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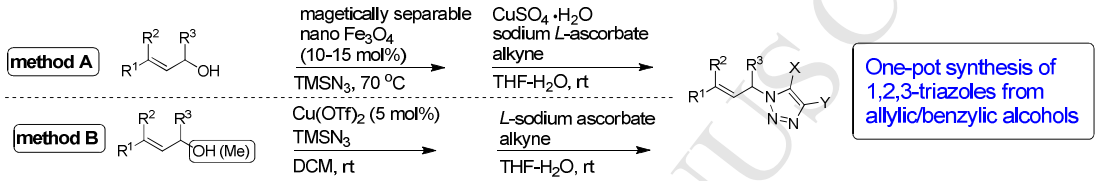

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ABSTRACT

Investigations on the one-pot direct azidation of allylic/benzylic alcohols or their methyl ethers followed by the click reaction are reported. Two methods involving sequential reactions were developed for synthesizing substituted 1,2,3 triazoles starting from allylic/benzylic alcohols. The first method involves magnetically separable nano Fe_3O_4-catalylzed direct azidation of various allylic/benzylic alcohols with $TMSN_3$ as the first step followed by the Cu-catalyzed click reaction of azides with alkynes as the second step. The second method involves $Cu(OTf)_2$–catalyzed direct azidation of allylic/benzylic alcohols and their methyl ethers with $TMSN_3$ as the first step followed by the click reaction of azides with alkynes as the second step. In this method, $Cu(OTf)_2$ served as a single catalyst for both the azidation of alcohol and click reaction steps. Utility of this protocol has been revealed by synthesizing new classes of polyether systems and macrocyles embedded with the 1,2,3-triazole and 1,3-diyne units.

Catalytic direct nucleophilic substitution of free OH group of allylic/benzylic alcohols by nucleophiles is an important process in organic chemistry.[1-3] In spite of the two known limitations, such as the poor ability of the OH group as a leaving group and the formation water as the by-product which requires the use of a water tolerant catalyst, several procedures involving a range of catalysts (e.g., transition metal, Brønsted acid, Lewis acid catalysts) were developed for the direct nucleophilic substitution of allylic/benzylic alcohols by various carbon-based or nitrogen-based nucleophiles. Consequently, the formation of carbon-nitrogen bonds via the direct catalytic substitution of OH group of alcohols with nitrogen-based nucleophiles is a simple synthetic procedure for obtaining allylic/benzylic amines and azides and other related nitrogenous compounds.[4-11] Several allylic/benzylic amines and azides are versatile synthetic building blocks for synthesizing heterocyclic compounds, natural products and biologically active molecules.[4-11] Notably, the azide moiety is reported to be a key component of the HIV/AIDS drug, zidovudine.[12]

Conversion of readily accessible alcohols to azides is a straightforward method for the synthesis of a variety of organic azides. Usually, this transformation has been carried out in two steps; first an alcohol is converted in to the respective halide or sulfonate and then, the corresponding halide/sulfonate is converted into an azide *via* the nucleophilic substitution reaction.[13] Consequently, the direct azidation of allylic/benzylic alcohols with an azide reagent is considered as one of the easy ways for synthesizing allylic/benzylic azides. The direct conversion of alcohols into azides has been accomplished using the well-established Mitsunobu reaction pathway and modified Mitsunobu-type procedures.[14,15] Along this line, there have been other methods for the direct conversion of alcohols into azides, which include, $NaN_3/BF_3{\cdot}OEt_2$,[5c] NaN_3/CCl_4-DMF,[16a] TsIm/TBAI/NaN_3,[16b] 2,4,6-trichloro[1,3,5]triazine/*n*-Bu_4NN_3,[16c] 2-azido-1,3 dimethylimidazolinium hexafluorophosphate (2-ADMP)/DBU[6a] and NaN_3/ionic liquid [H-NMP]HSO_4,[16d] NaN_3/amphiphilic resin-supported palladium phosphine complex[16e] and NaN_3/triphosgene.[6b] On the other hand, the direct azidation of allylic and benzylic alcohols with $TMSN_3$ as an azide reagent has been accomplished in the presence of various catalysts/promoters, e.g., AgOTf,[6c] Mo(IV) complex,[17a] $Cu(ClO_4)_2{\cdot}6H_2O$,[17b] $Cu(OTf)_2$[17c] and $BF_3{\cdot}OEt_2$.[4c] Further, the conversion of allyl esters into azides has been carried out in the presence of Pd(0) catalyst.[18]

The synthesis of 1,2,3-triazoles *via* the [3+2] cycloaddition of organic azides and alkynes (click reaction) has gained significant attention in the fields of chemistry, biology, medicine, and materials science.[10,11] Generally, the required organic azide molecules are prepared by the substitution reaction of the organic halides/pseudo halides by sodium azide. It is worth to mention that some of the organic azide molecules can be explosive and it is essential to handle the organic azides with care. Hence, a one-pot synthesis of organic azide followed by the click reaction procedure without isolating the corresponding azide would be very convenient.[19,20] Accordingly, the one-pot synthesis of 1,2,3-triazoles involving sequential reactions starting from organic

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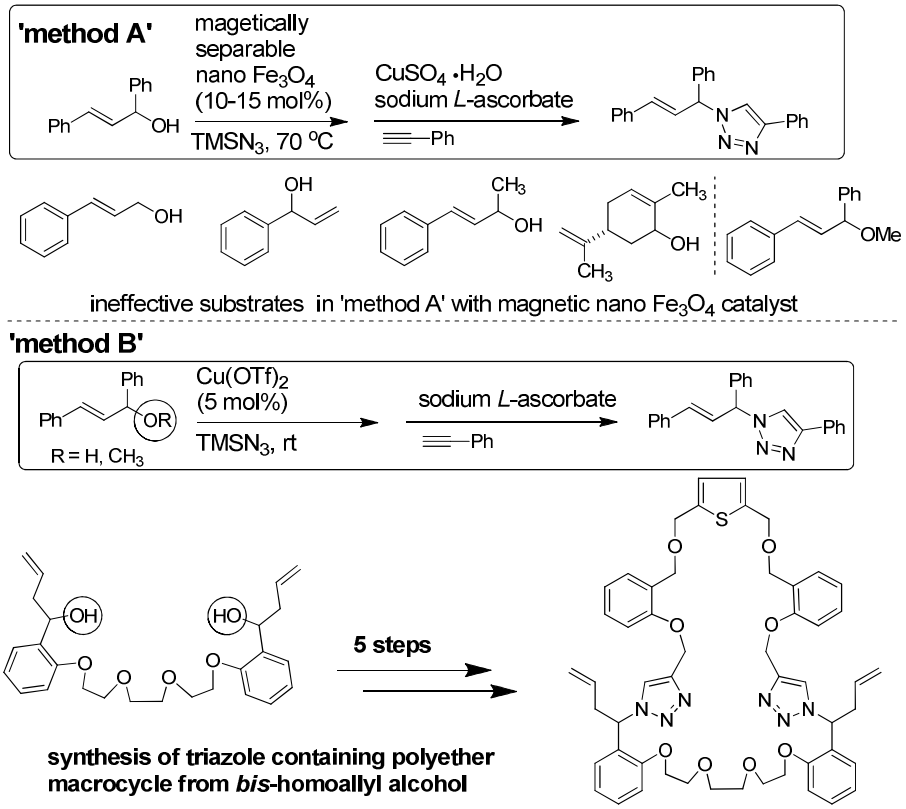
halide/pseudo halide, azide reagent and alkyne have been reported.[19-21]



Scheme 1: Theme of this work. One-pot direct azidation of allylic/benzylic alcohols and ethers followed by the click reaction.

In this one-pot process, if we can use readily accessible starting materials, e.g., alcohols instead of organic halides/pseudo halides or protected alcohols, then the synthetic procedure will be simple to work out. Although, methods for the direct conversion of alcohols into azides are well-known; however, to the best of our knowledge, one-pot sequential processes comprising, the direct azidation of allylic/benzylic alcohols followed by the Cu-catalyzed click reaction of the corresponding azides with alkynes are limited and not been well explored. Wang *et al.*[20] revealed a one-pot multistep synthesis of triazolylglycosides from unprotected monosaccharides. Sreedhar *et al.*[4d] revealed a one-pot sequential reaction procedure for the synthesis of 1,2,3-triazoles from homoallyl alcohols *via* the Pd-catalyzed azidation followed by the Cu(I)-catalyzed click reaction. Apart from this work, Fukuzawa,[21a] Chandrasekhar,[21b] Sreedhar,[21c] have revealed the one-pot sequential reaction procedures for the synthesis of 1,2,3-triazoles starting from benzyl acetates or Baylis–Hillman acetates. Yadav *et al.*[22] reported a four-component reaction of aldehyde, alcohol, azide, and alkyne *via* $Cu(OTf)_2$-catalyzed acetal formation followed by Cu(0)-mediated click reaction. Recently, we also reported our preliminary work[23] encompassing the direct azidation of allylic/benzylic alcohols catalyzed by magnetic nano Fe_3O_4[24] followed by the Cu-catalyzed click reaction of the corresponding azides with alkynes for the synthesis of 1,2,3-triazoles (Scheme 1). This method involves magnetically separable nano Fe_3O_4-catalyzed direct azidation of various allylic/benzylic alcohols with $TMSN_3$ as the first step followed by the Cu-catalyzed click reaction of the corresponding azides with alkynes as the second step. Further, we found some limitations with this method that some of the alcohols/methyl ethers did not react with $TMSN_3$ in the presence of nano Fe_3O_4 and subsequently, the click reaction also failed to afford the corresponding 1,2,3-triazole (Scheme 1).

We envisaged to overcome this limitation and simplify the reaction procedure using a single catalyst to perform the direct azidation of allylic/benzylic alcohols with $TMSN_3$ followed by the click reaction of the corresponding azides with alkynes. In view of developing synthetic procedures which are simple to work out and for achieving the chemical diversity, we envisioned to improve our method[23] and use of $Cu(OTf)_2$ a single catalyst for performing the one-pot direct azidation of allylic/benzylic alcohols with $TMSN_3$ and click reaction of the corresponding azides with alkynes (Scheme 1). Herein, we report our comprehensive works on the synthesis of several substituted 1,2,3-triazole *via* the one-pot direct azidation of allylic alcohols/ethers followed by the click reaction. Further, this protocol has been applied for the synthesis of acyclic and macrocyclic crown ethers/polyethers embedded with *bis*-triazole moieties and a 1,3-diyne unit, starting from *bis*-homoallylic alcohols and involving the Glaser-Eglinton-Hay coupling reaction.

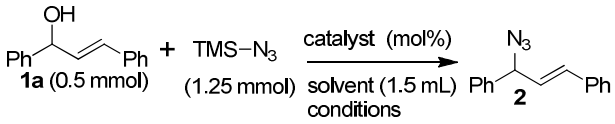
Scheme 1 illustrates the two different methods (method A and method B) presented in this paper for synthesizing several substituted 1,2,3 triazole derivatives starting from allylic and benzylic alcohols without isolating the corresponding azides. To accomplish the method A, initially, we performed various optimization reactions to find out the suitable reaction condition for the direct azidation of allylic alcohol **1a** with $TMSN_3$ in the presence of magnetically separable nano Fe_3O_4 catalyst[24-26] (particle size = < 50 nm). We found two best reaction conditions for the effective conversion of alcohol **1a** into the corresponding azide substrate **2**. We obtained the azide substrate **2** in 89% yield when the azidation of **1a** (1 equiv) was carried out with $TMSN_3$

(2.5 equiv) in the presence of 15 mol% of nano Fe_3O_4 in 1,2-DCE at rt (entry 2, Table 1). The azide substrate **2** was obtained in 98% yield when the azidation of **1a** (1 equiv) was carried out with $TMSN_3$ (2.5 equiv) in the presence of nano Fe_3O_4 (15 mol%) in 1,2-DCE at 70 °C (entry 5, Table 1). As shown in the Table 1, the conversion of alcohol **1a** into the corresponding azide substrate **2** was not effective when the reaction was carried out in solvents, such as 1,4-dioxane, MeCN, MeOH, acetone, THF and toluene and in the presence of other catalysts, e.g. nano Fe_2O_3 or powder Fe_3O_4. We have also checked the recyclability of the magnetic nano Fe_3O_4 catalyst and accordingly, the direct azidation of allylic alcohol **1a** with $TMSN_3$ afforded the product **2** in 95% yield in the 7th run (Table 1). The recovered nano Fe_3O_4 catalyst after the usage at different runs was analyzed by FT-IR and HRTEM. The FT-IR spectra of the fresh and recovered magnetic nano Fe_3O_4 catalyst showed no characteristic changes and the HRTEM analysis of the recovered magnetic nano Fe_3O_4 catalyst revealed that there was no significant change in the morphology of the nanoparticles.[23]

Next, we focused our attention to execute the one-pot method A and method B to synthesize substituted 1,2,3 triazole derivatives starting from allylic and benzylic alcohols. Having the best reaction condition for the direct azidation of **1a** with $TMSN_3$ in the presence of nano Fe_3O_4 catalyst (entry 5, Table 1), then, we decided to perform the Cu-catalyzed click reaction of the product **2** in the same RB without isolating the azide substrate **2**. Accordingly, at first, we carried out the method A procedure, in which the direct azidation of allylic alcohol **1a** was performed followed by the copper-catalyzed click reaction of the azide **2** ((*E*)-(3-azidoprop-1-ene-1,3-diyl)dibenzene) with ethyl propiolate which gave the substituted 1,2,3-triazole derivative **4a** in 86% yield (entry 1, method A, Table 2). Successively, we performed the one-pot direct azidation of substrate **1a** followed by the copper-catalyzed click reaction of the product **2** with various alkynes **3b-e**, **3g-j**, which gave the corresponding substituted 1,2,3-triazole derivatives **4b-e**, **4g-j** in 75-93% yields (method A, Table 2).

Method A involves nano Fe_3O_4-catalyzed direct azidation of **1a** with $TMSN_3$ as the first step followed by the Cu-catalyzed click reaction of the corresponding azides with alkynes as the second step. We envisaged simplifying the reaction procedure of the method A and using a single catalyst to perform the direct azidation of **1a** with $TMSN_3$ followed by the click reaction of the corresponding azides with alkynes. Accordingly, we used the method B procedure, in which the direct azidation of substrate **1a** with $TMSN_3$ was carried out in the presence of 5 mol% of $Cu(OTf)_2$ followed by the click reaction of the product **2** in the same RB with various alkynes. In this regard, initially, we performed the optimization of the reactions to find out the best reaction conditions for the method B. The direct azidation of the substrate **1a** with $TMSN_3$ in the presence of 5 mol% of $Cu(OTf)_2$ followed by the click reaction of the azide **2** with **3a** and without any additive in the click reaction step did not give the expected 1,2,3-triazole **4a** (entry 1, method B, Table 2). When we used DIPEA or *L*-ascorbic acid as an additive, the 1,2,3-triazole **4a** was obtained in 10 and 20% yields, respectively (entry 1, method B, Table 2). The use of sodium *L*-ascorbate as an additive in the click reaction step gave the 1,2,3-triazole **4a** in 87% yield (entry 1, method B, Table 2). Then, using the same reaction conditions, we performed the direct azidation of substrate **1a** followed by the click reaction of the product **2** with various alkynes **3b-i**, which gave the corresponding substituted 1,2,3-triazole derivatives **4b-i** in 72-98% yields (method B, Table 2).

Table 1. Nano Fe_3O_4-catalyzed reaction **1a** with $TMSN_3$.



Entry	Catalyst (mol %)	Solvent (1.5 mL)	Reaction Condition	Yield of azide **2** (%)
1	nil	1,2-DCE	70 °C, 40 h	0
2	nano Fe_3O_4 (15)	1,2-DCE	rt, 15 h	89
3	nano Fe_3O_4 (15)	1,2-DCE	rt, 15 h	80[a]
4	nano Fe_3O_4 (15)	1,2-DCE	rt, 15 h	83[b]
5	nano Fe_3O_4 (15)	1,2-DCE	70 °C, 6 h	98
6	nano Fe_3O_4 (15)	1,2-DCE	70 °C, 6 h	85[a]
7	nano Fe_3O_4 (15)	1,2-DCE	70 °C, 6 h	89[b]
8	nano Fe_3O_4 (15)	DCM	rt, 10 h	85
9	nano Fe_3O_4 (15)	DCM	reflux, 8 h	92
10	nano Fe_3O_4 (15)	1,4-dioxane	rt, 30 h	0
11	nano Fe_3O_4 (15)	MeCN	rt, 30 h	0
12	nano Fe_3O_4 (15)	MeOH	rt, 30 h	0
13	nano Fe_3O_4 (15)	acetone	rt, 30 h	23
14	nano Fe_3O_4 (15)	THF	rt, 30 h	20
15	nano Fe_3O_4 (15)	toluene	rt, 30 h	55
16	nano Fe_3O_4 (10)	1,2-DCE	70 °C, 16 h	92
17	nano Fe_2O_3 (15)	1,2-DCE	70 °C, 30 h	<5
18	powder Fe_3O_4 (15)	1,2-DCE	70 °C, 48 h	35

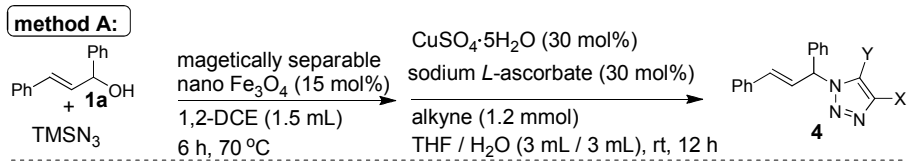
Recycling of nano Fe_3O_4[c]

Run	1	2	3	4	5	6	7
Time (h)	6	6	8	10	12	15	20
Yield of **2** (%)	98	97	97	97	97	96	95

[a] In this case, 0.55 mmol of $TMSN_3$ was used. [b] In this case, 0.75 mmol of $TMSN_3$ was used. [c] The reaction was carried out using **1a** (0.5 mmol), $TMSN_3$ (1.25 mmol) and nano Fe_3O_4 (15 mol%) in 1,2-DCE (1.5 mL) at 70 °C.

Next, we decided to explore the direct conversion of various allylic alcohols **1b-g** (Table 3) into the corresponding substituted 1,2,3-triazole derivatives in one-pot using either method A or method B procedure. The substituted 1,2,3-triazole derivatives **4k** (75%) and **4l** (60%) were synthesized from **1b** using the method B procedure involving $Cu(OTf)_2$ as the single catalyst (entries 1 and 2, Table 3). The substituted 1,2,3-triazole derivatives **4m-o** and **4oA** were synthesized from the corresponding alcohols **1b-d** and **1dA** using the method A or B procedures (entries 3-6, Table 3). The products **4n,o** and **4oA** were obtained as a mixture of regioisomers since the corresponding allylic alcohols **1c,d** and **1dA** underwent an allylic rearrangement under the experimental condition, thereby led to the formation of the corresponding rigioisomers. The allylic alcohols **1e-g** failed to afford corresponding substituted 1,2,3-triazole derivatives **4p** and **4q** when the direct azidation of allylic alcohols **1e-g** followed by the click reaction was performed using method A procedure. This is because the nano Fe_3O_4-catalyzded conversion of allylic alcohols **1e-g** into the corresponding azides did not occur in the first step as a result the subsequent click reaction failed to afford the 1,2,3-triazole derivatives **4p** and **4q** under the method A procedure (entries 6-8, method A, Table 3). However, the allylic alcohols **1e-g** successfully afforded the corresponding substituted 1,2,3-triazole derivatives **4p** (70-80%) and **4q** (76%) when the direct azidation of allylic alcohols **1e-g** followed by the click reaction was performed using the method B procedure (entries 7-10, method B, Table 3). Similarly, the substituted 1,2,3-triazole derivatives **4r** was obtained in 85% yield from the corresponding alcohols **1g** using the method B procedure (entry 9, method B Table 3).

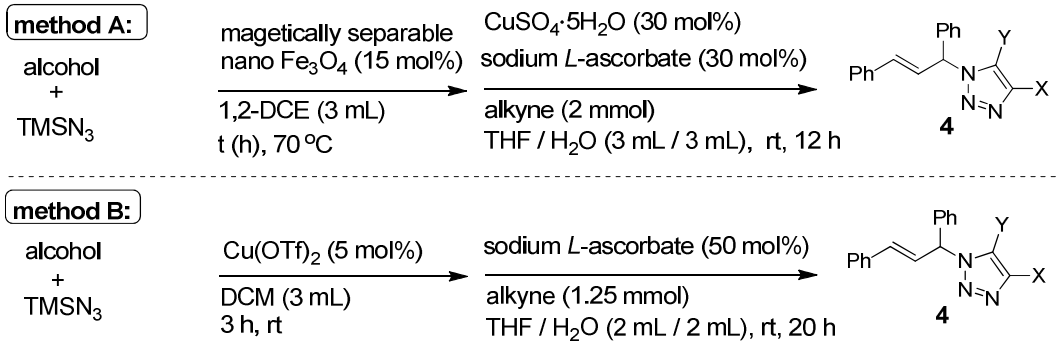
Table 2. One-Pot direct azidation of allylic alcohol **1a** followed by the click reaction with **4a-j**. Synthesis of substituted 1,2,3-triazoles **4a-j**.[a]

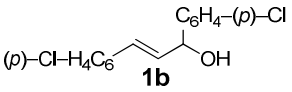
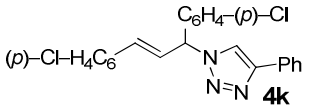
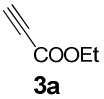
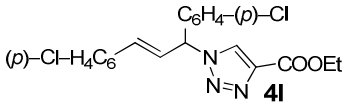
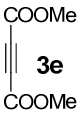
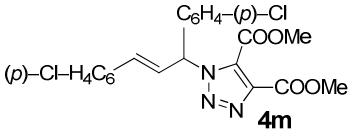
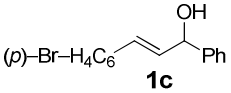
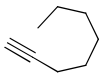
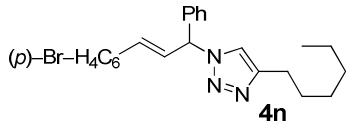
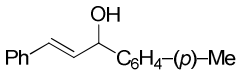
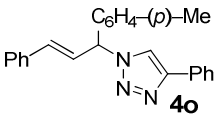
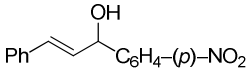
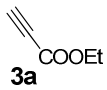
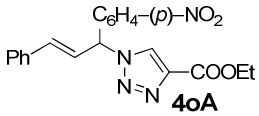
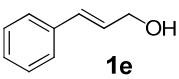
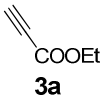
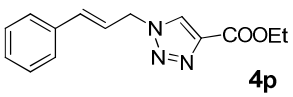
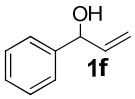
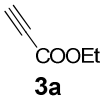
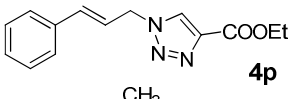
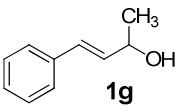
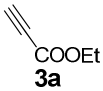
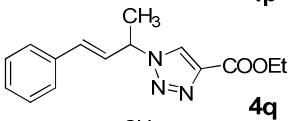
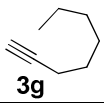
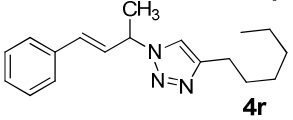


Entry	Alkyne	Triazole	Yield (%) Method A	Yield (%) Method B
1	EtOOC— **3a**	**4a**	86	(0),[b] (10),[c] (20),[d] (60),[e] (81),[f] (87)[g]
2	HO **3b**	**4b**	82	75
2	Ph— **3c**	**4c**	90	97
3	**3d**	**4d**	93	96
4	MeOOC—COOMe **3e**	**4e**	86	72
5	**3f**	**4f**	-[h]	98
6	**3g**	**4g**	85	97
7	**3h**	**4h**	92	93
8	CHO **3i**	**4i**	85	89
9	**3j**	**4j**	75	-[h]

[a] In method A, 0.5 mmol of **1a** and 1.5 mmol of $TMSN_3$ were used. In method B, 0.5 mmol of **1a** and 0.75 mmol of $TMSN_3$ were used. In both the methods, initially, the azidation of **1a** was carried out with $TMSN_3$ and after the reaction period the solvent was evaporated. Then, the click reaction was carried out.
[b] The reaction was carried out without sodium *L*-ascorbate.
[c] DIPEA (50 mol%) was used instead of sodium *L*-ascorbate.
[d] *L*-Ascorbic acid (50 mol%) was used instead of sodium *L*-ascorbate.
[e] CuCl (60 mol%) was used instead of sodium *L*-ascorbate.
[f] Sodium *L*-ascorbate (30 mol%) was used.
[g] Sodium *L*-ascorbate (50 mol%) was used.
[h] The reaction was not performed.

Table 3. One-Pot direct azidation of various allylic alcohols **1b-g** followed by the click reaction with alkynes. Synthesis of substituted 1,2,3-triazoles **4k-r** and **4oA**.[a]



Entry	Alcohol	Alkyne	Triazole	Yield (%) Method A	Yield (%) Method B[b]
1	 **1b**	 **3c**	 **4k**	-[c]	75
2	**1b**	 **3a**	 **4l**	-[c]	60
3	**1b**	 **3e**	 **4m**	52 (14 h)[d]	50
4	 **1c**	 **3g**	 **4n**	82 (12 h)[d] (50:50)[e]	70 (50:50)[e]
5	 **1d**	 **3c**	 **4o**	72 (15 h)[d] (50:50)[e]	64 (50:50)[e]
6	 **1dA**	 **3a**	 **4oA**	-[c]	68 (50:50)[e]
7	 **1e**	 **3a**	 **4p**	0	70
8	 **1f**	 **3a**	 **4p**	0	80
9	 **1g**	 **3a**	 **4q**	0	76
10	**1g**	 **3g**	 **4r**	-[c]	85

[a] In both the methods, initially, the azidation of **1a** was carried out with $TMSN_3$ and after the reaction period the solvent was evaporated. Then, the click reaction was carried out.

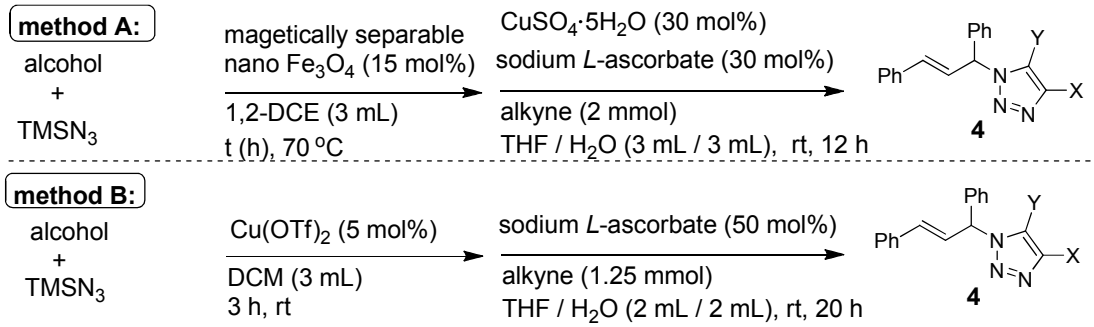
[b] In method B, for all the reactions, 0.5 mmol of **1a** and 0.75 mmol of $TMSN_3$ were used.

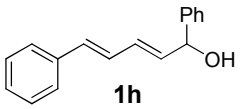
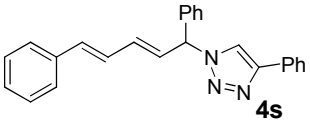
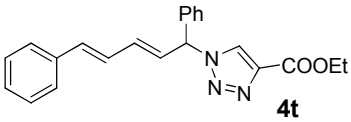
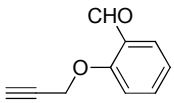
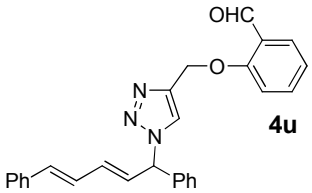
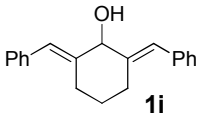
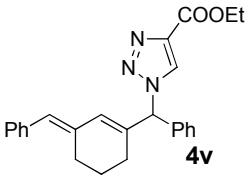
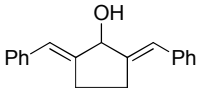
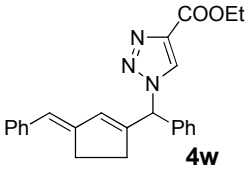
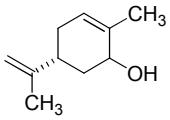
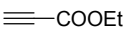
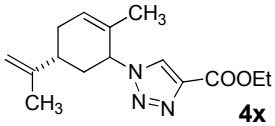
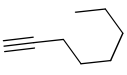
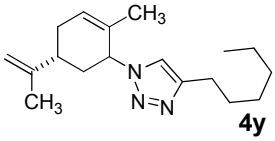
[c] The reaction was not performed.

[d] In this reaction, 1 mmol of alcohol and 3 mmol of $TMSN_3$ were used and the reaction time indicated in the parenthesis corresponds to azidation reaction.

[e] Products were obtained as a mixture of regioisomers due to an allylic rearrangement under the experimental condition.

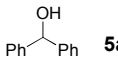
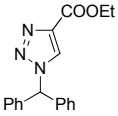
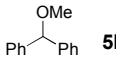
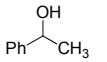
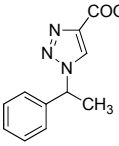
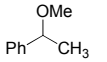
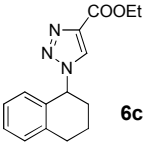
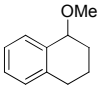
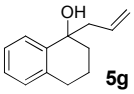
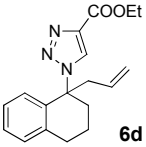
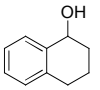
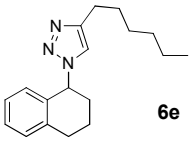
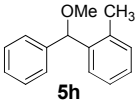
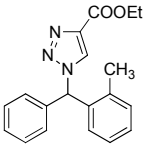
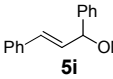
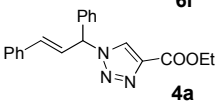
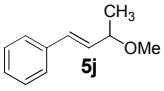
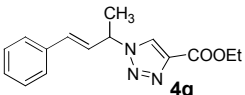
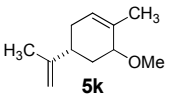
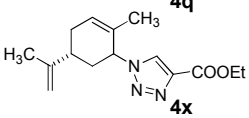
Table 4. One-Pot direct azidation of conjugated and cyclic allylic alcohols **1h-k** followed by the click reaction with alkynes. Synthesis of substituted 1,2,3-triazoles **4s-y**.



Entry	Alcohol	Alkyne	Triazole	Yield (%) Method A	Yield (%) Method B[b]
1	 **1h**	 **3c**	 **4s**	62 (18 h)[c]	68
2	**1h**	 **3a**	 **4t**	-[d]	73
3	**1h**	 **3i**	 **4u**	57 (18 h)[c]	42
4	 **1i**	 **3a**	 **4v**	62 (30 h)[c] (76:24)[e]	<5[f]
5	 **1j**	 **3a**	 **4w**	45 (24 h)[c] (88:12)[e]	<5[f]
6	 **1k** (60:40)	 **3a**	 **4x**	0 (24 h)[c]	80 (86:14)[g]
7	**1k** (60:40)	 **3g**	 **4y**	-[d]	87 (86:14)[g]

[a] In both the methods, initially, the azidation of **1a** was carried out with $TMSN_3$ and after the reaction period the solvent was evaporated. Then, the click reaction was carried out.
[b] In method B, for all the reactions, 0.5 mmol of **1a** and 0.75 mmol of $TMSN_3$ were used.
[c] In this reaction, 1 mmol of alcohol and 3 mmol of $TMSN_3$ were used and the reaction time indicated in the parenthesis corresponds to azidation reaction.
[d] The reaction was not performed.
[e] Products were obtained as a mixture of regioisomers due to an allylic rearrangement under the experimental condition.
[f] In this case, the reaction gave a mixture of compounds and the expected product could not be isolated in pure form.
[g] The products **4x,y** were obtained as a mixture of diastereomers as the starting material **1k** was used as diastereomers

Table 5. One-pot synthesis of 1,2,3-triazoles **6a-f** and **4a,q,x** from allylic and benzylic ethers **5a-k**.[a,b]

Entry	Ether Substrate	Triazole	Yield (%) Method A	Yield (%) Method B
1	 **5a**	 **6a**	71	-[d]
2	 **5b**	**6a**	0	75
3	 **5c**	 **6b**	35	-[d]
4	 **5d**	**6b**	-[d]	50
5	 **5e**	 **6c**	70	-[d]
6	 **5f**	**6c**	-[d]	70
7	 **5g**	 **6d**	52	-[d]
8[c]	 **5e**	 **6e**	70	-[d]
9	 **5h**	 **6f**	-[d]	87
10	 **5i**	 **4a**	0	80
11	 **5j**	 **4q**	-[d]	72
12	 **5k** (60:40)	 **4x**	-[d]	70 (84:16)[e]

[a] Reaction condition for method A: The reaction was performed using **5** (1 mmol), $TMSN_3$ (3 mmol) and nano Fe_3O_4 (15 mol%) in 1,2-DCE (3 mL) at 70 °C for 14-20 h and the solvent was evaporated and then, the click reaction was carried out using ethyl propiolate (**3a**, 2 mmol) in THF (3 mL) and water (3 mL) in the presence of $CuSO_4 \cdot 5H_2O$ (30 mol%) and sodium *L*-ascorbate (30 mol%) at rt for 12 h.

[b] Reaction condition for method B: The reaction was performed using **5** (0.5 mmol), $TMSN_3$ (0.75 mmol) and $Cu(OTf)_2$ (5 mol%) in DCM (3 mL) at rt for 3 h and the solvent was evaporated and then, the click reaction was carried out using ethyl propiolate (**3a**, 1.25 mmol) in THF (2 mL) and water (2 mL) in the presence sodium *L*-ascorbate (50 mol%) at rt for 20 h.

[c] In this case, alkyne **3g** was used instead of **3a**.

[d] The reaction was not performed.

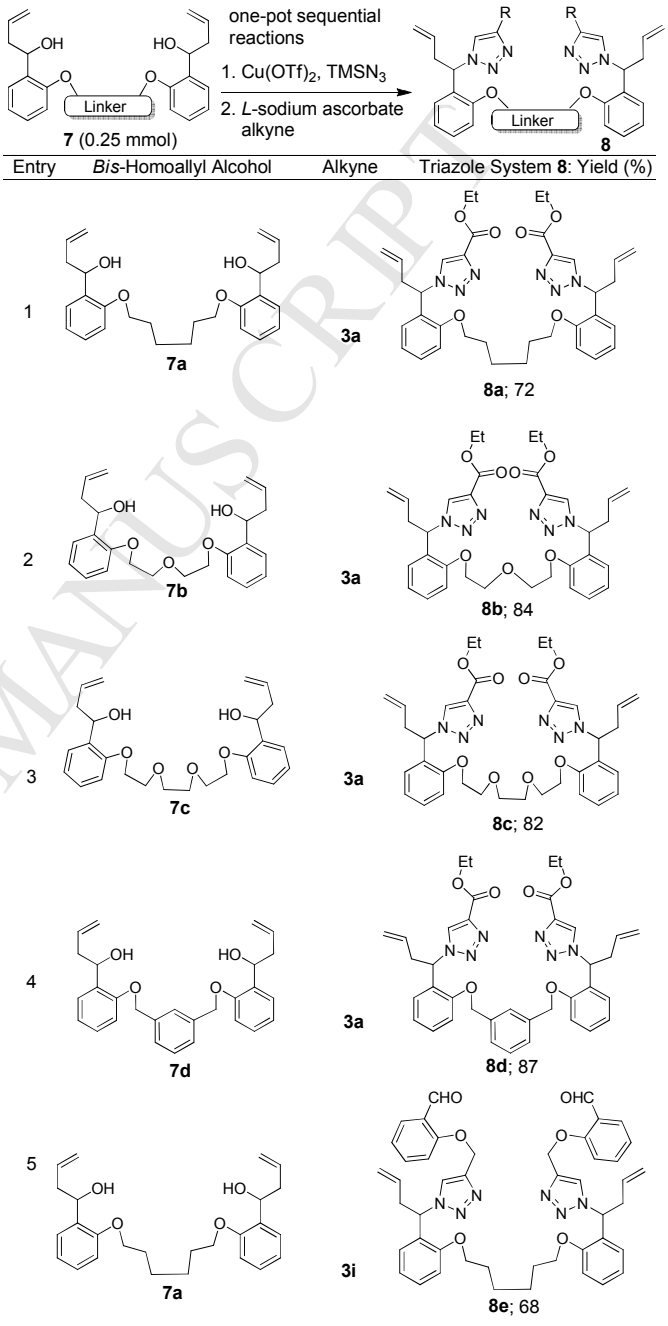
[e] Product was obtained as a mixture of diastereomers as the starting material **5k** was used as diastereomers.

Next, we performed the conversion of the conjugated and cyclic allylic alcohols **1h-k** (Table 4) into the corresponding substituted 1,2,3-triazole derivatives using the reaction conditions of either method A or method B. The direct azidation of the allylic alcohol **1h** followed by the click reaction with **3c** using the method A and method B procedures afforded the substituted 1,2,3-triazole derivative **4s** in 62 and 68% yields, respectively. The azidation of the allylic alcohol **1h** followed by the click reaction with different alkynes **3a** and **3i** afforded the corresponding 1,2,3-triazole derivatives **4t** (73% yield in method B) and **4u** (57% yield in method A). Then, the substituted 1,2,3-triazole derivatives **4v** (62%), and **4w** (45%) were synthesized from the corresponding cyclic allylic alcohols **1i** and **1j** using the method A procedure (entries 4 and 5, Table 4). The products **4v** and **4w** were obtained as a mixture of regioisomers since the corresponding cyclic allylic alcohols **1i** and **1j** underwent an allylic rearrangement under the experimental condition, thereby led to the formation of their rigioisomers, respectively.

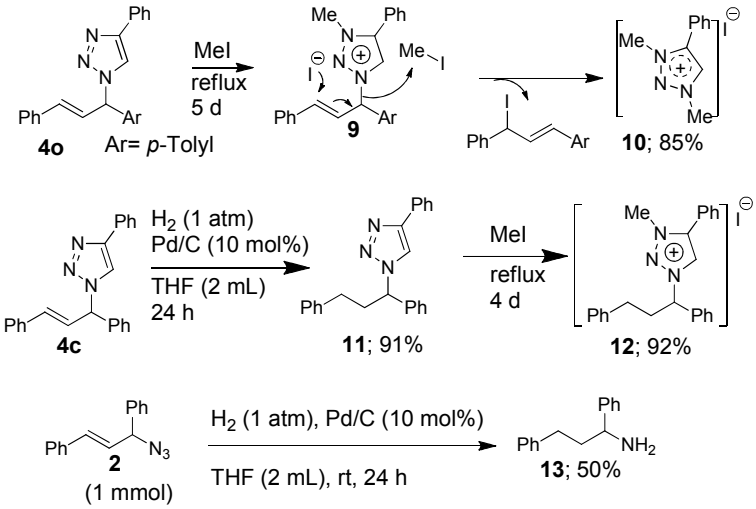
The cyclic allylic alcohol **1k** failed to afford corresponding substituted 1,2,3-triazole derivative **4x** when the direct azidation of allylic alcohol **1k** followed by the click reaction with **3a** was performed using the method A procedure. This is perhaps, because the nano Fe_3O_4-catalyzed conversion of allylic alcohol **1k** into the corresponding azides did not occur in the first step and as a result, the subsequent click reaction failed to afford the 1,2,3-triazole derivative **4x** (entry 6, method A, Table 4). However, the cyclic allylic alcohol **1k** successfully afforded the corresponding substituted 1,2,3-triazole derivatives **4x** (80%) when the direct azidation of allylic alcohol **1k** followed by the click reaction was performed using the method B procedure (entry 6, method B, Table 4). Similarly, the substituted 1,2,3-triazole derivatives **4y** (87%) was obtained from the alcohol **1k** using the method B procedure (entry 7, method B Table 4). Since, we used the alcohol **1k** as a mixture of diastereomers (dr 60:40), the corresponding substituted 1,2,3-triazole derivatives **4x** and **4y** were obtained as diastereomers with improved diastereoselectivity (dr 86:14) under the experimental condition. Our efforts to isolate the respective major isomers of **4x** and **4y** were failed and the stereochemistry of the major/minor diastereomers was not determined.

Next, we studied the direct conversion of the benzylic alcohols **5a,c,e,g** and methyl ethers **5b,d,f,h** prepared from their corresponding alcohols (Table 5) into the corresponding substituted 1,2,3-triazole derivatives using the reaction conditions of either method A or method B. The direct azidation of the benzylic alcohol **5a** followed by the click reaction with **3a** using the method A procedure afforded the substituted 1,2,3-triazole derivative **6a** in 71% yield (entry 1, method A, Table 5). On the other hand, the direct azidation of the ether **5b** followed by the click reaction with **3a** using the method A procedure failed to afford the substituted 1,2,3-triazole derivative **6a** (entry 2, method A, Table 5). However, the direct azidation of the substrate **5b** followed by the click reaction with **3a** using the method B procedure successfully afforded the product **6a** in 75% yield (entry 2, method B, Table 5). Similarly, various substituted 1,2,3-triazole derivatives **6b-f** were synthesized in 35-87% yields starting from the corresponding benzylic alcohols or their corresponding methyl ethers **5b-h** by using the method A and method B procedures, respectively (entries 3-9, Table 5). Additionally, the azidation of methyl ethers **5i-k** prepared from of their corresponding allyl alcohols followed by the click reaction with ethyl propiolate under the method B procedure successfully afforded the corresponding 1,2,3-triazole derivatives **4a** (80%), **4q** (72%), and **4x** (70%, dr 84:16, entries 10-12, Table 5).

Table 6. $Cu(OTf)_2$-catalyzed one-pot synthesis of *bis*-1,2,3-triazoles **8a-e** from *bis*-homoallyl alcohols.

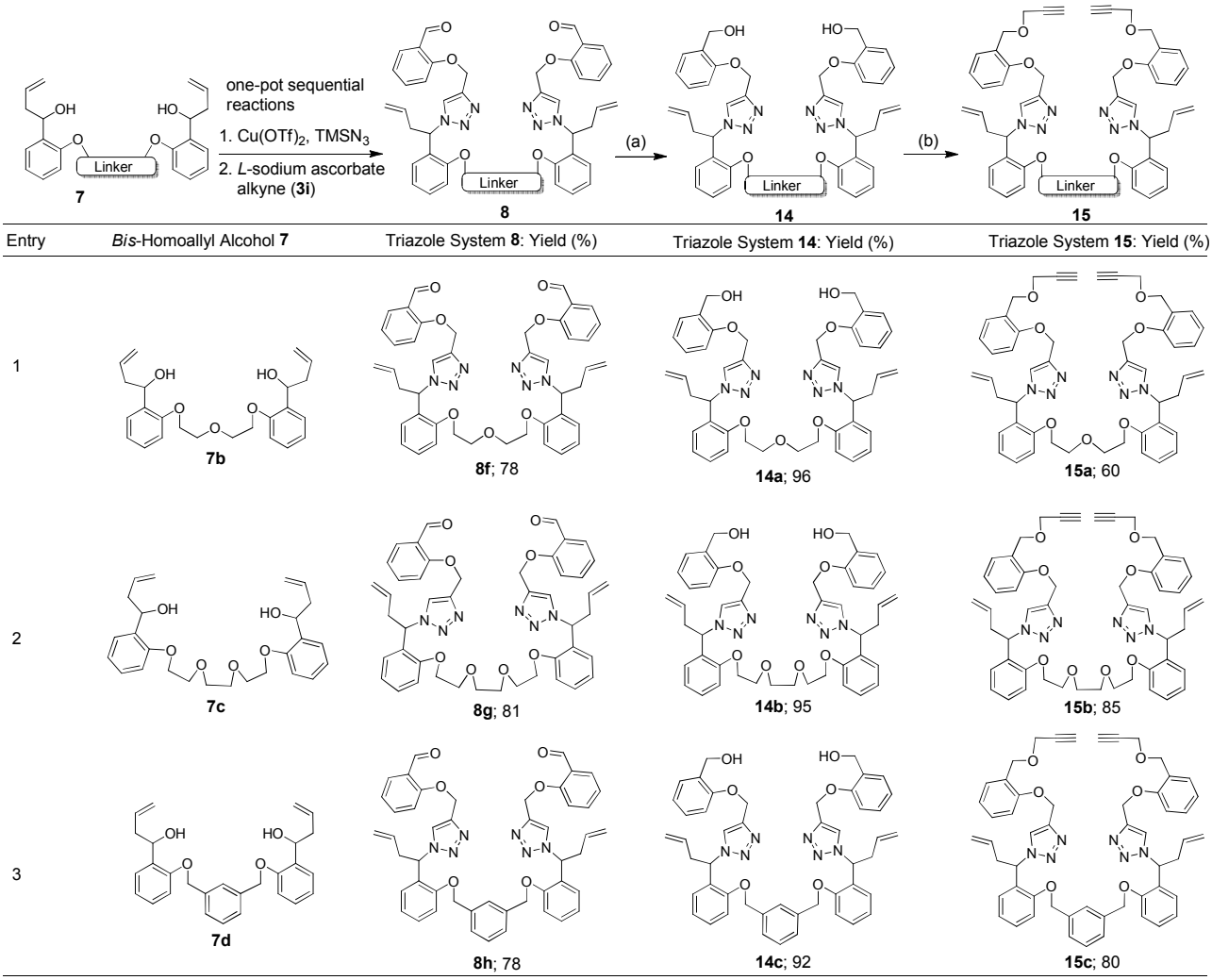


[a] Reagents and Conditions: The direct azidation of substrate **7** was carried out using $Cu(OTf)_2$ (10 mol%), $TMSN_3$ (3 equiv) in DCM (3 mL) at rt for 3 h and the solvent was evaporated in vacuum. Then, the click reaction was carried out using alkyne (5 equiv) in THF (2 mL) and water (2 mL) in the presence of *L*-sodium ascorbate (100 mol%) at rt for 20 h.



Scheme 2. Synthetic transformations of 1,2,3-triazole derivative **4c** and conversion of azide **2** into **13**.

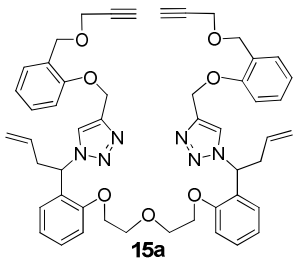
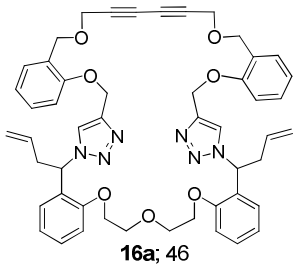
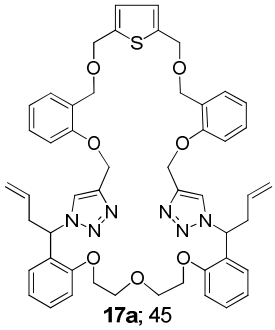
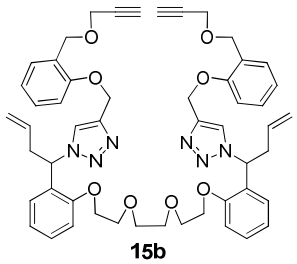
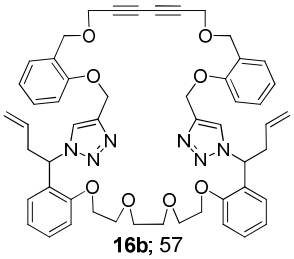
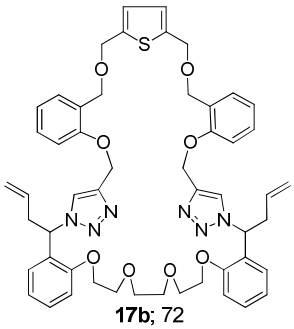
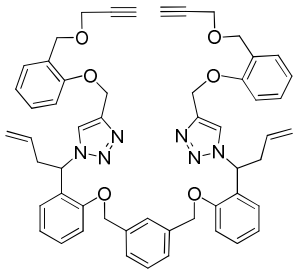
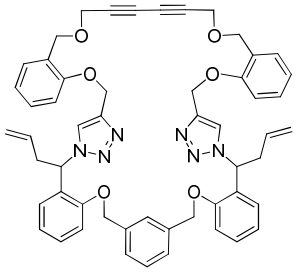
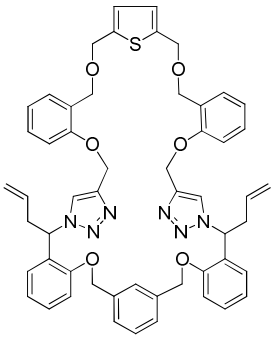
Table 7. Assembling of *bis*-1,2,3-triazole incorporated polyether systems **8**, **14** and **15**.[a]



Entry	*Bis*-Homoallyl Alcohol **7**	Triazole System **8**: Yield (%)	Triazole System **14**: Yield (%)	Triazole System **15**: Yield (%)
1	**7b**	**8f**; 78	**14a**; 96	**15a**; 60
2	**7c**	**8g**; 81	**14b**; 95	**15b**; 85
3	**7d**	**8h**; 78	**14c**; 92	**15c**; 80

[a] Reagents and Conditions: The direct azidation of substrate **7** was carried out using $Cu(OTf)_2$ (10 mol%), $TMSN_3$ (3 equiv) in DCM (3 mL) at rt for 3 h and the solvent was evaporated in vacuum. Then, the click reaction was carried out using alkyne (5 equiv) in THF (2 mL) and water (2 mL) in the presence of *L*-sodium ascorbate (100 mol%) at rt for 20 h. (a) $NaBH_4$ (4 equiv), THF (3 mL) and EtOH (7 mL), 1 h, r.t. (b) NaH (4 equiv), propargyl bromide (5 equiv), THF (3 mL), 20 h, r.t.

Table 8. Synthesis of new class of *bis*-1,2,3-triazole incorporated polyether macrocycles **16** and **17**.

Entry	Triazole System **15**	Macrocycle **16**: Yield (%)	Macrocycle **17**: Yield (%)
1	 **15a**	 **16a**; 46	 **17a**; 45
2	 **15b**	 **16b**; 57	 **17b**; 72
3	 **15c**	 **16c**; 42	 **17c**; 69

Further, we aimed to elaborate the scope of this work by synthesizing polyethers embedded with *bis*-triazole moieties[27] (**8** Table 6). Towards this end, at first, we prepared the *bis*-homoallylic alcohols **7a-d** from the Zn-mediated allylation of the corresponding *bis*-aldehydes, which were assembled from salicyladehyde and a suitable linker (aliphatic linker or polyether linker or aromatic linker).[27] Then, the *bis*-homoallylic alcohols having aliphatic linker (**7a**), polyether linker (**7b,c**) and aromatic linkers (**7d**) were treated with $TMSN_3$ (3 equiv) in the presence of $Cu(OTf)_2$ (10 mol%) at rt in DCM for 3 h and after this period, the solvent was evaporated and subsequently, we performed the click reaction of the corresponding azides obtained in the azidation step with ethyl propiolate, which gave the corresponding compounds **8a-d** with *bis*-triazole moieties linked through suitable linkers in 72-87% yields, (entries 1-4, Table 6). Similarly, the compound **8e** with *bis*-triazole moieties linked through suitable linkers was obtained in 68% yield from the direct azidation of the corresponding *bis*-homoallylic alcohols **7a** followed by the click reaction with **3i** (entries 5, Table 6).

We also explored the synthetic utility of representative 1,2,3-triazoles and in this regard, initially we carried out the reaction of MeI with the 1,2,3-triazole **4o** in which we observed the formation of an ionic liquid-type product **10**.[30] Presumably, in the reaction of MeI with **4o**, the product **10** formed *via* the loss of the allylic moiety present in the 1,2,3-triazole derivative **4o** (Scheme 2). To avoid the elimination of the allylic moiety present in the 1,2,3-triazole system, in a succeeding reaction, at first we carried out the hydrogenation of the olefin moiety present in the 1,2,3-triazole system **4c**, which gave the 1,2,3-triazole system **11**. Then, the reaction of the 1,2,3-triazole system **11** with MeI gave an ionic liquid-type product **12** (Scheme 2). We also carried out the hydrogenation of a representative azide compound **2**, which gave the benzylamine substrate **13** (1,3-diphenylpropan-1-amine) in 50% yield (Scheme 2).

There have been various reports on the synthesis of polyethers embedded with *bis*-triazole moieties[27] and 1,2,3-trizole moiety incorporated macrocyclic systems.[28] For example, recently, Beer *et al.* reported the synthesis of Ferrocene-based triazole moiety

incorporated macrocycles.[28e] Along this line and in continuation of our interest on the synthesis of macrocyclic polyethers/crown ethers,[29] we also intended to prepare the 1,2,3-trizole moiety incorporated macrocyclic polyether involving the direct azidation of alcohol as one of the steps. In this regard, the compounds **8f-h** with *bis*-triazole moieties linked through a polyether linker were treated with $NaBH_4$ to afford the compounds **14a-c** (Table 7). Then, the compounds **14a-c** were treated with propargyl bromide in the presence of NaH to give the products **15a-c** having two terminal alkyne units. Next, the Glaser–Eglinton–Hay-type cyclization[29b] of substrate **15a-c** in the presence of $Cu(OAc)_2 \cdot H_2O$ in DMSO at 110 ^oC under an open-air atmosphere gave a new class of polyether macrocyclic systems **16a-c** (Table 8) embedded with *1,2,3*-triazole moieties and the 1,3-diyne unit. Consequently, we planned to convert the 1,2-diyne unit present in the compounds **16a-c** into a thiophene ring .[29b] Accordingly, the reaction of macrocycles **16a-c** with $Na_2S \cdot xH_2O$ in the presence of catalytic amount of 1,10-phenanthroline and CuI in DMF at 90 ^oC under an open-air atmosphere gave a new class of polyether macrocyclic system **17a-c** embedded with *1,2,3*-triazole moieties and a thiophene ring (Table 8).

In summary, we have shown our investigations on the one-pot direct azidation of allylic alcohols/ethers followed by click reaction. Two methods were successfully developed for synthesizing various substituted 1,2,3 triazole derivatives directly from various allylic/benzylic alcohols without isolating the corresponding azides. The first method (Method A) involved magnetic nano Fe_3O_4-catalylzed direct azidation of various allylic/benzylic alcohols with $TMSN_3$ as the first step followed by the Cu-catalyzed click reaction of the corresponding azides with alkynes as the second step. The second method (Method B) involved the $Cu(OTf)_2$–catalyzed direct azidation of various allylic/benzylic alcohols and methyl ethers of allylic/benzylic alcohols with $TMSN_3$ as the first step followed by the click reaction of the corresponding azides with alkynes as the second step. In this method, $Cu(OTf)_2$ served as a single catalyst for both the azidation of alcohol and click reaction steps. We have also shown the utility of this protocol by synthesizing new class of polyethers embedded with triazole moiety and a 1,3-diyne unit.

Experimental Section

General. Melting points are uncorrected. FT-IR spectra of compounds were recorded as thin films or KBr pellets. ^1H and ^{13}C NMR spectra of compounds were recorded on 400 MHz and 100 MHz spectrometers (using TMS as an internal standard), respectively. Column chromatography was carried out on silica gel (100-200 mesh). Thin layer chromatography (TLC analysis) was performed on silica gel plates or neutral Al_2O_3 plates and components were visualized by observation under iodine. Solvents were dried by following the standard drying methods. Reactions were carried out in anhydrous solvent under a nitrogen atmosphere wherever required. Solutions were dried using anhydrous Na_2SO_4. Isolated yields of all the products were reported and yields were not optimized and total yield (all the isomers wherever applicable) is reported. Ratios of isomers were determined from the NMR spectra of crude reaction mixtures or after isolation. In some of the reactions, only the major product isomer was isolated in pure form (in some cases, the product was isolated as mixture of isomer). The particle size of Fe_3O_4 nanoparticles (before and after usage in the reaction) was determined from HRTEM analysis.[23] Compounds **1b-d**,[31a] **1e**,[31b] **1g**,[31a] **1h**,[31c] **1i,j**,[31d,e] **4r**,[31f] **4p**,[31g] **5b**,[31h,i] **5d**,[31h] **5f**,[31i] **5h**,[31j] **5i**,[31i] **5j**,[31k] **5k**.[31l] Though the compounds **7**, **8** and **14-17** have two remote stereocenters and due to the molecular symmetry, the molecules **7**, **8** and **14-17** were isolated as a mixture of diastereomers (*dr* = 50:50) and we could not separate the diastereomers and characterization data given for both isomers.

General procedure for the magnetic nano Fe_3O_4-catalyzed direct azidation of allylic/benzylic alcohol, Step '1'. A round-bottom flask containing a mixture of the corresponding allylic/benzylic alcohol **1** (0.5 mmol, 1 equiv), trimethylsilyl azide (1.25-1.5 mmol, 2.5-3 equiv) and magnetic nano Fe_3O_4 (particle size < 50 nm, 15 mol% and the Fe_3O_4 nanoparticles can be handled using a Teflon spatula) in 1,2-dichloroethane (1.5-3 mL) was stirred at 70 ^oC for 6 h. The purification of the corresponding azide product **2** and recovery of the catalyst (Fe_3O_4 nanoparticles) were performed as stated in Step '2'. **Step '2'.** After the reaction time, a magnet was externally appended to the RB flask, the magnetic Fe_3O_4 nanoparticles were gathered at the walls of the RB flask and the resulting clear solution of the reaction mixture was transferred in to an another RB flask with the help of a dropper. Then, the catalyst (Fe_3O_4 nanoparticles) was washed again using EtOAc (2 mL). The RB flask containing Fe_3O_4 nanoparticles was heated in an oven (at 100-110 ^oC, overnight) and the catalyst was reused in the next cycle. The combined organic layers were evaporated under vacuum and purified by column chromatography to give the corresponding azide product **2**.

General procedure (Method A) for the one-pot magnetic nano Fe_3O_4-catalyzed direct azidation of allylic alcohols and click reaction, Step '3'. The direct azidation of the corresponding allylic/benzylic alcohol **1** (0.5 mmol, 1 equiv) was carried out using the step '1' procedure. Next, the catalyst (Fe_3O_4 nanoparticles) was removed using an external magnet and the solvent was evaporated. Then, to the crude reaction mixture obtained in the step '1' procedure, THF (3 mL), water (3 mL), alkyne (1-1.2 mmol), $CuSO_4.5H_2O$ (30 mol%) and sodium *L*-ascorbate (30 mol%) were sequentially added. Then, the reaction mixture was stirred at rt for 12 h, then, was extracted using EtOAc and the combined organic layers were concentrated and the resulting crude reaction mixture was purified by column chromatography (50% EtOAc/Hexanes), to afford the corresponding 1,2,3-triazole product **4**/**6** (see the corresponding Tables/Schemes for specific entries).

General procedure for the copper(II) triflate-catalyzed one-pot direct azidation of alcohol followed by click reaction (Method B): A solution of allylic alcohol **1** (0.5 mmol) and $TMSN_3$ (0.75 mmol, 1.5 equiv) and copper(II) triflate (5 mol%) in DCM (3 mL) was stirred at rt for 3 h under an inert atmosphere. Then, DCM was removed under reduced pressure. After this, to the resulting crude reaction mixture THF (2-3 mL), water (2-3 mL), alkyne (1-1.25 mmol) and sodium *L*-ascorbate (50 mol%) were added and the reaction mixture was stirred at rt for 20 h. Then, the reaction mixture was extracted using EtOAc and the combined organic layers were evaporated and the resulting reaction mixture was purified by silica gel column chromatography to afford the triazole product **4**/**6** (See the corresponding Tables/Schemes for specific entries).

General procedure for the copper(II) triflate-catalyzed one-pot direct azidation of allylic and benzylic methyl ethers followed by click reaction (Method B): A solution of allyl methyl ether **5** (0.5 mmol) and $TMSN_3$ (0.75 mmol, 1.5 equiv) and copper(II) triflate (5 mol%) in DCM (3 mL) was stirred at rt for 3 h under an inert atmosphere. After this period, the solvent was evaporated. Then, to the resulting reaction mixture THF (2 mL), water (2 mL), alkyne (1.25 mmol, 2.5 equiv) and sodium *L*-ascorbate (50 mol%) were added and the reaction mixture was stirred at rt for 20 h. Then, the reaction mixture was extracted by using ethyl acetate (3 X 10 mL). The combined organic layers were dried over anhydrous Na_2SO_4 and the organic phase was

concentrated and the resulting crude reaction mixture was purified by silica gel column chromatography (EtOAc/Hexanes) to give the desired 1,2,3-trizole product **4**/**6** (see the corresponding Tables/Schemes for specific entries).

(*E*)-Ethyl 1-(1,3-diphenylallyl)-1*H*-1,2,3-triazole-4-carboxylate (4a). Following the general procedure, **4a** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 30:70) as a brown solid (286 mg, 86%); R_f (30% EtOAc/Hexanes) 0.42; mp 123-125 °C; IR (thin film): ν_{max} 2982, 1727, 1449, 1202 and 1038 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 8.12 (1 H, s), 7.42-7.29 (10 H, m), 6.70 (1 H, dd, J_1 = 15.7 Hz, J_2 = 6.8 Hz), 6.58 (1 H, d, J = 6.8 Hz), 6.50 (1 H, d, J = 15.7 Hz), 4.42 (2 H, q, J = 7.1 Hz), 1.40 (3 H, t, J = 7.1 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 160.8, 140.3, 137.1, 135.3, 135.2, 129.3, 129.1, 128.8, 127.5, 126.9, 124.9, 66.7, 61.4, 14.3 ppm; HRMS (ESI): MNa^+, found 356.1385. $C_{20}H_{19}N_3NaO_2$ requires 356.1375.

(*E*)-(1-(1,3-Diphenylallyl)-1*H*-1,2,3-triazol-4-yl)methanol (4b). Following the general procedure, **4b** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 50:50) as a colorless liquid (238 mg, 82%); R_f (50% EtOAc/Hexanes) 0.42; IR (thin film) ν_{max} 3375, 2954, 1731, 1450, 1223 and 1091 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.57 (1 H, s), 7.41-7.28 (10 H, m), 6.70 (1 H, dd, J_1 = 15.6 Hz, J_2 = 7.2 Hz), 6.52-6.47 (2 H, m), 4.79 (2 H, s) , 3.36 (1 H, br. s); ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 147.8, 137.7, 135.5, 134.7, 129.2, 128.8, 128.7, 128.6, 127.5, 126.9, 125.5, 121.2, 66.5, 56.4; HRMS (ESI): MNa^+, found 314.1254. $C_{18}H_{17}N_3ONa$ requires 314.1269.

(*E*)-1-(1,3-Diphenylallyl)-4-phenyl-1*H*-1,2,3-triazole (4c). Following the general procedure, **4c** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 30:70) as a colorless solid (303 mg, 90%); R_f (30% EtOAc/Hexanes) 0.42; mp 178-179 °C; IR (thin film) ν_{max} 2925, 1724, 1450, 1226 and 970 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.86 (2 H, d, J = 7.1 Hz), 7.79 (1 H, s), 7.45-7.31 (13 H, m), 6.77 (1 H, dd, J_1 = 15.8 Hz, J_2 = 6.7 Hz), 6.59-6.53 (2 H, m) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 147.9, 137.9, 135.6, 134.7, 130.5, 129.2, 128.8, 128.8, 128.6, 128.2, 127.5, 126.9, 125.8, 125.6, 118.9, 66.4 ppm; HRMS (ESI): MH^+, found 338.1642. $C_{23}H_{20}N_3$ requires 338.1657.

(*E*)-(1-(1,3-Diphenylallyl)-1*H*-1,2,3-triazol-4-yl)methyl acrylate (4d). Following the general procedure, **4d** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 30:70) as a colorless solid (321 mg, 93%); R_f (30% EtOAc/Hexanes) 0.42; mp 112-114 °C; IR (thin film) ν_{max} 2926, 1495, 1454 and 1045 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.66 (1 H, s), 7.43-7.29 (10 H, m), 6.72 (1 H, dd, J_1 = 15.6 Hz, J_2 = 7.2 Hz), 6.54-6.42 (3 H, m), 6.15 (1 H, dd, J_1 = 17.3 Hz, J_2 = 10.4 Hz), 5.87 (1 H, d, J = 10.4 Hz), 5.33 (2 H, s) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 166.0, 142.8, 137.7, 135.5, 134.9, 131.6, 129.2, 128.9, 128.7, 128.6, 128.0, 127.4, 126.9, 125.5, 123.1, 66.6, 57.8 ppm; HRMS (ESI): MH^+, found 346.1555. $C_{21}H_{20}N_3O_2$ requires 346.1556.

(*E*)-Dimethyl 1-(1,3-diphenylallyl)-1*H*-1,2,3-triazole-4,5-dicarboxylate (4e). Following the general procedure, **4e** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 30:70) as yellow liquid (324 mg, 86%); R_f (30% EtOAc/Hexanes) 0.42; IR (thin film) ν_{max} 2950, 1735, 1485, 1210 and 1020 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.45-7.28 (10 H, m), 6.96 (1 H, dd, J_1 = 15.7 Hz, J_2 = 8.0 Hz), 6.81 (1 H, d, J = 8.0 Hz), 6.64 (1 H, d, J = 15.7 Hz), 3.97 (3 H, s), 3.85 (3 H, s) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 160.6, 159.3, 139.8, 137.3, 135.5, 135.1, 130.2, 129.0, 128.8, 128.7, 128.6, 127.4, 127.0, 125.1, 67.1, 53.4, 52.7 ppm; HRMS (ESI): MNa^+, found 400.1285. $C_{21}H_{19}N_3NaO_4$ requires 400.1273.

(*E*)-4-Butyl-1-(1,3-diphenylallyl)-1*H*-1,2,3-triazole (4f). Following the general procedure, **4f** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 50:50) as a colorless liquid (154 mg, 98%); R_f (50% EtOAc/Hexanes) 0.42; IR (CH_2Cl_2): ν_{max} 2927, 1495, 1451,1215 and 747 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$): δ_H 7.43-7.28 (11 H, m), 6.72 (1 H, dd, J_1 = 16.1 Hz, J_2 = 6.6 Hz), 6.51 (1 H, d, J = 4.58 Hz), 6.48 (1 H, d, J = 2.8 Hz), 2.74 (2 H, t, J = 7.6 Hz), 1.71-1.63 (2 H, m), 1.42-1.35 (2 H, m), 0.94 (3 H, t, J = 7.3 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$): δ_C 138.2, 135.6, 134.4, 129.1, 128.7, 128.6, 128.5, 127.4, 126.8, 125.9, 119.8, 66.2, 31.6, 25.5, 22.4, 13.9 ppm; HRMS (ESI): MNa^+, found 340.1773. $C_{21}H_{23}N_3Na$ requires 340.1790.

(*E*)-1-(1,3-Diphenylallyl)-4-hexyl-1*H*-1,2,3-triazole (4g). Following the general procedure, **4g** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 30:70) as a colorless solid (293 mg, 85%); R_f (30% EtOAc/Hexanes) 0.42; mp 98-100 °C; IR (thin film) ν_{max} 2928, 1495, 1454 and 1044 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.42-7.28 (11 H, m), 6.73 (1 H, dd, J_1 = 16.1 Hz, J_2 = 6.5 Hz), 6.51-6.48 (2 H, m), 2.74 (2 H, t, J = 7.6 Hz), 1.72-1.67 (2 H, m), 1.39-1.29 (6 H, m), 0.89 (3 H, t, J = 6.1 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 148.6, 138.2, 135.7, 134.4, 129.1, 128.7, 128.6, 128.5, 127.4, 126.8, 126.0, 119.9, 66.2, 31.6, 29.4, 29.0, 25.9, 22.6, 14.1 ppm; HRMS (ESI): MH^+, found 346.2294. $C_{23}H_{28}N_3$ requires 346.2283.

(*E*)-1-(1,3-Diphenylallyl)-4-octyl-1*H*-1,2,3-triazole (4h). Following the general procedure, **4h** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 30:70) as a colorless solid (343 mg, 92%); R_f (30% EtOAc/Hexanes) 0.42; mp 99-101 °C; IR (thin film) ν_{max} 2926, 1495, 1454 and 967 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.43-7.28 (11 H, m), 6.72 (1 H, dd, J_1 = 16.1 Hz, J_2 = 6.6 Hz), 6.49 (2 H, dd, J_1 = 12.0 Hz, J_2 = 4.4 Hz), 2.73 (2 H, t, J = 7.7 Hz), 1.71-1.64 (2 H, m), 1.38-1.27 (10 H, m), 0.89 (3 H, t, J = 6.6 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 148.6, 138.2, 135.7, 134.4, 129.1, 128.7, 128.6, 128.5, 127.4, 126.8, 126.0, 119.8, 66.2, 31.9, 29.5, 29.3, 29.2, 25.8, 22.7, 14.1 ppm; HRMS (ESI): MH^+, found 374.2591. $C_{25}H_{32}N_3$ requires 374.2596.

(*E*)-2-((1-(1,3-Diphenylallyl)-1*H*-1,2,3-triazol-4-yl)methoxy)benzaldehyde (4i). Following the general procedure, **4i** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 27:73) as a red colored solid (336 mg, 85%); R_f (30% EtOAc/Hexanes) 0.55; mp 111-113 °C; IR (thin film) ν_{max} 3030, 1663, 1598, 1456 and 1236 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 10.44 (1 H, s), 7.82 (1 H, d, J = 7.6 Hz), 7.75 (1 H, br. s), 7.54 (1 H, t, J = 7.4 Hz), 7.42-7.27 (10 H, m), 7.17 (1 H, d, J = 8.5 Hz), 7.03 (1 H, t, J = 7.6 Hz), 6.74 (1 H, dd, J_1 = 16.1 Hz, J_2 = 6.8 Hz), 6.51 (2 H, dd, J_1 = 12.0 Hz, J_2 = 4.4 Hz), 5.33 (2 H, s) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 189.7, 160.5, 143.3, 137.7, 136.1, 135.4, 134.9, 129.2, 128.9, 128.8, 128.7, 128.6, 127.4, 126.9, 125.4, 125.0, 122.5, 121.3, 113.1, 66.7, 62.6 ppm; HRMS (ESI): MH^+, found 396.1702. $C_{25}H_{22}N_3O_2$ requires 396.1712.

1,12-Bis(1-((*E*)-1,3-diphenylallyl)-1*H*-1,2,3-triazol-4-yl)-2,5,8,11-tetraoxadodecane (4j). Following the general procedure, **4j** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 30:70) as colorless liquid (522 mg, 75%); R_f (30% EtOAc/Hexanes) 0.42; IR (thin film) ν_{max} 2869, 1495, 1450 and 1097 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.60 (2 H, s), 7.41-7.28 (20 H, m), 6.71 (2 H, dd, J_1 = 15.6 Hz, J_2 = 7.2 Hz), 6.52-6.47 (4 H, m), 4.69 (4 H, s), 3.70-3.62 (8 H, m), 3.60 (4 H, s) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 145.2, 137.9, 135.5, 134.7, 129.1, 128.8, 128.7, 128.5, 127.5, 126.8, 125.7, 121.9, 70.5, 70.5, 69.8, 66.4, 64.8 ppm; HRMS (ESI): MH^+, found 697.3505. $C_{42}H_{45}N_6O_4$ requires 697.3502.

(*E*)-1-(1,3-Bis(4-chlorophenyl)allyl)-4-phenyl-1*H*-1,2,3-triazole (4k). Following the general procedure, **4k** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 50:50) as a colorless solid (151 mg, 75%); R_f (30% EtOAc/Hexanes) 0.52; mp: 88-90 ^oC; IR (CH_2Cl_2) ν_{max} 2928, 1595, 1491, 1407 and 764 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.85 (2 H, dd, J_1 = 7.1 Hz, J_2 = 1.4 Hz), 7.79 (1 H, s), 7.45-7.25 (11 H, m), 6.71 (1 H, dd, J_1 = 15.8 Hz, J_2 = 6.8 Hz), 6.50-6.45 (2 H, m) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 148.0, 136.2, 134.9, 134.4, 133.8, 133.8, 130.3, 129.4, 129.0, 128.9, 128.8, 128.4, 128.1 125.8, 125.7, 118.9, 65.7 ppm; HRMS (ESI): MNa^+, found 428.0672. $C_{23}H_{17}Cl_2N_3Na$ requires 428.0697.

(*E*)-Ethyl 1-(1,3-bis(4-chlorophenyl)allyl)-1*H*-1,2,3-triazole-4-carboxylate (4l). Following the general procedure, **4l** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 50:50) as a colorless liquid (120 mg, 60%); R_f (30% EtOAc/Hexanes) 0.48; IR (CH_2Cl_2) ν_{max} 2983, 1731, 1594, 1492, 1093 and 737 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 8.10 (1 H, s), 7.39 (2 H, d, J = 8.5 Hz), 7.32 (4 H, s), 7.23 (2 H, d, J = 8.4 Hz), 6.65 (1 H, dd, J_1 = 15.8 Hz, J_2 = 6.5 Hz), 6.54 (1 H, d, J = 6.9 Hz), 6.46 (1 H, dd, J_1= 15.8 Hz, J_2= 1.1 Hz), 4.42 (2H, q, J = 7.1 Hz), 1.40 (3 H, t, J = 7.1 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 160.6, 140.4, 135.4, 135.3, 134.7, 134.4, 133.5, 129.6, 129.0, 128.8, 128.1, 126.8, 125.0, 66.0, 61.5, 14.3 ppm; HRMS (ESI): MNa^+, found 424.0578. $C_{20}H_{17}Cl_2N_3NaO_2$ requires 424.0596.

(*E*)-Dimethyl 1-(1,3-bis(4-chlorophenyl)allyl)-1*H*-1,2,3-triazole-4,5-dicarboxylate (4m). Following the general procedure, **4m** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 30:70) as a yellow liquid (232 mg, 52%); R_f (30% EtOAc/Hexanes) 0.42; IR (thin film): ν_{max} 2954, 1732, 1491, 1224 and 1092 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.37-7.26 (8 H, m), 6.88 (1 H, dd, J_1 = 15.6 Hz, J_2 = 7.7 Hz), 6.80 (1 H, d, J = 7.8 Hz), 6.56 (1 H, d, J = 15.6 Hz), 3.98 (3 H, s), 3.90 (3 H, s) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 160.5, 159.2, 140.1, 135.6, 135.0, 134.5, 134.1, 133.8, 129.6, 129.3, 129.0, 128.9, 128.2, 125.4, 66.1, 53.5, 52.8 ppm; HRMS (ESI): MNa^+, found 468.0487. $C_{21}H_{17}Cl_2N_3NaO_4$ requires 468.0494.

(*E*)-1-(3-(4-Bromophenyl)-1-phenylallyl)-4-hexyl-1*H*-1,2,3-triazole (4n). Following the general procedure, **4n** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 30:70) as colorless liquid (346 mg, 82%); R_f (30% EtOAc/Hexanes) 0.42; IR (thin film) ν_{max} 2927, 2857, 1588, 1488 and 1071 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.53-7.13 (10 H, m), 6.75-6.64 (1 H, m), 6.51-6.38 (2 H, m), 2.75-2.70 (2 H, m), 1.69-1.65 (2 H, m), 1.38-1.28 (6 H, m), 0.88 (3 H, t, J = 6.8 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 148.8, 148.7, 137.9, 137.3, 135.4, 134.9, 134.6, 133.1, 132.2, 131.8, 129.1, 129.1, 128.8, 128.7, 128.3, 127.4, 126.9, 126.9, 125.3, 122.7, 122.3, 119.9, 119.8, 66.1, 65.6, 31.5, 29.4, 29.0, 25.8, 22.6, 14.1 ppm; HRMS (ESI): MH^+, found 424.1386. $C_{23}H_{27}BrN_3$ requires 424.1388. Isolated as a mixture of regioisomers and NMR values given for both isomers.

(*E*)-4-Phenyl-1-(3-phenyl-1-(*p*-tolyl)allyl)-1*H*-1,2,3-triazole (4o). Following the general procedure, **4o** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 30:70) as colorless solid (253 mg, 72%); R_f (30% EtOAc/Hexanes) 0.42; mp 134-136 °C; IR (thin film) ν_{max} 2930, 1482, 1456, 1224 and 970 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.87 (2 H, d, J = 7.5 Hz), 7.82 (1 H, s), 7.55-7.19 (12 H, m), 6.85-6.33 (3 H, m), 2.32 (3 H, s) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 147.9, 147.6, 138.1, 136.7, 136.0, 135.7, 135.6, 134.8, 133.8, 132.8, 131.3, 130.6, 130.5, 129.2, 128.9, 128.5, 128.2, 127.4, 127.3, 127.0, 126.8, 126.8, 126.3, 126.0, 125.8, 125.7, 119.2, 118.8, 66.6, 63.0, 19.8, 19.2 ppm; HRMS (ESI): MH^+, found 352.1807. $C_{24}H_{22}N_3$ requires 352.1814. Isolated as a mixture of regioisomers and NMR values given for both isomers.

(*E*)-Ethyl 1-(1-(4-nitrophenyl)-3-phenylallyl)-1*H*-1,2,3-triazole-4-carboxylate (4oA). Following the general procedure, **4oA** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 30:70) as light yellow colour liquid (128 mg, 68%); R_f (30% EtOAc/Hexanes) 0.42; IR (thin film) ν_{max} 2979, 1731, 1519, 1344 and 733 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 8.28-8.19 (2 H, m), 8.06 (1 H, s), 7.57-7.28 (7 H, m), 6.92 (1 H, dd, J_1 = 15.9 Hz, J_2 = 6.5 Hz), 6.66-6.48 (2 H, m), 4.43 (2 H, q, J = 7.1 Hz), 1.40 (3 H, t, J = 7.1 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 160.7, 147.6, 141.6, 140.4, 137.1, 136.1, 132.5, 129.8, 129.6, 129.6, 129.3, 128.9, 128.2, 127.7, 127.7, 127.5, 127.0, 127.0, 126.9, 124.4, 124.1, 123.0, 66.5, 66.0, 61.6, 61.5, 14.3 ppm; HRMS (ESI): MNa^+, found 401.1239. $C_{20}H_{18}N_4NaO_4$ requires 401.1226. Isolated as a mixture of regioisomers and NMR values given for both isomers.

Ethyl 1-cinnamyl-1*H*-1,2,3-triazole-4-carboxylate (4p). Following the general procedure, **4p** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 50:50) as a colorless solid (89 mg, 70%); R_f (30% EtOAc/Hexanes) 0.42; mp: 87-89 ^oC; IR (CH_2Cl_2) ν_{max} 3139, 2983, 1731, 1450 and 759 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 8.16 (1 H, s), 7.39-7.28 (5 H, m), 6.69 (1 H, d, J = 15.8 Hz), 6.36-6.29 (1 H, m), 5.18 (2 H, d, J = 6.7 Hz), 4.39 (2 H, q, J = 7.1 Hz), 1.38 (3 H, t, J = 7.1 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 160.7, 140.7, 136.2, 135.2, 128.8, 127.3, 126.8, 120.9, 61.3, 52.6, 14.3 ppm; HRMS (ESI): MNa^+, found 280.1059. $C_{14}H_{15}N_3NaO_2$ requires 280.1062.

(*E*)-Ethyl 1-(4-phenylbut-3-en-2-yl)-1*H*-1,2,3-triazole-4-carboxylate (4q). Following the general procedure, **4q** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 50:50) as a colorless solid (102 mg, 76%); R_f (30% EtOAc/Hexanes) 0.50; mp: 77-79 ^oC; IR (CH_2Cl_2) ν_{max} 2984, 1738, 1494, 1376 and 754 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 8.16 (1 H, s), 7.37-7.24 (5 H, m), 6.59 (1 H, d, J = 15.9 Hz), 6.35 (1 H, dd, J_1 = 15.9 Hz, J_2 = 6.9 Hz), 5.49-5.44 (1 H, m), 4.39 (2 H, q, J = 7.1 Hz), 1.80 (3 H, d, J = 6.9 Hz), 1.37 (3 H, t, J = 7.1 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 160.8, 140.1, 135.3, 133.5, 128.7, 128.6, 126.8, 126.7, 125.9, 61.2, 59.0, 20.9, 14.3 ppm; HRMS (ESI): MNa^+, found 294.1208. $C_{15}H_{17}N_3NaO_2$ requires 294.1218.

(*E*)-4-Hexyl-1-(4-phenylbut-3-en-2-yl)-1*H*-1,2,3-triazole (4r). Following the general procedure, **4r** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 50:50) as a colorless liquid (120 mg, 85%); R_f (30% EtOAc/Hexanes) 0.45; IR (CH_2Cl_2) ν_{max} 3028, 1482, 1448, 1178 and 764 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.36-7.20 (6 H, m), 6.52 (1 H, d, J = 16.0 Hz), 6.35 (1 H, dd, J_1 = 15.9 Hz, J_2 = 6.6 Hz), 5.38-5.31 (1 H, m), 2.70 (2 H, t, J = 7.9 Hz), 1.75 (3 H, d, J = 6.9 Hz), 1.69-1.62 (2 H, m), 1.36-1.22 (6 H, m), 0.86 (3 H, t, J = 7.0 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 148.4, 135.7, 132.4, 128.7, 128.3, 128.1, 126.6, 118.9, 58.2, 31.6, 29.5, 29.0, 25.8, 22.6, 20.8, 14.1 ppm; HRMS (ESI): MH^+, found 284.2115. $C_{18}H_{26}N_3$ requires 284.2127.

1-((*2E*,*4E*)-1,5-Diphenylpenta-2,4-dien-1-yl)-4-phenyl-1*H*-1,2,3-triazole (4s). Following the general procedure, **4s** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 30:70) as a colorless solid (225 mg, 62%); R_f (30% EtOAc/Hexanes) 0.42; mp 131-133 °C; IR (thin film) ν_{max} 3028, 1494, 1449 and 990 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.87 (2 H, d, J = 8.4 Hz), 7.77 (1 H, s), 7.47-7.26 (13 H, m), 6.88 (1 H, dd, J_1 = 15.6 Hz, J_2 = 8.4 Hz), 6.60 (1 H, d, J = 15.6 Hz), 6.52 (1 H, d, J = 5.6 Hz), 6.40-6.28 (2 H, m) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 147.8, 137.8, 136.6, 135.1, 134.9, 130.6, 129.2,

129.1, 128.9, 128.8, 128.8, 128.7, 128.2, 128.1, 127.5, 127.0, 126.6, 125.8, 118.9, 66.2 ppm; HRMS (ESI): MNa^+, found 386.1622. $C_{25}H_{21}N_3Na$ requires 386.1633.

Ethyl 1-((*2E,4E*)-1,5-diphenylpenta-2,4-dien-1-yl)-1*H*-1,2,3-triazole-4-carboxylate (4t). Following the general procedure, **4t** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 50:50) as a colorless liquid (131 mg, 73%); R_f (30% EtOAc/Hexanes) 0.32; IR (CH_2Cl_2) ν_{max} 2983, 1731, 1449, 1377 and 736 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 8.10 (1 H, s), 7.41-7.38 (5 H, m), 7.33 (2 H, t, J = 7.5 Hz), 7.29-7.26 (3 H, m), 6.87-6.81 (1 H, m), 6.59 (1 H, d, J = 15.7 Hz), 6.51 (1 H, d, J = 5.3 Hz), 6.29-6.26 (2 H, m), 4.42 (2 H, q, J = 7.2 Hz), 1.40 (3 H, t, J = 7.0 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 160.8, 140.2, 137.1, 136.5, 135.5, 135.4, 129.3, 129.1, 128.7, 128.2, 128.2, 127.5, 126.9, 126.7, 126.6, 66.5, 61.4, 14.4 ppm; HRMS (ESI): MNa^+, found 382.1522. $C_{22}H_{21}N_3NaO_2$ requires 382.1531.

2-((1-((*2E,4E*)-1,5-Diphenylpenta-2,4-dien-1-yl)-1*H*-1,2,3-triazol-4-yl)methoxy)benzaldehyde (4u). Following the general procedure, **4u** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 30:70) as yellow liquid (240 mg, 57%); R_f (30% EtOAc/Hexanes) 0.42; IR (thin film) ν_{max} 3030, 1663, 1598, 1456 and 1236 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 10.46 (1 H, s), 7.85 (1 H, d, J = 7.5 Hz), 7.67 (1 H, s), 7.57 (1 H, t, J = 8.5 Hz), 7.42-7.26 (10 H, m), 7.19 (1 H, d, J = 8.4 Hz), 7.08 (1 H, t, J = 7.5 Hz), 6.86 (1 H, dd, J_1 = 15.6 Hz, J_2 = 9.4 Hz), 6.57 (1 H, d, J = 15.6 Hz), 6.46 (1 H, d, J = 5.7 Hz), 6.36-6.24 (2 H, m), 5.36 (2 H, s) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 189.7, 160.5, 143.4, 137.6, 136.5, 136.1, 135.2, 135.2, 129.2, 128.9, 128.7, 128.7, 128.6, 128.2, 127.4, 126.9, 126.6, 125.1, 122.2, 121.4, 113.1, 66.5, 62.7 ppm; HRMS (ESI): MH^+, found 422.1858. $C_{27}H_{24}N_3O_2$ requires 422.1869.

(*E*)-Ethyl 1-((3-benzylidenecyclohex-1-en-1-yl)(phenyl)methyl)-1*H*-1,2,3-triazole-4-carboxylate (4v). Following the general procedure, **4v** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 30:70) as a colorless solid (247 mg, 62%); R_f (30% EtOAc/Hexanes) 0.42; mp 135-137 °C; IR (thin film) ν_{max} 2936, 1722, 1447, 1224 and 1038 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 8.01/7.90* (1 H, s), 7.44-7.20 (9 H, m), 7.04 (1 H, d, J = 7.2 Hz), 6.48/6.35* (1 H, s), 6.25/6.17* (1 H, s), 5.74 (1 H, s), 4.44 (2 H, q, J = 7.2 Hz), 2.68-2.65/2.48-2.45* (2 H, m), 2.12 (2 H, t, J = 5.8 Hz), 1.88-1.85*/1.80-1.73 (2 H, m), 1.42 (3 H, t, J = 7.2 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 160.9, 139.9, 138.5, 137.2, 136.6, 135.7, 135.6, 134.3, 131.4, 129.4, 129.3, 129.3, 129.2, 129.1, 128.9, 128.3, 128.2, 128.2, 128.1, 127.5, 127.1, 126.7, 126.6, 125.3, 70.1, 70.0, 61.4, 61.3, 31.9, 28.0, 27.6, 26.4, 22.9, 22.5, 14.4 ppm; HRMS (ESI): MNa^+, found 422.1844. $C_{25}H_{25}N_3NaO_2$ requires 422.1844. Isolated as a mixture of regioisomers and the characterization data given correspond to both isomers and *corresponds to the minor isomer in the ^1H NMR.

(*E*)-Ethyl 1-((3-benzylidenecyclopent-1-en-1-yl)(phenyl)methyl)-1*H*-1,2,3-triazole-4-carboxylate (4w). Following the general procedure, **4w** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 30:70) as a colorless solid (173 mg, 45%); R_f (30% EtOAc/Hexanes) 0.42; mp 153-155 °C; IR (thin film) ν_{max} 2926, 1724, 1448, 1202 and 1039 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 8.05/8.00* (1 H, s), 7.45-7.43 (3 H, m), 7.34 (5 H, d, J = 4.4 Hz), 7.22-7.17 (1 H, m), 6.61 (1 H, s), 6.35 (1 H, s), 5.90 (1 H, s), 4.44 (2 H, q, J = 7.1 Hz), 3.02-2.99 (2 H, m), 2.63-2.60 (2 H, m), 1.42 (3 H, t, J = 7.1 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 160.8, 160.8, 150.7, 147.0, 145.8, 146.4, 140.1, 140.0, 138.1, 137.9, 136.7, 135.6, 135.4, 130.6, 129.4, 128.5, 128.1, 128.0, 128.0, 127.8, 127.0, 126.3, 126.3, 122.3, 120.7, 66.4, 66.2, 61.4, 34.0, 31.9, 31.5, 29.5, 14.4 ppm; HRMS (ESI): MNa^+, found 408.1696. $C_{24}H_{23}N_3NaO_2$ requires 408.1688. Isolated as a mixture of regioisomers and the characterization data given correspond to both isomers and *corresponds to the minor isomer in the ^1H NMR.

Ethyl 1-(2-methyl-5-(prop-1-en-2-yl)cyclohex-2-en-1-yl)-1*H*-1,2,3-triazole-4-carboxylate (4x). Following the general procedure, **4x** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 50:50) as a colorless liquid (110 mg, 80%); R_f (50% EtOAc/Hexanes) 0.42; IR (CH_2Cl_2) ν_{max} 3132, 2977, 1731, 1645, 1538 and 735 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 8.02*/8.01 (1 H, s), 5.92 (1 H, br. s), 5.12 (1 H, br. s), 4.64 (1 H, s), 4.57 (1 H, s), 4.34 (2 H, q, J = 7.0 Hz), 2.29-1.89 (5 H, m), 1.58 (6 H, s), 1.32 (3 H, t, J = 7.1 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 160.9, 160.8, 147.2, 147.0, 140.2, 139.6, 130.4, 130.0, 128.2, 127.7, 126.7, 126.0, 109.9, 109.9, 62.5, 61.2, 61.2, 60.0, 40.4, 36.5, 34.8, 34.6, 30.5, 30.3, 20.8, 20.7, 20.6, 20.5, 18.8, 14.3 ppm; HRMS (ESI): MNa^+, found 298.1519. $C_{15}H_{21}N_3NaO_2$ requires 298.1531. Isolated as a mixture of diastereomers and the characterization data given correspond to both isomers and *corresponds to the minor isomer in the ^1H NMR.

4-Hexyl-1-(2-methyl-5-(prop-1-en-2-yl)cyclohex-2-en-1-yl)-1*H*-1,2,3-triazole (4y). Following the general procedure, **4y** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 50:50) as a colorless liquid (124 mg, 87%); R_f (50% EtOAc/Hexanes) 0.42; IR (CH_2Cl_2): ν_{max} 3131, 2926, 2857, 1548, 1377 and 809 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$): δ_H 7.25 (1 H, s), 5.90 (1 H, br. s), 5.08 (1 H, br. s), 4.72 (1 H, s), 4.65 (1 H, s), 2.70 (2 H, t, J = 7.8 Hz), 2.34-1.90 (5 H, m), 1.66-1.62 (8 H, m), 1.35-1.25 (6 H, m), 0.86 (3 H, t, J = 6.8 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$): δ_C 148.6, 147.8, 147.7, 147.5, 131.2, 129.1, 128.9, 127.1, 119.7, 118.8, 109.7, 61.8, 59.2, 40.7, 36.5, 35.3, 34.9, 31.5, 30.6, 30.4, 29.4, 28.9, 25.8, 25.7, 22.5, 20.8, 20.7, 20.5, 18.9, 14.0 ppm; HRMS (ESI): MH^+, found 288.2436. $C_{18}H_{30}N_3$ requires 288.2440. Isolated as a mixture of diastereomers and the characterization data given correspond to both isomers.

Ethyl 1-benzhydryl-1*H*-1,2,3-triazole-4-carboxylate (6a). Following the general procedure, **6a** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 30:70) as a colorless solid (218 mg, 71%); R_f (30% EtOAc/Hexanes) 0.42; mp 146-148 °C; IR (thin film) ν_{max} 2983, 1722, 1453, 1207 and 1041 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.94 (1 H, s), 7.39-7.37 (6 H, m), 7.18 (1 H, s), 7.12-7.10 (4 H, m), 4.40 (2 H, q, J = 7.1 Hz), 1.39 (3 H, t, J = 7.1 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 160.8, 140.0, 137.4, 129.1, 128.9, 128.0, 127.7, 68.4, 61.4, 14.3 ppm; HRMS (ESI): MH^+, found 308.1398. $C_{18}H_{18}N_3O_2$ requires 308.1399.

Ethyl 1-(1-phenylethyl)-1*H*-1,2,3-triazole-4-carboxylate (6b). Following the general procedure, **6b** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 30:70) as yellow liquid (87 mg, 35%); R_f (30% EtOAc/Hexanes) 0.42; IR (thin film) ν_{max} 2926, 1731, 1375, 1220 and 1095 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.97 (1 H, s), 7.43-7.37 (3 H, m), 7.31-7.29 (2 H, m), 5.90 (1 H, q, J = 7.1 Hz), 4.41 (2 H, q, J = 7.1 Hz), 2.02 (3 H, d, J = 7.1 Hz), 1.40 (3 H, t, J = 7.1 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 160.9, 140.2, 138.9, 129.2, 129.0, 126.6, 126.2, 61.3, 60.7, 21.2, 14.3 ppm; HRMS (ESI): MH^+, found 246.1252. $C_{13}H_{16}N_3O_2$ requires 246.1243.

Ethyl 1-(1,2,3,4-tetrahydronaphthalen-1-yl)-1*H*-1,2,3-triazole-4-carboxylate (6c). Following the general procedure, **6c** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 30:70) as a colorless solid (190 mg, 70%); R_f (30% EtOAc/Hexanes) 0.42; mp 86-88 °C; IR

(thin film) ν_{max} 2939, 1721, 1452, 1198 and 1038 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ_H 7.69 (1 H, s), 7.26-7.10 (3 H, m), 6.89 (1 H, d, J = 7.6 Hz), 5.95 (1 H, t, J = 5.1 Hz), 4.31 (2 H, q, J = 7.1 Hz), 2.93-2.78 (2 H, m), 2.31-2.26 (2 H, m), 1.89-1.81 (1 H, m), 1.74-1.68 (1 H, m), 1.32 (3 H, t, J = 7.1 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 160.8, 139.7, 137.9, 131.6, 129.8, 129.1,128.9, 127.1, 126.8, 61.2, 59.4, 30.9, 28.6, 18.9, 14.3 ppm; HRMS (ESI): MH$^+$, found 272.1390. $C_{15}H_{18}N_3O_2$ requires 272.1399.

Ethyl 1-(1-allyl-1,2,3,4-tetrahydronaphthalen-1-yl)-1*H*-1,2,3-triazole-4-carboxylate (6d). Following the general procedure, **6d** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 30:70) as a colorless liquid (162 mg, 52%); R_f (30% EtOAc/Hexanes) 0.42; IR (thin film) ν_{max} 2939, 1739, 1319, 1221 and 773 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ_H 7.52 (1 H, s), 7.34-7.21 (4 H, m), 5.59-5.48 (1 H, m), 5.24-5.07 (2 H, m), 4.36 (2 H, q, J = 7.1 Hz), 3.52 (1 H, dd, J_1 = 14.4 Hz, J_2 = 8.4 Hz), 3.24-3.19 (1 H, m), 2.84-2.80 (2 H, m), 2.56-2.51 (1 H, m), 2.32-2.24 (1 H, m), 1.85-1.78 (1 H, m), 1.35 (3 H, t, J = 7.1 Hz), 1.38-1.34 (1 H, m) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 161.1, 138.7, 138.6, 134.0, 132.5, 130.2, 129.0, 128.3, 127.8, 127.0, 120.0, 66.1, 61.2, 45.0, 35.1, 29.5, 18.2, 14.3 ppm; HRMS (ESI): MH$^+$, found 312.1704. $C_{18}H_{22}N_3O_2$ requires 312.1712.

4-Hexyl-1-(1,2,3,4-tetrahydronaphthalen-1-yl)-1*H*-1,2,3-triazole (6e). Following the general procedure, **6e** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 30:70) as yellow liquid (198 mg, 70%); R_f (30% EtOAc/Hexanes) 0.42; IR (thin film) ν_{max} 2928, 1454, 1219 and 1042 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ_H 7.28 (1 H, t, J = 7.7 Hz), 7.21 (1 H, d, J = 6.1 Hz), 7.15 (1 H, t, J = 7.7 Hz), 6.95 (1 H, s), 6.91 (1 H, d, J = 7.7 Hz), 5.93 (1 H, t, J = 6.1 Hz), 3.00-2.83 (2 H, m), 2.67 (2 H, t, J = 7.5 Hz), 2.35-2.24 (2 H, m), 1.92-1.84 (2 H, m), 1.66-1.59 (2 H, m), 1.35-1.27 (6 H, m), 0.87 (3 H, t, J = 6.8 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 148.2, 137.7, 133.1, 129.5, 128.9, 128.3, 126.6, 119.8, 58.9, 31.5, 31.3, 29.4, 28.9, 25.8, 22.5, 19.7, 14.0 ppm; HRMS (ESI): MH$^+$, found 284.2118. $C_{18}H_{26}N_3$ requires 284.2127.

Ethyl 1-(phenyl(*o*-tolyl)methyl)-1*H*-1,2,3-triazole-4-carboxylate (6f). Following the general procedure, **6f** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 50:50) as a colorless liquid (139 mg, 87%); R_f (50% EtOAc/Hexanes) 0.42; IR (CH_2Cl_2) ν_{max} 2985, 1738, 1491, 1375 and 754 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ_H 7.83 (1 H, s), 7.35-7.25 (3 H, m), 7.30 (1 H, s), 7.23-7.13 (3 H, m), 7.03-7.02 (2 H, m), 6.66 (1 H, d, J = 7.7 Hz), 4.37 (2 H, q, J = 7.0 Hz), 2.16 (3 H, s), 1.33 (3 H, t, J = 7.1 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 160.8, 139.7, 136.8, 136.3, 135.7, 131.2, 129.2, 128.9, 128.9, 128.0, 128.0, 127.3, 126.6, 65.6, 61.3, 19.2, 14.3 ppm; HRMS (ESI): MNa$^+$, found 344.1366. $C_{19}H_{19}N_3NaO_2$ requires 344.1375.

General procedure for the synthesis of *bis*-alcohols 7a-d.[29] To a mixture of corresponding *bis*-aldehyde (3 mmol), allyl bromide (7 equiv) in THF (7 mL) were sequentially added sat. NH_4Cl (18 mL) and Zn metal (5 equiv) at rt. The resulting mixture was stirred at rt for 30 h. After this period, the reaction mixture was extracted by using ethyl acetate (3 X 7 mL). The combined organic layers were dried over anhydrous Na_2SO_4 and the organic phase was concentrated, and the resulting crude reaction mixture was purified by silica gel column chromatography (EtOAc/hexanes) to give the desired products **7a-d.**[29]

Compound 7a. Following the general procedure, **7a** as a colorless liquid (885 mg, 72%); R_f (30% EtOAc/Hexanes) 0.42; IR (CH_2Cl_2) ν_{max} 3413, 2937, 1600, 1453 and 751 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ_H 7.32 (2 H, d, J = 7.2 Hz), 7.19 (2 H, t, J = 7.4 Hz), 6.92 (2 H, t, J = 7.4 Hz), 6.82 (2 H, d, J = 8.1 Hz), 5.87-5.77 (2 H, m), 5.11-5.04 (4 H, m) 4.95 (2 H, br. s), 3.98-3.96 (4 H, m), 2.86 (2 H, s), 2.57-2.42 (4 H, m), 1.83-1.81 (4 H, m), 1.56-1.54 (4 H, m) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 155.7, 135.4, 132.1, 128.2, 126.8, 120.6, 117.4, 111.2, 69.6, 67.6, 42.1, 29.3, 26.0 ppm; HRMS (ESI): MNa$^+$, found 433.2357. $C_{26}H_{34}NaO_4$ requires 433.2355. Isolated as a mixture of diastereomers (*dr* = 50:50) and NMR values given for both isomers.

General procedure for the one-pot synthesis of 1,2,3-triazoles 8a-h directly from bis-homoallylic alcohols 7a-d. A solution of the corresponding *bis*-homoallylic alcohol **7** (0.5 mmol) and $TMSN_3$ (1.5 mmol, 3 equiv) and copper(II) triflate (10 mol%) in DCM (5.0 mL) was stirred at rt for 3 h under an inert atmosphere. After this period, the solvent was evaporated. Then, to the resulting reaction mixture THF (2-3 mL), water (2-3 mL), alkyne (2.5 mmol, 5 equiv) and sodium *L*-ascorbate (100 mol%) were added and stirred at rt for 20 h. Then, the reaction mixture was extracted by using ethyl acetate (3 X 10 mL). The combined organic layers were dried over anhydrous Na_2SO_4 and the organic phase was concentrated, and the resulting crude reaction mixture was purified by silica gel column chromatography (EtOAc/Hexanes) to give the desired 1,2,3-*bis*-triazole product **8** (see the corresponding Tables/Schemes for specific entries).

Diethyl 1,1'-(((hexane-1,6-diylbis(oxy))bis(2,1-phenylene))bis(but-3-ene-1,1-diyl))bis(1*H*-1,2,3-triazole-4-carboxylate) (8a). Following the general procedure, **8a** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 50:50) as a red color liquid (117 mg, 72%); R_f (50% EtOAc/Hexanes) 0.45; IR (CH_2Cl_2) ν_{max} 2939, 1738, 1602, 1542, 1494 and 754 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ_H 8.04 (2 H, s), 7.34-7.28 (4 H, m), 6.97 (2 H, t, J = 7.5 Hz), 6.91 (2 H, d, J = 8.6 Hz), 6.14 (2 H, t, J = 7.1 Hz), 5.74-5.70 (2 H, m), 5.14-5.02 (4 H, m), 4.38 (4 H, q, J = 7.2 Hz), 4.02-3.93 (4 H, m), 3.24-3.18 (2 H, m), 3.06-3.02 (2 H, m), 1.82-1.79 (4 H, m), 1.47-1.44 (4 H, m), 1.37 (6 H, t, J = 7.1 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 161.0, 156.1, 139.5, 132.9, 130.2, 127.5, 127.2, 127.2, 125.4, 120.7, 118.9, 111.7, 67.9, 61.2, 59.2, 59.2, 38.1, 29.0, 25.8, 14.3 ppm; HRMS (ESI): MNa$^+$, found 679.3224. $C_{36}H_{44}N_6NaO_6$ requires 679.3220. Isolated as a mixture of diastereomers (*dr* = 50:50) and NMR values given for both isomers.

Diethyl 1,1'-((((oxybis(ethane-2,1-diyl))bis(oxy))bis(2,1-phenylene))bis(but-3-ene-1,1-diyl))bis(1*H*-1,2,3-triazole-4-carboxylate) (8b). Following the general procedure, **8b** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 50:50) as a colorless liquid (135 mg, 84%); R_f (50% EtOAc/Hexanes) 0.45; IR (CH_2Cl_2) ν_{max} 2939, 1731, 1642, 1542, and 754 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ_H 8.18 (2 H, s), 7.36-7.28 (4 H, m), 6.97 (2 H, t, J = 7.5 Hz), 6.92 (2 H, d, J = 8.2 Hz), 6.12-6.07 (2 H, m), 5.67-5.60 (2 H, m), 5.08-4.97 (4 H, m), 4.34 (4 H, q, J = 7.1 Hz), 4.21-4.09 (4 H, m), 3.89 (4 H, t, J = 4.6 Hz), 3.26-3.19 (2 H, m), 3.08-3.01 (2 H, m), 1.34 (6 H, t, J = 7.1 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 161.0, 156.0, 139.5, 132.9, 130.3, 127.8, 127.6, 127.5, 125.6, 125.6, 121.2, 118.9, 112.0, 69.7, 69.7, 67.6, 61.2, 59.5, 59.5, 37.7, 14.3 ppm; HRMS (ESI): MNa$^+$, found 667.2863. $C_{34}H_{40}N_6NaO_7$ requires 667.2856. Isolated as a mixture of diastereomers (*dr* = 50:50) and NMR values given for both isomers.

Diethyl 1,1'-(((((ethane-1,2-diylbis(oxy))bis(ethane-2,1-diyl))bis(oxy))bis(2,1-phenylene))bis(but-3-ene-1,1-diyl))bis(1*H*-1,2,3-triazole-4-carboxylate) (8c). Following the general procedure, **8c** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 50:50) as a colorless liquid (141 mg, 82%); R_f (50% EtOAc/Hexanes) 0.45; IR (CH_2Cl_2) ν_{max} 2933, 1737, 1602, 1494, and 754 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ_H 8.22 (2 H, s), 7.33 (2 H, d, J = 7.5 Hz), 7.28 (2 H, t, J = 7.8 Hz), 6.96 (2 H, t, J = 7.5 Hz), 6.85 (2 H, d, J

= 8.2 Hz), 6.10 (2 H, t, *J* = 7.7 Hz), 5.70-5.63 (2 H, m), 5.11-4.97 (4 H, m), 4.37 (4 H, q, *J* = 7.1 Hz), 4.14-4.05 (4 H, m), 3.84 (4 H, t, *J* = 5.5 Hz), 3.77 (4 H, br. s), 3.29-3.21 (2 H, m), 3.09-3.02 (2 H, m), 1.36 (6 H, t, *J* = 7.1 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 161.0, 155.9, 139.4, 133.0, 130.2, 127.8, 127.8, 125.9, 121.2, 118.9, 112.0, 70.7, 69.4, 67.5, 61.1, 59.6, 37.7, 14.3 ppm; HRMS (ESI): MNa^+, found 711.3135. $C_{36}H_{44}N_6NaO_8$ requires 711.3118. Isolated as a mixture of diastereomers (*dr* = 50:50) and NMR values given for both isomers.

Diethyl 1,1'-((((1,3-phenylenebis(methylene))bis(oxy))bis(2,1-phenylene))bis(but-3-ene-1,1-diyl))bis(1*H*-1,2,3-triazole-4-carboxylate) (8d). Following the general procedure, **8d** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 50:50) as a colorless liquid (147 mg, 87%); R_f (50% EtOAc/Hexanes) 0.42; IR (CH_2Cl_2) ν_{max} 2982, 1732, 1493, 1227, 1041 and 754 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ_H 7.90 (2 H, s), 7.44 (4 H, s), 7.37-7.28 (4 H, m), 7.04-6.91 (4 H, m), 6.10-6.05 (2 H, m), 5.65-5.58 (2 H, m), 5.06-4.95 (8 H, m), 4.41-4.35 (4 H, m), 3.21-3.12 (2 H, m), 3.10-2.95 (2 H, m), 1.40-1.38 (6 H, m) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 160.9, 155.7, 155.7, 139.5, 134.5, 134.4, 132.6, 132.6, 130.4, 129.8, 129.7, 129.1, 127.7, 127.6, 127.2, 127.2, 125.7, 125.6, 121.5, 121.5, 119.1, 119.1, 112.3, 112.2, 68.2, 68.1, 61.2, 59.0, 58.8, 38.1, 14.3 ppm; HRMS (ESI): MNa^+, found 699.2918. $C_{38}H_{40}N_6NaO_6$ requires 699.2907. Isolated as a mixture of diastereomers (*dr* = 50:50) and NMR values given for both isomers.

2,2'-(((1,1'-(((Hexane-1,6-diylbis(oxy))bis(2,1-phenylene))bis(but-3-ene-1,1-diyl))bis(1*H*-1,2,3-triazole-4,1-diyl))bis(methylene))bis(oxy))dibenzaldehyde (8e). Following the general procedure, **8e** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 50:50) as a colorless liquid (131 mg, 68%); R_f (50% EtOAc/Hexanes) 0.42; IR (CH_2Cl_2) ν_{max} 2940, 1687, 1599, 1456 and 752 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ_H 10.42 (2 H, s), 7.80 (2 H, dd, J_1 = 5.8 Hz, J_2 = 1.8 Hz), 7.65 (2 H, s), 7.52 (2 H, t, *J* = 8.8 Hz), 7.31-7.26 (4 H, m), 7.13 (2 H, d, *J* = 8.4 Hz), 7.02 (2 H, t, *J* = 7.4 Hz), 6.95 (2 H, t, *J* = 8.2 Hz), 6.89 (2 H, d, *J* = 8.0 Hz), 6.11 (2 H, t, *J* = 8.7 Hz), 5.75-5.65 (2 H, m), 5.29 (4 H, s), 5.10-4.99 (4 H, m), 4.00-3.93 (4 H, m), 3.25-3.18 (2 H, m), 3.06-2.99 (2 H, m), 1.80-1.77 (4 H, m), 1.49-1.47 (4 H, m) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 189.6, 160.6, 156.0, 142.5, 136.0, 133.3, 129.9, 128.5, 127.4, 126.2, 125.0, 122.8, 121.2, 120.7, 118.5, 113.1, 111.6, 67.9, 62.7, 59.0, 38.3, 29.1, 25.8 ppm; HRMS (ESI): MNa^+, found 803.3548. $C_{46}H_{48}N_6NaO_6$ requires 803.3533. Isolated as a mixture of diastereomers (*dr* = 50:50) and NMR values given for both isomers.

2,2'-(((1,1'-((((Oxybis(ethane-2,1-diyl))bis(oxy))bis(2,1-phenylene))bis(but-3-ene-1,1-diyl))bis(1H-1,2,3-triazole-4,1-diyl))bis(methylene))bis(oxy))dibenzaldehyde (8f): Following the general procedure, **8f** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 50:50) as a colorless liquid (299 mg, 78%); R_f (50% EtOAc/Hexanes) 0.42; IR (CH_2Cl_2) ν_{max} 2976, 1686, 1599, 1483and 756 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ_H 10.41 (2 H, s), 7.79 (2 H, dd, J_1 = 7.6 Hz, J_2 = 1.1 Hz), 7.73 (2 H, s), 7.52 (2 H, td, J_1 = 7.8 Hz, J_2 = 1.2 Hz), 7.30-7.24 (4 H, m), 7.10 (2 H, d, *J* = 8.4 Hz), 7.02 (2 H, t, *J* = 7.6 Hz), 6.96 (2 H, t, *J* = 7.5 Hz), 6.85 (2 H, d, *J* = 8.2 Hz), 6.10-6.06 (2 H, m), 5.69-5.62 (2 H, m), 5.22 (4 H, d, *J* = 3.9 Hz), 5.05 (2 H, d, *J* = 17.1 Hz), 4.96 (2 H, d, *J* = 10.2 Hz), 4.17-4.06 (4 H, m), 3.88-3.84 (4 H, m), 3.25-3.17 (2 H, m), 3.07-3.02 (2 H, m) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 189.7, 160.5, 155.8, 142.5, 136.0, 133.3, 130.0, 128.5, 127.7, 126.5, 125.0, 122.9, 121.3, 121.2, 118.5, 113.1, 112.0, 69.7, 67.7, 62.7, 62.7, 59.1, 59.0, 38.0 ppm; HRMS (ESI): MNa^+, found 791.3150. $C_{44}H_{44}N_6NaO_7$ requires 791.3169. Isolated as a mixture of diastereomers (*dr* = 50:50) and NMR values given for both isomers.

2,2'-(((1,1'-(((((Ethane-1,2-diylbis(oxy))bis(ethane-2,1-diyl))bis(oxy))bis(2,1-phenylene))bis(but-3-ene-1,1-diyl))bis(1*H*-1,2,3-triazole-4,1-diyl))bis(methylene))bis(oxy))dibenzaldehyde (8g). Following the general procedure, **8g** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 50:50) as a colorless liquid (163 mg, 81%); R_f (50% EtOAc/Hexanes) 0.42; IR (CH_2Cl_2) ν_{max} 2875, 1687, 1599, 1493 and 756 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ_H 10.39 (2 H, s), 7.82 (2 H, s), 7.77-7.75 (2 H, m), 7.50-7.46 (2 H, m), 7.28-7.21 (4 H, m), 7.12 (2 H, d, *J* = 8.4 Hz), 7.00-6.90 (4 H, m), 6.81 (2 H, d, *J* = 8.1 Hz), 6.06 (2 H, t, *J* = 6.8 Hz), 5.69-5.62 (2 H, m), 5.25 (4 H, s), 5.07-4.93 (4 H, m), 4.10-4.00 (4 H, m), 3.78-3.76 (4 H, m), 3.69 (4 H, br. s), 3.25-3.18 (2 H, m), 3.04-3.00 (2 H, m) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 189.7, 160.6, 155.7, 142.4, 136.0, 133.4, 129.9, 128.4, 127.7, 126.6, 125.0, 123.3, 121.2, 121.2, 118.5, 113.2, 112.0, 70.6, 69.5, 67.6, 62.6, 59.2, 37.9 ppm; HRMS (ESI): MNa^+, found 835.3456. $C_{46}H_{48}N_6NaO_8$ requires 835.3431. Isolated as a mixture of diastereomers (*dr* = 50:50) and NMR values given for both isomers.

2,2'-(((1,1'-((((1,3-Phenylenebis(methylene))bis(oxy))bis(2,1-phenylene))bis(but-3-ene-1,1-diyl))bis(1H-1,2,3-triazole-4,1-diyl))bis(methylene))bis(oxy))dibenzaldehyde (8h): Following the general procedure, **8h** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 50:50) as a colorless liquid (312 mg, 78%); R_f (50% EtOAc/Hexanes) 0.42; IR (CH_2Cl_2) ν_{max} 2976, 1686, 1462, 1194 and 751 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ_H 10.37 (2 H, s), 7.79 (2 H, dd, J_1 = 7.4 Hz, J_2 = 0.9 Hz), 7.62 (2 H, s), 7.51 (2 H, td, J_1 = 7.8 Hz, J_2 = 1.7 Hz), 7.37-7.26 (8 H, m), 7.10 (2 H, d, *J* = 8.4 Hz), 7.03-6.96 (6 H, m), 6.16-6.12 (2 H, m), 5.73-5.62 (2 H, m), 5.24 (4 H, s), 5.12-4.97 (8 H, m), 3.26-3.18 (2 H, m), 3.07-3.00 (2 H, m) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 189.6, 160.5, 155.6, 142.5, 137.0, 136.0, 133.2, 130.0, 129.1, 128.5, 127.6, 127.1, 126.5, 126.2, 125.0, 123.0, 121.3, 121.2, 118.7, 113.1, 112.2, 70.0, 62.6, 58.9, 38.3 ppm; HRMS (ESI): MNa^+, found 823.3250. $C_{48}H_{44}N_6NaO_6$ requires 823.3220. Isolated as a mixture of diastereomers (*dr* = 50:50) and NMR values given for both isomers.

Preparation of the compound 10.[30] A solution of (*E*)-4-phenyl-1-(3-phenyl-1-(*p*-tolyl)allyl)-1*H*-1,2,3-triazole (**4o**) in MeI (5 mL) was refluxed for 5 d. After this period, excess of MeI was removed under vacuum and the resulting crude reaction mixture was washed with Hexanes and ether which gave the compound **10**.

1-(1,3-Diphenylpropyl)-4-phenyl-1*H*-1,2,3-triazole (11). To the solution of (*E*)-1-(1,3-diphenylallyl)-4-phenyl-1*H*-1,2,3-triazole (**4c**, 1 mmol) in THF (2 mL) was added Pd/C (10 mol%). The reaction mixture was stirred at room temperature for 24 h, under H_2 atm (1 atm). After completion of the reaction, the reaction mixture was filtered by using a layer of celite pad and the filtrate was evaporated under vacuum and the resulting crude reaction mixture was purified by silica gel column chromatography (EtOAc : Hexanes = 30 : 70) which gave the compound **11** as a colorless solid (311 mg, 91%); R_f (30% EtOAc/Hexanes) 0.42; mp 110-112 °C; IR (thin film) ν_{max} 3062, 3028, 1603, 1454 and 767 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ_H 7.84 (2 H, d, *J* = 7.1 Hz), 7.71 (1 H, s), 7.45-7.22 (11 H, m), 7.19 (2 H, d, *J* = 7.1 Hz), 5.61 (1 H, dd, J_1 = 9.2 Hz, J_2 = 6.2 Hz), 2.95-2.88 (1 H, m), 2.70-2.66 (3 H, m) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 147.8,140.3, 138.8, 130.6, 129.1, 128.8, 128.7, 128.7, 128.5, 128.2, 127.0, 126.4, 125.7, 118.8, 64.4, 36.6, 32.3 ppm; HRMS (ESI): MH^+, found 340.1806. $C_{23}H_{22}N_3$ requires 340.1814.

Preparation of the compound 12. A solution of (1-(1,3-diphenylpropyl)-4-phenyl-1*H*-1,2,3-triazole (**11**, 0.25 mmol) in MeI (5 mL) was refluxed for 4 d. After this period, excess of MeI

was removed under vacuum and the resulting crude reaction mixture was washed with Hexanes and ether which gave the compound **12** as a semi solid (110 mg, 92%); R_f (30% EtOAc/Hexanes) 0.42; IR (thin film) ν_{max} 2928, 1603, 1494, 1454, 1384 and 770 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 9.45 (1 H, s), 7.72 (2 H, d, J = 8.0 Hz), 7.61 (2 H, d, J = 8.0 Hz), 7.53-7.45 (3 H, m), 7.42-7.37 (3 H, m), 7.18 (4 H, d, J = 4.3 Hz), 7.13-7.08 (1 H, m), 6.54 (1 H, t, J = 7.6 Hz), 4.20 (3 H, s), 3.12-3.03 (1 H, m), 2.81-2.69 (3 H, m) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 142.8, 139.7, 135.5, 132.0, 130.0, 129.7, 129.5, 129.5, 128.9, 128.6, 128.4, 128.2, 126.3, 121.5, 68.9, 39.7, 35.6, 32.3 ppm; HRMS (ESI): M-IH$^+$, found 355.1996. $C_{24}H_{25}N_3$ requires 355.2048.

Preparation of the compound 13. To a solution of (*E*)-(3-azidoprop-1-ene-1,3-diyl)dibenzene (**2**, 1 mmol) in THF (2 mL) was added Pd/C (10 mol%). The reaction mixture was stirred at room temperature for 24 h under H_2 atm (1 atm). After completion of the reaction, the reaction mixture was filtered by using a layer of celite pad and the filtrate was evaporated under vacuum and the resulting crude reaction mixture was transferred into a separating funnel with DCM and extracted twice with 1 N HCl (4 mL). The acidic aqueous layer was washed 2 times with EtOAc (5 mL). The aqueous phase was then made basic (pH: 10-11) with 2 N NaOH and extracted with DCM (5 mL). The combined organic layers were dried over anhydrous Na_2SO_4 and the organic phase was concentrated to afford the compound **13** as colorless liquid (105 mg, 50%); IR (Thin film) ν_{max} 3026, 1602, 1453 and 1029 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.39-7.18 (10 H, m), 3.93 (1 H, t, J = 6.8 Hz), 2.70-2.55 (2 H, m), 2.07-2.01 (2 H, m), 1.73 (2 H, s) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 146.2, 141.9, 128.6, 128.4, 127.1, 126.4, 125.8, 55.8, 41.0, 32.8 ppm; HRMS (ESI): MH$^+$, found 212.1441. $C_{15}H_{18}N$ requires 212.1439.

Procedure forthe synthesis of *bis*-alcohol 14. $NaBH_4$ (4 mmol) was added to a mixture of *bis*-aldehyde **8** (1 mmol) in THF (3 mL) and ethanol (7 mL) at room temperature. The resulting mixture was stirred at room temperature for 1 h. After this period, the reaction mixture was poured on to cold water (5 mL). Then, extracted by using ethyl acetate (3 X 10 mL) and the combined organic layers were dried over anhydrous Na_2SO_4 and the organic phase was concentrated and the resulting crude reaction mixture was purified by silica gel column chromatography (EtOAc : Hexanes) to give the desired compound **14.**

Compound 14a: Following the general procedure, **14a** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 60:40) as a colorless liquid (741 mg, 96%); R_f (60% EtOAc/Hexanes) 0.42; IR (CH_2Cl_2) ν_{max} 3402, 2936, 1601, 1455and 754 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.65 (2 H, s), 7.31-7.20 (8 H, m), 6.99-6.89 (6 H, m), 6.84 (2 H, d, J = 8.2 Hz), 6.05-6.01 (2 H, m), 5.69-5.62 (2 H, m), 5.10-4.96 (8 H, m), 4.62 (4 H, s), 4.15-4.03 (4 H, m), 3.85-3.80 (4 H, m), 3.23-3.19 (2 H, m), 3.05-3.02 (2 H, m) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 156.1, 155.9, 155.8, 143.2, 143.2, 133.3, 133.3, 130.0, 129.9, 129.0, 129.0, 128.8, 127.8, 127.8, 126.4, 126.4, 122.7, 122.6, 121.3, 121.3, 118.5, 112.0, 69.8, 67.7, 62.3, 61.3, 59.1, 37.9, 37.8 ppm; HRMS (ESI): MNa$^+$, found 795.3467. $C_{44}H_{48}N_6NaO_7$ requires 795.3482. The OH protons could not be detected.

Compound 14b: Following the general procedure, **14b** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 50:50) as a colorless liquid (709 mg, 95%); R_f (60% EtOAc/Hexanes) 0.42; IR (CH_2Cl_2) ν_{max} 3412, 2876, 1589, 1602, 1454 and 754 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.75 (2 H, s), 7.32-7.19 (8 H, m), 6.98-6.91 (6 H, m), 6.83 (2 H, d, J = 8.2 Hz), 6.05 (2 H, t, J = 7.7 Hz), 5.71-5.64 (2 H, m), 5.16 (4 H, s), 5.10-4.97 (4 H, m), 4.63 (4 H, s), 4.08-3.98 (4 H, m), 3.75 (4 H, t, J = 4.8 Hz), 3.69 (4 H, br. s), 3.25-3.19 (2 H, m), 3.08-3.03 (2 H, m) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 156.1, 155.8, 143.1, 133.4, 130.0, 129.9, 128.9, 128.7, 127.9, 126.5, 122.9, 121.3, 121.2, 118.5, 112.0, 112.0, 70.6, 69.5, 67.5, 62.4, 61.1, 59.2, 37.9 ppm; HRMS (ESI): MNa$^+$, found 839.3761. $C_{46}H_{52}N_6NaO_8$ requires 839.3744. The OH protons could not be detected.

Compound 14c: Following the general procedure, **14c** was obtained after purification by silica gel column chromatography (EtOAc:Hexanes = 60:40) as a colorless liquid (739 mg, 92%); R_f (60% EtOAc/Hexanes) 0.42; IR (CH_2Cl_2) ν_{max} 3345, 1601, 1492, 1243 and 755 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.52 (2 H, s), 7.41 (2 H, t, J = 8.2 Hz), 7.30 (8 H, m), 7.22 (2 H, t, J = 8.0 Hz), 7.01-6.92 (8 H, m), 6.13-6.09 (2 H, m), 5.72-5.62 (2 H, m), 5.15-4.98 (12 H, m), 4.62 (4 H, s), 3.25-3.18 (2 H, m), 3.07-3.00 (2 H, m) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 156.1, 155.6, 143.2, 137.0, 133.2, 130.0, 129.9, 129.1, 128.9, 128.8, 127.6, 127.1, 127.1, 126.6, 126.6, 126.3, 126.3, 122.6, 122.6, 121.4, 118.6, 112.2, 112.0, 70.0, 62.4, 61.4, 58.9, 58.9, 38.2 ppm; HRMS (ESI): MH$^+$, found 805.3755. $C_{48}H_{49}N_6O_6$ requires 805.3714. The OH protons could not be detected.

Procedure for the syntheses of compounds 15. To a mixture of the diol compound **14** (0.5 mmol) in dry THF (3 mL) was added NaH (4 mmol, 55-60 % suspension in mineral oil) at rt. The mixture was stirred at room temperature for 10 min and then, propargyl bromide (5 mmol, 80 wt% in toluene) was added. The resulting mixture was stirred for 20 h at rt. After this period, few drops of EtOH was added and stirred for 10 min and then, the resulting mixture was poured on to water (20 mL) and was extracted by using ethyl acetate (3 X 10 mL).The combined organic layers were dried over anhydrous Na_2SO_4 and the organic phase was concentrated, and the resulting crude reaction mixture was purified by silica gel column chromatography (EtOAc/ Hexanes) to give the desired product **15**.

Compound 15a: Following the general procedure, **15a** was obtained after purification by silica gel column chromatography as colorless liquid (254 mg, 60%); R_f (40% EtOAc/Hexanes) 0.42; IR (CH_2Cl_2) ν_{max} 3288, 2976, 1602, 1455 and 755 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.68 (2 H, s), 7.36 (2 H, dd, J_1 = 7.8 Hz, J_2 = 1.4 Hz), 7.29-7.24 (6 H, m), 6.99-6.95 (6 H, m), 6.86 (2 H, d, J = 8.6 Hz), 6.11-6.06 (2 H, m), 5.71-5.64 (2 H, m), 5.18 (4 H, s), 5.07 (2 H, d, J = 17.1 Hz), 4.99 (2 H, d, J = 10.1 Hz), 4.61 (4 H, s), 4.16-4.08 (8 H, m), 3.88-3.84 (4 H, m), 3.22-3.17 (2 H, m), 3.07-2.99 (2 H, m), 2.37 (2 H, m) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 156.1, 155.7, 143.6, 133.4, 129.9, 129.8, 129.2, 127.6, 126.7, 126.1, 122.6, 122.6, 121.2, 121.1, 118.4, 112.1, 112.0, 80.0, 74.5, 69.8, 67.8, 66.7, 62.6, 58.9, 57.4, 38.1 ppm; HRMS (ESI): MH$^+$, found 849.3996. $C_{50}H_{53}N_6O_7$ requires 849.3976.

Compound 15b: Following the general procedure, **15b** was obtained after purification by silica gel column chromatography as colorless liquid (379 mg, 85%); R_f (40% EtOAc/Hexanes) 0.42; IR (CH_2Cl_2) ν_{max} 2875, 1602, 1493, 1454, 1247 and 755 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.73 (2 H, s), 7.37 (2 H, dd, J_1 = 7.4 Hz, J_2 = 1.5 Hz), 7.29-7.24 (6 H, m), 7.00-6.94 (6 H, m), 6.85 (2 H, d, J = 8.2 Hz), 6.11-6.07 (2 H, m), 5.73-5.67 (2 H, m), 5.21 (4 H, s), 5.11-5.98 (4 H, m), 4.61 (4 H, s), 4.14-4.03 (8 H, m), 3.79 (4 H, t, J = 4.8 Hz), 3.71 (4 H, s), 3.24-3.19 (2 H, m), 3.07-2.99 (2 H, m), 2.38 (2 H, t, J = 2.4 Hz) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 156.1, 155.7, 143.5, 133.5, 129.8, 129.7, 129.2, 127.6, 126.9, 126.1, 122.9, 121.2, 121.1, 118.4, 112.1, 112.0, 80.0, 74.5, 70.7, 69.6, 67.6, 66.7, 62.6, 59.0, 57.4, 38.1 ppm; HRMS (ESI): MH$^+$, found 893.4271. $C_{52}H_{57}N_6O_8$ requires 893.4238.

Compound 15c: Following the general procedure, **15c** was obtained after purification by silica gel column chromatography as colorless liquid (352 mg, 80%); R_f (40% EtOAc/Hexanes)

0.42; IR (CH_2Cl_2) ν_{max} 2973, 1603, 1461, 1249 and 669 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.58 (2 H, s), 7.43-7.23 (12 H, m), 7.01-6.95 (8 H, m), 6.14 (2 H, t, J = 7.1 Hz), 5.74-5.64 (2 H, m), 5.20 (4 H, m), 5.13-4.99 (8 H, m), 4.60 (4 H, s), 4.12-4.10 (4 H, m), 3.26-3.18 (2 H, m), 3.07-3.00 (2 H, m), 2.31 (2 H, t, J = 2.3) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 156.1, 155.5, 143.6, 137.0, 133.3, 129.9, 129.8, 129.2, 129.1, 127.5, 127.1, 126.8, 126.2, 126.1, 122.6, 121.3, 121.1, 118.6, 112.2, 112.1, 80.0, 74.5, 70.0, 66.7, 62.7, 58.8, 57.4, 38.4 ppm; HRMS (ESI): MNa^+, found 903.3871. $C_{54}H_{52}N_6NaO_6$ requires 903.3846.

Procedure[29b] for the synthesis of macrocyclic bis-triazole polyether 16. A mixture of **15** (0.5 mmol), $Cu(OAc)_2{\cdot}H_2O$ (100 mol%) and DMSO (2 mL) was taken in a 10 ml round bottom flask. The reaction mixture was stirred at 110 °C under open air atmosphere for 12 h. After this period, the resulting mixture was cooled to rt and diluted with water (4 mL). The mixture was filtered through a filtration funnel and then washed with ethyl acetate (4 times, using 5 mL of EtOAc) and extracted using EtOAc (3 X 5 mL) and the combined organic layers were dried over anhydrous Na_2SO_4. The solvent was removed under reduced pressure and the residue was purified by silica gel chromatography (EtOAc/Hexanes) which gave the macrocyclic bis-triazole polyether **16.**

Compound 16a: Following the general procedure, **16a** was obtained after purification by silica gel column chromatography as colorless liquid (194 mg, 46%); R_f (40% EtOAc/Hexanes) 0.42; IR (CH_2Cl_2) ν_{max} 2973, 1601, 1459, 1368 and 754 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.79 (2 H, s), 7.38 (2 H, dt, J_1 = 7.7 Hz, J_2 = 1.9 Hz), 7.33 (2 H, dd, J_1 = 7.3 Hz, J_2= 1.6 Hz), 7.29-7.22 (4 H, m), 7.00-6.95 (6 H, m), 6.82-6.79 (2 H, m), 6.04-5.99 (2 H, m), 5.70-5.63 (2 H, m), 5.22-5.15 (4 H, m), 5.07 (2 H, m), 5.00-4.96 (2 H, m), 4.60 (4 H, s), 4.23 (4 H, s), 4.16-4.06 (4 H, m), 3.88-3.81 (4 H, m), 3.31-3.28 (2 H, m), 3.10-3.05 (2 H, m) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 156.0, 155.9, 143.4, 133.4, 130.0, 129.2, 129.2, 128.2, 128.2, 126.5, 125.8, 123.1, 123.0, 121.2, 121.0, 118.4, 112.0, 111.9, 76.0, 70.3, 69.7, 69.7, 67.6, 67.6, 67.1, 62.7, 62.6, 59.3, 58.1, 37.7 ppm; HRMS (ESI): MH^+, found 847.3850. $C_{50}H_{51}N_6O_7$ requires 847.3819.

Compound 16b: Following the general procedure, **16b** was obtained after purification by silica gel column chromatography as colorless liquid (259 mg, 57%); R_f (40% EtOAc/Hexanes) 0.42; IR (CH_2Cl_2) ν_{max} 2926, 1603, 1493, 1454, 1247 and 754 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.88 (2 H, s), 7.38-7.24 (8 H, m), 7.03-6.95 (6 H, m), 6.81 (2 H, d, J = 8.2 Hz), 6.05-6.01 (2 H, m), 5.74-5.64 (2 H, m), 5.22 (4 H, t, J = 3.6 Hz), 5.11-5.07 (2 H, m), 5.00-4.98 (2 H, m), 4.61 (4 H, s), 4.24 (4 H, s), 4.05-4.00 (4 H, m), 3.75-3.71 (8 H, m), 3.35-3.27 (2 H, m), 3.12-3.05 (2 H, m) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 156.0, 155.8, 143.3, 133.5, 129.8, 129.2, 129.2, 128.1, 128.1, 126.8, 126.8, 125.9, 123.5, 121.2, 121.0, 118.4, 111.9, 111.9, 75.9, 70.6, 70.3, 69.5, 67.5, 67.5, 67.1, 62.6, 59.3, 59.3, 58.1, 37.7 ppm; HRMS (ESI): MH^+, found 891.4110. $C_{52}H_{55}N_6O_8$ requires 891.4081. This compound contains traces of residual DMSO signal.

Compound 16c: Following the general procedure, **16c** was obtained after purification by silica gel column chromatography as colorless liquid (184 mg, 42%); R_f (40% EtOAc/Hexanes) 0.42; IR (CH_2Cl_2) ν_{max} 2975, 1602, 1493, 1244 and 930 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.55 (2 H, s), 7.41-7.26 (12 H, m), 7.02-6.92 (8 H, m), 6.07-6.02 (2 H, m), 5.73-5.65 (2 H, m), 5.23-4.98 (12 H, m), 4.53 (4 H, s), 4.09-4.06 (4 H, m), 3.32-3.25 (2 H, m), 3.09-3.03 (2 H, m) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 156.1, 156.0, 155.7, 155.7, 143.4, 143.4, 137.0, 133.4, 133.4, 129.9, 129.5, 129.3, 129.1, 127.9, 127.4, 127.3, 126.6, 126.6, 125.8, 125.8, 123.1, 121.3, 121.1, 118.6, 112.1, 112.1, 111.9, 111.9, 75.8, 75.8, 70.3, 70.1, 70.0, 67.0, 62.7, 62.6, 59.0, 58.9, 57.9, 38.0, 38.0 ppm; HRMS (ESI): MH^+, found 879.3891. $C_{54}H_{51}N_6O_6$ requires 879.3870.

Procedure[29b] for the synthesis of macrocycle 17. A mixture of **16** (0.1 mmol), $Na_2S.xH_2O$ (70 mg), CuI (10 mol%), 1,10-phen (15 mol%) in DMF (0.5 mL) was stirred at 90 ^oC for 12 h under open air atmosphere. After this period, the reaction mixture was cooled to room temperature. Then, the resulting mixture was diluted with water (4 mL). The mixture was filtered through a filtration funnel and then washed with ethyl acetate (4 times, using 5 mL of EtOAc) and extracted using ethyl acetate (3 X 5 mL) and the combined organic layers were dried over anhydrous Na_2SO_4. The solvent was removed under reduced pressure and the residue was purified by silica gel chromatography (EtOAc/Hexanes) which gave the desired macrocyclic polyether **17**.

Compound 17a: Following the general procedure, **17a** was obtained after purification by silica gel column chromatography as yellow color liquid (39 mg, 45%); R_f (40% EtOAc/Hexanes) 0.42; IR (CH_2Cl_2) ν_{max} 2975, 1721, 1602, 1457 and 755 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.69 (2 H, s), 7.40-7.33 (4 H, m), 7.26-7.20 (4 H, m), 7.00-6.94 (6 H, m), 6.76-6.74 (4 H, m), 5.99-5.93 (2 H, m), 5.69-5.60 (2 H, m), 5.18 (4 H, br. s), 5.08-4.94 (4 H, m), 4.60 (4 H, d, J = 4.8 Hz), 4.56 (4 H, d, J = 4.7 Hz), 4.06-3.93 (4 H, m), 3.74-3.65 (4 H, m), 3.29-3.23 (2 H, m), 3.08-3.01 (2 H, m) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 156.1, 155.8, 155.8, 143.4, 141.7, 133.5, 129.9, 129.6, 129.0, 128.2, 128.1, 126.5, 126.4, 125.9, 123.0, 121.2, 121.0, 118.4, 111.9, 69.6, 69.5, 67.5, 67.5, 67.0, 67.0, 66.9, 66.9, 62.6, 62.6, 59.5, 59.3, 37.7, 37.7 ppm; HRMS (ESI): MNa^+, found 903.3545. $C_{50}H_{52}N_6NaO_7S$ requires 903.3516.

Compound 17b: Following the general procedure, **17b** was obtained after purification by silica gel column chromatography as yellow color liquid (66 mg, 72%); R_f (40% EtOAc/Hexanes) 0.42; IR (CH_2Cl_2) ν_{max} 2926, 1600, 1493, 1454, 1247 and 754 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.77 (2 H, s), 7.39 (2 H, d, J = 7.4 Hz), 7.31 (2 H, dt, J_1 = 7.7 Hz, J_2 = 1.8 Hz), 7.27-7.23 (4 H, m), 7.01-6.94 (6 H, m), 6.79 (2 H, d, J = 8.7 Hz), 6.78 (1 H, s), 6.76 (1 H, s), 5.99 (2 H, t, J = 8.2 Hz), 5.70-5.62 (2 H, m), 5.20 (4 H, br. s), 5.08-4.96 (4 H, m), 4.62 (4 H, s), 4.58 (4 H, s), 4.02-3.94 (4 H, m), 3.67-3.64 (4 H, m), 3.59 (4 H, s), 3.29-3.24 (2 H, m), 3.08-3.04 (2 H, m) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 156.1, 155.7, 143.4, 141.7, 133.5, 129.8, 129.5, 128.9, 128.1, 128.0, 126.9, 126.8, 126.7, 125.9, 123.4, 123.4, 121.2, 121.2, 121.0, 118.4, 112.0, 111.9, 70.6, 70.5, 69.4, 67.5, 67.5, 67.0, 66.9, 66.9, 62.6, 59.4, 59.3, 37.7 ppm; HRMS (ESI): MH^+, found 925.3987. $C_{52}H_{57}N_6O_8S$ requires 925.3959.

Compound 17c: Following the general procedure, **17c** was obtained after purification by silica gel column chromatography as yellow color liquid (62 mg, 69%); R_f (40% EtOAc/Hexanes) 0.42; IR (CH_2Cl_2) ν_{max} 2971, 1603, 1495, 1243 and 752 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ_H 7.47 (2 H, s), 7.38-7.32 (4 H, m), 7.28-7.20 (8 H, m), 7.00-6.95 (6 H, m), 6.90 (2 H, d, J = 8.3 Hz), 6.65 (1 H, s), 6.60 (1 H, s), 6.63-5.97 (2 H, m), 5.71-5.62 (2 H, m), 5.23-5.15 (4 H, m), 5.09-4.95 (8 H, m), 4.50-4.67 (8 H, m), 3.28-3.21 (2 H, m), 3.07-2.99 (2 H, m) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ_C 156.0, 155.6, 155.6, 143.5, 143.4, 141.6, 137.0, 133.4, 129.9, 129.9, 129.5, 129.2, 129.1, 129.0, 127.9, 127.8, 127.2, 126.6, 126.6, 126.6, 126.6, 126.4, 126.3, 125.8, 125.8, 123.1, 123.0, 121.3, 121.3, 121.1, 118.5, 112.1, 111.9, 69.9, 69.9, 66.8, 66.8, 66.7, 62.6, 62.6, 59.2, 58.9, 38.1, 38.0 ppm; HRMS (ESI): MH^+, found 913.3716. $C_{54}H_{53}N_6O_6S$ requires 913.3747.

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19. For papers dealing on the synthesis of 1,2,3-triazoles from organic halides/amines involving sequential reactions, see: (a) Appukkuttan, P.; Dehaen, W.; Fokin, V. V.; Van der Eycken, E. *Org. Lett.* **2004**, *6*, 4223. (b) Molander, G. A.; Ham, J. *Org. Lett* **2006**, *8*, 2767. (c) Kacprzak, K. *Synlett* **2005**, 943. (d) Beckmann, H. S. G.; Wittmann, V. *Org. Lett* **2007**, *9*, 1. For selected paper dealing on one-pot multicomponent synthesis of 1,2,3-triazoles, see: (e) Feldman, A. K.; Colasson, B.; Fokin, V. V. *Org. Lett* **2004**, *6*, 3897.
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supporting information of this reference for the FT-IR spectra and HRTEM analysis images).

24. Magnetic nano Fe_3O_4 used in this work was purchased from Sigma-Aldrich and the size of the nano particles was verified through HRTEM analysis (see the Supporting Information) before using the nano Fe_3O_4. For selected papers dealing on the preparation and characterization of nano Fe_3O_4, see; (a) Wu, S.; Sun, A.; Zhai, F.; Wang, J.; Xu, W.; Zhang, Q.; Volinsky, A. A. *Mater. Lett.* **2011**, *65*, 1882. (b) Yang, T.; Shen, C.; Li, Z.; Zhang, H.; Xiao, C.; Chen, S.; Xu, Z.; Shi, D.; Li, J.; Gao, H. *J. Phys. Chem. B* **2005**, *109*, 23233. (c) Sun, J.; Zhou, S.; Hou, P.; Yang, Y.; Weng, J.; Li, X.; Li, M. *J. Biomed. Mater. Res. A* **2007**, *80A*, 333. (d) Yuanbi, Z.; Zumin, Q.; Jiaying, H. *Chin. J. Chem. Eng.* **2008**, *16*, 451.
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▪ Supplementary data

Supplementary data (copy of ^{1}H, ^{13}C NMR Charts of all the compounds) associated with this article can be found, in the online version.

Supporting Information

Direct Azidation of Allylic/Benzylic Alcohols and Ethers Followed by the Click Reaction: One-Pot Synthesis of 1,2,3-Triazoles and 1,2,3-Triazole Moiety Embedded Macrocycles

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Contents

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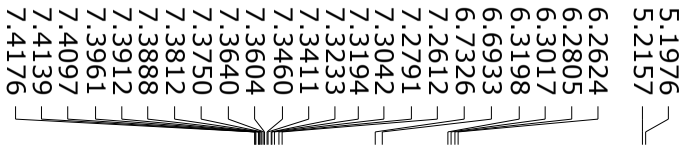

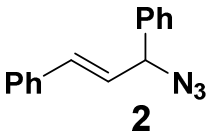

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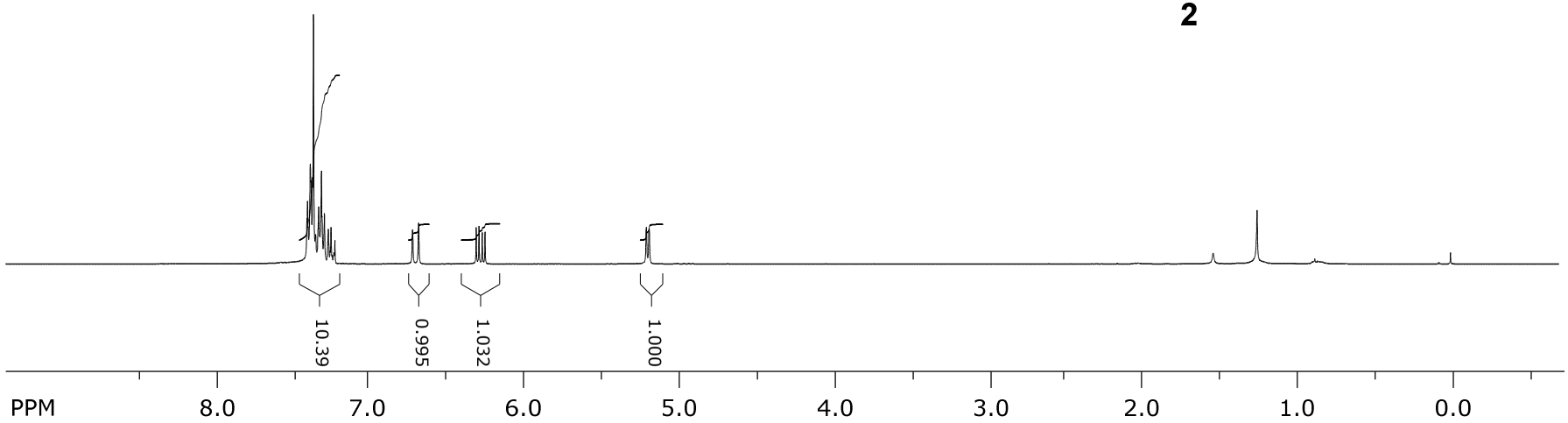

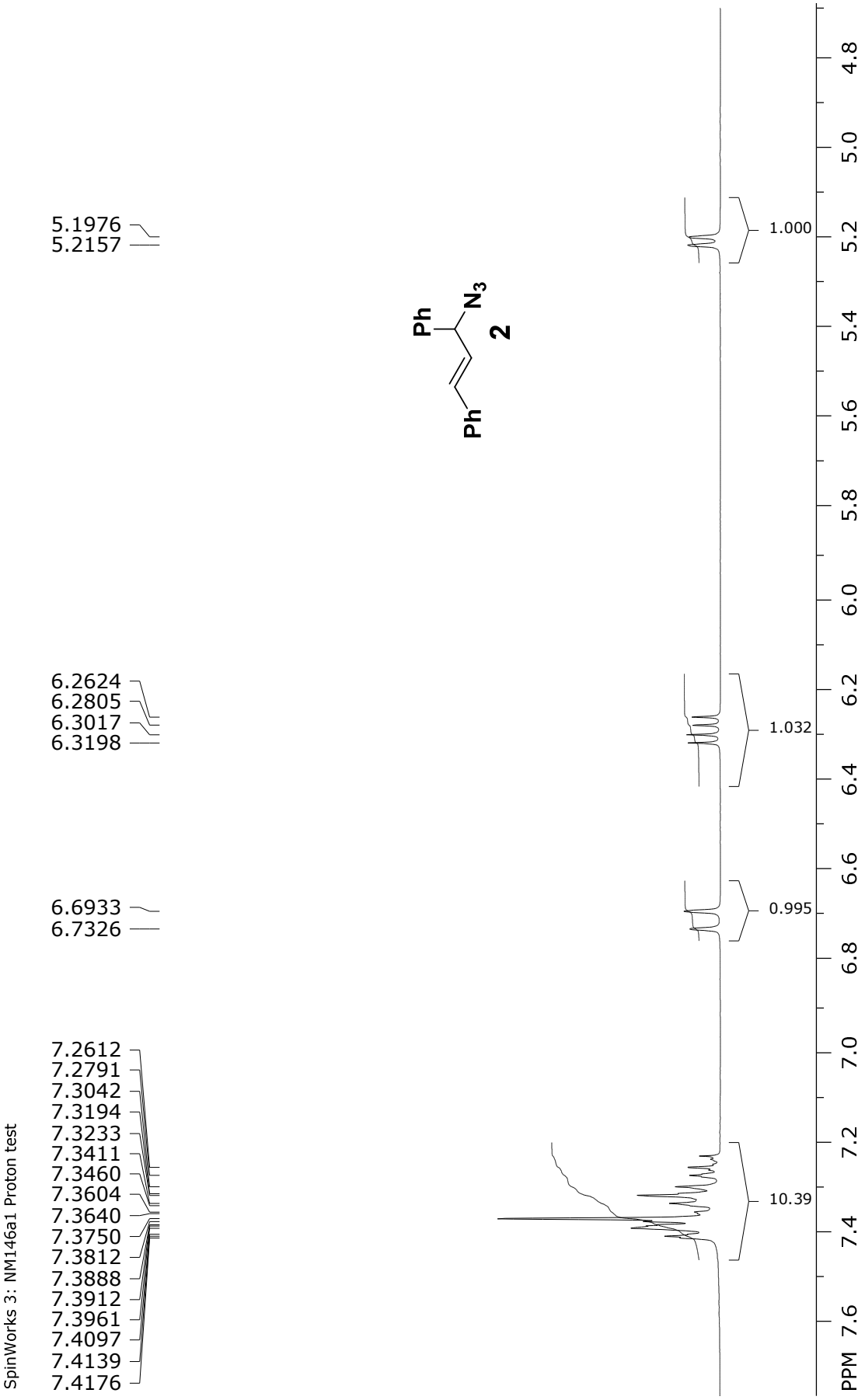
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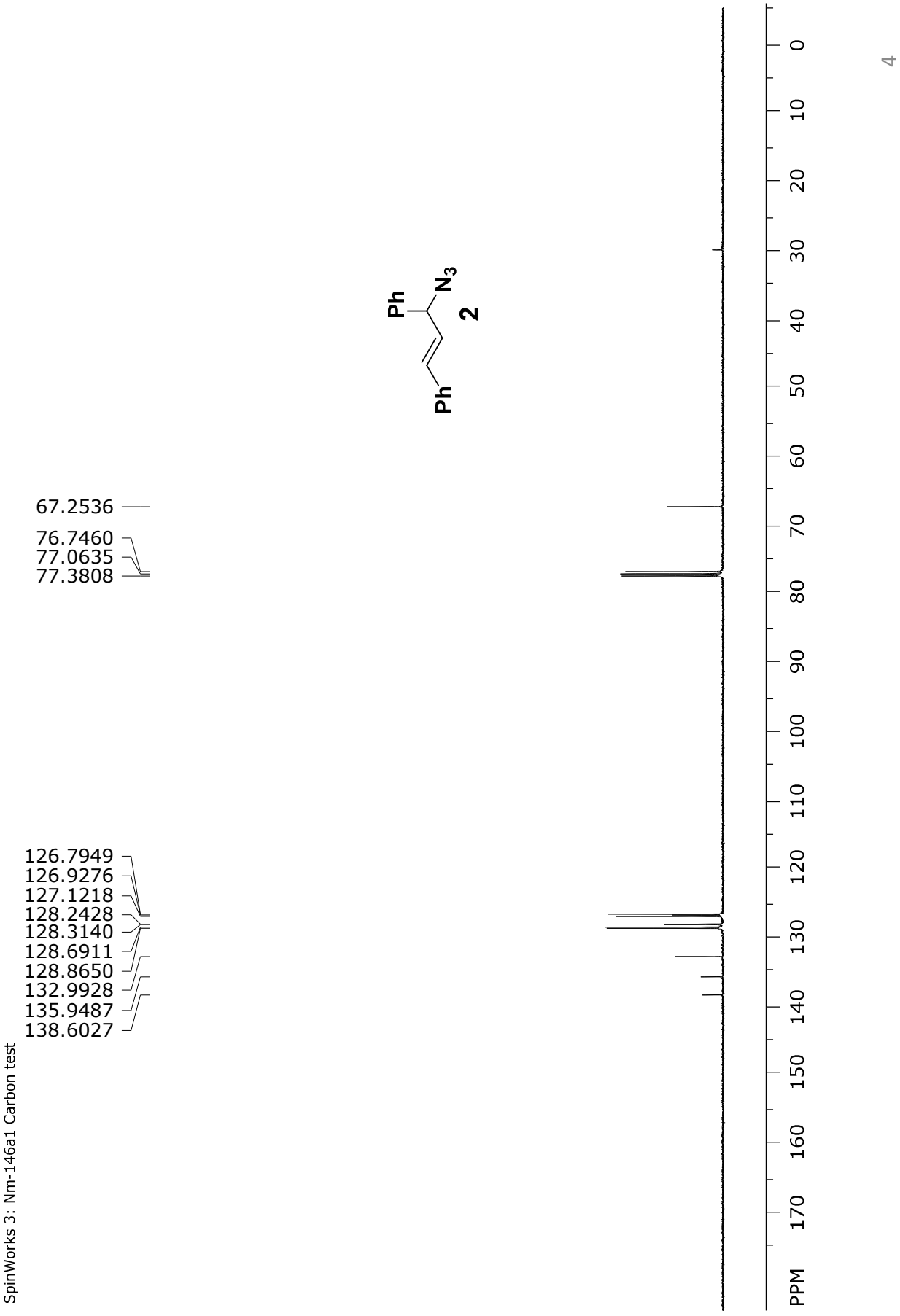
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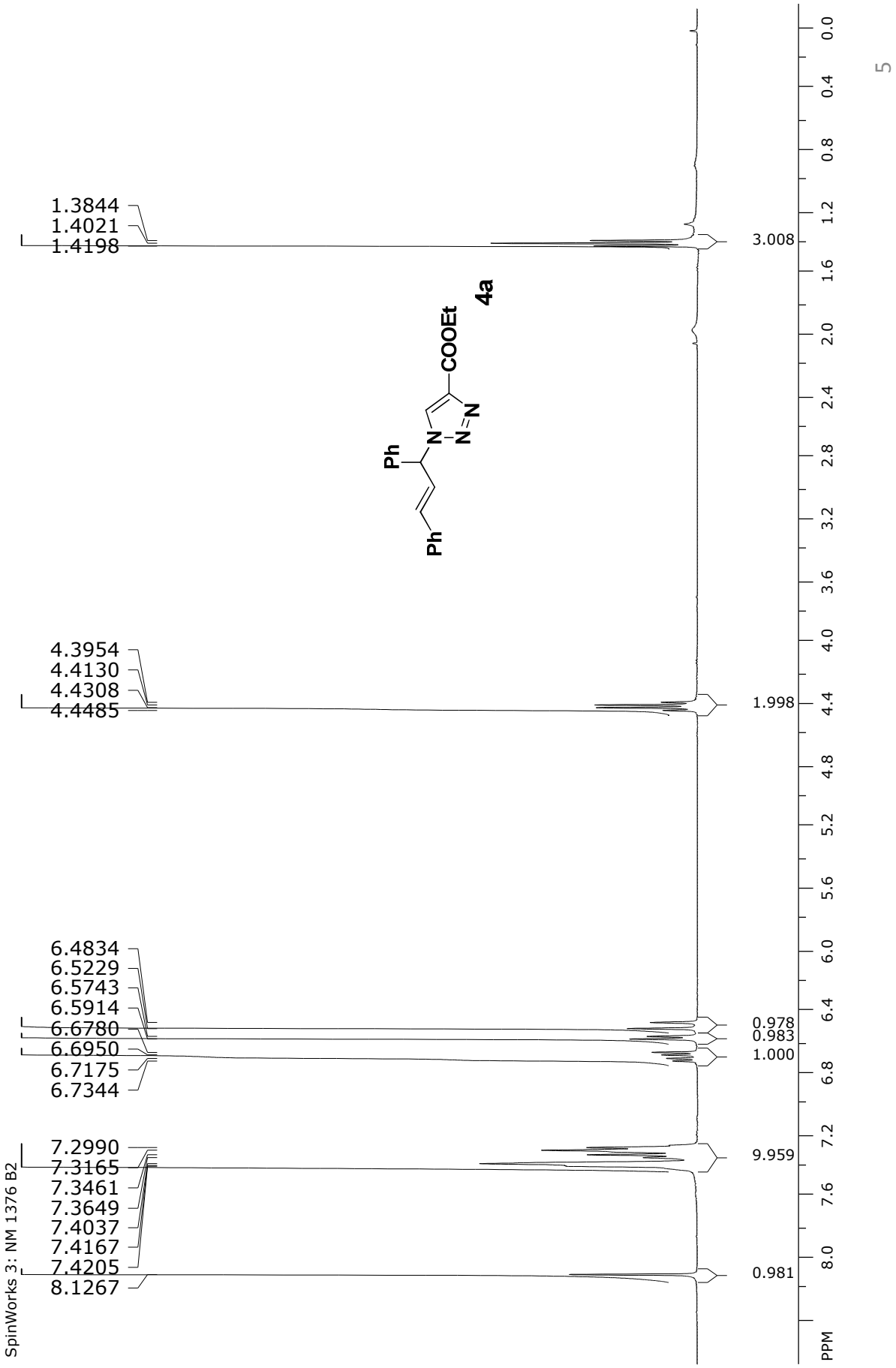
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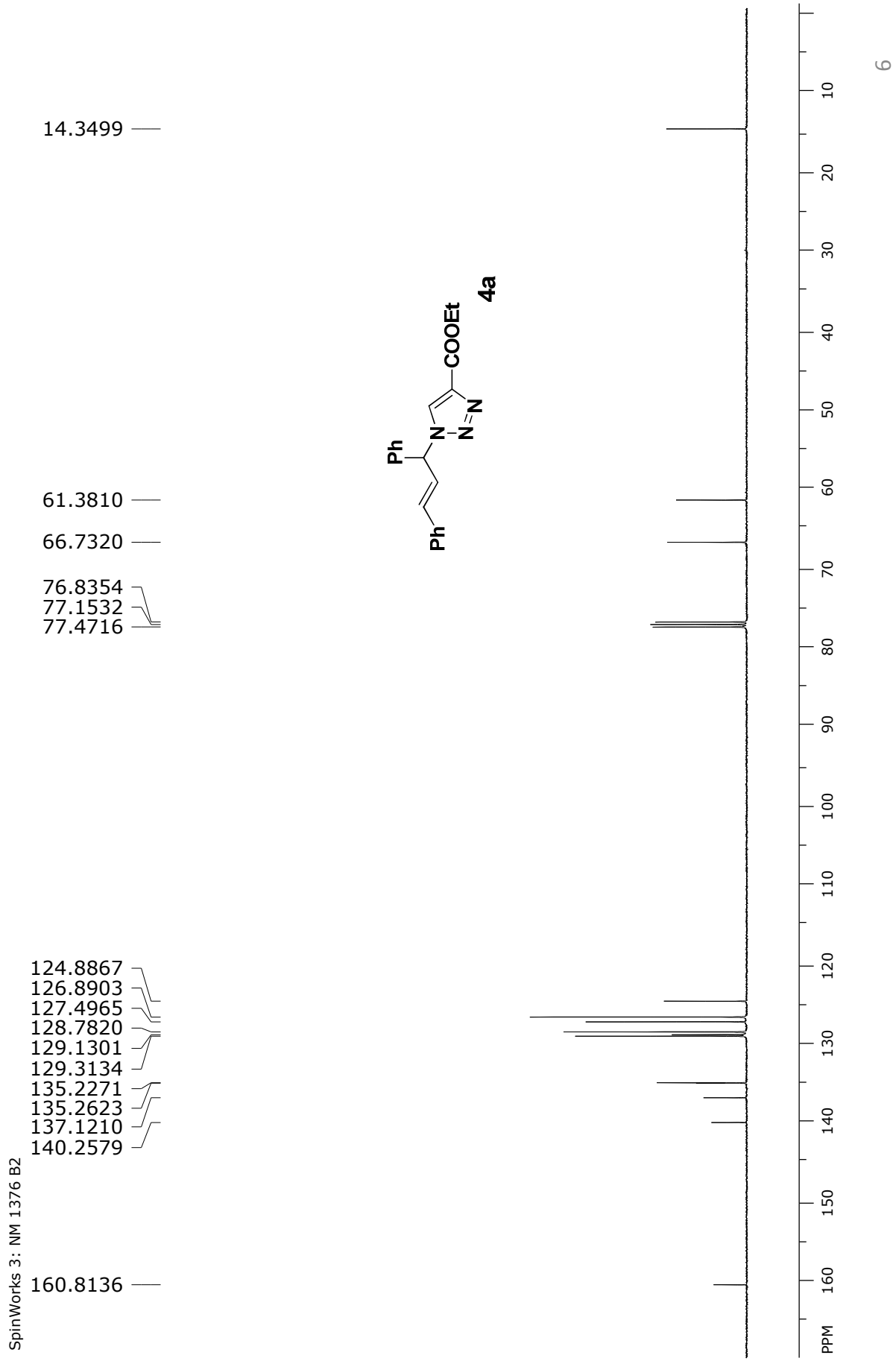
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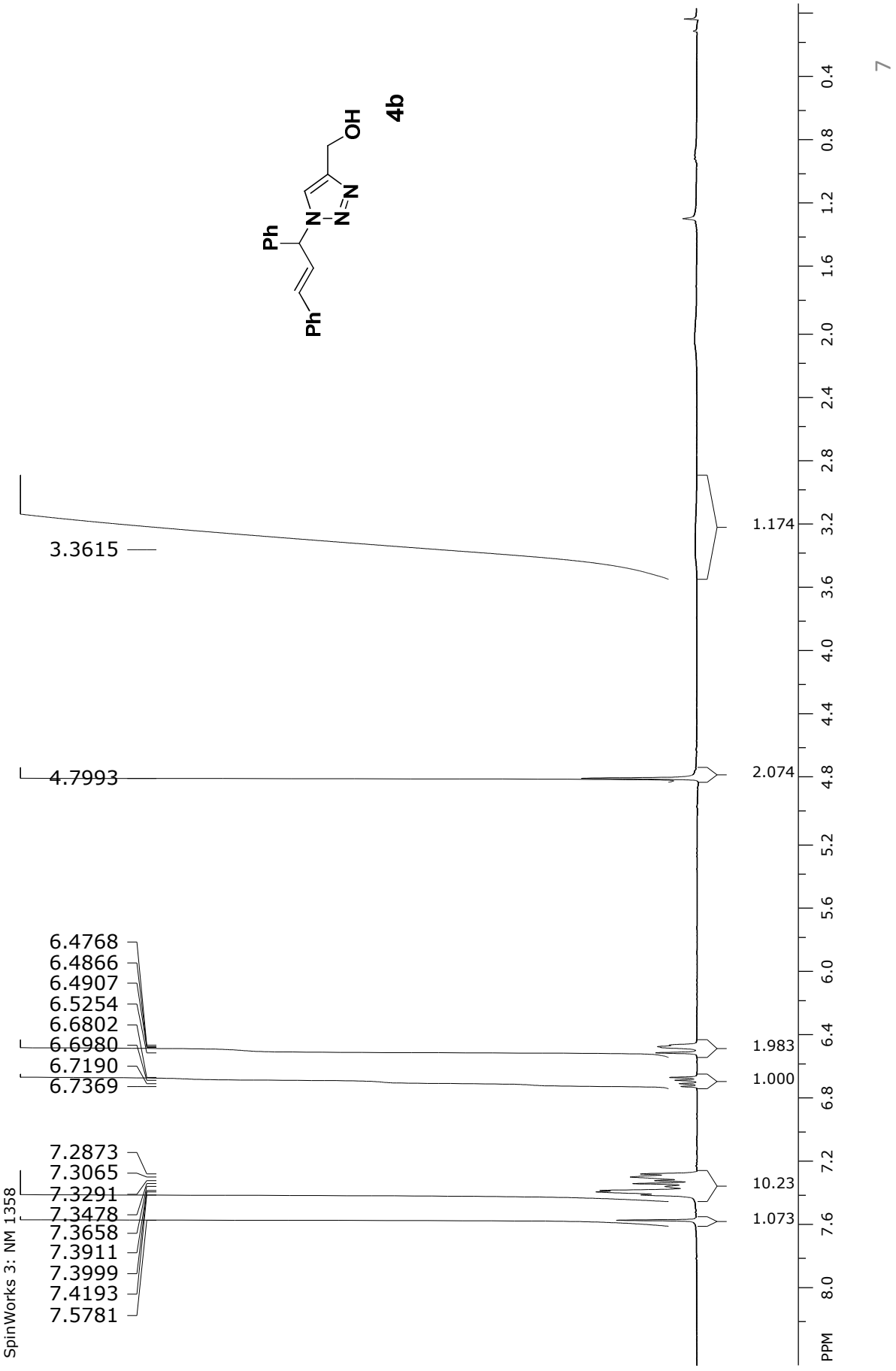
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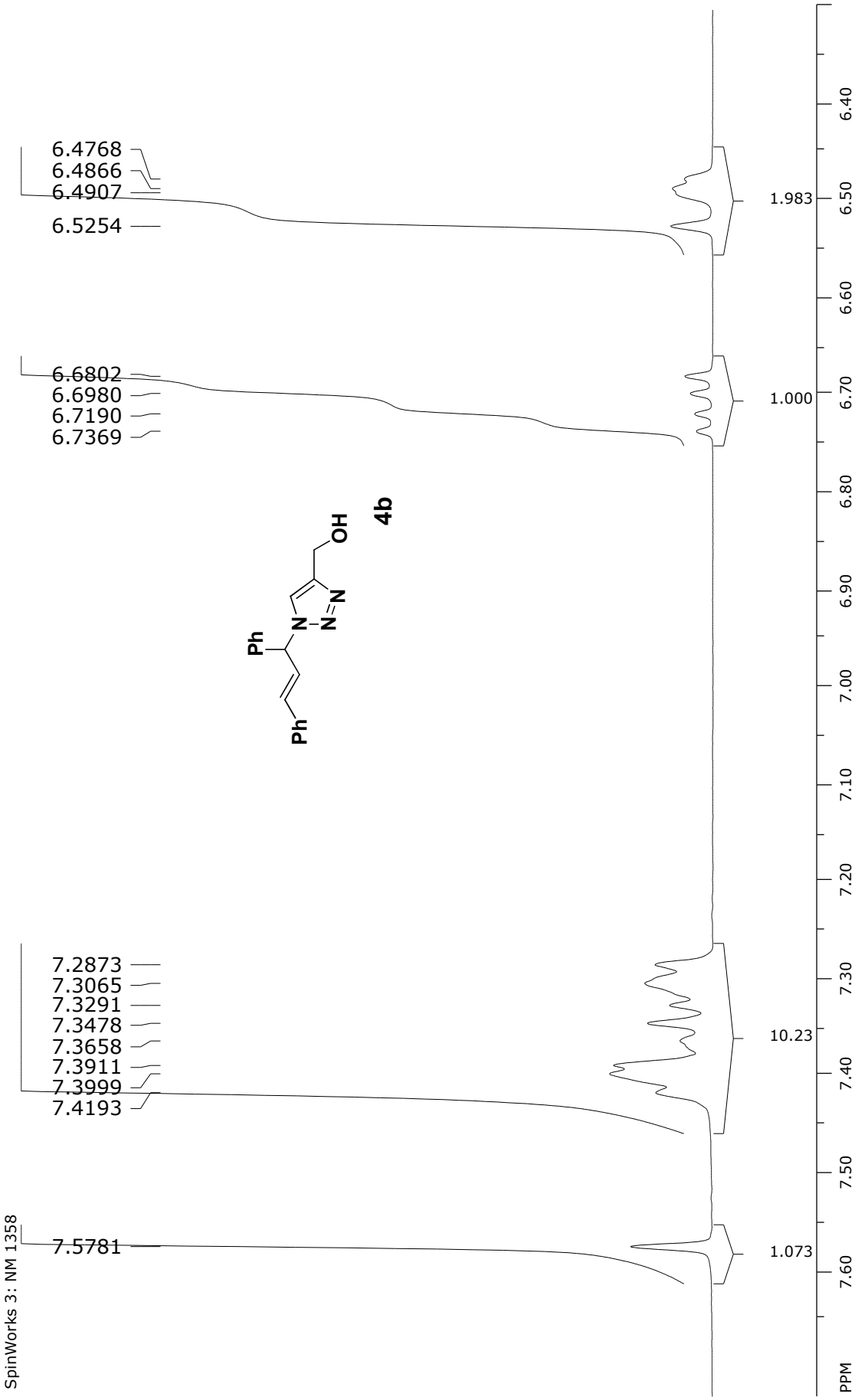
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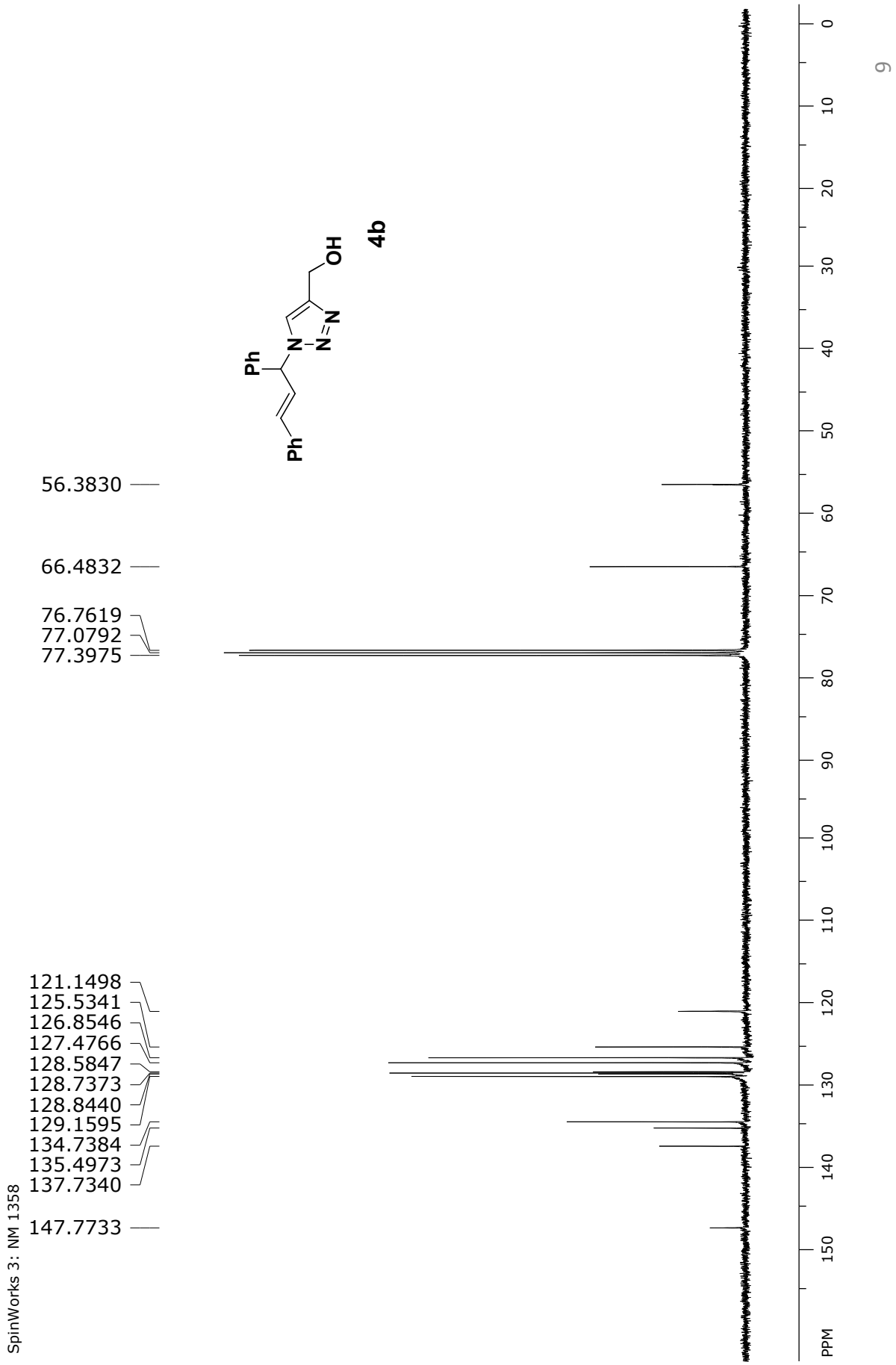
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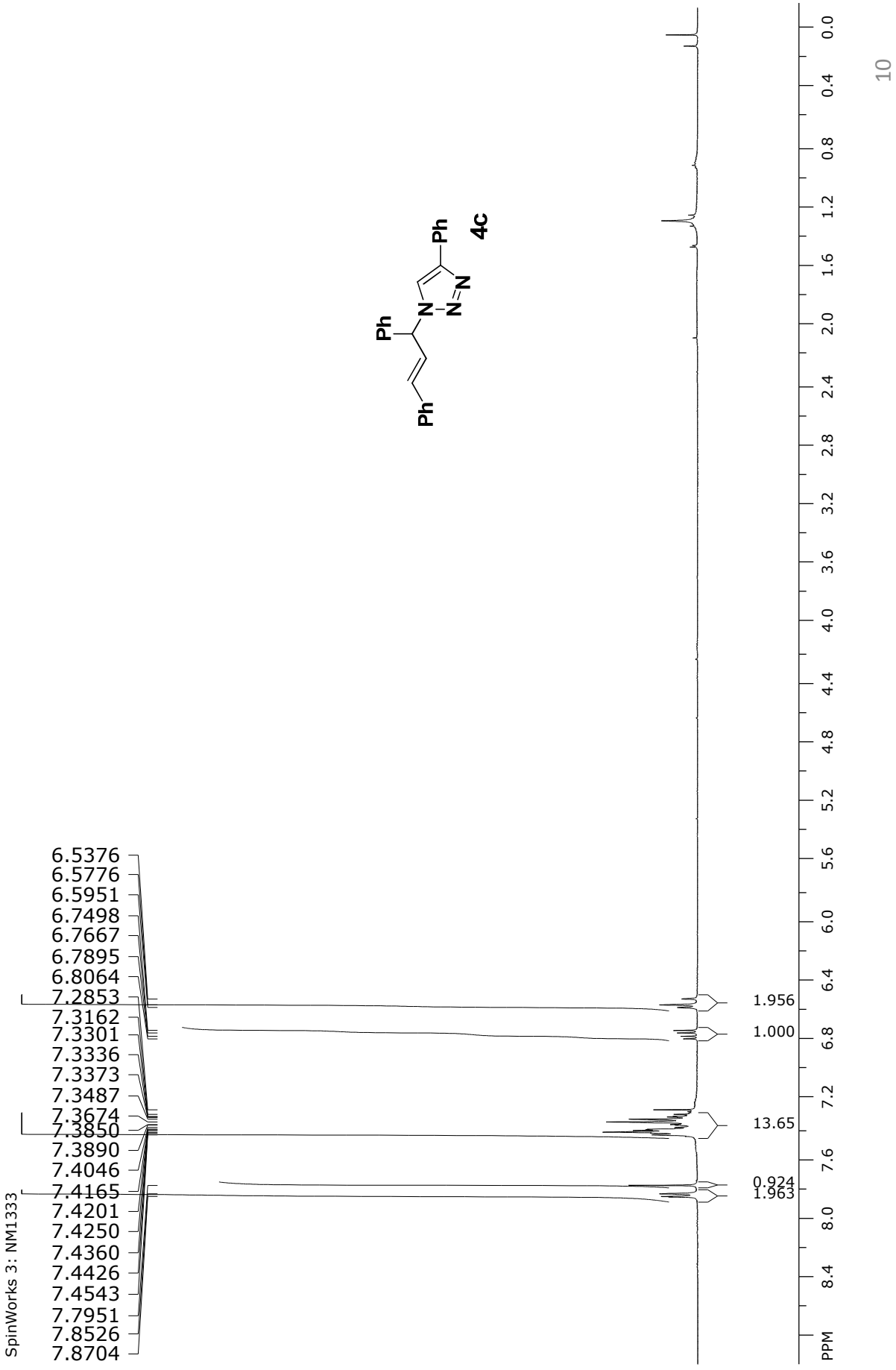
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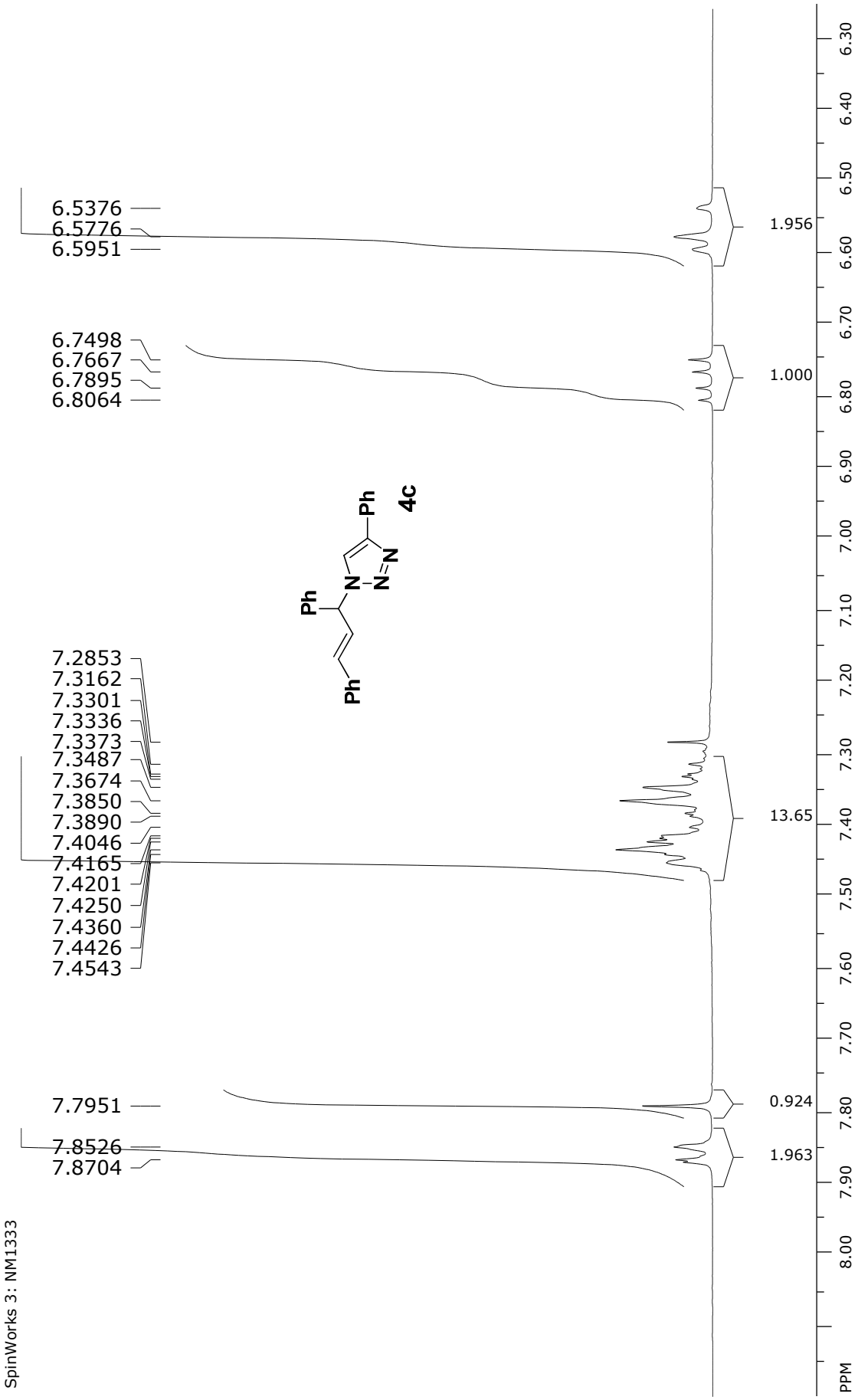
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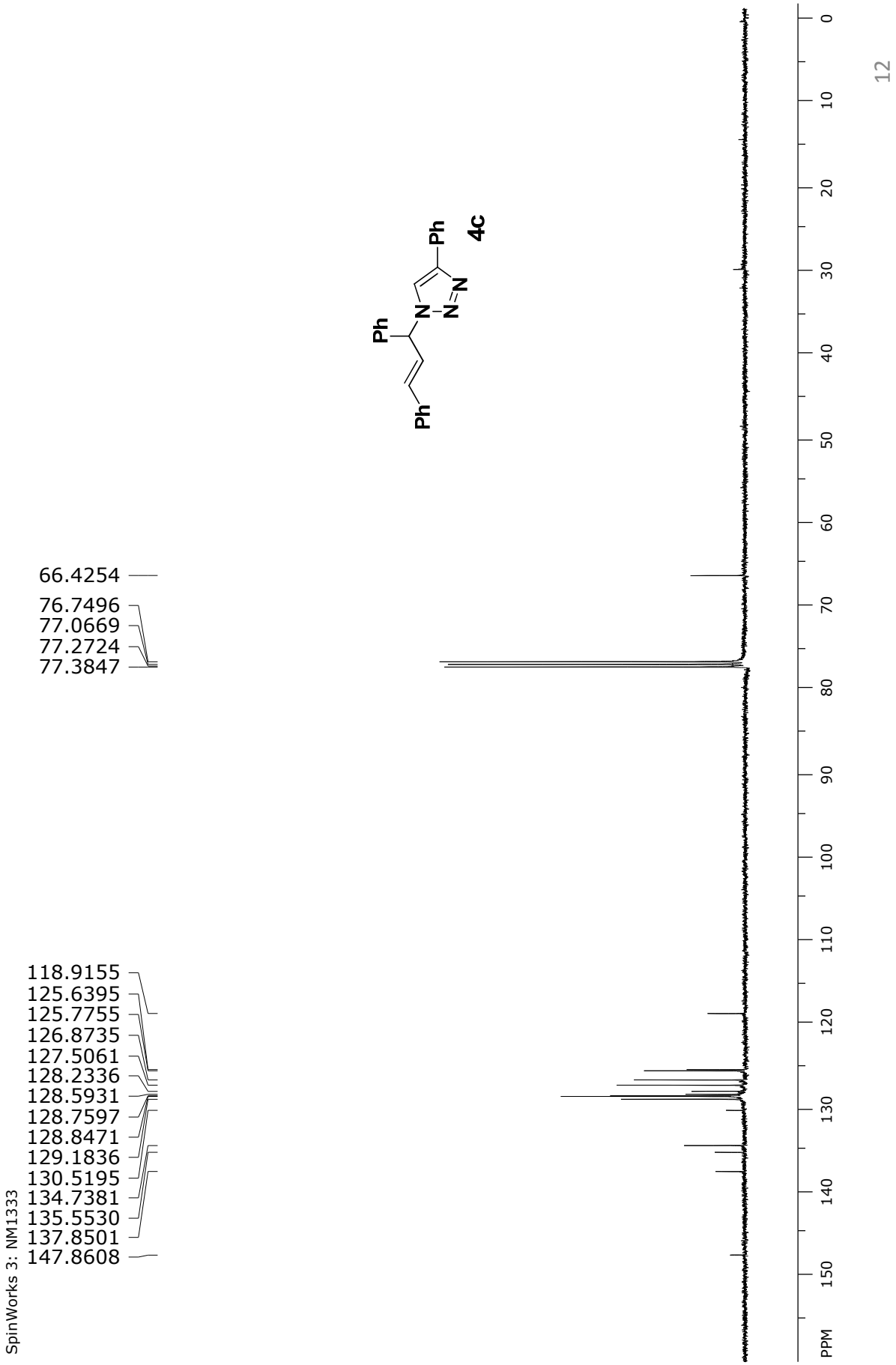
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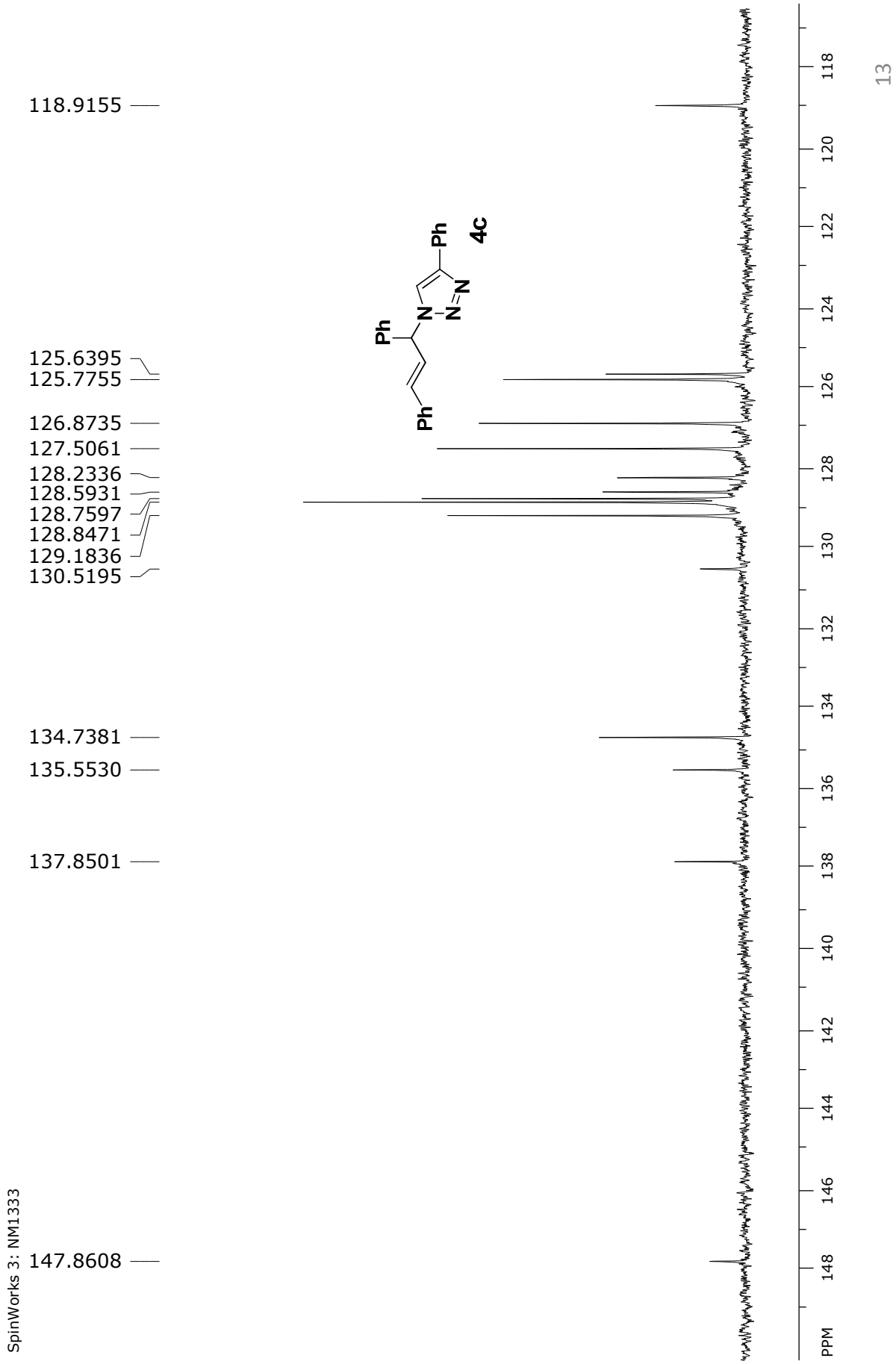
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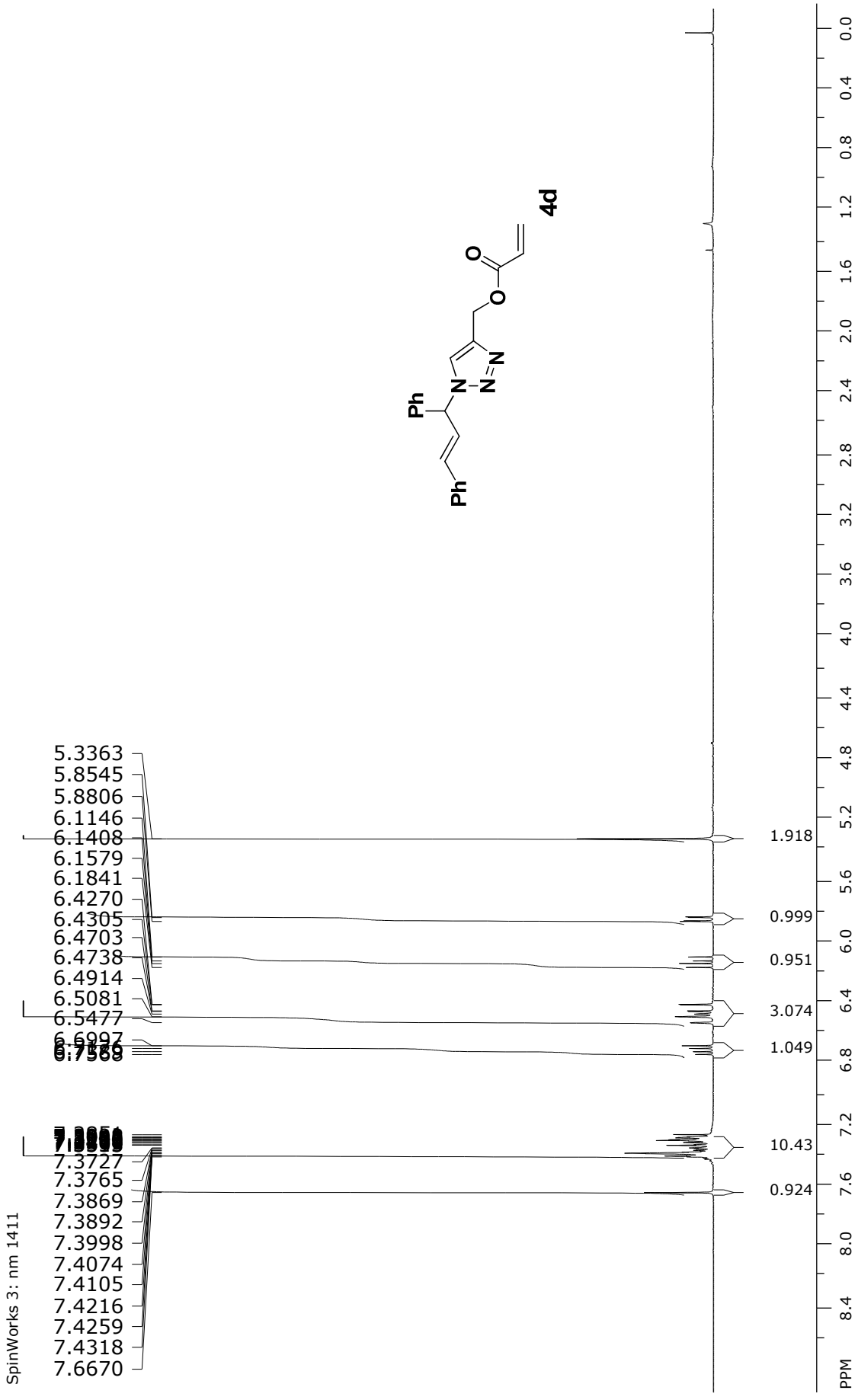
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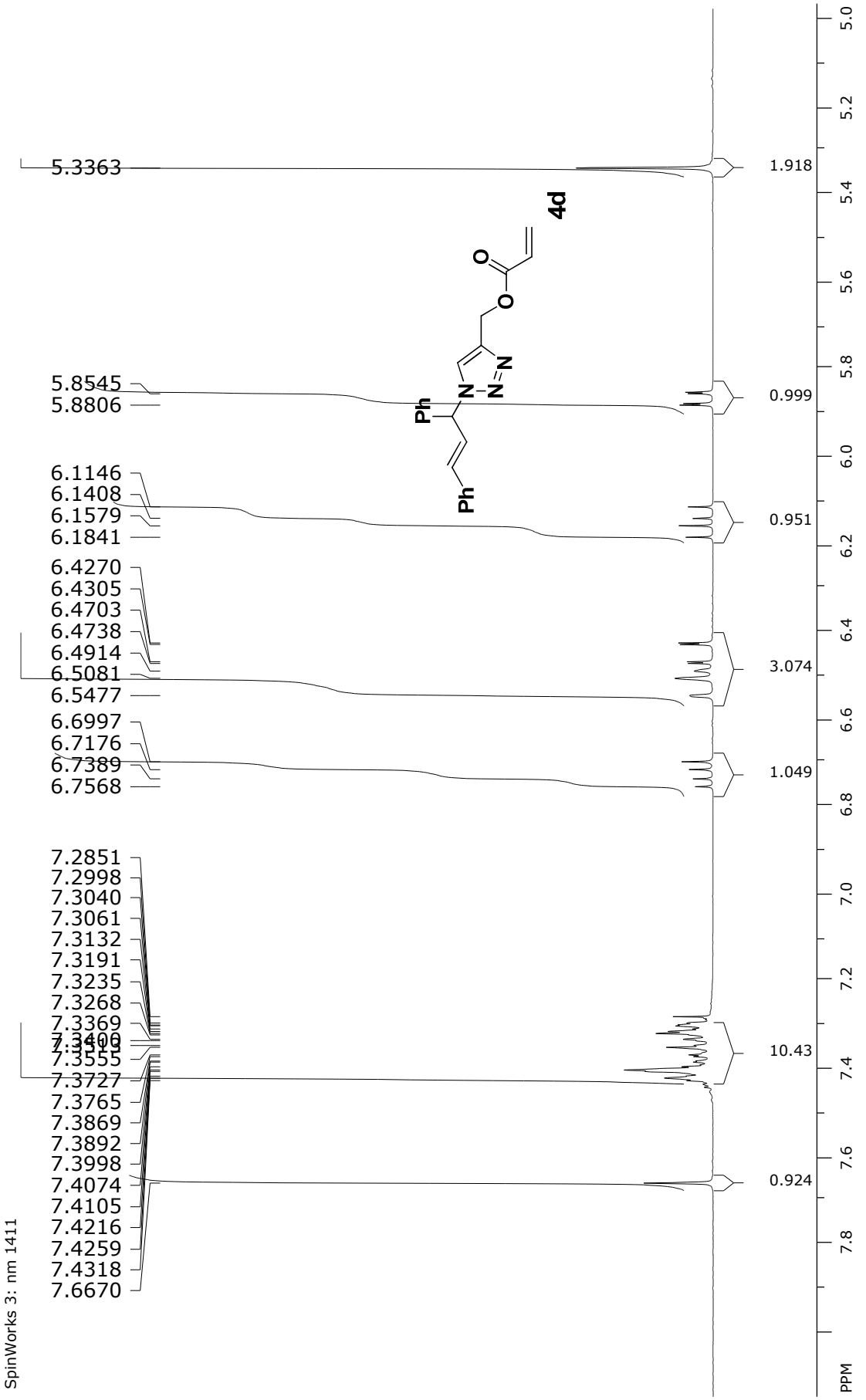
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5.8545
5.8806
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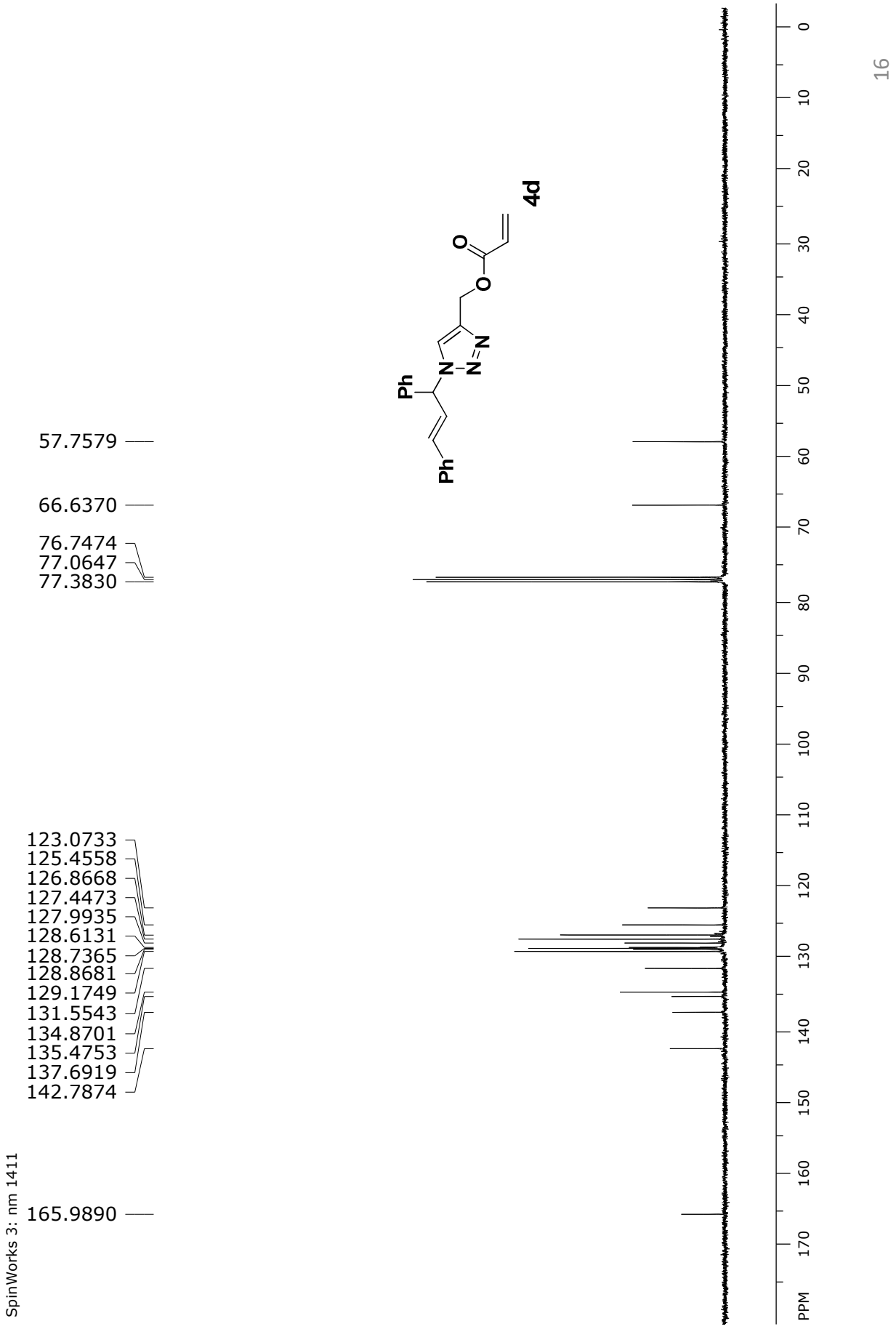
6.1408
6.1579
6.1841
6.4270
6.4305
6.4703
6.4738
6.4914
6.5081
6.5477
6.6997
6.7176
6.7389
6.7568
7.2851
7.2998
7.3040
7.3061
7.3132
7.3191
7.3235
7.3268
7.3369
7.3555
7.3727
7.3765
7.3869
7.3892
7.3998
7.4074
7.4105
7.4216
7.4259
7.4318
7.6670
1.918
0.999
0.951
3.074
1.049
10.43
0.924
Ph
Ph
N
N
N
O
O
SpinWorks 3: nm 1411
PPM
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
6.6
6.8
7.0
7.2
7.4
7.6
7.8


4d
O
O
N
N
N
Ph
Ph
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77.0647
77.3830
123.0733
125.4558
126.8668
127.4473
127.9935
128.6131
128.7365
128.8681
129.1749
131.5543
134.8701
135.4753
137.6919
142.7874
165.9890
SpinWorks 3: nm 1411
PPM
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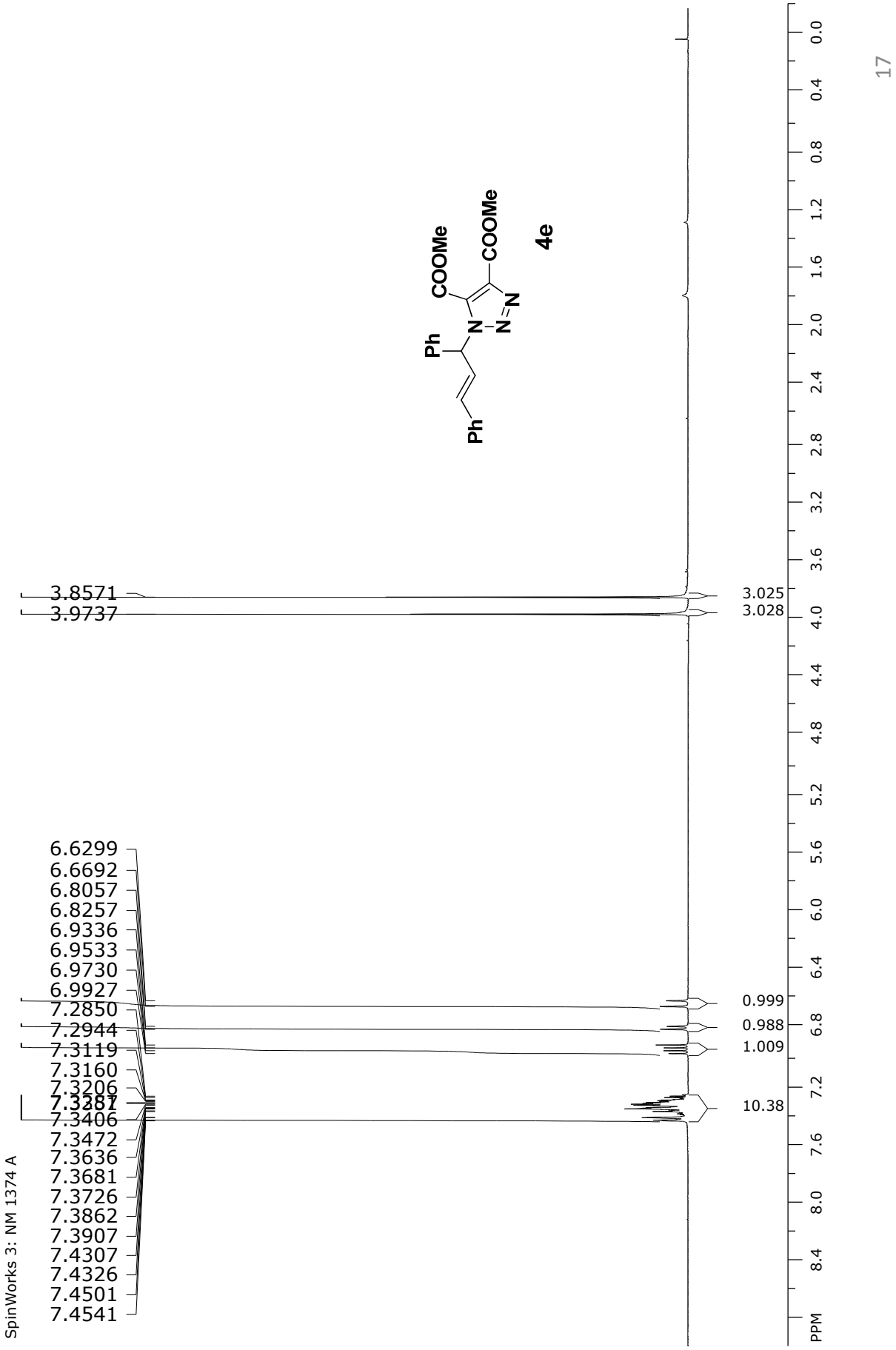
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170


4e
COOMe
COOMe
N
N
Ph
Ph
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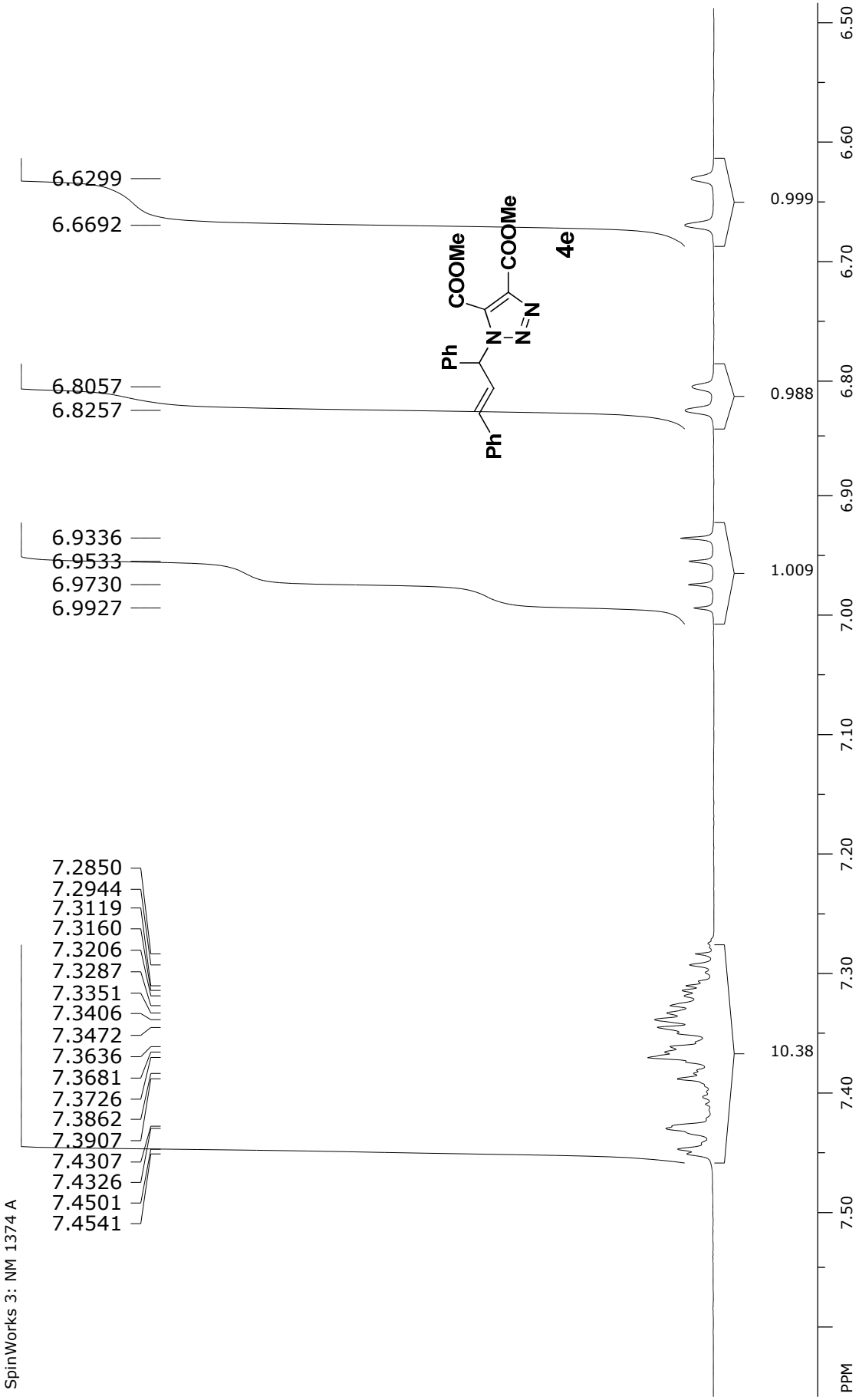
3.9737
6.6299
6.6692
6.8057
6.8257
6.9336
6.9533
6.9730
6.9927
7.2850
7.2944
7.3119
7.3160
7.3206
7.3281
7.3406
7.3472
7.3636
7.3681
7.3726
7.3862
7.3907
7.4307
7.4326
7.4501
7.4541
3.025
3.028
0.999
0.988
1.009
10.38
PPM
SpinWorks 3: NM 1374 A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6.6692
6.8057
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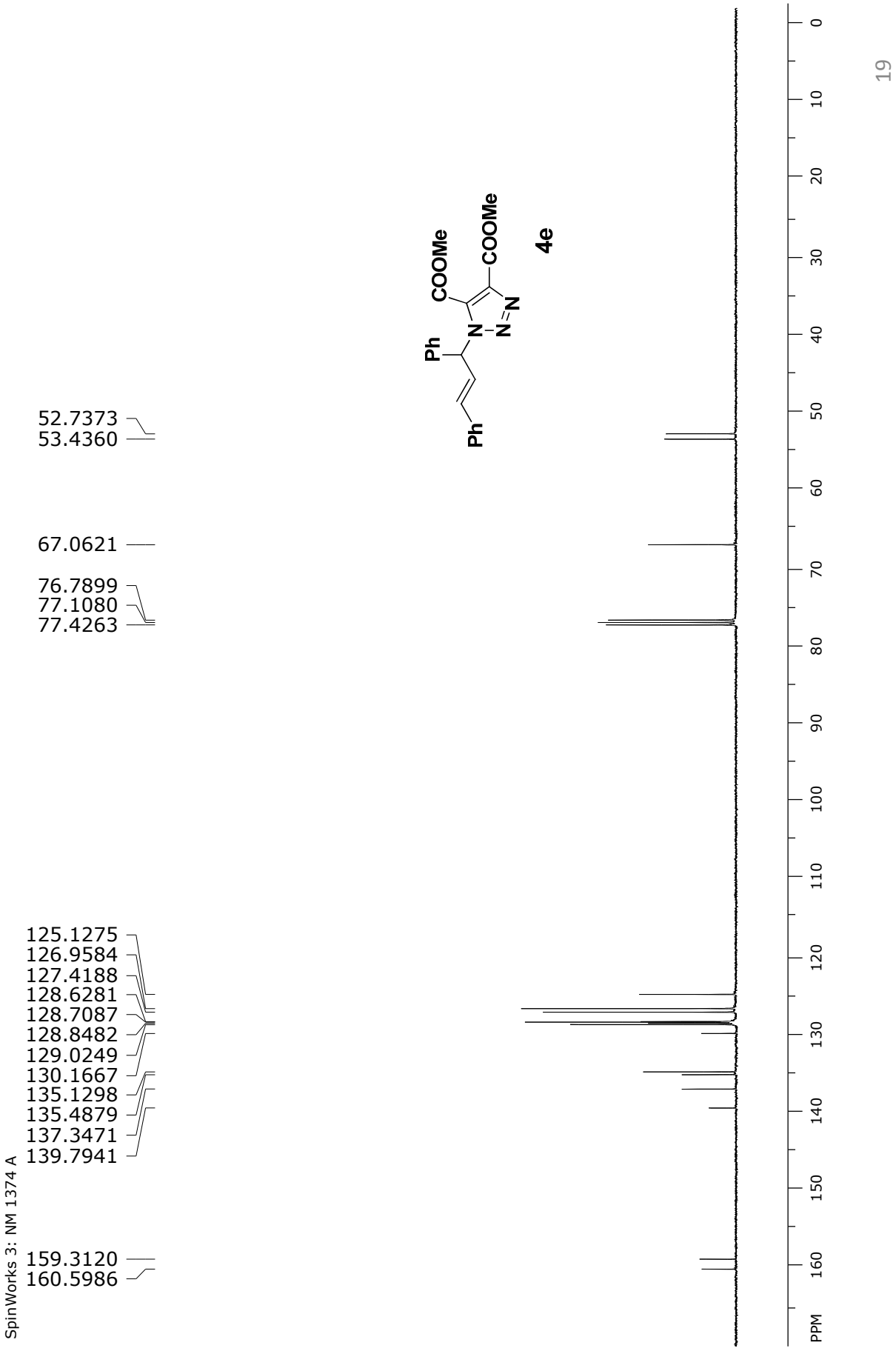
6.9336
6.9533
6.9730
6.9927
7.2850
7.2944
7.3119
7.3160
7.3206
7.3287
7.3351
7.3406
7.3472
7.3636
7.3681
7.3726
7.3862
7.3907
7.4307
7.4326
7.4501
7.4541
0.999
0.988
1.009
10.38
COOMe
COOMe
4e
Ph
Ph
N
N
N
6.50
6.60
6.70
6.80
6.90
7.00
7.10
7.20
7.30
7.40
7.50
PPM
SpinWorks 3: NM 1374 A


COOMe
COOMe
Ph
Ph
4e
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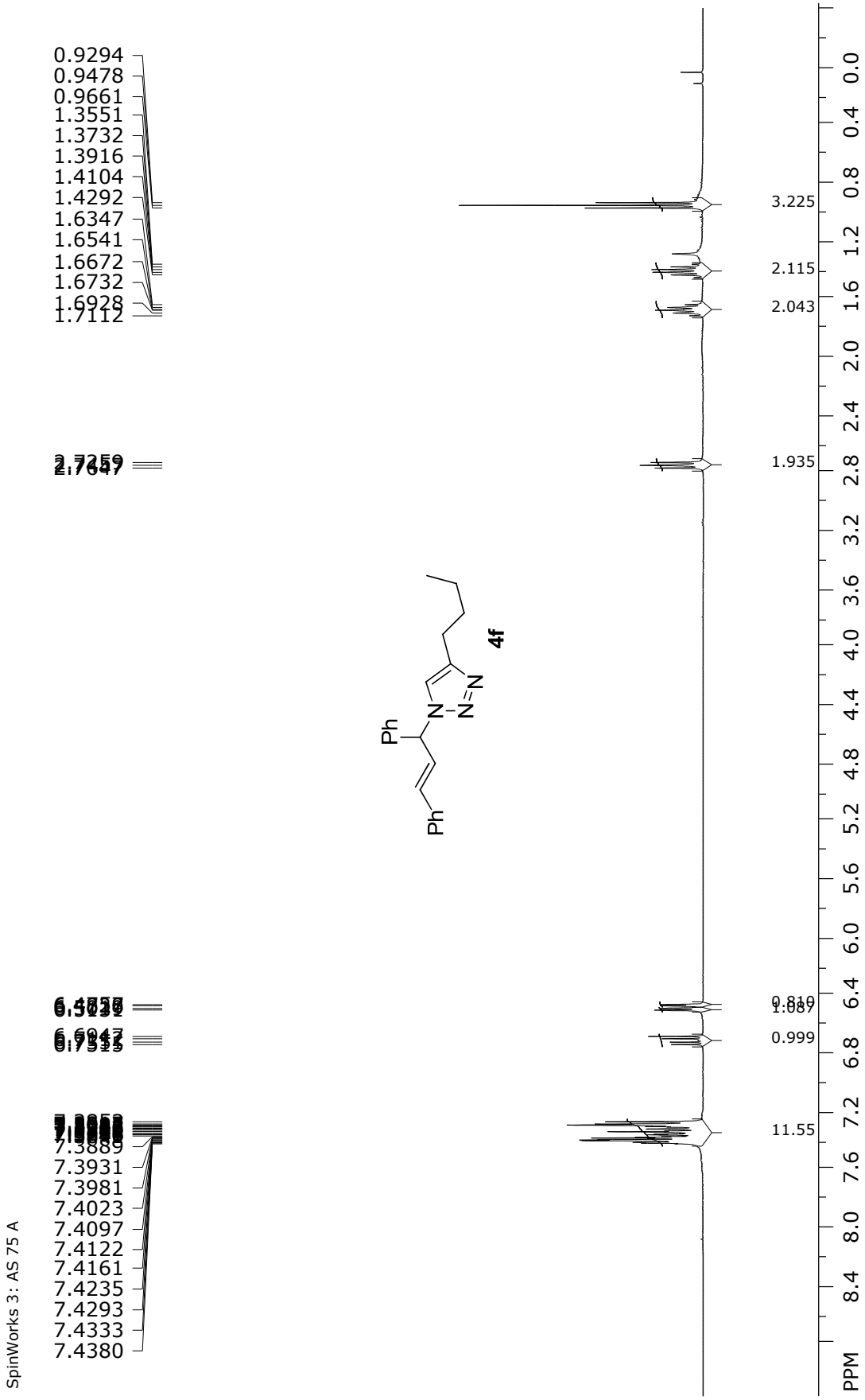
77.1080
77.4263
125.1275
126.9584
127.4188
128.6281
128.7087
128.8482
129.0249
130.1667
135.1298
135.4879
137.3471
139.7941
159.3120
160.5986
SpinWorks 3: NM 1374 A
PPM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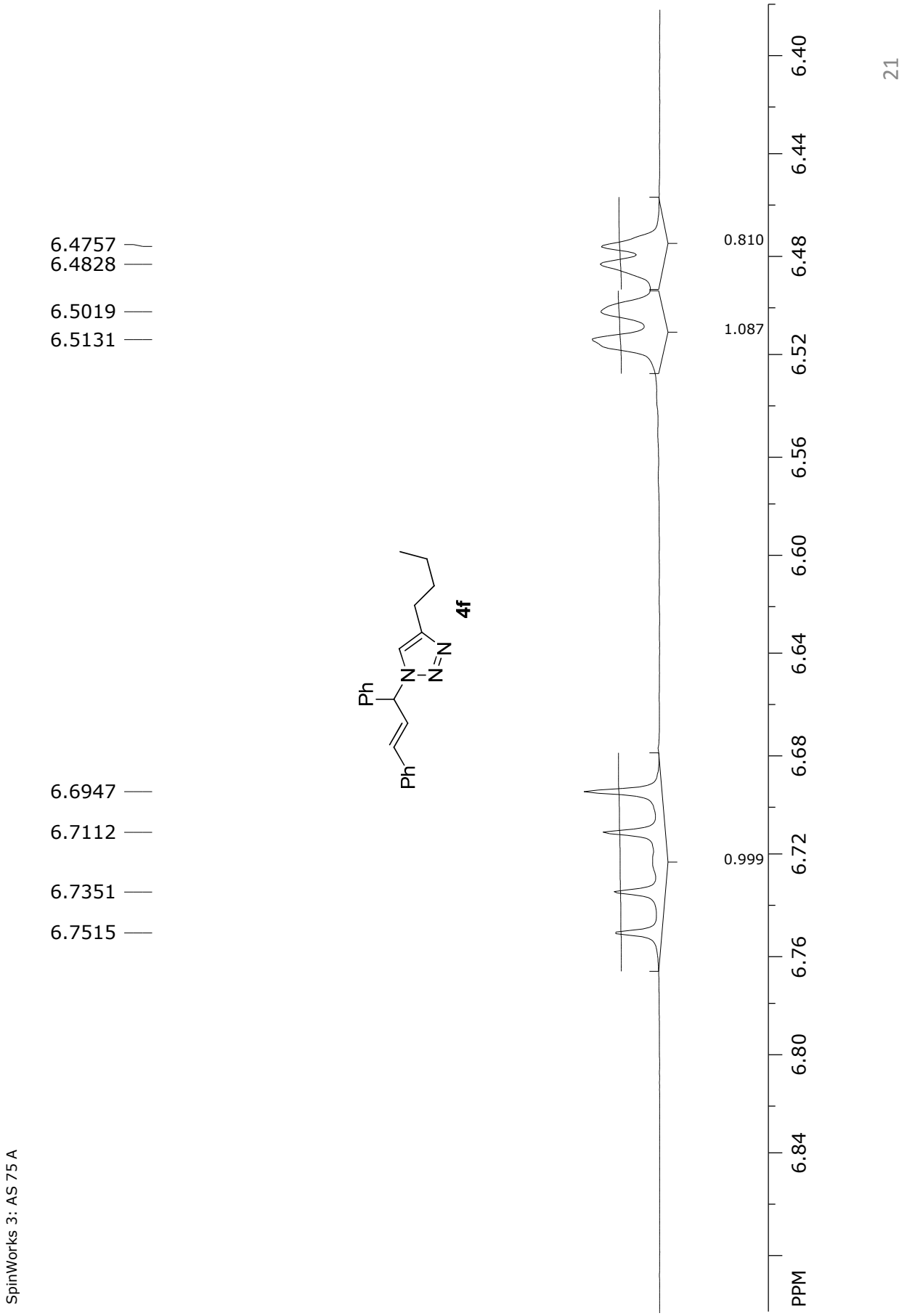
0.9478
0.9661
1.3551
1.3732
1.3916
1.4104
1.4292
1.6347
1.6541
1.6672
1.6732
1.6928
1.7112
7.3889
7.3931
7.3981
7.4023
7.4097
7.4122
7.4161
7.4235
7.4293
7.4333
7.4380
3.225
2.115
2.043
1.935
0.810
1.087
0.999
11.55
Ph
Ph
4f
PPM
SpinWorks 3: AS 75 A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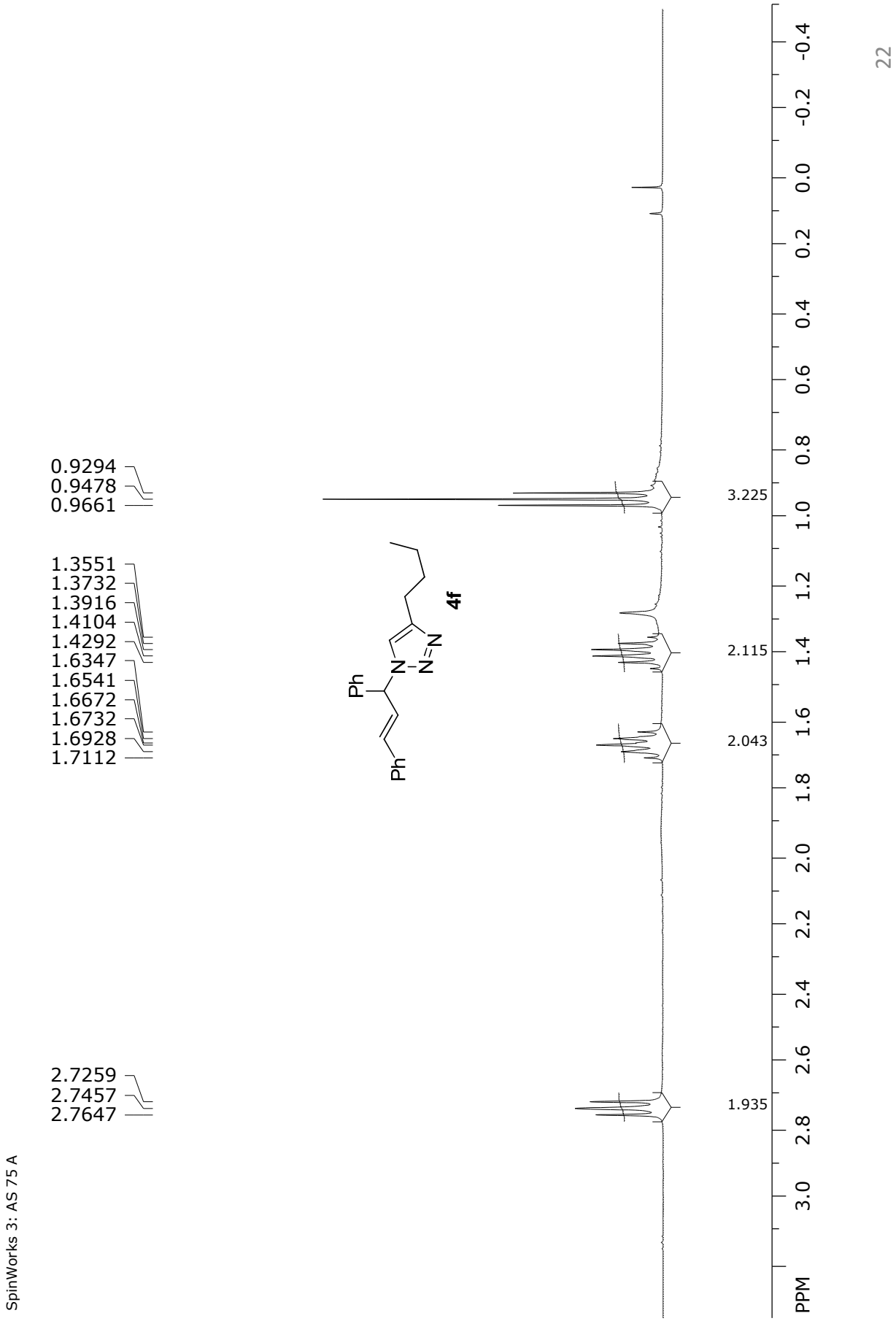
6.4828
6.5019
6.5131
6.6947
6.7112
6.7351
6.7515
Ph
Ph
N
N
N
4f
0.810
1.087
0.999
PPM
6.84
6.80
6.76
6.72
6.68
6.64
6.60
6.56
6.52
6.48
6.44
6.40
SpinWorks 3: AS 75 A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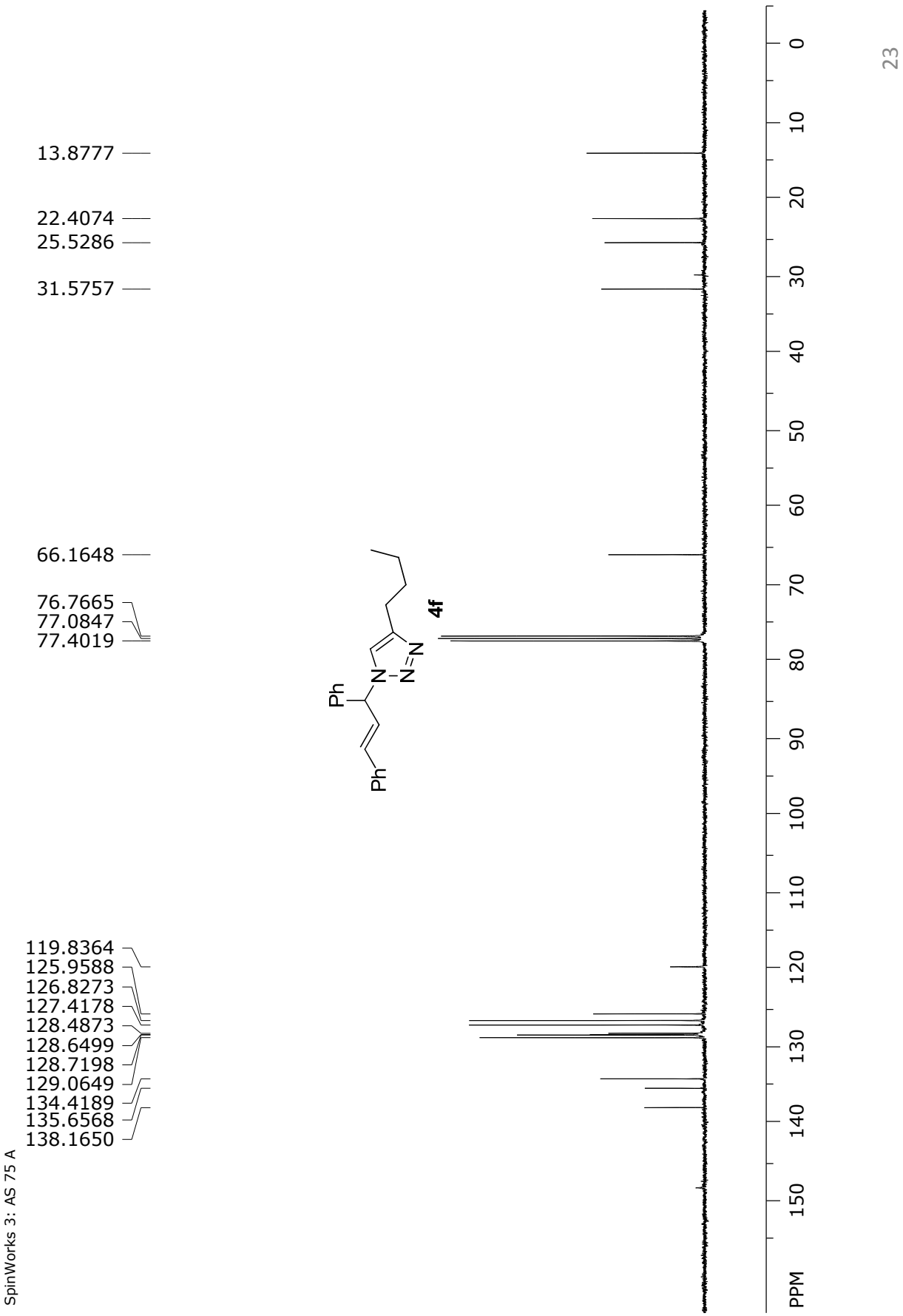
0.9478
0.9661
1.3551
1.3732
1.3916
1.4104
1.4292
1.6347
1.6541
1.6672
1.6732
1.6928
1.7112
2.7259
2.7457
2.7647
Ph
Ph
4f
3.225
2.115
2.043
1.935
PPM
SpinWorks 3: AS 75 A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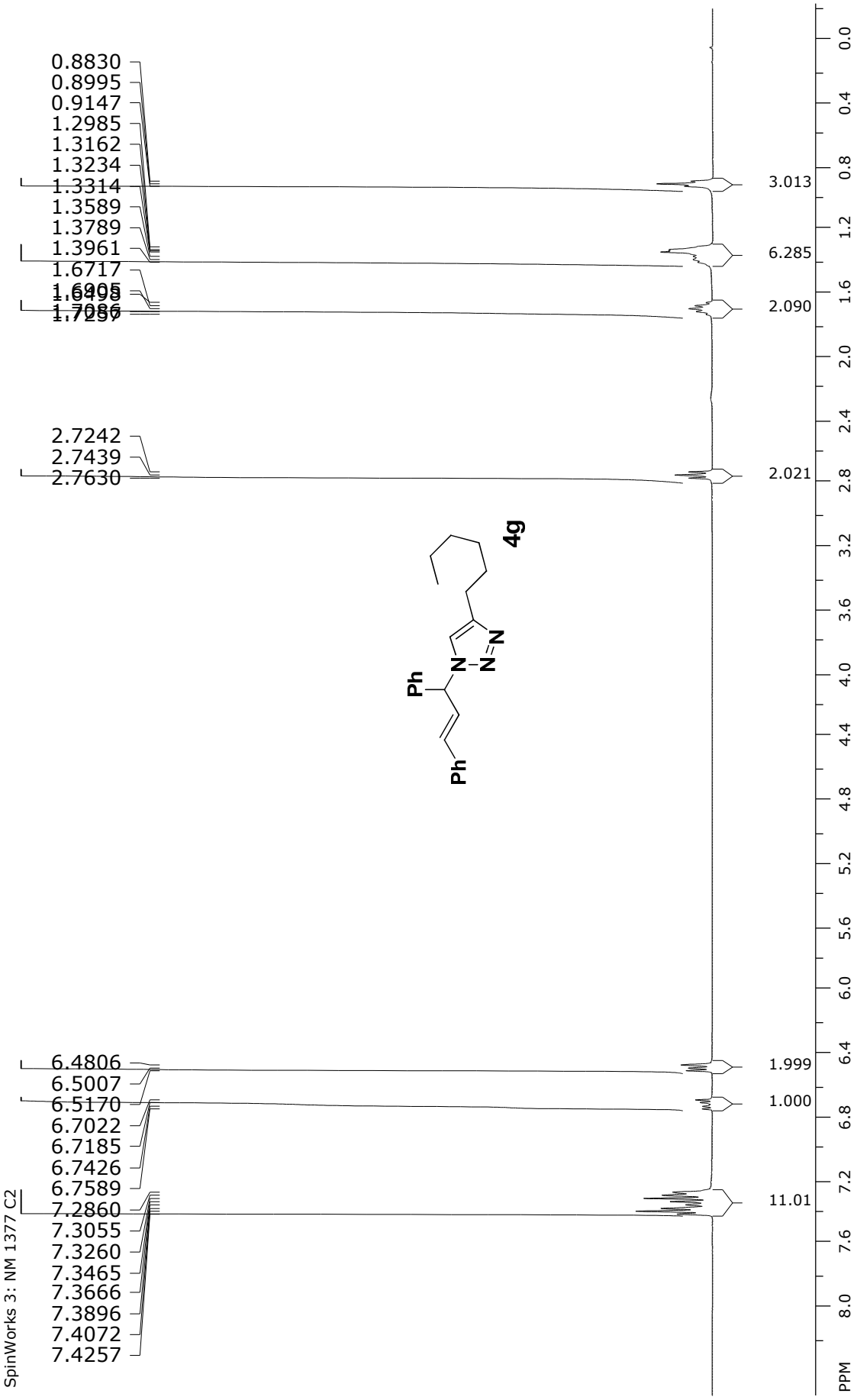
76.7665
77.0847
77.4019
119.8364
125.9588
126.8273
127.4178
128.4873
128.6499
128.7198
129.0649
134.4189
135.6568
138.1650
Ph
Ph
N
N
N
4f
SpinWorks 3: AS 75 A
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150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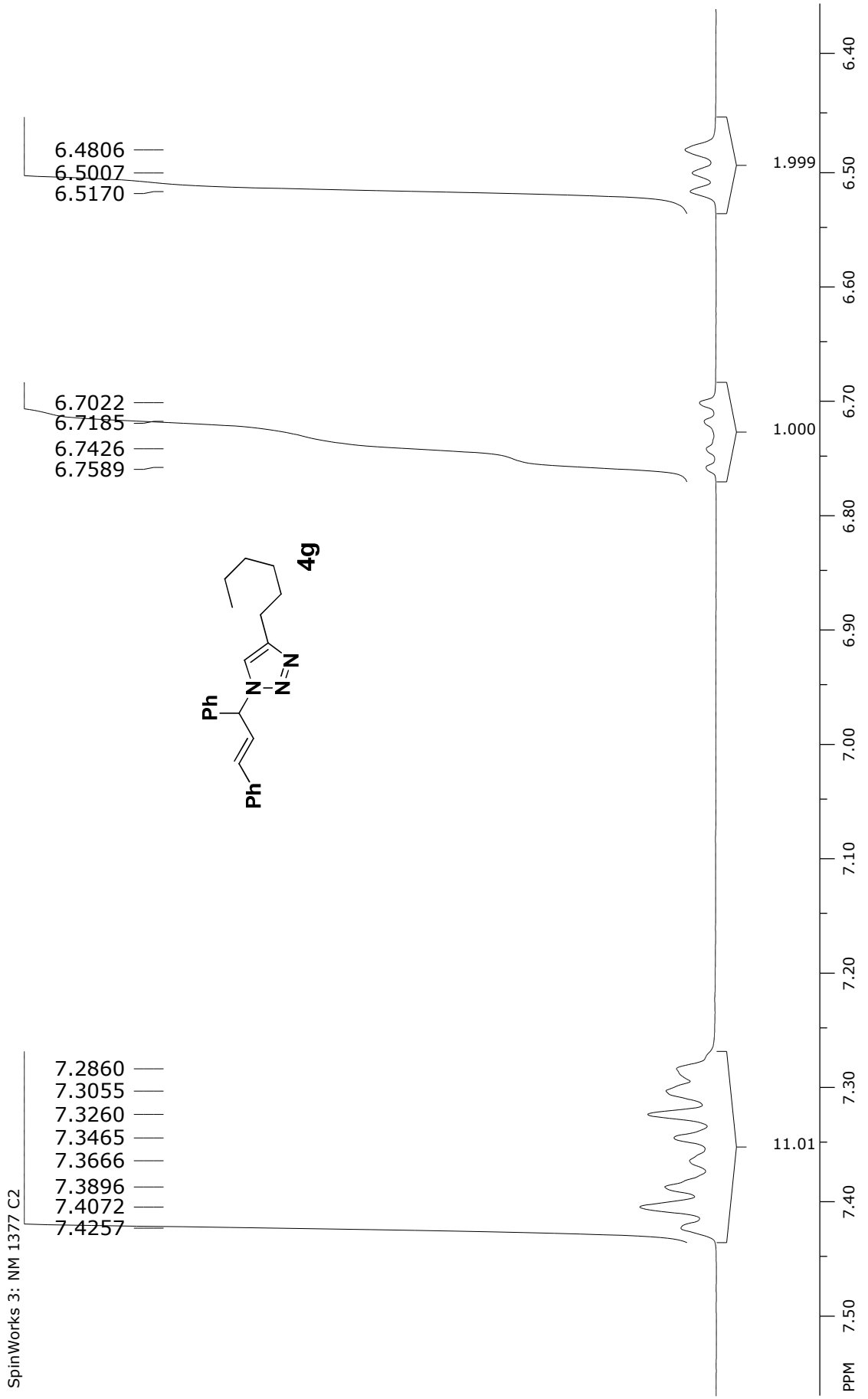
0.8995
0.9147
1.2985
1.3162
1.3234
1.3314
1.3589
1.3789
1.3961
1.6717
1.6905
1.6998
1.7086
1.7259
2.7242
2.7439
2.7630
6.4806
6.5007
6.5170
6.7022
6.7185
6.7426
6.7589
7.2860
7.3055
7.3260
7.3465
7.3666
7.3896
7.4072
7.4257
3.013
6.285
2.090
2.021
1.999
1.000
11.01
4g
Ph
Ph
N
N
N
PPM
SpinWorks 3: NM 1377 C2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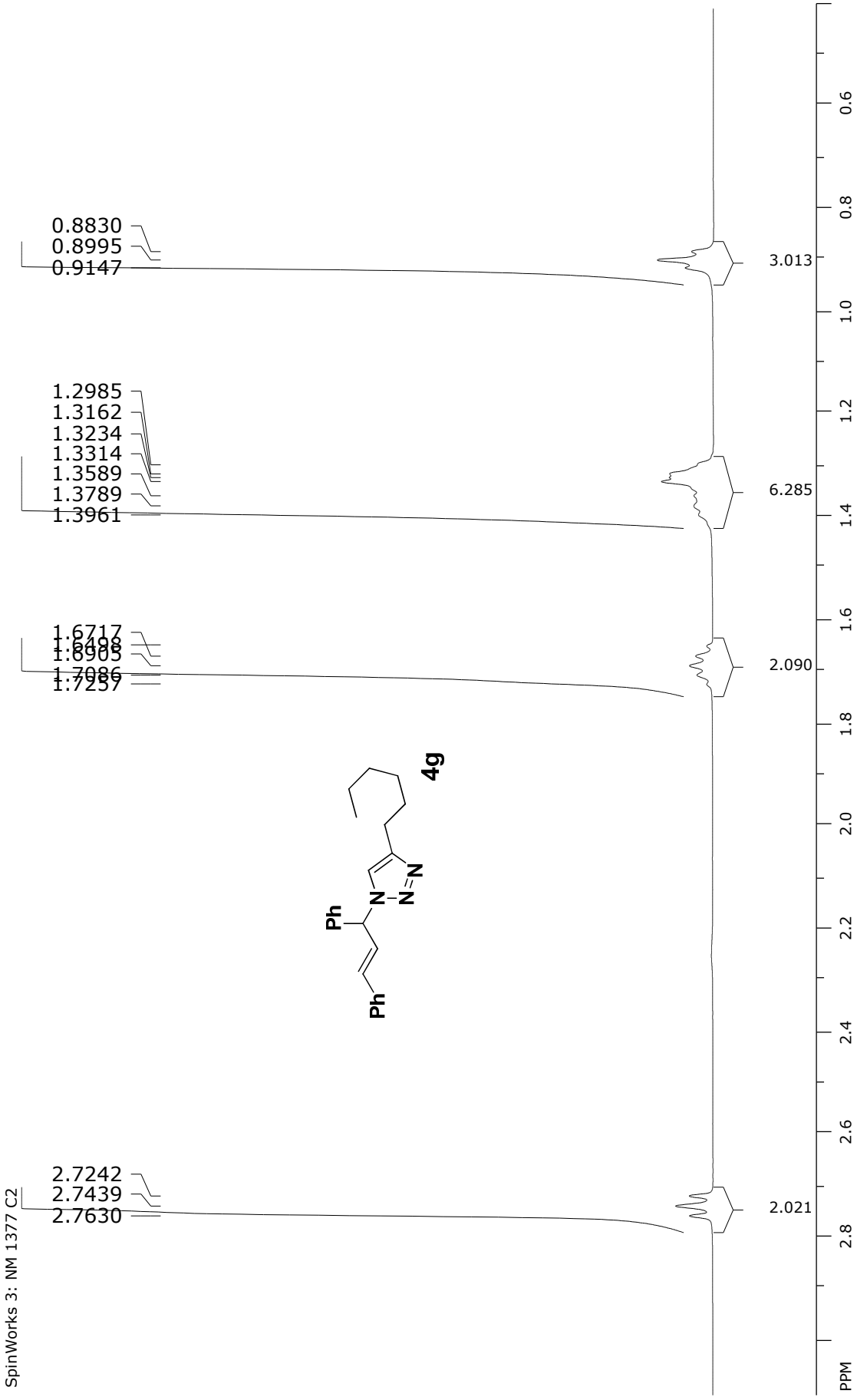
6.5007
6.5170
6.7022
6.7185
6.7426
6.7589
7.2860
7.3055
7.3260
7.3465
7.3666
7.3896
7.4072
7.4257
1.999
1.000
11.01
4g
Ph
Ph
N
N
6.40
6.50
6.60
6.70
6.80
6.90
7.00
7.10
7.20
7.30
7.40
7.50
PPM
SpinWorks 3: NM 1377 C2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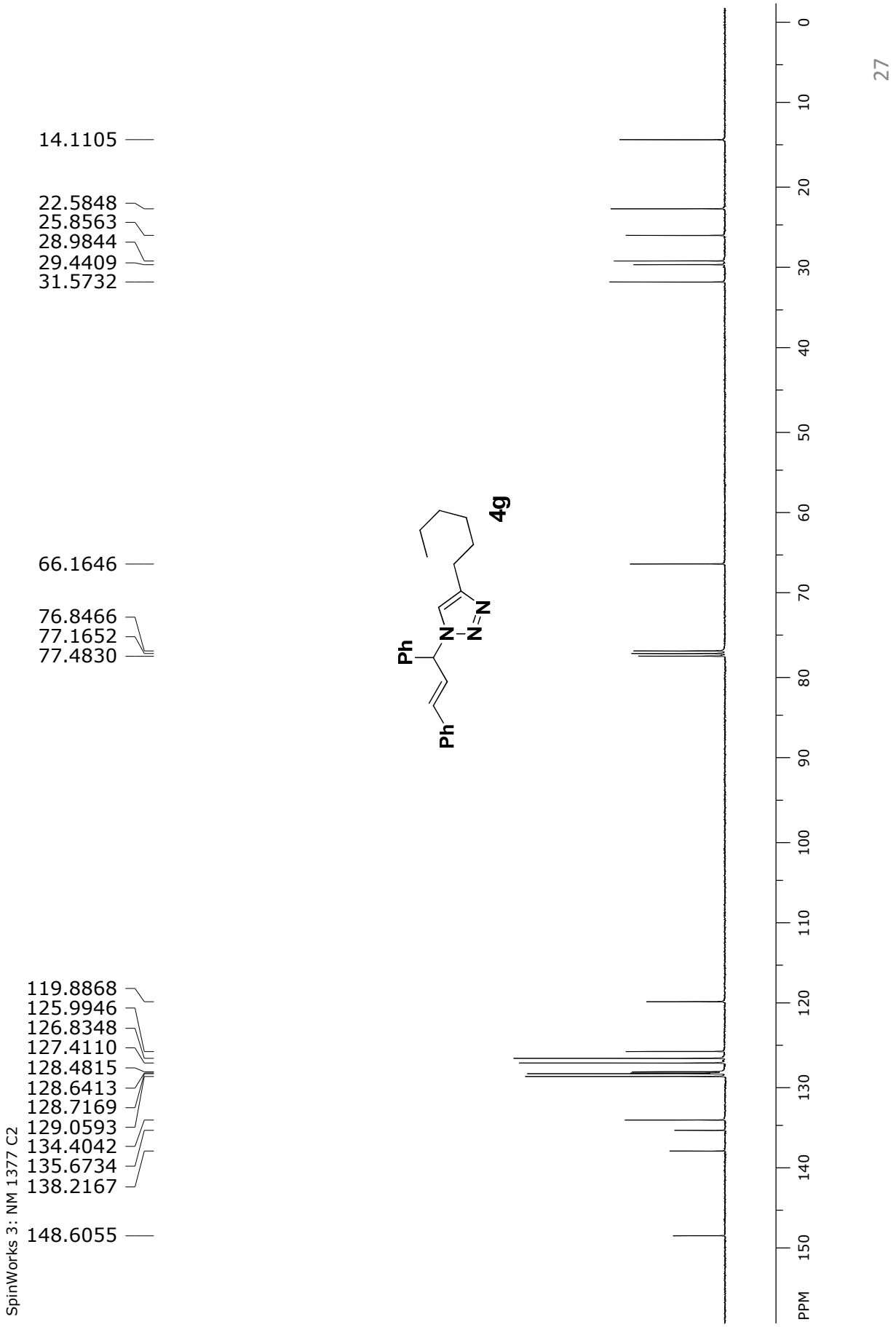
0.8995
0.9147
1.2985
1.3162
1.3234
1.3314
1.3589
1.3789
1.3961
1.6717
1.6905
1.7086
1.7257
2.7242
2.7439
2.7630
3.013
6.285
2.090
2.021
4g
Ph
Ph
N
N
N
PPM
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
SpinWorks 3: NM 1377 C2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25.8563
28.9844
29.4409
31.5732
66.1646
76.8466
77.1652
77.4830
119.8868
125.9946
126.8348
127.4110
128.4815
128.6413
128.7169
129.0593
134.4042
135.6734
138.2167
148.6055
4g
Ph
Ph
N
N
N
SpinWorks 3: NM 1377 C2
PPM
0
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40
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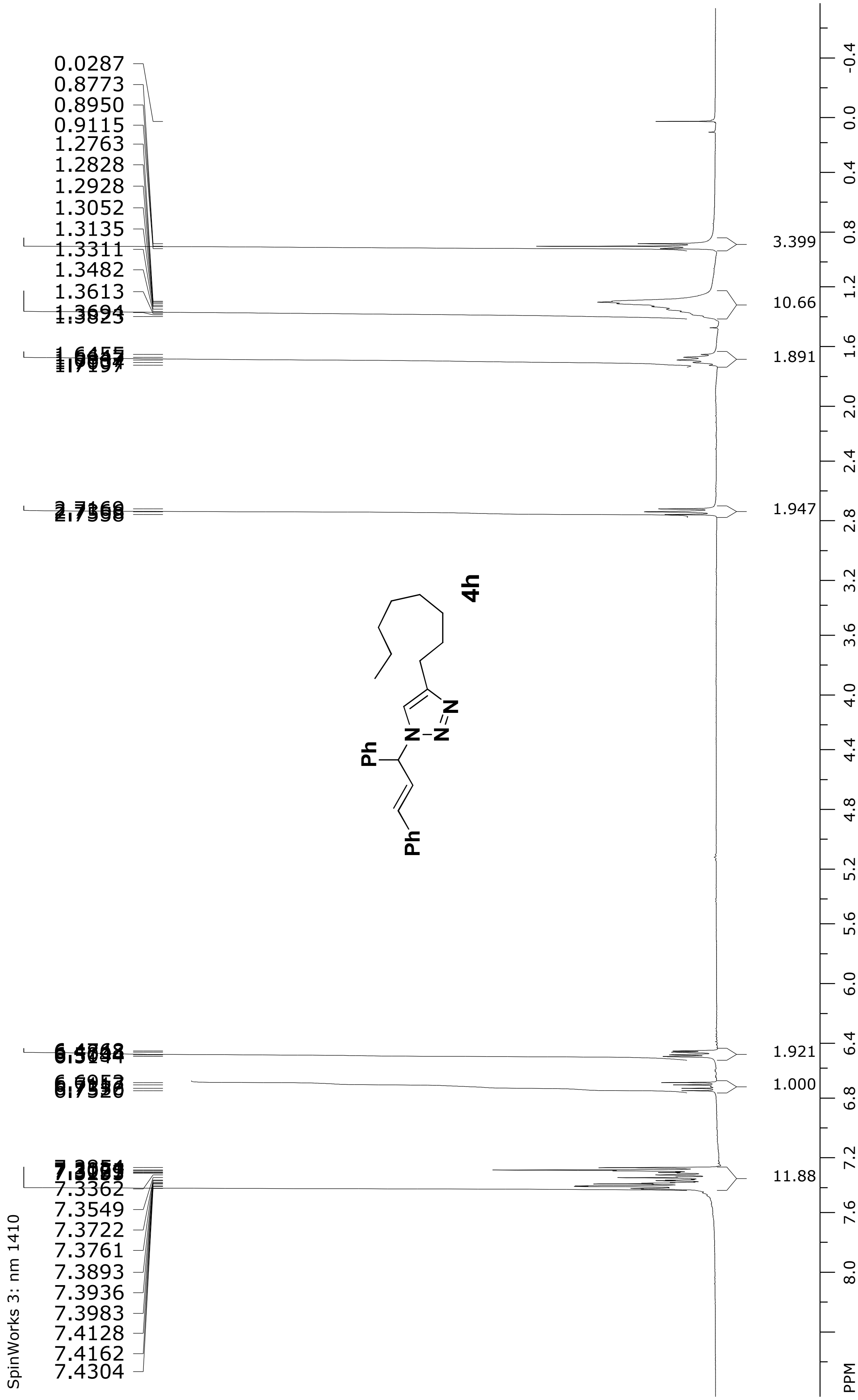
60
70
80
90
100
110
120
130
140
150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0.8950
0.9115
1.2763
1.2828
1.2928
1.3052
1.3135
1.3311
1.3482
1.3613
7.3362
7.3549
7.3722
7.3761
7.3893
7.3936
7.3983
7.4128
7.4162
7.4304
SpinWorks 3: nm 1410
4h
Ph
Ph
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N
N
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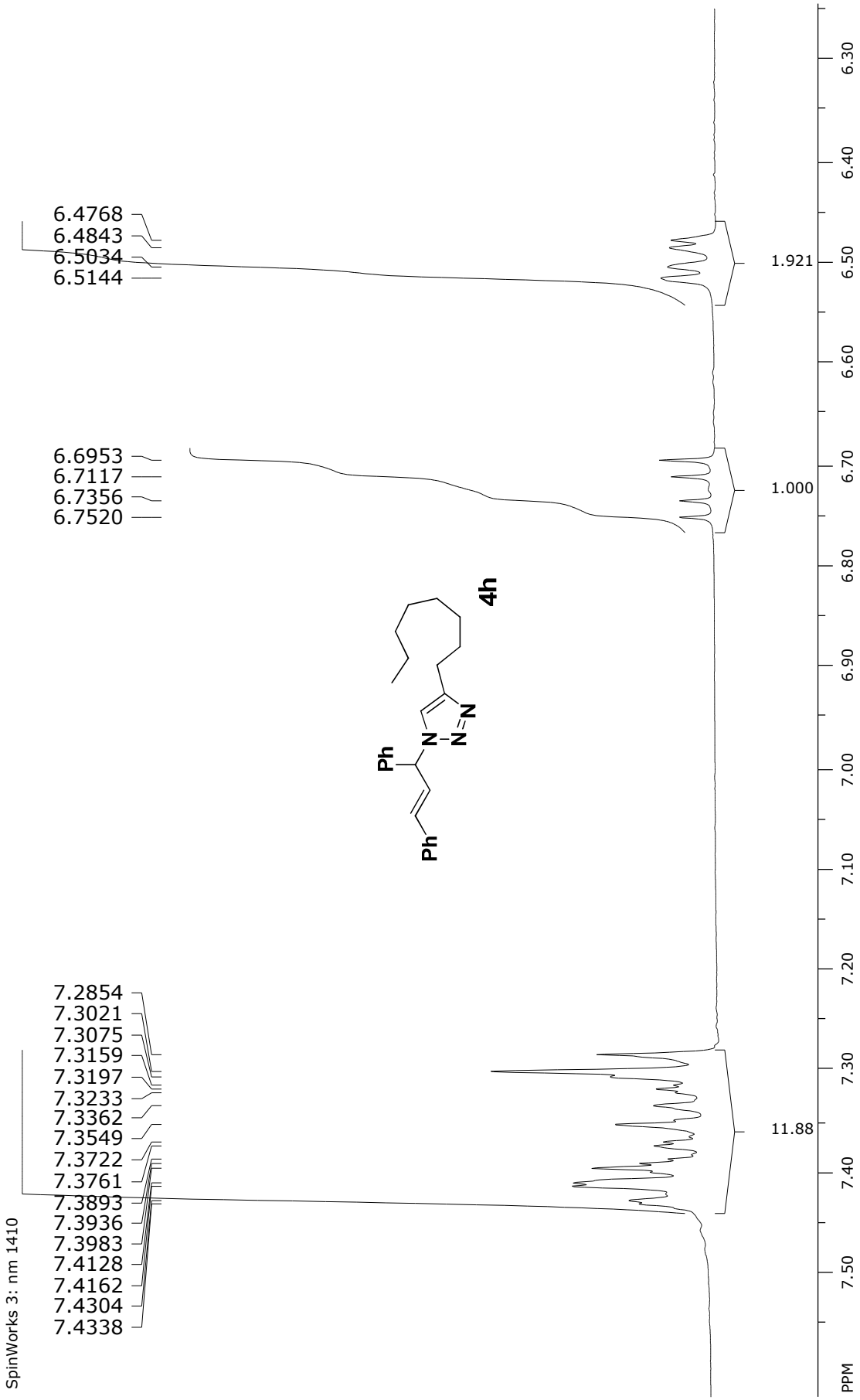
1.891
1.947
1.921
1.000
11.88
PPM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6.6953
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6.7356
6.7520
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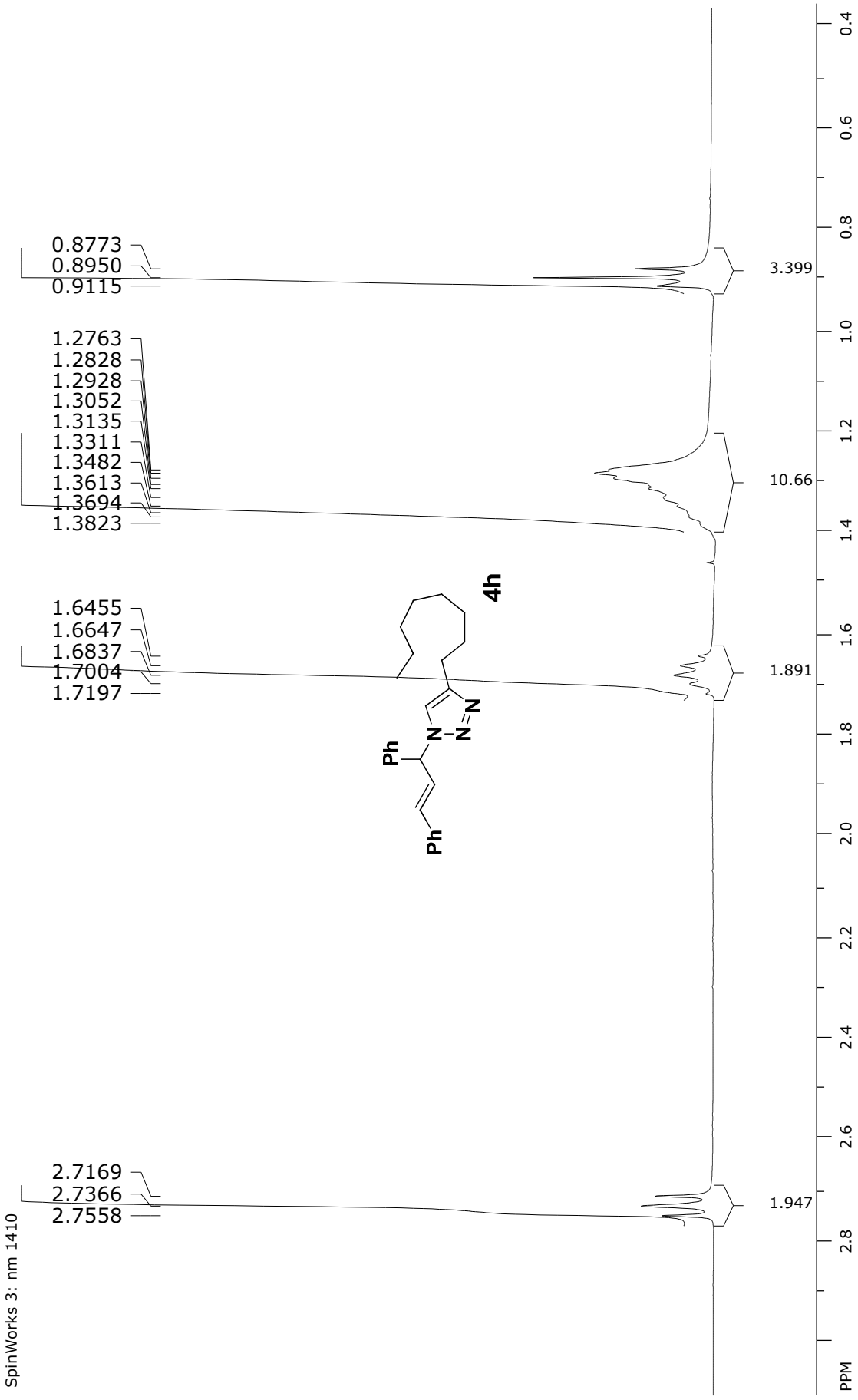
7.3021
7.3075
7.3159
7.3197
7.3233
7.3362
7.3549
7.3722
7.3761
7.3893
7.3936
7.3983
7.4128
7.4162
7.4304
7.4338
1.921
1.000
11.88
4h
Ph
Ph
N
N
N
6.30
6.40
6.50
6.60
6.70
6.80
6.90
7.00
7.10
7.20
7.30
7.40
7.50
PPM
SpinWorks 3: nm 1410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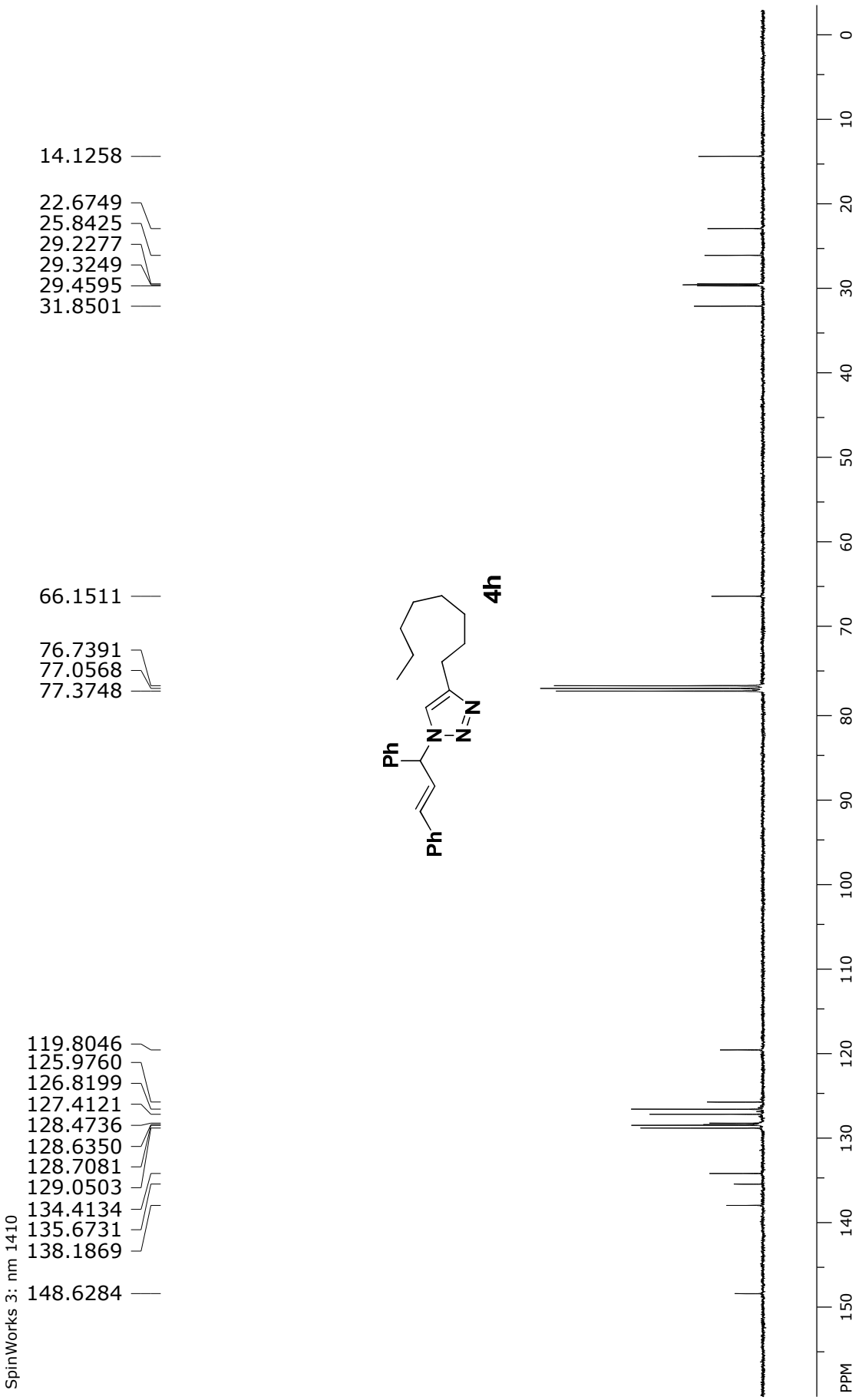
0.8950
0.9115
1.2763
1.2828
1.2928
1.3052
1.3135
1.3311
1.3482
1.3613
1.3694
1.3823
1.6455
1.6647
1.6837
1.7004
1.7197
2.7169
2.7366
2.7558
3.399
10.66
1.891
1.947
4h
Ph
Ph
N
N
N
PPM
SpinWorks 3: nm 1410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29.2277
29.3249
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31.8501
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76.7391
77.0568
77.3748
119.8046
125.9760
126.8199
127.4121
128.4736
128.6350
128.7081
129.0503
134.4134
135.6731
138.1869
148.6284
4h
Ph
Ph
N
N
N
PPM
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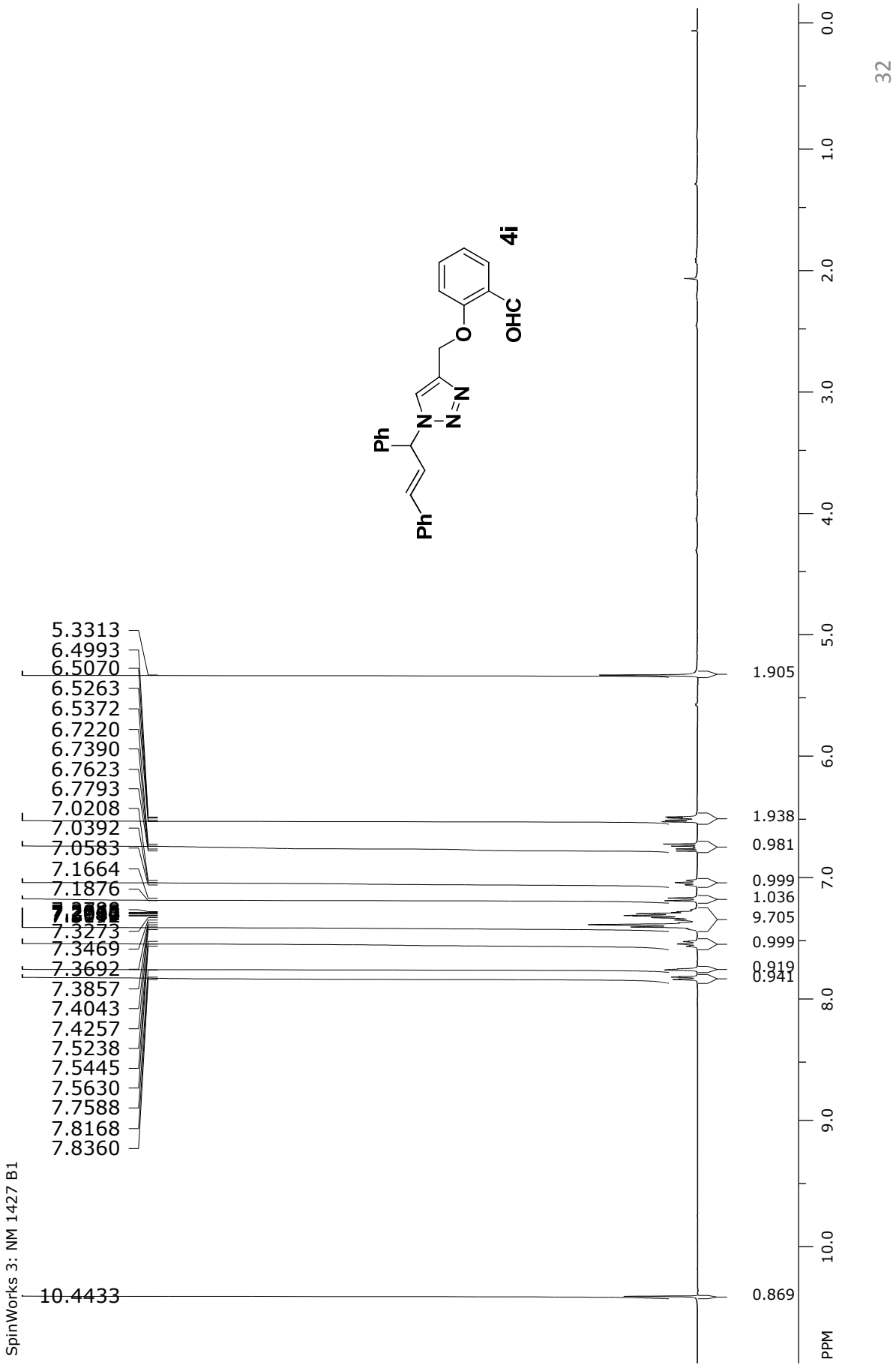
30
40
50
60
70
80
90
100
110
120
130
140
150
SpinWorks 3: nm 1410


4i
OHC
O
N
N
N
Ph
Ph
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6.5263
6.5372
6.7220
6.7390
6.7623
6.7793
7.0208
7.0392
7.0583
7.1664
7.1876
7.3273
7.3469
7.3692
7.3857
7.4043
7.4257
7.5238
7.5445
7.5630
7.7588
7.8168
7.8360
10.4433
1.905
1.938
0.981
0.999
1.036
9.705
0.999
0.919
0.941
0.869
SpinWorks 3: NM 1427 B1
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2.0
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4.0
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6.0
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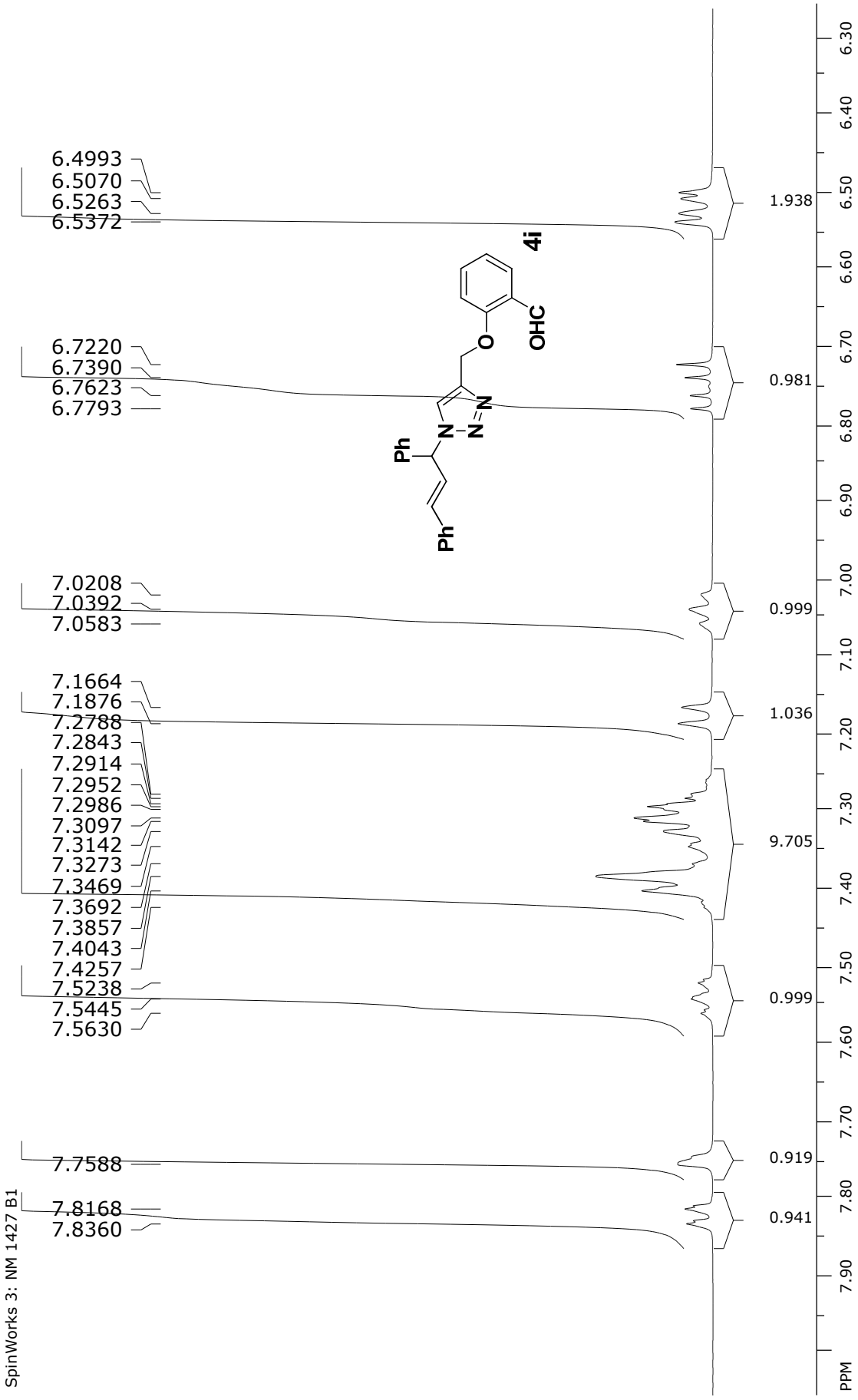
9.0
10.0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6.7623
6.7793
7.0208
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7.0583
7.1664
7.1876
7.2788
7.2843
7.2914
7.2952
7.2986
7.3097
7.3142
7.3273
7.3469
7.3692
7.3857
7.4043
7.4257
7.5238
7.5445
7.5630
7.7588
7.8168
7.8360
1.938
0.981
0.999
1.036
9.705
0.999
0.919
0.941
4i
OHC
O
N
N
N
Ph
Ph
SpinWorks 3: NM 1427 B1
PPM
6.30
6.40
6.50
6.60
6.70
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7.10
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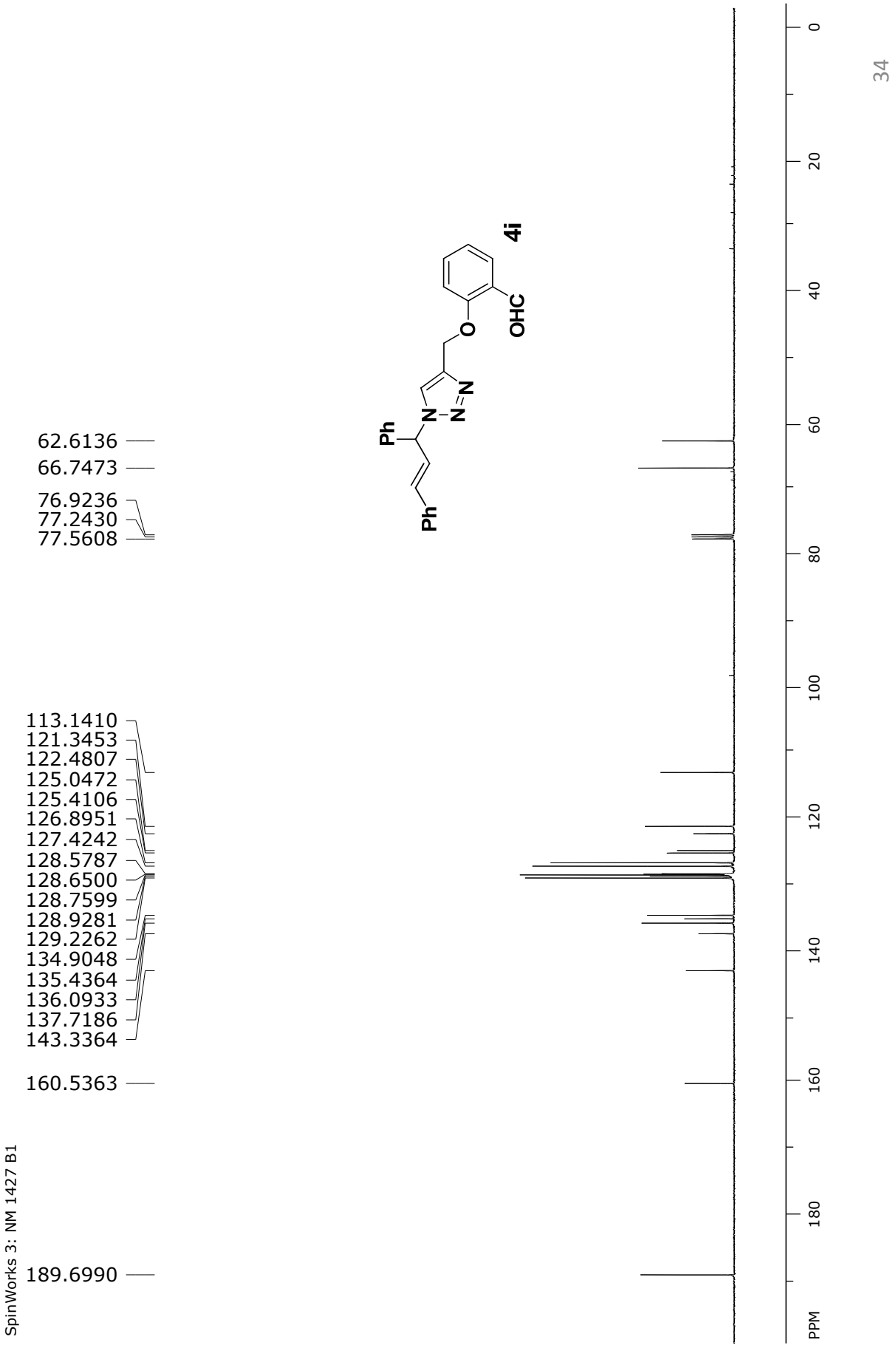
7.50
7.60
7.70
7.80
7.90


4i
OHC
O
N
N
N
Ph
Ph
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77.2430
77.5608
113.1410
121.3453
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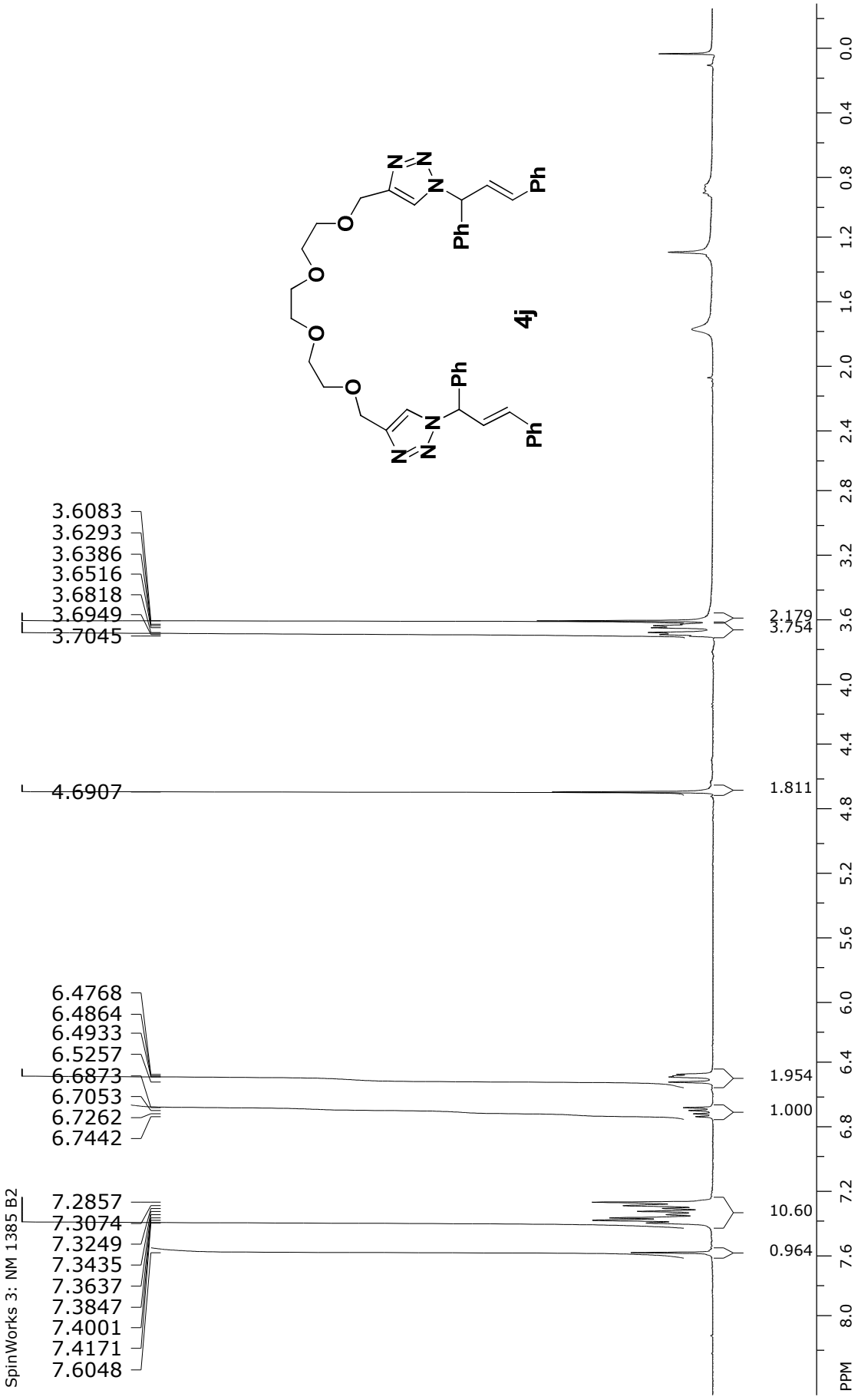
125.0472
125.4106
126.8951
127.4242
128.5787
128.6500
128.7599
128.9281
129.2262
134.9048
135.4364
136.0933
137.7186
143.3364
160.5363
189.6990
SpinWorks 3: NM 1427 B1
0
20
40
60
80
100
120
140
160
180
PPM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3.6949
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4.6907
6.4768
6.4864
6.4933
6.5257
6.6873
6.7053
6.7262
6.7442
7.2857
7.3074
7.3249
7.3435
7.3637
7.3847
7.4001
7.4171
7.6048
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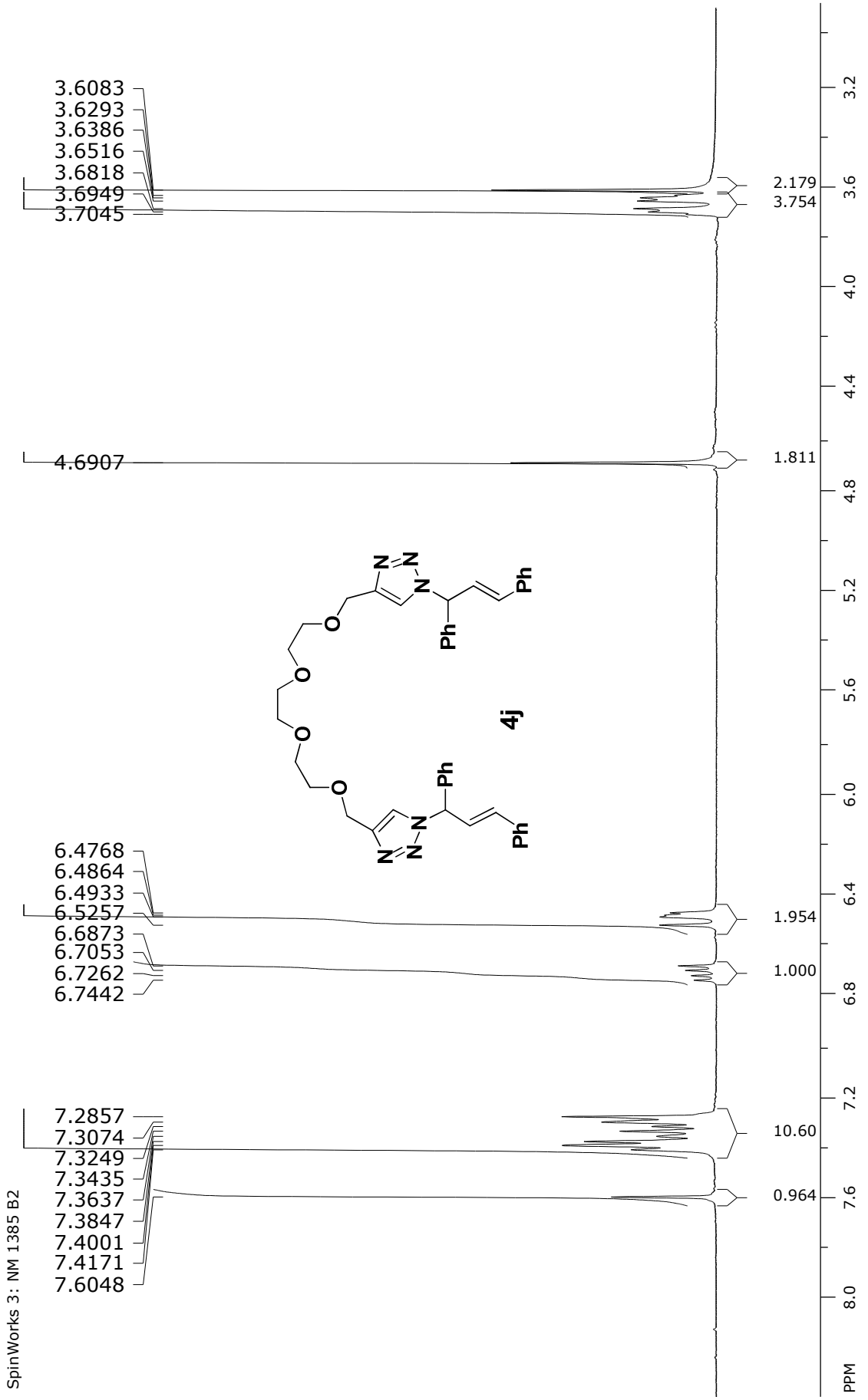
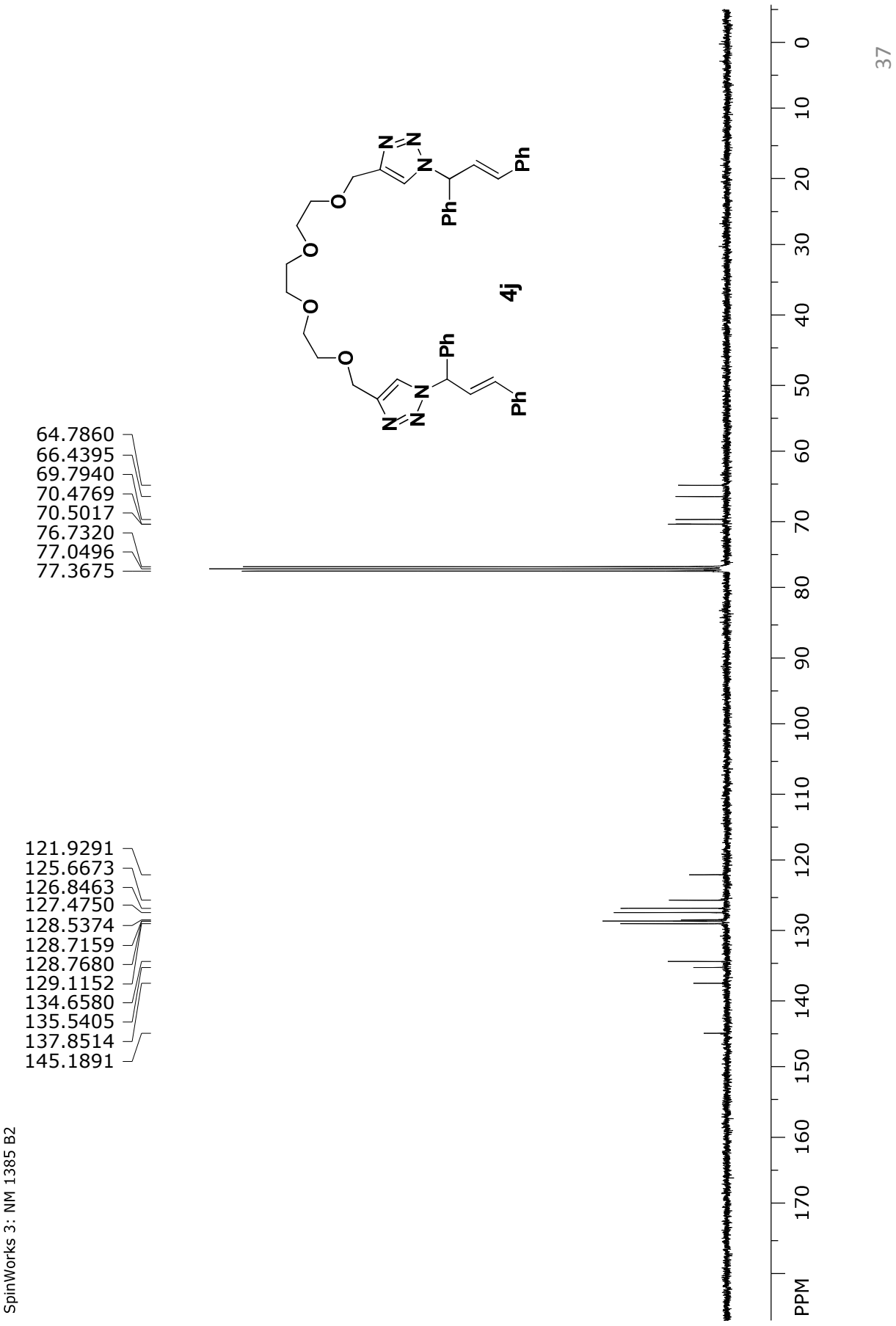
3.754
1.811
1.954
1.000
10.60
0.964
SpinWorks 3: NM 1385 B2
PPM


3.6083
3.6293
3.6386
3.6516
3.6818
3.6949
3.7045
4.6907
6.4768
6.4864
6.4933
6.5257
6.6873
6.7053
6.7262
6.7442
7.2857
7.3074
7.3249
7.3435
7.3637
7.3847
7.4001
7.4171
7.6048
2.179
3.754
1.811
1.954
1.000
10.60
0.964
4j
Ph
Ph
Ph
Ph
N
N
N
N
O
O
O
O
SpinWorks 3: NM 1385 B2
PPM
3.2
3.6
4.0
4.4
4.8
5.2
5.6
6.0
6.4
6.8
7.2
7.6
8.0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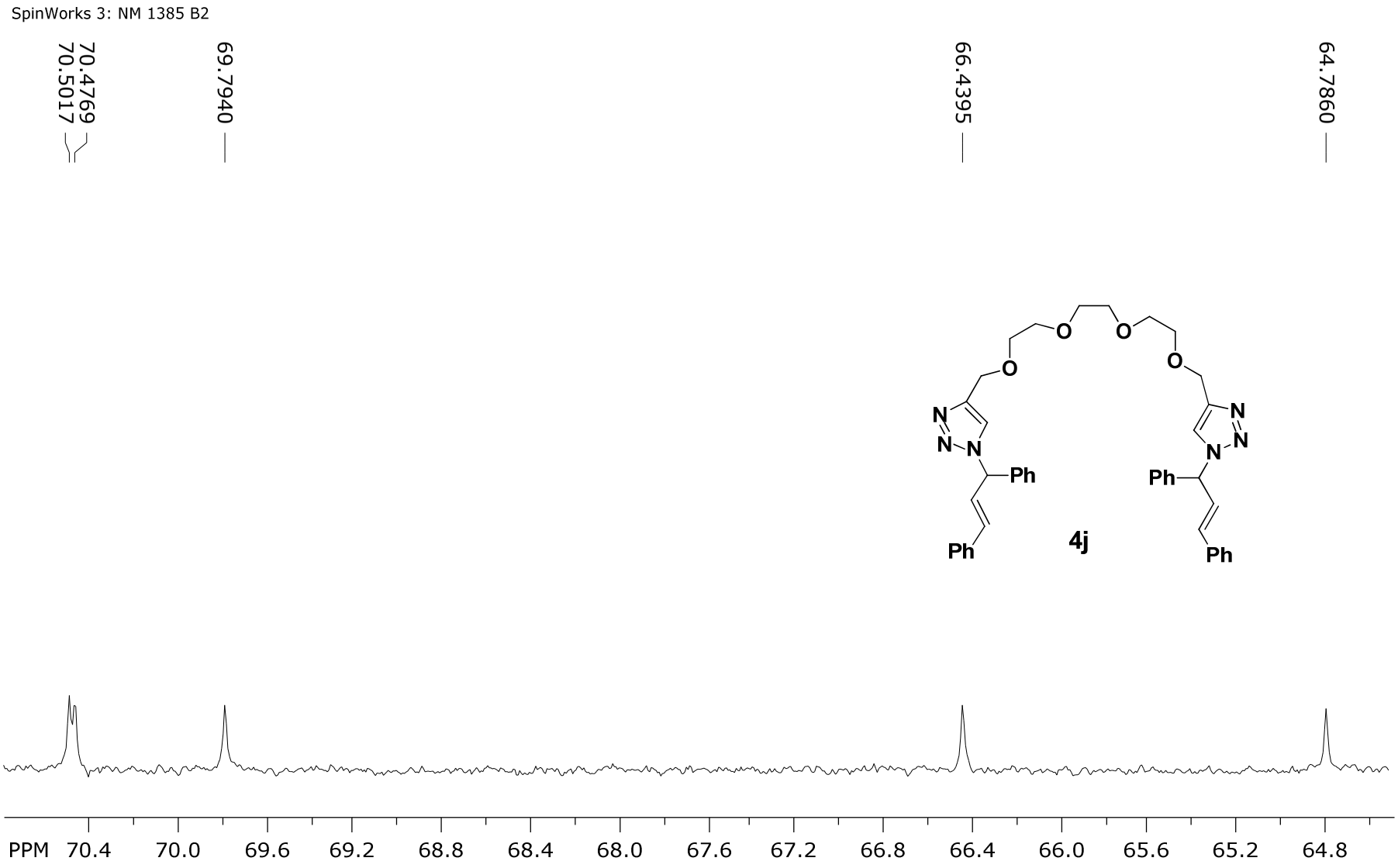
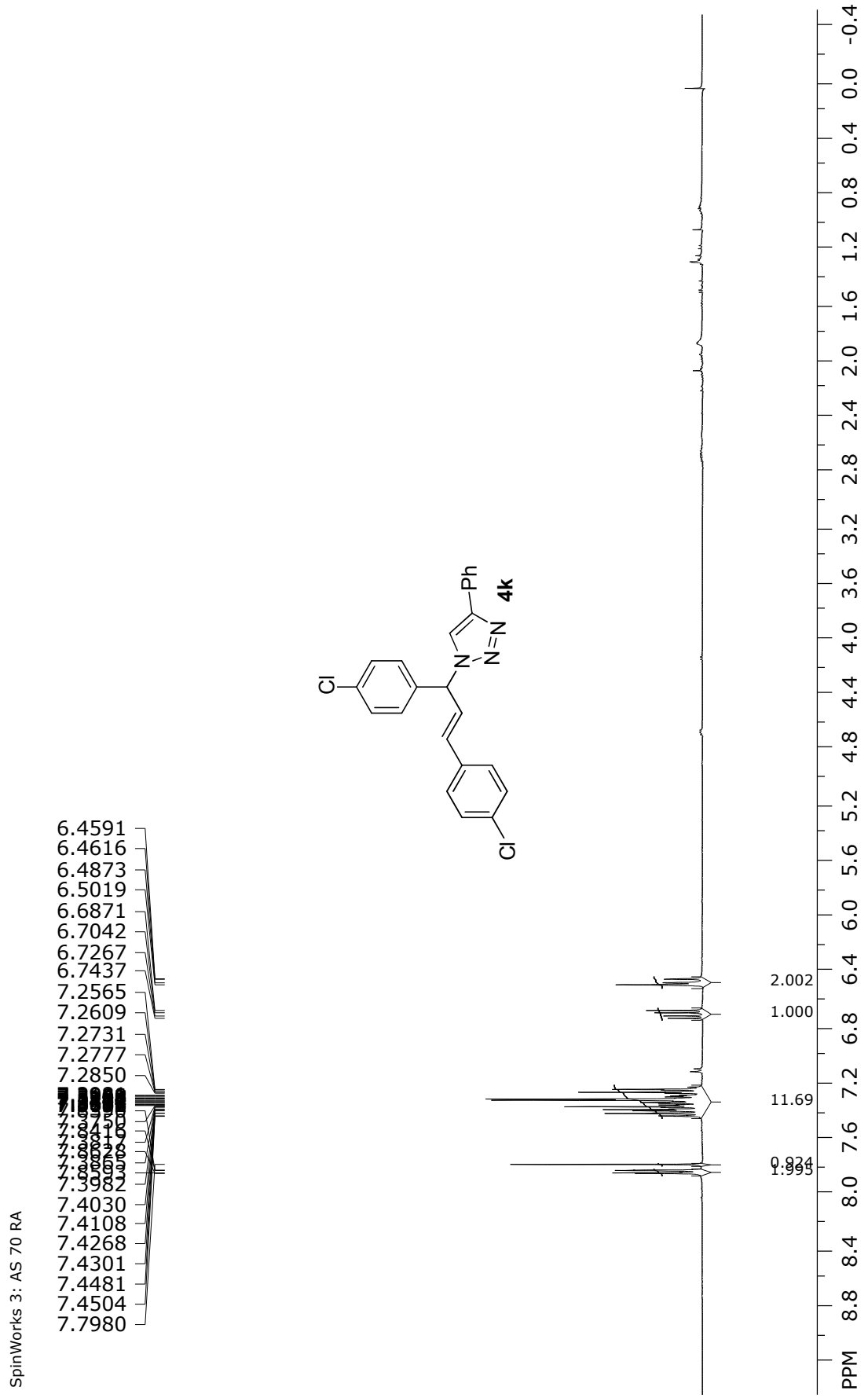
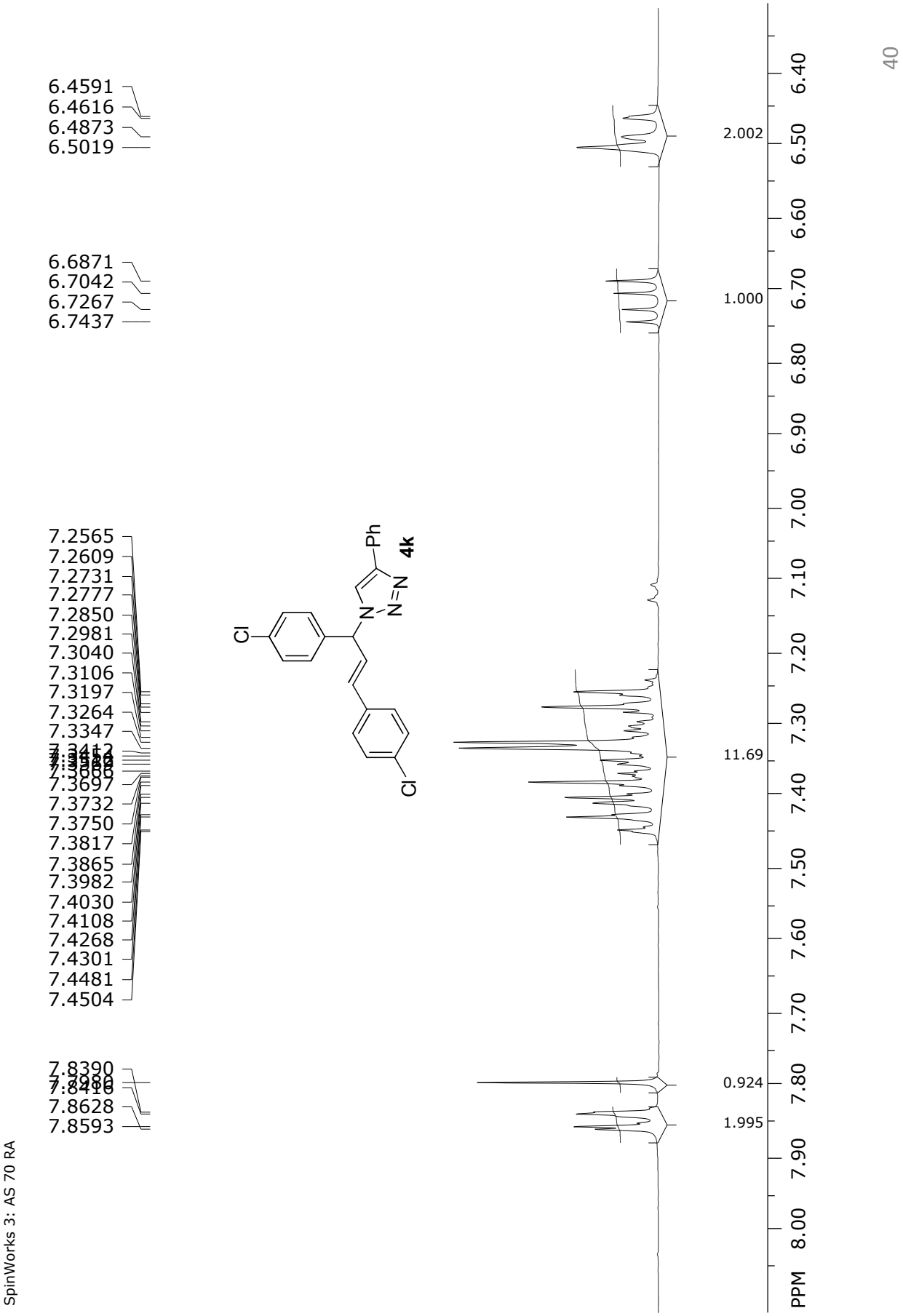
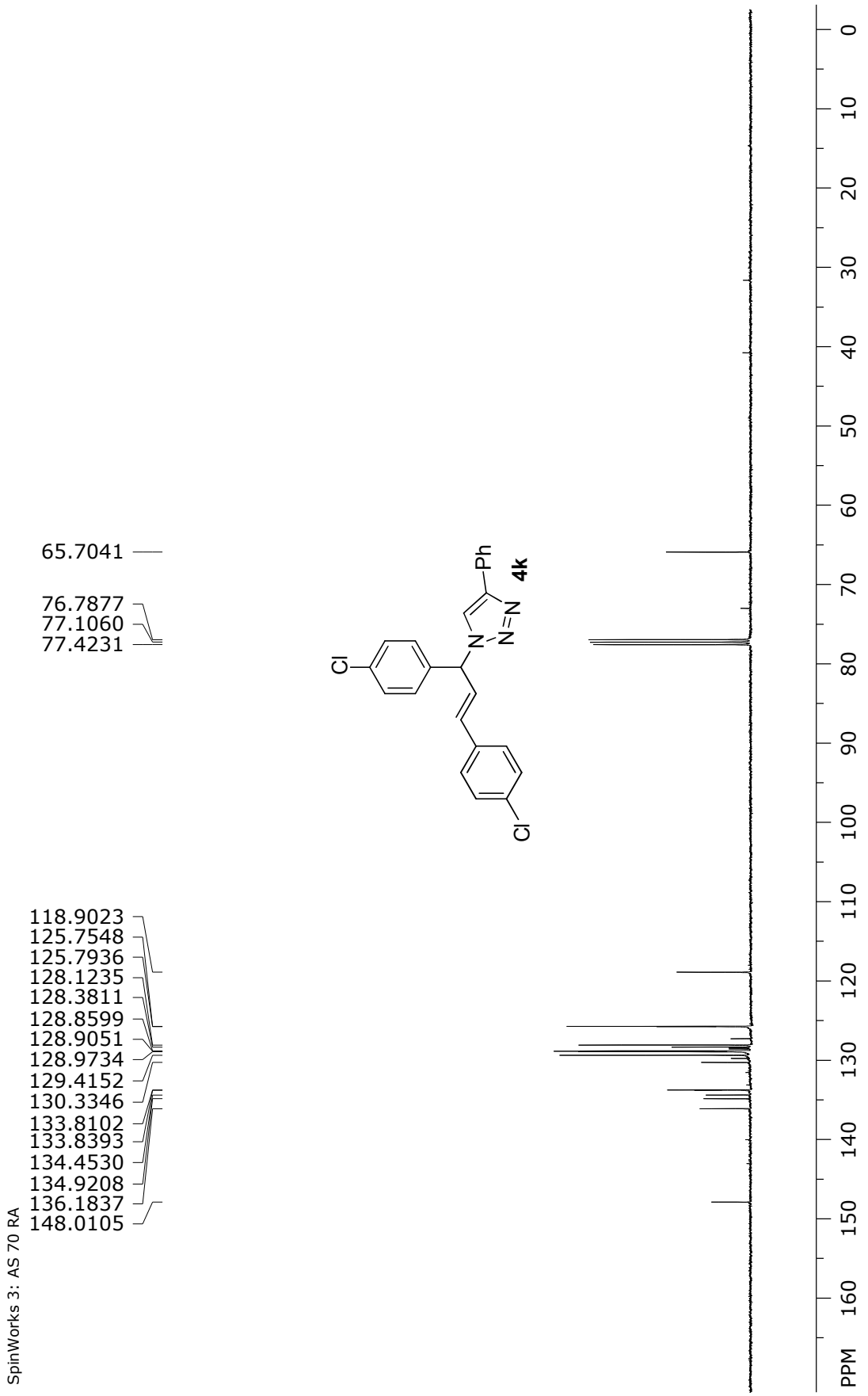
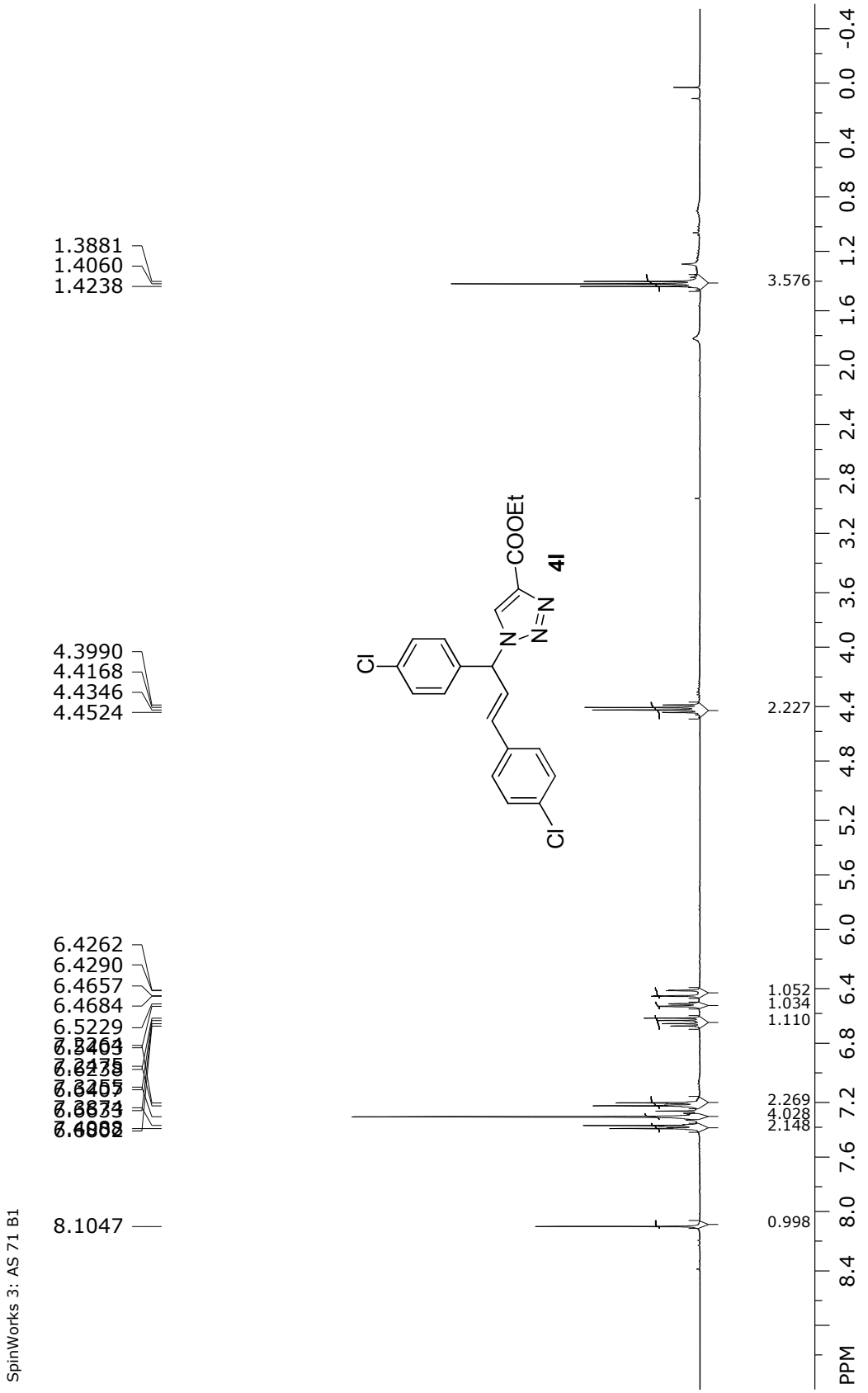
70.5017
76.7320
77.0496
77.3675
121.9291
125.6673
126.8463
127.4750
128.5374
128.7159
128.7680
129.1152
134.6580
135.5405
137.8514
145.1891
4j
Ph
Ph
Ph
Ph
PPM
SpinWorks 3: NM 1385 B2

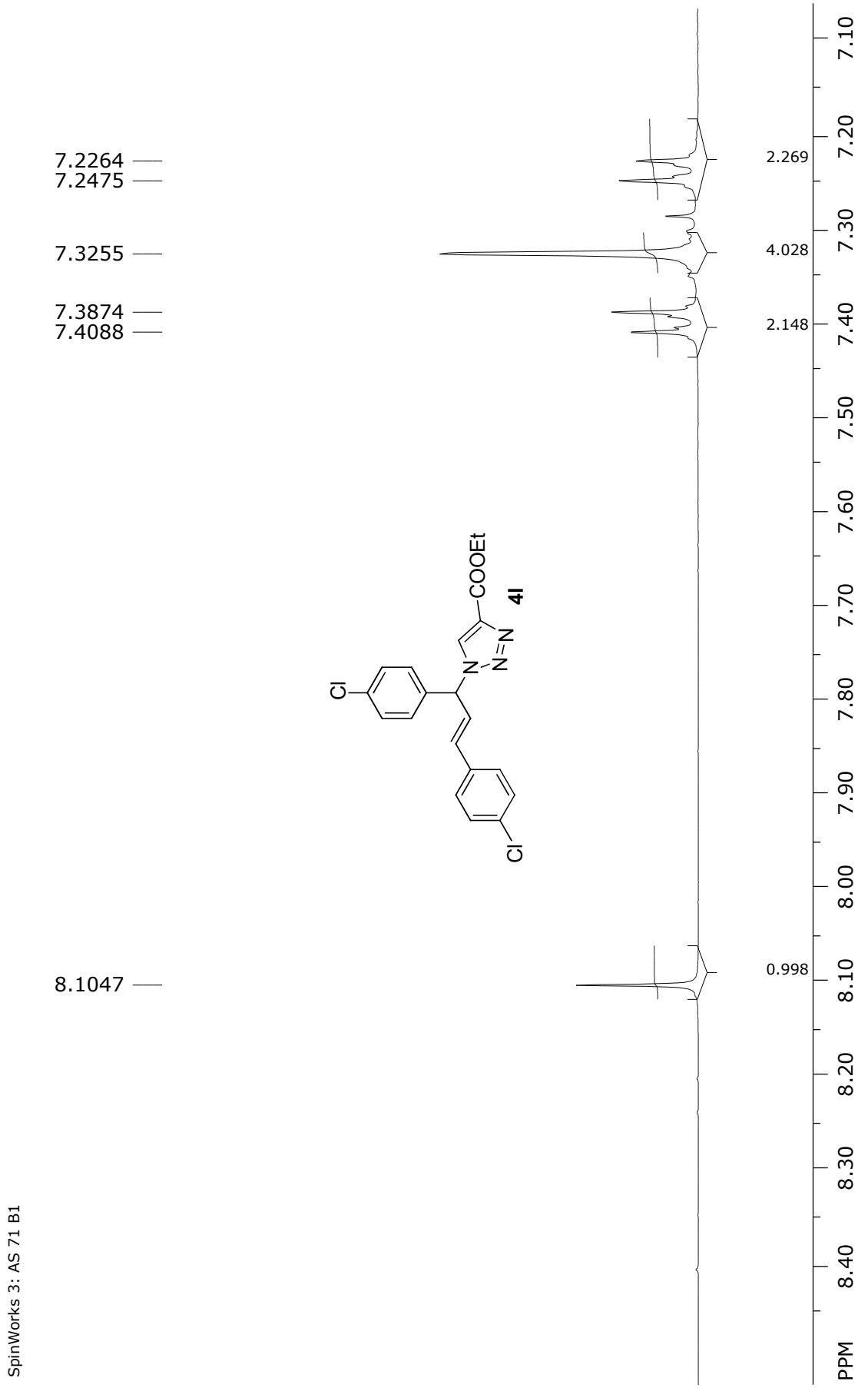



SpinWorks 3: AS 70 RA
6.4591
6.4616
6.4873
6.5019
6.6871
6.7042
6.7267
6.7437
7.2565
7.2609
7.2731
7.2777
7.2850
7.3982
7.4030
7.4108
7.4268
7.4301
7.4481
7.4504
7.7980
Ph
4k
N
N=N
Cl
Cl
2.002
1.000
11.69
0.934
1.995
PPM
8.8
8.4
8.0
7.6
7.2
6.8
6.4
6.0
5.6
5.2
4.8
4.4
4.0
3.6
3.2
2.8
2.4
2.0
1.6
1.2
0.8
0.4
0.0
-0.4

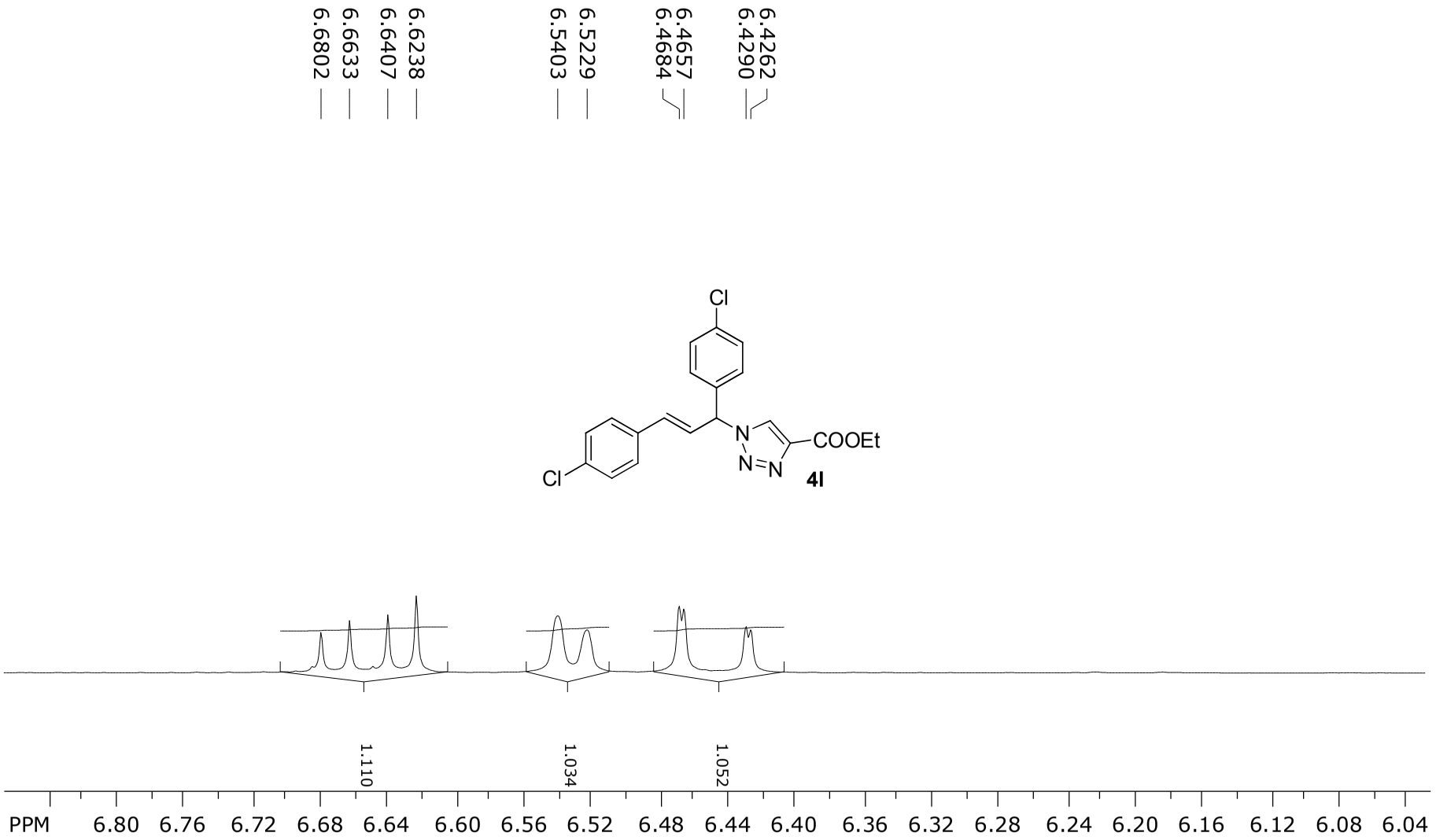

6.4591
6.4616
6.4873
6.5019
6.6871
6.7042
6.7267
6.7437
7.2565
7.2609
7.2731
7.2777
7.2850
7.2981
7.3040
7.3106
7.3197
7.3264
7.3347
7.3412
7.3697
7.3732
7.3750
7.3817
7.3865
7.3982
7.4030
7.4108
7.4268
7.4301
7.4481
7.4504
7.8390
7.8628
7.8593
Cl
Ph
N
N=N
Cl
4k
2.002
1.000
11.69
0.924
1.995
PPM
6.40
6.50
6.60
6.70
6.80
6.90
7.00
7.10
7.20
7.30
7.40
7.50
7.60
7.70
7.80
7.90
8.00
SpinWorks 3: AS 70 RA

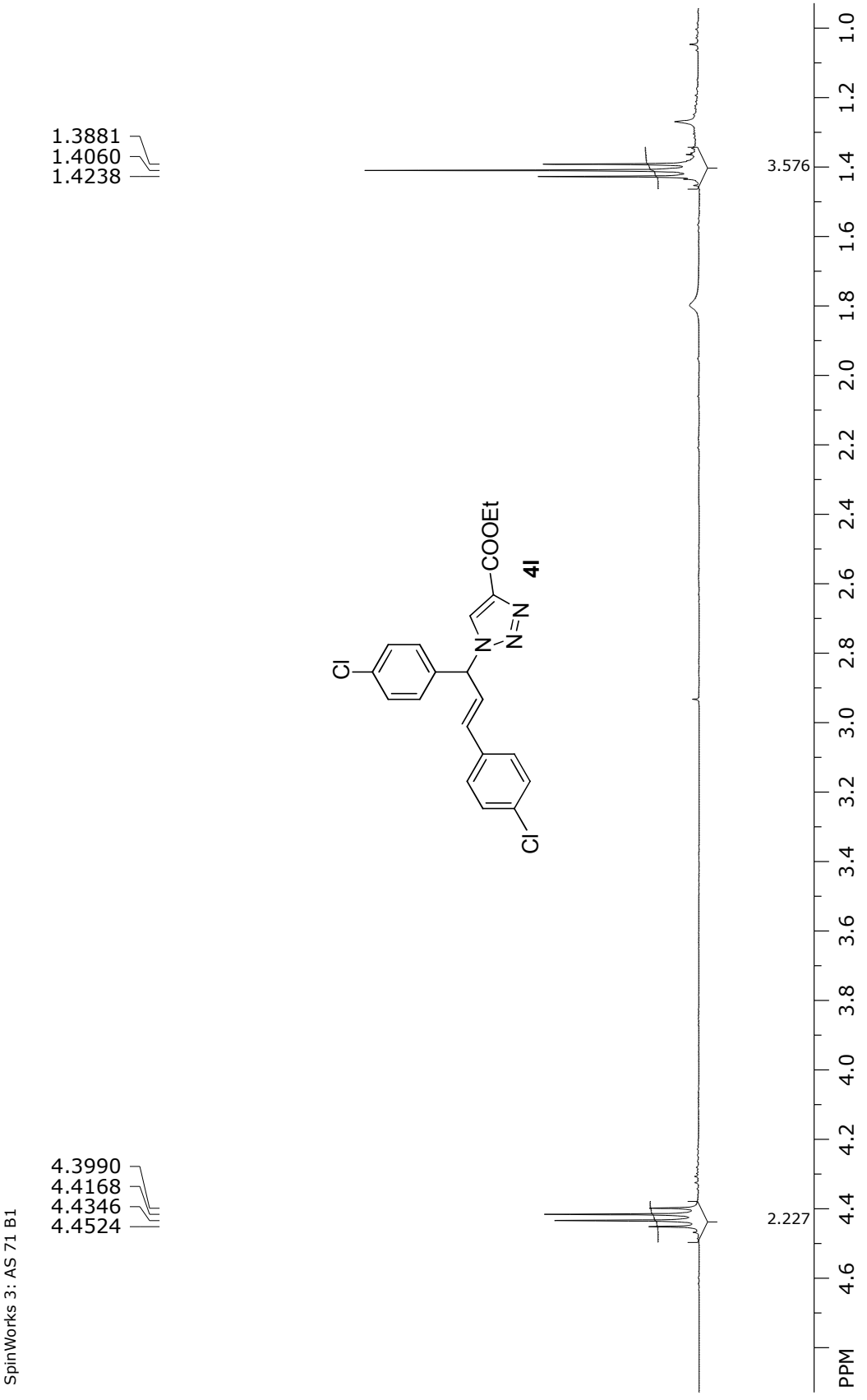

65.7041
76.7877
77.1060
77.4231
118.9023
125.7548
125.7936
128.1235
128.3811
128.8599
128.9051
128.9734
129.4152
130.3346
133.8102
133.8393
134.4530
134.9208
136.1837
148.0105
Ph
4k
N
N=N
Cl
Cl
SpinWorks 3: AS 70 RA
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160

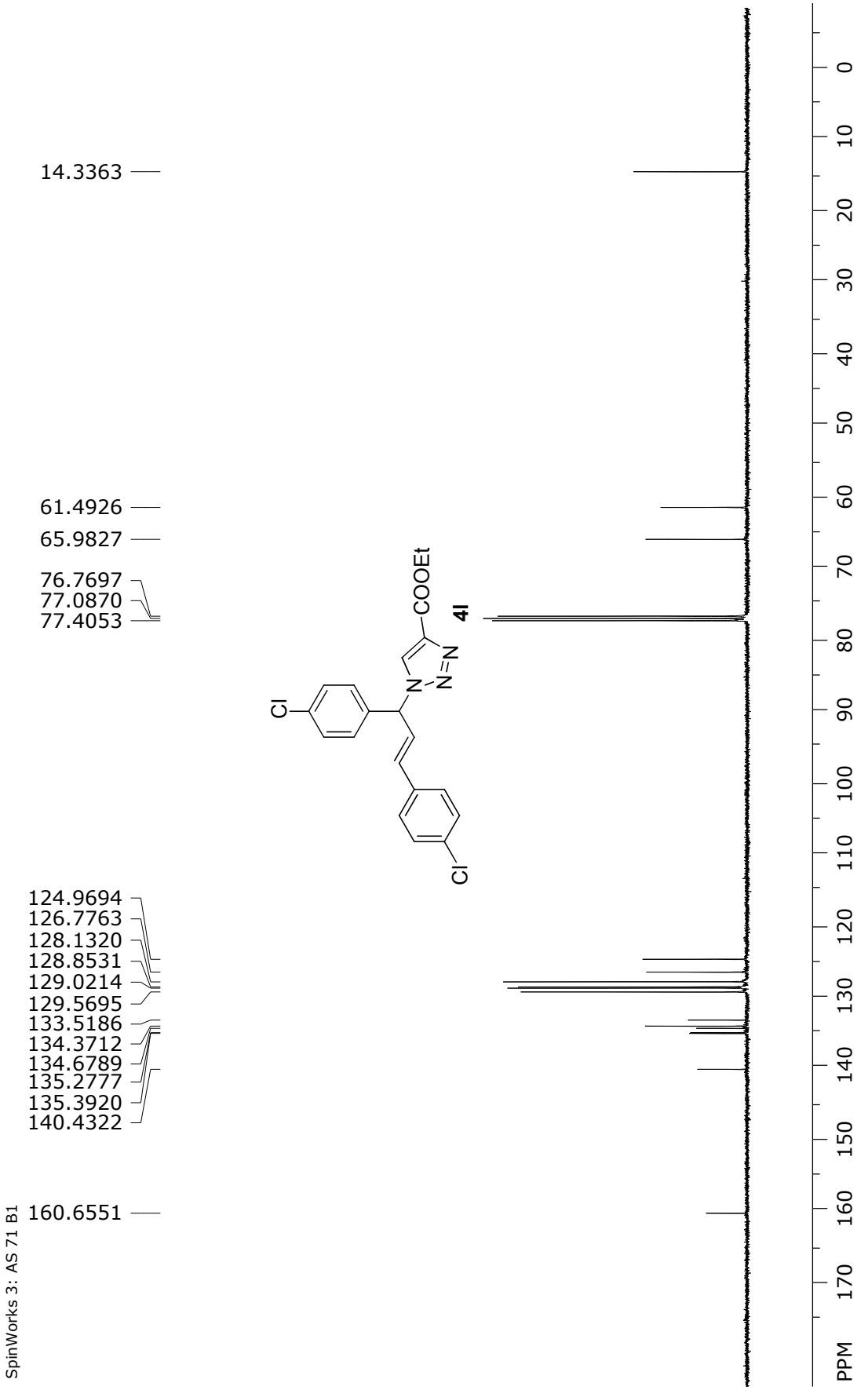

1.3881
1.4060
1.4238
4.3990
4.4168
4.4346
4.4524
6.4262
6.4290
6.4657
6.4684
6.5229
8.1047
COOEt
4l
Cl
Cl
3.576
2.227
1.052
1.034
1.110
2.269
4.028
2.148
0.998
PPM
SpinWorks 3: AS 71 B1

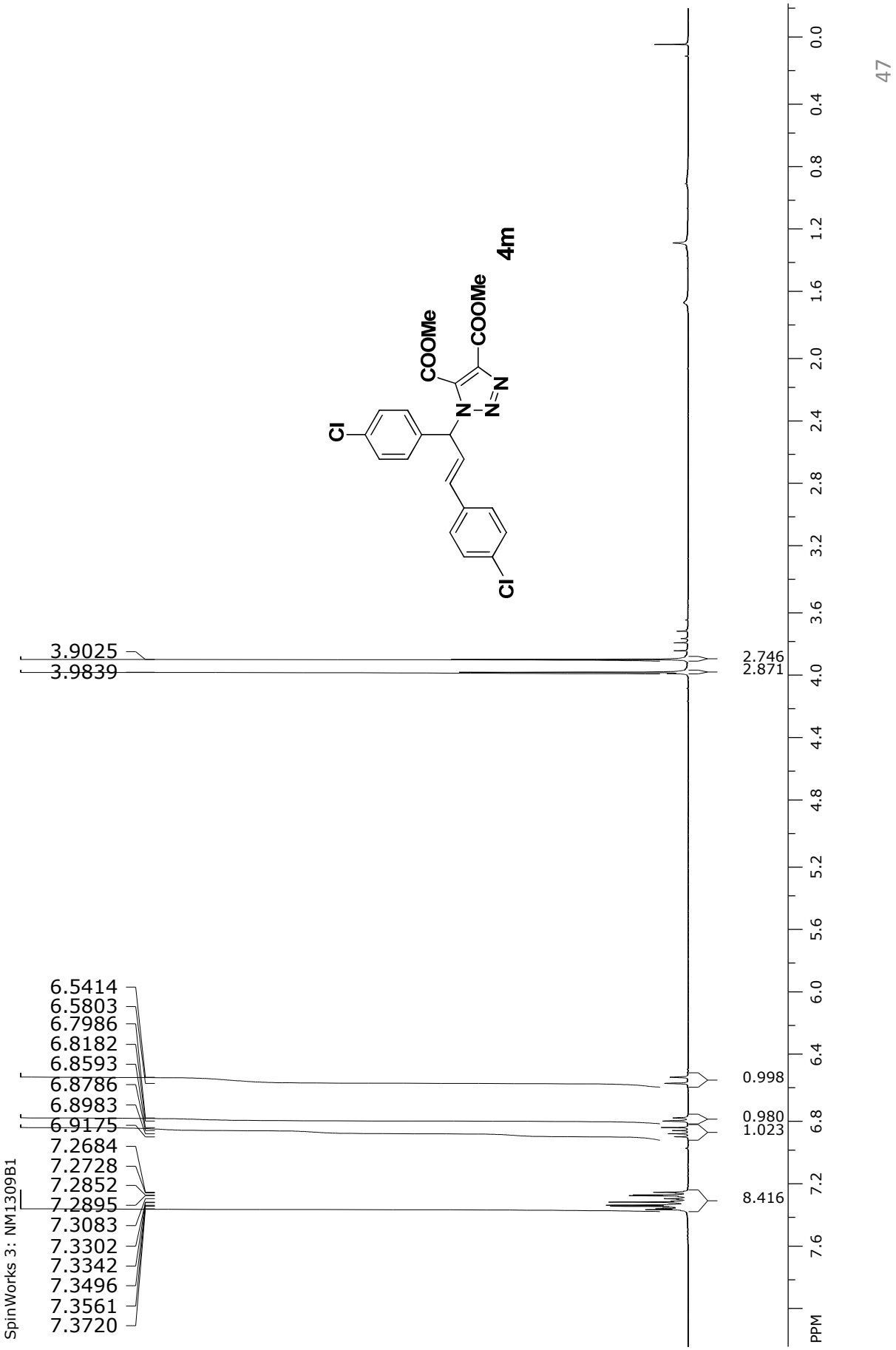

7.2264
7.2475
7.3255
7.3874
7.4088
8.1047
2.269
4.028
2.148
0.998
COOEt
4l
Cl
Cl
N
N
N
PPM
7.10
7.20
7.30
7.40
7.50
7.60
7.70
7.80
7.90
8.00
8.10
8.20
8.30
8.40
SpinWorks 3: AS 71 B1

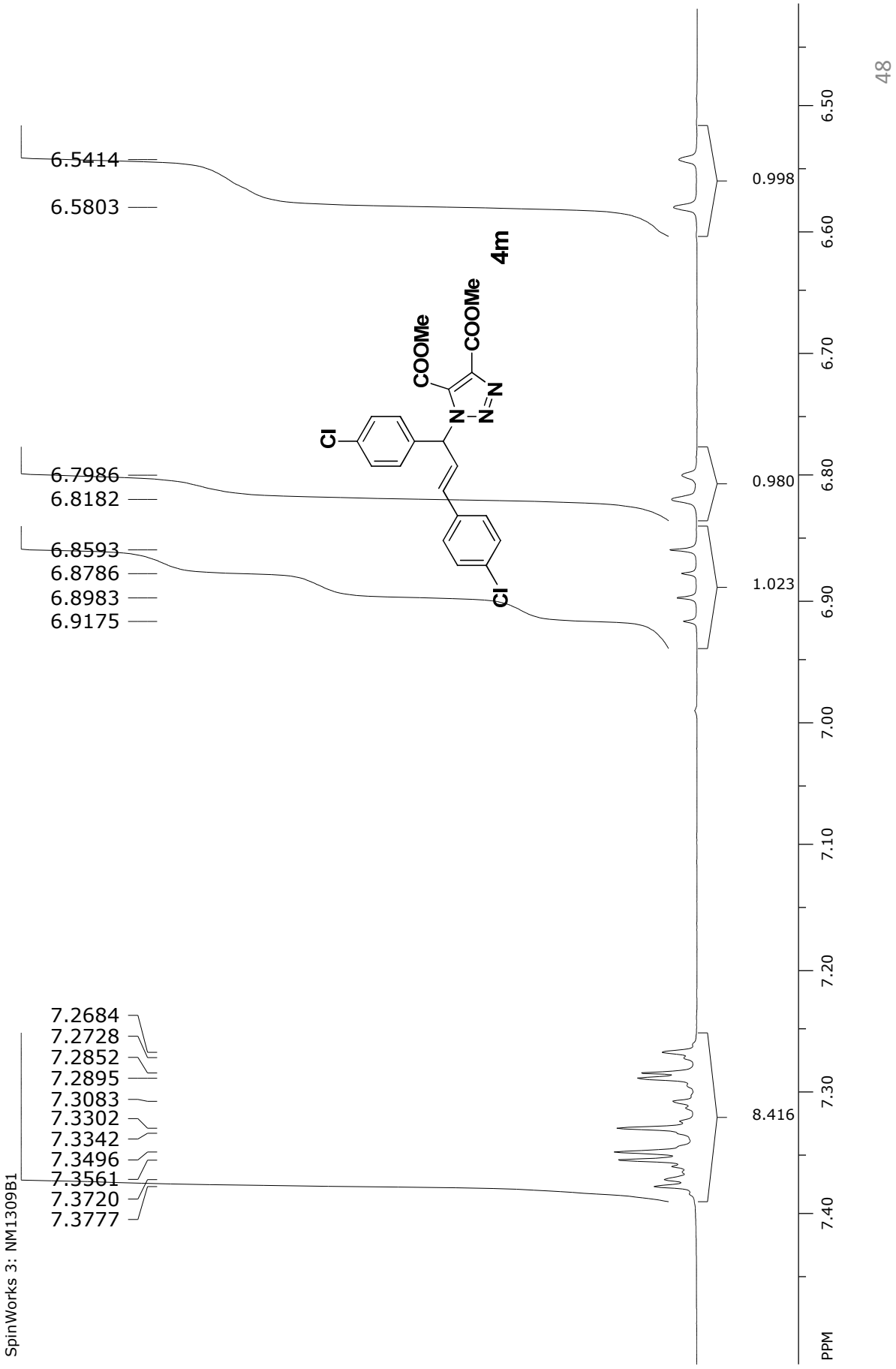
SpinWorks 3: AS 71 B1

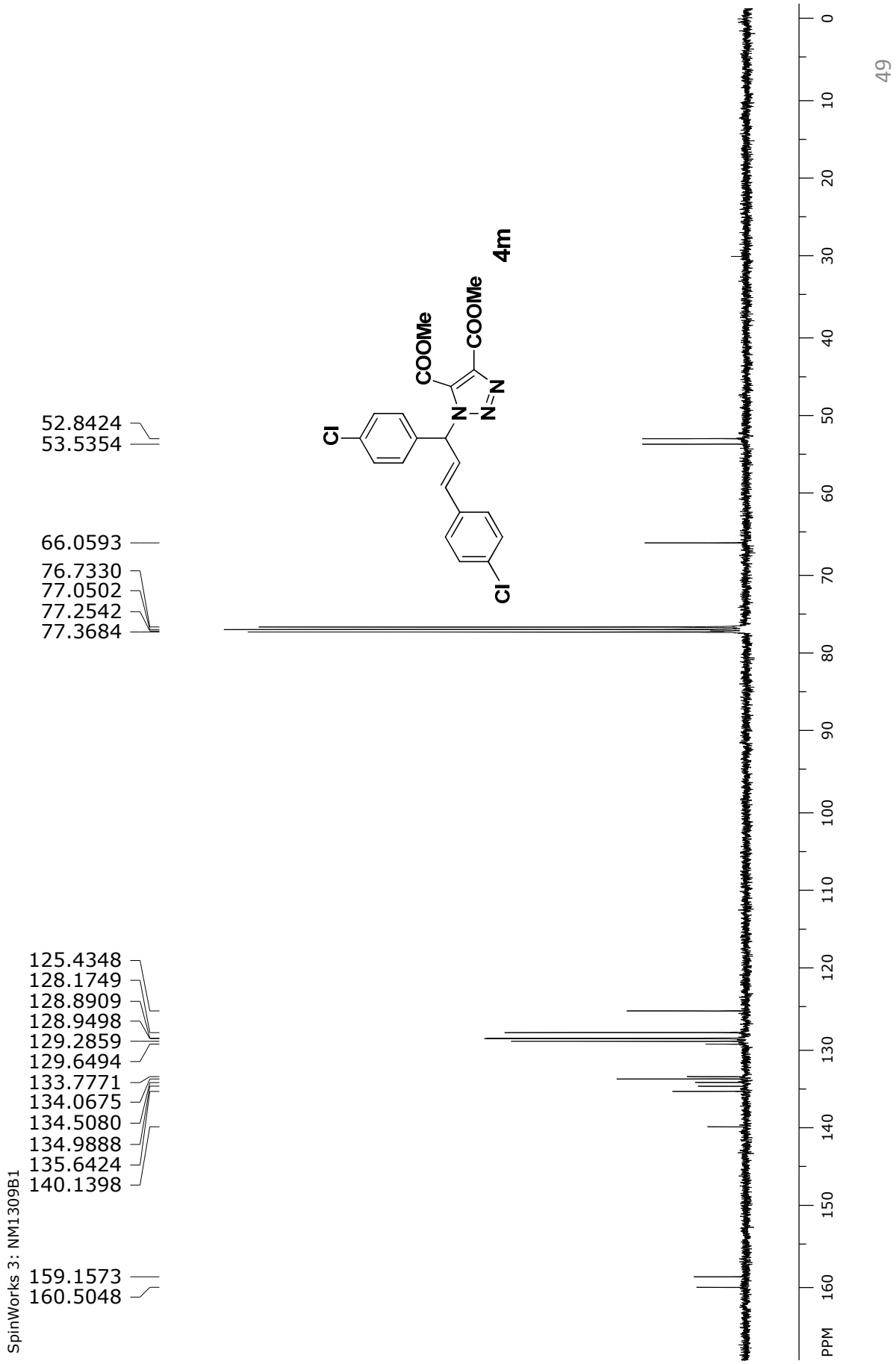


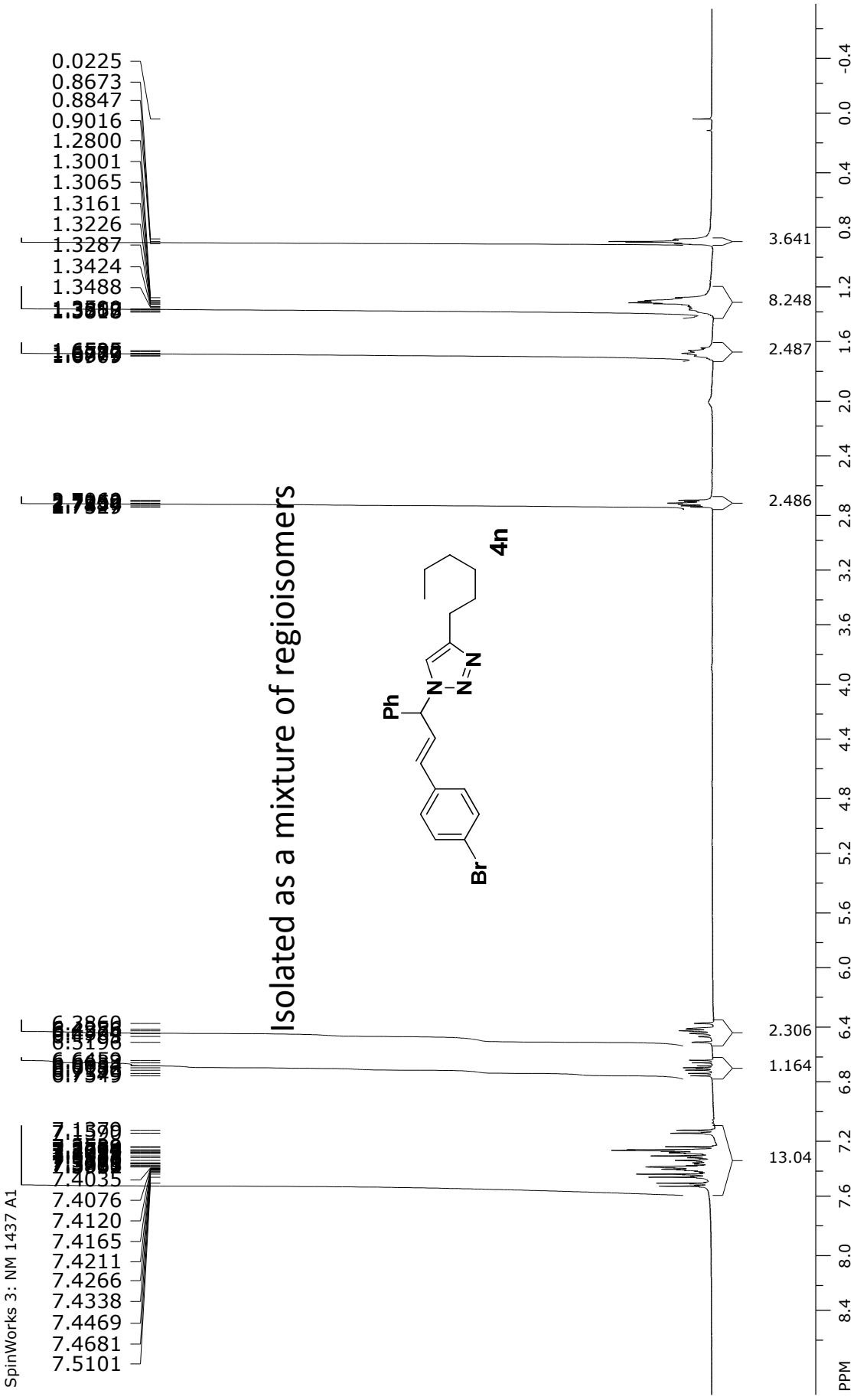

1.3881
1.4060
1.4238
4.3990
4.4168
4.4346
4.4524
3.576
2.227
COOEt
4l
Cl
Cl
PPM
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
SpinWorks 3: AS 71 B1

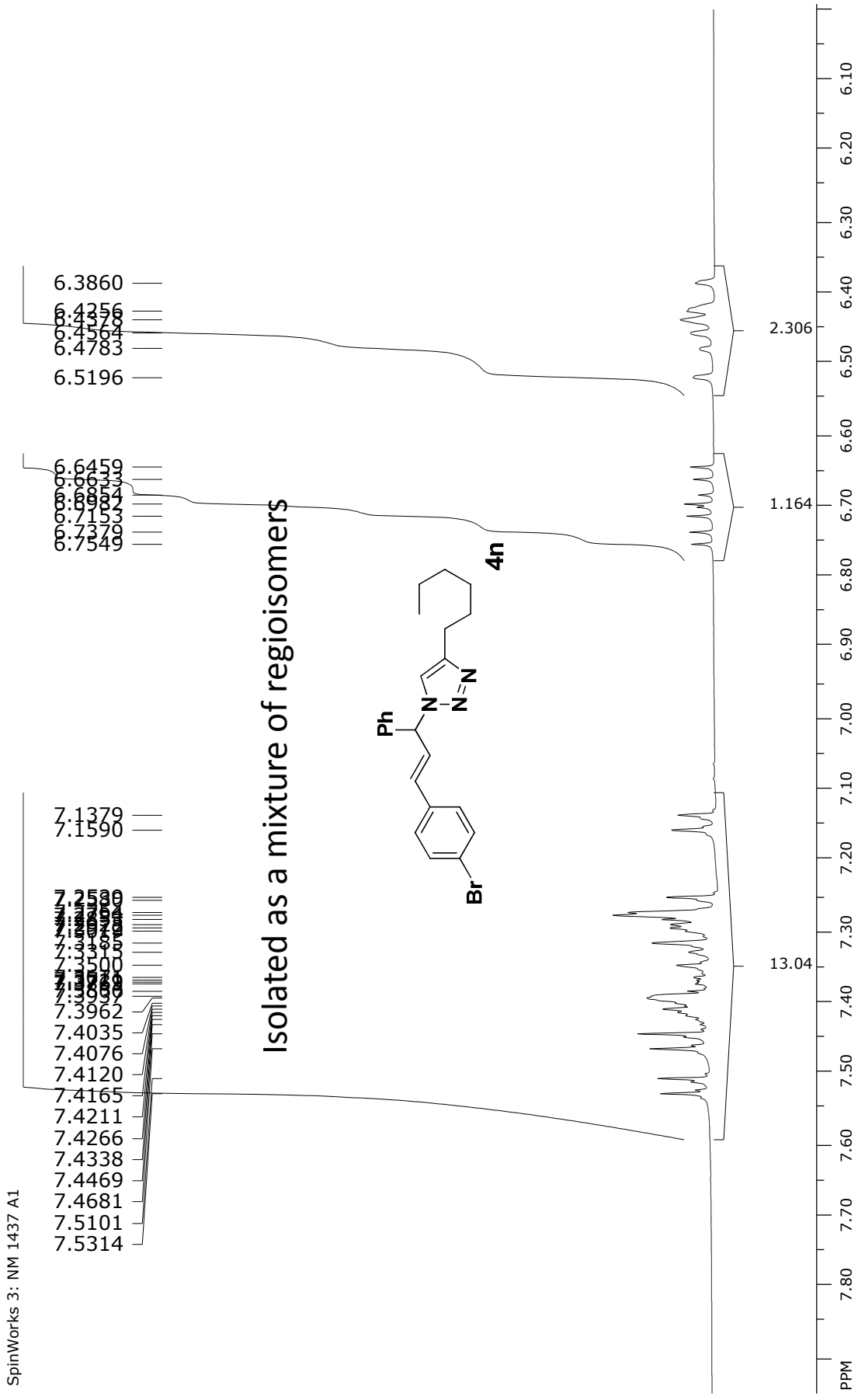

14.3363
61.4926
65.9827
76.7697
77.0870
77.4053
124.9694
126.7763
128.1320
128.8531
129.0214
129.5695
133.5186
134.3712
134.6789
135.2777
135.3920
140.4322
160.6551
SpinWorks 3: AS 71 B1
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
COOEt
4l
Cl
Cl
N
N
N

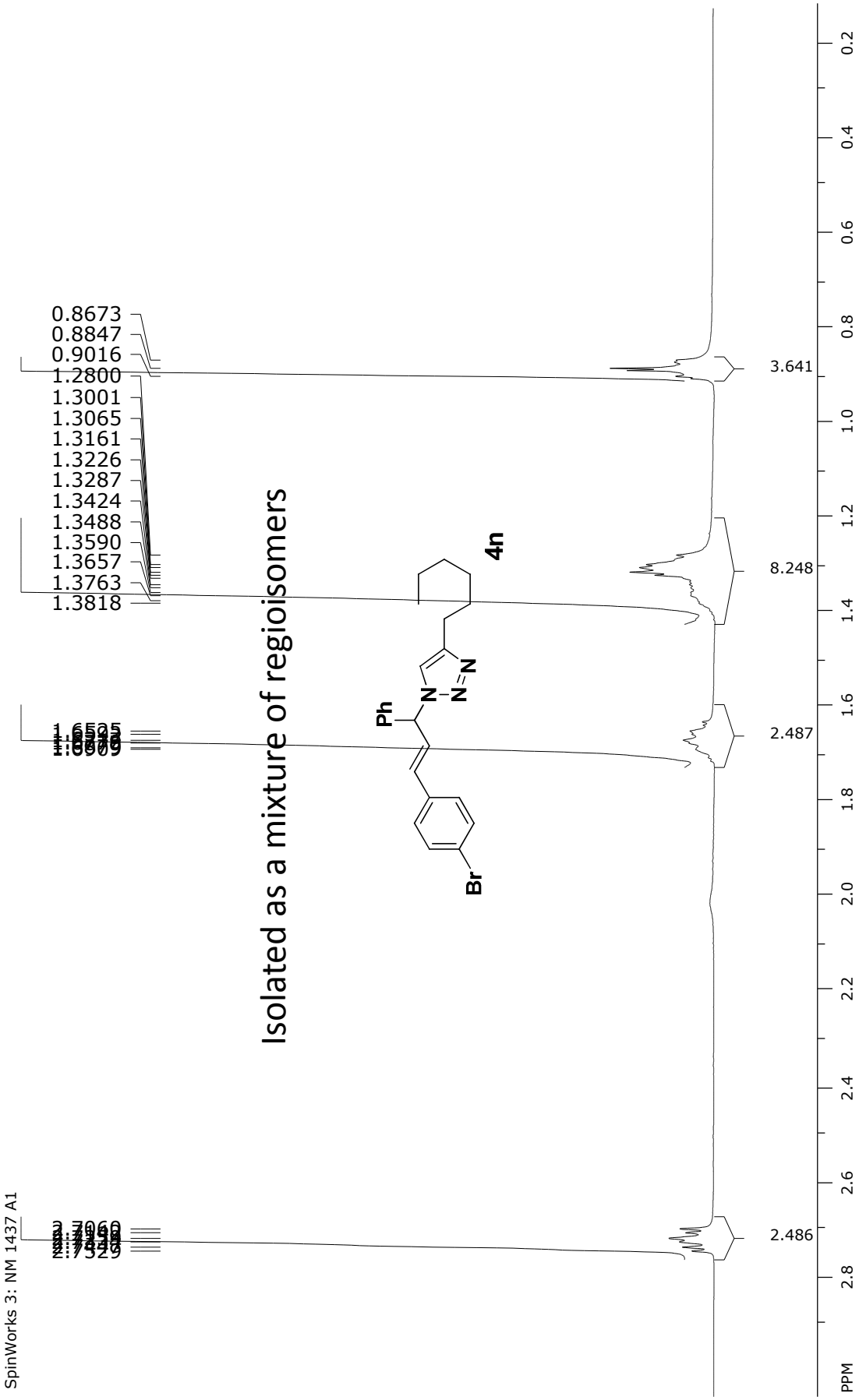

4m
COOMe
COOMe
Cl
Cl
N
N
N
3.9025
3.9839
6.5414
6.5803
6.7986
6.8182
6.8593
6.8786
6.8983
6.9175
7.2684
7.2728
7.2852
7.2895
7.3083
7.3302
7.3342
7.3496
7.3561
7.3720
2.746
2.871
0.998
0.980
1.023
8.416
SpinWorks 3: NM1309B1
PPM
0.0
0.4
0.8
1.2
1.6
2.0
2.4
2.8
3.2
3.6
4.0
4.4
4.8
5.2
5.6
6.0
6.4
6.8
7.2
7.6


4m
COOMe
COOMe
Cl
Cl
N
N
N
6.5414
6.5803
6.7986
6.8182
6.8593
6.8786
6.8983
6.9175
7.2684
7.2728
7.2852
7.2895
7.3083
7.3302
7.3342
7.3496
7.3561
7.3720
7.3777
0.998
0.980
1.023
8.416
6.50
6.60
6.70
6.80
6.90
7.00
7.10
7.20
7.30
7.40
PPM
SpinWorks 3: NM1309B1


4m
COOMe
COOMe
Cl
Cl
N
N
N
52.8424
53.5354
66.0593
76.7330
77.0502
77.2542
77.3684
125.4348
128.1749
128.8909
128.9498
129.2859
129.6494
133.7771
134.0675
134.5080
134.9888
135.6424
140.1398
159.1573
160.5048
SpinWorks 3: NM1309B1
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160


0.0225
0.8673
0.8847
0.9016
1.2800
1.3001
1.3065
1.3161
1.3226
1.3287
1.3424
1.3488
7.4035
7.4076
7.4120
7.4165
7.4211
7.4266
7.4338
7.4469
7.4681
7.5101
3.641
8.248
2.487
2.486
2.306
1.164
13.04
PPM
SpinWorks 3: NM 1437 A1
Isolated as a mixture of regioisomers
4n
Ph
N
N
N
Br


6.3860
6.4256
6.4378
6.4564
6.4783
6.5196
6.6459
6.6633
6.6854
6.6987
6.7153
6.7379
6.7549
7.1379
7.1590
7.3315
7.3500
7.3962
7.4035
7.4076
7.4120
7.4165
7.4211
7.4266
7.4338
7.4469
7.4681
7.5101
7.5314
2.306
1.164
13.04
Isolated as a mixture of regioisomers
4n
Ph
N
N
N
Br
PPM
6.10
6.20
6.30
6.40
6.50
6.60
6.70
6.80
6.90
7.00
7.10
7.20
7.30
7.40
7.50
7.60
7.70
7.80
SpinWorks 3: NM 1437 A1


SpinWorks 3: NM 1437 A1
0.8673
0.8847
0.9016
1.2800
1.3001
1.3065
1.3161
1.3226
1.3287
1.3424
1.3488
1.3590
1.3657
1.3763
1.3818
Isolated as a mixture of regioisomers
4n
Ph
N
N
N
Br
3.641
8.248
2.487
2.486
PPM
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8

SpinWorks 3: NM 1437 A1

148.7824
148.6572
137.8939
137.2902
135.4154
134.9379
134.6355
133.0642
132.1846
131.8207
129.1233
129.0510
128.7608
128.6647
128.3294
127.4396
126.8755
126.8505
125.2668
122.7443
122.3334
119.8899
119.7823

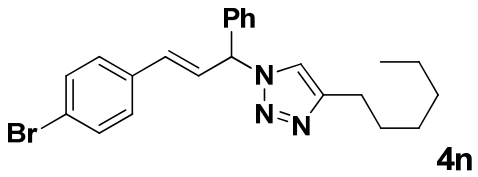
76.7821
77.1002
77.4182

65.5571
66.0904

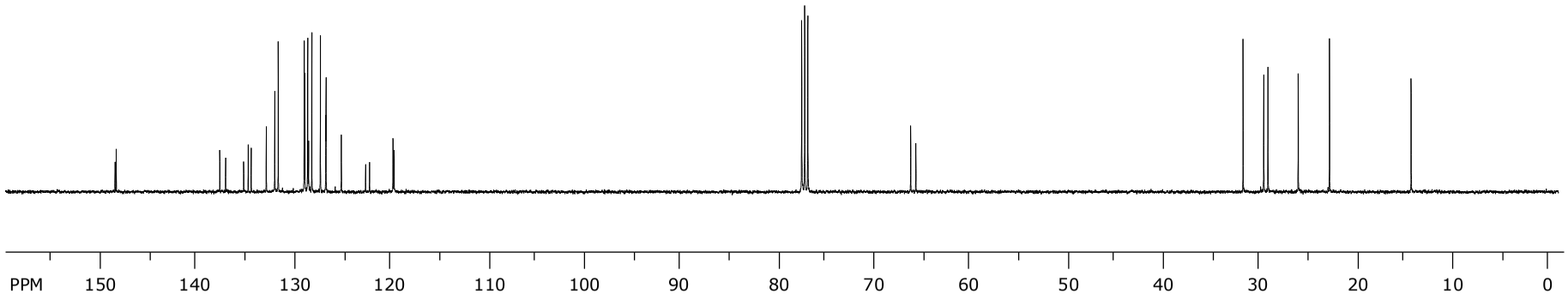
31.5451
29.3986
28.9618
25.8146
22.5619

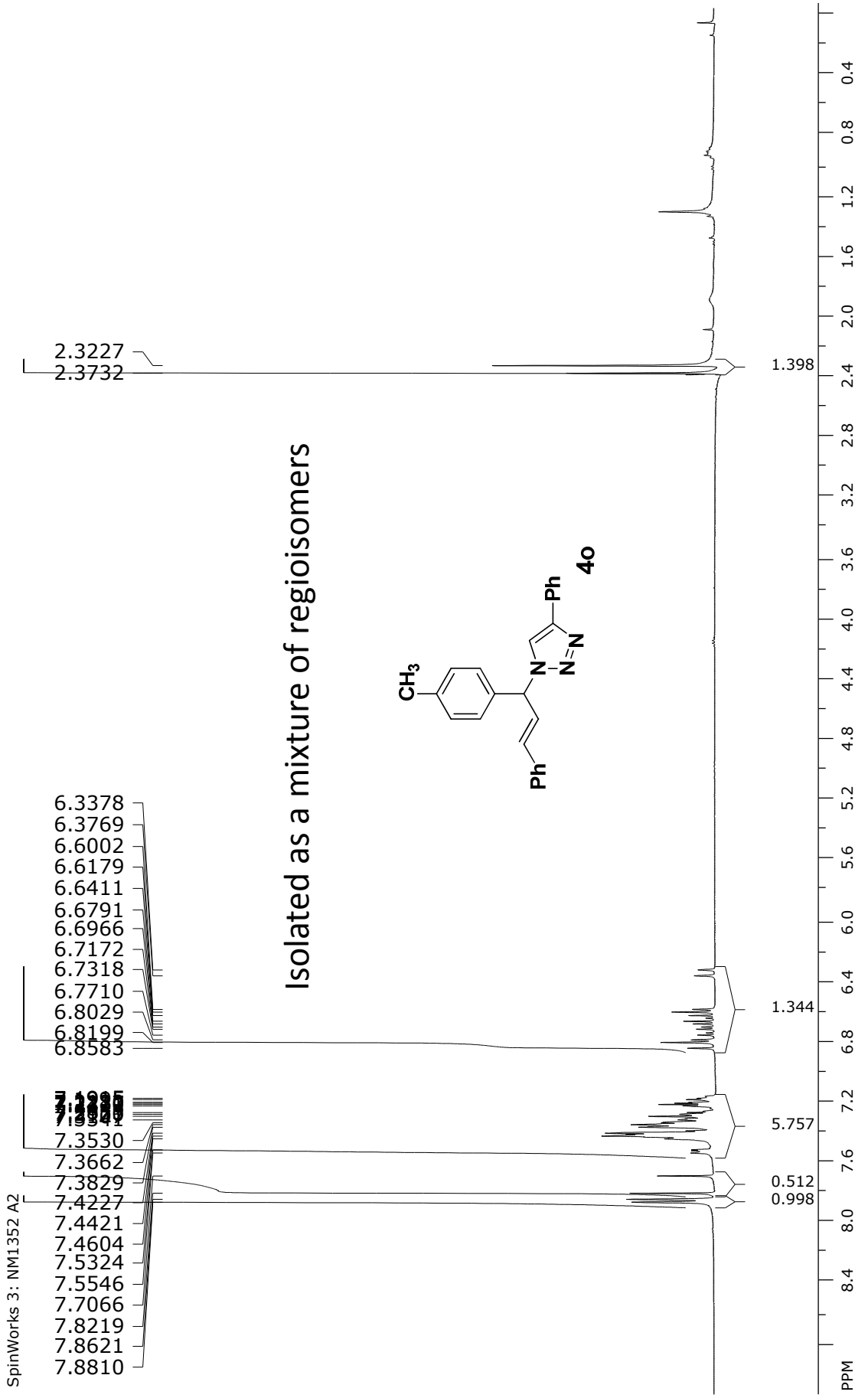
14.0797

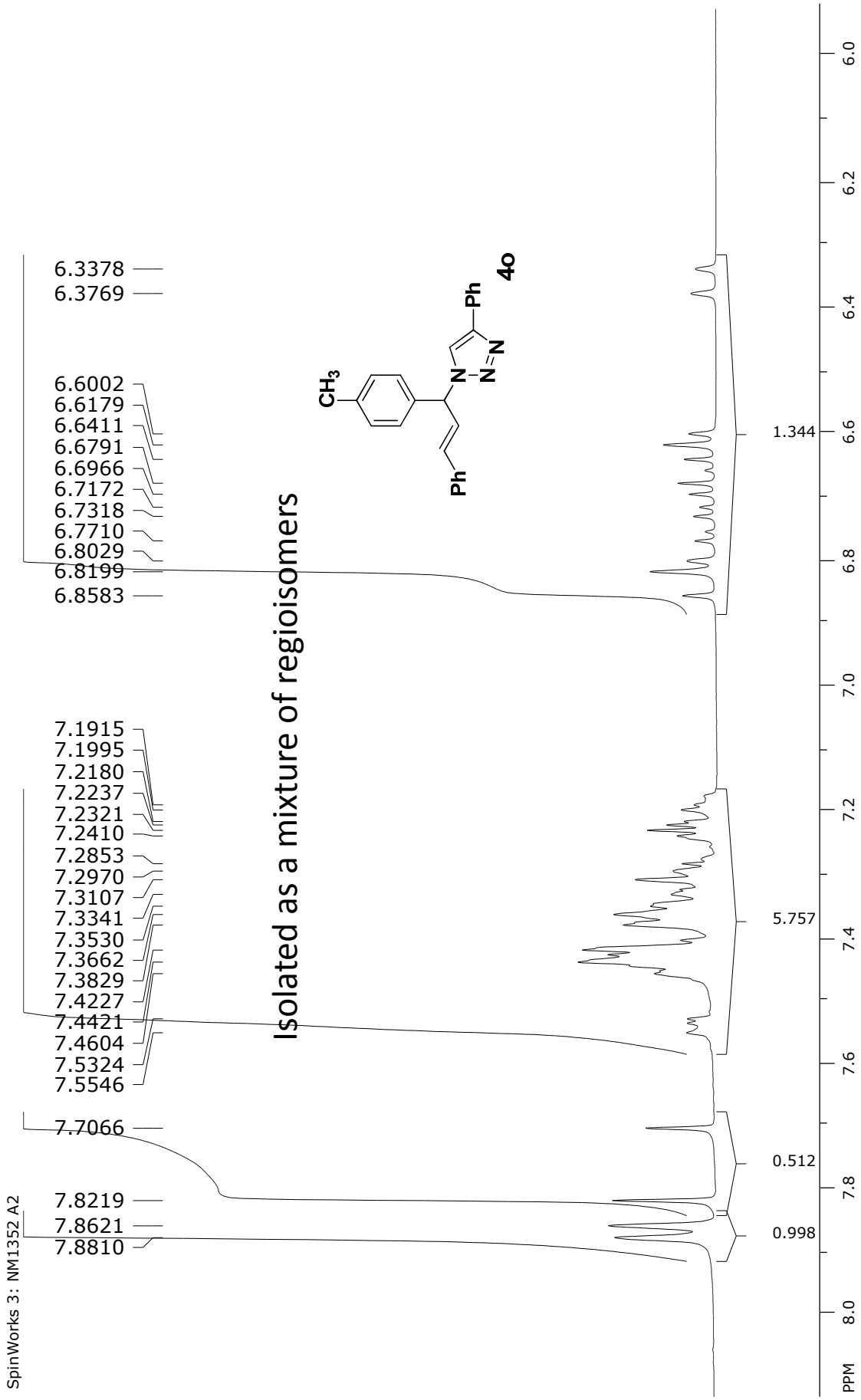
Isolated as a mixture of regioisomers

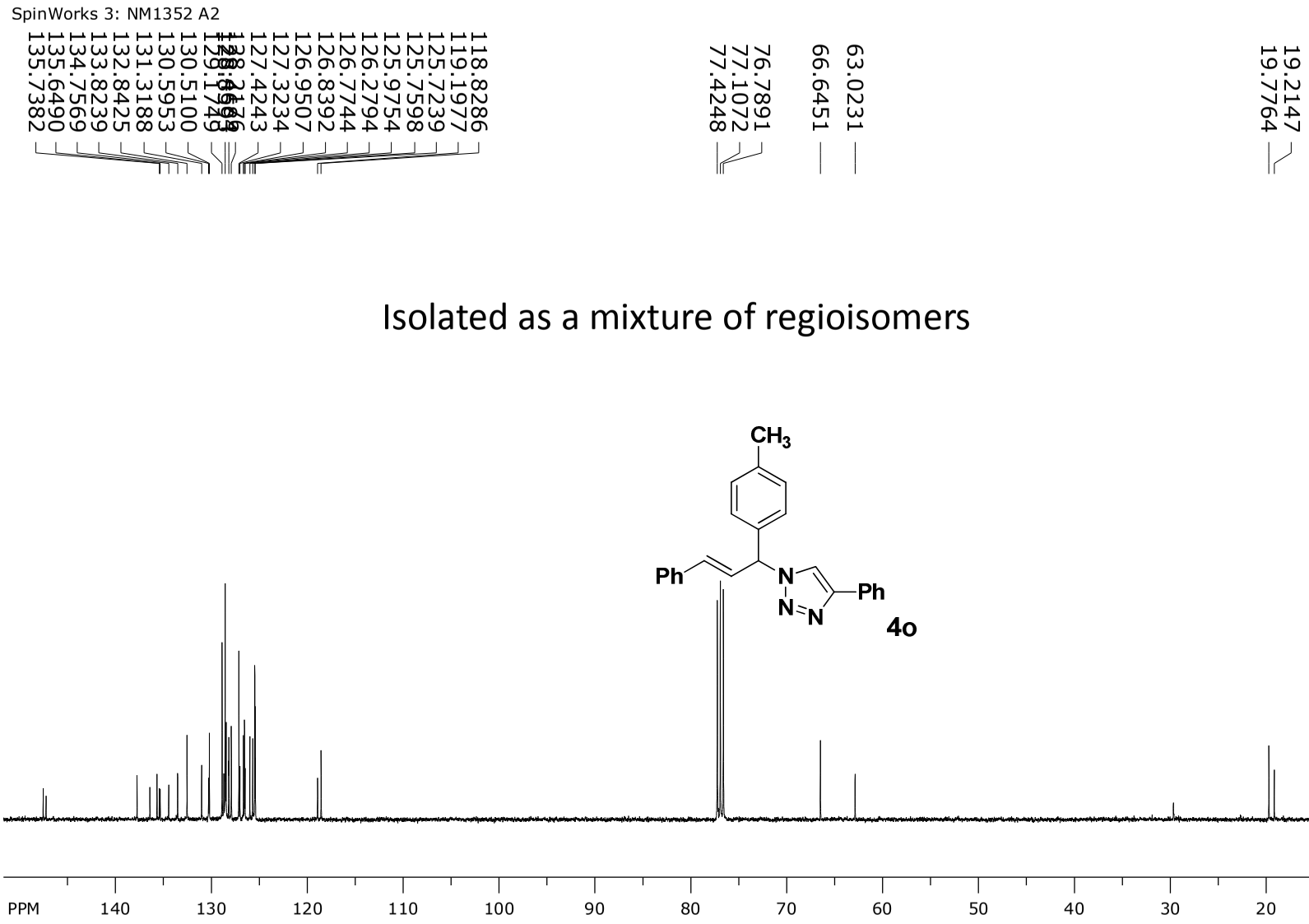


4n




SpinWorks 3: NM1352 A2
2.3227
2.3732
6.3378
6.3769
6.6002
6.6179
6.6411
6.6791
6.6966
6.7172
6.7318
6.7710
6.8029
6.8199
6.8583
7.3530
7.3662
7.3829
7.4227
7.4421
7.4604
7.5324
7.5546
7.7066
7.8219
7.8621
7.8810
1.398
1.344
5.757
0.512
0.998
PPM
Isolated as a mixture of regioisomers
4o
Ph
N
N
N
CH3
Ph

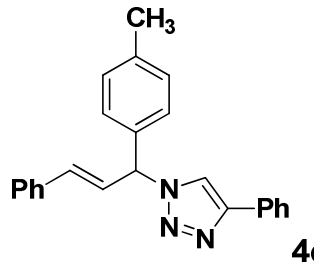

6.3378
6.3769
6.6002
6.6179
6.6411
6.6791
6.6966
6.7172
6.7318
6.7710
6.8029
6.8199
6.8583
7.1915
7.1995
7.2180
7.2237
7.2321
7.2410
7.2853
7.2970
7.3107
7.3341
7.3530
7.3662
7.3829
7.4227
7.4421
7.4604
7.5324
7.5546
7.7066
7.8219
7.8621
7.8810
Isolated as a mixture of regioisomers
4o
Ph
Ph
CH3
N
N
N
1.344
5.757
0.512
0.998
6.0
6.2
6.4
6.6
6.8
7.0
7.2
7.4
7.6
7.8
8.0
PPM
SpinWorks 3: NM1352 A2



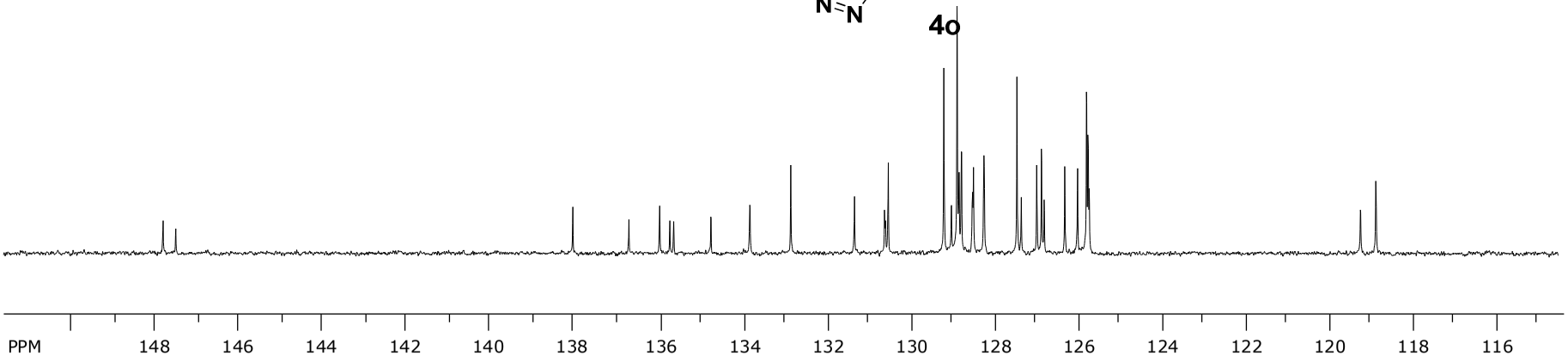
SpinWorks 3: NM1352 A2

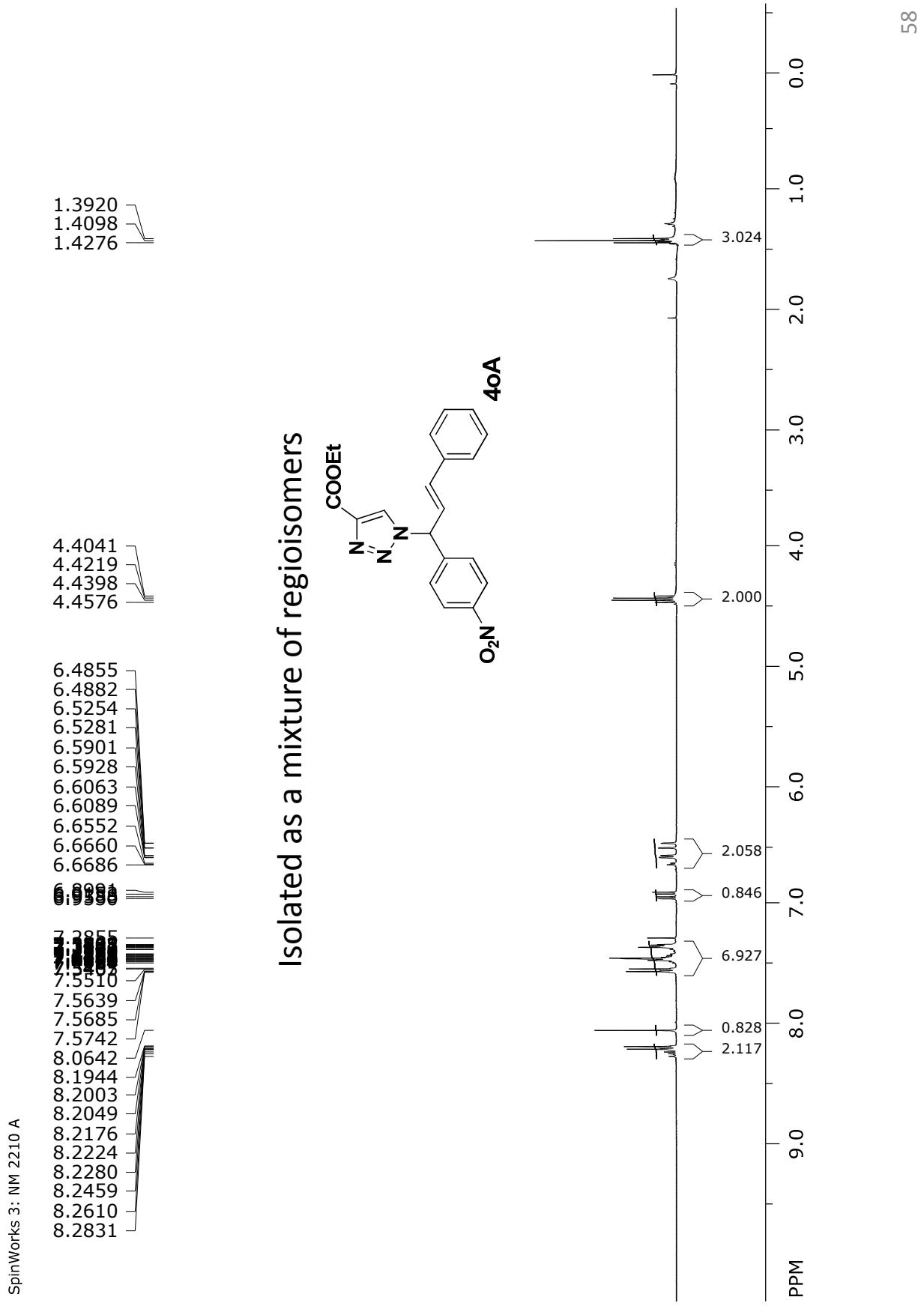
147.8785
147.5723
138.0641
136.7215
135.9843
135.7382
135.6490
134.7569
133.8239
132.8425
131.3188
130.5953
130.5100
129.1749
128.8593
128.4684
128.2176
127.4243
127.3234
126.9507
126.8392
126.7744
126.2794
125.9754
125.7598
125.7239
119.1977
118.8286

Isolated as a mixture of regioisomers



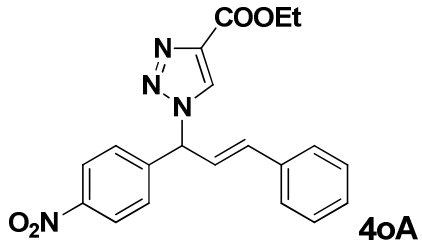
4o



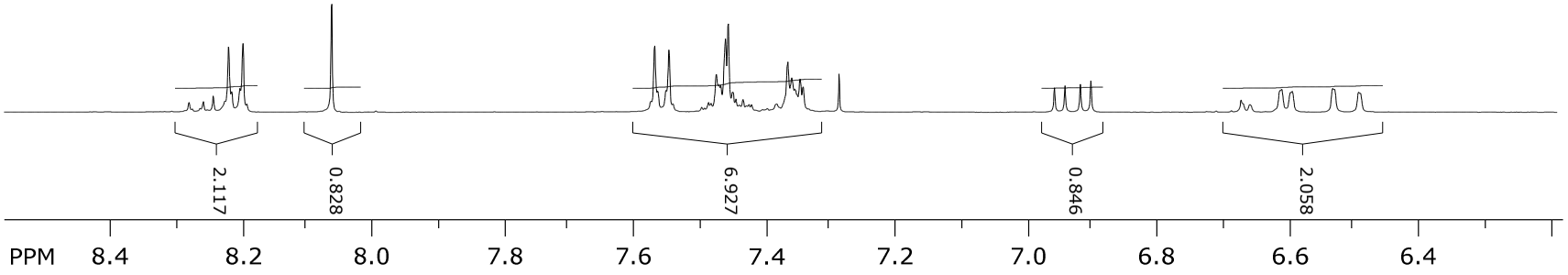

SpinWorks 3: NM 2210 A
1.3920
1.4098
1.4276
4.4041
4.4219
4.4398
4.4576
6.4855
6.4882
6.5254
6.5281
6.5901
6.5928
6.6063
6.6089
6.6552
6.6660
6.6686
7.5510
7.5639
7.5685
7.5742
8.0642
8.1944
8.2003
8.2049
8.2176
8.2224
8.2280
8.2459
8.2610
8.2831
Isolated as a mixture of regioisomers
COOEt
N
N
N
4oA
O2N
3.024
2.000
2.058
0.846
6.927
0.828
2.117
PPM
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0

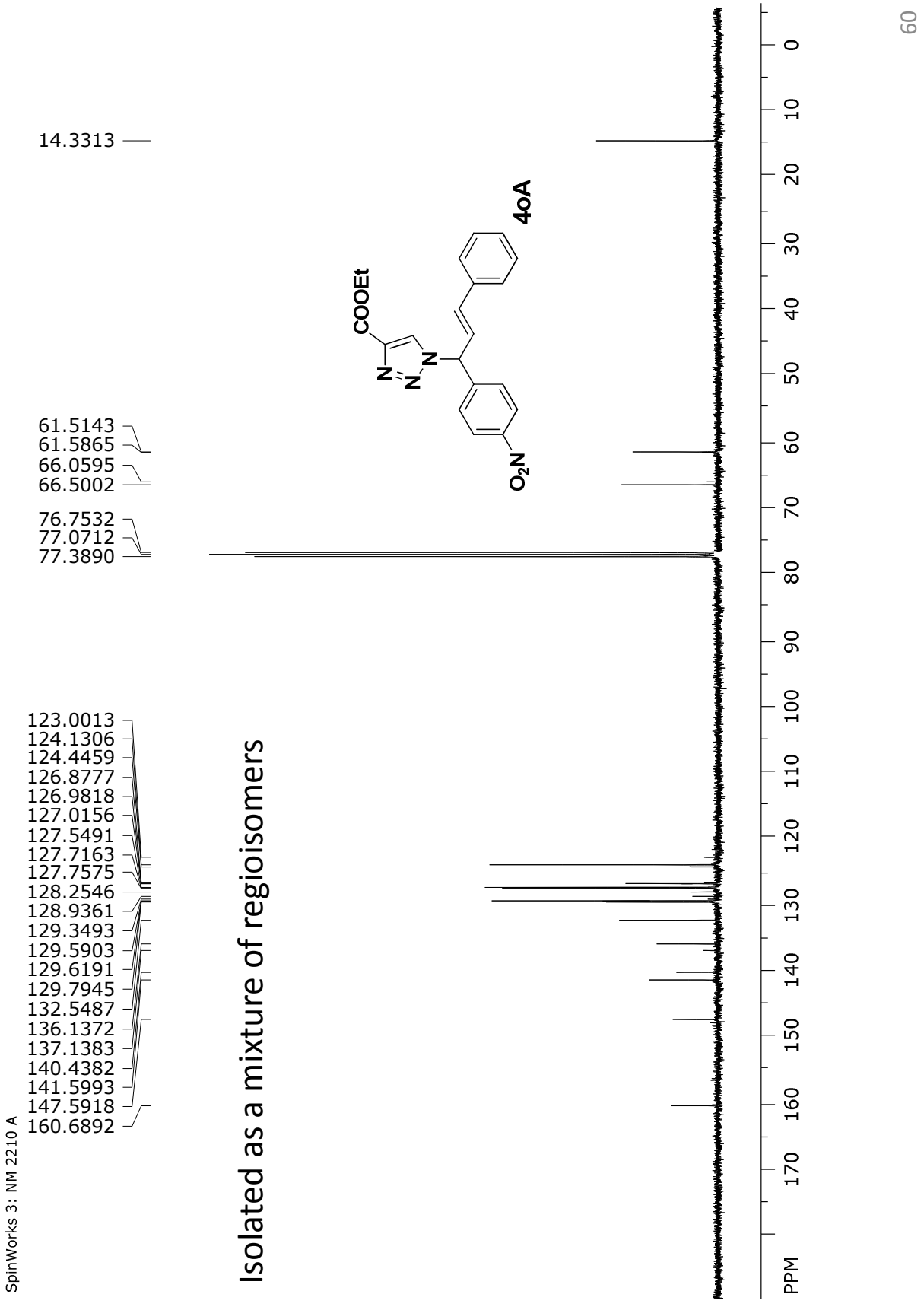
SpinWorks 3: NM 2210 A

Isolated as a mixture of regioisomers



4oA

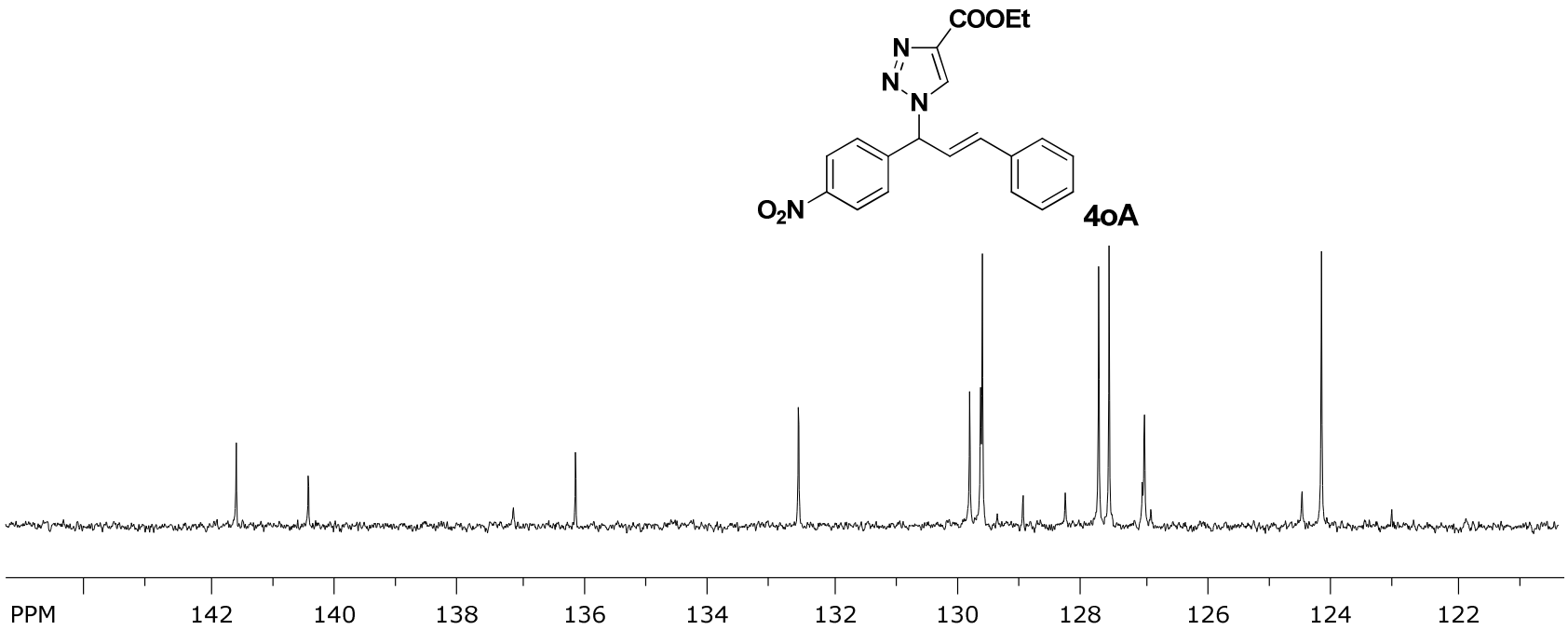


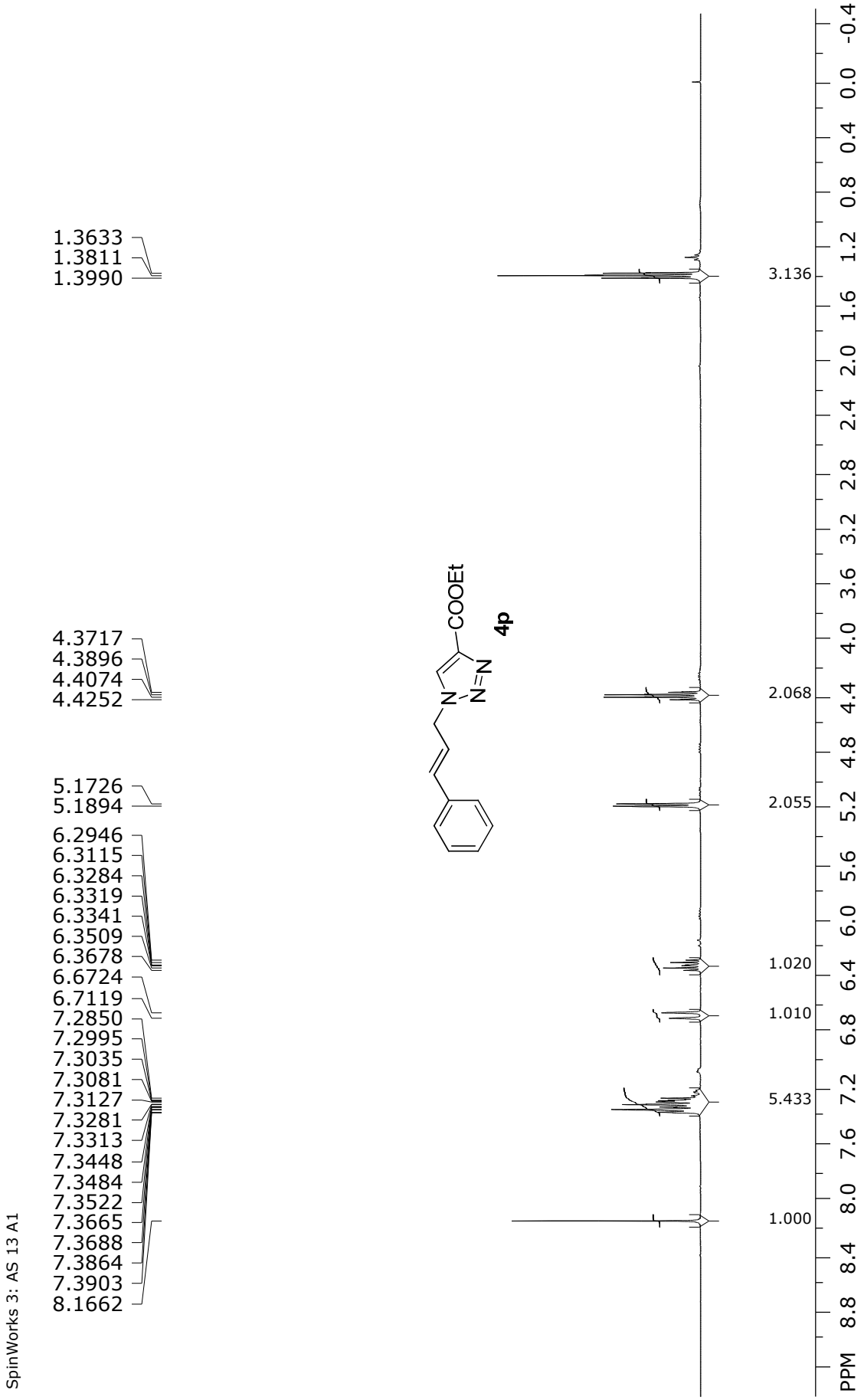

SpinWorks 3: NM 2210 A
Isolated as a mixture of regioisomers
4oA
COOEt
O_2N
14.3313
61.5143
61.5865
66.0595
66.5002
76.7532
77.0712
77.3890
123.0013
124.1306
124.4459
126.8777
126.9818
127.0156
127.5491
127.7163
127.7575
128.2546
128.9361
129.3493
129.5903
129.6191
129.7945
132.5487
136.1372
137.1383
140.4382
141.5993
147.5918
160.6892
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170

SpinWorks 3: NM 2210 A

141.5993
140.4382
137.1383
136.1372
132.5487
129.7945
129.6191
129.5903
129.3493
128.9361
128.2546
127.7575
127.7163
127.5491
127.0156
126.9818
126.8777
124.4459
124.1306
123.0013

Isolated as a mixture of regioisomers

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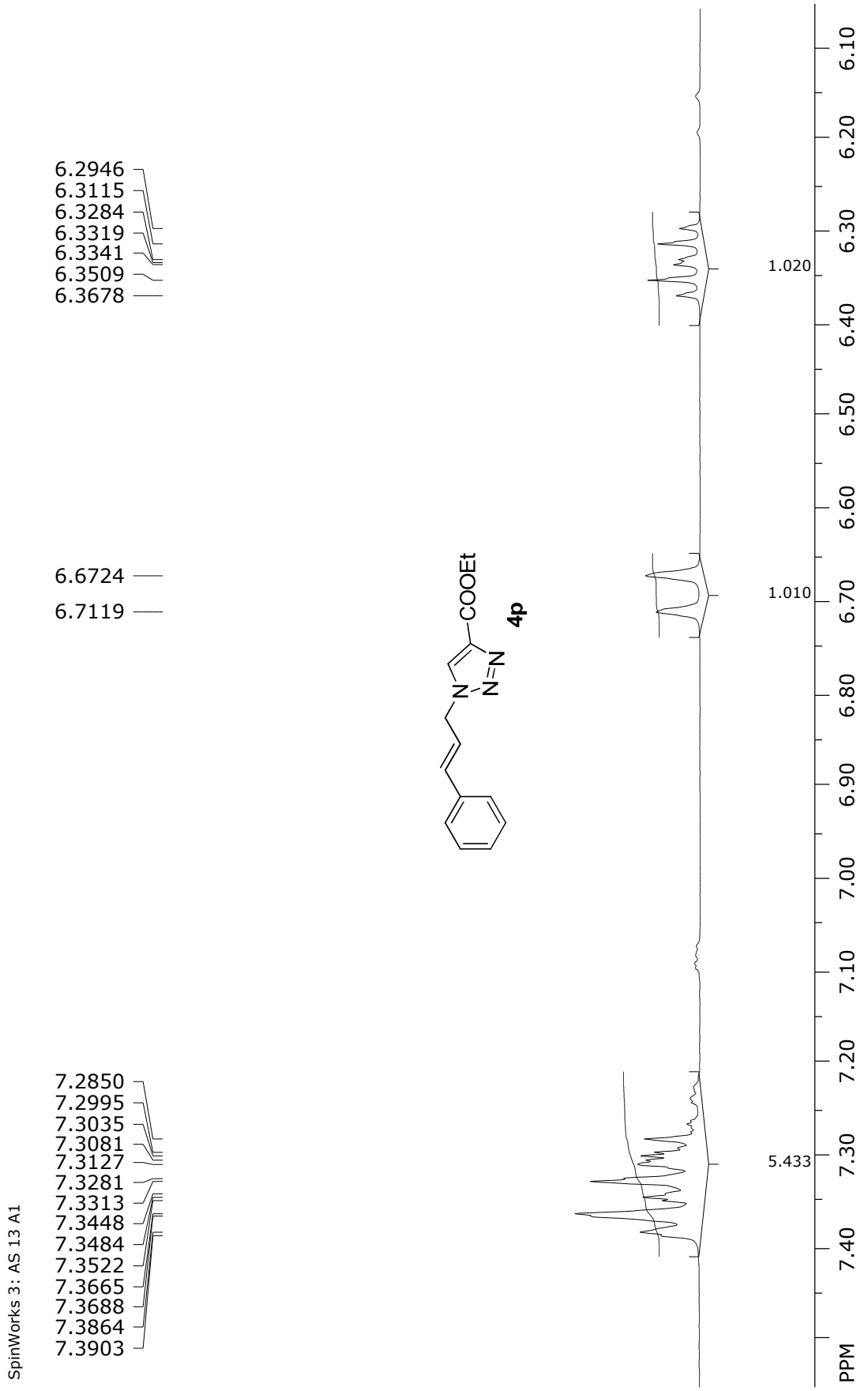
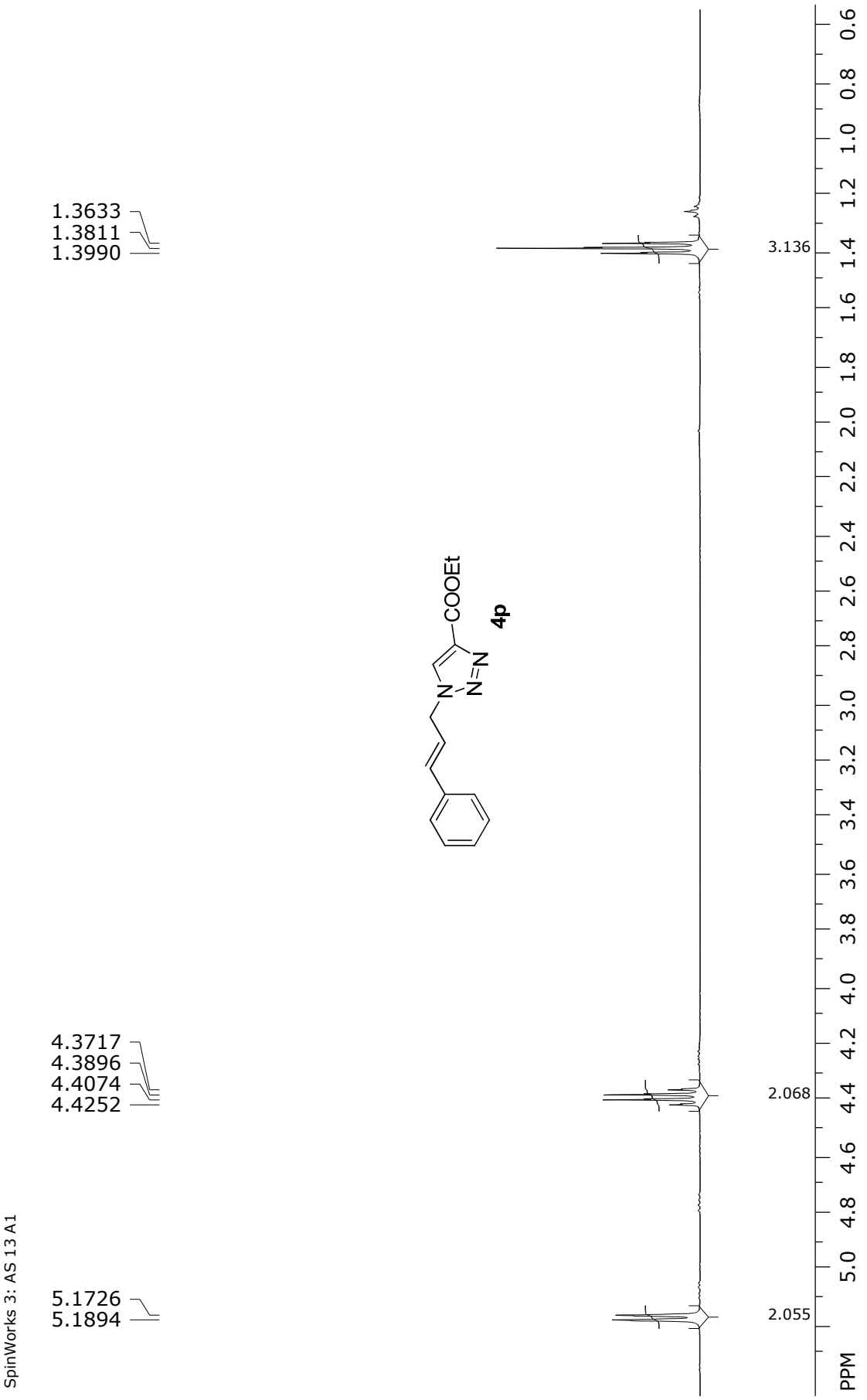
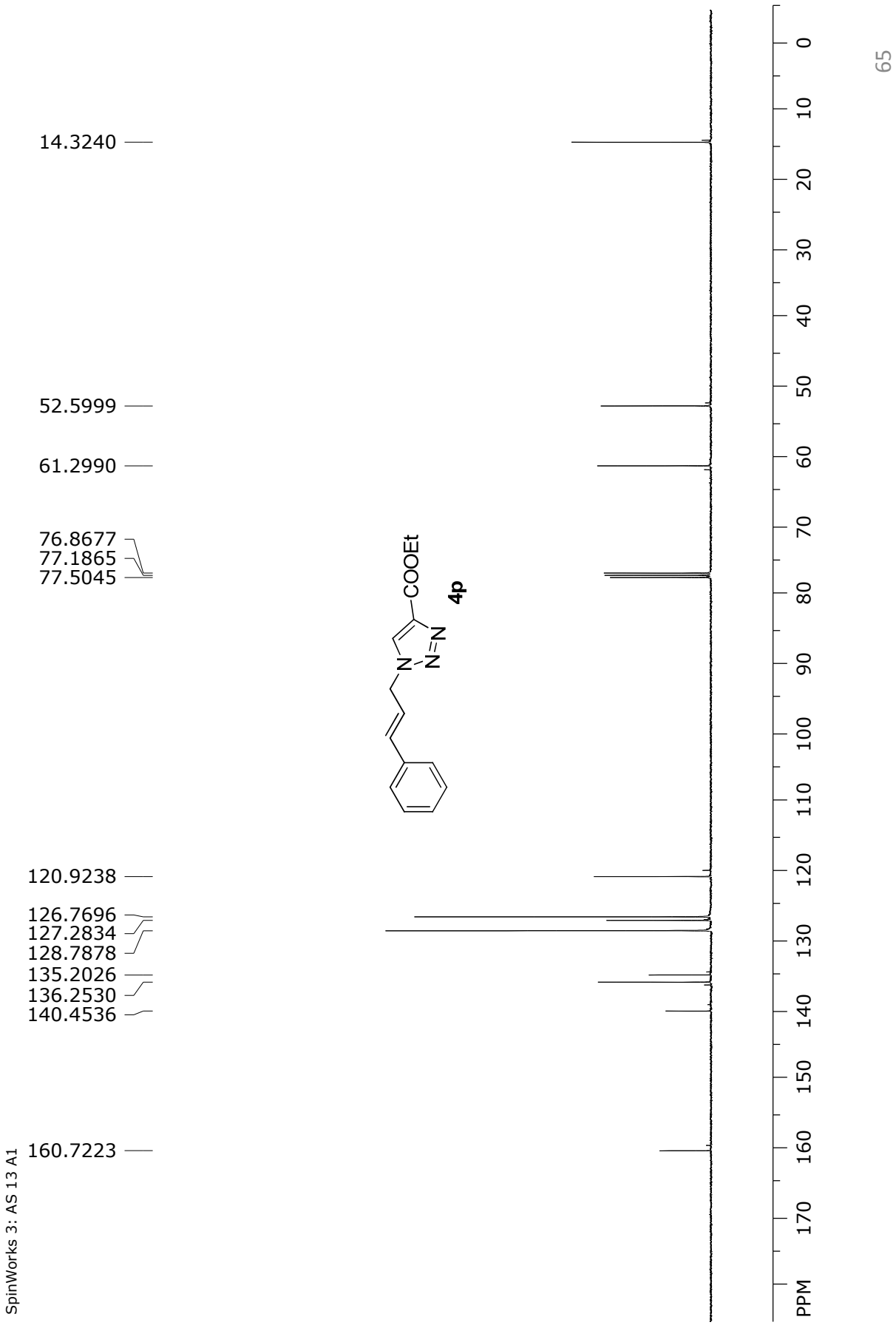
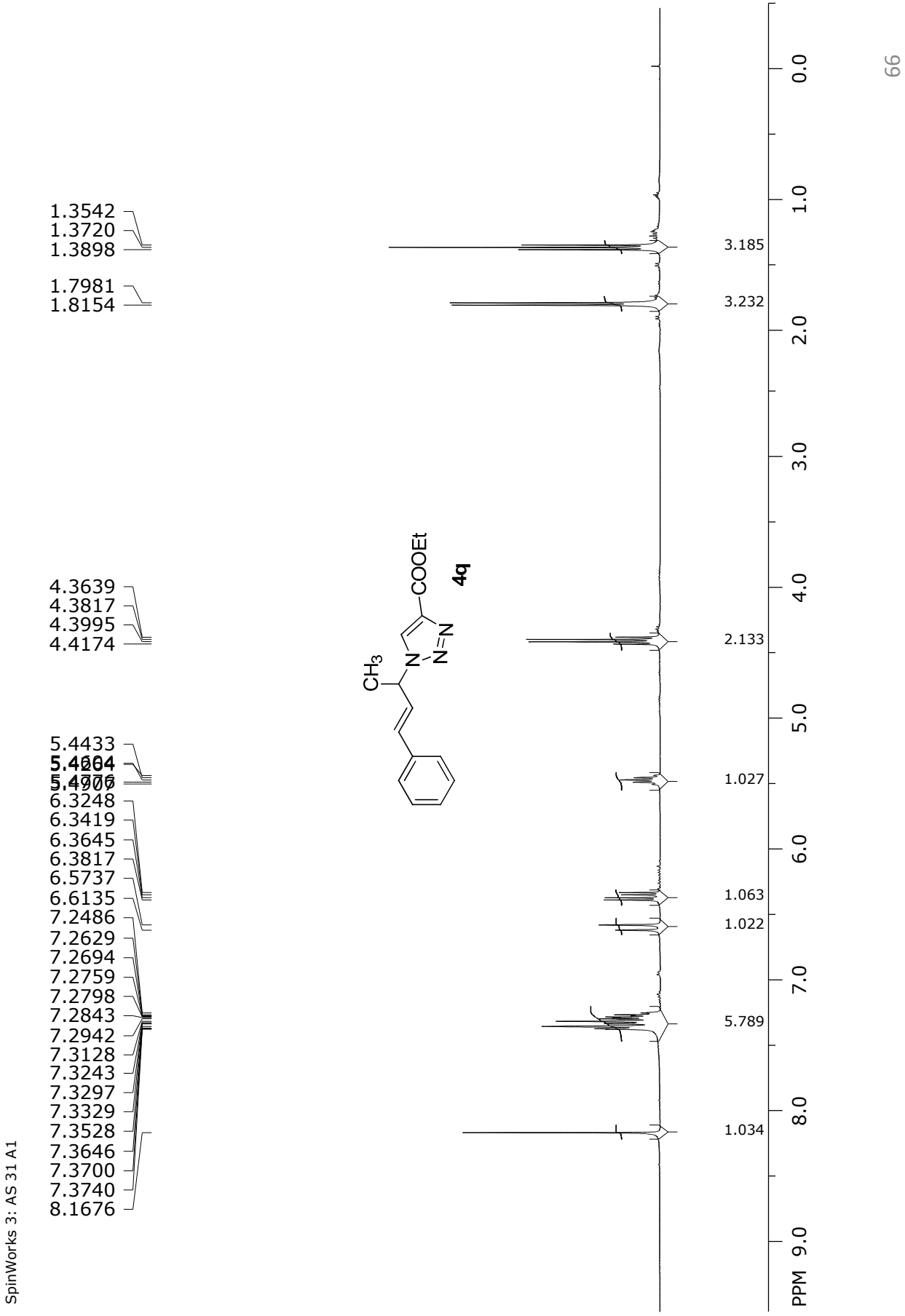
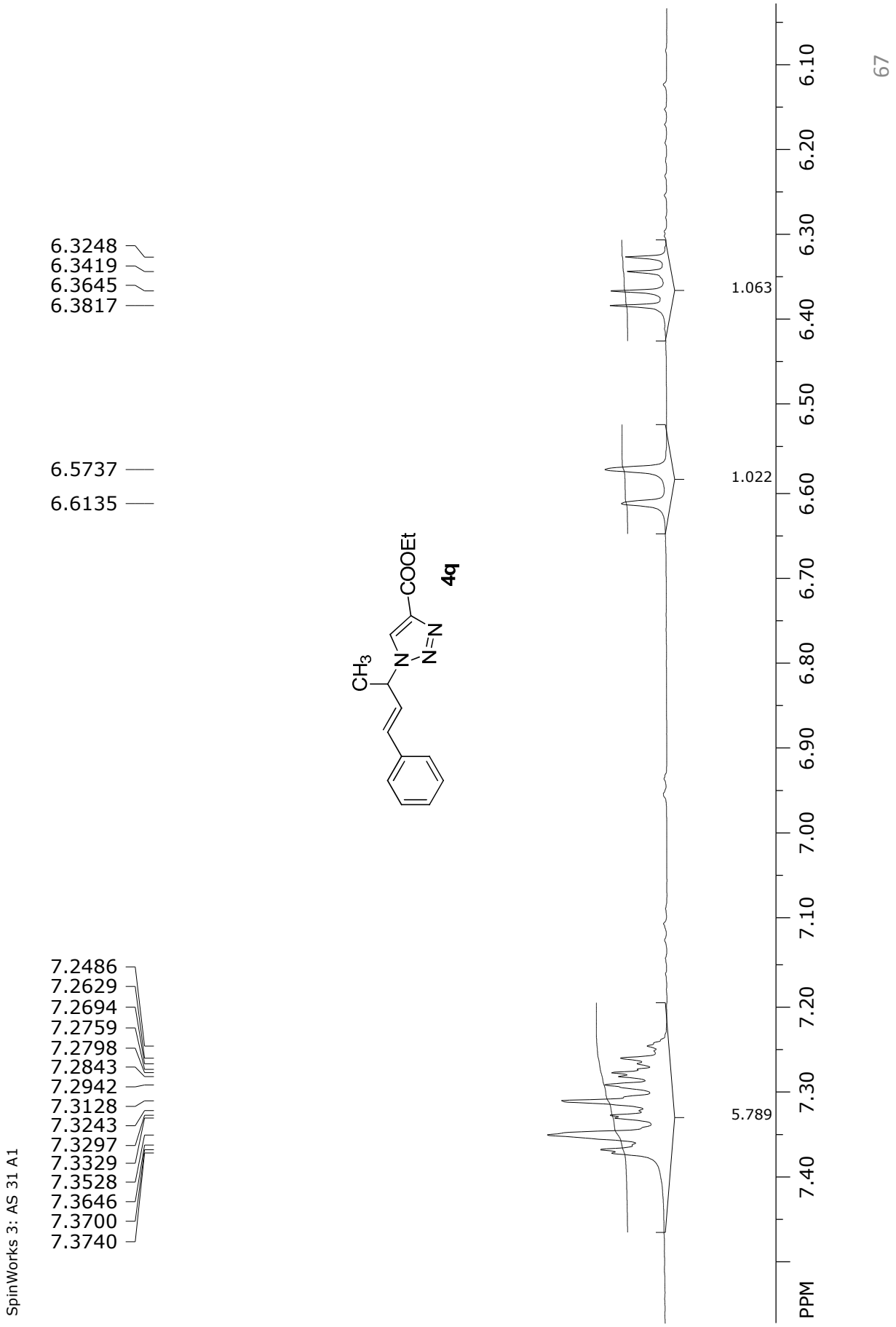
1.3811
1.3990
4.3717
4.3896
4.4074
4.4252
5.1726
5.1894
6.2946
6.3115
6.3284
6.3319
6.3341
6.3509
6.3678
6.6724
6.7119
7.2850
7.2995
7.3035
7.3081
7.3127
7.3281
7.3313
7.3448
7.3484
7.3522
7.3665
7.3688
7.3864
7.3903
8.1662
COOEt
N
N=N
4p
3.136
2.068
2.055
1.020
1.010
5.433
1.000
PPM
8.8
8.4
8.0
7.6
7.2
6.8
6.4
6.0
5.6
5.2
4.8
4.4
4.0
3.6
3.2
2.8
2.4
2.0
1.6
1.2
0.8
0.4
0.0
-0.4
SpinWorks 3: AS 13 A1

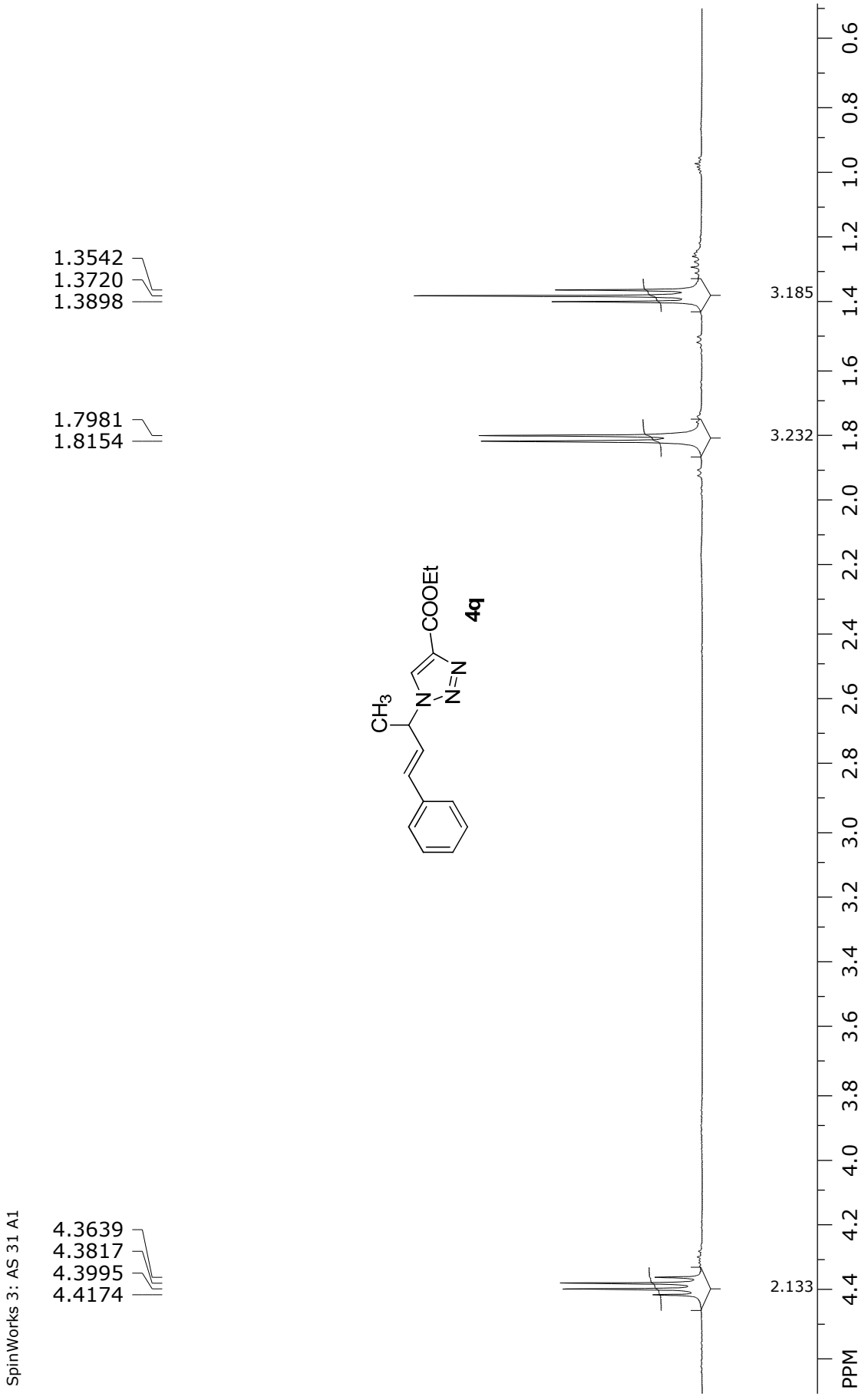

6.2946
6.3115
6.3284
6.3319
6.3341
6.3509
6.3678
6.6724
6.7119
7.2850
7.2995
7.3035
7.3081
7.3127
7.3281
7.3313
7.3448
7.3484
7.3522
7.3665
7.3688
7.3864
7.3903
SpinWorks 3: AS 13 A1
COOEt
N
N=N
4p
1.020
1.010
5.433
PPM
6.10
6.20
6.30
6.40
6.50
6.60
6.70
6.80
6.90
7.00
7.10
7.20
7.30
7.40

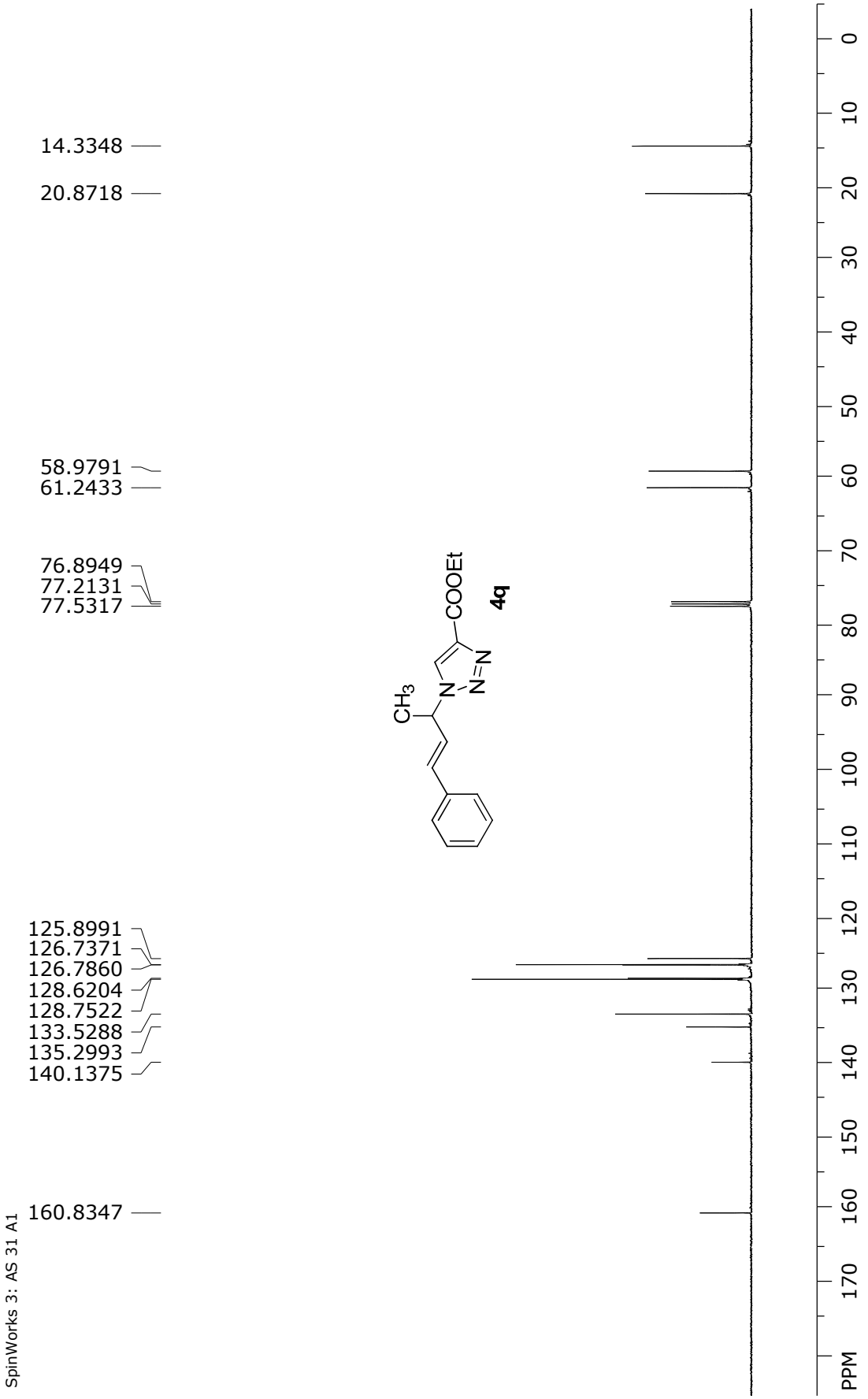

1.3633
1.3811
1.3990
4.3717
4.3896
4.4074
4.4252
5.1726
5.1894
COOEt
4p
3.136
2.068
2.055
PPM
SpinWorks 3: AS 13 A1

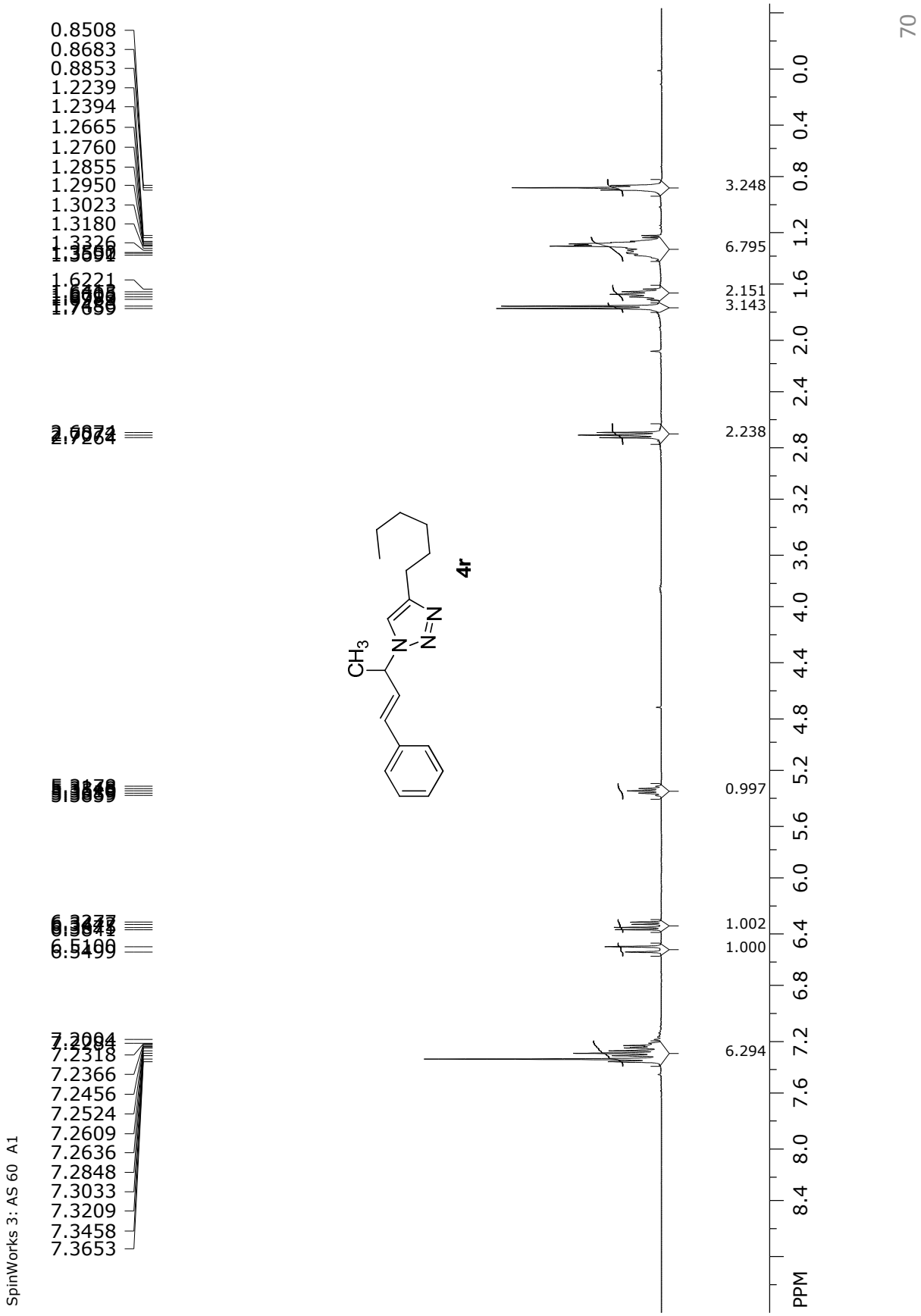

14.3240
52.5999
61.2990
76.8677
77.1865
77.5045
120.9238
126.7696
127.2834
128.7878
135.2026
136.2530
140.4536
160.7223
COOEt
4p
N
N=N
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
SpinWorks 3: AS 13 A1

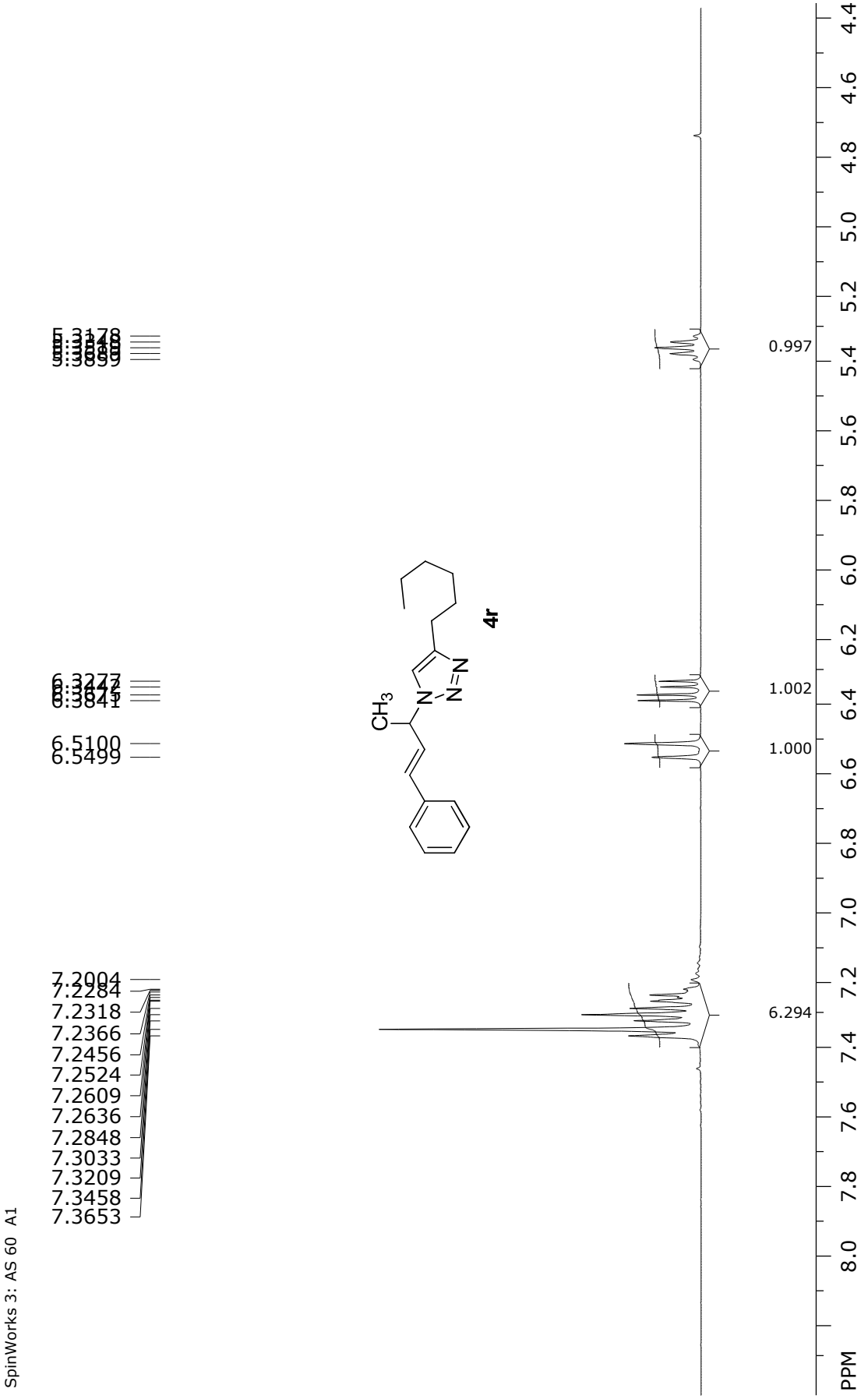

1.3542
1.3720
1.3898
1.7981
1.8154
4.3639
4.3817
4.3995
4.4174
5.4433
5.4604
6.3248
6.3419
6.3645
6.3817
6.5737
6.6135
7.2486
7.2629
7.2694
7.2759
7.2798
7.2843
7.2942
7.3128
7.3243
7.3297
7.3329
7.3528
7.3646
7.3700
7.3740
8.1676
SpinWorks 3: AS 31 A1
COOEt
4q
CH3
N
N=N
3.185
3.232
2.133
1.027
1.063
1.022
5.789
1.034
PPM 9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

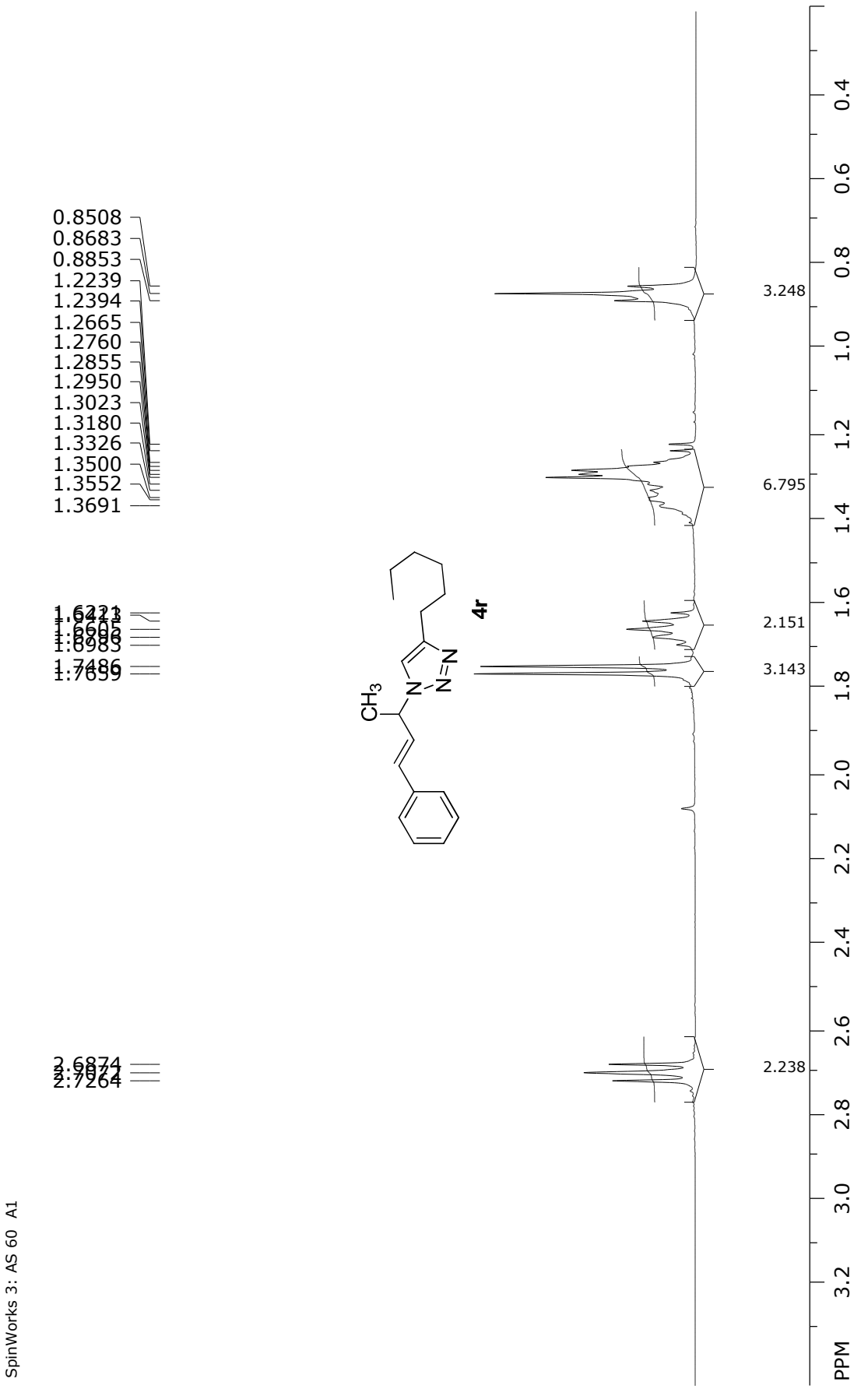

SpinWorks 3: AS 31 A1
6.3248
6.3419
6.3645
6.3817
6.5737
6.6135
7.2486
7.2629
7.2694
7.2759
7.2798
7.2843
7.2942
7.3128
7.3243
7.3297
7.3329
7.3528
7.3646
7.3700
7.3740
CH3
N
N=N
COOEt
4q
1.063
1.022
5.789
PPM
6.10
6.20
6.30
6.40
6.50
6.60
6.70
6.80
6.90
7.00
7.10
7.20
7.30
7.40


1.3542
1.3720
1.3898
1.7981
1.8154
4.3639
4.3817
4.3995
4.4174
3.185
3.232
2.133
COOEt
4q
CH3
N
N=N
PPM
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
SpinWorks 3: AS 31 A1

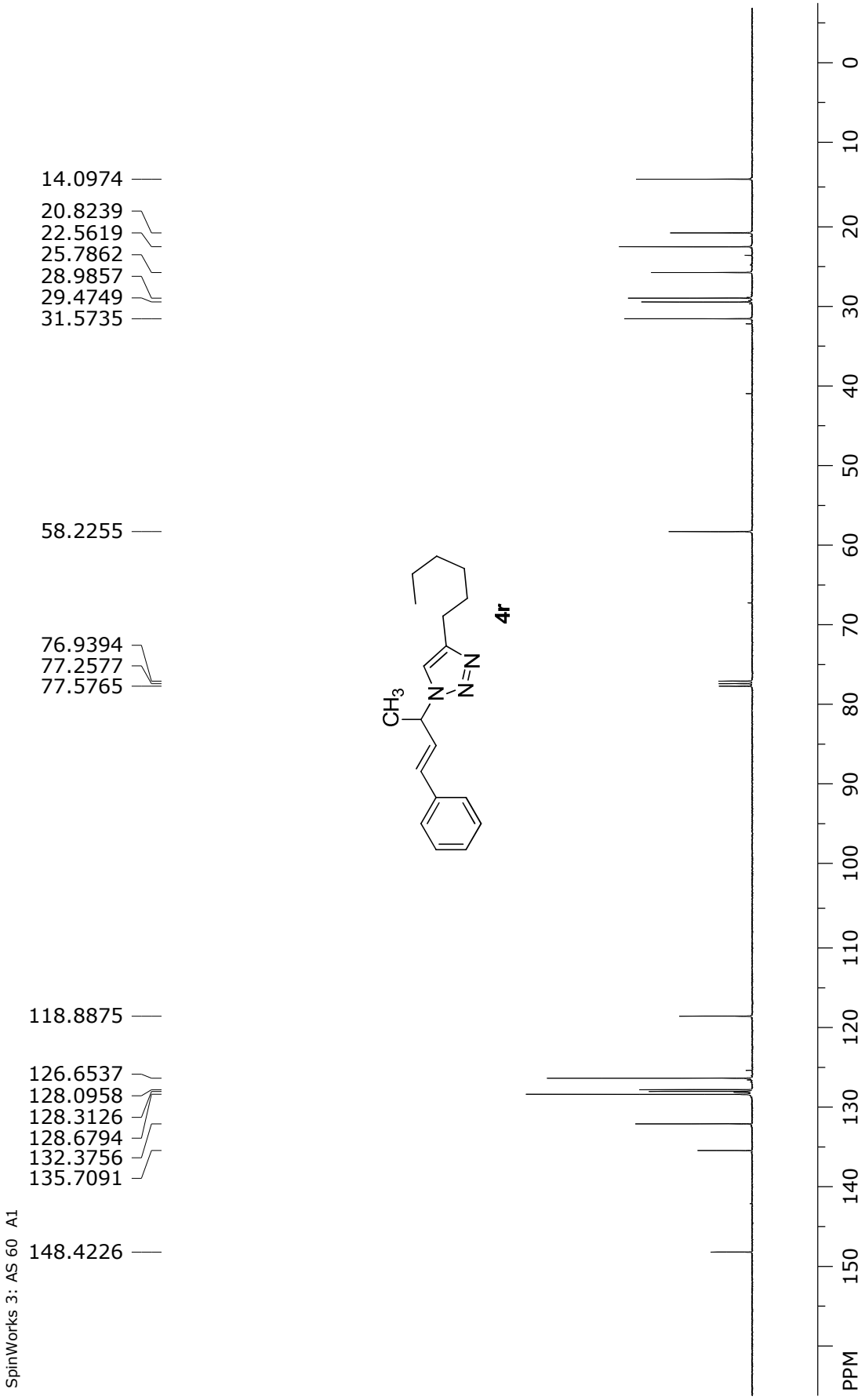

14.3348
20.8718
58.9791
61.2433
76.8949
77.2131
77.5317
125.8991
126.7371
126.7860
128.6204
128.7522
133.5288
135.2993
140.1375
160.8347
COOEt
4q
CH3
N
N=N
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
SpinWorks 3: AS 31 A1

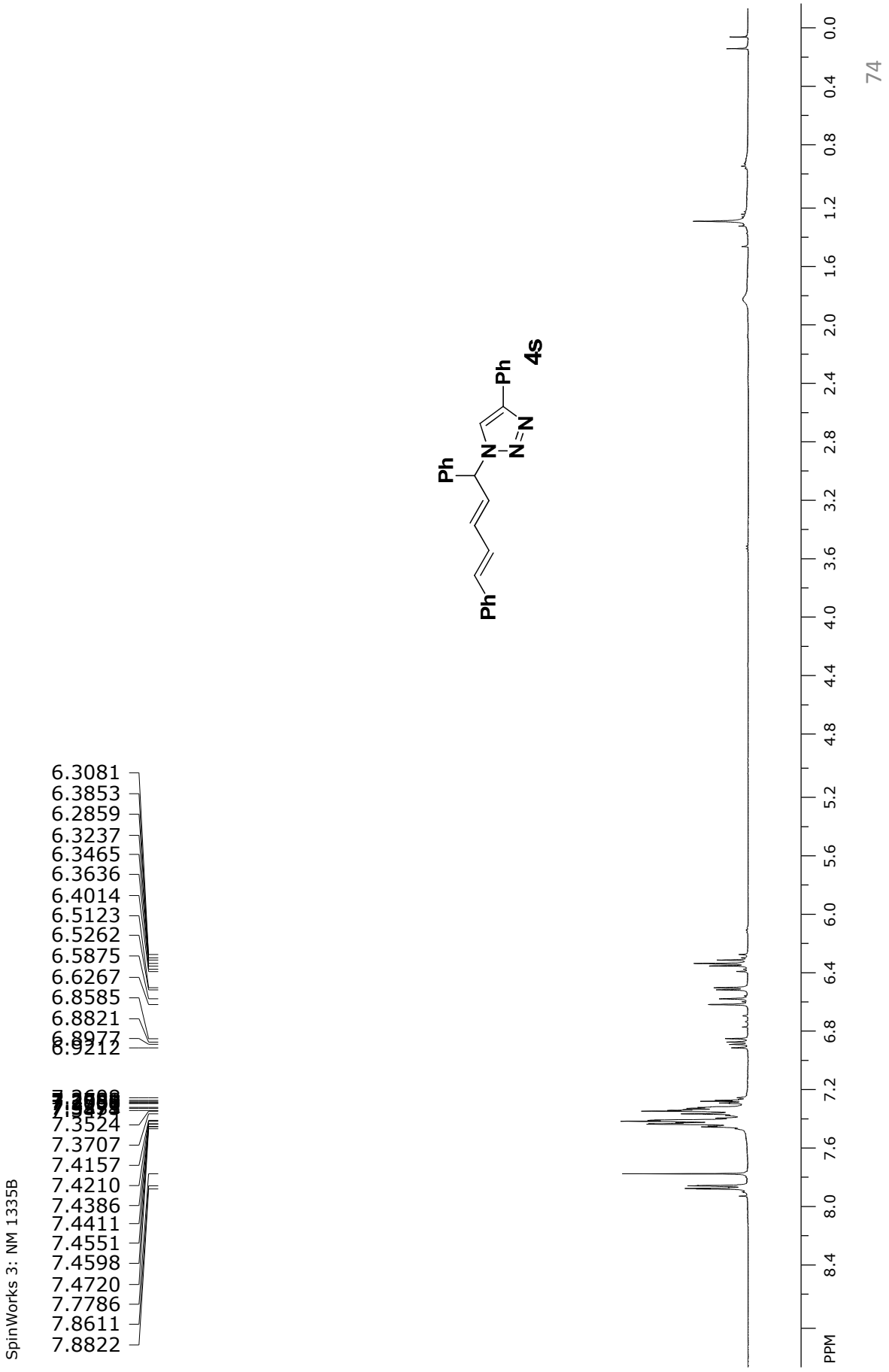

0.8508
0.8683
0.8853
1.2239
1.2394
1.2665
1.2760
1.2855
1.2950
1.3023
1.3180
1.3326
1.6221
7.2004
7.2318
7.2366
7.2456
7.2524
7.2609
7.2636
7.2848
7.3033
7.3209
7.3458
7.3653
3.248
6.795
2.151
3.143
2.238
0.997
1.002
1.000
6.294
PPM
4r
SpinWorks 3: AS 60 A1

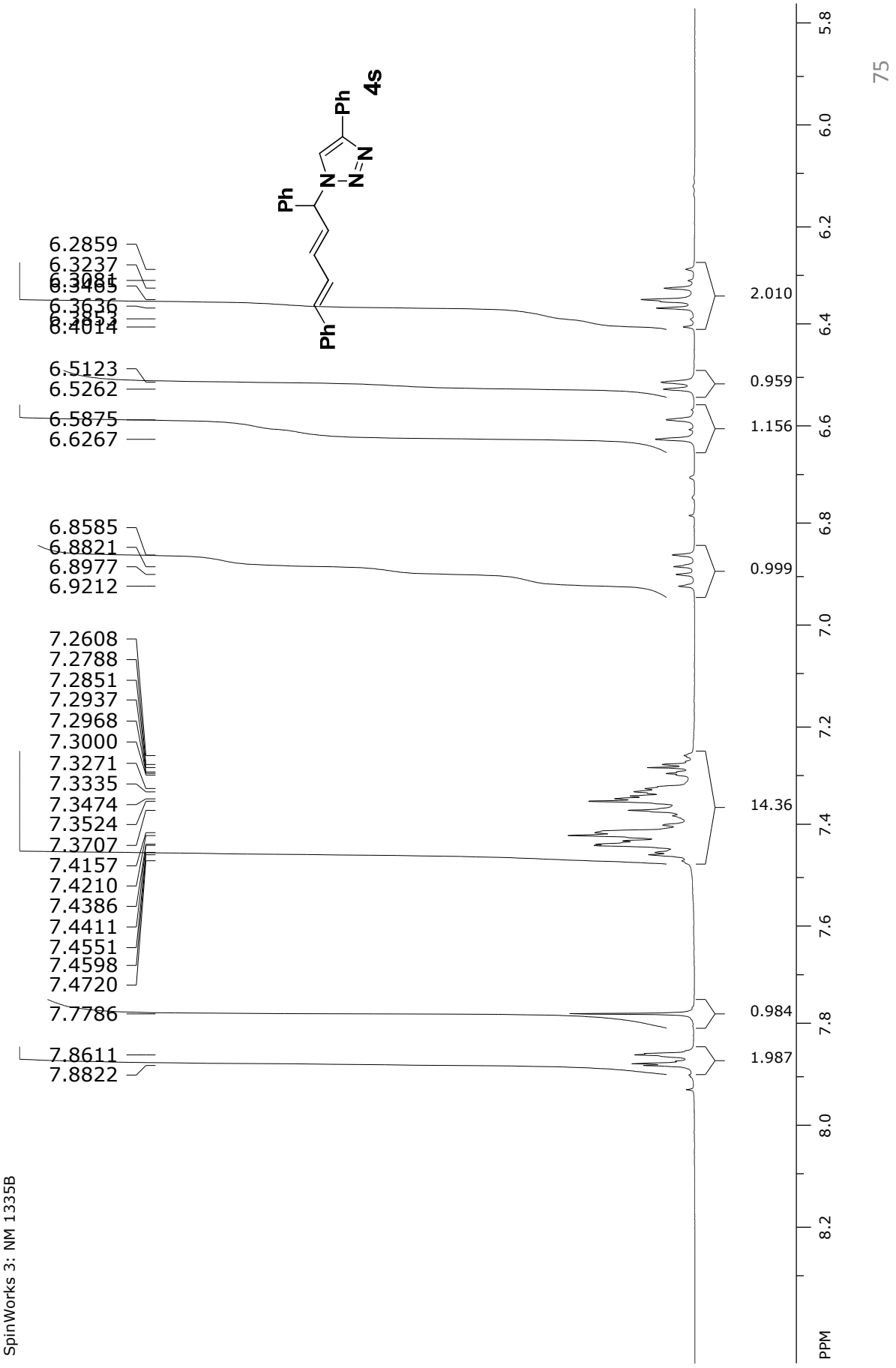

5.3178
5.3277
5.3442
5.3645
5.3841
6.5100
6.5499
7.2004
7.2284
7.2318
7.2366
7.2456
7.2524
7.2609
7.2636
7.2848
7.3033
7.3209
7.3458
7.3653
CH3
N
N=N
4r
0.997
1.002
1.000
6.294
PPM
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
6.6
6.8
7.0
7.2
7.4
7.6
7.8
8.0
SpinWorks 3: AS 60 A1

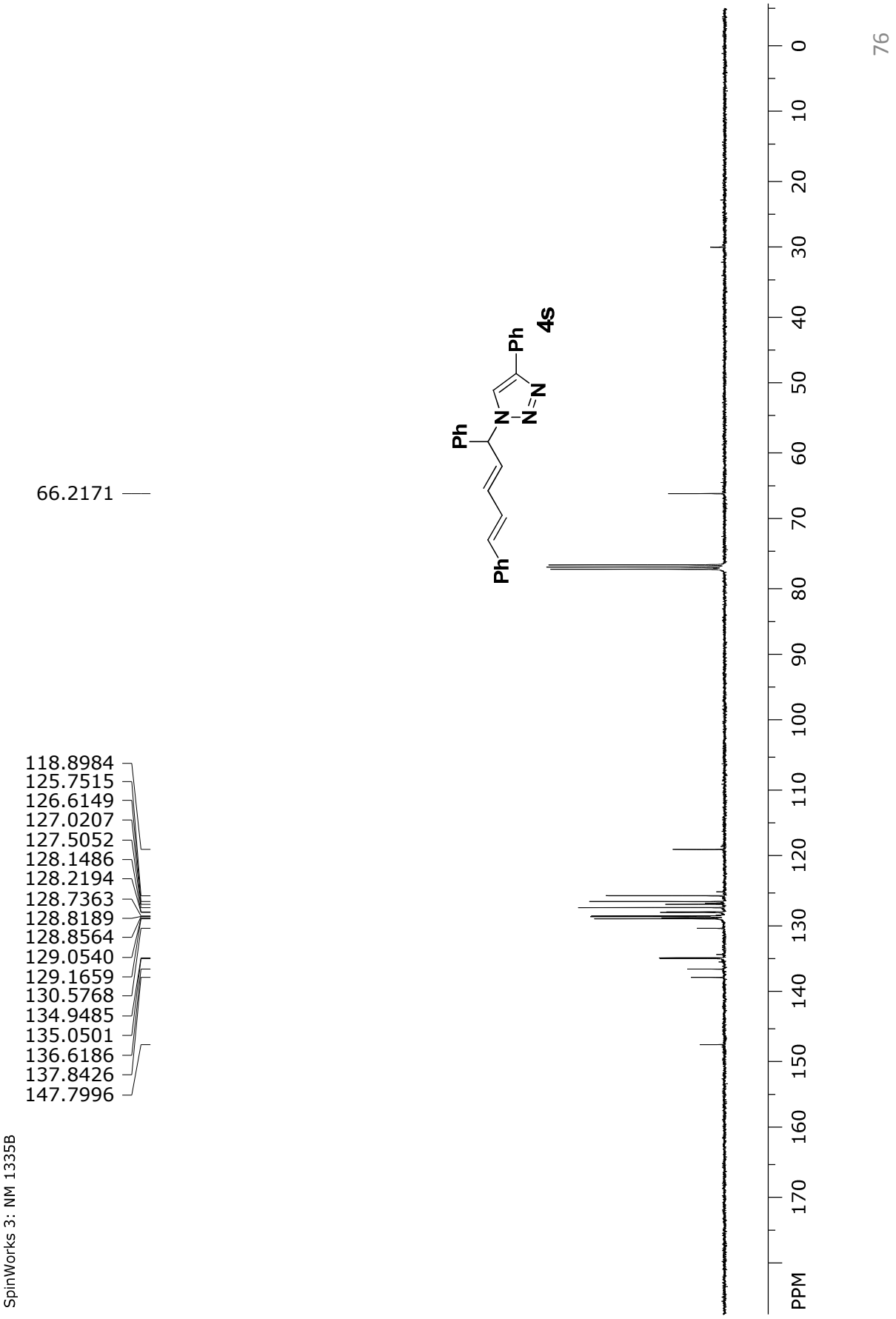


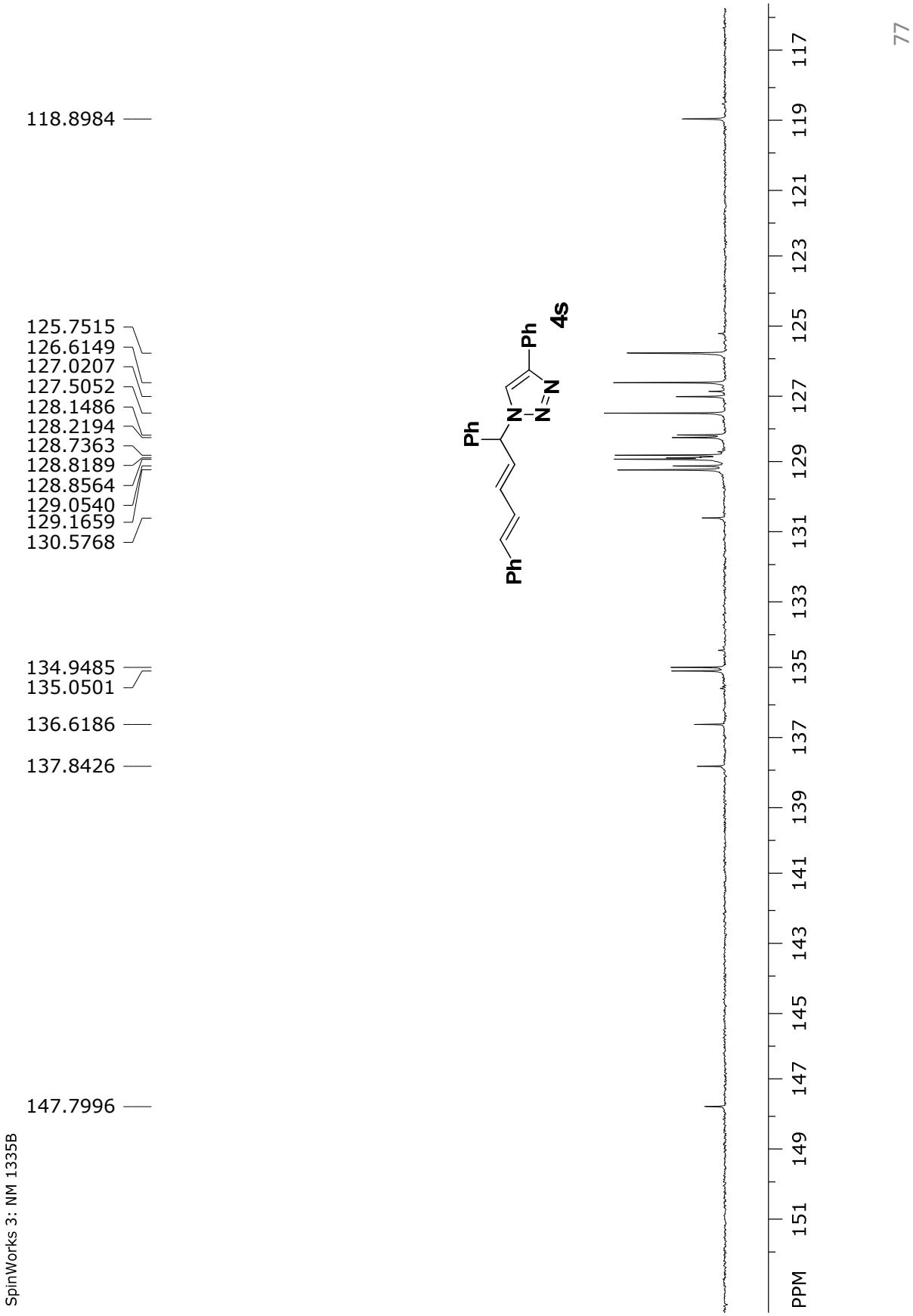
SpinWorks 3: AS 60 A1

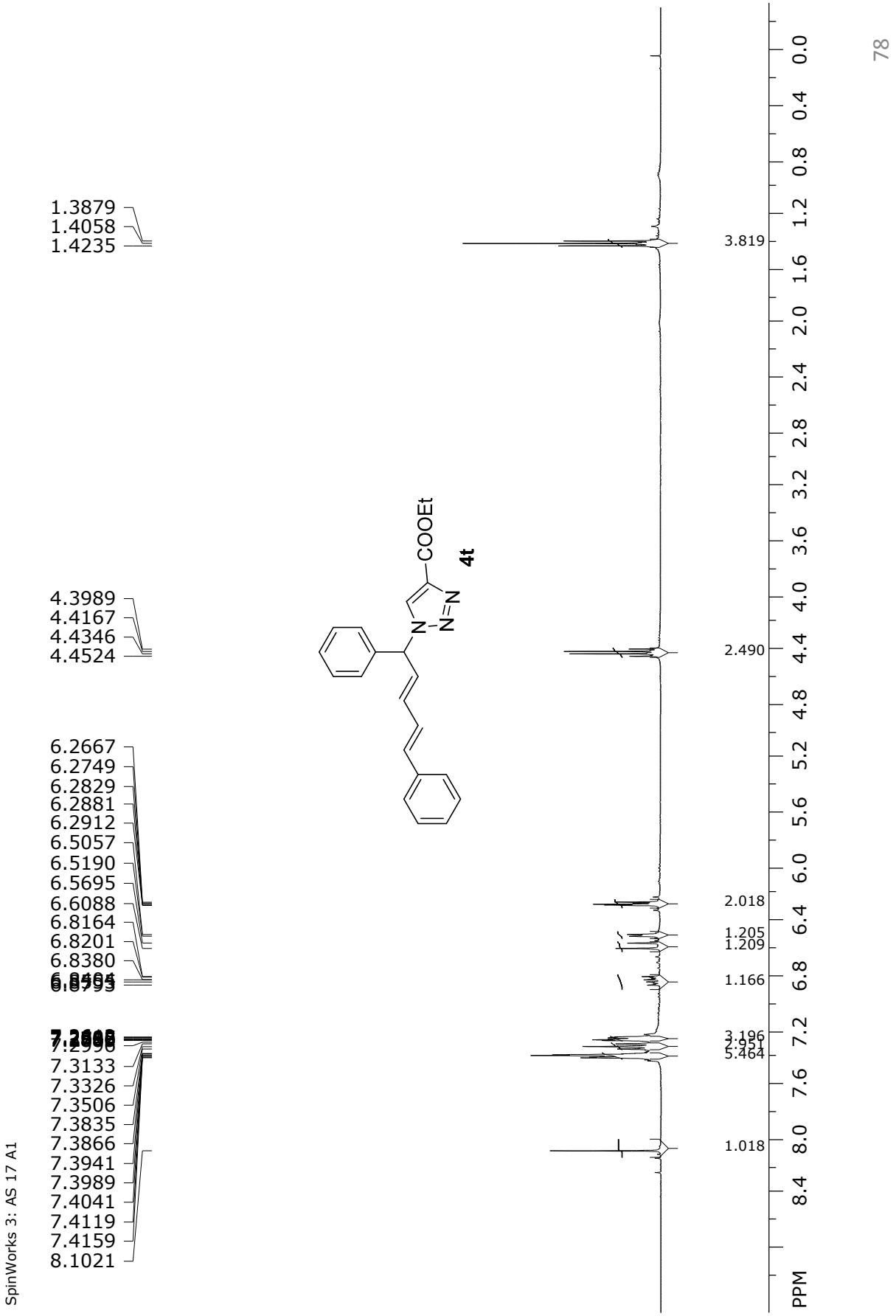

14.0974
20.8239
22.5619
25.7862
28.9857
29.4749
31.5735
58.2255
76.9394
77.2577
77.5765
118.8875
126.6537
128.0958
128.3126
128.6794
132.3756
135.7091
148.4226
SpinWorks 3: AS 60 A1
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
CH3
N
N=N
4r

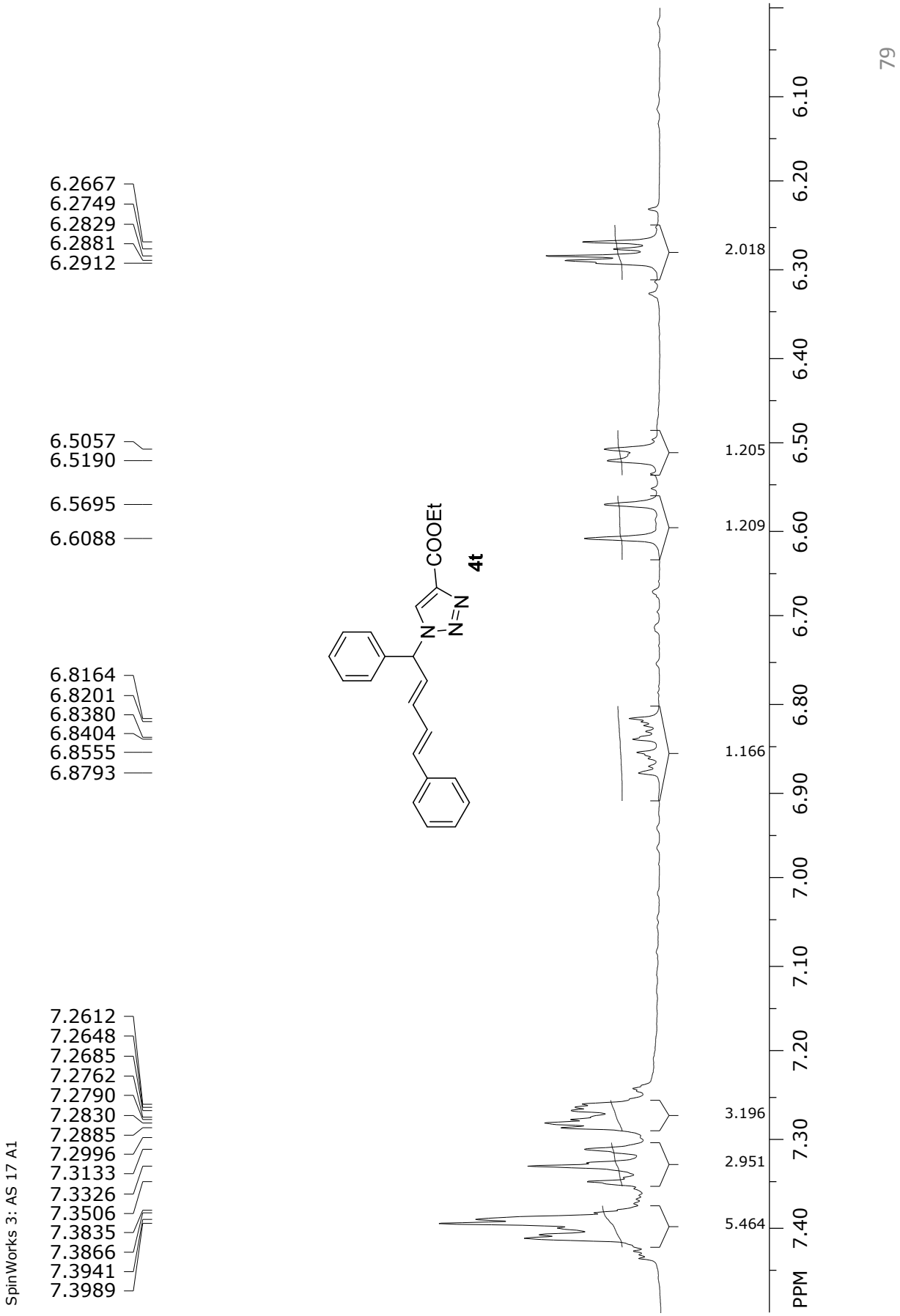

4s
Ph
Ph
Ph
N
N
N
6.3081
6.3853
6.2859
6.3237
6.3465
6.3636
6.4014
6.5123
6.5262
6.5875
6.6267
6.8585
6.8821
6.8977
6.9212
7.3524
7.3707
7.4157
7.4210
7.4386
7.4411
7.4551
7.4598
7.4720
7.7786
7.8611
7.8822
SpinWorks 3: NM 1335B
PPM
8.4
8.0
7.6
7.2
6.8
6.4
6.0
5.6
5.2
4.8
4.4
4.0
3.6
3.2
2.8
2.4
2.0
1.6
1.2
0.8
0.4
0.0

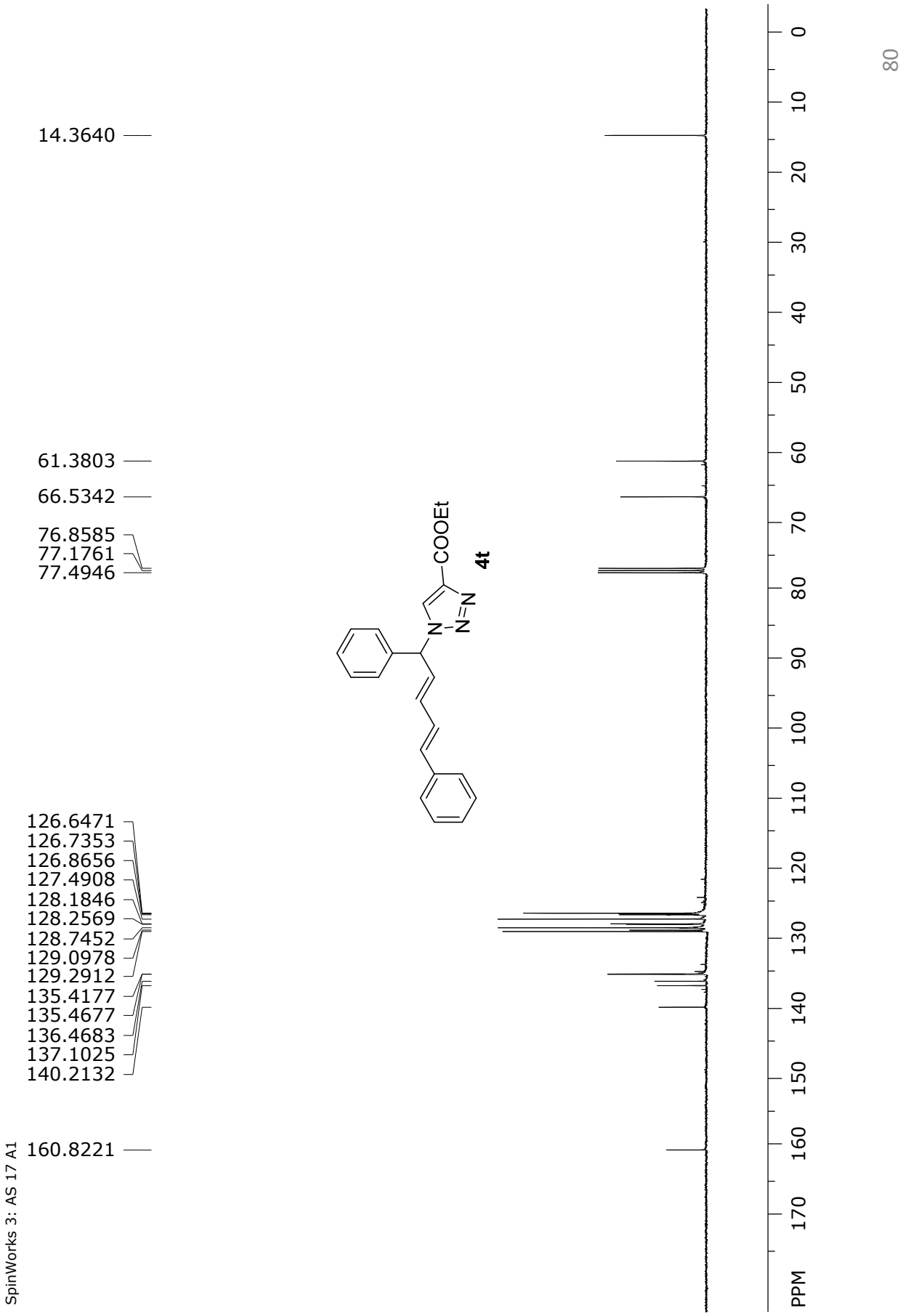

4s
Ph
Ph
Ph
N
N
N
6.2859
6.3237
6.3465
6.3636
6.4014
6.5123
6.5262
6.5875
6.6267
6.8585
6.8821
6.8977
6.9212
7.2608
7.2788
7.2851
7.2937
7.2968
7.3000
7.3271
7.3335
7.3474
7.3524
7.3707
7.4157
7.4210
7.4386
7.4411
7.4551
7.4598
7.4720
7.7786
7.8611
7.8822
2.010
0.959
1.156
0.999
14.36
0.984
1.987
5.8
6.0
6.2
6.4
6.6
6.8
7.0
7.2
7.4
7.6
7.8
8.0
8.2
PPM
SpinWorks 3: NM 1335B

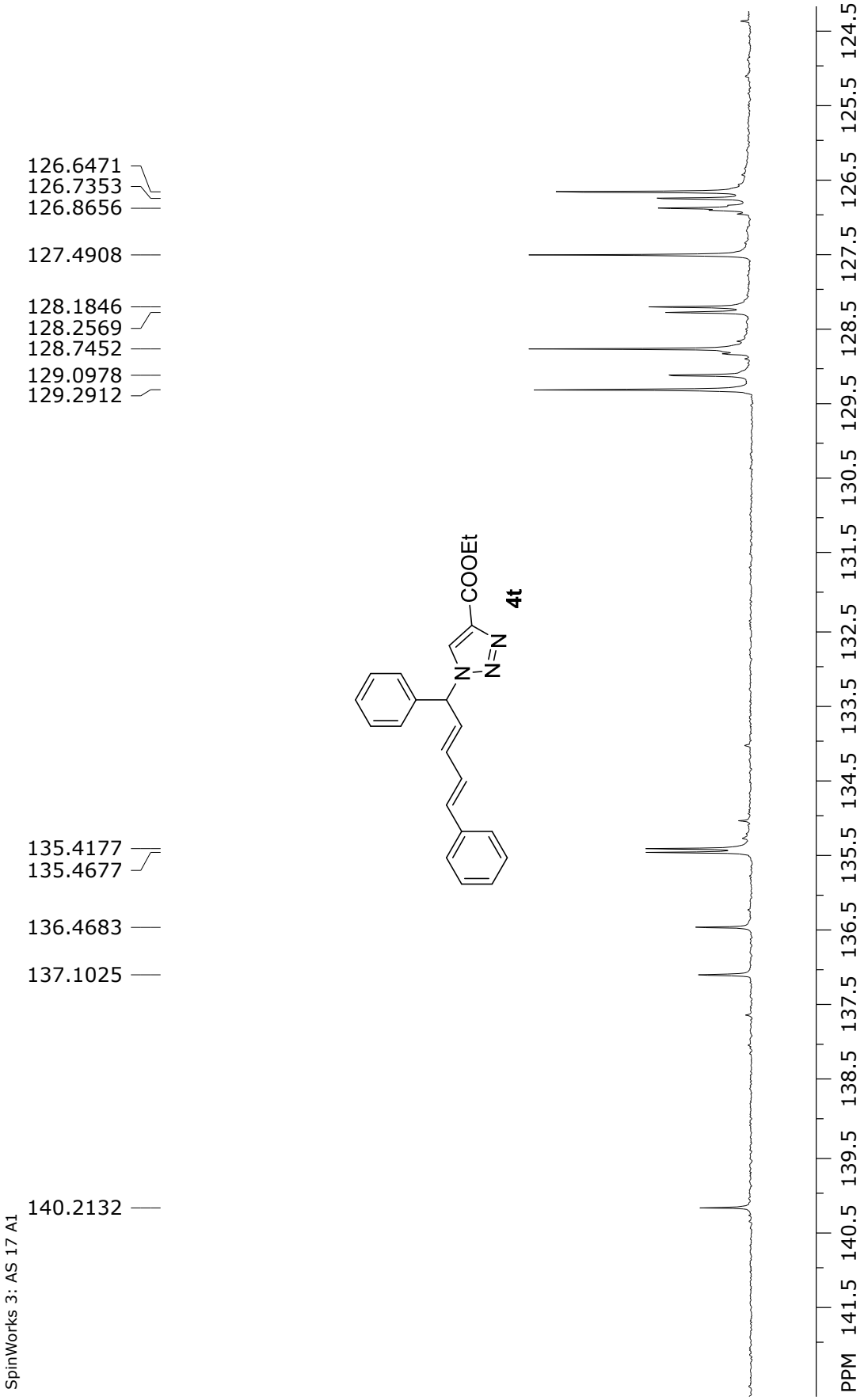

4s
Ph
Ph
Ph
N
N
N
66.2171
118.8984
125.7515
126.6149
127.0207
127.5052
128.1486
128.2194
128.7363
128.8189
128.8564
129.0540
129.1659
130.5768
134.9485
135.0501
136.6186
137.8426
147.7996
SpinWorks 3: NM 1335B
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170

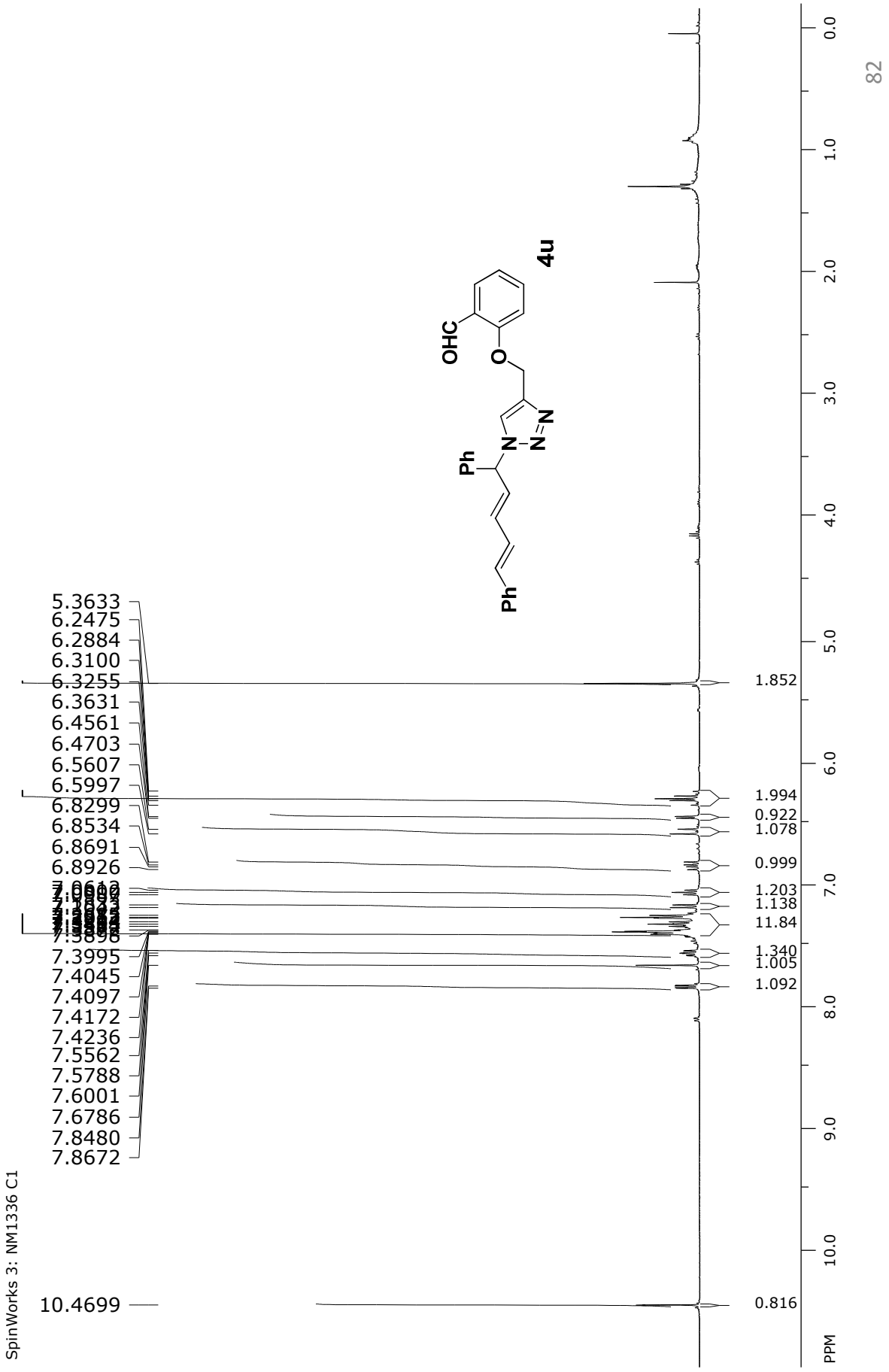

118.8984
125.7515
126.6149
127.0207
127.5052
128.1486
128.2194
128.7363
128.8189
128.8564
129.0540
129.1659
130.5768
134.9485
135.0501
136.6186
137.8426
147.7996
Ph
Ph
N
N
N
4s
PPM
151
149
147
145
143
141
139
137
135
133
131
129
127
125
123
121
119
117
SpinWorks 3: NM 1335B

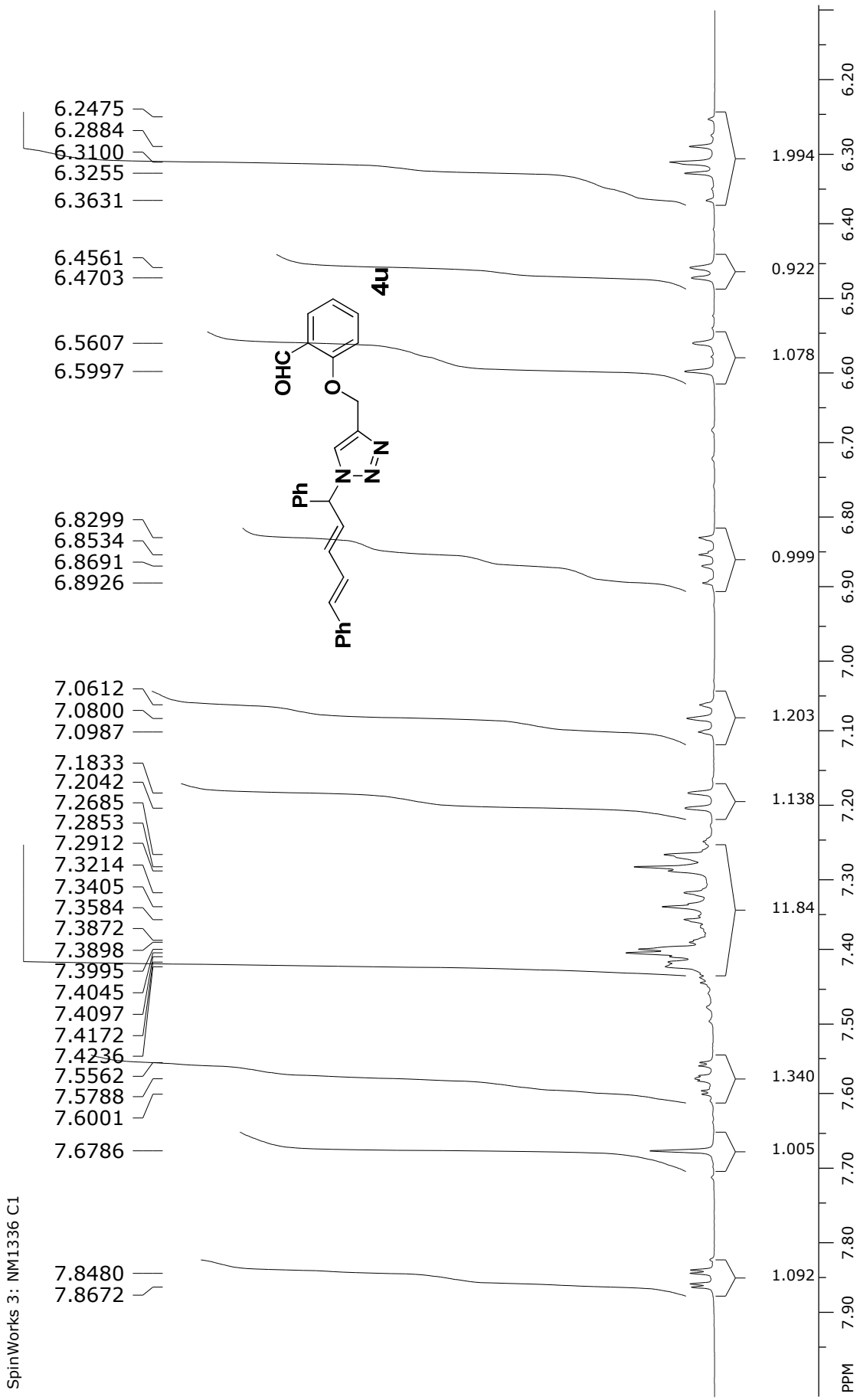

1.3879
1.4058
1.4235
4.3989
4.4167
4.4346
4.4524
6.2667
6.2749
6.2829
6.2881
6.2912
6.5057
6.5190
6.5695
6.6088
6.8164
6.8201
6.8380
7.3133
7.3326
7.3506
7.3835
7.3866
7.3941
7.3989
7.4041
7.4119
7.4159
8.1021
COOEt
4t
3.819
2.490
2.018
1.205
1.209
1.166
3.196
2.951
5.464
1.018
PPM
SpinWorks 3: AS 17 A1

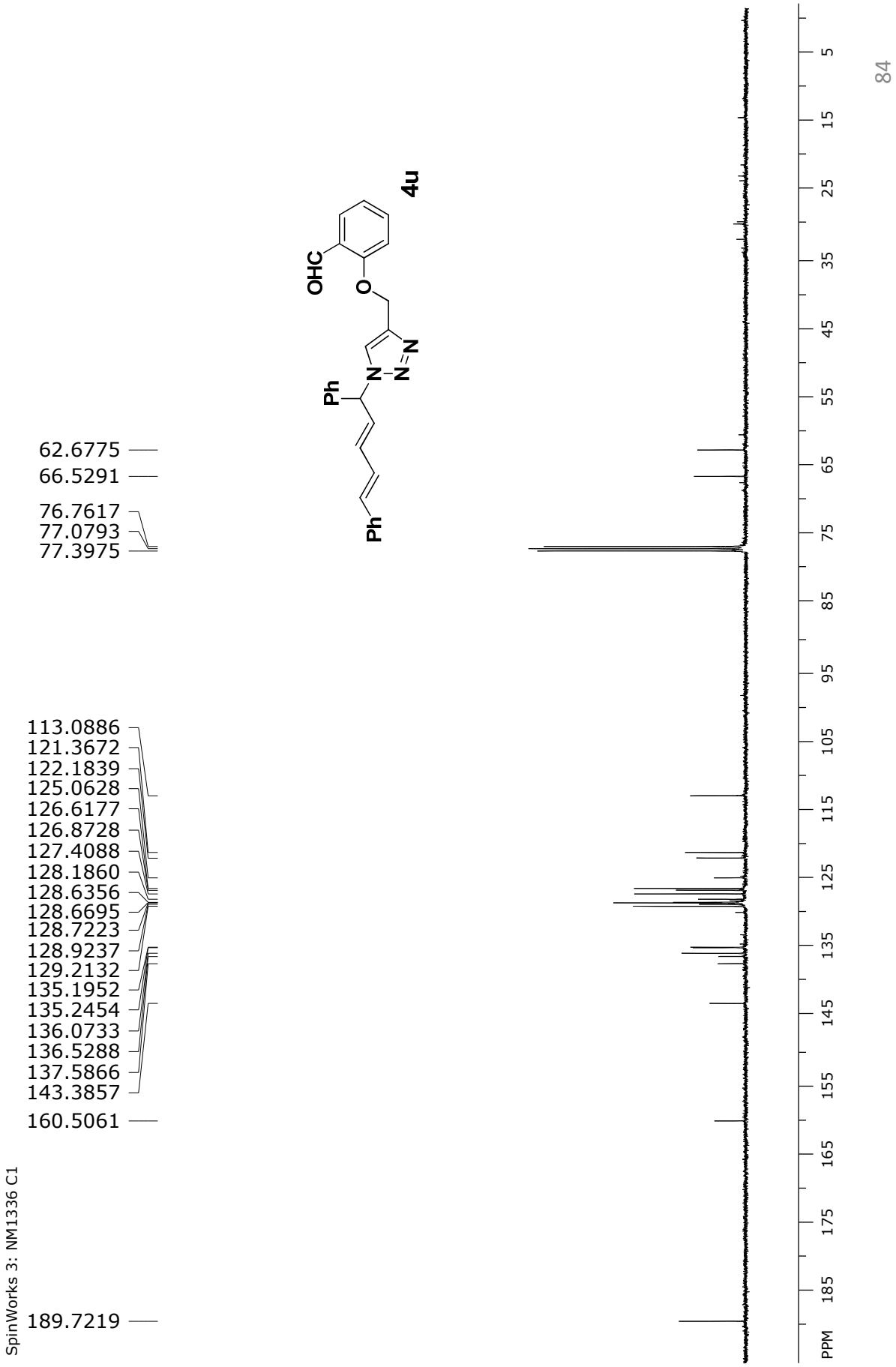

6.2667
6.2749
6.2829
6.2881
6.2912
6.5057
6.5190
6.5695
6.6088
6.8164
6.8201
6.8380
6.8404
6.8555
6.8793
7.2612
7.2648
7.2685
7.2762
7.2790
7.2830
7.2885
7.2996
7.3133
7.3326
7.3506
7.3835
7.3866
7.3941
7.3989
COOEt
4t
2.018
1.205
1.209
1.166
3.196
2.951
5.464
6.10
6.20
6.30
6.40
6.50
6.60
6.70
6.80
6.90
7.00
7.10
7.20
7.30
7.40
PPM
SpinWorks 3: AS 17 A1

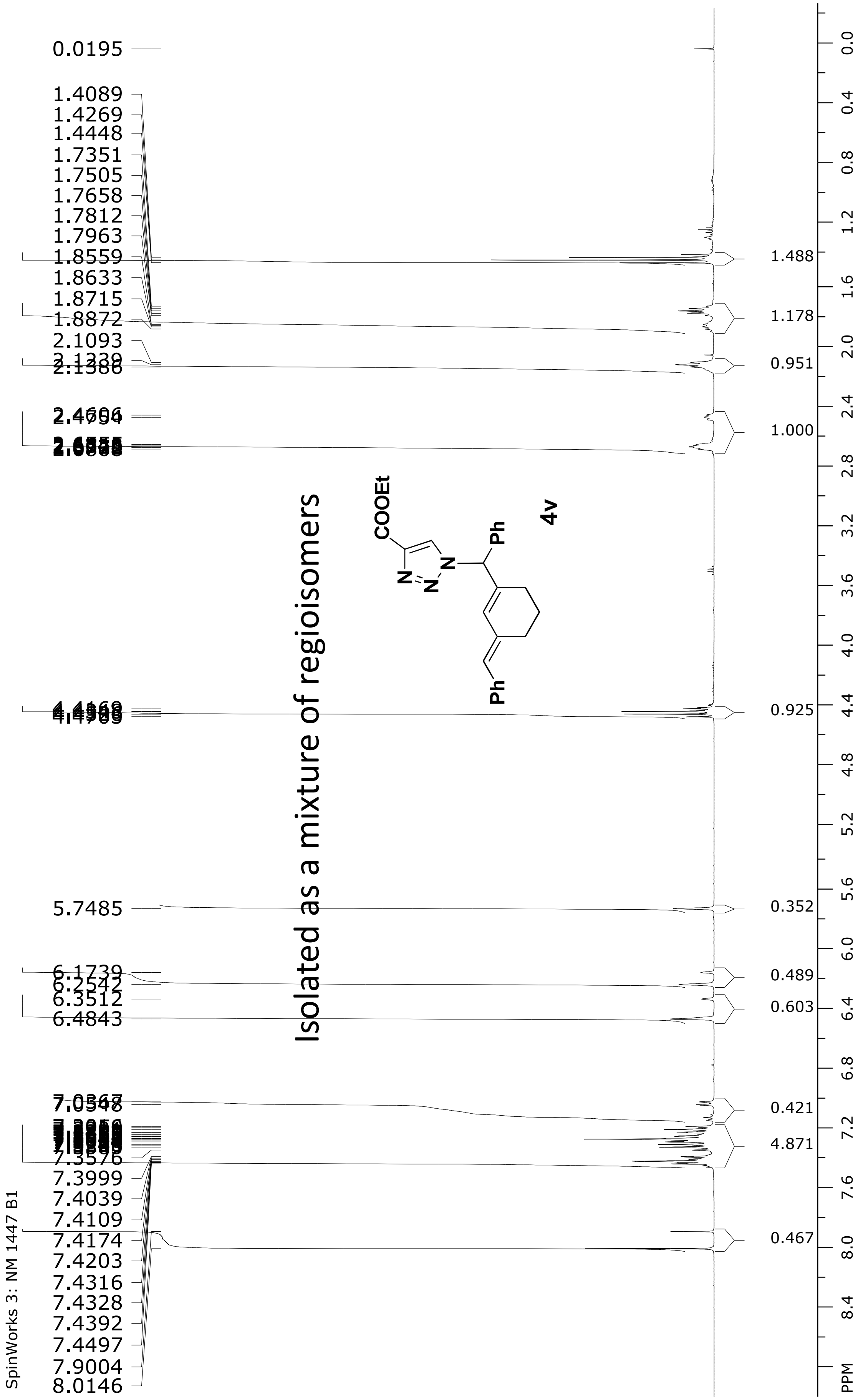

14.3640
61.3803
66.5342
76.8585
77.1761
77.4946
126.6471
126.7353
126.8656
127.4908
128.1846
128.2569
128.7452
129.0978
129.2912
135.4177
135.4677
136.4683
137.1025
140.2132
160.8221
COOEt
4t
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
SpinWorks 3: AS 17 A1

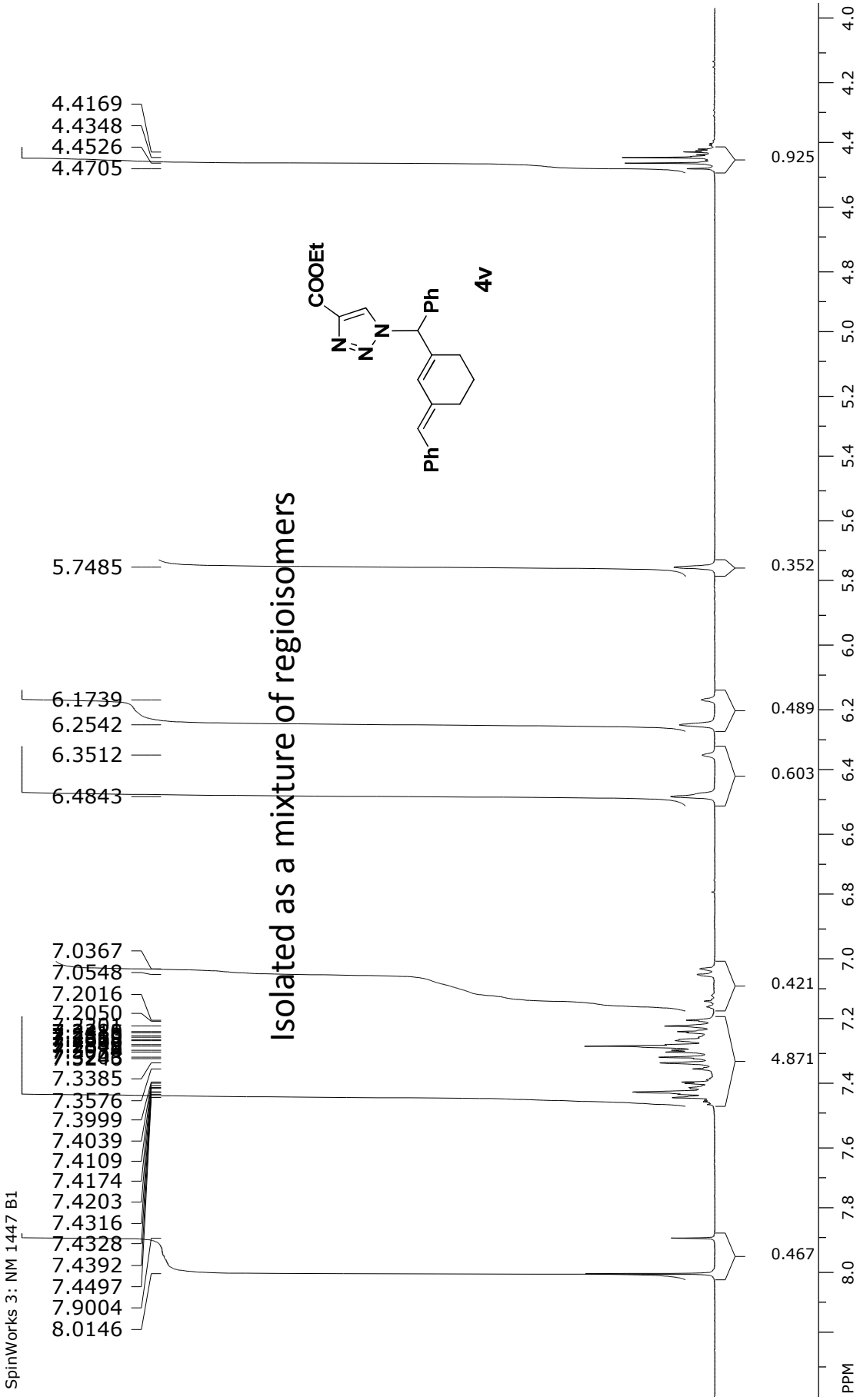

126.6471
126.7353
126.8656
127.4908
128.1846
128.2569
128.7452
129.0978
129.2912
135.4177
135.4677
136.4683
137.1025
140.2132
COOEt
4t
SpinWorks 3: AS 17 A1
PPM 141.5 140.5 139.5 138.5 137.5 136.5 135.5 134.5 133.5 132.5 131.5 130.5 129.5 128.5 127.5 126.5 125.5 124.5

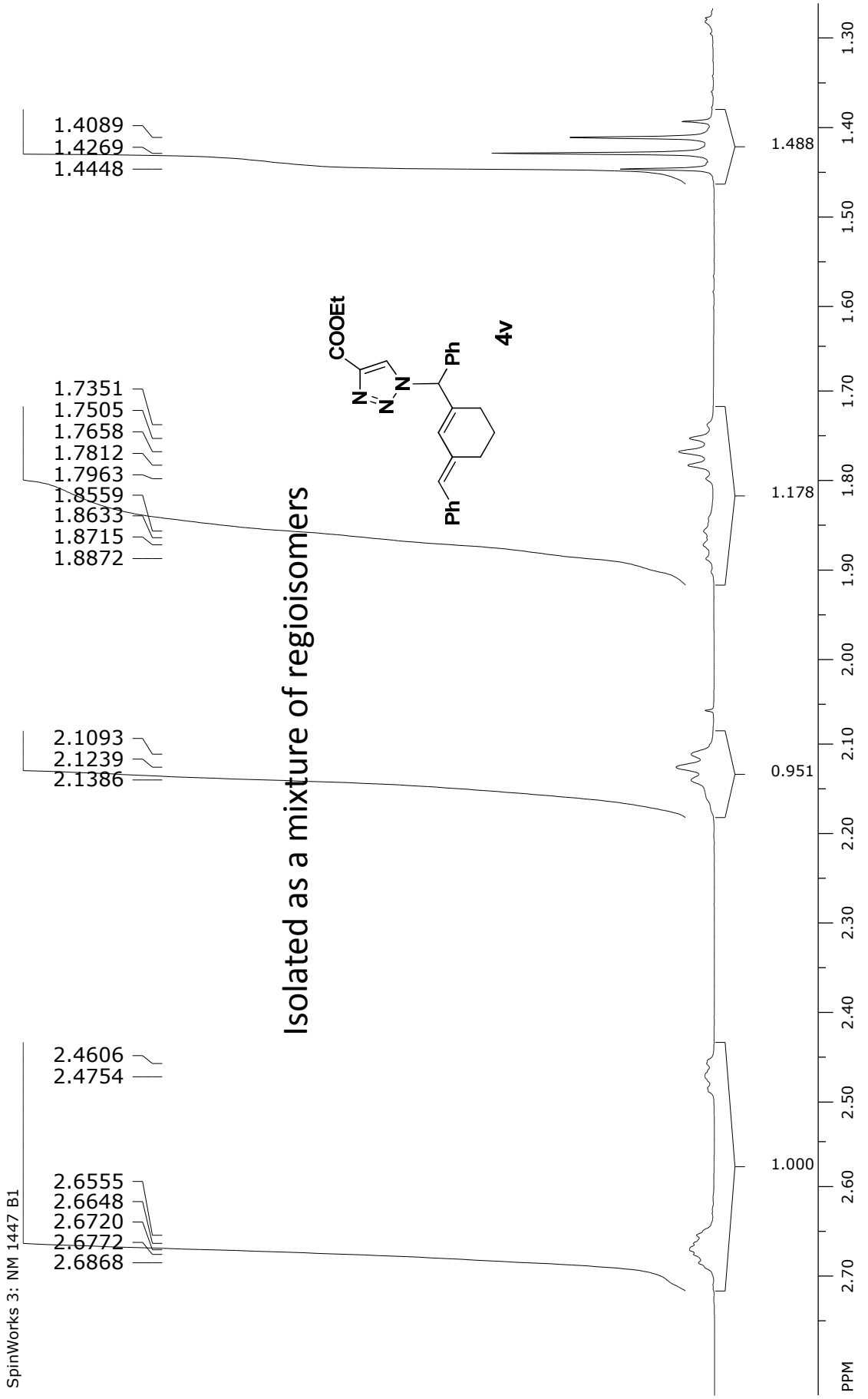

4u
OHC
O
N
N
N
Ph
Ph
5.3633
6.2475
6.2884
6.3100
6.3255
6.3631
6.4561
6.4703
6.5607
6.5997
6.8299
6.8534
6.8691
6.8926
7.3898
7.3995
7.4045
7.4097
7.4172
7.4236
7.5562
7.5788
7.6001
7.6786
7.8480
7.8672
10.4699
1.852
1.994
0.922
1.078
0.999
1.203
1.138
11.84
1.340
1.005
1.092
0.816
SpinWorks 3: NM1336 C1
PPM

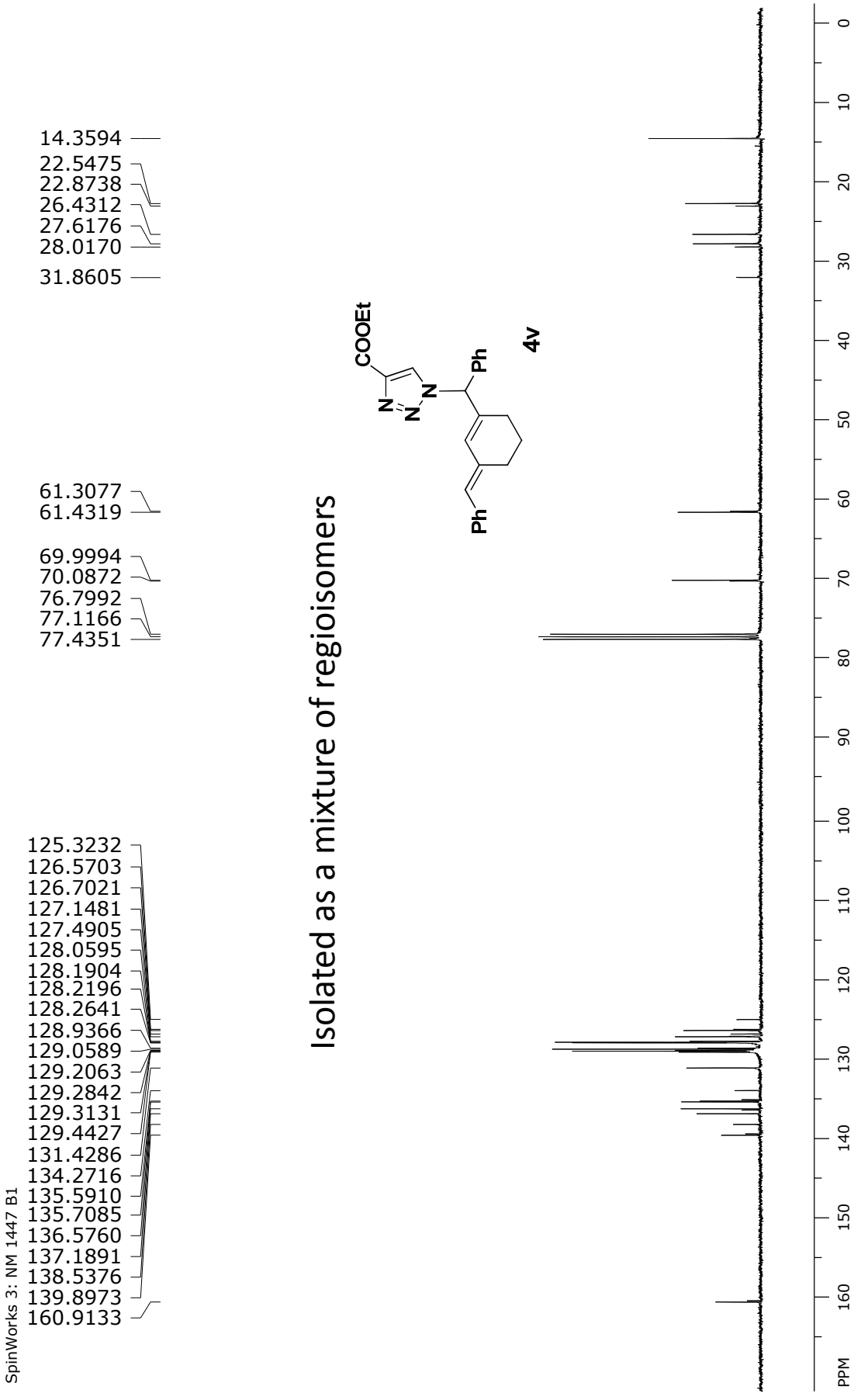

6.2475
6.2884
6.3100
6.3255
6.3631
6.4561
6.4703
6.5607
6.5997
6.8299
6.8534
6.8691
6.8926
7.0612
7.0800
7.0987
7.1833
7.2042
7.2685
7.2853
7.2912
7.3214
7.3405
7.3584
7.3872
7.3898
7.3995
7.4045
7.4097
7.4172
7.4236
7.5562
7.5788
7.6001
7.6786
7.8480
7.8672
1.994
0.922
1.078
0.999
1.203
1.138
11.84
1.340
1.005
1.092
4u
OHC
O
N
N
N
Ph
Ph
6.20
6.30
6.40
6.50
6.60
6.70
6.80
6.90
7.00
7.10
7.20
7.30
7.40
7.50
7.60
7.70
7.80
7.90
PPM
SpinWorks 3: NM1336 C1

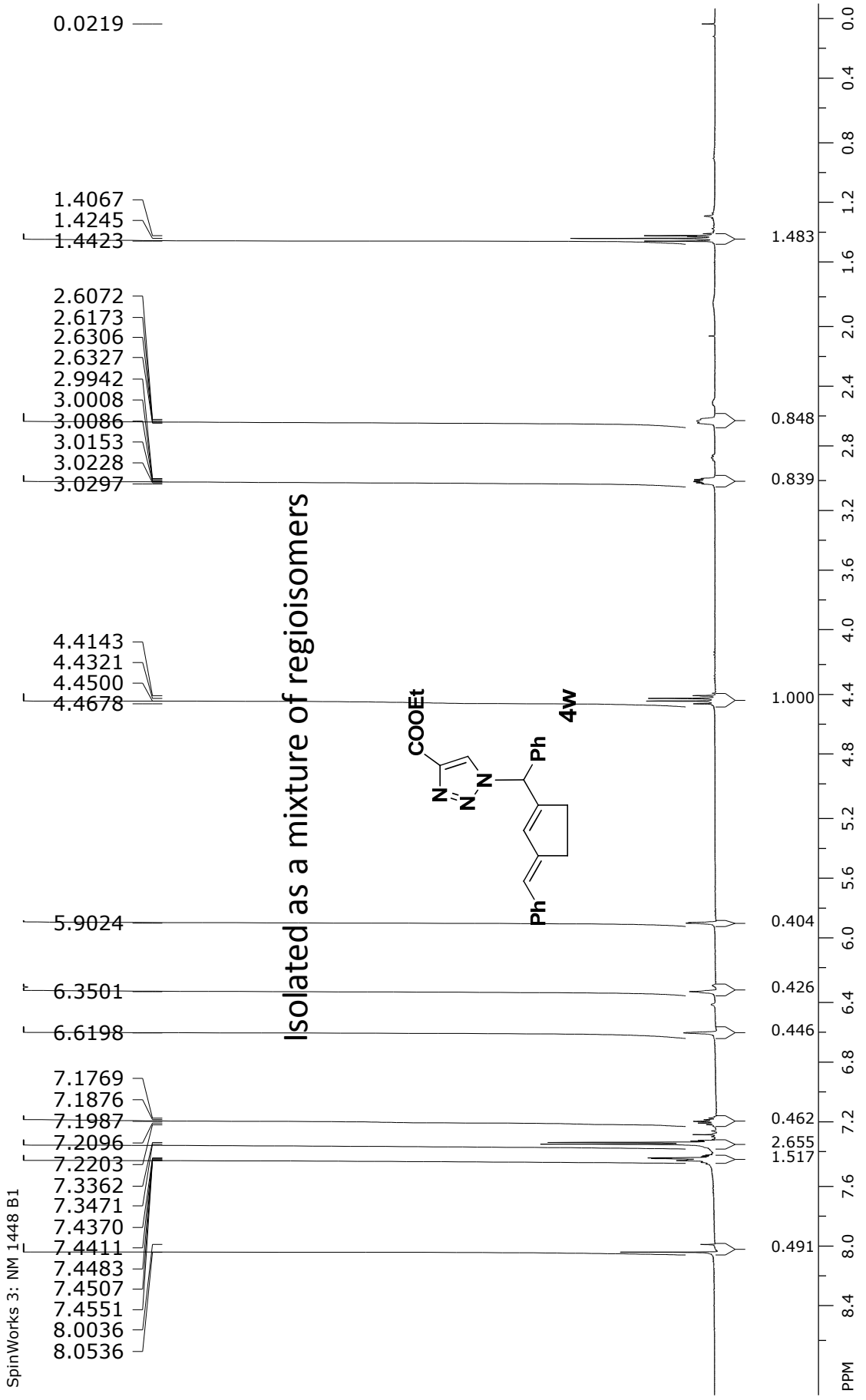

4u
OHC
O
N
N
N
Ph
Ph
62.6775
66.5291
76.7617
77.0793
77.3975
113.0886
121.3672
122.1839
125.0628
126.6177
126.8728
127.4088
128.1860
128.6356
128.6695
128.7223
128.9237
129.2132
135.1952
135.2454
136.0733
136.5288
137.5866
143.3857
160.5061
189.7219
SpinWorks 3: NM1336 C1
PPM
5
15
25
35
45
55
65
75
85
95
105
115
125
135
145
155
165
175
185


Isolated as a mixture of regioisomers
COOEt
N
N
N
Ph
Ph
4v
0.0195
1.4089
1.4269
1.4448
1.7351
1.7505
1.7658
1.7812
1.7963
1.8559
1.8633
1.8715
1.8872
2.1093
5.7485
6.1739
6.2542
6.3512
6.4843
7.3576
7.3999
7.4039
7.4109
7.4174
7.4203
7.4316
7.4328
7.4392
7.4497
7.9004
8.0146
1.488
1.178
0.951
1.000
0.925
0.352
0.489
0.603
0.421
4.871
0.467
PPM
SpinWorks 3: NM 1447 B1


4.4169
4.4348
4.4526
4.4705
0.925
COOEt
Ph
4v
Ph
5.7485
0.352
Isolated as a mixture of regioisomers
6.1739
6.2542
0.489
6.3512
6.4843
0.603
7.0367
7.0548
7.2016
7.2050
0.421
4.871
7.3385
7.3576
7.3999
7.4039
7.4109
7.4174
7.4203
7.4316
7.4328
7.4392
7.4497
7.9004
8.0146
0.467
SpinWorks 3: NM 1447 B1
PPM


1.4089
1.4269
1.4448
1.7351
1.7505
1.7658
1.7812
1.7963
1.8559
1.8633
1.8715
1.8872
2.1093
2.1239
2.1386
2.4606
2.4754
2.6555
2.6648
2.6720
2.6772
2.6868
1.488
1.178
0.951
1.000
COOEt
Ph
Ph
4v
Isolated as a mixture of regioisomers
SpinWorks 3: NM 1447 B1
PPM
1.30
1.40
1.50
1.60
1.70
1.80
1.90
2.00
2.10
2.20
2.30
2.40
2.50
2.60
2.70


14.3594
22.5475
22.8738
26.4312
27.6176
28.0170
31.8605
61.3077
61.4319
69.9994
70.0872
76.7992
77.1166
77.4351
125.3232
126.5703
126.7021
127.1481
127.4905
128.0595
128.1904
128.2196
128.2641
128.9366
129.0589
129.2063
129.2842
129.3131
129.4427
131.4286
134.2716
135.5910
135.7085
136.5760
137.1891
138.5376
139.8973
160.9133
SpinWorks 3: NM 1447 B1
Isolated as a mixture of regioisomers
COOEt
Ph
Ph
4v
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160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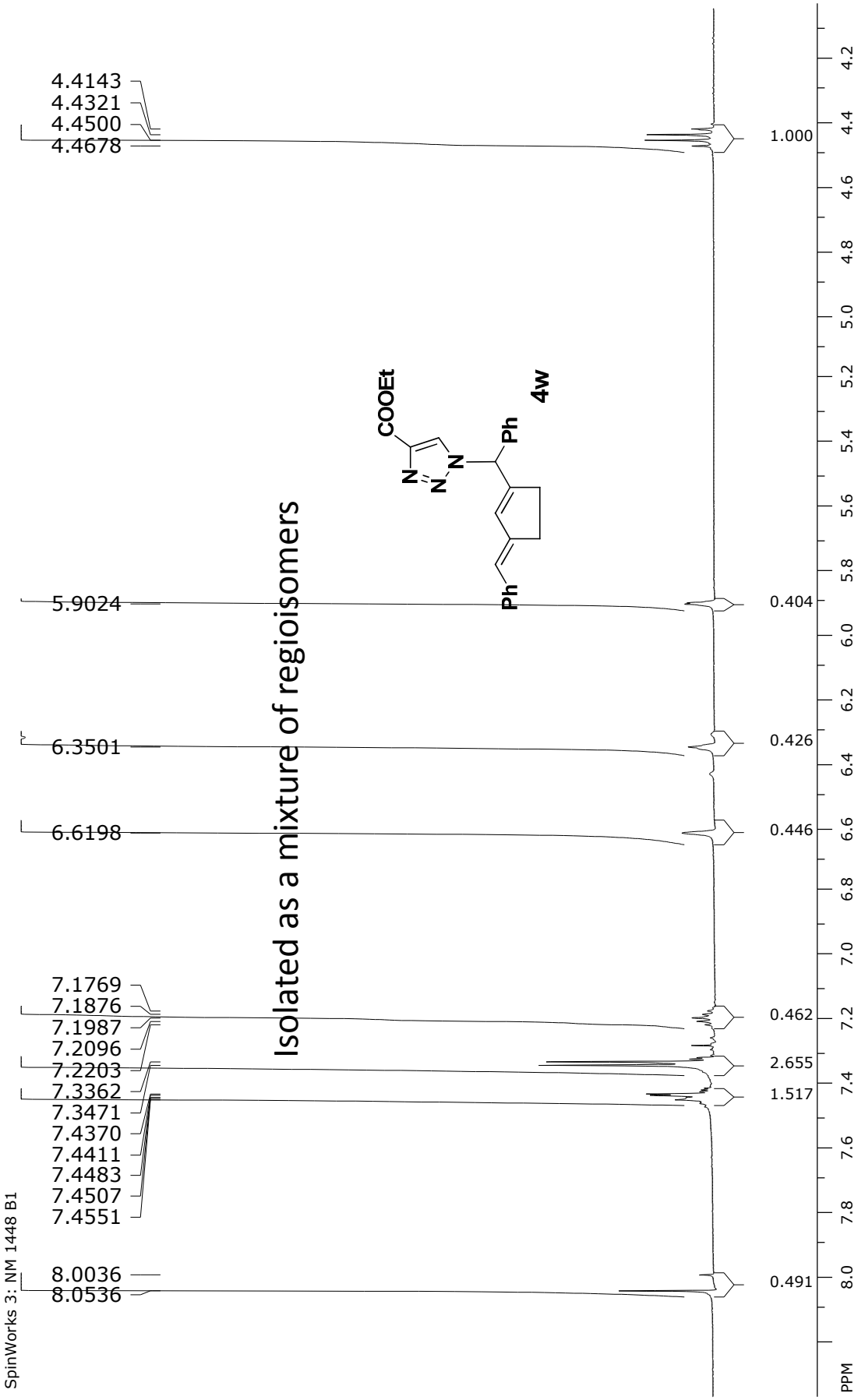
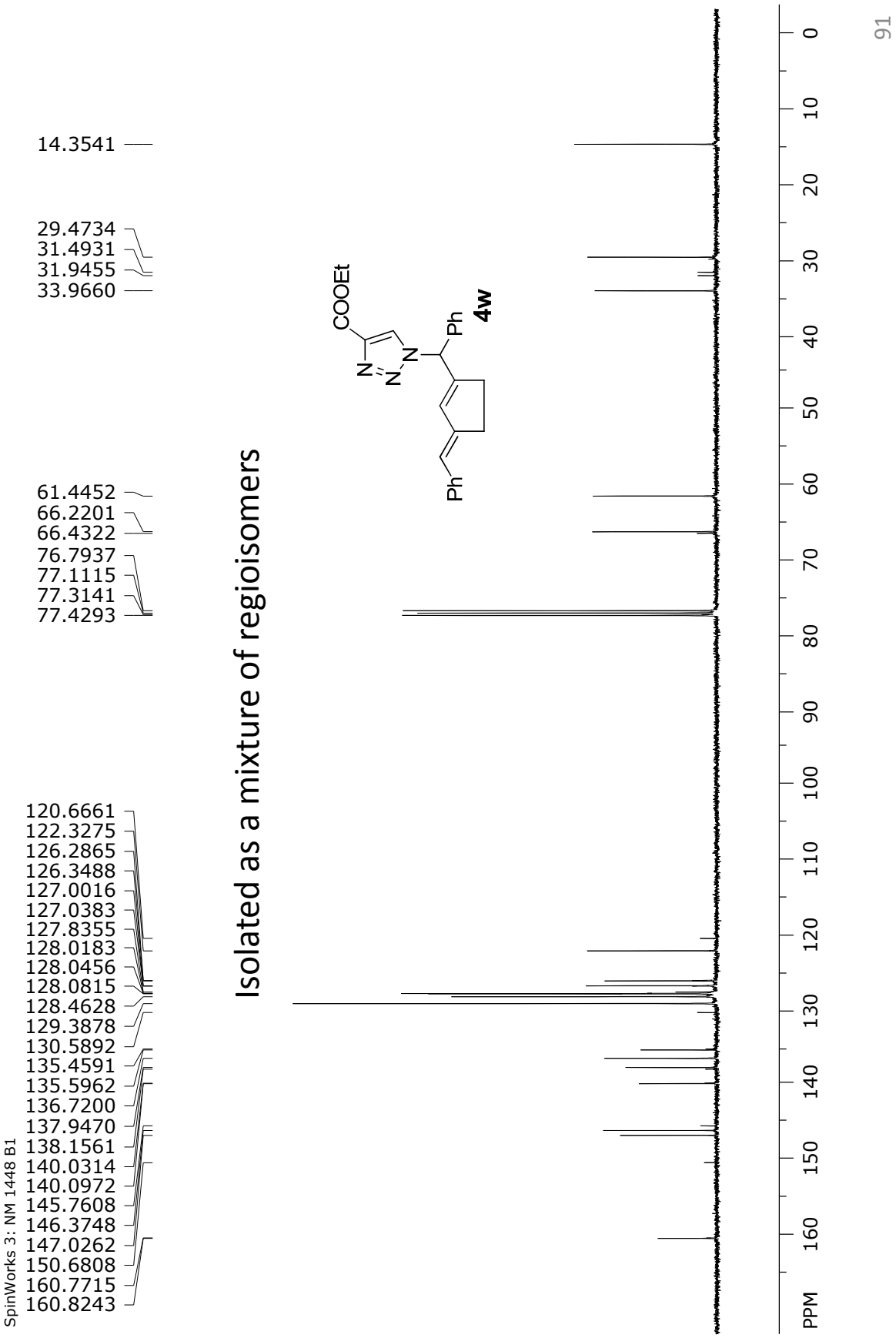
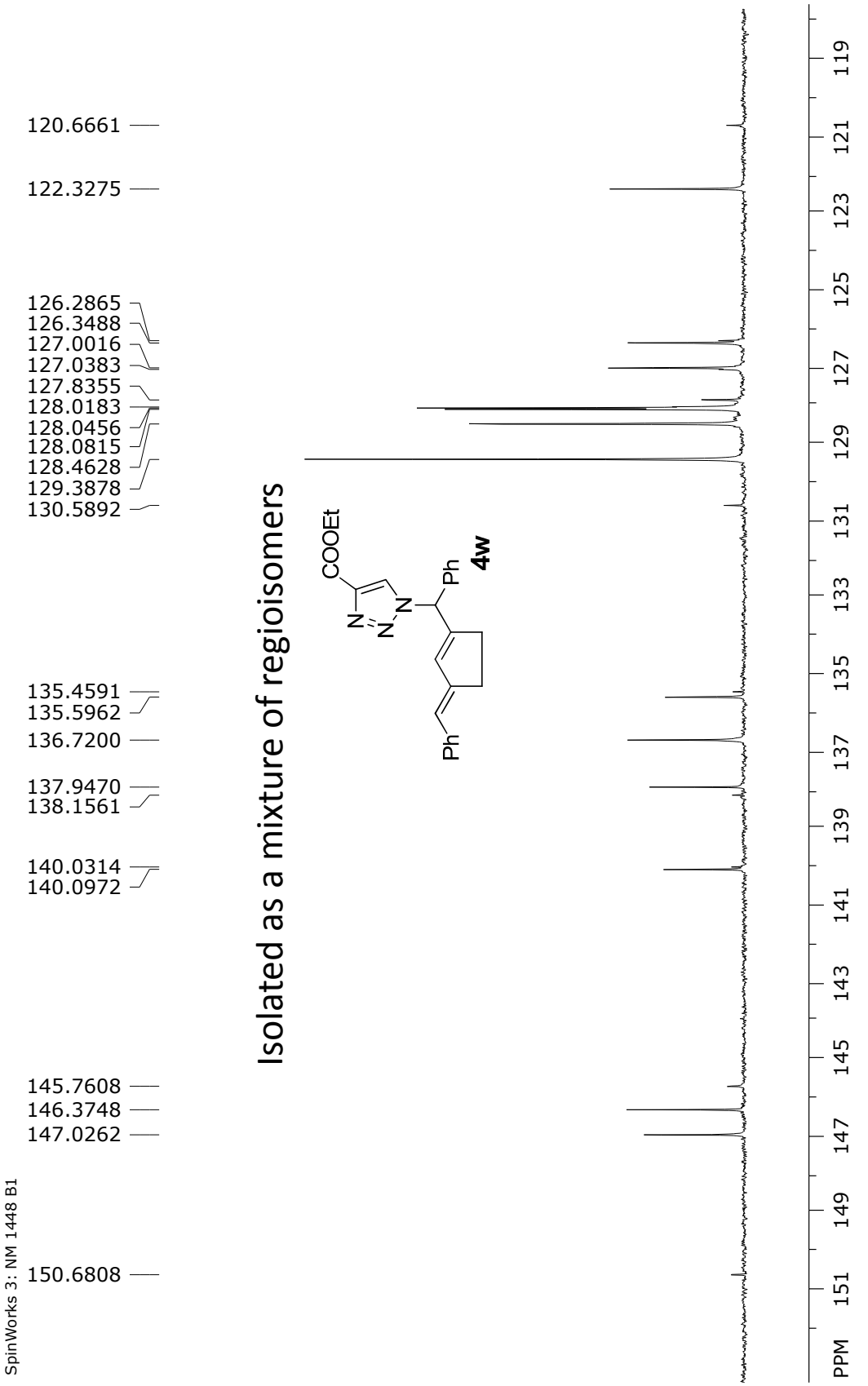
1.4067
1.4245
1.4423
2.6072
2.6173
2.6306
2.6327
2.9942
3.0008
3.0086
3.0153
3.0228
3.0297
4.4143
4.4321
4.4500
4.4678
5.9024
6.3501
6.6198
7.1769
7.1876
7.1987
7.2096
7.2203
7.3362
7.3471
7.4370
7.4411
7.4483
7.4507
7.4551
8.0036
8.0536
1.483
0.848
0.839
1.000
0.404
0.426
0.446
0.462
2.655
1.517
0.491
Isolated as a mixture of regioisomers
COOEt
Ph
Ph
4W
SpinWorks 3: NM 1448 B1
PPM


4.4143
4.4321
4.4500
4.4678
5.9024
6.3501
6.6198
7.1769
7.1876
7.1987
7.2096
7.2203
7.3362
7.3471
7.4370
7.4411
7.4483
7.4507
7.4551
8.0036
8.0536
1.000
0.404
0.426
0.446
0.462
2.655
1.517
0.491
Isolated as a mixture of regioisomers
COOEt
N
N
Ph
Ph
4w
SpinWorks 3: NM 1448 B1
PPM

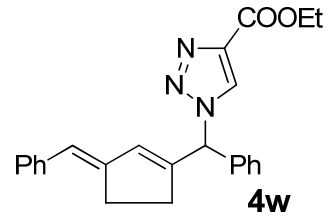

14.3541
29.4734
31.4931
31.9455
33.9660
61.4452
66.2201
66.4322
76.7937
77.1115
77.3141
77.4293
120.6661
122.3275
126.2865
126.3488
127.0016
127.0383
127.8355
128.0183
128.0456
128.0815
128.4628
129.3878
130.5892
135.4591
135.5962
136.7200
137.9470
138.1561
140.0314
140.0972
145.7608
146.3748
147.0262
150.6808
160.7715
160.8243
SpinWorks 3: NM 1448 B1
Isolated as a mixture of regioisomers
COOEt
Ph
Ph
4w
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160


SpinWorks 3: NM 1448 B1
120.6661
122.3275
126.2865
126.3488
127.0016
127.0383
127.8355
128.0183
128.0456
128.0815
128.4628
129.3878
130.5892
135.4591
135.5962
136.7200
137.9470
138.1561
140.0314
140.0972
145.7608
146.3748
147.0262
150.6808
Isolated as a mixture of regioisomers
COOEt
N
N
Ph
Ph
4w
PPM
151
149
147
145
143
141
139
137
135
133
131
129
127
125
123
121
119

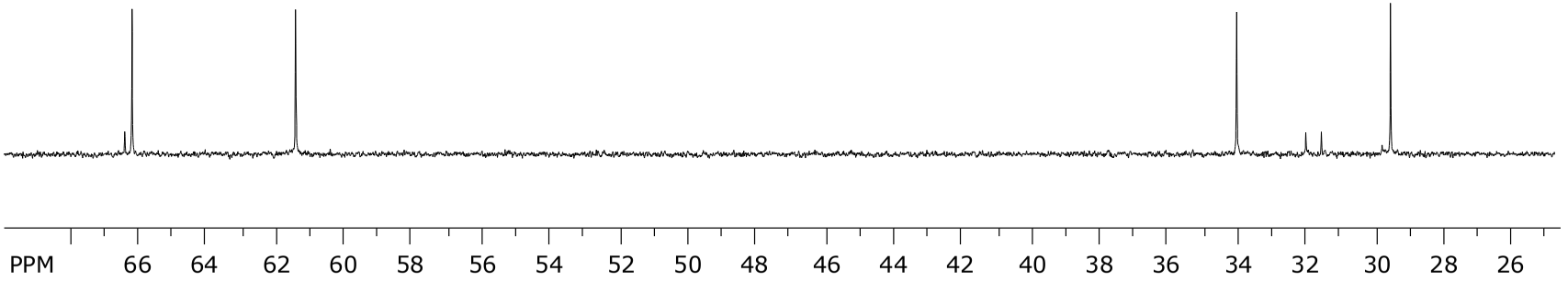
SpinWorks 3: NM 1448 B1

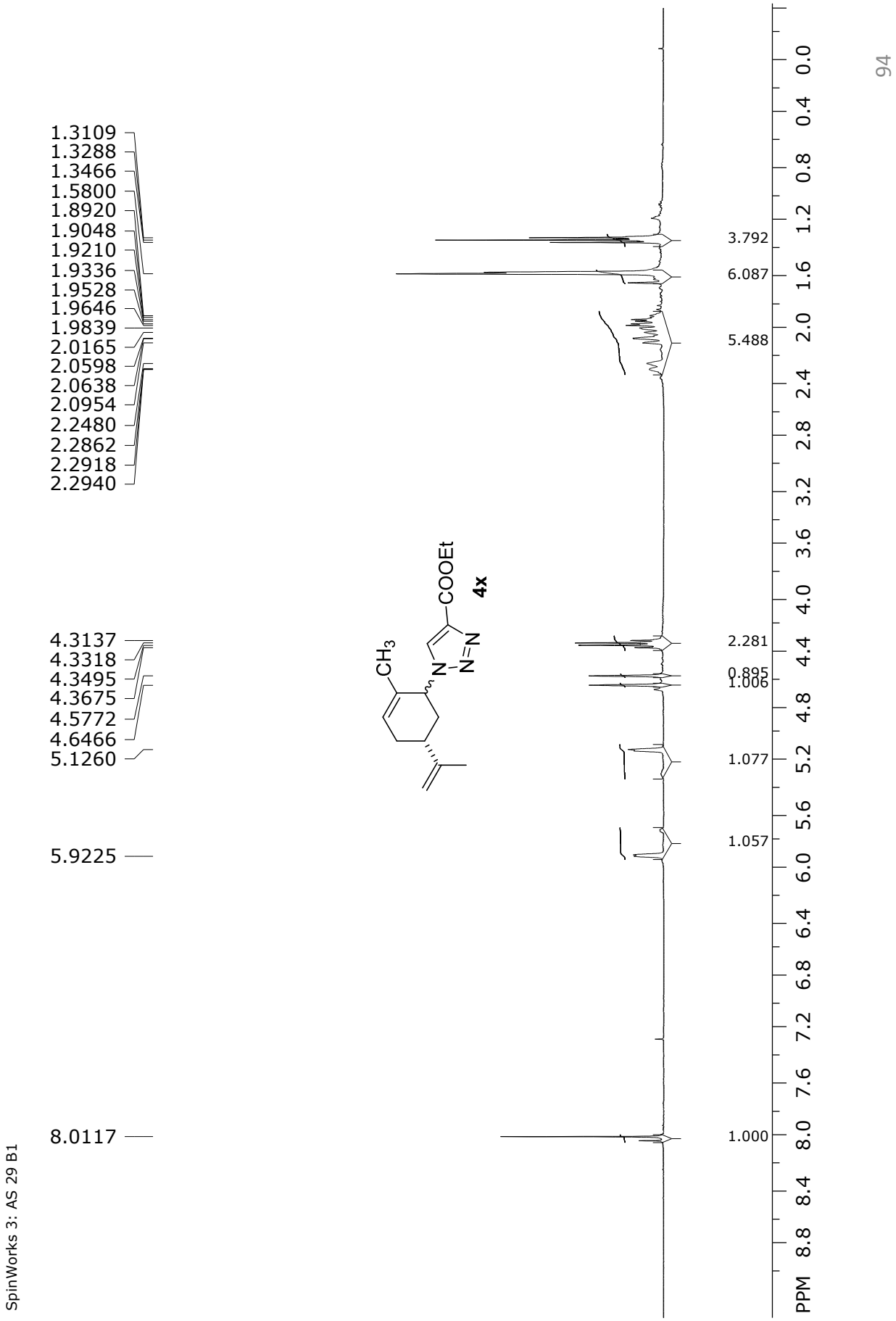
66.2201
66.4322
61.4452
33.9660
31.4931
31.9455
29.4734

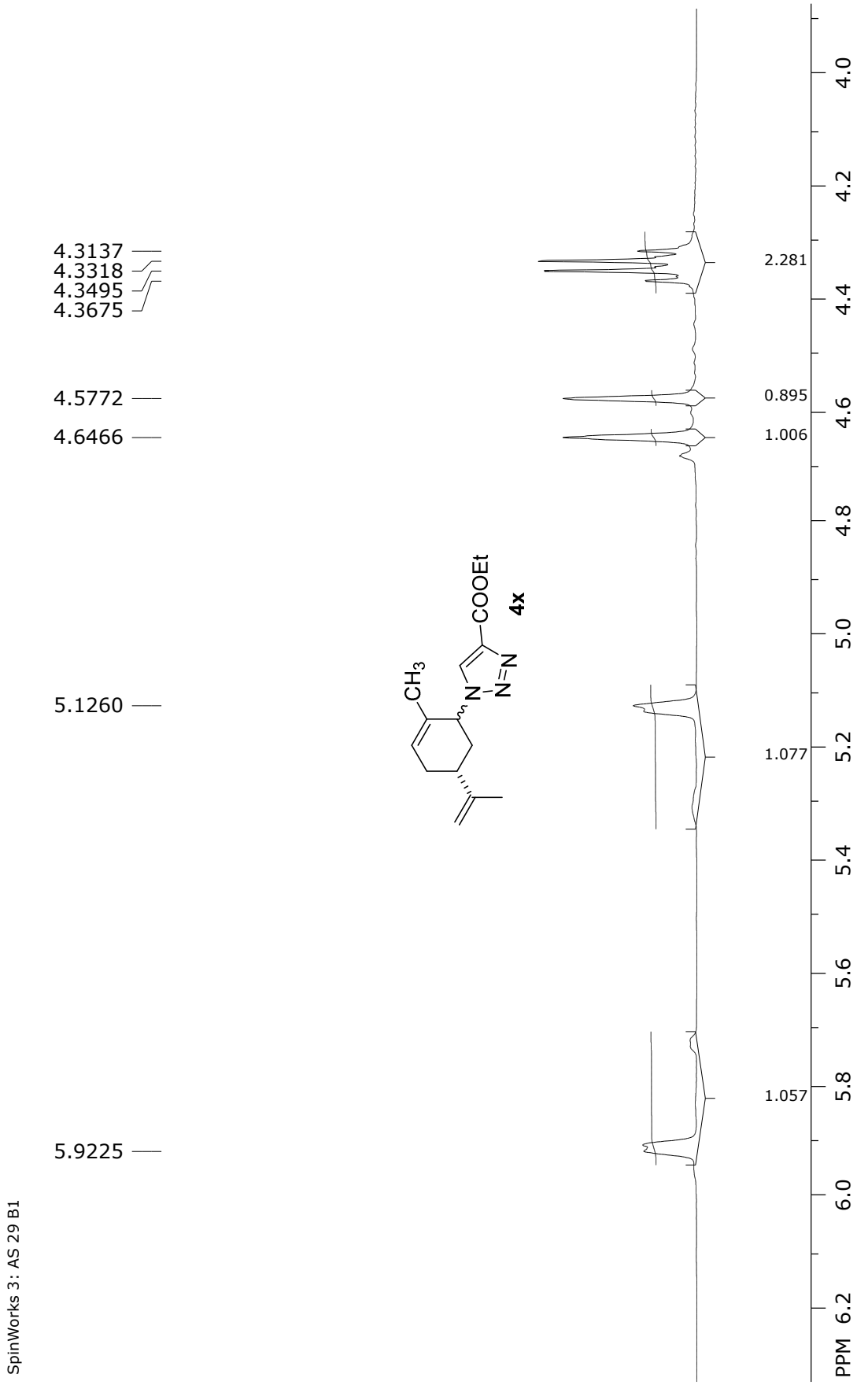
Isolated as a mixture of regioisomers

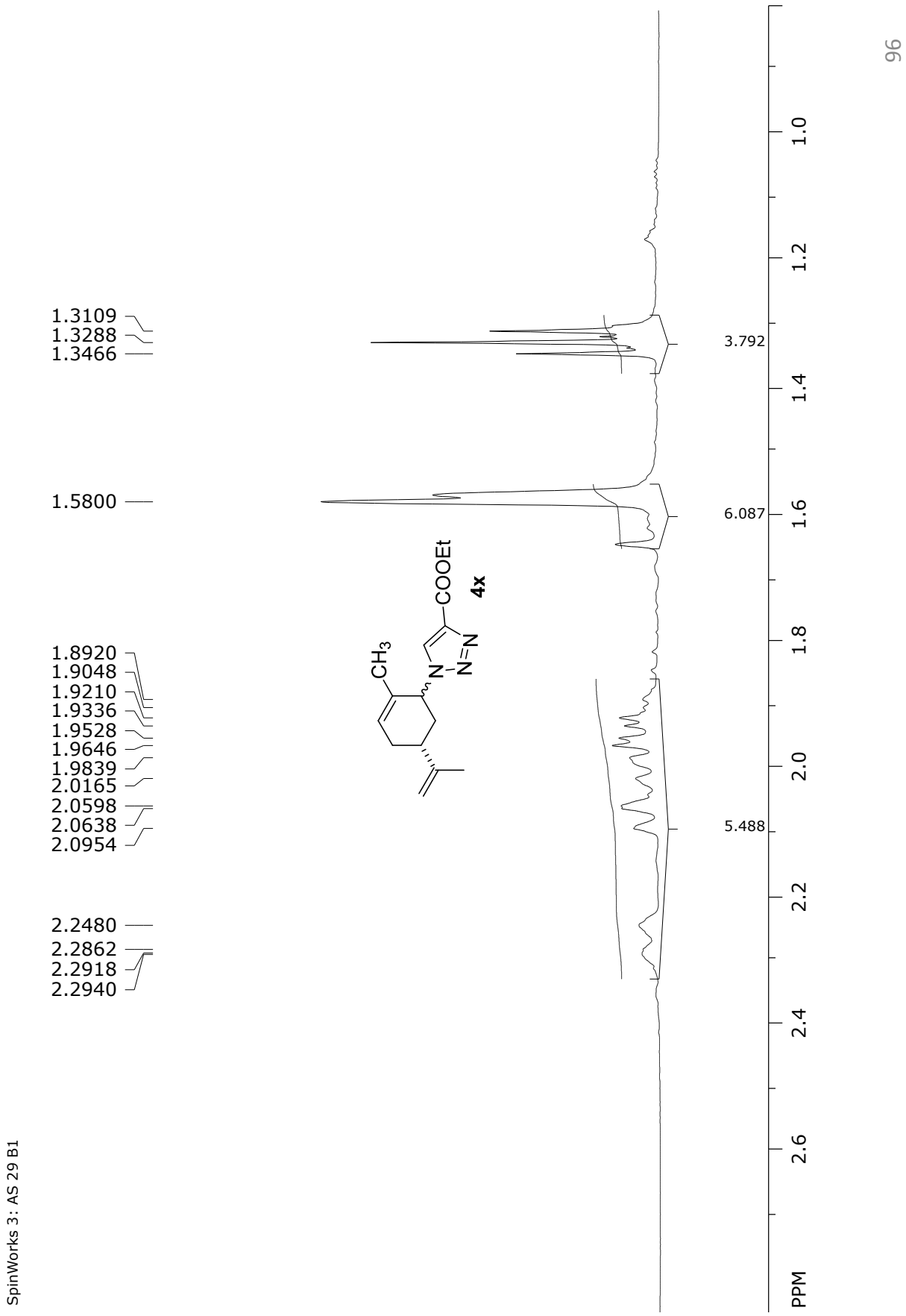


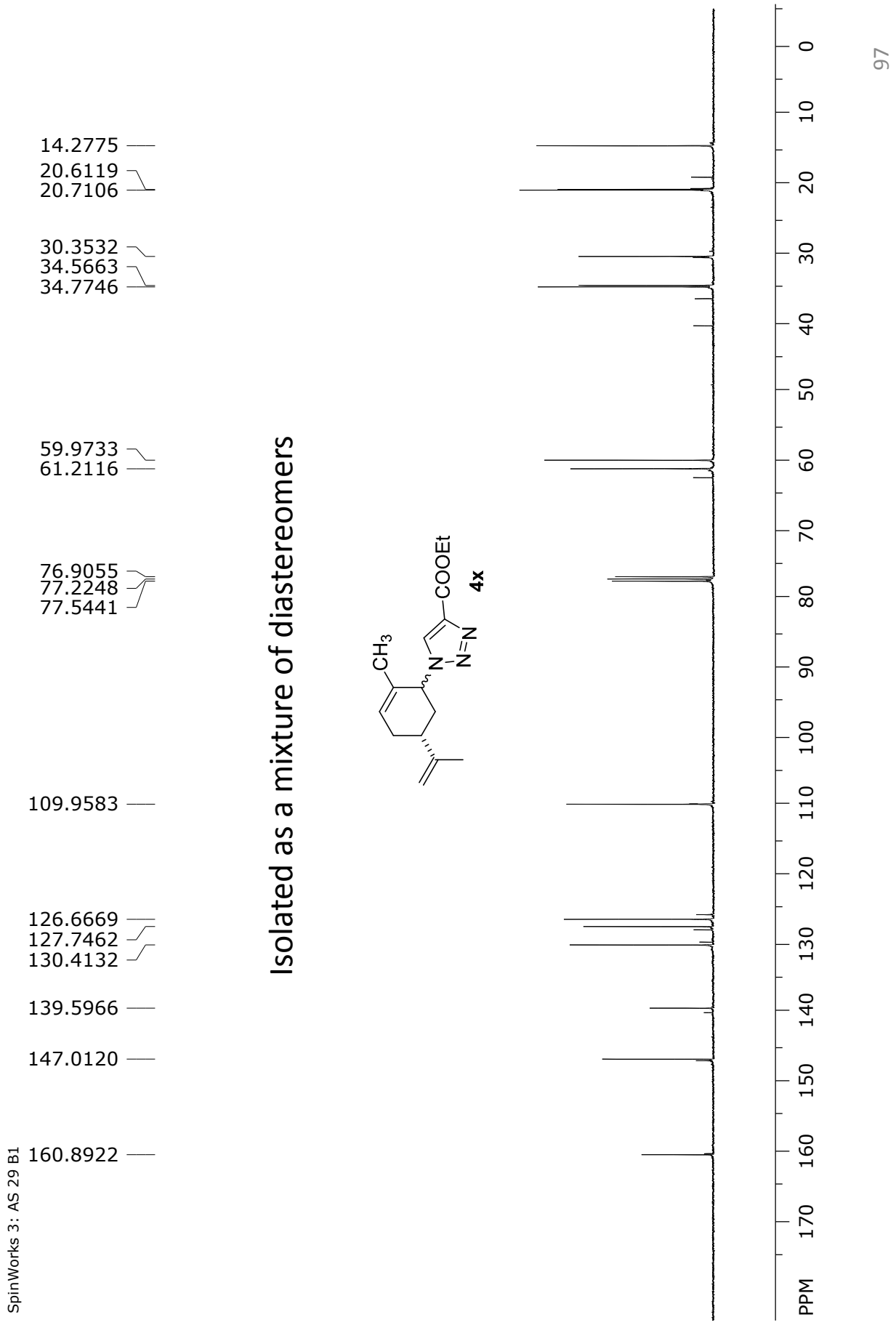
4w




1.3109
1.3288
1.3466
1.5800
1.8920
1.9048
1.9210
1.9336
1.9528
1.9646
1.9839
2.0165
2.0598
2.0638
2.0954
2.2480
2.2862
2.2918
2.2940
4.3137
4.3318
4.3495
4.3675
4.5772
4.6466
5.1260
5.9225
8.0117
COOEt
4x
CH3
N
N=N
3.792
6.087
5.488
2.281
0.895
1.006
1.077
1.057
1.000
PPM
8.8
8.4
8.0
7.6
7.2
6.8
6.4
6.0
5.6
5.2
4.8
4.4
4.0
3.6
3.2
2.8
2.4
2.0
1.6
1.2
0.8
0.4
0.0
SpinWorks 3: AS 29 B1


4.3137
4.3318
4.3495
4.3675
4.5772
4.6466
5.1260
5.9225
2.281
0.895
1.006
1.077
1.057
4x
COOEt
CH3
N
N=N
PPM 6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
SpinWorks 3: AS 29 B1


1.3109
1.3288
1.3466
1.5800
1.8920
1.9048
1.9210
1.9336
1.9528
1.9646
1.9839
2.0165
2.0598
2.0638
2.0954
2.2480
2.2862
2.2918
2.2940
3.792
6.087
5.488
COOEt
4x
CH3
N
N=N
PPM
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
SpinWorks 3: AS 29 B1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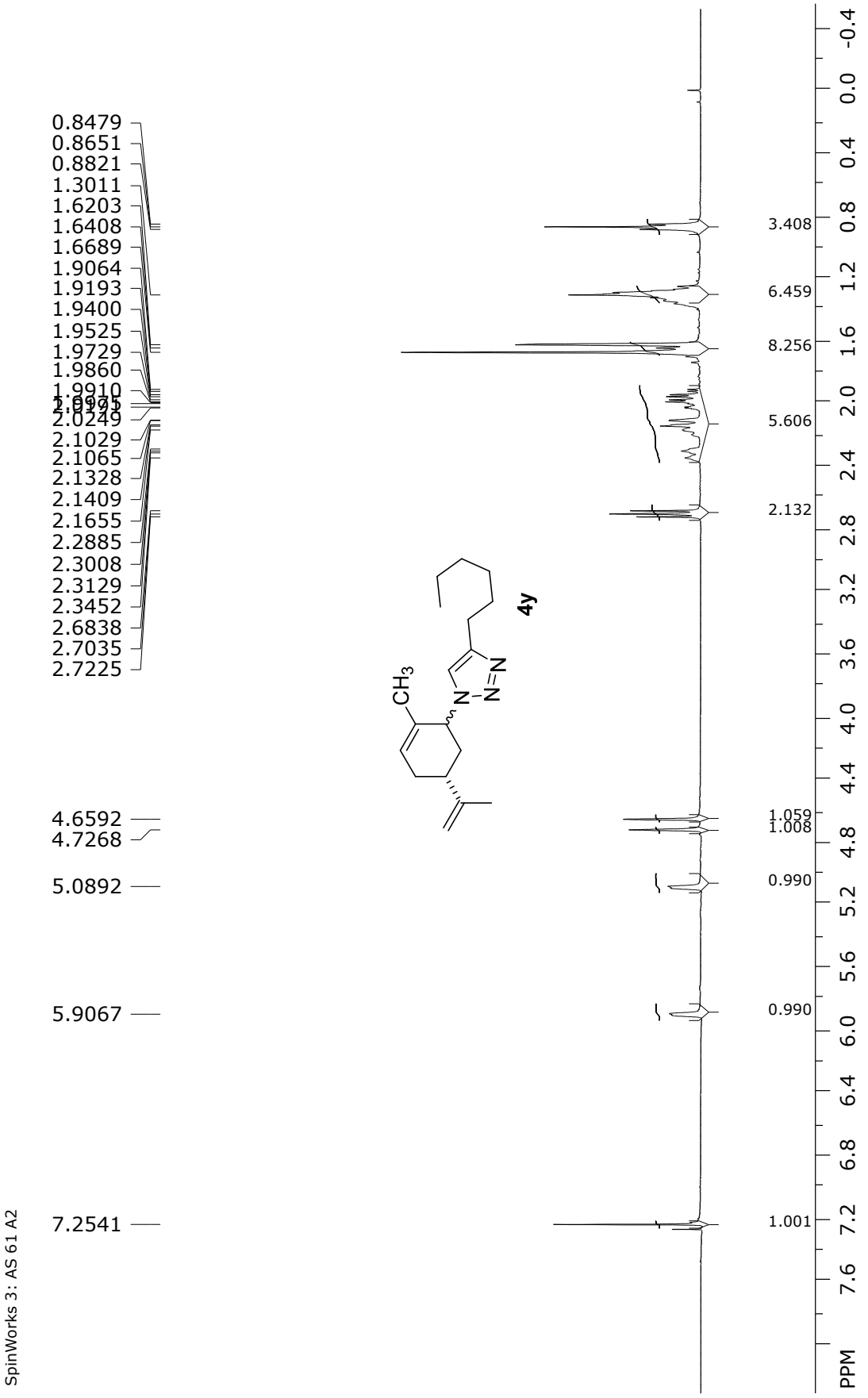
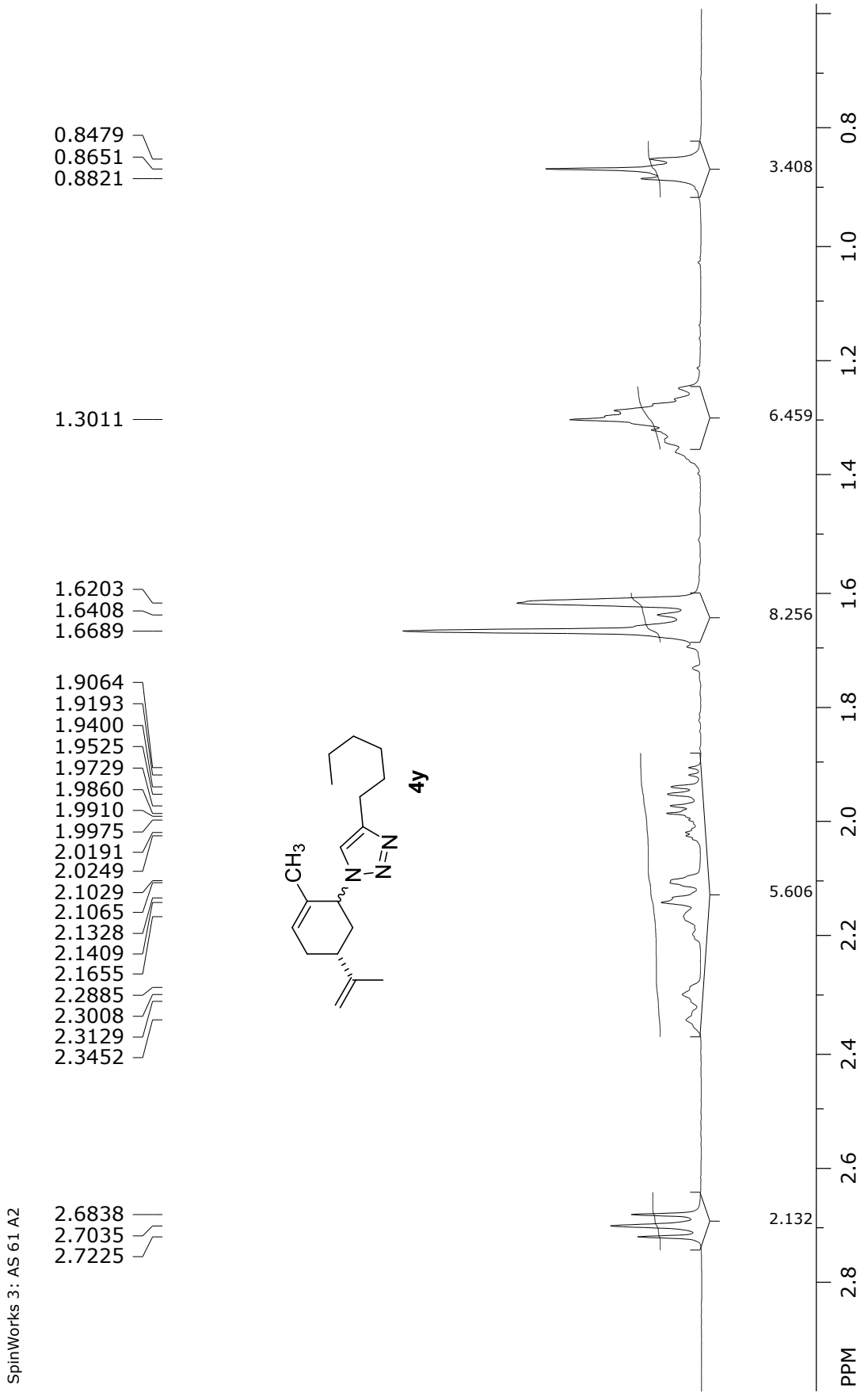
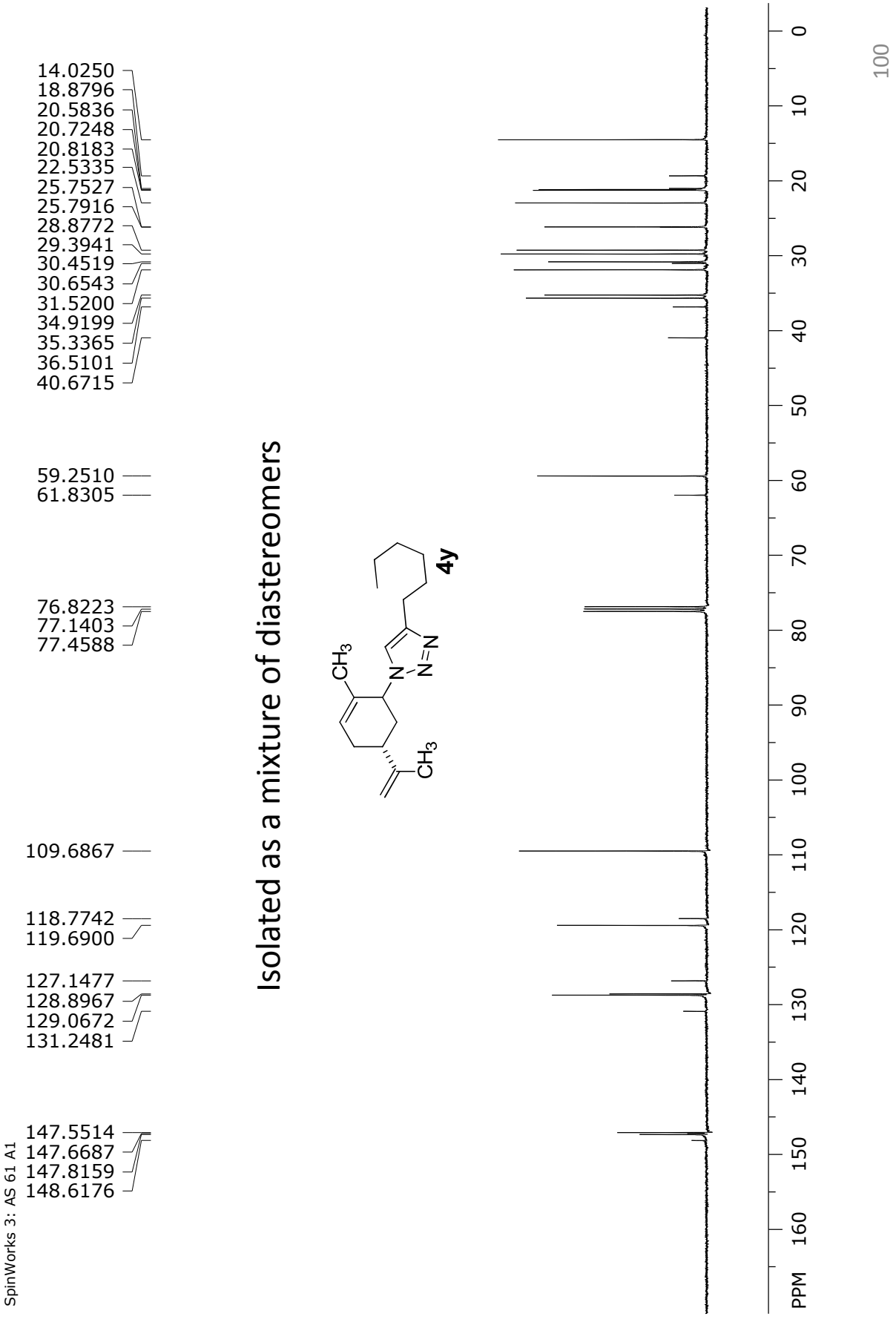
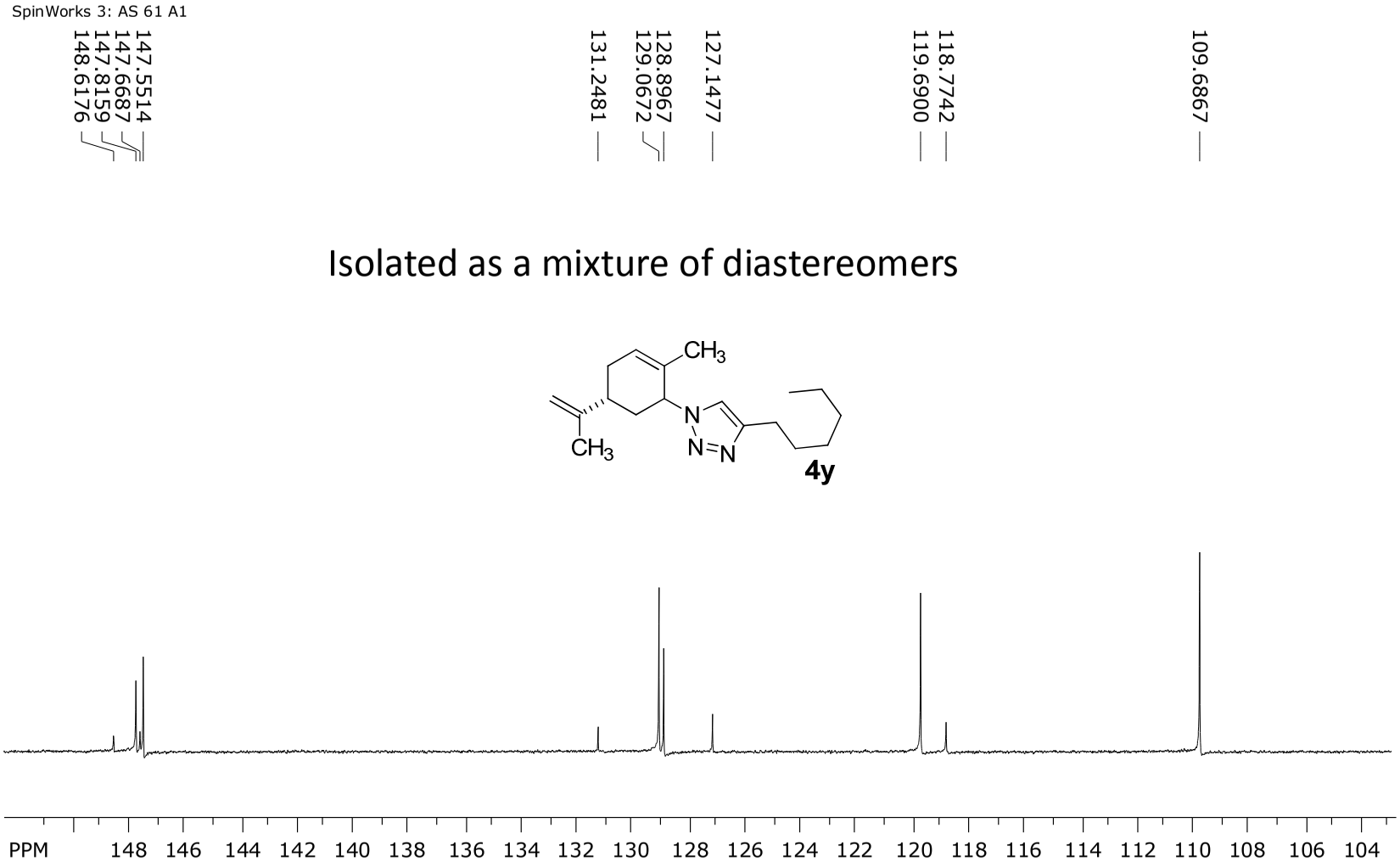
20.6119
20.7106
30.3532
34.5663
34.7746
59.9733
61.2116
76.9055
77.2248
77.5441
109.9583
126.6669
127.7462
130.4132
139.5966
147.0120
160.8922
SpinWorks 3: AS 29 B1
Isolated as a mixture of diastereomers
CH3
COOEt
4x
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170

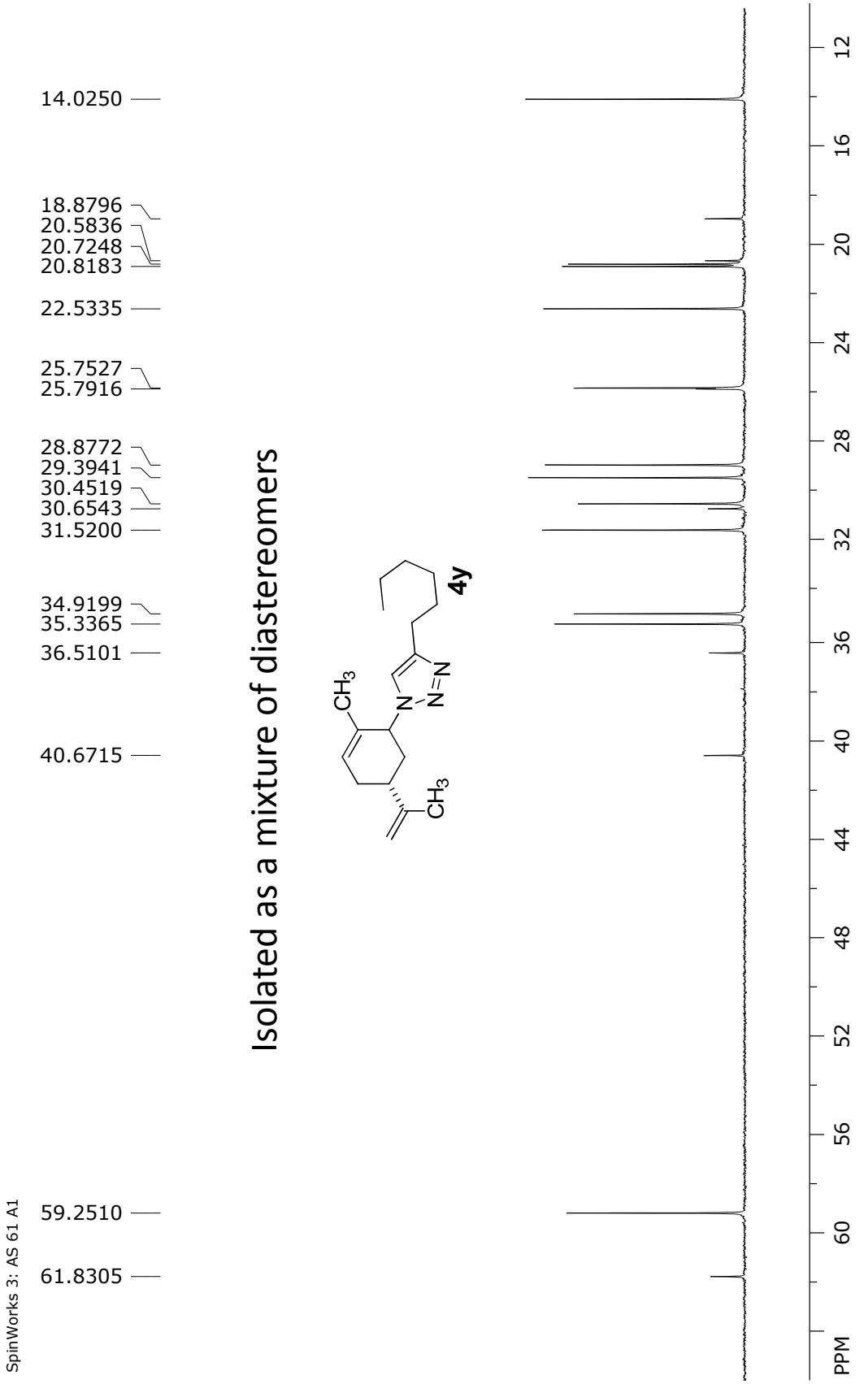


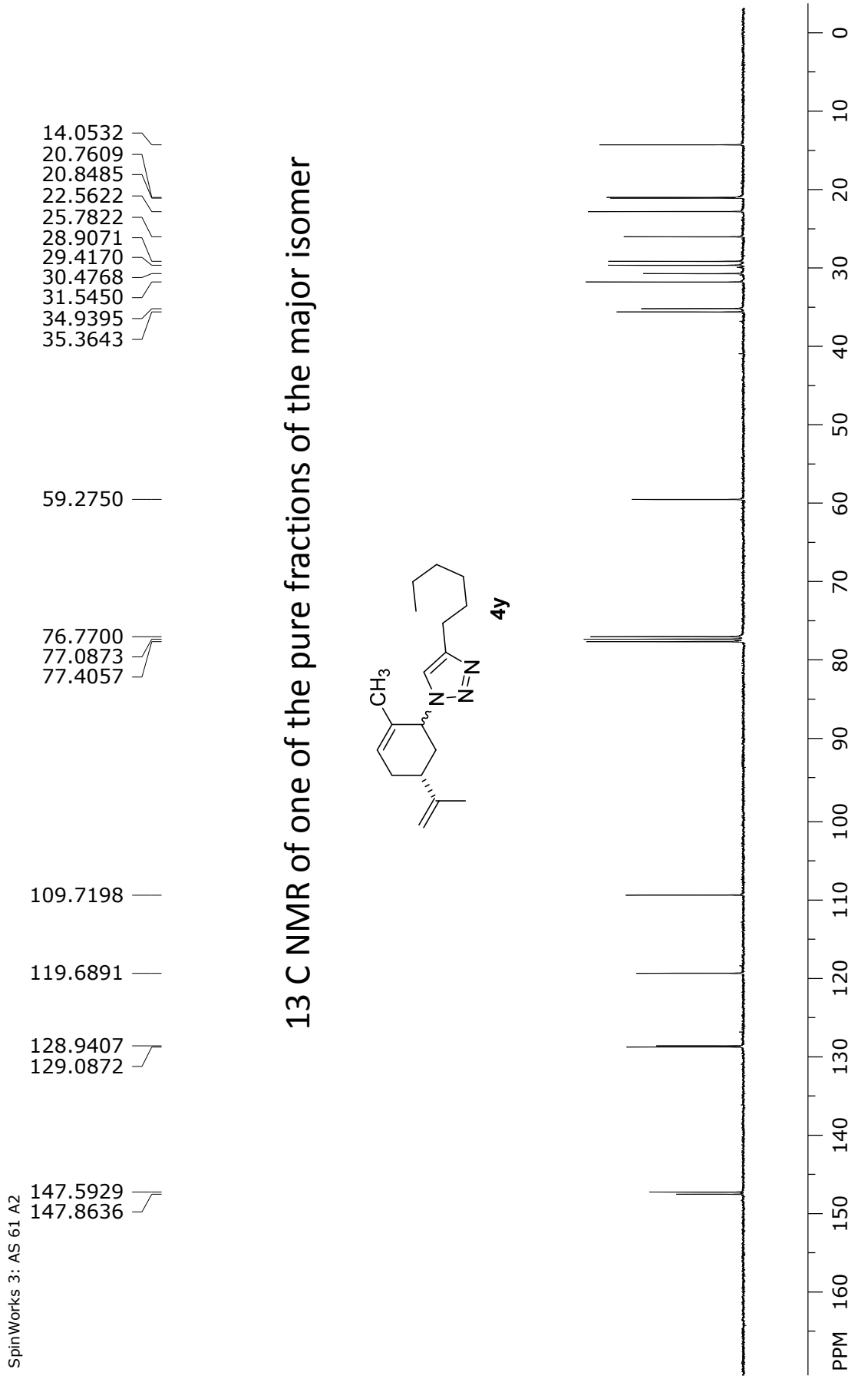
SpinWorks 3: AS 61 A2

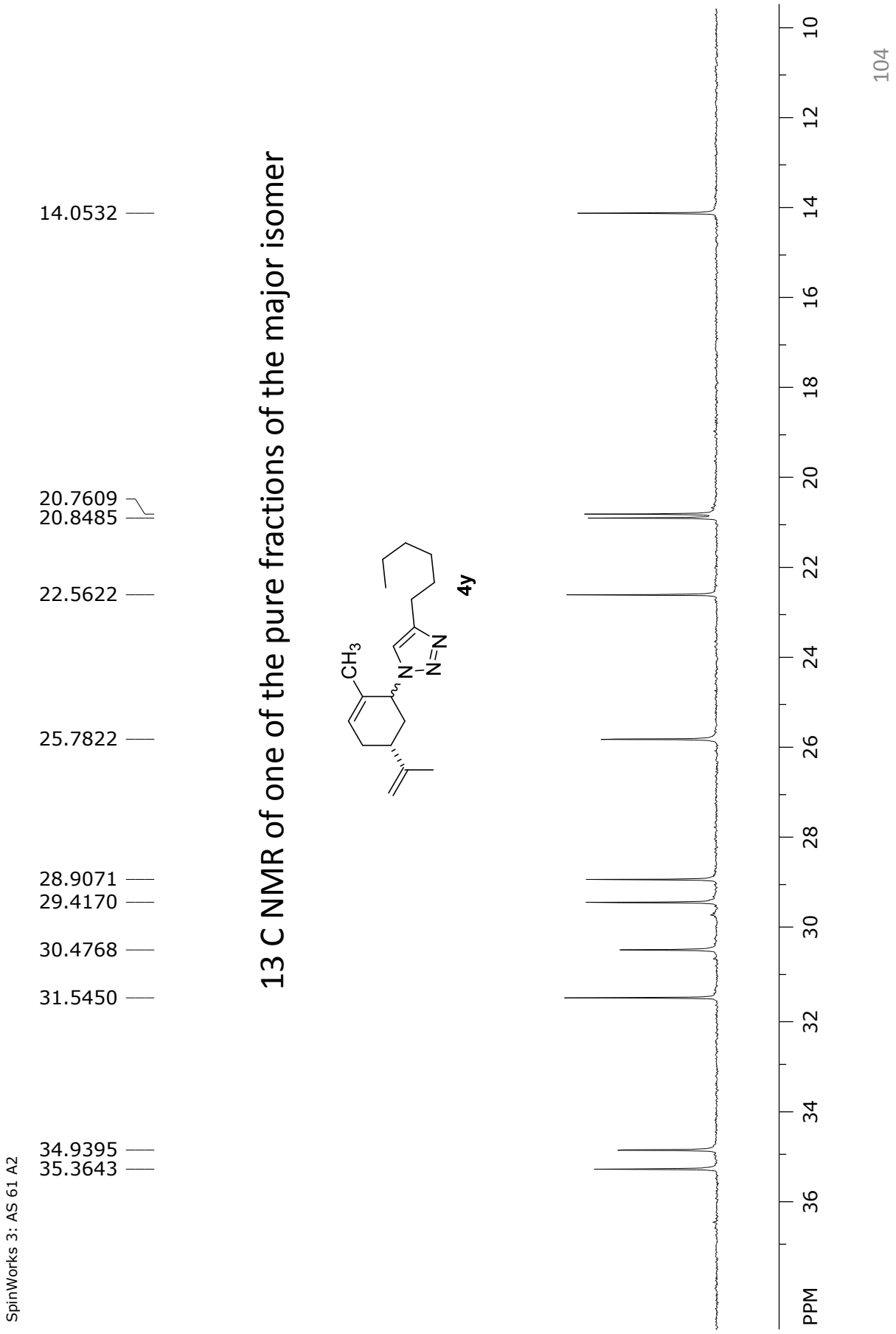

0.8479
0.8651
0.8821
1.3011
1.6203
1.6408
1.6689
1.9064
1.9193
1.9400
1.9525
1.9729
1.9860
1.9910
1.9975
2.0191
2.0249
2.1029
2.1065
2.1328
2.1409
2.1655
2.2885
2.3008
2.3129
2.3452
2.6838
2.7035
2.7225
4y
3.408
6.459
8.256
5.606
2.132
PPM
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
SpinWorks 3: AS 61 A2

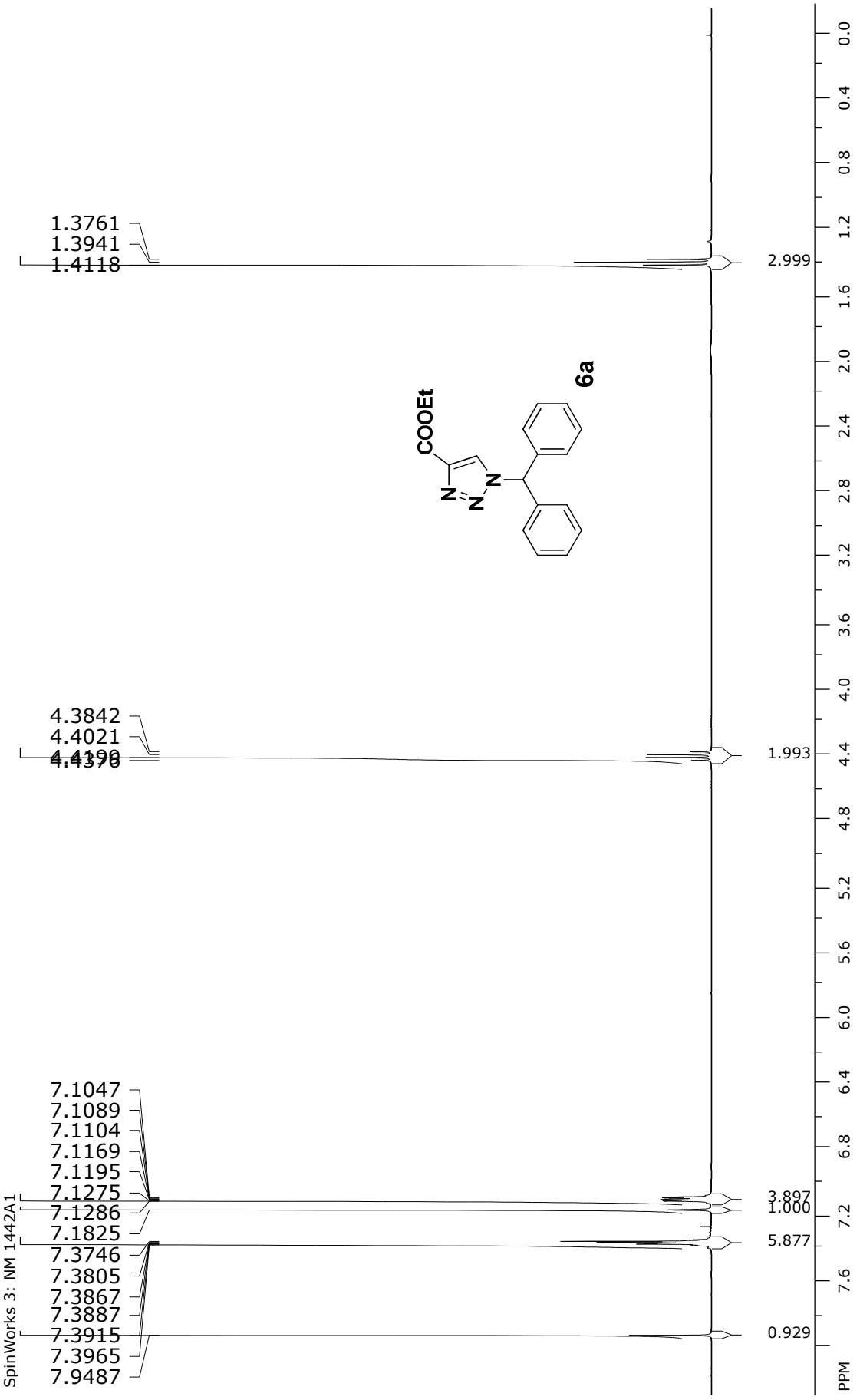

14.0250
18.8796
20.5836
20.7248
20.8183
22.5335
25.7527
25.7916
28.8772
29.3941
30.4519
30.6543
31.5200
34.9199
35.3365
36.5101
40.6715
59.2510
61.8305
76.8223
77.1403
77.4588
109.6867
118.7742
119.6900
127.1477
128.8967
129.0672
131.2481
147.5514
147.6687
147.8159
148.6176
Isolated as a mixture of diastereomers
4y
CH3
CH3
N
N=N
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
SpinWorks 3: AS 61 A1

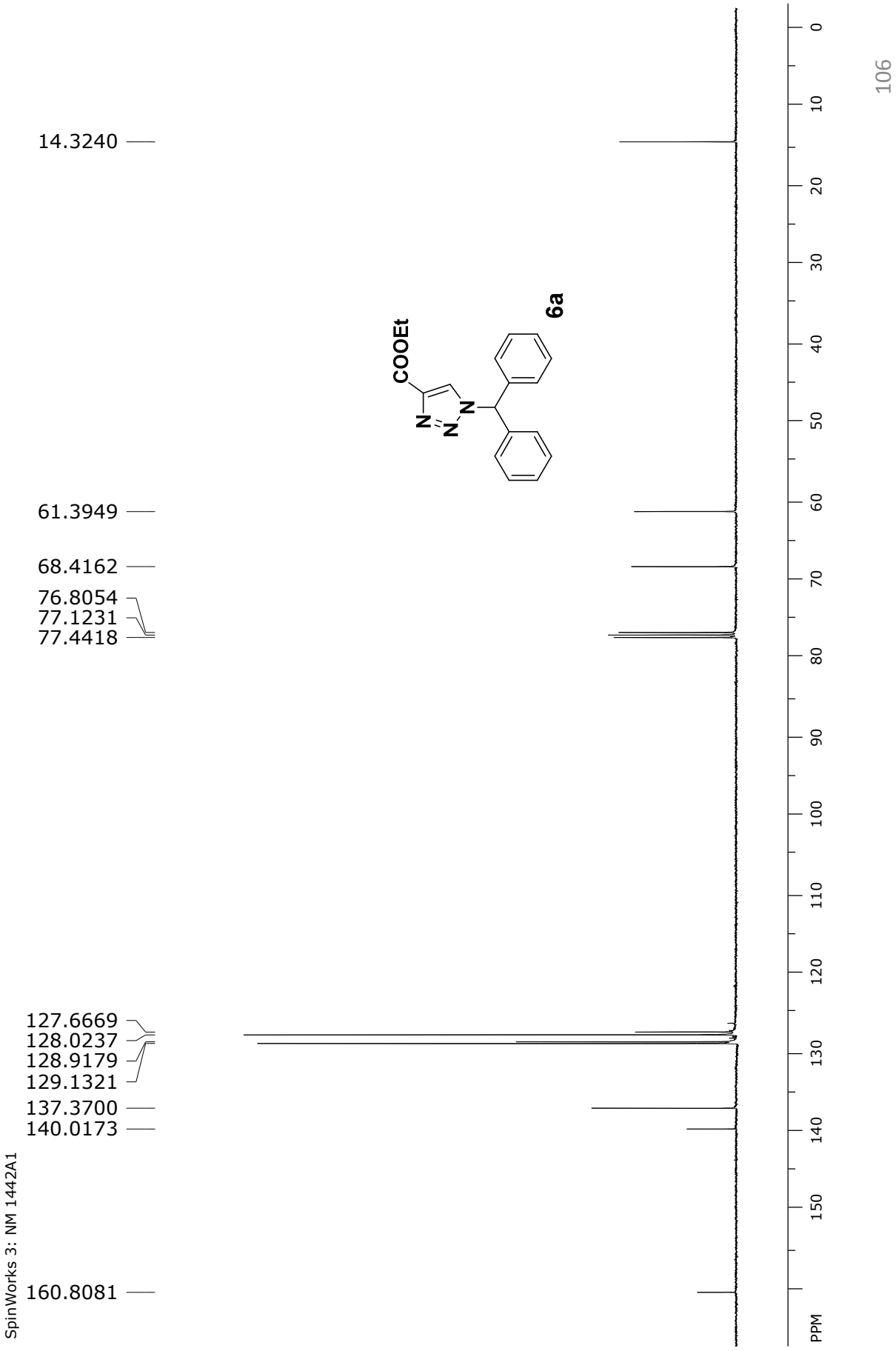



14.0250
18.8796
20.5836
20.7248
20.8183
22.5335
25.7527
25.7916
28.8772
29.3941
30.4519
30.6543
31.5200
34.9199
35.3365
36.5101
40.6715
59.2510
61.8305
Isolated as a mixture of diastereomers
4y
CH3
CH3
N
N=N
SpinWorks 3: AS 61 A1
PPM
12
16
20
24
28
32
36
40
44
48
52
56
60


13 C NMR of one of the pure fractions of the major isomer
4y
14.0532
20.7609
20.8485
22.5622
25.7822
28.9071
29.4170
30.4768
31.5450
34.9395
35.3643
59.2750
76.7700
77.0873
77.4057
109.7198
119.6891
128.9407
129.0872
147.5929
147.8636
SpinWorks 3: AS 61 A2
PPM


13 C NMR of one of the pure fractions of the major isomer
4y
14.0532
20.7609
20.8485
22.5622
25.7822
28.9071
29.4170
30.4768
31.5450
34.9395
35.3643
SpinWorks 3: AS 61 A2
PPM
10
12
14
16
18
20
22
24
26
28
30
32
34
36


1.3761
1.3941
1.4118
2.999
COOEt
6a
4.3842
4.4021
4.4190
4.4370
1.993
7.1047
7.1089
7.1104
7.1169
7.1195
7.1275
7.1286
7.1825
7.3746
7.3805
7.3867
7.3887
7.3915
7.3965
7.9487
3.897
1.000
5.877
0.929
SpinWorks 3: NM 1442A1
PPM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61.3949
68.4162
76.8054
77.1231
77.4418
127.6669
128.0237
128.9179
129.1321
137.3700
140.0173
160.8081
COOEt
N
N
6a
SpinWorks 3: NM 1442A1
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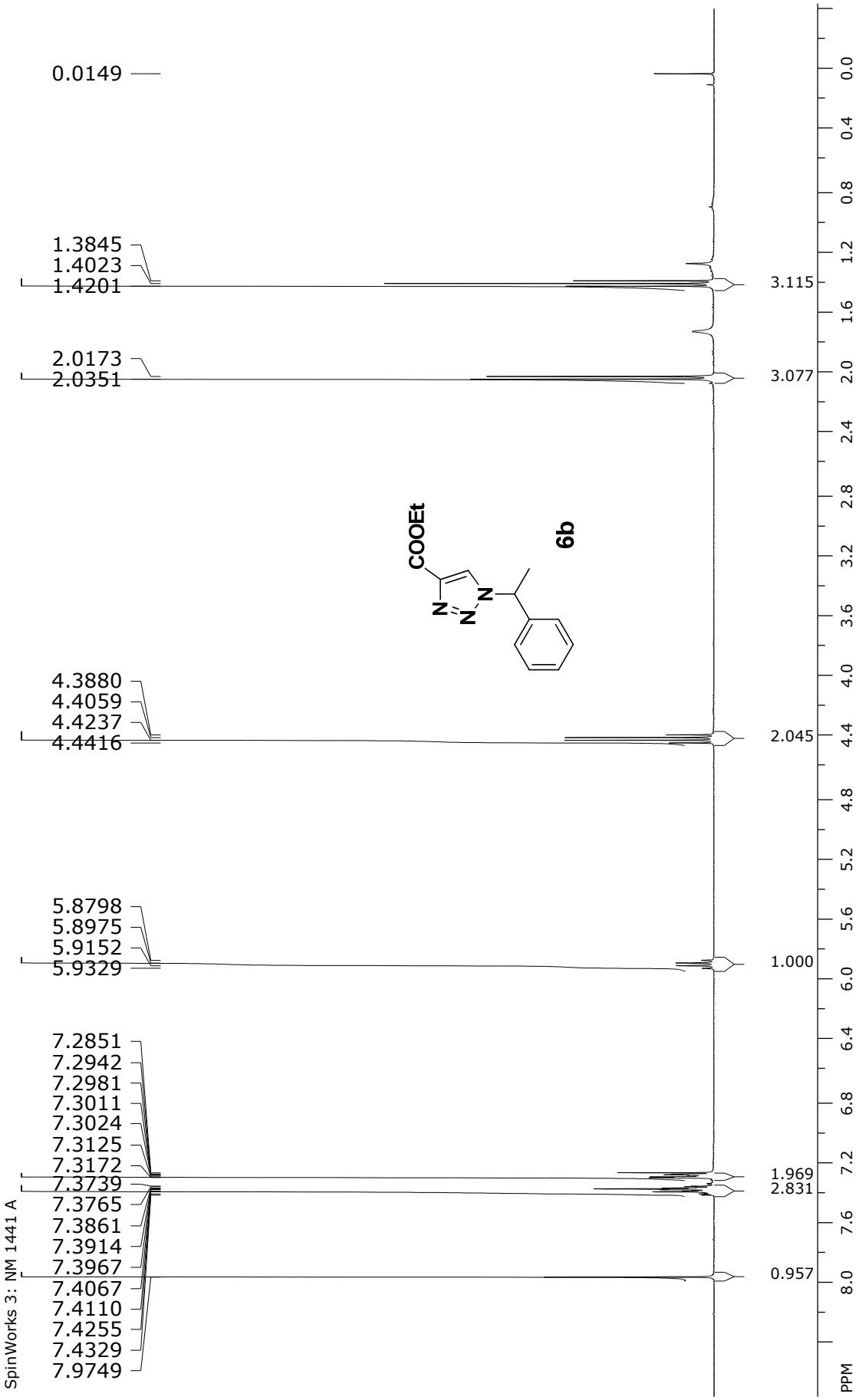
140
150
PPM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4.4237
4.4416
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5.8975
5.9152
5.9329
7.2851
7.2942
7.2981
7.3011
7.3024
7.3125
7.3172
7.3739
7.3765
7.3861
7.3914
7.3967
7.4067
7.4110
7.4255
7.4329
7.9749
3.115
3.077
2.045
1.000
1.969
2.831
0.957
COOEt
6b
N
N
SpinWorks 3: NM 1441 A
PPM
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0.4
0.8
1.2
1.6
2.0
2.4
2.8
3.2
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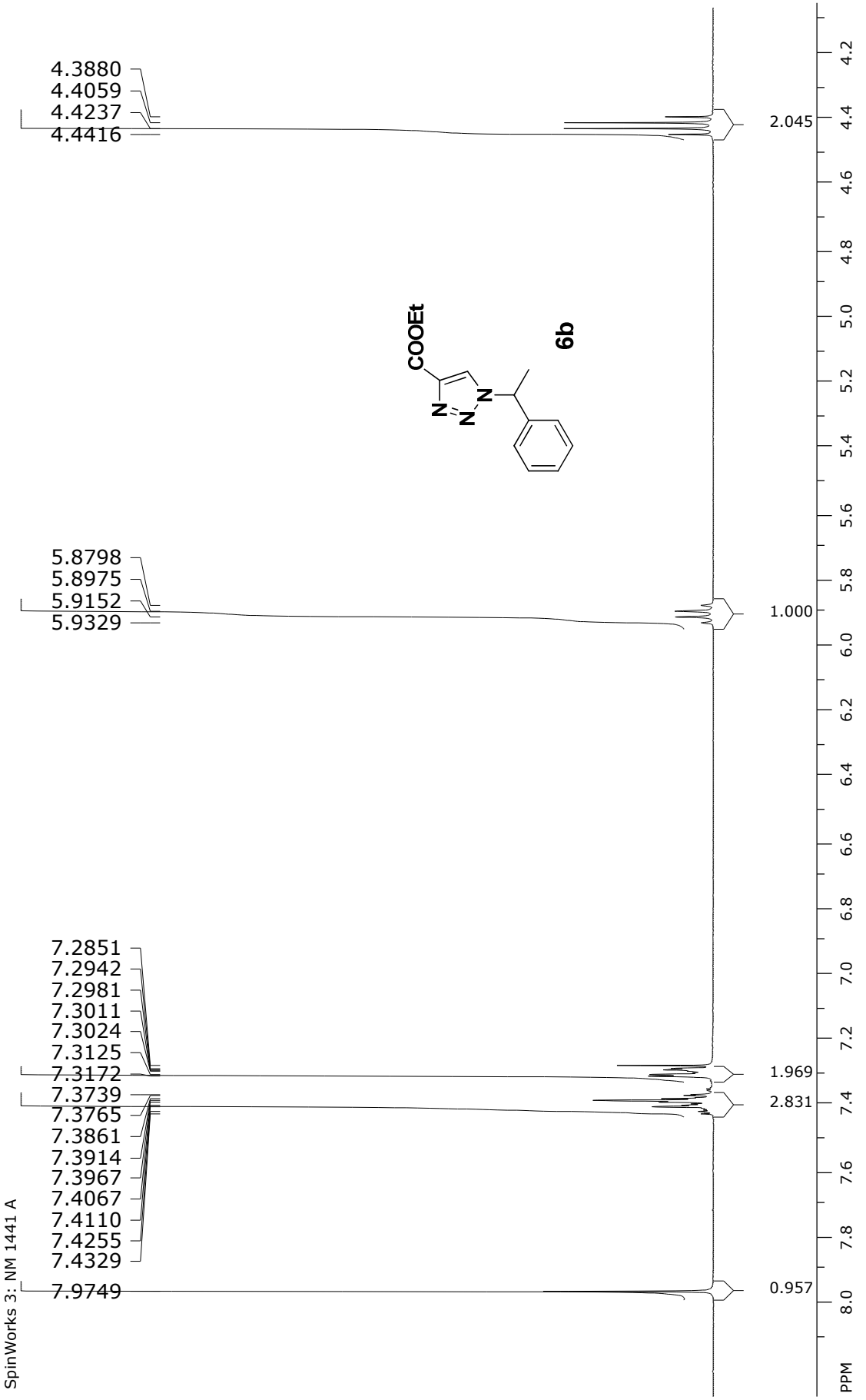
8.0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N
N
6b
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5.9152
5.9329
1.000
7.2851
7.2942
7.2981
7.3011
7.3024
7.3125
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1.969
7.3739
7.3765
7.3861
7.3914
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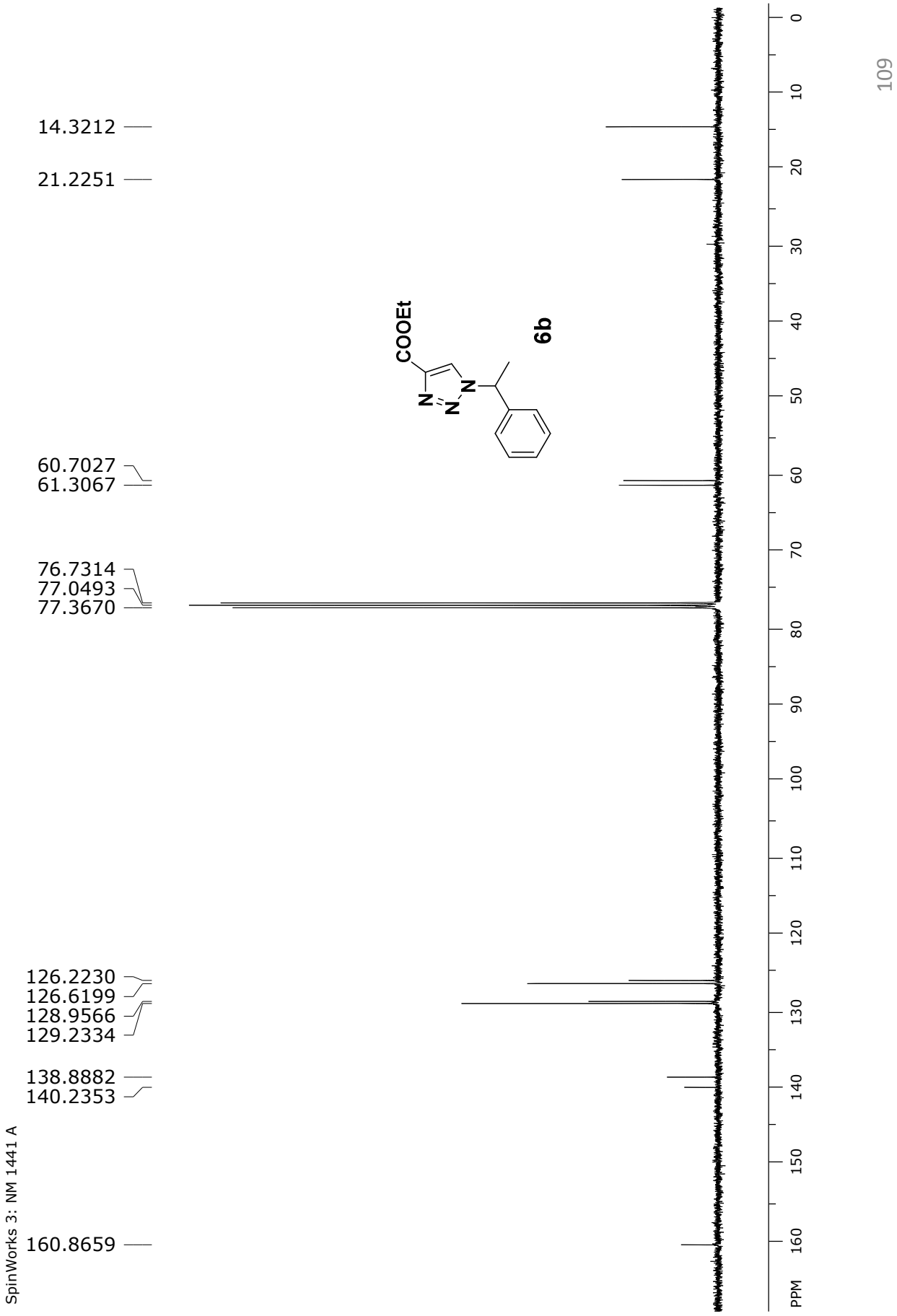
7.4110
7.4255
7.4329
2.831
7.9749
0.957
SpinWorks 3: NM 1441 A
PPM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138.8882
140.2353
160.8659
COOEt
6b
SpinWorks 3: NM 1441 A
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90
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150
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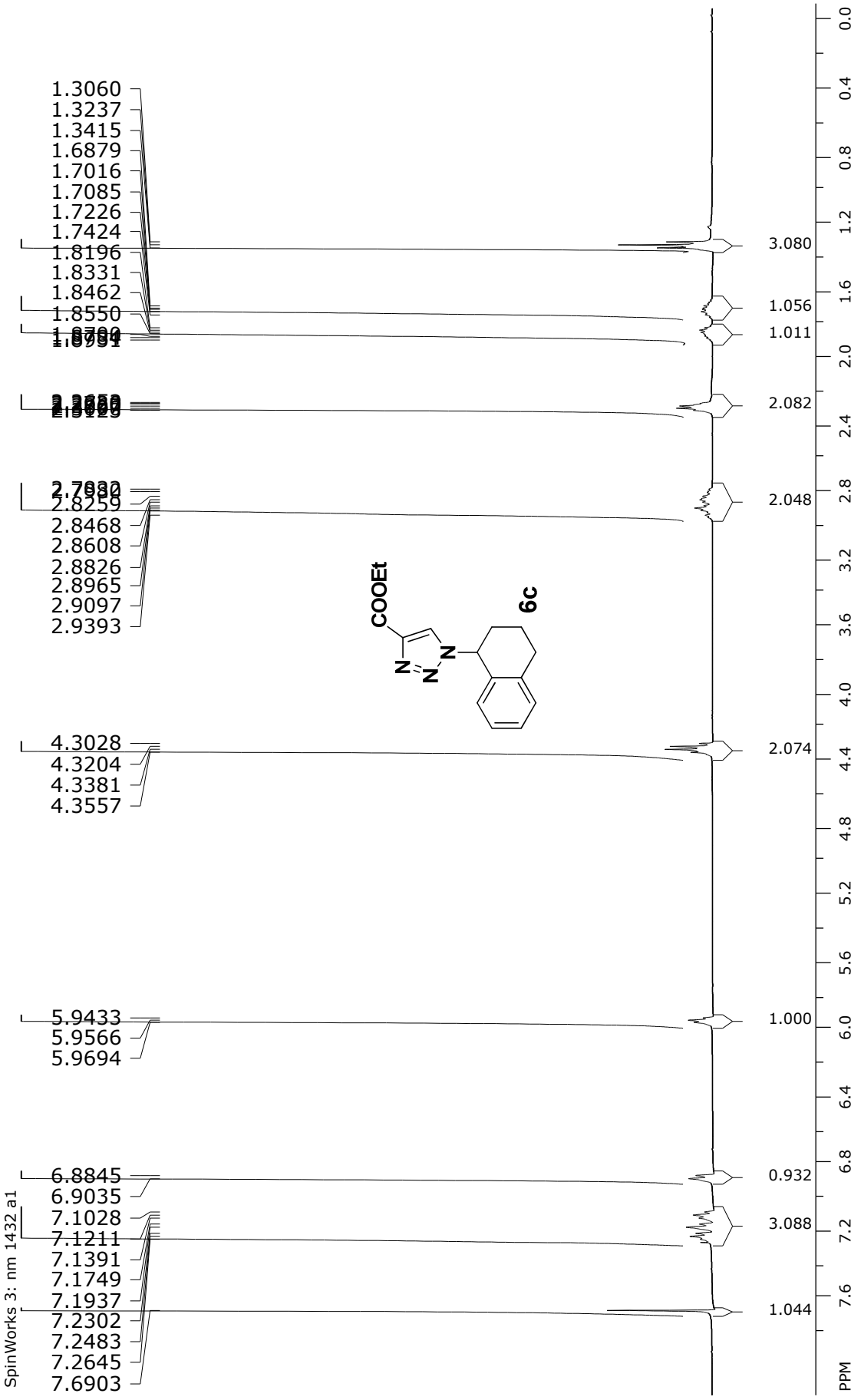
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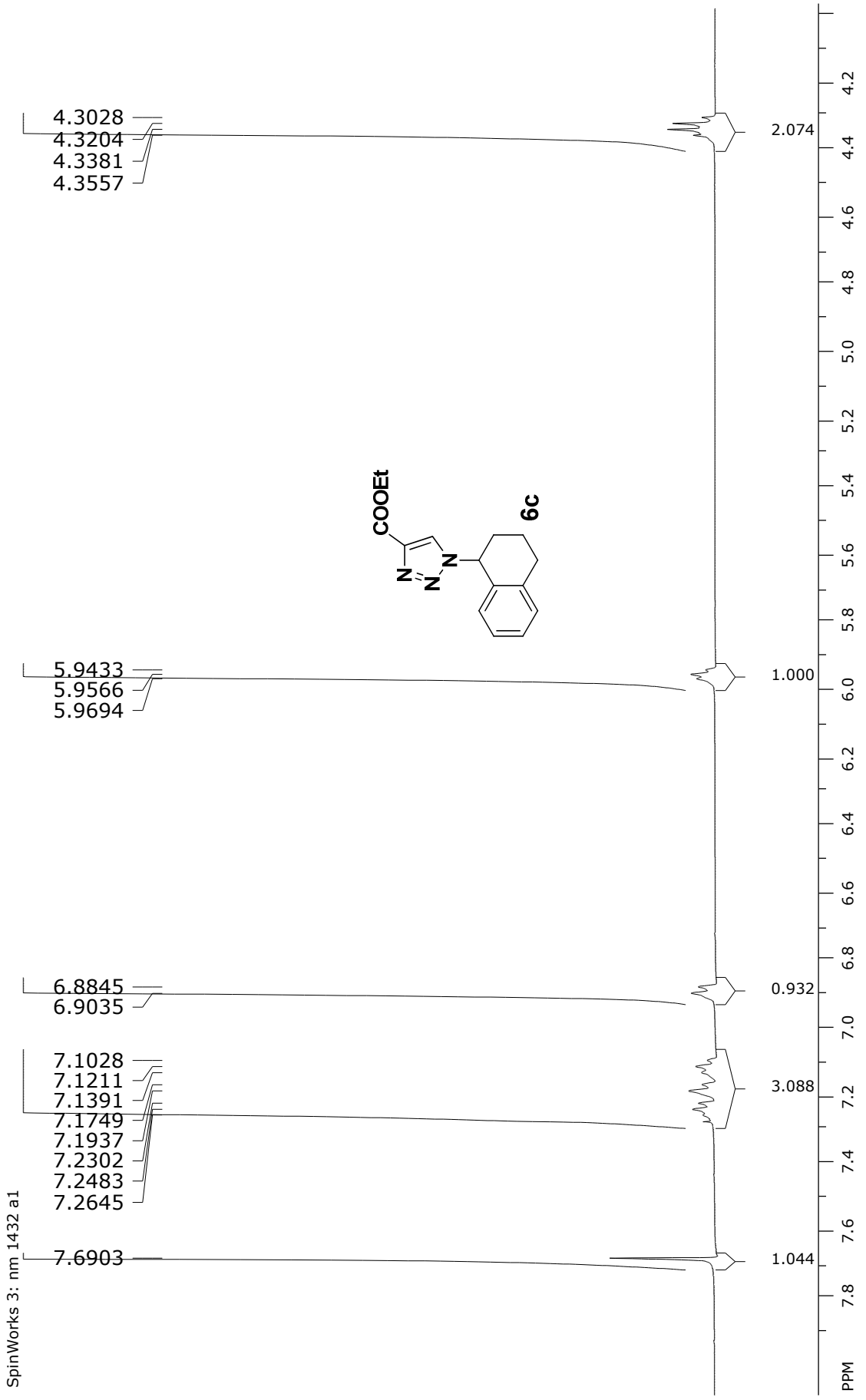
1.7085
1.7226
1.7424
1.8196
1.8331
1.8462
1.8550
2.8259
2.8468
2.8608
2.8826
2.8965
2.9097
2.9393
4.3028
4.3204
4.3381
4.3557
5.9433
5.9566
5.9694
6.8845
6.9035
7.1028
7.1211
7.1391
7.1749
7.1937
7.2302
7.2483
7.2645
7.6903
3.080
1.056
1.011
2.082
2.048
2.074
1.000
0.932
3.088
1.044
COOEt
6c
SpinWorks 3: nm 1432 a1
PPM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2.074
COOEt
6c
5.9433
5.9566
5.9694
1.000
6.8845
6.9035
0.932
7.1028
7.1211
7.1391
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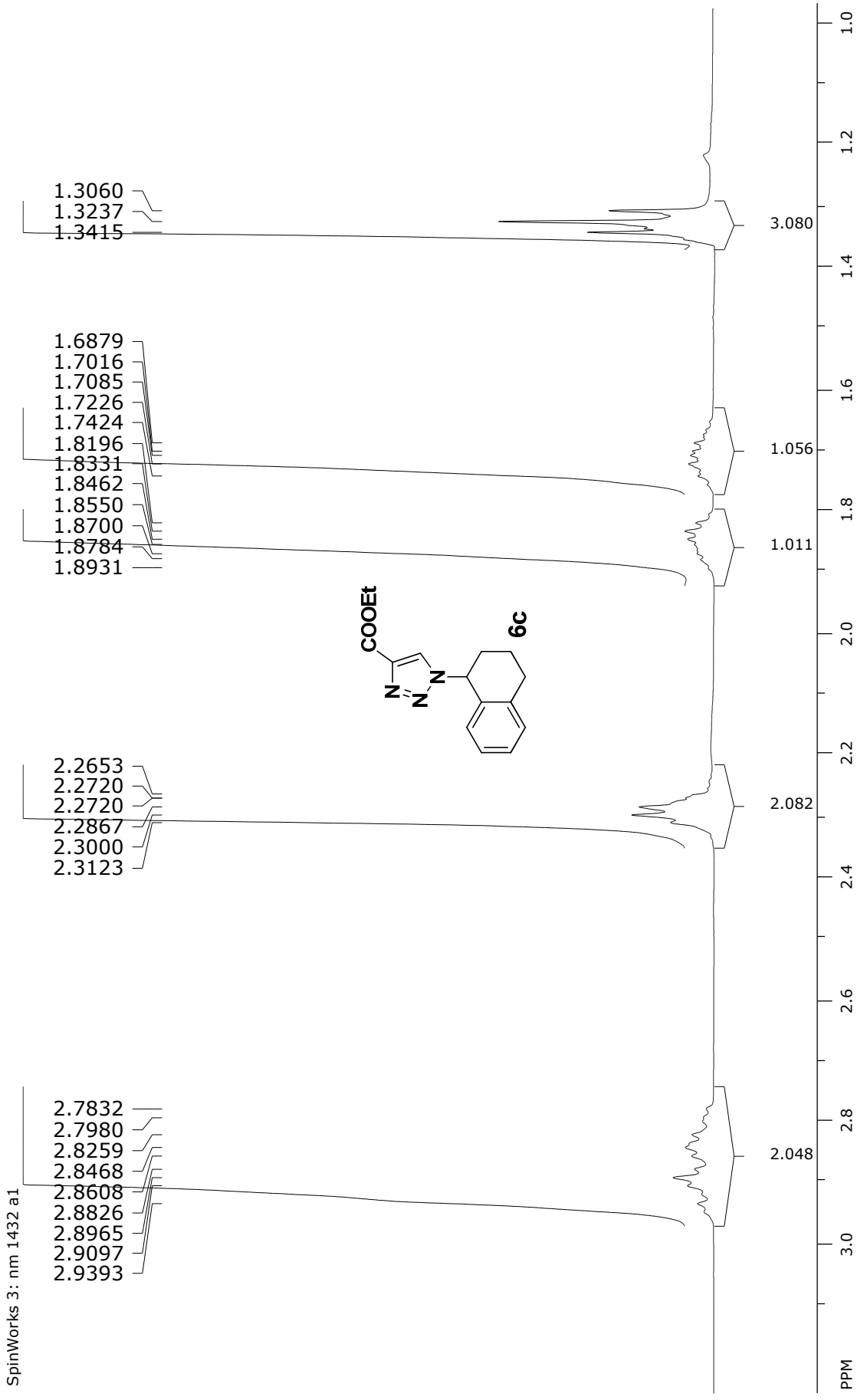
7.2302
7.2483
7.2645
3.088
7.6903
1.044
SpinWorks 3: nm 1432 a1
PPM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1.8550
1.8700
1.8784
1.8931
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2.2720
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2.3000
2.3123
2.7832
2.7980
2.8259
2.8468
2.8608
2.8826
2.8965
2.9097
2.9393
3.080
1.056
1.011
2.082
2.048
COOEt
6c
SpinWorks 3: nm 1432 a1
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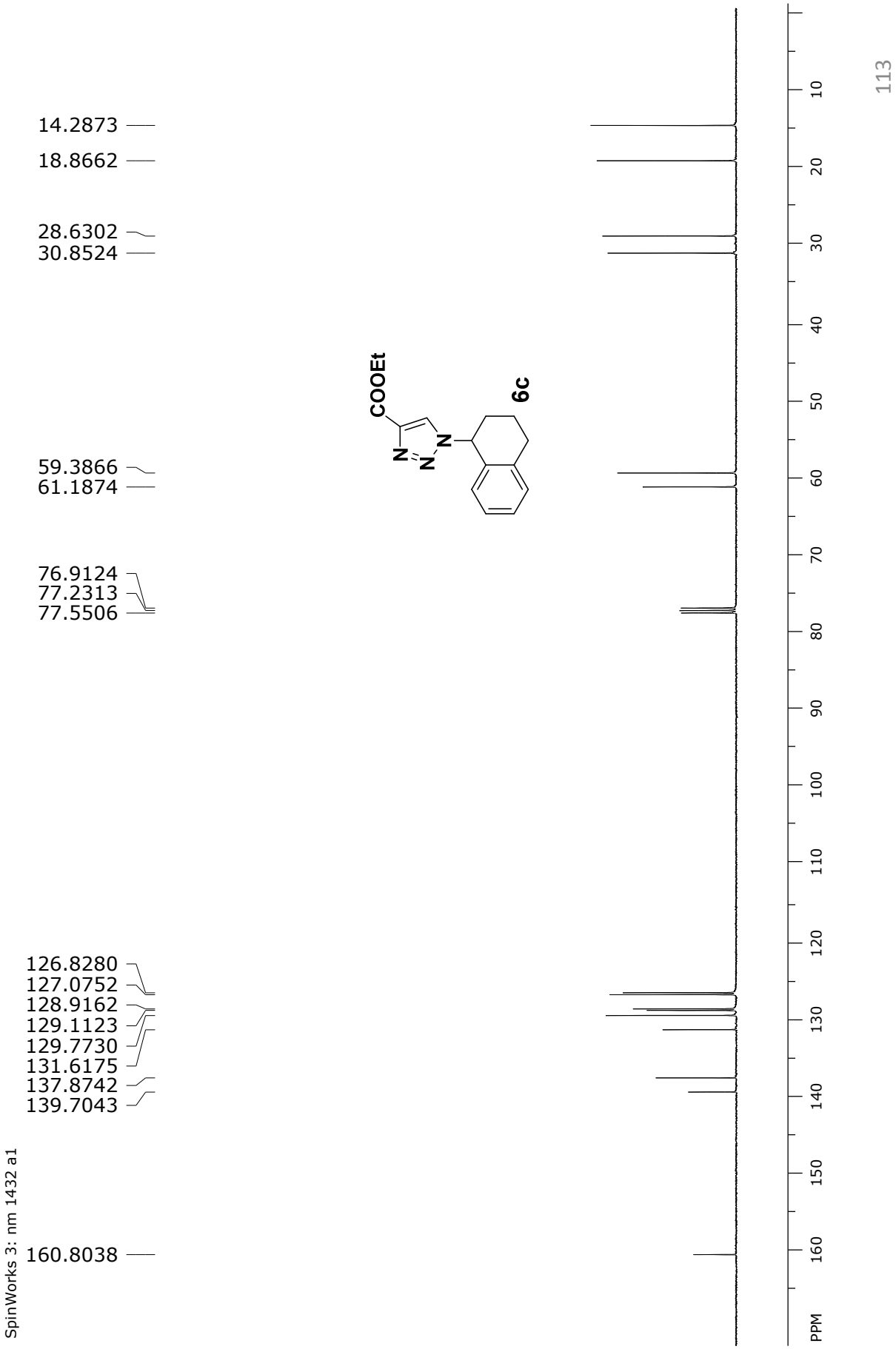
1.6
1.8
2.0
2.2
2.4
2.6
2.8
3.0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77.5506
126.8280
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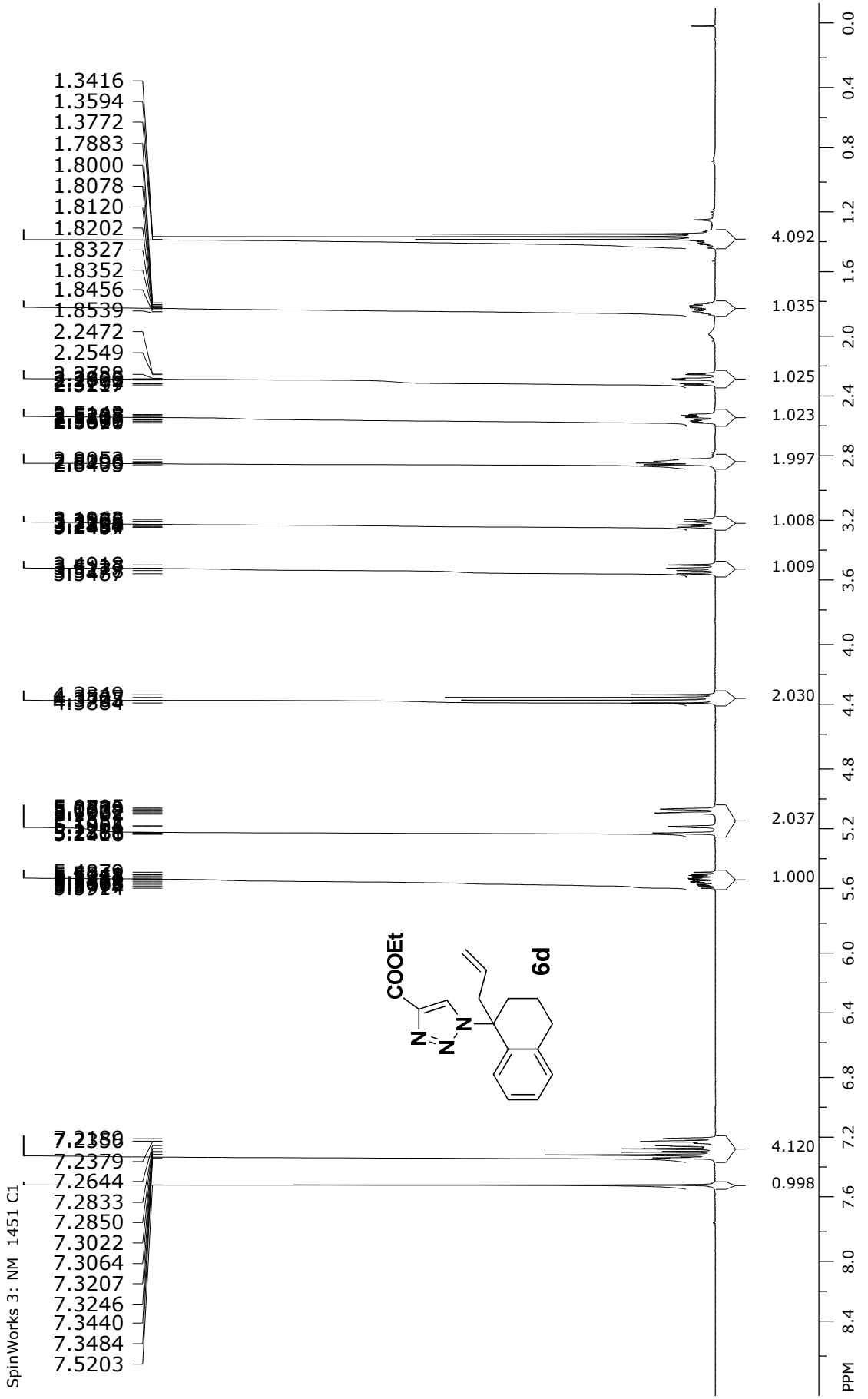
COOEt
6c
SpinWorks 3: nm 1432 a1
PPM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1.3772
1.7883
1.8000
1.8078
1.8120
1.8202
1.8327
1.8352
1.8456
1.8539
2.2472
2.2549
4.092
1.035
1.025
1.023
1.997
1.008
1.009
2.030
2.037
1.000
COOEt
6d
7.2379
7.2644
7.2833
7.2850
7.3022
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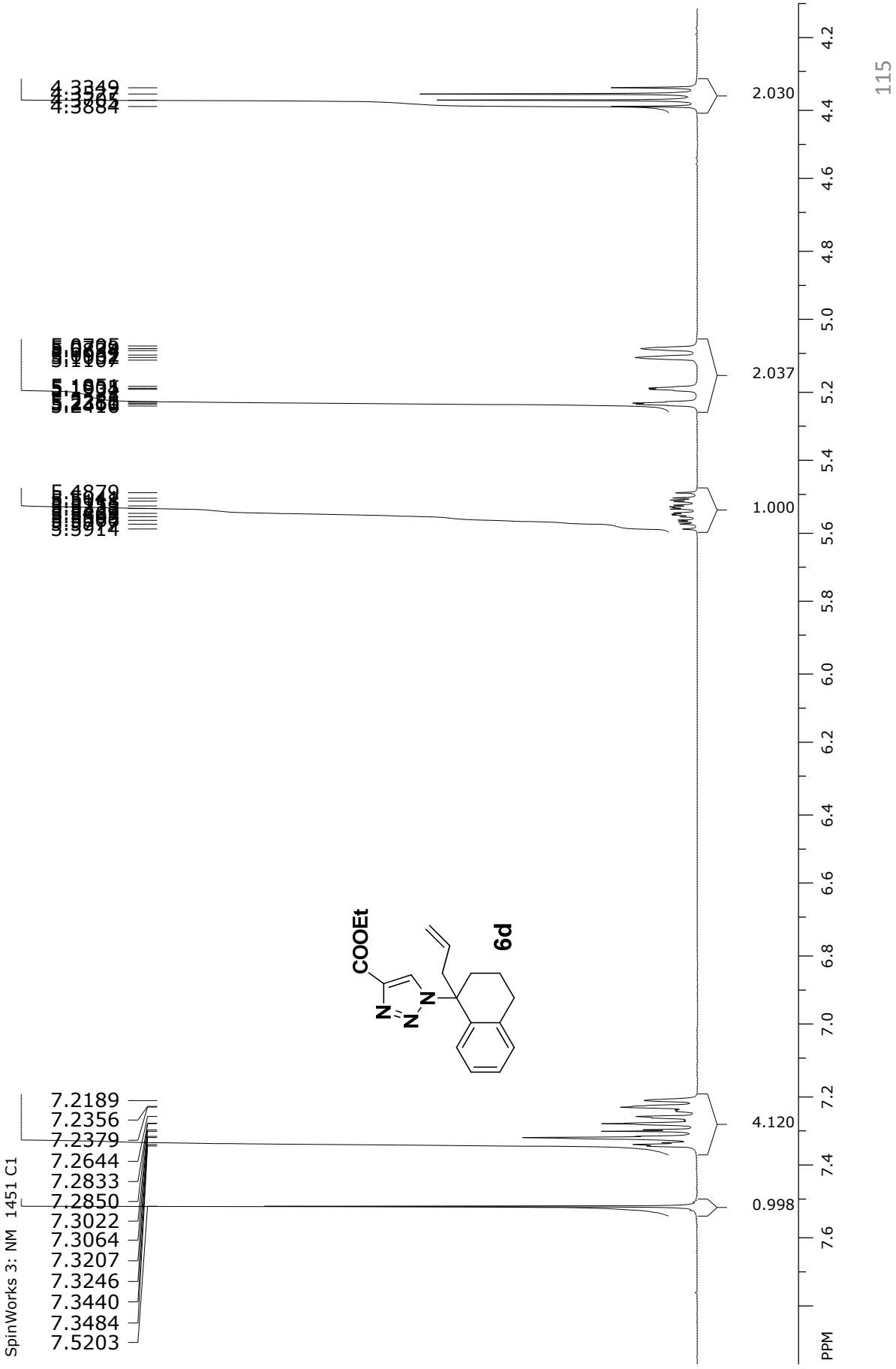
7.3440
7.3484
7.5203
4.120
0.998
SpinWorks 3: NM 1451 C1
PPM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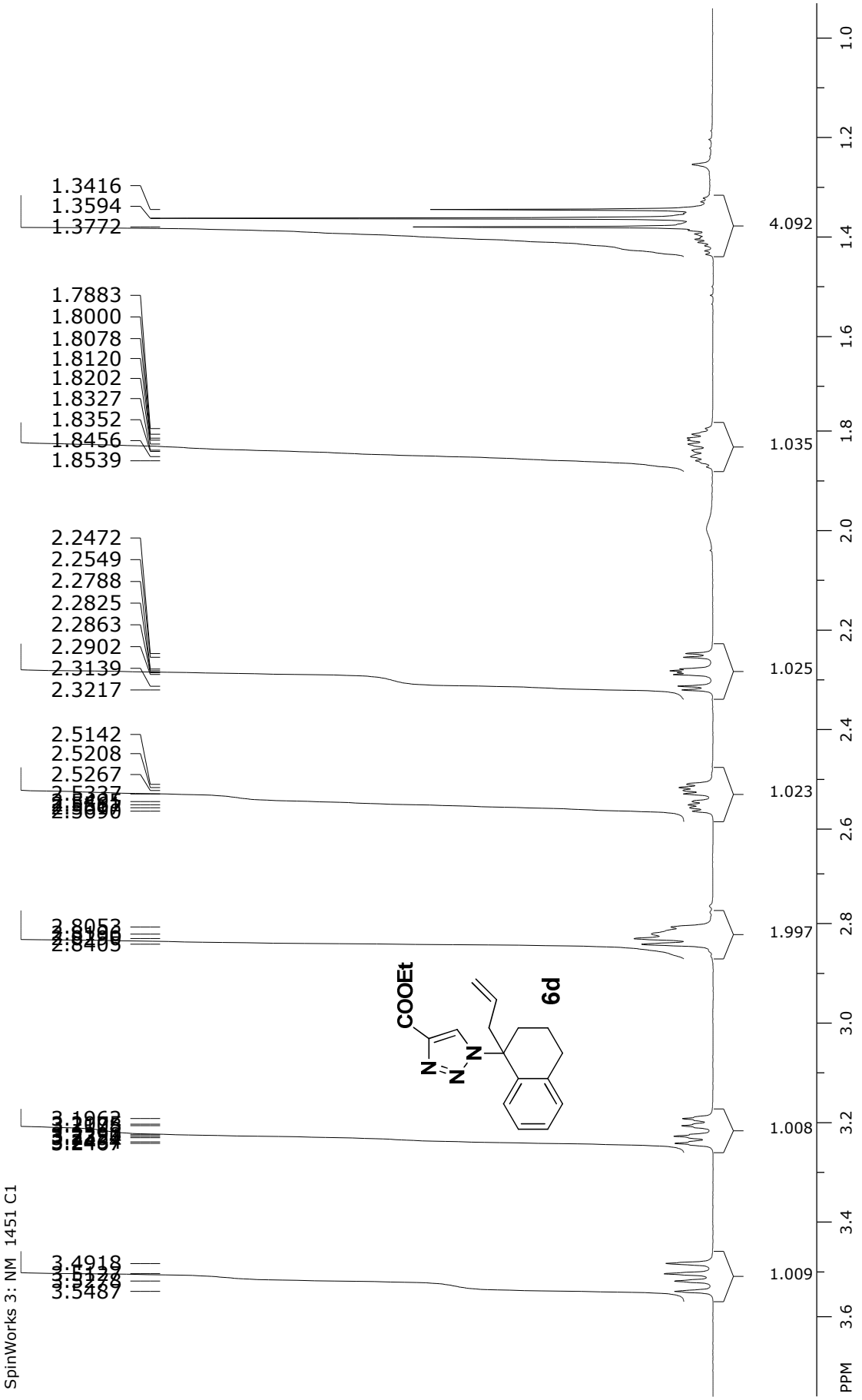
5.1051
5.2410
5.4879
5.5914
7.2189
7.2356
7.2379
7.2644
7.2833
7.2850
7.3022
7.3064
7.3207
7.3246
7.3440
7.3484
7.5203
2.030
2.037
1.000
4.120
0.998
COOEt
N
N
6d
SpinWorks 3: NM 1451 C1
PPM
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
6.6
6.8
7.0
7.2
7.4
7.6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1.3772
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1.7883
1.8000
1.8078
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1.8456
1.8539
1.035
2.2472
2.2549
2.2788
2.2825
2.2863
2.2902
2.3139
2.3217
1.025
2.5142
2.5208
2.5267
1.023
1.997
1.008
3.4918
3.5487
1.009
COOEt
N
N
N
6d
SpinWorks 3: NM 1451 C1
PPM
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
3.0
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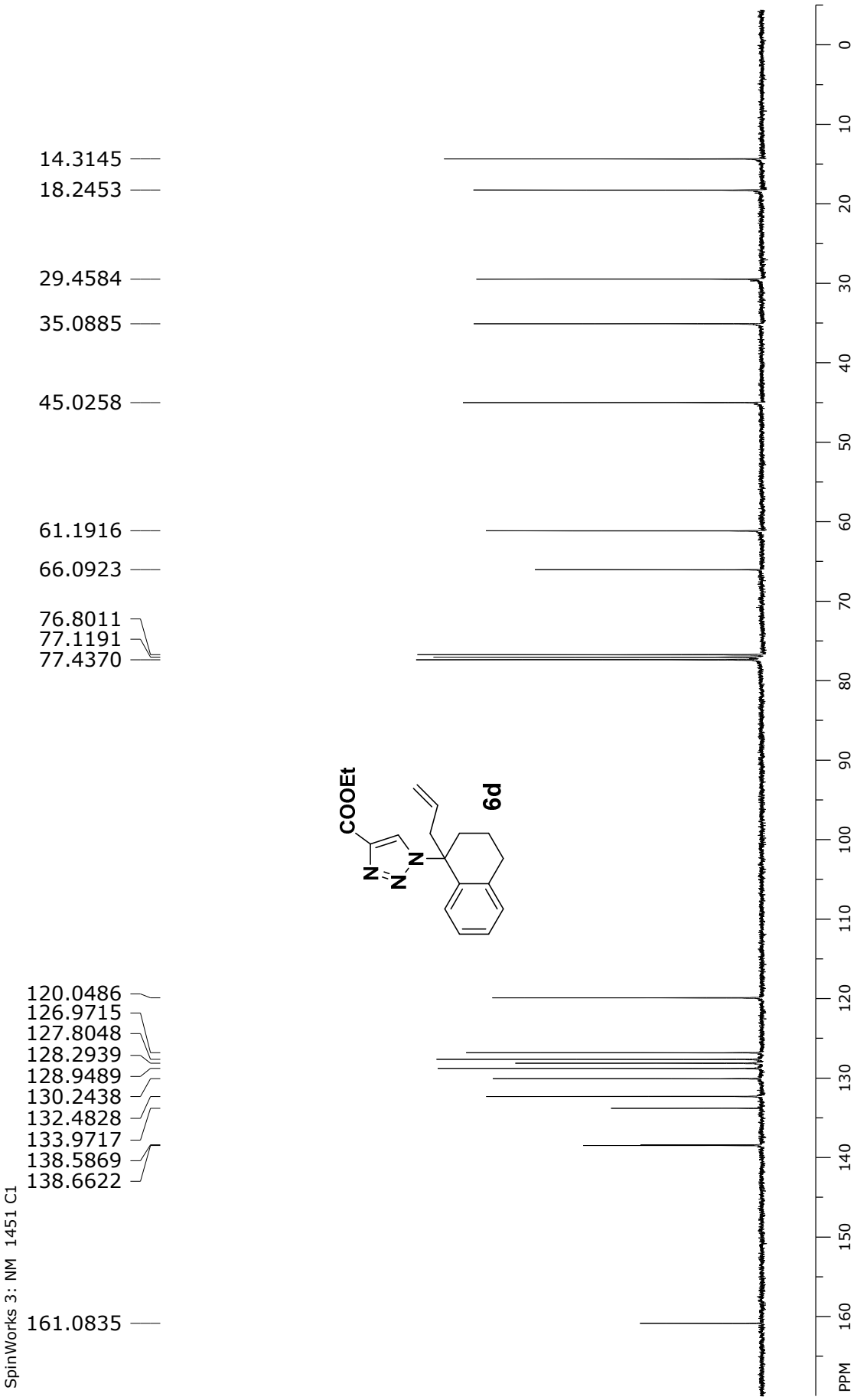
3.4
3.6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120.0486
126.9715
127.8048
128.2939
128.9489
130.2438
132.4828
133.9717
138.5869
138.6622
161.0835
COOEt
N
N
6d
SpinWorks 3: NM 1451 C1
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20
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40
50
60
70
80
90
100
110
120
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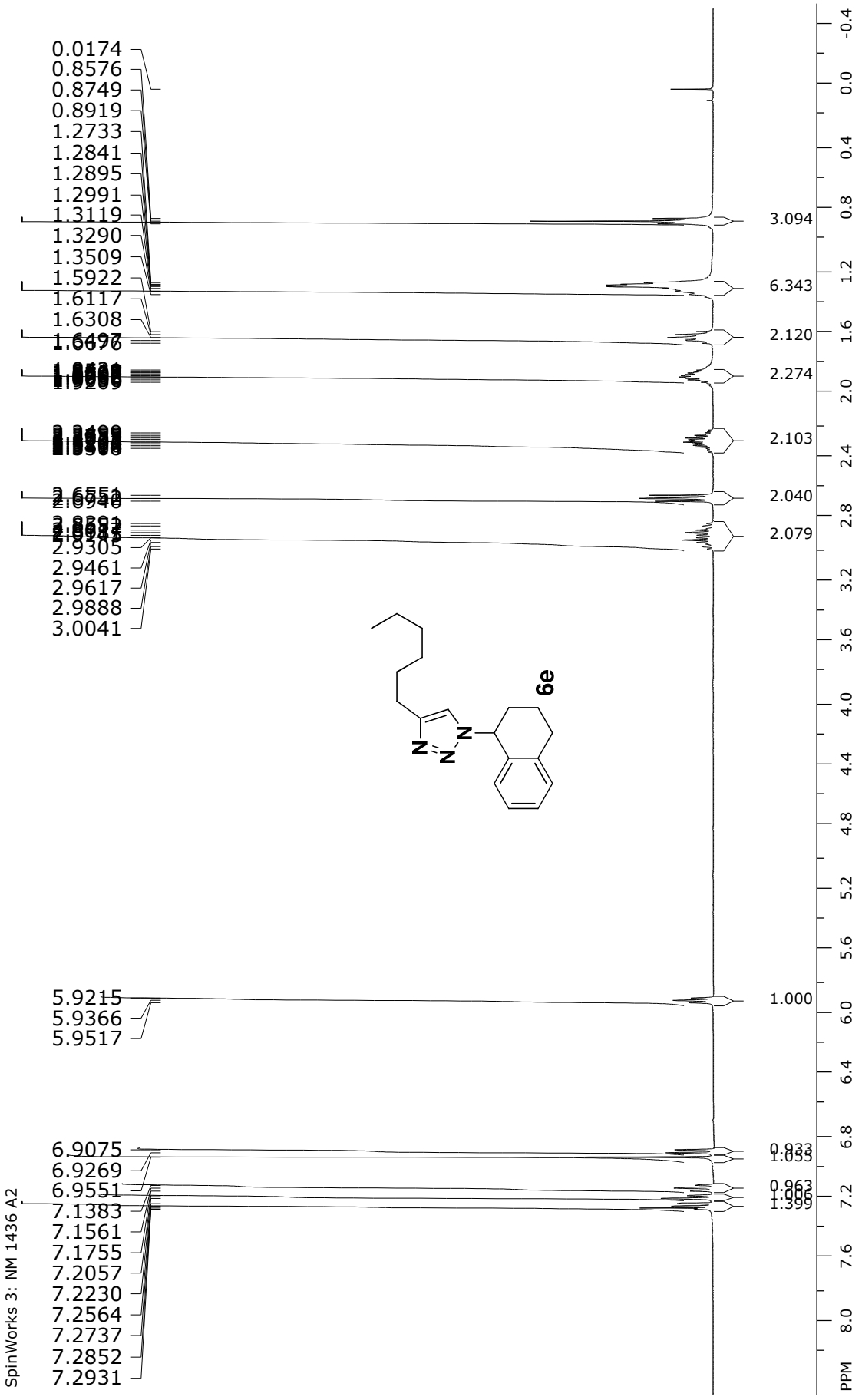
140
150
160
PPM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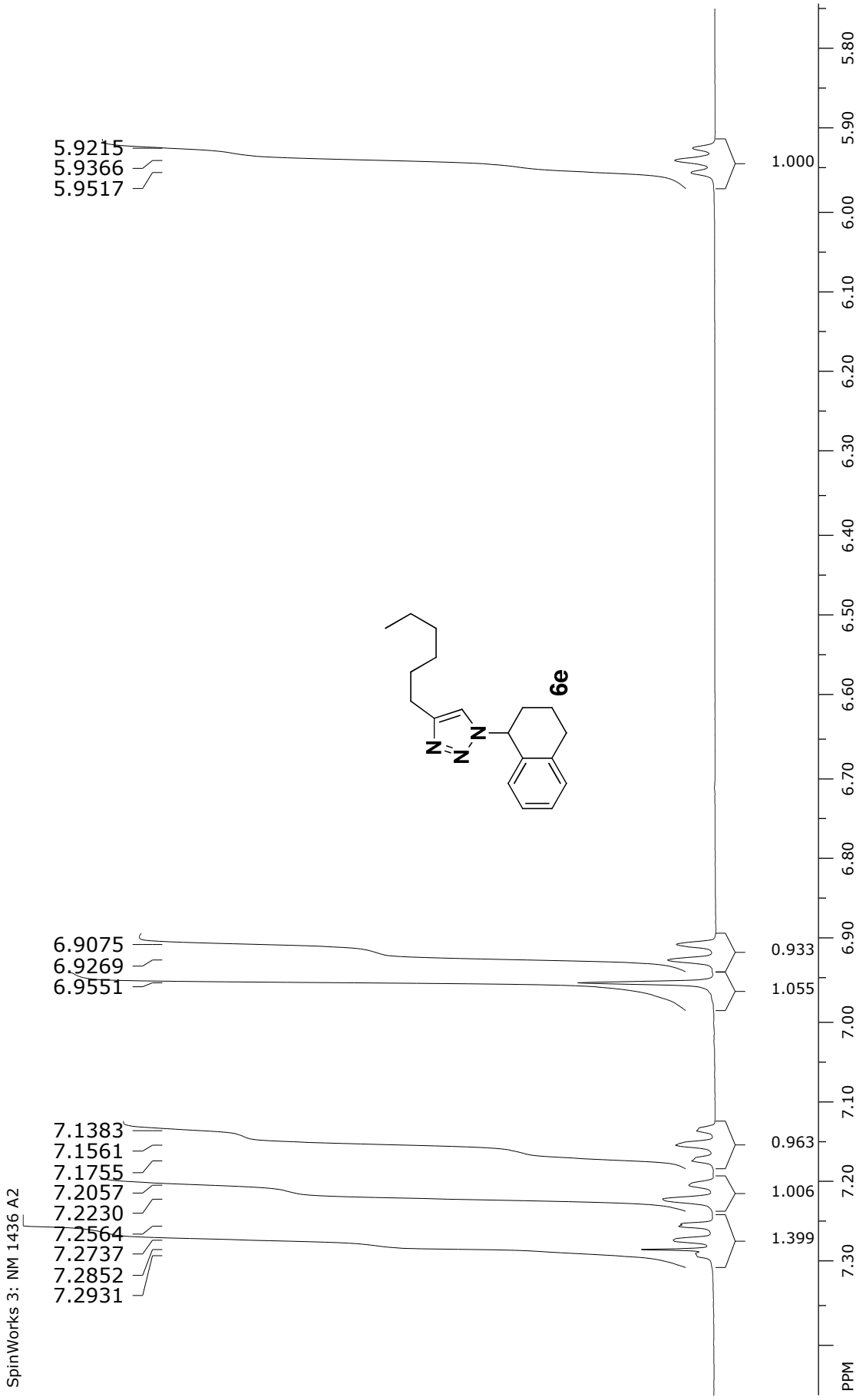
1.3119
1.3290
1.3509
1.5922
1.6117
1.6308
1.6497
1.6676
2.9305
2.9461
2.9617
2.9888
3.0041
5.9215
5.9366
5.9517
6.9075
6.9269
6.9551
7.1383
7.1561
7.1755
7.2057
7.2230
7.2564
7.2737
7.2852
7.2931
3.094
6.343
2.120
2.274
2.103
2.040
2.079
1.000
0.933
1.055
0.963
1.006
1.399
6e
SpinWorks 3: NM 1436 A2
PPM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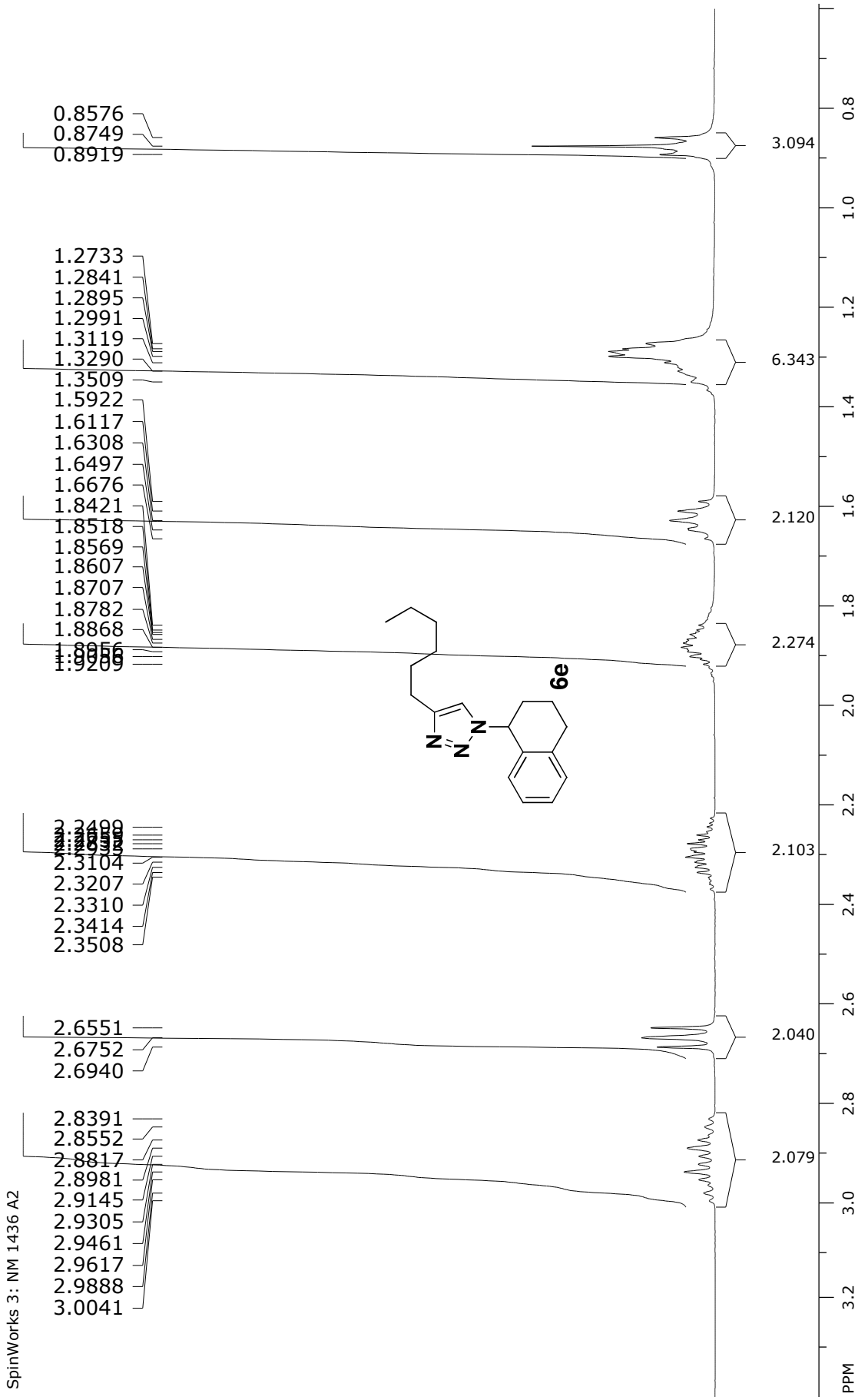
1.000
6e
6.9075
6.9269
6.9551
0.933
1.055
7.1383
7.1561
7.1755
7.2057
7.2230
7.2564
7.2737
7.2852
7.2931
0.963
1.006
1.399
SpinWorks 3: NM 1436 A2
5.80
5.90
6.00
6.10
6.20
6.30
6.40
6.50
6.60
6.70
6.80
6.90
7.00
7.10
7.20
7.30
PPM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0.8749
0.8919
1.2733
1.2841
1.2895
1.2991
1.3119
1.3290
1.3509
1.5922
1.6117
1.6308
1.6497
1.6676
1.8421
1.8518
1.8569
1.8607
1.8707
1.8782
1.8868
1.9209
2.3104
2.3207
2.3310
2.3414
2.3508
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2.8552
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2.8981
2.9145
2.9305
2.9461
2.9617
2.9888
3.0041
3.094
6.343
2.120
2.274
2.103
2.040
2.079
6e
N
N
N
0.8
1.0
1.2
1.4
1.6
1.8
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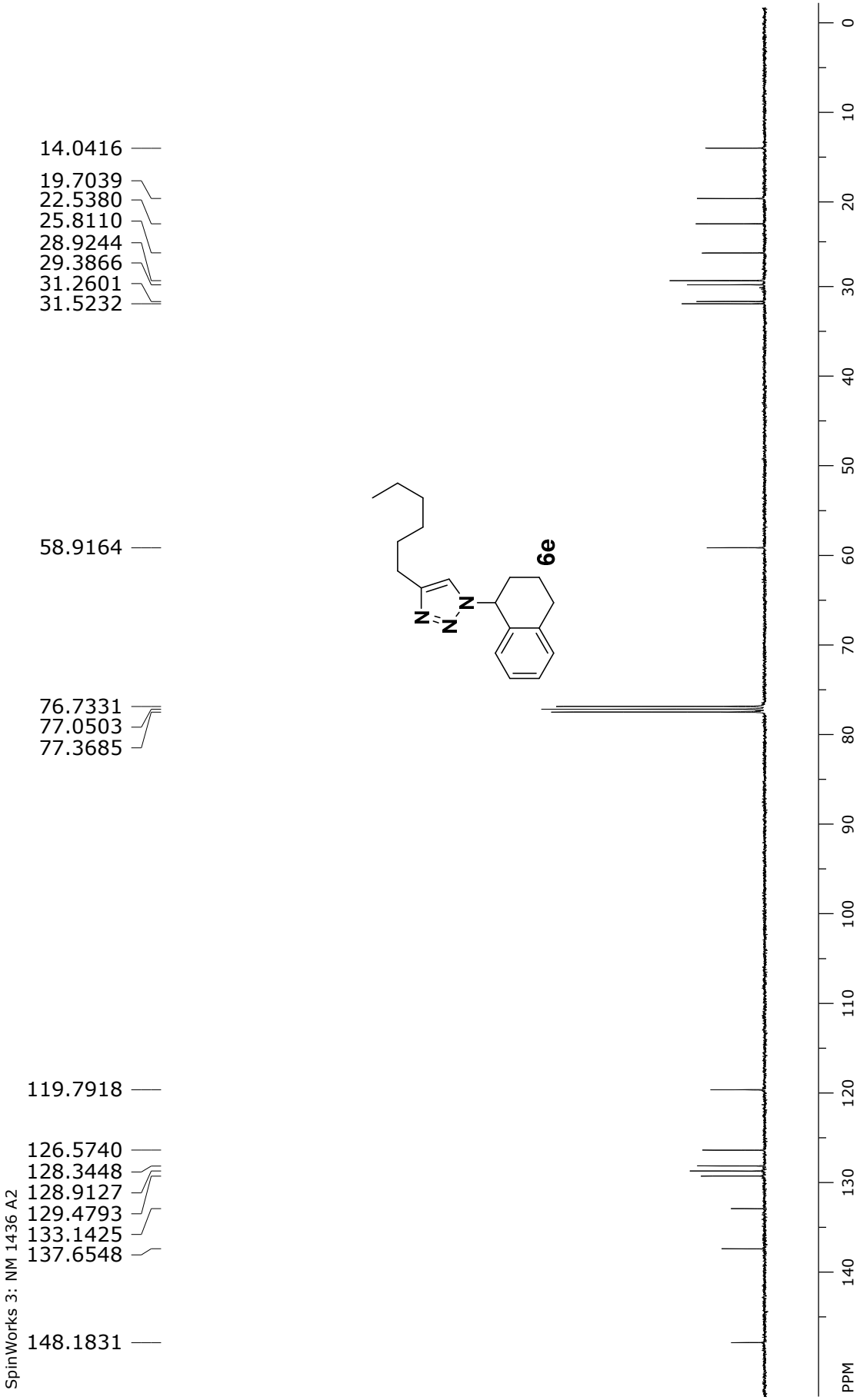
2.2
2.4
2.6
2.8
3.0
3.2
PPM
SpinWorks 3: NM 1436 A2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31.2601
31.5232
58.9164
76.7331
77.0503
77.3685
119.7918
126.5740
128.3448
128.9127
129.4793
133.1425
137.6548
148.1831
6e
N
N
N
SpinWorks 3: NM 1436 A2
PPM
0
10
20
30
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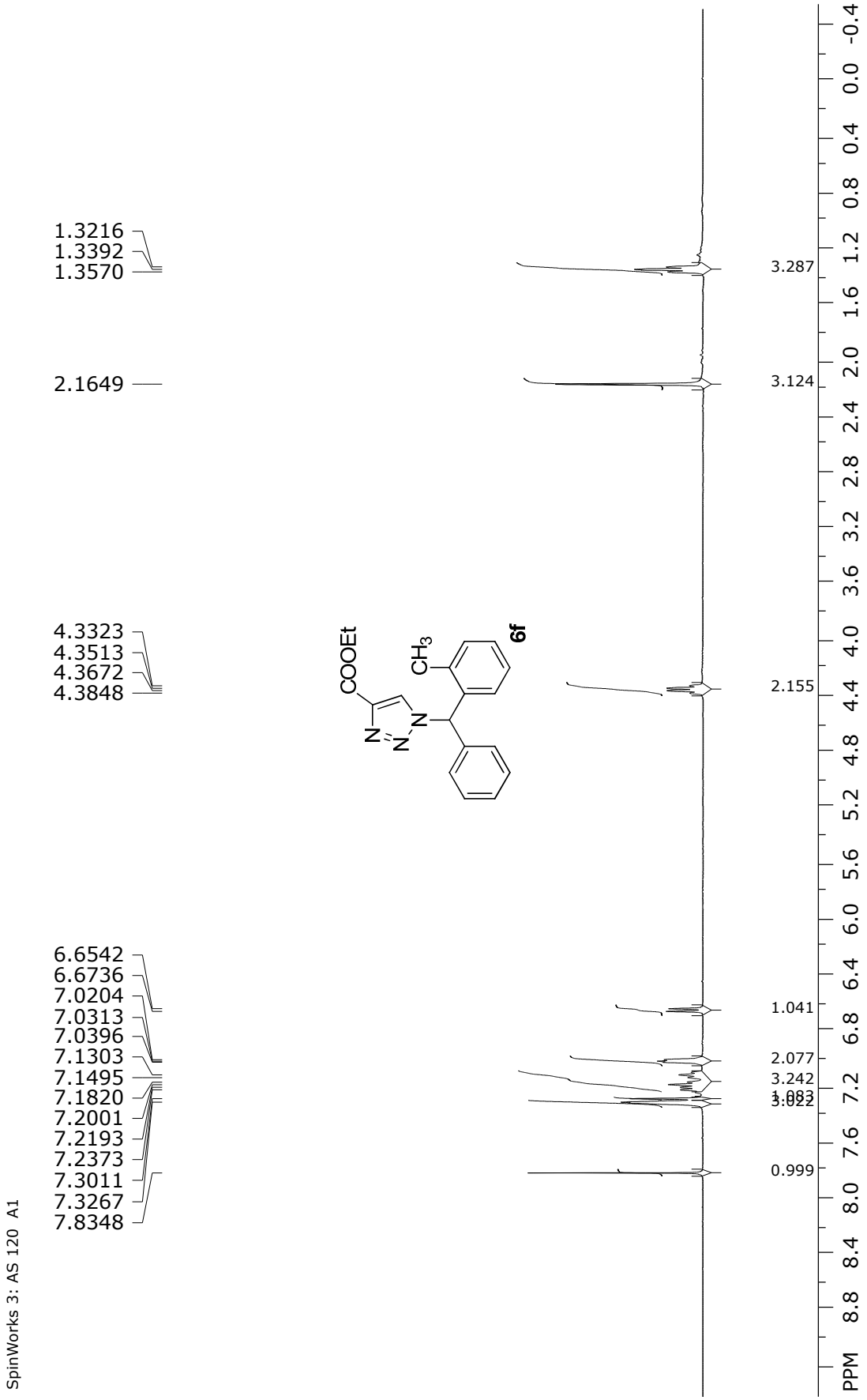
50
60
70
80
90
100
110
120
130
140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4.3672
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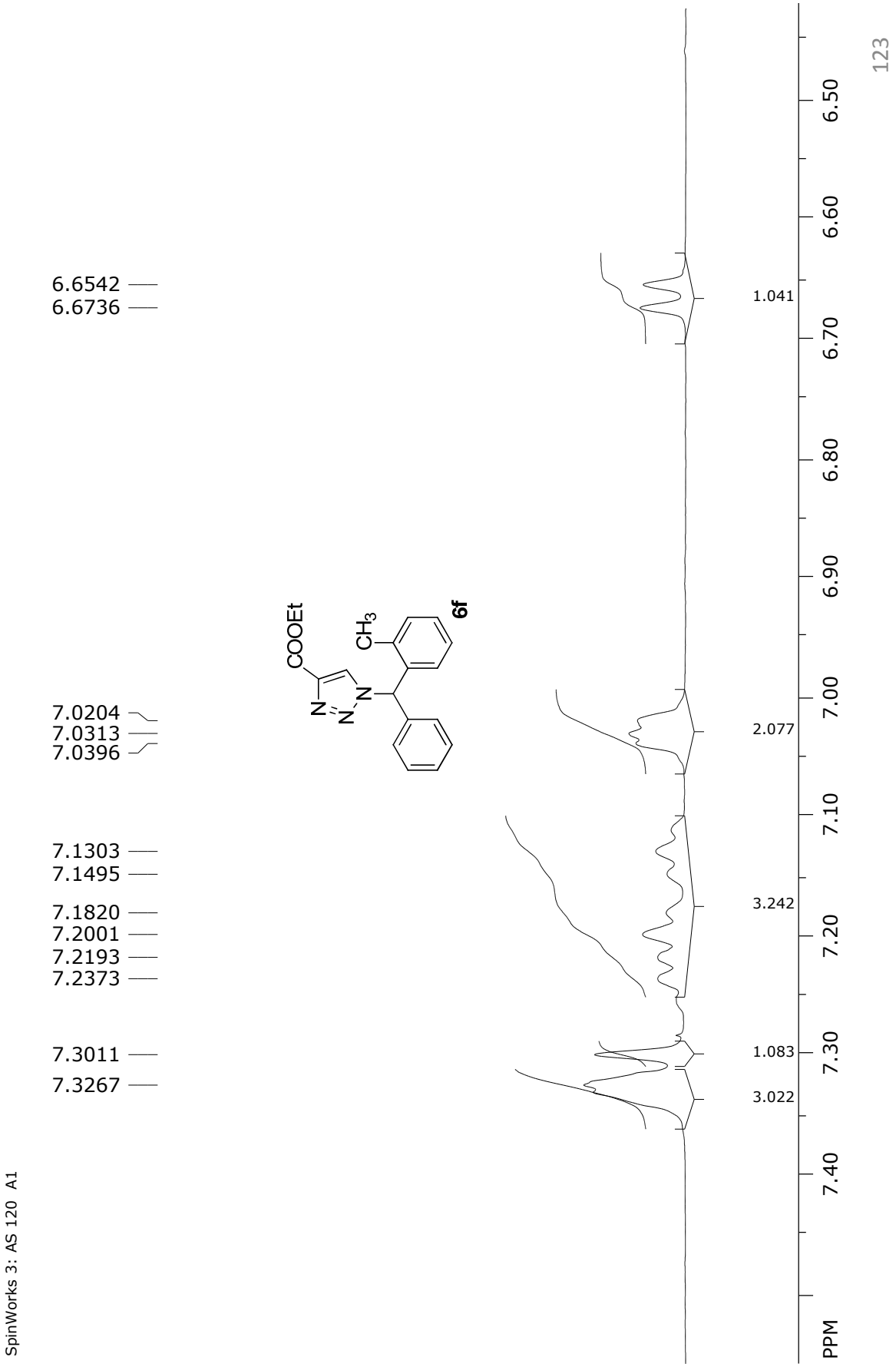
6.6542
6.6736
7.0204
7.0313
7.0396
7.1303
7.1495
7.1820
7.2001
7.2193
7.2373
7.3011
7.3267
7.8348
COOEt
CH3
N
N
6f
3.287
3.124
2.155
1.041
2.077
3.242
1.083
3.022
0.999
PPM
8.8
8.4
8.0
7.6
7.2
6.8
6.4
6.0
5.6
5.2
4.8
4.4
4.0
3.6
3.2
2.8
2.4
2.0
1.6
1.2
0.8
0.4
0.0
-0.4
SpinWorks 3: AS 120 A1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7.0204
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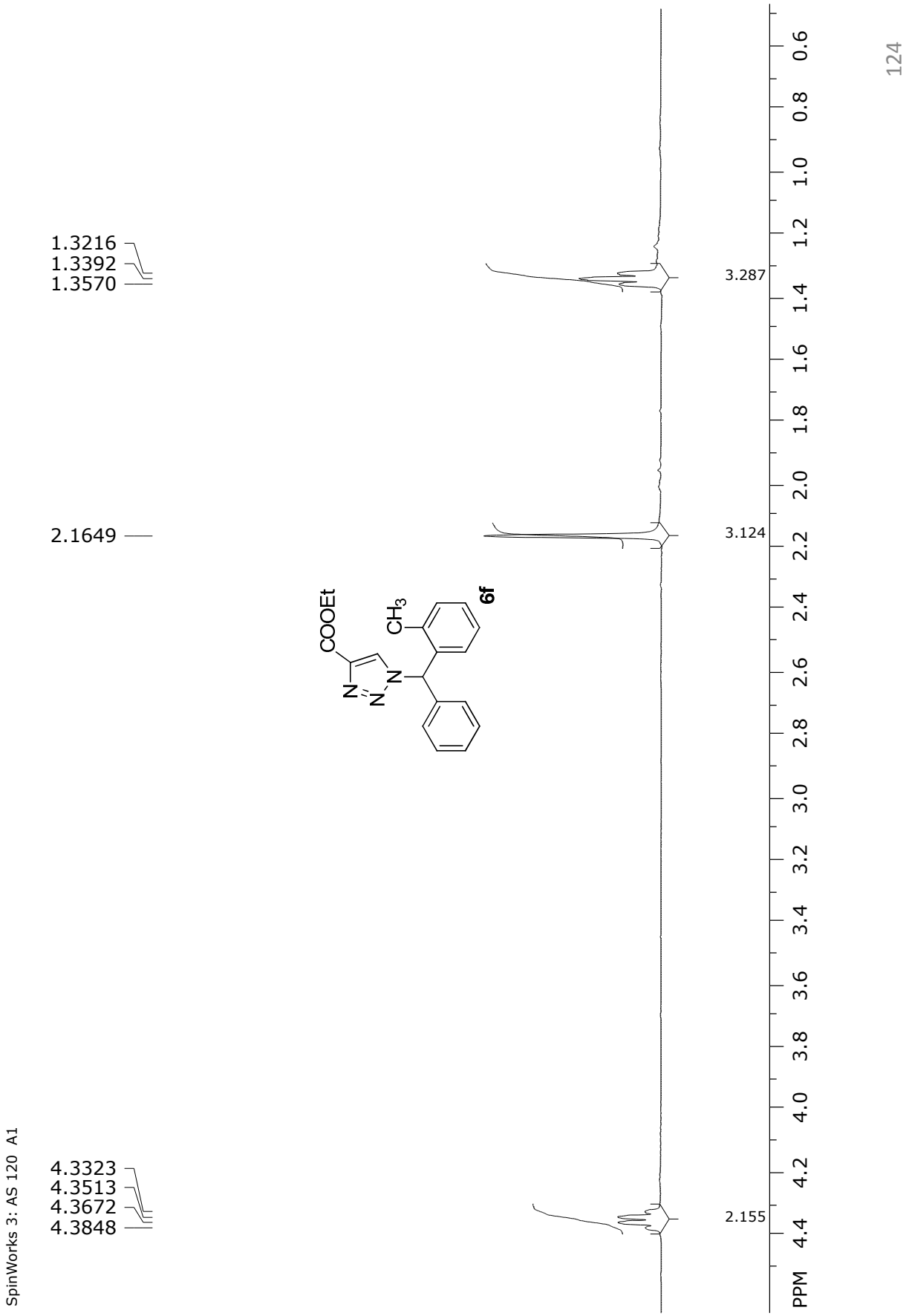
7.0396
7.1303
7.1495
7.1820
7.2001
7.2193
7.2373
7.3011
7.3267
COOEt
CH3
N
N
6f
1.041
2.077
3.242
1.083
3.022
6.50
6.60
6.70
6.80
6.90
7.00
7.10
7.20
7.30
7.40
PPM
SpinWorks 3: AS 120 A1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1.3570
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4.3323
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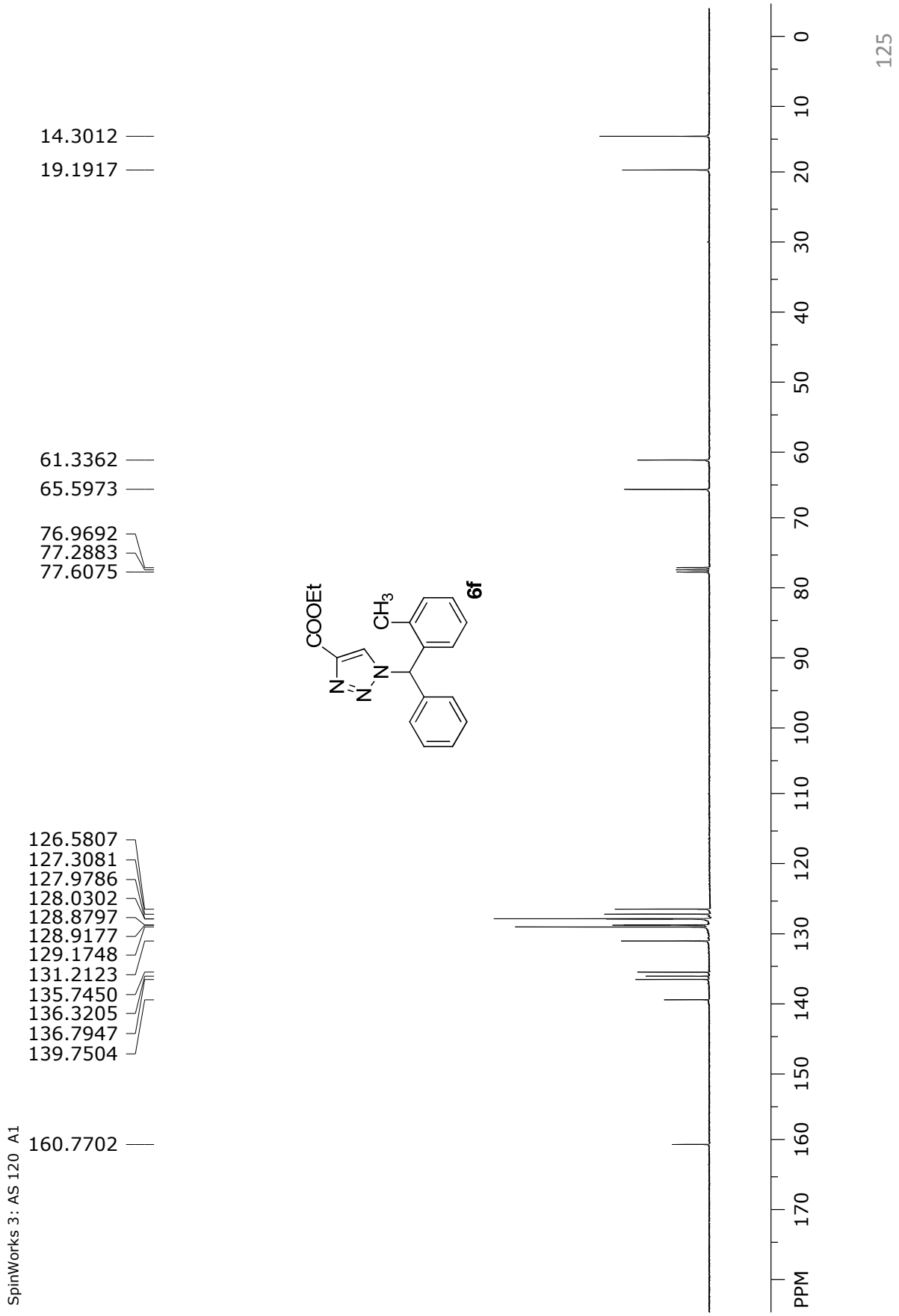
3.287
3.124
2.155
COOEt
CH3
6f
PPM
SpinWorks 3: AS 120 A1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77.2883
77.6075
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127.3081
127.9786
128.0302
128.8797
128.9177
129.1748
131.2123
135.7450
136.3205
136.7947
139.7504
160.7702
COOEt
CH3
N
N
6f
SpinWorks 3: AS 120 A1
PPM
0
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20
30
40
50
60
70
80
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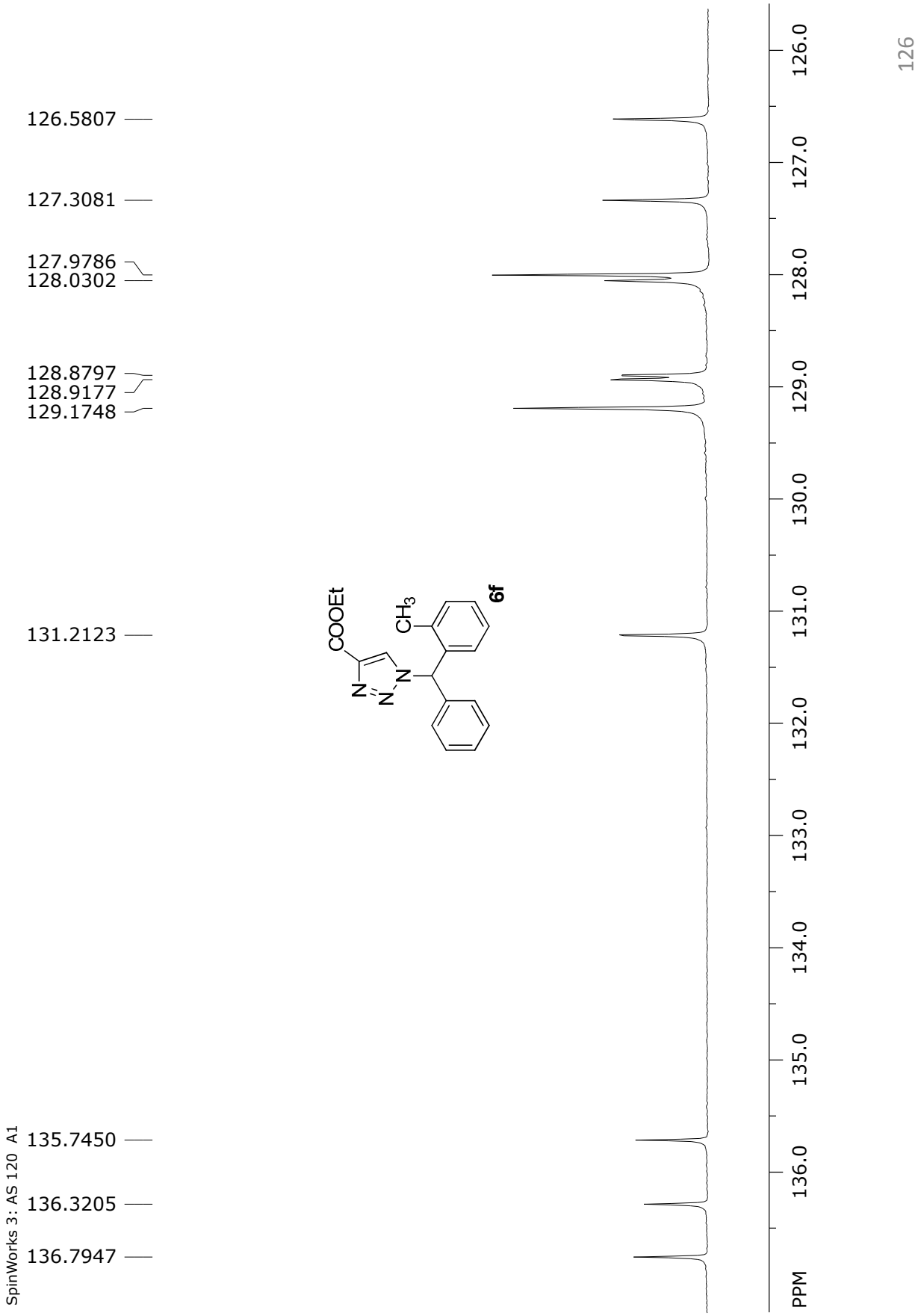
100
110
120
130
140
150
160
170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127.9786
128.0302
128.8797
128.9177
129.1748
131.2123
135.7450
136.3205
136.7947
SpinWorks 3: AS 120 A1
COOEt
CH3
N
N
6f
PPM
126.0
127.0
128.0
129.0
130.0
131.0
132.0
133.0
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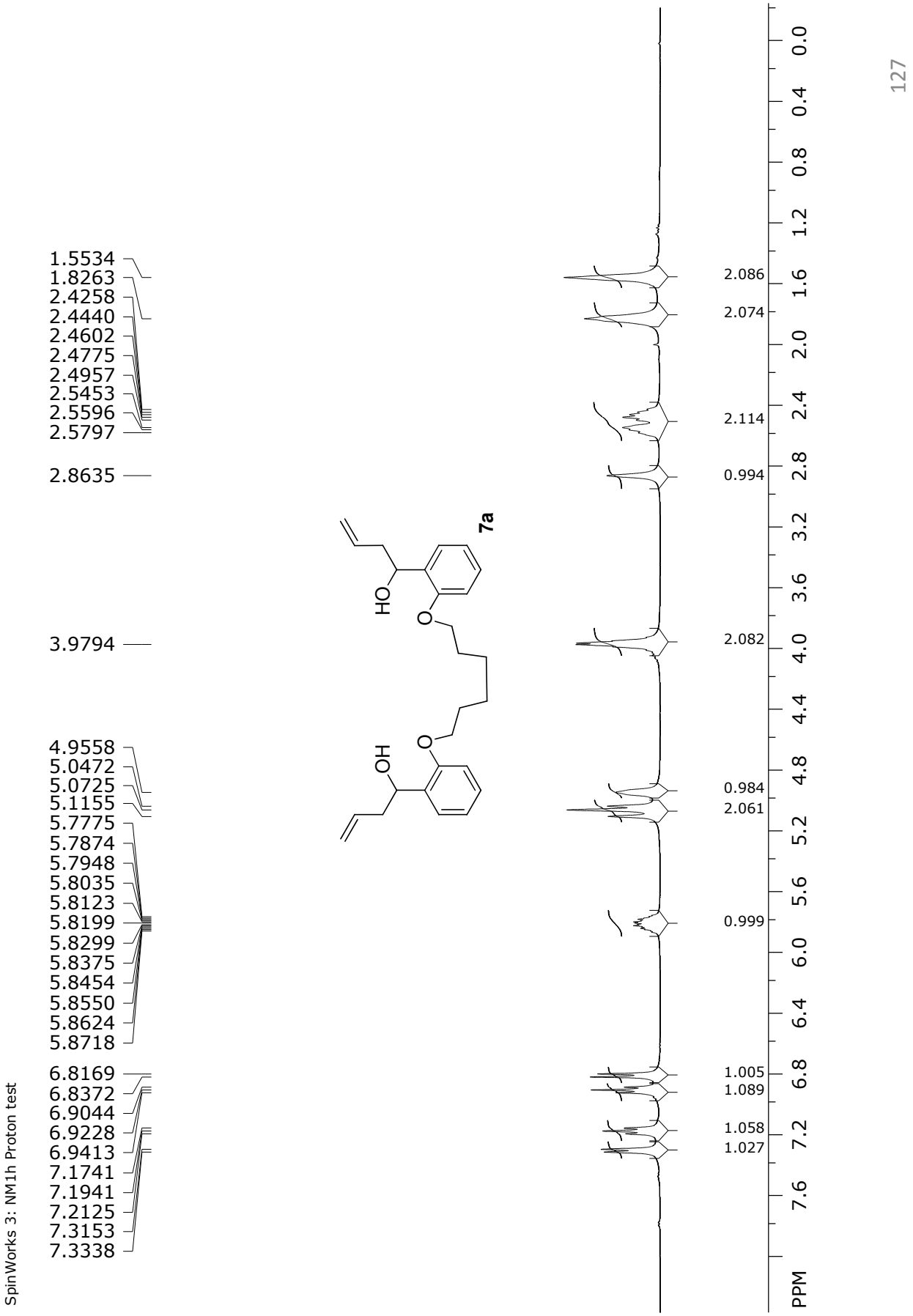
136.0


SpinWorks 3: NM1h Proton test
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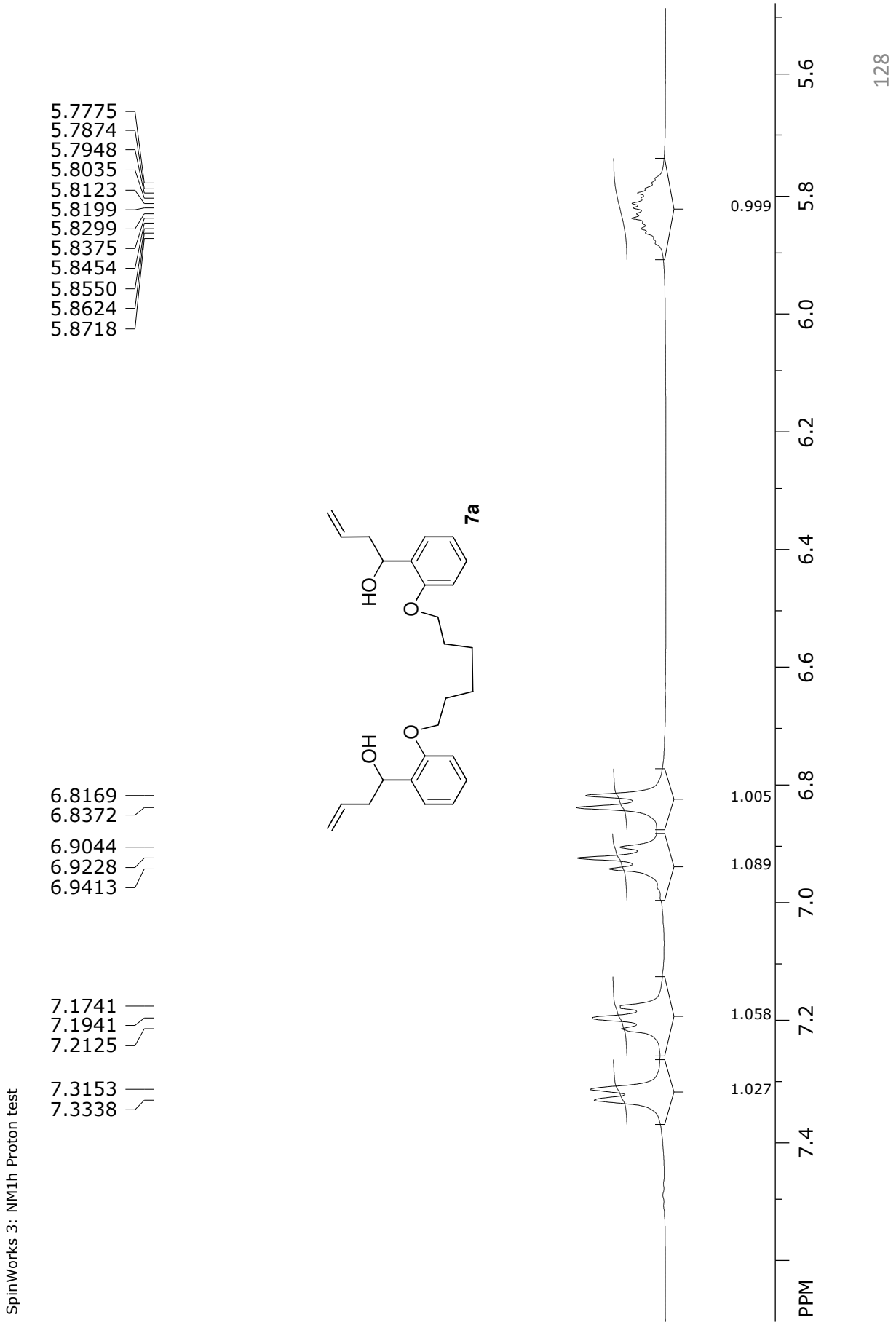
2.4957
2.5453
2.5596
2.5797
2.8635
3.9794
4.9558
5.0472
5.0725
5.1155
5.7775
5.7874
5.7948
5.8035
5.8123
5.8199
5.8299
5.8375
5.8454
5.8550
5.8624
5.8718
6.8169
6.8372
6.9044
6.9228
6.9413
7.1741
7.1941
7.2125
7.3153
7.3338
HO
O
O
OH
7a
2.086
2.074
2.114
0.994
2.082
0.984
2.061
0.999
1.005
1.089
1.058
1.027
PPM
7.6
7.2
6.8
6.4
6.0
5.6
5.2
4.8
4.4
4.0
3.6
3.2
2.8
2.4
2.0
1.6
1.2
0.8
0.4
0.0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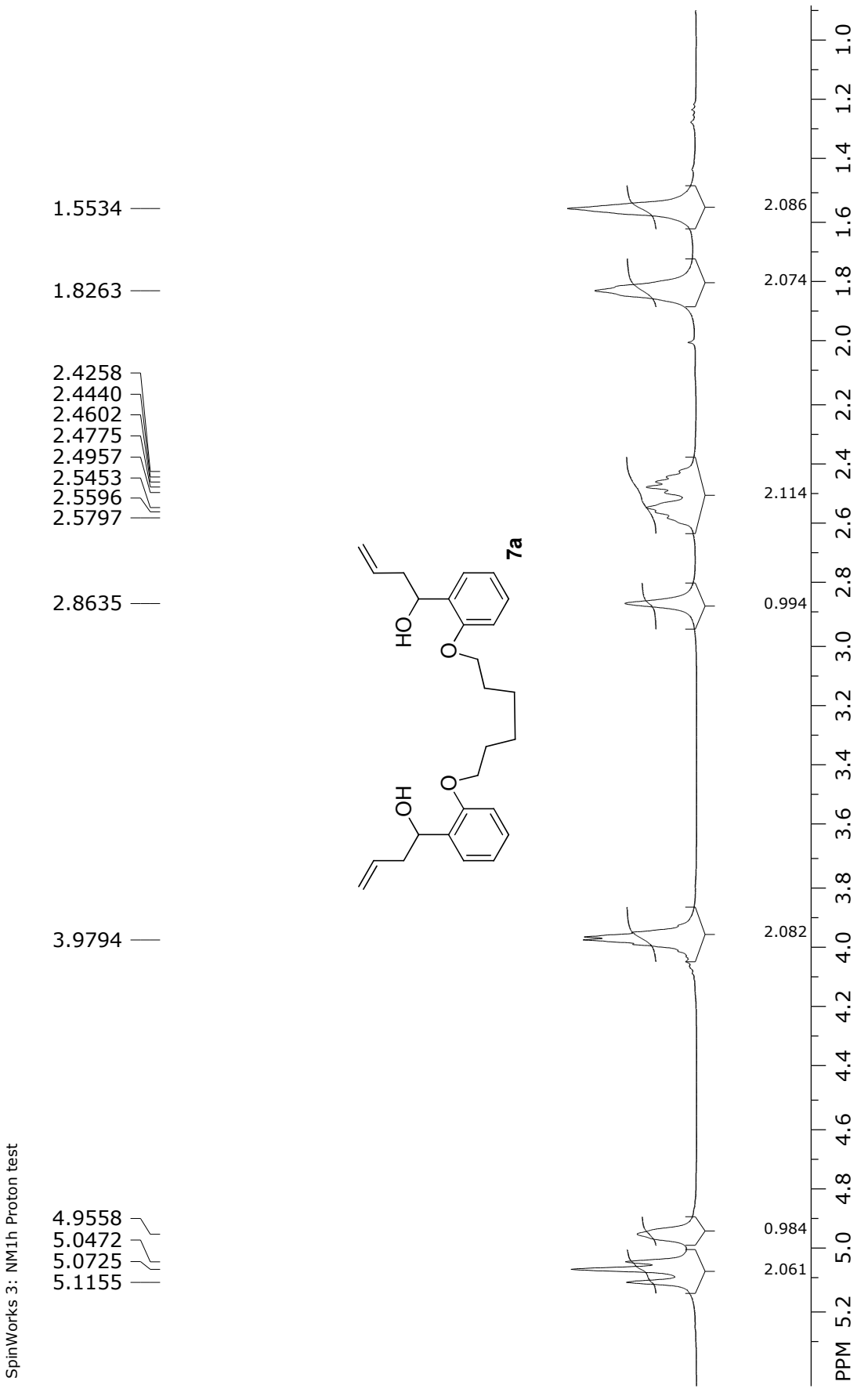
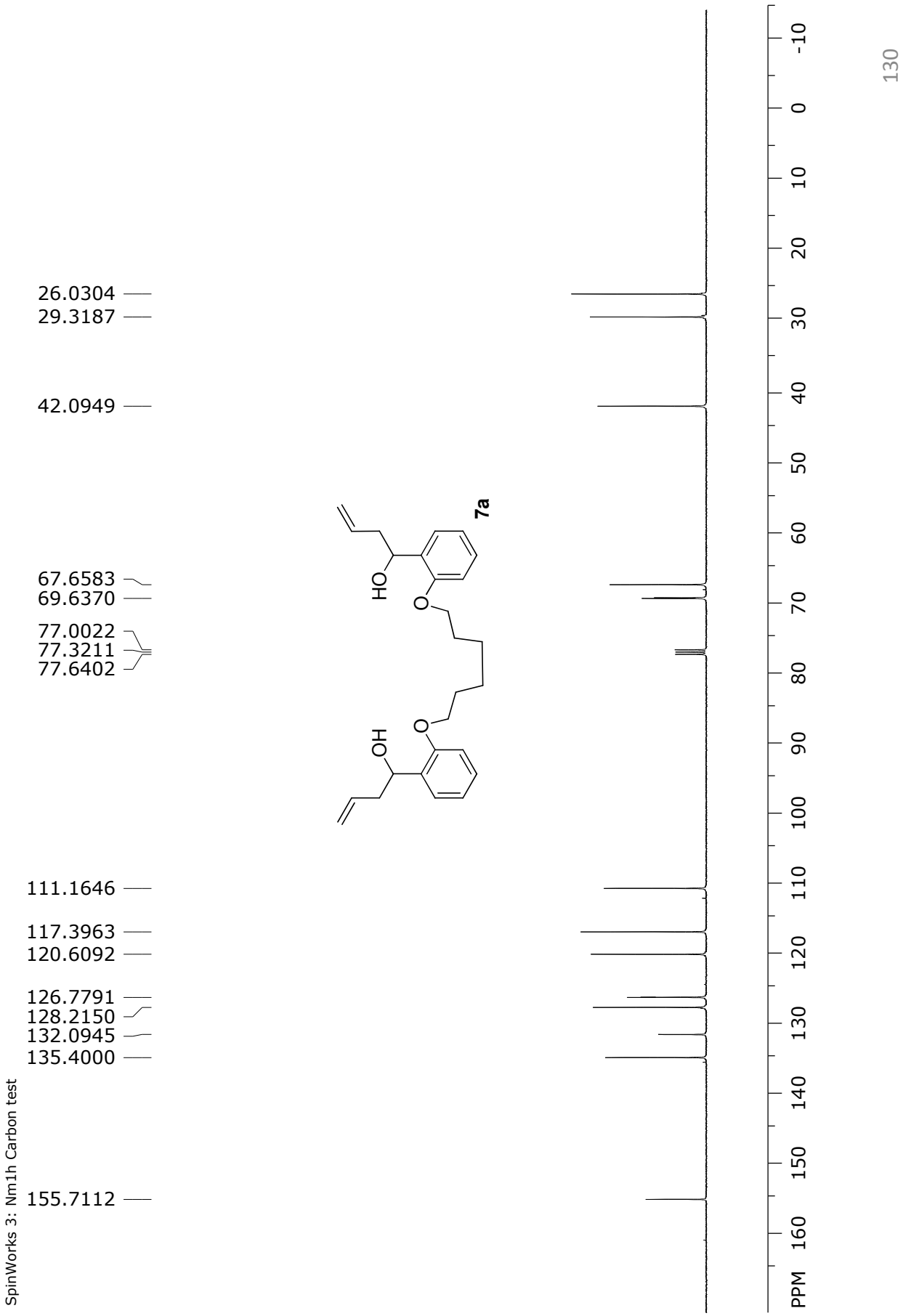
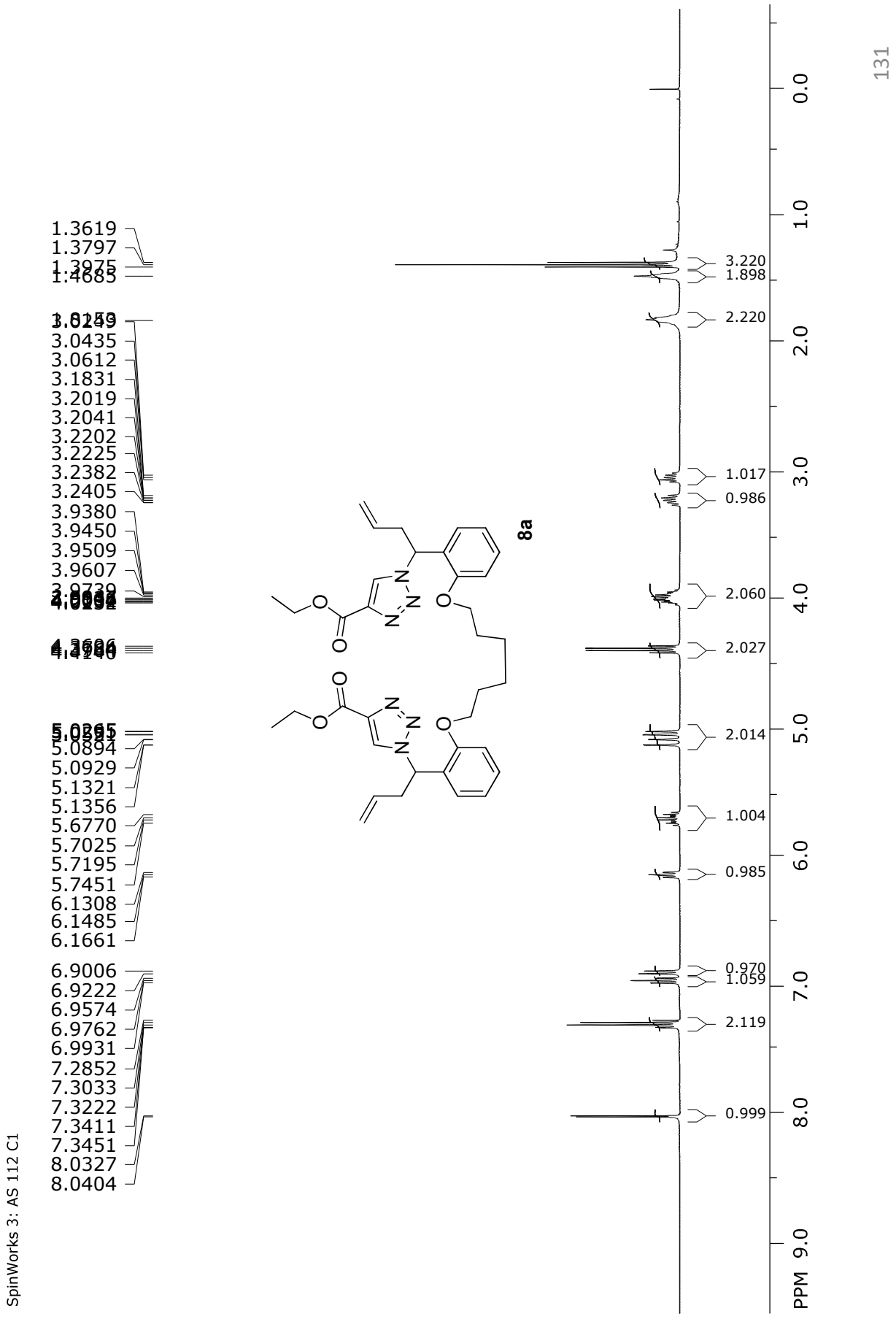
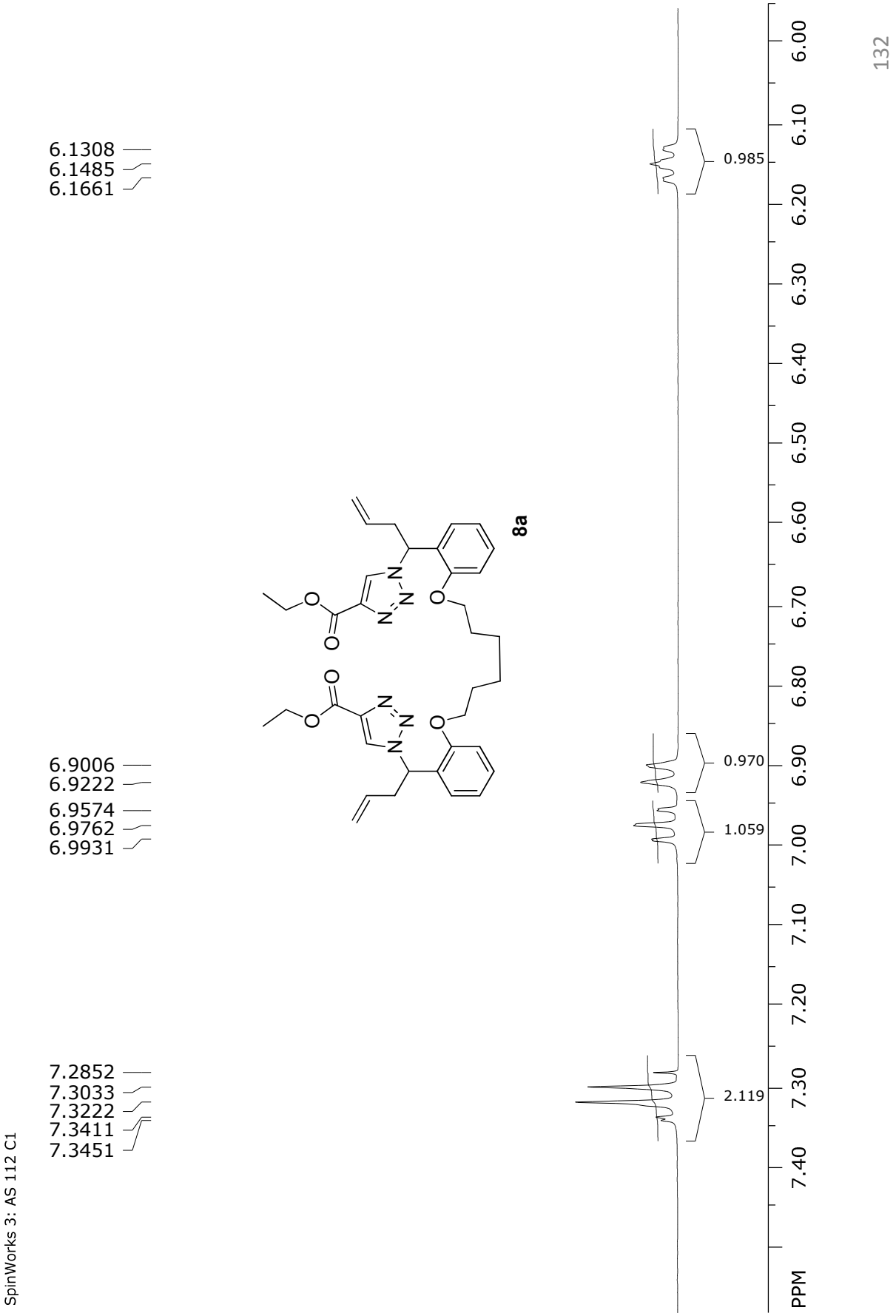
5.8718
6.8169
6.8372
6.9044
6.9228
6.9413
7.1741
7.1941
7.2125
7.3153
7.3338
HO
O
O
OH
7a
0.999
1.005
1.089
1.058
1.027
PPM
5.6
5.8
6.0
6.2
6.4
6.6
6.8
7.0
7.2
7.4
SpinWorks 3: NM1h Proton test

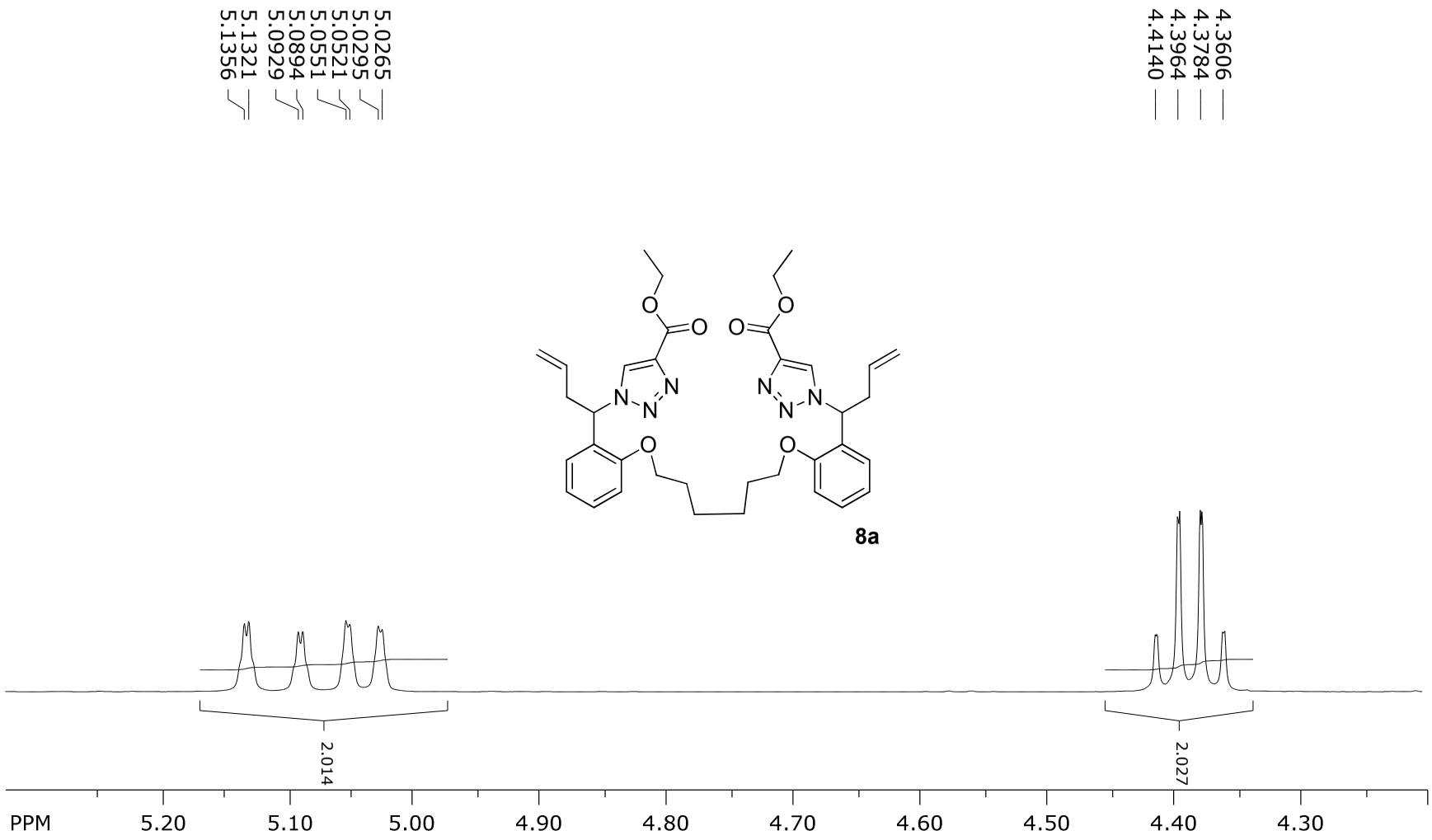

SpinWorks 3: NM1h Proton test
1.5534
1.8263
2.4258
2.4440
2.4602
2.4775
2.4957
2.5453
2.5596
2.5797
2.8635
3.9794
4.9558
5.0472
5.0725
5.1155
HO
O
O
OH
7a
2.086
2.074
2.114
0.994
2.082
0.984
2.061
PPM 5.2 5.0 4.8 4.6 4.4 4.2 4.0 3.8 3.6 3.4 3.2 3.0 2.8 2.6 2.4 2.2 2.0 1.8 1.6 1.4 1.2 1.0


26.0304
29.3187
42.0949
67.6583
69.6370
77.0022
77.3211
77.6402
111.1646
117.3963
120.6092
126.7791
128.2150
132.0945
135.4000
155.7112
HO
O
OH
O
7a
PPM
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
SpinWorks 3: Nm1h Carbon test



SpinWorks 3: AS 112 C1

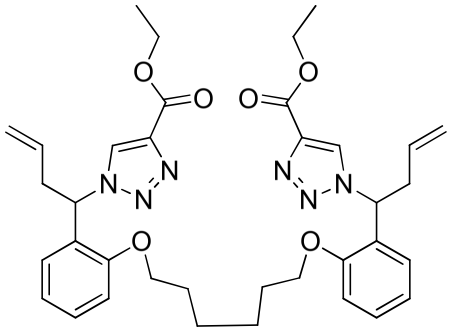

6.1308
6.1485
6.1661
6.9006
6.9222
6.9574
6.9762
6.9931
7.2852
7.3033
7.3222
7.3411
7.3451
8a
0.985
0.970
1.059
2.119
PPM
6.00
6.10
6.20
6.30
6.40
6.50
6.60
6.70
6.80
6.90
7.00
7.10
7.20
7.30
7.40
SpinWorks 3: AS 112 C1



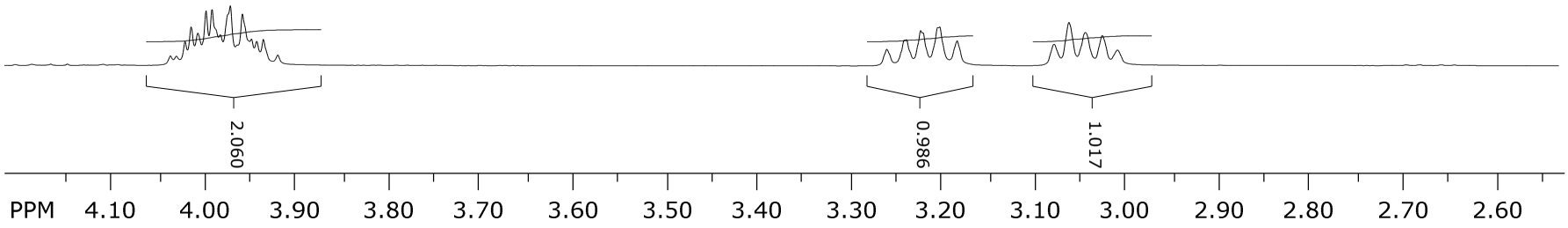
SpinWorks 3: AS 112 C1

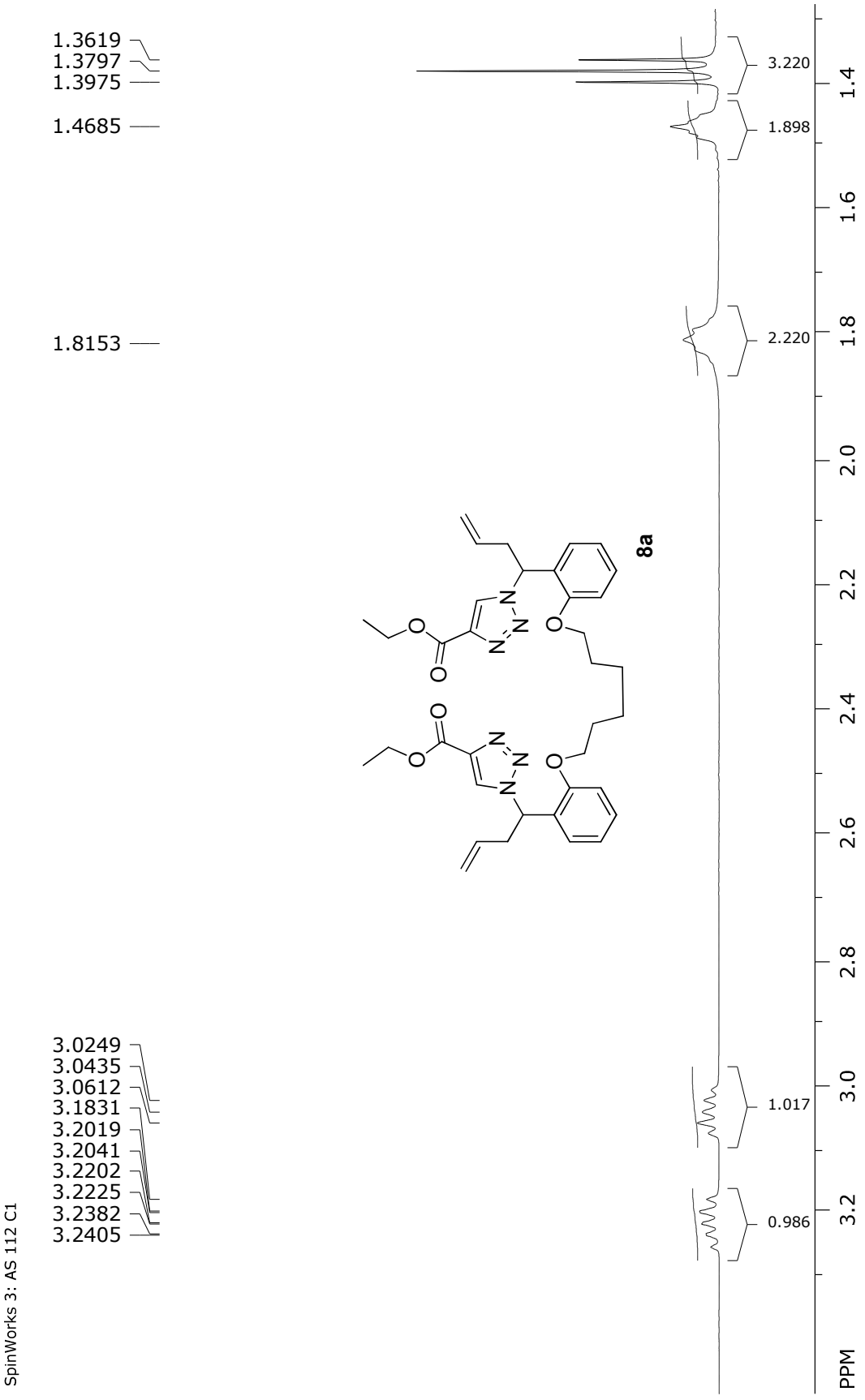
4.0232
4.0164
4.0092
4.0004
3.9936
3.9847
3.9739
3.9607
3.9509
3.9450
3.9380

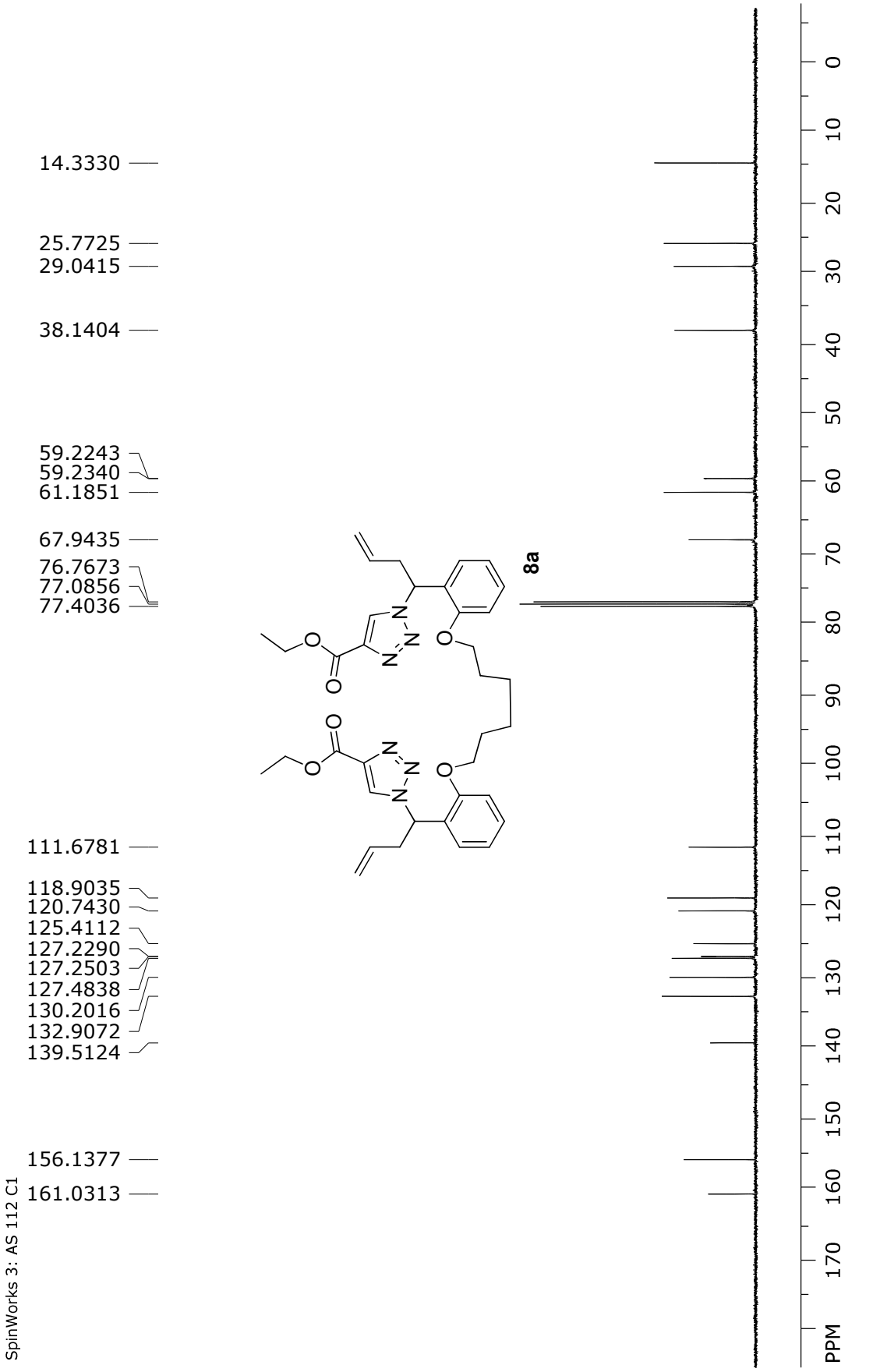
3.2405
3.2382
3.2225
3.2202
3.2041
3.2019
3.1831
3.0612
3.0435
3.0249

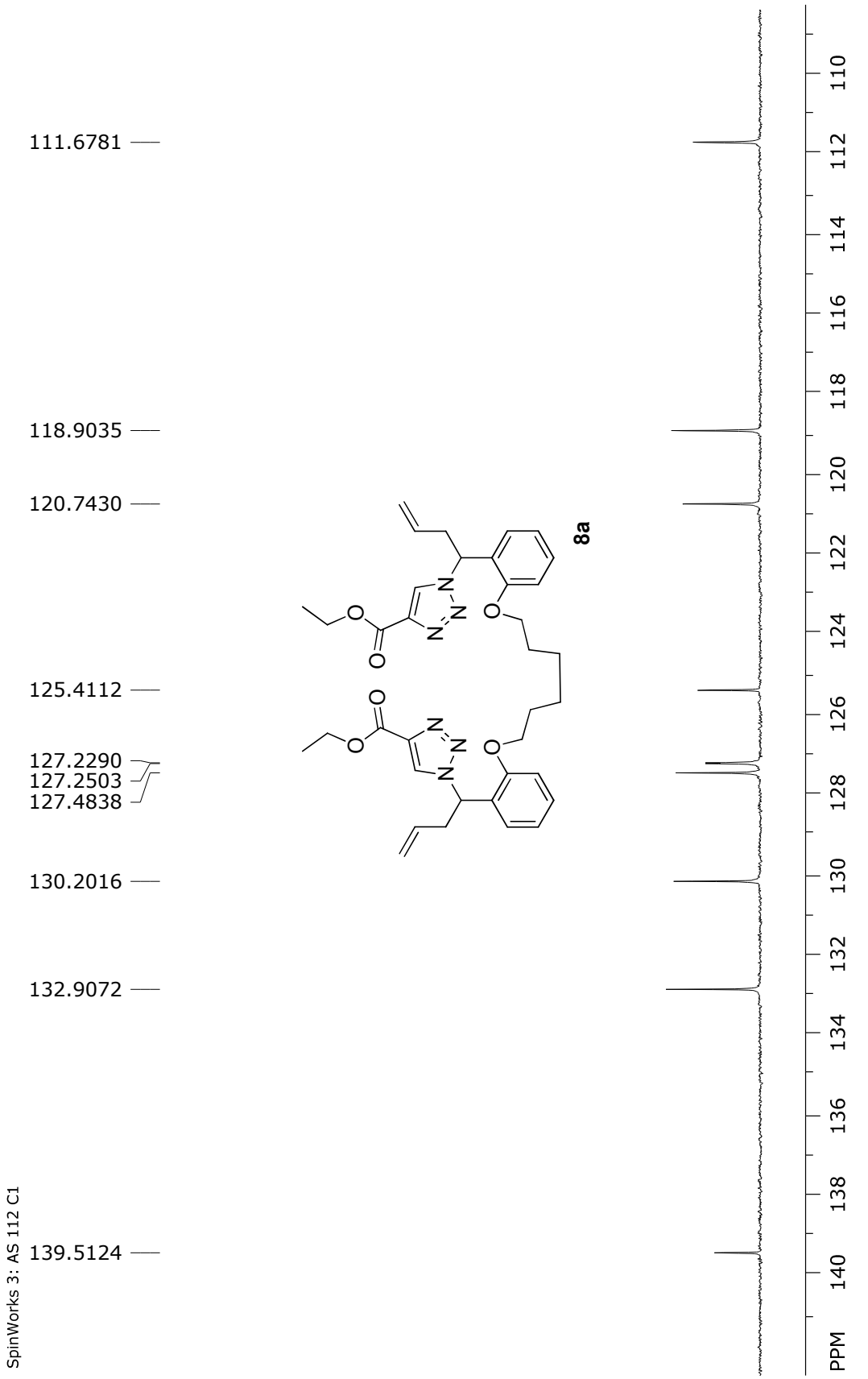


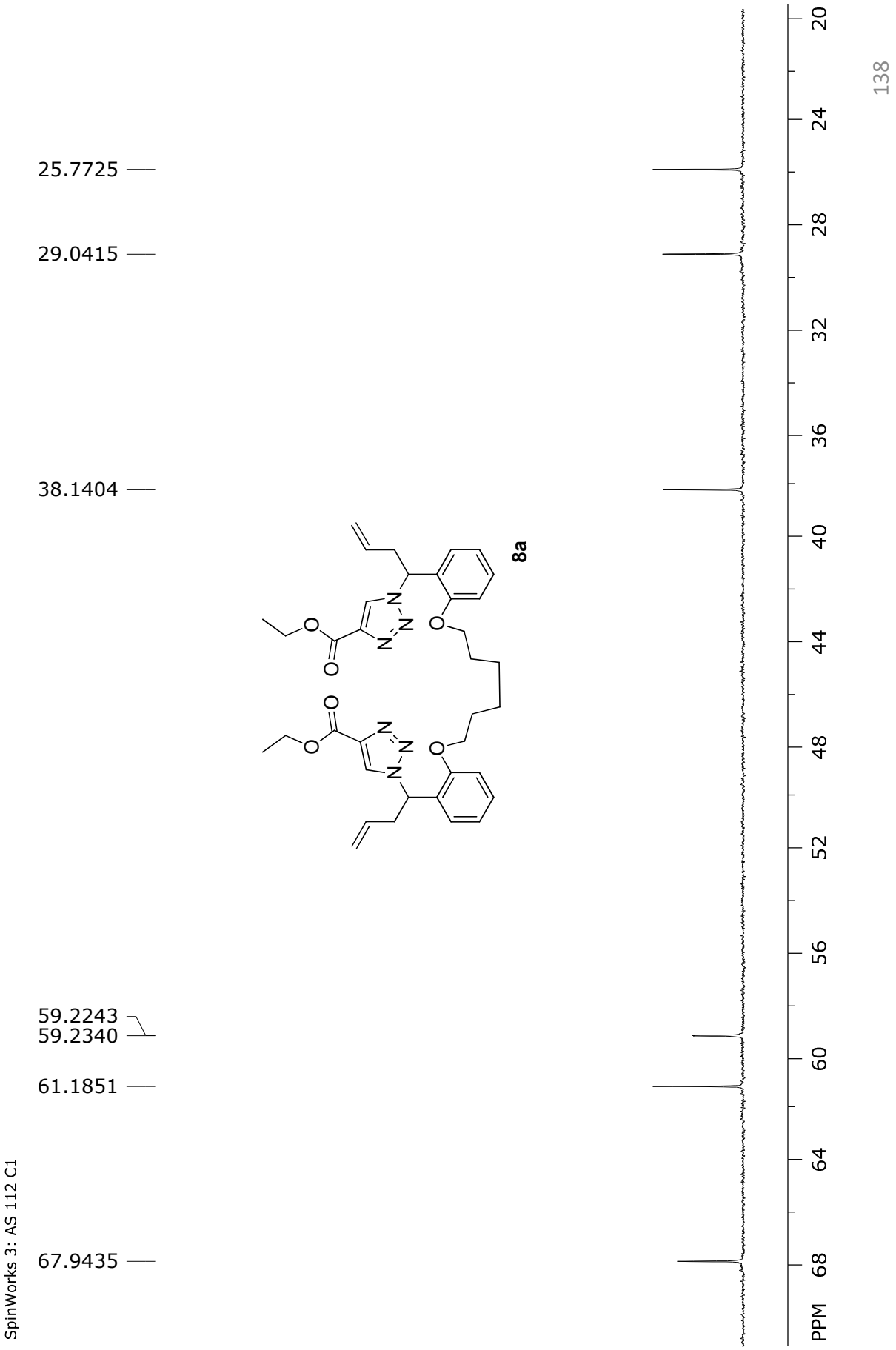
8a

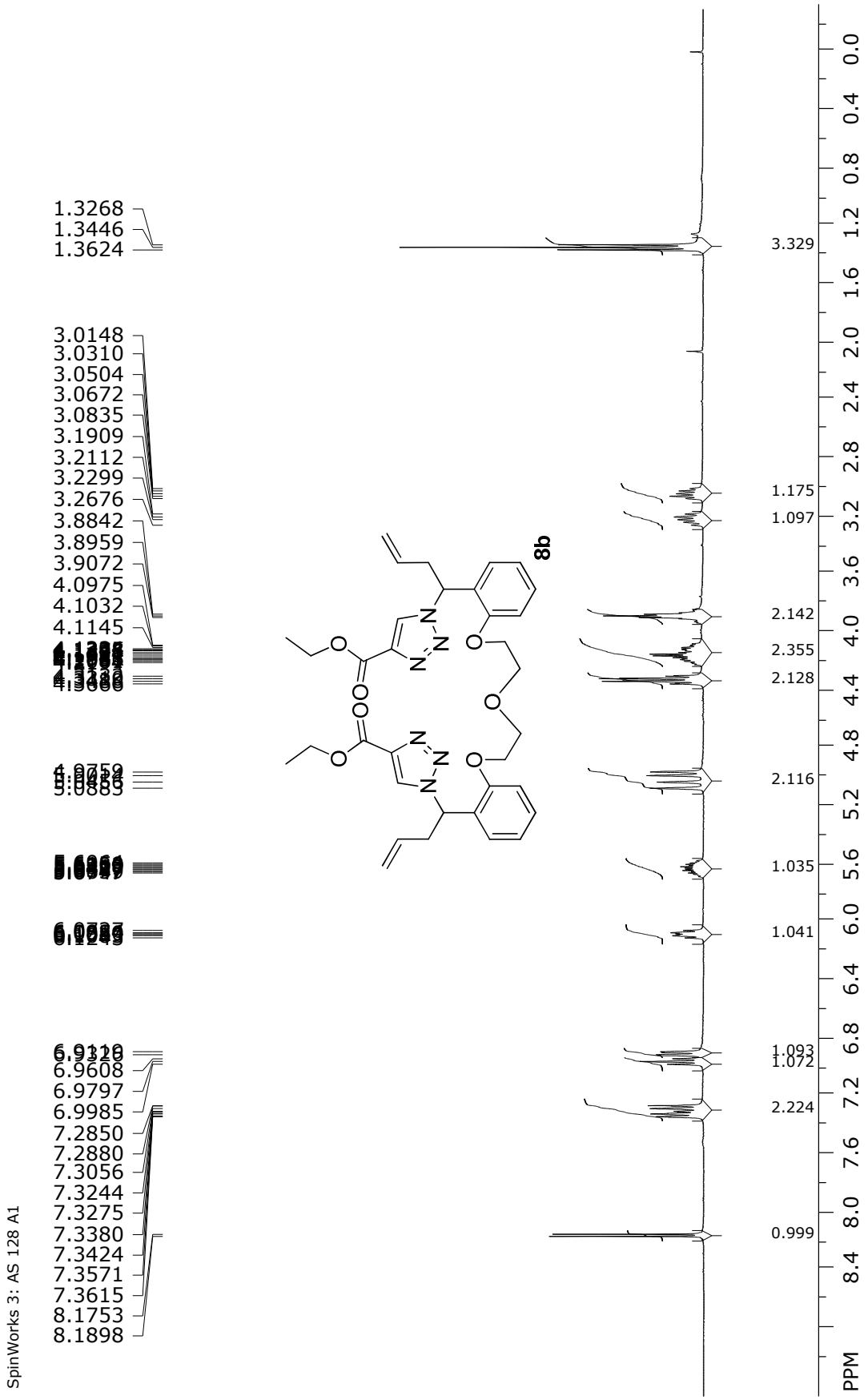


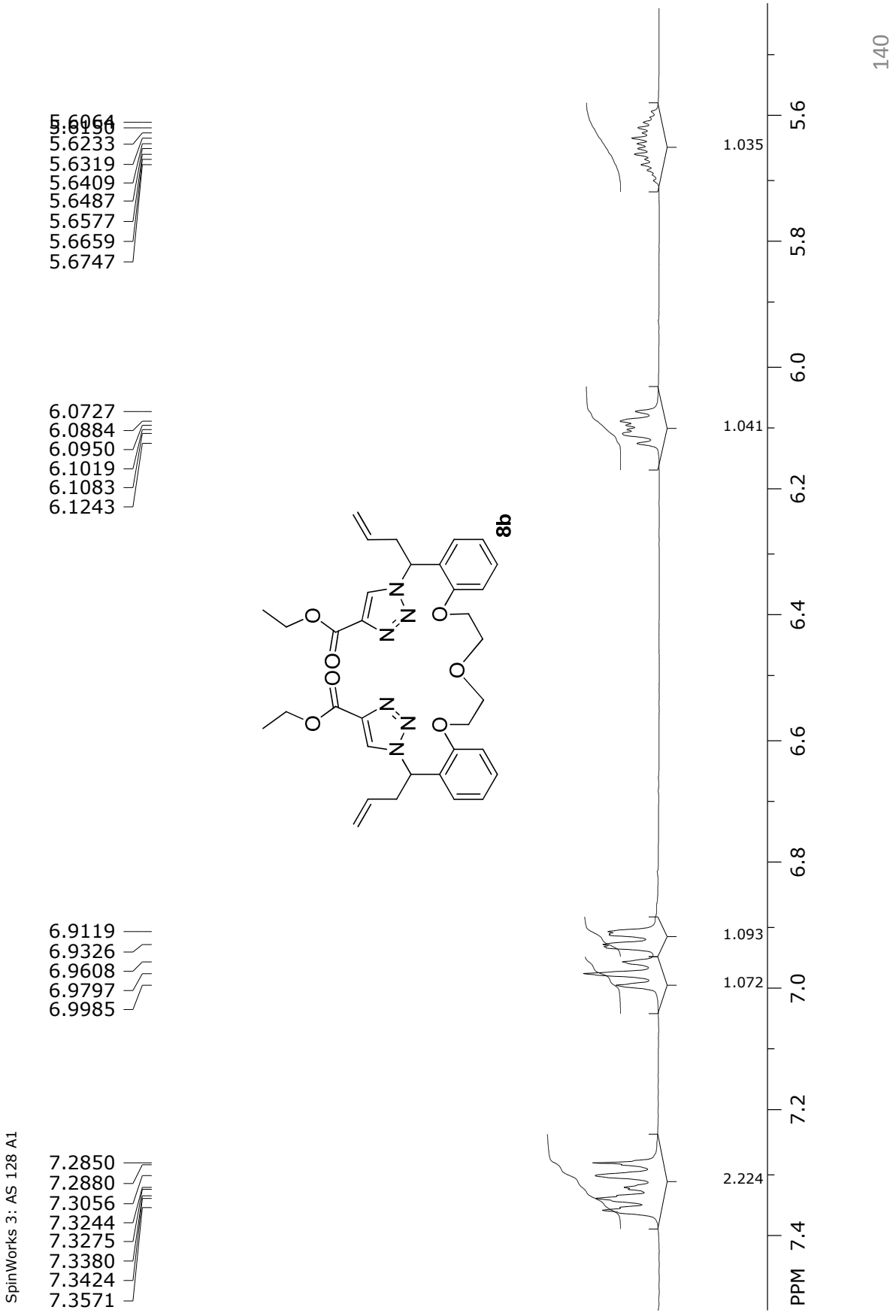

1.3619
1.3797
1.3975
1.4685
1.8153
3.0249
3.0435
3.0612
3.1831
3.2019
3.2041
3.2202
3.2225
3.2382
3.2405
3.220
1.898
2.220
1.017
0.986
PPM
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
3.0
3.2
8a
SpinWorks 3: AS 112 C1

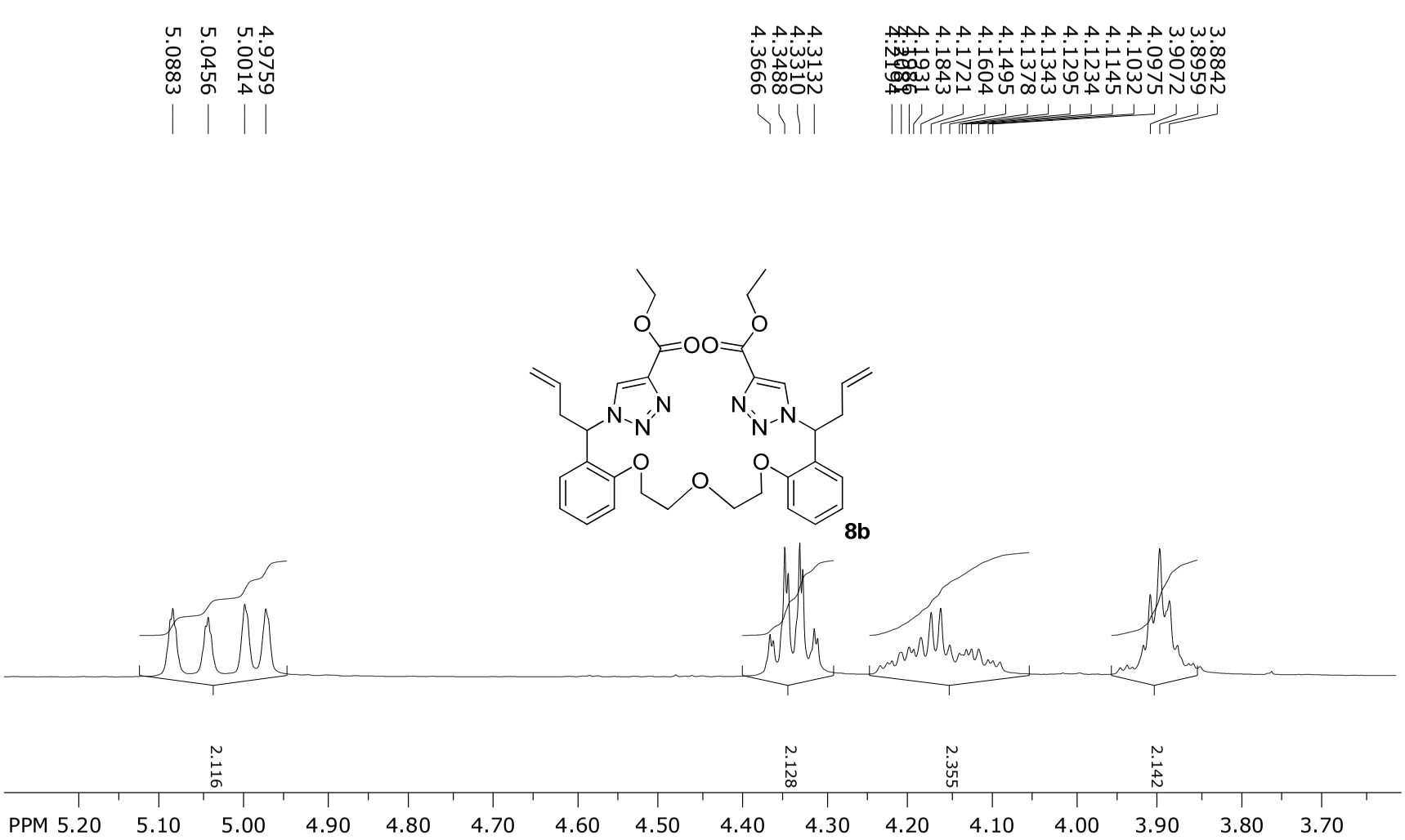

14.3330
25.7725
29.0415
38.1404
59.2243
59.2340
61.1851
67.9435
76.7673
77.0856
77.4036
111.6781
118.9035
120.7430
125.4112
127.2290
127.2503
127.4838
130.2016
132.9072
139.5124
156.1377
161.0313
8a
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
SpinWorks 3: AS 112 C1

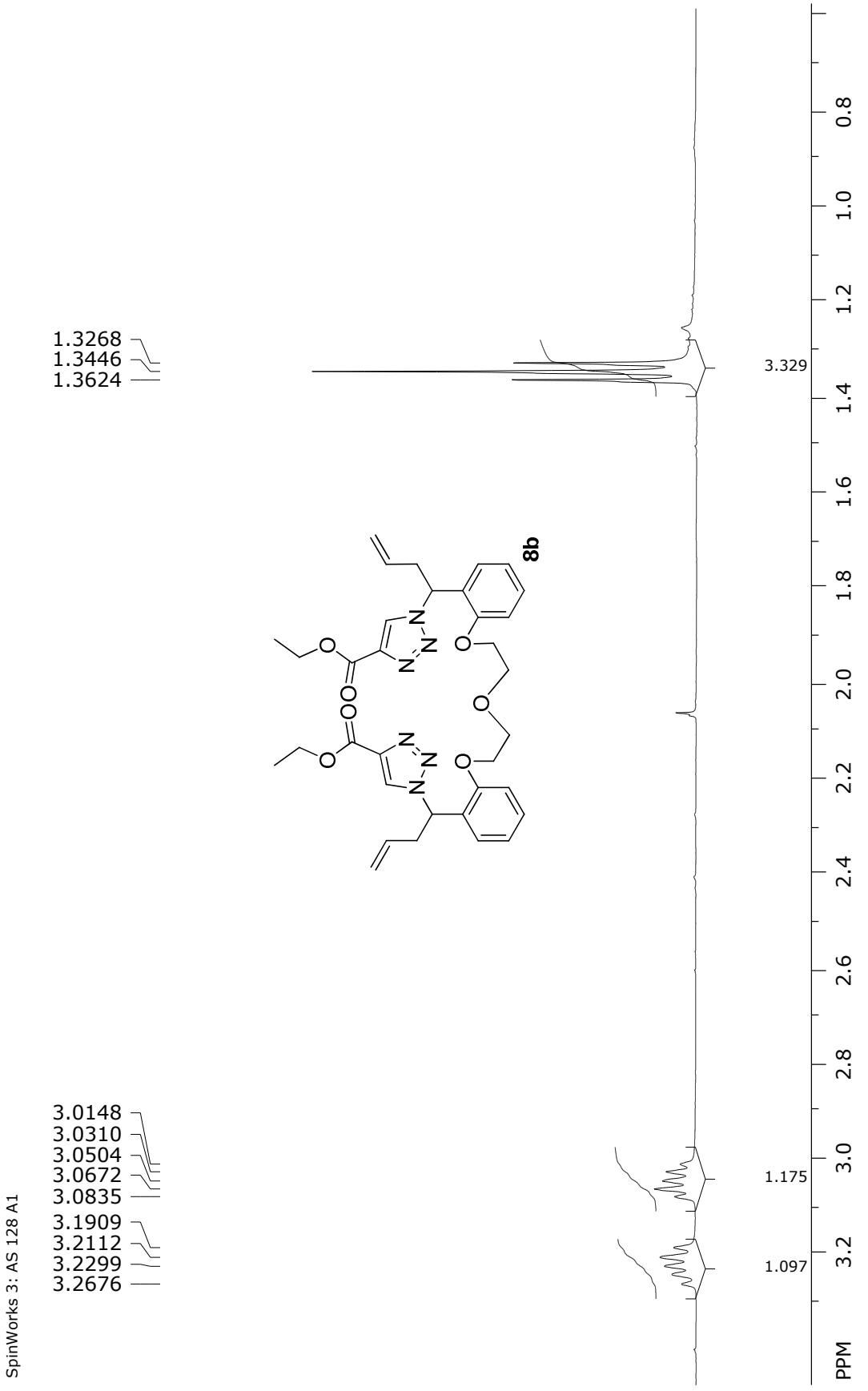

111.6781
118.9035
120.7430
125.4112
127.2290
127.2503
127.4838
130.2016
132.9072
139.5124
8a
PPM
110
112
114
116
118
120
122
124
126
128
130
132
134
136
138
140
SpinWorks 3: AS 112 C1

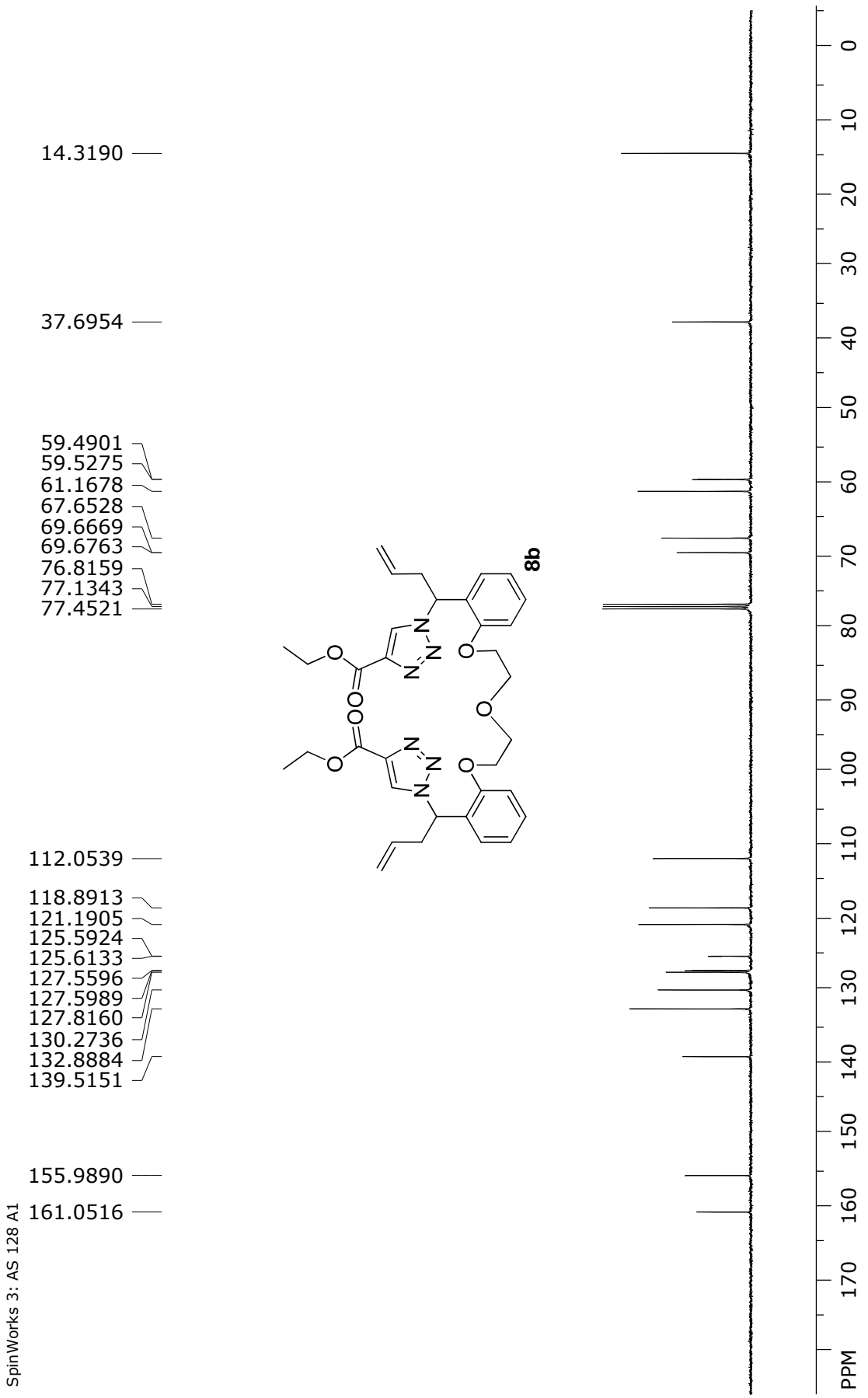

25.7725
29.0415
38.1404
59.2243
59.2340
61.1851
67.9435
SpinWorks 3: AS 112 C1
PPM
20
24
28
32
36
40
44
48
52
56
60
64
68
8a

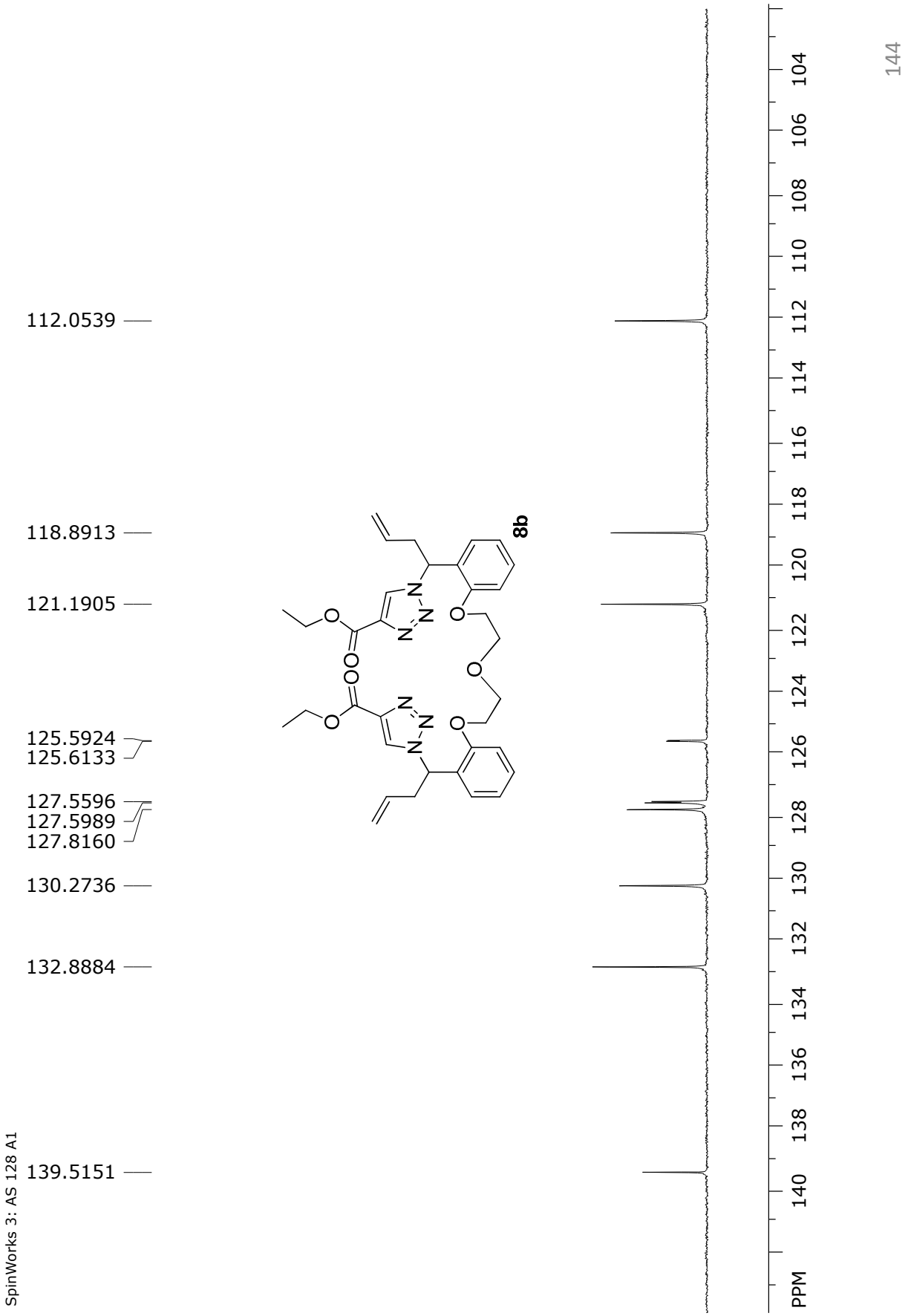

1.3268
1.3446
1.3624
3.0148
3.0310
3.0504
3.0672
3.0835
3.1909
3.2112
3.2299
3.2676
3.8842
3.8959
3.9072
4.0975
4.1032
4.1145
5.0889
6.9608
6.9797
6.9985
7.2850
7.2880
7.3056
7.3244
7.3275
7.3380
7.3424
7.3571
7.3615
8.1753
8.1898
8b
3.329
1.175
1.097
2.142
2.355
2.128
2.116
1.035
1.041
1.093
1.072
2.224
0.999
PPM
SpinWorks 3: AS 128 A1

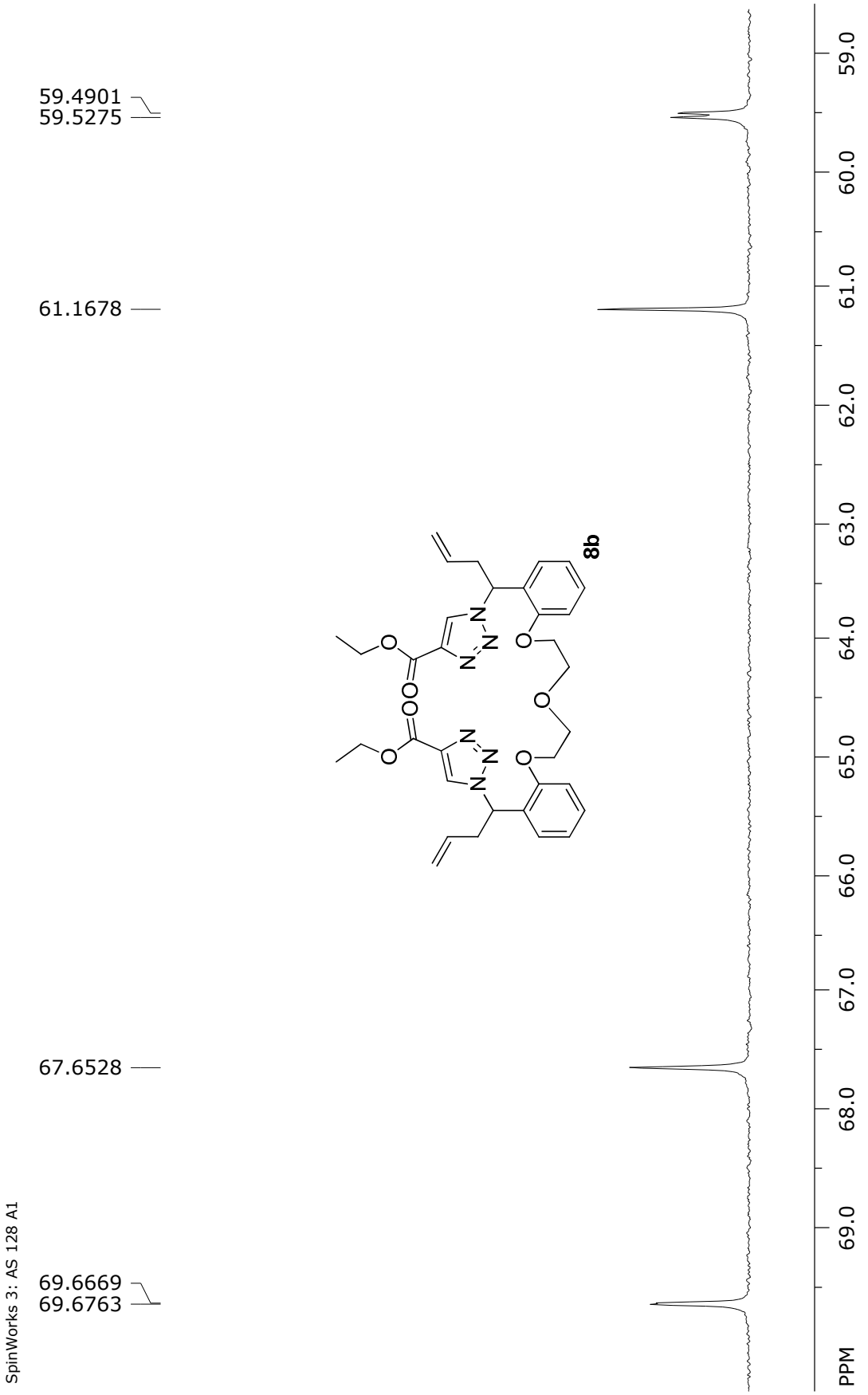

5.6064
5.6150
5.6233
5.6319
5.6409
5.6487
5.6577
5.6659
5.6747
6.0727
6.0884
6.0950
6.1019
6.1083
6.1243
6.9119
6.9326
6.9608
6.9797
6.9985
7.2850
7.2880
7.3056
7.3244
7.3275
7.3380
7.3424
7.3571
8b
1.035
1.041
1.093
1.072
2.224
5.6
5.8
6.0
6.2
6.4
6.6
6.8
7.0
7.2
7.4
PPM
SpinWorks 3: AS 128 A1

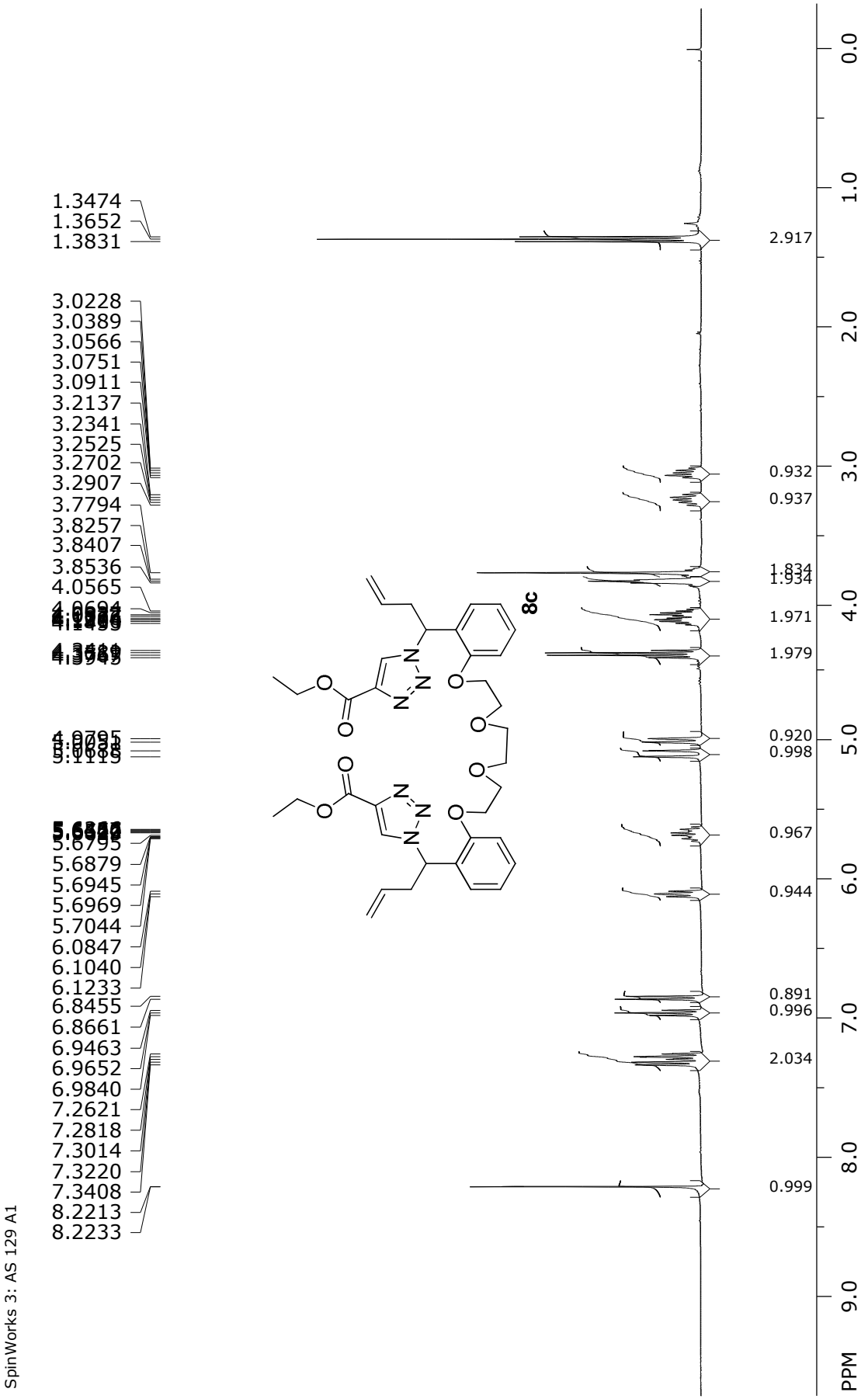


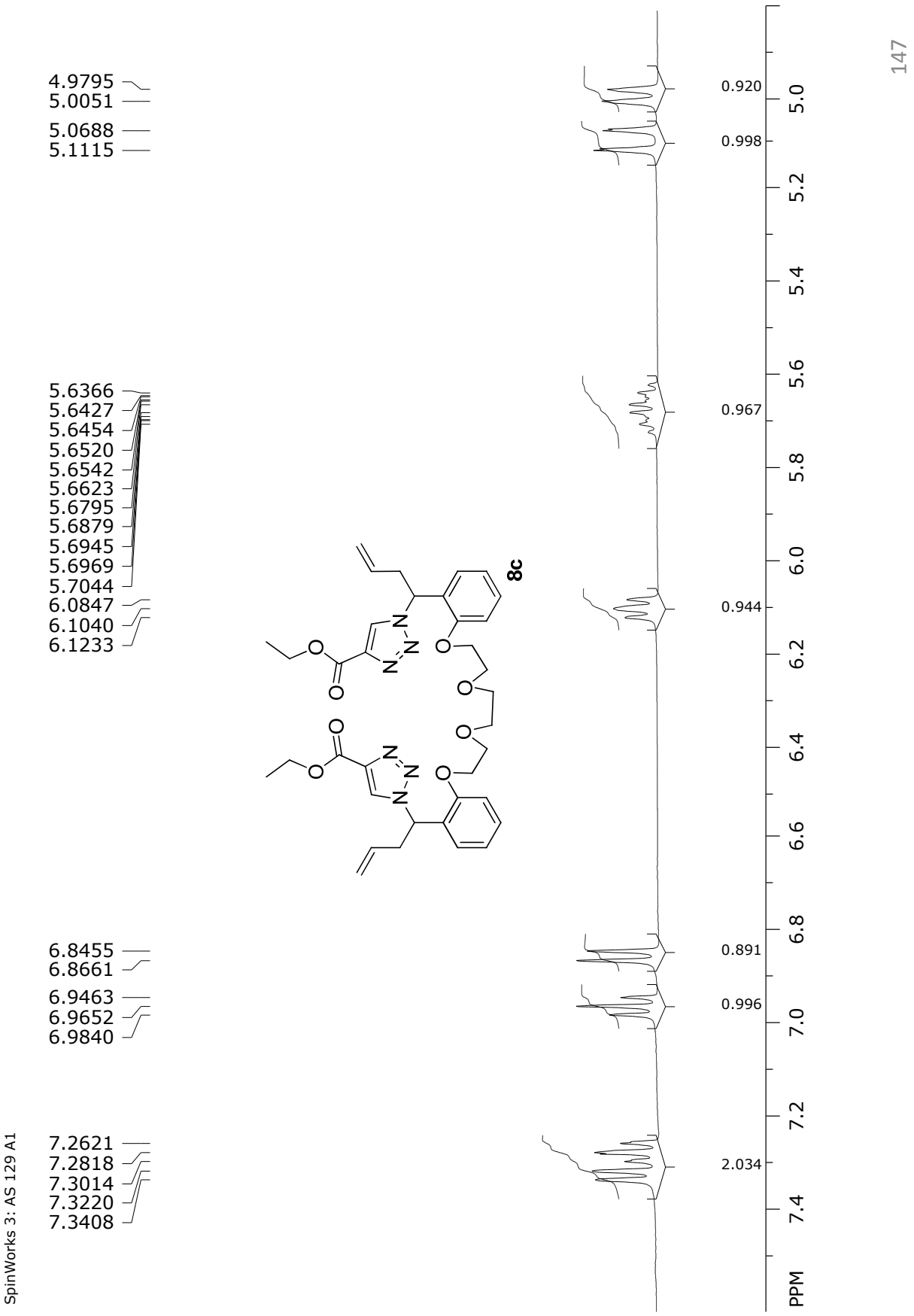

1.3268
1.3446
1.3624
3.329
8b
3.0148
3.0310
3.0504
3.0672
3.0835
3.1909
3.2112
3.2299
3.2676
1.175
1.097
PPM
SpinWorks 3: AS 128 A1

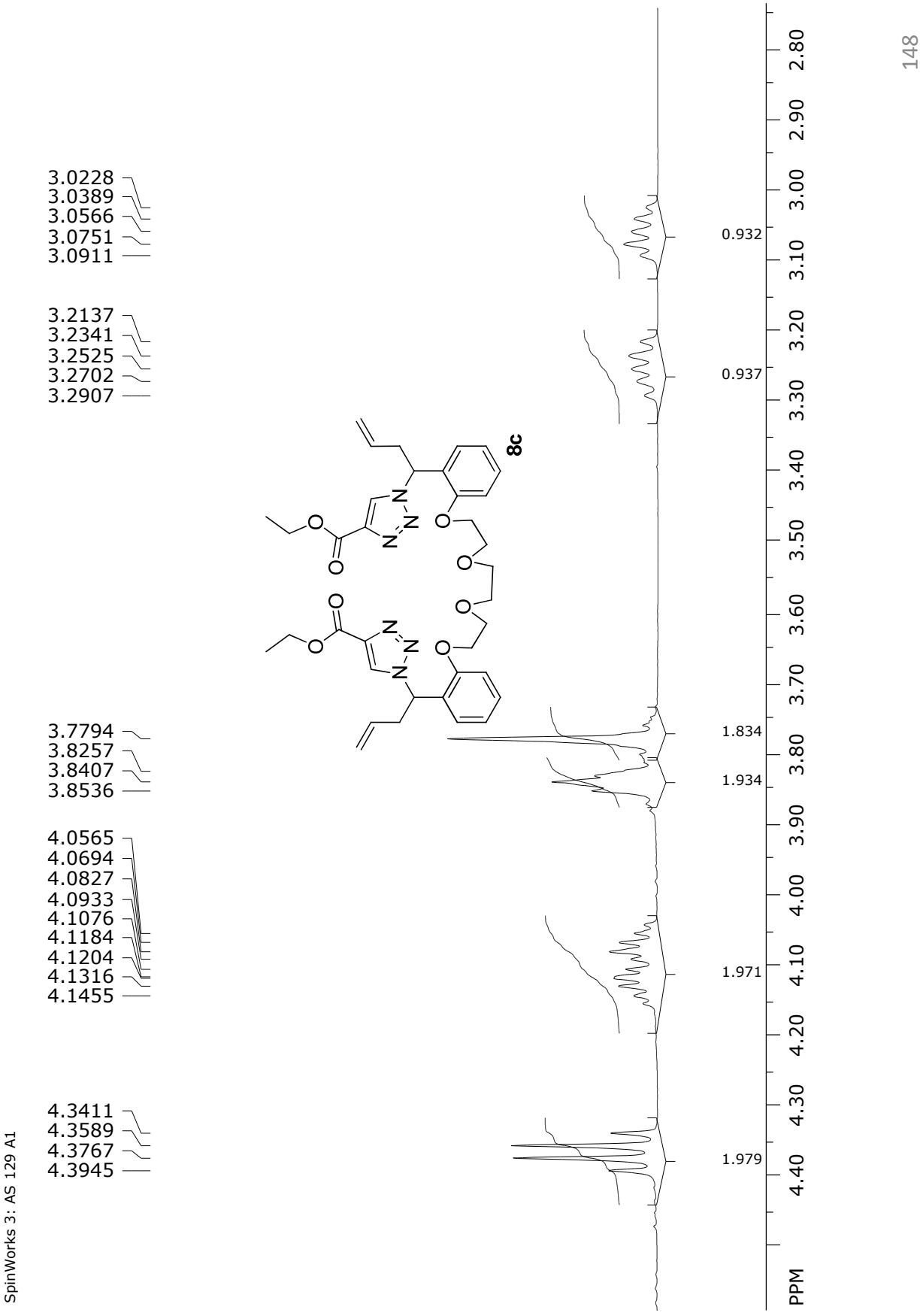

14.3190
37.6954
59.4901
59.5275
61.1678
67.6528
69.6669
69.6763
76.8159
77.1343
77.4521
112.0539
118.8913
121.1905
125.5924
125.6133
127.5596
127.5989
127.8160
130.2736
132.8884
139.5151
155.9890
161.0516
8b
SpinWorks 3: AS 128 A1
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170

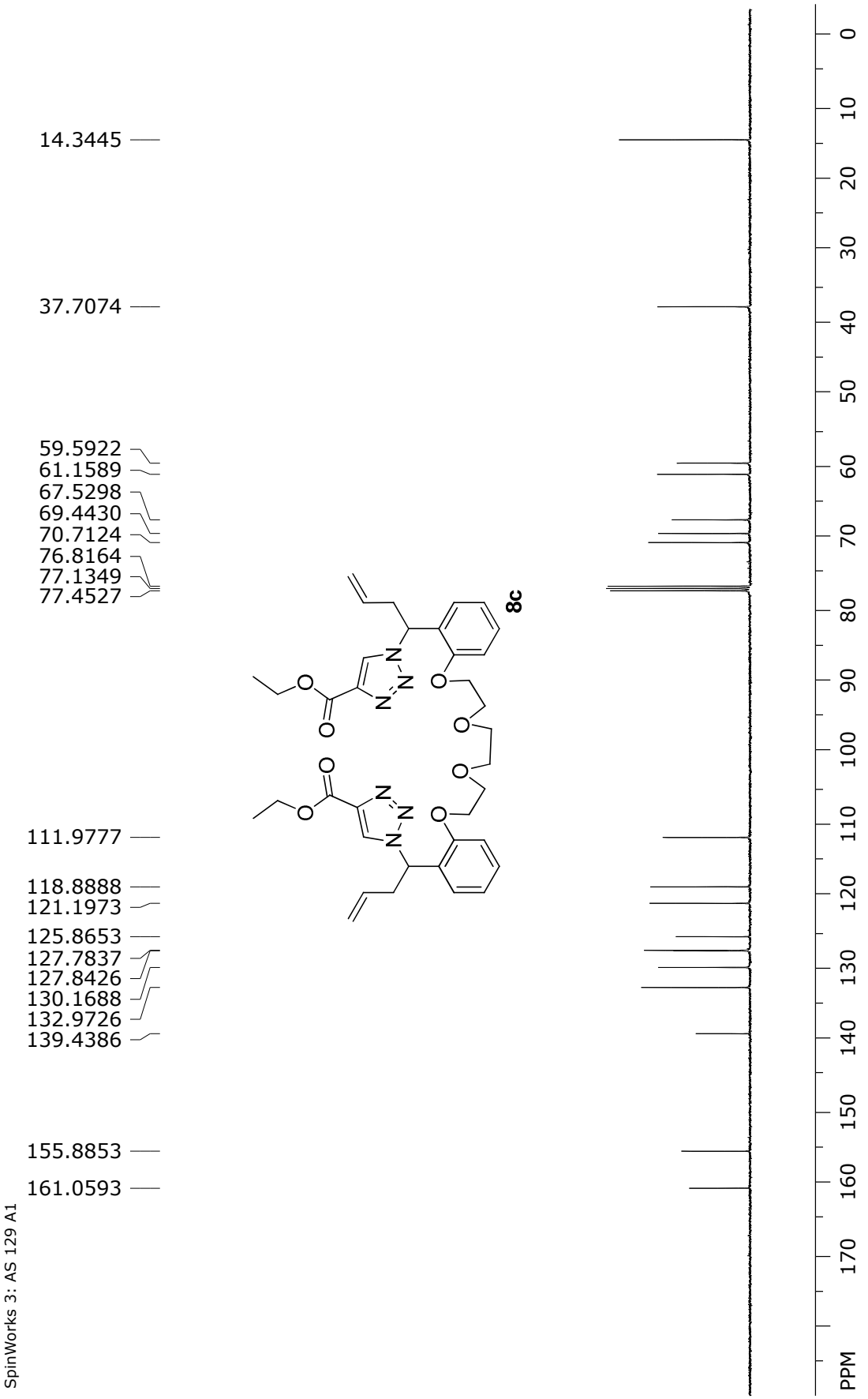

112.0539
118.8913
121.1905
125.5924
125.6133
127.5596
127.5989
127.8160
130.2736
132.8884
139.5151
8b
SpinWorks 3: AS 128 A1
PPM
140
138
136
134
132
130
128
126
124
122
120
118
116
114
112
110
108
106
104

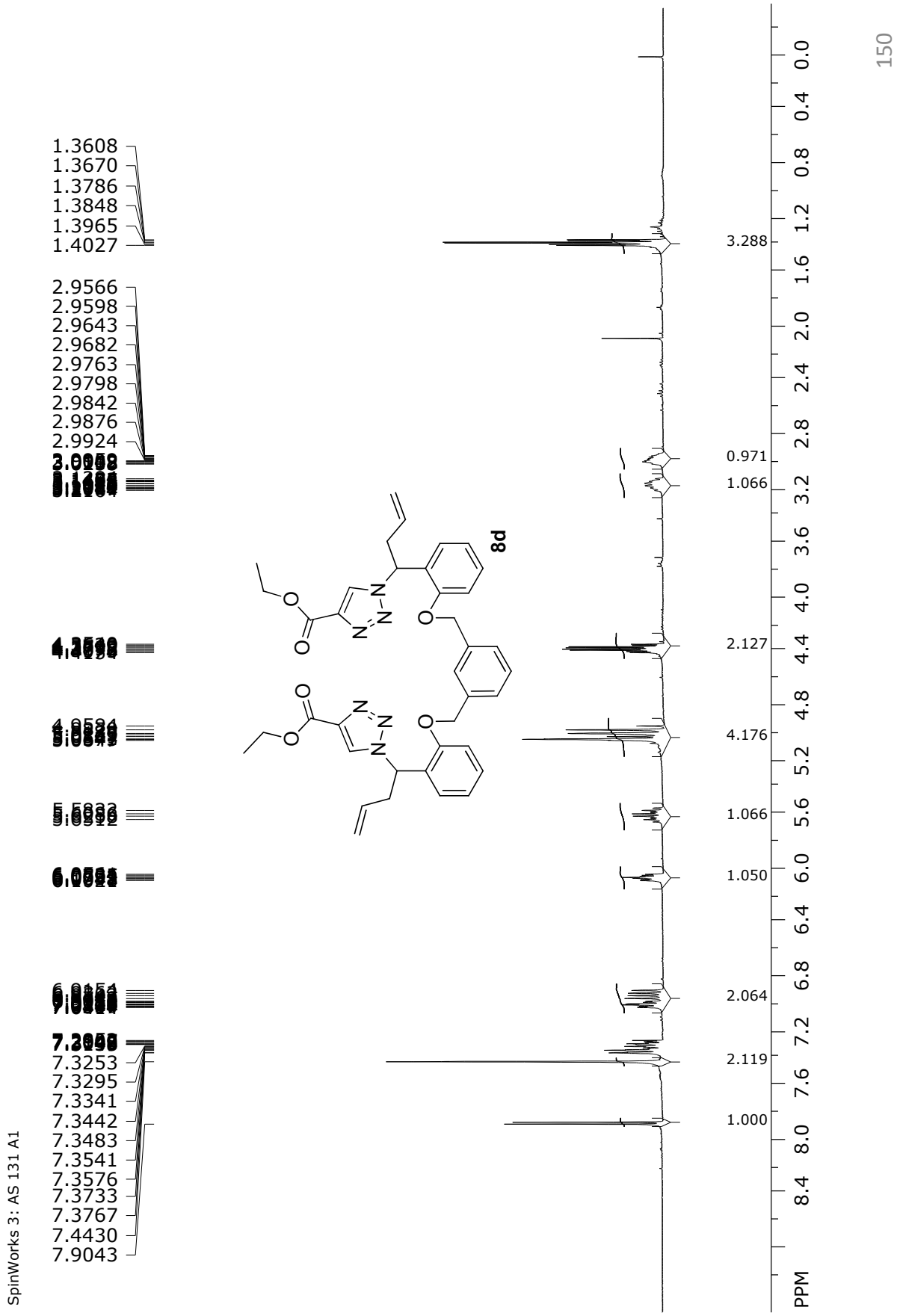

59.4901
59.5275
61.1678
67.6528
69.6669
69.6763
SpinWorks 3: AS 128 A1
PPM
59.0
60.0
61.0
62.0
63.0
64.0
65.0
66.0
67.0
68.0
69.0
8b

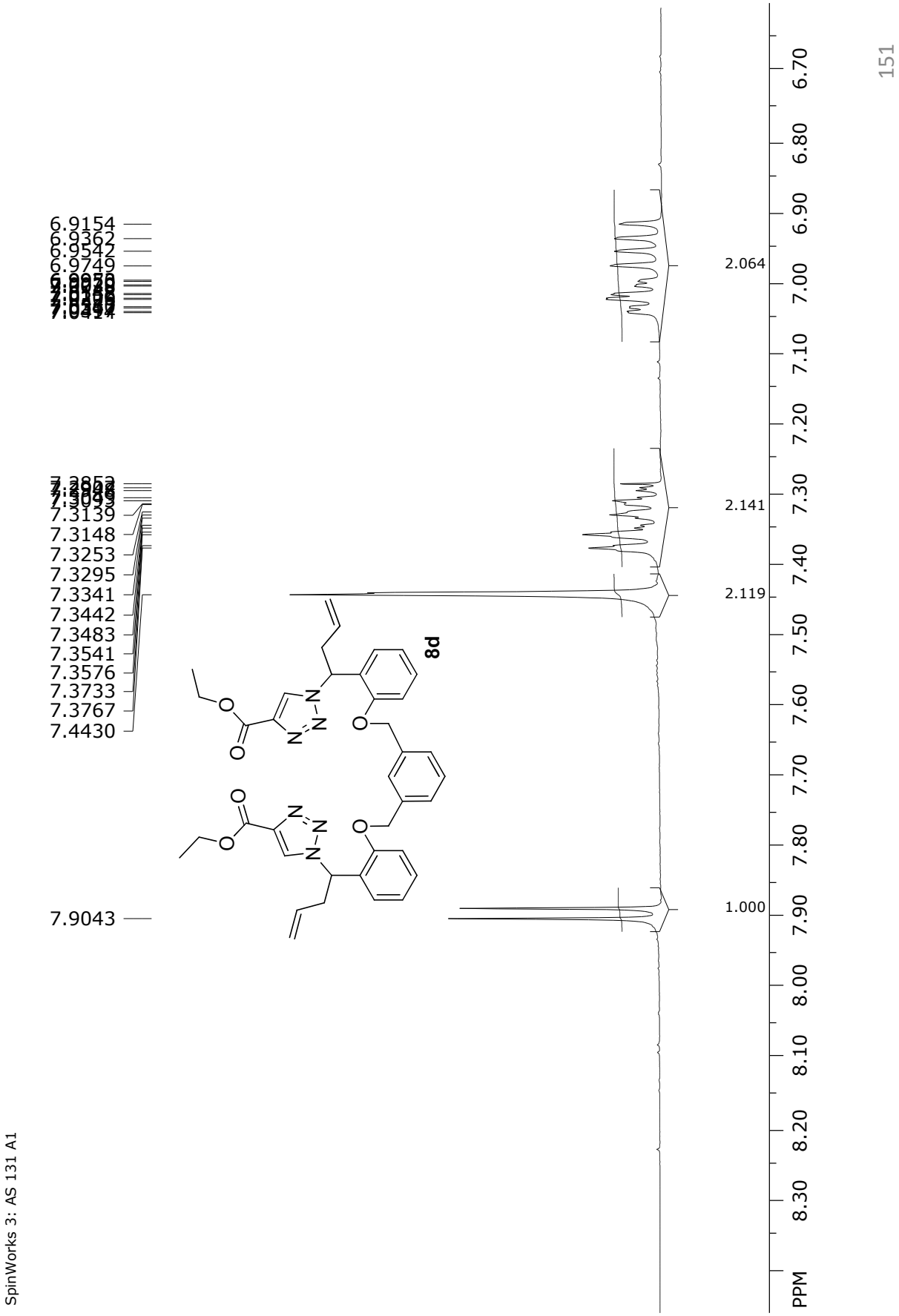

1.3474
1.3652
1.3831
3.0228
3.0389
3.0566
3.0751
3.0911
3.2137
3.2341
3.2525
3.2702
3.2907
3.7794
3.8257
3.8407
3.8536
4.0565
5.6795
5.6879
5.6945
5.6969
5.7044
6.0847
6.1040
6.1233
6.8455
6.8661
6.9463
6.9652
6.9840
7.2621
7.2818
7.3014
7.3220
7.3408
8.2213
8.2233
8c
2.917
0.932
0.937
1.834
1.934
1.971
1.979
0.920
0.998
0.967
0.944
0.891
0.996
2.034
0.999
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
PPM
SpinWorks 3: AS 129 A1

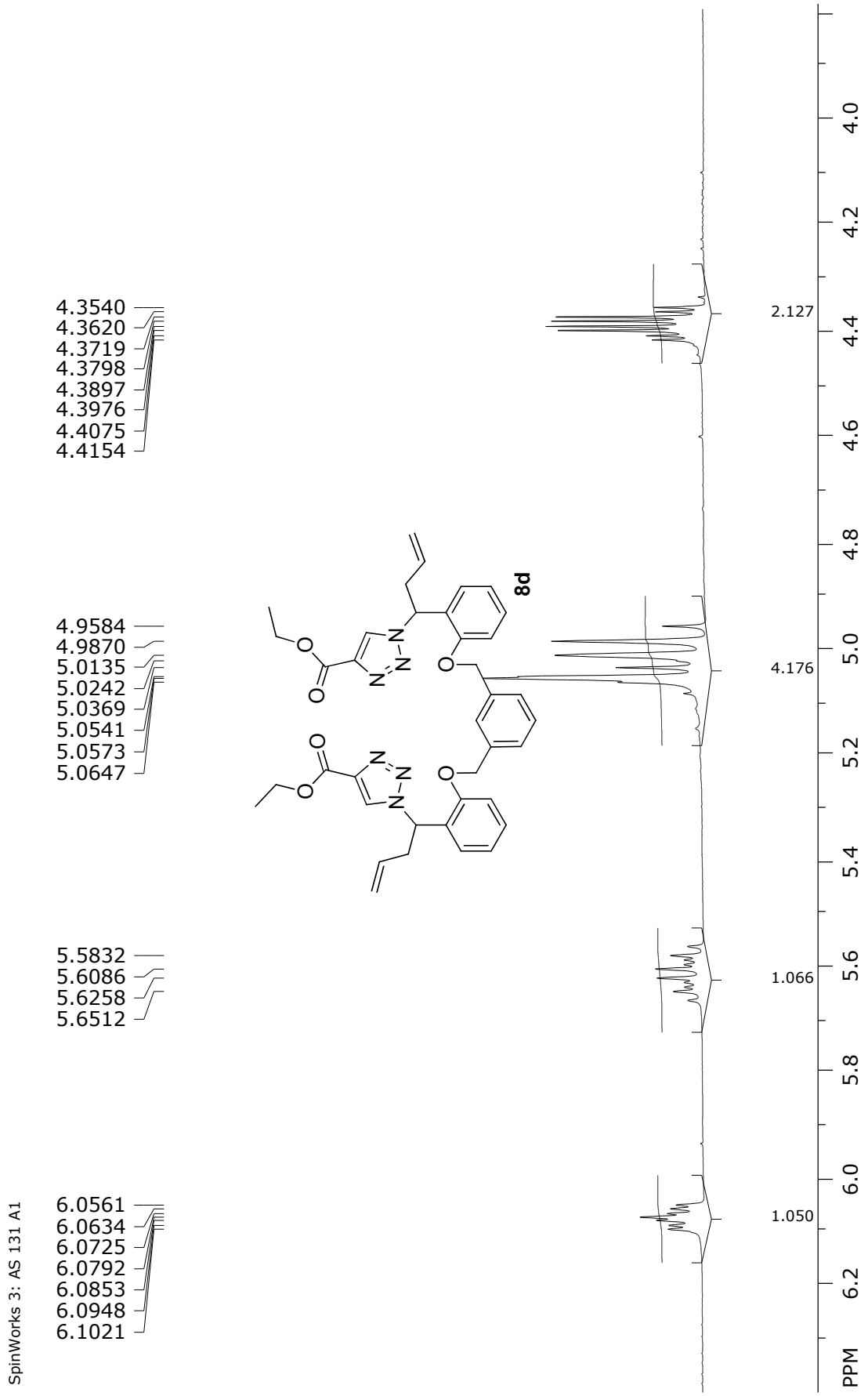

4.9795
5.0051
5.0688
5.1115
5.6366
5.6427
5.6454
5.6520
5.6542
5.6623
5.6795
5.6879
5.6945
5.6969
5.7044
6.0847
6.1040
6.1233
6.8455
6.8661
6.9463
6.9652
6.9840
7.2621
7.2818
7.3014
7.3220
7.3408
8c
0.920
0.998
0.967
0.944
0.891
0.996
2.034
PPM
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
6.6
6.8
7.0
7.2
7.4
SpinWorks 3: AS 129 A1

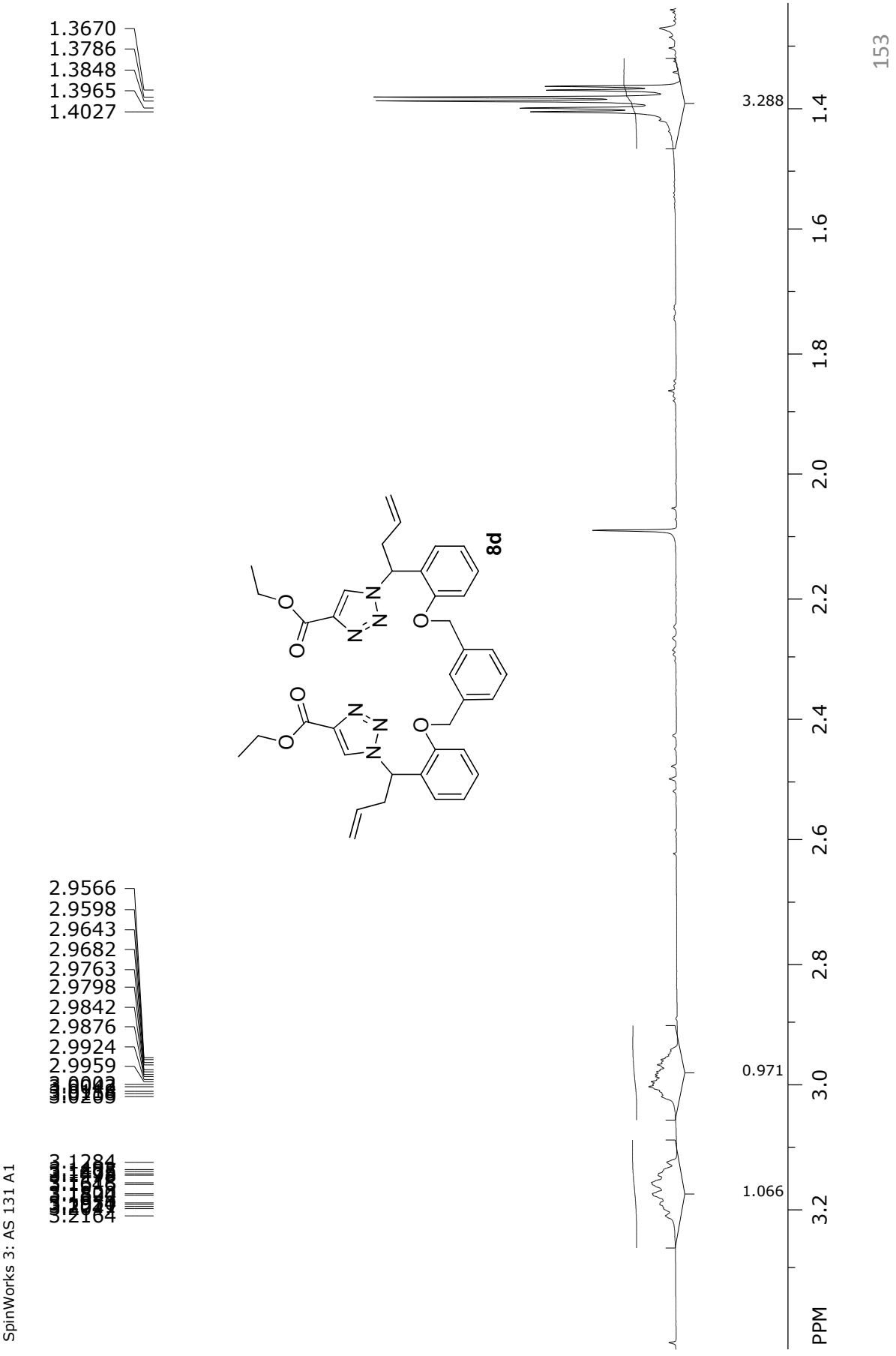

3.0228
3.0389
3.0566
3.0751
3.0911
3.2137
3.2341
3.2525
3.2702
3.2907
3.7794
3.8257
3.8407
3.8536
4.0565
4.0694
4.0827
4.0933
4.1076
4.1184
4.1204
4.1316
4.1455
4.3411
4.3589
4.3767
4.3945
8c
0.932
0.937
1.834
1.934
1.971
1.979
PPM
2.80
2.90
3.00
3.10
3.20
3.30
3.40
3.50
3.60
3.70
3.80
3.90
4.00
4.10
4.20
4.30
4.40
SpinWorks 3: AS 129 A1

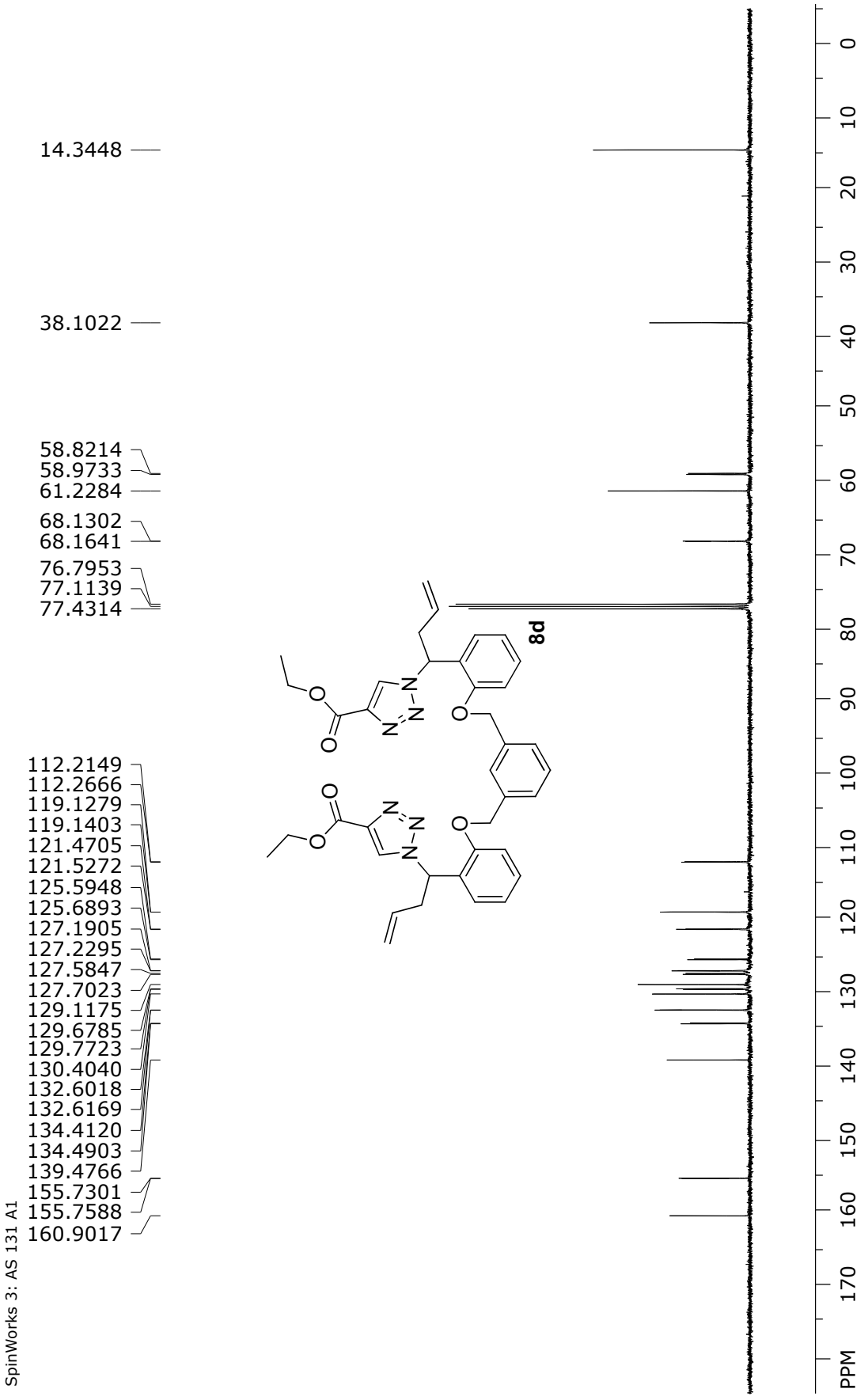

14.3445
37.7074
59.5922
61.1589
67.5298
69.4430
70.7124
76.8164
77.1349
77.4527
111.9777
118.8888
121.1973
125.8653
127.7837
127.8426
130.1688
132.9726
139.4386
155.8853
161.0593
8c
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
SpinWorks 3: AS 129 A1


1.3608
1.3670
1.3786
1.3848
1.3965
1.4027
2.9566
2.9598
2.9643
2.9682
2.9763
2.9798
2.9842
2.9876
2.9924
7.3253
7.3295
7.3341
7.3442
7.3483
7.3541
7.3576
7.3733
7.3767
7.4430
7.9043
8d
3.288
0.971
1.066
2.127
4.176
1.066
1.050
2.064
2.119
1.000
PPM
0.0
0.4
0.8
1.2
1.6
2.0
2.4
2.8
3.2
3.6
4.0
4.4
4.8
5.2
5.6
6.0
6.4
6.8
7.2
7.6
8.0
8.4
SpinWorks 3: AS 131 A1


6.9154
6.9362
6.9542
6.9749
7.3139
7.3148
7.3253
7.3295
7.3341
7.3442
7.3483
7.3541
7.3576
7.3733
7.3767
7.4430
7.9043
8d
2.064
2.141
2.119
1.000
PPM
6.70
6.80
6.90
7.00
7.10
7.20
7.30
7.40
7.50
7.60
7.70
7.80
7.90
8.00
8.10
8.20
8.30
SpinWorks 3: AS 131 A1


SpinWorks 3: AS 131 A1
4.3540
4.3620
4.3719
4.3798
4.3897
4.3976
4.4075
4.4154
4.9584
4.9870
5.0135
5.0242
5.0369
5.0541
5.0573
5.0647
5.5832
5.6086
5.6258
5.6512
6.0561
6.0634
6.0725
6.0792
6.0853
6.0948
6.1021
8d
2.127
4.176
1.066
1.050
PPM
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2


1.3670
1.3786
1.3848
1.3965
1.4027
2.9566
2.9598
2.9643
2.9682
2.9763
2.9798
2.9842
2.9876
2.9924
2.9959
3.1284
3.2164
8d
3.288
0.971
1.066
PPM
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
3.0
3.2
SpinWorks 3: AS 131 A1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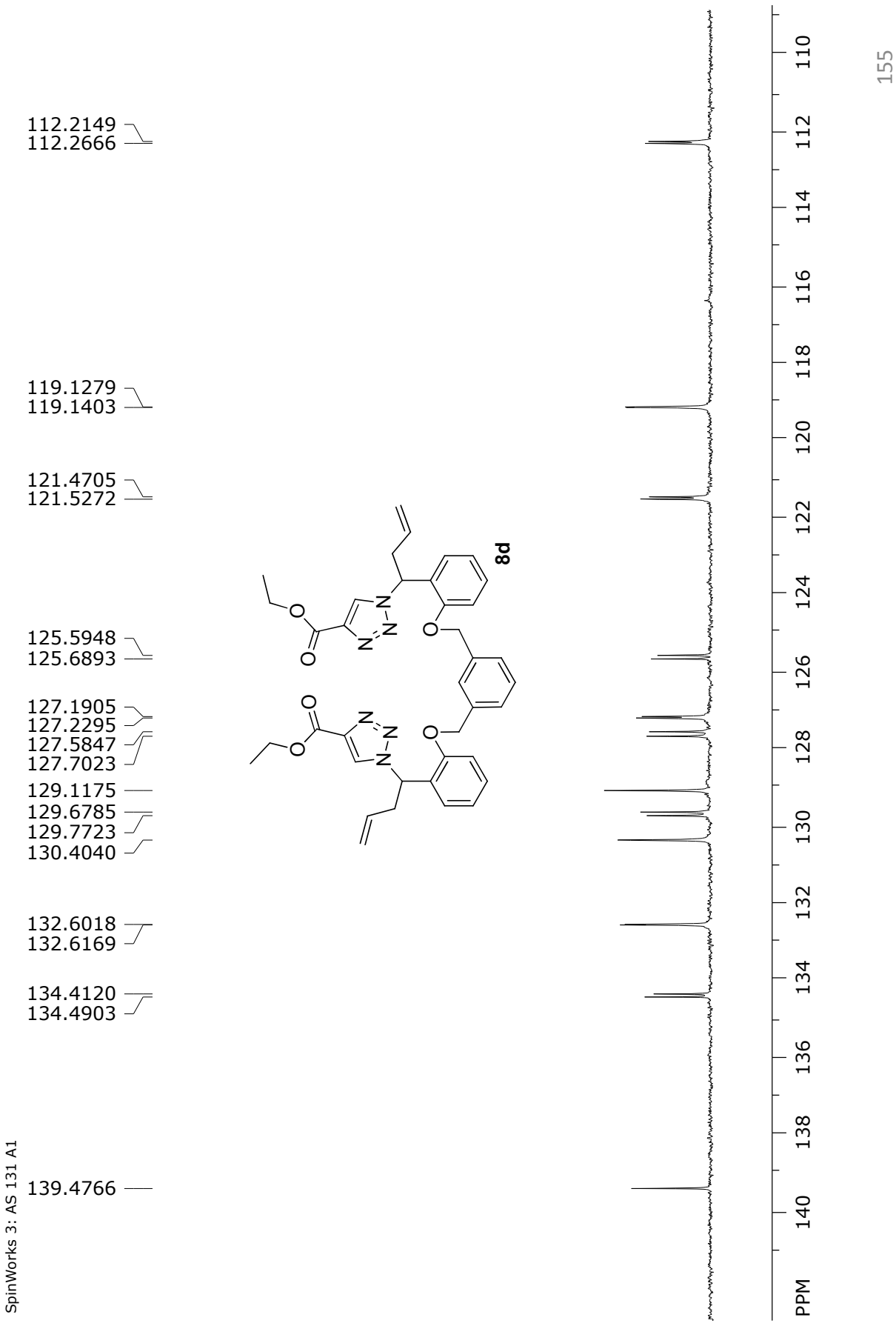
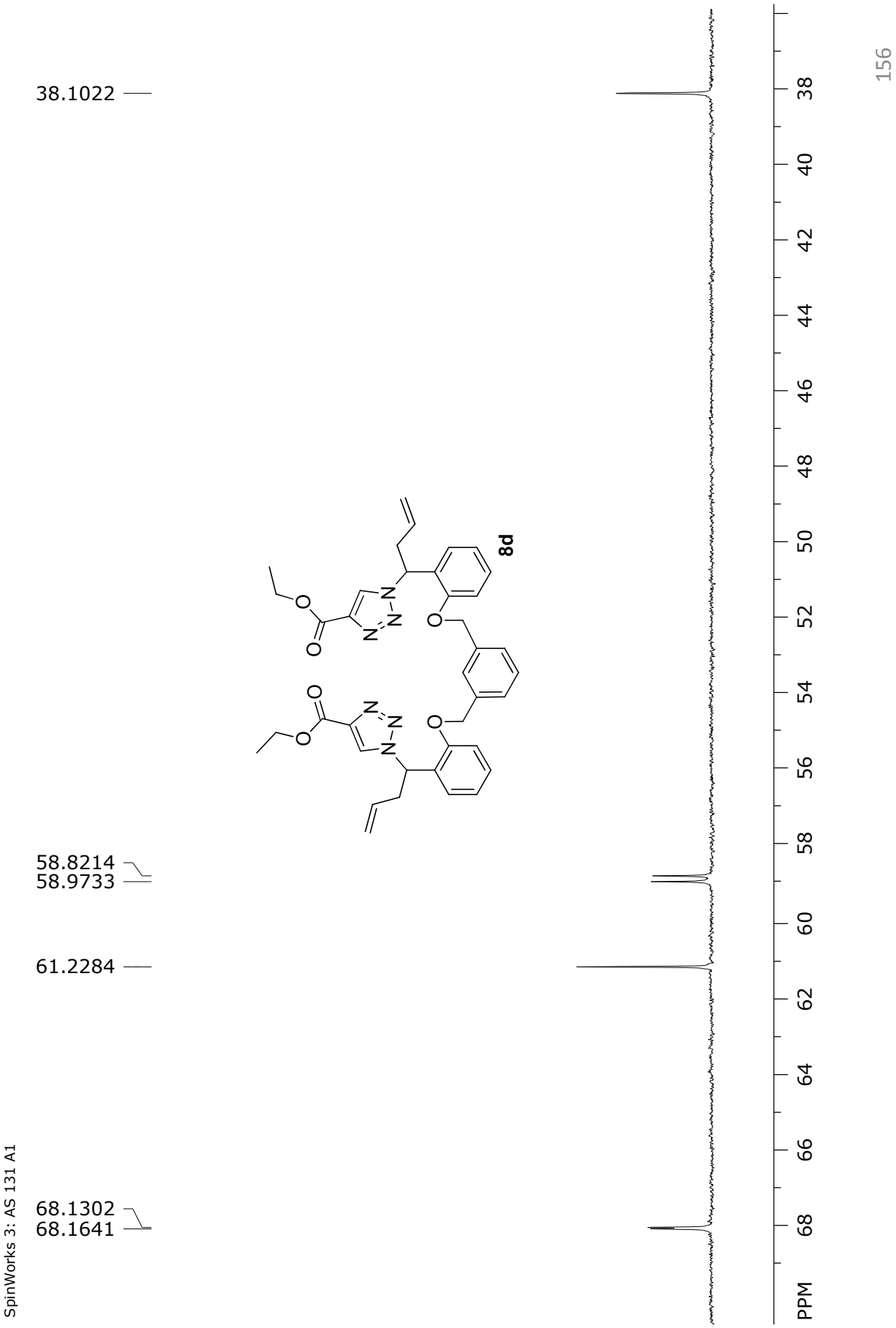
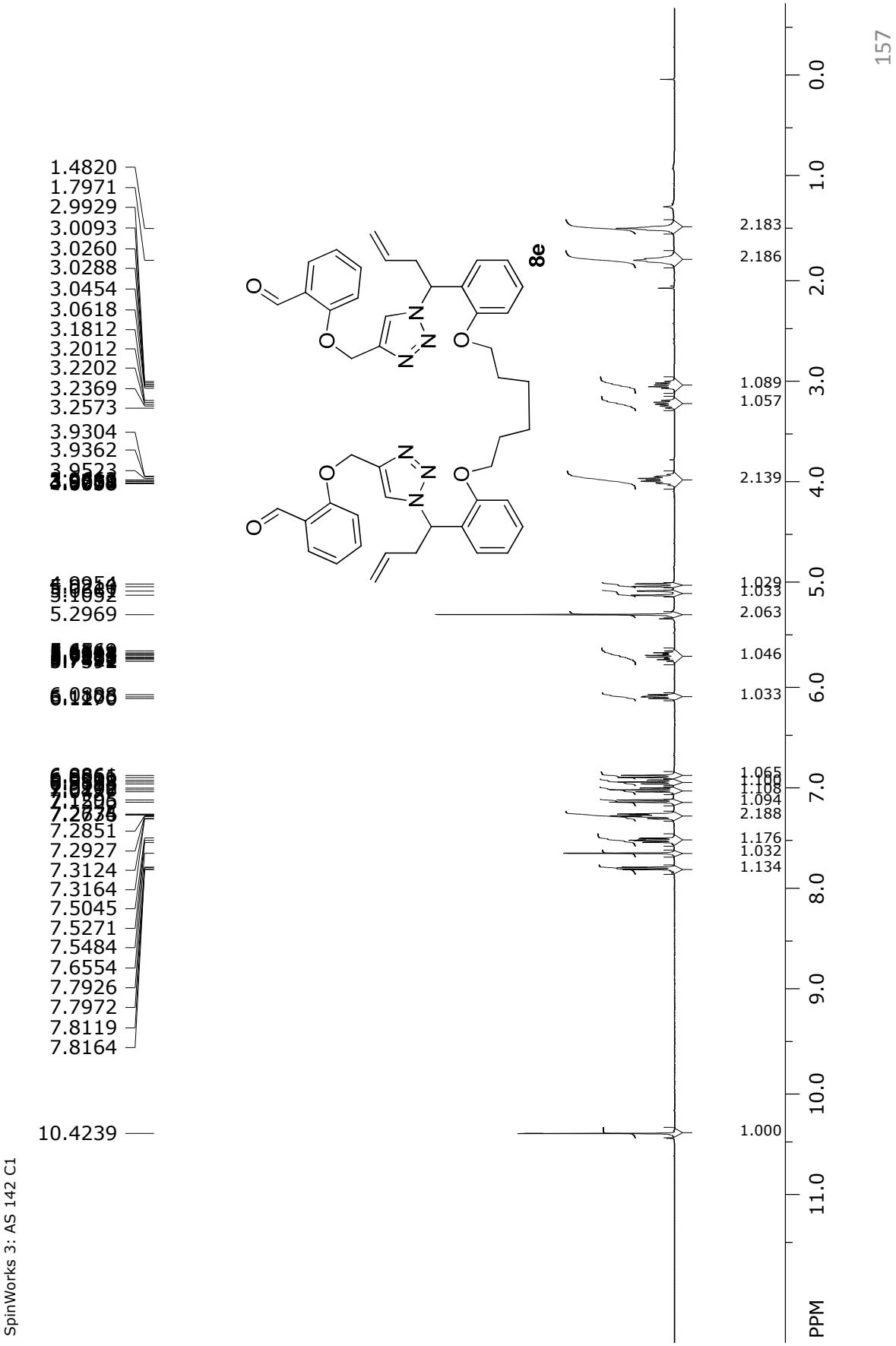
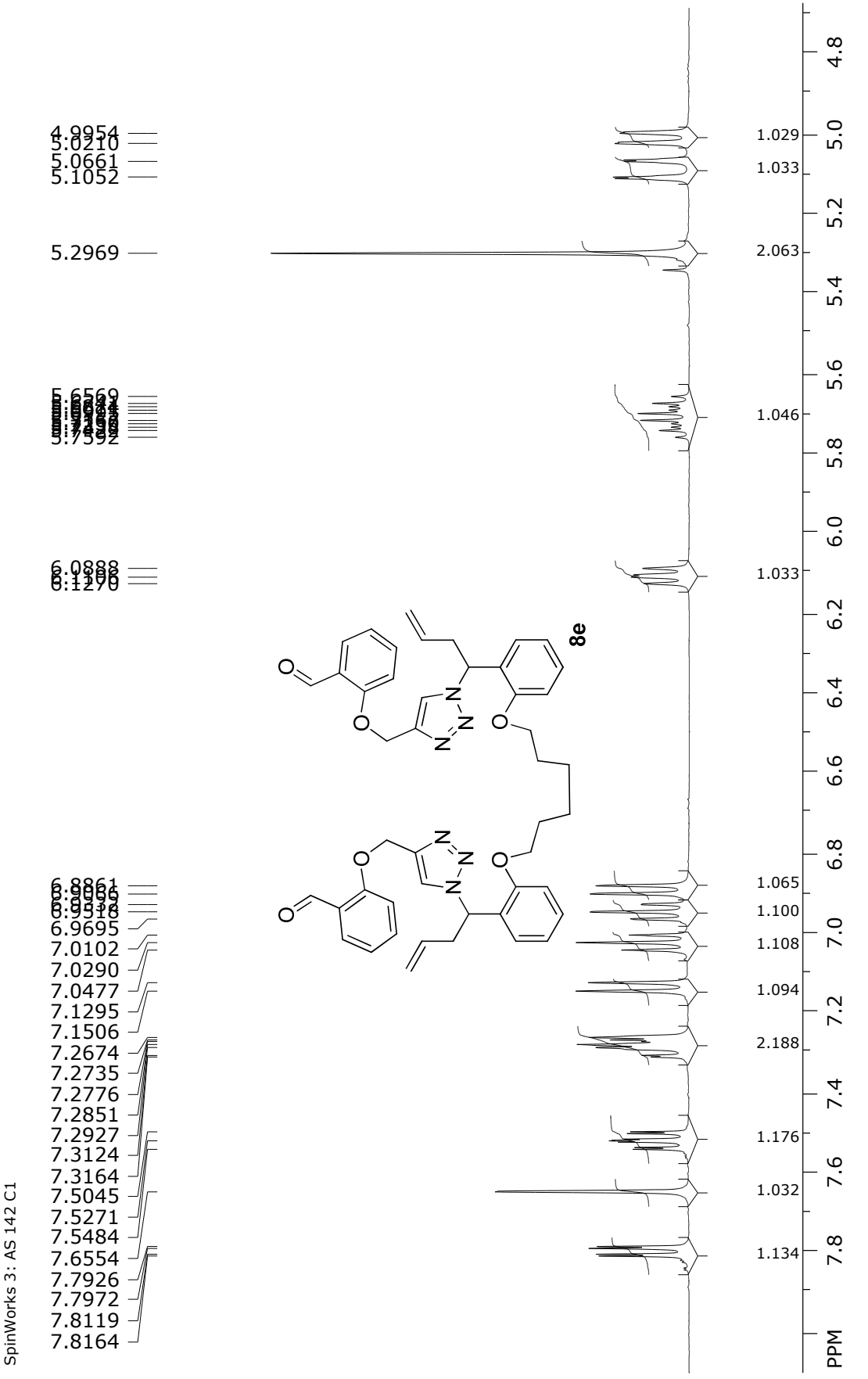
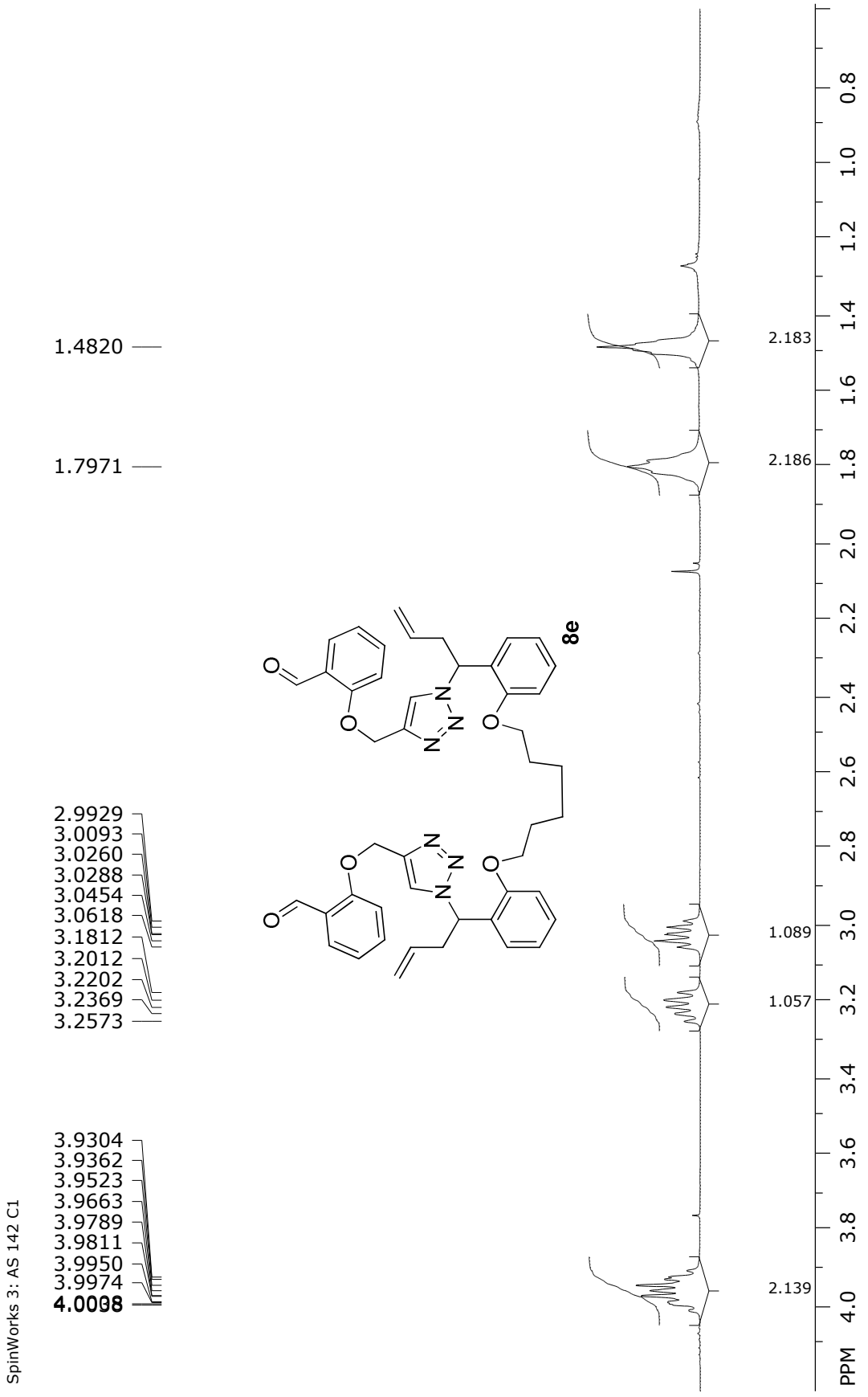
38.1022
58.8214
58.9733
61.2284
68.1302
68.1641
76.7953
77.1139
77.4314
112.2149
112.2666
119.1279
119.1403
121.4705
121.5272
125.5948
125.6893
127.1905
127.2295
127.5847
127.7023
129.1175
129.6785
129.7723
130.4040
132.6018
132.6169
134.4120
134.4903
139.4766
155.7301
155.7588
160.9017
SpinWorks 3: AS 131 A1
8d
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170

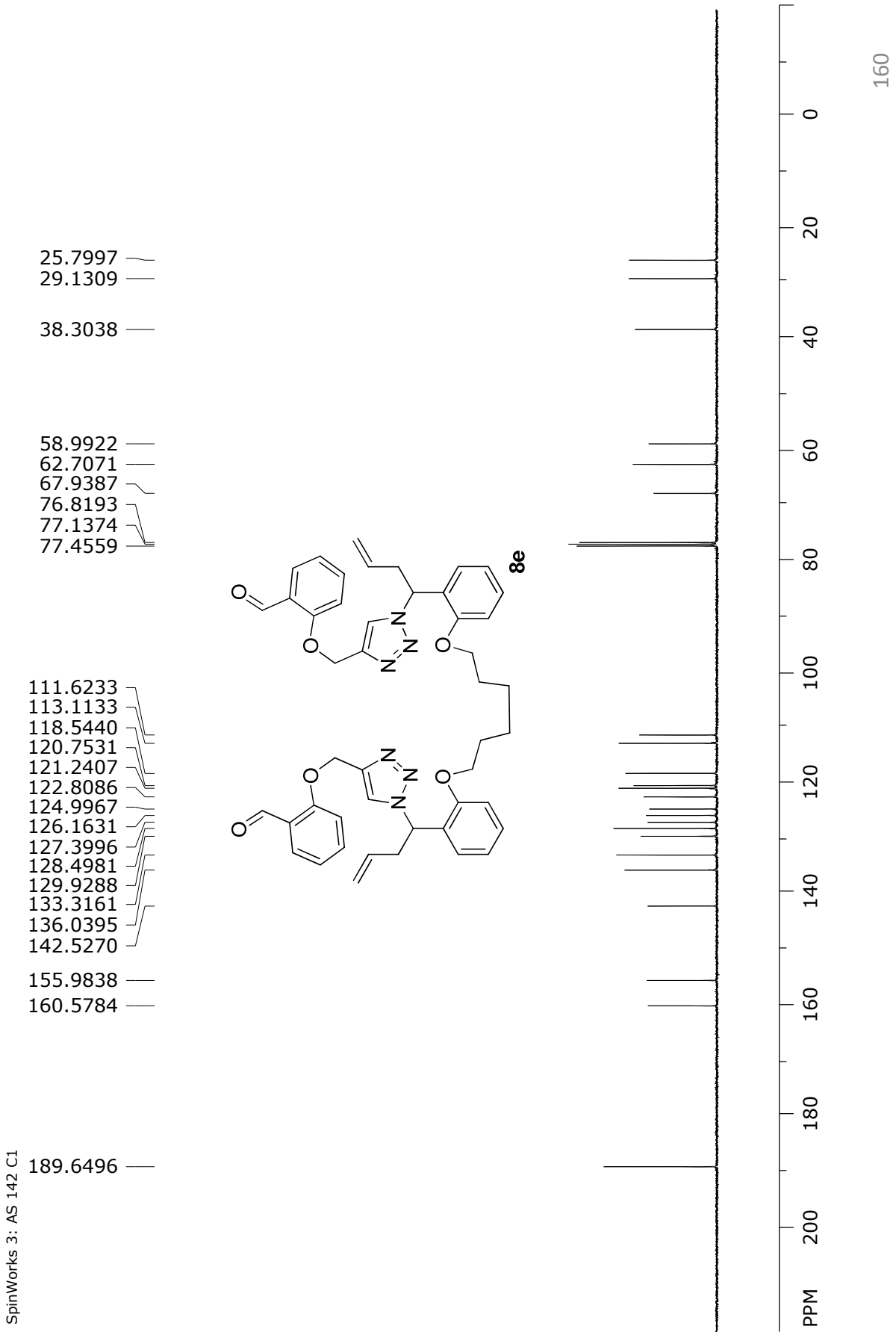

112.2149
112.2666
119.1279
119.1403
121.4705
121.5272
125.5948
125.6893
127.1905
127.2295
127.5847
127.7023
129.1175
129.6785
129.7723
130.4040
132.6018
132.6169
134.4120
134.4903
139.4766
8d
SpinWorks 3: AS 131 A1
PPM
140
138
136
134
132
130
128
126
124
122
120
118
116
114
112
110

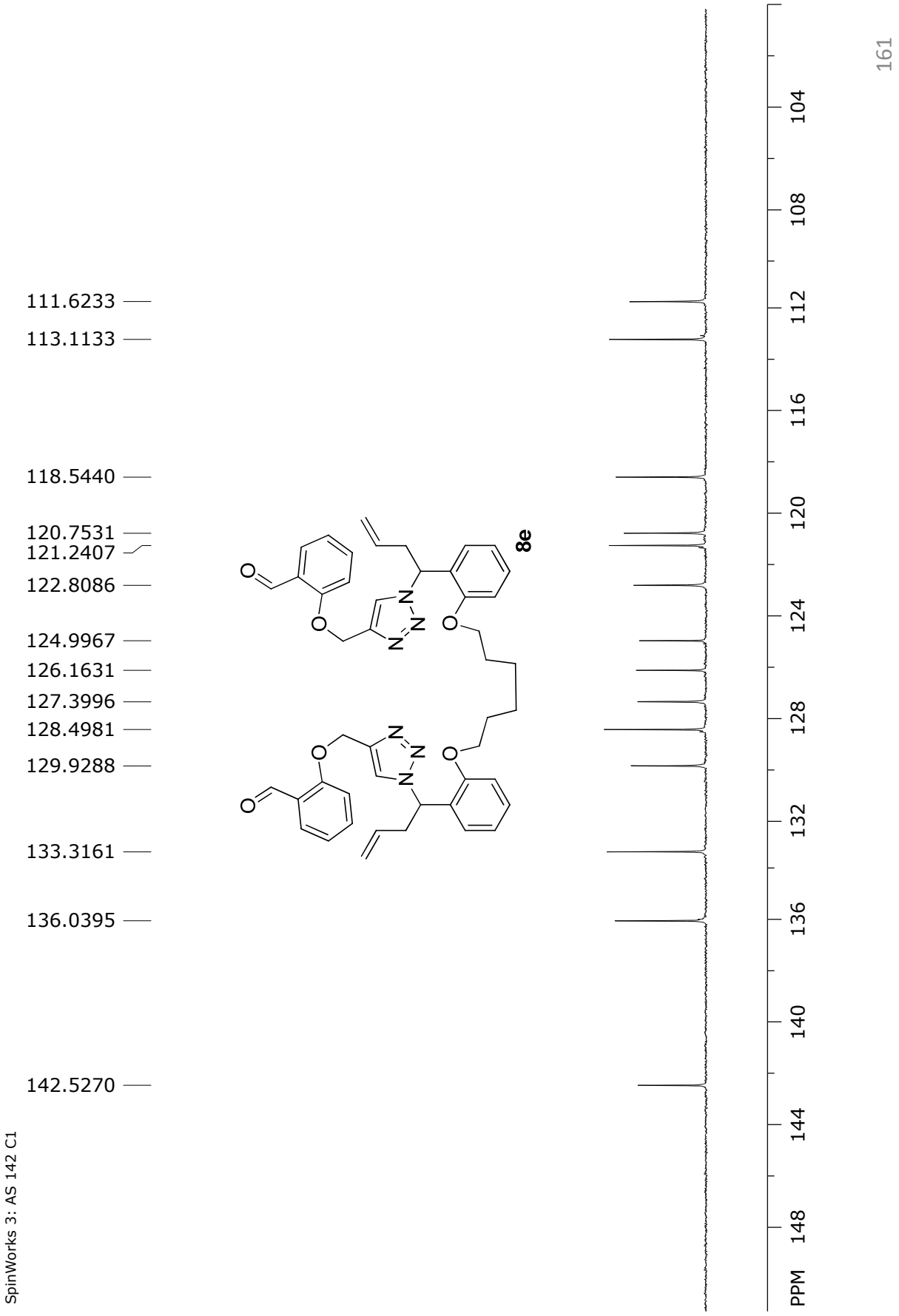

38.1022
58.8214
58.9733
61.2284
68.1302
68.1641
8d
PPM
38
40
42
44
46
48
50
52
54
56
58
60
62
64
66
68
SpinWorks 3: AS 131 A1

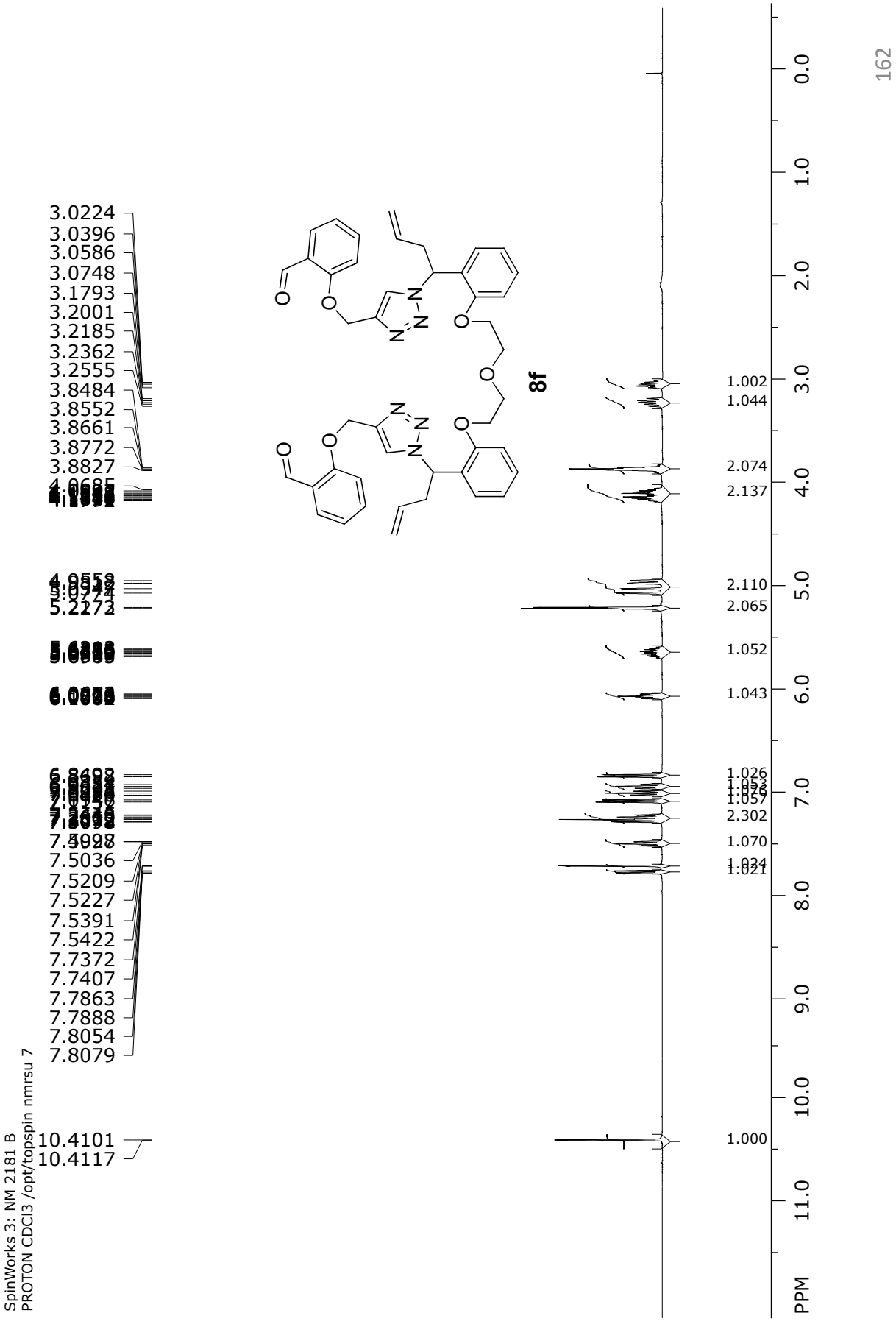

8e
1.4820
1.7971
2.9929
3.0093
3.0260
3.0288
3.0454
3.0618
3.1812
3.2012
3.2202
3.2369
3.2573
3.9304
3.9362
5.2969
10.4239
7.2851
7.2927
7.3124
7.3164
7.5045
7.5271
7.5484
7.6554
7.7926
7.7972
7.8119
7.8164
2.183
2.186
1.089
1.057
2.139
1.029
1.033
2.063
1.046
1.033
1.065
1.094
2.188
1.176
1.032
1.134
1.000
PPM
SpinWorks 3: AS 142 C1

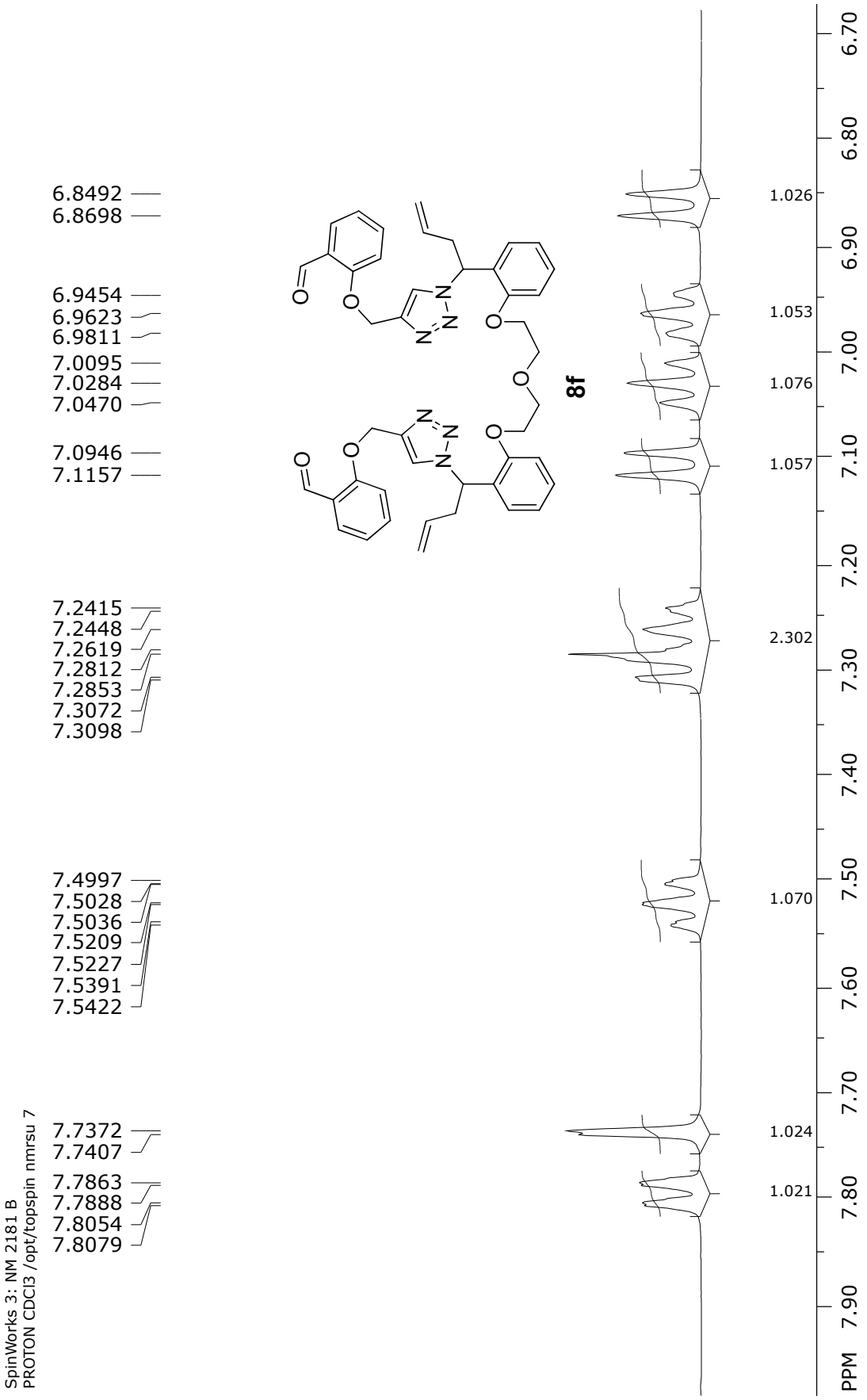

4.9954
5.0210
5.0661
5.1052
5.2969
5.6569
5.7592
6.0888
6.1270
6.8861
6.9518
6.9695
7.0102
7.0290
7.0477
7.1295
7.1506
7.2674
7.2735
7.2776
7.2851
7.2927
7.3124
7.3164
7.5045
7.5271
7.5484
7.6554
7.7926
7.7972
7.8119
7.8164
1.029
1.033
2.063
1.046
1.033
1.065
1.100
1.108
1.094
2.188
1.176
1.032
1.134
8e
PPM
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
6.6
6.8
7.0
7.2
7.4
7.6
7.8
SpinWorks 3: AS 142 C1

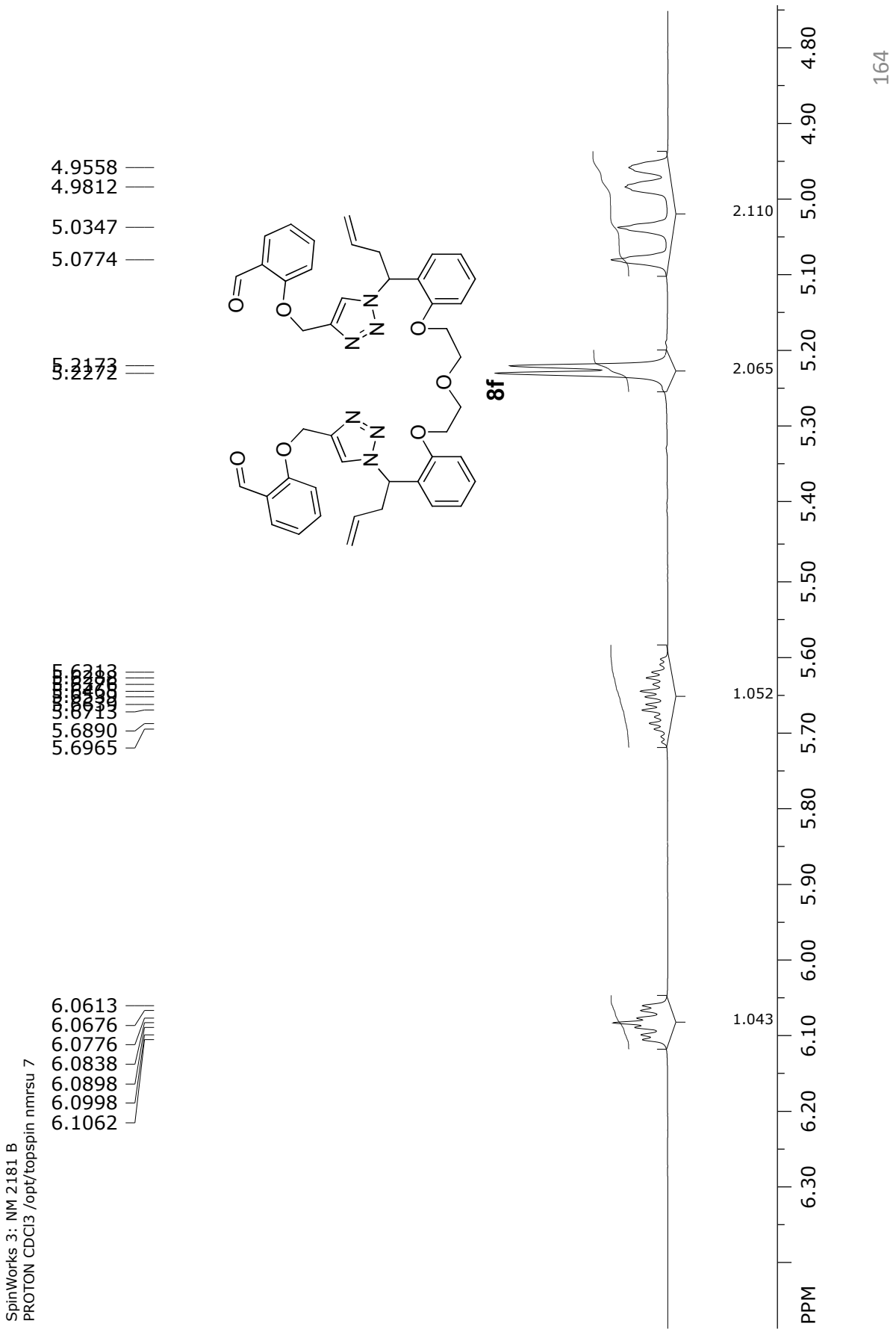

1.4820
1.7971
2.9929
3.0093
3.0260
3.0288
3.0454
3.0618
3.1812
3.2012
3.2202
3.2369
3.2573
3.9304
3.9362
3.9523
3.9663
3.9789
3.9811
3.9950
3.9974
4.0098
8e
2.183
2.186
1.089
1.057
2.139
PPM
SpinWorks 3: AS 142 C1

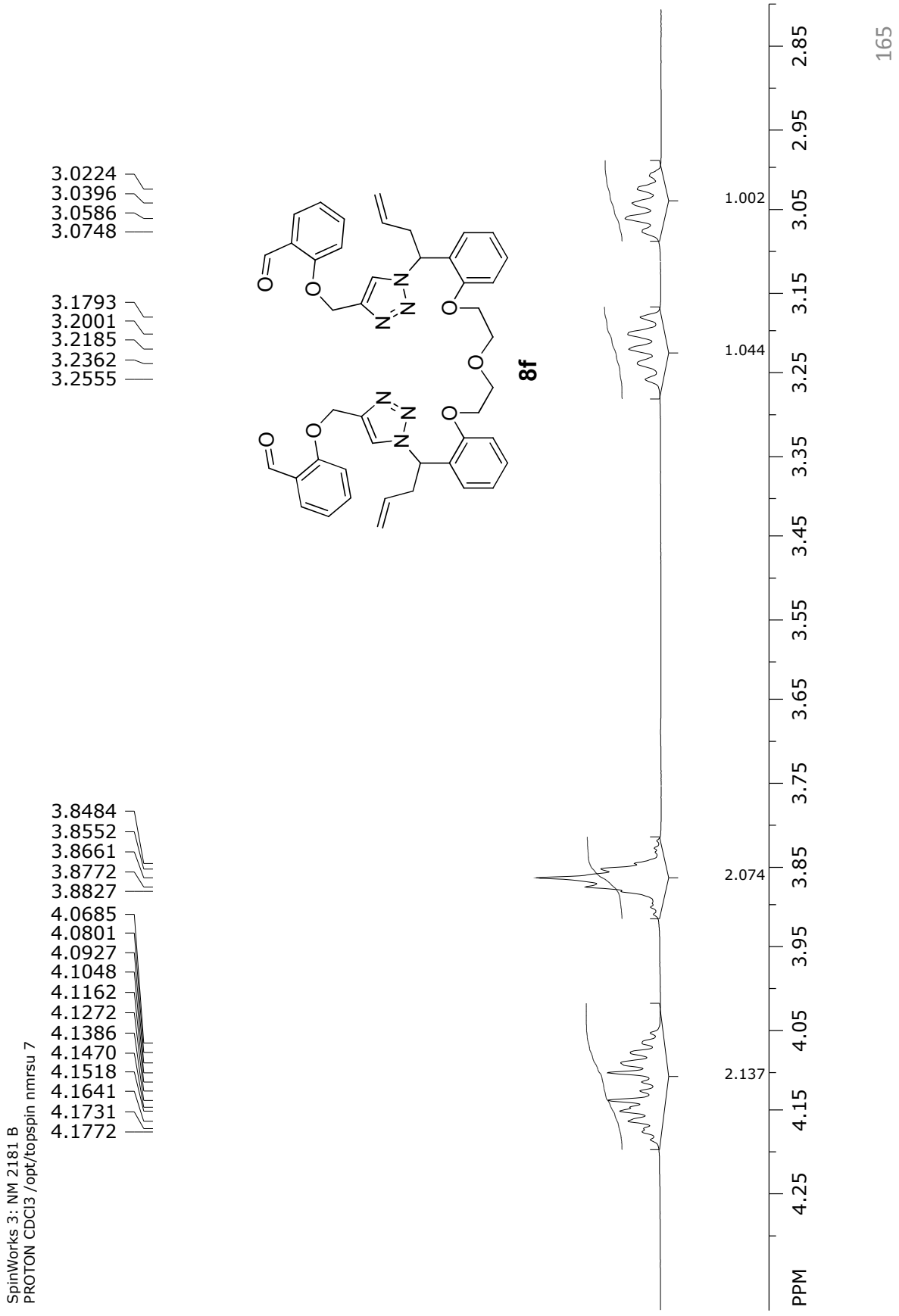

25.7997
29.1309
38.3038
58.9922
62.7071
67.9387
76.8193
77.1374
77.4559
111.6233
113.1133
118.5440
120.7531
121.2407
122.8086
124.9967
126.1631
127.3996
128.4981
129.9288
133.3161
136.0395
142.5270
155.9838
160.5784
189.6496
8e
SpinWorks 3: AS 142 C1
PPM
0
20
40
60
80
100
120
140
160
180
200

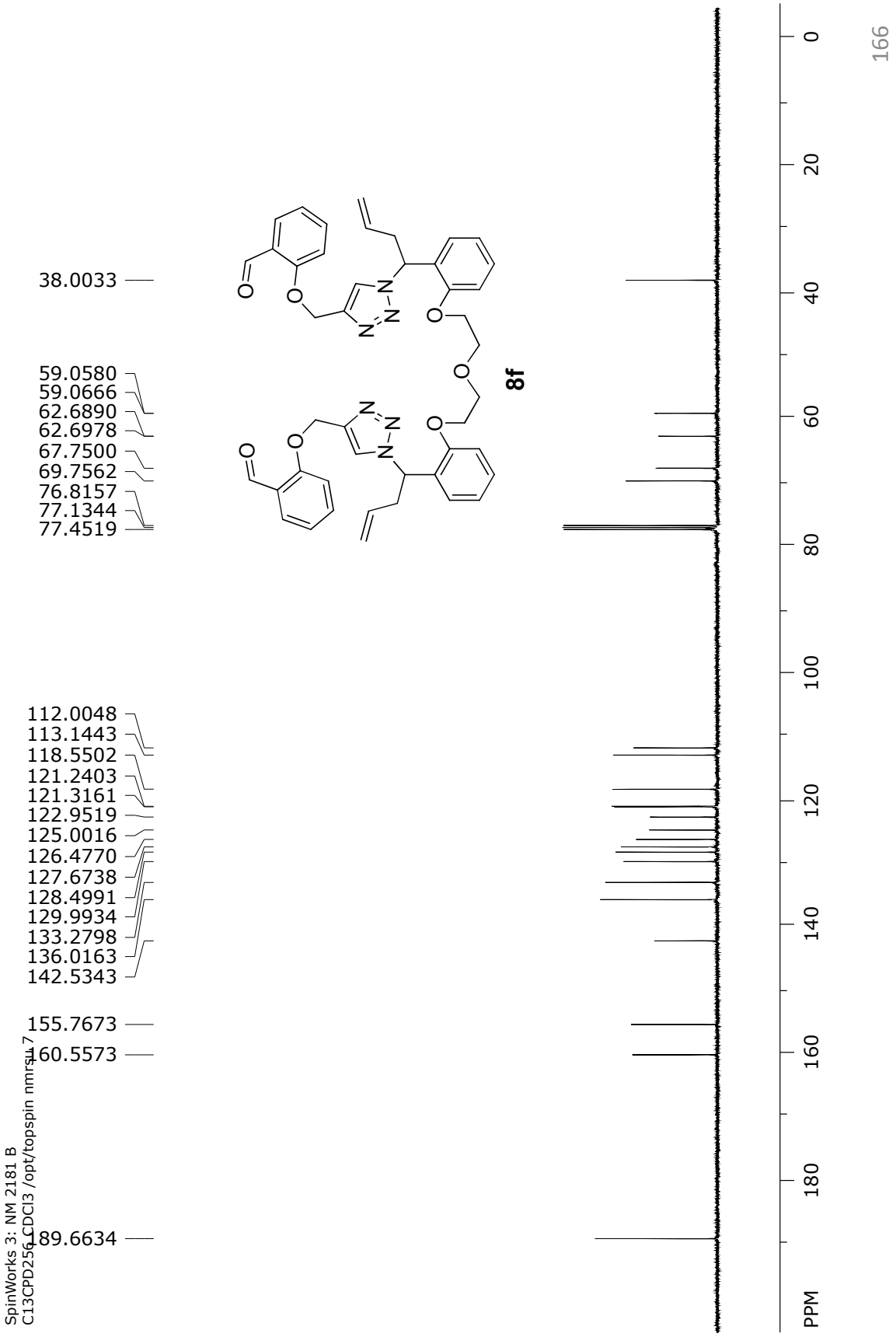

111.6233
113.1133
118.5440
120.7531
121.2407
122.8086
124.9967
126.1631
127.3996
128.4981
129.9288
133.3161
136.0395
142.5270
8e
PPM 148 144 140 136 132 128 124 120 116 112 108 104
SpinWorks 3: AS 142 C1

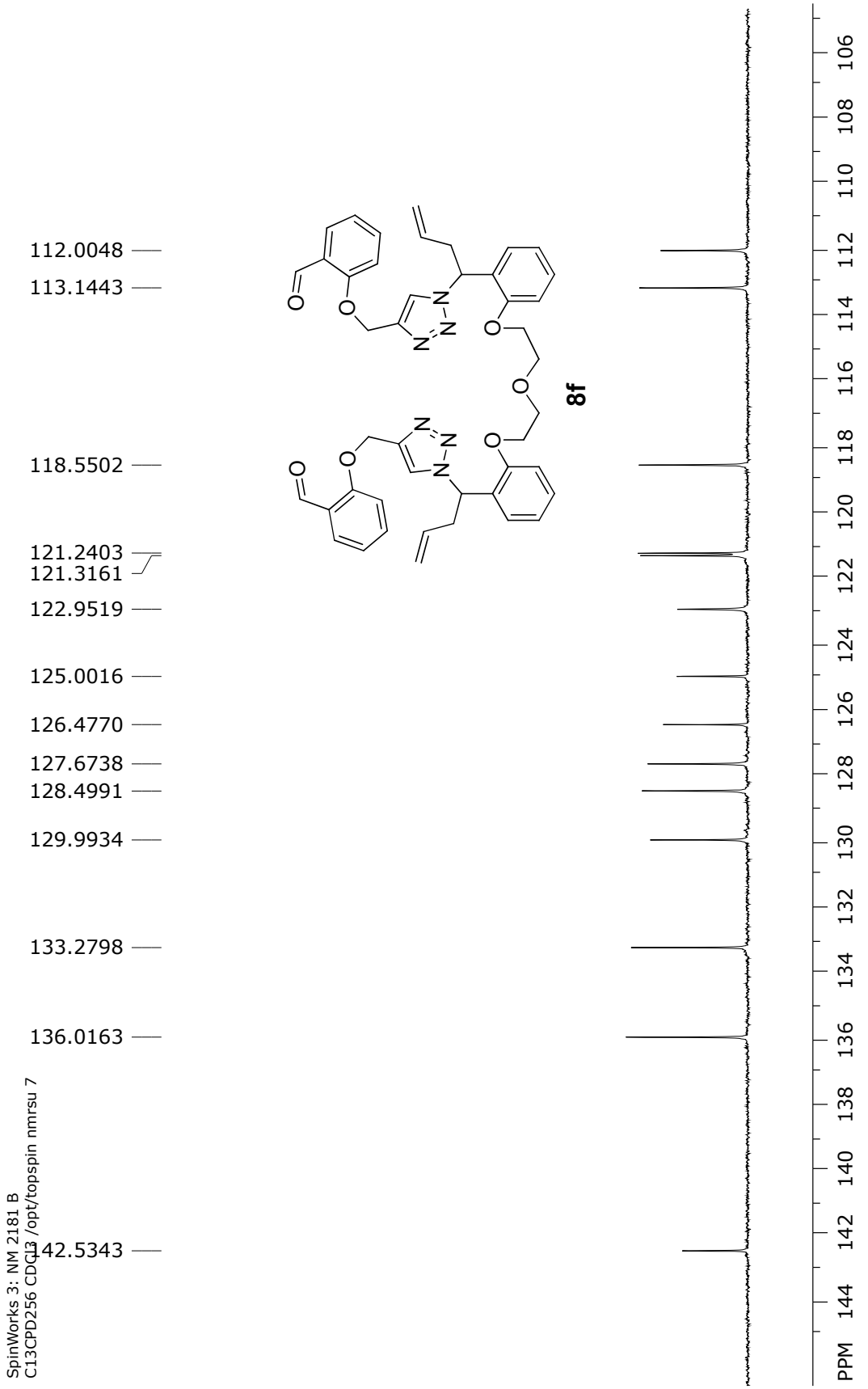

3.0224
3.0396
3.0586
3.0748
3.1793
3.2001
3.2185
3.2362
3.2555
3.8484
3.8552
3.8661
3.8772
3.8827
5.2273
7.5036
7.5209
7.5227
7.5391
7.5422
7.7372
7.7407
7.7863
7.7888
7.8054
7.8079
10.4101
10.4117
8f
1.002
1.044
2.074
2.137
2.110
2.065
1.052
1.043
1.026
1.057
2.302
1.070
1.000
PPM
SpinWorks 3: NM 2181 B
PROTON CDCl3 /opt/topspin nmrsu 7

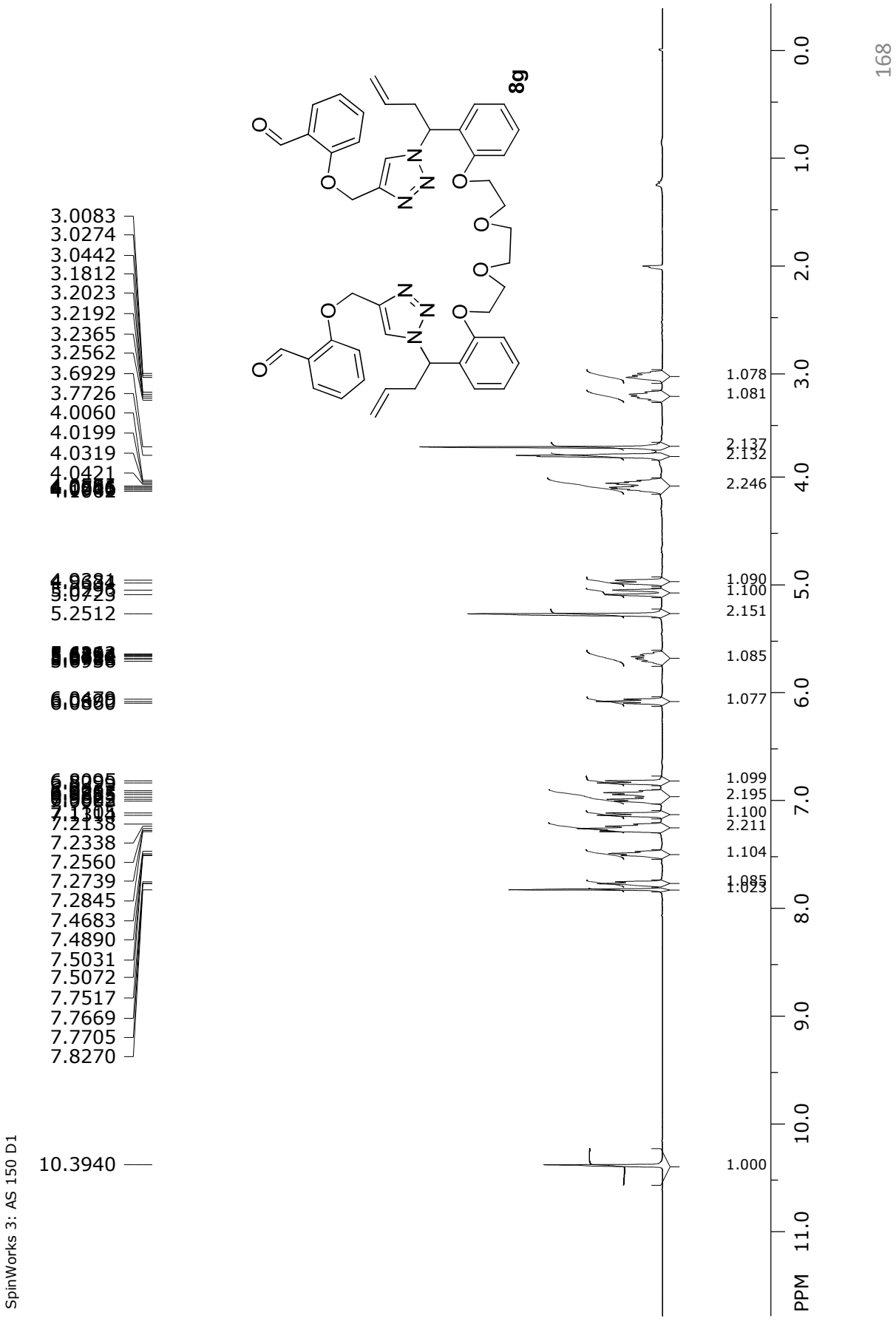

SpinWorks 3: NM 2181 B
PROTON CDCl3 /opt/topspin nmrsu 7
6.8492
6.8698
6.9454
6.9623
6.9811
7.0095
7.0284
7.0470
7.0946
7.1157
7.2415
7.2448
7.2619
7.2812
7.2853
7.3072
7.3098
7.4997
7.5028
7.5036
7.5209
7.5227
7.5391
7.5422
7.7372
7.7407
7.7863
7.7888
7.8054
7.8079
8f
1.026
1.053
1.076
1.057
2.302
1.070
1.024
1.021
PPM
6.70
6.80
6.90
7.00
7.10
7.20
7.30
7.40
7.50
7.60
7.70
7.80
7.90

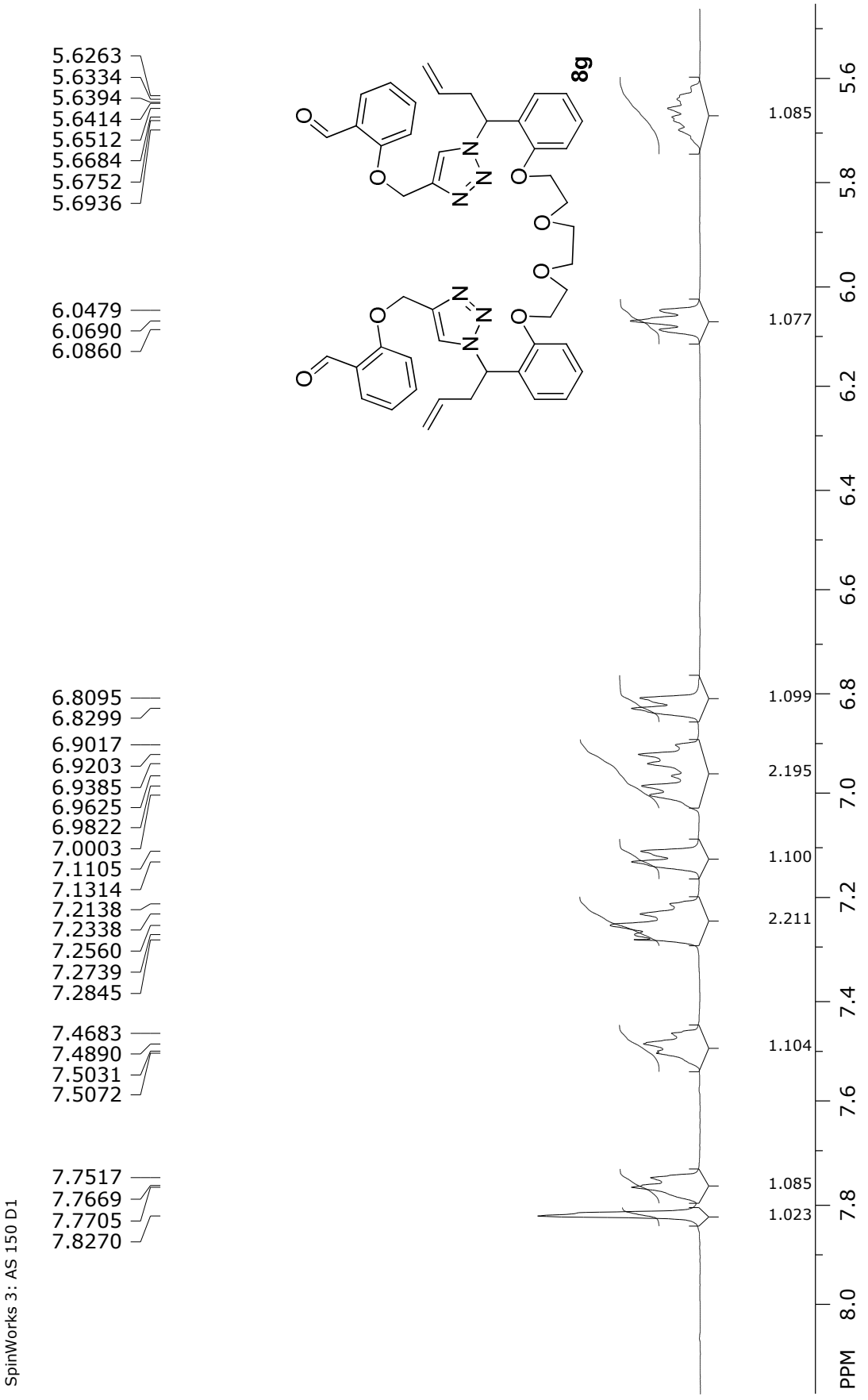

4.9558
4.9812
5.0347
5.0774
5.2173
5.2272
5.6213
5.6890
5.6965
6.0613
6.0676
6.0776
6.0838
6.0898
6.0998
6.1062
8f
2.110
2.065
1.052
1.043
PPM
4.80
4.90
5.00
5.10
5.20
5.30
5.40
5.50
5.60
5.70
5.80
5.90
6.00
6.10
6.20
6.30
SpinWorks 3: NM 2181 B
PROTON CDCl3 /opt/topspin nmrsu 7

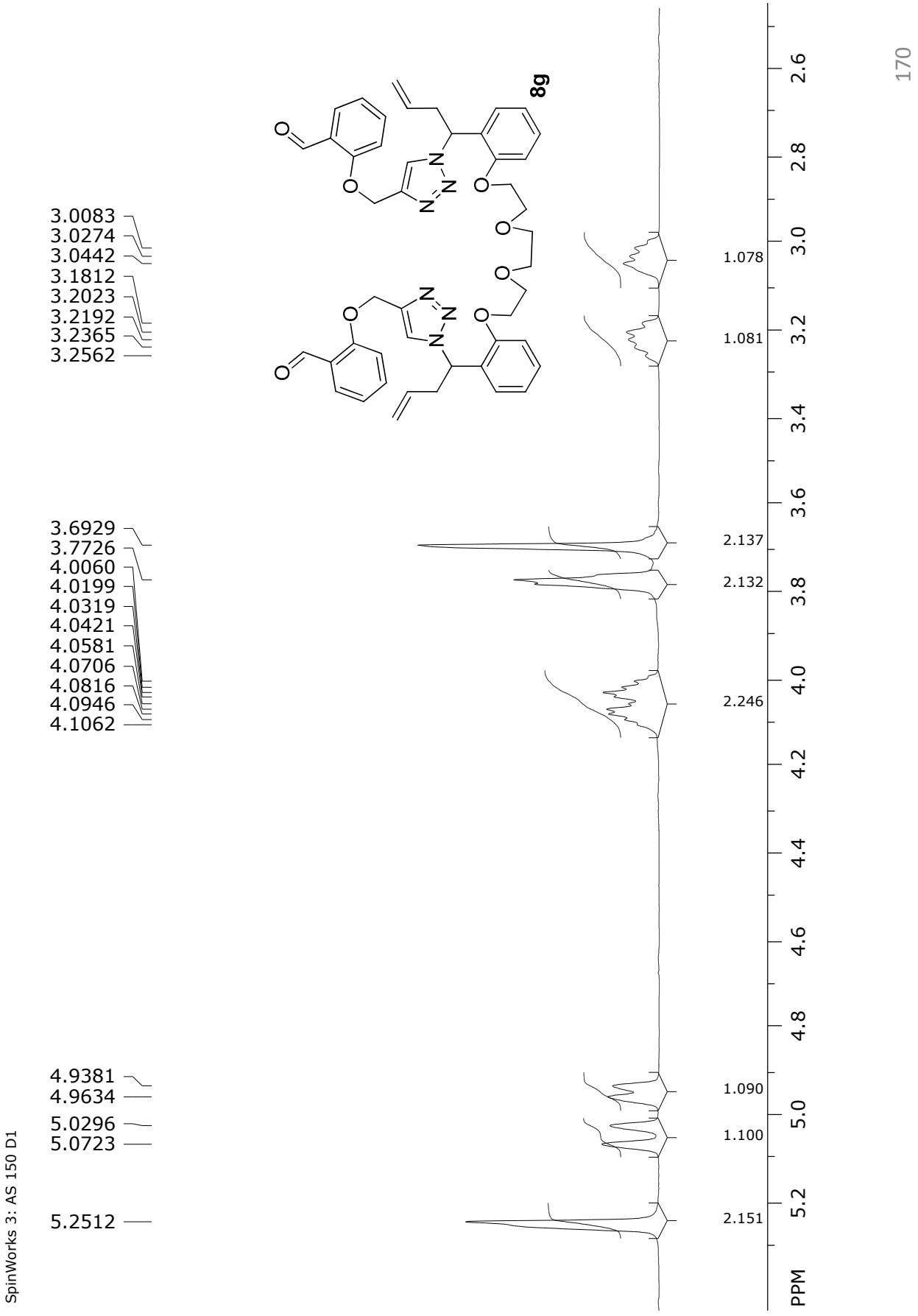

SpinWorks 3: NM 2181 B
PROTON CDCl3 /opt/topspin nmrsu 7
3.0224
3.0396
3.0586
3.0748
3.1793
3.2001
3.2185
3.2362
3.2555
3.8484
3.8552
3.8661
3.8772
3.8827
4.0685
4.0801
4.0927
4.1048
4.1162
4.1272
4.1386
4.1470
4.1518
4.1641
4.1731
4.1772
8f
1.002
1.044
2.074
2.137
PPM
4.25
4.15
4.05
3.95
3.85
3.75
3.65
3.55
3.45
3.35
3.25
3.15
3.05
2.95
2.85

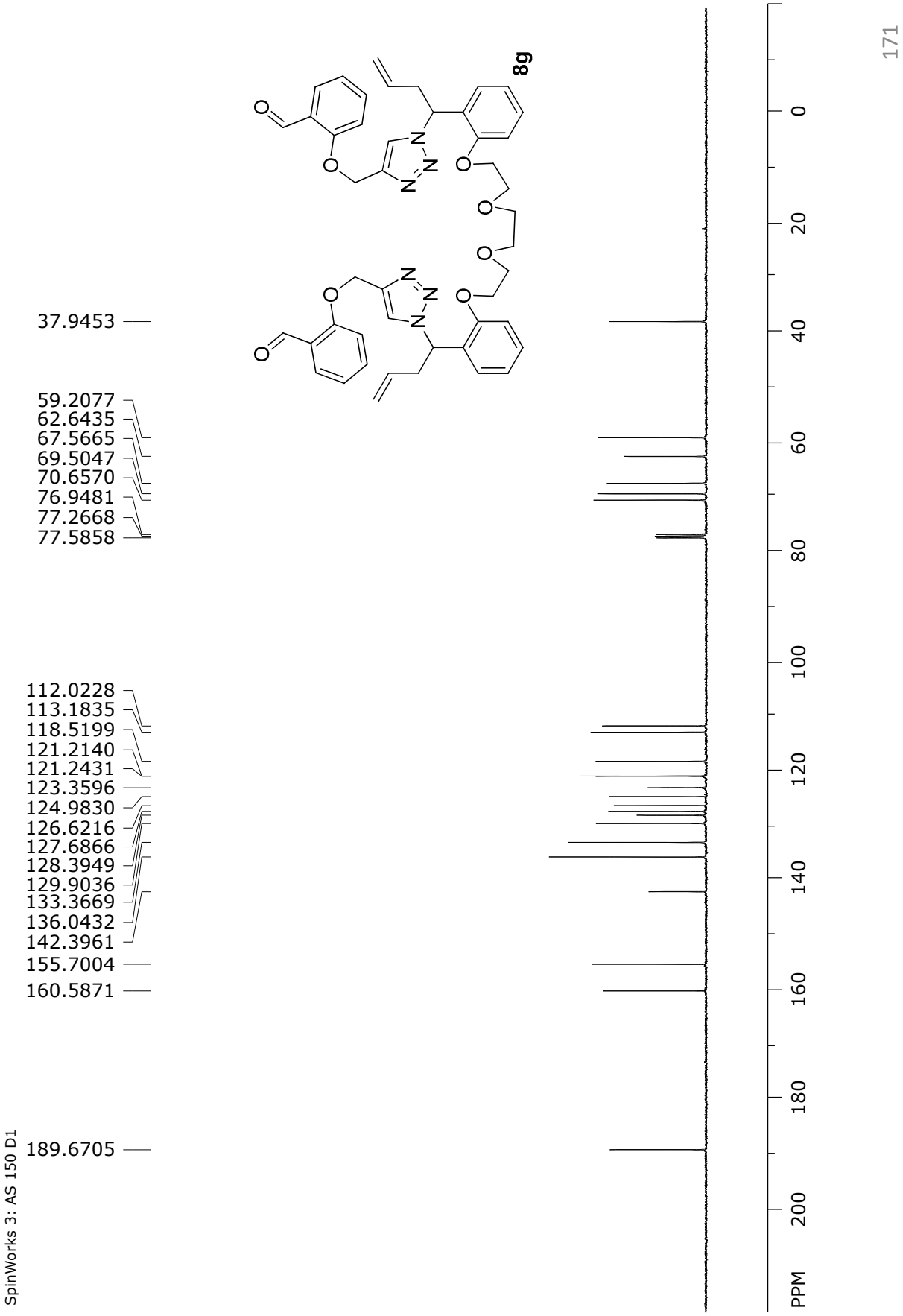

38.0033
59.0580
59.0666
62.6890
62.6978
67.7500
69.7562
76.8157
77.1344
77.4519
112.0048
113.1443
118.5502
121.2403
121.3161
122.9519
125.0016
126.4770
127.6738
128.4991
129.9934
133.2798
136.0163
142.5343
155.7673
160.5573
189.6634
8f
SpinWorks 3: NM 2181 B
C13CPD256 CDCl3 /opt/topspin nmrsu 7
PPM
0
20
40
60
80
100
120
140
160
180

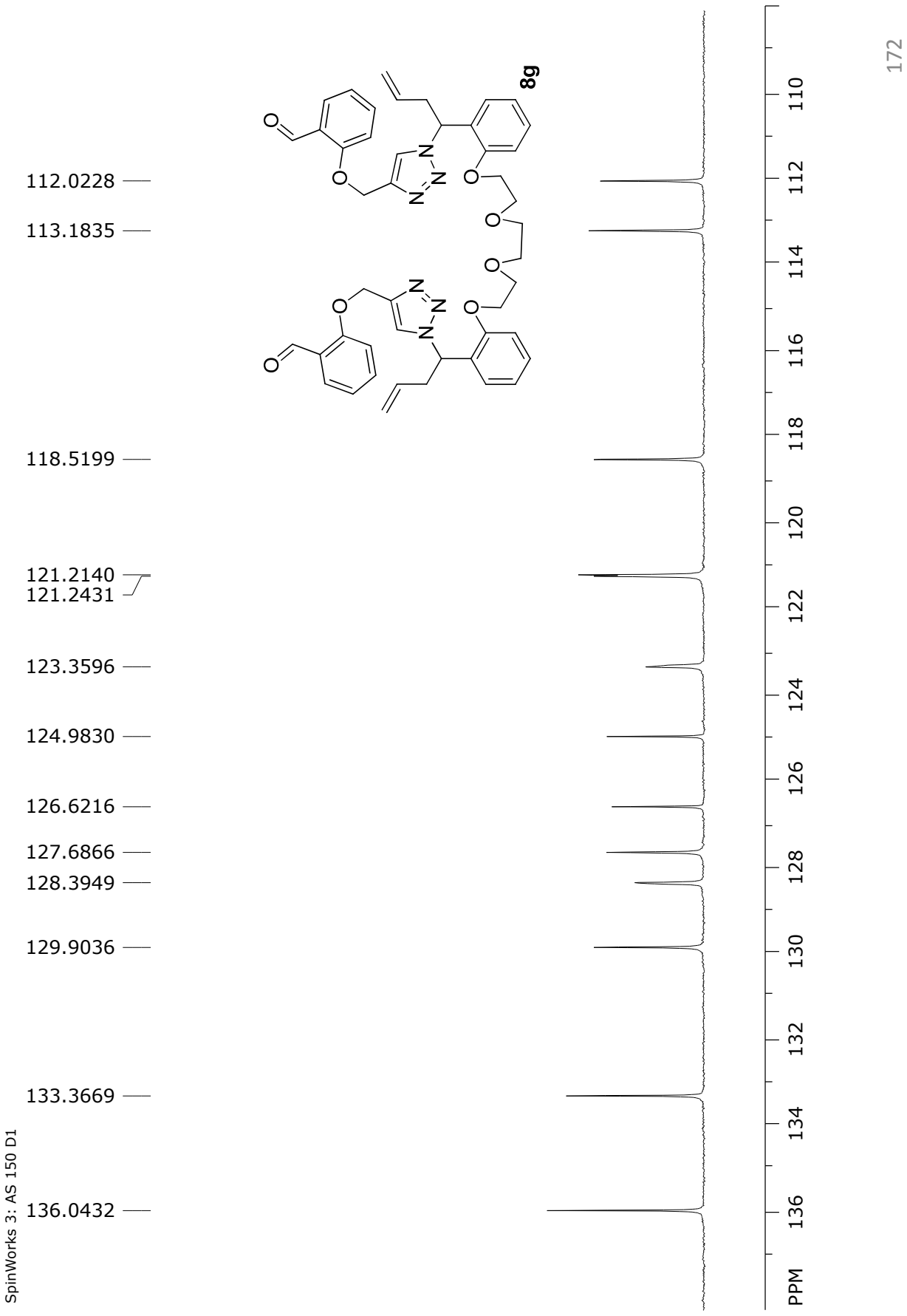

112.0048
113.1443
118.5502
121.2403
121.3161
122.9519
125.0016
126.4770
127.6738
128.4991
129.9934
133.2798
136.0163
142.5343
SpinWorks 3: NM 2181 B
C13CPD256 CDCl3 /opt/topspin nmrsu 7
PPM 144 142 140 138 136 134 132 130 128 126 124 122 120 118 116 114 112 110 108 106
8f

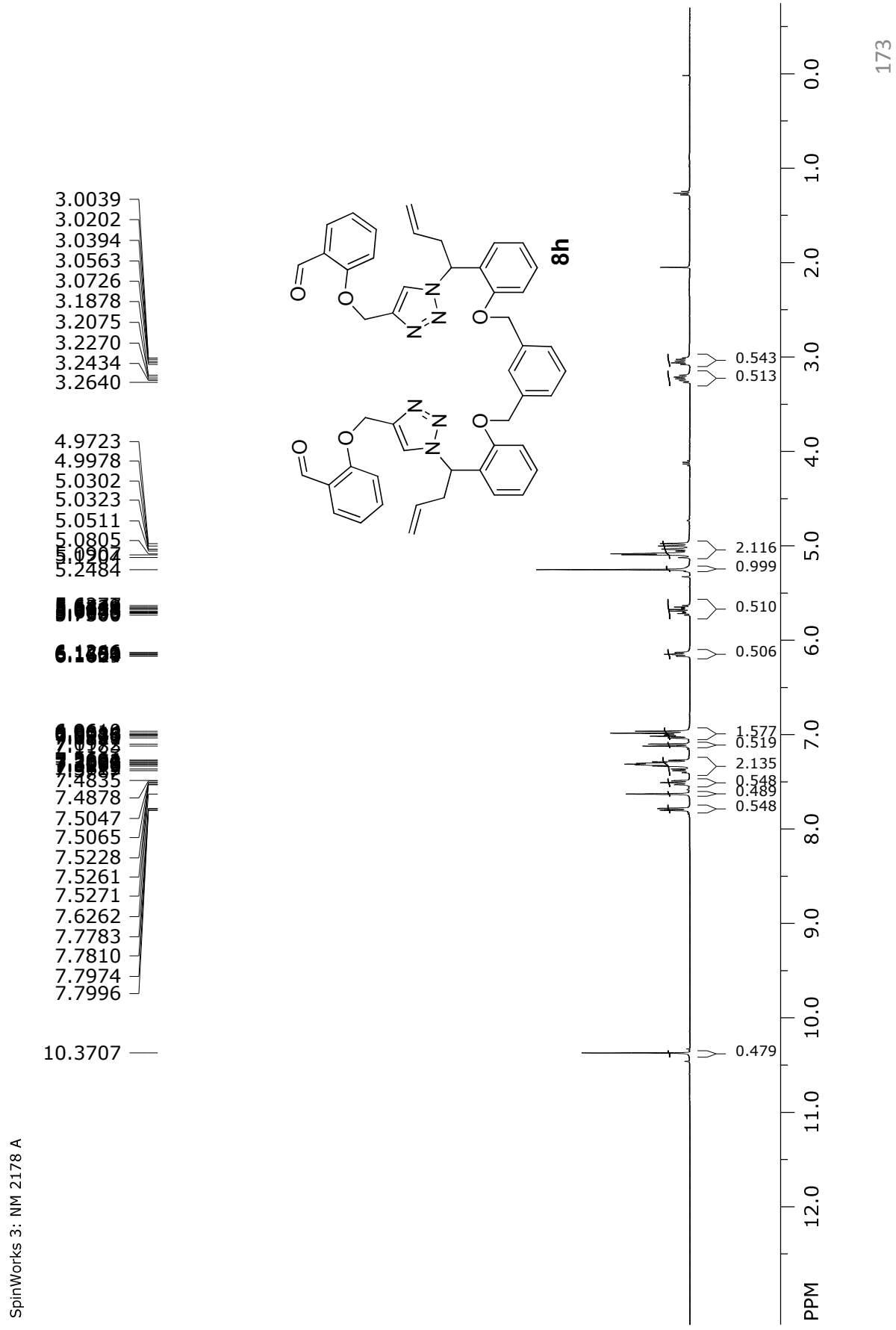

8g
3.0083
3.0274
3.0442
3.1812
3.2023
3.2192
3.2365
3.2562
3.6929
3.7726
4.0060
4.0199
4.0319
4.0421
5.2512
7.2138
7.2338
7.2560
7.2739
7.2845
7.4683
7.4890
7.5031
7.5072
7.7517
7.7669
7.7705
7.8270
10.3940
1.078
1.081
2.137
2.132
2.246
1.090
1.100
2.151
1.085
1.077
1.099
2.195
1.100
2.211
1.104
1.085
1.023
1.000
PPM
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
SpinWorks 3: AS 150 D1


8g
5.6263
5.6334
5.6394
5.6414
5.6512
5.6684
5.6752
5.6936
6.0479
6.0690
6.0860
6.8095
6.8299
6.9017
6.9203
6.9385
6.9625
6.9822
7.0003
7.1105
7.1314
7.2138
7.2338
7.2560
7.2739
7.2845
7.4683
7.4890
7.5031
7.5072
7.7517
7.7669
7.7705
7.8270
1.085
1.077
1.099
2.195
1.100
2.211
1.104
1.085
1.023
PPM
8.0
7.8
7.6
7.4
7.2
7.0
6.8
6.6
6.4
6.2
6.0
5.8
5.6
SpinWorks 3: AS 150 D1

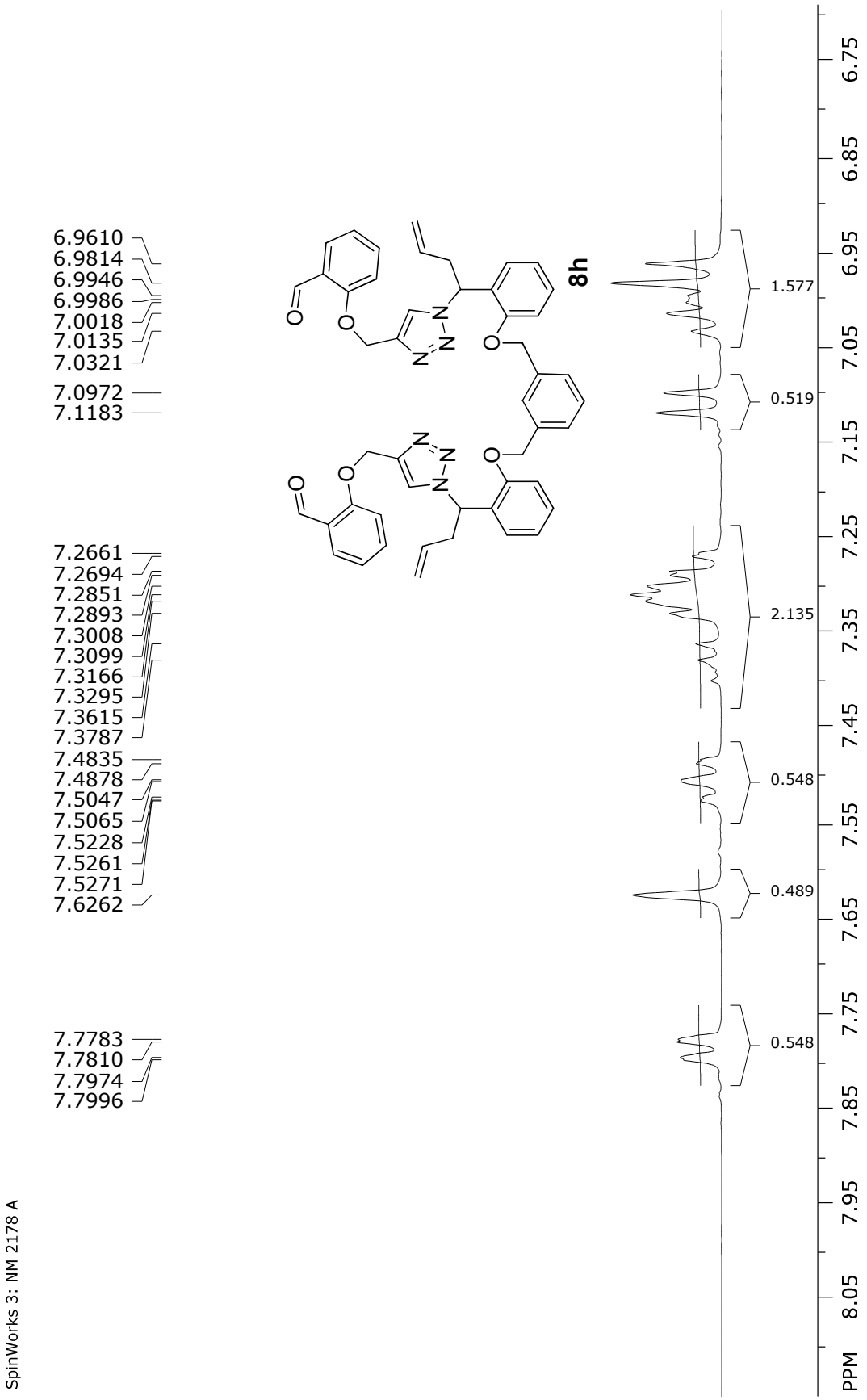

8g
3.0083
3.0274
3.0442
3.1812
3.2023
3.2192
3.2365
3.2562
3.6929
3.7726
4.0060
4.0199
4.0319
4.0421
4.0581
4.0706
4.0816
4.0946
4.1062
4.9381
4.9634
5.0296
5.0723
5.2512
1.078
1.081
2.137
2.132
2.246
1.090
1.100
2.151
PPM
2.6
2.8
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
SpinWorks 3: AS 150 D1

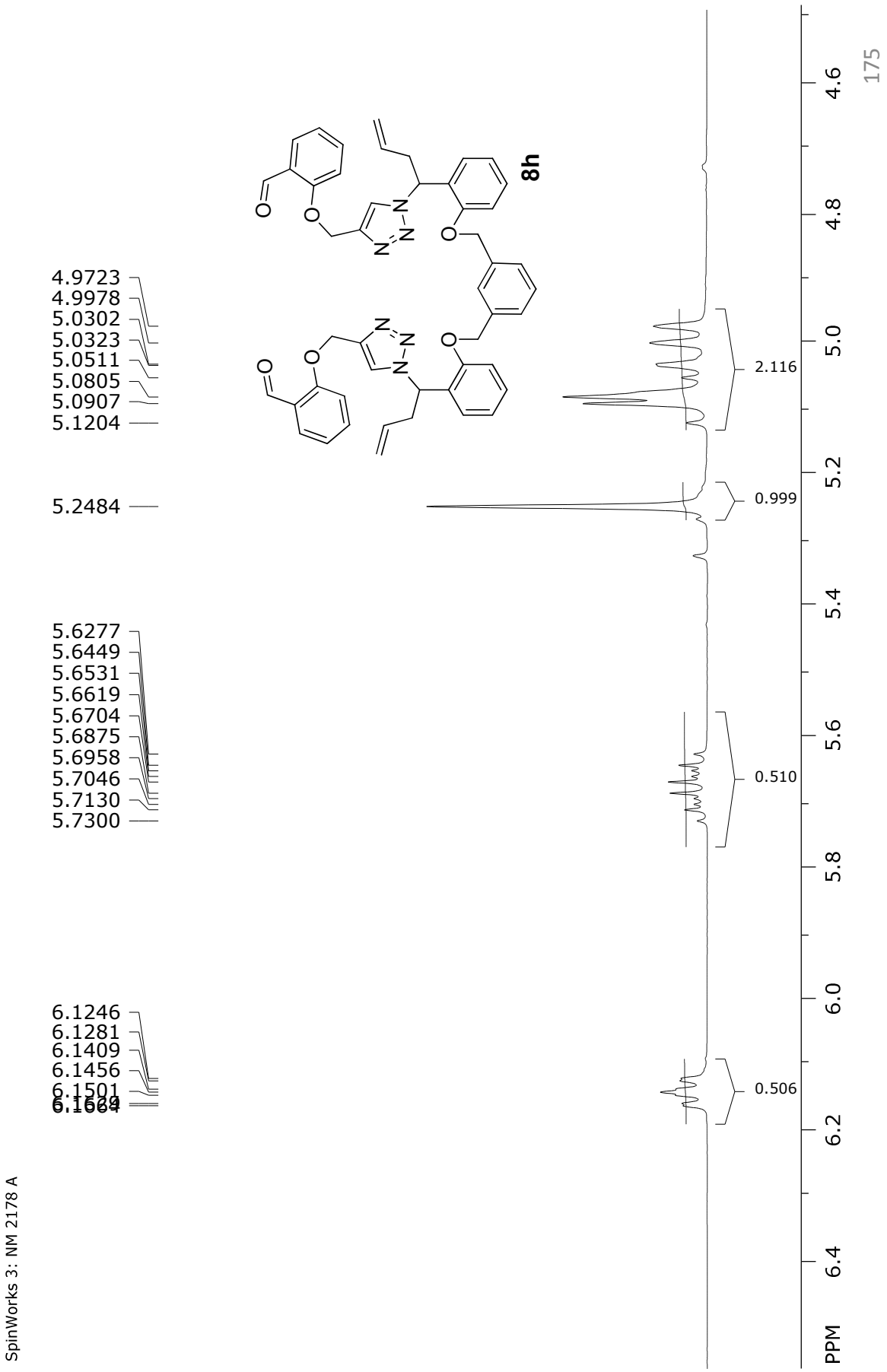

8g
37.9453
59.2077
62.6435
67.5665
69.5047
70.6570
76.9481
77.2668
77.5858
112.0228
113.1835
118.5199
121.2140
121.2431
123.3596
124.9830
126.6216
127.6866
128.3949
129.9036
133.3669
136.0432
142.3961
155.7004
160.5871
189.6705
SpinWorks 3: AS 150 D1
PPM
200
180
160
140
120
100
80
60
40
20
0

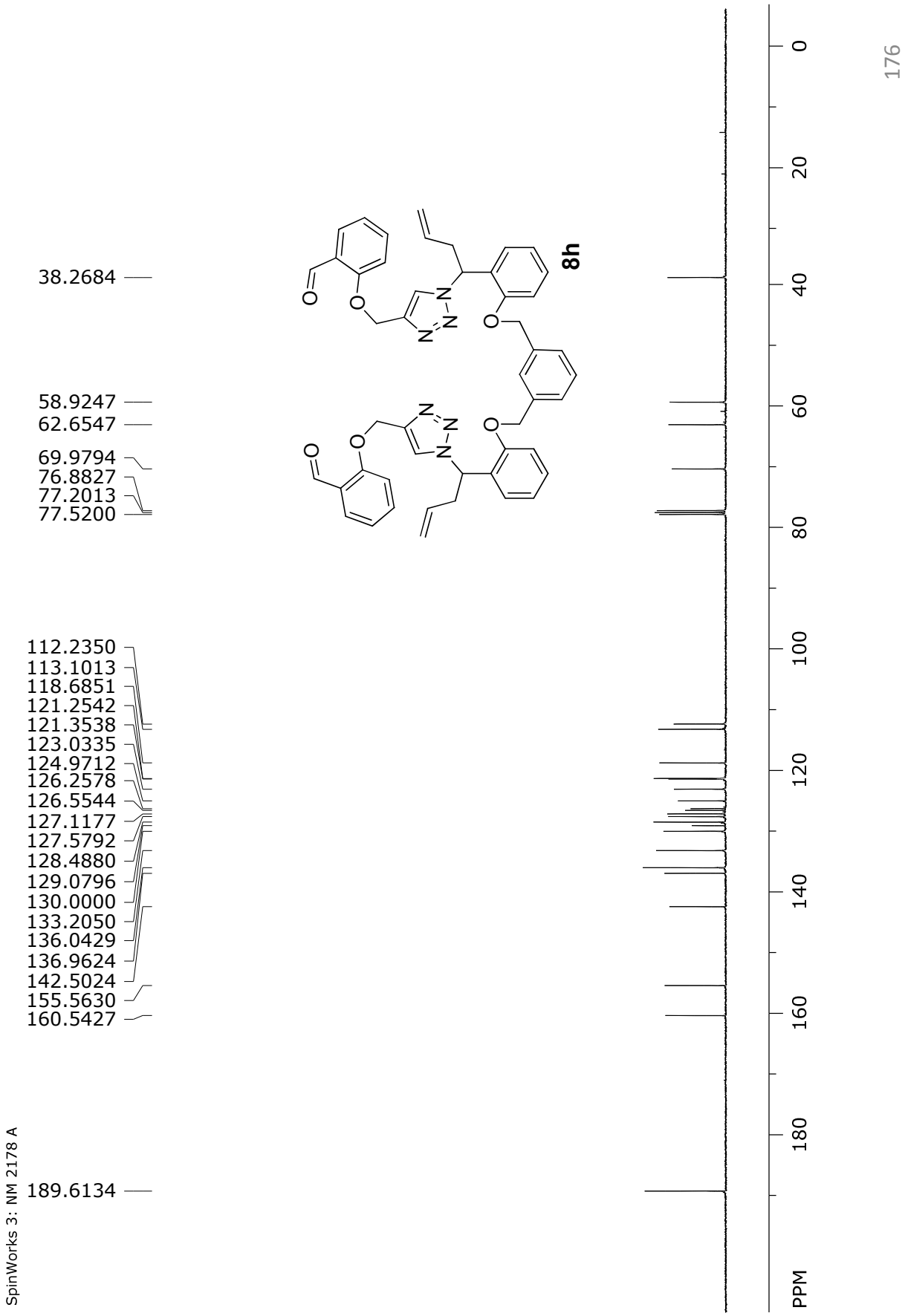

8g
112.0228
113.1835
118.5199
121.2140
121.2431
123.3596
124.9830
126.6216
127.6866
128.3949
129.9036
133.3669
136.0432
SpinWorks 3: AS 150 D1
PPM
110
112
114
116
118
120
122
124
126
128
130
132
134
136

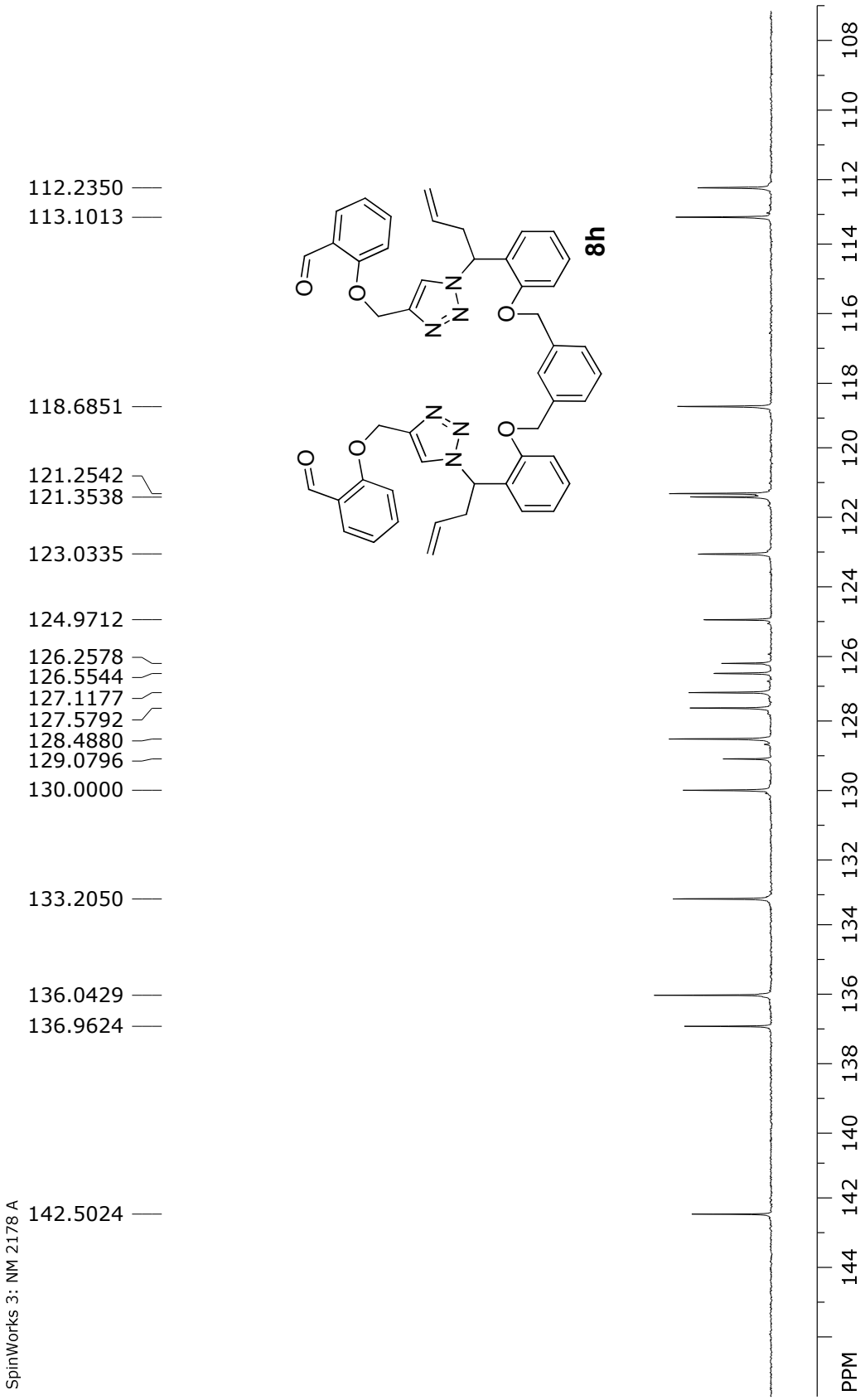


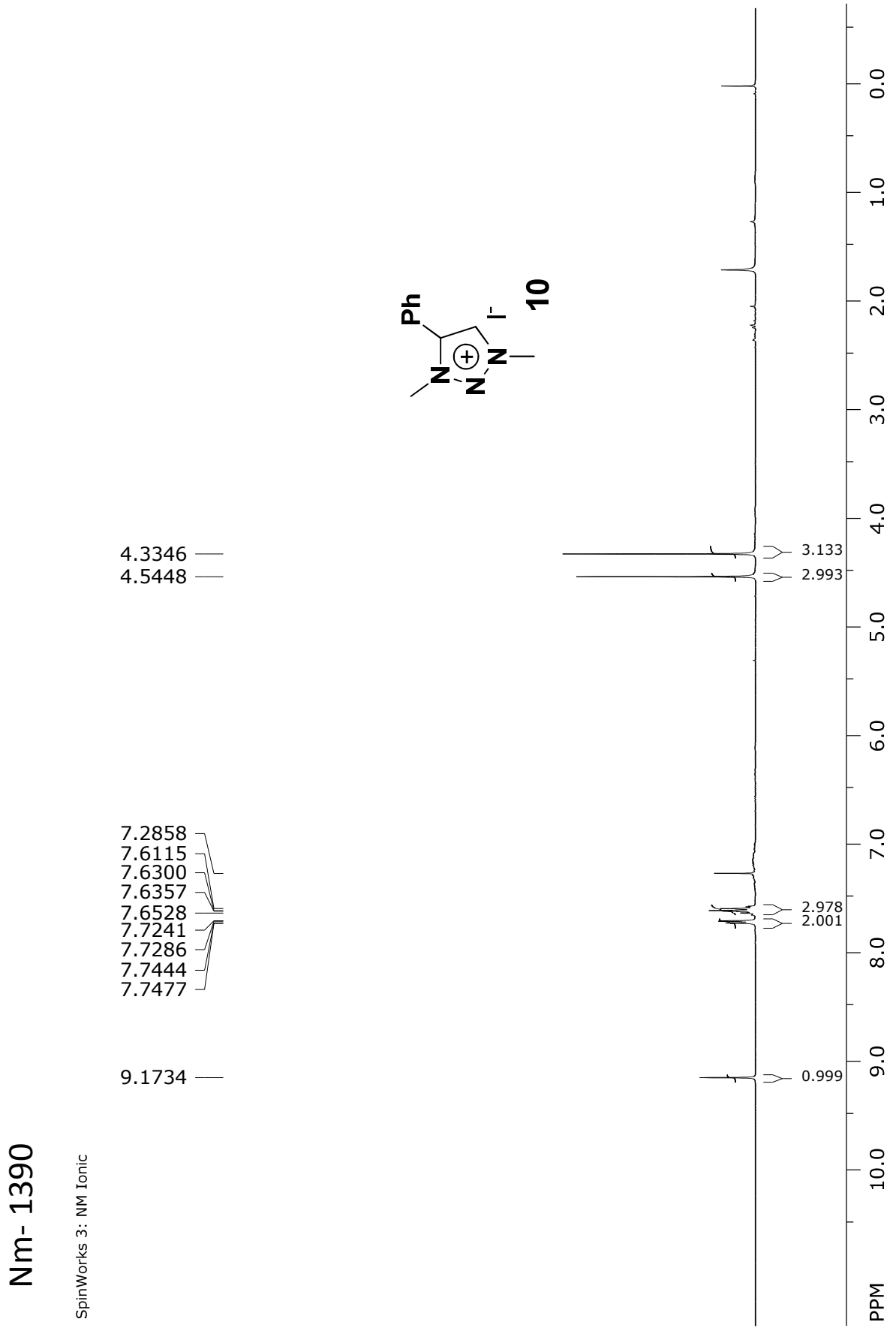
SpinWorks 3: NM 2178 A


6.9610
6.9814
6.9946
6.9986
7.0018
7.0135
7.0321
7.0972
7.1183
7.2661
7.2694
7.2851
7.2893
7.3008
7.3099
7.3166
7.3295
7.3615
7.3787
7.4835
7.4878
7.5047
7.5065
7.5228
7.5261
7.5271
7.6262
7.7783
7.7810
7.7974
7.7996
8h
1.577
0.519
2.135
0.548
0.489
0.548
PPM
8.05
7.95
7.85
7.75
7.65
7.55
7.45
7.35
7.25
7.15
7.05
6.95
6.85
6.75
SpinWorks 3: NM 2178 A


8h
4.9723
4.9978
5.0302
5.0323
5.0511
5.0805
5.0907
5.1204
5.2484
5.6277
5.6449
5.6531
5.6619
5.6704
5.6875
5.6958
5.7046
5.7130
5.7300
6.1246
6.1281
6.1409
6.1456
6.1501
2.116
0.999
0.510
0.506
PPM
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
SpinWorks 3: NM 2178 A

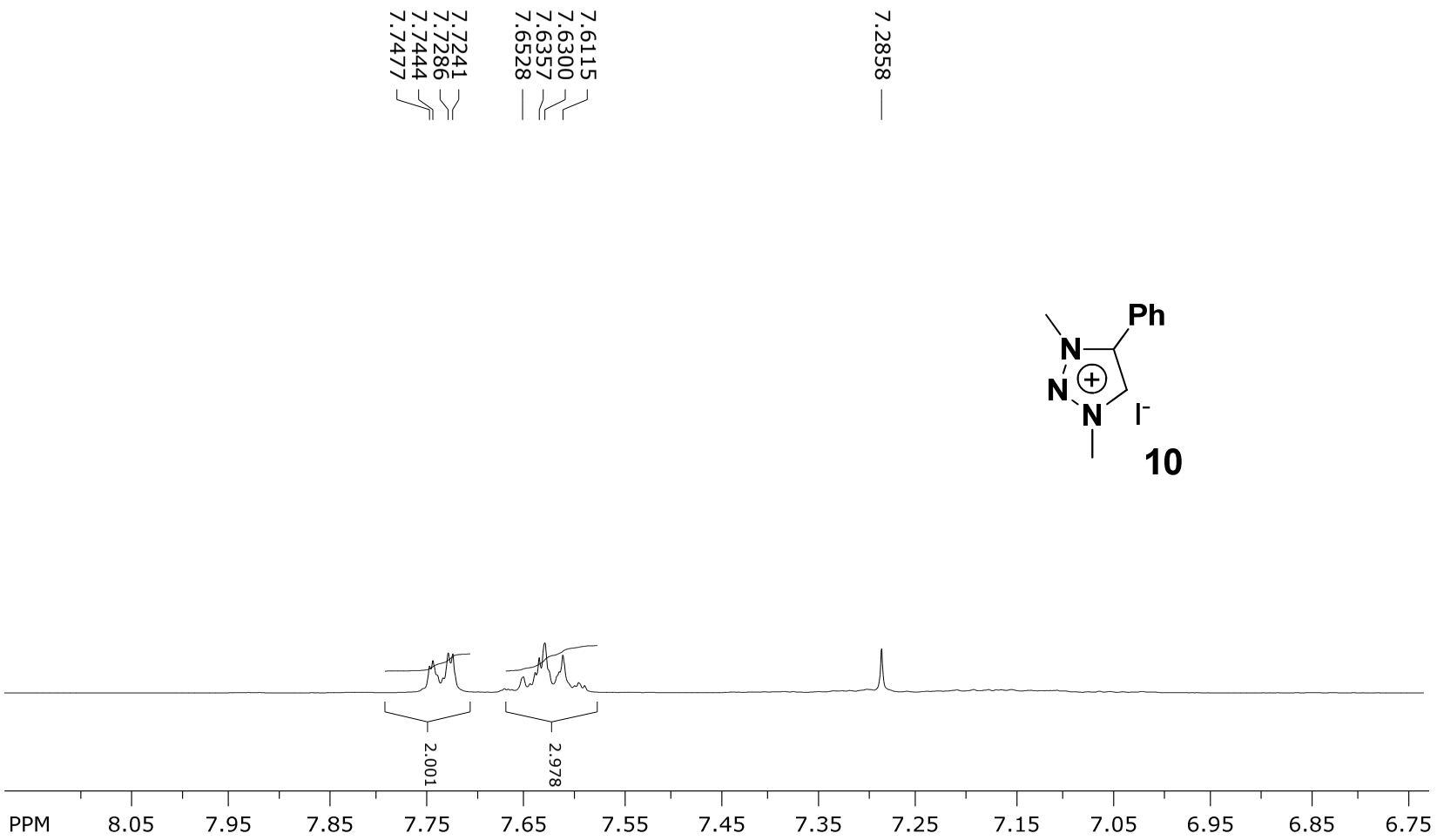

8h
38.2684
58.9247
62.6547
69.9794
76.8827
77.2013
77.5200
112.2350
113.1013
118.6851
121.2542
121.3538
123.0335
124.9712
126.2578
126.5544
127.1177
127.5792
128.4880
129.0796
130.0000
133.2050
136.0429
136.9624
142.5024
155.5630
160.5427
189.6134
SpinWorks 3: NM 2178 A
PPM
0
20
40
60
80
100
120
140
160
180

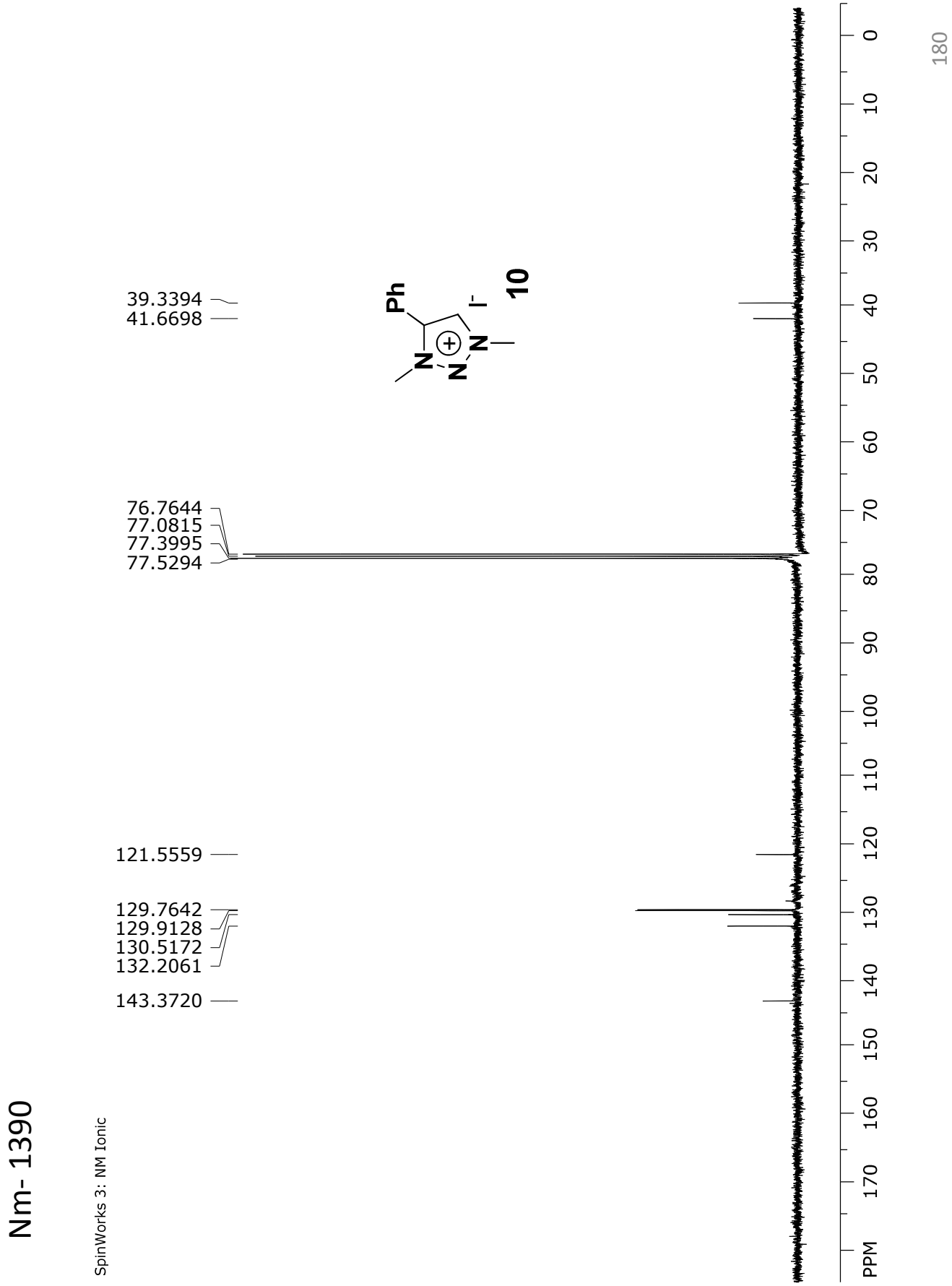

112.2350
113.1013
118.6851
121.2542
121.3538
123.0335
124.9712
126.2578
126.5544
127.1177
127.5792
128.4880
129.0796
130.0000
133.2050
136.0429
136.9624
142.5024
8h
SpinWorks 3: NM 2178 A
PPM
144
142
140
138
136
134
132
130
128
126
124
122
120
118
116
114
112
110
108


Nm- 1390
SpinWorks 3: NM Ionic
Ph
I⁻
10
4.3346
4.5448
7.2858
7.6115
7.6300
7.6357
7.6528
7.7241
7.7286
7.7444
7.7477
9.1734
3.133
2.993
2.978
2.001
0.999
PPM
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0

Nm- 1390

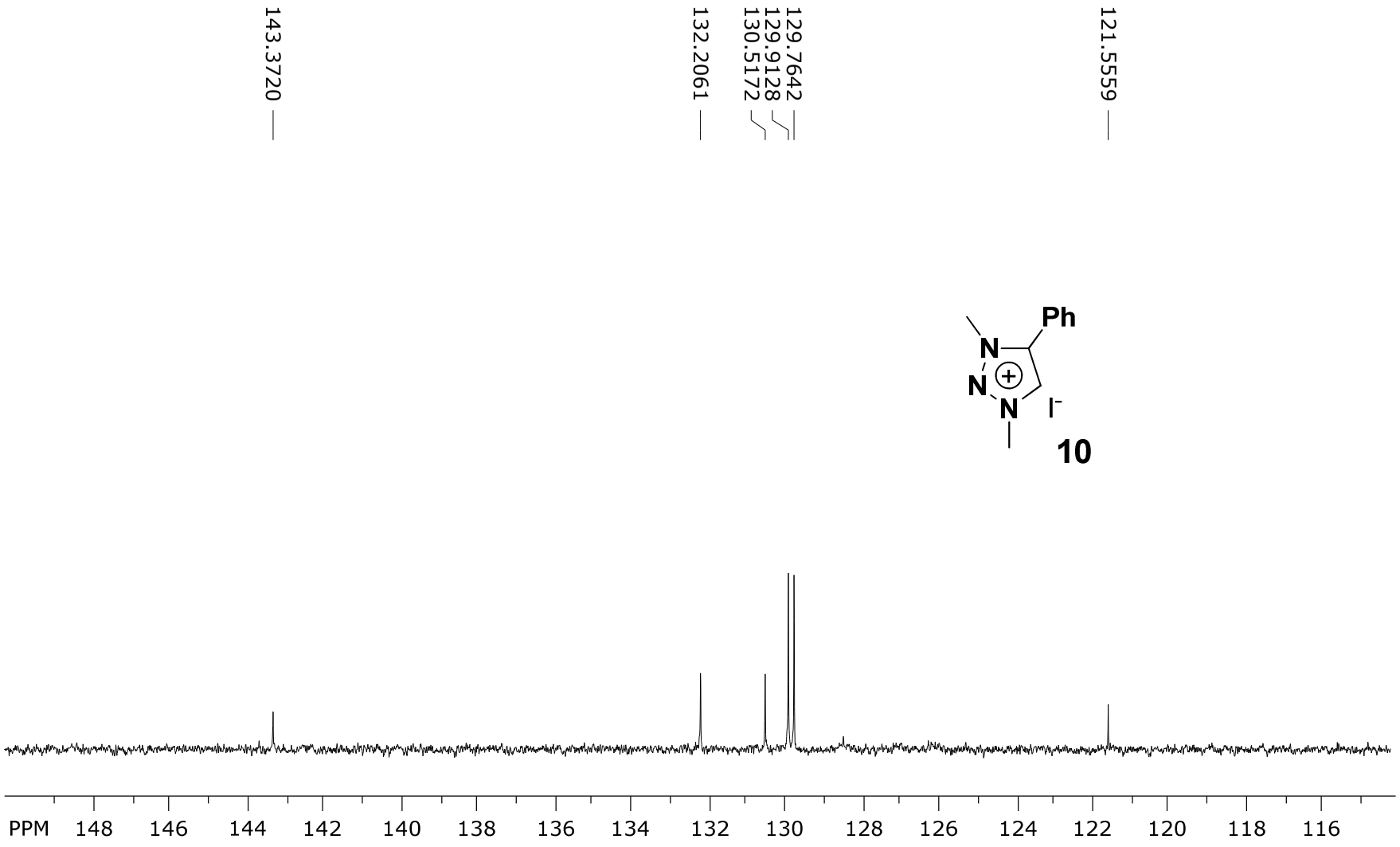
SpinWorks 3: NM Ionic

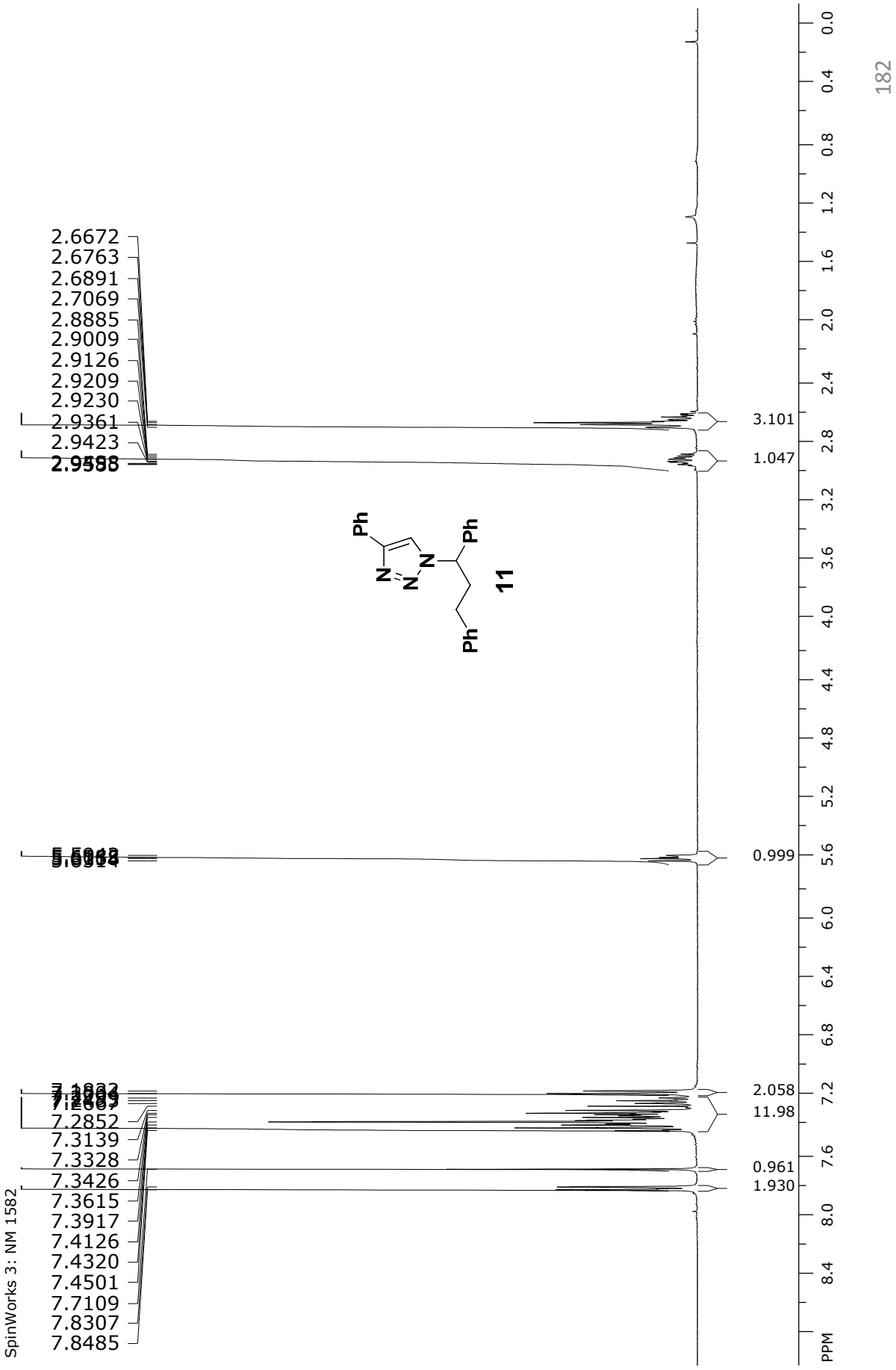


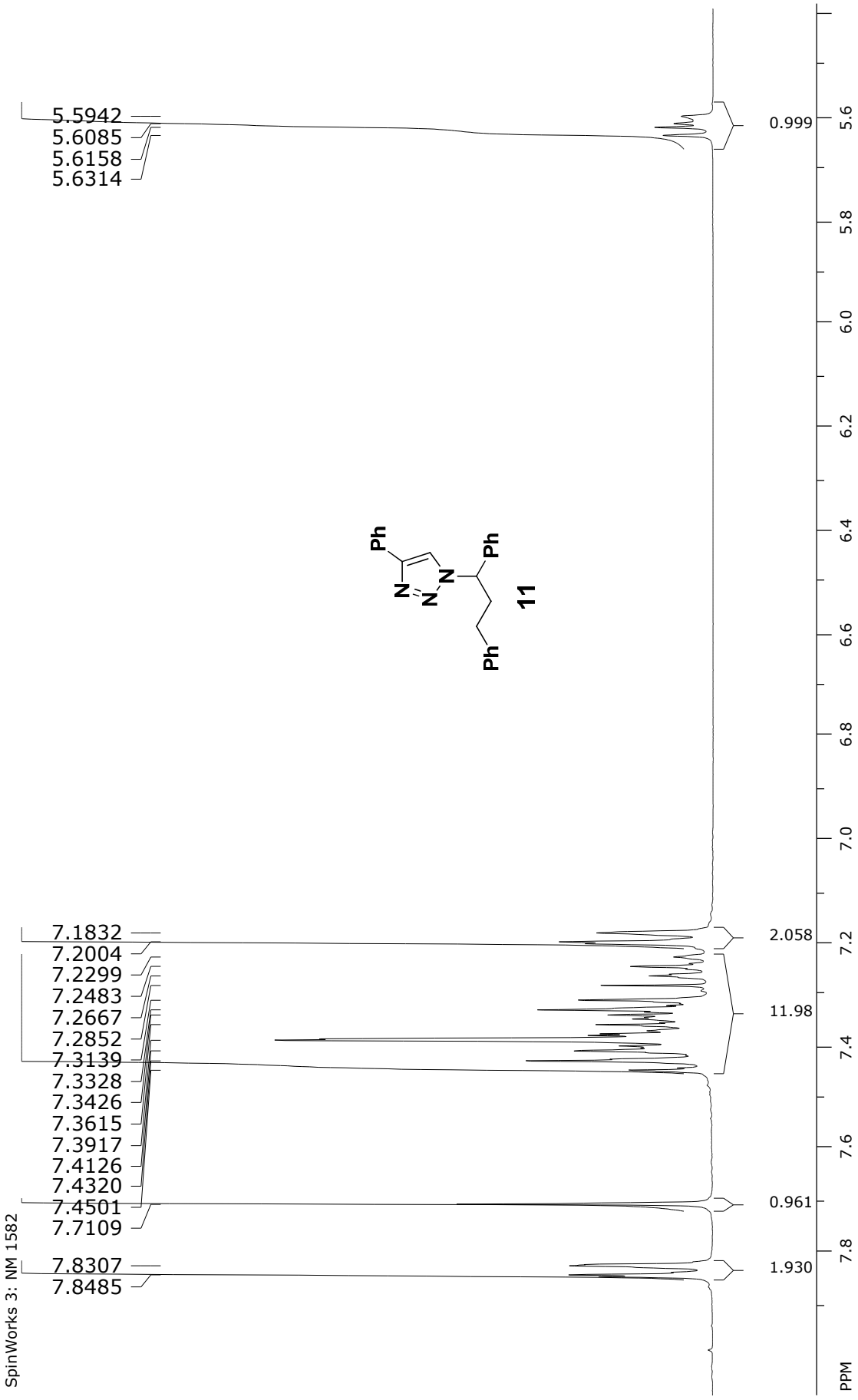

Nm- 1390
SpinWorks 3: NM Ionic
39.3394
41.6698
76.7644
77.0815
77.3995
77.5294
121.5559
129.7642
129.9128
130.5172
132.2061
143.3720
Ph
I⁻
10
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180

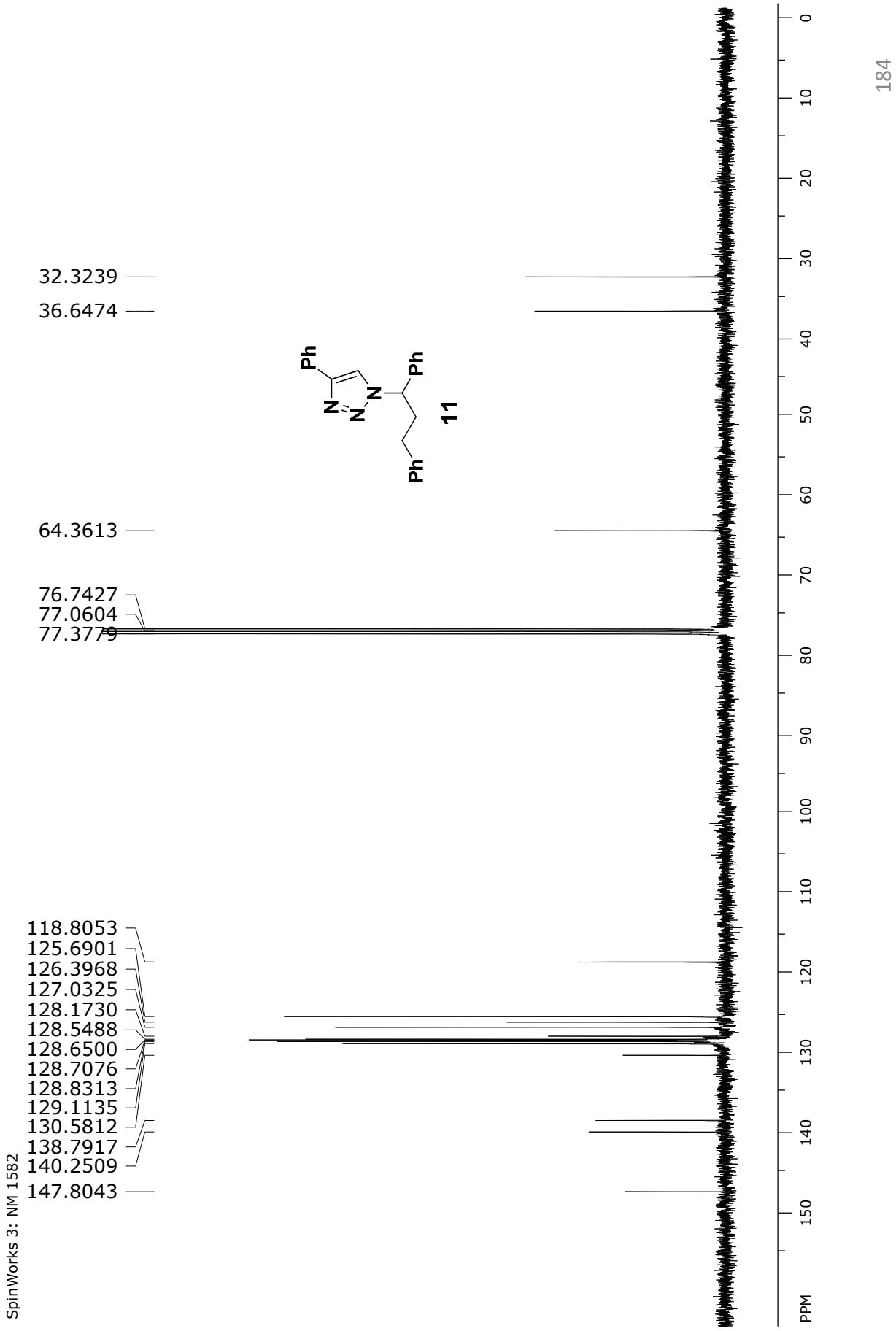
Nm- 1390

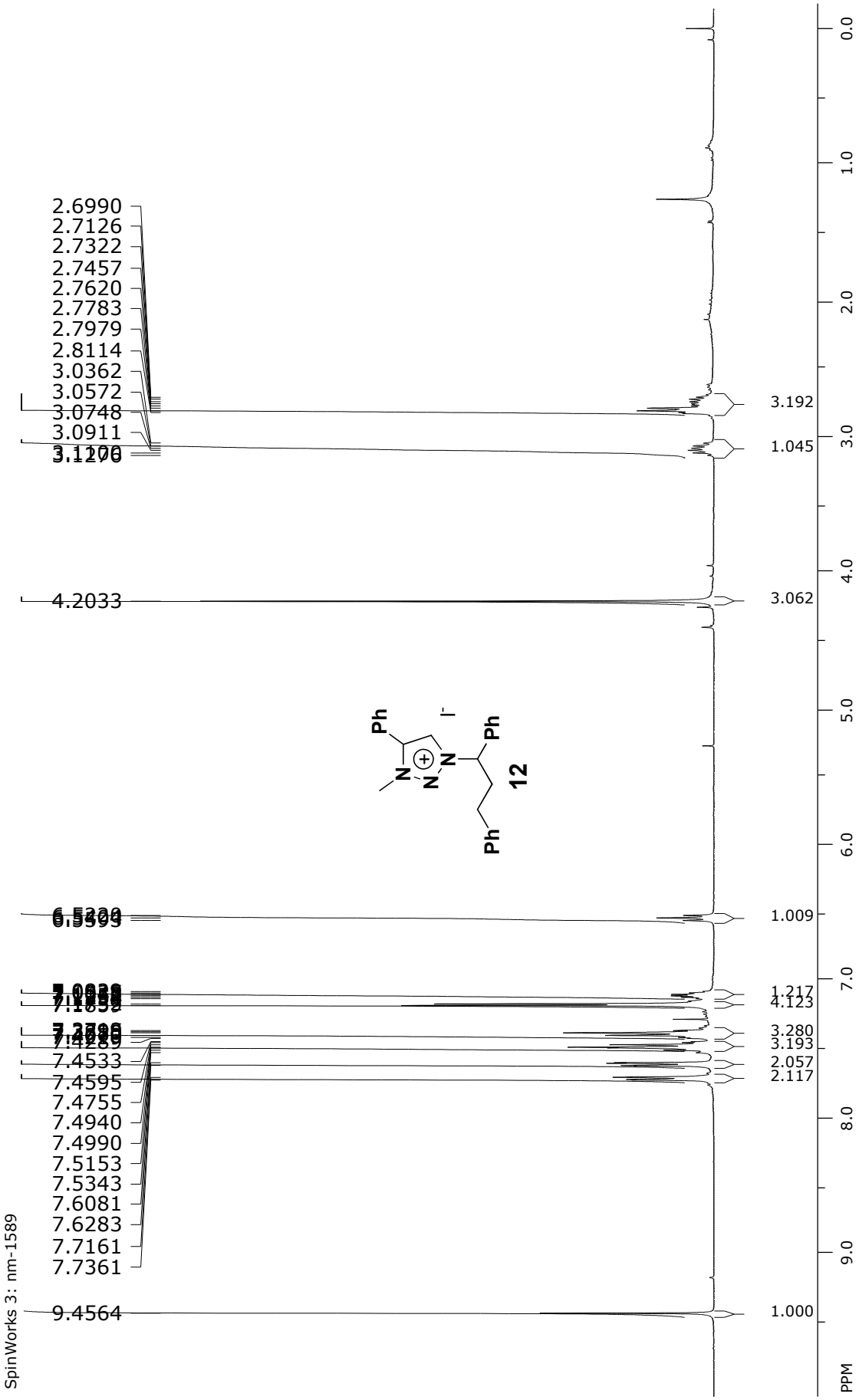
SpinWorks 3: NM Ionic

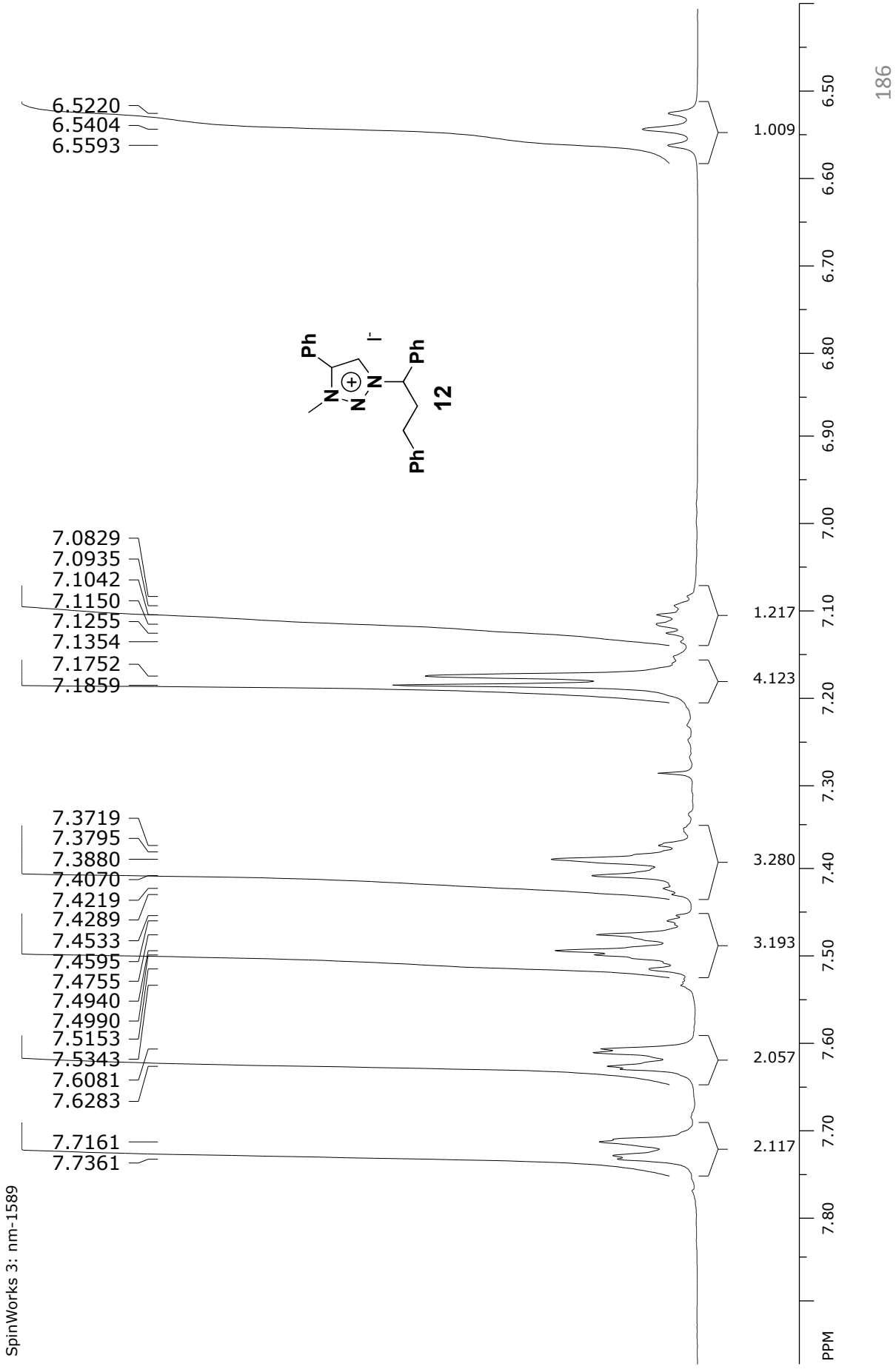


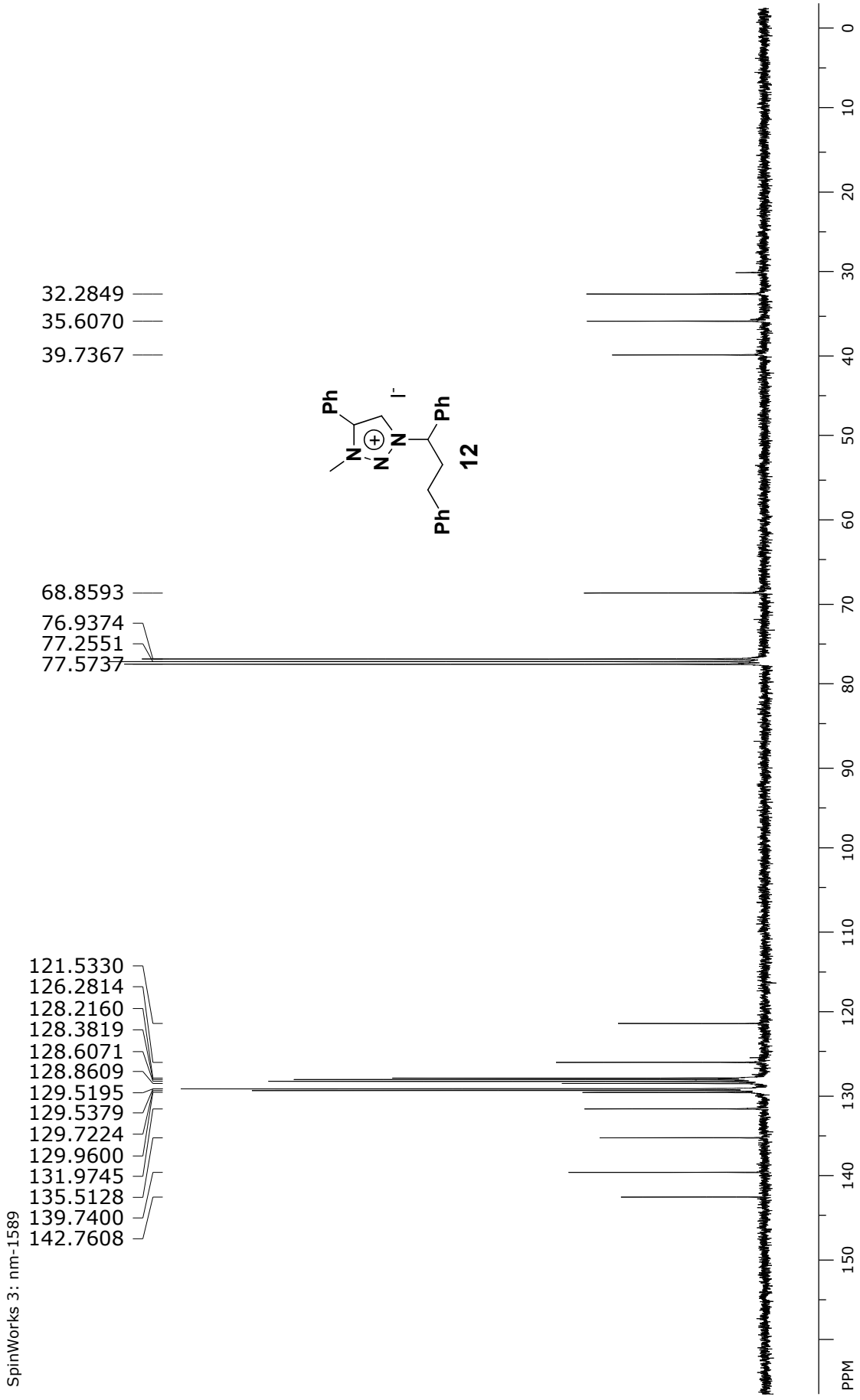

2.6672
2.6763
2.6891
2.7069
2.8885
2.9009
2.9126
2.9209
2.9230
2.9361
2.9423
2.9588
3.101
1.047
Ph
Ph
Ph
11
0.999
7.2852
7.3139
7.3328
7.3426
7.3615
7.3917
7.4126
7.4320
7.4501
7.7109
7.8307
7.8485
2.058
11.98
0.961
1.930
SpinWorks 3: NM 1582
PPM

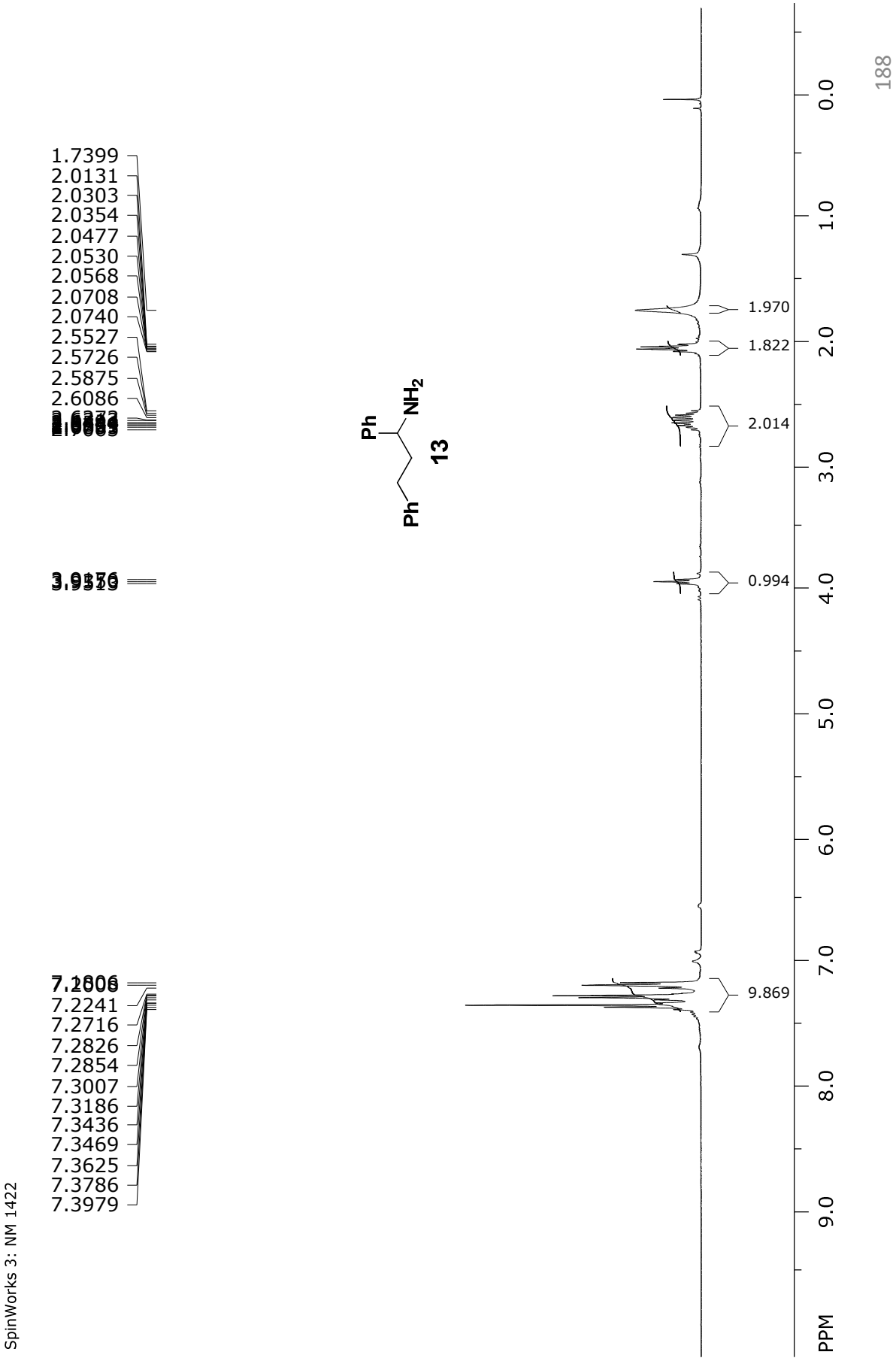

5.5942
5.6085
5.6158
5.6314
0.999
Ph
Ph
Ph
N
N
N
11
7.1832
7.2004
7.2299
7.2483
7.2667
7.2852
7.3139
7.3328
7.3426
7.3615
7.3917
7.4126
7.4320
7.4501
7.7109
7.8307
7.8485
2.058
11.98
0.961
1.930
SpinWorks 3: NM 1582
5.6
5.8
6.0
6.2
6.4
6.6
6.8
7.0
7.2
7.4
7.6
7.8
PPM

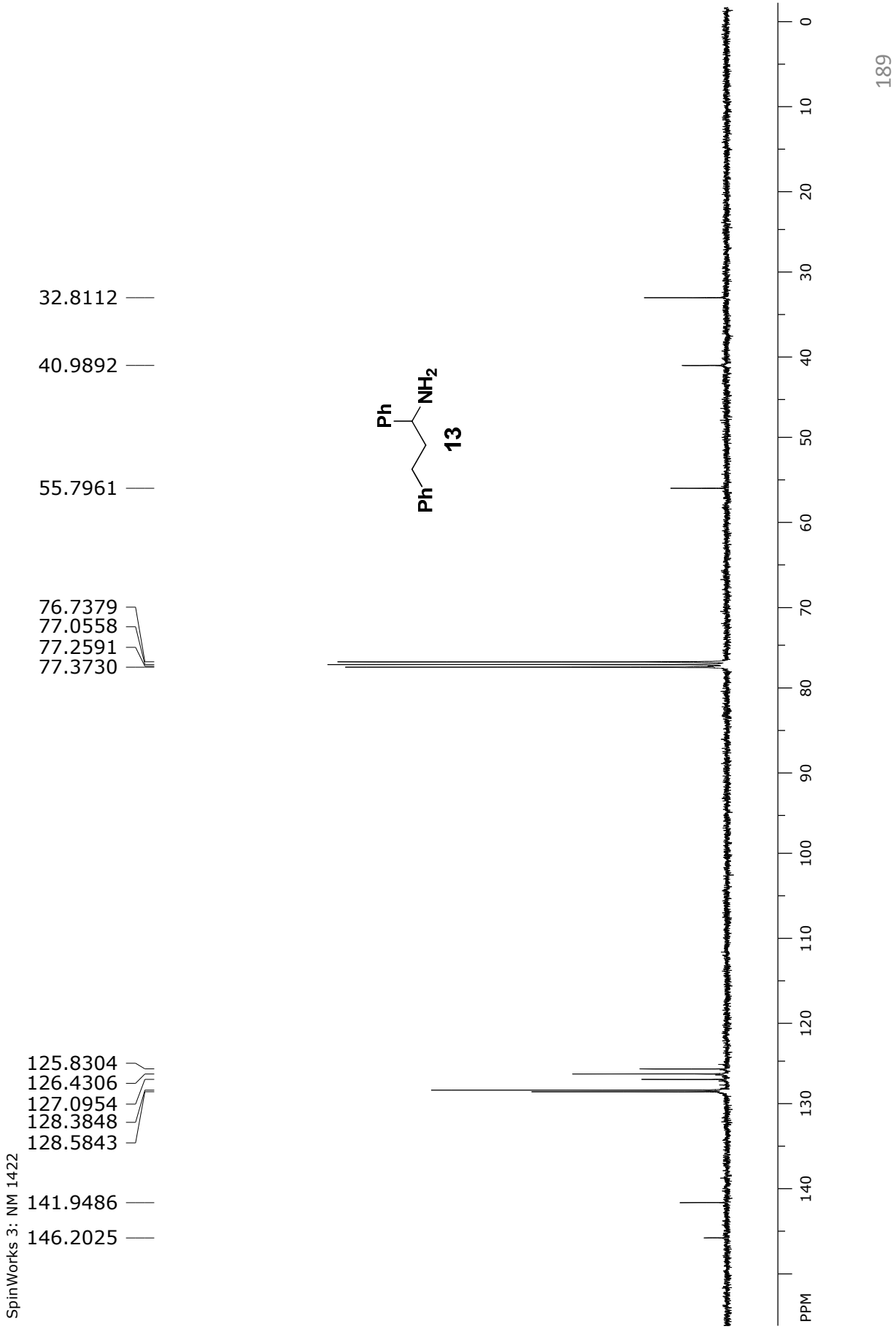

32.3239
36.6474
64.3613
76.7427
77.0604
77.3779
118.8053
125.6901
126.3968
127.0325
128.1730
128.5488
128.6500
128.7076
128.8313
129.1135
130.5812
138.7917
140.2509
147.8043
Ph
Ph
Ph
N
N
11
SpinWorks 3: NM 1582
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150

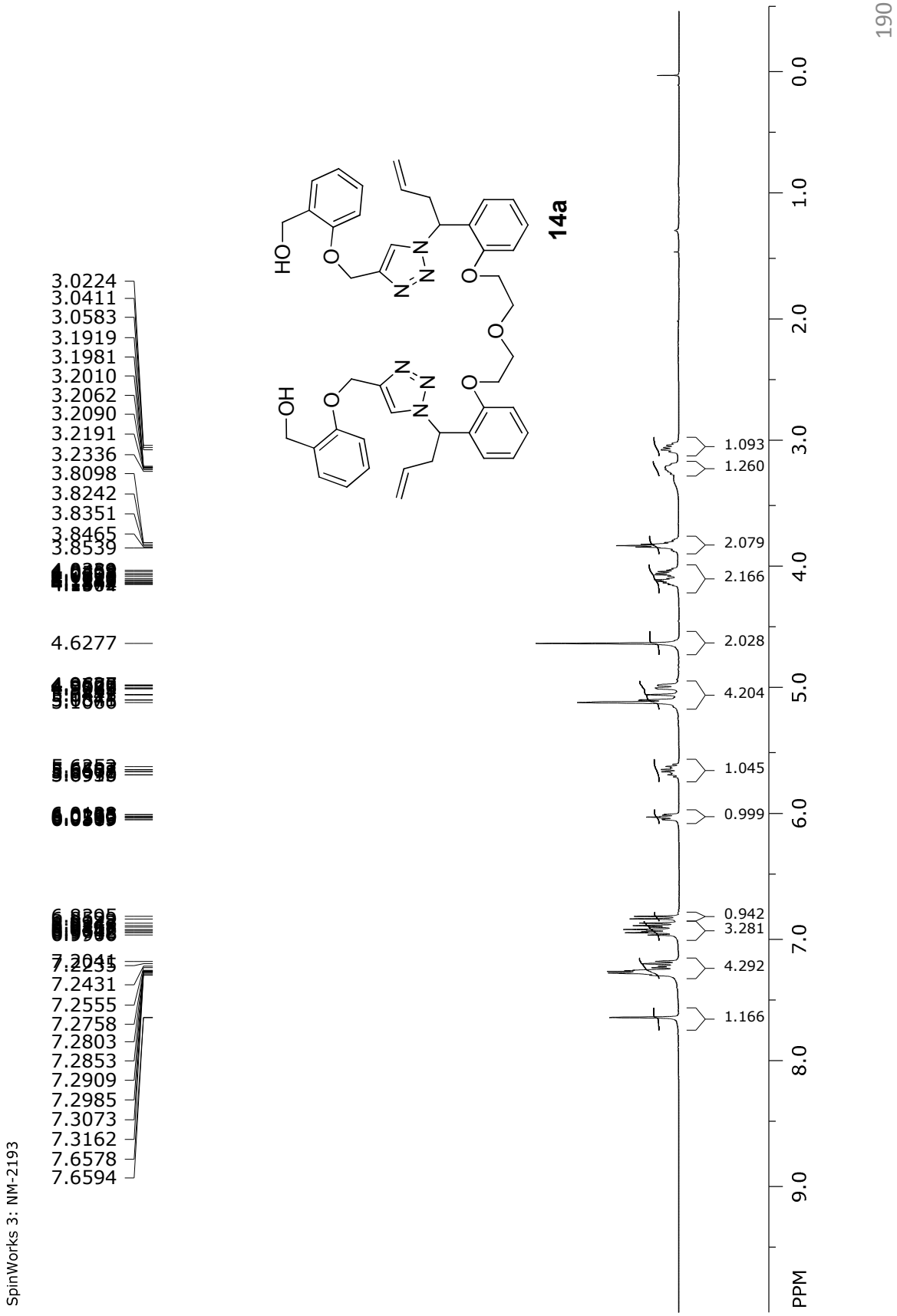

2.6990
2.7126
2.7322
2.7457
2.7620
2.7783
2.7979
2.8114
3.0362
3.0572
3.0748
3.0911
4.2033
7.4533
7.4595
7.4755
7.4940
7.4990
7.5153
7.5343
7.6081
7.6283
7.7161
7.7361
9.4564
3.192
1.045
3.062
1.009
1.217
4.123
3.280
3.193
2.057
2.117
1.000
Ph
Ph
Ph
I-
12
SpinWorks 3: nm-1589
PPM
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0


6.5220
6.5404
6.5593
7.0829
7.0935
7.1042
7.1150
7.1255
7.1354
7.1752
7.1859
7.3719
7.3795
7.3880
7.4070
7.4219
7.4289
7.4533
7.4595
7.4755
7.4940
7.4990
7.5153
7.5343
7.6081
7.6283
7.7161
7.7361
1.009
1.217
4.123
3.280
3.193
2.057
2.117
Ph
Ph
Ph
I-
12
6.50
6.60
6.70
6.80
6.90
7.00
7.10
7.20
7.30
7.40
7.50
7.60
7.70
7.80
PPM
SpinWorks 3: nm-1589

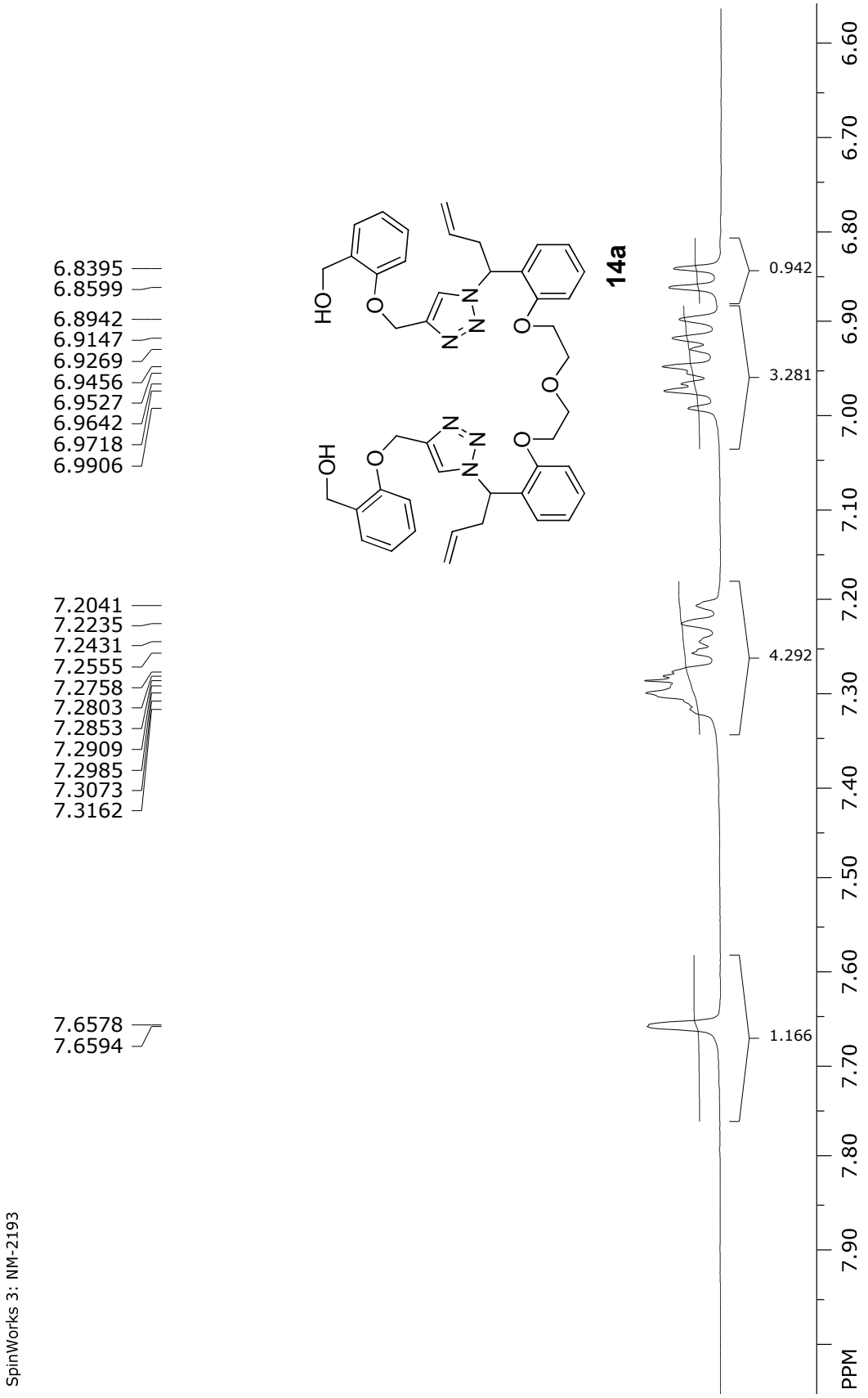

32.2849
35.6070
39.7367
68.8593
76.9374
77.2551
77.5737
121.5330
126.2814
128.2160
128.3819
128.6071
128.8609
129.5195
129.5379
129.7224
129.9600
131.9745
135.5128
139.7400
142.7608
Ph
Ph
Ph
I-
12
SpinWorks 3: nm-1589
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150

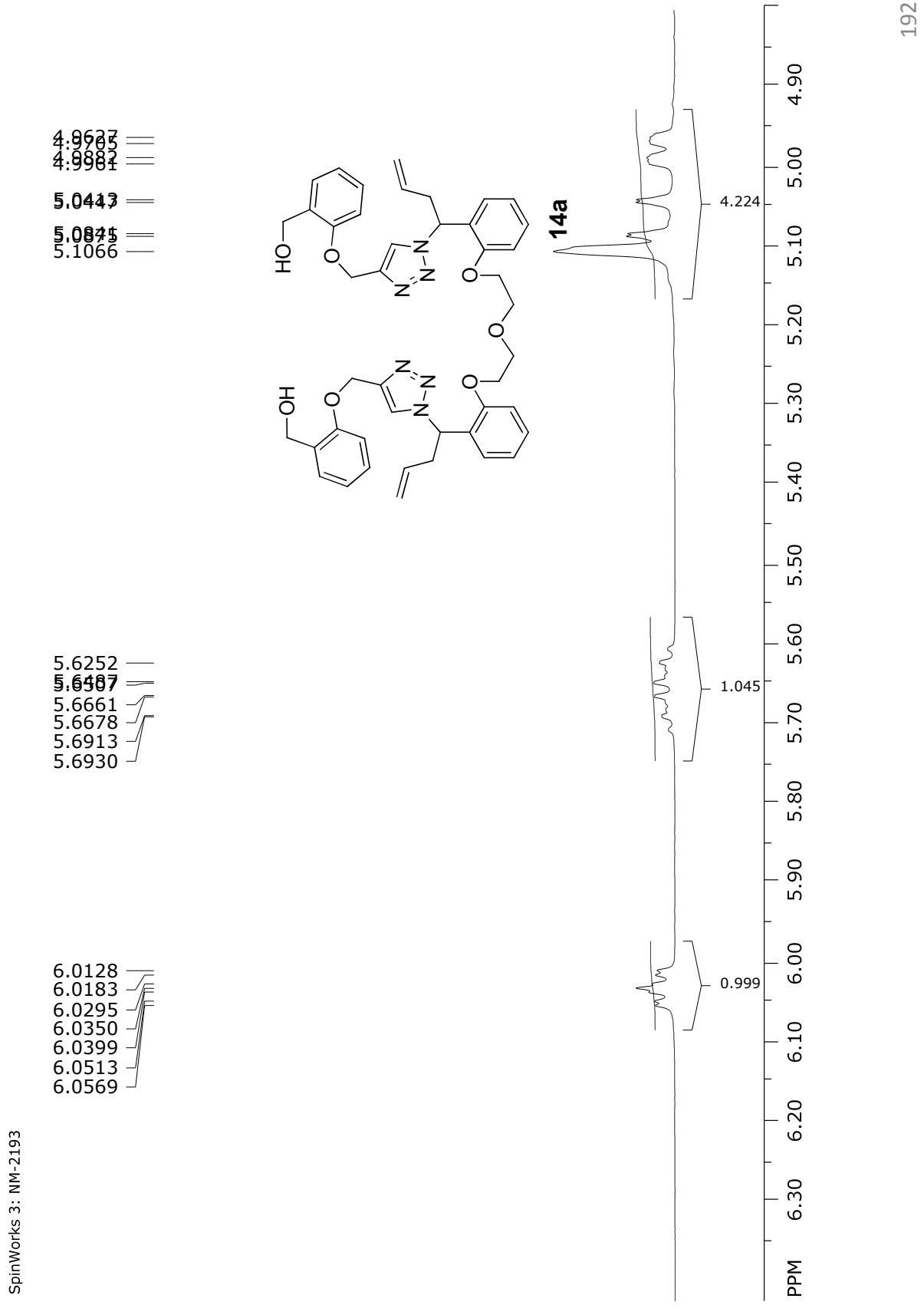

1.7399
2.0131
2.0303
2.0354
2.0477
2.0530
2.0568
2.0708
2.0740
2.5527
2.5726
2.5875
2.6086
7.2241
7.2716
7.2826
7.2854
7.3007
7.3186
7.3436
7.3469
7.3625
7.3786
7.3979
Ph
NH2
Ph
13
1.970
1.822
2.014
0.994
9.869
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
PPM
SpinWorks 3: NM 1422

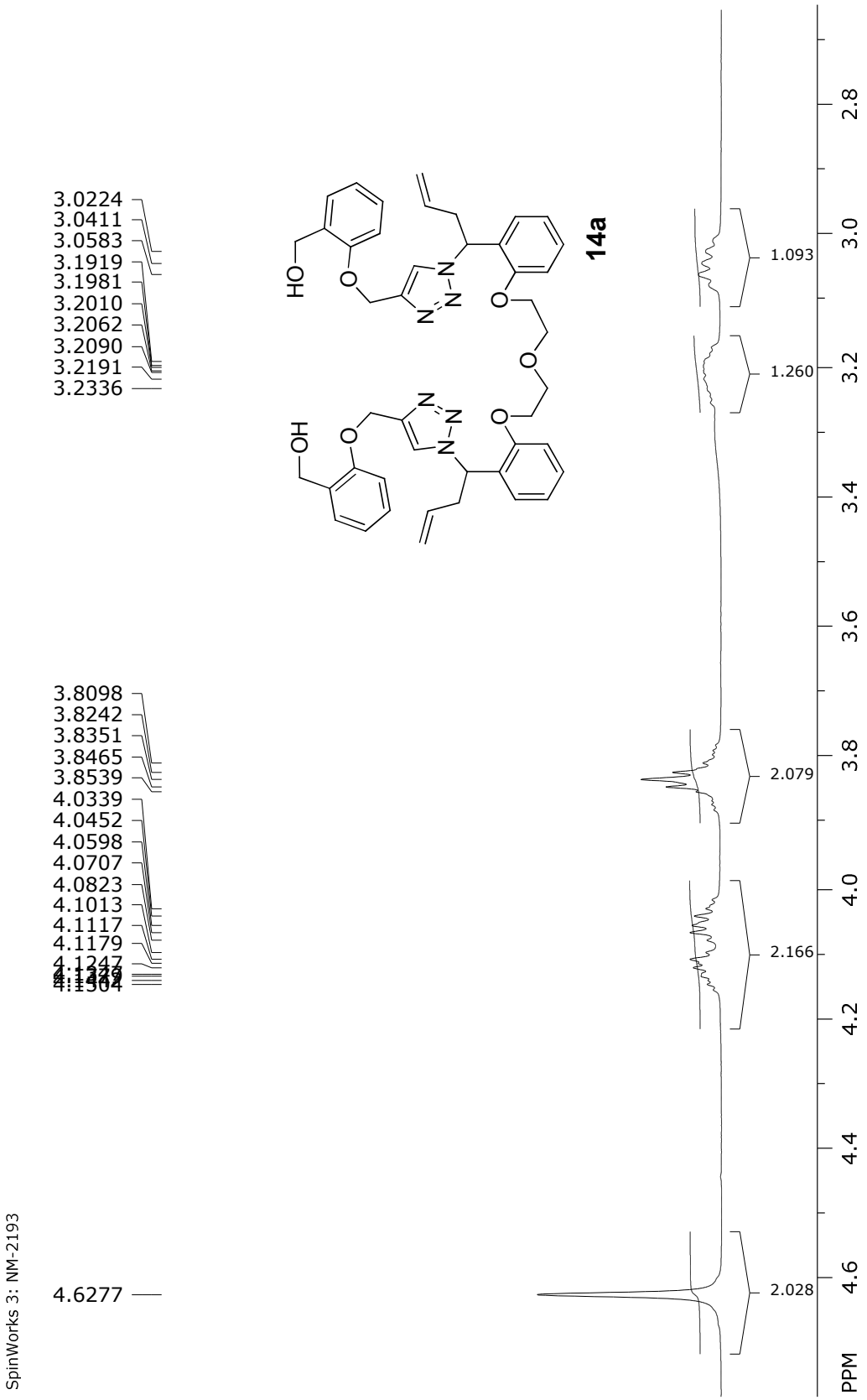

32.8112
40.9892
55.7961
76.7379
77.0558
77.2591
77.3730
125.8304
126.4306
127.0954
128.3848
128.5843
141.9486
146.2025
Ph
NH2
Ph
13
SpinWorks 3: NM 1422
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140

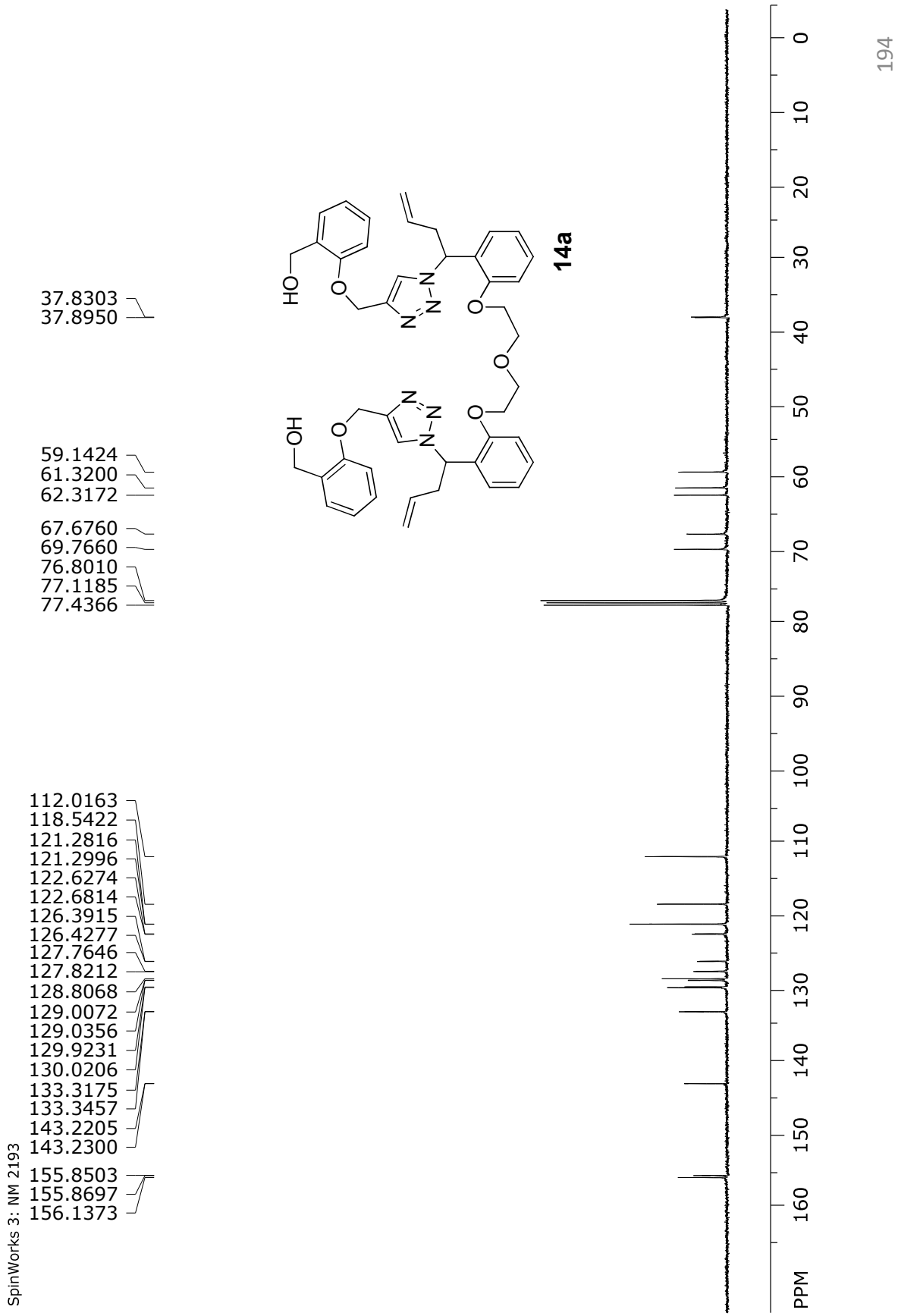


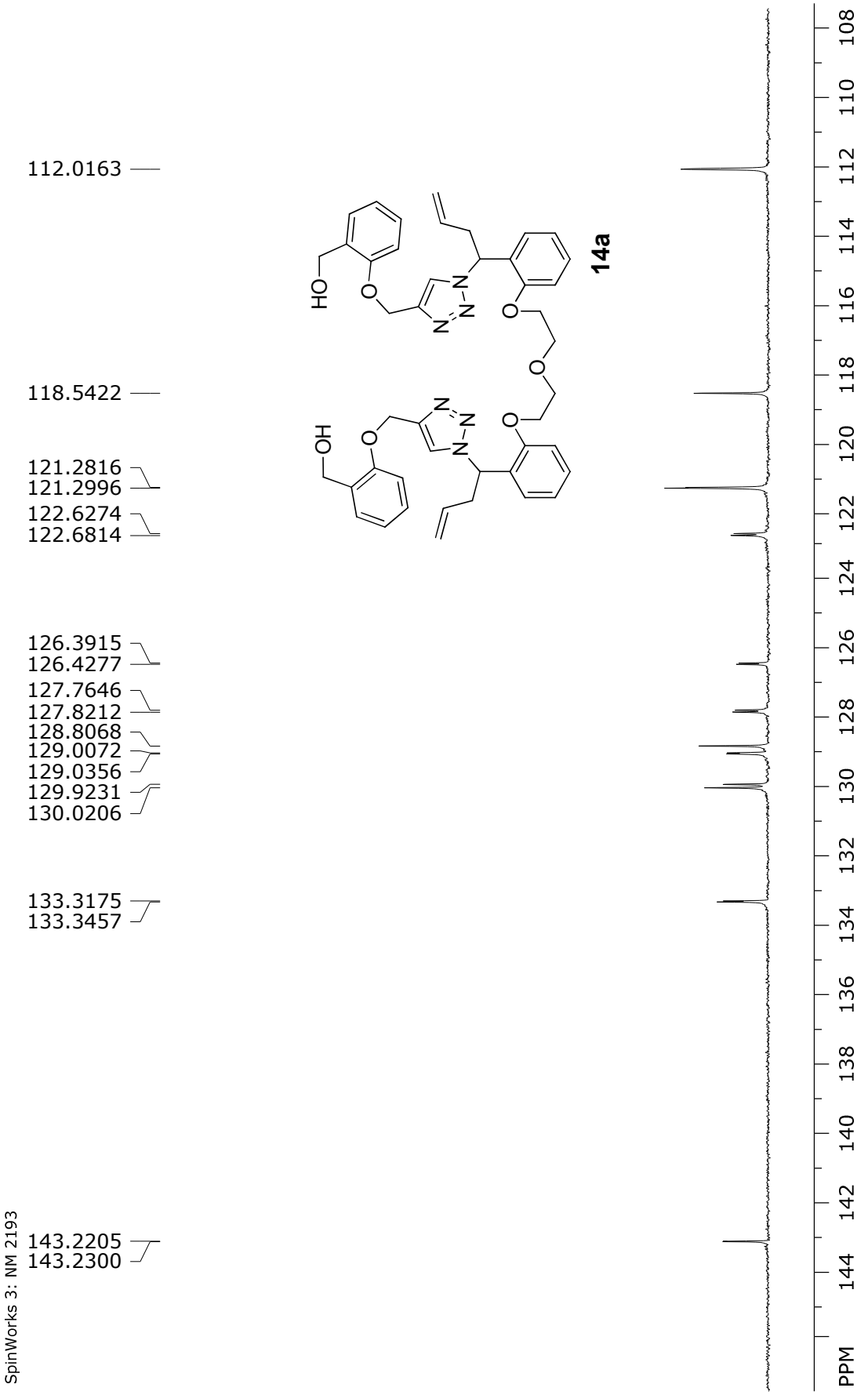
SpinWorks 3: NM-2193

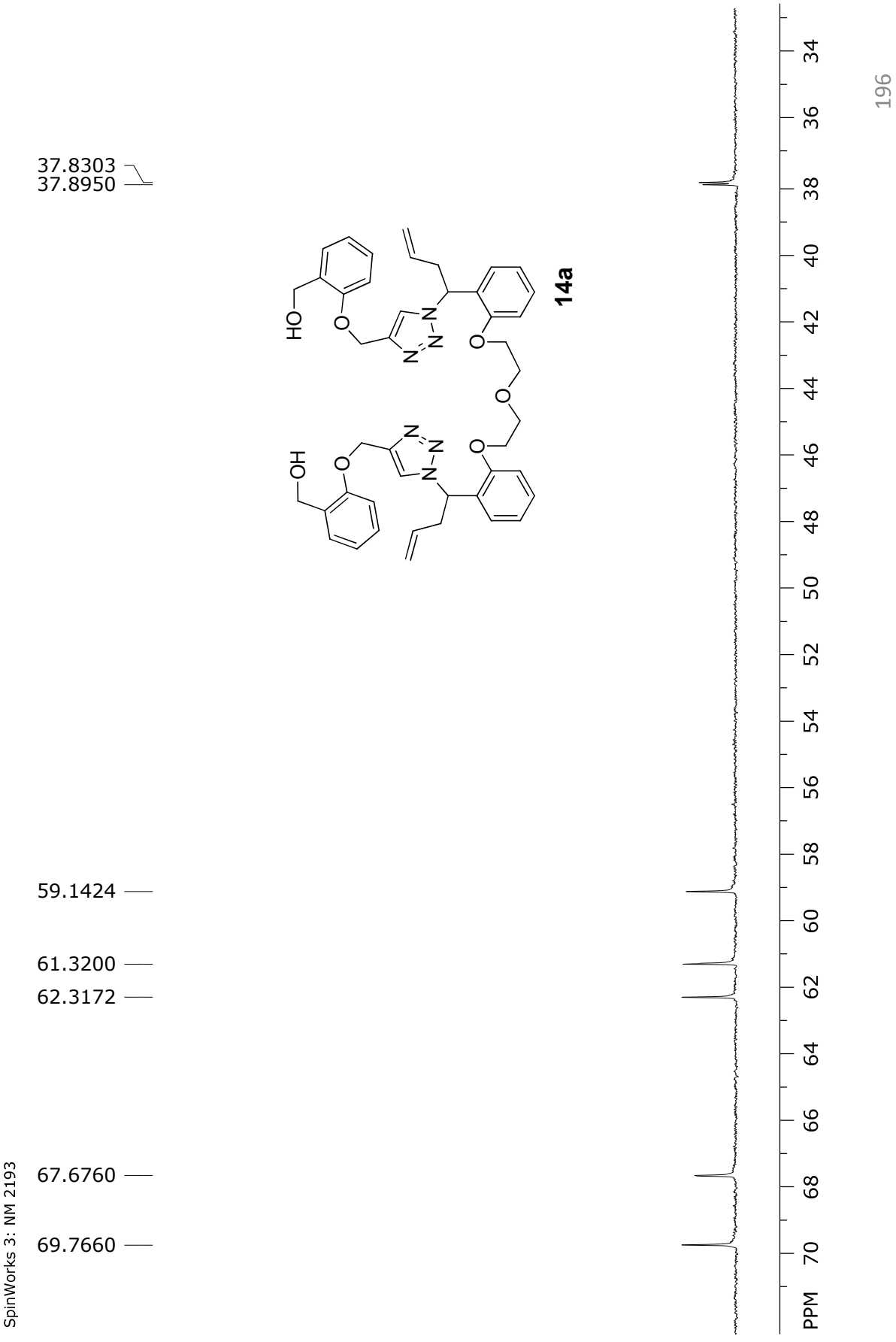

6.8395
6.8599
6.8942
6.9147
6.9269
6.9456
6.9527
6.9642
6.9718
6.9906
7.2041
7.2235
7.2431
7.2555
7.2758
7.2803
7.2853
7.2909
7.2985
7.3073
7.3162
7.6578
7.6594
HO
OH
N
O
14a
0.942
3.281
4.292
1.166
PPM
6.60
6.70
6.80
6.90
7.00
7.10
7.20
7.30
7.40
7.50
7.60
7.70
7.80
7.90
SpinWorks 3: NM-2193


4.9627
4.9705
4.9882
4.9961
5.0413
5.0447
5.0841
5.0875
5.1066
5.6252
5.6487
5.6661
5.6678
5.6913
5.6930
6.0128
6.0183
6.0295
6.0350
6.0399
6.0513
6.0569
HO
OH
N
O
14a
4.224
1.045
0.999
4.90
5.00
5.10
5.20
5.30
5.40
5.50
5.60
5.70
5.80
5.90
6.00
6.10
6.20
6.30
PPM
SpinWorks 3: NM-2193


3.0224
3.0411
3.0583
3.1919
3.1981
3.2010
3.2062
3.2090
3.2191
3.2336
3.8098
3.8242
3.8351
3.8465
3.8539
4.0339
4.0452
4.0598
4.0707
4.0823
4.1013
4.1117
4.1179
4.1247
4.6277
HO
OH
O
N
14a
1.093
1.260
2.079
2.166
2.028
PPM
2.8
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
SpinWorks 3: NM-2193

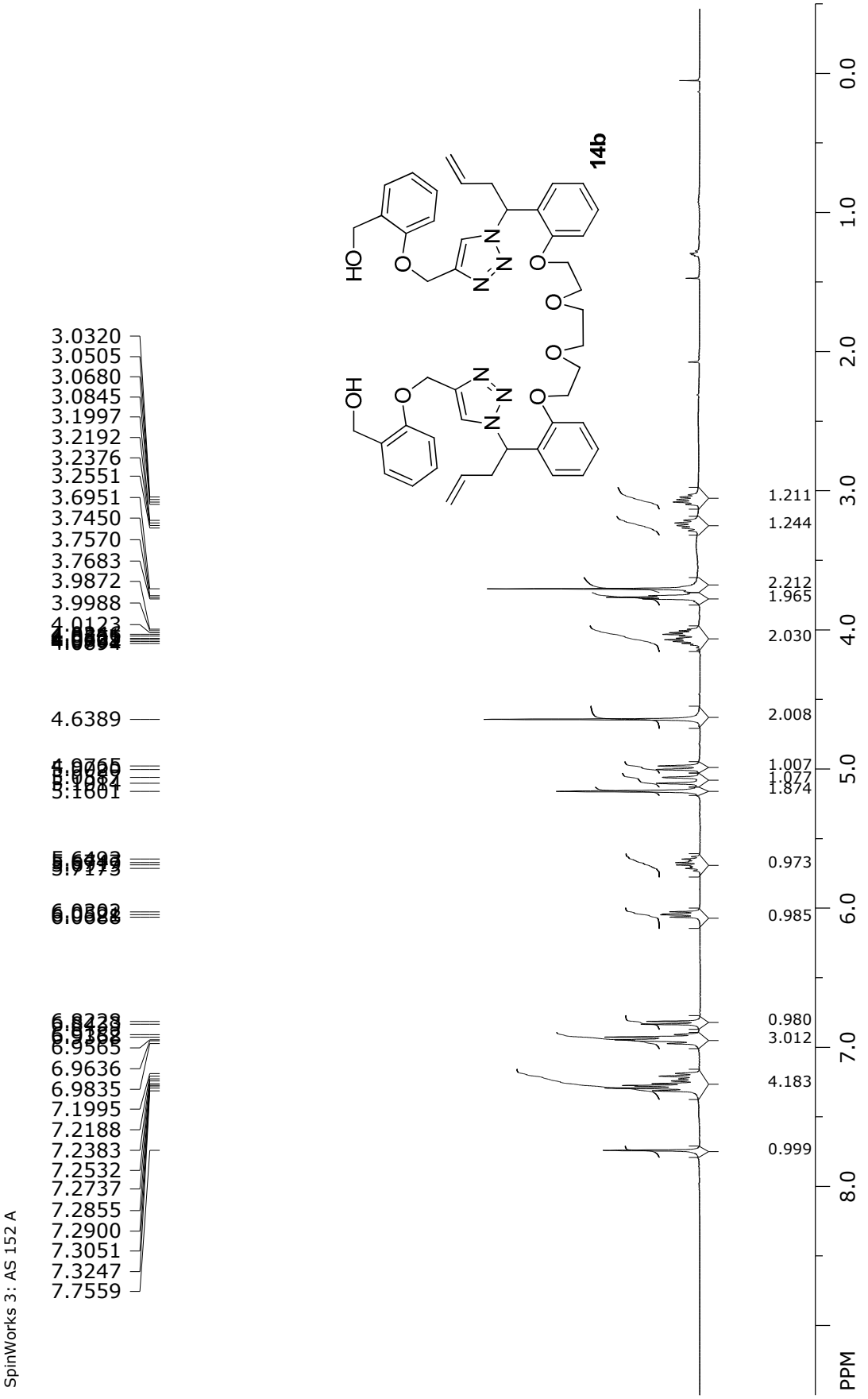

14a
37.8303
37.8950
59.1424
61.3200
62.3172
67.6760
69.7660
76.8010
77.1185
77.4366
112.0163
118.5422
121.2816
121.2996
122.6274
122.6814
126.3915
126.4277
127.7646
127.8212
128.8068
129.0072
129.0356
129.9231
130.0206
133.3175
133.3457
143.2205
143.2300
155.8503
155.8697
156.1373
SpinWorks 3: NM 2193
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160


112.0163
118.5422
121.2816
121.2996
122.6274
122.6814
126.3915
126.4277
127.7646
127.8212
128.8068
129.0072
129.0356
129.9231
130.0206
133.3175
133.3457
143.2205
143.2300
SpinWorks 3: NM 2193
HO
OH
14a
PPM
144
142
140
138
136
134
132
130
128
126
124
122
120
118
116
114
112
110
108

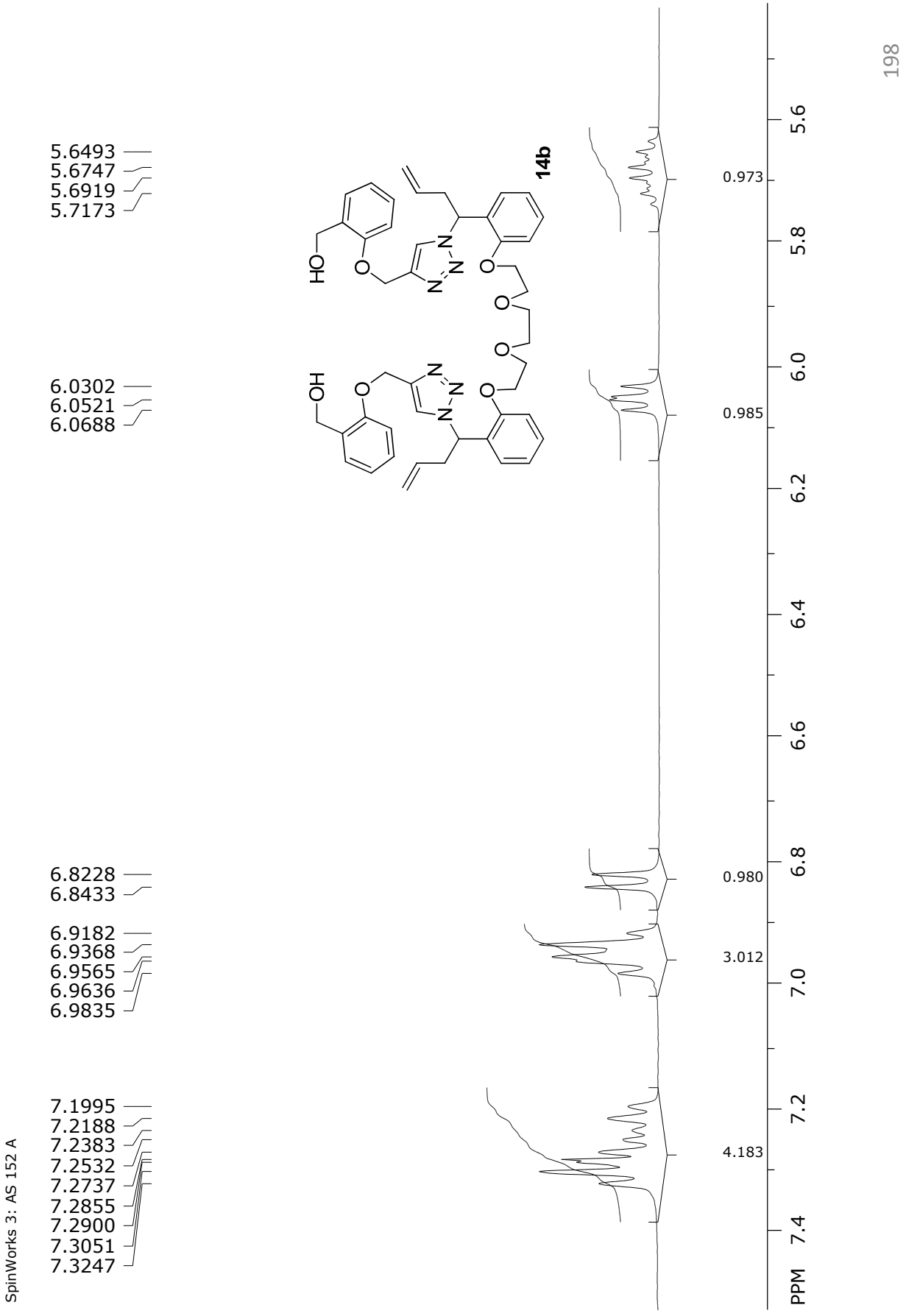

37.8303
37.8950
59.1424
61.3200
62.3172
67.6760
69.7660
SpinWorks 3: NM 2193
PPM
70
68
66
64
62
60
58
56
54
52
50
48
46
44
42
40
38
36
34

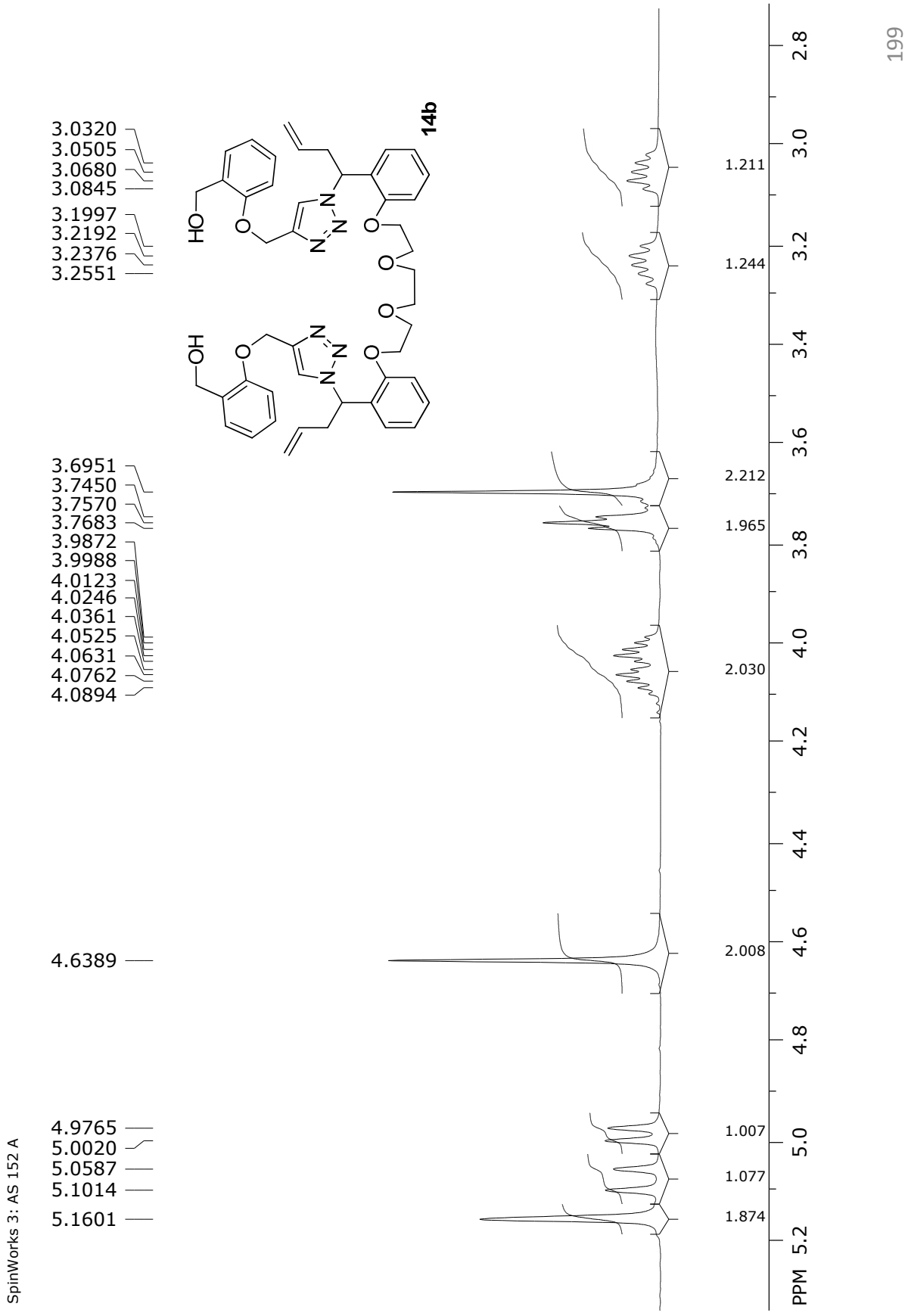
HO
O
N
N
N
O
O
O
N
N
N
OH
O

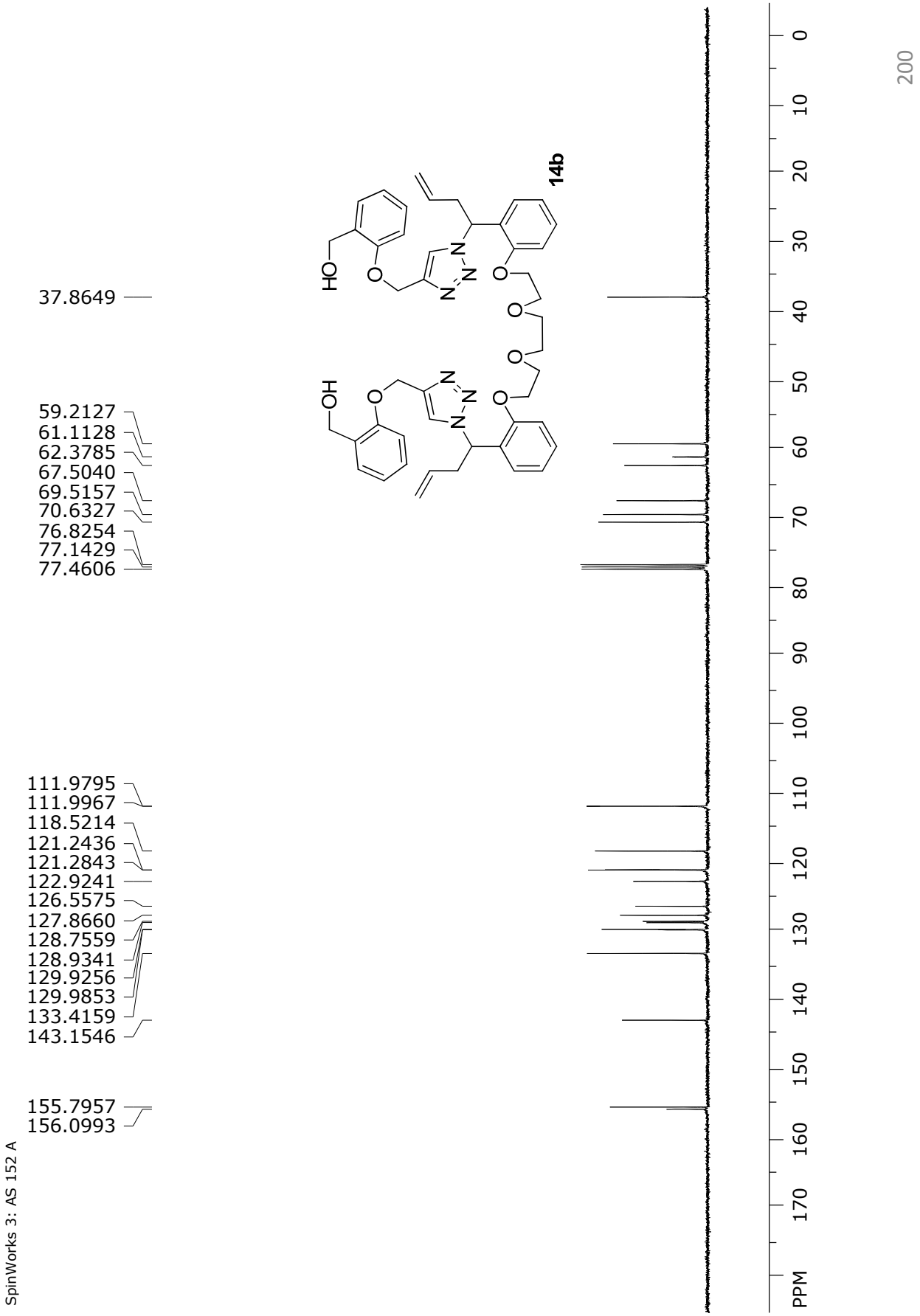
14a

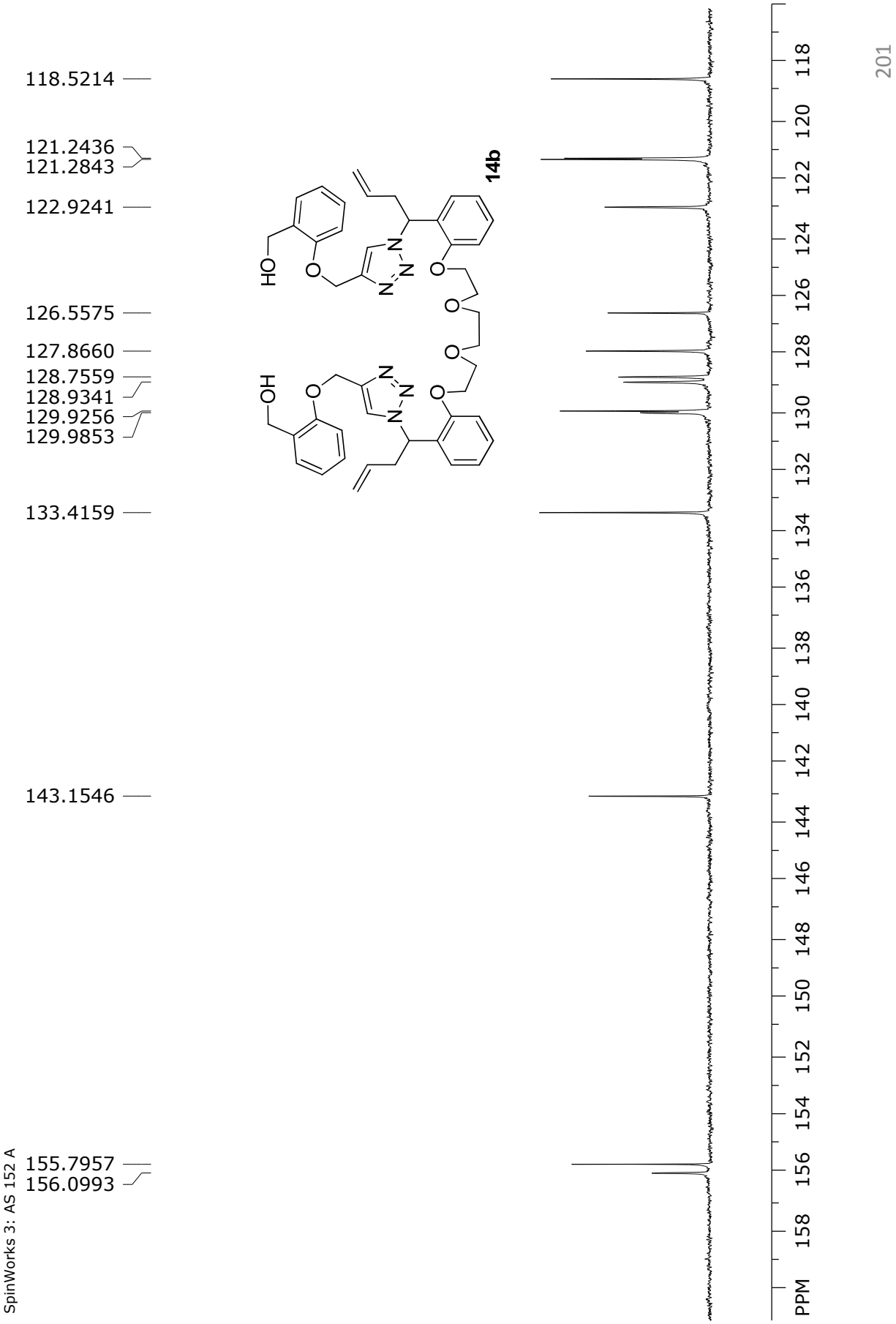


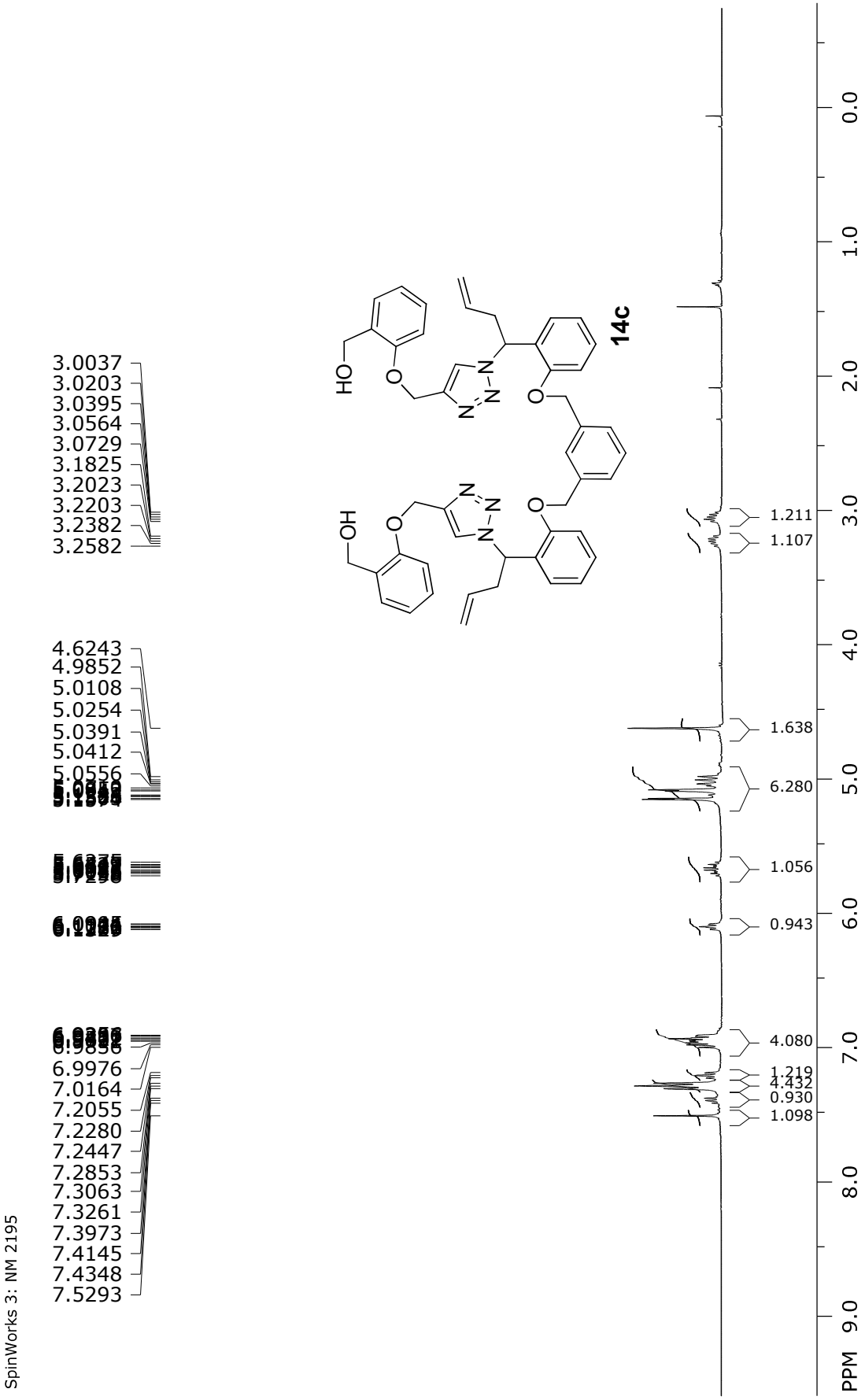
SpinWorks 3: AS 152 A


14b
5.6493
5.6747
5.6919
5.7173
6.0302
6.0521
6.0688
6.8228
6.8433
6.9182
6.9368
6.9565
6.9636
6.9835
7.1995
7.2188
7.2383
7.2532
7.2737
7.2855
7.2900
7.3051
7.3247
0.973
0.985
0.980
3.012
4.183
PPM
5.6
5.8
6.0
6.2
6.4
6.6
6.8
7.0
7.2
7.4
SpinWorks 3: AS 152 A


14b
3.0320
3.0505
3.0680
3.0845
3.1997
3.2192
3.2376
3.2551
3.6951
3.7450
3.7570
3.7683
3.9872
3.9988
4.0123
4.0246
4.0361
4.0525
4.0631
4.0762
4.0894
4.6389
4.9765
5.0020
5.0587
5.1014
5.1601
1.211
1.244
2.212
1.965
2.030
2.008
1.007
1.077
1.874
PPM 5.2 5.0 4.8 4.6 4.4 4.2 4.0 3.8 3.6 3.4 3.2 3.0 2.8
SpinWorks 3: AS 152 A


14b
HO
OH
37.8649
59.2127
61.1128
62.3785
67.5040
69.5157
70.6327
76.8254
77.1429
77.4606
111.9795
111.9967
118.5214
121.2436
121.2843
122.9241
126.5575
127.8660
128.7559
128.9341
129.9256
129.9853
133.4159
143.1546
155.7957
156.0993
SpinWorks 3: AS 152 A
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170


14b
118.5214
121.2436
121.2843
122.9241
126.5575
127.8660
128.7559
128.9341
129.9256
129.9853
133.4159
143.1546
155.7957
156.0993
SpinWorks 3: AS 152 A
PPM
118
120
122
124
126
128
130
132
134
136
138
140
142
144
146
148
150
152
154
156
158


14c
HO
OH
N
O
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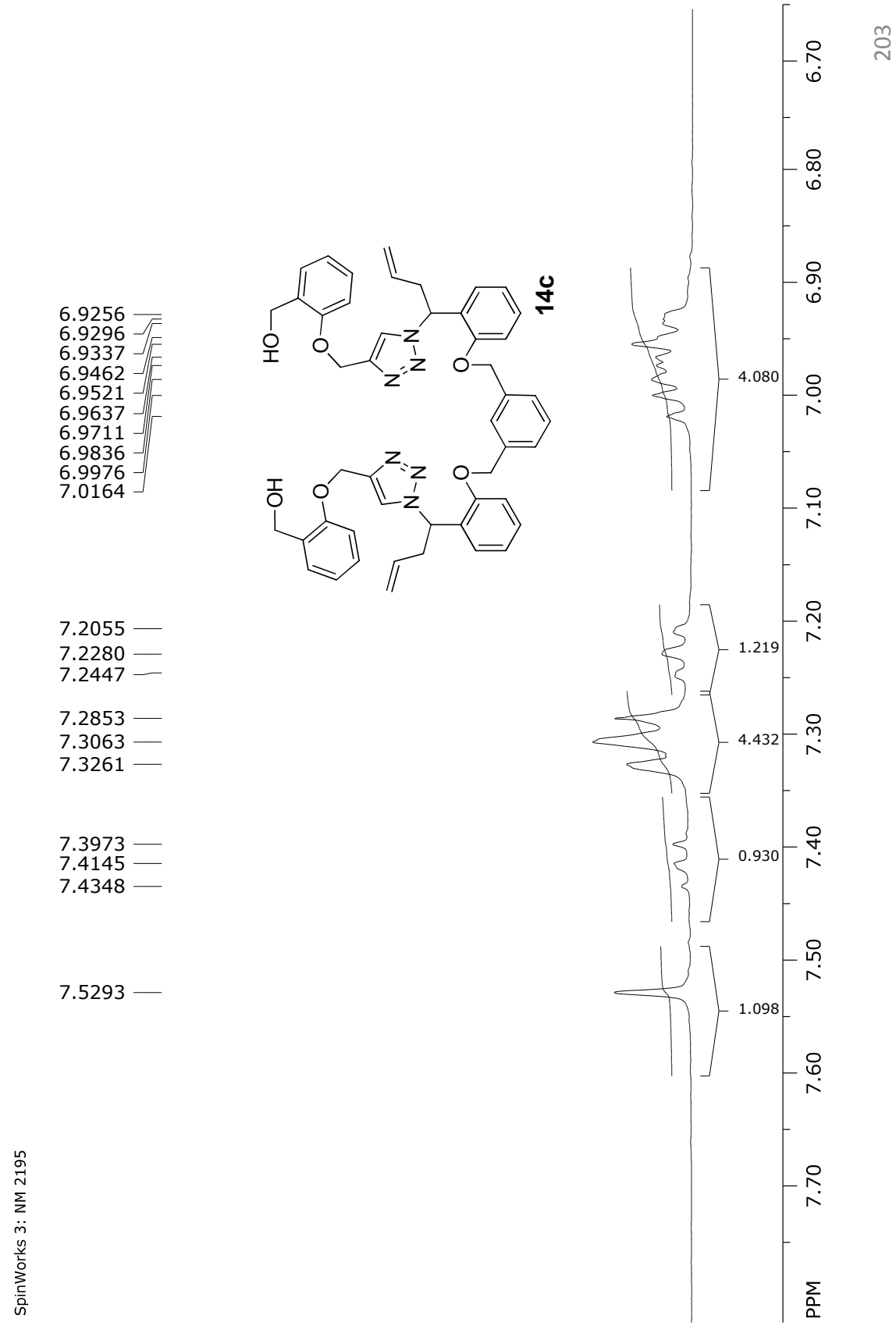
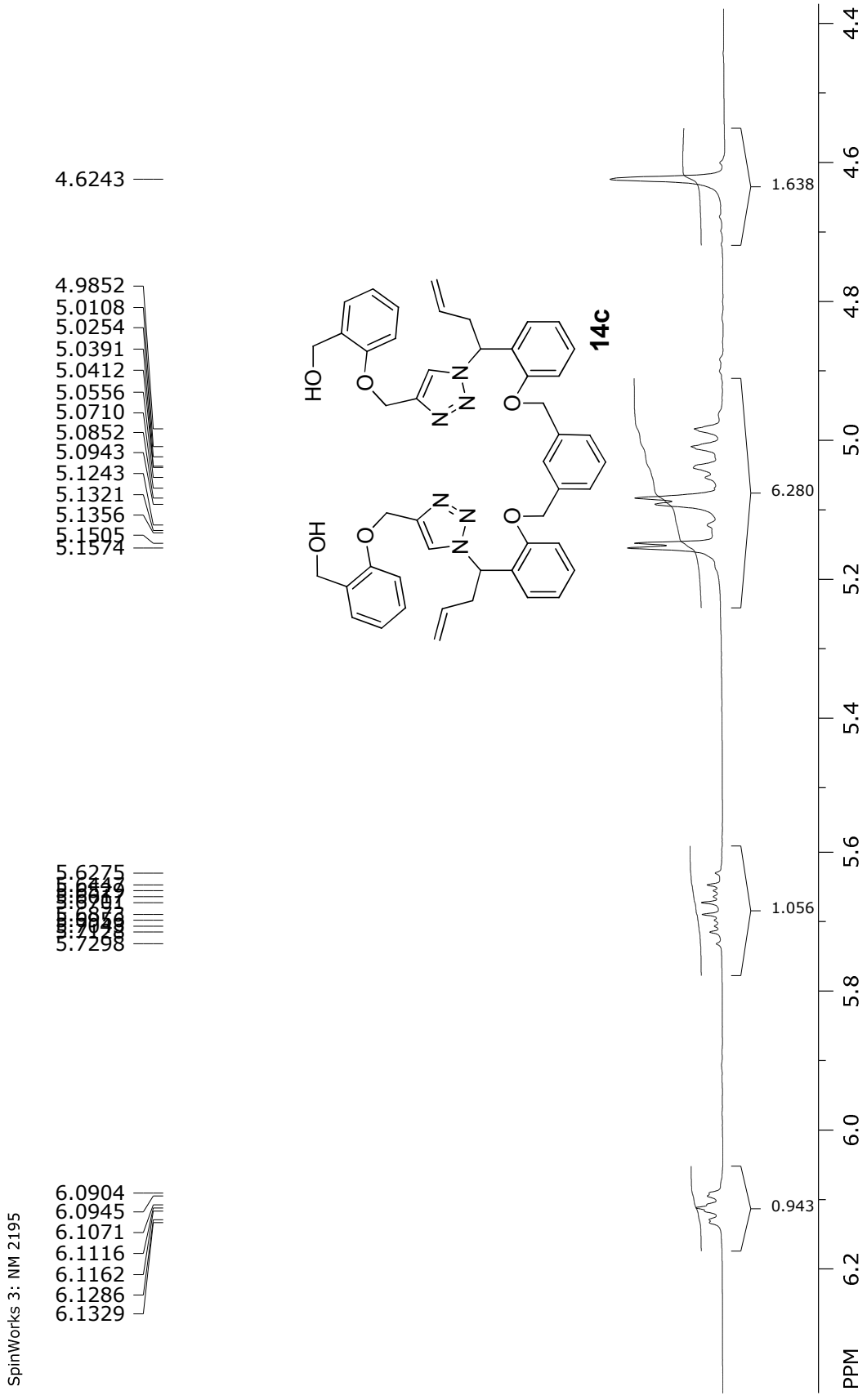
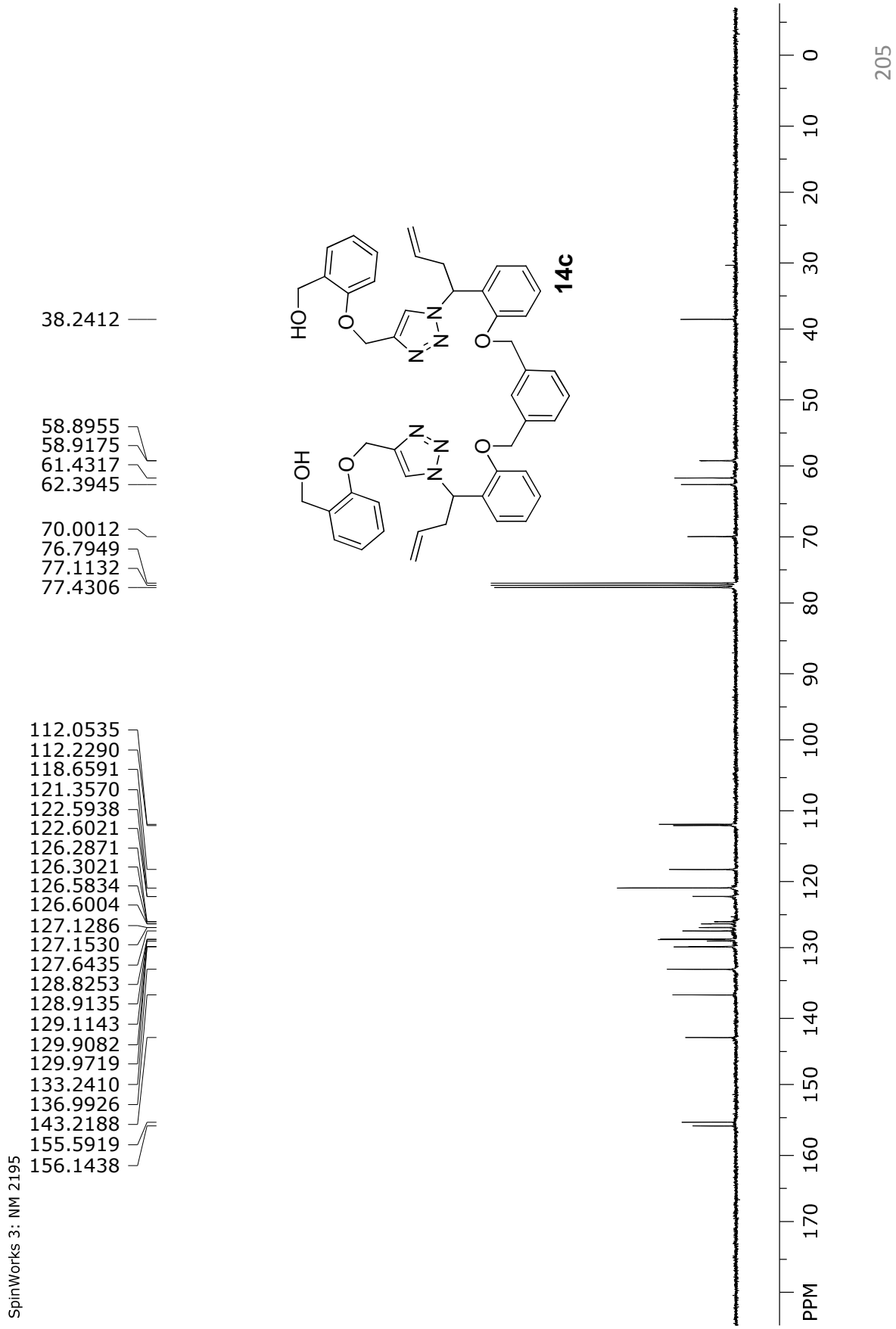
3.0203
3.0395
3.0564
3.0729
3.1825
3.2023
3.2203
3.2382
3.2582
4.6243
4.9852
5.0108
5.0254
5.0391
5.0412
5.0556
6.9976
7.0164
7.2055
7.2280
7.2447
7.2853
7.3063
7.3261
7.3973
7.4145
7.4348
7.5293
1.211
1.107
1.638
6.280
1.056
0.943
4.080
1.219
4.432
0.930
1.098
PPM 9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
SpinWorks 3: NM 2195


6.9256
6.9296
6.9337
6.9462
6.9521
6.9637
6.9711
6.9836
6.9976
7.0164
7.2055
7.2280
7.2447
7.2853
7.3063
7.3261
7.3973
7.4145
7.4348
7.5293
HO
OH
O
N
14c
4.080
1.219
4.432
0.930
1.098
6.70
6.80
6.90
7.00
7.10
7.20
7.30
7.40
7.50
7.60
7.70
PPM
SpinWorks 3: NM 2195


4.6243
4.9852
5.0108
5.0254
5.0391
5.0412
5.0556
5.0710
5.0852
5.0943
5.1243
5.1321
5.1356
5.1505
5.1574
5.6275
5.7298
6.0904
6.0945
6.1071
6.1116
6.1162
6.1286
6.1329
HO
OH
N
O
14c
1.638
6.280
1.056
0.943
PPM
4.4
4.6
4.8
5.0
5.2
5.4
5.6
5.8
6.0
6.2
SpinWorks 3: NM 2195


14c
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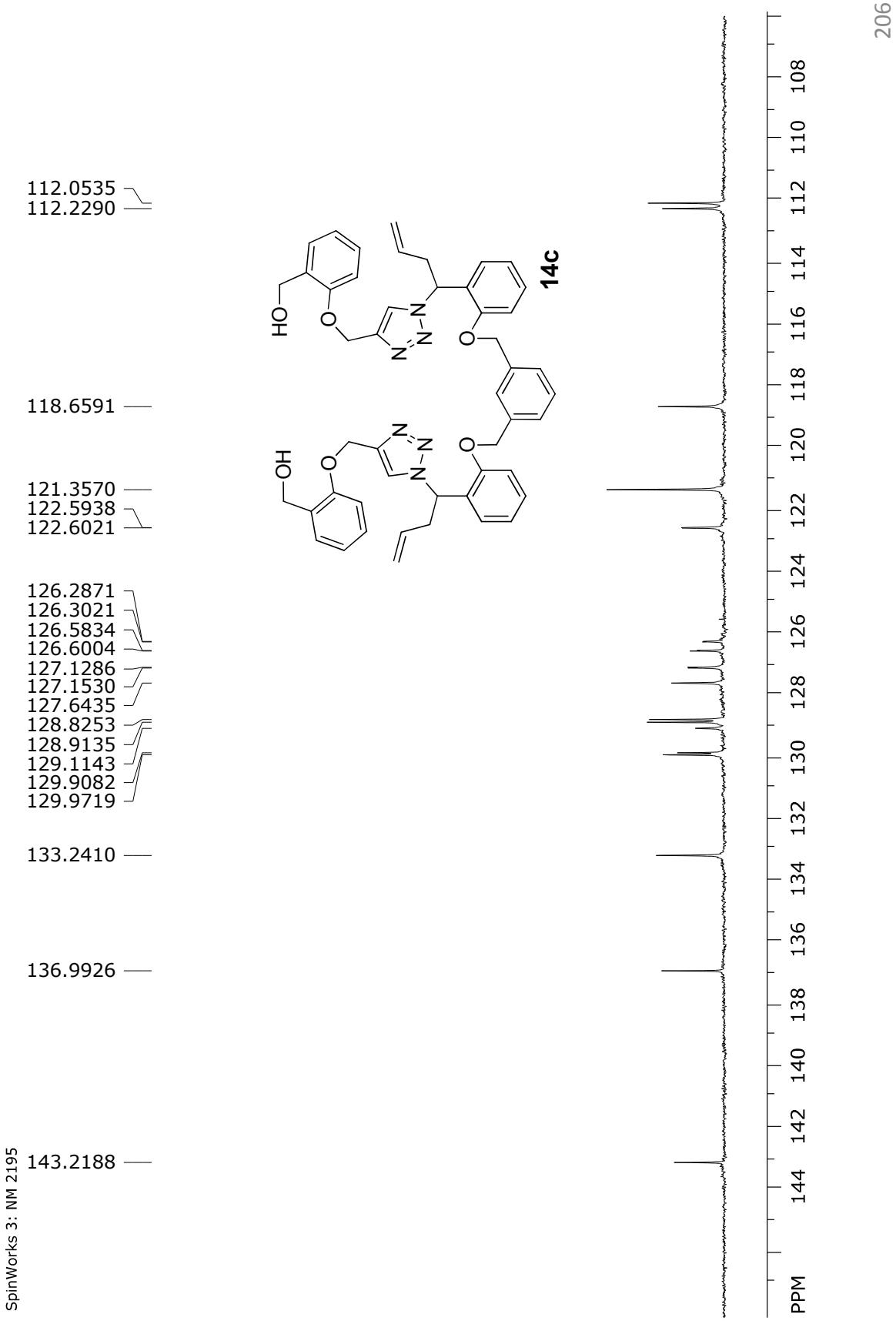
62.3945
70.0012
76.7949
77.1132
77.4306
112.0535
112.2290
118.6591
121.3570
122.5938
122.6021
126.2871
126.3021
126.5834
126.6004
127.1286
127.1530
127.6435
128.8253
128.9135
129.1143
129.9082
129.9719
133.2410
136.9926
143.2188
155.5919
156.1438
SpinWorks 3: NM 2195
PPM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112.2290
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122.6021
126.2871
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126.5834
126.6004
127.1286
127.1530
127.6435
128.8253
128.9135
129.1143
129.9082
129.9719
133.2410
136.9926
143.2188
SpinWorks 3: NM 2195
14c
HO
OH
PPM
144
142
140
138
136
134
132
130
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124
122
120
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114
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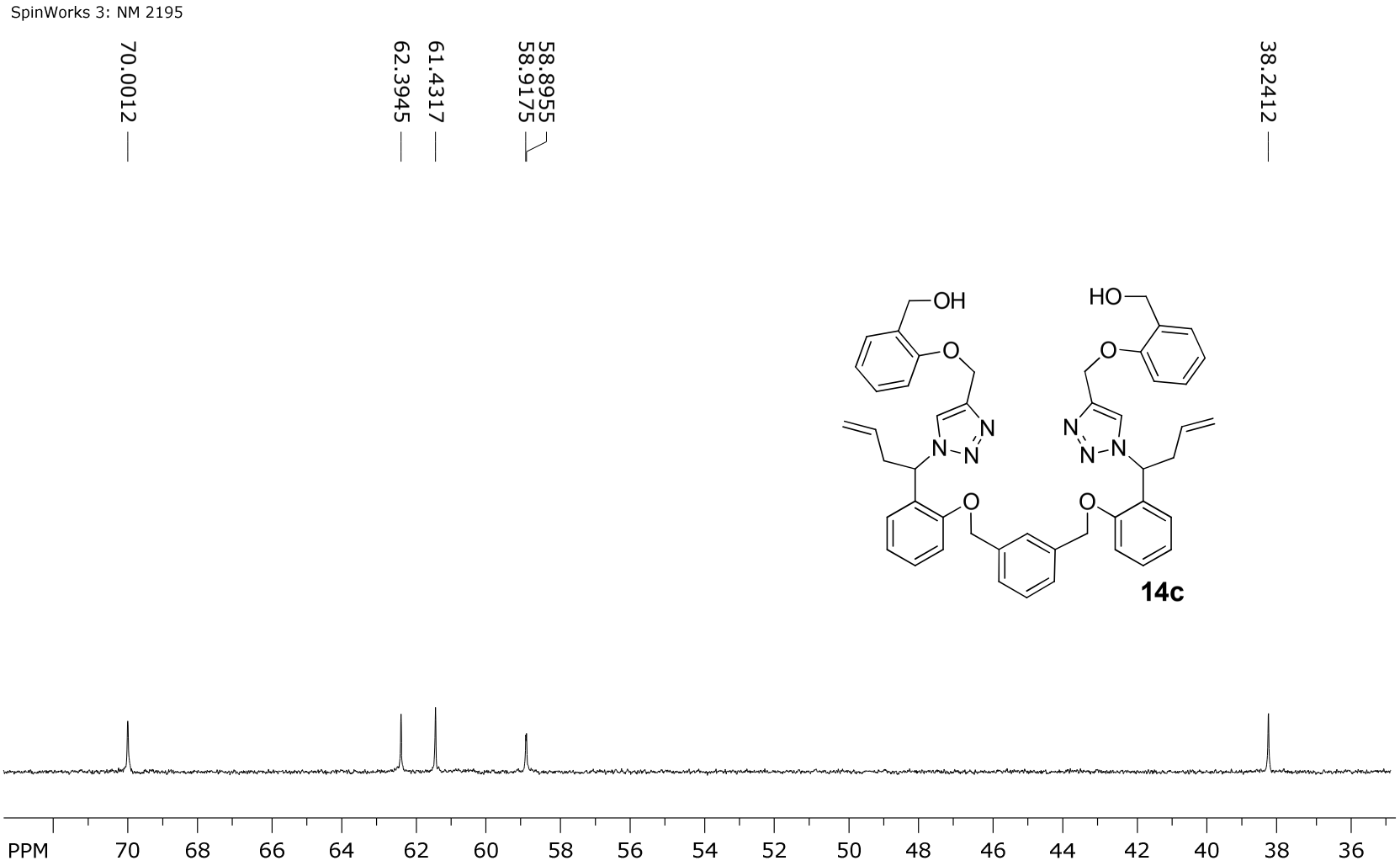
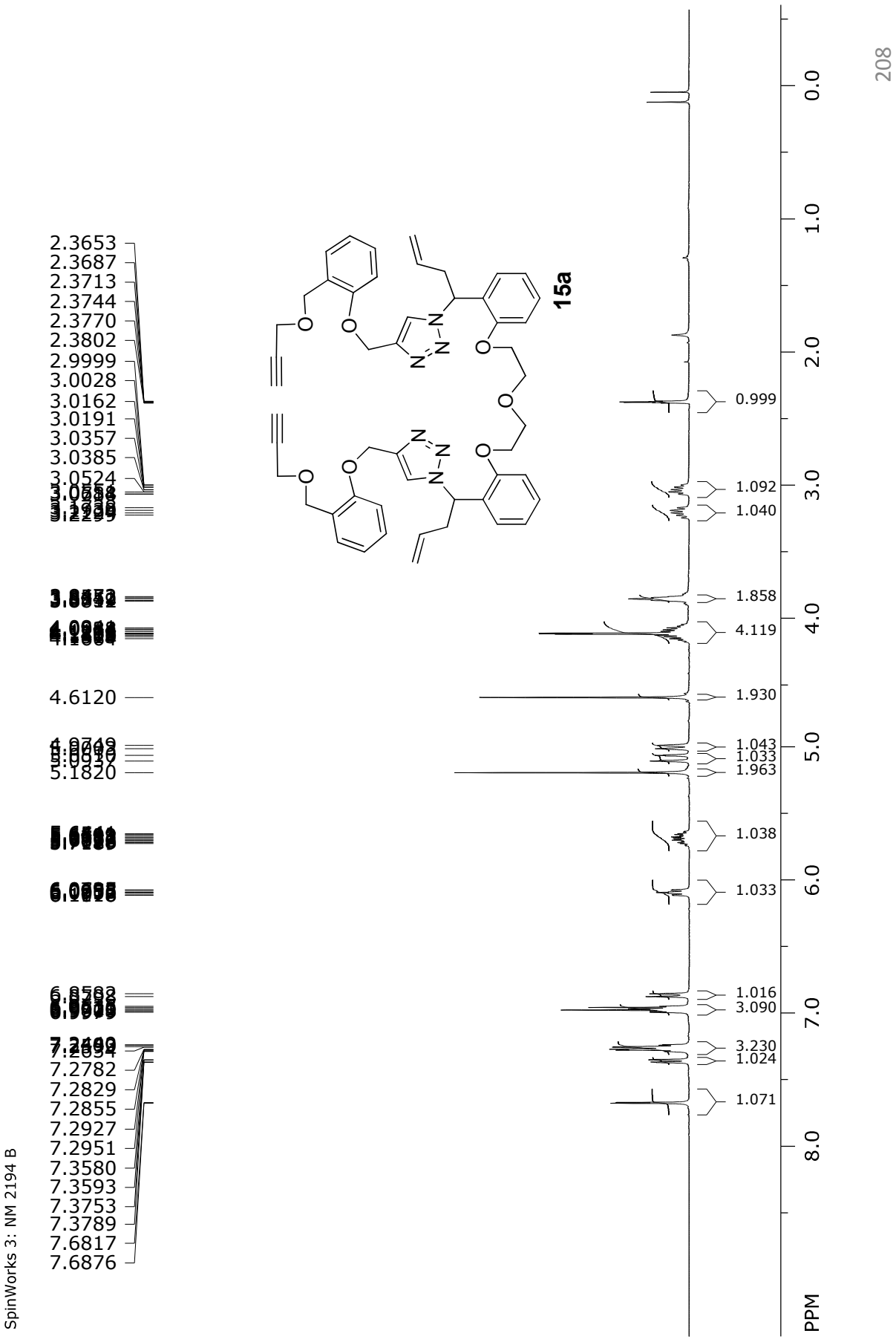
108

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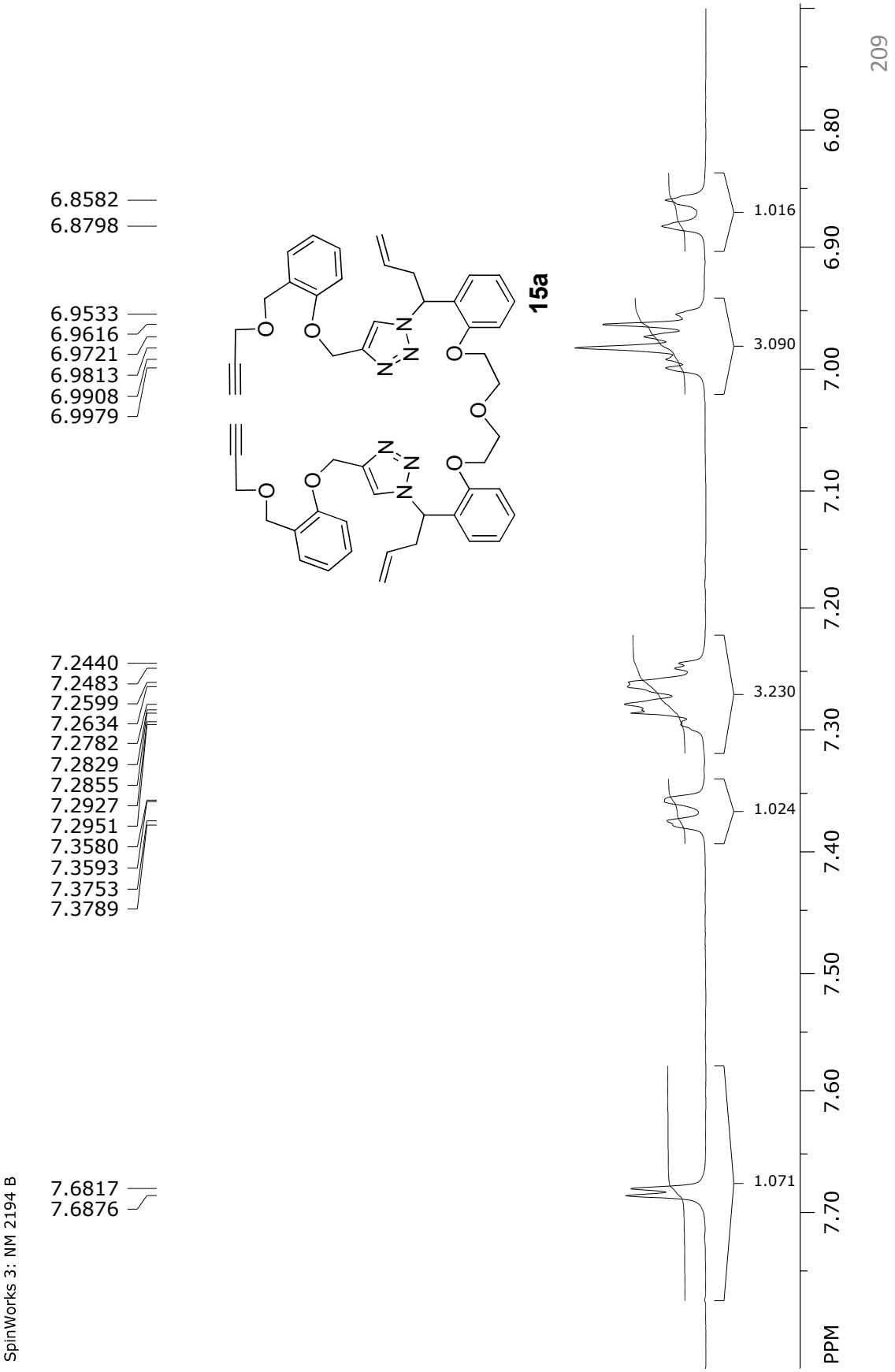
2.3653
2.3687
2.3713
2.3744
2.3770
2.3802
2.9999
3.0028
3.0162
3.0191
3.0357
3.0385
3.0524
4.6120
5.1820
7.2782
7.2829
7.2855
7.2927
7.2951
7.3580
7.3593
7.3753
7.3789
7.6817
7.6876
0.999
1.092
1.040
1.858
4.119
1.930
1.043
1.033
1.963
1.038
1.033
1.016
3.090
3.230
1.024
1.071
PPM
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
SpinWorks 3: NM 2194 B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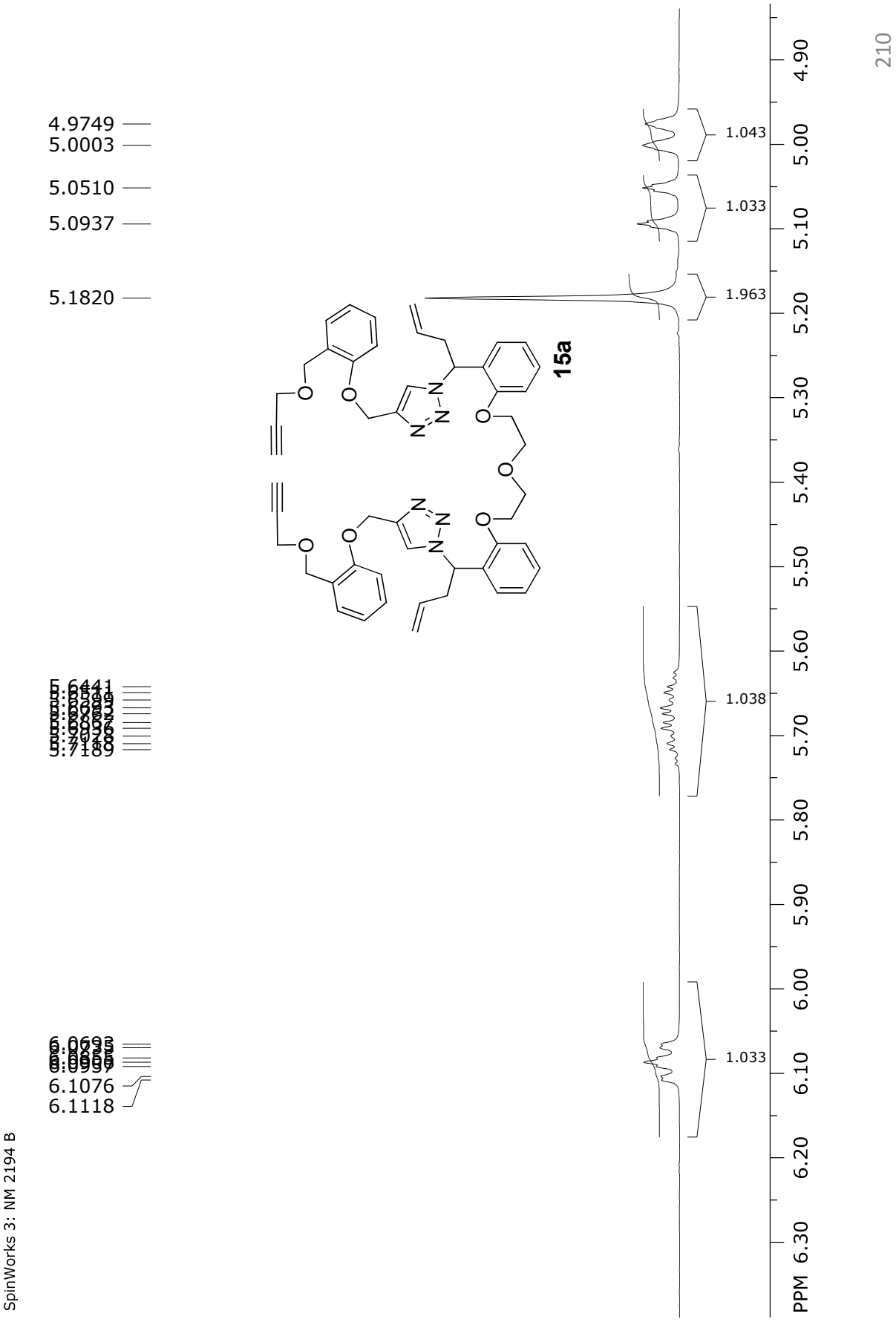
6.9533
6.9616
6.9721
6.9813
6.9908
6.9979
7.2440
7.2483
7.2599
7.2634
7.2782
7.2829
7.2855
7.2927
7.2951
7.3580
7.3593
7.3753
7.3789
7.6817
7.6876
15a
1.016
3.090
3.230
1.024
1.071
6.80
6.90
7.00
7.10
7.20
7.30
7.40
7.50
7.60
7.70
PPM
SpinWorks 3: NM 2194 B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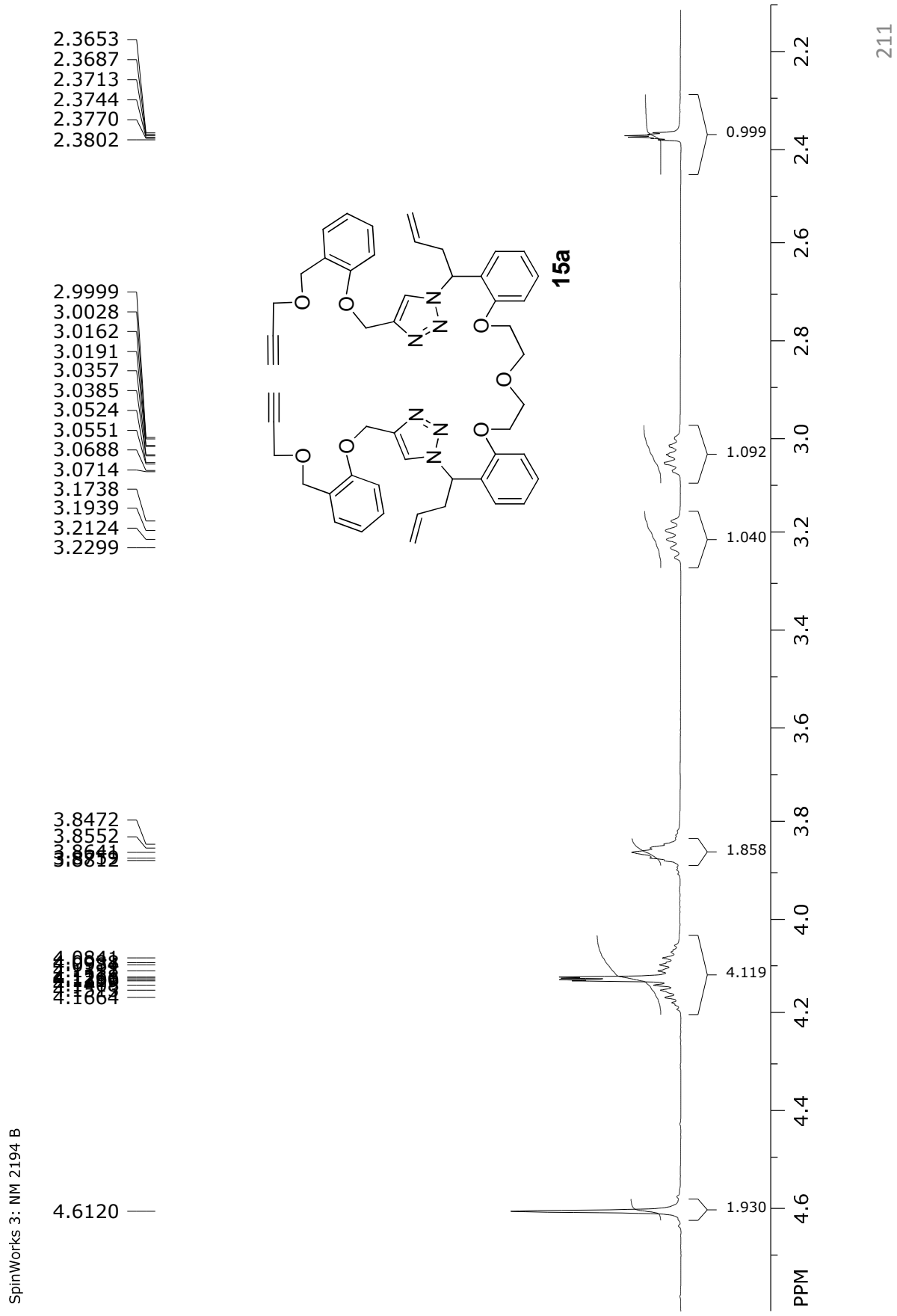
5.0003
5.0510
5.0937
5.1820
5.6441
5.7189
6.0693
6.1076
6.1118
15a
1.043
1.033
1.963
1.038
1.033
PPM 6.30 6.20 6.10 6.00 5.90 5.80 5.70 5.60 5.50 5.40 5.30 5.20 5.10 5.00 4.90
SpinWorks 3: NM 2194 B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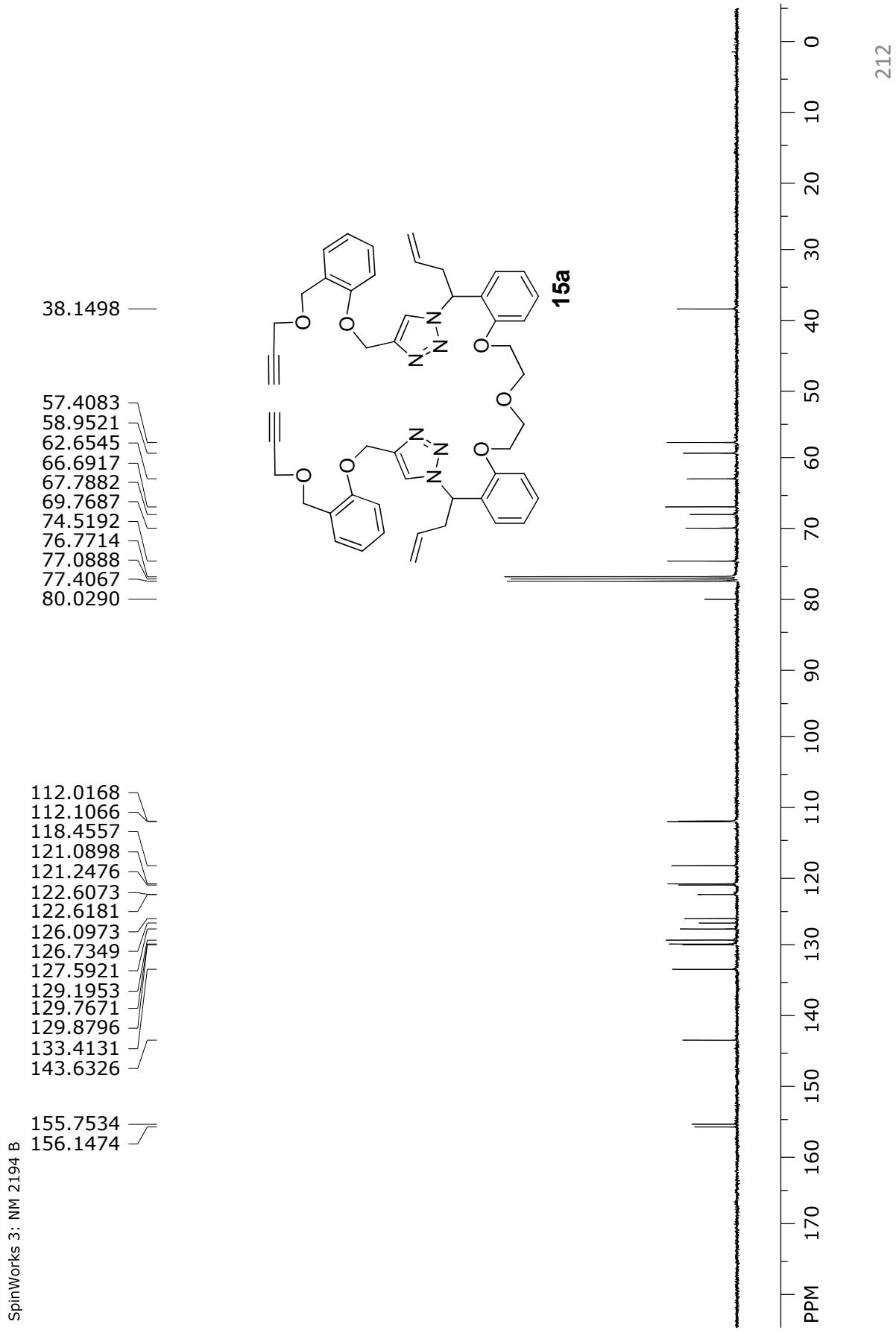
2.3687
2.3713
2.3744
2.3770
2.3802
2.9999
3.0028
3.0162
3.0191
3.0357
3.0385
3.0524
3.0551
3.0688
3.0714
3.1738
3.1939
3.2124
3.2299
3.8472
3.8552
4.6120
0.999
1.092
1.040
1.858
4.119
1.930
15a
PPM
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
SpinWorks 3: NM 2194 B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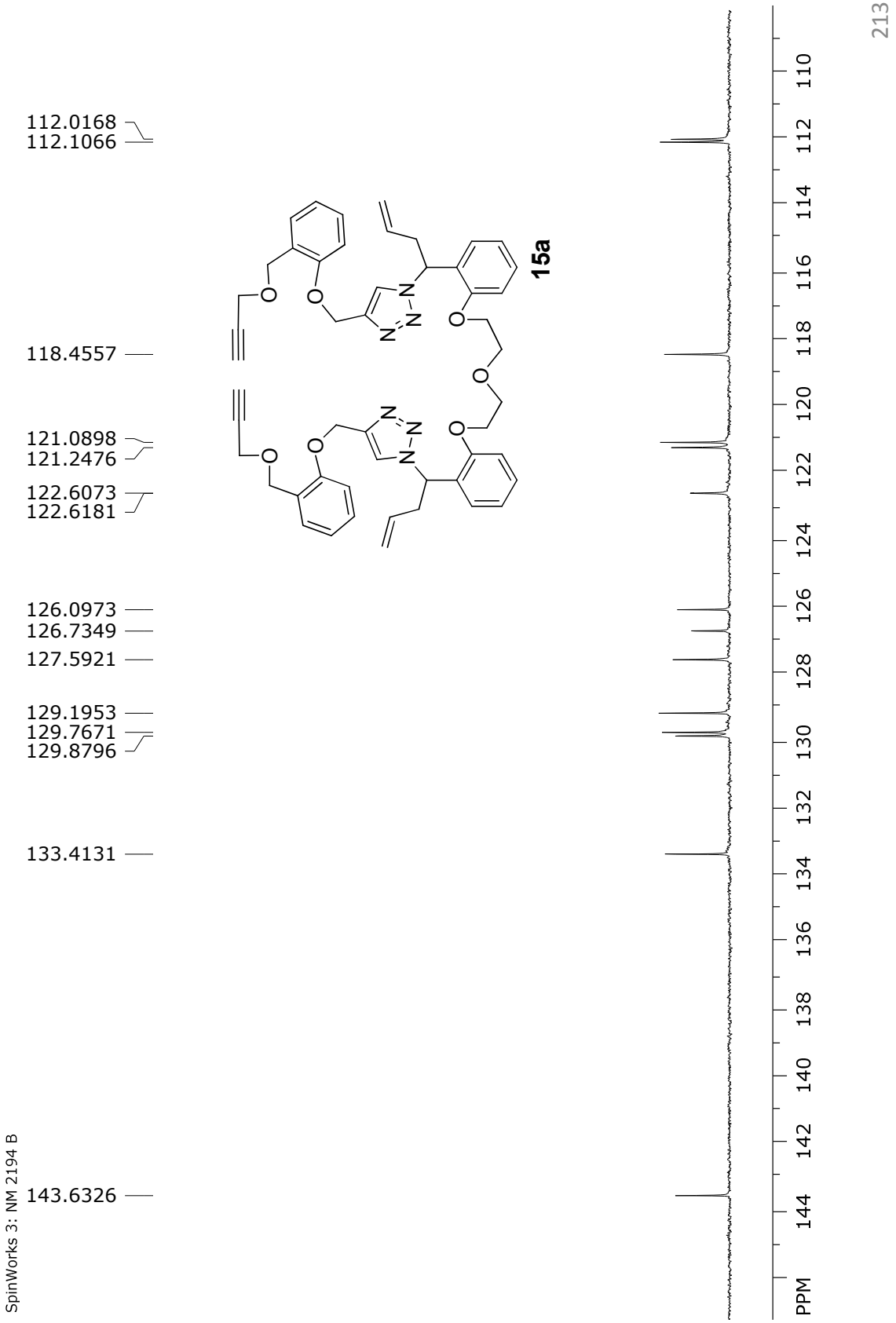
57.4083
58.9521
62.6545
66.6917
67.7882
69.7687
74.5192
76.7714
77.0888
77.4067
80.0290
112.0168
112.1066
118.4557
121.0898
121.2476
122.6073
122.6181
126.0973
126.7349
127.5921
129.1953
129.7671
129.8796
133.4131
143.6326
155.7534
156.1474
15a
PPM
SpinWorks 3: NM 2194 B


112.0168
112.1066
118.4557
121.0898
121.2476
122.6073
122.6181
126.0973
126.7349
127.5921
129.1953
129.7671
129.8796
133.4131
143.6326
15a
SpinWorks 3: NM 2194 B
PPM
144
142
140
138
136
134
132
130
128
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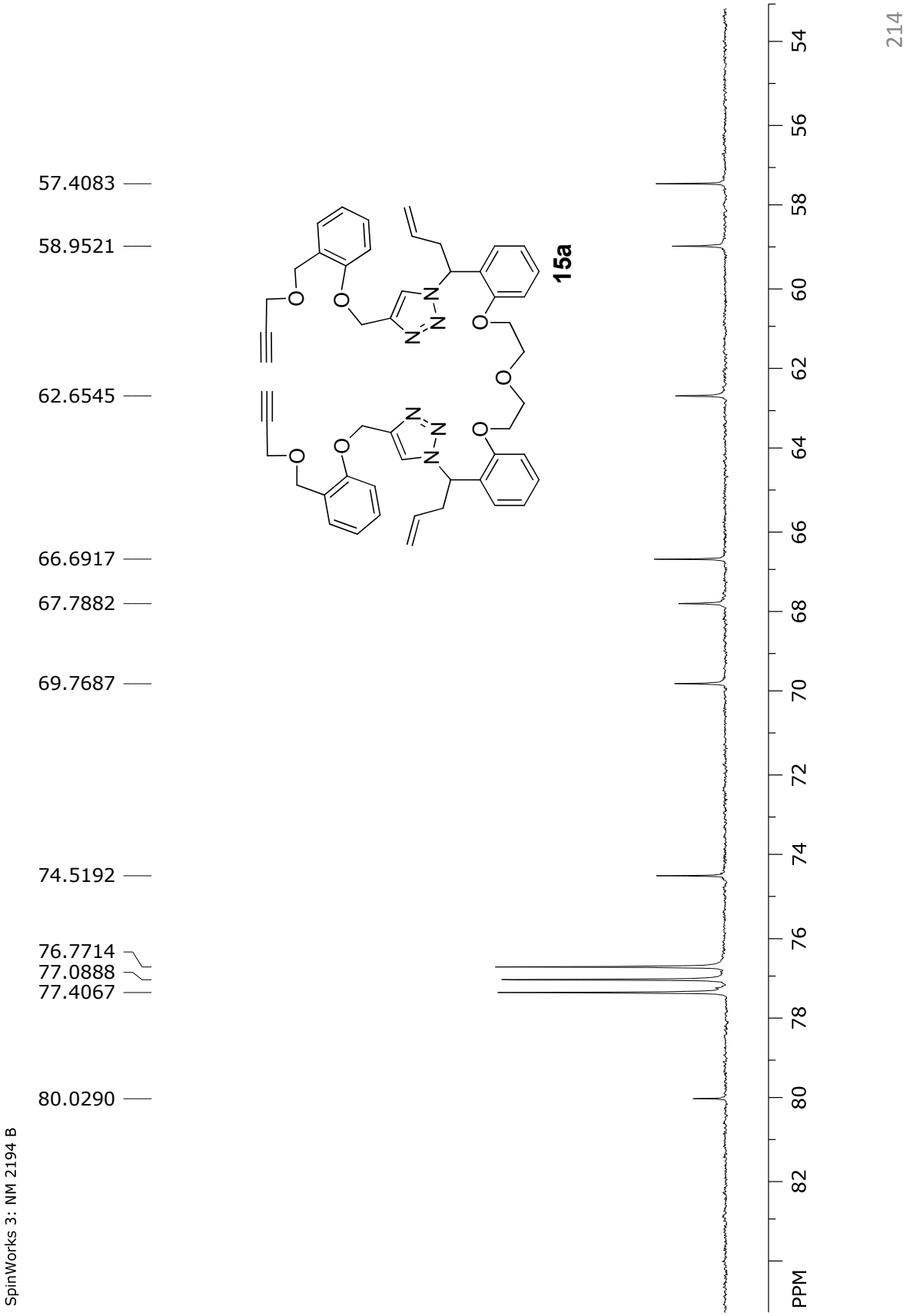
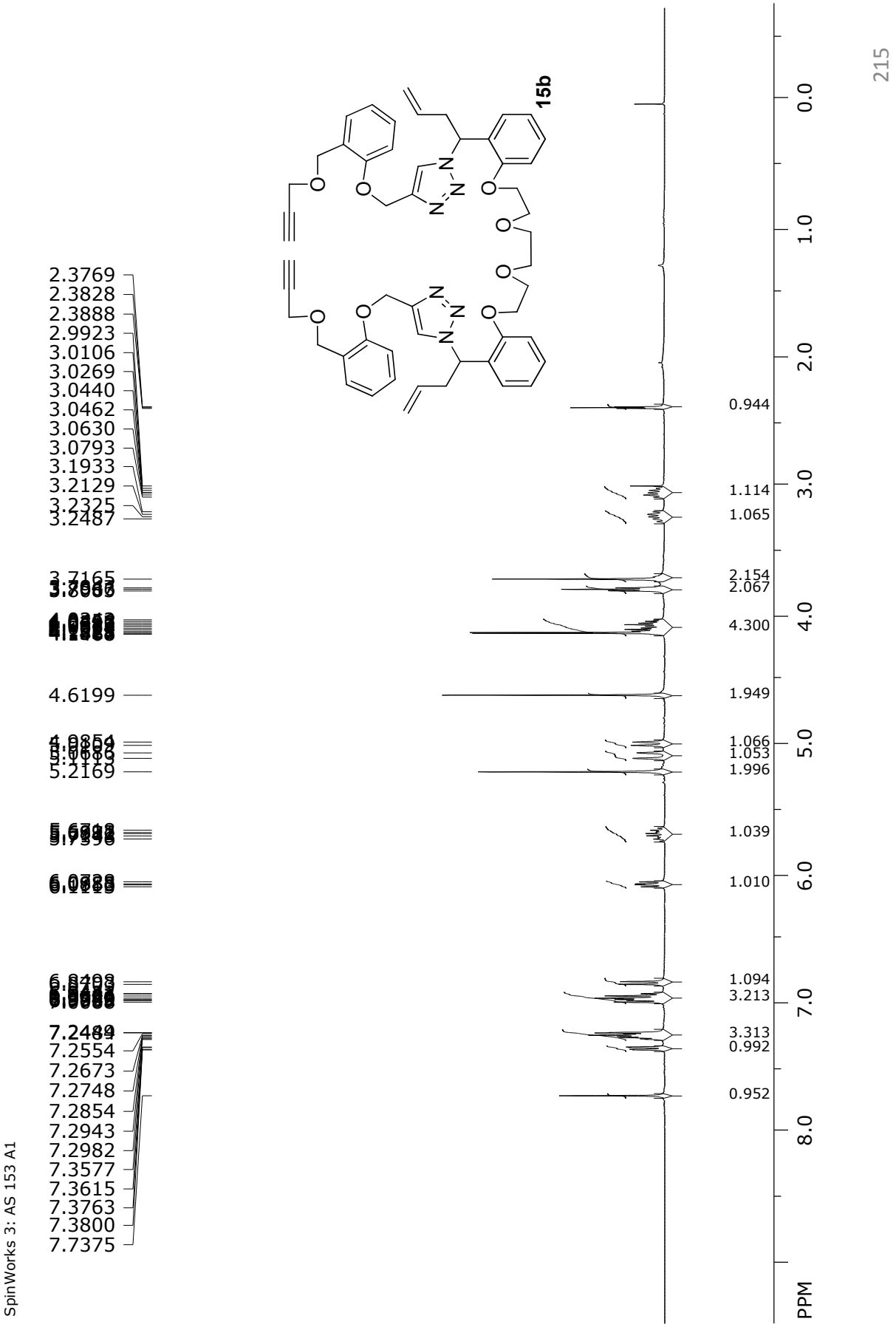
124
122
120
118
116
114
112
110


57.4083
58.9521
62.6545
66.6917
67.7882
69.7687
74.5192
76.7714
77.0888
77.4067
80.0290
15a
SpinWorks 3: NM 2194 B
PPM
54
56
58
60
62
64
66
68
70
72
74
76
78
80
82


15b
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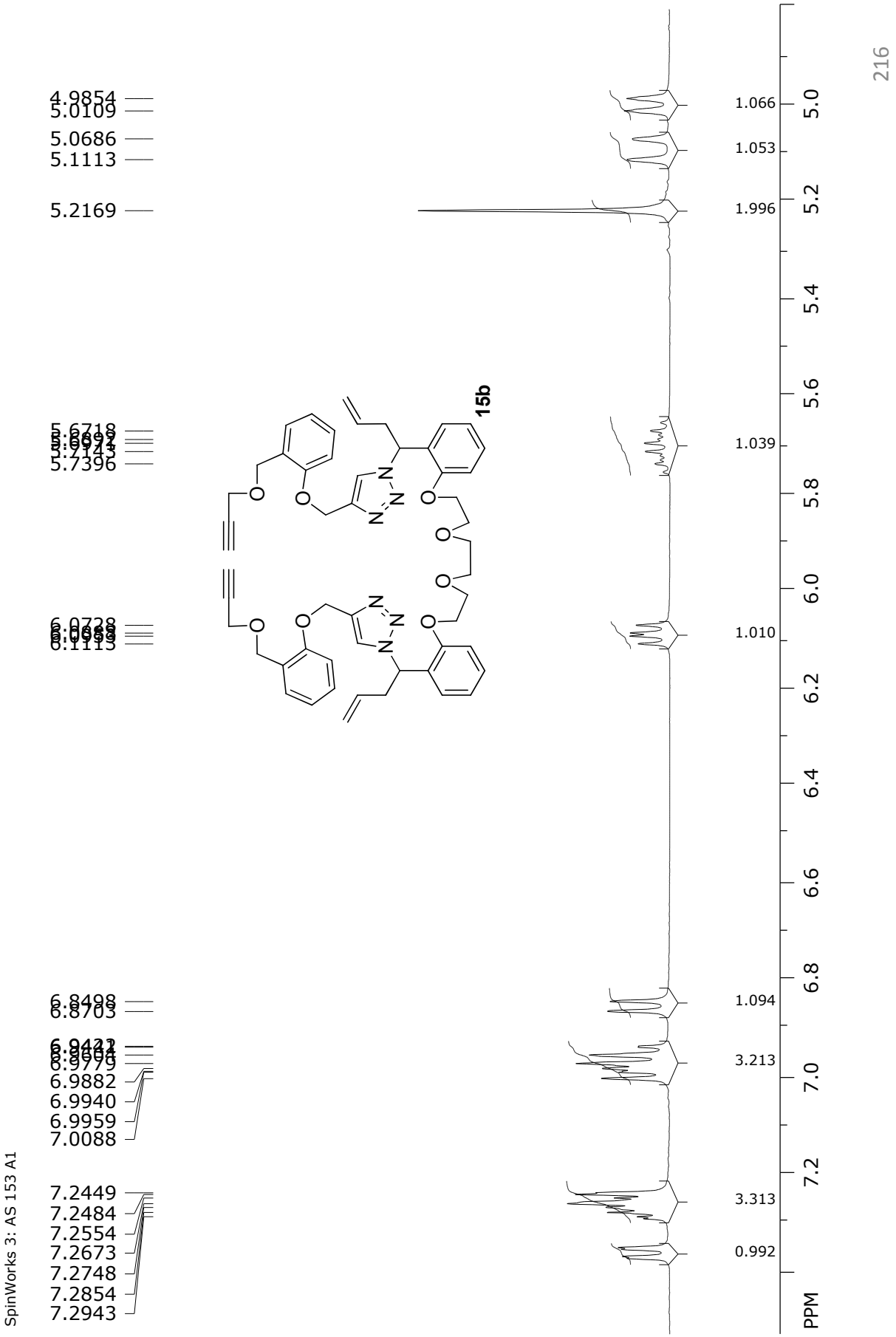
2.3828
2.3888
2.9923
3.0106
3.0269
3.0440
3.0462
3.0630
3.0793
3.1933
3.2129
3.2325
3.2487
4.6199
5.2169
7.2554
7.2673
7.2748
7.2854
7.2943
7.2982
7.3577
7.3615
7.3763
7.3800
7.7375
0.944
1.114
1.065
2.154
2.067
4.300
1.949
1.066
1.053
1.996
1.039
1.010
1.094
3.213
3.313
0.992
0.952
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
PPM
SpinWorks 3: AS 153 A1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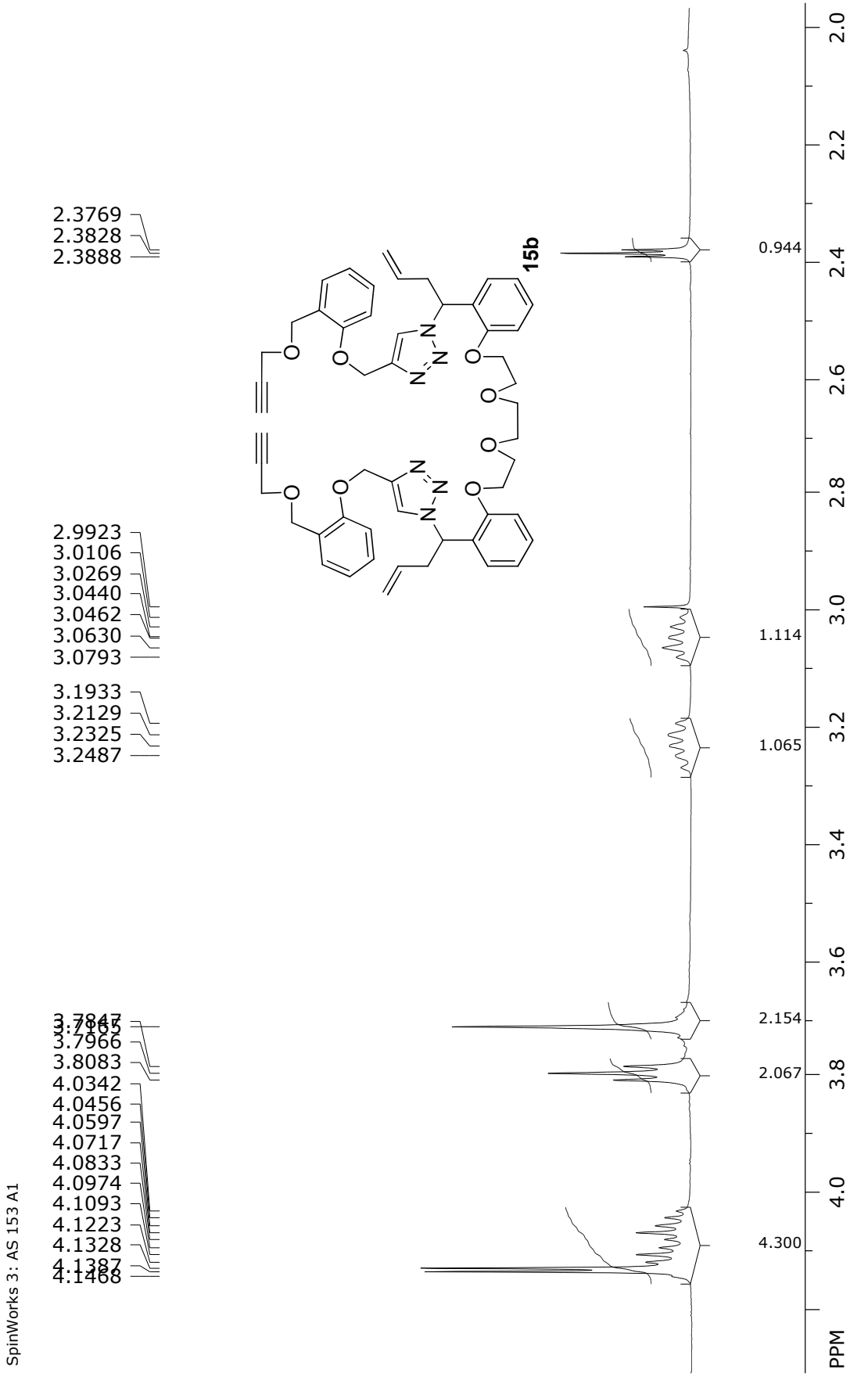
5.6718
5.6992
5.7143
5.7396
6.0728
6.1113
6.8498
6.8703
6.9779
6.9882
6.9940
6.9959
7.0088
7.2449
7.2484
7.2554
7.2673
7.2748
7.2854
7.2943
15b
1.066
1.053
1.996
1.039
1.010
1.094
3.213
3.313
0.992
5.0
5.2
5.4
5.6
5.8
6.0
6.2
6.4
6.6
6.8
7.0
7.2
PPM
SpinWorks 3: AS 153 A1


15b
2.3769
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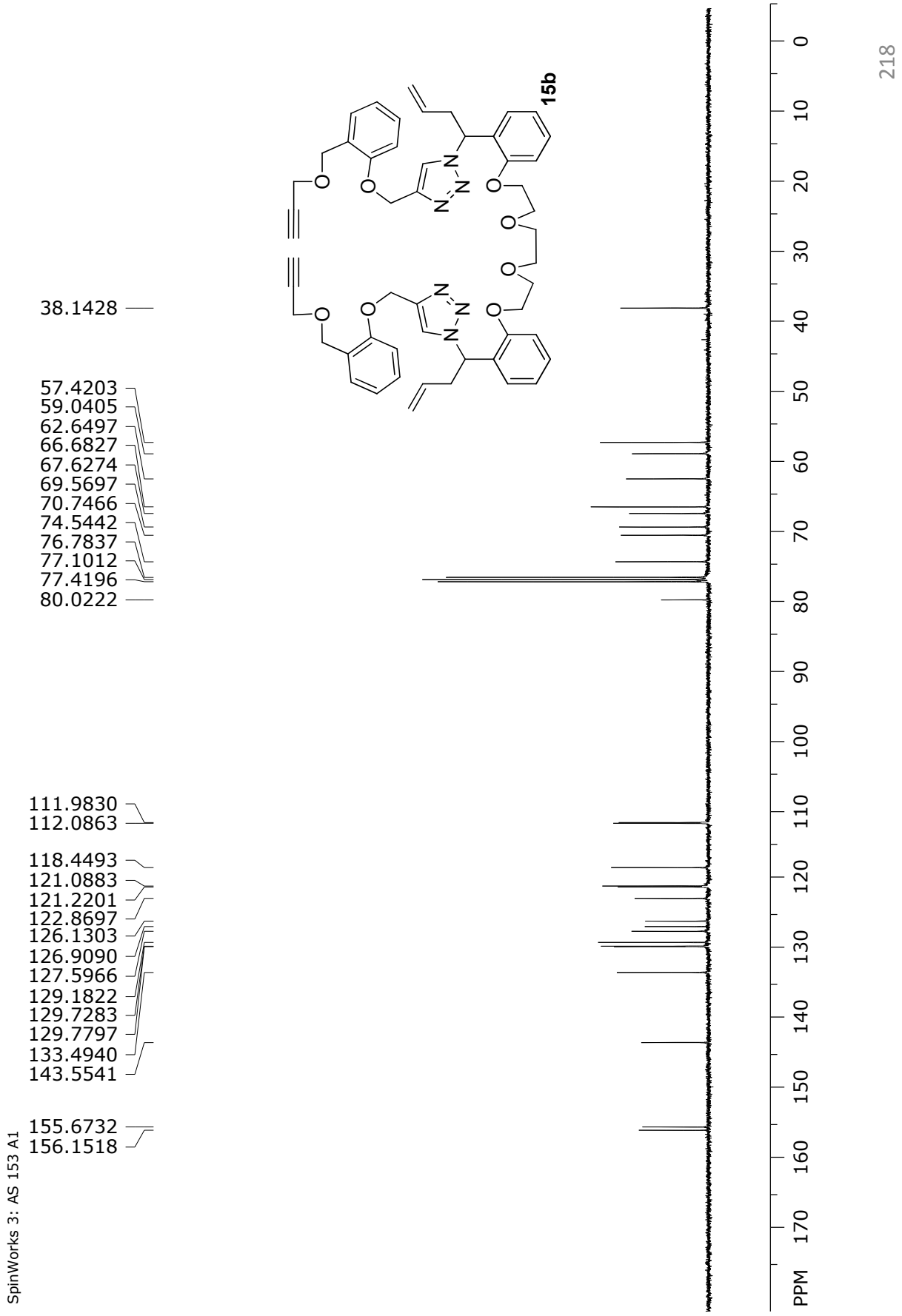
2.3888
2.9923
3.0106
3.0269
3.0440
3.0462
3.0630
3.0793
3.1933
3.2129
3.2325
3.2487
3.7847
3.7966
3.8083
4.0342
4.0456
4.0597
4.0717
4.0833
4.0974
4.1093
4.1223
4.1328
4.1387
4.1468
0.944
1.114
1.065
2.154
2.067
4.300
2.0
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
3.8
4.0
PPM
SpinWorks 3: AS 153 A1


15b
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57.4203
59.0405
62.6497
66.6827
67.6274
69.5697
70.7466
74.5442
76.7837
77.1012
77.4196
80.0222
111.9830
112.0863
118.4493
121.0883
121.2201
122.8697
126.1303
126.9090
127.5966
129.1822
129.7283
129.7797
133.4940
143.5541
155.6732
156.1518
SpinWorks 3: AS 153 A1
PPM
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20
30
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80
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100
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120
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140
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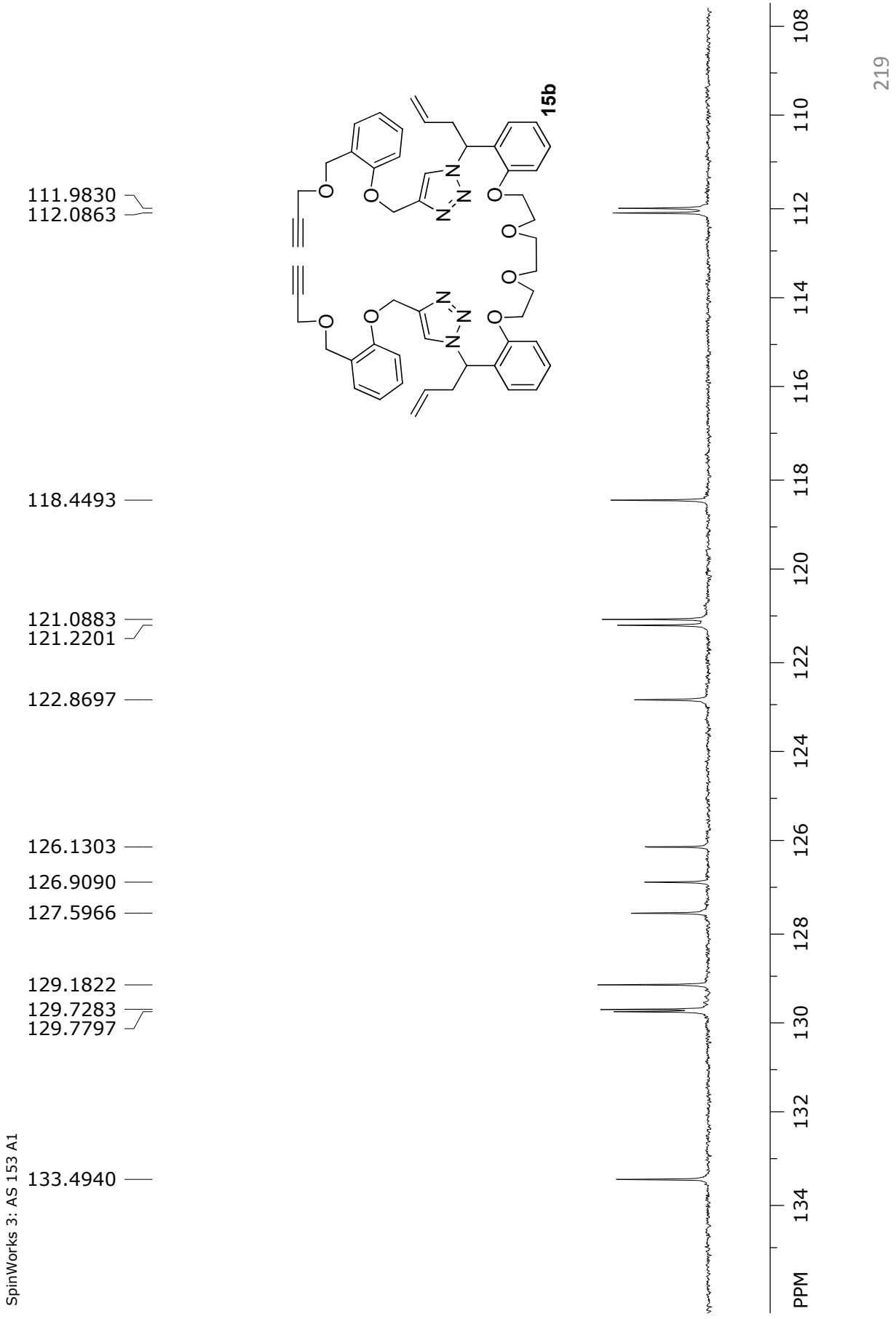
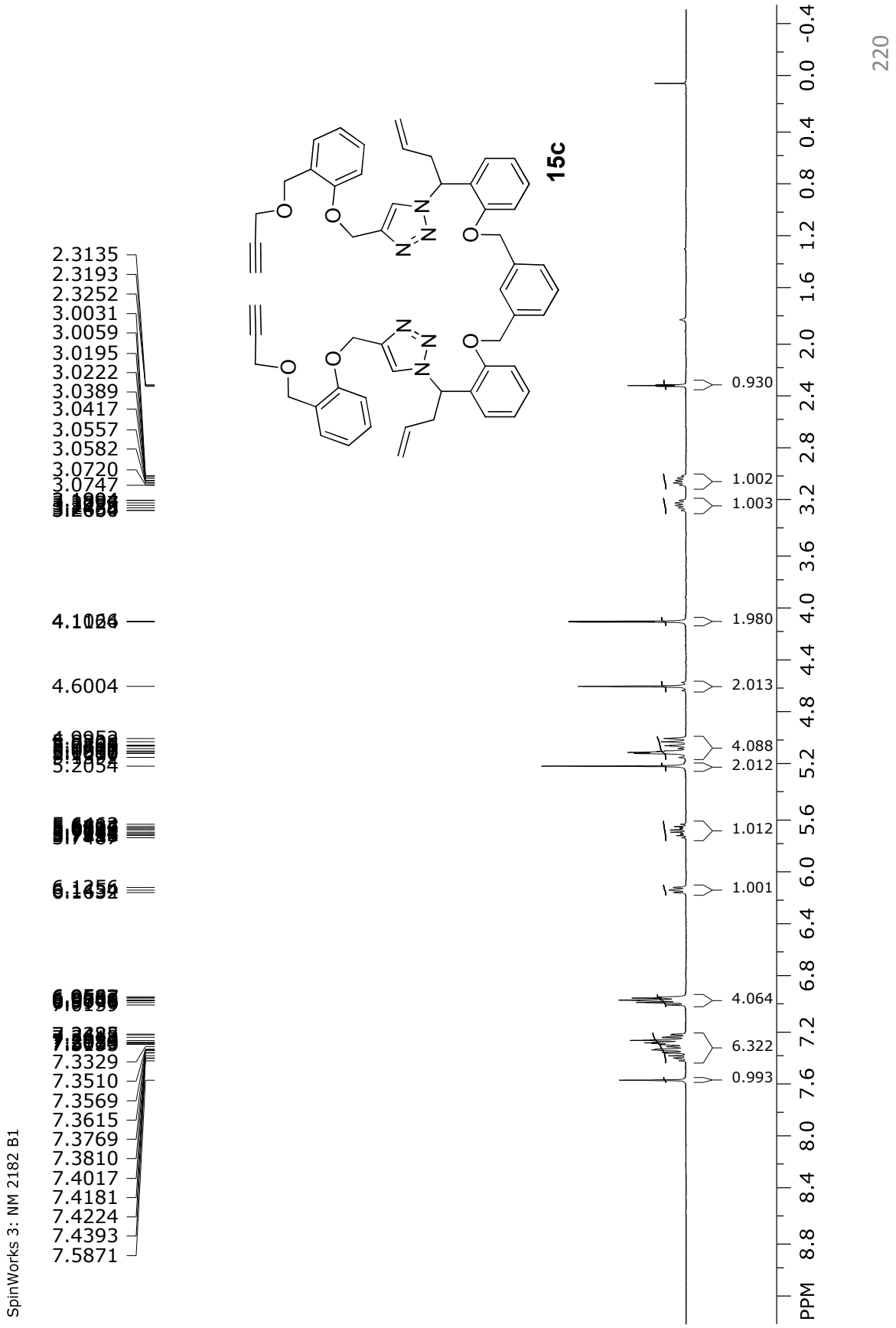
160
170


15b
111.9830
112.0863
118.4493
121.0883
121.2201
122.8697
126.1303
126.9090
127.5966
129.1822
129.7283
129.7797
133.4940
PPM
108
110
112
114
116
118
120
122
124
126
128
130
132
134
SpinWorks 3: AS 153 A1


15c
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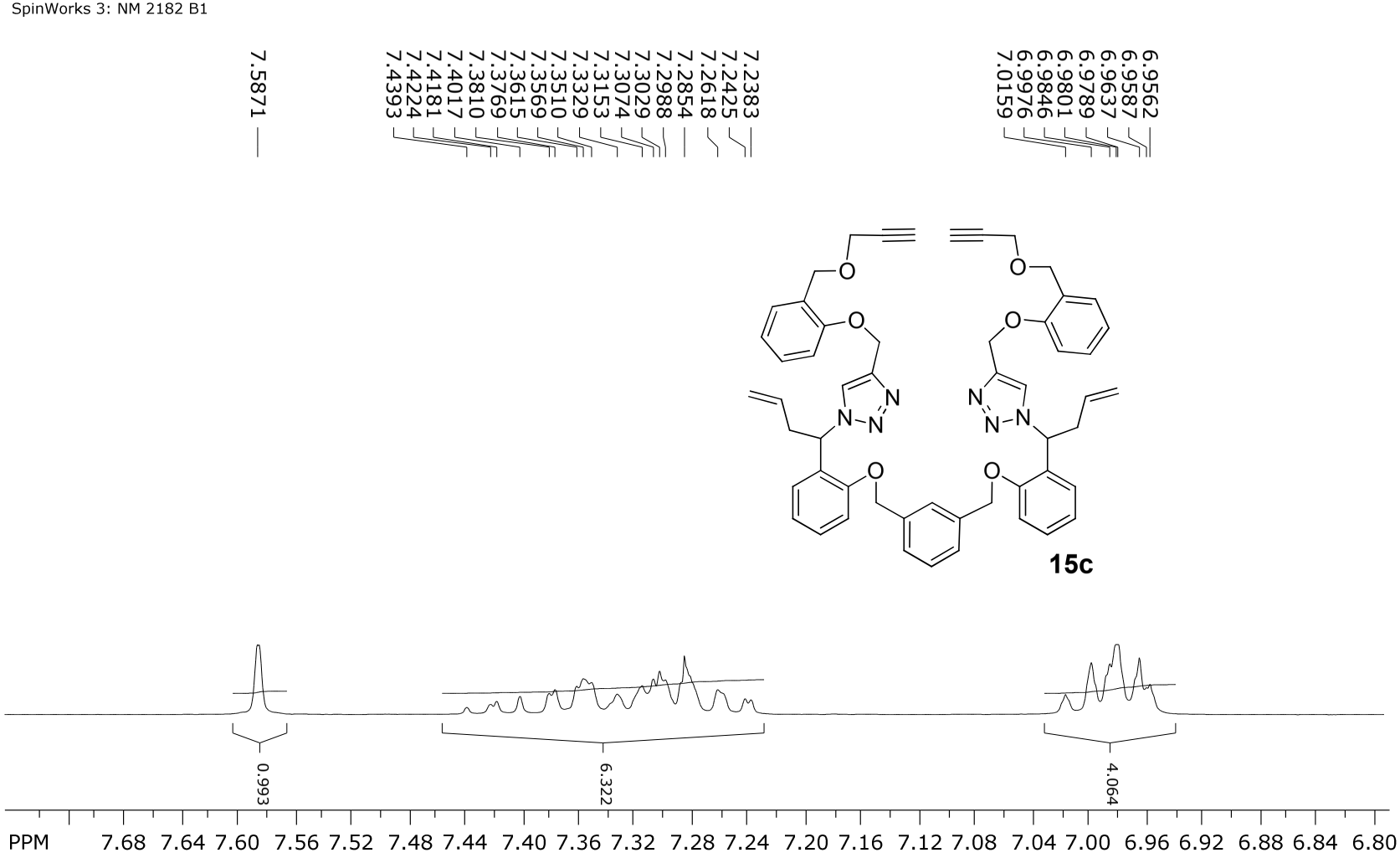
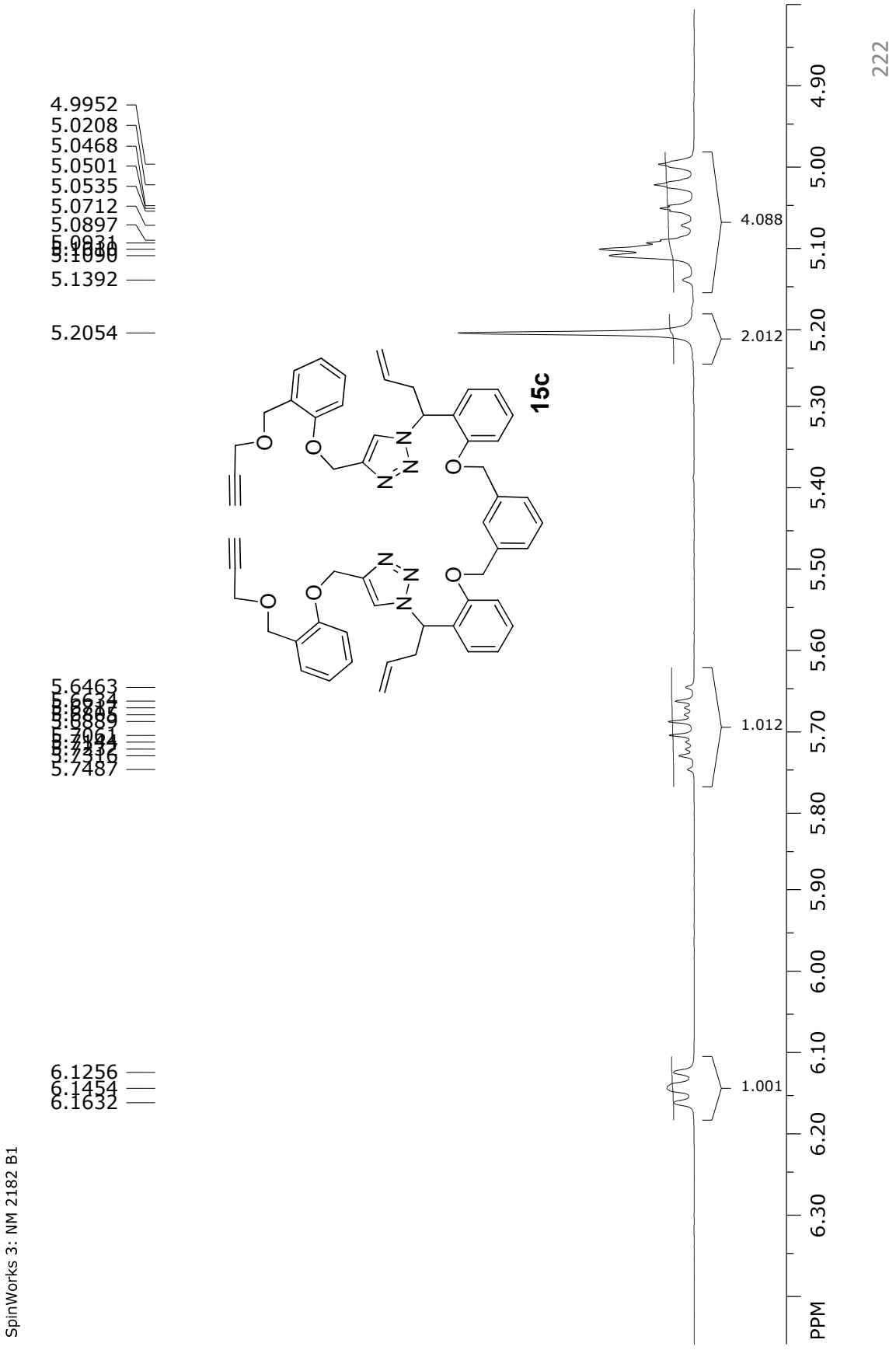
2.3193
2.3252
3.0031
3.0059
3.0195
3.0222
3.0389
3.0417
3.0557
3.0582
3.0720
3.0747
4.6004
5.2054
7.3329
7.3510
7.3569
7.3615
7.3769
7.3810
7.4017
7.4181
7.4224
7.4393
7.5871
0.930
1.002
1.003
1.980
2.013
4.088
2.012
1.012
1.001
4.064
6.322
0.993
PPM
SpinWorks 3: NM 2182 B1

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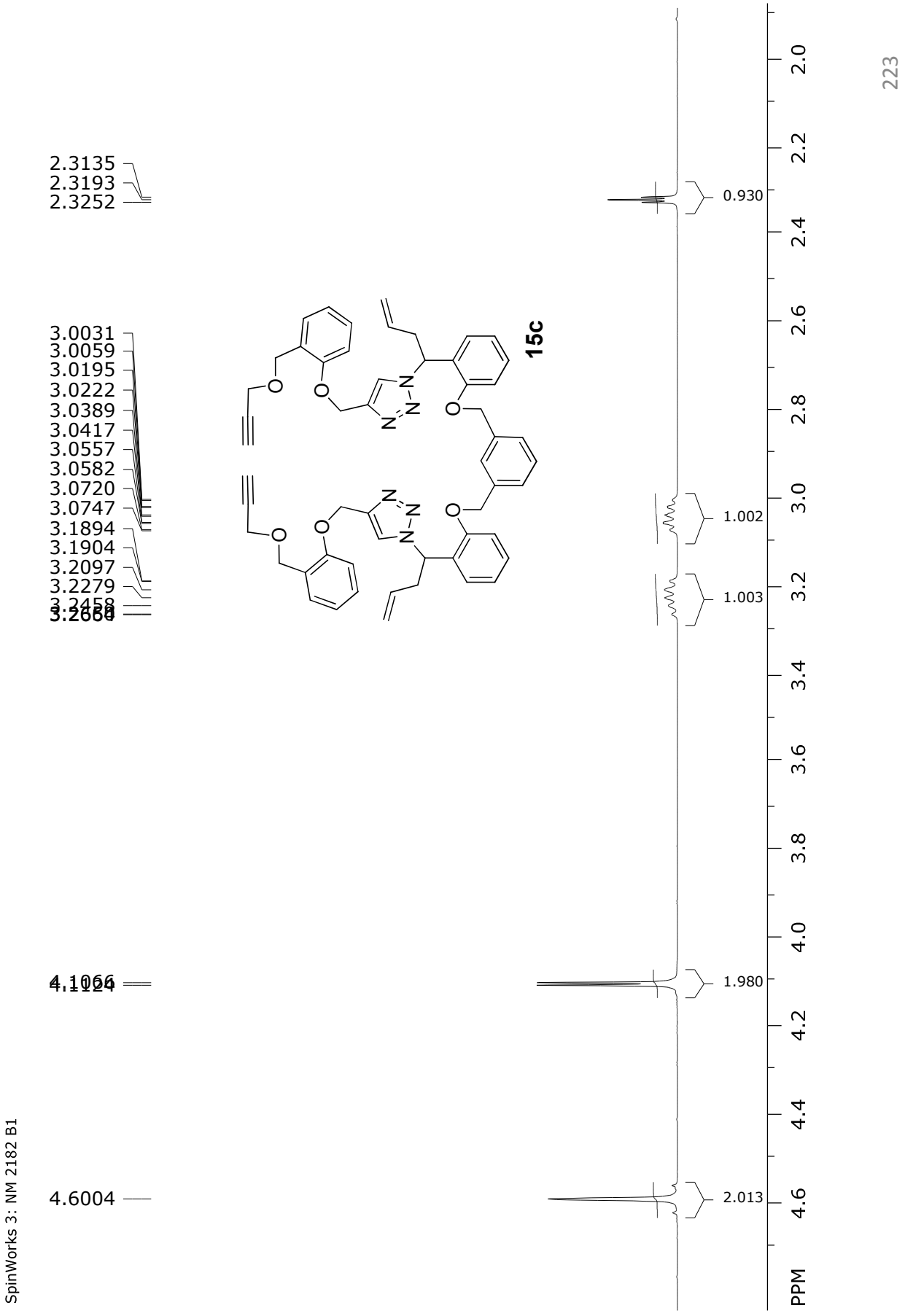
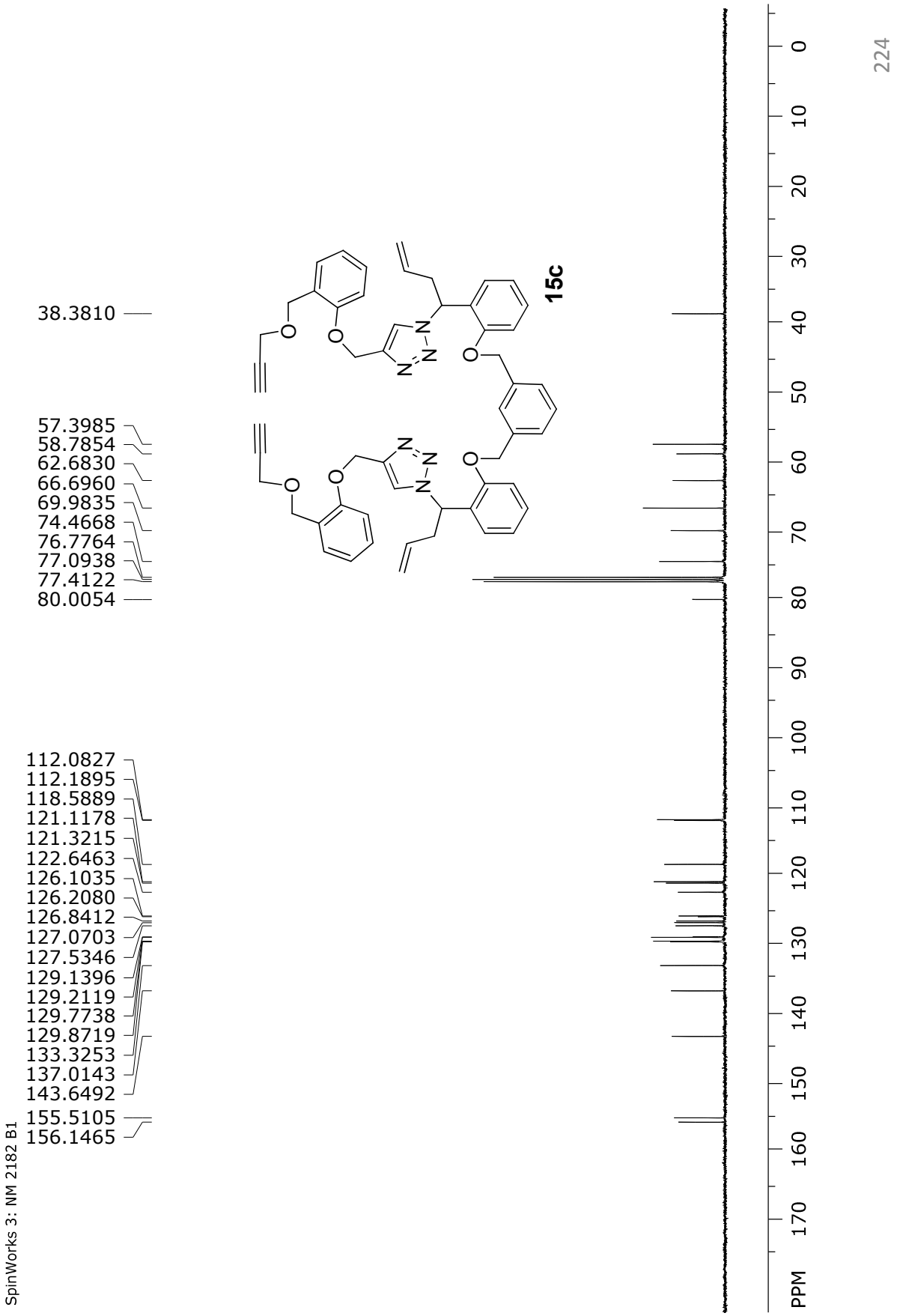
5.0468
5.0501
5.0535
5.0712
5.0897
5.1392
5.2054
5.6463
6.1256
6.1454
6.1632
15c
4.088
2.012
1.012
1.001
PPM
4.90
5.00
5.10
5.20
5.30
5.40
5.50
5.60
5.70
5.80
5.90
6.00
6.10
6.20
6.30
SpinWorks 3: NM 2182 B1


2.3135
2.3193
2.3252
3.0031
3.0059
3.0195
3.0222
3.0389
3.0417
3.0557
3.0582
3.0720
3.0747
3.1894
3.1904
3.2097
3.2279
4.1066
4.1124
4.6004
15c
0.930
1.002
1.003
1.980
2.013
PPM
2.0
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
SpinWorks 3: NM 2182 B1


15c
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69.9835
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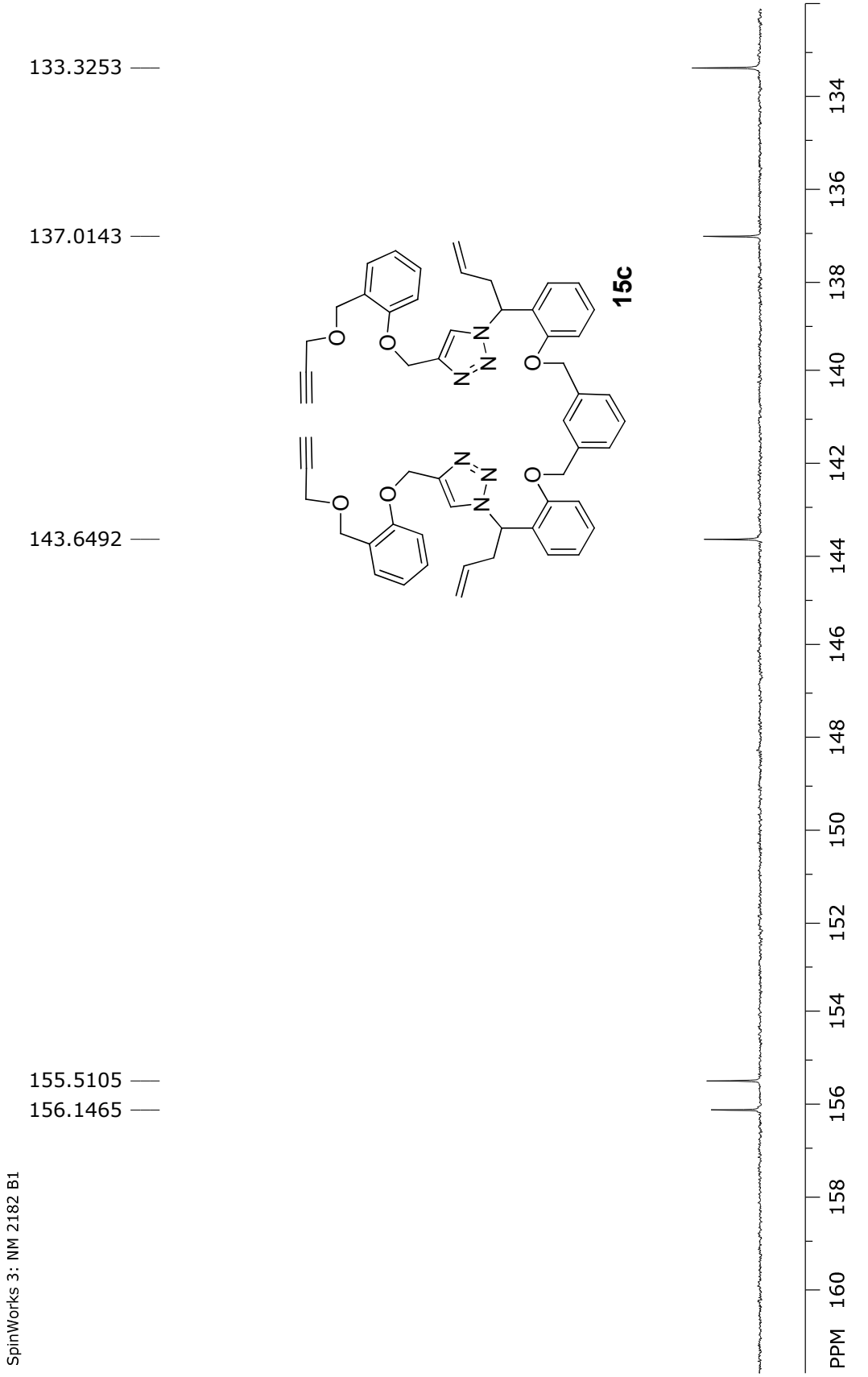
76.7764
77.0938
77.4122
80.0054
112.0827
112.1895
118.5889
121.1178
121.3215
122.6463
126.1035
126.2080
126.8412
127.0703
127.5346
129.1396
129.2119
129.7738
129.8719
133.3253
137.0143
143.6492
155.5105
156.1465
SpinWorks 3: NM 2182 B1
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170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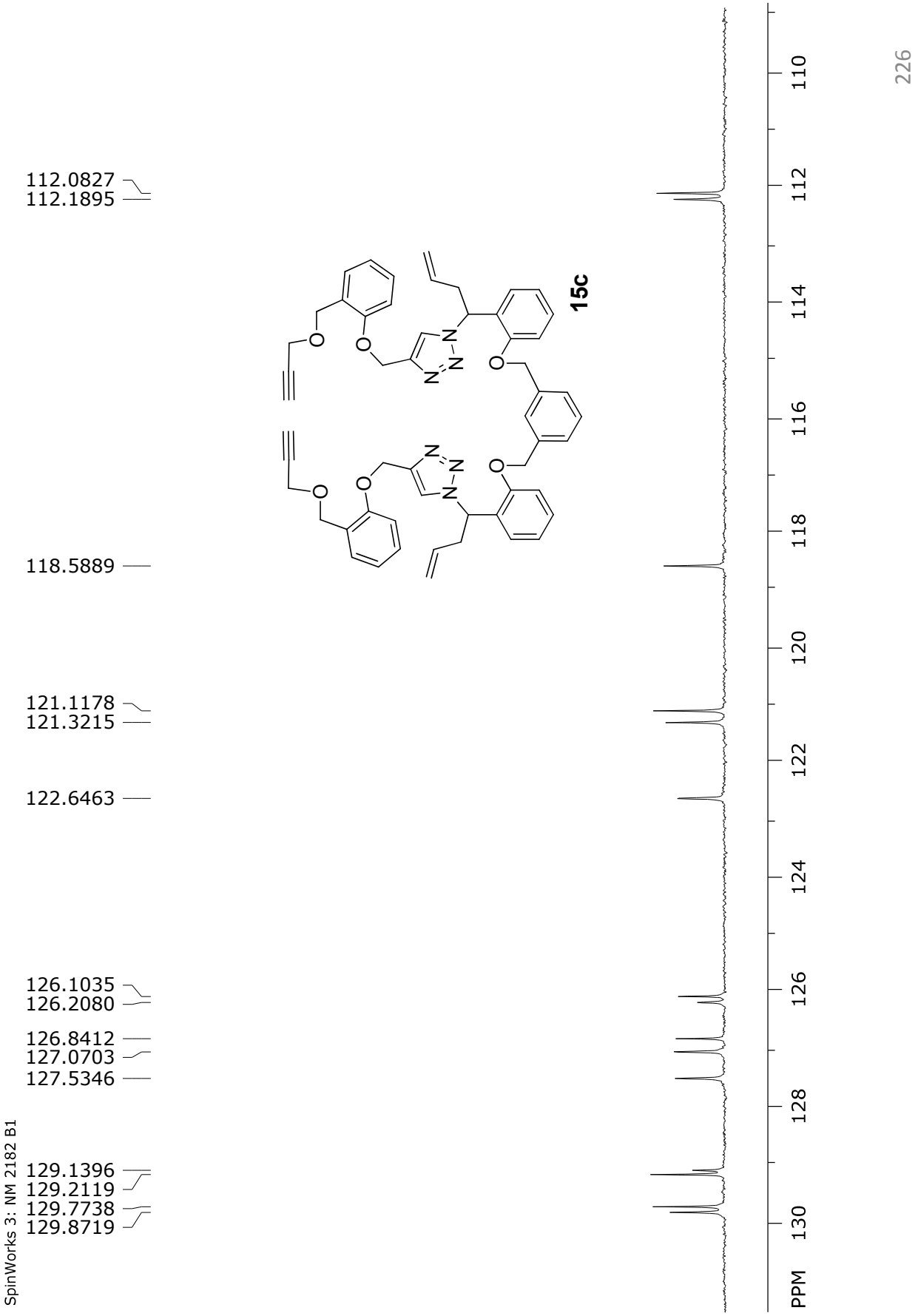
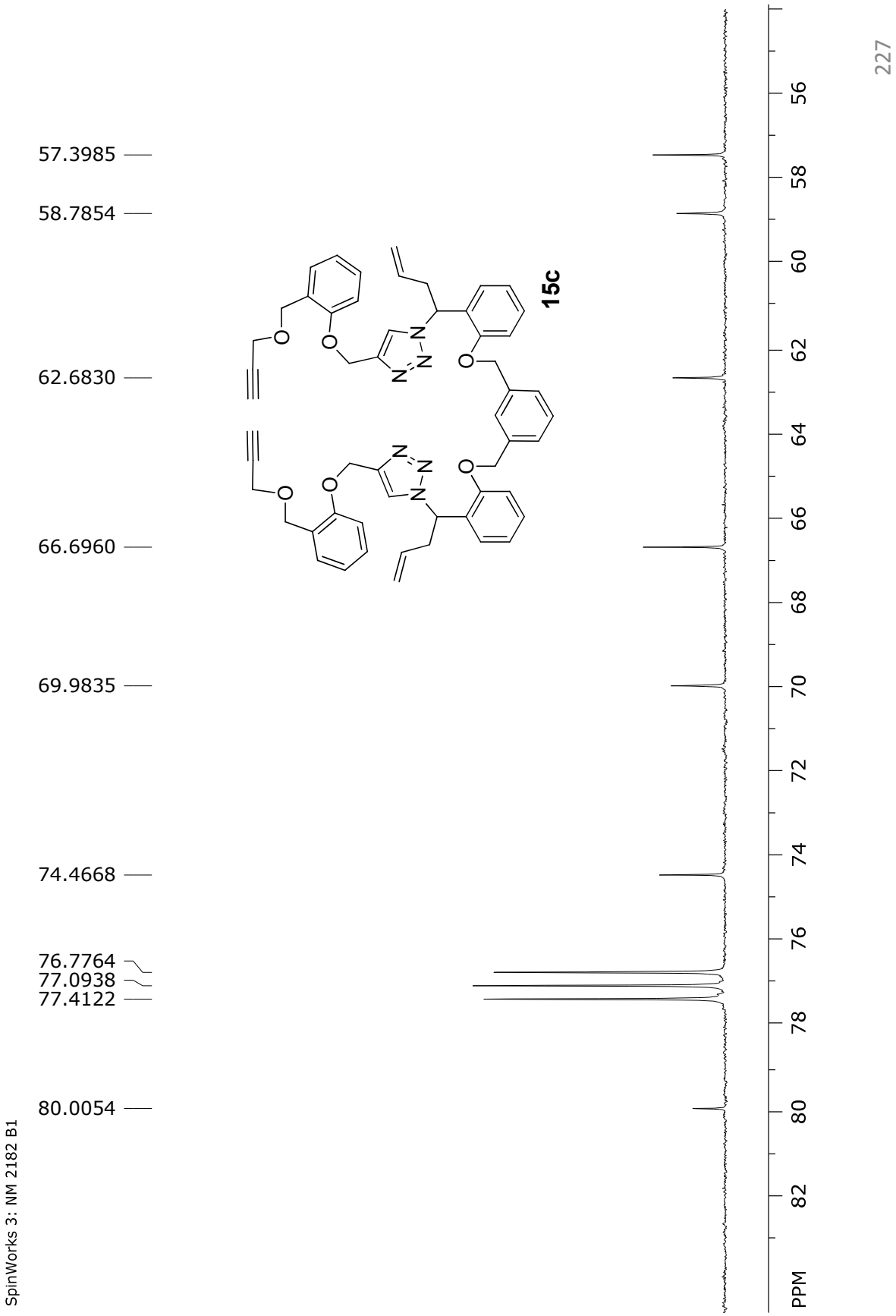
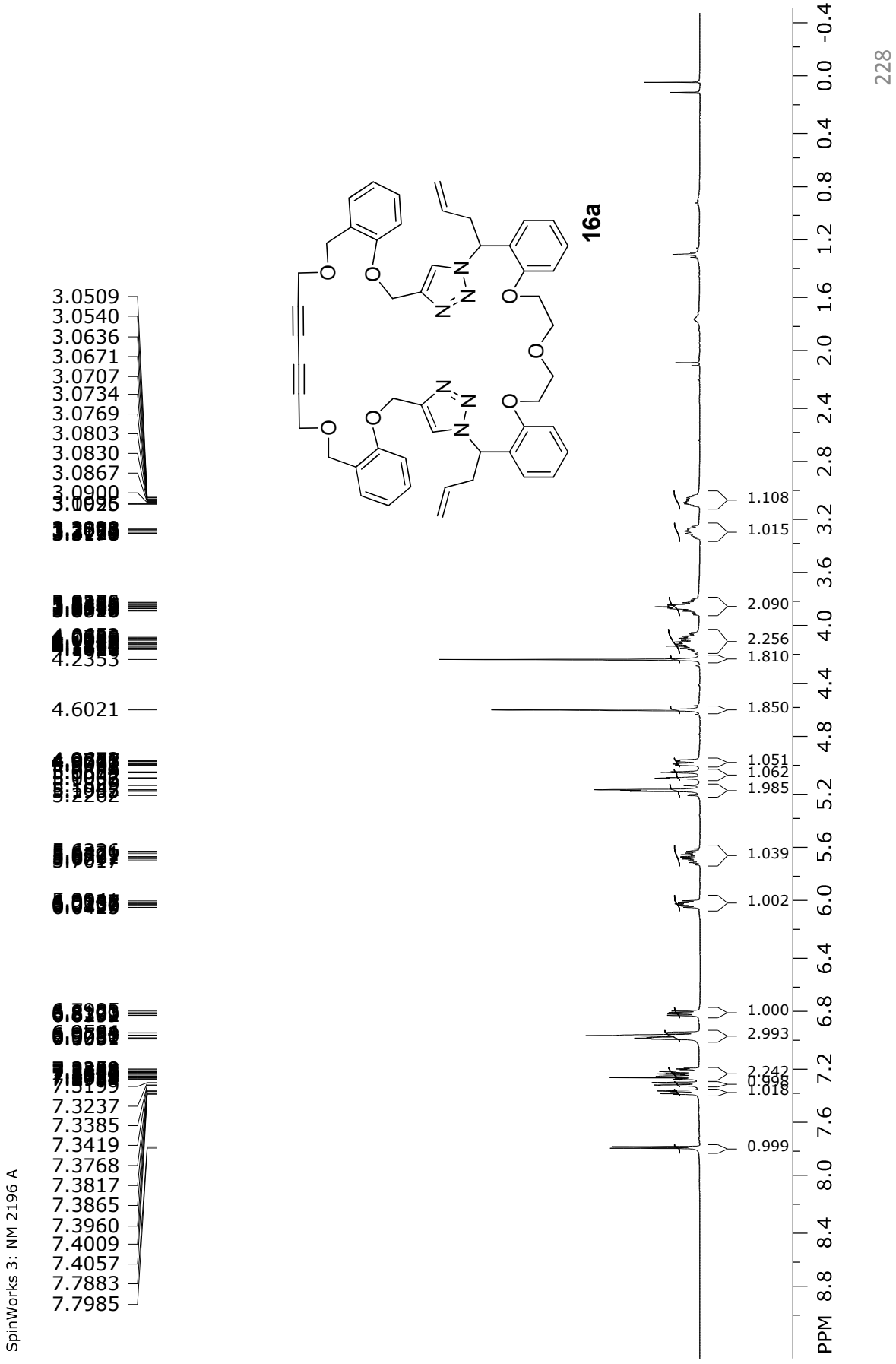
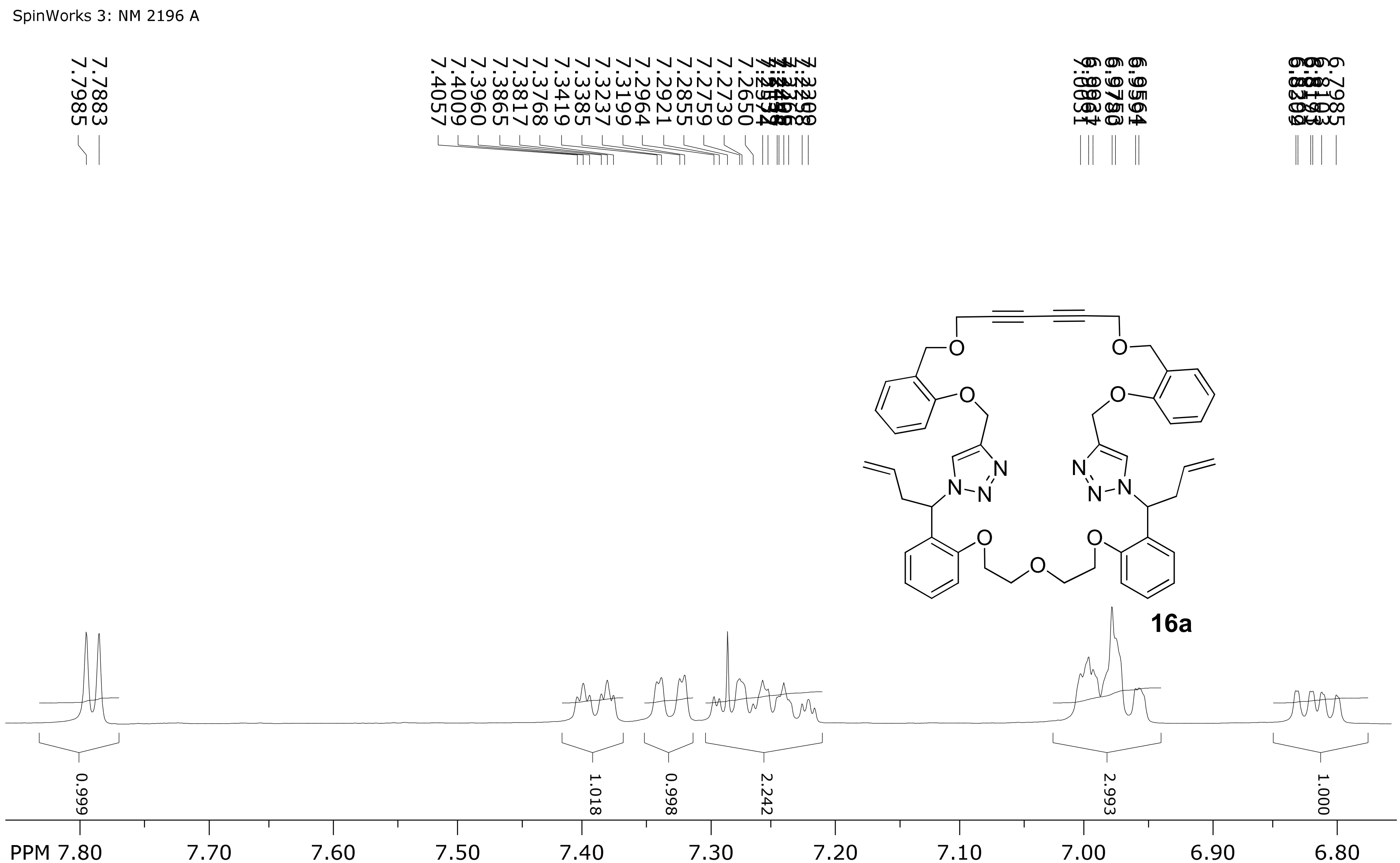
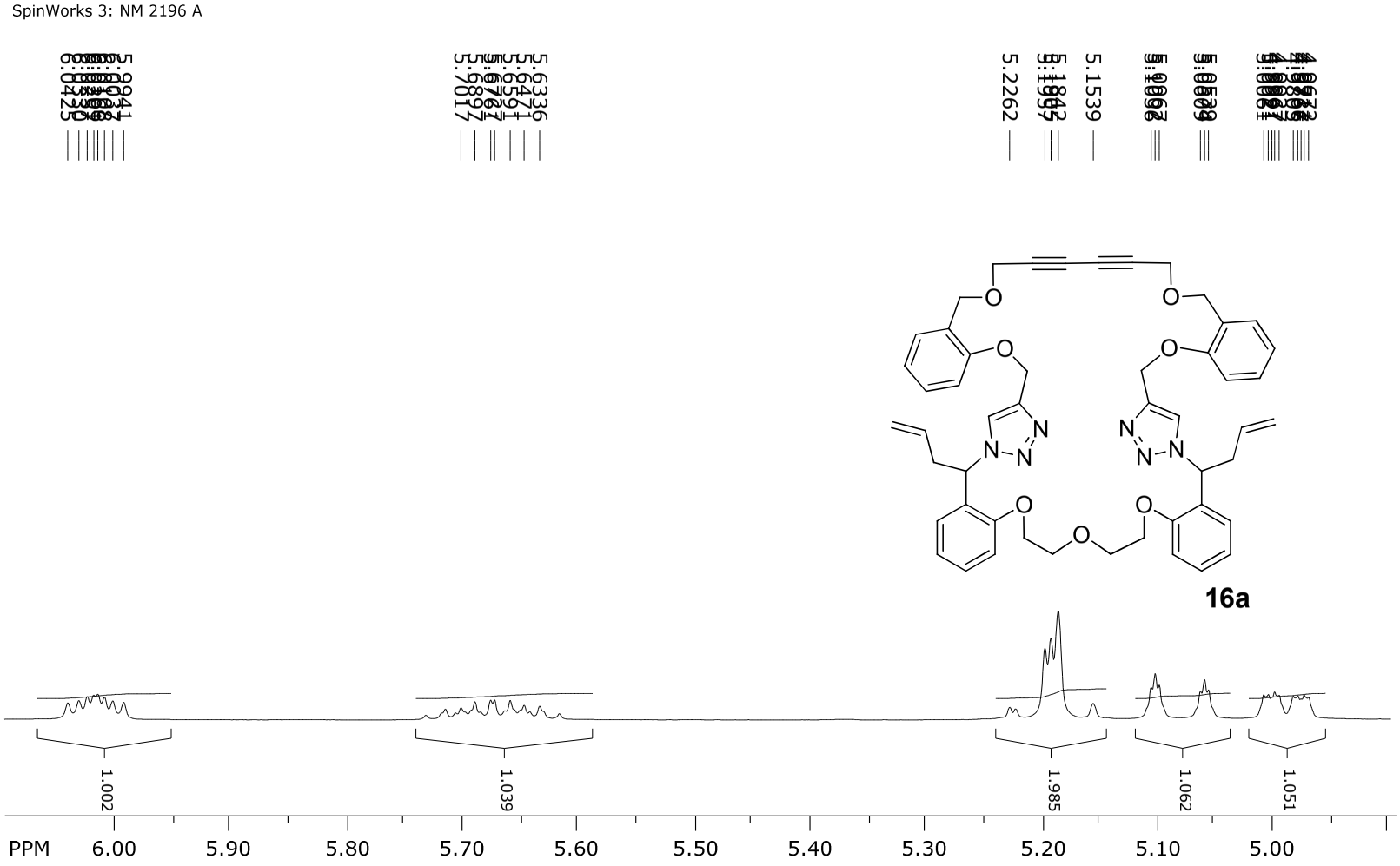
137.0143
143.6492
155.5105
156.1465
15c
PPM 160 158 156 154 152 150 148 146 144 142 140 138 136 134
SpinWorks 3: NM 2182 B1

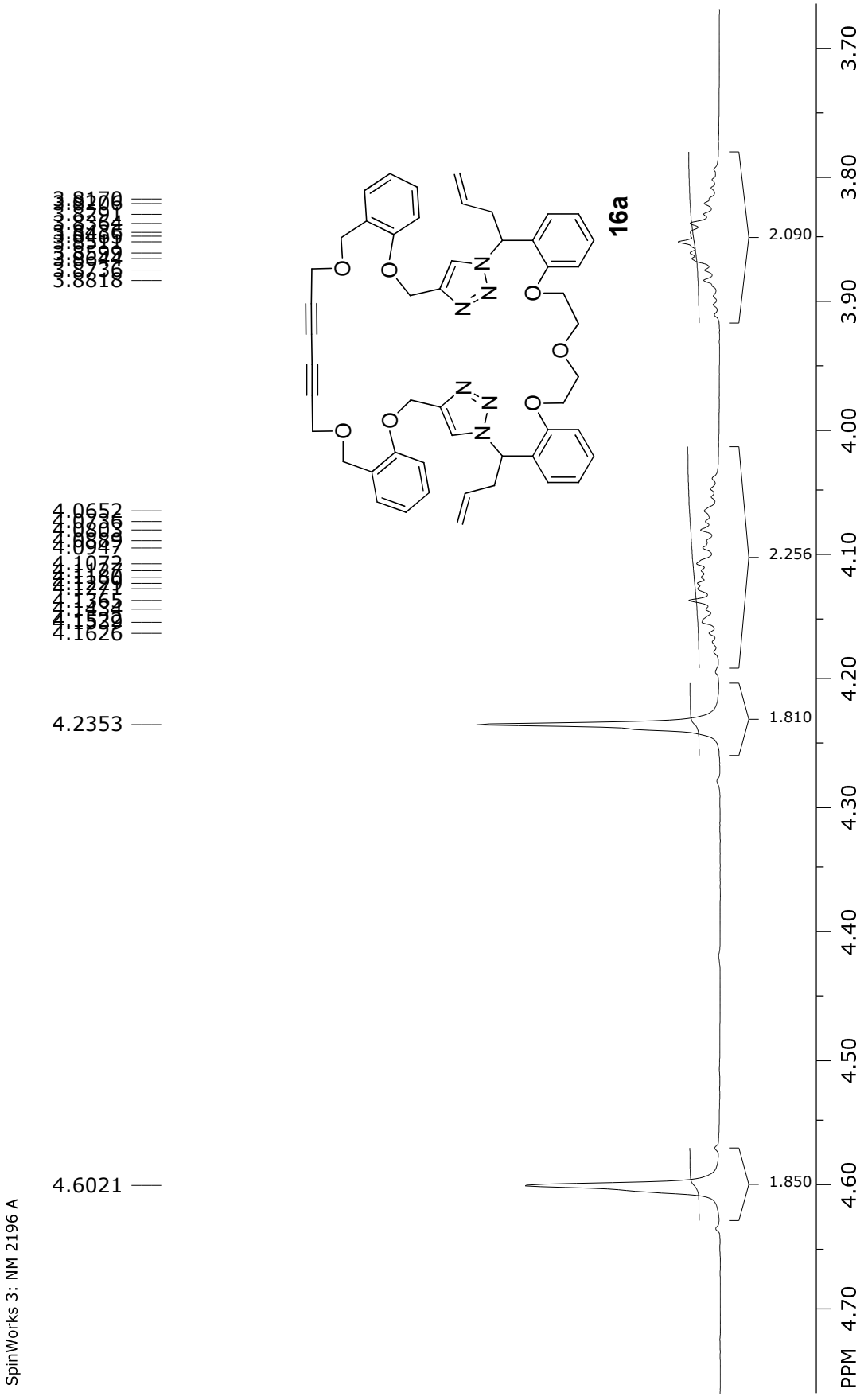

112.0827
112.1895
118.5889
121.1178
121.3215
122.6463
126.1035
126.2080
126.8412
127.0703
127.5346
129.1396
129.2119
129.7738
129.8719
SpinWorks 3: NM 2182 B1
15c
PPM
110
112
114
116
118
120
122
124
126
128
130

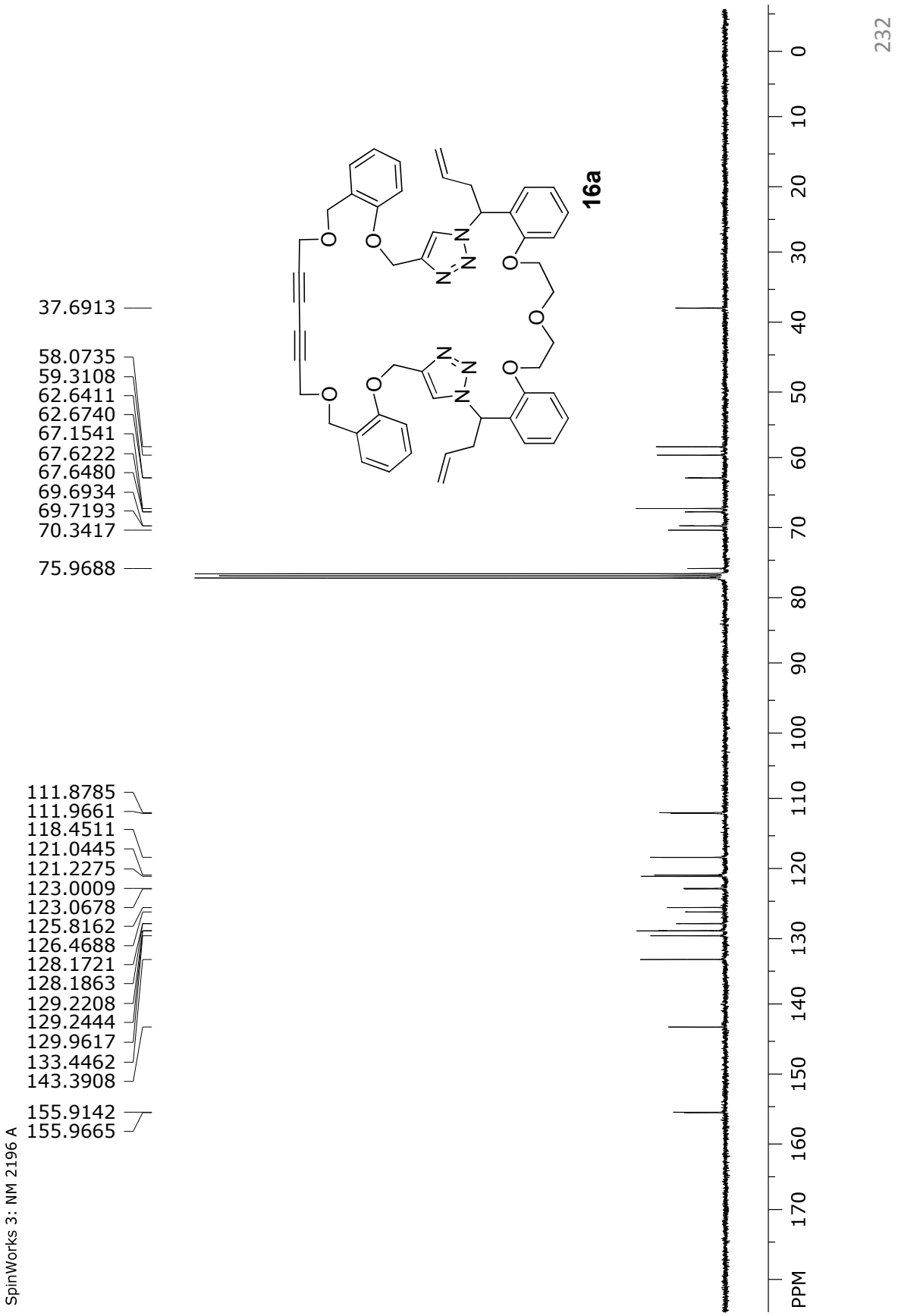

57.3985
58.7854
62.6830
66.6960
69.9835
74.4668
76.7764
77.0938
77.4122
80.0054
15c
PPM
56
58
60
62
64
66
68
70
72
74
76
78
80
82
SpinWorks 3: NM 2182 B1

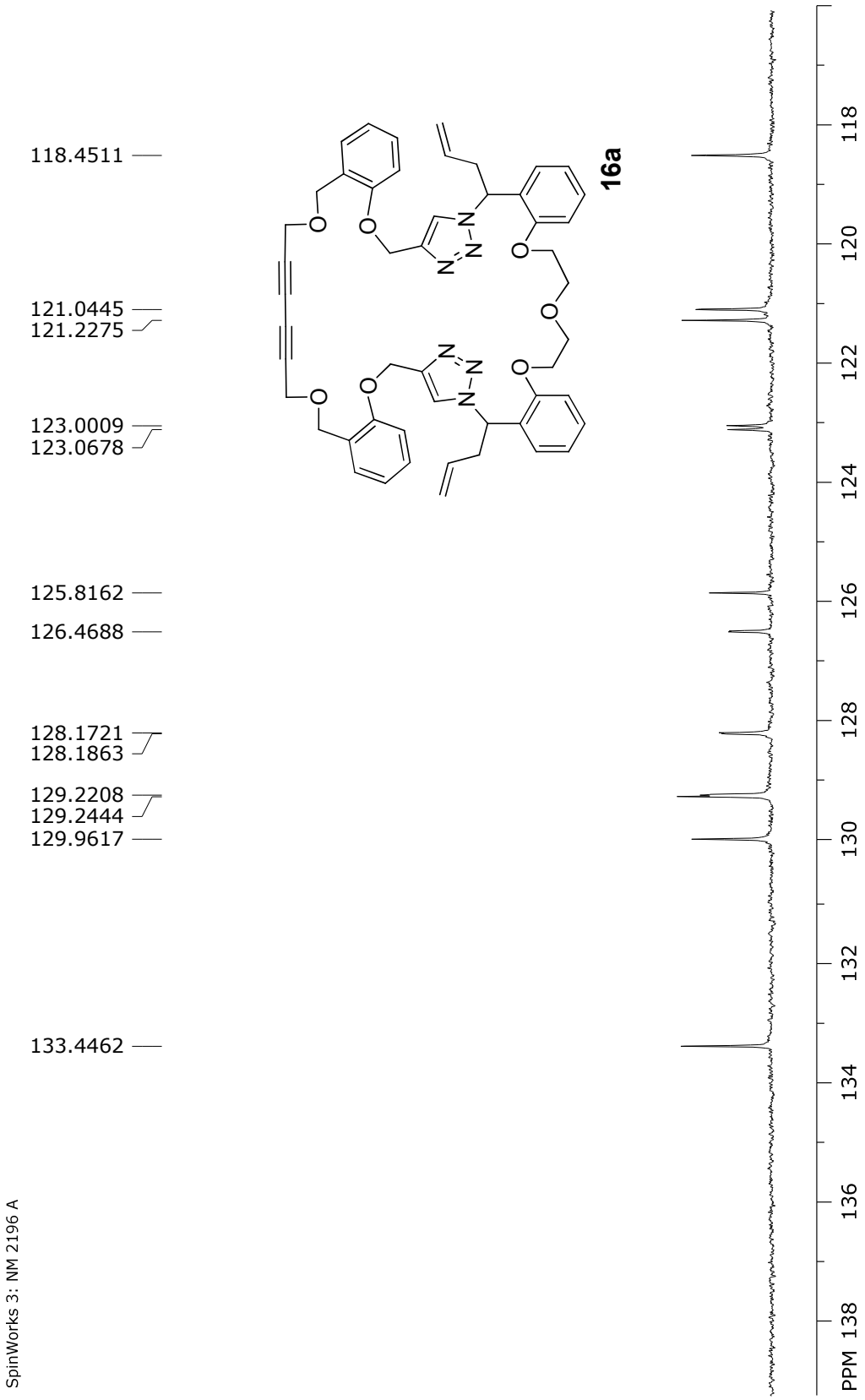

16a
3.0509
3.0540
3.0636
3.0671
3.0707
3.0734
3.0769
3.0803
3.0830
3.0867
3.0900
4.2353
4.6021
7.3237
7.3385
7.3419
7.3768
7.3817
7.3865
7.3960
7.4009
7.4057
7.7883
7.7985
1.108
1.015
2.090
2.256
1.810
1.850
1.051
1.062
1.985
1.039
1.002
1.000
2.993
2.242
0.998
1.018
0.999
PPM 8.8 8.4 8.0 7.6 7.2 6.8 6.4 6.0 5.6 5.2 4.8 4.4 4.0 3.6 3.2 2.8 2.4 2.0 1.6 1.2 0.8 0.4 0.0 -0.4
SpinWorks 3: NM 2196 A

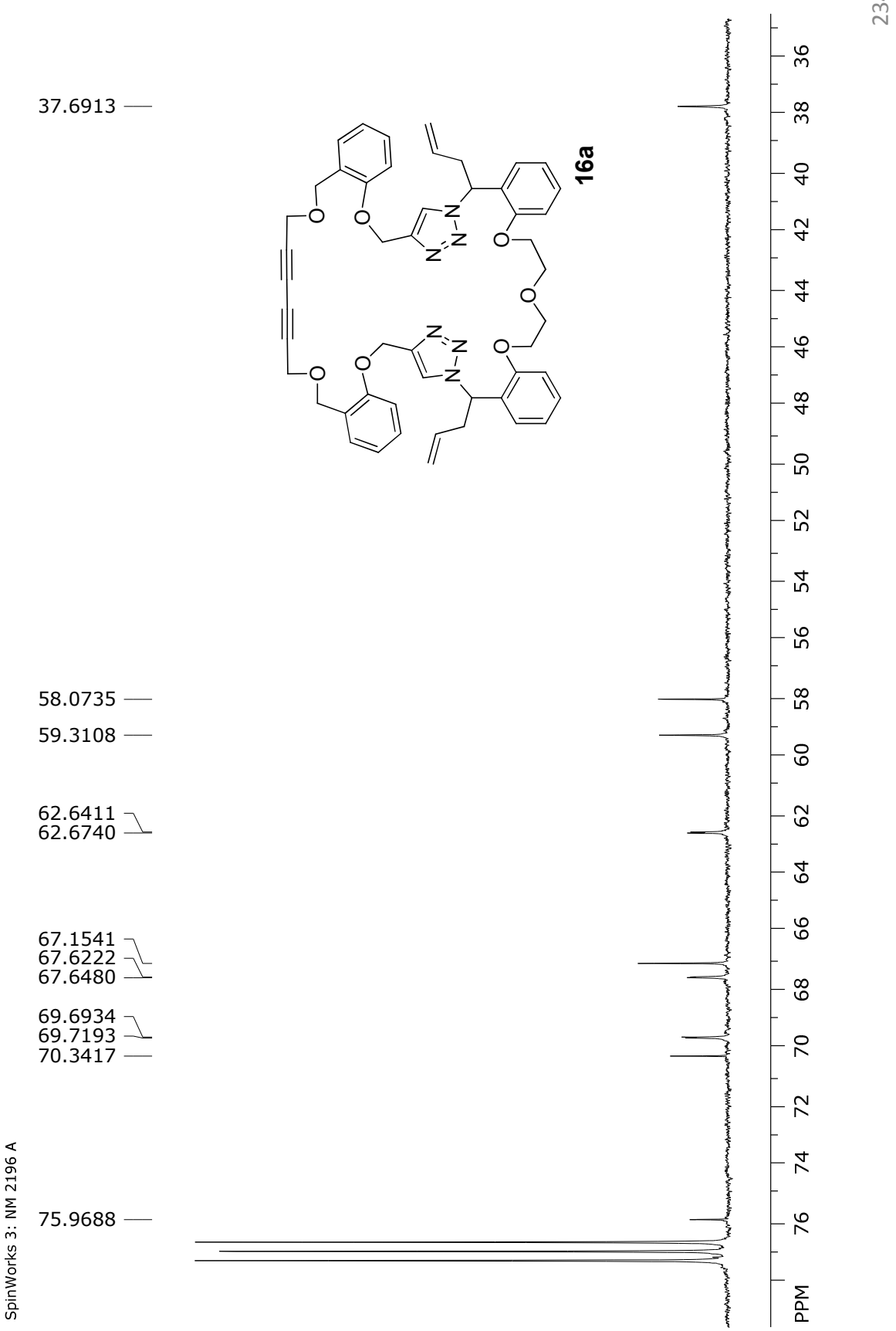

SpinWorks 3: NM 2196 A
7.7883
7.7985
7.2650
7.2739
7.2759
7.2855
7.2921
7.2964
7.3199
7.3237
7.3385
7.3419
7.3768
7.3817
7.3865
7.3960
7.4009
7.4057
7.2200
7.2574
7.0031
6.9564
6.9780
6.7985
16a
0.999
1.018
0.998
2.242
2.993
1.000
PPM 7.80
7.70
7.60
7.50
7.40
7.30
7.20
7.10
7.00
6.90
6.80

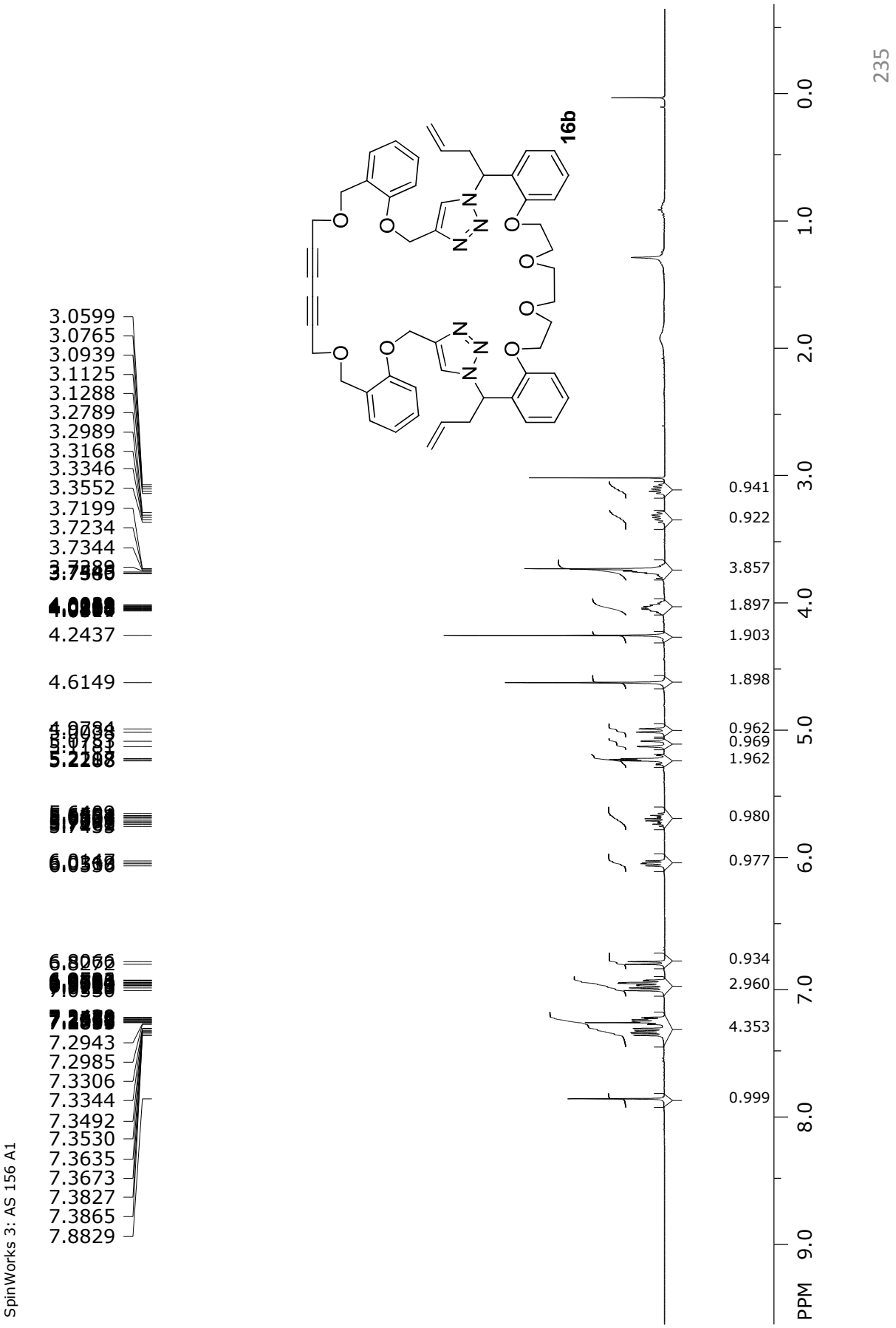


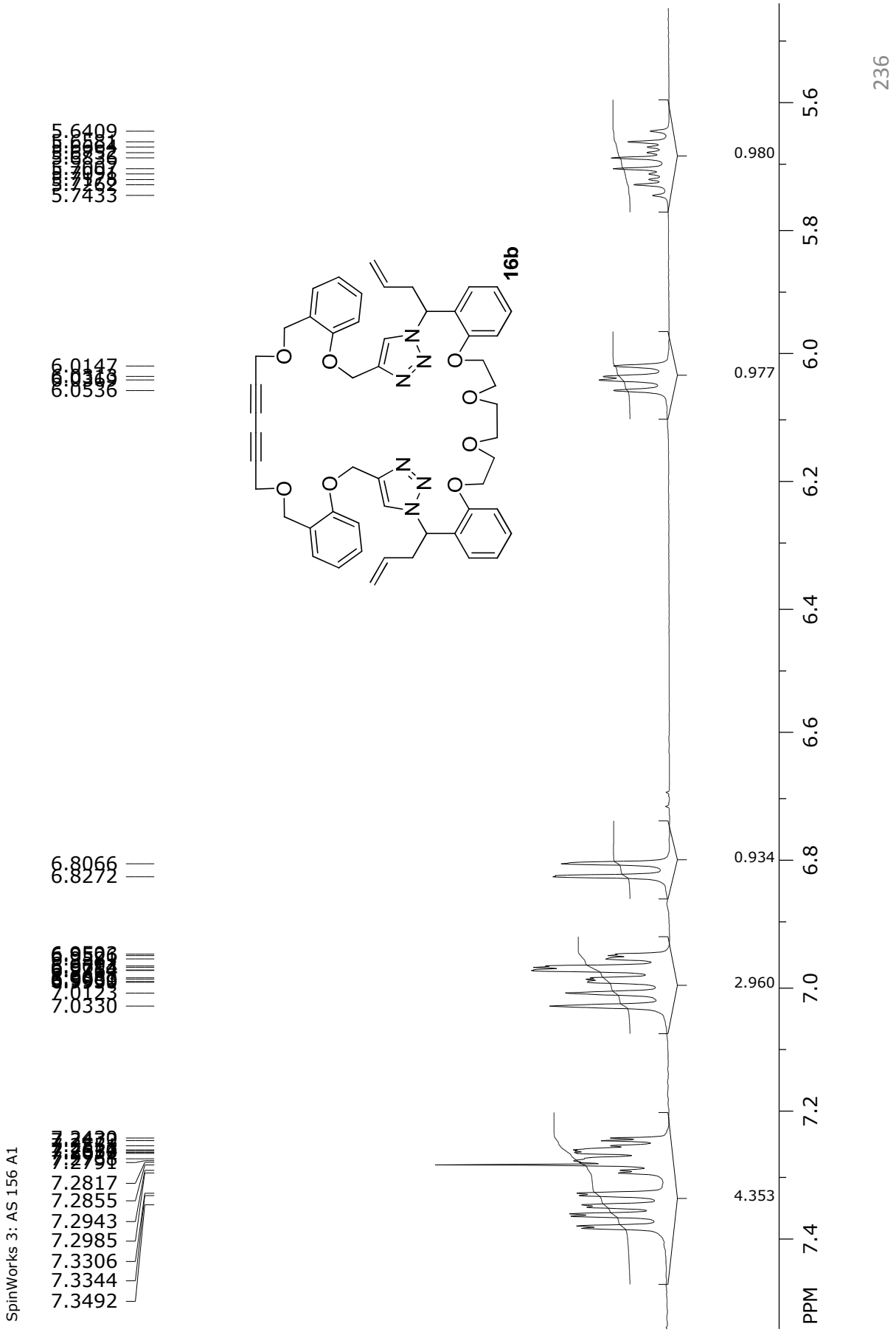

16a
3.8170
3.8818
4.0652
4.0947
4.1072
4.1626
4.2353
4.6021
2.090
2.256
1.810
1.850
PPM 4.70
4.60
4.50
4.40
4.30
4.20
4.10
4.00
3.90
3.80
3.70
SpinWorks 3: NM 2196 A

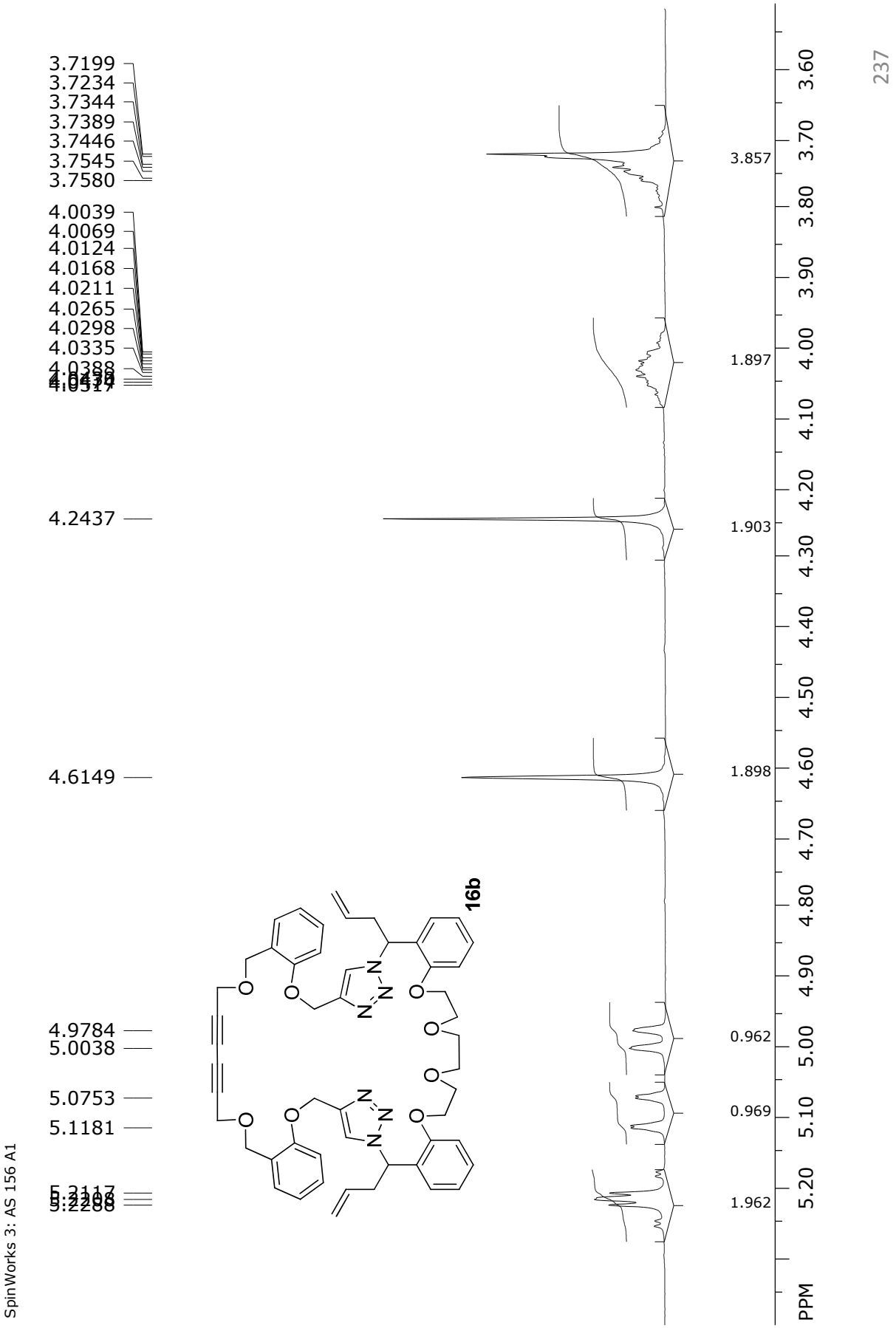

16a
37.6913
58.0735
59.3108
62.6411
62.6740
67.1541
67.6222
67.6480
69.6934
69.7193
70.3417
75.9688
111.8785
111.9661
118.4511
121.0445
121.2275
123.0009
123.0678
125.8162
126.4688
128.1721
128.1863
129.2208
129.2444
129.9617
133.4462
143.3908
155.9142
155.9665
SpinWorks 3: NM 2196 A
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170

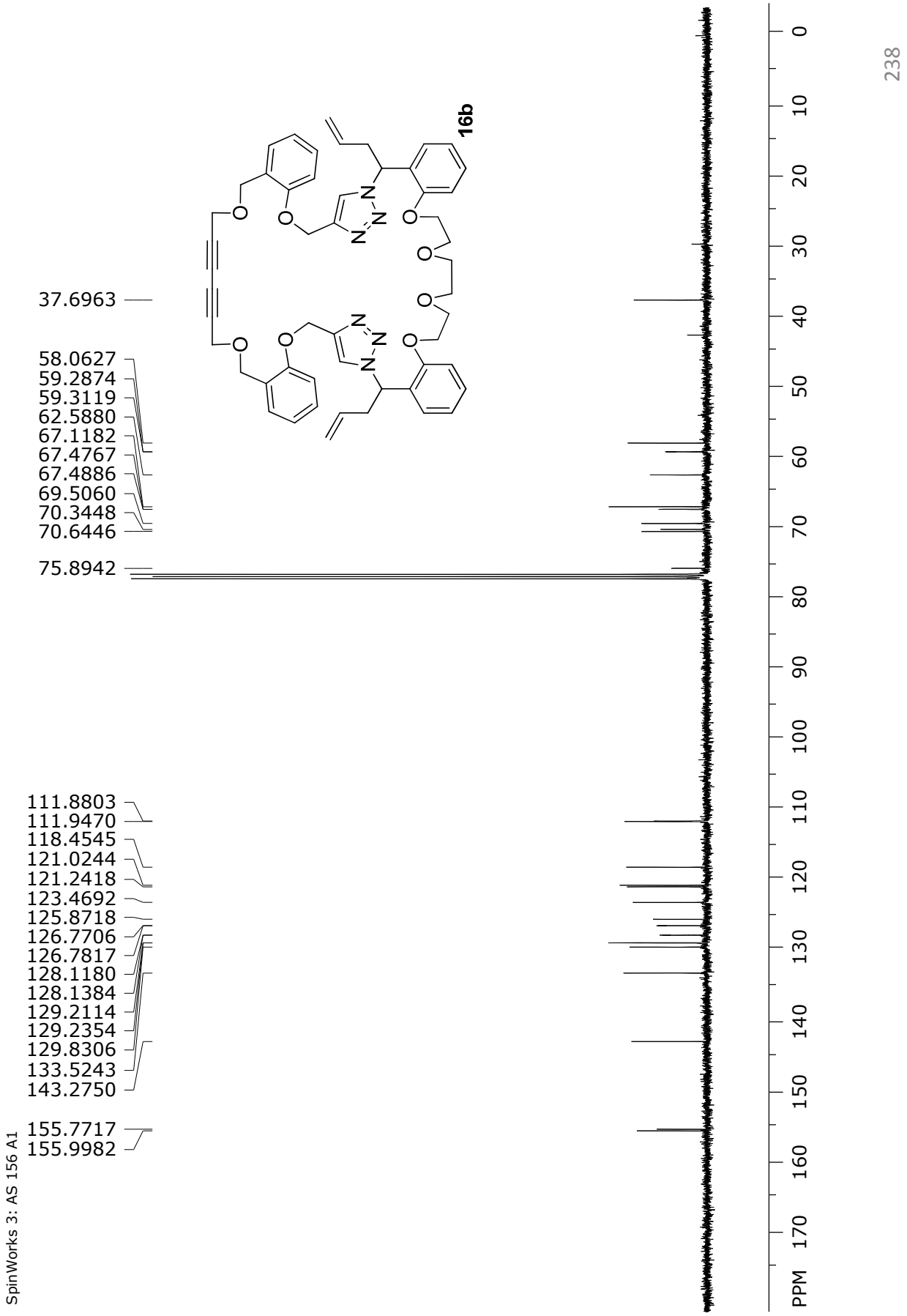

118.4511
121.0445
121.2275
123.0009
123.0678
125.8162
126.4688
128.1721
128.1863
129.2208
129.2444
129.9617
133.4462
16a
SpinWorks 3: NM 2196 A
PPM 138
136
134
132
130
128
126
124
122
120
118

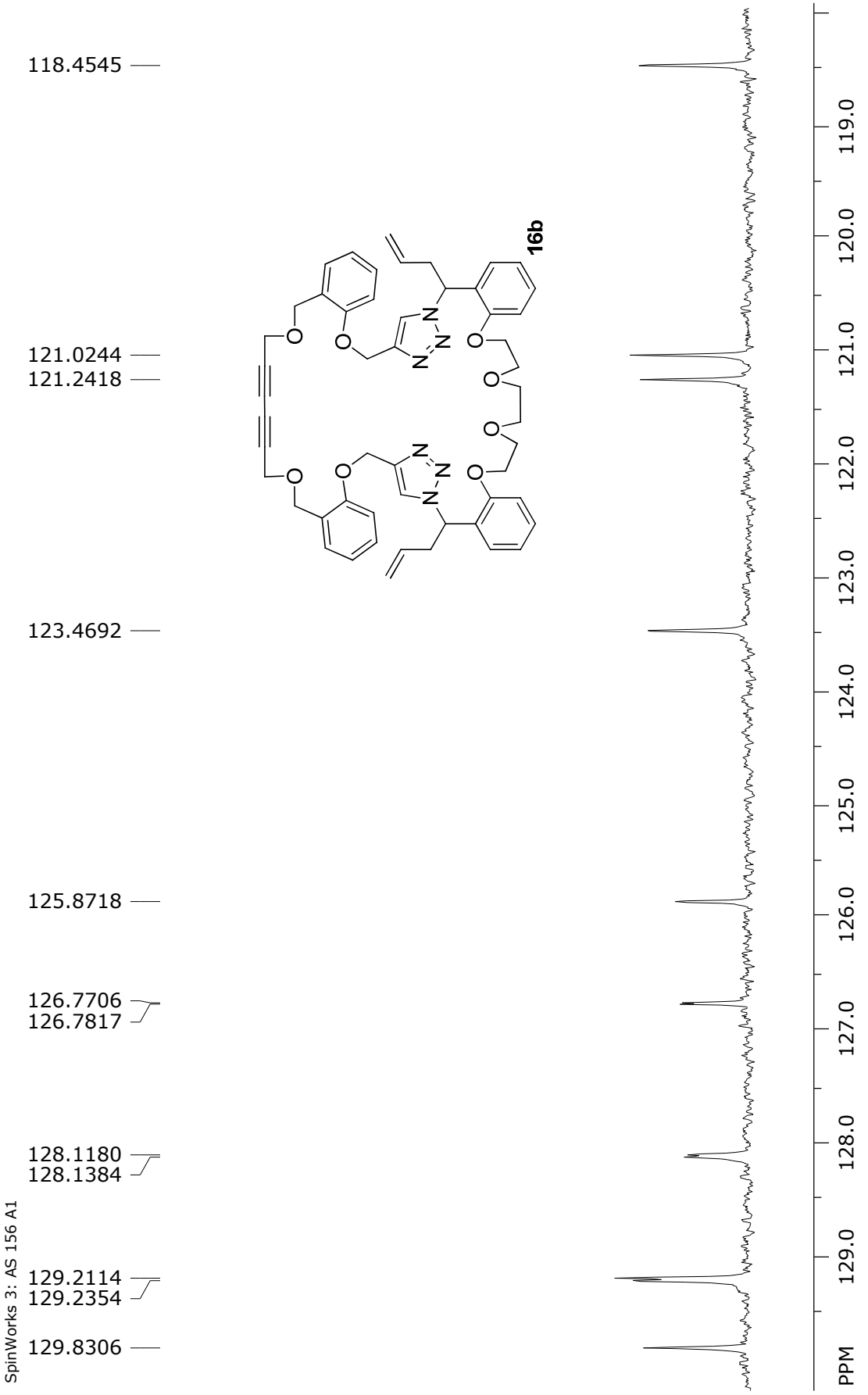

37.6913
58.0735
59.3108
62.6411
62.6740
67.1541
67.6222
67.6480
69.6934
69.7193
70.3417
75.9688
16a
SpinWorks 3: NM 2196 A
PPM
76
74
72
70
68
66
64
62
60
58
56
54
52
50
48
46
44
42
40
38
36

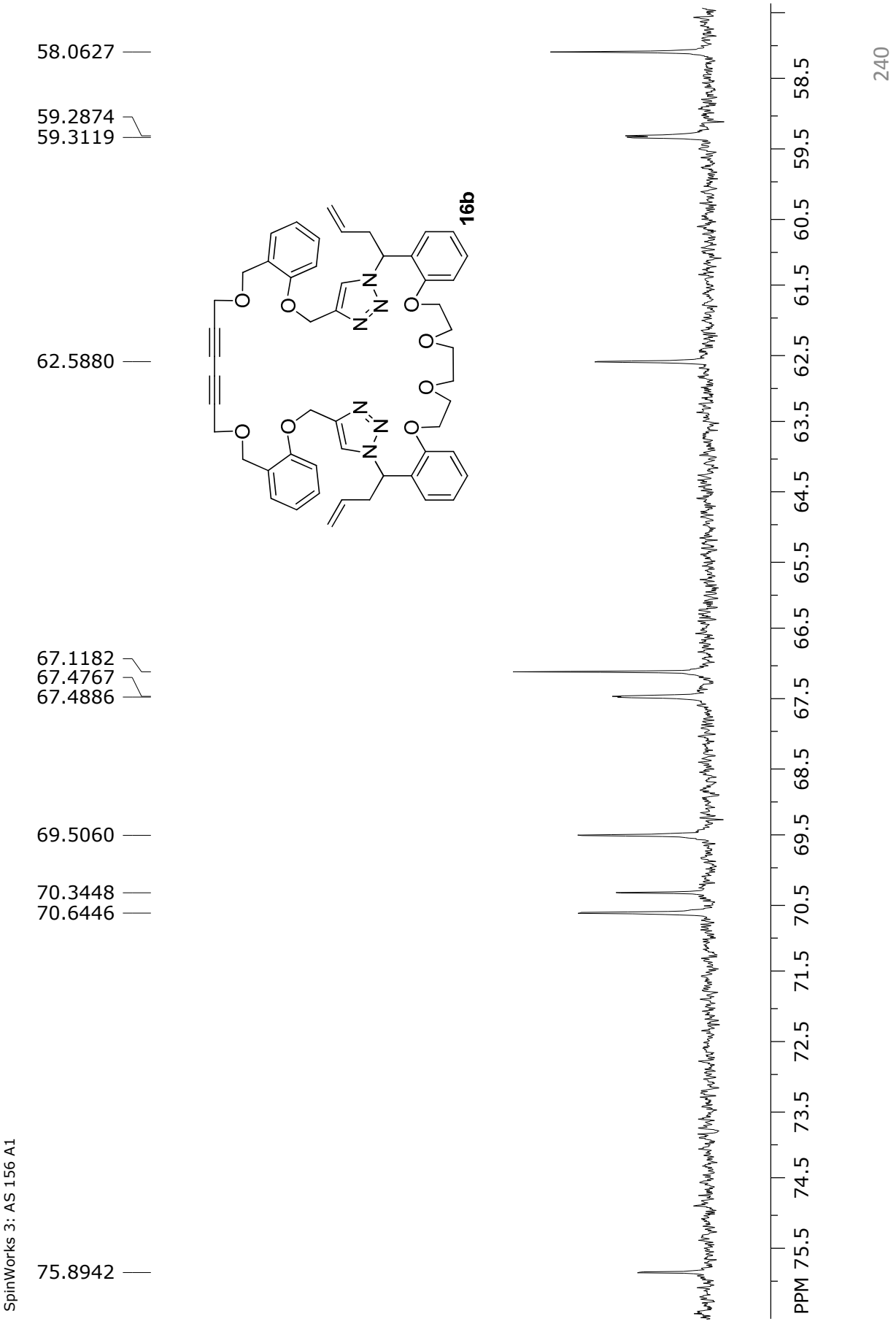

16b
3.0599
3.0765
3.0939
3.1125
3.1288
3.2789
3.2989
3.3168
3.3346
3.3552
3.7199
3.7234
3.7344
4.2437
4.6149
7.2943
7.2985
7.3306
7.3344
7.3492
7.3530
7.3635
7.3673
7.3827
7.3865
7.8829
0.941
0.922
3.857
1.897
1.903
1.898
0.962
0.969
1.962
0.980
0.977
0.934
2.960
4.353
0.999
PPM
SpinWorks 3: AS 156 A1

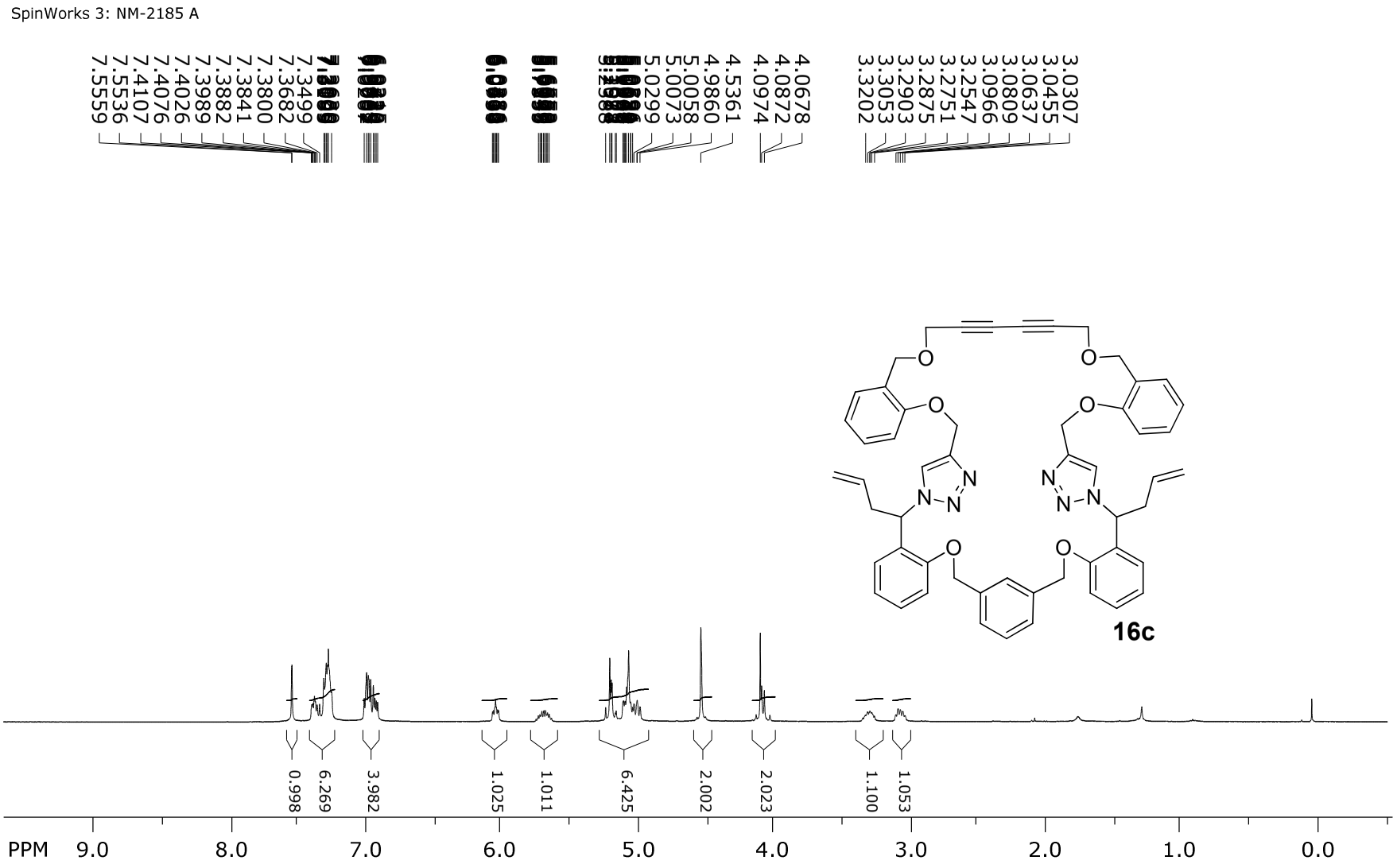

16b
5.6409
5.7433
6.0147
6.0536
6.8066
6.8272
7.0123
7.0330
7.2817
7.2855
7.2943
7.2985
7.3306
7.3344
7.3492
0.980
0.977
0.934
2.960
4.353
PPM
5.6
5.8
6.0
6.2
6.4
6.6
6.8
7.0
7.2
7.4
SpinWorks 3: AS 156 A1

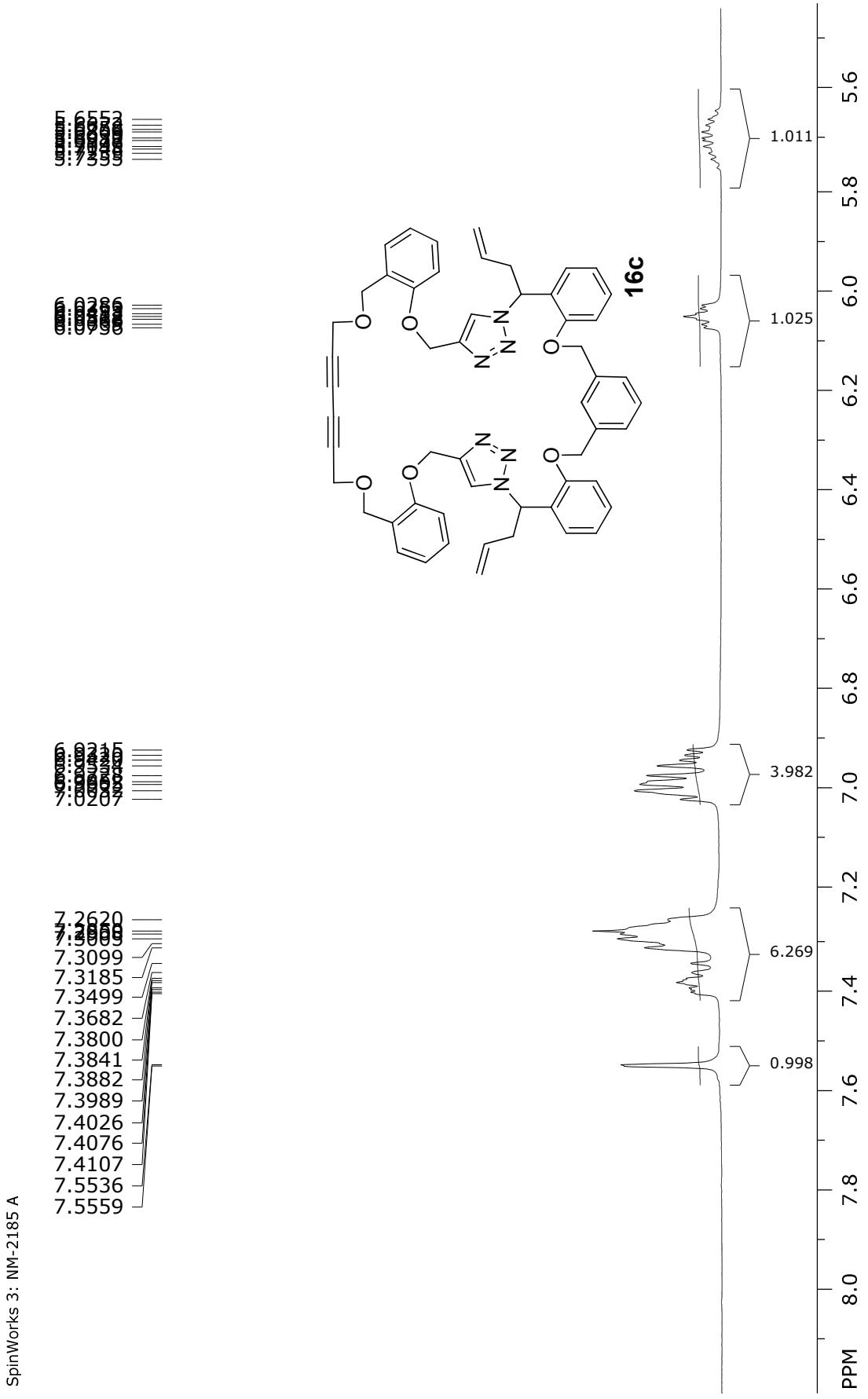

3.7199
3.7234
3.7344
3.7389
3.7446
3.7545
3.7580
4.0039
4.0069
4.0124
4.0168
4.0211
4.0265
4.0298
4.0335
4.0388
4.2437
4.6149
4.9784
5.0038
5.0753
5.1181
16b
3.857
1.897
1.903
1.898
0.962
0.969
1.962
PPM
3.60
3.70
3.80
3.90
4.00
4.10
4.20
4.30
4.40
4.50
4.60
4.70
4.80
4.90
5.00
5.10
5.20
SpinWorks 3: AS 156 A1

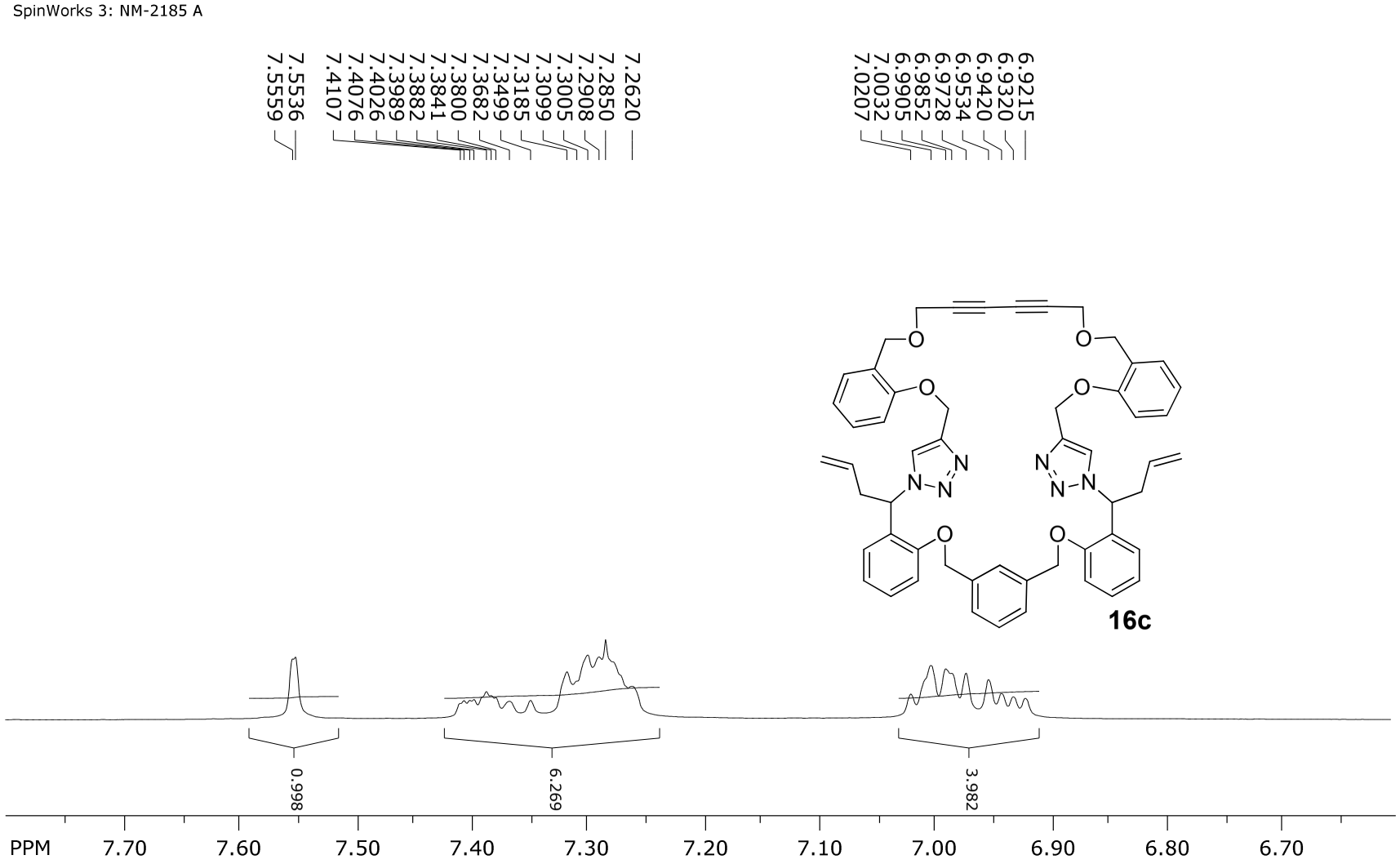

16b
37.6963
58.0627
59.2874
59.3119
62.5880
67.1182
67.4767
67.4886
69.5060
70.3448
70.6446
75.8942
111.8803
111.9470
118.4545
121.0244
121.2418
123.4692
125.8718
126.7706
126.7817
128.1180
128.1384
129.2114
129.2354
129.8306
133.5243
143.2750
155.7717
155.9982
SpinWorks 3: AS 156 A1
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170

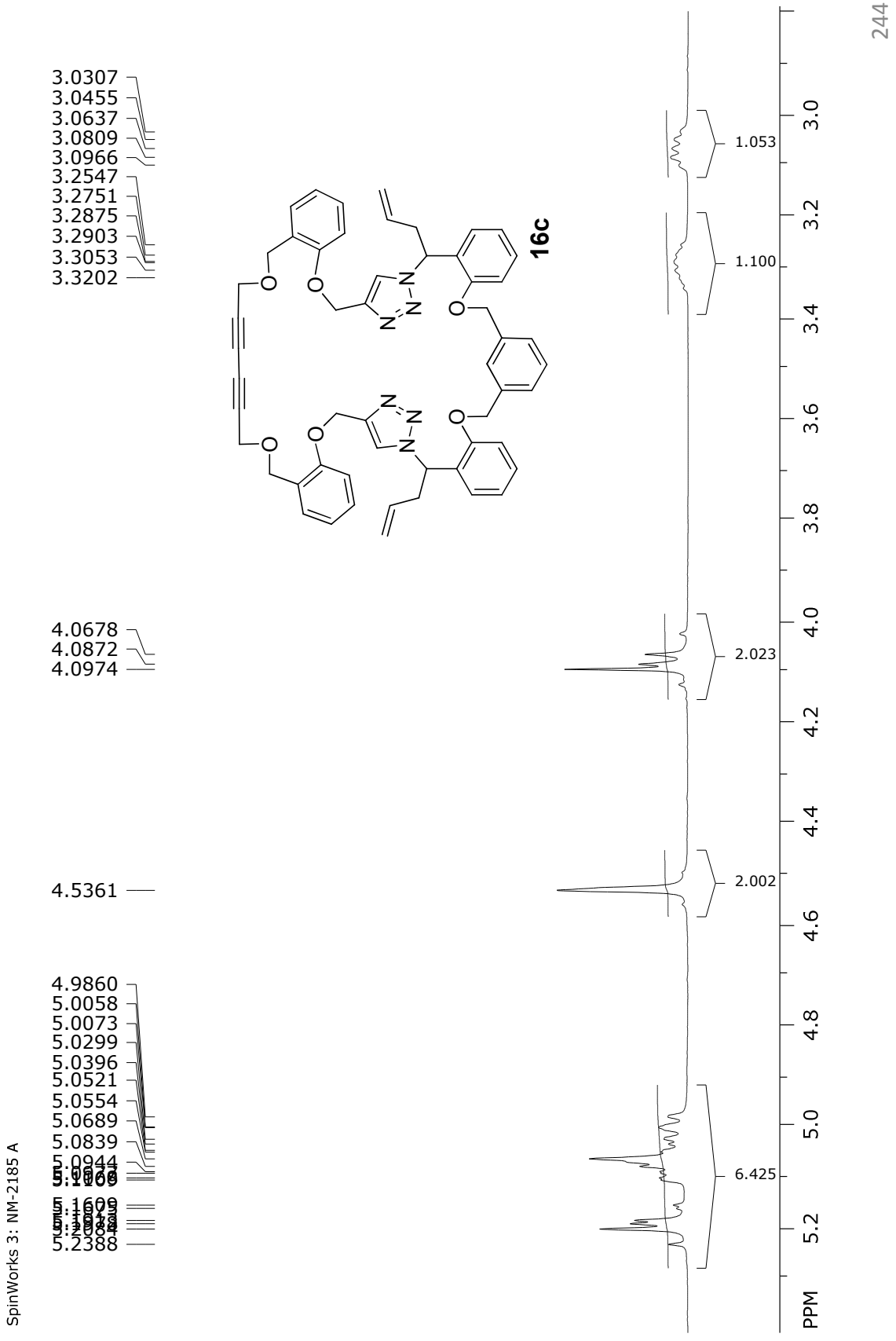

16b
118.4545
121.0244
121.2418
123.4692
125.8718
126.7706
126.7817
128.1180
128.1384
129.2114
129.2354
129.8306
SpinWorks 3: AS 156 A1
PPM
129.0
128.0
127.0
126.0
125.0
124.0
123.0
122.0
121.0
120.0
119.0


16b
58.0627
59.2874
59.3119
62.5880
67.1182
67.4767
67.4886
69.5060
70.3448
70.6446
75.8942
PPM 75.5 74.5 73.5 72.5 71.5 70.5 69.5 68.5 67.5 66.5 65.5 64.5 63.5 62.5 61.5 60.5 59.5 58.5
SpinWorks 3: AS 156 A1




16c
5.6553
5.7599
6.0386
7.0207
7.2620
7.3099
7.3185
7.3499
7.3682
7.3800
7.3841
7.3882
7.3989
7.4026
7.4076
7.4107
7.5536
7.5559
1.011
1.025
3.982
6.269
0.998
PPM
8.0
7.8
7.6
7.4
7.2
7.0
6.8
6.6
6.4
6.2
6.0
5.8
5.6
SpinWorks 3: NM-2185 A

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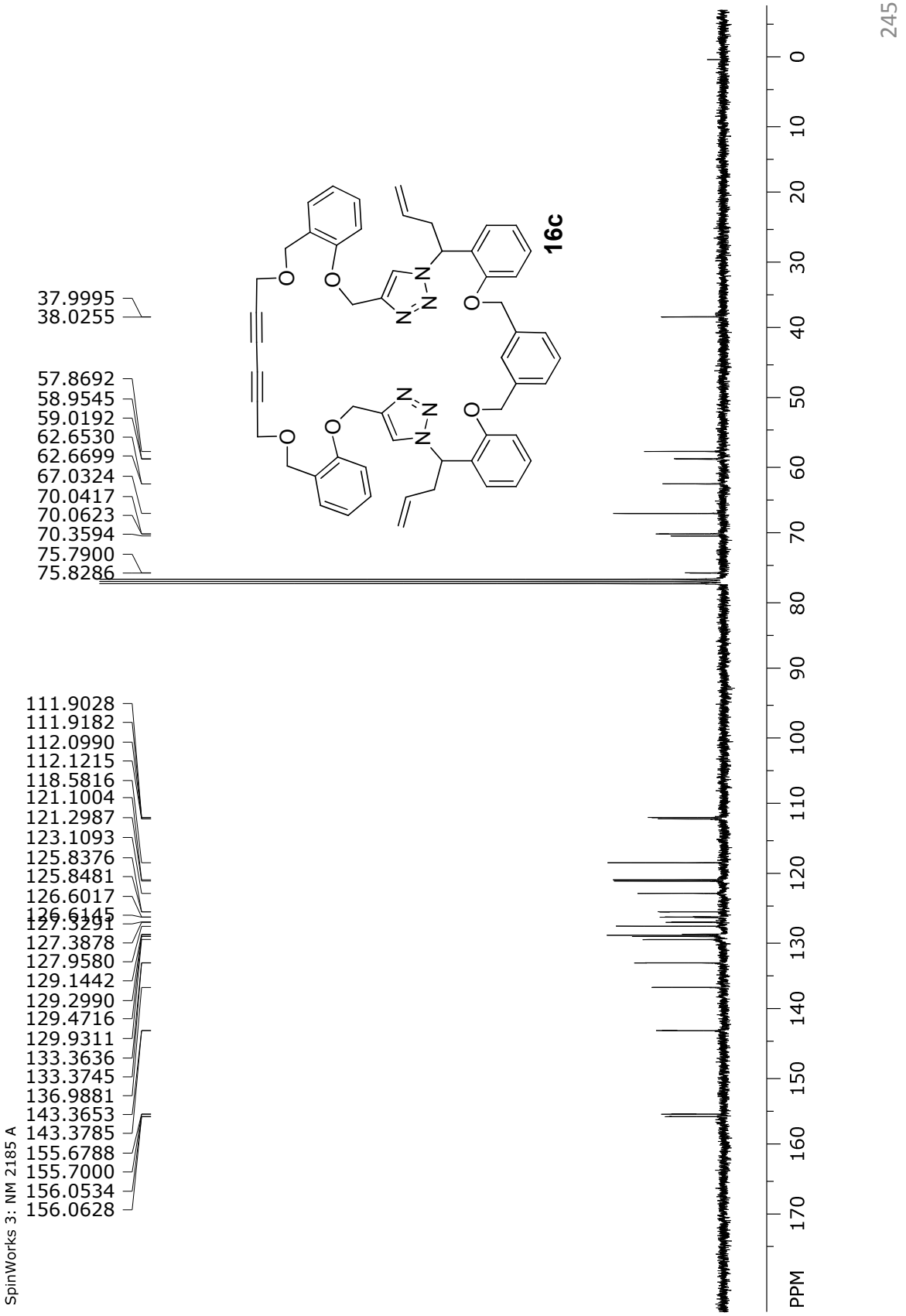
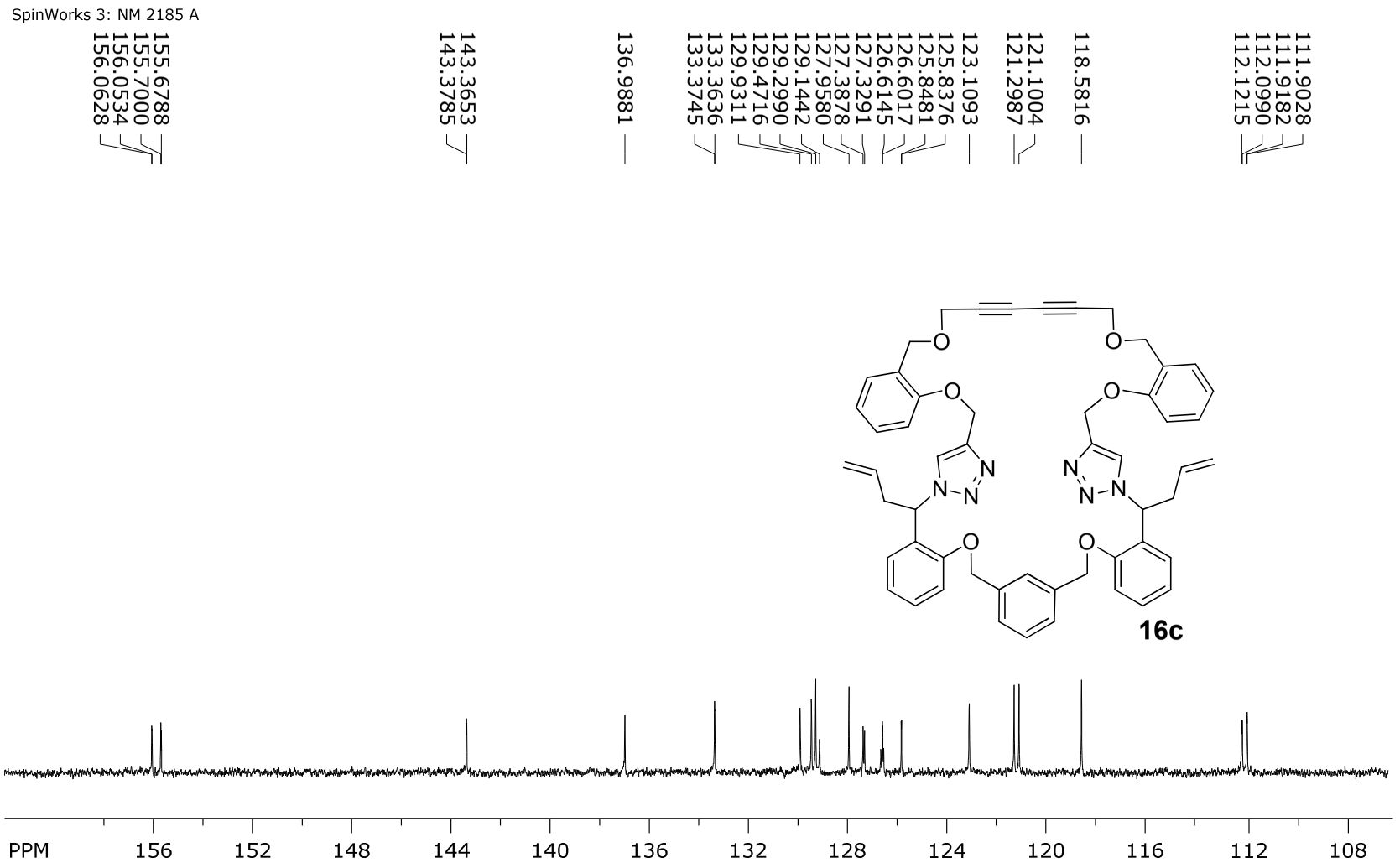
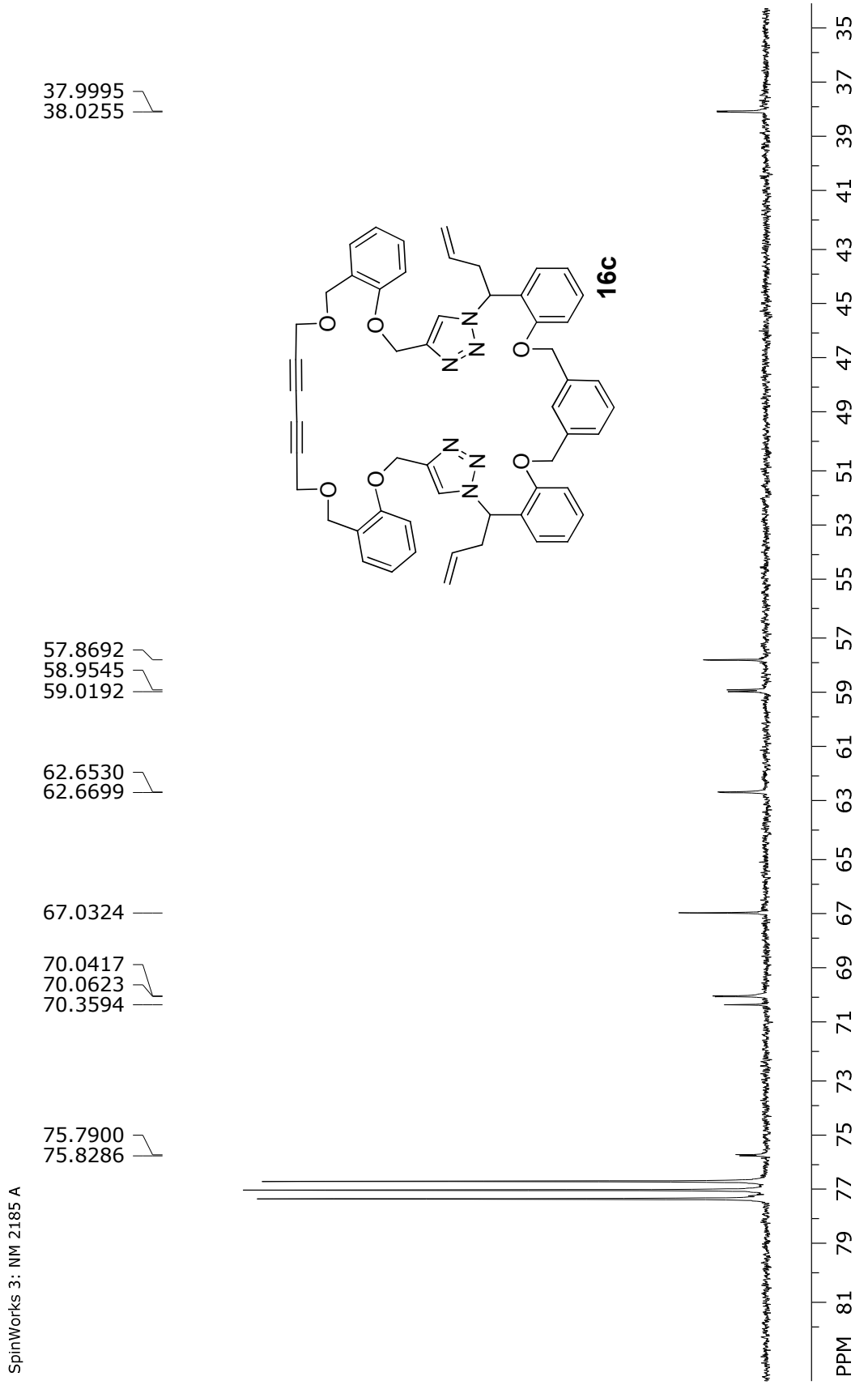
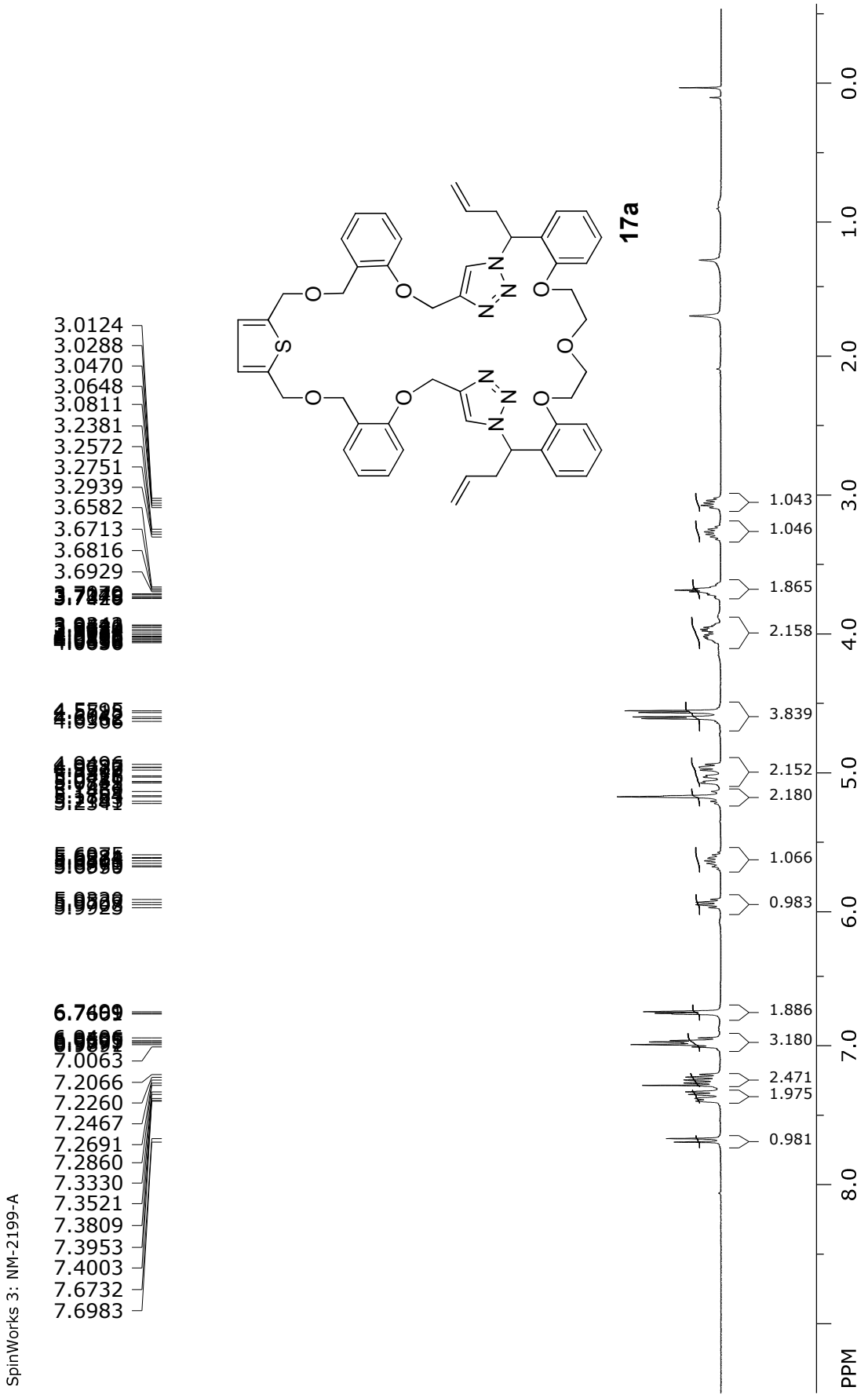
3.0455
3.0637
3.0809
3.0966
3.2547
3.2751
3.2875
3.2903
3.3053
3.3202
4.0678
4.0872
4.0974
4.5361
4.9860
5.0058
5.0073
5.0299
5.0396
5.0521
5.0554
5.0689
5.0839
5.0944
5.2388
16c
1.053
1.100
2.023
2.002
6.425
PPM
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
SpinWorks 3: NM-2185 A

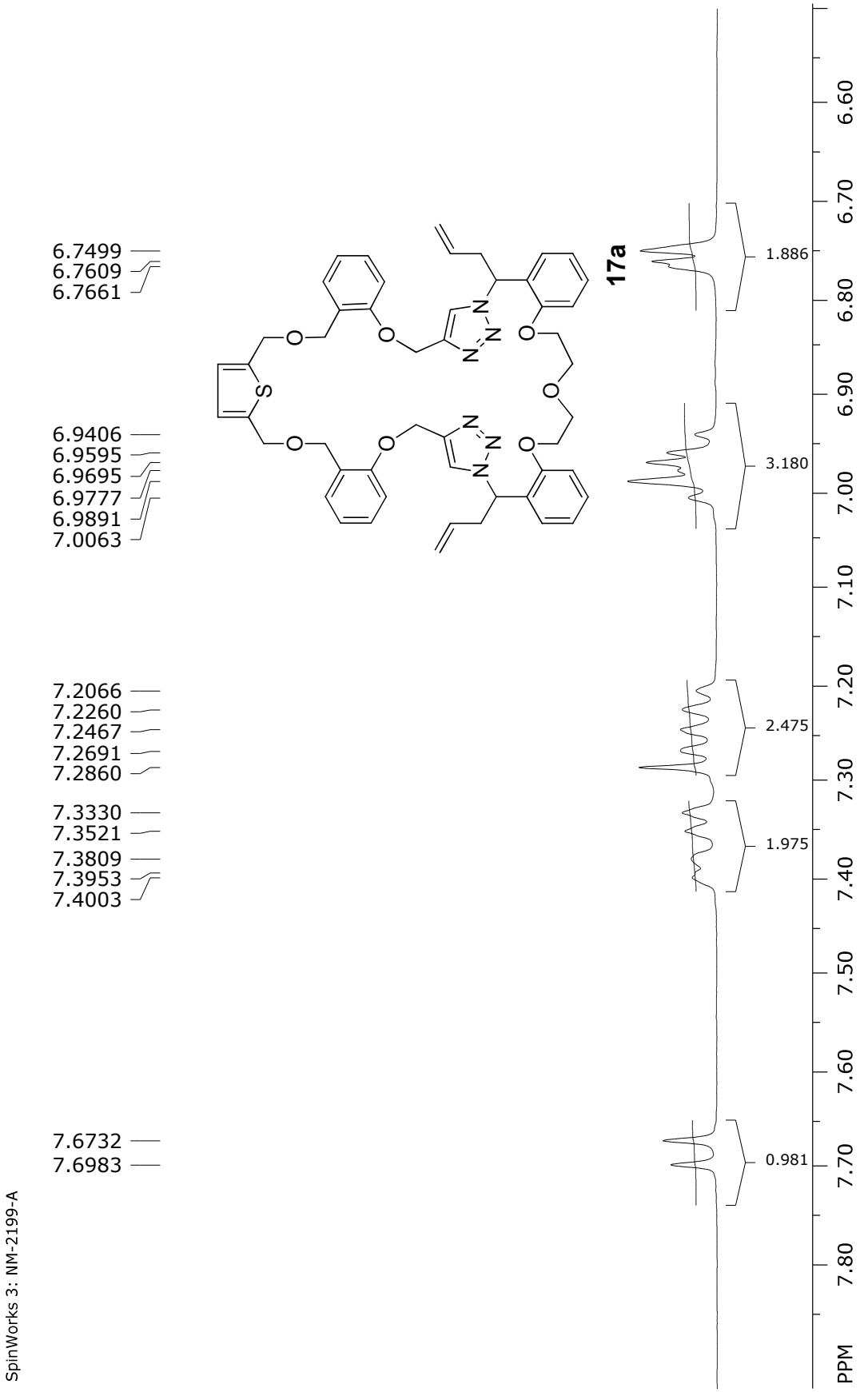

16c
37.9995
38.0255
57.8692
58.9545
59.0192
62.6530
62.6699
67.0324
70.0417
70.0623
70.3594
75.7900
75.8286
111.9028
111.9182
112.0990
112.1215
118.5816
121.1004
121.2987
123.1093
125.8376
125.8481
126.6017
126.6145
127.3291
127.3878
127.9580
129.1442
129.2990
129.4716
129.9311
133.3636
133.3745
136.9881
143.3653
143.3785
155.6788
155.7000
156.0534
156.0628
SpinWorks 3: NM 2185 A
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170

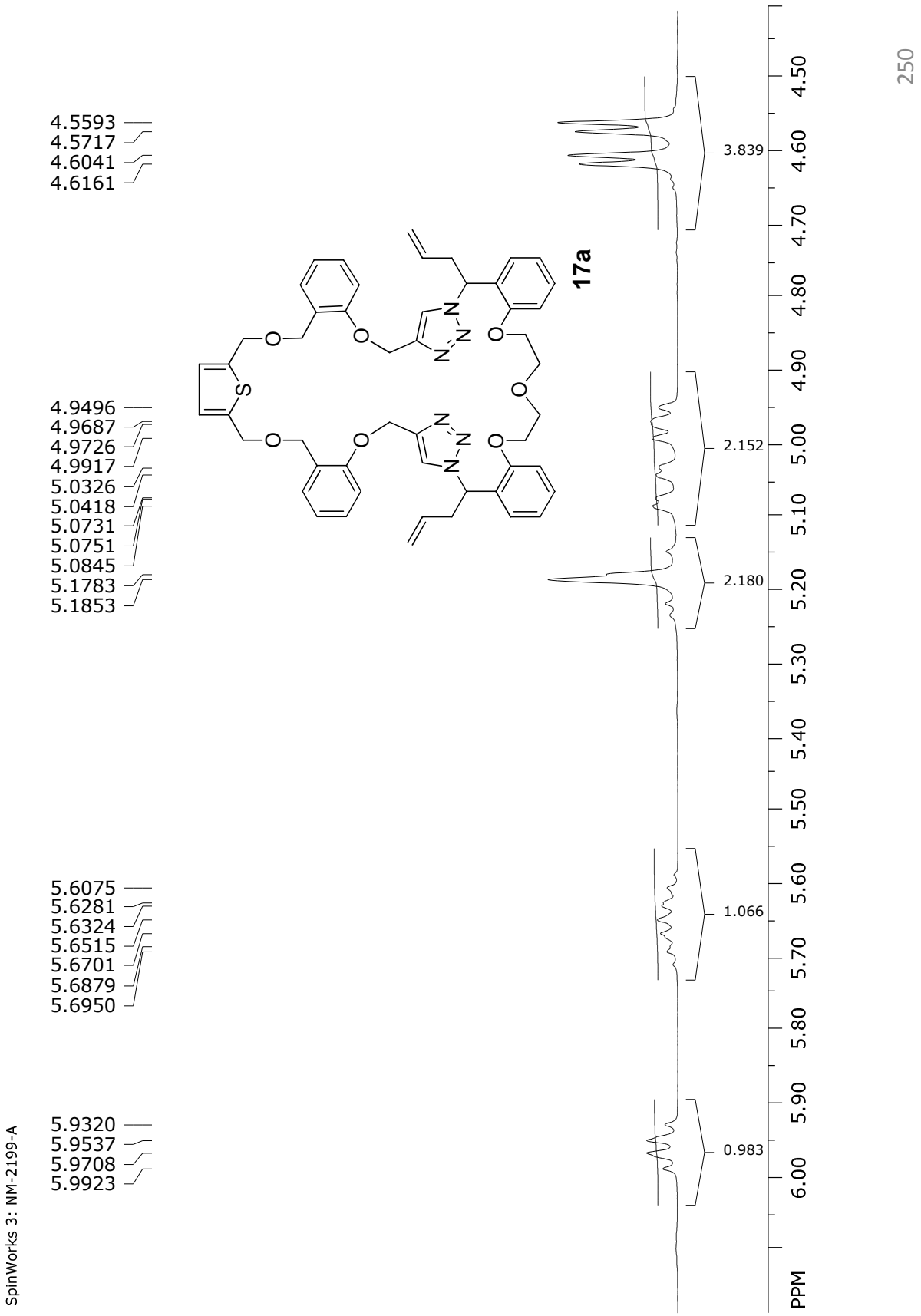


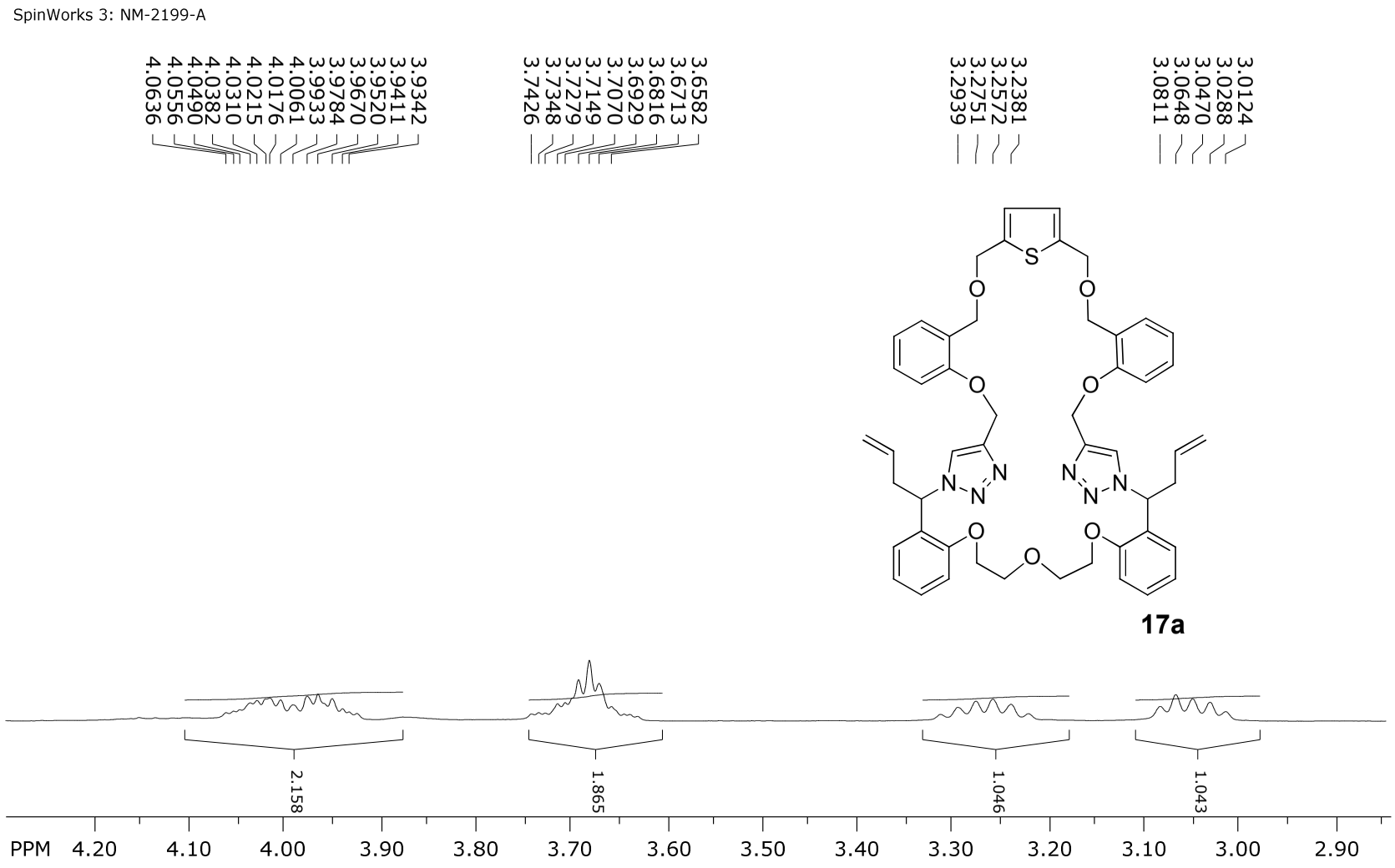

37.9995
38.0255
57.8692
58.9545
59.0192
62.6530
62.6699
67.0324
70.0417
70.0623
70.3594
75.7900
75.8286
16c
PPM
81
79
77
75
73
71
69
67
65
63
61
59
57
55
53
51
49
47
45
43
41
39
37
35
SpinWorks 3: NM 2185 A

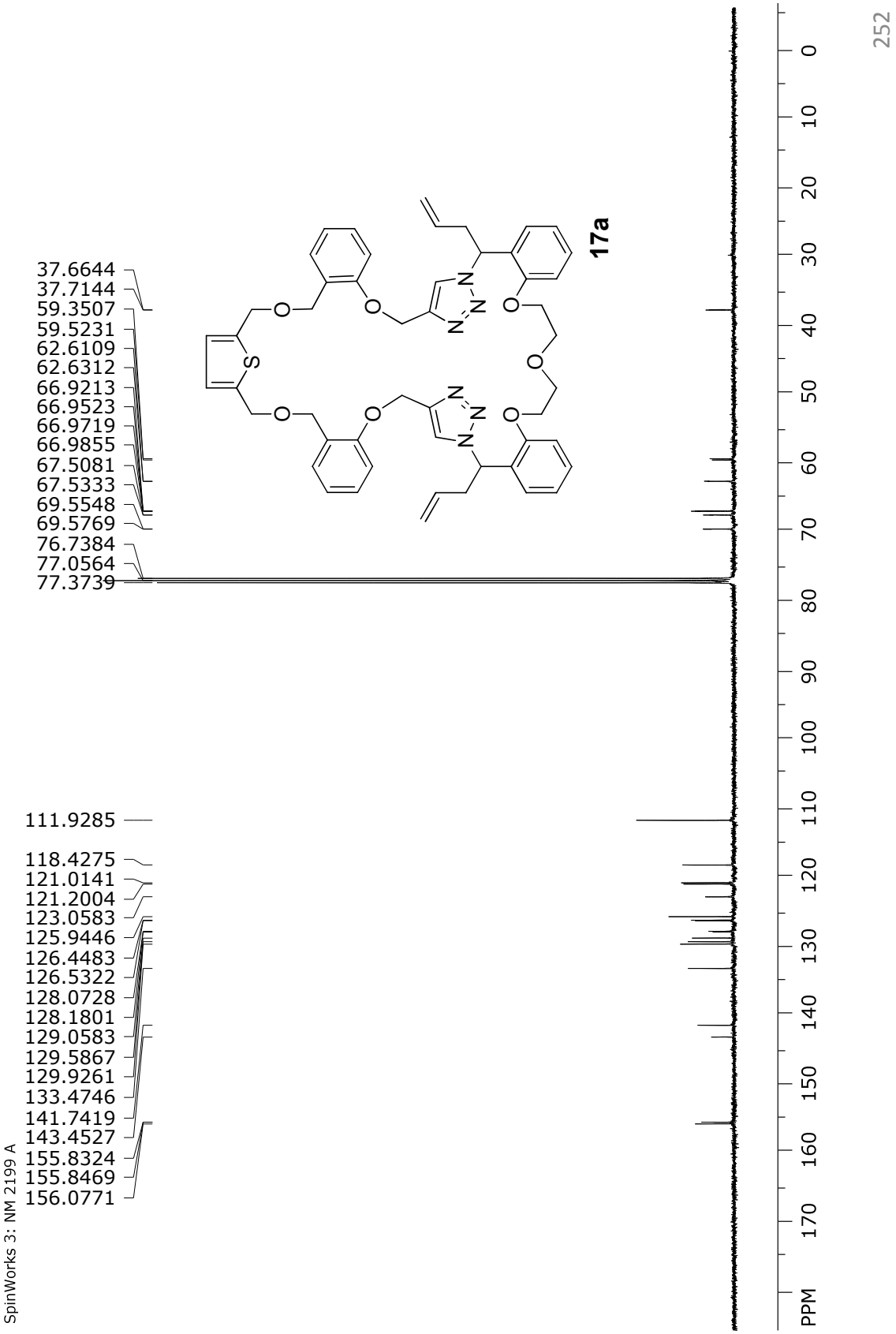


SpinWorks 3: NM-2199-A


6.7499
6.7609
6.7661
6.9406
6.9595
6.9695
6.9777
6.9891
7.0063
7.2066
7.2260
7.2467
7.2691
7.2860
7.3330
7.3521
7.3809
7.3953
7.4003
7.6732
7.6983
17a
1.886
3.180
2.475
1.975
0.981
PPM
6.60
6.70
6.80
6.90
7.00
7.10
7.20
7.30
7.40
7.50
7.60
7.70
7.80
SpinWorks 3: NM-2199-A


4.5593
4.5717
4.6041
4.6161
4.9496
4.9687
4.9726
4.9917
5.0326
5.0418
5.0731
5.0751
5.0845
5.1783
5.1853
5.6075
5.6281
5.6324
5.6515
5.6701
5.6879
5.6950
5.9320
5.9537
5.9708
5.9923
17a
3.839
2.152
2.180
1.066
0.983
PPM
6.00
5.90
5.80
5.70
5.60
5.50
5.40
5.30
5.20
5.10
5.00
4.90
4.80
4.70
4.60
4.50
SpinWorks 3: NM-2199-A




17a
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59.3507
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62.6109
62.6312
66.9213
66.9523
66.9719
66.9855
67.5081
67.5333
69.5548
69.5769
76.7384
77.0564
77.3739
111.9285
118.4275
121.0141
121.2004
123.0583
125.9446
126.4483
126.5322
128.0728
128.1801
129.0583
129.5867
129.9261
133.4746
141.7419
143.4527
155.8324
155.8469
156.0771
SpinWorks 3: NM 2199 A
PPM
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10
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60
70
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100
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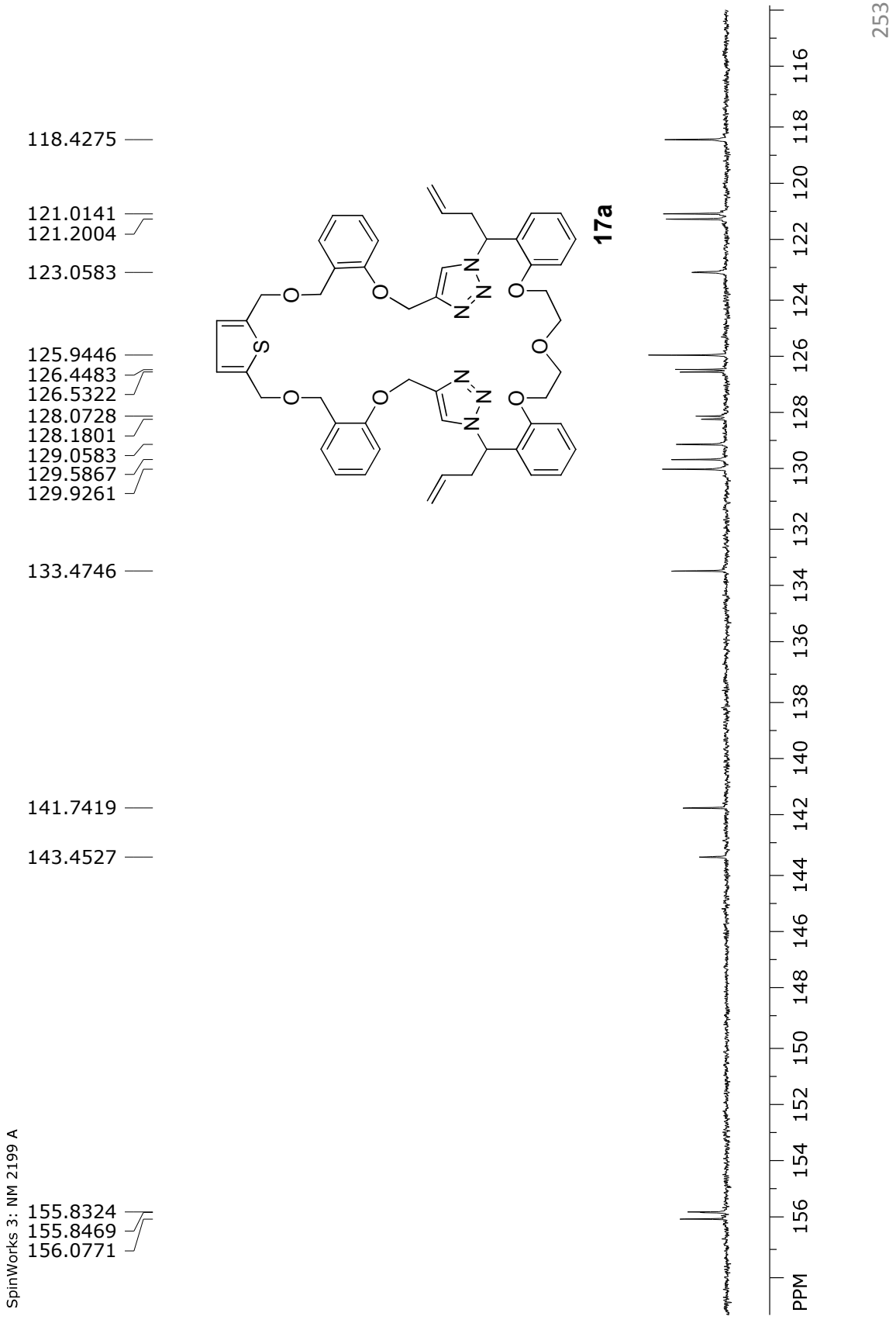
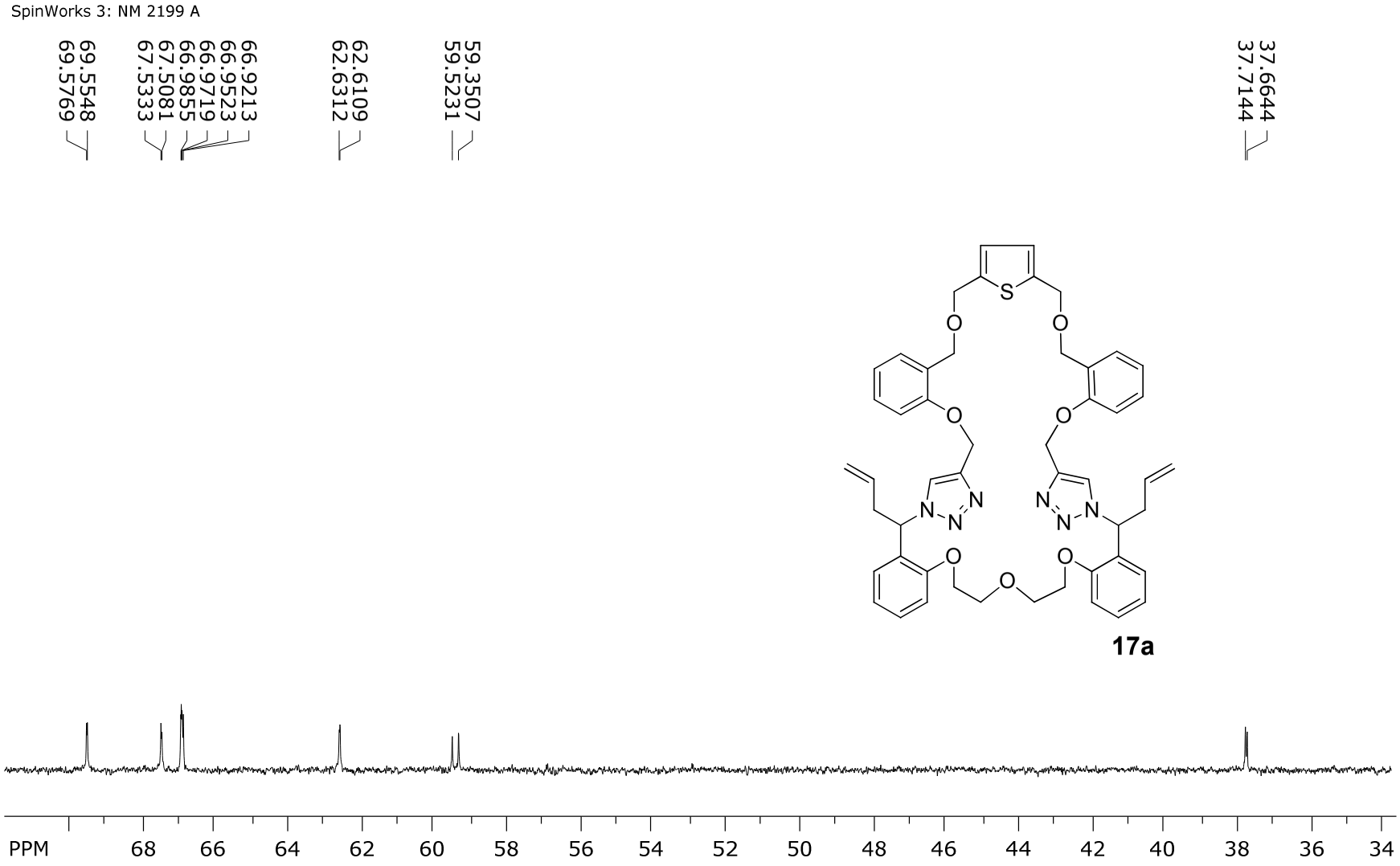
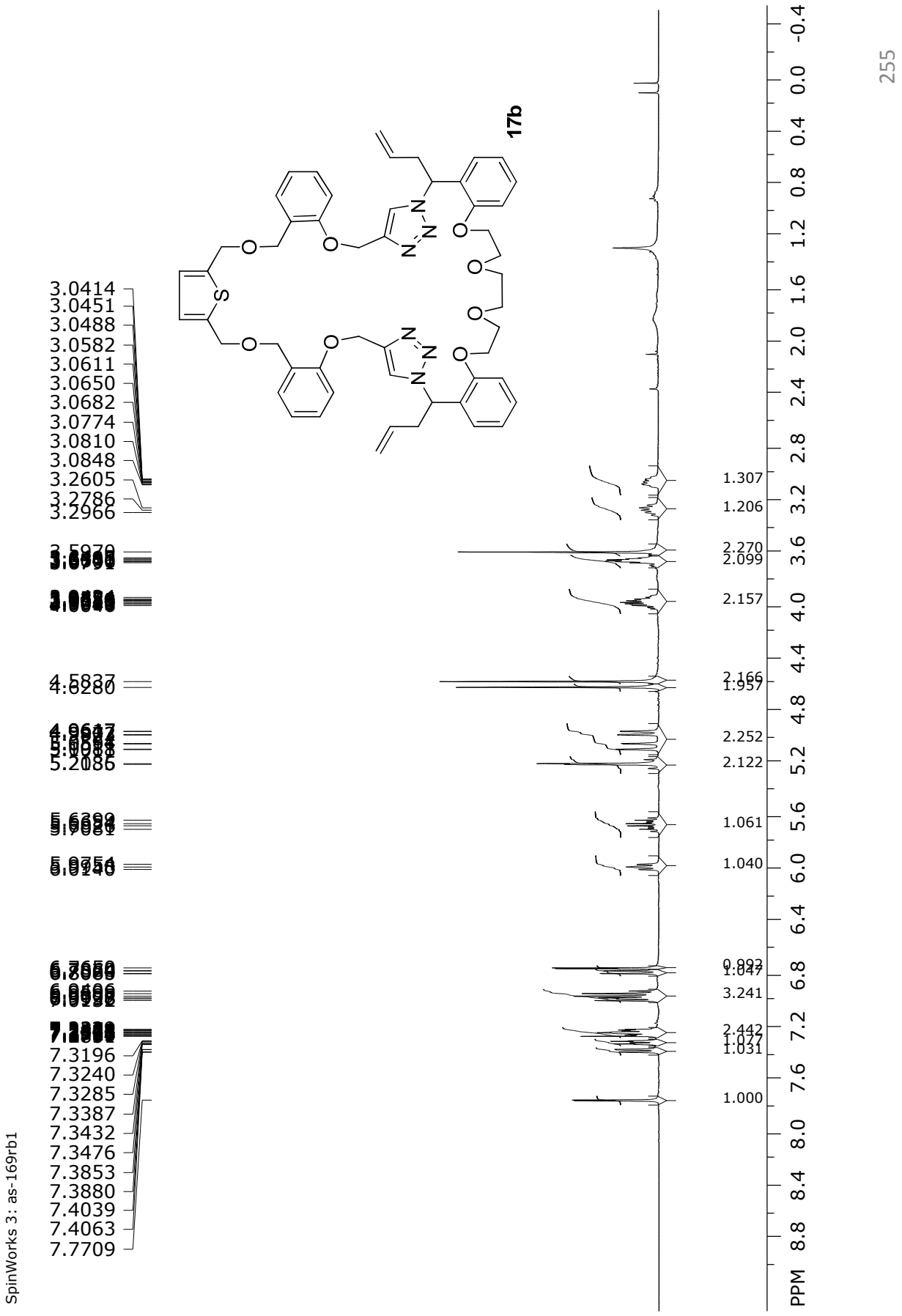
160
170


118.4275
121.0141
121.2004
123.0583
125.9446
126.4483
126.5322
128.0728
128.1801
129.0583
129.5867
129.9261
133.4746
141.7419
143.4527
155.8324
155.8469
156.0771
17a
PPM
156
154
152
150
148
146
144
142
140
138
136
134
132
130
128
126
124
122
120
118
116
SpinWorks 3: NM 2199 A

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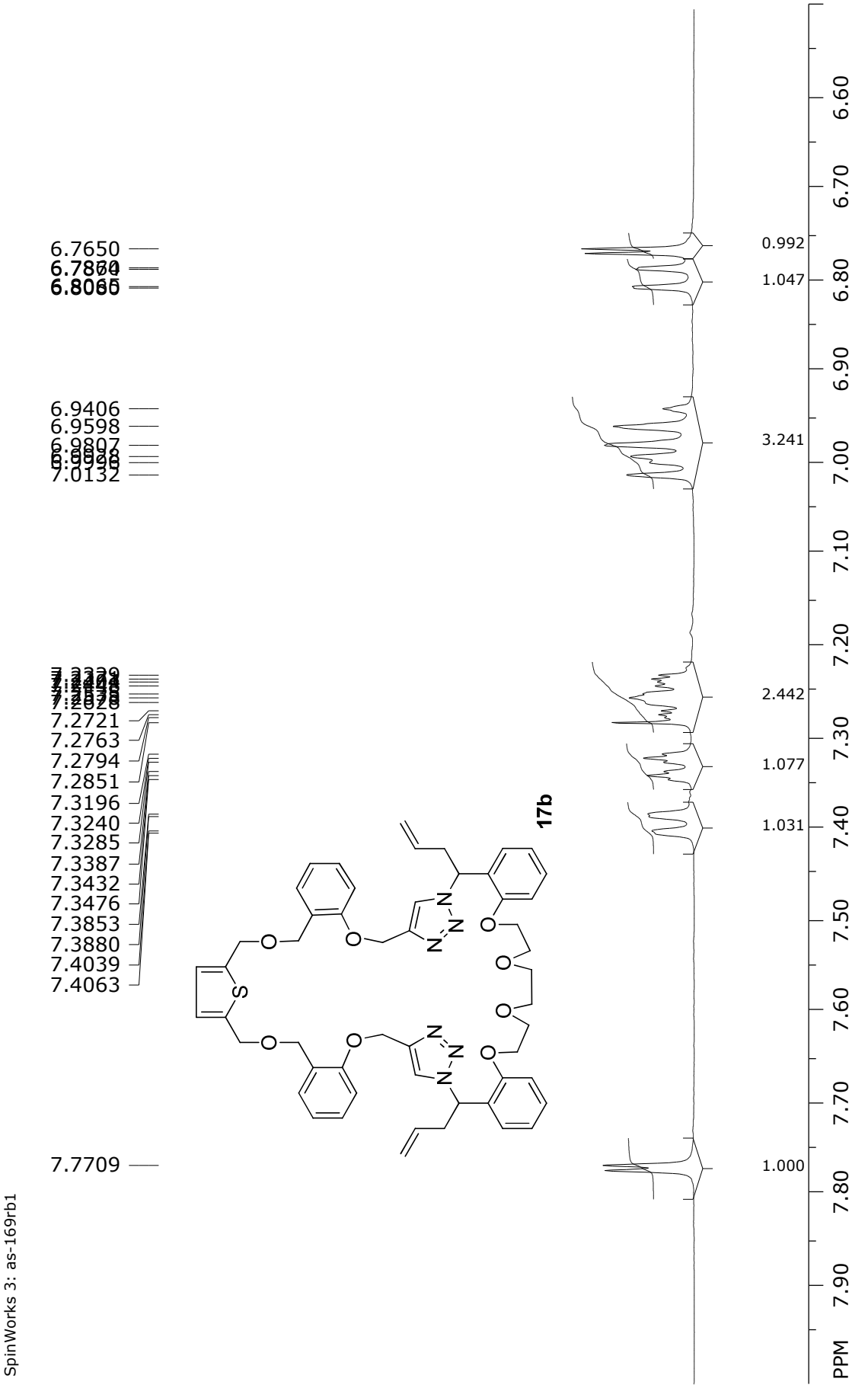
3.0451
3.0488
3.0582
3.0611
3.0650
3.0682
3.0774
3.0810
3.0848
3.2605
3.2786
3.2966
4.5837
4.6280
7.3196
7.3240
7.3285
7.3387
7.3432
7.3476
7.3853
7.3880
7.4039
7.4063
7.7709
1.307
1.206
2.270
2.099
2.157
2.166
1.957
2.252
2.122
1.061
1.040
0.892
1.047
3.241
2.442
1.077
1.031
1.000
PPM
SpinWorks 3: as-169rb1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6.9598
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7.2763
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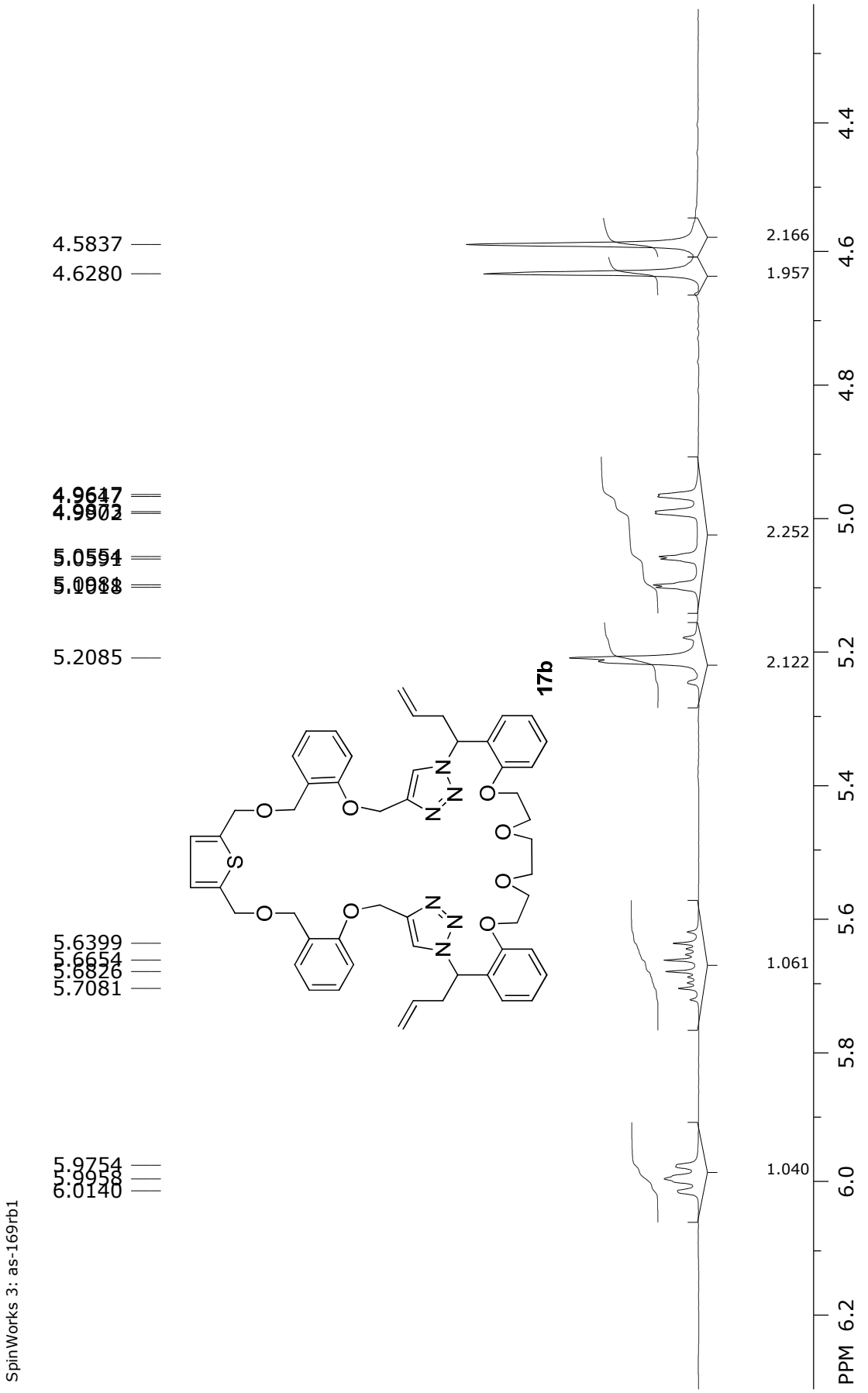
7.2851
7.3196
7.3240
7.3285
7.3387
7.3432
7.3476
7.3853
7.3880
7.4039
7.4063
7.7709
17b
0.992
1.047
3.241
2.442
1.077
1.031
1.000
6.60
6.70
6.80
6.90
7.00
7.10
7.20
7.30
7.40
7.50
7.60
7.70
7.80
7.90
PPM
SpinWorks 3: as-169rb1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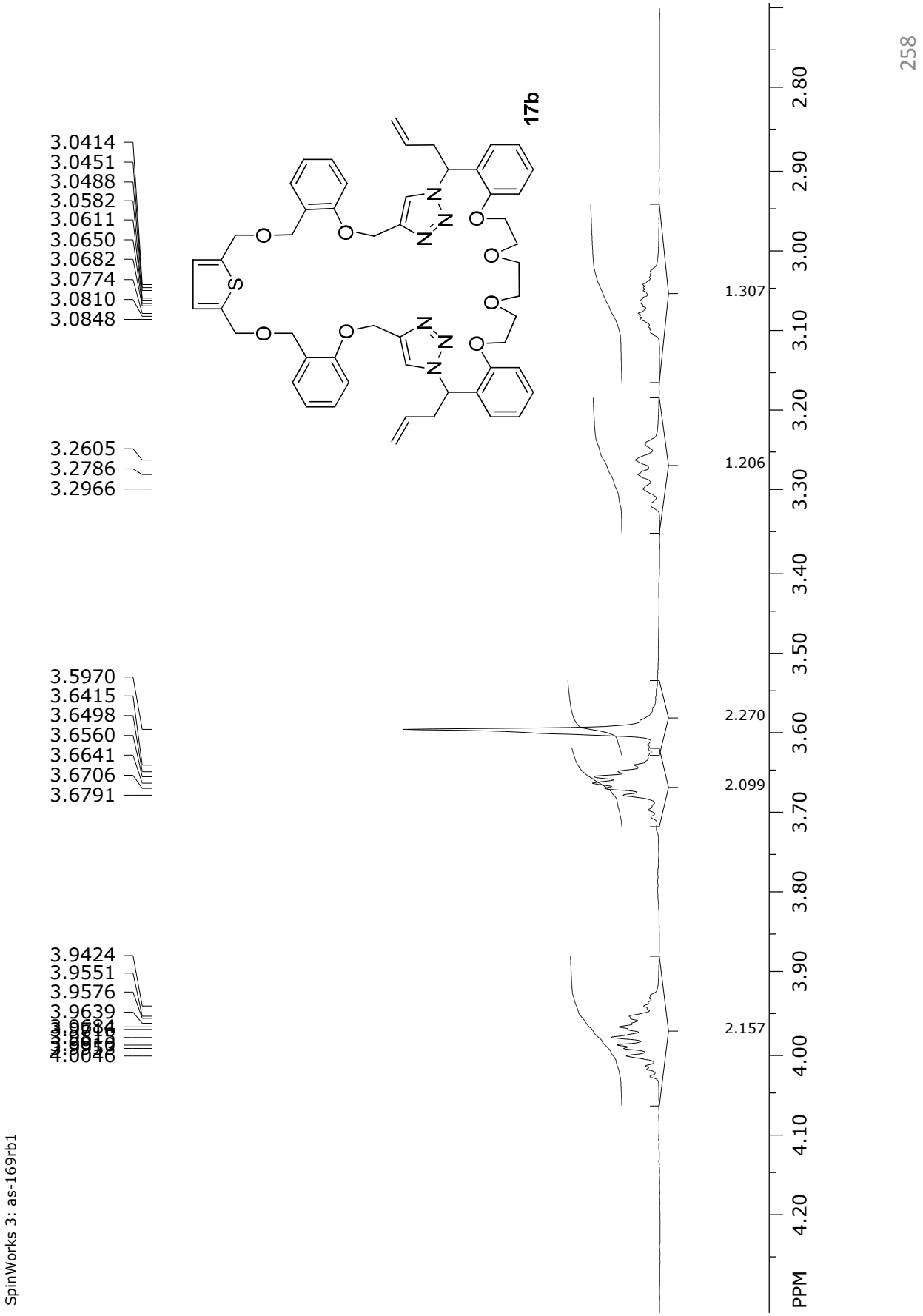
5.0591
5.0981
5.1018
5.2085
5.6399
5.6654
5.6826
5.7081
5.9754
6.0140
17b
2.166
1.957
2.252
2.122
1.061
1.040
PPM 6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
SpinWorks 3: as-169rb1


17b
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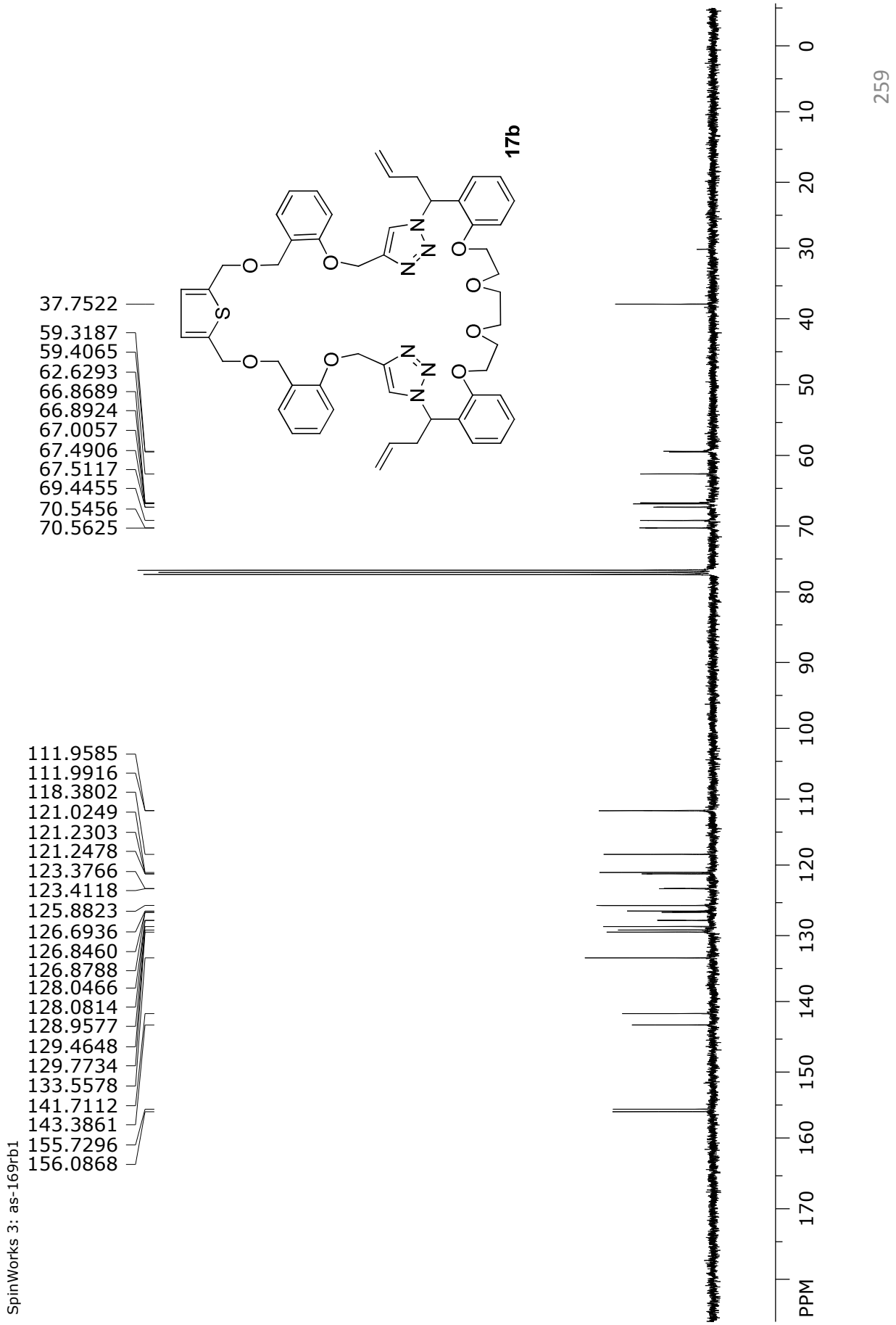
3.0488
3.0582
3.0611
3.0650
3.0682
3.0774
3.0810
3.0848
3.2605
3.2786
3.2966
3.5970
3.6415
3.6498
3.6560
3.6641
3.6706
3.6791
3.9424
3.9551
3.9576
3.9639
1.307
1.206
2.270
2.099
2.157
PPM
4.20
4.10
4.00
3.90
3.80
3.70
3.60
3.50
3.40
3.30
3.20
3.10
3.00
2.90
2.80
SpinWorks 3: as-169rb1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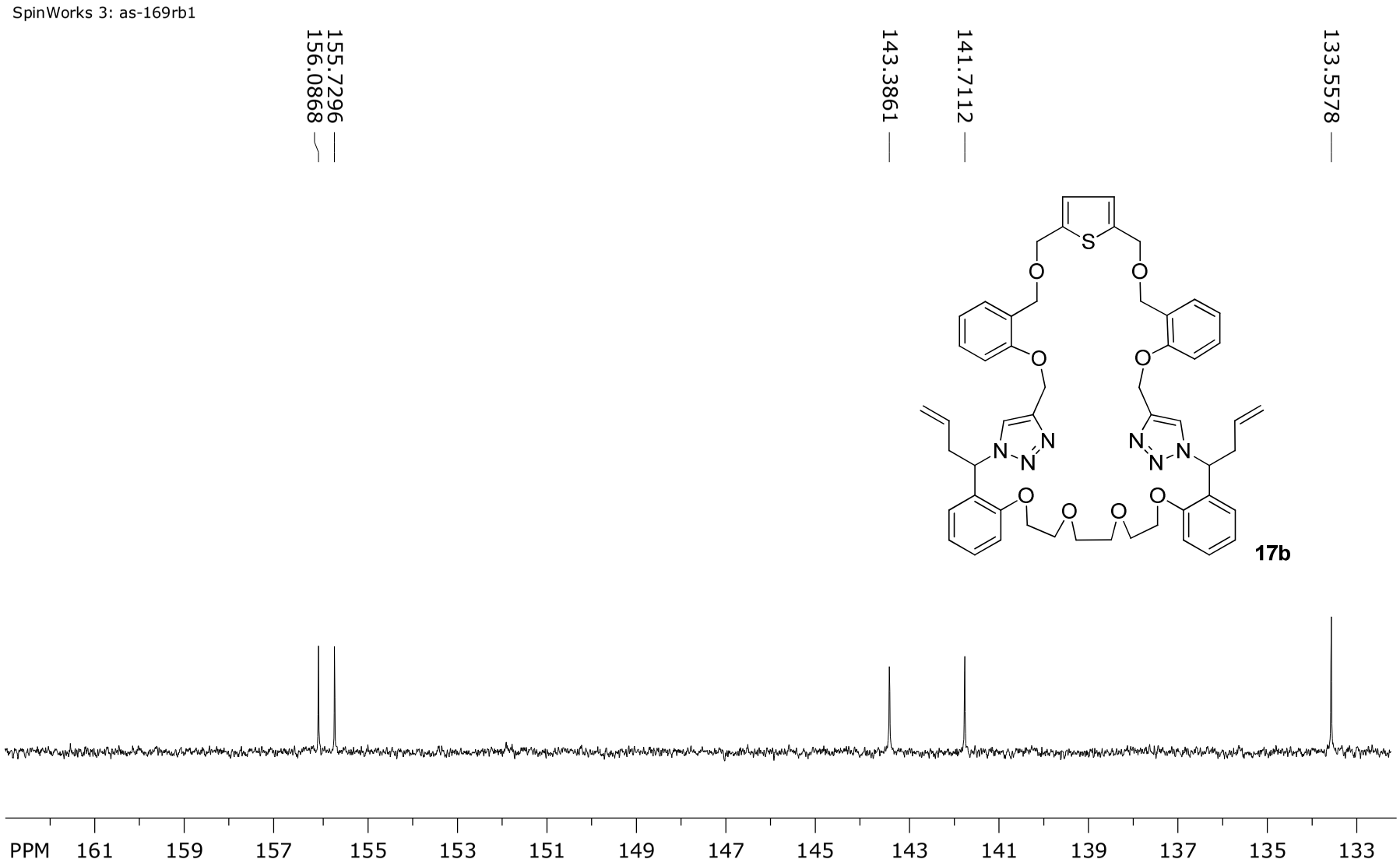
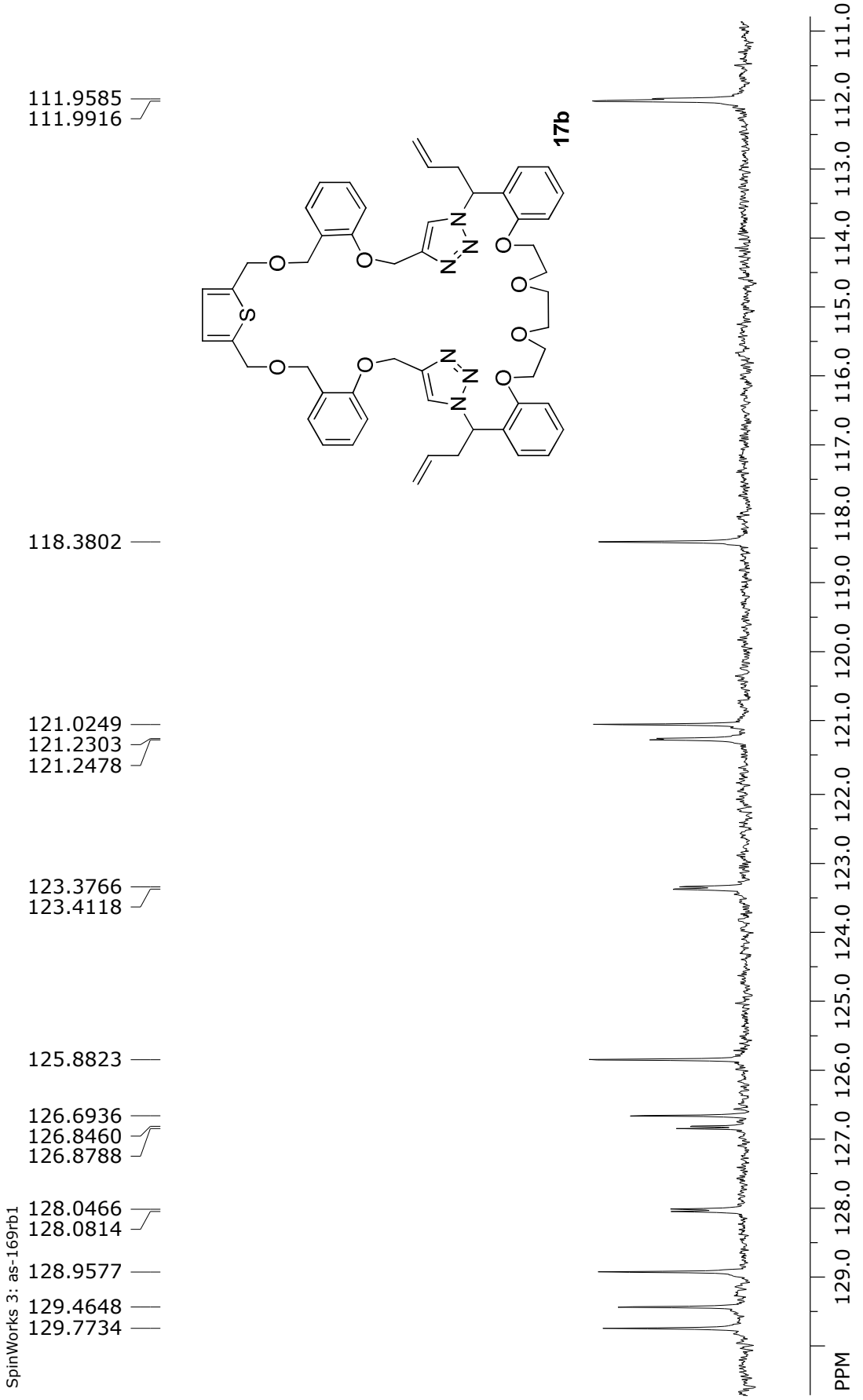
69.4455
70.5456
70.5625
111.9585
111.9916
118.3802
121.0249
121.2303
121.2478
123.3766
123.4118
125.8823
126.6936
126.8460
126.8788
128.0466
128.0814
128.9577
129.4648
129.7734
133.5578
141.7112
143.3861
155.7296
156.0868
SpinWorks 3: as-169rb1
PPM
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170




17b
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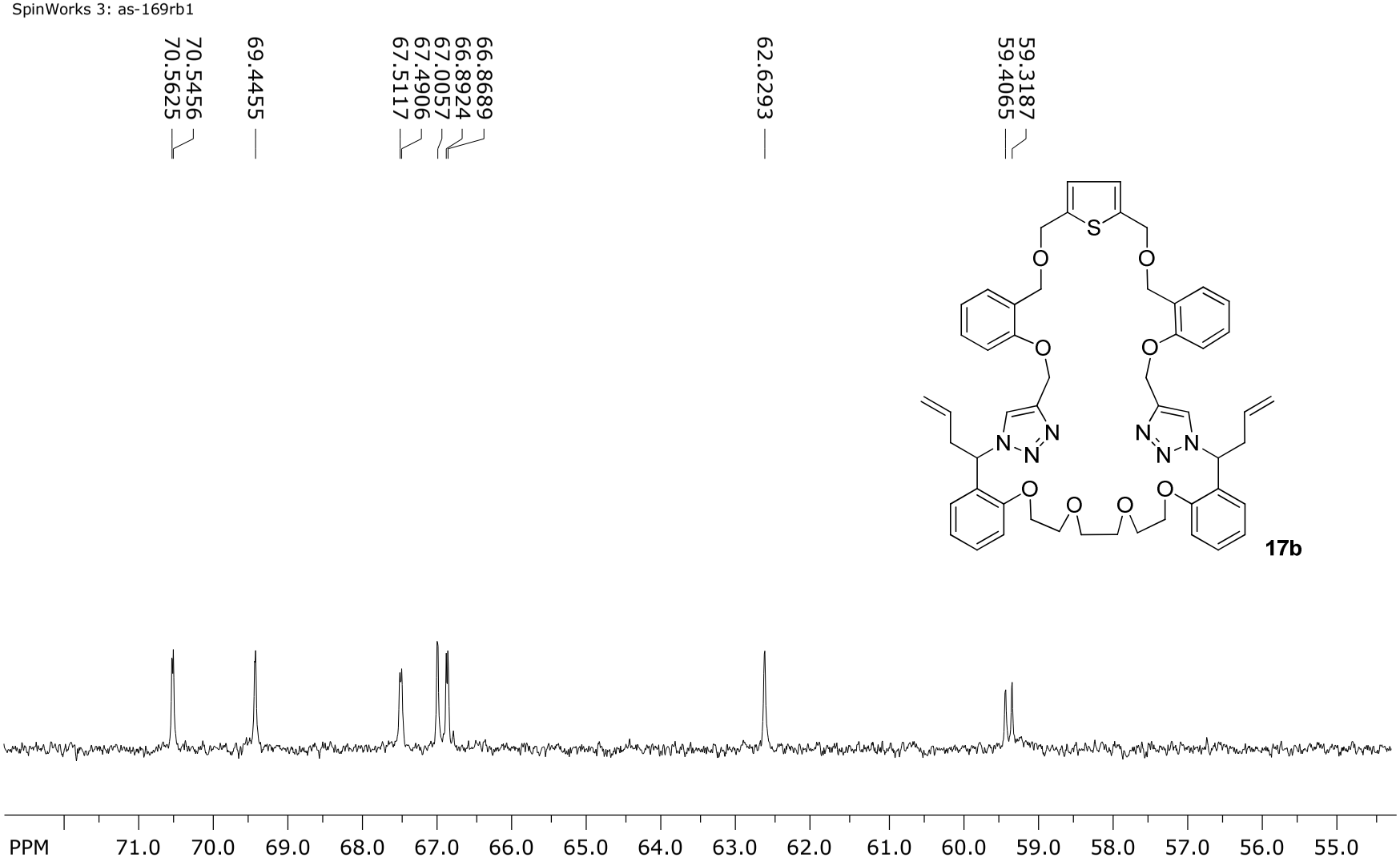
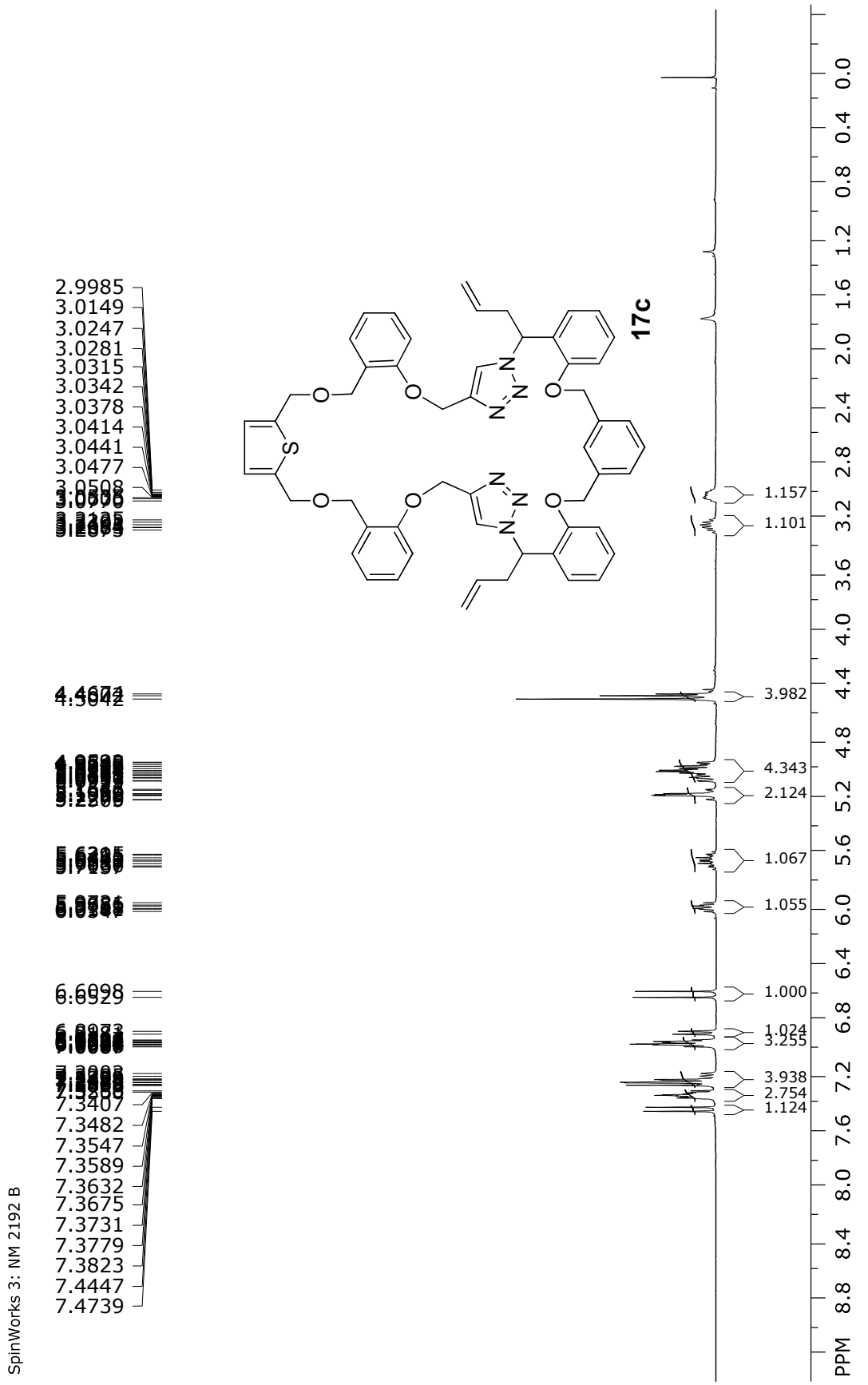
111.9916
118.3802
121.0249
121.2303
121.2478
123.3766
123.4118
125.8823
126.6936
126.8460
126.8788
128.0466
128.0814
128.9577
129.4648
129.7734
SpinWorks 3: as-169rb1
PPM
129.0 128.0 127.0 126.0 125.0 124.0 123.0 122.0 121.0 120.0 119.0 118.0 117.0 116.0 115.0 114.0 113.0 112.0 111.0

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3.0315
3.0342
3.0378
3.0414
3.0441
3.0477
3.0508
7.3407
7.3482
7.3547
7.3589
7.3632
7.3675
7.3731
7.3779
7.3823
7.4447
7.4739
1.157
1.101
3.982
4.343
2.124
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1.055
1.000
1.024
3.255
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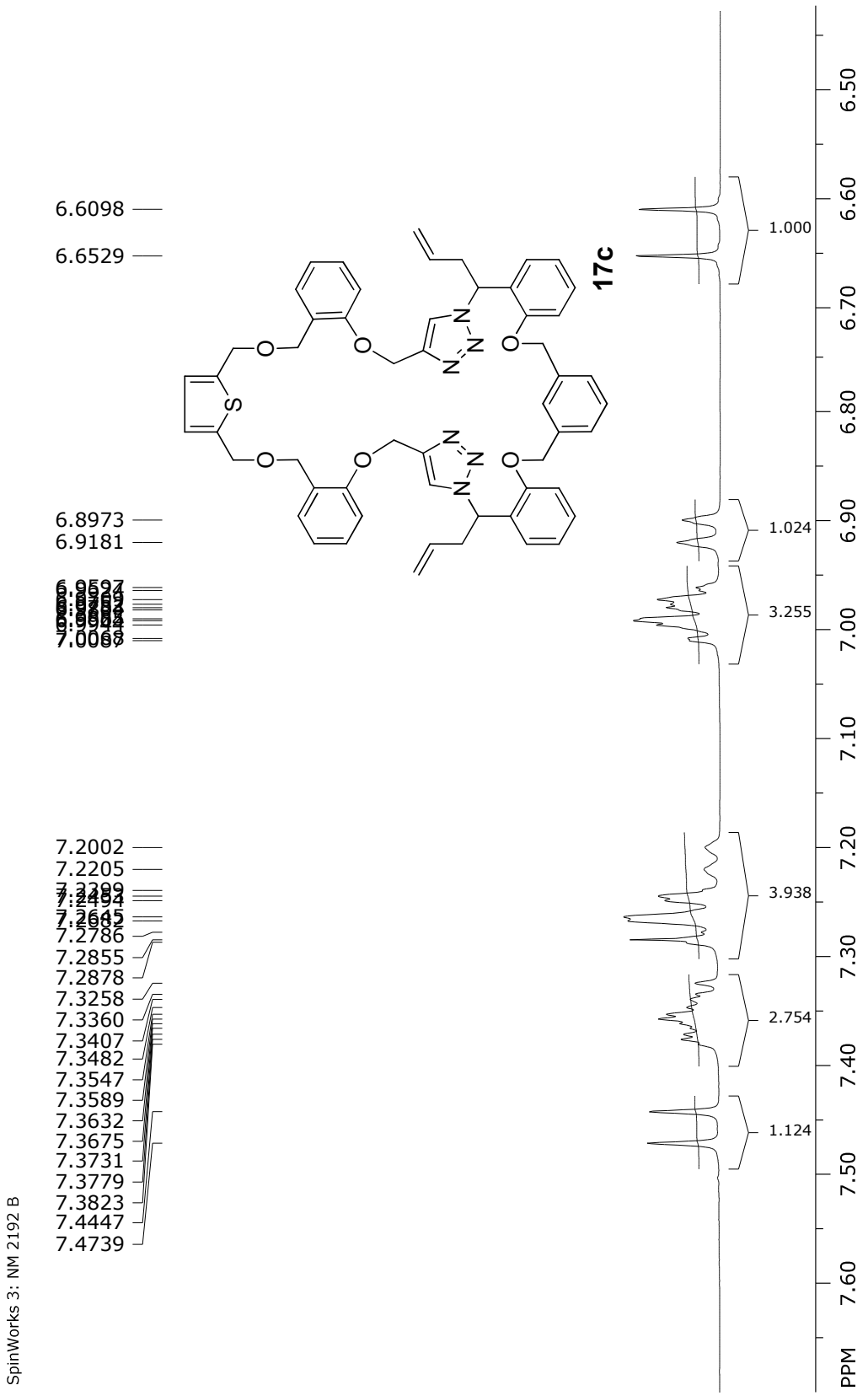
2.754
1.124
PPM
SpinWorks 3: NM 2192 B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7.2878
7.3258
7.3360
7.3407
7.3482
7.3547
7.3589
7.3632
7.3675
7.3731
7.3779
7.3823
7.4447
7.4739
17c
1.000
1.024
3.255
3.938
2.754
1.124
6.50
6.60
6.70
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7.00
7.10
7.20
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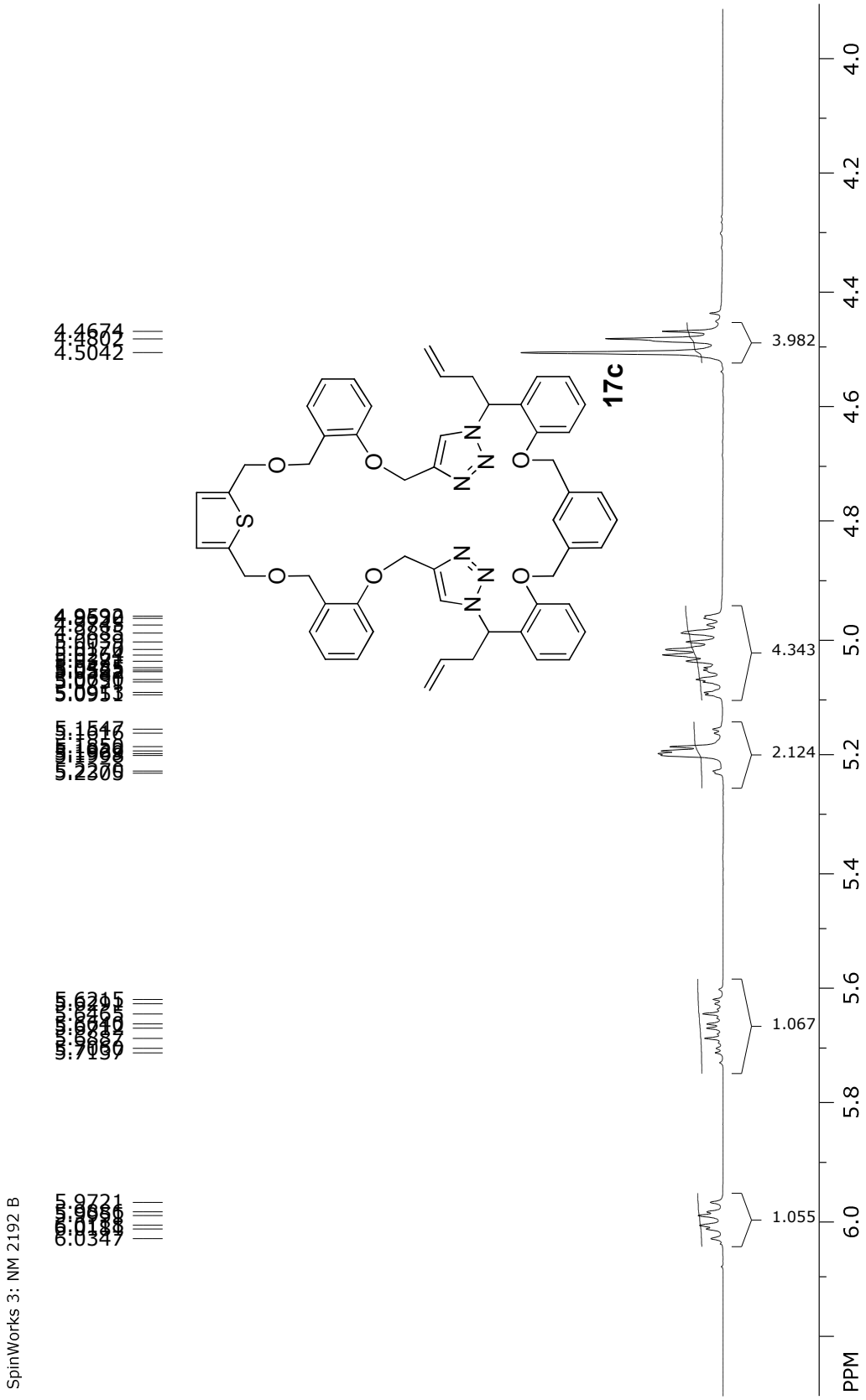
7.40
7.50
7.60
PPM
SpinWorks 3: NM 2192 B


SpinWorks 3: NM 2192 B
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3.982
4.343
2.124
1.067
1.055
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5.2
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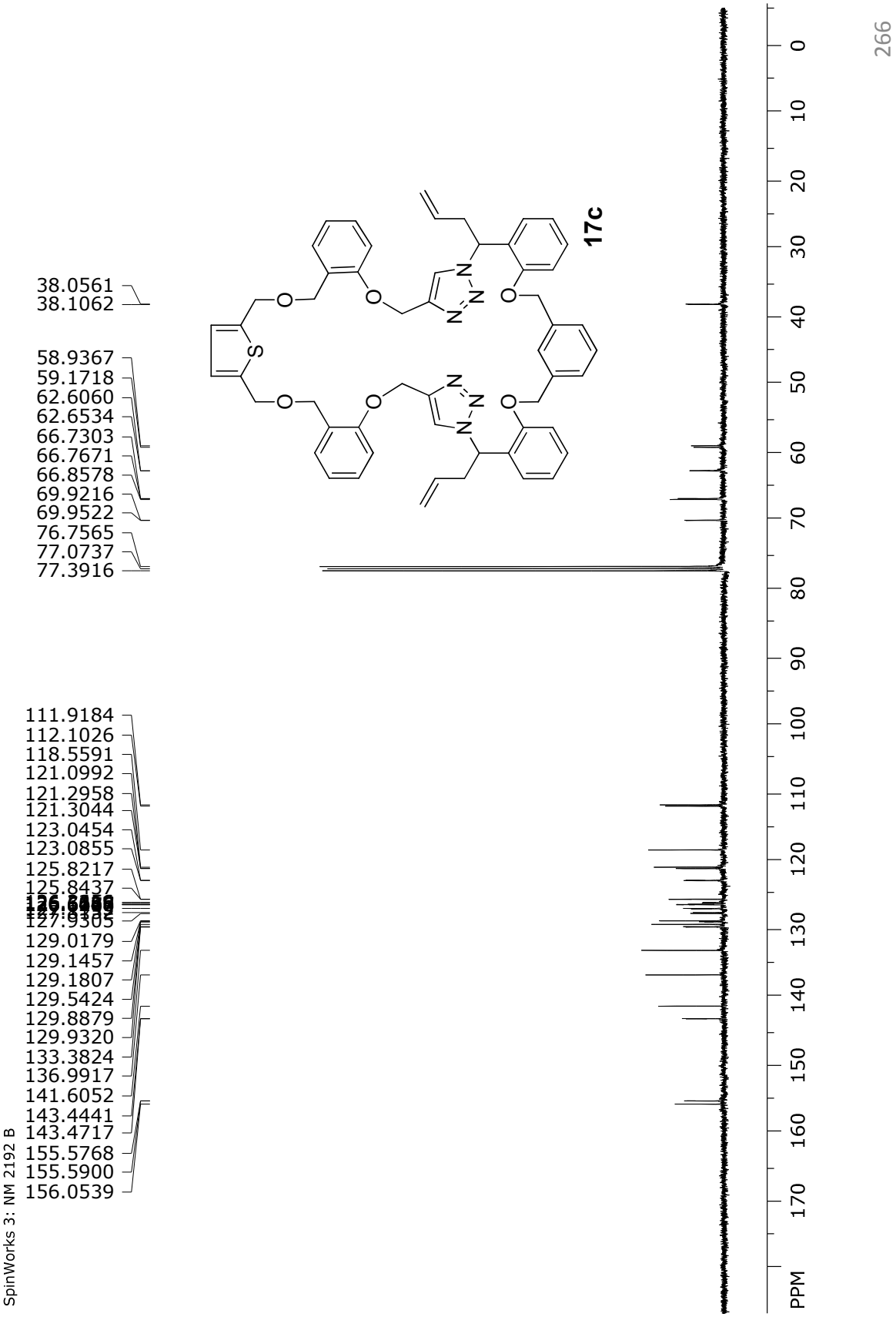
4.8
4.6
4.4
4.2
4.0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62.6534
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66.7671
66.8578
69.9216
69.9522
76.7565
77.0737
77.3916
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112.1026
118.5591
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123.0855
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125.8437
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129.0179
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156.0539
SpinWorks 3: NM 2192 B
PPM
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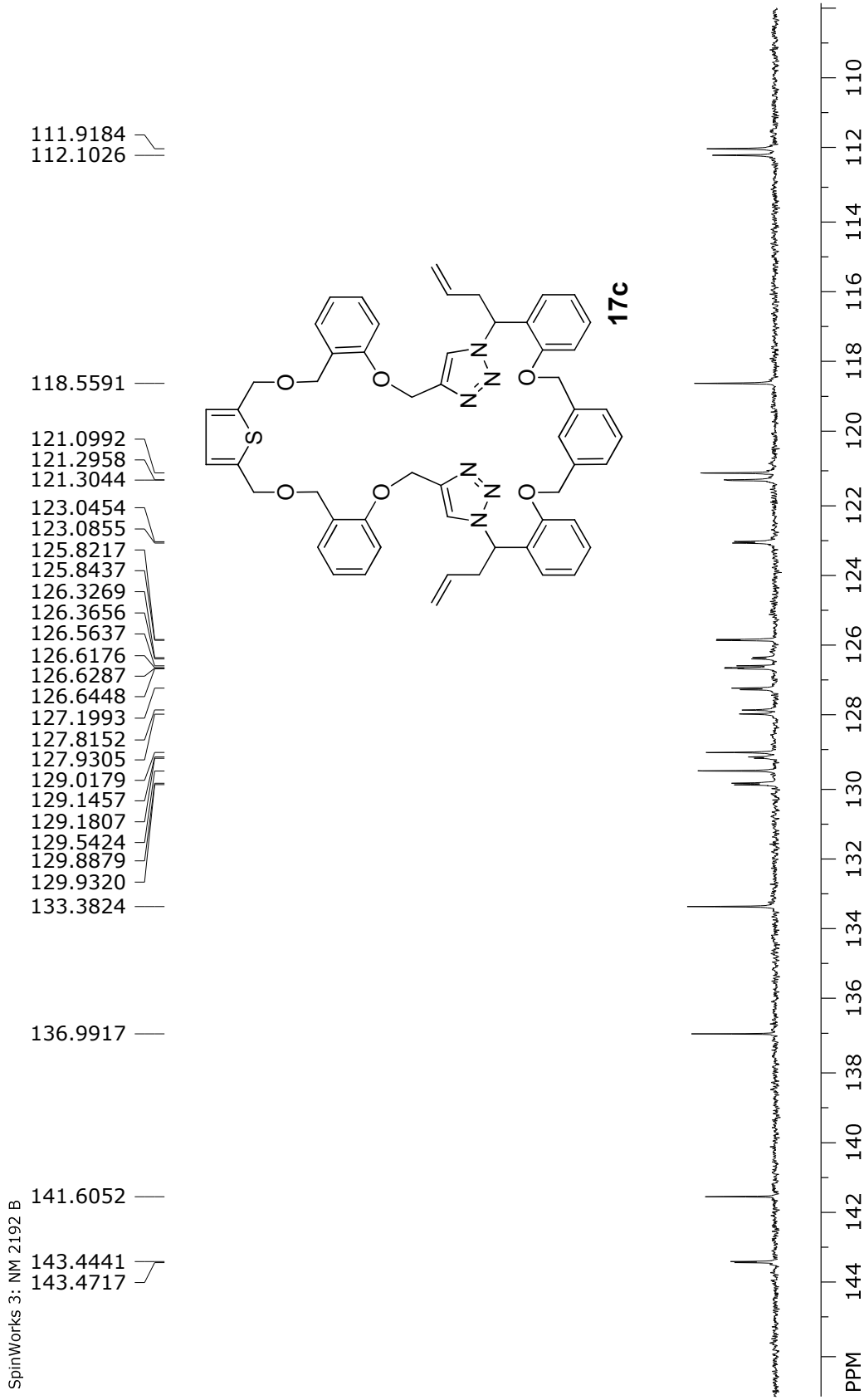
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17c
PPM
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136
138
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142
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SpinWorks 3: NM 2192 B