Electronic Supplementary Material (ESI) for RSC Advances.


Supporting Information for

# *Synthesis and characterization of functionalized molecular and macromolecular double-decker silsesquioxane systems*

Patrycja Żak,[a] Mariusz Majchrzak,[a] Grzegorz Wilkowski,[a] Beata Dudziec,[a] Michał Dutkiewicz[b] and Bogdan Marciniec*[,b]

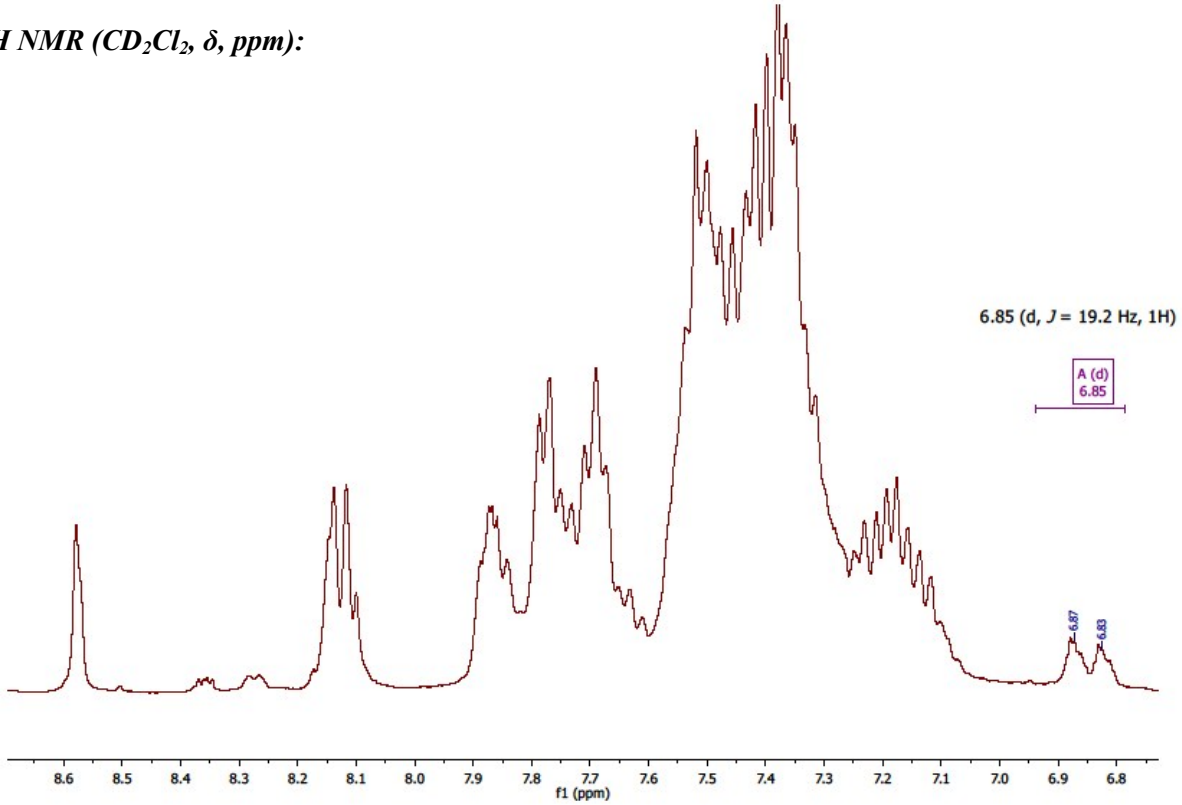
[a]*Department of Organometallic Chemistry, Faculty of Chemistry, A. Mickiewicz University in Poznan, Umultowska 89B, 61-614 Poznan, Poland.*
[b]*Center for Advanced Technologies, A. Mickiewicz University in Poznan, Umultowska 89C, 61-614 Poznan, Poland, Fax: (+48) 618291508.*

*E-mail: Bogdan.Marciniec@amu.edu.pl*

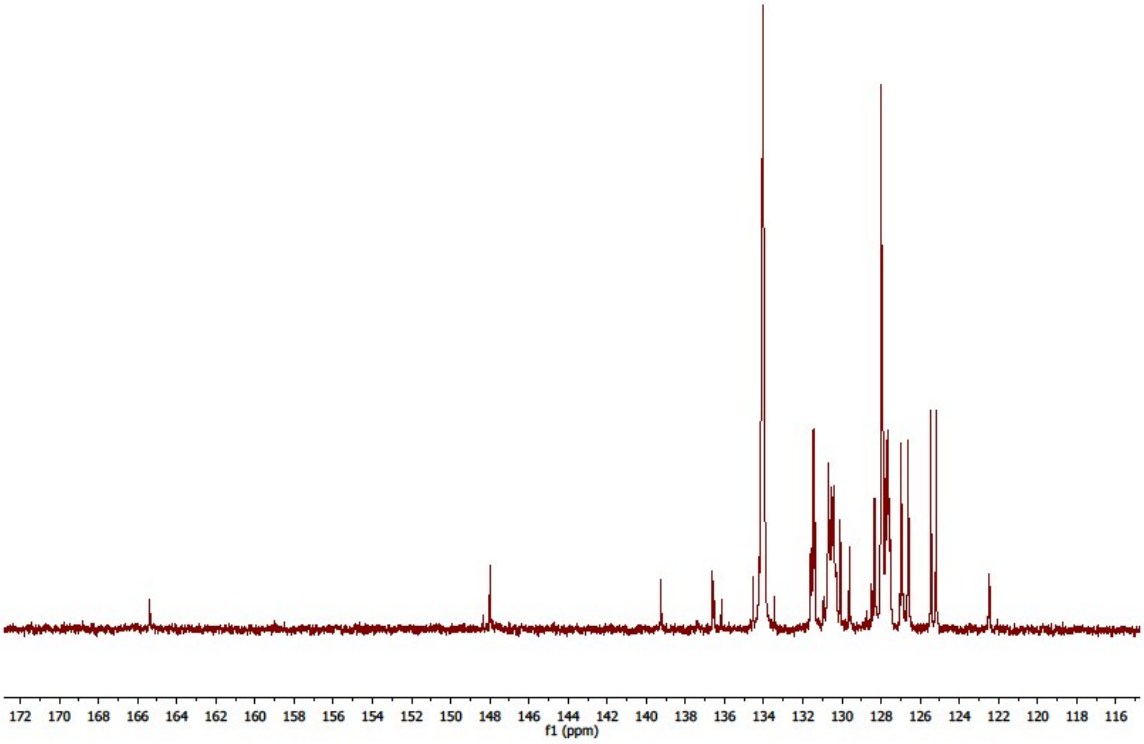
**$^{1}$H, $^{13}$C, $^{29}$Si NMR spectra of the isolated molecular compounds (1-8). The spectra are presented in selected regions due to their relevance and clarity according to chemical structure.**

**1:** ***trans di[9,19-(E)-4-(9-anthracenyl)styrylphenyl]-1,3,5,7,11,13,15,17-octaphenylpentacyclo-[11.7.1.1$^{3,11}$.1$^{5,17}$.1$^{7,15}$]decasiloxane***

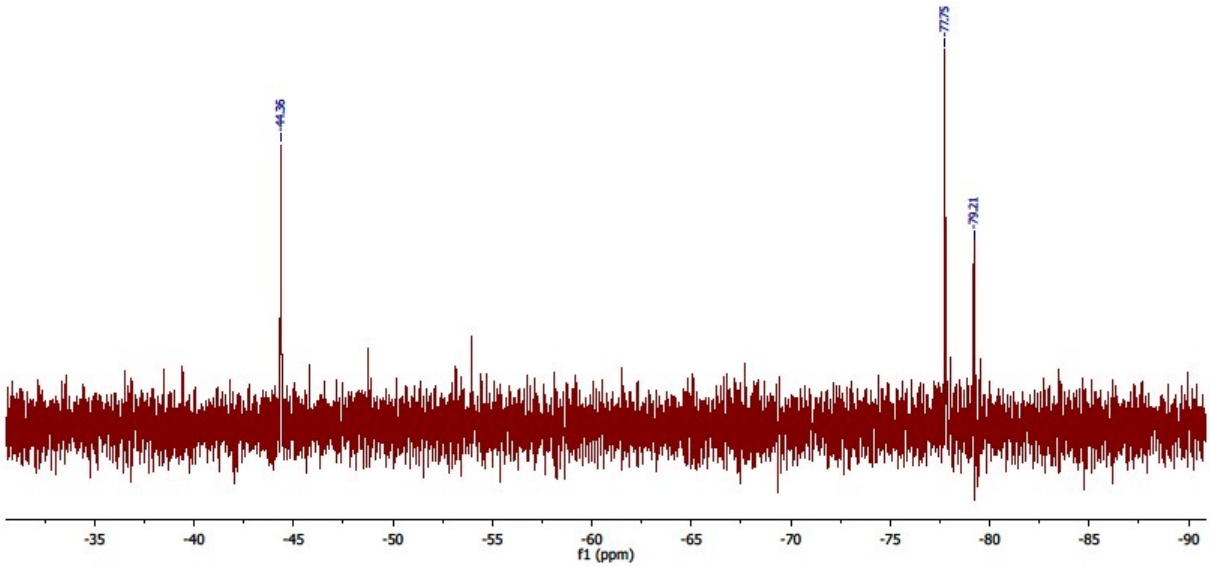
***$^{1}$H NMR ($CD_2Cl_2$, δ, ppm):***




***$^{13}$C NMR ($CD_2Cl_2$, δ, ppm):***

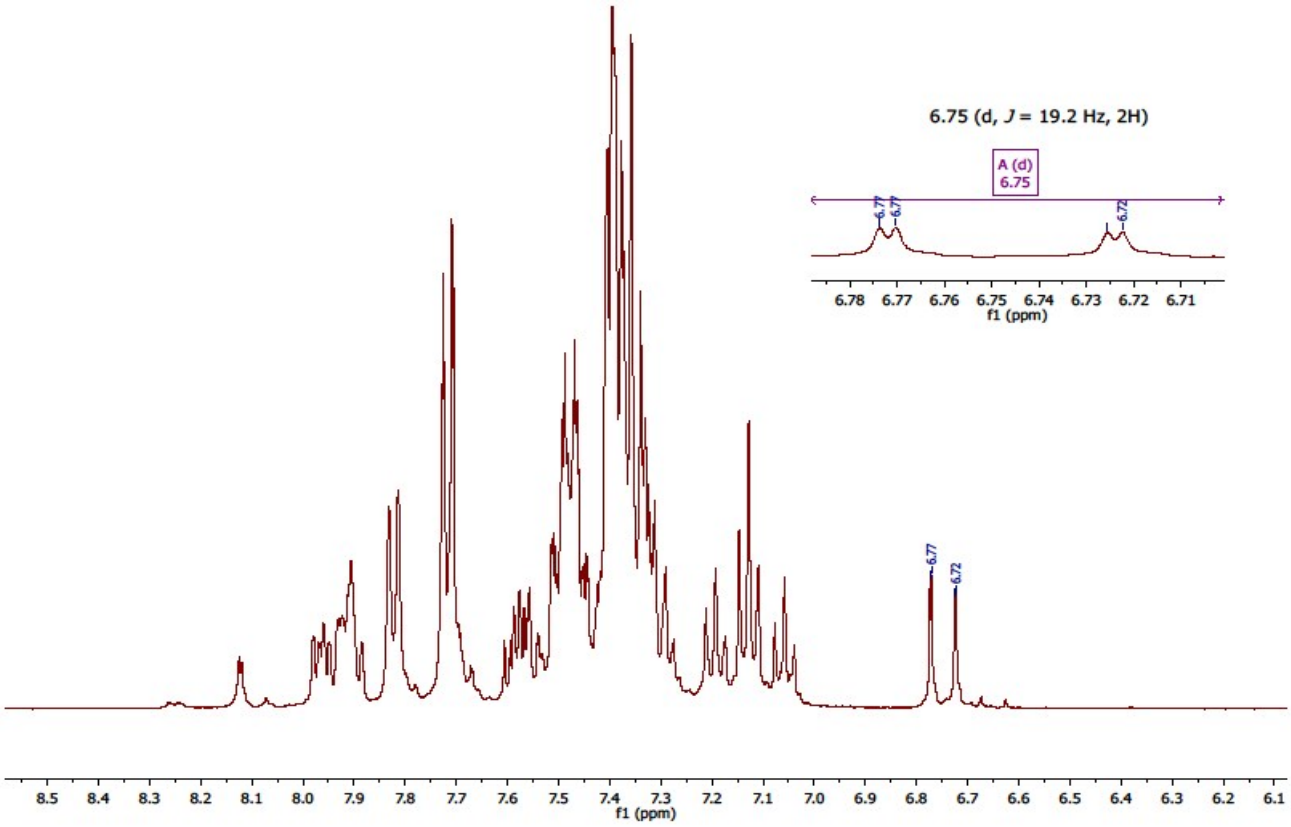


*$^{29}$Si NMR ($CD_2Cl_2$, δ, ppm):*

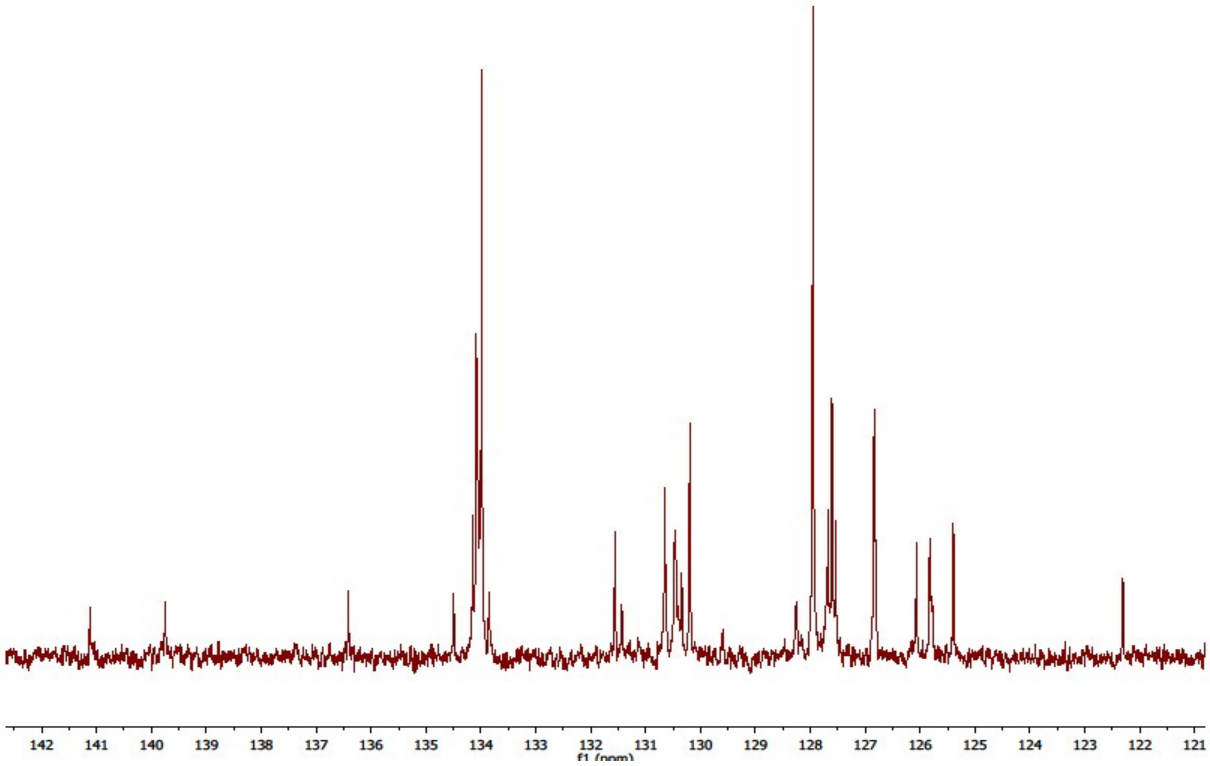



**2**: ***trans di[9,19-(E)-4-(1-naphthyl)styrylphenyl]-1,3,5,7,11,13,15,17-octaphenylpentacyclo-[11.7.1.1$^{3,11}$.1$^{5,17}$.1$^{7,15}$]decasiloxane***

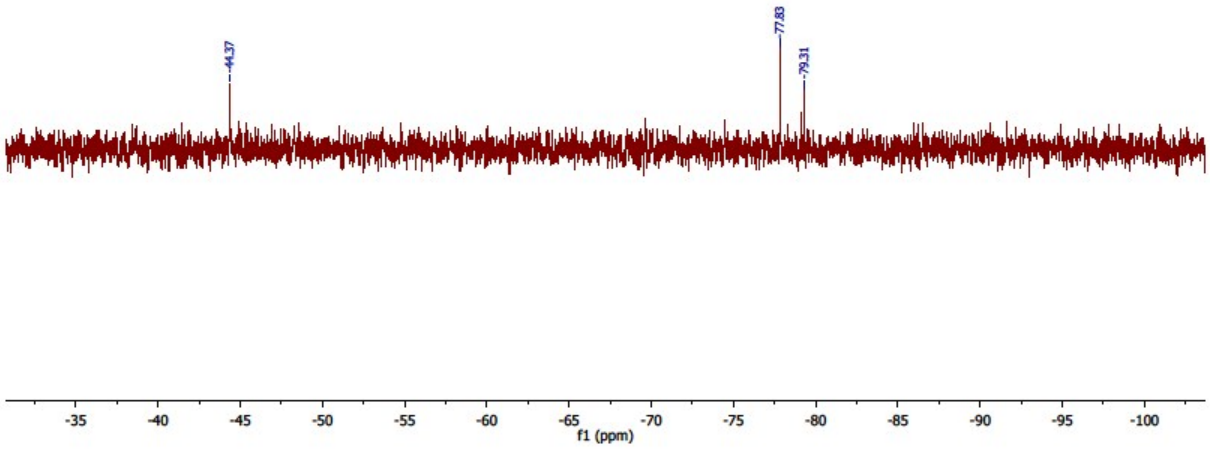
*$^{1}$H NMR ($CD_2Cl_2$, δ, ppm):*



*$^{13}C$ NMR ($CD_2Cl_2$, δ, ppm):*

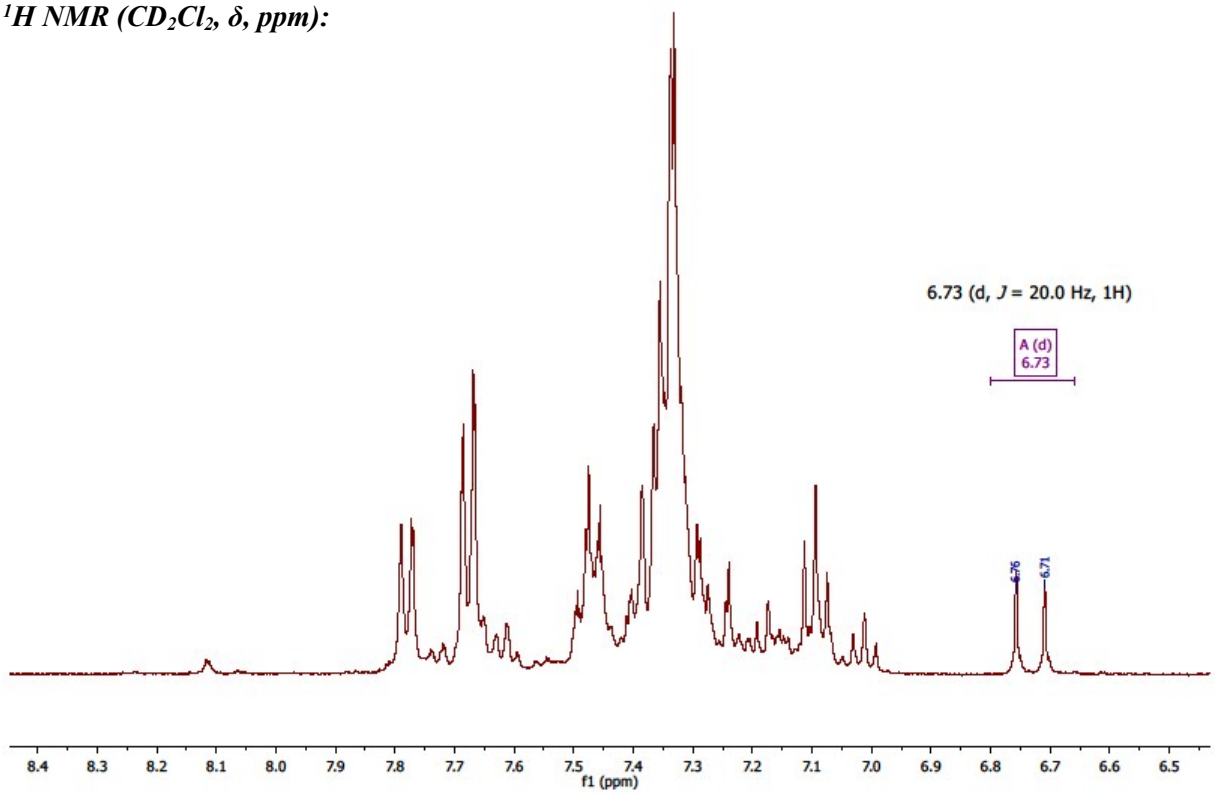



*$^{29}Si$ NMR ($CD_2Cl_2$, δ, ppm):*

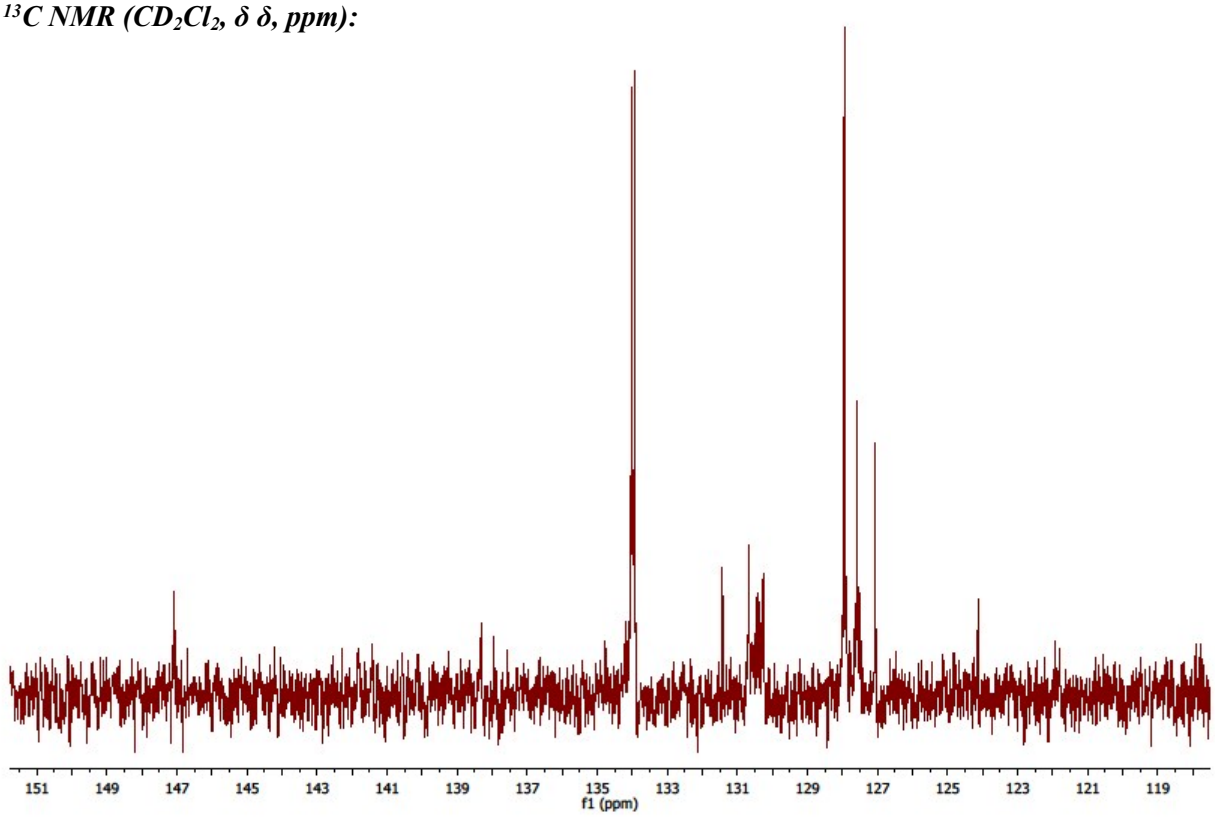


**3**: ***trans di[9,19-(E)-4-(2,3,4,5,6-pentafluorophenyl)styryl-phenyl]-1,3,5,7,11,13,15,17-octaphenyl-pentacyclo[11.7.1.1$^{3,11}$.1$^{5,17}$.1$^{7,15}$]decasiloxane:***

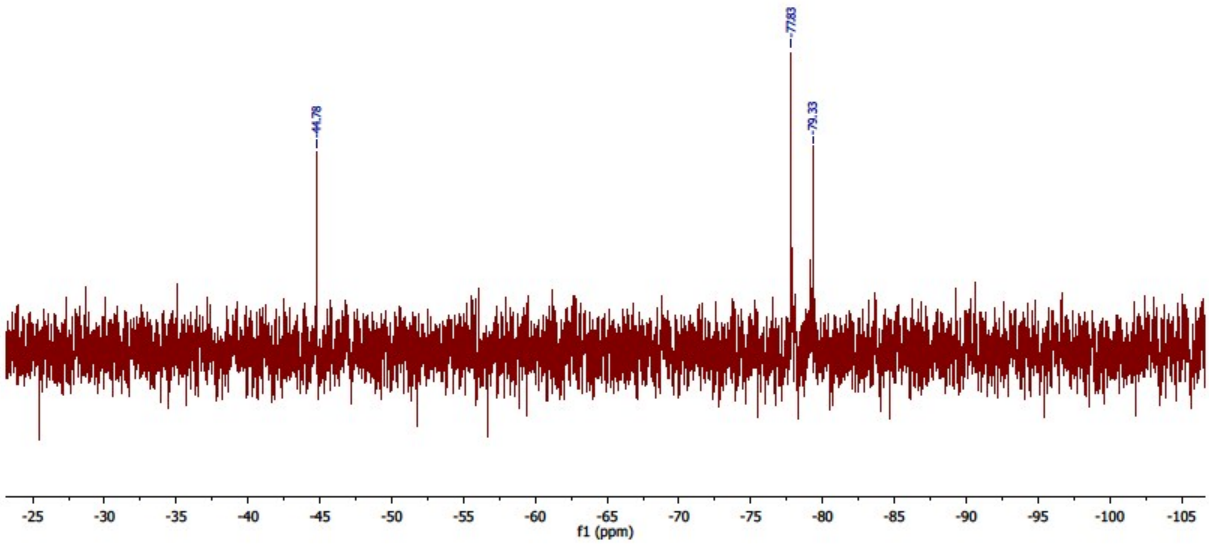
***$^{1}$H NMR ($CD_2Cl_2$, δ, ppm):***




***$^{13}$C NMR ($CD_2Cl_2$, δ δ, ppm):***

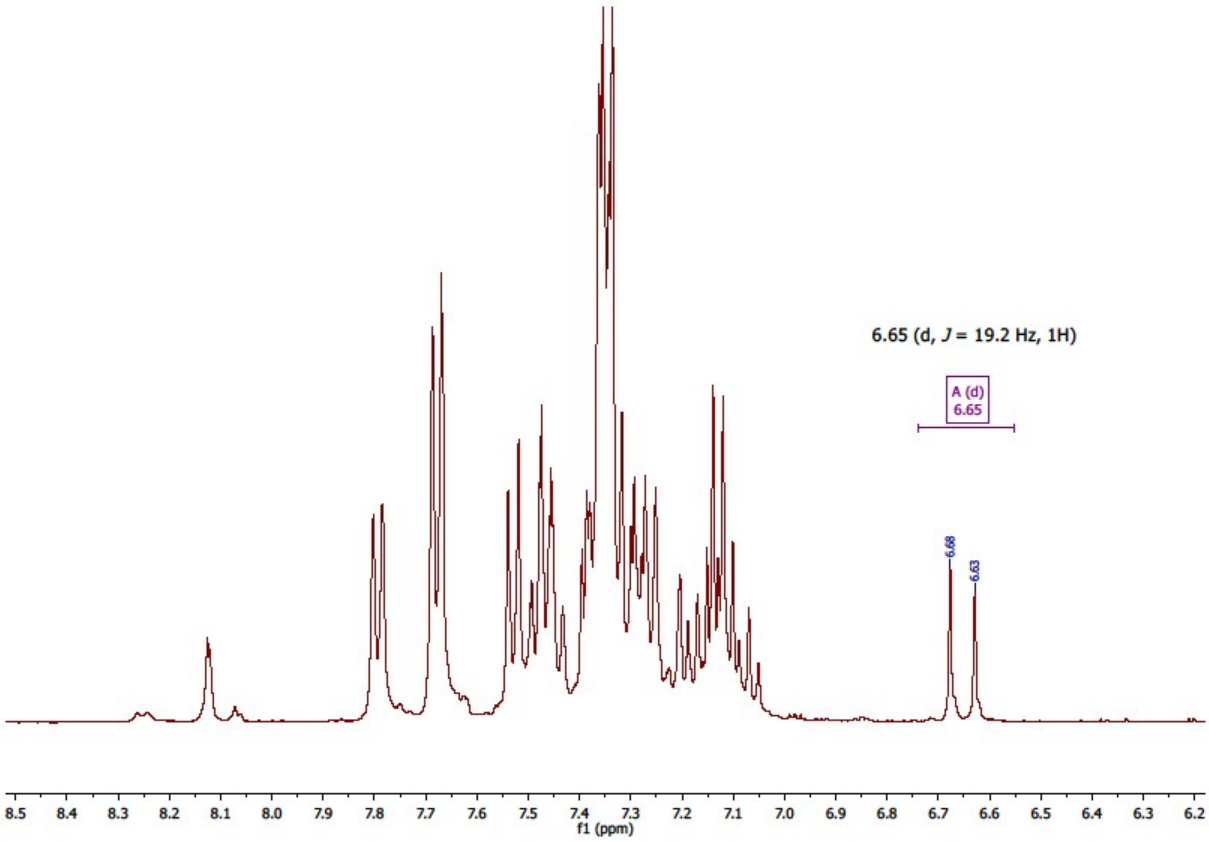


*$^{29}$Si NMR ($CD_2Cl_2$, δ, ppm):*

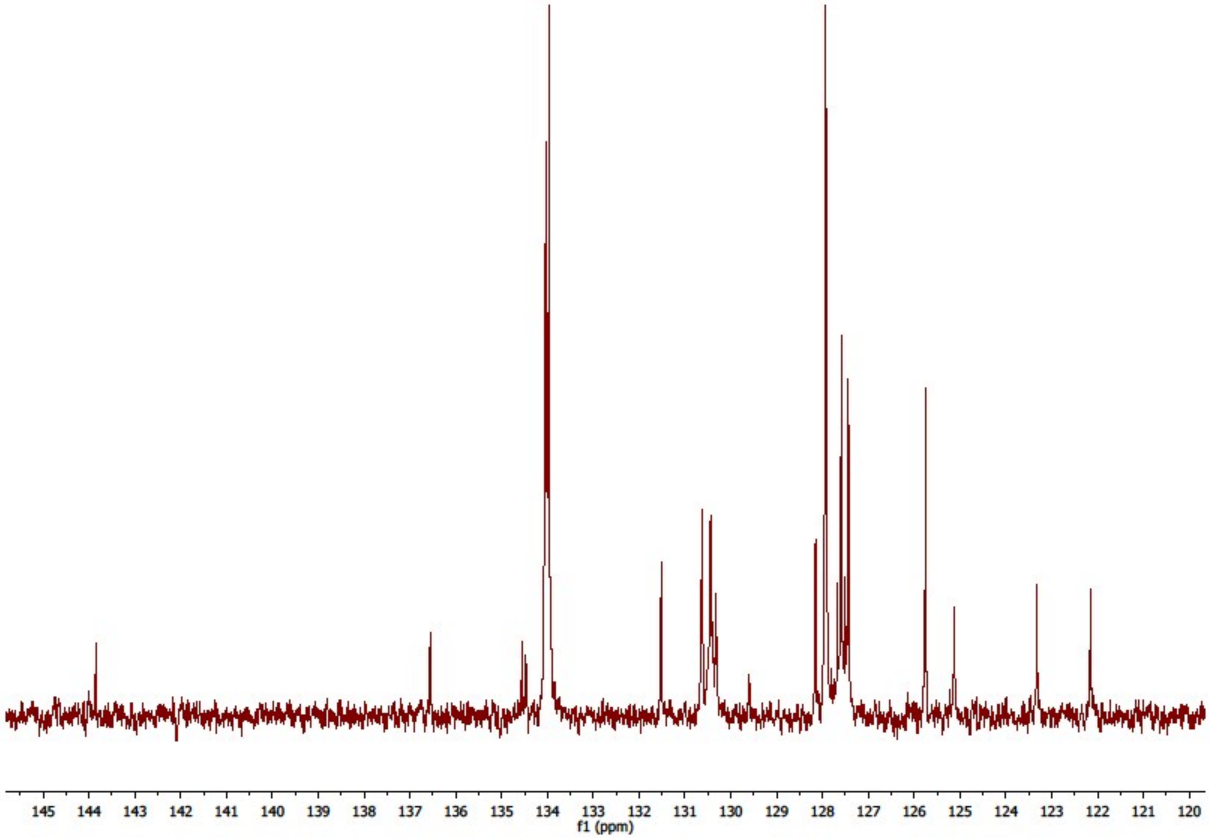



**4**: *trans di[9,19-(E)-4-(2-thienyl)styryl)phenyl]-1,3,5,7,11,13,15,17octaphenylpentacyclo-[11.7.1.1$^{3,11}$.1$^{5,17}$.1$^{7,15}$]decasiloxane*

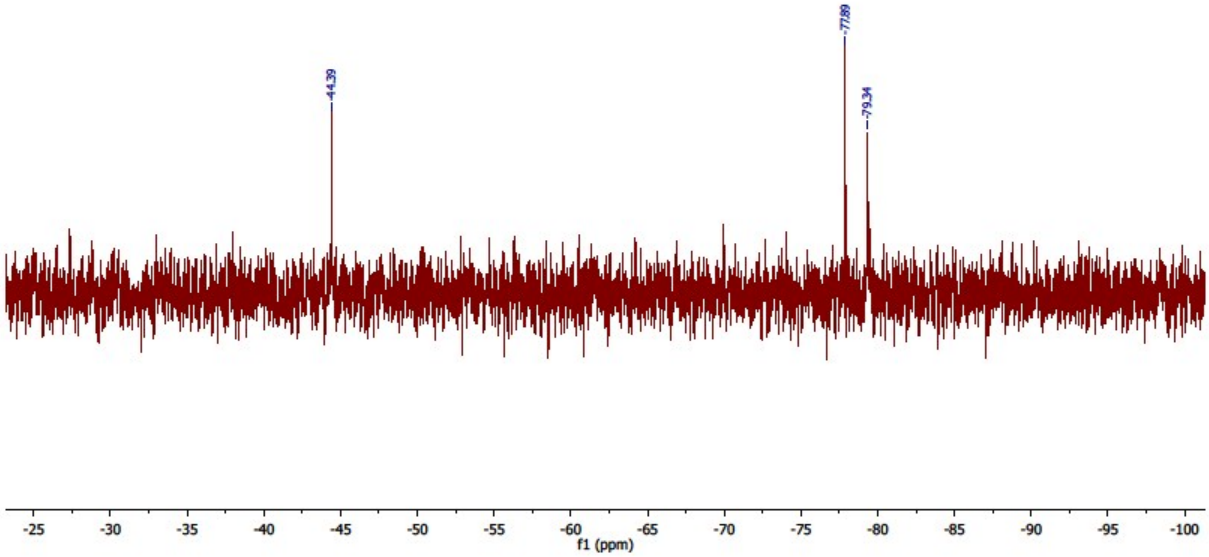
*$^{1}$H NMR ($CD_2Cl_2$, δ, ppm):*



***$^{13}C$ NMR ($CD_2Cl_2$, δ, ppm):***

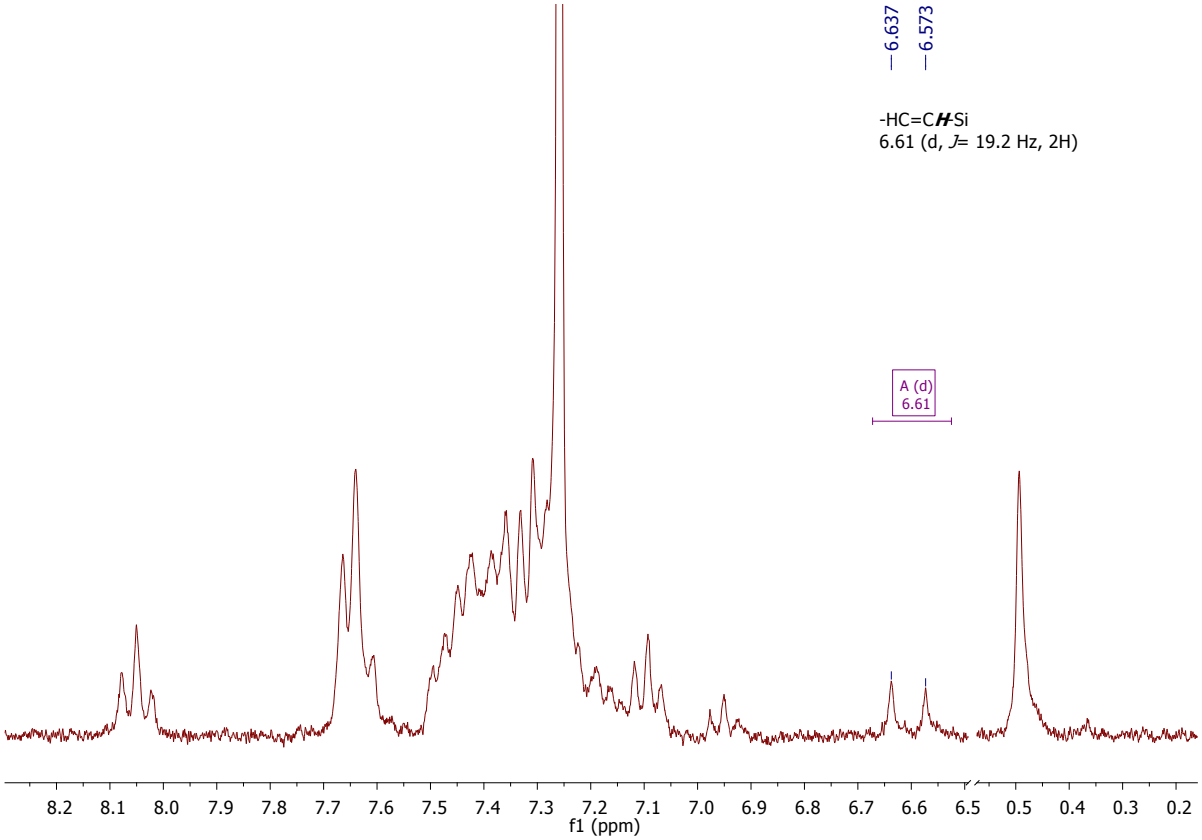



***$^{29}Si$ NMR ($CD_2Cl_2$, δ, ppm):***

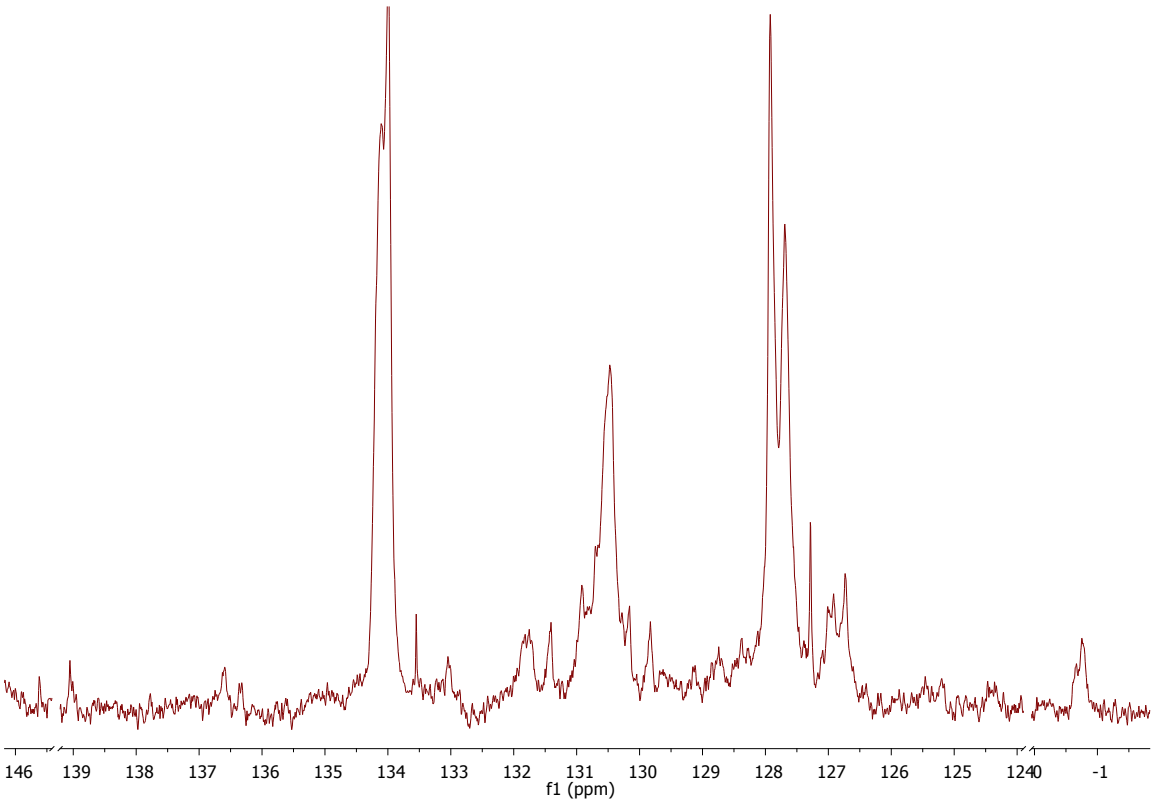


**5**: ***cis and trans mixture of di[9,19-(E)-4-(9-anthracenyl)styryl-methyl]-1,3,5,7,11,13,15,17-octaphenylpentacyclo [11.7.1.1$^{3,11}$.1$^{5,17}$.1$^{7,15}$]decasiloxane***

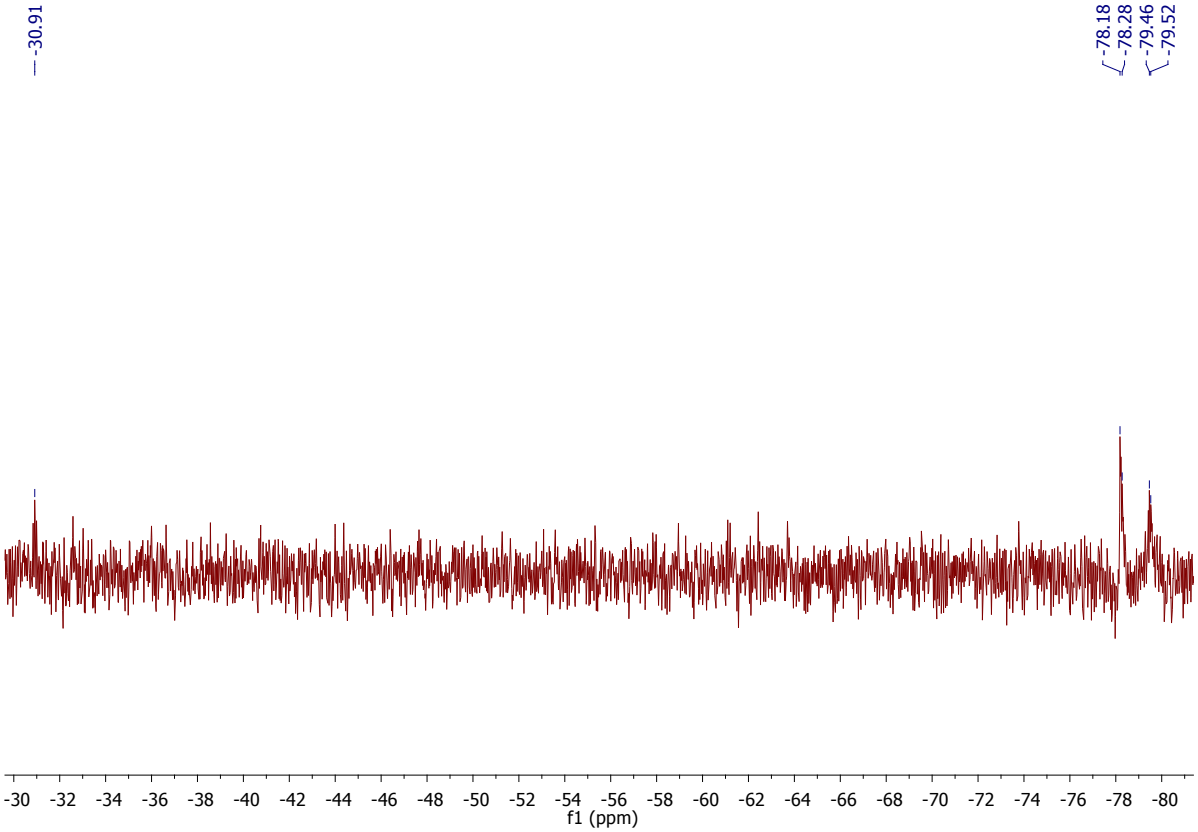
***$^{1}$H NMR ($CDCl_3$, δ, ppm):***




***$^{13}$C NMR ($CDCl_3$, δ, ppm):***

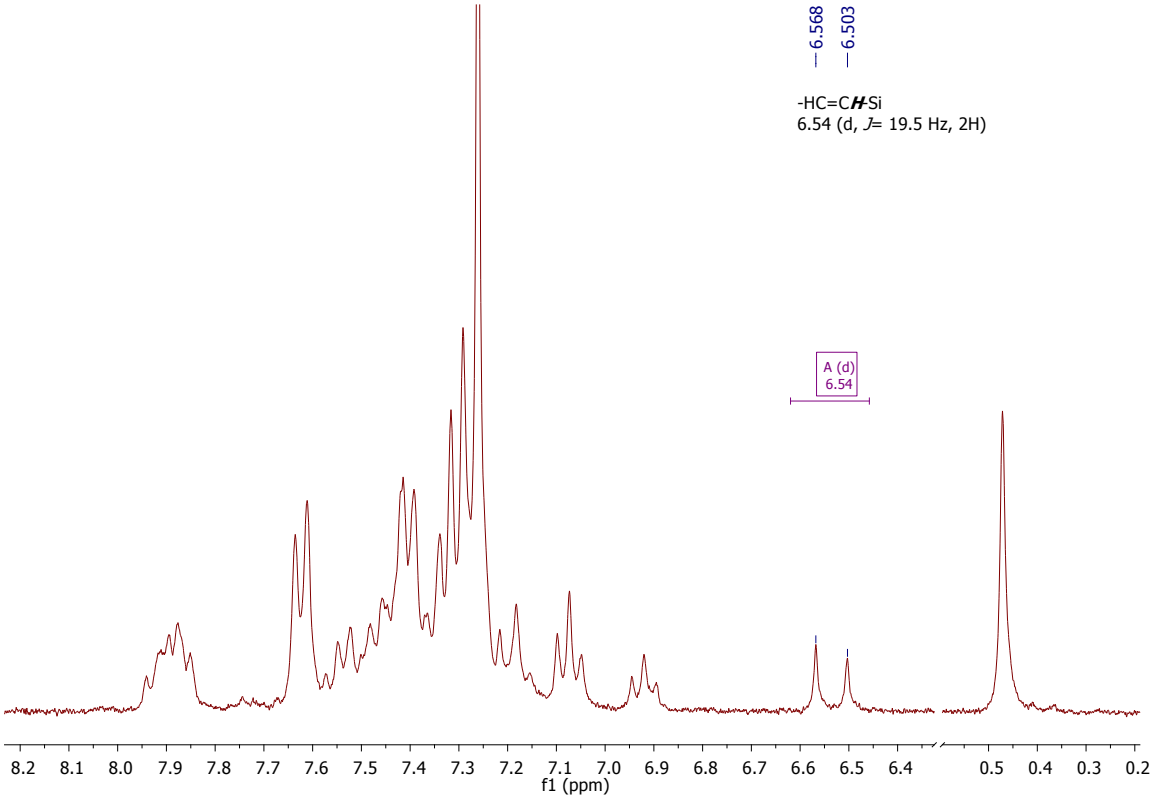


***$^{29}$Si NMR ($CDCl_3$, δ, ppm):***

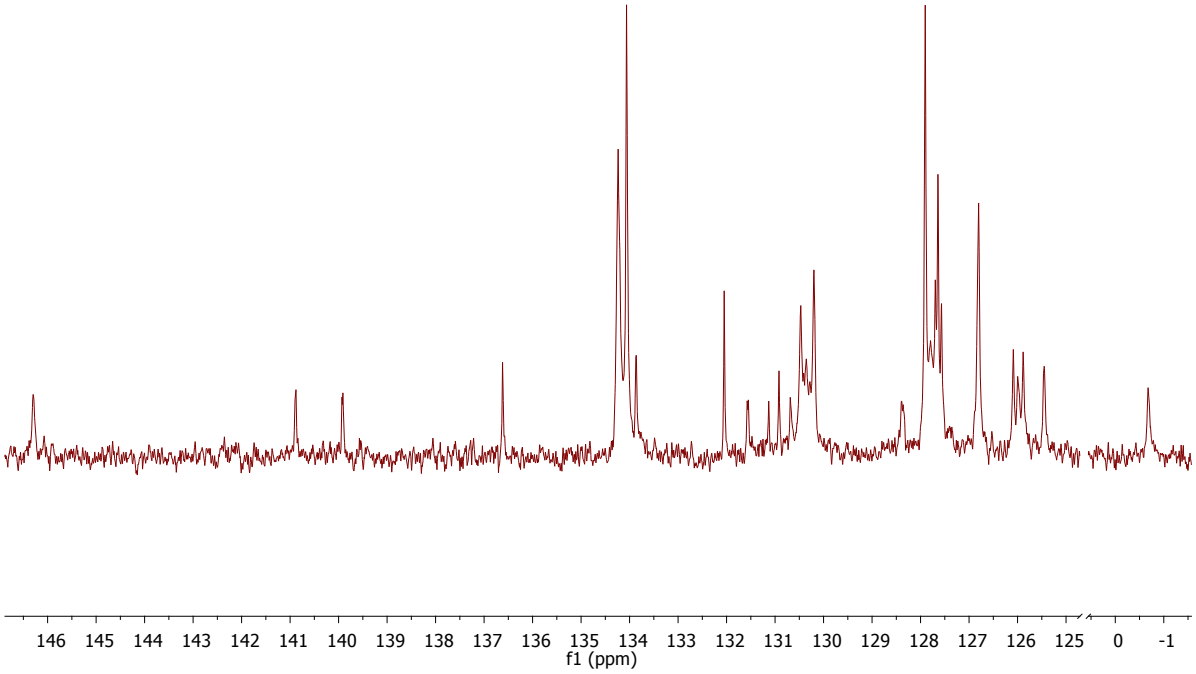



**6:** ***cis and trans mixture of di[9,19-(E)-4-(1-naphthyl)styrylmetyl]-1,3,5,7,11,13,15,17-octaphenylpentacyclo[11.7.1.1$^{3,11}$.1$^{5,17}$.1$^{7,15}$]decasiloxane***

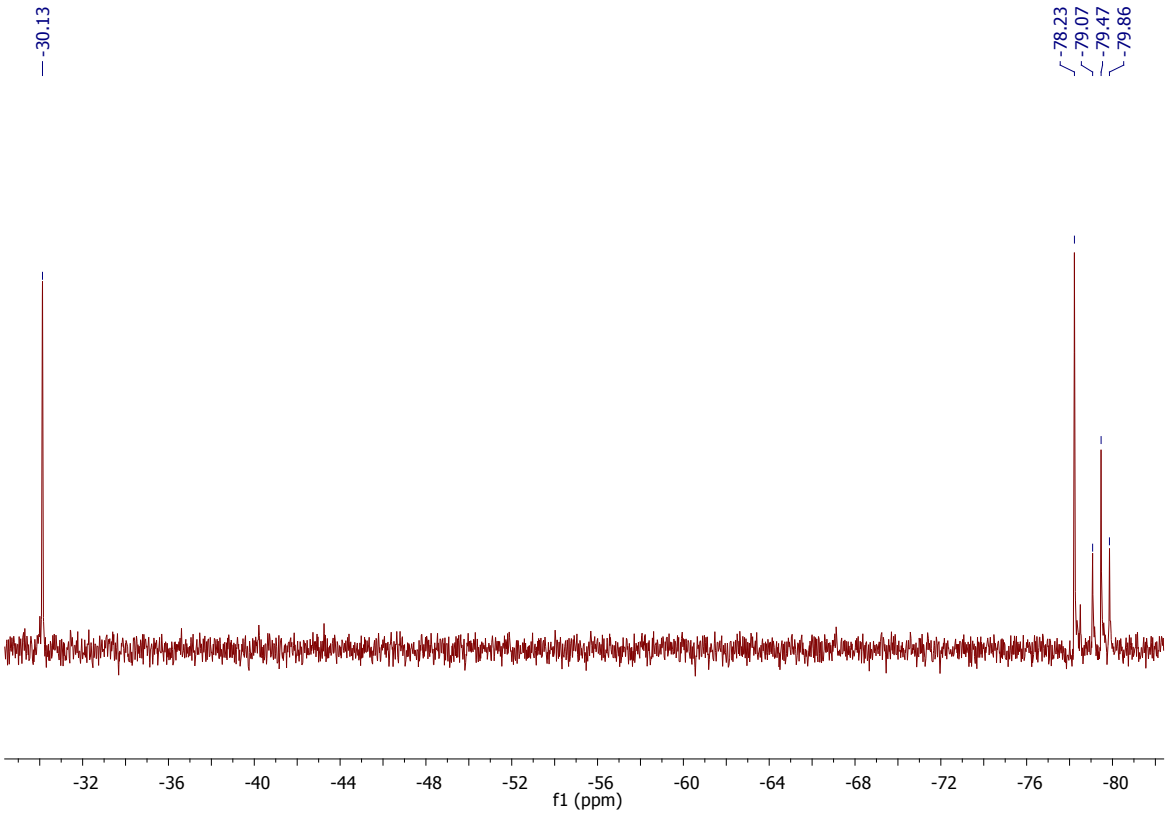
***$^{1}$H NMR ($CDCl_3$, δ, ppm):***



***$^{13}C$ NMR ($CDCl_3$, δ, ppm):***

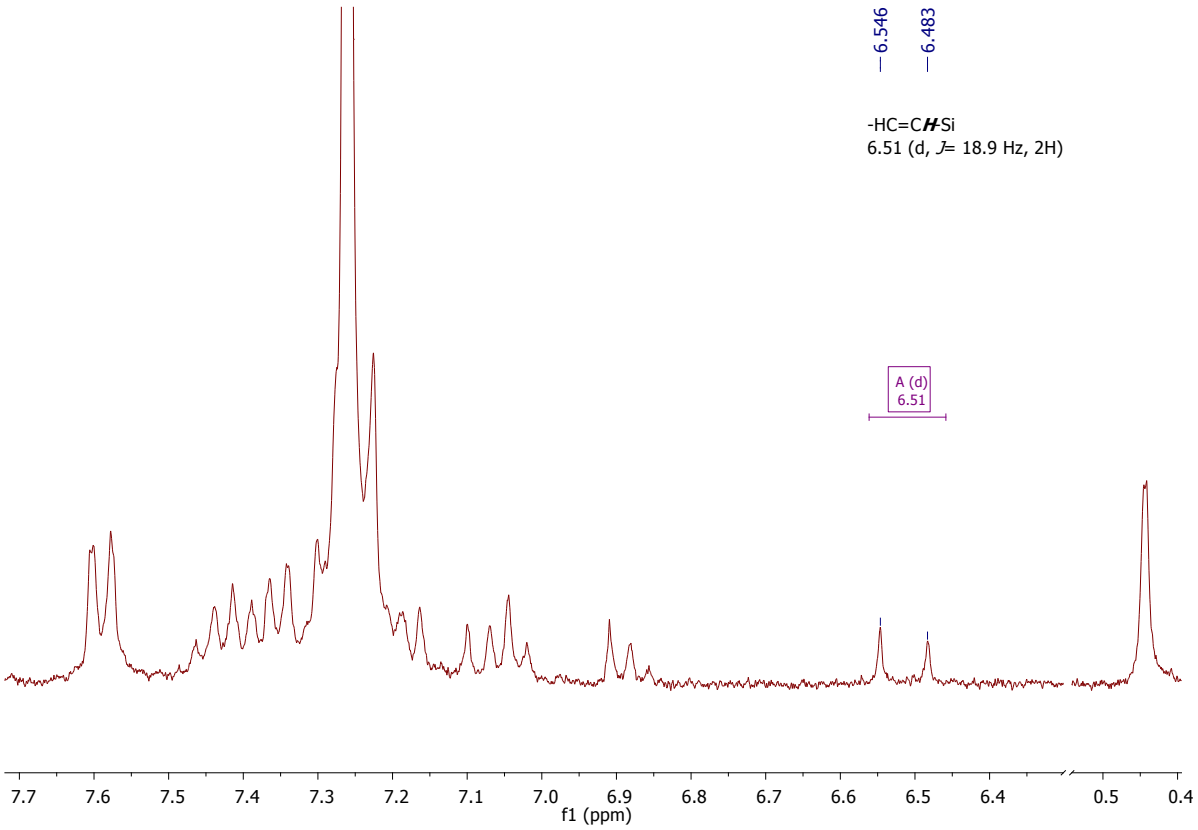



***$^{29}Si$ NMR ($CDCl_3$, δ, ppm):***

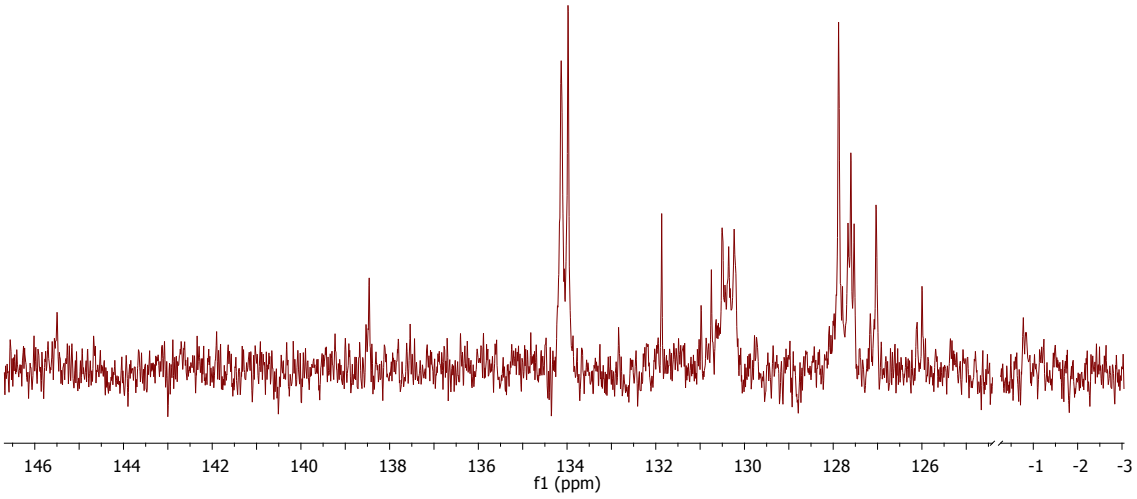


**7**: ***cis and trans mixture of di[9,19-(E)-4-(2,3,4,5,6-pentafluorophenyl)styrylmethyl]-1,3,5,7,11,13,15,17-octaphenylpentacyclo[11.7.1.1$^{3,11}$.1$^{5,17}$.1$^{7,15}$]decasiloxane***

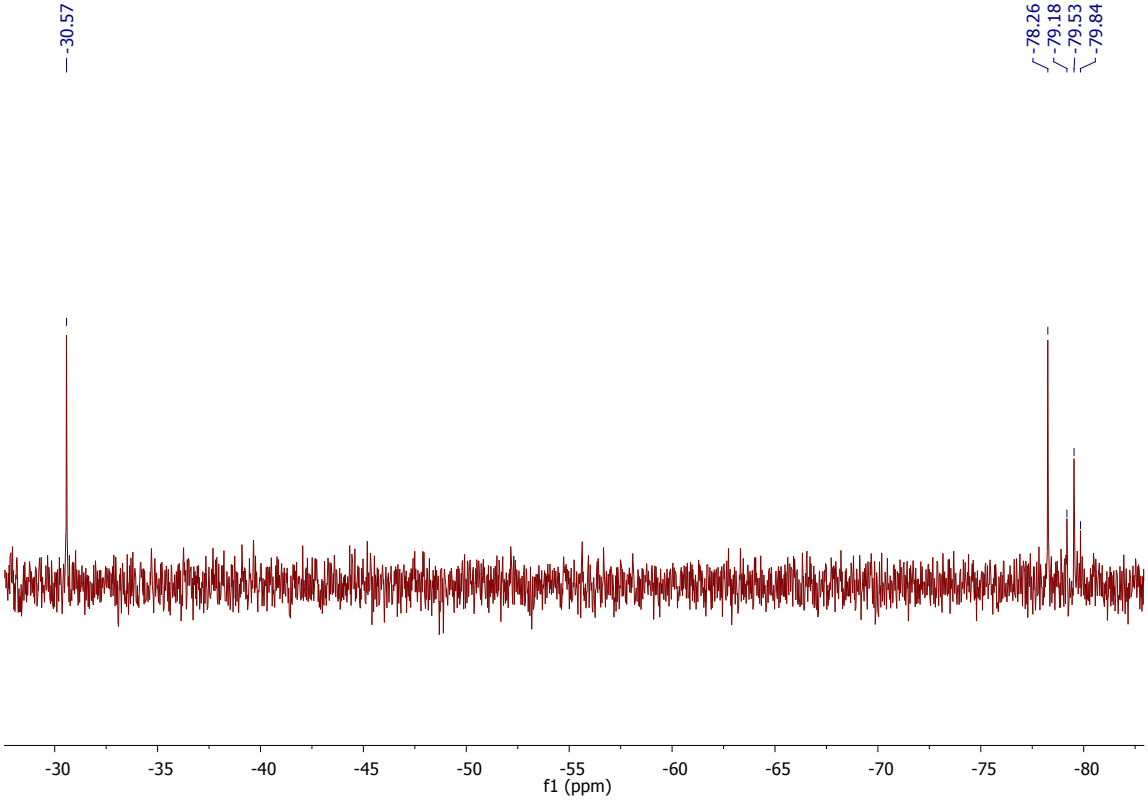
***$^{1}$H NMR ($CDCl_3$, δ, ppm):***




***$^{13}$C NMR ($CDCl_3$, δ, ppm):***

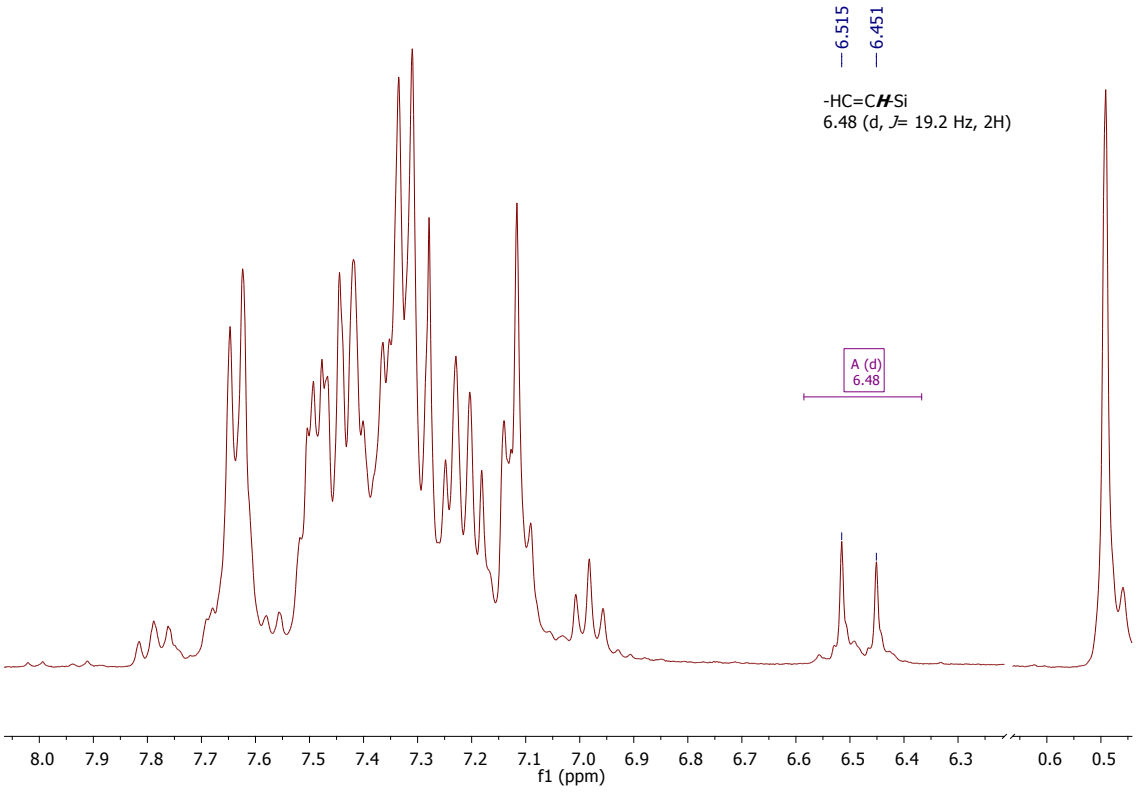


***$^{29}$Si NMR ($CDCl_3$, δ, ppm):***

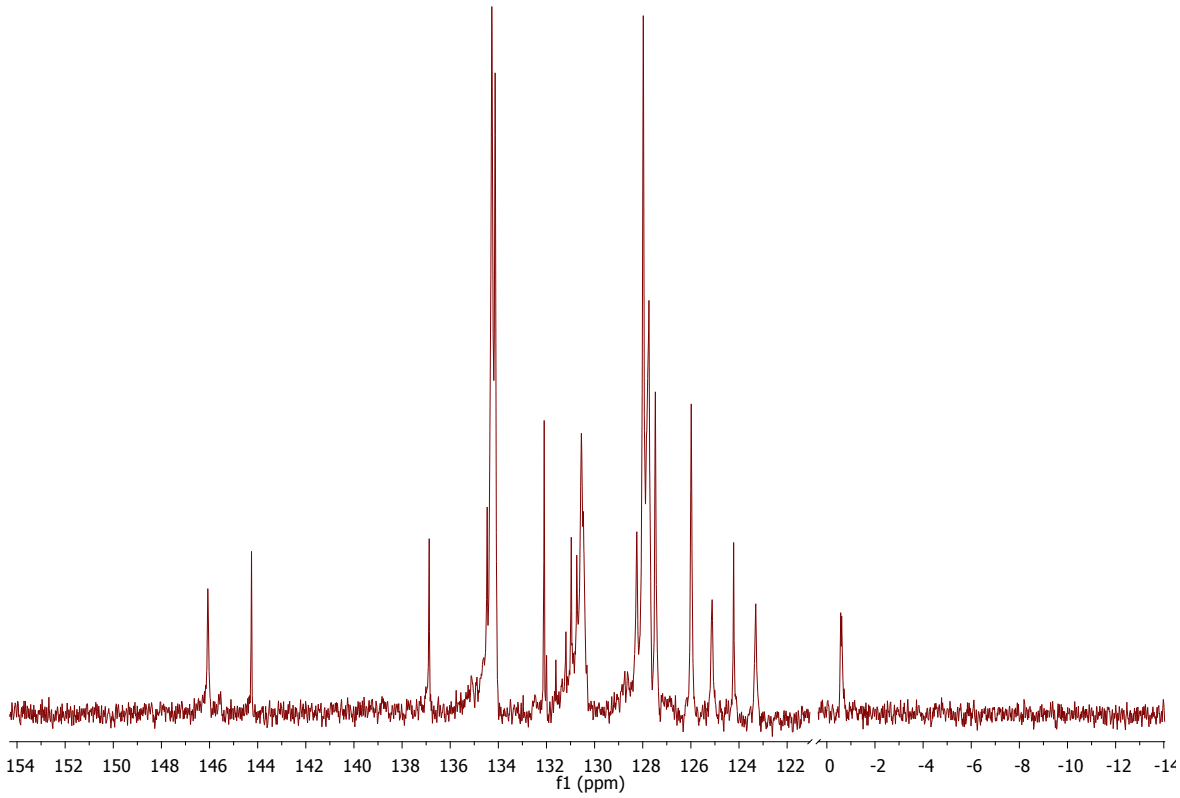



**8:** ***cis and trans mixture of di[9,19-(E)-4-(2-thienyl)styrylmethyl]-1,3,5,7,11,13,15,17-octaphenylpentacyclo[11.7.1.1$^{3,11}$.1$^{5,17}$.1$^{7,15}$]decasiloxane***

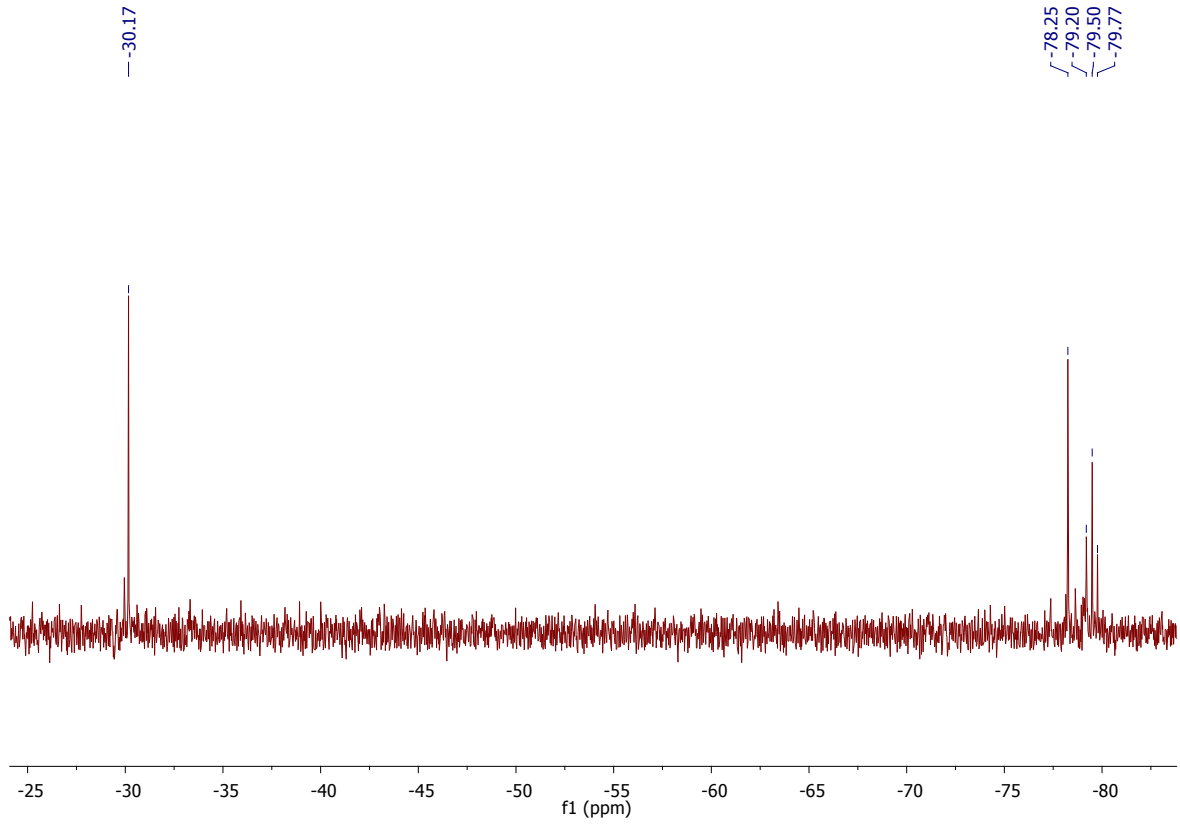
***$^{1}$H NMR ($CDCl_3$, δ, ppm):***



***$^{13}C$ NMR ( $CDCl_3$, δ, ppm):***



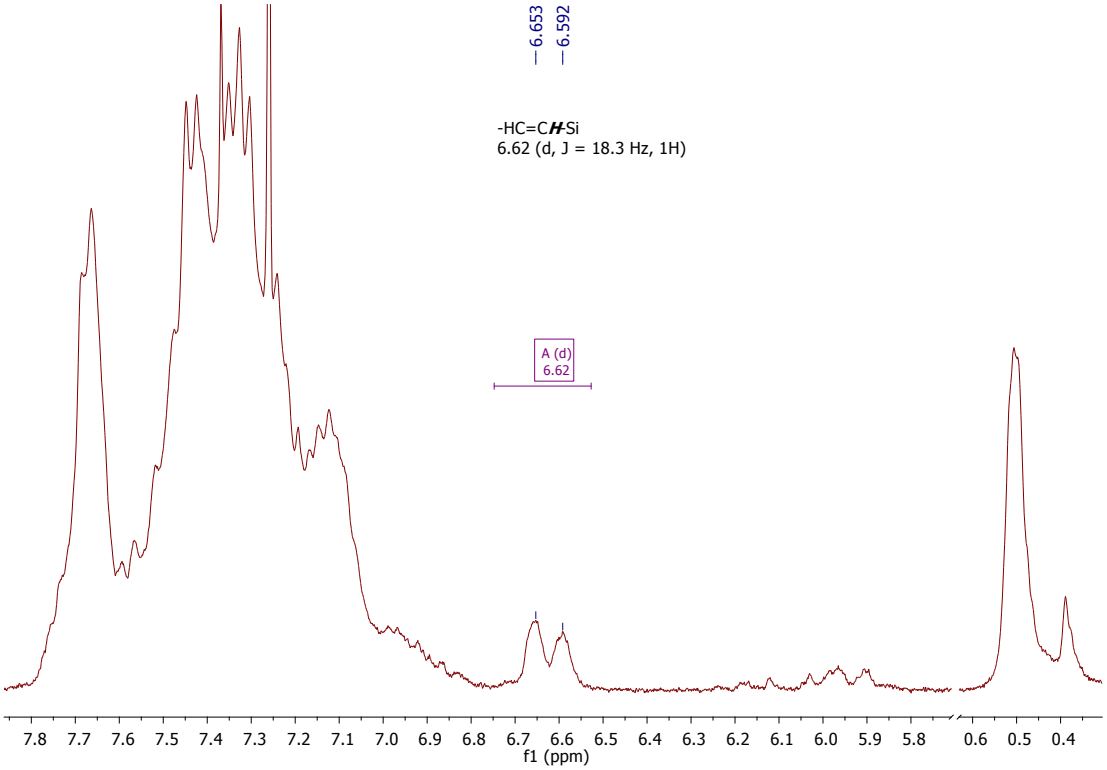

***$^{29}Si$ NMR ($CDCl_3$, δ, ppm):***



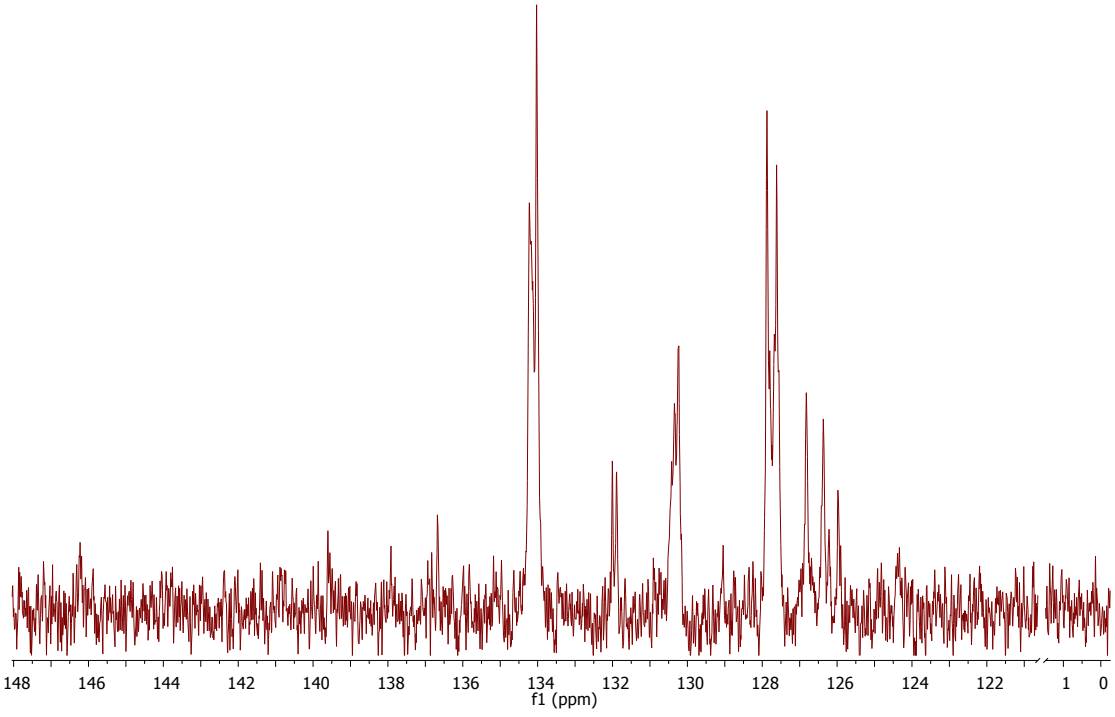
**$^{1}$H, $^{13}$C, $^{29}$Si NMR spectra of the for isolated molecular compounds (9-15).**

**9:** ***poly{[9,19-(E)-4-(1-naphthyl)styrylmethyl]-1,3,5,7,11,13,15,17-octaphenylpentacyclo-[11.7.1.1$^{3,11}$.1$^{5,17}$.1$^{7,15}$]decasiloxane}s***

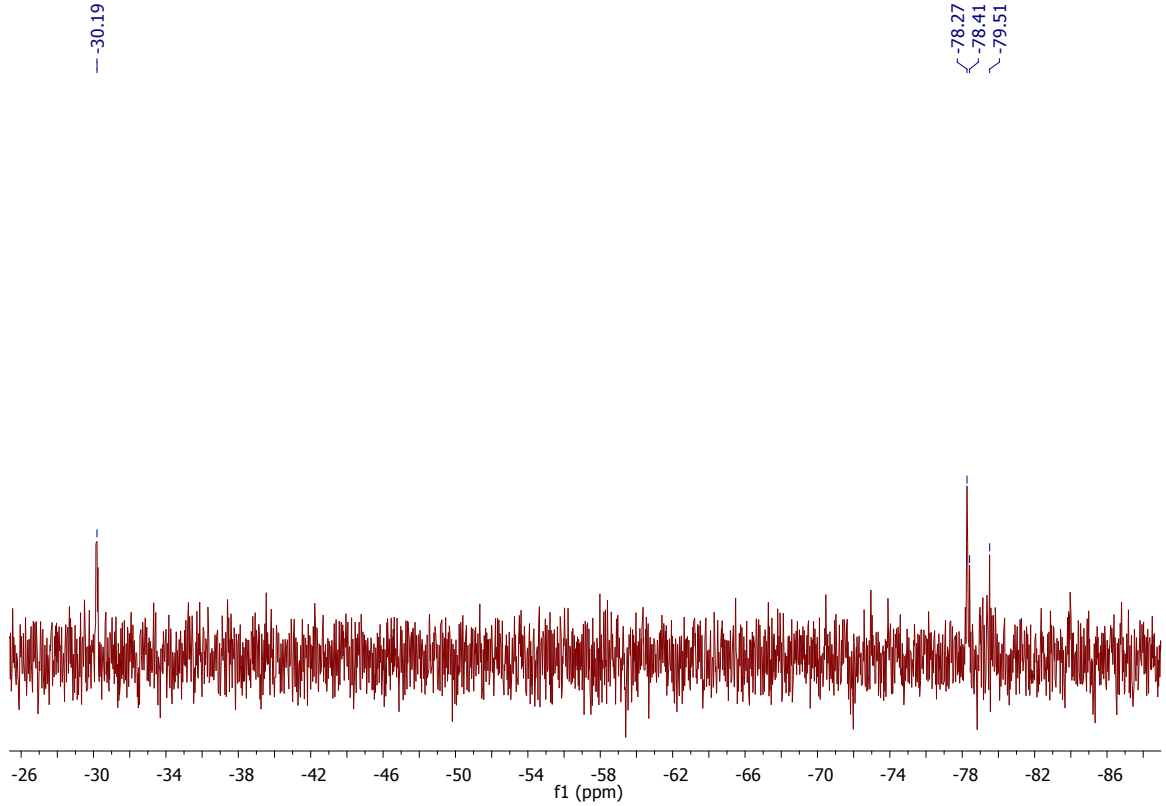
***$^{1}$H NMR (CDCl$_3$, δ, ppm):***




***$^{13}$C NMR (CDCl$_3$, δ, ppm):***

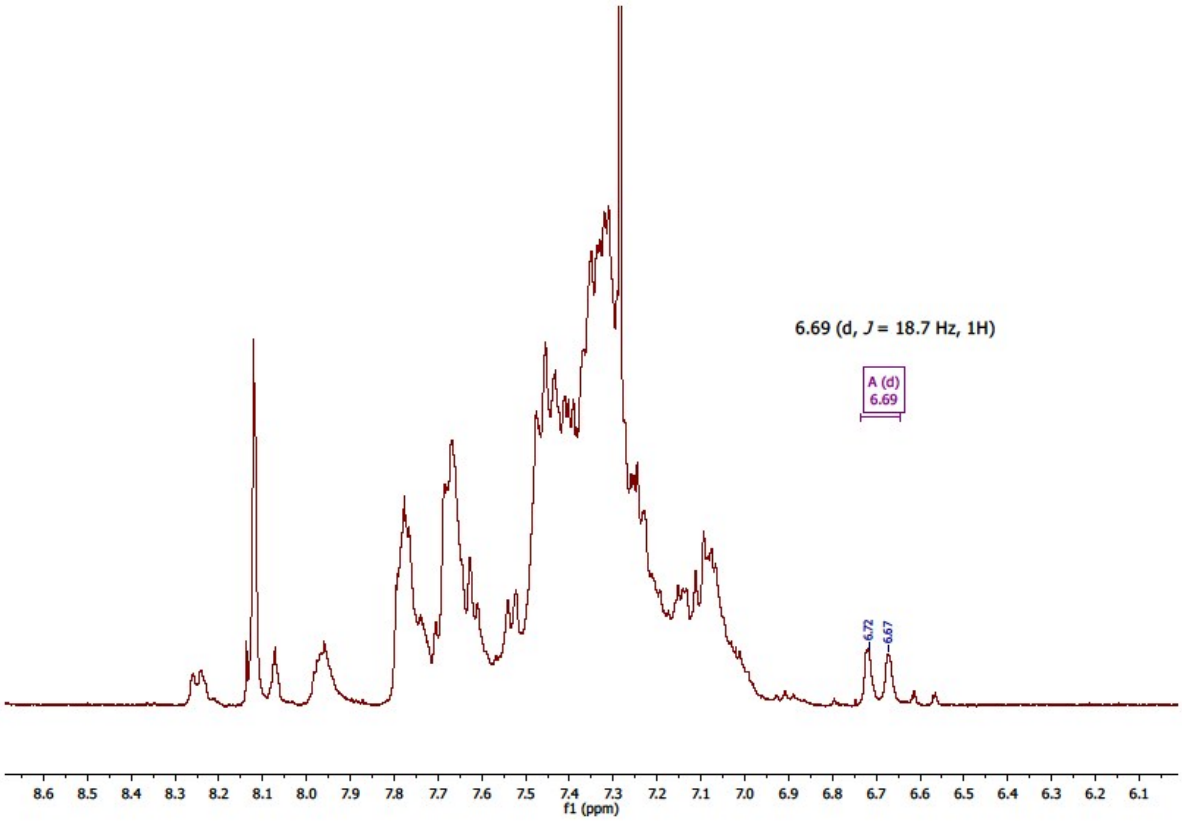


***$^{29}$Si NMR ($CDCl_3$, δ, ppm):***

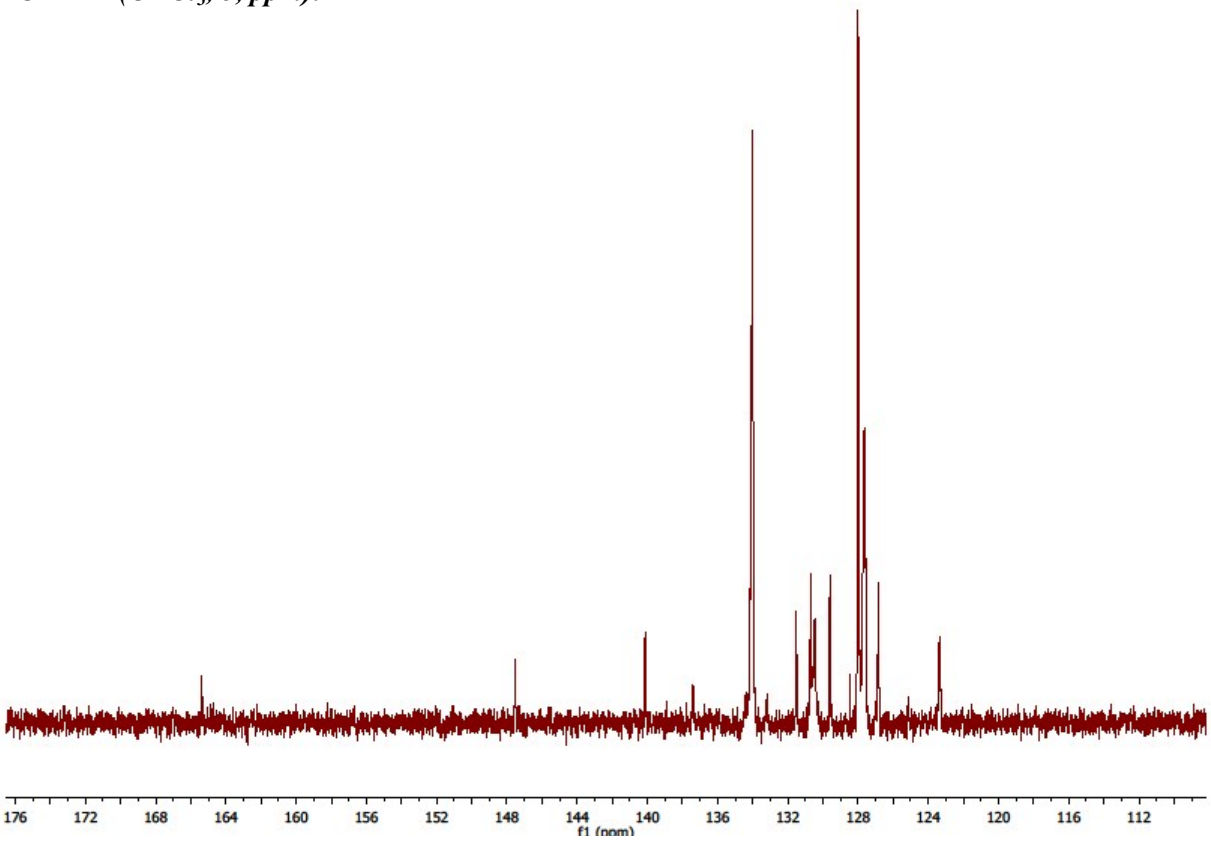



**10:** ***poly{[9,19-(E)-4-(1-naphthyl)styrylphenyl]-1,3,5,7,11,13,15, 17-octaphenylpentacyclo-[11.7.1.1$^{3,11}$.1$^{5,17}$.1$^{7,15}$]decasiloxane}s***

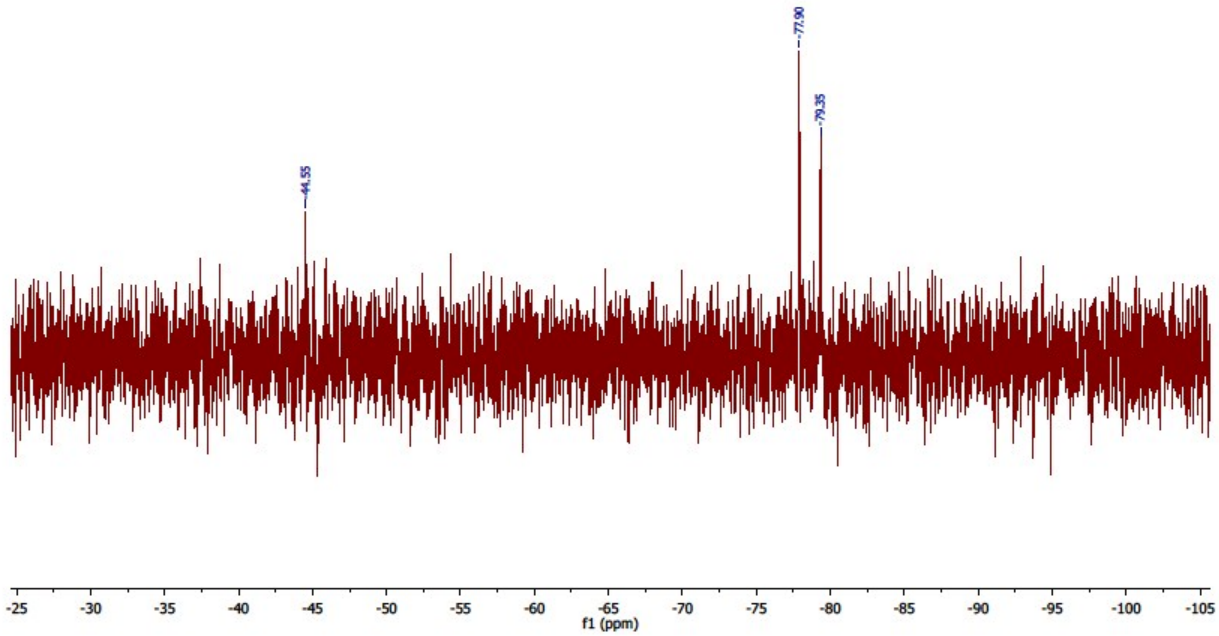
***$^{1}$H NMR ($CDCl_3$, δ, ppm):***



***$^{13}C$ NMR ($CDCl_3$, δ, ppm):***

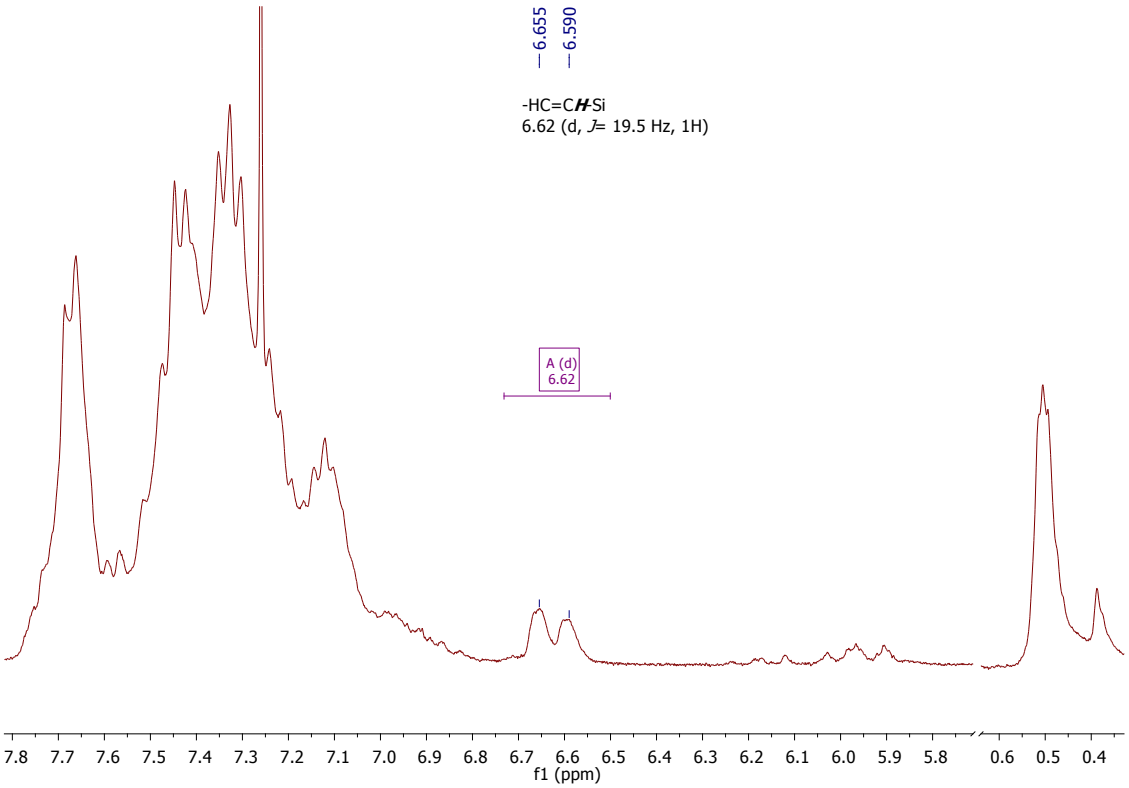



***$^{29}Si$ NMR ($CDCl_3$, δ, ppm):***

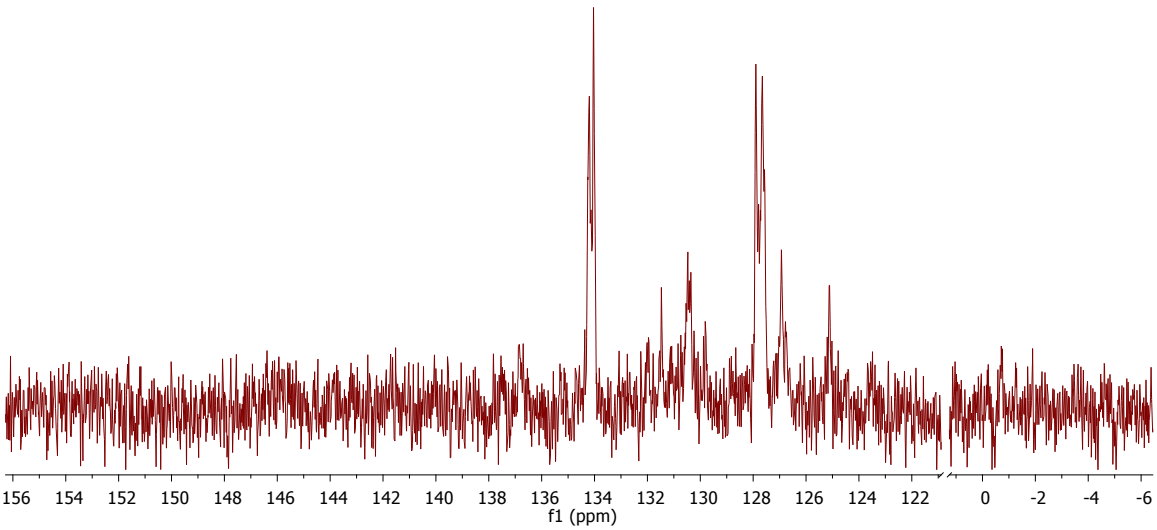


**11:** ***poly{[9,19-(E)-4-(9-anthracenyl)styrylmethyl]-1,3,5,7,11,13,15,17-octaphenylpentacyclo [11.7.1.1$^{3,11}$.1$^{5,17}$.1$^{7,15}$]decasiloxane}s***

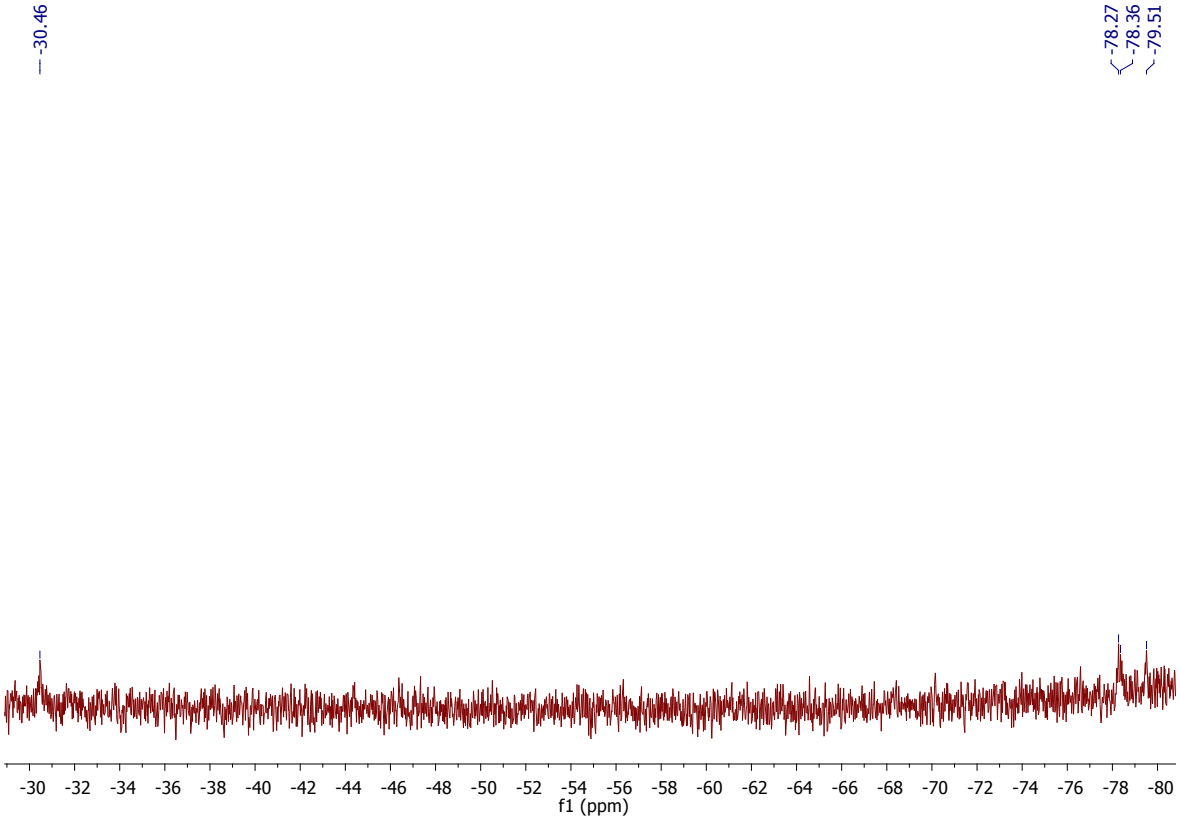
***$^{1}$H NMR ($CDCl_3$, δ, ppm):***




***$^{13}$C NMR ($CDCl_3$, δ, ppm):***

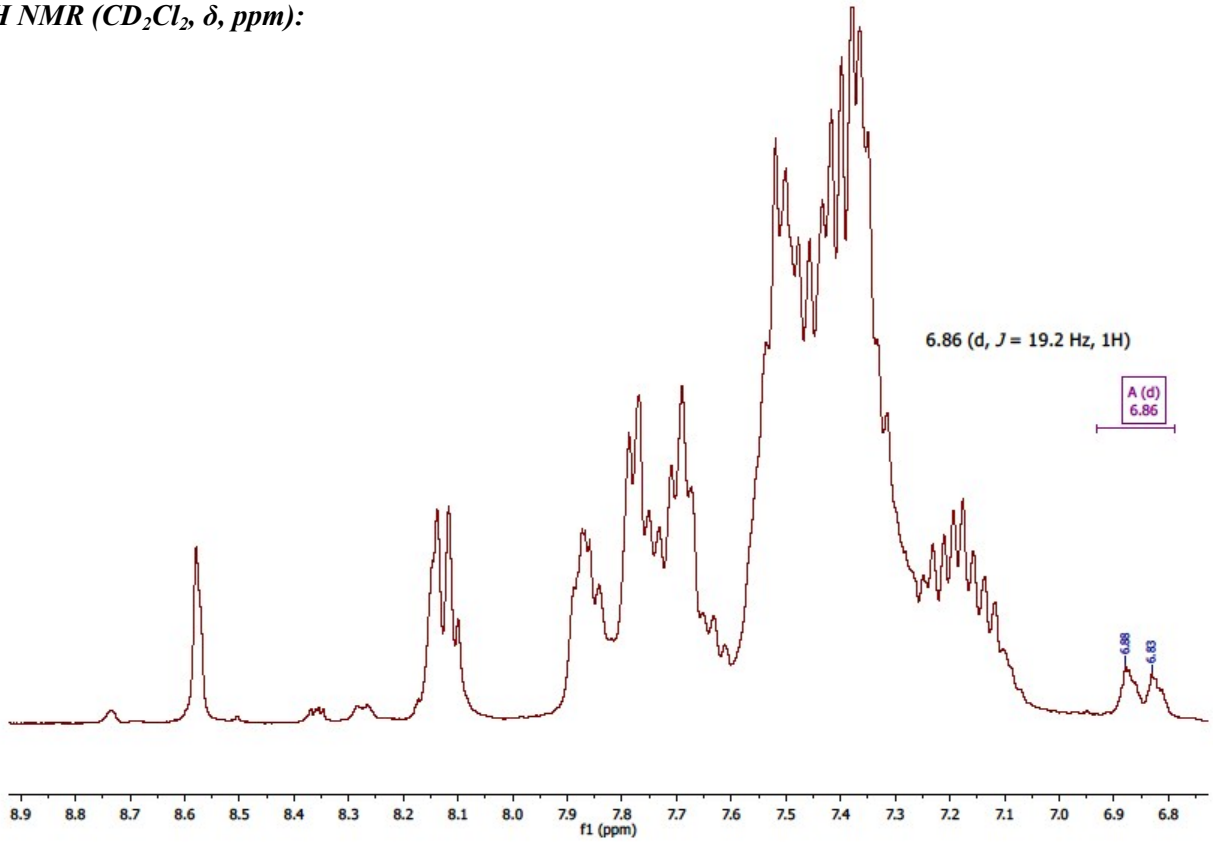


*$^{29}$Si NMR ($CDCl_3$, δ, ppm):*



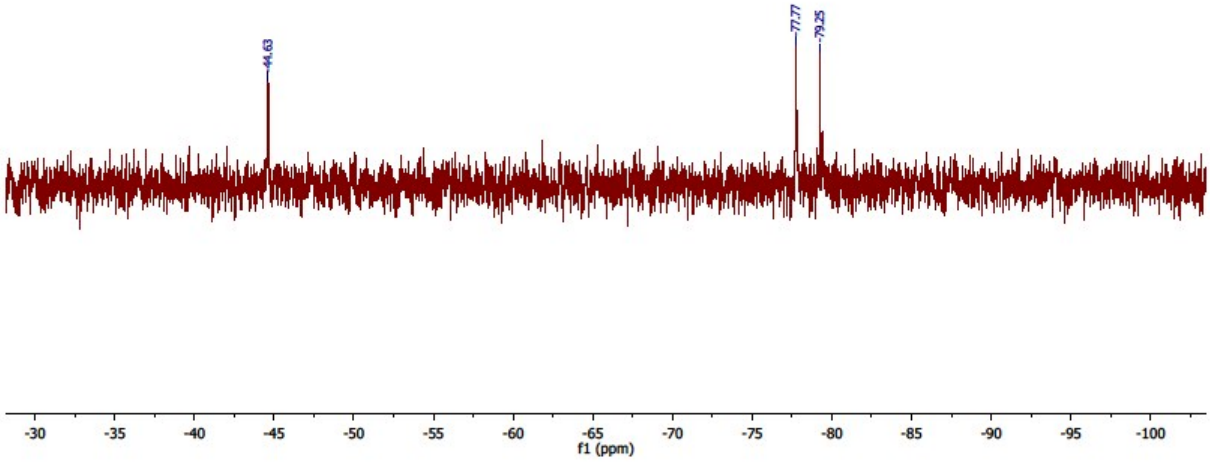

**12:** ***poly{[9,19-(E)-4-(9-anthracenyl)styrylphenyl- 1,3,5,7,11,13,15,17-octaphenylpentacyclo-[11.7.1.1$^{3,11}$.1$^{5,17}$.1$^{7,15}$]decasiloxane}s***

*$^{1}$H NMR ($CD_2Cl_2$, δ, ppm):*



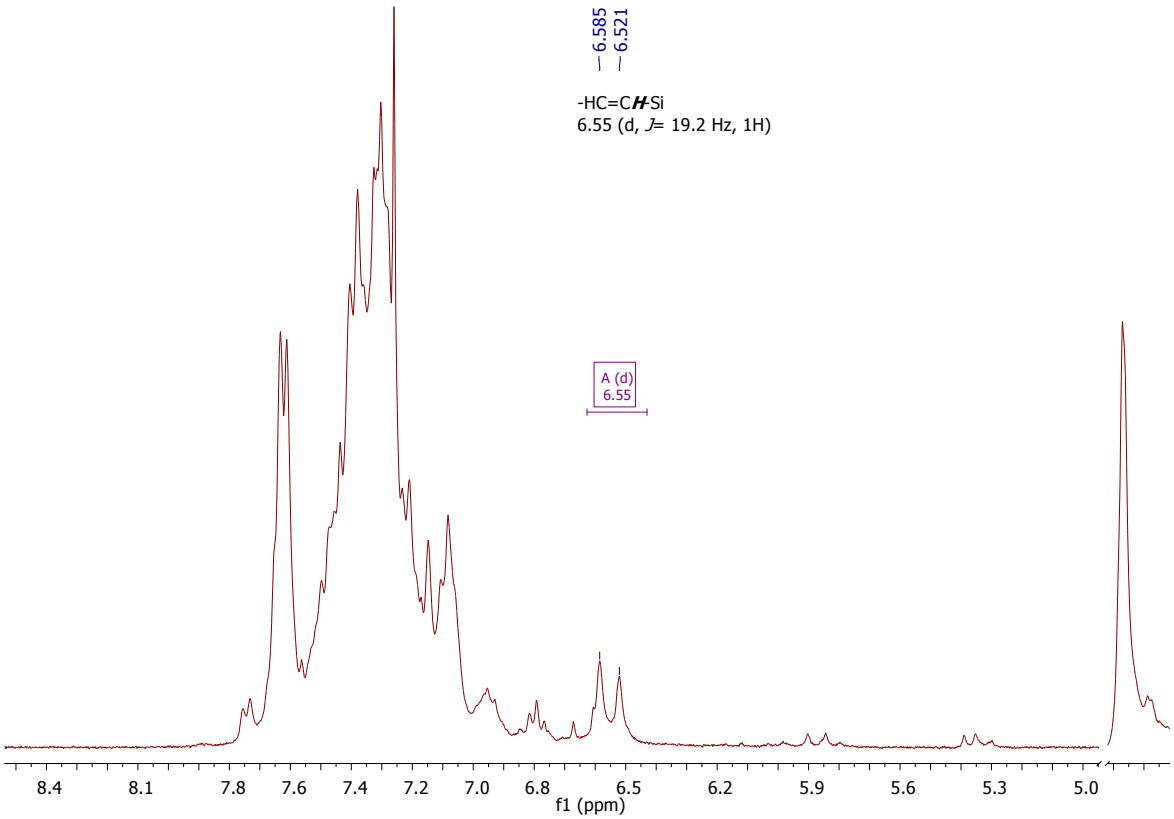
***$^{13}C$ NMR ($CD_2Cl_2$, δ, ppm):***

***$^{29}Si$ NMR ($CD_2Cl_2$, δ, ppm):***

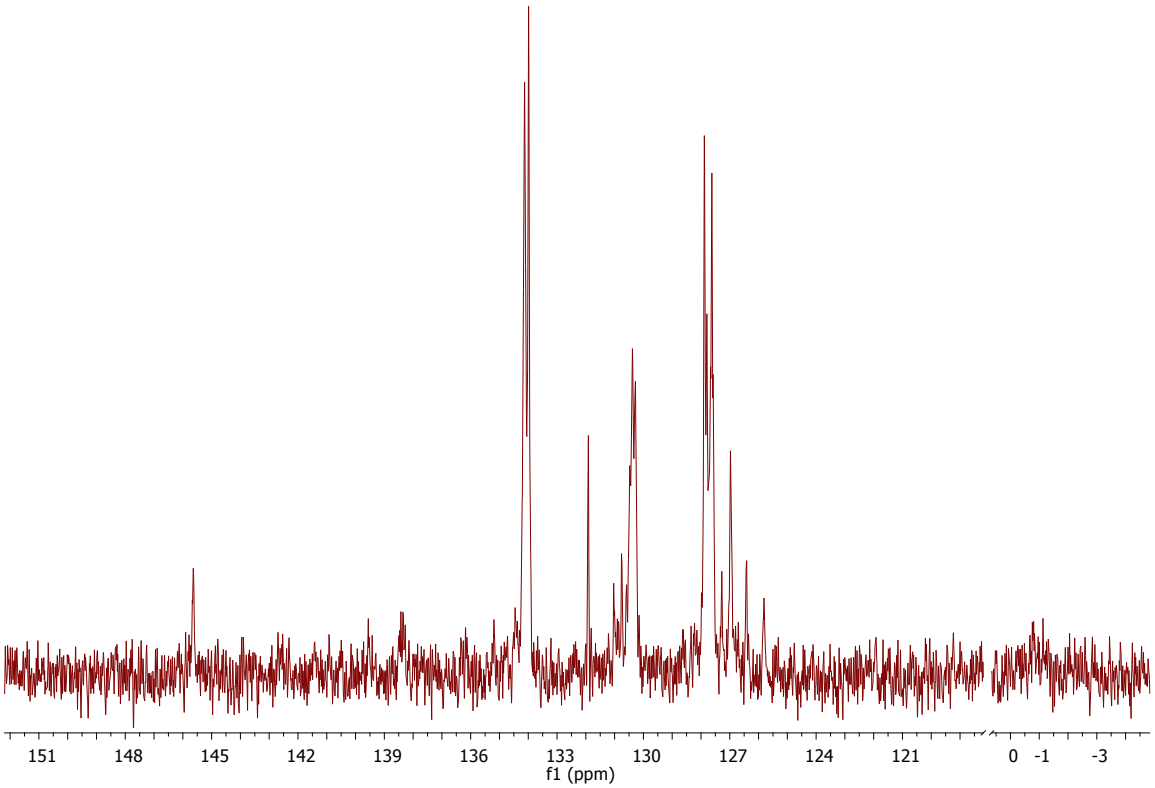


**13:** ***poly{[9,19-(E)-4-(2,3,5,6-tetrafluorophenyl)styrylmethyl]-1,3,5,7,11,13,15,17-octaphenylpentacyclo[11.7.1.1$^{3,11}$.1$^{5,17}$.1$^{7,15}$]decasiloxane}s***

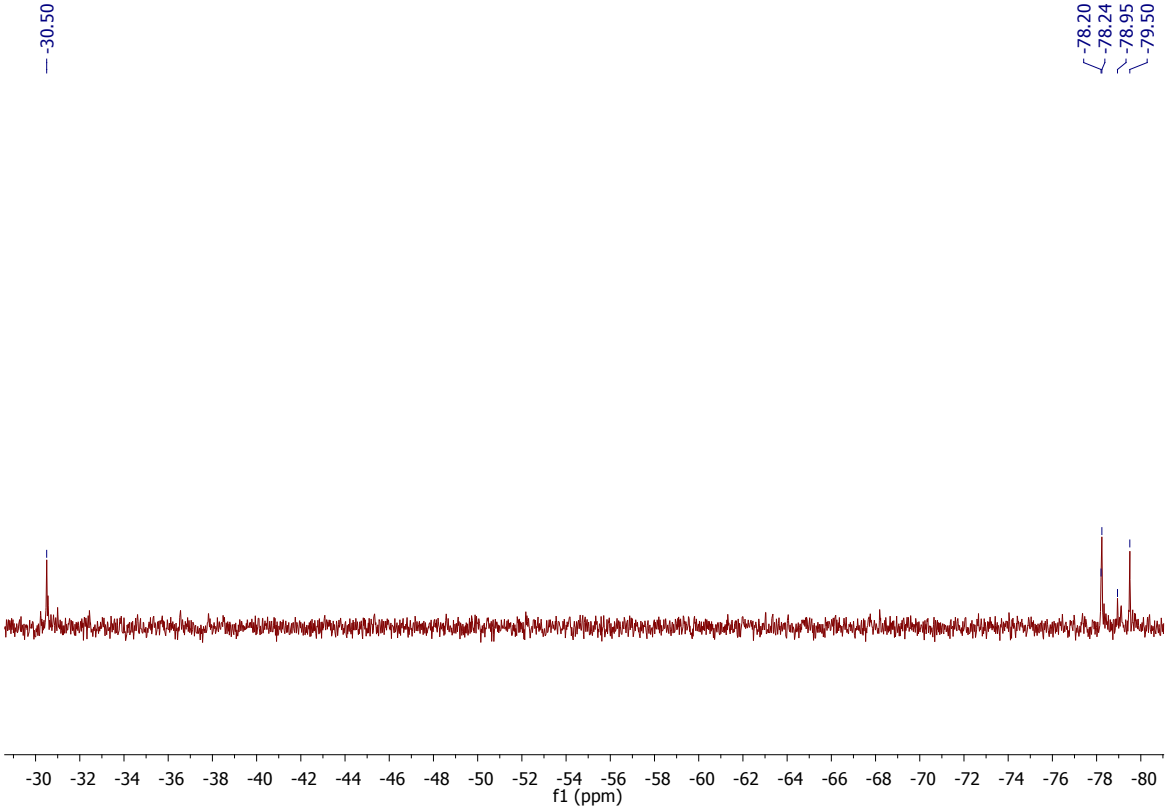
***$^{1}$H NMR ($CDCl_3$, δ, ppm):***




***$^{13}$C NMR ($CDCl_3$, δ, ppm):***

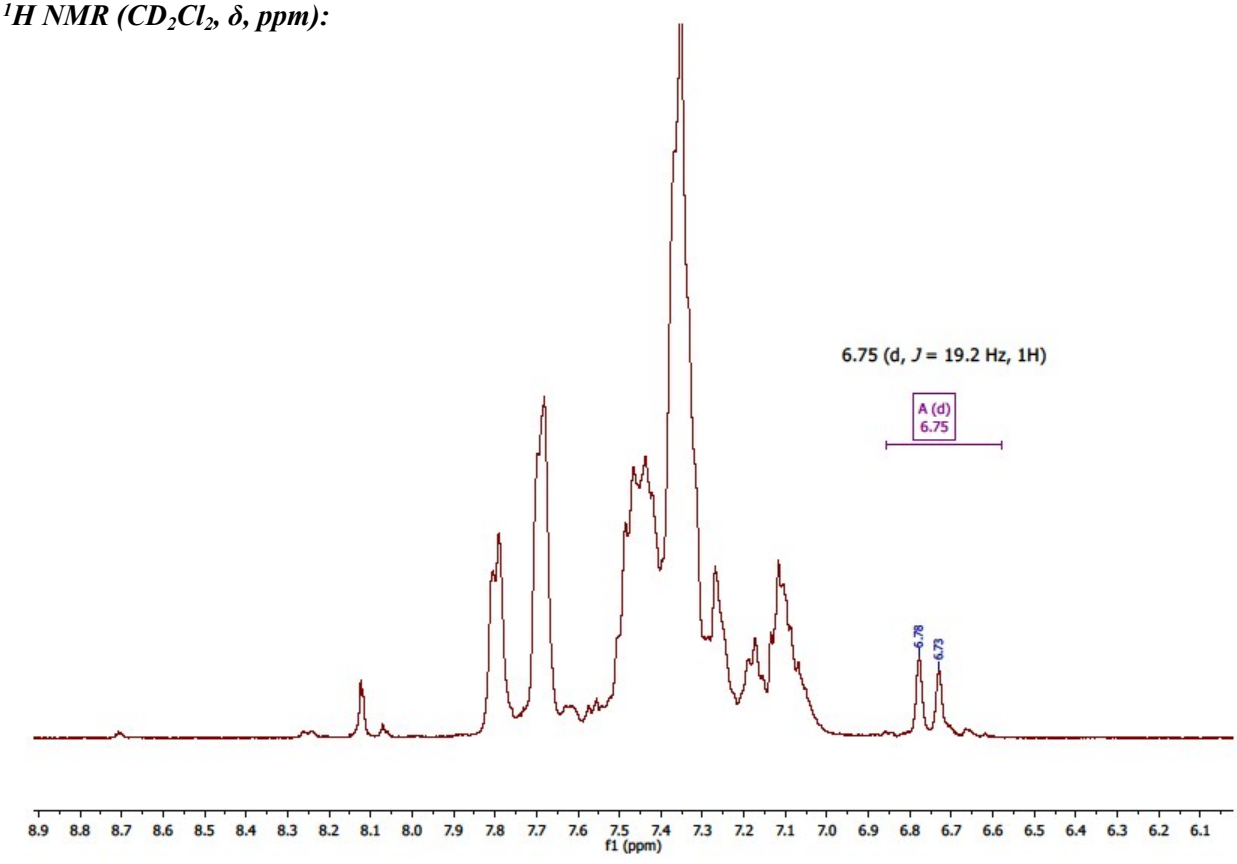


***$^{29}$Si NMR ($CDCl_3$, δ, ppm):***

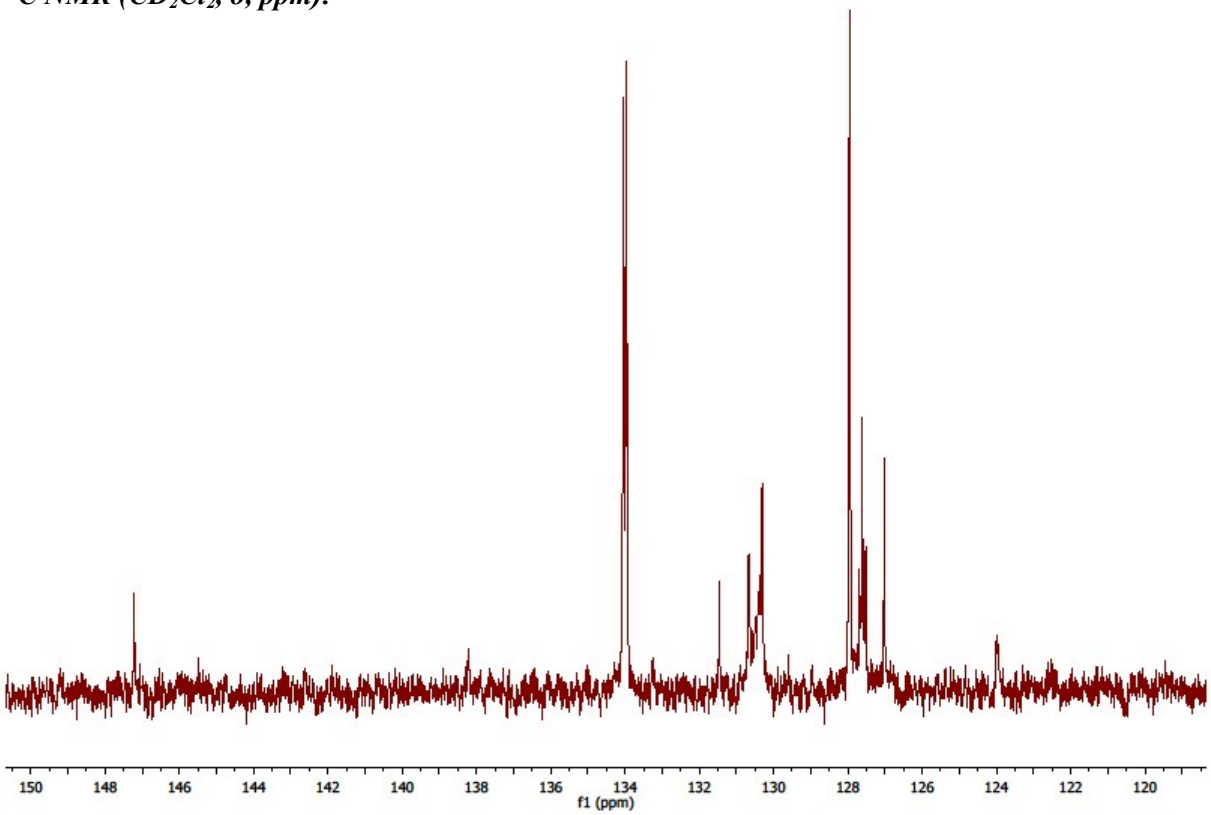



**14:** ***poly{[9,19-(E)-4-(2,3,5,6-tetrafluorophenyl)styrylphenyl]-1,3,5,7,11,13,15,17-octaphenylpentacyclo[11.7.1.1$^{3,11}$.1$^{5,17}$.1$^{7,15}$]decasiloxane}s***

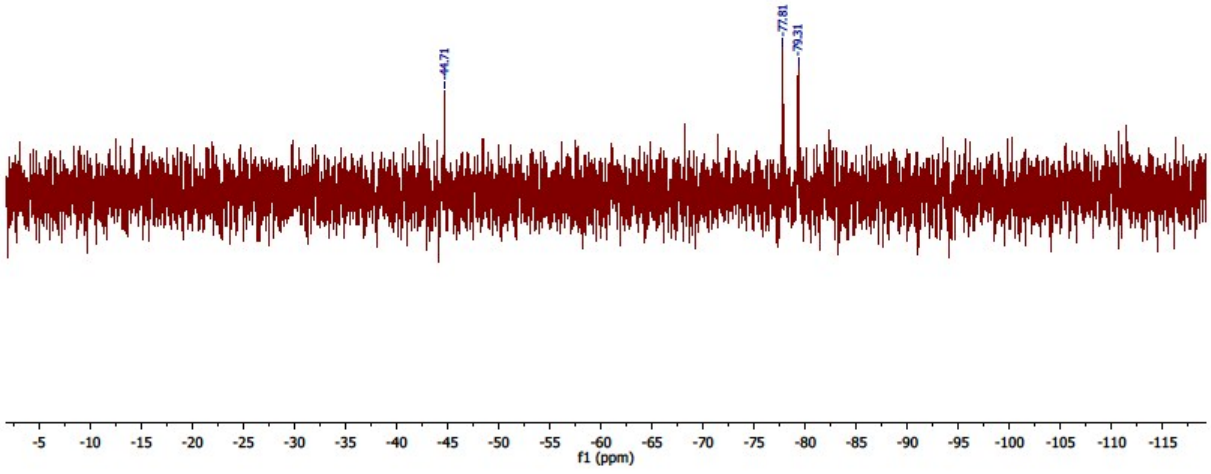
***$^{1}$H NMR ($CD_2Cl_2$, δ, ppm):***



***$^{13}C$ NMR ($CD_2Cl_2$, δ, ppm):***

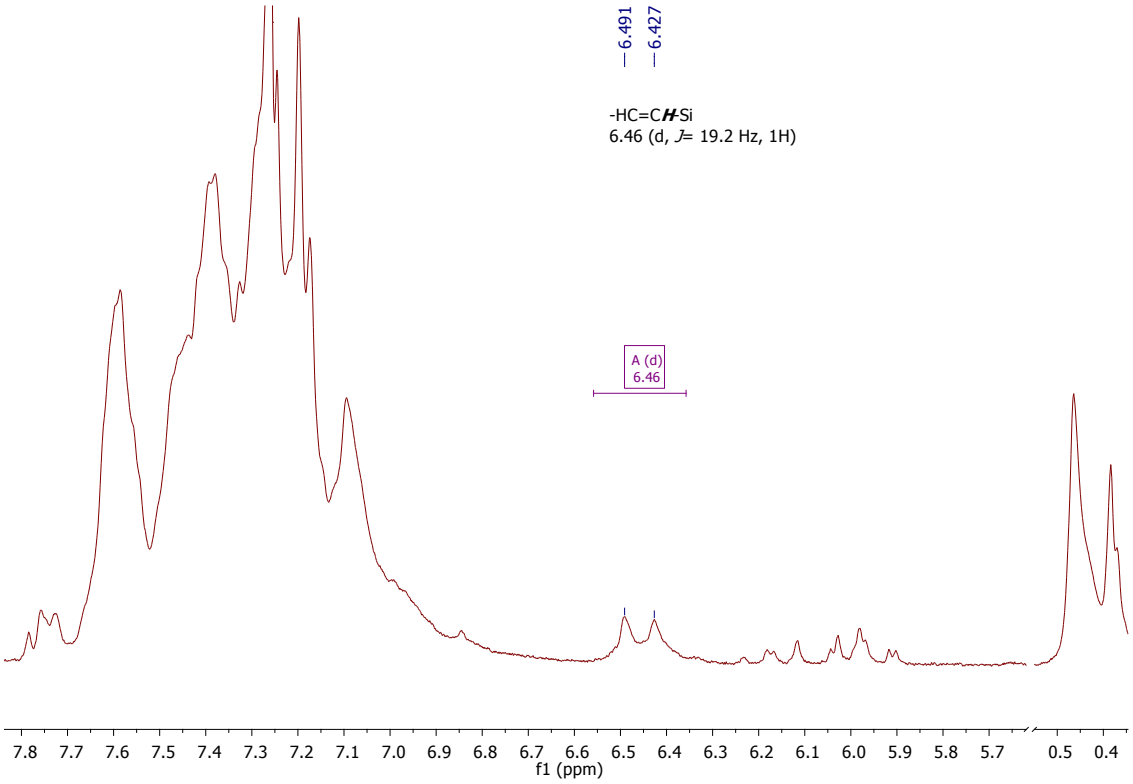



***$^{29}Si$ NMR ($CD_2Cl_2$, δ, ppm):***

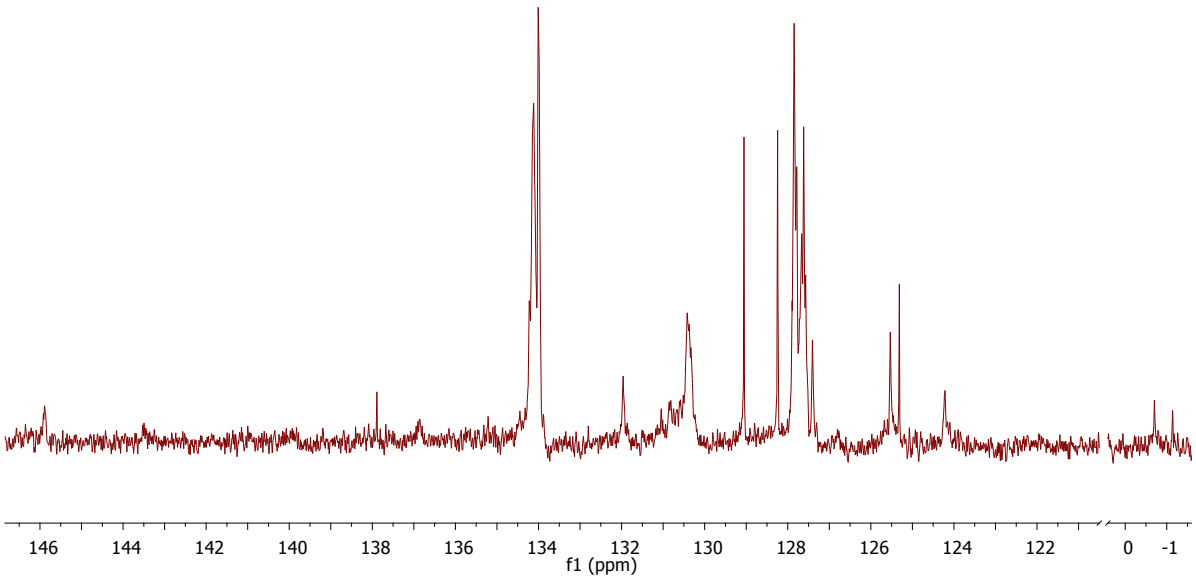


**15:** ***poly{[9,19-(E)-4-(2-thienyl)styrylmethyl]-1,3,5,7,11,13,15,17-octaphenylpentacyclo[11.7.1.1$^{3,11}$.1$^{5,17}$.1$^{7,15}$]decasiloxane}s***

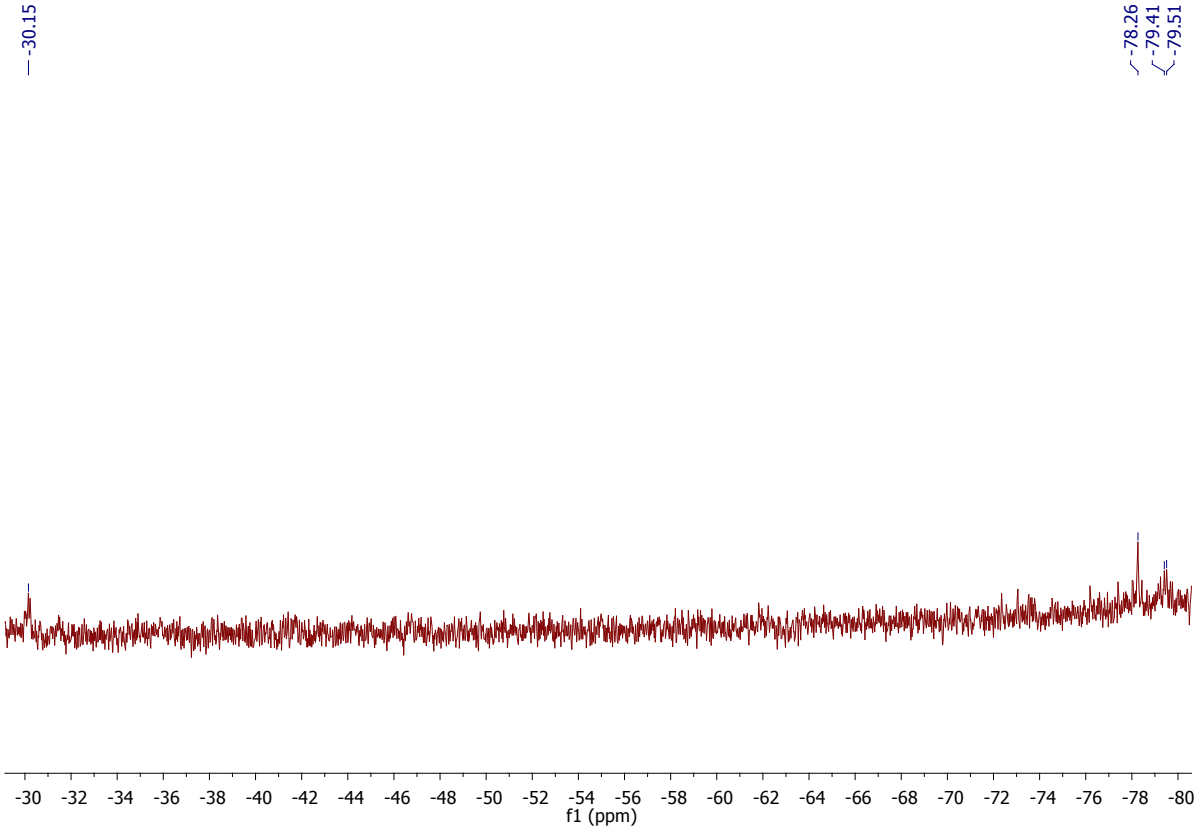
***$^{1}$H NMR ($CDCl_3$, δ, ppm):***



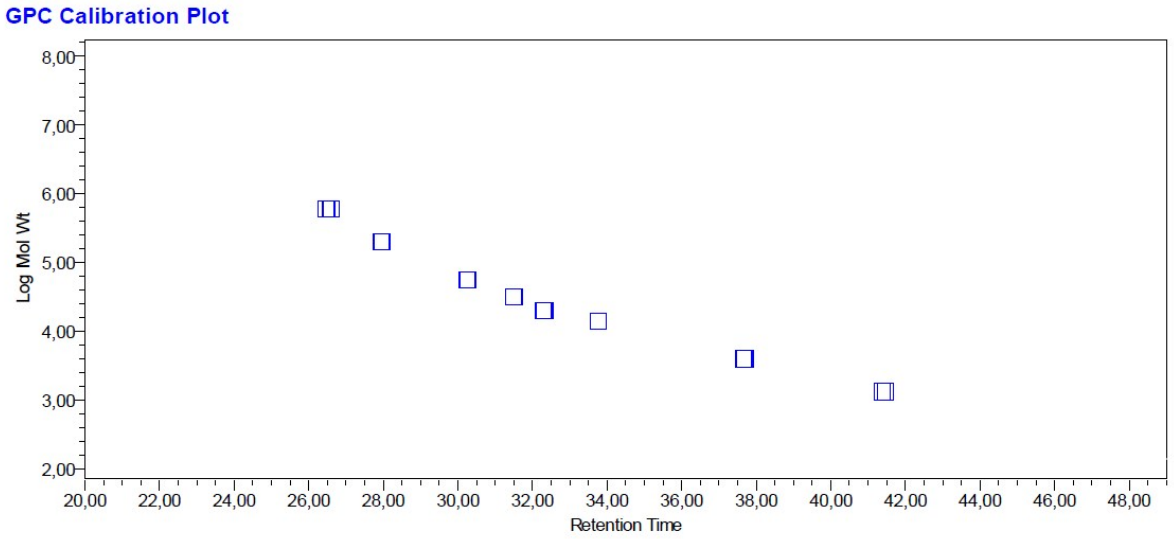

***$^{13}$C NMR ($CDCl_3$, δ, ppm):***



***$^{29}$Si NMR ($CDCl_3$, δ, ppm):***




## GPC Calibration Curve



## GPC Calibration Table

| | Mol Wt (Daltons) | Retention Time (min) | Calculated Weight (Daltons) | %Residual |
|---|---|---|---|---|
| 1 | 591000 | 26,483 | 610648 | -3,218 |
| 2 | 591000 | 26,480 | 611933 | -3,421 |
| 3 | 591000 | 26,609 | 554136 | 6,652 |
| 4 | 591000 | 26,590 | 562486 | 5,069 |
| 5 | 591000 | 26,465 | 619034 | -4,529 |
| 6 | 197000 | 27,943 | 198660 | -0,836 |
| 7 | 197000 | 27,959 | 196423 | 0,294 |
| 8 | 197000 | 27,954 | 196940 | 0,030 |
| 9 | 197000 | 27,947 | 198023 | -0,517 |
| 10 | 197000 | 27,966 | 195711 | 0,659 |
| 11 | 55100 | 30,243 | 55250 | -0,271 |
| 12 | 55100 | 30,242 | 55260 | -0,290 |
| 13 | 55100 | 30,244 | 55200 | -0,182 |
| 14 | 55100 | 30,246 | 55142 | -0,075 |
| 15 | 55100 | 30,262 | 54738 | 0,662 |
| 16 | 31400 | 31,500 | 31441 | -0,130 |
| 17 | 31400 | 31,507 | 31322 | 0,250 |
| 18 | 31400 | 31,495 | 31507 | -0,338 |
| 19 | 31400 | 31,506 | 31352 | 0,153 |
| 20 | 31400 | 31,506 | 31343 | 0,182 |
| 21 | 20000 | 32,326 | 19920 | 0,403 |
| 22 | 20000 | 32,322 | 19941 | 0,296 |
| 23 | 20000 | 32,321 | 19944 | 0,279 |
| 24 | 20000 | 32,299 | 20124 | -0,618 |
| 25 | 20000 | 32,282 | 20315 | -1,548 |
| 26 | 13900 | 33,773 | 13862 | 0,273 |
| 27 | 13900 | 33,767 | 13890 | 0,075 |
| 28 | 13900 | 33,761 | 13914 | -0,098 |
| 29 | 13900 | 33,762 | 13910 | -0,074 |
| 30 | 13900 | 33,761 | 13914 | -0,098 |
| 31 | 3950 | 37,668 | 3979 | -0,734 |
| 32 | 3950 | 37,699 | 3940 | 0,248 |
| 33 | 3950 | 37,701 | 3939 | 0,283 |
| 34 | 3950 | 37,697 | 3943 | 0,167 |
| 35 | 3950 | 37,691 | 3951 | -0,015 |
| 36 | 1310 | 41,376 | 1322 | -0,920 |
| 37 | 1310 | 41,460 | 1289 | 1,593 |
| 38 | 1310 | 41,385 | 1319 | -0,655 |