Experimental Supporting Information

$PhI(OAc)_2$ and Iodine-Mediated Synthesis of N-Alkyl Sulfonamides Derived from Polycyclic Aromatic Hydrocarbon Scaffolds and Determination of Their Antibacterial and Cytotoxic Activities

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Materials and Instrumentation: All solvents and reagents were purchased from commercial sources and used without further purification. I_2 (99.99+%, metal basis) was purchased from Alfa Aesar. ^{1}H and ^{13}C NMR spectra were recorded on a Varian 400 MHz spectrometer in deuterated chloroform ($CDCl_3$) or deuterated acetone ($(CD_3)_2CO$). Solvent residual peak used as internal reference ($CDCl_3$: ^{1}H = 7.26 ppm, ^{13}C = 77.02 ppm; $(CD_3)_2CO$: ^{1}H = 2.05 ppm, ^{13}C = 29.84 ppm). Data are reported in the following order: chemical shifts (δ) are reported in ppm, and spin-spin coupling constants (*J*) are reported in Hz, while multiplicities are abbreviated by s (singlet), bs (broad singlet), d (doublet), bd (broad doublet), dd (doublet of doublets), t (triplet), bt (broad triplet), dt (doublet of triplets), td (triplet of doublets), and m (multiplet). A Nicolet iS50 FT-IR spectrometer with peaks reported in reciprocal centimeters (cm^{-1}) was used for recording infrared spectra. Melting points (uncorrected) were recorded using a Mel-Temp II (Laboratory Devices, USA). HRMS were obtained using a Thermo Scientific Exactive spectrometer in positive ion electrospray mode (ESI-electrospray ionization).

Procedure for the preparation of 2,9-dibromo-9H-fluorene[1]

To a stirred solution of fluorenone substrate (5 mmol; 1.30 g) in THF/H2O (2.25 mL, v:v = 9:1) was added $NaBH_4$ (3.5 mmol; 0.132 g) in one portion. The mixture was stirred at rt for 20 h. The reaction was then quenched with H_2O (3 mL), extracted with Et_2O (2 X 10 mL), dried over Na_2SO_4, and concentrated to give 2-bromo-9H-fluoren-9-ol.

2-bromo-9H-fluoren-9-ol: White solid. M.p. 146-148 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.70 (s, 1H), 7.56 (dd, J_1 = 7.4 Hz , J_2 = 1.6 Hz, 2H), 7.46 (m, 2H), 7.35 (td, J_1 = 7.4 X (2) Hz, J_2 = 1.2 Hz, 1H), 7.31 (td, J_1 = 7.4 X (2) Hz, J_2 = 1.2 Hz, 1H), 5.46 (br s, 1H), 2.73 (br s, 1H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$) δ 147.6, 145.2, 139.0, 138.9, 132.1, 129.3, 128.6, 128.2, 125.2, 121.5, 121.3, 120.1, 74.9 ppm. IR (neat): ν = 3279, 1464, 1028, 759 cm^{-1}. HRMS (ESI): calculated for $C_{13}H_8Br_1$ $[M\text{-}H_2O]^+$ requires *m/z* 242.98094, found *m/z* 242.98358.

To a stirred solution of 2-bromo-9H-fluoren-9-ol (2.5 mmol; 0.653 g) in DCM (5 mL) at rt was added PBr_3 (1.33 mmol; 0.126 mL). The mixture was stirred at rt for 1h. The reaction was then quenched with sat. aqueous $NaHCO_3$ (10 mL), extracted with DCM (2 X 10 mL), dried over Na_2SO_4, and concentrated to give final brominated product.

2,9-dibromo-9H-fluorene: White solid. M.p. 122-124 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.71 (t, J_1 = 1.2 X (2) Hz, 1H), 7.57 (m, 1H), 7.53 (dd, J_1 = 5.9 Hz, J_2 = 1.6 Hz, 1H), 7.41 (m, 2H), 7.31 (dtd, J_1 = 12.9 Hz, J_2 = 7.4 X (2) Hz, 2H), 5.83 (s, 1H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$) δ 146.1, 143.8, 138.7, 132.3, 129.6, 129.4, 128.5, 126.4, 121.7, 121.6, 120.4, 44.9 ppm. IR (neat): ν = 2967, 1447, 1409, 1181, 1058, 819, 732, 647, 462 cm^{-1}. HRMS (ESI): calculated for $C_{13}H_7Br_2$ $[M\text{-}H]^-$ requires *m/z* 320.891446, found *m/z* 320.88831.

Procedure for the preparation of 9-bromo-9H-thioxanthene

To an oven-dried round bottom flask was added thioxanthone (2 mmol; 0.425 g) and THF (20 mL). The reaction flask was purged with argon and equipped with an argon balloon. The mixture was placed in an ice bath with stirring. A 1M LAH/THF solution (4 mL) was added dropwise. Once added, the reaction was removed from the ice bath and stirred at rt for 2 hours. Once the reaction was completed, it was quenched with water and extracted with 3 X 15 mL of EtOAc. The combined organic layers were washed with brine, dried over Na_2SO_4 and the solvent removed.

9H-thioxanthen-9-ol:[2] White solid. M.p. 102-104 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.62 (dd, J_1 = 7.0 Hz, J_2 = 1.6 Hz, 2H), 7.49 (dd, J_1 = 7.8 Hz, J_2 = 1.2 Hz, 2H), 7.30 (m, 4H), 5.56 (d, J_1 = 5.9 Hz, 1H), 2.39 (d, J_1 = 6.7 Hz, 1H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$) δ 136.5, 132.0, 127.7, 127.2, 126.9, 126.7, 72.1 ppm. IR (neat): ν = 3224, 3054, 1454, 1197, 1043, 734 cm^{-1}. HRMS (ESI): calculated for $C_{13}H_9S_1$ $[M\text{-}H_2O]^+$ requires *m/z* 197.04250, found *m/z* 197.04439.

9H-Thioxanthen-9-ol (1 mmol; 0.214 g) was dissolved in glacial acetic acid (3 mL) and 48% HBr (0.136 mL) was added. The reaction was heated at 50 °C for 5 hours. After reaction time, the mixture was quenched with 1-3 mL H_2O and extracted with 3 X 5 mL EtOAc. The combined organic layers were dried (Na_2SO_4) and concentrated to yield brominated product.

9-bromo-9H-thioxanthene:[3] Tan solid. M.p. 153-156 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.61 (dd, J_1 = 8.0 Hz, J_2 = 1.0 Hz, 1H), 7.57 (m, 2H), 7.45 (m, 2H), 7.30 (dd, J_1 = 6.7 Hz, J_2 = 1.6 Hz, 1H), 7.18 (m, 2H), 3.84 (s, 1H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$) δ 137.3, 136.2, 133.8, 132.3, 129.9, 129.2, 127.9, 126.9, 126.6, 126.5, 126.3, 126.0, 39.2 ppm. IR (neat): ν = 3050, 2917, 2849, 1641, 1588, 1440, 729 cm^{-1}.

Procedure for the preparation of 9-bromo-2-iodo-9H-fluorene

2-Iodofluorene (0.5 mmol; 0.146 g) and NBS (0.55 mmol; 0.0979 g) were added in CCl_4 (6.5 mL) and the mixture was refluxed overnight with benzoyl peroxide (0.004g) as initiator. After cooling, the succinimide formed was filtered. The mixture was washed with $NaHCO_3$ (1M; 20 mL) and brine (20 mL). The organic phase was dried over $MgSO_4$. The crude was purified via recrystallization from hexanes.

9-bromo-2-iodo-9H-fluorene:[4] Pale yellow solid. M.p. 122-125 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.98 (s, 1H), 7.72 (dd, J_1 = 8.0 Hz, J_2 = 1.4 Hz, 1H), 7.64 (m, 2H), 7.41 (d, J_1 = 8.2 Hz, 2H), 7.37 (m, 1H), 5.93 (s, 1H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$) δ 146.2, 143.6, 139.4, 138.8, 138.2, 135.4, 129.4, 128.7, 126.3, 121.8, 120.4, 92.9, 44.8 ppm. IR (neat): ν = 2965, 1715, 1446, 1403, 1179, 820, 732, 663 cm^{-1}. HRMS (ESI): calculated for $C_{13}H_7Br_1I_1$ $[M\text{-}H]^-$ requires *m/z* 368.87759, found *m/z* 368.87436.

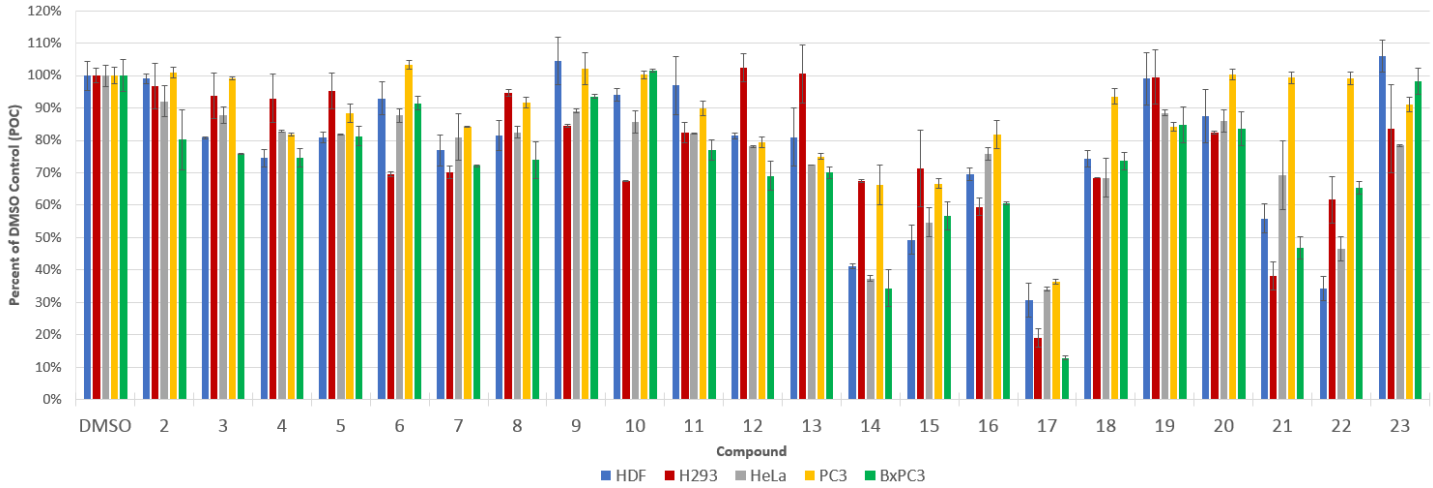


Figure S1. Cell viability screening of compounds **2-23** (50 μM), 24 h, CellTiter-Blue assay (Promega).

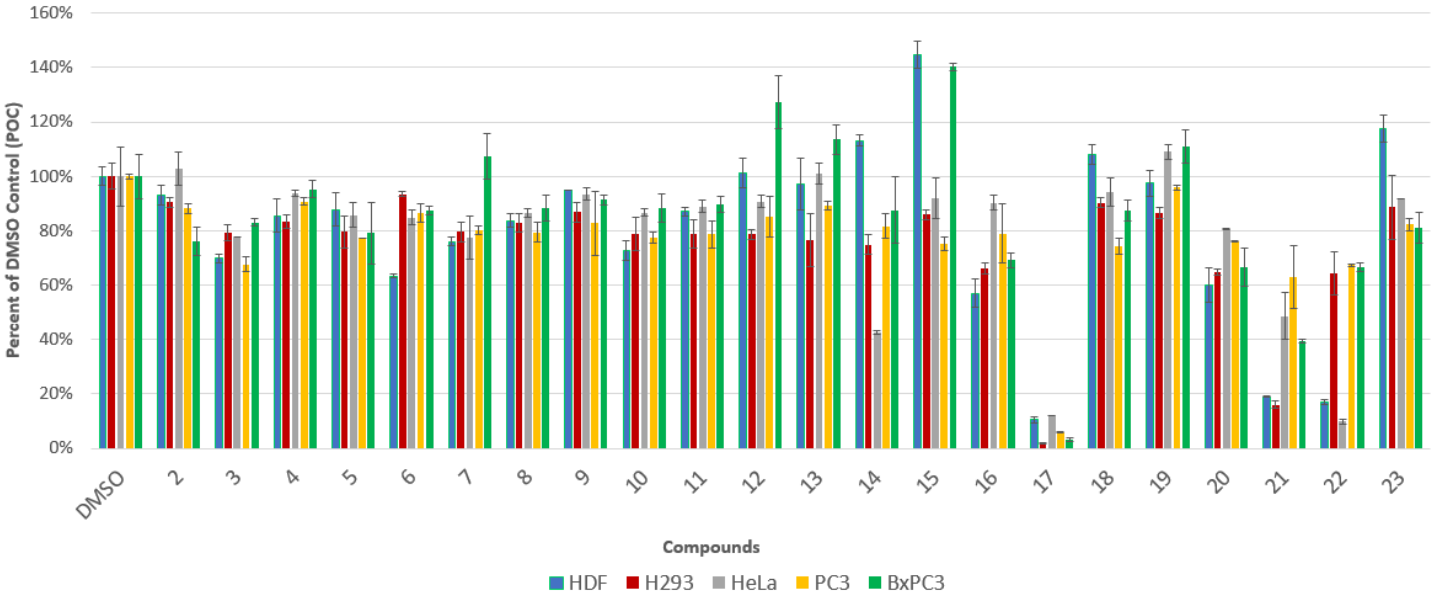


Figure S2. Cell viability screening of compounds **2-23** (50 μM), 24 h, CellTiter-Glo assay (Promega).

	Cell Lines (Values are shown as Percent of DMSO Control)				
Compounds	HDF	H293	HeLa	PC3	BxPC3
DMSO	100 ± 3.4%	100.0 ± 4.7%	100.0 ± 10.8%	100.0 ± 1.0%	100.0 ± 8.2%
2	93.2 ± 3.6%	90.4 ± 1.7%	102.7 ± 6.2%	88.2 ± 1.8%	76.1 ± 5.1%
3	69.9 ± 1.6%	79.3 ± 3.0%	77.5 ± 0.0%	67.7 ± 2.8%	83.1 ± 1.4%
4	85.6 ± 6.0%	83.3 ± 2.6%	93.8 ± 1.1%	90.8 ± 1.4%	95.2 ± 3.2%
5	87.7 ± 6.1%	79.6 ± 6.0%	85.8 ± 4.5%	77.4 ± 0.0%	79.2 ± 11.3%
6	63.4 ± 0.6%	93.4 ± 0.9%	84.8 ± 2.7%	86.5 ± 3.4%	87.4 ± 1.5%
7	76.1 ± 1.6%	79.5 ± 3.7%	77.5 ± 7.9%	80.2 ± 1.5%	107.4 ± 8.5%
8	83.8 ± 2.7%	82.9 ± 3.2%	86.6 ± 1.5%	79.3 ± 3.6%	88.3 ± 4.7%
9	94.9 ± 0.1%	86.8 ± 3.6%	93.5 ± 2.3%	82.7 ± 11.6%	91.3 ± 2.0%
10	72.8 ± 3.5%	78.7 ± 6.1%	86.7 ± 1.3%	77.4 ± 2.1%	88.3 ± 5.3%
11	87.1 ± 1.6%	78.8 ± 5.1%	88.9 ± 2.3%	78.6 ± 5.1%	89.8 ± 3.0%
12	101.3 ± 5.3%	78.6 ± 1.8%	90.7 ± 2.3%	85.2 ± 7.3%	127.3 ± 9.7%
13	97.2 ± 9.6	76.6 ± 9.8%	101.0 ± 3.8%	89.2 ± 1.7%	113.5 ± 5.3%
14	113.2 ± 2.2%	74.8 ± 3.6%	**42.5 ± 0.7%**	81.7 ± 4.6%	87.6 ± 12.4%
15	144.8 ± 5.0%	85.9 ± 1.7%	91.9 ± 7.3%	75.2 ± 2.4%	140.2 ± 1.2%
16	56.9 ± 5.2%	66.3 ± 2.0%	90.3 ± 2.7%	79.0 ± 5.2%	69.2 ± 2.8%
17	**10.5 ± 1.3%**	**1.9 ± 0.1%**	**12.1 ± 0.0%**	**5.9 ± 0.2%**	**3.2 ± 0.9%**
18	108.1 ± 3.6%	90.3 ± 1.8%	94.2 ± 5.2%	74.3 ± 3.0%	87.4 ± 3.8%
19	97.5 ± 4.7%	86.5 ± 2.2%	109.0 ± 2.7%	95.8 ± 0.9%	110.8 ± 6.1%
20	59.9 ± 6.4%	64.8 ± 1.2%	80.6 ± 0.3%	76.1 ± 0.1%	66.5 ± 6.9%
21	**19.0 ± 0.3%**	**16.0 ± 1.3%**	**48.7 ± 8.6%**	63.0 ± 11.4%	**39.4 ± 0.5%**
22	**16.9 ± 0.8%**	64.3 ± 8.1%	**9.8 ± 1.0%**	67.3 ± 0.4%	66.5 ± 1.5%
23	117.6 ± 4.9%	88.6 ± 11.8%	91.9 ± 0.0%	82.3 ± 2.3%	81.1 ± 5.5%

Table S1. Cell viability results from screening of compounds **2-23** (50 μM), 24 h, CellTiter-Glo assay (Promega). Compound "hits" (<50% percent of DMSO control) are shown in red.

Cmpd	MW	TPSA[a]	cLogP[b] (calc)	cLogP[c] (expmtl)	Solby[d]	Log Kp[e]	Drug-likeness (Number of violations)[f]					Drug score[g]
							Lipinski	Ghose	Veber	Egan	Muegge	
2	368	100.4	2.52	3.69	-4.04	-6.06	0	0	0	0	0	0.38
3	335	54.6	3.70	3.96	-5.1	-5.40	0	0	0	0	0	0.10
4	351	63.8	3.37	3.57	-4.77	-5.78	0	0	0	0	0	0.11
5	356	54.6	3.89	4.30	-5.49	-5.34	0	0	0	0	0	0.09
6	389	54.6	4.42	4.48	-5.53	-5.36	0	1	0	1	0	0.08
7	339	54.6	3.67	3.70	-5.07	-5.62	0	0	0	0	0	0.11
8	321	54.6	3.24	3.49	-4.75	-5.58	0	0	0	0	0	0.11
9	366	100.4	2.79	3.59	-5.21	-5.97	0	0	0	0	0	0.11
10	356	54.6	3.88	4.29	-5.49	-5.34	0	0	0	0	0	0.09
11	339	54.6	3.67	3.77	-5.07	-5.62	0	0	0	0	0	0.11
12	356	54.6	3.88	3.67	-5.49	-5.34	0	0	0	0	0	0.09
13	339	54.6	3.59	3.38	-5.07	-5.62	0	0	0	0	0	0.11
14	357	54.6	3.94	3.67	-5.38	-5.65	0	1	0	0	0	0.10
15	357	54.6	3.96	3.13	-5.38	-5.65	0	1	0	0	0	0.10
16	357	54.6	3.96	4.16	-5.38	-5.65	0	1	0	0	0	0.10
17	411	54.6	4.80	4.43	-6.32	-5.77	1	1	0	1	0	0.08
18	425	54.6	4.91	5.17	-6.96	-4.87	1	1	0	1	1	0.04
19	259	54.6	2.15	1.80	-4.51	-6.31	0	0	0	0	0	0.14
20	435	54.6	4.50	4.99	-6.32	-5.33	1	1	0	1	1	0.11
21	482	54.6	4.54	5.08	-6.5	-5.65	1	2	0	0	1	0.12
22	388	79.9	4.25	2.15	-5.19	-5.22	0	1	0	0	0	0.46
23	383	89.1	3.65	0.86	-4.47	-5.66	0	0	0	0	0	0.57

a) TPSA = Topological polar surface area; calculated by SwissADME. b) Calculated by SwissADME (average of 5 calculations – iLOGP; XLOGP3; WLOGP; MLOGP; SILICOS-IT). c) Experimentally obtained. d) Solubility (Log S) calculated by OSIRIS. e) Indicates skin permeation in cm/s; calculated by SwissADME. f) Calculated by SwissADME. g) Calculated by OSIRIS.

Table S2. Drug-likeness and physicochemical properties of compounds **2-23** as predicted by OSIRIS and SwissADME.

Reference Compounds					
Compound	Tr	T0 (ethyl acetate)	k	log(k)	log(P)
Nitrobenzene	4.528	3.809	0.1888	-0.7240	1.9
Toluene	6.93	3.814	0.8170	-0.0878	2.7
Naphthalene	8.466	3.827	1.2122	0.0836	3.6
Biphenyl	11.637	3.83	2.0384	0.3093	4.0
Bibenzyl	18.179	3.831	3.7452	0.5735	4.8
DDT	41.243	3.827	9.7768	0.9902	6.5

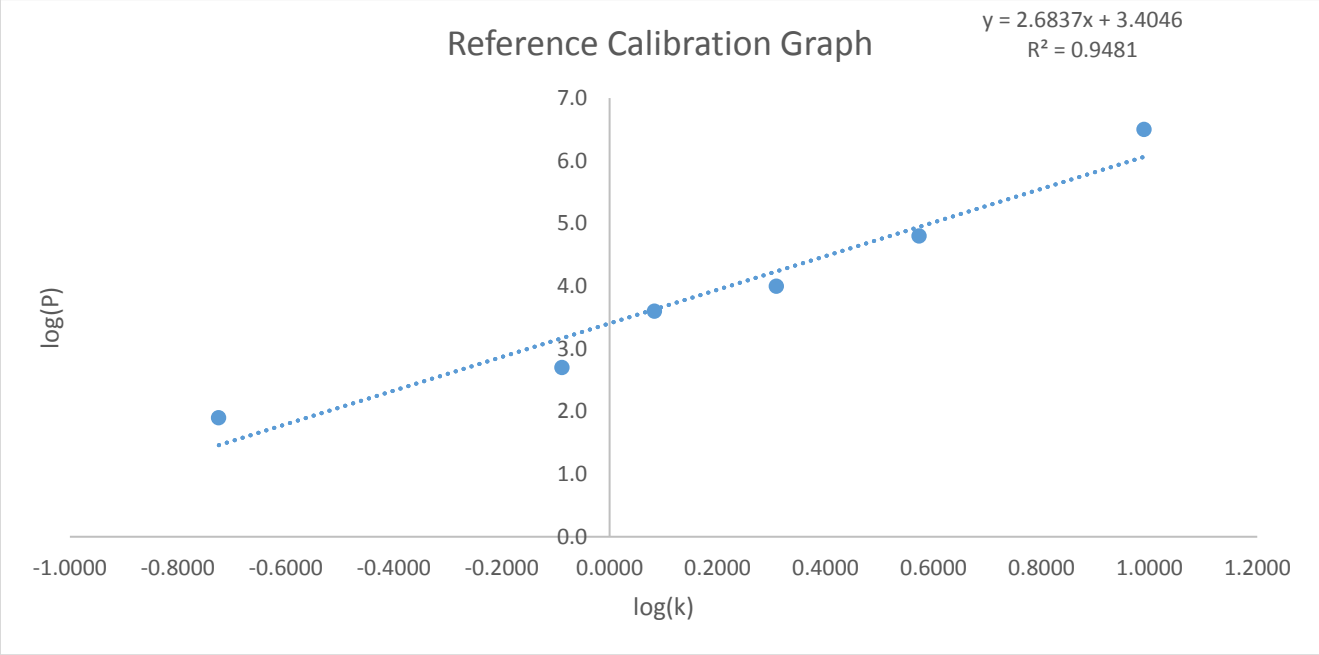
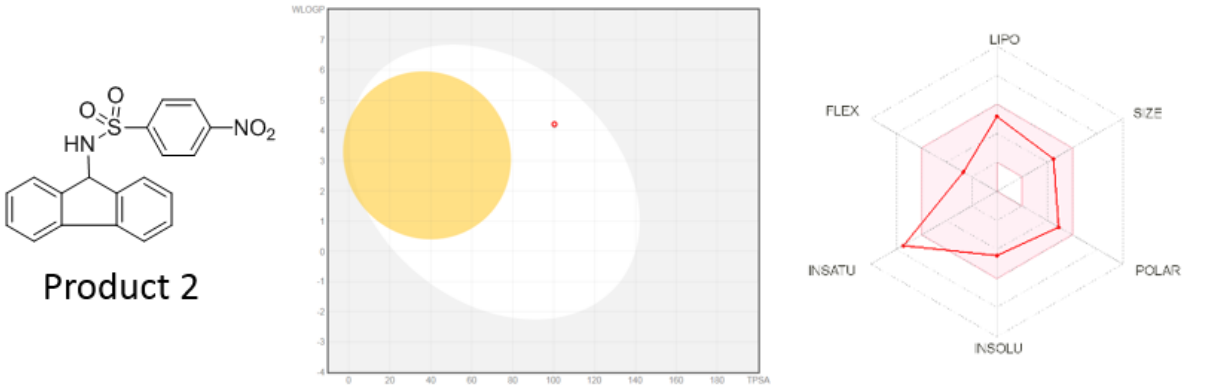


Figure S3. Calibration curve and raw data for calculation of LogP values of known calibration compounds.[5]

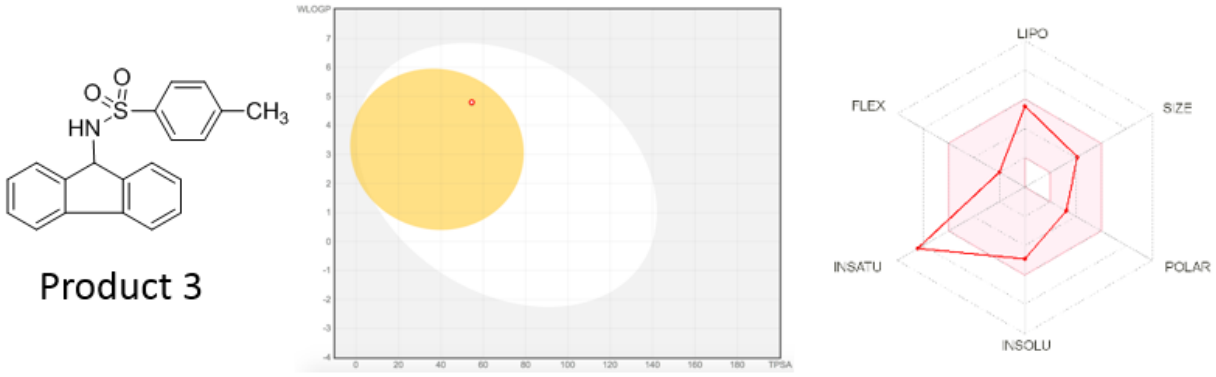
In Silico Predicted Properties (obtained using SwissADME):[6]

For a description of BOILED Egg, see reference 7.



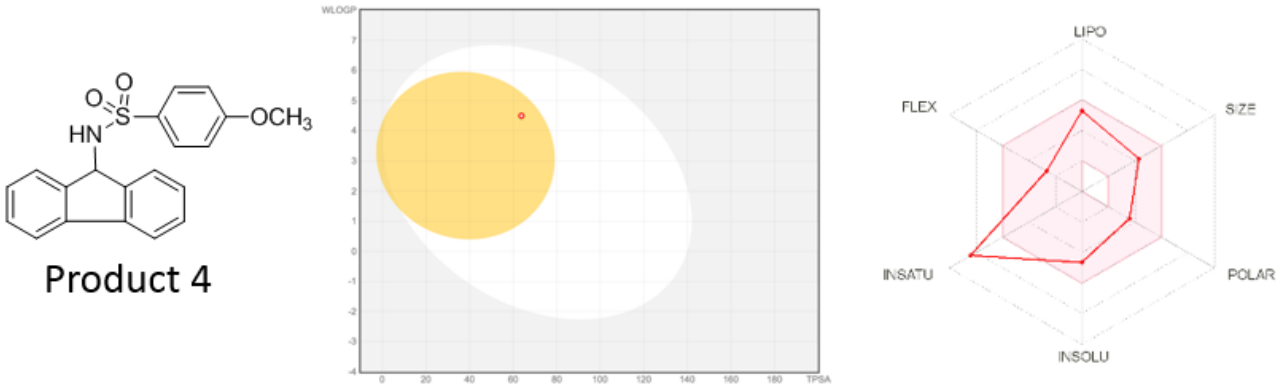
SMILES: [O-][N+](=O)C1=CC=C(C=C1)S(=O)(=O)NC1C2C=CC=CC2C2=C1C=CC=C2

Figure S4. BOILED EGG and graphical physicochemical property summary of product **2**.



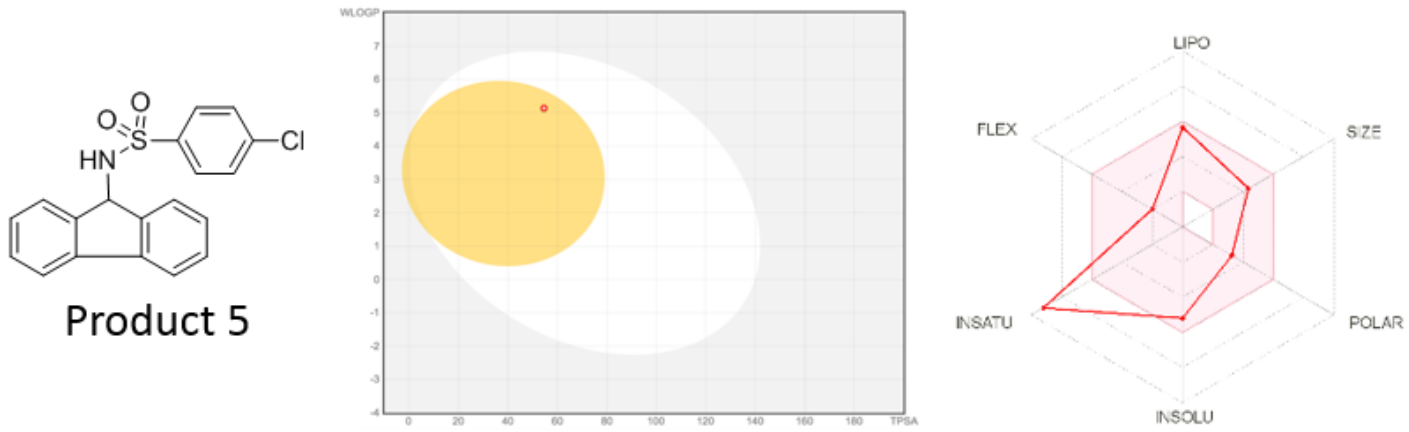
SMILES: CC1=CC=C(C=C1)S(=O)(=O)NC1C2=C(C=CC=C2)C2=C1C=CC=C2

Figure S5. BOILED EGG and graphical physicochemical property summary of product **3**.



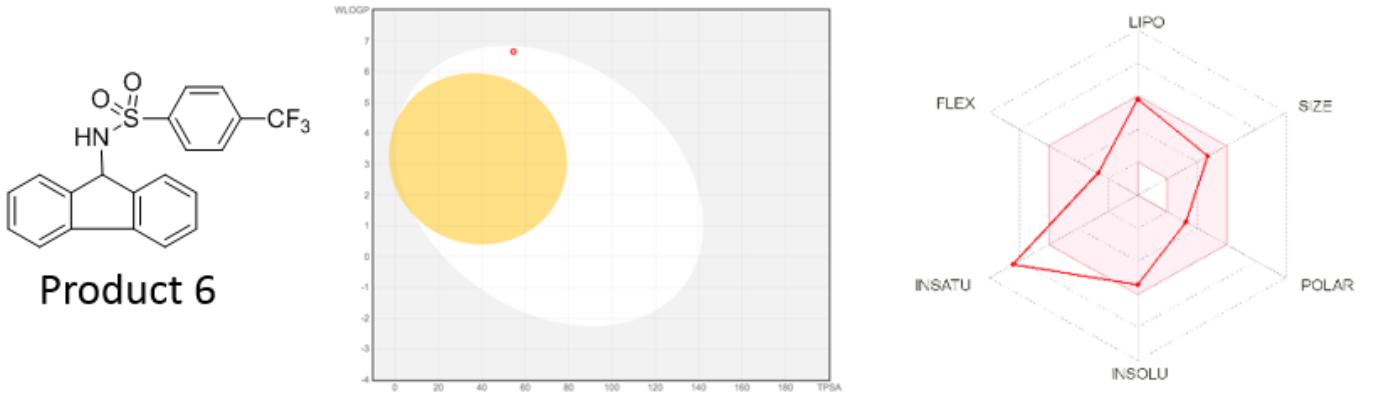
SMILES: COC1=CC=C(C=C1)S(=O)(=O)NC1C2=C(C=CC=C2)C2=C1C=CC=C2

Figure S6. BOILED EGG and graphical physicochemical property summary of product **4**.



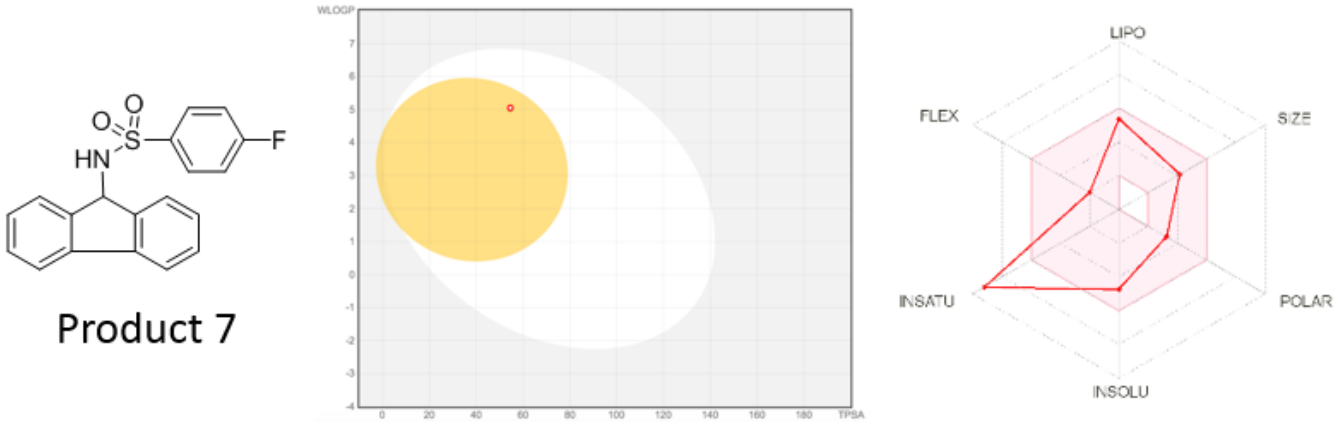
SMILES: ClC1=CC=C(C=C1)S(=O)(=O)NC1C2=C(C=CC=C2)C2=C1C=CC=C2

Figure S7. BOILED EGG and graphical physicochemical property summary of product **5**.



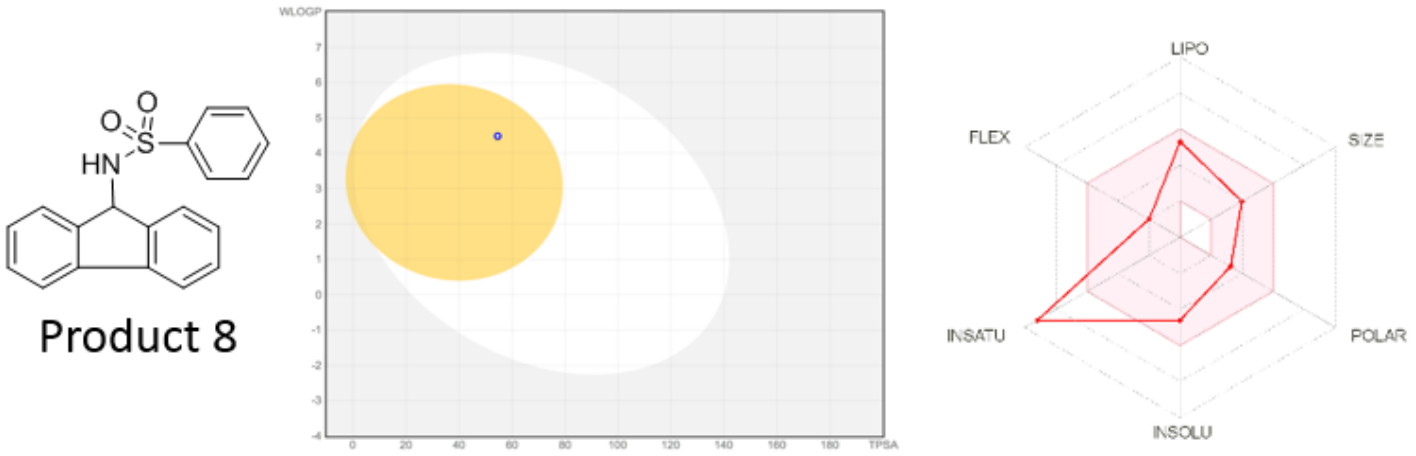
SMILES: FC(F)(F)C1=CC=C(C=C1)S(=O)(=O)NC1C2=C(C=CC=C2)C2=C1C=CC=C2

Figure S8. BOILED EGG and graphical physicochemical property summary of product **6**.



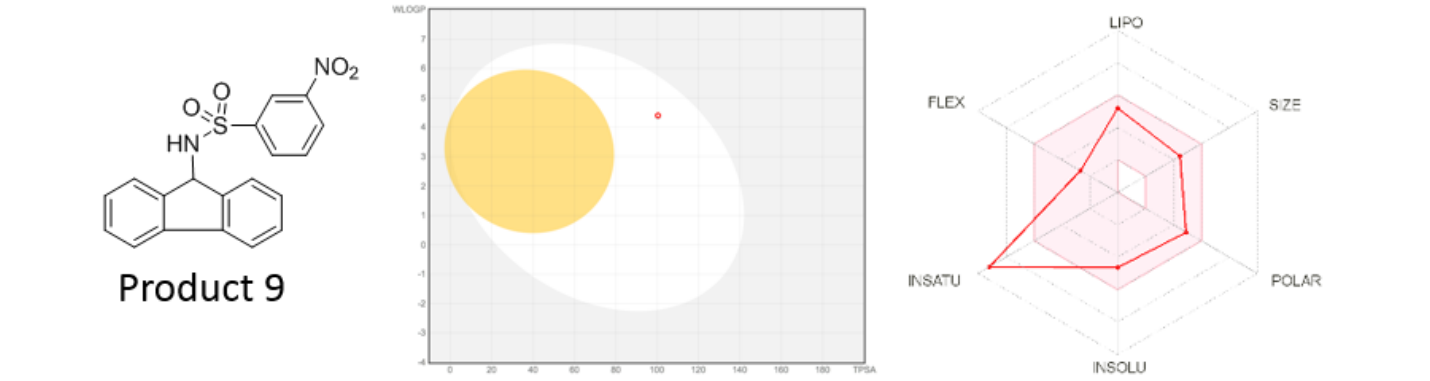
SMILES: FC1=CC=C(C=C1)S(=O)(=O)NC1C2=C(C=CC=C2)C2=C1C=CC=C2

Figure S9. BOILED EGG and graphical physicochemical property summary of product **7**.



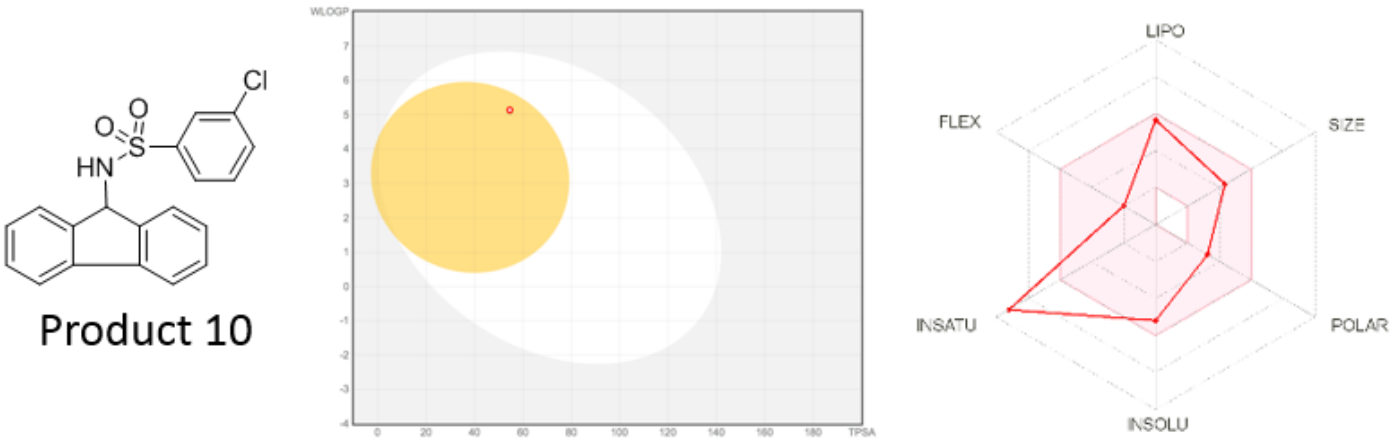
SMILES: O=S(=O)(NC1C2=C(C=CC=C2)C2=C1C=CC=C2)C1=CC=CC=C1

Figure S10. BOILED EGG and graphical physicochemical property summary of product **8**.



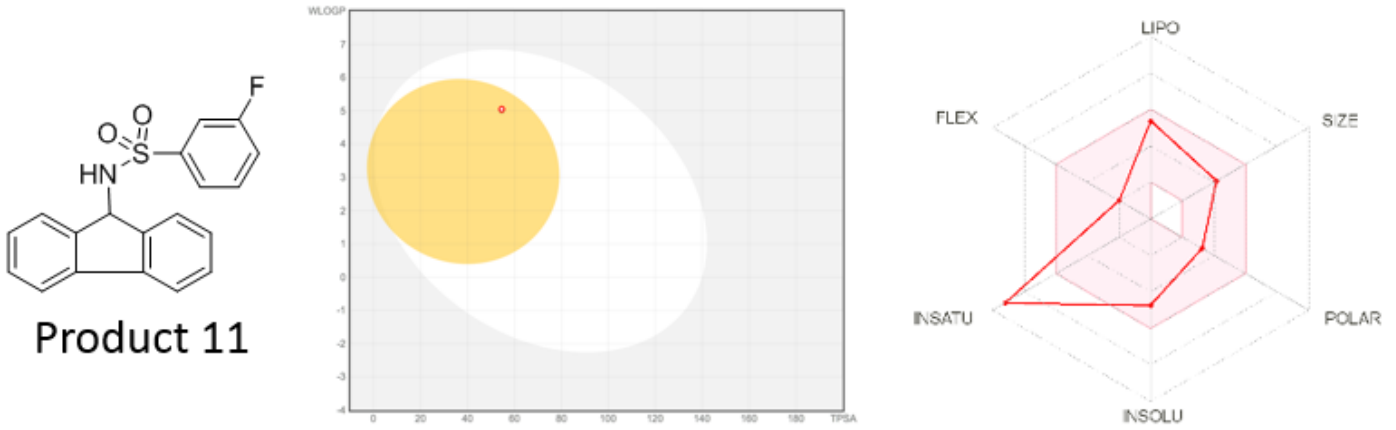
SMILES: [O-][N+](=O)C1=CC(=CC=C1)S(=O)(=O)NC1C2=C(C=CC=C2)C2=C1C=CC=C2

Figure S11. BOILED EGG and graphical physicochemical property summary of product **9**.



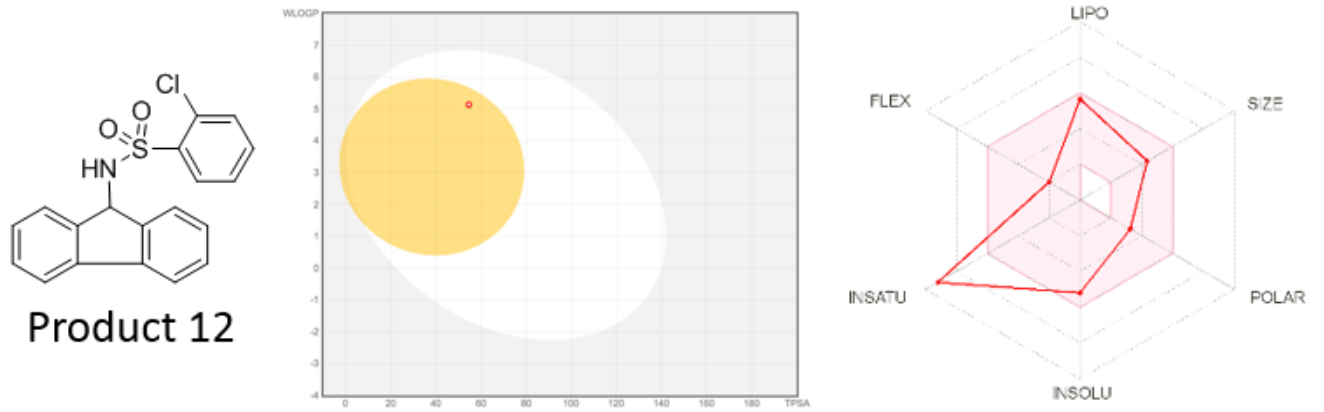
SMILES: ClC1=CC(=CC=C1)S(=O)(=O)NC1C2=C(C=CC=C2)C2=C1C=CC=C2

Figure S12. BOILED EGG and graphical physicochemical property summary of product **10**.



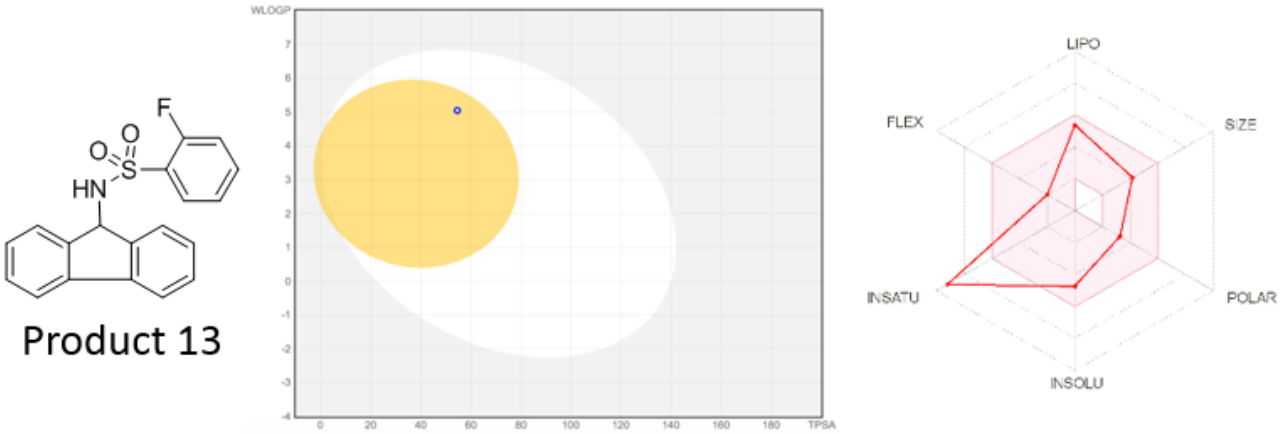
SMILES: FC1=CC(=CC=C1)S(=O)(=O)NC1C2=C(C=CC=C2)C2=C1C=CC=C2

Figure S13. BOILED EGG and graphical physicochemical property summary of product **11**.



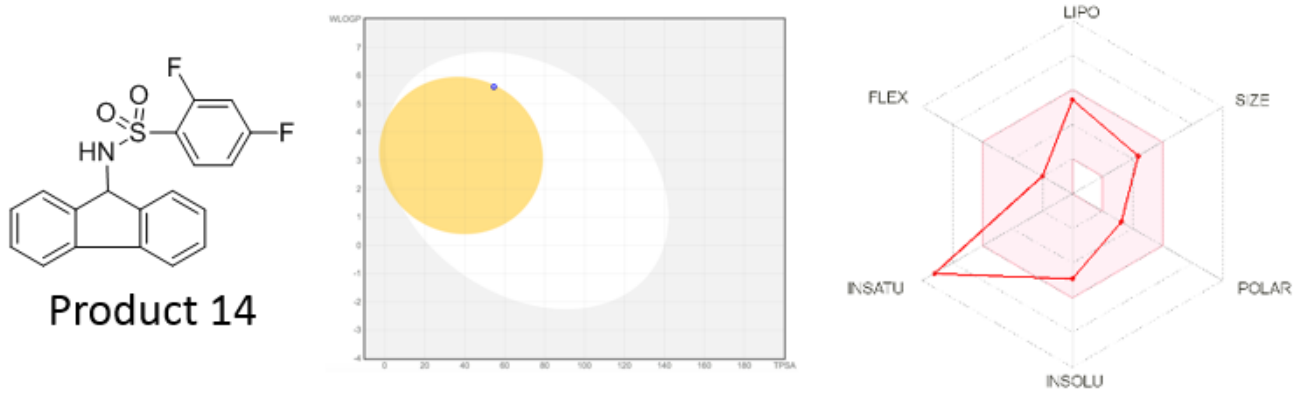
SMILES: ClC1=CC=CC=C1S(=O)(=O)NC1C2=C(C=CC=C2)C2=C1C=CC=C2

Figure S14. BOILED EGG and graphical physicochemical property summary of product **12**.



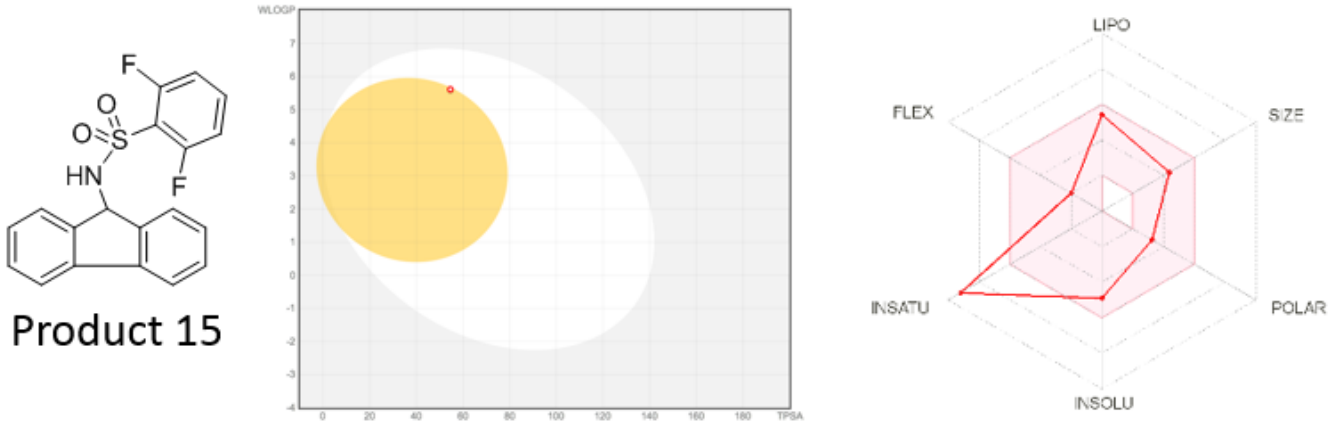
SMILES: FC1=CC=CC=C1S(=O)(=O)NC1C2=C(C=CC=C2)C2=C1C=CC=C2

Figure S15. BOILED EGG and graphical physicochemical property summary of product **13**.



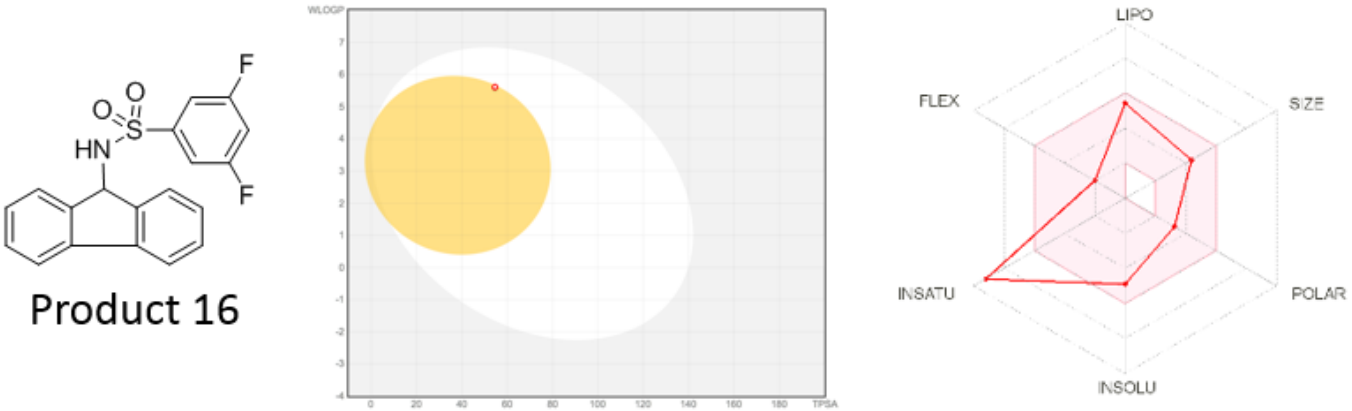
SMILES: FC1=CC=C(C(F)=C1)S(=O)(=O)NC1C2=C(C=CC=C2)C2=C1C=CC=C2

Figure S16. BOILED EGG and graphical physicochemical property summary of product **14**.



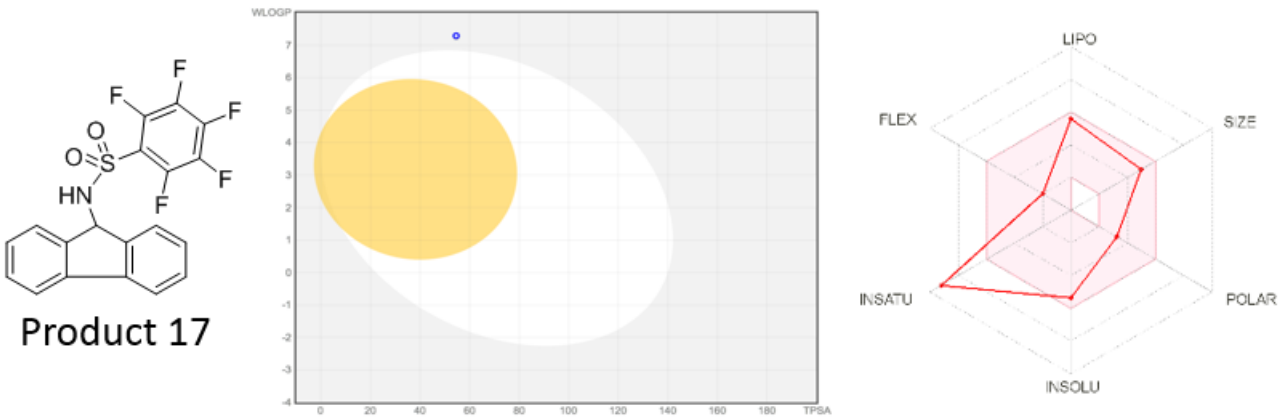
SMILES: FC1=CC=CC(F)=C1S(=O)(=O)NC1C2=C(C=CC=C2)C2=C1C=CC=C2

Figure S17. BOILED EGG and graphical physicochemical property summary of product **15**.



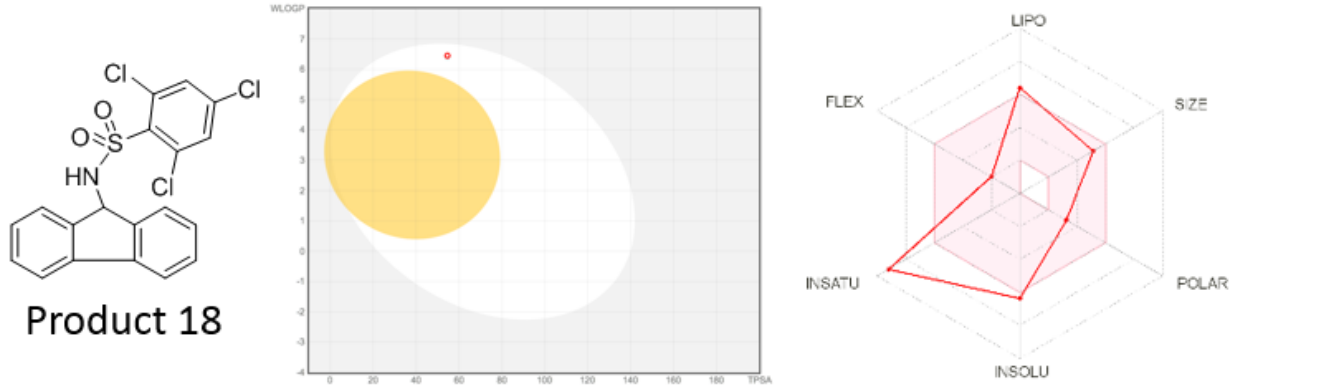
SMILES: FC1=CC(=CC(F)=C1)S(=O)(=O)NC1C2=C(C=CC=C2)C2=C1C=CC=C2

Figure S18. BOILED EGG and graphical physicochemical property summary of product **16**.



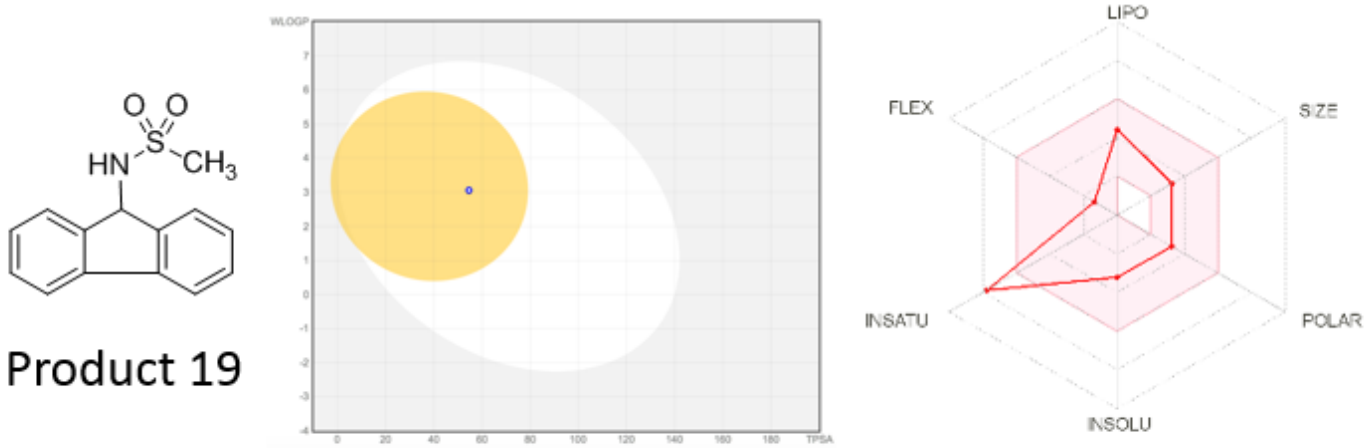
SMILES: FC1=C(F)C(F)=C(C(F)=C1F)S(=O)(=O)NC1C2=C(C=CC=C2)C2=C1C=CC=C2

Figure S19. BOILED EGG and graphical physicochemical property summary of product **17**.



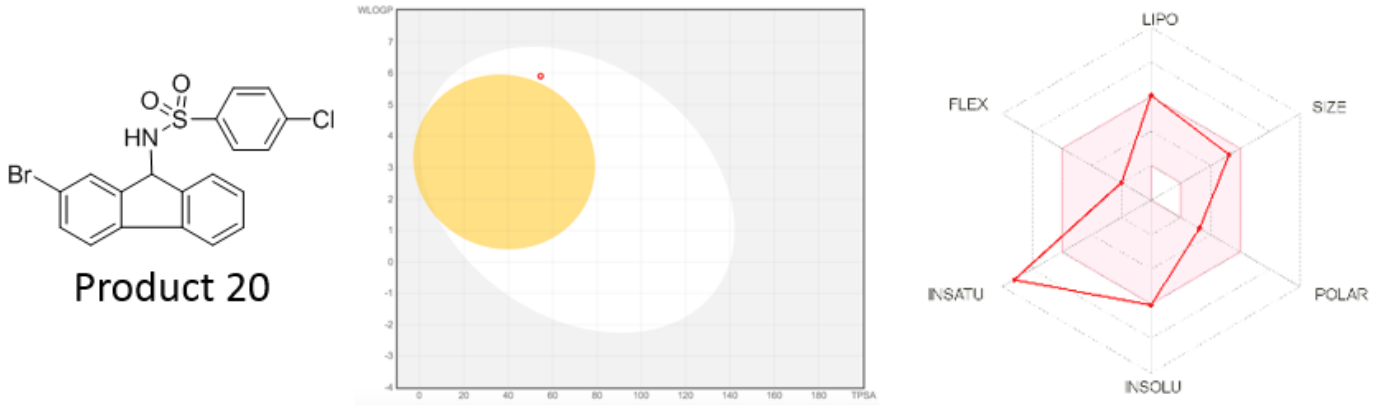
SMILES: ClC1=CC(Cl)=C(C(Cl)=C1)S(=O)(=O)NC1C2=C(C=CC=C2)C2=C1C=CC=C2

Figure S20. BOILED EGG and graphical physicochemical property summary of product **18**.



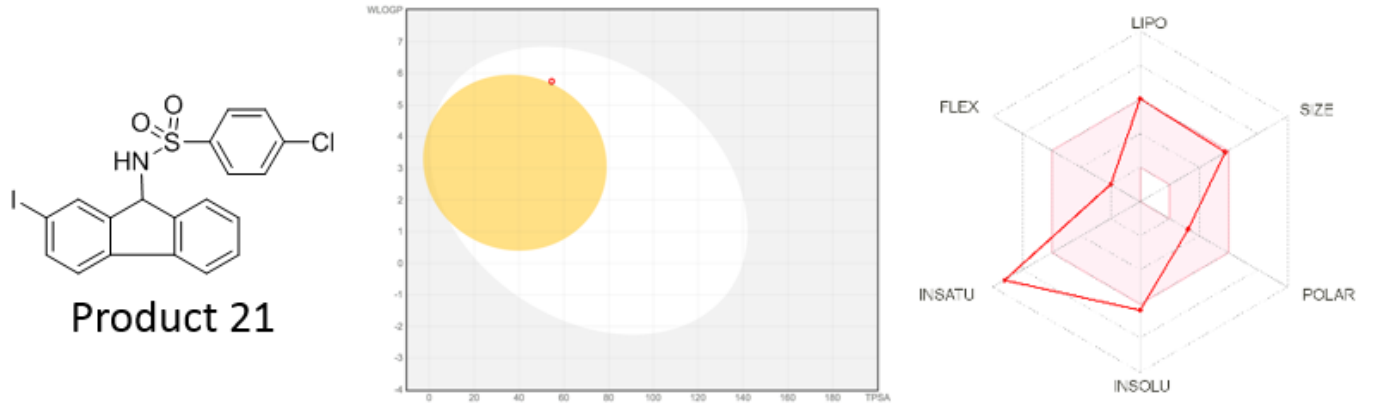
SMILES: CS(=O)(=O)NC1C2=C(C=CC=C2)C2=C1C=CC=C2

Figure S21. BOILED EGG and graphical physicochemical property summary of product **19**.



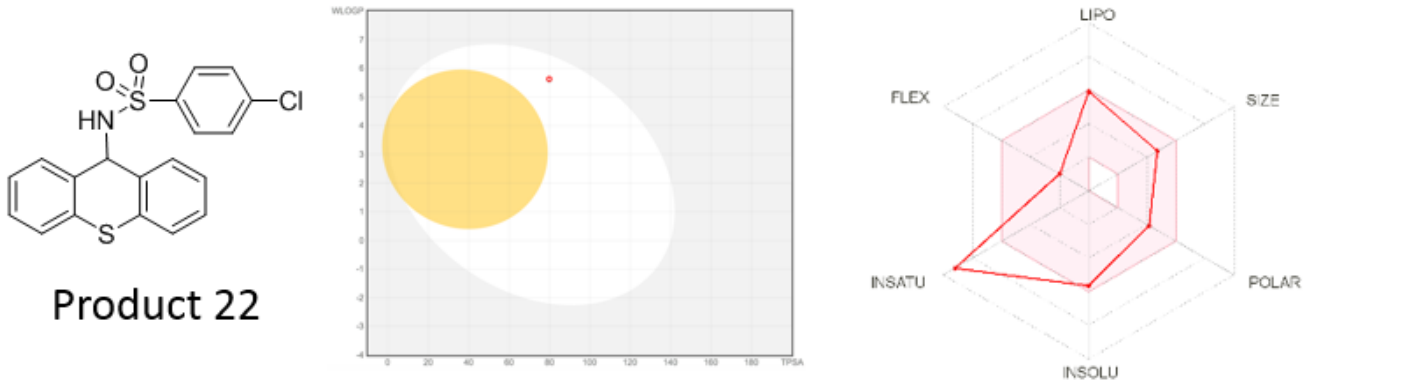
SMILES: ClC1=CC=C(C=C1)S(=O)(=O)NC1C2=C(C=CC=C2)C2=C1C=C(Br)C=C2

Figure S22. BOILED EGG and graphical physicochemical property summary of product **20**.



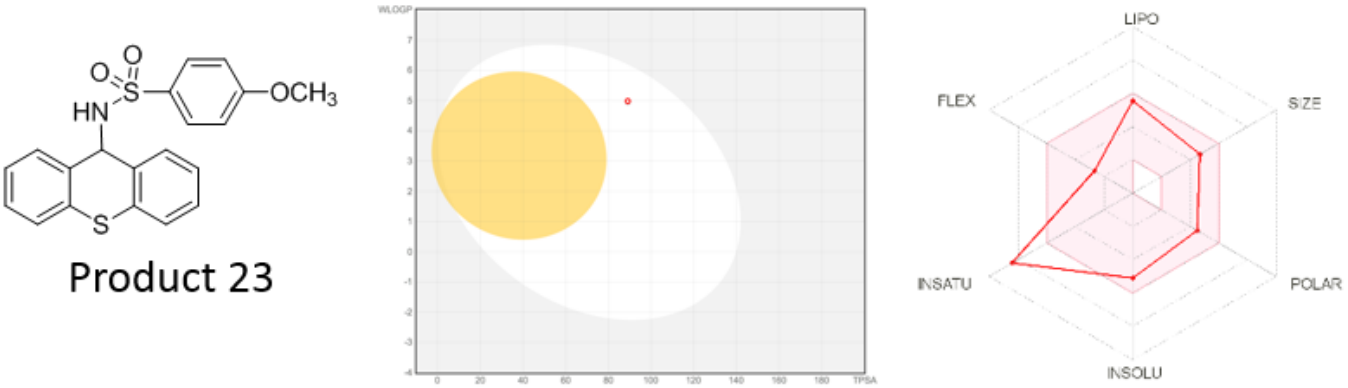
SMILES: ClC1=CC=C(C=C1)S(=O)(=O)NC1C2=C(C=CC=C2)C2=C1C=C(I)C=C2

Figure S23. BOILED EGG and graphical physicochemical property summary of product **21**.



SMILES: ClC1=CC=C(C=C1)S(=O)(=O)NC1C2=C(SC3=C1C=CC=C3)C=CC=C2

Figure S24. BOILED EGG and graphical physicochemical property summary of product **22**.



SMILES: COC1=CC=C(C=C1)S(=O)(=O)NC1C2=C(SC3=C1C=CC=C3)C=CC=C2

Figure S25. BOILED EGG and graphical physicochemical property summary of product **23**.

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Product Characterization:

All products were isolated according to general procedure unless otherwise noted and display the characterizational data shown below.

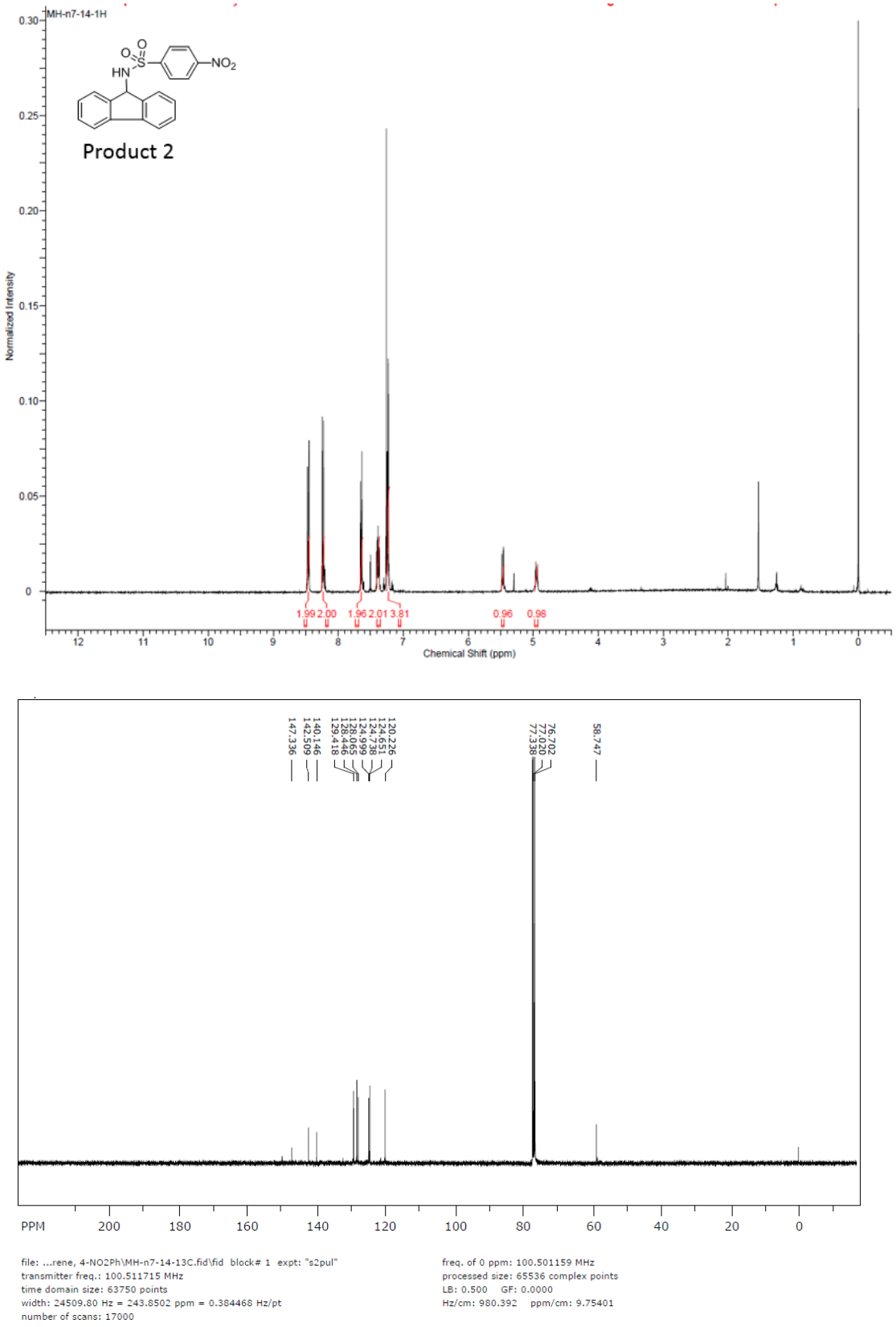

Figure S26. ^{1}H NMR and ^{13}C NMR of Product **2**.

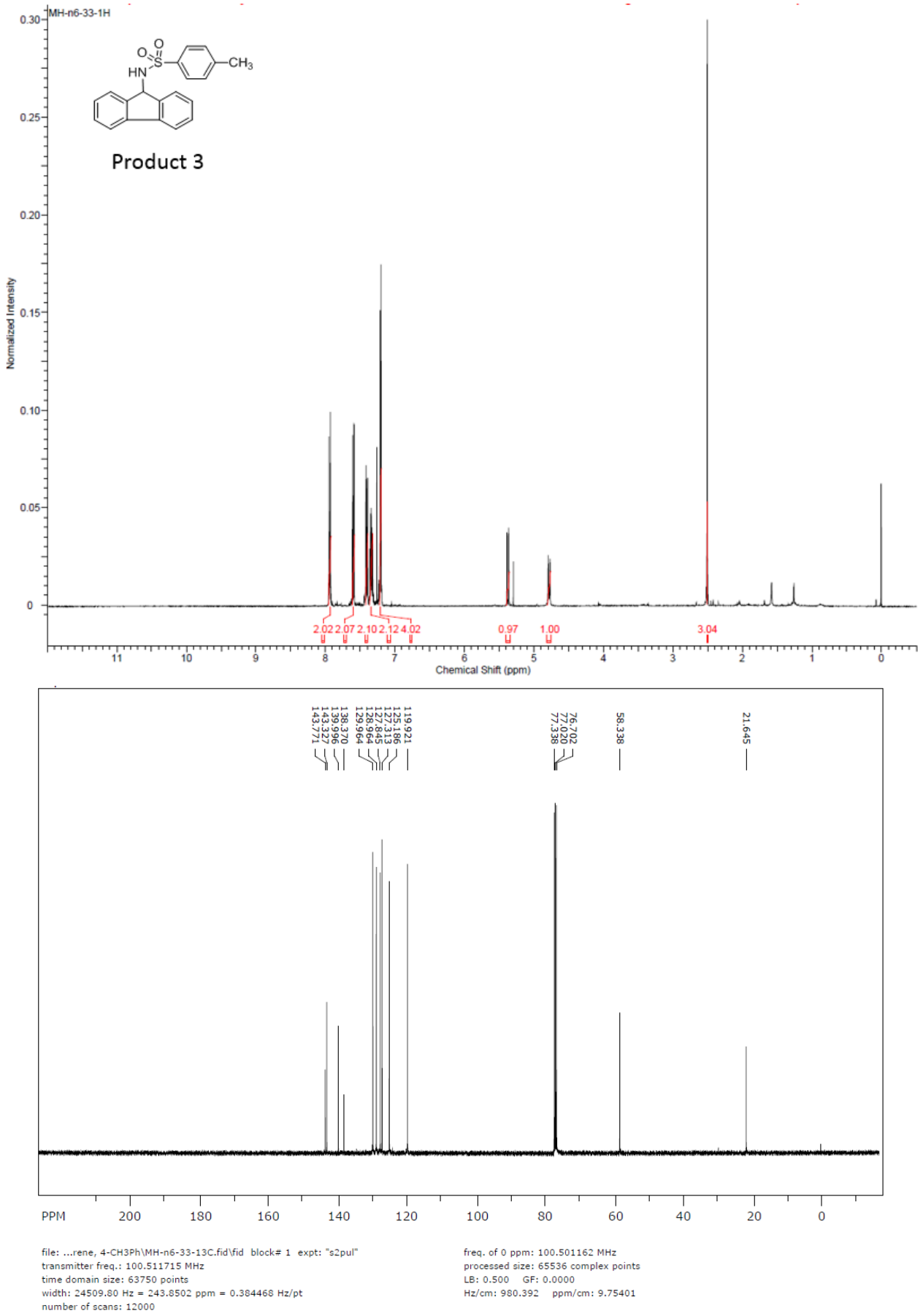

Figure S27. ^{1}H NMR and ^{13}C NMR of Product **3**.

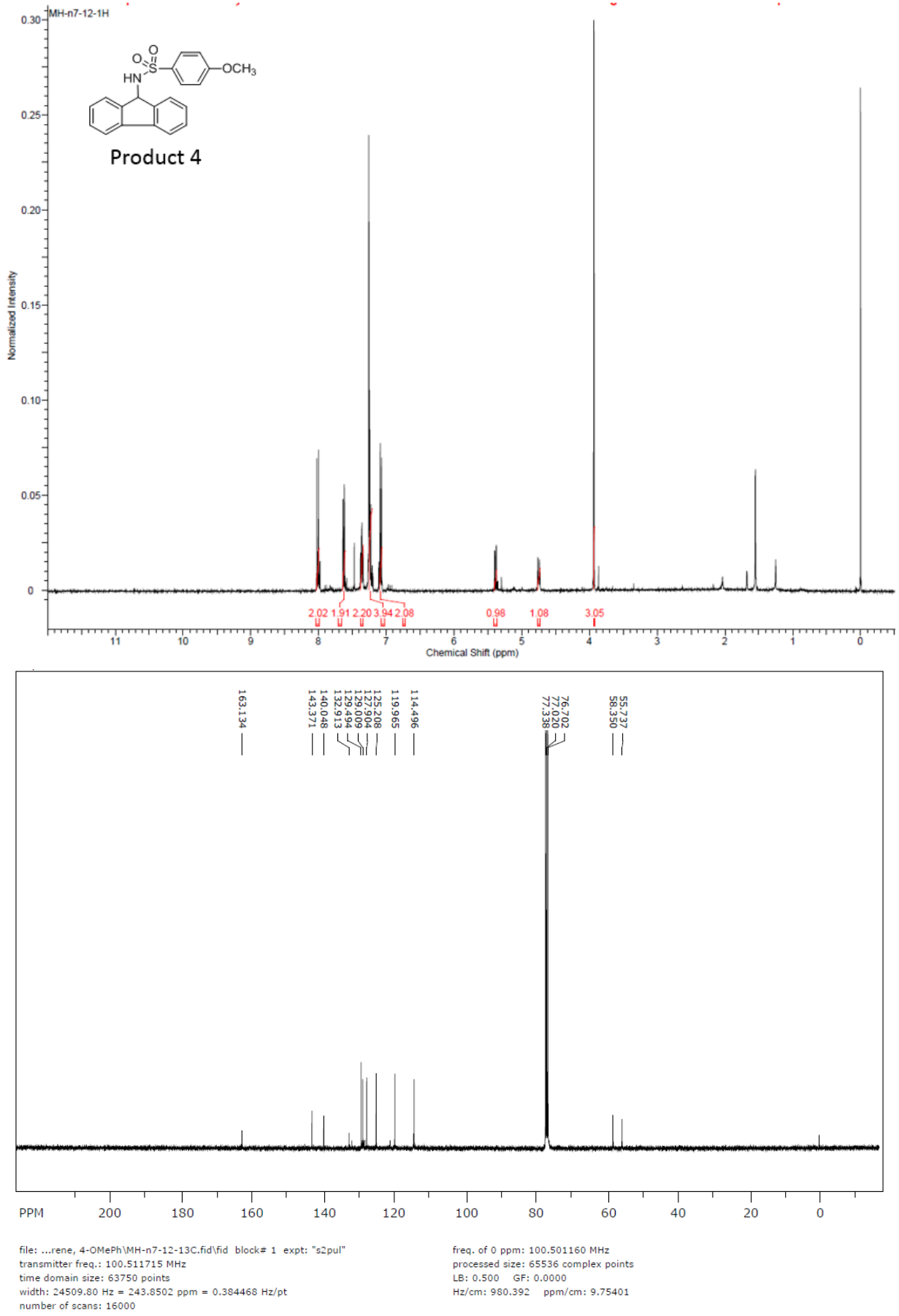

Figure S28. ^{1}H NMR and ^{13}C NMR of Product **4**.

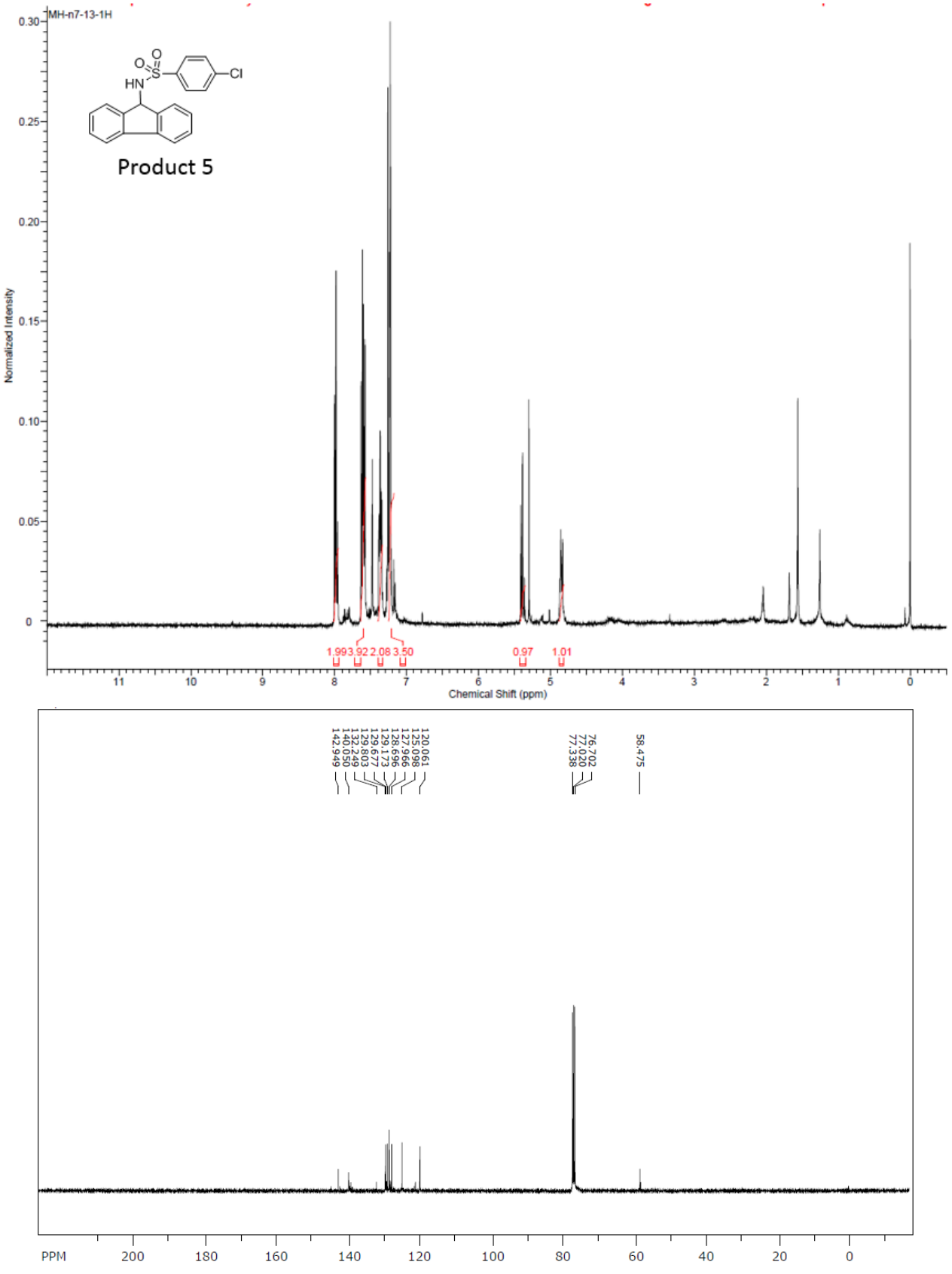

Figure S29. ^{1}H NMR and ^{13}C NMR of Product **5**.

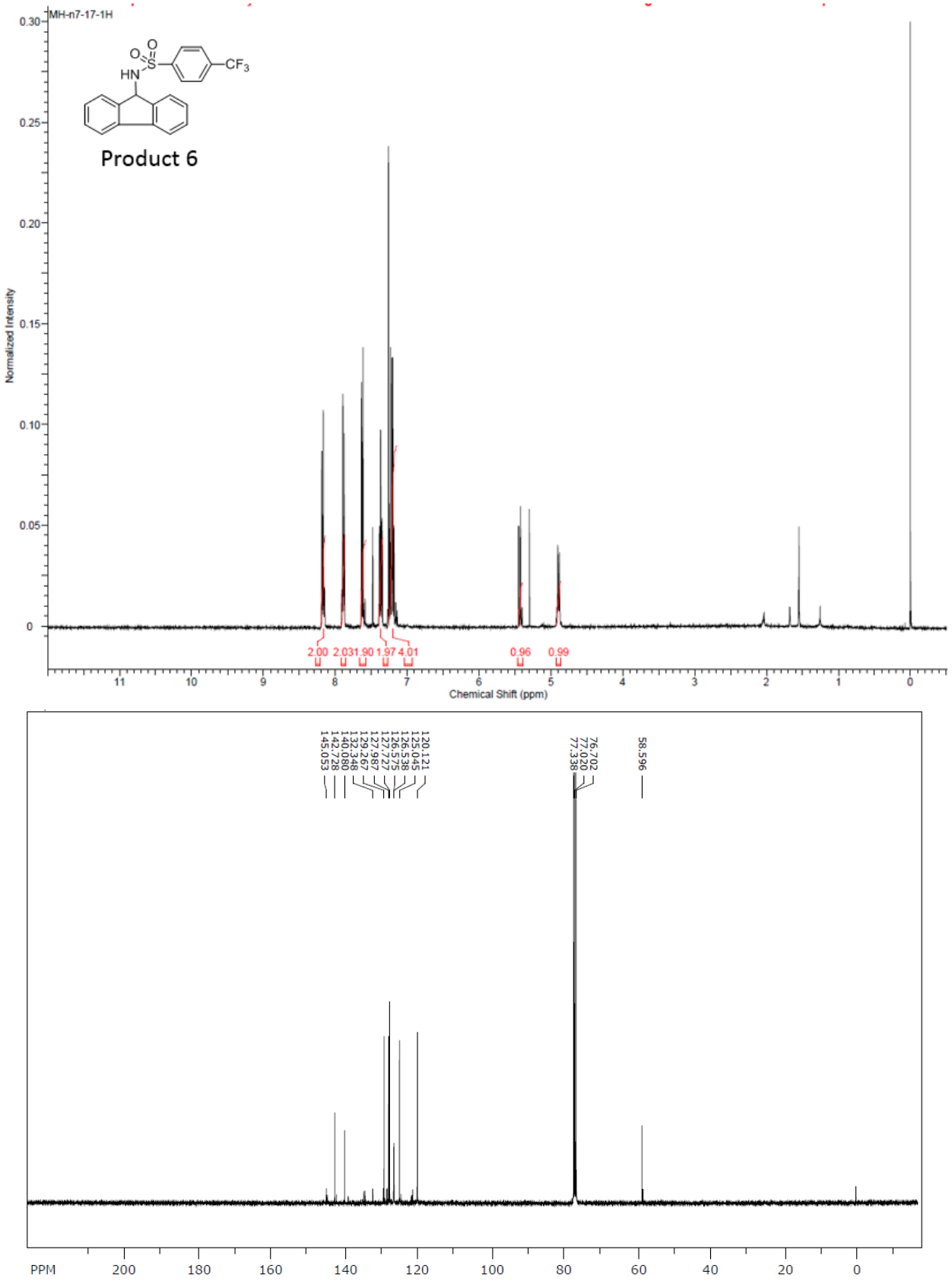

Figure S30. ^{1}H NMR and ^{13}C NMR of Product **6**.

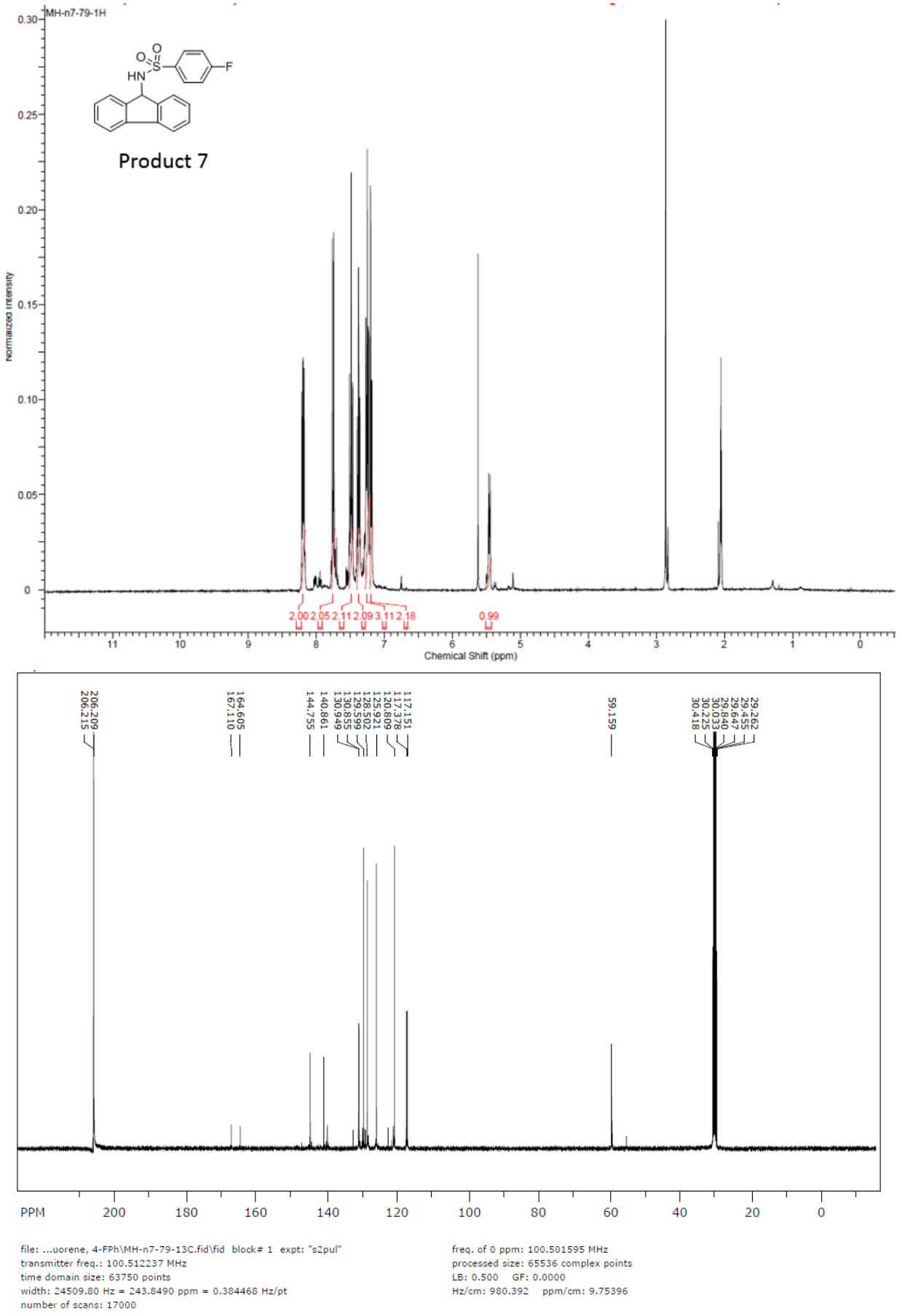

Figure S31. ^{1}H NMR and ^{13}C NMR of Product **7**.

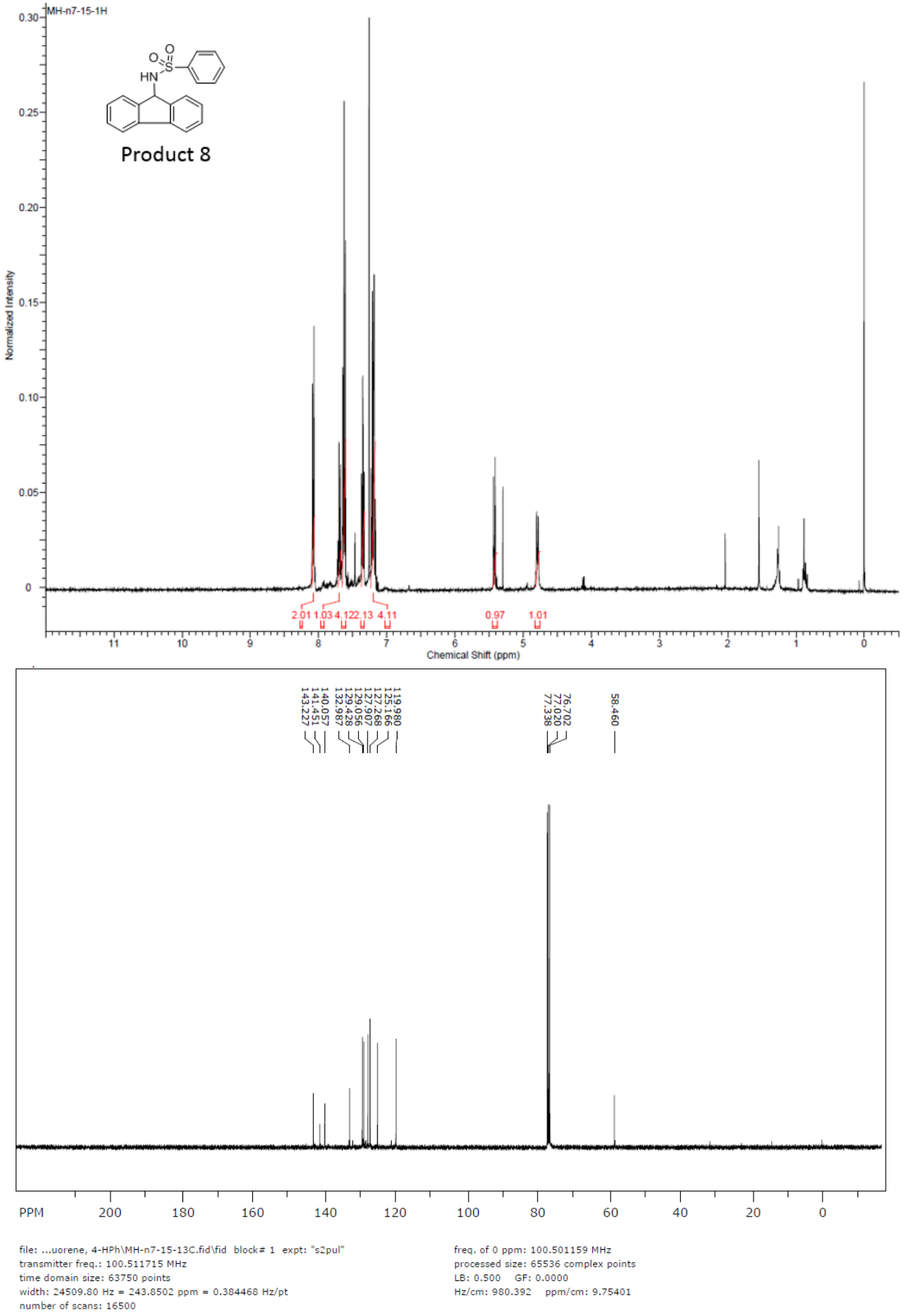

Figure S32. ^{1}H NMR and ^{13}C NMR of Product **8**.

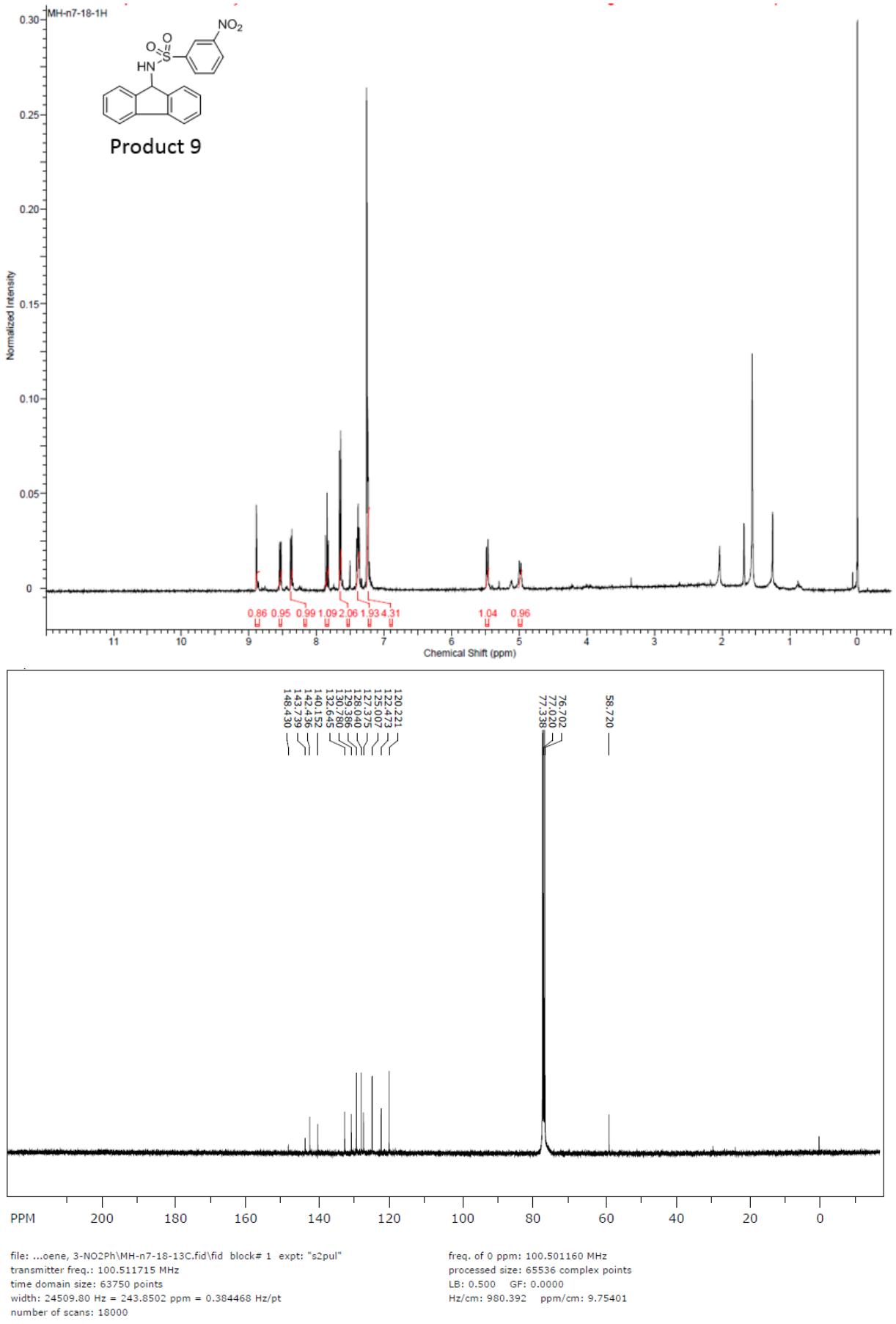

Figure S33. ^{1}H NMR and ^{13}C NMR of Product **9**.

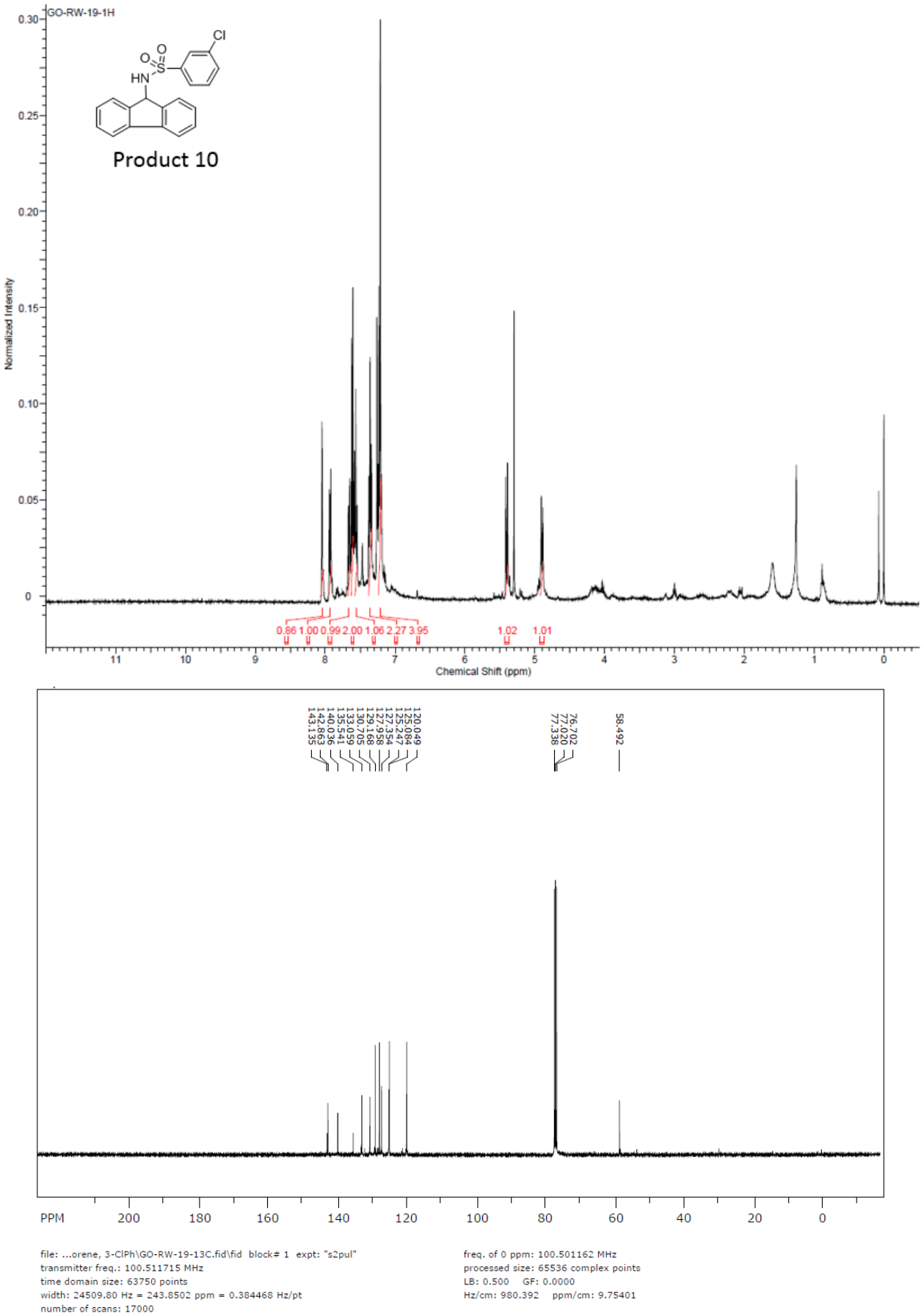

Figure S34. ^{1}H NMR and ^{13}C NMR of Product **10**.

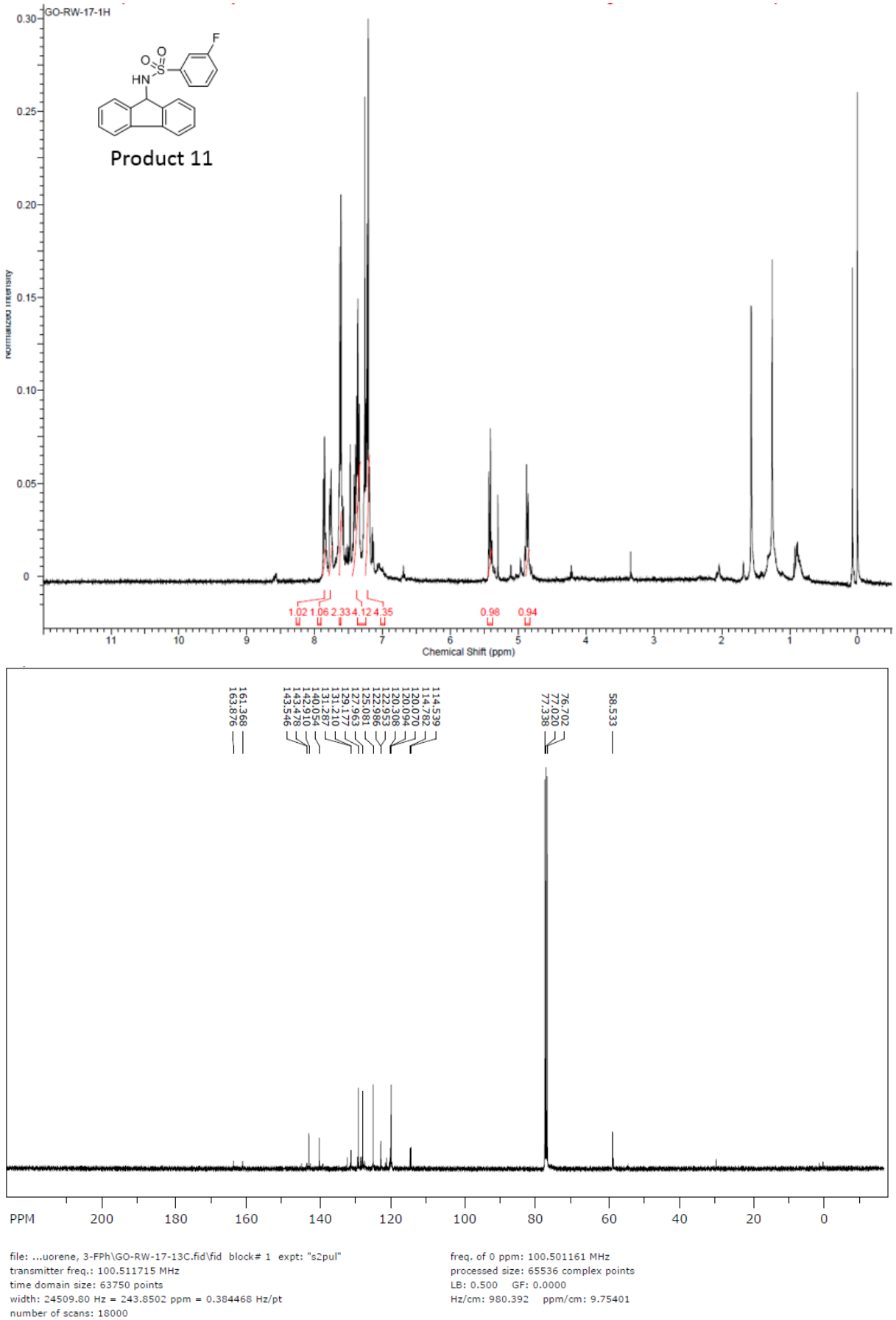

Figure S35. ^{1}H NMR and ^{13}C NMR of Product **11**.

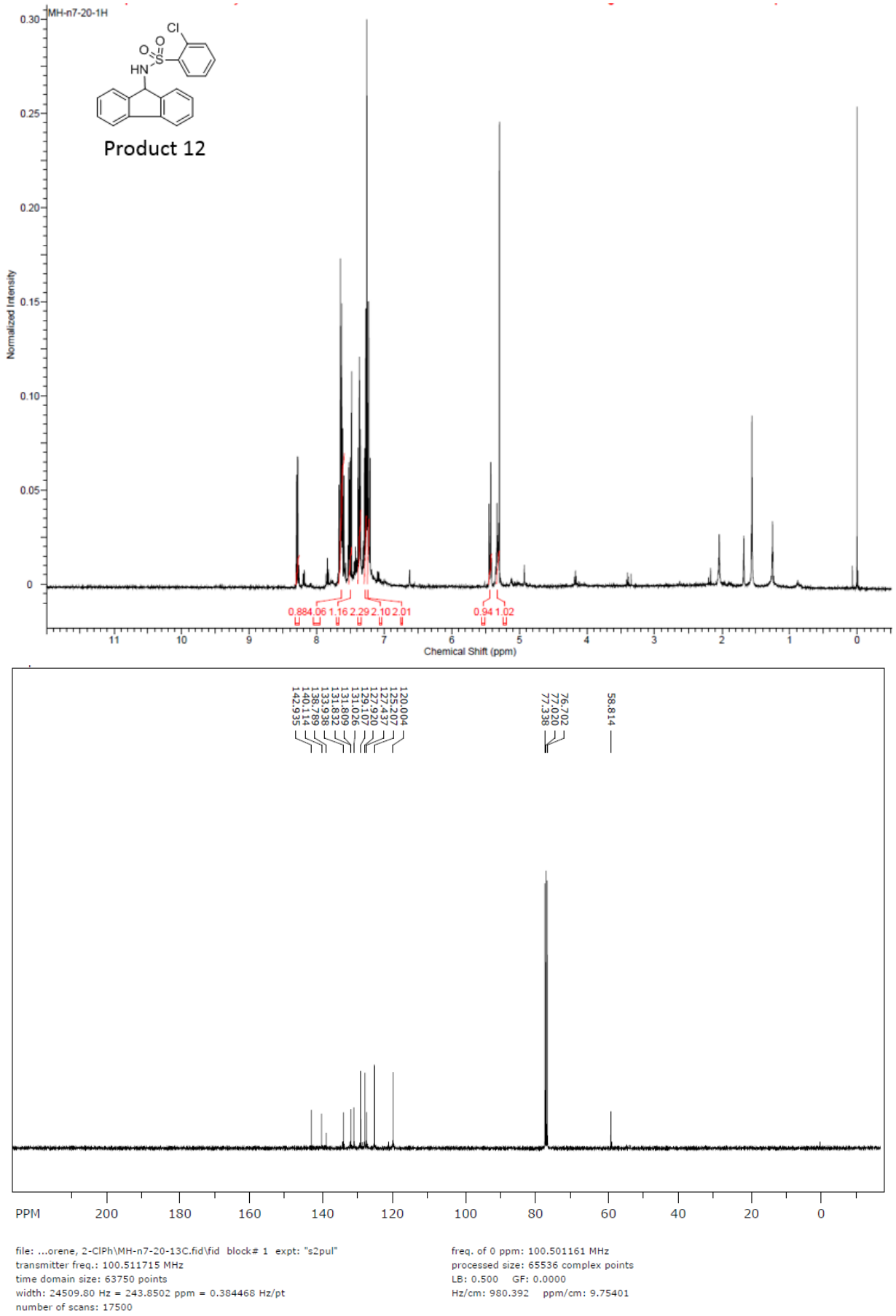

Figure S36. ^{1}H NMR and ^{13}C NMR of Product **12**.

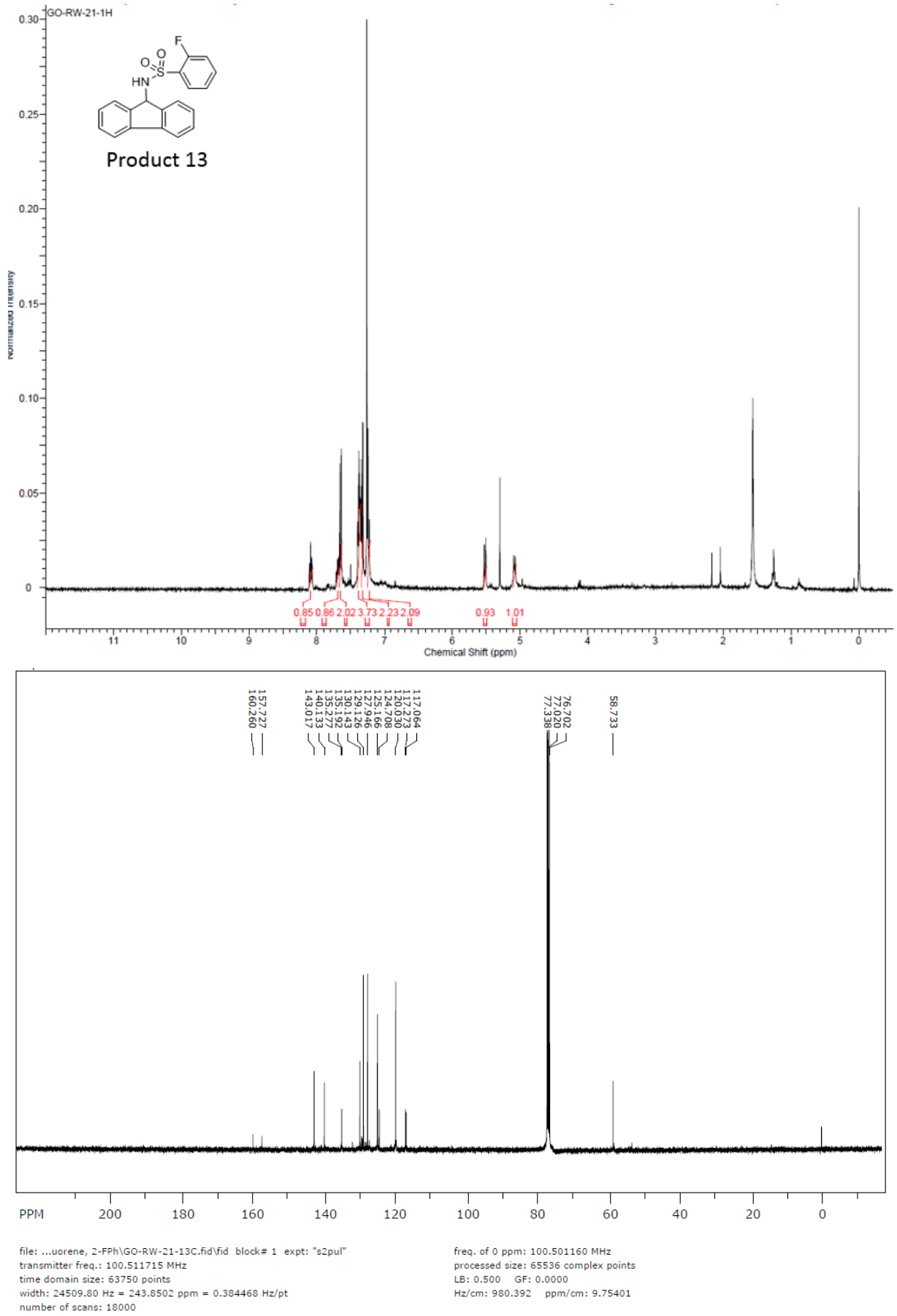

Figure S37. ^{1}H NMR and ^{13}C NMR of Product **13**.

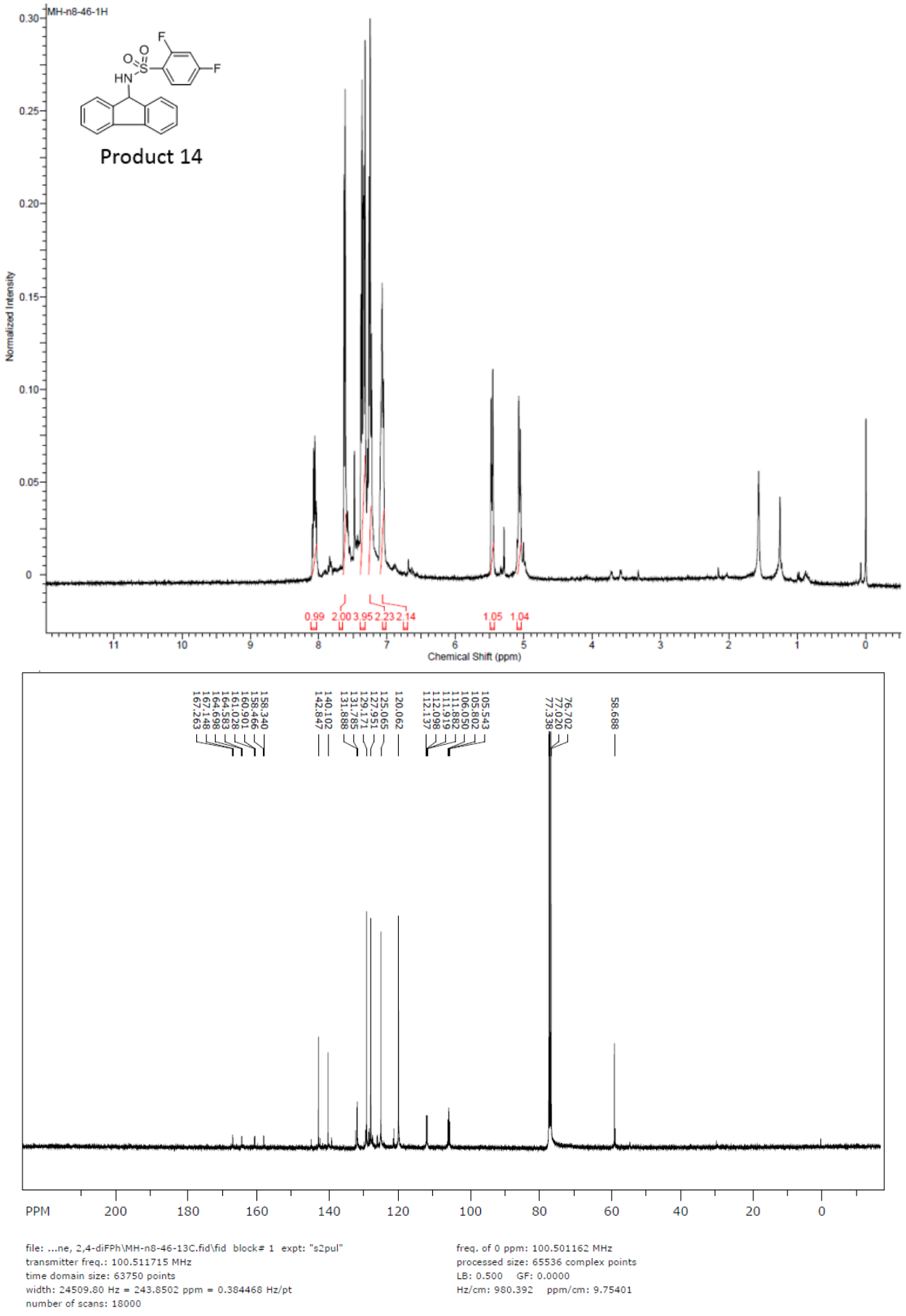

Figure S38. ^{1}H NMR and ^{13}C NMR of Product **14**.

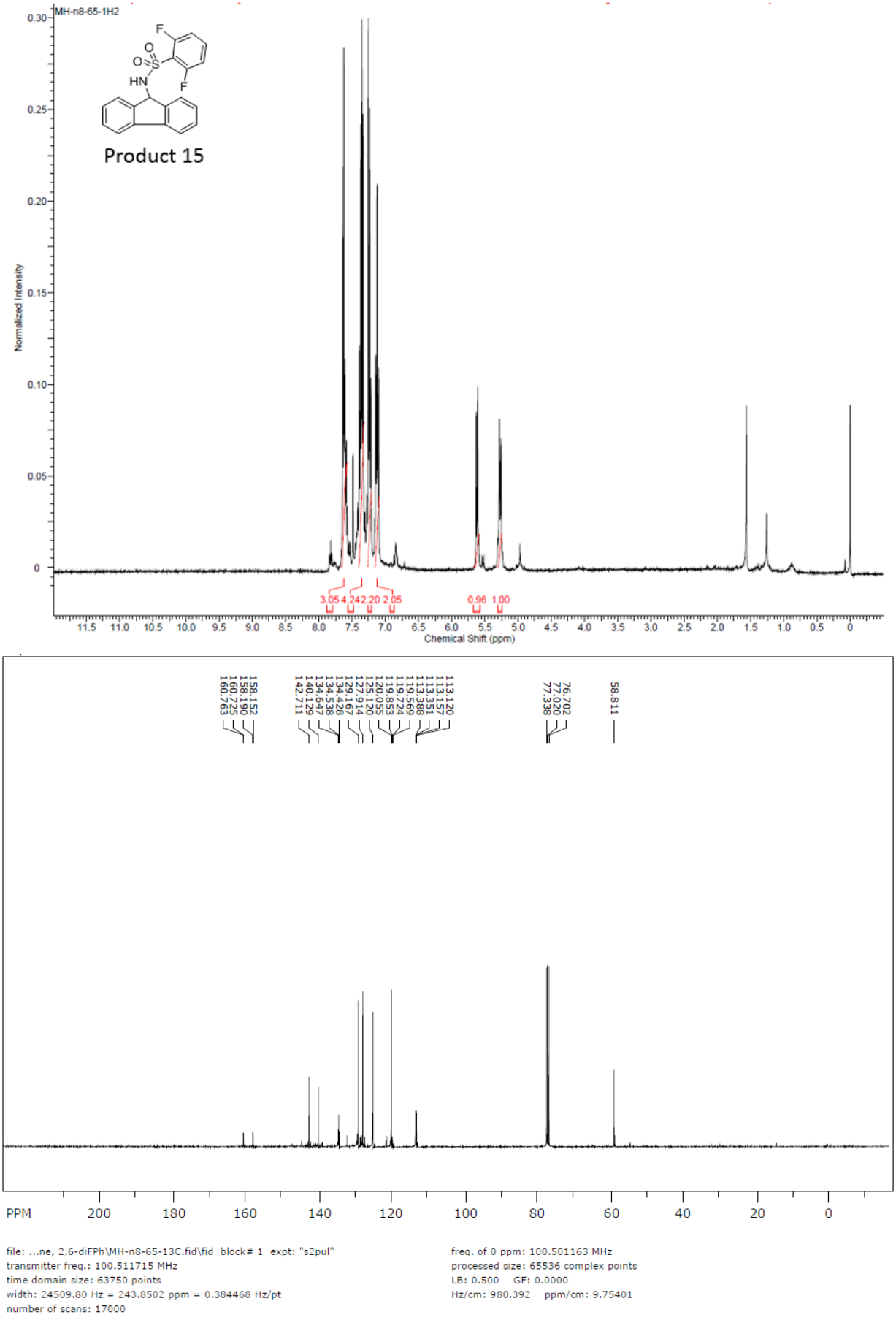

Figure S39. ^{1}H NMR and ^{13}C NMR of Product **15**.

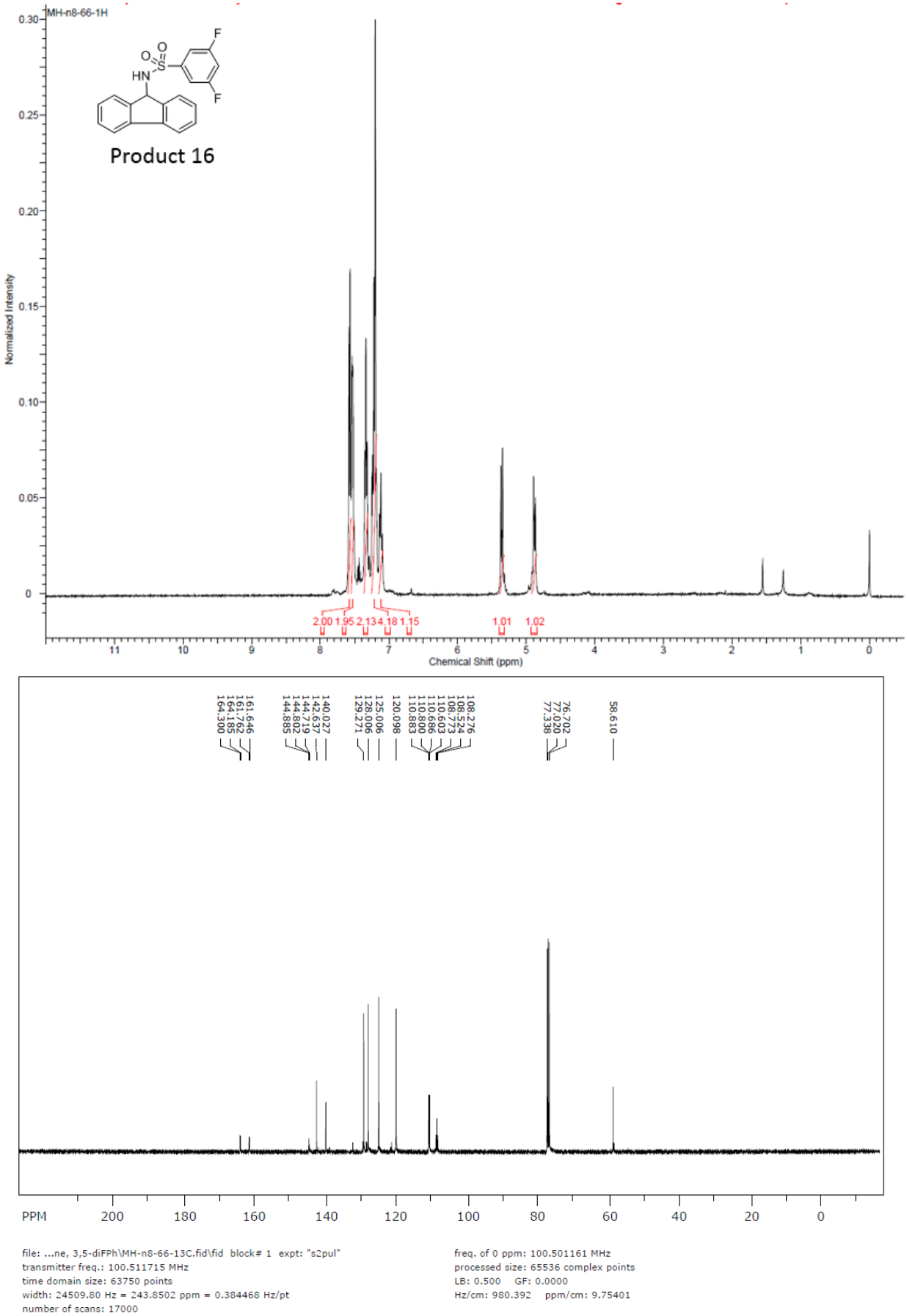

Figure S40. ^{1}H NMR and ^{13}C NMR of Product **16**.

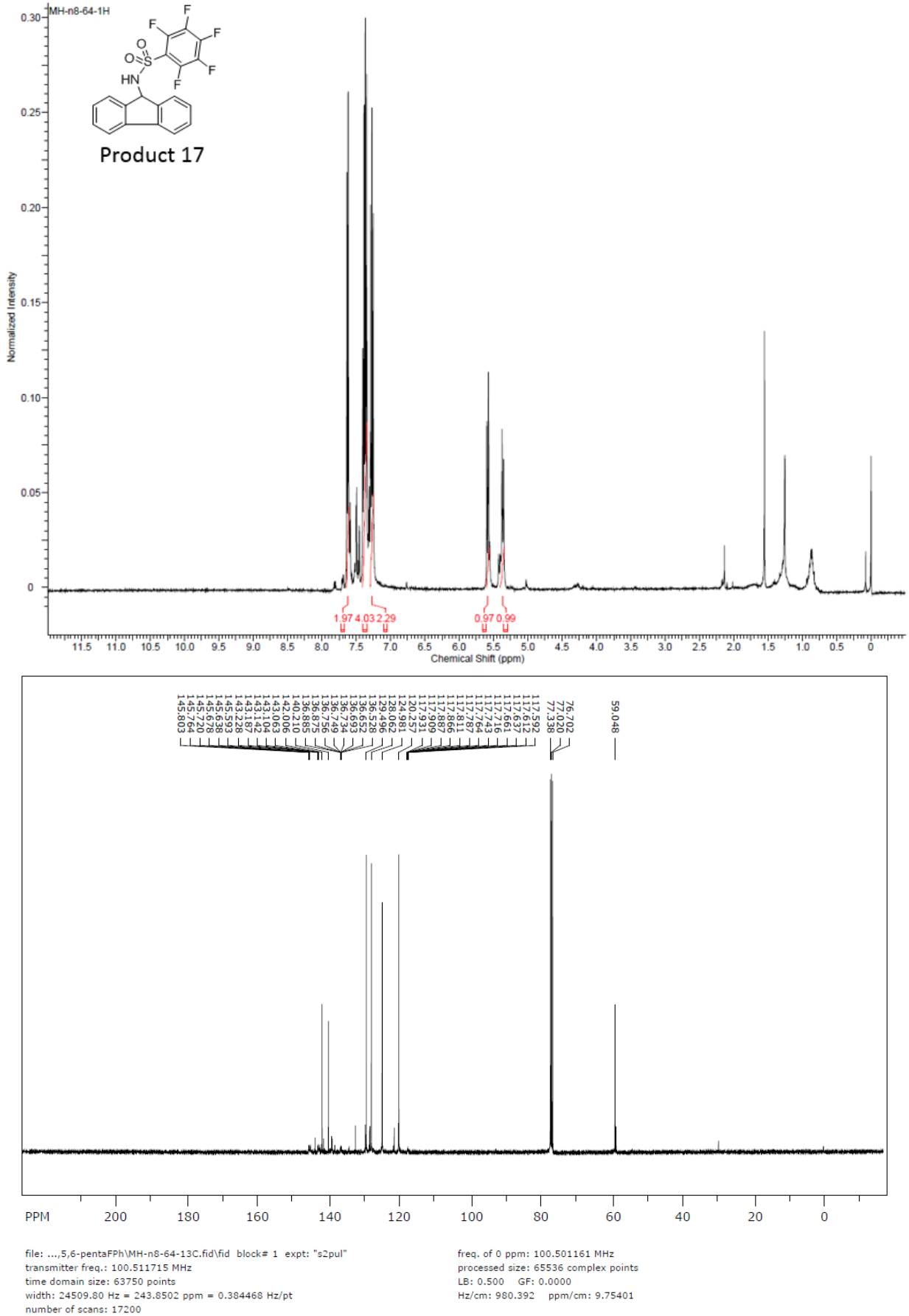

Figure S41. ^{1}H NMR and ^{13}C NMR of Product **17**.

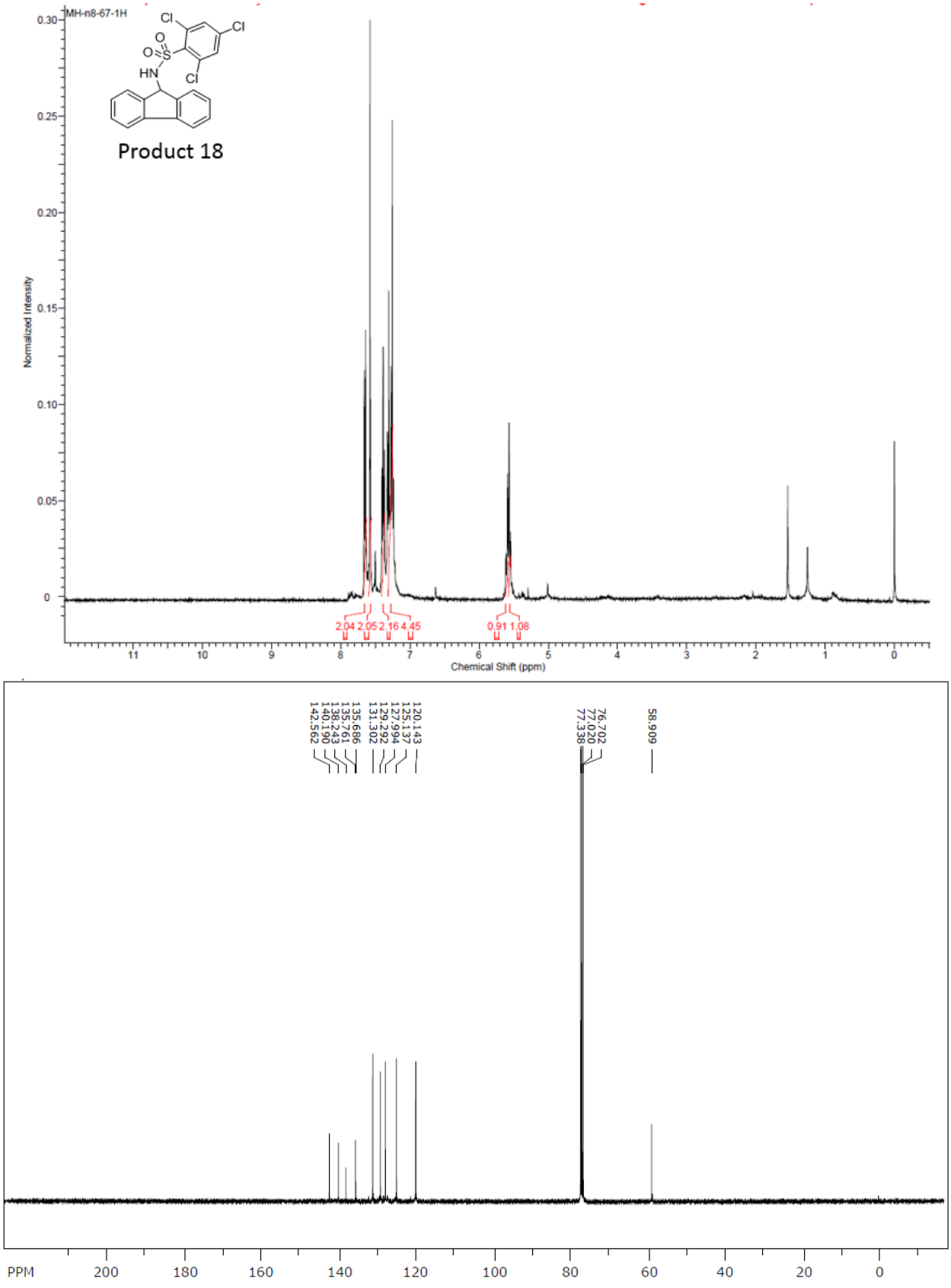

Figure S42. ^{1}H NMR and ^{13}C NMR of Product **18**.

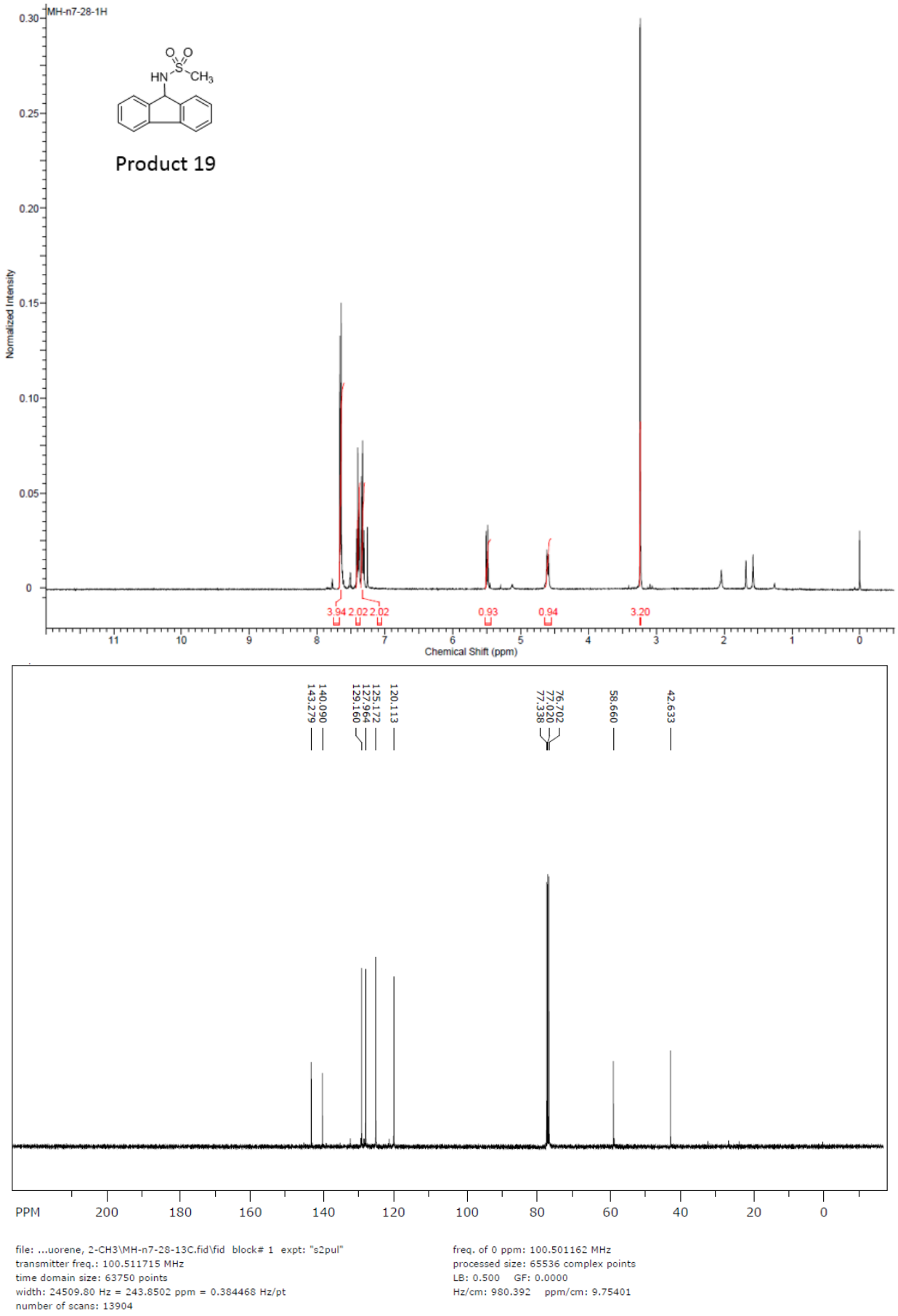

Figure S43. ^{1}H NMR and ^{13}C NMR of Product **19**.

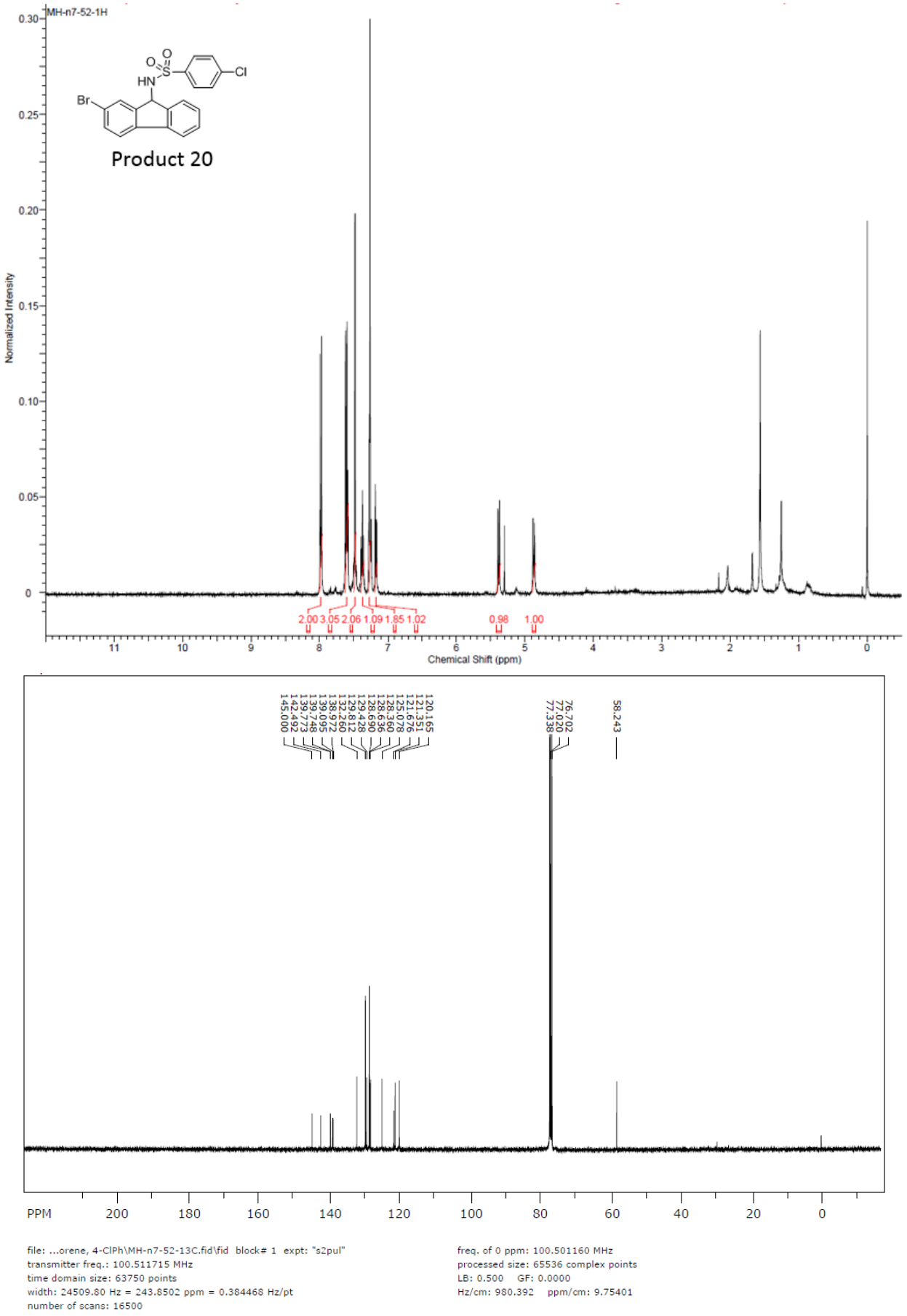

Figure S44. ^{1}H NMR and ^{13}C NMR of Product **20**.

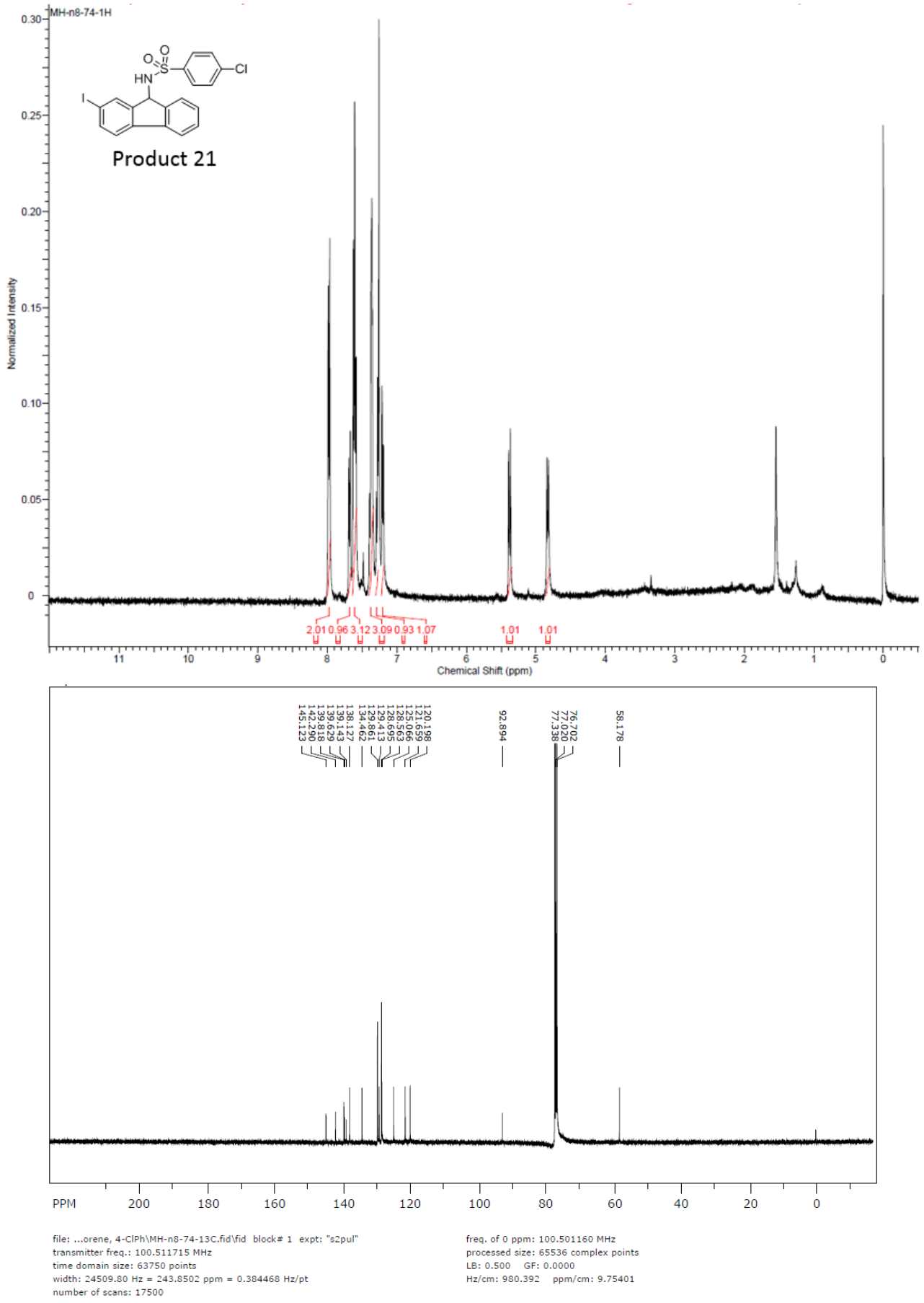

Figure S45. ^{1}H NMR and ^{13}C NMR of Product **21**.

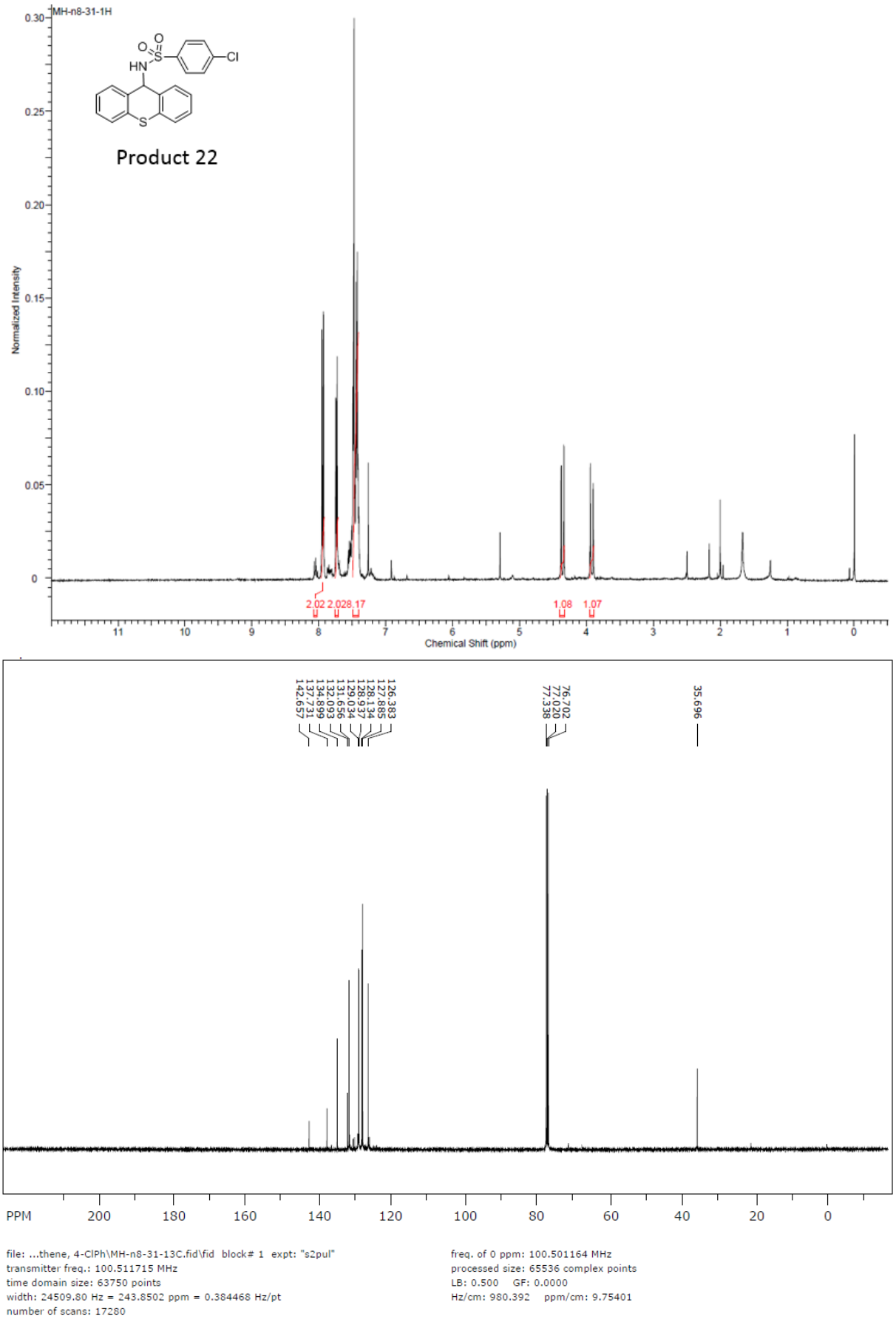

Figure S46. ^{1}H NMR and ^{13}C NMR of Product **22**.

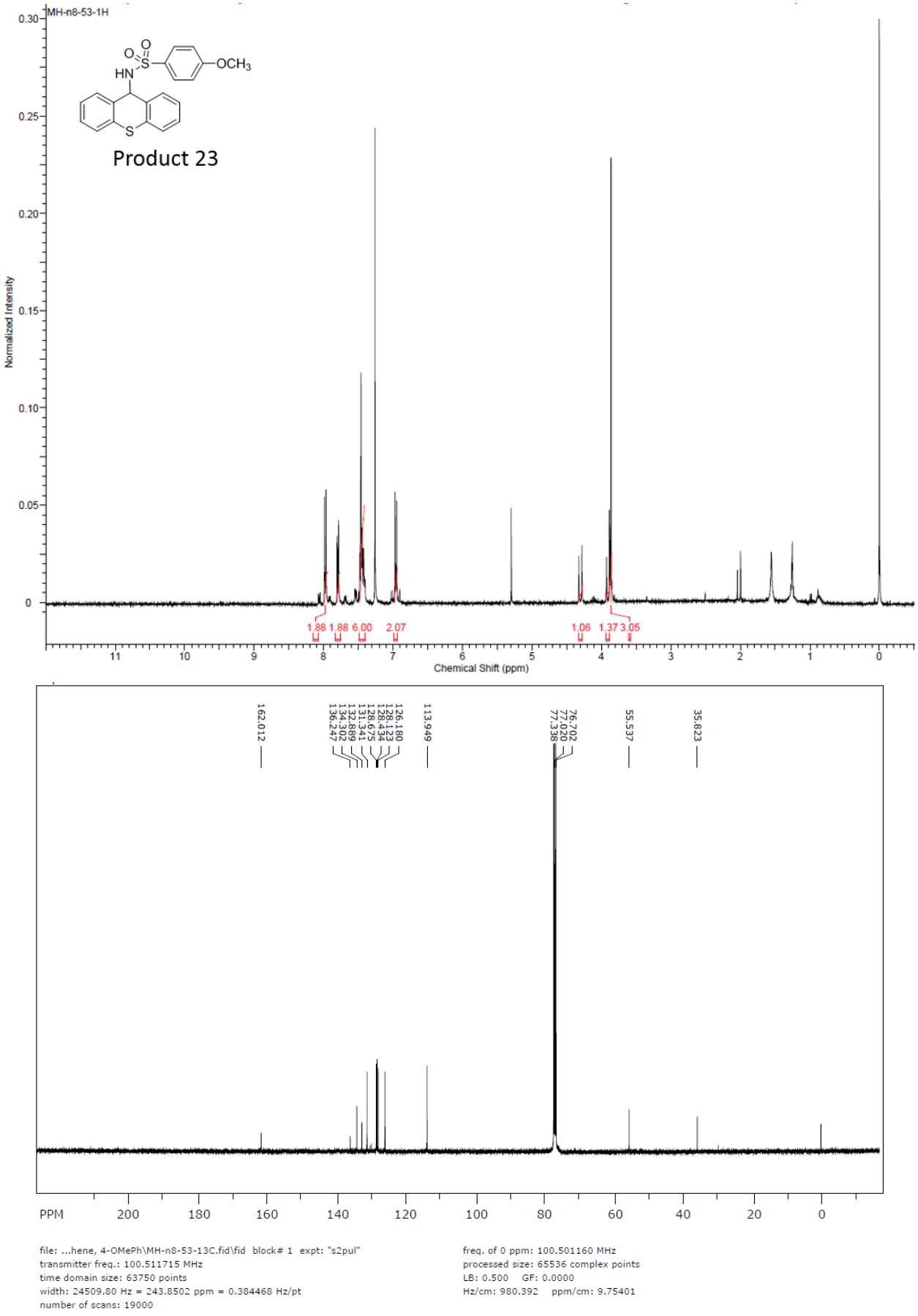

Figure S47. ^{1}H NMR and ^{13}C NMR of Product **23**.