Supplementary Material (ESI) for Chemical Communications

Supporting Information

Glycosylation Initiated Cationic Ring-Opening Polymerization of Tetrahydrofuran to Prepare Neo-glycopolymers

Yao Li and Biao Yu*

State Key Laboratory of Bio-organic and Natural Products Chemistry,

Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences,

Shanghai 200032, China.

E-mail: byu@mail.sioc.ac.cn

Contents

1. General procedures

Commercial reagents were used without further purification unless specialized. Solvents were dried and redistilled prior to use in the usual way. Thin layer chromatography (TLCs) were performed on precoated plates of Silica Gel HF254 (0.5 mm, Yantai, China). Flash column chromatography was performed on Silica Gel H (10–40 μ, Yantai, China). ^{1}H and ^{13}C NMR spectra were recorded on a Varian AM 300 or Bruker AM 400 spectrometer with Me_4Si as the internal standard. Chemical shifts are recorded in δ values and *J* values were given in Hz. Mass spectra were obtained on a Bruker Daltonics, Inc. APEXIII 7.0 TESLA FTMS mass spectrometer. Atomic force microscopy (AFM) was performed on a Veeco Nanoscope IVa MultiMode microscope. Molecular weights (*M*n, *M*w) and polydispersity indexes (*M*w/*M*n) of the synthesized G-PTHF samples were measured by conventional gel chromatography (GPC) system equipped with a waters 1515 Isocratic HPLC pump, a Waters 2414 refractive index detector, and a set of Waters Styragel columns (HR3, HR4 and HR5, 7.8×300 mm). GPC measurements were carried out at 35 ^{o}C using THF as eluent with a flow rate of 1.0 mL/min. The system was calibrated with linear Polystyrene standards.

Preparation of PPh_3AuNTf_2 (commercially available).[S1]

$HNTf_2$ (5620 mg, 20 mmol) was dissolved in H_2O (20 mL), Ag_2CO_3 (2760 mg, 10 mmol) was then added. After refluxing for 3 h, the solid was filtered off. The solution was dried in vacuo, and then dissolved in dry CH_2Cl_2 (20 mL). [$Au(PPh_3)Cl$] (7730 mg, 20 mmol) was added. After stirring in dark for 15 min, the solid (AgCl) was filtered off and the solution was dried in vacuo to provide PPh_3AuNTf_2 quantitatively.

2. Preparation and characterization of glycosyl *ortho*-hexynylbenzoates

General procedures for the preparation of glycosyl *ortho*-hexynylbenzoates

1a-e. Deca-*O*-acetyl-maltotriose[S2] (1550 mg, 1.68 mmol), *ortho*-hexynylbenzoic acid[S1] (372 mg, 1.84 mmol), EDCI (416 mg, 2.18 mmol), and DMAP (205 mg, 1.68 mmol) were dissolved in CH_2Cl_2 (3 mL), then DIPEA (0.6 mL, 3.35 mmol) was added. After stirring for 5 h, the solution was diluted with CH_2Cl_2, and was then washed with water and brine. The organic layer was dried over Na_2SO_4, filtered,

and evaporated in vacuo. The residue was purified by silica gel column chromatography (petroleum ether-EtOAc 1.5:1) to give deca-*O*-acetyl-maltotriosyl *ortho*-hexynylbenzoate **1e** (1739 mg, 94%, α/β = 3:17, which are inseparable) as a white foam.

(S1: Li, Y. et al.; Yang, X.; Liu, Y.; Zhu, C.; Yang, Y.; Yu, B. *Chem. Eur. J.* **2010**, 16, 1871-1882. S2: Buijsman, R.C.; Basten, J. E.; Dreef-Tromp, C. M.; van der Marel , G. A.; van Boeckel , CA. A.; van Boom, J. H. *Bioorg. Med. Chem*. **1999**, *7*, 1881–1890)

Characterization of glycosyl *ortho*-hexynylbenzoates: Literature for known compounds and characterization data for new compounds.

Compounds	Literature or characterization data
1a	Yang, Y.; Li, Y.; Yu, B. *J. Am. Chem. Soc*. **2009**, *131*, 12076–12077.
1b	Li, Y.; Yang, X.; Liu, Y.; Zhu, C.; Yang, Y.; Yu, B. *Chem. Eur. J.* **2010**, 16, 1871-1882.
1c	Li, Y.; Yang, X.; Liu, Y.; Zhu, C.; Yang, Y.; Yu, B. *Chem. Eur. J.* **2010**, 16, 1871-1882.
1d	Yang, Y.; Li, Y.; Yu, B. *J. Am. Chem. Soc*. **2009**, *131*, 12076–12077.
1e	^{1}H NMR (100 MHz, $CDCl_3$): δ 8.01 (d, 0.15 H, J = 7.6 Hz), 7.90 (d, 0.85 H, J = 7.6 Hz), 7.60–7.27 (m, 3 H), 6.54 (s, 0.15 H), 6.01 (d, 0.85 H, J = 8.0 Hz), 5.65 (t, 0.15 H, J = 9.6 Hz), 5.46–5.26 (m, 4.85 H), 5.14 (t, 1 H, J = 8.4 Hz), 5.07 (t, 1 H, J = 9.6 Hz), 4.86 (d, 1 H, J = 10.0 Hz), 4.76 (d, 1 H, J = 10.0 Hz), 4.56–3.88 (m, 11 H), 2.58–2.45 (m, 2 H), 2.20–1.94 (m, 30 H), 1.70–1.45 (m, 4 H), 0.97 (t, 3 H, J = 7.2 Hz); ^{13}C NMR (100 MHz, $CDCl_3$): δ 170.4, 170.3 (2C), 170.2, 170.1, 170.0, 169.5, 169.4, 169.2, 163.9, 163.0, 134.8, 134.5, 132.3, 130.6, 130.4, 129.8, 129.1, 127.2, 127.0, 125.6, 125.1, 97.1, 96.9, 95.9, 95.7, 95.5, 91.5, 89.4, 79.5, 78.8, 77.2, 74.8, 73.4, 73.3, 72.7, 72.4, 72.3, 71.9, 71.4, 70.8, 70.5, 70.2, 69.9, 69.8, 69.1, 68.8, 68.3, 67.7, 62.6, 62.4, 62.1, 61.2, 30.4, 30.3, 21.8, 21.7, 20.6 (2C), 20.5, 20.4, 20.3 (2C), 20.2, 19.2, 13.4; HRMS (ESI) calcd $C_{51}H_{64}O_{27}Na$ $[M+Na]^+$ 1131.35272, found 1131.35538.

3. Preparation and characterization of G-PTHFs

General procedures for preparation of G-PTHFs. Under an argon atmosphere, to a solution of 3,4,6-tri-*O*-acetyl-2-azido-2-deoxy-D-glucopyranosyl *ortho*-hexynylbenzoate **1a** (206 mg, 0.4 mmol) in dry THF (35 mL) at room temperature was added a THF solution of PPh_3AuNTf_2 (0.2 mmol, 5 mL) under vigorously stirring. After different reaction time, the mixture was poured into ice cold water. The resulting G-PTHF **2a** was precipitated, which was then taken from the solution and dried under vacuum.

For a small scale analysis, a sample was taken from the reaction mixture via syringe and charged into cold water. The resulting aqueous solution was concentrated to give a residue, which was then purified by silica gel column chromatography (petroleum ether-EtOAc 3 : 1 to CH_2Cl_2-MeOH 25 : 1) to provide the G-PTHF **2a**.

The G-PTHF could also be purified by gel column Sephadex LH-20 (CH_2Cl_2-MeOH 1 : 1) or precipitation from *N*,*N*-dimethylformamide.

The ^{1}H and ^{13}C NMR data of G-PTHFs

Compounds	characterization data
G-PTHF **2a** (0.1 M in THF-d8, at 2 d)	^{1}H NMR (400 MHz, $CDCl_3$): δ 5.48 (dd, 0.54 H, J = 10.0, 0.8 Hz, H4α), 5.09–4.95 (m, 2 H, H1α, H3α, H4β, H3β), 4.39(d, 0.46 H, J = 8.0 Hz, H1β), 4.29 (dd, 1 H, J = 12.4, 4.4 Hz, H6β, H6α), 4.15–4.00 (m, 1.76 H, H6β', H5α, H6α'), 3.62 (m, 0.52 H, H5β), 3.48 (m, 0.46 H, H2β), 3.39 (s, ~1.1 H, CD_2), 3.28 (m, 0.56 H, H2α), 2.05–1.99 (m, 9 H, Ac), 1.58 (s, ~1.1 H, CD_2).
G-PTHF **2a** (0.01 M in THF, at 15 min)	^{1}H NMR (400 MHz, $CDCl_3$): δ 5.48 (dd, 0.55 H, J = 10.0, 0.8 Hz, H4α), 5.09–4.95 (m, 2 H, H1α, H3α, H4β, H3β), 4.39(d, 0.46 H, J = 8.0 Hz, H1β), 4.29 (dd, 1 H, J = 12.4, 4.4 Hz, H6β, H6α), 4.15–4.00 (m, 1.85 H, H6β', H5α, H6α'), 3.41 (m, ~390 H,),. 2.05–1.99 (m, 9 H, Ac), 1.62 (m, ~390 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 170.4, 169.9, 169.6, 102.0, 97.8, 71.4, 70.7, 70.5, 68.8, 68.5, 67.9, 67.5, 63.7, 62.5, 61.8, 60.8, 26.5, 20.6.
G-PTHF **2b** (0.01 M in	^{1}H NMR (400 MHz, $CDCl_3$): δ 8.03–7.80 (m, 8 H), 7.59–7.25 (m, 12 H), 5.90 (t, 1 H, J = 9.6 Hz), 5.68 (t, 1 H, J = 9.6 Hz), 5.52 (t, 1

THF, at 9 min)	H, *J* = 8.0 Hz), 4.65 (dd, 1 H, *J* = 12.4, 2.8 Hz), 4.51 (dd, 1 H, *J* = 12.0, 5.2 Hz), 4.16 (m, 1 H), 3.41 (m, ~700 H,), 1.63 (m, ~700 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 166.1, 165.8, 165.0, 133.4, 133.1(2C), 129.9, 129.8, 129.7 (3C), 128.8, 128.4, 128.3 (2C), 101.2, 72.9, 72.2, 71.9, 70.8 (2C), 70.6, 70.4 (2C), 70.2, 70.1, 70.0, 69.8, 63.2, 62.7, 26.9, 26.7, 26.5, 26.3, 26.2, 26.0.
G-PTHF **2c** (0.01 M in THF, at 15 min)	^{1}H NMR (400 MHz, $CDCl_3$): δ 8.00 (d, 2 H, *J* = 7.6 Hz), 7.59–7.05 (m, 18 H), 5.25 (t, 1 H, *J* = 8.0 Hz), 4.83–4.70 (m, 2 H), 4.69–4.45 (m, 5 H), 3.90–3.70 (m, 5 H), 3.40 (m, ~1092 H,), 1.62 (m, ~1092 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 165.1, 138.1, 137.9, 137.8, 134.2, 134.0, 132.9, 132.0, 130.0, 129.7, 129.3, 129.1, 128.4, 128.3 (2C), 128.2, 128.0, 127.8, 127.7, 127.6, 101.1, 82.8, 78.0, 76.7, 75.2, 75.0, 73.8, 73.5, 71.4, 70.7, 70.6, 70.4, 70.1, 69.7, 69.4, 68.8, 67.4, 62.6, 27.3, 26.8, 26.6, 26.5, 26.3, 26.0.
G-PTHF **2d** (0.01 M in THF, at 15 min)	^{1}H NMR (400 MHz, $CDCl_3$) : δ 7.84–7.71 (m, 4 H), 7.40–7.25 (m, 5 H), 5.79 (t, 1 H, *J* = 9.6 Hz), 5.40 (d, 1 H, *J* = 8.4 Hz), 5.35 (t, 1 H, *J* = 9.6 Hz), 5.26 (d, 1 H, *J* = 3.6 Hz), 4.98 (t, 1 H, *J* = 9.6 Hz), 4.66 (m, 2 H), 4.22–4.00 (m, 4 H), 3.86–3.71 (m, 3 H), 3.62–3.19 (m, ~430 H), 2.05 (s, 3 H), 2.04 (s, 3 H), 2.02 (s, 3 H), 1.89 (s, 3 H), 1.75–1.50 (m, ~ 430 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 170.4, 169.8, 169.7, 169.6, 137.9, 134.1, 128.4, 127.7, 127.5, 123.4, 98.2, 97.8, 75.7, 74.2, 73.5, 71.5, 70.6, 70.3, 70.1, 69.6, 68.8, 68.3, 68.1, 62.6, 61.4, 61.0, 55.2, 26.9, 26.6, 26.5, 26.3, 26.1, 26.0, 20.6 (2C), 20.5.
G-PTHF **2e** (0.1 M in THF-d8, at 15 min)	^{1}H NMR (400 MHz, $CDCl_3$): δ 5.52 (t, 0.6 H, *J* = 9.2 Hz), 5.47–5.22 (m, 4.4 H), 5.07 (t, 1 H, *J* = 10.0 Hz), 4.95 (d, 0.6 H, *J* = 3.6 Hz), 4.89–4.70 (m, 3 H), 4.53–4.40 (m, 2.4 H), 4.36–4.16 (m, 3 H), 4.10–3.89 (m, 6 H), 3.39 (s, ~0.60 H, CD_2), 2.20–1.95 (m, 30 H), 1.56 (s, ~0.60 H, CD_2).
G-PTHF **2e** (0.01 M in THF, at 5 min)	^{1}H NMR (400 MHz, $CDCl_3$): δ 5.52 (t, 0.6 H, *J* = 9.2 Hz), 5.47–5.22 (m, 4.4 H), 5.07 (t, 1 H, *J* = 10.0 Hz), 4.95 (d, 0.6 H, *J* = 3.6 Hz), 4.89–4.70 (m, 3 H), 4.53–4.40 (m, 2.4 H), 4.36–4.16

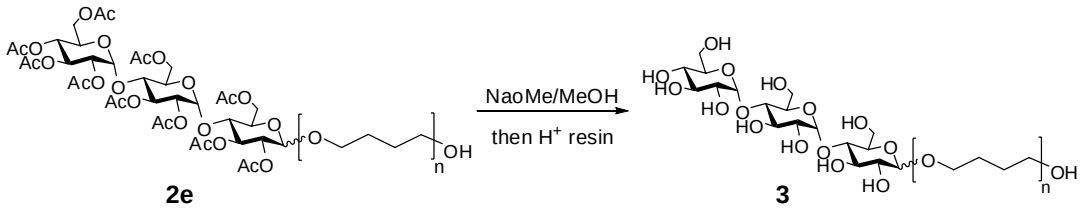
	(m, 3 H), 4.10–3.89 (m, 6 H), 3.39 (s, ~570 H), 2.20–1.97 (m, 30 H), 1.56 (s, ~570 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 170.6, 170.5, 170.3, 169.7, 95.7, 76.7, 72.6, 72.4, 72.2, 71.5, 70.6, 70.4, 70.2, 68.8, 62.7, 61.3, 26.9, 26.5, 26.1, 20.8 (2C), 20.5.

Characterization of the glycosylation initiated polymerization of THF with donors 1a-e.[a]

Entry	Donors	conc	Time (min)	Conv.[c] (%)	M_n[d]	M_w[d]	MP[d]	Mz[d]	Mz+1[d]	M_w/M_n
1[e]	**1a**	0.01	5	2.5	8984	11310	12403	13365	15405	1.26
2[e]	**1a**	0.01	15	4.7	16010	23351	32655	29534	34481	1.46
3	**1a**	0.01	45	8.8	20424	33507	35816	46160	56896	1.64
4	**1a**	0.01	120	9.8	23179	35951	37743	49334	61543	1.55
5[e]	**1b**	0.01	3	2.1	8968	10354	10559	11816	13476	1.15
6[e]	**1b**	0.01	9	4.6	17561	21622	24051	25105	28553	1.23
7	**1b**	0.01	17	7.1	25181	33354	41652	39513	44430	1.32
8	**1b**	0.01	28	8.3	28179	42297	61826	53190	61209	1.50
9	**1b**	0.01	65	9.1	29295	48365	53137	66246	81783	1.65
10	**1b**	0.01	120	10.6	31346	49670	54332	66706	81440	1.58
11	**1b**	0.01	2 d	19.0	73820	100625	102158	129219	155500	1.36
12	**1b**	0.005	2 d	8.0	50586	82580	87698	117150	147862	1.63
13	**1b**	0.04	2 d	60.0	32727	59630	57652	87806	115362	1.82
14[e]	**1c**	0.01	5	4.0	11823	12496	13121	13061	13551	1.06
15	**1c**	0.01	15	6.6	28488	29623	30852	30620	31509	1.04
16	**1c**	0.01	45	8.6	35984	52589	77932	64134	71732	1.46
17	**1c**	0.01	120	12.1	39663	61685	65898	81259	98753	1.56
18[e]	**1d**	0.01	5	2.6	12074	15664	17181	18857	21982	1.30
19	**1d**	0.01	15	3.3	18902	28351	37253	36903	44410	1.50
20	**1d**	0.01	45	3.9	20219	33713	39503	46552	57178	1.67
21	**1d**	0.01	120	5.0	23797	37572	43865	51413	63423	1.58
22[e]	**1e**	0.01	5	6.0	19126	23778	24000	28152	32550	1.24
23	**1e**	0.01	15	7.1	25723	33907	40095	40028	45113	1.32
24	**1e**	0.01	45	8.2	27115	47141	47614	68925	88290	1.74
25	**1e**	0.01	120	10.0	40844	74132	77039	107876	140935	1.81

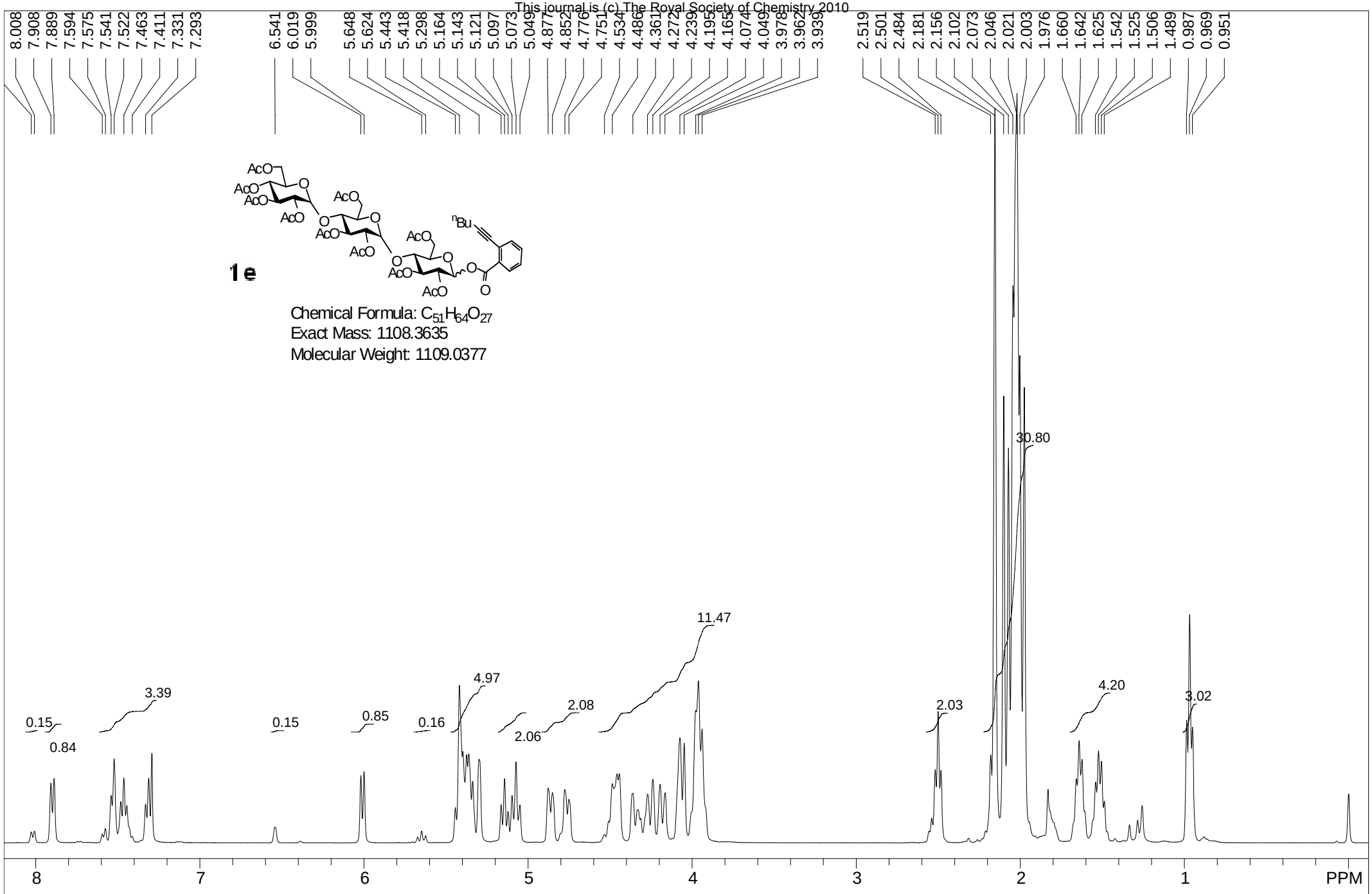
[a]In the presence of PPh_3AuNTf_2 (0.5 equiv) at rt. [b]The concentration of donor **1b** in THF (mol·L^{-1}). [c]The conversion of THF into G-PTHF (wt%). [d]Determined by GPC based on polystyrene standards. [e]Small scale experiments were performed (<20 mg initiator).

4. Preparation and characterization of G-PTHF 3



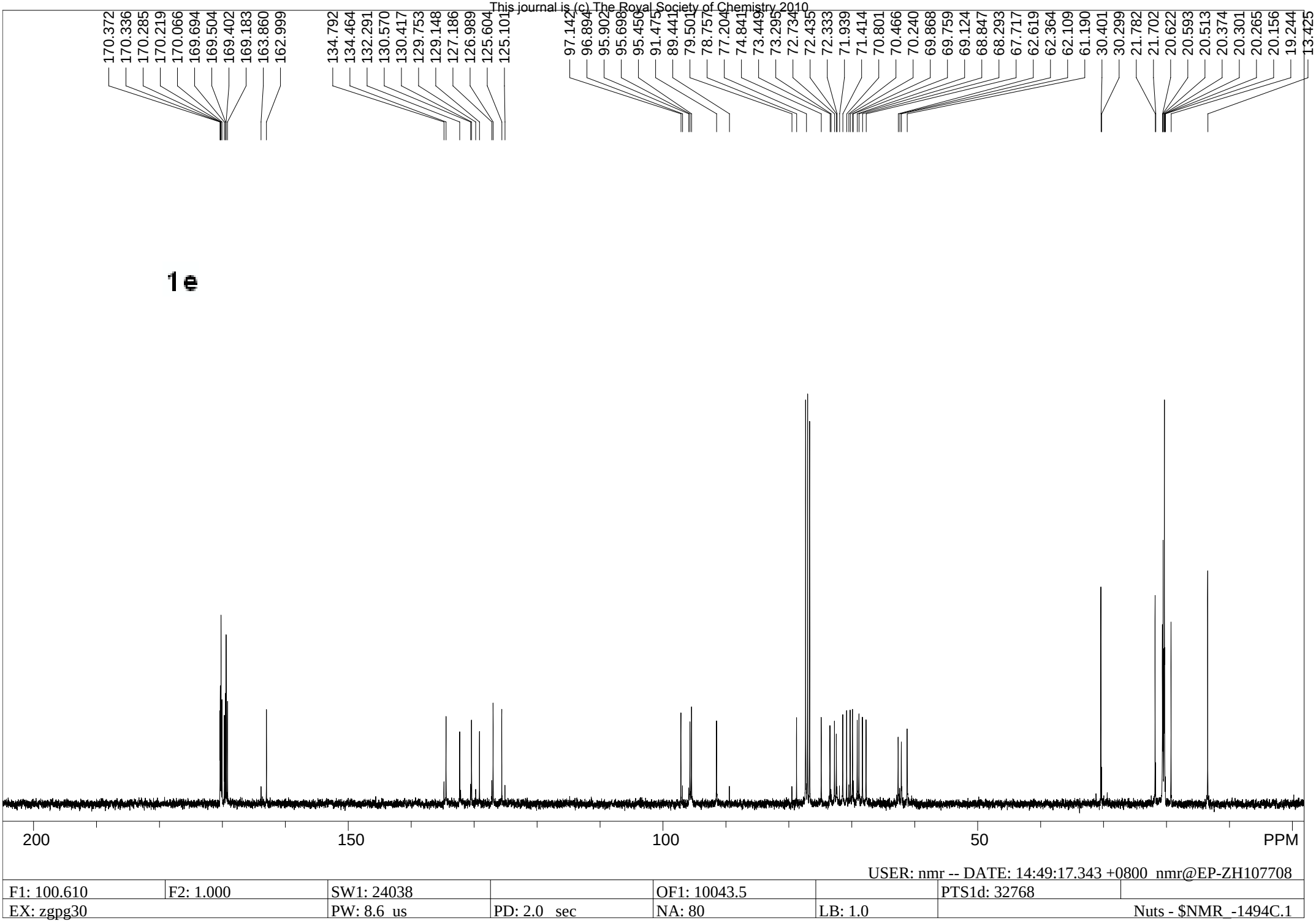
2e **3**

G-PTHF **2e** (60 mg, M_n = 19126, M_n/M_w = 1.24) was dissolved in MeOH (1.5 mL), NaOMe (4 mg) was added. After stirring overnight, the mixture was neutralized to pH = ~7 with Na^+ exchange resin. The solution was filtered and dried under vacuum to provide G-PTHF **3** (59 mg, 100%) as a white solid: ^{1}H NMR (300 MHz, $CD_3OD/CDCl_3$ = 1 : 1): δ 5.12 (d, 2 H, J = 3.9 Hz), 4.80 (d, 0.6 H, J = 3.9 Hz), 4.28 (d, 0.4 H, J = 7.8 Hz), 3.46 (s, ~570 H), 1.63 (s, ~570 H); ^{13}C NMR (100 MHz, $CD_3OD/CDCl_3$ = 1 : 1): δ 106.9, 105.5, 105.4, 84.6, 84.1, 84.0, 82.0, 80.4, 79.2, 77.7, 77.5, 77.3, 77.2, 76.8, 76.5, 75.9(2C), 75.8, 74.9, 74.8, 74.6, 74.5, 74.3, 74.1, 73.9, 73.3, 71.7, 65.4, 64.8, 64.7(2C), 52.5, 52.3, 52.0, 30.4, 30.2, 30.0, 29.9, 28.8.



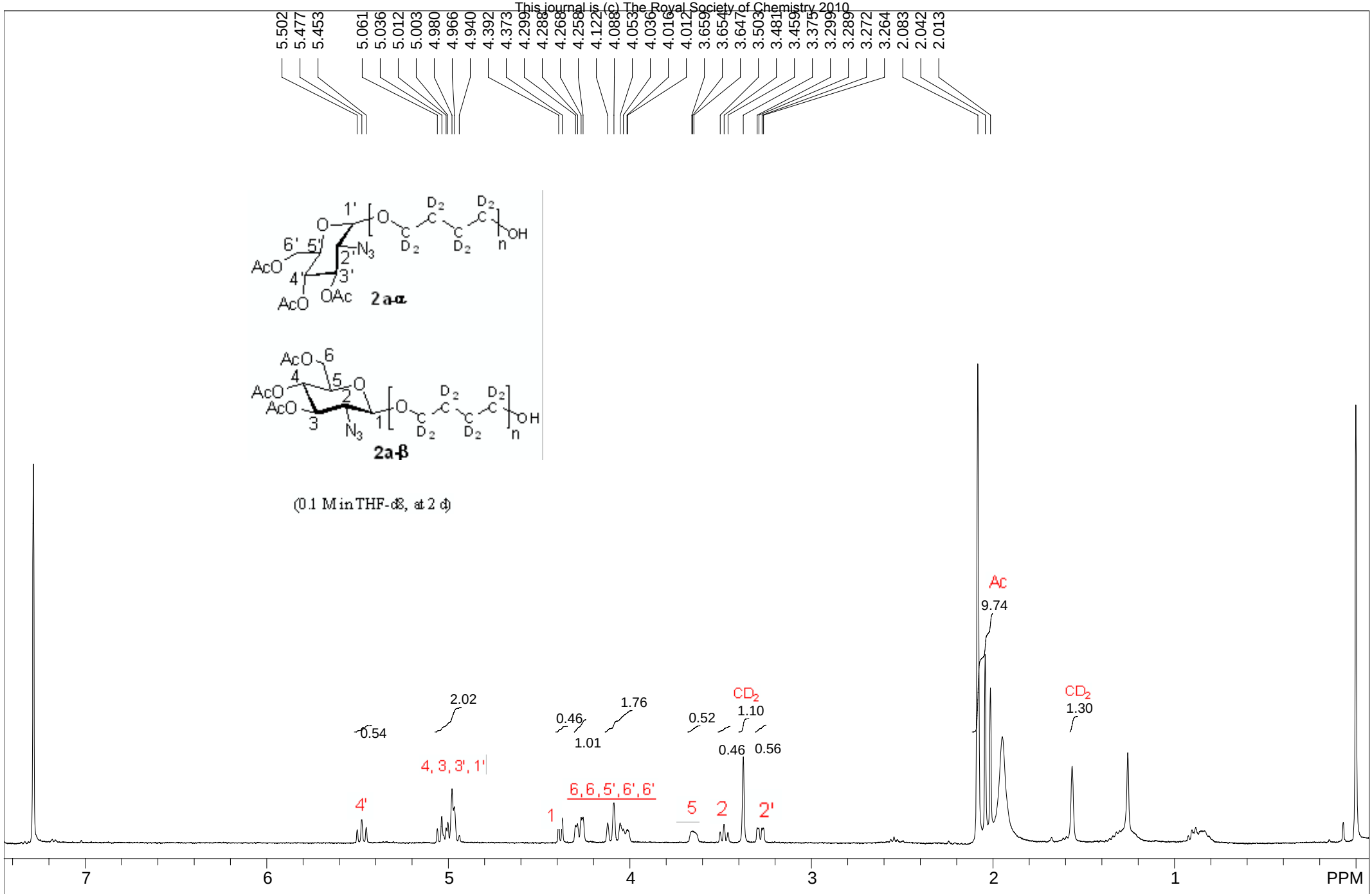
USER: nmr -- DATE: 09:36:28.843 +0800 nmr@EP-ZH107708

F1: 400.120	F2: 1.000	SW1: 8224		OF1: 2474.4		PTS1d: 32768
EX: zg30		PW: 9.3 us	PD: 1.0 sec	NA: 16	LB: 0.3	Nuts - $20051451494_10.1



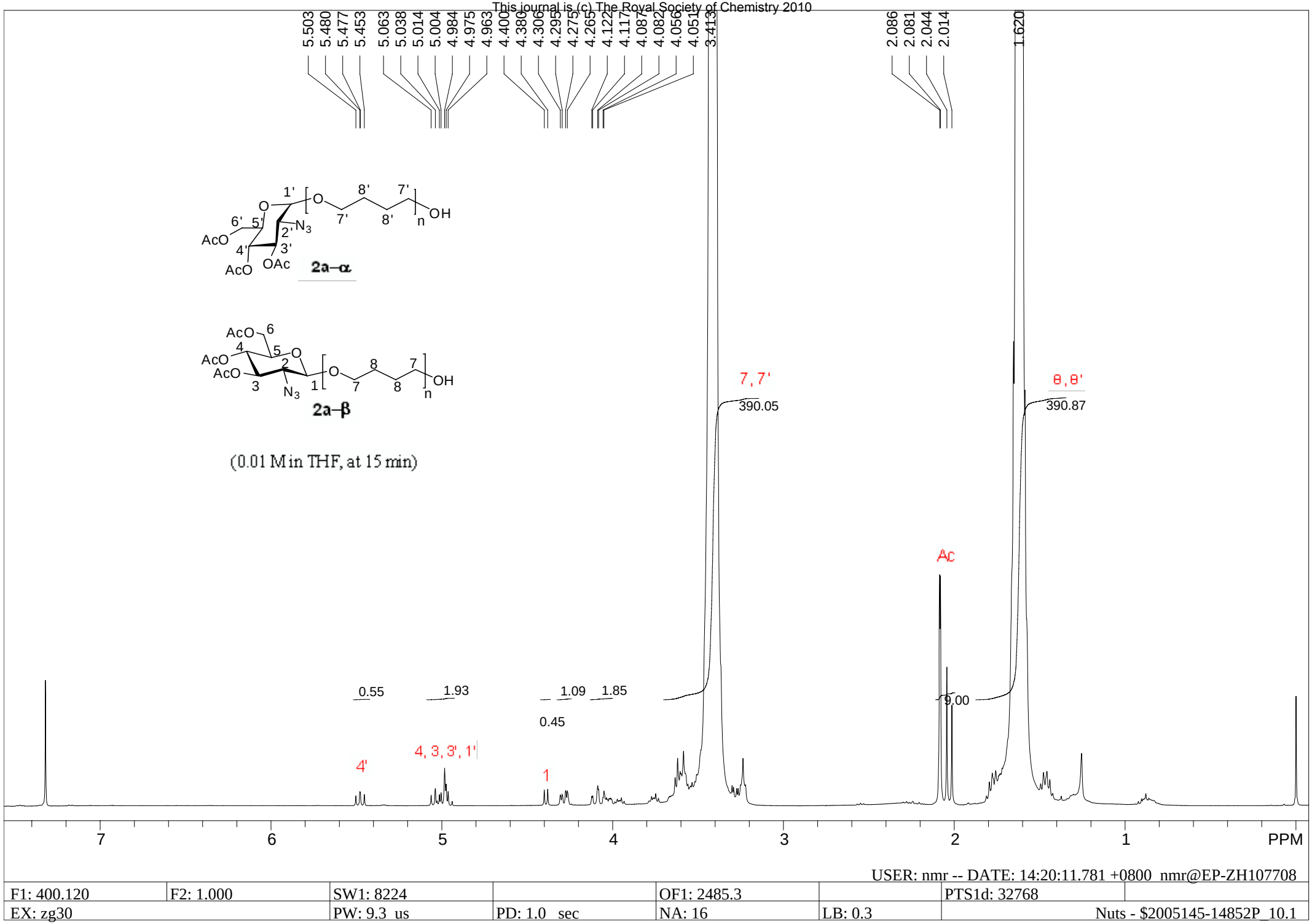
USER: nmr -- DATE: 14:49:17.343 +0800 nmr@EP-ZH107708

F1: 100.610	F2: 1.000	SW1: 24038		OF1: 10043.5		PTS1d: 32768	
EX: zgpg30		PW: 8.6 us	PD: 2.0 sec	NA: 80	LB: 1.0		Nuts - $NMR -1494C.1



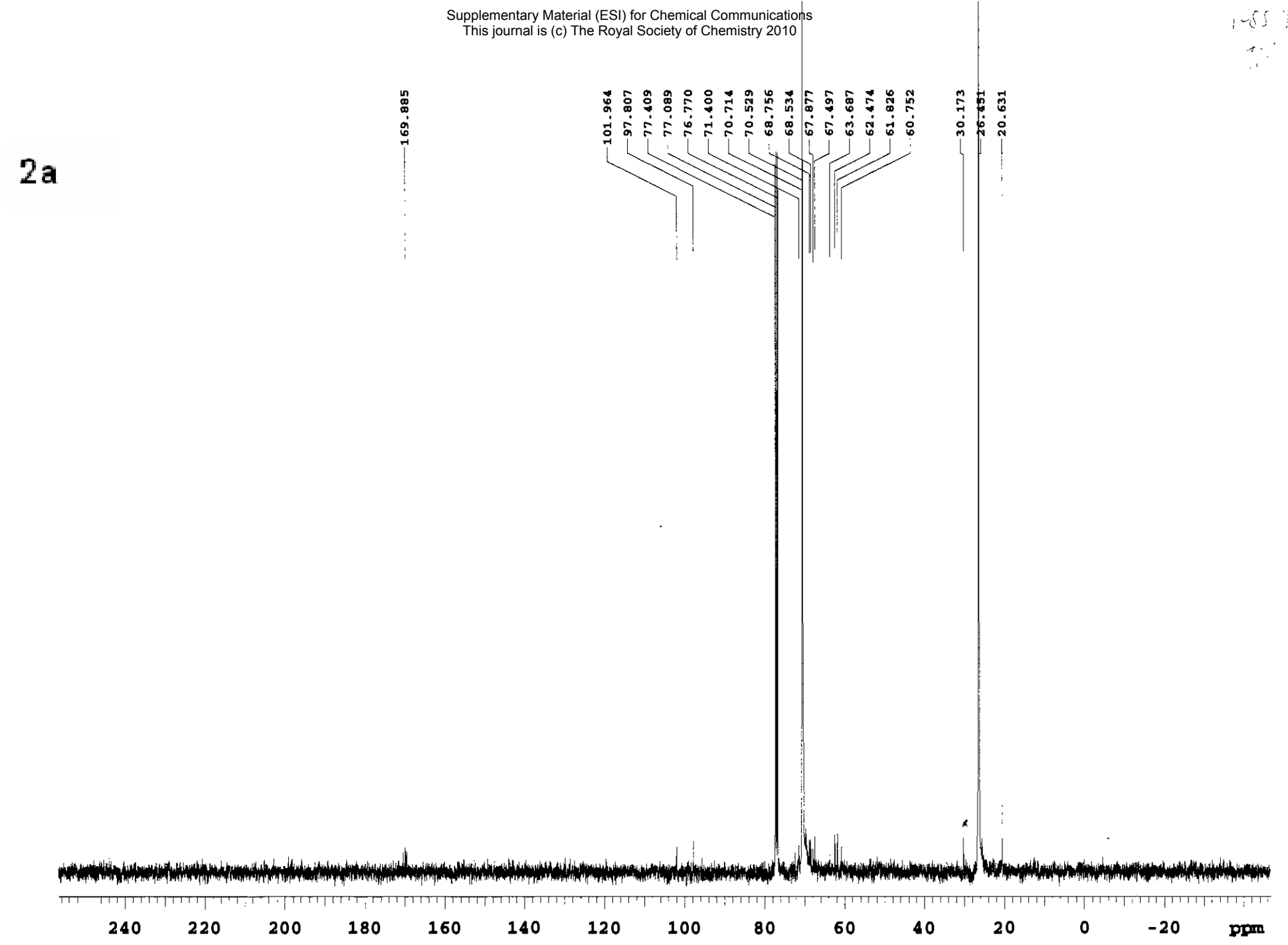
USER: nmr -- DATE: 14:19:42.578 +0800 nmr@EP-ZH107708

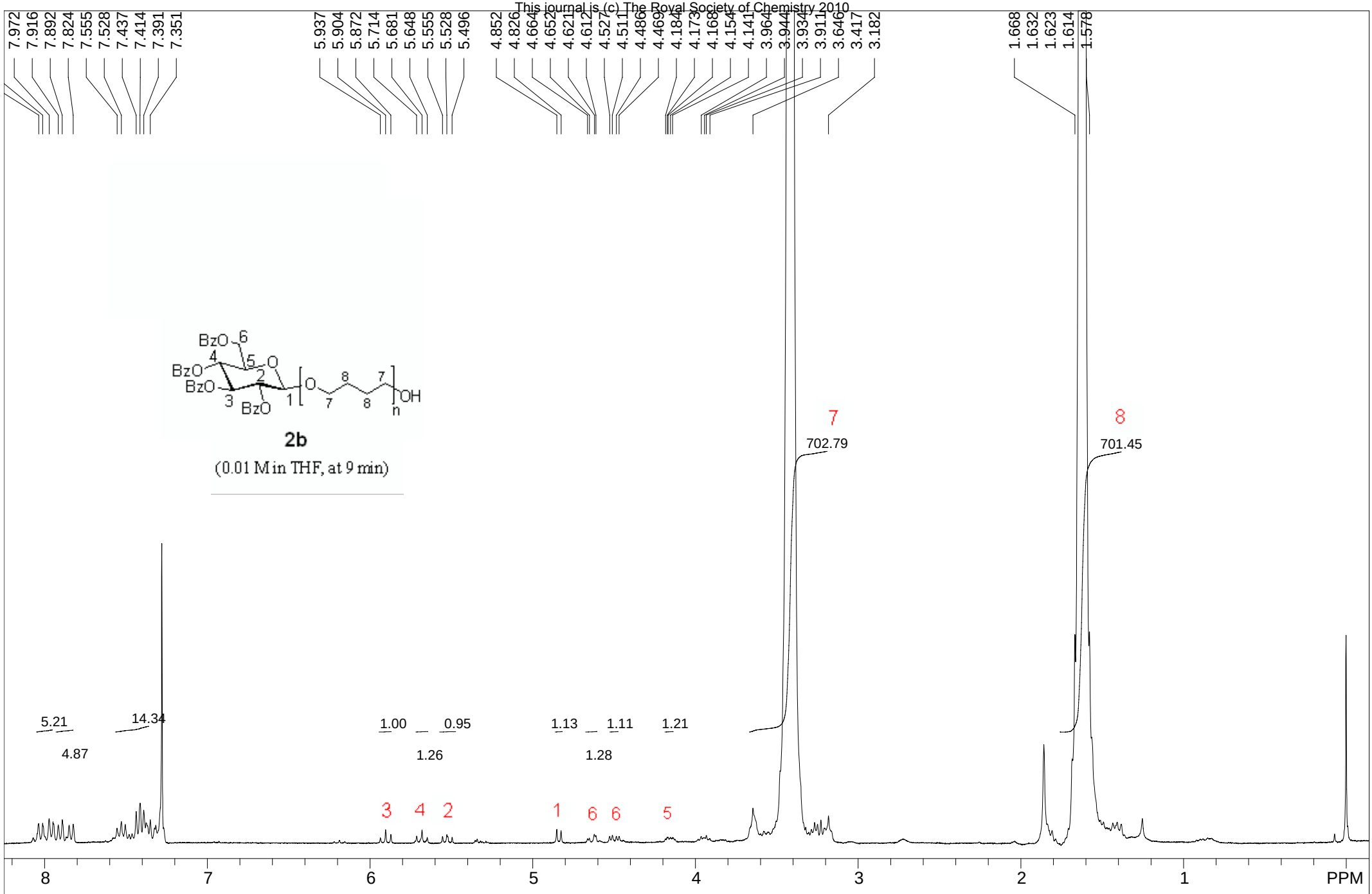
F1: 400.120	F2: 1.000	SW1: 8224		OF1: 2471.5		PTS1d: 32768
EX: zg30		PW: 9.3 us	PD: 1.0 sec	NA: 8	LB: 0.3	Nuts - $NMR -1447-.1



USER: nmr -- DATE: 14:20:11.781 +0800 nmr@EP-ZH107708

F1: 400.120	F2: 1.000	SW1: 8224		OF1: 2485.3		PTS1d: 32768
EX: zg30		PW: 9.3 us	PD: 1.0 sec	NA: 16	LB: 0.3	Nuts - $2005145-14852P_10.1

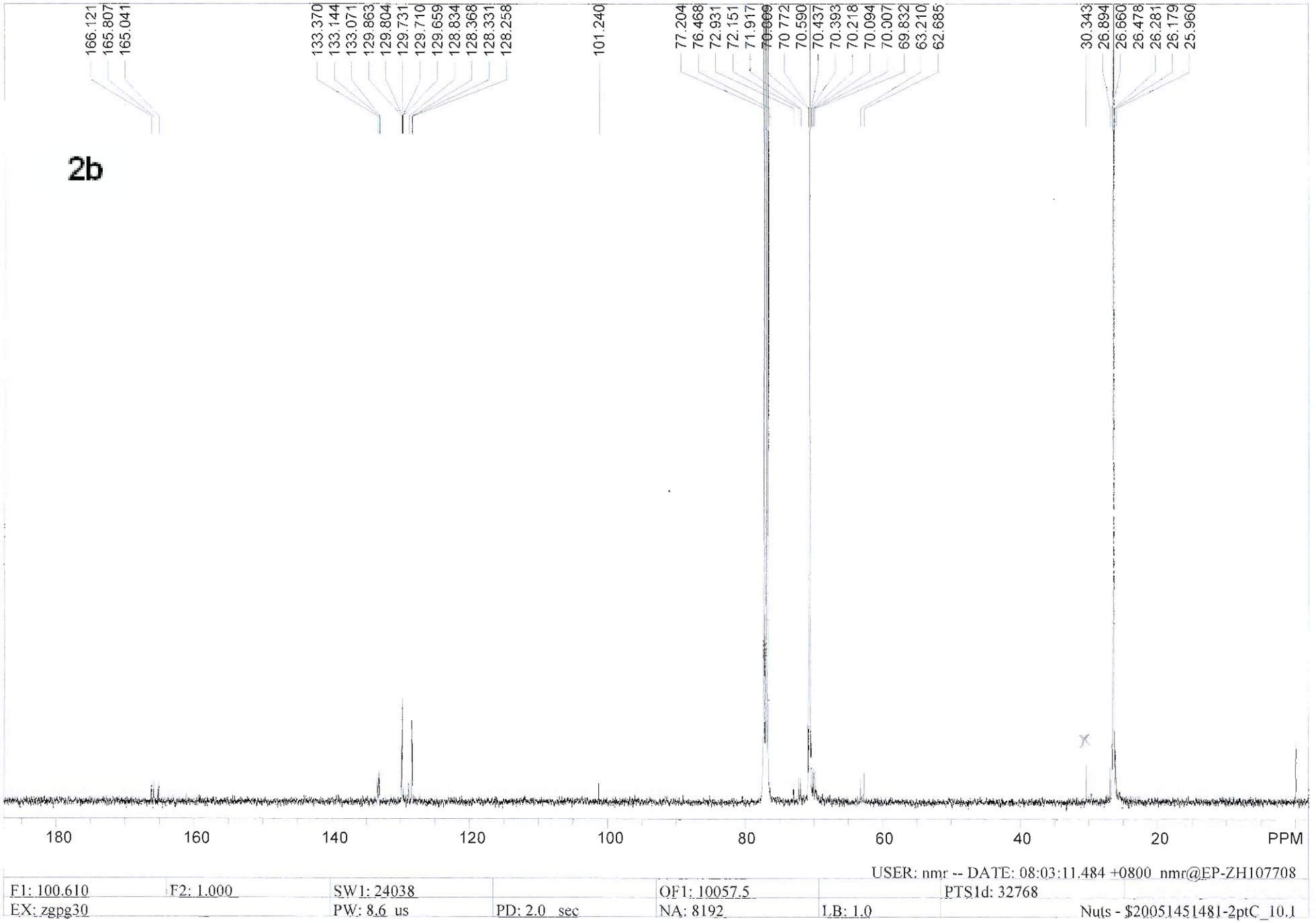

2a
169.885
101.964
97.807
77.409
77.089
76.770
71.400
70.714
70.529
68.756
68.534
67.877
67.497
63.687
62.474
61.826
60.752
30.173
26.451
20.631
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
ppm

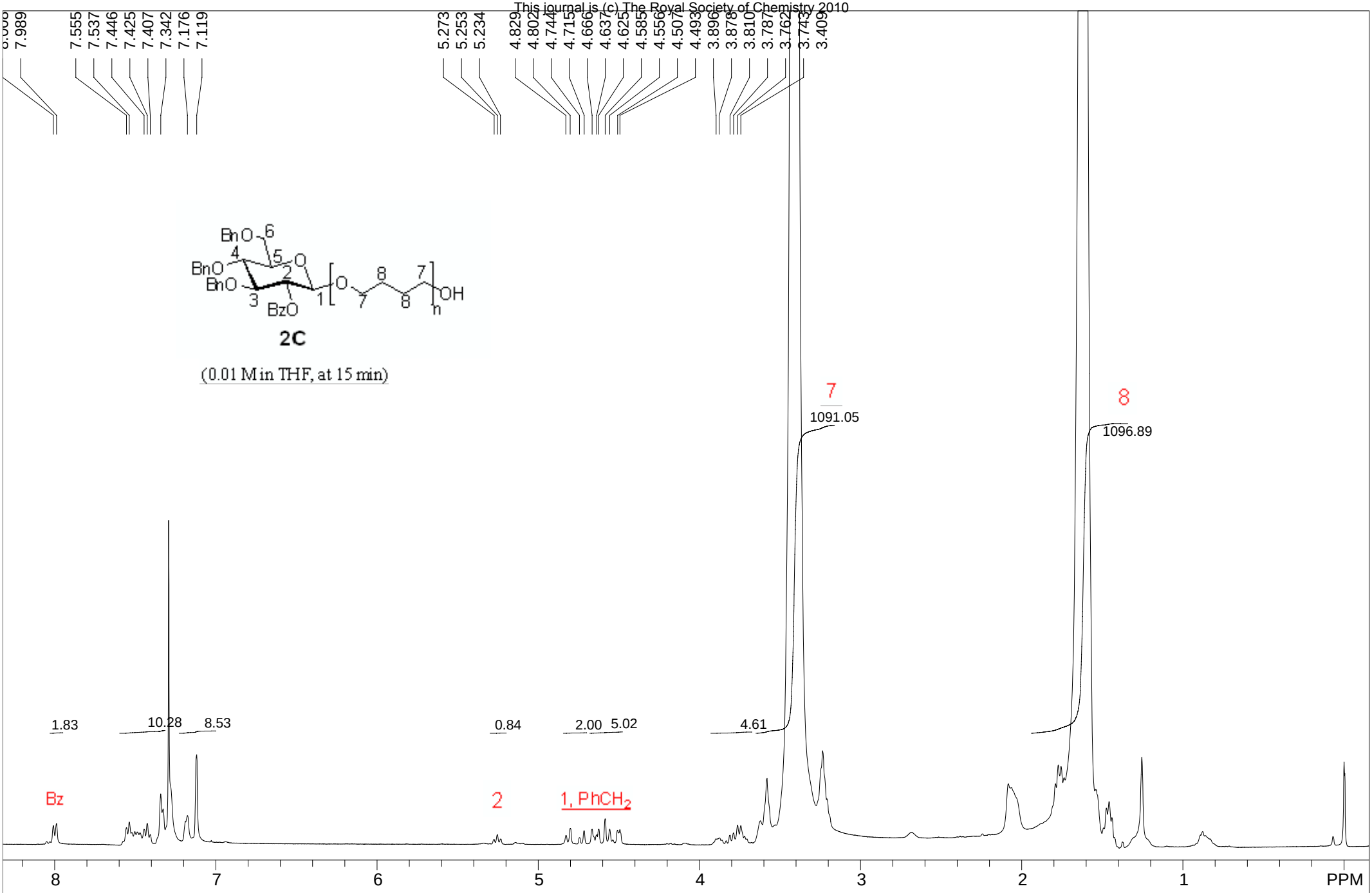


;blank line

USER: -- DATE: Jan 8 2010

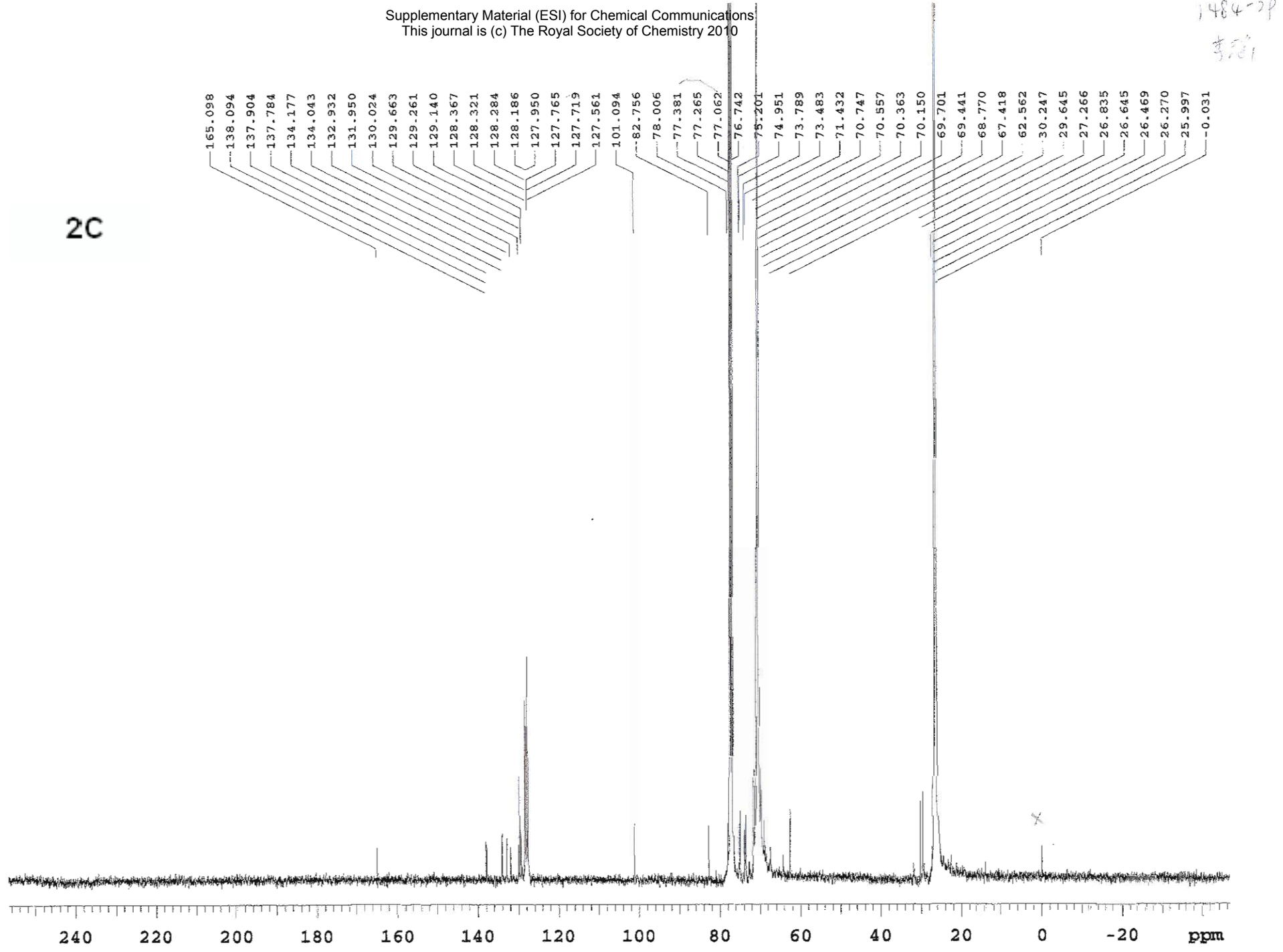
F1: 300.055	F2: 75.456	SW1: 4803		OF1: 1808.2		PTS1d: 9587 , 16384
EX: s2pul		PW: 5.8 us	PD: 1.0 sec	NA: 32	LB: 0.0	Nuts - $14812PTH_08Jan2010

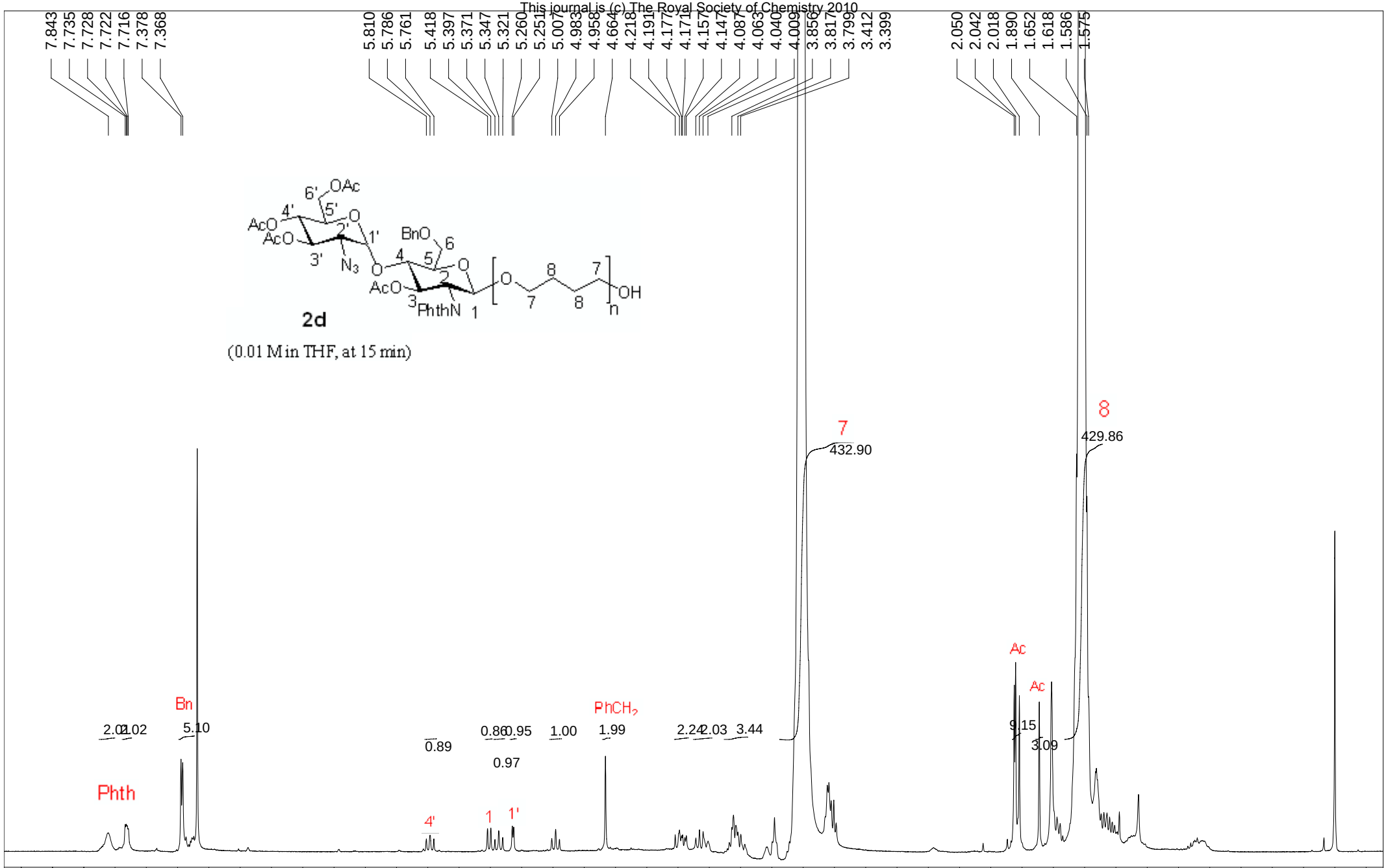

166.121
165.807
165.041
133.370
133.144
133.071
129.863
129.804
129.731
129.710
129.659
128.834
128.368
128.331
128.258
101.240
77.204
76.468
72.931
72.151
71.917
70.772
70.590
70.437
70.393
70.218
70.094
70.007
69.832
63.210
62.685
30.343
26.894
26.660
26.478
26.281
26.179
25.960
2b
180
160
140
120
100
80
60
40
20
PPM
USER: nmr -- DATE: 08:03:11.484 +0800 nmr@EP-ZH107708
F1: 100.610
F2: 1.000
SW1: 24038
OF1: 10057.5
PTS1d: 32768
EX: zgpg30
PW: 8.6 us
PD: 2.0 sec
NA: 8192
LB: 1.0
Nuts - $20051451481-2ptC_10.1



USER: nmr -- DATE: 15:32:27.265 +0800 nmr@EP-ZH107708

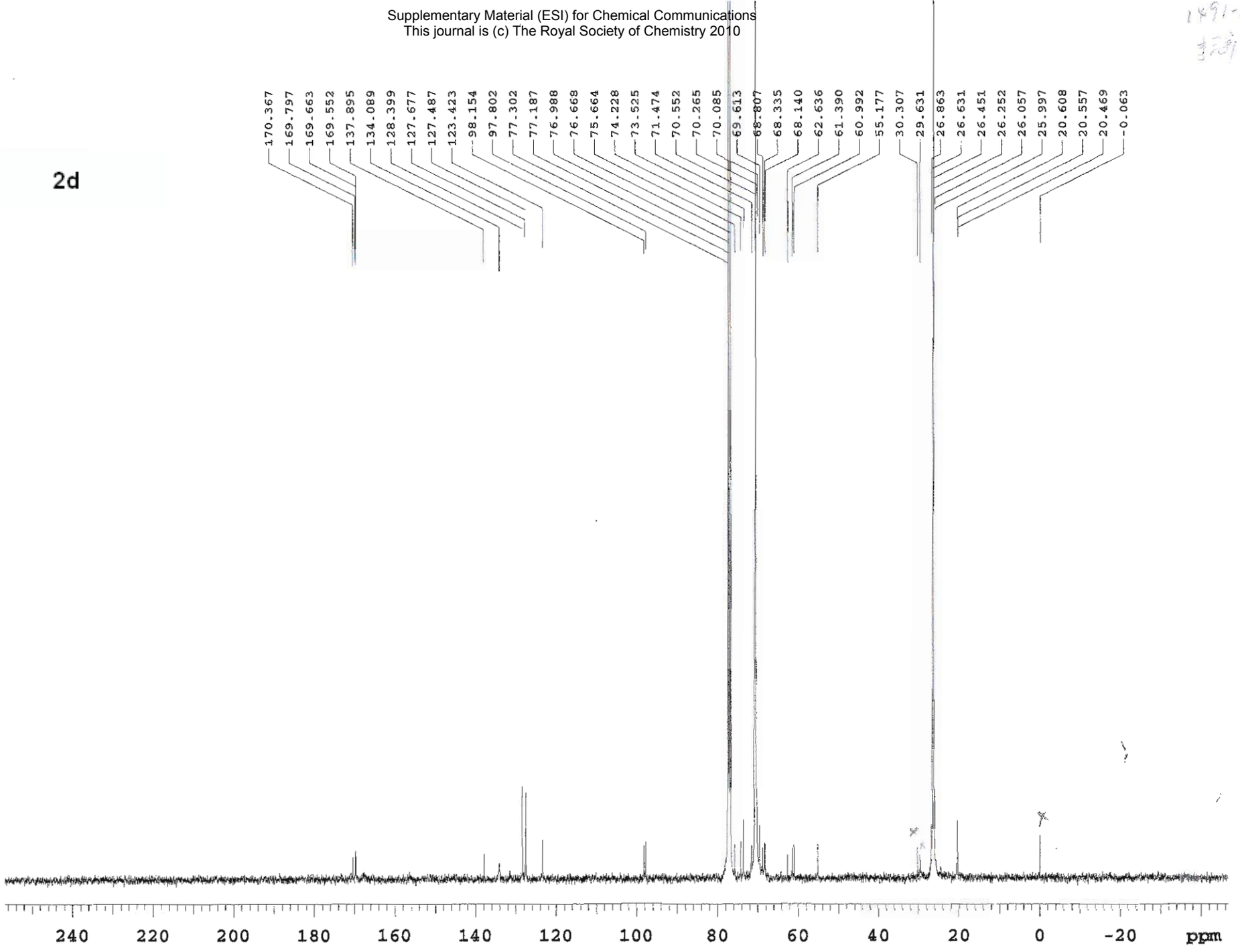
F1: 400.120	F2: 1.000	SW1: 8224		OF1: 2474.0		PTS1d: 32768
EX: zg30		PW: 9.3 us	PD: 1.0 sec	NA: 32	LB: 0.3	Nuts - $2005145-1484-2P_10.1

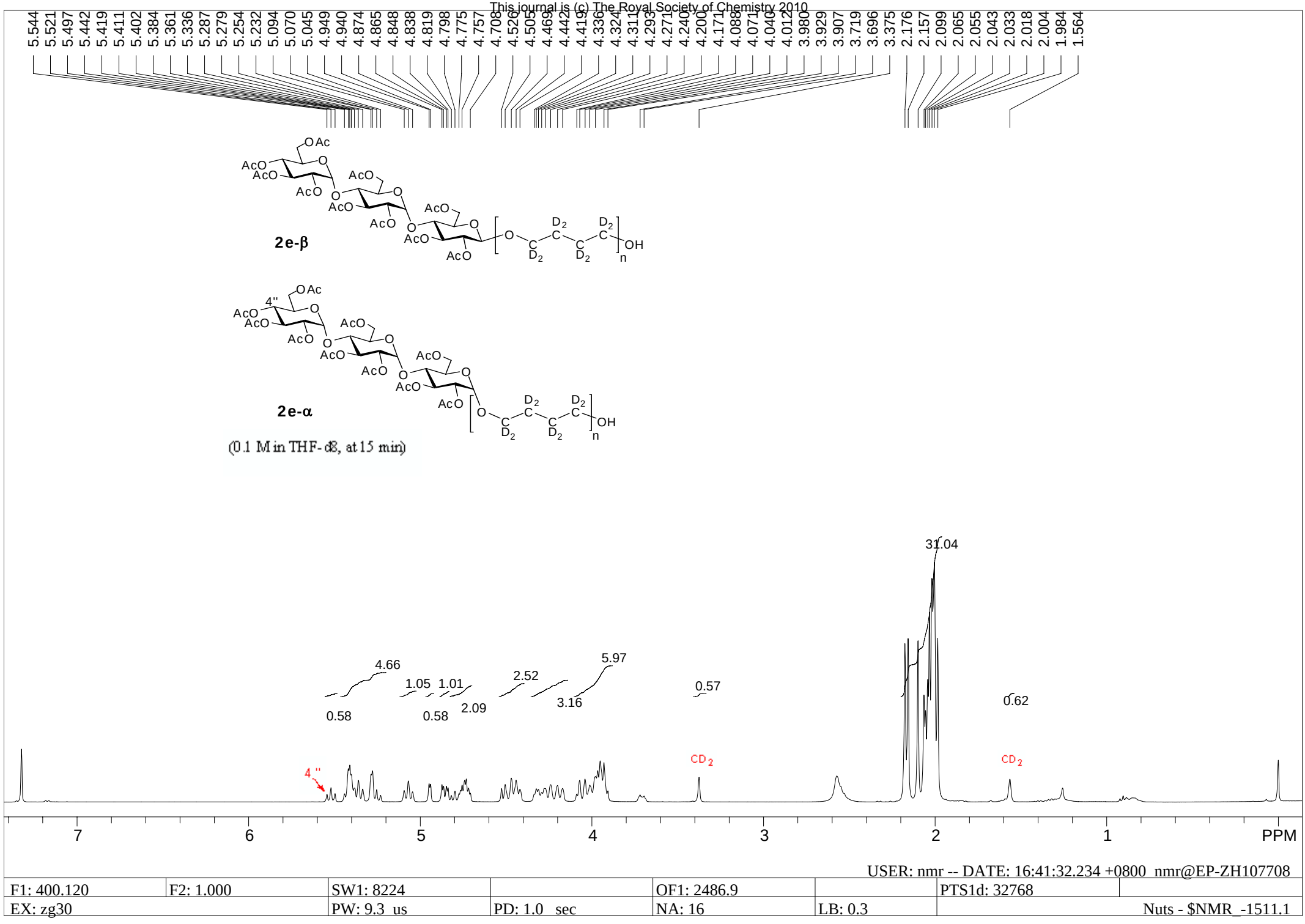

2C
165.098
138.094
137.904
137.784
134.177
134.043
132.932
131.950
130.024
129.663
129.261
129.140
128.367
128.321
128.284
128.186
127.950
127.765
127.719
127.561
101.094
82.756
78.006
77.381
77.265
77.062
76.742
75.201
74.951
73.789
73.483
71.432
70.747
70.557
70.363
70.150
69.701
69.441
68.770
67.418
62.562
30.247
29.645
27.266
26.835
26.645
26.469
26.270
25.997
-0.031
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
ppm



USER: nmr -- DATE: 16:27:23.359 +0800 nmr@EP-ZH107708

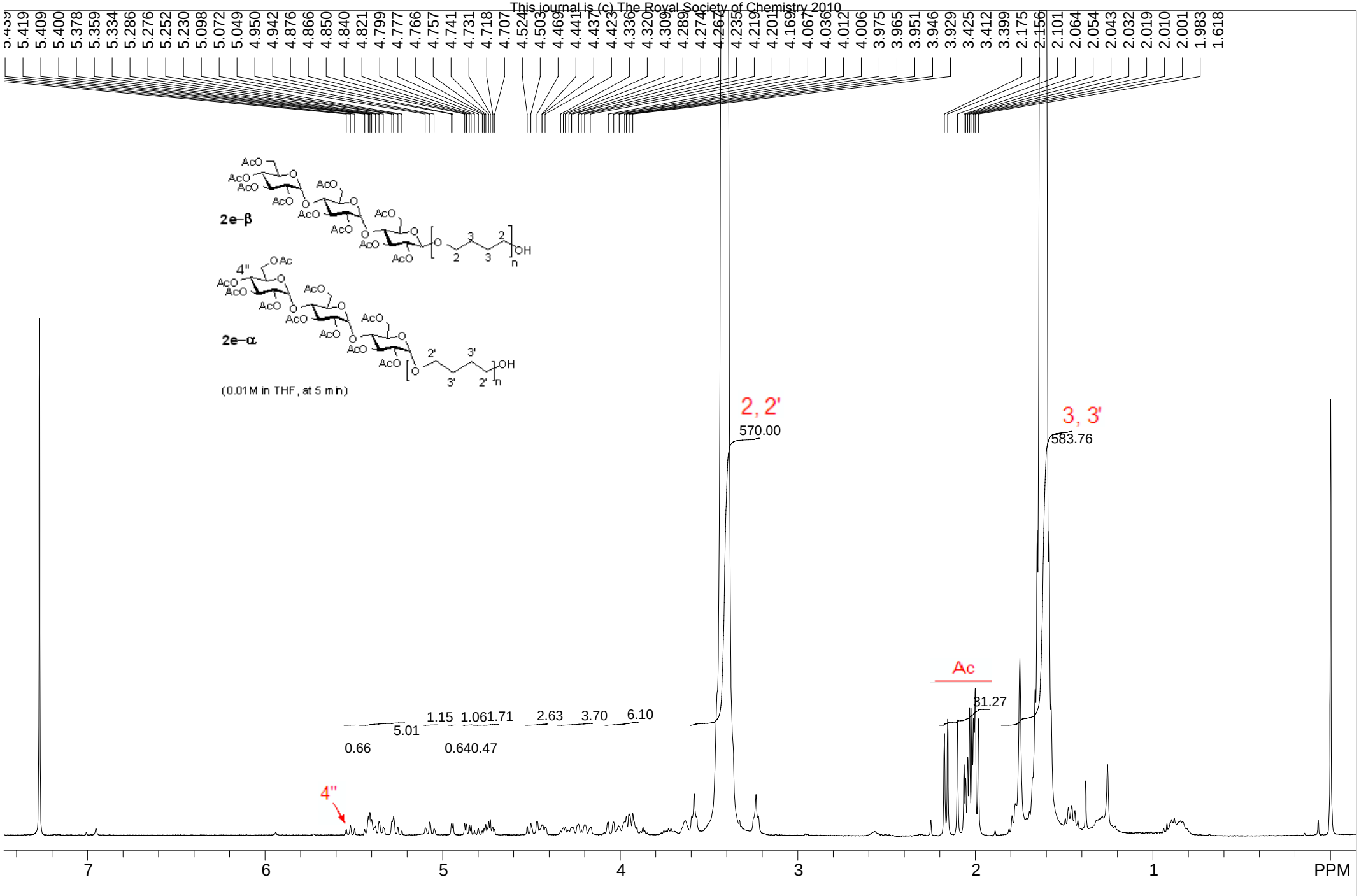
F1: 400.120	F2: 1.000	SW1: 8224		OF1: 2466.9		PTS1d: 32768
EX: zg30		PW: 9.3 us	PD: 1.0 sec	NA: 16	LB: 0.3	Nuts - $NMR_-1491-2p--.1


2d
170.367
169.797
169.663
169.552
137.895
134.089
128.399
127.677
127.487
123.423
98.154
97.802
77.302
77.187
76.988
76.668
75.664
74.228
73.525
71.474
70.552
70.265
70.085
69.613
68.807
68.335
68.140
62.636
61.390
60.992
55.177
30.307
29.631
26.863
26.631
26.451
26.252
26.057
25.997
20.608
20.557
20.469
0.063
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
ppm



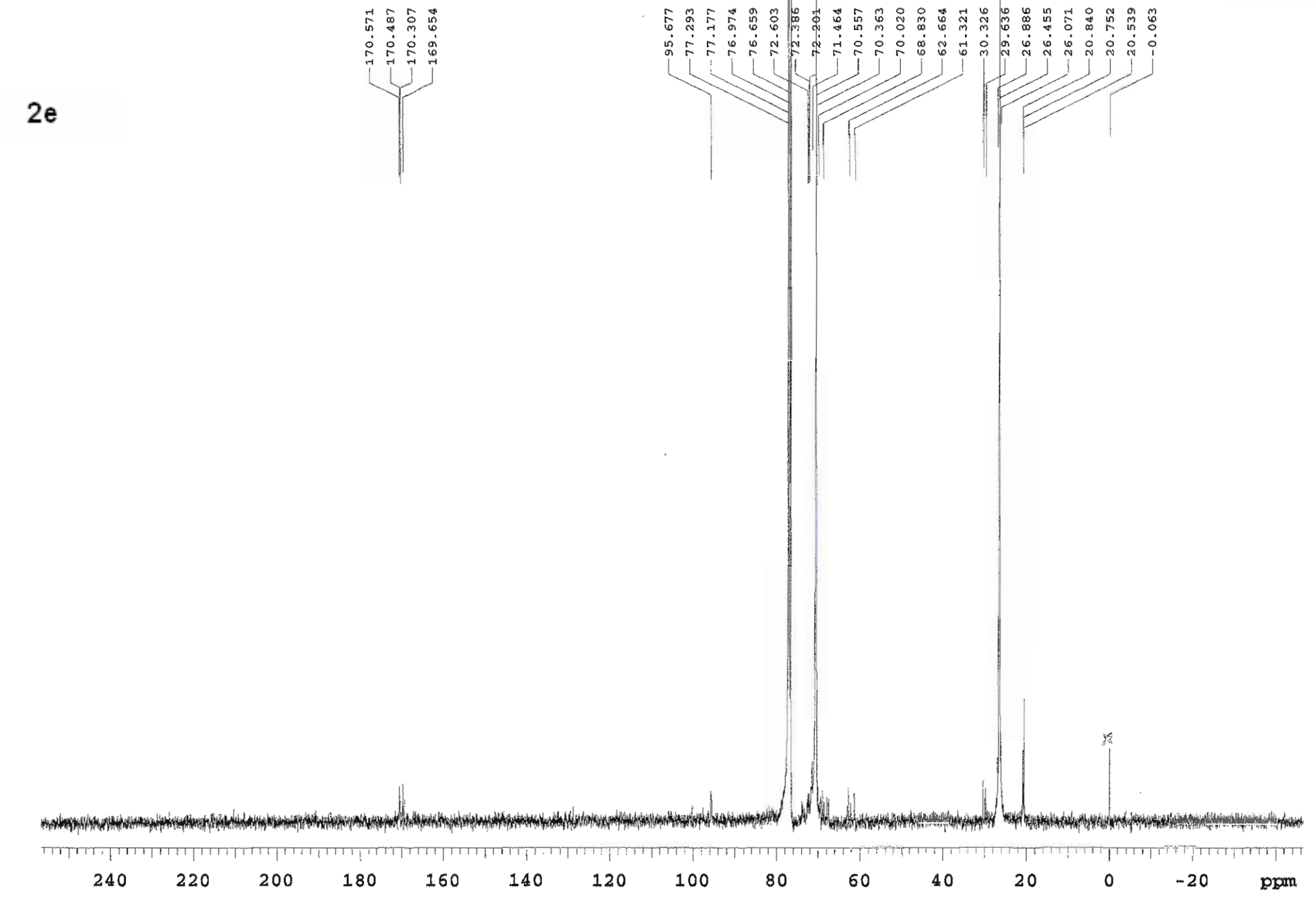
USER: nmr -- DATE: 16:41:32.234 +0800 nmr@EP-ZH107708

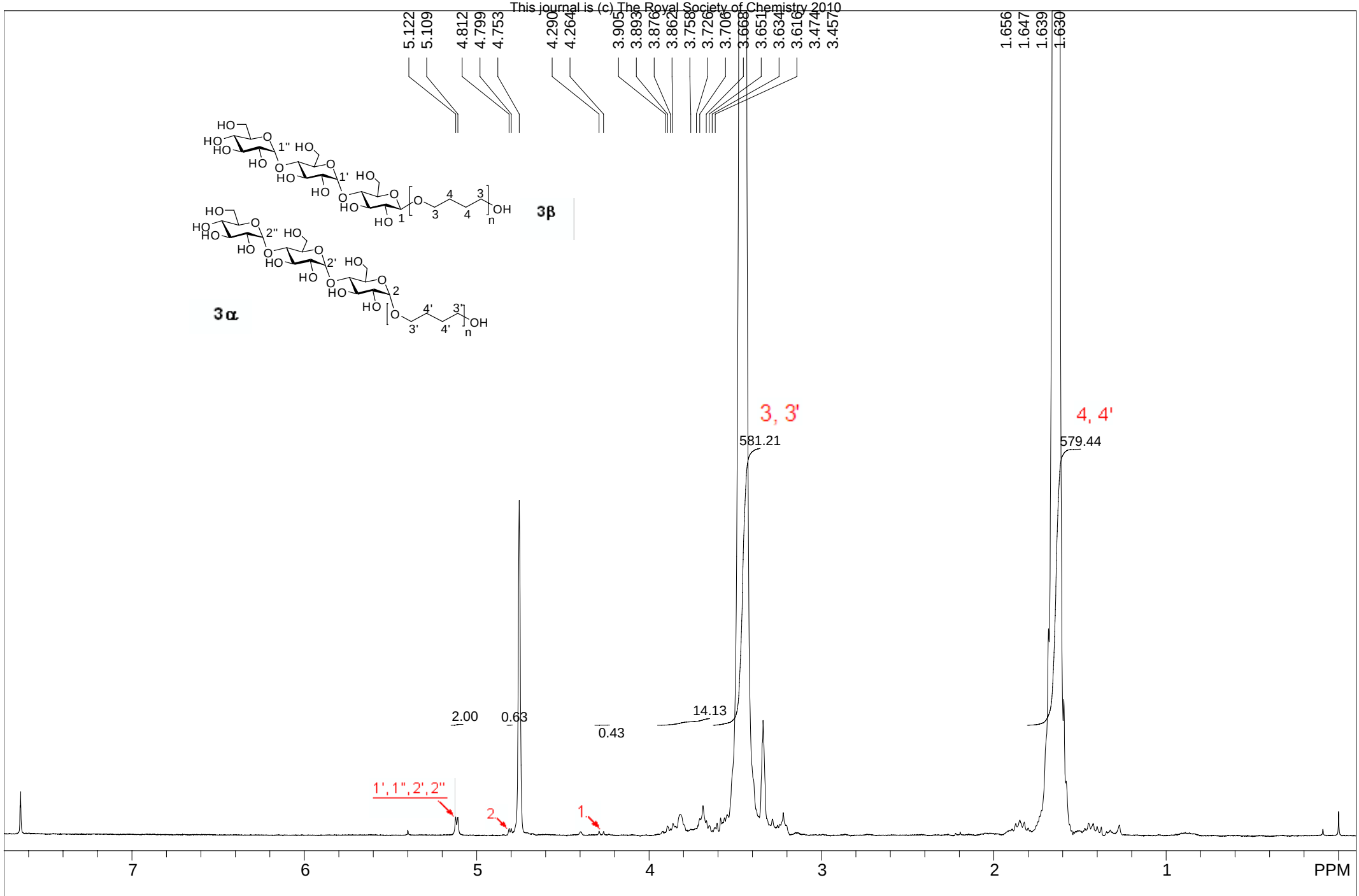
F1: 400.120	F2: 1.000	SW1: 8224		OF1: 2486.9		PTS1d: 32768
EX: zg30		PW: 9.3 us	PD: 1.0 sec	NA: 16	LB: 0.3	Nuts - $NMR -1511.1



USER: nmr -- DATE: 16:39:59.453 +0800 nmr@EP-ZH107708

F1: 400.120	F2: 1.000	SW1: 8224		OF1: 2465.2		PTS1d: 32768
EX: zg30		PW: 9.3 us	PD: 1.0 sec	NA: 16	LB: 0.3	Nuts - $NMR -1495-1p--.1

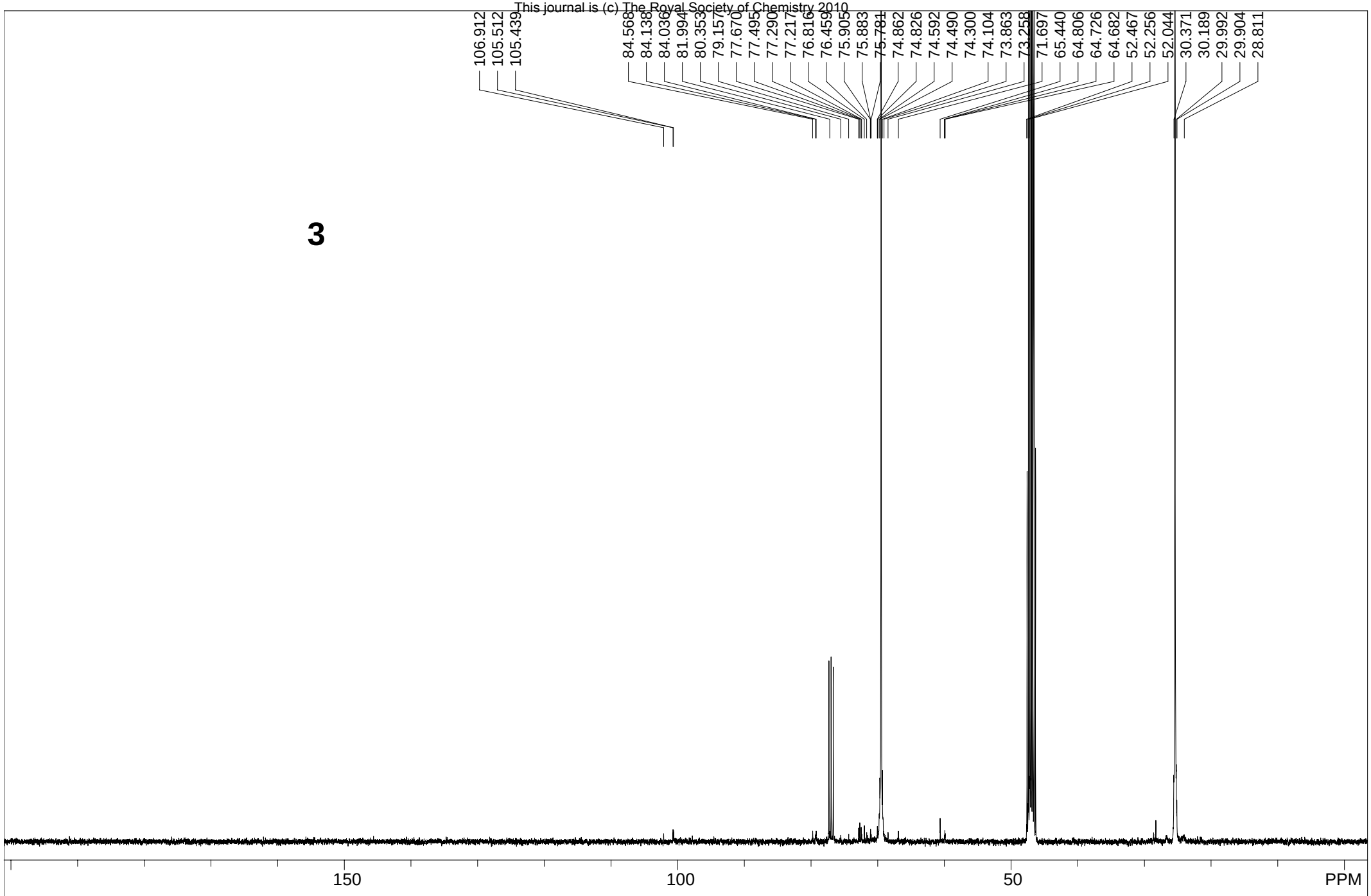

2e
170.571
170.487
170.307
169.654
95.677
77.293
77.177
76.974
76.659
72.603
72.386
72.201
71.464
70.557
70.363
70.020
68.830
62.664
61.321
30.326
29.636
26.886
26.455
26.071
20.840
20.752
20.539
-0.063
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
ppm



;blank line

USER: -- DATE: Dec 31 2009

F1: 300.055	F2: 75.456	SW1: 4803		OF1: 629.0		PTS1d: 9587 , 16384
EX: s2pul		PW: 5.8 us	PD: 1.0 sec	NA: 8	LB: 0.0	Nuts - $-14100p_31Dec2009



USER: nmr -- DATE: 19:12:39.015 +0800 nmr@EP-ZH107708

F1: 100.610	F2: 1.000	SW1: 24038		OF1: 9577.7		PTS1d: 32768	
EX: zgpg30		PW: 8.6 us	PD: 2.0 sec	NA: 2024	LB: 1.0		Nuts - $NMR -14100pC.1