88-1.85 (m, 1H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 142.7, 140.9, 140.7, 137.3, 132.8, 129.0, 128.9, 128.8, 128.7, 128.6, 128.4, 128.4, 128.3, 127.5, 126.8, 126.4, 126.0, 125.8, 61.8, 55.0, 52.1, 35.7, 34.7, 33.0; HRMS (ESI): $[M+H]^+$ calcd. for $C_{32}H_{34}N$: m/z = 432.2686; found, 432.2685.

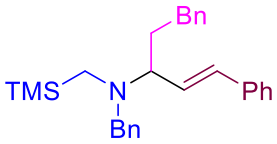
(*E*)-*N*-benzyl-*N*-(but-3-en-1-yl)-1,5-diphenylpent-1-en-3-amine (**4ha**)



The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (35 mg, 92%);^{1}H NMR (600 MHz, $CDCl_3$): δ 7.45-7.40 (m, 4H), 7.38-7.34 (m, 4H), 7.30-7.27 (m, 4H), 7.21-7.18 (m, 3H), 6.45 (d, *J* = 15.9 Hz, 1H), 6.26 (dd, *J* = 15.9,

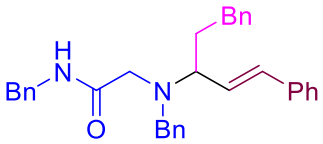
8.7 Hz, 1H), 5.88-5.82 (m, 1H), 5.06 (d, *J* = 16.2 Hz, 1H), 5.02 (d, *J* = 9.6 Hz, 1H), 3.92 (d, *J* = 14.1 Hz, 1H), 3.52 (d, *J* = 14.0 Hz, 1H), 3.27 (q, *J* = 7.4 Hz, 1H), 2.85-2.72 (m, 2H), 2.66-2.59 (m, 1H), 2.57-2.53 (m, 1H), 2.27 (q, *J* = 7.0 Hz, 2H), 2.09-2.02 (m, 1H), 1.89-1.83 (m, 1H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 142.7, 140.9, 137.3, 137.3, 132.7, 128.8, 128.8, 128.7, 128.6, 128.4, 128.3, 127.5, 126.8, 126.4, 125.8, 115.6, 61.6, 54.8, 49.6, 34.8, 33.4, 33.1; HRMS (ESI): $[M+H]^+$ calcd. for $C_{28}H_{32}N$: m/z = 382.2529; found, 382.2526.

(*E*)-*N*-benzyl-1,5-diphenyl-*N*-((trimethylsilyl)methyl)pent-1-en-3-amine (**4ia**)



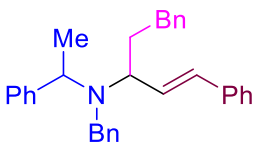
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (22 mg, 53%);^{1}H NMR (600 MHz, $CDCl_3$): δ 7.42-7.38 (m, 4H), 7.36-7.31 (m, 4H), 7.27-7.24 (m, 4H), 7.18-7.14 (m, 3H), 6.37 (d, *J* = 16.0 Hz, 1H), 6.28 (dd, *J* = 15.9, 8.5 Hz, 1H), 3.81 (d, *J* = 13.9 Hz, 1H), 3.43 (d, *J* = 13.9 Hz, 1H), 3.13 (q, *J* = 7.4 Hz, 1H), 2.78-2.73 (m, 1H), 2.58-2.53 (m, 1H), 2.20 (d, *J* = 14.6 Hz, 1H), 1.99-1.96 (m, 2H), 1.83-1.77 (m, 1H), 0.08 (s, 9H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 142.8, 140.8, 137.4, 133.2, 128.9, 128.7, 128.5, 128.4, 128.3, 127.5, 126.8, 126.4, 125.8, 62.5, 57.8, 40.6, 35.0, 33.1, 1.0; HRMS (ESI): $[M+H]^+$ calcd. for $C_{28}H_{36}NSi$: m/z = 414.2612; found, 414.2610.

(*E*)-*N*-benzyl-2-(benzyl(1,5-diphenylpent-1-en-3-yl)amino)acetamide (**4ja**)



The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:5); colorless oil (39 mg, 82%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.52 (t, *J* = 5.7 Hz, 1H), 7.40 (d, *J* = 7.6 Hz, 2H), 7.36 (t, *J* = 7.6 Hz, 2H), 7.32-7.25 (m, 9H), 7.20-7.16 (m, 5H), 7.07 (d, *J* = 7.5 Hz, 2H), 6.46 (d, *J* = 15.8 Hz, 1H), 6.14 (dd, *J* = 15.8, 9.0 Hz, 1H), 4.41-4.34 (m, 2H), 3.78 (d, *J* = 13.2 Hz, 1H), 3.57 (d, *J* = 13.2 Hz, 1H), 3.38 (d, *J* = 17.0 Hz, 1H), 3.24-3.18 (m, 2H), 2.59-2.56 (m, 2H), 2.03-1.97 (m, 1H), 1.94-1.88 (m, 1H), 0.08 (s, 9H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 171.4, 141.6, 138.5, 138.3, 136.6, 134.7, 129.0, 128.9, 128.8, 128.8, 128.6, 128.4, 128.0, 127.7, 127.6, 126.8, 126.6, 126.1, 63.1, 56.2, 54.1, 43.2, 34.6, 33.0; HRMS (ESI): $[M+H]^+$ calcd. for $C_{33}H_{35}N_2O$: m/z = 475.2744; found, 475.2738.

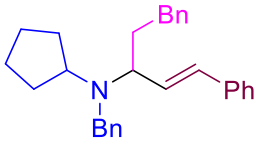
(*E*)-**N**-benzyl-1,5-diphenyl-*N*-(1-phenylethyl)pent-1-en-3-amine (**4ka**)



The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane

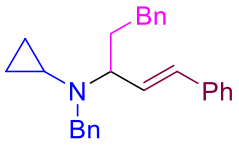
(1:50); colorless oil (36 mg, 84%, 1.6:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.55-7.54 (m, 2H), 7.50-7.35 (m, 9H), 7.31-7.26 (m, 6H), 7.20-7.06 (m, 3H), [6.44-6.36 (m), 6.27 (dd, *J* = 15.9, 3.1 Hz), 6.09-6.05 (m), total 2 H], [4.23-4.06 (m), 3.92-3.72 (m), total 3 H], 3.43-3.39 (m, 1H), 2.82-2.46 (m, 2H), 2.10-2.02 (m, 1H), 1.89-1.85 (m, 1H), [1.49 (dd, *J* = 6.6, 3.3 Hz), 1.31 (dd, *J* = 6.5, 3.4 Hz), total 3 H]; ^{13}C NMR (150 MHz, $CDCl_3$): δ 145.8 (major), 145.1 (minor), 143.3 (major), 142.7 (major), 142.6 (minor), 141.6 (minor), 137.5 (minor), 137.4 (major), 132.1 (minor), 131.4 (major), 129.6 (minor), 128.7 (major), 128.7 (major), 128.6 (major), 128.5 (major), 128.4 (major), 128.4 (minor), 128.3 (major), 128.1 (major), 128.0 (major), 127.9 (major), 127.8 (major), 127.4 (minor), 127.4 (major), 126.9 (minor), 126.7 (minor), 126.7 (minor), 126.4 (minor), 126.4 (major), 125.8 (major), 125.7 (minor), 61.0 (major), 60.5 (major), 59.7 (minor), 56.1 (minor), 51.0 (major), 50.5 (minor), 35.6 (major), 35.3 (minor), 33.4 (major), 33.2 (minor), 22.0 (major), 16.7 (minor); HRMS (ESI): $[M+H]^+$ calcd. for $C_{32}H_{34}N$: m/z = 432.2686; found, 432.2686.

(*E*)-*N*-benzyl-*N*-(1,5-diphenylpent-1-en-3-yl)cyclopentanamine (**4la**)



The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (36 mg, 91%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.42-7.39 (m, 4H), 7.36-7.31 (m, 4H), 7.26-7.23 (m, 4H), 7.16 (t, *J* = 7.3 Hz, 1H), 7.12 (d, *J* = 7.4 Hz, 2H), 6.39 (d, *J* = 15.8 Hz, 1H), 6.20 (dd, *J* = 15.8, 8.8 Hz, 1H), 3.86 (d, *J* = 15.1 Hz, 1H), 3.59 (d, *J* = 15.0 Hz, 1H), 3.44 (t, *J* = 8.1 Hz, 1H), 3.27 (q, *J* = 7.5 Hz, 1H), 2.76-2.71 (m, 1H), 2.57-2.52 (m, 1H), 2.02-1.97 (m, 1H), 1.84-1.77 (m, 2H), 1.72-1.68 (m, 1H), 1.62-1.56 (m, 3H), 1.55-1.51 (m, 1H), 1.48-1.44 (m, 2H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 142., 142.5, 137.5, 131.5, 130.5, 128.7, 128.5, 128.4, 128.2, 127.4, 126.5, 126.4, 125.7, 61.8, 60.5, 50.9, 35.3, 33.2, 32.1, 29.7, 24.8, 24.2; HRMS (ESI): $[M+H]^+$ calcd. for $C_{29}H_{34}N$: m/z = 396.2686; found, 396.2677.

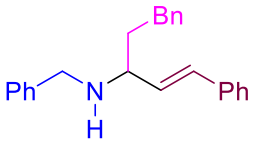
(*E*)-*N*-benzyl-*N*-(1,5-diphenylpent-1-en-3-yl)cyclopropanamine (**4ma**)



The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (32 mg, 87%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.41 (d, *J* = 7.5 Hz, 2H),, 7.37-7.29 (m, 6H), 7.28-7.24 (m, 4H), 7.17 (t, *J* = 7.5 Hz, 1H), 7.14 (d, *J* = 7.3 Hz, 2H), 6.45 (d, *J* = 15.9 Hz, 1H), 6.36 (dd, *J* = 15.9, 8.6 Hz, 1H), 3.96 (d, *J* = 13.8 Hz, 1H), 3.70 (d, *J* = 13.8 Hz, 1H), 3.30 (q, *J* = 7.6 Hz, 1H), 2.69-2.65 (m, 1H), 2.64-2.55 (m, 1H), 2.16-2.10 (m, 1H), 2.07-2.03 (m, 1H), 1.93-1.87 (m, 1H), 0.48-0.42 (m, 3H), 0.31-0.30 (m, 1H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 142.7, 140.8, 137.4, 132.7, 129.5, 129.2, 128.7, 128.5, 128.4, 128.1, 127.5, 126.7, 126.5, 125.8, 64.0, 56.5, 34.8, 33.9, 33.2, 9.1, 6.1; HRMS (ESI): $[M+H]^+$ calcd.

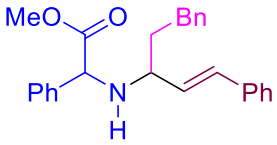
for $C_{27}H_{30}N$: m/z = 368.2373; found, 368.2374.

(*E*)-*N*-benzyl-1,5-diphenylpent-1-en-3-amine (**4na**)



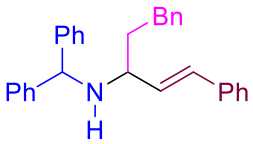
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:10); colorless oil (28 mg, 86%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.43 (d, J = 7.3 Hz, 2H), 7.38-7.33 (m, 6H), 7.30-7.25 (m, 4H), 7.19 (t, J = 8.1 Hz, 3H), 6.51 (d, J = 15.9 Hz, 1H), 6.11 (dd, J = 15.8, 8.4 Hz, 1H), 3.89 (d, J = 13.2 Hz, 1H), 3.71 (d, J = 13.2 Hz, 1H), 3.30-3.26 (m, 1H), 2.76-2.66 (m, 2H), 1.99-1.93 (m, 1H), 1.91-1.85 (m, 1H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 142.2, 140.6, 137.2, 132.8, 132.0, 129.5, 128.7, 128.5, 128.5, 128.3, 127.6, 127.0, 126.5, 125.9, 60.3, 51.5, 37.7, 32.4; HRMS (ESI): $[M+H]^+$ calcd. for $C_{24}H_{26}N$: m/z = 328.2060; found, 328.2061.

methyl (*E*)-2-((1,5-diphenylpent-1-en-3-yl)amino)-2-phenylacetate (**4oa**)



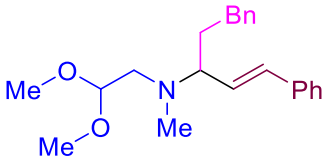
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:10); colorless oil (32 mg, 83%); ^{1}H NMR (600 MHz, $CDCl_3$): 7.40-7.33 (m, 9H), 7.27-7.23 (m, 3H), 7.18 (t, J = 7.6 Hz, 1H), 7.12 (d, J = 7.5 Hz, 1H), 6.34 (d, J = 15.8 Hz, 1H), 6.01 (dd, J = 15.8, 8.9 Hz, 1H), 4.47 (s, 1H), 3.57 (s, 3H), 3.06 (q, J = 7.2 Hz, 1H), 2.66 (t, J = 7.8 Hz, 2H), 1.98-1.92 (m, 1H), 1.89-1.84 (m, 1H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 173.9, 142.0, 138.5, 136.9, 132.2, 132.1, 128.8, 128.7, 128.5, 128.4, 128.2, 127.8, 127.7, 126.5, 125.9, 62.9, 58.6, 52.4, 37.7, 32.4; HRMS (ESI): $[M+H]^+$ calcd. for $C_{26}H_{28}NO_2$: m/z = 386.2115; found, 386.2107.

(*E*)-*N*-benzhydryl-1,5-diphenylpent-1-en-3-amine (**4pa**)



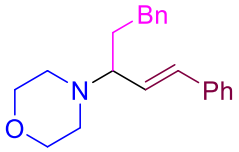
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:10); colorless oil (34 mg, 84%); ^{1}H NMR (600 MHz, $CDCl_3$): 7.43-7.32 (m, 10H), 7.29-7.25 (m, 6H), 7.20-7.16 (m, 4H), 6.34 (d, J = 15.8 Hz, 1H), 6.03 (dd, J = 15.8, 8.6 Hz, 1H), 4.98 (s, 1H), 3.19-3.16 (m, 1H), 2.78-2.74 (m, 1H), 2.72-2.67 (m, 1H), 1.99-1.93 (m, 1H), 1.89-1.83 (m, 1H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 145.0, 143.8, 142.4, 137.2, 132.8, 131.7, 128.7, 128.6, 128.6, 128.5, 128.4, 127.8, 127.6, 127.4, 127.1, 127.0, 126.5, 125.8, 63.9, 58.2, 38.2, 32.5; HRMS (ESI): $[M+H]^+$ calcd. for $C_{30}H_{30}N$: m/z = 404.2373; found, 404.2366.

(*E*)-*N*-(2,2-dimethoxyethyl)-*N*-methyl-1,5-diphenylpent-1-en-3-amine (**4qa**)



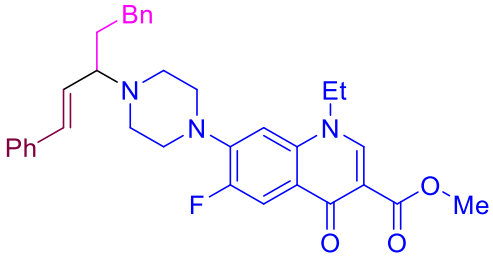
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:10); colorless oil (23 mg, 68%); ^{1}H NMR (600 MHz, $CDCl_3$): 7.39 (d, *J* = 7.6 Hz, 2H), 7.33 (t, *J* = 7.6 Hz, 2H), 7.30-7.23 (m, 3H), 7.21-7.17 (m, 3H), 6.47 (d, *J* = 15.9 Hz, 1H), 6.17 (dd, *J* = 15.9, 8.9 Hz, 1H), 4.47 (t, *J* = 5.3 Hz, 1H), 3.37 (d, *J* = 5.5 Hz, 6H), 3.11 (q, *J* = 8.5 Hz, 1H), 2.77-2.60 (m, 3H), 2.53 (dd, *J* = 13.4, 5.0 Hz, 1H), 2.37 (s, 3H), 2.07-2.01 (m, 1H), 1.87-1.81 (m, 1H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 142.5, 137.1, 133.3, 128.7, 128.6, 128.5, 128.3, 127.6, 126.5, 125.9, 103.7, 66.6, 55.3, 53.7, 53.7, 39.6, 34.6, 32.9; HRMS (ESI): $[M+H]^+$ calcd. for $C_{22}H_{30}NO_2$: m/z = 340.2271; found, 340.2266.

(*E*)-4-(1,5-diphenylpent-1-en-3-yl)morpholine (**4ra**)



The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:5); colorless oil (23 mg, 75%); ^{1}H NMR (600 MHz, $CDCl_3$): 7.40 (d, *J* = 7.5 Hz, 2H), 7.34 (t, *J* = 7.6 Hz, 2H), 7.29-7.24 (m, 3H), 7.20-7.18 (m, 3H), 6.47 (d, *J* = 15.9 Hz, 1H), 6.17 (dd, *J* = 15.9, 9.0 Hz, 1H), 3.76-3.70 (m, 4H), 2.95-2.91 (m, 1H), 2.75-2.70 (m, 1H), 2.65-2.60 (m, 3H), 2.59-2.52 (m, 2H), 2.12-2.07 (m, 1H), 1.87-1.80 (m, 1H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 142.3, 136.9, 133.5, 129.2, 128.8, 128.6, 128.5, 127.7, 126.5, 125.9, 67.6, 67.4, 50.5, 33.7, 32.6; HRMS (ESI): $[M+H]^+$ calcd. for $C_{21}H_{26}NO$: m/z = 308.2009; found, 308.2002.

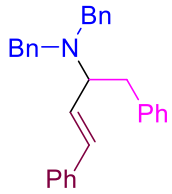
Methyl (*E*)-7-(4-(1,5-diphenylpent-1-en-3-yl)piperazin-1-yl)-1-ethyl-6-fluoro-4-oxo-1,4-dihydroquinoline-3-carboxylate (**4sa**)



The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:5); white solid (34 mg, 61%); mp 74-76 °C; ^{1}H NMR (600 MHz, $CDCl_3$): 8.40 (d, *J* = 2.9 Hz, 1H), 8.04 (dd, *J* = 13.3, 3.1 Hz, 1H), 7.41 (d, *J* = 7.6 Hz, 2H), 7.33 (t, *J* = 7.6 Hz, 2H), 7.30-7.24 (m, 3H), 7.21-7.18 (m, 3H), 6.70 (d, *J* = 6.7 Hz, 1H), 6.50 (d, *J* = 15.9 Hz, 1H), 6.20 (dd, *J* = 15.9, 9.1 Hz, 1H), 4.17 (d, *J* = 7.2 Hz, 2H), 3.90 (s, 3H), 3.29-3.23 (m, 4H), 3.08-3.04 (m,

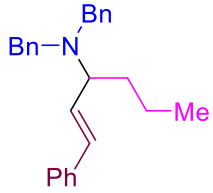
1H), 2.88-2.86 (m, 2H), 2.75-2.72 (m, 3H), 2.67-2.62 (m, 1H), 2.14-2.09 (m, 1H), 1.92-1.86 (m, 1H), 4.17 (t, J = 7.2 Hz, 3H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 173.2, 166.7, 153.4 (d, J = 247.5 Hz), 152.5, 148.3, 144.9 (d, J = 10.5 Hz), 142.2, 136.8, 136.2, 133.7, 128.7, 128.6, 128.5, 127.8, 126.5, 126.0, 123.8, 113.7 (d, J = 22.5 Hz), 110.2, 103.9, 67.0, 52.2, 50.5, 49.4, 49.1, 33.9, 32.6, 14.5; HRMS (ESI): $[M+H]^+$ calcd. for $C_{34}H_{37}FN_3O_3$: m/z = 554.2814; found, 554.2811.

(*E*)-*N*,*N*-dibenzyl-1,4-diphenylbut-3-en-2-amine (**4ab**)



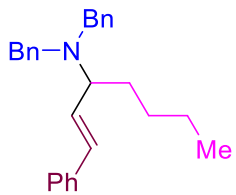
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); white solid (36 mg, 89%); mp 84-86 °C; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.39 (d, J = 7.5 Hz, 2H), 7.34 (t, J = 7.7 Hz, 2H), 7.27-7.21 (m, 14H), 7.08 (d, J = 7.1 Hz, 2H), 6.37 (d, J = 15.9 Hz, 1H), 6.31 (dd, J = 15.9, 8.2 Hz, 1H), 3.90 (d, J = 13.9 Hz, 2H), 3.58-3.50 (m, 3H), 3.12 (dd, J = 13.8, 7.7 Hz, 1H), 2.89 (dd, J = 13.8, 7.4 Hz, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 140.2, 139.6, 137.2, 133.3, 129.7, 128.7, 128.7, 128.3, 128.2, 128.1, 127.6, 126.8, 126.5, 126.1, 61.9, 53.8, 39.0; HRMS (ESI): $[M+H]^+$ calcd. for $C_{30}H_{30}N$: m/z = 404.2373; found, 404.2376.

(*E*)-*N*,*N*-dibenzyl-1-phenylhex-1-en-3-amine (**4bb**)



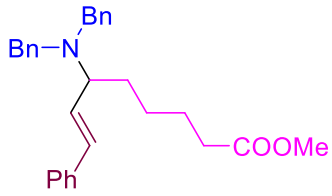
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (27 mg, 76%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.45-7.43 (m, 6H), 7.38-7.33 (m, 6H), 7.29-7.24 (m, 3H), 6.39 (d, J = 15.9 Hz, 1H), 6.26 (dd, J = 15.9, 8.9 Hz, 1H), 3.90 (d, J = 13.8 Hz, 2H), 3.47 (d, J = 13.8 Hz, 2H), 3.22 (q, J = 7.4 Hz, 1H), 1.84-1.78 (m, 1H), 1.57-1.45 (m, 2H), 1.40-1.34 (m, 1H), 0.87 (t, J = 7.3 Hz, 3H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 140.7, 137.4, 132.9, 128.9, 128.8, 128.7, 128.3, 127.5, 126.8, 126.4, 60.3, 53.9, 35.1, 19.9, 14.3; HRMS (ESI): $[M+H]^+$ calcd. for $C_{26}H_{30}N$: m/z = 356.2373; found, 356.2372.

(*E*)-*N*,*N*-dibenzyl-1-phenylhept-1-en-3-amine (**4cb**)



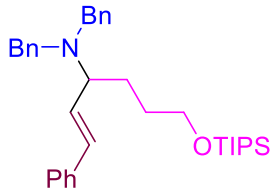
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (27 mg, 73%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.46-7.43 (m, 6H), 7.39-7.33 (m, 6H), 7.29-7.24 (m, 3H), 6.39 (d, J = 15.8 Hz, 1H), 6.26 (dd, J = 15.7, 9.0 Hz, 1H), 3.90 (d, J = 13.8 Hz, 2H), 3.46 (d, J = 13.8 Hz, 2H), 3.19 (q, J = 8.1 Hz, 1H), 1.84-1.79 (m, 1H), 1.59-1.54 (m, 1H), 1.43-1.42 (m, 1H), 1.33-1.25 (m, 3H), 0.89 (t, J = 6.9 Hz, 3H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 140.7, 137.4, 132.9, 128.9, 128.8, 128.7, 128.3, 127.5, 126.8, 126.4, 60.5, 53.9, 32.5, 28.9, 22.8, 14.2; HRMS (ESI): $[M+H]^+$ calcd. for $C_{27}H_{32}N$: m/z = 370.2530; found, 370.2530.

methyl (*E*)-6-(dibenzylamino)-8-phenyloct-7-enoate (**4db**)



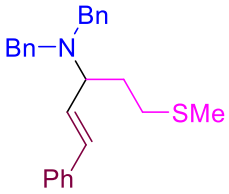
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:20); colorless oil (36 mg, 84%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.43-7.39 (m, 6H), 7.37-7.31 (m, 6H), 7.28-7.22 (m, 3H), 6.37 (d, J = 15.9 Hz, 1H), 6.22 (dd, J = 15.9, 8.9 Hz, 1H), 3.86 (d, J = 13.8 Hz, 2H), 3.64 (s, 3H), 3.43 (d, J = 13.8 Hz, 2H), 3.17 (q, J = 7.4 Hz, 1H), 2.28 (t, J = 7.5 Hz, 2H), 1.84-1.78 (m, 1H), 1.57-1.52 (m, 3H), 1.50-1.44 (m, 1H), 1.37-1.30 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 174.3, 140.6, 137.3, 133.2, 128.8, 128.7, 128.5, 128.4, 127.6, 126.9, 126.5, 60.3, 53.9, 51.6, 34.2, 32.5, 26.2, 25.0; HRMS (ESI): $[M+H]^+$ calcd. for $C_{29}H_{34}NO_2$: m/z = 428.2584; found, 428.2578.

(*E*)-*N*,*N*-dibenzyl-1-phenyl-6-((triisopropylsilyl)oxy)hex-1-en-3-amine (**4eb**)



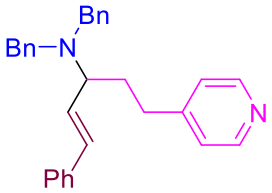
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (38 mg, 72%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.45-7.42 (m, 6H), 7.38-7.32 (m, 6H), 7.29-7.23 (m, 3H), 6.41 (d, J = 15.9 Hz, 1H), 6.27 (dd, J = 15.9, 8.8 Hz, 1H), 3.90 (d, J = 13.7 Hz, 2H), 3.69-3.61 (m, 2H), 3.47 (d, J = 13.8 Hz, 2H), 3.22 (q, J = 7.6 Hz, 1H), 1.93-1.87 (m, 1H), 1.77-1.72 (m, 1H), 1.70-1.64 (m, 1H), 1.58-1.55 (m, 1H), 1.10-1.06 (m, 21H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 140.6, 137.4, 133.0, 128.9, 128.7, 128.3, 127.5, 126.8, 126.5, 63.3, 60.4, 53.9, 30.2, 28.9, 18.2, 12.1; HRMS (ESI): $[M+H]^+$ calcd. for $C_{35}H_{50}NOSi$: m/z = 528.3656; found, 528.3653.

(*E*)-*N*,*N*-dibenzyl-5-(methylthio)-1-phenylpent-1-en-3-amine (**4fb**)



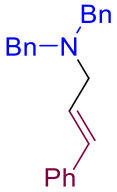
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (31 mg, 80%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.45-7.43 (m, 6H), 7.38-7.33 (m, 6H), 7.29-7.24 (m, 3H), 6.39 (d, J = 15.9 Hz, 1H), 6.26 (dd, J = 15.9, 8.9 Hz, 1H), 3.90 (d, J = 13.8 Hz, 2H), 3.47 (d, J = 13.8 Hz, 2H), 3.22 (q, J = 7.4 Hz, 1H), 1.84-1.78 (m, 1H), 1.57-1.46 (m, 2H), 1.40-1.34 (m, 1H), 0.87 (d, J = 7.3 Hz, 3H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 140.7, 137.4, 133.0, 128.9, 128.8, 128.7, 128.3, 127.5, 126.8, 126.4, 60.3, 53.9, 35.1, 19.9, 14.3; HRMS (ESI): $[M+H]^+$ calcd. for $C_{26}H_{30}NS$: m/z = 388.2093; found, 388.2091.

(*E*)-*N*,*N*-dibenzyl-1-phenyl-5-(pyridin-4-yl)pent-1-en-3-amine (**4gb**)



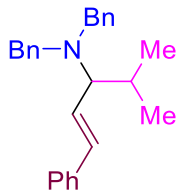
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:20); colorless oil (31 mg, 80%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.40 (d, J = 5.5 Hz, 2H), 7.43 (d, J = 7.6 Hz, 2H), 7.39-7.37 (m, 4H), 7.36-7.31 (m, 5H), 7.29-7.25 (m, 4H), 6.97 (d, J = 5.9 Hz, 2H), 6.39 (d, J = 15.9 Hz, 1H), 6.26 (dd, J = 15.9, 8.9 Hz, 1H), 3.90 (d, J = 13.7 Hz, 2H), 3.45 (d, J = 13.7 Hz, 2H), 3.24 (q, J = 7.5 Hz, 1H), 2.82-2.77 (m, 1H), 2.60-2.55 (m, 1H), 2.14-2.08 (m, 1H), 1.88-1.82 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 151.6, 149.7, 140.2, 137.0, 133.8, 128.9, 128.8, 128.5, 127.8, 127.7, 127.1, 126.5, 124.0, 60.1, 54.1, 33.6, 32.3; HRMS (ESI): $[M+H]^+$ calcd. for $C_{30}H_{31}N_2$: m/z = 419.2482; found, 419.2483.

(*E*)-*N*,*N*-dibenzyl-3-phenylprop-2-en-1-amine (**4hb**)



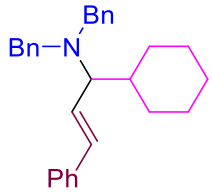
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (24 mg, 77%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.40(d, J = 7.7 Hz, 4H), 7.38 (d, J = 7.7 Hz, 2H), 7.35-7.31 (m, 6H), 7.27-7.22 (m, 3H), 6.56 (d, J = 15.9 Hz, 1H), 6.33 (dt, J = 15.9, 6.5 Hz, 1H), 3.65 (s, 4H), 3.25 (d, J = 6.4 Hz, 2H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 139.8, 137.3, 132.6, 128.9, 128.7, 128.4, 127.9, 127.4, 127.0, 126.4, 58.1, 55.9; HRMS (ESI): $[M+H]^+$ calcd. for $C_{23}H_{24}N$: m/z = 314.1903; found, 314.1907.

(*E*)-*N*,*N*-dibenzyl-4-methyl-1-phenylpent-1-en-3-amine (**4ib**)



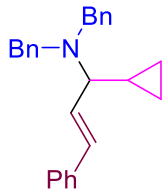
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (25 mg, 70%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.45-7.42 (m, 6H), 7.36 (t, J = 7.7 Hz, 2H), 7.34-7.31 (m, 4H), 7.28-7.22 (m, 3H), 6.30 (d, J = 15.9 Hz, 1H), 6.16 (dd, J = 15.8, 9.8 Hz, 1H), 3.92 (d, J = 13.8 Hz, 2H), 3.36 (d, J = 13.8 Hz, 2H), 2.65 (d, J = 10.0 Hz, 1H), 2.01-1.95 (m, 1H), 1.13 (d, J = 6.5 Hz, 3H), 0.78 (d, J = 6.7 Hz, 3H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 140.6, 137.3, 134.2, 128.9, 128.8, 128.3, 127.8, 127.5, 126.8, 126.4, 67.8, 53.9, 29.7, 21.1, 20.6; HRMS (ESI): $[M+H]^+$ calcd. for $C_{26}H_{30}N$: m/z = 356.2373; found, 356.2372.

(*E*)-*N*,*N*-dibenzyl-1-cyclohexyl-3-phenylprop-2-en-1-amine (**4jb**)



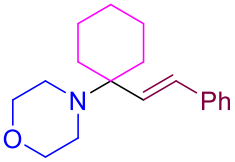
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (32 mg, 81%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.45-7.42 (m, 6H), 7.39-7.33 (m, 6H), 7.29-7.24 (m, 3H), 6.30 (d, J = 15.8 Hz, 1H), 6.18 (dd, J = 15.8, 10.0 Hz, 1H), 3.94 (d, J = 13.8 Hz, 2H), 3.39 (d, J = 13.8 Hz, 2H), 2.80 (t, J = 10.0 Hz, 1H), 2.47 (d, J = 12.9 Hz, 1H), 1.76 (d, J = 13.1 Hz, 1H), 1.69 (d, J = 10.6 Hz, 1H), 1.65-1.62 (m, 3H), 1.28-1.17 (m, 2H), 1.14-1.10 (m, 1H), 0.92-0.85 (m, 1H), 0.75-0.69 (m, 1H) ^{13}C NMR (150 MHz, $CDCl_3$): δ 140.6, 137.3, 134.3, 128.9, 128.8, 128.3, 127.6, 127.5, 126.8, 126.4, 66.5, 53.9, 39.1, 31.6, 30.7, 26.9, 26.5; HRMS (ESI): $[M+H]^+$ calcd. for $C_{29}H_{34}N$: m/z = 396.2686; found, 396.2689.

(*E*)-*N*,*N*-dibenzyl-1-cyclopropyl-3-phenylprop-2-en-1-amine (**4kb**)



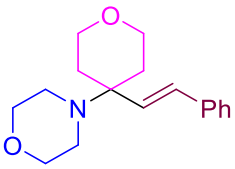
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (19 mg, 54%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.44-7.41 (m, 6H), 7.35-7.30 (m, 6H), 7.25-7.21 (m, 3H), 6.47 (d, J = 15.9 Hz, 1H), 6.33 (dd, J = 15.8, 6.7 Hz, 1H), 3.94 (d, J = 13.9 Hz, 2H), 3.64 (d, J = 13.8 Hz, 2H), 2.62 (t, J = 7.8 Hz, 1H), 1.12-1.10 (m, 1H), 0.64-0.58 (m, 1H), 0.55-0.50 (m, 1H), 0.32-0.28 (m, 1H), 0.11-0.06 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 140.8, 137.5, 132.4, 129.0, 128.7, 128.3, 127.4, 126.8, 126.5, 64.9, 54.4, 12.7, 4.3, 3.3; HRMS (ESI): $[M+H]^+$ calcd. for $C_{26}H_{28}N$: m/z = 354.2216; found, 354.2215.

(*E*)-4-(1-styrylcyclohexyl)morpholine (**4lb**)



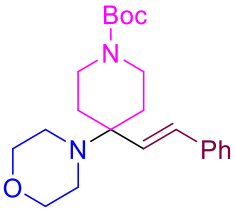
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:5); colorless oil (21 mg, 77%);^{1}H NMR (600 MHz, $CDCl_3$): δ 7.38 (d, J = 7.5 Hz, 2H), 7.31 (t, J = 7.4 Hz, 2H), 7.22 (t, J = 7.3 Hz, 1H), 6.37 (d, J = 16.6 Hz, 1H), 6.11 (d, J = 16.6 Hz, 1H), 3.74-3.63 (m, 4H), 2.65-2.53 (m, 4H), 1.77-1.65 (m, 6H), 1.44-1.38 (m, 4H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 137.5, 132.7, 130.7, 128.7, 127.4, 126.3, 68.0, 58.9, 45.7, 33.3, 26.4, 22.1; HRMS (ESI): $[M+H]^+$ calcd. for $C_{18}H_{26}NO$: m/z = 272.2009; found, 272.2007.

(*E*)-4-(4-styryltetrahydro-2H-pyran-4-yl)morpholine (**4mb**)



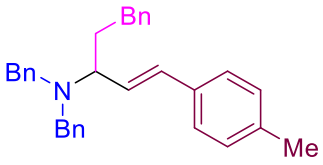
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:5); white solid (23 mg, 84%); mp 110-113 °C;^{1}H NMR (600 MHz, $CDCl_3$): δ 7.38 (d, J = 7.5 Hz, 2H), 7.32 (t, J = 7.6 Hz, 2H), 7.27-7.22 (m, 1H), 6.38 (d, J = 16.6 Hz, 1H), 6.08 (d, J = 16.6 Hz, 1H), 3.92-3.89 (m, 2H), 3.70-3.68 (m, 4H), 3.58-3.55 (m, 2H), 2.60-2.58 (m, 4H), 1.92-1.85 (m, 4H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 136.9, 132.0, 130.6, 128.8, 127.8, 126.4, 67.8, 64.2, 57.3, 45.7, 34.0; HRMS (ESI): $[M+H]^+$ calcd. for $C_{17}H_{24}NO_2$: m/z = 274.1802; found, 274.1803.

tert-butyl (*E*)-4-morpholino-4-styrylpiperidine-1-carboxylate (**4nb**)



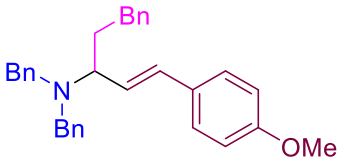
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:5); colorless oil (33 mg, 89%);^{1}H NMR (600 MHz, $CDCl_3$): δ 7.38 (d, J = 7.4 Hz, 2H), 7.32 (t, J = 7.3 Hz, 2H), 7.25 (t, J = 7.6 Hz, 1H), 6.39 (d, J = 16.6 Hz, 1H), 6.14 (d, J = 16.6 Hz, 1H), 3.71-3.68 (m, 4H), 3.57-3.54 (m, 2H), 3.42-3.38 (m, 2H), 2.60-2.58 (m, 4H), 1.91-1.87 (m, 2H), 1.77-1.73 (m, 2H), 1.46 (s, 9H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 155.1, 136.9, 131.5, 130.6, 128.8, 127.8, 126.4, 79.5, 67.8, 57.5, 40.3, 39.4, 32.7, 28.6; HRMS (ESI): $[M+H]^+$ calcd. for $C_{22}H_{33}N_2O_3$: m/z = 373.2486; found, 373.2478.

(*E*)-*N*,*N*-dibenzyl-5-phenyl-1-(p-tolyl)pent-1-en-3-amine (**4ac**)



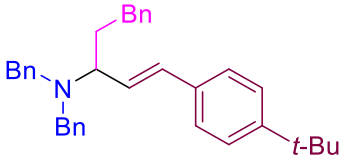
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); white solid (36 mg, 84%); mp 78-81 °C; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.44 (d, J = 7.4 Hz, 4H), 7.38-7.32 (m, 6H), 7.28-7.25 (m, 4H), 7.19 (dd, J = 14.5, 7.6 Hz, 3H), 7.14-7.13 (m, 2H), 6.41 (d, J = 15.9 Hz, 1H), 6.25 (dd, J = 15.8, 8.9 Hz, 1H), 3.93 (d, J = 13.7 Hz, 2H), 3.49 (d, J = 13.8 Hz, 2H), 3.30 (q, J = 7.4 Hz, 1H), 2.88-2.83 (m, 1H), 2.63-2.58 (m, 1H), 2.40 (s, 3H), 2.17-2.11 (m, 1H), 1.92-1.86 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 142.7, 140.5, 137.4, 134.5, 133.2, 129.4, 128.9, 128.5, 128.4, 128.4, 127.2, 126.9, 126.4, 125.8, 60.4, 54.0, 34.9, 33.2, 21.3; HRMS (ESI): $[M+H]^+$ calcd. for $C_{32}H_{34}N$: m/z = 432.2686; found, 432.2679.

(*E*)-*N*,*N*-dibenzyl-1-(4-methoxyphenyl)-5-phenylpent-1-en-3-amine (**4bc**)



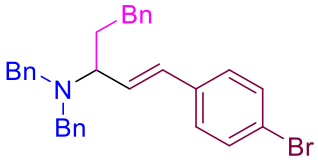
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (39 mg, 87%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.40 (d, J = 7.3 Hz, 4H), 7.37-7.34 (m, 2H), 7.32-7.28 (m, 4H), 7.24-7.20 (m, 4H), 7.15-7.12 (m, 1H), 7.09 (d, J = 7.2 Hz, 2H), 6.90-6.86 (m, 2H), 6.33 (d, J = 15.8 Hz, 1H), 6.11 (dd, J = 15.8, 8.9 Hz, 1H), 3.88 (d, J = 13.7 Hz, 2H), 3.81 (s, 3H), 3.45 (d, J = 13.8 Hz, 2H), 3.24 (q, J = 7.3 Hz, 1H), 2.83-2.78 (m, 1H), 2.59-2.53 (m, 1H), 2.13-2.06 (m, 1H), 1.87-1.81 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 159.3, 142.8, 140.6, 132.8, 130.0, 129.0, 128.9, 128.5, 128.4, 128.4, 127.6, 126.9, 126.0, 125.7, 60.5, 55.5, 54.0, 34.9, 33.2; HRMS (ESI): $[M+H]^+$ calcd. for $C_{32}H_{34}NO$: m/z = 448.2635; found, 448.2626.

(*E*)-*N*,*N*-dibenzyl-1-(4-(*tert*-butyl)phenyl)-5-phenylpent-1-en-3-amine (**4cc**)



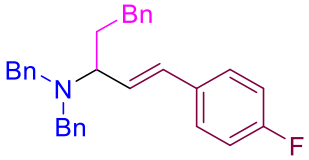
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (40 mg, 85%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.43-7.39 (m, 8H), 7.33 (t, J = 7.6 Hz, 4H), 7.26-7.22 (m, 4H), 7.16 (t, J = 7.3 Hz, 1H), 7.12 (t, J = 7.2 Hz, 2H), 6.40 (d, J = 15.9 Hz, 1H), 6.25 (dd, J = 15.9, 8.9 Hz, 1H), 3.90 (d, J = 13.8 Hz, 2H), 3.46 (d, J = 13.8 Hz, 2H), 3.28 (q, J = 7.4 Hz, 1H), 2.84-2.79 (m, 1H), 2.60-2.55 (m, 1H), 2.15-2.09 (m, 1H), 1.90-1.84 (m, 1H), 1.36 (s, 9H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 150.8, 142.8, 140.5, 134.5, 133.2, 128.9, 128.5, 128.4, 128.4, 127.4, 126.9, 126.2, 125.8, 125.7, 60.5, 54.0, 34.9, 34.7, 33.2, 31.5; HRMS (ESI): $[M+H]^+$ calcd. for $C_{35}H_{40}N$: m/z = 474.3155; found, 474.3148.

(*E*)-*N*,*N*-dibenzyl-1-(4-bromophenyl)-5-phenylpent-1-en-3-amine (**4dc**)



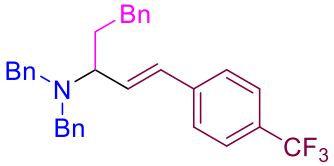
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (43 mg, 87%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.48-7.46 (m, 2H), 7.41 (d, *J* = 7.3 Hz, 4H), 7.33 (t, *J* = 7.6 Hz, 4H), 7.29-7.22 (m, 6H), 7.16 (t, *J* = 7.4 Hz, 1H), 7.11 (d, *J* = 7.3 Hz, 2H), 6.34 (d, *J* = 15.9 Hz, 1H), 6.27 (dd, *J* = 15.9, 8.5 Hz, 1H), 3.90 (d, *J* = 13.7 Hz, 2H), 3.46 (d, *J* = 13.8 Hz, 2H), 3.28 (q, *J* = 7.4 Hz, 1H), 2.85-2.80 (m, 1H), 2.60-2.55 (m, 1H), 2.15-2.09 (m, 1H), 1.89-1.83 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 142.5, 140.3, 136.1, 132.1, 131.8, 129.3, 128.9, 128.5, 128.5, 128.4, 128.0, 127.0, 125.8, 121.3, 60.3, 54.0, 34.6, 33.1; HRMS (ESI): $[M+H]^+$ calcd. for $C_{31}H_{31}BrN$: m/z = 496.1634; found, 496.1627.

(*E*)-*N*,*N*-dibenzyl-1-(4-fluorophenyl)-5-phenylpent-1-en-3-amine (**4ec**)



The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (28 mg, 64%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.42-7.37 (m, 6H), 7.33 (t, *J* = 7.4 Hz, 4H), 7.26-7.23 (m, 4H), 7.16 (t, *J* = 7.4 Hz, 1H), 7.11 (d, *J* = 6.7 Hz, 2H), 7.06-7.03 (m, 2H), 6.37 (d, *J* = 15.9 Hz, 1H), 6.19 (dd, *J* = 15.9, 8.8 Hz, 1H), 3.90 (d, *J* = 13.7 Hz, 2H), 3.47 (d, *J* = 13.8 Hz, 2H), 3.28 (q, *J* = 7.4 Hz, 1H), 2.85-2.80 (m, 1H), 2.60-2.55 (m, 1H), 2.16-2.09 (m, 1H), 1.89-1.83 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 162.4 (d, *J* = 246.2 Hz), 142.6, 140.4, 133.4, 132.1, 128.9, 128.5, 128.4, 128.4, 128.1, 128.0 (d, *J* = 8.2 Hz), 126.9, 125.8, 115.6 (d, *J* = 21.6 Hz), 60.4, 54.0, 34.7, 33.1; HRMS (ESI): $[M+H]^+$ calcd. for $C_{31}H_{31}FN$: m/z = 436.2435; found, 436.2427.

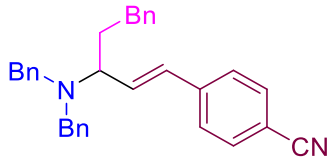
(*E*)-*N*,*N*-dibenzyl-5-phenyl-1-(4-(trifluoromethyl)phenyl)pent-1-en-3-amine (**4fc**)



The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (40 mg, 82%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.61 (d, *J* = 8.2 Hz, 2H), 7.51 (d, *J* = 8.2 Hz, 2H), 7.42 (d, *J* = 7.4 Hz, 4H), 7.35 (t, *J* = 7.6 Hz, 4H), 7.28-7.24 (m, 4H), 7.18 (t, *J* = 7.5 Hz, 1H), 7.14-7.10 (m, 2H), 6.45 (d, *J* = 16.0 Hz, 1H), 6.39 (dd, *J* = 15.9, 8.2 Hz, 1H), 3.93 (d, *J* = 13.7 Hz, 2H), 3.49 (d, *J* = 13.8 Hz, 2H), 3.33 (q, *J* = 7.3 Hz, 1H), 2.87-2.82 (m, 1H), 2.62-2.57 (m, 1H), 2.19-2.13 (m, 1H), 1.92-1.86 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 142.5, 140.6, 140.2, 131.9, 131.4, 129.4 (q, *J* = 32.7 Hz), 128.9, 128.5, 128.5, 127.0, 126.6, 125.9, 125.7, 125.7, 124.4 (q, *J* = 271.9 Hz), 60.3, 54.1, 34.5, 33.1; HRMS (ESI):

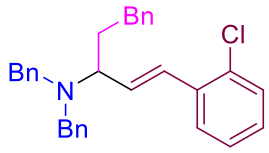
$[M+H]^+$ calcd. for $C_{32}H_{31}F_3N$: m/z = 486.2403; found, 486.2396.

(*E*)-4-(3-(dibenzylamino)-5-phenylpent-1-en-1-yl)benzonitrile (**4gc**)



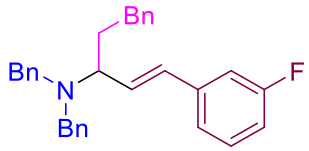
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (23 mg, 52%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.63 (d, *J* = 7.6 Hz, 2H), 7.48 (d, *J* = 7.6 Hz, 2H), 7.40 (d, *J* = 7.3 Hz, 4H), 7.33 (t, *J* = 7.2 Hz, 4H), 7.27-7.23 (m, 4H), 7.17 (t, *J* = 7.3 Hz, 1H), 7.10 (d, *J* = 7.3 Hz, 2H), 6.43-6.40 (m, 2H), 3.91 (d, *J* = 13.7 Hz, 2H), 3.47 (d, *J* = 13.7 Hz, 2H), 3.32 (q, *J* = 5.5 Hz, 1H), 2.85-2.80 (m, 1H), 2.60-2.55 (m, 1H), 2.18-2.13 (m, 1H), 1.90-1.84 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 142.3, 141.6, 140.1, 133.0, 132.6, 131.6, 128.8, 128.5, 127.1, 127.0, 125.9, 119.1, 110.8, 60.2, 54.1, 34.3, 33.0; HRMS (ESI): $[M+H]^+$ calcd. for $C_{32}H_{31}N_2$: m/z = 443.2482; found, 443.2474.

(*E*)-*N*,*N*-dibenzyl-1-(2-chlorophenyl)-5-phenylpent-1-en-3-amine (**4hc**)



The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (41 mg, 91%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.56 (dd, *J* = 7.7, 1.4 Hz, 1H), 7.41 (d, *J* = 7.4 Hz, 4H), 7.42-7.39 (m, 1H), 7.34 (t, *J* = 7.6 Hz, 4H), 7.28-7.20 (m, 6H), 7.17 (t, *J* = 7.3 Hz, 1H), 7.13 (d, *J* = 7.2 Hz, 2H), 6.81 (d, *J* = 15.8 Hz, 1H), 6.22 (dd, *J* = 15.8, 8.9 Hz, 1H), 3.92 (d, *J* = 13.7 Hz, 2H), 3.48 (d, *J* = 13.7 Hz, 2H), 3.33 (q, *J* = 7.4 Hz, 1H), 2.88-2.83 (m, 1H), 2.62-2.57 (m, 1H), 2.17-2.10 (m, 1H), 1.92-1.86 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 142.6, 140.3, 135.6, 133.1, 131.3, 129.9, 128.9, 128.6, 128.5, 128.5, 128.4, 127.1, 127.0, 127.0, 125.8, 60.3, 54.0, 34.6, 33.1; HRMS (ESI): $[M+H]^+$ calcd. for $C_{31}H_{31}ClN$: m/z = 452.2140; found, 452.2135.

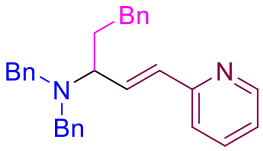
(*E*)-*N*,*N*-dibenzyl-1-(3-fluorophenyl)-5-phenylpent-1-en-3-amine (**4ic**)



The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (39 mg, 90%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.43 (d, *J* = 7.4 Hz, 4H), 7.37-7.30 (m, 5H), 7.29-7.23 (m, 4H), 7.19-7.12 (m, 5H), 6.98 (td, *J* = 8.3, 2.5 Hz, 1H), 6.39 (d, *J* = 15.9 Hz, 1H), 6.30 (dd, *J* = 15.9, 8.5 Hz, 1H), 3.92 (d, *J* = 13.7 Hz, 2H), 3.48 (d, *J* = 13.8 Hz, 2H), 3.30 (q, *J* = 7.5 Hz, 1H), 2.86-2.81 (m, 1H), 2.62-2.57 (m, 1H), 2.17-2.11 (m, 1H), 1.91-1.85 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 163.3 (d, *J* = 245.1 Hz), 142.5, 140.3,

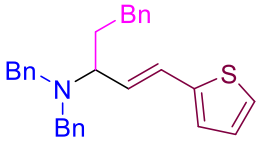
139.6 (d, J = 7.3 Hz), 132.2, 130.2 (d, J = 8.3 Hz), 129.9, 128.9, 128.5, 128.5, 128.4, 127.0, 125.8, 122.4, 114.4 (d, J = 21.2 Hz), 112.9 (d, J = 21.7 Hz), 60.2, 54.0, 34.6, 33.1; HRMS (ESI): $[M+H]^+$ calcd. for $C_{31}H_{31}FN$: m/z = 436.2435; found, 436.2428.

(*E*)-*N*,*N*-dibenzyl-5-phenyl-1-(pyridin-2-yl)pent-1-en-3-amine (**4jc**)



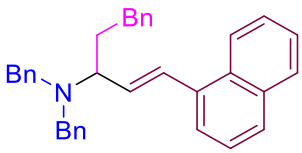
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:20); colorless oil (25 mg, 60%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.61 (d, J = 4.5 Hz, 1H), 7.66 (td, J = 7.7, 1.6 Hz, 1H), 7.41 (d, J = 7.5 Hz, 4H), 7.33-7.29 (m, 5H), 7.25-7.21 (m, 4H), 7.18-7.13 (m, 2H), 7.10 (d, J = 7.2 Hz, 2H), 6.84 (dd, J = 15.7, 8.9 Hz, 1H), 6.51 (d, J = 15.7 Hz, 1H), 3.91 (d, J = 13.8 Hz, 2H), 3.52 (d, J = 13.8 Hz, 2H), 3.34 (q, J = 7.4 Hz, 1H), 2.86-2.79 (m, 1H), 2.61-2.56 (m, 1H), 2.17-2.11 (m, 1H), 1.93-1.87 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 155.4, 149.7, 142.6, 140.4, 136.7, 133.1, 133.1, 128.9, 128.5, 128.4, 128.4, 126.9, 125.8, 122.3, 121.9, 60.0, 54.0, 34.4, 33.1; HRMS (ESI): $[M+H]^+$ calcd. for $C_{30}H_{31}N_2$: m/z = 419.2482; found, 419.2475.

(*E*)-*N*,*N*-dibenzyl-5-phenyl-1-(thiophen-2-yl)pent-1-en-3-amine (**4kc**)



The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (40 mg, 95%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.43 (d, J = 7.5 Hz, 4H), 7.34 (t, J = 7.5 Hz, 4H), 7.28-7.23 (m, 4H), 7.20-7.16 (m, 2H), 7.12 (d, J = 7.4 Hz, 2H), 7.03-7.00 (m, 1H), 6.99 (d, J = 3.2 Hz, 1H), 6.55 (d, J = 15.7 Hz, 1H), 6.14 (dd, J = 15.7, 8.7 Hz, 1H), 3.91 (d, J = 13.8 Hz, 2H), 3.49 (d, J = 13.8 Hz, 2H), 3.26 (q, J = 7.4 Hz, 1H), 2.86-2.81 (m, 1H), 2.62-2.57 (m, 1H), 2.15-2.09 (m, 1H), 1.90-1.84 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 144.6, 142.4, 140.4, 128.9, 128.5, 128.4, 128.4, 128.2, 127.5, 127.0, 126.4, 125.8, 125.5, 124.0, 60.2, 54.0, 34.6, 33.1; HRMS (ESI): $[M+H]^+$ calcd. for $C_{29}H_{30}NS$: m/z = 424.2093; found, 424.2085.

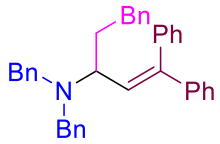
(*E*)-*N*,*N*-dibenzyl-1-(naphthalen-1-yl)-5-phenylpent-1-en-3-amine (**4lc**)



The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (42 mg, 90%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.16 (d, J = 8.3 Hz, 1H), 7.93-7.90 (m, 1H), 7.85 (d, J = 8.2 Hz, 1H), 7.68 (d, J = 7.0 Hz, 1H), 7.62-7.47 (m, 7H), 7.39

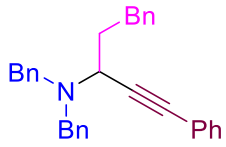
(t, *J* = 7.6 Hz, 4H), 7.33-7.27 (m, 4H), 7.24-7.15 (m, 4H), 6.33 (dd, *J* = 15.7, 8.9 Hz, 1H), 4.01 (d, *J* = 13.8 Hz, 2H), 3.59 (d, *J* = 13.8 Hz, 2H), 3.47 (q, *J* = 7.4 Hz, 1H), 2.97-2.92 (m, 1H), 2.72-2.67 (m, 1H), 2.26-2.20 (m, 1H), 2.03-1.97 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): *δ* 142.7, 140.5, 135.2, 133.8, 131.8, 131.3, 130.8, 128.9, 128.7, 128.5, 128.5, 128.4, 128.0, 127.0, 126.2, 125.9, 125.8, 125.8, 124.1, 124.0, 60.7, 54.1, 34.8, 33.3; HRMS (ESI): $[M+H]^+$ calcd. for $C_{35}H_{34}N$: m/z = 468.2686; found, 468.2678.

N,*N*-dibenzyl-1,1,5-triphenylpent-1-en-3-amine (**4mc**)



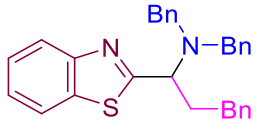
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); white solid (46 mg, 93%); mp 85-87 °C; ^{1}H NMR (600 MHz, $CDCl_3$): *δ* 7.36-7.34 (m, 5H), 7.32-7.26 (m, 1H), 7.25-7.17 (m, 11H), 7.14-7.13 (m, 4H), 6.98 (d, *J* = 7.4 Hz, 2H), 6.91-6.85 (m, 2H), 6.21 (d, *J* = 10.5 Hz, 1H), 3.91 (d, *J* = 13.6 Hz, 2H), 3.57-3.51 (m, 1H), 3.48 (d, *J* = 13.5 Hz, 2H), 2.81-2.76 (m, 1H), 2.61-2.56 (m, 1H), 2.23-2.17 (m, 1H), 1.86-1.80 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): *δ* 144.8, 143.5, 142.7, 140.4, 139.7, 130.2, 129.0, 128.8, 128.6, 128.4, 128.3, 128.3, 128.1, 127.9, 127.5, 127.1, 126.7, 125.6, 55.6, 54.1, 35.1, 32.5; HRMS (ESI): $[M+H]^+$ calcd. for $C_{37}H_{36}N$: m/z = 494.2842; found, 494.2835.

N,*N*-dibenzyl-1,5-diphenylpent-1-yn-3-amine (**4nc**)



The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (7.4 mg, 18%); ^{1}H NMR (600 MHz, $CDCl_3$): *δ* 7.50 (d, *J* = 6.7 Hz, 2H), 7.41 (d, *J* = 7.4 Hz, 4H), 7.34-7.30 (m, 7H), 7.25-7.23 (m, 2H), 7.21-7.19 (m, 2H), 7.13 (t, *J* = 7.1 Hz, 1H), 7.06 (d, *J* = 7.2 Hz, 2H), 3.92 (d, *J* = 13.7 Hz, 2H), 3.67 (t, *J* = 7.4 Hz, 1H), 3.51 (d, *J* = 13.7 Hz, 2H), 2.84-2.79 (m, 1H), 2.70-2.65 (m, 1H), 2.15-2.09 (m, 1H), 2.06-1.99 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): *δ* 142.0, 139.8, 132.0, 129.1, 128.6, 128.4, 128.1, 127.1, 125.9, 123.6, 87.8, 85.7, 55.3, 52.1, 35.9, 32.9; HRMS (ESI): $[M+H]^+$ calcd. for $C_{31}H_{30}N$: m/z = 416.2373; found, 416.2382.

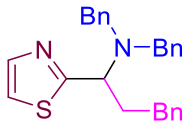
1-(benzo[*d*]thiazol-2-yl)-*N*,*N*-dibenzyl-3-phenylpropan-1-amine (**4oc**)



The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (36 mg, 80%); ^{1}H NMR (600 MHz, $CDCl_3$): *δ* 8.07 (d, *J* = 8.0 Hz, 1H), 7.93 (d, *J* = 7.9 Hz, 1H), 7.51-7.47 (m, 1H), 7.42-7.39 (m, 5H), 7.35-7.32 (m, 4H), 7.30-7.32

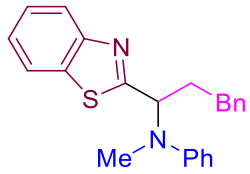
(m, 4H), 7.23-7.19 (m, 3H), 4.14-4.12 (m, 1H), 3.75 (d, *J* = 13.8 Hz, 2H), 3.68 (d, *J* = 13.7 Hz, 2H), 2.97-2.94 (m, 1H), 2.91-2.86 (m, 1H), 2.54-2.48 (m, 1H), 2.44-2.38 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 173.6, 153.4, 142.1, 139.4, 135.5, 129.0, 128.7, 128.6, 128.5, 127.2, 126.0, 125.8, 125.0, 123.2, 121.7, 59.9, 54.2, 33.5, 31.2; HRMS (ESI): $[M+H]^+$ calcd. for $C_{30}H_{29}N_2S$: m/z = 449.2046; found, 449.2044.

N,*N*-dibenzyl-3-phenyl-1-(thiazol-2-yl)propan-1-amine (**4pc**)



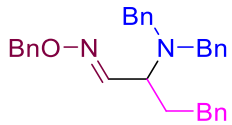
The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (28 mg, 70%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.82 (d, *J* = 3.4 Hz, 1H), 7.39 (d, *J* = 7.4 Hz, 4H), 7.33-7.30 (m, 5H), 7.25 (t, *J* = 7.7 Hz, 4H), 7.19 (t, *J* = 7.4 Hz, 1H), 7.13 (d, *J* = 7.2 Hz, 2H), 4.07 (t, *J* = 6.9 Hz, 1H), 3.78 (d, *J* = 13.8 Hz, 2H), 3.52 (d, *J* = 13.8 Hz, 2H), 2.85-2.76 (m, 2H), 2.37 (q, *J* = 7.6 Hz, 2H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 171.7, 142.4, 142.2, 139.6, 129.0, 128.6, 128.5, 128.4, 127.1, 126.0, 118.9, 59.1, 54.1, 33.4, 32.4; HRMS (ESI): $[M+H]^+$ calcd. for $C_{26}H_{27}N_2S$: m/z = 399.1889; found, 399.1885.

N-(1-(benzo[*d*]thiazol-2-yl)-3-phenylpropyl)-*N*-methylaniline (**4qc**)



The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (20 mg, 56%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.01 (d, *J* = 8.2 Hz, 1H), 7.81 (d, *J* = 8.0 Hz, 1H), 7.49-7.44 (m, 1H), 7.36 (t, *J* = 7.5 Hz, 1H), 7.30-7.24 (m, 4H), 7.19 (t, *J* = 7.3 Hz, 1H), 7.14 (d, *J* = 7.2 Hz, 2H), 6.87 (d, *J* = 8.2 Hz, 2H), 6.83 (t, *J* = 7.3 Hz, 1H), 5.20-5.18 (m, 1H), 2.95 (s, 3H), 2.85-2.79 (m, 2H), 2.76-2.71 (m, 1H), 2.50-2.45 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 175.0, 153.7, 149.9, 141.2, 135.5, 129.4, 128.8, 128.5, 126.2, 126.0, 125.1, 123.0, 121.8, 118.3, 113.9, 61.6, 33.6, 32.8, 32.6; HRMS (ESI): $[M+H]^+$ calcd. for $C_{23}H_{23}N_2S$: m/z = 359.1577; found, 359.1578.

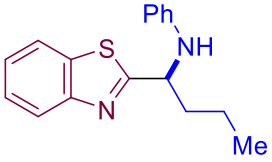
(*E*)-2-(dibenzylamino)-4-phenylbutanal *O*-benzyl oxime (**4rc**)



The titled compound was synthesized following the general procedure A. EtOAc/*n*-hexane (1:50); colorless oil (35 mg, 78%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.56 (d, *J* = 7.0 Hz, 1H), 7.44 (d, *J* = 7.3 Hz, 2H), 7.40 (t, *J* = 7.5 Hz, 2H), 7.35-7.30 (m, 9H), 7.26-7.23 (m, 3H), 7.17 (t, *J* = 7.3 Hz, 1H), 7.07 (d, *J* = 7.4 Hz, 2H), 5.16 (s, 2H), 3.82 (d, *J* = 13.6 Hz, 2H), 3.47 (d, *J* = 13.7 Hz, 2H), 3.36 (q, *J* = 7.4 Hz, 1H), 2.77-2.72 (m, 1H), 2.56-2.51 (m, 1H), 2.08-2.02 (m, 1H), 1.95-1.89 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 150.3, 142.2, 139.7, 138.0, 129.0,

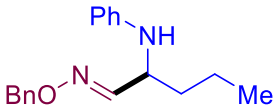
128.5, 128.5, 128.5, 128.4, 128.0, 127.1, 125.9, 76.0, 56.9, 54.1, 32.7, 32.0; HRMS (ESI): $[M+H]^+$ calcd. for $C_{31}H_{33}N_2O$: m/z = 449.2587; found, 449.2590.

(*S*)-*N*-(1-(benzo[*d*]thiazol-2-yl)butyl)aniline (**7**)



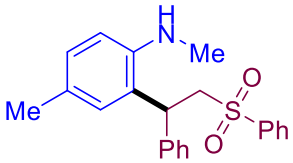
The titled compound was synthesized following procedure similar to the general procedure B. EtOAc/*n*-hexane (1:20); colorless oil (7.2 mg, 13%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.00 (d, J = 8.2 Hz, 1H), 7.81 (d, J = 7.9 Hz, 1H), 7.46 (t, J = 7.6 Hz, 1H), 7.34 (t, J = 7.5 Hz, 1H), 7.14 (t, J = 7.5 Hz, 2H), 6.73 (t, J = 7.2 Hz, 1H), 6.66 (d, J = 7.9 Hz, 2H), 4.82 (t, J = 6.1 Hz, 1H), 4.28 (brs, 1H), 2.13-2.07 (m, 1H), 2.00-1.94 (m, 1H), 1.62-1.50 (m, 2H), 0.99 (t, J = 7.3 Hz, 3H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 178.7, 153.8, 146.8, 135.1, 129.4, 126.0, 124.9, 122.9, 122.0, 118.7, 113.5, 57.4, 39.6, 19.4, 13.9; HRMS (ESI): $[M+H]^+$ calcd. for $C_{17}H_{19}N_2S$: m/z = 283.1263; found, 283.1260.

(*S*,*E*)-2-(phenylamino)pentanal *O*-benzyl oxime (**8**)



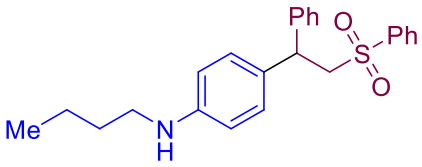
The titled compound was synthesized following procedure similar to the general procedure B. EtOAc/*n*-hexane (1:20); colorless oil (5.6 mg, 10%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.35-7.33 (m, 4H), 7.31-7.28 (m, 1H), 7.27-7.22 (m, 1H), 7.13 (t, J = 7.8 Hz, 2H), 6.71 (t, J = 7.2 Hz, 1H), 6.63 (d, J = 8.2 Hz, 2H), 5.08 (s, 2H), 4.01 (q, J = 6.9 Hz, 1H), 3.76 (brs, 1H), 1.69-1.62 (m, 2H), 1.47-1.39 (m, 2H), 0.94 (t, J = 7.3 Hz, 3H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 152.4, 147.1, 137.7, 129.3, 128.5, 128.3, 127.9, 117.9, 113.5, 76.0, 52.8, 36.1, 18.8, 14.0; HRMS (ESI): $[M+H]^+$ calcd. for $C_{18}H_{23}N_2O$: m/z = 283.1805; found, 283.1800.

(*S*)-*N*,4-dimethyl-2-(1-phenyl-2-(phenylsulfonyl)ethyl)aniline (**9b**)



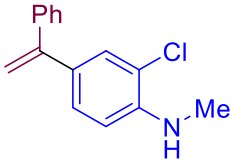
The titled compound was synthesized following the general procedure B. EtOAc/*n*-hexane (1:5); pale yellow oil (106 mg, 58%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.76 (d, J = 7.6 Hz, 2H), 7.54 (t, J = 7.5 Hz, 1H), 7.39 (t, J = 7.8 Hz, 2H), 7.28-7.22 (m, 2H), 7.09-7.00 (m, 4H), 6.68 (d, J = 8.5 Hz, 2H), 5.60 (dd, J = 9.2, 4.8 Hz, 1H), 3.95 (dd, J = 14.9, 9.3 Hz, 1H), 3.75 (dd, J = 15.0, 4.8 Hz, 1H), 2.28 (s, 3H), 2.14 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 147.0, 139.9, 137.4, 133.5, 129.9, 129.0, 128.7, 128.2, 127.9, 127.9, 127.1, 115.2, 58.8, 57.4, 32.0, 20.5; HRMS (ESI): $[M+H]^+$ calcd. for $C_{22}H_{24}NO_2S$: m/z = 366.1522; found, 366.1516.

N-butyl-4-(1-phenyl-2-(phenylsulfonyl)ethyl)aniline (**9x-C4**)



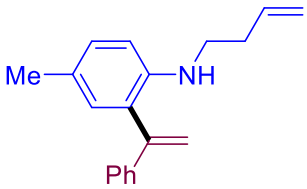
The titled compound was synthesized following the general procedure B. EtOAc/*n*-hexane (1:5); pale yellow oil (11 mg, 14%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.63 (d, J = 7.4 Hz, 2H), 7.48 (t, J = 7.5 Hz, 1H), 7.38-7.31 (m, 2H), 7.17-7.14 (m, 2H), 7.11-7.09 (m, 3H), 6.90 (d, J = 8.4 Hz, 2H), 6.40 (d, J = 8.5 Hz, 2H), 4.51 (t, J = 7.2 Hz, 1H), 3.93-3.80 (m, 2H), 3.03 (t, J = 7.1 Hz, 2H), 1.58-1.53 (m, 2H), 1.43-1.37 (m, 2H), 0.94 (t, J = 7.4 Hz, 3H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 147.5, 142.1, 139.9, 133.1, 129.7, 128.9, 128.7, 128.5, 128.1, 127.6, 126.8, 112.8, 62.0, 45.5, 43.7, 31.7, 20.4, 14.0; HRMS (ESI): $[M+H]^+$ calcd. for $C_{24}H_{28}NO_2S$: m/z = 394.1835; found, 394.1842.

2-chloro-*N*-methyl-4-(1-phenylvinyl)aniline (**10h-C4**)



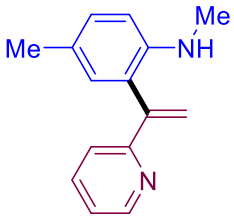
The titled compound was synthesized following the general procedure D. EtOAc/*n*-hexane (1:30); pale yellow oil (19 mg, 16%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.36-7.30 (m, 5H), 7.28 (d, J = 2.1 Hz, 1H), 7.16 (dd, J = 8.4, 2.1 Hz, 1H), 6.60 (d, J = 8.6 Hz, 1H), 5.37 (s, 1H), 5.29 (d, 0.9 Hz, 1H), 4.41 (brs, 1H), 2.93 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 149.1, 144.7, 141.8, 130.7, 128.8, 128.5, 128.3, 127.9, 127.8, 118.9, 112.4, 110.2, 30.6; HRMS (ESI): $[M+H]^+$ calcd. for $C_{15}H_{15}ClN$: m/z = 244.0888; found, 244.0890.

N-(but-3-en-1-yl)-4-methyl-2-(1-phenylvinyl)aniline (**10u**)



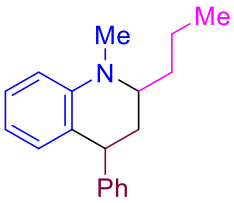
The titled compound was synthesized following the general procedure D. EtOAc/*n*-hexane (1:30); pale yellow oil (28 mg, 21%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.36-7.34 (m, 2H), 7.32-7.29 (m, 3H), 7.07 (dd, J = 8.2, 1.9 Hz, 1H), 6.94 (d, J = 1.9 Hz, 1H), 6.60 (d, J = 8.2 Hz, 1H), 5.77 (d, J = 1.4 Hz, 1H), 5.57-5.50 (m, 1H), 5.33 (d, J = 1.4 Hz, 1H), 4.93-4.84 (m, 2H), 3.54 (brs, 1H), 3.06 (t, J = 6.6 Hz, 2H), 2.28 (s, 3H), 2.16-2.13 (m, 2H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 147.4, 143.5, 140.0, 135.6, 131.3, 129.5, 128.6, 128.1, 127.6, 126.8, 125.9, 116.9, 116.3, 111.0, 43.3, 33.6, 20.5; HRMS (ESI): $[M+H]^+$ calcd. for $C_{19}H_{22}N$: m/z = 264.1747; found, 264.1751.

N,4-dimethyl-2-(1-(pyridin-2-yl)vinyl)aniline (**10w**)



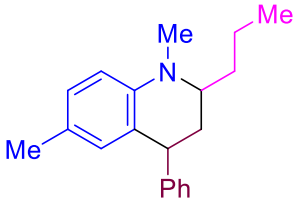
The titled compound was synthesized following the general procedure D. EtOAc/*n*-hexane (1:10); pale yellow oil (20 mg, 18%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.63 (d, J = 4.8 Hz, 1H), 7.55 (td, J = 7.7, 1.9 Hz, 1H), 7.21-7.14 (m, 1H), 7.10 (dd, J = 8.2, 1.8 Hz, 1H), 7.03 (d, J = 7.9 Hz, 1H), 6.92 (d, J = 1.8 Hz, 1H), 6.60 (d, J = 8.2 Hz, 1H), 6.50 (d, J = 2.1 Hz, 1H), 5.49 (d, J = 2.1 Hz, 1H), 2.72 (s, 3H), 2.27 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 156.7, 149.6, 146.2, 144.7, 136.8, 131.0, 129.7, 126.4, 126.0, 122.7, 121.8, 120.2, 110.2, 31.2 20.5; HRMS (ESI): $[M+H]^+$ calcd. for $C_{15}H_{17}N_2$: m/z = 225.1386; found, 225.1384.

1-methyl-4-phenyl-2-propyl-1,2,3,4-tetrahydroquinoline (**11aa**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (18 mg, 68%, 8:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.36-7.31 (m, 2H), 7.28-7.22 (m, 3H), 7.12-7.09 (m, 1H), [6.65 (d, J = 8.2 Hz), 6.63 (d, J = 7.5 Hz), total 1H], [6.59 (d, J = 8.2 Hz), 6.54-6.49 (m), total 2H], [4.04 (dd, J = 11.2, 6.1 Hz), 3.98 (dd, J = 11.2, 6.1 Hz), total 1H], [3.45-3.37 (m), 3.29-3.26 (m), total 1H], [2.99 (s), 2.97 (s), total 3H], [2.31-2.28 (m), 2.14-2.11 (m), total 1H], 2.08-2.04 (m, 1H), 1.74-1.68 (m, 1H), 1.46-1.31 (m, 1H), 1.32-1.22 (m, 2H), [0.96 (t, J = 7.3 Hz), 0.88 (t, J = 7.3 Hz), total 3H]. ^{13}C NMR (150 MHz, $CDCl_3$): δ 147.5 (major), 144.8 (major), 129.4 (minor), 129.0 (minor), 128.9 (major), 128.6 (major), 128.3 (major), 127.9 (minor), 127.5 (major), 127.5 (major), 126.5 (major), 126.4 (minor), 116.1 (major), 115.5 (minor), 112.2 (major), 110.3 (minor), 58.8 (major), 58.6 (minor), 43.3 (major), 40.3 (minor), 38.3 (minor), 37.5 (major), 36.9 (major), 36.4 (major), 34.8 (minor), 34.0 (minor), 19.4 (minor), 18.4 (major), 14.5 (major); HRMS (ESI): $[M+H]^+$ calcd. for $C_{19}H_{24}N$: m/z = 266.1903; found, 266.1904.

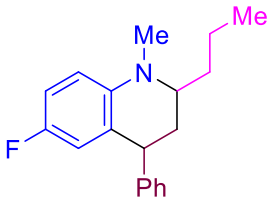
1,6-dimethyl-4-phenyl-2-propyl-1,2,3,4-tetrahydroquinoline (**11ba**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (15 mg, 54%, 5:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.37-7.32 (m, 2H),

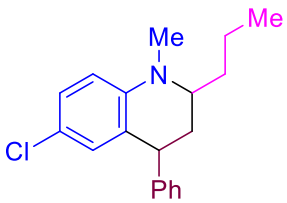
7.29-7.21 (m, 3H), 6.99-6.92 (m, 1H), [6.60 (d, *J* = 8.2 Hz), 6.53 (d, *J* = 7.5 Hz), total 1H], [6.48 (s), 6.37 (s), total 1H], [4.04 (dd, *J* = 10.7, 6.3 Hz), 3.98 (dd, *J* = 11.3, 4.4 Hz), total 1H], [3.37-3.33 (m), 3.25-3.22 (m), total 1H], [2.96 (s), 2.95 (s), total 3H], [2.30-2.26 (m), 2.15-2.12 (m), total 1H], 2.11 (s, 3H), [2.10-2.08 (m), 2.06-2.00 (m), total 1H], 1.73-1.68 (m, 1H), [1.55-1.49 (m), 1.43-1.37 (m), total 1H], 1.34-1.22 (m, 2H), [0.96 (t, *J* = 7.4 Hz), 0.88 (t, *J* = 7.3 Hz), total 3H]. ^{13}C NMR (150 MHz, $CDCl_3$): δ 146.4 (minor), 145.5 (major), 145.0 (major), 143.8 (minor), 130.0 (minor), 128.9 (major), 128.6 (major), 128.5 (major), 128.4 (major), 128.0 (minor), 127.9 (major), 126.5 (major), 126.3 (minor), 125.3 (major), 124.6 (minor), 112.7 (major), 111.2 (minor), 58.8 (major), 58.5 (minor), 43.4 (major), 40.4 (minor), 38.4 (minor), 37.8 (major), 37.1 (major), 36.3 (major), 35.2 (minor), 33.6 (minor), 20.5 (major), 20.4 (minor), 19.3 (minor), 18.4 (major), 14.5 (major), 14.5 (minor); HRMS (ESI): $[M+H]^+$ calcd. for $C_{20}H_{26}N$: m/z = 280.2060; found, 280.2060.

6-fluoro-1-methyl-4-phenyl-2-propyl-1,2,3,4-tetrahydroquinoline (**11ca**)



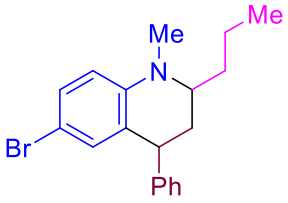
The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (24 mg, 85%, 5:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.37-7.32 (m, 2H), 7.30-7.21 (m, 1H), 7.23-7.20 (m, 2H), 6.81-6.78 (m, 1H), [6.56 (d, *J* = 8.9, 4.8 Hz), 6.48 (dd, *J* = 9.0, 4.8 Hz), total 1H], [6.40-6.37 (m), 6.28-6.25 (m), total 1H], [4.01 (t, *J* = 8.4 Hz), 3.93 (dd, *J* = 11.6, 4.3 Hz), total 1H], [3.39-3.34 (m), 3.26-3.23 (m), total 1H], [2.95 (s), 2.93 (s), total 3H], [2.32-2.28 (dt, *J* = 13.1, 4.8 Hz), 2.13-2.12 (m), total 1H], [2.11 (d, *J* = 4.0 Hz), 2.02-1.97 (m), total 1H], 1.74-1.63 (m, 1H), [1.54-1.46 (m), 1.42-1.36 (m), total 1H], 1.33-1.23 (m, 2H), [0.96 (t, *J* = 7.4 Hz), 0.89 (t, *J* = 7.4 Hz), total 3H]. ^{13}C NMR (150 MHz, $CDCl_3$): δ 155.1 (d, *J* = 234.2 Hz) (major), 145.4 (minor), 144.0 (major), 143.9 (major), 142.3 (minor), 130.5 (minor), 130.5 (minor), 128.8 (minor), 128.8 (major), 128.8 (major), 128.7 (minor), 126.8 (major), 126.7 (minor), 115.9 (d, *J* = 22.7 Hz) (minor), 114.5 (d, *J* = 23.2 Hz) (major), 113.6 (d, *J* = 22.0 Hz) (minor), 113.3 (d, *J* = 21.8 Hz) (major), 113.1 (d, *J* = 7.4 Hz) (major), 111.4 (d, *J* = 7.4 Hz) (minor), 58.8 (major), 58.6 (minor), 43.4 (major), 40.5 (minor), 38.7 (minor), 37.6 (major), 37.2 (major), 36.2 (major), 34.7 (minor), 33.5 (minor), 19.3 (minor), 18.4 (major), 14.5 (major), 14.4 (minor); HRMS (ESI): $[M+H]^+$ calcd. for $C_{19}H_{23}FN$: m/z = 284.1809; found, 284.1808.

6-chloro-1-methyl-4-phenyl-2-propyl-1,2,3,4-tetrahydroquinoline (**11da**)



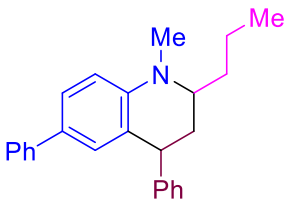
The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (23 mg, 77%, 3.3:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.37-7.32 (m, 2H), 7.29-7.26 (m, 1H), 7.22-7.19 (m, 2H), 7.04-7.02 (m, 1H), [6.59-6.58 (m), 6.53 (d, J = 8.6 Hz), total 1H], 6.48-6.47 (m, 1H), [4.01-3.96 (m), 3.91 (dd, J = 11.3, 4.2 Hz), total 1H], [3.42-3.38 (m), 3.28-3.24 (m), total 1H], [2.95 (s), 2.93 (s), total 3H], [2.30-2.26 (m), 2.11-2.09 (m), total 1H], [2.09-2.08 (m), 2.04-1. 98 (m), total 1H], 1.72-1.63 (m, 1H), [1.53-1.43 (m), 1.41-1.34 (m), total 1H], 1.29-1.20 (m, 2H), [0.96 (t, J = 7.3 Hz), 0.87 (t, J = 7.3 Hz), total 3H]. ^{13}C NMR (150 MHz, $CDCl_3$): δ 146.1 (major), 145.2 (minor), 144.3 (minor), 143.7 (major), 130.1 (major), 129.0 (minor), 128.8 (major), 128.8 (major), 127.4 (major), 127.3 (minor), 127.1 (major), 127.0 (minor), 126.9 (major), 126.7 (minor), 120.8 (major), 120.2 (minor), 113.3 (major), 111.9 (minor), 58.7 (major), 58.6 (minor), 43.2 (major), 40.2 (minor), 38.4 (minor), 37.3 (major), 36.9 (major), 36.2 (major), 34.5 (minor), 33.9 (minor), 19.3 (minor), 18.3 (major), 14.4 (major), 14.4 (minor); HRMS (ESI): $[M+H]^+$ calcd. for $C_{19}H_{23}ClN$: m/z = 300.1514; found, 300.1516.

6-bromo-1-methyl-4-phenyl-2-propyl-1,2,3,4-tetrahydroquinoline (**11ea**)



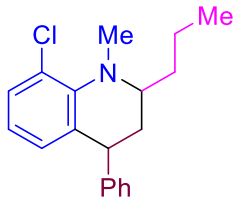
The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (28 mg, 82%, 4:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.37-7.32 (m, 2H), 7.30-7.26 (m, 1H), 7.22-7.20 (m, 2H), 7.19-7.15 (m, 1H), [6.72-6.71 (m), 6.62-6.60 (m), total 1H], [6.49 (d, J = 8.8 Hz), 6.43 (d, J = 8.9 Hz), total 1H], [4.00 (dd, J = 10.1, 7.2 Hz), 3.92 (dd, J = 11.2, 4.2 Hz), total 1H], [3.42-3.38 (m), 3.28-3.24 (m), total 1H], [2.95 (s), 2.93 (s), total 3H], [2.30-2.26 (m), 2.11-2.09 (m), total 1H], [2.09-2.08 (m), 2.04-1. 99 (m), total 1H], 1.72-1.63 (m, 1H), [1.53-1.43 (m), 1.41-1.34 (m), total 1H], 1.28-1.20 (m, 2H), [0.96 (t, J = 7.4 Hz), 0.87 (t, J = 7.4 Hz), total 3H]. ^{13}C NMR (150 MHz, $CDCl_3$): δ 146.5 (major), 145.2 (minor), 144.8 (minor), 143.7 (major), 131.7 (minor), 130.5 (major), 130.1 (major), 130.1 (major), 128.8 (major), 128.8 (major), 127.5 (minor), 126.9 (major), 126.8 (minor), 113.7 (major), 112.4 (minor), 108.0 (major), 107.4 (minor), 58.7 (major), 58.6 (minor), 43.1 (major), 40.2 (minor), 38.4 (minor), 37.3 (major), 36.8 (major), 36.2 (major), 34.5 (minor), 33.9 (minor), 19.3 (minor), 18.3 (major), 14.4 (major), 14.4 (minor); HRMS (ESI): $[M+H]^+$ calcd. for $C_{19}H_{23}BrN$: m/z = 344.1009; found, 344.1003.

1-methyl-4,6-diphenyl-2-propyl-1,2,3,4-tetrahydroquinoline (**11fa**)



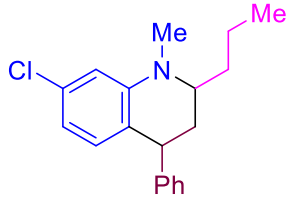
The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (17 mg, 50%, 8.4:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.39-7.33 (m, 5H), 7.32-7.25 (m, 5H), 7.19-7.16 (m, 1H), [6.93-6.92 (m), 6.85-6.82 (m), total 1H], [6.72 (d, J = 8.5 Hz), 6.66 (d, J = 8.5 Hz), total 1H], [4.15-4.10 (m), 4.07-4.04 (m), total 1H], [3.46-3.42 (m), 3.32-3.29 (m), total 1H], [3.03 (s), 3.01 (s), total 3H], 2.34-2.30 (m, 1H), 2.14-2.08 (m, 1H), 1.73-1.69 (m, 1H), 1.44-1.38 (m, 1H), 1.30-1.24 (m, 2H), [0.98 (t, J = 7.4 Hz), 0.87 (t, J = 7.4 Hz), total 3H]. ^{13}C NMR (150 MHz, $CDCl_3$): δ 147.0 (major), 144.7 (major), 141.6 (major), 128.9 (minor), 128.9 (major), 128.7 (major), 128.7 (major), 128.6 (major), 128.1 (major), 126.7 (major), 126.6 (major), 126.3 (major), 126.3 (minor), 126.1 (major), 125.8 (major), 112.5 (major), 111.1 (minor), 58.9 (major), 43.3 (major), 40.4 (minor), 37.3 (major), 36.9 (major), 36.2 (major), 34.9 (minor), 34.1 (minor), 19.4 (minor), 18.4 (major), 14.5 (major); HRMS (ESI): $[M+H]^+$ calcd. for $C_{25}H_{28}N$: m/z = 342.2216; found, 342.2213.

8-chloro-1-methyl-4-phenyl-2-propyl-1,2,3,4-tetrahydroquinoline (**11ga**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (22 mg, 74%, 1.7:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.35-7.29 (m, 2H), 7.27-7.13 (m, 4H), [6.77-6.74 (m), 6.67 (t, J = 7.8 Hz), 6.55 (d, J = 7.6 Hz), total 2H], [4.06 (dd, J = 9.2, 6.6 Hz), 4.01 (dd, J = 11.9, 5.5 Hz), total 1H], [3.21-3.17 (m), 2.98-2.95 (m), total 1H], [2.94 (s), 2.91 (s), total 3H], [2.19-2.15 (m), 2.12-2.08 (m), total 1H], 1.95-1.88 (m, 1H), [1.75-1.70 (m), 1.55-1.47 (m), total 1H], 1.46-1.40 (m, 3H), [0.96 (t, J = 7.1 Hz), 0.91 (t, J = 7.2 Hz), total 3H]. ^{13}C NMR (150 MHz, $CDCl_3$): δ 147.3 (minor), 146.5 (major), 145.8 (minor), 145.2 (major), 136.4 (major), 134.1 (minor), 129.1 (minor), 128.9 (major), 128.8 (major), 128.7 (major), 128.6 (major), 128.5 (minor), 127.3 (major), 127.0 (minor), 126.7 (major), 126.4 (minor), 121.9 (minor), 121.4 (major), 60.5 (major), 58.3 (minor), 45.4 (major), 43.1 (minor), 41.7 (major), 39.5 (major), 36.5 (major), 35.4 (minor), 35.0 (minor), 32.2 (minor), 19.6 (minor), 19.3 (major), 14.5 (major), 14.3 (minor); HRMS (ESI): $[M+H]^+$ calcd. for $C_{19}H_{23}ClN$: m/z = 300.1514; found, 300.1517.

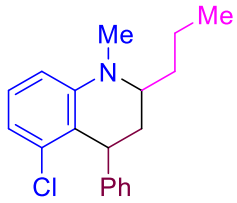
7-chloro-1-methyl-4-phenyl-2-propyl-1,2,3,4-tetrahydroquinoline (**11ha**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (16 mg, 54%, 7.7:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.35-7.31 (m, 2H), 7.28-7.25 (m, 1H), 7.21-7.18 (m, 2H), [6.58 (d, J = 1.9 Hz), 6.52-6.51 (m), total 1H], 6.47-6.45

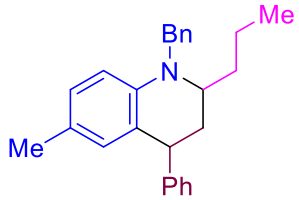
(m, 1H), 6.44-6.41 (m, 1H), [3.97 (t, J = 8.7 Hz), 3.90 (dd, J = 11.0, 4.3 Hz), total 1H], [3.44-3.40 (m), 3.30-3.26 (m), total 1H], [2.96 (s), 2.94 (s), total 3H], [2.29-2.25 (m), 2.10-2.08 (m), total 1H], 2.05-1.99 (m, 1H), 1.71-1.66 (m, 1H), 1.40-1.34 (m, 1H), 1.28-1.20 (m, 2H), [0.96 (t, J = 7.3 Hz), 0.86 (t, J = 7.3 Hz), total 3H]. ^{13}C NMR (150 MHz, $CDCl_3$): δ 148.4 (major), 144.2 (major), 133.1 (major), 130.4 (minor), 128.8 (minor), 128.8 (major), 128.7 (major), 126.7 (major), 126.6 (minor), 126.4 (major), 123.7 (minor), 115.5 (major), 115.1 (minor), 111.8 (major), 110.4 (minor), 58.7 (major), 42.7 (major), 39.7 (minor), 38.4 (minor), 37.0 (major), 36.7 (major), 36.2 (major), 34.5 (minor), 34.1 (minor), 19.3 (minor), 18.3 (major), 14.4 (major); HRMS (ESI): $[M+H]^+$ calcd. for $C_{19}H_{23}ClN$: m/z = 300.1514; found, 300.1510.

5-chloro-1-methyl-4-phenyl-2-propyl-1,2,3,4-tetrahydroquinoline (**11ia**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (17 mg, 57%, 7:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.37-7.06 (m, 6H), 6.71 (d, J = 7.7 Hz, 1H), [6.55 (d, J = 8.2 Hz), 6.50 (d, J = 8.1 Hz), total 1H], [4.55 (d, J = 5.2 Hz), 3.42-3.33 (m), total 1H], [3.25-3.18 (m), 3.14-3.12 (m), total 1H], [3.11 (s), 2.93 (s), total 3H], 2.46 (d, J = 13.8 Hz, 1H), 2.23 (dd, J = 13.0, 6.3 Hz, 1H), [1.30-1.09 (m), 0.92-0.82 (m), total 4H], [0.72 (t, J = 6.9 Hz), 0.50 (t, J = 6.9 Hz), total 3H]. ^{13}C NMR (150 MHz, $CDCl_3$): δ 147.1 (major), 144.7 (major), 135.7 (major), 128.6 (major), 128.4 (major), 128.2 (major), 127.9 (minor), 127.8 (major), 127.7 (minor), 125.9 (major), 119.3 (minor), 116.2 (major), 109.7 (minor), 108.7 (major), 65.2 (minor), 59.0 (major), 41.2 (minor), 38.6 (major), 38.1 (major), 34.2 (major), 30.7 (minor), 30.5 (major), 27.5 (minor), 26.0 (minor), 21.2 (minor), 19.2 (major), 14.4 (minor), 13.9 (major); HRMS (ESI): $[M+H]^+$ calcd. for $C_{19}H_{23}ClN$: m/z = 300.1514; found, 300.1514.

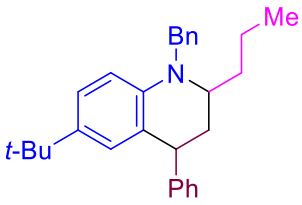
1-benzyl-6-methyl-4-phenyl-2-propyl-1,2,3,4-tetrahydroquinoline (**11ja**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (22 mg, 62%, 6:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.39-7.33 (m, 6H), 7.30-7.28 (m, 3H), 7.25-7.17 (m, 1H), [6.89-6.82 (m), 6.80 (dd, J = 8.3, 1.6 Hz), total 1H], 6.47 (d, J = 8.3 Hz, 1H), 6.42(s, 1H), [4.63 (d, J = 17.1 Hz), 4.62 (d, J = 16.7 Hz), total 1 H], [4.47 (d, J = 16.8 Hz), 4.44 (d, J = 17.1 Hz), total 1 H], 4.10-4.07 (m, 1H), [3.48-3.44 (m), 3.37-3.35 (m), total 1H], 2.37-2.34 (m, 1H), 2.20-2.11 (m, 1H), [2.09 (s), 2.08 (s), total 3H], 1.64-1.59 (m, 1H), 1.36-1.25 (m, 2H), 1.22-1.13 (m, 1H), [0.91 (t, J = 7.4 Hz), 0.76 (t, J = 7.3 Hz), total

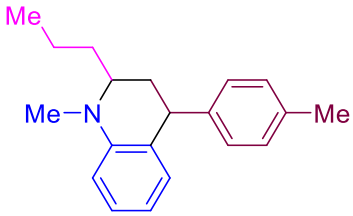
3H]. ^{13}C NMR (150 MHz, $CDCl_3$): δ 145.2 (major), 145.2 (major), 140.6 (major), 131.2 (minor), 130.2 (minor), 129.0 (major), 128.9 (major), 128.7 (minor), 128.6 (major), 128.6 (major), 128.5 (minor), 128.4 (minor), 128.1 (minor), 128.0 (minor), 128.0 (major), 127.7 (minor), 127.5 (major), 126.7 (major), 126.7 (major), 126.5 (major), 125.6 (major), 113.4 (major), 112.3 (minor), 58.7 (major), 57.2 (minor), 55.0 (major), 54.8 (minor), 43.5 (major), 40.3 (minor), 37.6 (major), 36.9 (major), 35.6 (minor), 35.0 (minor), 34.8 (minor), 20.4 (major), 19.3 (minor), 19.0 (major), 14.3 (minor), 14.3 (major); HRMS (ESI): $[M+H]^+$ calcd. for $C_{19}H_{23}BrN$: m/z = 356.2373; found, 356.2373.

1-benzyl-6-(*tert*-butyl)-4-phenyl-2-propyl-1,2,3,4-tetrahydroquinoline (**11ka**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (24 mg, 60%, 9:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.38-7.34 (m, 6H), 7.30-7.24 (m, 4H), 7.01 (dd, *J* = 8.6, 2.1 Hz, 1H), [6.72 (d, *J* = 2.2 Hz), 6.66 (d, *J* = 1.6 Hz), total 1H], [6.48 (d, *J* = 8.5 Hz), 6.44 (d, *J* = 8.7 Hz), total 1 H)], 4.60 (d, *J* = 17.3 Hz, 1H), 4.46 (d, *J* = 17.2 Hz, 1 H), 4.15 (dd, *J* = 10.7, 4.4 Hz, 1H), 3.47-3.43 (m, 1H), 2.39-2.35 (m, 1H), 2.20-2.15 (m, 1H), 1.62-1.57 (m, 1H), 1.34-1.23 (m, 2H), 1.20-1.14 (m, 1H), [1.13 (s), 1.10 (s), total 9H], [0.90 (t, *J* = 7.4 Hz), 0.73 (t, *J* = 7.3 Hz), total 3H]. ^{13}C NMR (150 MHz, $CDCl_3$): δ 145.4 (major), 145.3 (major), 140.9 (major), 140.0 (minor), 139.0 (major), 128.9 (major), 128.7 (minor), 128.6 (major), 128.5 (major), 126.7 (major), 126.6 (major), 126.5 (major), 126.4 (major), 125.9 (major), 124.2 (major), 112.8 (major), 111.5 (minor), 59.0 (major), 57.0 (minor), 55.4 (major), 54.6 (minor), 43.7 (major), 37.5 (major), 37.0 (major), 35.0 (minor), 34.9 (minor), 33.8 (major), 31.5 (minor), 31.5 (major), 19.3 (minor), 19.1 (major), 14.4 (minor), 14.3 (major); HRMS (ESI): $[M+H]^+$ calcd. for $C_{29}H_{36}N$: m/z = 398.2843; found, 398.2842.

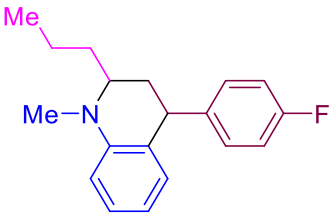
1-methyl-2-propyl-4-(*p*-tolyl)-1,2,3,4-tetrahydroquinoline (**11la**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (13 mg, 47%, 7.3:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.18-7.09 (m, 5H), 6.64 (d, *J* = 8.3 Hz, 1H), [6.58 (d, *J* = 8.2 Hz), 6.56-6.48 (m), total 2H], [4.01 (dd, *J* = 11.4, 5.9 Hz), 3.94 (dd, *J* = 11.5, 4.2 Hz), total 1H], [3.43-3.39 (m), 3.29-3.26 (m), total 1H], [2.98 (s), 2.96 (s), total 3H], [2.37 (s), 2.36 (s), total 3H], 2.27 (dt, *J* = 13.0, 4.7 Hz, 1H), 2.06-2.01 (m, 1H), 1.75-1.69 (m, 1H), 1.45-1.38 (m, 1H), 1.32-1.24 (m, 2H), [0.96 (t, *J* = 7.3 Hz), 0.89 (t, *J*

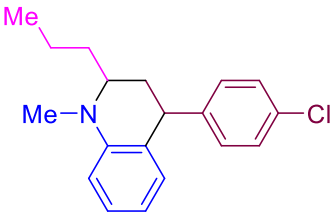
= 7.3 Hz), total 3H]. ^{13}C NMR (150 MHz, $CDCl_3$): δ 147.6 (major), 145.7 (minor), 143.1 (minor), 141.6 (major), 136.0 (major), 135.9 (minor), 129.3 (minor), 129.3 (major), 128.8 (minor), 128.8 (major), 128.6 (major), 127.7 (major), 127.4 (minor), 127.4 (major), 116.0 (major), 115.4 (minor), 112.3 (major), 110.7 (minor), 58.8 (major), 58.7 (minor), 42.9 (major), 39.7 (minor), 38.3 (minor), 37.7 (major), 36.8 (major), 36.4 (major), 34.7 (minor), 33.9 (minor), 21.2 (major), 19.3 (minor), 18.3 (major), 14.5 (major), 14.4 (minor); HRMS (ESI): $[M+H]^+$ calcd. for $C_{20}H_{26}N$: m/z = 280.2060; found, 280.2060.

4-(4-fluorophenyl)-1-methyl-2-propyl-1,2,3,4-tetrahydroquinoline (**11ma**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (20 mg, 71%, 8:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.20-7.16 (m, 2H), 7.13-7.10 (m, 1H), 7.05-6.99 (m, 2H), [6.65 (d, J = 8.2 Hz), 6.59 (dd, J = 12.5, 7.9 Hz), 6.52 (dt, J = 13.1, 7.2 Hz), total 3H], [4.04 (t, J = 8.6 Hz), 3.97 (dd, J = 11.1, 4.2 Hz), total 1H], [3.42-3.38 (m), 3.28-3.25 (m), total 1H], [2.98 (s), 2.96 (s), total 3H], [2.29-2.25 (m), 2.10-2.07 (m), 2.04-1.98 (m), total 2H], 1.73-1.68 (m, 1H), 1.42-1.35 (m, 1H), 1.31-1.22 (m, 2H), [0.96 (t, J = 7.4 Hz), 0.88 (t, J = 7.3 Hz), total 3H]. ^{13}C NMR (150 MHz, $CDCl_3$): δ 161.7 (d, J = 244.2 Hz) (major), 147.5 (major), 145.7 (minor), 141.8 (minor), 140.5 (major), 130.2 (d, J = 7.4 Hz) (major), 129.3 (minor), 128.0 (major), 127.7 (major), 127.7 (minor), 127.6 (major), 125.1 (minor), 118.9 (minor), 116.1 (major), 115.5 (minor), 115.4 (d, J = 20.1 Hz) (major), 112.3 (major), 110.9 (minor), 58.7 (major), 58.5 (minor), 42.5 (major), 39.5 (minor), 38.3 (minor), 37.5 (major), 36.9 (major), 36.3 (major), 34.9 (minor), 34.0 (minor), 19.4 (minor), 18.4 (major), 14.5 (major), 14.4 (minor); HRMS (ESI): $[M+H]^+$ calcd. for $C_{19}H_{23}FN$: m/z = 284.1809; found, 284.1810.

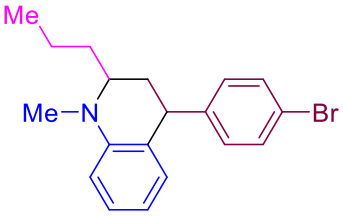
4-(4-chlorophenyl)-1-methyl-2-propyl-1,2,3,4-tetrahydroquinoline (**11na**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (24 mg, 80%, 5.3:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ [7.31 (d, J = 8.3 Hz), 7.28 (d, J = 8.3 Hz), total 2H], 7.17-7.10 (m, 3H), [6.65 (d, J = 8.2 Hz), 6.59 (t, J = 8.8 Hz), 6.52 (dt, J = 14.6, 7.4 Hz), total 3H], [4.03 (t, J = 8.6 Hz), 3.96 (dd, J = 11.0, 4.3 Hz), total 1H], [3.41-3.37 (m), 3.28-3.24 (m), total 1H], [2.97 (s), 2.96 (s), total 3H], [2.28-2.24 (m),

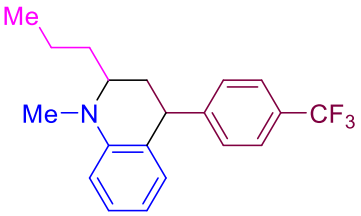
2.09-2.07 (m), 2.03-1.97 (m), total 2H], 1.73-1.64 (m, 1H), 1.41-1.35 (m, 1H), 1.32-1.21 (m, 2H), [0.96 (t, J = 7.3 Hz), 0.88 (t, J = 7.4 Hz), total 3H].^{13}C NMR (150 MHz, $CDCl_3$): δ 147.5 (major), 145.7 (minor), 144.8 (minor), 143.4 (major), 132.2 (major), 132.1 (minor), 130.2 (major), 129.3 (minor), 128.7 (major), 127.8 (major), 127.7 (major), 127.6 (minor), 124.7 (major), 116.1 (major), 115.6 (minor), 112.4 (major), 111.0 (minor), 58.7 (major), 58.5 (minor), 42.7 (major), 39.8 (minor), 38.3 (minor), 37.4 (major), 36.9 (major), 36.3 (major), 34.9 (minor), 33.9 (minor), 19.4 (minor), 18.4 (major), 14.5 (major); HRMS (ESI): $[M+H]^+$ calcd. for $C_{19}H_{23}ClN$: m/z = 300.1514; found, 300.1512.

4-(4-bromophenyl)-1-methyl-2-propyl-1,2,3,4-tetrahydroquinoline (**11oa**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (24 mg, 70%, 5.9:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ [7.47-7.45 (m), 7.44-7.42 (m), total 2H], 7.13-7.08 (m, 3H), [6.65 (d, J = 8.2 Hz), 6.59 (dd, J = 10.2, 8.3 Hz), 6.51 (dt, J = 14.6, 7.1 Hz), total 3H], [4.01 (t, J = 8.6 Hz), 3.95 (dd, J = 11.1, 4.4 Hz), total 1H], [3.41-3.37 (m), 3.28-3.24 (m), total 1H], [2.97 (s), 2.96 (s), total 3H], [2.28-2.24 (m), 2.08-2.06 (m), 2.03-1.97 (m), total 2H], 1.72-1.64 (m, 1H), 1.41-1.35 (m, 1H), 1.32-1.21 (m, 2H), [0.96 (t, J = 7.3 Hz), 0.88 (t, J = 7.4 Hz), total 3H].^{13}C NMR (150 MHz, $CDCl_3$): δ 147.5 (major), 145.3 (minor), 143.9 (major), 131.7 (major), 130.6 (major), 129.3 (minor), 127.8 (major), 127.7 (major), 127.5 (major), 120.2 (major), 120.1 (minor), 116.1 (major), 115.6 (minor), 112.4 (major), 111.0 (minor), 58.6 (major), 58.5 (minor), 42.8 (major), 39.8 (minor), 38.3 (minor), 37.4 (major), 36.9 (major), 36.3 (major), 34.8 (minor), 33.9 (minor), 19.4 (minor), 18.4 (major), 14.5 (major); HRMS (ESI): $[M+H]^+$ calcd. for $C_{19}H_{23}BrN$: m/z = 344.1009; found, 344.1005.

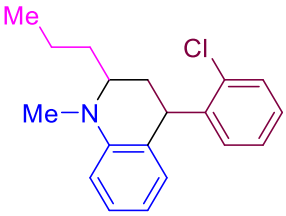
1-methyl-2-propyl-4-(4-(trifluoromethyl)phenyl)-1,2,3,4-tetrahydroquinoline (**11pa**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (22 mg, 66%, 2.6:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ [7.60 (d, J = 8.0 Hz), 7.57 (d, J = 8.0 Hz), total 2H], [7.35 (d, J = 8.0 Hz), 7.33 (d, J = 7.8 Hz), total 2H], [7.26-7.23 (m), 7.14-7.11 (m), total 1H], [6.67 (d, J = 8.2 Hz), 6.59 (dd, J = 15.8, 7.8 Hz), 6.53 (q, J = 7.1 Hz), 6.48 (d, J = 7.3 Hz), total 3H], [4.01 (t, J = 8.6 Hz), 4.07 (dd, J = 10.7, 4.2 Hz), total 1H], [3.41-3.39 (m), 3.29-3.27 (m), total 1H], [2.99 (s), 2.97 (s), total 3H], [2.29 (dt, J = 12.8,

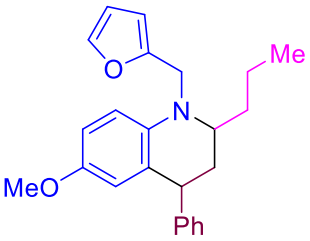
4.6 Hz), 2.29 (dd, *J* = 8.5, 3.9 Hz), 2.09-2.02 (m), total 2H], 1.73-1.66 (m, 1H), 1.41-1.31 (m, 1H), 1.30-1.21 (m, 2H), [0.96 (t, *J* = 7.3 Hz), 0.87 (t, *J* = 7.3 Hz), total 3H].^{13}C NMR (150 MHz, $CDCl_3$): δ 150.6 (minor), 149.2 (major), 147.5 (major), 145.7 (minor), 129.4 (minor), 129.2 (major), 127.9 (minor), 127.9 (major), 127.8 (major), 126.9 (major), 125.5 (major), 125.4 (major), 124.5 (q, *J* = 270.0 Hz) (major), 124.2 (minor), 116.2 (major), 115.7 (minor), 112.5 (major), 111.1 (minor), 58.6 (major), 58.5 (minor), 43.2 (major), 40.3 (minor), 38.3 (minor), 37.5 (minor), 37.2 (major), 36.9 (major), 36.2 (major), 34.9 (minor), 33.8 (minor), 19.4 (minor), 18.4 (major), 14.4 (major); HRMS (ESI): $[M+H]^+$ calcd. for $C_{20}H_{23}F_3N$: m/z = 334.1777; found, 334.1779.

4-(2-chlorophenyl)-1-methyl-2-propyl-1,2,3,4-tetrahydroquinoline (**11qa**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (13 mg, 43%, 14:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.44-7.39 (m, 1H), 7.22-7.11 (m, 4H), [6.67 (d, *J* = 8.2 Hz), 6.65 (d, *J* = 7.3 Hz), total 1H], [6.61 (d, *J* = 8.2 Hz), 6.57-6.47 (m), total 2H], [4.68 (dd, *J* = 11.4, 5.5 Hz), 4.58-4.51 (m), total 1H], [3.43-3.39 (m), 3.28-3.22 (m), total 1H], [2.99 (s), 2.97 (s), total 3H], 2.28-2.24 (m, 1H), 2.18-2.02 (m, 1H), 1.73-1.67 (m, 1H), 1.43-1.36 (m, 1H), 1.28-1.21 (m, 2H), [0.97 (t, *J* = 7.3 Hz), 0.86 (t, *J* = 7.4 Hz), total 3H]. ^{13}C NMR (150 MHz, $CDCl_3$): δ 147.7 (major), 142.4 (major), 134.7 (major), 130.4 (minor), 130.1 (major), 129.6 (major), 129.4 (minor), 129.2 (minor), 127.8 (major), 127.7 (major), 127.6 (major), 127.5 (minor), 127.2 (minor), 127.0 (major), 126.4 (major), 116.2 (major), 115.7 (minor), 112.4 (major), 111.2 (minor), 58.7 (major), 58.5 (minor), 39.3 (minor), 38.3 (minor), 36.9 (major), 36.2 (major), 35.3 (major), 33.5 (minor), 33.1 (minor), 19.3 (minor), 18.4 (major), 14.5 (major); HRMS (ESI): $[M+H]^+$ calcd. for $C_{19}H_{23}ClN$: m/z = 300.1514; found, 300.1520.

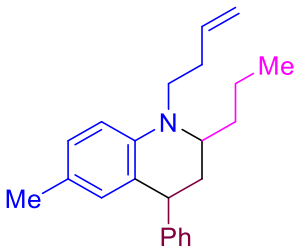
1-(furan-2-ylmethyl)-6-methoxy-4-phenyl-2-propyl-1,2,3,4-tetrahydroquinoline (**11ra**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:20); colorless oil (14 mg, 39%, 12:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.37 (d, *J* = 2.0 Hz, 1H), 7.33 (t, *J* = 7.6 Hz, 2H), 7.26-7.21 (m, 3H), [6.67 (d, *J* = 8.9 Hz), 6.72 (dd, *J* = 8.9, 1.3 Hz), total 1H)], [6.68 (dd, *J* = 8.8, 2.6 Hz), 6.65 (dd, *J* = 8.8, 3.2 Hz), total 1H], [6.32 (dd,

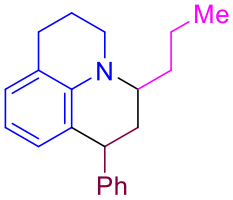
J = 3.2, 1.9 Hz), 6.28 (dd, *J* = 6.7, 2.8 Hz), total 1H], 6.17-6.15 (m, 2H), 4.53 (d, *J* = 16.9 Hz, 1H), 4.36 (d, *J* = 16.8 Hz, 1H), 3.98 (dd, *J* = 11.6, 4.3 Hz, 1H), [3.59 (s), 3.58 (s), total 3H], 3.41-3.36 (m, 1H), 2.27-2.19 (m, 1H), 2.05-1.99 (m, 1H), 1.73-1.67 (m, 1H), 1.45-1.39 (m, 1H), 1.35-1.29 (m, 1H), 1.26-1.20 (m, 1H), [0.97 (t, *J* = 7.3 Hz), 0.84 (t, *J* = 7.4 Hz), total 3H]. ^{13}C NMR (150 MHz, $CDCl_3$): δ 153.9 (major), 151.6 (major), 144.7 (major), 141.6 (major), 141.4 (major), 130.4 (major), 128.9 (major), 128.7 (major), 126.7 (major), 115.3 (major), 114.8 (major), 112.4 (major), 110.4 (major), 107.2 (major), 58.2 (major), 55.7 (major), 48.4 (major), 43.9 (major), 37.8 (major), 36.8 (major), 18.6 (major), 14.4 (major); HRMS (ESI): $[M+H]^+$ calcd. for $C_{24}H_{28}NO_2$: m/z = 362.2115; found, 362.2112.

1-(but-3-en-1-yl)-6-methyl-4-phenyl-2-propyl-1,2,3,4-tetrahydroquinoline (**11sa**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (20 mg, 63%, >20:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.34 (t, *J* = 7.6 Hz, 2H), 7.27-7.23 (m, 3H), 6.92-6.90 (m, 1H), 6.64 (d, *J* = 8.3 Hz, 1H), 6.39 (s, 1H), 5.90-5.83 (m, 1H), 5.12 (dd, *J* = 17.2, 1.3 Hz, 1H), 5.06 (dd, *J* = 10.3, 1.7 Hz, 1H), 3.97 (dd, *J* = 10.8, 4.5 Hz, 1H), 3.55-3.50 (m, 1H), 3.43-3.39 (m, 1H), 3.25-3.20 (m, 1H), 2.43-2.32 (m, 2H), 2.27-2.23 (m, 1H), 2.10 (s, 3H), 2.06-2.01 (m, 1H), 1.68-1.62 (m, 1H), 1.39-1.33 (m, 1H), 1.32-1.19 (m, 2H), 0.86 (t, *J* = 7.3 Hz, 3H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 145.2, 144.0, 136.3, 129.1, 128.9, 128.5, 128.2, 127.9, 126.4, 125.3, 116.2, 113.0, 57.3, 48.6, 43.4, 37.4, 36.5, 31.9, 20.5, 18.5, 14.5; HRMS (ESI): $[M+H]^+$ calcd. for $C_{23}H_{30}N$: m/z = 320.2373; found, 320.2370.

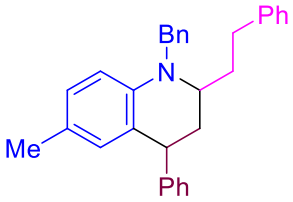
1-phenyl-3-propyl-2,3,6,7-tetrahydro-1*H*,5*H*-pyrido[3,2,1-*ij*]quinoline (**11ta**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (16 mg, 55%, 4.5:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.36-7.31 (m, 2H), 7.25-7.22 (m, 3H), [6.91 (t, *J* = 8.7 Hz), 6.83-6.80 (m), total 1H], [6.69 (t, *J* = 7.5 Hz), 6.43-6.35 (m), total 2H], [4.07 (dd, *J* = 10.5, 5.2 Hz), 4.00 (dd, *J* = 10.6, 6.4 Hz), total 1H], 3.47-3.43 (m, 1H), 3.34-3.30 (m, 1H), [3.20-3.17 (m), 2.97-2.94 (m), total 1H], [2.89-2.87 (m), 2.82-2.77 (m), total 1H], 2.73-2.69 (m, 1H), [2.23-2.13 (m), 2.09-2.03 (m), 2.02-1.99 (m), total 4H], 1.70-1.63 (m, 1H), 1.51-1.45 (m, 1H), 1.33-1.22 (m, 2H), [1.00-0.96 (m), 0.87 (t, *J* = 7.4 Hz), total 3H]. ^{13}C NMR (150 MHz, $CDCl_3$): δ 145.9 (major), 143.6 (major), 129.2 (minor), 129.0

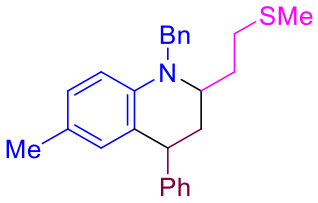
(minor), 128.9 (major), 128.5 (major), 128.3 (minor), 127.4 (minor), 127.3 (major), 127.2 (major), 126.4 (major), 125.5 (major), 123.1 (major), 121.3 (minor), 120.0 (minor), 115.5 (major), 114.6 (minor), 57.8 (major), 57.4 (minor), 48.8 (minor), 46.4 (major), 43.7 (major), 40.2 (minor), 36.9 (major), 35.4 (major), 34.2 (minor), 33.7 (minor), 28.2 (major), 25.3 (minor), 22.9 (major), 22.3 (minor), 19.2 (minor), 17.9 (major), 14.6 (major), 14.5 (minor); HRMS (ESI): $[M+H]^+$ calcd. for $C_{21}H_{26}N$: m/z = 292.2060; found, 292.2060.

1-benzyl-6-methyl-2-phenethyl-4-phenyl-1,2,3,4-tetrahydroquinoline (**11ab**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (19 mg, 46%, 8:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.41-7.36 (m, 2H), 7.35-7.30 (m, 7H), 7.28-7.23 (m, 1H), 7.21-7.18 (m, 2H), 7.14-7.12 (m, 1H), [7.02-6.93 (m), 6.90 (d, 7.2 Hz), total 2H], 6.83 (dd, *J* = 8.2, 1.7 Hz, 1H), 6.51 (d, *J* = 8.3 Hz, 1H), 6.47-6.44 (m, 1H), 4.62-4.56 (m, 1H), 4.45-4.41 (m, 1H), 4.13 (dd, *J* = 10.0, 4.6 Hz, 1H), [3.53-3.45 (m), 3.39-3.35 (m), total 1H], [2.74-2.69 (m), 2.60-2.51 (m), total 1H], 2.45-2.39 (m, 2H), [2.32-2.28 (m), 2.26-2.23 (m), total 1H], [2.11 (s), 2.09 (s), total 3H], 1.95-1.89 (m, 1H), 1.72-1.65 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 145.2 (major), 145.0 (major), 142.1 (major), 140.3 (major), 129.2 (major), 129.0 (major), 128.7 (major), 128.6 (major), 128.5 (major), 128.4 (major), 128.3 (major), 128.1 (major), 127.2 (major), 126.9 (major), 126.8 (major), 126.6 (major), 125.8 (major), 113.5 (major), 58.3 (major), 55.0 (major), 43.2 (major), 40.4 (minor), 37.0 (major), 36.1 (major), 34.1 (minor), 32.3 (minor), 31.9 (major), 20.4 (major); HRMS (ESI): $[M+H]^+$ calcd. for $C_{31}H_{32}N$: m/z = 418.2530; found, 418.2527.

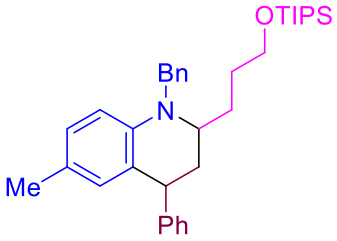
1-benzyl-6-methyl-2-(2-(methylthio)ethyl)-4-phenyl-1,2,3,4-tetrahydroquinoline (**11bb**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (19 mg, 49%, 5.8:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.38-7.32 (m, 6H), 7.29-7.23 (m, 4H), 6.83-6.80 (m, 1H), [6.51 (d, *J* = 8.3 Hz), 6.47 (d, *J* = 8.5 Hz), 6.45 (s), total 2H], [4.63 (d, 17.1 Hz), 4.61 (d, 16.6 Hz), total 1H], [4.49 (d, 16.7 Hz), 4.45 (d, 17.0 Hz), total 1H], 4.15-4.07 (m, 1H), [3.61-3.56 (m), 3.52-3.48 (m), total 1H], [2.57-2.53 (m), 2.48-2.45 (m), 2.39-2.30 (m), total 3H], 2.19-2.11 (m, 1H), [2.10 (s), 2.08 (s), total 3H], 1.89 (s, 3H), 1.91-1.85 (m, 1H), 1.68-1.62 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 145.0 (major), 144.8 (major), 140.2 (major), 130.3 (minor), 129.2 (major), 128.9 (major), 128.7 (major), 128.7 (major), 128.1 (major), 127.0 (major), 127.0 (minor), 126.9 (major), 126.8 (major), 126.6 (major), 126.0

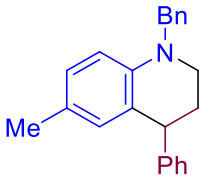
(major), 113.6 (major), 113.0 (minor), 57.8 (major), 56.3 (minor), 55.2 (major), 43.1 (major), 40.4 (minor), 37.0 (major), 34.9 (minor), 33.9 (major), 32.0 (minor), 31.3 (minor), 31.0 (minor), 30.4 (major), 21.2 (minor), 20.4 (major), 15.8 (minor), 15.5 (major); HRMS (ESI): $[M+H]^+$ calcd. for $C_{26}H_{30}NS$: m/z = 388.2094; found, 388.2095.

1-benzyl-6-methyl-4-phenyl-2-(3-((triisopropylsilyl)oxy)propyl)-1,2,3,4-tetrahydroquinoline (**11cb**)



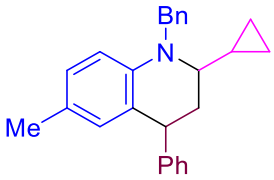
The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (25 mg, 47%, >20:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.36 (t, J = 7.6 Hz, 2H), 7.34-7.31 (m, 4H), 7.30-7.27 (m, 3H), 7.24-7.21 (m, 1H), 6.81-6.76 (m, 1H), 6.45 (d, J = 8.3 Hz, 1H), 6.39 (s, 1H), 4.62 (d, J = 17.2 Hz, 1H), 4.43 (d, J = 17.2 Hz, 1H), 4.07 (dd, J = 11.2, 4.1 Hz, 1H), 3.53-3.44 (m, 3H), 4.07 (dt, J = 13.0, 4.3 Hz, 1H), 2.19-2.11 (m, 1H), 2.07 (s, 3H), 1.78-1.74 (m, 1H), 1.50- 1.45 (m, 1H), 1.40-1.33 (m, 2H), 0.98-0.95 (m, 21H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 145.2, 145.0, 140.5, 128.9, 128.9, 128.6, 128.5, 128.0, 127.5, 126.7, 126.6, 126.6, 125.6, 113.3, 57.8, 56.3, 55.2, 43.1, 40.4, 37.0, 63.3, 58.9, 55.0, 43.6, 37.7, 31.1, 29.1, 20.4, 18.1, 12.0; HRMS (ESI): $[M+H]^+$ calcd. for $C_{35}H_{50}NOSi$: m/z = 528.3656; found, 528.3655.

1-benzyl-6-methyl-4-phenyl-1,2,3,4-tetrahydroquinoline (**11db**)



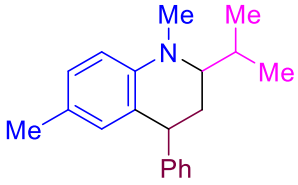
The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (12 mg, 38%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.34-7.29 (m, 6H), 7.25-7.20 (m, 2H), 7.14 (d, J = 7.4 Hz, 2H), 6.85 (dd, J = 8.3, 1.8 Hz, 1H), 6.64 (d, J = 1.4 Hz, 1H), 6.53 (d, J = 8.3 Hz, 1H), 4.51 (s, 2H), 4.17 (t, J = 5.5 Hz, 1H), 3.36-3.15 (m, 2H), 2.32-2.26 (m, 1H), 2.13 (s, 3H), 2.13-2.08 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 146.5, 143.7, 139.2, 130.8, 128.8, 128.7, 128.4, 128.3, 126.9, 126.8, 126.2, 125.1, 124.1, 111.4, 55.6, 46.6, 43.5, 31.0, 20.3; HRMS (ESI): $[M+H]^+$ calcd. for $C_{23}H_{24}N$: m/z = 314.1903; found, 314.1904.

1-benzyl-2-cyclopropyl-6-methyl-4-phenyl-1,2,3,4-tetrahydroquinoline (**11eb**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (19 mg, 54%, 2:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.38-7.31 (m, 6H), 7.29 (d, *J* = 7.2 Hz, 2H), 7.25-7.21 (m, 2H), [6.82 (dd, *J* = 8.5, 2.0 Hz), 6.79 (dd, *J* = 8.3, 1.8 Hz), total 1H], [6.58 (d, *J* = 2.8 Hz), 6.48-6.45 (m), 6.42 (s), total 3H], [4.92 (d, *J* = 17.4 Hz), 4.71 (d, *J* = 2.5 Hz), 4.65 (d, *J* = 17.4 Hz), total 2H], [4.24 (dd, *J* = 8.8, 5.3 Hz), 4.11 (dd, *J* = 10.8, 5.4 Hz), total 1H], [2.70 (td, *J* = 9.3, 4.3 Hz), 2.53-2.48 (m), total 1H], [2.40-2.34 (m), 2.29-2.23 (m), total 2H], [2.11 (s), 2.08 (s), total 3H], [1.04-0.98 (m), 0.72-0.67 (m), total 1H], [0.56-0.52 (m), 0.48-0.41 (m), 0.37-0.33 (m), total 2H], 0.31-0.23 (m, 1H), [0.05-0.02 (m), -0.04--0.08 (m), total 1H]. ^{13}C NMR (150 MHz, $CDCl_3$): δ 146.3 (minor), 145.4 (major), 144.7 (major), 143.5 (minor), 140.9 (major), 140.2 (minor), 130.2 (minor), 129.4 (major), 128.9 (major), 128.9 (minor), 128.6 (major), 128.6 (minor), 128.5 (minor), 128.5 (major), 128.2 (minor), 128.1 (major), 126.7(minor), 126.6 (major), 126.5 (major), 126.4 (major), 126.3 (minor), 125.4 (major), 125.0 (major), 124.9 (minor), 112.5 (major), 112.0 (minor), 63.7 (major), 61.2 (minor), 53.6 (minor), 52.8 (major), 44.3 (major), 41.4 (minor), 39.7 (major), 37.3 (minor), 20.4 (major), 20.3 (minor), 16.8 (major), 15.4 (minor), 7.6 (major), 6.9 (minor), 1.7 (major), 0.8 (minor); HRMS (ESI): $[M+H]^+$ calcd. for $C_{26}H_{28}N$: m/z = 354.2216; found, 354.2218.

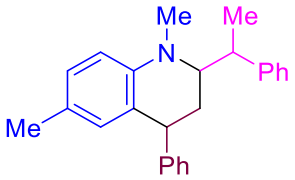
2-isopropyl-1,6-dimethyl-4-phenyl-1,2,3,4-tetrahydroquinoline (**11fb**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (16 mg, 57%, 5.7:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ [7.42-7.39 (m), 7.33-7.29 (m), 7.26-7.21 (m), 7.20-7.18 (m), total 5H], [6.96 (dd, *J* = 8.3, 1.9 Hz), 6.92 (dd, *J* = 8.4, 1.5 Hz), total 1H], [6.57 (d, *J* = 8.2 Hz), 6.29 (s), total 2H], [4.05 (dd, *J* = 10.2, 5.3 Hz), 3.88 (dd, *J* = 12.5, 3.6 Hz), total 1H], [3.38 (dt, *J* = 10.2, 5.2 Hz), 2.88-2.82 (m), total 1H], [3.05 (s), 2.98 (s), total 3H], [2.31-2.26 (m), 2.14 (s), 2.14-2.12 (m), 2.11(s), 2009-2.00 (m), 1.96 (td, *J* = 12.7. 11.3 Hz), total 6H], [0.94 (d, *J* = 6.9 Hz), 0.92 (d, *J* = 6.7 Hz), 0.77 (d, *J* = 6.8 Hz), total 6H]. ^{13}C NMR (150 MHz, $CDCl_3$): δ 146.4 (minor), 146.0 (major), 144.3 (major), 144.2 (minor), 130.0 (minor), 129.7 (major), 129.0 (major), 128.7 (major), 128.7 (minor), 128.5 (minor), 128.1 (minor), 127.8 (major), 127.5 (major), 126.6 (major), 126.2 (minor), 125.4 (minor), 124.9 (major), 124.4 (minor), 112.3 (major), 111.8 (minor), 63.8 (minor), 63.7 (major), 43.4 (major), 41.4 (minor), 40.4 (minor), 37.0 (major), 32.5 (minor), 32.1 (major), 30.9 (minor), 29.8 (major), 20.7 (minor), 20.5 (major), 20.4 (minor), 19.6 (major), 18.2 (minor),

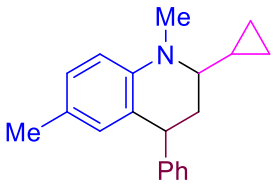
14.9 (major); HRMS (ESI): $[M+H]^+$ calcd. for $C_{20}H_{26}N$: m/z = 280.2060; found, 280.2060.

1,6-dimethyl-4-phenyl-2-(1-phenylethyl)-1,2,3,4-tetrahydroquinoline (**11gb**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (18 mg, 53%, 2.2:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.35 (q, J = 7.9 Hz, 2H), 7.31-7.27 (m, 2H), 7.25-7.22 (m, 3H), 7.21-7.18 (m, 1H), 7.16-7.15 (m, 1H), 6.96-6.92 (m, 2H), [6.65 (d, J = 8.2 Hz), 6.61 (d, J = 8.1 Hz), total 1H], [6.38 (s), 6.29 (s), total 1H], [3.99 (dd, J = 9.5, 4.9 Hz), 3.78 (dd, J = 11.8, 3.6 Hz), total 1H], [3.65 (dt, J = 10.5, 5.2 Hz), 3.53 (dt, J = 8.9, 5.4 Hz), total 1H], [3.50-3.43 (m), 3.22-3.19 (m), total 1H], [3.17 (s), 3.07 (s), total 3H], [2.20-2.11 (m), 2.06-2.02 (m), total 1H], [2.11 (s), 2.11 (s), total 3H], [1.86-1.81 (m), 1.77-1.73 (m), total 1H], [1.31 (d, J = 7.4 Hz), 1.15 (d, J = 7.1 Hz), total 3H]. ^{13}C NMR (150 MHz, $CDCl_3$): δ 145.7 (minor), 145.6 (major), 145.4 (minor), 144.0 (major), 143.8 (major), 143.6 (minor), 129.7 (minor), 129.1 (minor), 129.0 (major), 128.9 (minor), 128.6 (major), 128.6 (major), 128.4 (major), 128.2 (minor), 128.0 (minor), 127.9 (minor), 127.9 (major), 127.8 (major), 127.7 (major), 127.7 (minor), 126.6 (major), 126.4 (minor), 126.3 (major), 126.1 (minor), 125.6 (minor), 125.3 (major), 114.4 (minor), 112.6 (major), 65.7 (minor), 64.9 (major), 43.0 (major), 42.8 (minor), 41.9 (minor), 41.2 (minor), 41.0 (major), 37.8 (major), 33.1 (minor), 32.1 (major), 20.6 (major), 20.5 (minor), 18.4 (minor), 11.5 (major); HRMS (ESI): $[M+H]^+$ calcd. for $C_{25}H_{28}N$: m/z = 342.2216; found, 342.2218.

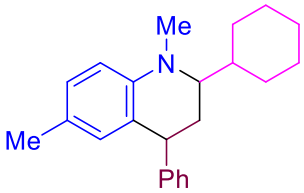
2-cyclopropyl-1,6-dimethyl-4-phenyl-1,2,3,4-tetrahydroquinoline (**11hb**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (17 mg, 61%, 3:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.36-7.30 (m, 2H), 7.27-7.19 (m, 3H), 6.95-6.92 (m, 1H), [6.66 (d, J = 8.3 Hz), 6.60 (d, J = 8.6 Hz), total 1 H], [6.53 (d, J = 2.3 Hz), 6.40 (d, J = 2.3 Hz), total 1 H], [4.19 (dd, J = 9.57, 6.23 Hz), 4.00 (dd, J = 12.02, 4.97 Hz), total 1 H], [3.07 (s), 3.03 (s), total 3 H], [2.43-2.37 (m), 2.38-2.34 (m), total 2 H],2.21-2.15 (m, 1H), [2.12 (s), 2.10 (s), total 3 H], [0.98-0.88 (m), 0.77-0.64 (m), total 2 H], 0.46-0.38 (m, 2H), [0.10-0.06 (m), -0.01--0.04 (m), total 1 H]; ^{13}C NMR (150 MHz, $CDCl_3$): δ 146.6 (minor), 145.5 (major), 145.3 (major), 143.8 (minor), 130.2 (minor), 129.2 (major), 128.9 (minor), 128.9 (major), 128.6 (major), 128.5 (minor), 128.1 (minor), 127.9 (major), 127.8 (major), 126.5 (major), 126.3 (minor), 125.6 (major), 125.5 (minor), 125.0 (minor), 112.3 (major), 111.4 (minor), 64.3 (major), 63.0 (minor), 44.1 (major), 41.3 (minor), 39.9

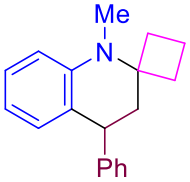
(major), 38.0 (minor), 37.5 (minor), 36.0 (major), 20.4 (major), 20.4 (minor), 16.5 (major), 13.8 (minor), 7.9 (major), 6.7 (minor), 1.4 (major), 0.3 (minor); HRMS (ESI): $[M+H]^+$ calcd. for $C_{20}H_{24}N$: m/z = 278.1903; found, 278.1903.

2-cyclohexyl-1,6-dimethyl-4-phenyl-1,2,3,4-tetrahydroquinoline (**11ib**)



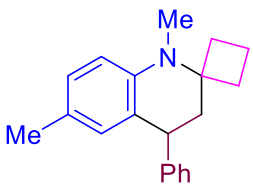
The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (15 mg, 47%, >20:1 d.r.); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.39 (t, J = 7.5 Hz, 2H), 7.32-7.26 (m, 3H), 6.92 (d, J = 8.4 Hz, 1H), 6.55 (d, J = 8.2 Hz, 1H), 6.29 (s, 1H), 3.86 (dd, J = 12.17, 3.60 Hz, 1H), 3.35 (p, J = 5.17 Hz, 1H), 2.98 (s, 3H)， 2.15-2.12 (m, 1H), 2.10 (s, 3H), 2.05-1.99 (m, 1H), 1.87-1.84 (m, 1H), 1.78-1,67 (m, 4H), 1.55 (d, J = 12.0 Hz, 1H), 1.46 (d, J = 12.0 Hz, 1H), 1.28-1.24 (m, 1H), 1.19-1.15 (m, 1H), 1.14-1.08 (m, 2H), 1.00-0.93 (m, 1H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 145.9, 144.3, 129.6, 129.0, 128.6, 127.8, 127.5, 126.6, 124.9, 112.2, 63.3, 43.4, 41.0, 37.2, 33.6, 30.5, 27.2, 27.0, 26.5, 25.8, 20.5; HRMS (ESI): $[M+H]^+$ calcd. for $C_{23}H_{30}N$: m/z = 320.2373; found, 320.2374.

1'-methyl-4'-phenyl-3',4'-dihydro-1'*H*-spiro[cyclobutane-1,2'-quinoline] (**11jb**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (12 mg, 46%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.35 (t, J = 7.2 Hz, 2H), 7.28-7.25 (m, 3H), 7.09 (t, J = 7.2 Hz, 1H), 6.63 (d, J = 8.2 Hz, 1H), 6.51-6.48 (m, 2H), 3.90 (d, J = 11.4 Hz, 1H), 3.05 (s, 3H), 2.67 (q, J = 10.3 Hz, 1H), 2.50-2.36 (m, 2H), 2.14 (t, J = 12.6 Hz, 1H), 1.90 (t, J = 10.1 Hz, 1H), 1.82 (t, J = 10.2 Hz, 1H), 1.76-1.67 (m, 2H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 146.0, 144.5, 129.0, 128.7, 127.8, 127.8, 127.5, 126.6, 115.8, 111.3, 59.8, 42.8, 41.1, 33.4, 33.4, 32.8, 12.9; HRMS (ESI): $[M+H]^+$ calcd. for $C_{19}H_{22}N$: m/z = 264.1747; found, 264.1745.

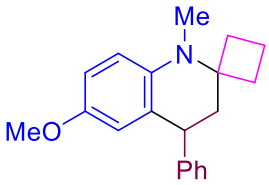
1',6'-dimethyl-4'-phenyl-3',4'-dihydro-1'*H*-spiro[cyclobutane-1,2'-quinoline] (**11kb**)



The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane

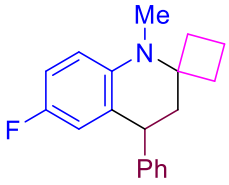
(1:50); colorless oil (15 mg, 54%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.37 (t, J = 7.6 Hz, 2H), 7.31-7.24 (m, 3H), 6.92 (d, J = 6.2 Hz, 1H), 6.58 (d, J = 8.3 Hz, 1H), 6.38 (s, 1H), 3.93 (dd, J = 12.2, 3.9 Hz, 1H), 3.04 (s, 3H), 2.66 (q, J = 11.7 Hz, 1H), 2.45 (d, J = 10.3 Hz, 1H), 2.40 (dd, J = 13.0 Hz, 1H), 2.15 (td, J = 12.7, 1.7 Hz, 1H), 2.10 (s, 3H), 1.93-1.88 (m, 1H), 1.84-1.79 (m, 1H), 1.76-1.68 (m, 2H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 144.8, 144.0, 129.0, 128.7, 128.6, 127.9, 127.8, 126.6, 125.1, 111.8, 59.8, 43.0, 41.2, 33.3, 33.0, 32.9, 20.4, 12.9; HRMS (ESI): $[M+H]^+$ calcd. for $C_{20}H_{24}N$: m/z = 278.1903; found, 278.1899.

6'-methoxy-1'-methyl-4'-phenyl-3',4'-dihydro-1'*H*-spiro[cyclobutane-1,2'-quinoline] (**11lb**)



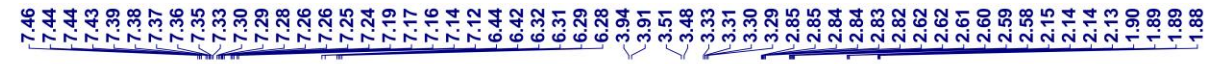
The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (14 mg, 48%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.36-7.33 (m, 2H), 7.27-7.24 (m, 3H), 6.69 (dd, J = 8.9, 2.7 Hz, 1H), 6.62 (d, J = 8.9 Hz, 1H), 6.20-6.17 (m, 1H), 3.92 (dd, J = 12.3, 4.1 Hz, 1H), 3.59 (s, 3H), 2.99 (s, 3H), 2.63 (q, J = 9.8 Hz, 1H), 2.45-2.36 (m, 2H), 2.12 (td, J = 12.6, 1.6 Hz, 1H), 1.92-1.87 (m, 1H), 1.83-1.78 (m, 1H), 1.75-1.67 (m, 2H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 151.1, 144.5, 140.8, 129.5, 129.0, 128.7, 126.7, 114.9, 113.0, 112.2, 59.8, 55.8, 42.5, 41.4, 33.6, 33.2, 32.7, 12.9; HRMS (ESI): $[M+H]^+$ calcd. for $C_{20}H_{24}NO$: m/z = 294.1853; found, 294.1851.

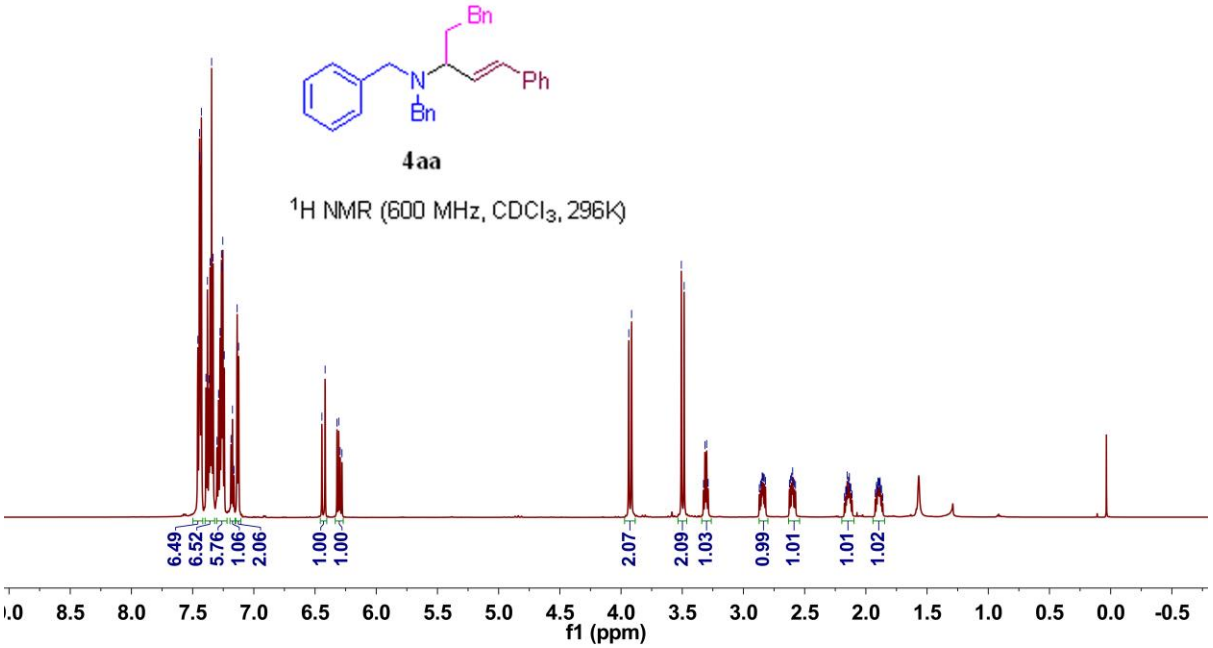
6'-fluoro-1'-methyl-4'-phenyl-3',4'-dihydro-1'*H*-spiro[cyclobutane-1,2'-quinoline] (**11mb**)

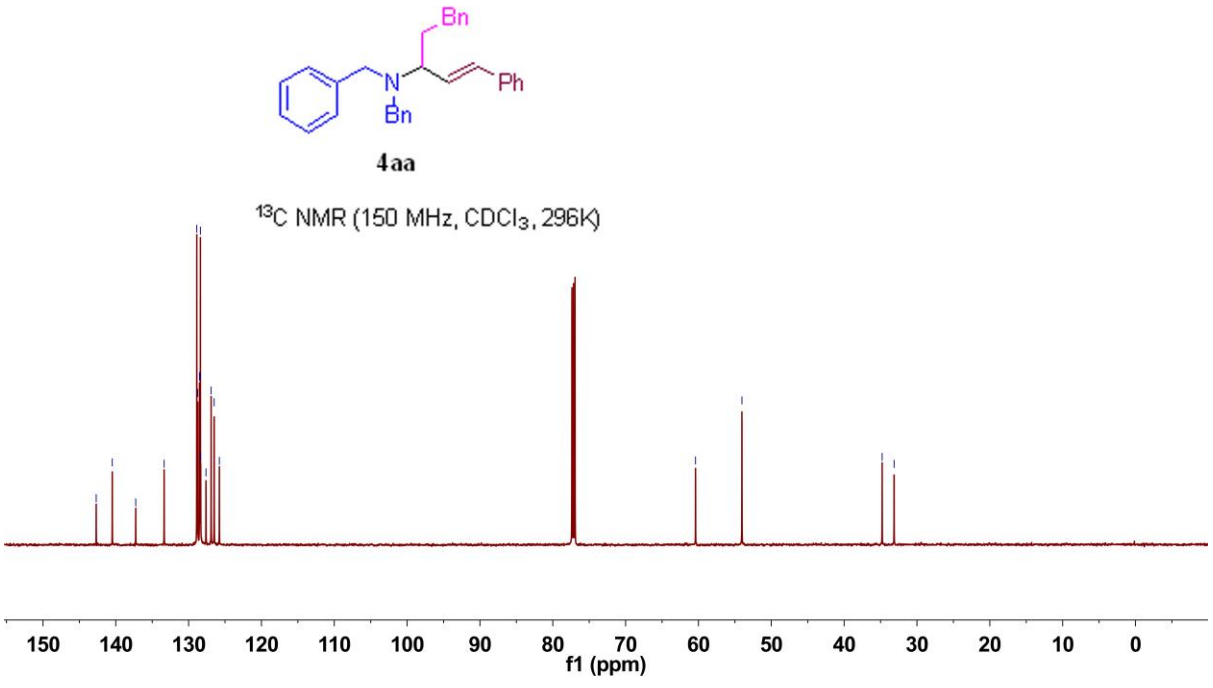


The titled compound was synthesized following the general procedure E. EtOAc/*n*-hexane (1:50); colorless oil (15 mg, 53%); ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.37-7.34 (m, 2H), 7.29-7.27 (m, 1H), 7.25-7.23 (m, 2H), 6.79-6.76 (td, J = 8.5, 2.8 Hz, 1H), 6.52 (dd, J = 9.0, 4.7 Hz, 1H), 6.27-6.24 (m, 1H), 3.86 (dd, J = 12.4, 3.7 Hz, 1H), 3.01 (s, 3H), 2.65 (q, J = 11.9 Hz, 1H), 2.45-2.39 (m, 2H), 2.10 (td, J = 12.7, 1.8 Hz, 1H), 1.91-1.86 (m, 1H), 1.84-1.79 (m, 1H), 1.75-1.66 (m, 2H). ^{13}C NMR (150 MHz, $CDCl_3$): δ 155.0 (d, J = 234.0 Hz), 143.9, 142.5, 129.6 (d, J = 5.8 Hz), 128.9, 128.9, 126.9, 114.6 (d, J = 22.9 Hz), 113.4 (d, J = 21.8 Hz), 112.1 (d, J = 7.2 Hz), 59.8, 42.5, 41.2, 33.3, 33.1, 12.9; HRMS (ESI): $[M+H]^+$ calcd. for $C_{19}H_{21}FN$: m/z = 282.1653; found, 282.1653.

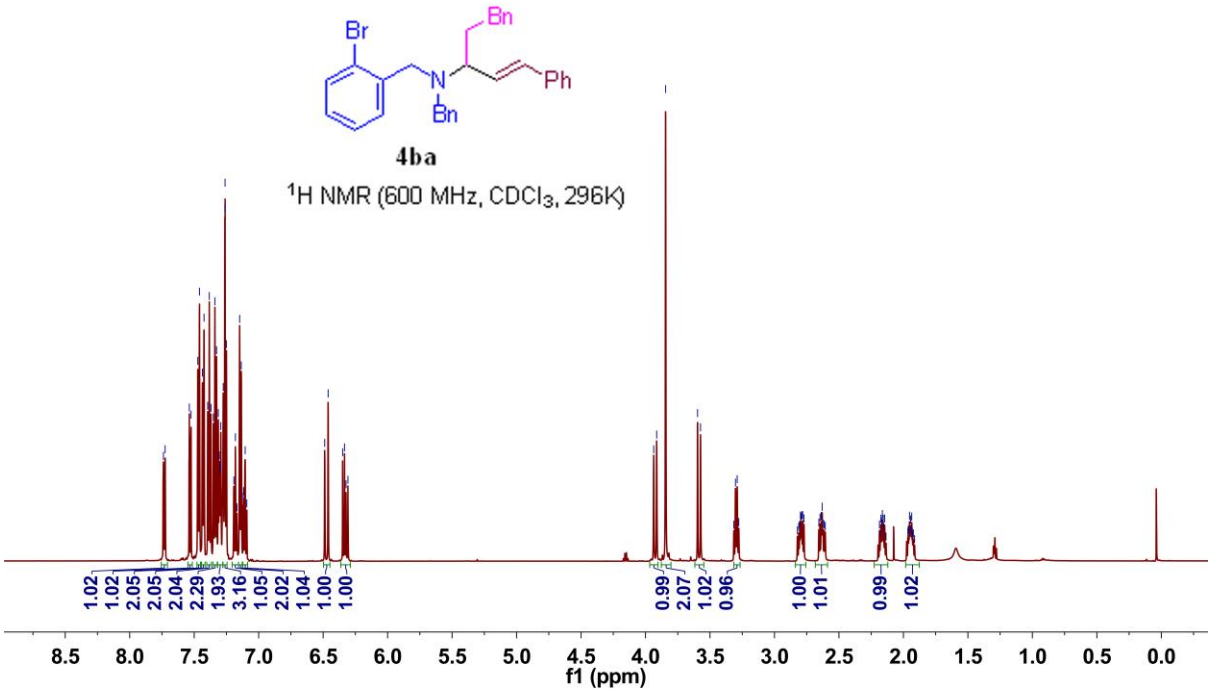
12. Copies of Product 1H NMR and 13C NMR

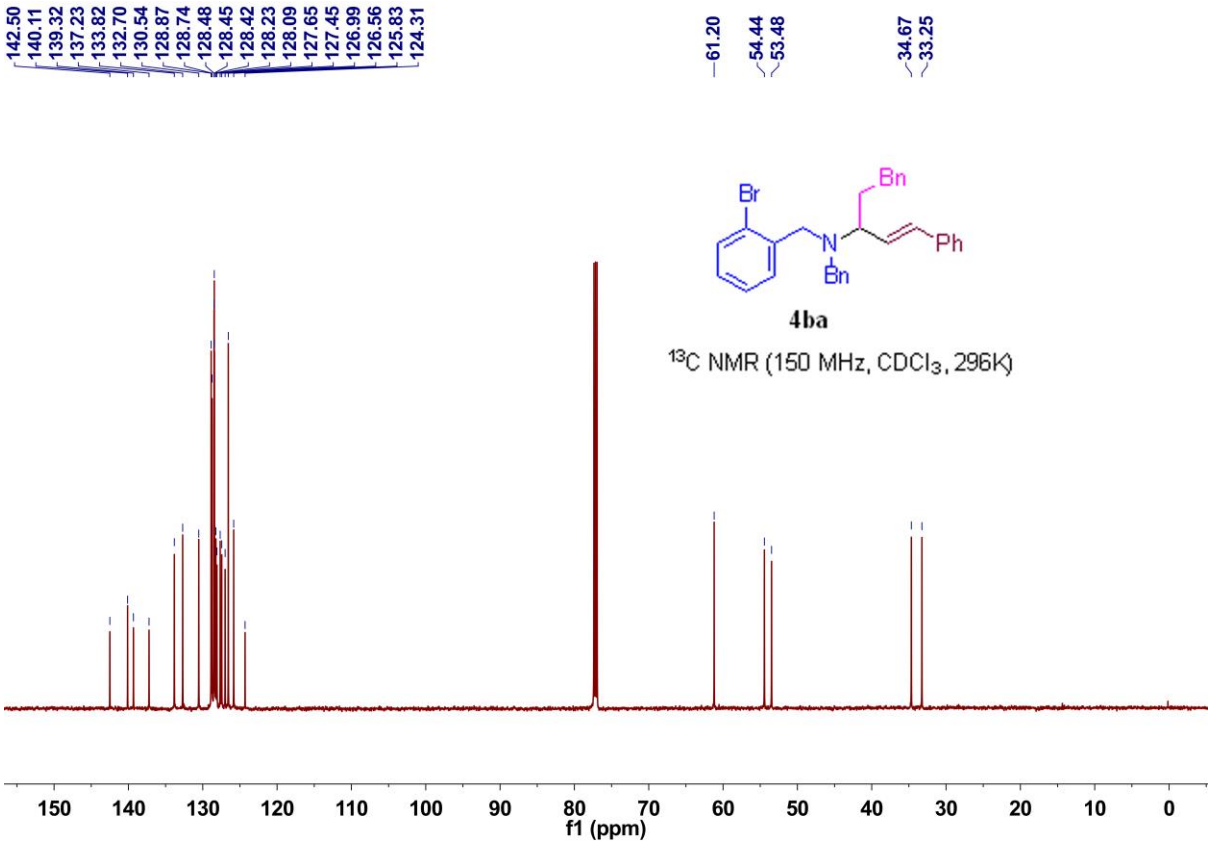


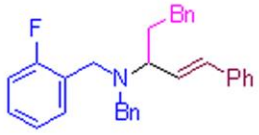





7.74
7.73
7.54
7.52
7.47
7.46
7.44
7.42
7.40
7.38
7.37
7.35
7.34
7.33
7.31
7.31
7.30
7.30
7.29
7.27
7.26
7.26
7.25
7.19
7.18
7.17
7.15
7.13
7.12
7.12
7.10
7.09
6.49
6.46
6.35
6.33
6.32
6.31
3.94
3.91
3.84
3.60
3.57
3.30
3.29
2.80
2.80
2.79
2.78
2.77
2.65
2.64
2.63
2.16
1.95
1.94

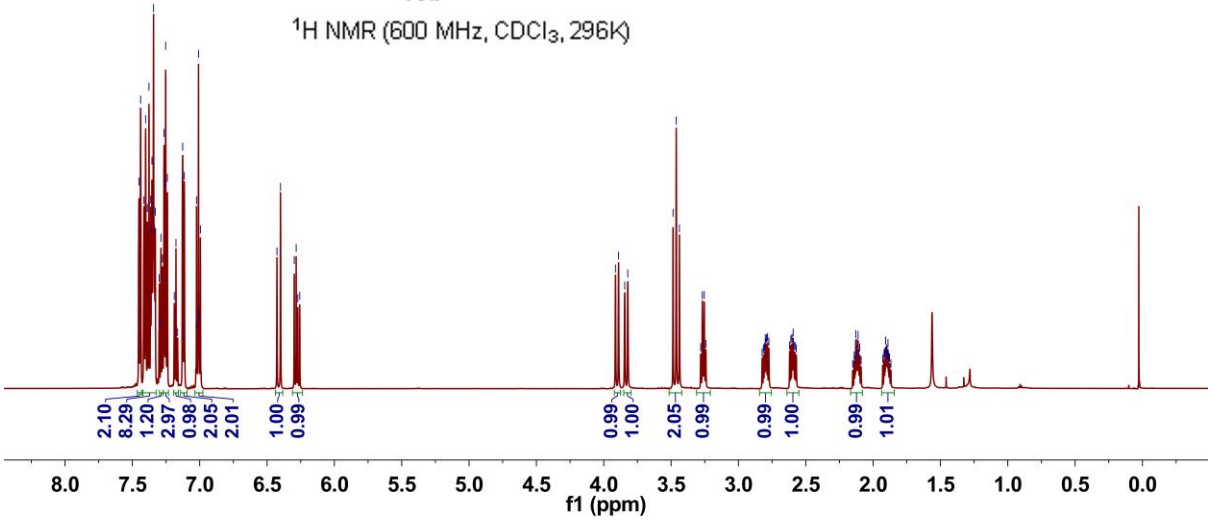

Br
Bn
N
Bn
Ph
4ba
1H NMR (600 MHz, CDCl3, 296K)
1.02
1.02
2.05
2.05
2.04
2.29
1.93
3.16
1.05
2.02
1.04
1.00
1.00
0.99
2.07
1.02
0.96
1.00
1.01
0.99
1.02
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


142.50
140.11
139.32
137.23
133.82
132.70
130.54
128.87
128.74
128.48
128.45
128.42
128.23
128.09
127.65
127.45
126.99
126.56
125.83
124.31
61.20
54.44
53.48
34.67
33.25
Br
Bn
N
Bn
Ph
4ba
13C NMR (150 MHz, CDCl3, 296K)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)



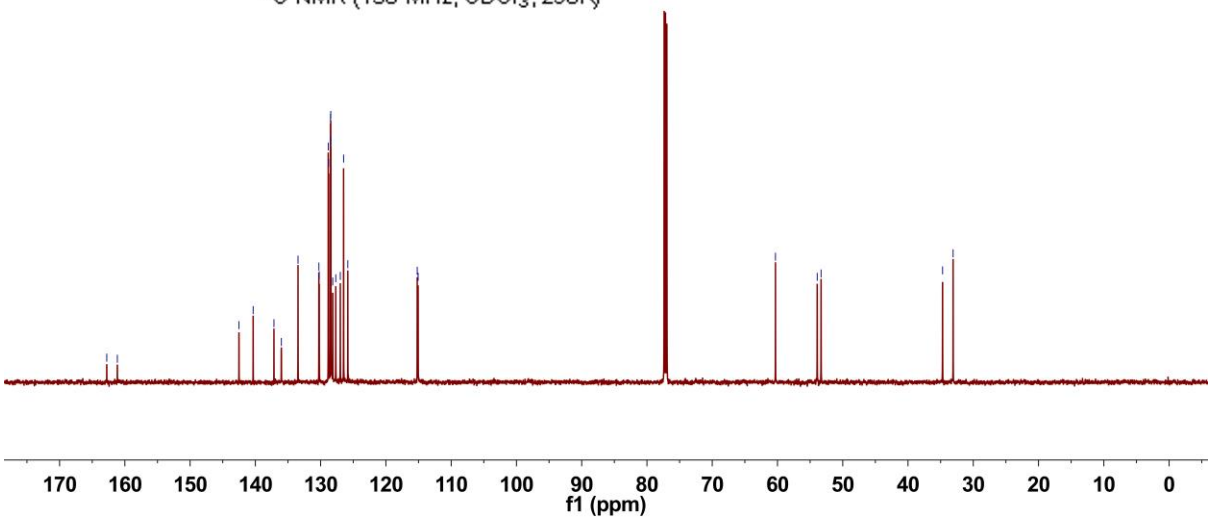
4ca

^{1}H NMR (600 MHz, $CDCl_3$, 296K)



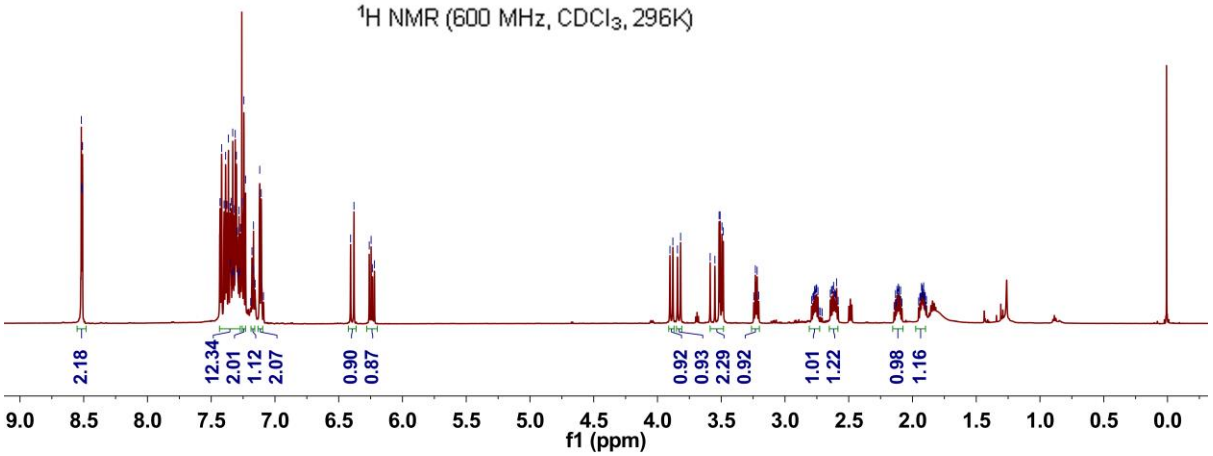
4ca

^{13}C NMR (150 MHz, $CDCl_3$, 296K)



4da

^{1}H NMR (600 MHz, $CDCl_3$, 296K)

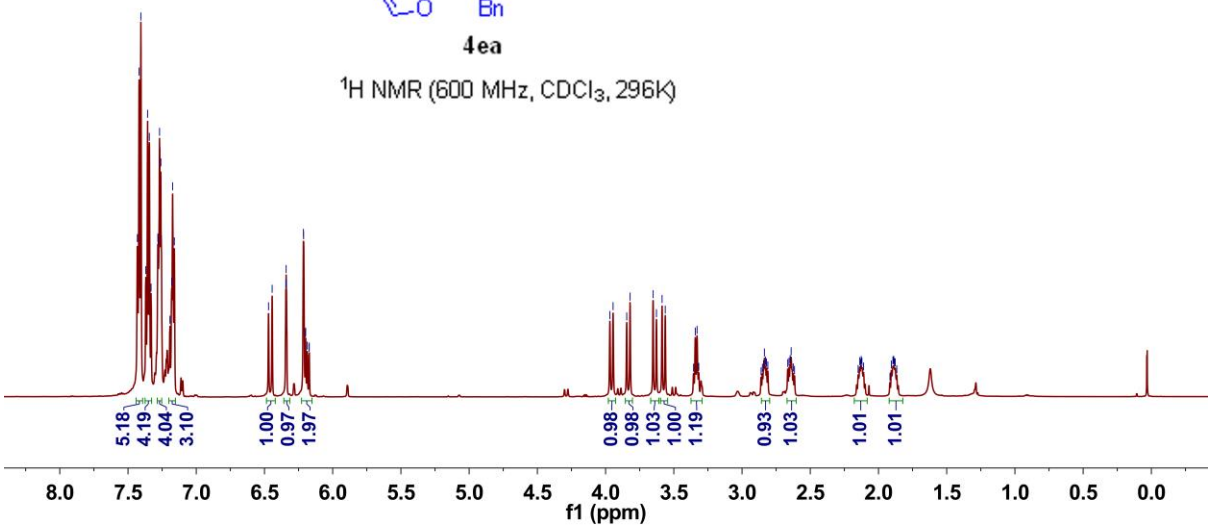


4da

^{13}C NMR (150 MHz, $CDCl_3$, 296K)

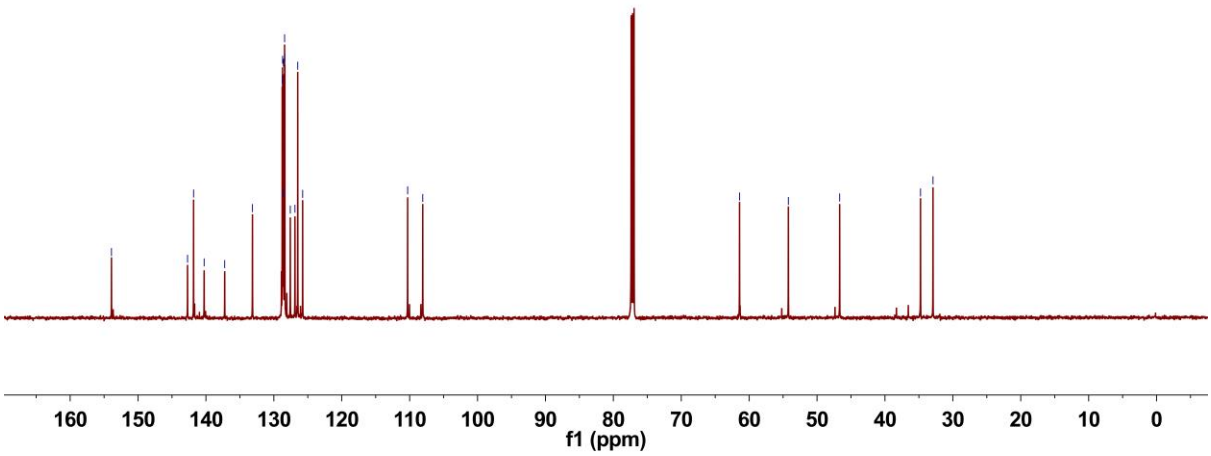
4ea

^{1}H NMR (600 MHz, $CDCl_3$, 296K)



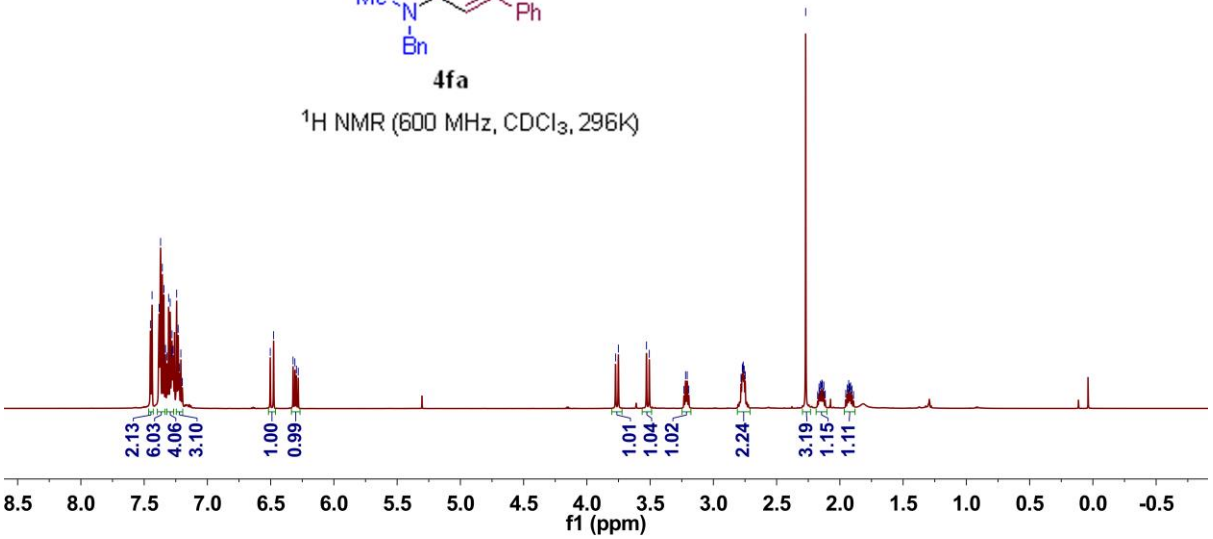
4ea

^{13}C NMR (150 MHz, $CDCl_3$, 296K)



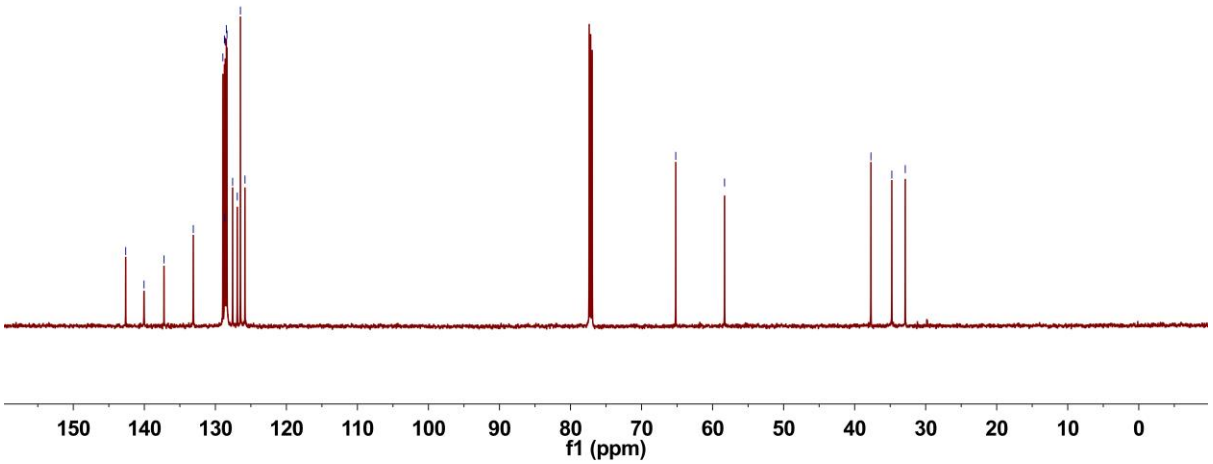
4fa

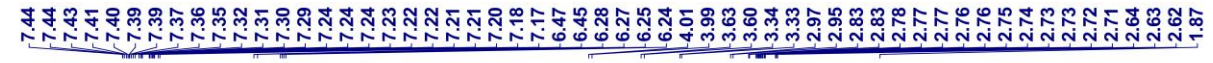
^{1}H NMR (600 MHz, $CDCl_3$, 296K)

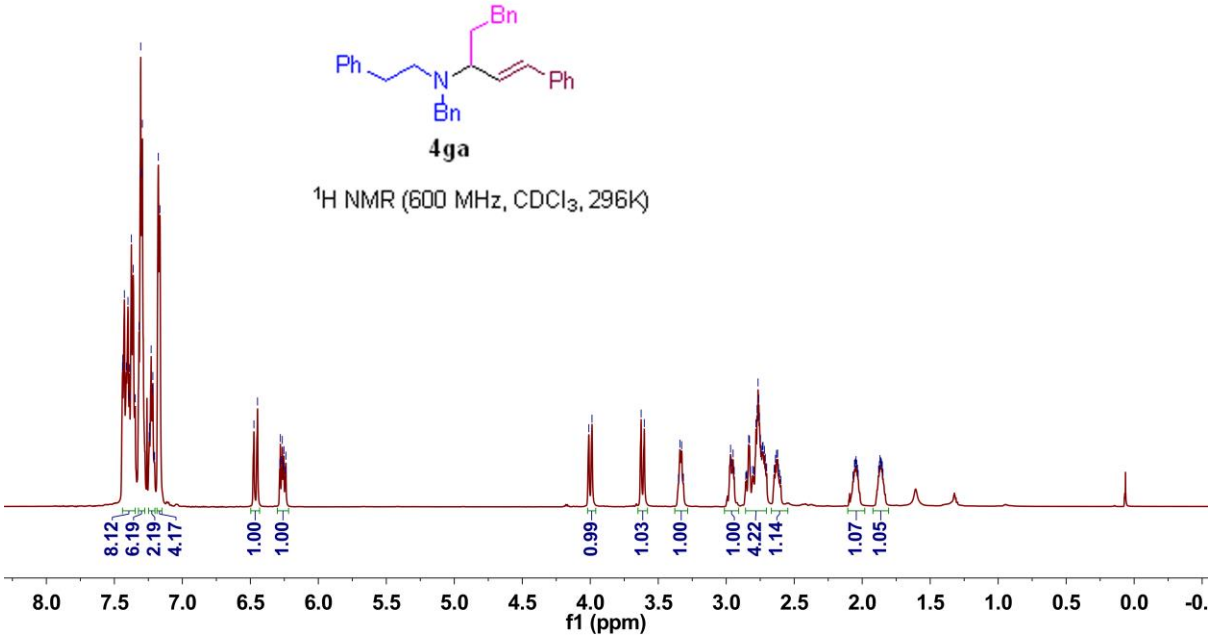


4fa

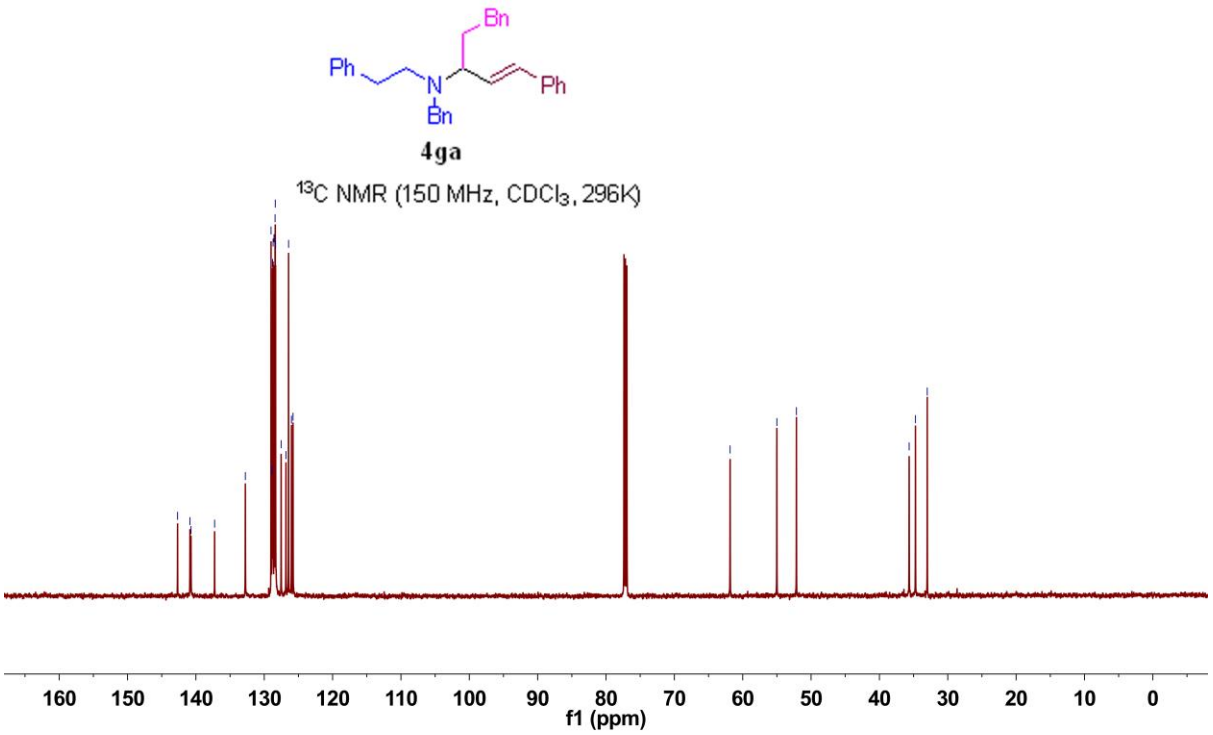
^{13}C NMR (150 MHz, $CDCl_3$, 296K)

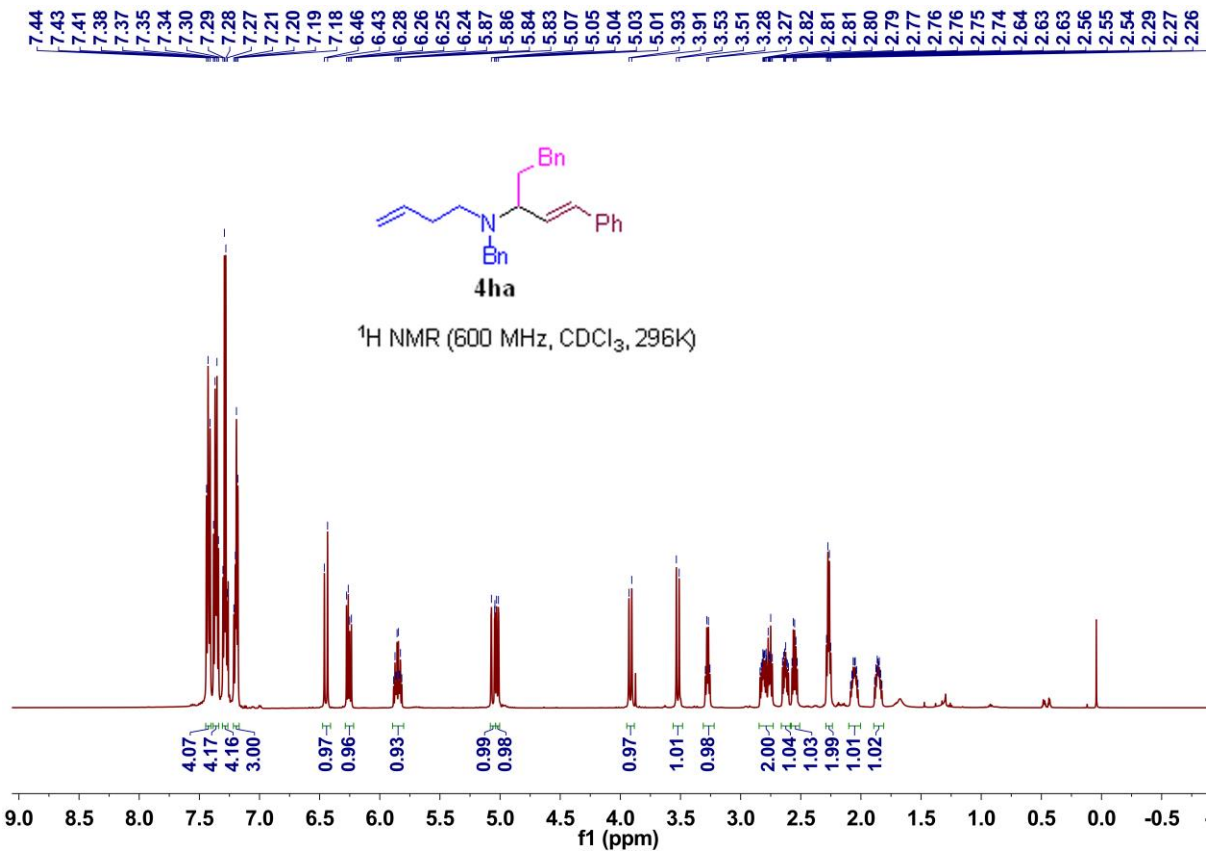


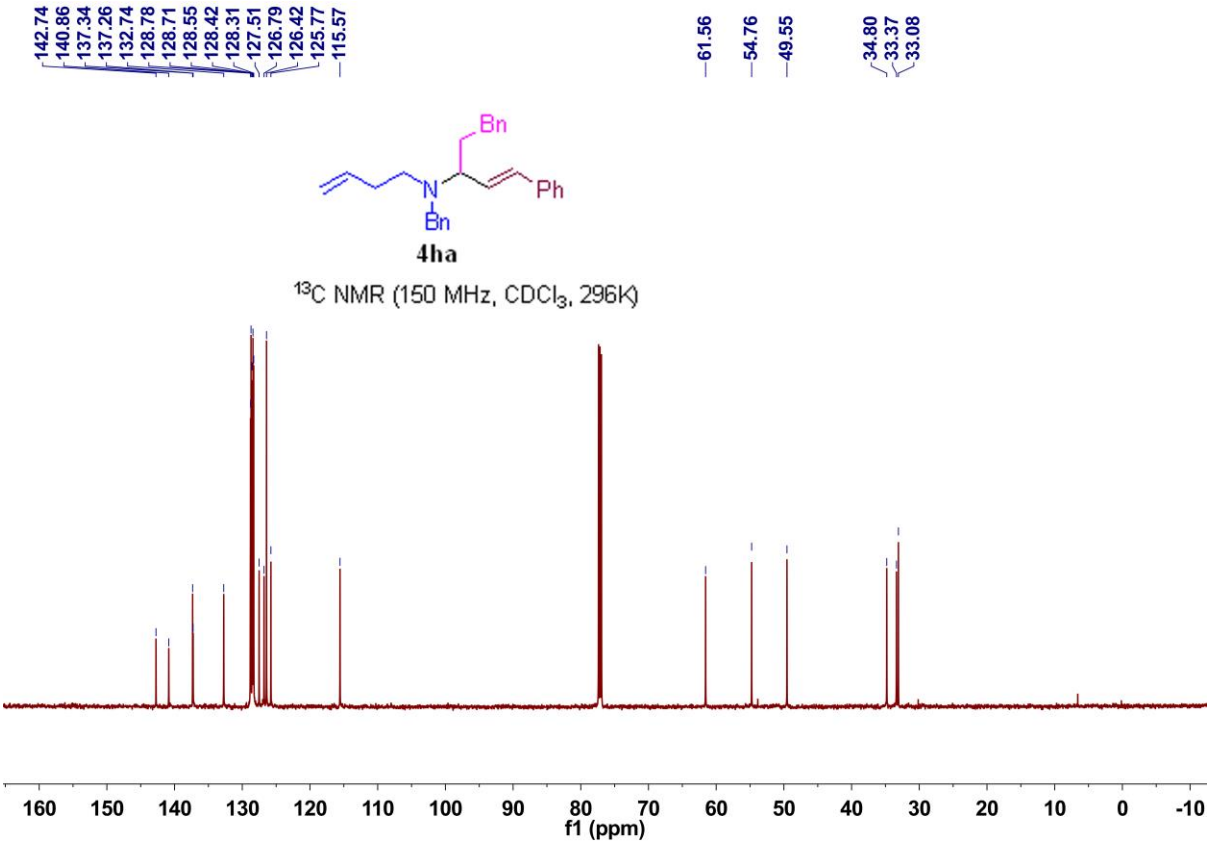

7.44 7.44 7.43 7.41 7.40 7.39 7.39 7.37 7.36 7.35 7.32 7.31 7.30 7.29 7.24 7.24 7.24 7.23 7.22 7.22 7.21 7.21 7.20 7.18 7.17 6.47 6.45 6.28 6.27 6.25 6.24 4.01 3.99 3.63 3.60 3.34 3.33 2.97 2.95 2.83 2.83 2.78 2.77 2.77 2.76 2.76 2.75 2.74 2.73 2.73 2.72 2.71 2.64 2.63 2.62 1.87


Bn
Ph
N
Ph
Bn
4ga
¹H NMR (600 MHz, CDCl₃, 296K)
8.12 6.19 2.19 4.17 1.00 1.00 0.99 1.03 1.00 1.00 4.22 1.14 1.07 1.05
8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.
f1 (ppm)

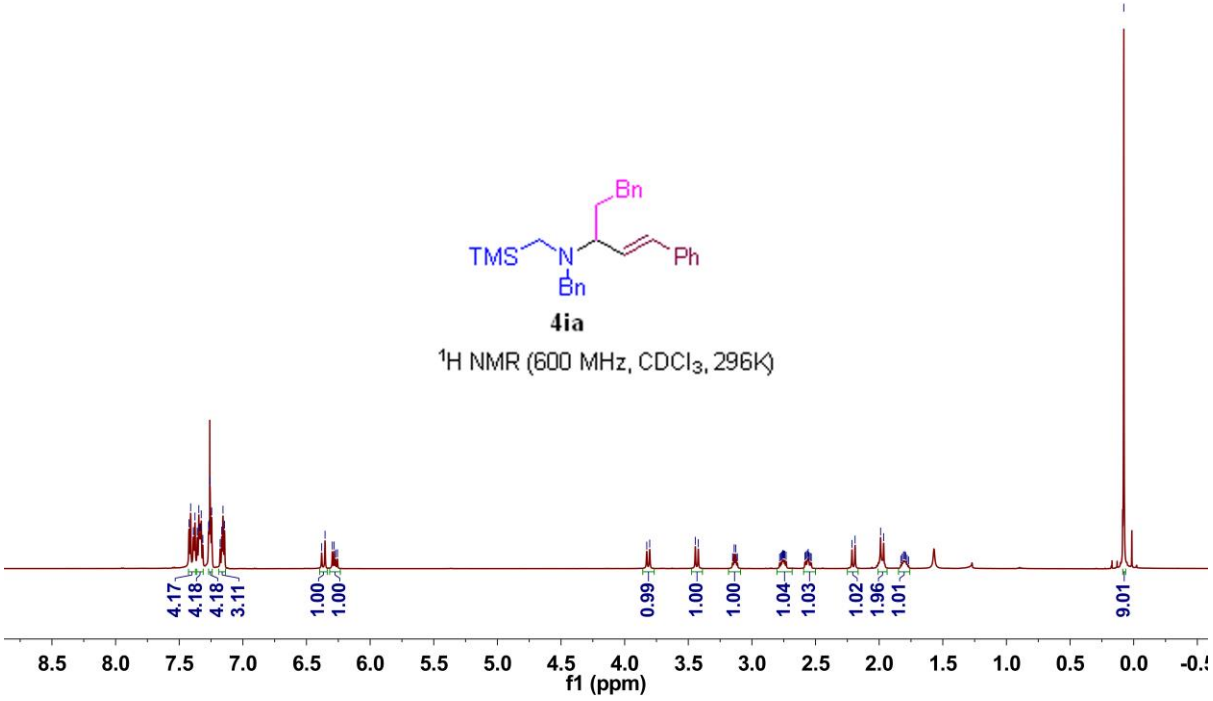

142.68 140.86 140.72 137.26 132.77 129.01 128.88 128.79 128.71 128.57 128.42 128.39 128.34 127.53 126.82 126.44 126.02 125.79
61.84 55.01 52.14 35.65 34.72 33.00


Bn
Ph
N
Ph
Bn
4ga
¹³C NMR (150 MHz, CDCl₃, 296K)
160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

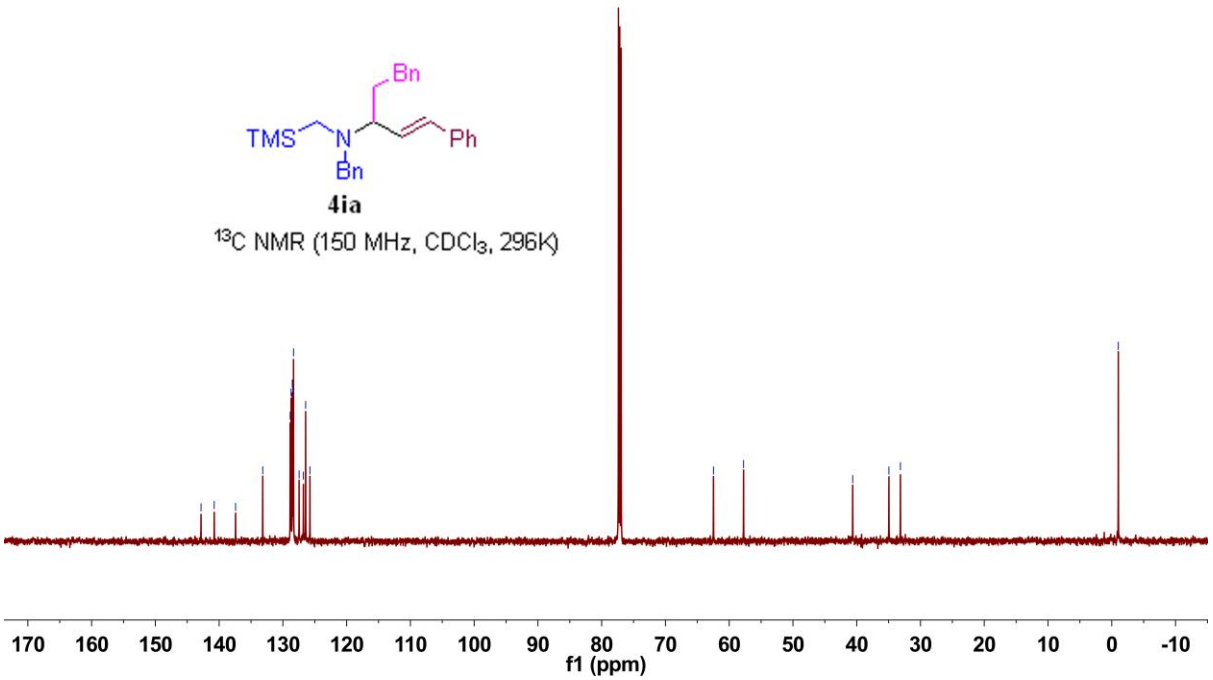

7.44 7.43 7.41 7.38 7.37 7.35 7.34 7.30 7.29 7.28 7.27 7.21 7.20 7.19 7.18 6.46 6.43 6.28 6.26 6.25 6.24 5.87 5.86 5.84 5.83 5.07 5.05 5.04 5.03 5.01 3.93 3.91 3.53 3.51 3.28 3.27 2.82 2.81 2.81 2.80 2.79 2.77 2.76 2.76 2.75 2.74 2.64 2.63 2.63 2.56 2.55 2.54 2.29 2.27 2.26
Bn
N
Bn
Ph
4ha
1H NMR (600 MHz, CDCl3, 296K)
4.07 4.17 4.16 3.00 0.97 0.96 0.93 0.99 0.98 0.97 1.01 0.98 2.00 1.04 1.03 1.99 1.01 1.02
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)


142.74 140.86 137.34 137.26 132.74 128.78 128.71 128.55 128.42 128.31 127.51 126.79 126.42 125.77 115.57
61.56 54.76 49.55 34.80 33.37 33.08
Bn
N
Bn
Ph
4ha
13C NMR (150 MHz, CDCl3, 296K)
160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

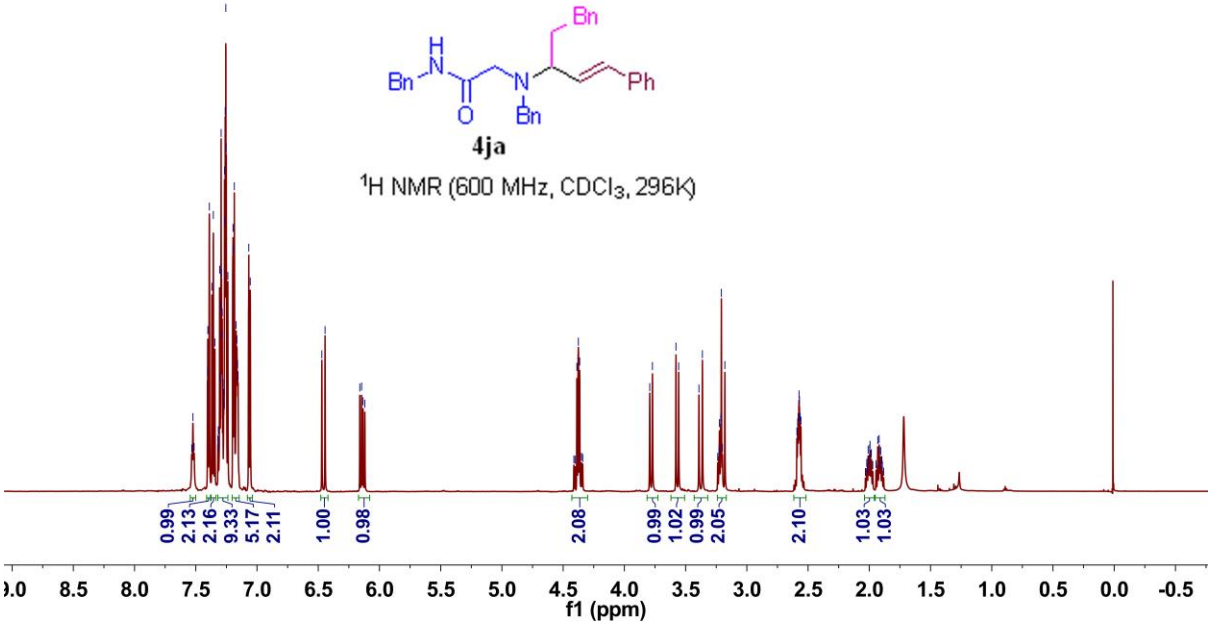

7.42 7.41 7.39 7.38 7.36 7.35 7.34 7.33 7.33 7.31 7.27 7.27 7.26 7.24 7.18 7.17 7.16 7.14 6.38 6.35 6.30 6.28 6.27 6.26
3.83 3.80 3.44 3.42 3.15 3.14 3.13 3.11 2.78 2.77 2.76 2.76 2.75 2.75 2.74 2.73 2.58 2.57 2.57 2.56 2.55 2.54 2.53 2.21 2.19 1.99 1.96 1.82 1.81 1.80 1.79 0.08


Bn
TMS
N
Bn
Ph
4ia
^{1}H NMR (600 MHz, $CDCl_3$, 296K)
4.17 4.18 4.18 3.11 1.00 1.00 0.99 1.00 1.00 1.04 1.03 1.02 1.96 1.01 9.01
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

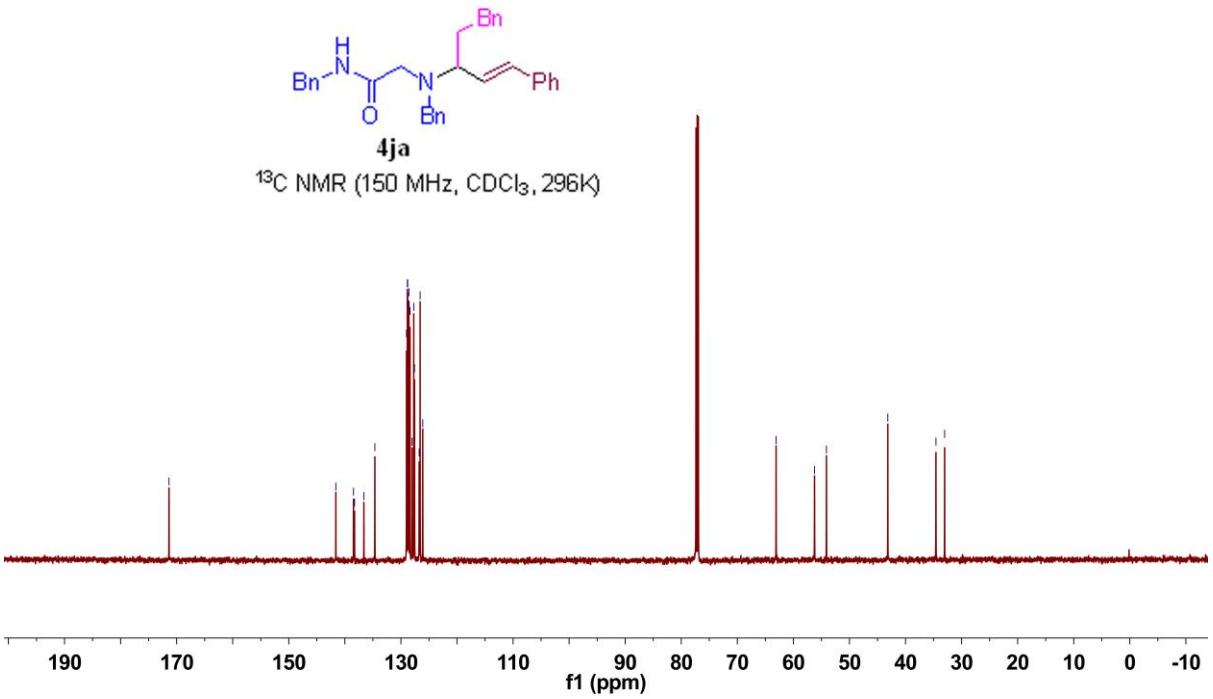

142.84 140.77 137.42 133.16 128.85 128.71 128.53 128.44 128.34 127.46 126.78 126.43 125.76
62.47 57.75 40.63 34.95 33.14 -1.03

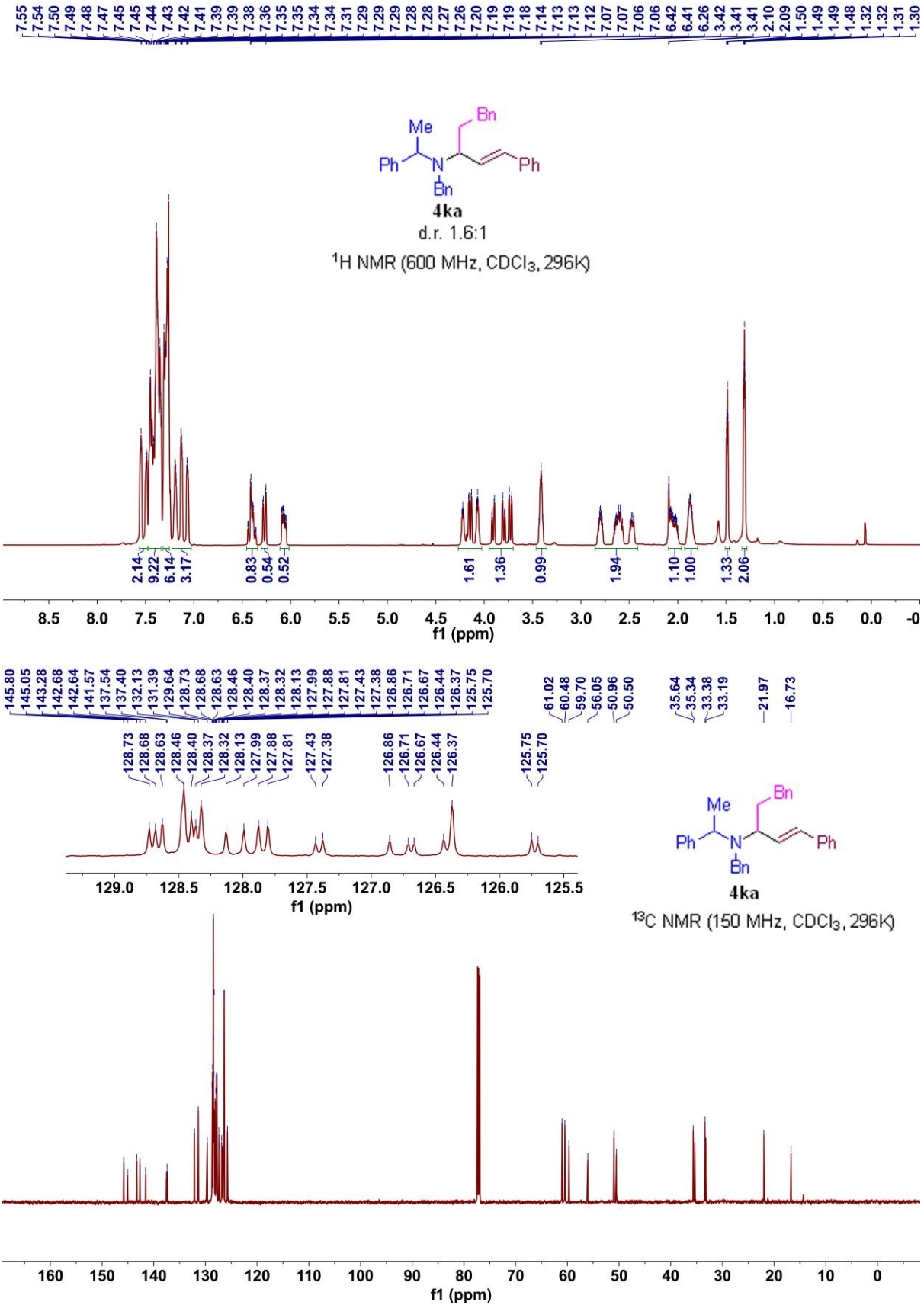

Bn
TMS
N
Bn
Ph
4ia
^{13}C NMR (150 MHz, $CDCl_3$, 296K)
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

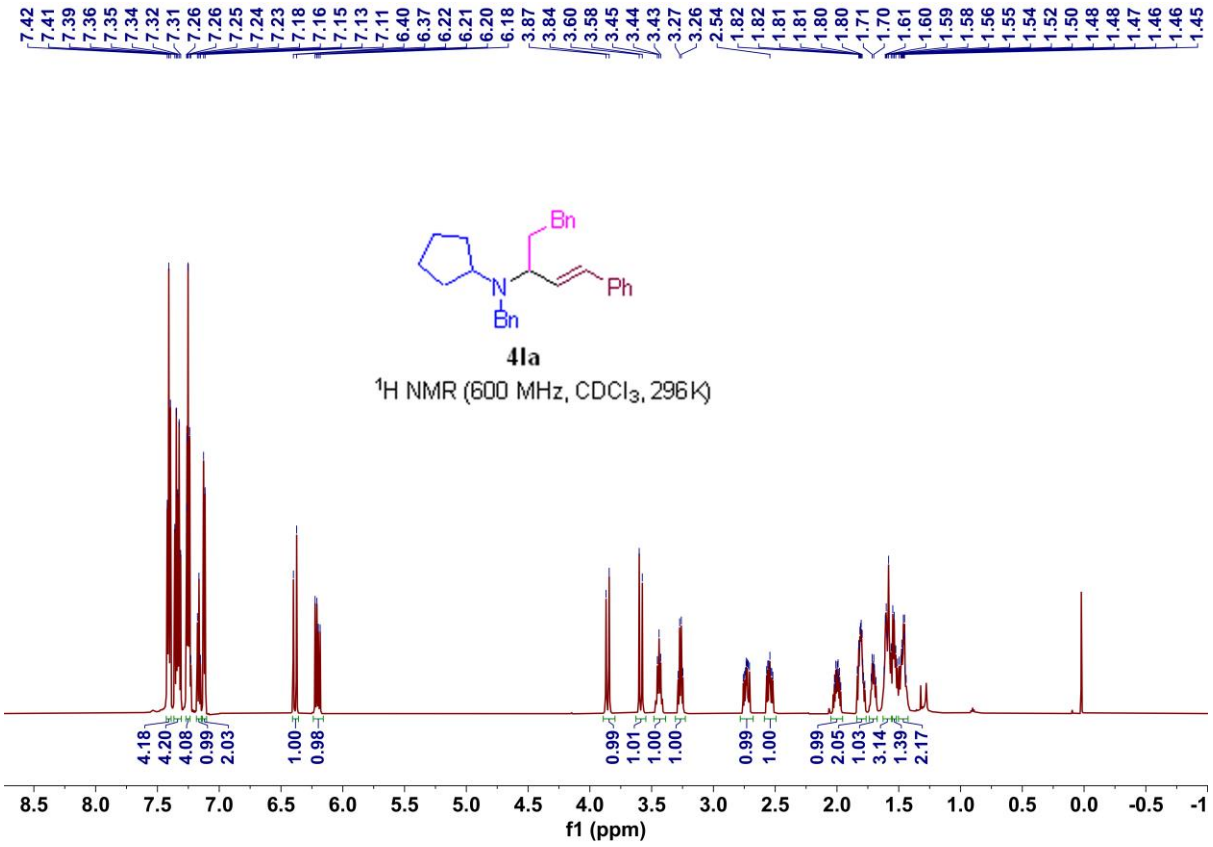

7.52 7.40 7.40 7.39 7.37 7.36 7.34 7.31 7.30 7.30 7.29 7.29 7.29 7.28 7.28 7.27 7.27 7.27 7.26 7.26 7.25 7.25 7.24 7.20 7.20 7.19 7.17 7.16 7.16 7.15 7.07 7.06 6.47 6.44 6.16 6.15 6.13 6.12 4.39 4.38 4.37 3.79 3.77 3.58 3.56 3.39 3.36 3.21 3.21 3.18 2.58 2.58 2.57 2.57 2.57 2.56


Bn
H
N
Bn
O
N
Bn
Ph
4ja
¹H NMR (600 MHz, CDCl₃, 296K)
0.99 2.13 2.16 9.33 5.17 2.11 1.00 0.98 2.08 0.99 1.02 0.99 2.05 2.10 1.03 1.03
f1 (ppm)


171.36 141.60 138.46 138.28 136.61 134.65 129.00 128.85 128.80 128.76 128.58 128.38 128.01 127.71 127.58 126.75 126.57 126.10 63.09 56.23 54.11 43.16 34.58 33.03

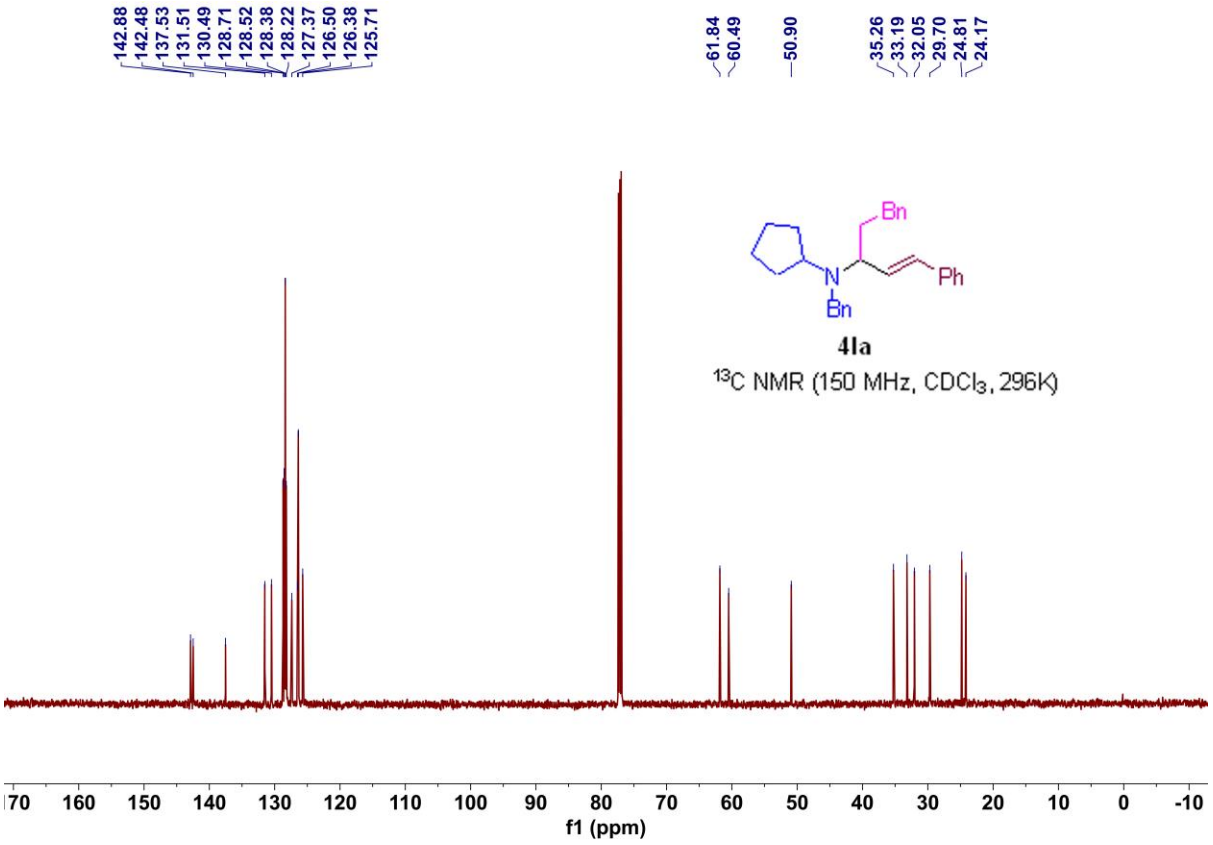

Bn
H
N
Bn
O
N
Bn
Ph
4ja
¹³C NMR (150 MHz, CDCl₃, 296K)
f1 (ppm)


7.55 7.54 7.50 7.49 7.48 7.47 7.45 7.45 7.44 7.43 7.42 7.41 7.39 7.39 7.38 7.36 7.35 7.35 7.34 7.34 7.31 7.29 7.29 7.29 7.28 7.28 7.27 7.26 7.20 7.19 7.19 7.18 7.14 7.13 7.13 7.12 7.07 7.07 7.06 7.06 6.42 6.41 6.26 3.42 3.41 3.41 2.10 2.09 1.50 1.49 1.49 1.48 1.32 1.32 1.31 1.30
Me
Bn
Ph
N
Ph
Bn
4ka
d.r. 1.6:1
1H NMR (600 MHz, CDCl3, 296K)
2.14 9.22 6.14 3.17 0.83 0.54 0.52 1.61 1.36 0.99 1.94 1.10 1.00 1.33 2.06
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0
f1 (ppm)
145.80 145.05 143.28 142.68 142.64 141.57 137.54 137.40 132.13 131.39 129.64 128.73 128.68 128.63 128.46 128.40 128.37 128.32 128.13 127.99 127.88 127.81 127.43 127.38 126.86 126.71 126.67 126.44 126.37 125.75 125.70
61.02 60.48 59.70 56.05 50.96 50.50 35.64 35.34 33.38 33.19 21.97 16.73
129.0 128.5 128.0 127.5 127.0 126.5 126.0 125.5
f1 (ppm)
Me
Bn
Ph
N
Ph
Bn
4ka
13C NMR (150 MHz, CDCl3, 296K)
160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)



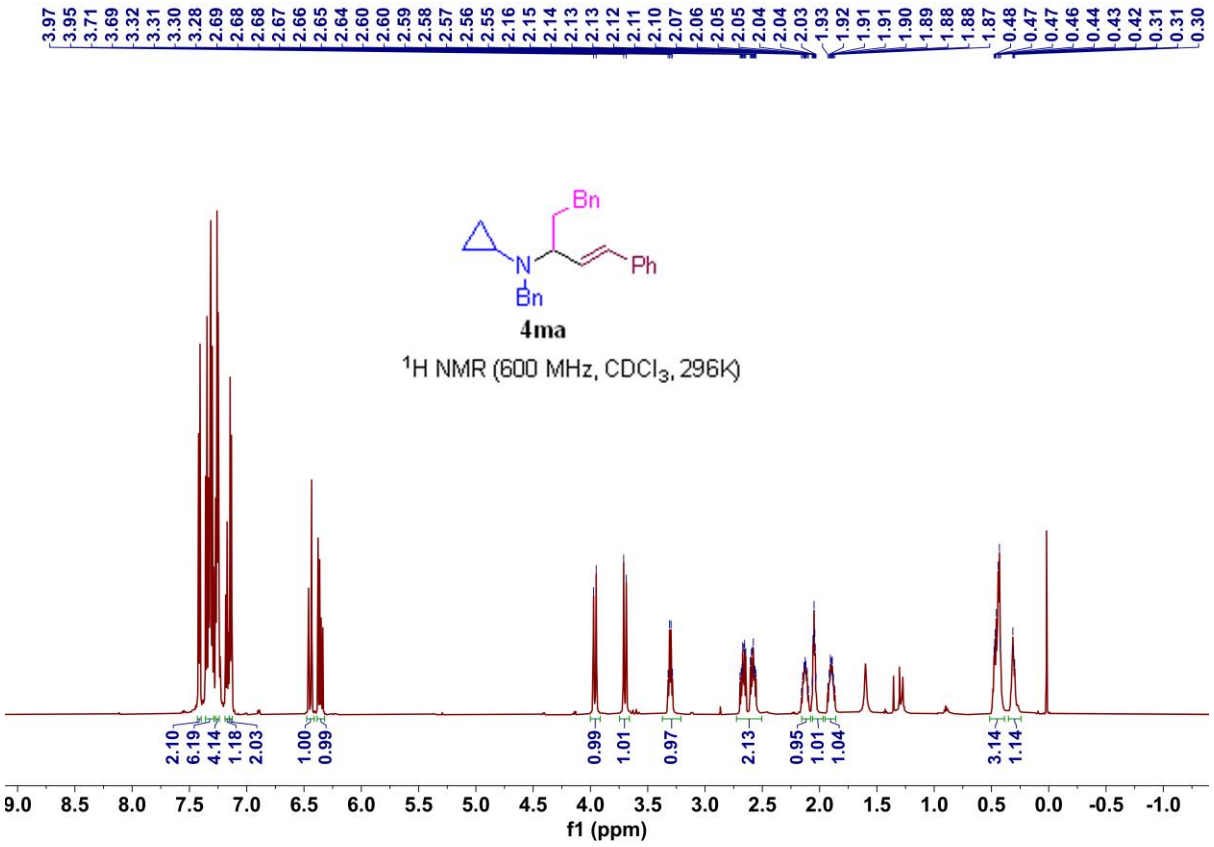
4la

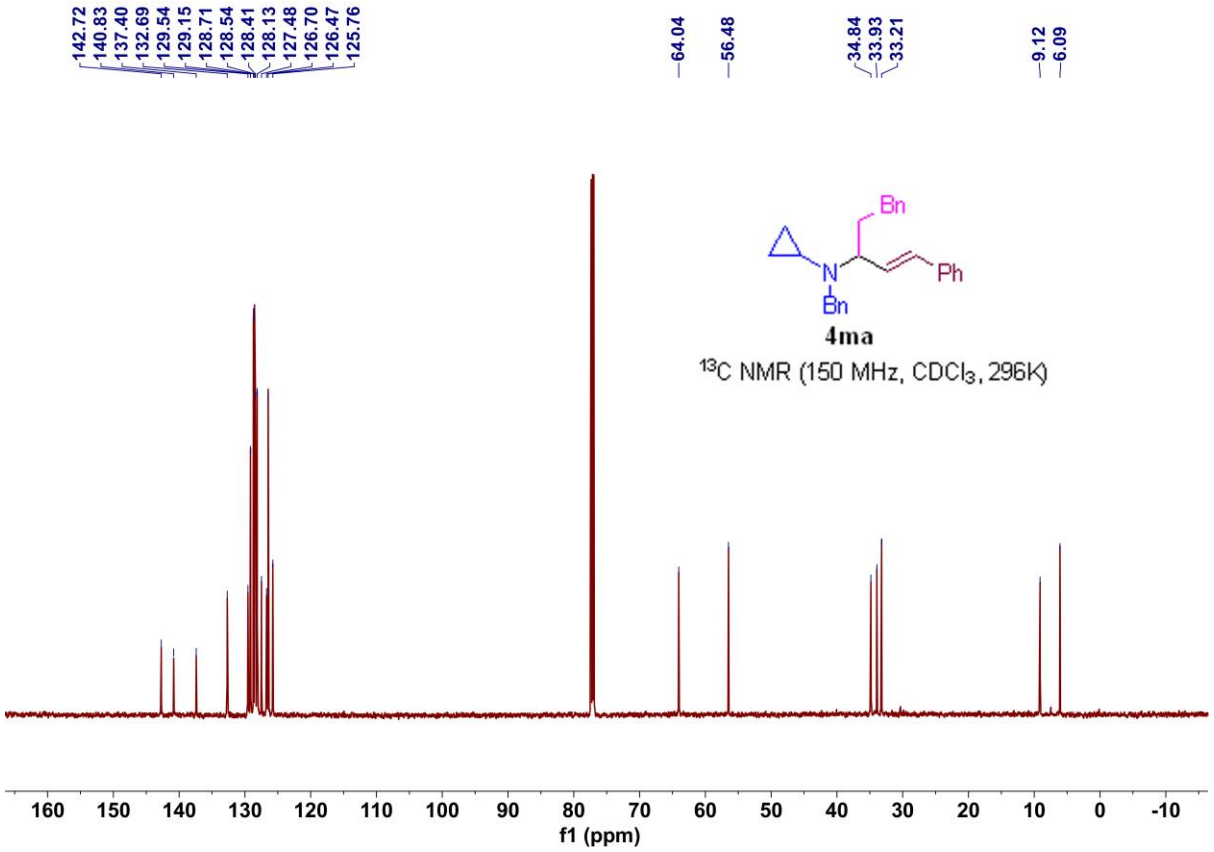
^{1}H NMR (600 MHz, $CDCl_3$, 296K)



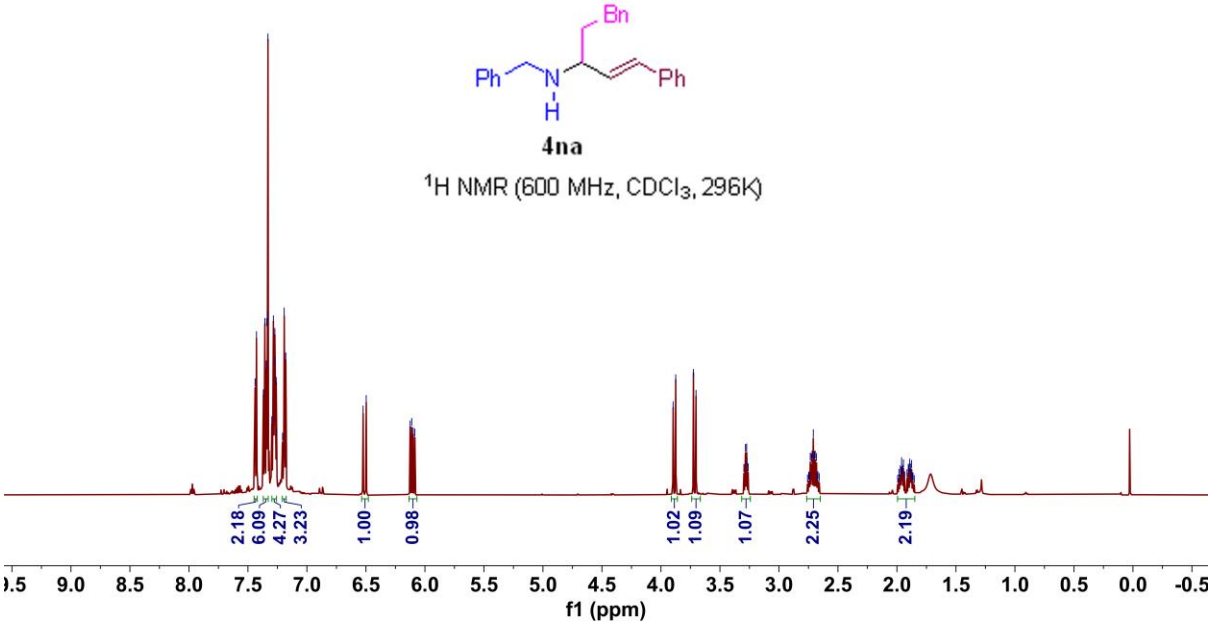
4la

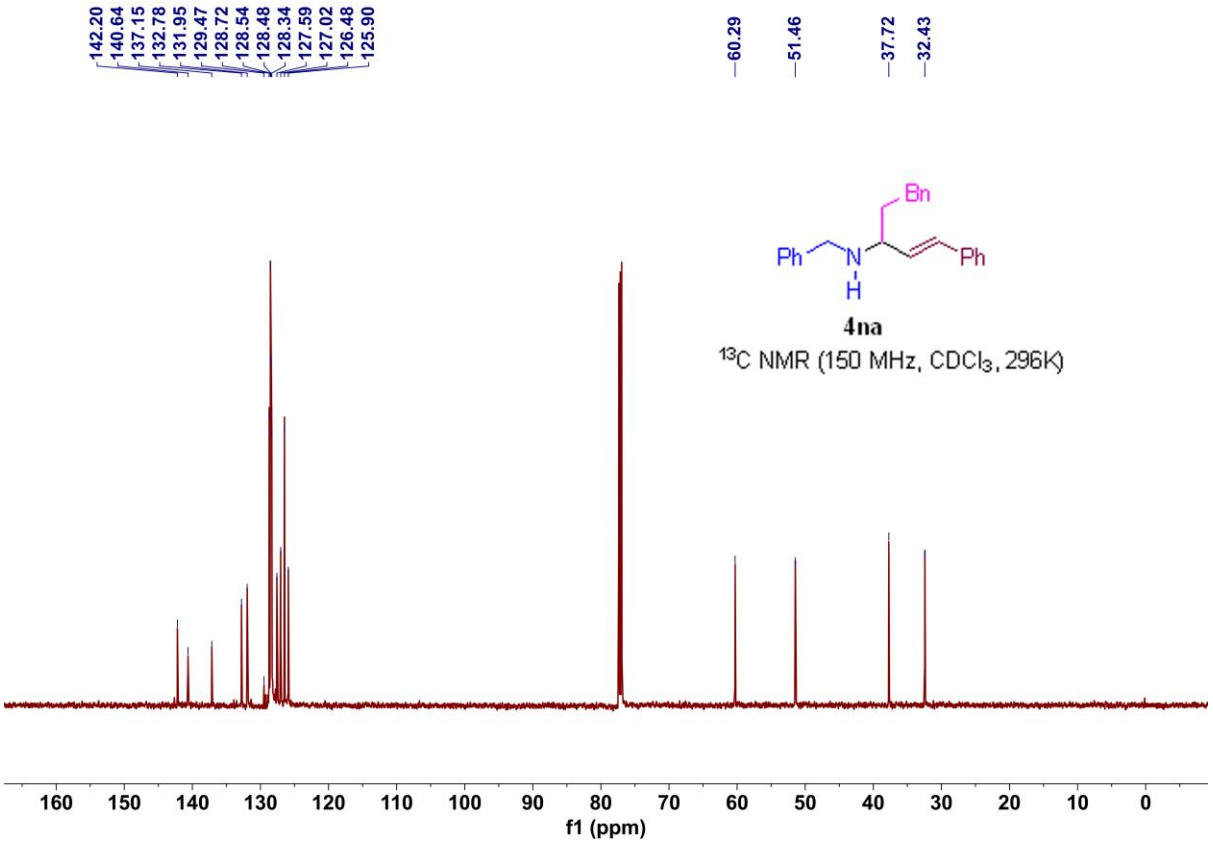
^{13}C NMR (150 MHz, $CDCl_3$, 296K)

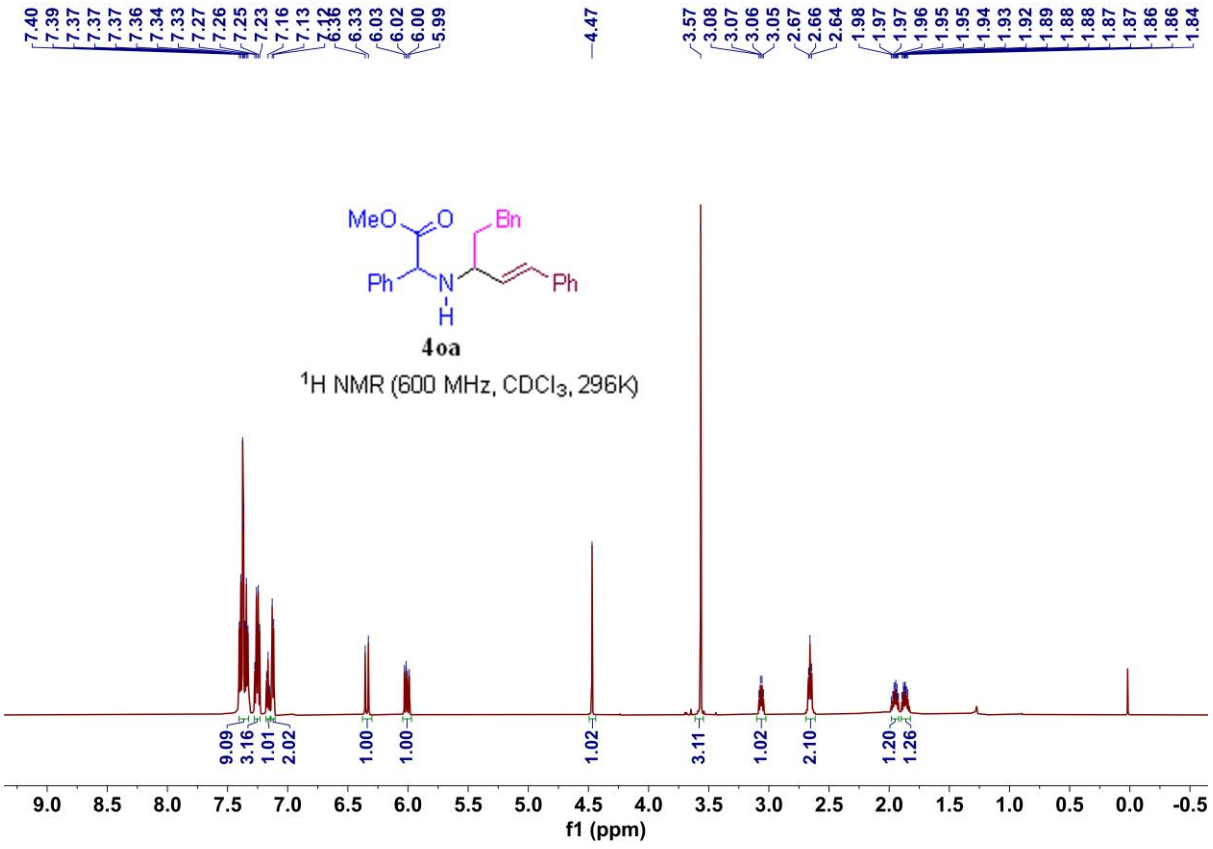

3.97 3.95 3.71 3.69 3.32 3.31 3.30 3.28 2.69 2.68 2.68 2.67 2.66 2.65 2.64 2.60 2.60 2.59 2.58 2.57 2.56 2.55 2.16 2.15 2.14 2.13 2.13 2.12 2.11 2.10 2.07 2.06 2.05 2.05 2.04 2.04 2.03 1.93 1.92 1.91 1.91 1.90 1.89 1.88 1.88 1.87 0.48 0.47 0.47 0.46 0.44 0.43 0.42 0.31 0.31 0.30
Bn
N
Bn
Ph
4ma
1H NMR (600 MHz, CDCl3, 296K)
2.10 6.19 4.14 1.18 2.03 1.00 0.99 0.99 1.01 0.97 2.13 0.95 1.01 1.04 3.14 1.14
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)

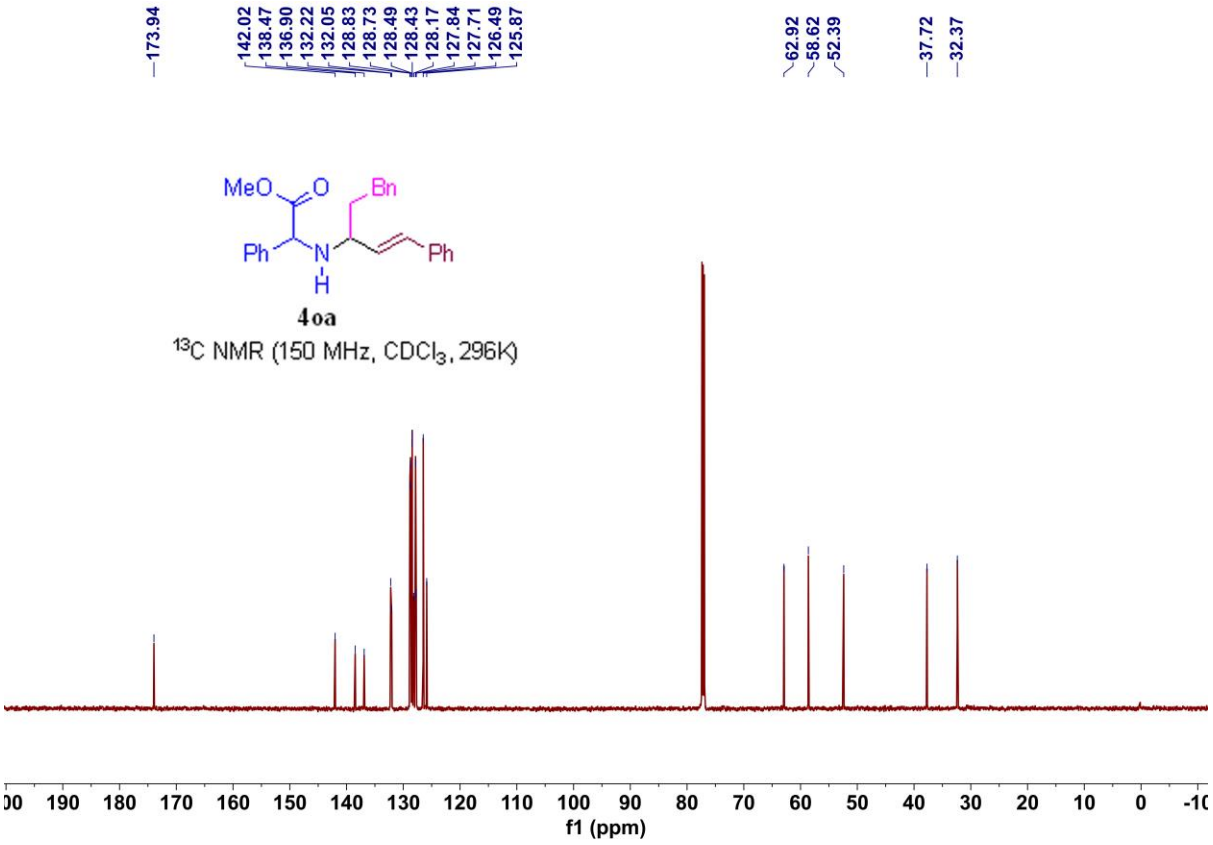

142.72 140.83 137.40 132.69 129.54 129.15 128.71 128.54 128.41 128.13 127.48 126.70 126.47 125.76
64.04
56.48
34.84 33.93 33.21
9.12 6.09
Bn
N
Bn
Ph
4ma
13C NMR (150 MHz, CDCl3, 296K)
160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

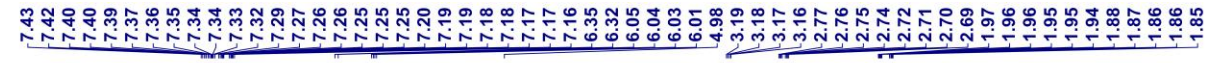

7.44 7.43 7.37 7.36 7.34 7.34 7.33 7.33 7.30 7.28 7.27 7.27 7.26 7.26 7.21 7.19 7.18 6.52 6.50 6.13 6.11 6.10 6.09 3.90 3.87 3.72 3.70 3.30 3.28 3.27 3.27 3.26 2.73 2.72 2.72 2.71 2.70 2.69 2.68 2.67 1.98 1.97 1.97 1.96 1.95 1.95 1.94 1.91 1.90 1.90 1.90 1.89 1.89 1.89 1.88 1.88 1.88

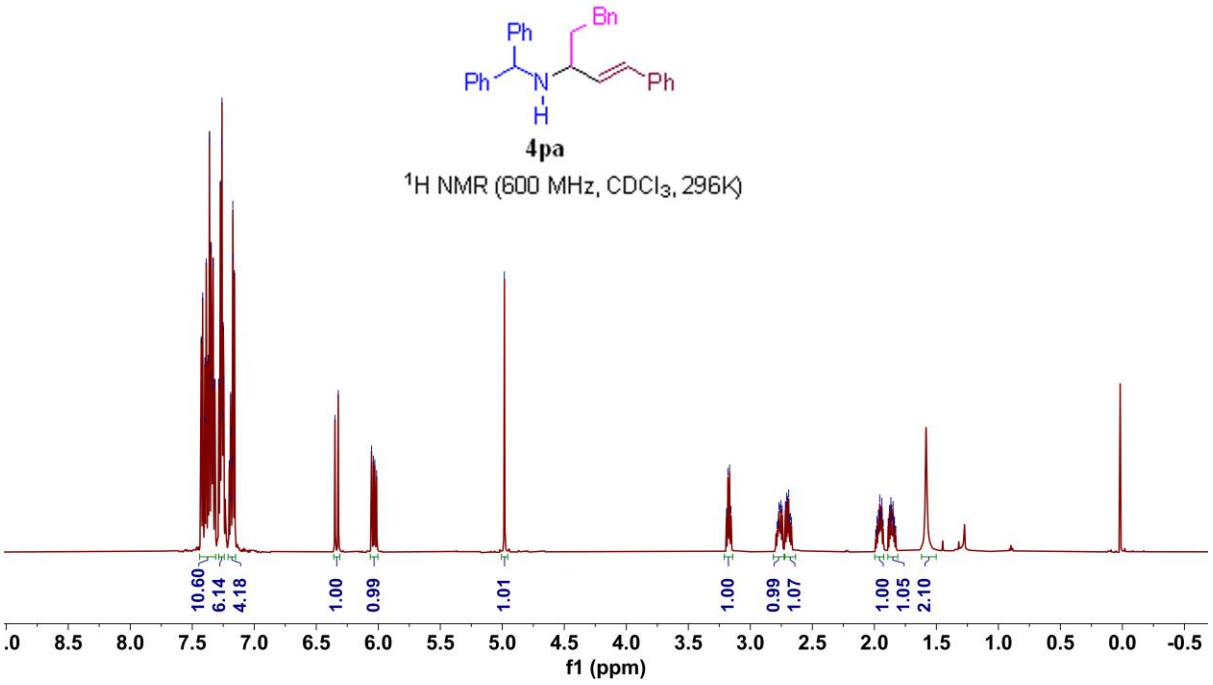

Bn
Ph
N
H
Ph
4na
^{1}H NMR (600 MHz, CDCl$_3$, 296K)
2.18 6.09 4.27 3.23 1.00 0.98 1.02 1.09 1.07 2.25 2.19
f1 (ppm)


142.20 140.64 137.15 132.78 131.95 129.47 128.72 128.54 128.48 128.34 127.59 127.02 126.48 125.90
60.29 51.46 37.72 32.43
Bn
Ph
N
H
Ph
4na
^{13}C NMR (150 MHz, CDCl$_3$, 296K)
f1 (ppm)


7.40 7.39 7.37 7.37 7.37 7.36 7.34 7.33 7.27 7.26 7.25 7.23 7.16 7.13 7.12 7.10 6.33 6.03 6.02 6.00 5.99
4.47
3.57 3.08 3.07 3.06 3.05 2.67 2.66 2.64 1.98 1.97 1.97 1.96 1.95 1.95 1.94 1.93 1.92 1.89 1.88 1.88 1.87 1.87 1.86 1.86 1.84
MeO O Bn Ph N H Ph
4oa
^{1}H NMR (600 MHz, $CDCl_3$, 296K)
9.09 3.16 1.01 2.02 1.00 1.00 1.02 3.11 1.02 2.10 1.20 1.26
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

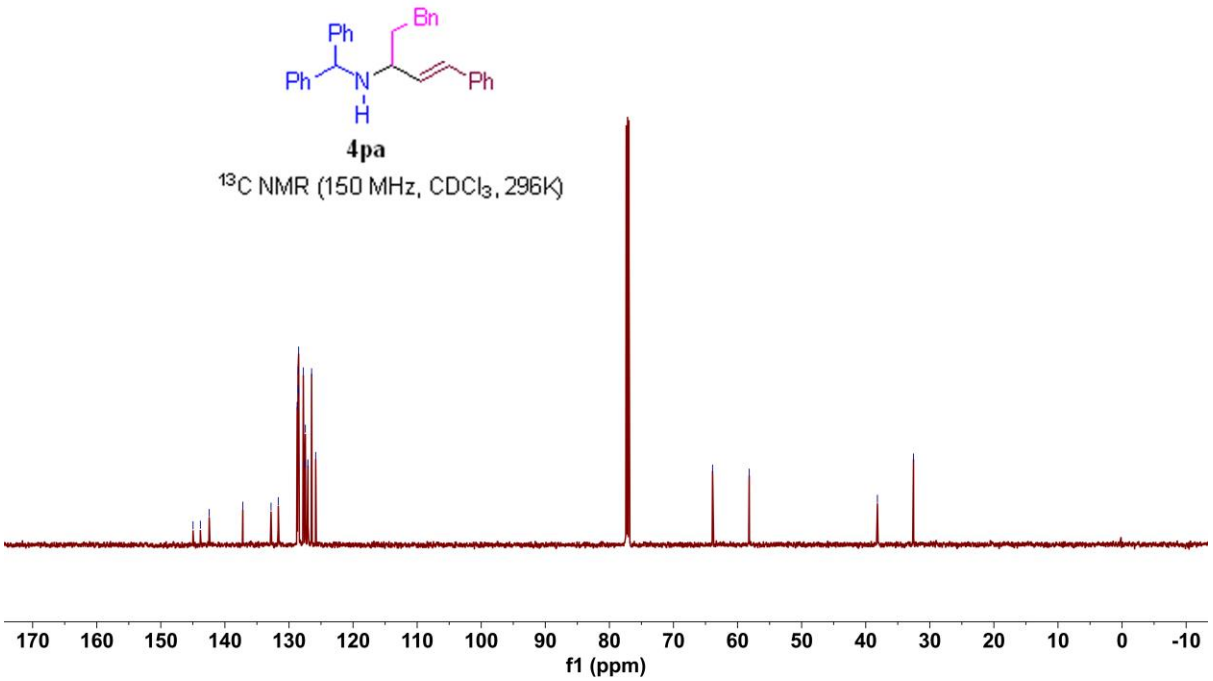

173.94
142.02 138.47 136.90 132.22 132.05 128.83 128.73 128.49 128.43 128.17 127.84 127.71 126.49 125.87
62.92 58.62 52.39
37.72 32.37
MeO O Bn Ph N H Ph
4oa
^{13}C NMR (150 MHz, $CDCl_3$, 296K)
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)





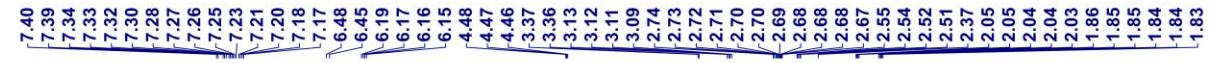
4pa

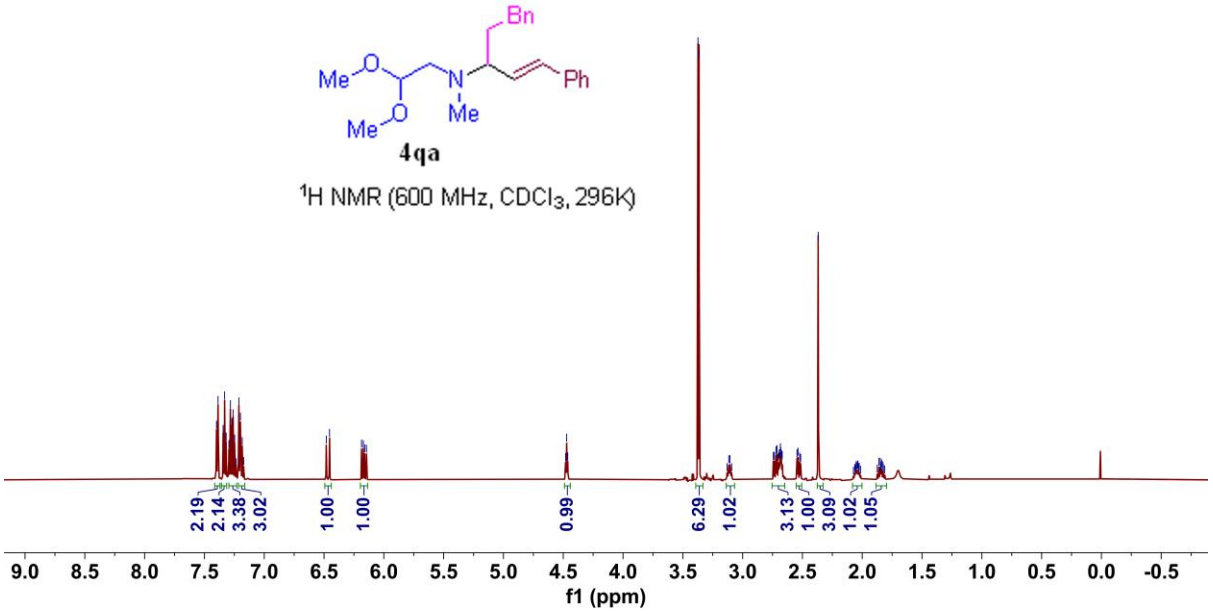
^{1}H NMR (600 MHz, $CDCl_3$, 296K)



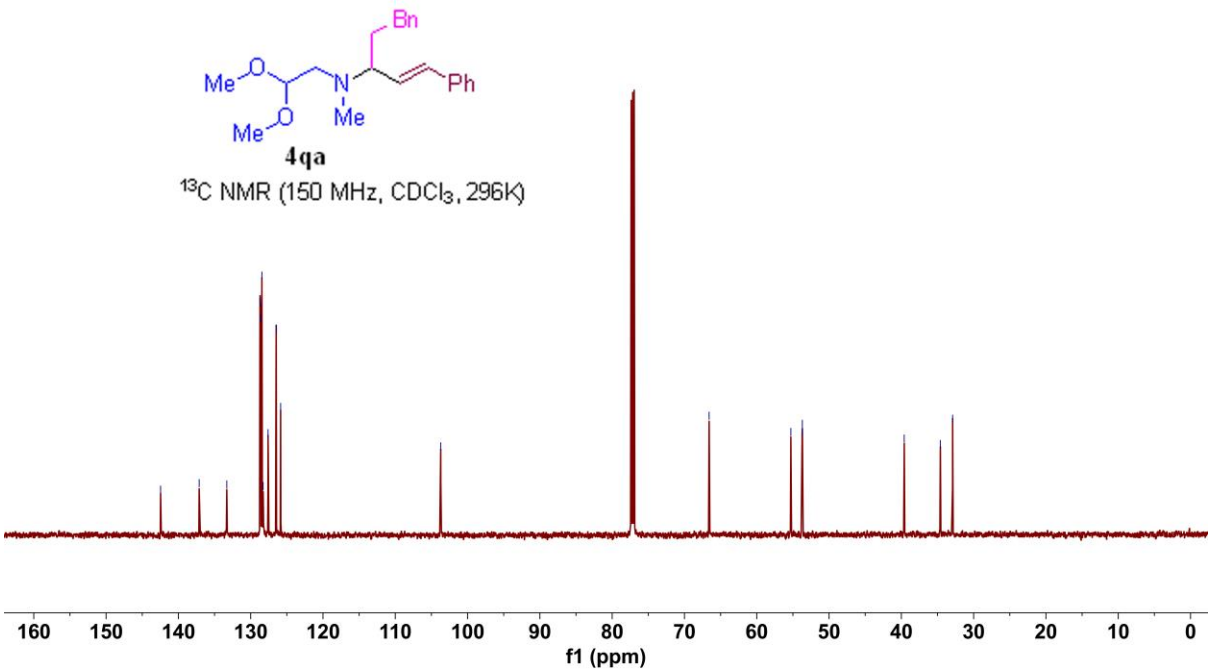
4pa

^{13}C NMR (150 MHz, $CDCl_3$, 296K)

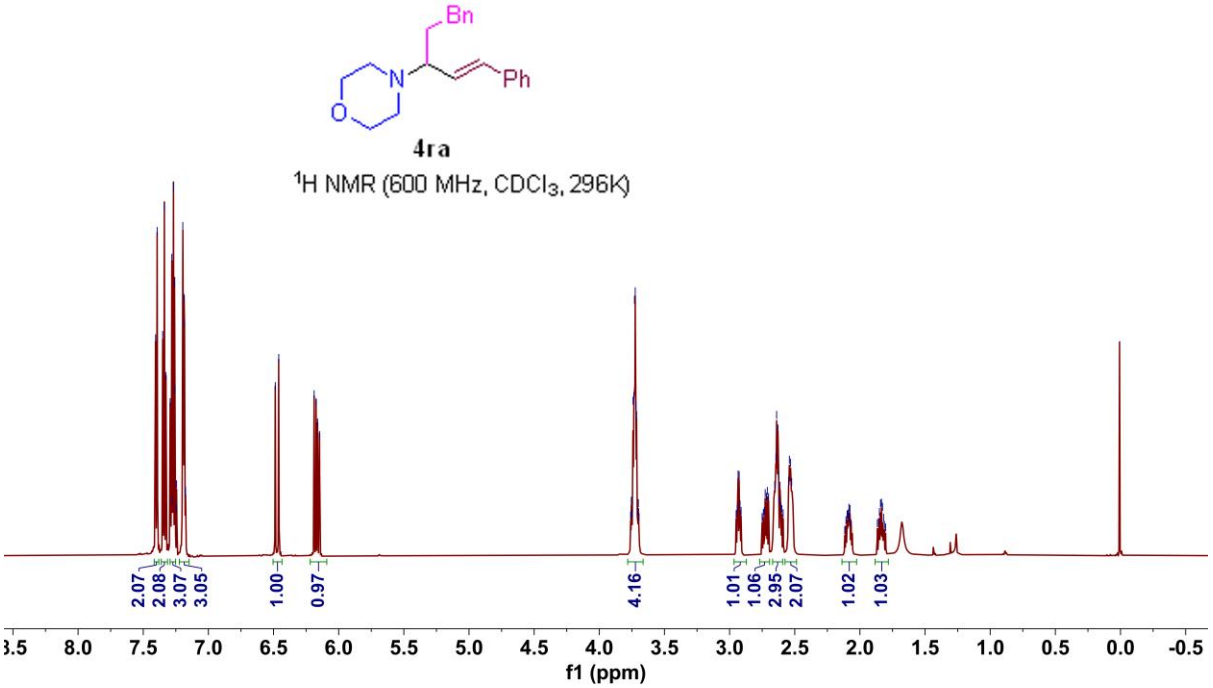

7.40 7.39 7.34 7.33 7.32 7.30 7.28 7.27 7.26 7.25 7.23 7.21 7.20 7.18 7.17 6.48 6.45 6.19 6.17 6.16 6.15 4.48 4.47 4.46 3.37 3.36 3.13 3.12 3.11 3.09 2.74 2.73 2.72 2.71 2.70 2.70 2.69 2.68 2.68 2.68 2.67 2.55 2.54 2.52 2.51 2.37 2.05 2.05 2.04 2.04 2.03 1.86 1.85 1.85 1.84 1.84 1.83

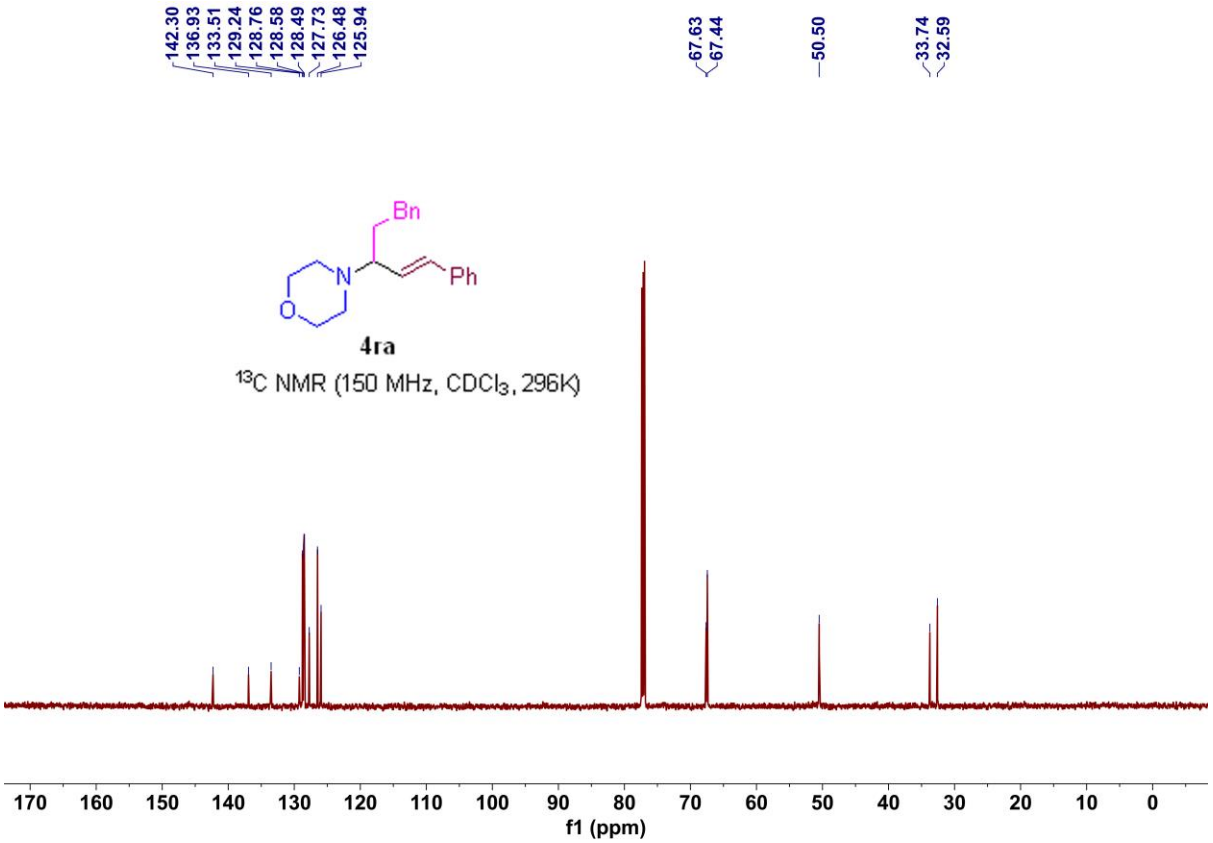

Bn
Me
O
N
Ph
Me
O
Me
Me
4qa
1H NMR (600 MHz, CDCl3, 296K)
2.19 2.14 3.38 3.02 1.00 1.00 0.99 6.29 1.02 3.13 1.00 3.09 1.02 1.05
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

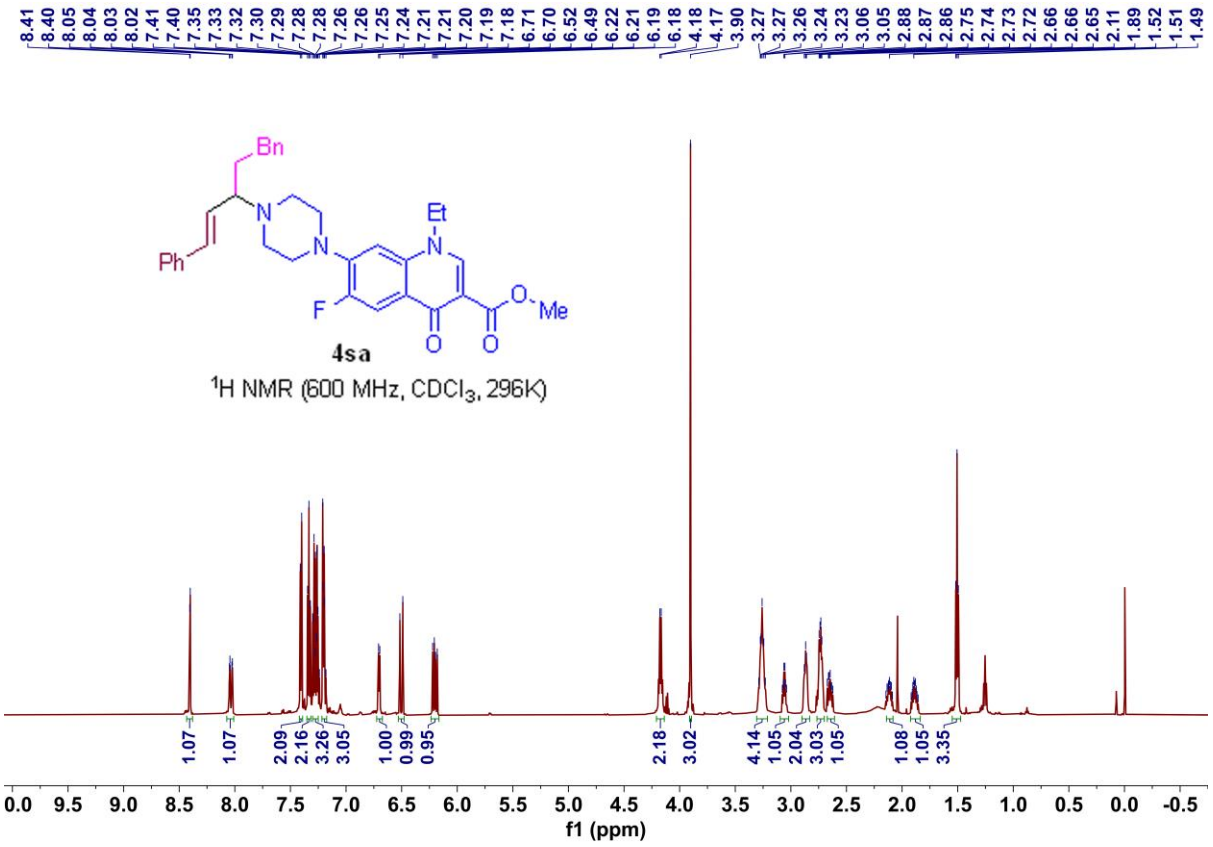

142.46 137.12 133.30 128.71 128.63 128.45 128.28 127.60 126.46 125.86
103.71
66.59
55.28 53.72 53.69
39.60 34.60 32.90

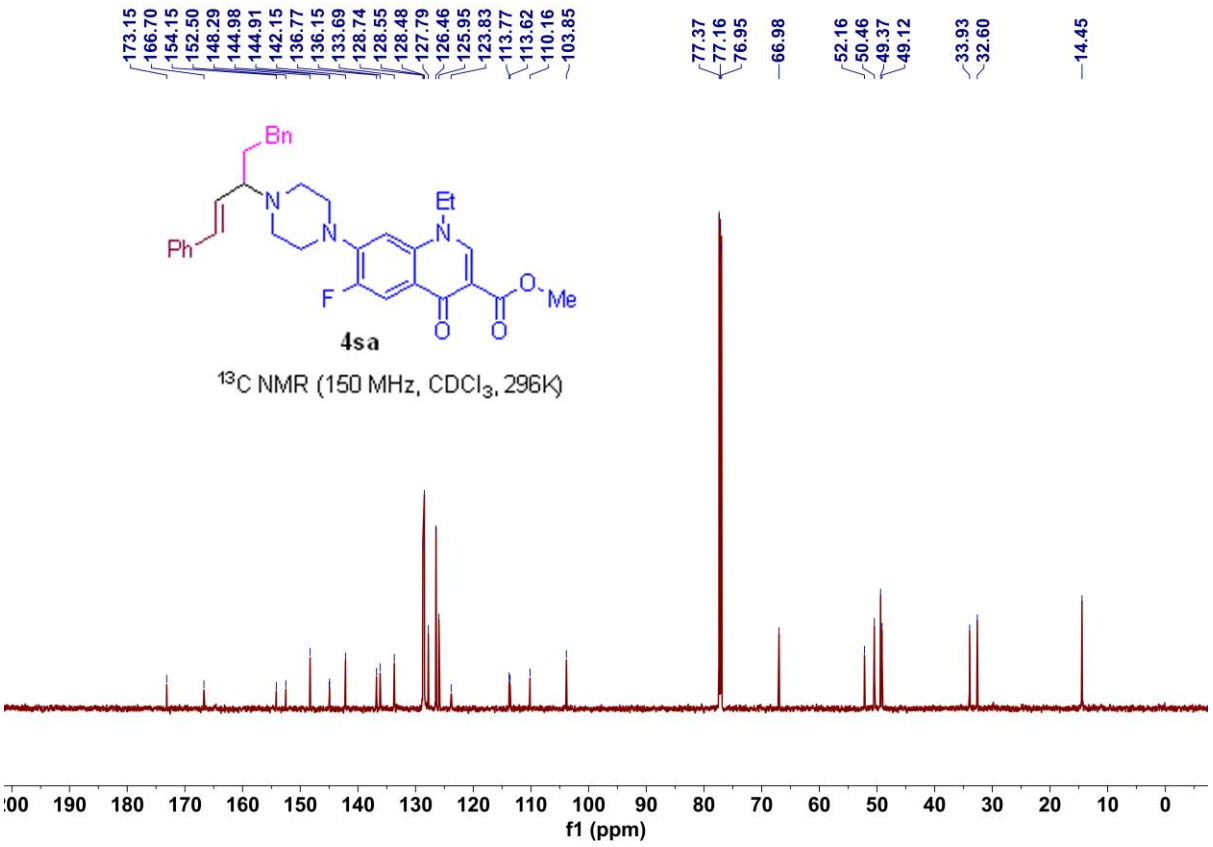

Bn
Me
O
N
Ph
Me
O
Me
Me
4qa
13C NMR (150 MHz, CDCl3, 296K)
160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

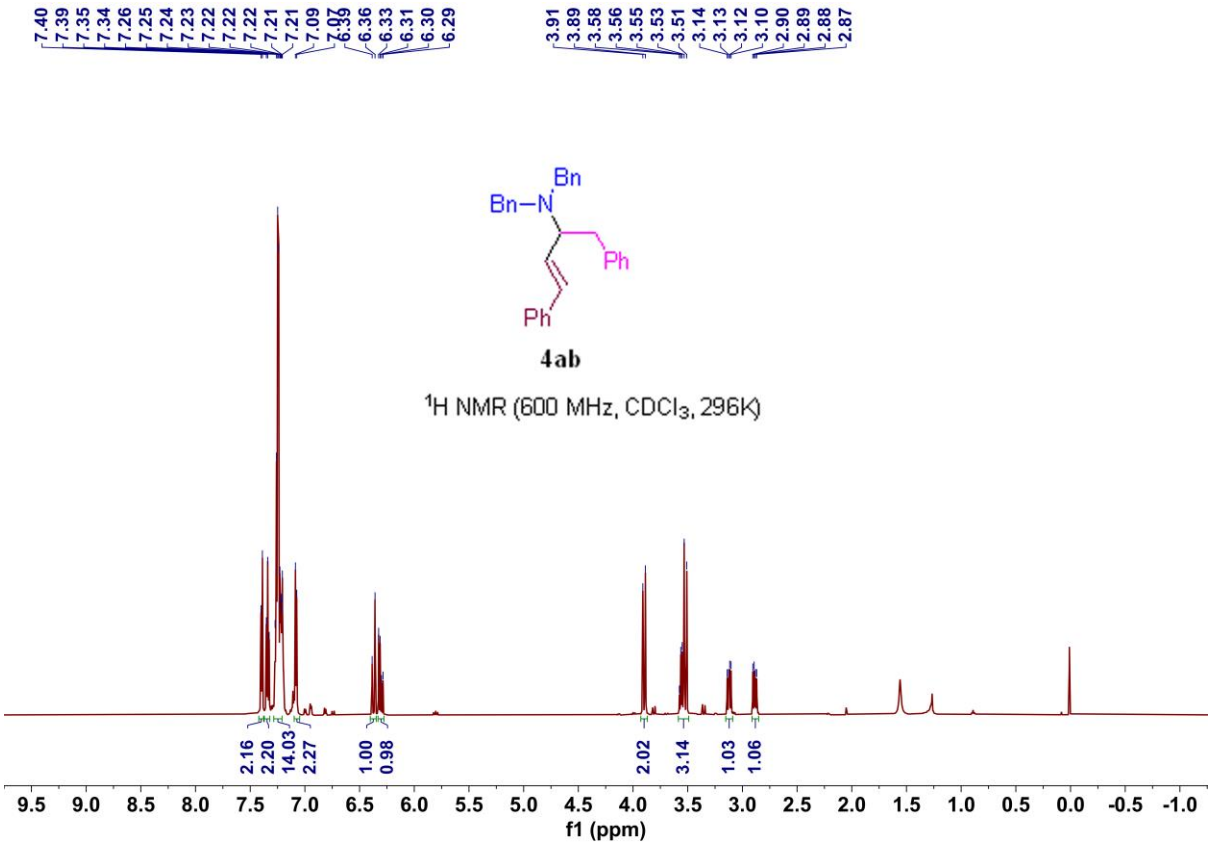

7.41
7.39
7.35
7.34
7.33
7.29
7.28
7.27
7.27
7.26
7.26
7.25
7.24
7.20
7.19
7.18
7.18
7.18
6.49
6.46
6.19
6.17
6.16
6.15
3.75
3.74
3.74
3.73
3.72
3.72
3.71
3.70
2.94
2.93
2.93
2.92
2.73
2.72
2.71
2.70
2.65
2.64
2.64
2.63
2.62
2.62
2.61
2.61
2.55
2.54
2.53
2.52
2.08
2.08
1.84
1.83
1.83

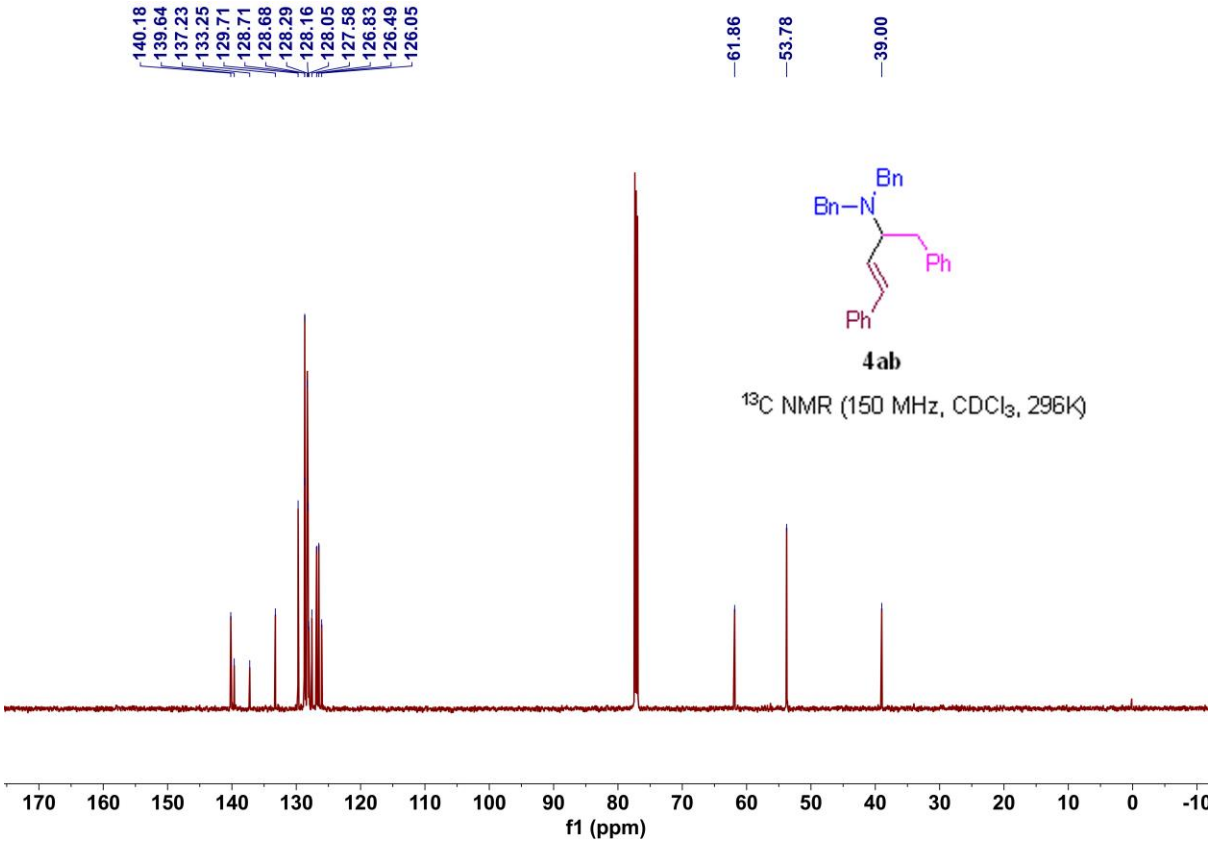

Bn
N
O
Ph
4ra
¹H NMR (600 MHz, CDCl3, 296K)
2.07
2.08
3.07
3.05
1.00
0.97
4.16
1.01
1.06
2.95
2.07
1.02
1.03
f1 (ppm)

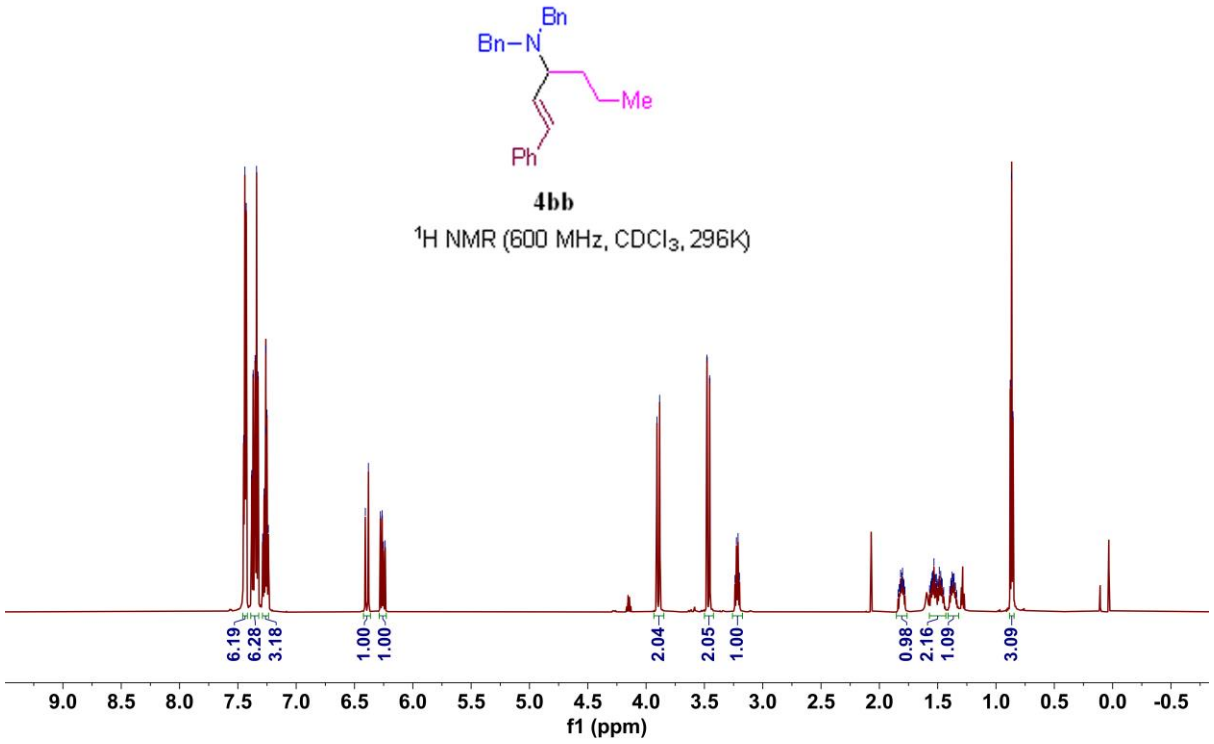

142.30
136.93
133.51
129.24
128.76
128.58
128.49
127.73
126.48
125.94
67.63
67.44
50.50
33.74
32.59
Bn
N
O
Ph
4ra
¹³C NMR (150 MHz, CDCl3, 296K)
f1 (ppm)


8.41 8.40 8.05 8.04 8.03 8.02 7.41 7.40 7.35 7.33 7.32 7.30 7.29 7.28 7.28 7.26 7.26 7.25 7.24 7.21 7.21 7.20 7.19 7.18 6.71 6.70 6.52 6.49 6.22 6.21 6.19 6.18 4.18 4.17 3.90 3.27 3.27 3.26 3.24 3.23 3.06 3.05 2.88 2.87 2.86 2.75 2.74 2.73 2.72 2.66 2.66 2.65 2.11 1.89 1.52 1.51 1.49
Bn
Et
N
N
N
Ph
F
O
Me
O
O
4sa
1H NMR (600 MHz, CDCl3, 296K)
1.07 1.07 2.09 2.16 3.26 3.05 1.00 0.99 0.95 2.18 3.02 4.14 1.05 2.04 3.03 1.05 1.08 1.05 3.35
0.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)


173.15 166.70 154.15 152.50 148.29 144.98 144.91 142.15 136.77 136.15 133.69 128.74 128.55 128.48 127.79 126.46 125.95 123.83 113.77 113.62 110.16 103.85
77.37 77.16 76.95 66.98 52.16 50.46 49.37 49.12 33.93 32.60 14.45
Bn
Et
N
N
N
Ph
F
O
Me
O
O
4sa
13C NMR (150 MHz, CDCl3, 296K)
00 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

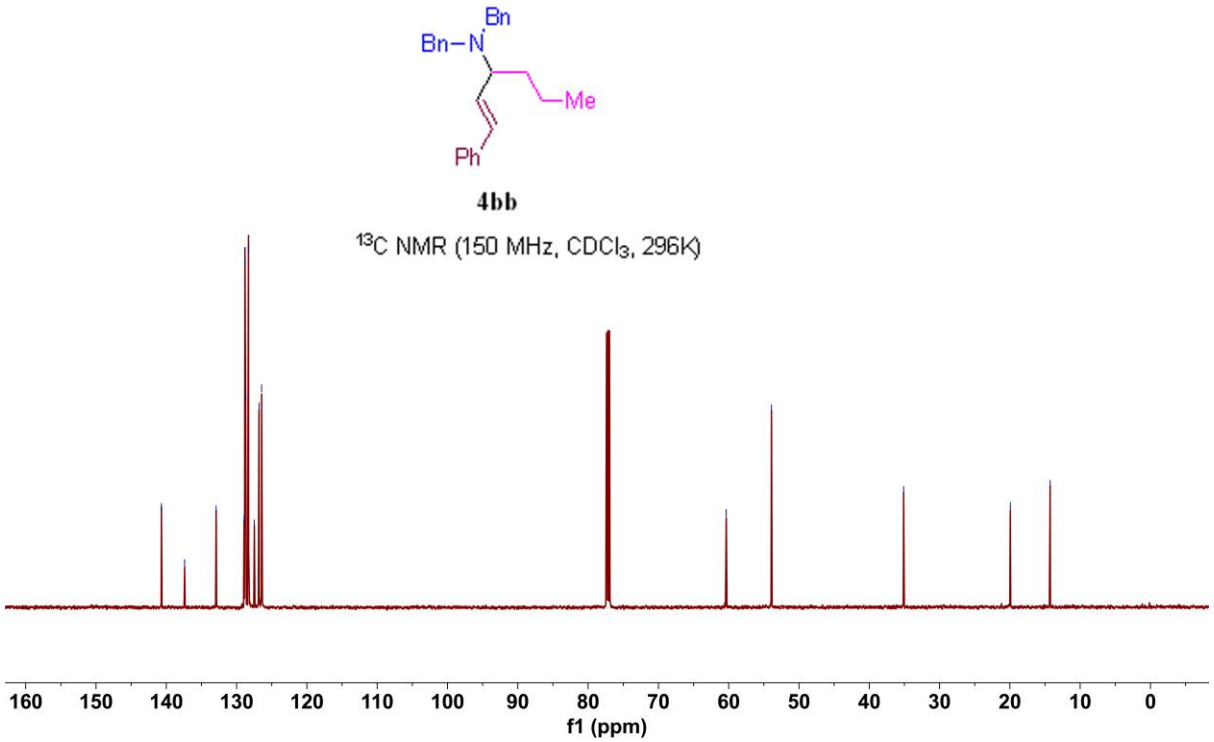

7.40
7.39
7.35
7.34
7.26
7.25
7.24
7.23
7.22
7.22
7.22
7.21
7.21
7.09
6.39
6.36
6.33
6.31
6.30
6.29
3.91
3.89
3.58
3.56
3.55
3.53
3.51
3.14
3.13
3.12
3.10
2.90
2.89
2.88
2.87
Bn
Bn–N
Ph
Ph
4ab
1H NMR (600 MHz, CDCl3, 296K)
2.16
2.20
14.03
2.27
1.00
0.98
2.02
3.14
1.03
1.06
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)


140.18
139.64
137.23
133.25
129.71
128.71
128.68
128.29
128.16
128.05
127.58
126.83
126.49
126.05
61.86
53.78
39.00
Bn
Bn–N
Ph
Ph
4ab
13C NMR (150 MHz, CDCl3, 296K)
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)



4bb

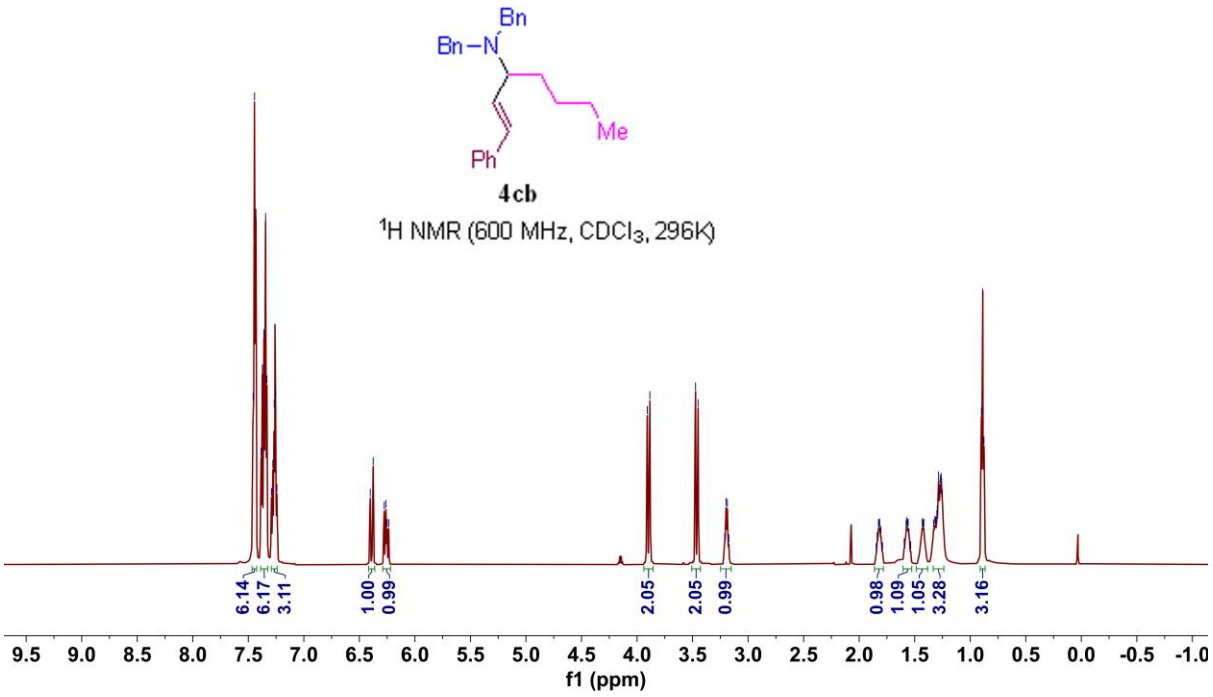
^{1}H NMR (600 MHz, $CDCl_3$, 296K)

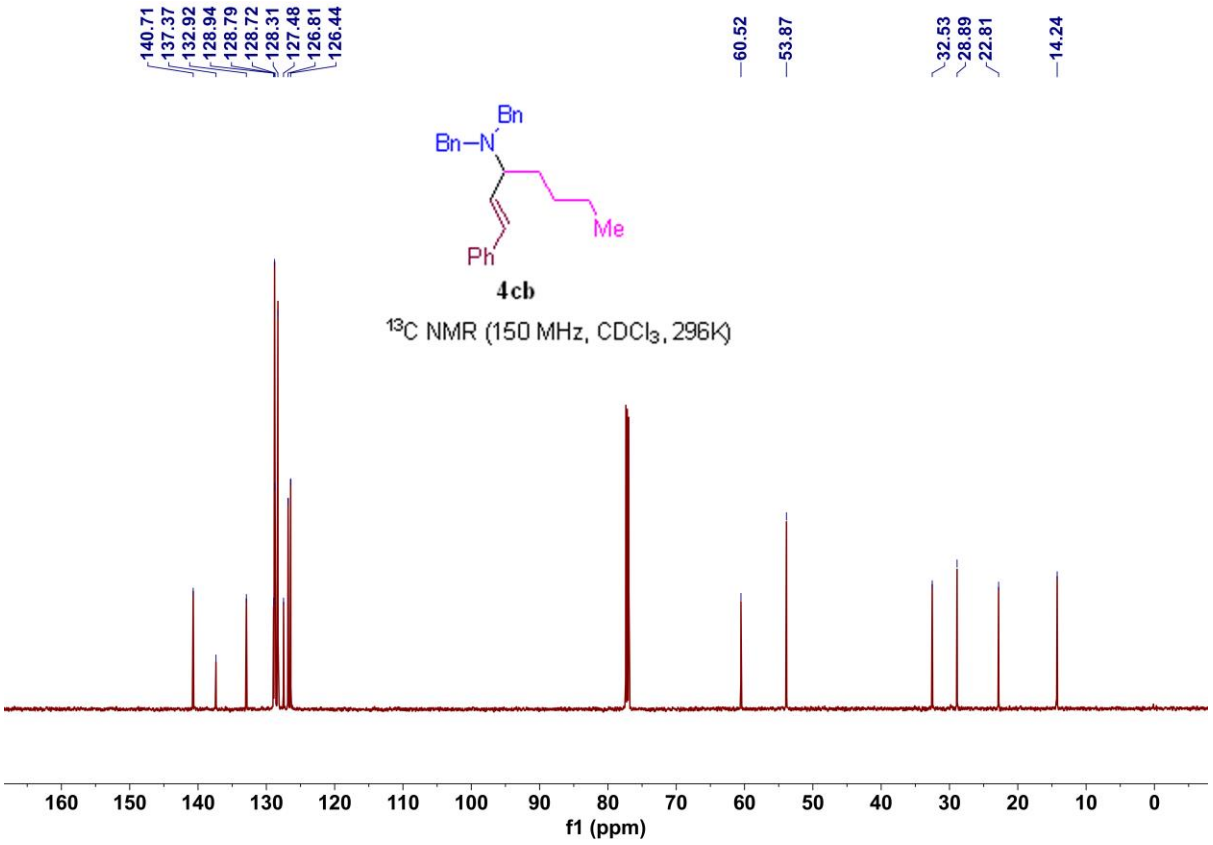


4bb

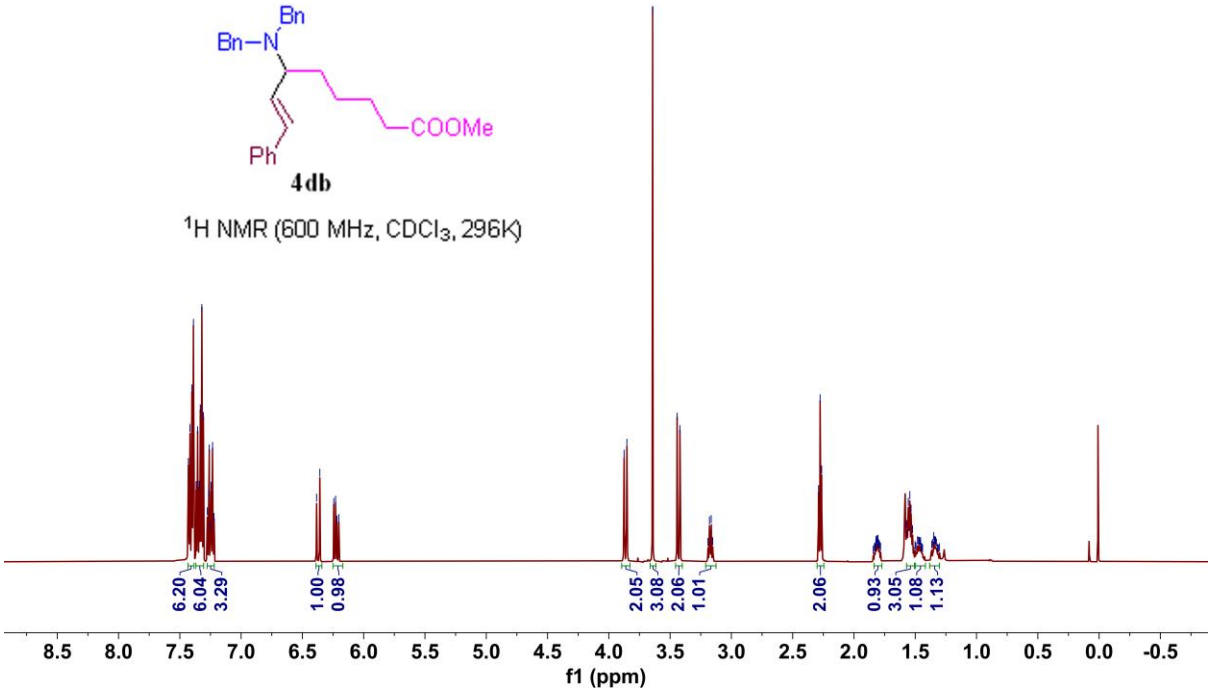
^{13}C NMR (150 MHz, $CDCl_3$, 296K)

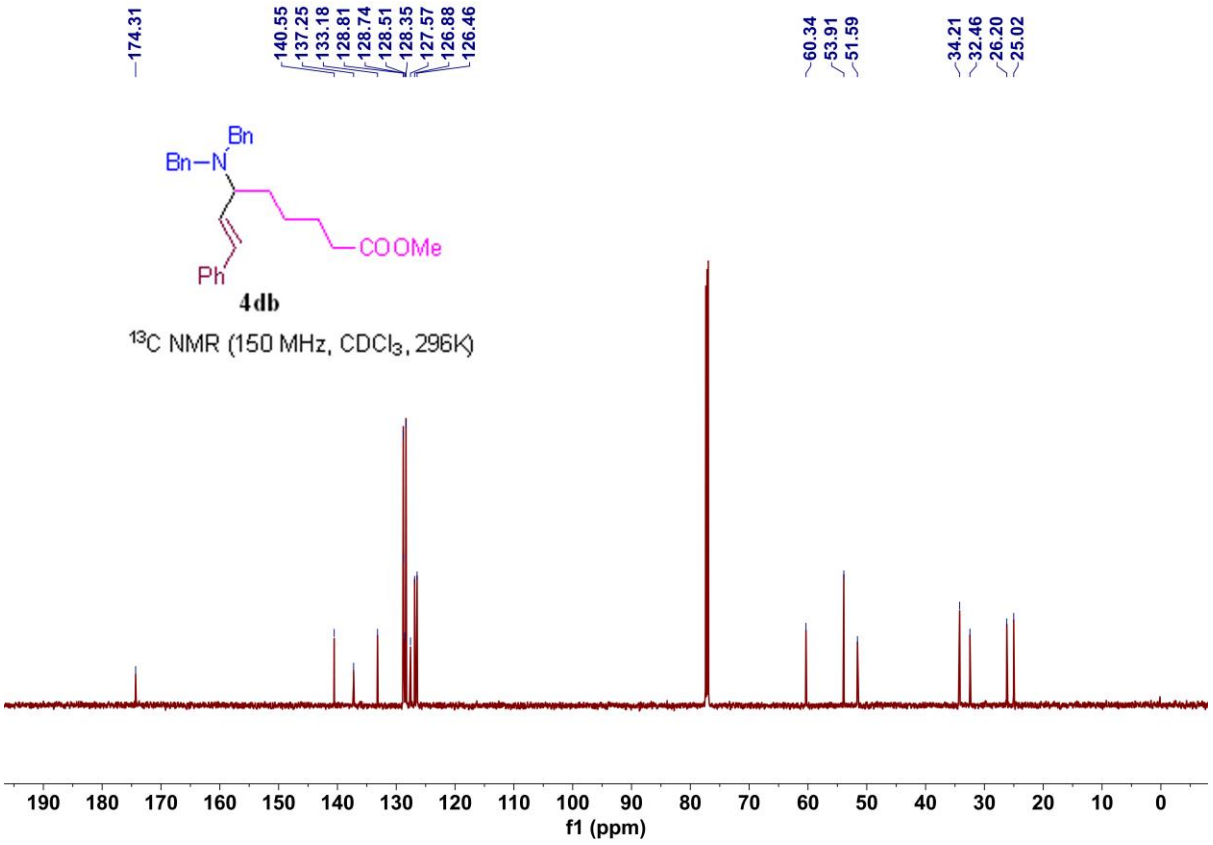

7.46
7.44
7.43
7.39
7.37
7.36
7.34
7.33
7.29
7.28
7.27
7.25
7.24
6.40
6.38
6.28
6.26
6.25
6.24
3.91
3.88
3.47
3.45
3.21
3.20
3.19
3.17
1.84
1.83
1.82
1.82
1.80
1.59
1.58
1.57
1.57
1.56
1.55
1.54
1.43
1.43
1.42
1.42
1.33
1.32
1.31
1.30
1.30
1.29
1.28
1.27
1.26
1.26
1.25
0.90
0.89
0.88

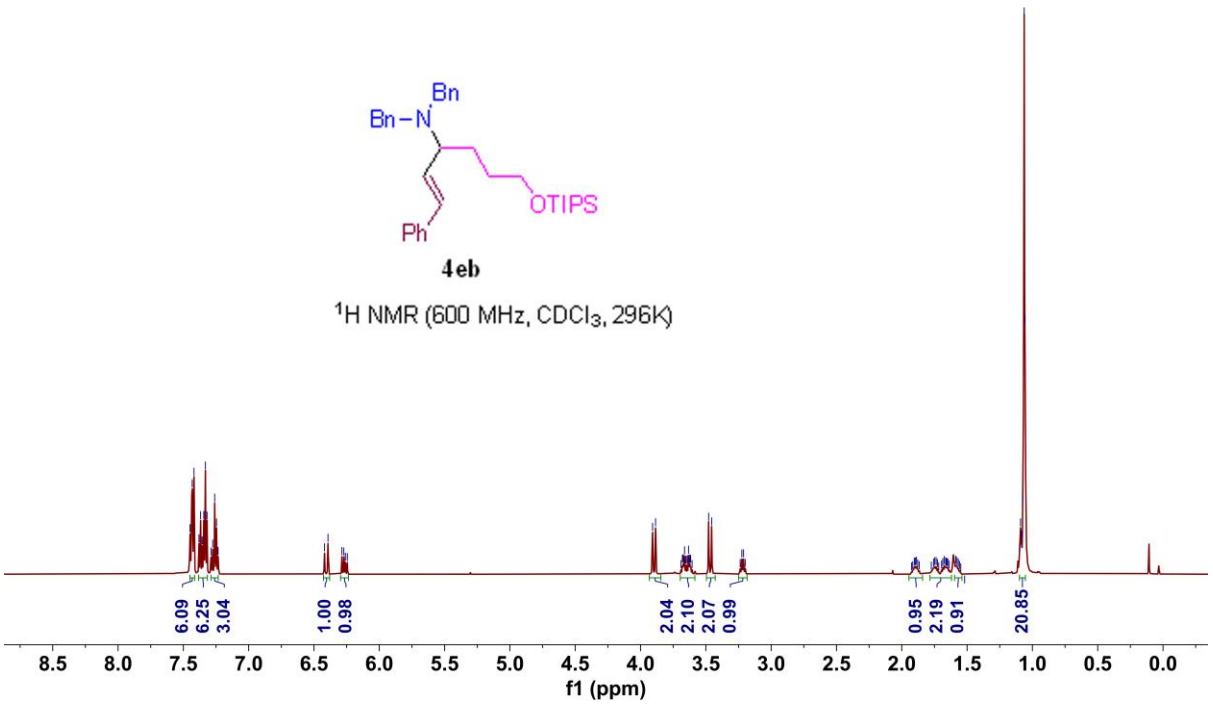

Bn
Bn–N
Me
Ph
4cb
^{1}H NMR (600 MHz, $CDCl_3$, 296K)
6.14
6.17
3.11
1.00
0.99
2.05
2.05
0.99
0.98
1.09
1.05
3.28
3.16
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)


140.71
137.37
132.92
128.94
128.79
128.72
128.31
127.48
126.81
126.44
60.52
53.87
32.53
28.89
22.81
14.24
Bn
Bn–N
Me
Ph
4cb
^{13}C NMR (150 MHz, $CDCl_3$, 296K)
160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


7.43 7.42 7.40 7.39 7.37 7.35 7.34 7.33 7.32 7.31 7.28 7.26 7.26 7.25 7.25 7.23 7.22 6.38 6.36 6.24 6.23 6.22 6.20
3.88 3.85 3.64 3.44 3.42 3.19 3.18 3.16 3.15 2.29 2.28 2.26 1.82 1.82 1.81 1.81 1.80 1.57 1.56 1.56 1.54 1.53 1.52 1.48 1.47 1.47 1.47 1.46 1.46 1.35 1.34 1.34 1.33 1.33

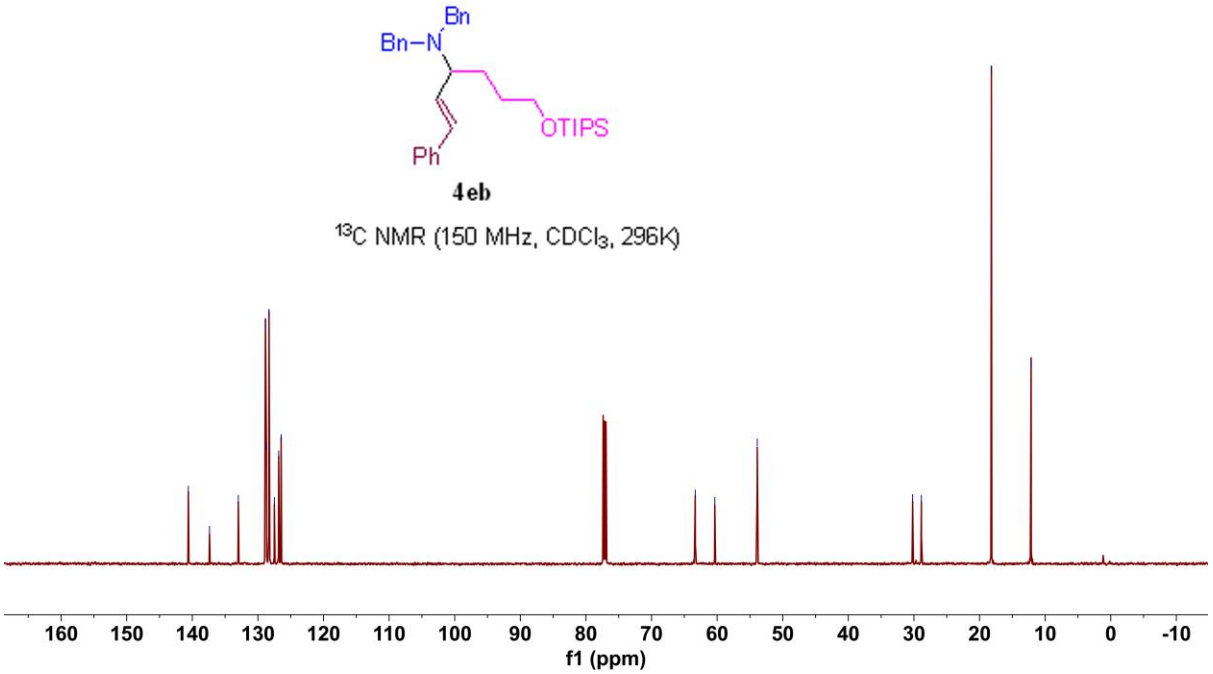

Bn
Bn—N
COOMe
Ph
4db
^{1}H NMR (600 MHz, $CDCl_3$, 296K)
6.20 6.04 3.29 1.00 0.98 2.05 3.08 2.06 1.01 2.06 0.93 3.05 1.08 1.13
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)


174.31
140.55 137.25 133.18 128.81 128.74 128.51 128.35 127.57 126.88 126.46
60.34 53.91 51.59
34.21 32.46 26.20 25.02
Bn
Bn—N
COOMe
Ph
4db
^{13}C NMR (150 MHz, $CDCl_3$, 296K)
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)



4eb

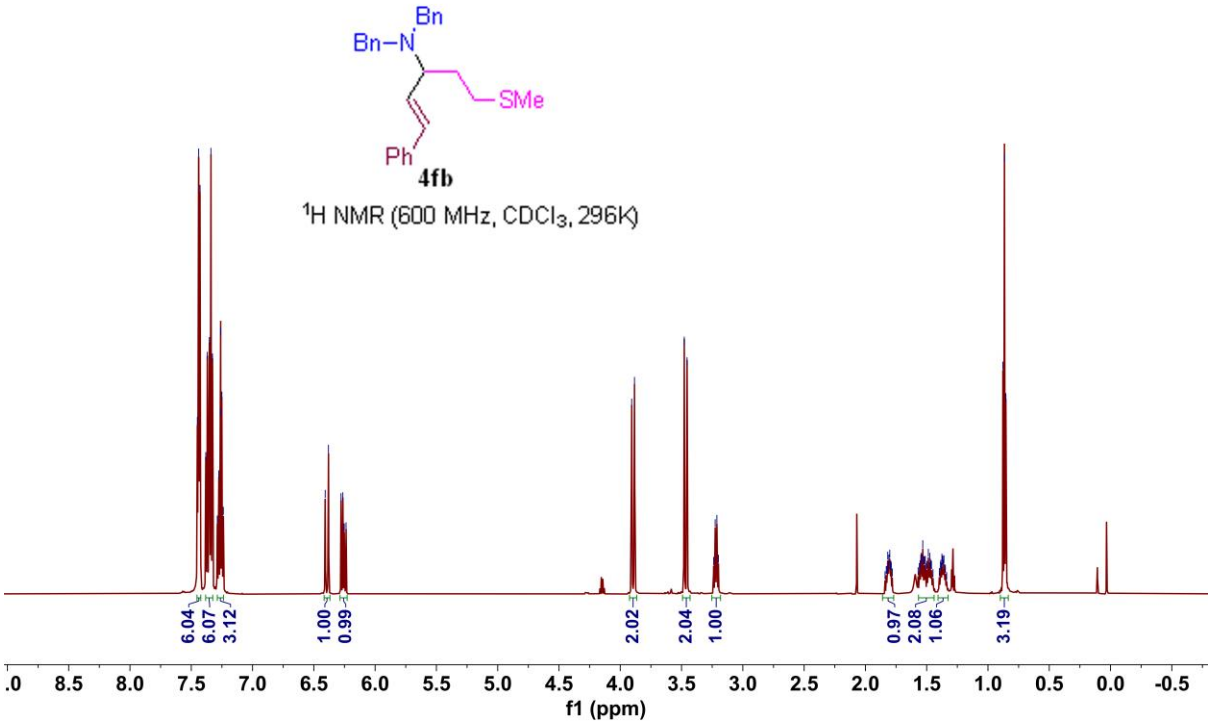
^{1}H NMR (600 MHz, $CDCl_3$, 296K)

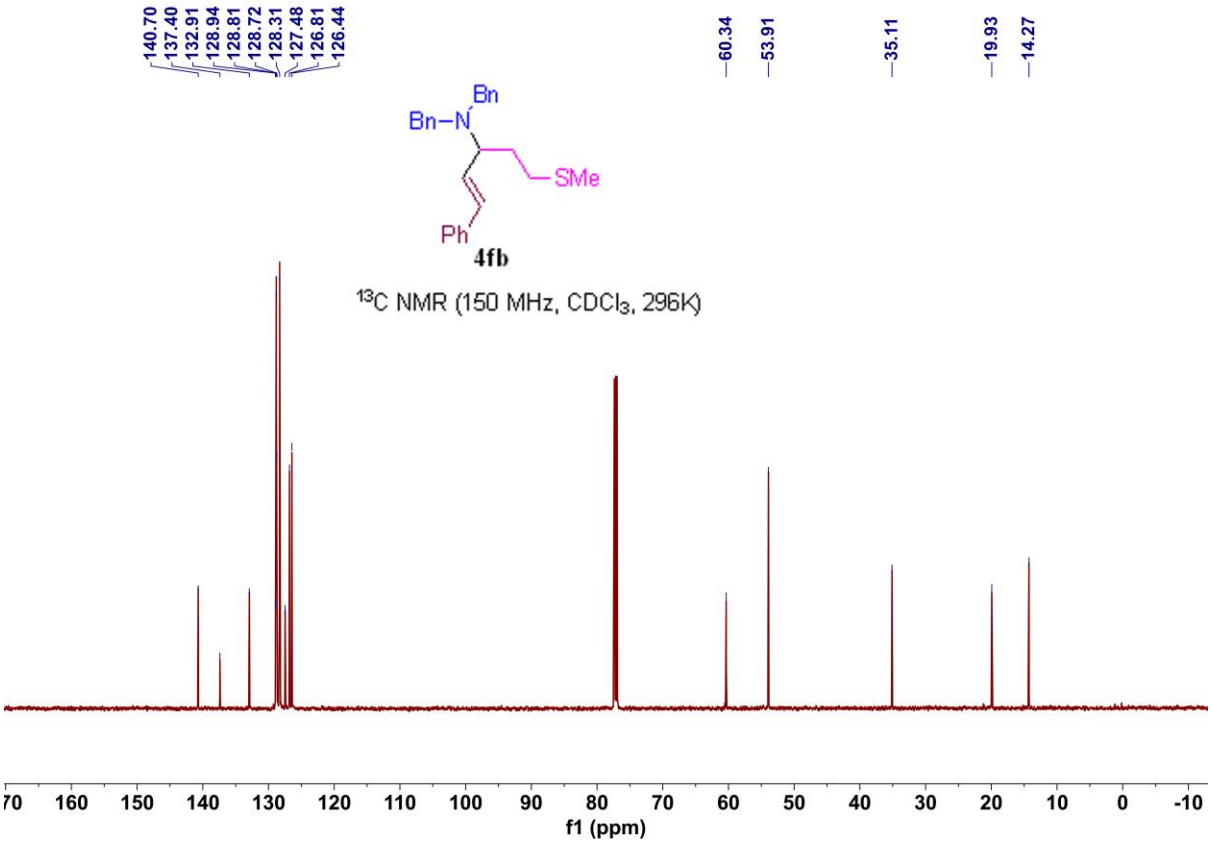


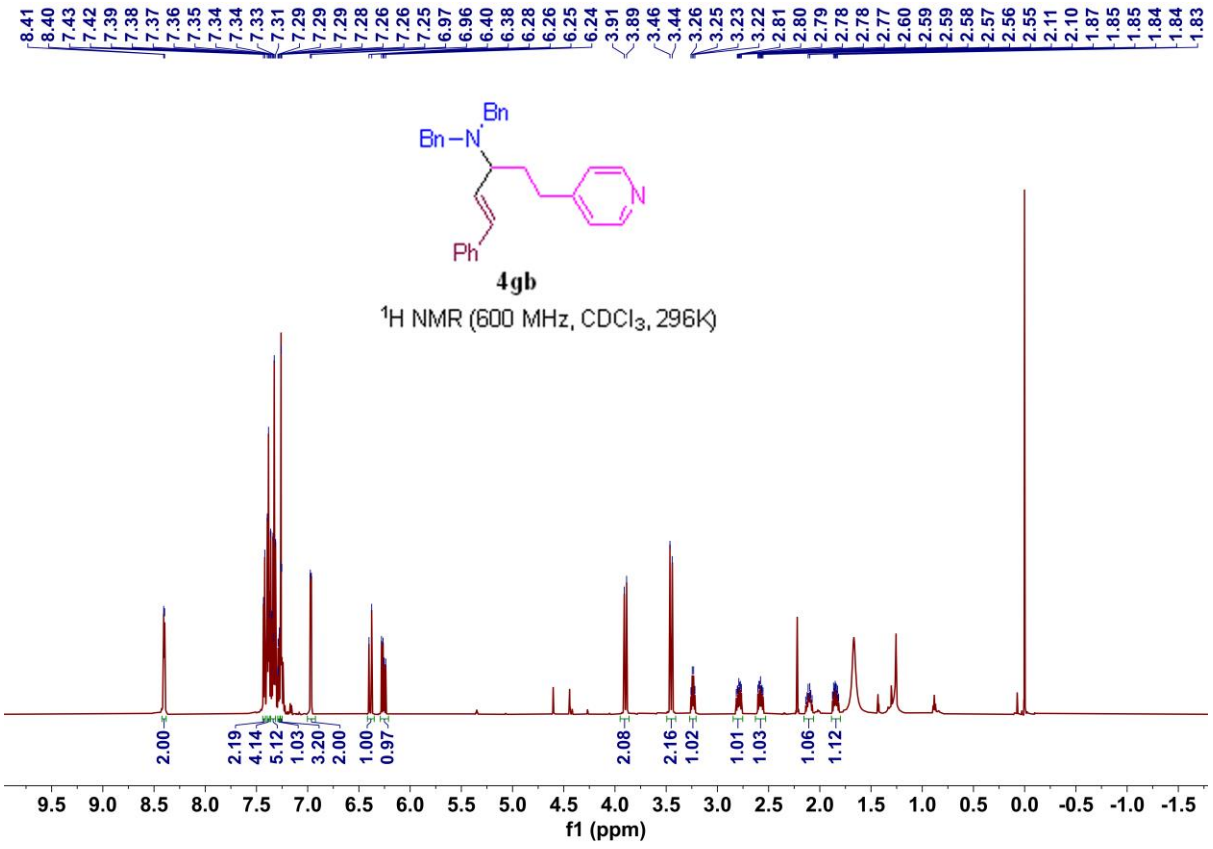
4eb

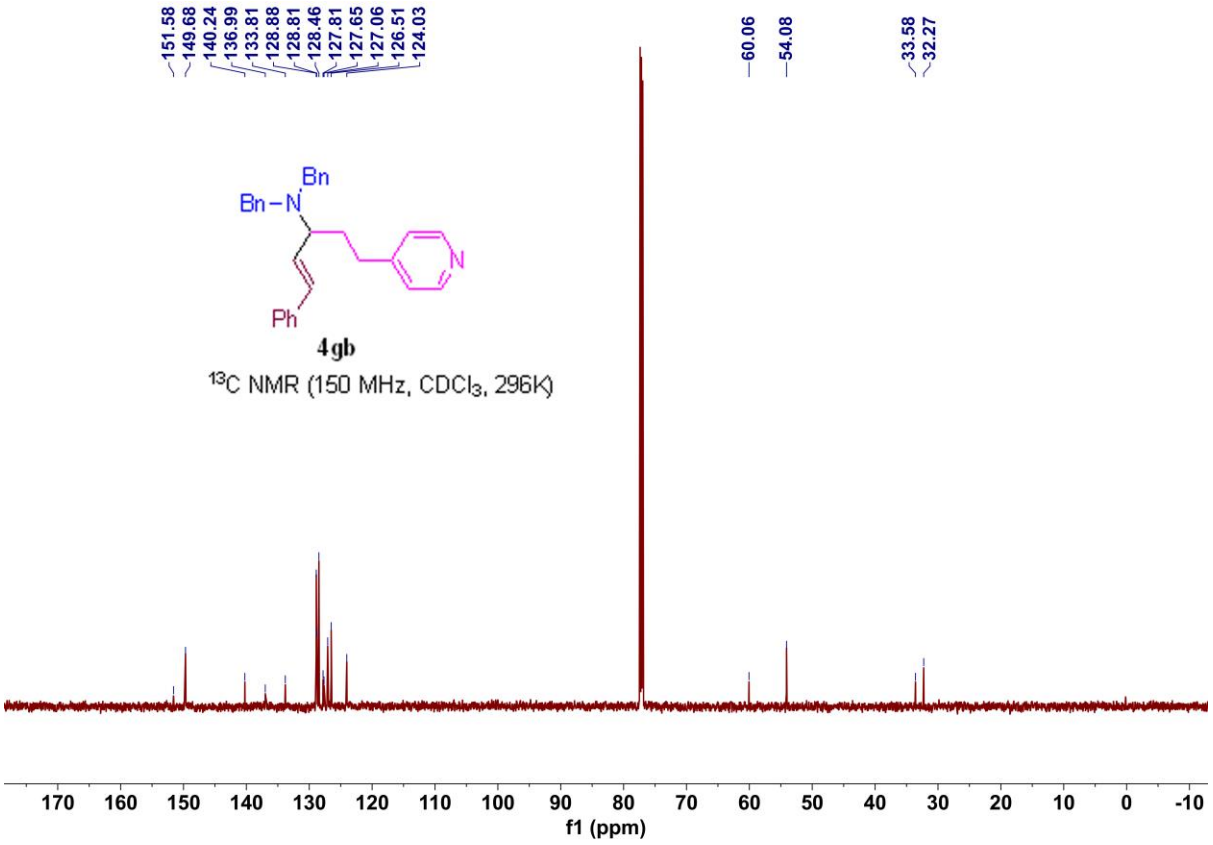
^{13}C NMR (150 MHz, $CDCl_3$, 296K)

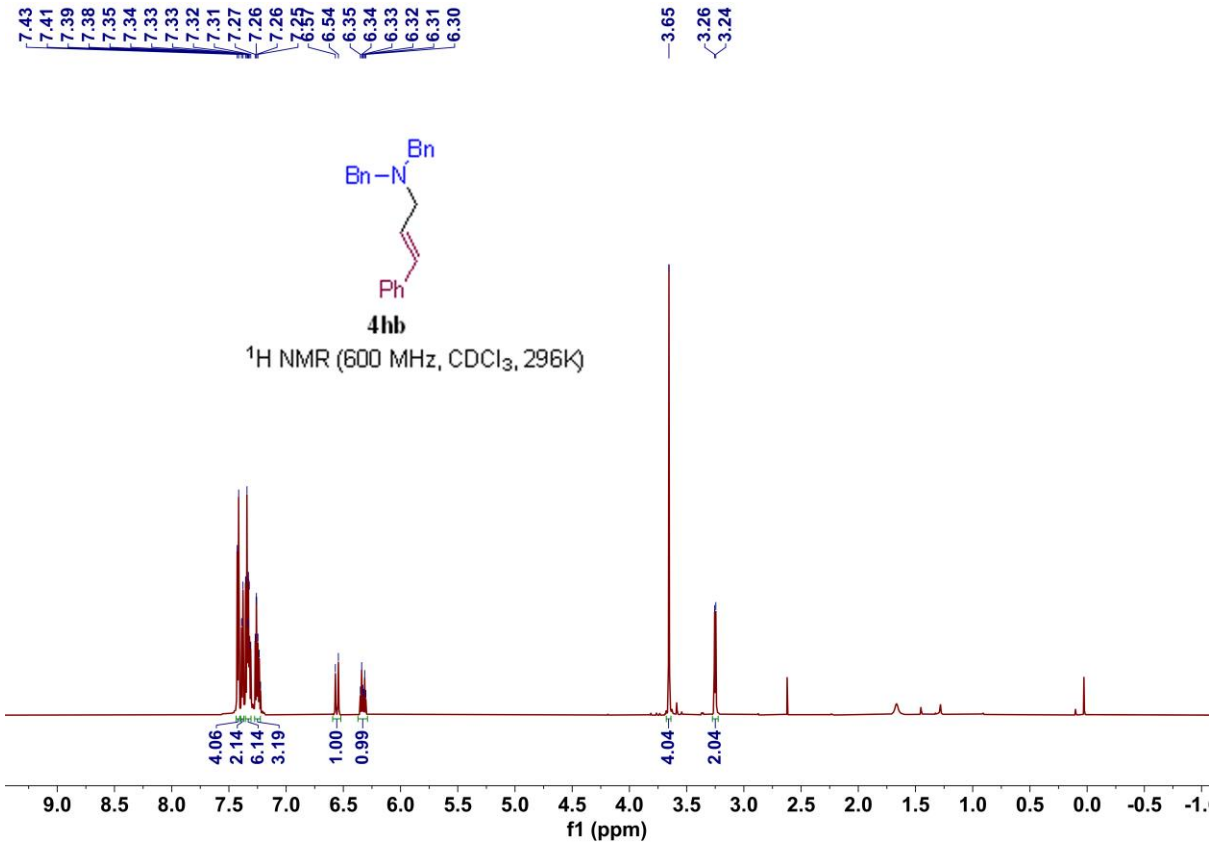

7.45 7.44 7.43 7.38 7.37 7.35 7.34 7.33 7.29 7.28 7.26 7.26 7.25 7.24 6.41 6.38 6.28 6.26 6.25 6.24 3.91 3.88 3.48 3.46 3.24 3.23 3.21 3.20 1.82 1.81 1.80 1.80 1.79 1.55 1.55 1.54 1.54 1.53 1.52 1.52 1.51 1.50 1.49 1.47 1.47 1.46 1.46 1.39 1.38 1.38 1.37 1.37 1.36 1.36 0.88 0.87 0.85

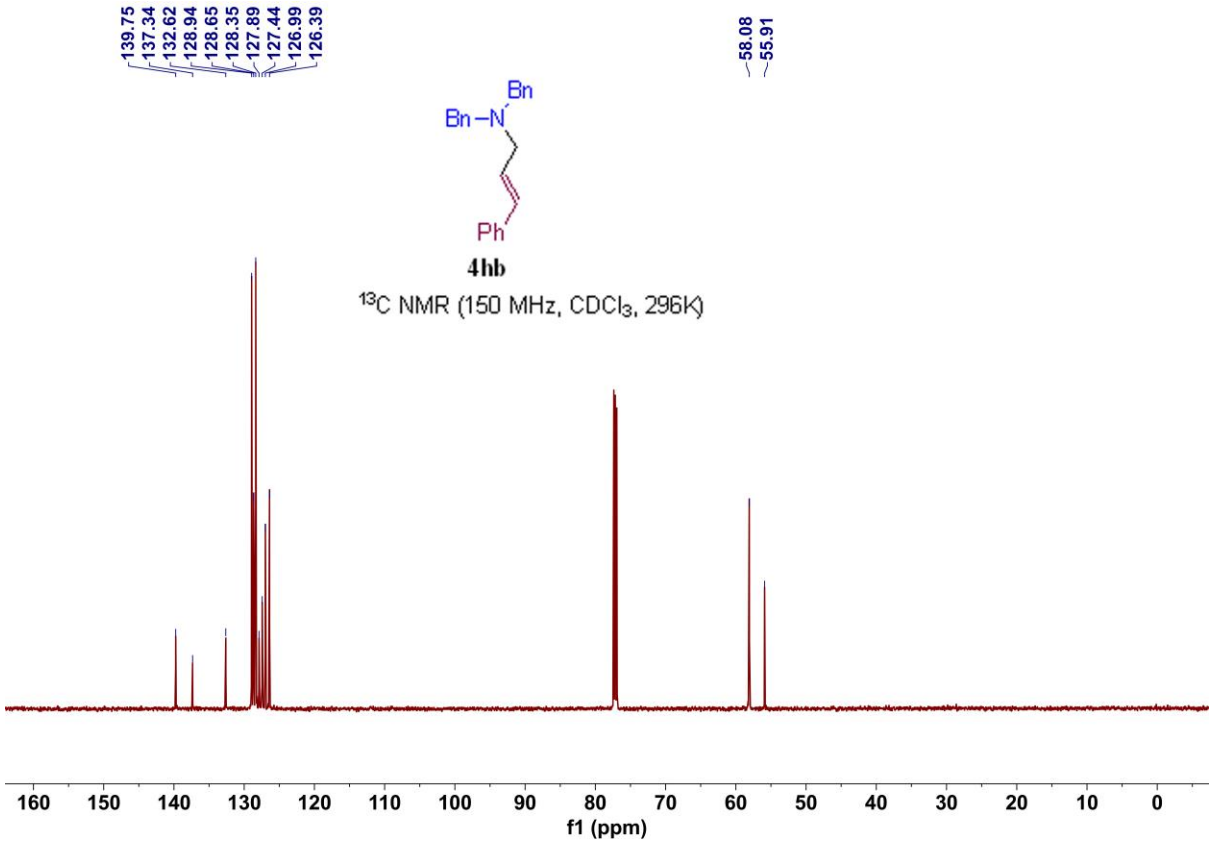

Bn
Bn–N
SMe
Ph
4fb
¹H NMR (600 MHz, CDCl3, 296K)
6.04 6.07 3.12 1.00 0.99 2.02 2.04 1.00 0.97 2.08 1.06 3.19
f1 (ppm)

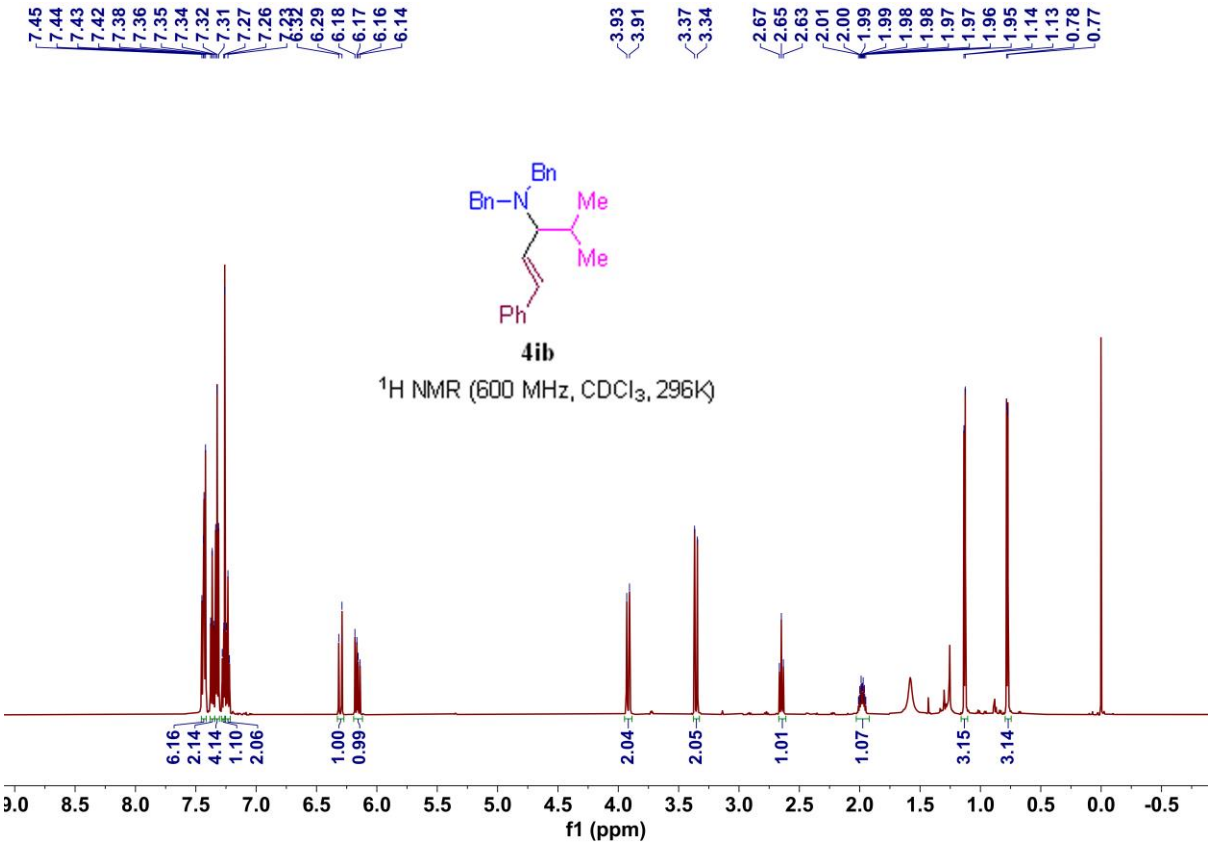

140.70 137.40 132.91 128.94 128.81 128.72 128.31 127.48 126.81 126.44
60.34 53.91 35.11 19.93 14.27
Bn
Bn–N
SMe
Ph
4fb
¹³C NMR (150 MHz, CDCl3, 296K)
f1 (ppm)

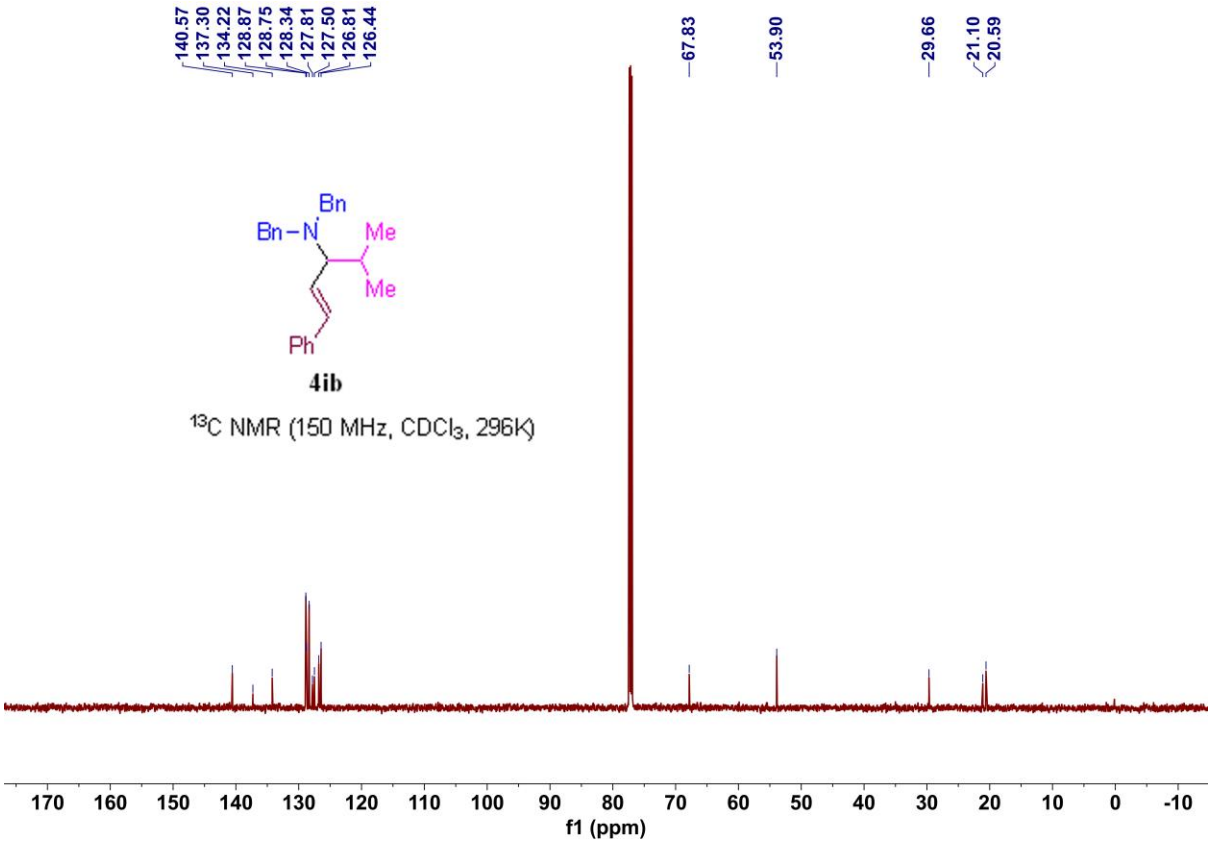

8.41 8.40 7.43 7.42 7.39 7.38 7.37 7.36 7.35 7.34 7.34 7.33 7.31 7.29 7.29 7.29 7.28 7.26 7.26 7.25 6.97 6.96 6.40 6.38 6.28 6.26 6.25 6.24 3.91 3.89 3.46 3.44 3.26 3.25 3.23 3.22 2.81 2.80 2.79 2.78 2.78 2.77 2.60 2.59 2.59 2.58 2.57 2.56 2.55 2.11 2.10 1.87 1.85 1.85 1.84 1.84 1.83
Bn
Bn–N
N
Ph
4gb
¹H NMR (600 MHz, CDCl3, 296K)
2.00 2.19 4.14 5.12 1.03 3.20 2.00 1.00 0.97 2.08 2.16 1.02 1.01 1.03 1.06 1.12
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)

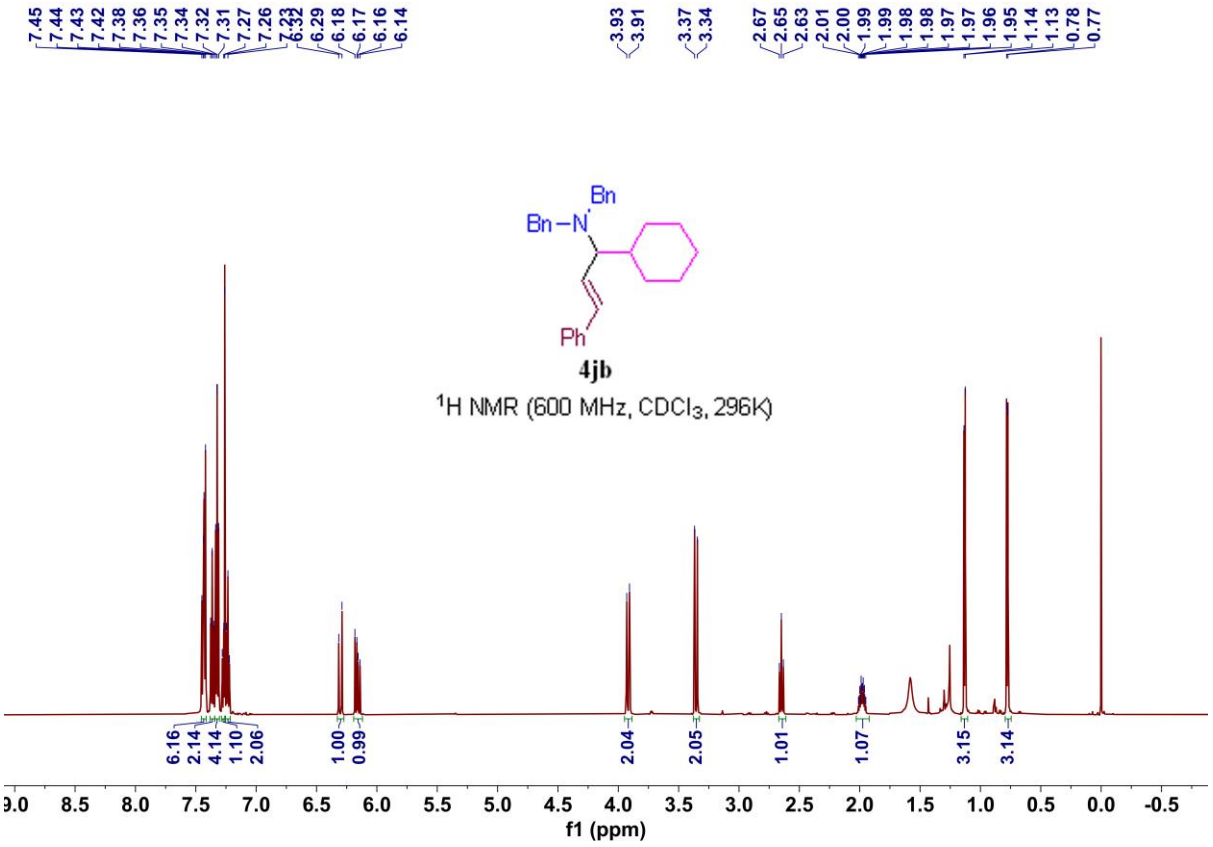

151.58 149.68 140.24 136.99 133.81 128.88 128.81 128.46 127.81 127.65 127.06 126.51 124.03
60.06 54.08 33.58 32.27
Bn
Bn–N
N
Ph
4gb
¹³C NMR (150 MHz, CDCl3, 296K)
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

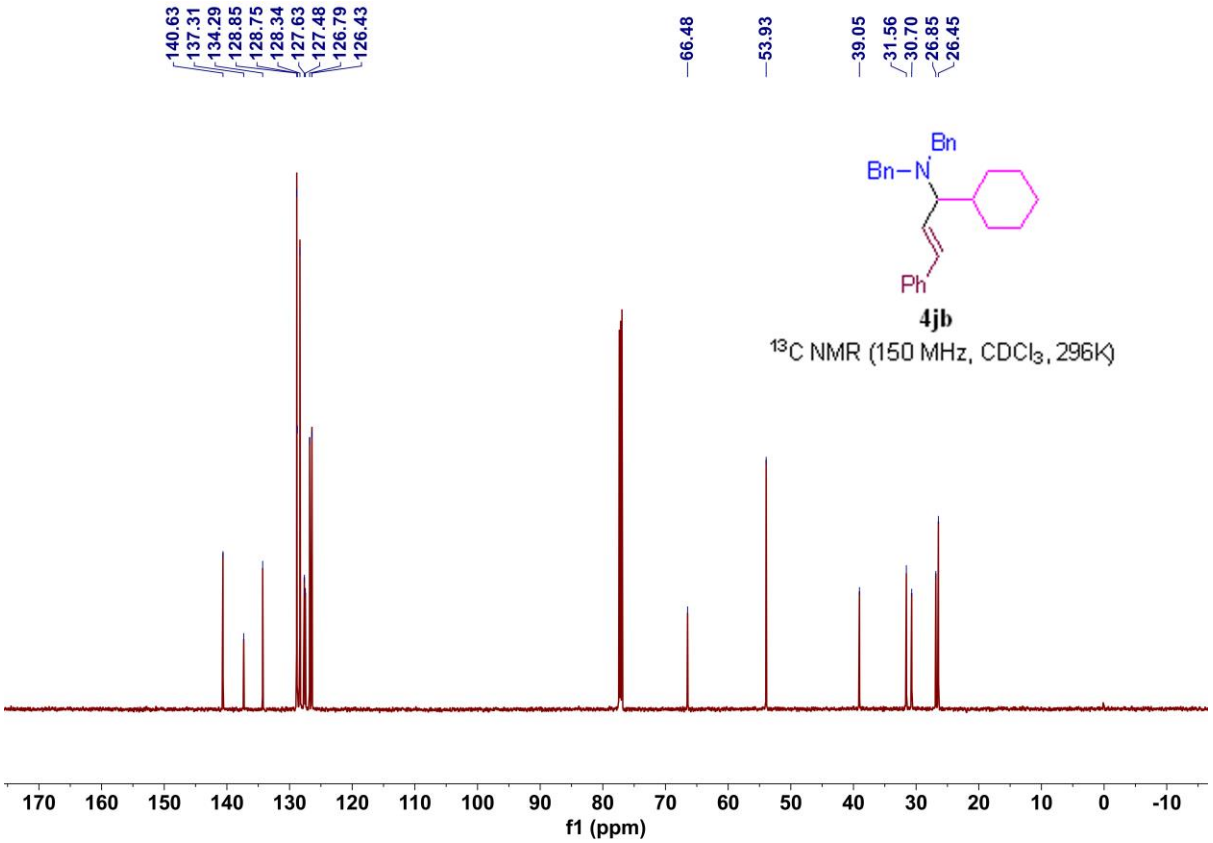

7.43
7.41
7.39
7.38
7.35
7.34
7.33
7.33
7.32
7.31
7.27
7.26
7.26
7.25
6.57
6.54
6.35
6.34
6.33
6.32
6.31
6.30
3.65
3.26
3.24
Bn
Bn–N
Ph
4hb
1H NMR (600 MHz, CDCl3, 296K)
4.06
2.14
6.14
3.19
1.00
0.99
4.04
2.04
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

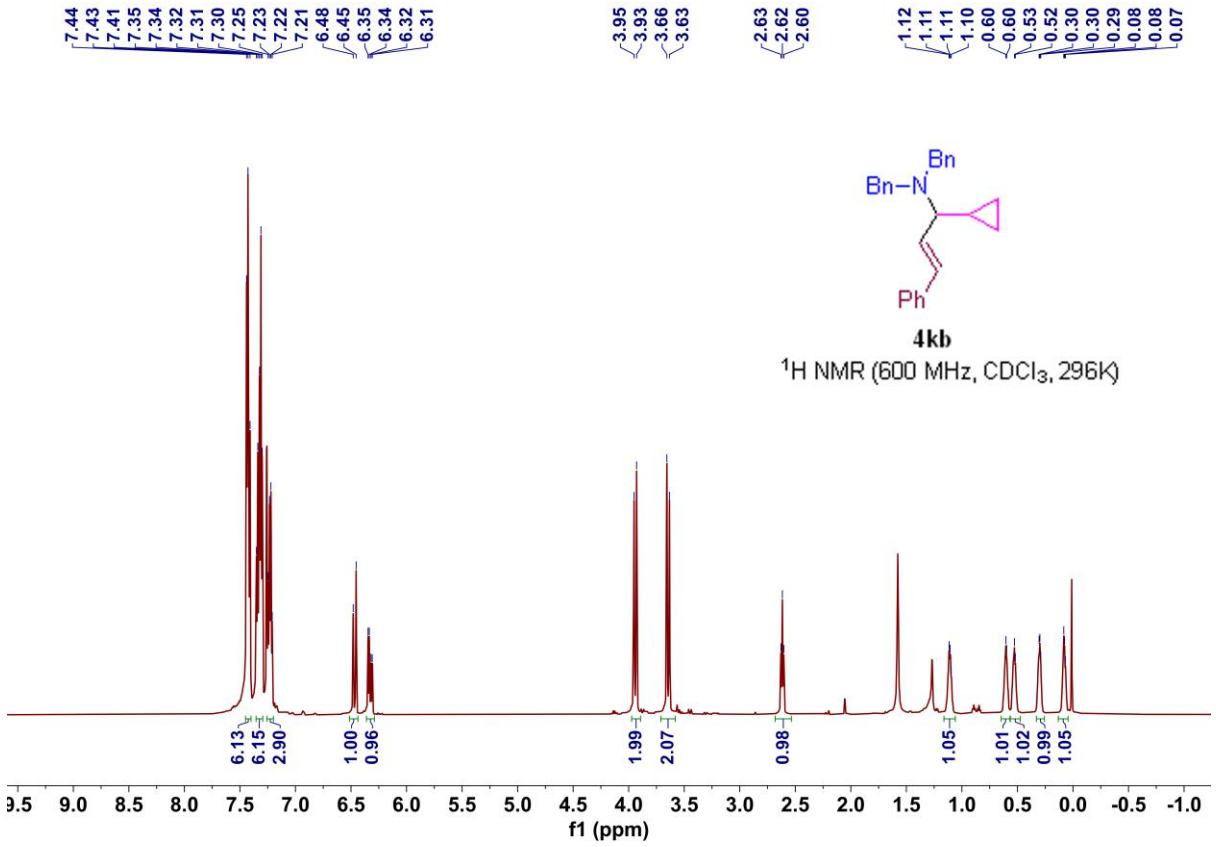

139.75
137.34
132.62
128.94
128.65
128.35
127.89
127.44
126.99
126.39
58.08
55.91
Bn
Bn–N
Ph
4hb
13C NMR (150 MHz, CDCl3, 296K)
160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

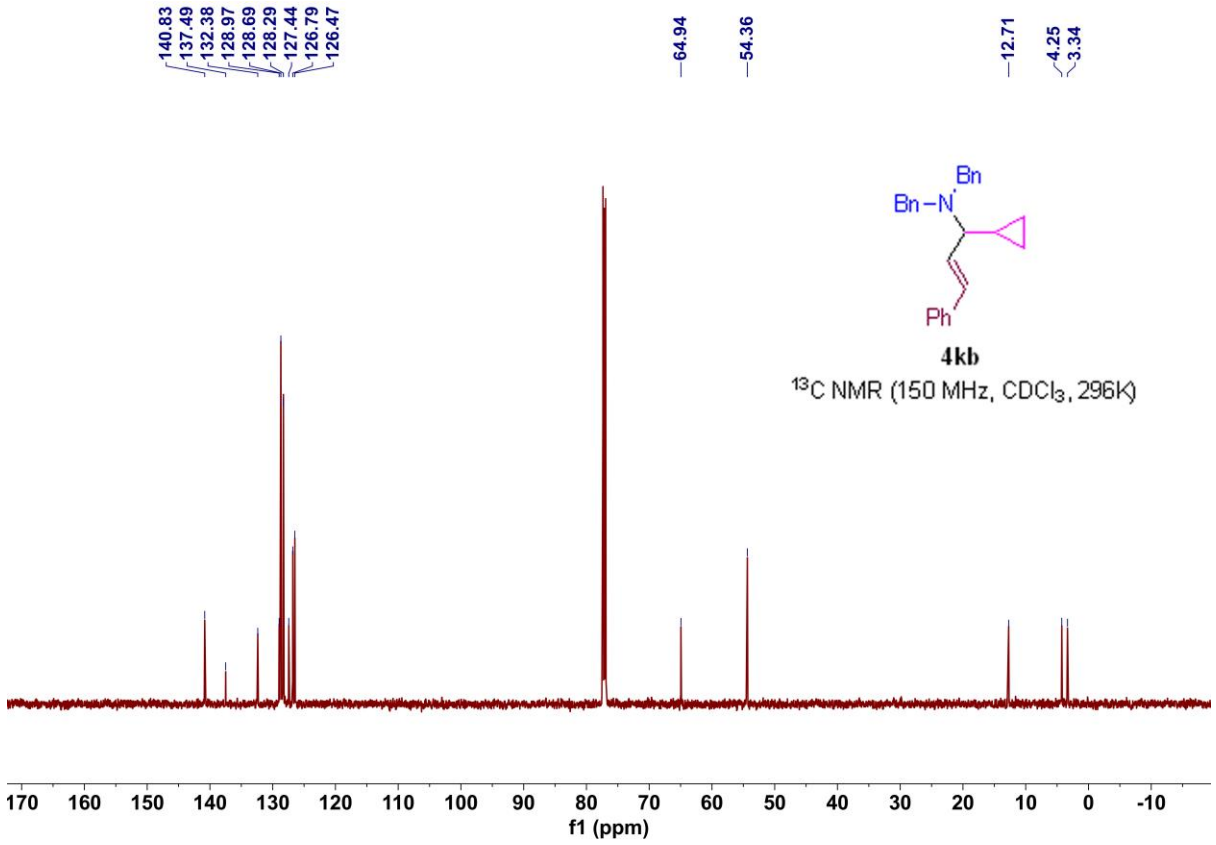

7.45 7.44 7.43 7.42 7.38 7.36 7.35 7.34 7.32 7.31 7.27 7.26 7.23 6.32 6.29 6.18 6.17 6.16 6.14
3.93 3.91 3.37 3.34
2.67 2.65 2.63 2.01 2.00 1.99 1.99 1.98 1.98 1.97 1.97 1.96 1.95 1.14 1.13 0.78 0.77
Bn
Bn–N
Me
Me
Ph
4ib
1H NMR (600 MHz, CDCl3, 296K)
6.16 2.14 4.14 1.10 2.06 1.00 0.99 2.04 2.05 1.01 1.07 3.15 3.14
f1 (ppm)

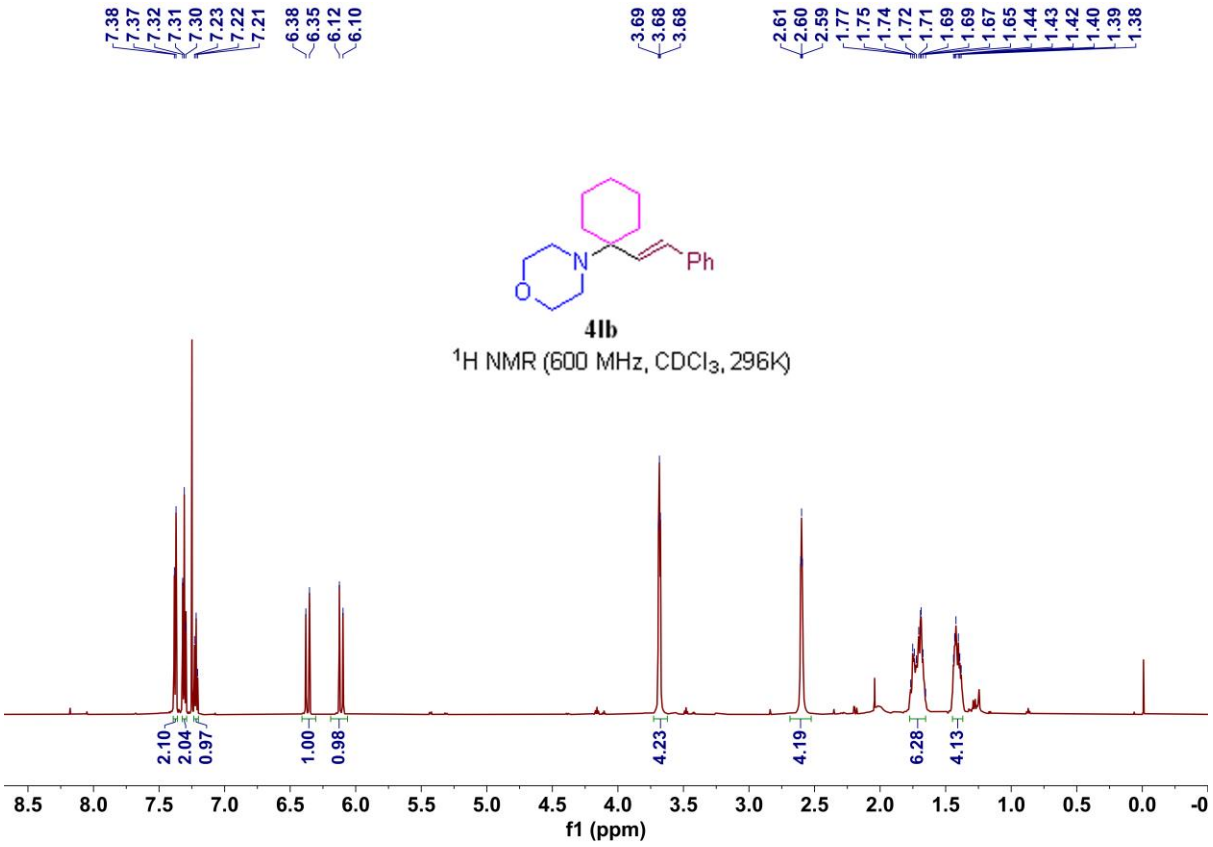

140.57 137.30 134.22 128.87 128.75 128.34 127.81 127.50 126.81 126.44
67.83
53.90
29.66
21.10 20.59
Bn
Bn–N
Me
Me
Ph
4ib
13C NMR (150 MHz, CDCl3, 296K)
f1 (ppm)

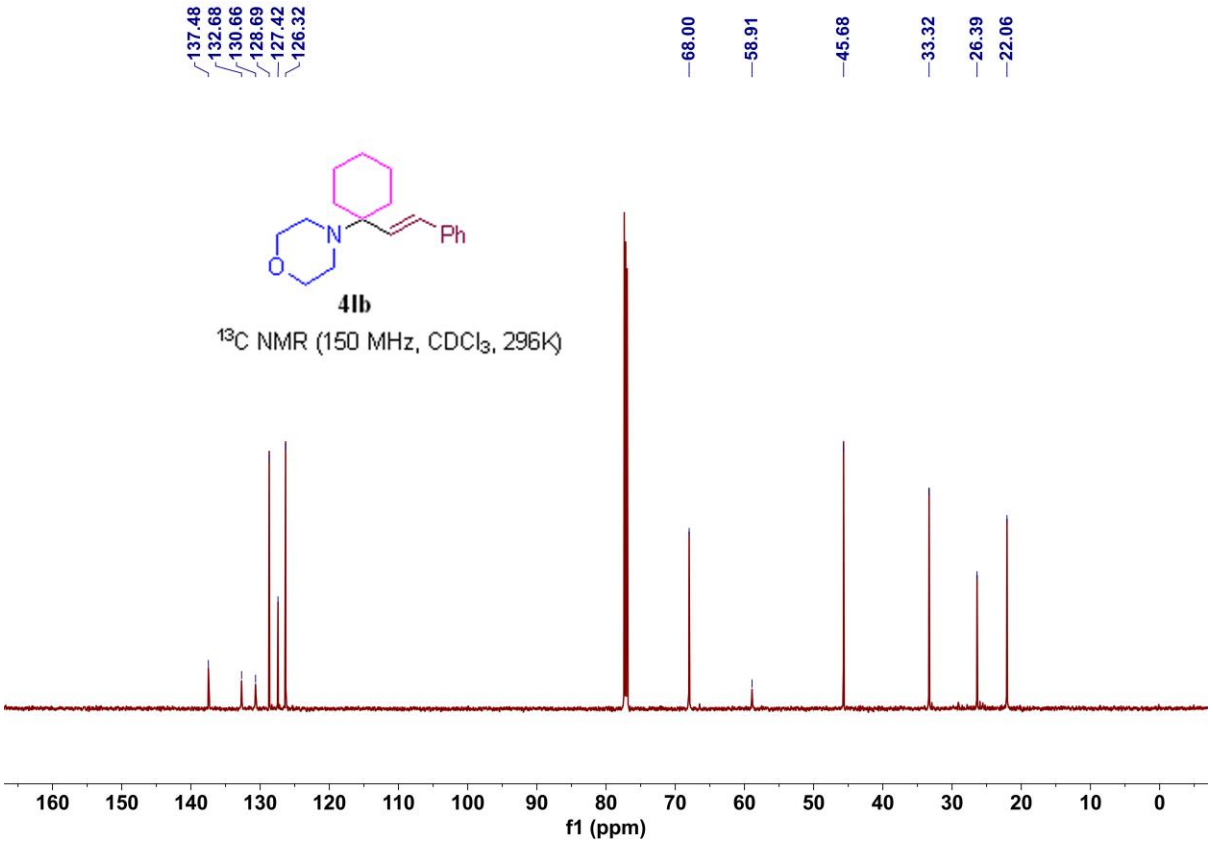

7.45 7.44 7.43 7.42 7.38 7.36 7.35 7.34 7.32 7.31 7.27 7.26 7.23 6.32 6.29 6.18 6.17 6.16 6.14
3.93 3.91 3.37 3.34
2.67 2.65 2.63 2.01 2.00 1.99 1.99 1.98 1.98 1.97 1.97 1.96 1.95 1.14 1.13 0.78 0.77
Bn
Bn–N
Ph
4jb
1H NMR (600 MHz, CDCl3, 296K)
6.16 2.14 4.14 1.10 2.06 1.00 0.99 2.04 2.05 1.01 1.07 3.15 3.14
f1 (ppm)

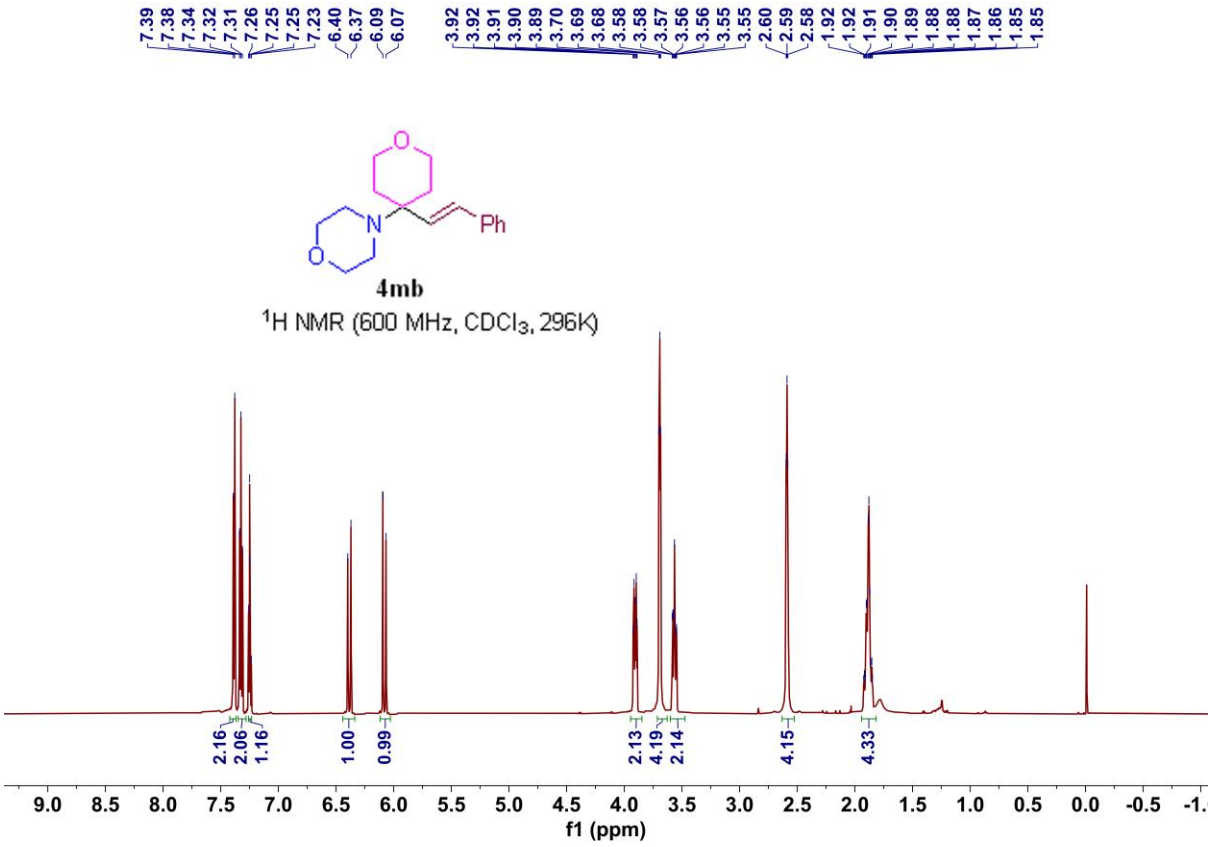

140.63 137.31 134.29 128.85 128.75 128.34 127.63 127.48 126.79 126.43
66.48 53.93 39.05 31.56 30.70 26.85 26.45
Bn
Bn–N
Ph
4jb
13C NMR (150 MHz, CDCl3, 296K)
f1 (ppm)

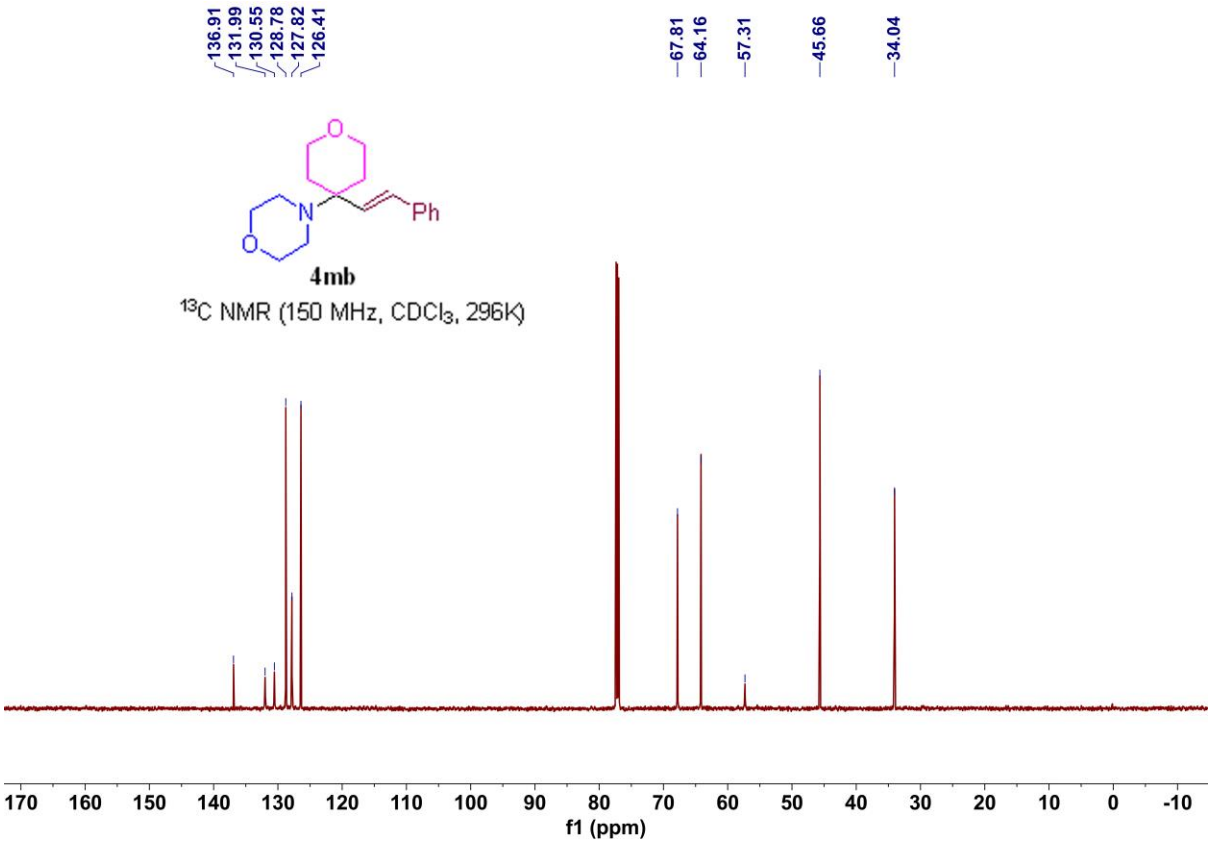

7.44
7.43
7.41
7.35
7.34
7.32
7.31
7.30
7.25
7.23
7.22
7.21
6.48
6.45
6.35
6.34
6.32
6.31
3.95
3.93
3.66
3.63
2.63
2.62
2.60
1.12
1.11
1.11
1.10
0.60
0.60
0.53
0.52
0.30
0.30
0.29
0.08
0.08
0.07
Bn
Bn–N
Ph
4kb
1H NMR (600 MHz, CDCl3, 296K)
6.13
6.15
2.90
1.00
0.96
1.99
2.07
0.98
1.05
1.01
1.02
0.99
1.05
f1 (ppm)

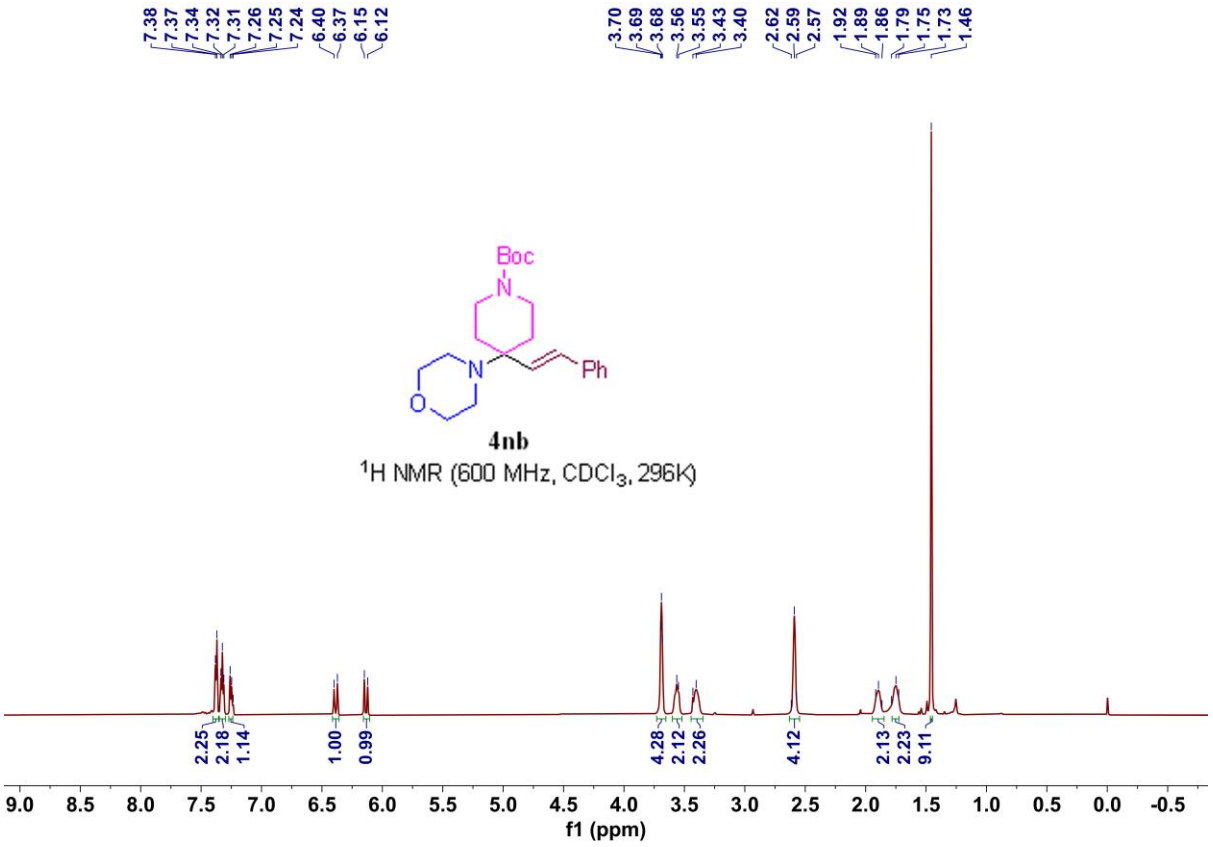

140.83
137.49
132.38
128.97
128.69
128.29
127.44
126.79
126.47
64.94
54.36
12.71
4.25
3.34
Bn
Bn–N
Ph
4kb
13C NMR (150 MHz, CDCl3, 296K)
f1 (ppm)

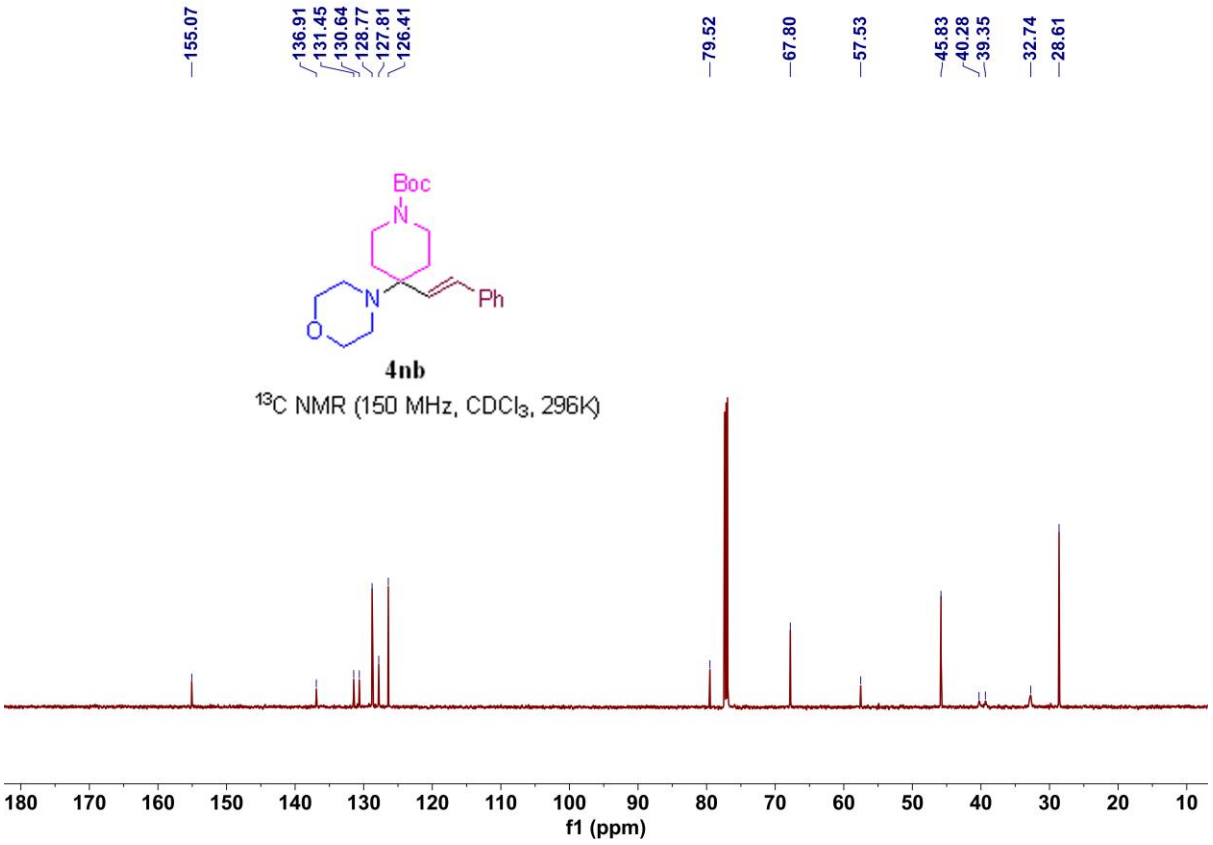

7.38
7.37
7.32
7.31
7.30
7.23
7.22
7.21
6.38
6.35
6.12
6.10
3.69
3.68
3.68
2.61
2.60
2.59
1.77
1.75
1.74
1.72
1.71
1.69
1.69
1.67
1.65
1.44
1.43
1.42
1.40
1.39
1.38
Ph
N
O
4Ib
^{1}H NMR (600 MHz, $CDCl_3$, 296K)
2.10
2.04
0.97
1.00
0.98
4.23
4.19
6.28
4.13
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0
f1 (ppm)

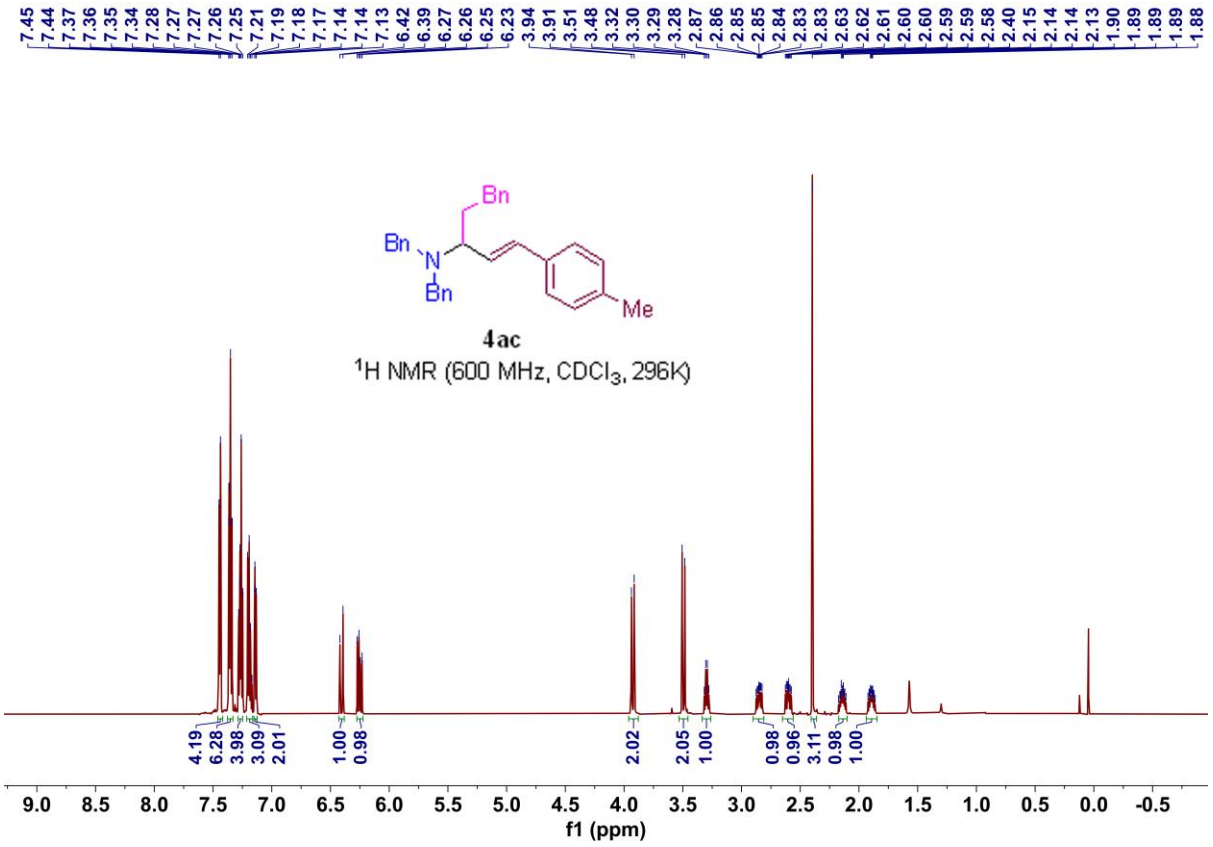

137.48
132.68
130.66
128.69
127.42
126.32
68.00
58.91
45.68
33.32
26.39
22.06
Ph
N
O
4Ib
^{13}C NMR (150 MHz, $CDCl_3$, 296K)
160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

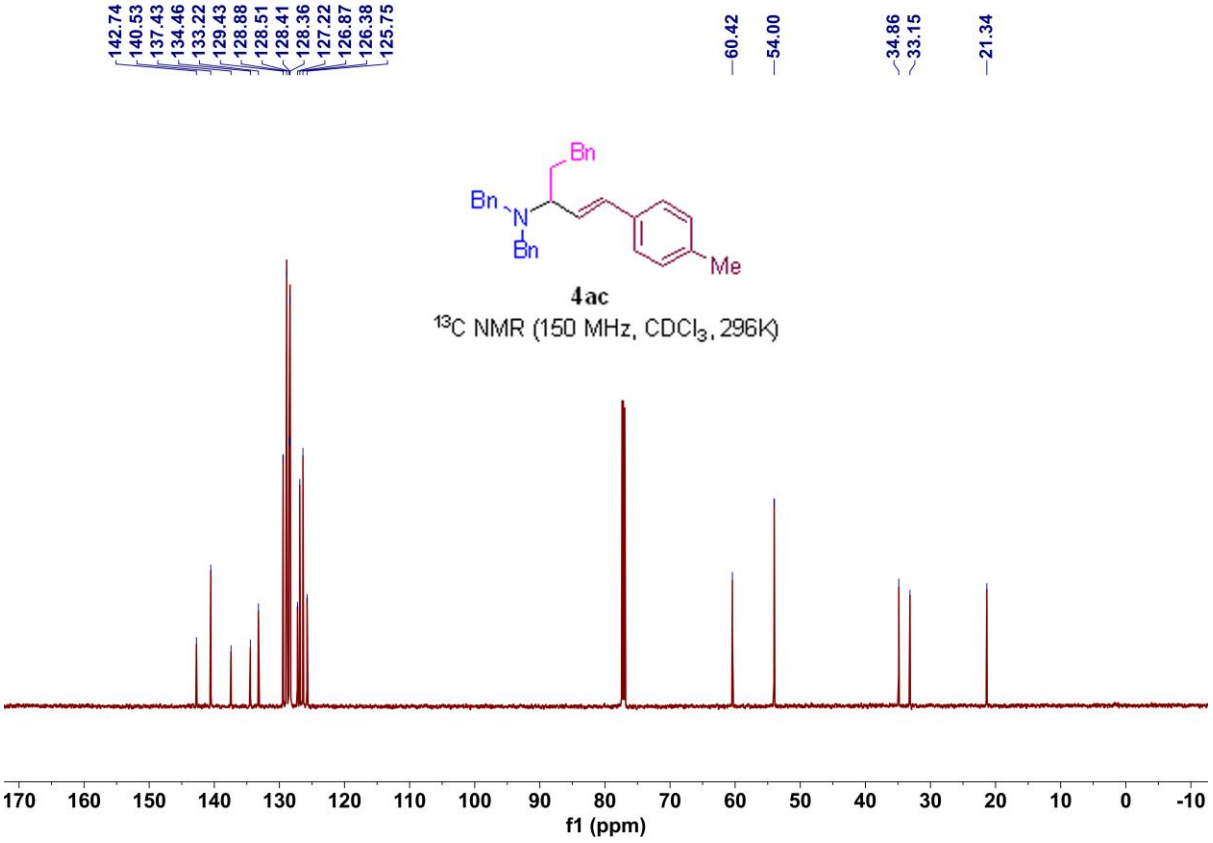

7.39 7.38 7.34 7.32 7.31 7.26 7.25 7.25 7.23 6.40 6.37 6.09 6.07
3.92 3.92 3.91 3.90 3.89 3.70 3.69 3.68 3.58 3.58 3.57 3.56 3.56 3.55 3.55 2.60 2.59 2.58 1.92 1.92 1.91 1.90 1.89 1.88 1.88 1.87 1.86 1.85 1.85
O
N
O
Ph
4mb
1H NMR (600 MHz, CDCl3, 296K)
2.16 2.06 1.16 1.00 0.99 2.13 4.19 2.14 4.15 4.33
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.
f1 (ppm)

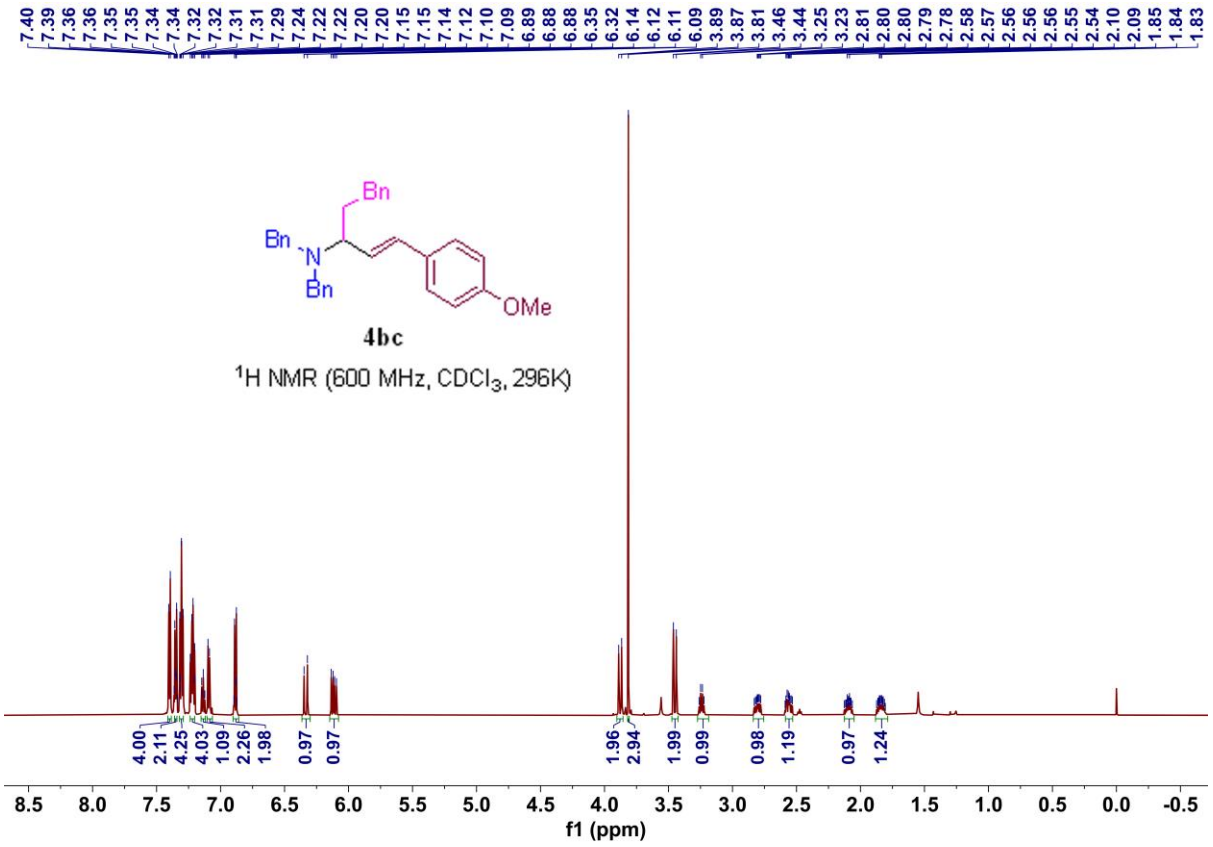

136.91 131.99 130.55 128.78 127.82 126.41
67.81 64.16 57.31 45.66 34.04
O
N
O
Ph
4mb
13C NMR (150 MHz, CDCl3, 296K)
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

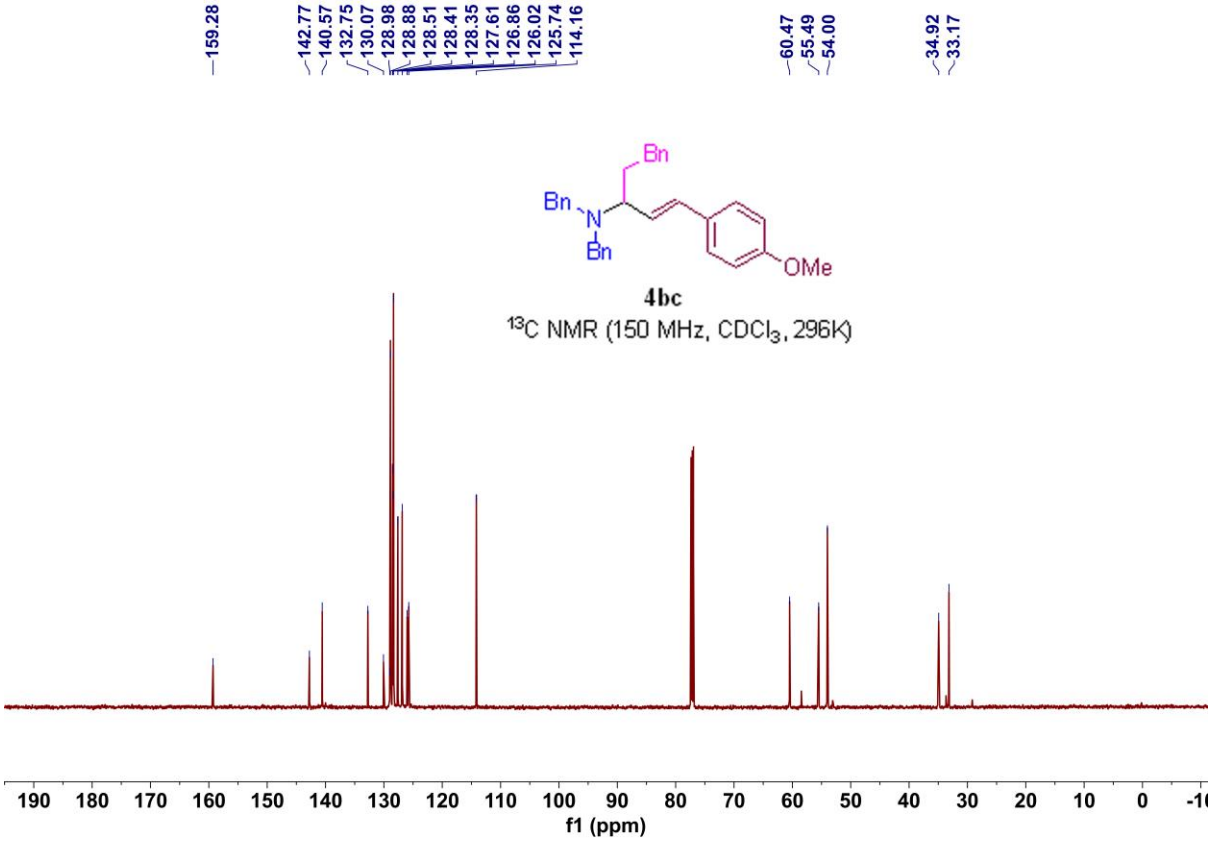

7.38
7.37
7.34
7.32
7.31
7.26
7.25
7.24
6.40
6.37
6.15
6.12
3.70
3.69
3.68
3.56
3.55
3.43
3.40
2.62
2.59
2.57
1.92
1.89
1.86
1.79
1.75
1.73
1.46
Boc
N
N
O
Ph
4nb
1H NMR (600 MHz, CDCl3, 296K)
2.25
2.18
1.14
1.00
0.99
4.28
2.12
2.26
4.12
2.13
2.23
9.11
f1 (ppm)

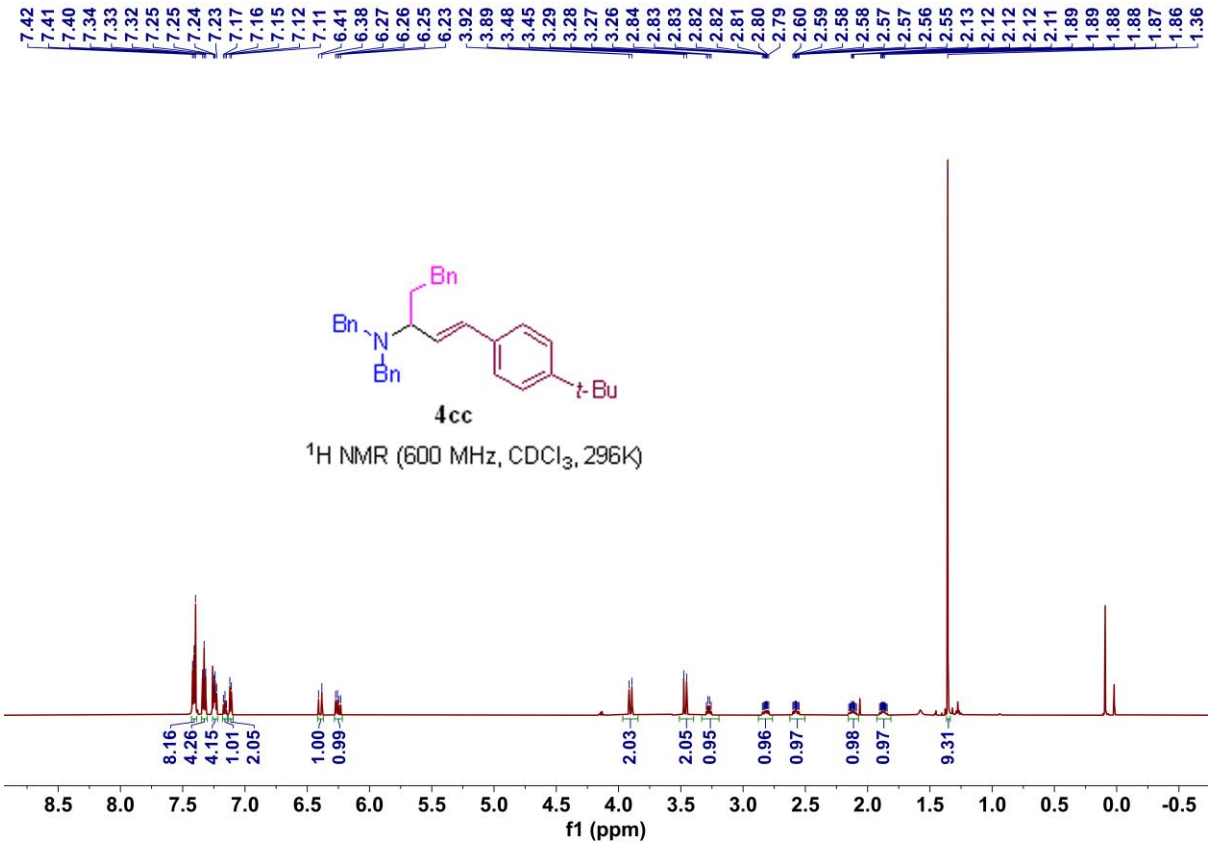

155.07
136.91
131.45
130.64
128.77
127.81
126.41
79.52
67.80
57.53
45.83
40.28
39.35
32.74
28.61
Boc
N
N
O
Ph
4nb
13C NMR (150 MHz, CDCl3, 296K)
f1 (ppm)

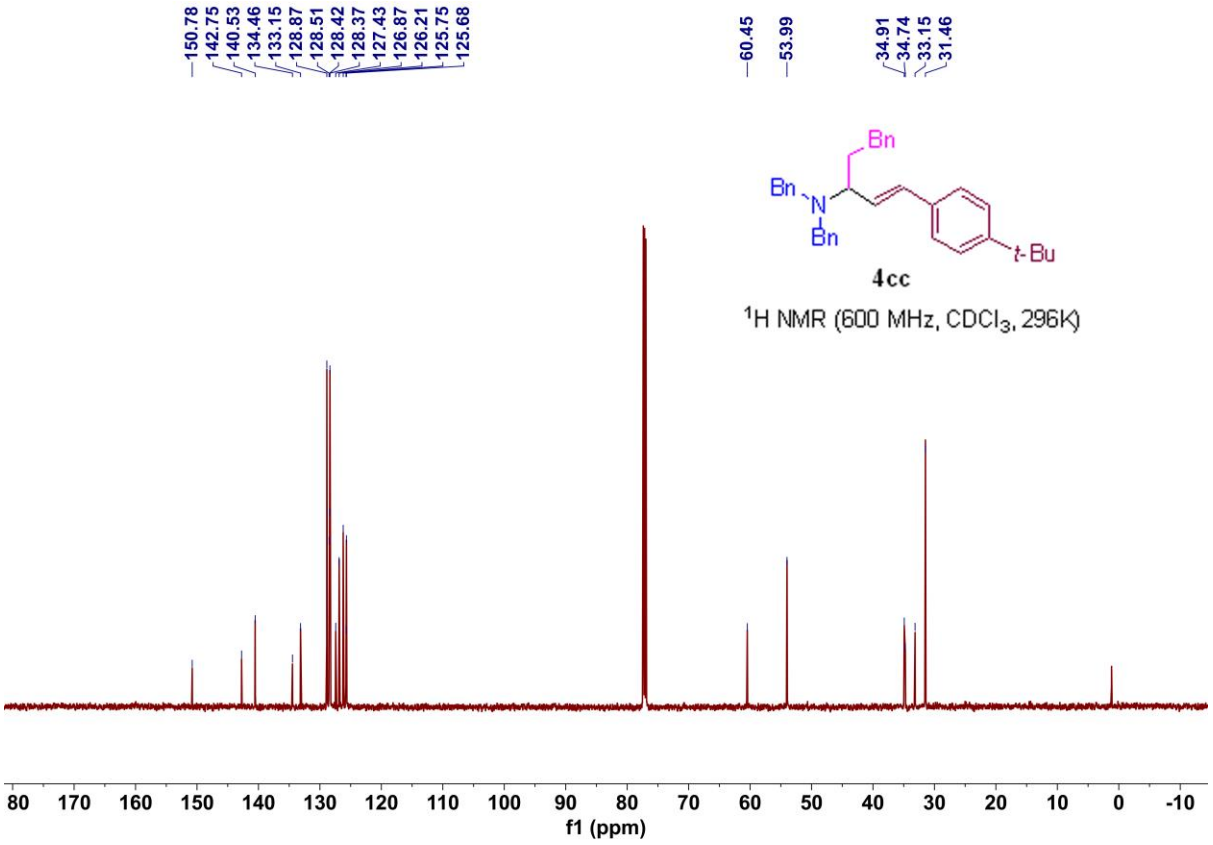

7.45 7.44 7.37 7.36 7.35 7.34 7.28 7.27 7.27 7.26 7.25 7.21 7.19 7.18 7.17 7.14 7.14 7.13 6.42 6.39 6.27 6.26 6.25 6.23 3.94 3.91 3.51 3.48 3.32 3.30 3.29 3.28 2.87 2.86 2.85 2.85 2.84 2.83 2.83 2.63 2.62 2.61 2.60 2.60 2.59 2.59 2.58 2.40 2.15 2.14 2.14 2.13 1.90 1.89 1.89 1.89 1.88
Bn
Bn
N
Bn
Me
4ac
1H NMR (600 MHz, CDCl3, 296K)
4.19 6.28 3.98 3.09 2.01 1.00 0.98 2.02 2.05 1.00 0.98 0.96 3.11 0.98 1.00
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)


142.74 140.53 137.43 134.46 133.22 129.43 128.88 128.51 128.41 128.36 127.22 126.87 126.38 125.75
60.42 54.00 34.86 33.15 21.34
Bn
Bn
N
Bn
Me
4ac
13C NMR (150 MHz, CDCl3, 296K)
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

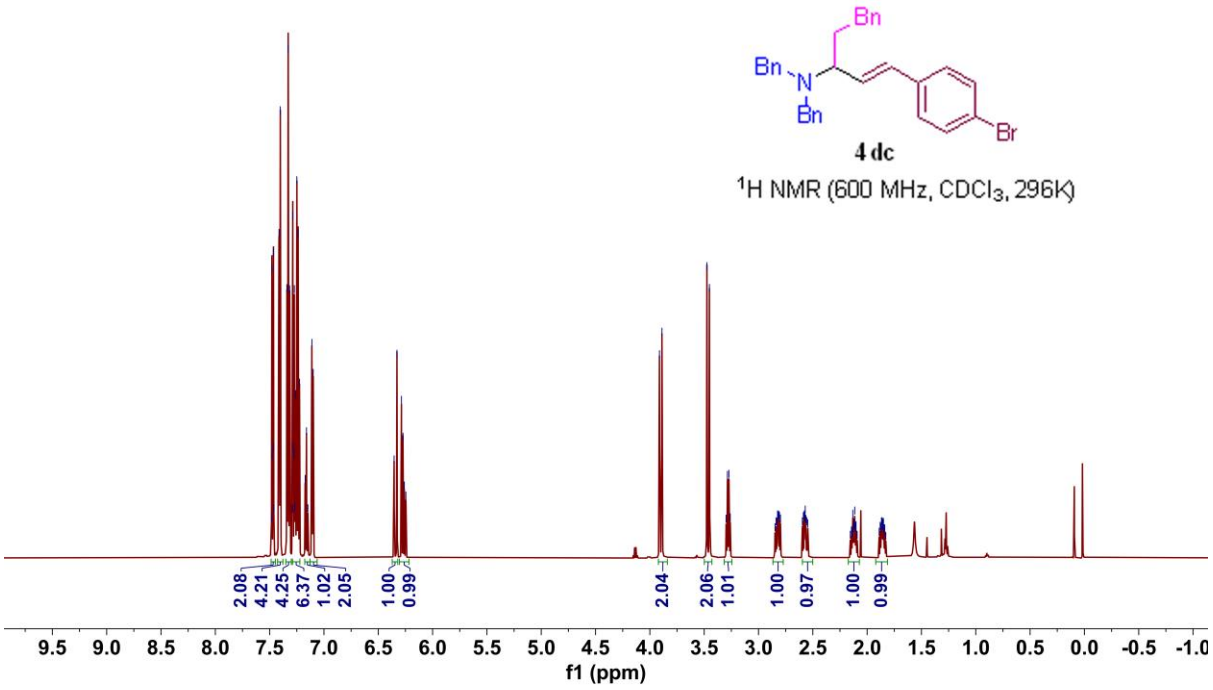

7.40 7.39 7.36 7.36 7.35 7.35 7.34 7.34 7.32 7.32 7.31 7.31 7.29 7.24 7.22 7.22 7.20 7.20 7.15 7.15 7.14 7.12 7.10 7.09 6.89 6.88 6.88 6.35 6.32 6.14 6.12 6.11 6.09 3.89 3.87 3.81 3.46 3.44 3.25 3.23 2.81 2.80 2.80 2.79 2.78 2.58 2.57 2.56 2.56 2.56 2.55 2.54 2.10 2.09 1.85 1.84 1.83
Bn
Bn
N
Bn
OMe
4bc
1H NMR (600 MHz, CDCl3, 296K)
4.00 2.11 4.25 4.03 1.09 2.26 1.98 0.97 0.97 1.96 2.94 1.99 0.99 0.98 1.19 0.97 1.24
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

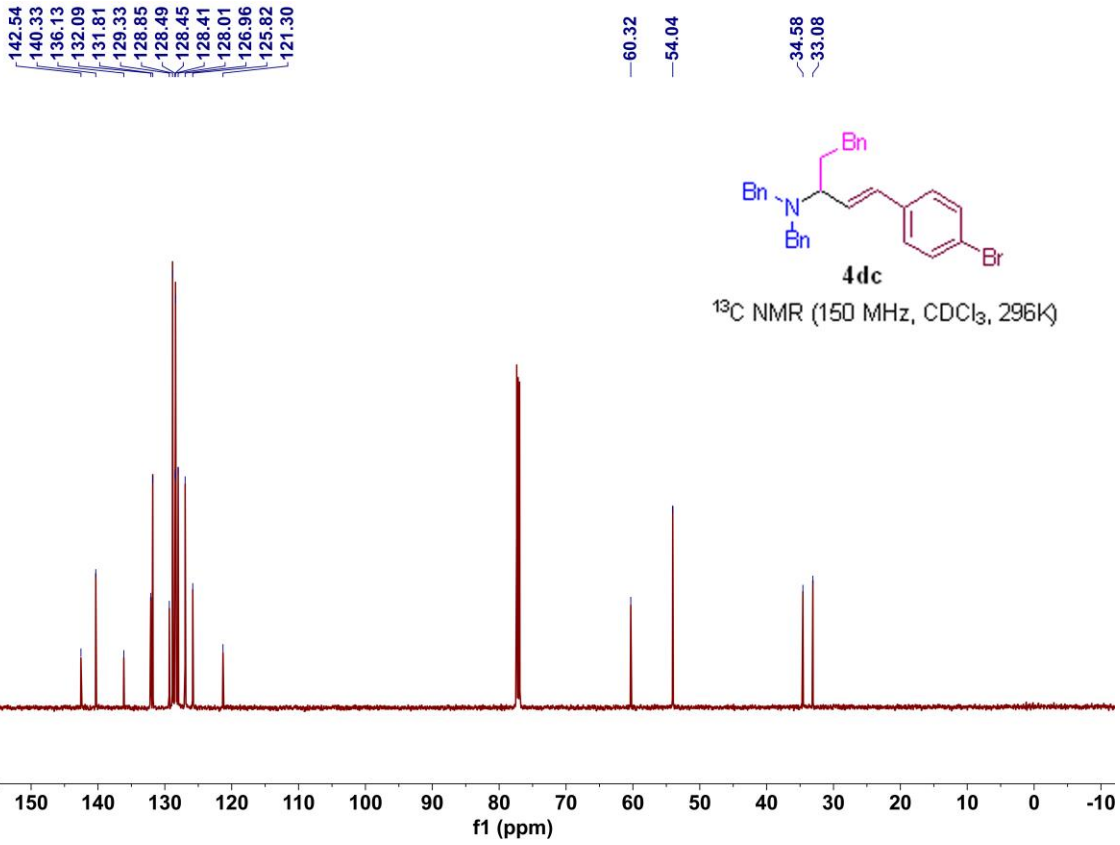

159.28 142.77 140.57 132.75 130.07 128.98 128.88 128.51 128.41 128.35 127.61 126.86 126.02 125.74 114.16 60.47 55.49 54.00 34.92 33.17
Bn
Bn
N
Bn
OMe
4bc
13C NMR (150 MHz, CDCl3, 296K)
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

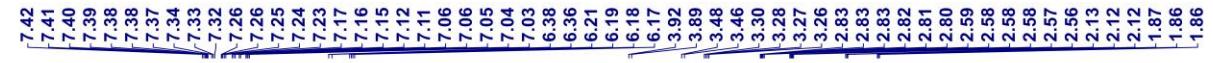

7.42 7.41 7.40 7.34 7.33 7.32 7.25 7.25 7.24 7.23 7.17 7.16 7.15 7.12 7.11 6.41 6.38 6.27 6.26 6.25 6.23 3.92 3.89 3.48 3.45 3.29 3.28 3.27 3.26 2.84 2.83 2.83 2.82 2.82 2.81 2.80 2.79 2.60 2.59 2.58 2.58 2.57 2.57 2.56 2.55 2.13 2.12 2.12 2.12 2.11 1.89 1.89 1.88 1.88 1.87 1.86 1.36
Bn
Bn
N
Bn
t-Bu
4cc
1H NMR (600 MHz, CDCl3, 296K)
8.16 4.26 4.15 1.01 2.05 1.00 0.99 2.03 2.05 0.95 0.96 0.97 0.98 0.97 9.31
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

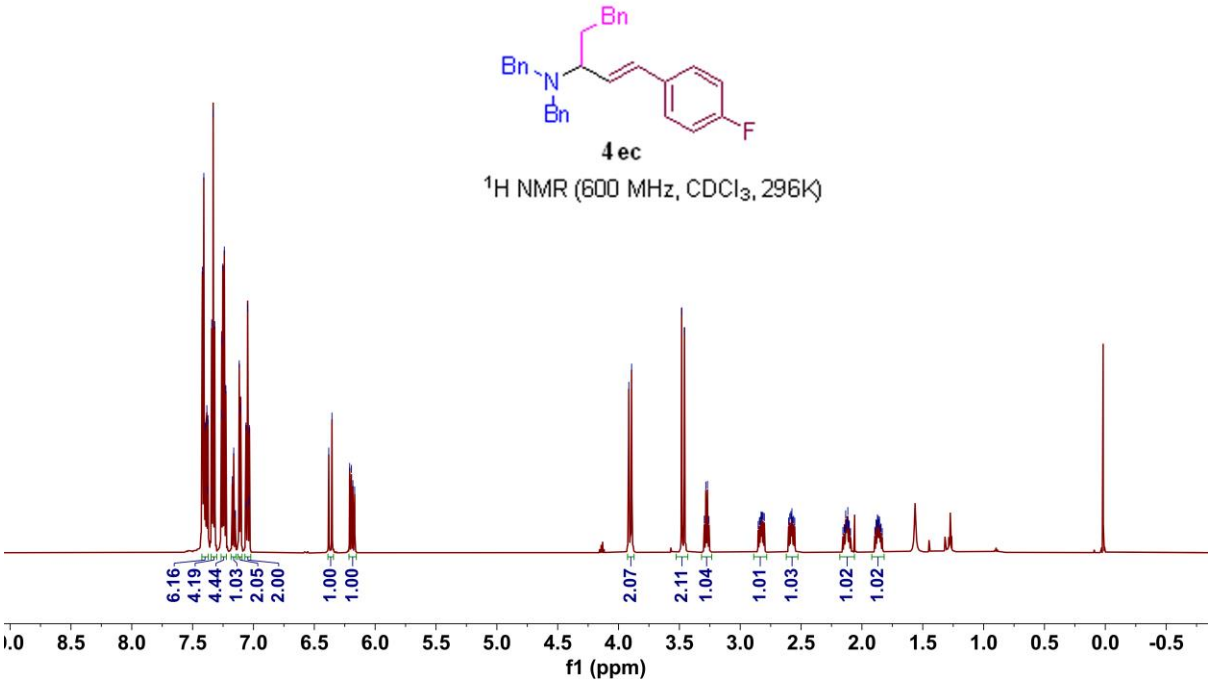

150.78 142.75 140.53 134.46 133.15 128.87 128.51 128.42 128.37 127.43 126.87 126.21 125.75 125.68
60.45 53.99 34.91 34.74 33.15 31.46
Bn
Bn
N
Bn
t-Bu
4cc
1H NMR (600 MHz, CDCl3, 296K)
80 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


7.48 7.48 7.47 7.47 7.46 7.41 7.40 7.34 7.33 7.32 7.29 7.29 7.28 7.28 7.27 7.27 7.26 7.25 7.24 7.22 7.17 7.16 7.15 7.11 7.10 6.35 6.33 6.29 6.27 6.26 6.25 3.91 3.89 3.47 3.45 3.30 3.29 3.27 3.26 2.84 2.82 2.82 2.82 2.81 2.80 2.60 2.59 2.58 2.57 2.57 2.56 2.56 2.13 2.11 1.87 1.86


Bn
Bn
N
Bn
Br
4 dc
^{1}H NMR (600 MHz, $CDCl_3$, 296K)
2.08 4.21 4.25 6.37 1.02 2.05 1.00 0.99 2.04 2.06 1.01 1.00 0.97 1.00 0.99
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)

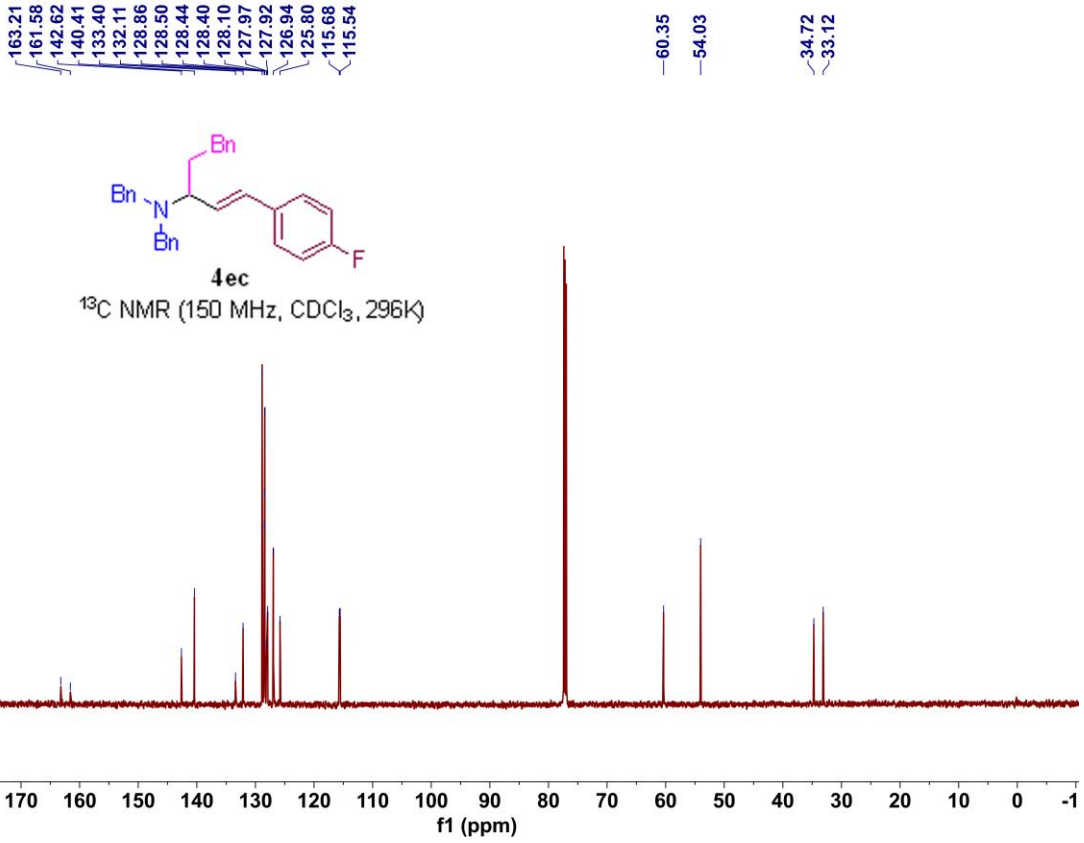

142.54 140.33 136.13 132.09 131.81 129.33 128.85 128.49 128.45 128.41 128.01 126.96 125.82 121.30
60.32 54.04 34.58 33.08
Bn
Bn
N
Bn
Br
4 dc
^{13}C NMR (150 MHz, $CDCl_3$, 296K)
160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)





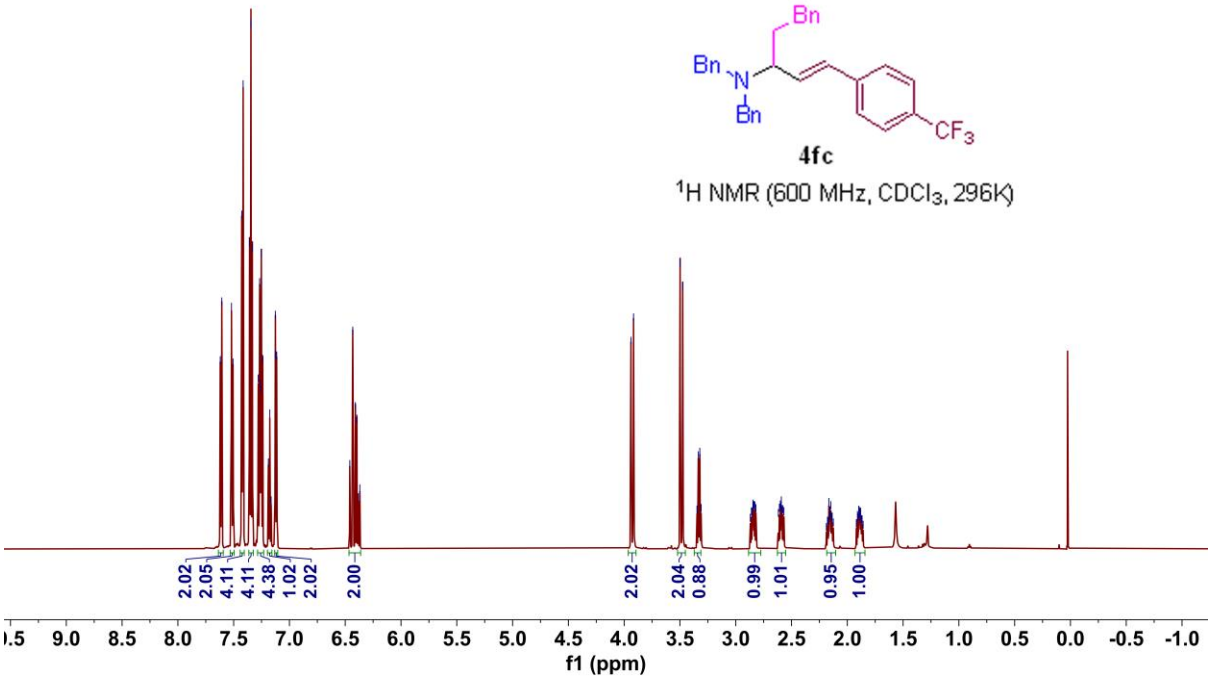
4ec

^{1}H NMR (600 MHz, $CDCl_3$, 296K)



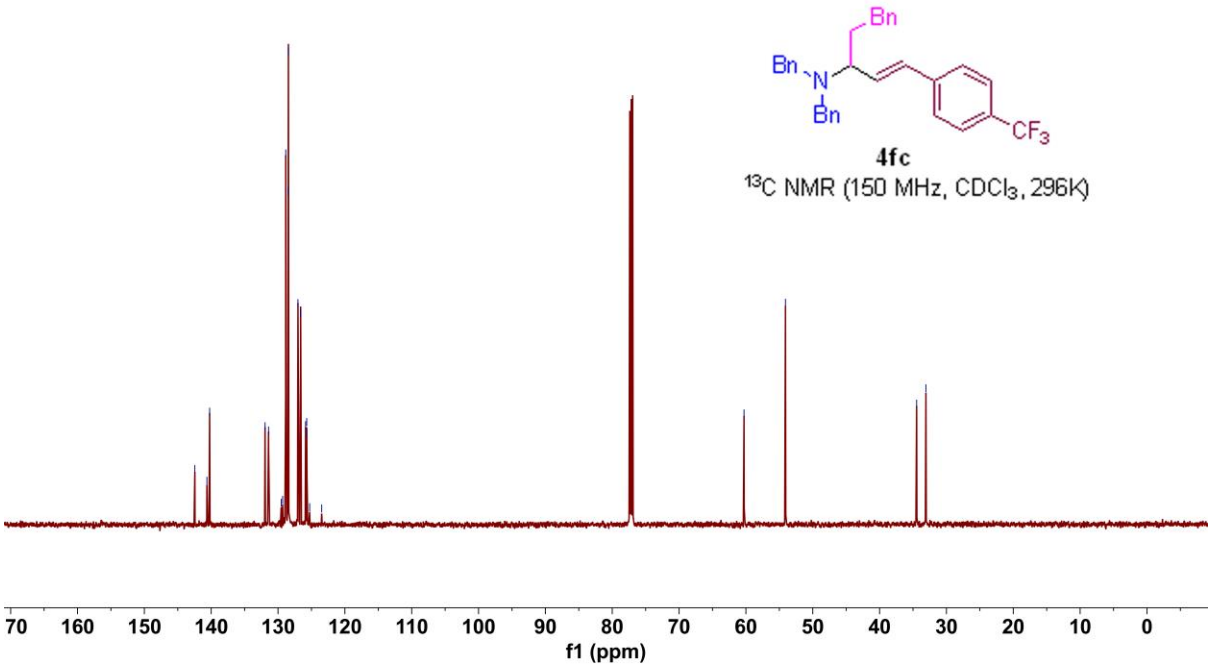
4ec

^{13}C NMR (150 MHz, $CDCl_3$, 296K)



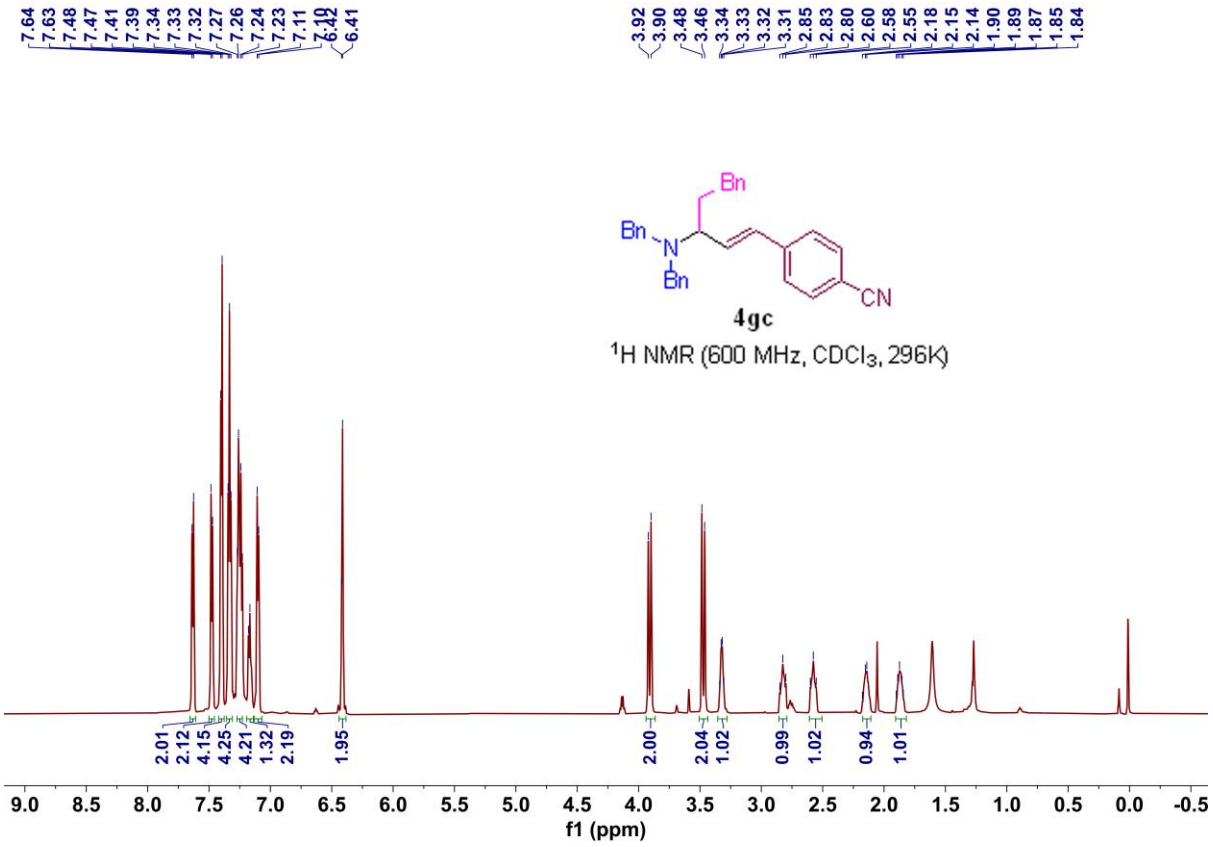
4fc

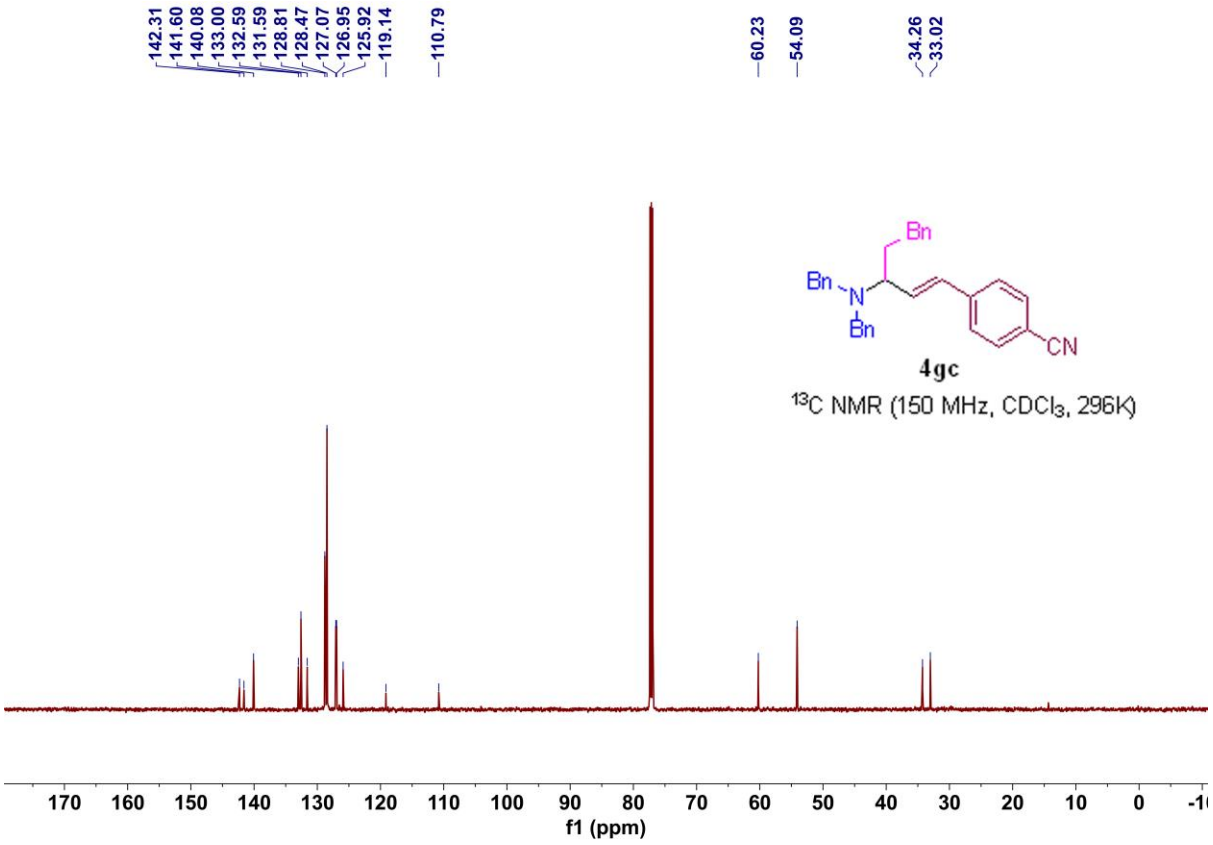
^{1}H NMR (600 MHz, $CDCl_3$, 296K)



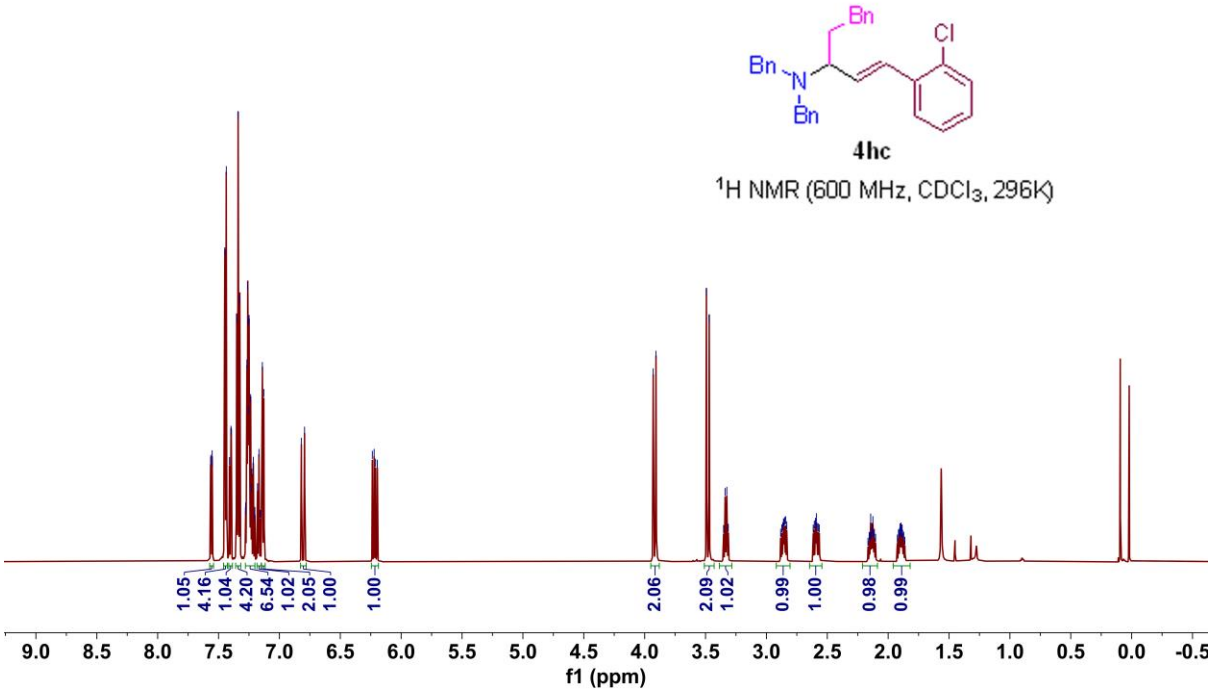
4fc

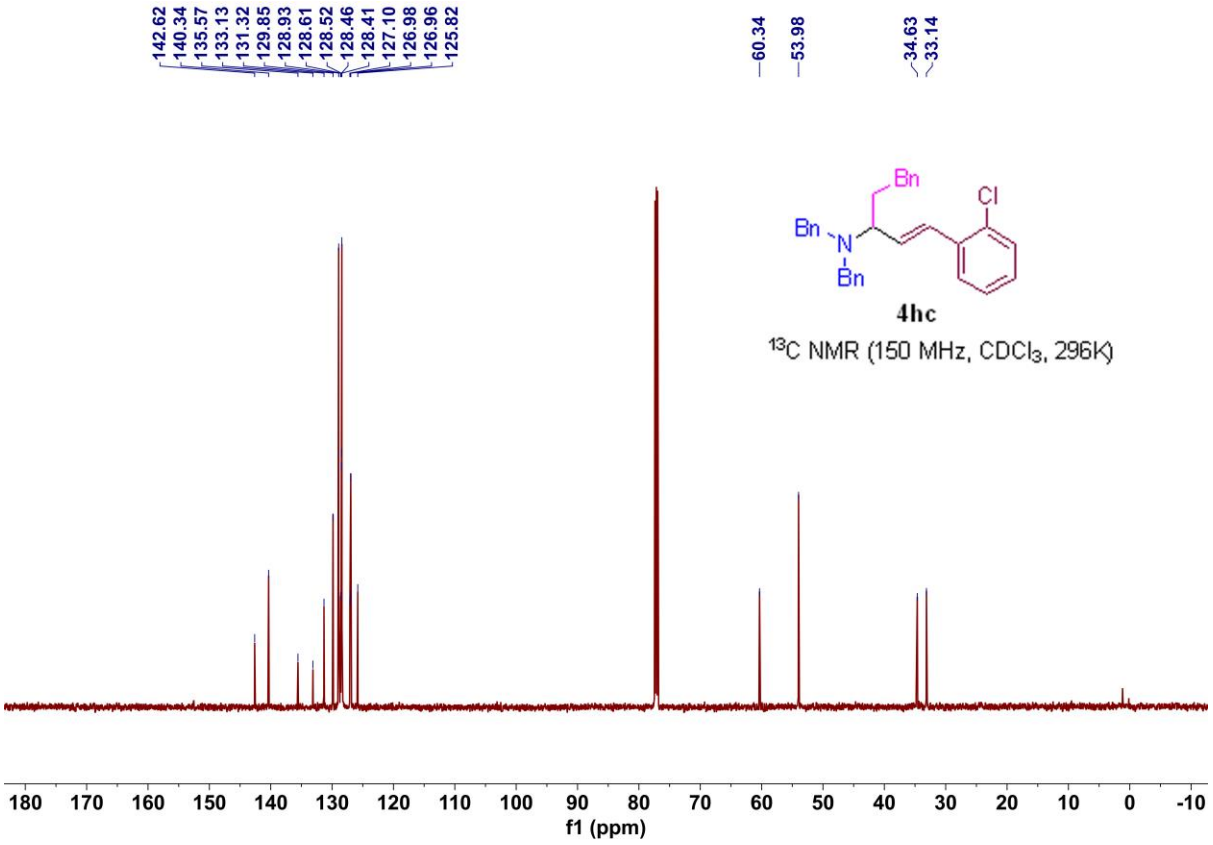
^{13}C NMR (150 MHz, $CDCl_3$, 296K)

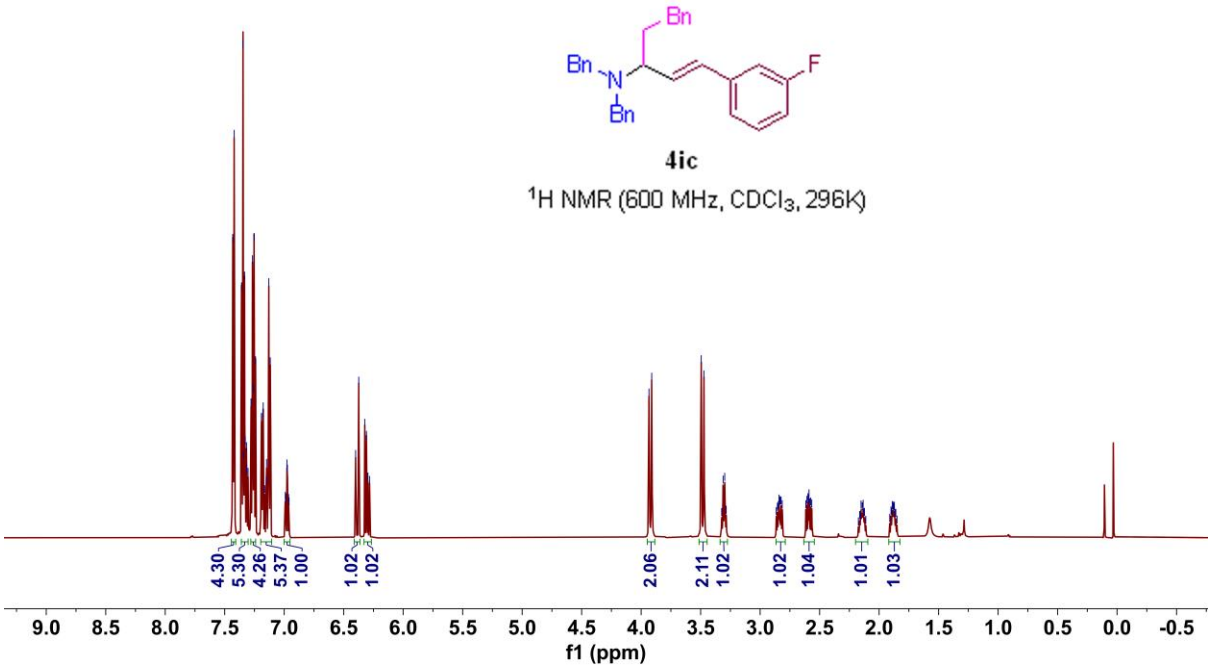

7.64
7.63
7.48
7.47
7.41
7.39
7.34
7.33
7.32
7.27
7.26
7.24
7.23
7.11
7.10
6.42
6.41
3.92
3.90
3.48
3.46
3.34
3.33
3.32
3.31
2.85
2.83
2.80
2.60
2.58
2.55
2.18
2.15
2.14
1.90
1.89
1.87
1.85
1.84
Bn
Bn
N
Bn
CN
4gc
^{1}H NMR (600 MHz, $CDCl_3$, 296K)
2.01
2.12
4.15
4.25
4.21
1.32
2.19
1.95
2.00
2.04
1.02
0.99
1.02
0.94
1.01
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)


142.31
141.60
140.08
133.00
132.59
131.59
128.81
128.47
127.07
126.95
125.92
119.14
110.79
60.23
54.09
34.26
33.02
Bn
Bn
N
Bn
CN
4gc
^{13}C NMR (150 MHz, $CDCl_3$, 296K)
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


7.57 7.56 7.55 7.55 7.45 7.44 7.41 7.40 7.40 7.35 7.34 7.33 7.28 7.28 7.27 7.26 7.26 7.25 7.25 7.24 7.23 7.23 7.22 7.21 7.20 7.20 7.18 7.17 7.16 7.14 7.13 6.82 6.79 6.24 6.22 6.21 6.20 3.93 3.91 3.49 3.47 3.34 3.33 2.87 2.86 2.86 2.85 2.84 2.83 2.61 2.60 2.59 2.59 2.14 2.13 2.13 1.89

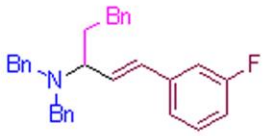

Bn
Cl
Bn
N
Bn
4hc
1H NMR (600 MHz, CDCl3, 296K)
1.05 4.16 1.04 4.20 6.54 1.02 2.05 1.00 1.00 2.06 2.09 1.02 0.99 1.00 0.98 0.99
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)


142.62 140.34 135.57 133.13 131.32 129.85 128.93 128.61 128.52 128.46 128.41 127.10 126.98 126.96 125.82
60.34
53.98
34.63
33.14
Bn
Cl
Bn
N
Bn
4hc
13C NMR (150 MHz, CDCl3, 296K)
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)



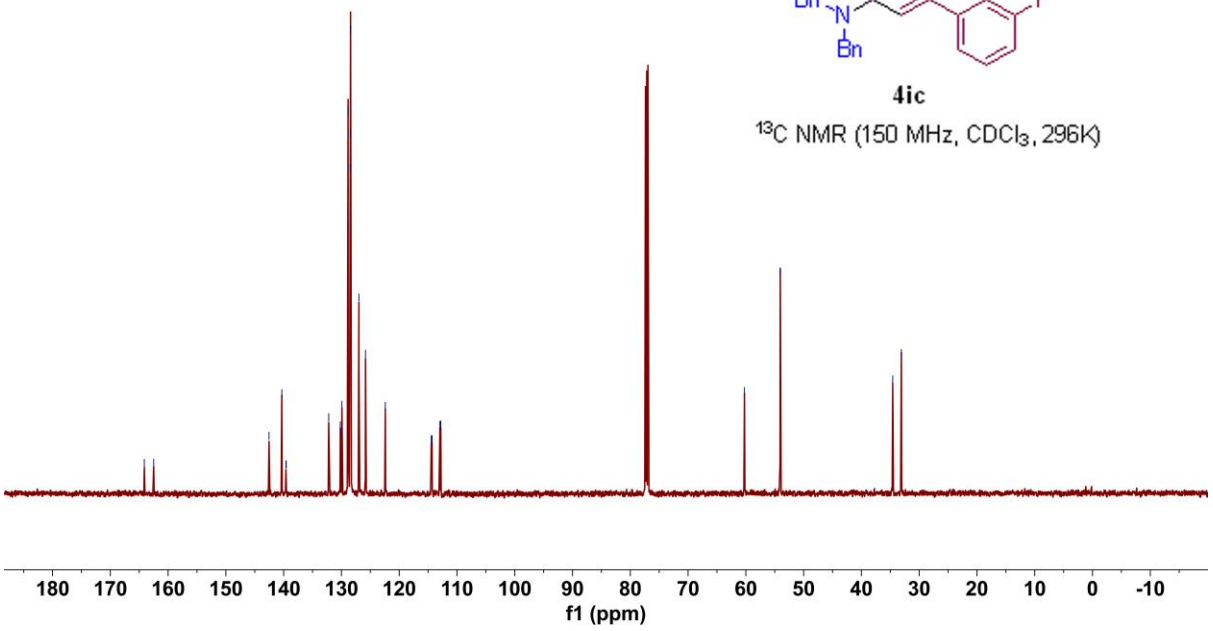
4ic

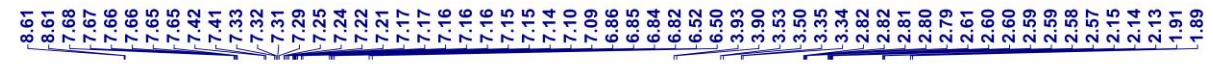
^{1}H NMR (600 MHz, $CDCl_3$, 296K)

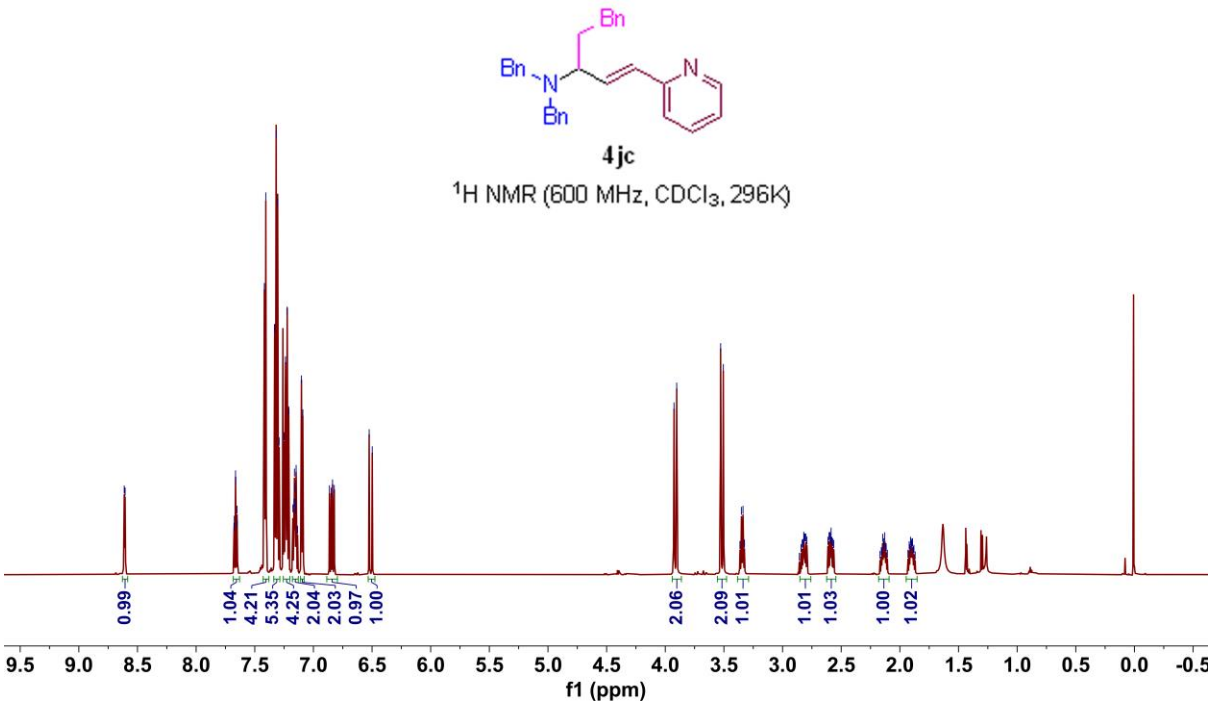


4ic

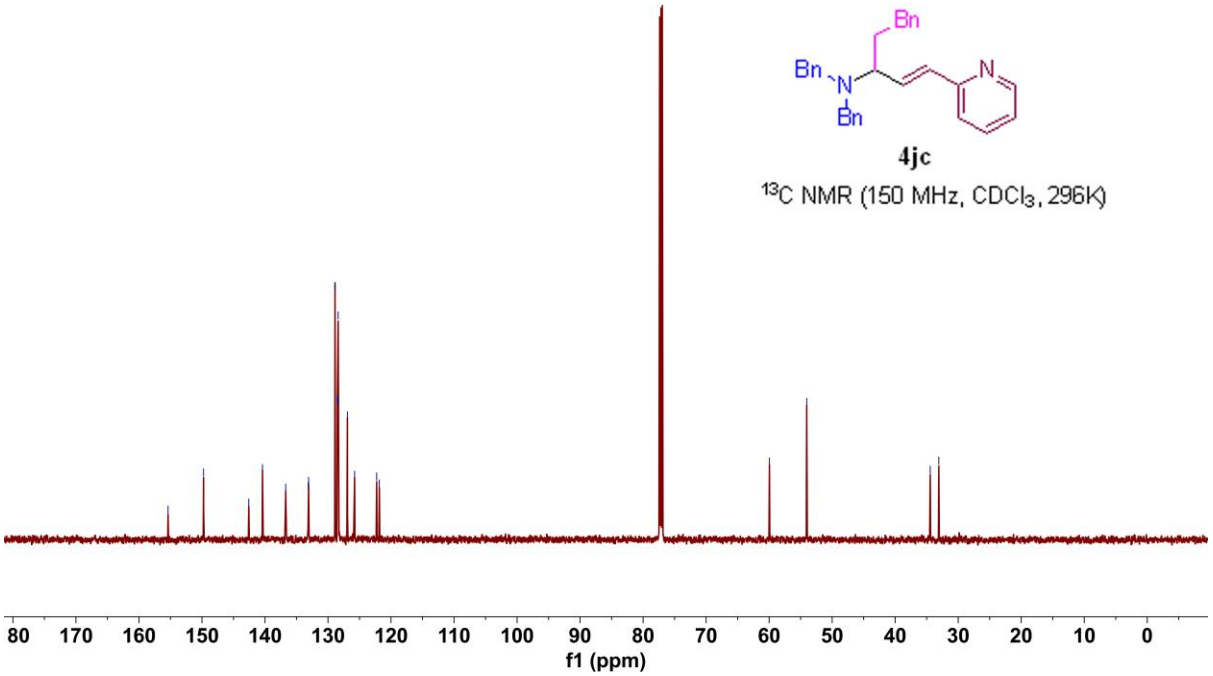
^{13}C NMR (150 MHz, $CDCl_3$, 296K)

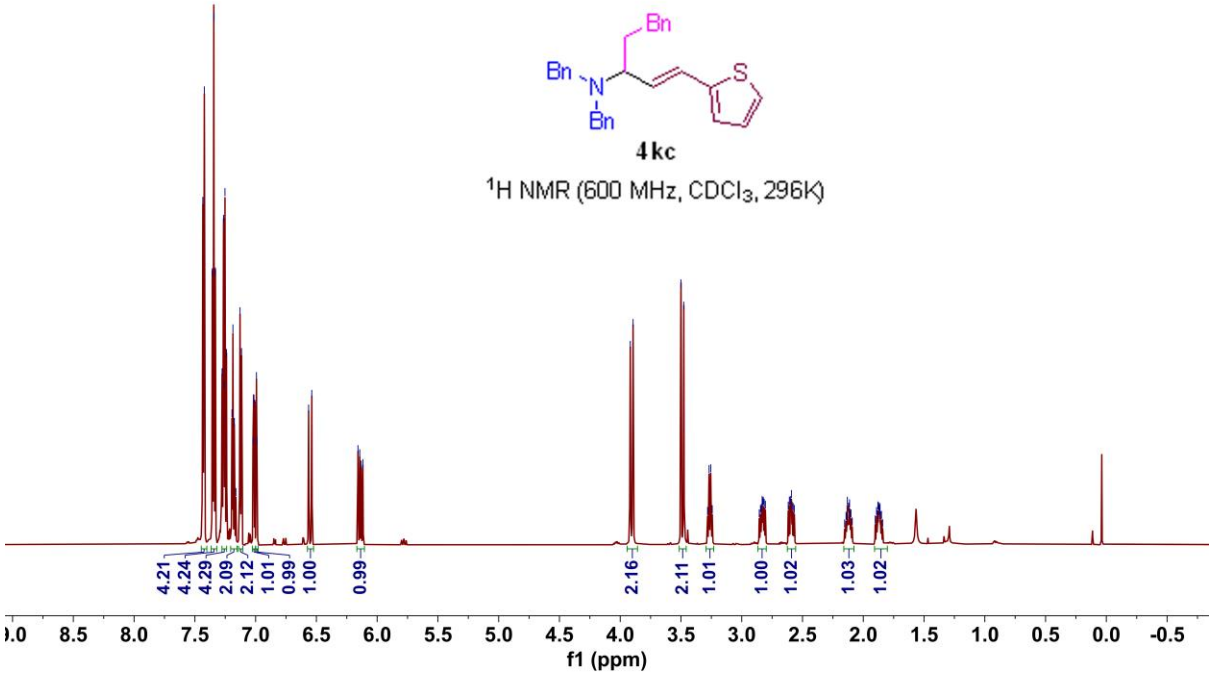



8.61 8.61 7.68 7.67 7.66 7.66 7.65 7.65 7.42 7.41 7.33 7.32 7.31 7.29 7.25 7.24 7.22 7.21 7.17 7.17 7.16 7.16 7.15 7.15 7.14 7.10 7.09 6.86 6.85 6.84 6.82 6.52 6.50 3.93 3.90 3.53 3.50 3.35 3.34 2.82 2.82 2.81 2.80 2.79 2.61 2.60 2.60 2.59 2.59 2.58 2.57 2.15 2.14 2.13 1.91 1.89


Bn
Bn
N
Bn
N
4jc
^{1}H NMR (600 MHz, $CDCl_3$, 296K)
0.99 1.04 4.21 5.35 4.25 2.04 2.03 0.97 1.00 2.06 2.09 1.01 1.01 1.03 1.00 1.02
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

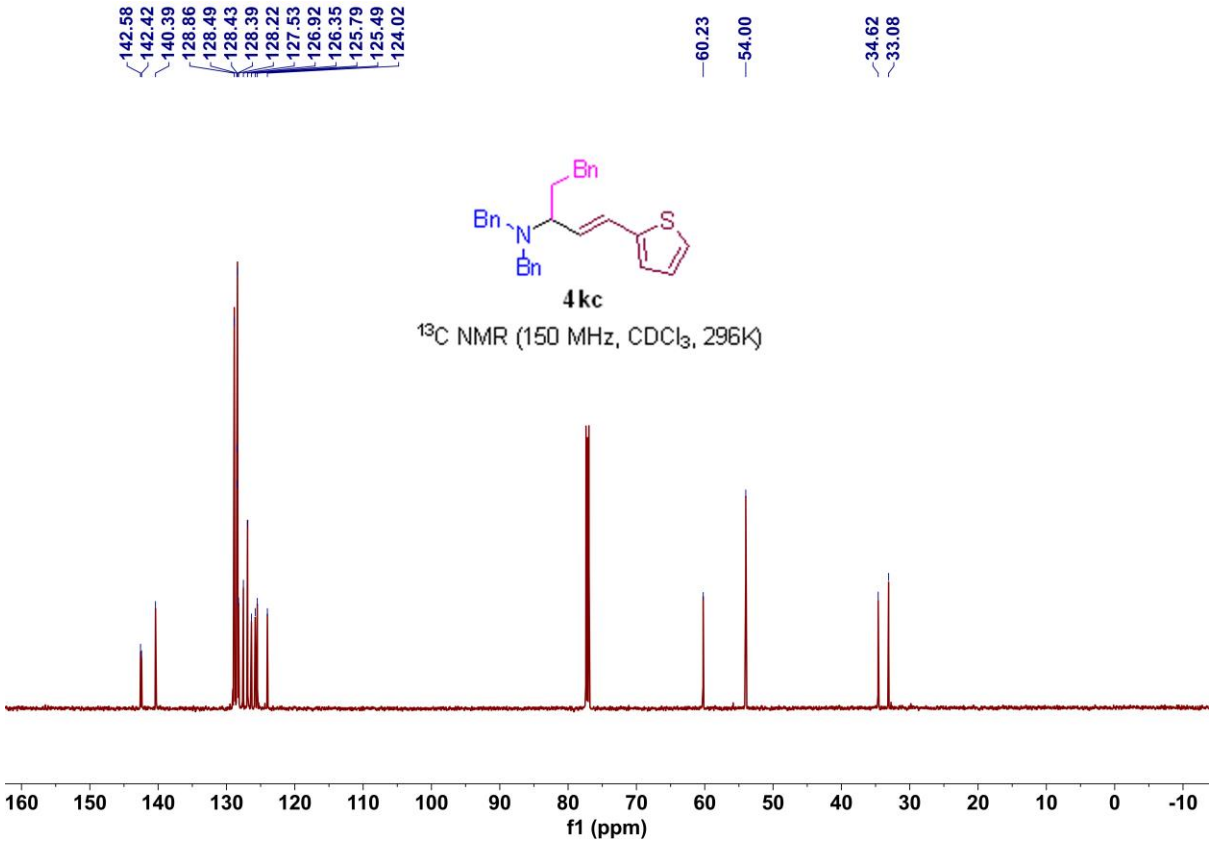

155.38 149.74 142.57 140.40 136.71 133.14 133.08 128.89 128.51 128.43 128.39 126.92 125.78 122.27 121.86
59.95 54.04
34.44 33.08


Bn
Bn
N
Bn
N
4jc
^{13}C NMR (150 MHz, $CDCl_3$, 296K)
80 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)



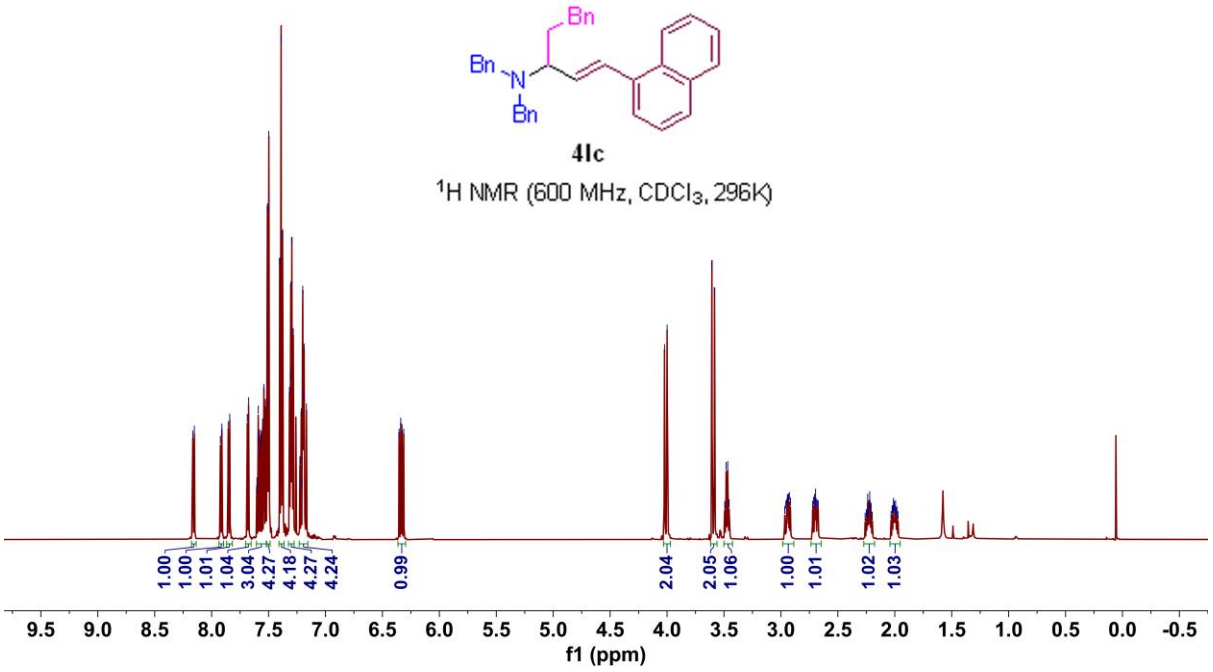
4kc

^{1}H NMR (600 MHz, $CDCl_3$, 296K)



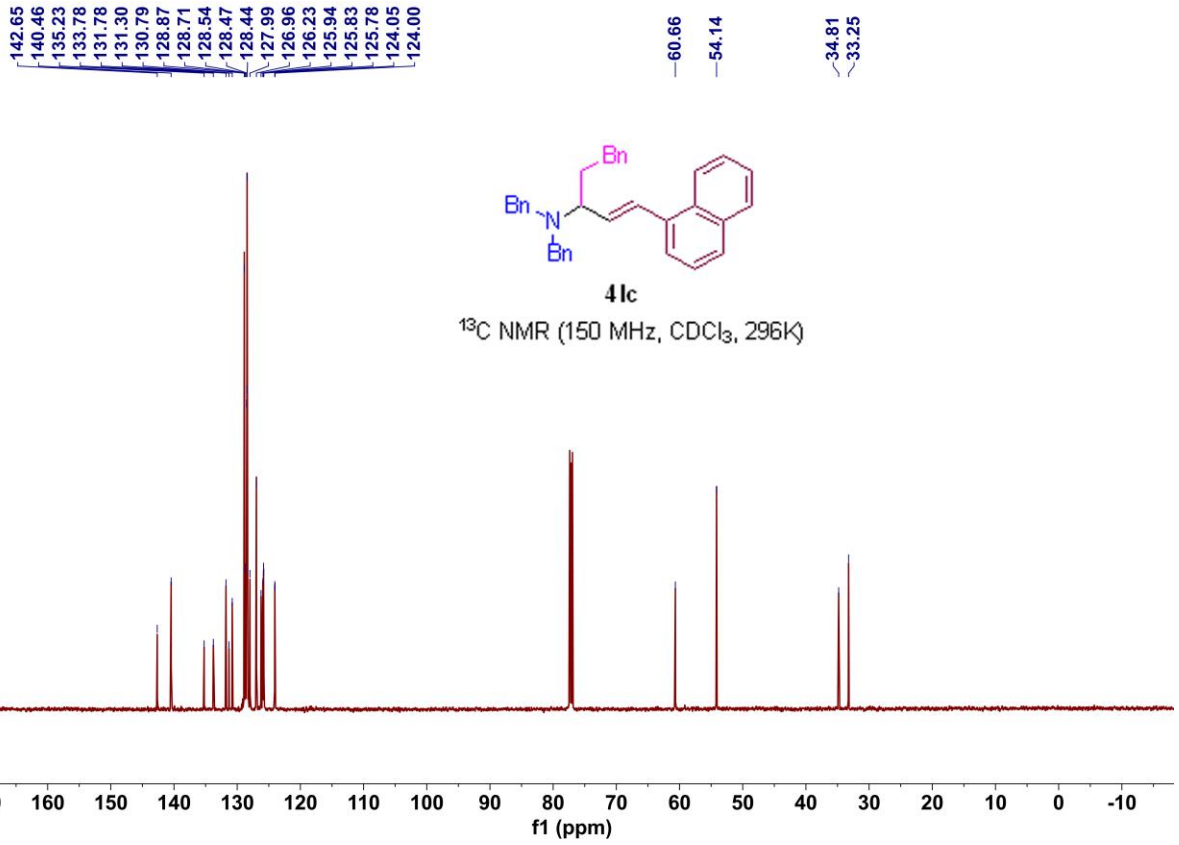
4kc

^{13}C NMR (150 MHz, $CDCl_3$, 296K)



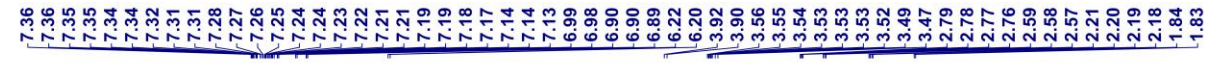
4Ic

^{1}H NMR (600 MHz, $CDCl_3$, 296K)



4Ic

^{13}C NMR (150 MHz, $CDCl_3$, 296K)

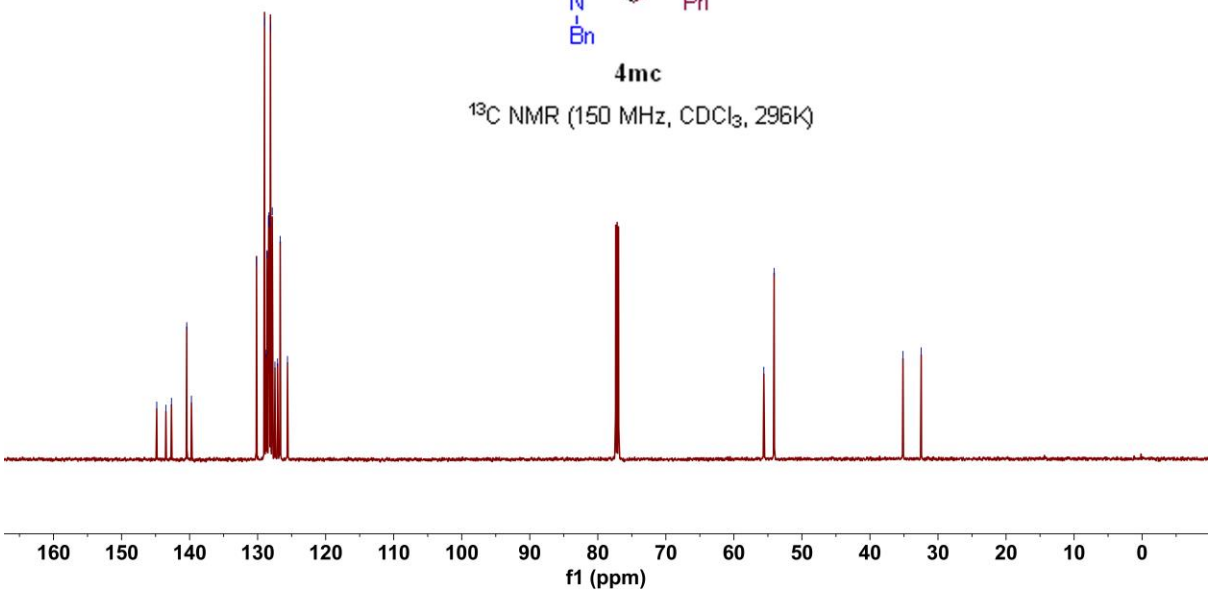


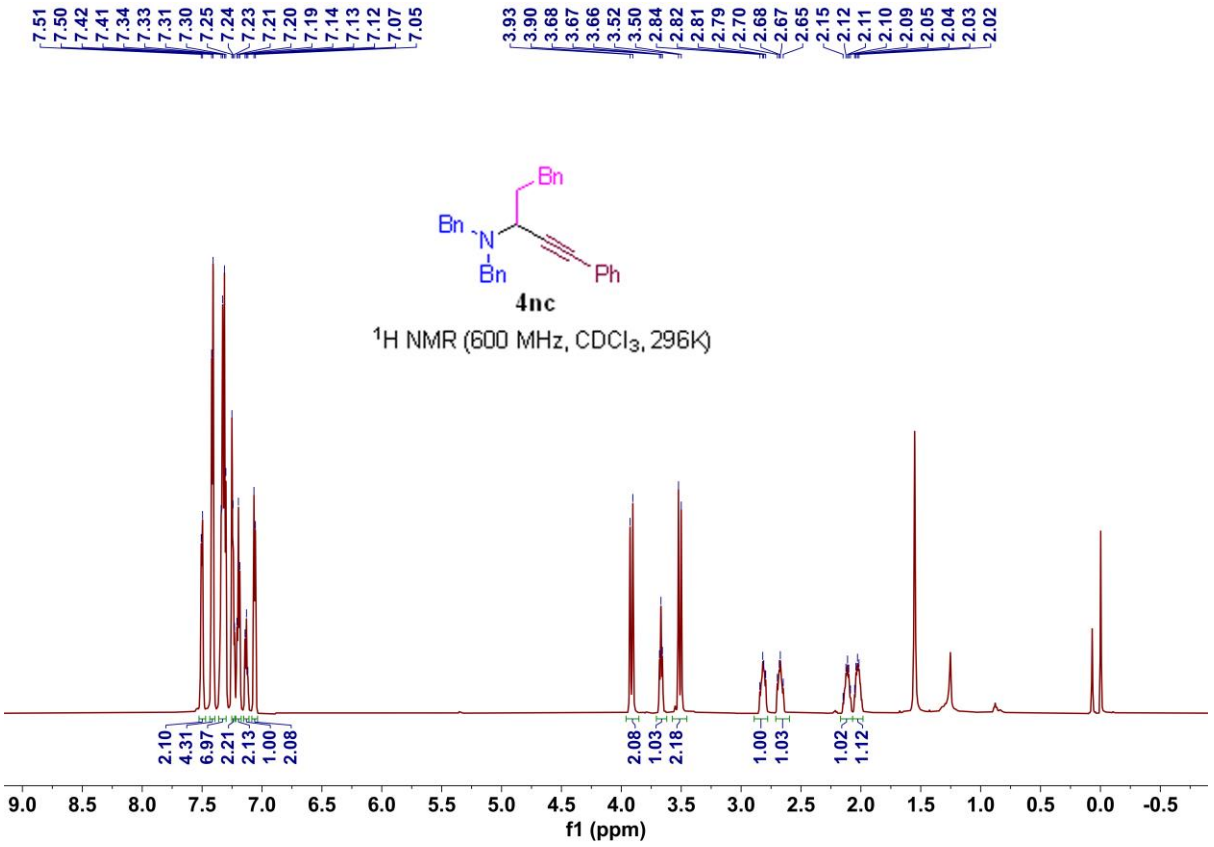
4mc

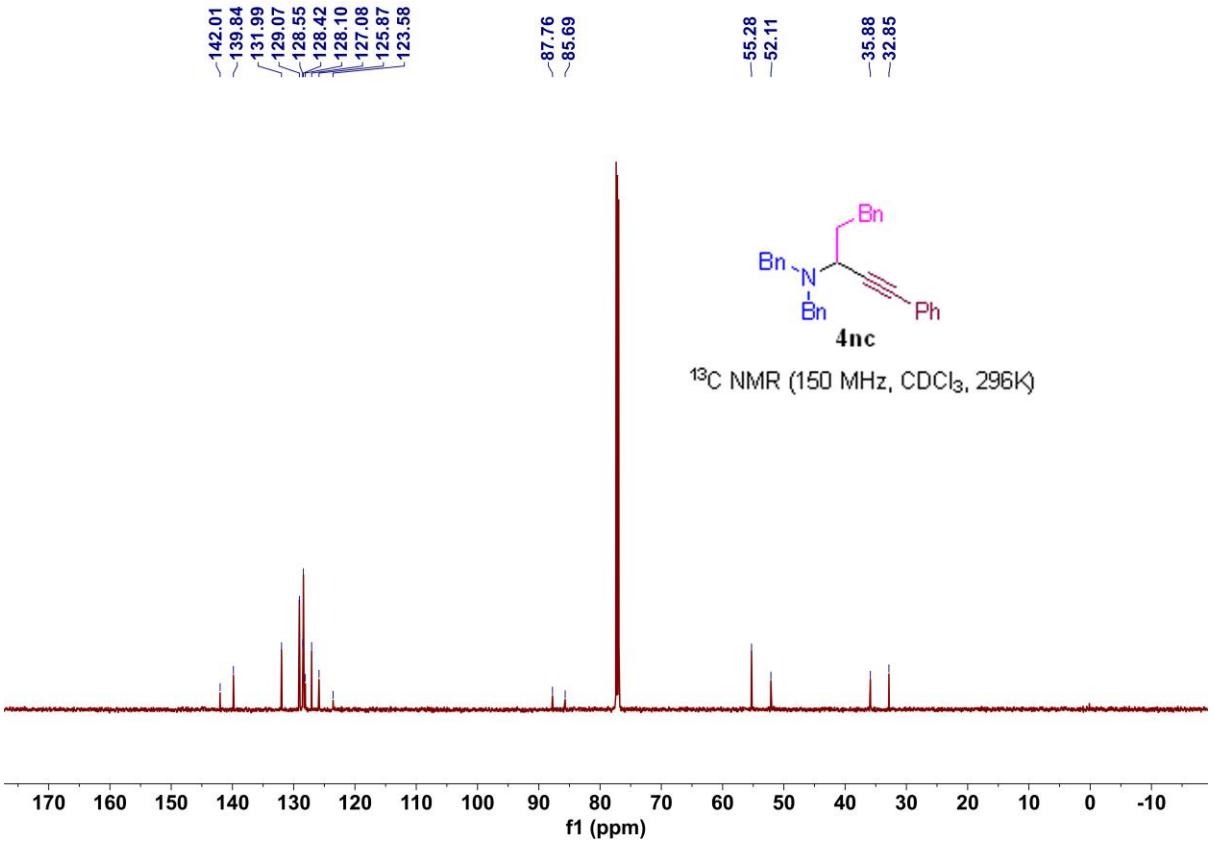
^{1}H NMR (600 MHz, $CDCl_3$, 296K)

4mc

^{13}C NMR (150 MHz, $CDCl_3$, 296K)




7.51
7.50
7.42
7.41
7.34
7.33
7.31
7.30
7.25
7.24
7.23
7.21
7.20
7.19
7.14
7.13
7.12
7.07
7.05
3.93
3.90
3.68
3.67
3.66
3.52
3.50
2.84
2.82
2.81
2.79
2.70
2.68
2.67
2.65
2.15
2.12
2.11
2.10
2.09
2.05
2.04
2.03
2.02
Bn
Bn
N
Bn
Ph
4nc
1H NMR (600 MHz, CDCl3, 296K)
2.10
4.31
6.97
2.21
2.13
1.00
2.08
2.08
1.03
2.18
1.00
1.03
1.02
1.12
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

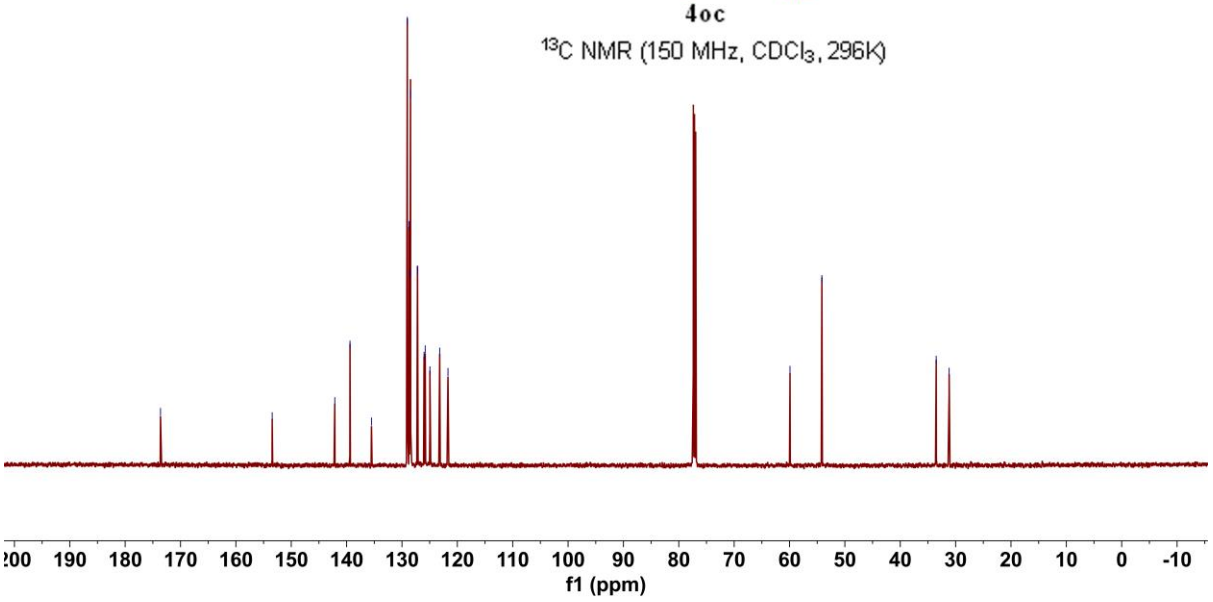

142.01
139.84
131.99
129.07
128.55
128.42
128.10
127.08
125.87
123.58
87.76
85.69
55.28
52.11
35.88
32.85
Bn
Bn
N
Bn
Ph
4nc
13C NMR (150 MHz, CDCl3, 296K)
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

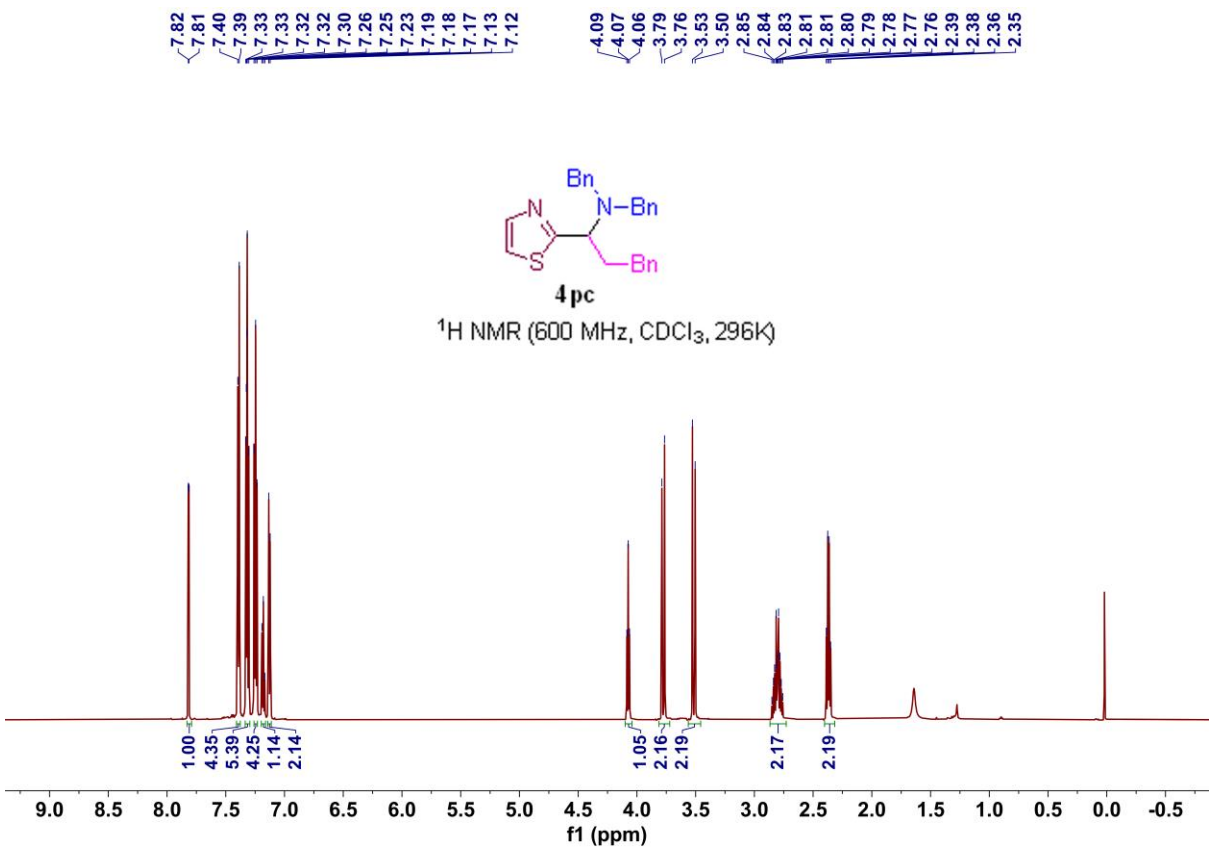
4oc

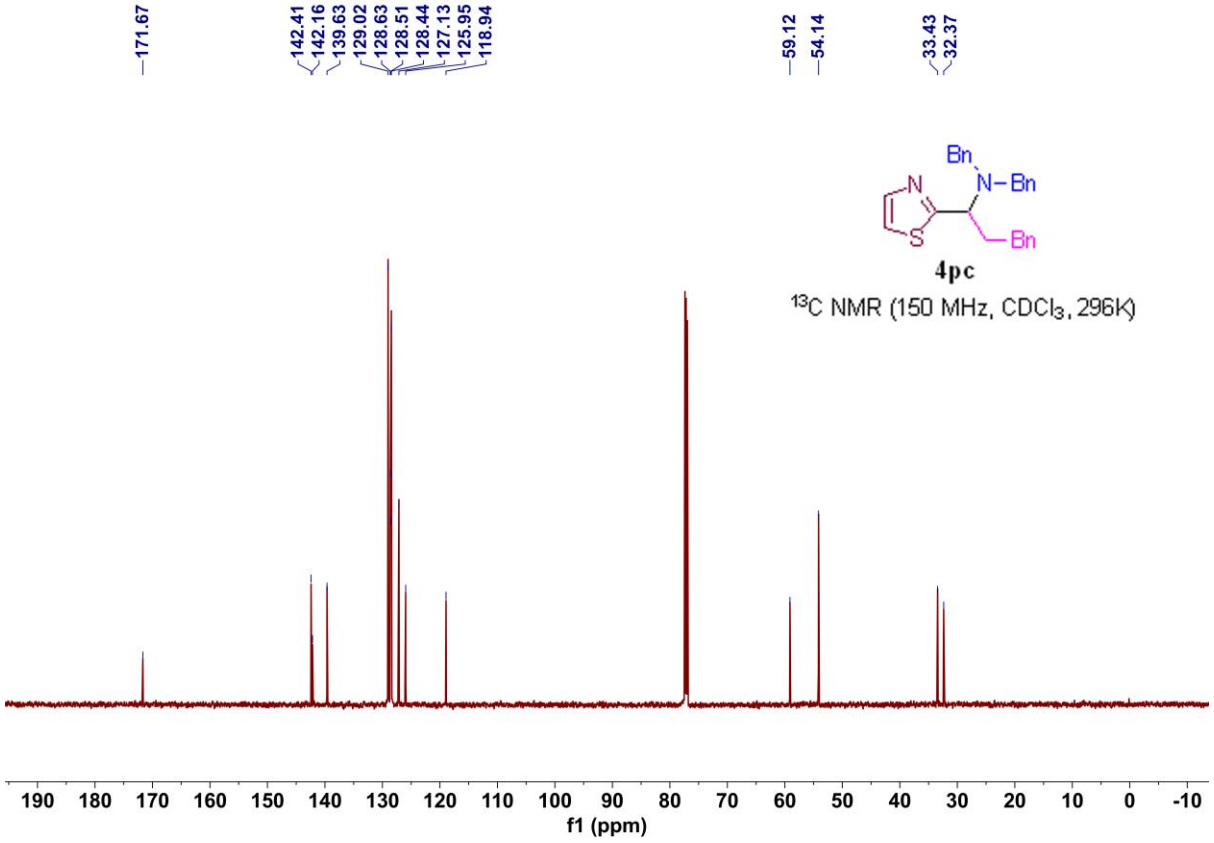
^{1}H NMR (600 MHz, $CDCl_3$, 296K)

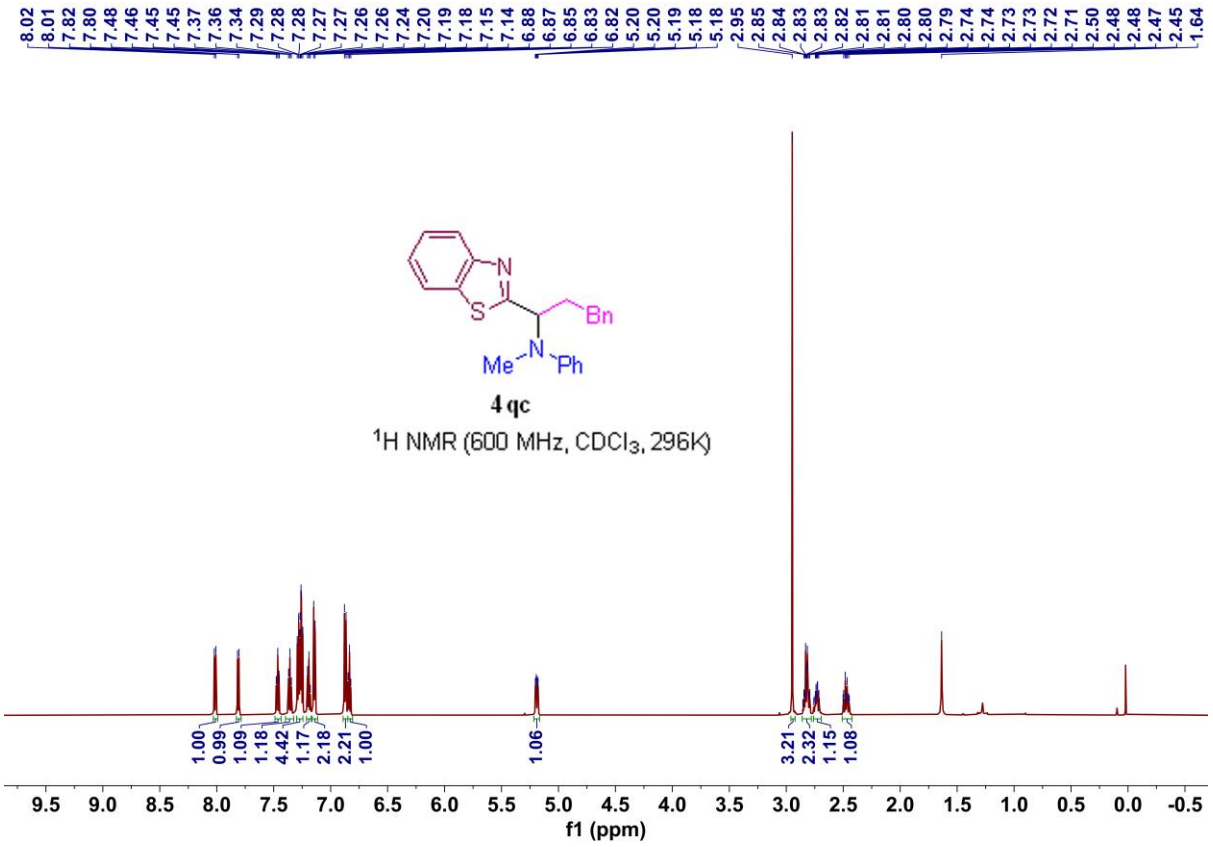
4oc

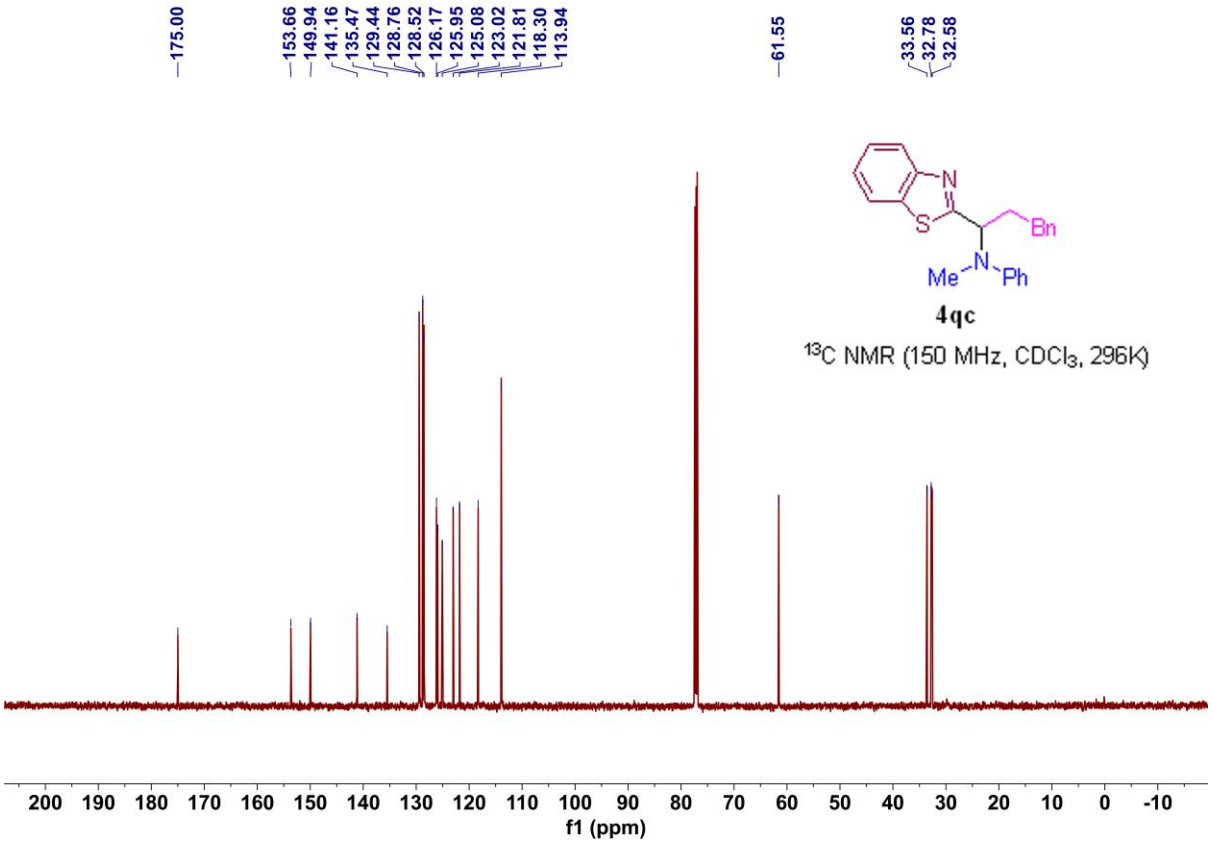
^{13}C NMR (150 MHz, $CDCl_3$, 296K)



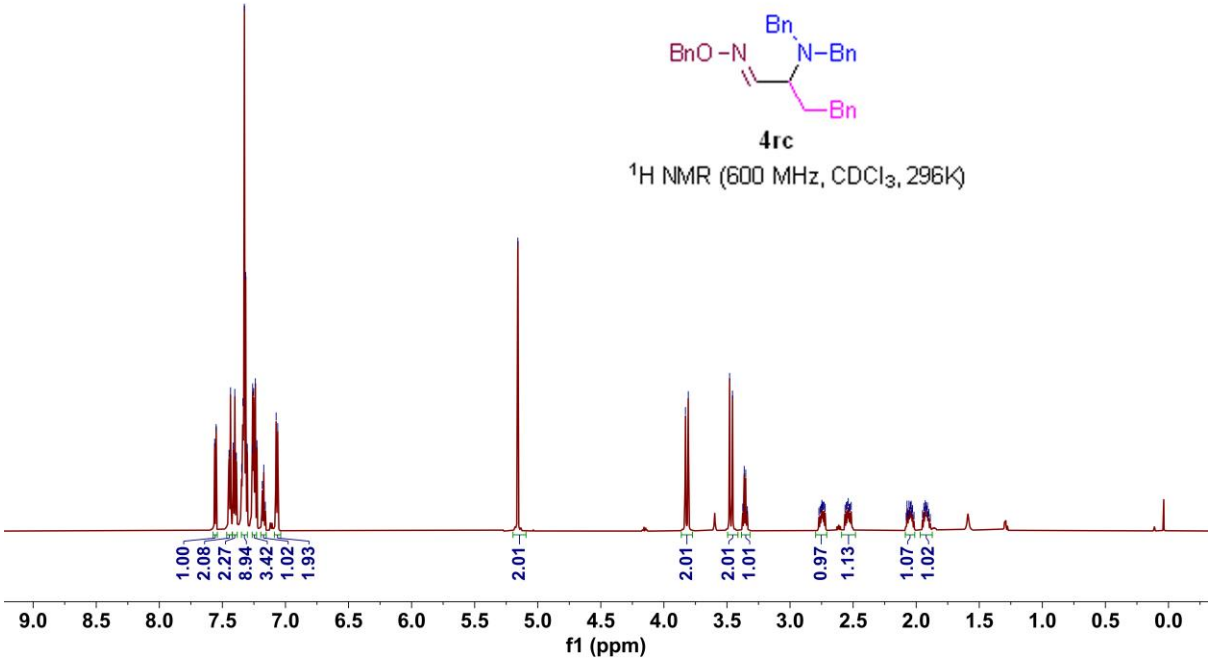

7.82
7.81
7.40
7.39
7.33
7.33
7.32
7.32
7.30
7.26
7.25
7.23
7.19
7.18
7.17
7.13
7.12
4.09
4.07
4.06
3.79
3.76
3.53
3.50
2.85
2.84
2.83
2.81
2.81
2.80
2.79
2.78
2.77
2.76
2.39
2.38
2.36
2.35
Bn
N
N–Bn
S
Bn
4pc
1H NMR (600 MHz, CDCl3, 296K)
1.00
4.35
5.39
4.25
1.14
2.14
1.05
2.16
2.19
2.17
2.19
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)


171.67
142.41
142.16
139.63
129.02
128.63
128.51
128.44
127.13
125.95
118.94
59.12
54.14
33.43
32.37
Bn
N
N–Bn
S
Bn
4pc
13C NMR (150 MHz, CDCl3, 296K)
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

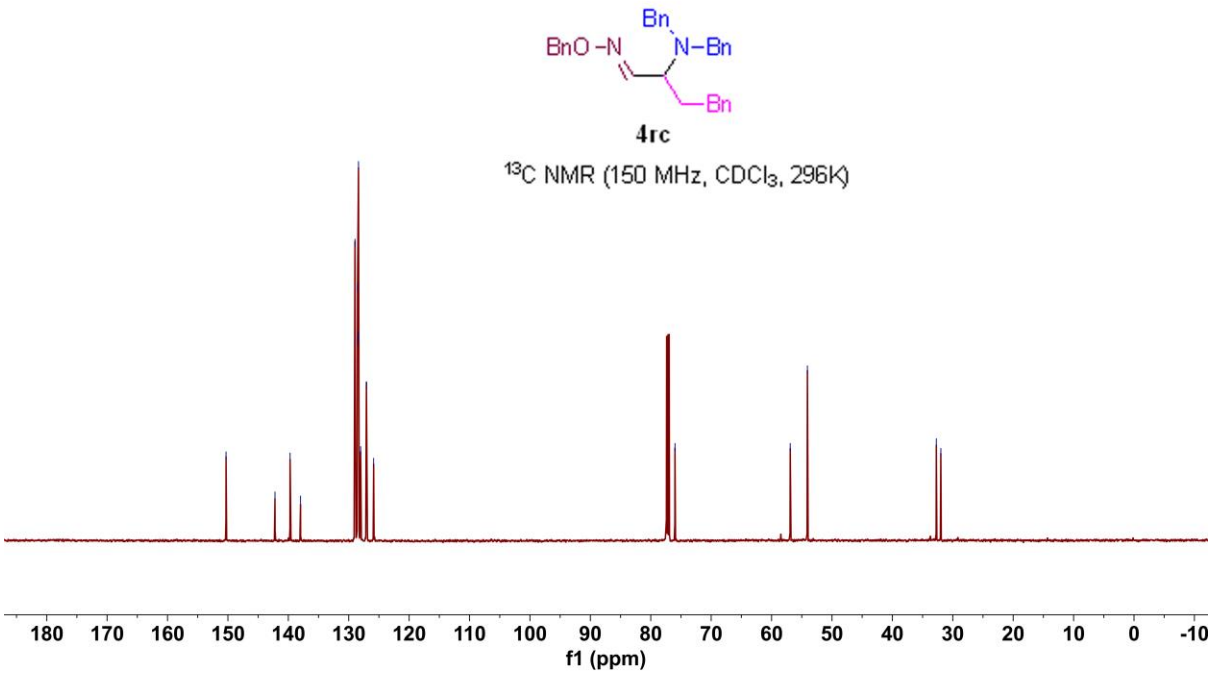

8.02 8.01 7.82 7.80 7.48 7.46 7.45 7.45 7.37 7.36 7.34 7.29 7.28 7.28 7.27 7.27 7.26 7.26 7.24 7.20 7.19 7.18 7.15 7.14 6.88 6.87 6.85 6.83 6.82 5.20 5.20 5.19 5.18 5.18 2.95 2.85 2.84 2.83 2.83 2.82 2.81 2.81 2.80 2.80 2.79 2.74 2.74 2.73 2.73 2.72 2.71 2.50 2.48 2.48 2.47 2.45 1.64
N
S
Bn
Me
N
Ph
4 qc
1H NMR (600 MHz, CDCl3, 296K)
1.00 0.99 1.09 1.18 4.42 1.17 2.18 2.21 1.00 1.06 3.21 2.32 1.15 1.08
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

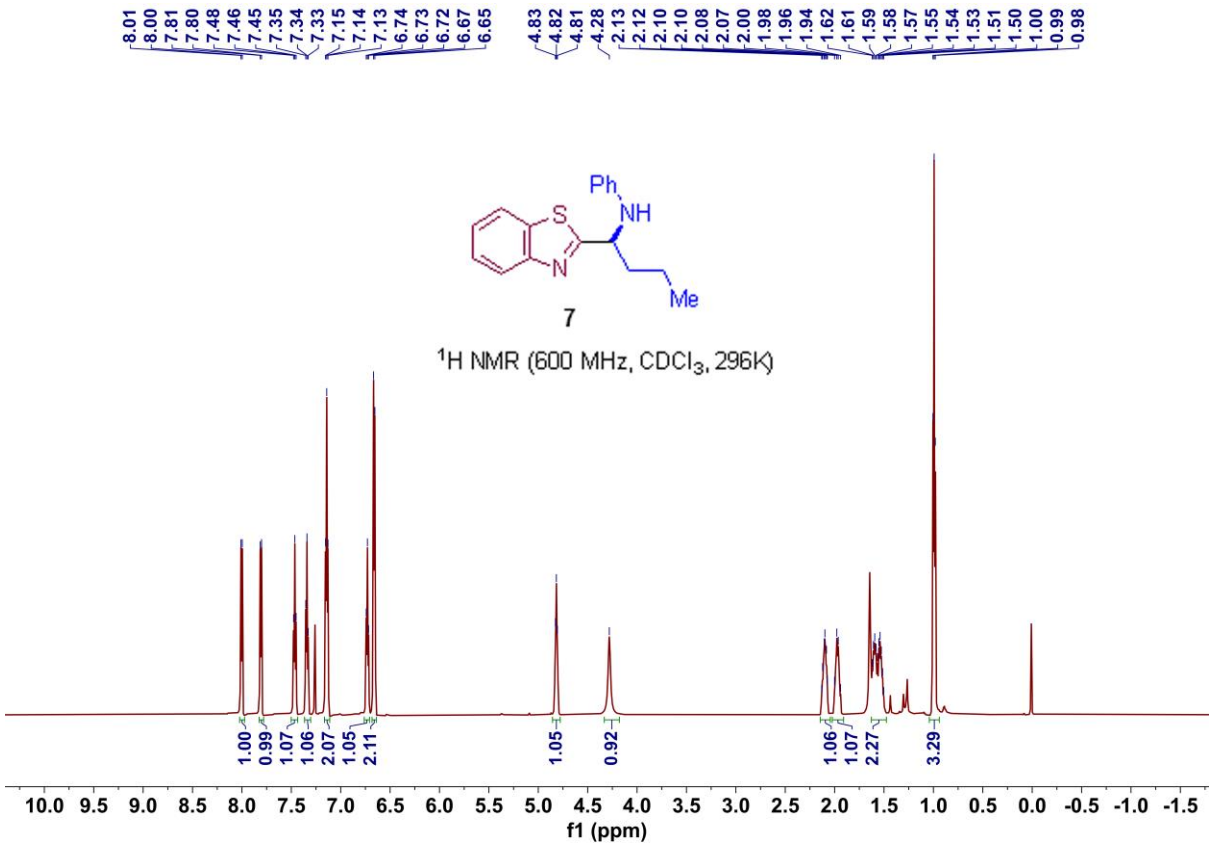

175.00 153.66 149.94 141.16 135.47 129.44 128.76 128.52 126.17 125.95 125.08 123.02 121.81 118.30 113.94 61.55 33.56 32.78 32.58
N
S
Bn
Me
N
Ph
4 qc
13C NMR (150 MHz, CDCl3, 296K)
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

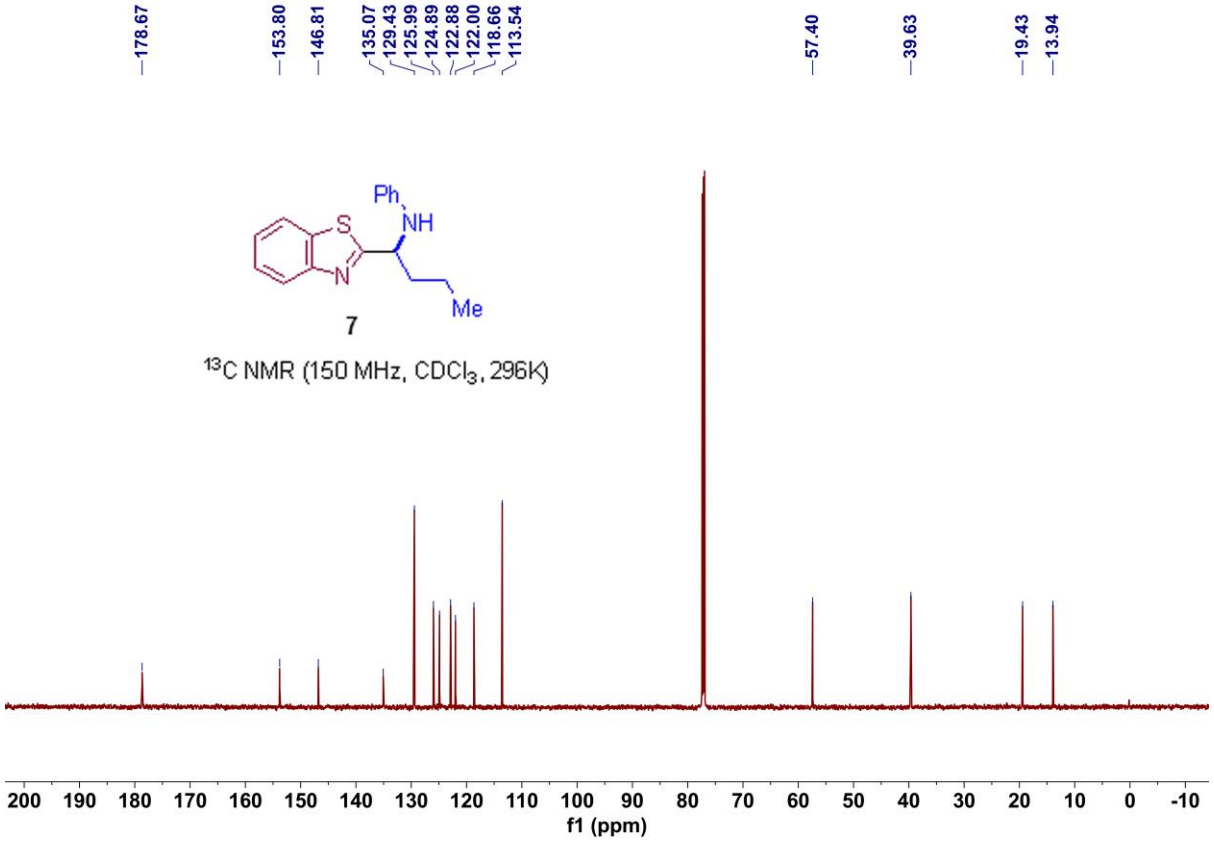

7.56 7.55 7.45 7.44 7.41 7.40 7.39 7.35 7.34 7.33 7.31 7.30 7.26 7.26 7.25 7.24 7.23 7.18 7.17 7.16 7.07 7.06 5.16 3.83 3.81 3.48 3.46 3.37 3.36 3.35 3.34 2.76 2.75 2.75 2.75 2.74 2.73 2.72 2.56 2.55 2.55 2.54 2.53 2.52 2.51 2.07 2.06 2.05 2.05 2.04 2.03 1.94 1.93 1.93 1.92 1.92 1.91

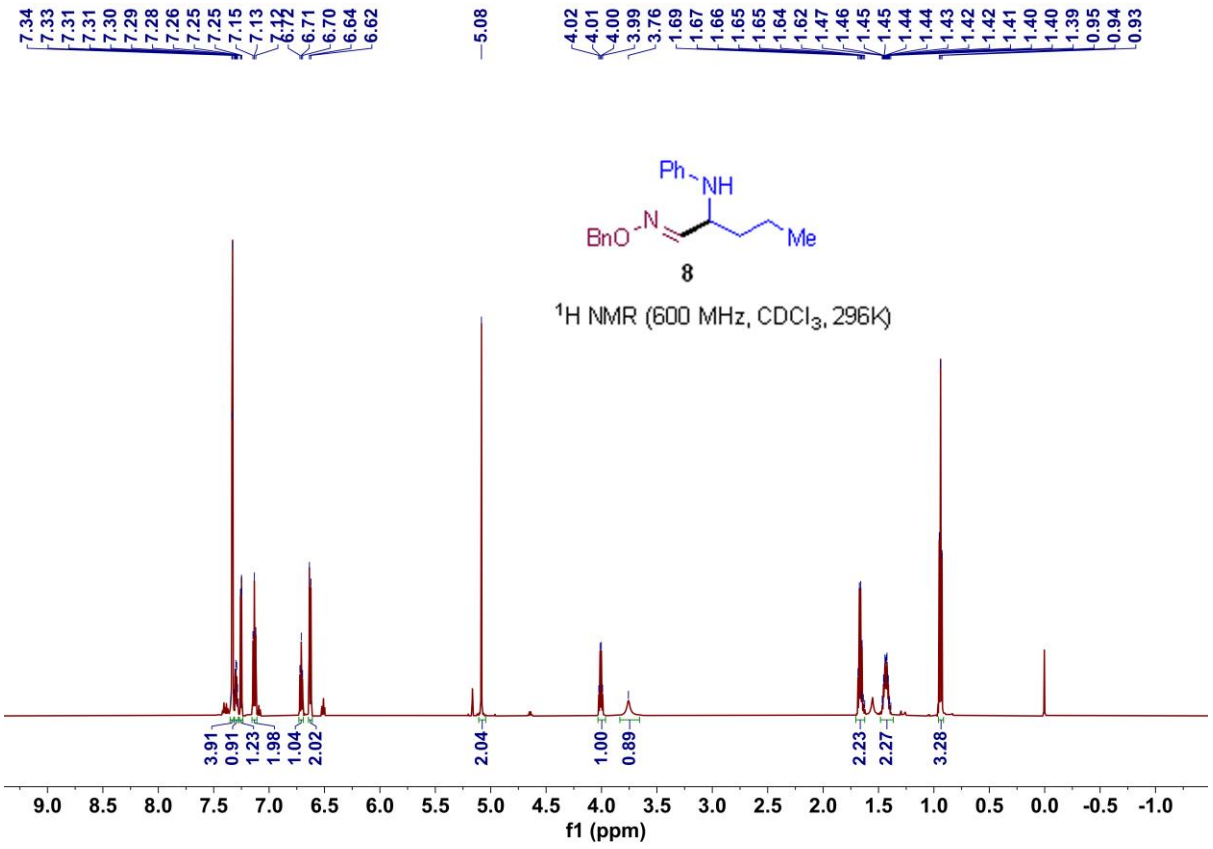

Bn
BnO–N
N–Bn
Bn
4rc
^{1}H NMR (600 MHz, CDCl$_3$, 296K)
1.00 2.08 2.27 8.94 3.42 1.02 1.93 2.01 2.01 2.01 1.01 0.97 1.13 1.07 1.02
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

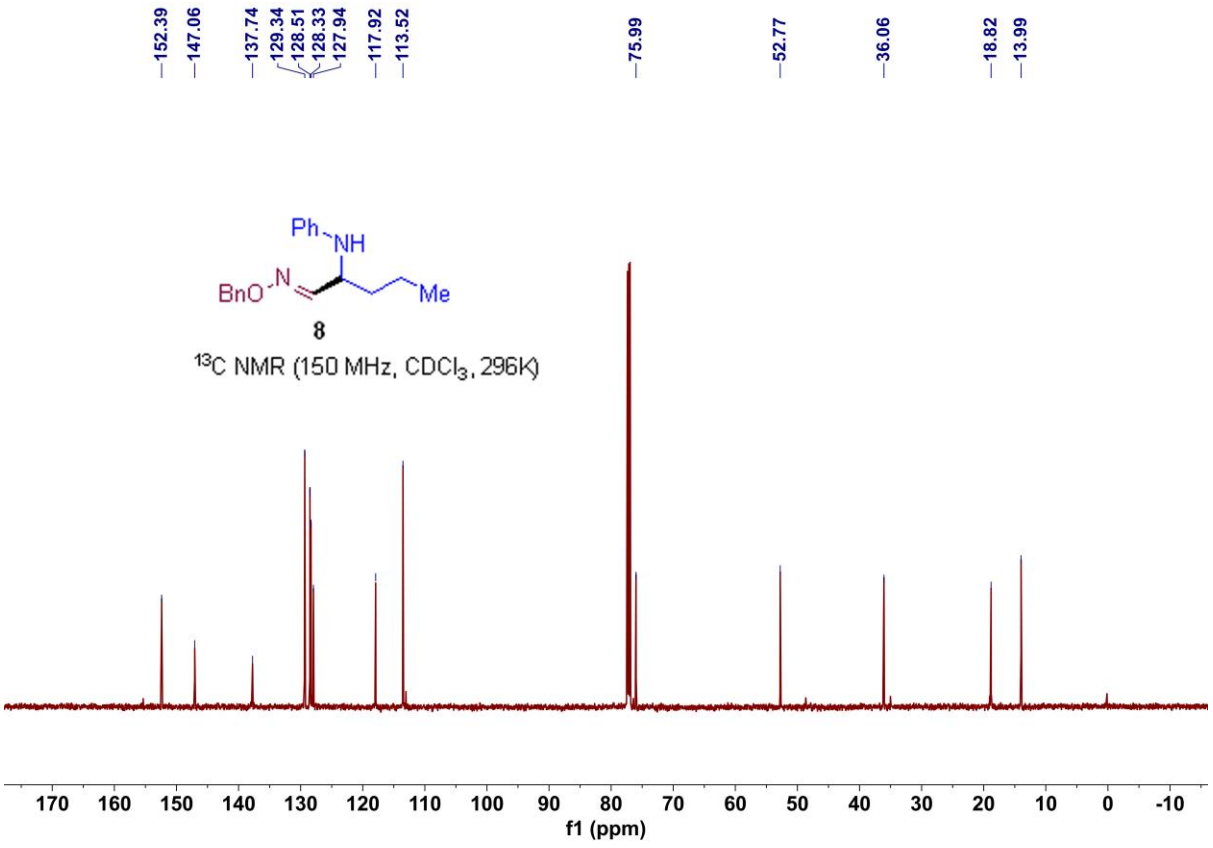

150.31 142.21 139.71 137.98 128.96 128.54 128.52 128.45 128.38 128.02 127.07 125.88 75.99 56.91 54.07 32.72 31.98

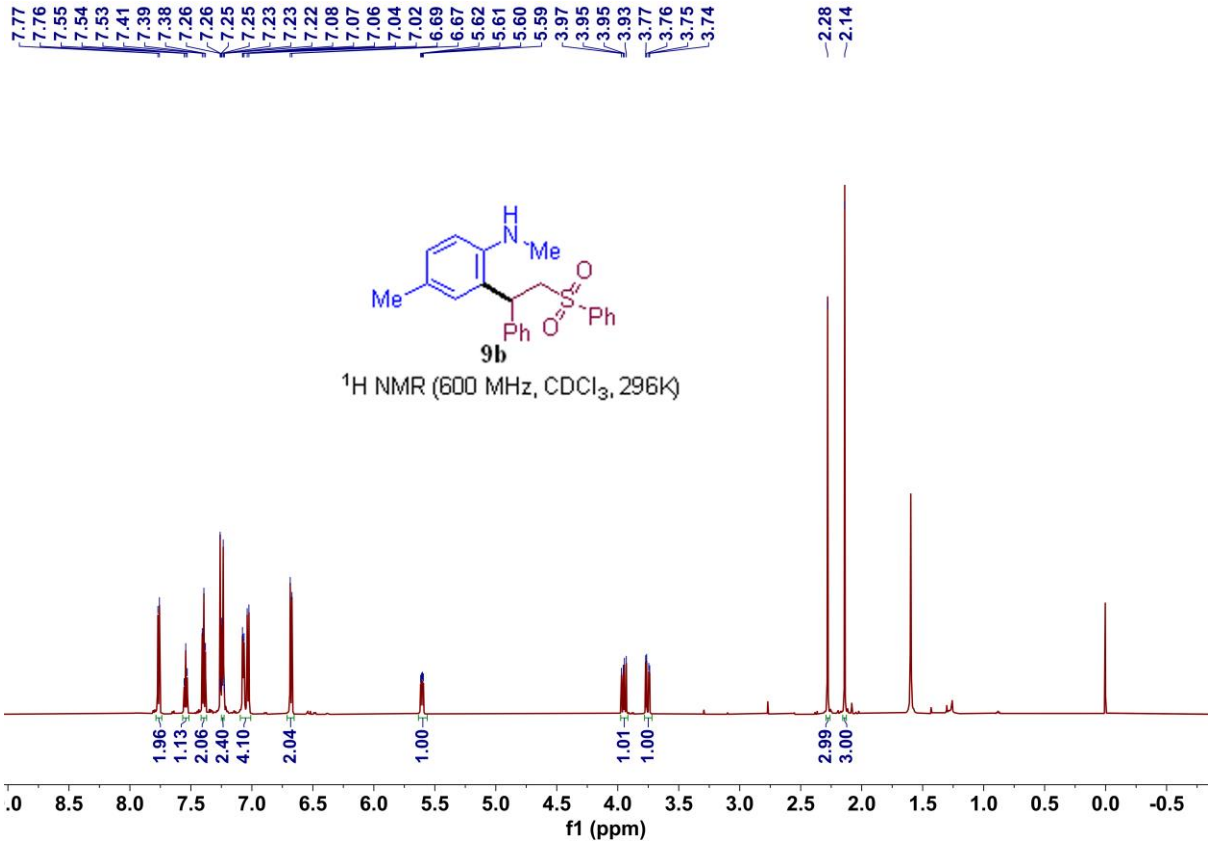

Bn
BnO–N
N–Bn
Bn
4rc
^{13}C NMR (150 MHz, CDCl$_3$, 296K)
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

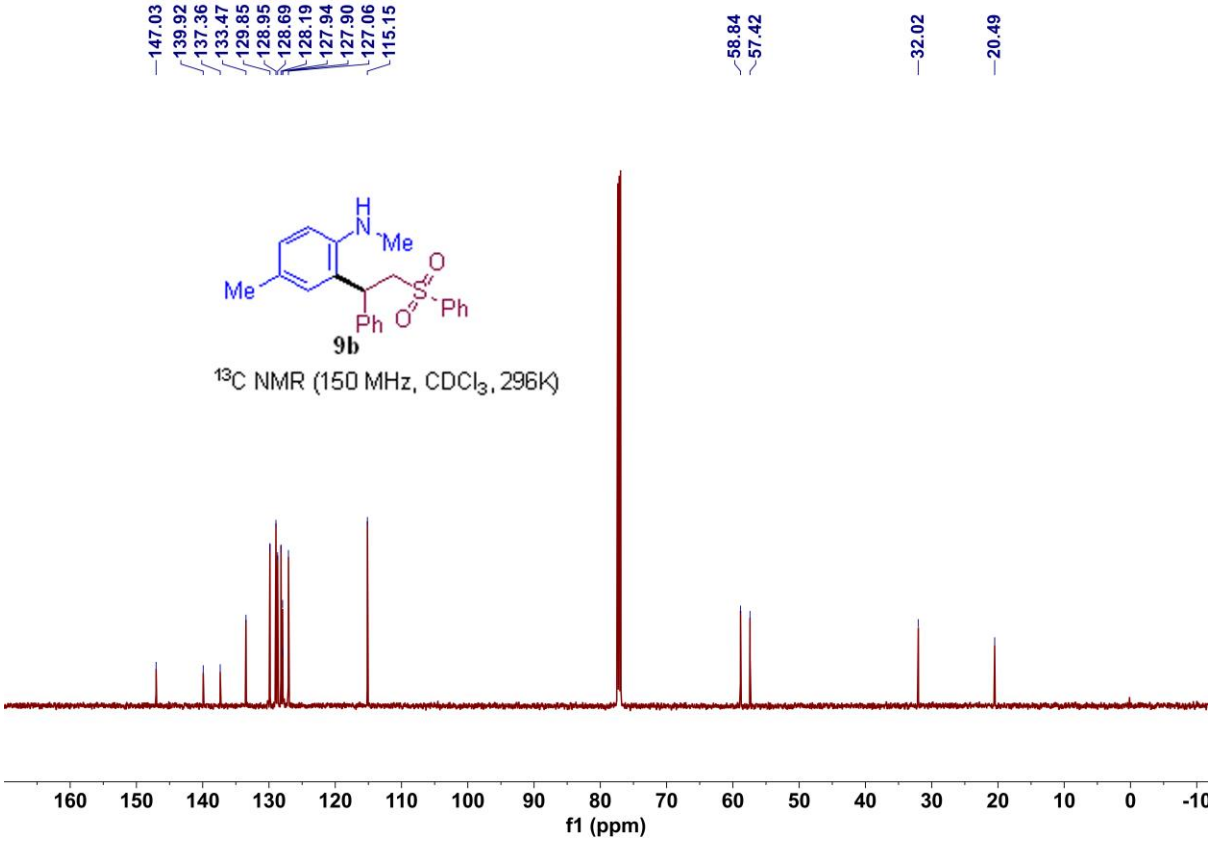

8.01 8.00 7.81 7.80 7.48 7.46 7.45 7.35 7.34 7.33 7.15 7.14 7.13 6.74 6.73 6.72 6.67 6.65
4.83 4.82 4.81 4.28 2.13 2.12 2.10 2.10 2.08 2.07 2.00 1.98 1.96 1.94 1.62 1.61 1.59 1.58 1.57 1.55 1.54 1.53 1.51 1.50 1.00 0.99 0.98
Ph
NH
S
N
Me
7
1H NMR (600 MHz, CDCl3, 296K)
1.00 0.99 1.07 1.06 2.07 1.05 2.11 1.05 0.92 1.06 1.07 2.27 3.29
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)

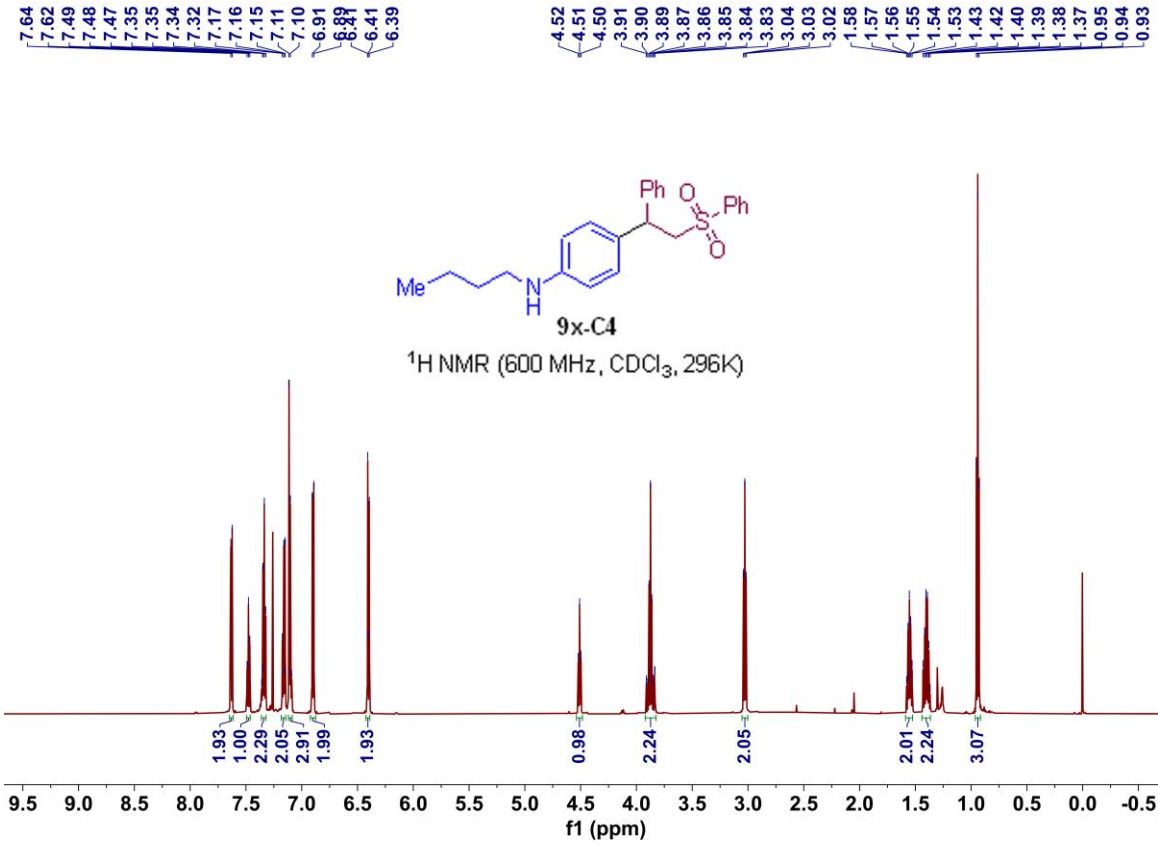

178.67 153.80 146.81 135.07 129.43 125.99 124.89 122.88 122.00 118.66 113.54 57.40 39.63 19.43 13.94
Ph
NH
S
N
Me
7
13C NMR (150 MHz, CDCl3, 296K)
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

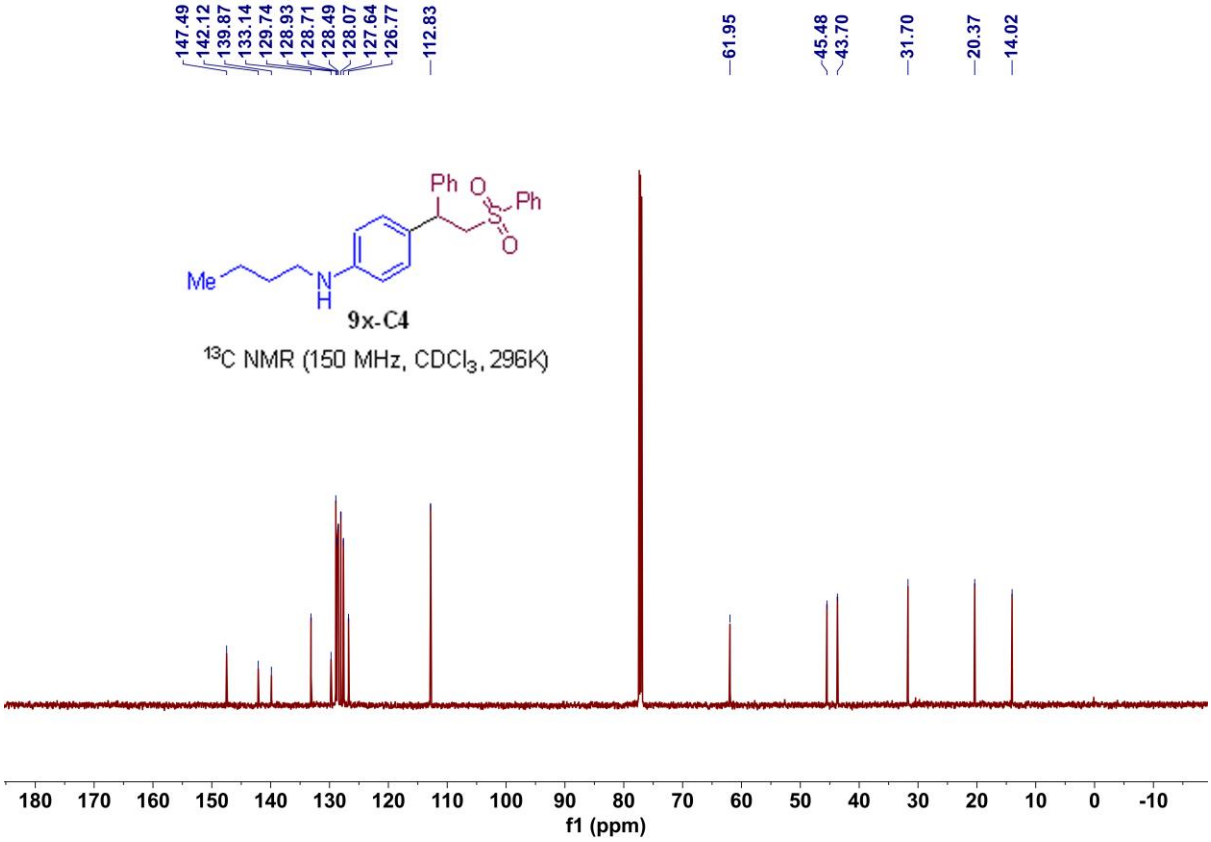

7.34 7.33 7.31 7.31 7.30 7.29 7.28 7.26 7.25 7.25 7.15 7.13 7.12 6.71 6.70 6.64 6.62
5.08
4.02 4.01 4.00 3.99 3.76 1.69 1.67 1.66 1.65 1.65 1.64 1.62 1.47 1.46 1.45 1.45 1.44 1.44 1.43 1.42 1.42 1.41 1.40 1.40 1.39 0.95 0.94 0.93
Ph NH
BnO N
Me
8
1H NMR (600 MHz, CDCl3, 296K)
3.91 0.91 1.23 1.98 1.04 2.02 2.04 1.00 0.89 2.23 2.27 3.28
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)

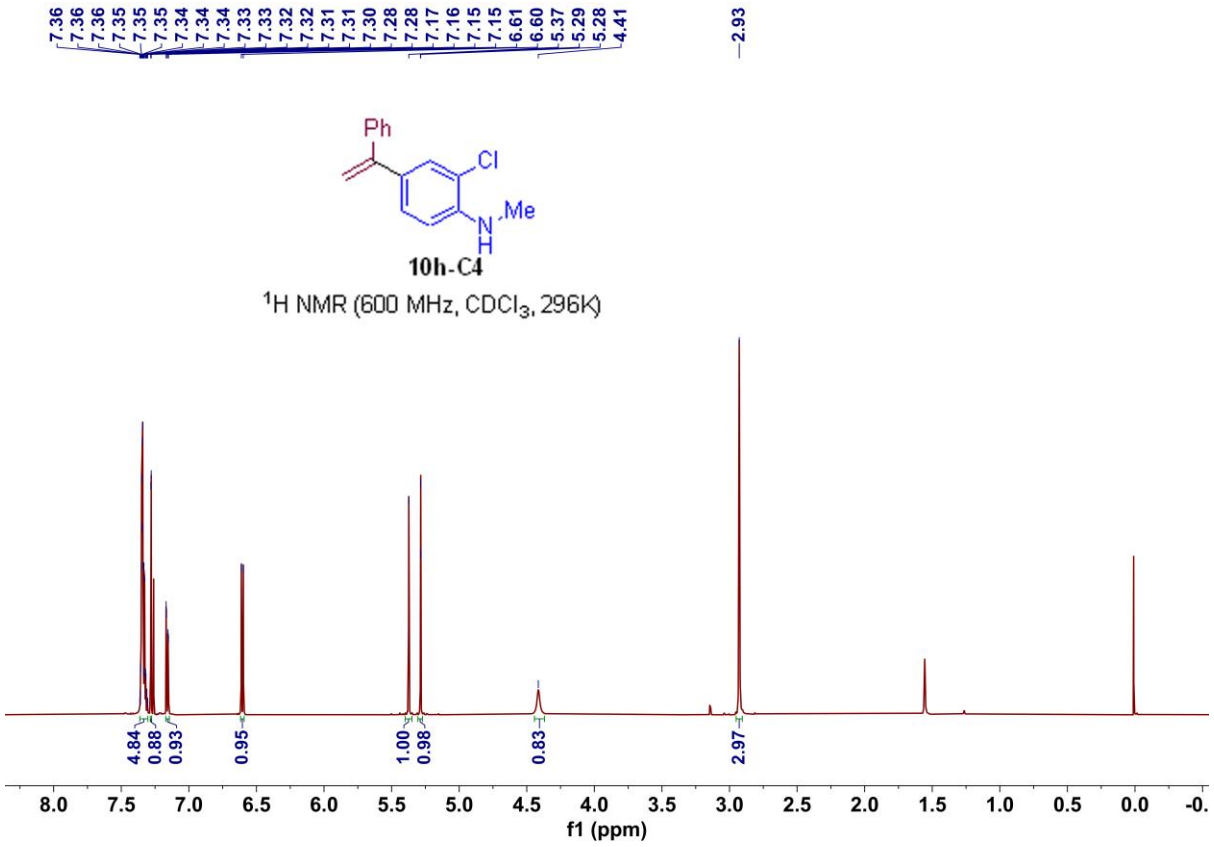

152.39 147.06 137.74 129.34 128.51 128.33 127.94 117.92 113.52 75.99 52.77 36.06 18.82 13.99
Ph NH
BnO N
Me
8
13C NMR (150 MHz, CDCl3, 296K)
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

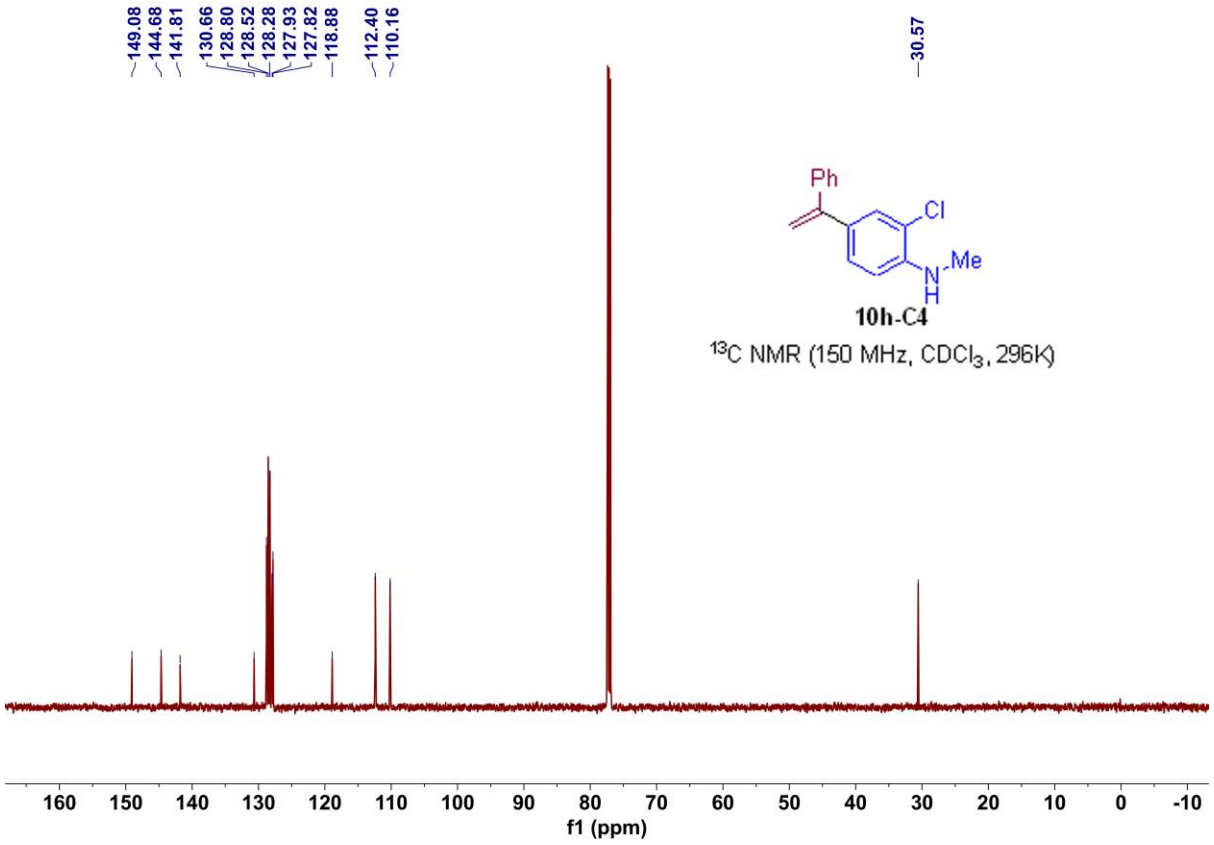

7.77
7.76
7.55
7.54
7.53
7.41
7.39
7.38
7.26
7.25
7.25
7.23
7.23
7.22
7.08
7.07
7.06
7.04
7.02
6.69
6.67
5.62
5.61
5.60
5.59
3.97
3.95
3.95
3.93
3.77
3.76
3.75
3.74
2.28
2.14
Me
Me
Ph
Ph
9b
1H NMR (600 MHz, CDCl3, 296K)
1.96
1.13
2.06
2.40
4.10
2.04
1.00
1.01
1.00
2.99
3.00
f1 (ppm)

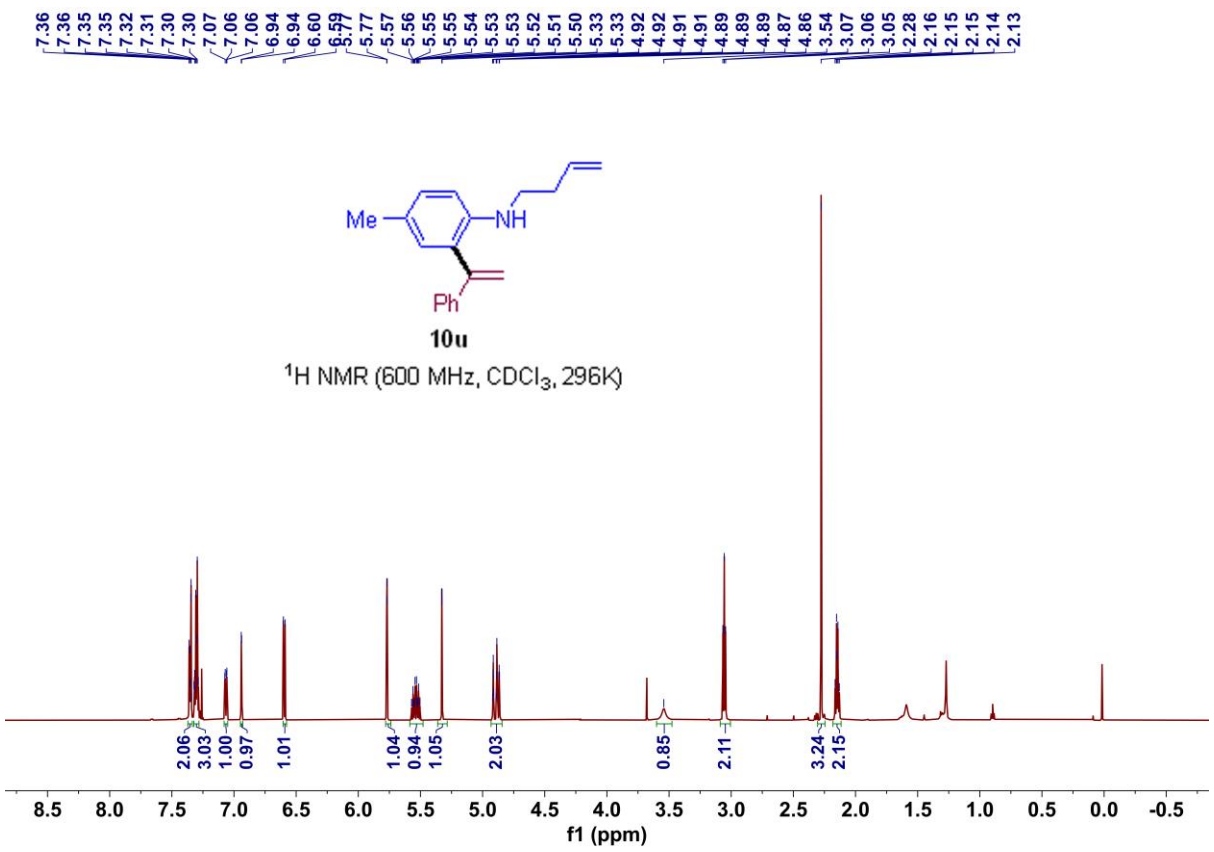

147.03
139.92
137.36
133.47
129.85
128.95
128.69
128.19
127.94
127.90
127.06
115.15
58.84
57.42
32.02
20.49
Me
Me
Ph
Ph
9b
13C NMR (150 MHz, CDCl3, 296K)
f1 (ppm)

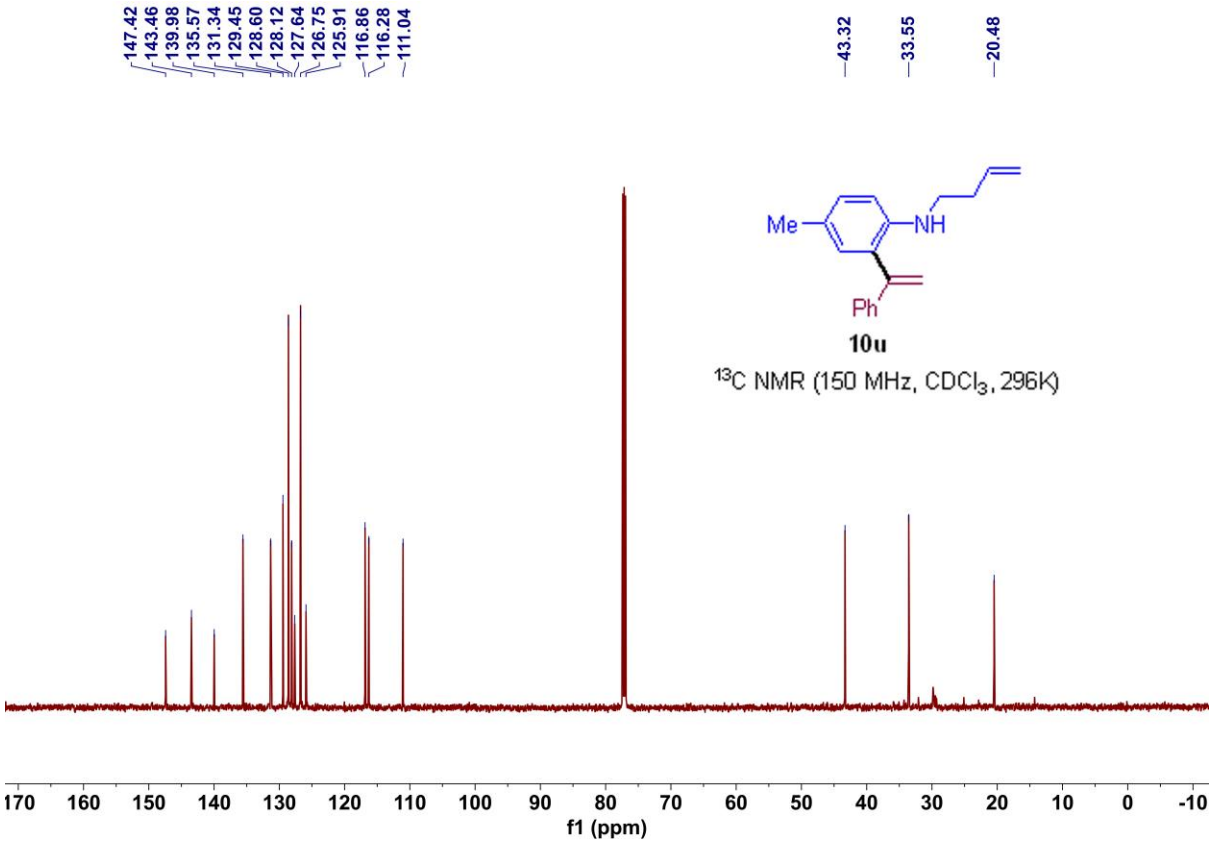

7.64
7.62
7.49
7.48
7.47
7.35
7.34
7.32
7.17
7.16
7.15
7.11
7.10
6.91
6.89
6.41
6.39
4.52
4.51
4.50
3.91
3.90
3.89
3.87
3.86
3.85
3.84
3.83
3.04
3.03
3.02
1.58
1.57
1.56
1.55
1.54
1.53
1.43
1.42
1.40
1.39
1.38
1.37
0.95
0.94
0.93
Ph
O
S
Ph
O
Me
N
H
9x-C4
1H NMR (600 MHz, CDCl3, 296K)
1.93
1.00
2.29
2.05
2.91
1.99
1.93
0.98
2.24
2.05
2.01
2.24
3.07
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
f1 (ppm)

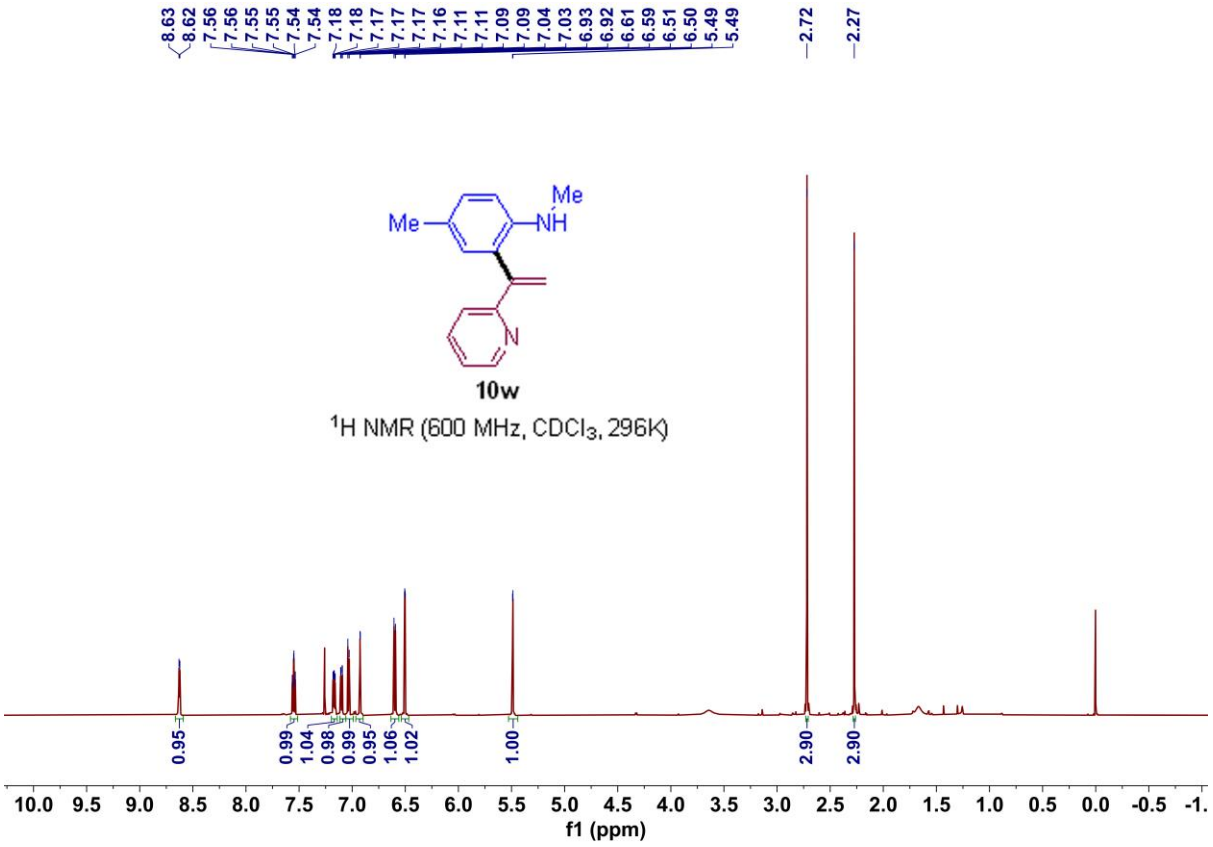

147.49
142.12
139.87
133.14
129.74
128.93
128.71
128.49
128.07
127.64
126.77
112.83
61.95
45.48
43.70
31.70
20.37
14.02
Ph
O
S
Ph
O
Me
N
H
9x-C4
13C NMR (150 MHz, CDCl3, 296K)
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

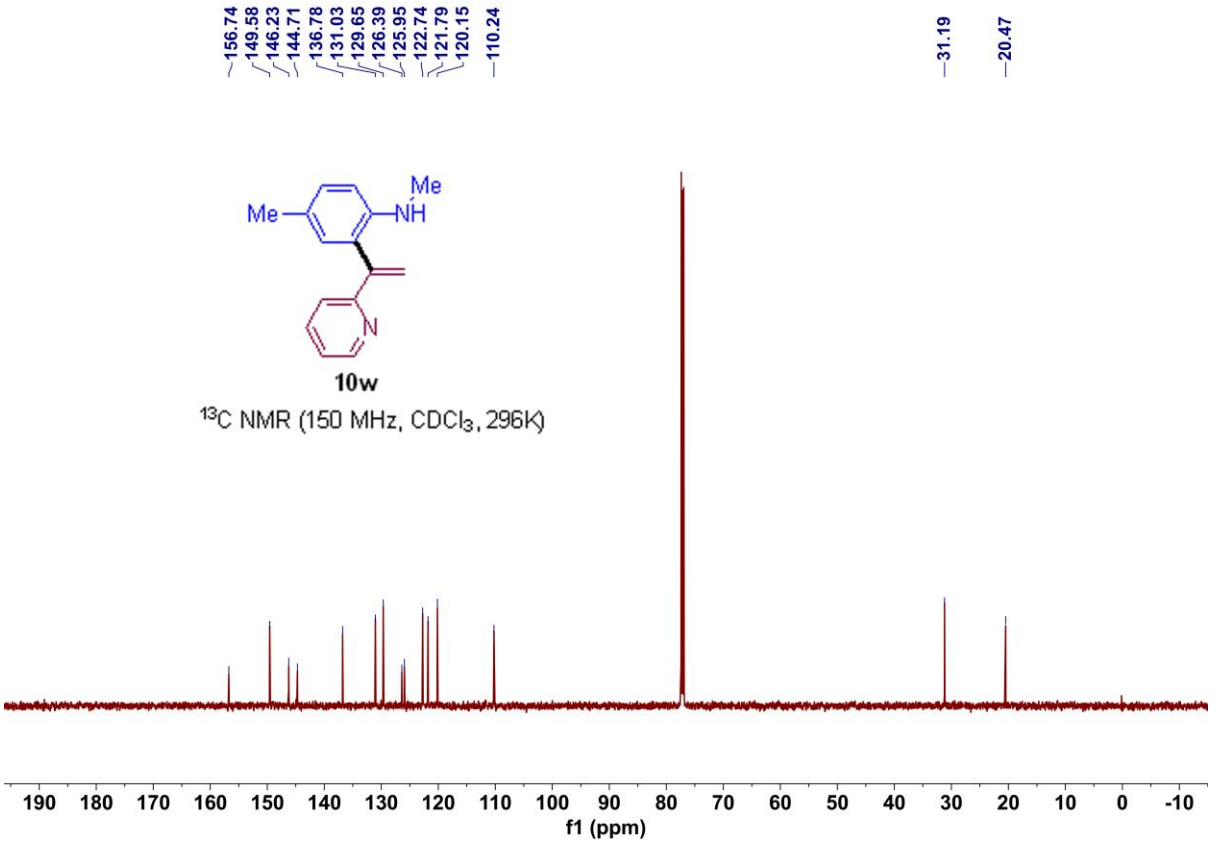

7.36
7.36
7.36
7.35
7.35
7.35
7.34
7.34
7.34
7.33
7.33
7.32
7.32
7.31
7.31
7.30
7.28
7.28
7.17
7.16
7.15
7.15
6.61
6.60
5.37
5.29
5.28
4.41
2.93
Ph
Cl
Me
N
H
10h-C4
1H NMR (600 MHz, CDCl3, 296K)
4.84
0.88
0.93
0.95
1.00
0.98
0.83
2.97
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.
f1 (ppm)

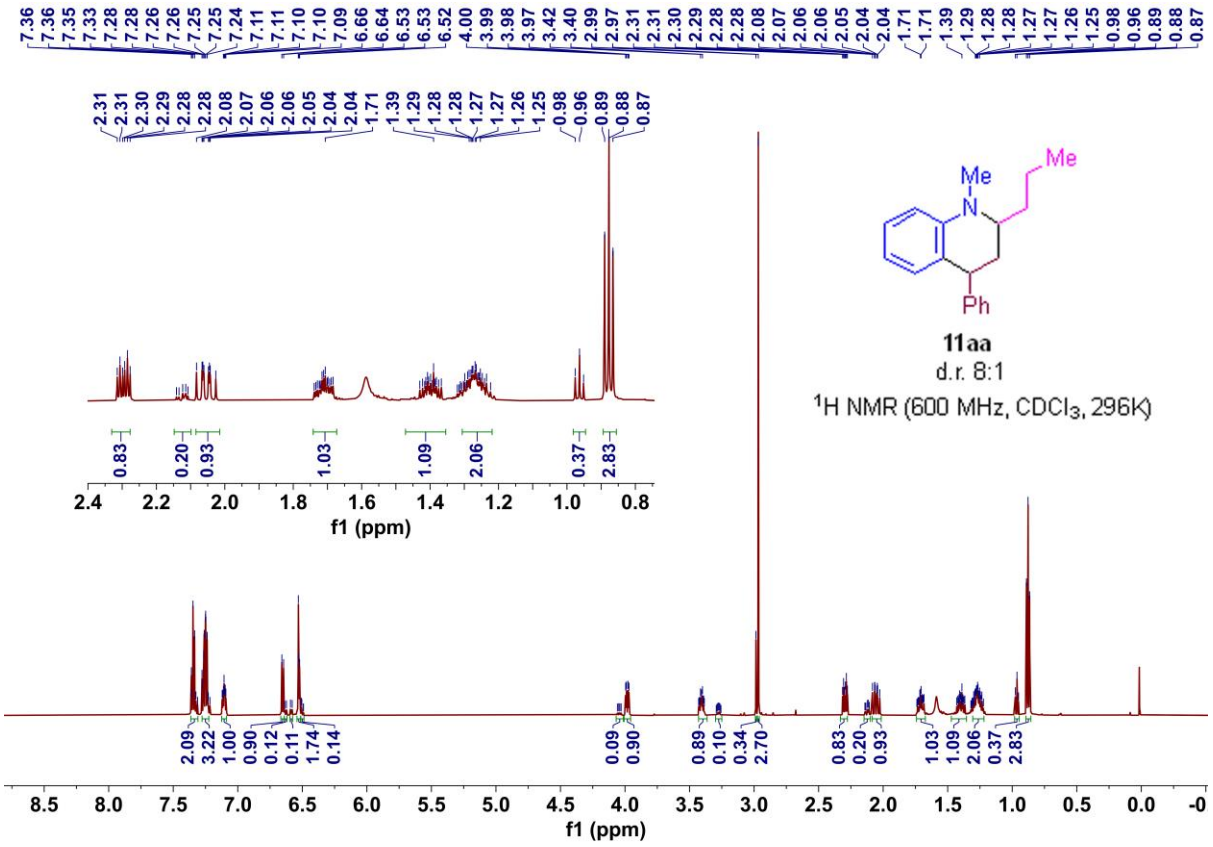

149.08
144.68
141.81
130.66
128.80
128.52
128.28
127.93
127.82
118.88
112.40
110.16
30.57
Ph
Cl
Me
N
H
10h-C4
13C NMR (150 MHz, CDCl3, 296K)
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

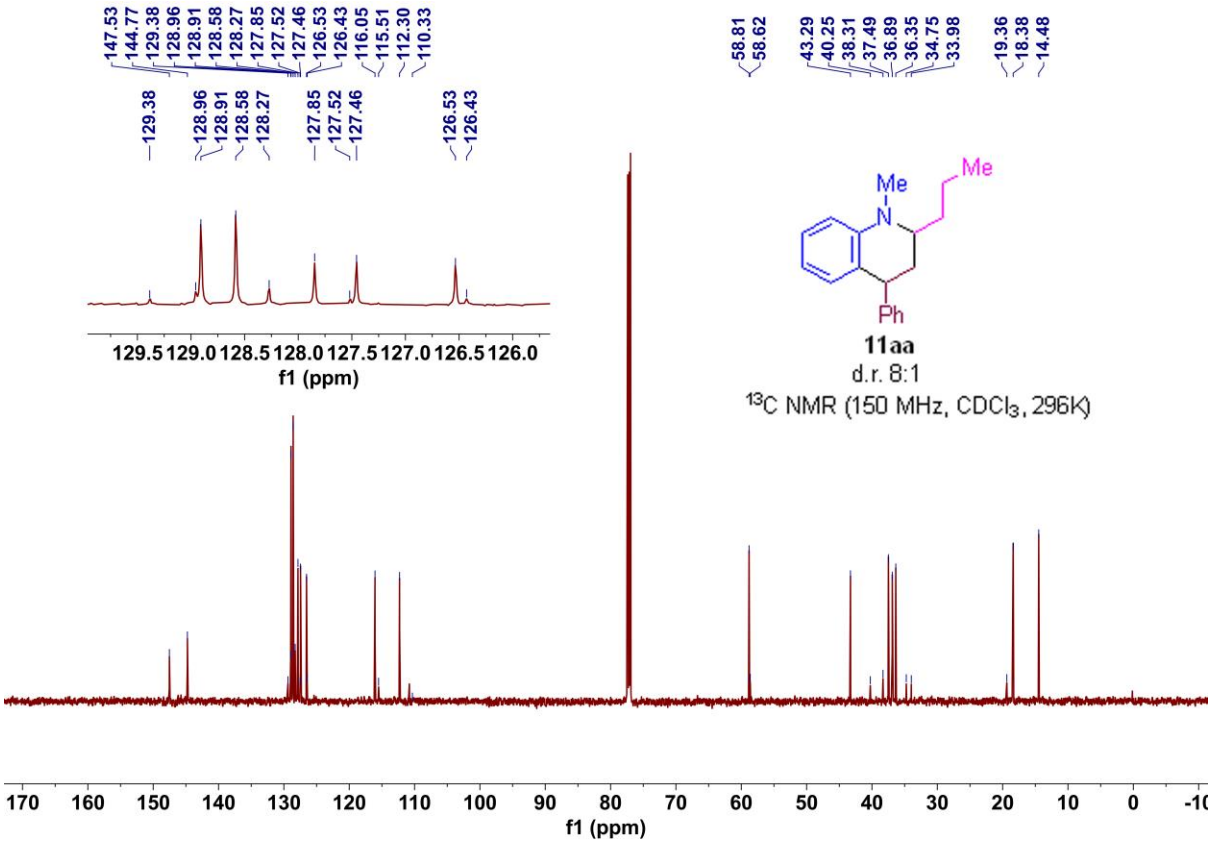

7.36
7.36
7.35
7.35
7.32
7.31
7.30
7.30
7.07
7.06
7.06
6.94
6.60
5.77
5.57
5.56
5.55
5.55
5.54
5.53
5.53
5.52
5.51
5.50
5.33
5.33
4.92
4.91
4.91
4.89
4.89
4.87
4.86
3.54
3.07
3.06
3.05
2.28
2.16
2.15
2.15
2.14
2.13
Me
NH
Ph
10u
1H NMR (600 MHz, CDCl3, 296K)
2.06
3.03
1.00
0.97
1.01
1.04
0.94
1.05
2.03
0.85
2.11
3.24
2.15
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

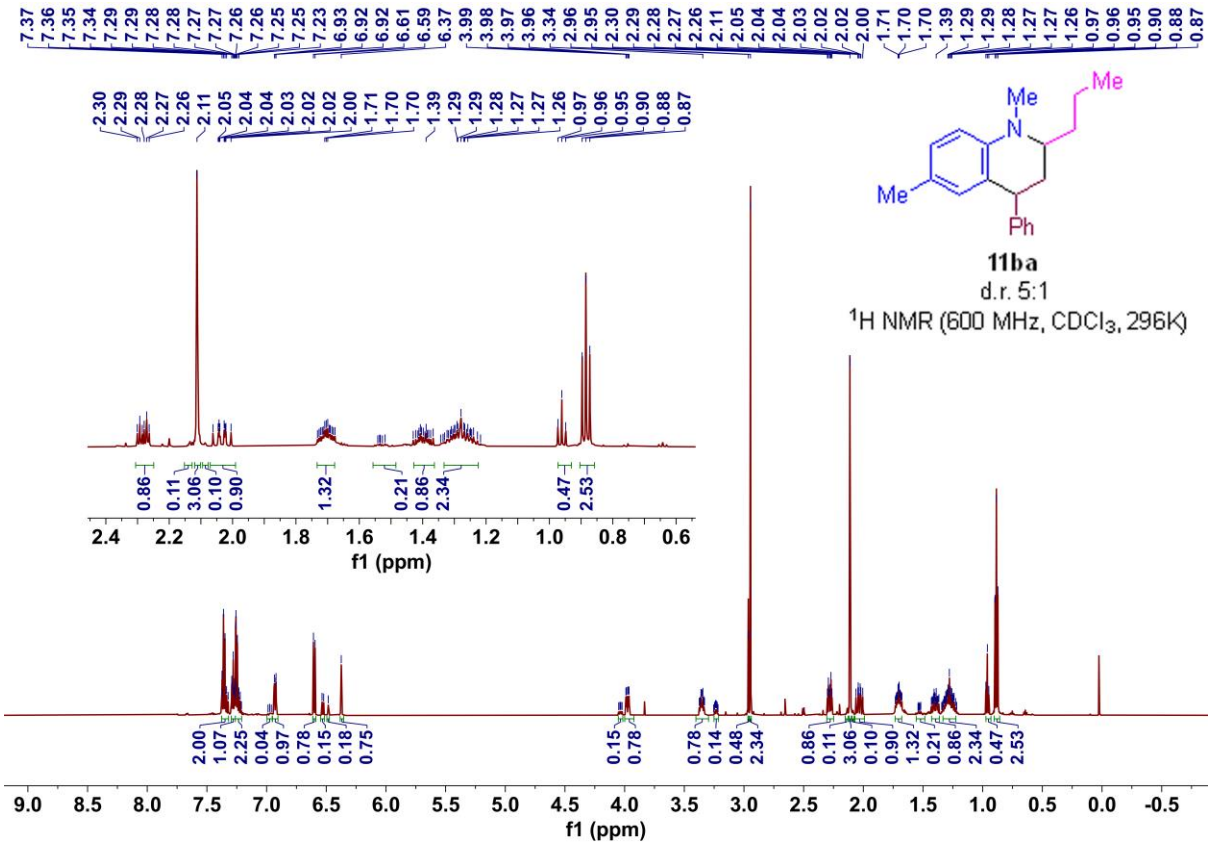

147.42
143.46
139.98
135.57
131.34
129.45
128.60
128.12
127.64
126.75
125.91
116.86
116.28
111.04
43.32
33.55
20.48
Me
NH
Ph
10u
13C NMR (150 MHz, CDCl3, 296K)
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

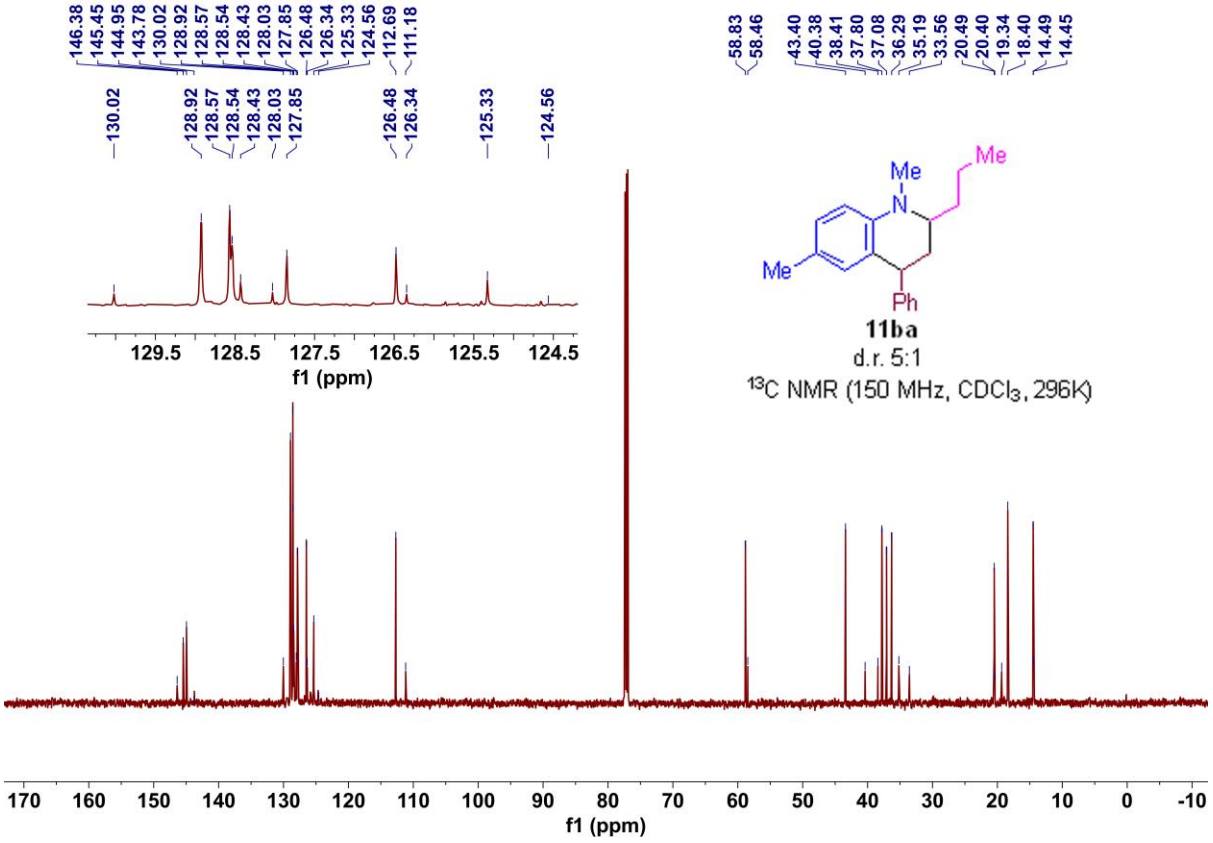

8.63
8.62
7.56
7.56
7.55
7.55
7.54
7.54
7.18
7.18
7.17
7.17
7.17
7.16
7.11
7.11
7.09
7.09
7.04
7.03
6.93
6.92
6.61
6.59
6.51
6.50
5.49
5.49
2.72
2.27
Me
Me
NH
N
10w
1H NMR (600 MHz, CDCl3, 296K)
0.95
0.99
1.04
0.98
0.99
0.95
1.06
1.02
1.00
2.90
2.90
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.
f1 (ppm)

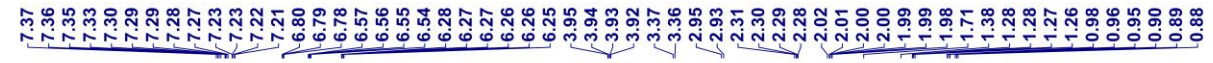

156.74
149.58
146.23
144.71
136.78
131.03
129.65
126.39
125.95
122.74
121.79
120.15
110.24
31.19
20.47
Me
Me
NH
N
10w
13C NMR (150 MHz, CDCl3, 296K)
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

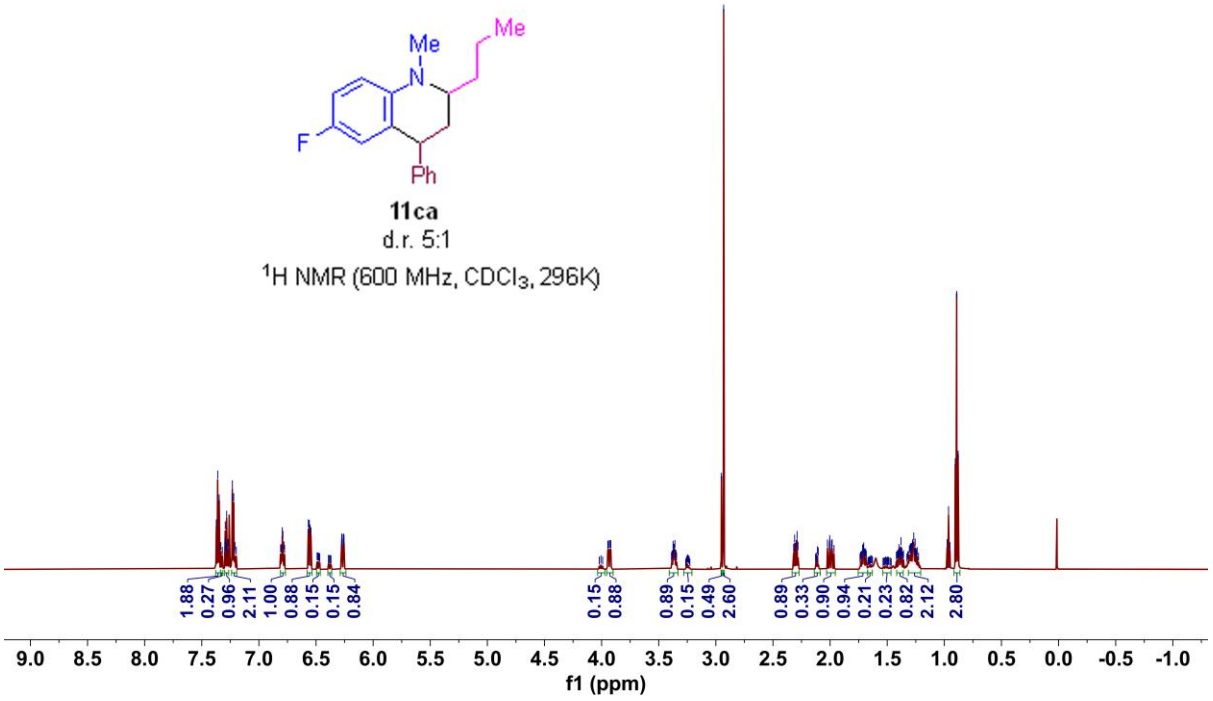

Me
N
Me
Ph
11aa
d.r. 8:1
1H NMR (600 MHz, CDCl3, 296K)
f1 (ppm)

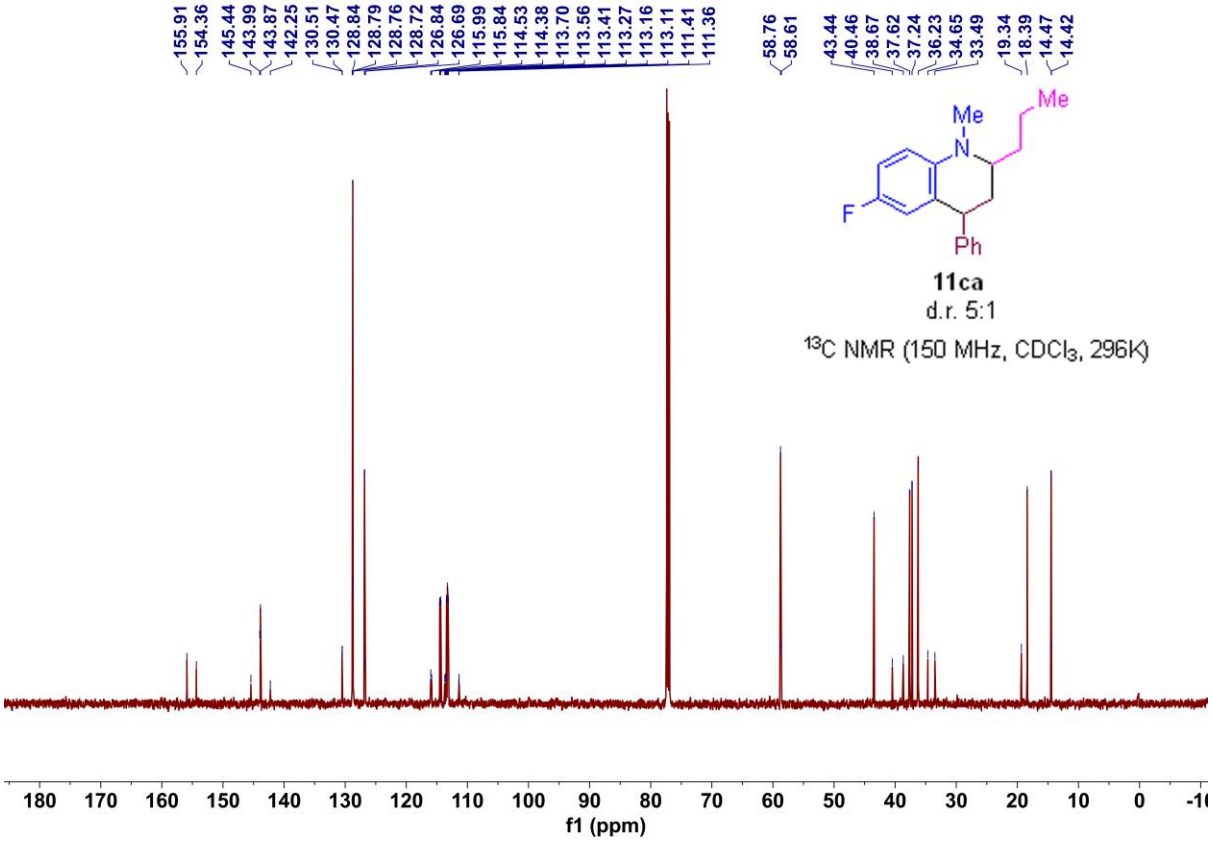

Me
N
Me
Ph
11aa
d.r. 8:1
13C NMR (150 MHz, CDCl3, 296K)
f1 (ppm)

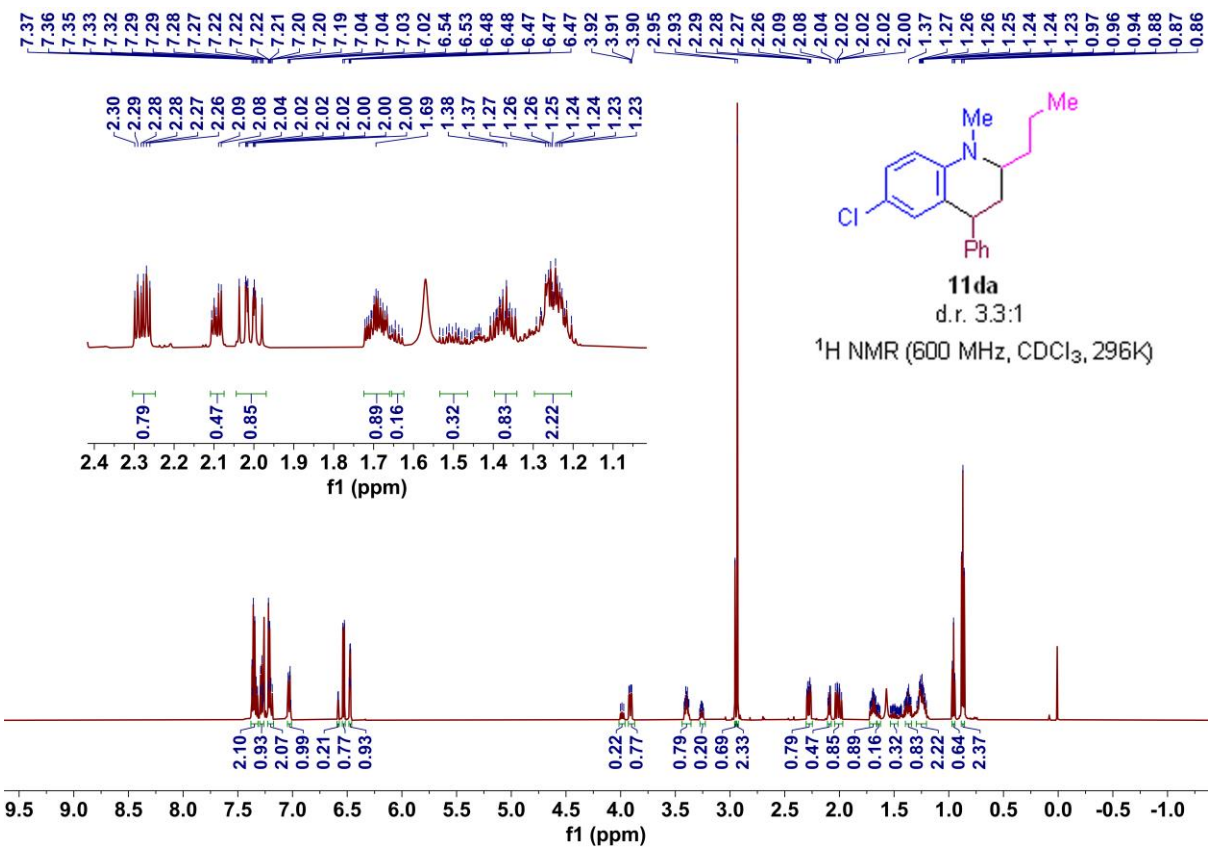

Me
N
Me
Ph
11ba
d.r. 5:1
1H NMR (600 MHz, CDCl3, 296K)
f1 (ppm)

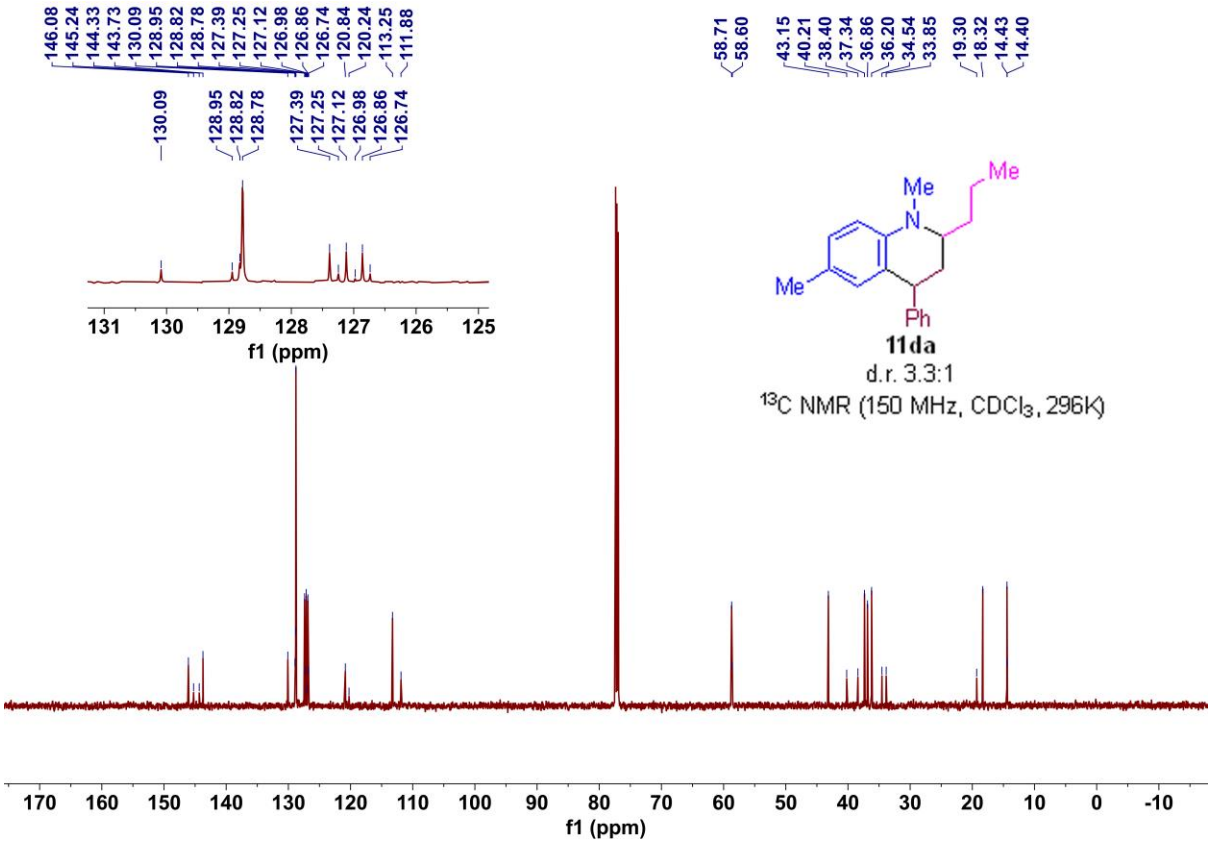

Me
N
Me
Ph
11ba
d.r. 5:1
13C NMR (150 MHz, CDCl3, 296K)
f1 (ppm)

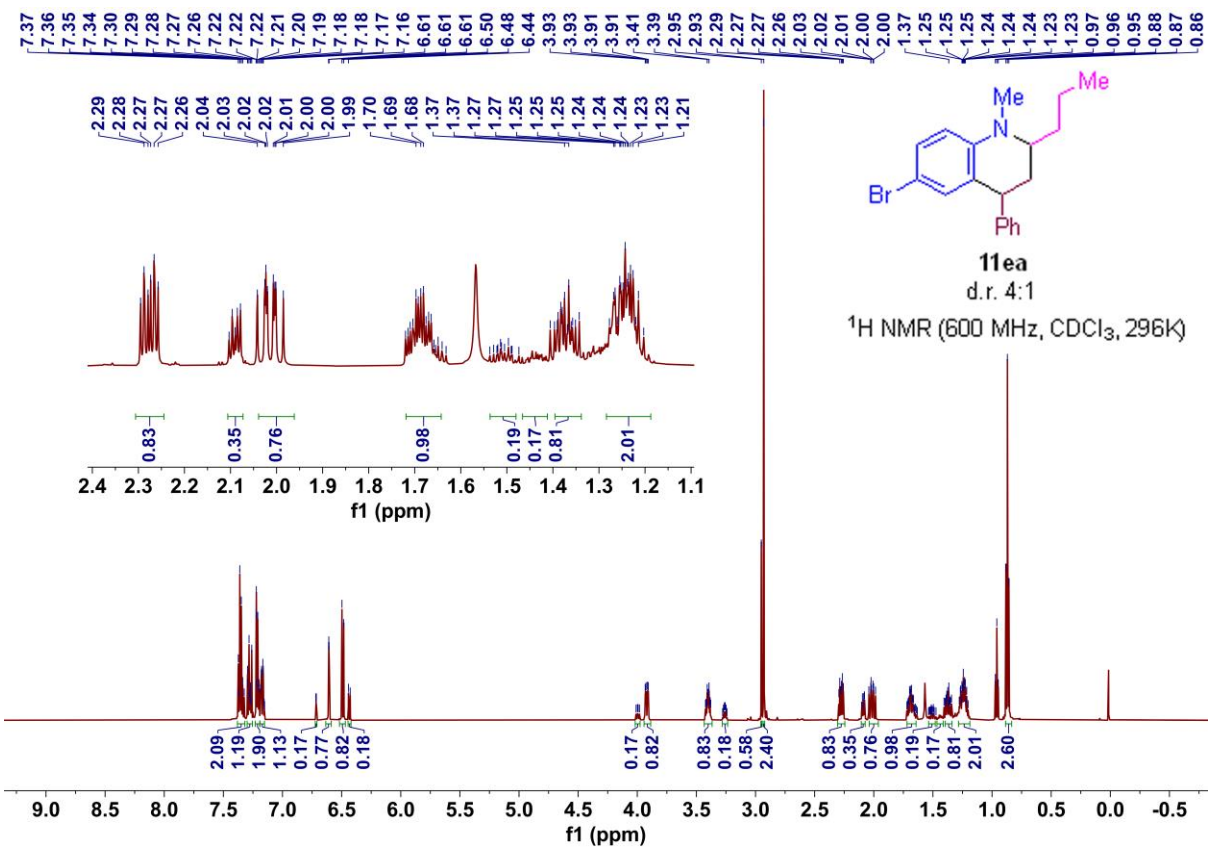

7.37 7.36 7.35 7.33 7.30 7.29 7.28 7.27 7.23 7.22 7.21 6.80 6.79 6.78 6.57 6.56 6.55 6.54 6.28 6.27 6.27 6.26 6.26 6.25 3.95 3.94 3.93 3.92 3.37 3.36 2.95 2.93 2.31 2.30 2.29 2.28 2.02 2.01 2.00 2.00 1.99 1.99 1.98 1.71 1.38 1.28 1.28 1.27 1.26 0.98 0.96 0.95 0.90 0.89 0.88

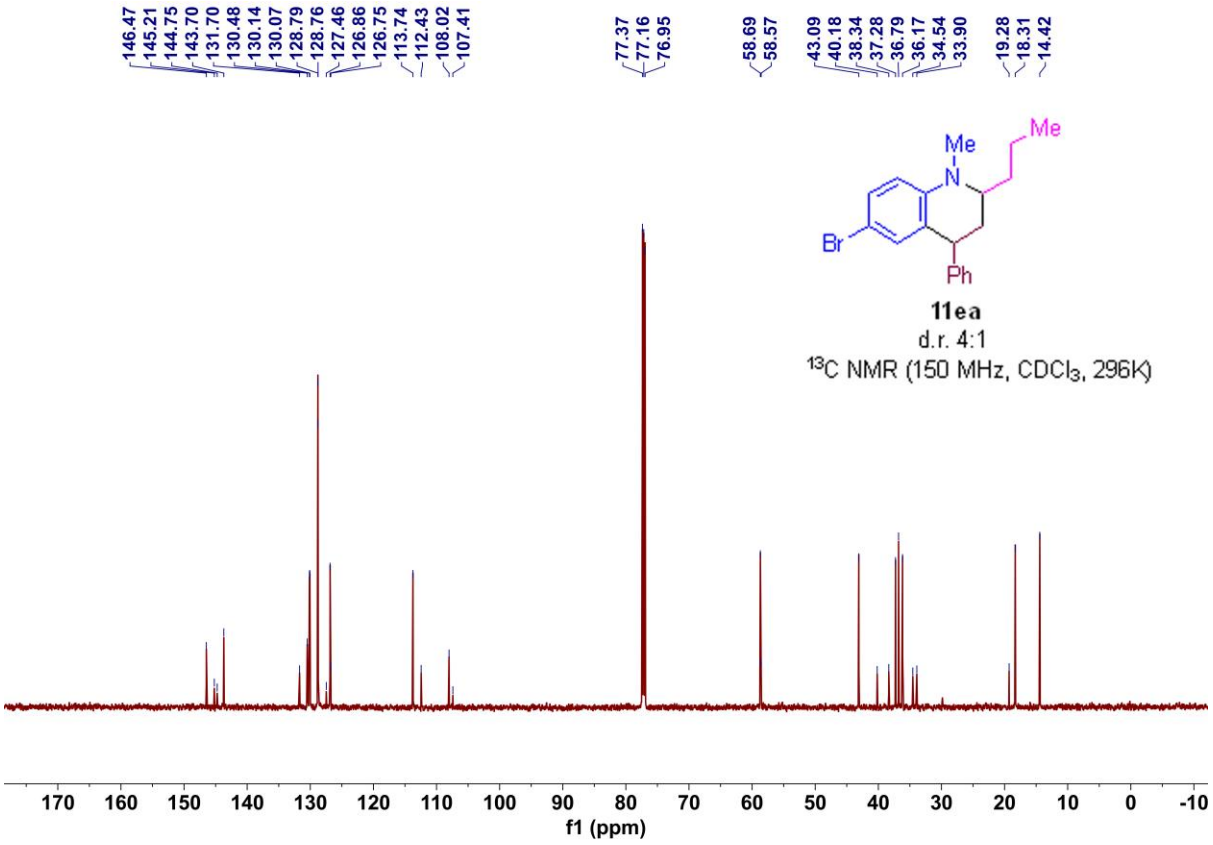

Me
N
Me
F
Ph
11ca
d.r. 5:1
1H NMR (600 MHz, CDCl3, 296K)
1.88 0.27 0.96 2.11 1.00 0.88 0.15 0.15 0.84 0.15 0.88 0.89 0.15 0.49 2.60 0.89 0.33 0.90 0.94 0.21 0.23 0.82 2.12 2.80
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)

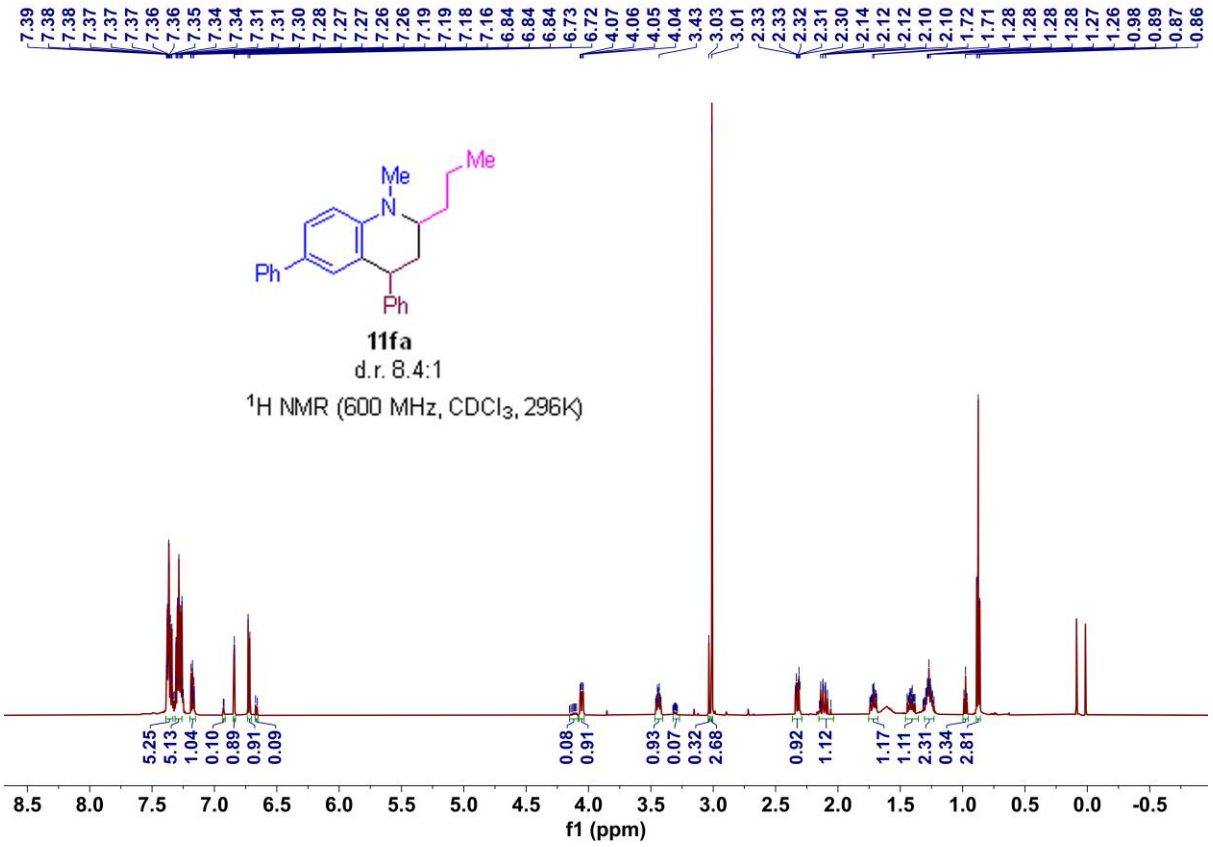

155.91 154.36 145.44 143.99 143.87 142.25 130.51 130.47 128.84 128.79 128.76 128.72 126.84 126.69 115.99 115.84 114.53 114.38 113.70 113.56 113.41 113.27 113.16 113.11 111.41 111.36 58.76 58.61 43.44 40.46 38.67 37.62 37.24 36.23 34.65 33.49 19.34 18.39 14.47 14.42
Me
N
Me
F
Ph
11ca
d.r. 5:1
13C NMR (150 MHz, CDCl3, 296K)
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

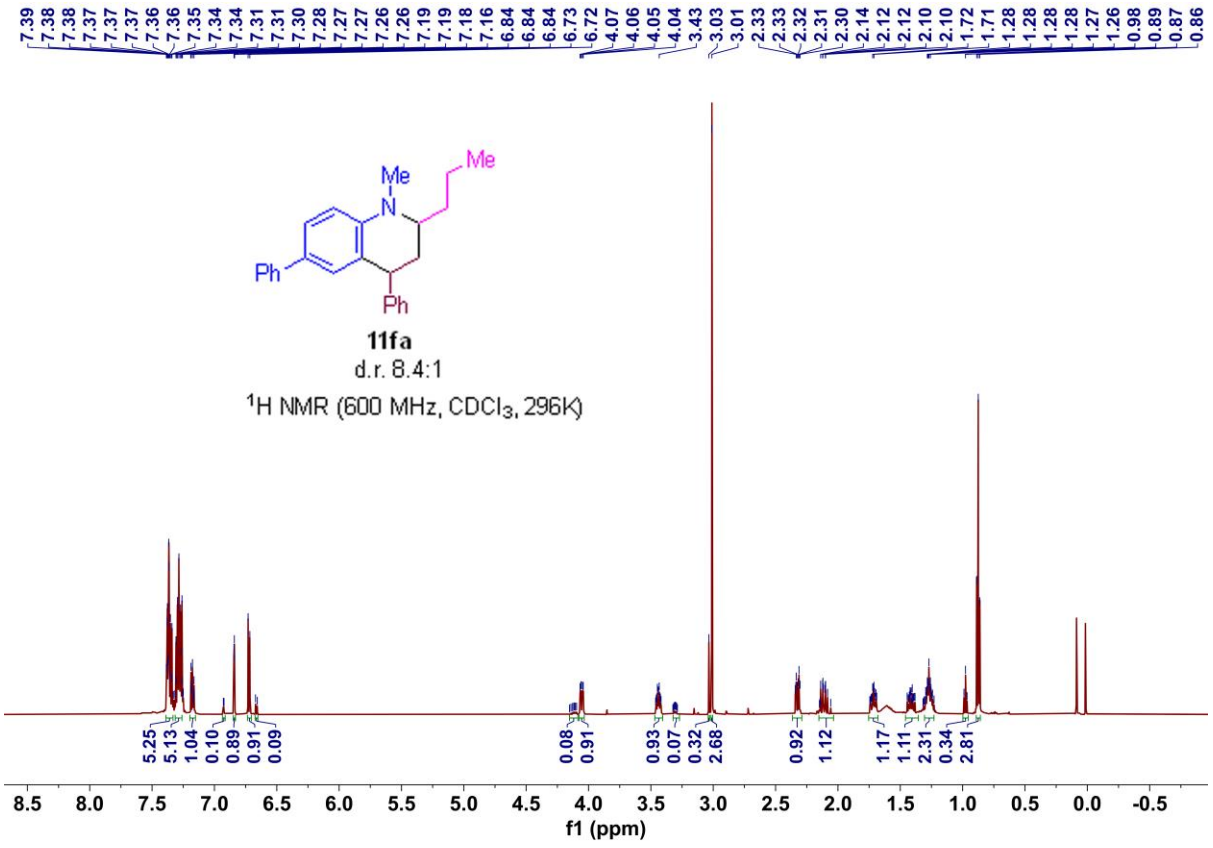

Me
N
Me
Cl
Ph
11da
d.r. 3.3:1
1H NMR (600 MHz, CDCl3, 296K)
f1 (ppm)

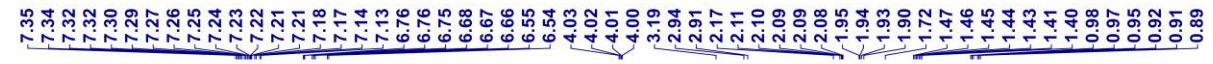

Me
N
Me
Me
Ph
11da
d.r. 3.3:1
13C NMR (150 MHz, CDCl3, 296K)
f1 (ppm)

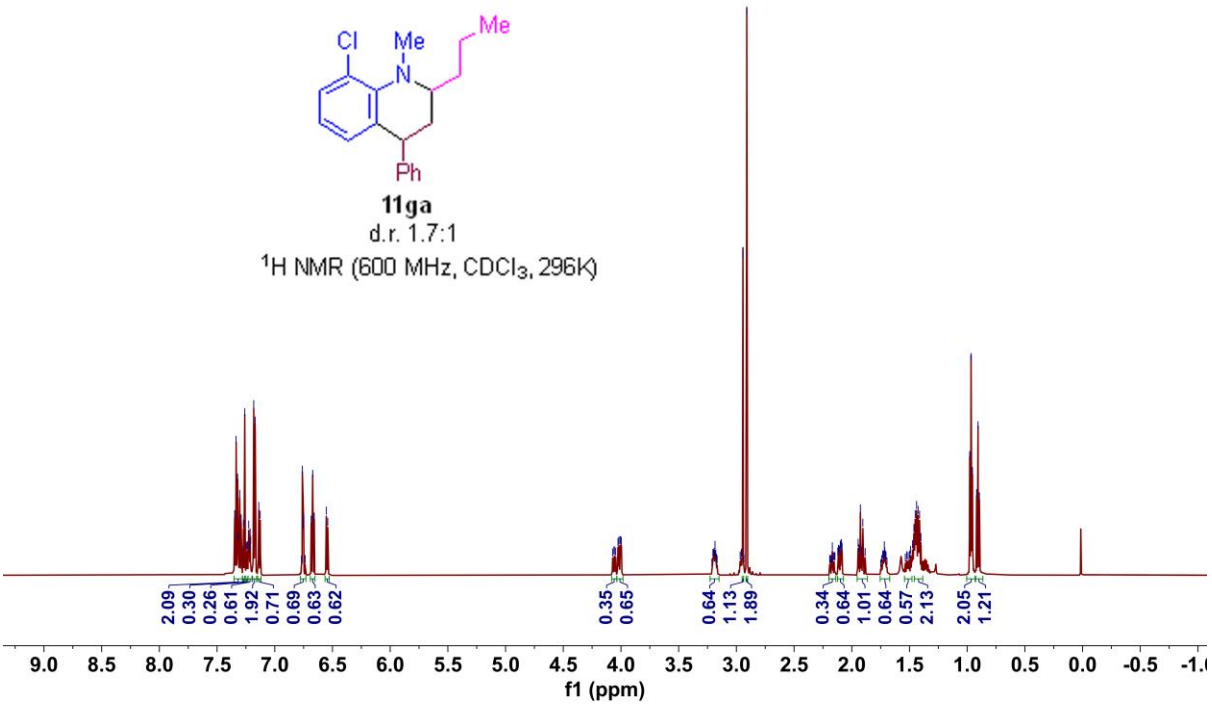

Me
N
Me
Br
Ph
11ea
d.r. 4:1
1H NMR (600 MHz, CDCl3, 296K)
f1 (ppm)


Me
N
Me
Br
Ph
11ea
d.r. 4:1
13C NMR (150 MHz, CDCl3, 296K)
f1 (ppm)

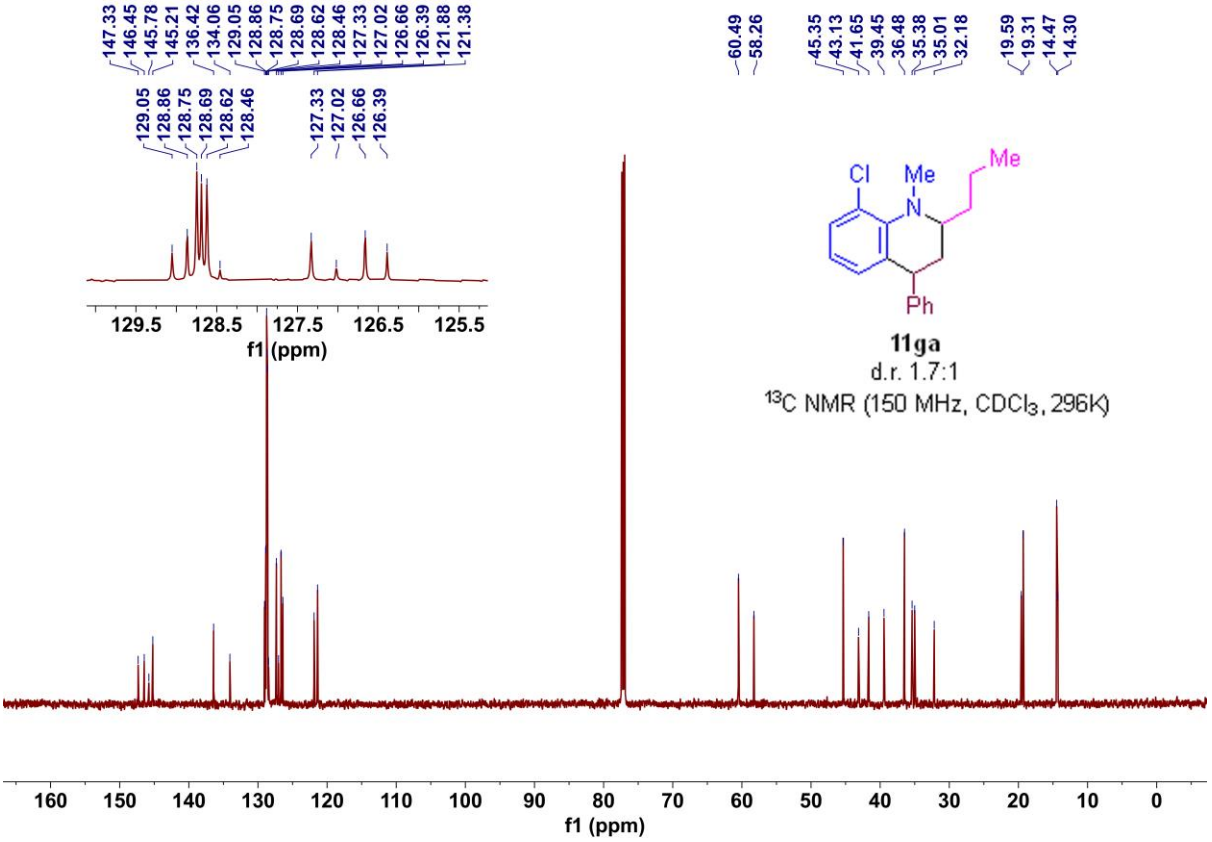

7.39 7.38 7.38 7.37 7.37 7.37 7.36 7.36 7.35 7.34 7.34 7.31 7.31 7.30 7.28 7.27 7.27 7.26 7.26 7.19 7.19 7.18 7.16 6.84 6.84 6.73 6.72 4.07 4.06 4.05 4.04 3.43 3.03 3.01 2.33 2.33 2.32 2.31 2.30 2.14 2.12 2.12 2.10 2.10 1.72 1.71 1.28 1.28 1.28 1.28 1.27 1.26 0.98 0.89 0.87 0.86
Me
N
Me
Ph
Ph
11fa
d.r. 8.4:1
1H NMR (600 MHz, CDCl3, 296K)
5.25 5.13 1.04 0.10 0.89 0.91 0.09 0.08 0.91 0.93 0.07 0.32 2.68 0.92 1.12 1.17 1.11 2.31 0.34 2.81
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)


7.39 7.38 7.38 7.37 7.37 7.37 7.36 7.36 7.35 7.34 7.34 7.31 7.31 7.30 7.28 7.27 7.27 7.26 7.26 7.19 7.19 7.18 7.16 6.84 6.84 6.73 6.72 4.07 4.06 4.05 4.04 3.43 3.03 3.01 2.33 2.33 2.32 2.31 2.30 2.14 2.12 2.12 2.10 2.10 1.72 1.71 1.28 1.28 1.28 1.28 1.27 1.26 0.98 0.89 0.87 0.86
Me
N
Me
Ph
Ph
11fa
d.r. 8.4:1
1H NMR (600 MHz, CDCl3, 296K)
5.25 5.13 1.04 0.10 0.89 0.91 0.09 0.08 0.91 0.93 0.07 0.32 2.68 0.92 1.12 1.17 1.11 2.31 0.34 2.81
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

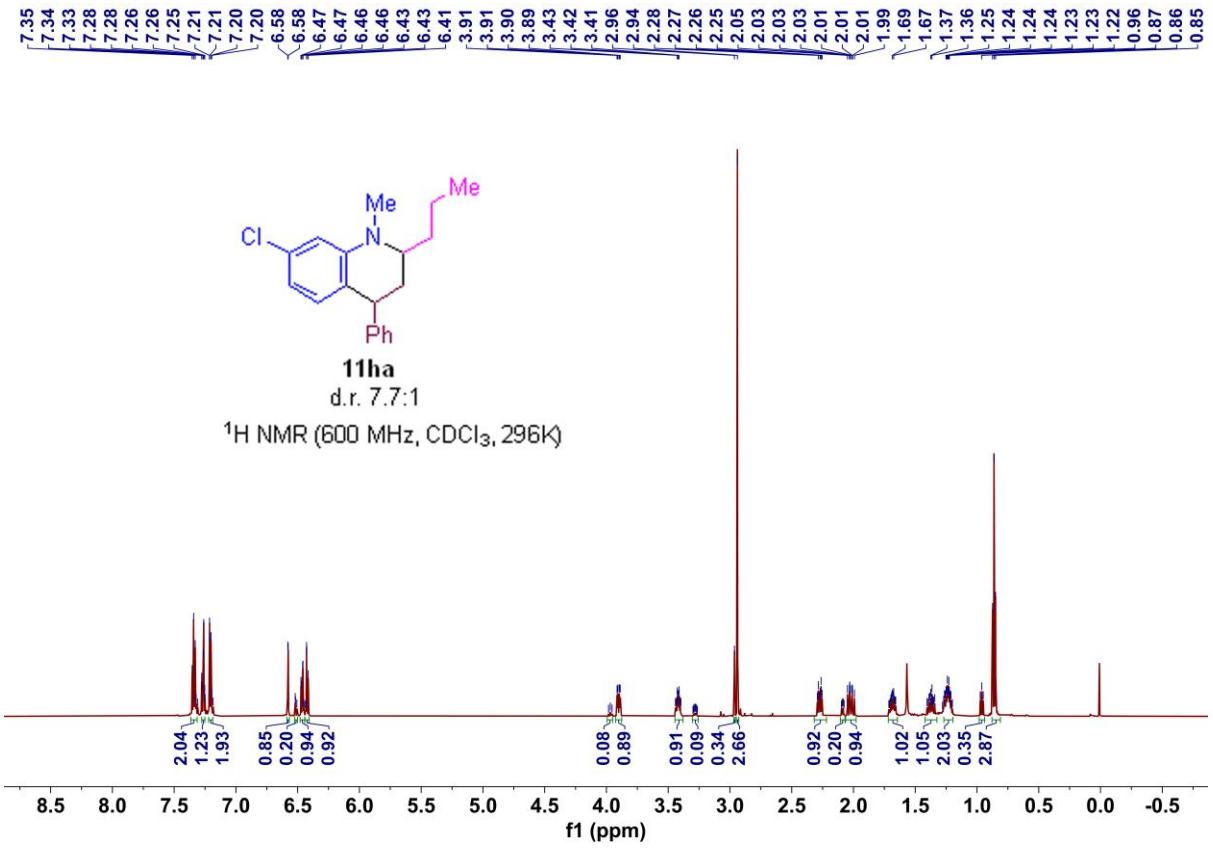


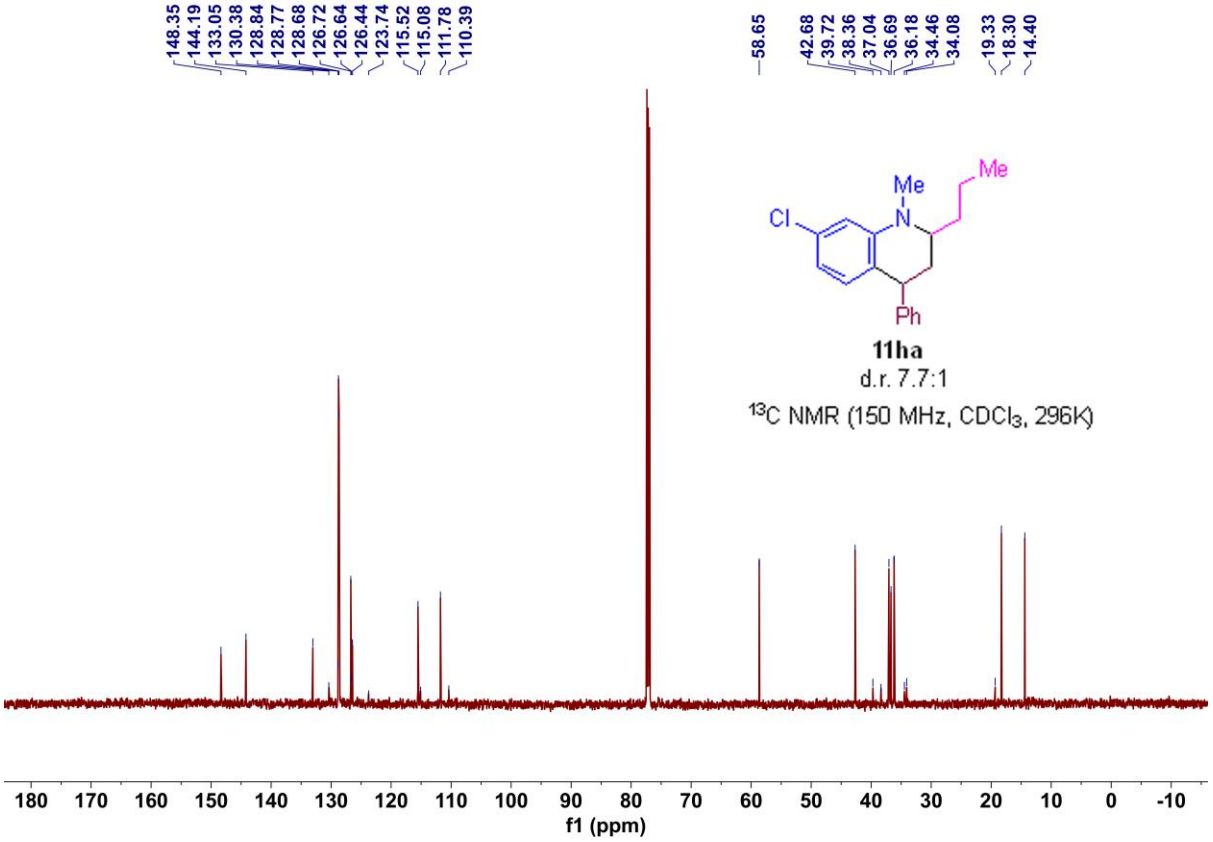


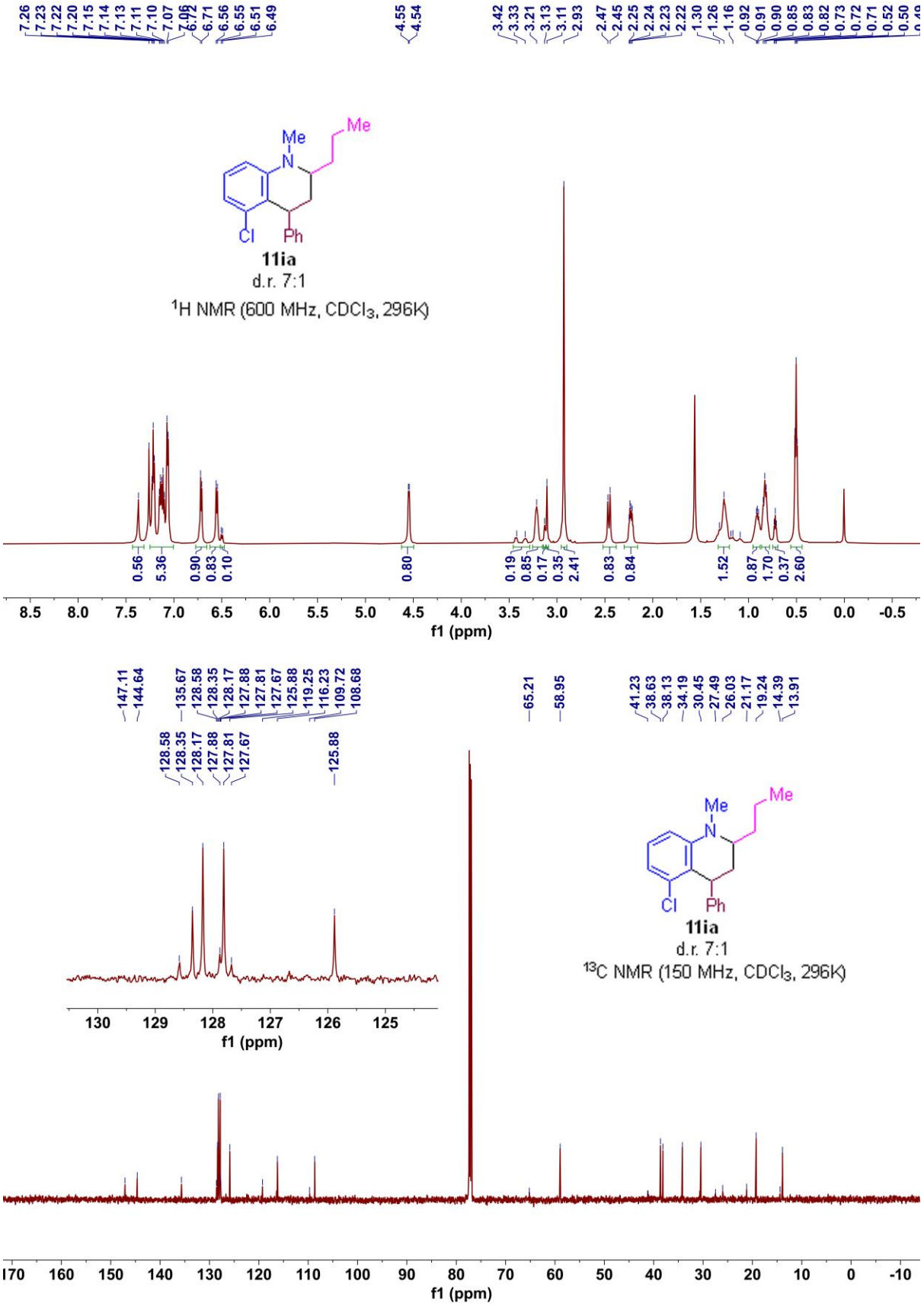
11ga
d.r. 1.7:1
^{1}H NMR (600 MHz, $CDCl_3$, 296K)

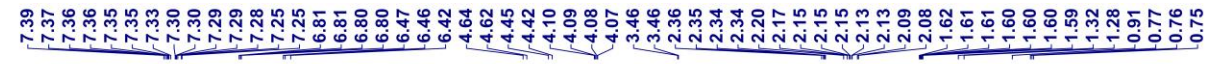


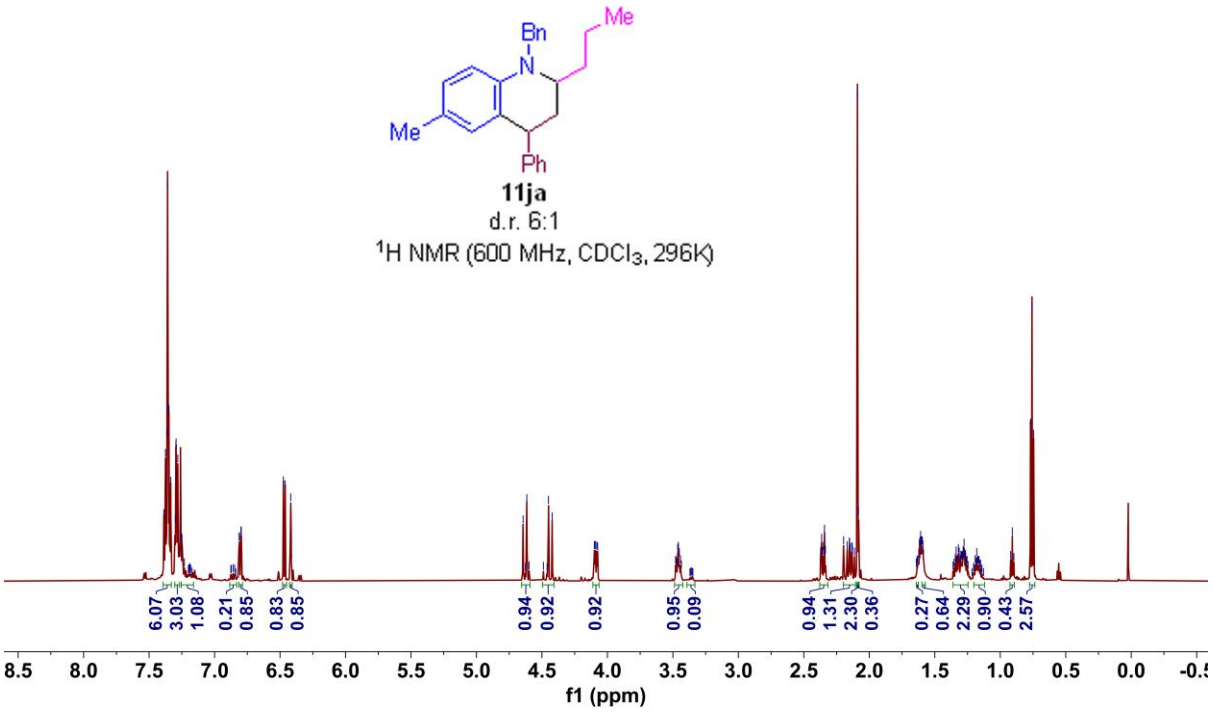
11ga
d.r. 1.7:1
^{13}C NMR (150 MHz, $CDCl_3$, 296K)

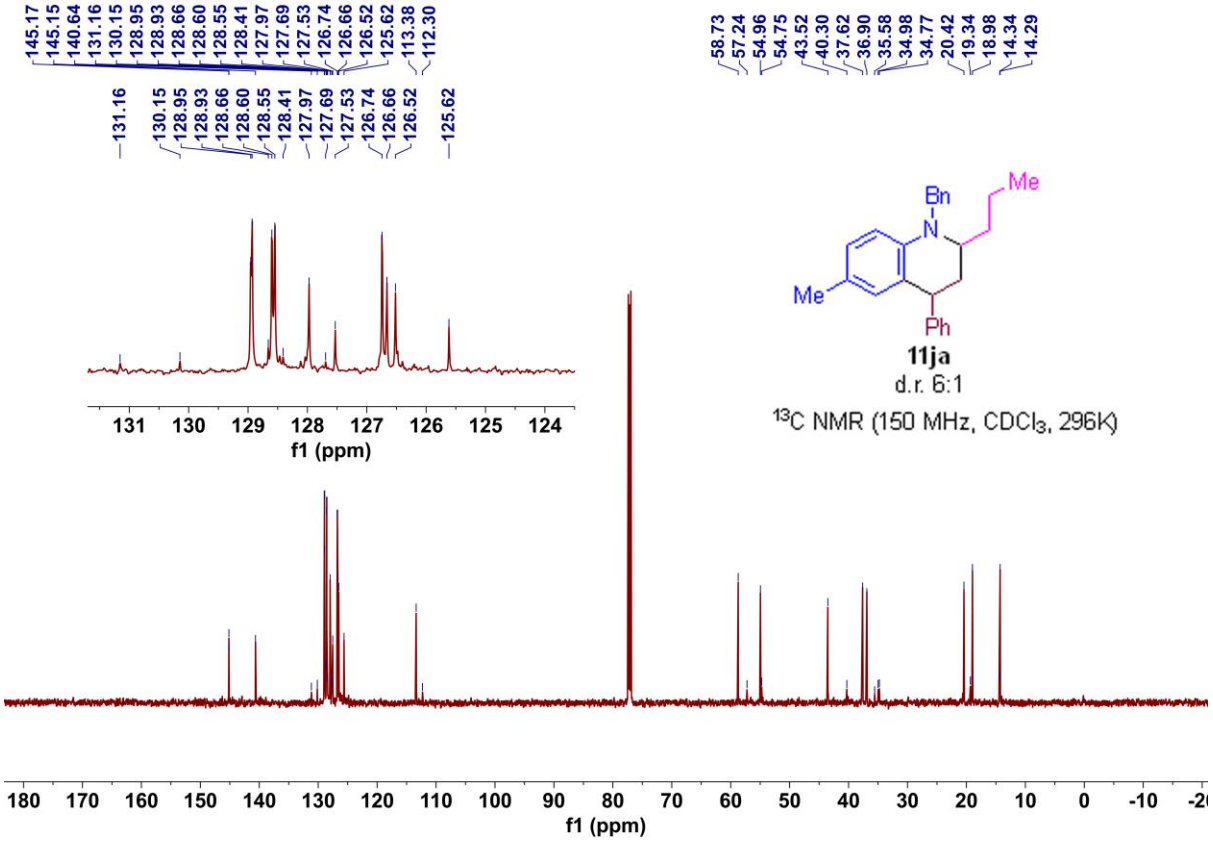

7.35 7.34 7.33 7.28 7.28 7.26 7.26 7.25 7.21 7.21 7.20 7.20 6.58 6.58 6.47 6.47 6.46 6.46 6.43 6.43 6.41 3.91 3.91 3.90 3.89 3.43 3.42 3.41 2.96 2.94 2.28 2.27 2.26 2.25 2.05 2.03 2.03 2.03 2.01 2.01 2.01 1.99 1.69 1.67 1.37 1.36 1.25 1.24 1.24 1.24 1.23 1.23 1.22 0.96 0.87 0.86 0.85
Me
Me
N
Cl
Ph
11ha
d.r. 7.7:1
1H NMR (600 MHz, CDCl3, 296K)
2.04 1.23 1.93 0.85 0.20 0.94 0.92 0.08 0.89 0.91 0.09 0.34 2.66 0.92 0.20 0.94 1.02 1.05 2.03 0.35 2.87
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

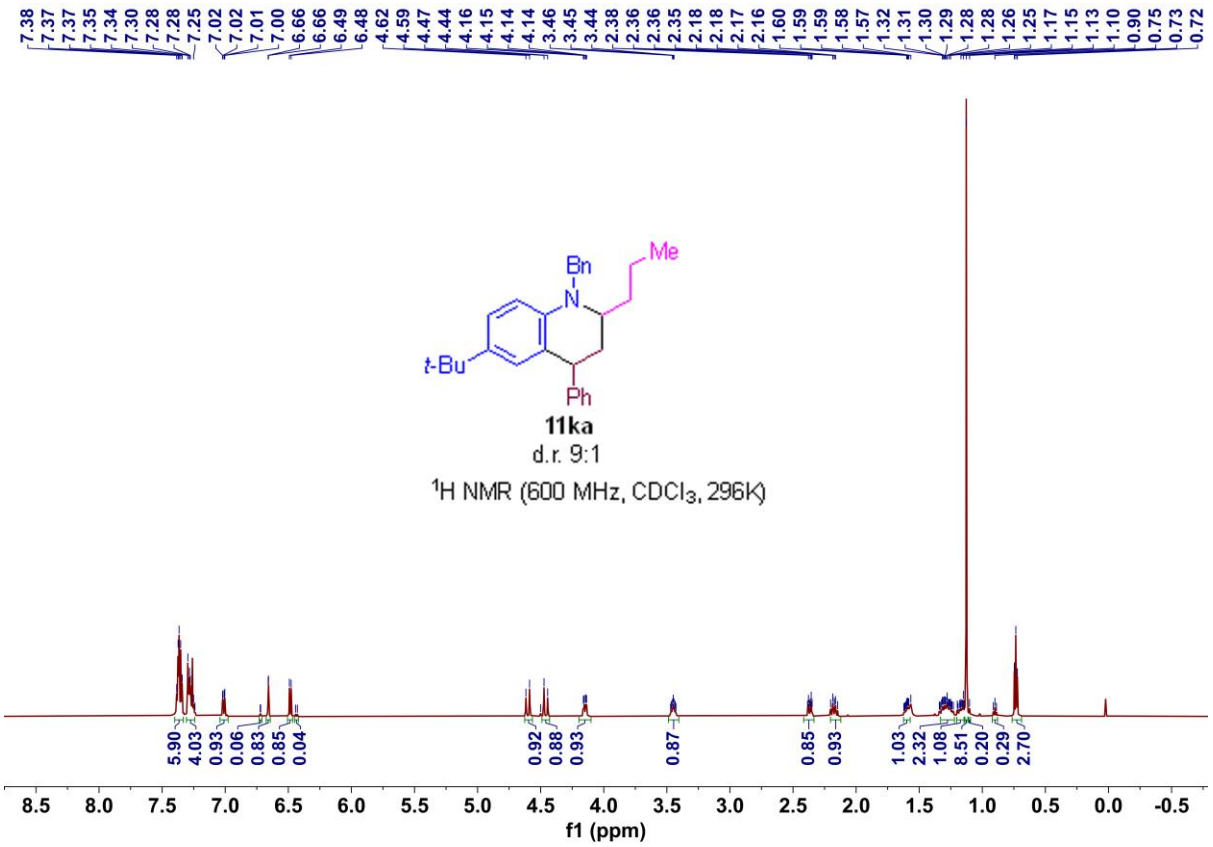

148.35 144.19 133.05 130.38 128.84 128.77 128.68 126.72 126.64 126.44 123.74 115.52 115.08 111.78 110.39
58.65 42.68 39.72 38.36 37.04 36.69 36.18 34.46 34.08 19.33 18.30 14.40
Me
Me
N
Cl
Ph
11ha
d.r. 7.7:1
13C NMR (150 MHz, CDCl3, 296K)
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

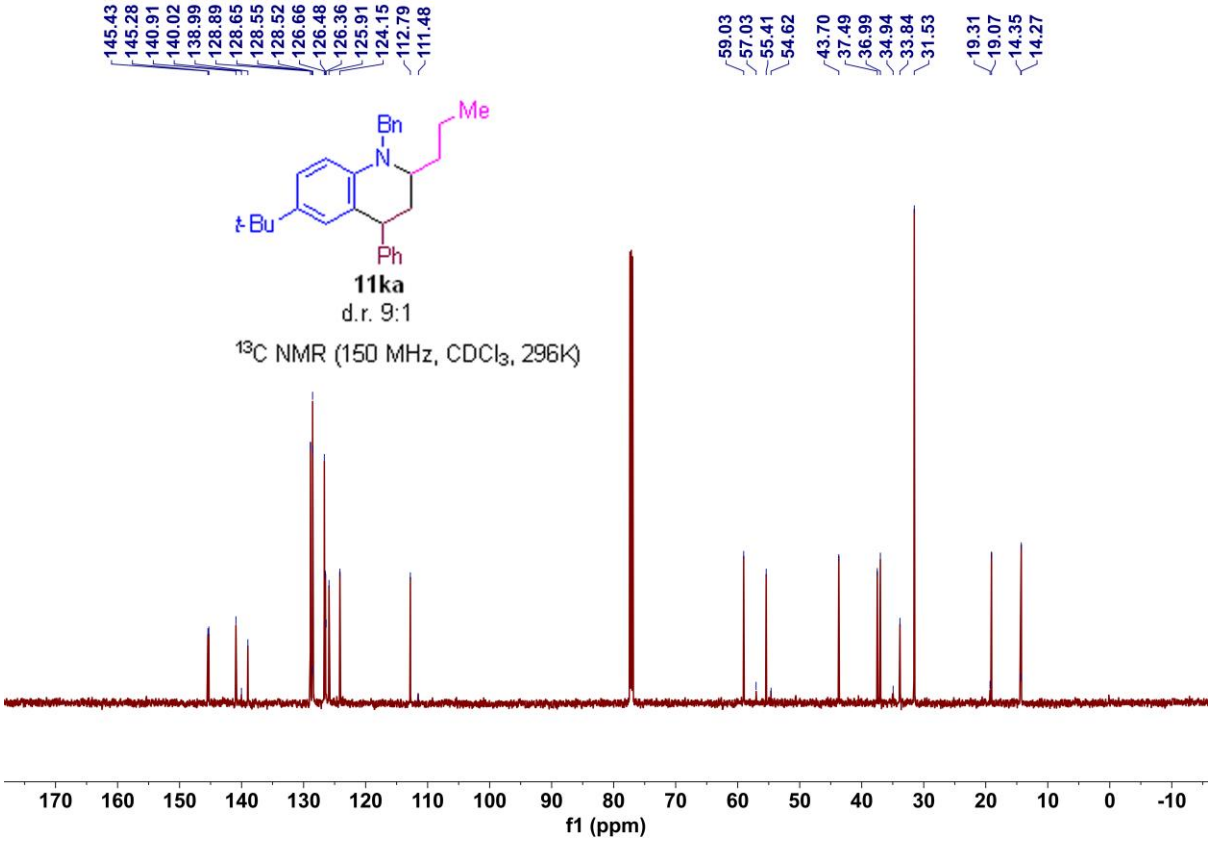

Me
N
Me
Cl
Ph
11ia
d.r. 7:1
1H NMR (600 MHz, CDCl3, 296K)
f1 (ppm)
13C NMR (150 MHz, CDCl3, 296K)
f1 (ppm)

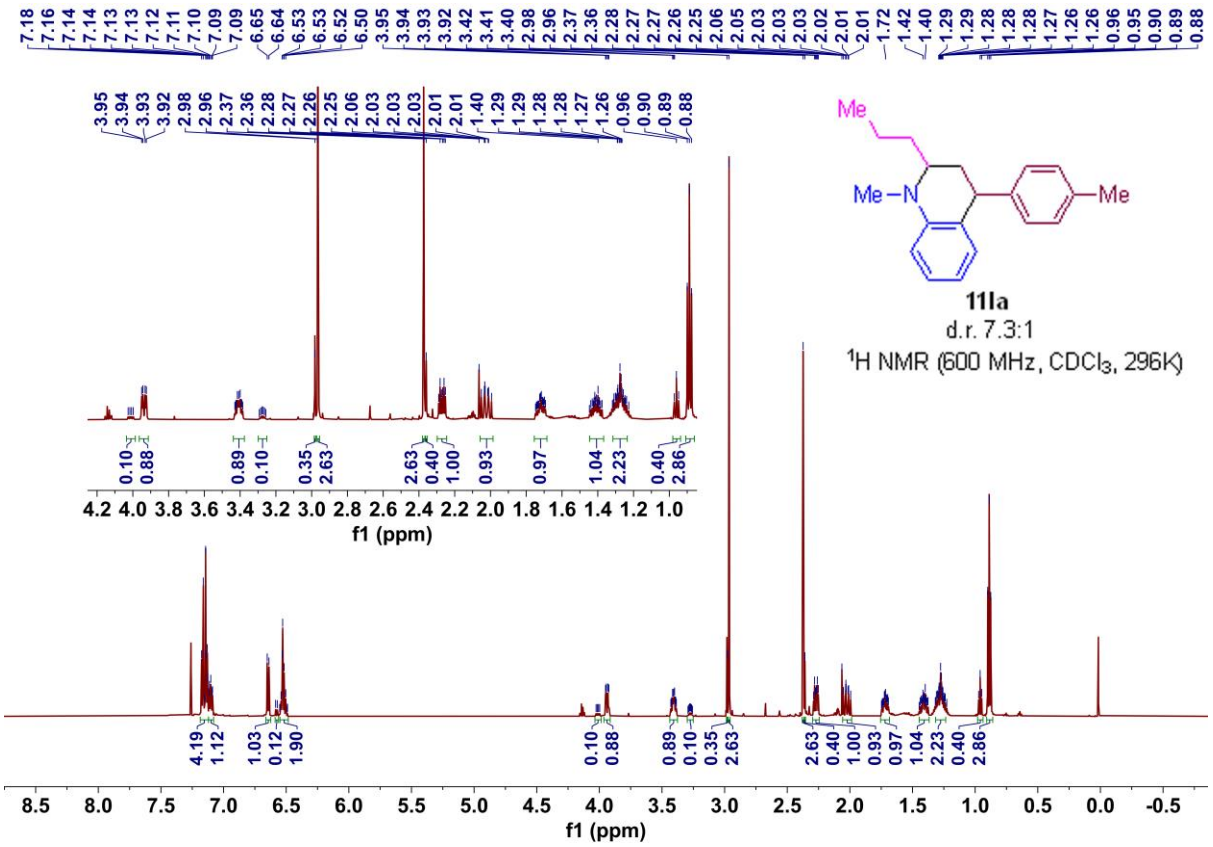

7.39 7.37 7.36 7.36 7.35 7.35 7.33 7.30 7.30 7.29 7.29 7.28 7.25 7.25 6.81 6.81 6.80 6.80 6.47 6.46 6.42 4.64 4.62 4.45 4.42 4.10 4.09 4.08 4.07 3.46 3.46 2.36 2.35 2.34 2.34 2.20 2.17 2.15 2.15 2.15 2.13 2.13 2.09 2.08 1.62 1.61 1.61 1.60 1.60 1.60 1.59 1.32 1.28 0.91 0.77 0.76 0.75

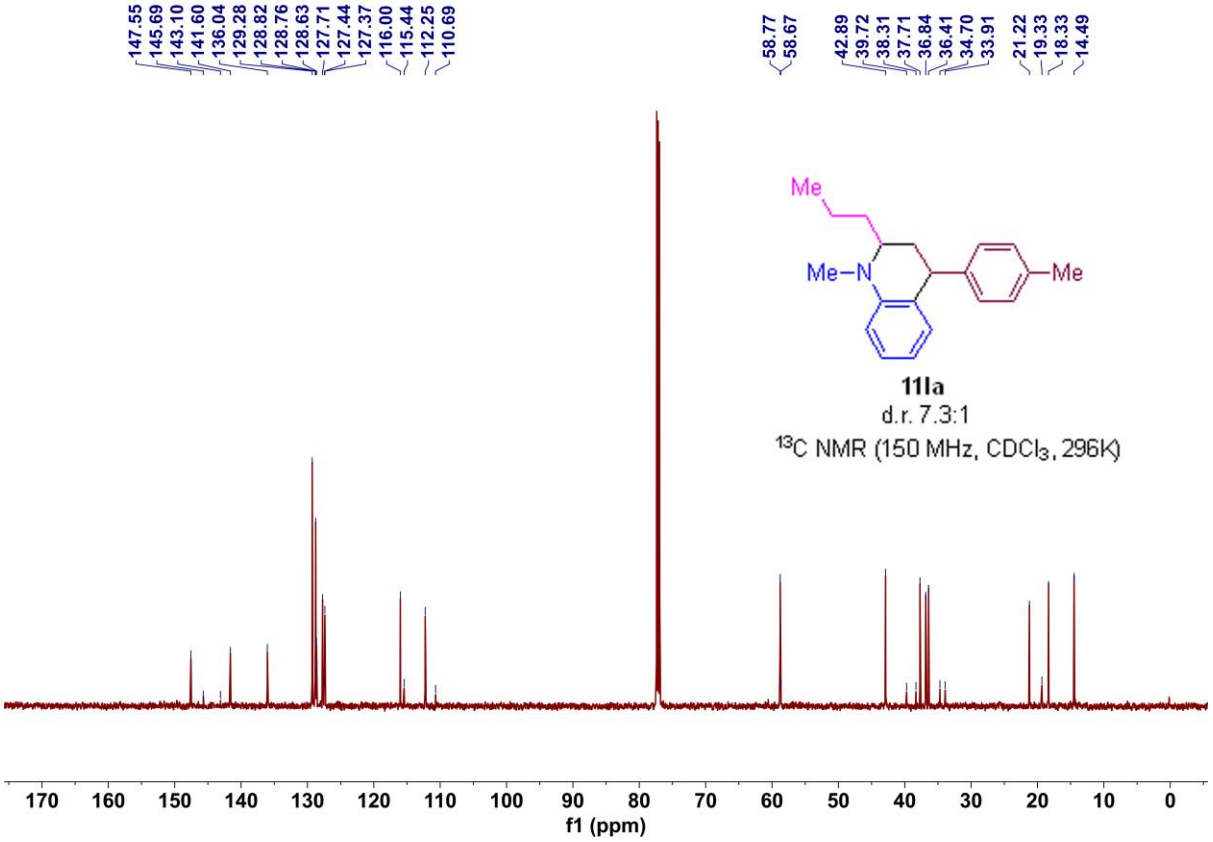

Bn
N
Me
Me
Ph
11ja
d.r. 6:1
1H NMR (600 MHz, CDCl3, 296K)
6.07 3.03 1.08 0.21 0.85 0.83 0.85 0.94 0.92 0.92 0.95 0.09 0.94 1.31 2.30 0.36 0.27 0.64 2.29 0.90 0.43 2.57
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

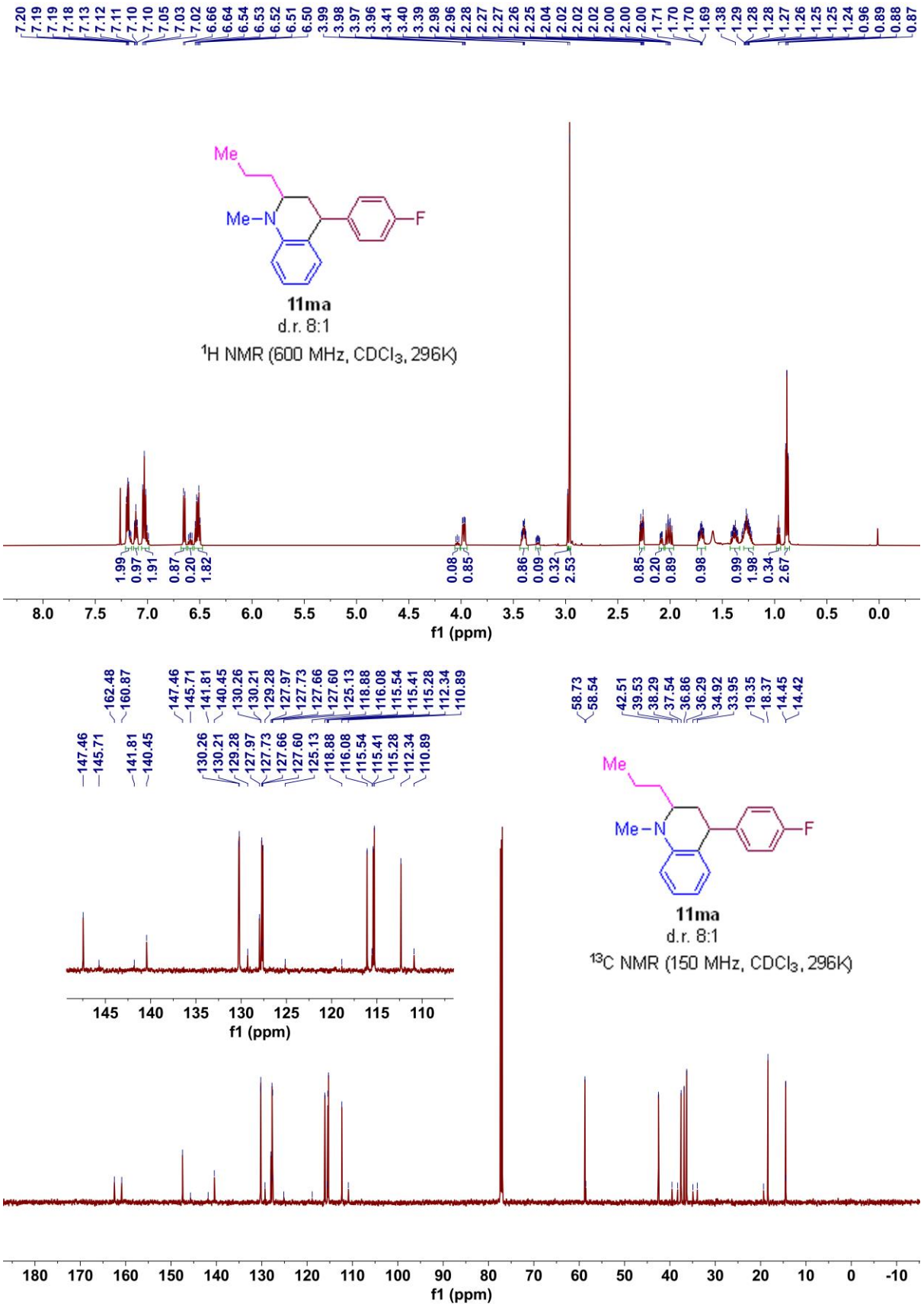

145.17 145.15 140.64 131.16 130.15 128.95 128.93 128.66 128.60 128.55 128.41 127.97 127.69 127.53 126.74 126.66 126.52 125.62 113.38 112.30
58.73 57.24 54.96 54.75 43.52 40.30 37.62 36.90 35.58 34.98 34.77 20.42 19.34 18.98 14.34 14.29
131.16 130.15 128.95 128.93 128.66 128.60 128.55 128.41 127.97 127.69 127.53 126.74 126.66 126.52 125.62
131 130 129 128 127 126 125 124
f1 (ppm)
Bn
N
Me
Me
Ph
11ja
d.r. 6:1
13C NMR (150 MHz, CDCl3, 296K)
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


Bn
N
Me
t-Bu
Ph
11ka
d.r. 9:1
^{1}H NMR (600 MHz, $CDCl_3$, 296K)
f1 (ppm)

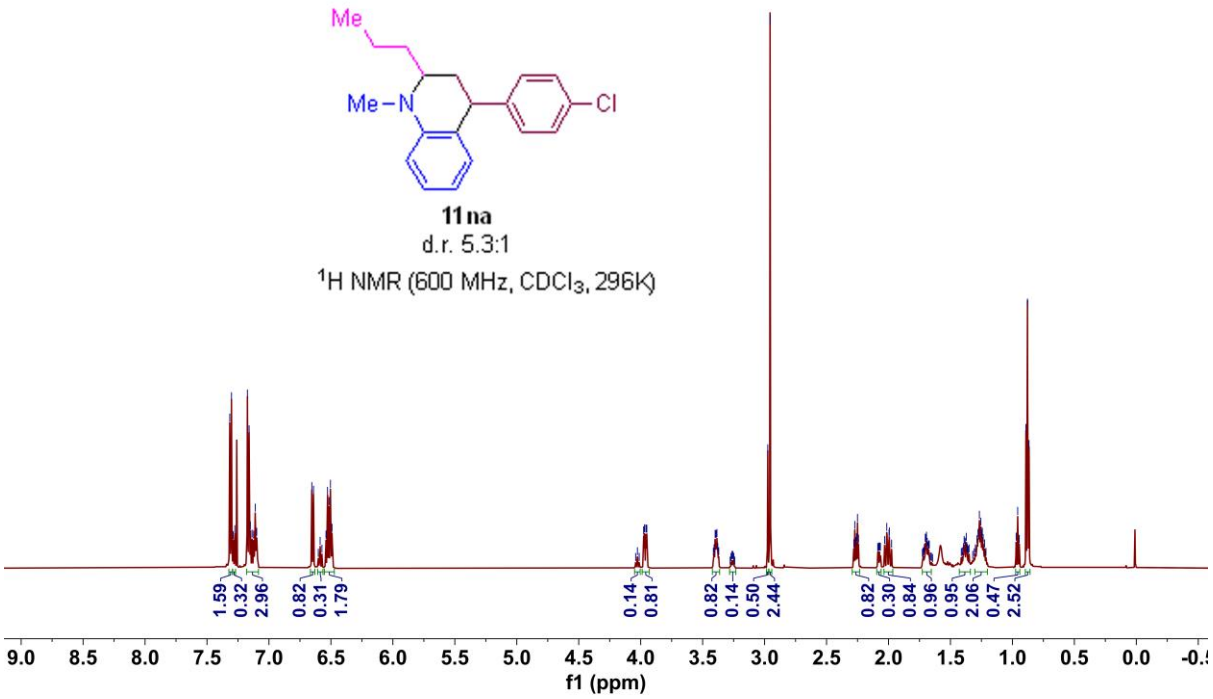

Bn
N
Me
t-Bu
Ph
11ka
d.r. 9:1
^{13}C NMR (150 MHz, $CDCl_3$, 296K)
f1 (ppm)

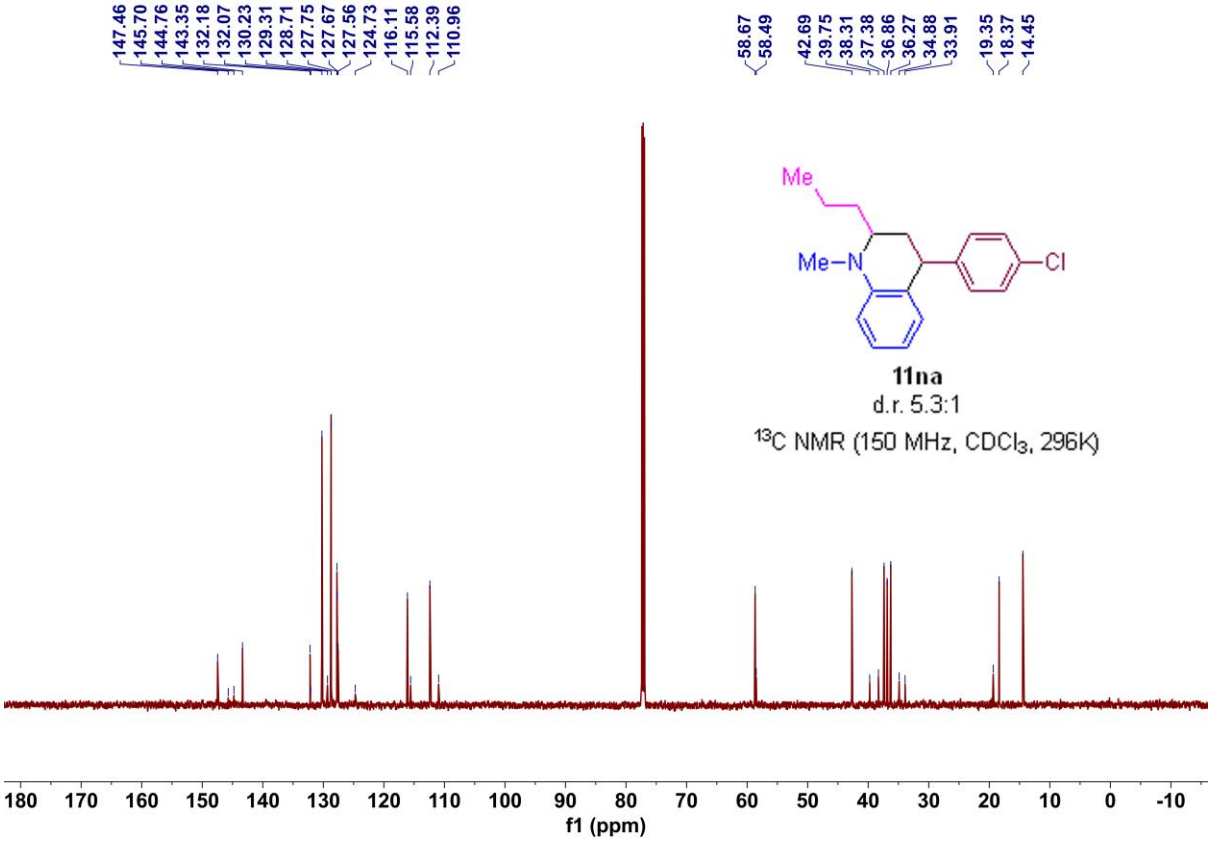

Me
Me–N
Me
11la
d.r. 7.3:1
¹H NMR (600 MHz, CDCl₃, 296K)
f1 (ppm)

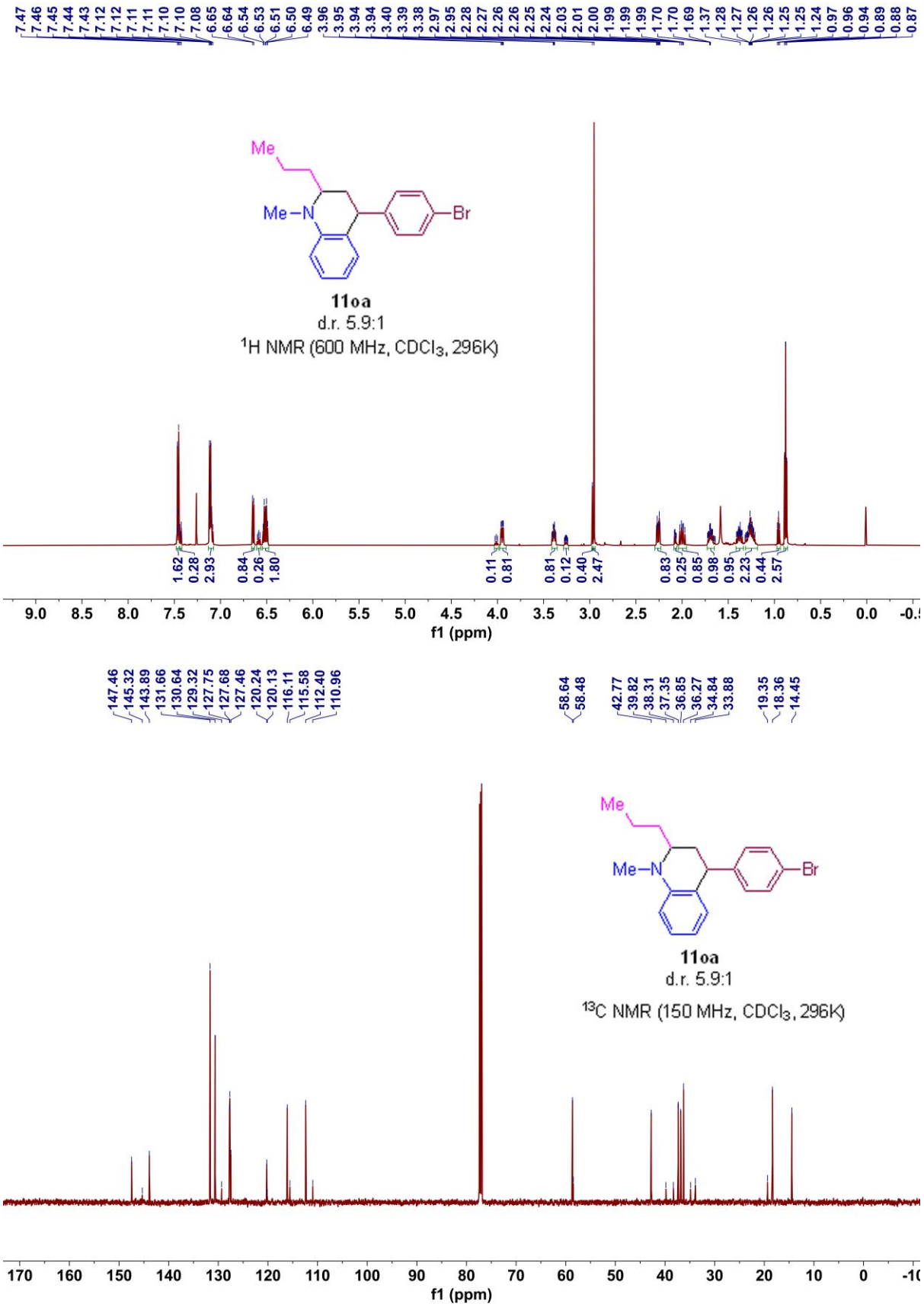

Me
Me–N
Me
11la
d.r. 7.3:1
¹³C NMR (150 MHz, CDCl₃, 296K)
f1 (ppm)


Me
Me–N
F
11ma
d.r. 8:1
1H NMR (600 MHz, CDCl3, 296K)
f1 (ppm)
13C NMR (150 MHz, CDCl3, 296K)
f1 (ppm)

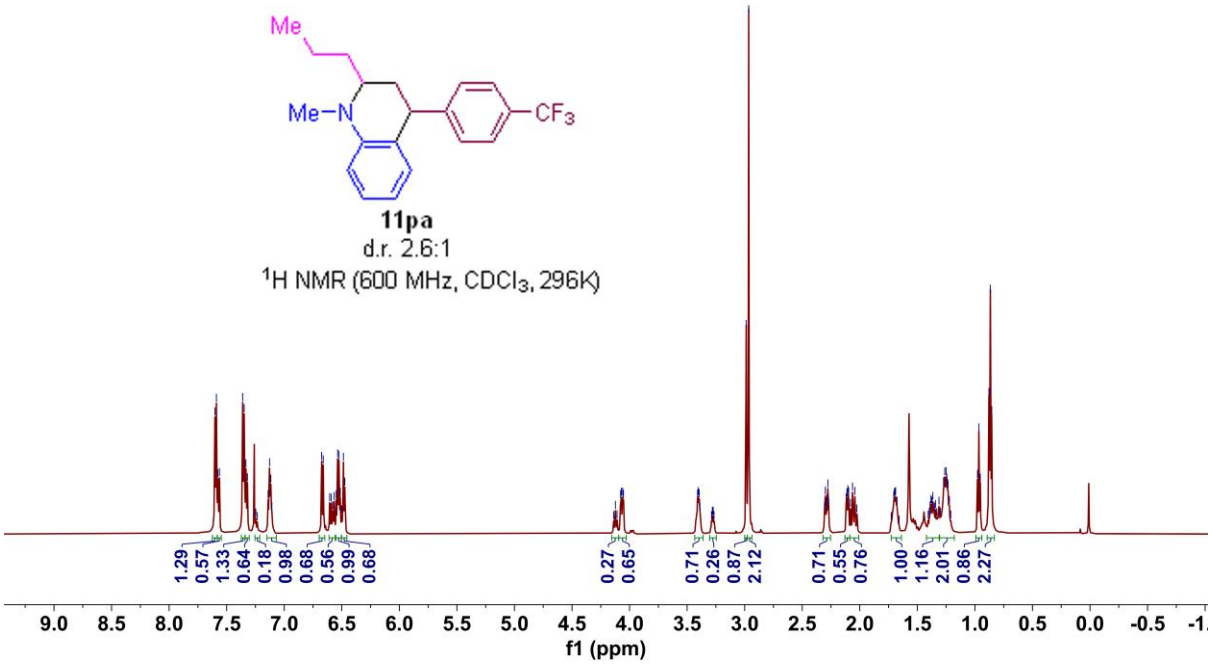

7.32
7.30
7.29
7.28
7.17
7.16
7.15
7.14
7.12
7.11
7.10
6.65
6.64
6.59
6.54
6.53
6.52
6.50
6.49
3.98
3.97
3.96
3.95
3.40
3.39
3.38
2.97
2.96
2.27
2.26
2.26
2.25
2.24
2.03
2.01
2.00
1.99
1.70
1.70
1.69
1.39
1.38
1.37
1.29
1.28
1.27
1.27
1.25
1.25
1.24
1.24
0.97
0.96
0.95
0.89
0.88
0.87

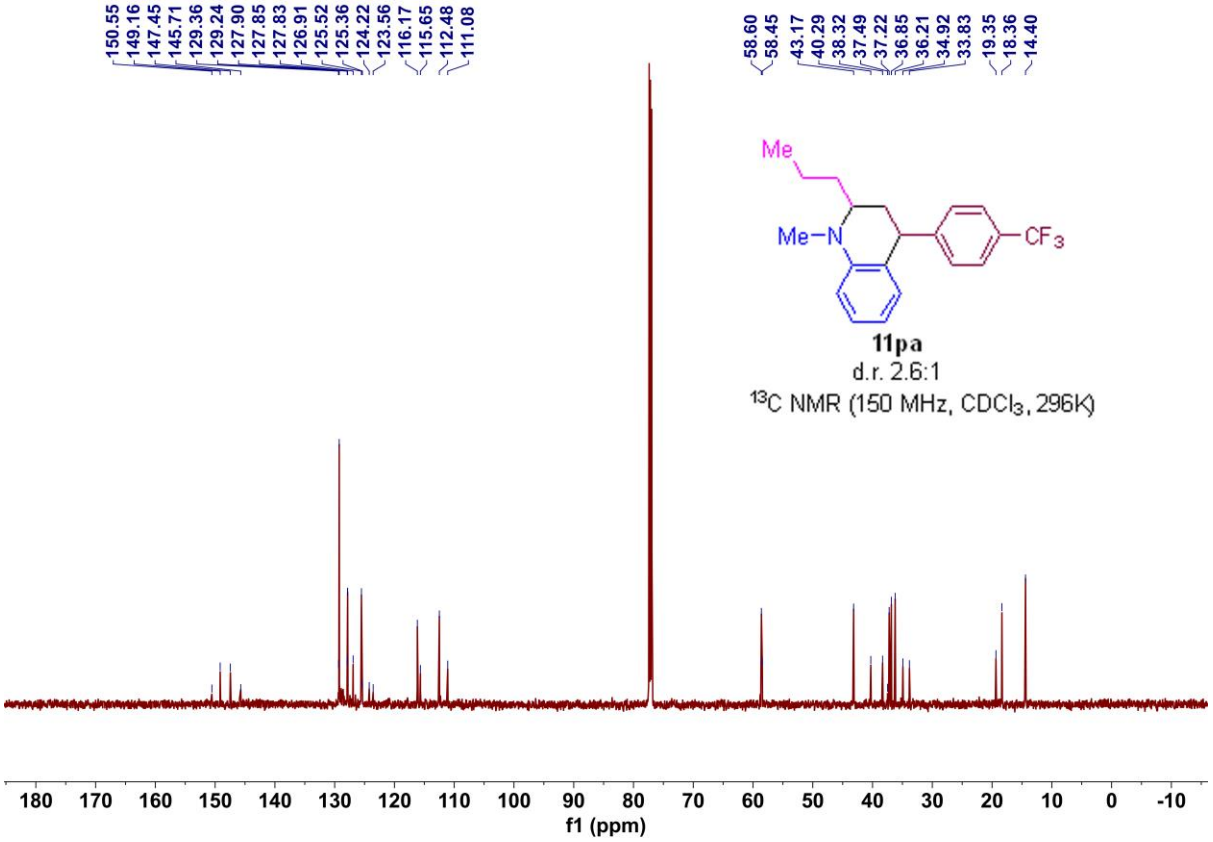

Me
Me–N
Cl
11na
d.r. 5.3:1
1H NMR (600 MHz, CDCl3, 296K)
1.59
0.32
2.96
0.82
0.31
1.79
0.14
0.81
0.82
0.14
0.50
2.44
0.82
0.30
0.84
0.96
0.95
2.06
0.47
2.52
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

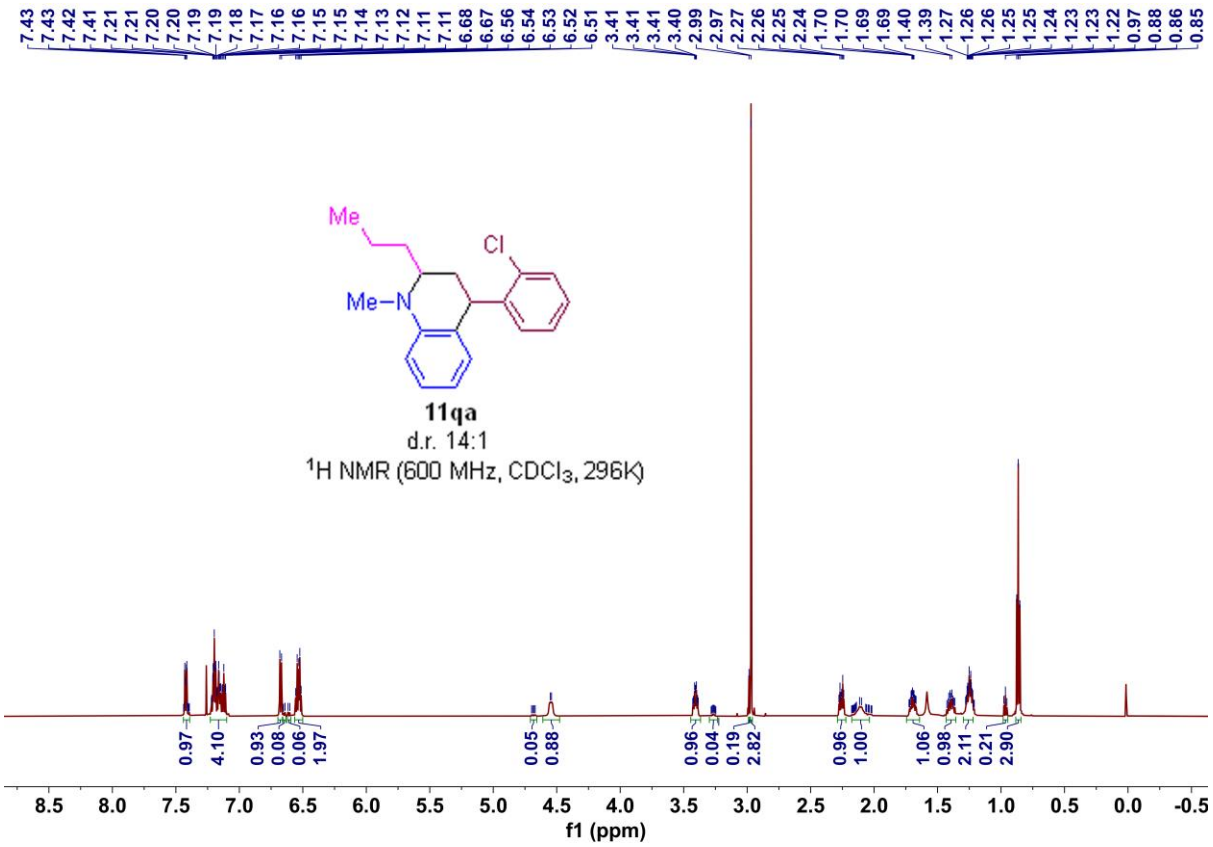

147.46
145.70
144.76
143.35
132.18
132.07
130.23
129.31
128.71
127.75
127.67
127.56
124.73
116.11
115.58
112.39
110.96
58.67
58.49
42.69
39.75
38.31
37.38
36.86
36.27
34.88
33.91
19.35
18.37
14.45
Me
Me–N
Cl
11na
d.r. 5.3:1
13C NMR (150 MHz, CDCl3, 296K)
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

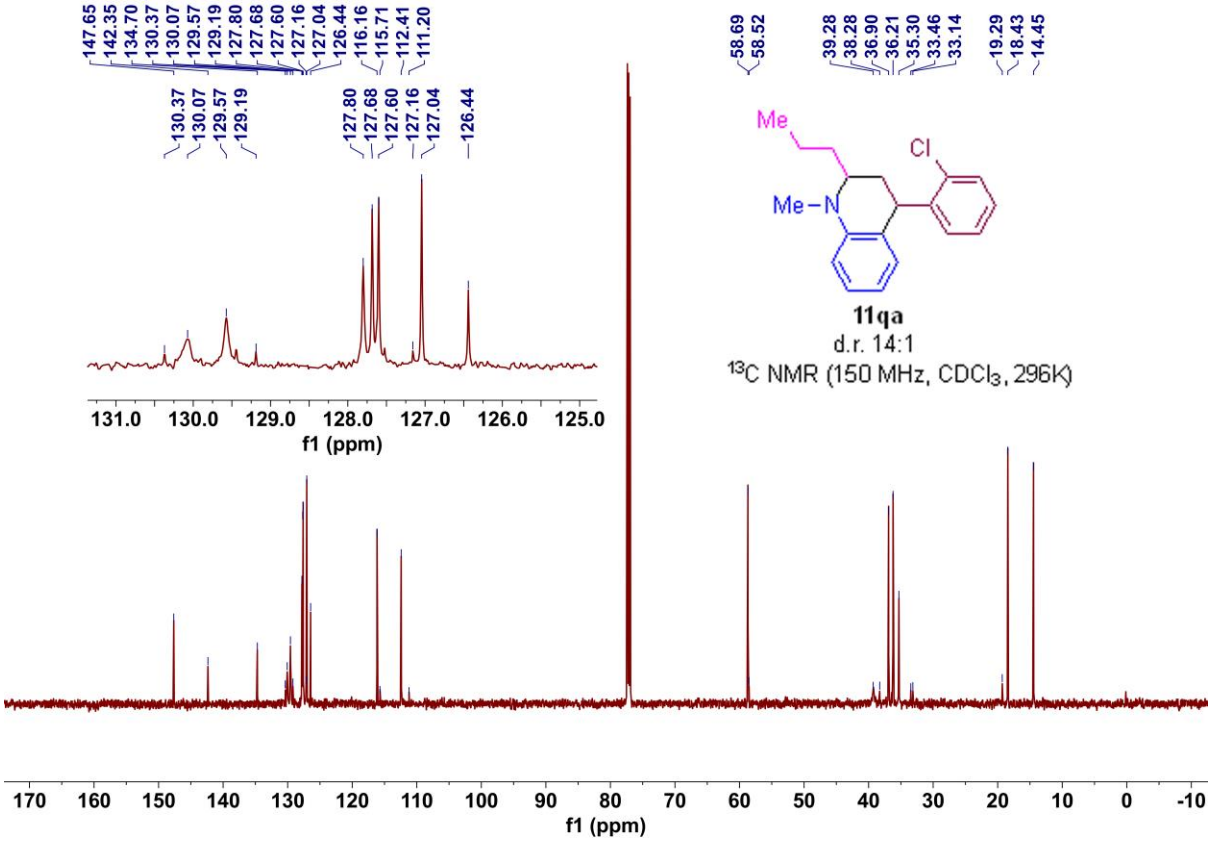

7.47 7.46 7.45 7.44 7.43 7.12 7.12 7.11 7.11 7.10 7.10 7.08 6.65 6.64 6.54 6.53 6.51 6.50 6.49 3.96 3.95 3.94 3.94 3.40 3.39 3.38 2.97 2.95 2.28 2.27 2.26 2.26 2.25 2.24 2.03 2.01 2.00 1.99 1.99 1.99 1.70 1.69 1.37 1.28 1.27 1.26 1.26 1.25 1.25 1.24 0.97 0.96 0.94 0.89 0.88 0.87
Me
Me–N
Br
11oa
d.r. 5.9:1
1H NMR (600 MHz, CDCl3, 296K)
1.62 0.28 2.93 0.84 0.26 1.80 0.11 0.81 0.81 0.12 0.40 2.47 0.83 0.25 0.85 0.98 0.95 2.23 0.44 2.57
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)
147.46 145.32 143.89 131.66 130.64 129.32 127.75 127.68 127.46 120.24 120.13 116.11 115.58 112.40 110.96
58.64 58.48 42.77 39.82 38.31 37.35 36.85 36.27 34.84 33.88 19.35 18.36 14.45
Me
Me–N
Br
11oa
d.r. 5.9:1
13C NMR (150 MHz, CDCl3, 296K)
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

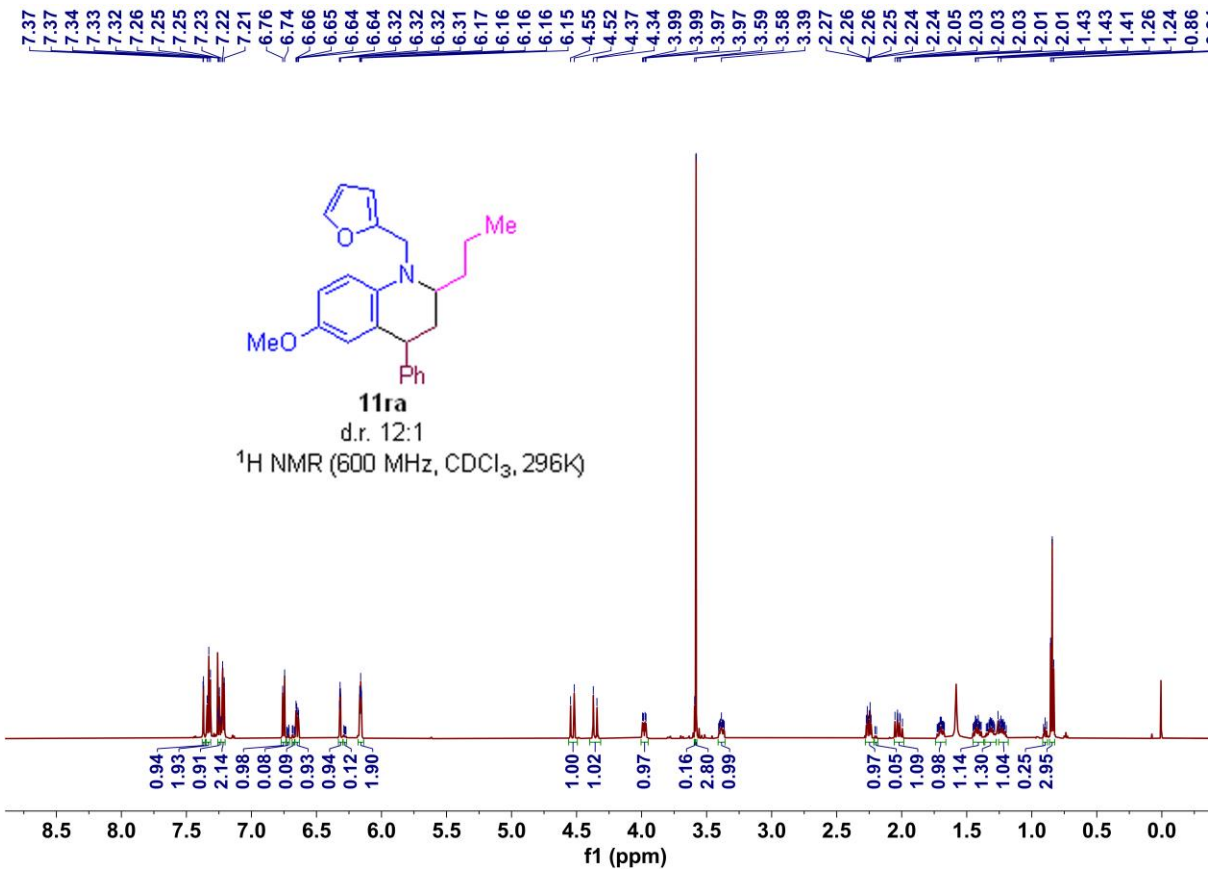

7.60 7.59 7.58 7.56 7.36 7.35 7.33 7.32 7.14 7.13 7.12 6.67 6.66 6.61 6.59 6.57 6.55 6.54 6.52 6.51 6.49 6.47 4.08 4.07 4.06 4.05 3.41 3.40 3.40 2.99 2.97 2.30 2.29 2.28 2.12 2.11 2.10 2.10 2.06 2.04 1.70 1.70 1.69 1.69 1.37 1.27 1.26 1.25 1.24 1.24 1.23 0.98 0.97 0.95 0.88 0.87 0.85

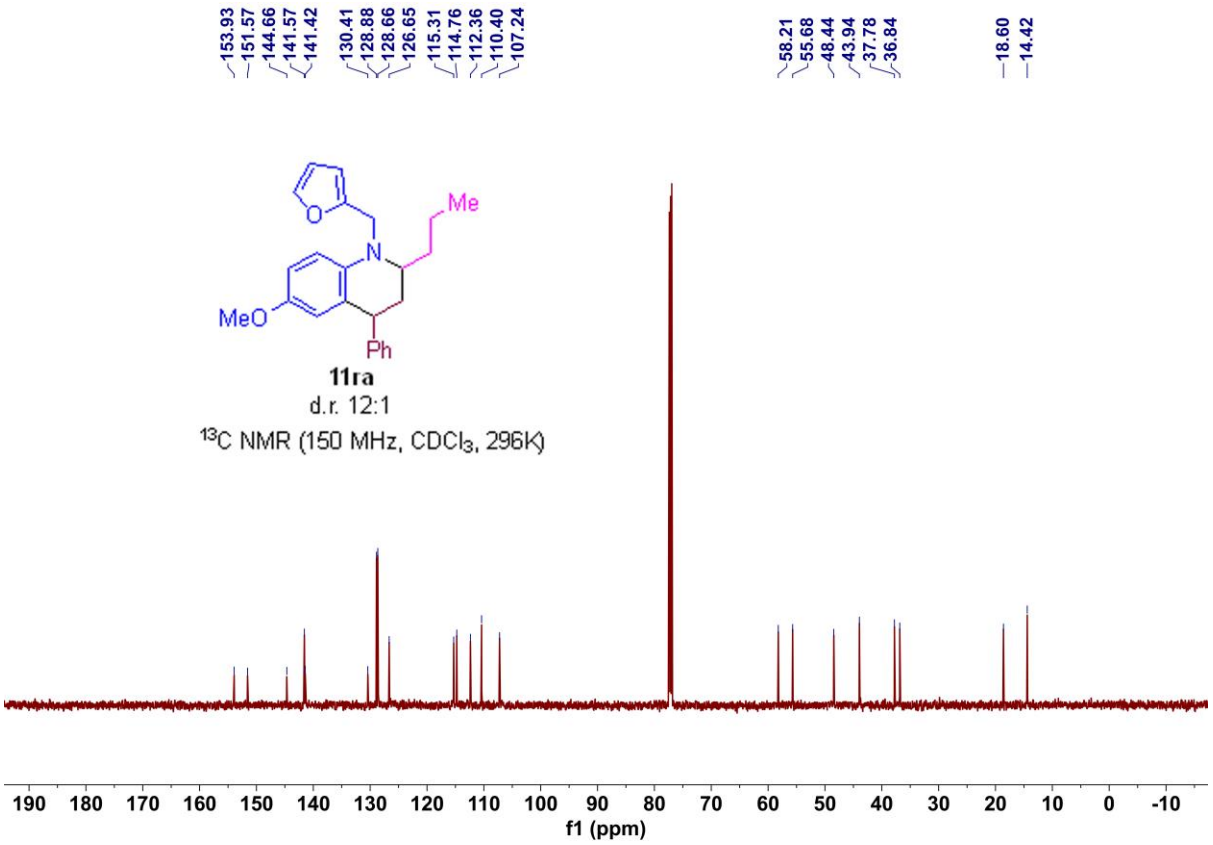

Me
Me–N
CF3
11pa
d.r. 2.6:1
1H NMR (600 MHz, CDCl3, 296K)
1.29 0.57 1.33 0.64 0.18 0.98 0.68 0.56 0.99 0.68 0.27 0.65 0.71 0.26 0.87 2.12 0.71 0.55 0.76 1.00 1.16 2.01 0.86 2.27
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

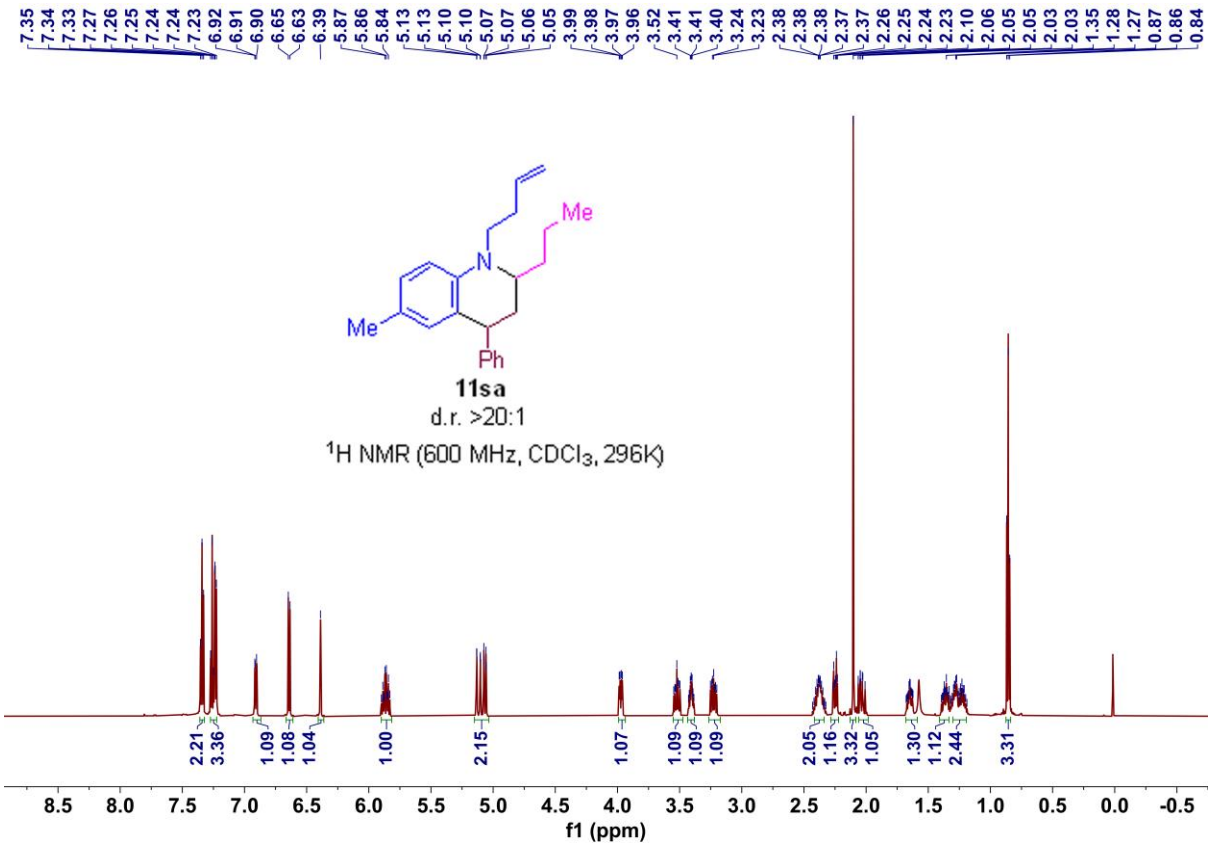

150.55 149.16 147.45 145.71 129.36 129.24 127.90 127.85 127.83 126.91 125.52 125.36 124.22 123.56 116.17 115.65 112.48 111.08
58.60 58.45 43.17 40.29 38.32 37.49 37.22 36.85 36.21 34.92 33.83 19.35 18.36 14.40
Me
Me–N
CF3
11pa
d.r. 2.6:1
13C NMR (150 MHz, CDCl3, 296K)
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

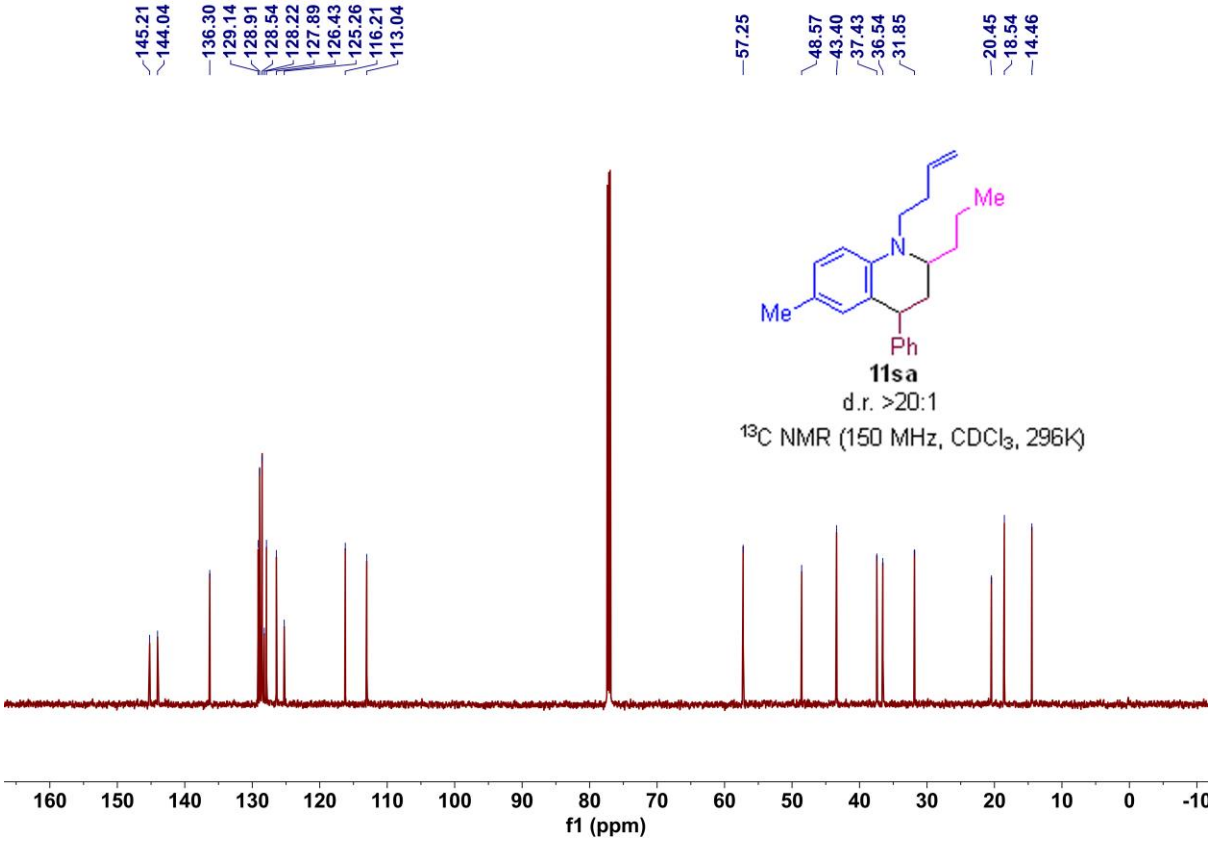

Me
Cl
Me–N
11qa
d.r. 14:1
1H NMR (600 MHz, CDCl3, 296K)
f1 (ppm)

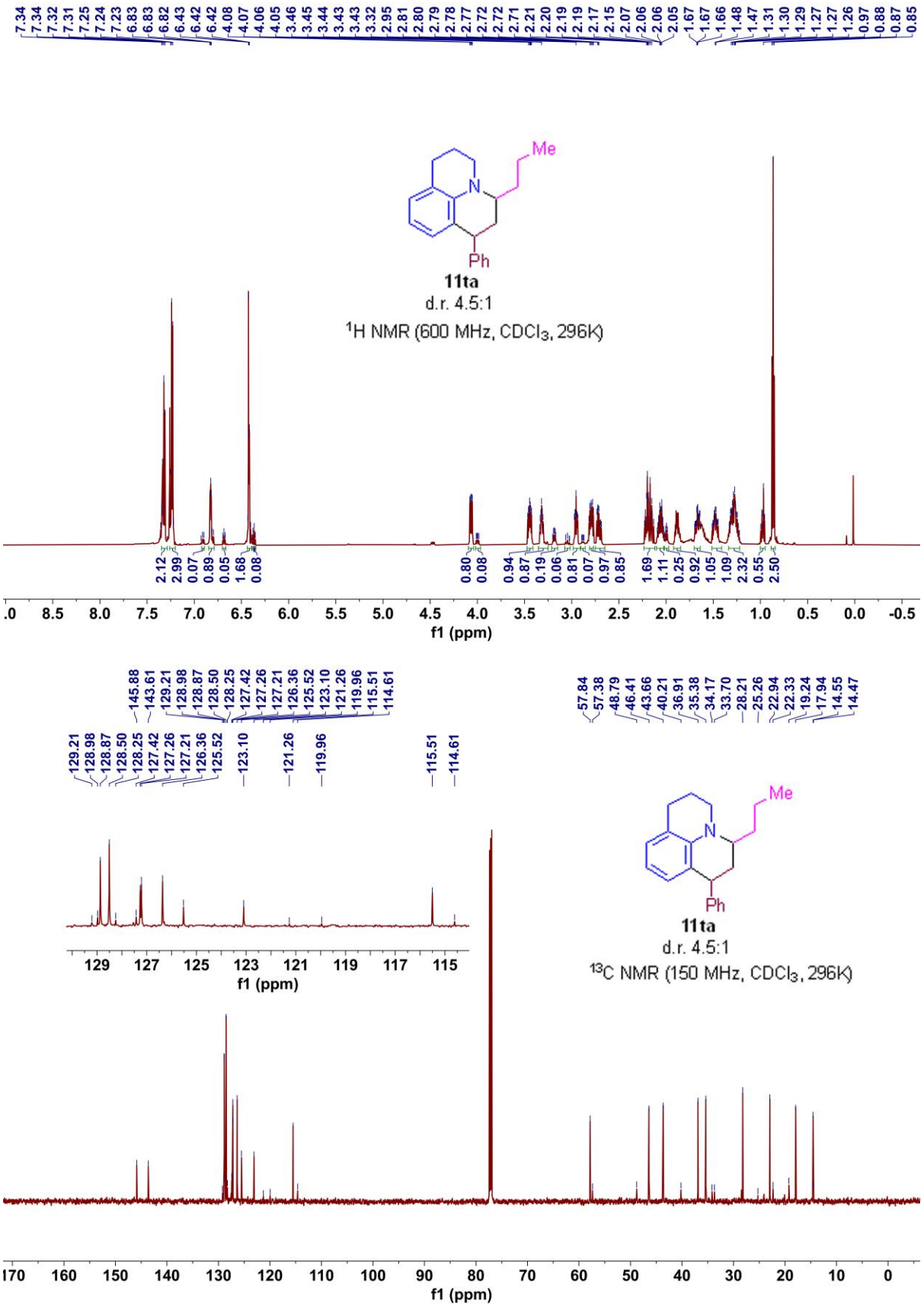

Me
Cl
Me–N
11qa
d.r. 14:1
13C NMR (150 MHz, CDCl3, 296K)
f1 (ppm)

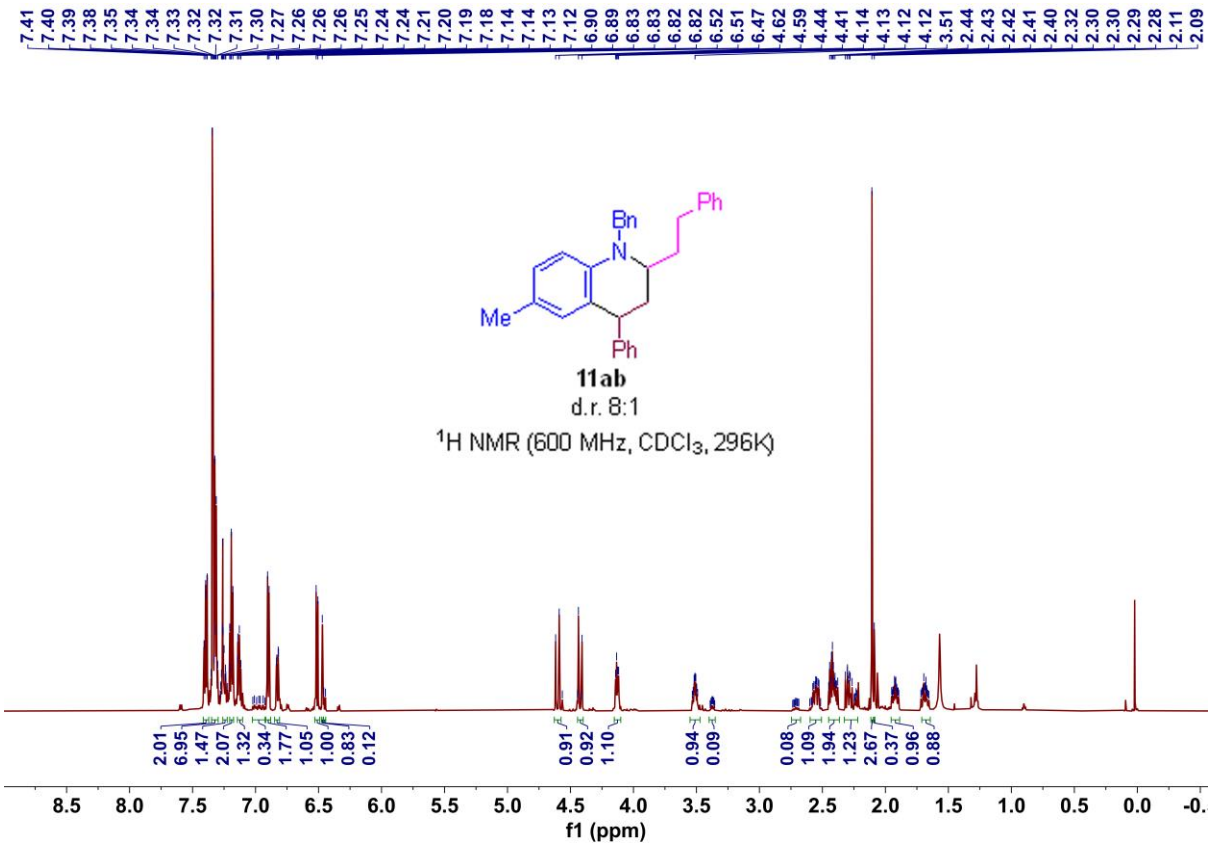

7.37 7.37 7.34 7.33 7.32 7.26 7.25 7.25 7.23 7.22 7.21 6.76 6.74 6.66 6.65 6.64 6.64 6.32 6.32 6.31 6.17 6.16 6.16 6.15 4.55 4.52 4.37 4.34 3.99 3.99 3.97 3.97 3.59 3.58 3.39 2.27 2.26 2.26 2.25 2.24 2.24 2.05 2.03 2.03 2.01 2.01 1.43 1.43 1.41 1.26 1.24 0.86
Me
N
MeO
Ph
11ra
d.r. 12:1
1H NMR (600 MHz, CDCl3, 296K)
0.94 1.93 0.91 2.14 0.98 0.08 0.09 0.93 0.94 0.12 1.90 1.00 1.02 0.97 0.16 2.80 0.99 0.97 0.05 1.09 0.98 1.14 1.30 1.04 0.25 2.95
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

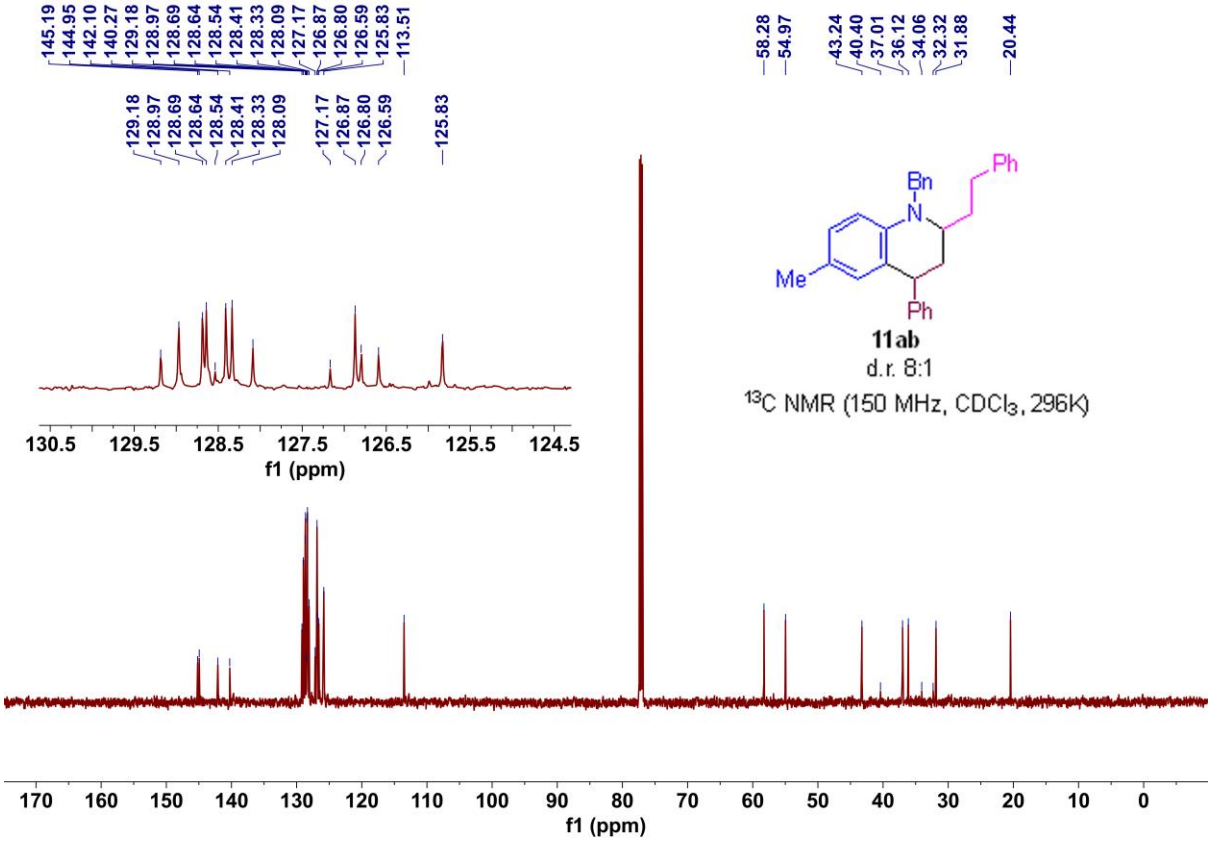

153.93 151.57 144.66 141.57 141.42 130.41 128.88 128.66 126.65 115.31 114.76 112.36 110.40 107.24 58.21 55.68 48.44 43.94 37.78 36.84 18.60 14.42
Me
N
MeO
Ph
11ra
d.r. 12:1
13C NMR (150 MHz, CDCl3, 296K)
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


7.35 7.34 7.33 7.27 7.26 7.25 7.24 7.24 7.23 6.92 6.91 6.90 6.65 6.63 6.39 5.87 5.86 5.84 5.13 5.13 5.10 5.10 5.07 5.07 5.06 5.05 3.99 3.98 3.97 3.96 3.52 3.41 3.41 3.40 3.24 3.23 2.38 2.38 2.38 2.37 2.37 2.26 2.25 2.24 2.23 2.10 2.06 2.05 2.05 2.03 2.03 1.35 1.28 1.27 0.87 0.86 0.84
Me
N
Me
Ph
11sa
d.r. >20:1
1H NMR (600 MHz, CDCl3, 296K)
2.21 3.36 1.09 1.08 1.04 1.00 2.15 1.07 1.09 1.09 1.09 2.05 1.16 3.32 1.05 1.30 1.12 2.44 3.31
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

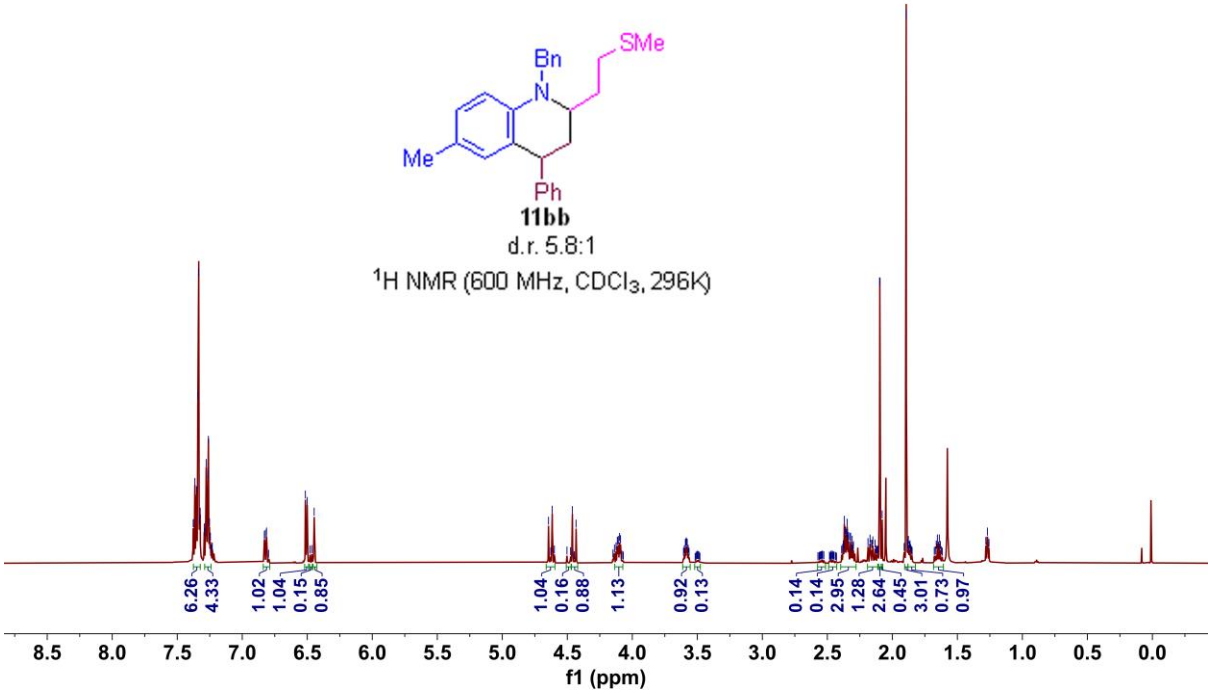

145.21 144.04 136.30 129.14 128.91 128.54 128.22 127.89 126.43 125.26 116.21 113.04 57.25 48.57 43.40 37.43 36.54 31.85 20.45 18.54 14.46
Me
N
Me
Ph
11sa
d.r. >20:1
13C NMR (150 MHz, CDCl3, 296K)
160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


Me
N
Ph
11ta
d.r. 4.5:1
1H NMR (600 MHz, CDCl3, 296K)
f1 (ppm)
13C NMR (150 MHz, CDCl3, 296K)


Bn
N
Ph
Me
Ph
11ab
d.r. 8:1
1H NMR (600 MHz, CDCl3, 296K)
f1 (ppm)

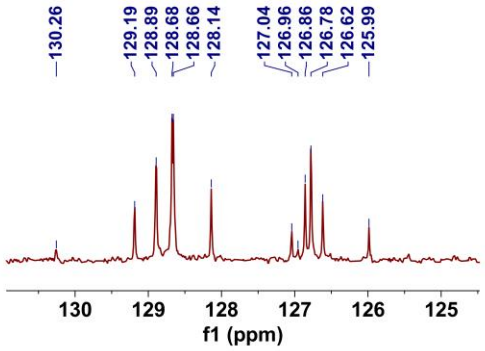

Bn
N
Ph
Me
Ph
11ab
d.r. 8:1
13C NMR (150 MHz, CDCl3, 296K)
f1 (ppm)


7.38 7.36 7.35 7.34 7.33 7.33 7.32 7.29 7.29 7.28 7.26 7.26 7.25 7.25 6.83 6.82 6.81 6.51 6.50 6.45 4.64 4.62 4.46 4.43 4.12 4.11 4.10 4.09 3.59 3.59 3.58 2.37 2.36 2.35 2.35 2.34 2.34 2.34 2.32 2.32 2.31 2.19 2.17 2.16 2.15 2.13 2.10 2.08 1.89 1.88 1.88 1.65 1.64 1.28 1.27 1.26


Bn
N
SMe
Me
Ph
11bb
d.r. 5.8:1
¹H NMR (600 MHz, CDCl3, 296K)
6.26 4.33 1.02 1.04 0.15 0.85 1.04 0.16 0.88 1.13 0.92 0.13 0.14 0.14 2.95 1.28 2.64 0.45 3.01 0.73 0.97
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

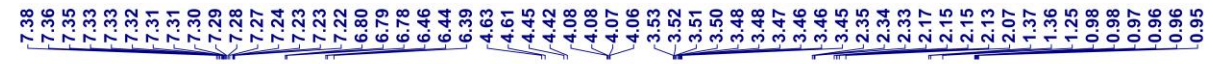

144.99 144.79 140.20 130.26 129.19 128.89 128.68 128.66 128.14 127.04 126.96 126.86 126.78 126.62 125.99 113.58 113.01

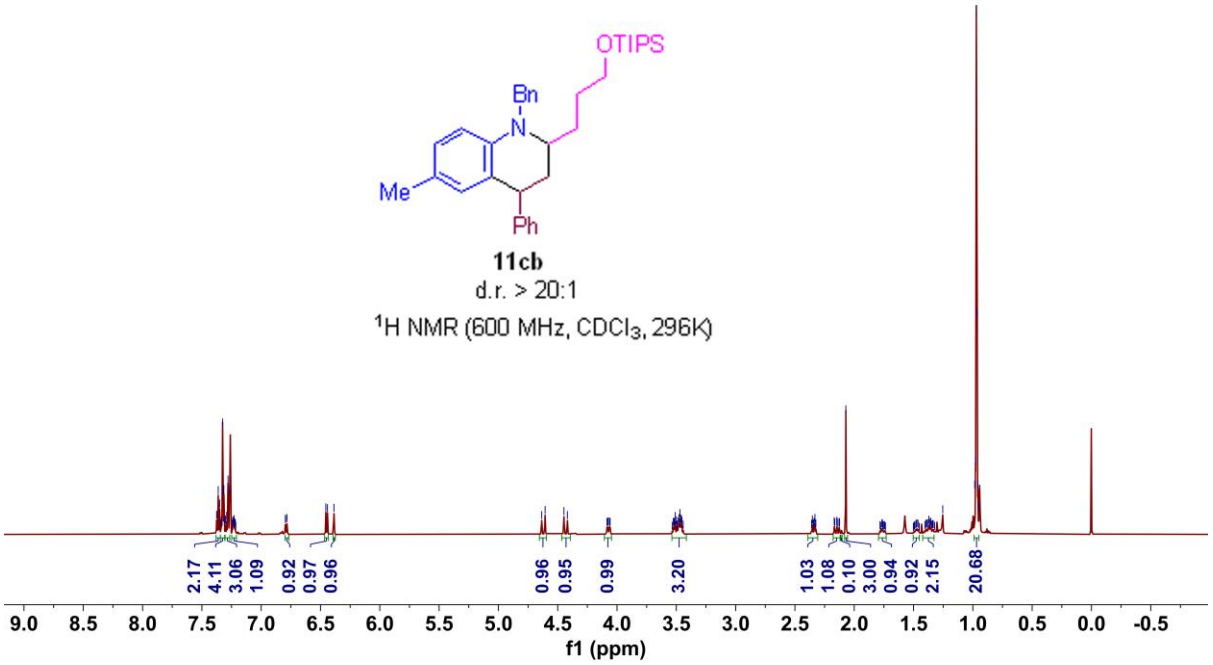

57.83 56.25 55.19 43.08 40.36 36.96 34.91 33.92 32.04 31.30 30.96 30.38 21.19 20.43 15.79 15.54

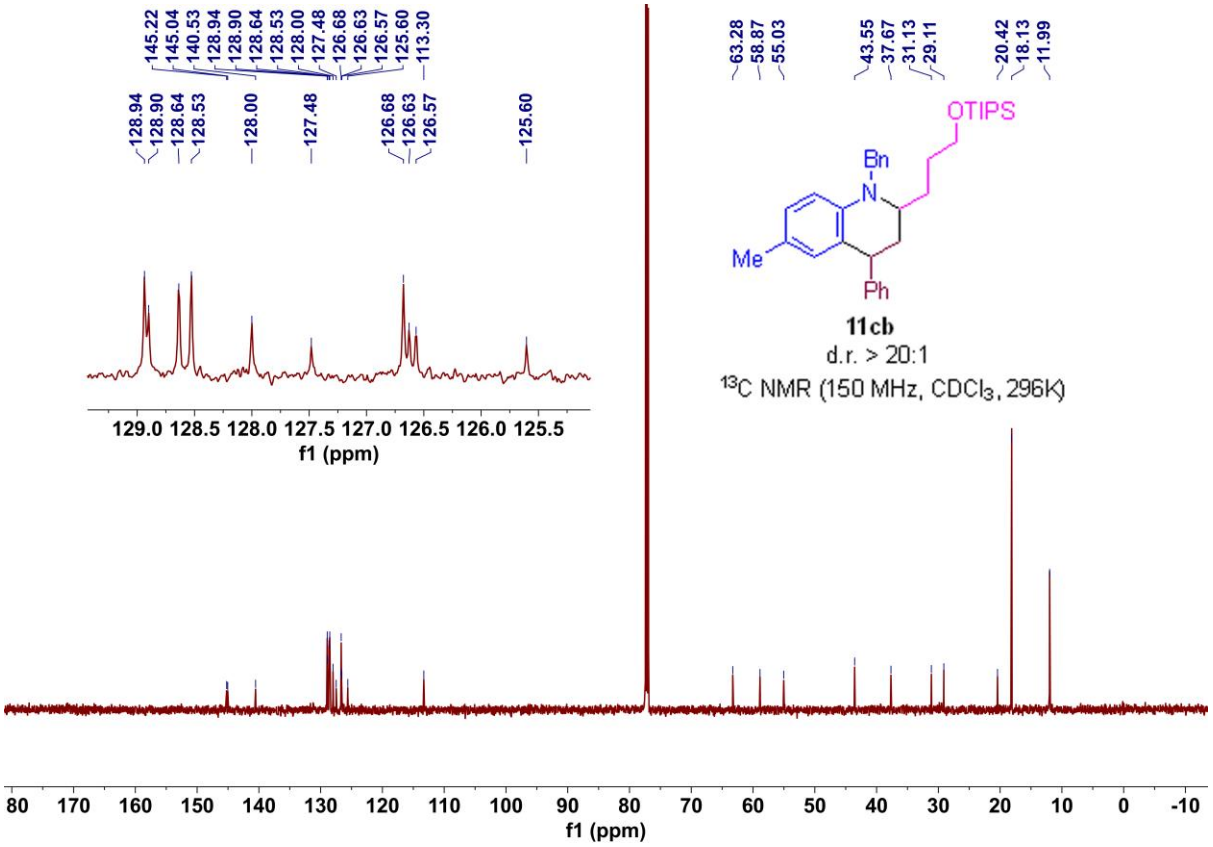

130.26 129.19 128.89 128.68 128.66 128.14 127.04 126.96 126.86 126.78 126.62 125.99
130 129 128 127 126 125
f1 (ppm)

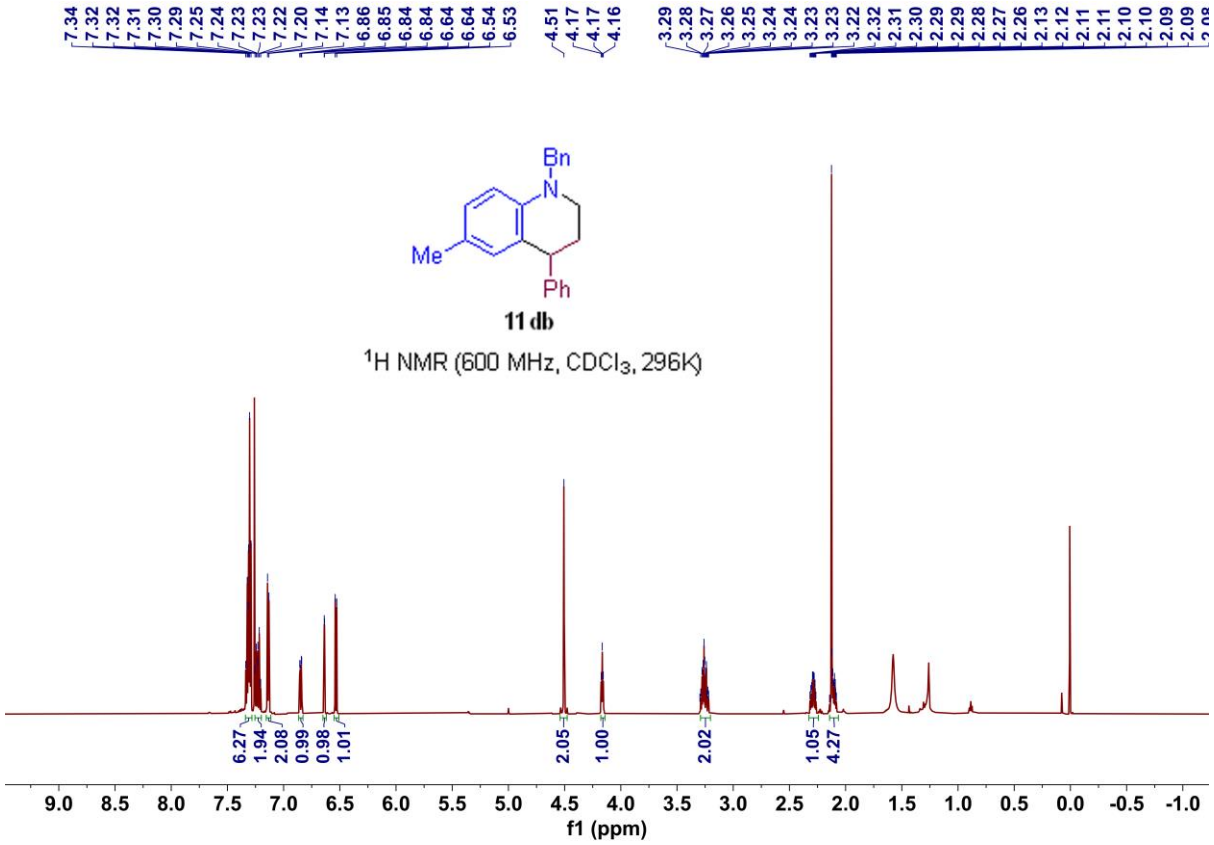

Bn
N
SMe
Me
Ph
11bb
d.r. 5.8:1
¹³C NMR (150 MHz, CDCl3, 296K)

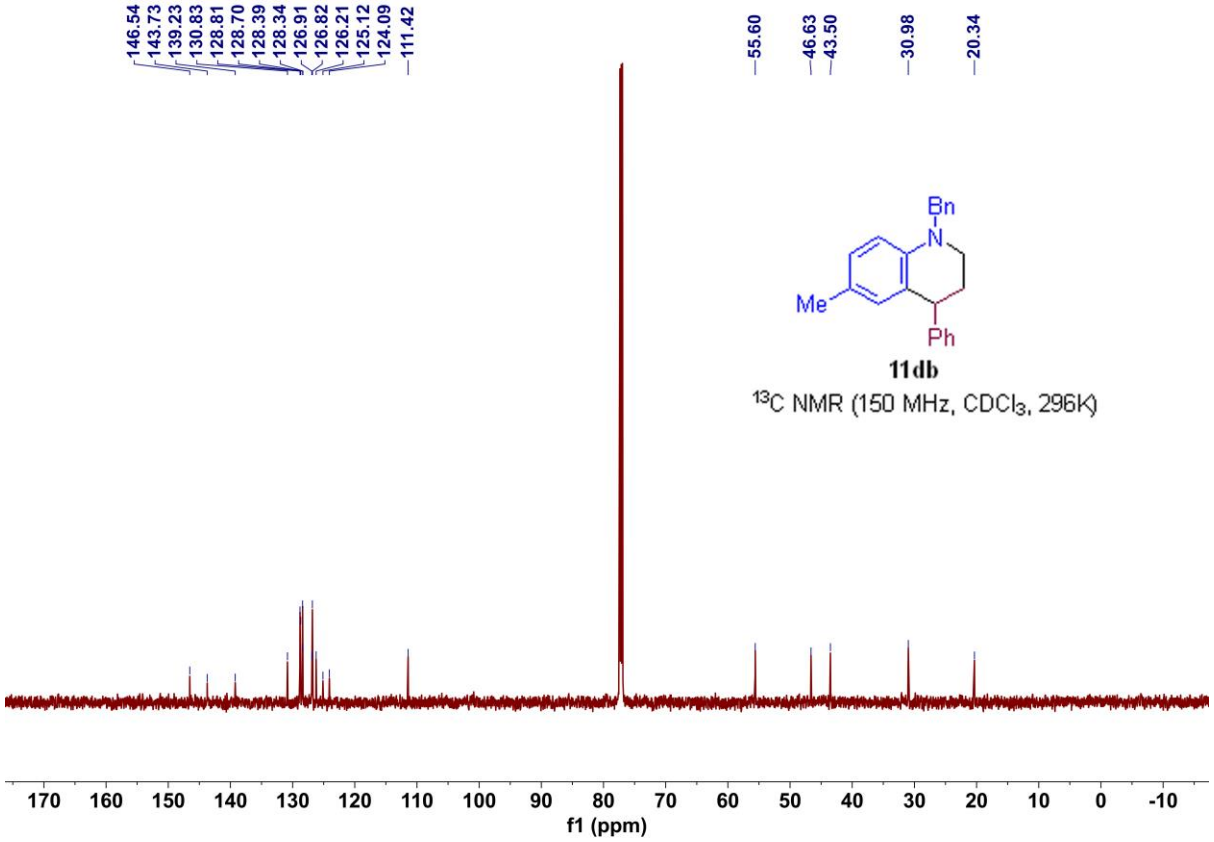
160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

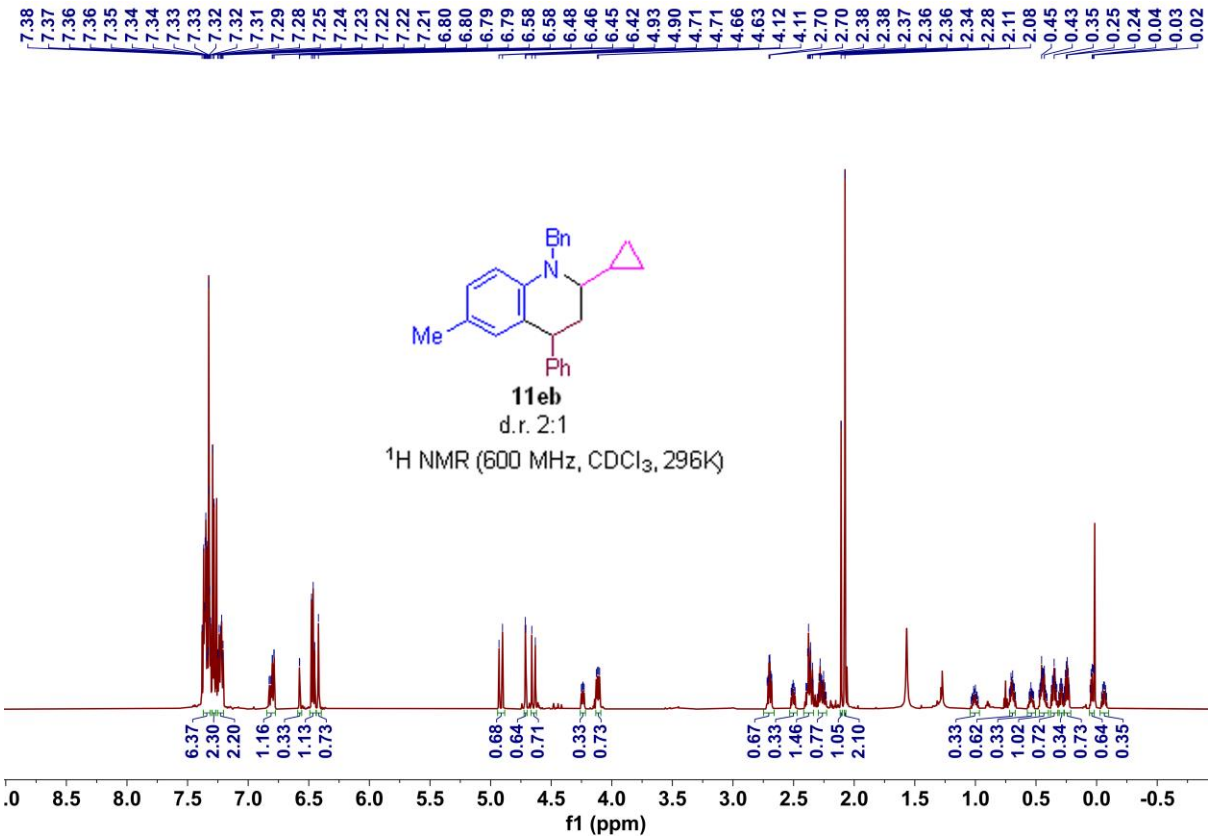

7.38 7.36 7.35 7.33 7.33 7.32 7.31 7.31 7.30 7.29 7.28 7.27 7.24 7.23 7.23 7.22 6.80 6.79 6.78 6.46 6.44 6.39 4.63 4.61 4.45 4.42 4.08 4.08 4.07 4.06 3.53 3.52 3.51 3.50 3.48 3.48 3.47 3.46 3.46 3.45 2.35 2.34 2.33 2.17 2.15 2.15 2.13 2.07 1.37 1.36 1.25 0.98 0.98 0.97 0.96 0.96 0.95

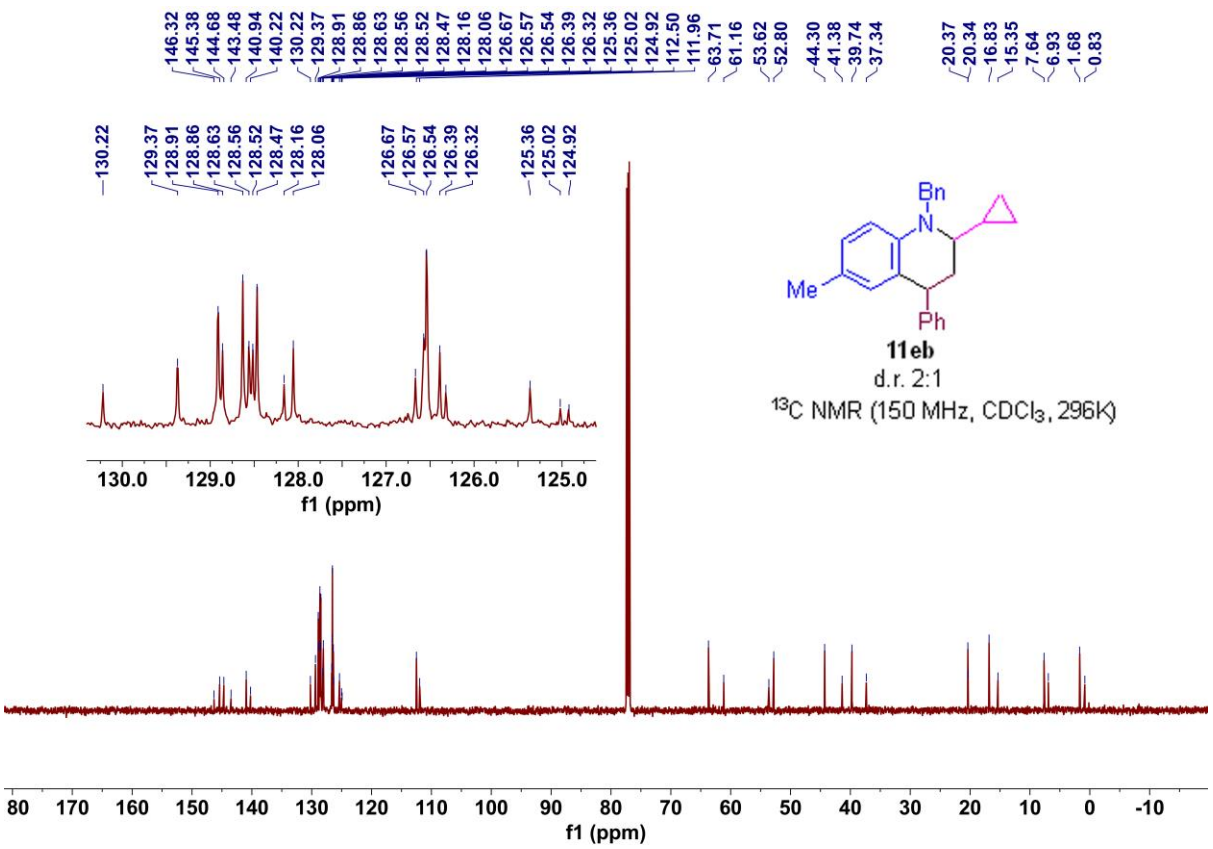

OTIPS
Bn
N
Me
Ph
11cb
d.r. > 20:1
1H NMR (600 MHz, CDCl3, 296K)
2.17 4.11 3.06 1.09 0.92 0.97 0.96 0.96 0.95 0.99 3.20 1.03 1.08 0.10 3.00 0.94 0.92 2.15 20.68
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

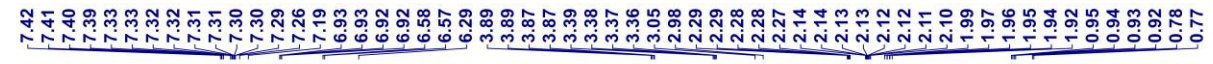

145.22 145.04 140.53 128.94 128.90 128.64 128.53 128.00 127.48 126.68 126.63 126.57 125.60 113.30
128.94 128.90 128.64 128.53 128.00 127.48 126.68 126.63 126.57 125.60
129.0 128.5 128.0 127.5 127.0 126.5 126.0 125.5
f1 (ppm)
63.28 58.87 55.03 43.55 37.67 31.13 29.11 20.42 18.13 11.99
OTIPS
Bn
N
Me
Ph
11cb
d.r. > 20:1
13C NMR (150 MHz, CDCl3, 296K)
80 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

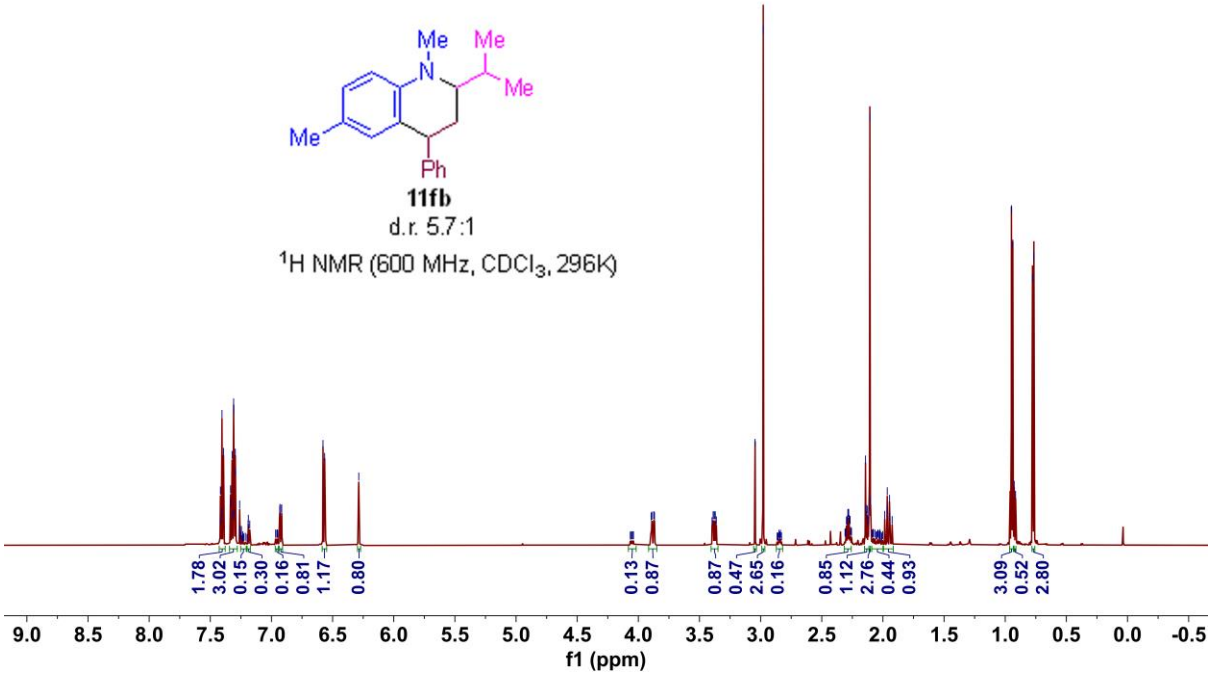

7.34 7.32 7.32 7.31 7.30 7.29 7.25 7.24 7.23 7.23 7.22 7.20 7.14 7.13 6.86 6.85 6.84 6.84 6.64 6.64 6.54 6.53
4.51 4.17 4.17 4.16
3.29 3.28 3.27 3.26 3.25 3.24 3.24 3.23 3.23 3.22 2.32 2.31 2.30 2.29 2.29 2.28 2.27 2.26 2.13 2.12 2.11 2.11 2.10 2.10 2.09 2.09
Bn
N
Me
Ph
11db
1H NMR (600 MHz, CDCl3, 296K)
6.27 1.94 2.08 0.99 0.98 1.01 2.05 1.00 2.02 1.05 4.27
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)

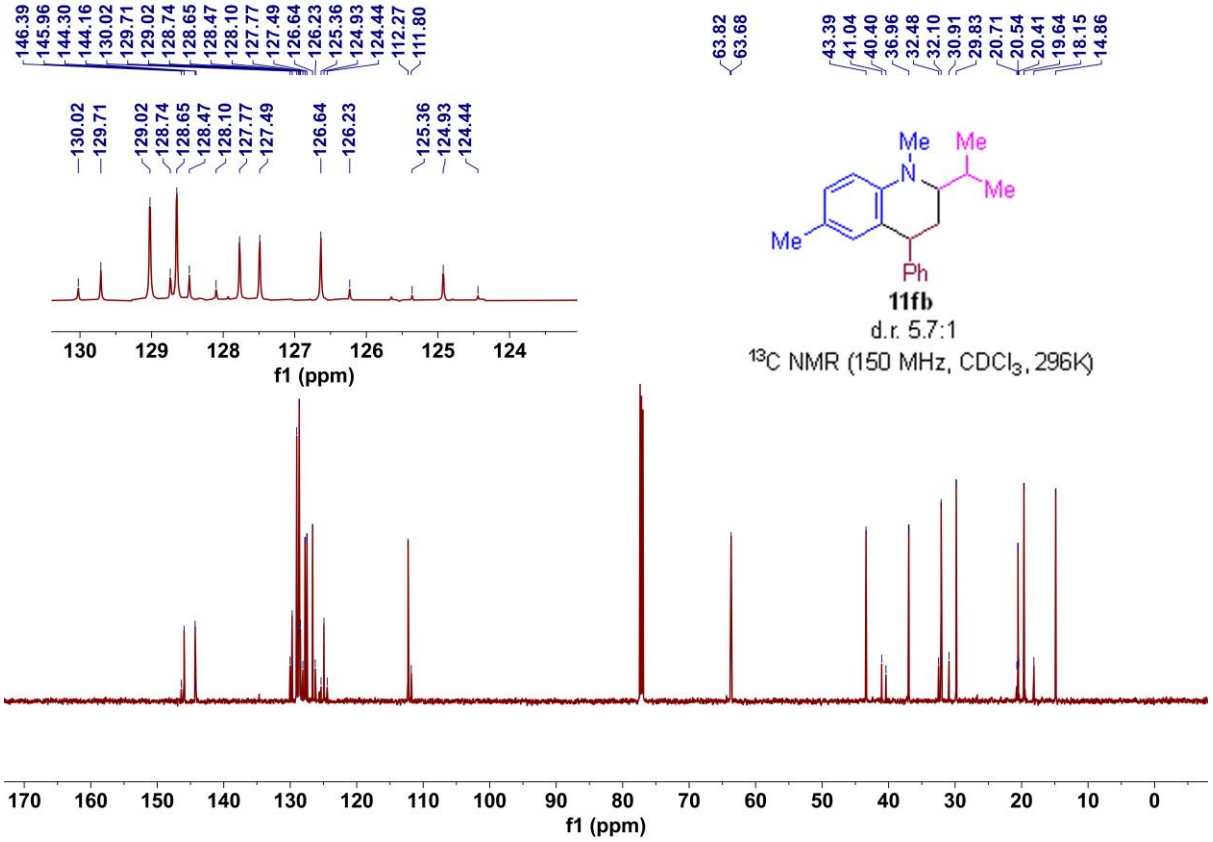

146.54 143.73 139.23 130.83 128.81 128.70 128.39 128.34 126.91 126.82 126.21 125.12 124.09 111.42
55.60 46.63 43.50 30.98 20.34
Bn
N
Me
Ph
11db
13C NMR (150 MHz, CDCl3, 296K)
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

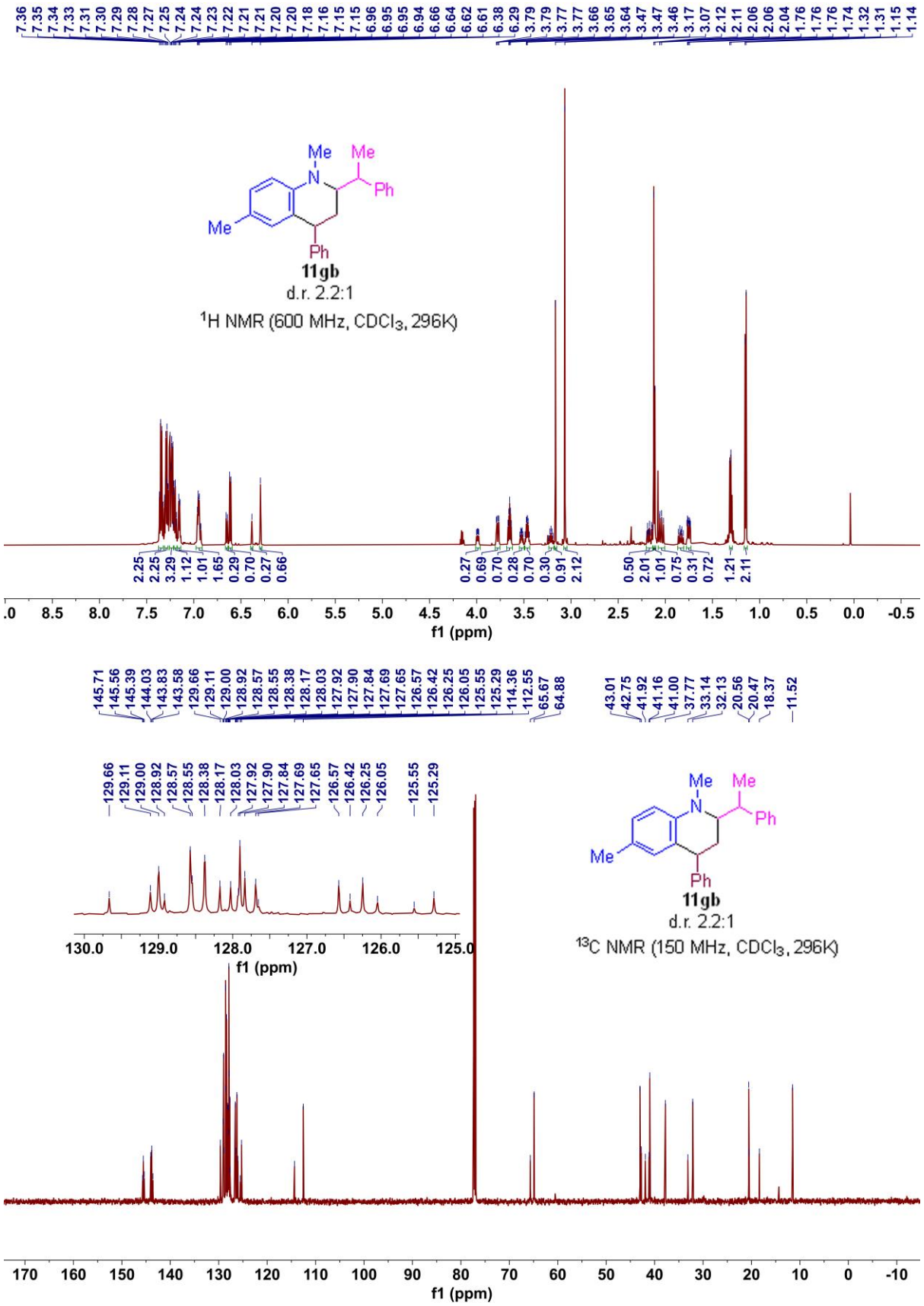

7.38 7.37 7.36 7.36 7.35 7.34 7.34 7.33 7.33 7.32 7.32 7.31 7.29 7.28 7.25 7.24 7.23 7.22 7.22 7.21 6.80 6.80 6.79 6.79 6.58 6.58 6.48 6.46 6.45 6.42 4.93 4.90 4.71 4.71 4.66 4.63 4.12 4.11 2.70 2.70 2.38 2.38 2.37 2.36 2.36 2.34 2.28 2.11 2.08 0.45 0.43 0.35 0.25 0.24 0.04 0.03 0.02
Bn
N
Me
Ph
11eb
d.r. 2:1
1H NMR (600 MHz, CDCl3, 296K)
6.37 2.30 2.20 1.16 0.33 1.13 0.73 0.68 0.64 0.71 0.33 0.73 0.67 0.33 1.46 0.77 1.05 2.10 0.33 0.62 0.33 1.02 0.72 0.34 0.73 0.64 0.35
f1 (ppm)


146.32 145.38 144.68 143.48 140.94 140.22 130.22 129.37 128.91 128.86 128.63 128.56 128.52 128.47 128.16 128.06 126.67 126.57 126.54 126.39 126.32 125.36 125.02 124.92 112.50 111.96 63.71 61.16 53.62 52.80 44.30 41.38 39.74 37.34 20.37 20.34 16.83 15.35 7.64 6.93 1.68 0.83
130.22 129.37 128.91 128.86 128.63 128.56 128.52 128.47 128.16 128.06 126.67 126.57 126.54 126.39 126.32 125.36 125.02 124.92
130.0 129.0 128.0 127.0 126.0 125.0
f1 (ppm)
Bn
N
Me
Ph
11eb
d.r. 2:1
13C NMR (150 MHz, CDCl3, 296K)
f1 (ppm)

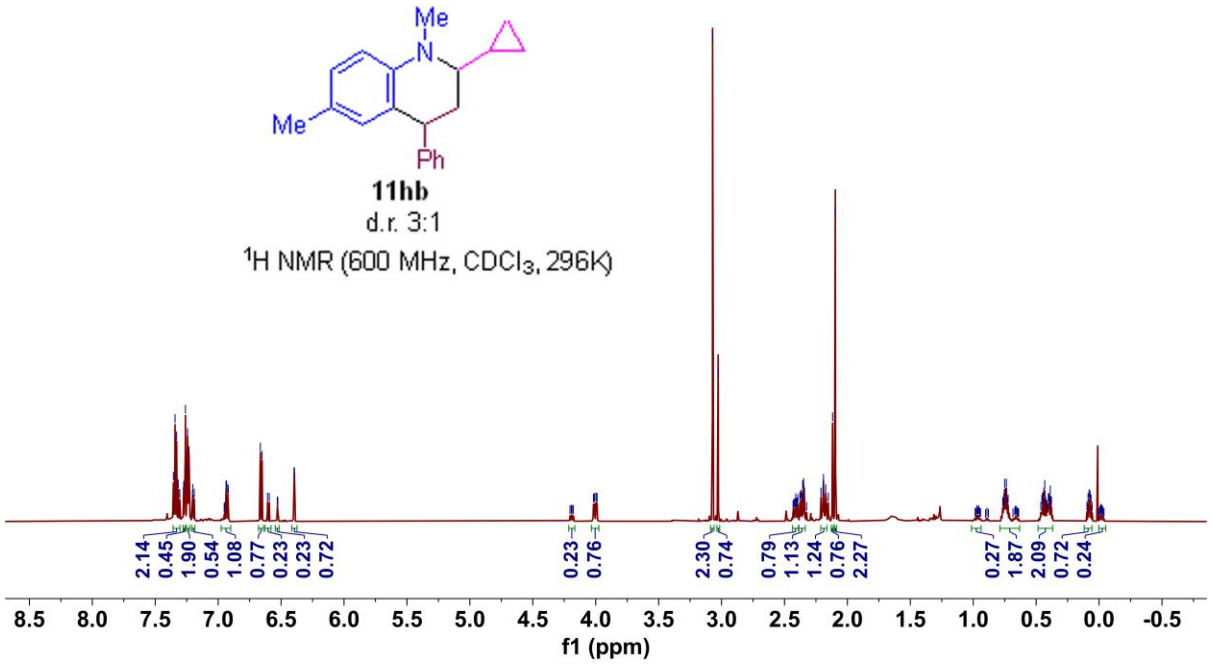

7.42 7.41 7.40 7.39 7.33 7.33 7.32 7.32 7.31 7.31 7.30 7.30 7.29 7.26 7.19 6.93 6.93 6.92 6.92 6.58 6.57 6.29
3.89 3.89 3.87 3.87 3.39 3.38 3.37 3.36 3.05 2.98 2.29 2.29 2.28 2.28 2.27 2.14 2.14 2.13 2.13 2.12 2.12 2.11 2.10 1.99 1.97 1.96 1.95 1.94 1.92 0.95 0.94 0.93 0.92 0.78 0.77


Me
Me
N
Me
Me
Ph
11fb
d.r. 5.7:1
1H NMR (600 MHz, CDCl3, 296K)
1.78 3.02 0.15 0.30 0.16 0.81 1.17 0.80 0.13 0.87 0.87 0.47 2.65 0.16 0.85 1.12 2.76 0.44 0.93 3.09 0.52 2.80
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

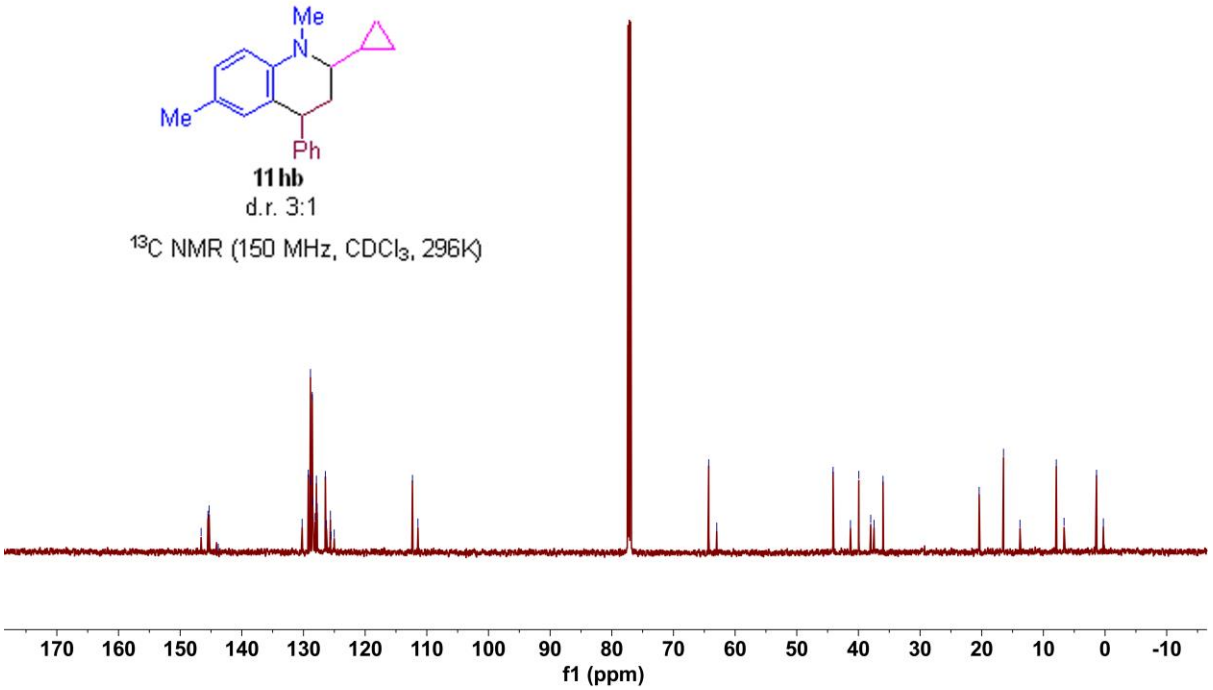

146.39 145.96 144.30 144.16 130.02 129.71 129.02 128.74 128.65 128.47 128.10 127.77 127.49 126.64 126.23 125.36 124.93 124.44 112.27 111.80
63.82 63.68
43.39 41.04 40.40 36.96 32.48 32.10 30.91 29.83 20.71 20.54 20.41 19.64 18.15 14.86
130.02 129.71 129.02 128.74 128.65 128.47 128.10 127.77 127.49 126.64 126.23 125.36 124.93 124.44
130 129 128 127 126 125 124
f1 (ppm)
Me
Me
N
Me
Me
Ph
11fb
d.r. 5.7:1
13C NMR (150 MHz, CDCl3, 296K)
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

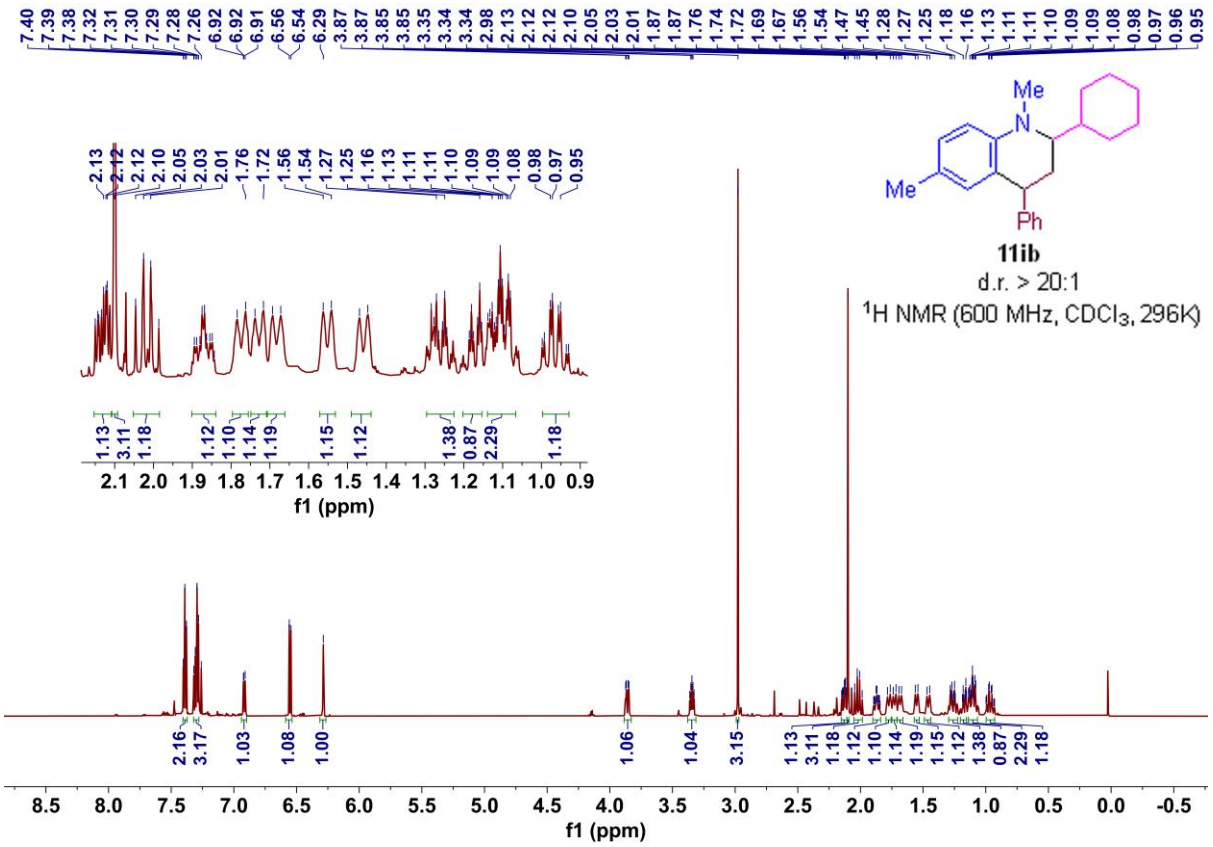

11gb
d.r. 2.2:1
1H NMR (600 MHz, CDCl3, 296K)
f1 (ppm)
11gb
d.r. 2.2:1
13C NMR (150 MHz, CDCl3, 296K)
f1 (ppm)

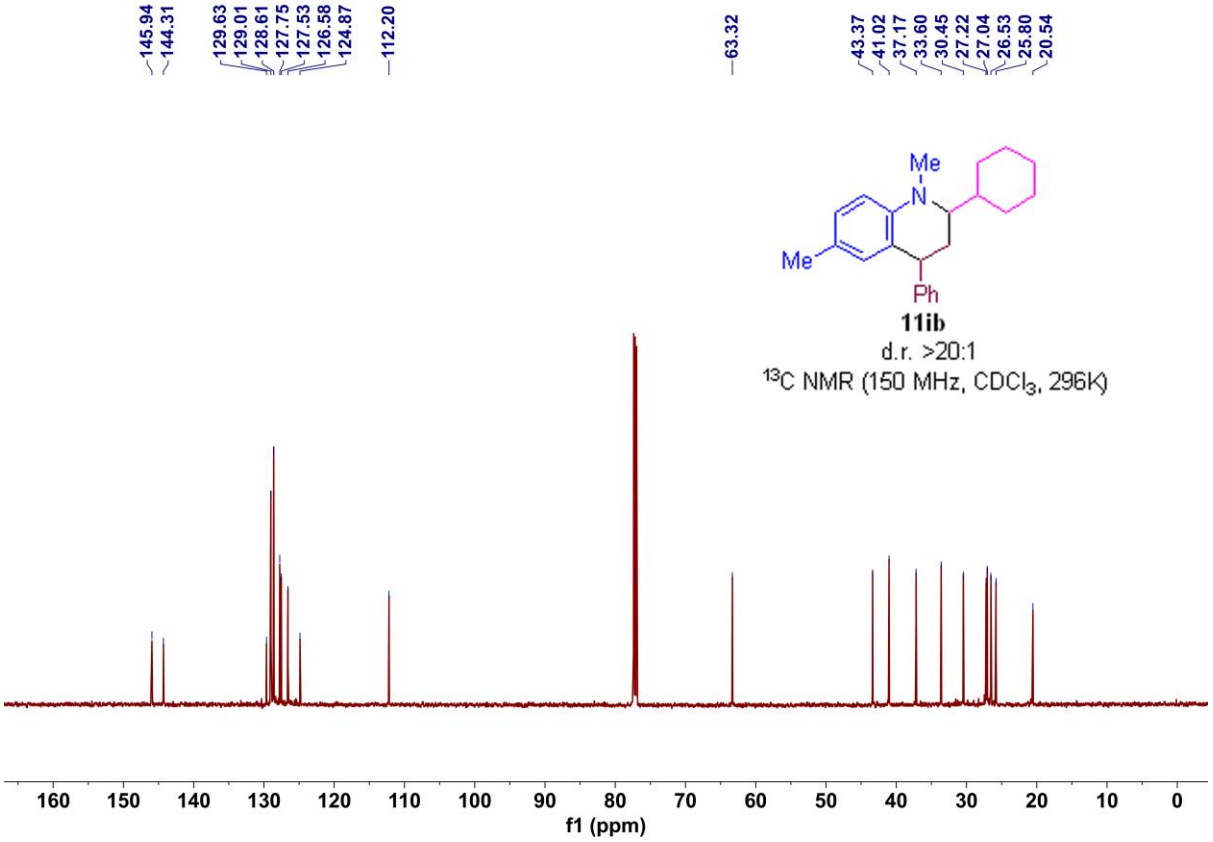

7.36
7.34
7.33
7.32
7.30
7.27
7.26
7.25
7.24
7.23
7.20
7.20
7.19
6.94
6.93
6.92
6.92
6.66
6.65
6.61
6.59
6.40
6.39
4.01
4.00
3.99
3.07
3.03
2.38
2.37
2.36
2.36
2.35
2.34
2.21
2.19
2.19
2.19
2.17
2.15
2.12
2.10
0.75
0.74
0.74
0.45
0.44
0.43
0.39
0.09
0.08
0.07

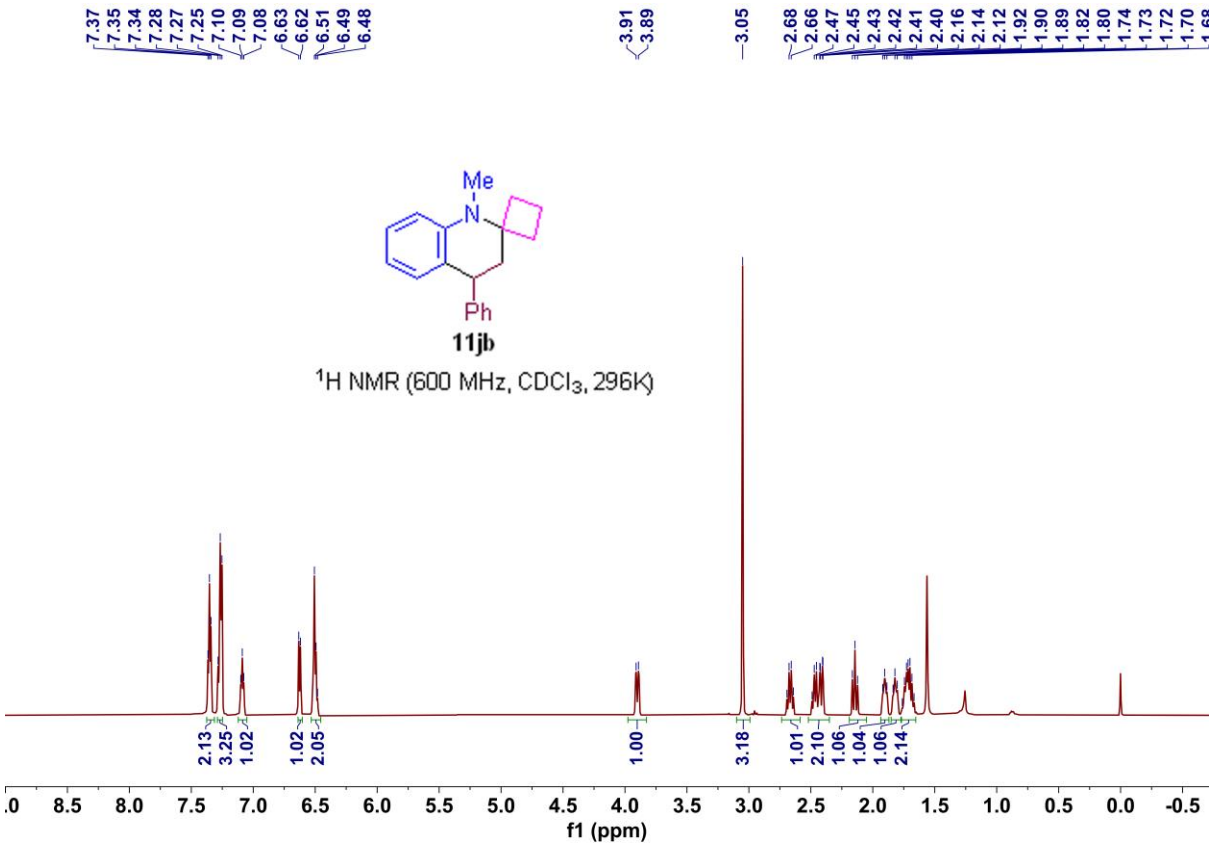

Me
N
Me
Ph
11hb
d.r. 3:1
1H NMR (600 MHz, CDCl3, 296K)
2.14
0.45
1.90
0.54
1.08
0.77
0.23
0.23
0.72
0.23
0.76
2.30
0.74
0.79
1.13
1.24
0.76
2.27
0.27
1.87
2.09
0.72
0.24
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

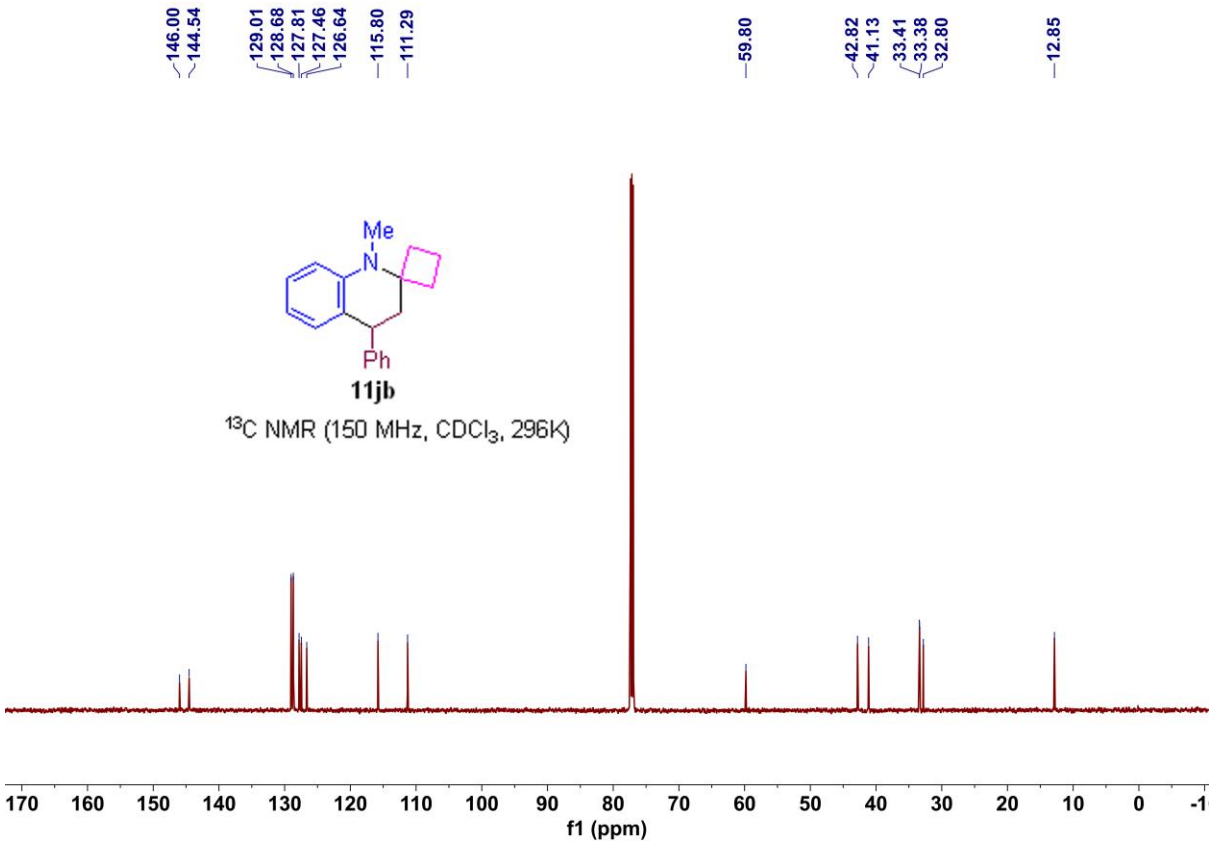

146.60
145.50
145.31
143.82
130.22
129.22
128.90
128.87
128.59
128.50
128.10
127.91
127.78
126.45
126.27
125.63
125.53
125.02
112.33
111.44
64.28
62.98
44.11
41.29
39.93
38.00
37.47
36.01
20.42
16.47
13.80
7.91
6.65
1.38
0.27

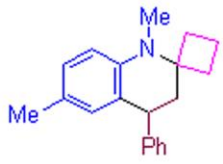

Me
N
Me
Ph
11hb
d.r. 3:1
13C NMR (150 MHz, CDCl3, 296K)
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)


Me
N
Me
Ph
11ib
d.r. > 20:1
^{1}H NMR (600 MHz, $CDCl_3$, 296K)
f1 (ppm)


Me
N
Me
Ph
11ib
d.r. >20:1
^{13}C NMR (150 MHz, $CDCl_3$, 296K)
f1 (ppm)

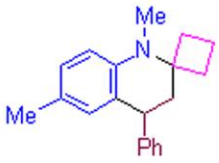

7.37
7.35
7.34
7.28
7.27
7.25
7.10
7.09
7.08
6.63
6.62
6.51
6.49
6.48
3.91
3.89
3.05
2.68
2.66
2.47
2.45
2.43
2.42
2.41
2.40
2.16
2.14
2.12
1.92
1.90
1.89
1.82
1.80
1.74
1.73
1.72
1.70
Me
N
Ph
11jb
^{1}H NMR (600 MHz, $CDCl_3$, 296K)
2.13
3.25
1.02
1.02
2.05
1.00
3.18
1.01
2.10
1.06
1.04
1.06
2.14
f1 (ppm)


146.00
144.54
129.01
128.68
127.81
127.46
126.64
115.80
111.29
59.80
42.82
41.13
33.41
33.38
32.80
12.85
Me
N
Ph
11jb
^{13}C NMR (150 MHz, $CDCl_3$, 296K)
f1 (ppm)



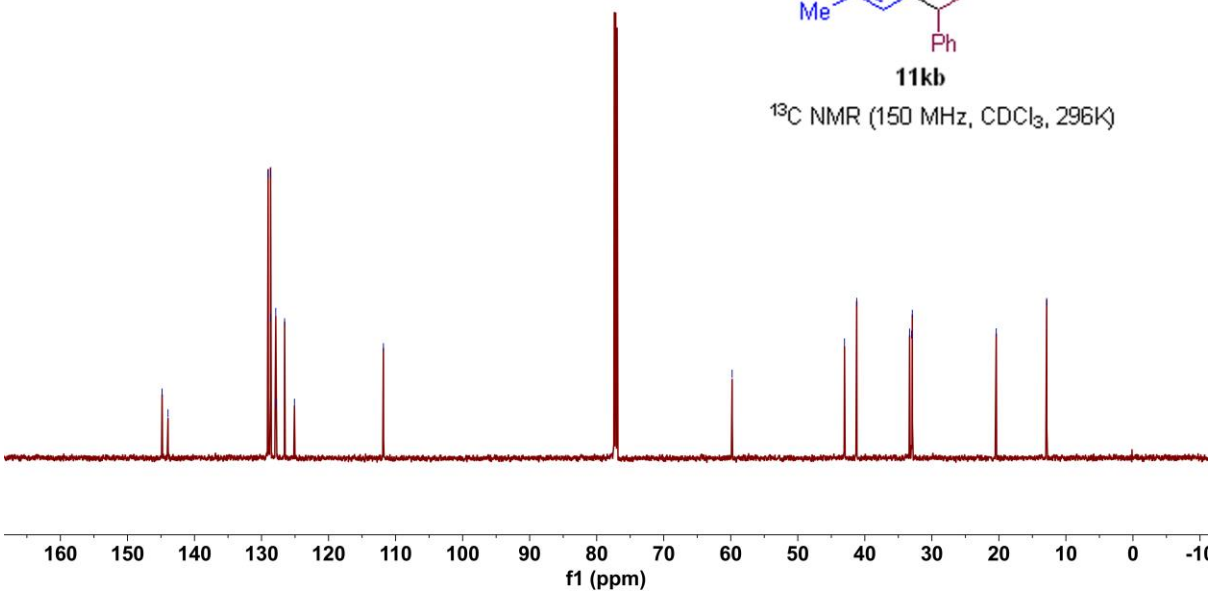
11kb

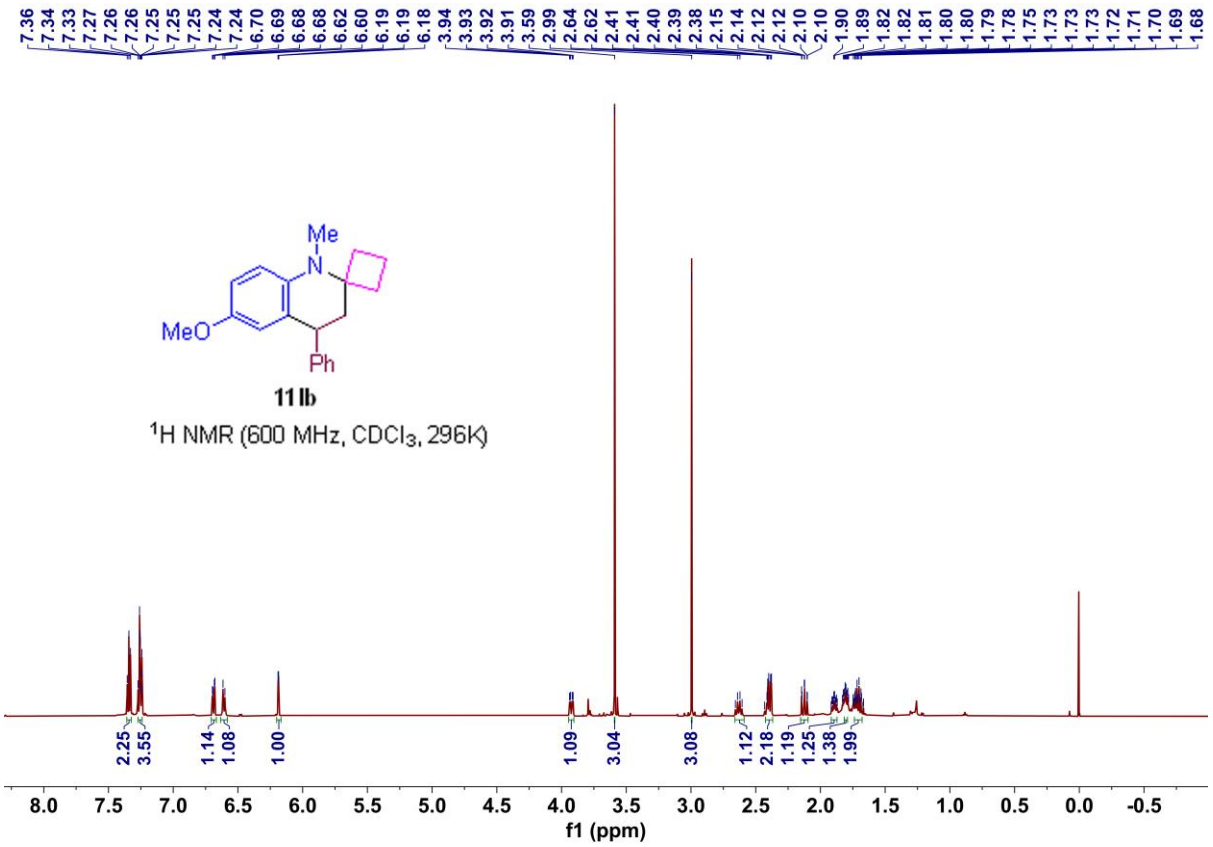
^{1}H NMR (600 MHz, $CDCl_3$, 296K)

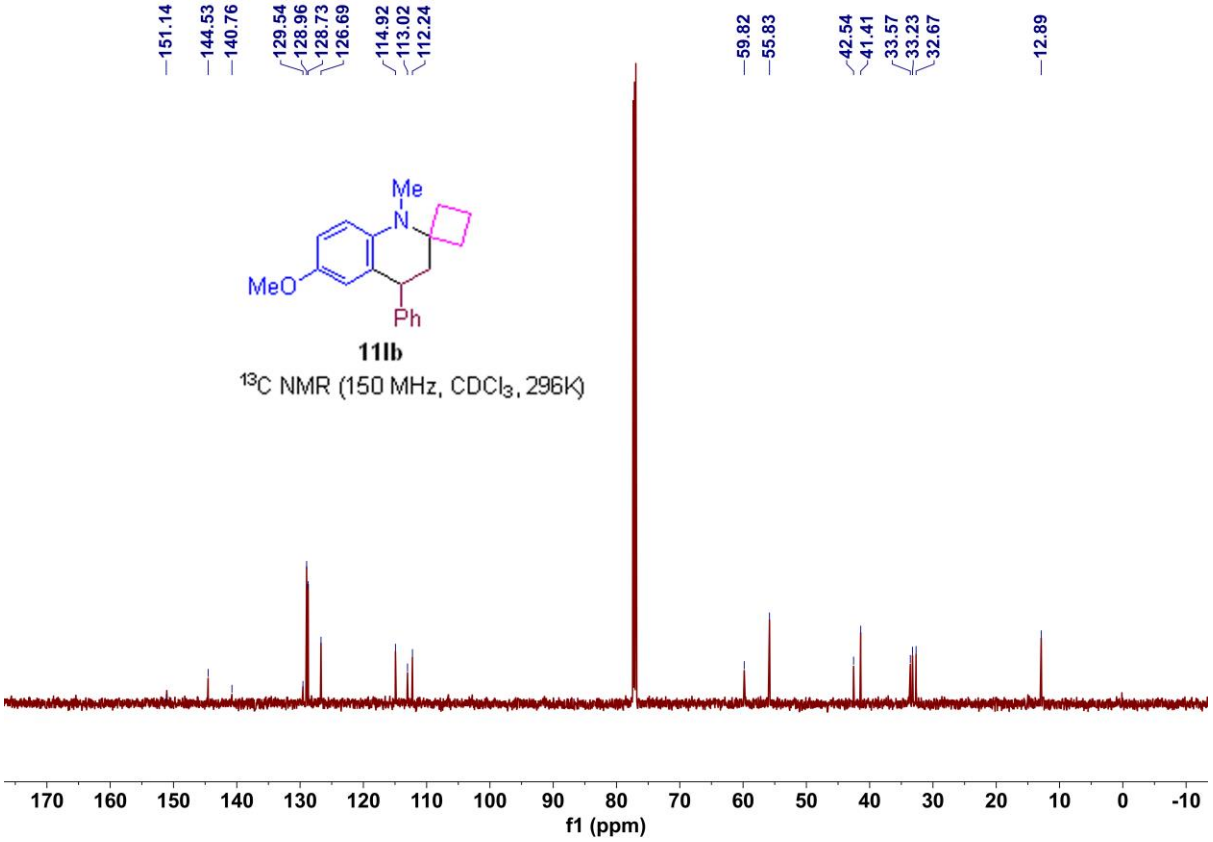


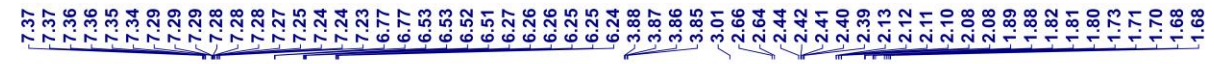
11kb

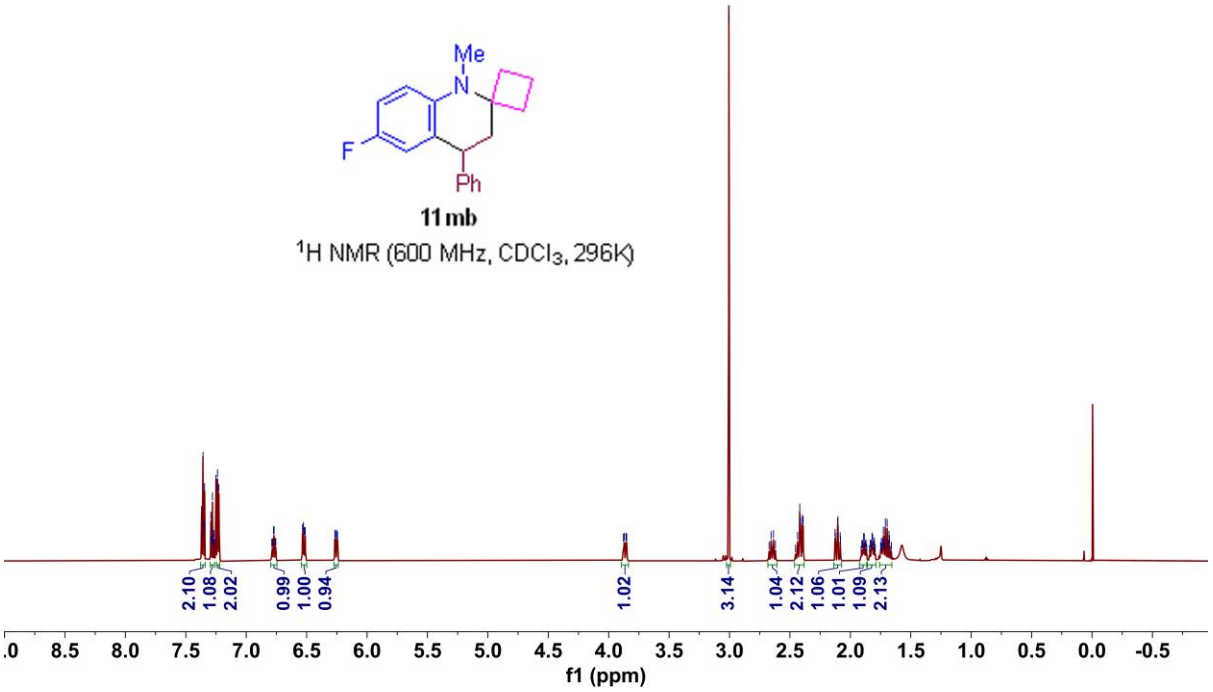
^{13}C NMR (150 MHz, $CDCl_3$, 296K)




Me
N
MeO
Ph
11lb
1H NMR (600 MHz, CDCl3, 296K)
f1 (ppm)

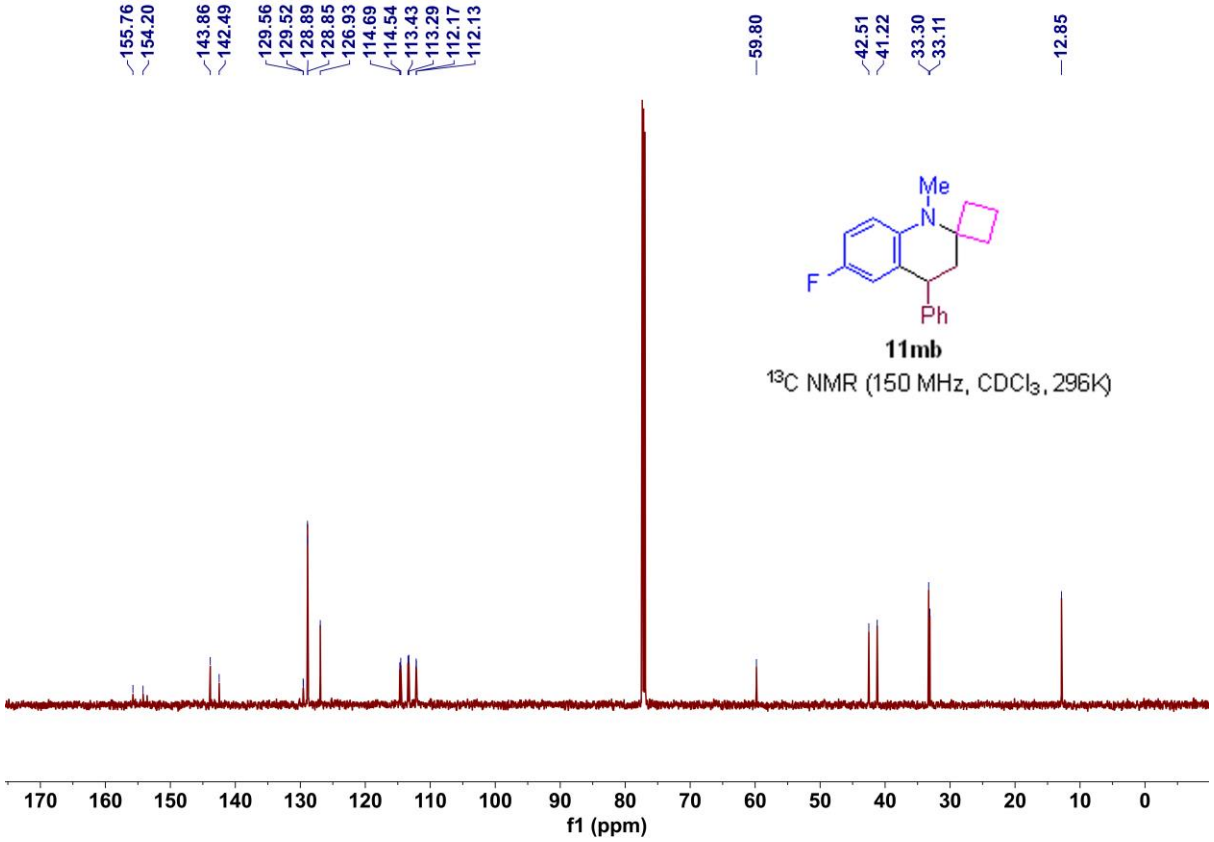

Me
N
MeO
Ph
11lb
13C NMR (150 MHz, CDCl3, 296K)
f1 (ppm)





11mb

^{1}H NMR (600 MHz, $CDCl_3$, 296K)



11mb

^{13}C NMR (150 MHz, $CDCl_3$, 296K)

13. References:

[1] Dolomanov, O.V., Bourhis, L.J., Gildea, R.J, Howard, J.A.K. Puschmann, H. (2009), *J. Appl. Cryst.* **2009**, *42*, 339-341.
[2] Sheldrick, G.M. *Acta Cryst*. **2015**, A71, 3-8.
[3] Sheldrick, G.M. *Acta Cryst*. **2015**, C71, 3-8.