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ELECTRONIC SUPPORTING INFORMATION

Efficient synthesis of cyanohydrin trimethylsilyl ethers via 1,2-chemoselective cyanosilylation of carbonyls

Giacomo Strappaveccia[a], Daniela Lanari[b] *, Dmitri Gelman[c], Ferdinando Pizzo,[a] Ornelio Rosati[b], Massimo Curini[b] and Luigi Vaccaro[a]*

[a]*Laboratory of Green Synthetic Organic Chemistry, CEMIN - Dipartimento di Chimica, Università di Perugia Via Elce di Sotto, 8; Perugia, Italia. Fax: +39 075 5855560; Tel: +39 075 5855541; E-mail: luigi@unipg.it*
[b]*Dipartimento di Chimica e Tecnologia del Farmaco, Università di Perugia, Via del Liceo, 06123 Perugia, Italy.*
[c]*Institute of Chemistry, The Hebrew University, Edmond Safra Campus, Givat Ram, 91904 Jerusalem (Israel).*

CONTENTS

Experimental Section

Unless otherwise stated, all chemicals were purchased and used without any further purification. GC analyses were performed by using Hewlett-Packard HP 5890A equipped with a capillary column DB-35MS (30 m, 0.53 mm), a FID detector and helium as gas carrier. GC-EIMS analyses were carried out by using a Hewlett-Packard HP 6890N Network GC system/5975 Mass Selective Detector equipped with an electron impact ionizer at 70 eV.

All ^{1}H NMR and ^{13}C NMR spectra were recorded at 200 MHz or 400 MHz, and at 50.3 or 100.6 MHz respectively, using a Bruker DRX-ADVANCE 200 MHz and a Bruker DRX-ADVANCE 400 MHz spectrometers. The deuterated solvent used was $CDCl_3$, and TMS was employed as internal standard. Chemical shifts were reported in ppm and coupling constants in hertz. Elemental analyses were realized by using a FISONS instrument EA 1108 CHN.

Triphenylphosphine on polystyrene (PS-TPP) (2% cross linking, 200-400 mesh) was purchased from Aldrich.

Compounds **2a**[1], **2b**[2], **2c**[3], **2d**[4], **2f**[5], **2g**[6], **4a**[4], **4b**[4], **4c**[7], **4d**[4], **4e**[8], **4f**[9], **4g**[10], **4h**[10], **4i**[11], **4j**[11], **4k**[12], **4l**[6], **4m**[13] are known compounds. Compound **2e** is an unknown compound.

Characterization data and copies of the ^{1}H and ^{13}C NMR spectra for compounds **2a-g** and **4a-m** are reported below.

References

1. J. Cao, F. Zhou, J. Zhou, *Angew. Chem. Int. Ed.* **2010**, *49*, 4976 -4980
2. H. Deng, M. P. Isler, M. L. Snapper, A. H. Hoveyda, *Angew. Chem. Int. Ed.* **2002**, *41*, 1009-1012
3. Y. Hirata, T. Yukawa, N. Kashihara, Y. Nakao, T. Hiyama, *J. Am. Chem. Soc.* **2009**, *131*, 10964-10973
4. Z. Shen, S. Ji, *Synthetic Communications* **2009**, *39*, 775-791
5. S. S. Kim, G. Rajagopal, S. C. George, *Appl. Organometal. Chem.* **2007**, *21*, 368-372
6. S. M. Raders, J. G. Verkade, *Tetrahedron Lett.* **2009**, *50*, 5317-5321
7. S. J. Zuend, E. N. Jacobsen, *J. Am. Chem. Soc.* **2007**, *129*, 15872-15883
8. X. Wang, S. Tian, *Tetrahedron Lett.* **2007**, *48*, 6010-6013
9. B. M. Fetterly, J. G. Verkade, *Tetrahedron Lett.* **2005**, *46,* 8061-8066
10. S. C. George, S. S. Kim, S. T. Kadam, *Appl. Organometal. Chem*. **2007**, *21*, 994-998
11. Y. Teng, P. H. Toy, *Synlett* **2011**, 551-554
12. N. Kurono, M. Yamaguchi, K. Suzuki, T. Ohkuma, *J. Org. Chem.*, **2005**, *70*, 6530-6532
13. S. T. Kadam, S. S. Kim, *Bull. Korean Chem. Soc*., **2008**, *29*, 1320-1322

Batch procedure (20 mmol)

In a flask equipped with a magnetic stirrer PS-TPP (125 mg, 0.4 mmol, 3.2 mmol/g), acetophenone (**3a**) (d= 1.03, 2.3 mL, 2.4 g, 20 mmol), and TMSCN (d= 0.793, 2.75 mL, 2.18 g, 22 mmol) were consecutively added and the resulting mixture was left under stirring at 60 °C. After 3 hours the minimal amount of EtOAc to filter the catalyst was added (4 mL), then 4 x 1 mL of EtOAc were used to wash the catalyst from the remaining product (the effective presence of the product was checked after each addition of washing solvent). The organic layer was removed under vacuum and pure **4a** was obtained as an oil (99% yield, 4.33 g).

Cyclic-mode flow procedure (20 mmol)

Acetophenone (**3a**) (d = 1.03, 2.3 mL, 2.4 g, 20 mmol) and TMSCN (d= 0.793, 2.75 mL, 2.18 g, 22 mmol) were charged into a glass column functioning as reservoir and PS-TPP (0.4 mmol, 2 mol% measured on the ketone **3a,** 125 mg) was charged into a glass column (labelled as PS-TPP). The pump was set at 0.5 mL/min flow, and the reactor was heated to 60 °C. The reaction mixture was continuously pumped through the catalysts for 3 h untill complete conversion to **4a** was achieved.

At this point the pump was left to run in order to recover the reaction mixture into the reservoir. Then EtOAc (2 x 1 mL) was introduced into the system and cyclically pumped (10 min) to wash the catalyst and then collected into the reservoir. After the evaporation of the solvent product **4a** was obtained pure in 99% yield and with a very low E-factor of 0.47 (see below for calculation).

Recycling catalyst procedure

The catalyst into the column coming from the EtOAc washing, was dried by flowing nitrogen and reused ten times following the cyclic-mode flow procedure.

Continuous flow procedure (200 mmol)

Acetophenone (**3a**) (d= 1.03, 23 mL, 24 g, 200 mmol) and TMSCN (d = 0.793, 27.5 mL, 21.8 g, 220 mmol) were charged into a flask while PS-TPP (125 mg, 0.4 mmol, 3.2 mmol/g) was dispersed in 45-60 mesh borosilicate spheres and charged into a glass column .

The reaction mixture was pumped at a 0.04 mL/min flow rate trough the catalyst at 60 °C for 20 h, and collected into a recovery flask. EtOAc (2.5 mL x 2) was then cyclically pumped through the catalyst, the system was washed and the product **4a** was recovered in 99% yield (oil, 43.3 g) and with a 0.16 E-factor value (see below for calculation).

Representative E-Factor calculation

-**Batch** (0.5 mmol):
(Acetophenone (60 mg) + TMSCN (54 mg) + Washing EtO2 (710 mg) + PS-TPP (3 mg) – Product mass (106 mg)) / Product mass (106 mg) = **7**

-**Batch** (20 mmol):
(Acetophenone (2.4 g)+TMSCN (2.18 g)+Washing EtOAc (7.2 g) – Product mass (4.34 g)) / Product mass (4.34 g) = **1.7**

-**Cyclic-mode flow reactor** (20 mmol) (1st run):
(Acetophenone (2.4 g)+TMSCN (2.18 g)+Washing EtOAc (1.8 g) – Product mass (4.34 g)) / Product mass (4.34 g) = **0.47**

- **Continuous flow reactor** (200 mmol):
(Acetophenone (24 g) + TMSCN (21.8 g) + Washing EtOAc (4.5 g) – Product mass (43.4 g)) / Product mass (43.4 g)= **0.16**

S. A. Pourmousavi et al. Bulletin of the Korean Chemical Society (2011), 32(5), 1575-1578
To a stirred mixture of aldehyde (1 mmol) and TMSCN (1.5 mmol) was added SbCl3 (17 mol % for aldehydes and 26 mol % for ketones) at room temperature in a 10 mL round bottom flask. The reaction mixture was stirred continuously and progress of the reaction was followed by TLC using Cyclohexane/ Ethylacetate (9:1) as eluent. After completion of the reaction, the mixture was washed with n-hexane (3 × 5 mL) and filtered off. The combined organic layers were washed with distilled water (3 × 5 mL) and then dried over MgSO4 and evaporated under vacuum to give almost pure cyanosilylether. Further purification, if necessary, was preceded using preparative TLC by an appropriate solvent.

E-Factor: ((1 mmol acetophenone (120 mg) + 1.5 mmol TMSCN (149 mg) + 0.26 mmol SbCl3 (59 mg) + 15 ml hexane (9.8 g) + 15 ml water (15 g) – weight product (98% yield) (215 mg)) / weight product (98% yield) (215 mg)= **116**

Mohammad G. Dekamin et al. Applied Organometallic Chemistry (2010), 24(3), 229-235
TMSCN (1.2 mmol, 0.15 ml) was added to a mixture of 1.0 mmol of carbonyl compound and PBPDC (1, 0.02 mmol, 5.8 mg). The resulting mixture was stirred at room temperature for time indicated in Table 2. The reaction was monitored by TLC. After completion, the reaction mixture was quenched with water (1.0 ml) and the organic materials were extracted with EtOAc (2 × 1.5ml). The organic phase was washed with brine followed by water (1.5 ml) and dried over MgSO4. The solvent was evaporated under reduced pressure to afford the desired products which in some cases were essentially pure cyanohydrin TMS ethers. Further purification of the products could be performed by silica gel column chromatography (EtOAc–hexane, 1 : 10). The isolated yields were in good agreement with those obtained by GC analysis.

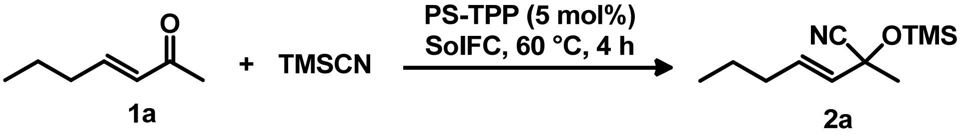
E-Factor: ((1 mmol acetophenone (120 mg) + 1.2 mmol TMSCN (119 mg) + 0.02 mmol PBPDC (5.8 mg) + 2.5 ml water (2.5 g) + 3 ml EtOAc (2.7 g) – weight product (62% yield) (136 mg)) / weight product (62% yield) (136 mg)= 39

Marc Taillefer et al. Chem.- Eur. J. (2011), (17), 12276–12279

After standard cycles of evacuation and back-filling with dry and pure nitrogen, an oven-dried tube (Carousel ThermoFischer Scientific Omnistation) or a Schlenk tube equipped with a magnetic stirring bar was charged with the aldehyde or ketone (1.74 mmol, 1 eq.) trimethylsilylcyanide (280 µL, 2.09 mmol, 1.2 eq.) and PNPCl catalyst. The tube was sealed under a positive pressure of nitrogen and stirred at room temperature for 1 to 8 hours. The crude product was purified by silica gel chromatography with heptanes/diethylether mixture.
E-Factor: ((1.74 mmol acetophenone (209 mg) + 2.1 mmol TMSCN (207 mg) + 0.017 mmol PNPCl (10 mg) – weight product (90% yield) (343 mg)) / weight product (90% yield) (343 mg) = 0.24

In the calculation is not reported the consumption of solvents for silica gel chromatography because not reported.

Chem. Name	(E)-2-methyl-2-((trimethylsilyl)oxy)hept-3-enenitrile **(2a)**
Lit. Ref.	*Angew. Chem. Int. Ed.* **2010**, *49*, 4976-4980



Mol.Wt.:211

METHOD:
In a screw capped vial equipped with a magnetic stirrer PS-TPP (8 mg, 0.025 mmol, 3.2 mmol/g), (E)-hept-3-en-2-one (**1a**) (0.065 mL, 0.5 mmol), and TMSCN (0.075 mL, 0.6 mmol) were consecutively added and the resulting mixture was left under stirring at 60 °C. After 4 hours Et_2O (1 mL) was added and the catalyst was filtered off and the solvent was removed under vacuum. In this way pure (E)-2-methyl-2-((trimethylsilyl)oxy)hept-3-enenitrile (**2a**) was obtained as an oil (99% yield, 104 mg).

Mol Formula	$C_{11}H_{21}NOSi$	**m.p.**	Oil

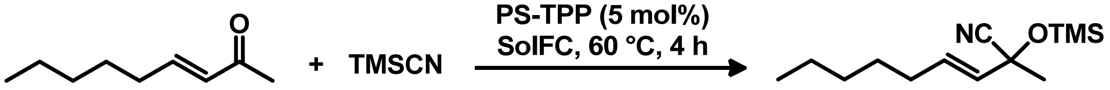
Elemental Analysis: Calcd. C, 62.50; H, 10.01; N, 6.63; found C, 62.35; H, 10.07; N, 6.59

^{1}H NMR 400 MHz $CDCl_3$	**δ value**	**No. H**	**Mult.**	**j value/Hz**
	0.20	9	*s*	
	0.92	3	*t*	7.4
	1.39-1.49	2	*m*	
	1.63	3	*s*	
	2.03-2.08	2	*m*	
	5.45	1	*d*	15.5
	6.00	1	*dt*	15.5; 6.8

^{13}C NMR (100.6 MHz, $CDCl_3$) δ : 1.1; 13.4; 21.6; 30.6; 33.5; 69.5; 120.6; 130.8; 132.2.

GC-EIMS (m/z, %): 211 (M^+, 1), 196 (54), 169 (55), 154 (19), 127 (50), 97 (61), 75 (100), 73 (47), 55 (19), 45 (19).

Chem. Name	(E)-2-methyl-2-((trimethylsilyl)oxy)non-3-enenitrile **(2b)**
Lit. Ref.	*Angew. Chem. Int. Ed.* **2002**, *41*, 1009-1012



1b

2b

Mol.Wt.: 239

METHOD:
In a screw capped vial equipped with a magnetic stirrer PS-TPP (8 mg, 0.025 mmol, 3.2 mmol/g), (E)-non-3-en-2-one (**1b**) (0.087 mL, 0.5 mmol), and TMSCN (0.075 mL, 0.6 mmol) were consecutively added and the resulting mixture was left under stirring at 60 °C. After 4 hours Et_2O (1 mL) was added and the catalyst was filtered off and the solvent was removed under vacuum. In this way pure (E)-2-methyl-2-((trimethylsilyl)oxy)non-3-enenitrile (**2b**) was obtained as an oil (94% yield, 113 mg).

Mol Formula	$C_{13}H_{25}NOSi$	**m.p.**	Oil

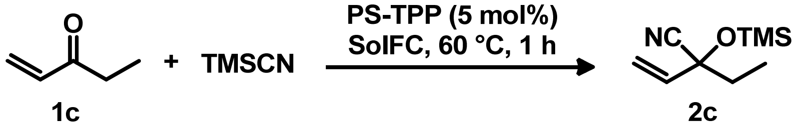
Elemental Analysis: C, 65.21; H, 10.52; N, 5.85; found C, 65.31; H, 10.49; N, 5.80

	δ value	**No. H**	**Mult.**	**j value/Hz**
^{1}H NMR 400 MHz $CDCl_3$	0.21	9	*s*	
	0.89	3	*t*	6.6
	1.24-1.46	6	*m*	
	1.63	3	*s*	
	2.04-2.10	2	*m*	
	5.45	1	*d*	15.4
	6.01	1	*dt*	15.4; 6.8

^{13}C NMR (100.6 MHz, $CDCl_3$) δ : 1.3; 13.9; 22.3; 28.2; 30.8; 31.3; 31.6; 69.8; 120.9; 130.6; 132.7.

GC-EIMS (m/z, %): 239 (M^+,1), 224 (57), 197 (38), 154 (36), 127 (51), 125 (47), 75 (100), 73 (58), 55 (30).

Chem. Name	2-ethyl-2-((trimethylsilyl)oxy)but-3-enenitrile **(2c)**
Lit. Ref.	*J. Am. Chem. Soc.* ***2009****, 131, 10964-10973*



1c **2c**

Mol.Wt.: 183

METHOD:
In a screw capped vial equipped with a magnetic stirrer PS-TPP (8 mg, 0.025 mmol, 3.2 mmol/g), pent-1-en-3-one (**1c**) (0.050 mL, 0.5 mmol), and TMSCN (0.075 mL, 0.6 mmol) were consecutively added and the resulting mixture was left under stirring at 60 °C. After 1 hour Et_2O (1 mL) was added and the catalyst was filtered off and the solvent was removed under vacuum. In this way pure 2-ethyl-2-((trimethylsilyl)oxy)but-3-enenitrile (**2c**) was obtained as an oil (80% yield, 73 mg).

Mol Formula	$C_9H_{17}NOSi$	**m.p.**	Oil

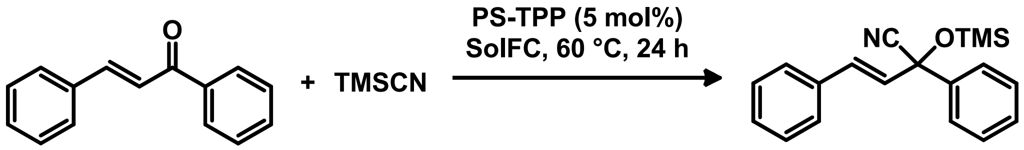
Elemental Analysis: C, 58.96; H, 9.35; N, 7.64; found C, 58.80; H, 9.30; N, 7.58

^{1}H NMR 400 MHz $CDCl_3$	**δ value**	**No. H**	**Mult.**	**j value/Hz**
	0.22	9	*s*	
	1.02	3	*t*	7.4
	1.70-1.79	1	*m*	
	1.82-1.91	1	*m*	
	5.32	1	*d*	10.3
	5.58	1	*d*	17.1
	5.76	1	*dd*	17.1; 10.3

^{13}C NMR (100.6 MHz, $CDCl_3$) δ : 1.2; 8.1, 35.7; 74.7; 116.8; 119.6; 137.6.

GC-EIMS (m/z, %): 183 (M^+, 1), 168 (14), 154 (65), 141 (52), 84 (18), 75 (100), 73 (79), 55 (86), 45 (32).

Chem. Name	(E)-2,4-diphenyl-2-((trimethylsilyl)oxy)but-3-enenitrile **(2d)**
Lit. Ref.	*Synthetic Communications* ***2009****, 39, 775-791*



1d

2d

Mol.Wt.: 307

METHOD:
In a screw capped vial equipped with a magnetic stirrer PS-TPP (8 mg, 0.025 mmol, 3.2 mmol/g), (E)-chalcone (**1d**) (104 mg, 0.5 mmol), and TMSCN (0.075 mL, 0.6 mmol) were consecutively added and the resulting mixture was left under stirring at 60 °C. After 24 hours Et_2O (1 mL) was added and the catalyst was filtered off and the solvent was removed under vacuum. In this way pure (E)-2,4-diphenyl-2-((trimethylsilyl)oxy)but-3-enenitrile (**2d**) was obtained as an oil (97% yield, 150 mg).

Mol Formula	$C_{19}H_{21}NOSi$	**m.p.**	Oil

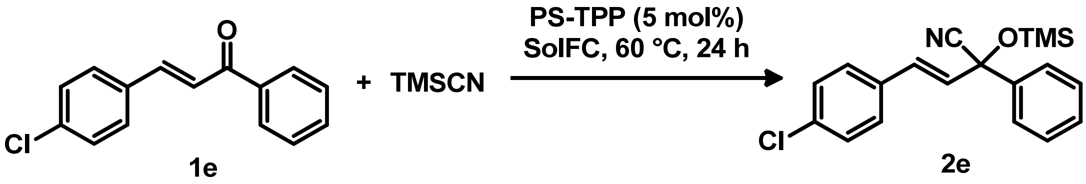
Elemental Analysis: C, 74.22; H, 6.88; N, 4.56; found C, 74.30; H, 6.90; N, 4.50

^{1}H NMR 400 MHz $CDCl_3$	**δ value**	**No. H**	**Mult.**	**j value/Hz**
	0.24	9	*s*	
	6.19	1	*d*	15.8
	7.00	1	*d*	15.8
	7.28-7.42	8	*m*	
	7.56-7.58	2	*m*	

^{13}C NMR (100.6 MHz, $CDCl_3$) δ : 1.4; 75.1; 119.7; 125.5; 127.1; 128.8; 128.9; 129.8; 131.0; 135.1; 140.4.

GC-EIMS (m/z, %): 307 (M^+, 81), 292 (57), 217 (65), 208 (85), 191 (48), 180 (45), 140 (100), 105 (48), 73 (77).

Chem. Name	(E)-4-(4'-chlorophenyl)-2-phenyl-2-((trimethylsilyl)oxy)but-3-enenitrile **(2e)**
Lit. Ref.	/



1e **2e**

Mol.Wt.: 341

METHOD:
In a screw capped vial equipped with a magnetic stirrer PS-TPP (8 mg, 0.025 mmol, 3.2 mmol/g), (E)-3-(4'-chlorophenyl)-1-phenylprop-2-en-1-one (**1e**) (121 mg, 0.5 mmol), and TMSCN (0.075 mL, 0.6 mmol) were consecutively added and the resulting mixture was left under stirring at 60 °C. After 24 hours Et_2O (1 mL) was added and the catalyst was filtered off and the solvent was removed under vacuum. In this way pure (E)-4-(4'-chlorophenyl)-2-phenyl-2-((trimethylsilyl)oxy)but-3-enenitrile (**2e**) was obtained as an oil (90% yield, 153 mg).

Mol Formula	$C_{19}H_{20}ClNOSi$	**m.p.**	Oil

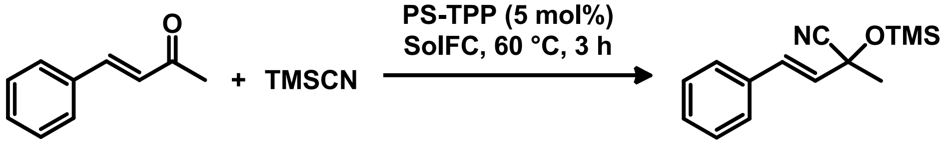
Elemental Analysis: C, 66.74; H, 5.90; N, 4.10; found C, 66.78; H, 5.91; N, 4.13

^{1}H NMR 400 MHz $CDCl_3$	**δ value**	**No. H**	**Mult.**	**j value/Hz**
	0.23	9	*s*	
	6.16	1	*d*	15.8
	6.94	1	*d*	15.8
	7.29-7.43	7	*m*	
	7.55-7.57	2	*m*	

^{13}C NMR (100.6 MHz, $CDCl_3$) δ : 1.3; 75.0; 119.5; 125.5; 128.3; 128.8; 128.9; 129.0; 129.5; 130.4; 133.6; 134.4; 140.1.

GC-EIMS (m/z, %): 343 (M^++2, 38), 341 (M^+, 97), 326 (37), 252 (39), 242 (74), 225 (42), 216 (64), 214 (67), 207 (70), 179 (48), 140 (81), 105 (41), 73 (100).

Chem. Name	(E)-2-methyl-4-phenyl-2-((trimethylsilyl)oxy)but-3-enenitrile **(2f)**
Lit. Ref.	*Appl. Organometal. Chem.* ***2007**, 21, 368-372*



1f

2f

Mol.Wt.: 245

METHOD:
In a screw capped vial equipped with a magnetic stirrer PS-TPP (0.008 mg, 0.025 mmol, 3.2 mmol/g), (E)-4-phenylbut-3-en-2-one (**1f**) (73 mg, 0.5 mmol), and TMSCN (0.094 mL, 0.75 mmol) were consecutively added and the resulting mixture was left under stirring at 60 °C. After 3 hours Et_2O (1 mL) was added and the catalyst was filtered off and the solvent was removed under vacuum. In this way pure (E)-2-methyl-4-phenyl-2-((trimethylsilyl)oxy)but-3-enenitrile (**2f**) was obtained as an oil (90% yield, 110 mg).

Mol Formula	$C_{14}H_{19}NOSi$	**m.p.**	Oil

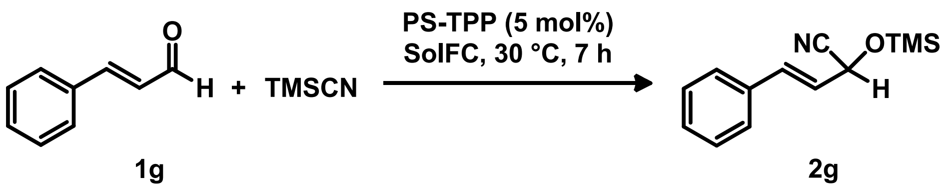
Elemental Analysis: C, 68.52; H, 7.80; N, 5.71; found C, 68.60; H, 7.77; N, 5.68

^{1}H NMR 400 MHz $CDCl_3$	**δ value**	**No. H**	**Mult.**	**j value/Hz**
	0.25	9	*s*	
	1.76	3	*s*	
	6.14	1	*d*	15.9
	6.89	1	*d*	15.9
	7.29-7.43	5	*m*	

^{13}C NMR (100.6 MHz, $CDCl_3$) δ : 1.4; 30.9; 70.0; 120.7; 126.9; 128.6; 128.8; 129.6; 131.0; 135.1.

GC-EIMS (m/z, %): 245 (M^+, 23), 230 (54), 202 (30), 156 (16), 131 (100), 129 (29), 128 (25), 103 (17), 77 (15), 75 (59), 73 (48).

Chem. Name	(E)-4-phenyl-2-((trimethylsilyl)oxy)but-3-enenitrile **(2g)**
Lit. Ref.	*Tetrahedron Lett.* ***2009****, 50, 5317-5321*



Mol.Wt.: 231

METHOD:
In a screw capped vial equipped with a magnetic stirrer PS-TPP (8 mg, 0.025 mmol, 3.2 mmol/g), cinnamaldehyde (**1g**) (66 mg, 0.5 mmol), and TMSCN (0.075 mL, 0.6 mmol) were consecutively added and the resulting mixture was left under stirring at 30 °C. After 7 hours Et_2O (1 mL) was added and the catalyst was filtered off and the solvent was removed under vacuum. In this way pure (E)-4-phenyl-2-((trimethylsilyl)oxy)but-3-enenitrile (**2g**) was obtained as an oil (96% yield, 111 mg).

Mol Formula	$C_{13}H_{17}NOSi$	**m.p.**	Oil

Elemental Analysis: C, 67.49; H, 7.41; N, 6.05; found C, 67.55; H, 7.45; N, 6.00

^{1}H NMR 400 MHz $CDCl_3$	**δ value**	**No. H**	**Mult.**	**j value/Hz**
	0.26	9	*s*	
	5.12	1	*d*	5.9
	6.19	1	*dd*	15.8; 5.9
	6.81	1	*d*	15.8
	7.29-7.42	5	*m*	

^{13}C NMR (100.6 MHz, $CDCl_3$) δ : 0.2; 62.1; 118.3; 123.5; 126.9; 128.7; 128.7; 133.8; 134.9.

GC-EIMS (m/z, %): 231 (M^+, 36), 216 (46), 189 (35), 142 (36), 131 (27), 115 (100), 104 (98), 75 (28), 73 (70).

Chem. Name	2-phenyl-2-((trimethylsilyl)oxy)propanenitrile **(4a)**
Lit. Ref.	*Synthetic Communications **2009**, 39, 775-791*

Mol.Wt.: 219

METHOD:
In a screw capped vial equipped with a magnetic stirrer PS-TPP (3 mg, 0.01 mmol, 3.2 mmol/g), acetophenone (**3a**) (0.058 mL, 0.5 mmol), and TMSCN (0.069 mL, 0.55 mmol) were consecutively added and the resulting mixture was left under stirring at 60 °C. After 3 hours Et_2O (1 mL) was added and the catalyst was filtered off and the solvent was removed under vacuum. In this way pure 2-phenyl-2-((trimethylsilyl)oxy)propanenitrile (**4a**) was obtained as an oil (97% yield, 106 mg).

Mol Formula	$C_{12}H_{17}NOSi$	**m.p.**	Oil

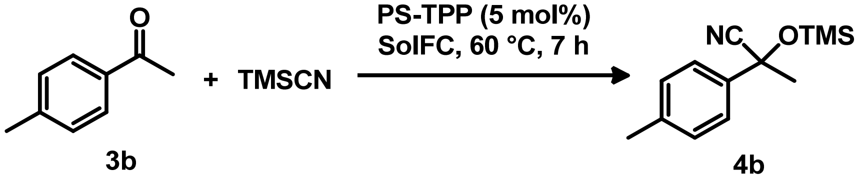
Elemental Analysis: C, 65.71; H, 7.81; N, 6.39; found C, 65.68; H, 7.85; N, 6.44

^{1}H NMR 400 MHz $CDCl_3$	**δ value**	**No. H**	**Mult.**	**j value/Hz**
	0.18	9	*s*	
	1.86	3	*s*	
	7.33-7.42	3	*m*	
	7.54-7.55	2	*m*	

^{13}C NMR (100.6 MHz, $CDCl_3$) δ : 1.0; 33.6; 71.6; 121.6; 124.6; 128.6, 142.0.

GC-EIMS (m/z, %): 219 (M^+, 1), 204 (84), 177 (100), 135 (22), 105 (62), 77 (26), 75 (66).

Chem. Name	2-(p-tolyl)-2-((trimethylsilyl)oxy)propanenitrile **(4b)**
Lit. Ref.	*Synthetic Communications* ***2009****, 39, 775-791*



Mol.Wt.: 233

METHOD:
In a screw capped vial equipped with a magnetic stirrer PS-TPP (7.5 mg, 0.025 mmol, 3.2 mmol/g), 1-(p-tolyl)ethanone (**3b**) (0.067 mL, 0.5 mmol), and TMSCN (0.069 mL, 0.55 mmol) were consecutively added and the resulting mixture was left under stirring at 60 °C. After 7 hours Et_2O (1 mL) was added and the catalyst was filtered off and the solvent was removed under vacuum. In this way pure 2-(p-tolyl)-2-((trimethylsilyl)oxy)propanenitrile (**4b**) was obtained as an oil (96% yield, 112 mg).

Mol Formula	$C_{13}H_{19}NOSi$	**m.p.**	Oil

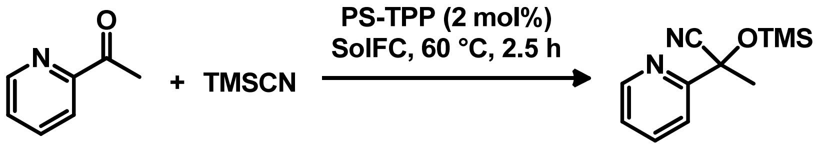
Elemental Analysis: C, 66.90; H, 8.21; N, 6.00; found C, 66.88; H, 8.26; N, 6.02

	δ value	**No. H**	**Mult.**	**j value/Hz**
^{1}H NMR 400 MHz $CDCl_3$	0.16	9	*s*	
	1.84	3	*s*	
	2.36	3	*s*	
	7.18-7.20	2	*m*	
	7.41-7.43	2	*m*	

^{13}C NMR (100.6 MHz, $CDCl_3$) δ : 1.0; 20.9; 33.4; 71.4; 121.6; 124.5; 129.2; 138.4; 139.0.

GC-EIMS (m/z, %): 233 (M^+, 6), 218 (87), 191 (57), 119 (100), 91 (22), 75 (69).

Chem. Name	2-(pyridin-2-yl)-2-((trimethylsilyl)oxy)propanenitrile **(4c)**
Lit. Ref.	*J. Am. Chem. Soc.* ***2007**, 129, 15872-15883*



3c

4c

Mol.Wt.: 220

METHOD:
In a screw capped vial equipped with a magnetic stirrer PS-TPP (3 mg, 0.01 mmol, 3.2 mmol/g), 1-(pyridin-2-yl)ethanone (**3c**) (0.056 mL, 0.5 mmol), and TMSCN (0.069 mL, 0.55 mmol) were consecutively added and the resulting mixture was left under stirring at 60 °C. After 2.5 hours Et_2O (1 mL) was added and the catalyst was filtered off and the solvent was removed under vacuum. In this way pure 2-(pyridin-2-yl)-2-((trimethylsilyl)oxy)propanenitrile (**4c**) was obtained as an oil (96% yield, 105 mg).

Mol Formula	$C_{11}H_{16}N_2OSi$	**m.p.**	Oil

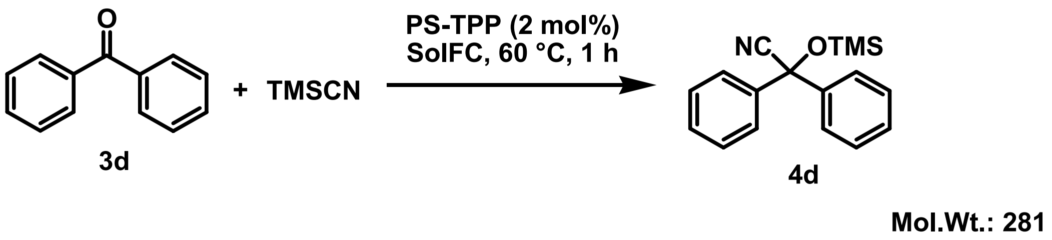
Elemental Analysis: C, 59.96; H, 7.32; N, 12.71; found C, 60.02; H, 7.27; N, 12.65

	δ value	No. H	Mult.	j value/Hz
^{1}H NMR 400 MHz $CDCl_3$	0.25	9	*s*	
	1.92	3	*s*	
	7.26-7.30	1	*m*	
	7.59-7.61	1	*m*	
	7.75-7.79	1	*m*	
	8.62-8.63	1	*m*	

^{13}C NMR (100.6 MHz, $CDCl_3$) δ : 1.1; 31.2; 72.9; 119.0; 121.3; 123.4; 137.2; 149.0; 160.0.

GC-EIMS (m/z, %): 220 (M^+, 3), 205 (100), 190 (22), 178 (61).

Chem. Name	2,2-diphenyl-2-((trimethylsilyl)oxy)acetonitrile **(4d)**
Lit. Ref.	*Synthetic Communications* ***2009****, 39, 775-791*



METHOD:
In a screw capped vial equipped with a magnetic stirrer PS-TPP (3 mg, 0.01 mmol, 3.2 mmol/g), benzophenone (**3d**) (91 mg, 0.5 mmol), and TMSCN (0.069 mL, 0.55 mmol) were consecutively added and the resulting mixture was left under stirring at 60 °C. After 1 hour Et_2O (1 mL) was added and the catalyst was filtered off and the solvent was removed under vacuum. In this way pure 2,2-diphenyl-2-((trimethylsilyl)oxy)acetonitrile (**4d**) was obtained as an oil (98% yield, 138 mg).

Mol Formula	$C_{17}H_{19}NOSi$	**m.p.**	Oil

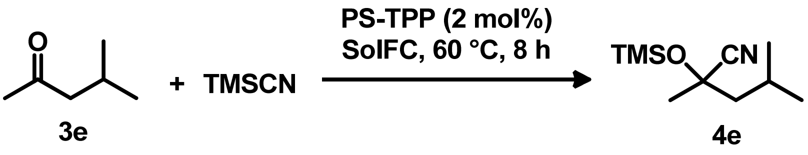
Elemental Analysis: C, 72.55; H, 6.80; N, 4.98; found C, 72.60; H, 6.77; N, 4.95

^{1}H NMR 400 MHz $CDCl_3$	**δ value**	**No. H**	**Mult.**	**j value/Hz**
	0.13	9	*s*	
	7.30-7.38	6	*m*	
	7.49-7.51	4	*m*	

^{13}C NMR (100.6 MHz, $CDCl_3$) δ: 0.9; 76.3; 120.7; 125.9; 128.5; 128.6; 141.9.

GC-EIMS (m/z, %): 205 (20), 190 (100), 116 (24), 105 (21), 84 (32).

Chem. Name	2,4-dimethyl-2-((trimethylsilyl)oxy)pentanenitrile **(4e)**
Lit. Ref.	*Tetrahedron Lett.* ***2007****, 48, 6010–6013*



Mol.Wt.: 199

METHOD:
In a screw capped vial equipped with a magnetic stirrer PS-TPP (3 mg, 0.01 mmol, 3.2 mmol/g), 4-methylpentan-2-one (**3e**) (0.062 mL, 0.5 mmol), and TMSCN (0.069 mL, 0.55 mmol) were consecutively added and the resulting mixture was left under stirring at 60 °C. After 8 hours Et_2O (1 mL) was added and the catalyst was filtered off and the solvent was removed under vacuum. In this way pure 2,4-dimethyl-2-((trimethylsilyl)oxy)pentanenitrile (**4e**) was obtained as an oil (72% yield, 72 mg).

Mol Formula	$C_{10}H_{21}NOSi$	**m.p.**	Oil

Elemental Analysis: C, 60.24; H, 10.62; N, 7.03; found C, 60.20; H, 10.70; N, 7.05

^{1}H NMR 400 MHz $CDCl_3$	**δ value**	**No. H**	**Mult.**	**j value/Hz**
	0.24	9	*s*	
	1.01	6	*dd*	6.6; 4.2
	1.58-1.69	5	*m*	
	1.89-1.98	1	*m*	

^{13}C NMR (100.6 MHz, $CDCl_3$) δ : 1.3; 23.7; 23.8; 24.9; 29.8; 51.4; 69.1; 122.6.

GC-EIMS (m/z, %): 184 (19), 157 (72), 142 (46), 115 (75), 100 (100), 75 (56), 73 (78), 45 (24).

Chem. Name	2-methyl-2-((trimethylsilyl)oxy)decanenitrile **(4f)**
Lit. Ref.	*Tetrahedron Lett.* ***2005****, 46, 8061–8066*

Mol.Wt.: 255

METHOD:
In a screw capped vial equipped with a magnetic stirrer PS-TPP (3 mg, 0.01 mmol, 3.2 mmol/g), decan-2-one (**3f**) (78 mg, 0.5 mmol), and TMSCN (0.069 mL, 0.55 mmol) were consecutively added and the resulting mixture was left under stirring at 60 °C. After 4.5 hours Et_2O (1 mL) was added and the catalyst was filtered off and the solvent was removed under vacuum. In this way pure 2-methyl-2-((trimethylsilyl)oxy)decanenitrile (**4f**) was obtained as an oil (96% yield, 122 mg).

Mol Formula	$C_{14}H_{29}NOSi$	**m.p.**	Oil

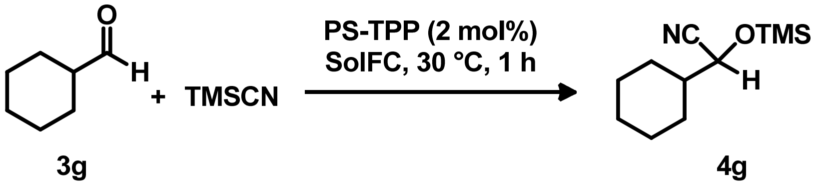
Elemental Analysis: C, 65.82; H, 11.44; N, 5.48; found C, 65.88; H, 11.46; N, 5.44

	δ value	**No. H**	**Mult.**	**j value/Hz**	
^{1}H NMR 400 MHz $CDCl_3$	0.23	9	*s*		
	0.88	3	*t*	6.4	
	1.27-1.29	9	*m*		
	1.39-1.60	6	*m*		
	1.67-1.76	2	*m*		

^{13}C NMR (100.6 MHz, $CDCl_3$) δ : 1.2; 14.1; 22.6; 24.2; 28.8; 29.1; 29.3; 29.3; 31.8; 43.3; 69.6; 122.2.

GC-EIMS (m/z, %): 233 (6), 218 (84), 191 (53), 119 (100), 91 (22), 75 (71).

Chem. Name	2-cyclohexyl-2-((trimethylsilyl)oxy)acetonitrile **(4g)**
Lit. Ref.	*Appl. Organometal. Chem.* ***2007****, 21, 994–998*



Mol.Wt.: 211

METHOD:
In a screw capped vial equipped with a magnetic stirrer PS-TPP (3 mg, 0.01 mmol, 3.2 mmol/g), cyclohexanecarbaldehyde (**3g**) (0.061 mL, 0.5 mmol), and TMSCN (0.069 mL, 0.55 mmol) were consecutively added and the resulting mixture was left under stirring at 30 °C. After 1 hour Et_2O (1 mL) was added and the catalyst was filtered off and the solvent was removed under vacuum. In this way pure 2-cyclohexyl-2-((trimethylsilyl)oxy)acetonitrile (**4g**) was obtained as an oil (83% yield, 88 mg).

Mol Formula	$C_{11}H_{21}NOSi$	**m.p.**	Oil

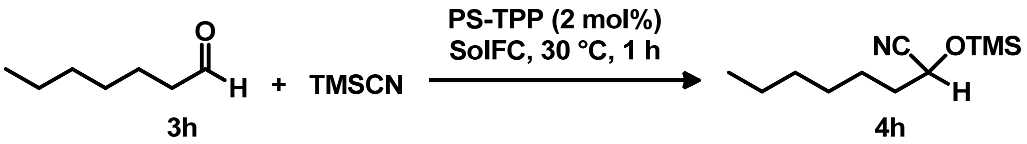
Elemental Analysis: C, 62.50; H, 10.01; N, 6.63; found C, 62.45; H, 10.07; N, 6.60

^{1}H NMR 400 MHz $CDCl_3$	**δ value**	**No. H**	**Mult.**	**j value/Hz**
	0.20	9	*s*	
	1.00-1.32	5	*m*	
	1.60-1.71	2	*m*	
	1.77-1.89	4	*m*	
	4.14	1	*d*	6.4

^{13}C NMR (100.6 MHz, $CDCl_3$) δ : -0.5; 25.5; 26.0; 27.8; 28.1; 28.8; 42.9; 66.4; 119.4.

GC-EIMS (m/z, %): 211 (M^+, 1), 169 (31), 129 (100), 75 (28), 73 (21).

Chem. Name	2-((trimethylsilyl)oxy)octanenitrile **(4h)**
Lit. Ref.	*Appl. Organometal. Chem.* ***2007****, 21, 994–998*



Mol.Wt.: 213

METHOD:
In a screw capped vial equipped with a magnetic stirrer PS-TPP (3 mg, 0.01 mmol, 3.2 mmol/g), heptanal (**3h**) (0.067 mL, 0.5 mmol), and TMSCN (0.069 mL, 0.55 mmol) were consecutively added and the resulting mixture was left under stirring at 30 °C. After 1 hour Et_2O (1 mL) was added and the catalyst was filtered off and the solvent was removed under vacuum. In this way pure 2-((trimethylsilyl)oxy)octanenitrile (**4h**) was obtained as an oil (85% yield, 90 mg).

Mol Formula	$C_{11}H_{23}NOSi$	**m.p.**	Oil

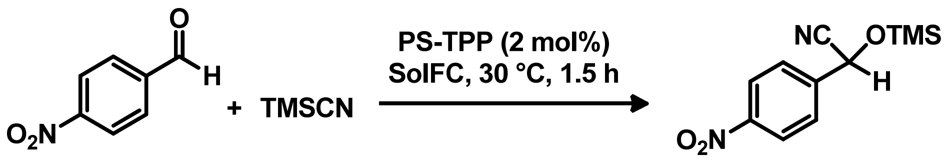
Elemental Analysis: C, 61.91; H, 10.86; N, 6.56; found C, 61.99; H, 10.80; N, 6.60

^{1}H NMR 400 MHz $CDCl_3$	**δ value**	**No. H**	**Mult.**	**j value/Hz**
	0.20	9	*s*	
	0.89	3	*t*	5.9
	1.25-1.36	6	*m*	
	1.40-1.48	2	*m*	
	1.75-1.81	2	*m*	
	4.38	1	*t*	6.6

^{13}C NMR (100.6 MHz, $CDCl_3$) δ : -0.4; 14.0; 22.4; 24.5; 28.5; 31.5; 36.2; 61.4; 120.1.

GC-EIMS (m/z, %): 198 (38), 171 (100), 114 (20), 101 (29), 97 (23), 84 (21), 75 (58), 73 (50), 55 (81).

Chem. Name	2-(4’-nitrophenyl)-2-((trimethylsilyl)oxy)acetonitrile **(4i)**
Lit. Ref.	*Synlett **2011**, 551-554*



3i **4i**

Mol.Wt.: 250

METHOD:
In a screw capped vial equipped with a magnetic stirrer PS-TPP (3 mg, 0.01 mmol, 3.2 mmol/g), 4-nitrobenzaldehyde (**3i**) (75 mg, 0.5 mmol), and TMSCN (0.069 mL, 0.55 mmol) were consecutively added and the resulting mixture was left under stirring at 30 °C. After 1.5 hours Et_2O (1 mL) was added and the catalyst was filtered off and the solvent was removed under vacuum. In this way pure 2-(4’-nitrophenyl)-2-((trimethylsilyl)oxy)acetonitrile (**4i**) was obtained as an oil (95% yield, 119 mg).

Mol Formula	$C_{11}H_{14}N_2O_3Si$	**m.p.**	Oil

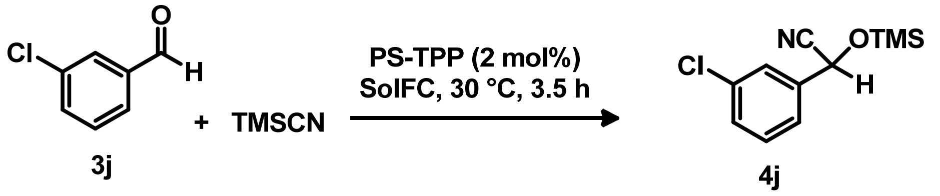
Elemental Analysis: C, 52.78; H, 5.64; N, 11.19; found C, 52.86; H, 5.60; N, 11.24

^{1}H NMR 400 MHz $CDCl_3$	**δ value**	**No. H**	**Mult.**	**j value/Hz**
	0.29	9	*s*	
	5.59	1	*s*	
	7.66-7.68	2	*m*	
	8.28-8.30	2	*m*	

^{13}C NMR (100.6 MHz, $CDCl_3$) δ : 0.4; 62.6; 118.1; 124.1; 127.1; 142.8; 148.4.

GC-EIMS (m/z, %): 235 (100), 84 (63), 75 (10), 73 (13), 45 (10).

Chem. Name	2-(3'-chlorophenyl)-2-((trimethylsilyl)oxy)acetonitrile **(4j)**
Lit. Ref.	*Synlett* ***2011**, 551-554*



Mol.Wt.: 239

METHOD:
In a screw capped vial equipped with a magnetic stirrer PS-TPP (3 mg, 0.01 mmol, 3.2 mmol/g), 3-chlorobenzaldehyde (**3j**) (0.057 mL, 0.5 mmol), and TMSCN (0.069 mL, 0.55 mmol) were consecutively added and the resulting mixture was left under stirring at 30 °C. After 3.5 hours Et_2O (1 mL) was added and the catalyst was filtered off and the solvent was removed under vacuum. In this way pure 2-(3'-chlorophenyl)-2-((trimethylsilyl)oxy)acetonitrile (**4j**) was obtained as an oil (96% yield, 115 mg).

Mol Formula	$C_{11}H_{14}ClNOSi$	**m.p.**	Oil

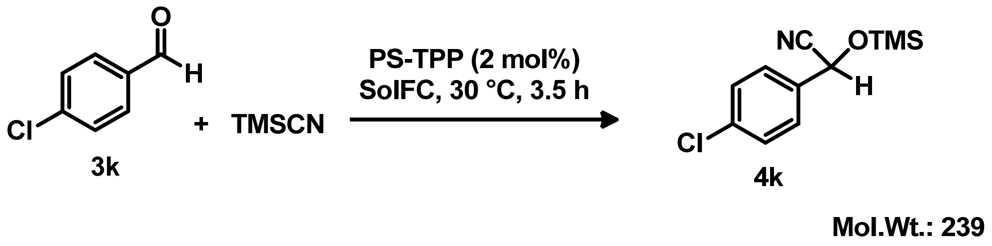
Elemental Analysis: C, 55.10; H, 5.89; N, 5.84; found C, 55.15; H, 5.80; N, 5.88

^{1}H NMR 400 MHz $CDCl_3$	**δ value**	**No. H**	**Mult.**	**j value/Hz**
	0.25	9	*s*	
	5.47	1	*s*	
	7.36	3	*m*	
	7.47	1	*m*	

^{13}C NMR (100.6 MHz, $CDCl_3$) δ : -0.3; 62.9; 118.7; 124.4; 126.4; 129.5; 130.2; 134.9; 138.2.

GC-EIMS (m/z, %): 241 (M^++2, 3), 239 (M^+, 9), 226 (39), 224 (100), 84 (54).

Chem. Name	2-(4'-chlorophenyl)-2-((trimethylsilyl)oxy)acetonitrile **(4k)**
Lit. Ref.	*J. Org. Chem.*, **2005**, *70*, 6530-6532



METHOD:
In a screw capped vial equipped with a magnetic stirrer PS-TPP (3 mg, 0.01 mmol, 3.2 mmol/g), 4-chlorobenzaldehyde (**3k**) (70 mg, 0.5 mmol), and TMSCN (0.069 mL, 0.55 mmol) were consecutively added and the resulting mixture was left under stirring at 30 °C. After 3.5 hours Et_2O (1 mL) was added and the catalyst was filtered off and the solvent was removed under vacuum. In this way pure 2-(4'-chlorophenyl)-2-((trimethylsilyl)oxy)acetonitrile (**4k**) was obtained as an oil (95% yield, 114 mg).

Mol Formula	$C_{11}H_{14}ClNOSi$	**m.p.**	Oil

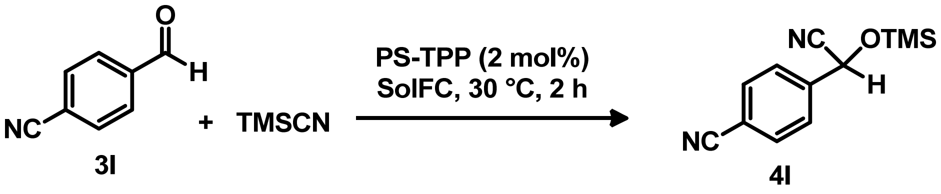
Elemental Analysis: C, 55.10; H, 5.89; N, 5.84; found C, 55.08; H, 5.90; N, 5.91

^{1}H NMR 400 MHz $CDCl_3$	**δ value**	**No. H**	**Mult.**	**j value/Hz**
	0.24	9	*s*	
	5.46	1	*s*	
	7.38-7.43	4	*m*	

^{13}C NMR (100.6 MHz, $CDCl_3$) δ : -0.4; 62.9; 118.7; 127.6; 129.1; 134.8; 135.2.

GC-EIMS (m/z, %): 241 (M^++2, 4), 239 (M^+, 12), 226 (38), 224 (100), 152 (11), 150 (34), 84 (42).

Chem. Name	2-(4'-cyanophenyl)-2-((trimethylsilyl)oxy)acetonitrile **(4l)**
Lit. Ref.	*Tetrahedron Lett.* **2009**, *50*, 5317-5321



Mol.Wt.: 230

METHOD:
In a screw capped vial equipped with a magnetic stirrer PS-TPP (3 mg, 0.01 mmol, 3.2 mmol/g), 4-cyanobenzaldehyde (**3l**) (65 mg, 0.5 mmol), and TMSCN (0.069 mL, 0.55 mmol) were consecutively added and the resulting mixture was left under stirring at 30 °C. After 2 hours Et_2O (1 mL) was added and the catalyst was filtered off and the solvent was removed under vacuum. In this way pure 2-(4'-cyanophenyl)-2-((trimethylsilyl)oxy)acetonitrile (**4l**) was obtained as an oil (98% yield, 113 mg).

Mol Formula	$C_{12}H_{14}N_2OSi$	**m.p.**	Oil

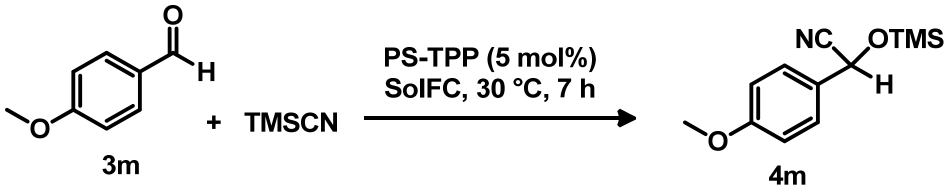
Elemental Analysis: C, 62.57; H, 6.13; N, 12.16; found C, 62.55; H, 6.08; N, 12.19

	δ value	**No. H**	**Mult.**	**j value/Hz**	
^{1}H NMR 400 MHz $CDCl_3$	0.27	9	*s*		
	5.54	1	*s*		
	7.59-7.61	2	*m*		
	7.72-7.74	2	*m*		

^{13}C NMR (100.6 MHz, $CDCl_3$) δ : 0.4; 62.8; 113.2; 118.2; 118.1; 126.8; 132.7; 141.1.

GC-EIMS (m/z, %): 230 (M^+, 9), 215 (100), 114 (14), 84 (64), 45 (10).

Chem. Name	2-(4'-methoxyphenyl)-2-((trimethylsilyl)oxy)acetonitrile **(4m)**
Lit. Ref.	*Bull. Korean Chem. Soc.*, ***2008***, *29*, *1320-1322*



Mol.Wt.: 235

METHOD:
In a screw capped vial equipped with a magnetic stirrer PS-TPP (8 mg, 0.025 mmol, 3.2 mmol/g), 4-methoxybenzaldehyde (**3m**) (0.061 mL, 0.5 mmol), and TMSCN (0.069 mL, 0.55 mmol) were consecutively added and the resulting mixture was left under stirring at 30 °C. After 7 hours Et_2O (1 mL) was added and the catalyst was filtered off and the solvent was removed under vacuum. In this way pure 2-(4'-methoxyphenyl)-2-((trimethylsilyl)oxy)acetonitrile (**4m**) was obtained as an oil (94% yield, 112 mg).

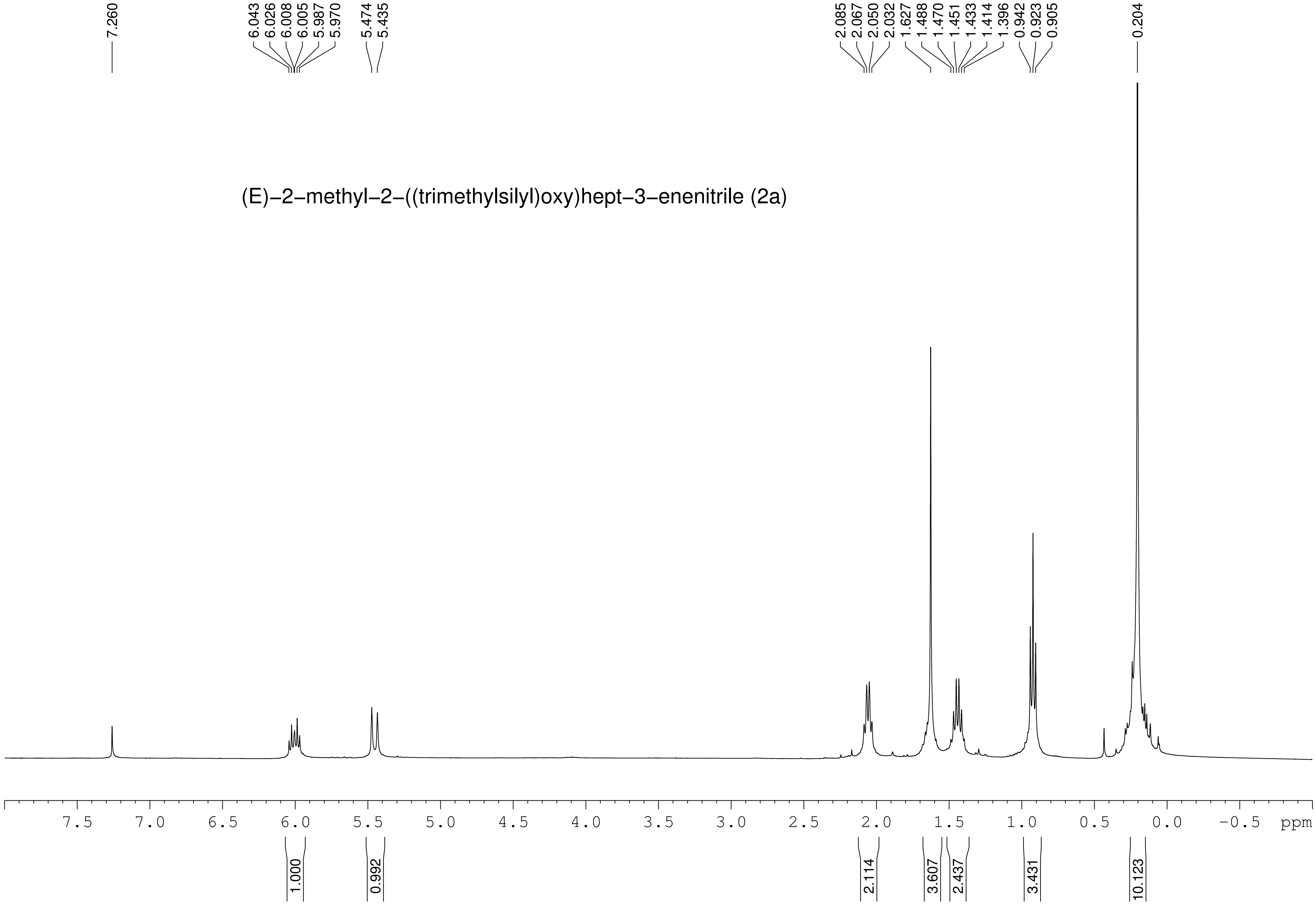
Mol Formula	$C_{12}H_{17}NO_2Si$	**m.p.**	Oil

Elemental Analysis: C, 61.24; H, 7.28; N, 5.95; found C, 61.30; H, 7.20; N, 5.93

^{1}H NMR 400 MHz $CDCl_3$	**δ value**	**No. H**	**Mult.**	**j value/Hz**
	0.21	9	*s*	
	3.82	3	*s*	
	5.44	1	*s*	
	6.92-6.94	2	*m*	
	7.38-7.40	2	*m*	

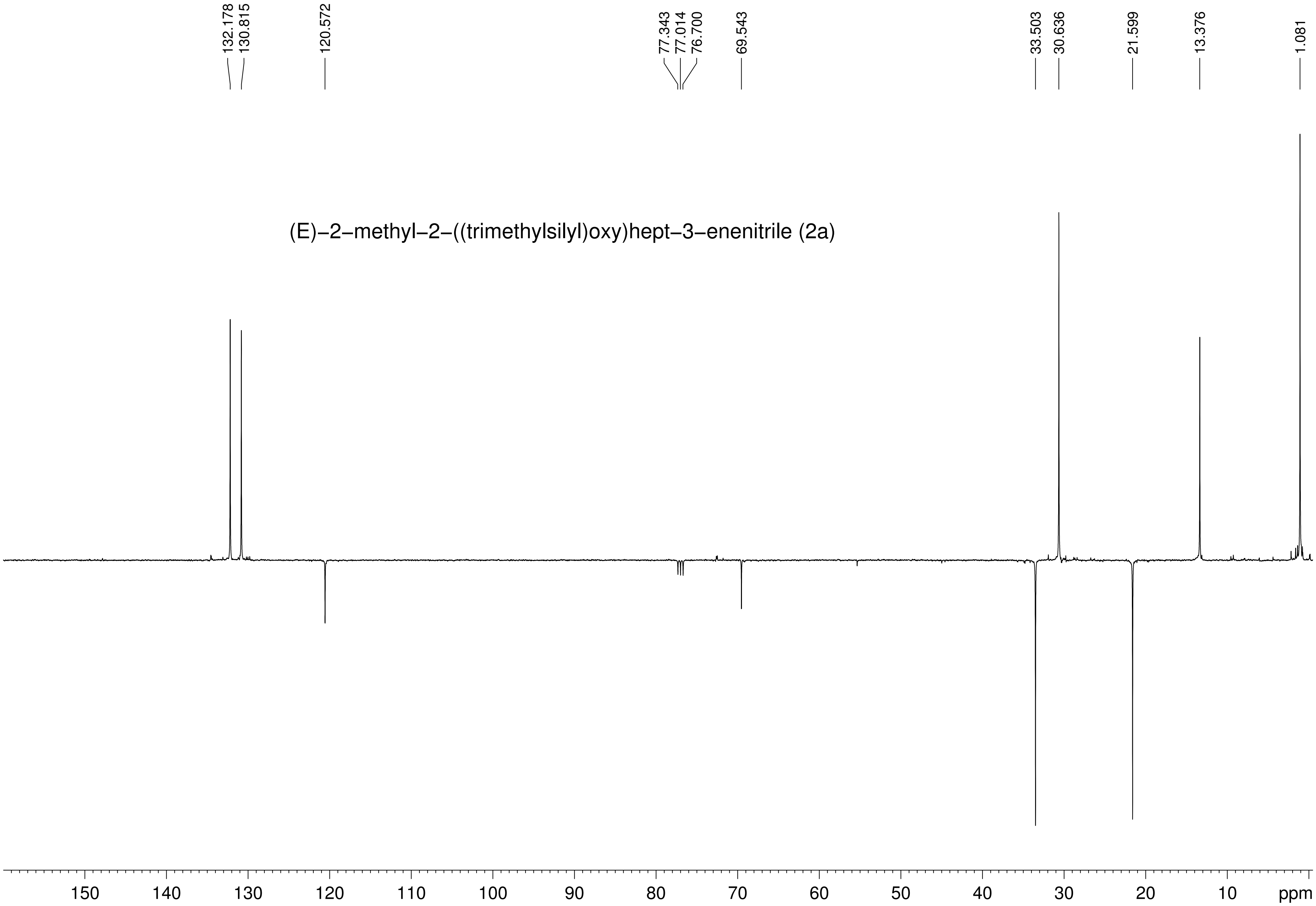
^{13}C NMR (100.6 MHz, $CDCl_3$) δ : 0.3; 55.2; 63.2; 114.2; 119.3; 127.8; 128.4; 160.3.

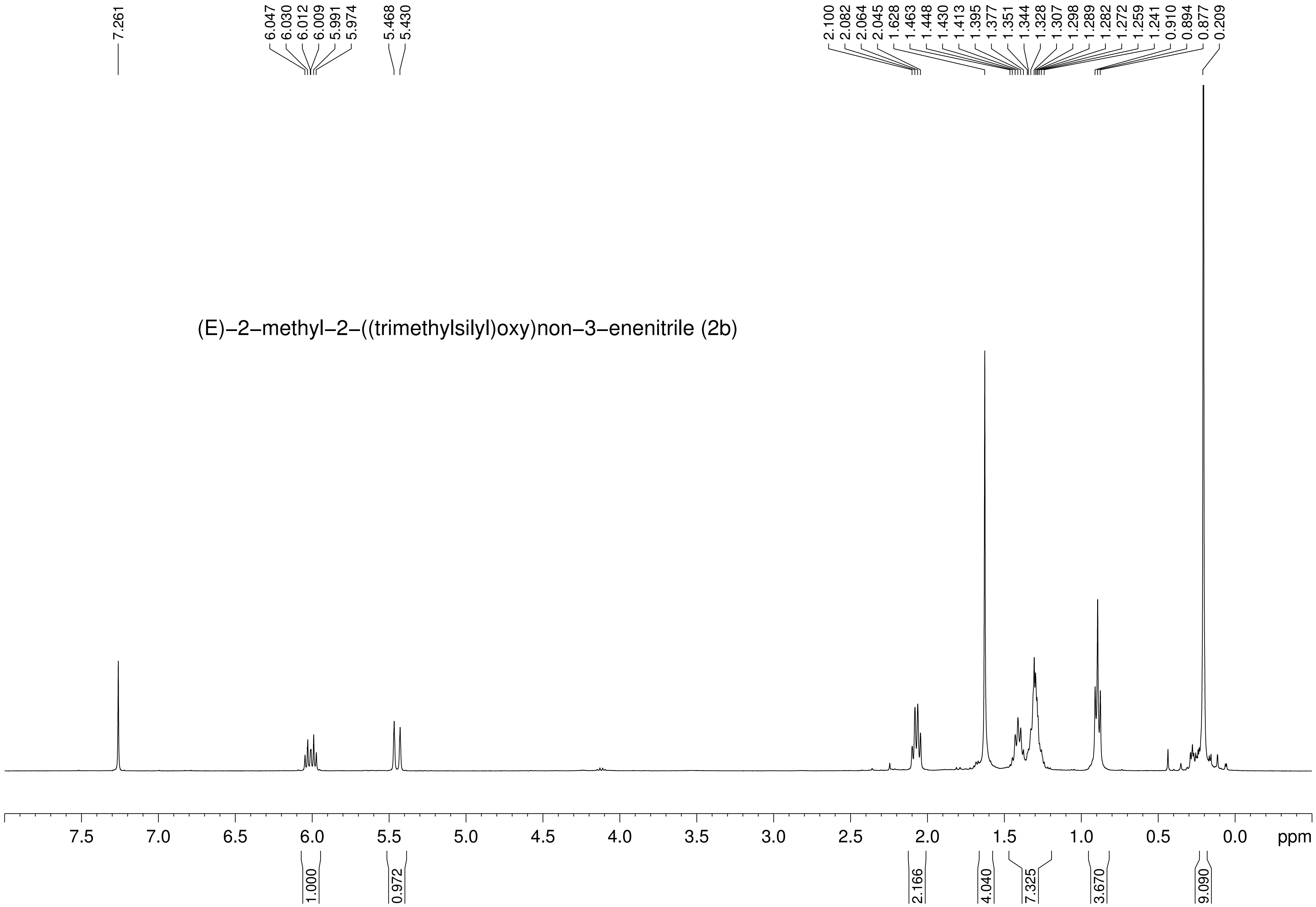
GC-EIMS (m/z, %): 235 (M^+, 31), 220 (48), 146 (100), 135 (15).



(E)−2−methyl−2−((trimethylsilyl)oxy)hept−3−enenitrile (2a)

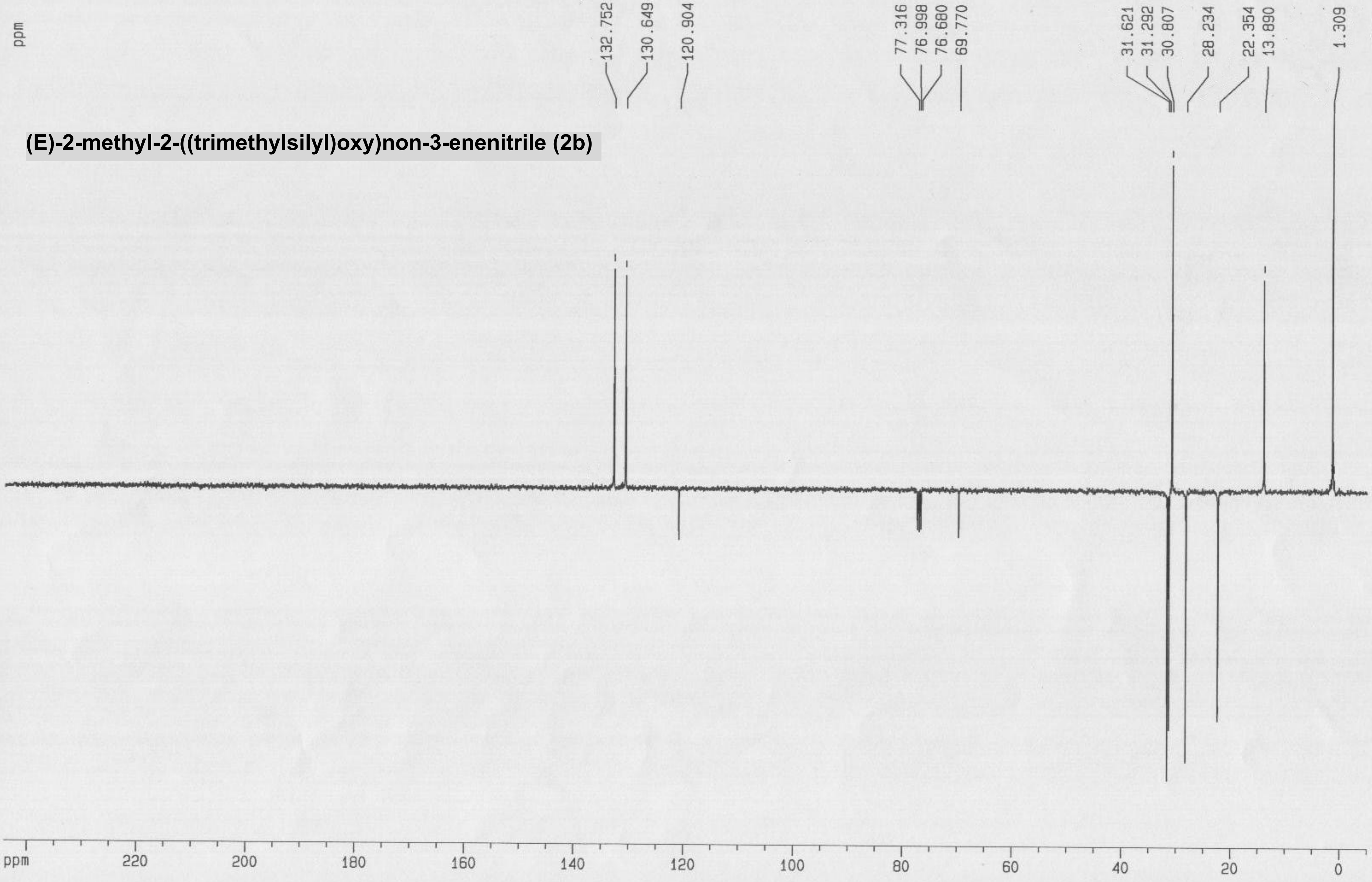
(E)−2−methyl−2−((trimethylsilyl)oxy)hept−3−enenitrile (2a)

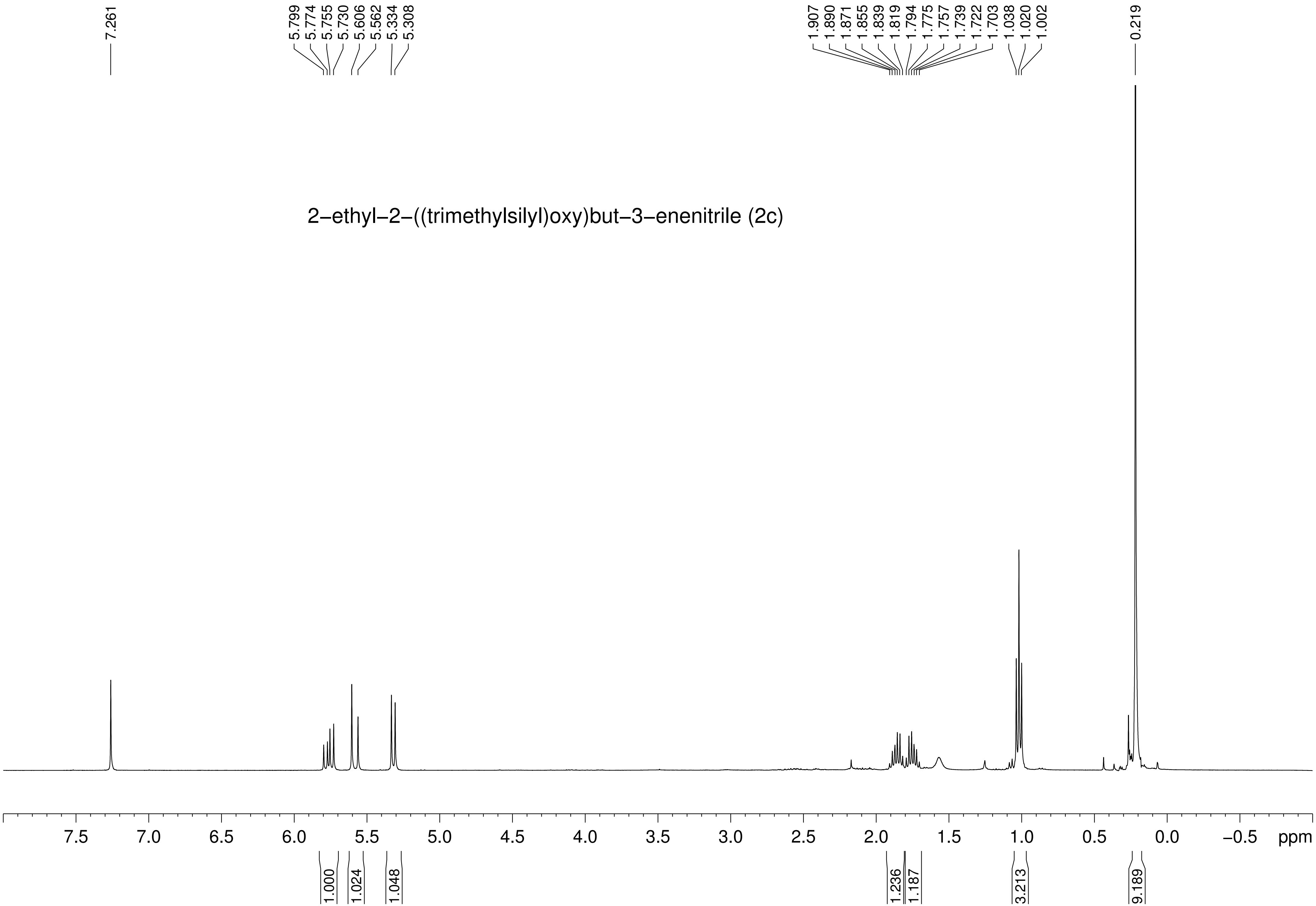




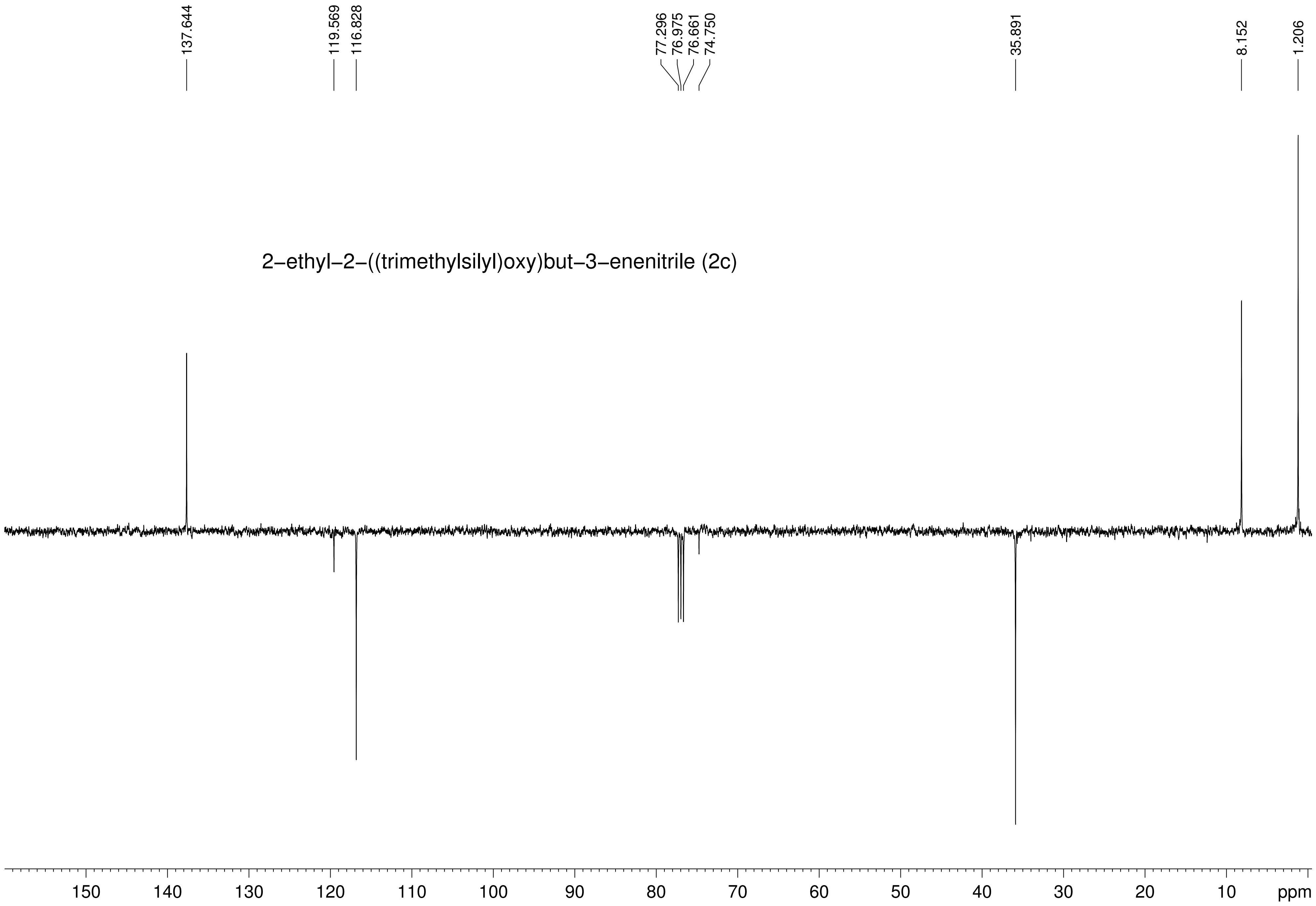
(E)−2−methyl−2−((trimethylsilyl)oxy)non−3−enenitrile (2b)

(E)-2-methyl-2-((trimethylsilyl)oxy)non-3-enenitrile (2b)

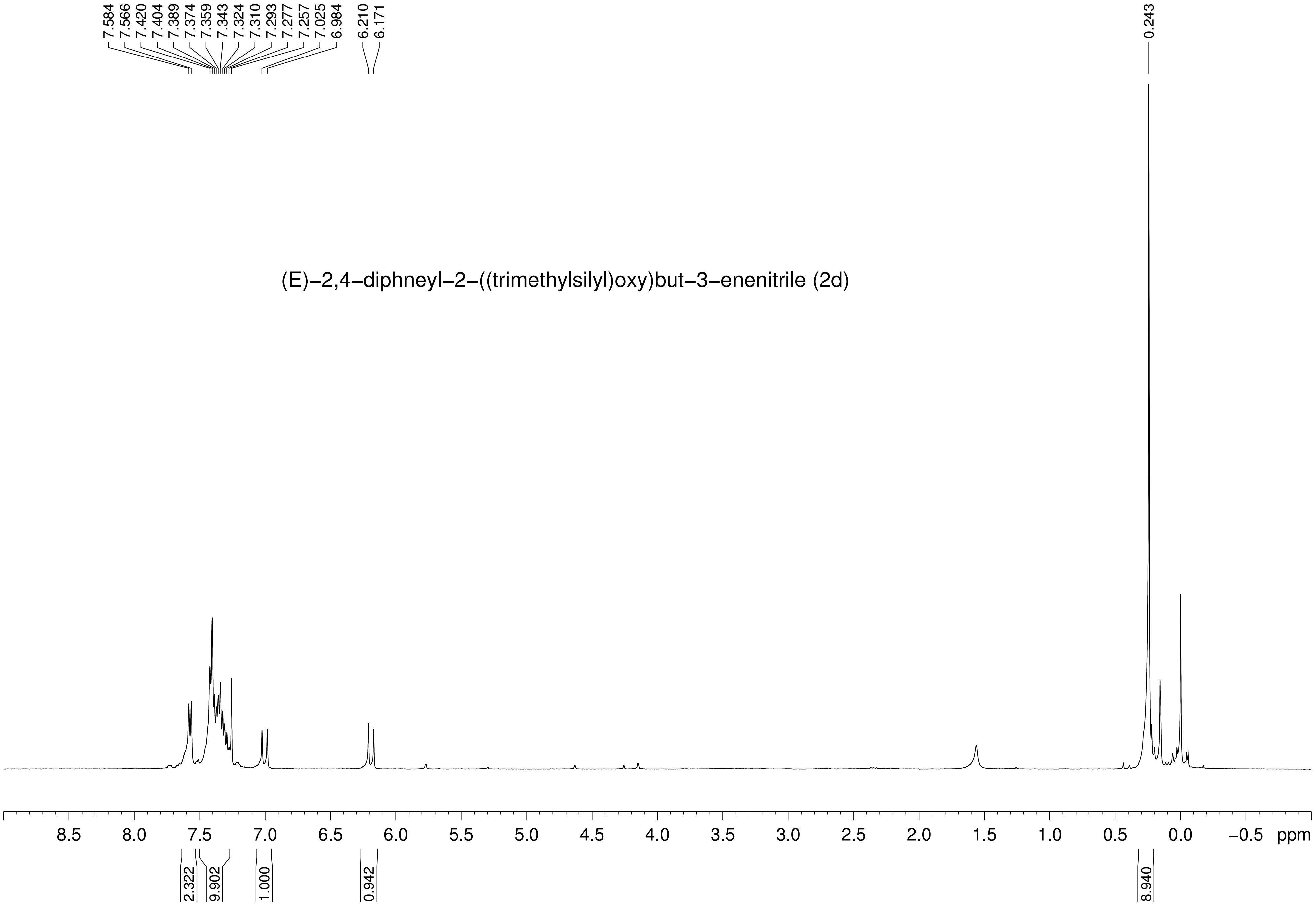




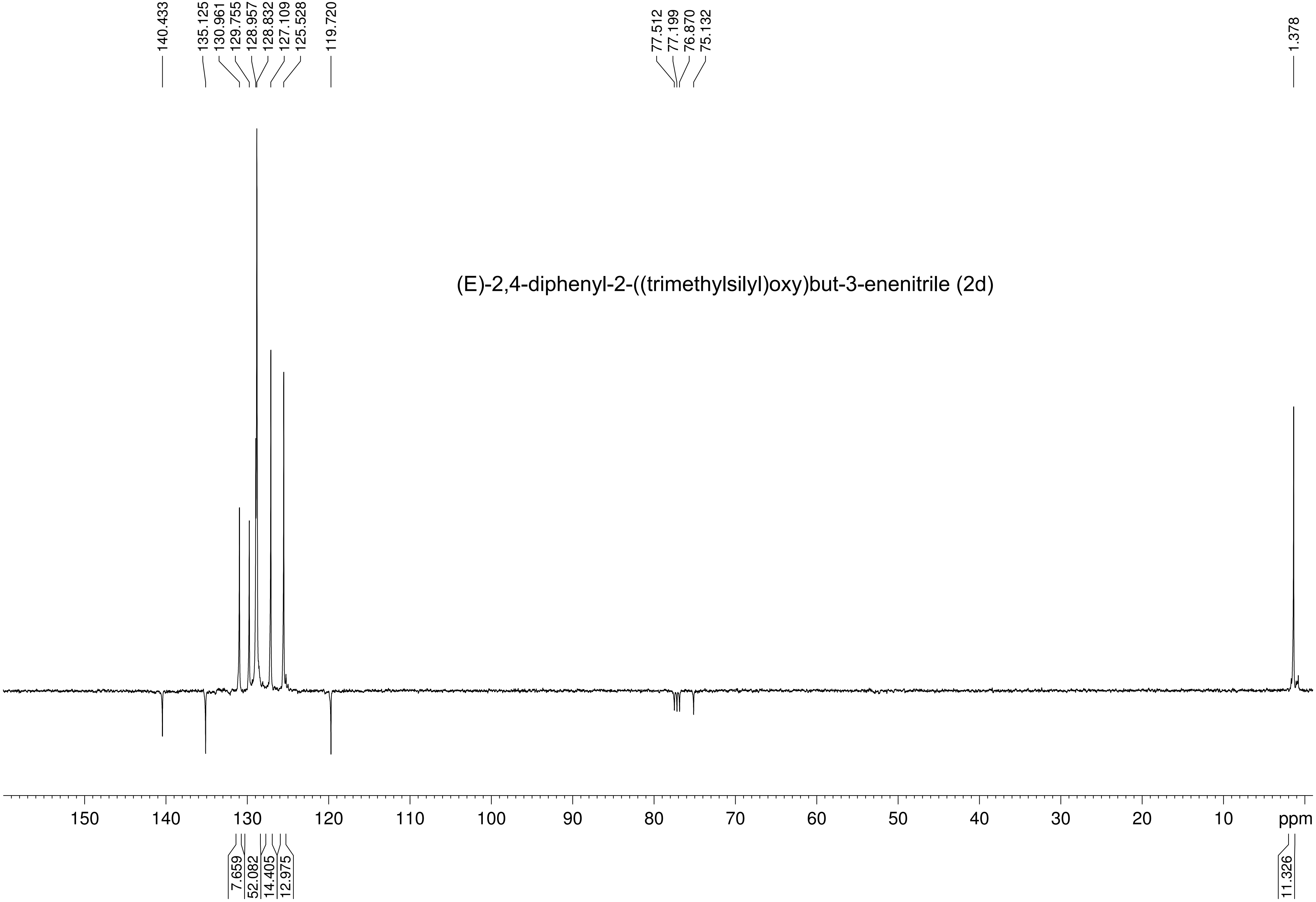
2−ethyl−2−((trimethylsilyl)oxy)but−3−enenitrile (2c)



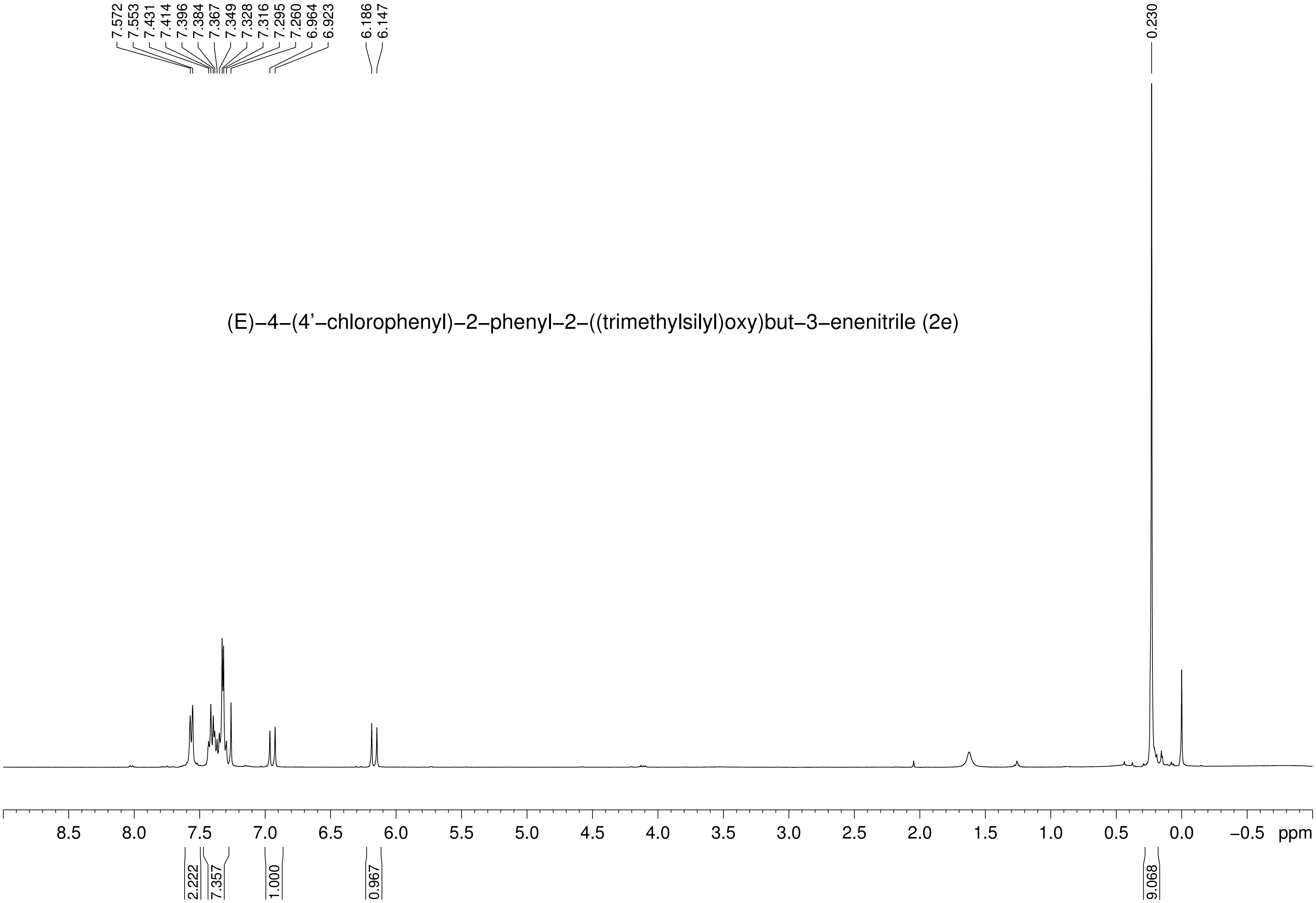
2−ethyl−2−((trimethylsilyl)oxy)but−3−enenitrile (2c)



(E)−2,4−diphneyl−2−((trimethylsilyl)oxy)but−3−enenitrile (2d)

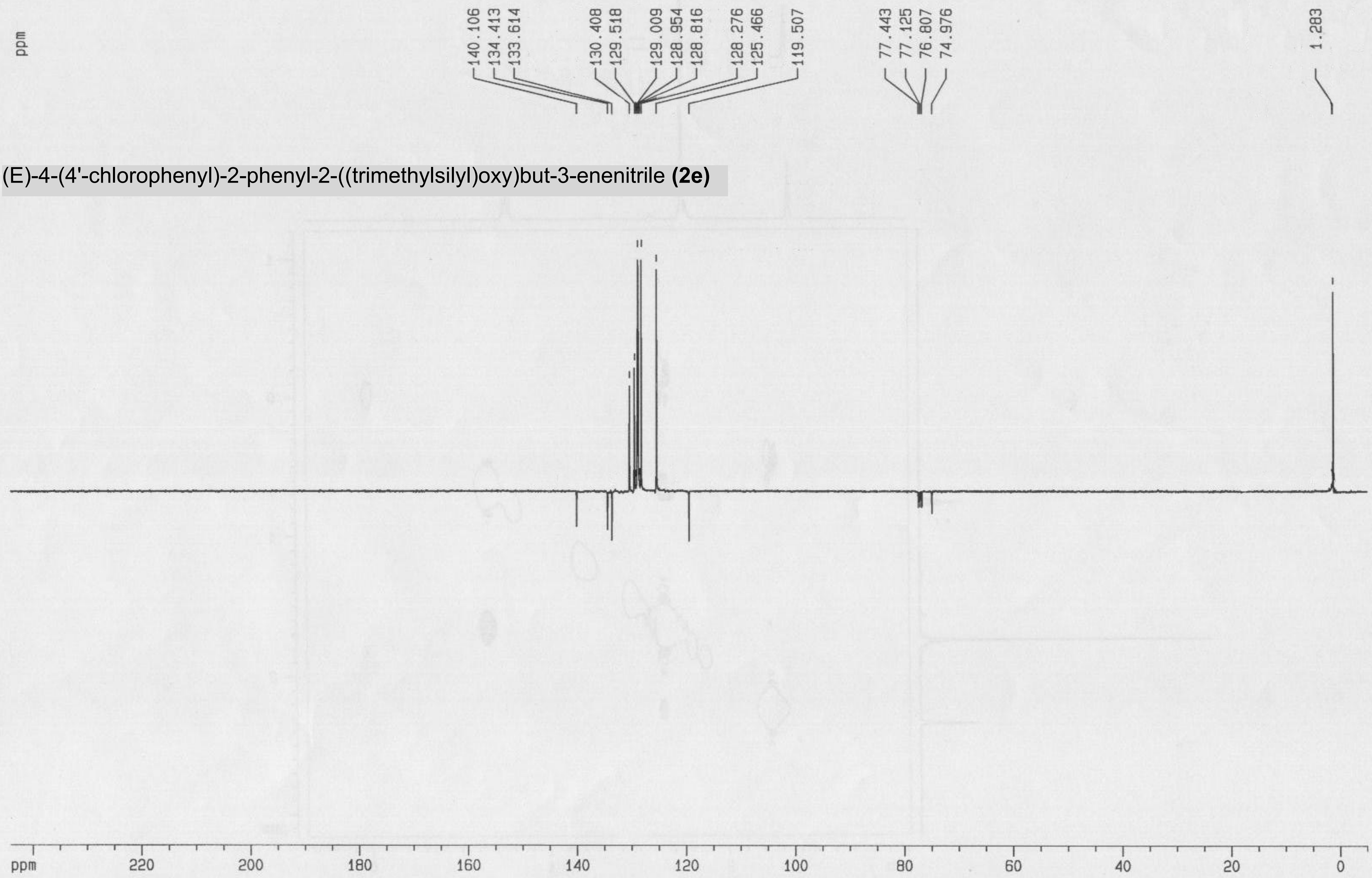


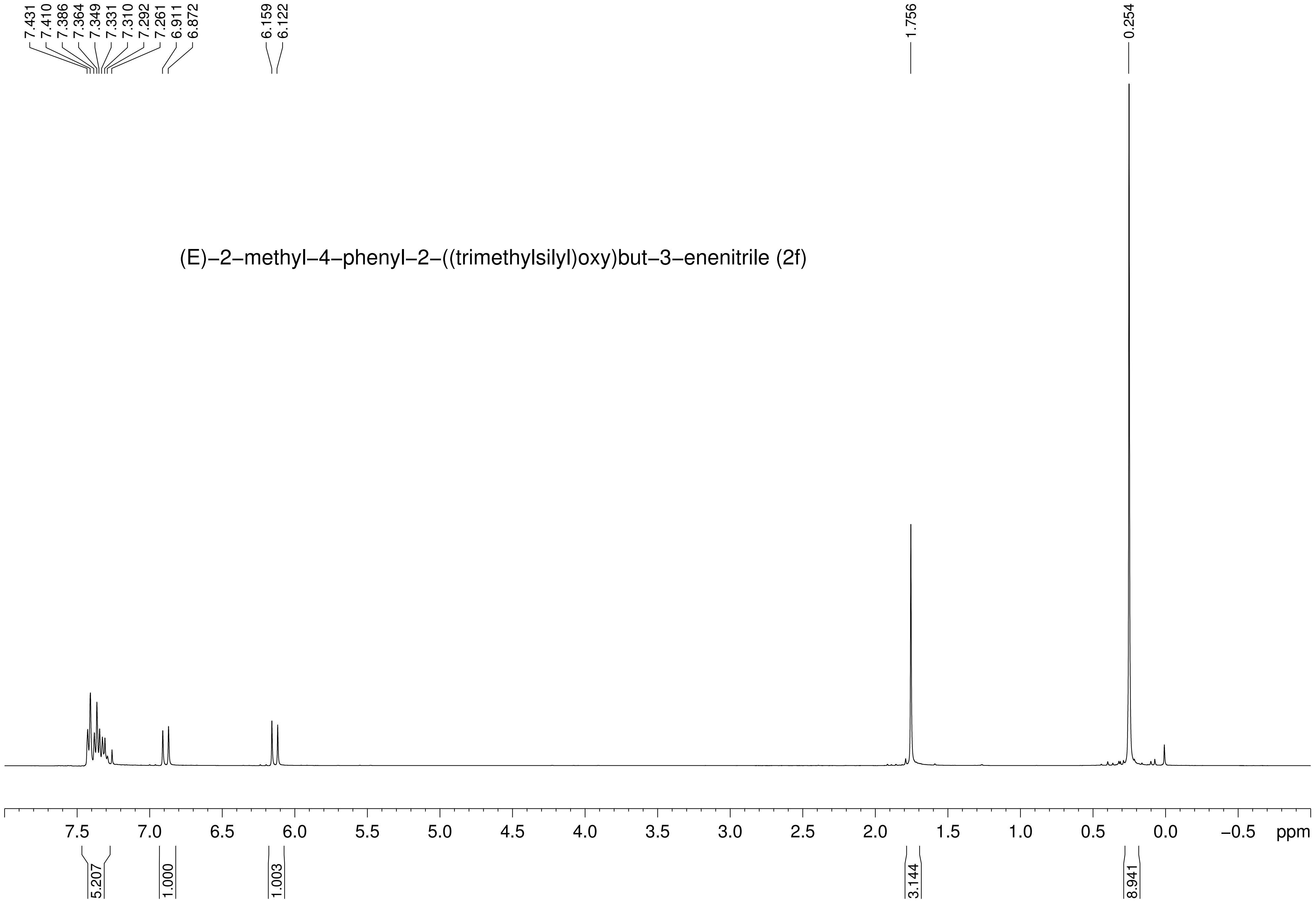
(E)-2,4-diphenyl-2-((trimethylsilyl)oxy)but-3-enenitrile (2d)

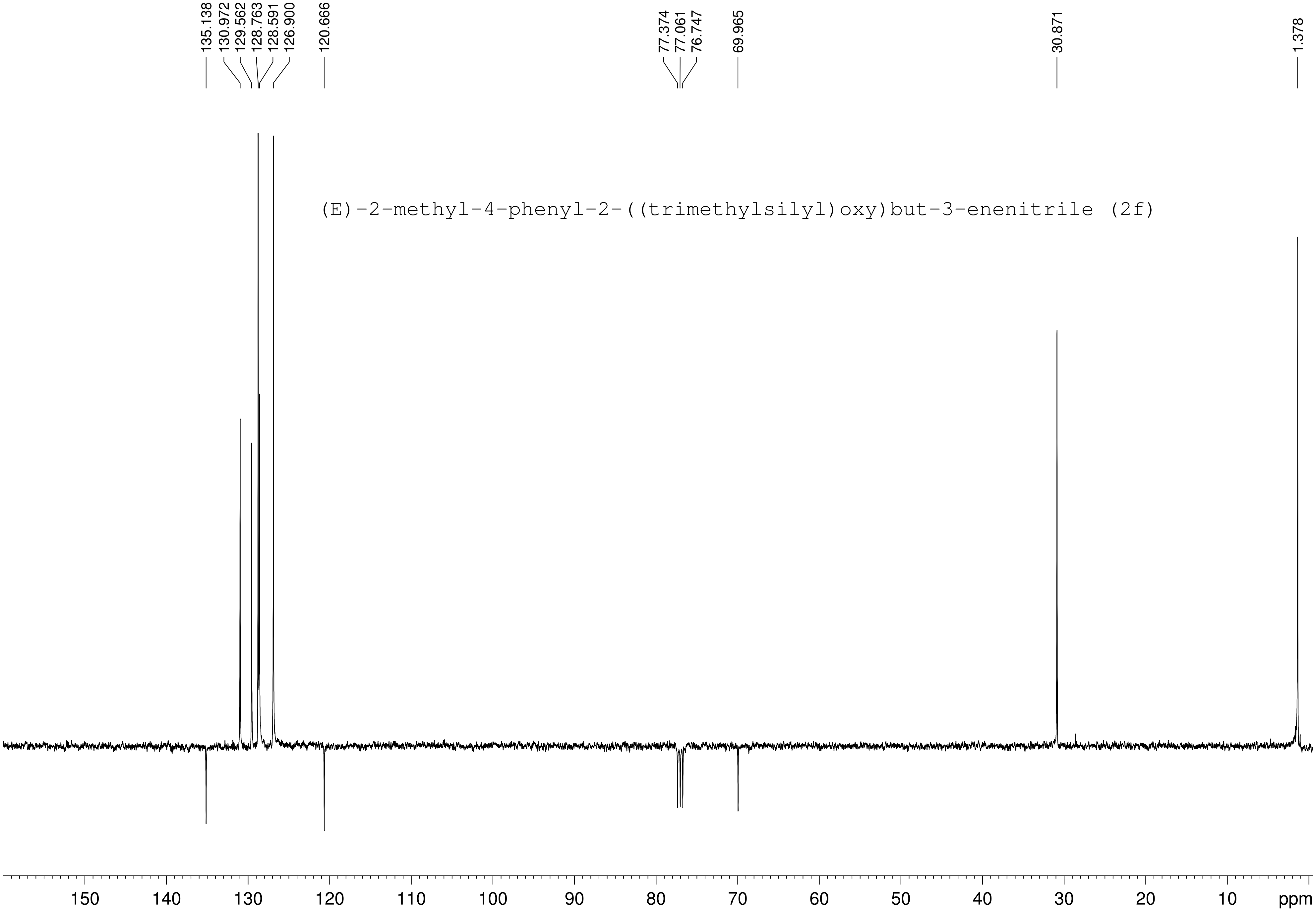


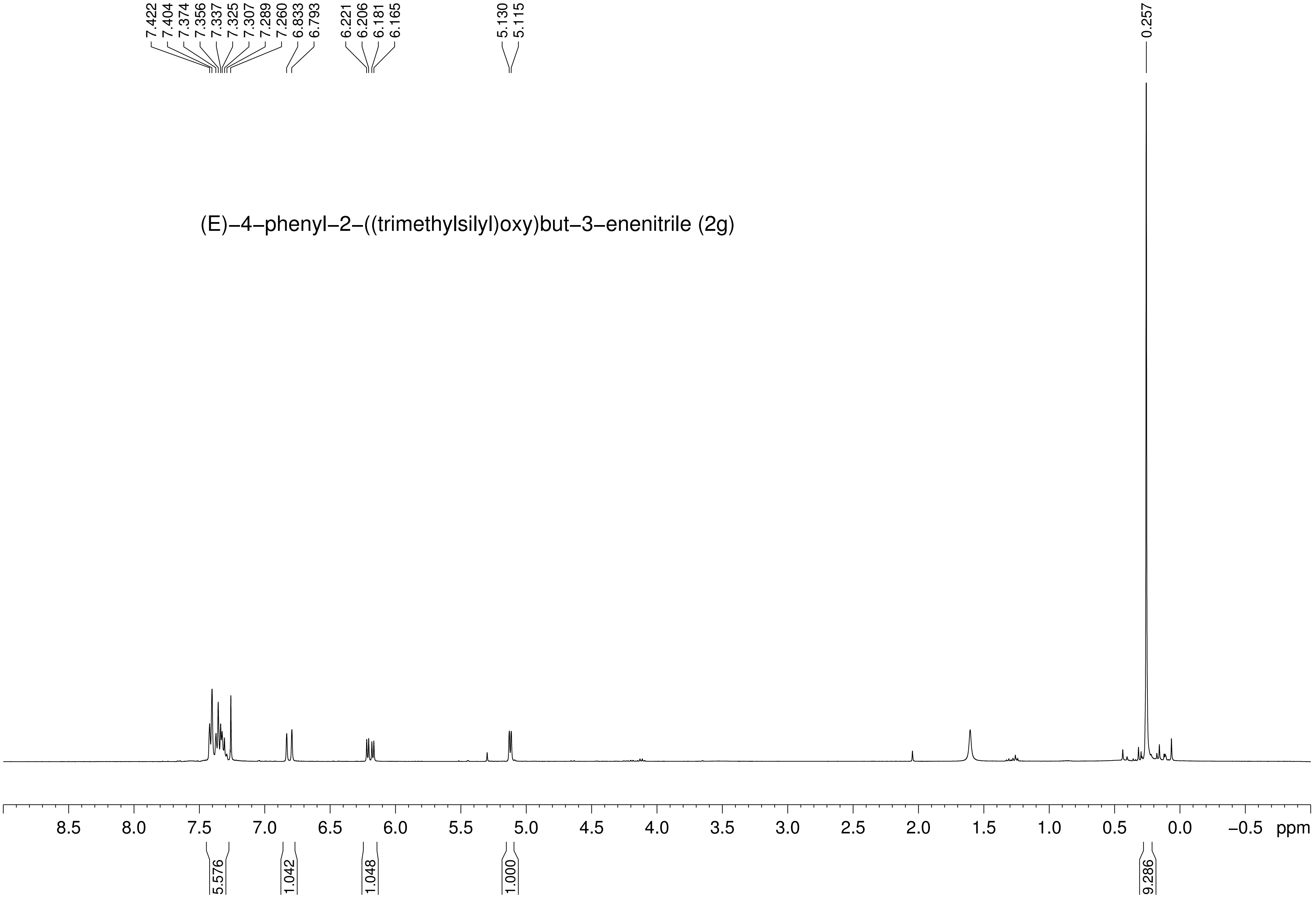
(E)–4–(4'–chlorophenyl)–2–phenyl–2–((trimethylsilyl)oxy)but–3–enenitrile (2e)

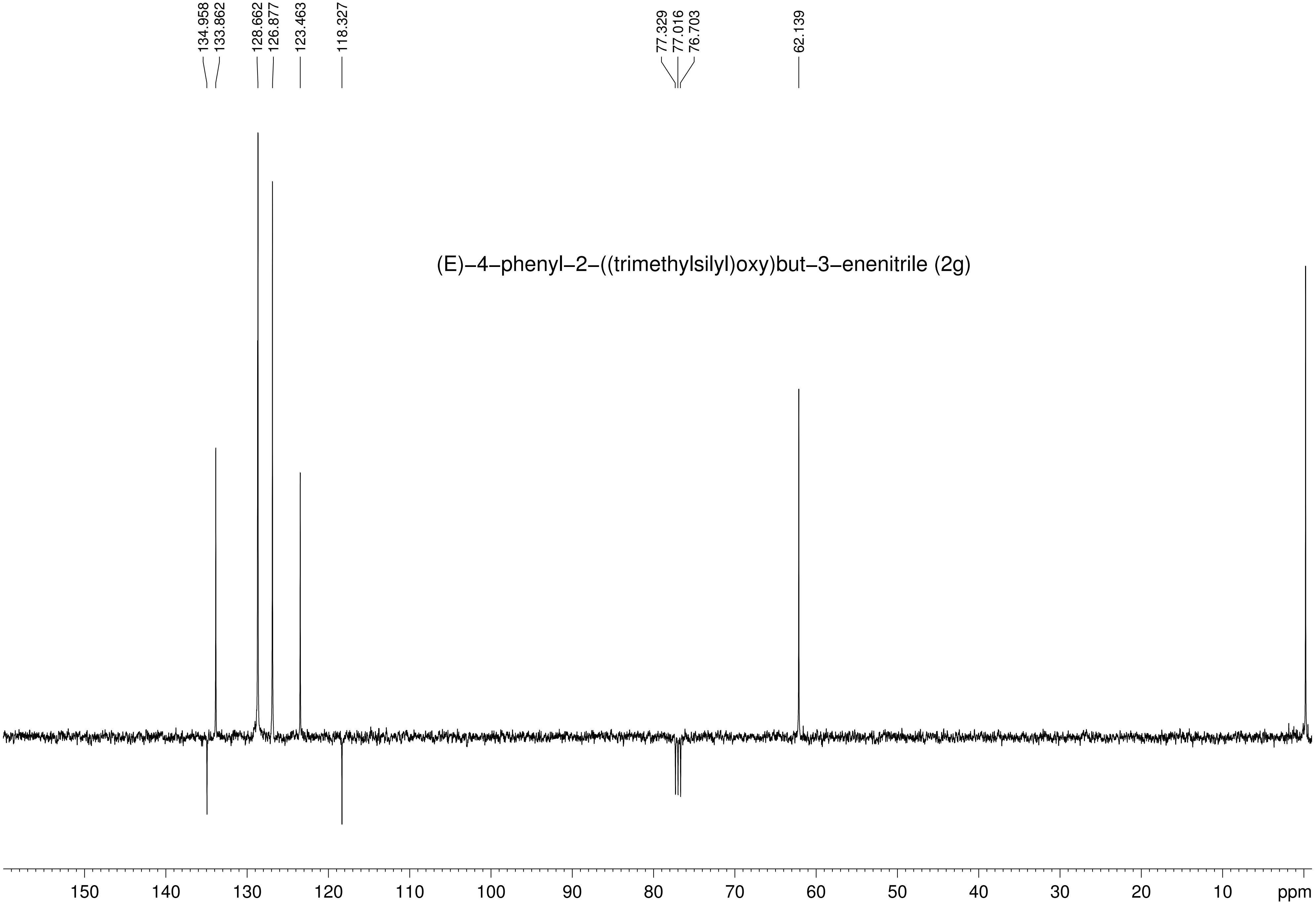
(E)-4-(4'-chlorophenyl)-2-phenyl-2-((trimethylsilyl)oxy)but-3-enenitrile **(2e)**



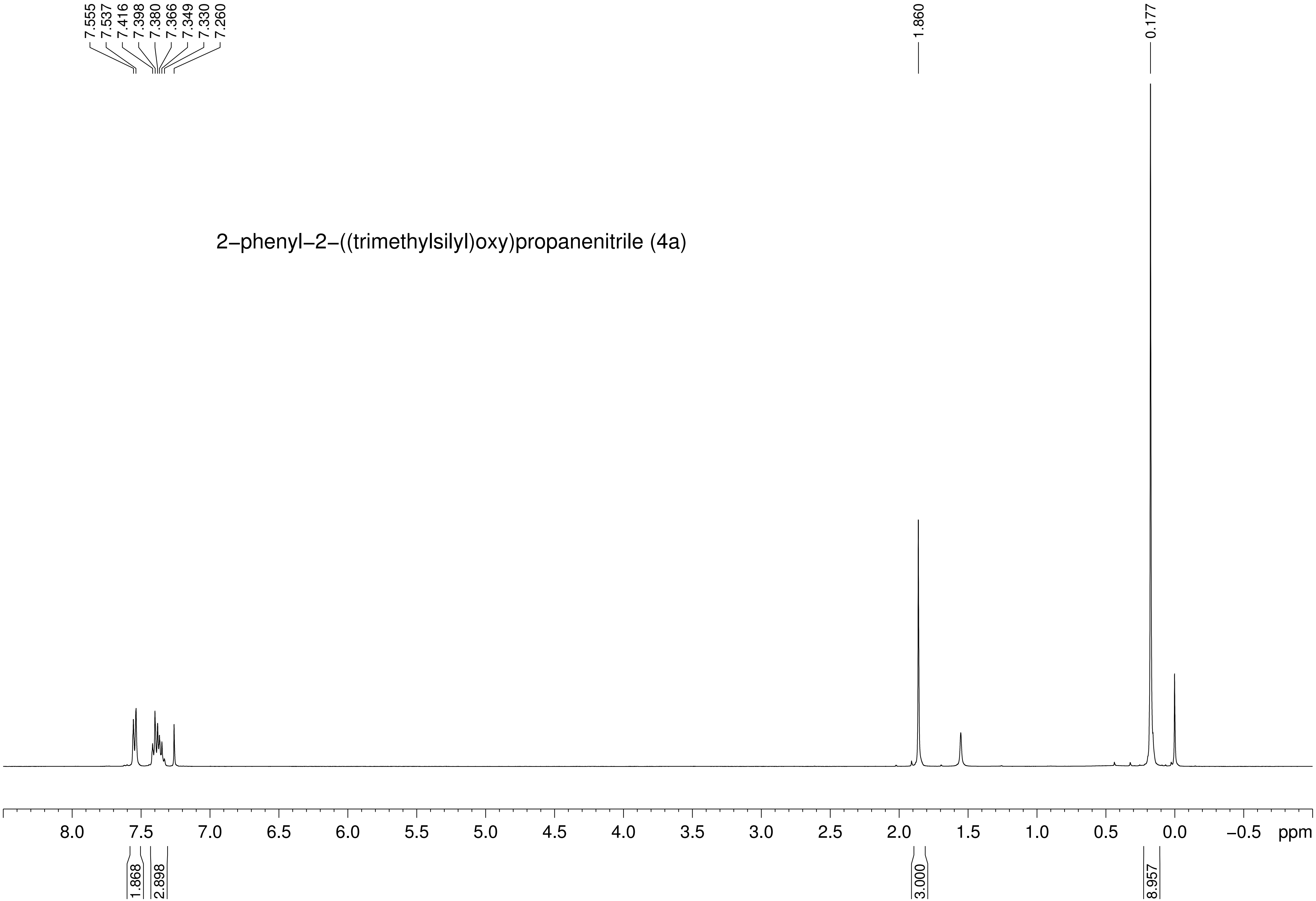

(E)−2−methyl−4−phenyl−2−((trimethylsilyl)oxy)but−3−enenitrile (2f)

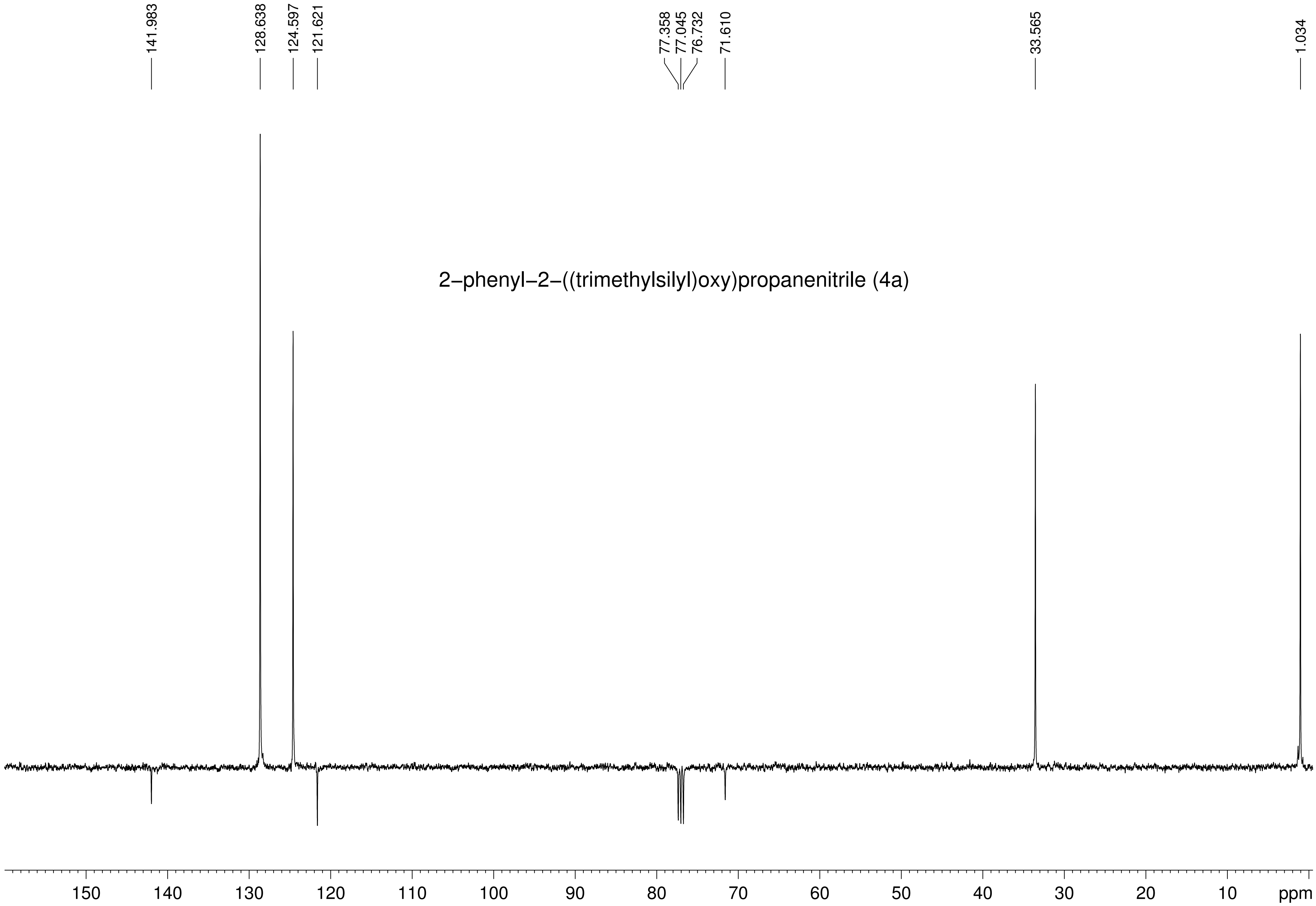

135.138
130.972
129.562
128.763
128.591
126.900
120.666
77.374
77.061
76.747
69.965
30.871
1.378
(E)-2-methyl-4-phenyl-2-((trimethylsilyl)oxy)but-3-enenitrile (2f)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

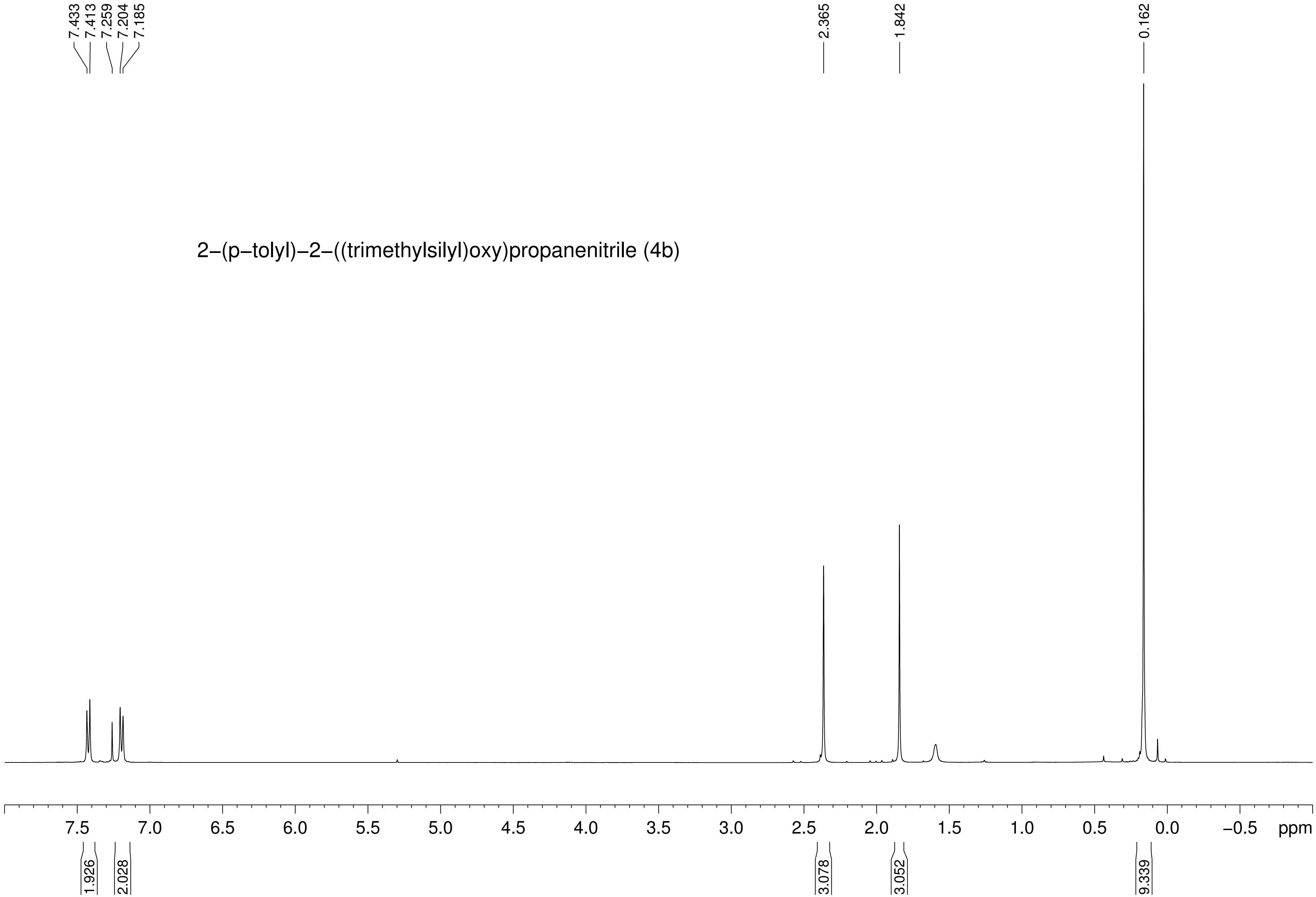

7.422
7.404
7.374
7.356
7.337
7.325
7.307
7.289
7.260
6.833
6.793
6.221
6.206
6.181
6.165
5.130
5.115
0.257
(E)−4−phenyl−2−((trimethylsilyl)oxy)but−3−enenitrile (2g)
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
ppm
5.576
1.042
1.048
1.000
9.286


134.958
133.862
128.662
126.877
123.463
118.327
77.329
77.016
76.703
62.139
(E)−4−phenyl−2−((trimethylsilyl)oxy)but−3−enenitrile (2g)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

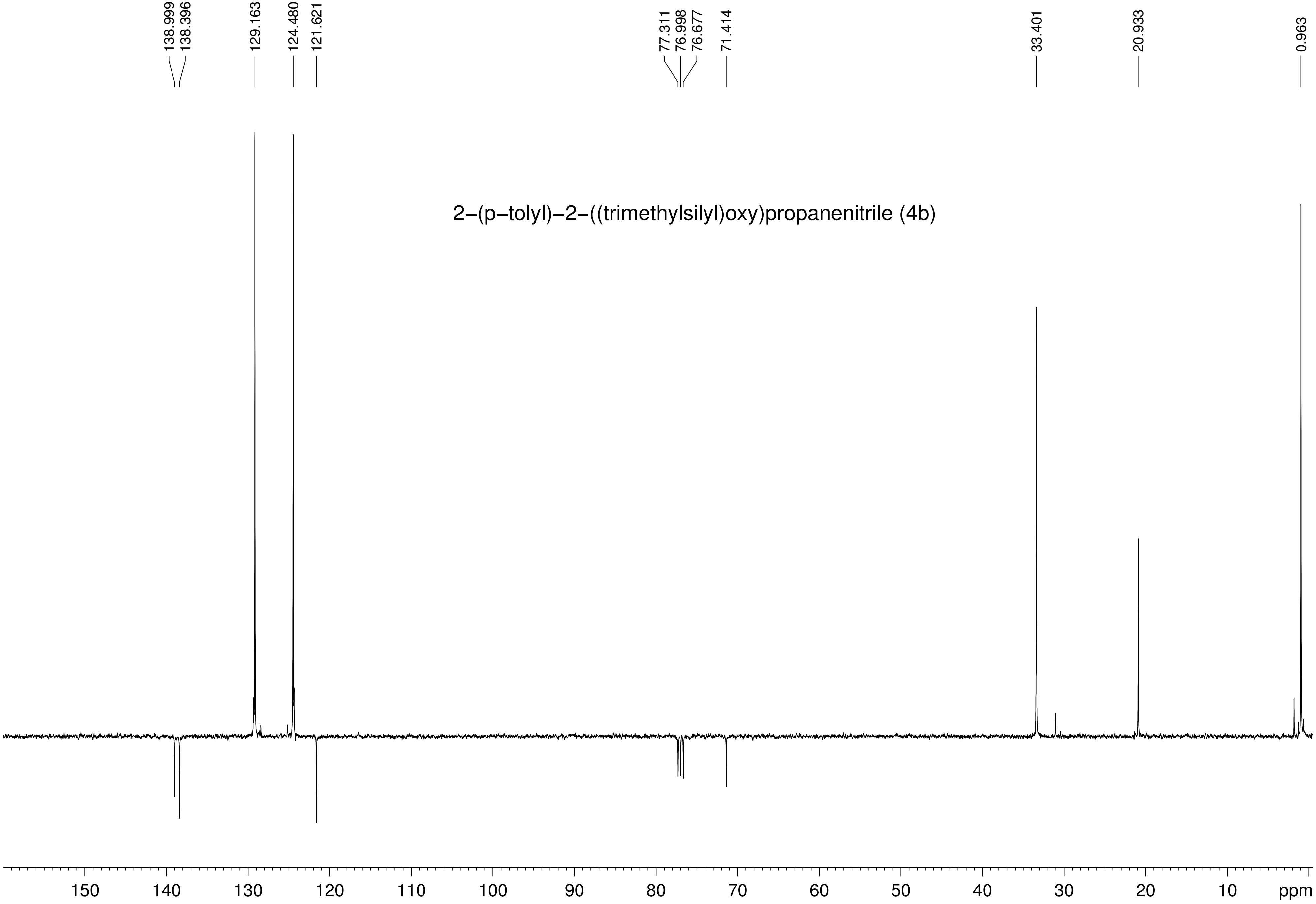
2−phenyl−2−((trimethylsilyl)oxy)propanenitrile (4a)

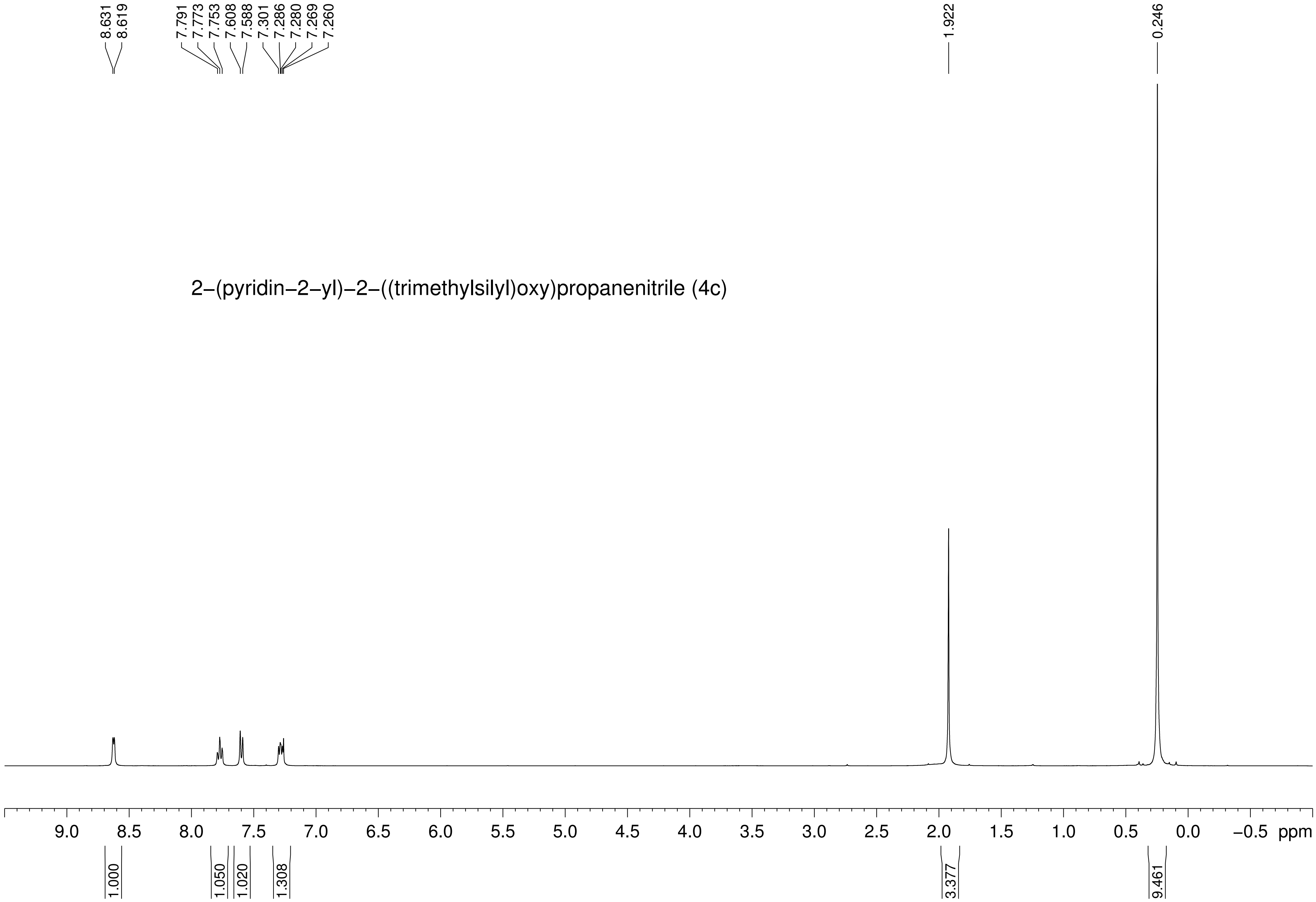



141.983
128.638
124.597
121.621
77.358
77.045
76.732
71.610
33.565
1.034
2–phenyl–2–((trimethylsilyl)oxy)propanenitrile (4a)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

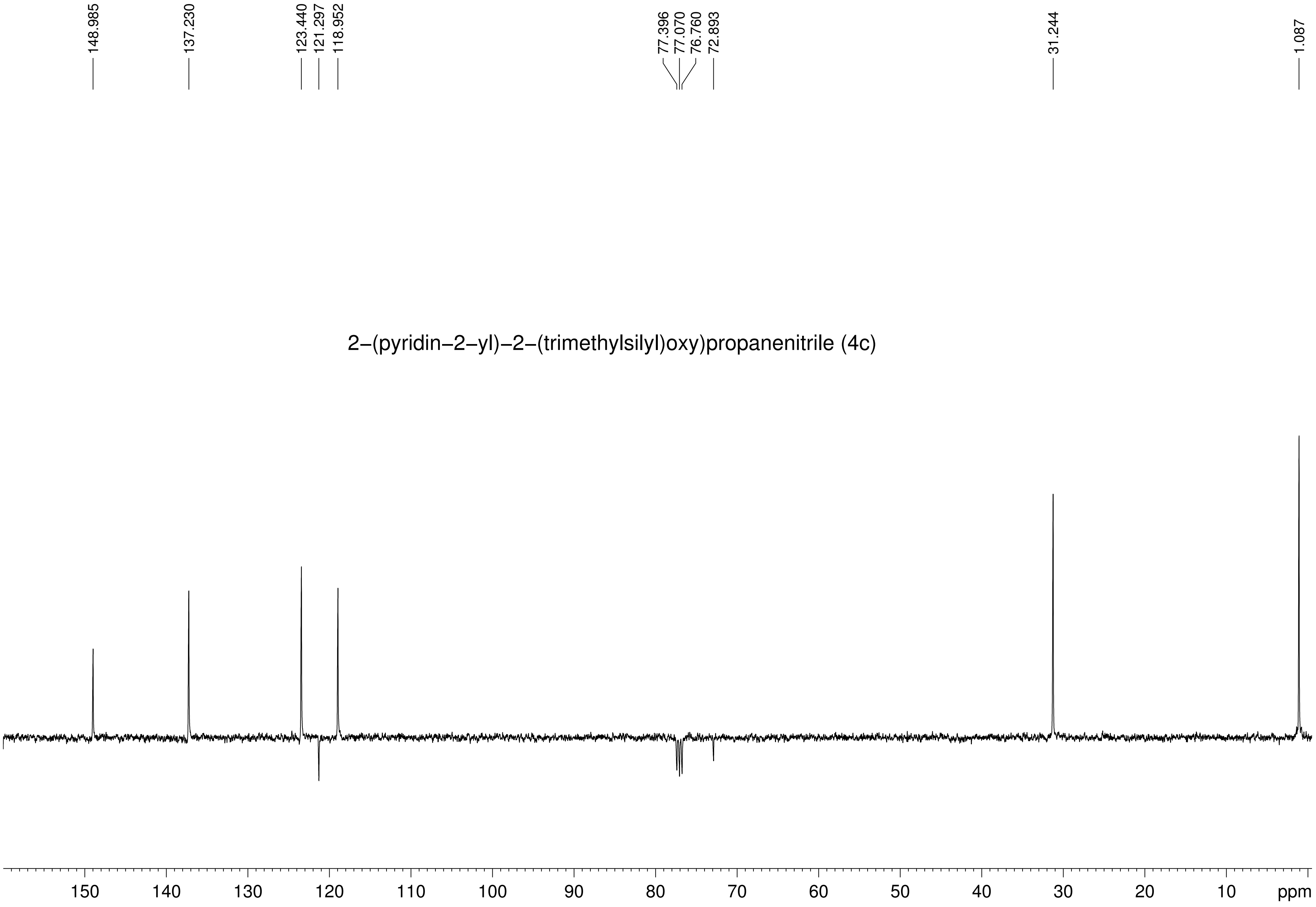


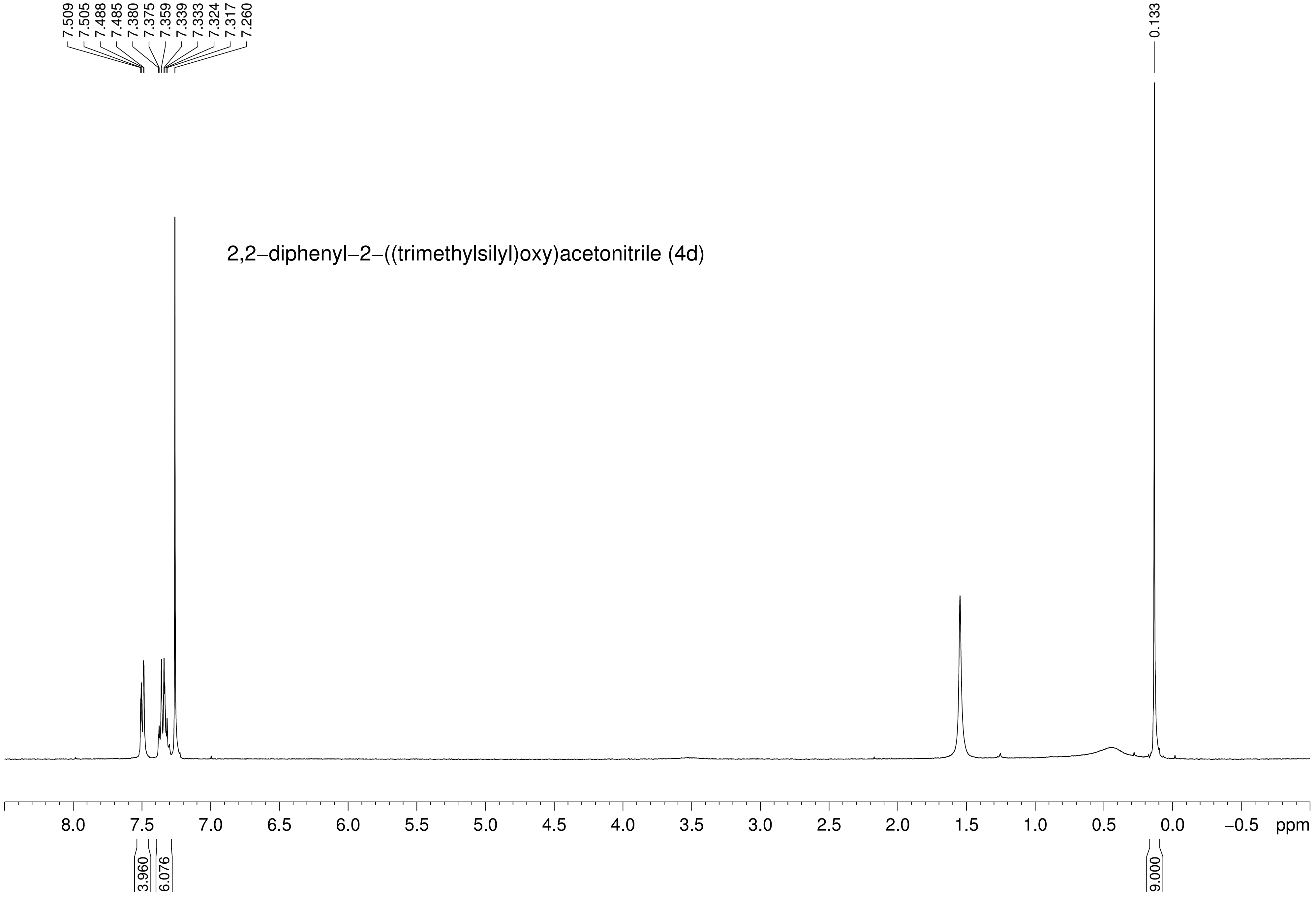
2–(p–tolyl)–2–((trimethylsilyl)oxy)propanenitrile (4b)

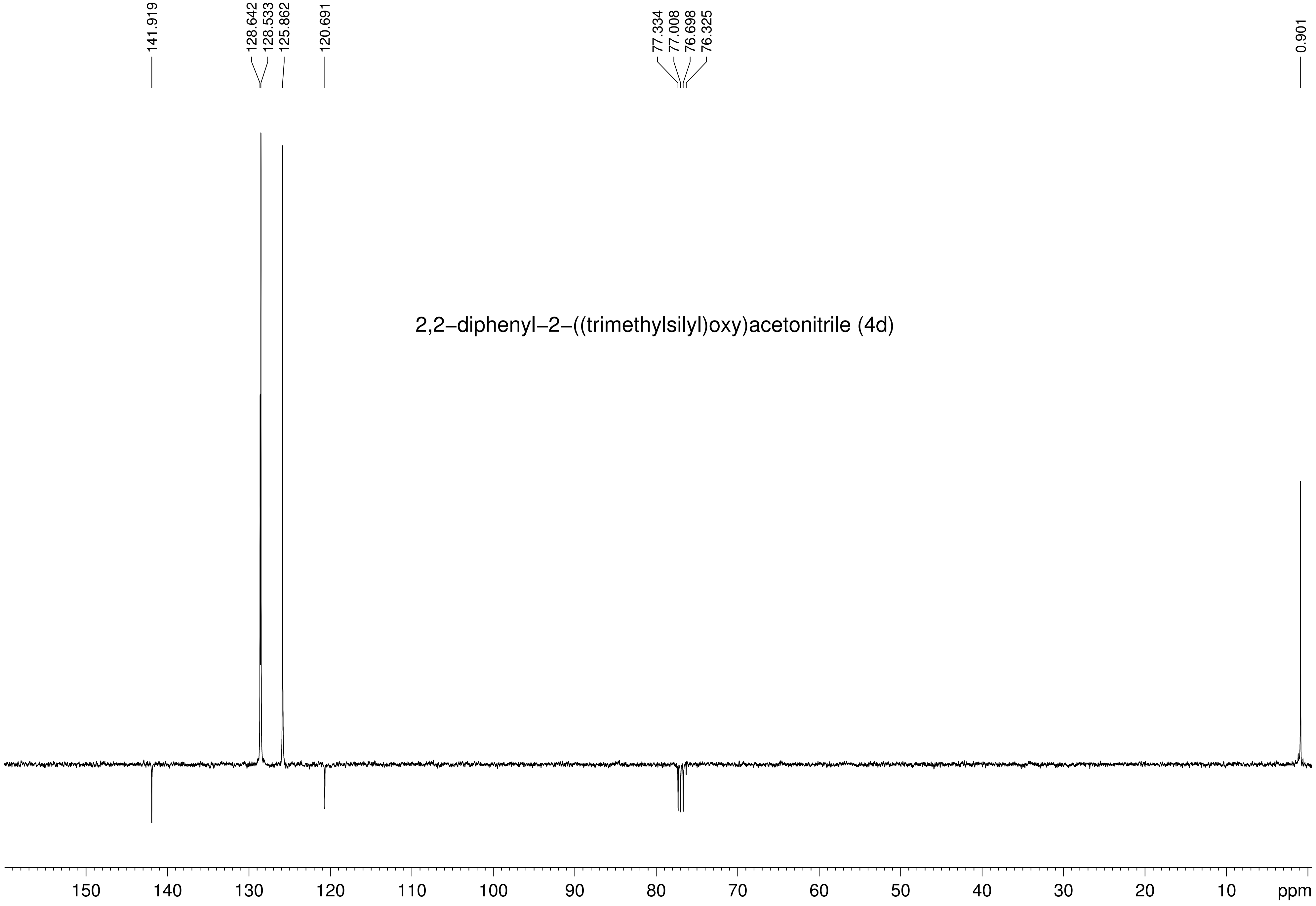

138.999
138.396
129.163
124.480
121.621
77.311
76.998
76.677
71.414
33.401
20.933
0.963
2–(p–tolyl)–2–((trimethylsilyl)oxy)propanenitrile (4b)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

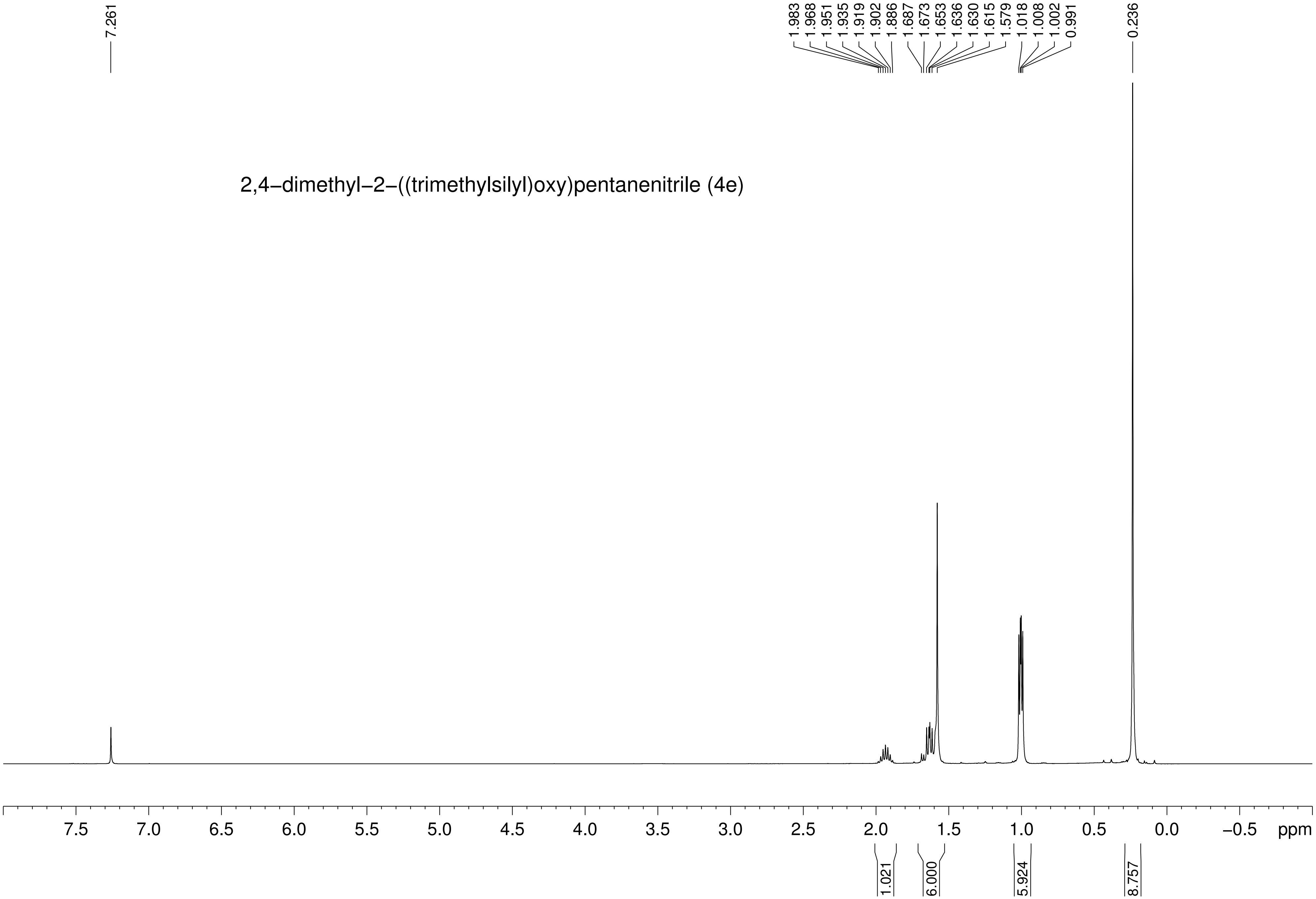


2−(pyridin−2−yl)−2−((trimethylsilyl)oxy)propanenitrile (4c)

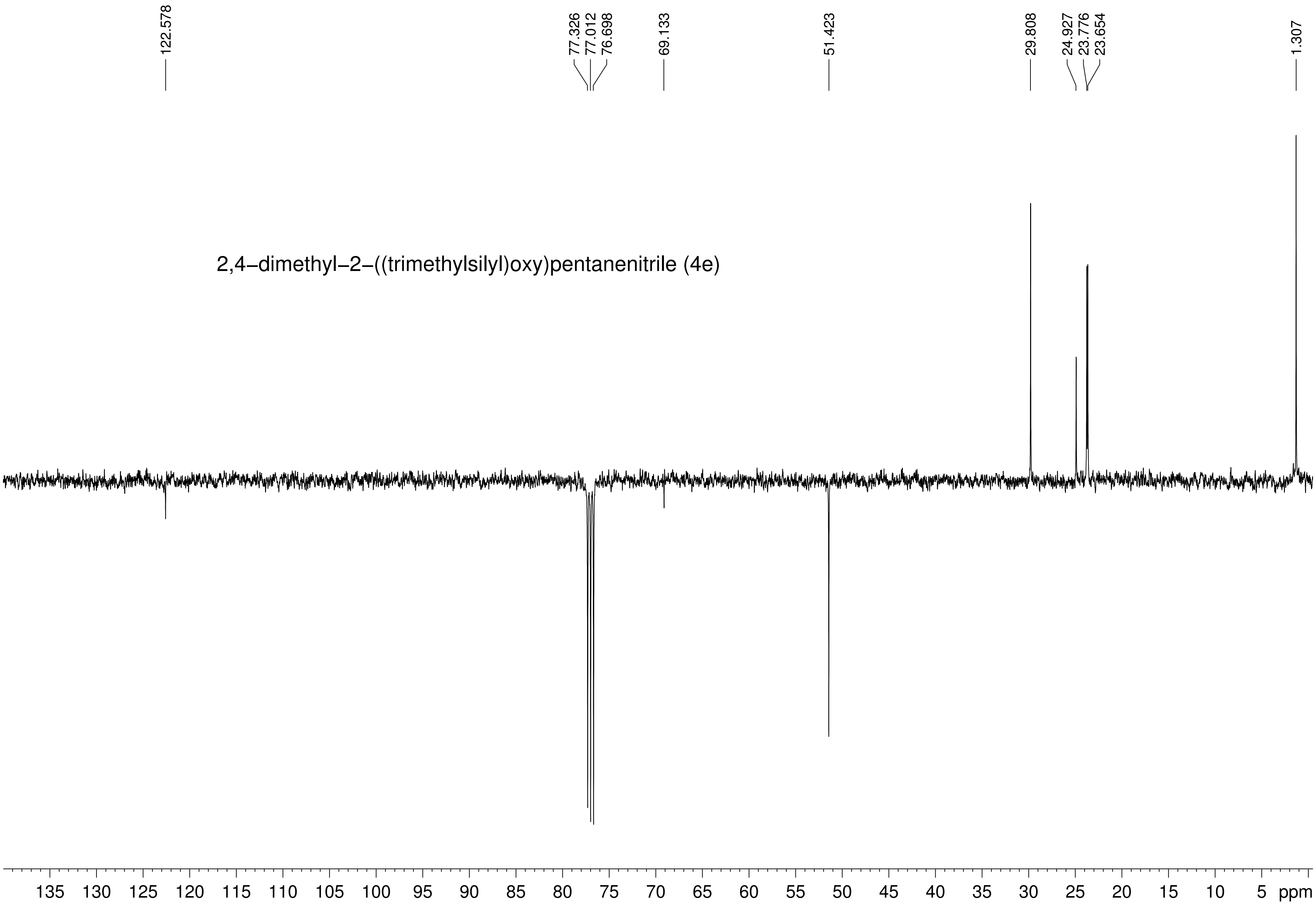

148.985
137.230
123.440
121.297
118.952
77.396
77.070
76.760
72.893
31.244
1.087
2−(pyridin−2−yl)−2−(trimethylsilyl)oxy)propanenitrile (4c)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

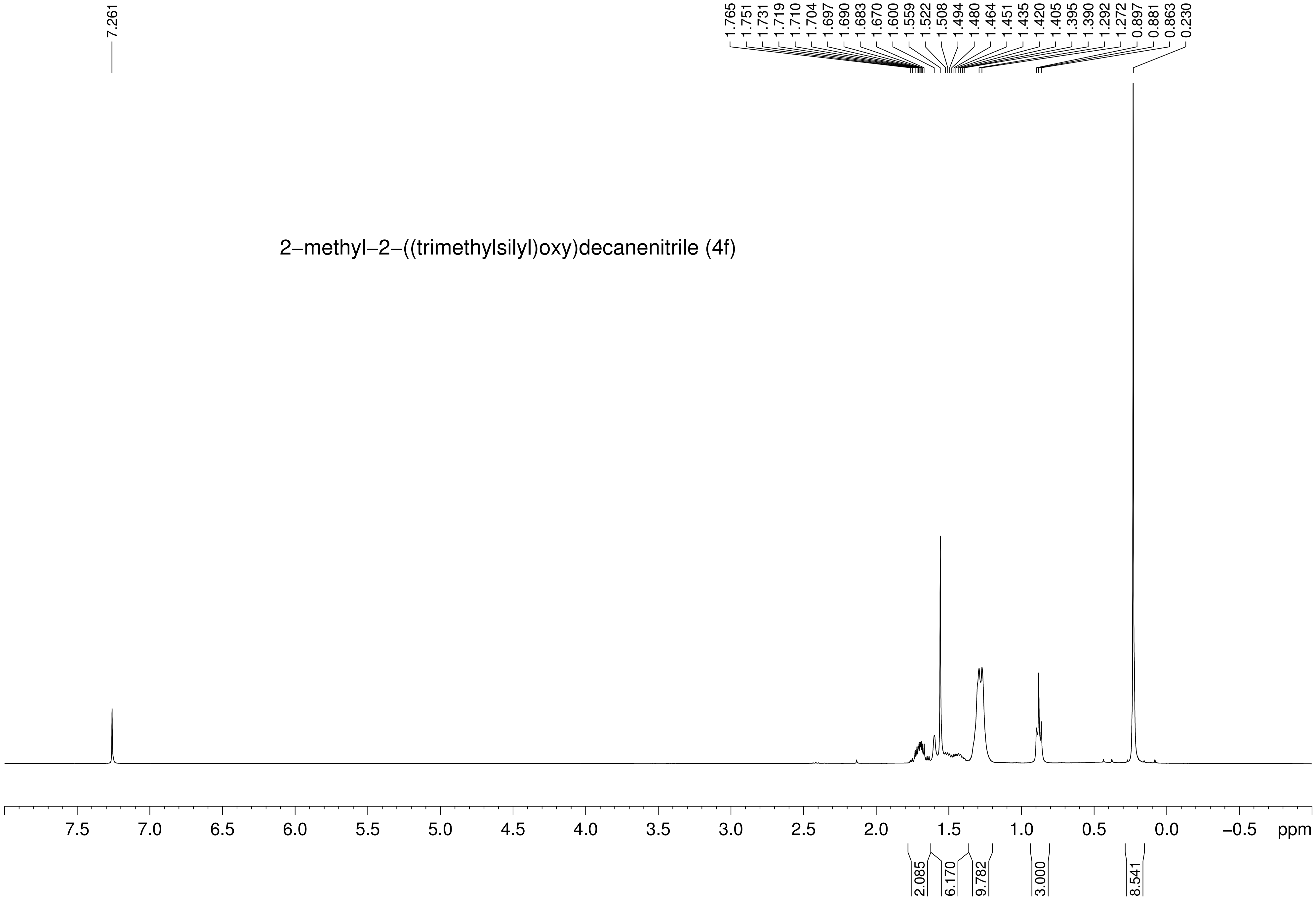

7.509
7.505
7.488
7.485
7.380
7.375
7.359
7.339
7.333
7.324
7.317
7.260
0.133
2,2–diphenyl–2–((trimethylsilyl)oxy)acetonitrile (4d)
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
–0.5
ppm
3.960
6.076
9.000


141.919
128.642
128.533
125.862
120.691
77.334
77.008
76.698
76.325
0.901
2,2−diphenyl−2−((trimethylsilyl)oxy)acetonitrile (4d)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

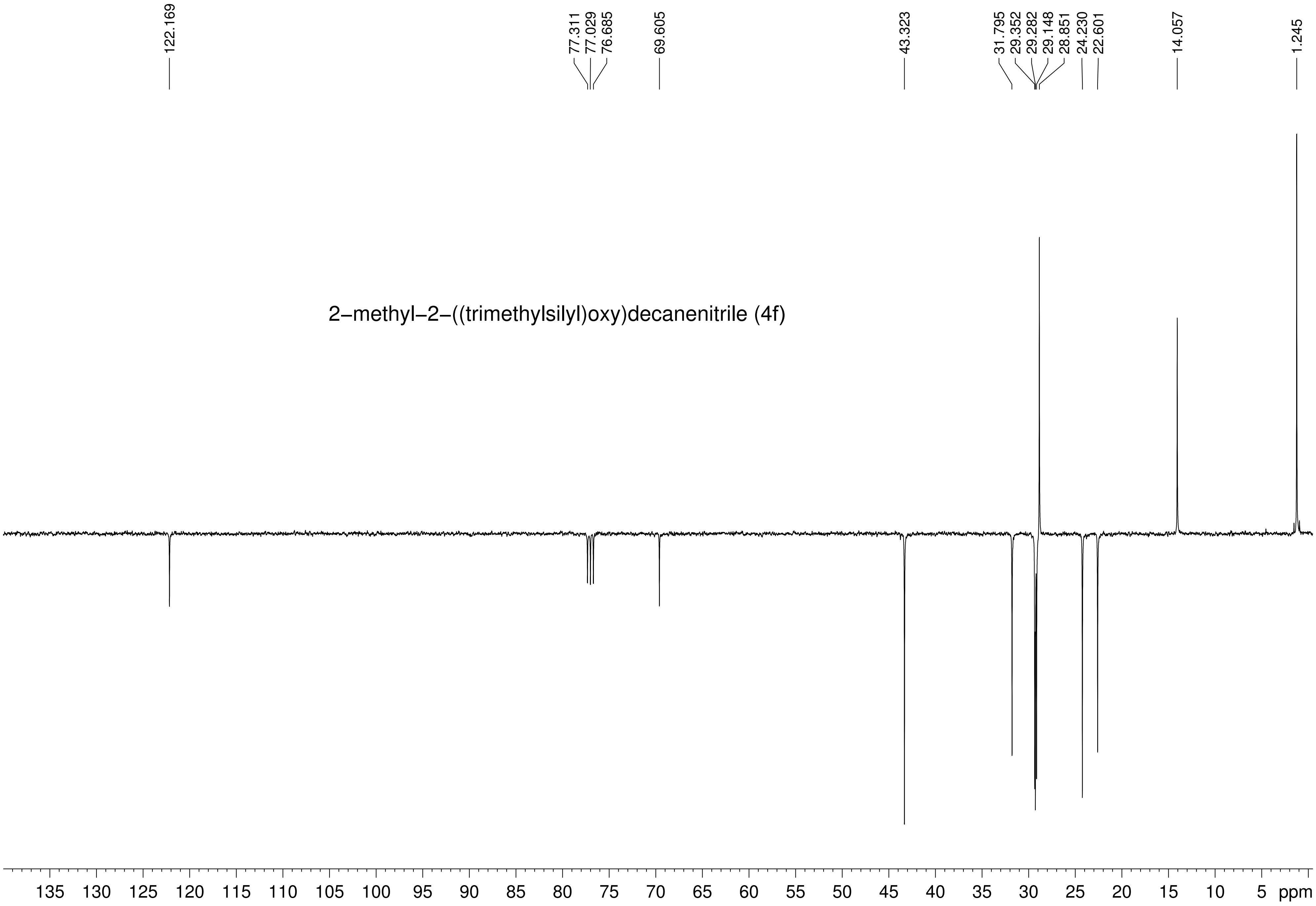


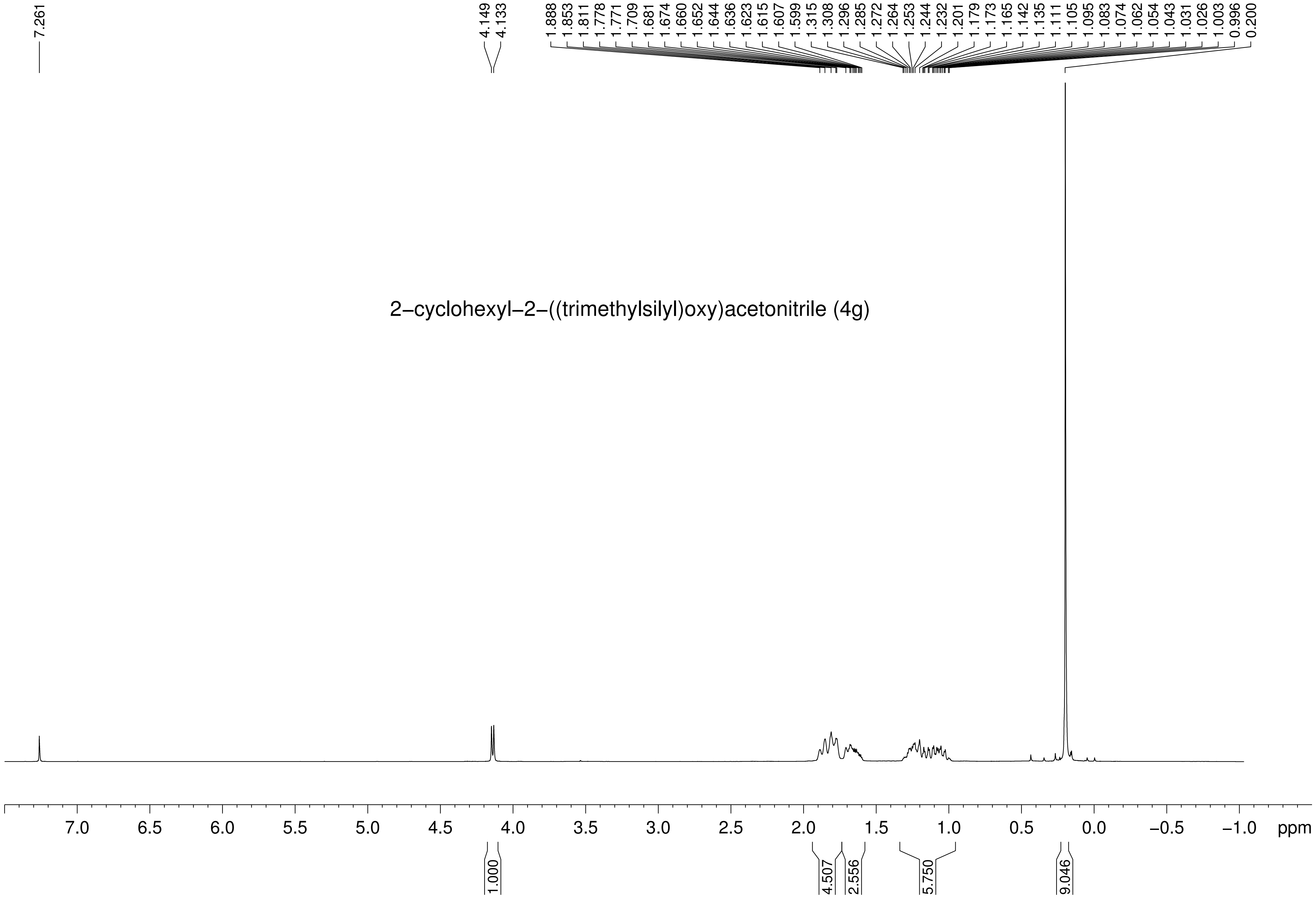
2,4–dimethyl–2–((trimethylsilyl)oxy)pentanenitrile (4e)


122.578
77.326
77.012
76.698
69.133
51.423
29.808
24.927
23.776
23.654
1.307
2,4−dimethyl−2−((trimethylsilyl)oxy)pentanenitrile (4e)
135
130
125
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
ppm

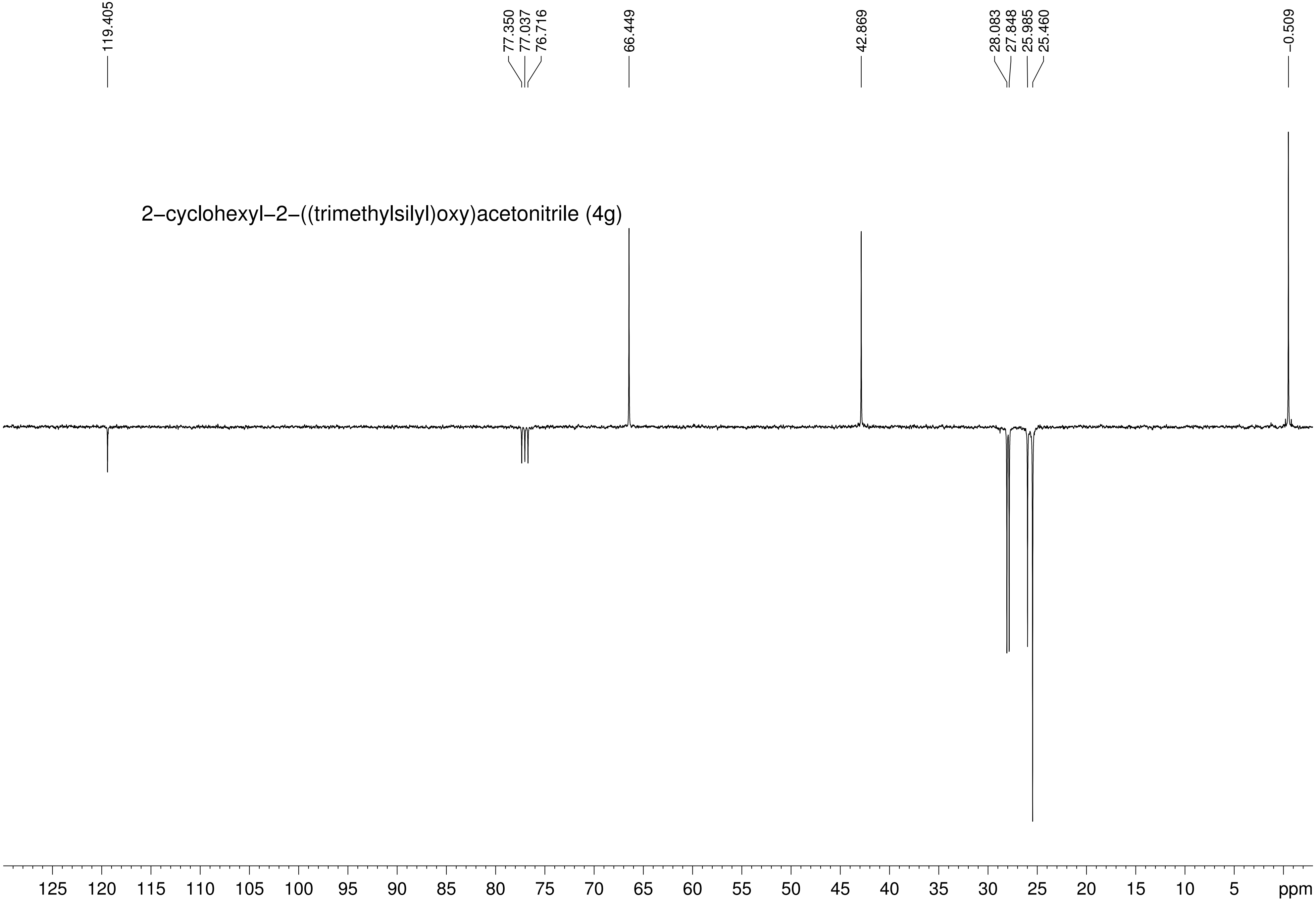


2−methyl−2−((trimethylsilyl)oxy)decanenitrile (4f)

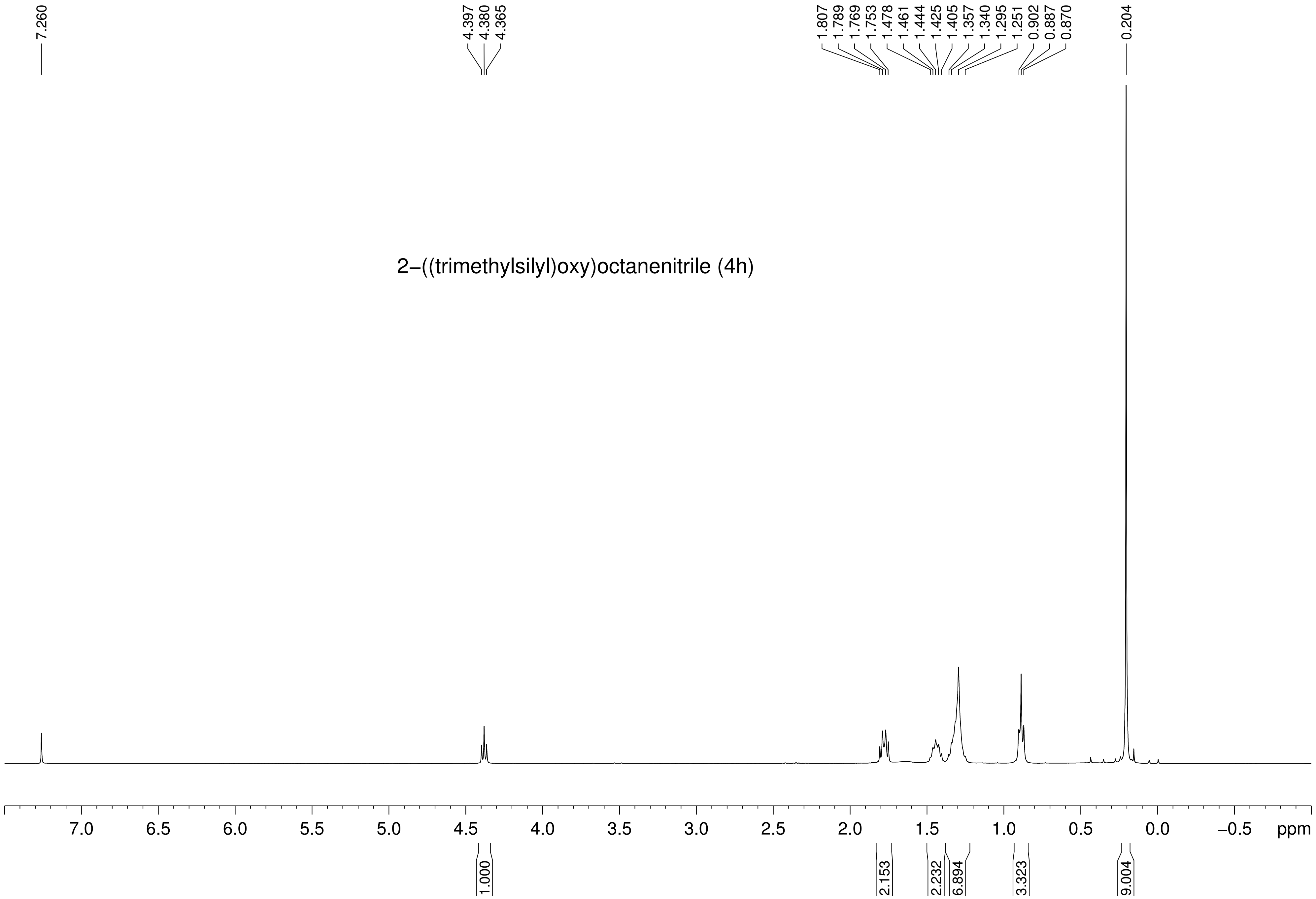

122.169
77.311
77.029
76.685
69.605
43.323
31.795
29.352
29.282
29.148
28.851
24.230
22.601
14.057
1.245
2–methyl–2–((trimethylsilyl)oxy)decanenitrile (4f)
135
130
125
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
ppm



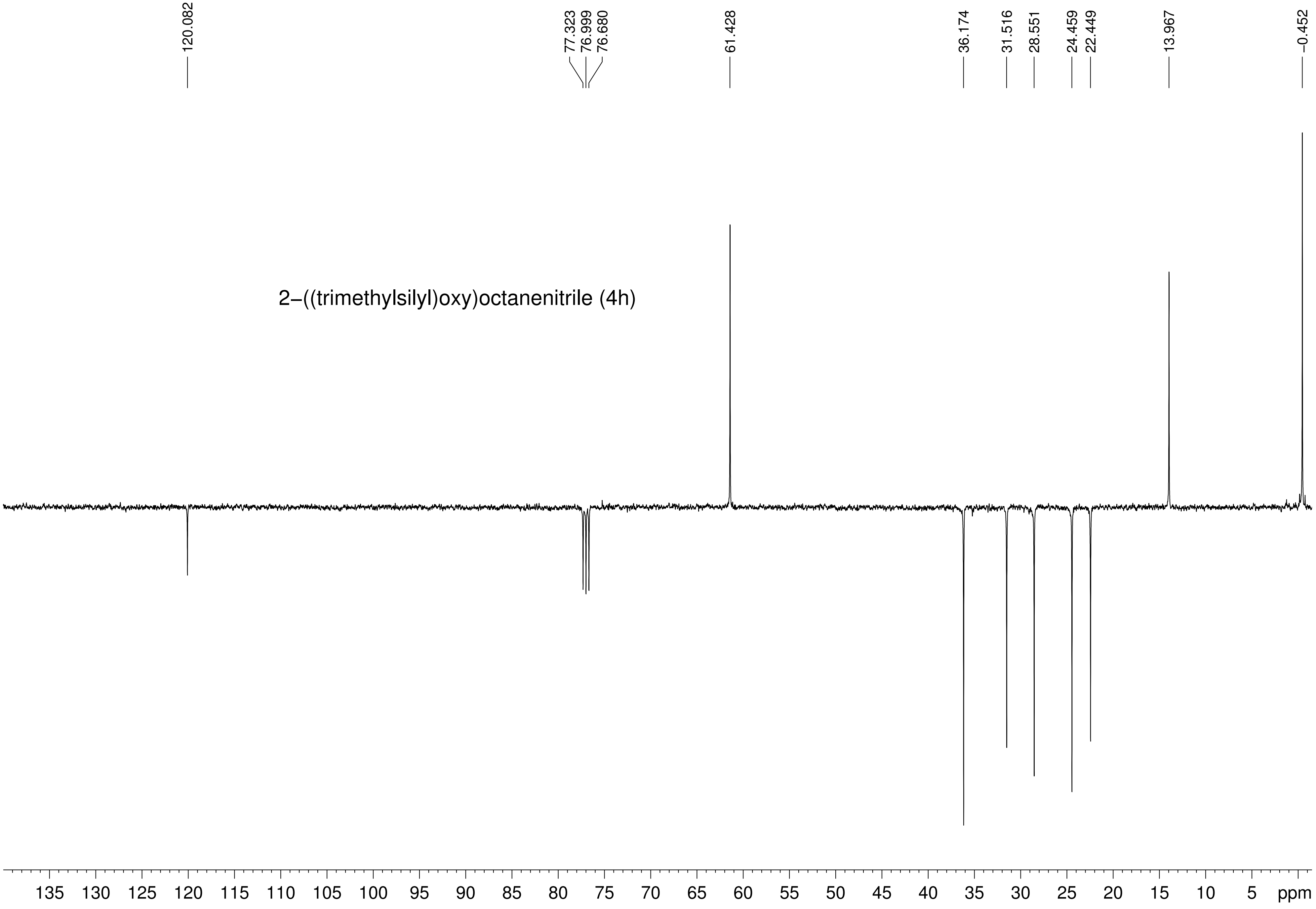
2−cyclohexyl−2−((trimethylsilyl)oxy)acetonitrile (4g)

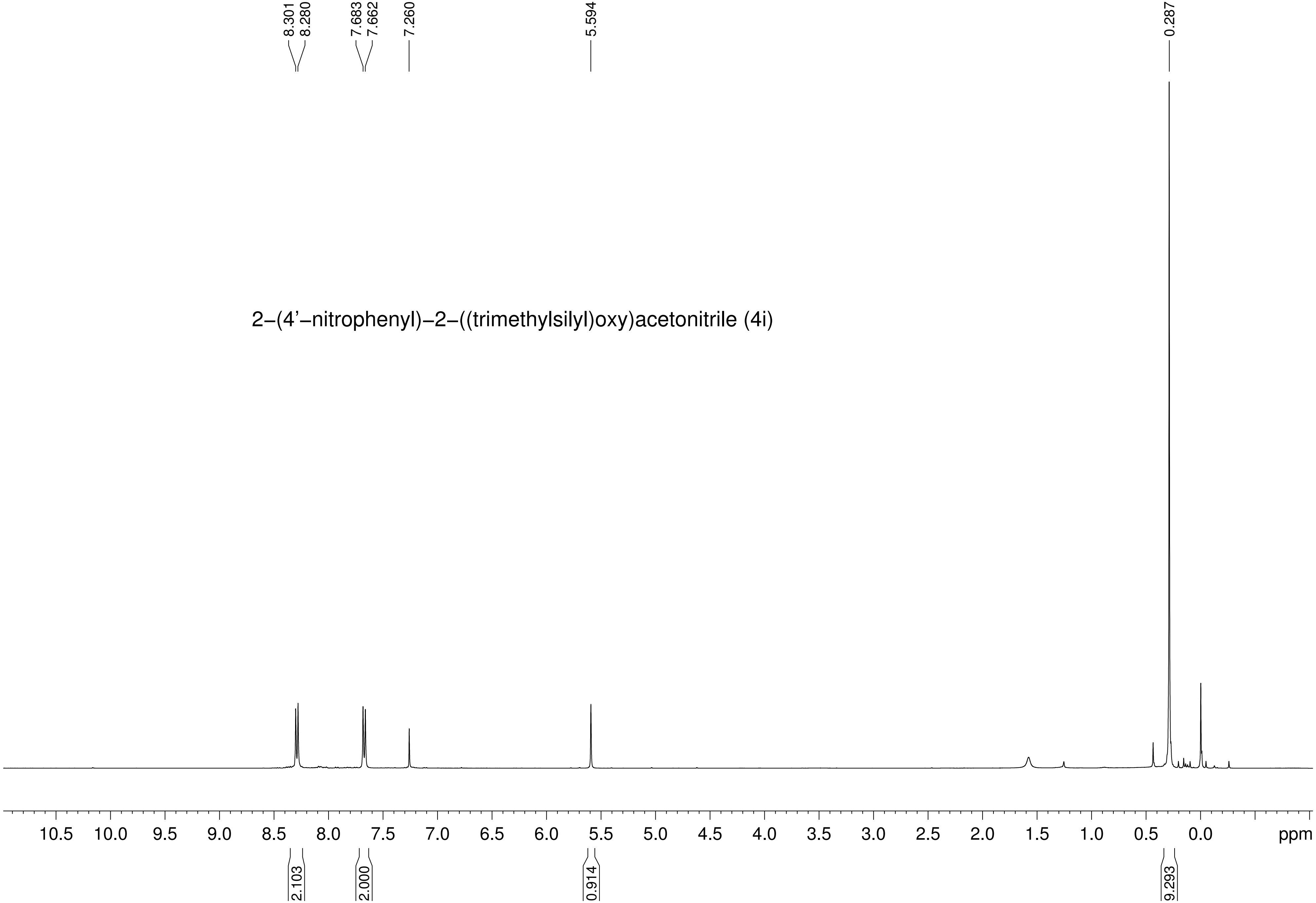


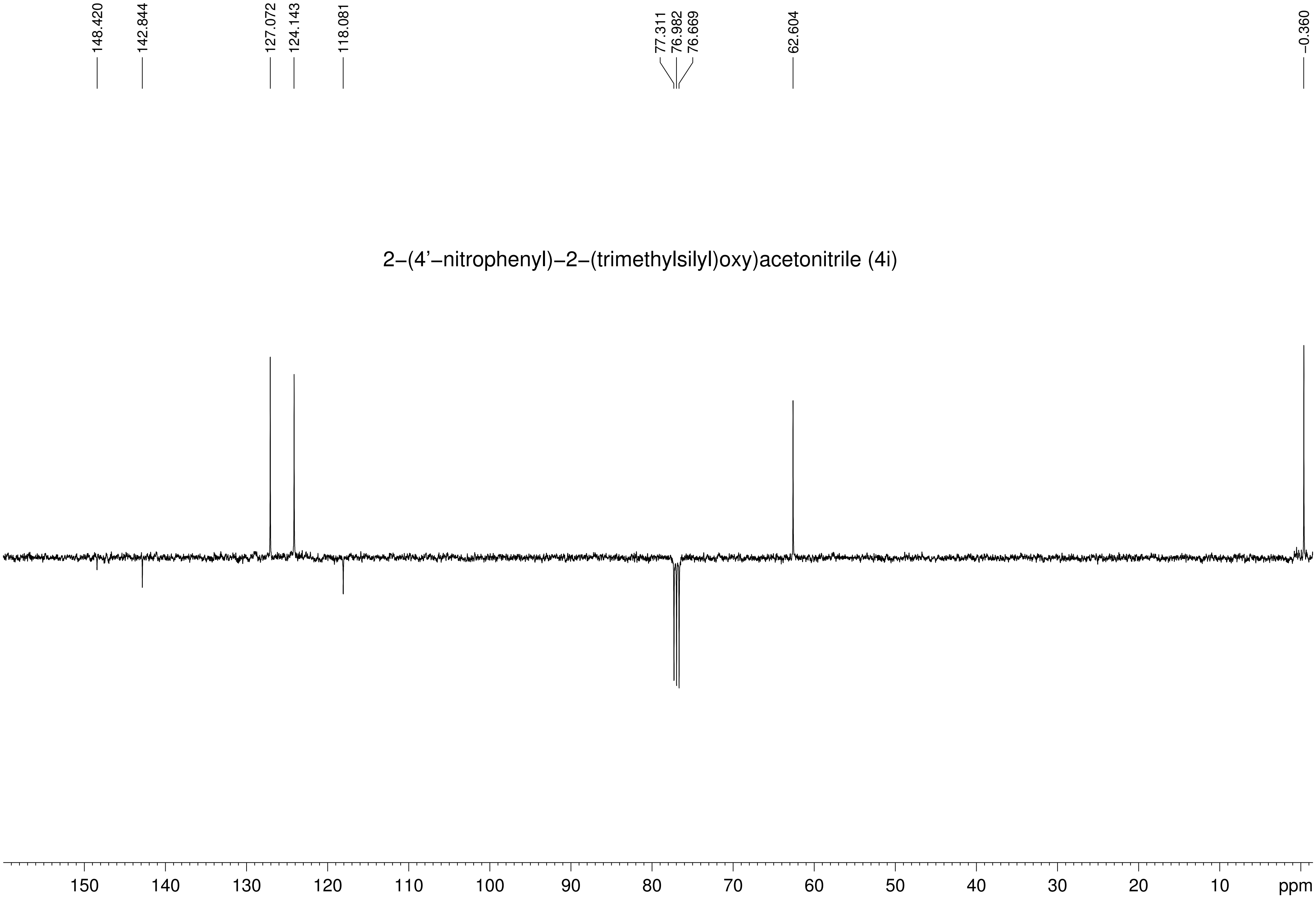
2−cyclohexyl−2−((trimethylsilyl)oxy)acetonitrile (4g)



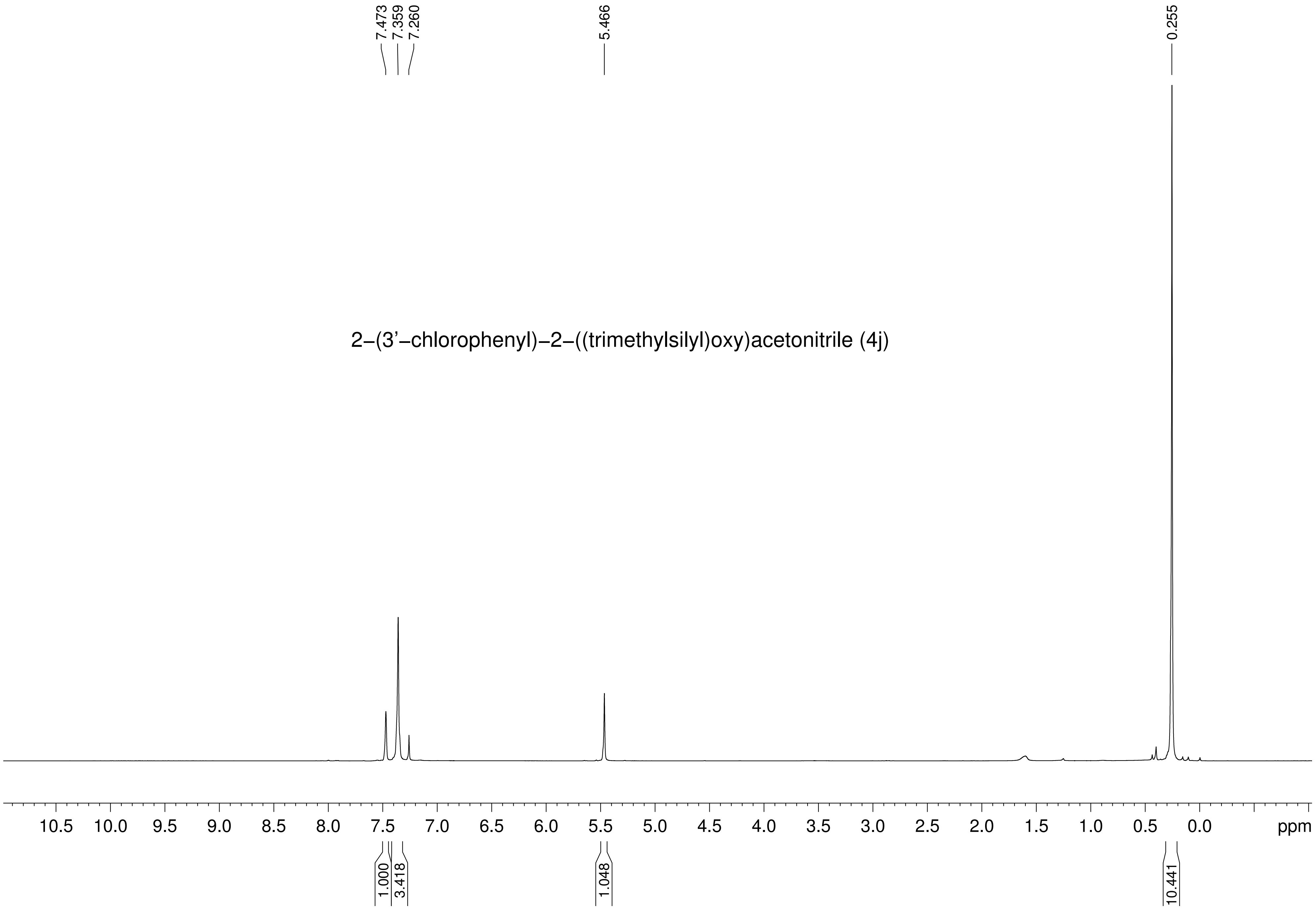
2–((trimethylsilyl)oxy)octanenitrile (4h)


120.082
77.323
76.999
76.680
61.428
36.174
31.516
28.551
24.459
22.449
13.967
-0.452
2–((trimethylsilyl)oxy)octanenitrile (4h)
135
130
125
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
ppm

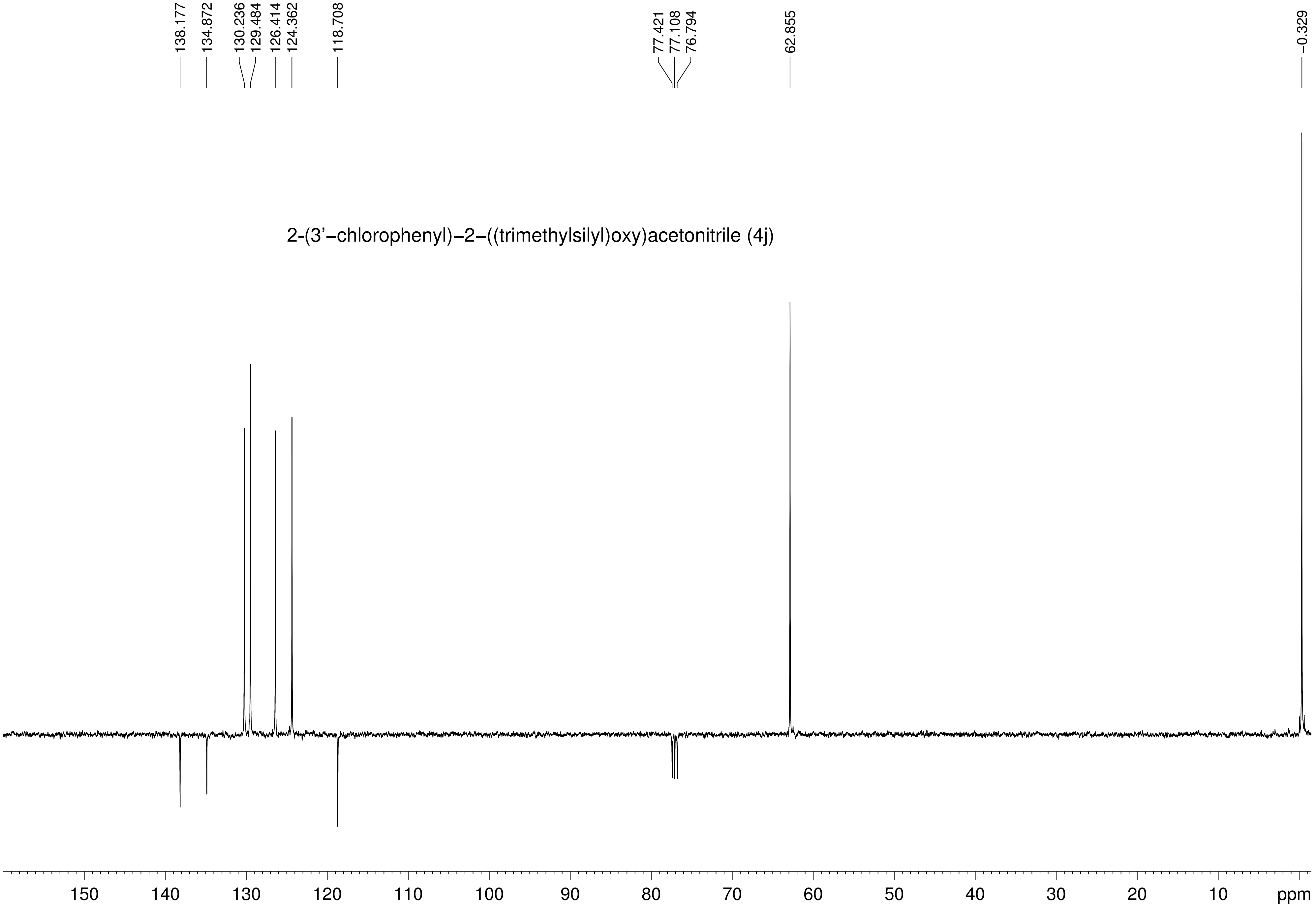

8.301
8.280
7.683
7.662
7.260
5.594
0.287
2–(4'–nitrophenyl)–2–((trimethylsilyl)oxy)acetonitrile (4i)
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
ppm
2.103
2.000
0.914
9.293



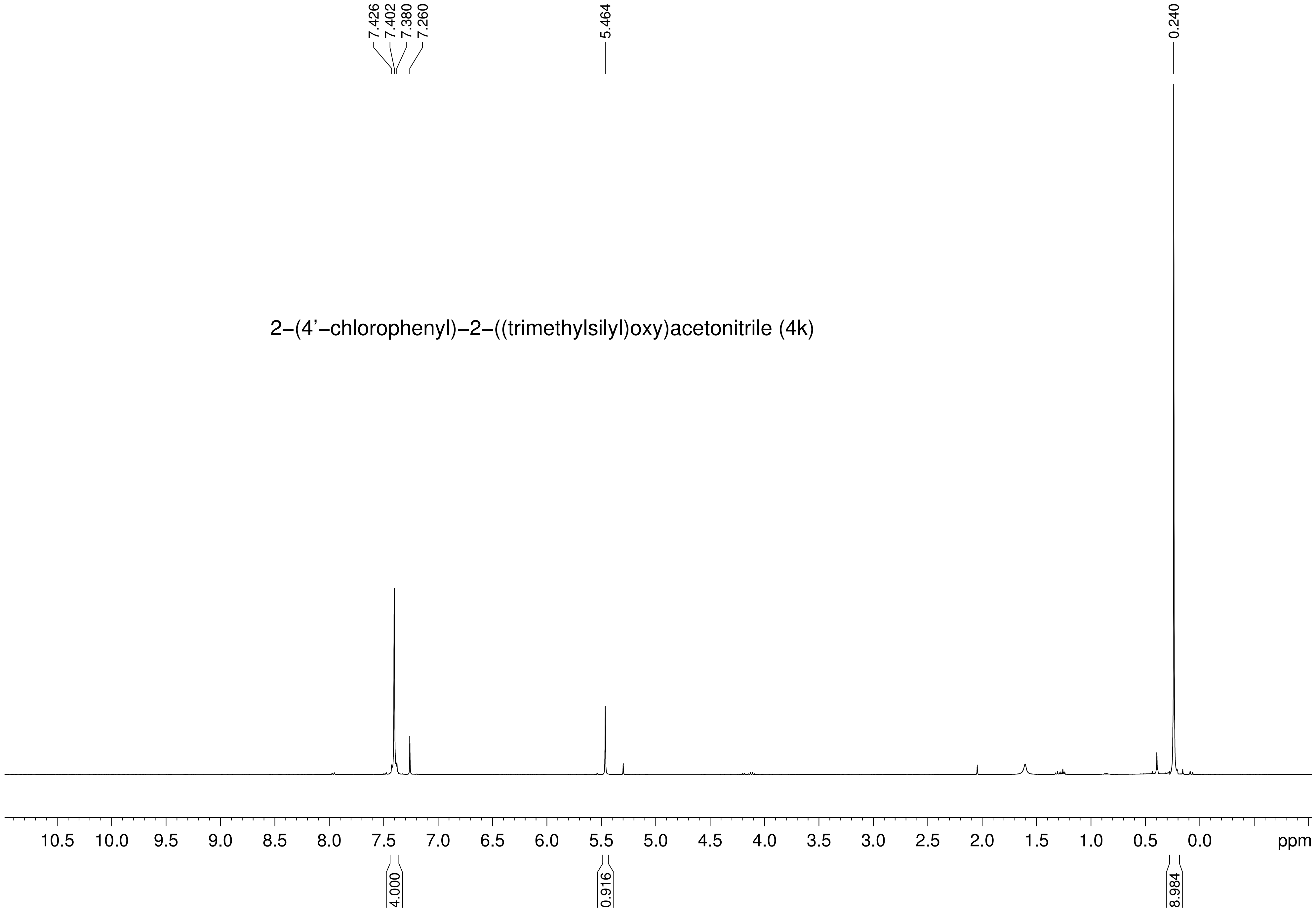
2–(4'–nitrophenyl)–2–(trimethylsilyl)oxy)acetonitrile (4i)

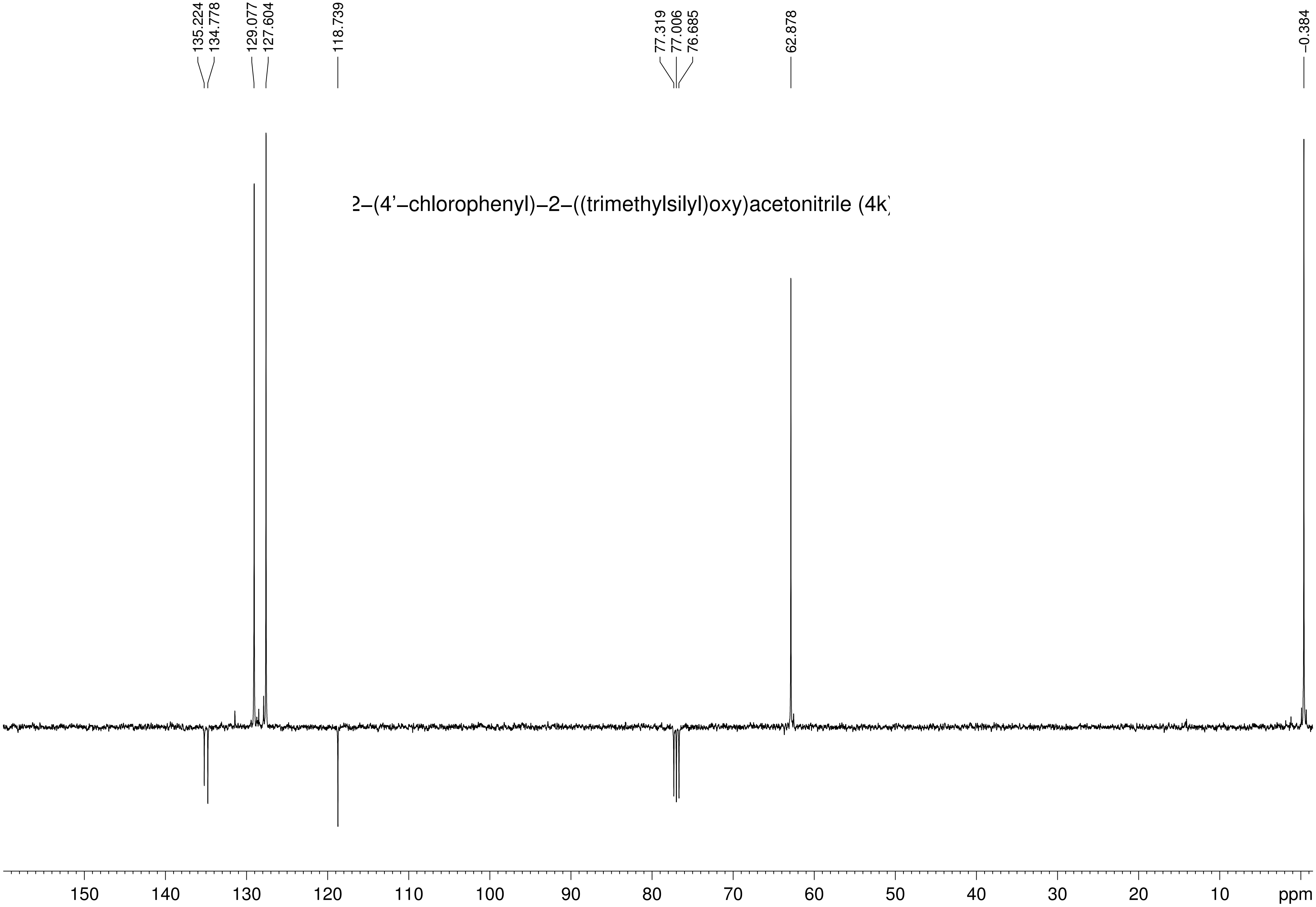


2–(3’–chlorophenyl)–2–((trimethylsilyl)oxy)acetonitrile (4j)

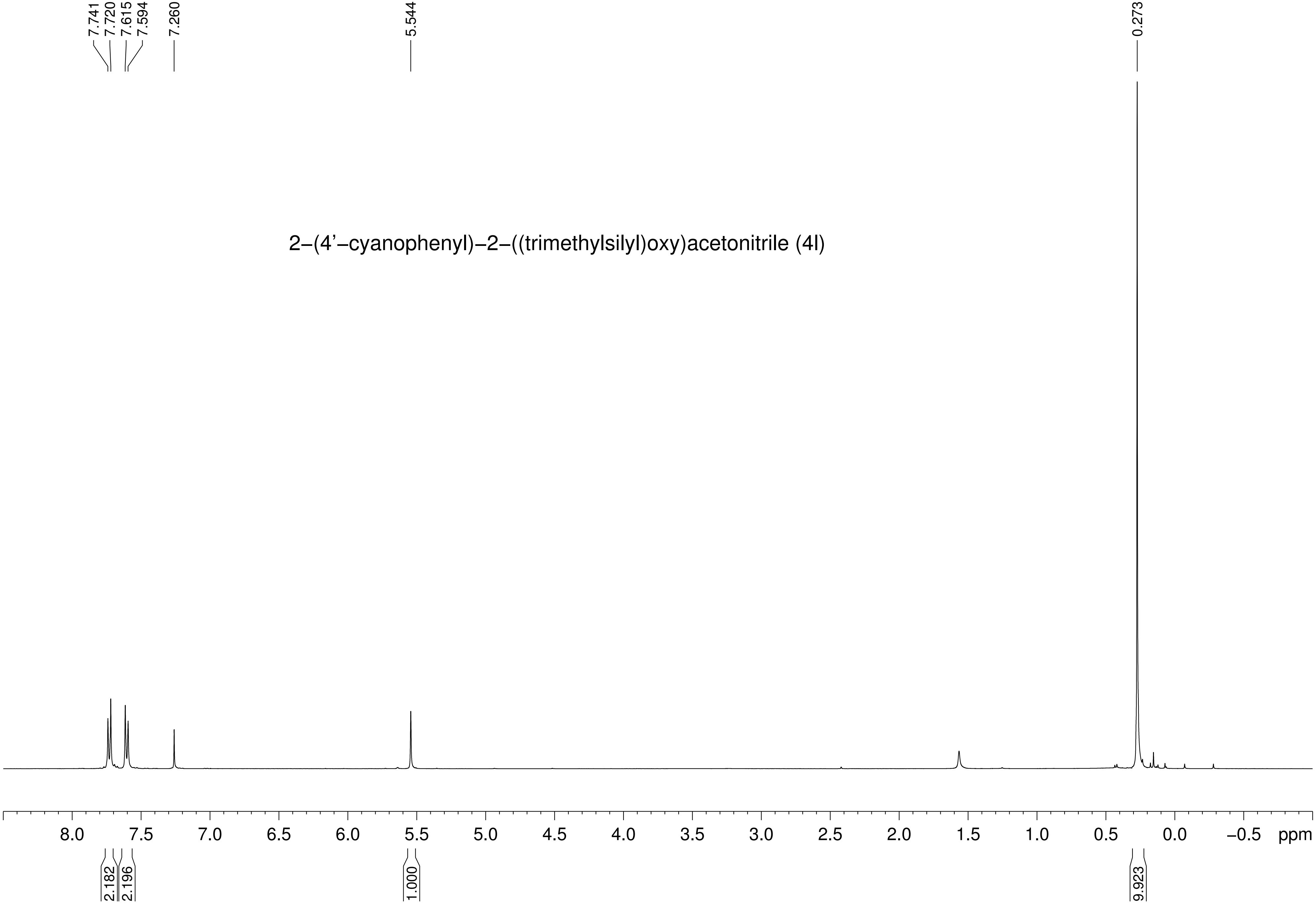

138.177
134.872
130.236
129.484
126.414
124.362
118.708
77.421
77.108
76.794
62.855
-0.329
2-(3'-chlorophenyl)-2-((trimethylsilyl)oxy)acetonitrile (4j)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

2–(4'–chlorophenyl)–2–((trimethylsilyl)oxy)acetonitrile (4k)

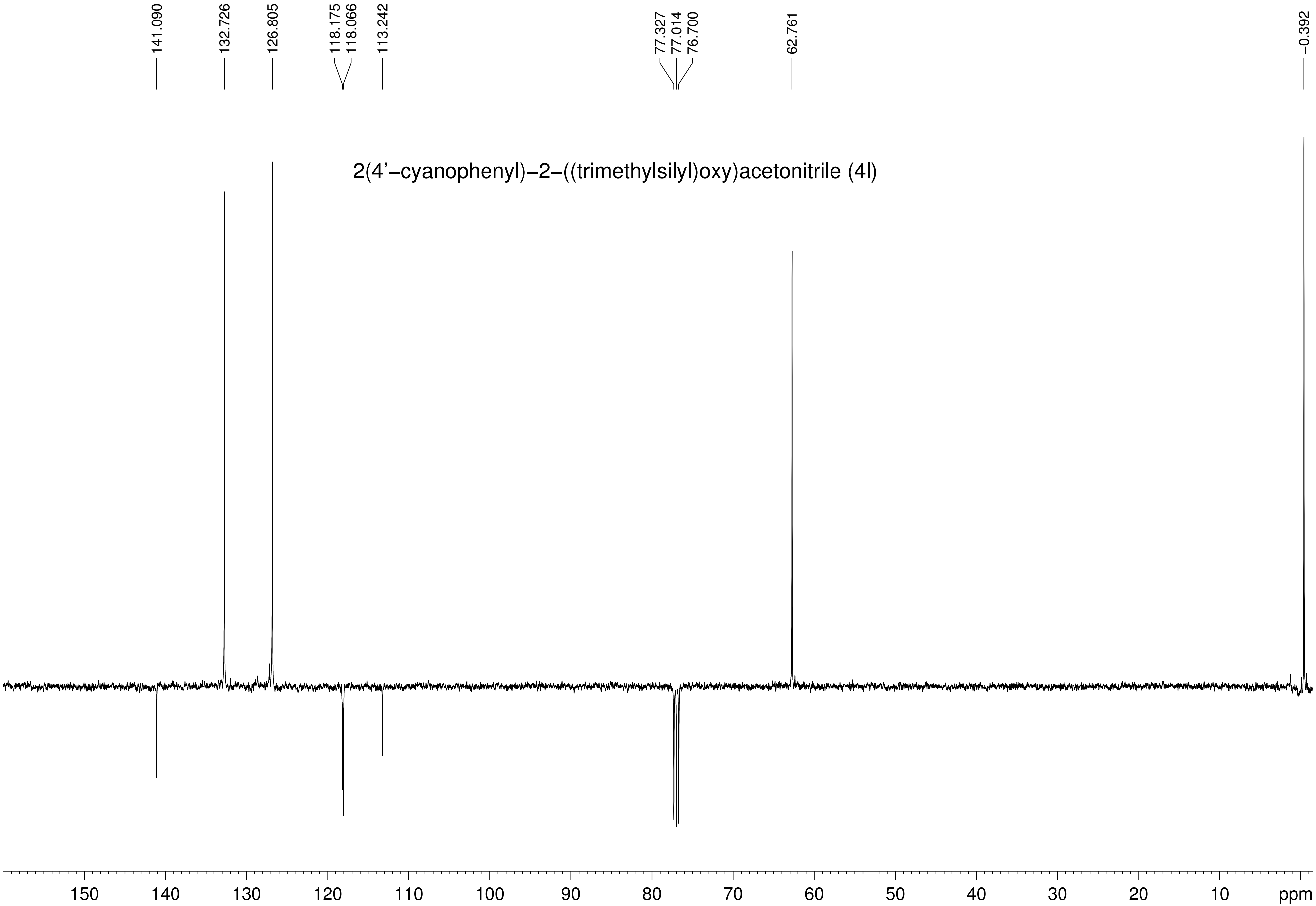


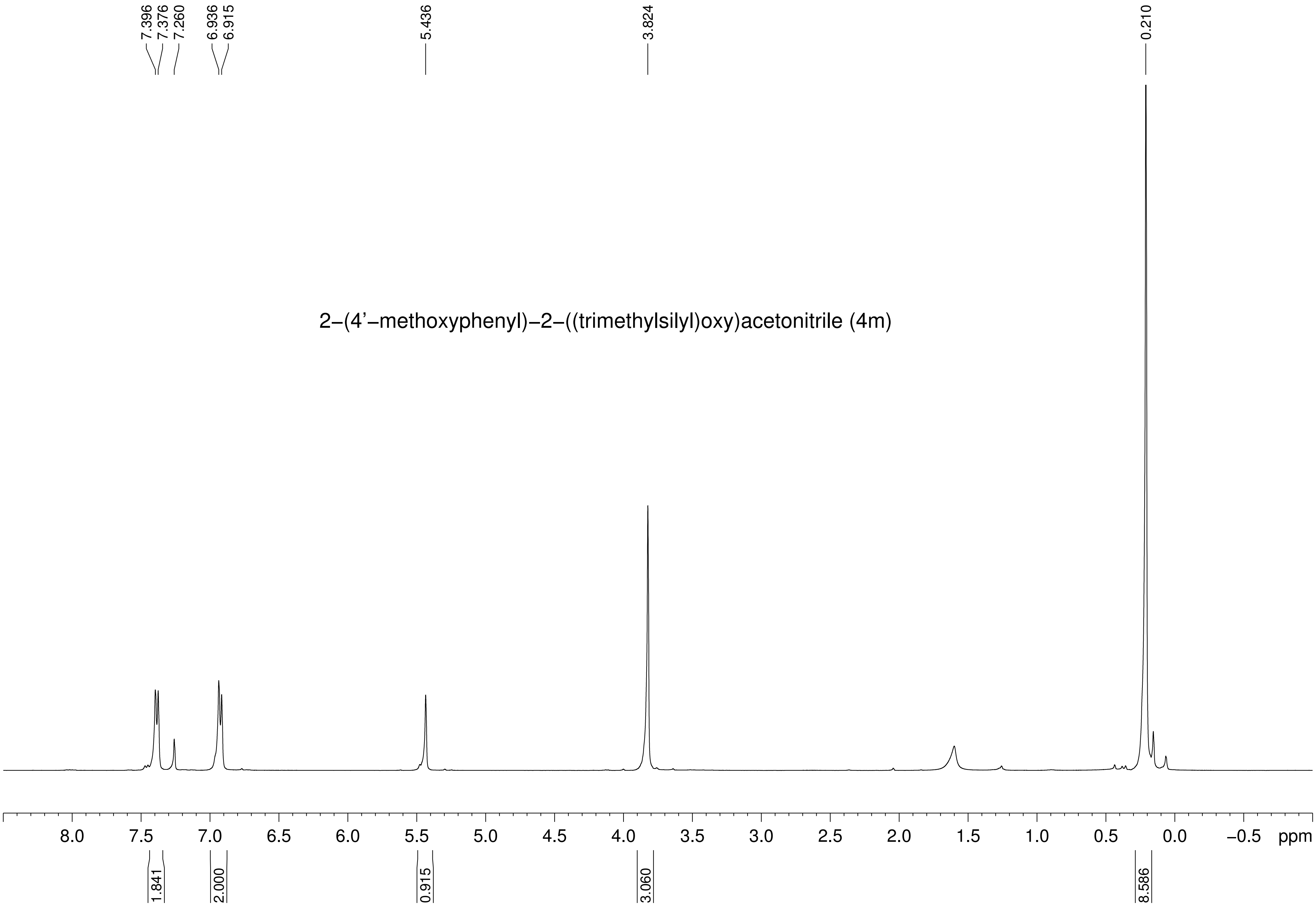


2–(4'–chlorophenyl)–2–((trimethylsilyl)oxy)acetonitrile (4k)

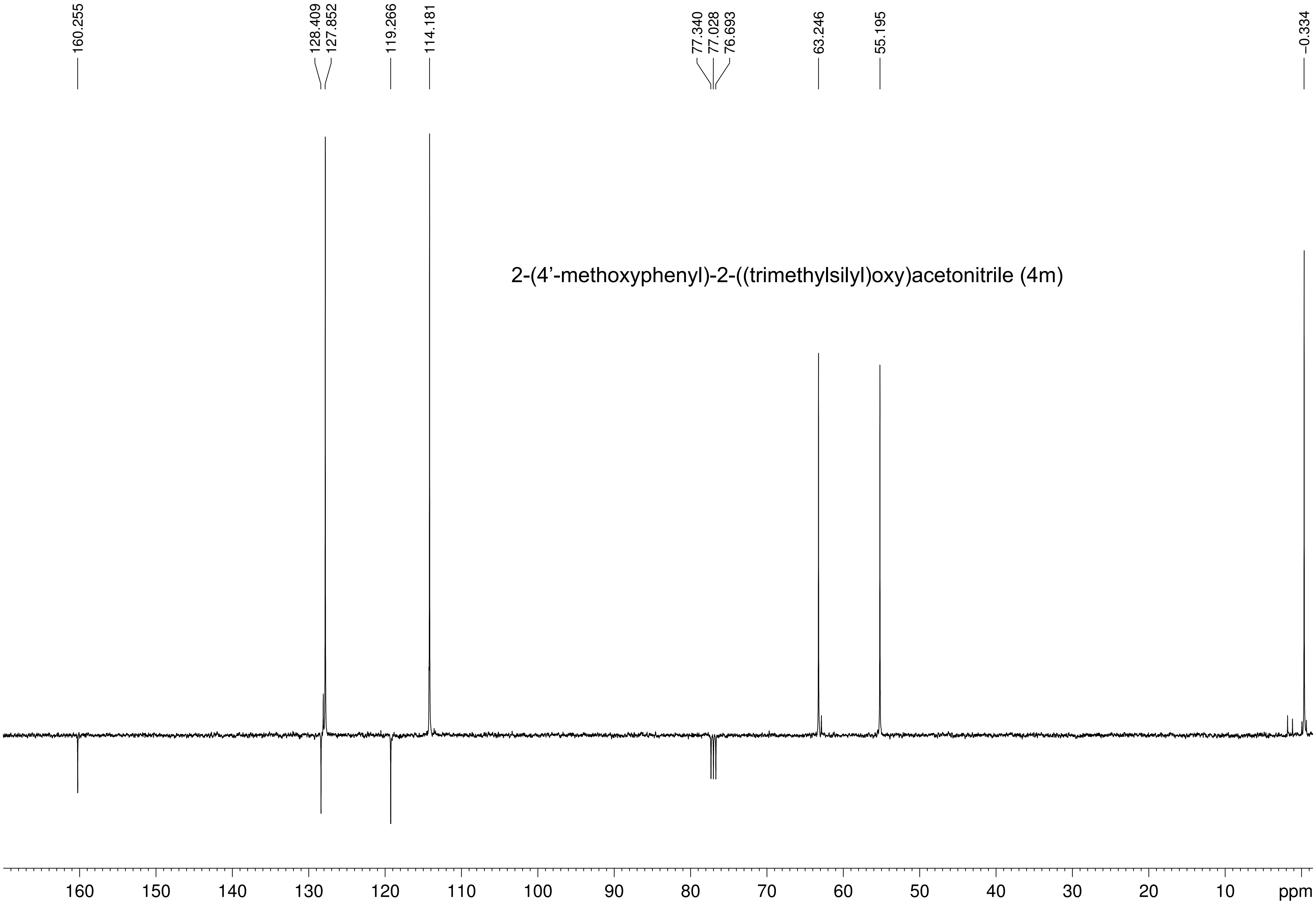


2–(4’–cyanophenyl)–2–((trimethylsilyl)oxy)acetonitrile (4l)


141.090
132.726
126.805
118.175
118.066
113.242
77.327
77.014
76.700
62.761
-0.392
2(4'−cyanophenyl)−2−((trimethylsilyl)oxy)acetonitrile (4l)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm



2–(4’–methoxyphenyl)–2–((trimethylsilyl)oxy)acetonitrile (4m)


160.255
128.409
127.852
119.266
114.181
77.340
77.028
76.693
63.246
55.195
-0.334
2-(4’-methoxyphenyl)-2-((trimethylsilyl)oxy)acetonitrile (4m)
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm