

Supporting Information
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Enantioselective, Copper-Catalyzed Addition of Nucleophilic Silicon to Alkenyl-Substituted Phosphine Oxides

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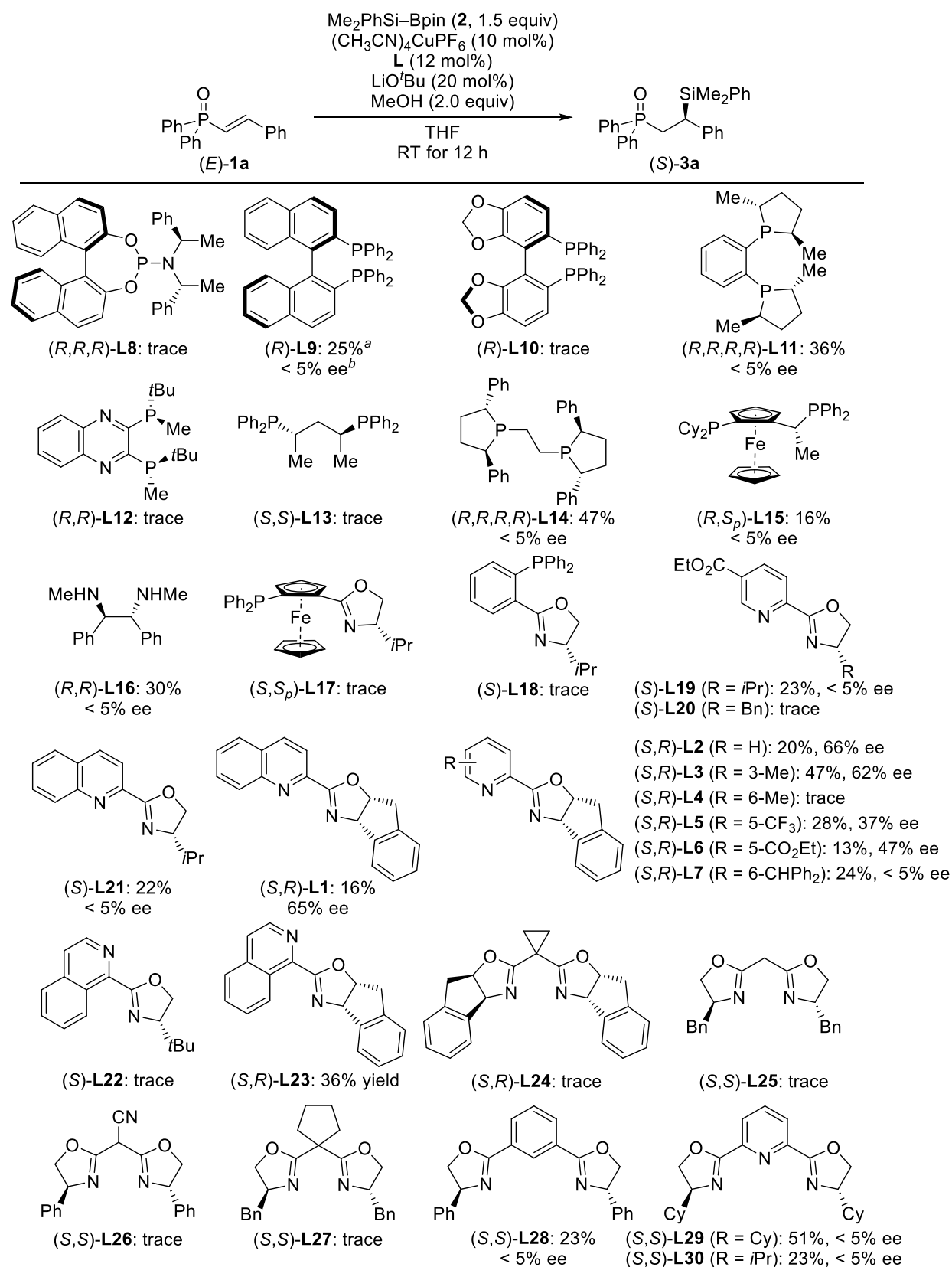
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Supporting Information

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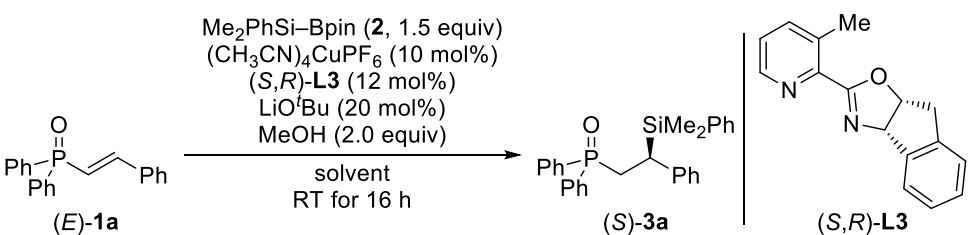
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1. Optimization Study



Scheme S1: Ligand screening for asymmetric silylation of alkenyl-substituted phosphine oxides. All reactions were performed on a 0.20 mmol scale. ^aDetermined by ¹H NMR spectroscopic analysis using mesitylene as the internal standard. ^bDetermined by HPLC analysis on a chiral stationary phase.

Table S1. Solvent screening for asymmetric silylation of alkenyl-substituted phosphine oxides^a



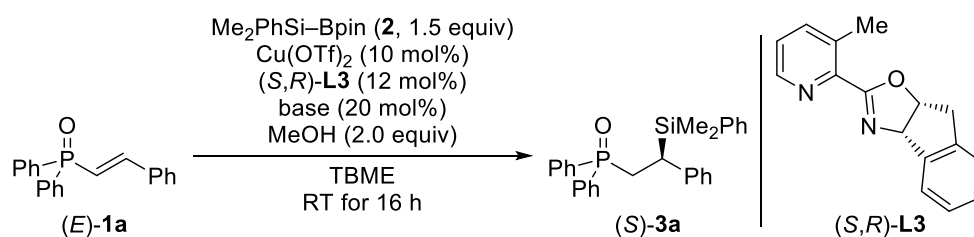
entry	solvent	yield (%) ^b	ee (%) ^c
1	THF	47	62
2	2-MeTHF	47	75
3	dioxane	14	78
4	Et ₂ O	45	86
5	TBME	38	91
6	toluene	38	75
7	CH ₂ Cl ₂	13	70
8	EtOAc	28	85
9	H ₂ O	trace	-

^aAll reactions were performed on a 0.20 mmol scale. ^bDetermined by ¹H NMR spectroscopic analysis using mesitylene as internal standard. ^cDetermined by HPLC analysis on a chiral stationary phase.

Table S2. Copper-salt screening for asymmetric silylation of alkenyl-substituted phosphine oxides^a

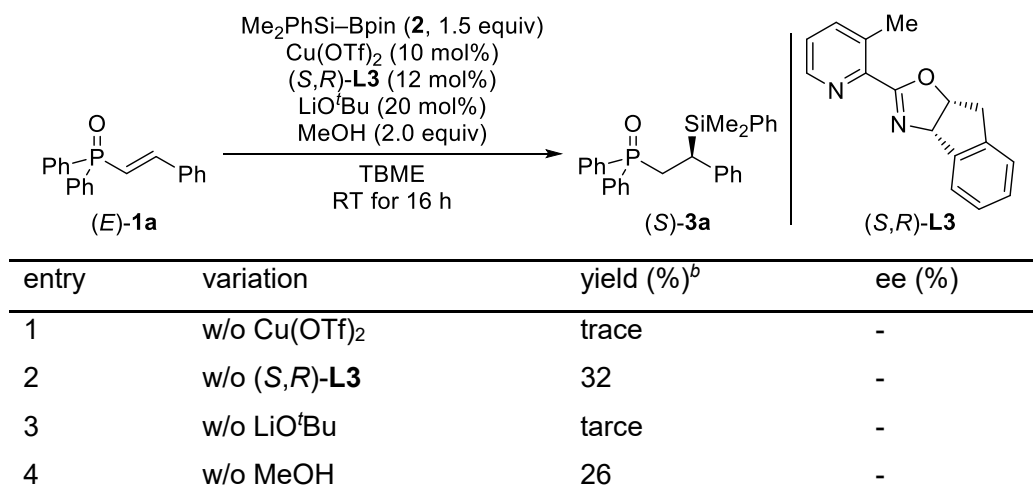
entry	copper salt	yield (%) ^b	ee (%) ^c
1	Cu(CH ₃ CN) ₄ PF ₆	38	91
2	CuTc	69	91
3	Cu(acac) ₂	85	91
4	Cu(OTf) ₂	83 (96)	93
5	CuBr	81	65
6	CuI	46	55
7	CuBr·SMe ₂	63	75
8	CuSCN	56	79
9	(Ph ₃ P) ₂ CuBH ₄	72	77
10	CuF	trace	-
11	CuCN	88	23
12	CuCl ₂ ·2H ₂ O	44	87
13	Cu(TMHD) ₂	71	90
14	Cu(CF ₃ COCH ₂ COCH ₃) ₂	66	93
15	Cu(COOCH ₃) ₂	33	93

^aAll reactions were performed on a 0.20 mmol scale. ^bDetermined by ¹H NMR spectroscopic analysis using mesitylene as internal standard (isolated yield in the parentheses). ^cDetermined by HPLC analysis on a chiral stationary phase.

Table S3. Base screening for asymmetric silylation of alkenyl-substituted phosphine oxides^a

entry	base	yield (%) ^b	ee (%) ^c
1	LiO ^t Bu	96 ^[d]	93
2	NaO ^t Bu	12	-
3	KO ^t Bu	trace	-
4	NaOEt	trace	-
5	NaOMe	trace	-
6	Na ₂ CO ₃	trace	-
7	NaHCO ₃	tarce	-
8	NaOH	42	83
9	Et ₃ N	28	85
10	DBU	64	84
11	DMAP	trace	-

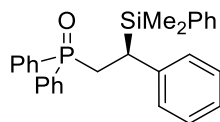
^aAll reactions were performed on a 0.10 mmol scale. ^bDetermined by ¹H NMR spectroscopic analysis using mesitylene as internal standard. ^cDetermined by HPLC analysis on a chiral stationary phase.

Table S4. Control experiments^a

^aAll reactions were performed on a 0.10 mmol scale. ^bDetermined by ¹H NMR spectroscopic analysis using mesitylene as internal standard.

2. Determination of the Absolute Configuration

[2-(Dimethylphenylsilyl)-2-phenylethyl]diphenylphosphine oxide [(*S*)-**3a**]



Crystals of (*S*)-**3a** were obtained through recrystallization from a solution of (*S*)-**3a** in CH₂Cl₂ and *n*-heptane at room temperature. The absolute configuration was unambiguously confirmed by X-ray diffraction analysis, and other compounds were assigned by analogy. CCDC 2118372 contains the supplementary crystallographic data for this compound.

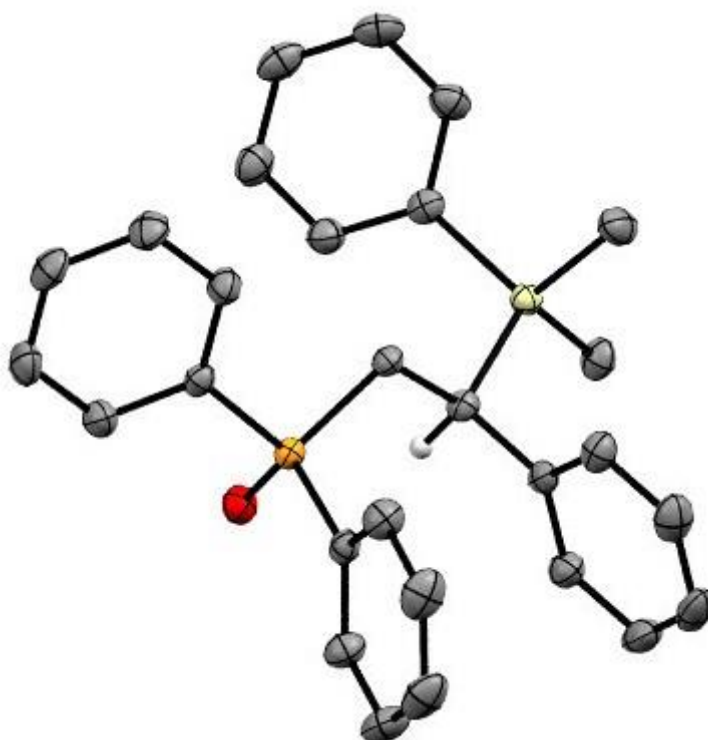


Figure S1. Molecular structure of (*S*)-**3a**. Thermal ellipsoids represent 50% probability level. H atoms are omitted for clarity except at C3.

Table S5. Crystal data and structure refinement

Empirical formula	C ₂₈ H ₂₉ OPSi [(S)- 3a]	
Formula weight	440.57	
Temperature	150.01(10) K	
Wavelength	1.54184 Å	
Crystal system	Orthorhombic	
Space group	P2 ₁ 2 ₁ 2 ₁ (no. 19)	
Unit cell dimensions	a = 6.05219(6) Å	α = 90°.
	b = 17.31329(19) Å	β = 90°.
	c = 22.5495(2) Å	γ = 90°.
Volume	2362.81(4) Å ³	
Z	4	
Density (calculated)	1.239 Mg/m ³	
Absorption coefficient	1.640 mm ⁻¹	
F(000)	936	
Crystal size	0.52 x 0.12 x 0.08 mm ³	
Theta range for data collection	3.22 to 67.49°.	
Index ranges	-7<=h<=7, -20<=k<=17, -26<=l<=27	
Reflections collected	15640	
Independent reflections	4254 [R(int) = 0.0212]	
Completeness to theta = 67.49°	100.0 %	
Absorption correction	Semi-empirical from equivalents	
Max. and min. transmission	0.8745 and 0.4814	
Refinement method	Full-matrix least-squares on F ²	
Data / restraints / parameters	4254 / 0 / 281	
Goodness-of-fit on F ²	1.061	
Final R indices [>2sigma(I)]	R1 = 0.0227, wR2 = 0.0610	
R indices (all data)	R1 = 0.0234, wR2 = 0.0613	
Absolute structure parameter	0.019(13)	
Largest diff. peak and hole	0.204 and -0.213 e.Å ⁻³	

Table S6. Atomic coordinates ($\times 10^4$) and equivalent isotropic displacement parameters ($\text{\AA}^2 \times 10^3$) for (S)-**3a**. $U(\text{eq})$ is defined as one third of the trace of the orthogonalized U^{ij} tensor.

	x	y	z	U(eq)
P(1)	4106(1)	5306(1)	5404(1)	17(1)
Si(1)	6876(1)	3666(1)	6739(1)	18(1)
O(1)	1792(2)	5043(1)	5508(1)	23(1)
C(1)	6149(2)	4721(1)	5782(1)	18(1)
C(2)	5541(2)	4581(1)	6439(1)	18(1)
C(3)	6029(2)	5264(1)	6841(1)	19(1)
C(4)	4486(3)	5500(1)	7261(1)	25(1)
C(5)	4917(3)	6113(1)	7644(1)	33(1)
C(6)	6906(3)	6497(1)	7611(1)	36(1)
C(7)	8465(3)	6276(1)	7194(1)	33(1)
C(8)	8040(3)	5661(1)	6814(1)	25(1)
C(9)	4462(2)	6306(1)	5616(1)	20(1)
C(10)	2712(3)	6676(1)	5898(1)	26(1)
C(11)	2906(3)	7446(1)	6062(1)	34(1)
C(12)	4833(3)	7844(1)	5939(1)	35(1)
C(13)	6558(3)	7483(1)	5650(1)	35(1)
C(14)	6383(2)	6712(1)	5489(1)	27(1)
C(15)	4890(2)	5261(1)	4630(1)	18(1)
C(16)	6991(3)	5045(1)	4441(1)	25(1)
C(17)	7427(3)	4970(1)	3838(1)	29(1)
C(18)	5802(3)	5127(1)	3425(1)	29(1)
C(19)	3735(3)	5362(1)	3610(1)	31(1)
C(20)	3267(3)	5424(1)	4212(1)	26(1)
C(21)	6405(2)	2839(1)	6209(1)	20(1)
C(22)	8044(3)	2278(1)	6140(1)	27(1)
C(23)	7773(3)	1657(1)	5756(1)	33(1)
C(24)	5857(3)	1582(1)	5430(1)	31(1)
C(25)	4193(3)	2127(1)	5490(1)	30(1)
C(26)	4472(2)	2748(1)	5875(1)	26(1)
C(27)	5695(3)	3448(1)	7486(1)	26(1)
C(28)	9916(2)	3817(1)	6806(1)	31(1)

Table S7. Bond lengths [Å] and angles [°] for (S)-**3a**.

P(1)-O(1)	1.4909(10)
P(1)-C(9)	1.8086(13)
P(1)-C(15)	1.8104(13)
P(1)-C(1)	1.8110(13)
Si(1)-C(28)	1.8649(15)
Si(1)-C(27)	1.8687(14)
Si(1)-C(21)	1.8856(14)
Si(1)-C(2)	1.9020(13)
C(1)-C(2)	1.5472(17)
C(2)-C(3)	1.5188(18)
C(3)-C(4)	1.3909(19)
C(3)-C(8)	1.399(2)
C(4)-C(5)	1.393(2)
C(5)-C(6)	1.377(3)
C(6)-C(7)	1.387(2)
C(7)-C(8)	1.391(2)
C(9)-C(14)	1.389(2)
C(9)-C(10)	1.3919(19)
C(10)-C(11)	1.389(2)
C(11)-C(12)	1.382(2)
C(12)-C(13)	1.381(2)
C(13)-C(14)	1.388(2)
C(15)-C(20)	1.3899(19)
C(15)-C(16)	1.392(2)
C(16)-C(17)	1.392(2)
C(17)-C(18)	1.381(2)
C(18)-C(19)	1.380(2)
C(19)-C(20)	1.392(2)
C(21)-C(22)	1.398(2)
C(21)-C(26)	1.400(2)
C(22)-C(23)	1.390(2)
C(23)-C(24)	1.379(2)
C(24)-C(25)	1.388(2)
C(25)-C(26)	1.391(2)
O(1)-P(1)-C(9)	111.27(6)
O(1)-P(1)-C(15)	112.58(6)

C(9)-P(1)-C(15)	105.37(6)
O(1)-P(1)-C(1)	113.35(6)
C(9)-P(1)-C(1)	109.25(6)
C(15)-P(1)-C(1)	104.51(6)
C(28)-Si(1)-C(27)	109.43(7)
C(28)-Si(1)-C(21)	107.86(7)
C(27)-Si(1)-C(21)	111.13(6)
C(28)-Si(1)-C(2)	109.33(7)
C(27)-Si(1)-C(2)	109.01(6)
C(21)-Si(1)-C(2)	110.05(6)
C(2)-C(1)-P(1)	112.11(9)
C(3)-C(2)-C(1)	113.76(10)
C(3)-C(2)-Si(1)	110.79(9)
C(1)-C(2)-Si(1)	111.70(9)
C(4)-C(3)-C(8)	117.99(12)
C(4)-C(3)-C(2)	120.24(12)
C(8)-C(3)-C(2)	121.75(12)
C(3)-C(4)-C(5)	121.31(15)
C(6)-C(5)-C(4)	119.94(14)
C(5)-C(6)-C(7)	119.82(13)
C(6)-C(7)-C(8)	120.23(15)
C(7)-C(8)-C(3)	120.70(14)
C(14)-C(9)-C(10)	119.86(12)
C(14)-C(9)-P(1)	122.01(10)
C(10)-C(9)-P(1)	118.10(10)
C(11)-C(10)-C(9)	119.97(15)
C(12)-C(11)-C(10)	119.77(15)
C(13)-C(12)-C(11)	120.47(14)
C(12)-C(13)-C(14)	120.06(15)
C(13)-C(14)-C(9)	119.84(14)
C(20)-C(15)-C(16)	119.54(12)
C(20)-C(15)-P(1)	117.37(10)
C(16)-C(15)-P(1)	123.05(10)
C(17)-C(16)-C(15)	119.78(14)
C(18)-C(17)-C(16)	120.35(14)
C(19)-C(18)-C(17)	120.05(13)
C(18)-C(19)-C(20)	120.09(14)
C(15)-C(20)-C(19)	120.14(14)

C(22)-C(21)-C(26)	117.04(13)
C(22)-C(21)-Si(1)	119.39(11)
C(26)-C(21)-Si(1)	123.57(10)
C(23)-C(22)-C(21)	121.57(15)
C(24)-C(23)-C(22)	120.25(14)
C(23)-C(24)-C(25)	119.64(13)
C(24)-C(25)-C(26)	119.88(14)
C(25)-C(26)-C(21)	121.62(14)

Symmetry transformations used to generate equivalent atoms.

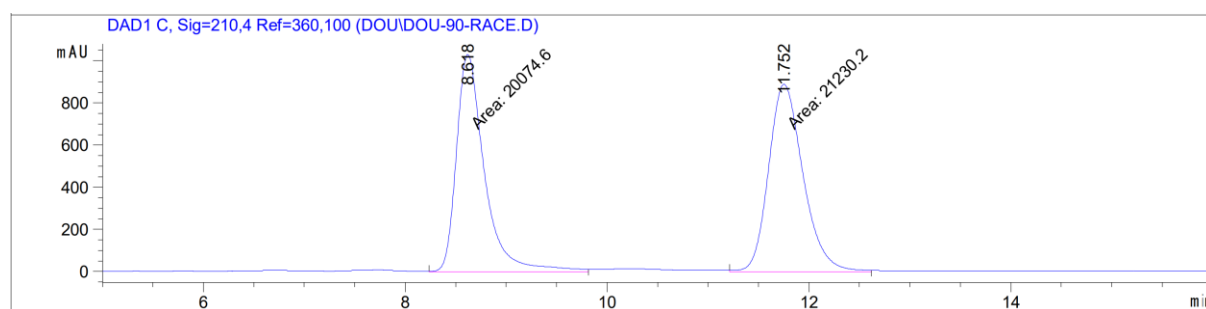
Table S8. Anisotropic displacement parameters ($\text{\AA}^2 \times 10^3$) for (S)-**3a**. The anisotropic displacement factor exponent takes the form: $-2\pi^2 [h^2 a^{*2} U^{11} + \dots + 2 h k a^* b^* U^{12}]$

	U^{11}	U^{22}	U^{33}	U^{23}	U^{13}	U^{12}
P(1)	17(1)	17(1)	15(1)	-1(1)	0(1)	-1(1)
Si(1)	18(1)	18(1)	18(1)	0(1)	0(1)	0(1)
O(1)	20(1)	26(1)	24(1)	-1(1)	0(1)	-5(1)
C(1)	19(1)	20(1)	16(1)	-1(1)	1(1)	1(1)
C(2)	17(1)	19(1)	17(1)	1(1)	2(1)	-2(1)
C(3)	25(1)	18(1)	15(1)	3(1)	-1(1)	3(1)
C(4)	27(1)	27(1)	21(1)	-1(1)	1(1)	4(1)
C(5)	46(1)	31(1)	23(1)	-6(1)	0(1)	15(1)
C(6)	57(1)	22(1)	28(1)	-8(1)	-11(1)	6(1)
C(7)	41(1)	23(1)	34(1)	1(1)	-8(1)	-6(1)
C(8)	31(1)	23(1)	22(1)	1(1)	0(1)	-3(1)
C(9)	25(1)	19(1)	16(1)	1(1)	-2(1)	0(1)
C(10)	28(1)	25(1)	25(1)	-2(1)	5(1)	-1(1)
C(11)	44(1)	26(1)	33(1)	-7(1)	9(1)	5(1)
C(12)	56(1)	20(1)	31(1)	-3(1)	2(1)	-5(1)
C(13)	42(1)	27(1)	35(1)	0(1)	1(1)	-14(1)
C(14)	28(1)	26(1)	28(1)	0(1)	3(1)	-4(1)
C(15)	22(1)	16(1)	16(1)	0(1)	0(1)	-1(1)
C(16)	24(1)	32(1)	19(1)	-1(1)	-1(1)	1(1)
C(17)	28(1)	37(1)	22(1)	-3(1)	6(1)	0(1)
C(18)	41(1)	31(1)	16(1)	-1(1)	3(1)	-2(1)
C(19)	37(1)	36(1)	20(1)	2(1)	-8(1)	3(1)
C(20)	27(1)	27(1)	23(1)	0(1)	-2(1)	4(1)
C(21)	24(1)	18(1)	19(1)	2(1)	4(1)	-2(1)
C(22)	28(1)	22(1)	31(1)	2(1)	-1(1)	2(1)
C(23)	38(1)	20(1)	40(1)	-3(1)	7(1)	5(1)
C(24)	40(1)	21(1)	31(1)	-6(1)	8(1)	-6(1)
C(25)	29(1)	29(1)	31(1)	-5(1)	-1(1)	-6(1)
C(26)	23(1)	25(1)	29(1)	-4(1)	2(1)	0(1)
C(27)	32(1)	27(1)	18(1)	3(1)	-1(1)	-2(1)
C(28)	21(1)	30(1)	41(1)	-8(1)	-4(1)	1(1)

3. HPLC Traces

(S)-[2-(Dimethylphenylsilyl)-2-phenylethyl]diphenylphosphine Oxide [(S)-3a]

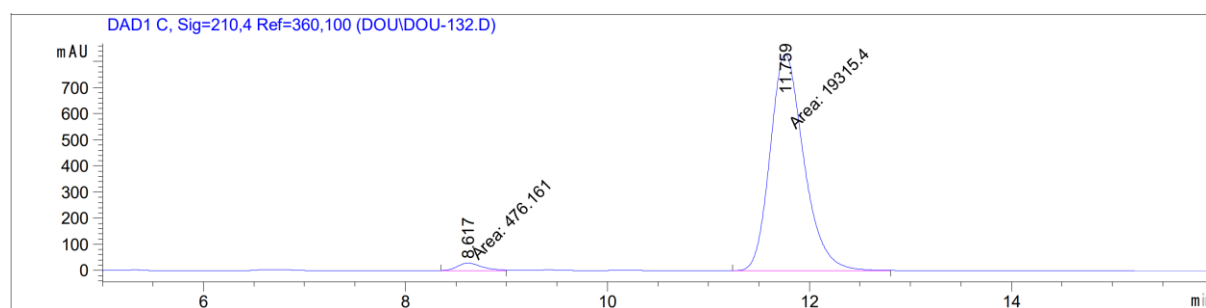
rac-3a



Signal 3: DAD1 C, Sig=210,4 Ref=360,100

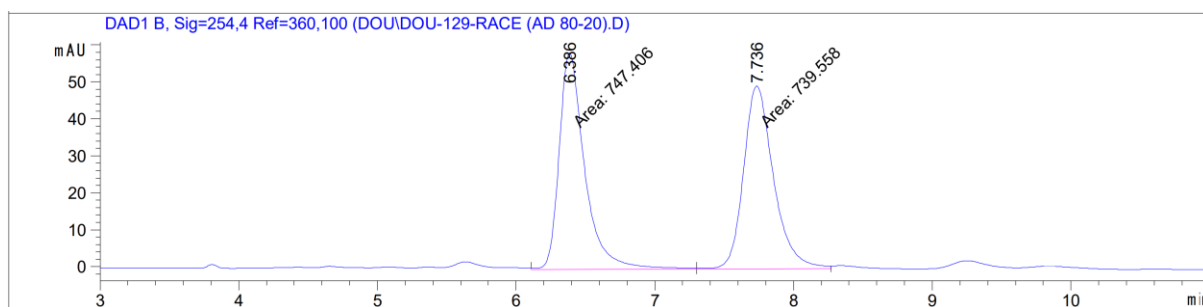
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	8.618	MM	0.3243	2.00746e4	1031.53699	48.6011
2	11.752	MM	0.3973	2.12302e4	890.69684	51.3989

(S)-3a (95% ee)



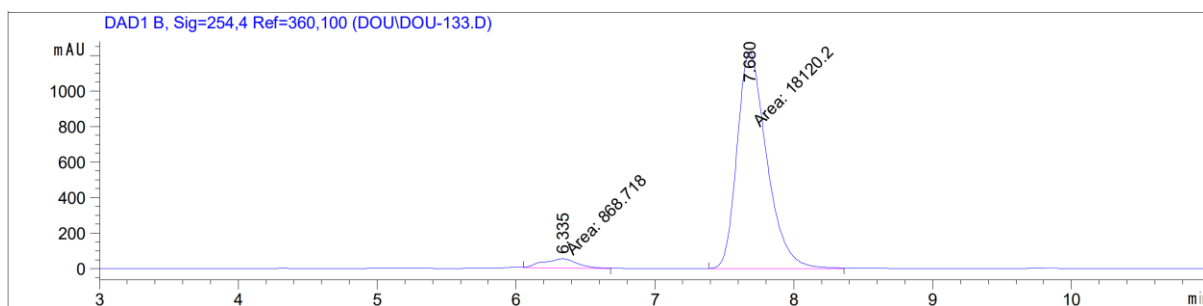
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Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	8.617	MM	0.2799	476.16077	28.35384	2.4059
2	11.759	MM	0.3877	1.93154e4	830.33533	97.5941

(S)-[2-(Dimethylphenylsilyl)-2-(2-methyl)phenylethyl]diphenylphosphine Oxide [(S)-3b]**rac-3b**

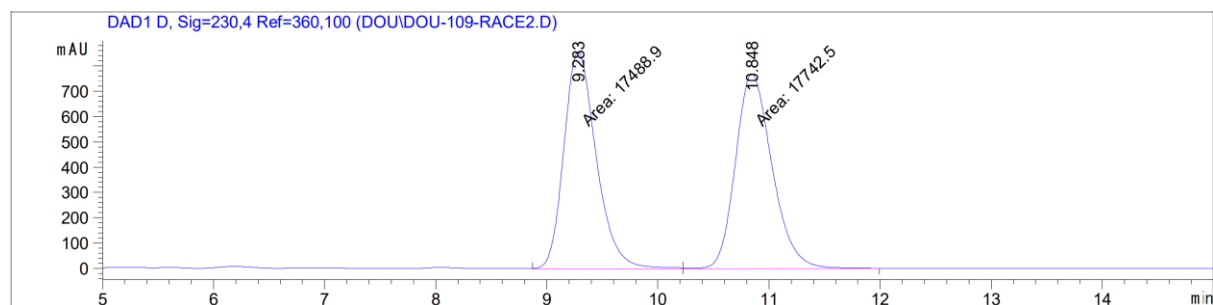
Signal 2: DAD1 B, Sig=254,4 Ref=360,100

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	6.386	MF	0.2126	747.40576	58.59755	50.2639
2	7.736	FM	0.2494	739.55841	49.41473	49.7361

(S)-3b (91% ee)

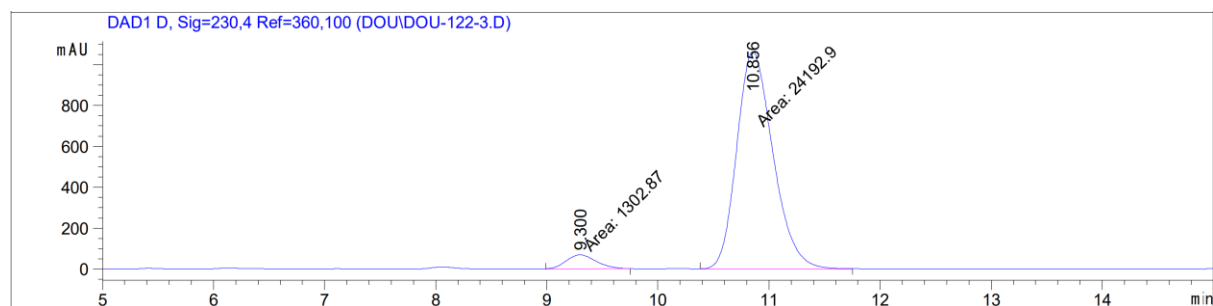
Signal 2: DAD1 B, Sig=254,4 Ref=360,100

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	6.335	MM	0.2776	868.71838	52.14796	4.5749
2	7.680	MM	0.2476	1.81202e4	1219.92224	95.4251

(S)-[2-(Dimethylphenylsilyl)-2-(3-methyl)phenylethyl]diphenylphosphine Oxide [(S)-3c]**rac-3c**

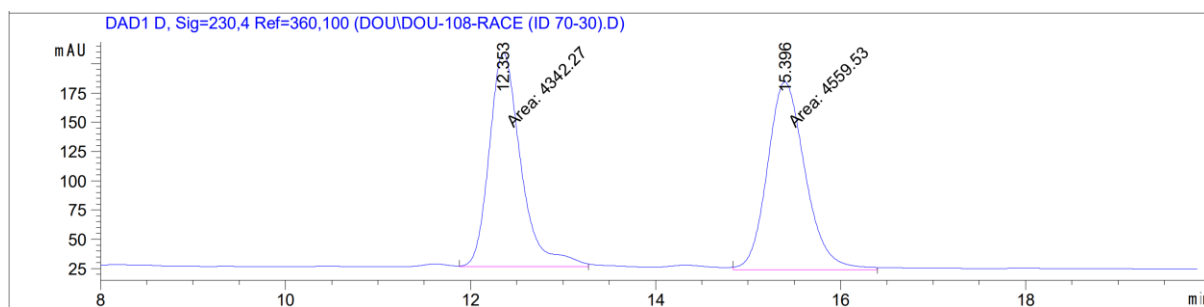
Signal 4: DAD1 D, Sig=230,4 Ref=360,100

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	9.283	MF	0.3391	1.74889e4	859.50067	49.6400
2	10.848	FM	0.3840	1.77425e4	770.06976	50.3600

(S)-3c (90% ee)

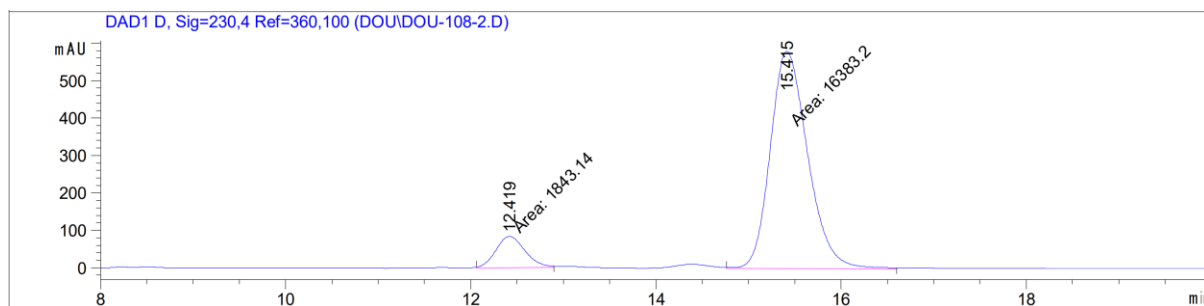
Signal 4: DAD1 D, Sig=230,4 Ref=360,100

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	9.300	MM	0.3155	1302.86816	68.82661	5.1101
2	10.856	MM	0.3795	2.41929e4	1062.46875	94.8899

(S)-[2-(Dimethylphenylsilyl)-2-(4-methyl)phenylethyl]diphenylphosphine Oxide [(S)-3d]**rac-3d**

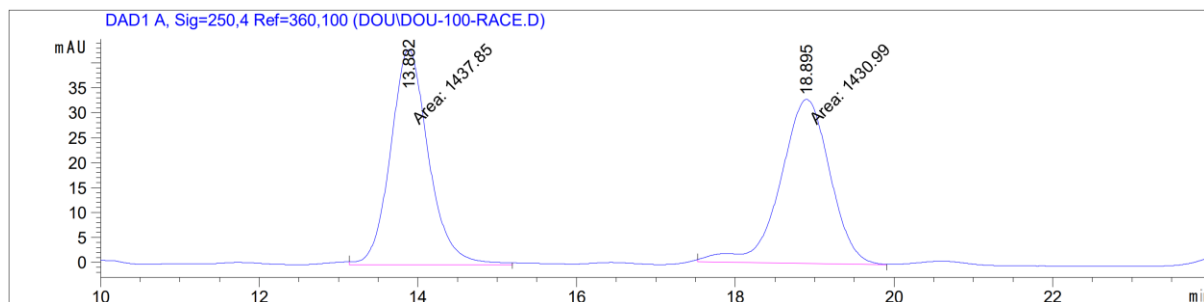
Signal 4: DAD1 D, Sig=230,4 Ref=360,100

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.353	MM	0.3956	4342.26660	182.95294	48.7797
2	15.396	MM	0.4741	4559.52881	160.29059	51.2203

(S)-3d (80% ee)

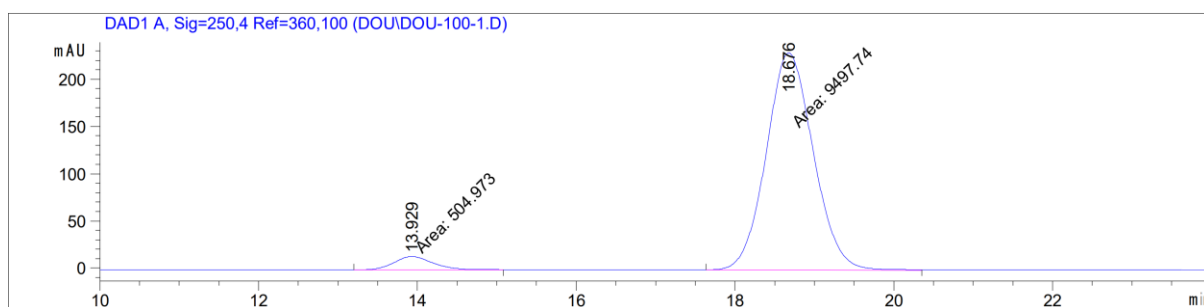
Signal 4: DAD1 D, Sig=230,4 Ref=360,100

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.419	MM	0.3664	1843.13940	83.84680	10.1125
2	15.415	MM	0.4698	1.63832e4	581.25458	89.8875

(S)-[2-(Dimethylphenylsilyl)-2-(4-methoxy)phenylethyl]diphenylphosphine Oxide [(S)-3e]**rac-3e**

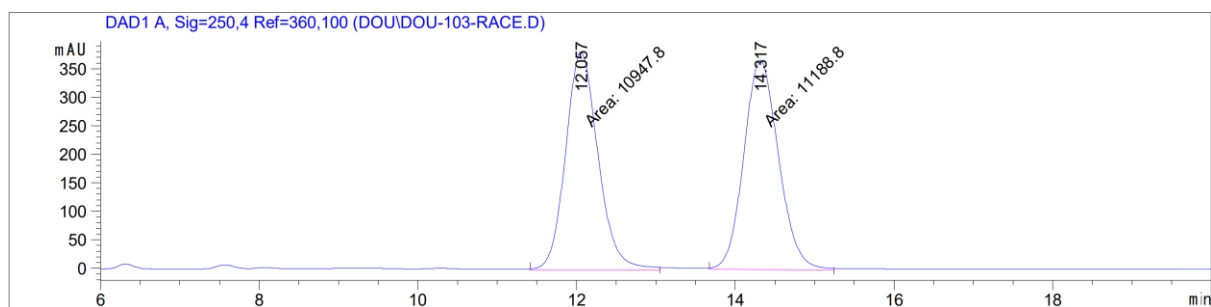
Signal 1: DAD1 A, Sig=250,4 Ref=360,100

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	13.882	MM	0.5555	1437.84949	43.14032	50.1195
2	18.895	MM	0.7251	1430.99194	32.89127	49.8805

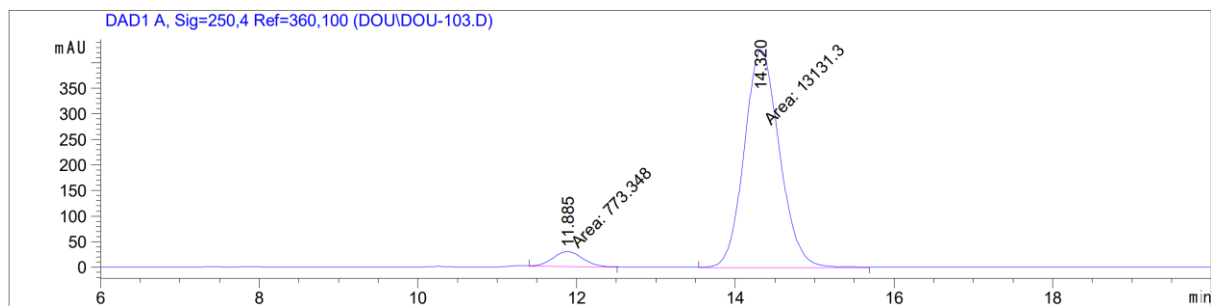
(S)-3e (90% ee)

Signal 1: DAD1 A, Sig=250,4 Ref=360,100

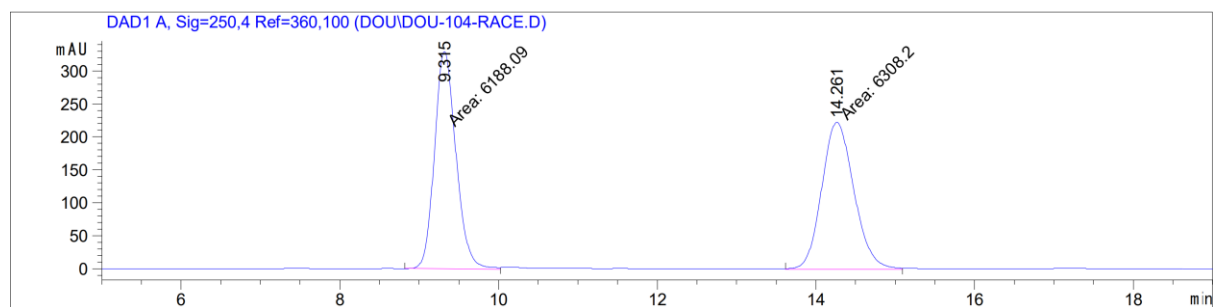
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	13.929	MM	0.5880	504.97269	14.31260	5.0484
2	18.676	MM	0.6879	9497.73633	230.12593	94.9516

(S)-[2-(Dimethylphenylsilyl)-2-(4-bromo)phenylethyl]diphenylphosphine Oxide [(S)-3f]**rac-3f**

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.057	MM	0.4767	1.09478e4	382.80048	49.4556
2	14.317	MM	0.5086	1.11888e4	366.68353	50.5444

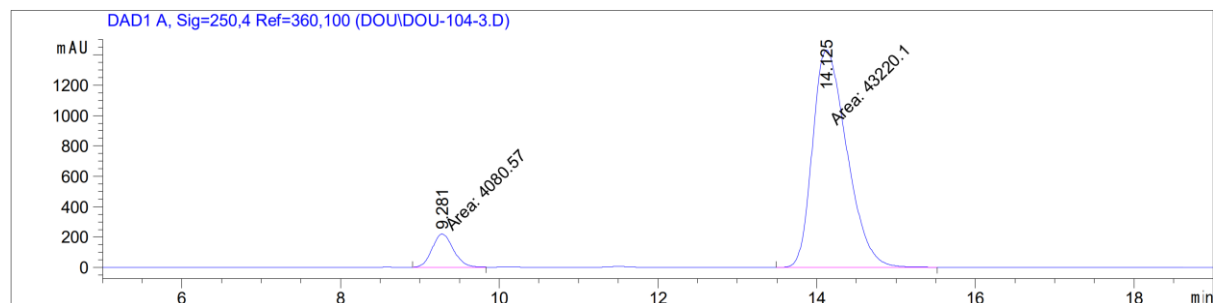
(S)-3f (89% ee)

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.885	MM	0.4399	773.34839	29.29693	5.5618
2	14.320	MM	0.5143	1.31313e4	425.51837	94.4382

(S)-[2-(Dimethylphenylsilyl)-2-(4-trifluoromethyl)phenylethyl]diphenylphosphine Oxide [(S)-3g]**rac-3g**

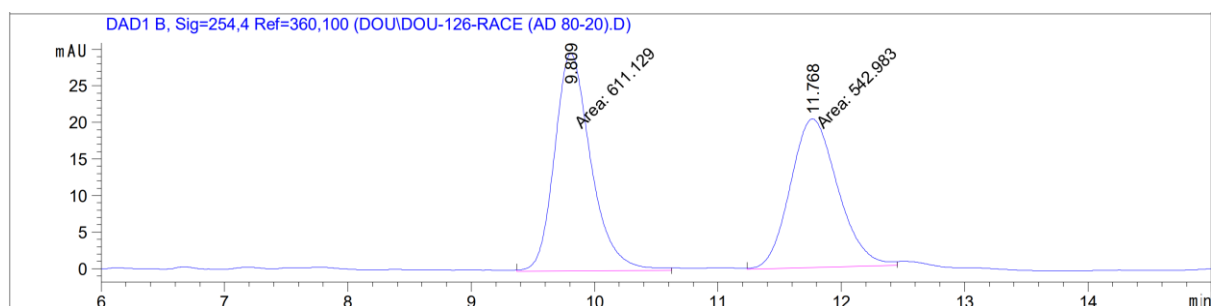
Signal 1: DAD1 A, Sig=250,4 Ref=360,100

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	9.315	MM	0.3134	6188.09180	329.12299	49.5194
2	14.261	MM	0.4718	6308.20410	222.85934	50.4806

(S)-3g (83% ee)

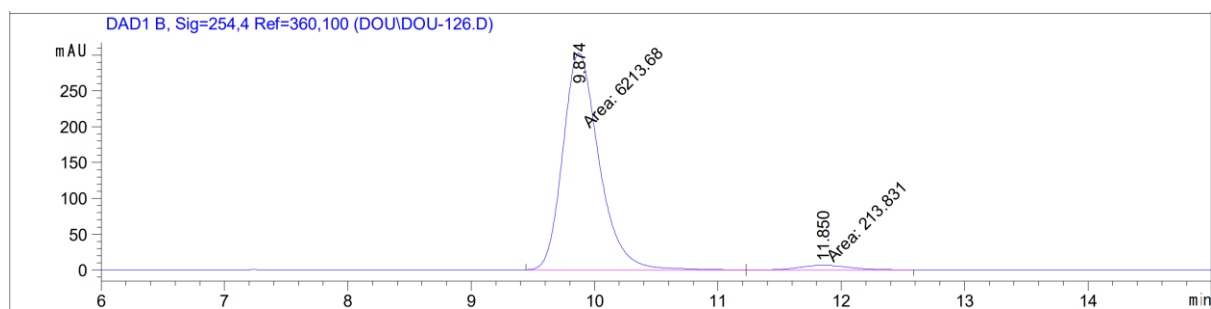
Signal 1: DAD1 A, Sig=250,4 Ref=360,100

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	9.281	MM	0.3110	4080.57471	218.66298	8.6269
2	14.125	MM	0.5028	4.32201e4	1432.50610	91.3731

(S)-[2-(Dimethylphenylsilyl)-2-(1-naphthalen)ethyl]diphenyl-phosphine Oxide [(S)-3h]**rac-3h**

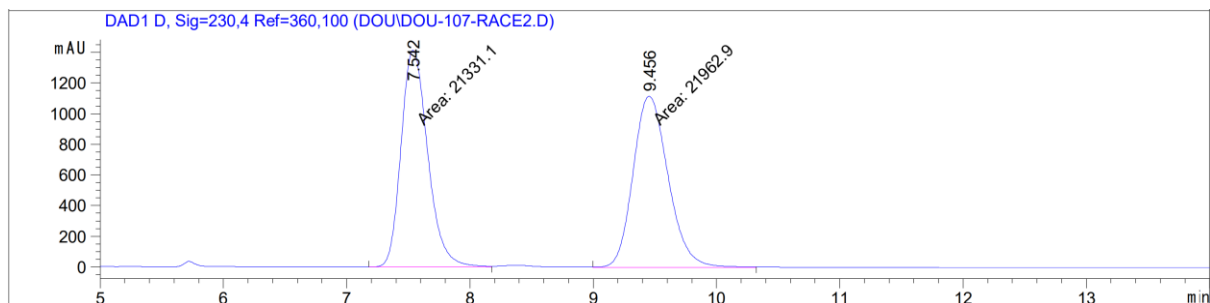
Signal 2: DAD1 B, Sig=254,4 Ref=360,100

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	9.809	MM	0.3424	611.12872	29.75062	52.9523
2	11.768	MM	0.4455	542.98303	20.31515	47.0477

(S)-3h (93% ee)

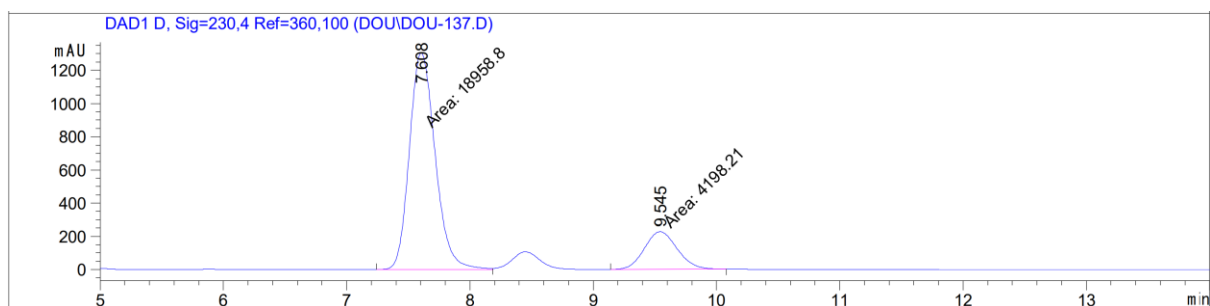
Signal 2: DAD1 B, Sig=254,4 Ref=360,100

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	9.874	MF	0.3419	6213.67529	302.91019	96.6732
2	11.850	FM	0.5142	213.83141	6.93103	3.3268

(S)-[2-(Dimethylphenylsilyl)octyl]diphenylphosphine Oxide [(S)-3i]**rac-3i**

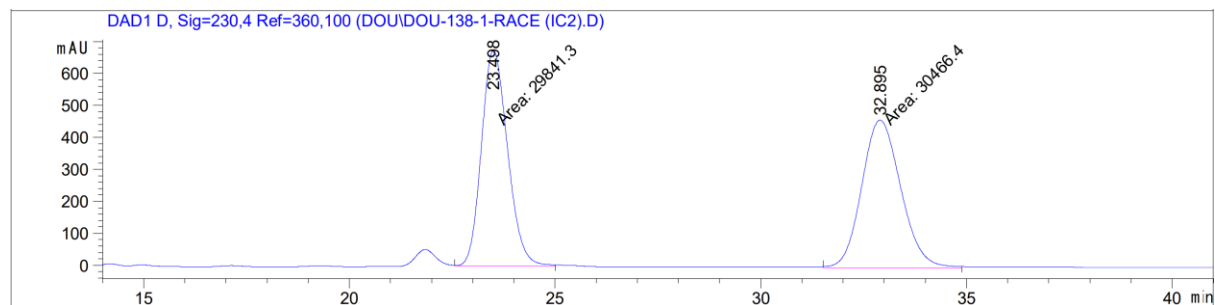
Signal 4: DAD1 D, Sig=230,4 Ref=360,100

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	7.542	MM	0.2511	2.13311e4	1415.58508	49.2704
2	9.456	MM	0.3279	2.19629e4	1116.43628	50.7296

(S)-3i (64% ee)

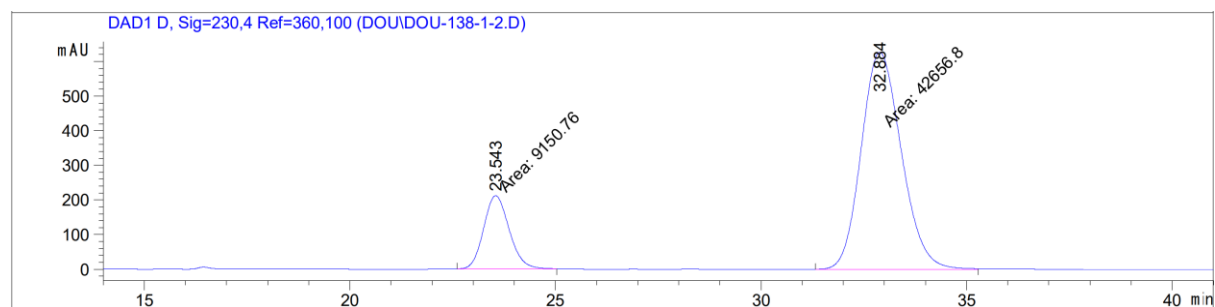
Signal 4: DAD1 D, Sig=230,4 Ref=360,100

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	7.608	MM	0.2421	1.89588e4	1305.02148	81.8707
2	9.545	MM	0.3084	4198.20898	226.88165	18.1293

(S)-(2-Hydroxyoctyl)diphenylphosphine Oxide [(S)-4i]**rac-4i**

Signal 4: DAD1 D, Sig=230,4 Ref=360,100

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	23.498	MM	0.7371	2.98413e4	674.74695	49.4818
2	32.895	MM	1.0992	3.04664e4	461.96088	50.5182

(S)-4i (65% ee)

Signal 4: DAD1 D, Sig=230,4 Ref=360,100

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	23.543	MM	0.7209	9150.75684	211.55998	17.6630
2	32.884	MM	1.1333	4.26568e4	627.34644	82.3370

4. NMR Spectra of New Compounds

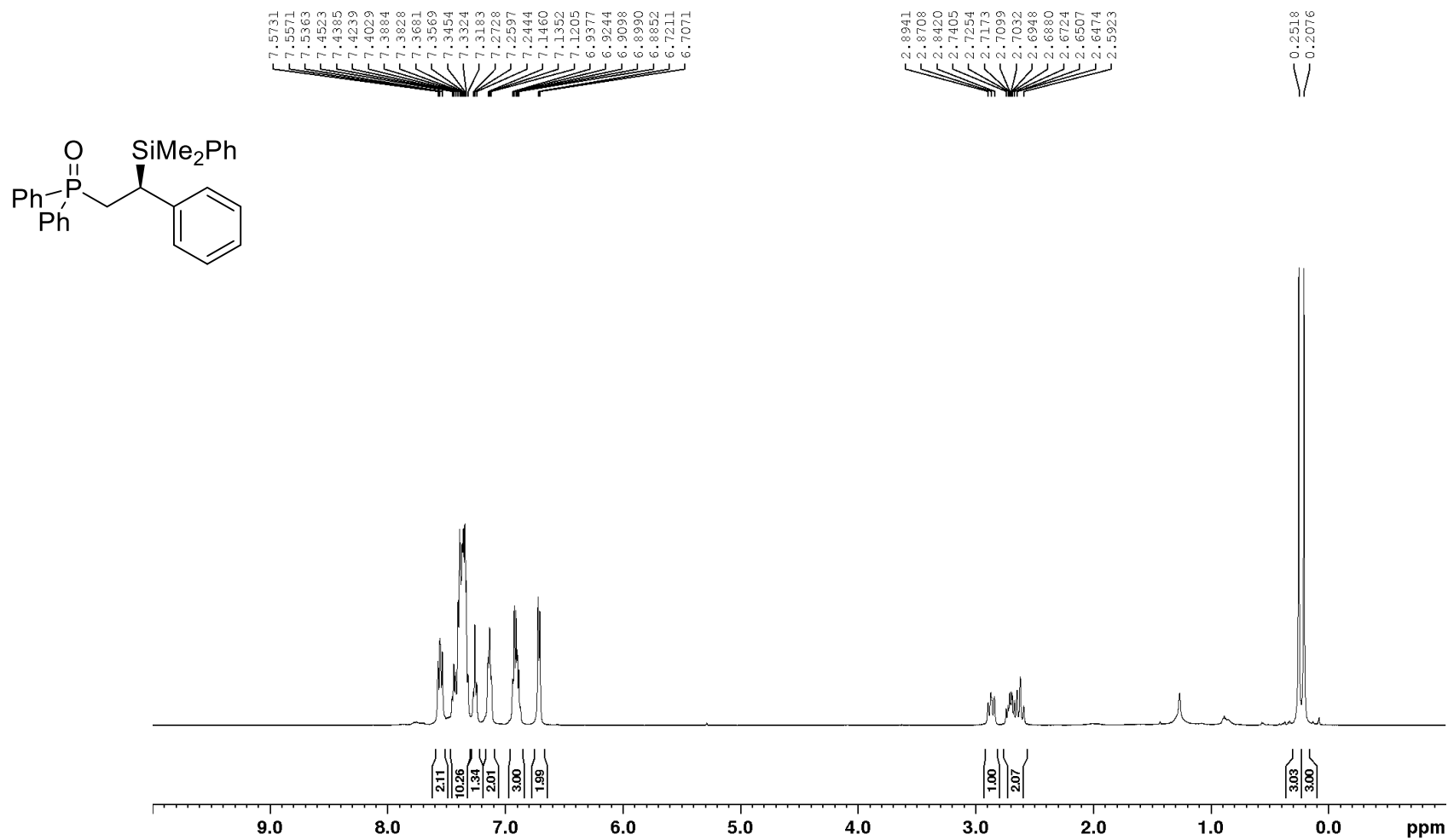
Figure S2. ^1H NMR (500 MHz, CDCl_3 , 298 K) of (*S*)-[2-(Dimethylphenylsilyl)-2-phenylethyl]diphenylphosphine Oxide [(*S*)-3a]

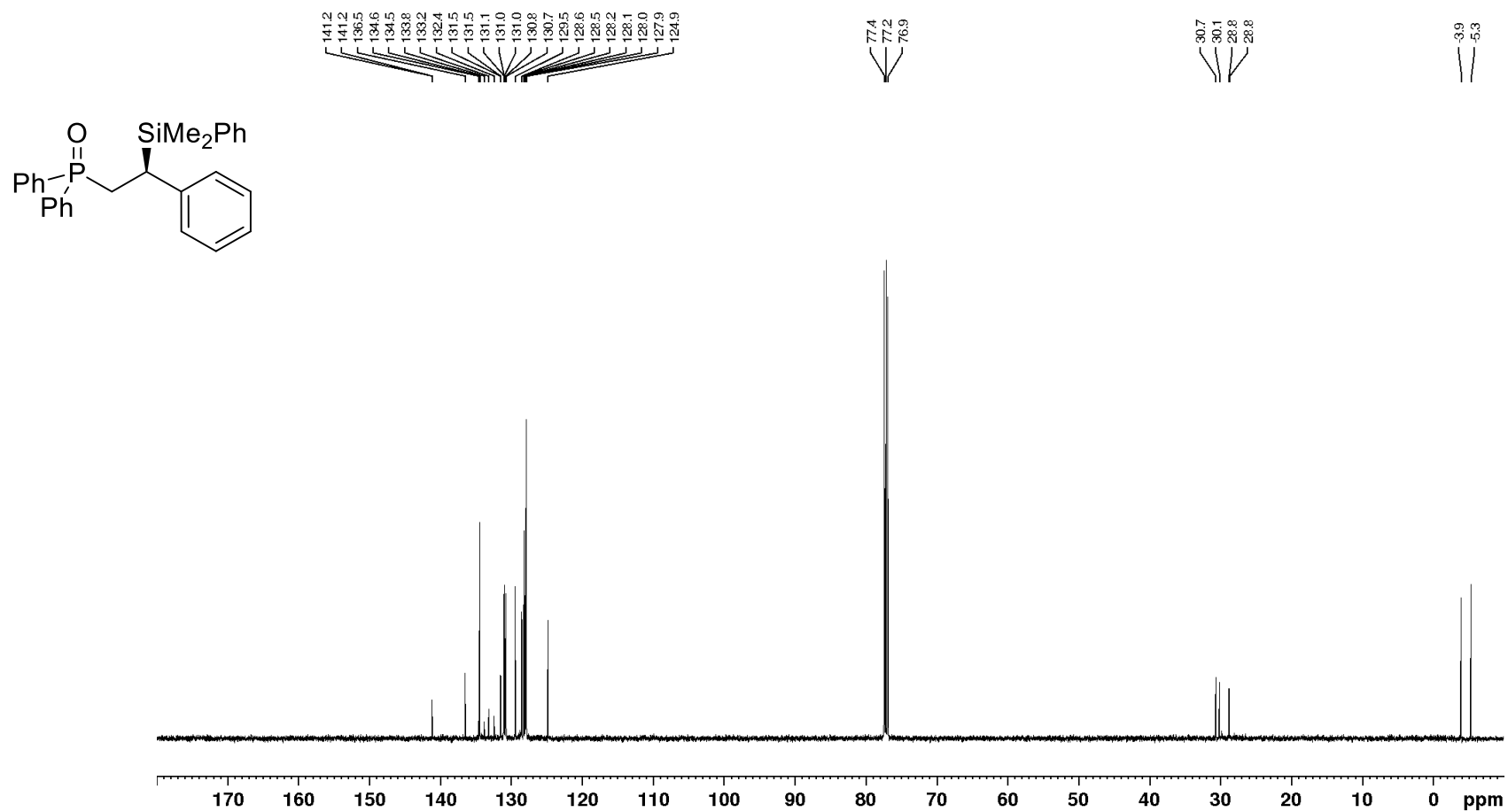
Figure S3. ^{13}C NMR (125 MHz, CDCl_3 , 298K) of (*S*)-[2-(Dimethylphenylsilyl)-2-phenylethyl]diphenylphosphine Oxide [(*S*)-3a]

Figure S4. ^{29}Si DEPT NMR (99 MHz, CDCl_3 , 298K) of (**S**)-[2-(Dimethylphenylsilyl)-2-phenylethyl]diphenylphosphine Oxide [(**S**)-**3a**]

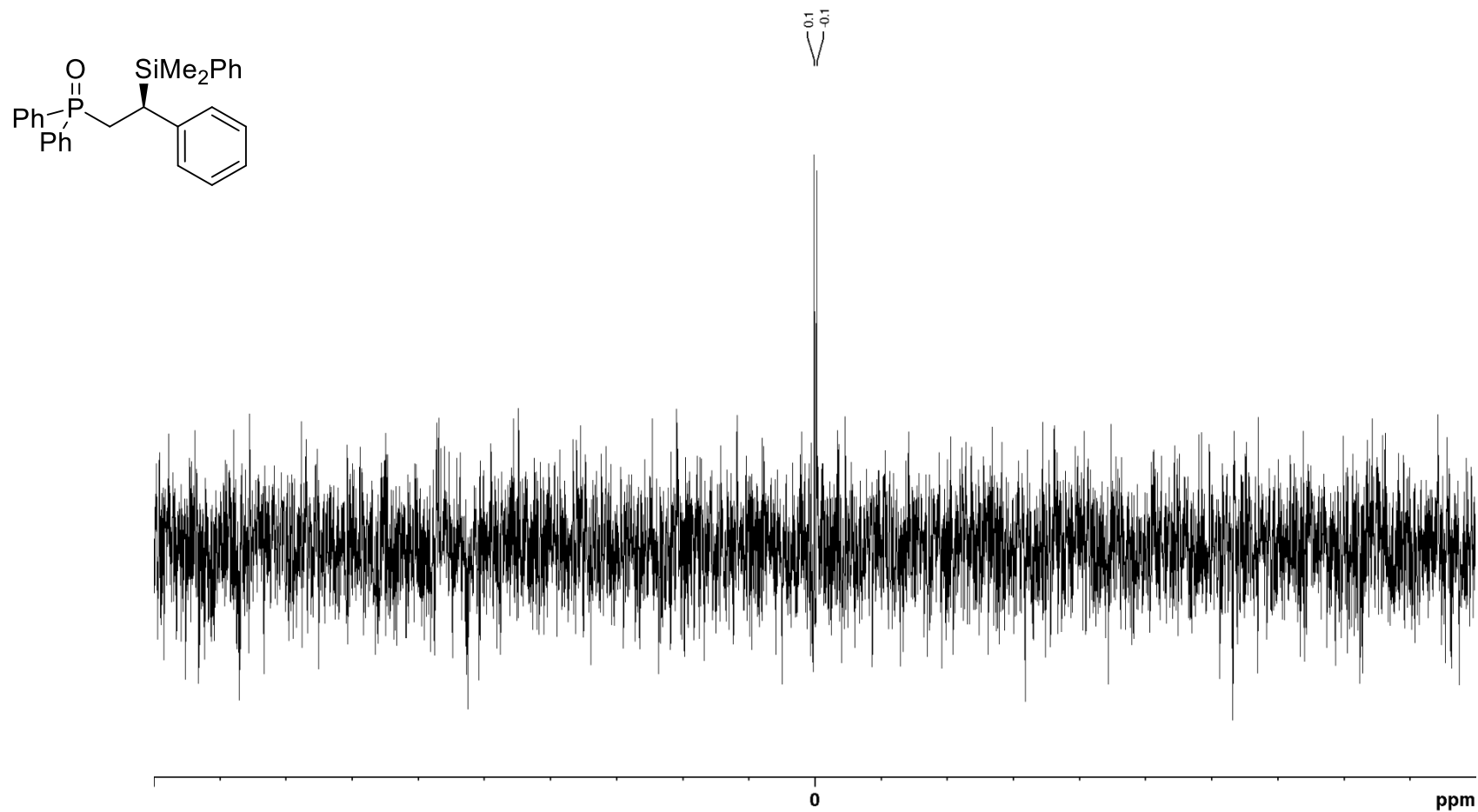


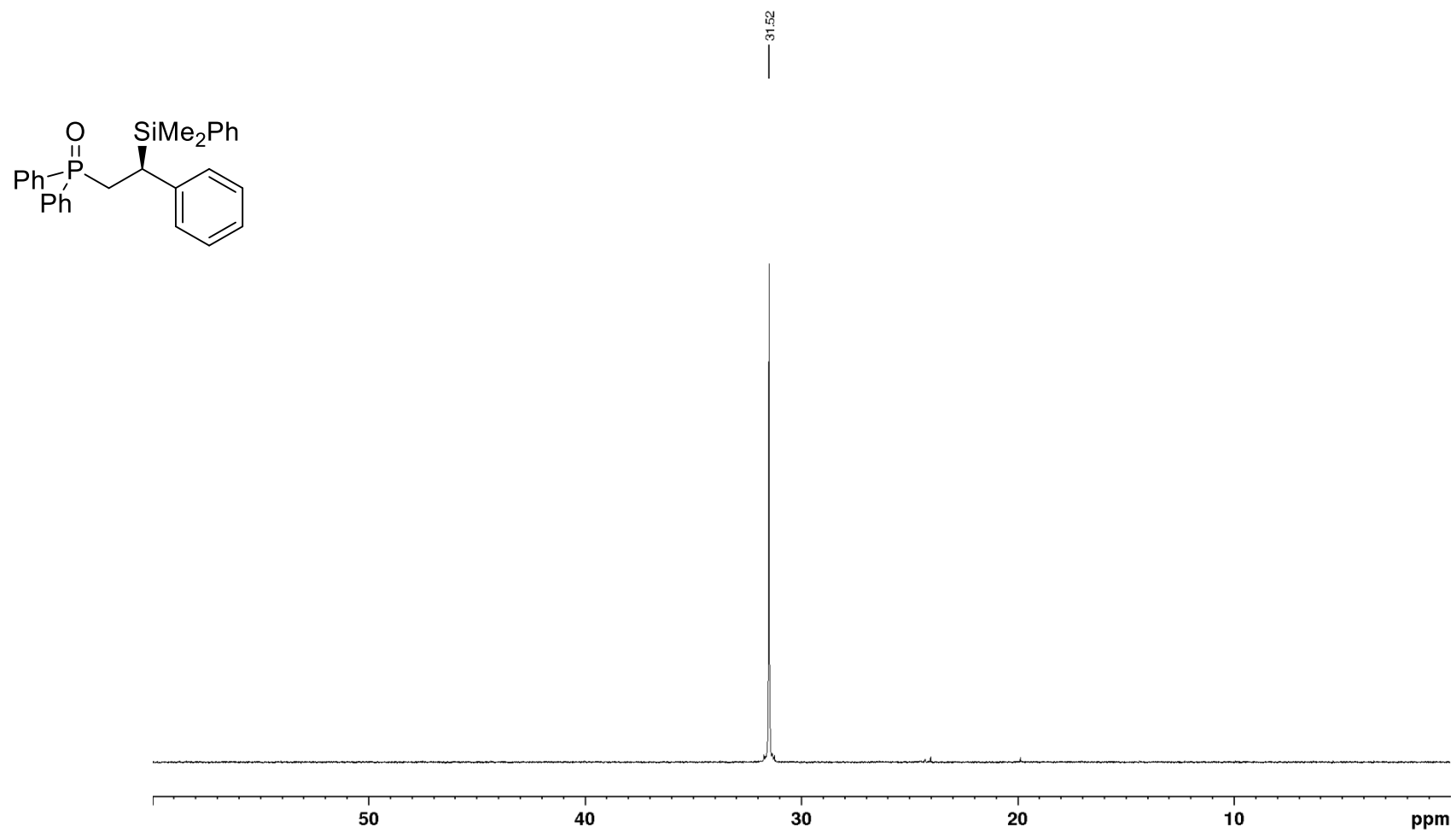
Figure S5. ^{31}P NMR (202 MHz, CDCl_3 , 298K) of (*S*)-[2-(Dimethylphenylsilyl)-2-phenylethyl]diphenylphosphine Oxide [(*S*)-3a]

Figure S6. ^1H NMR (500 MHz, CDCl_3 , 298K) of (*S*)-[2-(Dimethylphenylsilyl)-2-(2-methyl)phenylethyl]diphenylphosphine Oxide [(*S*)-3b]

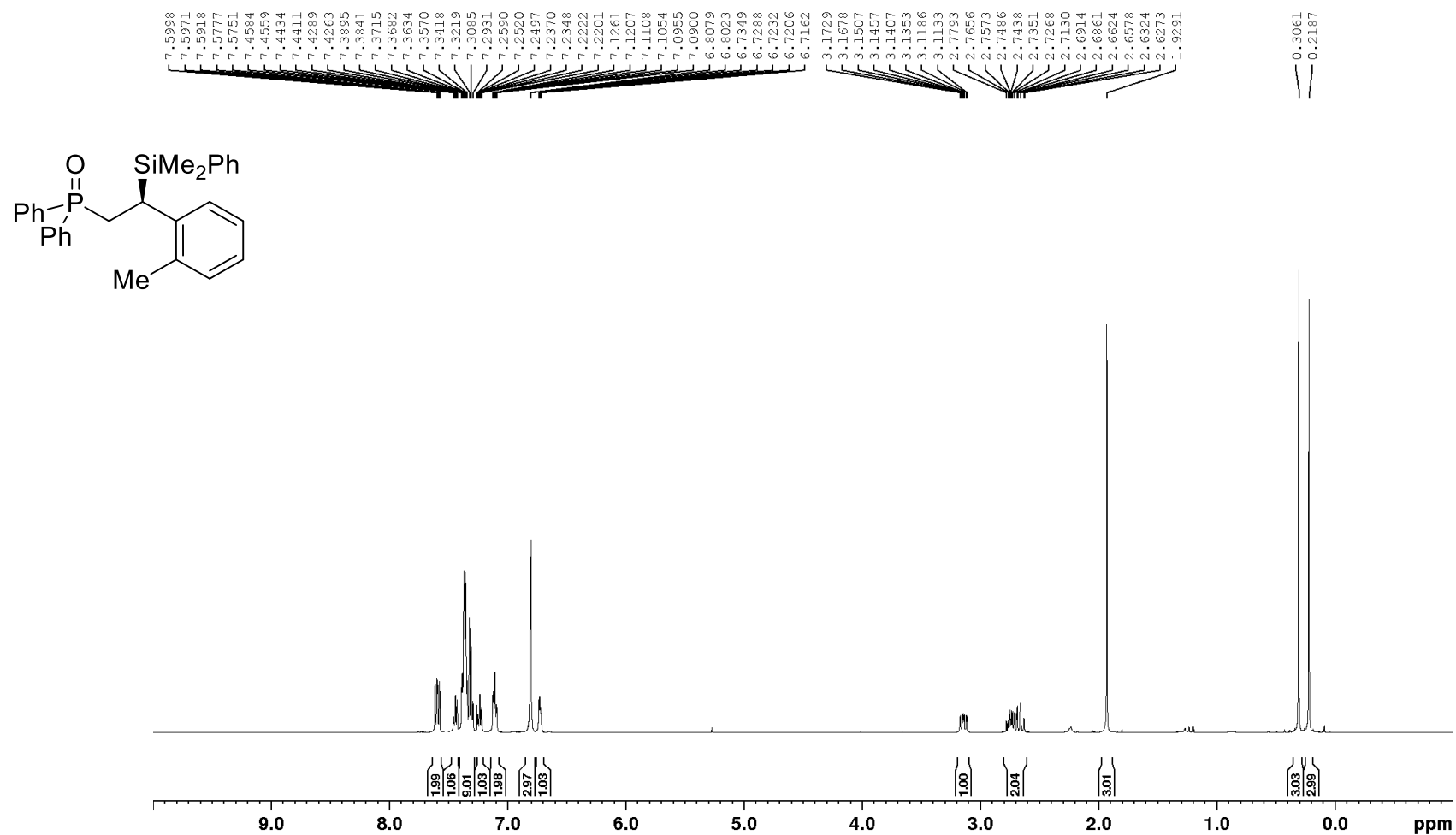


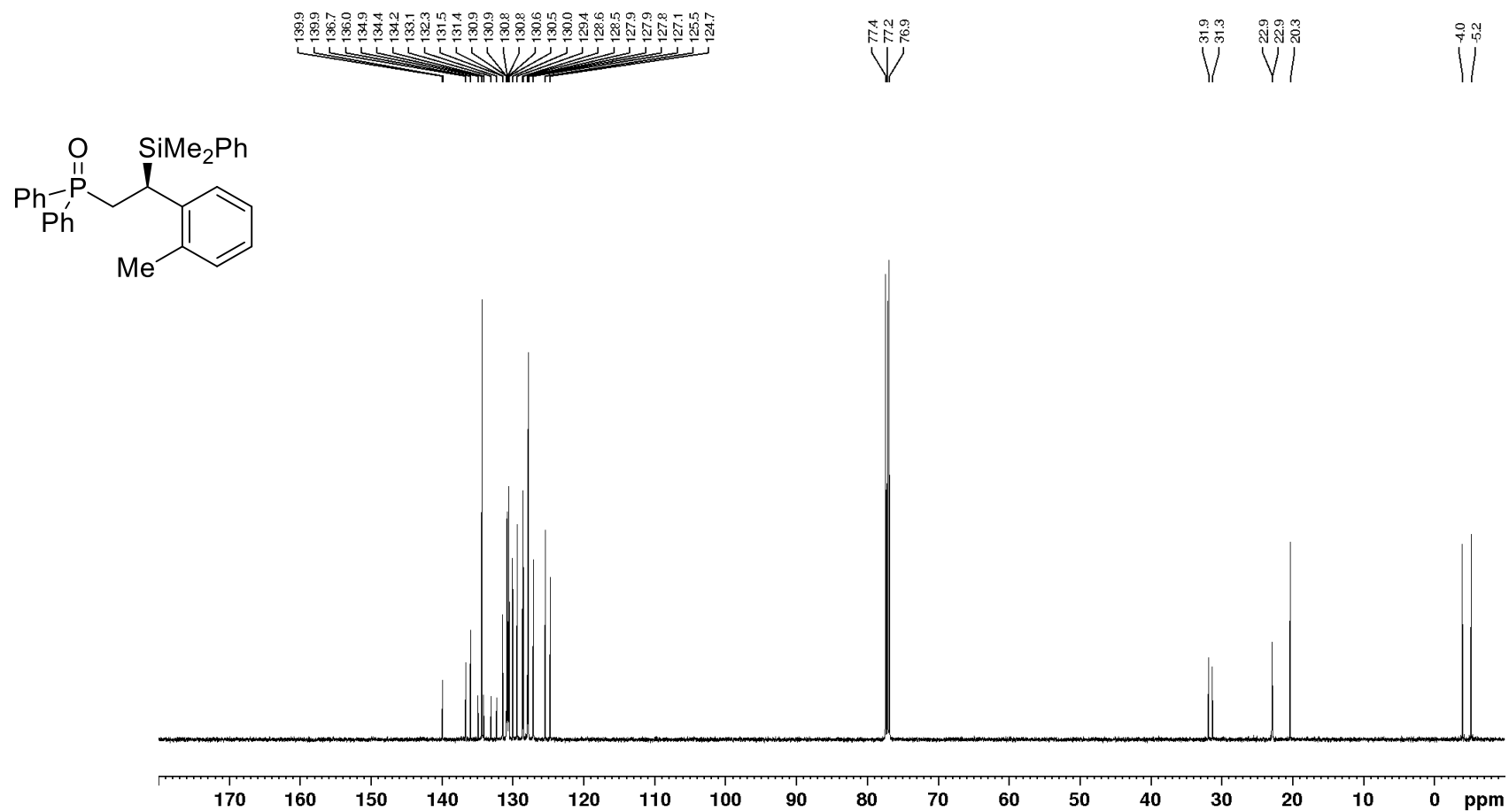
Figure S7. ^{13}C NMR (125 MHz, CDCl_3 , 298K) of **(S)**-[2-(Dimethylphenylsilyl)-2-(2-methyl)phenylethyl]diphenylphosphine Oxide [(S)-3b]

Figure S8. ^{29}Si DEPT NMR (99 MHz, CDCl_3 , 298K) of **(S)-[2-(Dimethylphenylsilyl)-2-(2-methyl)phenylethyl]diphenylphosphine Oxide [(S)-3b]**

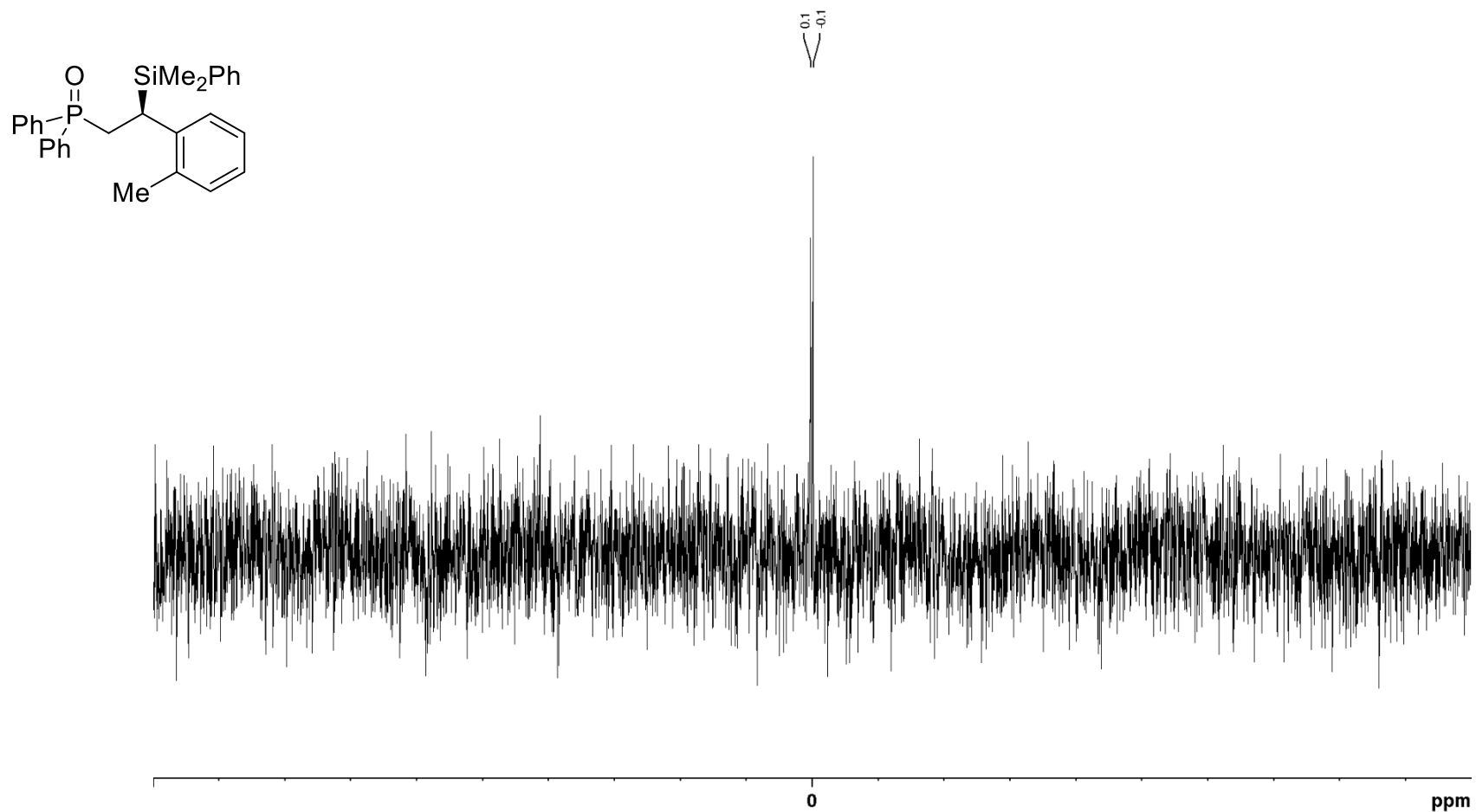


Figure S9. ^{31}P NMR (203 MHz, CDCl_3 , 298K) of **(S)-[2-(Dimethylphenylsilyl)-2-(2-methyl)phenylethyl]diphenylphosphine Oxide [(S)-3b]**

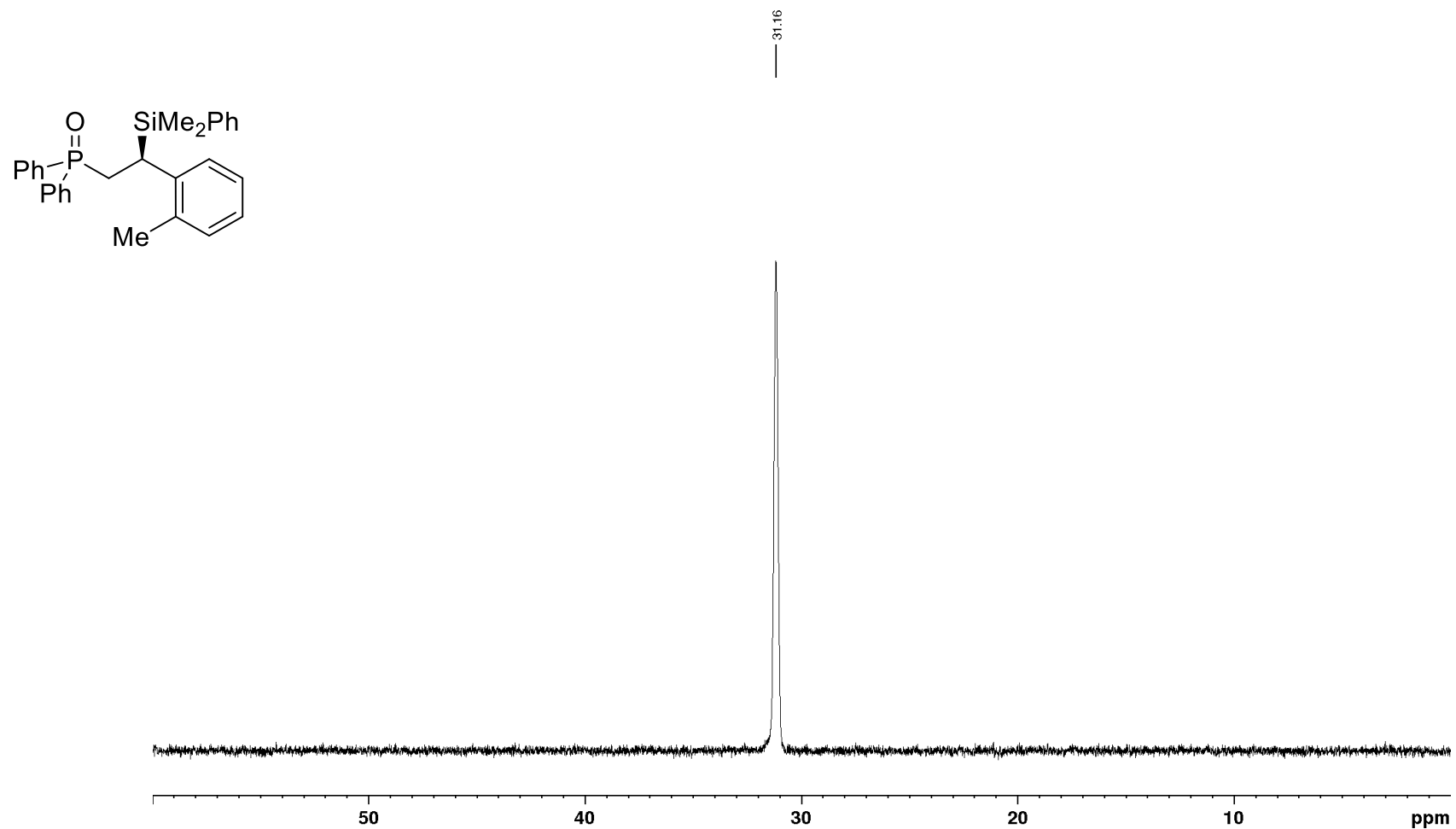


Figure S10. ^1H NMR (500 MHz, CDCl_3 , 298K) of **(S)-[2-(Dimethylphenylsilyl)-2-(3-methyl)phenylethyl]diphenylphosphine Oxide [(S)-3c]**

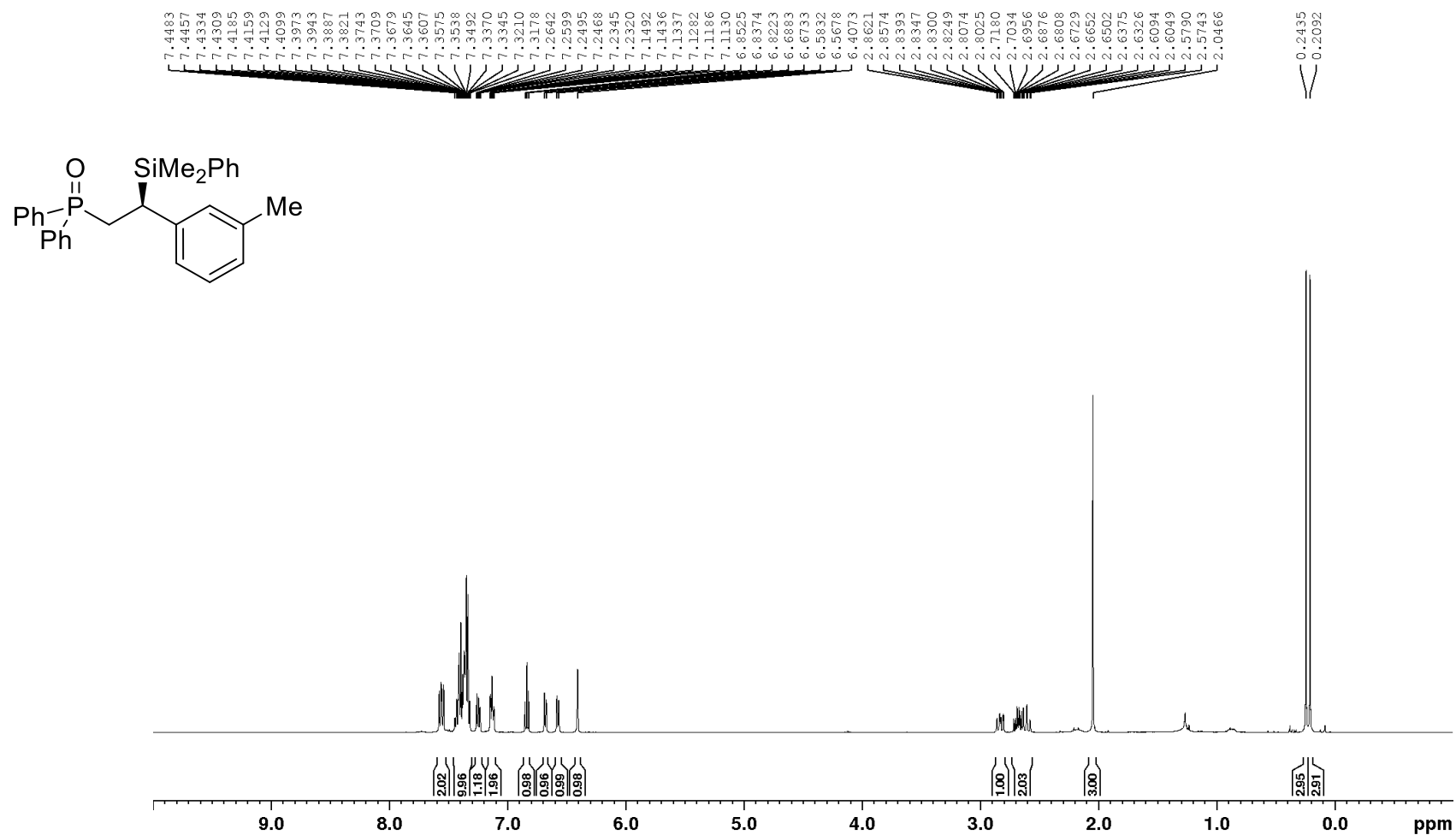


Figure S11. ^{13}C NMR (175 MHz, CDCl_3 , 298K) of **(S)-[2-(Dimethylphenylsilyl)-2-(3-methyl)phenylethyl]diphenylphosphine Oxide [(S)-3c]**

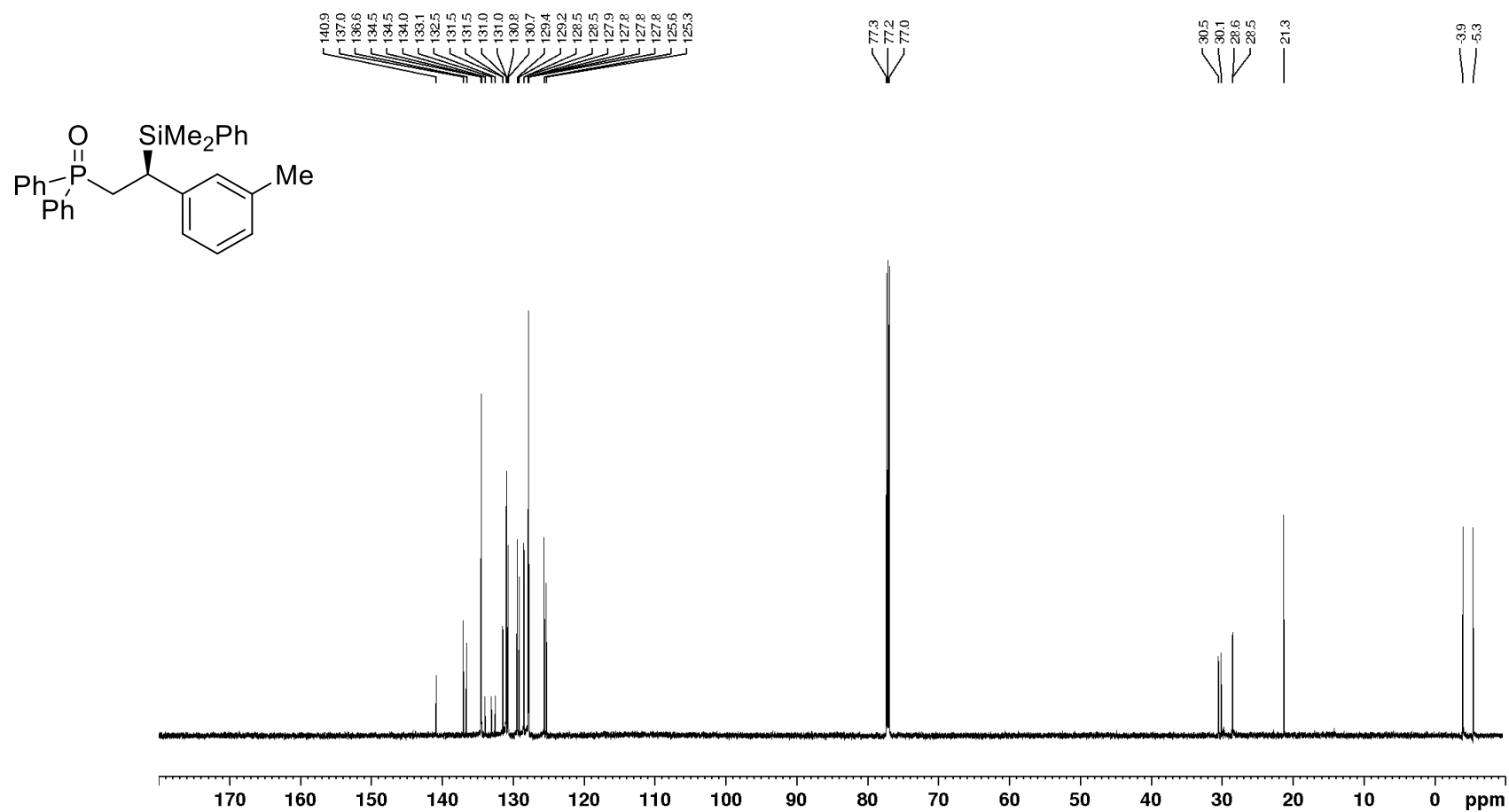


Figure S12. ^{29}Si DEPT NMR (99 MHz, CDCl_3 , 298K) of **(S)-[2-(Dimethylphenylsilyl)-2-(3-methyl)phenylethyl]diphenylphosphine Oxide [(S)-3c]**

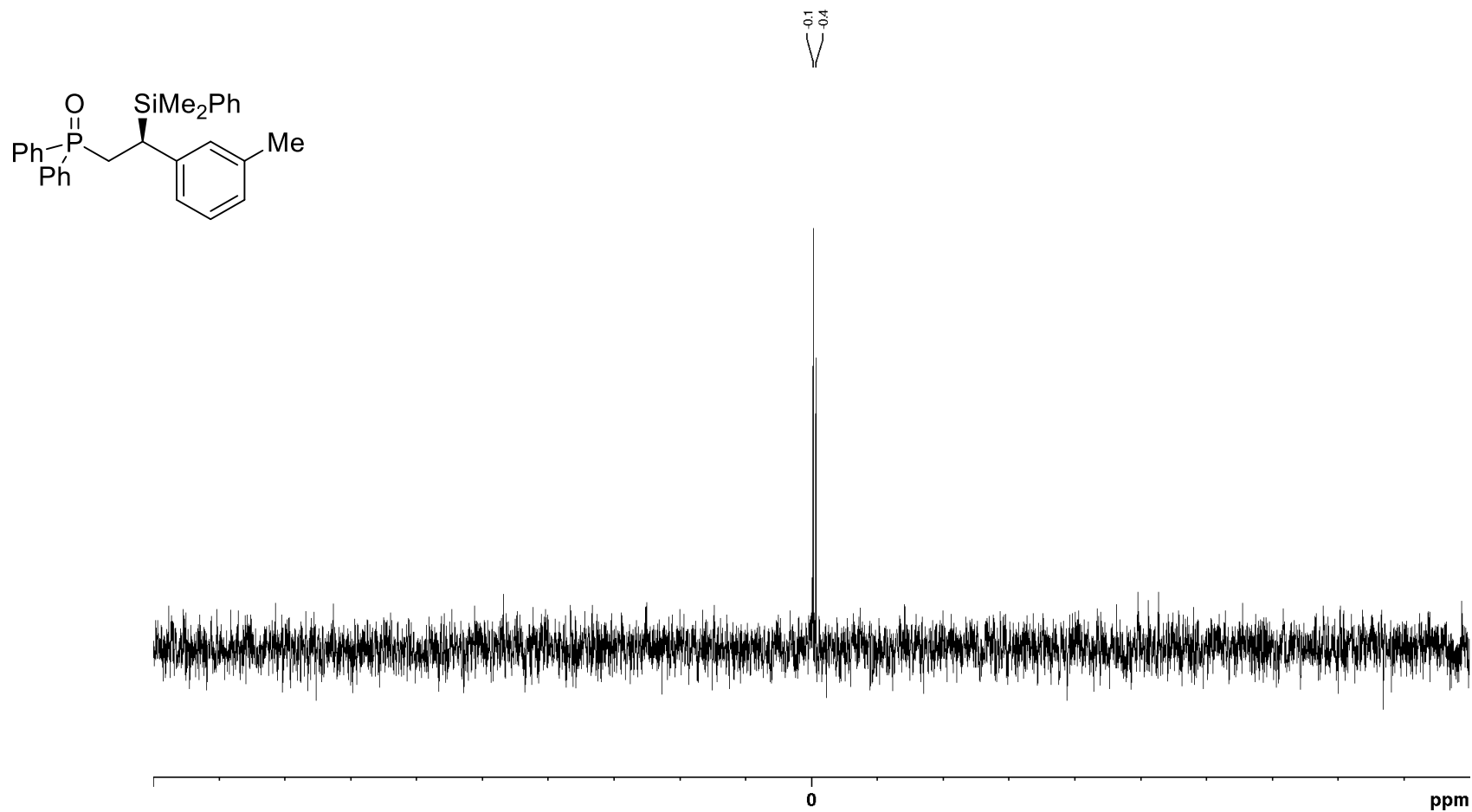


Figure S13. ^{31}P NMR (203 MHz, CDCl_3 , 298K) of **(S)-[2-(Dimethylphenylsilyl)-2-(3-methyl)phenylethyl]diphenylphosphine Oxide [(S)-3c]**

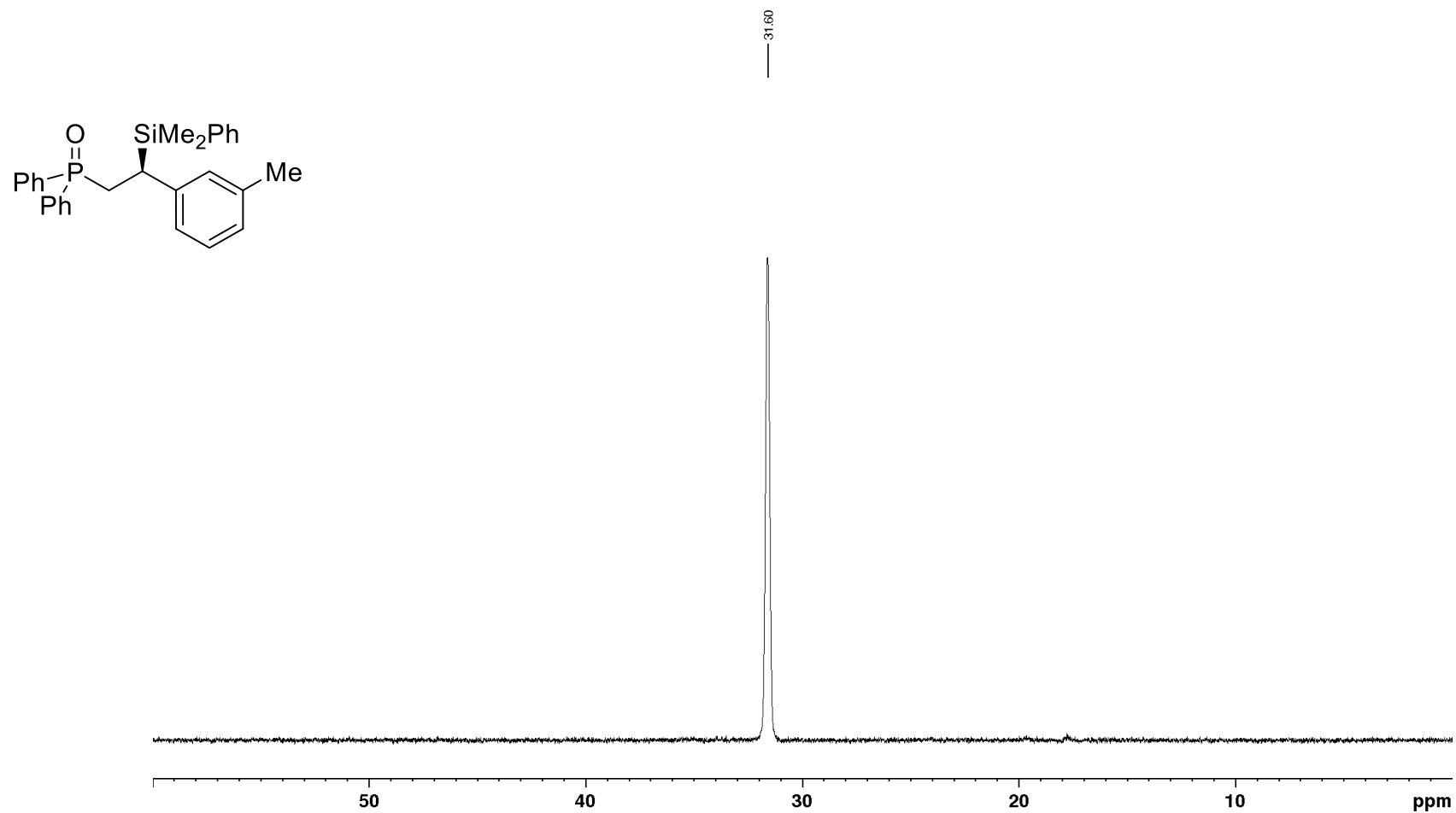


Figure S14. ^1H NMR (500 MHz, CDCl_3 , 298K) of **(S)-[2-(Dimethylphenylsilyl)-2-(4-methyl)phenylethyl]diphenylphosphine Oxide [(S)-3d]**

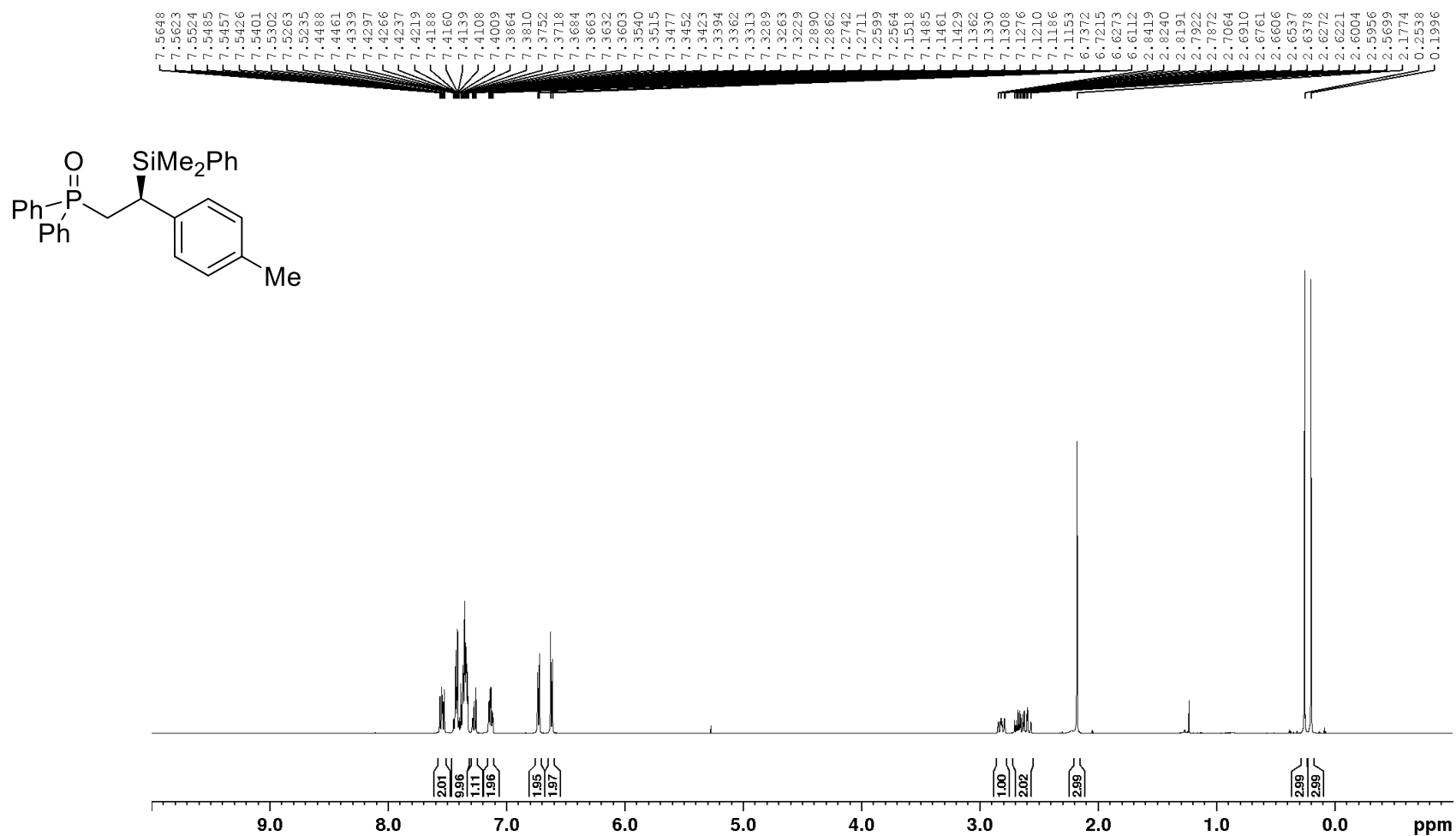


Figure S15. ^{13}C NMR (125 MHz, CDCl_3 , 298K) of **(S)-[2-(Dimethylphenylsilyl)-2-(4-methyl)phenylethyl]diphenylphosphine Oxide [(S)-3d]**

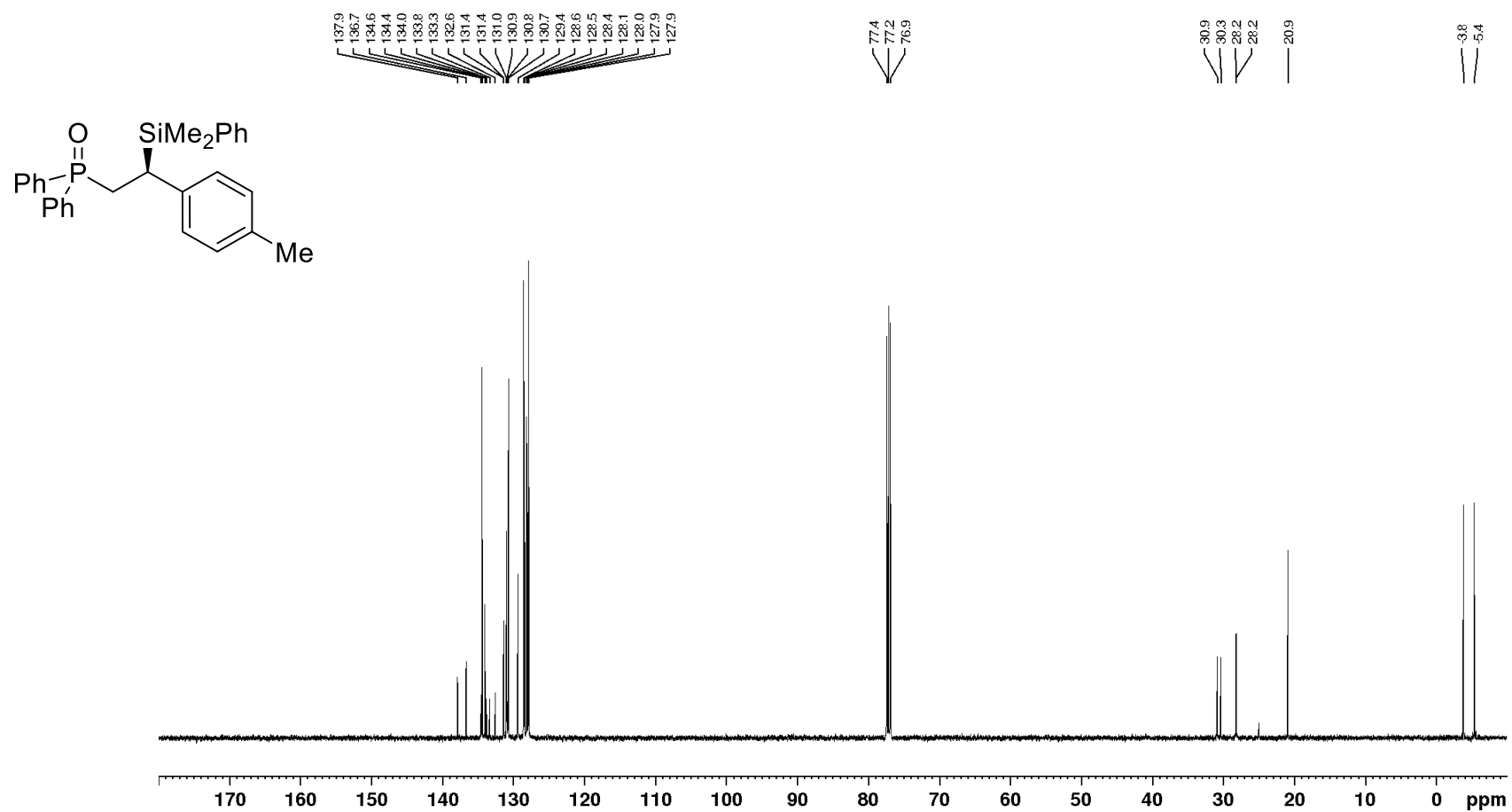


Figure S16. ^{29}Si DEPT NMR (99 MHz, CDCl_3 , 298K) of (*S*)-[2-(Dimethylphenylsilyl)-2-(4-methyl)phenylethyl]diphenylphosphine Oxide [(*S*)-3d]

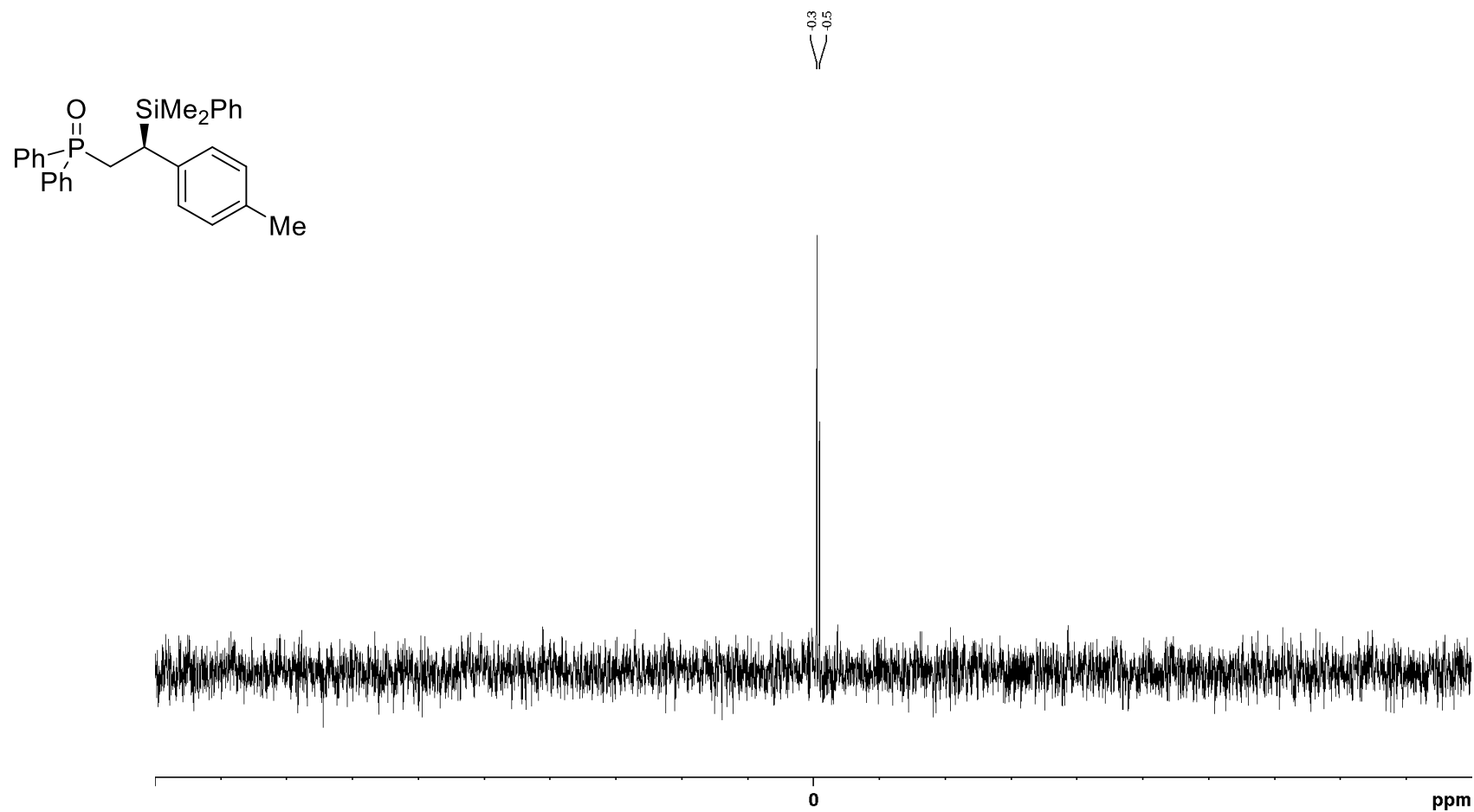


Figure S17. ^{31}P NMR (203 MHz, CDCl_3 , 298K) of **(S)-[2-(Dimethylphenylsilyl)-2-(4-methyl)phenylethyl]diphenylphosphine Oxide [(S)-3d]**

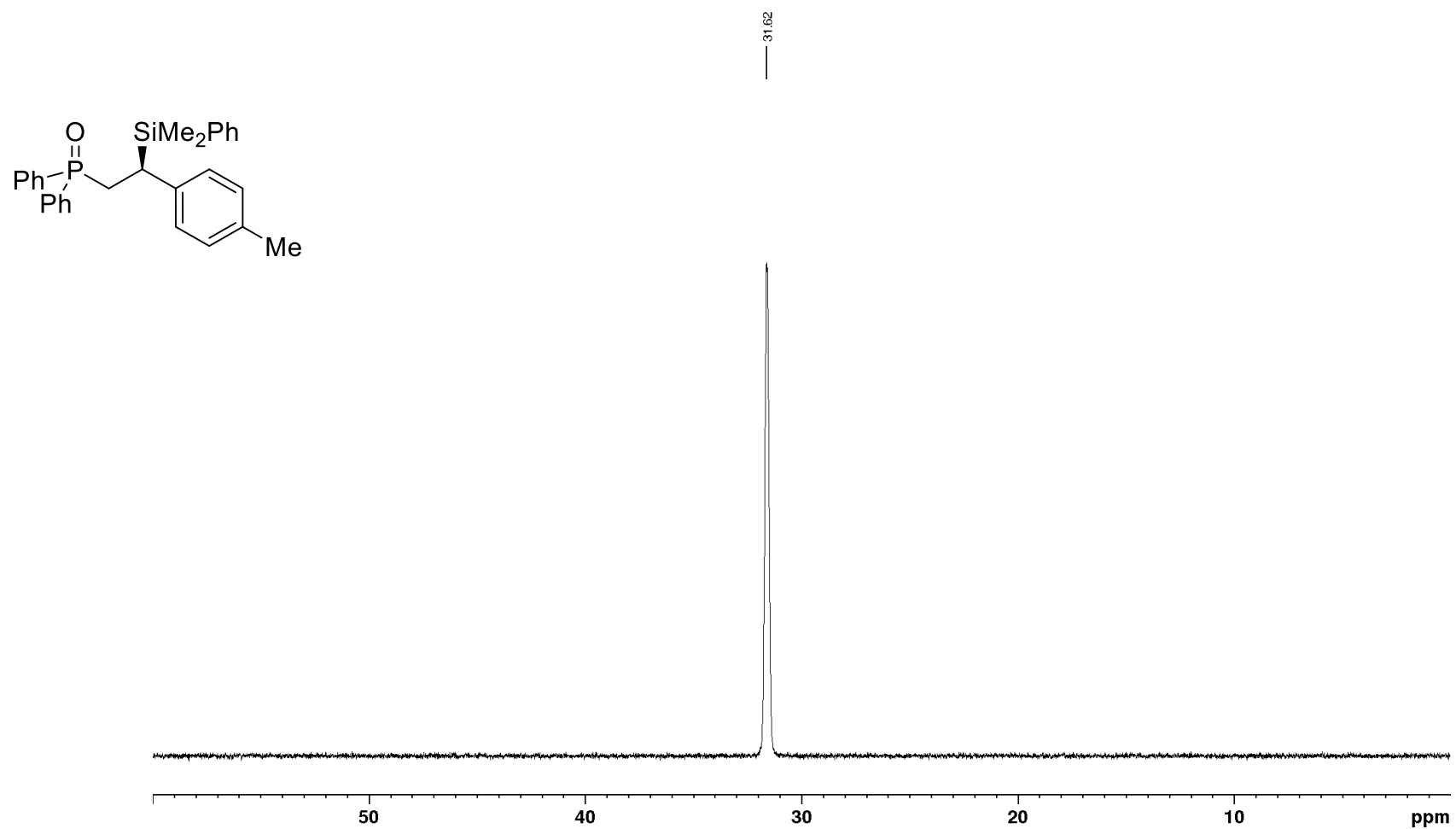


Figure S18. ^1H NMR (500 MHz, CDCl_3 , 298K) of **(S)**-[2-(Dimethylphenylsilyl)-2-(4-methoxy)phenylethyl]diphenylphosphine Oxide [(S)-3e]

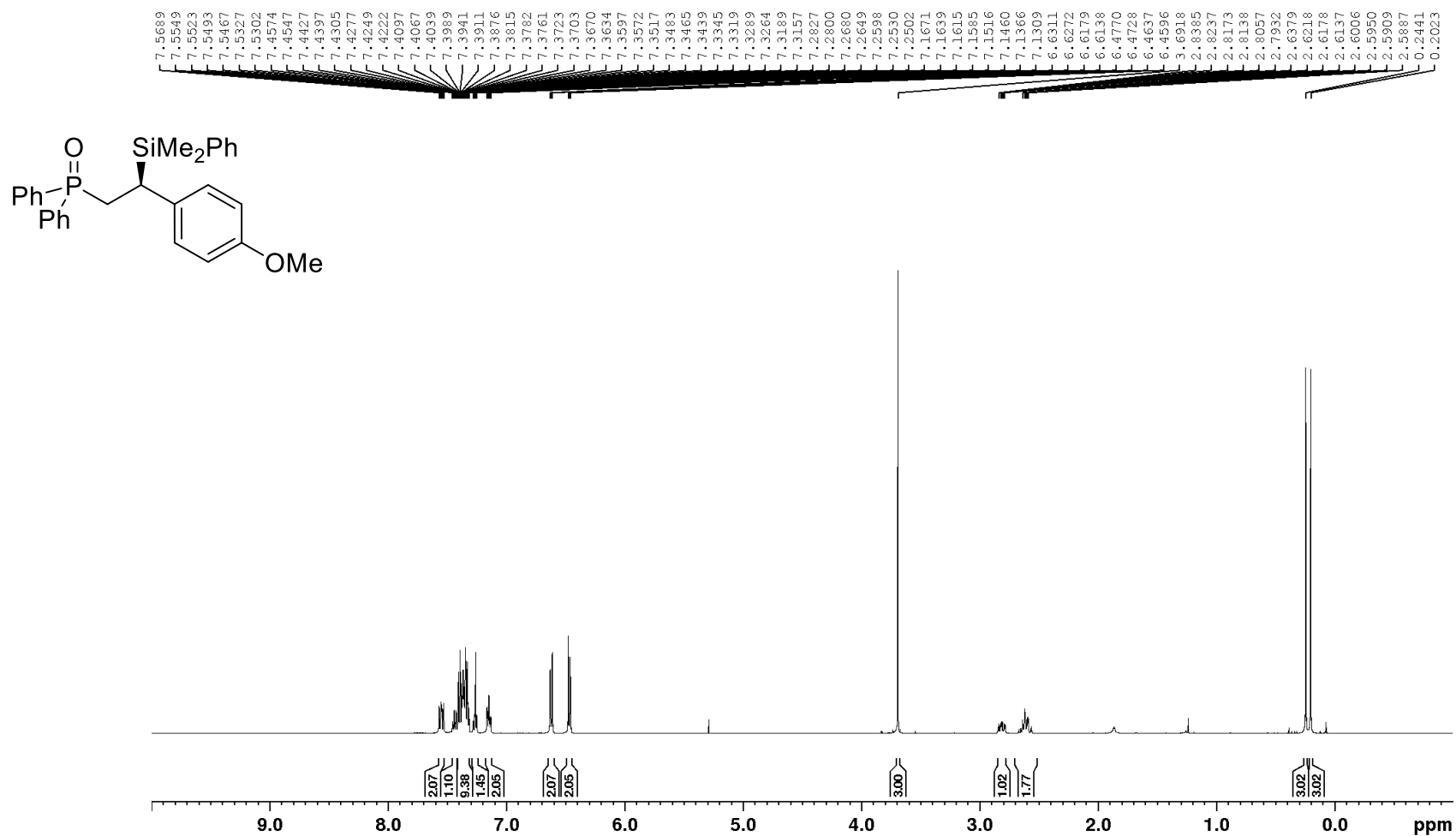


Figure S19. ^{13}C NMR (125 MHz, CDCl_3 , 298K) of **(S)-[2-(Dimethylphenylsilyl)-2-(4-methoxy)phenylethyl]diphenylphosphine Oxide [(S)-3e]**

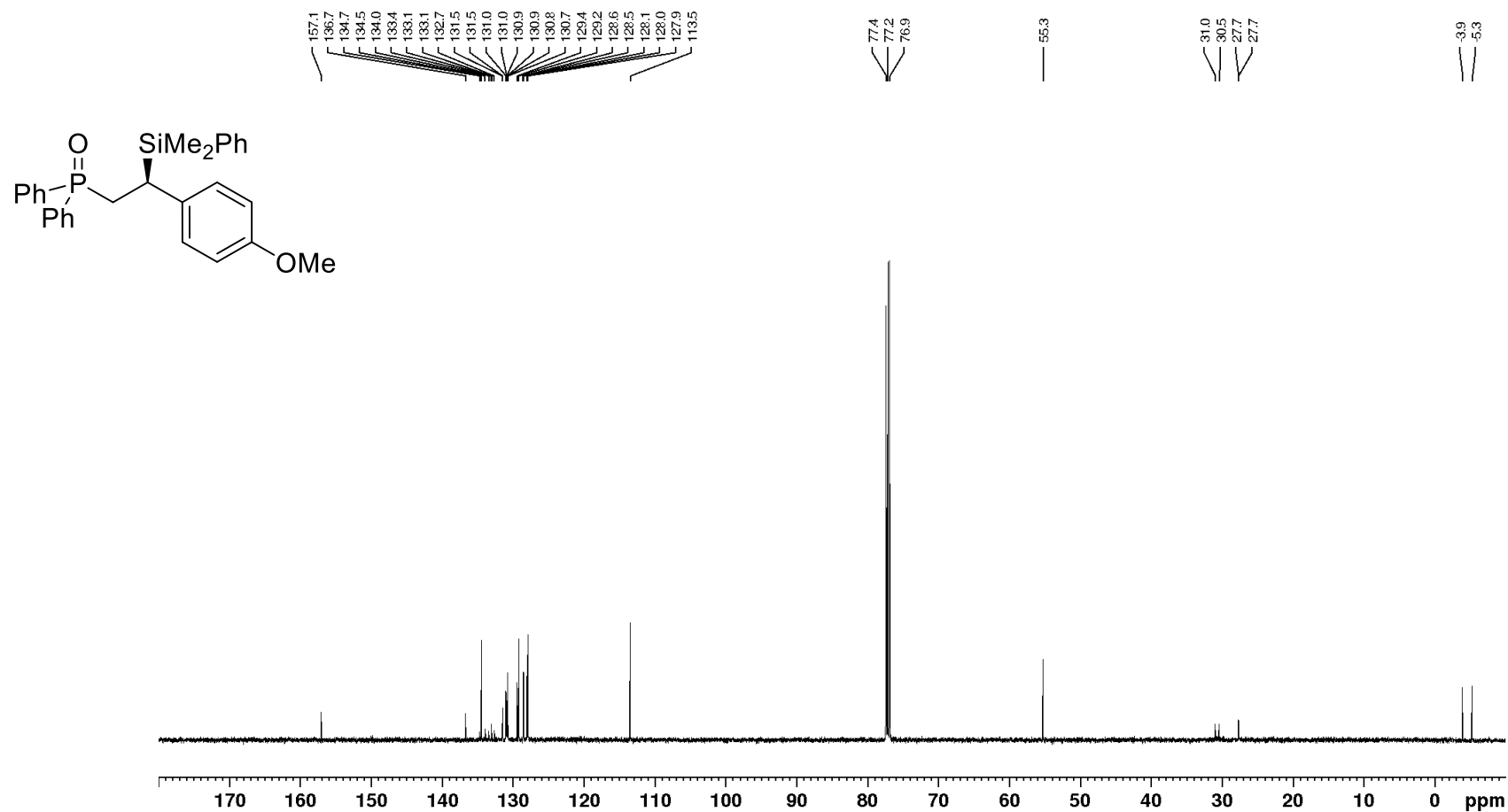


Figure S20. ^{29}Si DEPT NMR (99 MHz, CDCl_3 , 298K) of (*S*)-[2-(Dimethylphenylsilyl)-2-(4-methoxy)phenylethyl]diphenylphosphine Oxide [(*S*)-3e]

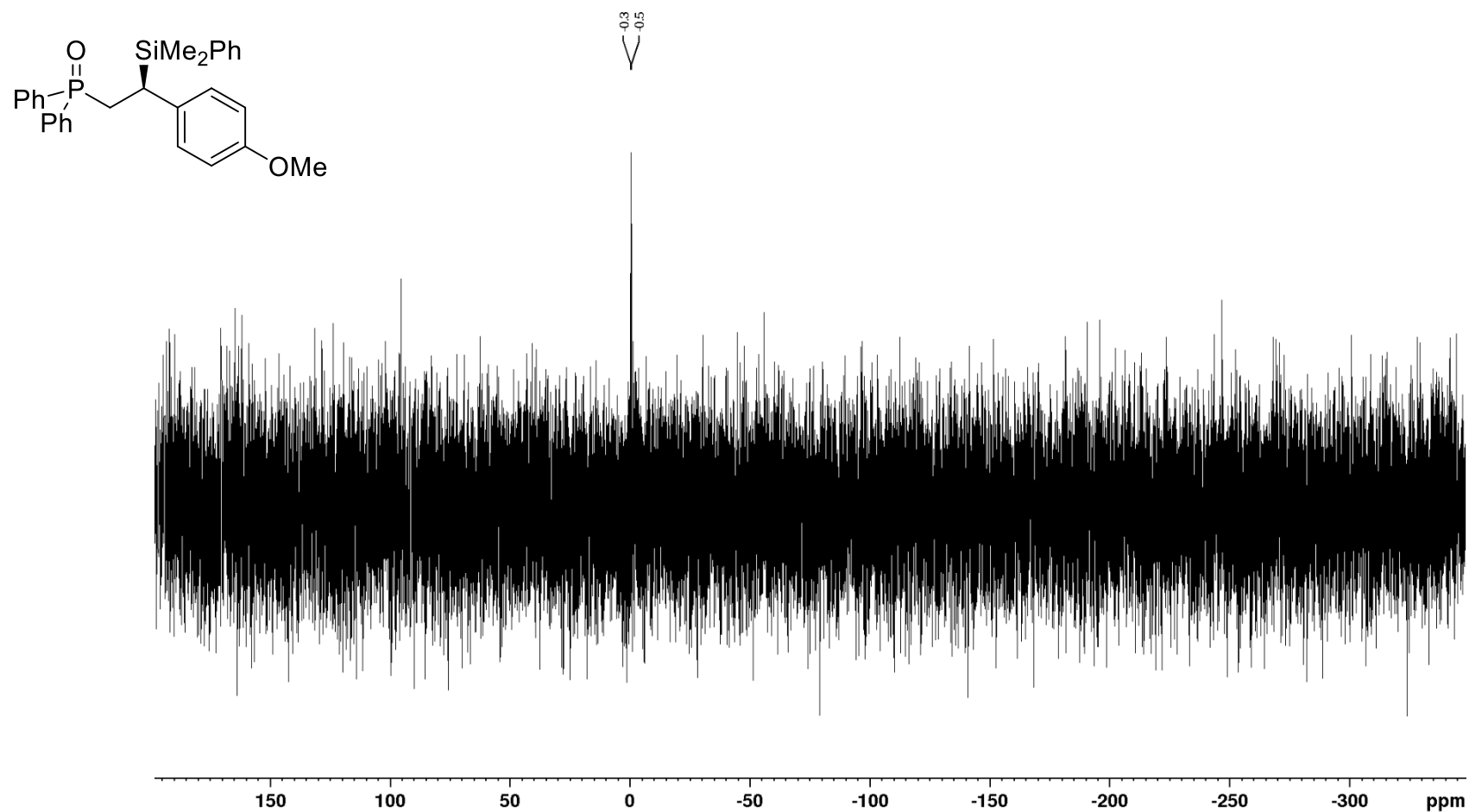


Figure S21. ^{31}P NMR (202 MHz, CDCl_3 , 298K) of **(S)**-[2-(Dimethylphenylsilyl)-2-(4-methoxy)phenylethyl]diphenylphosphine Oxide [(S)-3e]

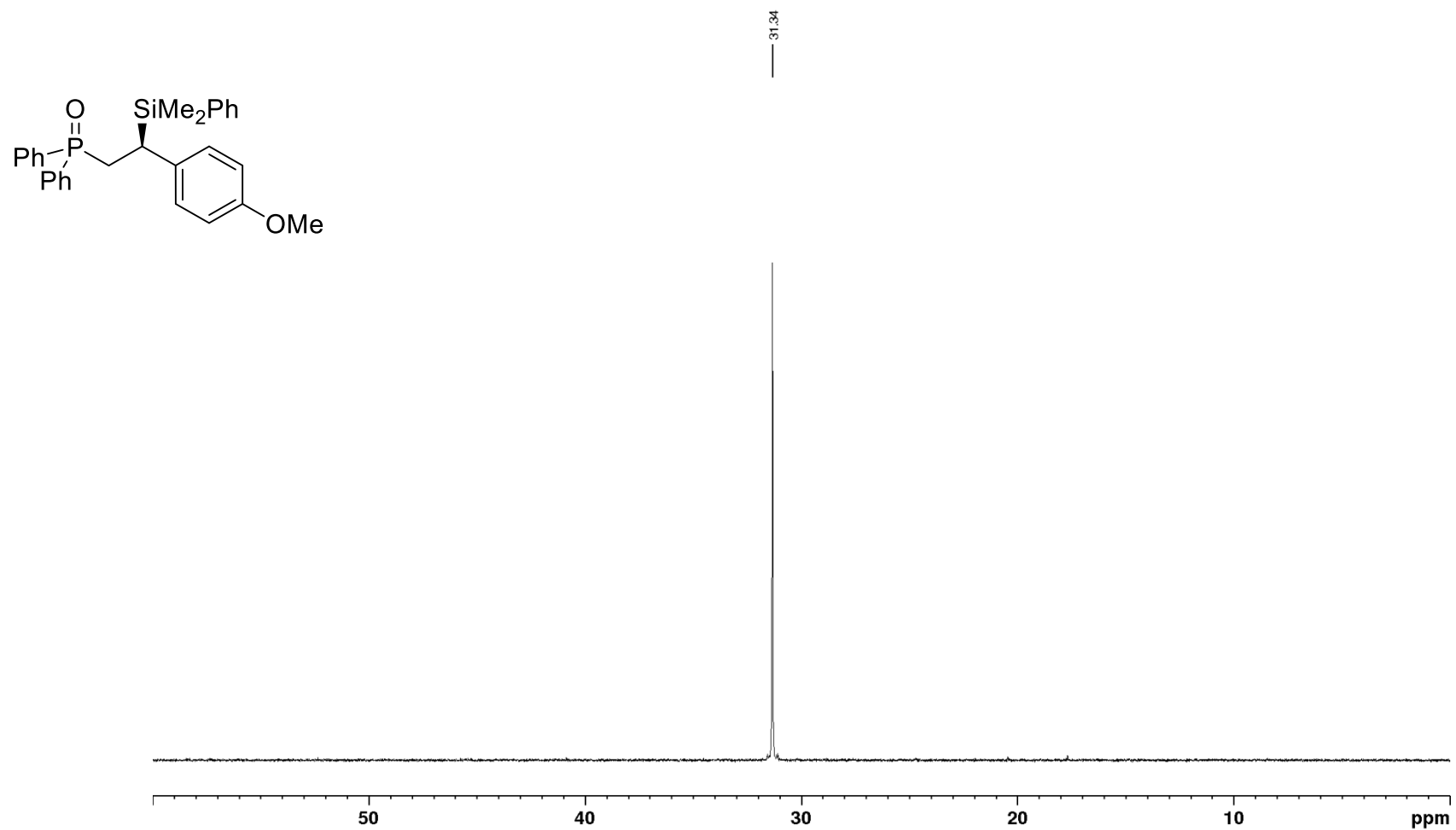


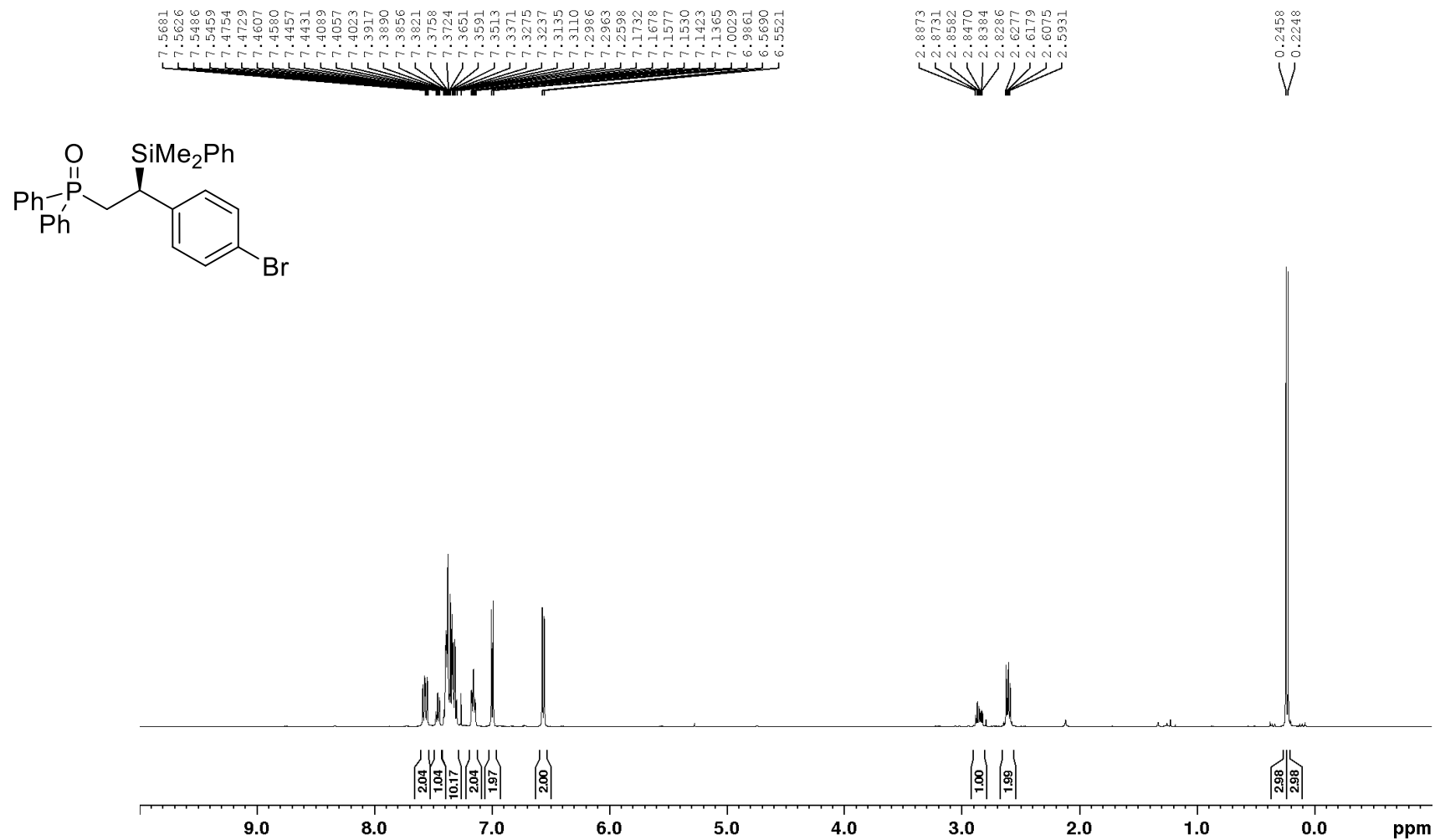
Figure S22. ^1H NMR (500 MHz, CDCl_3 , 298K) of **(S)**-[2-(Dimethylphenylsilyl)-2-(4-bromo)phenylethyl]diphenylphosphine Oxide [(S)-3f]

Figure S23. ^{13}C NMR (125 MHz, CDCl_3 , 298K) of **(S)-[2-(Dimethylphenylsilyl)-2-(4-bromo)phenylethyl]diphenylphosphine Oxide [(S)-3f]**

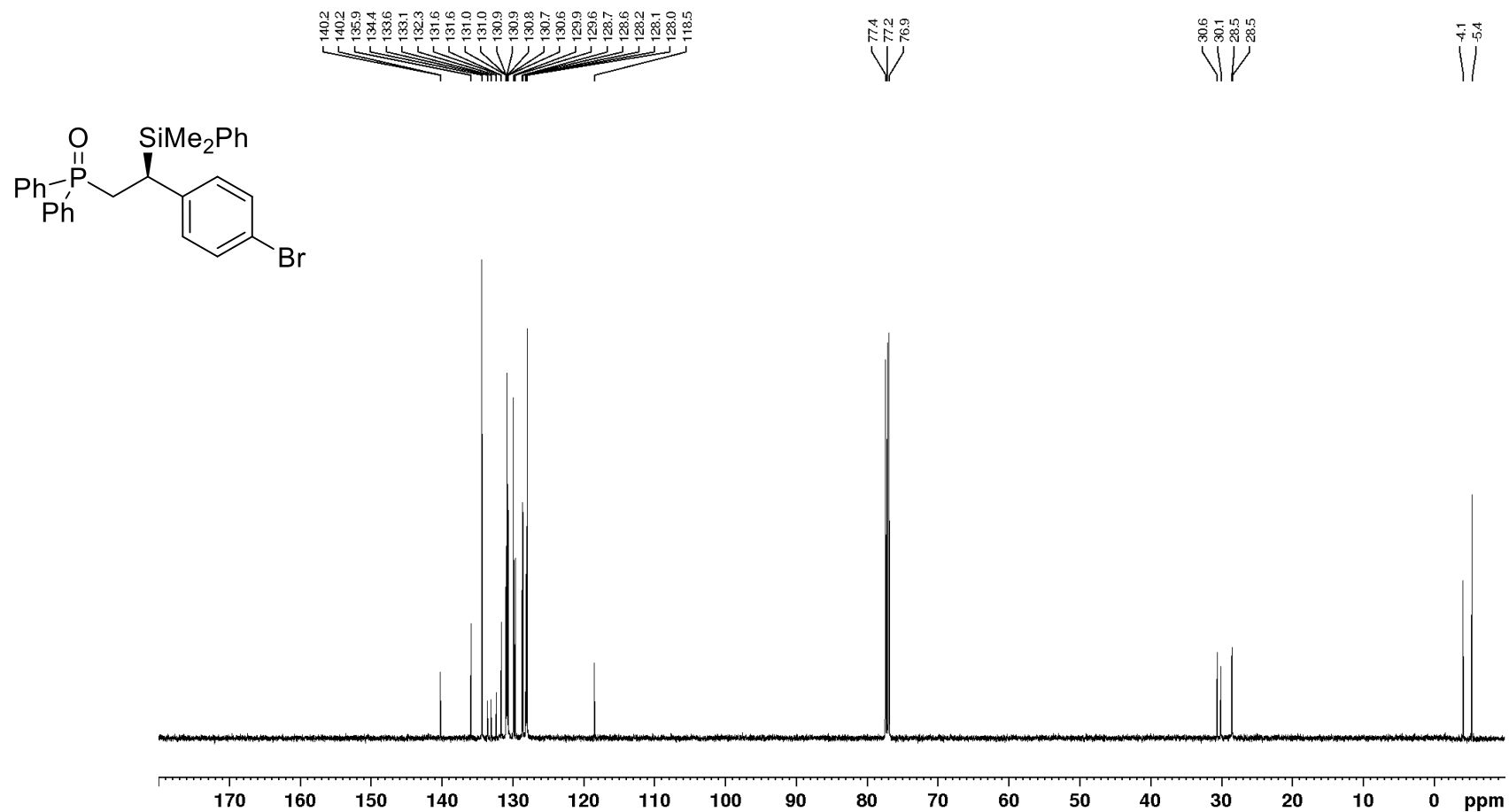


Figure S24. ^{29}Si DEPT NMR (99 MHz, CDCl_3 , 298K) of **(S)**-[2-(Dimethylphenylsilyl)-2-(4-bromo)phenylethyl]diphenylphosphine Oxide [(S)-3f]

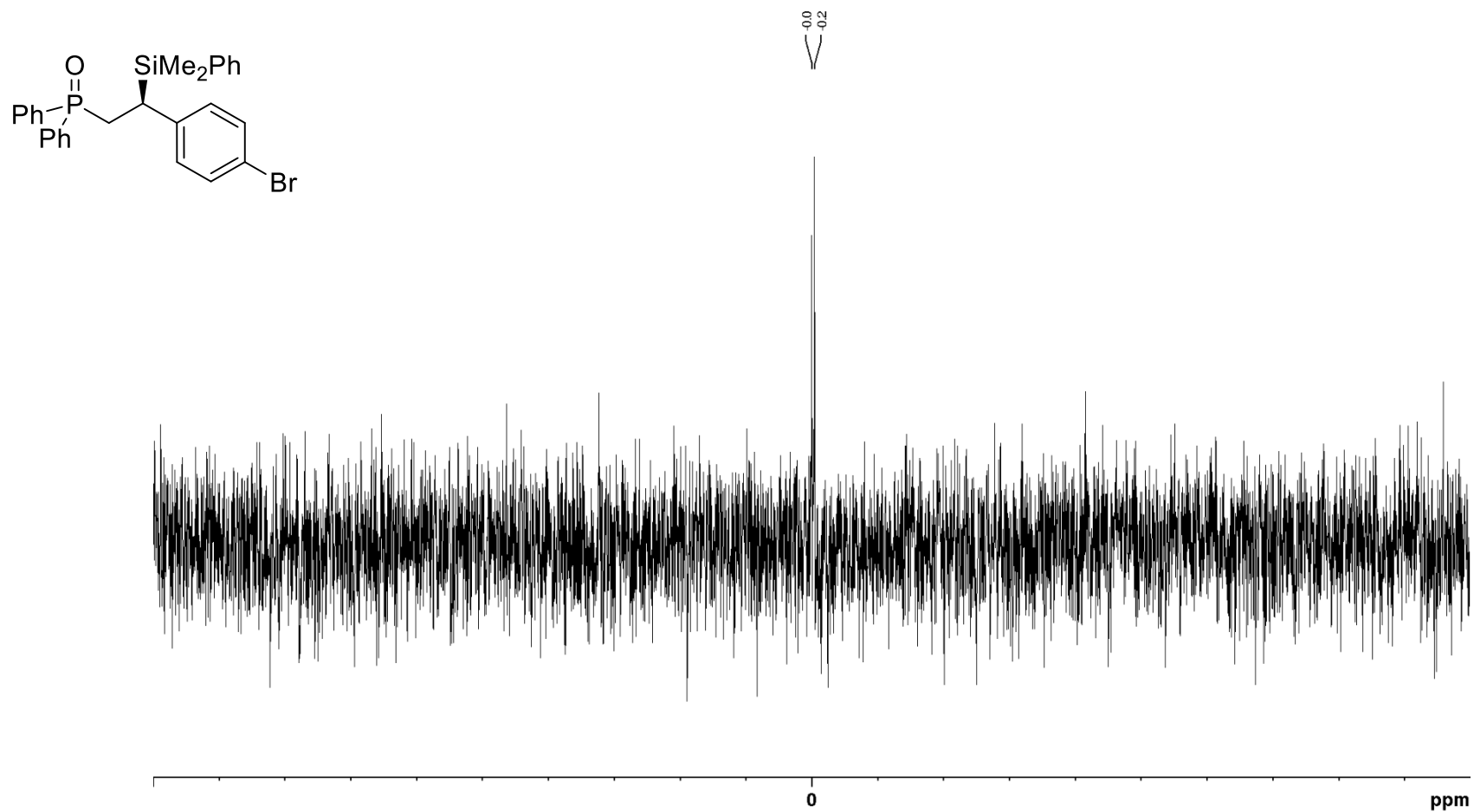


Figure S25. ^{31}P NMR (203 MHz, CDCl_3 , 298K) of **(S)-[2-(Dimethylphenylsilyl)-2-(4-bromo)phenylethyl]diphenylphosphine Oxide [(S)-3f]**

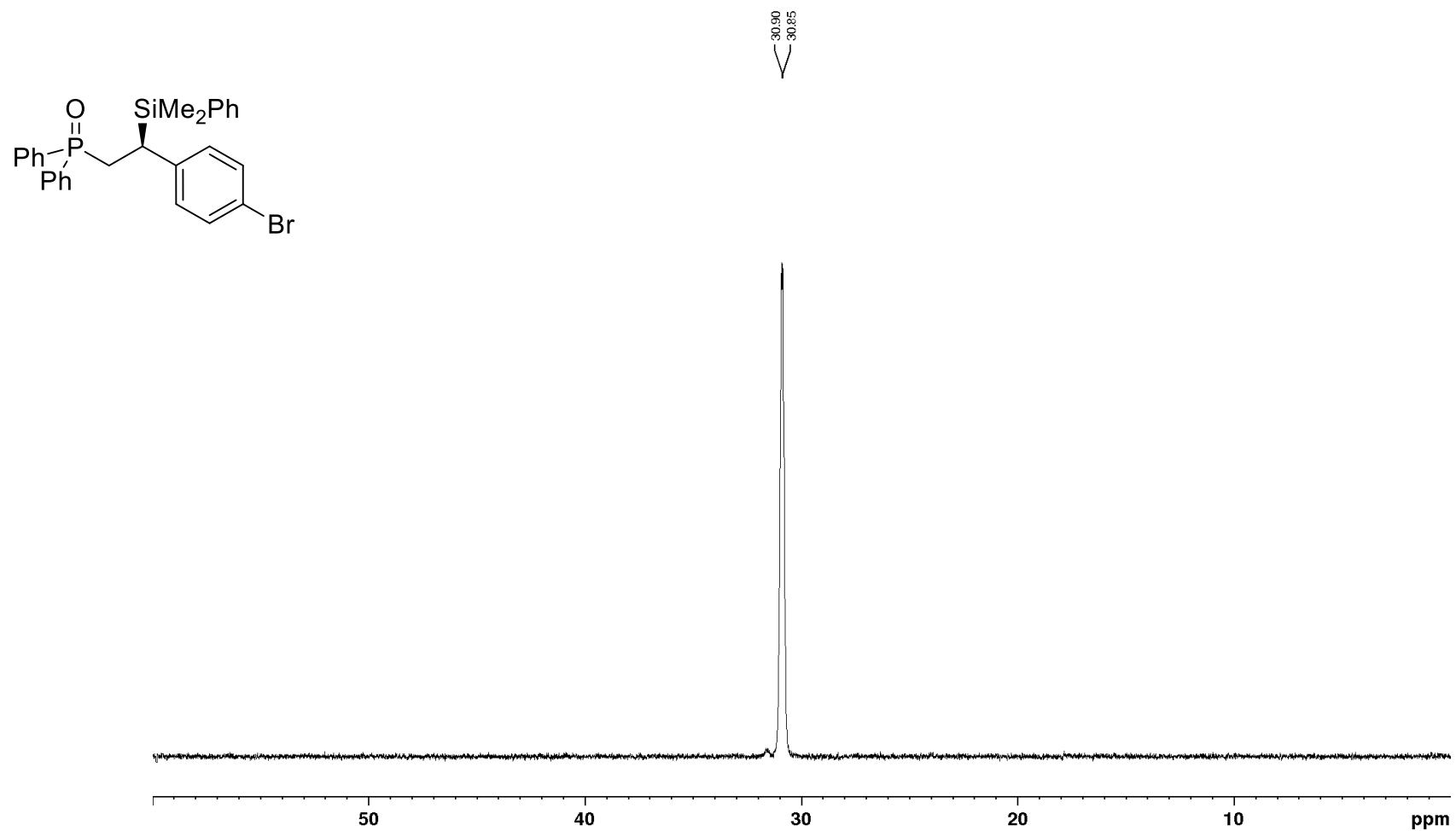


Figure S26. ^1H NMR (500 MHz, CDCl_3 , 298K) of (*S*)-[2-(Dimethylphenylsilyl)-2-(4-trifluoromethyl)phenylethyl]diphenylphosphine Oxide [(*S*)-3g]

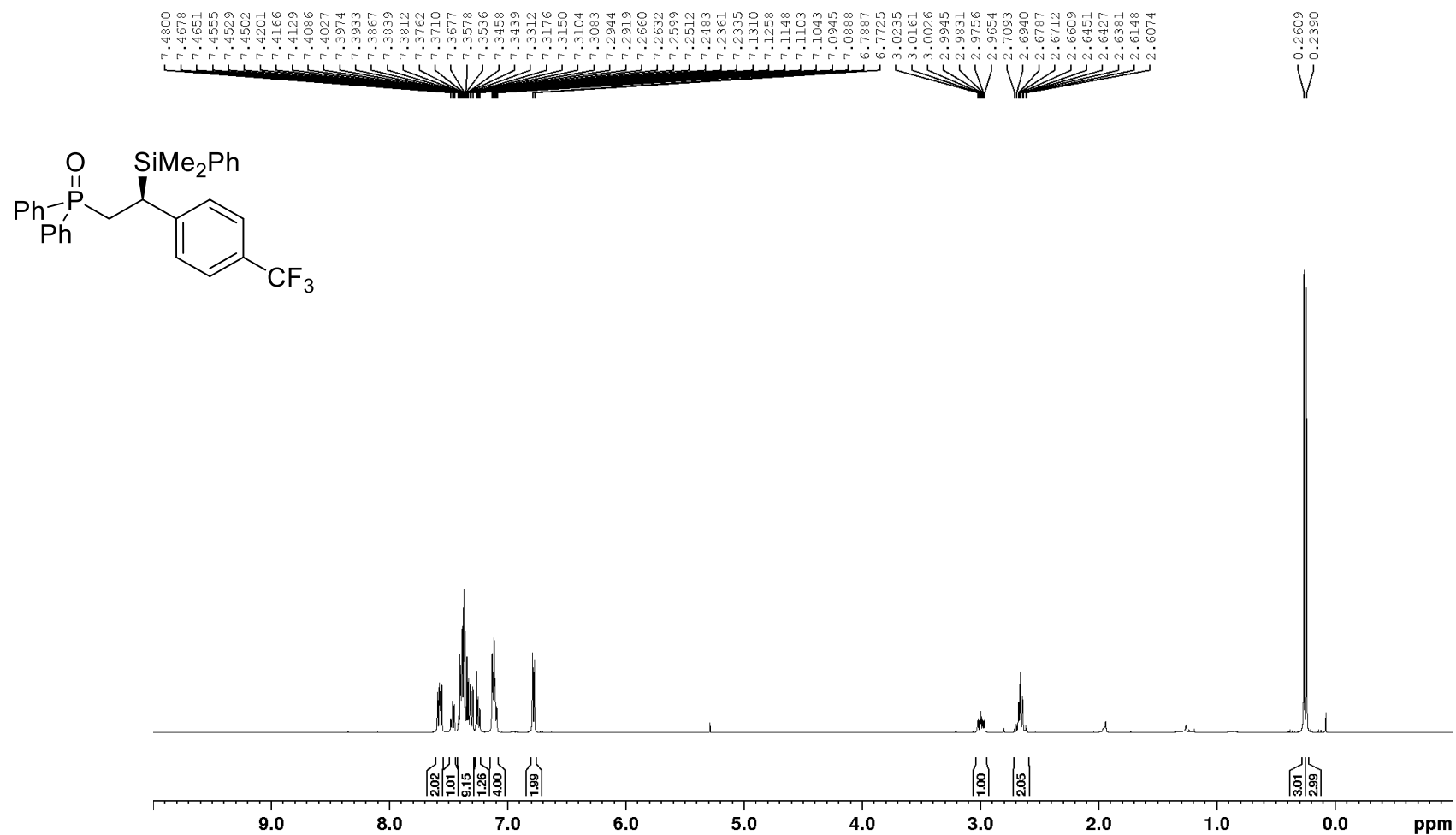


Figure S27. ^{13}C NMR (125 MHz, CDCl_3 , 298K) of **(S)-[2-(Dimethylphenylsilyl)-2-(4-trifluoromethyl)phenylethyl]diphenylphosphine Oxide [(S)-3g]**

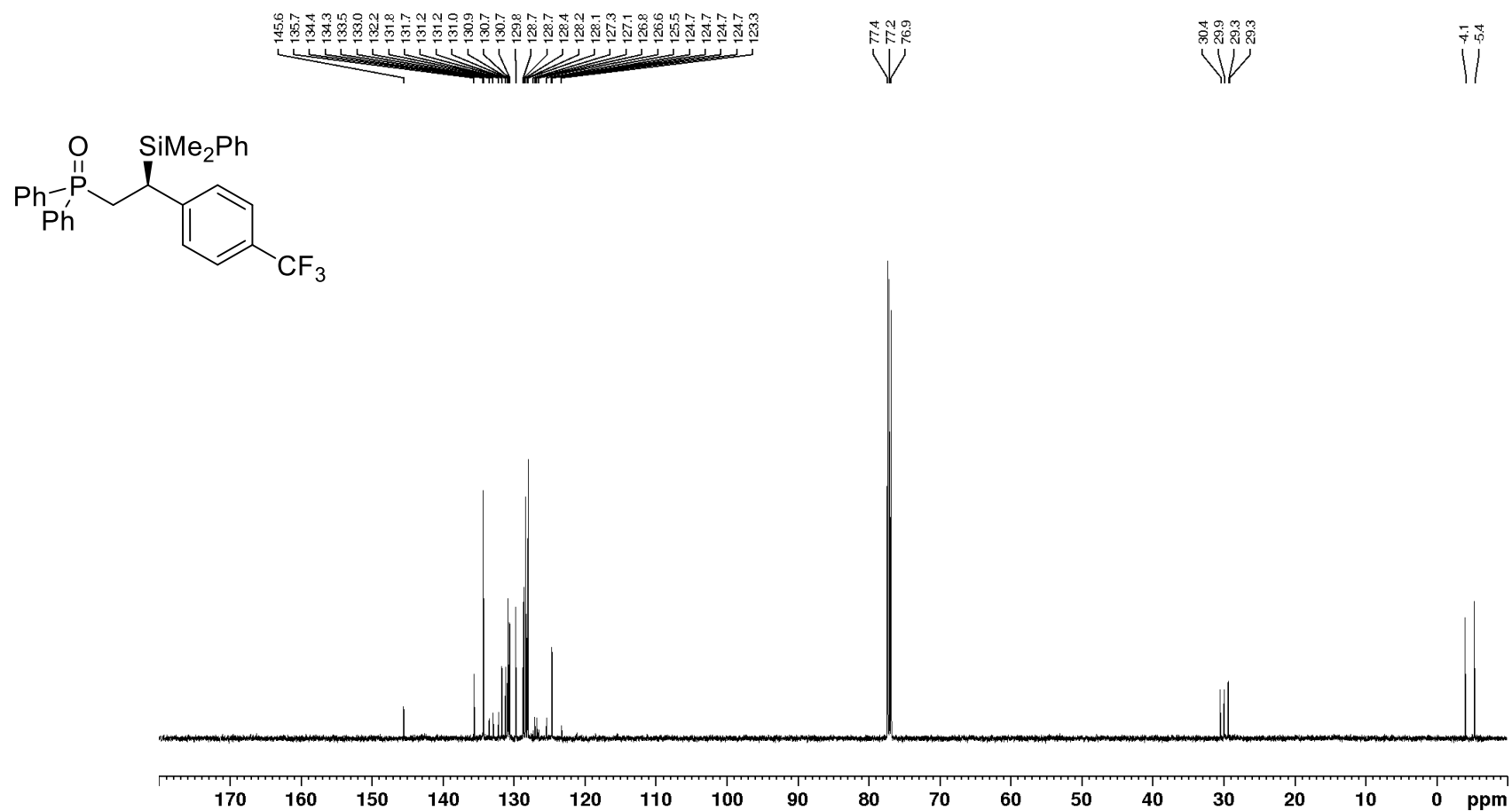


Figure S28. ^{29}Si DEPT NMR (99 MHz, CDCl_3 , 298K) of **(S)-[2-(Dimethylphenylsilyl)-2-(4-trifluoromethyl)phenylethyl]diphenylphosphine Oxide [(S)-3g]**

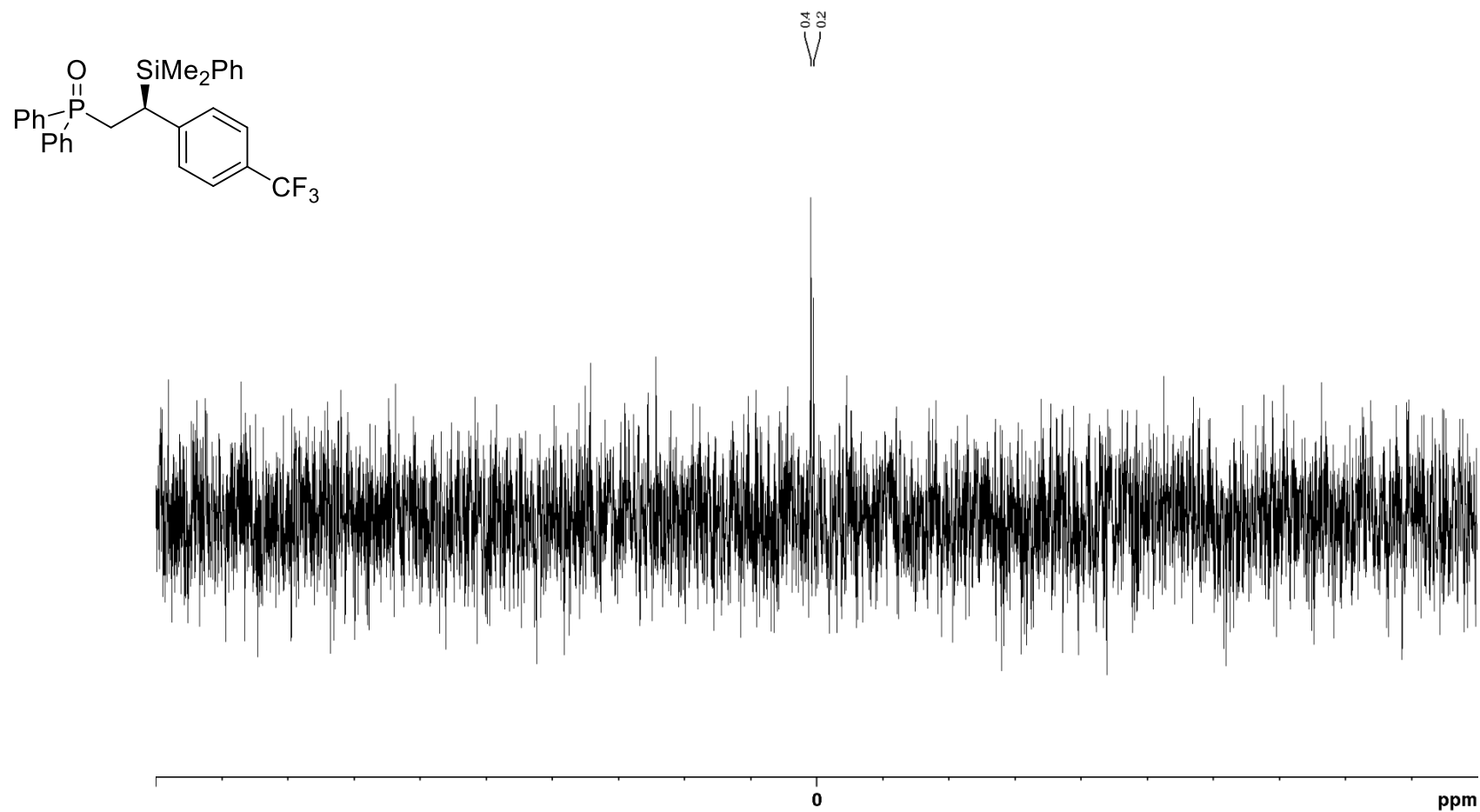


Figure S29. ^{31}P NMR (202 MHz, CDCl_3 , 298K) of **(S)-[2-(Dimethylphenylsilyl)-2-(4-trifluoromethyl)phenylethyl]diphenylphosphine Oxide [(S)-3g]**

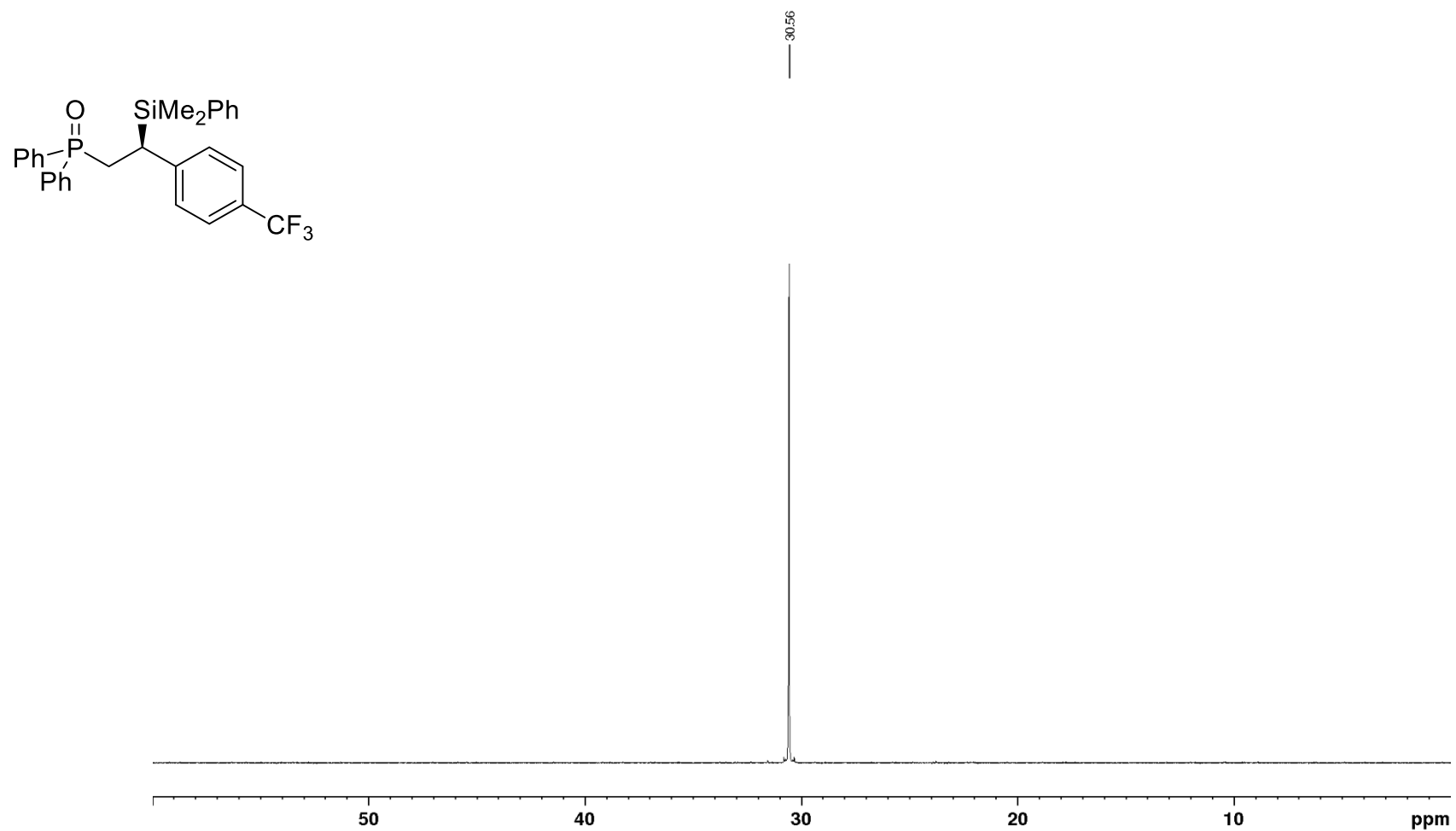


Figure S30. ^{19}F NMR (471 MHz, CDCl_3 , 298K) of (*S*)-[2-(Dimethylphenylsilyl)-2-(4-trifluoromethyl)phenylethyl]diphenylphosphine Oxide [(*S*)-3g]

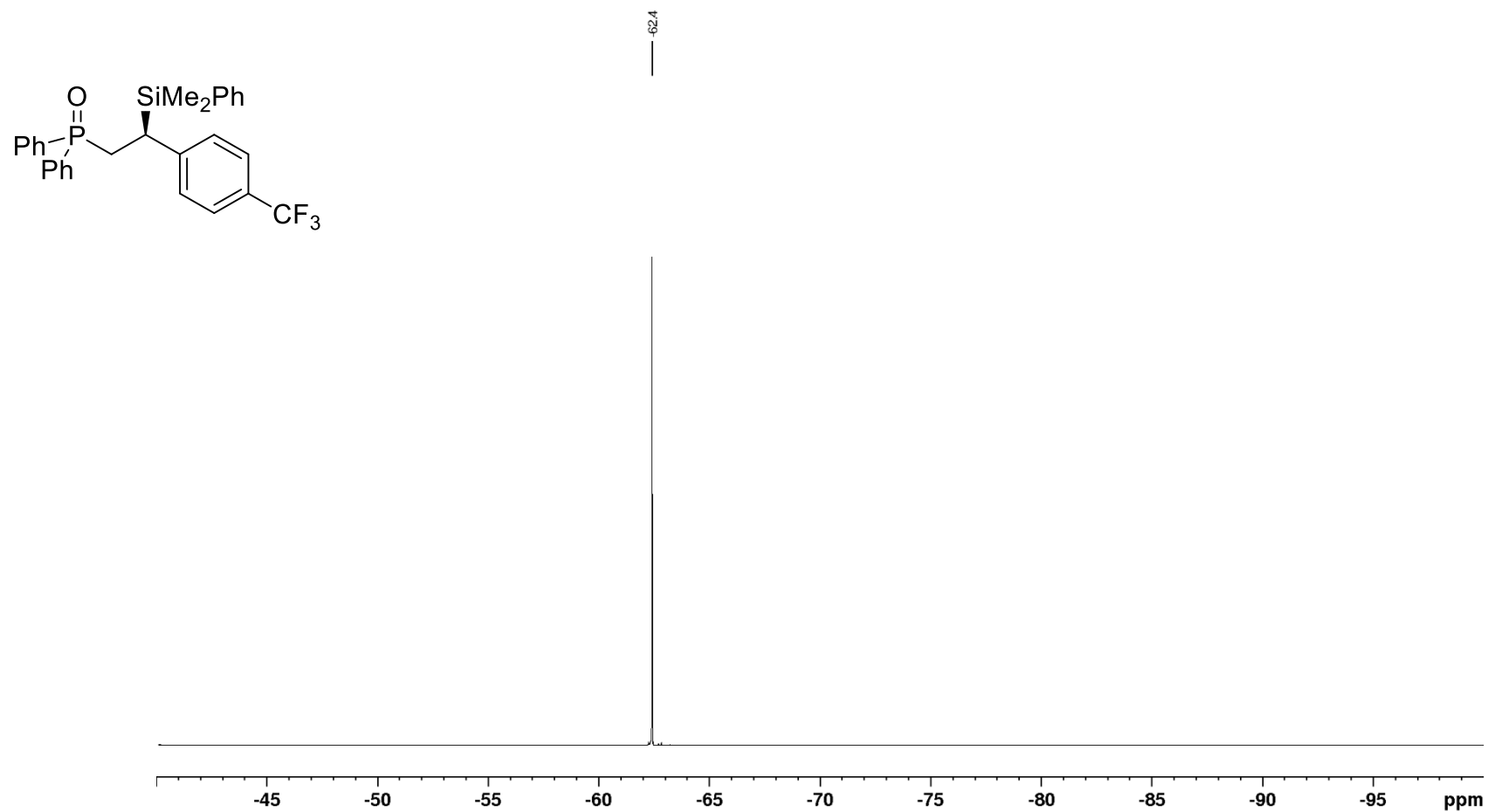


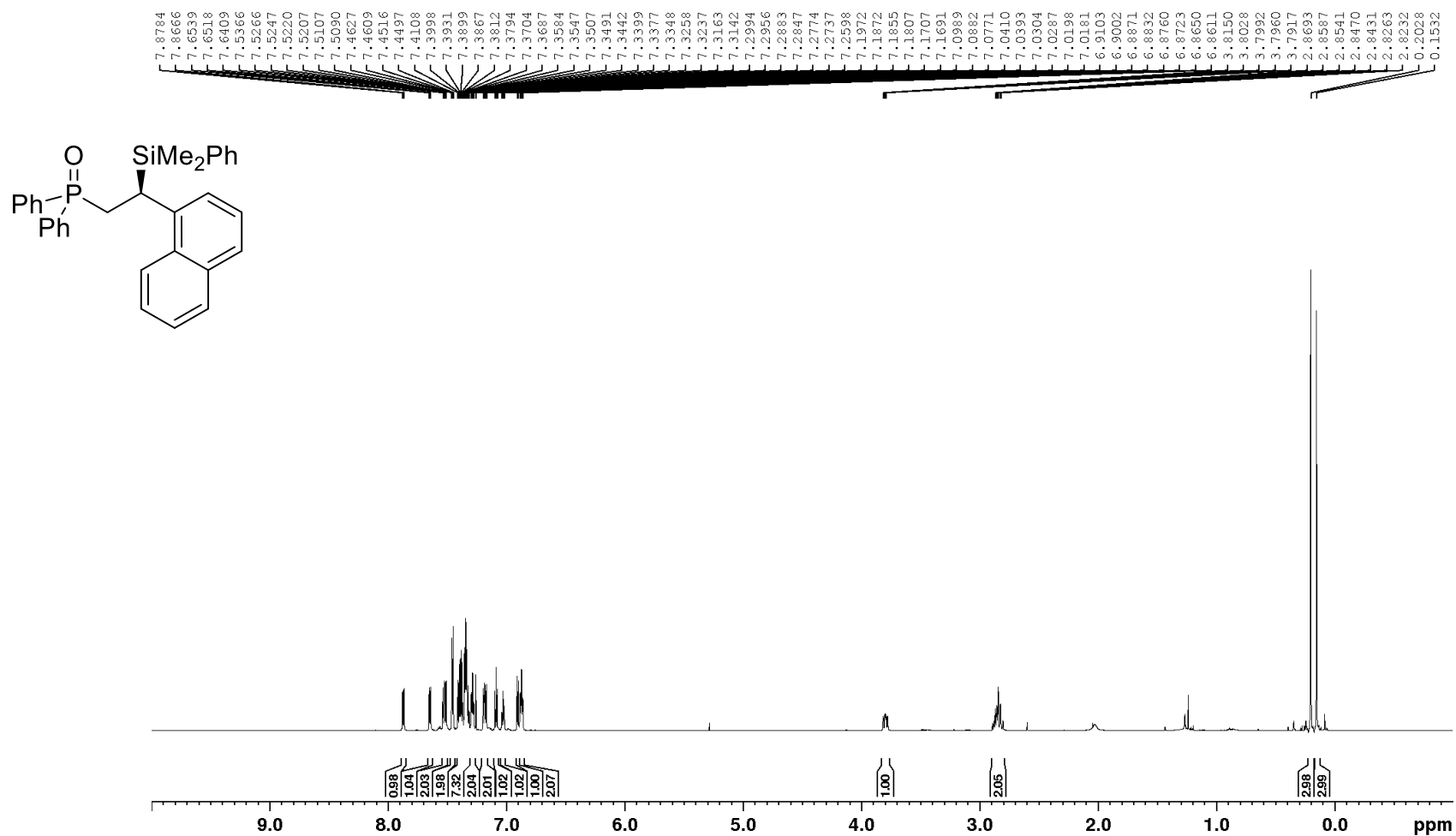
Figure S31. ^1H NMR (700 MHz, CDCl_3 , 298K) of **(S)-[2-(Dimethylphenylsilyl)-2-(1-naphthalen)ethyl]diphenyl-phosphine Oxide [(S)-3h]**

Figure S32. ^{13}C NMR (175 MHz, CDCl_3 , 298K) of (*S*)-[2-(Dimethylphenylsilyl)-2-(1-naphthalen)ethyl]diphenyl-phosphine Oxide [(*S*)-3h]

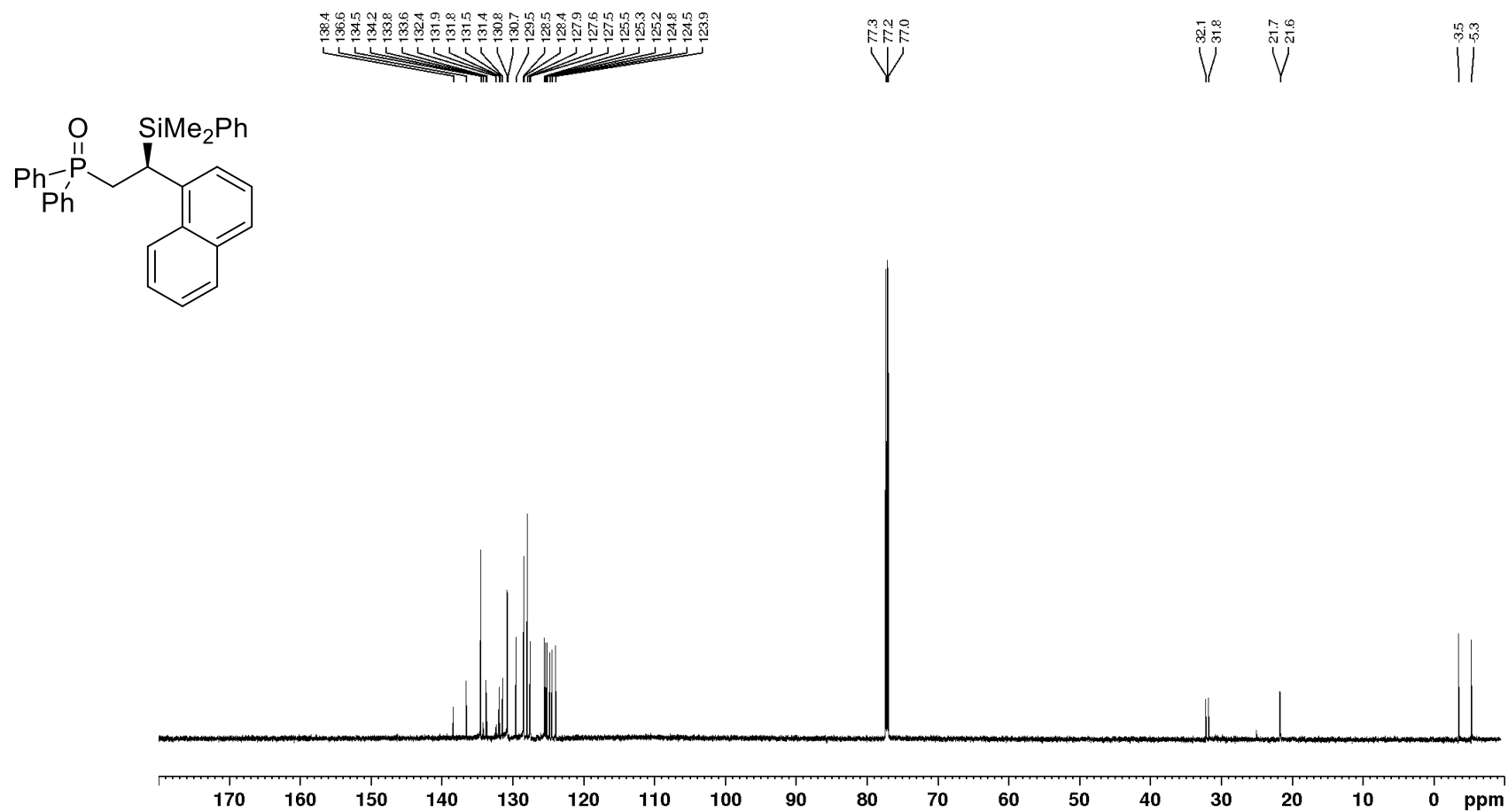


Figure S33. ^{29}Si DEPT NMR (99 MHz, CDCl_3 , 298K) of (*S*)-[2-(Dimethylphenylsilyl)-2-(1-naphthalen)ethyl]diphenyl-phosphine Oxide [(*S*)-3h]

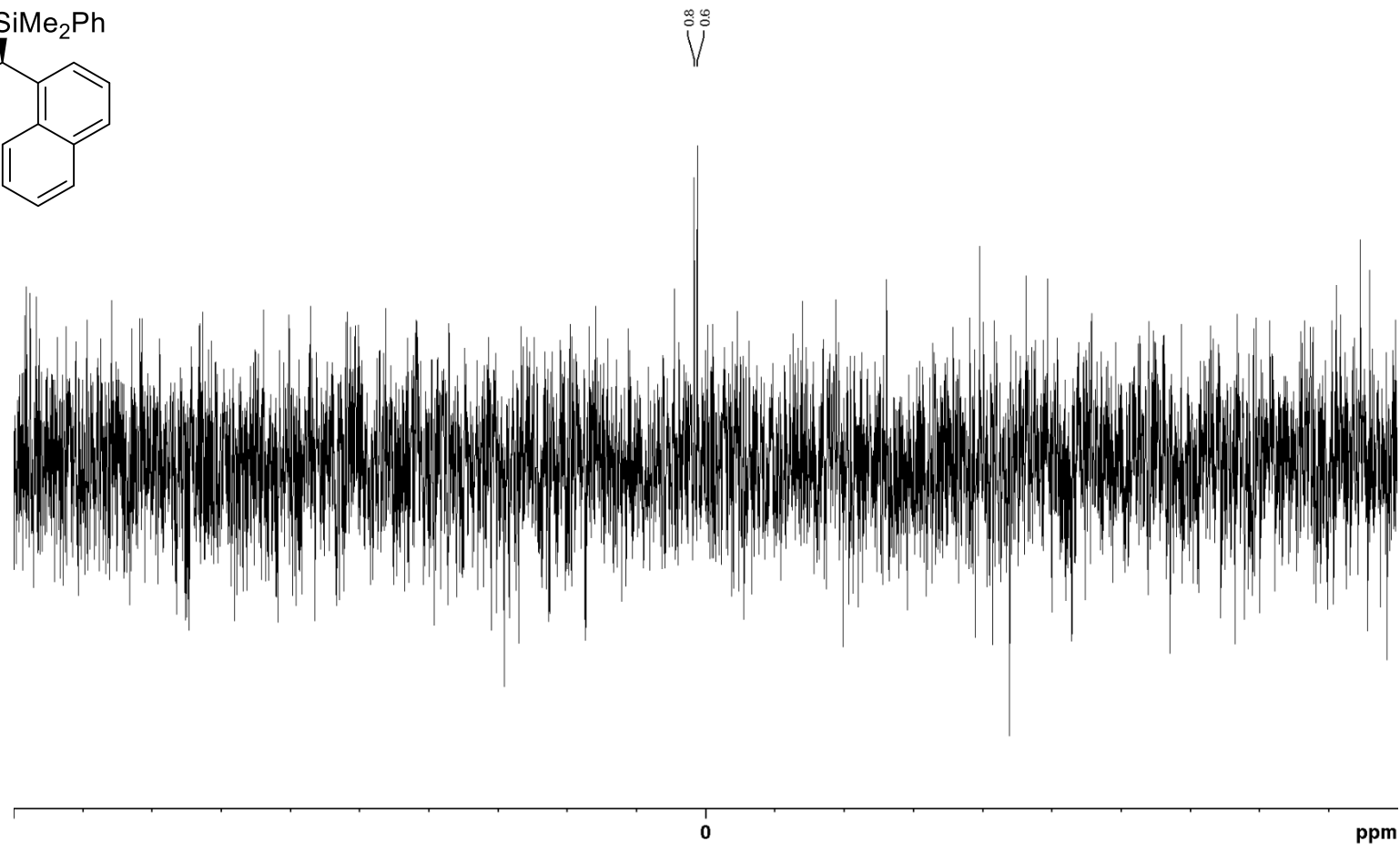
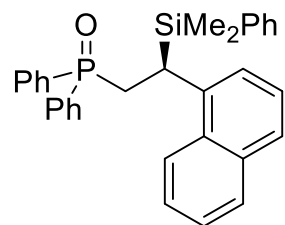


Figure S34. ^{31}P NMR (203 MHz, CDCl_3 , 298K) of (*S*)-[2-(Dimethylphenylsilyl)-2-(1-naphthalen)ethyl]diphenyl-phosphine Oxide [(*S*)-3h]

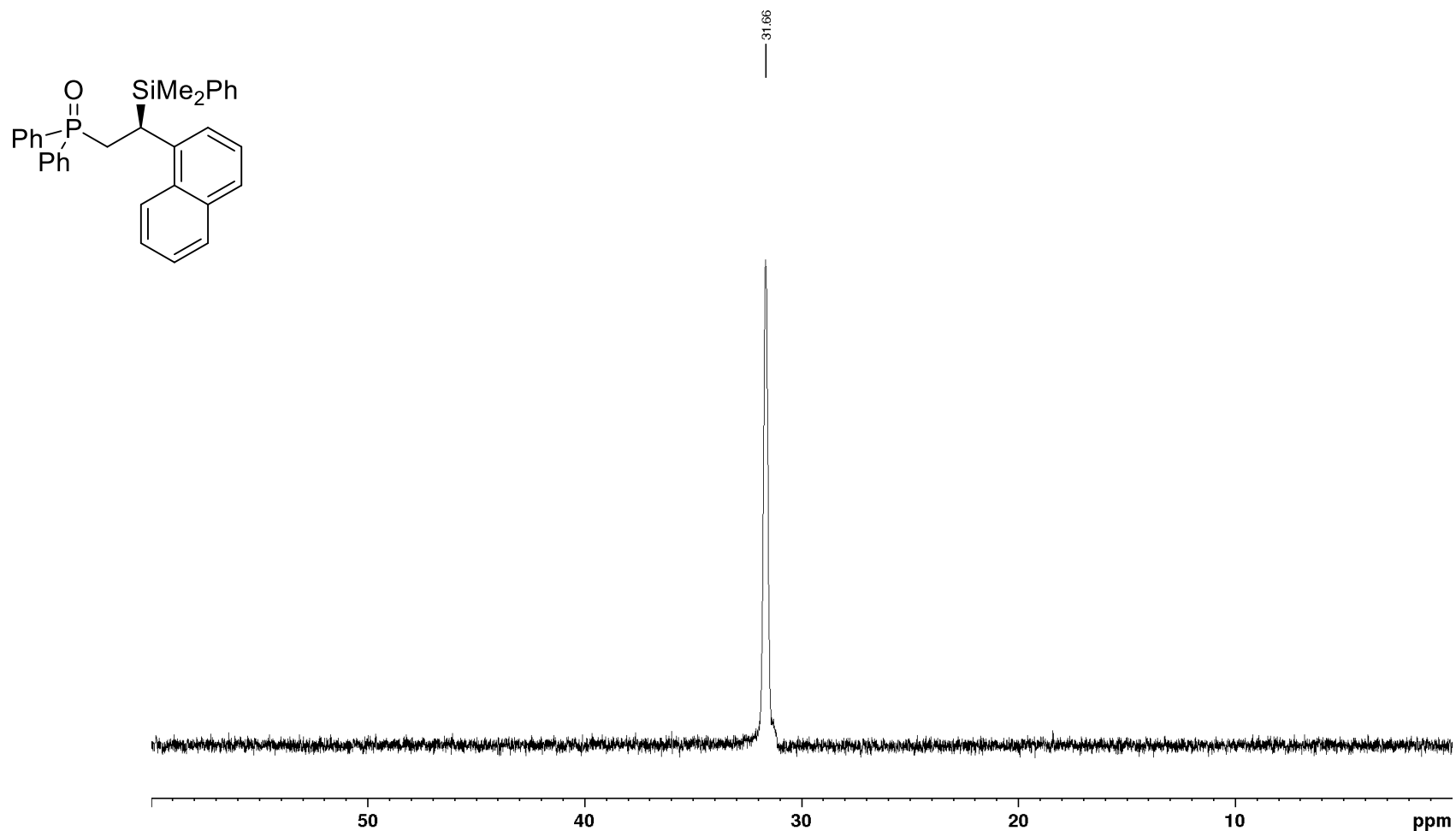


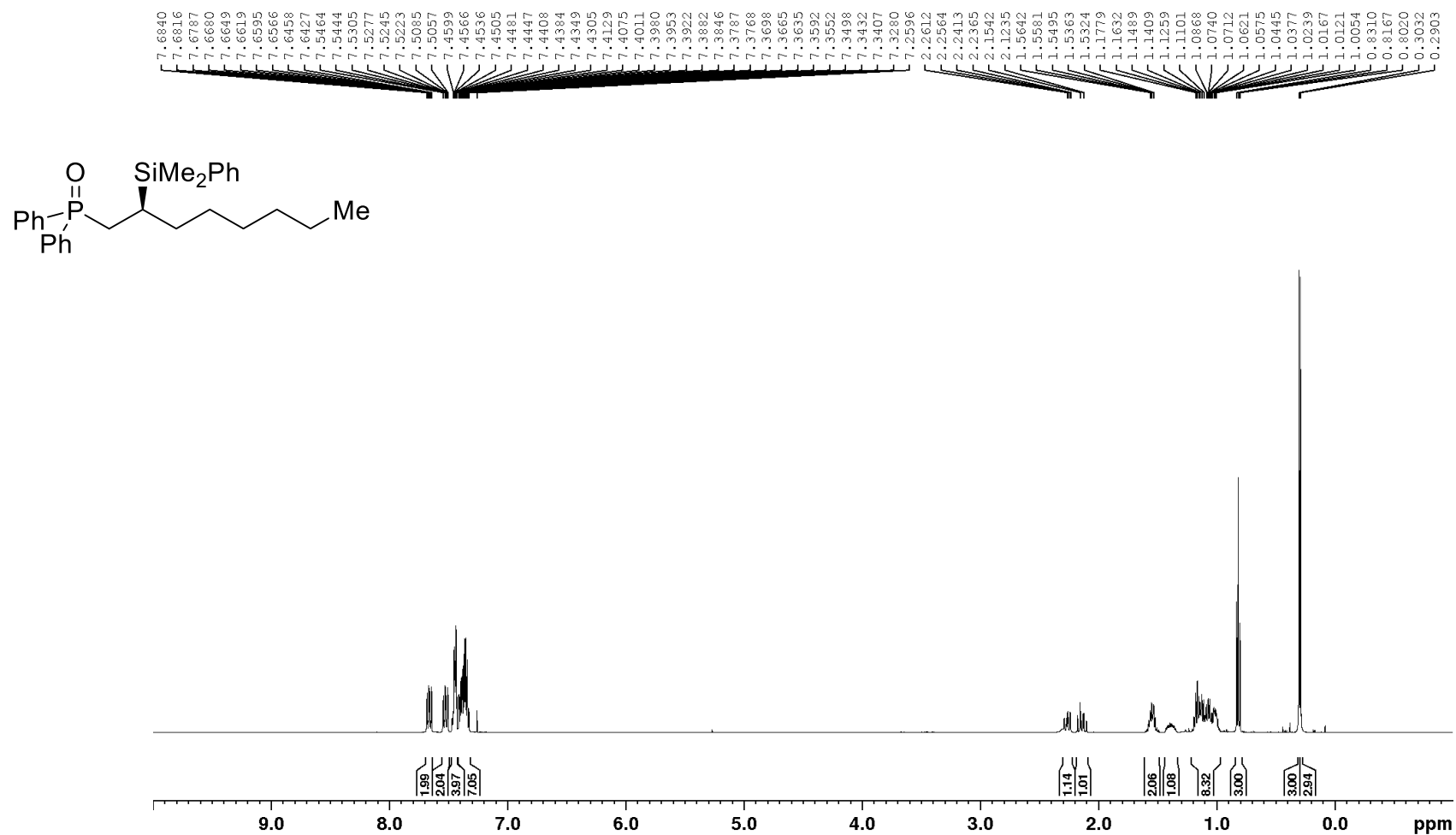
Figure S35. ^1H NMR (500 MHz, CDCl_3 , 298K) of (**S**)-[2-(Dimethylphenylsilyl)octyl]diphenylphosphine Oxide [(**S**)-3i]

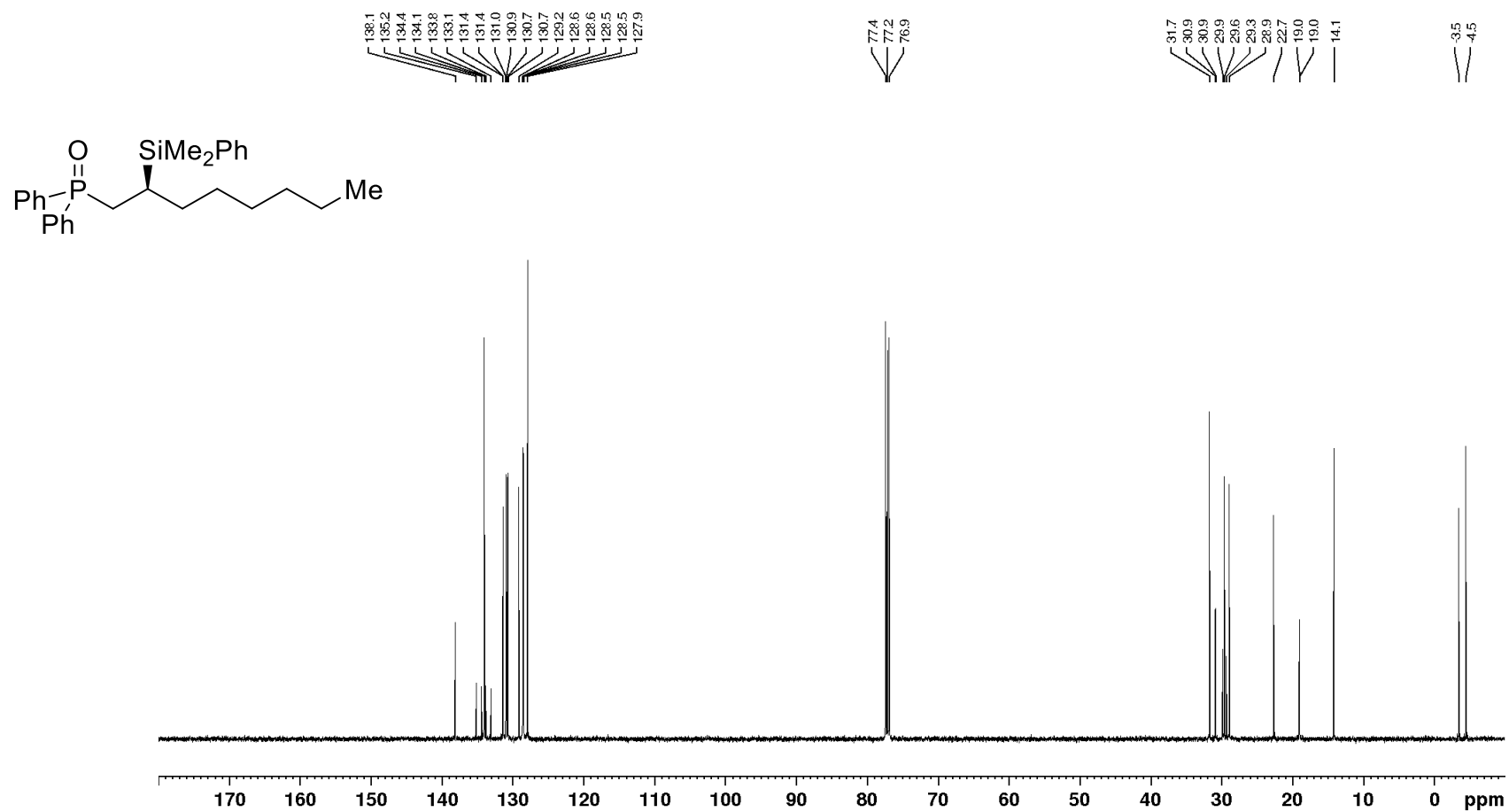
Figure S36. ^{13}C NMR (125 MHz, CDCl_3 , 298K) of **(S)**-[2-(Dimethylphenylsilyl)octyl]diphenylphosphine Oxide [(S)-3i]

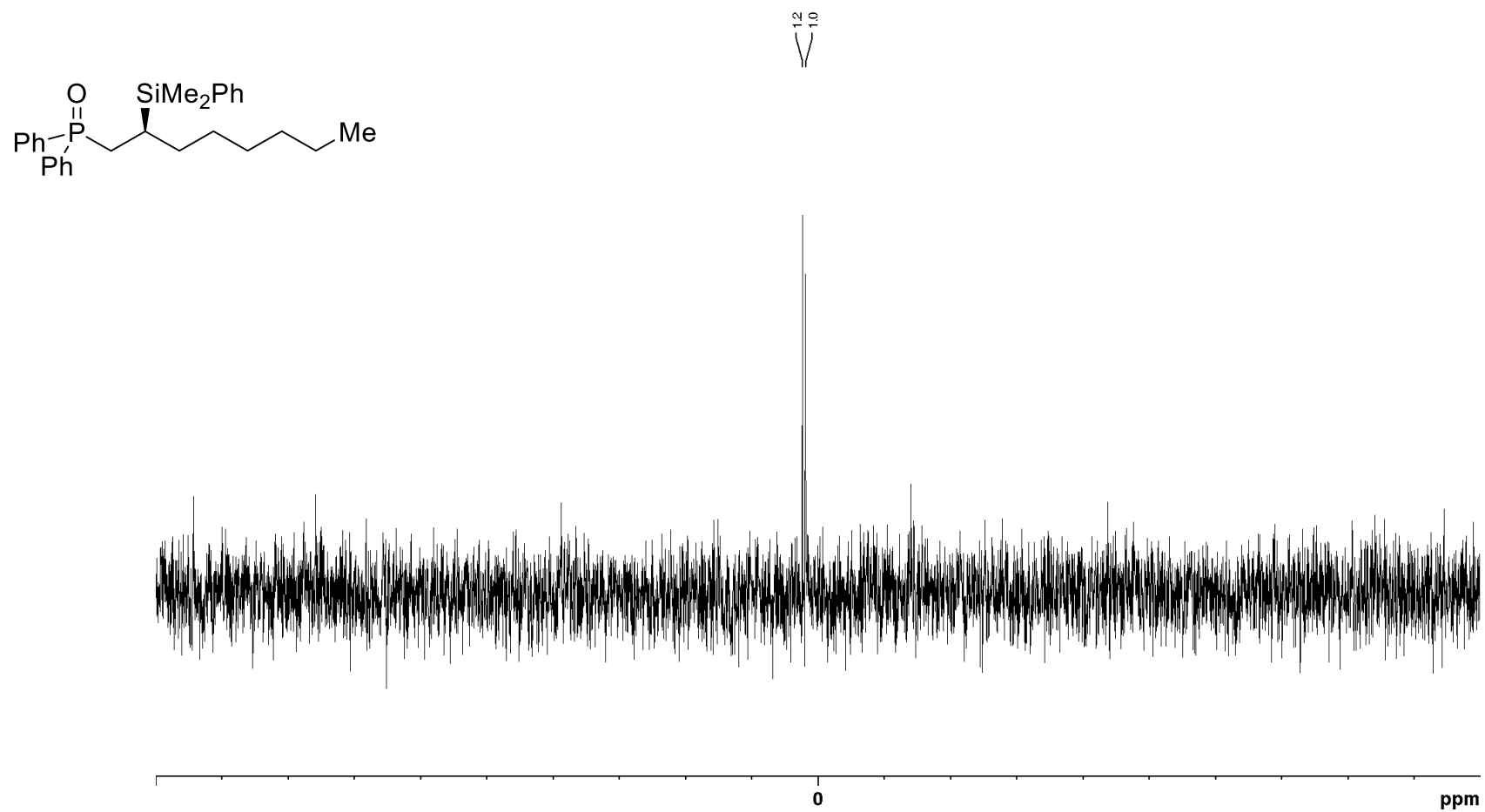
Figure S37. ^{29}Si DEPT NMR (99 MHz, CDCl_3 , 298K) of (**S**)-[2-(Dimethylphenylsilyl)octyl]diphenylphosphine Oxide [(**S**)-3i]

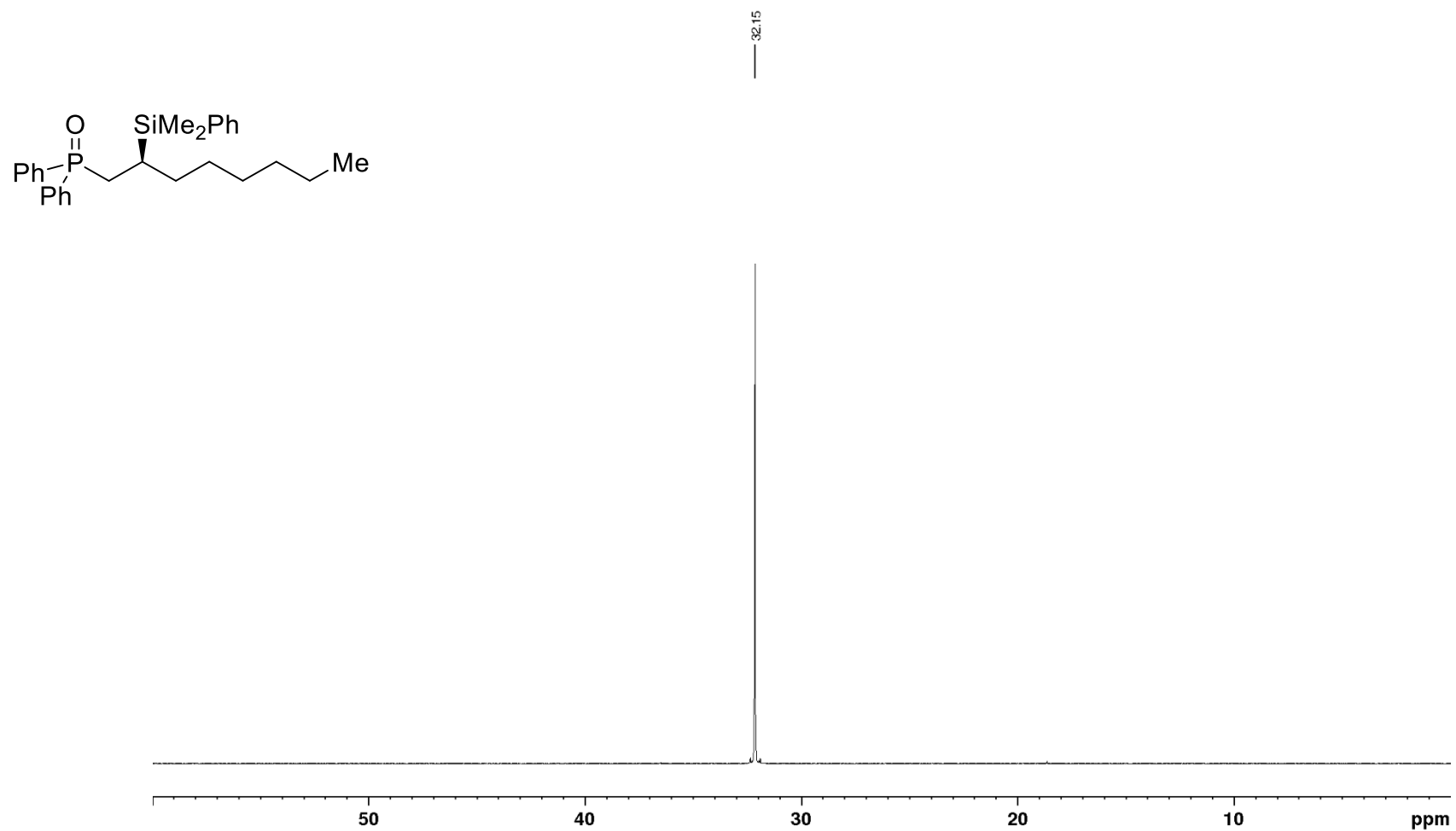
Figure S38. ^{31}P NMR (202 MHz, CDCl_3 , 298K) of **(S)-[2-(Dimethylphenylsilyl)octyl]diphenylphosphine Oxide [(S)-3i]**

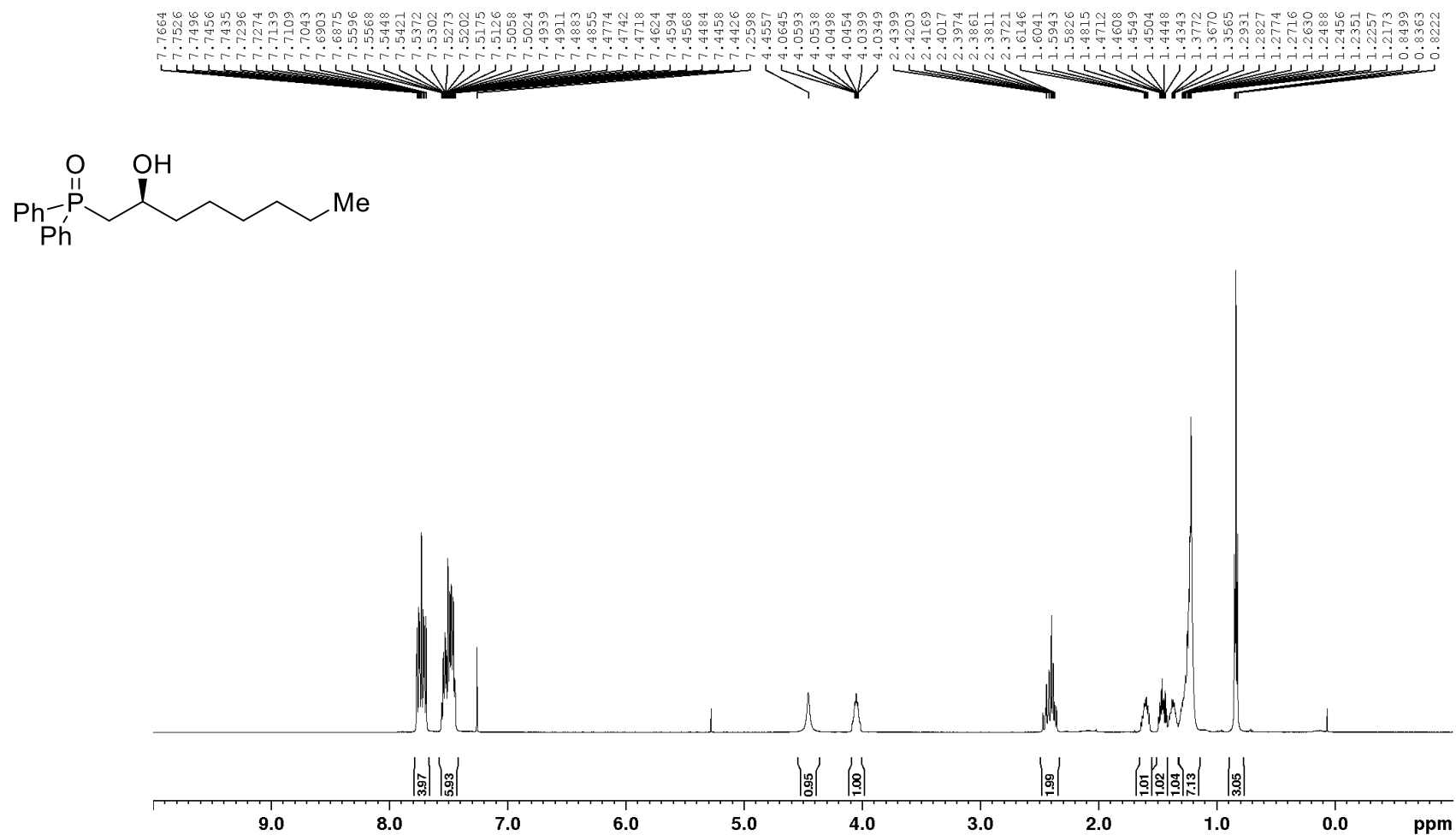
Figure S39. ^1H NMR (500 MHz, CDCl_3 , 298K) of (**S**)-(2-Hydroxyoctyl)diphenylphosphine Oxide [(**S**)-4i]

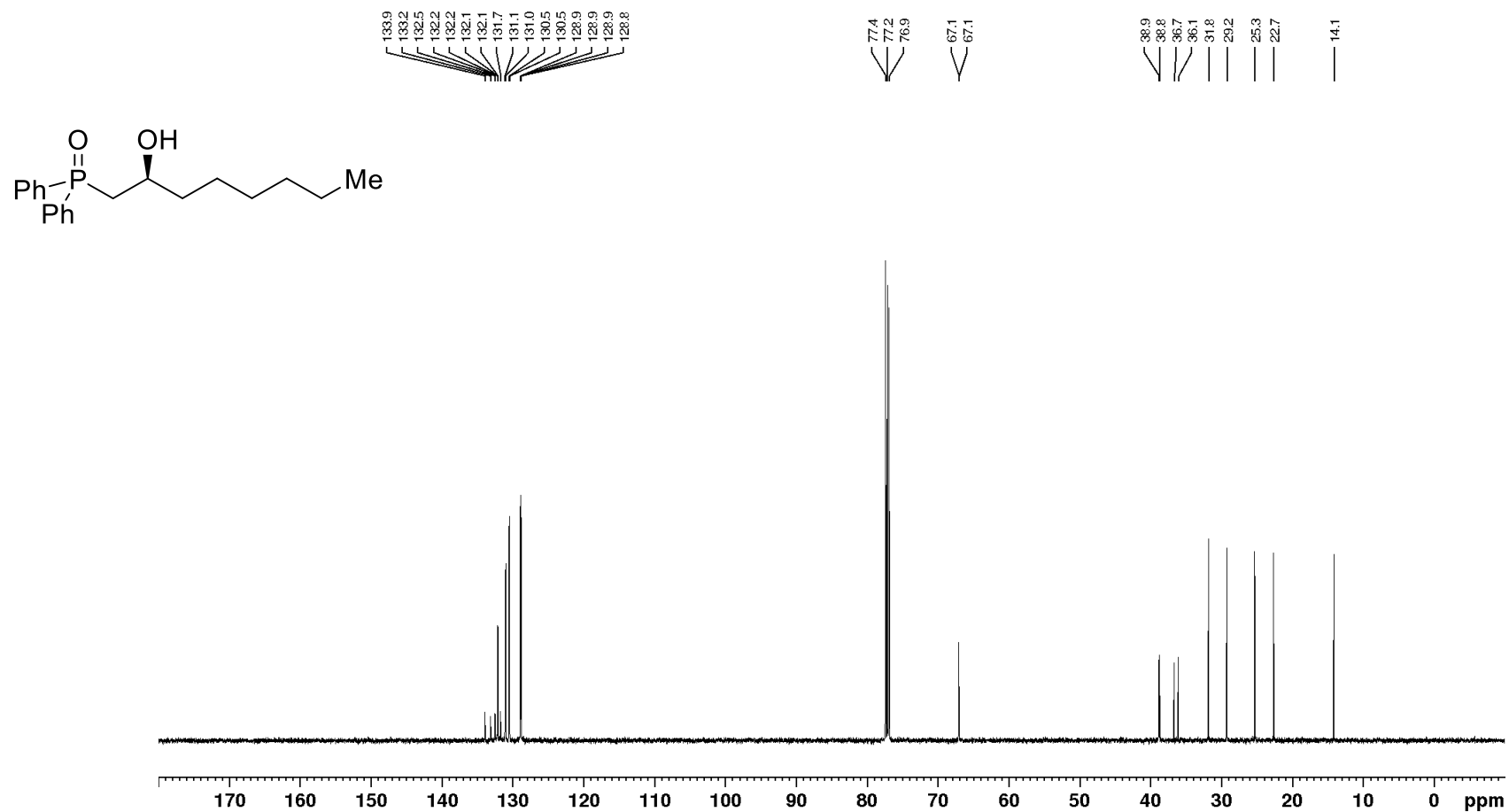
Figure S40. ^{13}C NMR (125 MHz, CDCl_3 , 298K) of **(S)**-(2-Hydroxyoctyl)diphenylphosphine Oxide [(S)-4i]

Figure S41. ^{31}P NMR (203 MHz, CDCl_3 , 298K) of **(S)**-(2-Hydroxyoctyl)diphenylphosphine Oxide [(S)-4i]