Electronic Supplementary Material

Structure-properties relationships in a series of diglycerol tetraether model lipids and their lyotropic assemblies: Effect of branching topology and chirality

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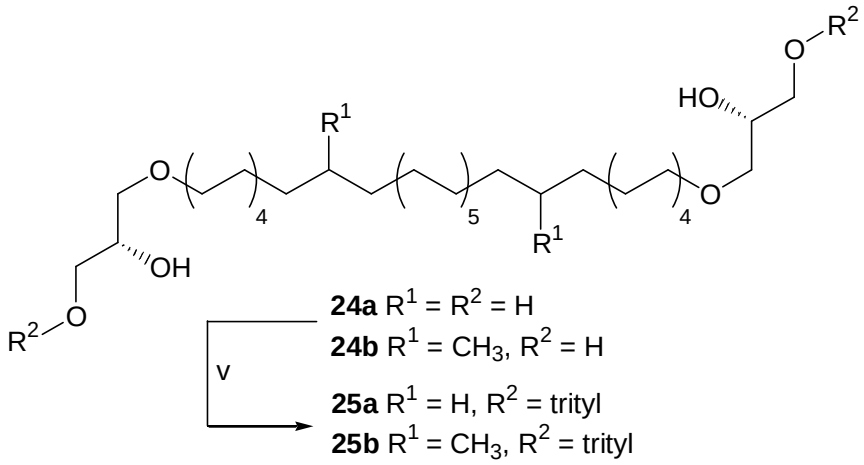
Content:

1. Multiple tritylation reaction on 3,3'-*O*,*O*-(alkane-1,32-diyl)bis(*sn*-glycerol)s (24)

Reaction scheme:



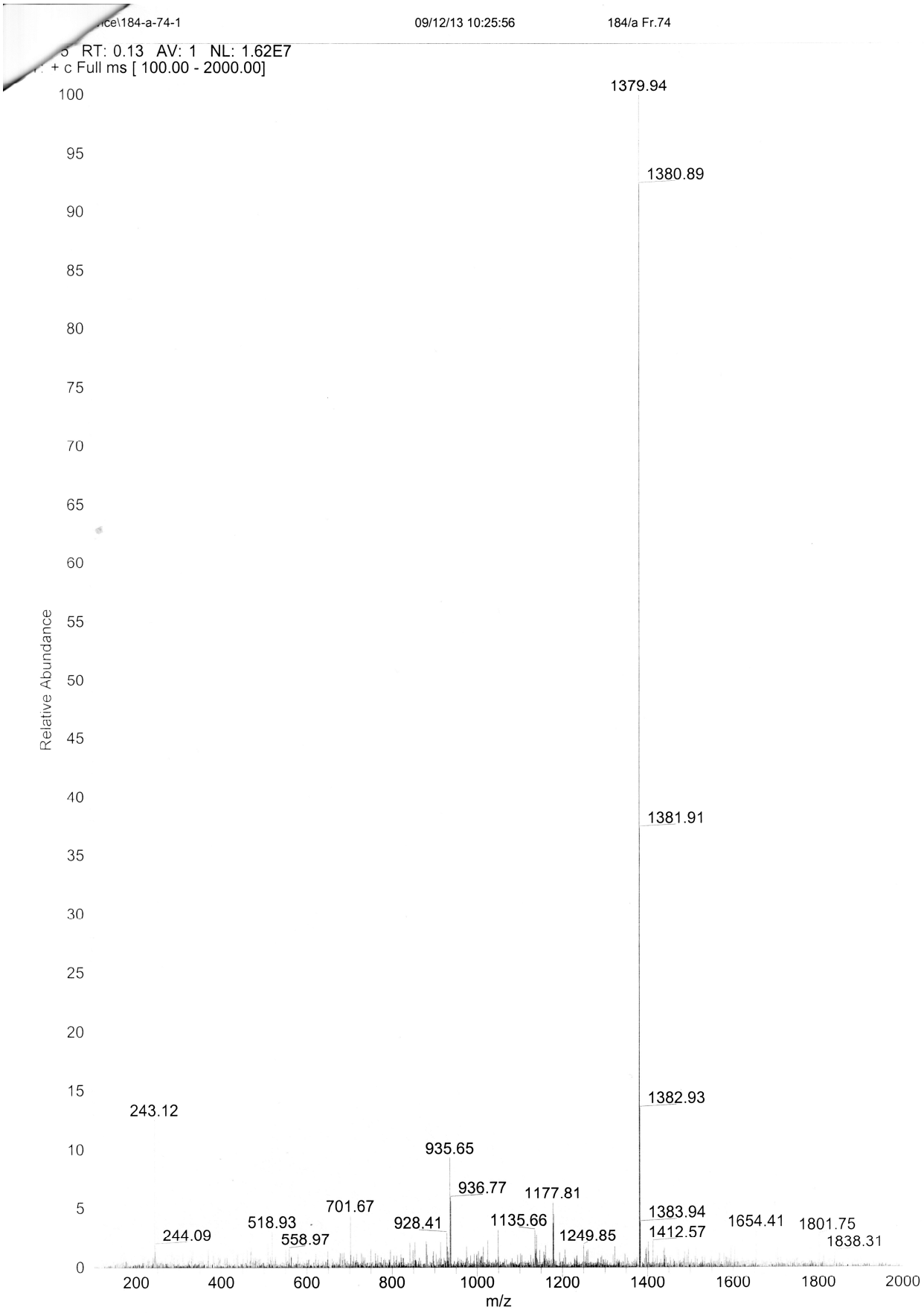
Reaction of **24a**:

main product with 2 trityl moieties (compound **25a**):	$C_{76}H_{106}O_6$	MW = 1,115.65 g mol^{-1}
side-product with 3 trityl moieties:	$C_{95}H_{120}O_6$	MW = 1,357.96 g mol^{-1}
	$C_{95}H_{119}O_6Na$	MW = 1,379.94 g mol^{-1}
side product with 4 trityl moieties:	$C_{114}H_{134}O_6$	MW = 1,600.27 g mol^{-1}
	$C_{114}H_{134}O_6Na$	MW = 1,623.26 g mol^{-1}

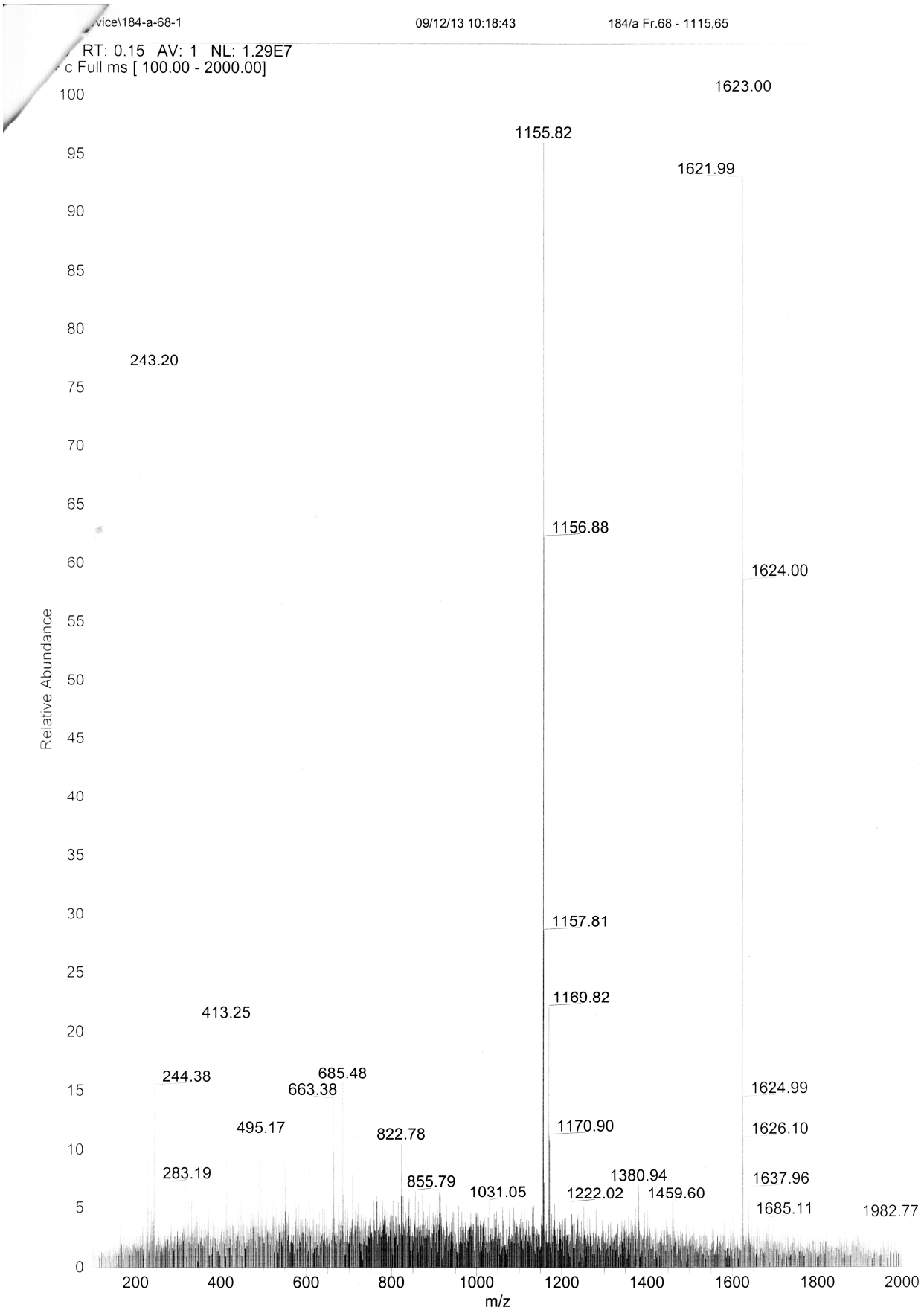
Reaction of **24b**:

main product with 2 trityl moieties (compound **25b**):	$C_{78}H_{110}O_6$	MW = 1,143.70 g mol^{-1}
side-product with 3 trityl moieties:	$C_{97}H_{124}O_6$	MW = 1,386.01 g mol^{-1}
	$C_{97}H_{123}O_6Na$	MW = 1,408.00 g mol^{-1}

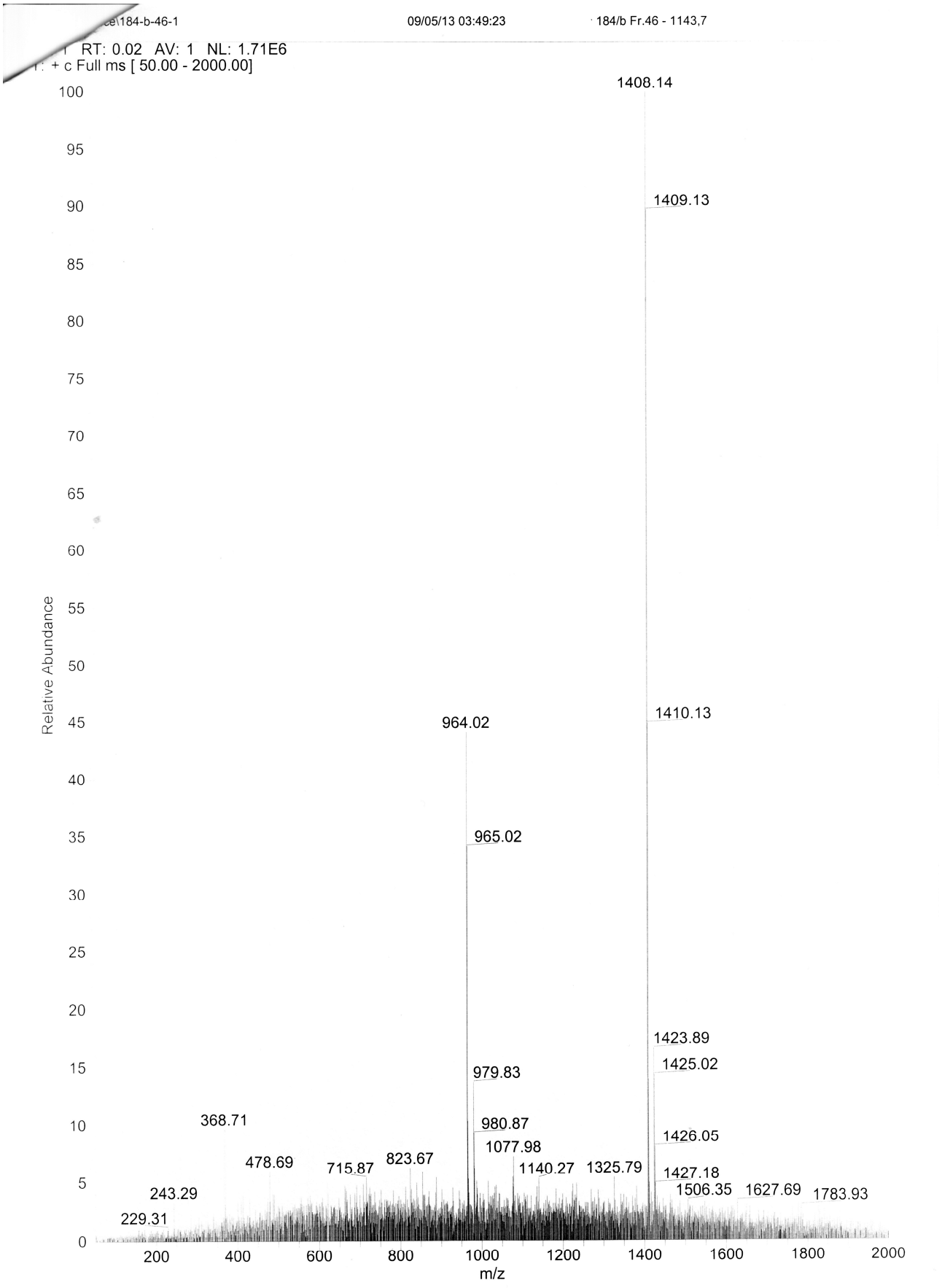
*ESI-MS, positive mode side-product of **25a** with 3 trityl moieties*



*ESI-MS, positive mode side-product of **25a** with 4 trityl moieties*



*ESI-MS, positive mode side-product of **25b** with 3 trityl moieties*



2. DLS measurements

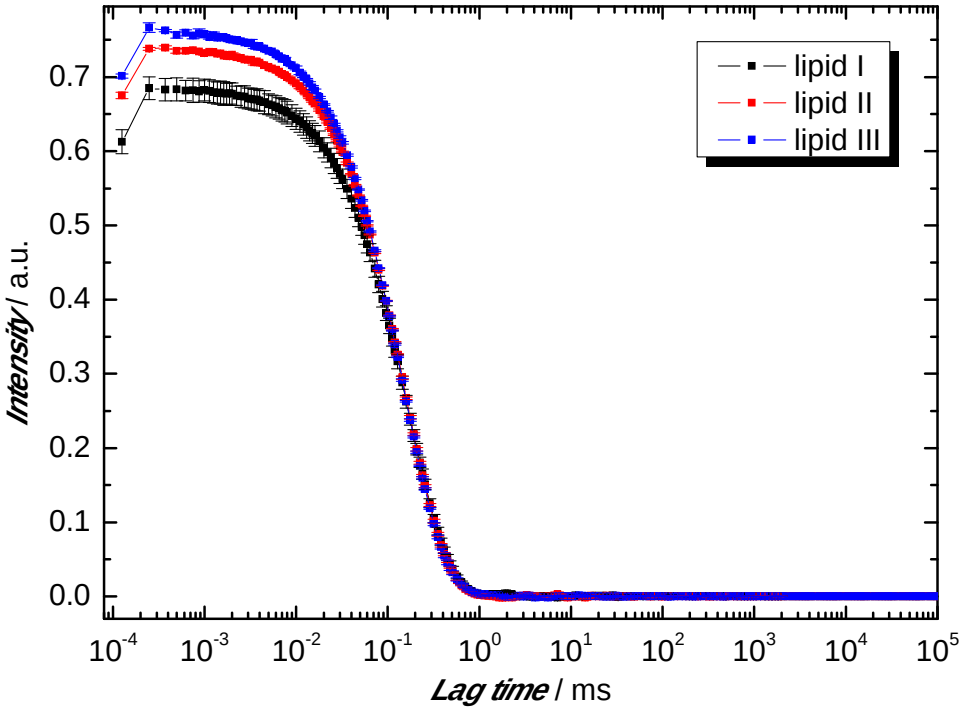


Figure S1: Intensity correlation function of liposomes prepared from aqueous lipid suspensions (c = 1 mg mL^{-1}) using the technique described by Bangham et al.[1] (n = 3). DLS measurements were performed directly after preparation.

Correlation data were fitted using ALV-Regularized Fit (model: *DLS-Exponential* (g2(t)), lag time = 1 – 512 µs, min decay time = 0.001 ms, max decay time = 1000 ms)

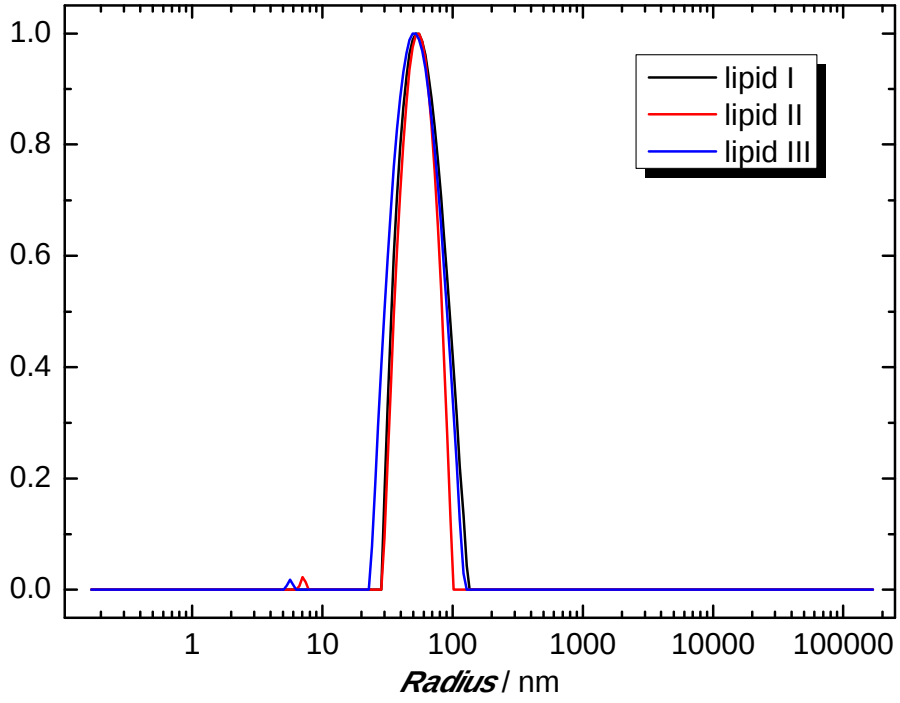


Figure S2: Unweighted (logarithmic) size distribution of liposomes prepared from aqueous lipid suspensions (c = 1 mg mL^{-1}) using the technique described by Bangham et al.[1] (n = 3).

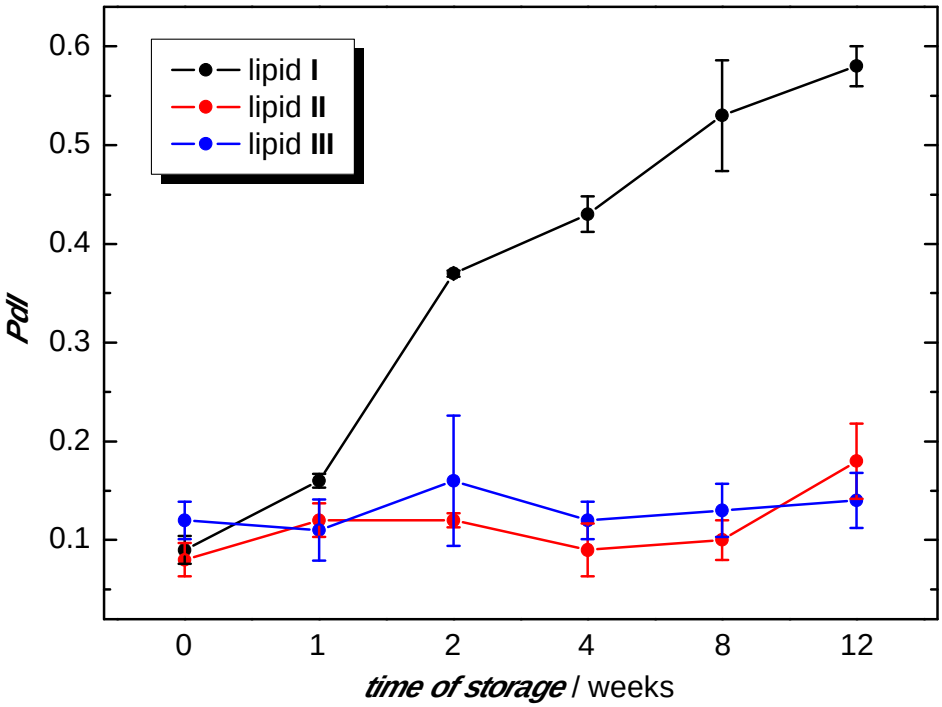


Figure S3: PdI values of liposomes prepared from aqueous lipid suspensions (c = 1 mg mL^{-1}) using the technique described by Bangham et al.[1] after different time of storage (n = 3).

3. Syntheses of compounds

Synthesis of methyl-branched bromoalkanes – the malonic ester pathway

Hexyl(methyl)malonic acid diethyl ester (2a). To a suspension of NaH (60%, 12.0 g, 0.3 mol) in dry toluene (300 mL) was added a solution of methyl malonic acid diethyl ester (**1**; 52.3 g, 0.3 mol) in dry toluene (50 mL). After the salt formation was complete 1-bromohexane (57.8 g, 0.35 mol) was added and the mixture was stirred under reflux for 8 h. After common work up the crude hexyl(methyl)malonic acid diethyl ester (**2a**) was purified by vacuum distillation yielding a colourless liquid (64.3 g, 83%). K.p. (0.5 kPa) 93–95 °C; $C_{14}H_{26}O_4$ requires C, 65.08; H, 10.15; found: C, 65.03; H, 10.23%; ^{1}H NMR (400 MHz; $CDCl_3$) δ 0.85 (t, J = 6.9 Hz, 3 H, $(CH_2)_5CH_3$), 1.15–1.35 (m, 14 H, CH_2, OCH_2CH_3), 1.40 (s, 3 H, CCH_3), 1.80–1.85 (m, 2 H, $H_3C(CH_2)_4\ CH_2$), 4.15–4.21 (m, 4 H, OCH_2CH_3); EI-MS *m/z* 213 (18%, M – OC_2H_5), 185 (20, M – $COOC_2H_5$), 174 (100, M – C_6H_{12}). The data are in agreement with published values.[2]

Hexyl(methyl)malonic acid (3a). Compound **2a** (46.6 g, 0.2 mol) and potassium hydroxide (33.0 g, 0.6 mol) were dissolved in water (145 mL) and EtOH (300 mL), and were heated under reflux for 6 h. The alcoholic portion was removed mainly in vacuum. The residue was mixed with water (150 mL), extracted two times with Et_2O (50 mL) and acidified with ice-cold aqueous HCl to a final pH value of 2. The precipitate was collected und recrystallised from heptane yielding a white solid substance (32.4 g, 80%). M.p. 133–134 °C; $C_{10}H_{18}O_4$ requires C, 59.38; H, 8.97; found: C, 59.61; H, 8.73%; ^{1}H NMR (400 MHz; $CDCl_3$) δ 0.88 (t, J = 6.9 Hz, 3 H, CH_2CH_3), 1.10–1.50 (m, 8 H, CH_2) 1.54 (s, 3 H, CCH_3), 1.87–1.94 (m, 2 H, $H_3C(CH_2)_4CH_2$). The data are in agreement with published values.[3]

(2*RS*)-2-Methyloctanoic acid (4a). The hexyl(methyl)malonic acid (**3a**; 30.3 g, 0.15 mol) was heated up to 180 °C within 2 h. When the CO_2 evolution was finished the crude acid was distilled in vacuum yielding colourless oil (23.0 g, 97%). Kp (0.4 kPa) 94 °C; $C_9H_{18}O_2$ requires C, 68.31; H, 11.46; found: C, 68.56; H, 11.37%; ^{1}H NMR (400 MHz; $CDCl_3$) δ 0.88 (t, J = 6.4 Hz, 3 H, CH_2CH_3), 1.17 (d, J = 6.9 Hz, 3 H, $CHCH_3$), 1.21–1.40 (m, 8 H, CH_2), 1.39–1.46 and 1.64–1.71 (2 m, 2 H, CH_2CH), 2.41–2.48 (m, 1 H, $CHCH_3$); EI-MS *m/z* 158 (28%, M), 129 (68, M – C_2H_5). The data are in agreement with published values.[4]

(2*RS*)-2-Methyloctan-1-ol (5a). 2-Methyloctanoic acid (**4a**; 25.0 g, 0.158 mol) were heated with MeOH (130 mL, 4 mol) and conc. H_2SO_4 (5 mL, 28 mmol) for 2 h under reflux. The mixture was evaporated to the half of the original volume. Water (100 mL) was added and the mixture was extracted two times with Et_2O (100 mL). The combined ethereal extracts were washed with conc. sodium acetate solution (50 mL) and water (100 mL). After drying over Na_2SO_4 the solvent was removed in vacuum. The crude methyl ester was reduced to 2-methyloctanol (**5a**) without further purification. Therefore, the ester was dissolved in dry Et_2O (100 mL) and dropped into a stirred mixture of lithium aluminium hydride (7.12 g, 0.188 mol) in dry Et_2O (150 mL). The mixture was heated for 2 h under reflux. After the generally work up procedure with water, acidification,

separation and drying, the solvent was evaporated and the residue was purified by chromatography yielding colourless liquid (18.0 g, 79%); $C_9H_{20}O$ requires C, 74.93; H, 3.98; found: C, 74.70; H, 13.96%; ^{1}H NMR (400 MHz; $CDCl_3$) δ 0.84–0.90 (m, 6 H, 2× CH_3), 1.05–1.10 (m, 2 H, CH_2), 1.17–1.40 (m, 8 H, CH_2), 1.54–1.62 (m, 1 H, C*H*), 3.37–3.50 (m, 2 H, CH_2OH); EI-MS *m/z* 144 (M), 143 (M – H), 129 (M – CH_3). The data are in agreement with published values.[5]

(2*RS*)-1-Bromo-2-methyloctane (6a). 2-Methyloctan-1-ol (**5a**; 17.31 g, 0.12 mol) and TEA (13.2 g, 0.13 mol) were dissolved in dry $CHCl_3$ (150 mL). Methansulphonic acid chloride (14.89 g, 0.13 mol) diluted in dry $CHCl_3$ (50 mL) was added drop wise at 0 °C. The mixture was stirred for 1 h at that temperature and then at r.t. overnight. The solution was poured into ice (200 mL) and the organic layer was separated. The water phase was extracted two times with $CHCl_3$ (100 mL) and the collected organic layers were dried over Na_2SO_4. The solvent was removed under reduced pressure and residue was taken up in dry acetone (100 mL). LiBr (18 g, 0.2 mol) was added in one portion and the mixture was stirred for 6–8 h (TLC control) under reflux. Afterwards, the mixture was concentrated to 50 mL, ice water (150 mL) was added and the mixture was extracted three times with petrol ether (50 mL). After drying the organic layers with Na_2SO_4, the solvent was removed and the residue was purified by column chromatography using heptane/Et_2O as eluent and gradient technique yielding colourless oil (16.9 g, 68%). $C_9H_{19}Br$ requires C, 52.18; H, 9.25; found: C, 52.26; H, 9.38%; ^{1}H NMR (400 MHz; $CDCl_3$) δ 0.80 (t, J = 6.9 Hz, 3 H, CH_2CH_3), 0.94 (d, J = 6.5 Hz, 2 H, $CHCH_3$), 1.10–1.45 (m, 10 H, CH_2), 1.65–1.78 (m, 1 H, C*H*), 3.20–3.35 (m, 2 H, $BrCH_2$); EI-MS *m/z* 206/208 (3.5%, M). The data are in agreement with published values.[3]

Synthesis of methyl-branched bromoalkanes – the citronellyl bromide pathway

(4*RS*)-6-Bromo-4-methylhexan-1-ol (9). Compound **9** was synthesised from (*RS*)-citronellyl bromide (**8**) according to the procedure described previously.[6] The crude alcohol **9** was used for the subsequently performed blocking of the hydroxyl moiety.

2-{[(4*RS*)-6-Bromo-4-methylhexyl)oxy]tetrahydro-2*H*-pyran (10). Compound **9** (7.8 g, 40 mmol) was dissolved in CH_2Cl_2 (50 mL), 3,4-dihydro-2*H*-pyran (5.04 g, 60 mmol) and PPTS (0.1 g) were added and the mixture was stirred for 18 h at r.t. Afterwards, the solution was washed with water (50 mL), dried with Na_2SO_4, evaporated and the residue was purified by column chromatography using heptane/Et_2O as eluent yielding **10** (10.6 g, 95%), colourless liquid. $C_{12}H_{23}O_2Br$ requires C, 51.62; H, 8.30; found: C, 51.56; H, 8.28%; ^{1}H NMR (400 MHz; $CDCl_3$) δ 0.88 (d, J = 5.8 Hz, 3 H, CH_3), 1.14–1.25 (m, 1 H, CH_2CH$(CH_2)_2$Br), 1.32–1.43 (m, 1 H, CH_2CH$(CH_2)_2$Br), 1.47–1.72 (m, 9 H, 2× CH_2CH$_2$O, CH_2CH_2CHO, C*H*CH$_3$), 1.76–1.91 (m, 2 H, CH_2CH$_2$Br), 3.32–3.50 (m, 4 H, CH_2Br, 2× CHOC*H*H), 3.66–3.73 (m, 1 H, CHOC*H*H), 3.81–3.87 (m, 1 H, CHOC*H*H), 4.53–4.55 (m, 1 H, OC*H*O); EI-MS m/z 277/279 (5%, M).

2-{[(4*RS*)-4-Methylundec-10-en-1-yl]oxy}tetrahydro-2*H*-pyran (11). Bromopent-1-ene (16.4 g, 0.11 mol), dissolved in dry Et_2O (70 mL), was slowly added to Mg turnings (3.2 g, 0.132 mol). The mixture was stirred for 2 h at reflux. The Grignard solution was decanted from excess Mg under a stream of argon. After removing the Et_2O *in vacuo* the oily residue was diluted in dry THF and

cooled to –5 °C. Afterwards, compound **10** (21.5 g, 77 mmol), dissolved in dry THF (10 mL), was added in one portion followed by a freshly prepared Li_2CuCl_4 solution (10 mL, 0.1 m). The mixture was stirred for 2–3 h at –5 to 0 °C. Then, the mixture was poured into an ice-cold saturated solution of NH_4Cl. The organic layer was separated and the aqueous phase was extracted with Et_2O. The combined ethereal phases were washed with water and brine, dried with Na_2SO_4 and evaporated. The oily residues were purified by column chromatography yielding **11** (14.3 g, 69%) as colourless oil. $C_{17}H_{32}O_2$ requires C, 76.06; H, 12.02; found: C, 76.06; H, 12.17%; ^{1}H NMR (400 MHz; $CDCl_3$) δ 0.85 (d, J = 6.4 Hz, 3 H, C*H*3), 1.07–1.40 (m, 11 H, CH_2C*H*(CH_2)$_4$), 1.47–1.62 (m, 6 H, 2× CH_2CH$_2$O, CH_2CH$_2$ CHO), 1.67–1.73 (m, 1 H, CH_2CHO), 1.79–1.83 (m, 1 H, CH_2CHO), 1.99–2.04 (m, 2 H, CH_2CH=CH$_2$), 3.32–3.38 (m, 1 H, CHOCH_2), 3.45–3.51 (m, 1 H, CHOCH_2), 3.66–3.73 (m, 1 H, CHOCH_2), 3.83–3.88 (m, 1 H, CHOCH_2), 4.55–4.56 (m, 1 H, OC*H*O), 4.89–5.00 (m, 2 H, CH=CH_2), 5.74–5.84 (m, 1 H, C*H*=CH$_2$); EI-MS *m/z* 367 (1%, M – H).

(8*RS*)-11-Bromo-8-methylundec-1-ene (12). Triphenylphosphane (21.5 g, 82 mmol) was dissolved in dry CH_2Cl_2 (200 mL) and Br_2 (13.1 g, 82 mmol) diluted in CH_2Cl_2 (50 mL), was added dropwise into the solution whilst stirring at 0 °C. Compound **11** (13.68 g, 51 mmol) was added and the mixture was stirred overnight at r.t. The organic layer was washed with water and the crude bromide **12** was purified by column chromatography with heptane as eluent yielding **12** (10.46 g, 83%) as colourless oil. $C_{12}H_{23}Br$ requires C, 58.30; H, 9.38; found: C, 58.36; H, 9.55%; ^{1}H NMR (400 MHz; $CDCl_3$) δ 0.85 (d, J = 6.4 Hz, 3 H, CH_3), 1.07–1.45 (m, 11 H, CH_2C*H*(CH_2)$_4$), 1.75–1.92 (m, 2 H, BrCH$_2$CH_2), 2.00–2.05 (m, 2 H, CH_2CH=CH$_2$), 3.37 (t, J = 7.0 Hz, 2 H, BrCH_2), 4.90–5.00 (m, 2 H, CH=CH_2), 5.74–5.84 (m, 1 H, C*H*=CH$_2$); EI-MS *m/z* 246/248 (1%, M).

General procedure for the synthesis of 2-[(10-Methylalk-1-yl)oxy]tetrahydro-2*H*-pyrans 13a and 13b

Method A.

Mg (2.19 g, 90 mmol) was poured into an argon-secured flask. Then compounds **6a,b** (75 mmol) dissolved in dry Et_2O (50 mL) were added dropwise whilst stirring. The mixture was heated for 3 h under reflux. Afterwards, the Et_2O was removed under reduced pressure and dry THF (80 mL) was added at 0 °C. A solution of 2-[(8-bromooctyl)oxy]tetrahydro-2*H*-pyran (**7a**; 17.6 g, 60 mmol) in dry THF (10 mL) was added in one portion whereas the temperature should be below 0 °C. At a temperature of –3 to 0 °C, a Li_2CuCl_4 solution in THF (0.1m, 5 mL) was added and the mixture was stirred at that temperature for 3 h. For work up, saturated NH_4Cl solution (100 mL) and Et_2O (100 mL) were added and the organic layer was separated. The water phase was extracted with Et_2O (50 mL) and the collected organic layers were dried over Na_2SO_4 followed by evaporation of the solvent. The purification of the compounds **13** were realised using column chromatography with heptane/Et_2O and gradient technique.

Method B.

The Grignard reagent was prepared from Mg (1.46 g, 60 mmol) and 2-[(6-bromohexyl)-oxy]tetrahydro-2*H*-pyran (**7b**; 13.25 g, 50 mmol) in dry THF (100 mL) according to the procedure described above. The resulting Grignard solution was coupled with compound **12** (34 mmol) under catalytic conditions with Li_2CuCl_4 (0.1m, 3.5 mL) at 0 °C. After work-up as described above, the crude product was purified by column chromatography with heptane/Et_2O and gradient technique.

2-{[(10*RS*)-10-Methylhexadecyl]oxy}tetrahydro-2*H*-pyran (**13a**). Following the general procedure method A, **6a** (15.54 g) gave **13a** (16.3 g, 80%), colourless oil. $C_{22}H_{44}O_2$ requires C, 71.64; H, 12.21; found: C, 72.64; H, 12.94%; ^{1}H NMR (400 MHz, $CDCl_3$) δ 0.81 (d, *J* = 6.5 Hz, 3 H, CHC*H*$_3$), 0.88 (t, *J* = 6.9 Hz, 3 H, CH_2C*H*$_3$), 1.18–1.29 (m, 25 H, C*H*$_2$, C*H*CH$_3$), 1.45–1.88 (m, 8 H, 2× C*H*$_2$CH$_2$O, C*H*$_2$C*H*$_2$CHO), 3.32–3.40 (m, 1 H, CHOC*H*$_2$), 3.45–3.51 (m, 1 H, CHOC*H*$_2$), 3.68–3.75 (m, 1 H, CHOC*H*$_2$), 3.83–3.89 (m, 1 H, CHOC*H*$_2$), 4.55–4.57 (m, 1 H, OC*H*O); ESI-MS *m/z* 363.3 (M + Na).

2-{[(10*RS*)-10-Methylheptadec-16-en-1-yl]oxy}tetrahydro-2*H*-pyran (13b). Following the general procedure method A, **6b** (16.44 g) gave **13b** (16.5 g, 78%). Following the general procedure method B, **12** (8.35 g) gave **13b** (8.75g 73%), colourless oil. $C_{23}H_{44}O_2$ requires C, 78.35; H, 12.58; found: C, 78.07; H, 12.92%; ^{1}H NMR (400 MHz; $CDCl_3$) *δ* 0.82 (d, *J* = 6.6 Hz, 3 H, C*H*$_3$), 1.05–1.38 (m, 23 H, C*H*$_2$, C*H*CH$_3$), 1.47–1.61 (m, 6 H, 2× C*H*$_2$CH$_2$O, C*H*$_2$CH$_2$CHO), 1.67–1.73 (m, 1 H, C*H*$_2$CHO), 1.78-1.83 (m, 1 H, C*H*$_2$CHO), 2.00–2.05 (m, 2 H, C*H*$_2$CH=CH$_2$), 3.34–3.39 (m, 1 H, CHOC*H*$_2$), 3.45–3.50 (m, 1 H, CHOC*H*$_2$), 3.68–3.74 (m, 1 H, CHOC*H*$_2$), 3.83–3.88 (m, 1 H, CHOC*H*$_2$), 4.55–4.57 (m, 1 H, OC*H*O), 4.89–5.00 (m, 2 H, CH=C*H*$_2$), 5.74–5.85 (m, 1 H, C*H*=CH$_2$); EI-MS *m/z* 351 (0.7%, M – H).

Methyl-branched bromoalkanes 14a and 14b.
The bromides **14a,b** were prepared from triphenylphosphoranediyl dibromide and compounds **13a,b** according to the method described above for compound **12**.

(10*RS*)-1-Bromo-10-methylhexadecane (14a). Following the general procedure, triphenylphosphane (13.0 g, 51 mmol), Br_2 (8.15 g, 51 mmol), and **13a** (7.83 g, 23 mmol) gave **14a** (7.12 g, 97%), colourless oil. $C_{17}H_{35}Br$ requires C, 63.93; H, 11.05; found: C, 64.13; H, 11.18%; ^{1}H NMR (400 MHz; $CDCl_3$) δ 0.81–0.88 (m, 6 H, 2× C*H*$_3$), 1.03–1.42 (m, 25 H, (C*H*$_2$)$_7$C*H*(C*H*$_2$)$_5$), 1.84 (quint, *J* = 7.0 Hz, 2 H, BrCH$_2$C*H*$_2$), 3.37–3.41 (m, 2 H, BrC*H*$_2$); EI-MS *m/z* 318/320 (1%, M).

(8*RS*)-17-Bromo-8-methylheptadec-1-ene (14b). Following the general procedure, triphenylphosphane (13.0 g, 51 mmol), Br_2 (8.15 g, 51 mmol), and **13b** (8.11 g, 23 mmol) gave **14b** (7.09 g, 93%), colourless oil. $C_{18}H_{35}Br$ requires C, 65.24; H 10.65; found: C, 64.91; H, 10.76%. ^{1}H NMR (400 MHz; $CDCl_3$) *δ* 0.82 (d, *J* = 6.6 Hz, 3 H, C*H*$_3$), 1.03–1.43 (m, 23 H, (C*H*$_2$)$_7$C*H*(C*H*$_2$)$_4$), 1.84 (quint, *J* = 7.0 Hz, 2 H, BrCH$_2$C*H*$_2$), 2.00–2.05 (m, 2 H, C*H*$_2$CH=CH$_2$), 3.39 (t, *J* = 7.0 Hz, 2 H, BrC*H*$_2$), 4.90–5.00 (m, 2 H, CH=C*H*$_2$), 5.75–5.85 (m, 1 H, C*H*=CH$_2$); EI-MS *m/z* 330/332 (2.4%, M).

Synthesis of diglycerol tetraethers – reaction pathway I

General procedure of *O*-alkylation of 1,2-*O*-isopropylidene-*sn*-glycerols 16.
Suspension of KH (22.5 mmol, 30%) was freed from paraffin oil by washing with dry toluene under argon. The residue of KH was suspended in dry toluene (8 mL). A solution of 1,2-*O*-isopropylidene-*sn*-glycerol (**15**; 2.61 g, 22.5 mmol) in dry toluene (20 mL) was dropped into the slurry whilst stirring. The mixture was stirred for a further 18 h at r.t. until the K-salt formation was completed. Afterwards, compounds **14** (17 mmol), dissolved in dry toluene (10 mL), were added and the mixture was heated for 10 h under reflux. After cooling to r.t., water (30 mL) was added and the mixture was stirred for 30 min. The organic layer was separated and the water phase was extracted two times with $CHCl_3$ (20 mL). The combined organic layers were dried over Na_2SO_4, evaporated and purified using column chromatography and heptane/Et_2O as eluent and gradient technique.

1,2-*O*-isopropylidene-3-*O*-(heptadec-16-en-1-yl)-*sn*-glycerol (16a). Following the general procedure, **14a** (5.4 g) gave **16a** (4.51 g, 73%), colourless oil. $[\alpha]_D^{22}$ +12.82 (*c* 0.86 g/mL, pure); $C_{23}H_{44}O_3$ requires C, 74.95; H, 12.03; found: C, 75.07; H, 12.24%; ^{1}H NMR (400 MHz; $CDCl_3$) δ 1.23–1.32 (m, 24 H, $(CH_2)_{12}$), 1.34 (s, 3 H, CH_3), 1.40 (s, 3 H, CH_3), 1.55 (quint, J = 7.0 Hz, 2 H, CH_2CH_2O), 1.99–2.04 (m, 2 H, $CH_2CH{=}CH_2$), 3.37–3.51 (m, 4 H, 2× CH_2O), 3.68–3.72 (m, 1 H, $CHHOC(CH_3)_2O$), 4.01–4.05 (m, 1 H, $CHHOC(CH_3)_2O$). 4.23 (quint, J = 6.0 Hz, 1 H, CHO), 4.88–4.99 (m, 2 H, $CH{=}CH_2$), 5.74–5.84 (m, 1 H, $CH{=}CH_2$); ^{13}C NMR (100 MHz; $CDCl_3$) δ 25.89, 26.22, 26.94, 29.10, 29.30, 29.60–29.80, 33.94, 67.07, 71.91, 71.96, 74.85, 109.32, 114.0, 139.18; EI-MS *m/z* 368 (8.6%, M).

1,2-*O*-isopropylidene-3-*O*-[(10*RS*)-10-methylheptadec-16-en-1-yl]-*sn*-glycerol (16b). Following the general procedure, **14b** (5.6 g) gave **16b** (4.42 g, 68%), colourless oil. $C_{24}H_{46}O_3$ requires C, 75.34; H, 12.12; found: C, 75.27; H 12.24%; ^{1}H NMR (400 MHz; $CDCl_3$) δ 0.82 (d, J = 6.6 Hz, 3 H, $CHCH_3$), 1.05-1.36 (m, 23 H, $(CH_2)_7CH(CH_2)_4$), 1.34 (s, 3 H, CCH_3), 1.40 (s, 3 H, CCH_3), 1.50–1.59 (m, 2 H, CH_2CH_2O), 1.99–2.05 (m, 2 H, $CH_2CH{=}CH_2$), 3.38–3.52 (m, 4 H, 2× CH_2O), 3.69–3.73 (m, 1 H, $CHHOC(CH_3)_2O$), 4.02–4.05 (m, 1 H, $CHHOC(CH_3)_2O$), 4.21–4.27 (m, 1 H, CHO), 4.89–5.00 (m, 2 H, $CH{=}CH_2$), 5.74–5.85 (m, 1 H, $CH{=}CH_2$); ^{13}C NMR (100 MHz; $CDCl_3$) δ 19.76, 25.49, 26.12, 26.83, 26.96, 27.12, 29.04, 29.52–29.69, 30.05, 32.79, 33.86, 37.07, 37.12, 67.01, 71.86, 71.91, 74.81, 109.32, 114.06, 139.19; EI-MS *m/z* 382 (4.3%, M).

General procedure of the synthesis of 3-*O*-alkyl-*sn*-glycerols 17.
Compounds **16a** or **16b** (12 mmol) and PPTS (50 mg) were suspended in dry MeOH (40 mL) and heated for 10 h at reflux. Then, the solvent was removed, the residue was dissolved in $CHCl_3$ (70 mL) and washed with water (70 mL). The water layer was extracted two times with a $CHCl_3$/MeOH mixture (70 mL; 9/1, v/v) and the combined organic layers were dried over Na_2SO_4 and evaporated. The crude products were purified by column chromatography using $CHCl_3$/Et_2O as eluent and gradient technique.

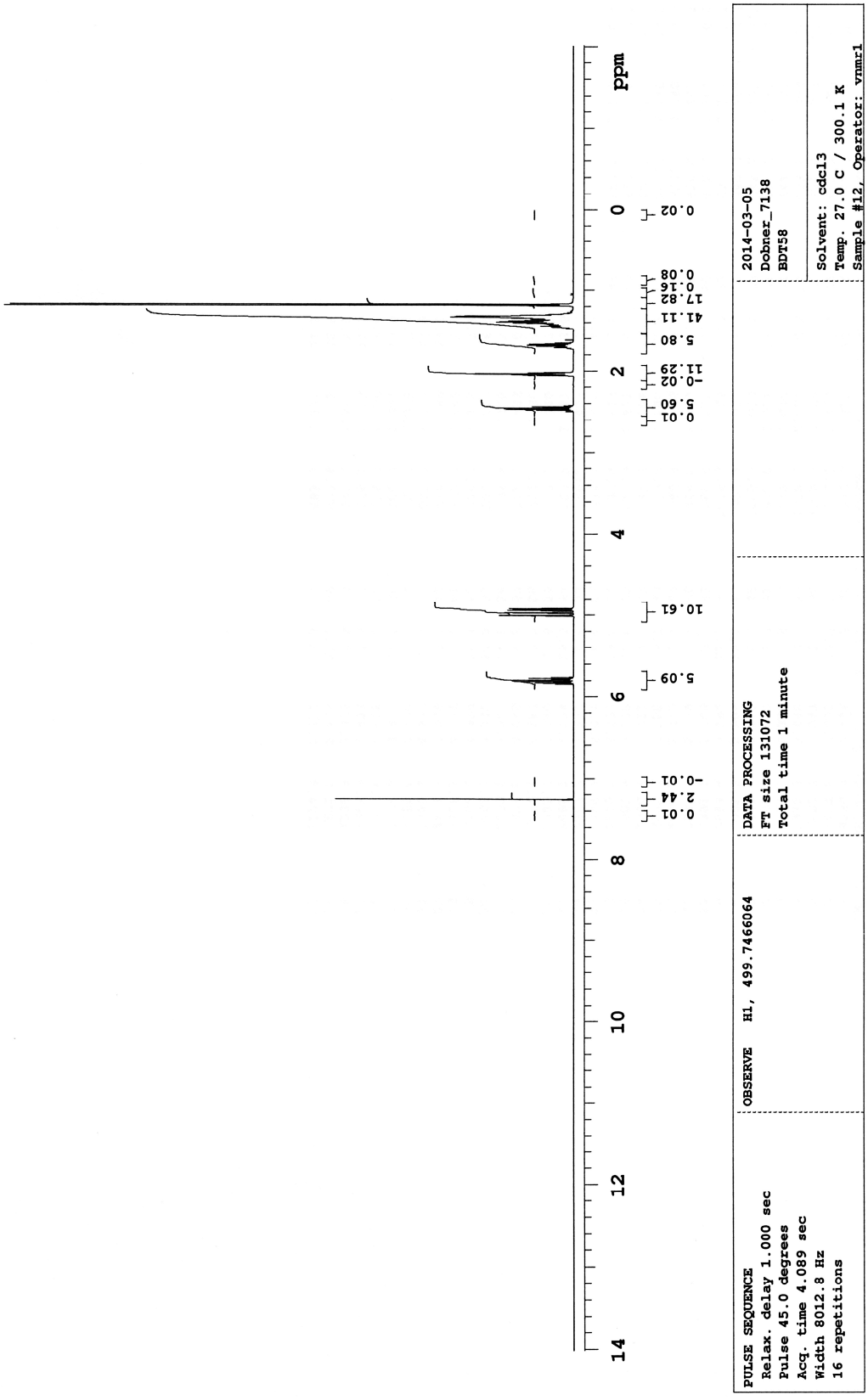
3-*O*-(Heptadec-16-en-1-yl)-*sn*-glycerol (17a). Following the general procedure, **16a** (4.42 g) gave **17a** (3.35 g, 85%), white solid substance. M.p. 56 °C; $[\alpha]_{22}^D$ –0.6 (*c* 0.1 g/mL, $CHCl_3$); $C_{20}H_{40}O_3$

requires C, 73.12; H, 12.27; found: C, 73.28; H, 11.94%; ^{1}H NMR (400 MHz; $CDCl_3$) δ 1.19–1.37 (m, 24 H, (C*H*$_2$)$_{12}$), 1.52–1.59 (m, 2 H, C*H*$_2$CH$_2$O), 1.99–2.04 (m, 2 H, C*H*$_2$CH=CH$_2$), 2.29 (bs, 2 H, 2× O*H*), 3.42–3.53 (m, 4 H, 2× C*H*$_2$O), 3.61–3.72 (m, 2 H, C*H*$_2$OH), 3.81–3.86 (m, 1 H, C*H*OH), 4.89–5.00 (m, 2 H, CH=C*H*$_2$), 5.74–5.84 (m, 1 H, C*H*=CH$_2$); ^{13}C NMR (100 MHz; $CDCl_3$) δ 26.14, 29.01, 29.21, 29.52–29.71, 33.85, 64.27, 70.59, 71.88, 72.46, 114.05, 139.20; EI-MS *m/z* 328 (8.9%, M).

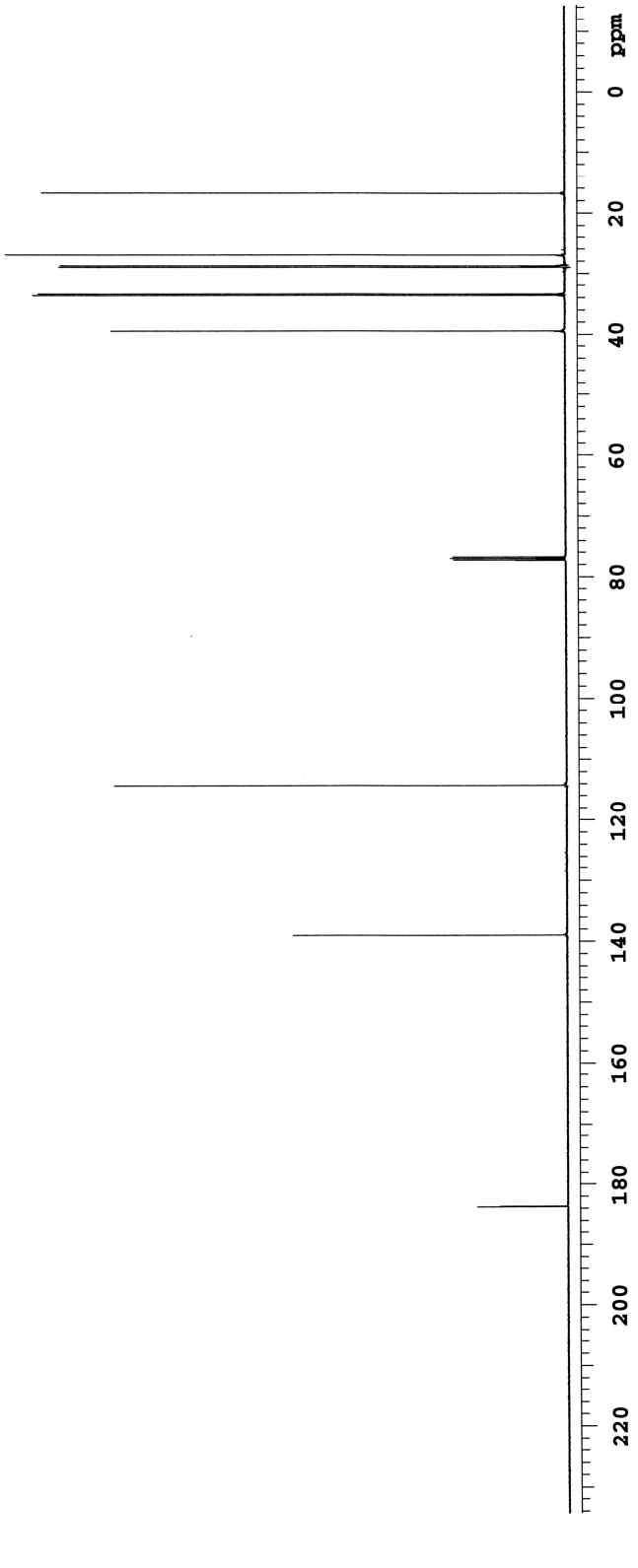
3-*O*-[(10*RS*)-10-methylheptadec-16-en-1-yl]-*sn*-glycerol (17b). Following the general procedure, **16b** (4.59 g) gave **17b** (3.74 g, 91%), colourless oil. $C_{21}H_{42}O_3$ requires C, 73.63; H, 12.36; found: C, 73.27; H, 12.35%; ^{1}H NMR (400 MHz; $CDCl_3$) δ 0.81 (d, *J* = 6.6 Hz, 3 H, C*H*$_3$), 1.04–1.37 (m, 23 H, (C*H*$_2$)$_7$C*H*(C*H*$_2$)$_4$), 1.51–1.58 (m, 2 H, C*H*$_2$CH$_2$O), 1.99–2.04 (m, 2 H, C*H*$_2$CH=CH$_2$), 2.52 (bs, 2 H, 2× O*H*), 3.39–3.54 (m, 4 H, 2× C*H*$_2$O), 3.59–3.70 (m, 2 H, C*H*$_2$OH), 3.81–3.85 (m, 1 H, C*H*OH), 4.88–4.99 (m, 2 H, CH=C*H*$_2$), 5.75–5.84 (m, 1 H, C*H*=CH$_2$); ^{13}C NMR (100 MHz; $CDCl_3$) δ 19.76, 26.14, 26.96, 27.12, 29.04, 29.52–29.70, 30.05, 32.79, 33.86, 37.07, 37.13, 64.31, 70.52, 71.89, 72.51, 114.06, 139.21; ESI-MS *m/z* 365.4 (M + Na).

4. Characterisation of products – MS, ^{1}H NMR, ^{13}C NMR spectra

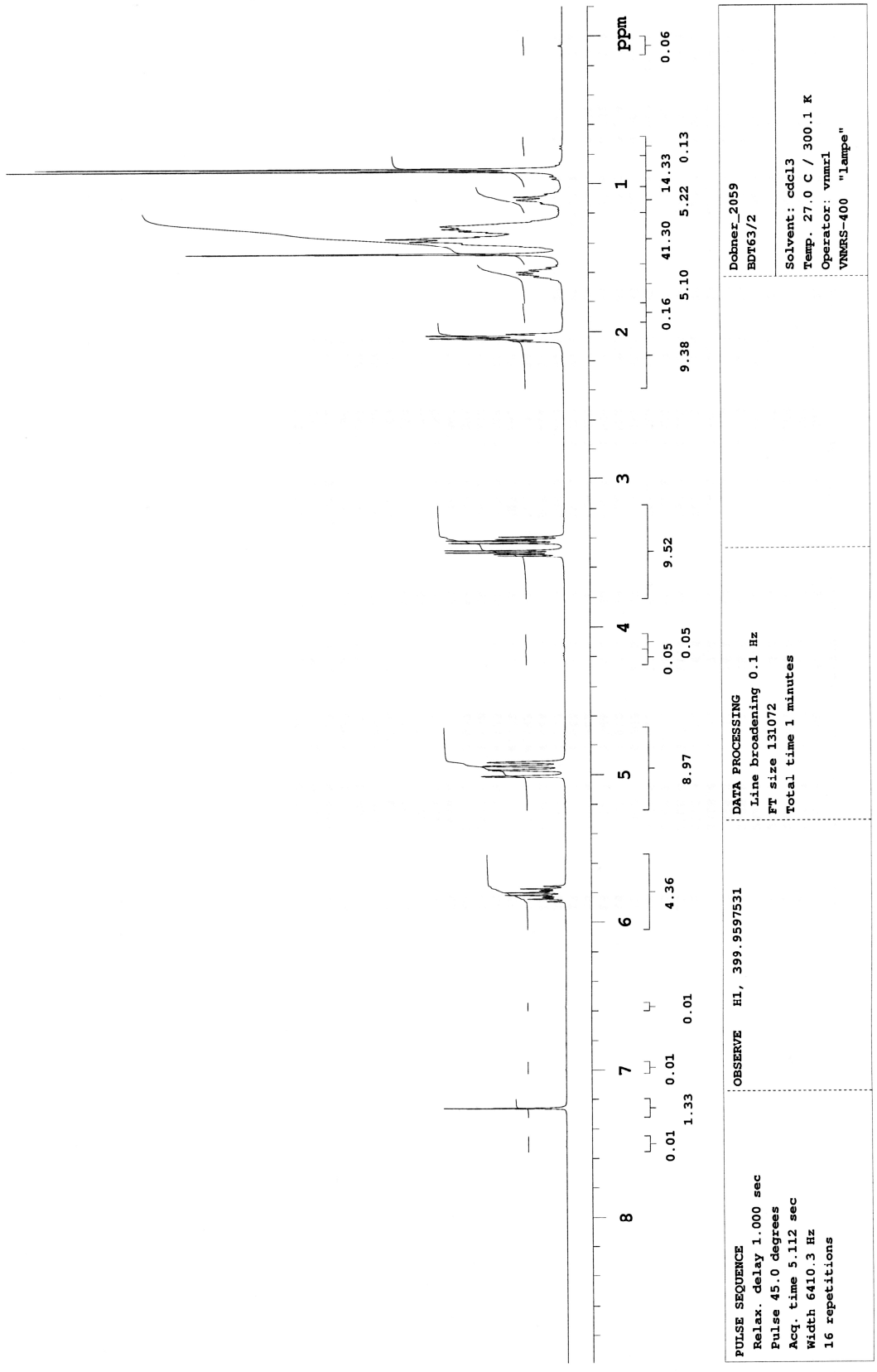
*Compound **4b**: ^{1}H-NMR*



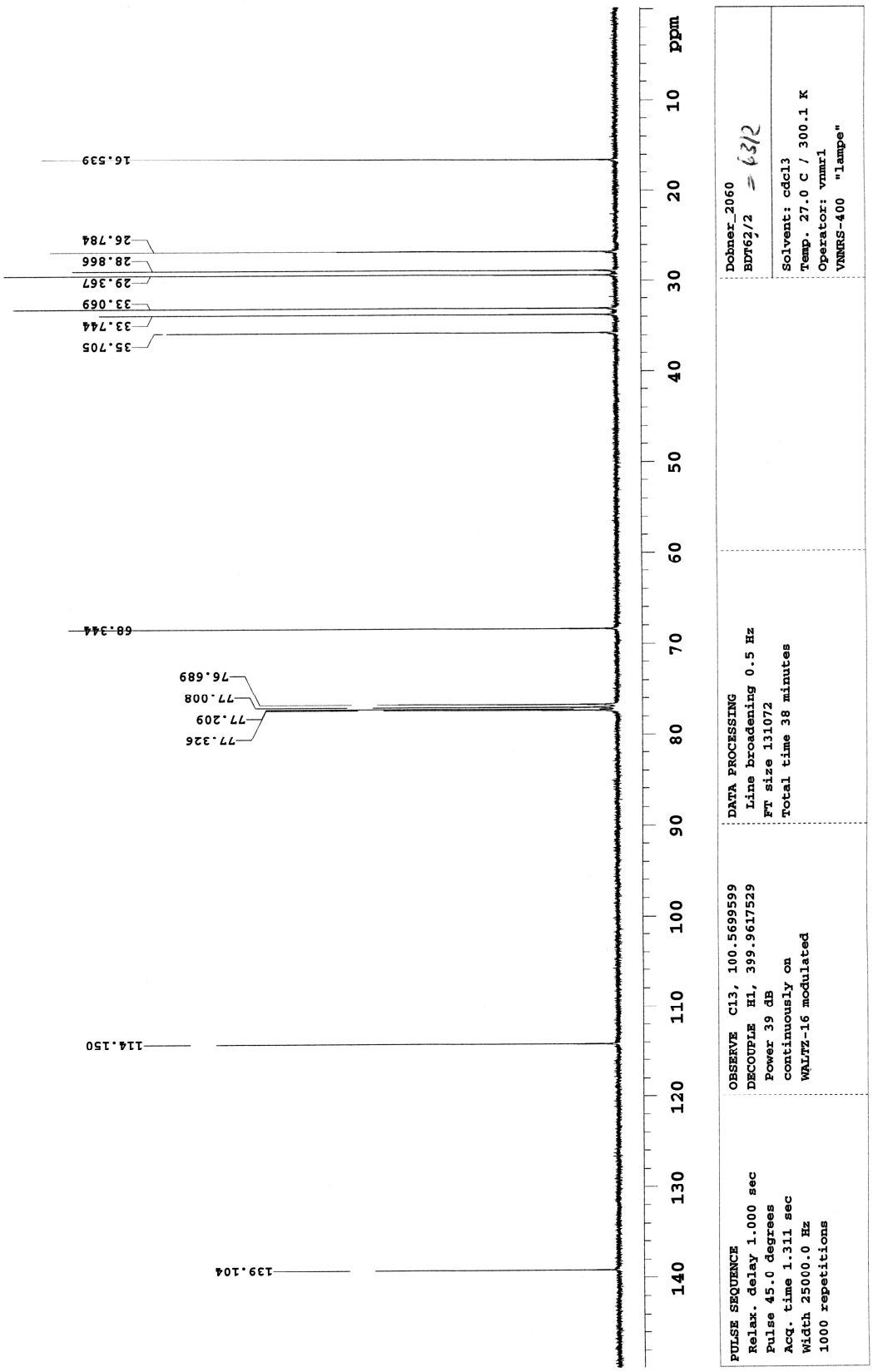
*Compound **4b**: ^{13}C-NMR*



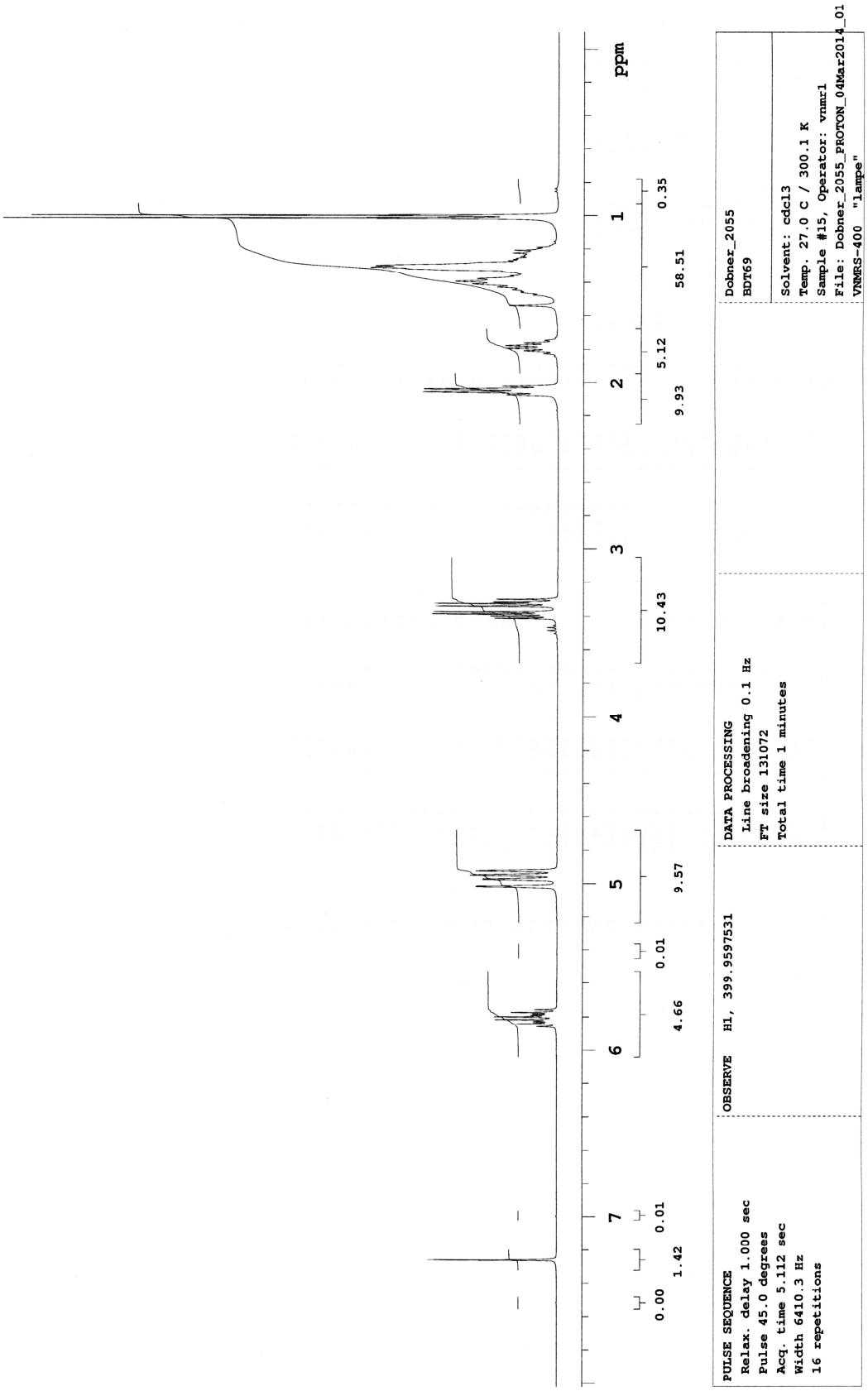
*Compound **5b**: ^{1}H-NMR*



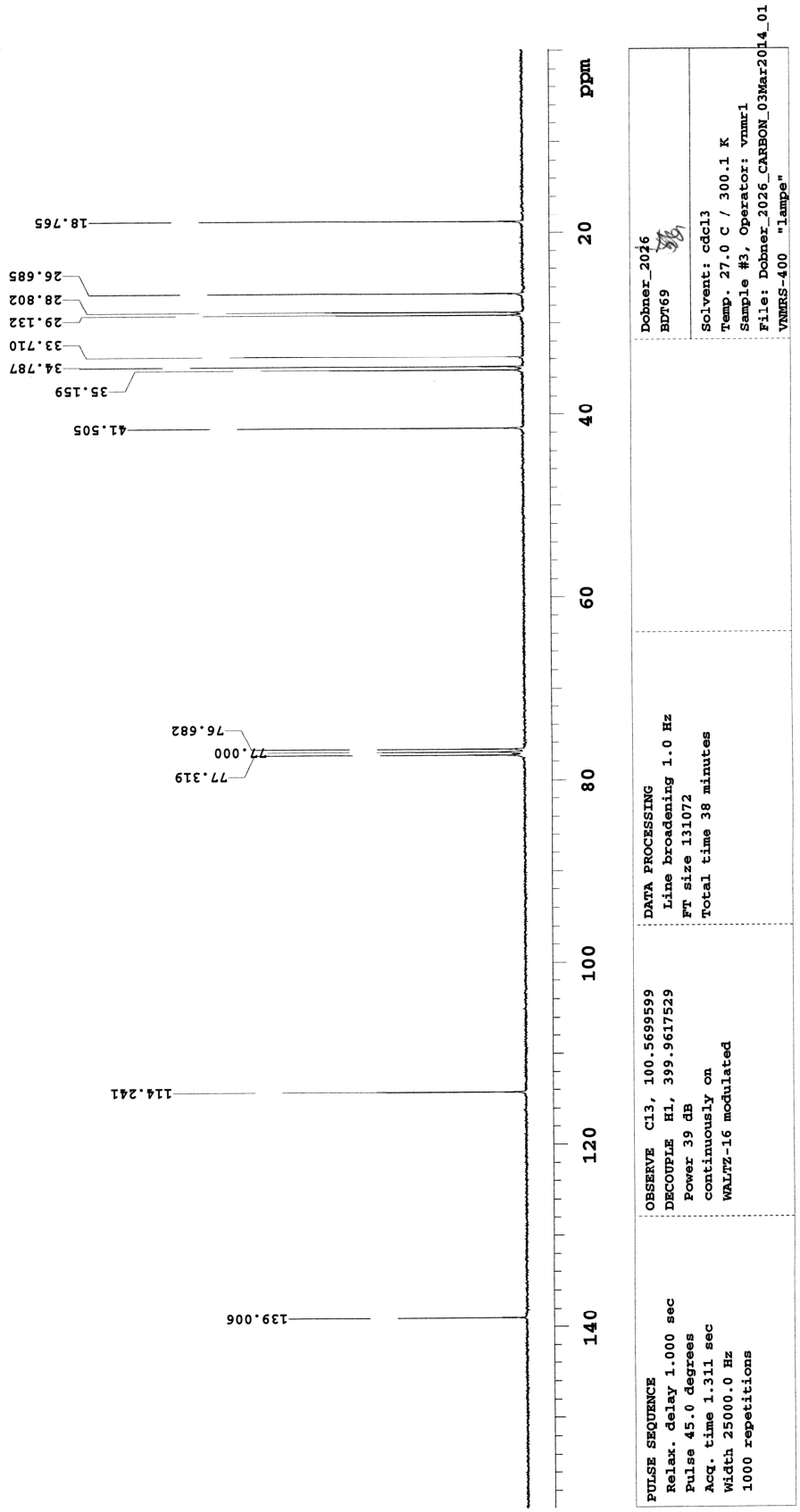
*Compound **5b**: ^{13}C-NMR*



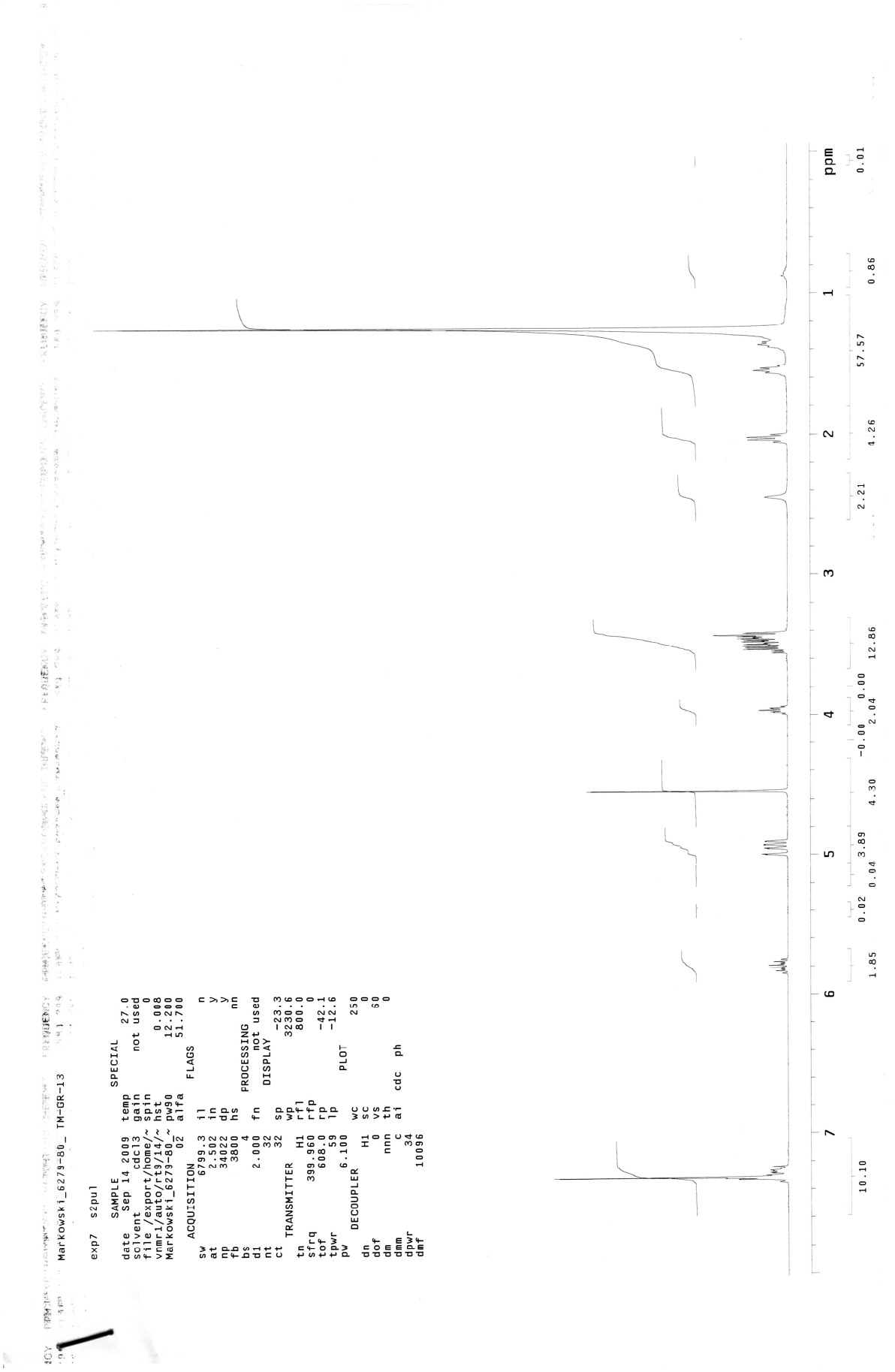
*Compound **6b**: ^{1}H-NMR*



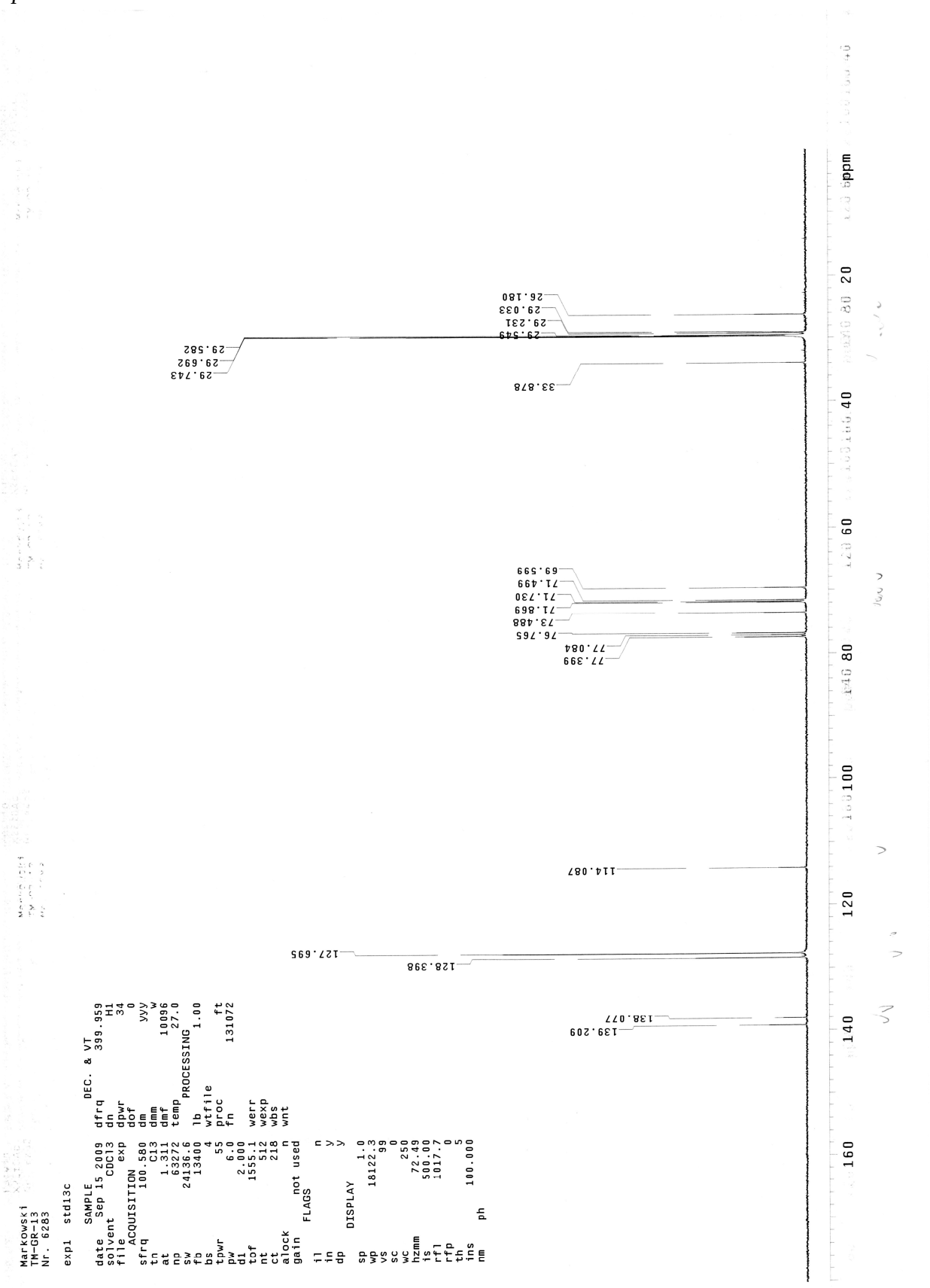
*Compound **6b**: ^{13}C-NMR*



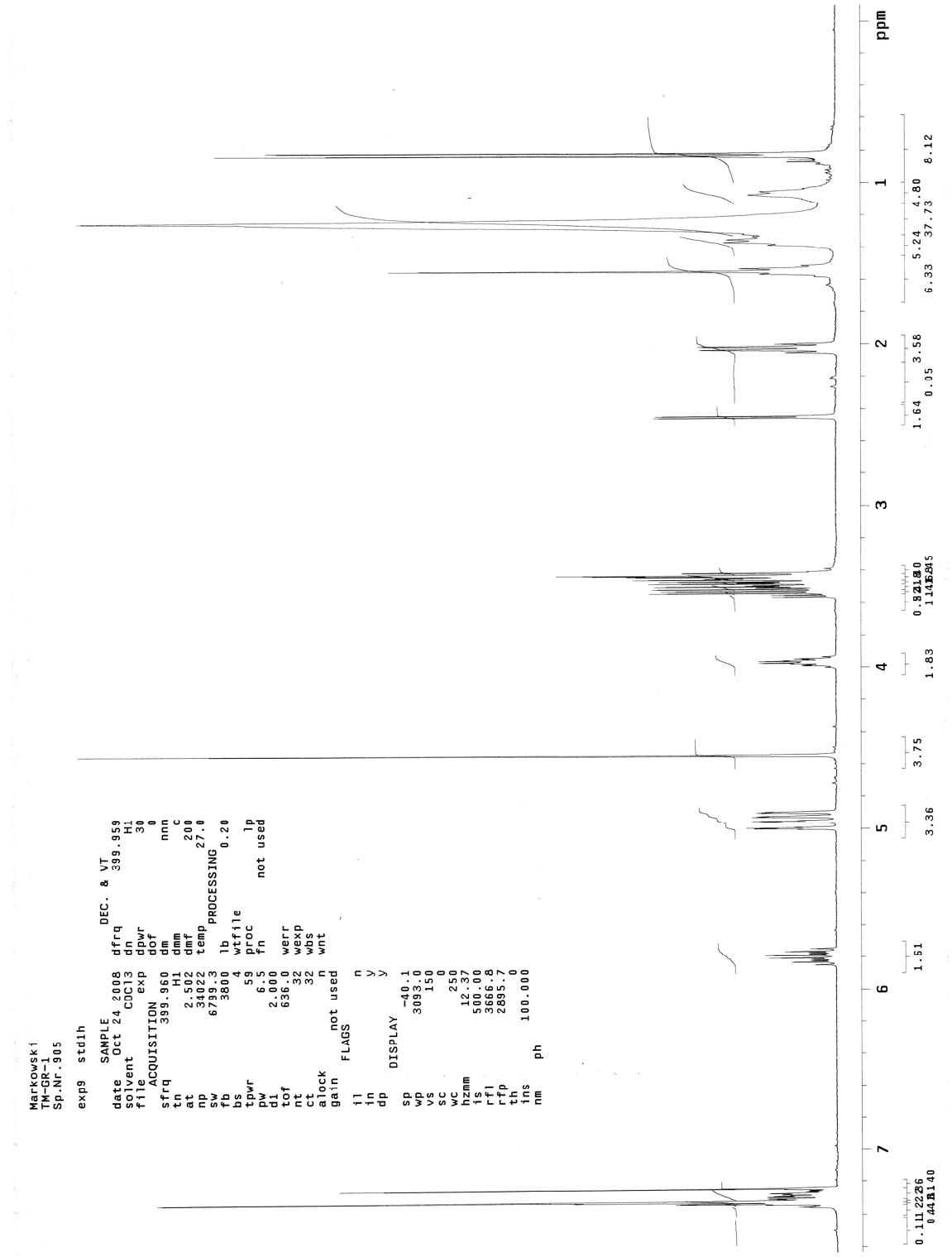
*Compound **18a**: ^{1}H-NMR*



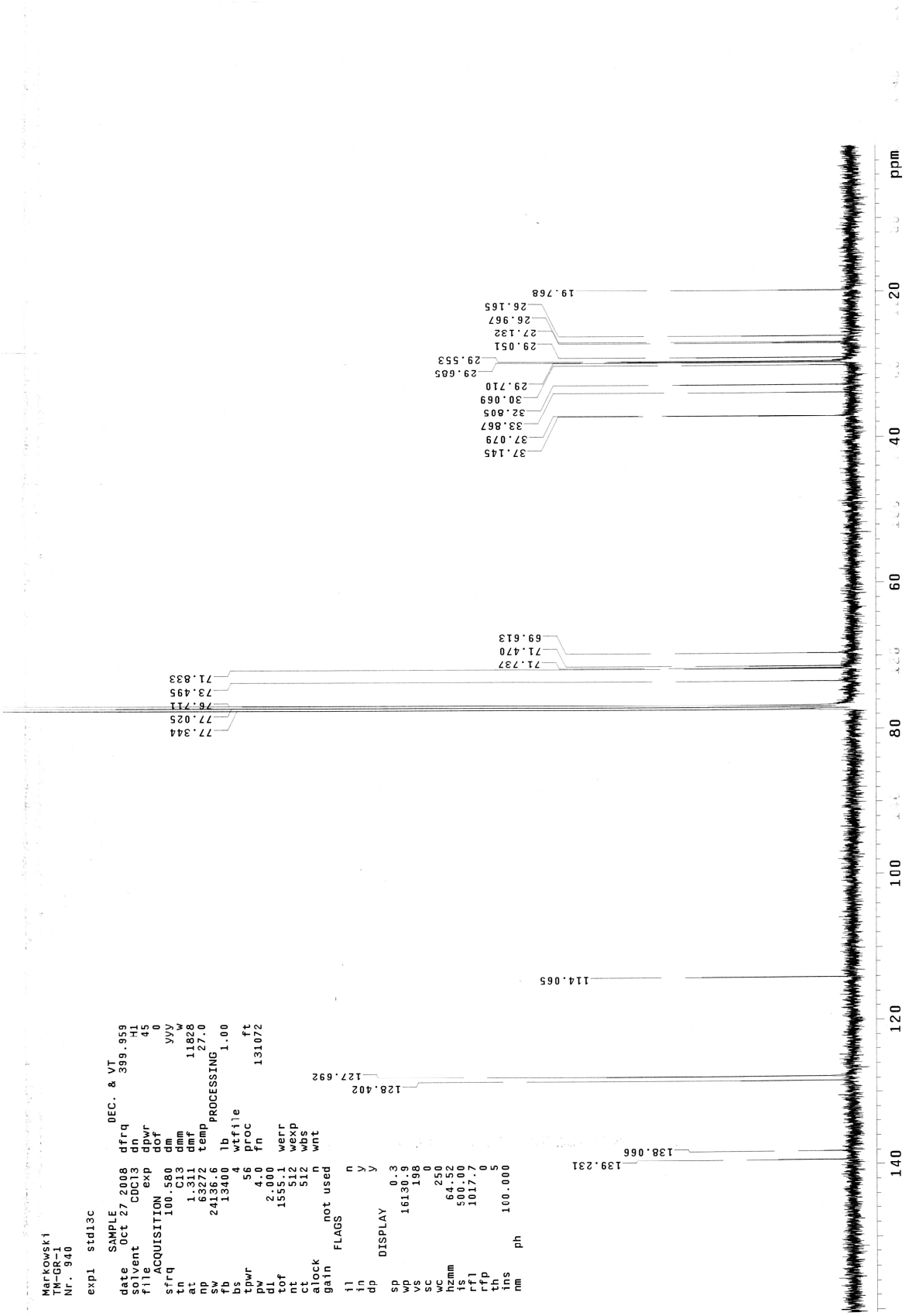
*Compound **18a**: ^{13}C-NMR*



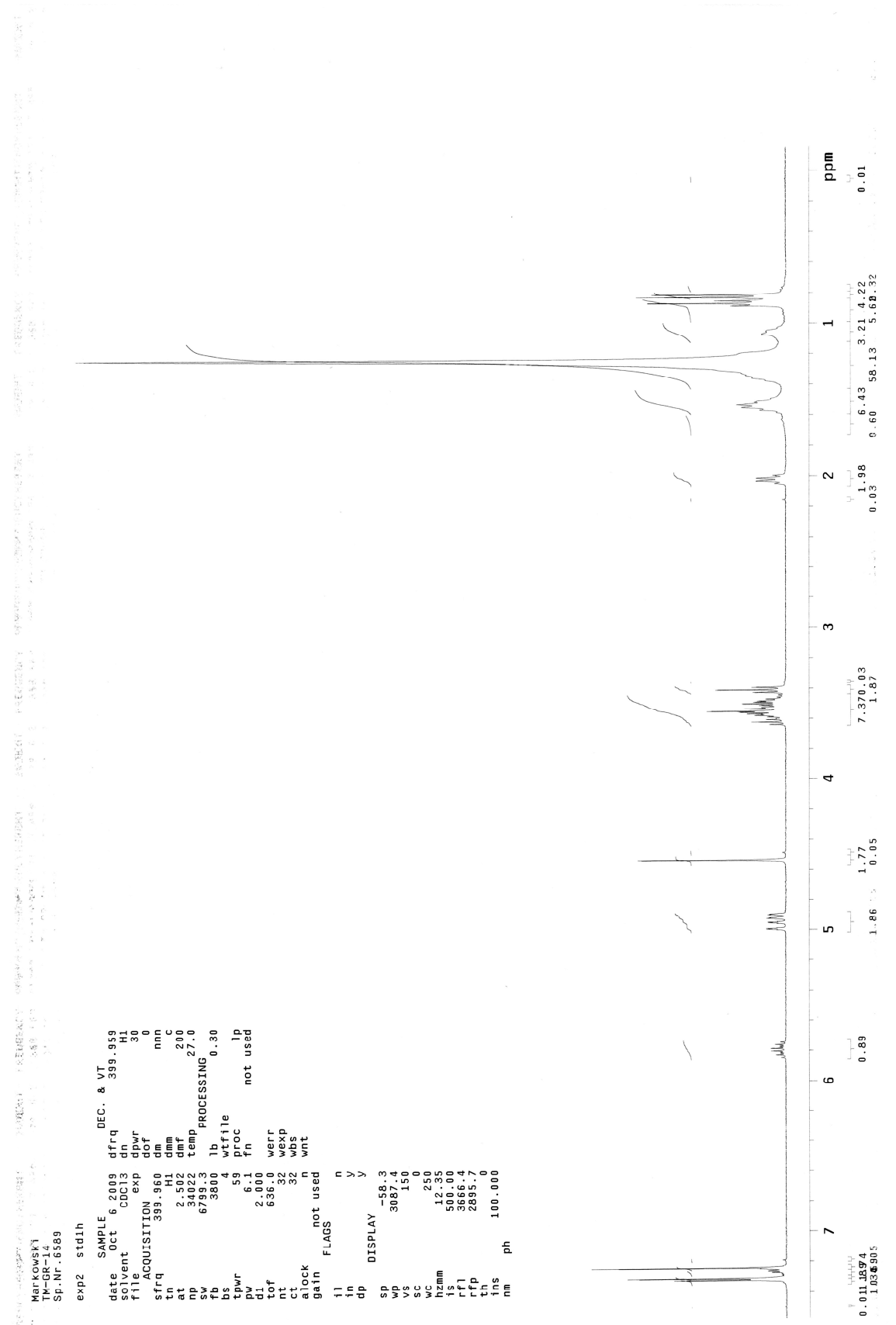
*Compound **18b**: ^{1}H-NMR*



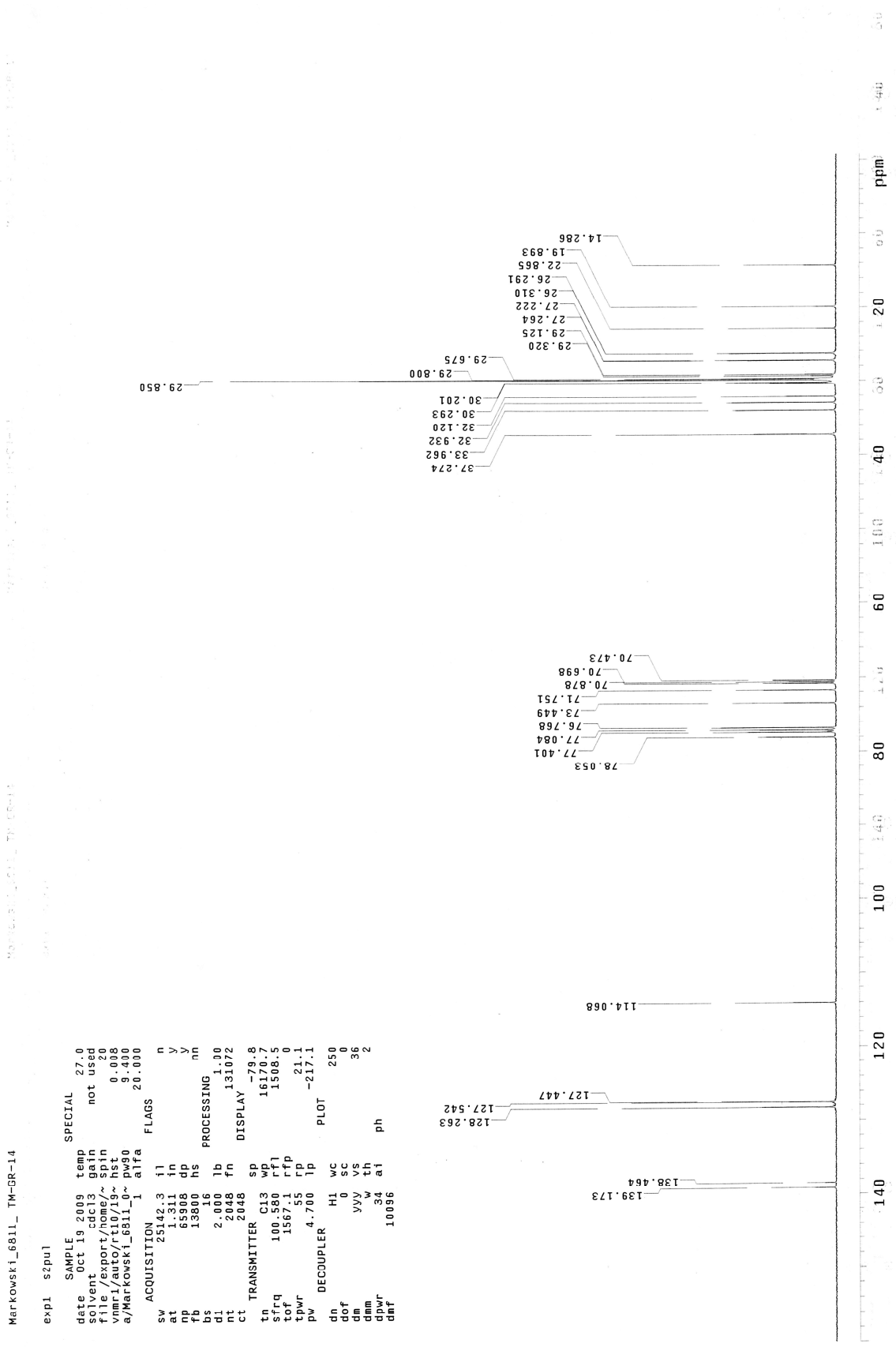
*Compound **18b**: ^{13}C-NMR*



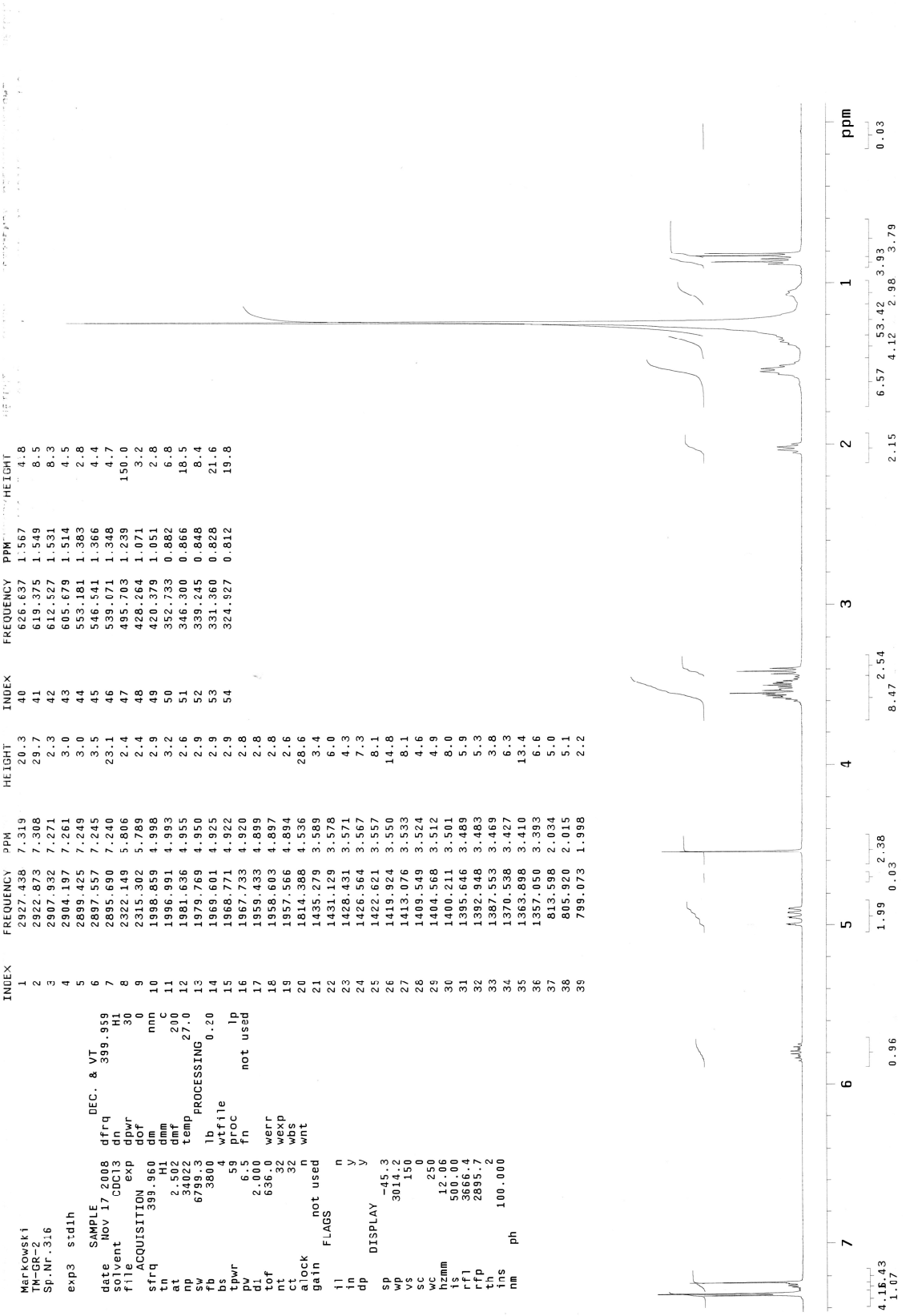
*Compound **19a**: ^{1}H-NMR*



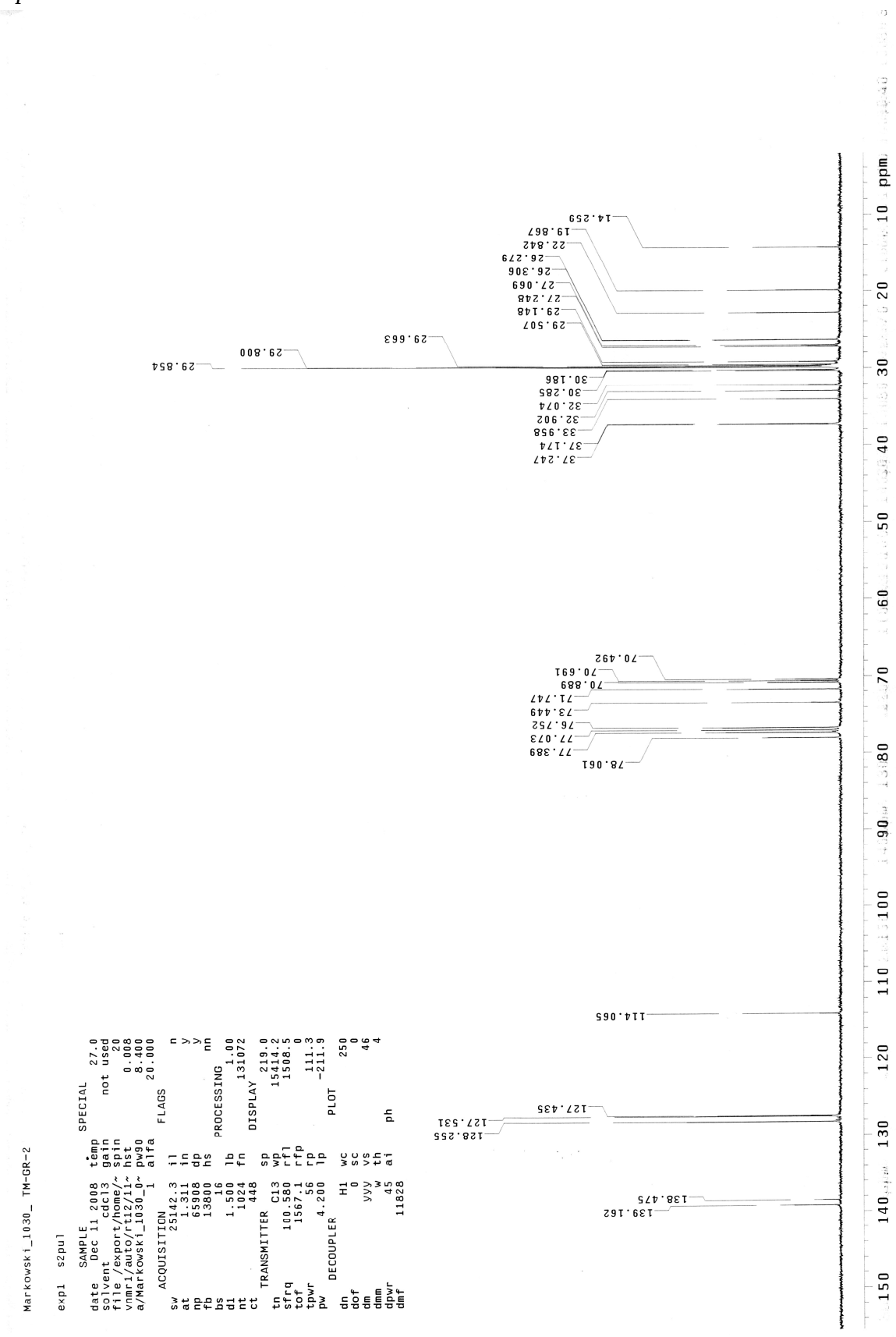
*Compound **19a**: ^{13}C-NMR*



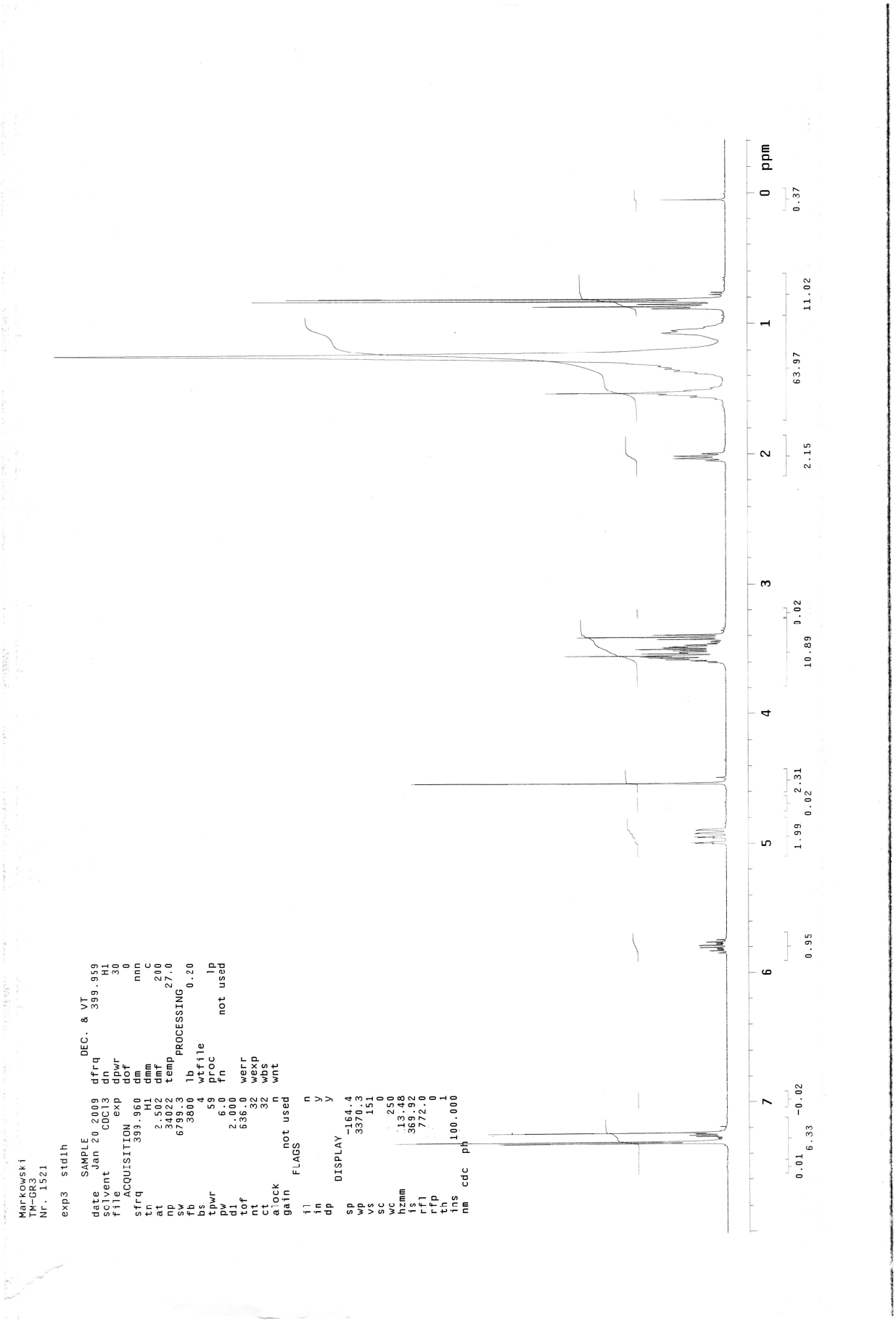
*Compound **19b**: ^{1}H-NMR*



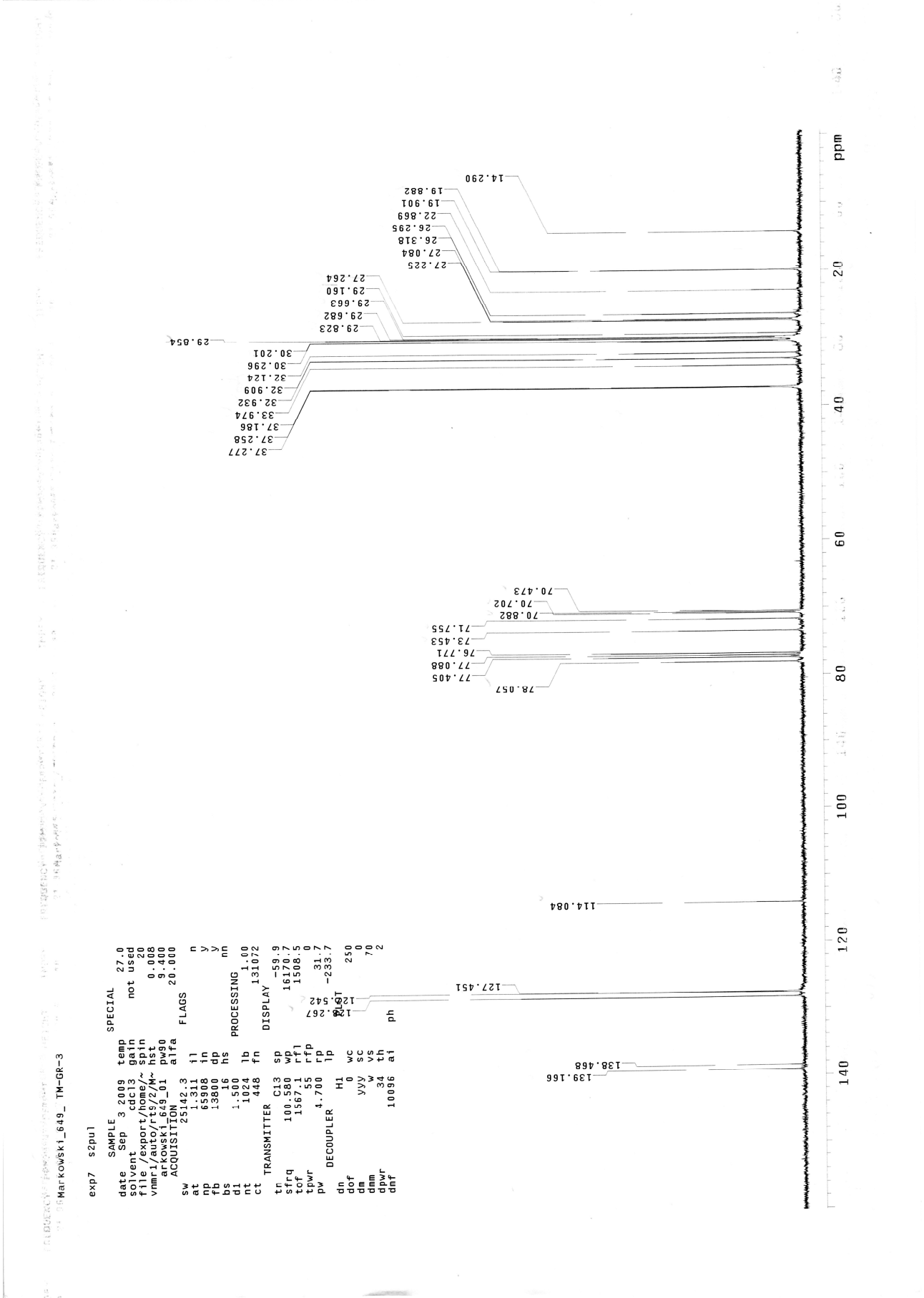
*Compound **19b**: ^{13}C-NMR*



*Compound **19c**: ^{1}H-NMR*



*Compound **19c**: ^{13}C-NMR*



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exp9 std1h

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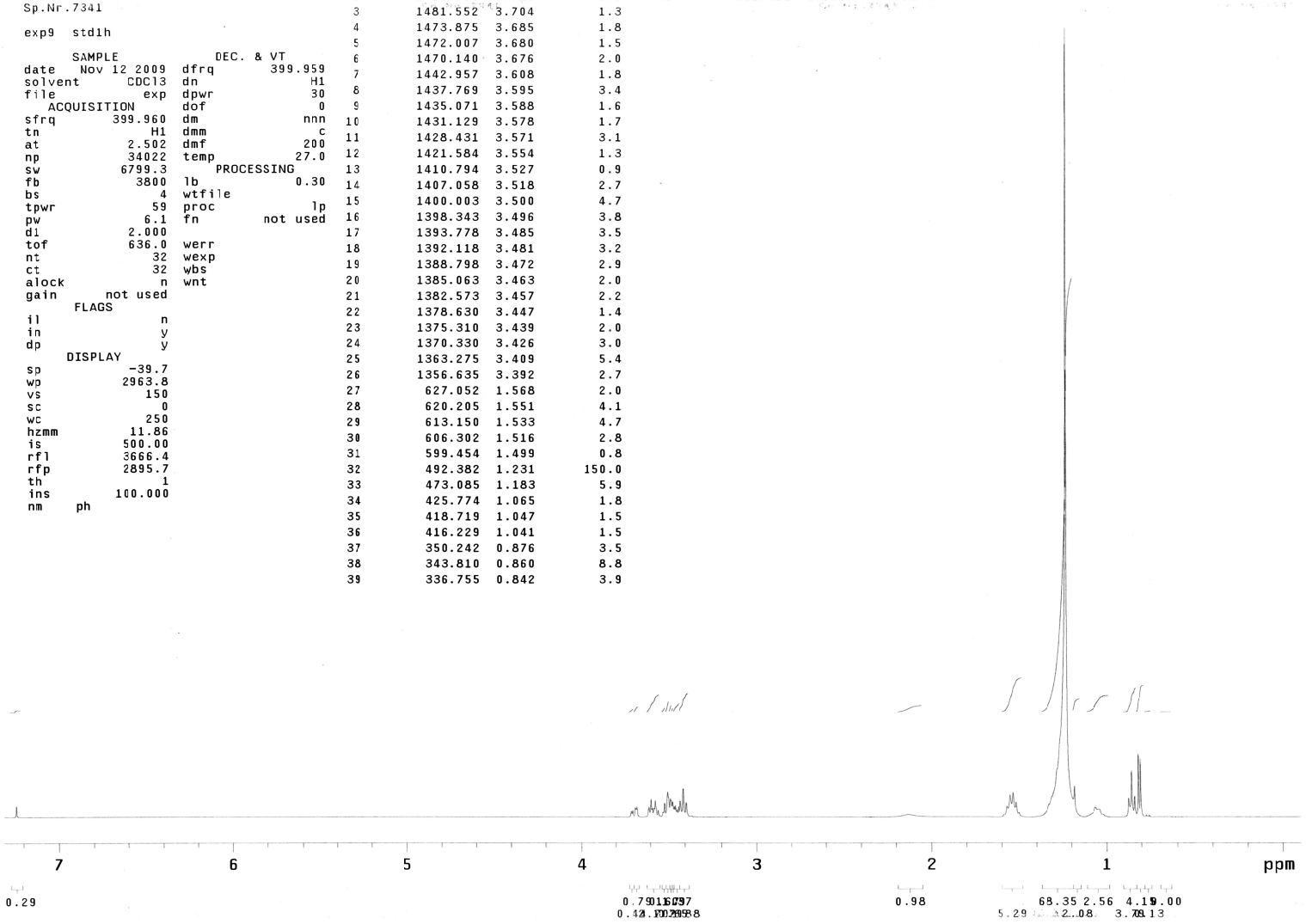
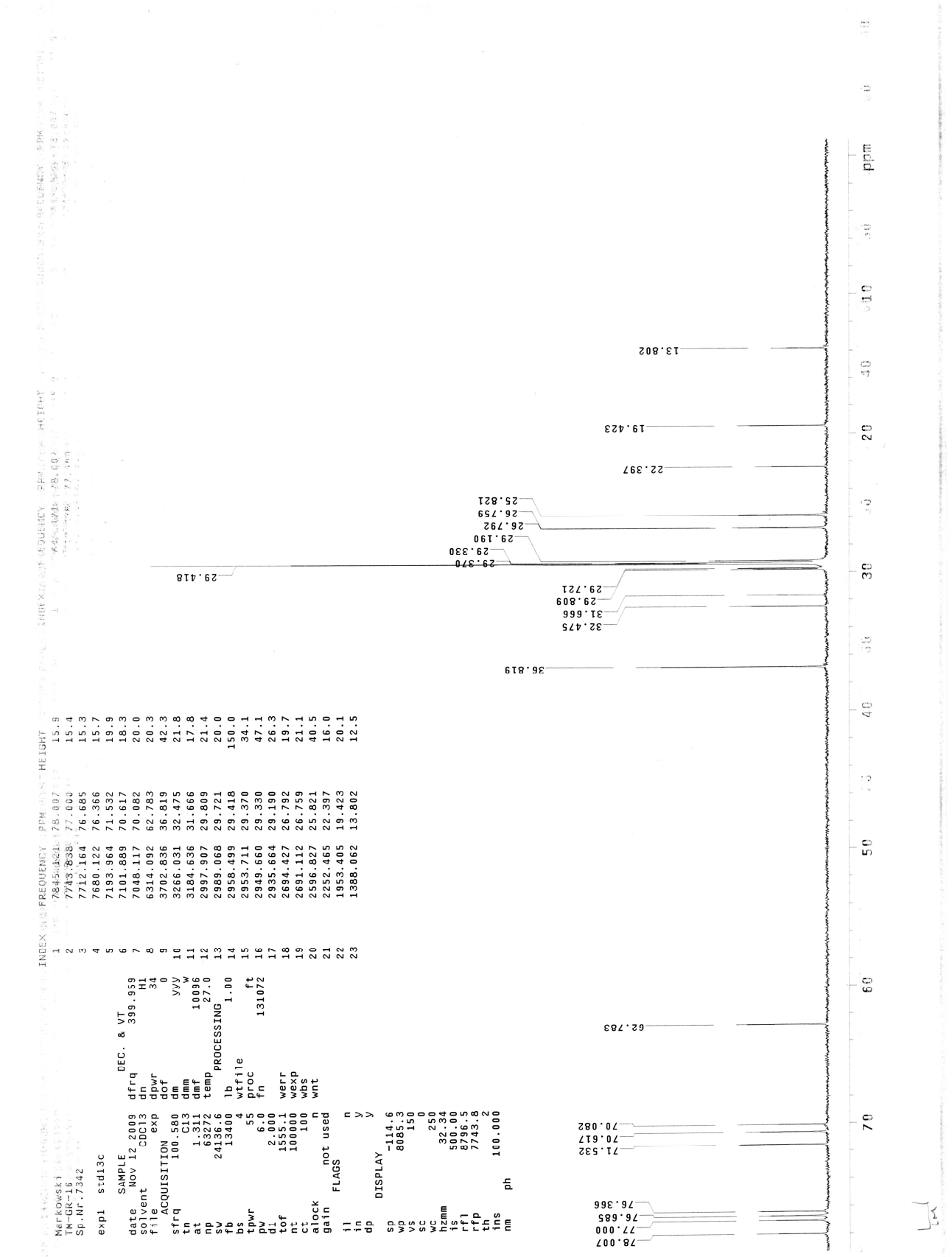
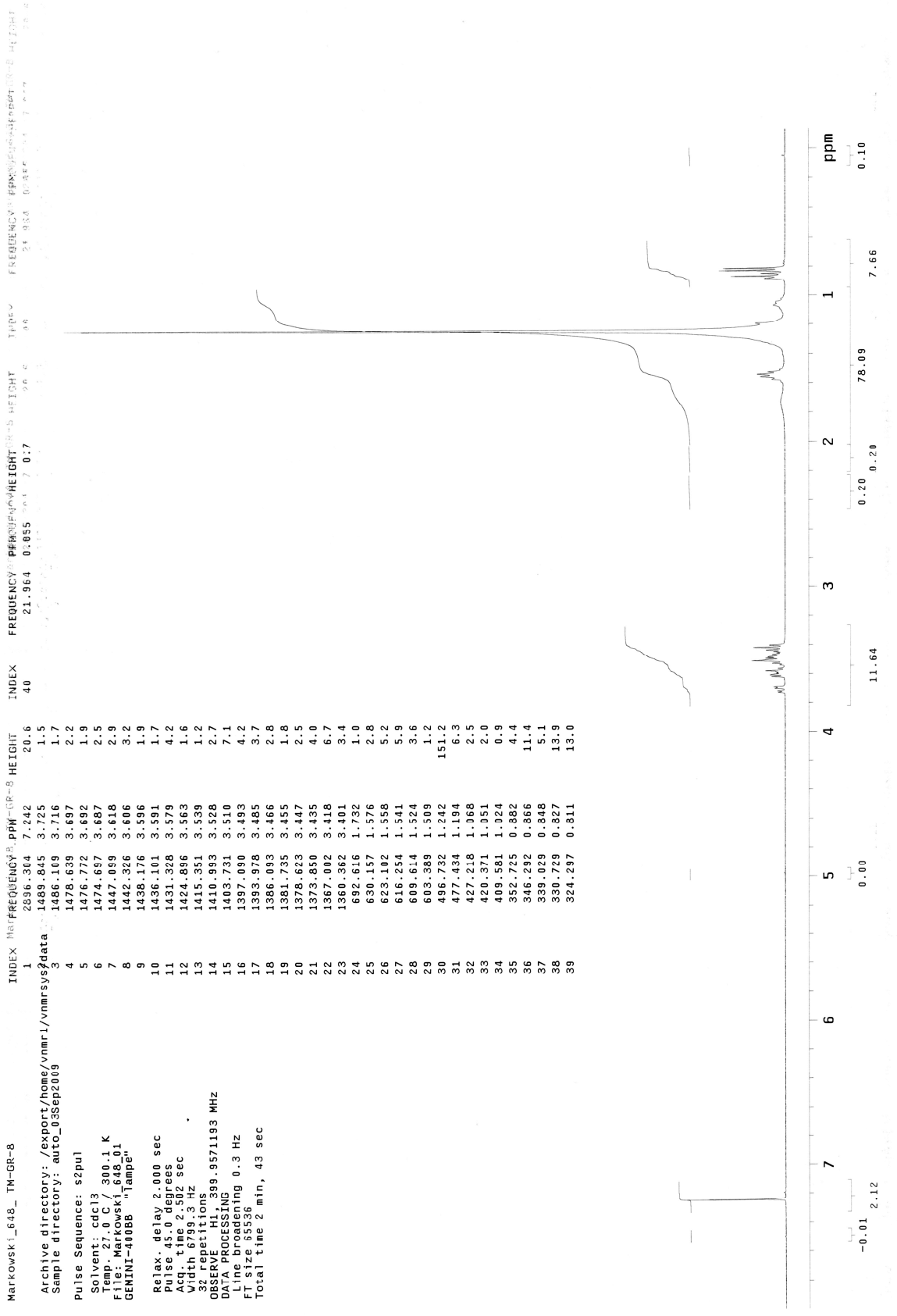


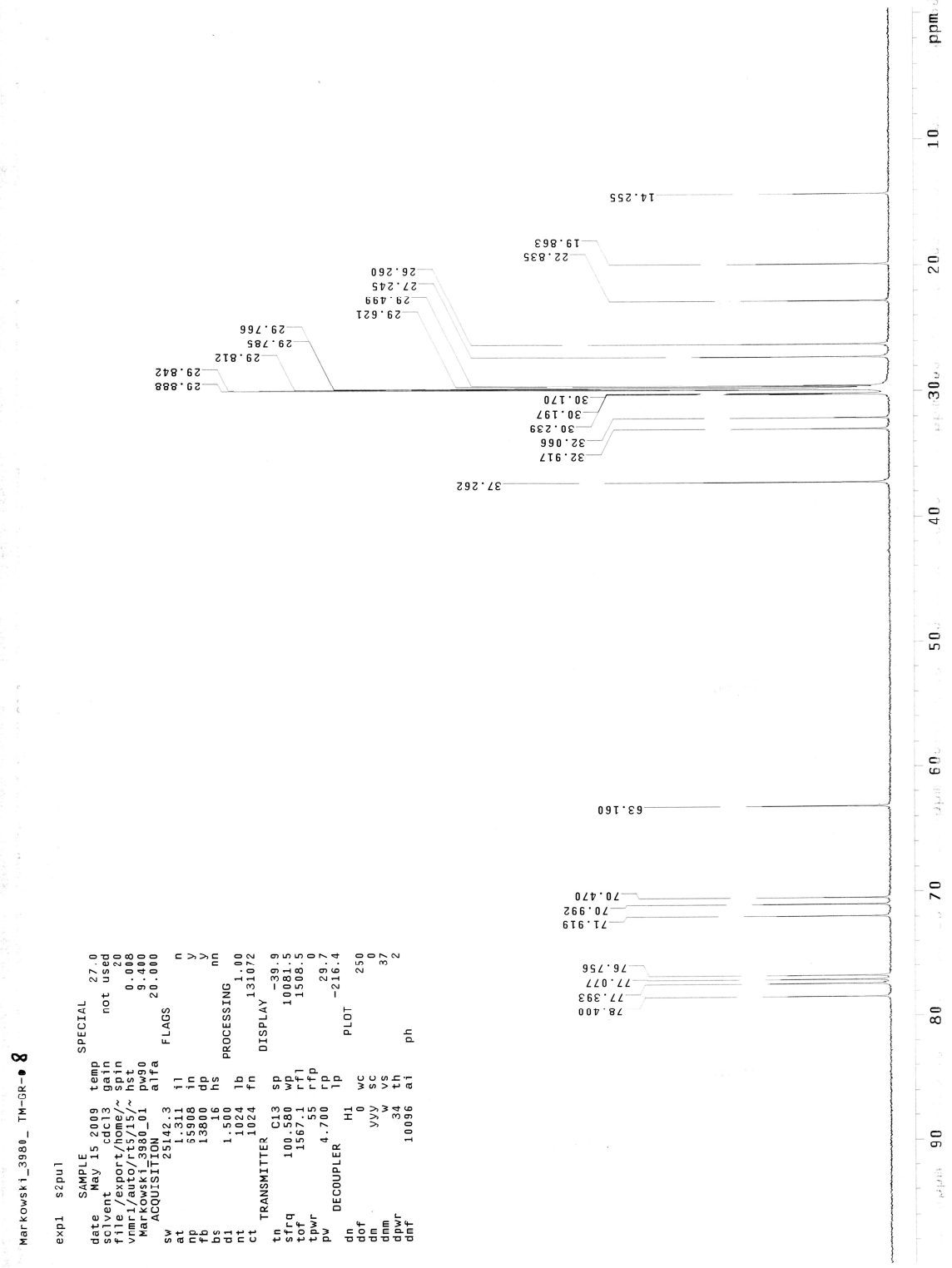
*Compound **20a**: ^{13}C NMR*



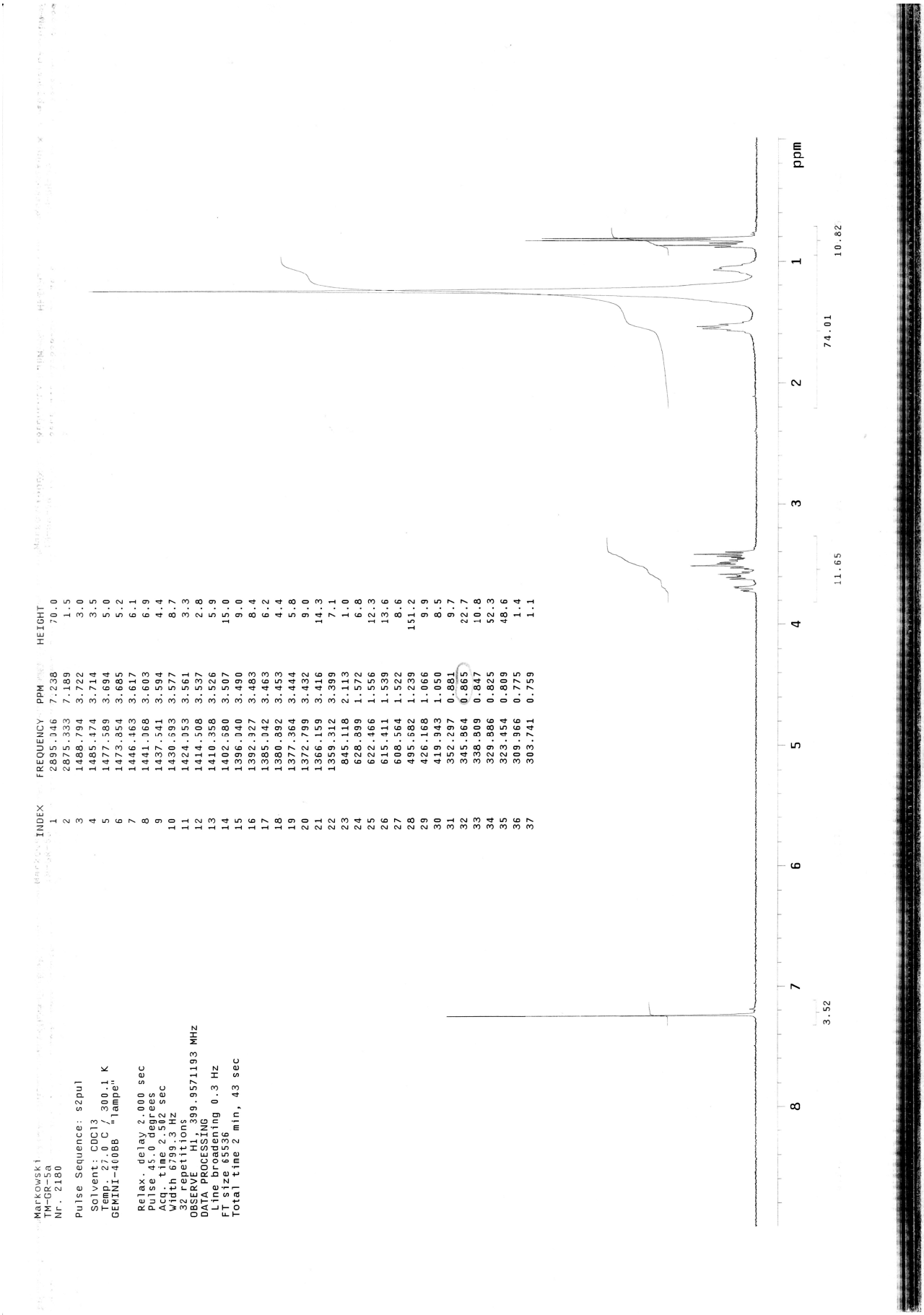
*Compound **20b**: ^{1}H NMR*



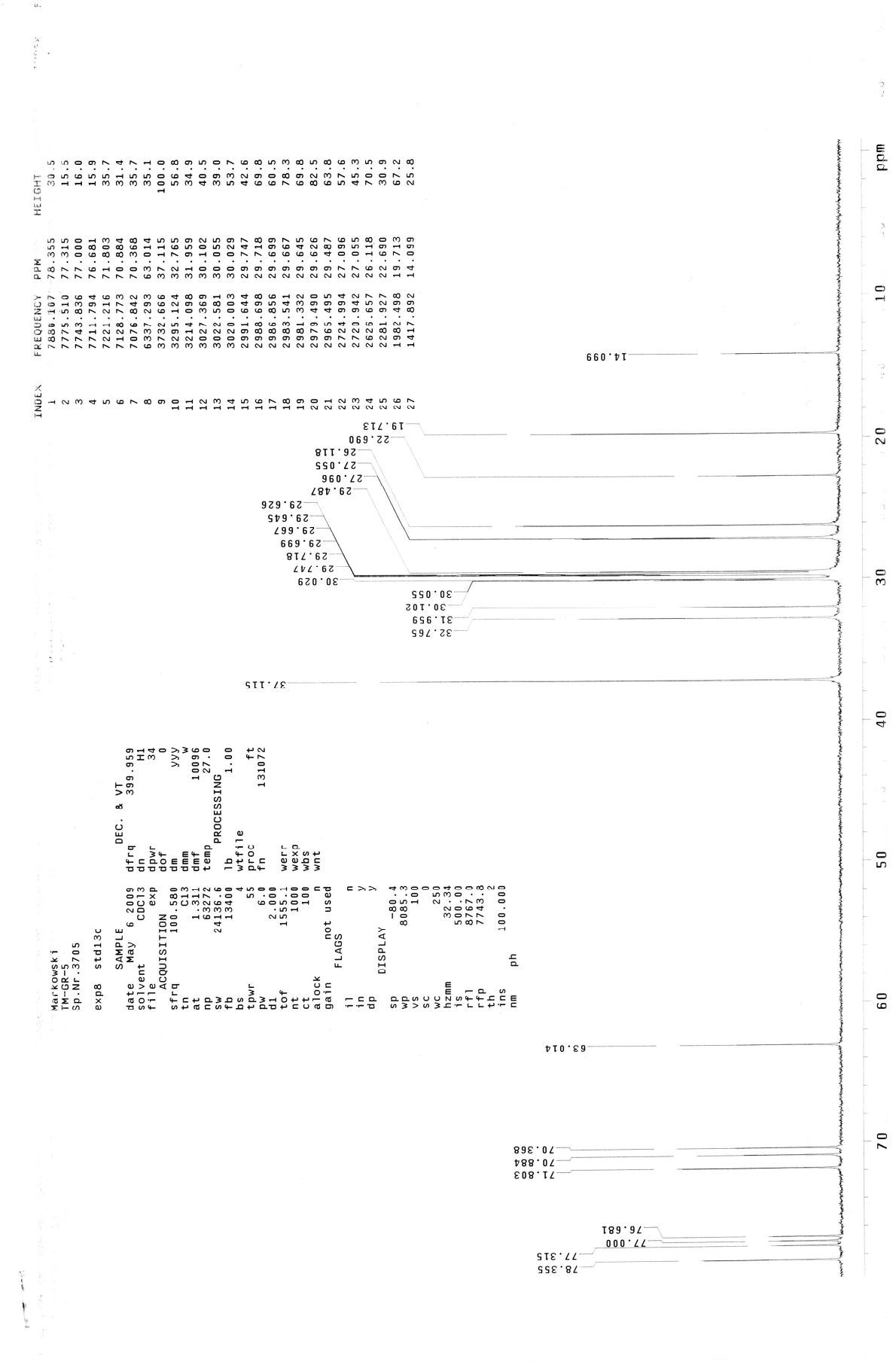
*Compound **20b**: ^{13}C NMR*



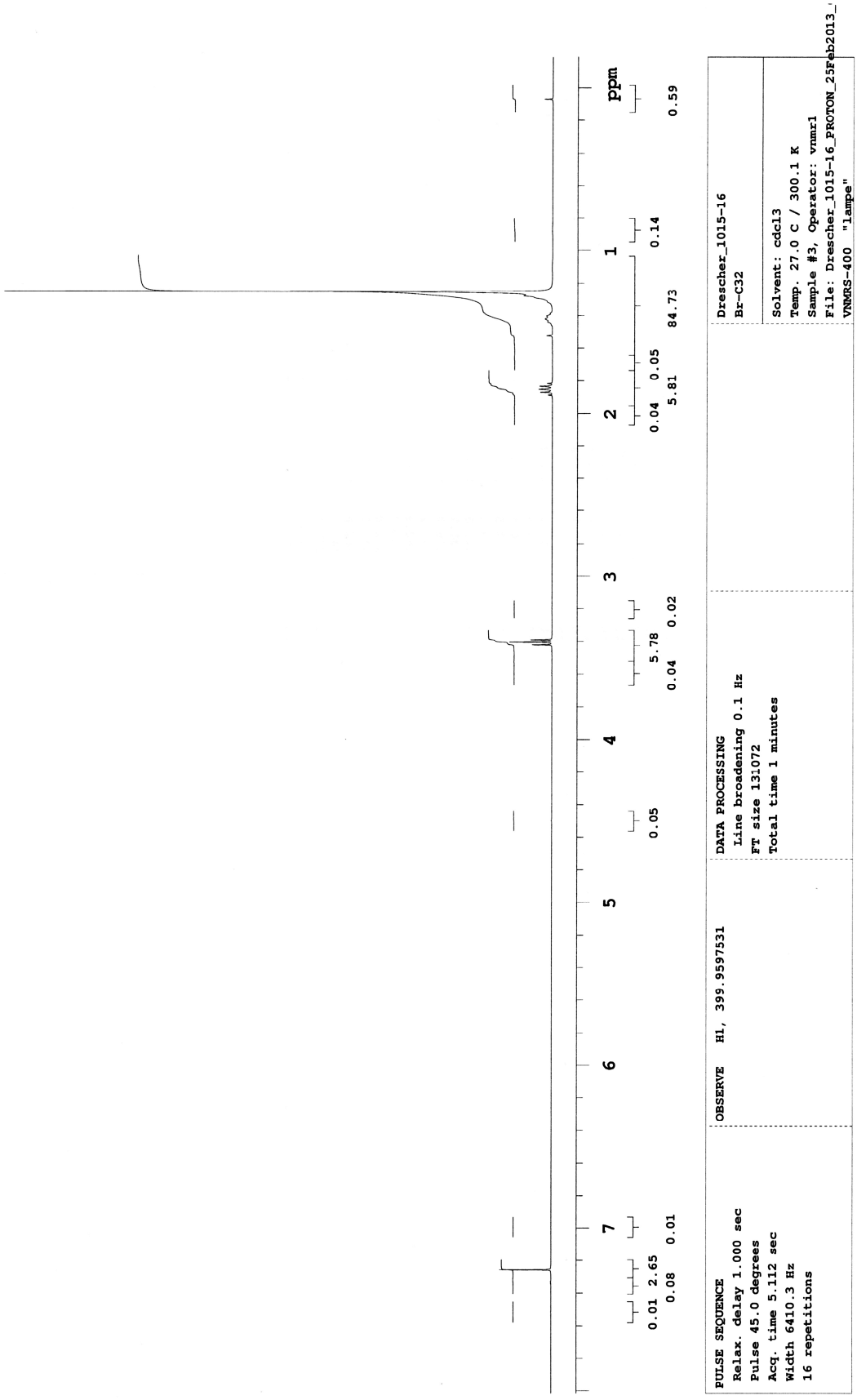
*Compound **20c**: ^{1}H NMR*



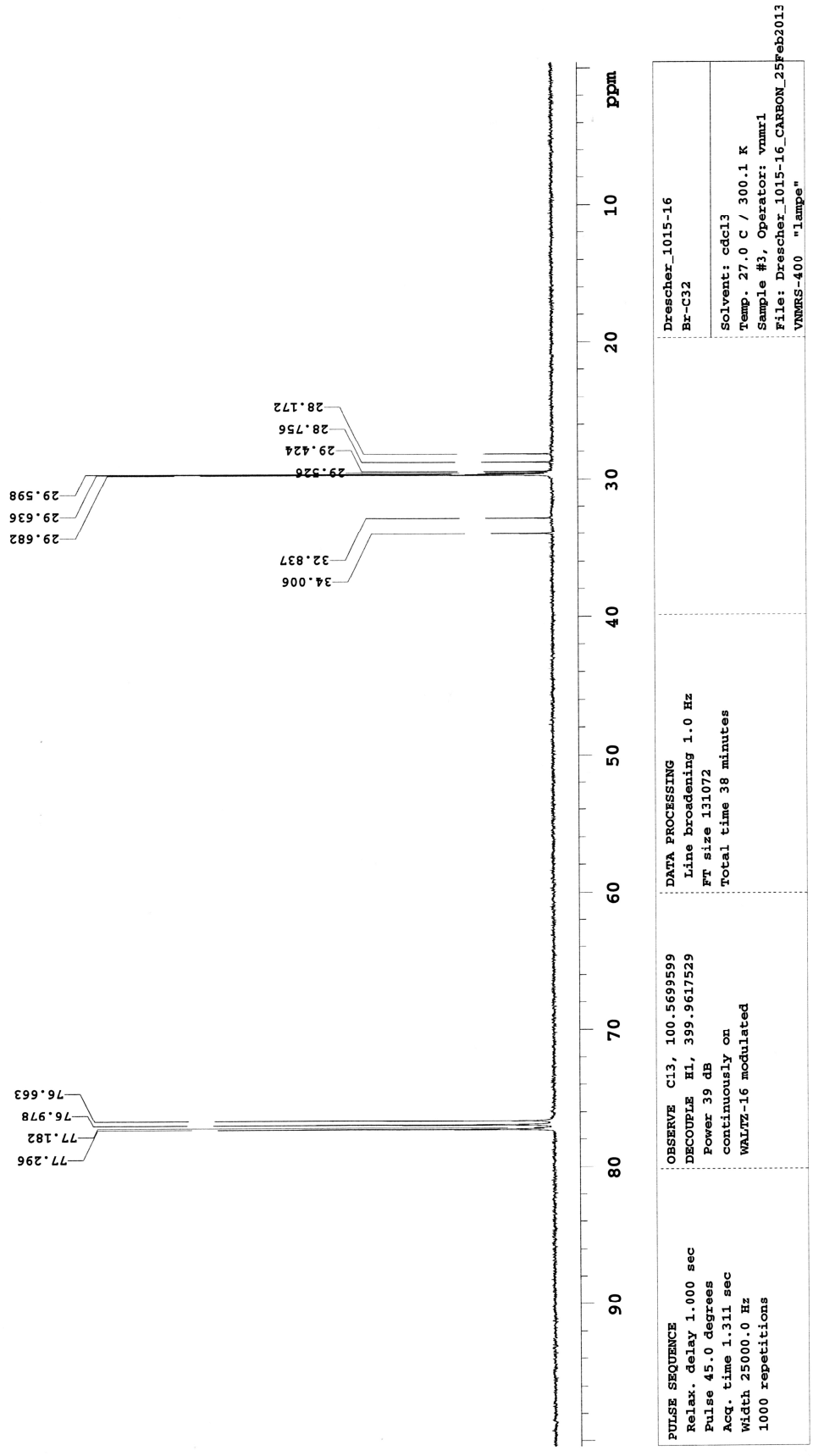
*Compound **20c**: ^{13}C NMR*



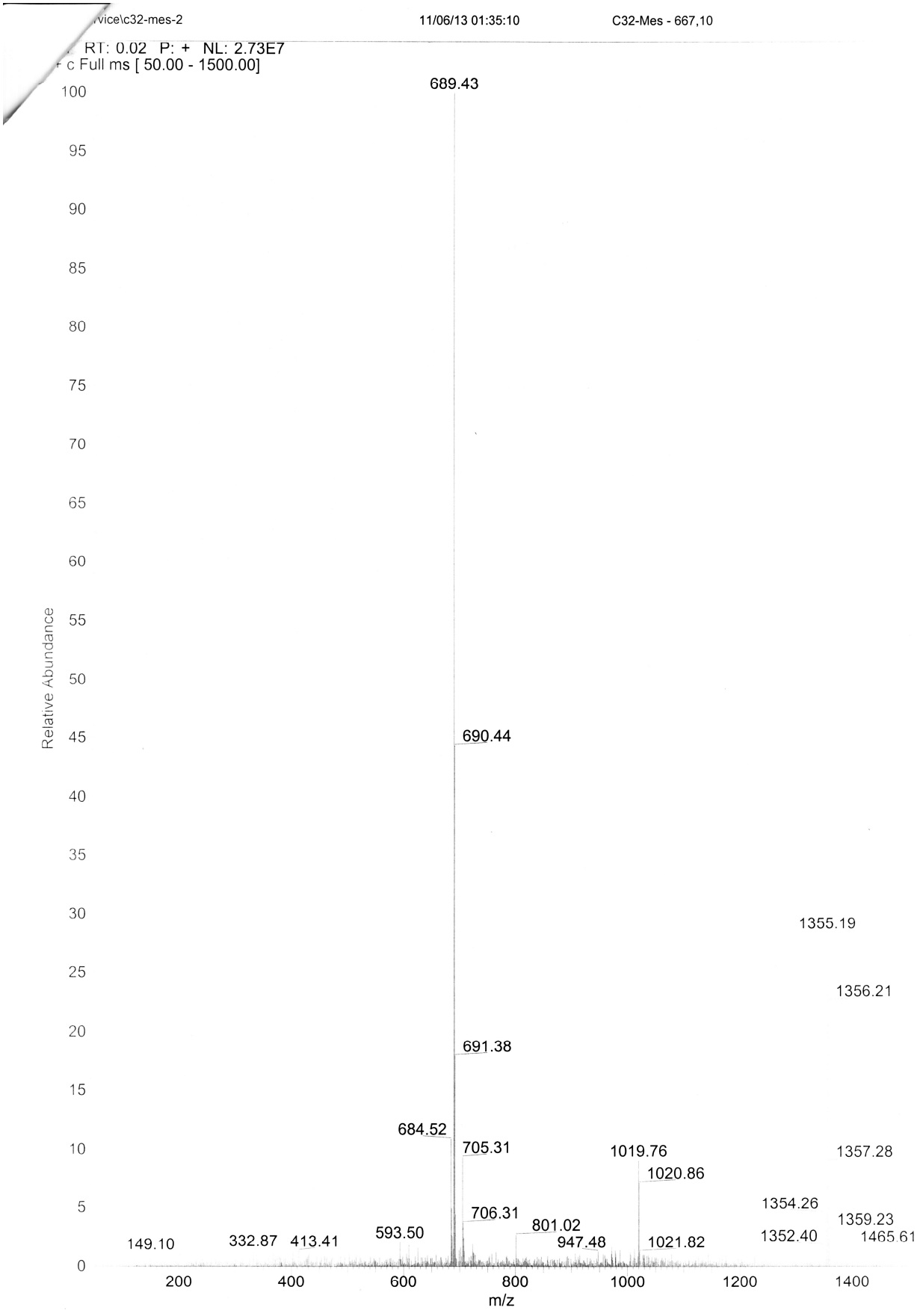
*Compound **22a**: ^{1}H NMR*



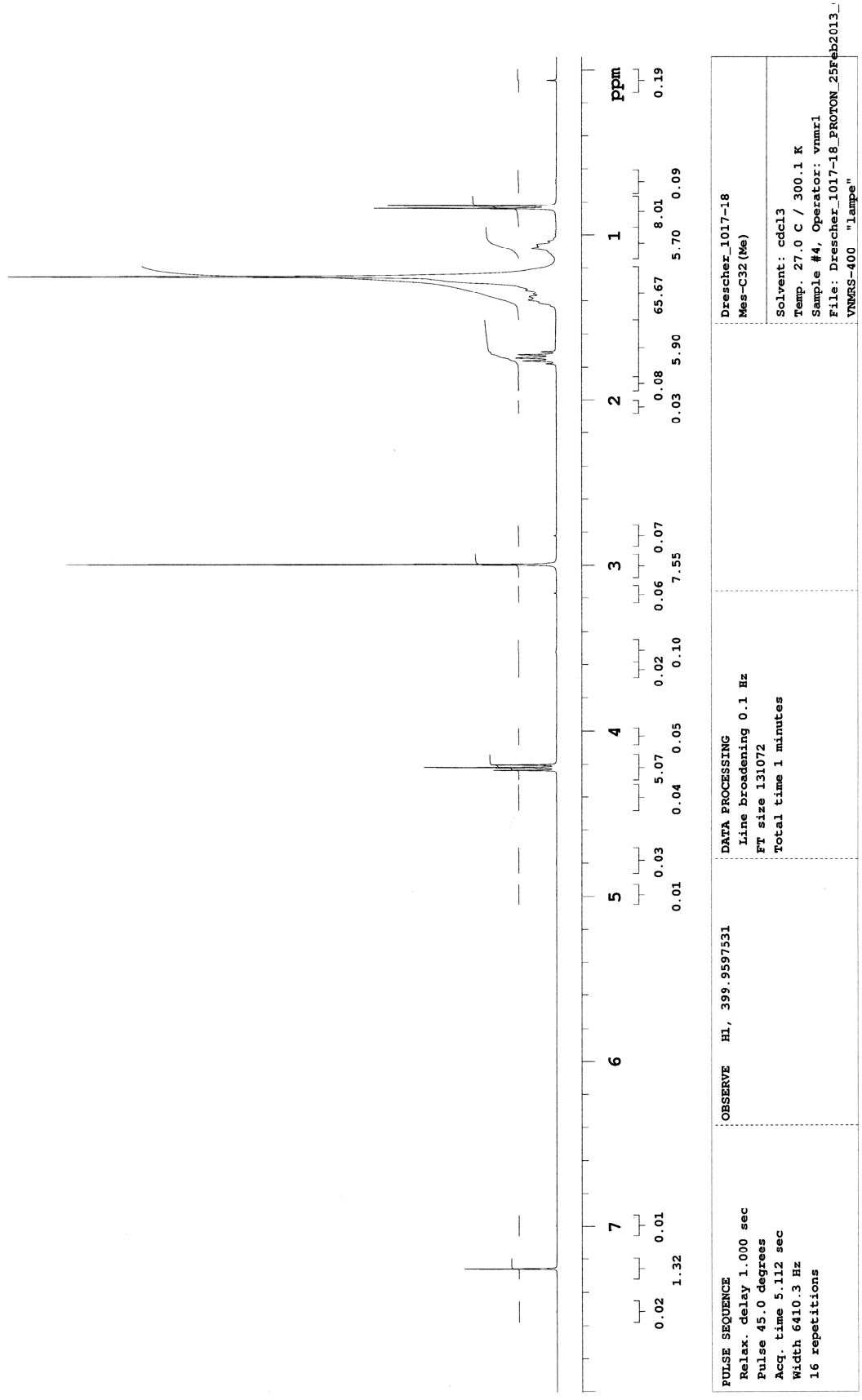
*Compound **22a**: ^{13}C NMR*



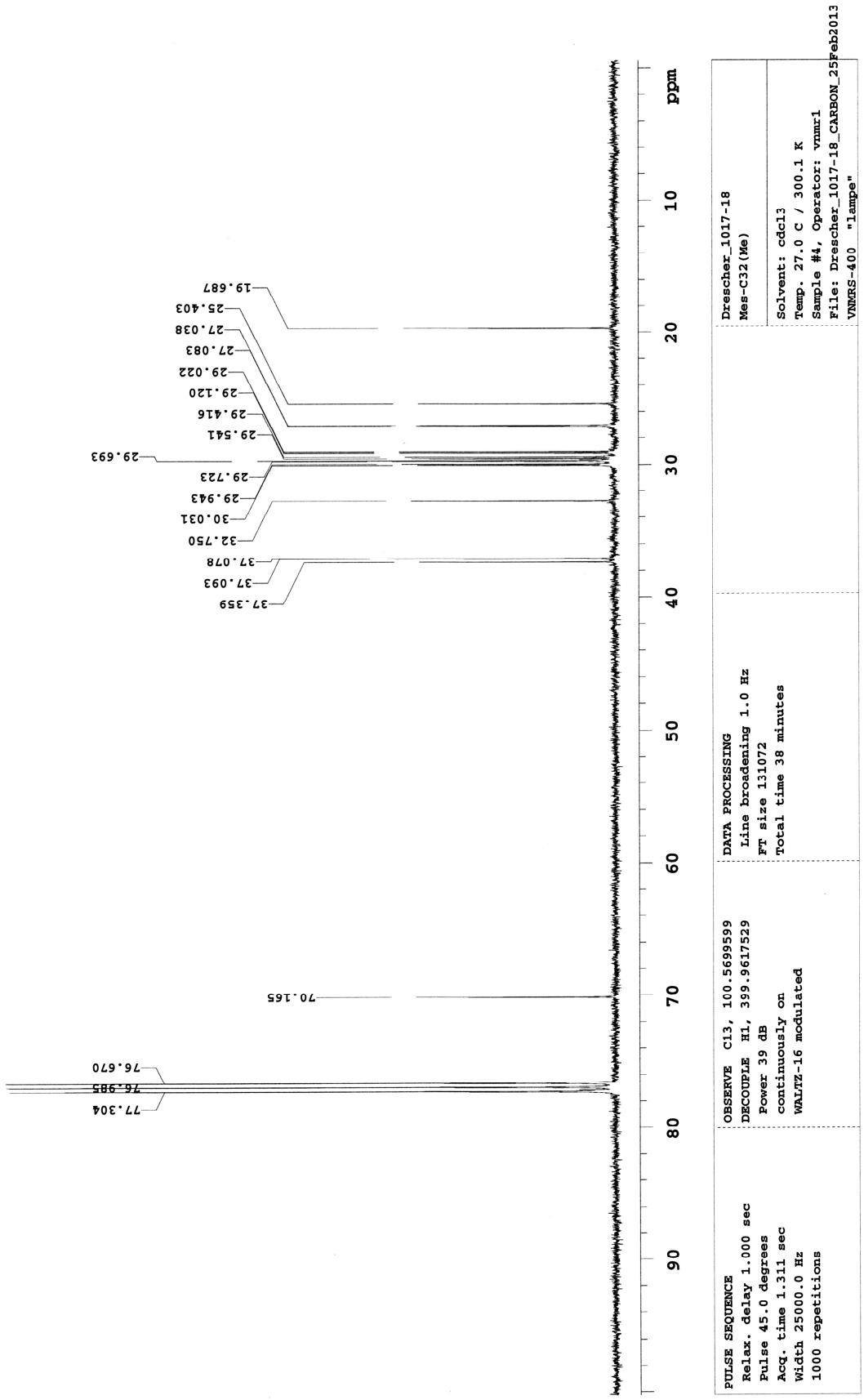
*Compound **22b**: ESI-MS, positive mode*



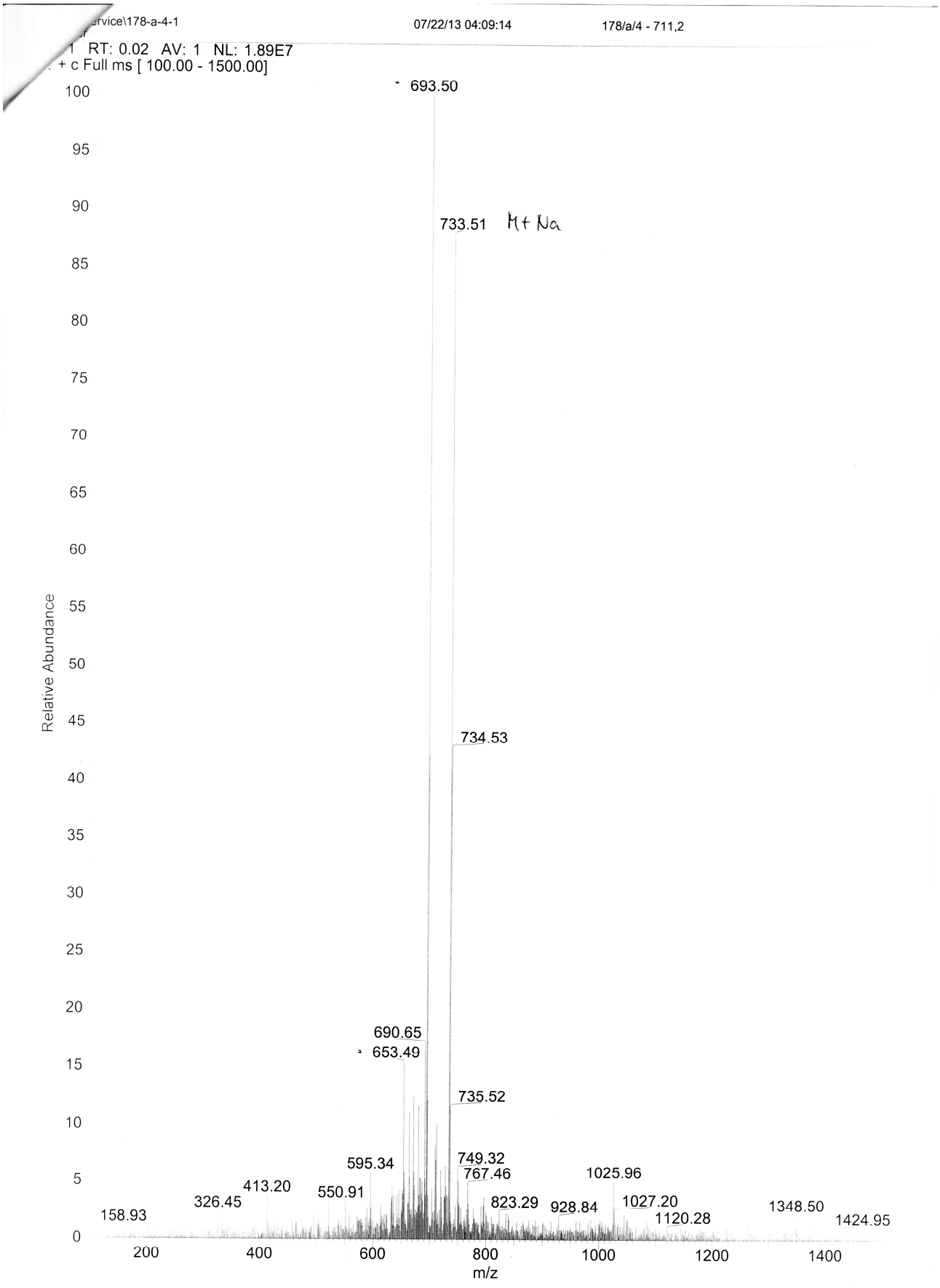
*Compound **22b**: ^{1}H NMR*



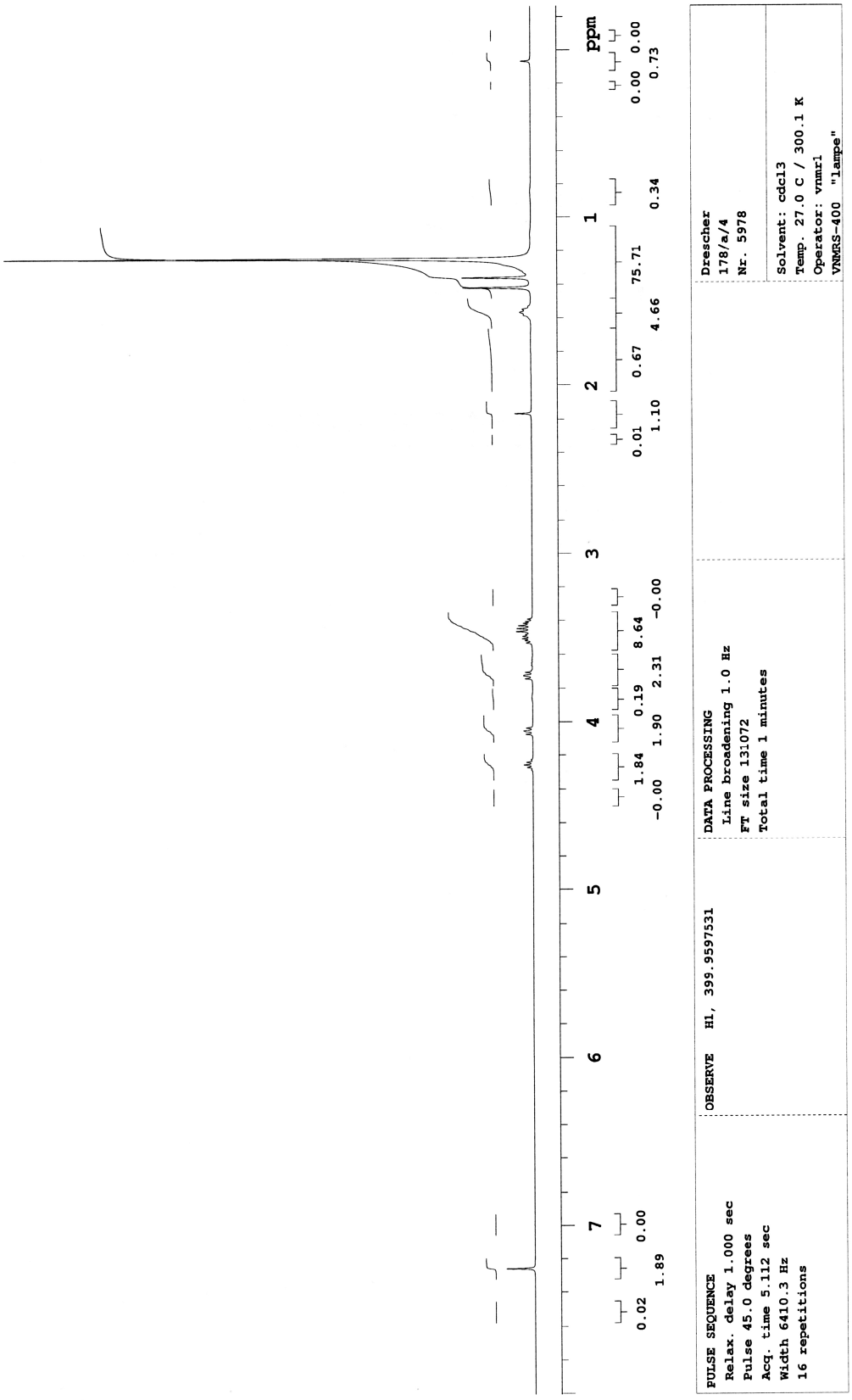
*Compound **22b**: ^{13}C NMR*



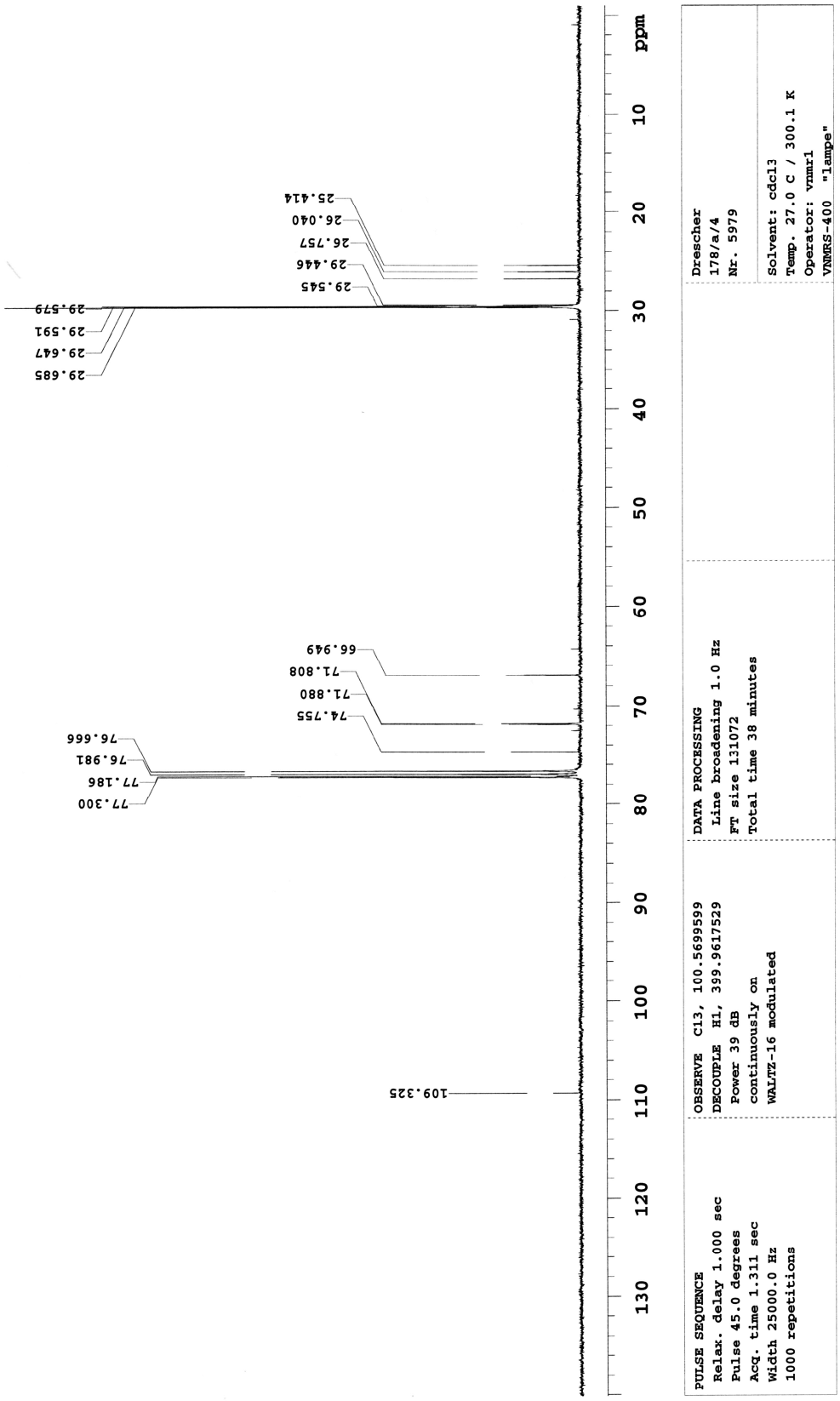
*Compound **23a**: ESI-MS, positive mode*



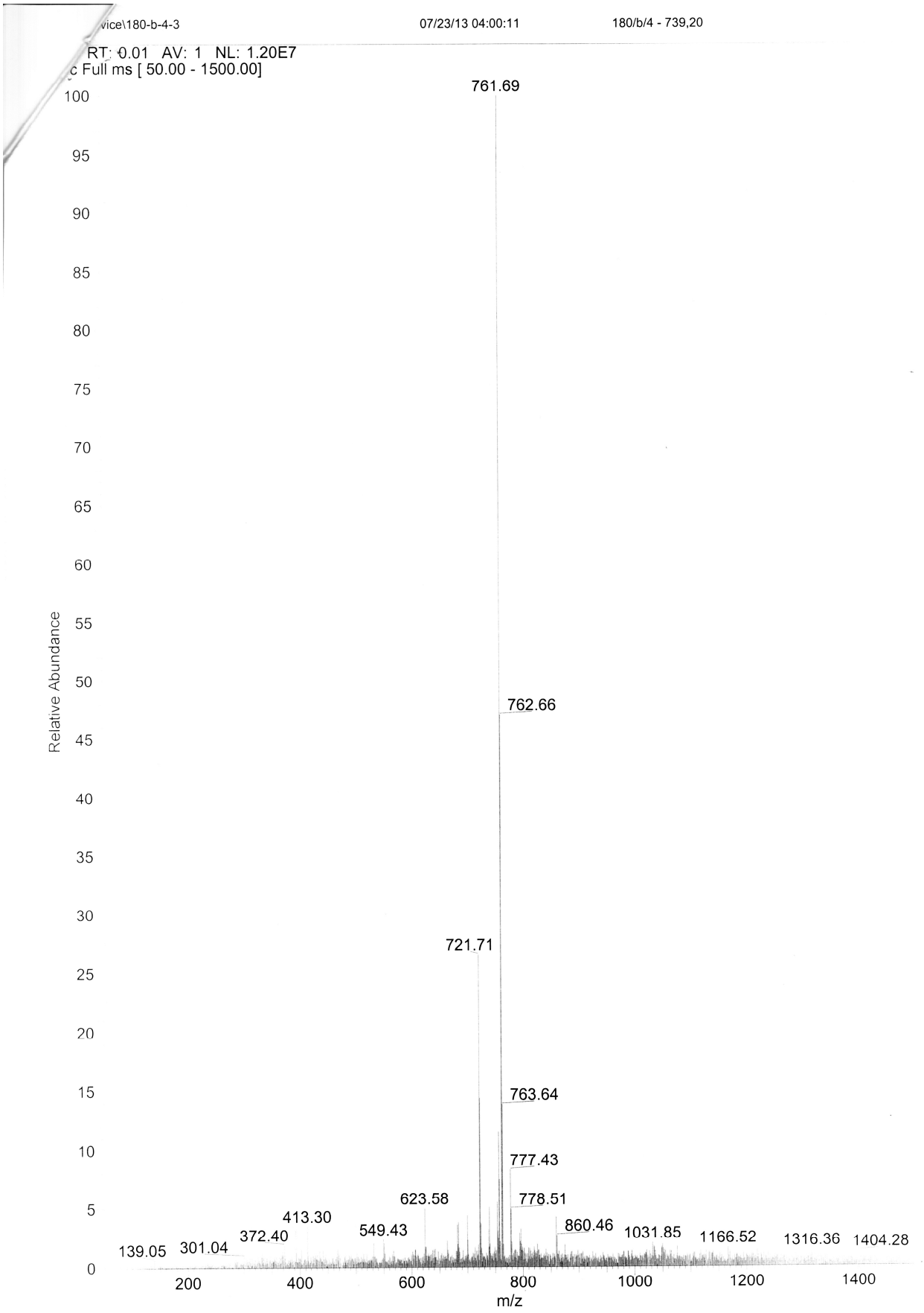
*Compound **23a**: ^{1}H NMR*



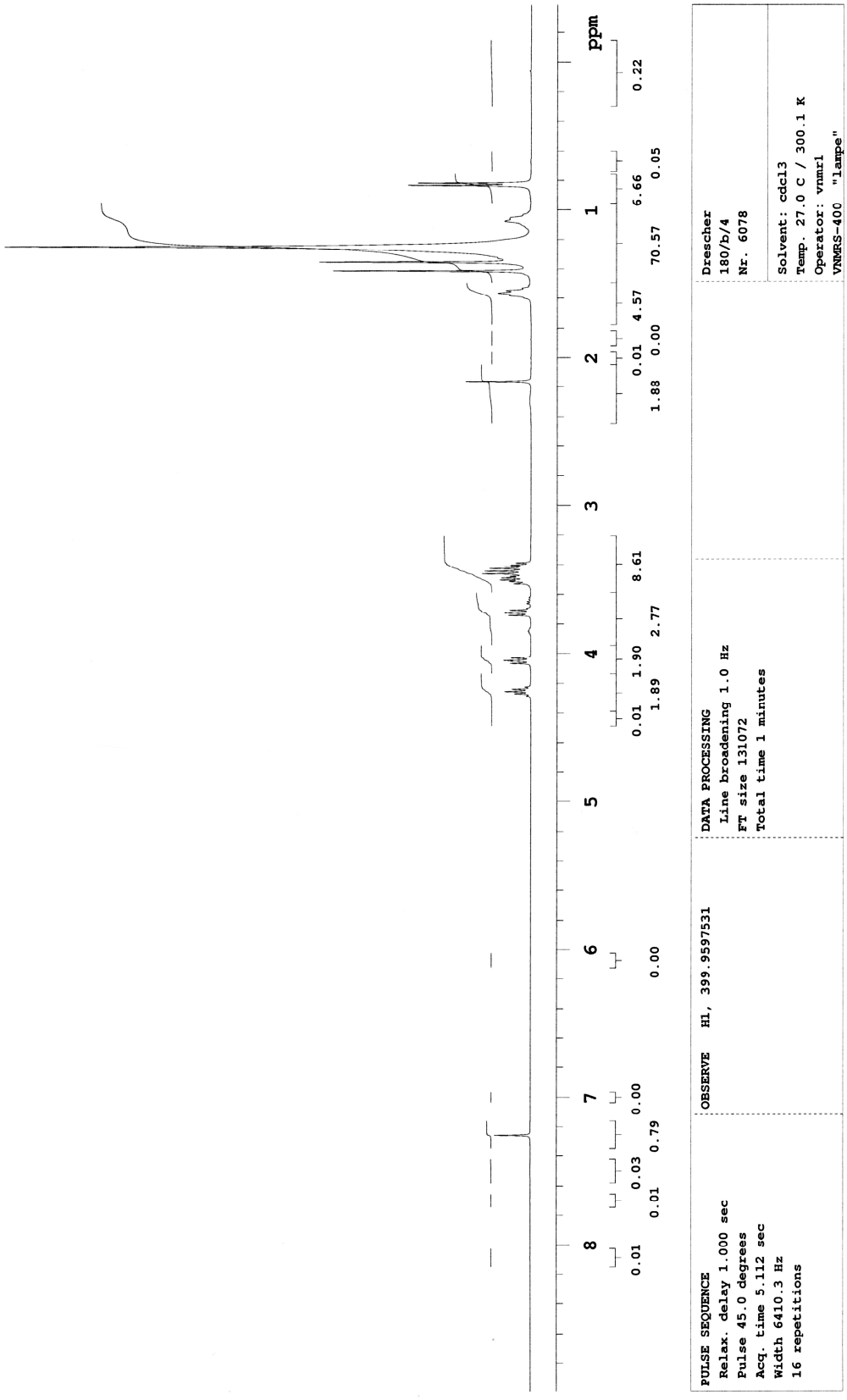
*Compound **23a**: ^{13}C NMR*



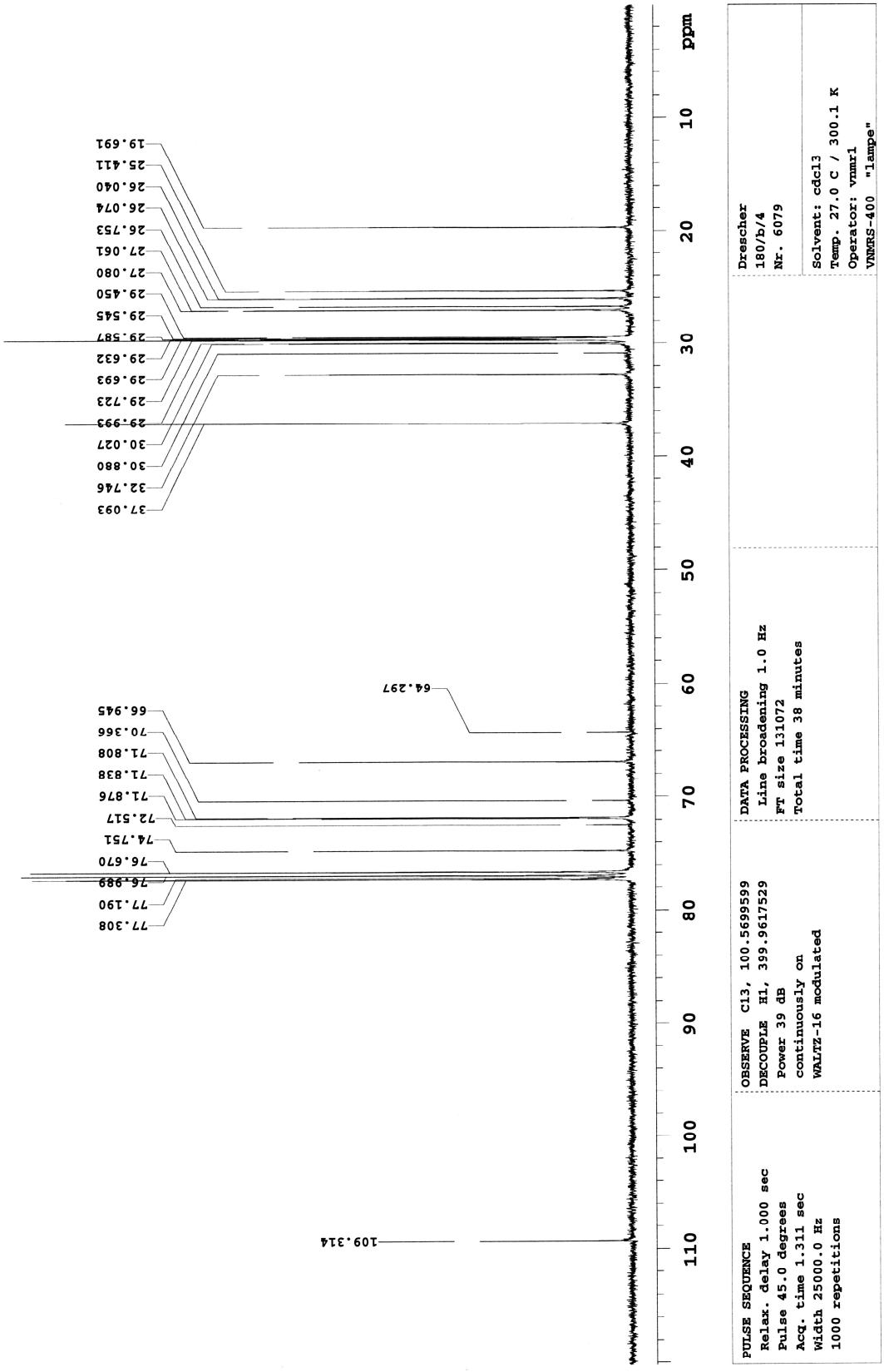
*Compound **23b**: ESI-MS, positive mode*



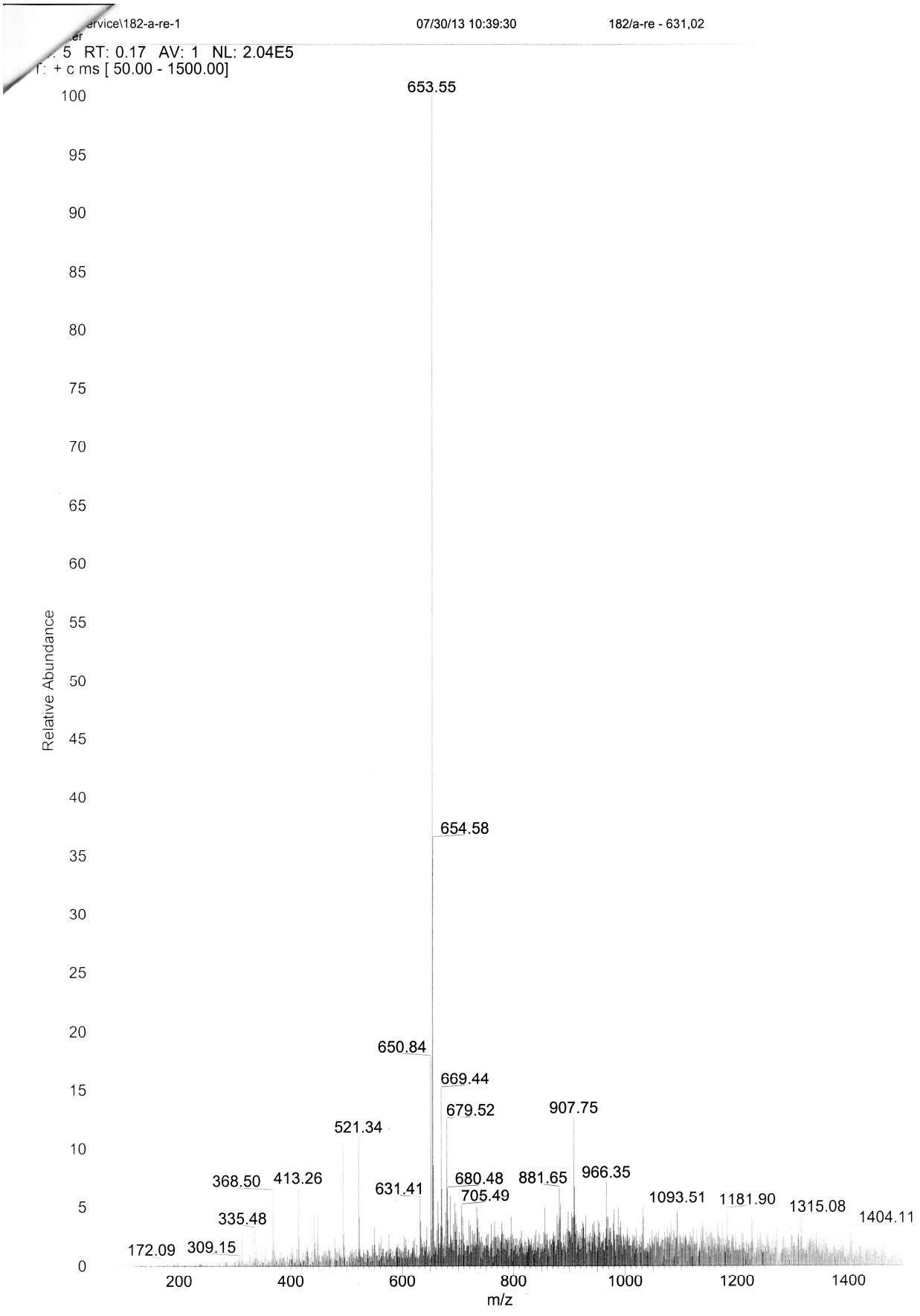
*Compound **23b**: ^{1}H NMR*



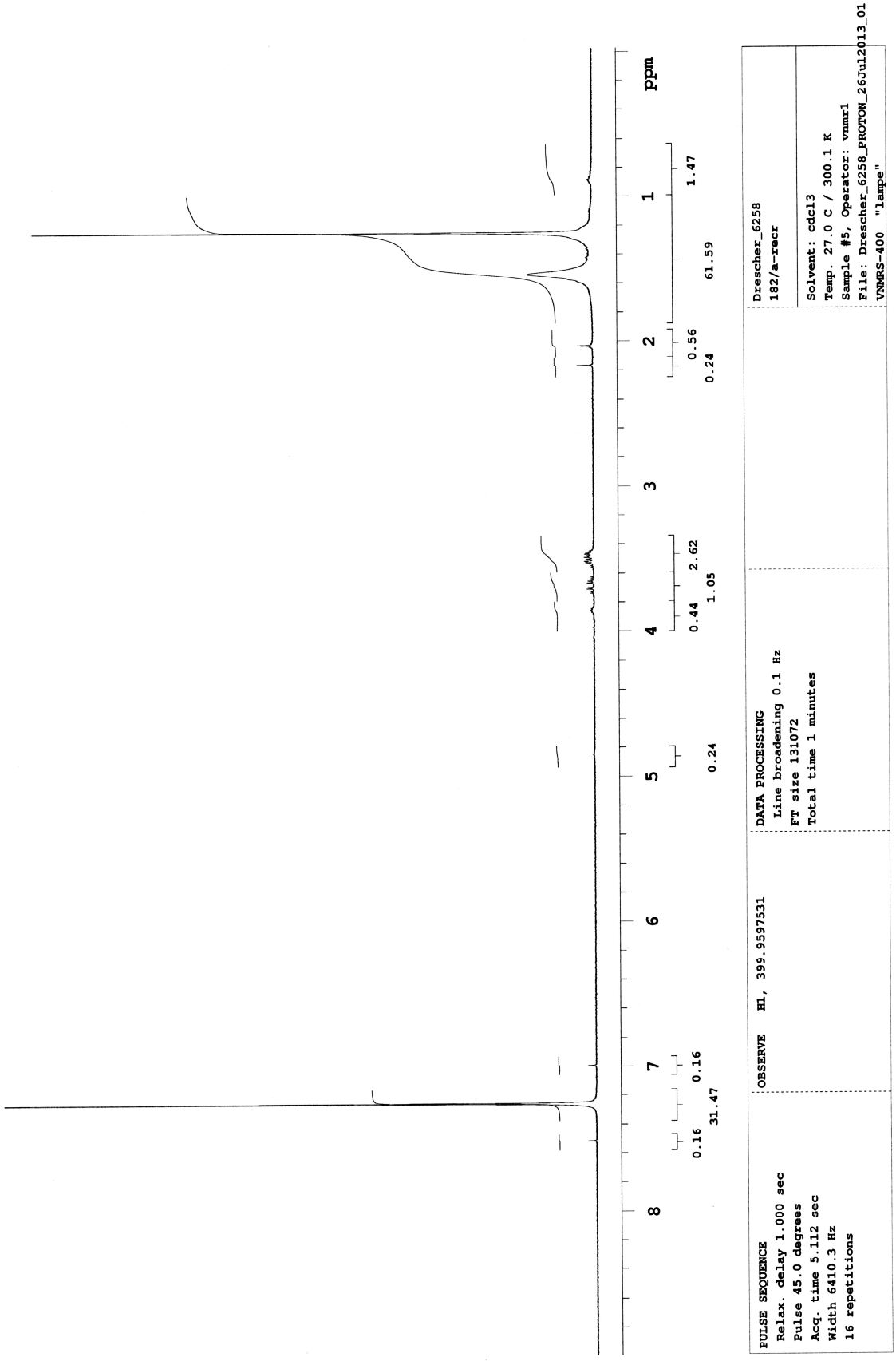
*Compound **23b**: ^{13}C NMR*



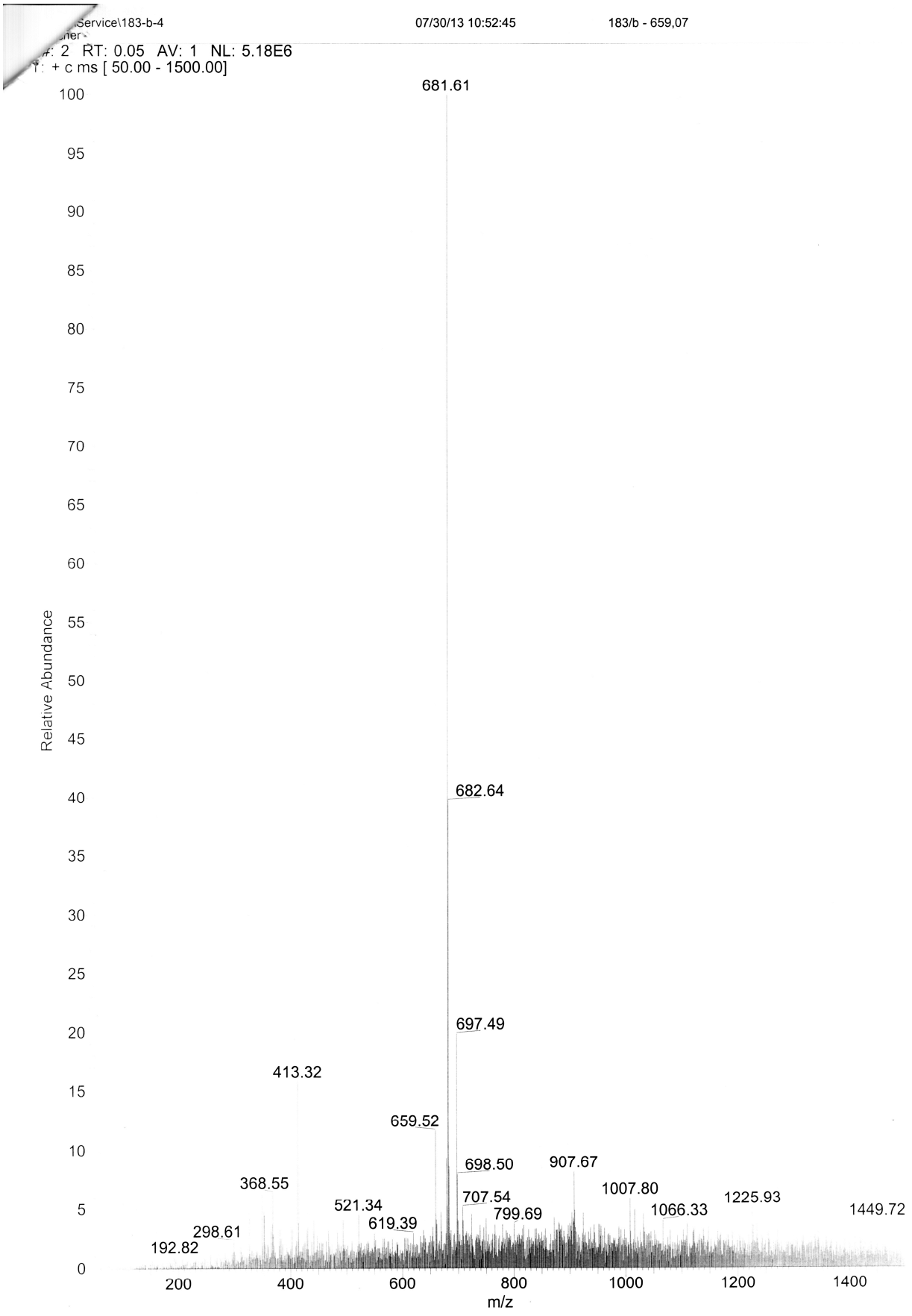
*Compound **24a**: ESI-MS, positive mode*



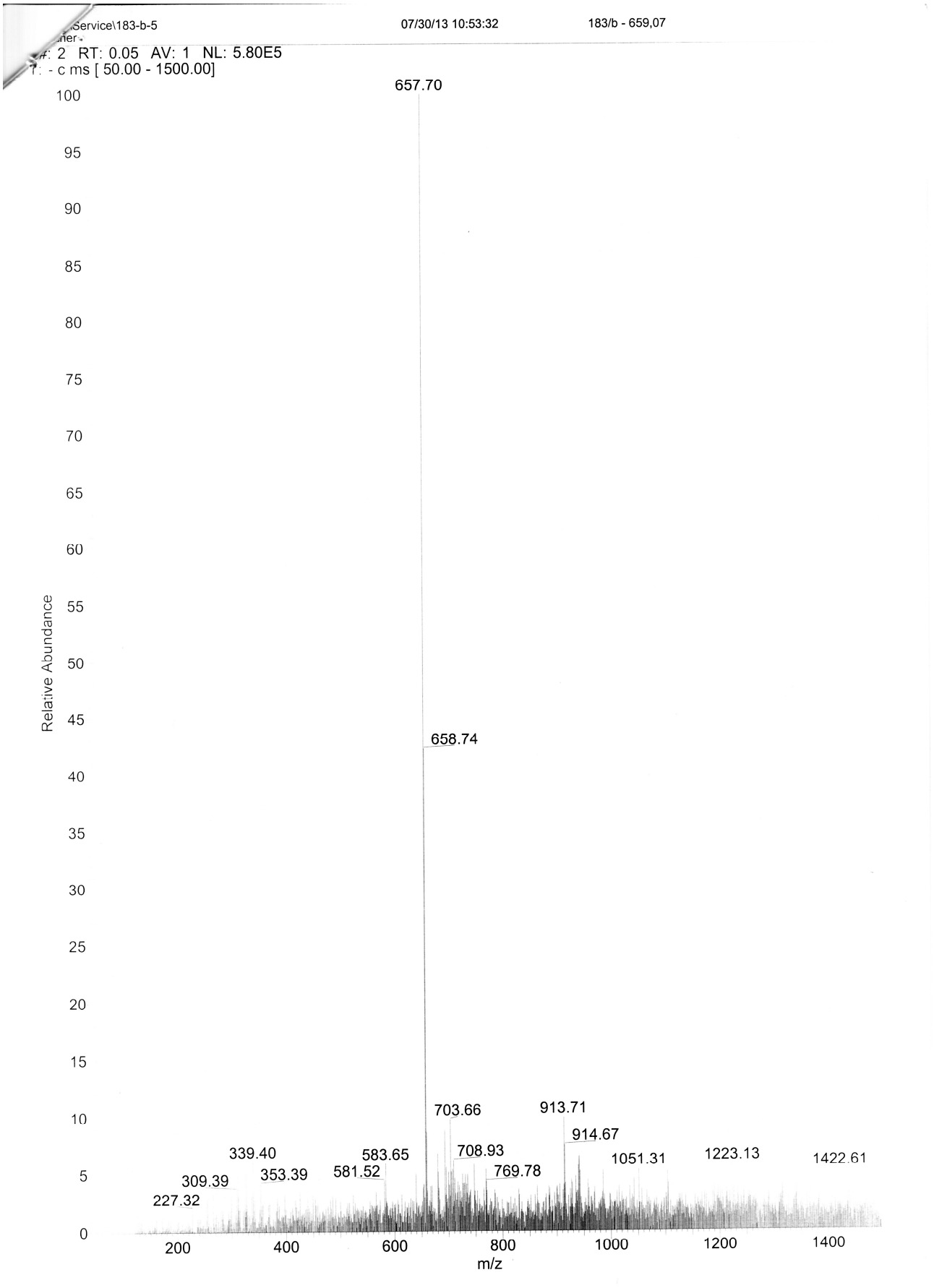
*Compound **24a**: ^{1}H NMR*



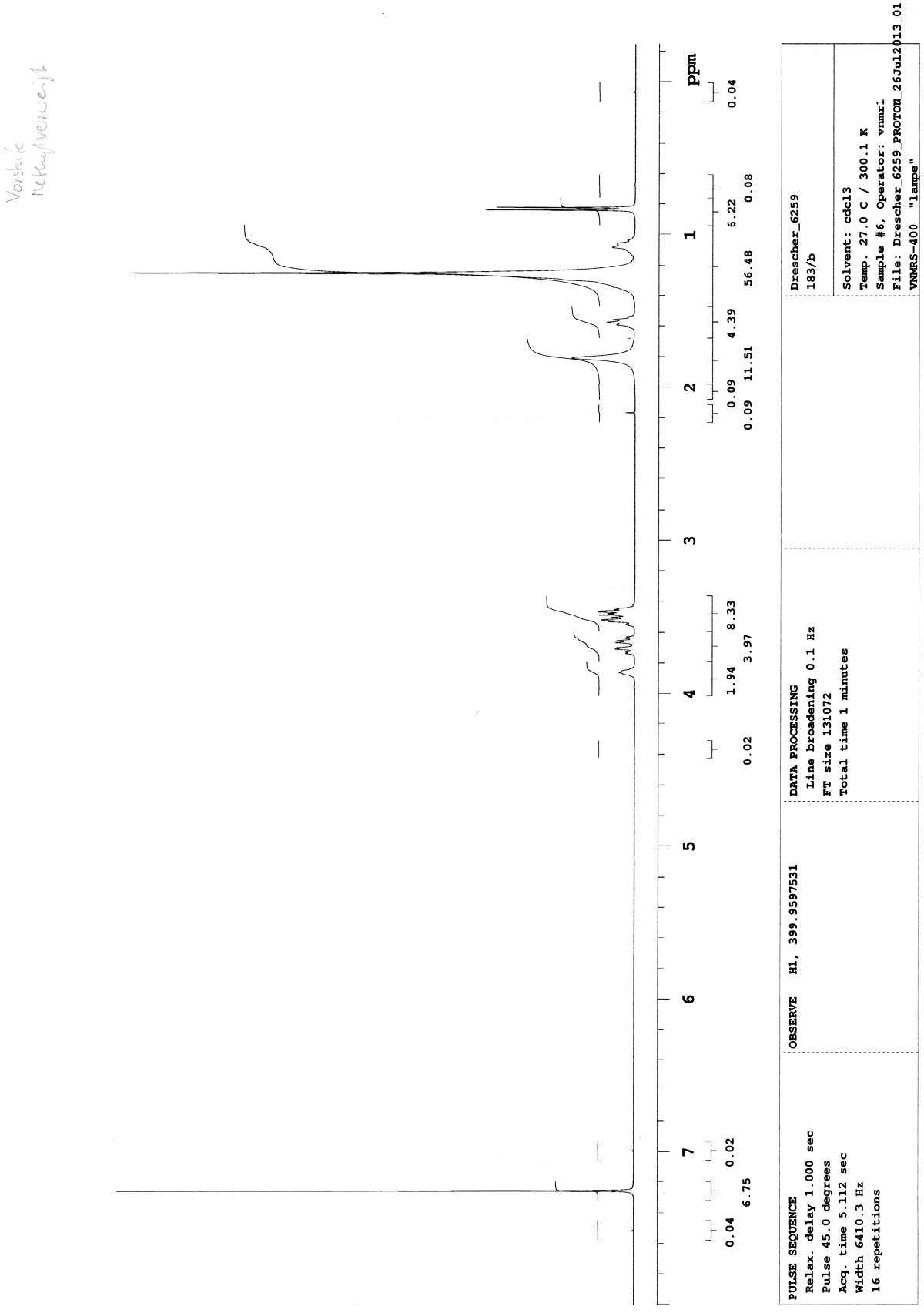
*Compound **24b**: ESI-MS, positive mode*



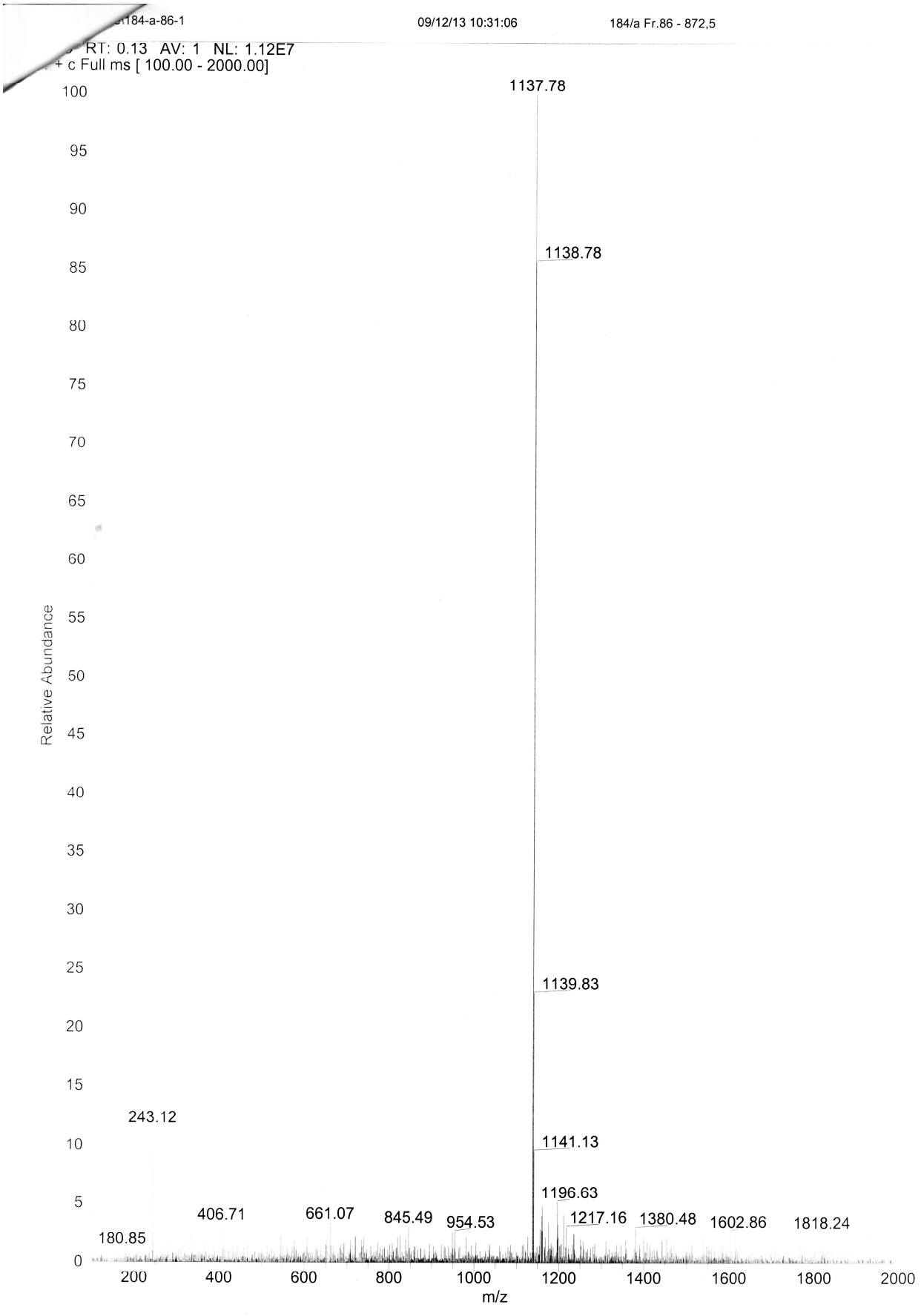
*Compound **24b**: ESI-MS, negative mode*



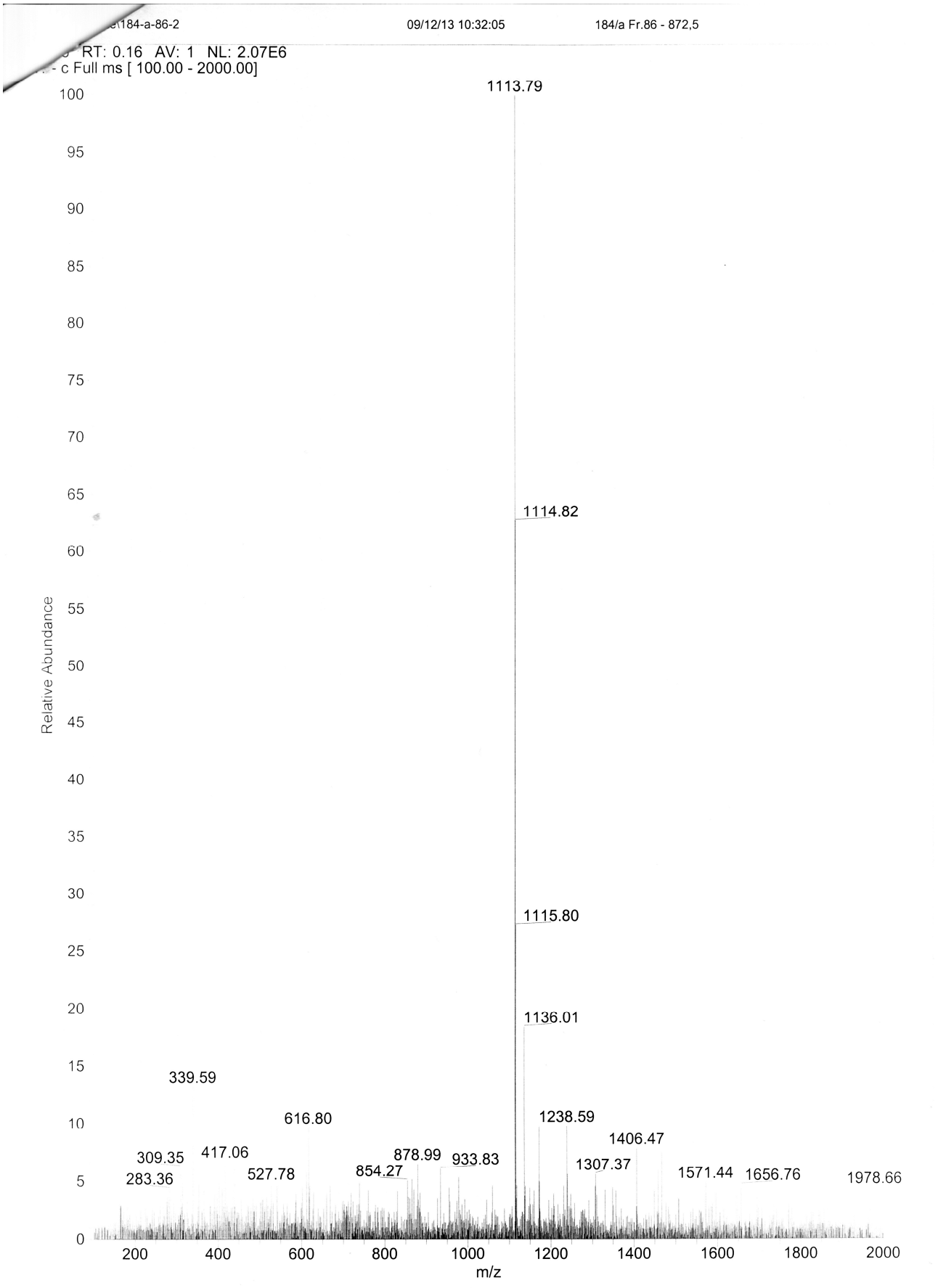
*Compound **24b**: ^{1}H NMR*



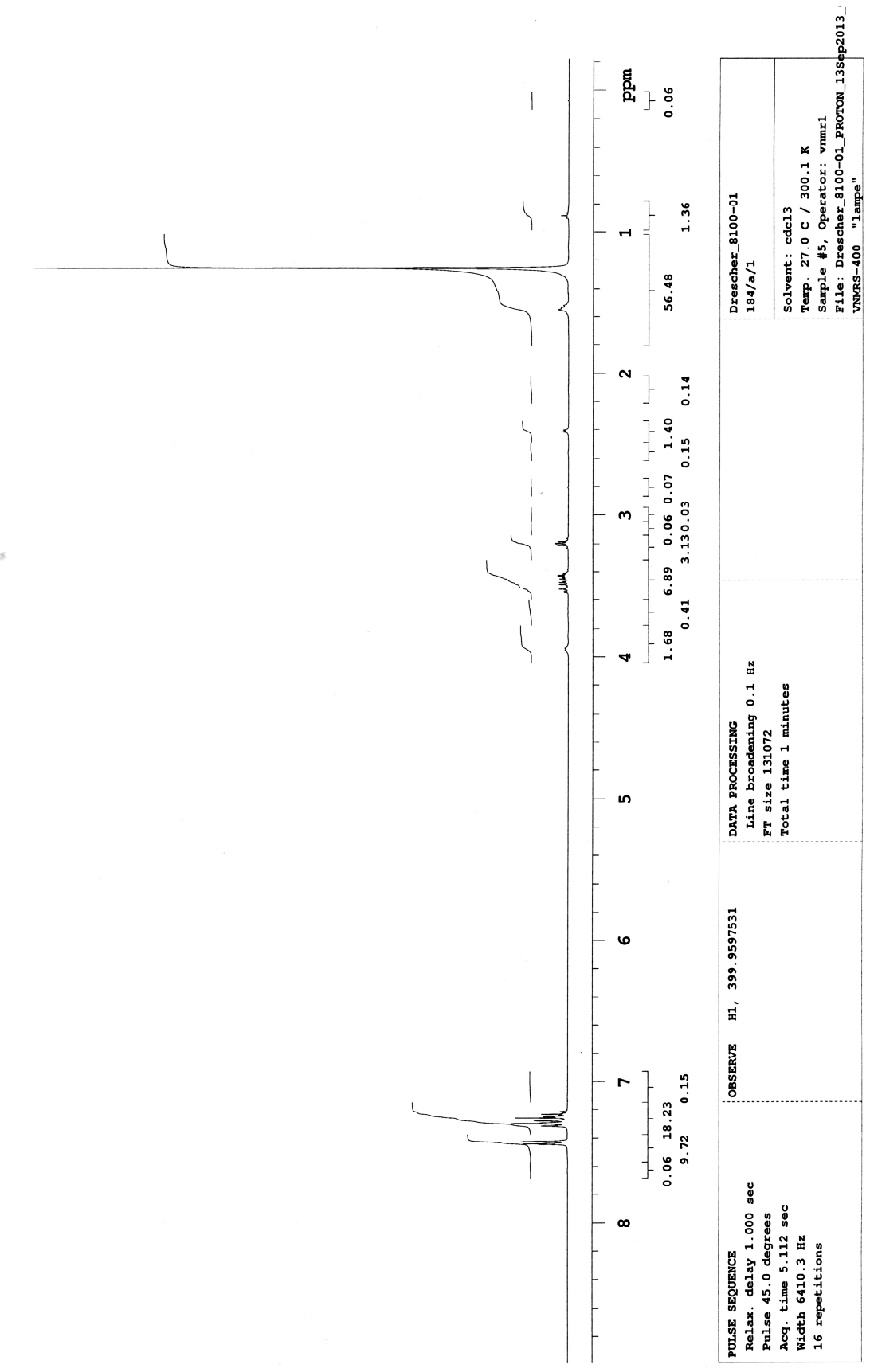
*Compound **25a**: ESI-MS, positive mode*



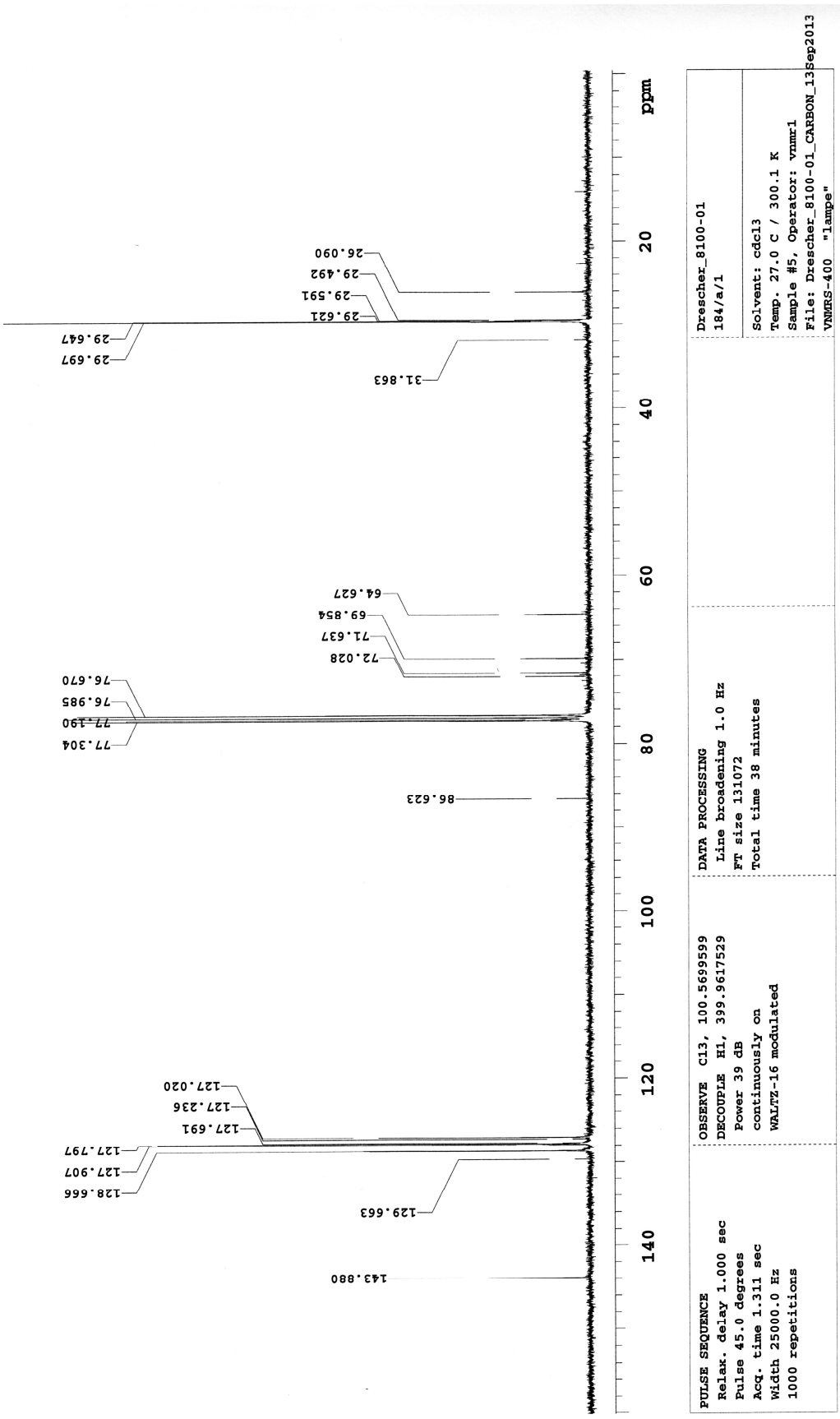
*Compound **25a**: ESI-MS, negative mode*



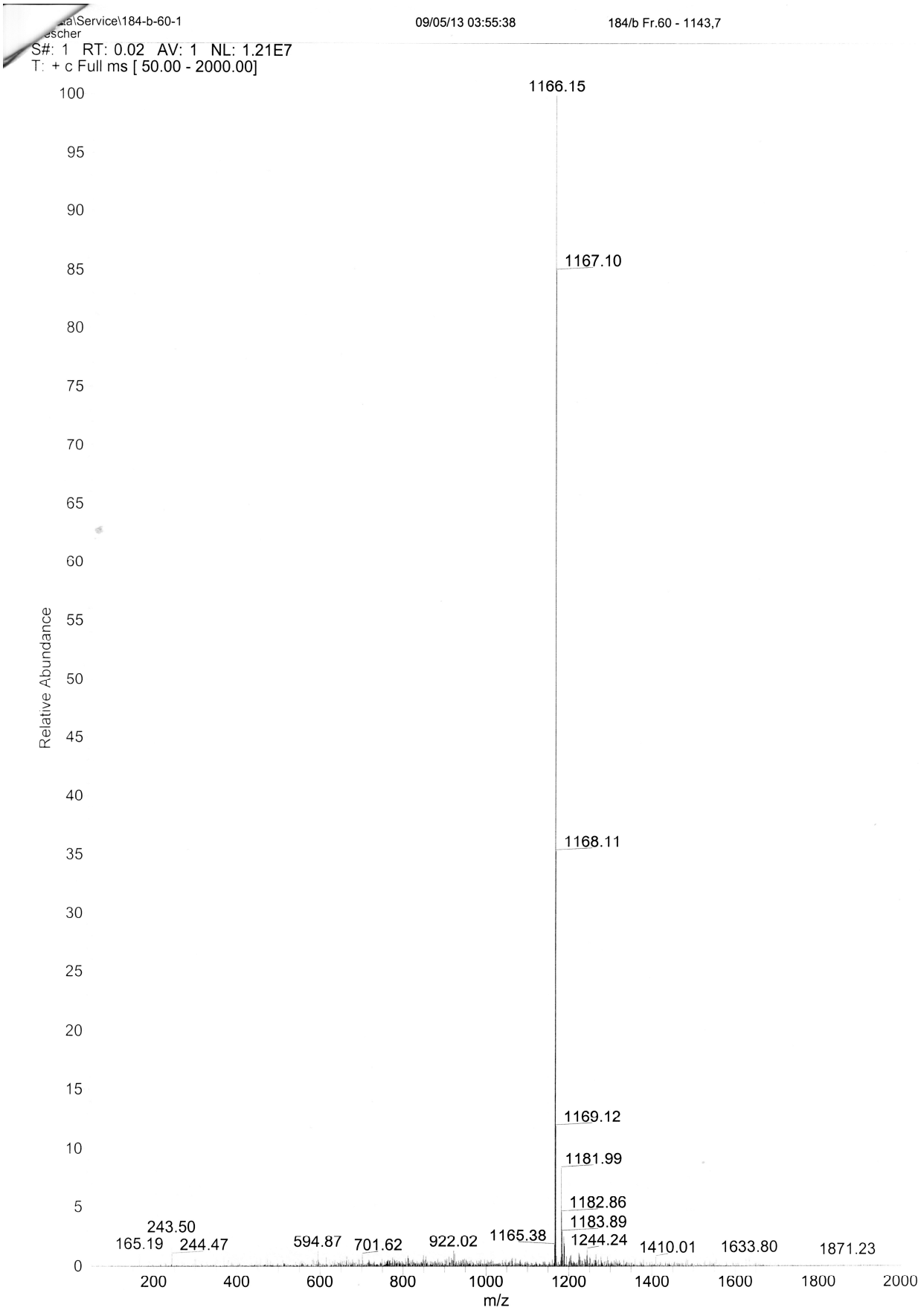
*Compound **25a**: ^{1}H NMR*



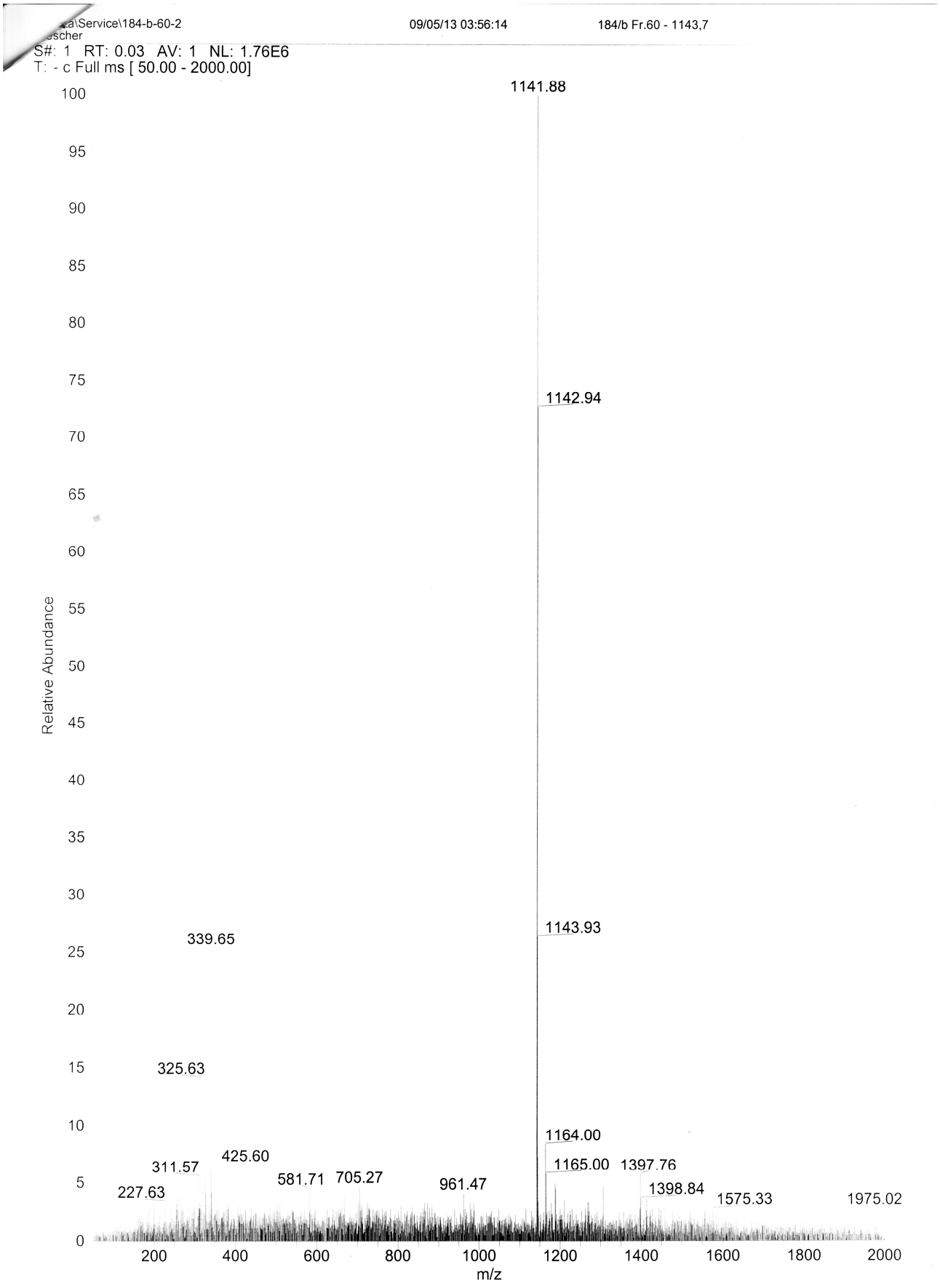
*Compound **25a**: ^{13}C NMR*



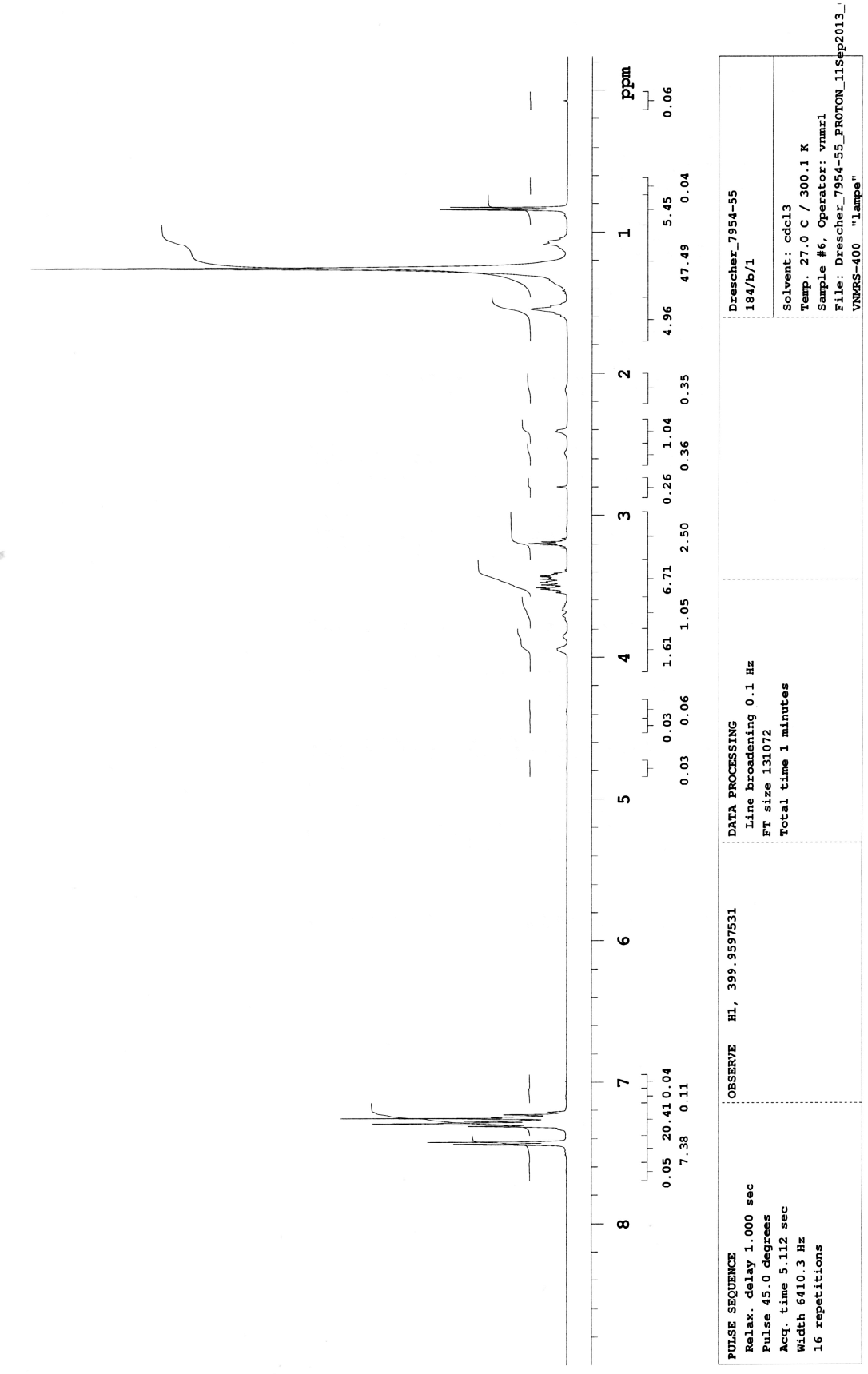
*Compound **25b**: ESI-MS, positive mode*



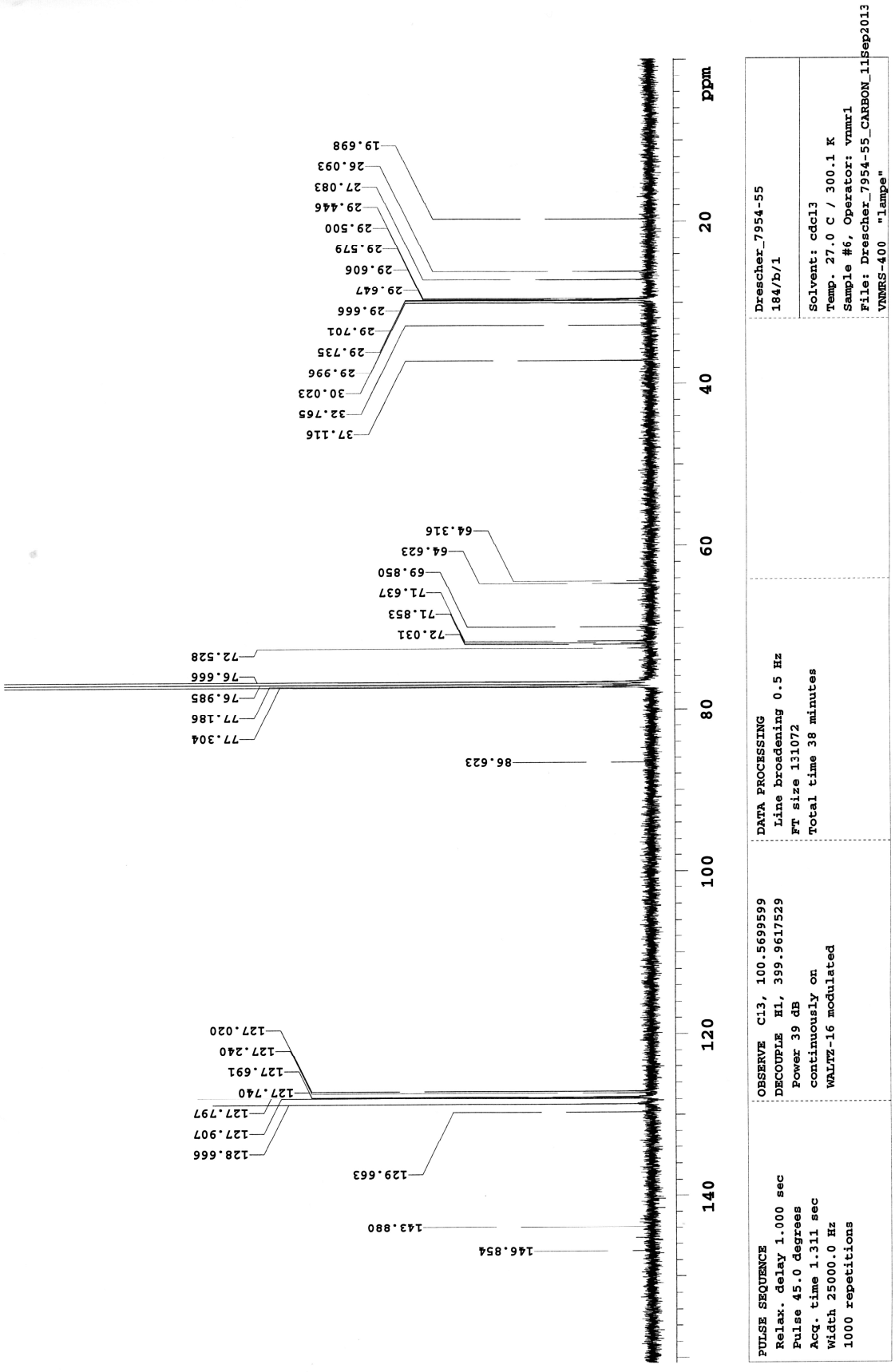
*Compound **25b**: ESI-MS, negative mode*



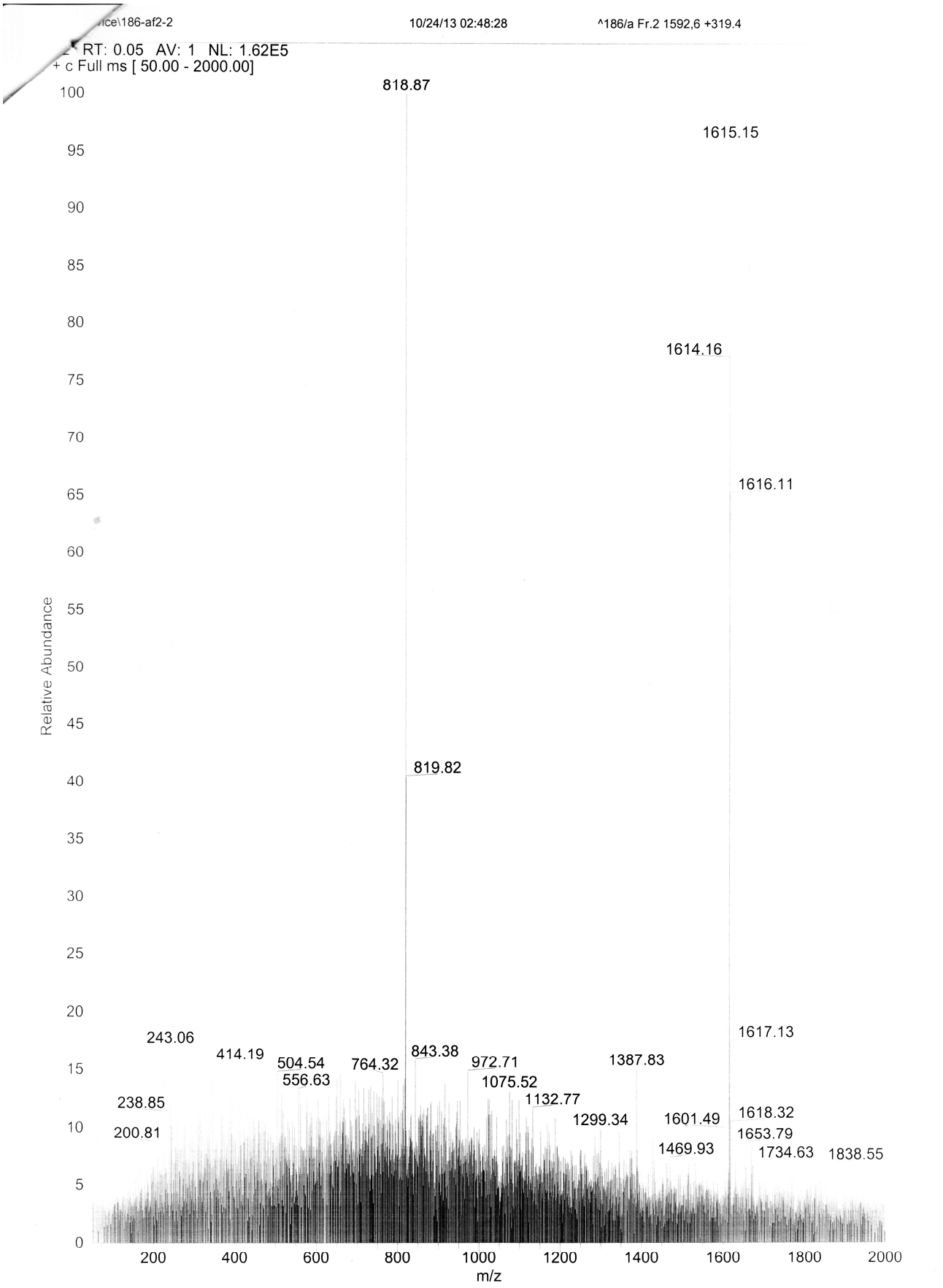
*Compound **25b**: ^{1}H NMR*



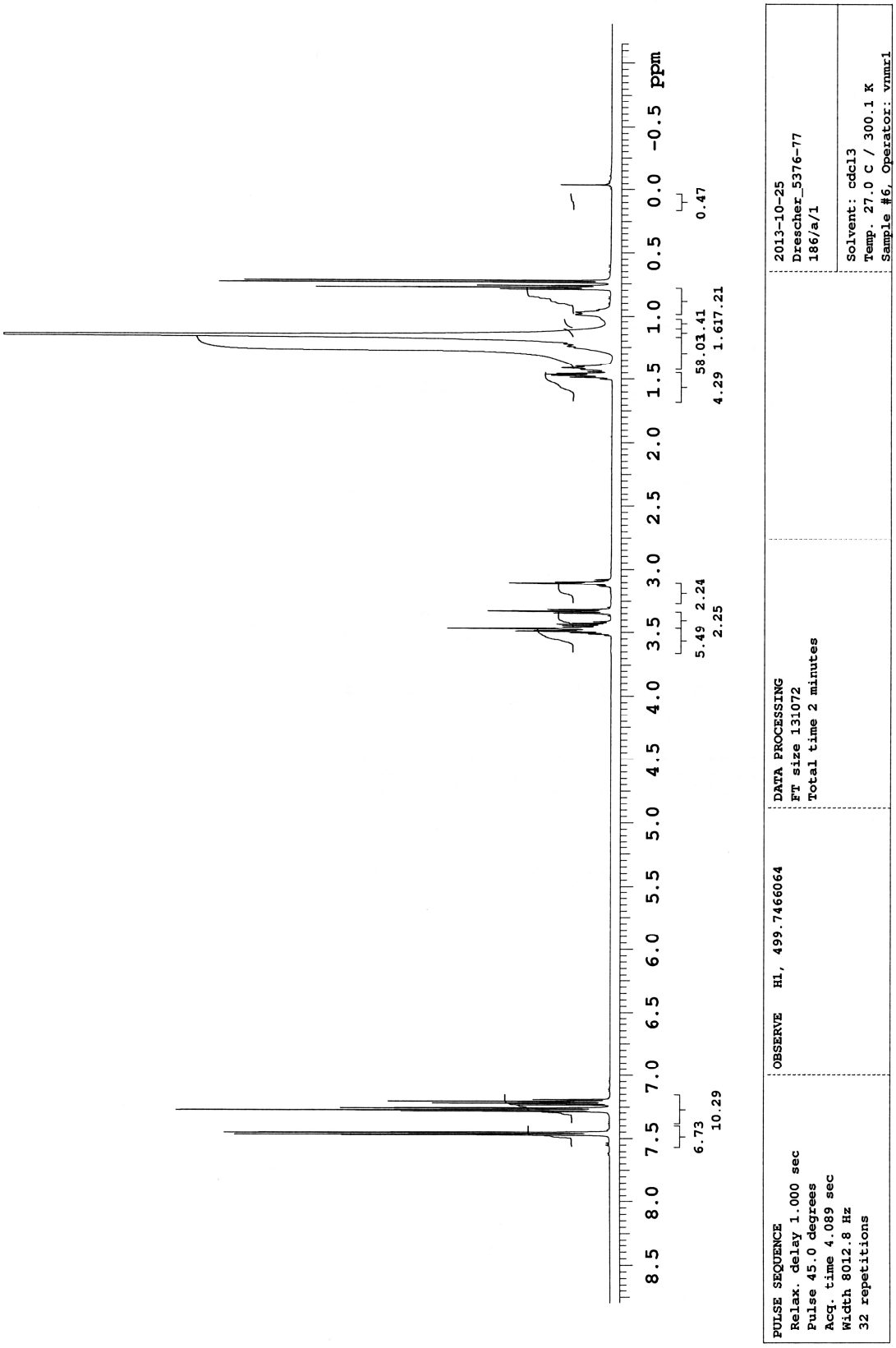
*Compound **25b**: ^{13}C NMR*



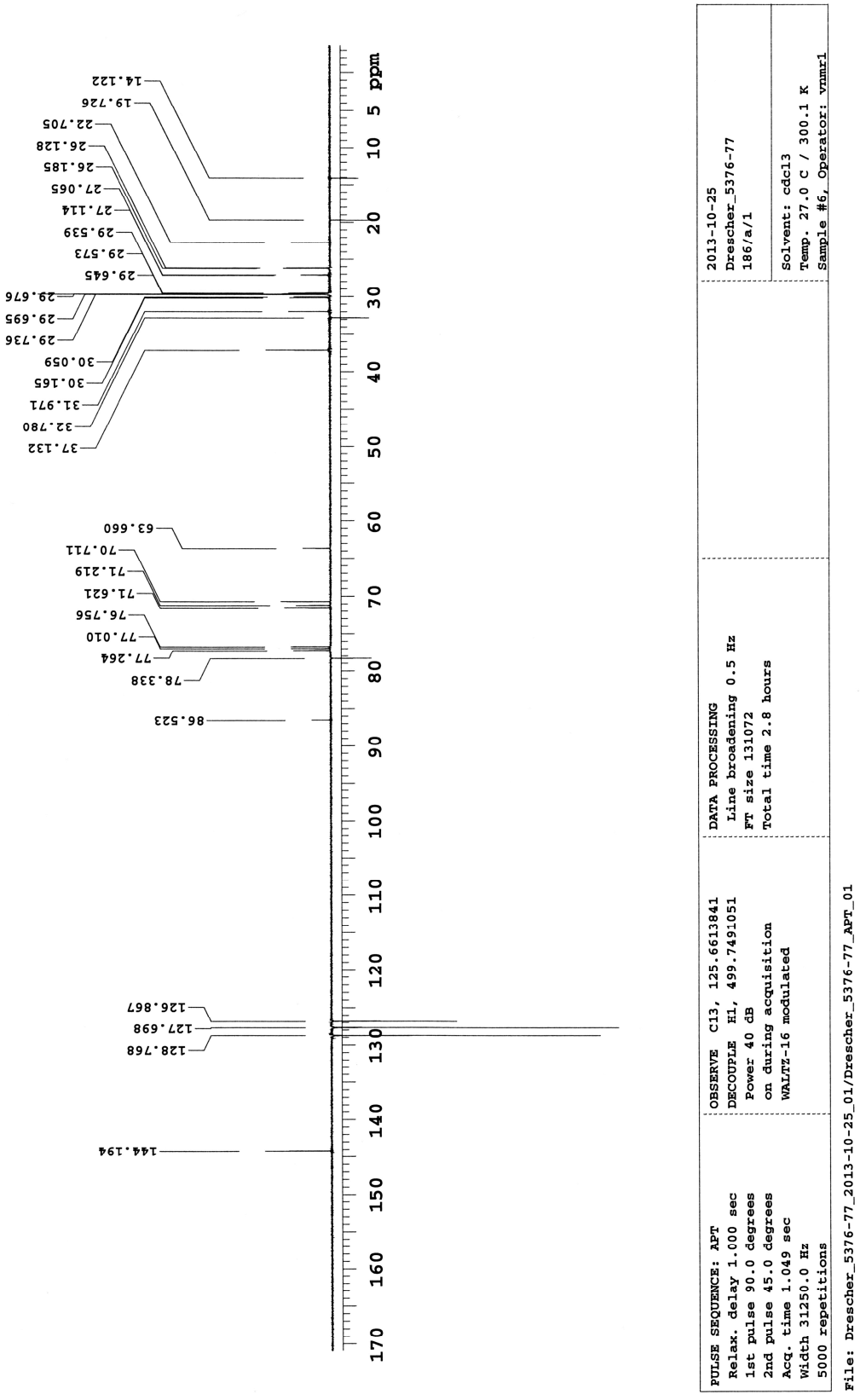
*Compound **26a**: ESI-MS, positive mode*



*Compound **26a**: ^{1}H NMR*

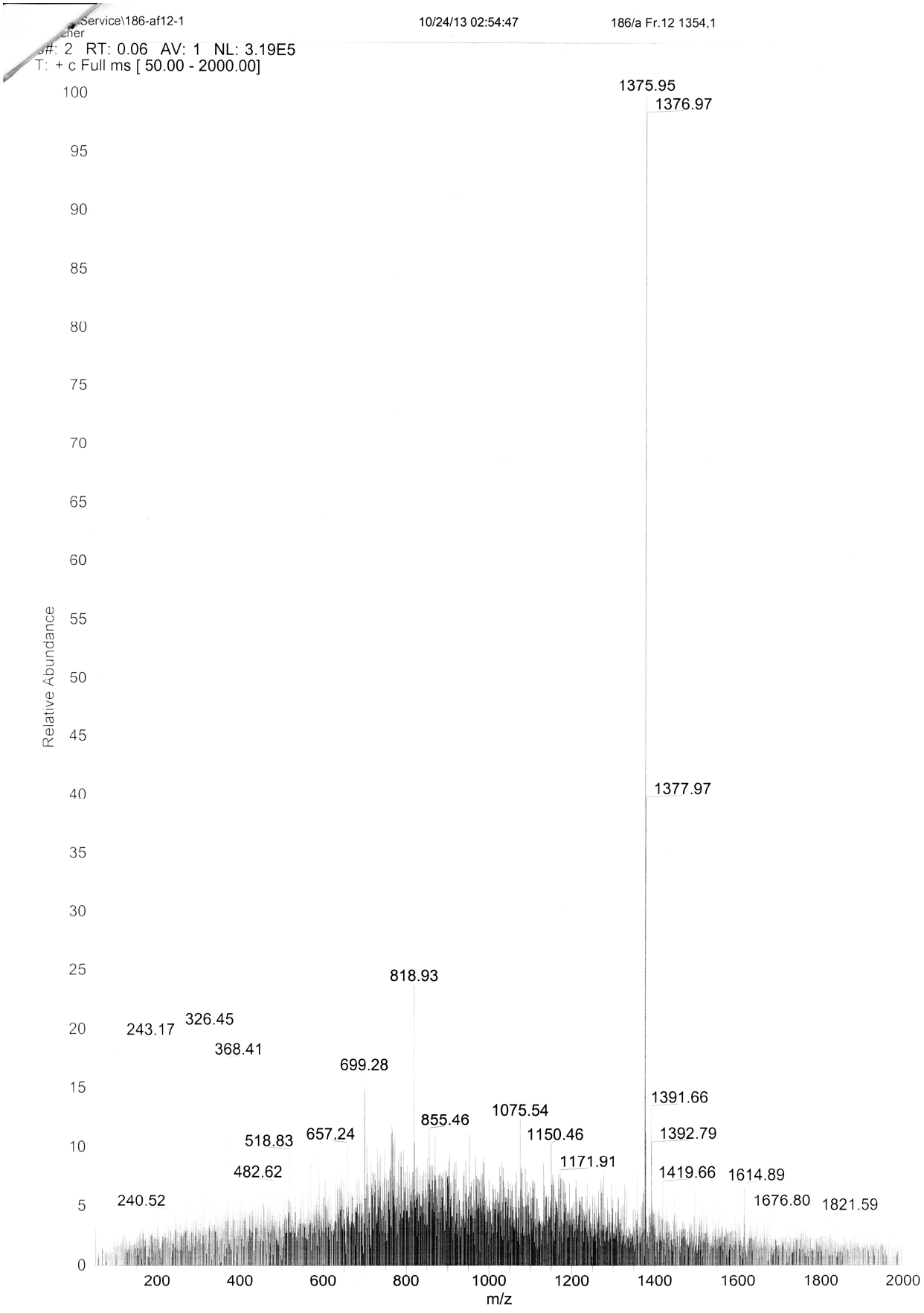


*Compound **26a**: ^{13}C NMR, APT mode*

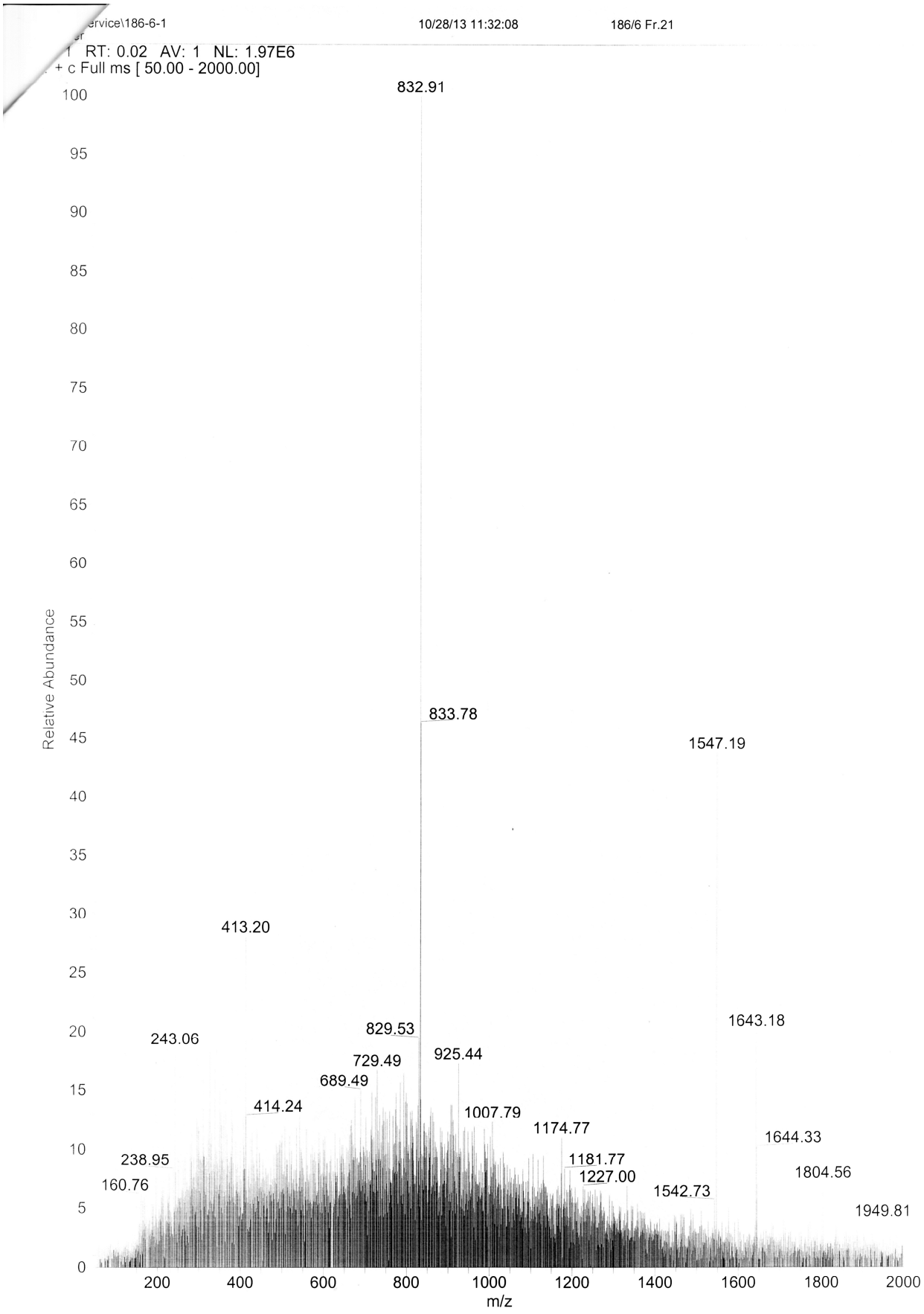


*Compound **26a** – monoalkylate side-product: ESI-MS, positive mode*

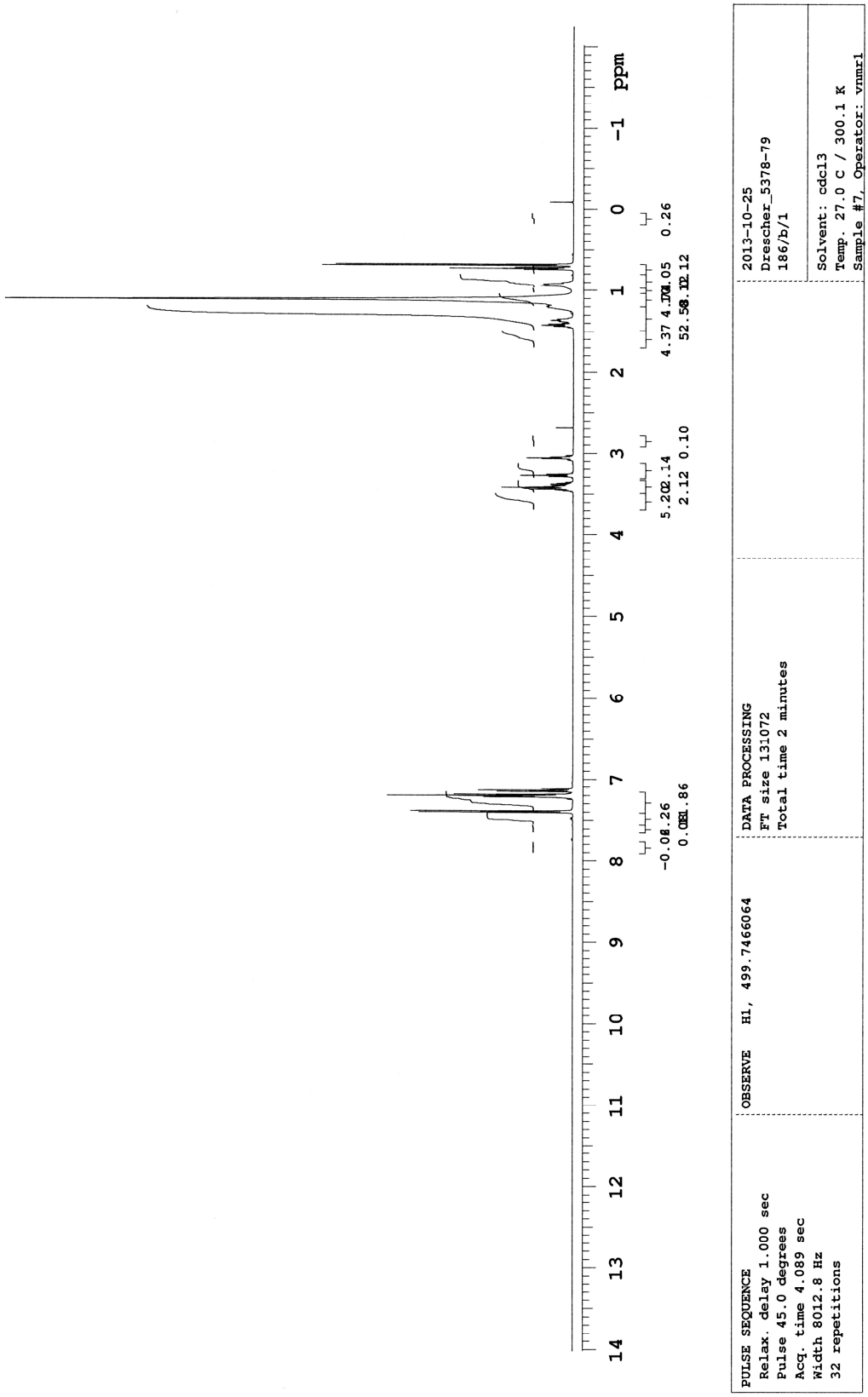
$C_{93}H_{140}O_6Na$ $[M + Na]^+$ – 1376.05 g mol^{-1}



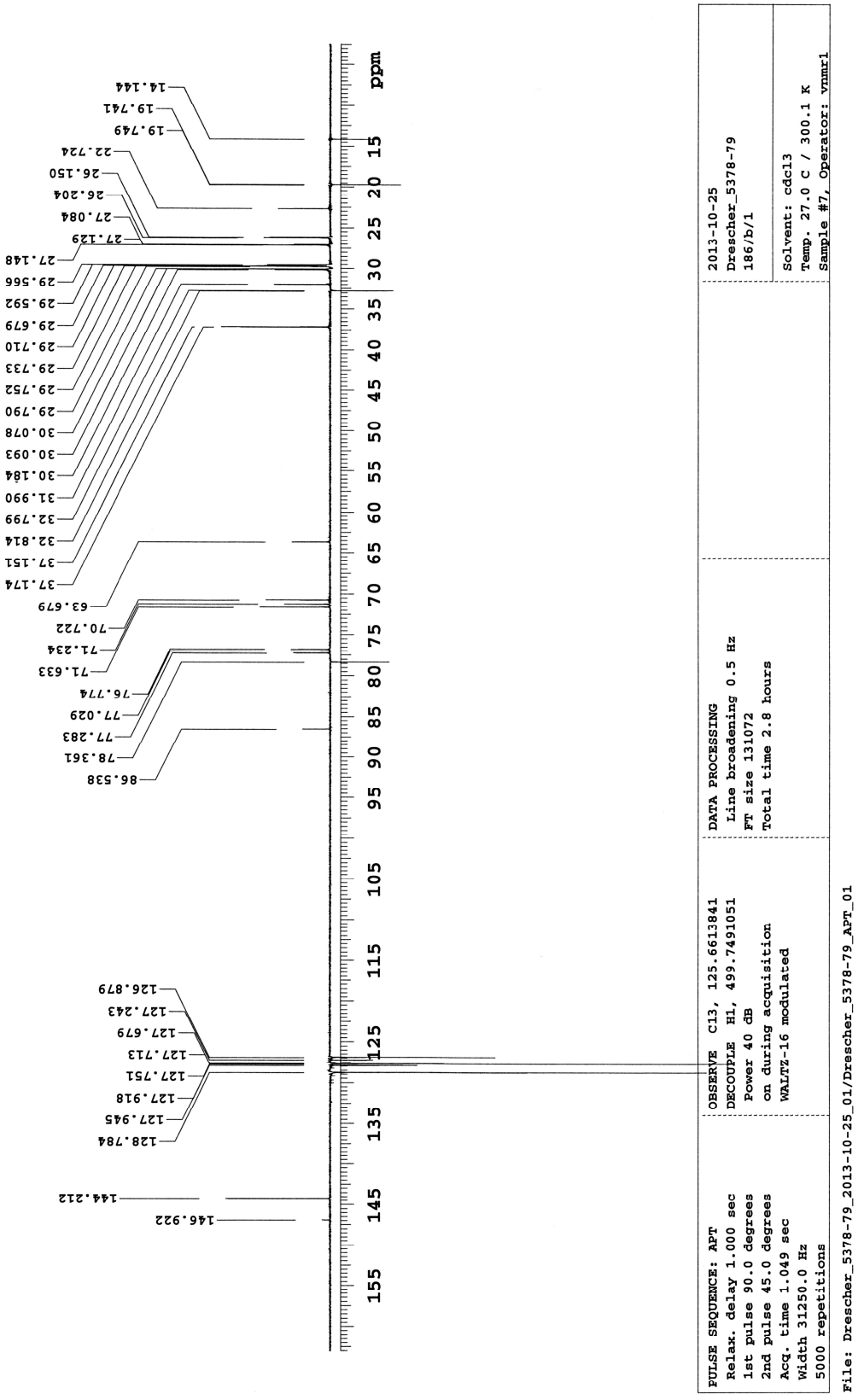
*Compound **26b**: ESI-MS, positive mode*



*Compound **26b**: ^{1}H NMR*

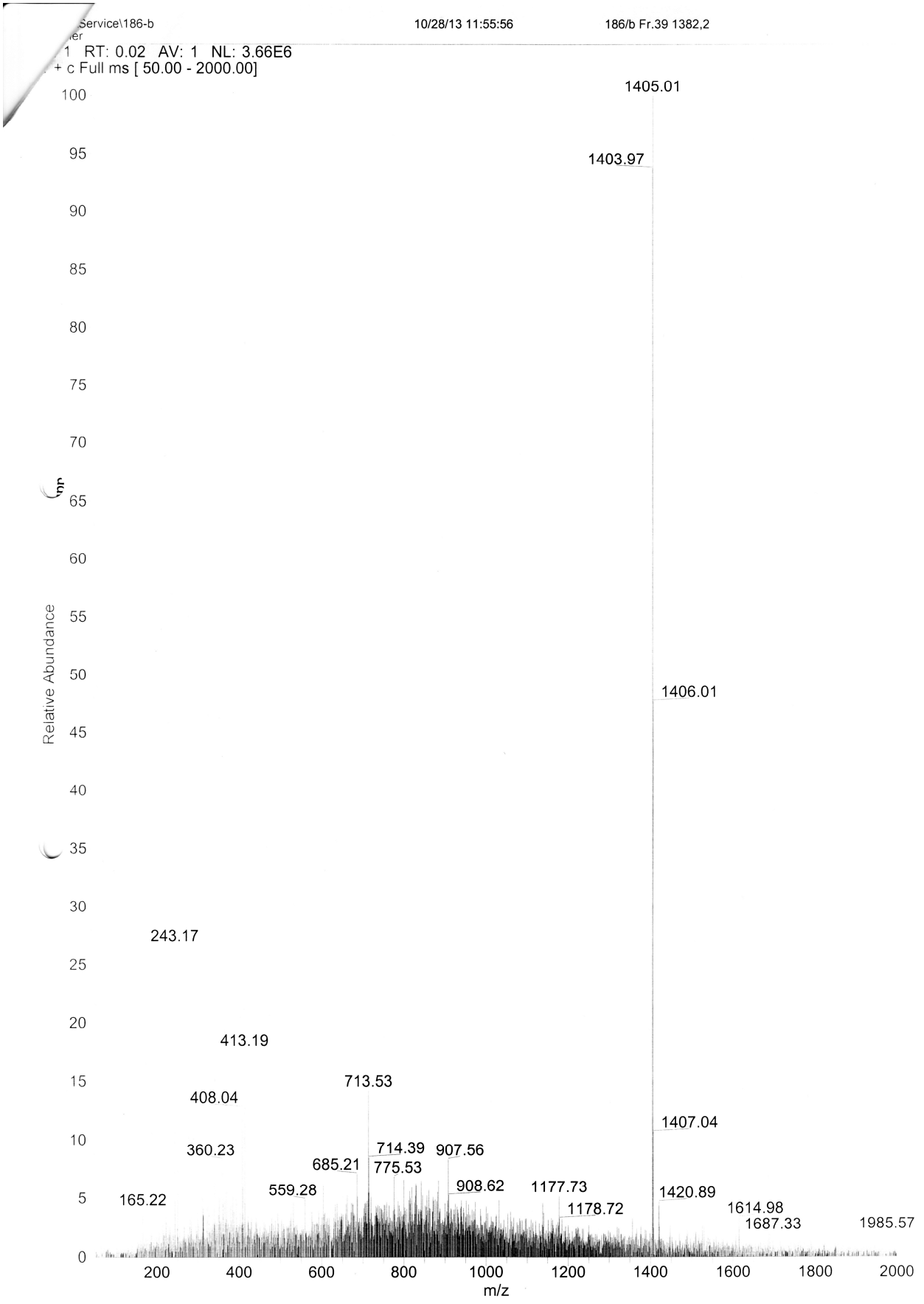


*Compound **26b**: ^{13}C NMR, APT mode*

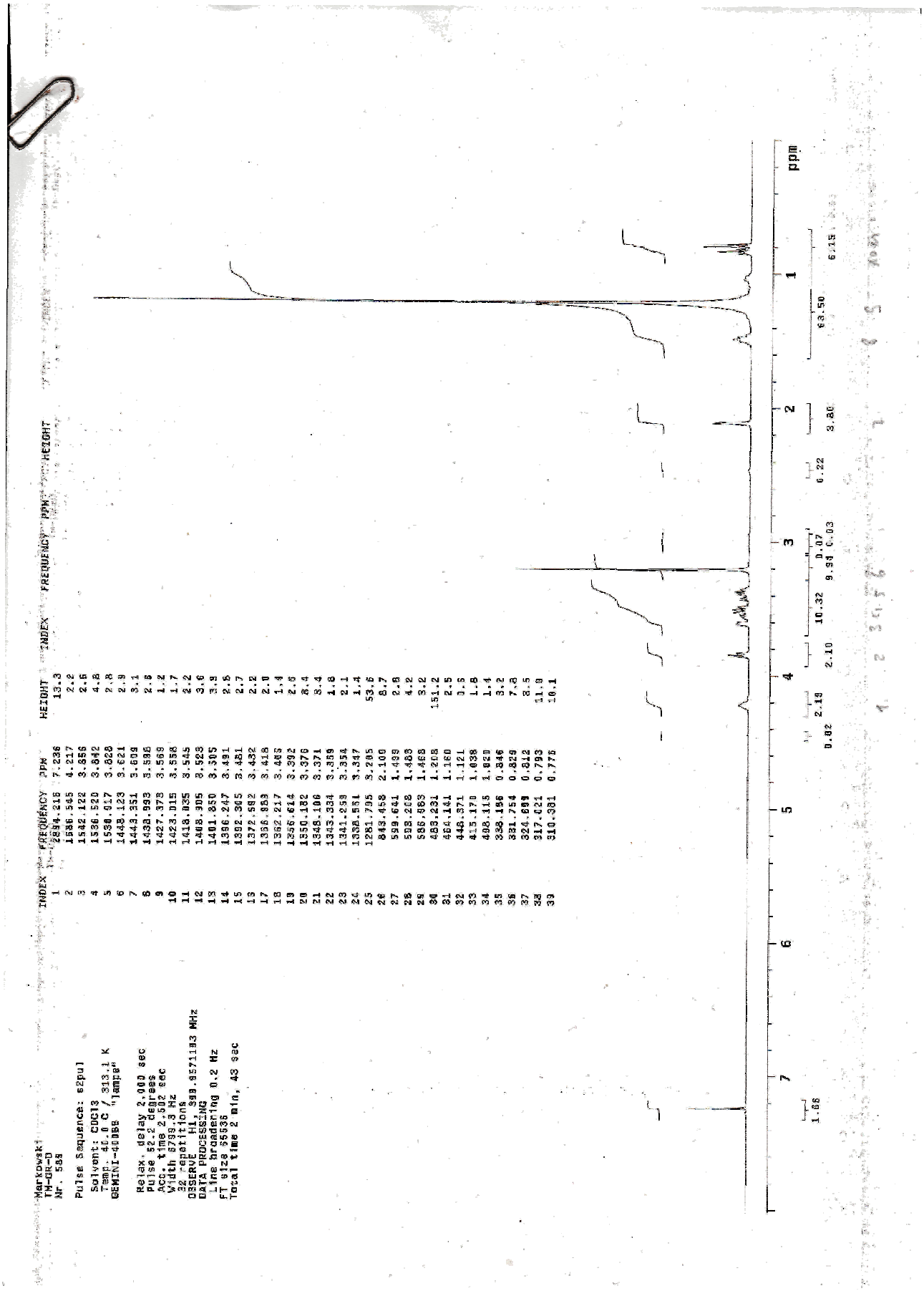


*Compound **26b** – monoalkylated side-product: ESI-MS, positive mode*

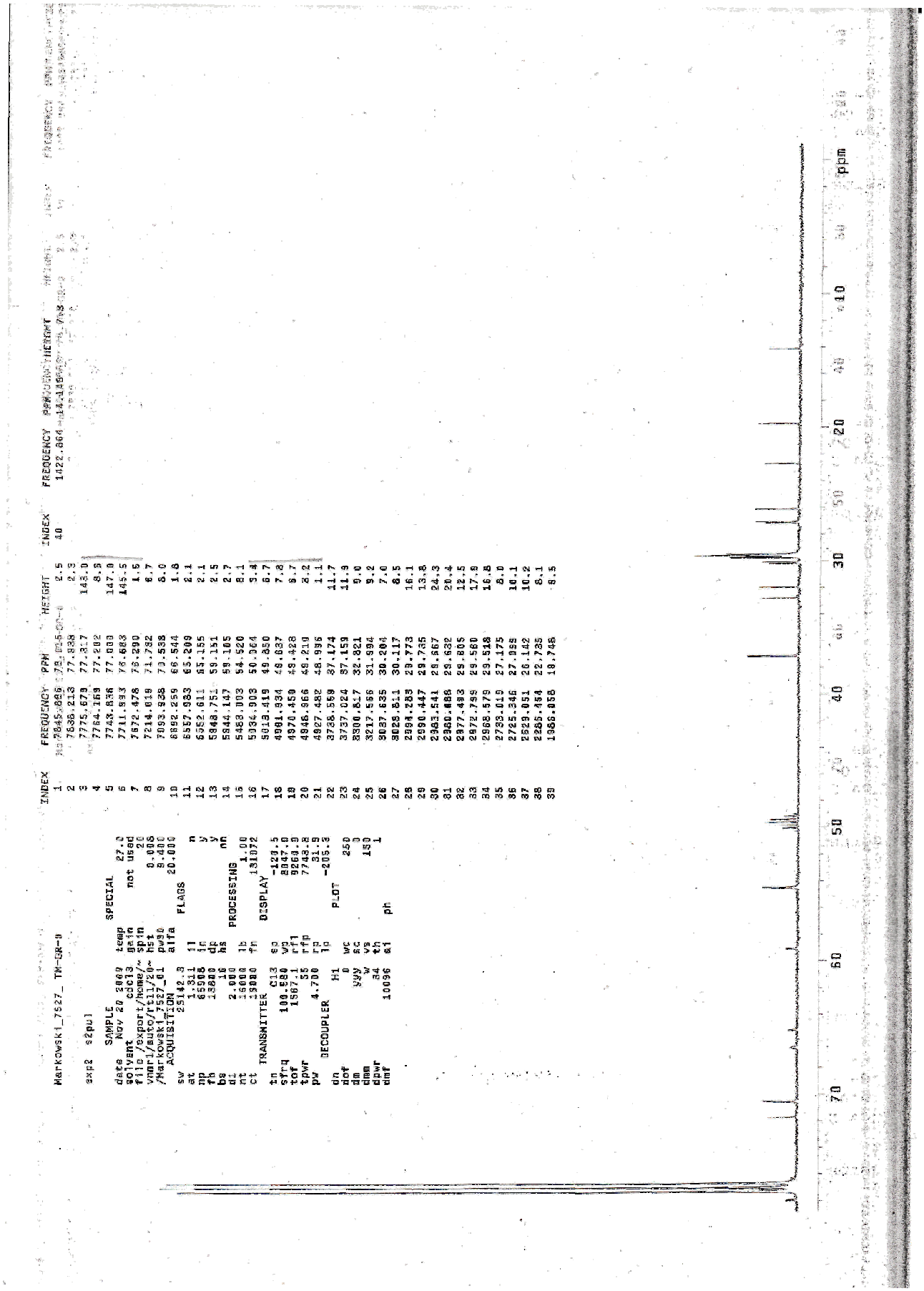
$C_{95}H_{144}O_6Na$ $[M + Na]^+$ – 1404.08 g mol^{-1}



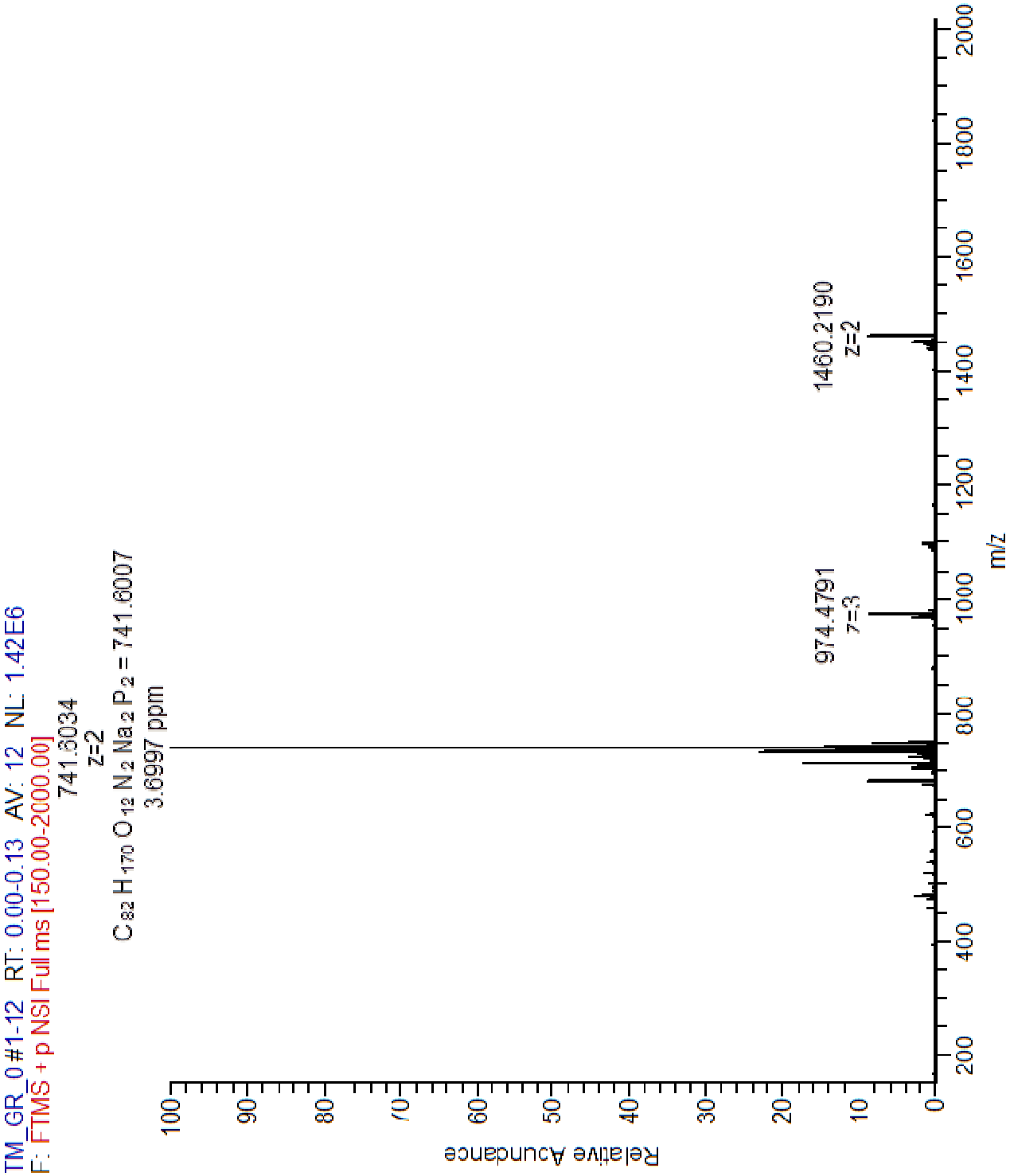
***Lipid I**: ^{1}H NMR*



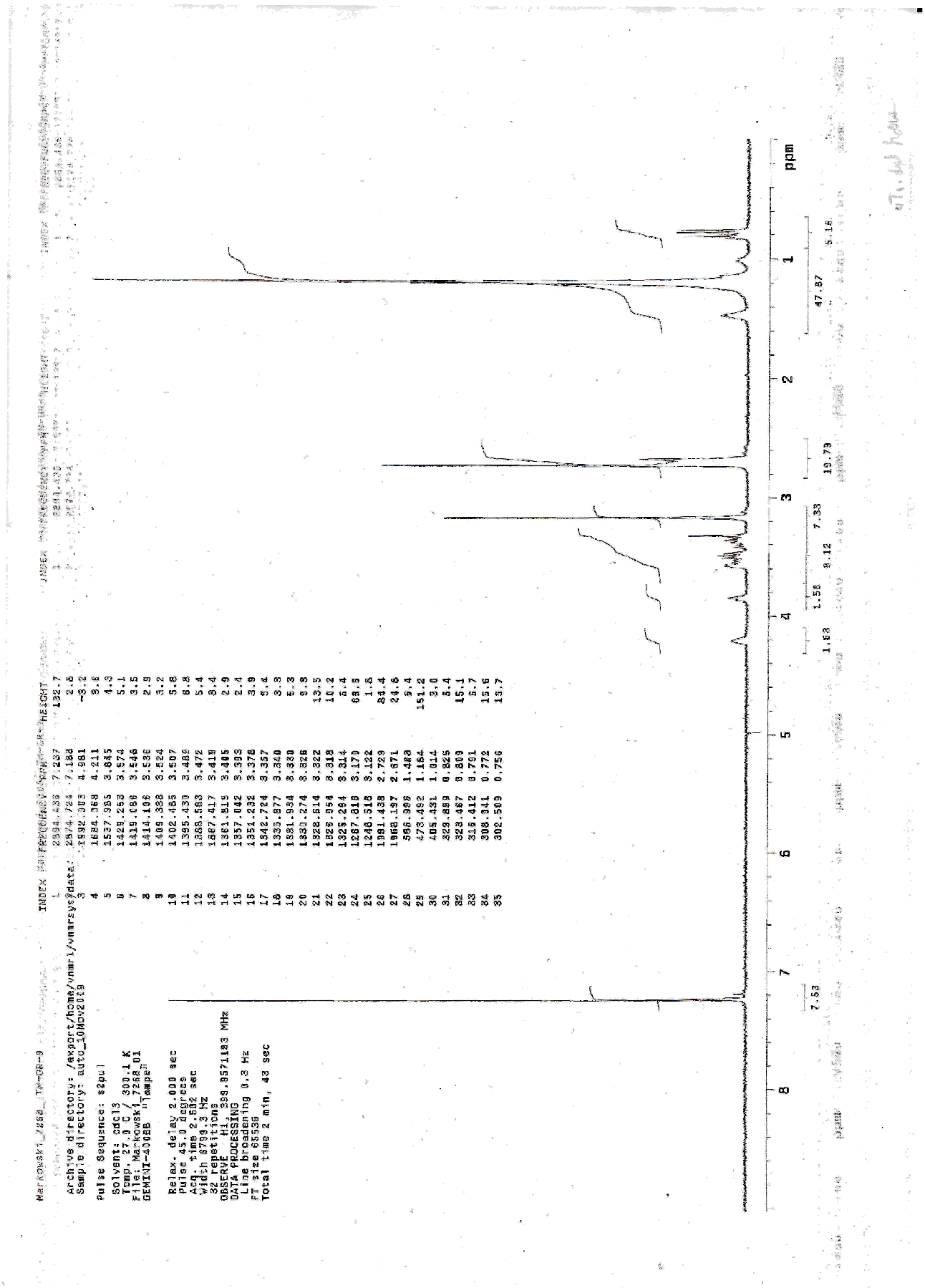
***Lipid I**: ^{13}C NMR*



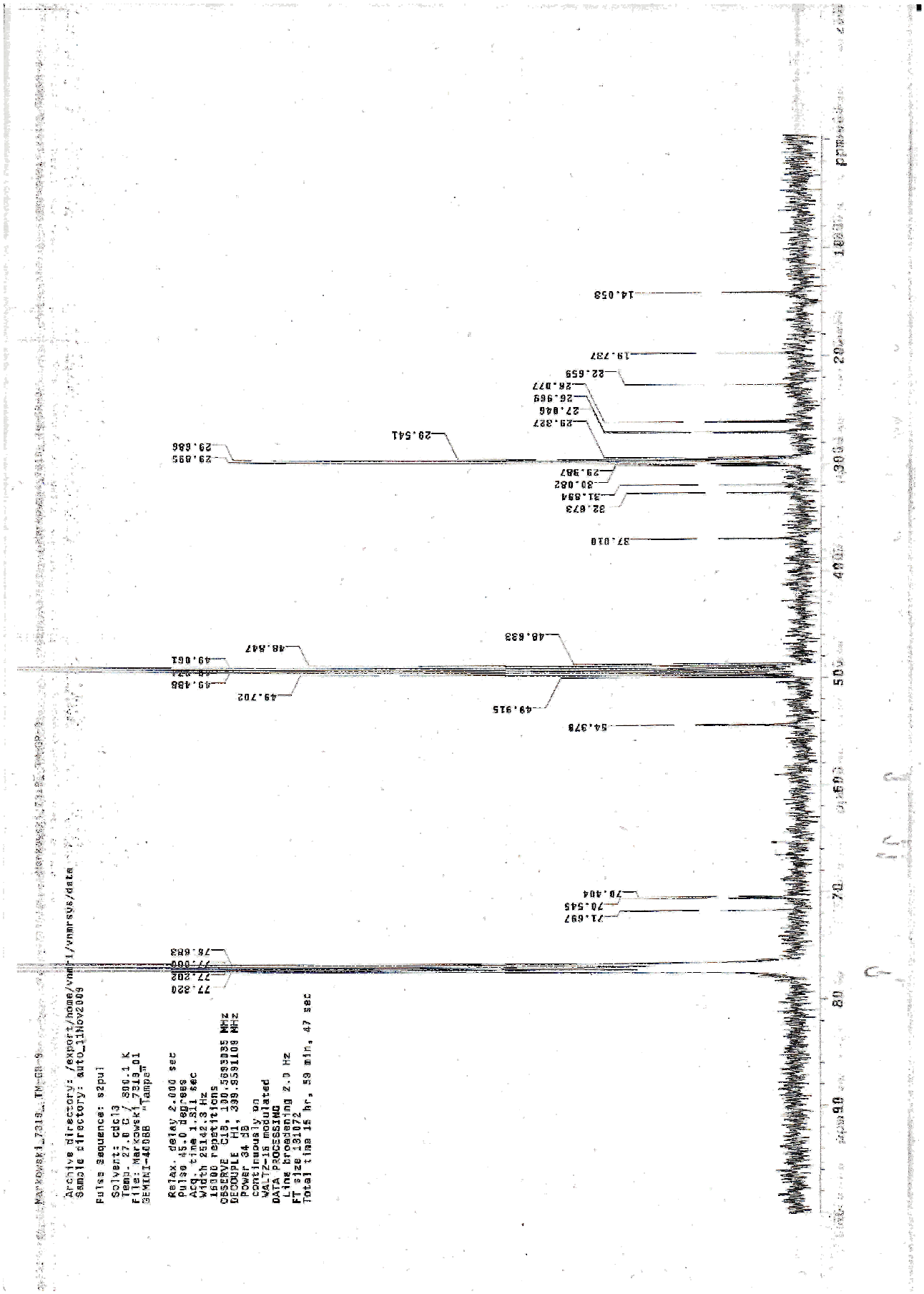
***Lipid I**: HR-MS, positive mode*



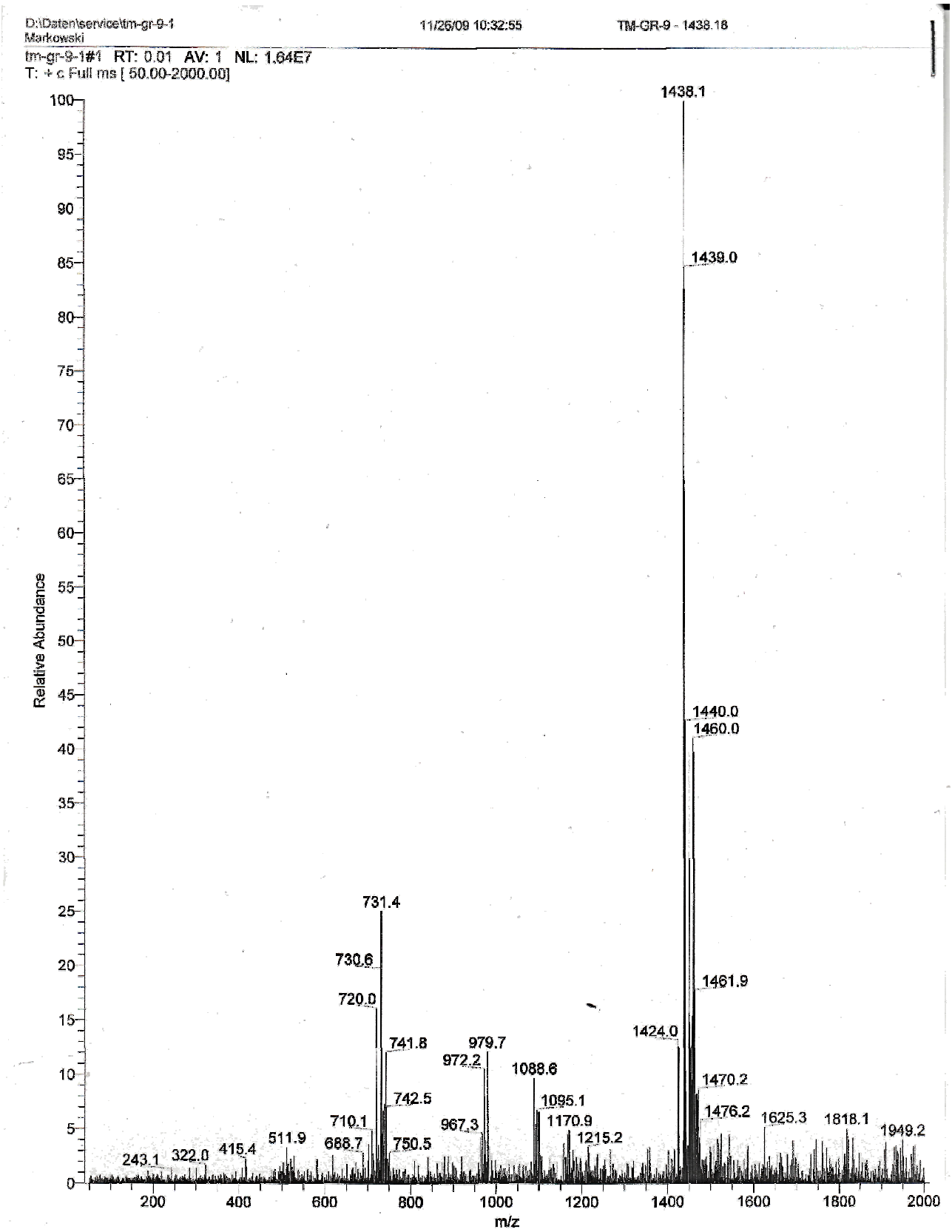
***Lipid II**: ^{1}H NMR*



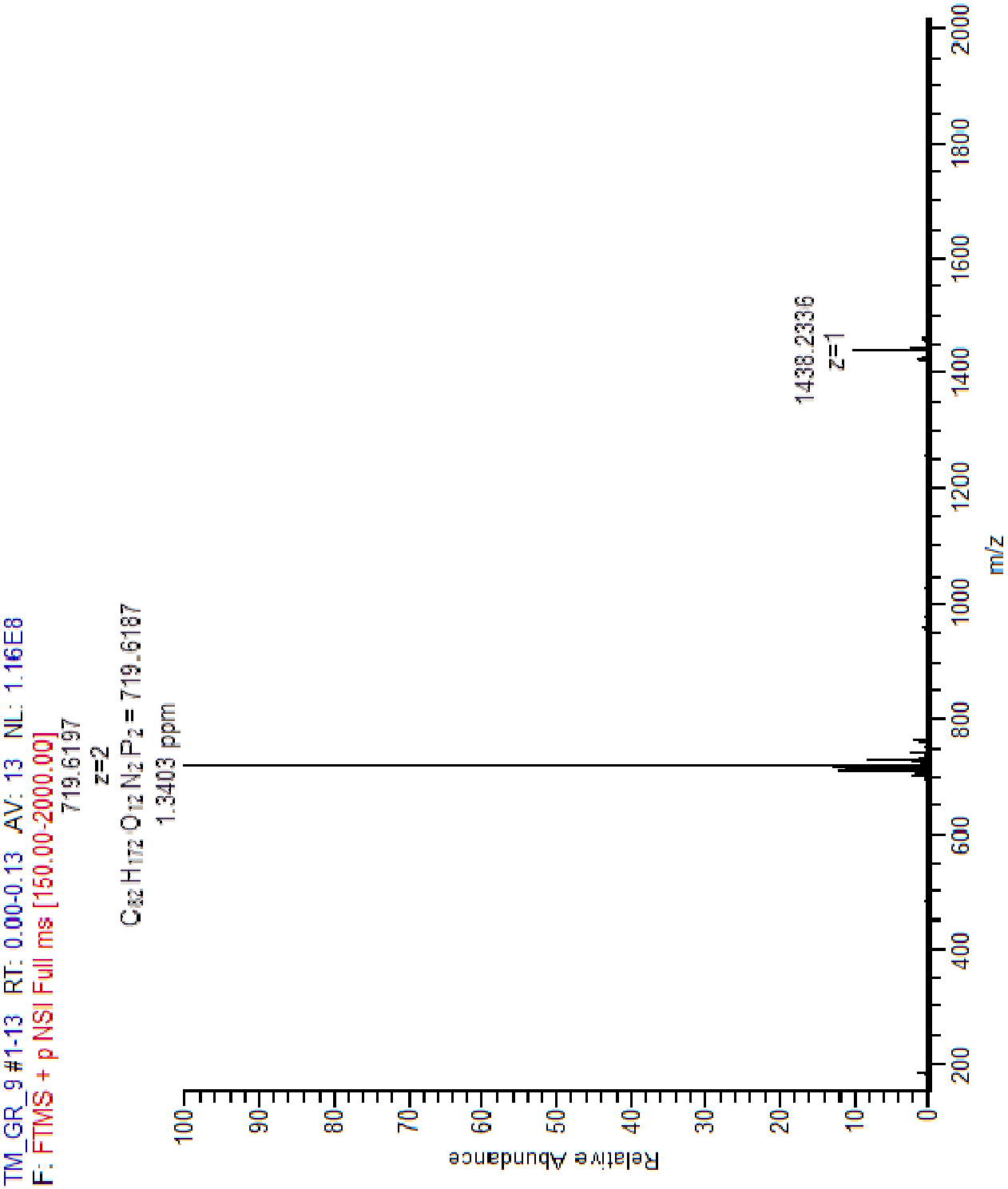
Lipid II: *^{13}C NMR*



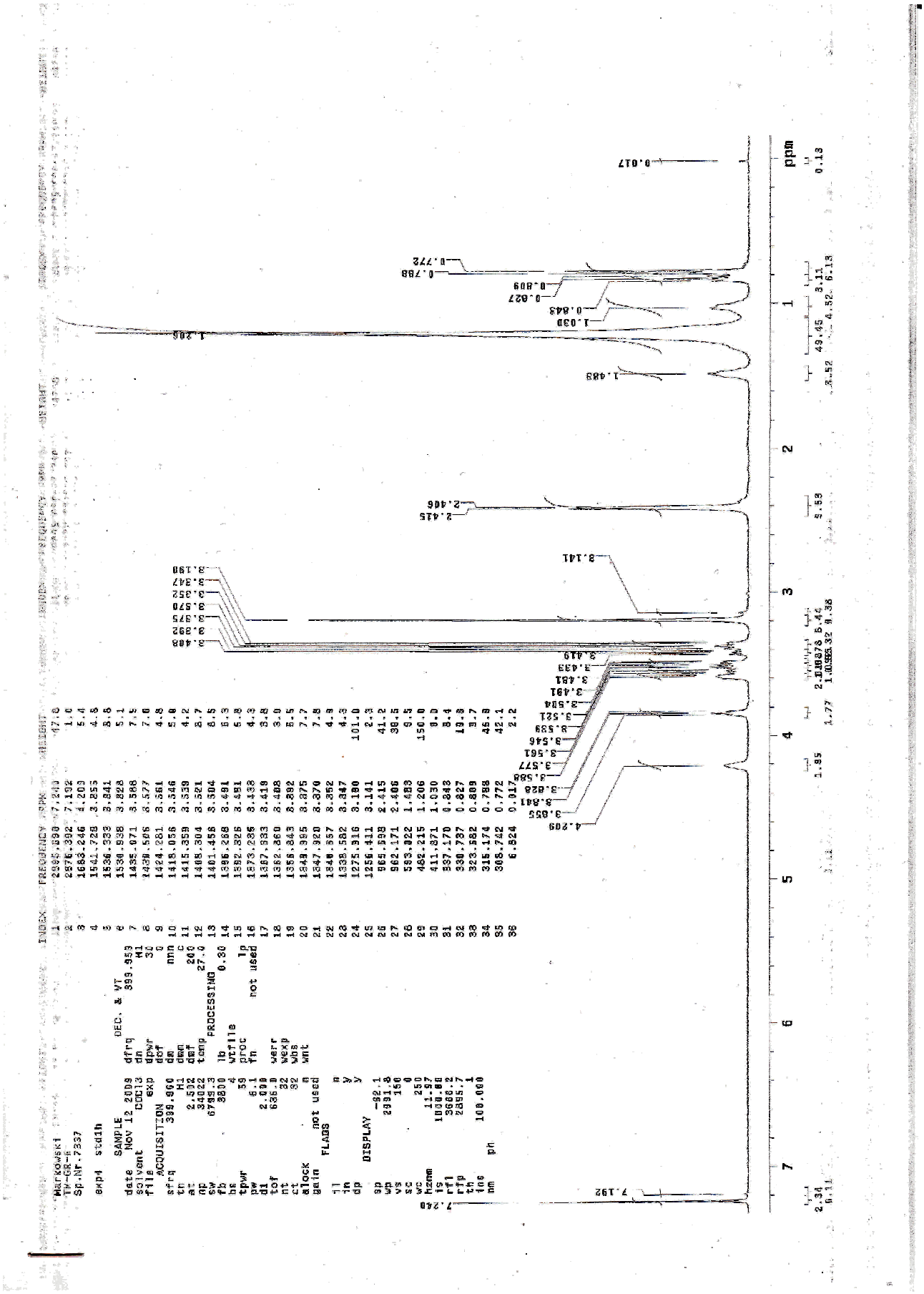
***Lipid II**: ESI-MS, positive mode*



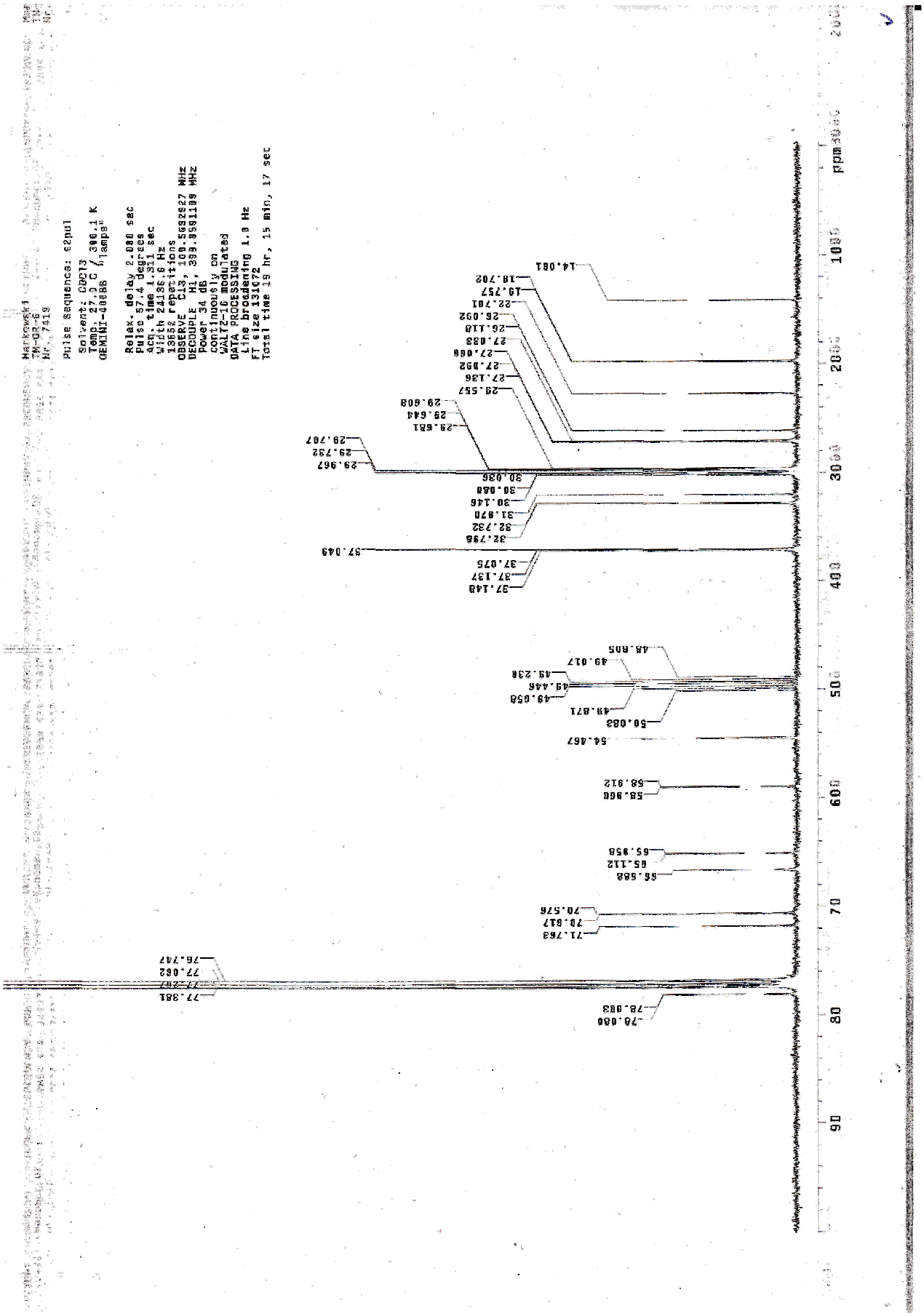
***Lipid II**: HR-MS, positive mode*



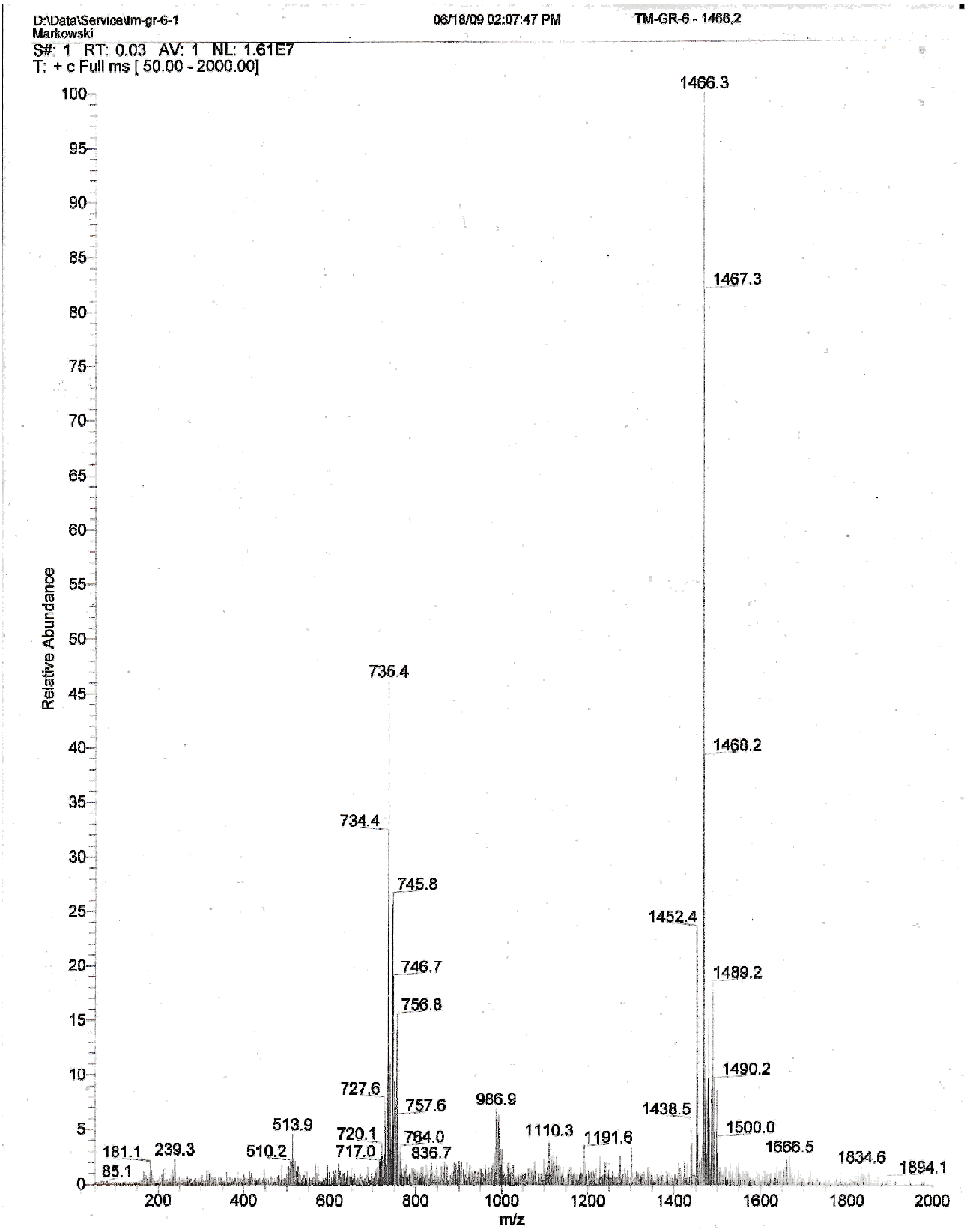
***Lipid III**: ^{1}H NMR*



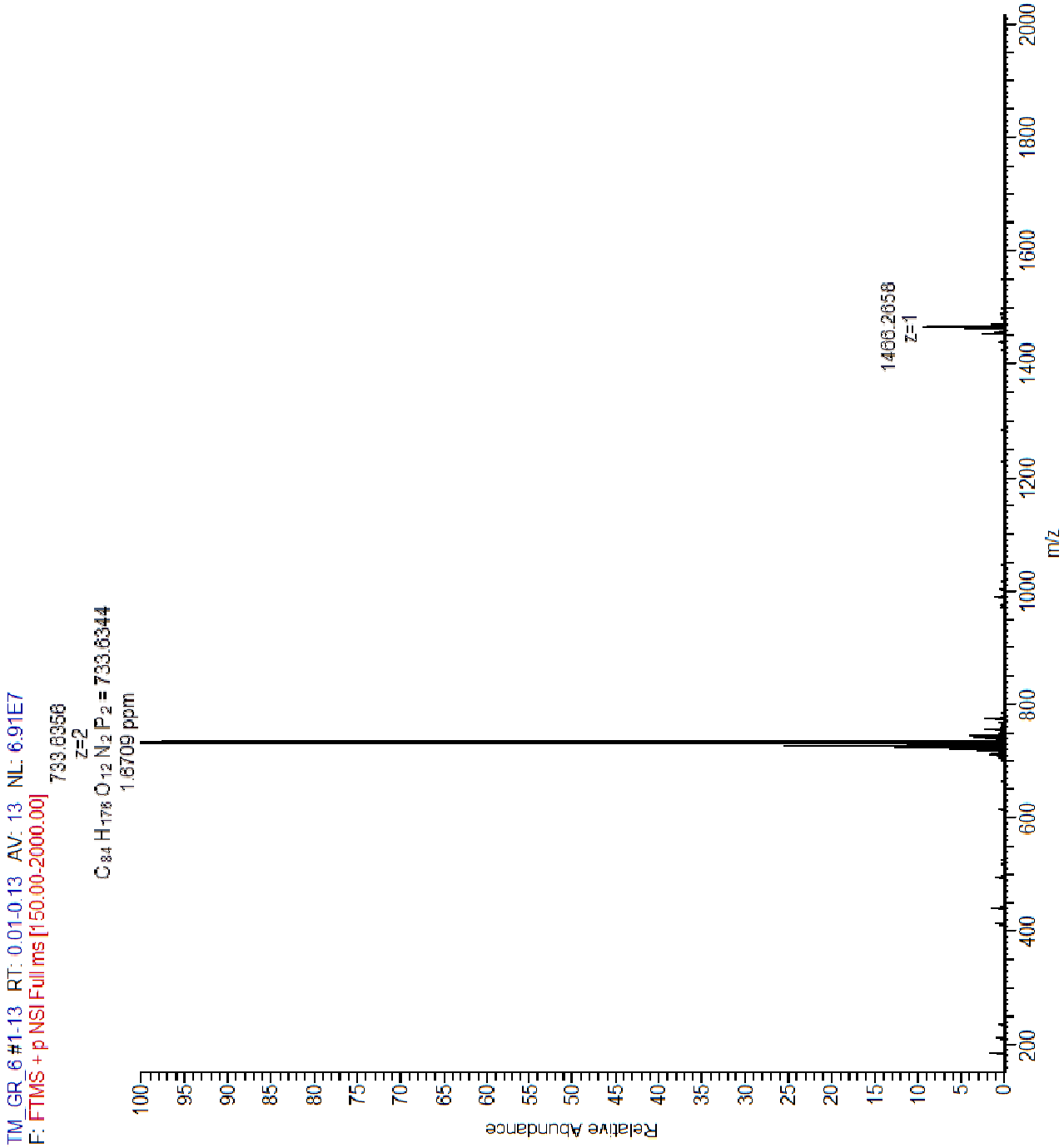
Lipid III: *^{13}C NMR*



***Lipid III**: ESI-MS, positive mode*



***Lipid III**: HR-MS, positive mode*



5. **References**

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