Supporting Information for:

Ir-Catalyzed Borylation as an Efficient Route to a Nicotine Hapten

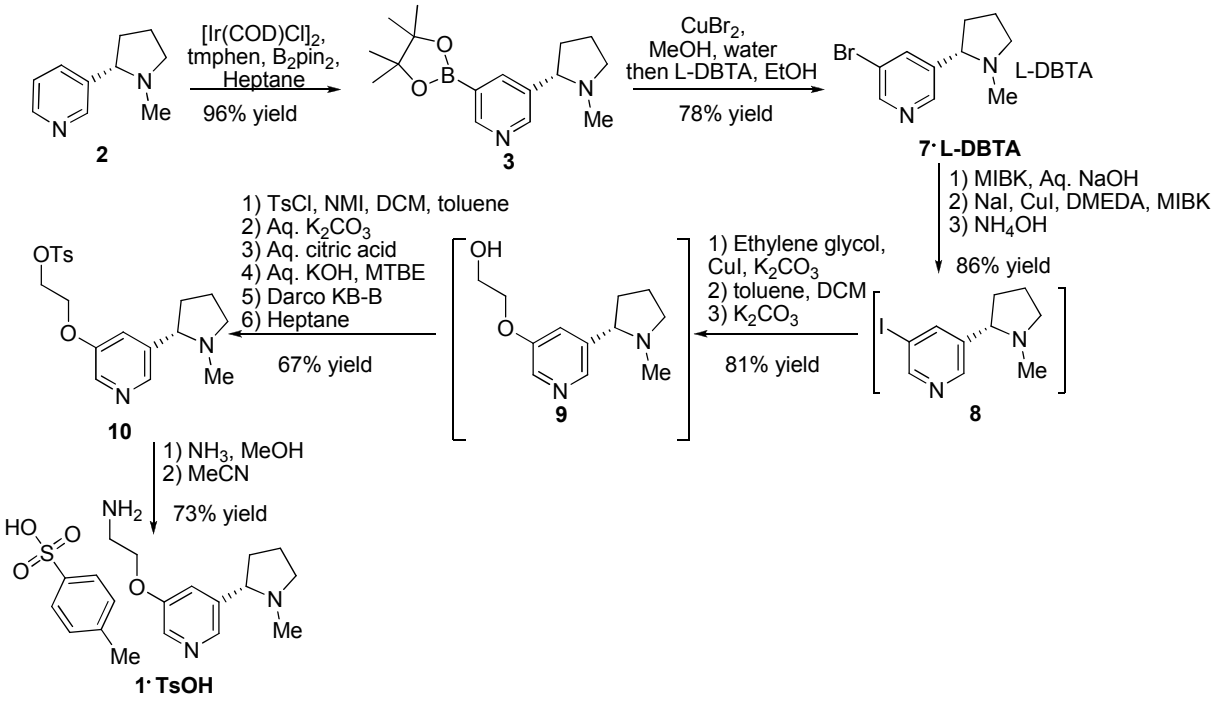
Janice E. Sieser,[†] *Mark T. Maloney,*[†] *Esmort Chisowa,*[†] *Steven J. Brenek,*[†] *Sebastien Monfette,*[†] *John J. Salisbury,*[‡] *Nga M. Do,*[†] *Robert A. Singer*[*†]

[†] Chemical Research and Development, Pfizer Worldwide Research and Development, Groton Labs, Eastern Point Road, Groton, CT 06340, USA

[‡] Analytical Research and Development, Pfizer Worldwide Research and Development, Groton Labs, Eastern Point Road, Groton, CT 06340, USA

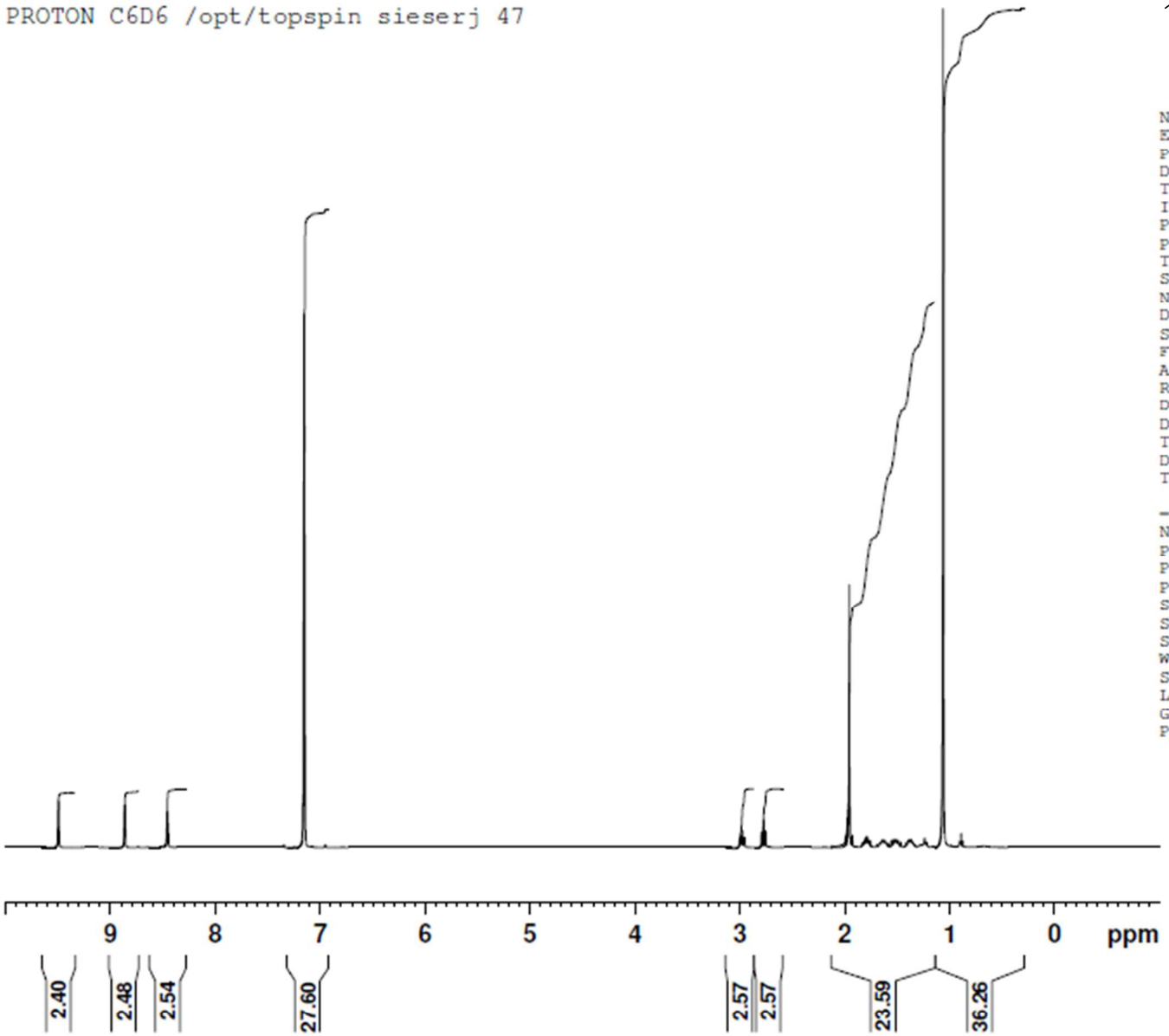
robert.a.singer@pfizer.com

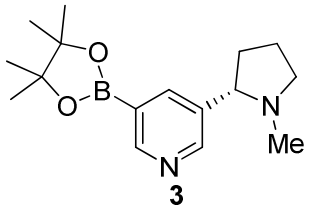
Content: NMR data and assignments for isolated compounds



Scheme 1. New Overall Route to Mono-Tosylate Salt of 1

^{1}H NMR (C_6D_6) for compound **3**:

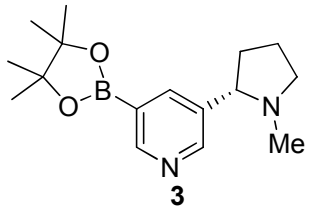




3

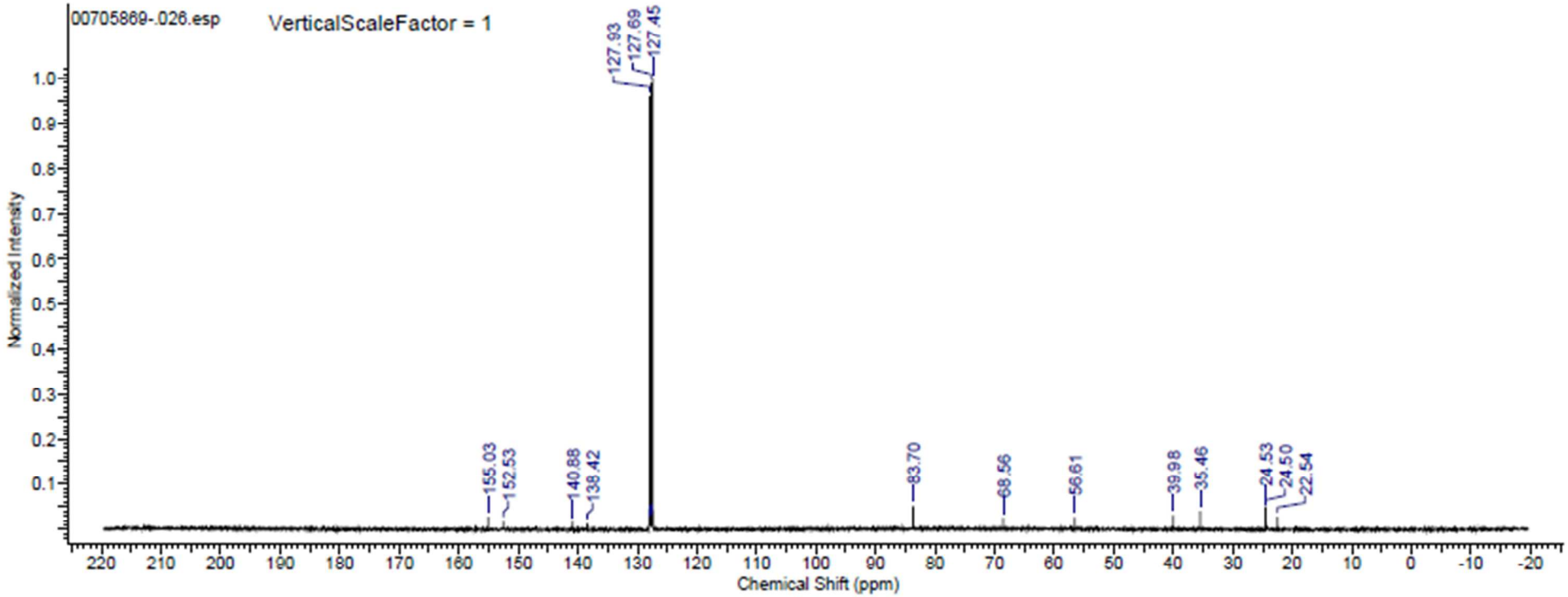
NAME	03052013-sieserj	
EXPNO	3	
PROCNO	1	
Date_	20130305	
Time	13.00	
INSTRUM	spect	
PROBHD	5 mm PABBO BB-	
PULPROG	zg30	
TD	65536	
SOLVENT	C6D6	
NS	16	
DS	2	
SWH	8223.685	Hz
FIDRES	0.125483	Hz
AQ	3.9846387	sec
RG	203	
DW	60.800	usec
DE	6.50	usec
TE	294.8	K
D1	1.00000000	sec
TD0	1	
-------- CHANNEL f1 --------		
NUC1	1H	
P1	14.10	usec
PL1	-1.00	dB
PL1W	13.02858353	W
SFO1	400.1324710	MHz
SI	32768	
SF	400.1300000	MHz
WDW	EM	
SSB	0	
LB	0.30	Hz
GB	0	
PC	1.00	

^{13}C NMR (C_6D_6) data for compound **3**:



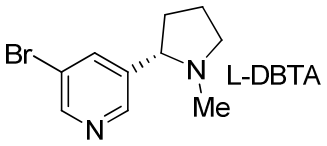
3

Acquisition Time (sec)	1.3631				
Comment	NMR System BNMR_319-1 400 10206243 Pfizer Confidential compound 3 carbon C6D6 {C:\Bruker\TopSpin3.5pl6} singerra 3				
Date	27 Mar 2018 08:45:52	*Date Stamp*	27 Mar 2018 08:45:52		
File Name	\\AMRGROBCZC642.AMER.PFIZER.COM\BKDATA~.DATA\SINGERRA\NMR\00705869-\26\FID				
Frequency (MHz)	100.50	*Nucleus*	13C	*Number of Transients*	512
Origin	spect	*Original Points Count*	32768	*Owner*	FCNGRO-BRKOA
Points Count	32768	*Pulse Sequence*	zgpg30	*Receiver Gain*	185.95
SW(cyclical) (Hz)	24038.46	*Solvent*	BENZENE-d6	*Spectrum Offset (Hz)*	10056.1631
Spectrum Type	STANDARD	*Sweep Width (Hz)*	24037.73	*Temperature (degree C)*	25.154



^{1}H NMR (CD_3OD) data for compound **7• L-DBTA**:

```
NMR System BNMR_319-1 400 10206243
Pfizer Confidential
compound 7 L-DBTA
proton MeOD {C:\Bruker\TopSpin3.5pl6} singerra 42
```

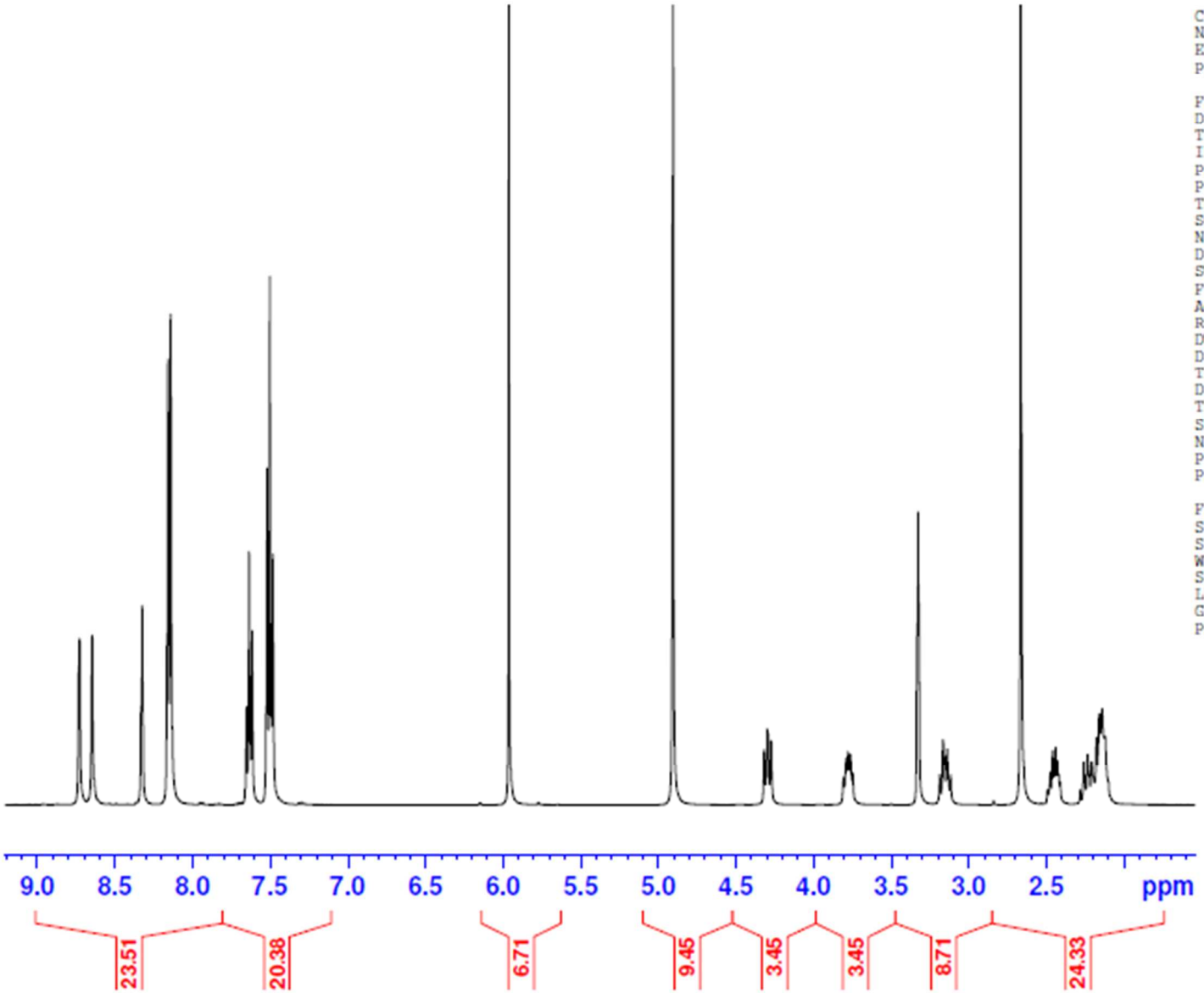


7 L-DBTA

```
Current Data Parameters
NAME                  00705869-
EXPNO                        20
PROCNO                        1

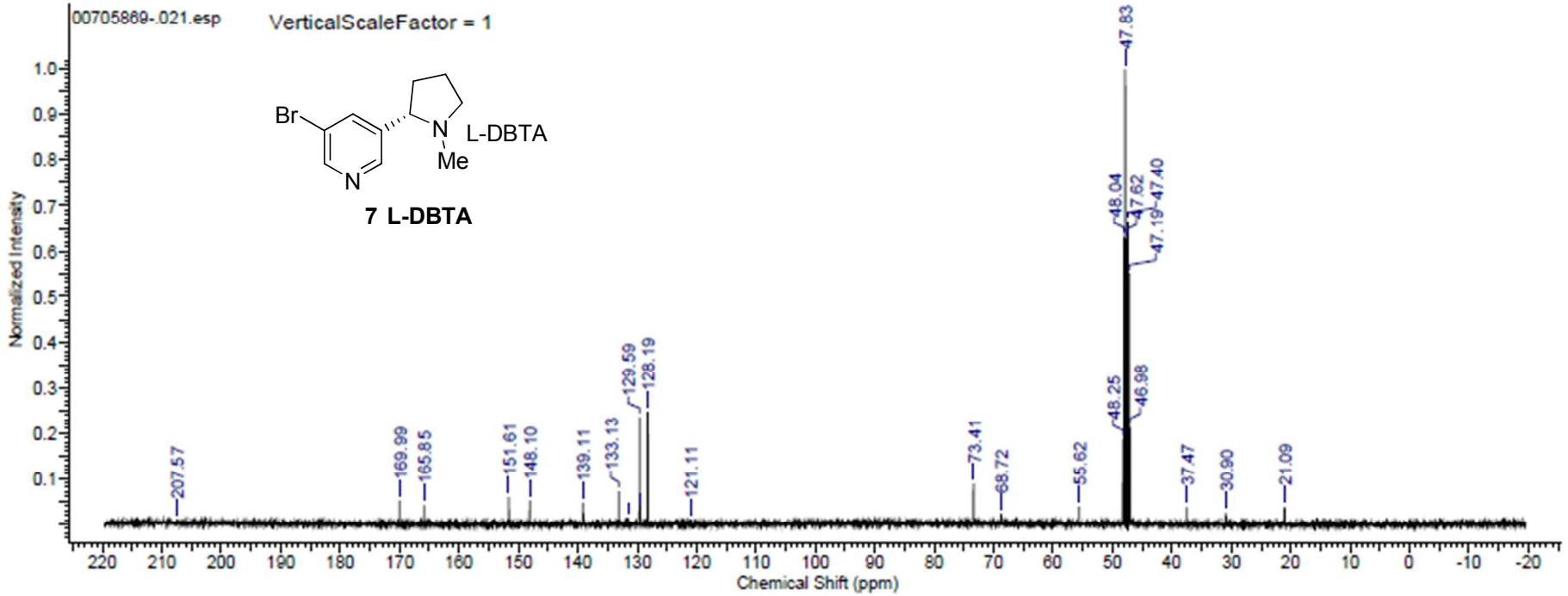
F2 - Acquisition Parameters
Date_                  20180326
Time                     16.47 h
INSTRUM                   spect
PROBHD    Z122623_0029 (
PULPROG                    zg30
TD                        32768
SOLVENT                    MeOD
NS                           16
DS                            2
SWH                    6393.862 Hz
FIDRES                 0.390250 Hz
AQ                     2.5624576 sec
RG                        112.22
DW                        78.200 usec
DE                        10.00 usec
TE                        298.2 K
D1                     0.75000000 sec
TD0                           1
SFO1                 399.6823996 MHz
NUC1                         1H
P1                        12.00 usec
PLW1                  8.04230022 W

F2 - Processing parameters
SI                        65536
SF                 399.6800000 MHz
WDW                          EM
SSB                   0
LB                        0.39 Hz
GB                    0
PC                        1.00
```



^{13}C NMR (CD_3OD) data for compound **7• L-DBTA**:

Acquisition Time (sec)	1.3631				
Comment	NMR System BNMR_319-1 400 10206243 Pfizer Confidential compound 7 L-DBTA carbon_5min MeOD {C:\Bruker\TopSpin3.5pl6} singerra 42				
Date	26 Mar 2018 16:54:24	*Date Stamp*	26 Mar 2018 16:54:24		
File Name	\\AMRGROBCZC642.AMER.PFIZER.COM\BKDATA:.DATA\SINGERRA\NMR\00705869-\21\FID				
Frequency (MHz)	100.50	*Nucleus*	13C	*Number of Transients*	128
Origin	spect	*Original Points Count*	32768	*Owner*	FCNGRO-BRKOA
Points Count	32768	*Pulse Sequence*	zgpg30	*Receiver Gain*	112.22
SW(cyclical) (Hz)	24038.46	*Solvent*	METHANOL-d4	*Spectrum Offset (Hz)*	10056.1631
Spectrum Type	STANDARD	*Sweep Width (Hz)*	24037.73	*Temperature (degree C)*	25.146



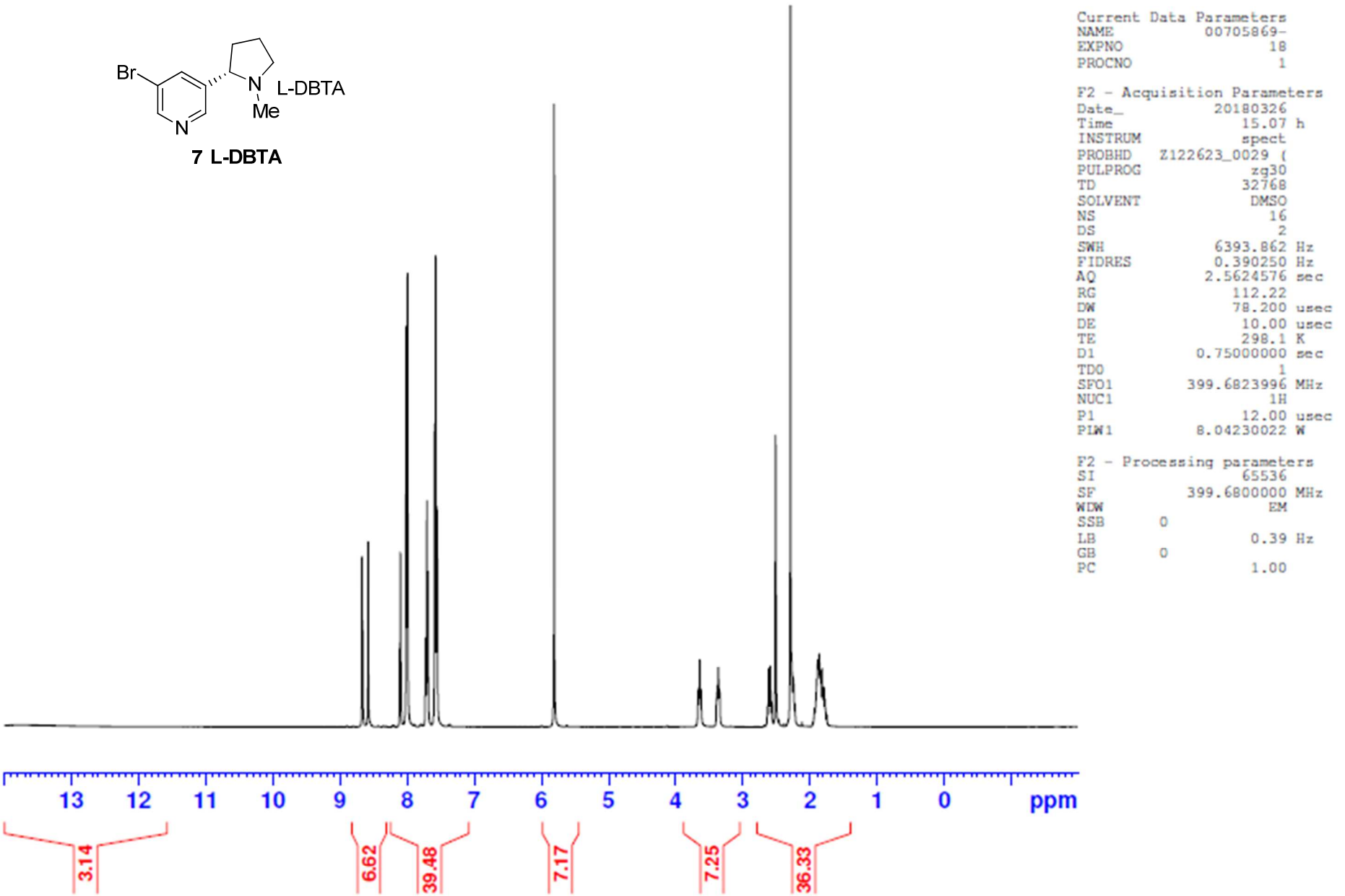
No.	(ppm)	(Hz)	Height
1	21.09	2119.8	0.0374
2	30.90	3105.7	0.0246
3	37.47	3765.9	0.0370
4	46.98	4721.1	0.2119
5	47.19	4742.4	0.5500
6	47.40	4763.6	0.6650
7	47.62	4785.6	0.6273

No.	(ppm)	(Hz)	Height
8	47.83	4806.9	1.0000
9	48.04	4828.2	0.6302
10	48.25	4849.5	0.1850
11	55.62	5589.7	0.0377
12	68.72	6906.5	0.0240
13	73.41	7378.2	0.0880
14	121.11	12171.5	0.0102

No.	(ppm)	(Hz)	Height
15	128.19	12883.1	0.2470
16	129.59	13023.9	0.2351
17	129.66	13031.3	0.0332
18	131.59	13224.9	0.0144
19	133.13	13379.7	0.0714
20	139.11	13980.5	0.0464
21	148.10	14884.3	0.0523

No.	(ppm)	(Hz)	Height
22	151.61	15236.4	0.0591
23	165.85	16667.7	0.0414
24	169.99	17083.6	0.0520
25	207.57	20860.9	0.0082

^{1}H NMR (DMSO-d_6) data for compound **7• L-DBTA**:



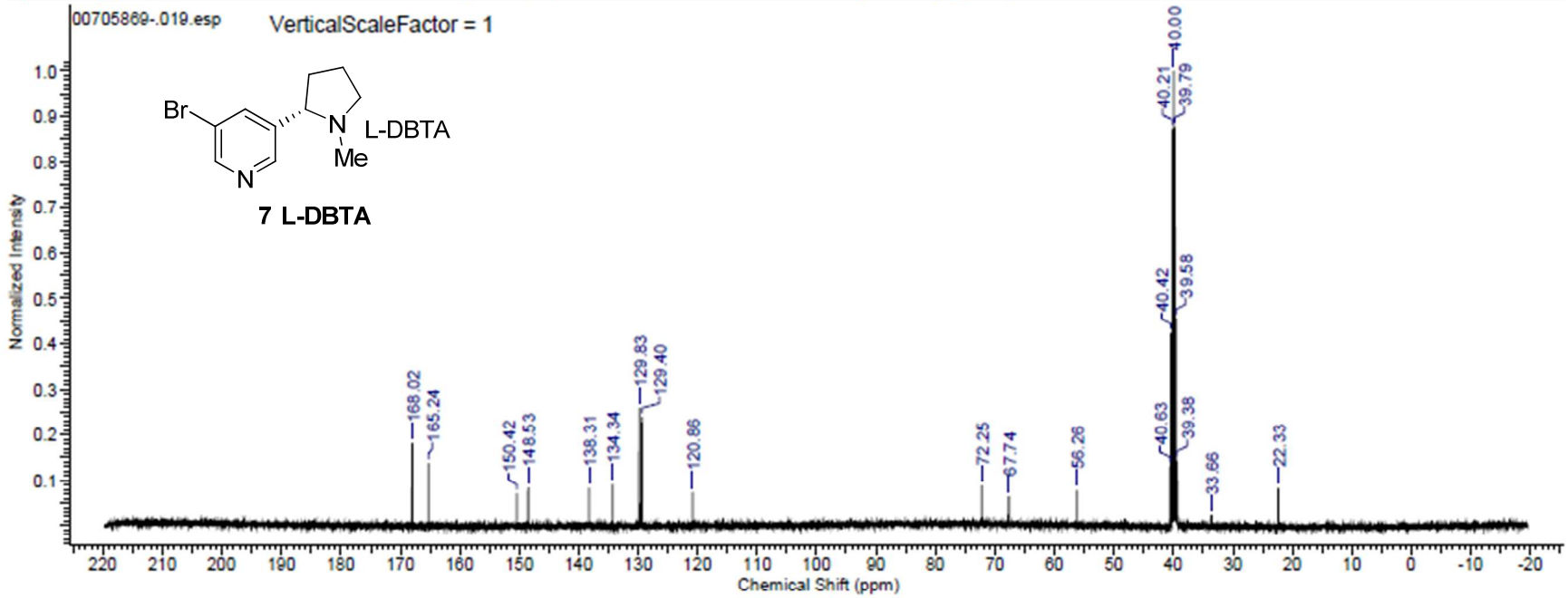

```
Current Data Parameters
NAME                  00705869-
EXPNO                        18
PROCNO                        1

F2 - Acquisition Parameters
Date_                  20180326
Time                      15.07 h
INSTRUM                   spect
PROBHD    Z122623_0029 (
PULPROG                    zg30
TD                        32768
SOLVENT                    DMSO
NS                           16
DS                            2
SWH                    6393.862 Hz
FIDRES                 0.390250 Hz
AQ                     2.5624576 sec
RG                        112.22
DW                        78.200 usec
DE                        10.00 usec
TE                        298.1 K
D1                     0.75000000 sec
TD0                           1
SFO1                399.6823996 MHz
NUC1                         1H
P1                        12.00 usec
PLW1                8.04230022 W

F2 - Processing parameters
SI                        65536
SF                  399.6800000 MHz
WDW                          EM
SSB       0
LB                        0.39 Hz
GB        0
PC                        1.00
```

^{13}C NMR (DMSO-d_6) data for compound **7• L-DBTA**:

Acquisition Time (sec)	1.3631				
Comment	NMR System BNMR_319-1 400 10206243 Pfizer Confidential PF-06437351-GD carbon_5min DMSO {C:\Bruker\TopSpin3.5pl6} singerra 16				
Date	26 Mar 2018 15:14:08	*Date Stamp*	26 Mar 2018 15:14:08		
File Name	\\AMRGROBCZC642.AMER.PFIZER.COM\BKDATA: DATA\SINGERRA\NMR\00705869-\19\FID				
Frequency (MHz)	100.50	*Nucleus*	13C	*Number of Transients*	128
Origin	spect	*Original Points Count*	32768	*Owner*	FCNGRO-BRKOA
Points Count	32768	*Pulse Sequence*	zgpg30	*Receiver Gain*	158.02
SW(cyclical) (Hz)	24038.46	*Solvent*	DMSO-d6	*Spectrum Offset (Hz)*	10056.1631
Spectrum Type	STANDARD	*Sweep Width (Hz)*	24037.73	*Temperature (degree C)*	25.154



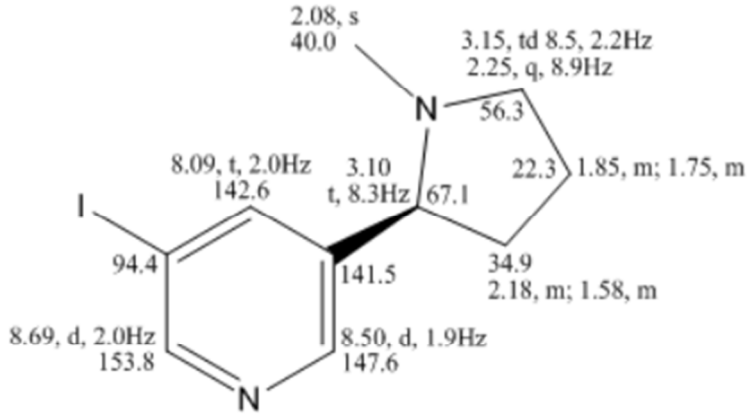
No.	(ppm)	(Hz)	Height
1	22.33	2244.5	0.0826
2	33.66	3383.0	0.0231
3	39.38	3957.4	0.1436
4	39.58	3978.0	0.4553
5	39.79	3999.2	0.8773
6	40.00	4019.8	1.0000

No.	(ppm)	(Hz)	Height
7	40.21	4041.0	0.8726
8	40.42	4062.3	0.4229
9	40.63	4082.9	0.1313
10	56.26	5654.2	0.0779
11	67.74	6807.4	0.0643
12	72.25	7260.8	0.0887

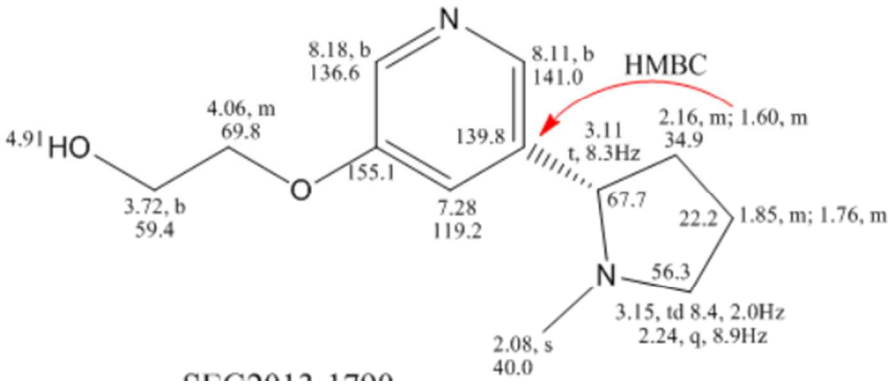
No.	(ppm)	(Hz)	Height
13	120.86	12146.5	0.0740
14	129.38	13002.6	0.1526
15	129.40	13004.9	0.2388
16	129.83	13048.1	0.2588
17	134.34	13501.5	0.0908
18	138.31	13899.8	0.0825

No.	(ppm)	(Hz)	Height
19	148.53	14926.9	0.0839
20	150.42	15116.9	0.0702
21	165.24	16606.1	0.1383
22	168.02	16885.6	0.1813

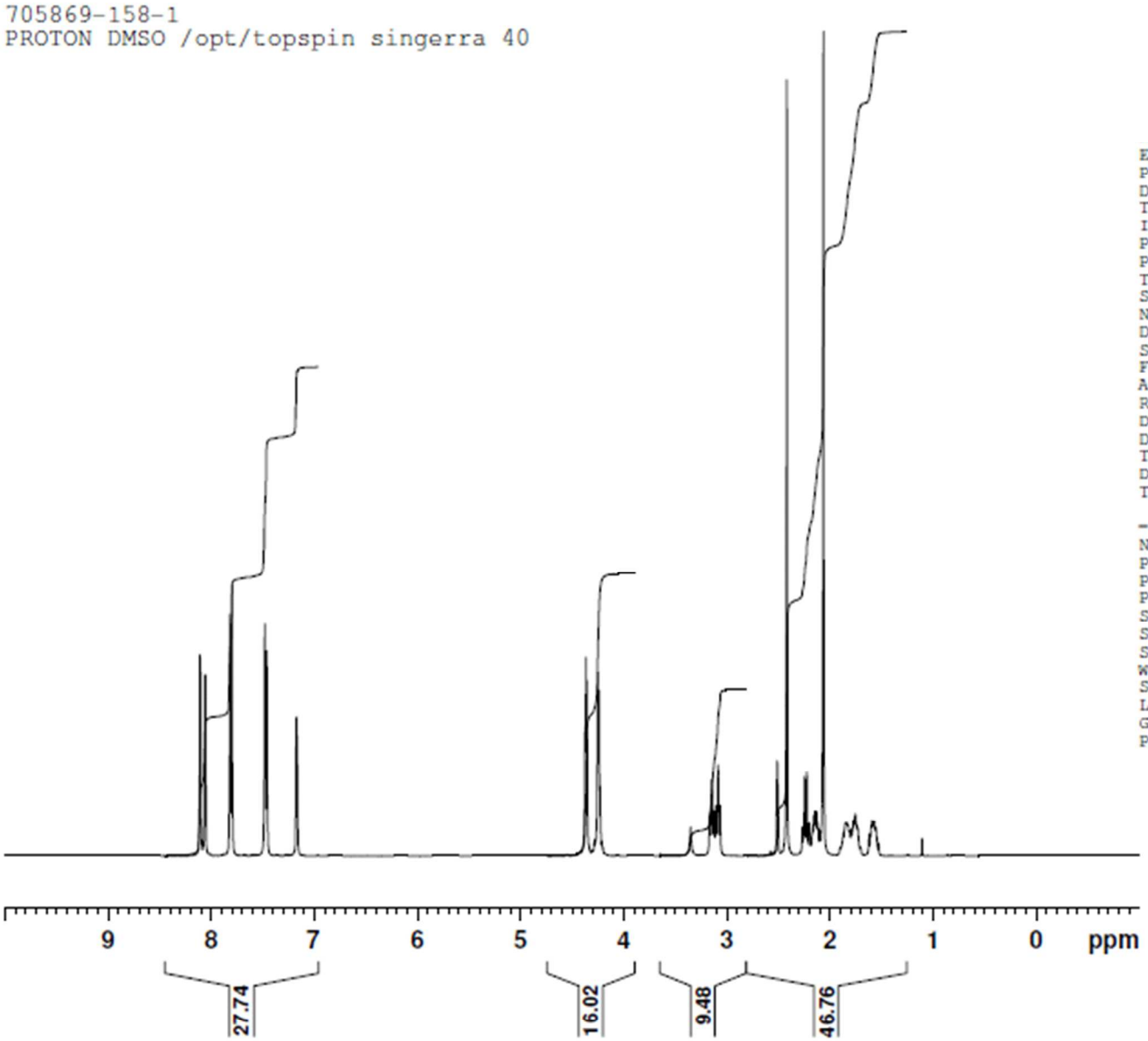
^{1}H NMR (DMSO-d_6) assignments for compound **8**:

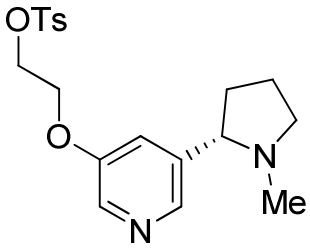


^{1}H NMR (DMSO-d_6) assignments for compound **9**:



^{1}H NMR (DMSO-d_6) data for compound **10**:

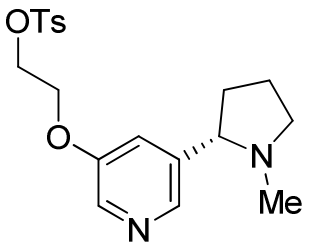




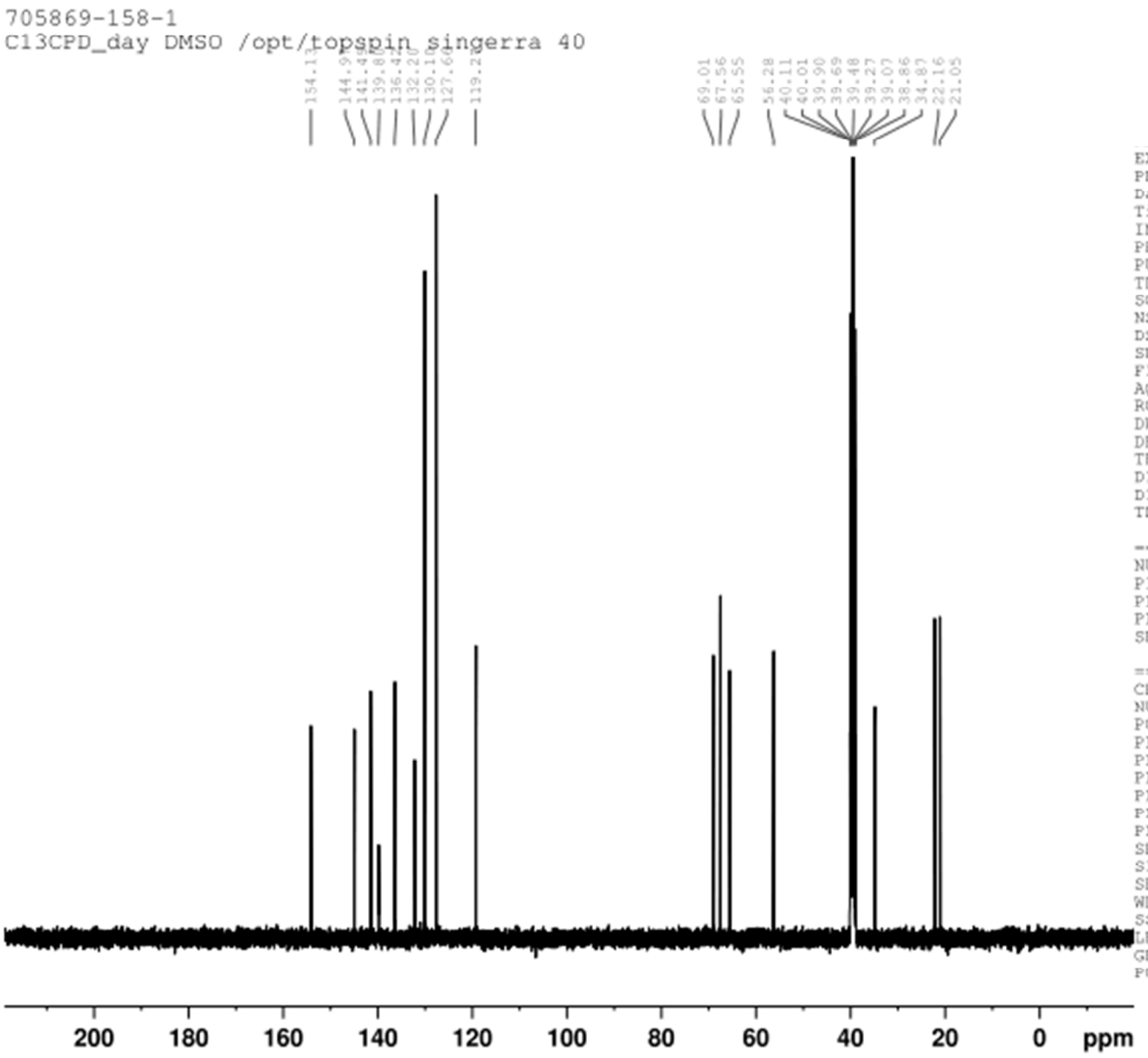
10

EXPNO	5	
PROCNO	1	
Date_	20131007	
Time	11.05	
INSTRUM	spect	
PROBHD	5 mm PABBO BB-	
PULPROG	zg30	
TD	65536	
SOLVENT	DMSO	
NS	16	
DS	2	
SWH	8223.685	Hz
FIDRES	0.125483	Hz
AQ	3.9846387	sec
RG	64	
DW	60.800	usec
DE	6.50	usec
TE	295.5	K
D1	1.00000000	sec
TD0	1	
======== CHANNEL f1 ========		
NUC1	1H	
P1	14.10	usec
PL1	-1.00	dB
PL1W	13.02858353	W
SFO1	400.1324710	MHz
SI	32768	
SF	400.1300000	MHz
WDW	EM	
SSB	0	
LB	0.30	Hz
GB	0	
PC	1.00	

^{13}C NMR (DMSO-d_6) data for compound **10**:

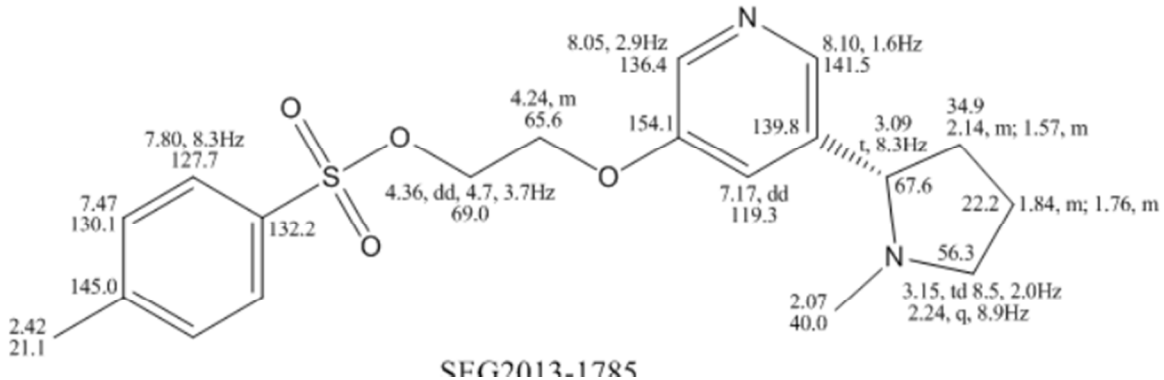


10



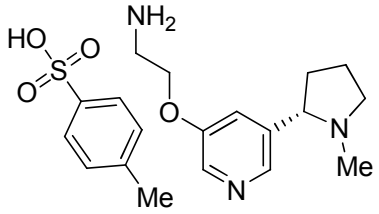
EXPNO	6
PROCNO	1
Date_	20131007
Time	11.16
INSTRUM	spect
PROBHD	5 mm PABBO BB-
PULPROG	zgpg30
TD	65536
SOLVENT	DMSO
NS	256
DS	4
SWH	24038.461 Hz
FIDRES	0.366798 Hz
AQ	1.3631988 sec
RG	203
DW	20.800 usec
DE	6.50 usec
TE	296.2 K
D1	1.00000000 sec
D11	0.03000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	13C
P1	9.80 usec
PL1	-2.00 dB
PL1W	56.53121948 W
SFO1	100.6228298 MHz
======== CHANNEL f2 ========	
CPDPRG2	waltz16
NUC2	1H
PCPD2	90.00 usec
PL2	-1.00 dB
PL12	15.10 dB
PL13	17.10 dB
PL2W	13.02858353 W
PL12W	0.31981379 W
PL13W	0.20178886 W
SFO2	400.1316005 MHz
SI	32768
SF	100.6128193 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

^{1}H NMR (DMSO-d_6) assignments for compound **10**:



^{1}H NMR (DMSO-d_6) data for compound **1**•TsOH:

```
NMR System BNMR_319-1 400 10206243
Pfizer Confidential
proton DMSO {C:\Bruker\TopSpin3.5pl6} singerra 25
```



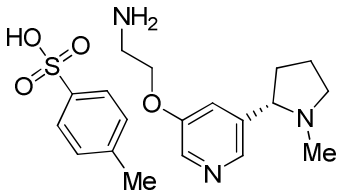
1·**TsOH**


```
Current Data Parameters
NAME                  00705869-
EXPNO                        27
PROCNO                        1

F2 - Acquisition Parameters
Date_                  20180327
Time                      15.12 h
INSTRUM                   spect
PROBHD    Z122623_0029 (
PULPROG                   zg30
TD                       32768
SOLVENT                   DMSO
NS                           16
DS                            2
SWH                    6393.862 Hz
FIDRES                 0.390250 Hz
AQ                     2.5624576 sec
RG                       112.22
DW                        78.200 usec
DE                        10.00 usec
TE                        298.1 K
D1                    0.75000000 sec
TD0                           1
SFO1                399.6823996 MHz
NUC1                         1H
P1                        12.00 usec
PLW1                8.04230022 W

F2 - Processing parameters
SI                        65536
SF                  399.6800000 MHz
WDW                          EM
SSB          0
LB                        0.39 Hz
GB           0
PC                        1.00
```

^{13}C NMR data for compound **1**•TsOH:



1· TsOH

Acquisition Time (sec)	1.3631				
Comment	NMR System BNMR_319-1 400 10206243 Pfizer Confidential compound 1 carbon_5min DMSO (C:\Bruker\TopSpin3.5pl6) singerra 25				
Date	27 Mar 2018 15:20:32	*Date Stamp*	27 Mar 2018 15:20:32		
File Name	\\AMRGROBCZC642.AMER.PFIZER.COM\BKDATA:.DATA\SINGERRA\NMR\00705869-\28\FID				
Frequency (MHz)	100.50	*Nucleus*	13C	*Number of Transients*	128
Origin	spect	*Original Points Count*	32768	*Owner*	FCNGRO-BRKOA
Points Count	32768	*Pulse Sequence*	zgpg30	*Receiver Gain*	128.20
SW(cyclical) (Hz)	24038.46	*Solvent*	DMSO-d6	*Spectrum Offset (Hz)*	10056.1631
Spectrum Type	STANDARD	*Sweep Width (Hz)*	24037.73	*Temperature (degree C)*	25.146

