Supplementary Information (SI) for RSC Pharmaceutics.

Effect of fluorine substituents in 4-(1-benzyl-1H-benzo[d]imidazol-2-yl)thiazole for the study of antiparasitic treatment of cysticercosis on the *Taenia crassiceps* model

Monserrath I. Rodríguez-Mora,[a] Raúl Colorado-Peralta,[b] Viviana Reyes-Márquez,[c] Marco A. García-Eleno,[d] Erick Cuevas-Yáñez,[d] Jesús R. Parra-Unda,[e] Abraham Landa[f] and David Morales-Morales*[a]

Supplementary Information

CONTENT

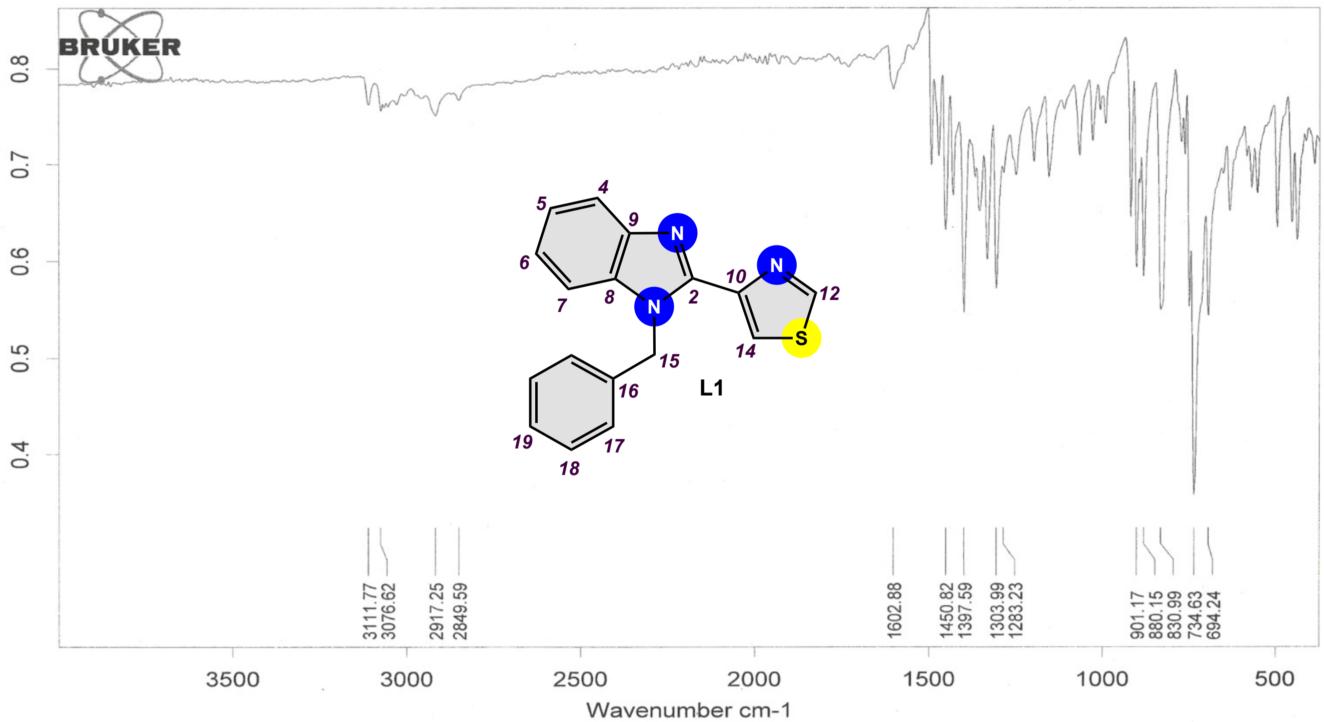

Figure S1. Infrared spectrum (ATR) of **L1**

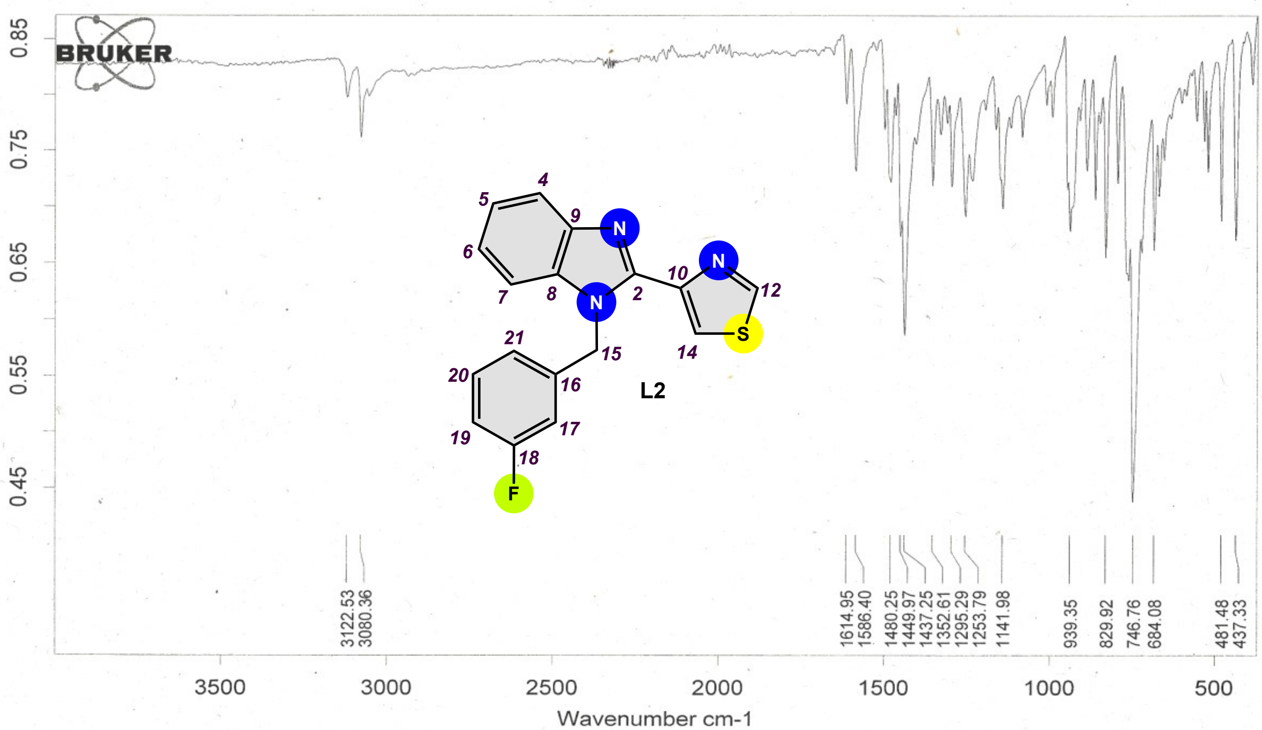

Figure S2. Infrared spectrum (ATR) of **L2**

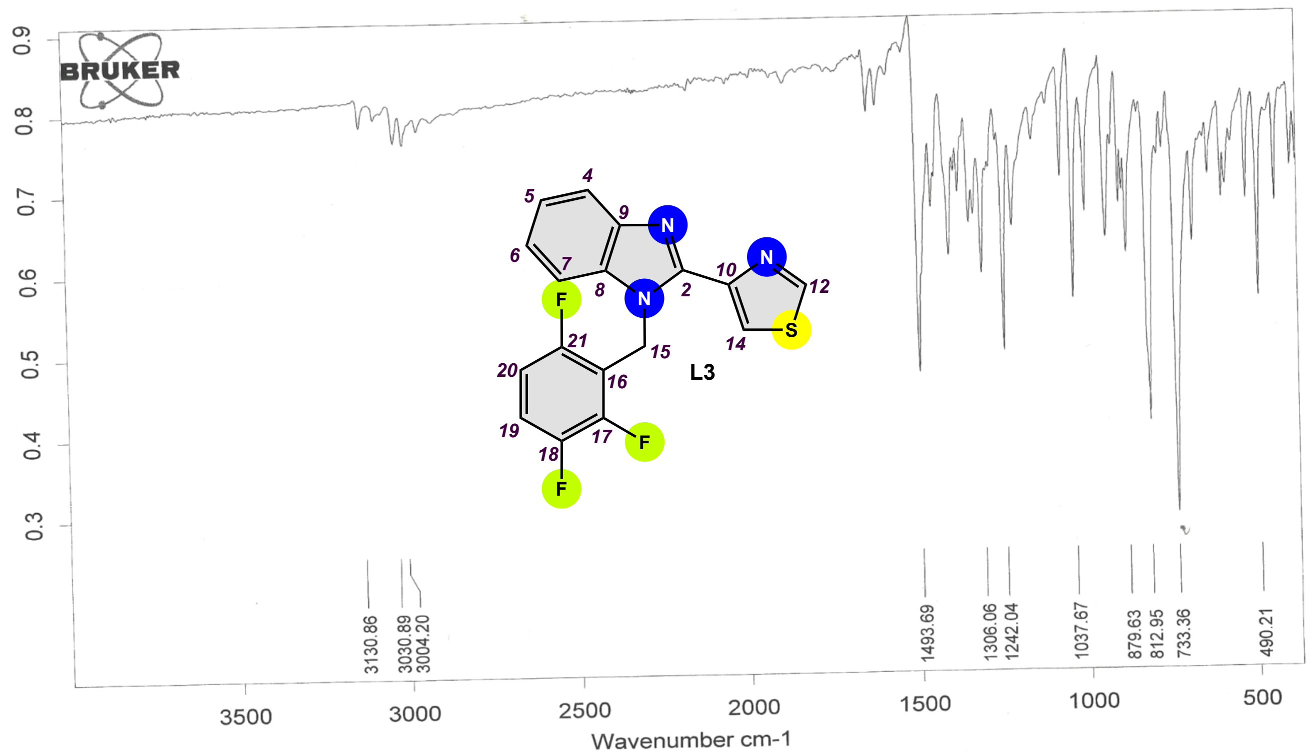

Figure S3. Infrared spectrum (ATR) of **L3**

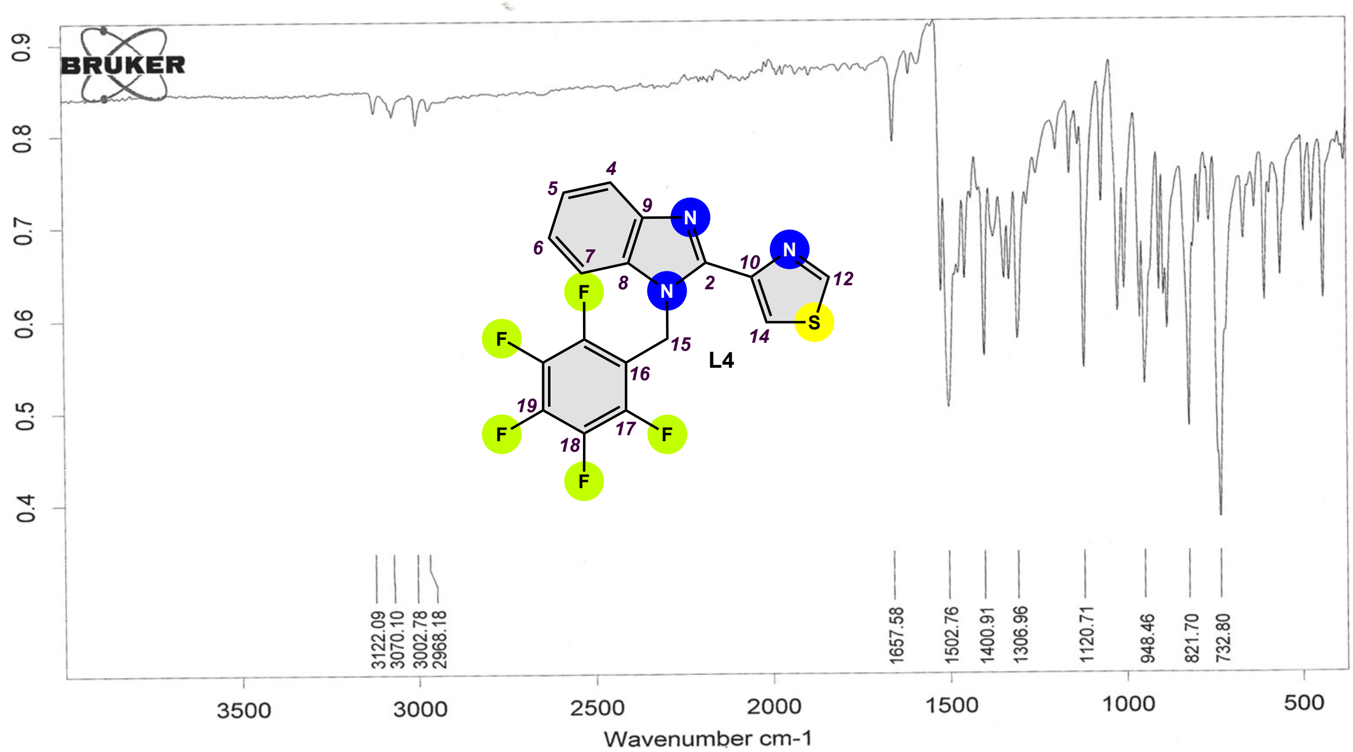

Figure S4. Infrared spectrum (ATR) of **L4**

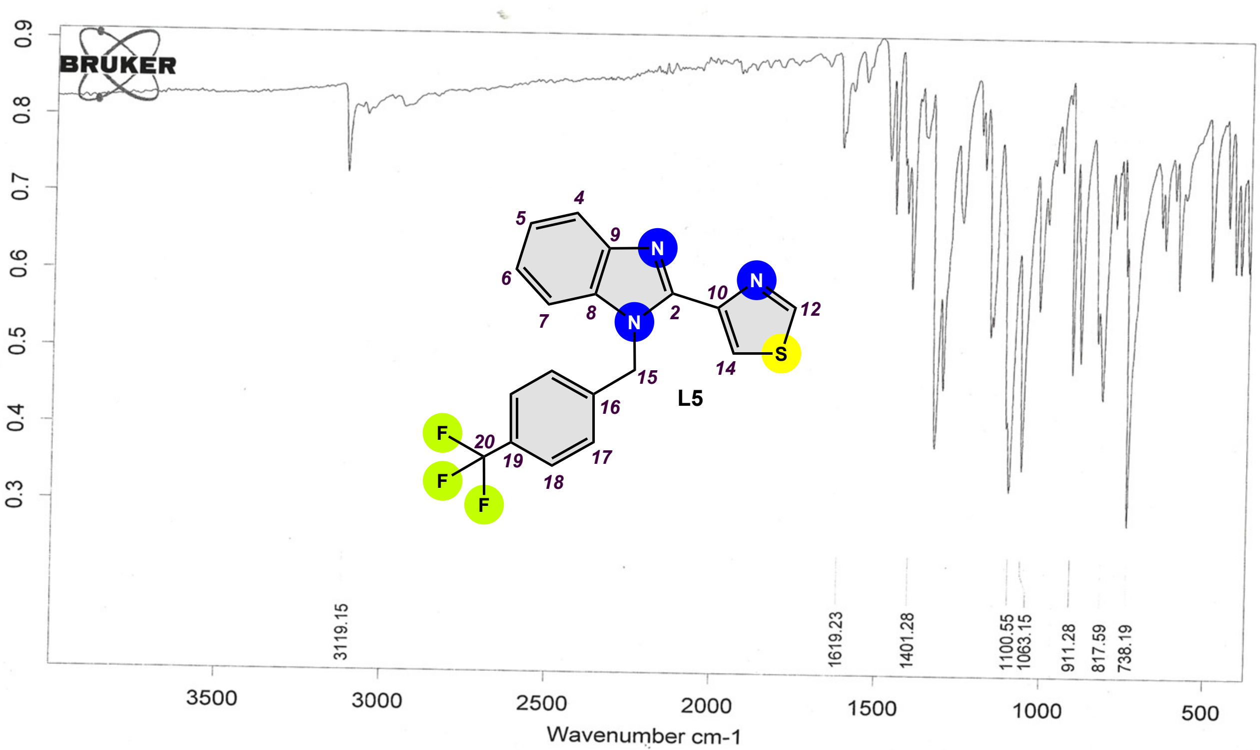

Figure S5. Infrared spectrum (ATR) of **L5**

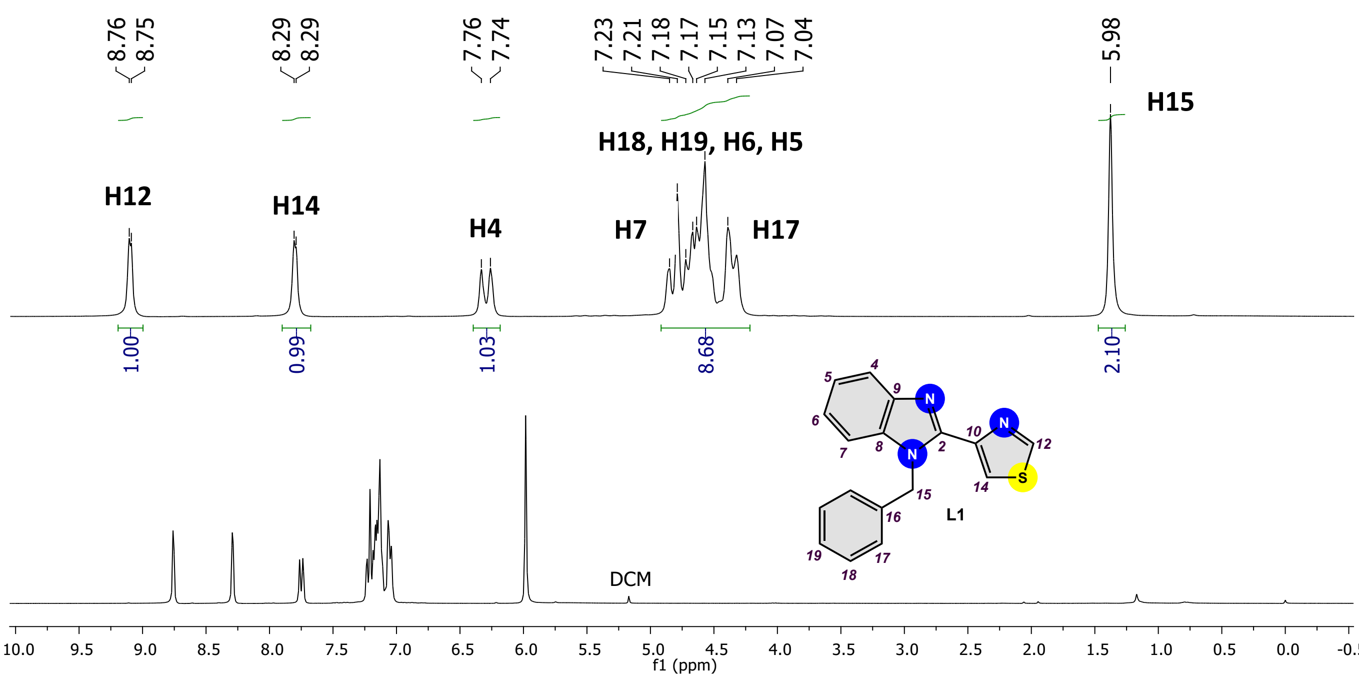

Figure S6. ^{1}H NMR spectrum in $CDCl_3$ of **L1**

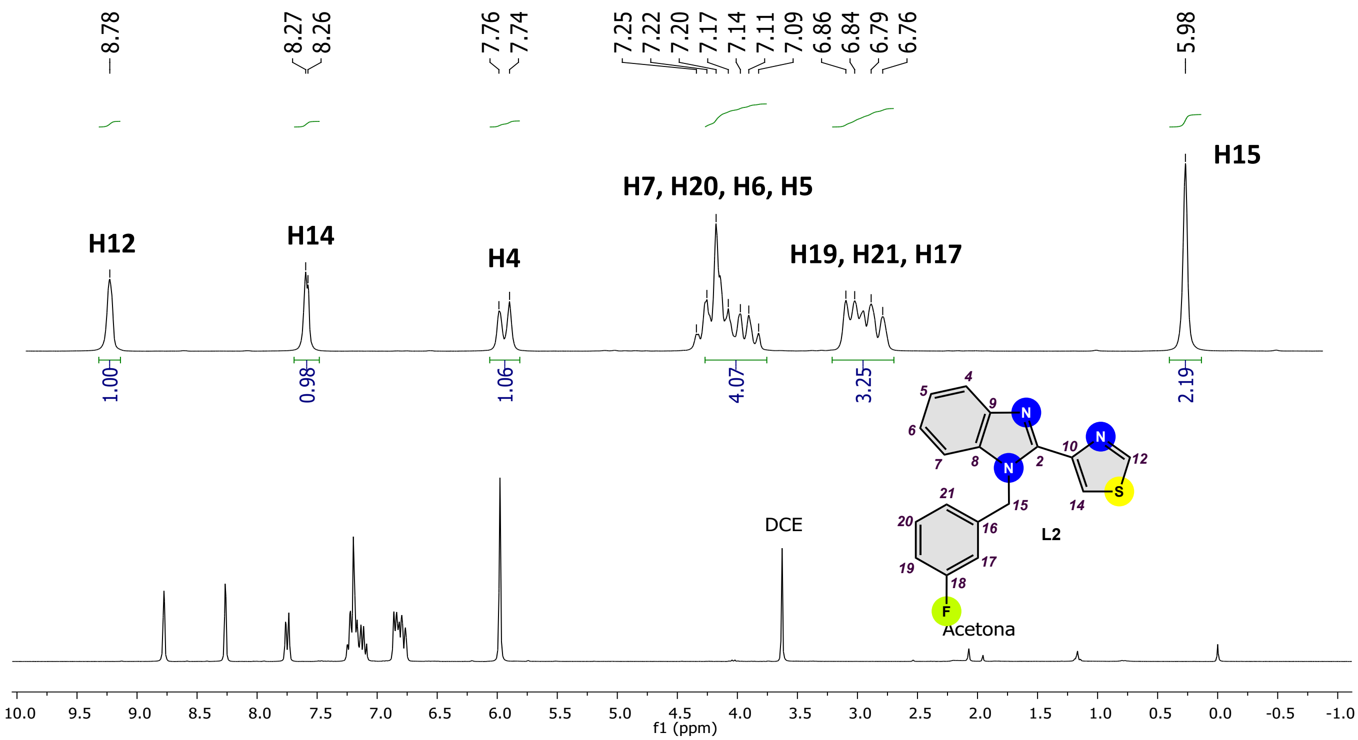

Figure S7. [1]H NMR spectrum in $CDCl_3$ of **L2**

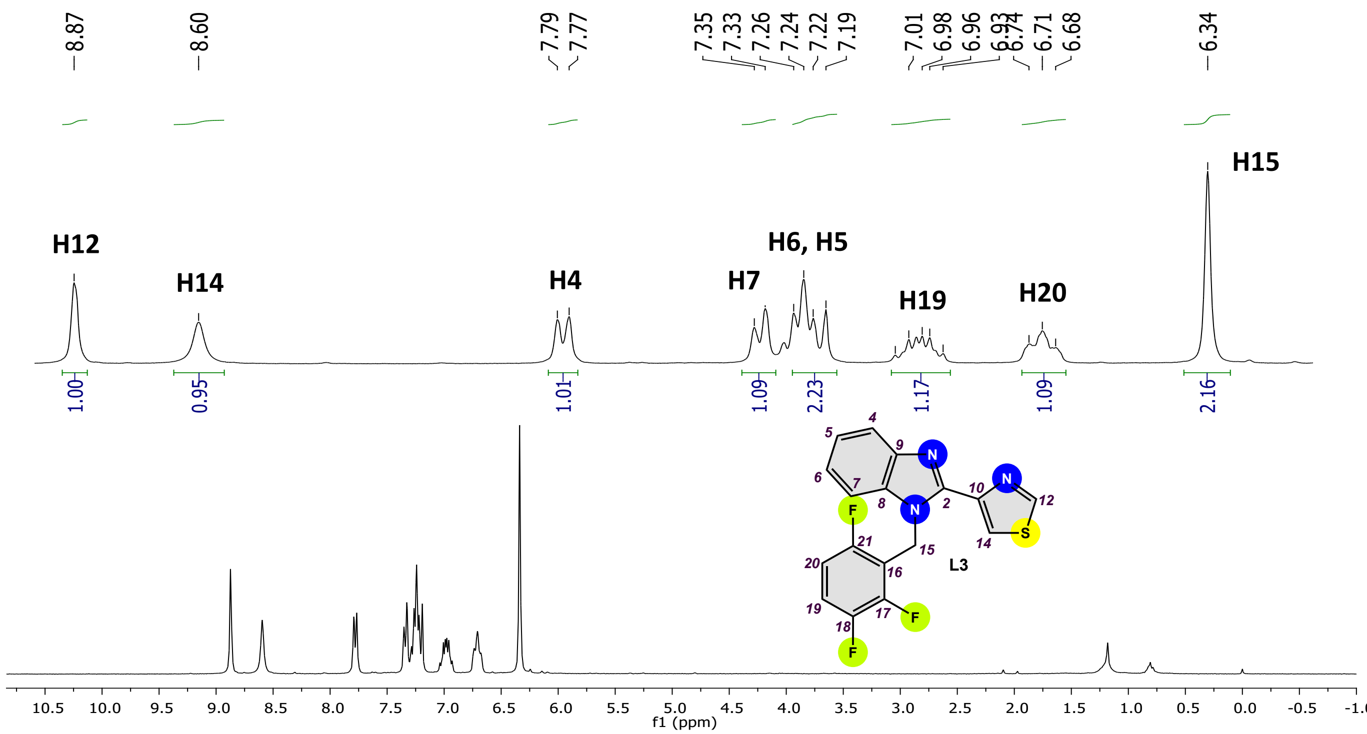

Figure S8. [1]H NMR spectrum in $CDCl_3$ of **L3**

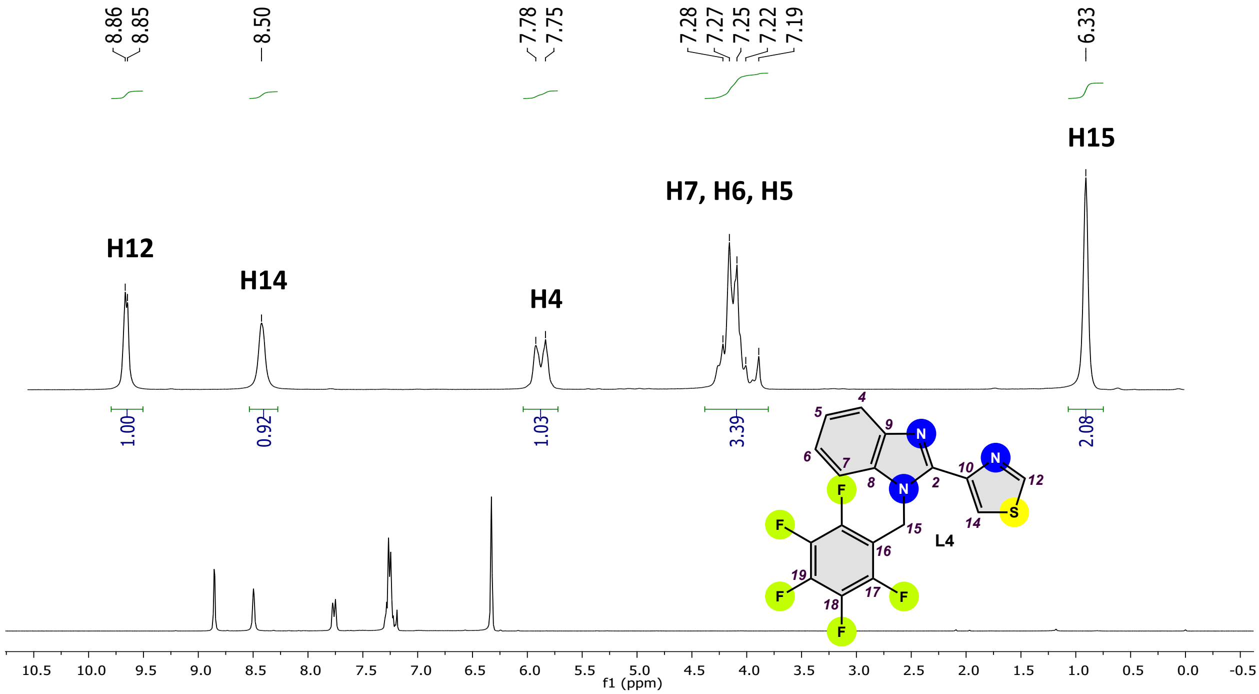

Figure S9. ^{1}H NMR spectrum in $CDCl_3$ of **L4**

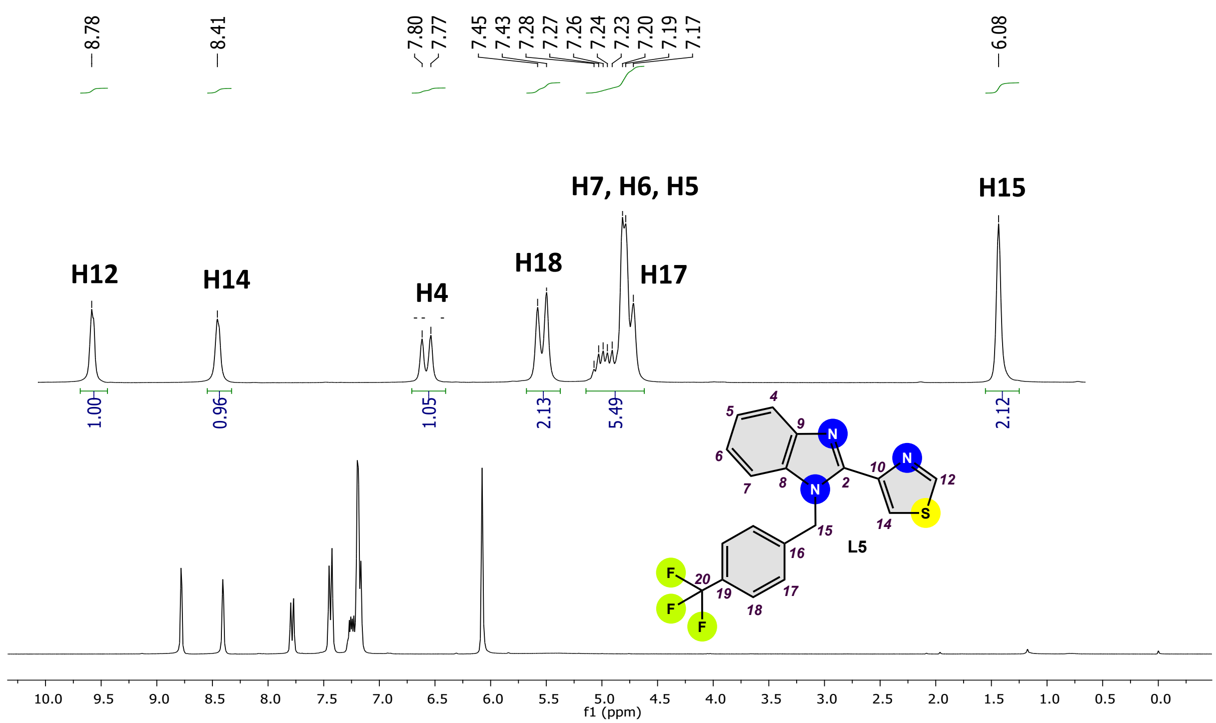

Figure S10. ^{1}H NMR spectrum in $CDCl_3$ of **L5**

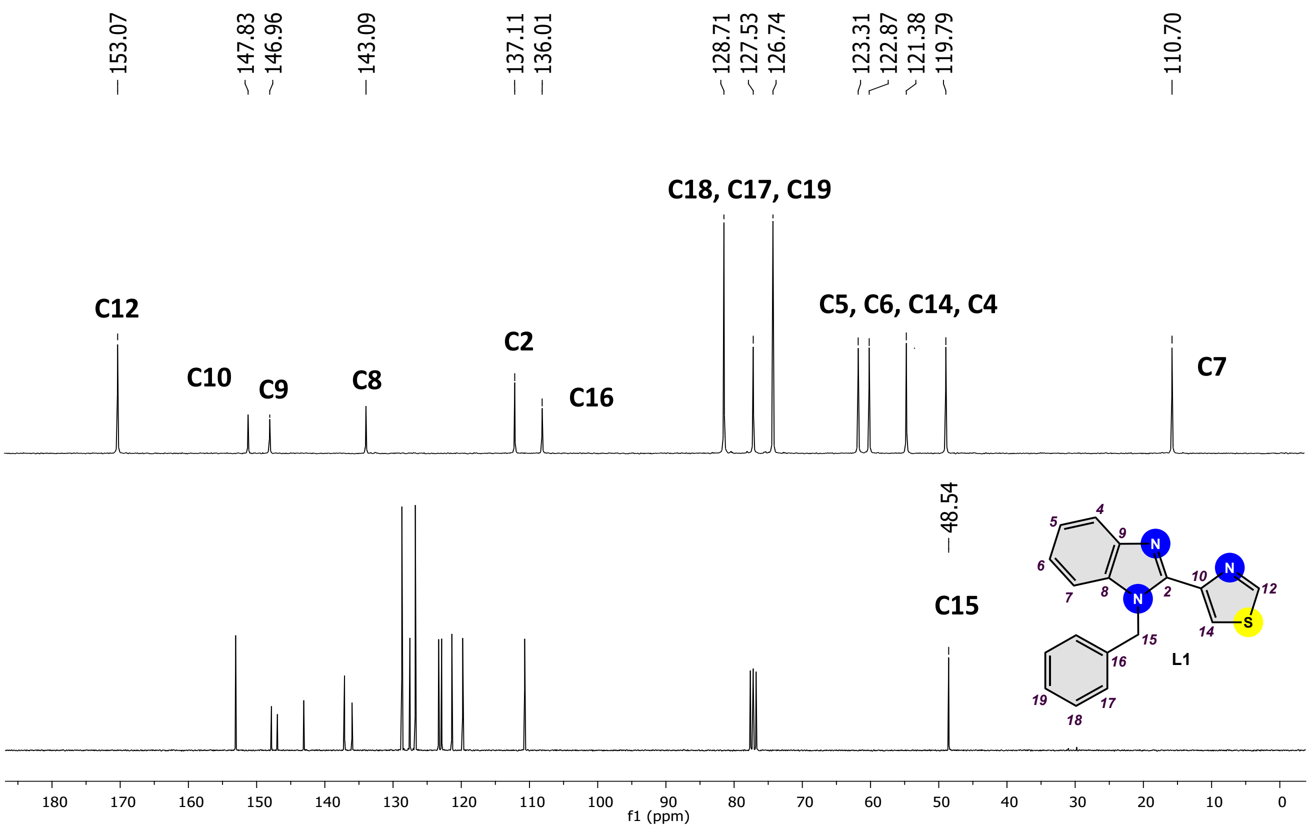

Figure S11. ^{13}C NMR spectrum in $CDCl_3$ of **L1**

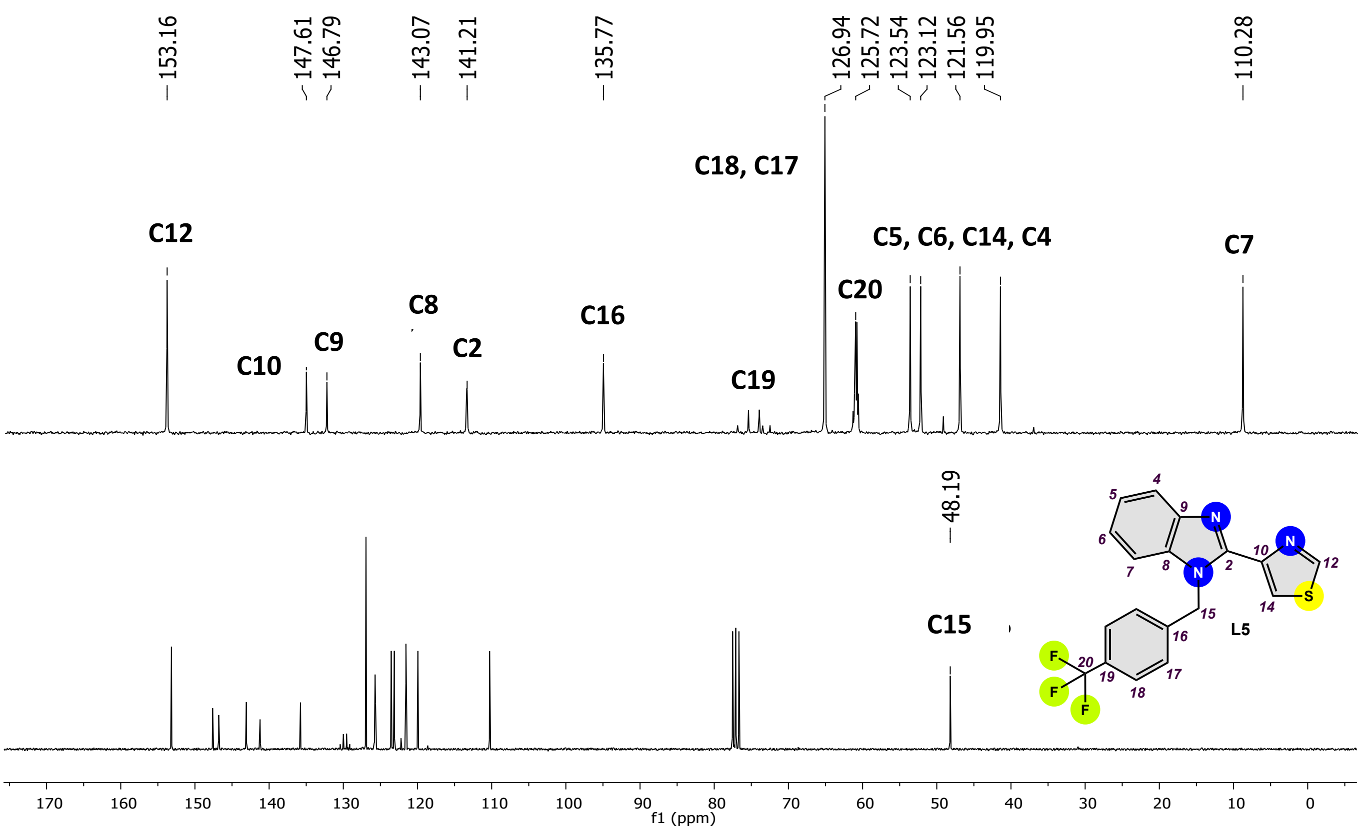

Figure S12. ^{13}C NMR spectrum in $CDCl_3$ of **L5**

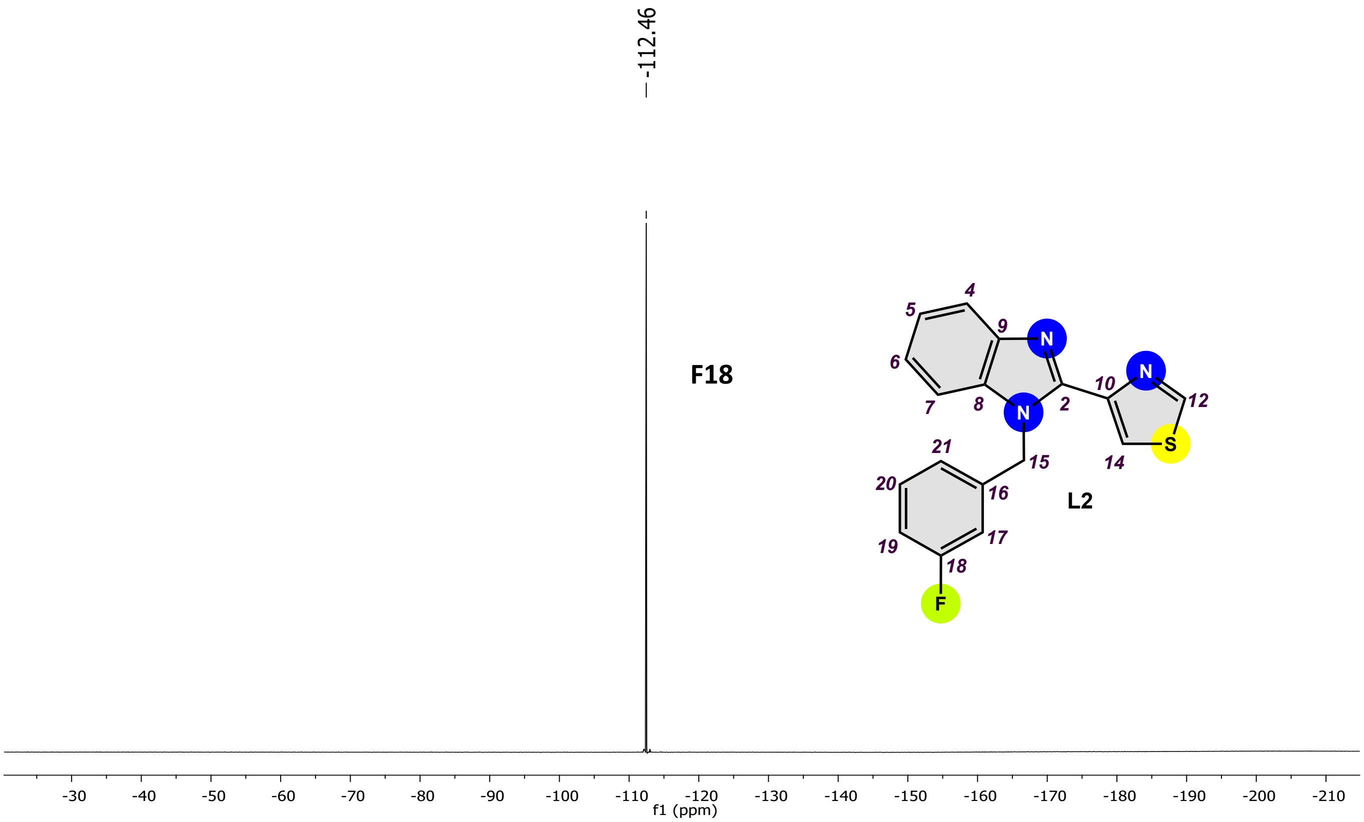

Figure S13. ^{19}F NMR spectrum in $CDCl_3$ of **L2**

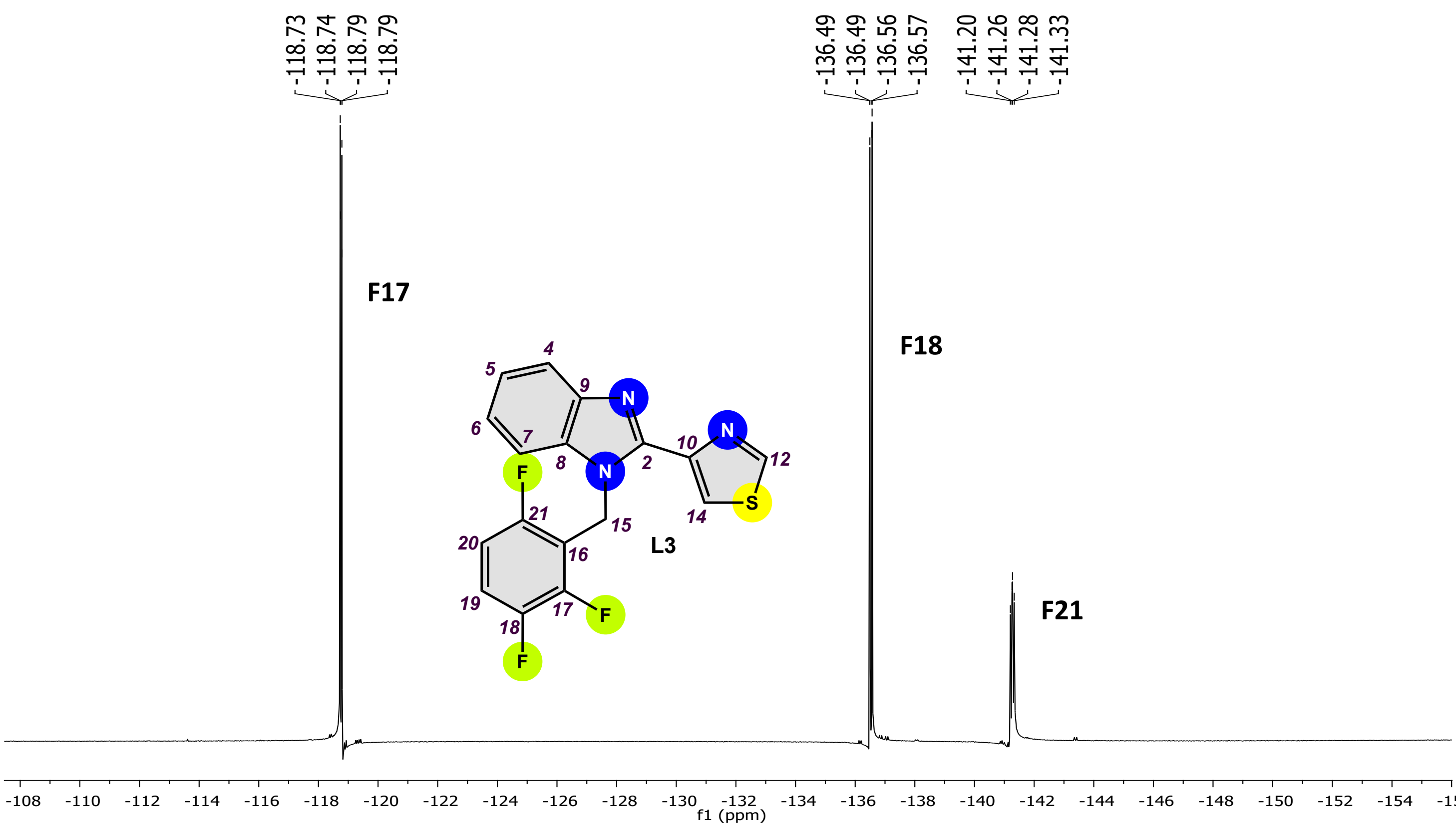

Figure S14. ^{19}F NMR spectrum in $CDCl_3$ of **L3**

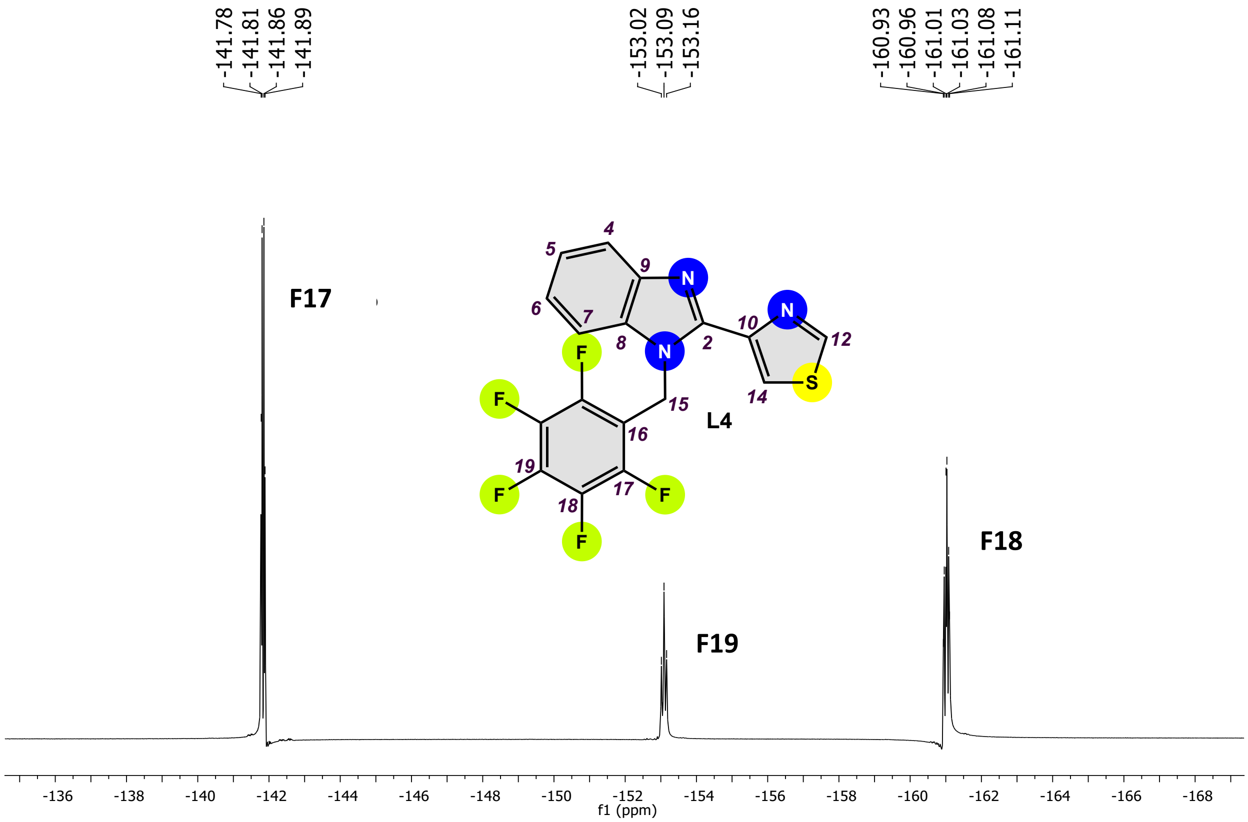

Figure S15. ^{19}F NMR spectrum in $CDCl_3$ of **L4**

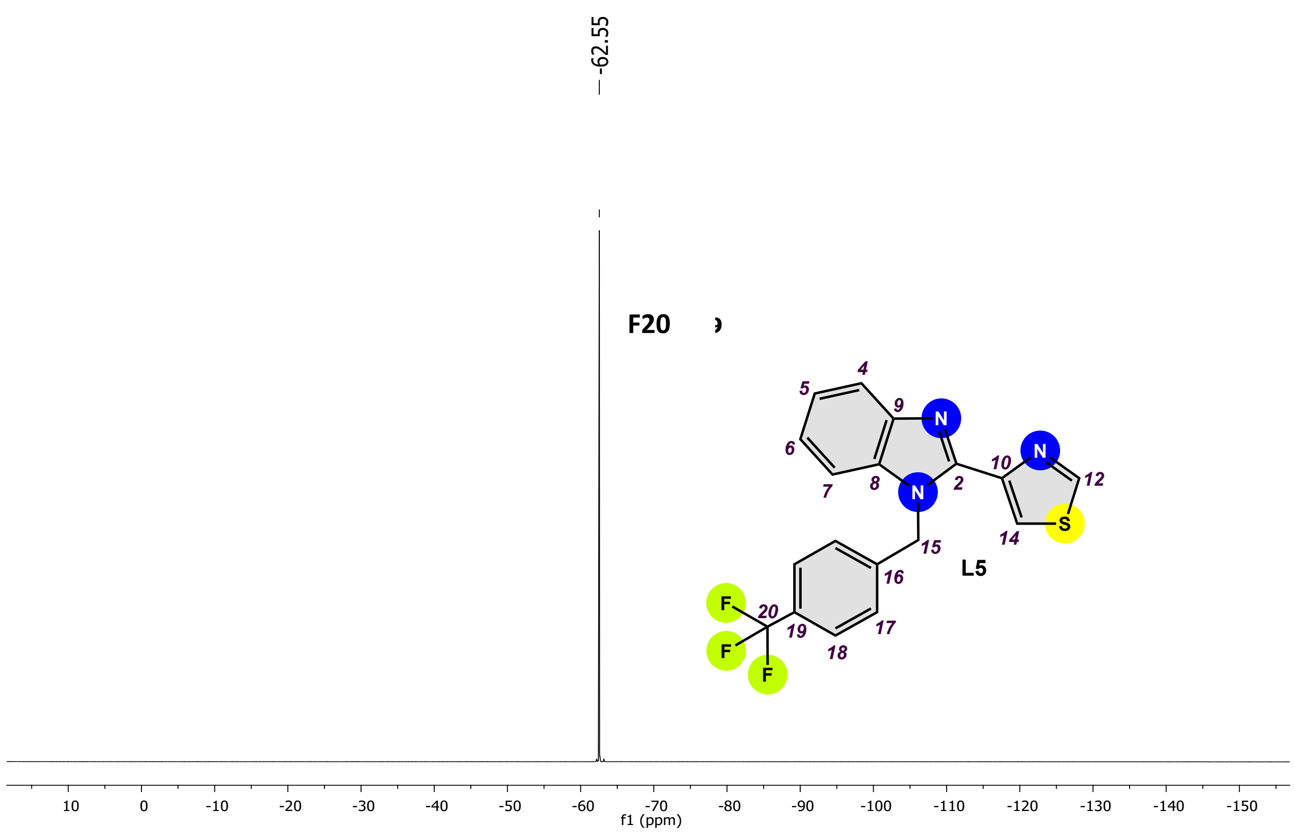

Figure S16. ^{19}F NMR spectrum in $CDCl_3$ of **L5**

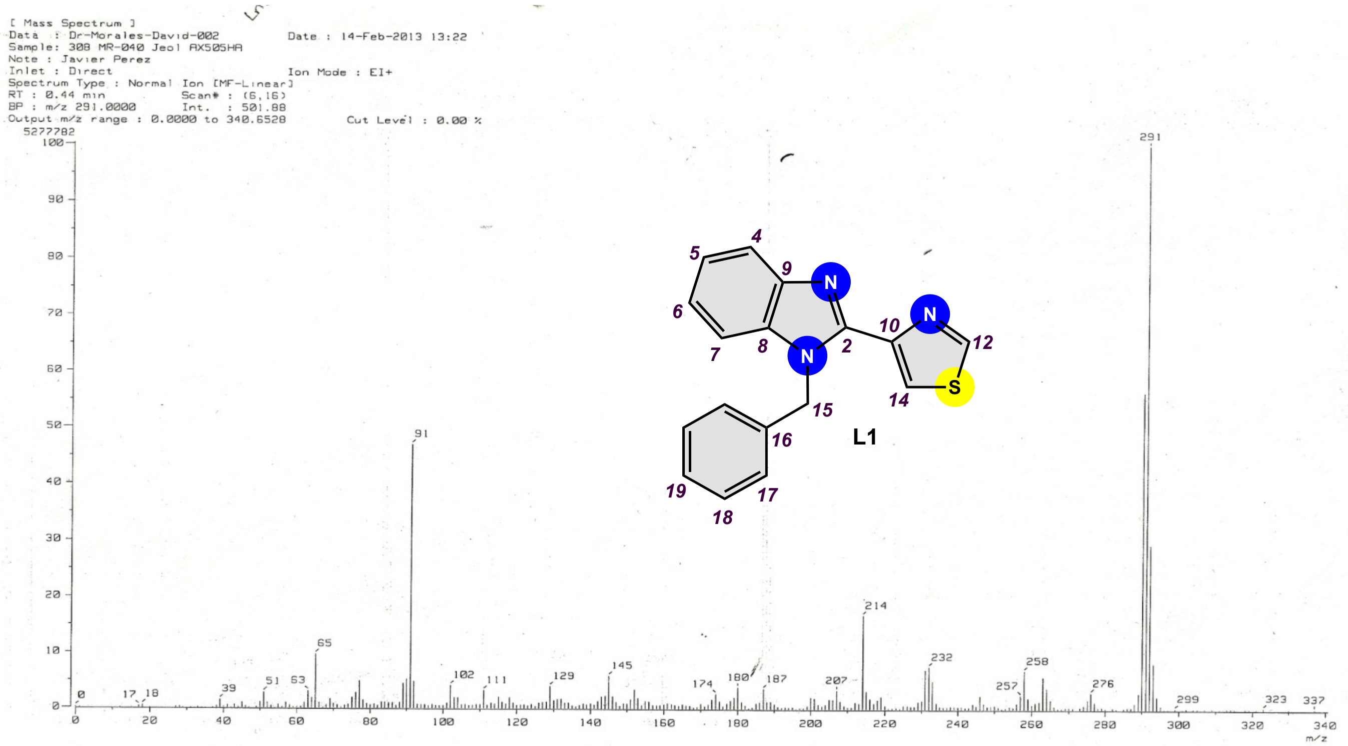

Figure S17. Mass spectrum (IE+) of **L1**

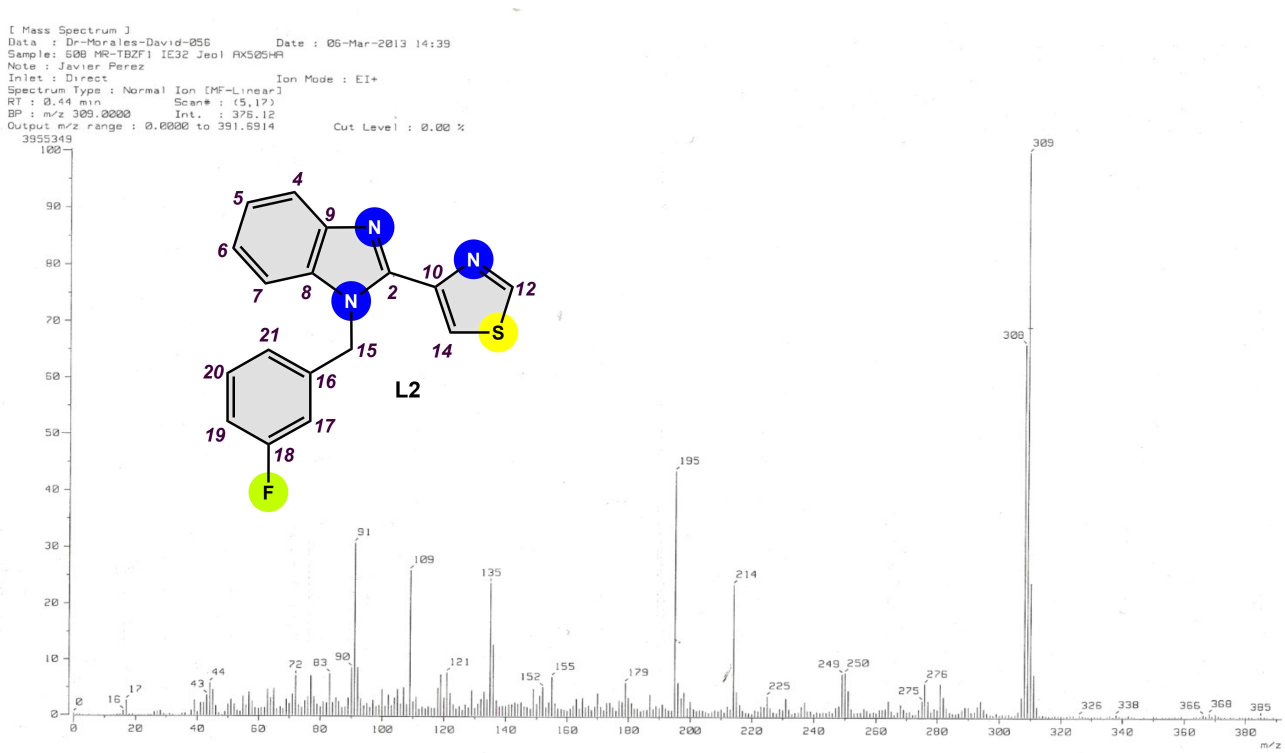

Figure S18. Mass spectrum (IE+) of **L2**

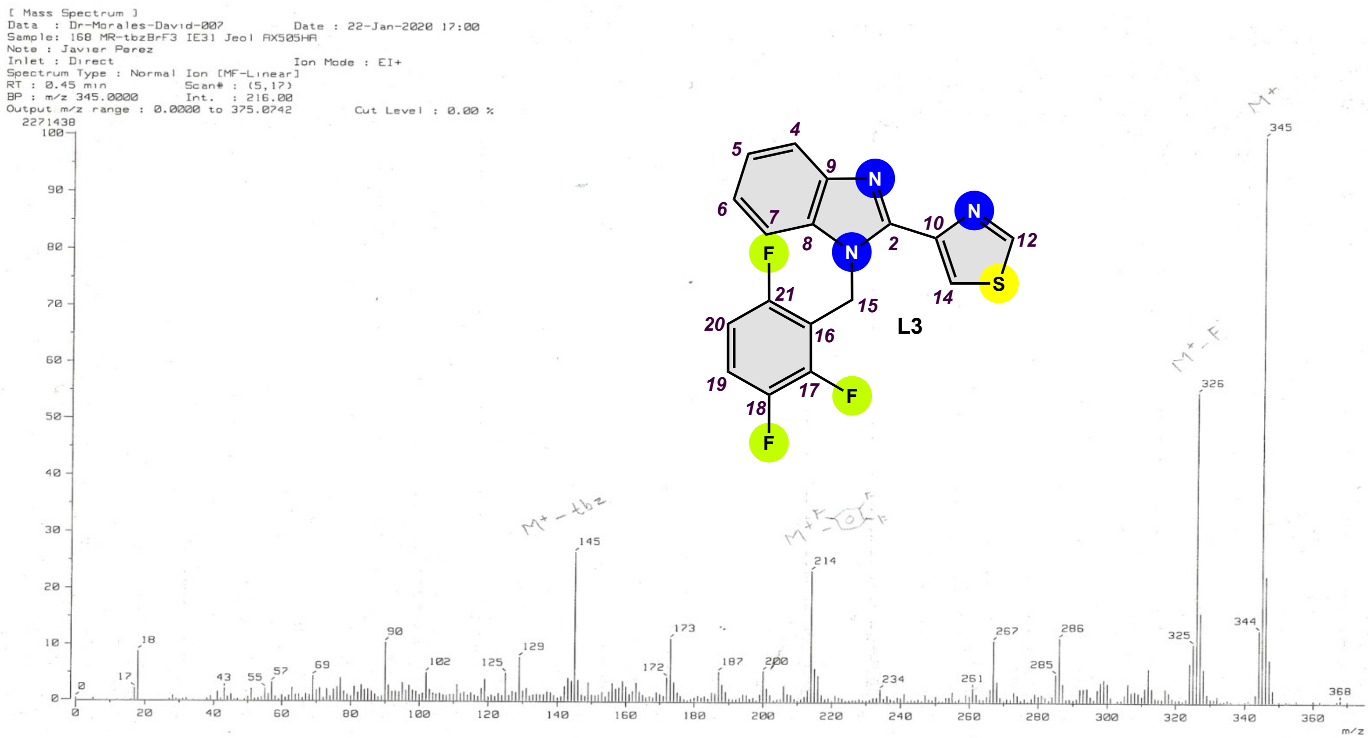

Figure S19. Mass spectrum (IE+) of **L3**

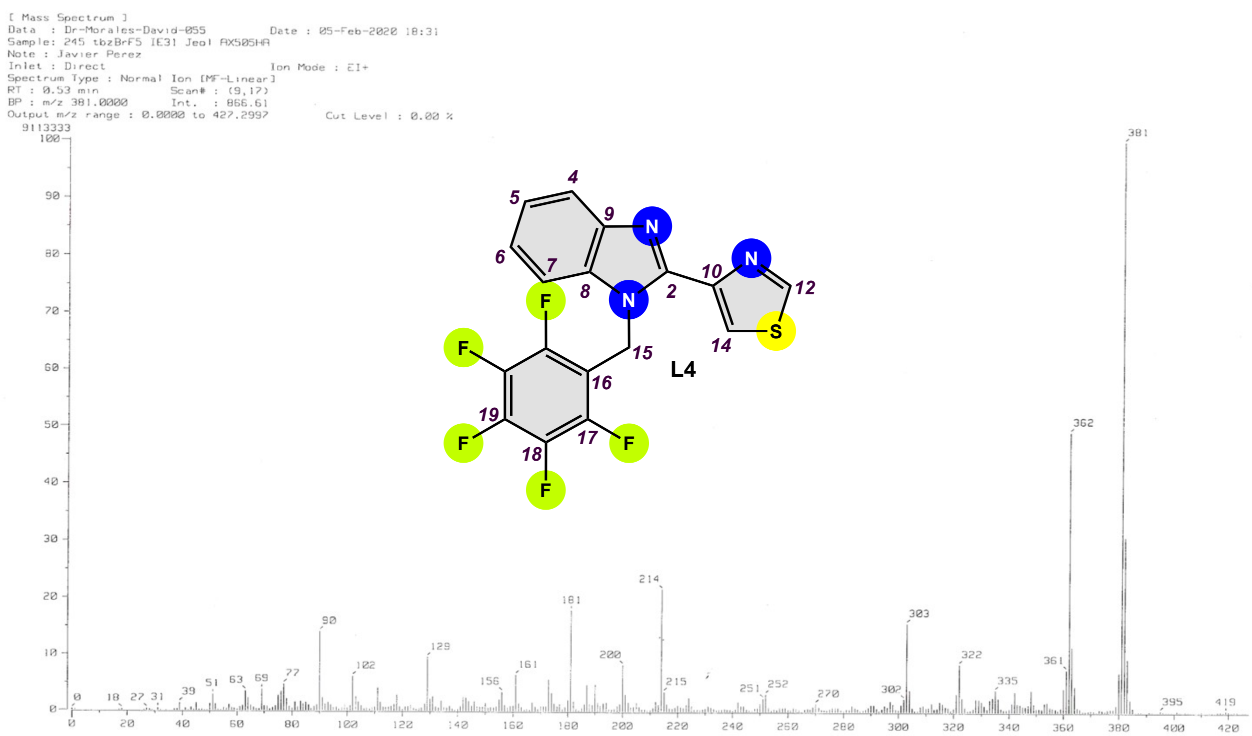

Figure S20. Mass spectrum (IE+) of **L4**

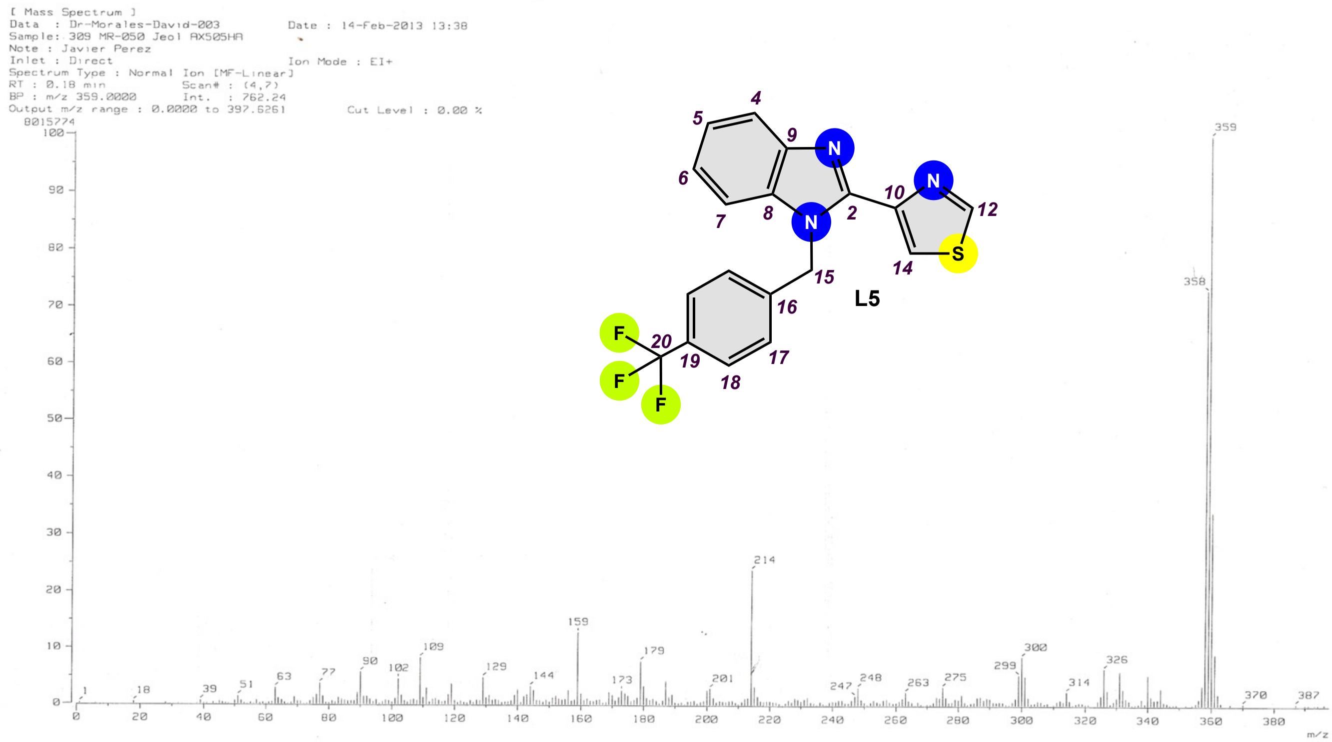

Figure S21. Mass spectrum (IE+) of **L5**

Table S1. Bond lengths [Å] and angles [°] for **L1**.

N(1)-C(2)	1.379(4)	N(1)-C(8)-C(9)	105.6(3)
N(1)-C(8)	1.386(4)	N(3)-C(9)-C(8)	110.7(3)
N(1)-C(15)	1.457(4)	N(3)-C(9)-C(4)	130.5(4)
C(2)-N(3)	1.328(4)	C(8)-C(9)-C(4)	118.8(4)
C(2)-C(13)	1.462(5)	C(14)-S(10)-C(11)	89.0(2)
N(3)-C(9)	1.385(4)	N(12)-C(11)-S(10)	116.2(3)
C(4)-C(5)	1.364(5)	C(11)-N(12)-C(13)	109.4(3)
C(4)-C(9)	1.408(5)	C(14)-C(13)-N(12)	114.5(3)
C(5)-C(6)	1.401(5)	C(14)-C(13)-C(2)	123.7(3)
C(6)-C(7)	1.376(5)	N(12)-C(13)-C(2)	121.8(3)
C(7)-C(8)	1.383(5)	C(13)-C(14)-S(10)	110.8(3)
C(8)-C(9)	1.394(5)	N(1)-C(15)-C(16)	114.9(3)
S(10)-C(14)	1.686(4)	C(17)-C(16)-C(21)	118.0(3)
S(10)-C(11)	1.695(4)	C(17)-C(16)-C(15)	123.1(3)
C(11)-N(12)	1.295(5)	C(21)-C(16)-C(15)	118.9(3)
N(12)-C(13)	1.378(4)	C(18)-C(17)-C(16)	120.5(4)
C(13)-C(14)	1.355(5)	C(19)-C(18)-C(17)	121.1(4)
C(15)-C(16)	1.500(4)	C(18)-C(19)-C(20)	119.4(4)
C(16)-C(17)	1.382(4)	C(19)-C(20)-C(21)	119.0(4)
C(16)-C(21)	1.382(4)	C(16)-C(21)-C(20)	121.9(4)
C(17)-C(18)	1.378(5)	C(22)-N(21)-C(35)	135.2(4)
C(18)-C(19)	1.368(5)	C(22)-N(21)-C(28)	104.3(3)
C(19)-C(20)	1.385(5)	C(35)-N(21)-C(28)	120.4(3)
C(20)-C(21)	1.384(5)	N(23)-C(22)-N(21)	117.1(4)
N(21)-C(22)	1.347(5)	N(23)-C(22)-C(33)	119.6(4)
N(21)-C(35)	1.449(4)	N(21)-C(22)-C(33)	123.2(4)
N(21)-C(28)	1.460(5)	C(22)-N(23)-C(29)	102.4(4)
C(22)-N(23)	1.291(5)	C(29)-C(24)-C(25)	124.1(4)
C(22)-C(33)	1.446(6)	C(24)-C(25)-C(26)	110.7(4)
N(23)-C(29)	1.467(5)	C(27)-C(26)-C(25)	125.3(4)
C(24)-C(29)	1.393(5)	C(28)-C(27)-C(26)	118.9(4)
C(24)-C(25)	1.428(5)	C(29)-C(28)-C(27)	121.8(4)
C(25)-C(26)	1.432(5)	C(29)-C(28)-N(21)	105.5(4)
C(26)-C(27)	1.364(5)	C(27)-C(28)-N(21)	132.7(4)
C(27)-C(28)	1.355(5)	C(28)-C(29)-C(24)	119.1(4)
C(28)-C(29)	1.342(5)	C(28)-C(29)-N(23)	110.7(4)
S(30)-C(31)	1.669(4)	C(24)-C(29)-N(23)	130.2(4)
S(30)-C(34)	1.689(4)	C(31)-S(30)-C(34)	90.7(2)
C(31)-N(32)	1.306(5)	N(32)-C(31)-S(30)	118.0(3)
N(32)-C(33)	1.413(5)	C(31)-N(32)-C(33)	107.9(4)
C(33)-C(34)	1.405(5)	C(34)-C(33)-N(32)	114.1(4)
C(35)-C(36)	1.514(4)	C(34)-C(33)-C(22)	122.7(4)
C(36)-C(37)	1.378(5)	N(32)-C(33)-C(22)	123.1(4)
C(36)-C(41)	1.383(4)	C(33)-C(34)-S(30)	109.2(3)
C(37)-C(38)	1.376(5)	N(21)-C(35)-C(36)	114.3(3)
C(38)-C(39)	1.390(5)	C(37)-C(36)-C(41)	118.2(3)
C(39)-C(40)	1.366(5)	C(37)-C(36)-C(35)	122.9(3)
C(40)-C(41)	1.376(5)	C(41)-C(36)-C(35)	118.9(3)
		C(36)-C(37)-C(38)	121.1(3)
		C(37)-C(38)-C(39)	119.7(4)
		C(40)-C(39)-C(38)	119.6(4)
		C(39)-C(40)-C(41)	120.1(4)
		C(40)-C(41)-C(36)	121.3(4)

Table S2. Bond lengths [Å] and angles [°] for **L2**.

N(1)-C(2)	1.376(2)	C(5)-C(6)-H(6)	119.1
N(1)-C(8)	1.385(2)	C(6)-C(7)-C(8)	116.67(17)
N(1)-C(15)	1.466(2)	C(6)-C(7)-H(7)	121.7
C(2)-N(3)	1.323(2)	C(8)-C(7)-H(7)	121.7
C(2)-C(13)	1.462(2)	N(1)-C(8)-C(7)	131.69(16)
N(3)-C(9)	1.394(2)	N(1)-C(8)-C(9)	105.80(13)
C(4)-C(5)	1.374(2)	C(7)-C(8)-C(9)	122.50(16)
C(4)-C(9)	1.392(2)	C(4)-C(9)-C(8)	119.50(16)
C(4)-H(4)	0.9300	C(4)-C(9)-N(3)	130.32(16)
C(5)-C(6)	1.391(3)	C(8)-C(9)-N(3)	110.18(15)
C(5)-H(5)	0.9300	C(11)-S(10)-C(14)	89.15(10)
C(6)-C(7)	1.373(2)	N(12)-C(11)-S(10)	116.17(16)
C(6)-H(6)	0.9300	N(12)-C(11)-H(11)	121.9
C(7)-C(8)	1.389(2)	S(10)-C(11)-H(11)	121.9
C(7)-H(7)	0.9300	C(11)-N(12)-C(13)	109.52(16)
C(8)-C(9)	1.393(2)	C(14)-C(13)-N(12)	114.35(16)
S(10)-C(11)	1.686(2)	C(14)-C(13)-C(2)	123.95(16)
S(10)-C(14)	1.6900(18)	N(12)-C(13)-C(2)	121.67(15)
C(11)-N(12)	1.303(2)	C(13)-C(14)-S(10)	110.80(14)
C(11)-H(11)	0.9300	C(13)-C(14)-H(14)	124.6
N(12)-C(13)	1.375(2)	S(10)-C(14)-H(14)	124.6
C(13)-C(14)	1.357(2)	N(1)-C(15)-C(16)	112.42(13)
C(14)-H(14)	0.9300	N(1)-C(15)-H(15A)	109.1
C(15)-C(16)	1.510(2)	C(16)-C(15)-H(15A)	109.1
C(15)-H(15A)	0.9700	N(1)-C(15)-H(15B)	109.1
C(15)-H(15B)	0.9700	C(16)-C(15)-H(15B)	109.1
C(16)-C(17)	1.384(2)	H(15A)-C(15)-H(15B)	107.9
C(16)-C(21)	1.387(2)	C(17)-C(16)-C(21)	118.77(17)
C(17)-C(18)	1.373(3)	C(17)-C(16)-C(15)	120.70(15)
C(17)-H(17)	0.9300	C(21)-C(16)-C(15)	120.52(16)
C(18)-F(1)	1.358(2)	C(18)-C(17)-C(16)	118.82(17)
C(18)-C(19)	1.364(3)	C(18)-C(17)-H(17)	120.6
C(19)-C(20)	1.367(3)	C(16)-C(17)-H(17)	120.6
C(19)-H(19)	0.9300	F(1)-C(18)-C(19)	118.79(19)
C(20)-C(21)	1.384(3)	F(1)-C(18)-C(17)	118.10(18)
C(20)-H(20)	0.9300	C(19)-C(18)-C(17)	123.11(19)
C(21)-H(21)	0.9300	C(18)-C(19)-C(20)	118.15(19)
		C(18)-C(19)-H(19)	120.9
		C(20)-C(19)-H(19)	120.9
		C(19)-C(20)-C(21)	120.47(19)
		C(19)-C(20)-H(20)	119.8
		C(21)-C(20)-H(20)	119.8
		C(20)-C(21)-C(16)	120.68(19)
		C(20)-C(21)-H(21)	119.7
		C(16)-C(21)-H(21)	119.7

Table S3. Bond lengths [Å] and angles [°] for **L4**.

C(15)-N(1)	1.453(4)	C(7)-C(6)-C(5)	120.7(5)
C(15)-N(1A)	1.453(6)	C(8)-C(7)-C(6)	117.1(5)
C(15)-C(16)	1.504(4)	C(7)-C(8)-C(9)	122.8(5)
N(1)-C(2)	1.383(4)	C(7)-C(8)-N(1)	132.7(5)
N(1)-C(8)	1.407(6)	C(9)-C(8)-N(1)	104.5(4)
C(2)-N(3)	1.301(5)	C(4)-C(9)-C(8)	119.9(5)
C(2)-C(13)	1.450(6)	C(4)-C(9)-N(3)	129.0(4)
N(3)-C(9)	1.397(6)	C(8)-C(9)-N(3)	111.1(4)
C(4)-C(5)	1.342(7)	C(11)-S(10)-C(14)	89.6(3)
C(4)-C(9)	1.388(6)	N(12)-C(11)-S(10)	116.0(4)
C(5)-C(6)	1.447(8)	C(11)-N(12)-C(13)	109.8(5)
C(6)-C(7)	1.405(8)	C(14)-C(13)-N(12)	114.4(4)
C(7)-C(8)	1.353(7)	C(14)-C(13)-C(2)	121.5(4)
C(8)-C(9)	1.391(6)	N(12)-C(13)-C(2)	124.0(4)
S(10)-C(11)	1.689(5)	C(13)-C(14)-S(10)	110.2(4)
S(10)-C(14)	1.691(5)	C(2A)-N(1A)-C(8A)	106.0(4)
C(11)-N(12)	1.293(6)	C(2A)-N(1A)-C(15)	130.5(5)
N(12)-C(13)	1.379(7)	C(8A)-N(1A)-C(15)	123.4(5)
C(13)-C(14)	1.363(7)	N(3A)-C(2A)-C(13A)	122.5(11)
N(1A)-C(2A)	1.380(7)	N(3A)-C(2A)-N(1A)	113.8(5)
N(1A)-C(8A)	1.409(8)	C(13A)-C(2A)-N(1A)	123.6(11)
C(2A)-N(3A)	1.300(8)	C(2A)-N(3A)-C(9A)	104.5(5)
C(2A)-C(13A)	1.38(3)	C(5A)-C(4A)-C(9A)	119.8(8)
N(3A)-C(9A)	1.399(9)	C(4A)-C(5A)-C(6A)	117.6(9)
C(4A)-C(5A)	1.348(11)	C(7A)-C(6A)-C(5A)	119.6(9)
C(4A)-C(9A)	1.385(8)	C(8A)-C(7A)-C(6A)	117.0(8)
C(5A)-C(6A)	1.461(12)	C(7A)-C(8A)-C(9A)	122.8(7)
C(6A)-C(7A)	1.408(12)	C(7A)-C(8A)-N(1A)	132.9(6)
C(7A)-C(8A)	1.350(9)	C(9A)-C(8A)-N(1A)	104.3(5)
C(8A)-C(9A)	1.392(8)	C(4A)-C(9A)-C(8A)	119.9(6)
S(10A)-C(14A)	1.673(10)	C(4A)-C(9A)-N(3A)	129.0(6)
S(10A)-C(11A)	1.689(9)	C(8A)-C(9A)-N(3A)	111.1(5)
C(11A)-N(12A)	1.296(11)	C(14A)-S(10A)-C(11A)	90.2(4)
N(12A)-C(13A)	1.45(3)	N(12A)-C(11A)-S(10A)	115.3(7)
C(13A)-C(14A)	1.37(2)	C(11A)-N(12A)-C(13A)	110.8(11)
C(16)-C(17)	1.367(4)	C(14A)-C(13A)-C(2A)	126.1(19)
C(16)-C(21)	1.375(4)	C(14A)-C(13A)-N(12A)	110.1(17)
C(17)-F(1)	1.349(4)	C(2A)-C(13A)-N(12A)	123.7(17)
C(17)-C(18)	1.381(4)	C(13A)-C(14A)-S(10A)	113.1(12)
C(18)-F(2)	1.345(3)	C(17)-C(16)-C(21)	115.7(3)
C(18)-C(19)	1.354(5)	C(17)-C(16)-C(15)	121.8(3)
C(19)-F(3)	1.343(4)	C(21)-C(16)-C(15)	122.4(3)
C(19)-C(20)	1.357(5)	F(1)-C(17)-C(16)	120.4(3)
C(20)-F(4)	1.334(4)	F(1)-C(17)-C(18)	117.1(3)
C(20)-C(21)	1.360(4)	C(16)-C(17)-C(18)	122.5(3)
C(21)-F(5)	1.345(3)	F(2)-C(18)-C(19)	121.2(3)
		F(2)-C(18)-C(17)	119.5(3)
		C(19)-C(18)-C(17)	119.4(3)
		F(3)-C(19)-C(18)	119.5(3)
		F(3)-C(19)-C(20)	120.7(3)
		C(18)-C(19)-C(20)	119.7(3)
		F(4)-C(20)-C(19)	119.1(3)
		F(4)-C(20)-C(21)	120.9(3)
		C(19)-C(20)-C(21)	119.9(3)
		F(5)-C(21)-C(20)	117.8(3)
		F(5)-C(21)-C(16)	119.5(3)
		C(20)-C(21)-C(16)	122.7(3)

Additional Information. Crystallographic details

Colourless prismatic crystals for **L1**, **L2**, and **L4** were obtained independently from dichloromethane and acetone. They were mounted on glass fibres and placed in a Bruker Smart Apex II diffractometer with a Mo-target X-ray source (λ = 0.71073 Å). The detector was placed 5.0 cm from the crystal frames and collected with a scan width of 0.3 in ω and an exposure time of 10 s/frame. The following reflections were collected: 25355 for **L1**, 12341 for **L2** and 13161 for **L4**. Reflections were collected and integrated with the Bruker SAINT software package using a narrow-frame integration algorithm. The independent reflections were 5207 (R_{int} = 9.19%), 2679 (R_{int} = 4.21%) and 2837 (R_{int} = 8.51%) for **L1**, **L2**, and **L4**, respectively. The monoclinic spatial groups used intensity statistics and systematic absences: P2(1)/n for **L1** and **L2**, and P2(1)/c for **L4**. The structure was solved using Patterson's methods in the SHELXS-2014/7 program. The remaining atoms were located by a few cycles of least squares refinements and difference Fourier maps. Hydrogen atoms were placed at calculated positions and allowed to ride on the atoms to which they were attached. The thermal parameters were refined for the hydrogen atoms on the aromatic carbon atoms using a Ueq = 1.2 Å. The refinement process used 2249 reflections for L1, 1910 for L2, and 1400 for L4. The final refinement cycle was carried out on all non-zero data using SHELXL-2019/2. In **L4**, the 4-(1*H*-benzo[*d*]imidazole-2-yl)thiazole fragment is disordered, so it was modelled and anisotropically refined into two major positions using a variable site occupational factor (SOF). The SOF ratio was 0.793(3) for N1 > C14 and 0.20(2) for N1A > C14A. 608 parameter restraints were applied: 492 for SIMU, 82 for DELU, and 34 for SAME/SADI. One disagreeable reflection was omitted. **L1** crystallised as two independent crystallographic molecules.