Electronic Supplementary Material (ESI) for Organic Chemistry Frontiers.

Supplementary Information

One-pot Synthesis of 2-Naphthols from Nitrones and MBH Adducts via Decarboxylative N–O Bond Cleavage

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General methods

Commercially available reagents were used without additional purification, unless otherwise stated. Nitrone **1a** was purchased from Sigma-Aldrich. Nitrones **1b–1v** and Morita-Baylis-Hillman adducts (MBH adducts) **2a** and **2b** were prepared according to the reported literatures.[1,2] Sealed tubes (13 × 100 mm^2) were purchased from Fischer Scientific and dried in oven for overnight and cooled at room temperature prior to use. Thin layer chromatography was carried out using plates coated with Kieselgel 60 F_{254} (Merck). For flash column chromatography, E. Merck Kieselgel 60 (230–400 mesh) was used. Nuclear magnetic resonance spectra (^1H and ^{13}C NMR) were recorded on a Bruker Unity 400 and 500 spectrometers in $CDCl_3$ and CD_3OD solution and chemical shifts are reported as parts per million (ppm). Resonance patterns are reported with the notations s (singlet), d (doublet), t (triplet), q (quartet), dd (doublet of doublets), dt (doublet of triplets), br s (broad singlet) and m (multiplet). Coupling constants (*J*) are reported in hertz (Hz). IR spectra were recorded on a Varian 2000 Infrared spectrophotometer and are reported as cm^{-1}. High-resolution mass spectra (HRMS) were recorded on a JEOL JMS-600 spectrometer.

Density Functional Theory (DFT) calculation data

All the calculations were performed with Gaussian 09 software.[1] Geometry optimization of all species was carried out with the B3LYP functional[2] using the 6-31G(d) basis set. Frequency analysis was conducted to ensure the stationary point as minimum or transition state. For the solvent effect of dichloroethane, the single-point calculation on the optimized geometry with SMD solvation model.[3] The single-point calculation was carried out by using B3LYP-D3[4] with a 6-311+G(d,p) basis set.

- Cartesian coordinates of optimized structures (Å)

6d

Lowest three frequencies(cm^{-1}): 43.4106, 48.7947, 59.4029

C	4.39288400	0.01542200	-0.23731300
C	3.21574900	0.63249600	-0.66446800
C	1.97348000	0.03677300	-0.42784400
C	1.90160100	-1.19814200	0.24395900
C	3.08796800	-1.80841600	0.66812400
C	4.32680200	-1.20881000	0.43248300
H	5.35402700	0.48628500	-0.42675300
H	3.03999600	-2.76313400	1.18800100
C	0.67084800	0.69290600	-0.85662700
H	0.84857300	1.49119200	-1.57809800
N	0.01627200	1.24461400	0.35935100
C	-0.85472800	2.45456000	0.21852800
C	0.09784000	3.62910600	-0.07379000
H	-0.46111100	4.57080800	-0.03966300
H	0.89828800	3.67592100	0.67263800
H	0.55752200	3.55719600	-1.06560900
C	-1.51079500	2.68409800	1.59203700
H	-2.05103600	3.63747900	1.59256600
H	-2.22015900	1.88734300	1.83102700
H	-0.75158600	2.71650100	2.38151300
O	-0.81081600	0.11826500	0.85251500
C	-1.94378000	2.37023500	-0.86596300
H	-2.60238900	1.51426000	-0.69376100
H	-2.55781500	3.27866000	-0.84599700
H	-1.51595400	2.29057800	-1.87192300
C	0.55846300	-1.86898900	0.49002400
H	0.53059100	-2.84389700	-0.00907200
H	0.41768100	-2.06209100	1.56071800
C	-0.62369700	-1.01619300	-0.00819300
C	-0.28678700	-0.39332000	-1.37077400
H	0.19580400	-1.09979800	-2.05022900

H	-1.17323700	0.02397500	-1.84926600
C	-1.91978000	-1.83085300	-0.04339200
O	-1.95163300	-3.04386000	-0.11826100
O	-3.01409500	-1.05723000	-0.02966100
C	-4.27511900	-1.75329000	-0.11700100
H	-4.40036300	-2.42454100	0.73656300
H	-5.03747700	-0.97394000	-0.10185100
H	-4.33491800	-2.32695700	-1.04577700
H	3.25909600	1.58607100	-1.18647700
H	5.23722500	-1.69711300	0.77051300

Int1

Lowest three frequencies(cm^{-1}): 41.3531, 55.8873, 73.2557

C	-3.90986100	-1.29484700	-0.22392600
C	-2.60299600	-1.47443000	-0.67699300
C	-1.63963100	-0.48377200	-0.45671600
C	-1.96979500	0.70266100	0.22932400
C	-3.28541800	0.86389000	0.68027200
C	-4.24743600	-0.12300200	0.45869700
H	-4.65796300	-2.06244000	-0.40082100
H	-3.55677300	1.77425200	1.20991300
C	-0.21259500	-0.65359900	-0.92905600
H	-0.08585900	-1.49119300	-1.61226800
N	0.65097100	-0.92400700	0.32038400
C	1.88940500	-1.84713600	0.23797000
C	1.36549800	-3.24821400	-0.09821000
H	2.20342100	-3.95016200	-0.04475700
H	0.60606800	-3.57981100	0.62009100
H	0.94763800	-3.30857800	-1.10765900
C	2.51467100	-1.82993800	1.63954900
H	3.34419600	-2.54307100	1.65782100
H	2.90279400	-0.84112300	1.89301700
H	1.79137800	-2.13501900	2.40572900
O	1.02933100	0.37401300	0.81425000
C	2.86701700	-1.32014900	-0.80988900
H	3.11322800	-0.27024400	-0.62330500
H	3.78485500	-1.91373000	-0.74936000
H	2.47177800	-1.42478500	-1.82562200
C	-0.92629300	1.78814100	0.45204400
H	-1.22990100	2.71266100	-0.04973200
H	-0.85251800	2.03642400	1.51747200
C	0.46201100	1.41295400	-0.07085800
C	0.35743700	0.67996500	-1.40489000
H	-0.32978200	1.17010300	-2.09853700
H	1.33674600	0.58224200	-1.87219300
C	1.51732600	2.59366400	-0.09355500
O	1.04215100	3.73453000	0.09806600
O	2.69416000	2.24105500	-0.33938500
H	-2.32852800	-2.38088700	-1.21133500

H	-5.26289000	0.02388900	0.81713100
H	0.04414500	-1.32438900	1.04571700

Int1-TS

Lowest three frequencies(cm^{-1}): -433.2132, 53.1145, 63.9309

C	-3.91734200	-1.18480100	-0.30413700
C	-2.60397200	-1.39485200	-0.72344000
C	-1.61481700	-0.44140900	-0.45512300
C	-1.93092800	0.73915900	0.24476300
C	-3.25470800	0.93359100	0.66143300
C	-4.23986200	-0.01749400	0.39409500
H	-4.68295800	-1.92506400	-0.51945700
H	-3.51287700	1.84276300	1.20003200
C	-0.17393500	-0.65697000	-0.87419200
H	-0.07096000	-1.41368200	-1.65513500
N	0.60434300	-1.07429000	0.30869000
C	1.74998100	-2.04079600	0.25727500
C	1.17110200	-3.43634600	-0.04746800
H	1.97963700	-4.17460200	-0.01035500
H	0.41459100	-3.72353100	0.69186400
H	0.72033600	-3.47912300	-1.04417900
C	2.38820100	-2.03174100	1.65481200
H	3.19218400	-2.77336800	1.68909400
H	2.80779800	-1.05068400	1.89025900
H	1.65426700	-2.29354700	2.42686800
O	1.20171000	0.57714200	0.81878000
C	2.76730900	-1.62237300	-0.80718500
H	3.14944400	-0.61736900	-0.61262800
H	3.60700800	-2.32430700	-0.78235700
H	2.34225300	-1.65430000	-1.81565700
C	-0.86931500	1.80118100	0.51087300
H	-1.16871700	2.73665100	0.02582800
H	-0.80499000	2.01929100	1.58320400
C	0.51973100	1.39676400	0.00263200
C	0.44330500	0.70407900	-1.34187500
H	-0.21280300	1.18780100	-2.07022900
H	1.43574200	0.56744300	-1.76849900
C	1.63990400	2.78995000	-0.13399600
O	2.68997600	2.47954300	-0.67972000
O	1.11676300	3.79315000	0.33745400
H	-2.34222200	-2.29962000	-1.26735300
H	-5.26024900	0.15361400	0.72713500
H	0.00659400	-1.28467200	1.10782100

Int2

Lowest three frequencies(cm^{-1}): 15.0726, 24.3776, 32.5054

C	1.77619800	-3.68694400	0.11975500
C	2.00176700	-2.38230900	-0.32178300
C	0.97201200	-1.43411100	-0.31195500
C	-0.30589200	-1.80097700	0.14843700
C	-0.52669500	-3.11475500	0.57957400
C	0.50600800	-4.05379300	0.57093300
H	2.58373000	-4.41423900	0.10397700
H	-1.51738100	-3.40303100	0.92452100
C	1.20290000	-0.00866200	-0.78657900
H	2.09017000	-0.00026800	-1.43327300
N	1.37314700	0.88279400	0.38924200
C	2.38942500	1.96986000	0.32690300
C	3.82390300	1.42635800	0.15120700
H	4.55719300	2.24220300	0.16093900
H	4.07883000	0.73568300	0.96506000
H	3.94431600	0.89131100	-0.79793500
C	2.29060800	2.70514400	1.67438800
H	3.01219300	3.52859500	1.72473700
H	1.28489600	3.11518700	1.81966900
H	2.50255000	2.02427500	2.50924100
O	-2.20279800	1.16462900	-0.96547500
C	2.06130000	2.94943000	-0.81028700
H	1.04034900	3.33536300	-0.71297200
H	2.75187700	3.80029300	-0.78247300
H	2.16154300	2.48217700	-1.79635500
C	-1.41931200	-0.77630600	0.19018100
H	-2.39901800	-1.24846700	0.04940700
H	-1.45831700	-0.29586100	1.17915100
C	-1.29353700	0.36194800	-0.81737100
C	-0.01367800	0.43850200	-1.62159800
H	-0.12602100	-0.23436700	-2.48590300
H	0.09610400	1.45367100	-2.00758600
C	-4.62966700	0.99229000	0.42530000
O	-4.23963300	1.70299200	1.26756200
O	-5.07647700	0.27681600	-0.38463600
H	2.98605900	-2.09422600	-0.68420400
H	0.31735600	-5.06965800	0.90833600
H	1.62076300	0.30226100	1.18874700

Int3

Lowest three frequencies(cm^{-1}):

C	2.90836000	-2.13654100	0.33364500
C	1.61247000	-1.76115300	0.69220900
C	1.11459400	-0.49665500	0.35764700
C	1.93054000	0.40790400	-0.34680000
C	3.23238900	0.02703000	-0.69420800
C	3.72093100	-1.23762400	-0.36131800
H	3.28332400	-3.12063000	0.60253900

H	3.86833300	0.72904300	-1.22921800
C	-0.29341600	-0.07056700	0.74020100
H	-0.63637000	-0.71335800	1.56144300
N	-1.18395300	-0.17344500	-0.44510900
C	-2.56965700	-0.68521300	-0.25959200
C	-2.59902300	-2.14209400	0.25150800
H	-3.62909800	-2.51369100	0.31704600
H	-2.04611400	-2.80285000	-0.42823300
H	-2.15582500	-2.23545600	1.24965300
C	-3.22094500	-0.62763200	-1.65227600
H	-4.25409400	-0.99191600	-1.61646600
H	-3.22809100	0.39928700	-2.03460000
H	-2.67120200	-1.25194700	-2.36881700
O	-0.05349200	3.48384200	0.09497800
C	-3.35429400	0.21897400	0.70278200
H	-3.33317700	1.26173000	0.36650600
H	-4.40098500	-0.10344800	0.74811800
H	-2.95592300	0.17610300	1.72262900
C	1.38918900	1.76753300	-0.73258600
H	2.19180400	2.50942300	-0.81474100
H	0.92259000	1.72048900	-1.72799700
C	0.31490100	2.32544200	0.19875500
C	-0.25022600	1.38534300	1.24515500
H	0.40408000	1.44386300	2.12889100
H	-1.23513200	1.74985800	1.54422000
H	0.97960400	-2.45351600	1.24309100
H	4.73427400	-1.51696700	-0.63801400
H	-0.73727100	-0.79112700	-1.12084600

CO_2

Lowest three frequencies(cm^{-1}): 623.9334, 623.9334, 1373.9776

C	0.00000000	0.00000000	0.00000000
O	0.00000000	0.00000000	1.16895400
O	0.00000000	0.00000000	-1.16895400

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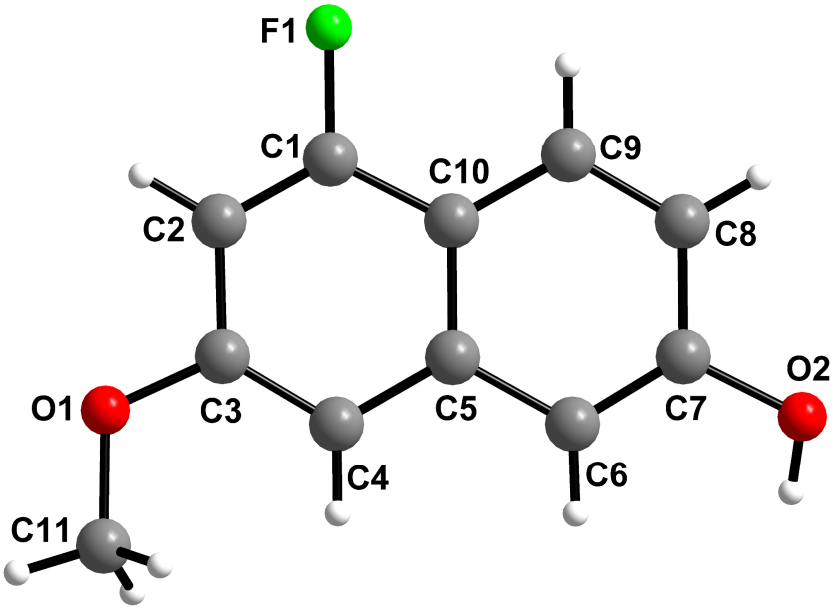
[4] Grimme, S.; Antony, J.; Ehrlich, S.; Krieg, H. *J. Chem. Phys.* **2010**, *132*, 154104.

X-ray crystallographic data of compound 3pa (CCDC 1858383)

A colorless block-like specimen of $C_{11}H_9FO_2$, approximate dimensions 0.140 mm x 0.180 mm x 0.200 mm, was used for the X-ray crystallographic analysis. The X-ray intensity data were measured.



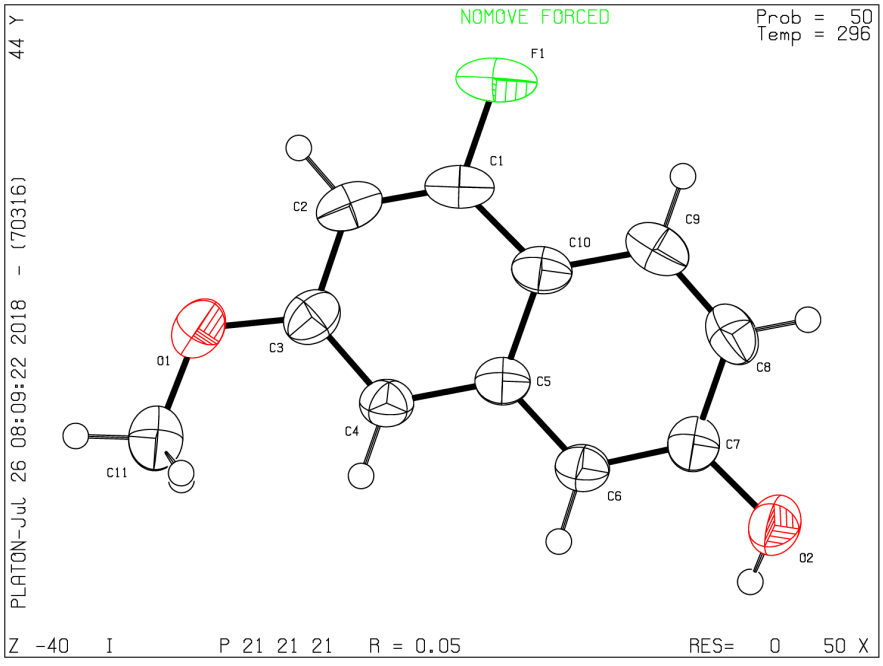


Table S1. Crystal data and structure refinement for 3pa.

Empirical formula	C11 H9 F O2	
Formula weight	192.18	
Temperature	296(2) K	
Wavelength	0.71073 Å	
Crystal system	Orthorhombic	
Space group	P 2_1 2_1 2_1	
Unit cell dimensions	a = 4.9693(3) Å	α = 90°.
	b = 5.8579(3) Å	β = 90°.
	c = 31.3863(17) Å	γ = 90°.
Volume	913.64(9) $Å^3$	
Z	4	
Density (calculated)	1.397 Mg/m^3	
Absorption coefficient	0.109 mm^{-1}	
F(000)	400	
Crystal size	0.190 x 0.180 x 0.050 mm^3	
Theta range for data collection	2.596 to 28.759°.	
Index ranges	-6<=h<=6, -7<=k<=7, -42<=l<=42	
Reflections collected	29989	
Independent reflections	2375 [R(int) = 0.0540]	
Completeness to theta = 25.242°	99.7 %	
Absorption correction	Multi-scan	
Refinement method	Full-matrix least-squares on F^2	
Data / restraints / parameters	2375 / 0 / 129	
Goodness-of-fit on F^2	1.064	
Final R indices [I>2sigma(I)]	R1 = 0.0506, wR2 = 0.0992	
R indices (all data)	R1 = 0.0690, wR2 = 0.1060	
Absolute structure parameter	-0.5(3)	
Largest diff. peak and hole	0.142 and -0.145 $e.Å^{-3}$	

Table S2. Atomic coordinates (Å x 10^4) and equivalent isotropic displacement parameters (Å^{2}x 10^3) for 3pa. U(eq) is defined as one third of the trace of the orthogonalized U^{ij} tensor.

	x	y	z	U(eq)
C(1)	2684(6)	4479(4)	1454(1)	48(1)
C(2)	966(6)	4193(4)	1780(1)	50(1)
C(3)	-734(5)	2270(4)	1779(1)	45(1)
C(4)	-682(5)	753(4)	1447(1)	41(1)
C(5)	1106(5)	1100(4)	1102(1)	36(1)
C(6)	1219(5)	-435(4)	752(1)	40(1)
C(7)	3000(5)	-74(4)	427(1)	40(1)
C(8)	4777(5)	1784(5)	432(1)	49(1)
C(9)	4706(5)	3297(5)	762(1)	50(1)
C(10)	2871(5)	3005(4)	1100(1)	41(1)
C(11)	-4045(7)	136(5)	2155(1)	60(1)
F(1)	4397(4)	6295(3)	1458(1)	72(1)
O(1)	-2340(4)	2084(4)	2131(1)	58(1)
O(2)	3180(4)	-1498(3)	78(1)	53(1)

Table S3. Bond lengths [Å] and angles [°] for 3pa.

C(1)-C(2)	1.344(4)
C(1)-F(1)	1.362(3)
C(1)-C(10)	1.409(4)
C(2)-C(3)	1.408(4)
C(2)-H(2)	0.9300
C(3)-O(1)	1.367(3)
C(3)-C(4)	1.371(3)
C(4)-C(5)	1.416(3)
C(4)-H(4)	0.9300
C(5)-C(10)	1.419(3)
C(5)-C(6)	1.419(3)
C(6)-C(7)	1.367(3)
C(6)-H(6)	0.9300
C(7)-O(2)	1.380(3)
C(7)-C(8)	1.401(3)
C(8)-C(9)	1.364(4)
C(8)-H(8)	0.9300
C(9)-C(10)	1.410(4)
C(9)-H(9)	0.9300
C(11)-O(1)	1.423(3)
C(11)-H(11A)	0.9600
C(11)-H(11B)	0.9600
C(11)-H(11C)	0.9600
O(2)-H(2A)	0.8200
C(2)-C(1)-F(1)	119.1(2)
C(2)-C(1)-C(10)	124.4(2)
F(1)-C(1)-C(10)	116.4(2)
C(1)-C(2)-C(3)	118.7(2)
C(1)-C(2)-H(2)	120.7
C(3)-C(2)-H(2)	120.7
O(1)-C(3)-C(4)	125.0(2)
O(1)-C(3)-C(2)	114.4(2)
C(4)-C(3)-C(2)	120.6(2)

C(3)-C(4)-C(5)	120.1(2)
C(3)-C(4)-H(4)	120.0
C(5)-C(4)-H(4)	120.0
C(4)-C(5)-C(10)	120.2(2)
C(4)-C(5)-C(6)	121.6(2)
C(10)-C(5)-C(6)	118.2(2)
C(7)-C(6)-C(5)	120.2(2)
C(7)-C(6)-H(6)	119.9
C(5)-C(6)-H(6)	119.9
C(6)-C(7)-O(2)	122.7(2)
C(6)-C(7)-C(8)	121.4(2)
O(2)-C(7)-C(8)	115.9(2)
C(9)-C(8)-C(7)	119.7(2)
C(9)-C(8)-H(8)	120.1
C(7)-C(8)-H(8)	120.1
C(8)-C(9)-C(10)	120.6(2)
C(8)-C(9)-H(9)	119.7
C(10)-C(9)-H(9)	119.7
C(1)-C(10)-C(9)	124.1(2)
C(1)-C(10)-C(5)	116.0(2)
C(9)-C(10)-C(5)	119.8(2)
O(1)-C(11)-H(11A)	109.5
O(1)-C(11)-H(11B)	109.5
H(11A)-C(11)-H(11B)	109.5
O(1)-C(11)-H(11C)	109.5
H(11A)-C(11)-H(11C)	109.5
H(11B)-C(11)-H(11C)	109.5
C(3)-O(1)-C(11)	116.97(19)
C(7)-O(2)-H(2A)	109.5

Symmetry transformations used to generate equivalent atoms:

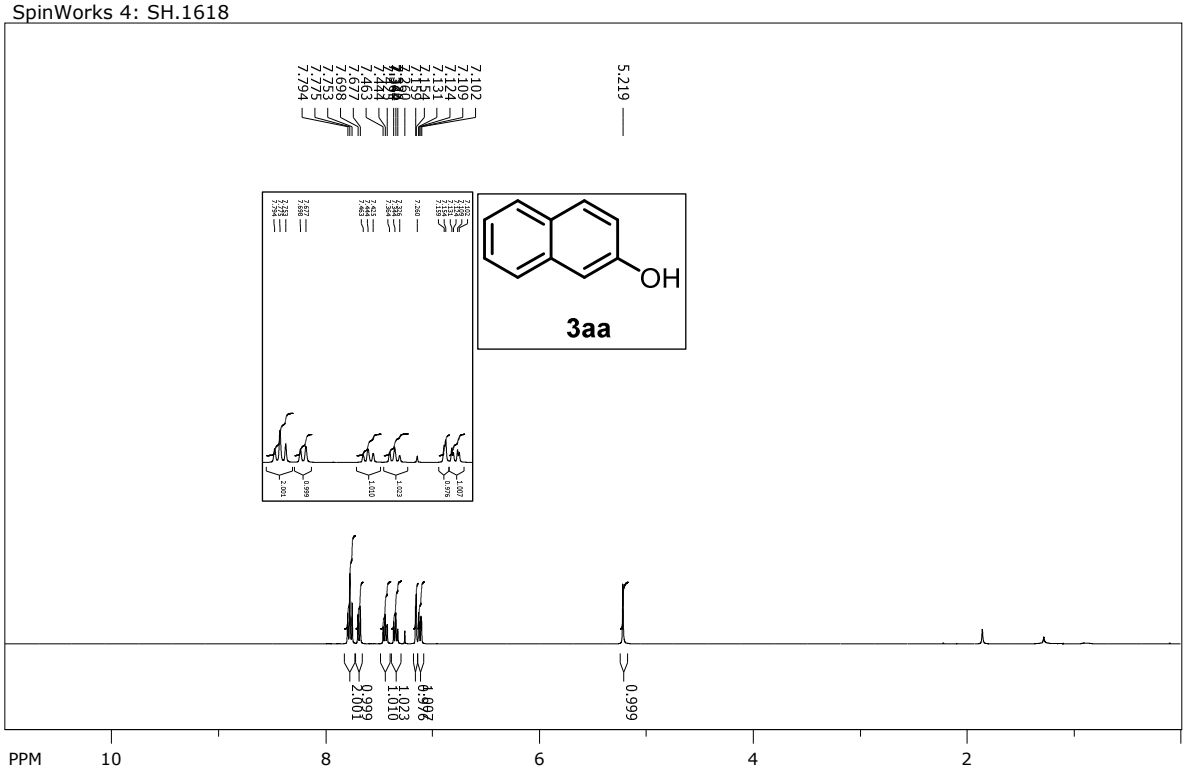
Table S4. Anisotropic displacement parameters ($Å^2 x\ 10^3$) for 3pa. The anisotropic displacement factor exponent takes the form: $-2\pi^2[h^2 a^{*2} U^{11} + ... + 2 h k a^* b^* U^{12}]$

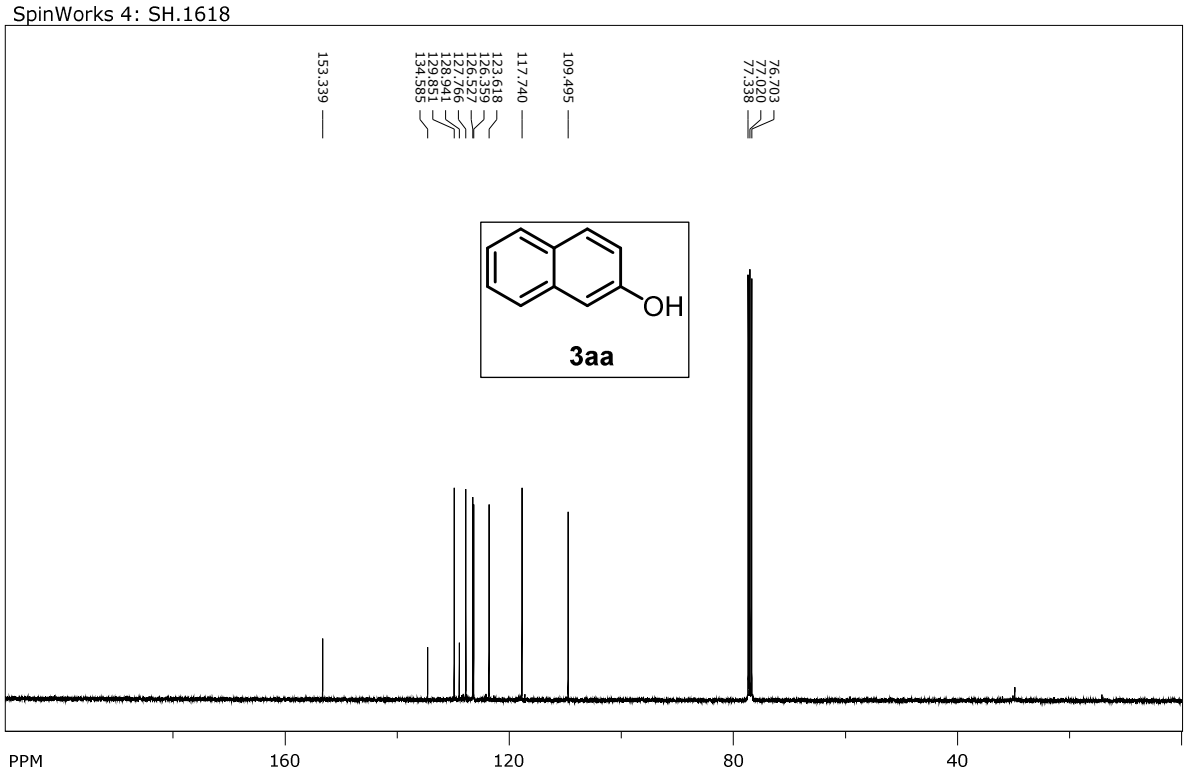
	U^{11}	U^{22}	U^{33}	U^{23}	U^{13}	U^{12}
C(1)	49(2)	33(1)	63(2)	-2(1)	-16(1)	-7(1)
C(2)	55(2)	40(1)	55(2)	-12(1)	-13(2)	4(1)
C(3)	45(1)	47(1)	44(1)	-5(1)	-6(1)	5(1)
C(4)	37(1)	42(1)	45(1)	-5(1)	-3(1)	-4(1)
C(5)	32(1)	36(1)	40(1)	1(1)	-10(1)	1(1)
C(6)	37(1)	41(1)	43(1)	-2(1)	-4(1)	-5(1)
C(7)	33(1)	50(1)	38(1)	0(1)	-5(1)	4(1)
C(8)	37(1)	63(2)	48(2)	10(1)	2(1)	-6(1)
C(9)	42(1)	47(1)	61(2)	10(1)	-6(1)	-10(1)
C(10)	39(1)	35(1)	48(1)	3(1)	-11(1)	-2(1)
C(11)	64(2)	65(2)	50(2)	-2(1)	10(2)	-1(2)
F(1)	80(1)	44(1)	94(1)	-9(1)	-12(1)	-24(1)
O(1)	62(1)	65(1)	48(1)	-17(1)	8(1)	-4(1)
O(2)	42(1)	71(1)	47(1)	-13(1)	4(1)	-2(1)

Table S5. Hydrogen coordinates (Å x 10^4) and isotropic displacement parameters (Å^{2}x 10^3) for 3pa.

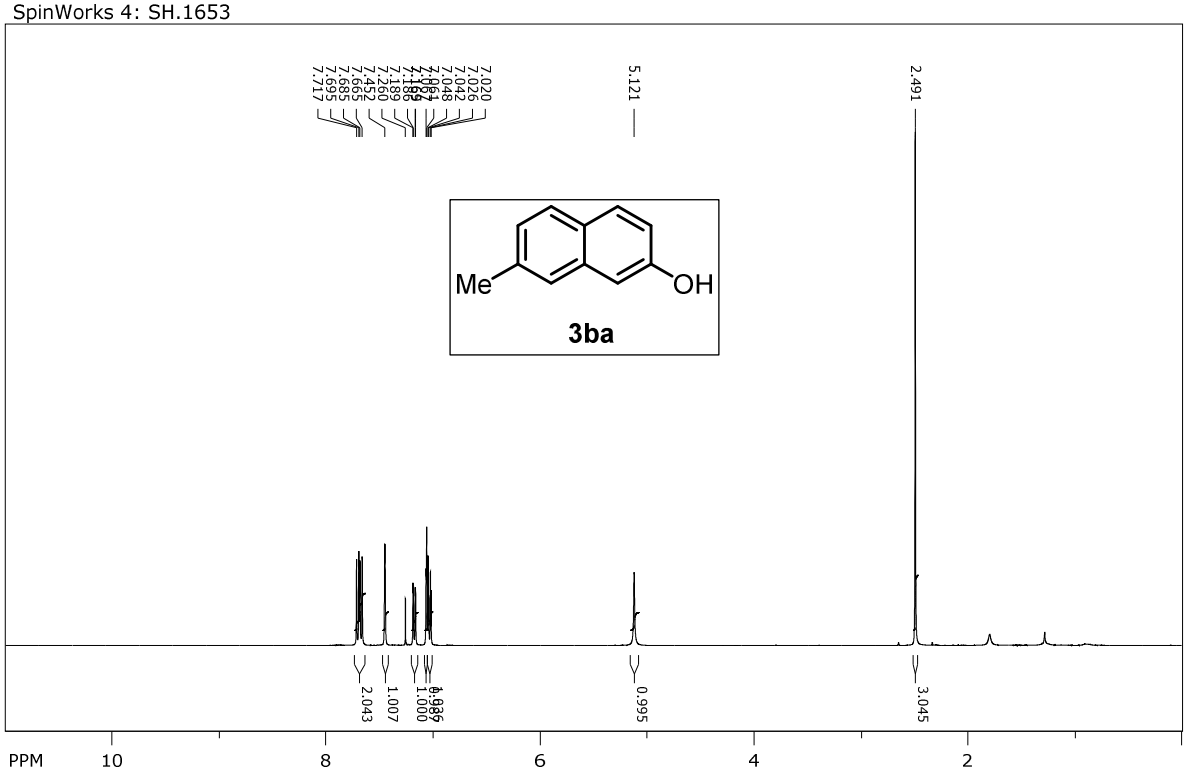
	x	y	z	U(eq)
H(2)	901	5245	2002	60
H(4)	-1823	-506	1448	49
H(6)	75	-1692	744	48
H(8)	6000	1984	211	59
H(9)	5879	4534	764	60
H(11A)	-5239	124	1914	89
H(11B)	-5078	195	2413	89
H(11C)	-2968	-1224	2153	89
H(2A)	1735	-2146	42	80

^{1}H NMR and ^{13}C NMR spectra of all compounds

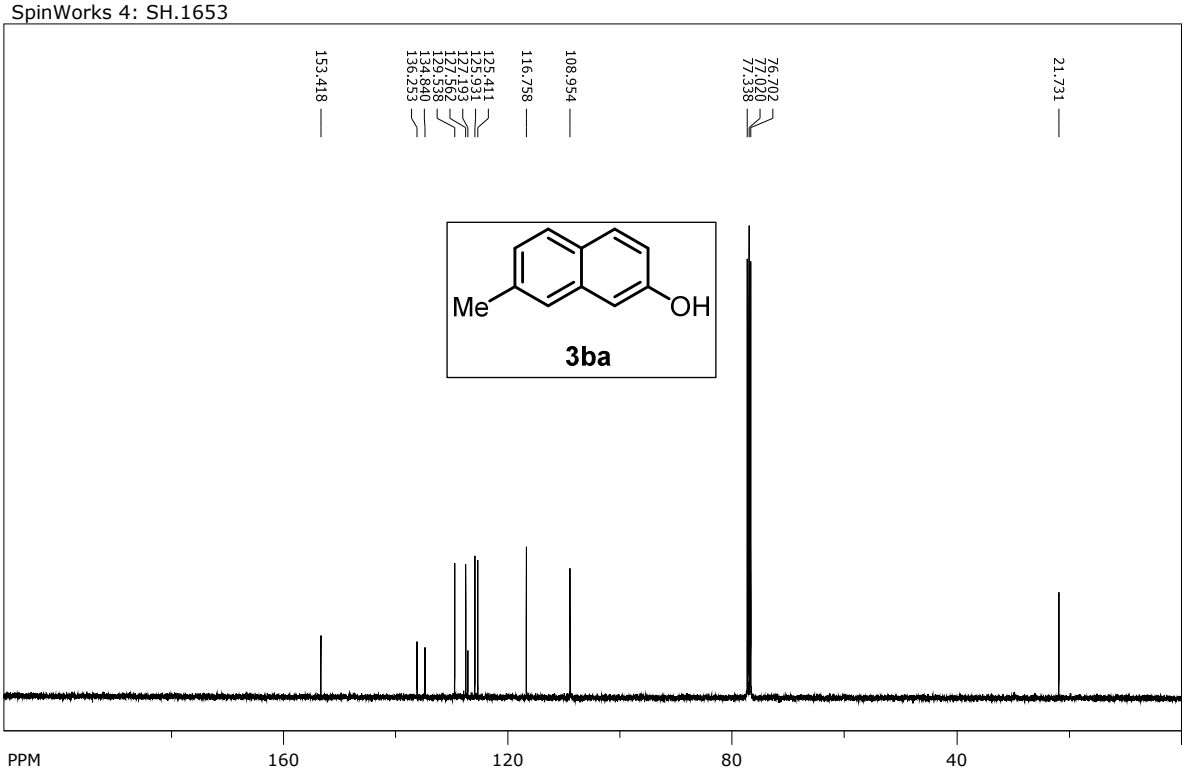




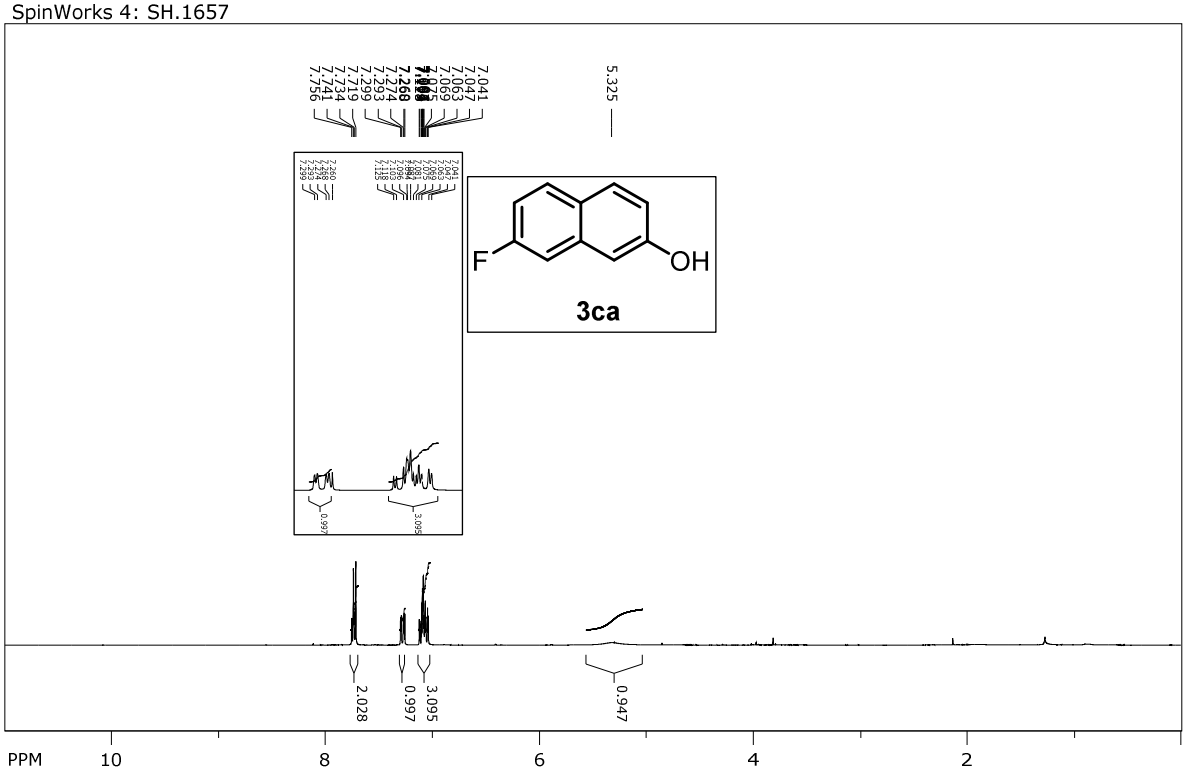
SpinWorks 4: SH.1653



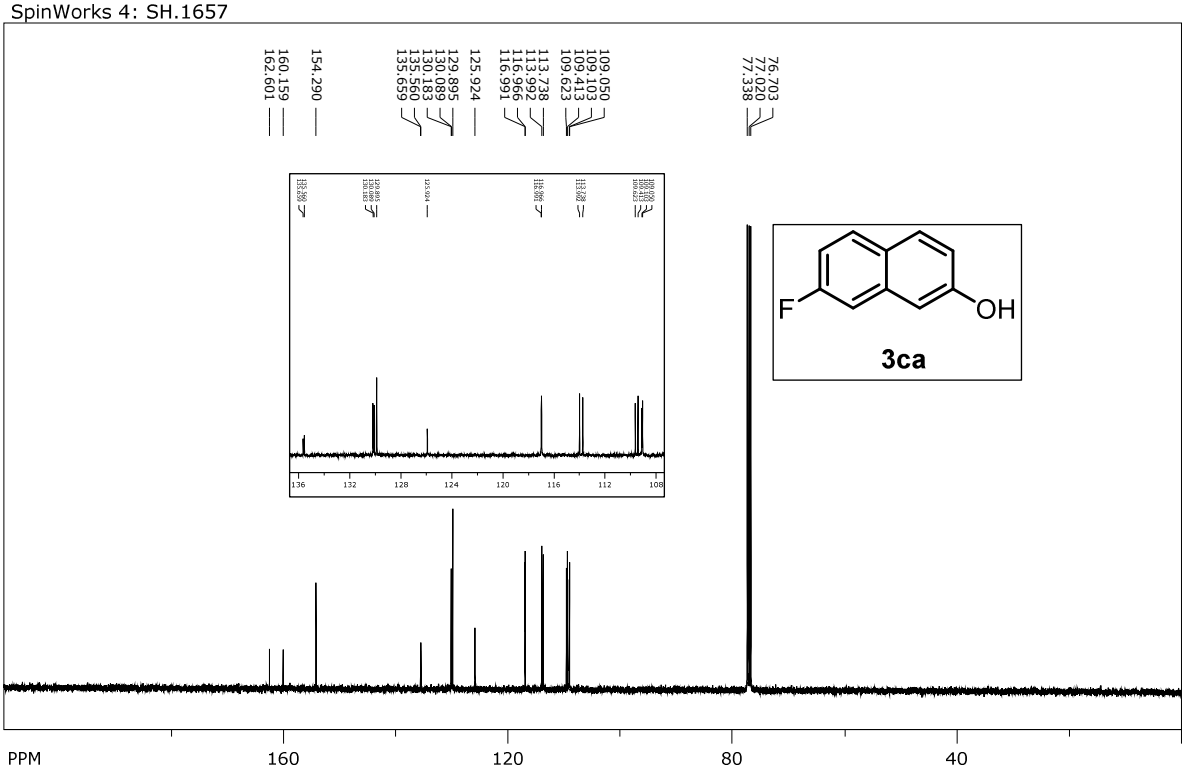
SpinWorks 4: SH.1653



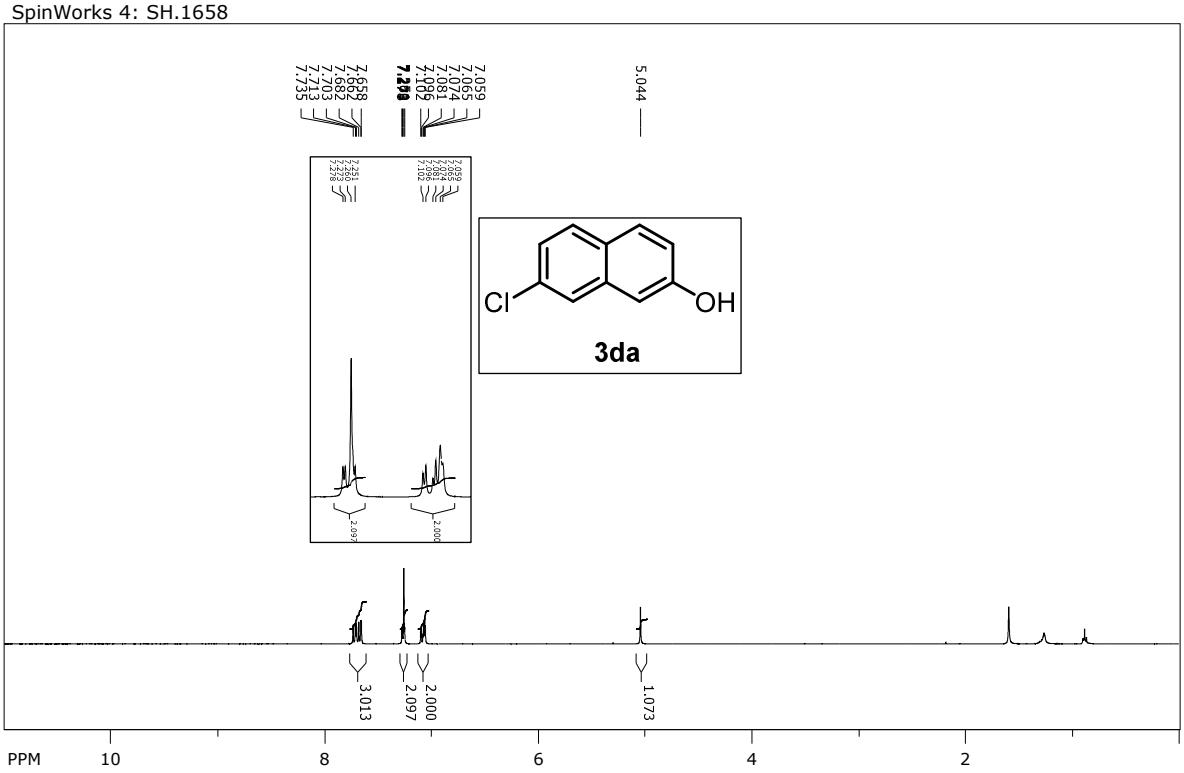
SpinWorks 4: SH.1657



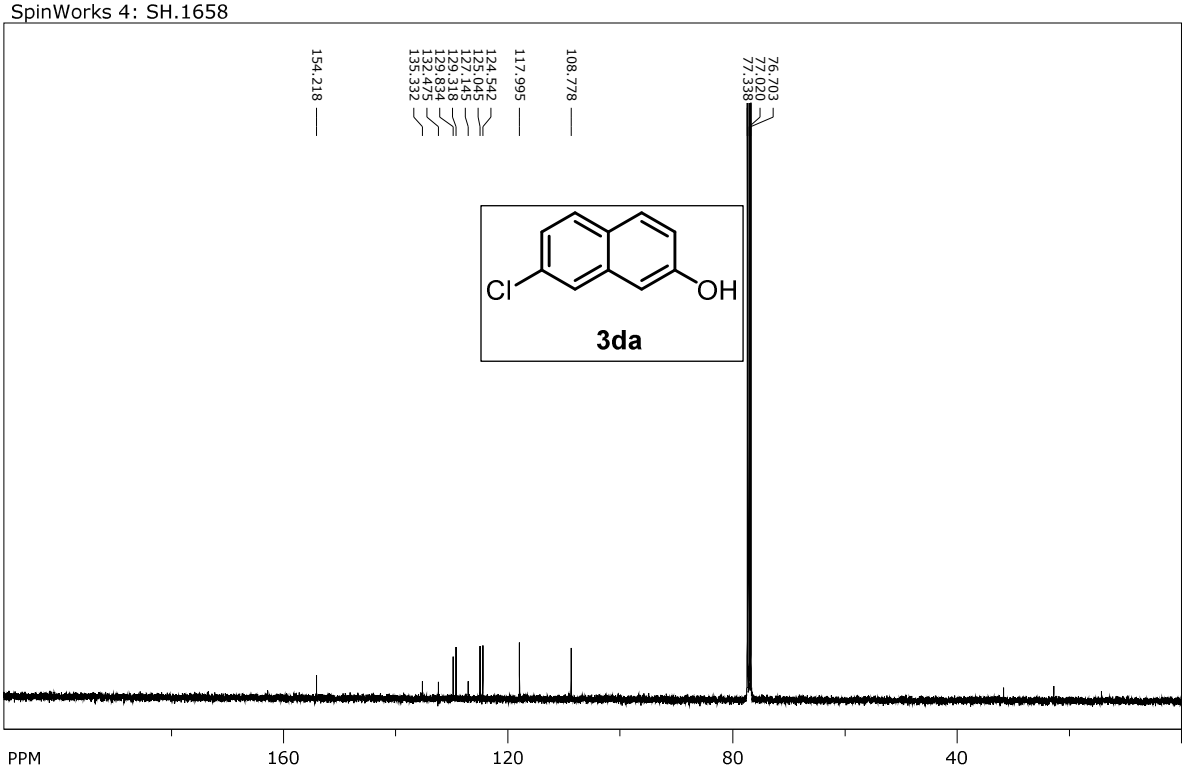
SpinWorks 4: SH.1657



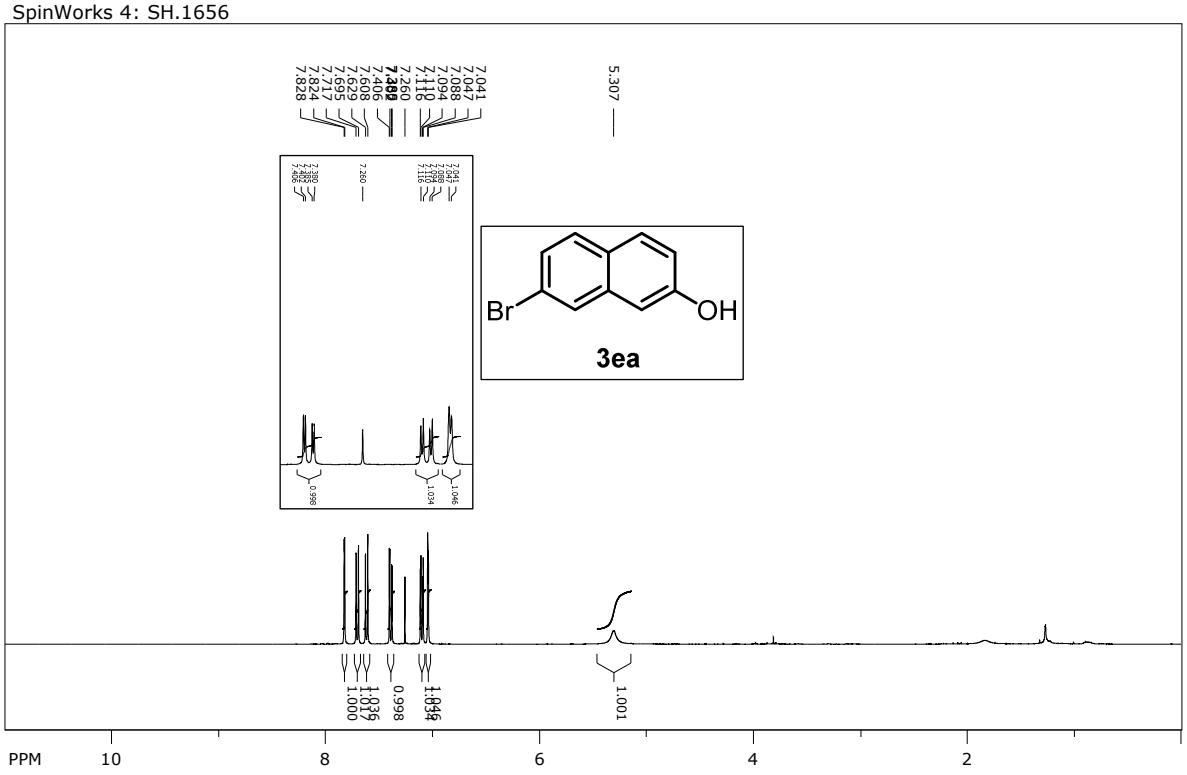
SpinWorks 4: SH.1658



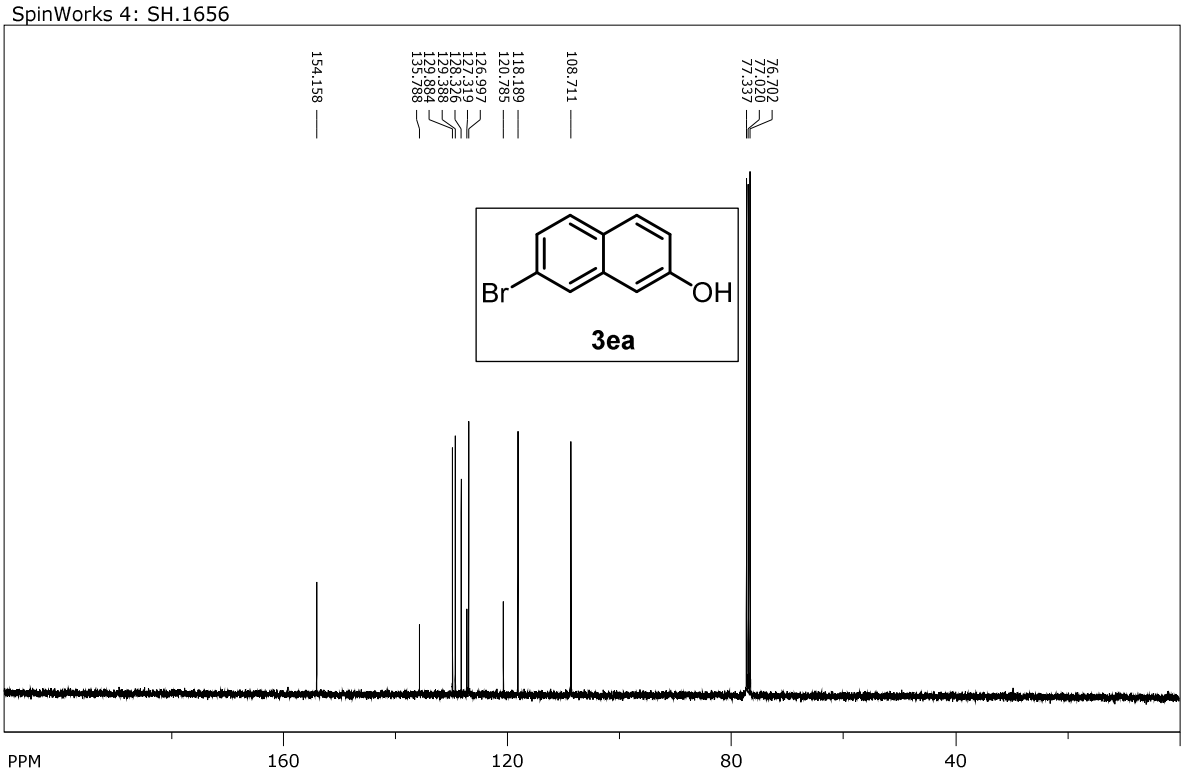
SpinWorks 4: SH.1658

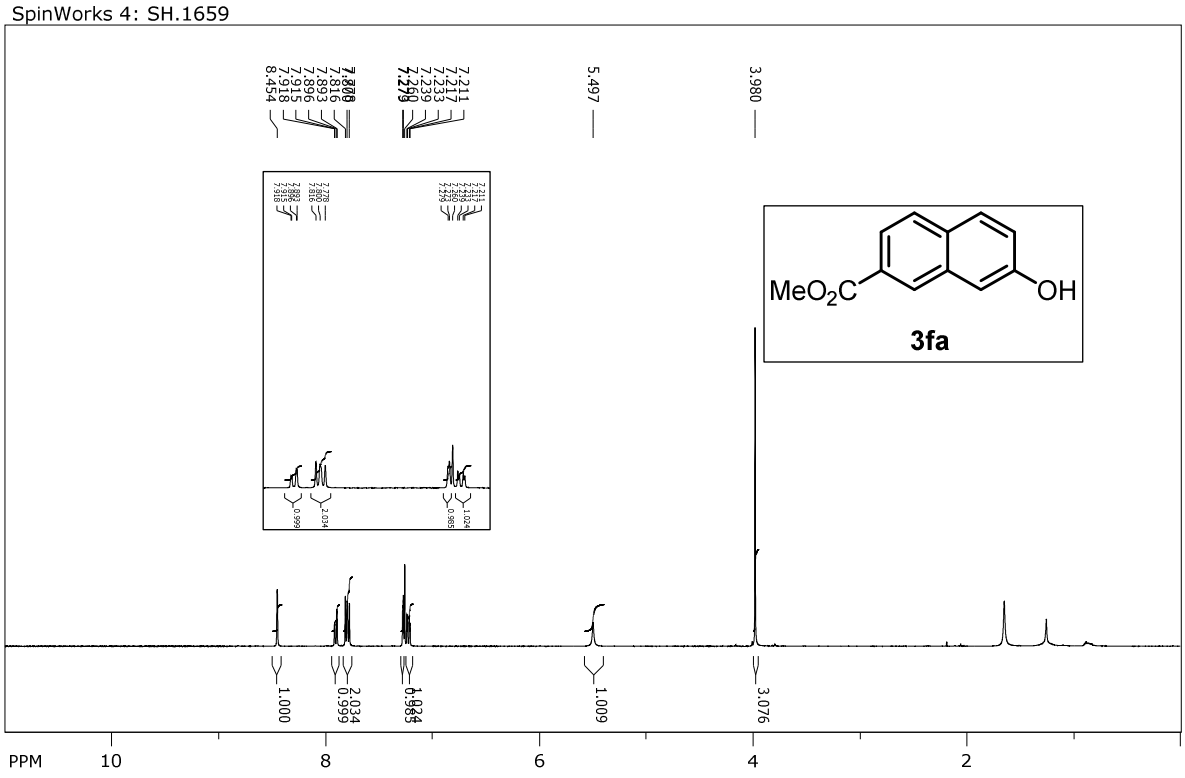


SpinWorks 4: SH.1656



SpinWorks 4: SH.1656




SpinWorks 4: SH.1659
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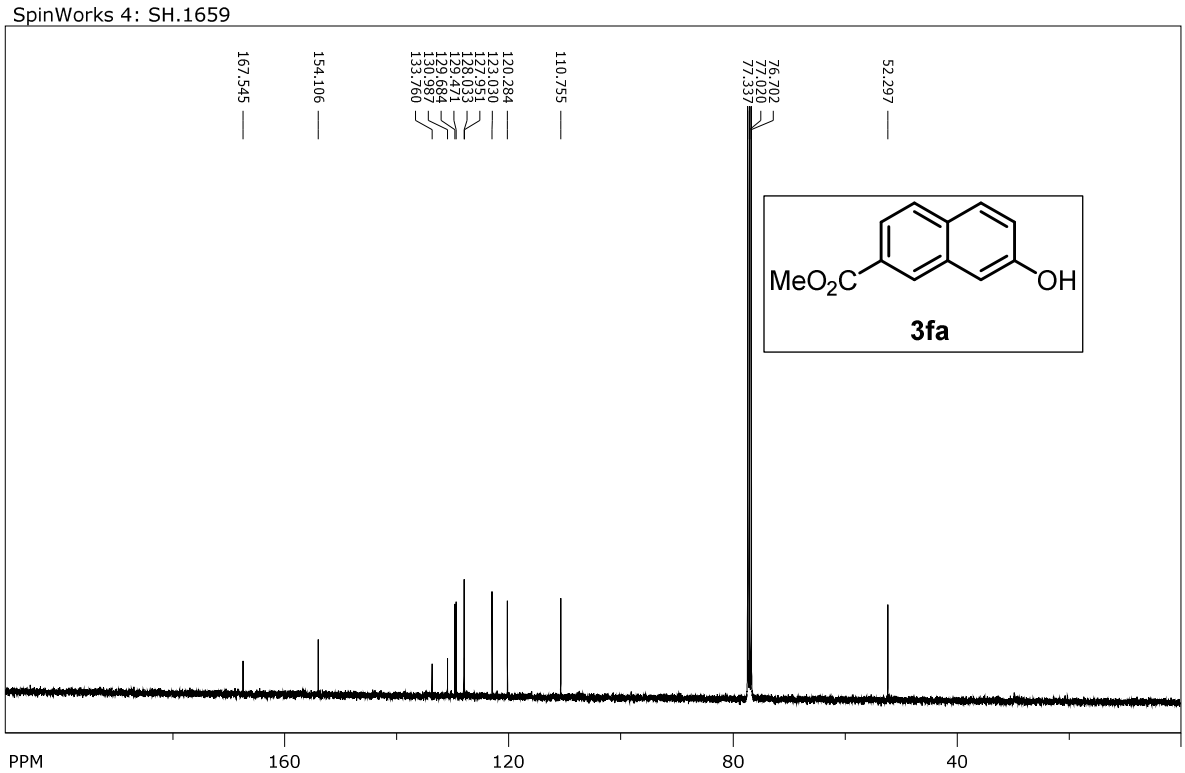
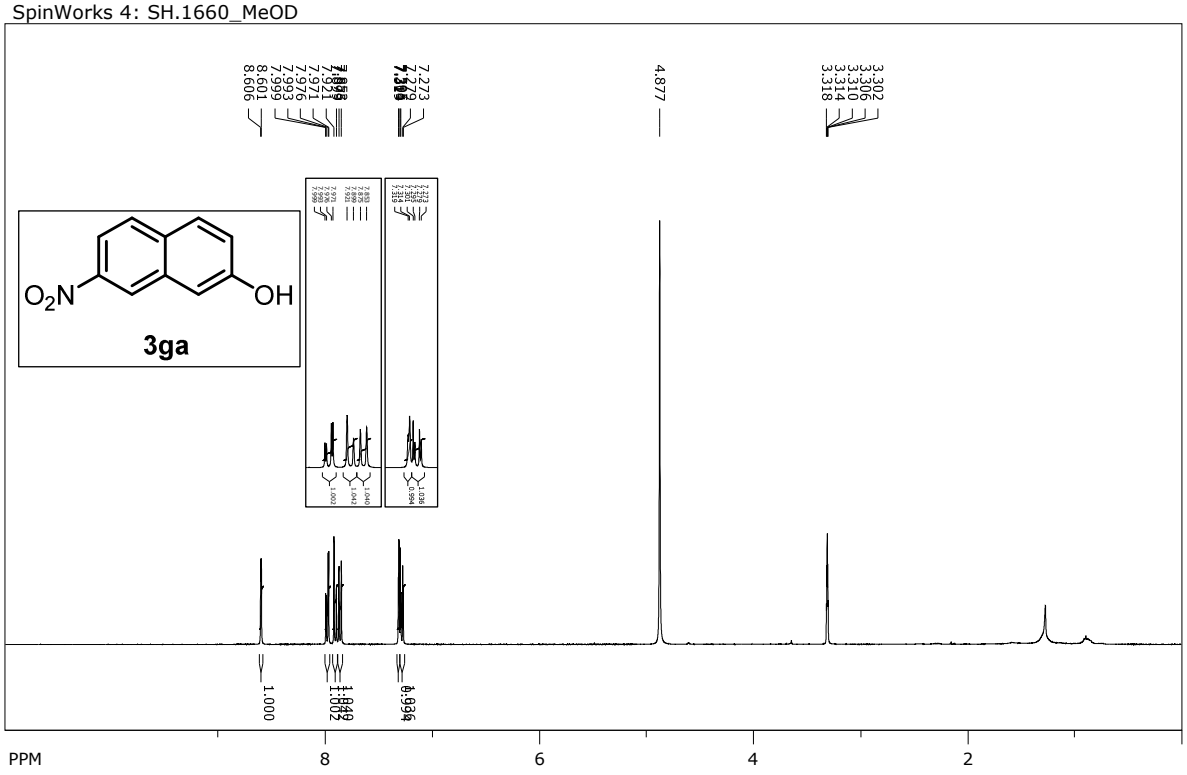
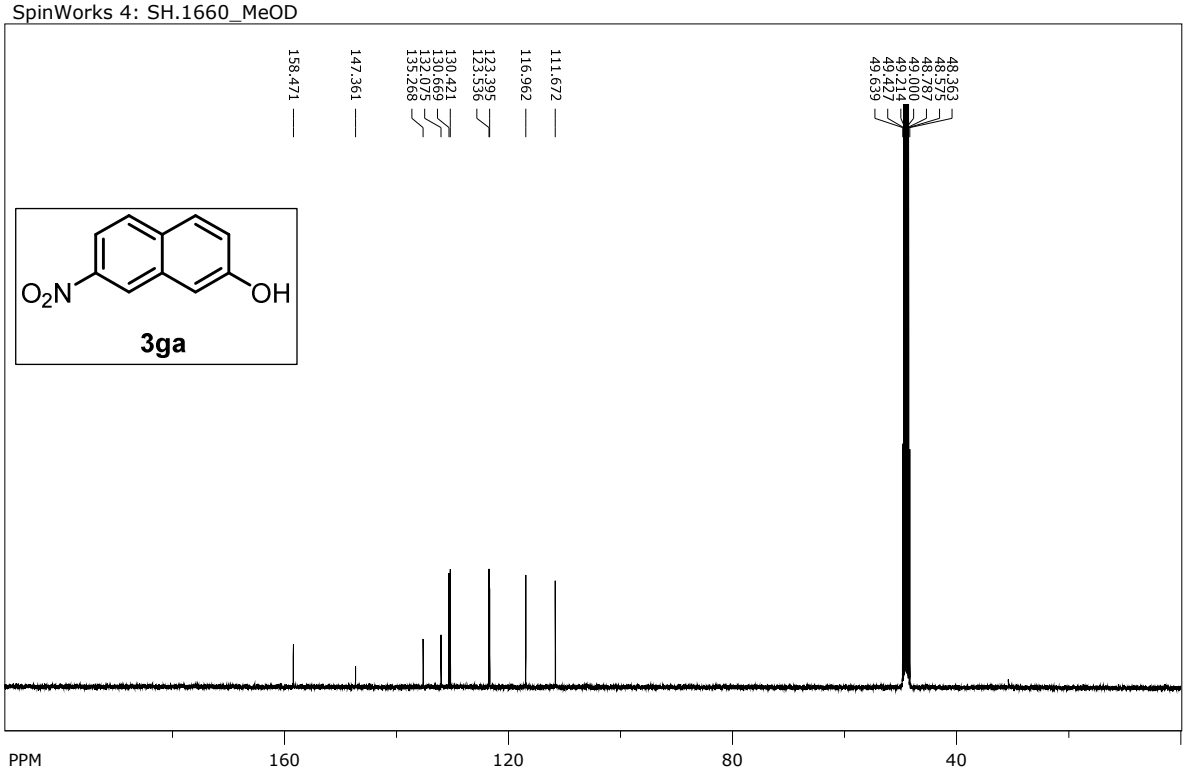
7.918
7.915
7.896
7.893
7.816
7.813
7.260
7.239
7.233
7.211
5.497
3.980
MeO2C
OH
3fa
1.000
2.034
0.999
1.009
3.076
PPM
10
8
6
4
2


SpinWorks 4: SH.1659
167.545
154.106
133.760
130.987
129.684
129.471
128.033
123.050
120.284
110.755
77.337
77.020
76.702
52.297
MeO2C
OH
3fa
PPM
160
120
80
40

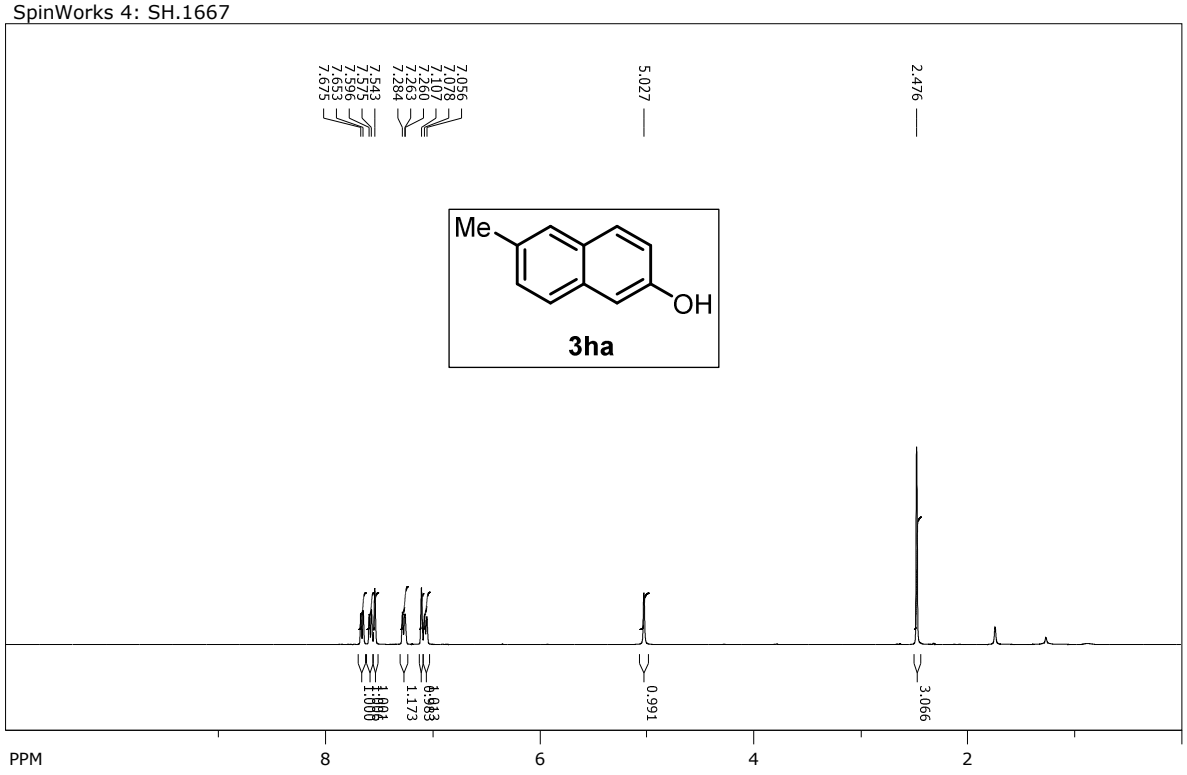
SpinWorks 4: SH.1660_MeOD



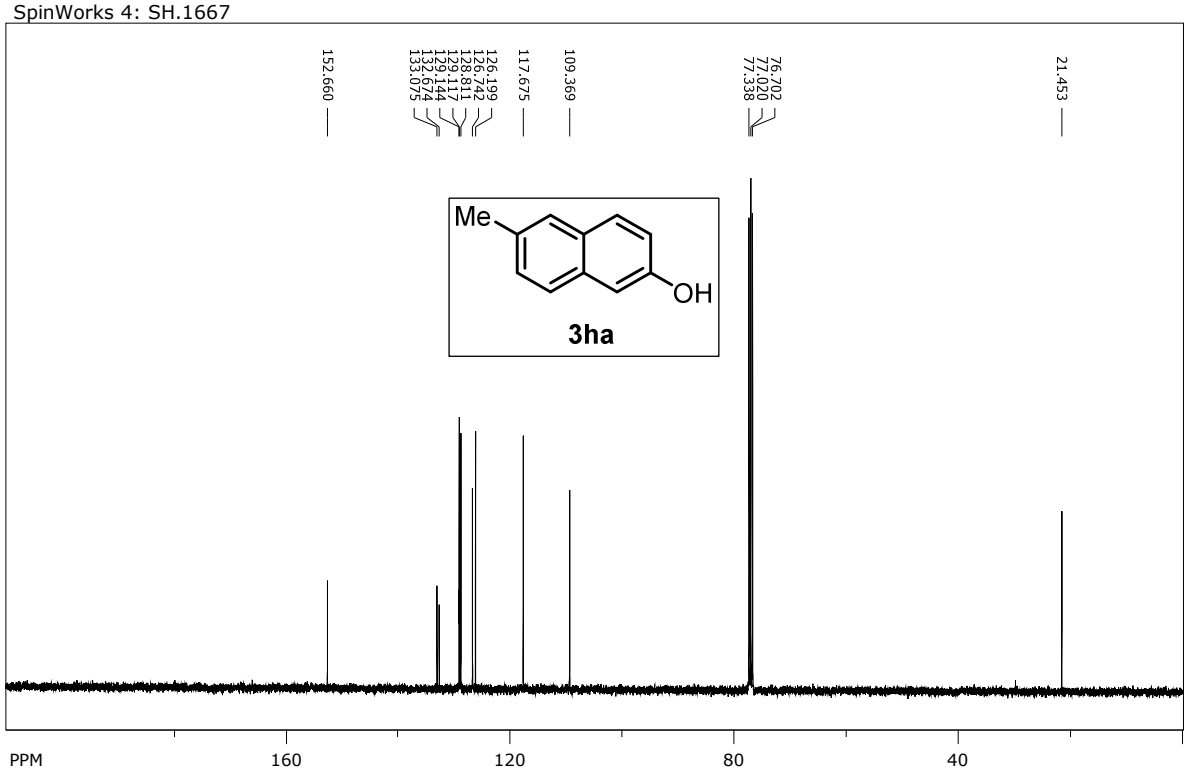
SpinWorks 4: SH.1660_MeOD



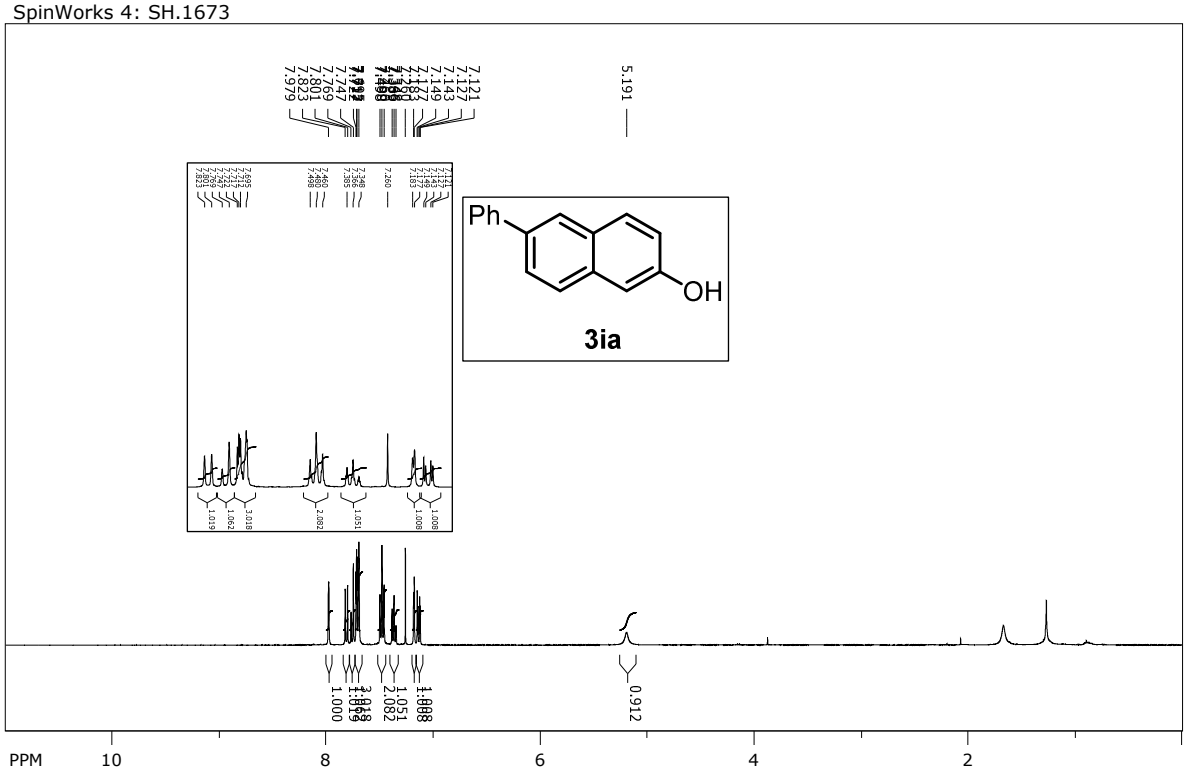
SpinWorks 4: SH.1667



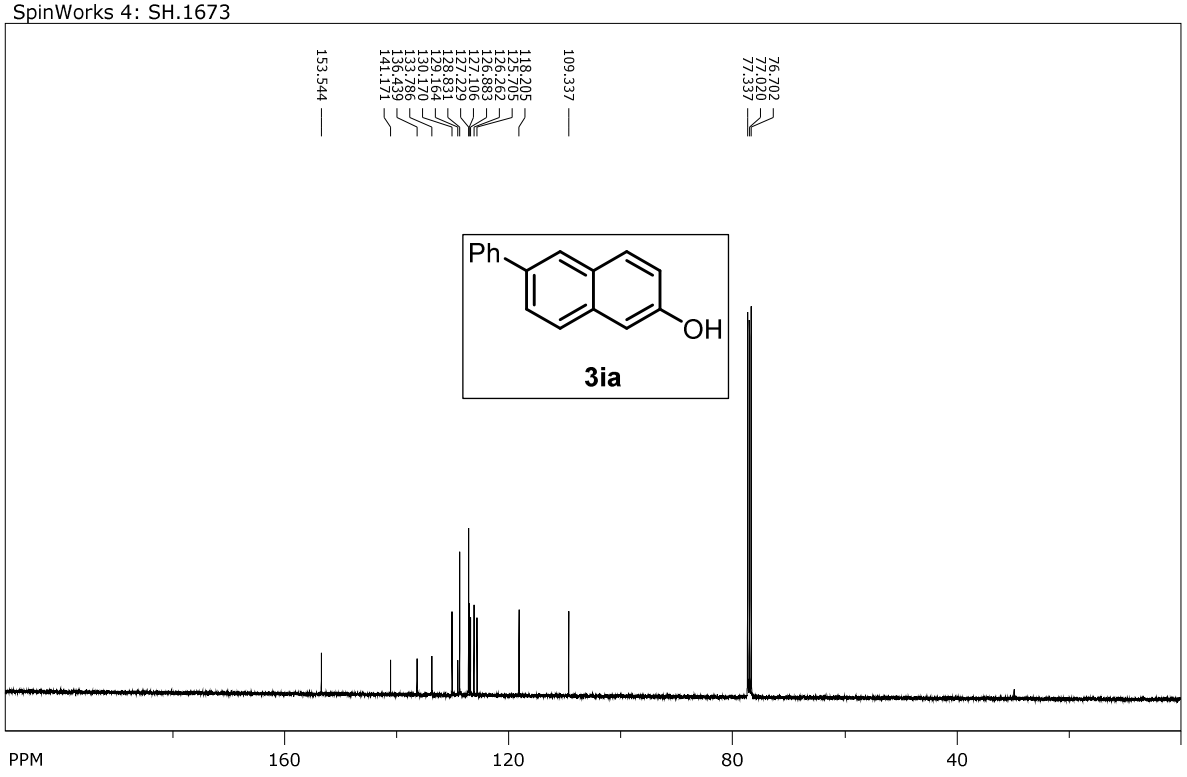
SpinWorks 4: SH.1667



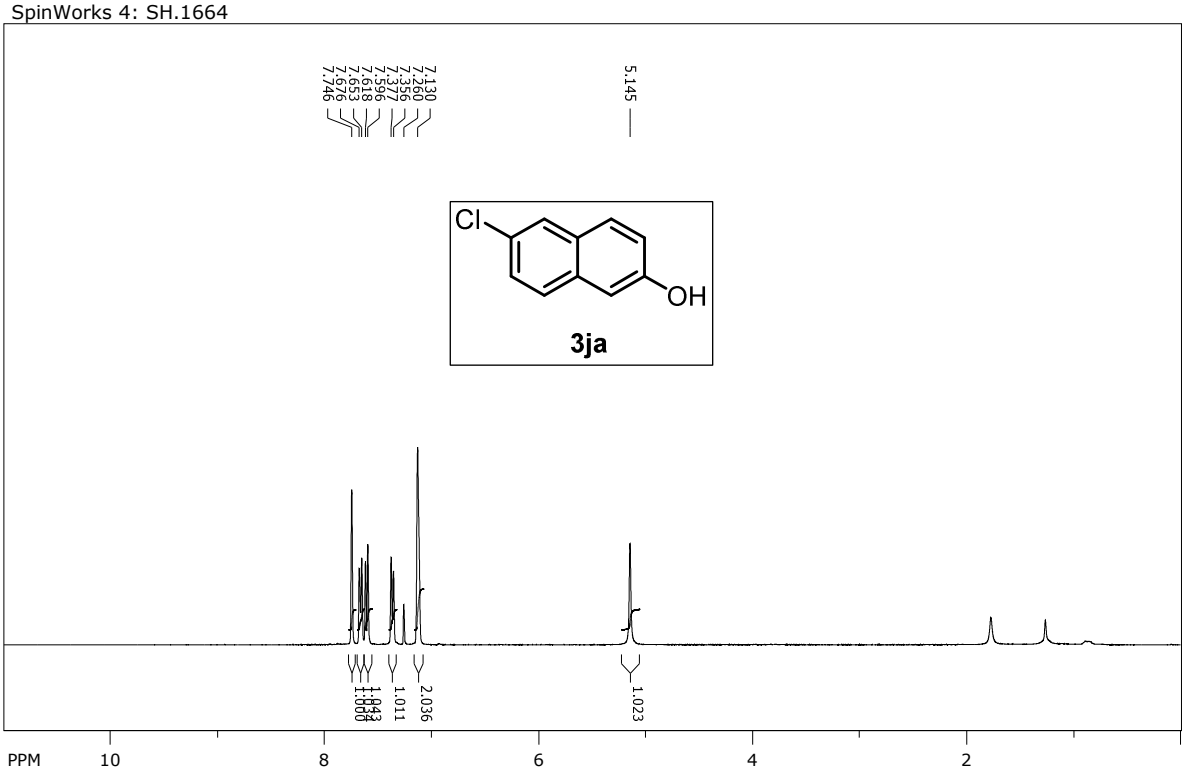
SpinWorks 4: SH.1673



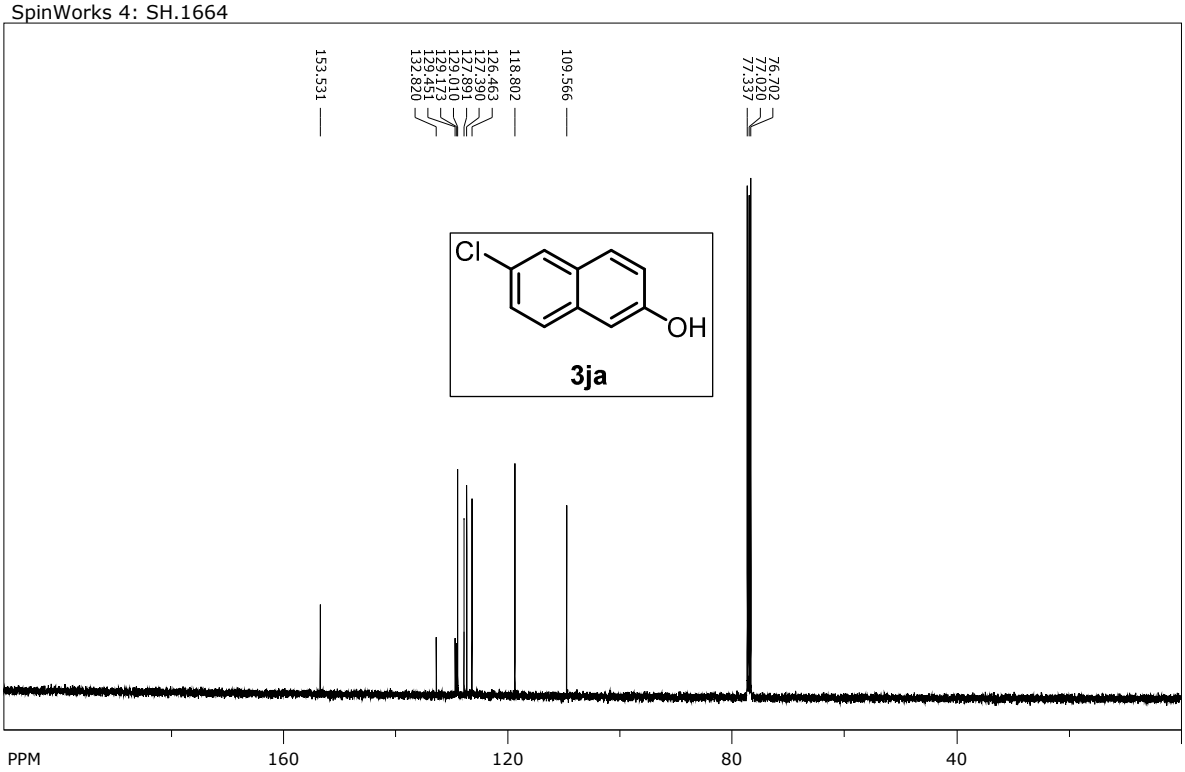
SpinWorks 4: SH.1673



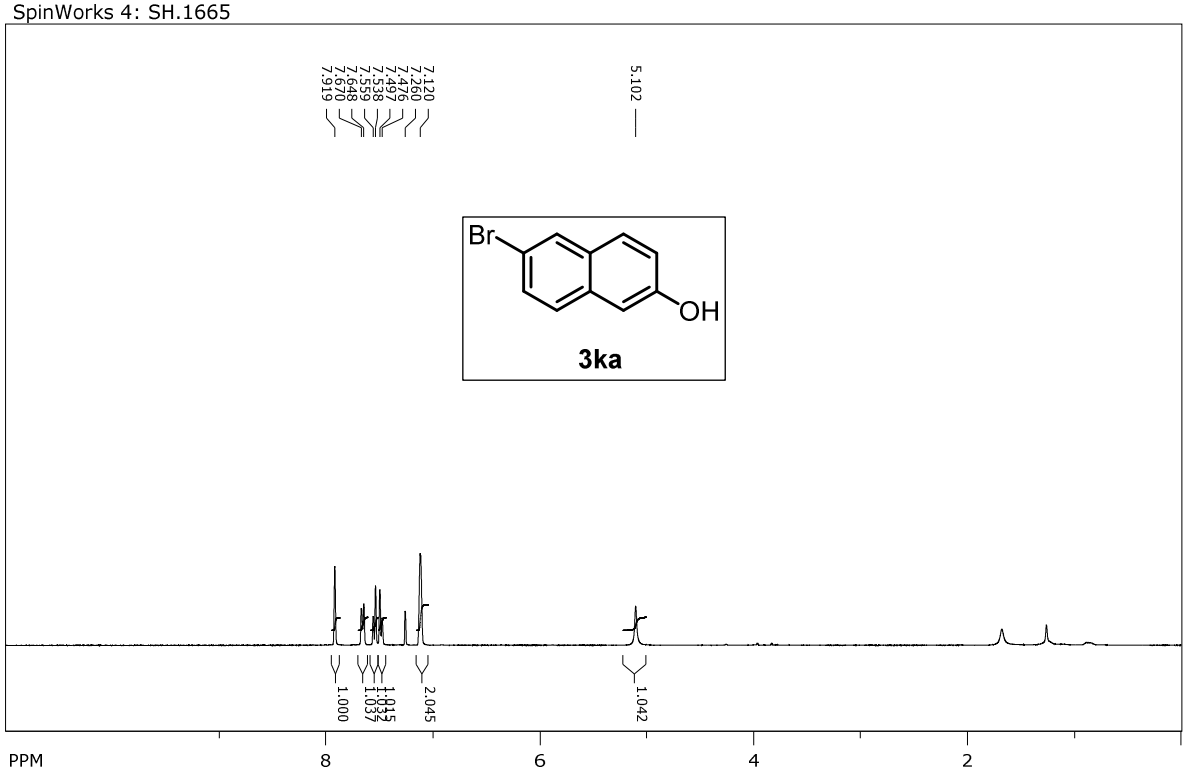
SpinWorks 4: SH.1664



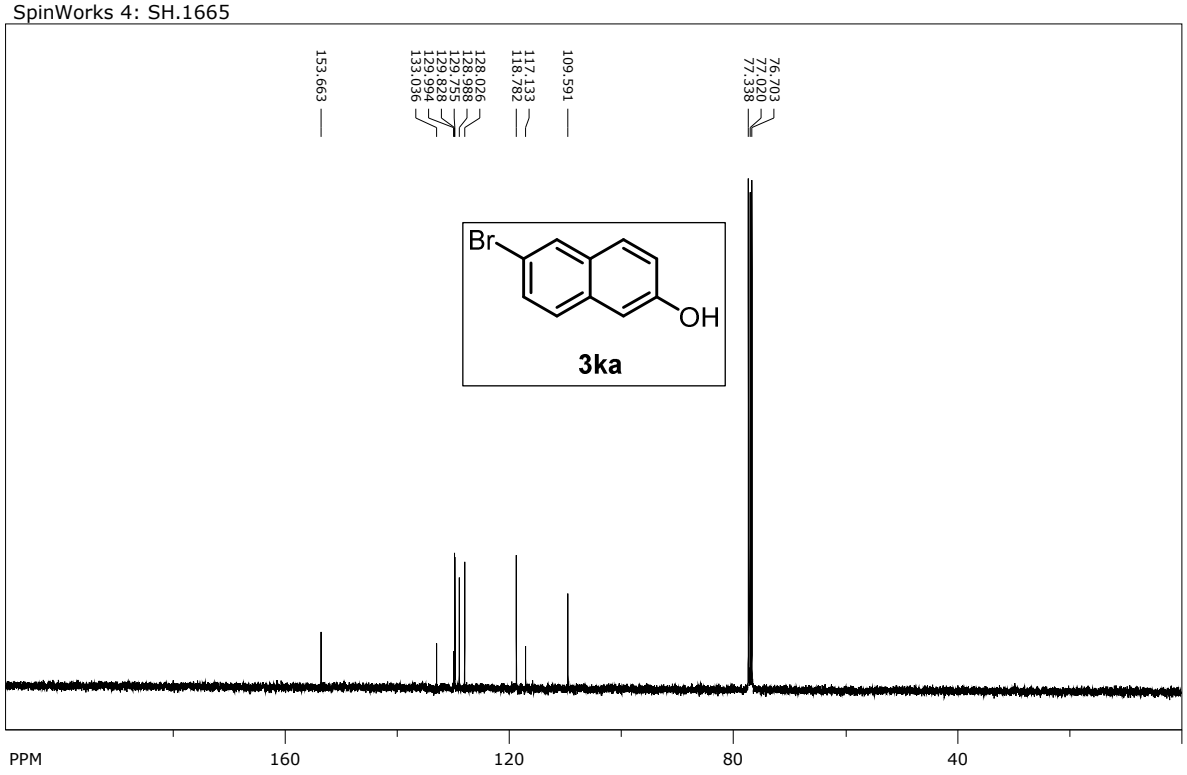
SpinWorks 4: SH.1664



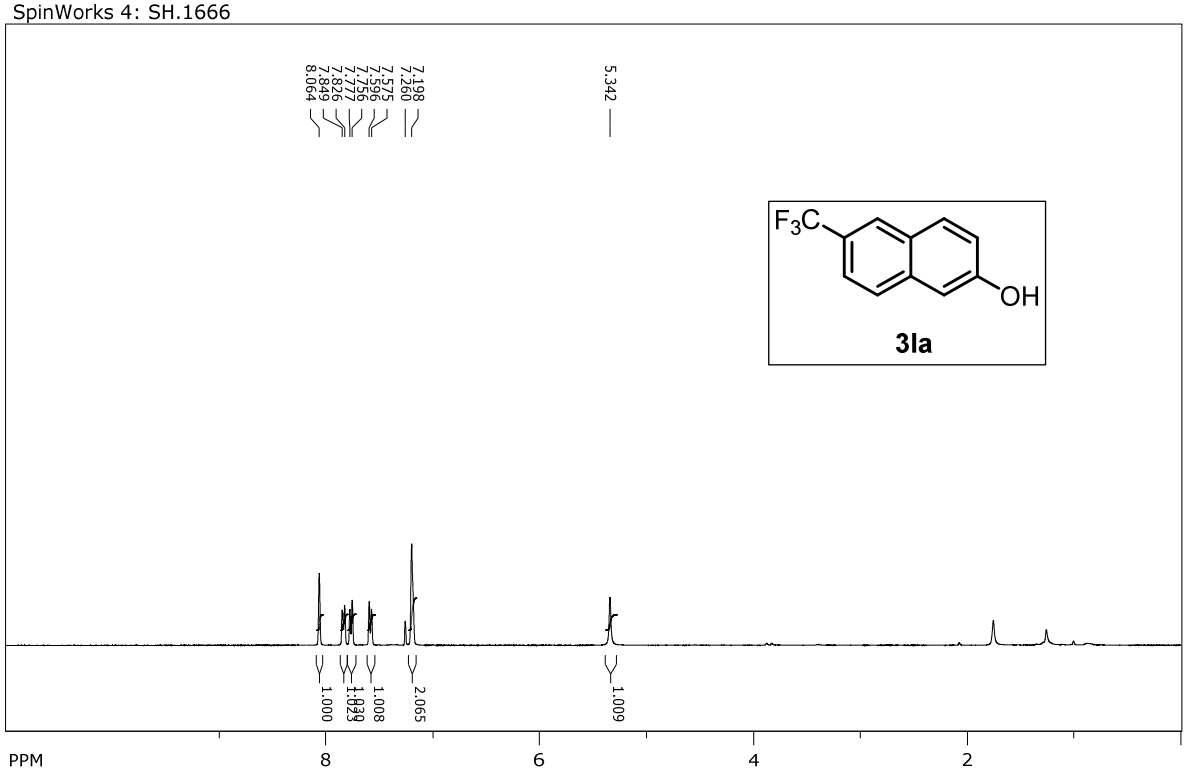
SpinWorks 4: SH.1665



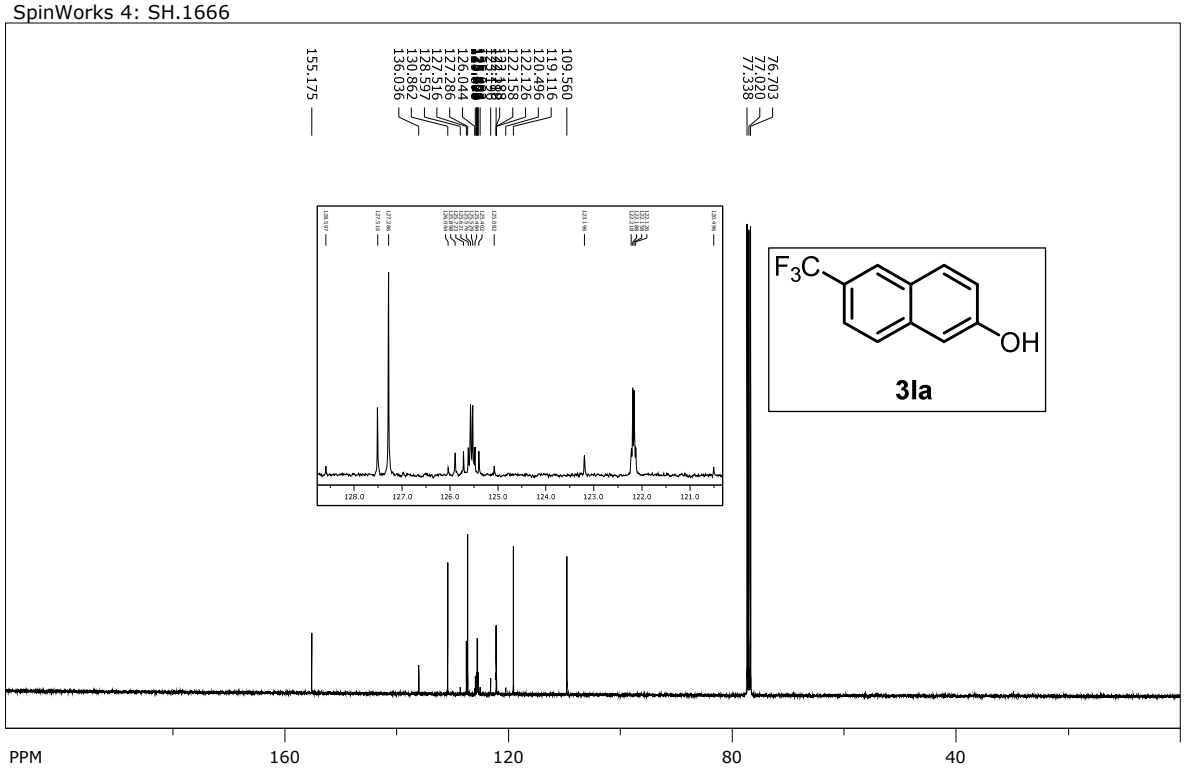
SpinWorks 4: SH.1665



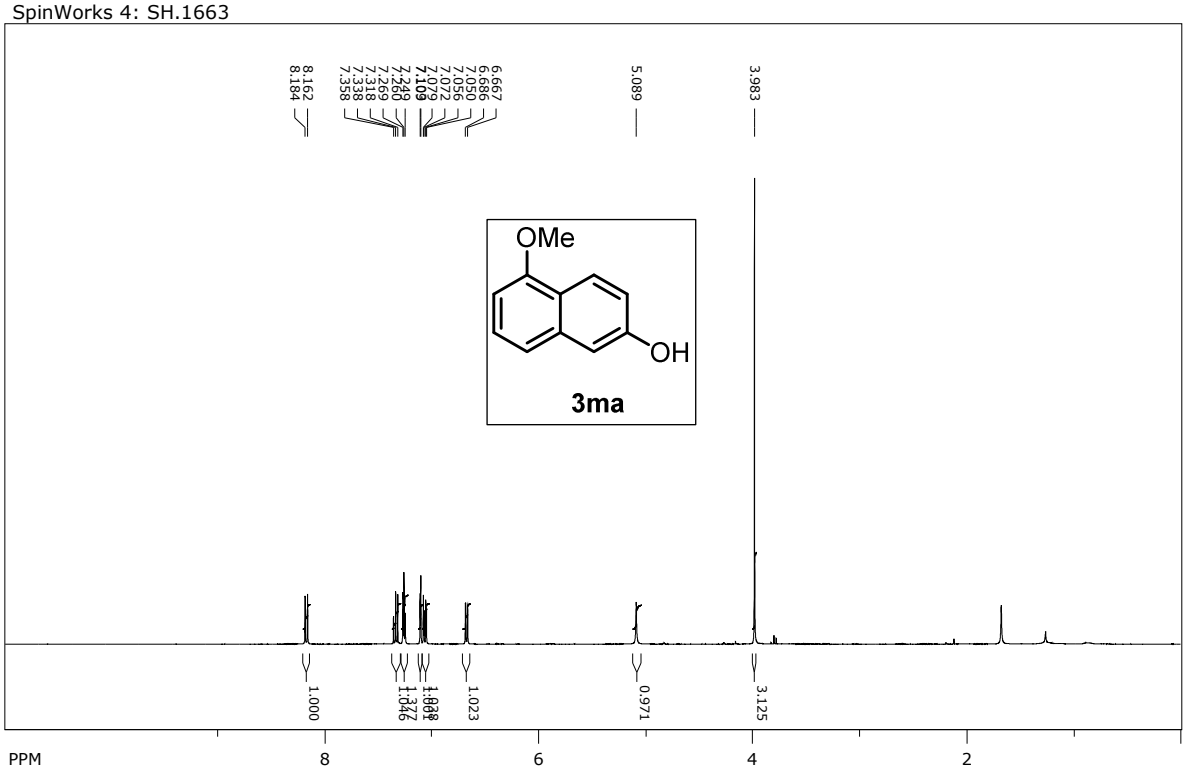
SpinWorks 4: SH.1666



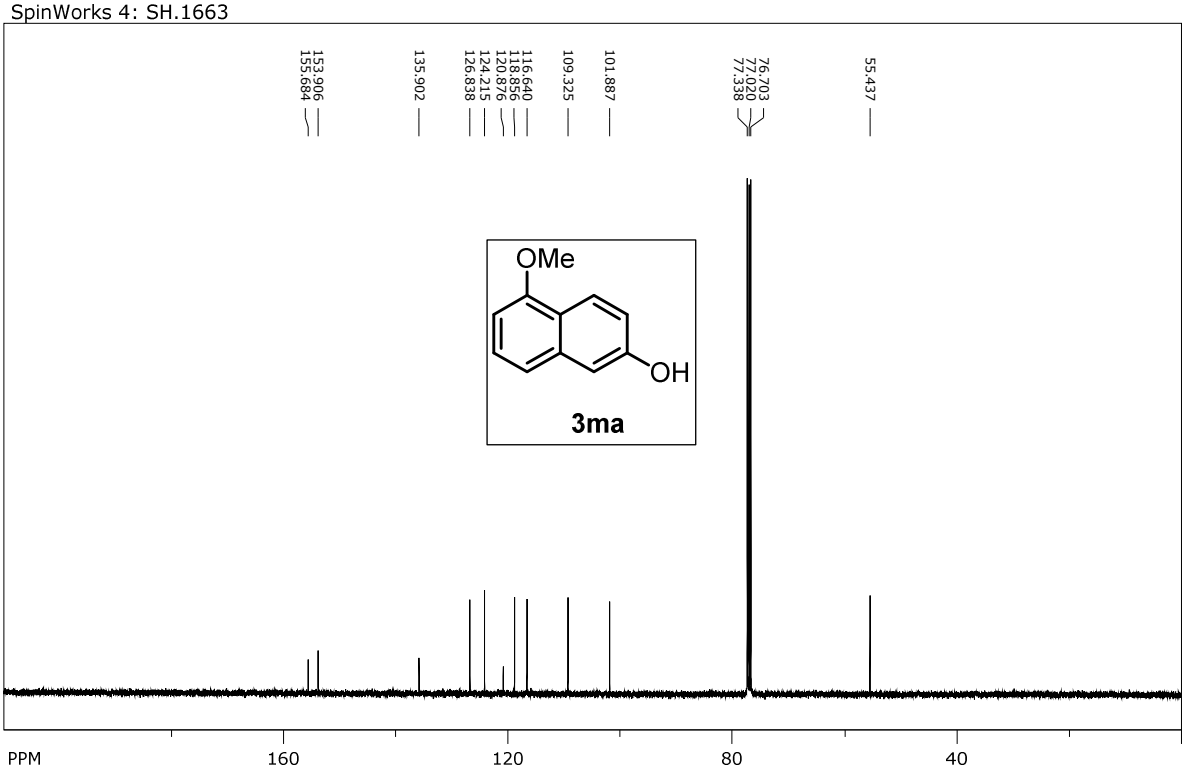
SpinWorks 4: SH.1666



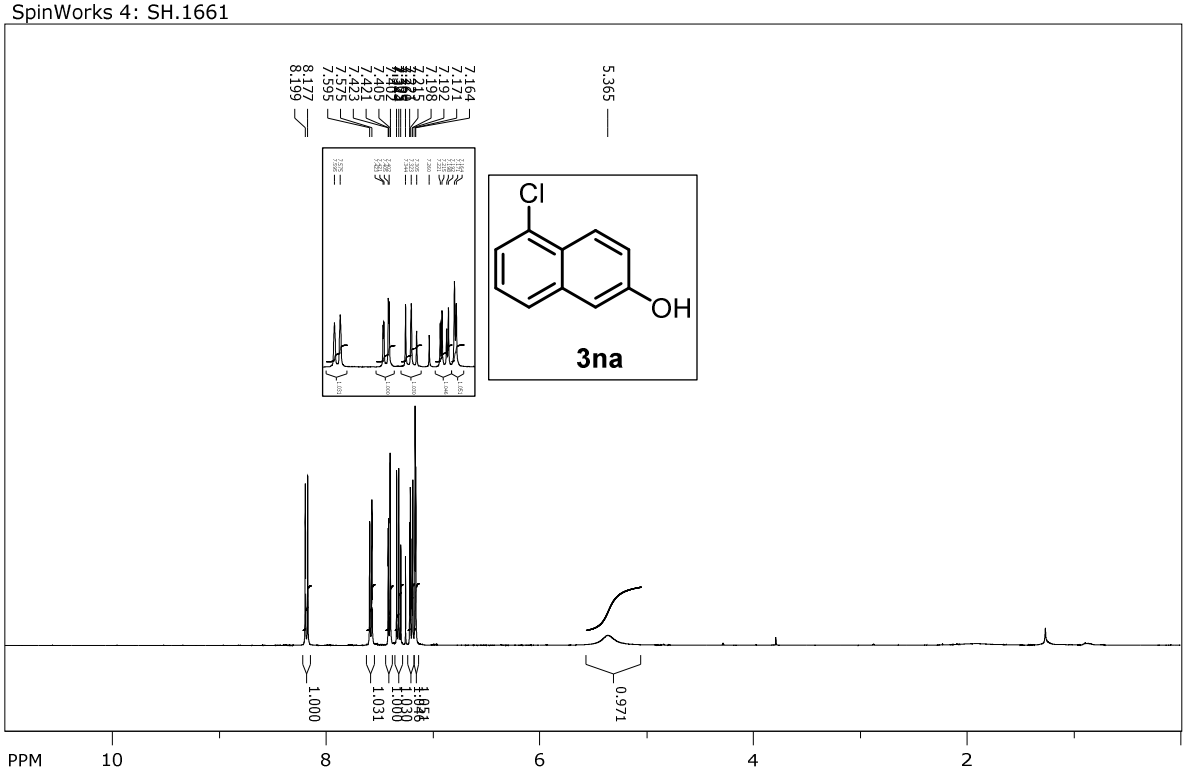
SpinWorks 4: SH.1663



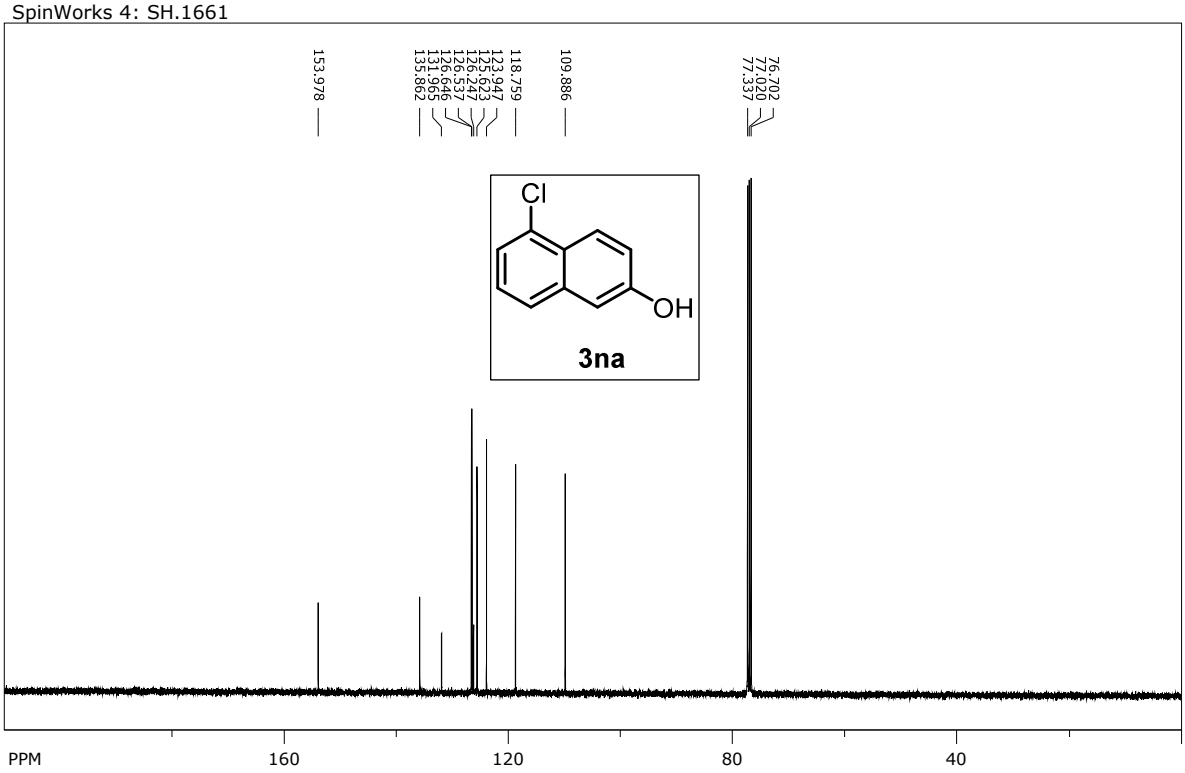
SpinWorks 4: SH.1663



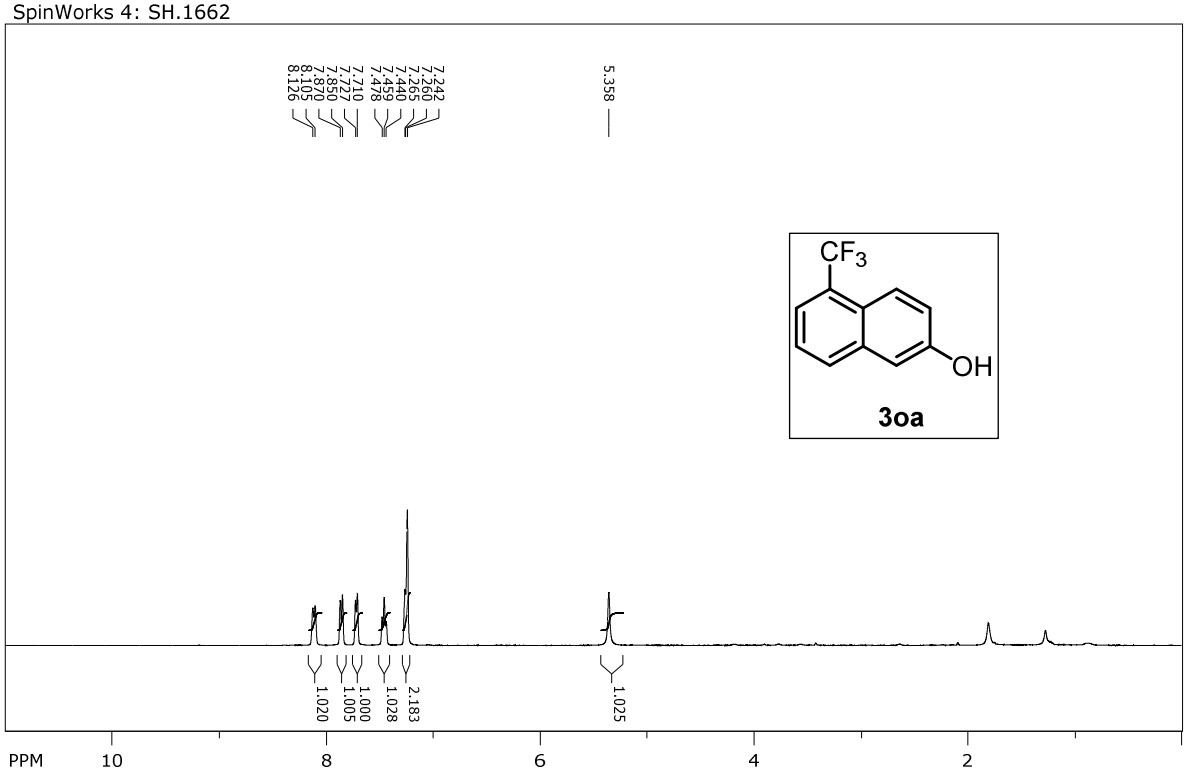
SpinWorks 4: SH.1661



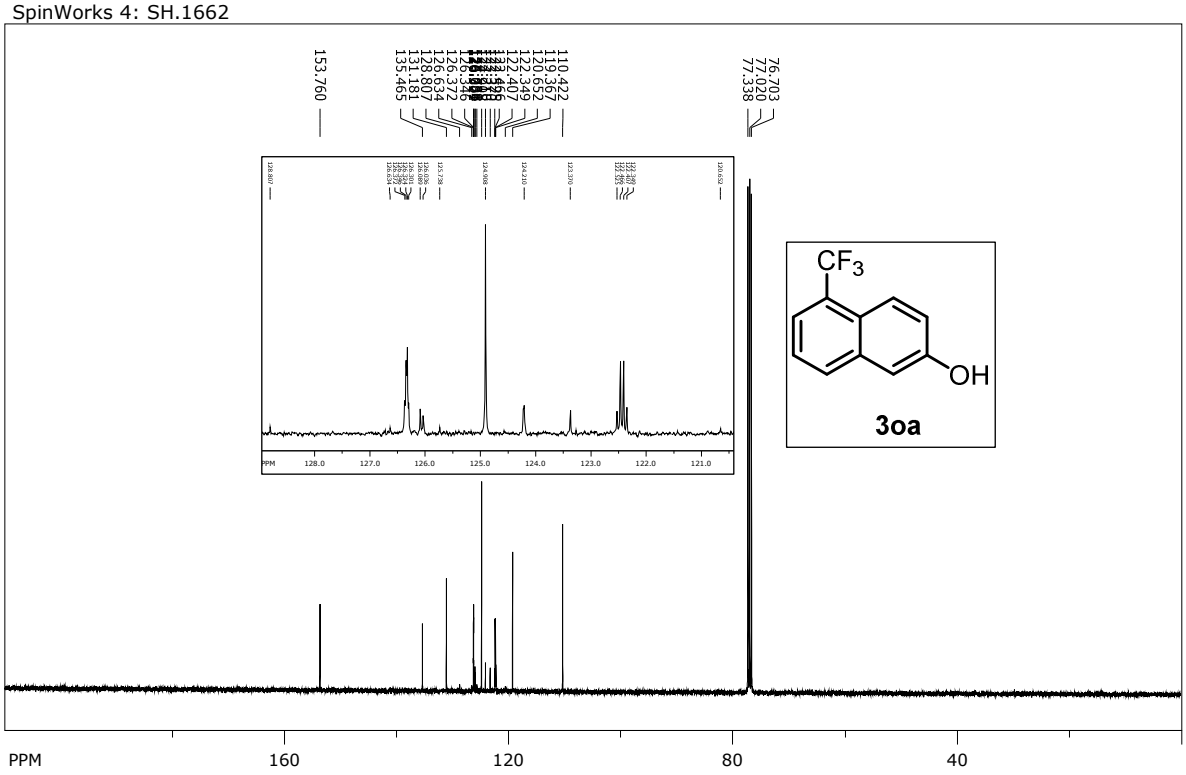
SpinWorks 4: SH.1661



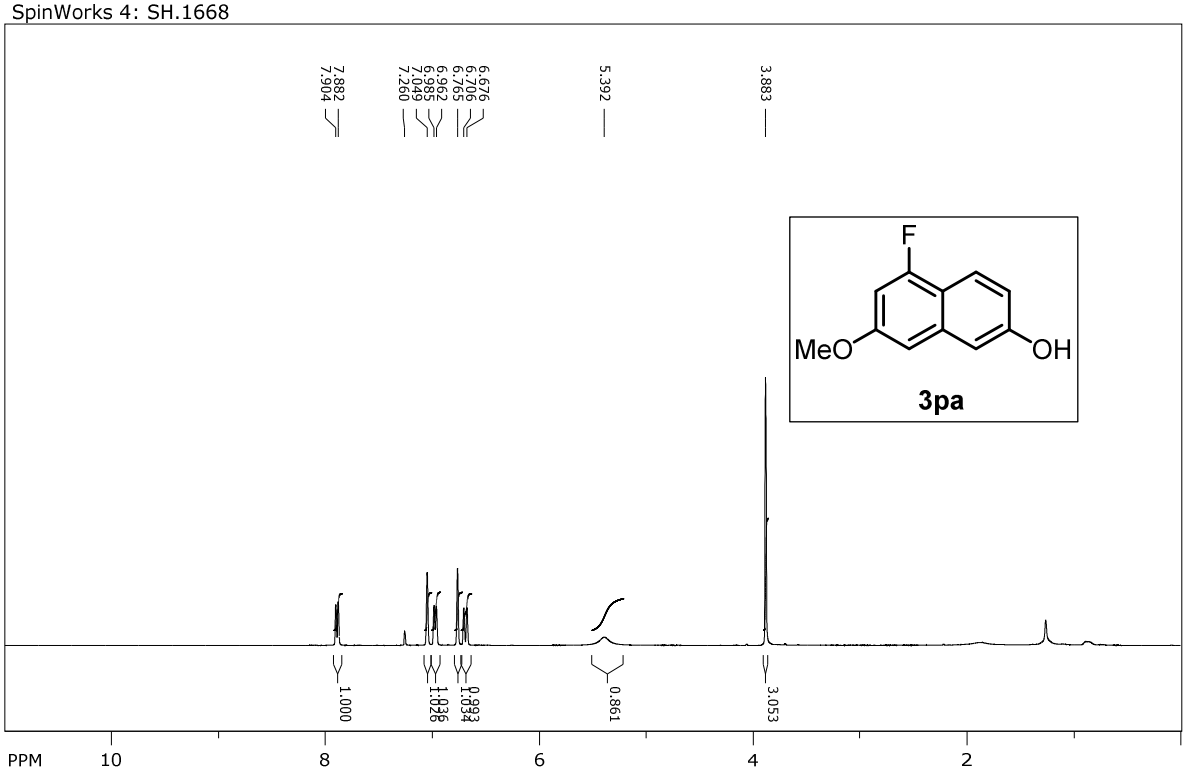
SpinWorks 4: SH.1662



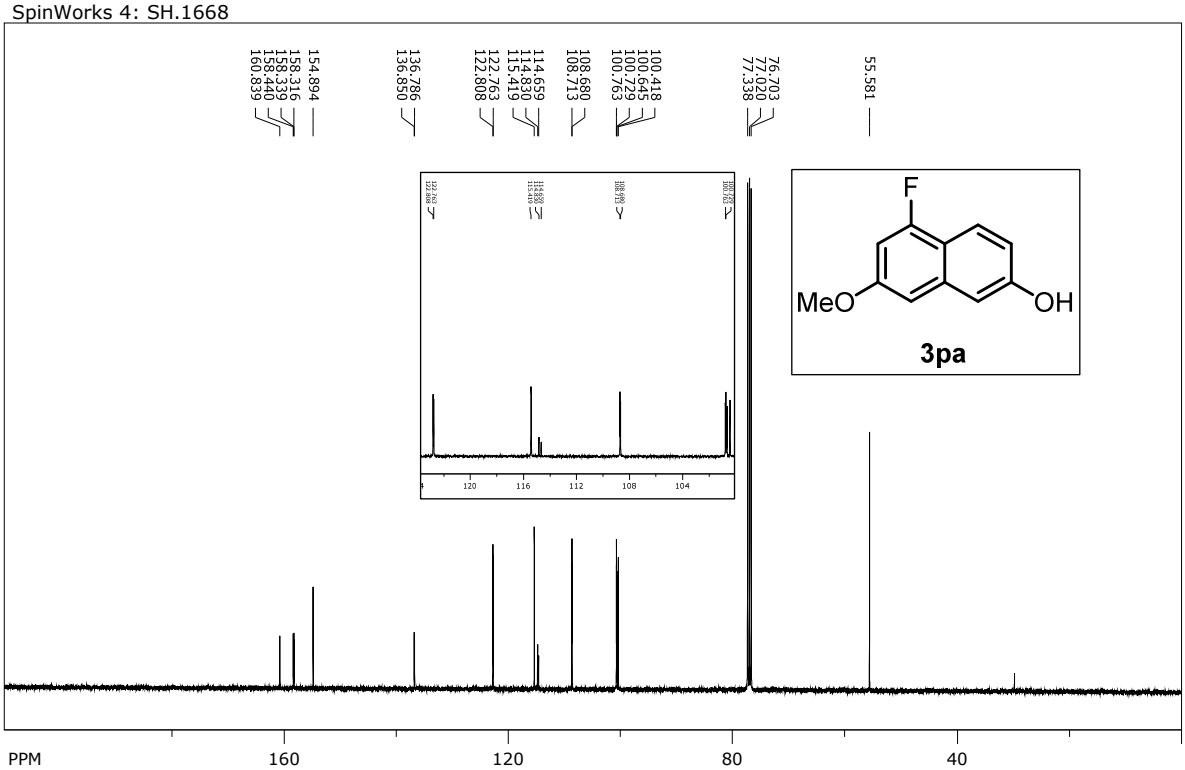
SpinWorks 4: SH.1662



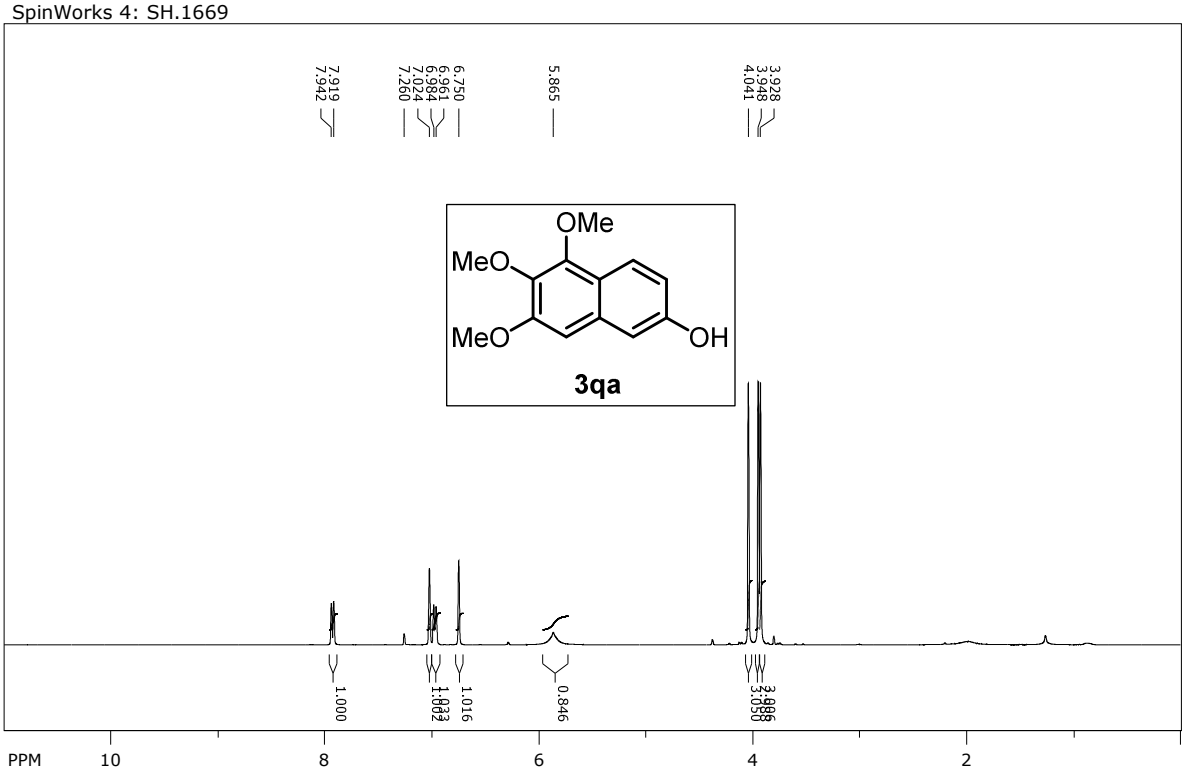
SpinWorks 4: SH.1668



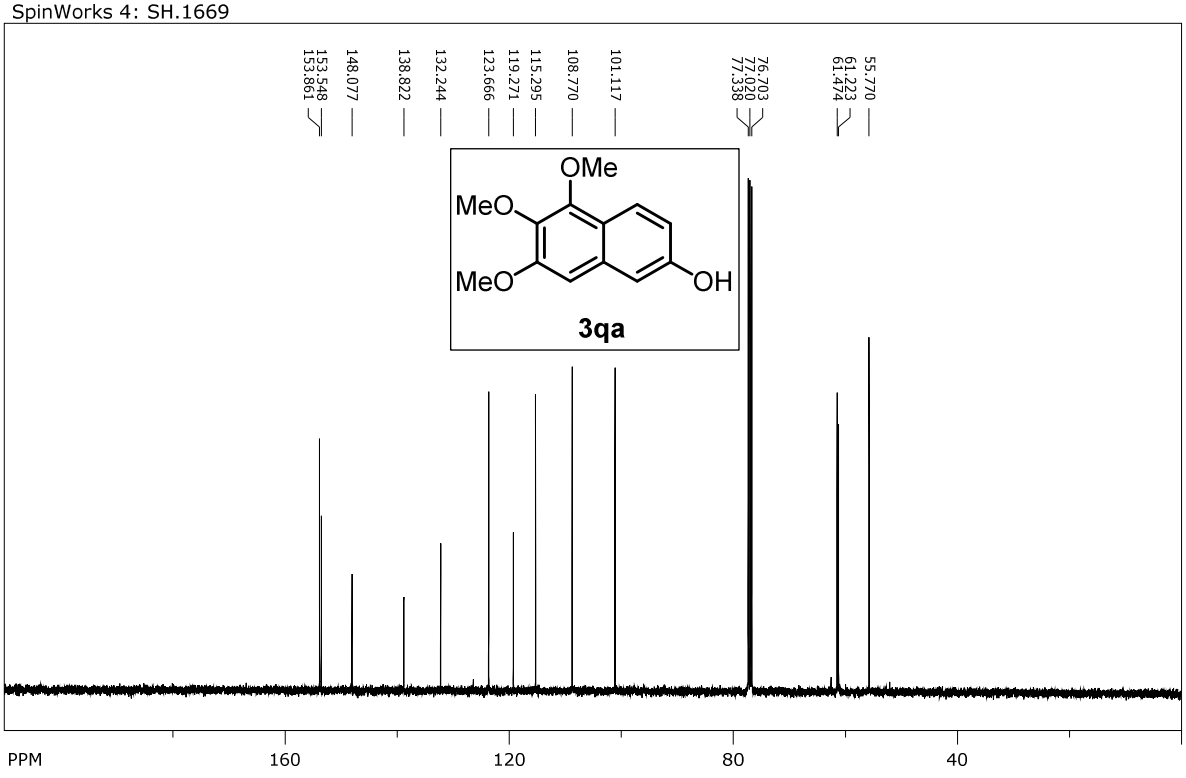
SpinWorks 4: SH.1668



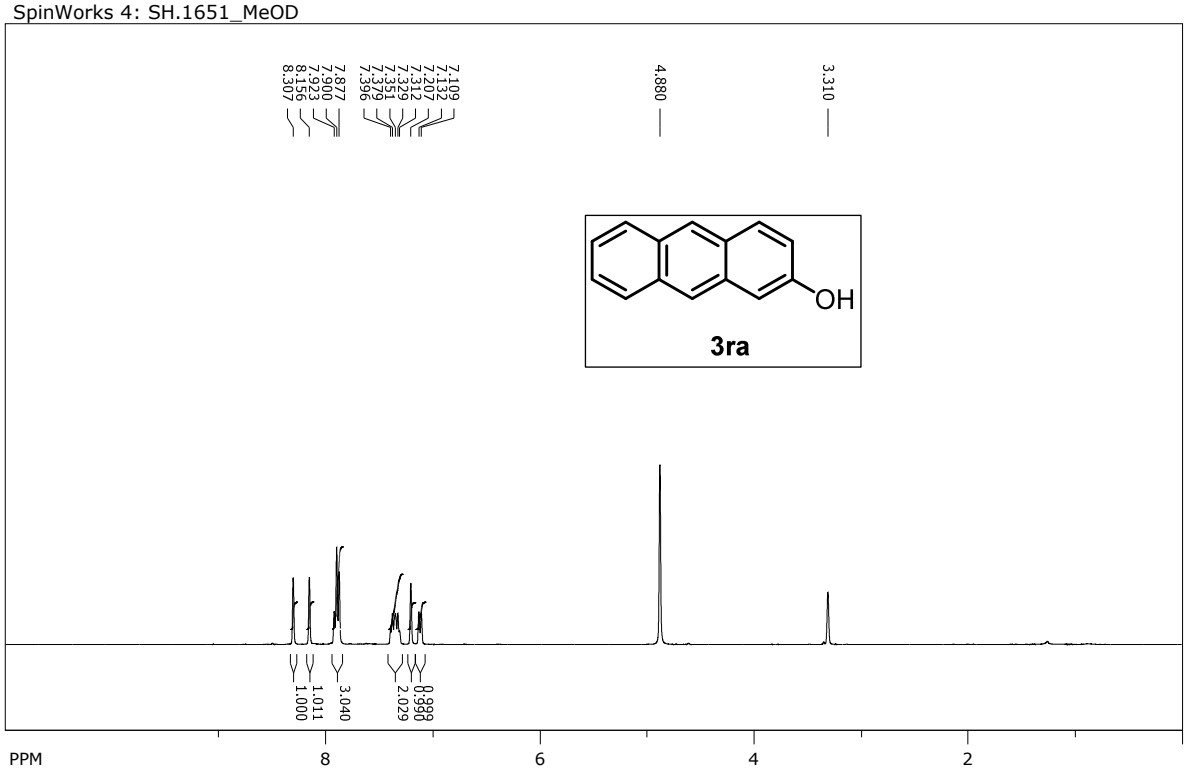
SpinWorks 4: SH.1669



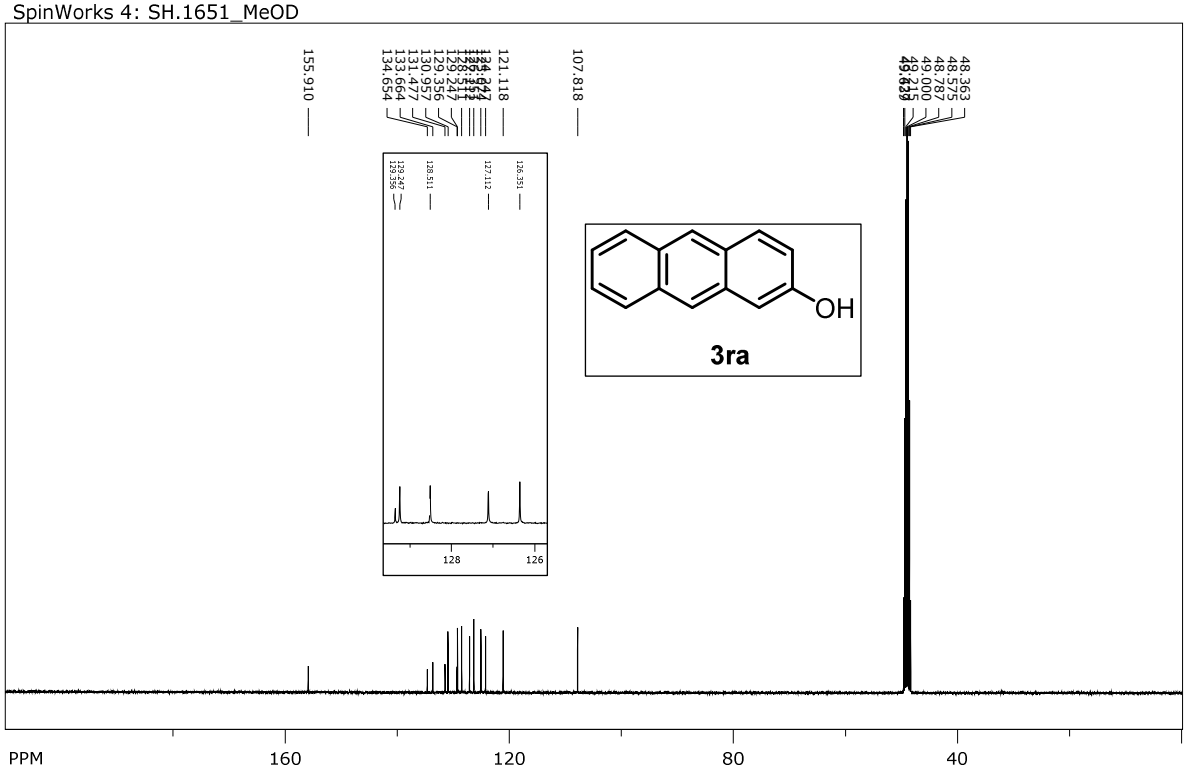
SpinWorks 4: SH.1669

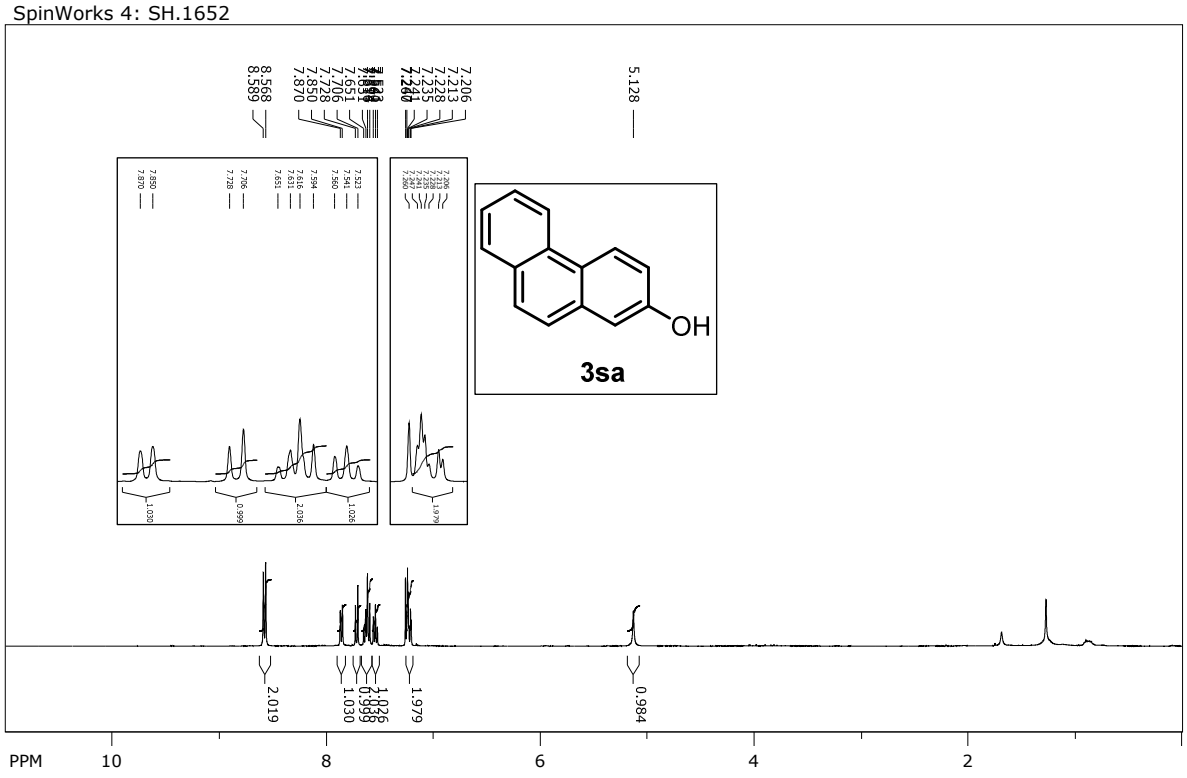


SpinWorks 4: SH.1651_MeOD



SpinWorks 4: SH.1651_MeOD




SpinWorks 4: SH.1652
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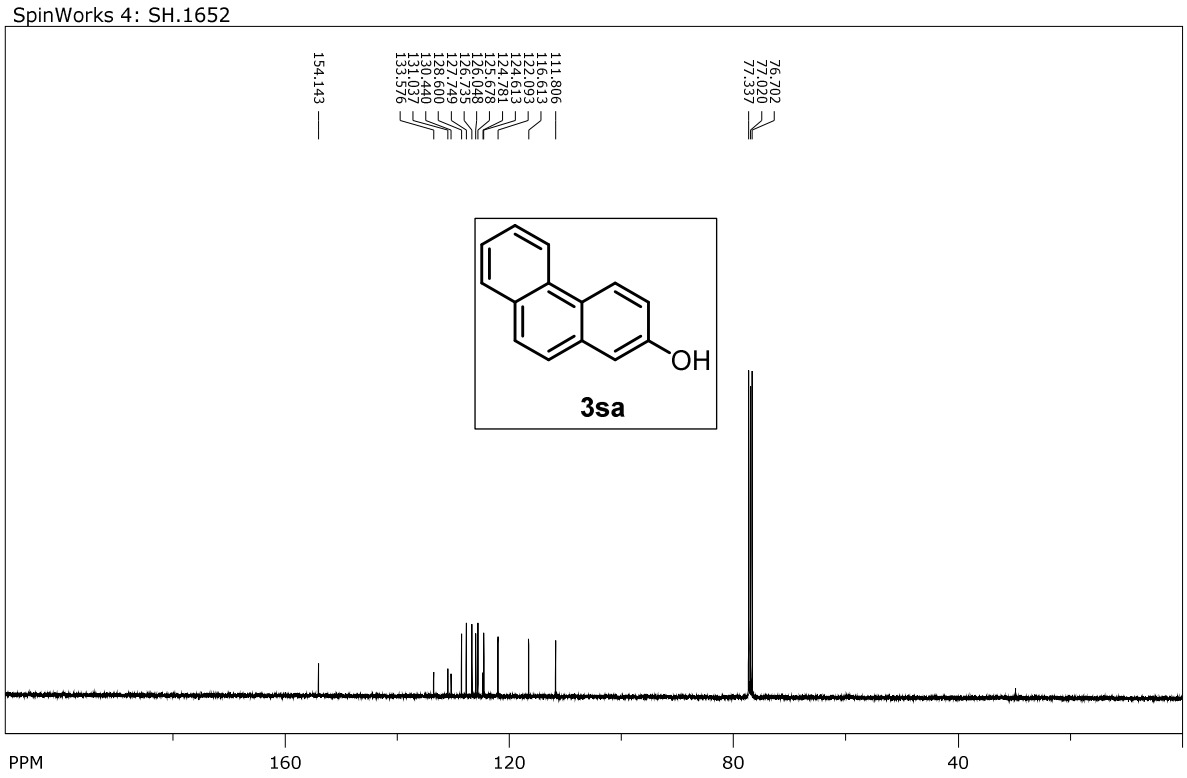
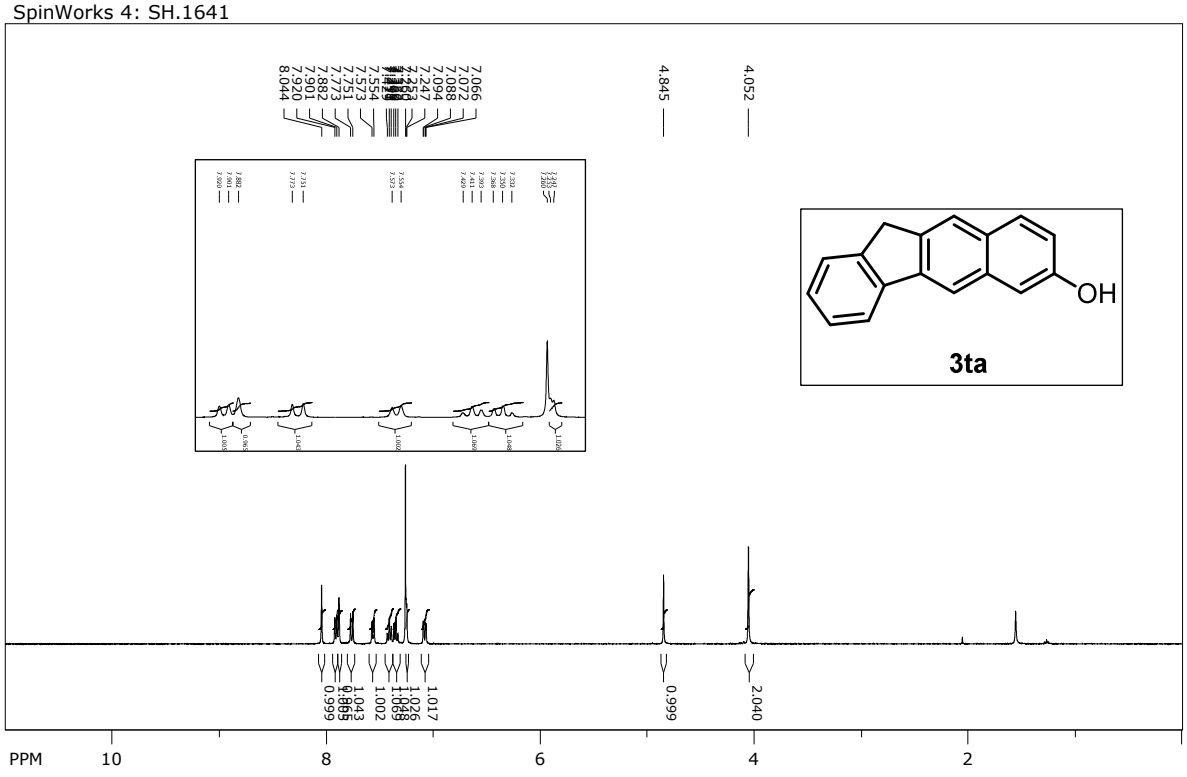
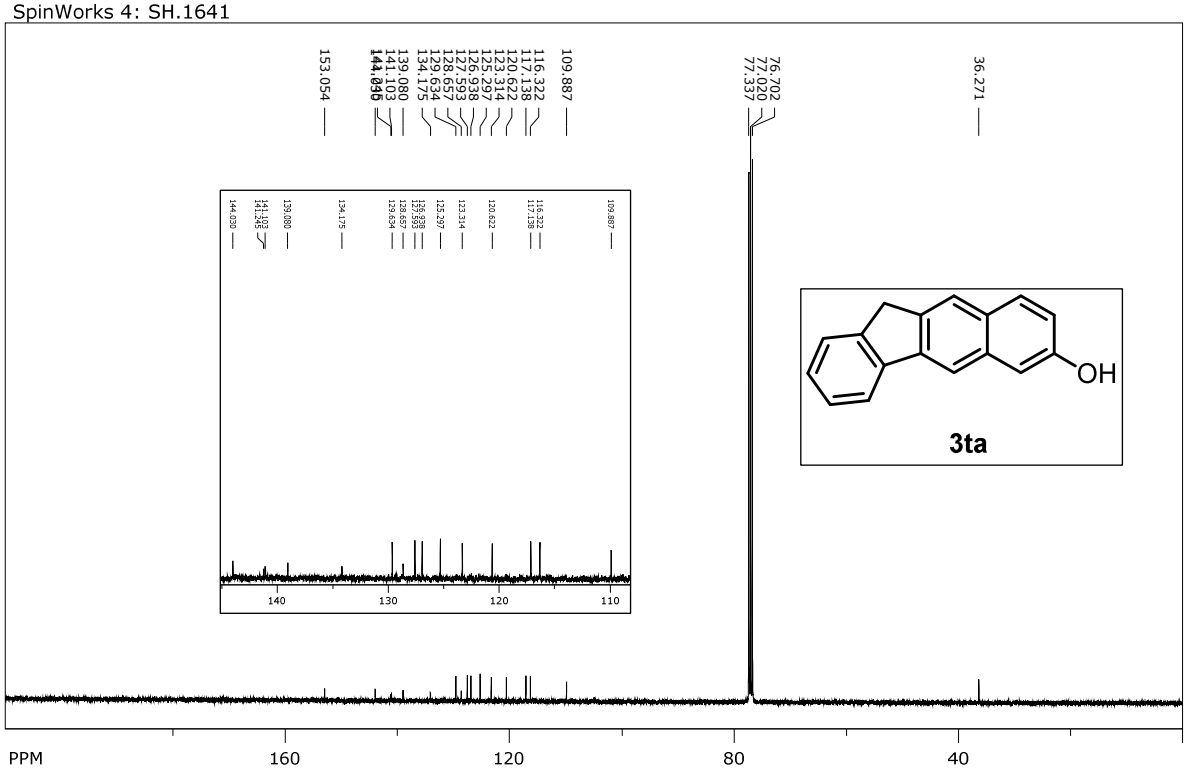
8.589
7.870
7.858
7.706
7.651
7.206
7.213
7.228
7.235
7.241
7.260
5.128
OH
3sa
2.019
1.030
0.999
2.036
1.026
1.979
0.984
PPM
10
8
6
4
2


SpinWorks 4: SH.1652
154.143
133.576
131.037
130.440
128.600
127.735
126.948
125.678
124.781
124.613
122.093
116.613
111.806
77.337
77.020
76.702
OH
3sa
PPM
160
120
80
40

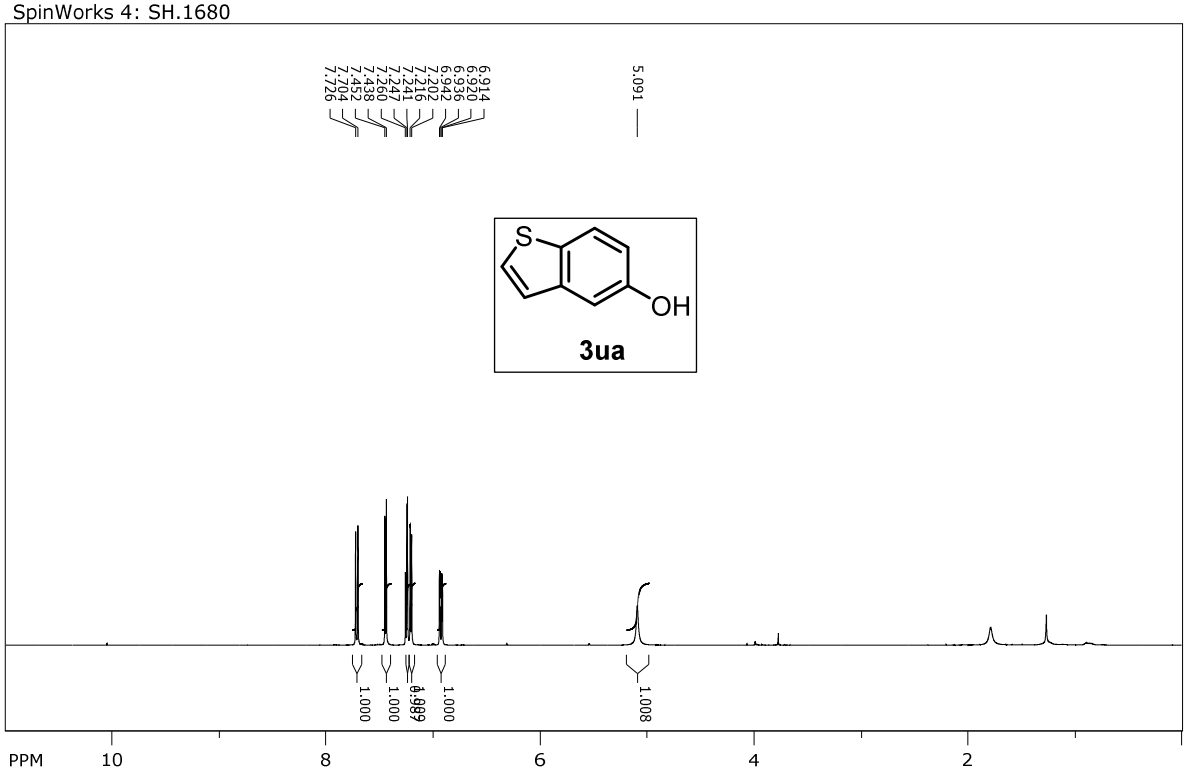
SpinWorks 4: SH.1641



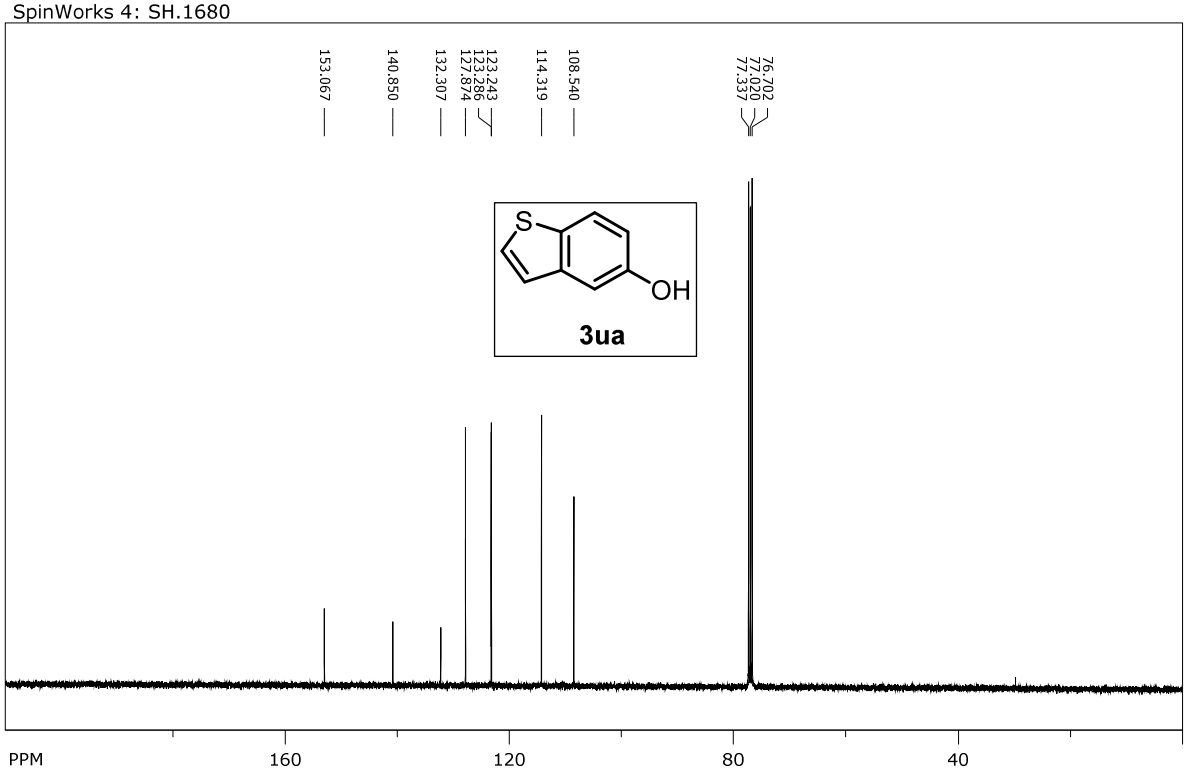
SpinWorks 4: SH.1641



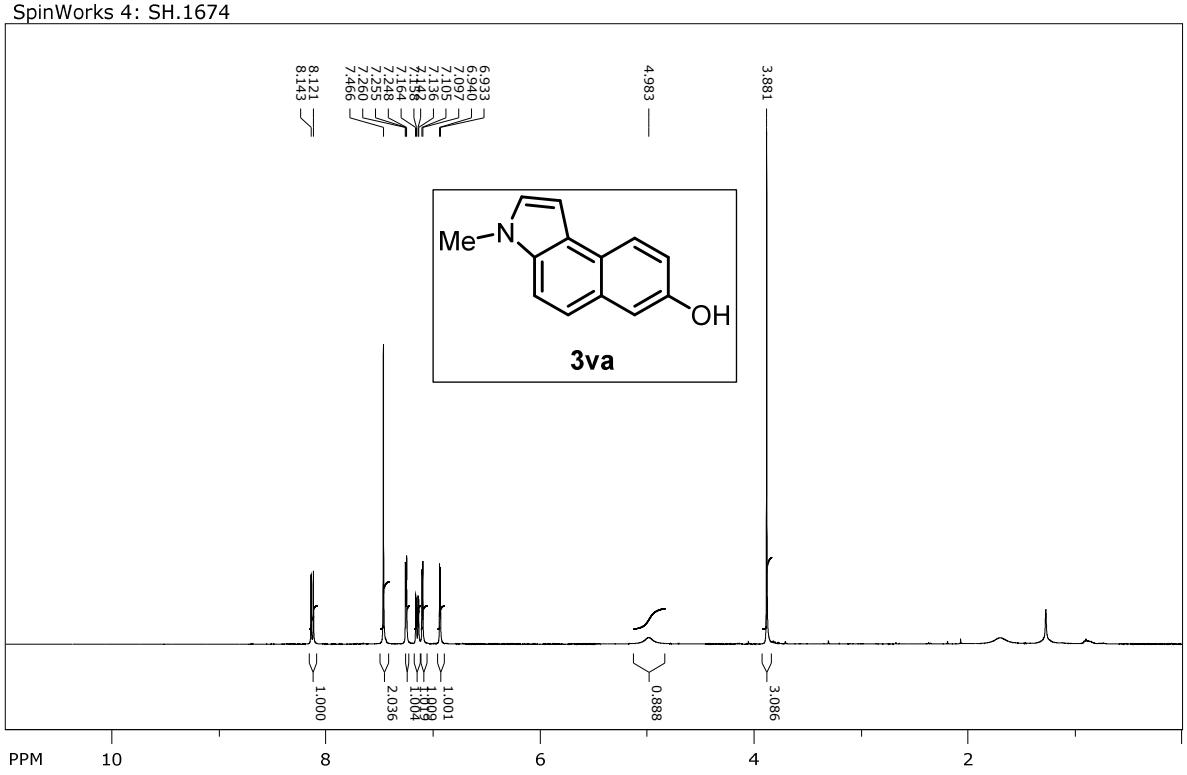
SpinWorks 4: SH.1680



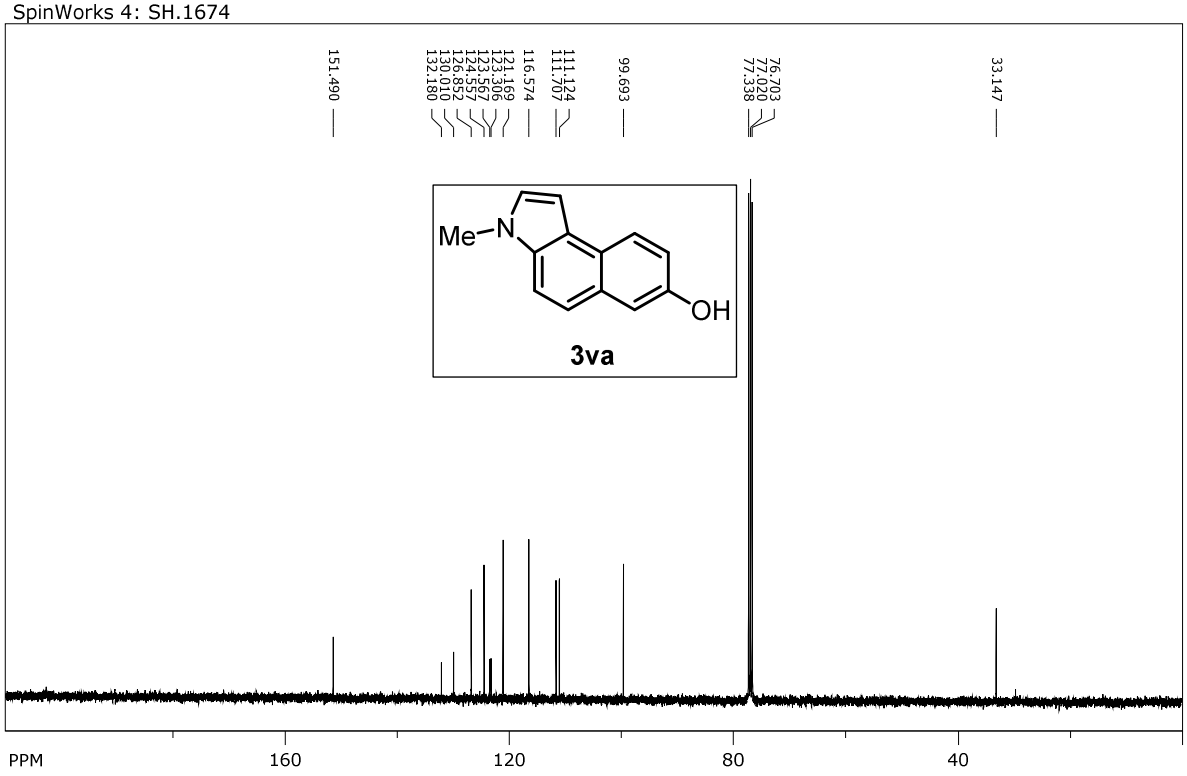
SpinWorks 4: SH.1680



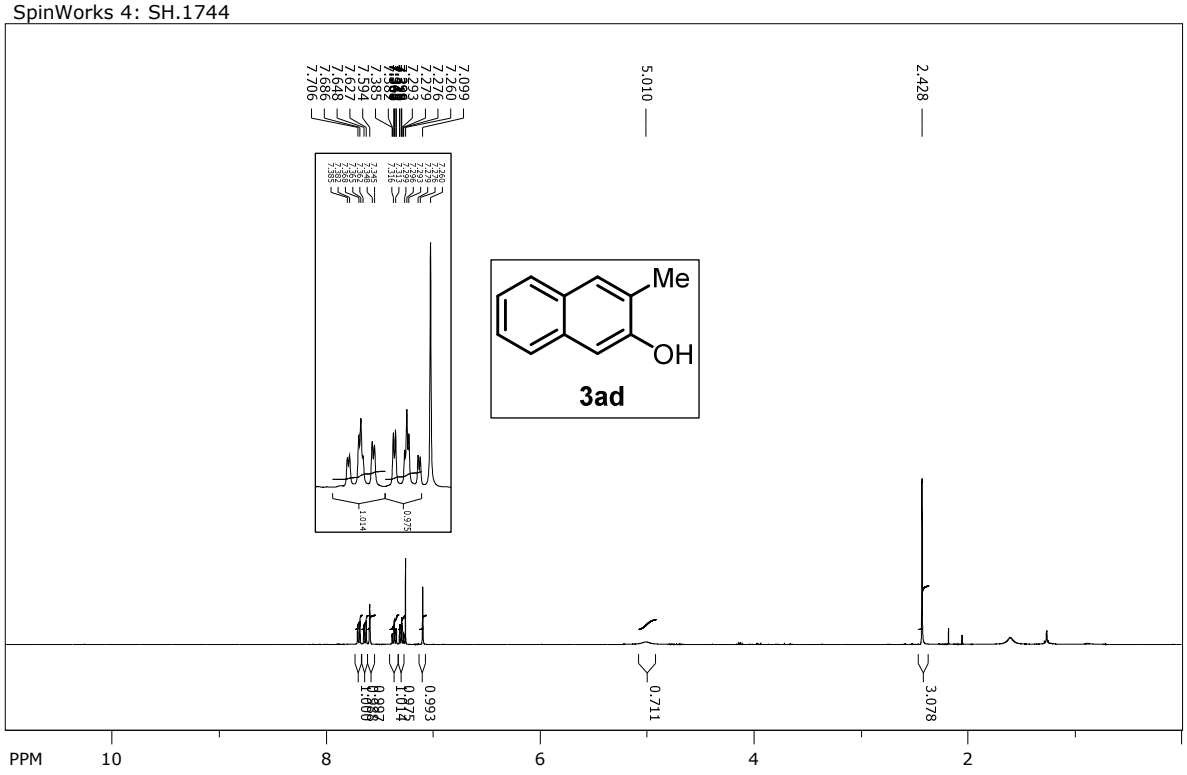
SpinWorks 4: SH.1674



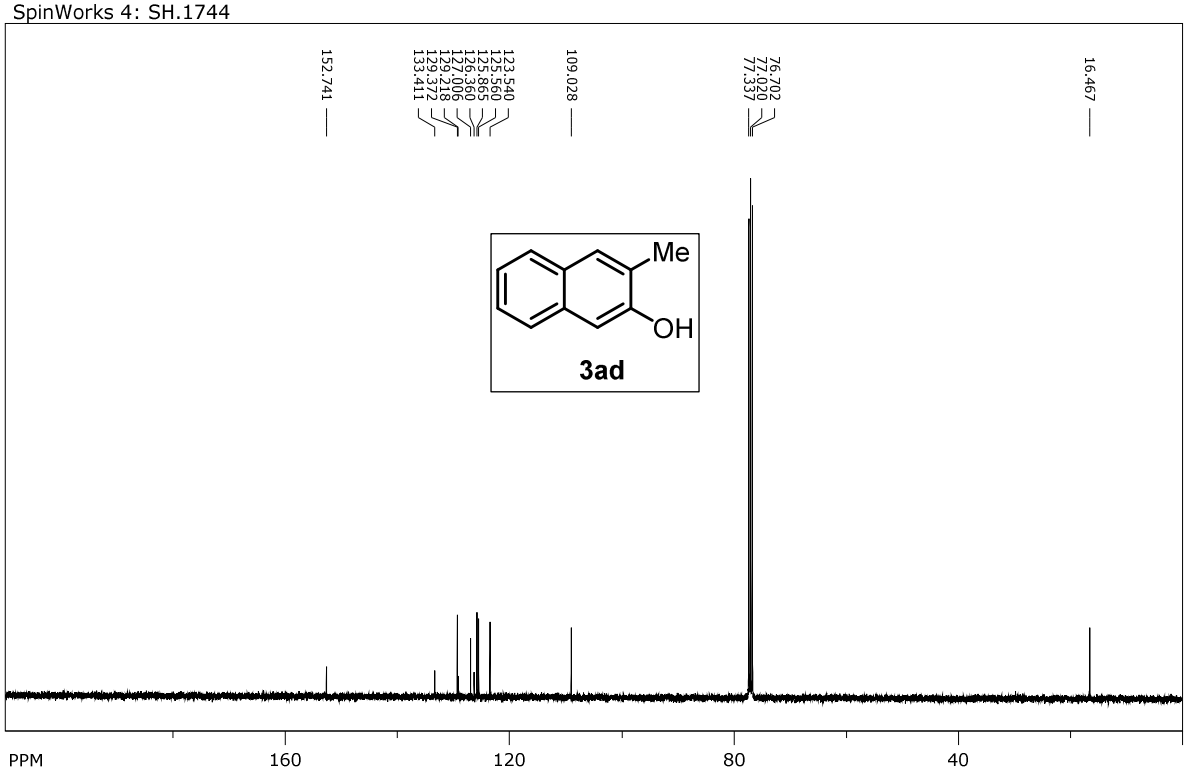
SpinWorks 4: SH.1674



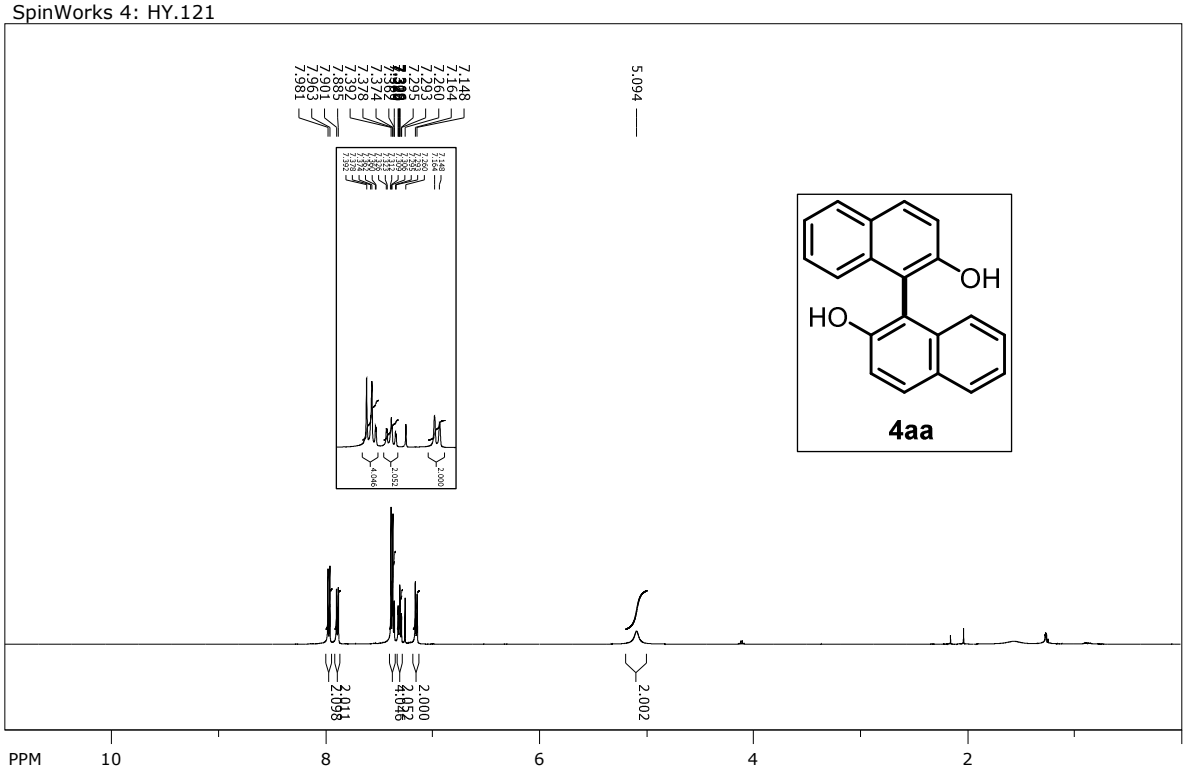
SpinWorks 4: SH.1744



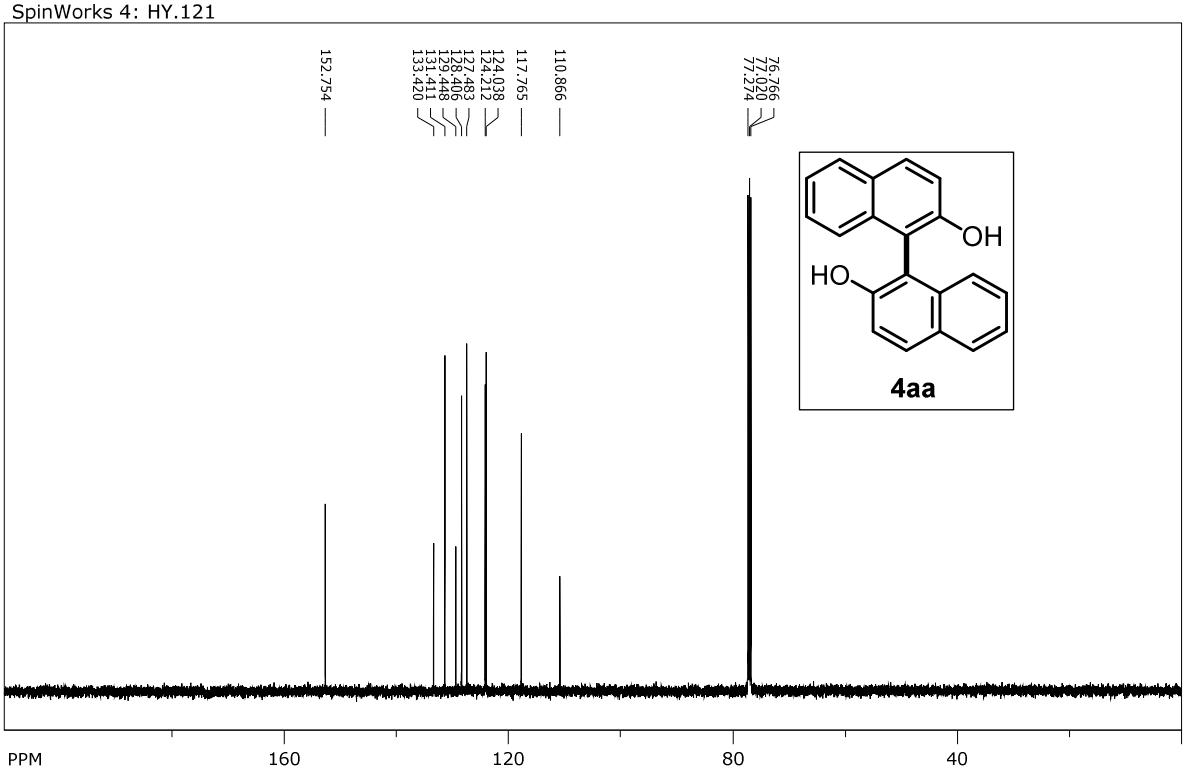
SpinWorks 4: SH.1744



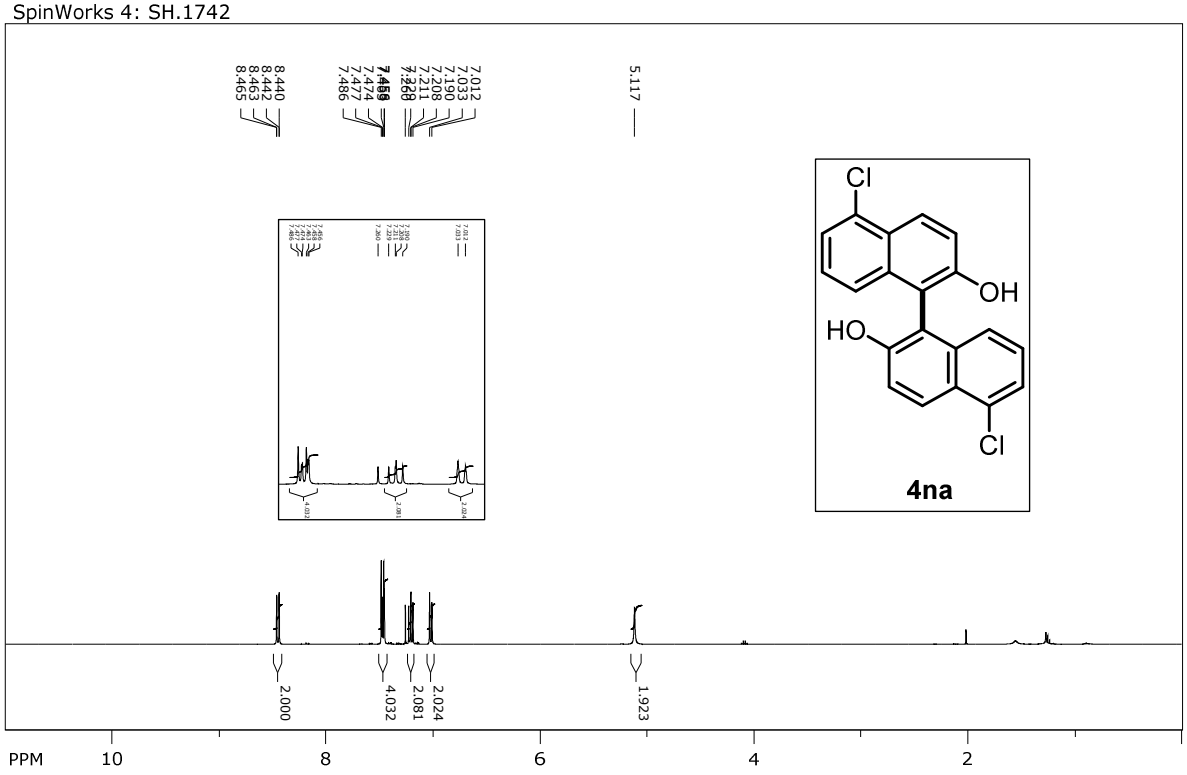
SpinWorks 4: HY.121



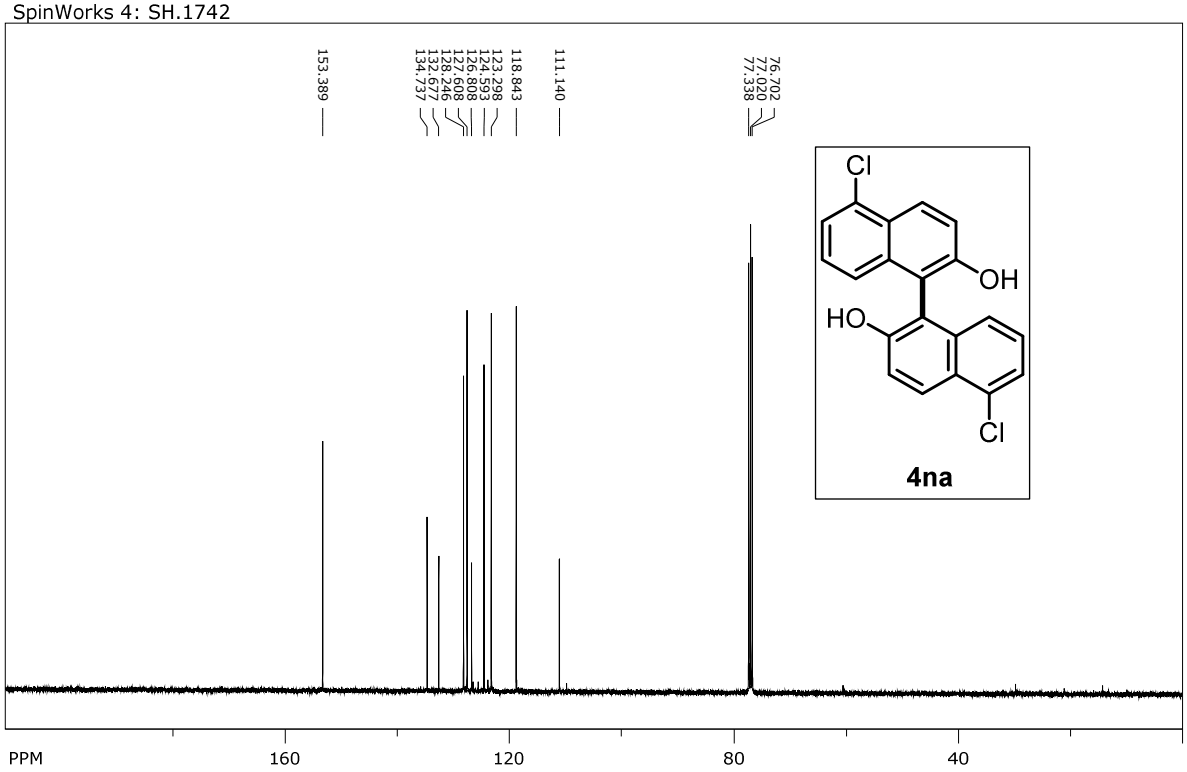
SpinWorks 4: HY.121



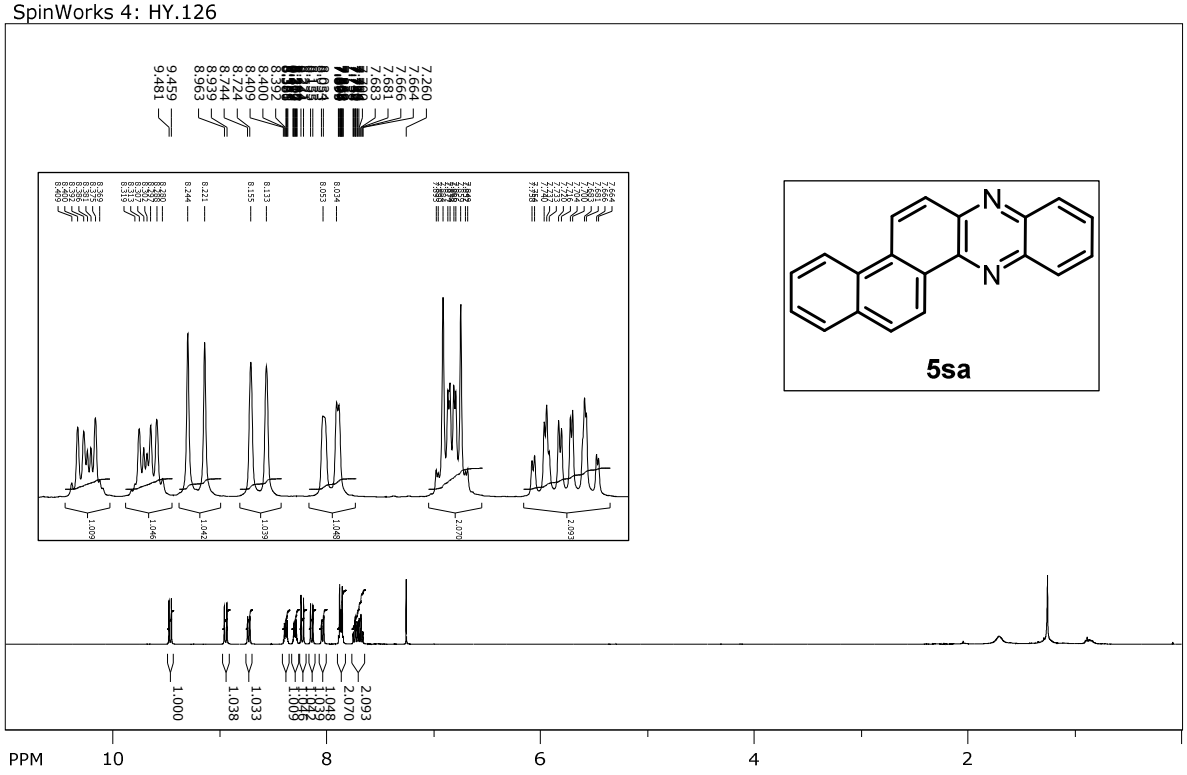
SpinWorks 4: SH.1742



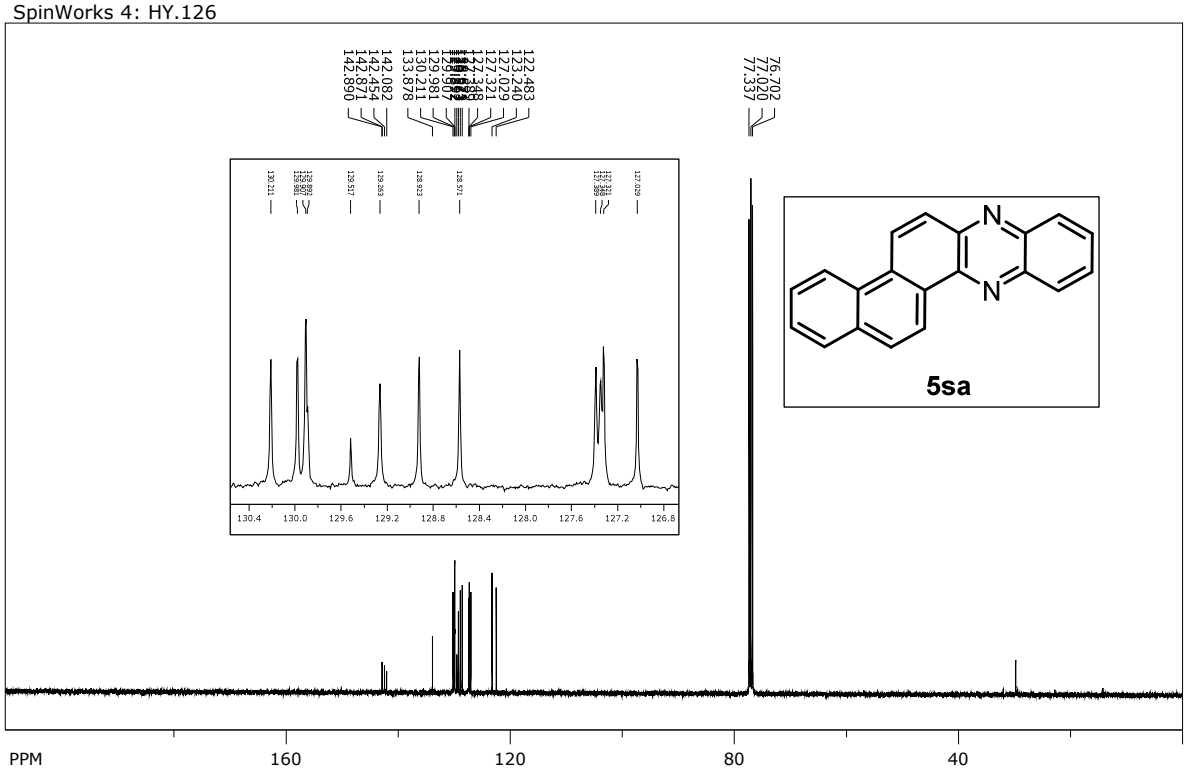
SpinWorks 4: SH.1742



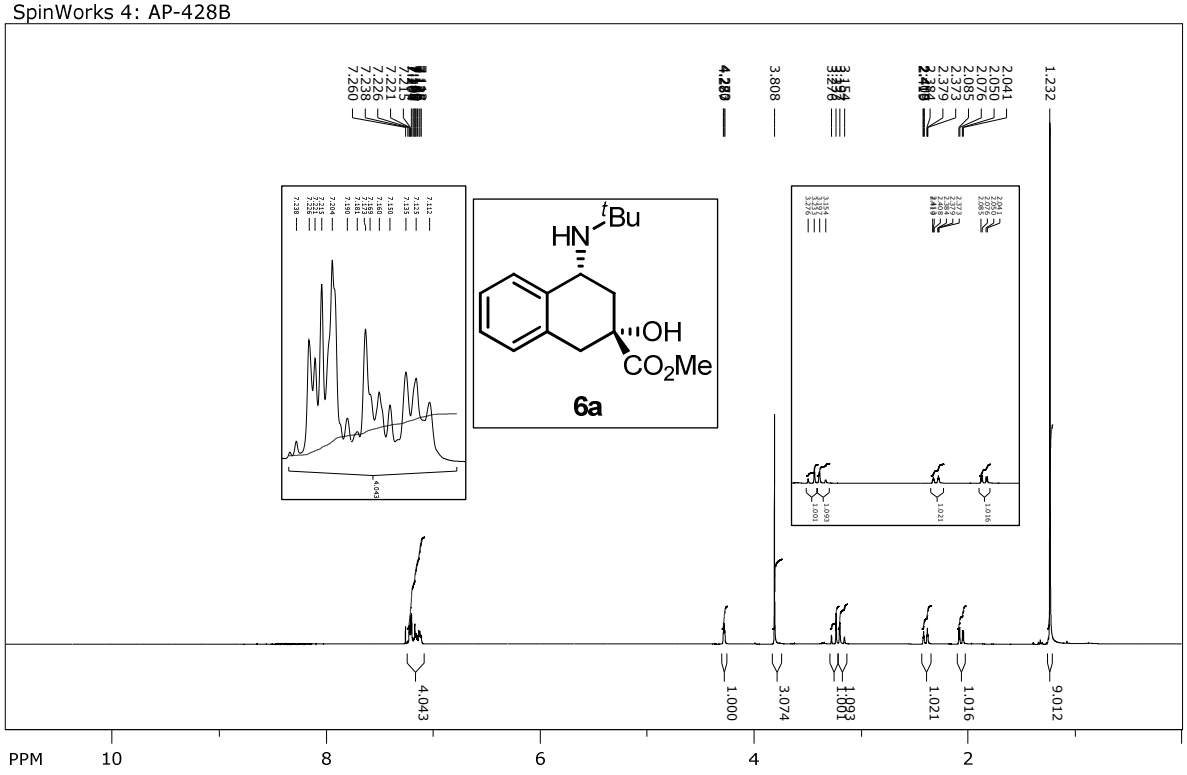
SpinWorks 4: HY.126



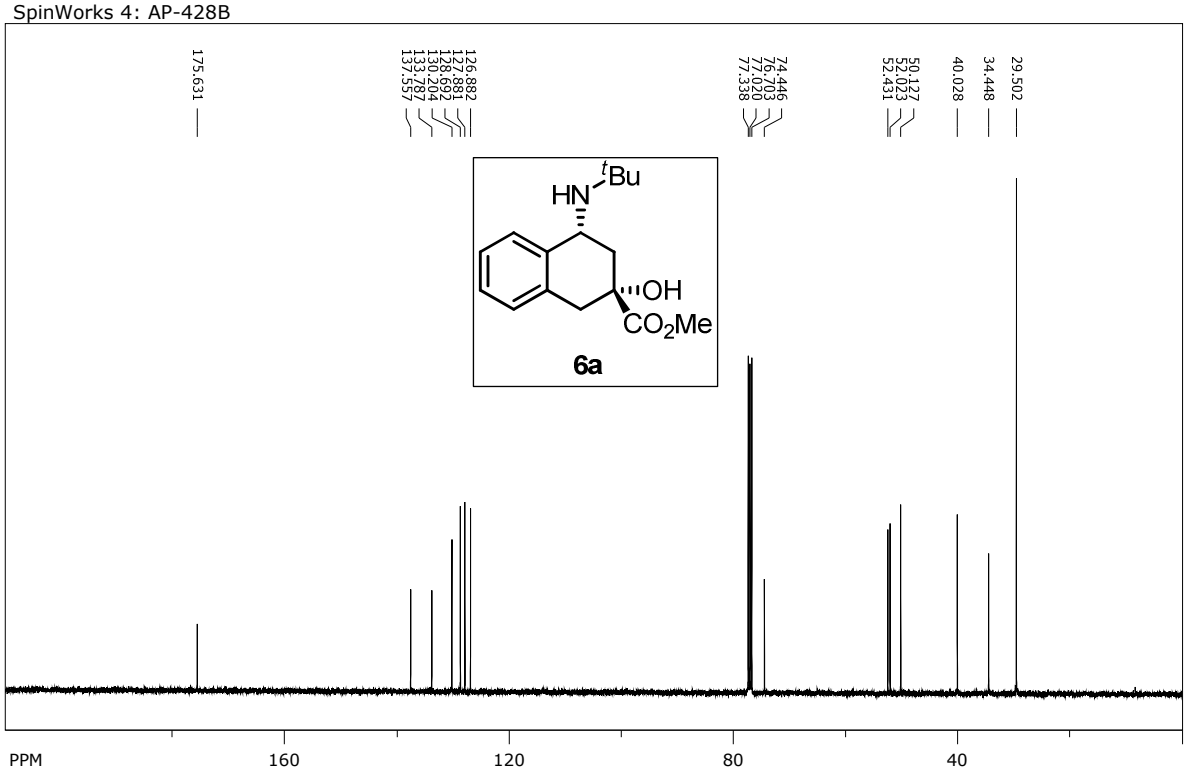
SpinWorks 4: HY.126

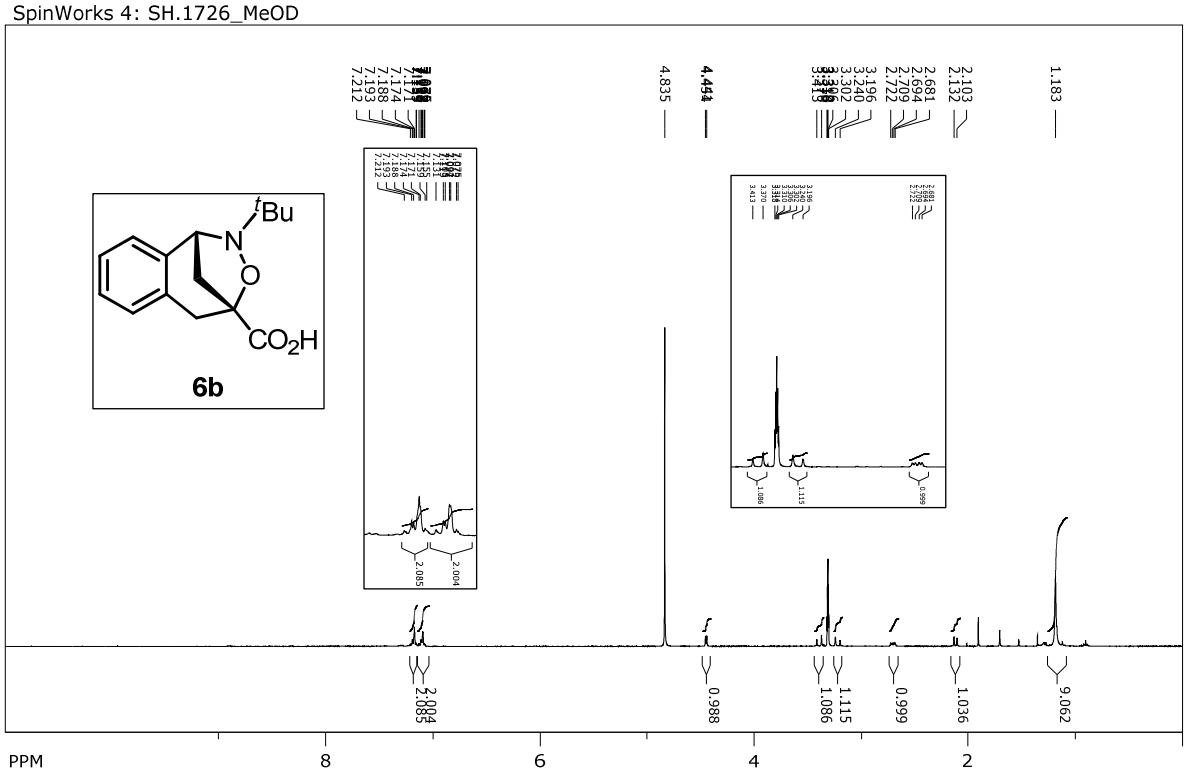


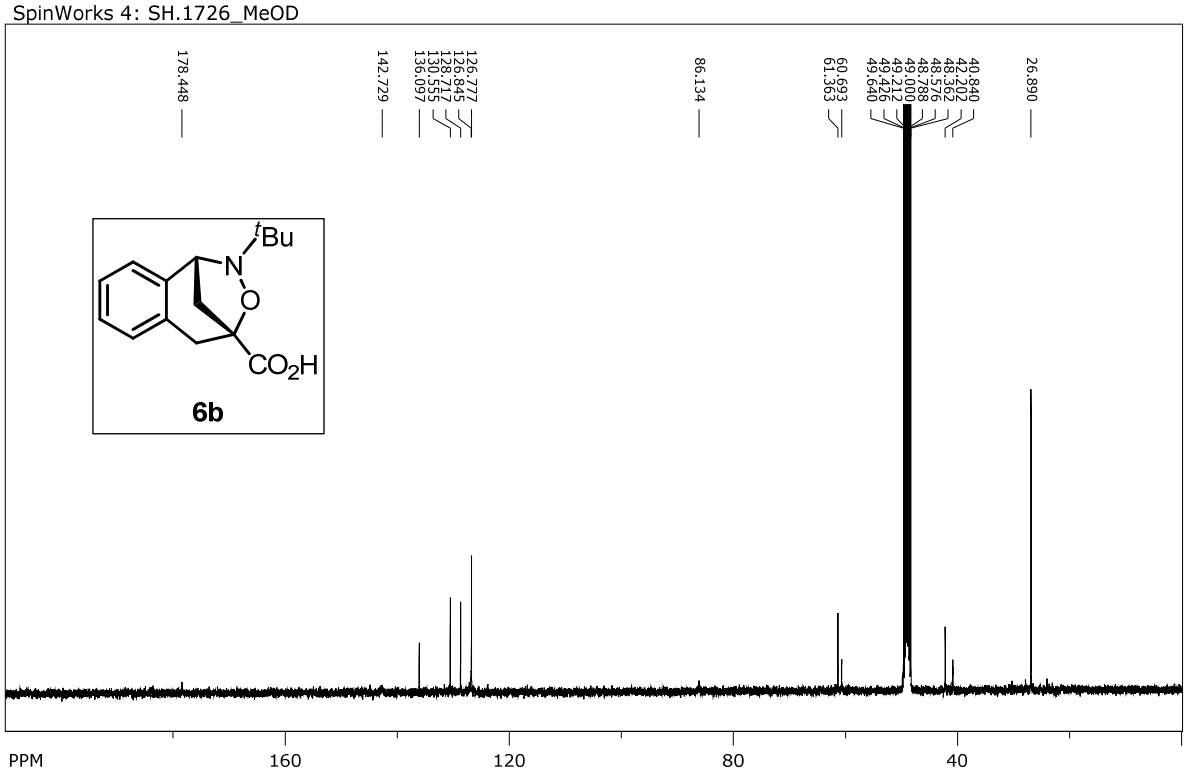
SpinWorks 4: AP-428B



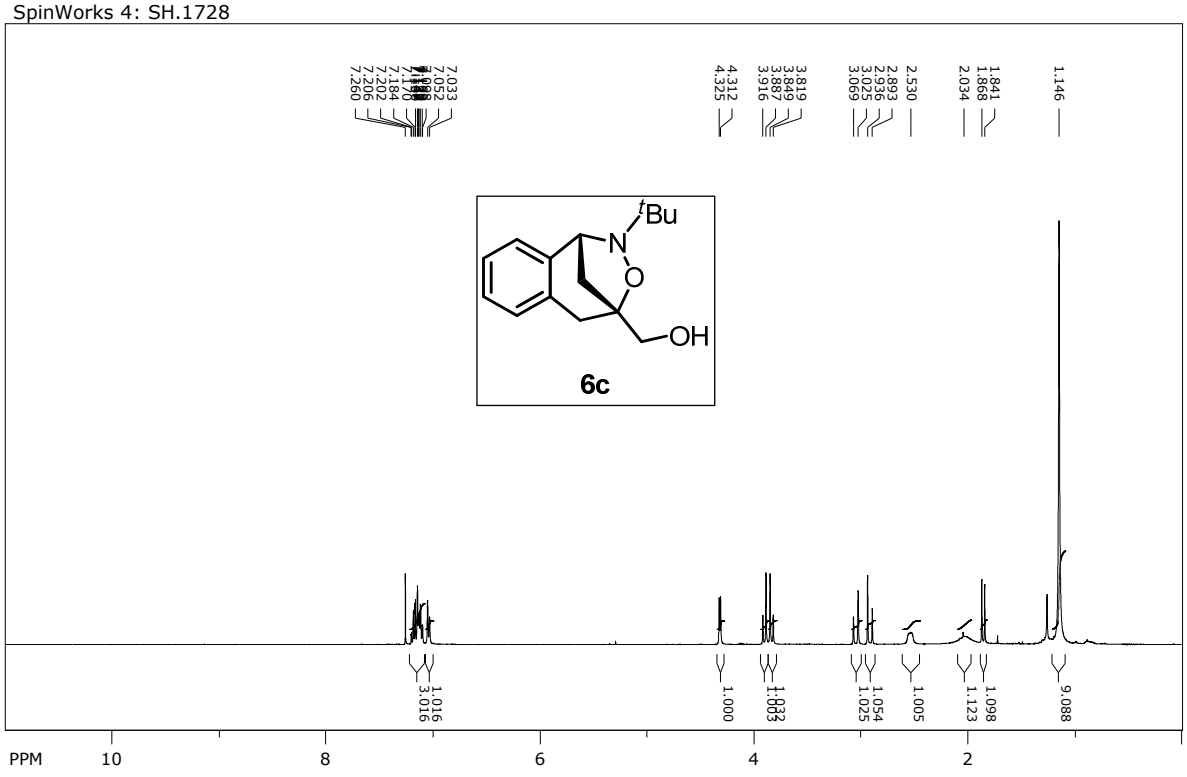
SpinWorks 4: AP-428B



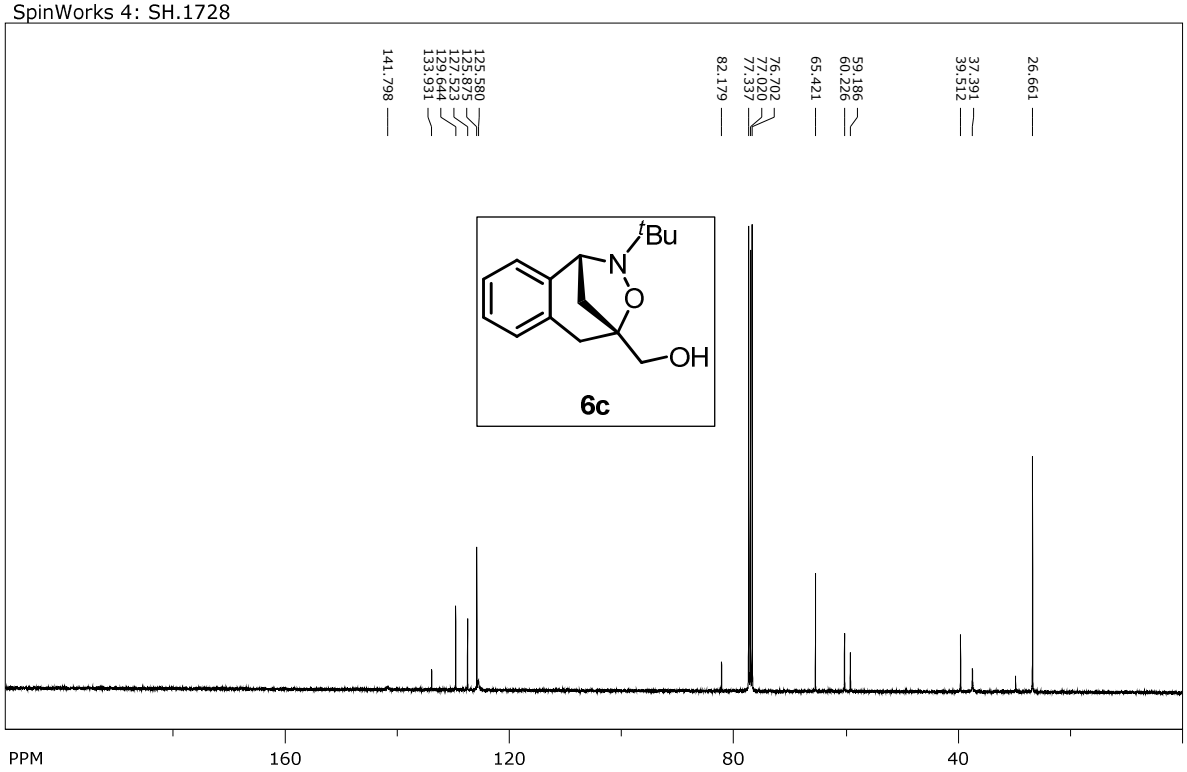

SpinWorks 4: SH.1726_MeOD
4.835
1.183
6b
PPM
8
6
4
2

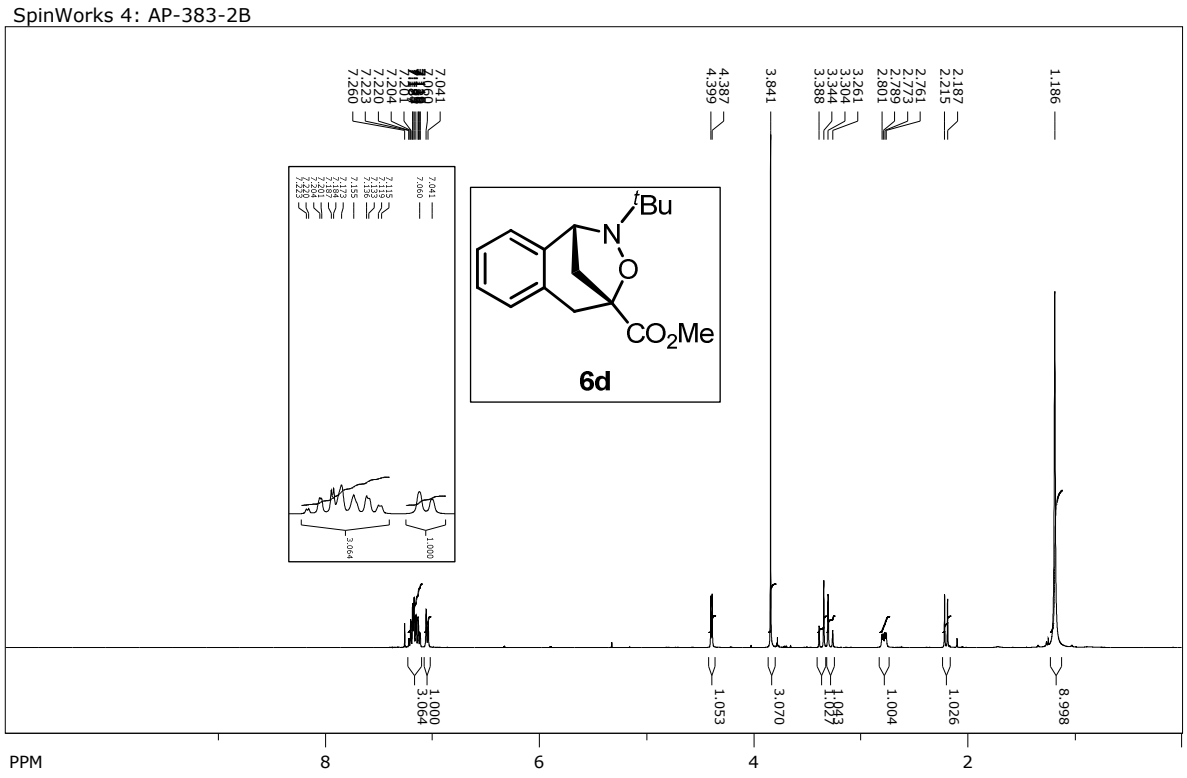

SpinWorks 4: SH.1726_MeOD
178.448
142.729
126.777
126.845
128.717
130.555
136.097
86.134
60.693
61.363
49.212
49.426
49.640
49.000
48.788
48.576
48.362
42.202
40.840
26.890
6b
PPM
160
120
80
40

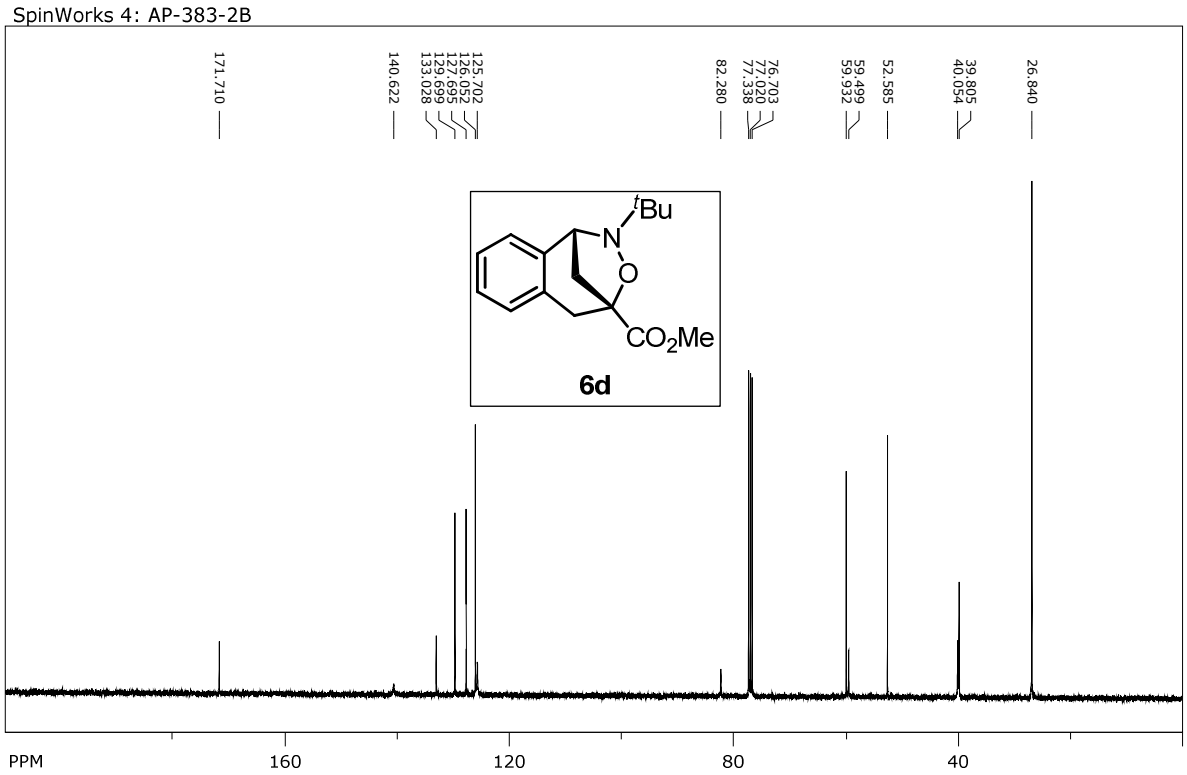
SpinWorks 4: SH.1728



SpinWorks 4: SH.1728




SpinWorks 4: AP-383-2B
7.041
7.260
4.387
4.399
3.841
3.261
3.304
3.344
3.388
2.761
2.773
2.789
2.801
2.187
2.215
1.186
tBu
N
O
CO2Me
6d
1.000
3.064
1.053
3.070
1.004
1.026
8.998
PPM
8
6
4
2


SpinWorks 4: AP-383-2B
171.710
140.622
133.028
82.280
77.338
59.932
52.585
40.054
26.840
tBu
N
O
CO2Me
6d
PPM
160
120
80
40

SpinWorks 4: SH.1679 = SH.1618-d