Supporting Information

Homogeneous and Gas–Liquid Catellani-Type Reaction Enabled by Continuous-Flow Chemistry

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1. **General information**

All reagents and solvents were used as received without further purification, unless stated otherwise. Reagents and solvents were bought from Sigma Aldrich and TCI and if applicable, kept under argon atmosphere. Technical solvents were bought from VWR International and Biosolve, and are used as received. All capillary tubing and microfluidic fittings were purchased from IDEX Health & Science. Used syringes were of BD Discardit II® or NORM-JECT®, purchased from VWR Scientific. Syringe pumps were purchased from Chemix Inc. model Fusion 200 Touch. Product isolation was performed manually, using silica (60, F254, Merck™) or automatically by a Biotage® Isolera Four, with Biotage® SNAP KP-Sil 10 or 25 g flash chromatography cartridges. TLC analysis was performed using Silica on aluminum foils TLC plates (F254, Supelco Sigma-Aldrich™) with visualization under ultraviolet light (254 nm and 365 nm) or appropriate TLC staining. $^1$H (400MHz), $^{13}$C (100MHz) and $^{19}$F (376 MHz) NMR spectra were recorded on ambient temperature using a Bruker-Avance 400 or Mercury 400. $^1$H NMR spectra are reported in parts per million (ppm) downfield relative to CDCl$_3$ (7.26 ppm) and all $^{13}$C NMR spectra are reported in ppm relative to CDCl$_3$ (77.2 ppm) unless stated otherwise. NMR spectra uses the following abbreviations to describe the multiplicity: s = singlet, d = doublet, t = triplet, q = quartet, p = pentet, h = hextet, hept = heptet, m = multiplet, dd = double doublet, td = triple doublet. NMR data was processed using the MestReNova 9.0.1 software package. Known products were characterized by comparing to the corresponding $^1$H NMR and $^{13}$C NMR from literature. GC analyses were performed on a GC-MS combination (Shimadzu GC-2010 Plus coupled to a Mass Spectrometer; Shimadzu GCMS-QP 2010 Ultra) with an auto sampler unit (AOC-20i, Shimadzu). Melting points were determined with a Buchi B-540 capillary melting point apparatus in open capillaries and are uncorrected. The names of all products were generated using the PerkinElmer ChemBioDraw Ultra v.12.0.2 software package.
2. **Optimization of reaction conditions**

Table S1: Initial base screening in batch

| Entry | base                | Yield (%)b | Homogeneity solution |
|-------|---------------------|------------|----------------------|
| 1     | K₂CO₃               | 94         |                      |
| 2     | K₂CO₃/tBuNBr        | 91         |                      |
| 3     | AcOK                | 94         |                      |
| 4     | PivOK               | 69         |                      |
| 5     | KHCO₃               | 94         |                      |
| 6     | PhOK                | 32c        |                      |
| 7     | Et₃N                | 33c        |                      |
| 8     | Et₃N (2 equiv)      | 37c        |                      |
| 9     | TBAA                | 46         |                      |

aReaction conditions: 2.5 mol % Pd(OAc)₂, 0.3 equiv norbornene, 1 equiv 1a (0.44 mmol), 0.6 equiv 2a, 1.1 equiv base, 4 mL DMF, performed under Argon atmosphere. bYield determined via GC analysis with an internal standard; cno full conversion.

In order to ensure homogeneous conditions for the flow procedure, we performed an initial screening of different bases (see Table S1) in batch. All inorganic bases, such as K₂CO₃, KHCO₃, AcOK, and PivOK (Table S1, entries 1-5) revealed to be effective for the reaction. However, all these candidate were not soluble in the reaction media, and are therefore considered not suitable. The use of potassium phenoxide (PhOK) or triethylamine (Et₃N) provided excellent solubility, however only a fair yield of 32-37% was obtained due to incomplete conversion (entry 6-8). Finally, the use of tetrabutylammonium acetate (TBAA) resulted in an improved yield of 46% showcasing excellent solubility and full conversion within 2 hours reaction time, and was therefore considered to be the most suitable candidate (entry 9).
Table S2: Optimization of catalyst and norbornene loading\textsuperscript{a}

| Entry | Pd(OAc)\textsubscript{2} (mol %) | Norbornene (equiv) | Yield (%) |
|-------|-------------------------------|-------------------|-----------|
| 1     | 2.5                           | 0.3               | 46        |
| 2     | 2.5                           | 0.6               | 55        |
| 3     | 2.5                           | 1.0               | 48        |
| 4     | 5.0                           | 0.6               | 45        |
| 5     | 5.0                           | 1.2               | 53        |

\textsuperscript{a}Reaction conditions: 2.5 – 5.0 mol % Pd(OAc)\textsubscript{2}, 0.3 – 1.2 equiv norbornene, 1 equiv 1a (0.44 mmol), 0.6 equiv 2a, 1.1 equiv TBAA, 4 mL DMF, performed under Argon atmosphere. \textsuperscript{b}Yield determined via GC analysis with an internal standard.

After obtaining a suitable base, further reaction optimization was performed by carefully tuning different reaction parameters, \textit{i.e.} catalyst and norbornene loadings (Table S2). Employing 0.6 equivalents of norbornene (entry 2) resulted in an improved yield (55\%). However, further increase did not affect the reaction positively (entry 4). An increment of the catalyst loading did not provide improved reactivity (entries 5-6).

Table S3: Ligand screening\textsuperscript{a}

| Entry | Ligand        | Yield (%) |
|-------|---------------|-----------|
| 1     | none          | 55        |
| 2     | PPh\textsubscript{3} | 64        |
| 3     | CyJohnPhos    | 56        |
| 4     | JohnPhos      | 69        |
| 5     | Xphos         | 94        |
| 6     | Ac-Val-OH     | 66        |
| 7     | Ac-Ile-OH     | 59        |
| 8     | Boc-Ile-OH    | 48        |

\textsuperscript{a}
Reaction conditions: 2.5 mol % Pd(OAc)$_2$, 5.0 mol % ligand, 0.6 equiv norbornene, 1 equiv 1a (0.44 mmol), 0.6 equiv 2a, 1.1 equiv base, 4 mL DMF, performed under Argon atmosphere. $^b$Yield determined via GC analysis with an internal standard.

Next, different ligands were investigated in order to improve the reactivity of the catalyst (Table S3). The use of triphenyl phosphine (PPh$_3$) resulted in a slight improved yield (entry 2). Using CyJohnPhos or JohnPhos resulted in comparable results (56 and 69% respectively, entries 3-4). XPhos performed better than all other phosphine ligands, obtaining 94% yield of the desired product 3a (entry 8).

Finally, a series of mono-protected amino acids were investigated, but all resulted in moderate yields (entries 6-8).

Table S 4: Flow optimizations $^a$

| Entry | T (°C) | NB (equiv) | 2a (equiv) | Yield (%)$^b$ |
|-------|--------|------------|------------|---------------|
| 1     | 105    | 0.6        | 0.6        | 28            |
| 2     | 115    | 0.6        | 0.6        | 64            |
| 3     | 125    | 0.6        | 0.6        | 65            |
| 4     | 115    | 1.0        | 0.6        | 58            |
| 5     | 115    | 0.6        | 0.8        | 69            |
| 6     | 115    | 0.6        | 1.0        | 80            |
| 7$^c$ | 115    | 0.6        | 1.0        | 93 (91)       |
| 8$^d$ | 115    | 0.6        | 1.0        | 84            |

$^a$Reaction conditions: 2.5 mol % Pd(OAc)$_2$, 5.0 mol % XPhos, 0.6 equiv norbornene (NB), 1 equiv 1a (1.0 mmol), 1 equiv 2a, 1.1 equiv TBAA, 10 mL DMF, residence time of 2 hours, flow rate 0.16 mL/min. $^b$Yield determined via GC analysis with an internal standard. Isolated yield between brackets $^c$ 0.2 M. $^d$without XPhos.

With the aim on performing gas-liquid reaction, the reaction was translated into a continuous-flow millireactor (20 mL, 1.65mm i.d.). Translating the optimized reaction conditions in flow resulted in a fair yield of 28% with incomplete conversion (Table S4, entry 1). A temperature screening revealed that 115°C was optimal in order to accelerate the reaction conditions in order to obtain full conversion (entries 1-3). However, increasing the amount of norbornene did not result in an improved yield (entry 4). Finally, it was demonstrated that by increasing the equivalents of 2a from 0.6 to 1.0 equivalents, ensured excellent yield of the desired product 3a, within 2 hours residence.
3. Batch control experiment for the gas-liquid Catellani reaction

Identified by-products in batch experiment:

Scheme S1: Overview of identified by-products for the gas-liquid Catellani reaction in batch (AY = area yield using dodecane as internal standard in GC-MS)

Figure S1: GC-MS result crude reaction mixture of the batch control experiment. 0.5 mmol of dodecane (170 g/mol) used as internal standard.
4. Flow setup pictures and schematics

A. Continuous-flow reactor setup for the liquid-phase reactions

B. Continuous-flow reactor setup for the gas-liquid reactions

Scheme S2: Schematic representation of the gas-liquid flow setup.

Figure S2: A) Slug flow (Taylor flow) for the continuous-flow gas-liquid Catellani reaction.
Figure S3: Gas-liquid flow setup
5. **General procedures**

5.1. **Base screening in batch (GP1)**

A 25 mL oven-dried glass tube was charged with a magnetic stirring bar and the selected base (0.48 mmol), fitted with a septum and flushed with alternating vacuum and argon backfill. Next, a 5 mL vials were charged with methyl 2-iodobenzoate (1a, 115 mg, 0.44 mmol), methyl acrylate (2a, 23 mg, 0.26 mmol), norbornene (13 mg, 0.13 mmol), hexadecane (as internal standard, 0.2 mmol) and purged with argon respectively. A second 5mL vial was charged with palladium acetate (2.5 mg, 0.011 mmol). The vials were filled with 2 mL of anhydrous DMF and the two resulting solutions were added via syringe to the 25 mL glass-tube (containing the catalyst and ligand). The reaction mixture was stirred at room temperature for 10 minutes to evaluate the solubility of the base and then heated at 105 °C for 2 hours. The reaction was cooled to room temperature and the crude was analyzed using GC-FID with hexadecane as internal standard.

5.2. **Batch reactions (GP2)**

A 25 mL oven-dried glass tube was charged with a magnetic stirring bar, palladium acetate (2.5 mg, 0.011 mmol) and 2-Dicyclohexylphosphino-2’,4’,6’-triisopropylbiphenyl (XPhos, 11 mg, 0.022 mmol), fitted with a septum and flushed with alternating vacuum and argon backfill. Next, a 5 mL vials was charged with methyl 2-iodobenzoate (1a, 115 mg, 0.44 mmol), methyl acrylate (2a, 23 mg, 0.26 mmol), norbornene (26 mg, 0.26 mmol), hexadecane (as internal standard, 0.2 mmol) and purged with argon respectively. A second 5mL vial was charged with tetrabutylammonium acetate (146 mg, 0.48 mmol) and was heated with a heat gun under vacuum for 5 min in order to eliminate any residual water content. Both 5mL vials were filled with 2 mL of anhydrous DMF and the two resulting solutions were added via syringe to the 25 mL glass-tube (containing the catalyst and ligand). The reaction mixture was stirred and heated at 105 °C for 16 hours. The reaction was cooled to room temperature and the crude was analyzed using GC-FID with hexadecane as internal standard.

5.3. **Single phase flow reactions (GP3)**

A 25 mL oven-dried glass tube was charged with a magnetic stirring bar, palladium acetate (5.6 mg, 0.025 mmol) and 2-Dicyclohexylphosphino-2’,4’,6’-triisopropylbiphenyl (XPhos, 24 mg, 0.05 mmol), fitted with a septum and flushed with alternating vacuum and argon backfill. Next, a 5 mL vials was charged with methyl 2-iodobenzoate (1a, 262 mg, 1.0 mmol), methyl acrylate (2a, 86 mg, 1.0 mmol),

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norbornene (56 mg, 0.6 mmol) and purged with argon respectively. A second 5mL vial was charged with tetrabutylammonium acetate (332 mg, 1.1 mmol) and was heated with a heat gun under vacuum for 5 min in order to eliminate any residual water content. Both 5mL vials were filled with 2.5 mL of anhydrous DMF and the two resulting solutions were added via syringe to the 25 mL glass-tube (containing the catalyst and ligand). The reaction mixture was stirred at room temperature for 10 minutes to make the solution homogeneous. The solution was charged in a 5 mL BD Discardit® syringe. Next, the syringe was fitted to a syringe pump (Fusion 200 Classic) and connected to the inlet of the 20 mL PFA coil (1.65 mm I.D.). The reactor was submerged into a thermostatic oil bath and kept at 115 °C during operation. The syringe pump was operating at 0.16 mL/min (residence time = 2 hours). The outlet of the reactor was fitted to a collection vial via a needle connection. Three extra syringes of each 10 mL anhydrous DMF were pumped after the sample (0.16 mL/min) in order to collect the complete sample. The resulted reaction mixture was monitored using TLC and/or GC-MS. The organic mixture was diluted in ethyl acetate and was introduced into a separation funnel. The organic phase was washed with 1x distilled water and 1x with brine solution respectively. Aqueous phase was backwashed with 1x with ethyl acetate. Collected organic phase was dried over MgSO4, filtered and concentrated under reduced pressure at the rotavap. Purification was performed via flash chromatography on silica using an EtOAc/cyclohexane eluent mixture. The final product was dried, weighted and characterized by 1H NMR, 13C NMR, 19F NMR (if applicable), HRMS and melting point analysis (if applicable).

5.4. Gas-liquid flow reactions (GP4)

A 25 mL oven-dried glass tube was charged with a magnetic stirring bar, palladium acetate (5.6 mg, 0.025 mmol) and 2-Dicyclohexylphosphino-2',4',6'-triisopropylbiphenyl (XPhos, 24 mg, 0.05 mmol), fitted with a septum and flushed with alternating vacuum and argon backfill. Next, a 5 mL vials was charged with 1-iodo-2-methylbenzene (1aa, 116 mg, 0.5 mmol), methyl 2-bromobenzoate (1b, 108 mg, 0.5 mmol), norbornene (39 mg, 0.4 mmol) and purged with argon respectively. A second 5mL vial was charged with tetrabutylammonium acetate (332 mg, 1.1 mmol) and was heated with a heat gun under vacuum for 5 min in order to eliminate any residual water content. Both 5mL vials were filled with 2.5 mL of anhydrous DMF and the two resulting solutions were added via syringe to the 25 mL glass-tube (containing the catalyst and ligand). The reaction mixture was stirred at room temperature for 10 minutes to make the solution homogeneous. The solution was charged in a 5 mL BD Discardit II® syringe. Next, the syringe was fitted to a syringe pump (Fusion 200 Classic) and connected to a Tefzel® T-mixer (ID = 500 μm). A Bronkhorst mass flow controller was used to introduce ethylene gas (4a) into the reaction mixture via a T-mixer. The gas was added perpendicular
to the reaction mixture flow direction in order to produce a stable segmented flow. The syringe pump and mass flow controller were operated at a 1:10 reaction mixture-gas volume flow ratio (liquid flow rate 0.04 mL/min, gas flow rate 0.4 mL/min) in order to ensure a molar ratio 1:2 and a residence time of 2 hours. The reactor consists of a 20 mL PFA coil (1.65 mm I.D.). A 100 psi back pressure regulator was used in order to ensure a stable slug flow regime. The outlet of the reactor was fitted to a collection vial via a needle connection. Three extra syringes of each 10 mL anhydrous DMF were pumped after the sample (0.16 mL/min) in order to collect the complete sample. The resulted reaction mixture was monitored using TLC and/or GC-MS. The organic mixture was diluted in ethyl acetate and was introduced into a separation funnel. The organic phase was washed with 1x distilled water and 1x with brine solution respectively. Aqueous phase was backwashed once with ethyl acetate. Collected organic phase was dried over MgSO₄, filtered and concentrated under reduced pressure at the rotavap. Purification was performed via flash chromatography on silica using an EtOAc/cyclohexane eluent mixture. The final product was dried, weighted and characterized by ¹H NMR, ¹³C NMR, ¹⁹F NMR (if applicable), HRMS and melting point analysis (if applicable).
6. Characterization data

Dimethyl 2′-[1E]-3-methoxy-3-oxoprop-1-en-1-yl)biphenyl-2,3′-dicarboxylate (3a) was synthesized following GP 3 from methyl 2-iodo benzoate (1a, 262 mg) and methyl acrylate (2a, 86 mg). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as yellow oil (165 mg, 93% yield). $^1$H NMR (400 MHz, CDCl₃) δ 7.93 (dd, J = 7.8, 1.1 Hz, 1H), 7.90 – 7.82 (m, 2H), 7.49 (td, J = 7.5, 1.3 Hz, 1H), 7.39 (td, J = 7.8, 1.9 Hz, 2H), 7.31 (dd, J = 7.7, 1.3 Hz, 1H), 7.16 (dd, J = 7.6, 0.9 Hz, 1H), 5.50 (d, J = 16.2 Hz, 1H), 3.86 (s, 3H), 3.62 (d, J = 0.6 Hz, 6H) $^{13}$C NMR (101 MHz, CDCl₃) δ 167.8, 167.2, 166.4, 143.4, 142.0, 141.4, 134.8, 133.0, 131.8, 131.3, 130.3, 130.2, 129.3, 127.7, 127.7, 123.5, 52.3, 51.9, 51.5.

Dimethyl 2′-[1E]-3-oxo-3-(2,2,2-trifluoroethoxy)prop-1-en-1-yl)biphenyl-2,3′-dicarboxylate (3b) was synthesized following the GP 3 from methyl 2-iodo benzoate (1a, 262 mg) and 2,2,2-trifluoroethyl acrylate (2b, 154 mg). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as pale yellow oil (188 mg, 89% yield). $^1$H NMR (400 MHz, CDCl₃) δ 7.99 (d, J = 16.3 Hz, 1H), 7.94 (ddd, J = 7.8, 3.3, 1.3 Hz, 2H), 7.52 (td, J = 7.5, 1.4 Hz, 1H), 7.47 – 7.34 (m, 3H), 7.18 (dd, J = 7.6, 1.0 Hz, 1H), 5.51 (d, J = 16.2 Hz, 1H), 4.43 (qd, J = 8.5, 3.1 Hz, 2H), 3.88 (s, 3H), 3.64 (s, 3H). $^{13}$C NMR (101 MHz, CDCl₃) δ 167.5, 167.1, 164.1, 145.9, 142.1, 141.2, 134.4, 133.1, 131.9, 131.3, 130.3, 130.1, 130.0, 129.4, 128.1, 127.8, 121.5, 60.0 (q, J = 36.6 Hz), 52.3, 51.9. $^{19}$F NMR (377 MHz, CDCl₃) δ -73.88 (t, J = 8.5 Hz).

Dimethyl 2′-[2-(methoxycarbonyl)prop-2-en-1-yl)biphenyl-2,3′-dicarboxylate (3c) was synthesized following the GP 3 from methyl 2-iodo benzoate (1a, 262 mg) and methyl methacrylate (2c, 200 mg). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as pale yellow oil (99 mg, 54% yield, 85% conversion). $^1$H NMR (400 MHz, CDCl₃) δ 8.02 – 7.95 (m, 1H), 7.91 (dd, J = 7.7, 1.6 Hz, 1H), 7.48 (td, J = 7.5, 1.6 Hz, 1H), 7.42 (td, J = 7.6, 1.5 Hz, 1H), 7.33 (t, J = 7.7 Hz, 1H), 7.29 – 7.24 (m, 1H), 7.18 – 7.13 (m, 1H), 6.05 (dd, J = 2.8, 1.6 Hz, 1H), 4.96 (dd, J = 3.1, 1.9 Hz, 1H), 3.95 (dt, J = 17.3, 1.7 Hz, 1H), 3.82 (s, 3H), 3.65 (s, 3H), 3.62 – 3.56 (m, 4H). $^{13}$C NMR (101 MHz, CDCl₃) δ 168.1, 167.1, 167.1, 143.7, 141.6, 140.0, 136.9, 132.9, 131.5, 130.9, 130.8, 130.4, 129.9, 129.8, 127.7, 125.8, 124.7, 52.0, 51.8, 51.7, 32.4.
Dimethyl 2'-[(1E)-3-oxobut-1-en-1-yl]biphenyl-2,3'-dicarboxylate (3d) was synthesized following the GP 3 from methyl 2-iodo benzoate (1a, 262 mg) and 3-buten-2-one (2d, 70 mg). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as yellow oil (142 mg, 84% yield). $^1$H NMR (400 MHz, CDCl$_3$) δ 7.93 (ddd, $J$ = 7.8, 4.7, 1.3 Hz, 2H), 7.73 (d, $J$ = 16.7 Hz, 1H), 7.51 (td, $J$ = 7.5, 1.4 Hz, 1H), 7.46 – 7.34 (m, 3H), 7.19 (dd, $J$ = 7.6, 1.0 Hz, 1H), 5.67 (d, $J$ = 16.7 Hz, 1H), 3.87 (s, 3H), 3.63 (s, 3H), 2.12 (s, 3H). $^{13}$C NMR (101 MHz, CDCl$_3$) δ 198.0, 167.6, 167.2, 142.4, 141.9, 141.3, 135.2, 133.1, 131.8, 131.3, 130.2, 130.2, 129.7, 129.4, 127.8, 127.8, 52.3, 51.9, 26.5.

Dimethyl 2'-[(1E)-3-oxoprop-1-en-1-yl]biphenyl-2,3'-dicarboxylate (3e) was synthesized following the GP 3 from methyl 2-iodo benzoate (1a, 262 mg) and acrylaldehyde (2e, 56 mg). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as yellow oil (139 mg, 86% yield). $^1$H NMR (400 MHz, CDCl$_3$) δ 9.42 (d, $J$ = 7.8 Hz, 1H), 7.96 (ddd, $J$ = 7.3, 5.8, 1.3 Hz, 2H), 7.82 (d, $J$ = 16.2 Hz, 1H), 7.52 (td, $J$ = 7.5, 1.4 Hz, 1H), 7.48 – 7.39 (m, 2H), 7.36 (dd, $J$ = 7.7, 1.3 Hz, 1H), 7.18 (dd, $J$ = 7.6, 1.2 Hz, 1H), 5.72 (dd, $J$ = 16.2, 7.8 Hz, 1H), 3.89 (s, 3H), 3.64 (s, 3H). $^{13}$C NMR (101 MHz, CDCl$_3$) δ 193.4, 167.4, 166.9, 151.8, 141.9, 141.2, 134.5, 134.2, 133.3, 131.9, 131.2, 130.5, 129.9, 129.6, 129.5, 128.3, 128.0, 52.3, 52.00.

Dimethyl 2'-(1E)-3-(dimethylamino)-3-oxoprop-1-en-1-ylbiphenyl-2,3'-dicarboxylate (3f) was synthesized following the GP 3 from methyl 2-iodo benzoate (1a, 262 mg) and N,N-Dimethyl-2-propenamide (2f, 99 mg). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as orange oil (141 mg, 77% yield). $^1$H NMR (400 MHz, MeOD) δ 7.85 (dd, $J$ = 7.8, 1.1 Hz, 1H), 7.80 (dd, $J$ = 7.8, 1.4 Hz, 1H), 7.65 (d, $J$ = 15.7 Hz, 1H), 7.53 (td, $J$ = 7.6, 1.4 Hz, 1H), 7.43 – 7.35 (m, 2H), 7.28 (dd, $J$ = 7.7, 1.3 Hz, 1H), 7.20 (dd, $J$ = 7.6, 0.9 Hz, 1H), 5.98 (d, $J$ = 15.7 Hz, 1H), 3.81 (s, 3H), 3.55 (s, 3H), 2.80 (s, 3H), 2.59 (s, 3H). $^{13}$C NMR (101 MHz, MeOD) δ 169.6, 169.1, 168.0, 143.5, 143.4, 141.7, 136.7, 134.4, 133.2, 132.9, 132.2, 132.1, 131.3, 130.3, 129.0, 128.9, 125.1, 53.0, 52.7, 37.5, 36.1.
Dimethyl 2'-[(1E)-(4{tert-butyl}styryl)-biphenyl]-2,3'-dicarboxylate (3g) was synthesized following the GP 3 from methyl 2-iodo benzoate (1a, 262 mg) and 4-tertbutylstirene (2g, 320 mg, 2 mmol). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10% Ethyl acetate in hexanes) to afford the product as colorless oil (141 mg, 66% yield). \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 7.83 (dd, \(J = 7.8, 1.1\) Hz, 1H), 7.70 (dd, \(J = 6.8, 2.3\) Hz, 1H), 7.42 (td, \(J = 7.5, 1.4\) Hz, 1H), 7.33 – 7.23 (m, 3H), 7.20 – 7.15 (m, 3H), 7.05 – 6.97 (m, 3H), 6.12 (d, \(J = 16.5\) Hz, 1H), 3.76 (s, 3H), 3.51 (s, 3H), 1.20 (s, 9H). \(^13\)C NMR (101 MHz, CDCl\(_3\)) \(\delta\) 169.3, 167.6, 150.5, 142.2, 141.7, 136.9, 134.6, 134.5, 132.4, 131.6, 130.7, 130.6, 130.1, 128.9, 127.3, 126.2, 126.1, 125.4, 125.3, 52.2, 51.9, 34.5, 31.2.

Dimethyl [(1E)-2'-(3,5-bis(trifluoromethyl)styryl)-biphenyl]-2,3'-dicarboxylate (3h) was synthesized following the GP 3 from methyl 2-iodo benzoate (1a, 262 mg) and 3,5-bis(trifluoromethyl)stirene (2h, 480 mg, 2 mmol). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10% Ethyl acetate in hexanes) to afford the product as yellow oil (165 mg, 65% yield). \(^1\)H NMR (399 MHz, CDCl\(_3\)) \(\delta\) 7.86 (dd, \(J = 5.7, 3.6\) Hz, 1H), 7.81 (dd, \(J = 7.8, 1.2\) Hz, 1H), 7.57 (s, 1H), 7.47 – 7.40 (m, 3H), 7.34 – 7.26 (m, 4H), 7.18 (dd, \(J = 7.6, 1.0\) Hz, 1H), 6.06 (d, \(J = 16.5\) Hz, 1H), 3.79 (s, 3H), 3.56 (s, 3H). \(^13\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) 168.1, 167.5, 142.0, 141.9, 139.5, 136.5, 133.1, 132.2, 131.9, 131.7, 131.5, 131.3, 131.2, 131.0, 130.6, 130.1, 129.9, 129.5, 127.5, 127.2, 126.0 (d, \(J = 2.7\) Hz), 124.6, 121.9, 120.7 (dt, \(J = 7.6, 3.8\) Hz), 52.2, 51.9. \(^19\)F NMR (376 MHz, CDCl\(_3\)) \(\delta\) -63.04.

Dimethyl [(1E)-2'-(4-methoxycarbonyl)styryl]-biphenyl]-2,3'-dicarboxylate (3i) was synthesized following the GP 3 from methyl 2-iodo benzoate (1a, 262 mg) and 4-methoxycarbonylstirene (2i, 344 mg, 2 mmol). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10% Ethyl acetate in hexanes) to afford the product as yellow oil (163 mg, 76% yield). \(^1\)H NMR (399 MHz, CDCl\(_3\)) \(\delta\) 7.94 – 7.83 (m, 4H), 7.51 (td, \(J = 7.5, 1.3\) Hz, 1H), 7.41 – 7.35 (m, 3H), 7.33 – 7.24 (m, 2H), 7.19 (d, \(J = 8.3\) Hz, 2H), 6.17 (d, \(J = 16.5\) Hz, 1H), 3.86 (d, \(J = 6.0\) Hz, 6H), 3.60 (s, 3H). \(^13\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) 168.6, 167.4, 166.8, 142.0, 141.8, 142.0, 136.7, 133.5, 132.8, 131.6, 131.5, 130.6, 130.2, 130.0, 129.7, 129.2, 129.0, 128.8, 127.4, 126.7, 126.1, 52.2, 51.9, 51.9.
Dimethyl [(1E)-2'-{(2-(pyridin-4-yl)vinyl)benzene}-2,3'-dicarboxylate (3j)] was synthesized following the GP 3 from methyl 2-iodo benzoate (1a, 262 mg) and 4-vinylpyridine (2j, 210 mg, 2 mmol). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as orange oil (134 mg, 72% yield). $^1$H NMR (400 MHz, CDCl$_3$) δ 8.45 (s, 2H), 7.92 (dd, J = 7.3, 1.9 Hz, 1H), 7.88 (dd, J = 7.8, 1.0 Hz, 1H), 7.57 (d, J = 16.5 Hz, 1H), 7.50 (td, J = 7.5, 1.3 Hz, 1H), 7.39 (tt, J = 7.6, 4.7 Hz, 3H), 7.22 (dd, J = 7.6, 0.7 Hz, 1H), 7.15 (d, J = 5.4 Hz, 2H), 6.04 (d, J = 16.5 Hz, 1H), 3.85 (s, 3H), 3.60 (s, 3H). $^{13}$C NMR (101 MHz, CDCl$_3$) δ 167.9, 167.3, 147.7, 146.7, 141.9, 141.6, 136.0, 134.2, 133.1, 131.7, 131.4, 130.5, 130.4, 130.1, 129.8, 129.5, 127.6, 127.4, 121.4, 121.4, 52.2, 51.9.

Dimethyl 2'-(1E)-(oct-1-en-1-yl)-[1,1'-biphenyl]-2,3'-dicarboxylate (3k) and dimethyl (E)-2'-(oct-2-en-1-yl)-[1,1'-biphenyl]-2,3'-dicarboxylate ($3k'$) was synthesized following the GP 3 from methyl 2-iodo benzoate (1a, 262 mg) and 1-octene (2k, 224 mg). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as colorless oil (127 mg, 67% yield) ratio vinyl : allyl olefin 1:3. $^1$H NMR (400 MHz, CDCl$_3$) δ 8.04 (dd, J = 7.8, 1.3 Hz, 4H), 7.87 – 7.79 (m, 4H), 7.59 – 7.51 (m, 4H), 7.50 – 7.44 (m, 4H), 7.29 – 7.19 (m, 12H), 5.40 – 5.28 (m, 4H), 5.21 (dd, J = 7.4, 5.9, 4.4 Hz, 2H), 5.00 – 4.91 (m, 1H), 3.91 (t, J = 4.4 Hz, 12H), 3.64 – 3.53 (m, 14H), 3.30 (dd, J = 14.7, 5.7 Hz, 1H), 2.98 – 2.75 (m, 3H), 2.58 (dddd, J = 25.9, 12.7, 10.7, 5.4 Hz, 3H), 2.11 – 2.02 (m, 1H), 1.96 (dd, J = 14.3, 7.8, 6.8 Hz, 2H), 1.92 – 1.74 (m, 10H), 1.63 (dd, J = 2.8, 1.6 Hz, 3H), 1.58 – 1.54 (m, 1H), 1.33 – 1.07 (m, 22H), 0.94 (dd, J = 11.9, 4.4 Hz, 2H), 0.91 – 0.82 (m, 8H). $^{13}$C NMR (101 MHz, CDCl$_3$) δ 168.8, 168.8, 168.7, 167.4, 167.3, 167.2, 143.2, 143.0, 142.9, 142.8, 142.3, 142.2, 142.1, 141.5, 141.4, 141.3, 140.7, 138.6, 132.4, 132.4, 131.7, 131.5, 131.5, 131.4, 131.4, 131.3, 131.3, 131.2, 130.9, 130.8, 130.6, 130.4, 130.3, 130.4, 130.2, 130.4, 130.2, 130.1, 129.8, 129.7, 129.6, 129.5, 129.1, 129.1, 127.5, 127.5, 127.4, 125.1, 124.9, 124.8, 124.7, 124.4, 123.5, 51.9, 51.8, 51.7, 34.6, 33.9, 33.8, 32.8, 32.5, 32.3, 32.1, 32.0, 31.6, 31.4, 31.2, 30.8, 30.7, 30.6, 30.5, 30.4, 29.9, 29.5, 29.3, 29.1, 28.9, 28.7, 26.6, 25.5, 22.6, 22.5, 22.1, 17.9, 14.0, 13.9, 13.7, 12.7.

Dimethyl 2'-(E)-2-cyanoethyl-1,1'-biphenyl-2,3'-dicarboxylate (3l)$^2$ was synthesized following the GP 3 from methyl 2-iodo benzoate (1a, 262 mg) and acrylonitrile (2l, 53 mg). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as white solid (143 mg, 89% yield). Mp. 85.2 – 86.6 °C. $^1$H NMR (399 MHz, CDCl$_3$) δ 7.98 (ddd, J = 9.2, 7.9, 1.2 Hz, 2H), 7.74 (d, J = 16.8 Hz, 1H), 7.55 (td, J = 7.5, 1.4 Hz, 1H), 7.48 – 7.41 (m, 2H), 7.33 (dd, J = 7.7, 1.2 Hz, 1H), 7.14 (dd, J =
7.6, 1.0 Hz, 1H), 5.03 (d, J = 16.8 Hz, 1H), 3.91 (s, 3H), 3.67 (s, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) δ 167.1, 166.9, 149.8, 141.9, 140.9, 133.9, 133.3, 132.0, 131.2, 130.5, 129.9, 129.6, 129.6, 128.4, 128.1, 117.3, 102.2, 52.4, 52.0.

Methyl (2E)-3-[(2',3-dimethylbiphenyl-2-yl)prop-2-enoate (3m)$^1$ was synthesized following the GP 3 from 2-iodo toluene (1b, 218 mg) and methyl acrylate (2a, 86 mg). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as colorless oil (39 mg, 29% yield, conversion 65%). $^1$H NMR (399 MHz, CDCl$_3$) δ 7.62 (d, J = 16.4 Hz, 2H), 7.25 (dt, J = 10.7, 6.8 Hz, 11H), 7.10 (d, J = 7.3 Hz, 2H), 7.05 (d, J = 7.2 Hz, 2H), 5.63 (d, J = 16.4 Hz, 2H), 3.66 (s, 6H), 2.47 (s, 6H), 2.03 (s, 6H). $^{13}$C NMR (100 MHz, CDCl$_3$) δ 167.2, 142.5, 142.0, 141.0, 137.3, 135.3, 132.6, 130.1, 129.8, 129.6, 128.5, 127.5, 125.7, 122.7, 51.5, 21.3, 20.0.

Methyl (2E)-3-[(2',3-diethylbiphenyl-2-yl)prop-2-enoate (3n)$^1$ was synthesized following the GP 3 from 2-ethyl-1-iodo-benzene (1c, 232 mg) and methyl acrylate (2a, 86 mg). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as colorless oil (54 mg, 37% yield, 74% conversion). $^1$H NMR (400 MHz, CDCl$_3$) δ 7.66 (d, J = 16.3 Hz, 1H), 7.33 – 7.23 (m, 4H), 7.19 (td, J = 7.2, 1.8 Hz, 1H), 7.09 – 7.02 (m, 2H), 5.53 (d, J = 16.3 Hz, 1H), 3.64 (s, 3H), 2.78 (q, J = 7.5 Hz, 2H), 2.33 (ddq, J = 22.0, 14.8, 7.4 Hz, 2H), 1.25 (t, J = 7.5 Hz, 3H), 1.02 (t, J = 7.6 Hz, 3H). $^{13}$C NMR (101 MHz, CDCl$_3$) δ 167.1, 143.3, 142.4, 141.5, 141.2, 140.6, 132.2, 129.8, 128.4, 128.4, 128.3, 127.9, 127.7, 125.6, 123.0, 51.5, 27.0, 26.0, 15.5, 14.7.

Methyl (2E)-3-[(1,2'-binaphthalene-1'-yl)prop-2-enoate (3o)$^1$ was synthesized following the GP 3 from 1-iodo naphtalene (1d, 254 mg) and methyl acrylate (2a, 86 mg). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as yellowish oil (86 mg, 51% yield). $^1$H NMR (400 MHz, CDCl$_3$) δ 8.27 (dd, J = 7.9, 1.8 Hz, 1H), 7.99 – 7.95 (m, 1H), 7.95 – 7.89 (m, 4H), 7.64 – 7.57 (m, 2H), 7.54 (dd, J = 8.2, 7.1 Hz, 1H), 7.52 – 7.45 (m, 3H), 7.40 – 7.35 (m, 2H), 6.00 (d, J = 16.3 Hz, 1H), 3.63 (s, 3H). $^{13}$C NMR (101 MHz, CDCl$_3$) δ 166.7, 142.3, 138.6, 138.0, 133.6, 133.1, 131.9, 131.5, 131.3, 129.0, 128.5, 128.5, 128.3, 128.0, 127.9, 127.0, 126.2, 125.9, 125.8, 125.2, 125.2, 124.7, 51.5.
Methyl (2E)-3-(2′,3-dimethoxybiphenyl-2-yl)prop-2-enoate (3p)\textsuperscript{1} was synthesized following the GP 3 from 2-iodo anisole (1e, 234 mg) and methyl acrylate (2a, 86 mg). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as white solid (48 mg, 32% yield, conversion 63%). Mp. 101.7–102.9 °C. \textsuperscript{1}H NMR (399 MHz, CDCl\textsubscript{3}) δ 7.54 (d, J = 16.2 Hz, 1H), 7.36 (dt, J = 13.9, 6.9 Hz, 2H), 7.15 (d, J = 7.3 Hz, 1H), 7.02 (t, J = 7.4 Hz, 1H), 6.98 – 6.93 (m, 2H), 6.90 (d, J = 7.6 Hz, 1H), 6.54 (d, J = 16.2 Hz, 1H), 3.93 (s, 3H), 3.73 (s, 3H), 3.68 (s, 3H). \textsuperscript{13}C NMR (100 MHz, CDCl\textsubscript{3}) δ 168.5, 159.0, 156.4, 141.9, 140.6, 131.2, 130.0, 129.4, 129.3, 123.3, 122.2, 120.8, 120.7, 111.1, 110.0, 55.5, 51.3.

Dimethyl 4′-[(1E)-3-methoxy-3-oxoprop-1-en-1-yl]-3,3′-bithiophene-2,5′-dicarboxylate (3s) was synthesized following the GP 3 from methyl 3-iodothiophene-2-carboxylate (1h, 268 mg) and methyl acrylate (2a, 86 mg). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as colorless oil (99 mg, 54% yield). Mp 163.2 – 164.1 °C. \textsuperscript{1}H NMR (400 MHz, CDCl\textsubscript{3}) δ 8.38 – 8.24 (m, 1H), 7.56 (d, J = 5.0 Hz, 1H), 7.36 (d, J = 0.4 Hz, 1H), 6.98 (d, J = 5.0 Hz, 1H), 5.48 (d, J = 16.5 Hz, 1H), 3.91 (s, 3H), 3.72 (s, 3H), 3.69 (s, 3H). \textsuperscript{13}C NMR (100 MHz, CDCl\textsubscript{3}) δ 167.0, 162.3, 161.9, 141.5, 140.7, 137.1, 136.9, 131.3, 131.2, 131.1, 129.9, 129.3, 122.4, 52.5, 52.2, 51.8.

Methyl 3′-ethyl-2′-[(1E)-3-methoxy-3-oxoprop-1-en-1-yl]biphenyl-2-carboxylate (3t)\textsuperscript{1} was synthesized following the GP 3 from 2-ethyl-1-iodo benzene (1c, 116 mg), methyl 2-bromo benzoate (4a, 108 mg) and methyl acrylate (2a, 86 mg). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as colorless oil (123 mg, 76% yield). \textsuperscript{1}H NMR (399 MHz, CDCl\textsubscript{3}) δ 7.91 (d, J = 7.8 Hz, 1H), 7.67 (d, J = 16.3 Hz, 1H), 7.49 (t, J = 7.5 Hz, 1H), 7.39 (t, J = 7.6 Hz, 1H), 7.32 – 7.23 (m, 2H), 7.20 (d, J = 7.6 Hz, 1H), 7.00 (d, J = 7.2 Hz, 1H), 5.59 (d, J = 16.3 Hz, 1H), 3.66 (s, 3H), 3.63 (s, 3H), 2.77 (q, J = 7.5 Hz, 2H), 1.25 (t, J = 7.5 Hz, 3H). \textsuperscript{13}C NMR (100 MHz, CDCl\textsubscript{3}) δ 167.7, 166.9, 142.8, 142.6, 141.4, 132.2, 131.6, 131.4, 130.6, 130.1, 128.2, 127.9, 127.3, 127.3, 124.0, 51.9, 51.5, 26.9, 15.4.
Dimethyl 2'-ethenylbiphenyl-2,3'-dicarboxylate (6a) was synthesized following the GP 4 from methyl 2-iodo benzoate (1a, 262 mg) and ethylene (5a). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as pale yellow oil (117 mg, 79% yield). $^1$H NMR (400 MHz, CDCl$_3$) δ 7.94 (dd, $J = 7.8, 1.2$ Hz, 1H), 7.75 (dd, $J = 7.5, 1.6$ Hz, 1H), 7.51 (td, $J = 7.5, 1.4$ Hz, 1H), 7.40 (td, $J = 7.6, 1.3$ Hz, 1H), 7.33 (t, $J = 7.6$ Hz, 1H), 7.29 (dd, $J = 7.6, 1.6$ Hz, 1H), 7.22 (dd, $J = 7.6, 1.0$ Hz, 1H), 6.75 (dd, $J = 17.8, 11.4$ Hz, 1H), 5.12 (dd, $J = 11.4, 1.5$ Hz, 1H), 4.89 (dd, $J = 17.8, 1.5$ Hz, 1H), 3.85 (s, 3H), 3.60 (s, 3H). $^{13}$C NMR (101 MHz, CDCl$_3$) δ 168.9, 167.4, 142.1, 141.6, 137.4, 134.6, 132.2, 131.5, 131.4, 130.4, 130.0, 128.5, 127.2, 126.3, 119.6, 52.0, 51.8.

Methyl 2'-ethenyl-3'-methylbiphenyl-2-carboxylate (6b) was synthesized following the GP 4 from 2-iodo toluene (1b, 109 mg), methyl 2-bromo benzoate (4a, 108 mg) and ethylene (5a). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as colorless oil (83 mg, 66% yield). $^1$H NMR (399 MHz, CDCl$_3$) δ 7.97 (d, $J = 7.8$ Hz, 2H), 7.56 (t, $J = 7.5$ Hz, 2H), 7.45 (t, $J = 7.6$ Hz, 2H), 7.34 – 7.21 (m, 7H), 7.06 (d, $J = 6.6$ Hz, 2H), 6.52 (dd, $J = 17.9, 11.6$ Hz, 2H), 5.27 (d, $J = 11.5$ Hz, 2H), 5.03 (d, $J = 17.9$ Hz, 2H), 3.69 (s, 6H), 2.46 (s, 6H). $^{13}$C NMR (100 MHz, CDCl$_3$) δ 167.9, 143.4, 140.7, 136.0, 135.4, 134.6, 131.6, 131.2, 130.7, 129.7, 129.4, 126.8, 126.3, 120.0, 51.8, 21.0.

Methyl 2'-ethenyl-3'-ethylbiphenyl-2-carboxylate (6c) was synthesized following the GP 4 from 2-ethyl-1-iodo benzene (1c, 116 mg), methyl 2-bromo benzoate (4a, 108 mg) and ethylene (5a). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as colorless oil (85 mg, 64% yield). $^1$H NMR (399 MHz, CDCl$_3$) δ 7.93 (d, $J = 7.8$ Hz, 1H), 7.53 (t, $J = 7.5$ Hz, 1H), 7.41 (t, $J = 7.6$ Hz, 1H), 7.33 – 7.23 (m, 3H), 7.04 (dd, $J = 5.4, 3.4$ Hz, 1H), 6.57 (dd, $J = 17.9, 11.5$ Hz, 1H), 5.21 (d, $J = 11.5$ Hz, 1H), 5.00 – 4.88 (m, 1H), 3.65 (s, 3H), 2.78 (q, $J = 7.5$ Hz, 2H), 1.27 (t, $J = 7.5$ Hz, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) δ 168.0, 143.5, 141.6, 140.7, 135.8, 134.3, 131.6, 131.2, 130.8, 129.7, 127.5, 126.8, 126.7, 126.5, 120.1, 51.8, 26.7, 15.3.
Methyl 2-(1-ethylnaphthalen-2-yl)benzoate (6d) was synthesized following the GP 4 from 1-iodo naphtalene (1d, 127 mg), methyl 2-bromo benzoate (4a, 108 mg) and ethylene (5a). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as colorless oil (88 mg, 61% yield). $^1$H NMR (400 MHz, CDCl$_3$) δ 8.24 – 8.15 (m, 1H), 7.93 (dd, J = 7.8, 1.1 Hz, 1H), 7.86 – 7.82 (m, 1H), 7.75 (d, J = 8.4 Hz, 1H), 7.52 – 7.44 (m, 3H), 7.39 (td, J = 7.6, 1.3 Hz, 1H), 7.29 – 7.21 (m, 2H), 6.76 (dd, J = 17.9, 11.5 Hz, 1H), 5.41 (dd, J = 11.5, 2.0 Hz, 1H), 5.20 (dd, J = 17.9, 1.9 Hz, 1H), 3.51 (s, 3H). $^{13}$C NMR (101 MHz, CDCl$_3$) δ 167.9, 143.3, 137.6, 133.8, 133.6, 133.0, 131.8, 131.4, 130.9, 130.0, 128.3, 127.4, 127.1, 126.7, 126.2, 125.7, 125.6, 121.7, 51.9.

Methyl 2'-ethenyl-3'-methoxybiphenyl-2-carboxylate (6f) was synthesized following the GP 4 from 2-iodo anisole (1e, 117 mg), methyl 2-bromo benzoate (4a, 108 mg) and ethylene (5a). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as yellow oil (94 mg, 70% yield). $^1$H NMR (400 MHz, CDCl$_3$) δ 7.92 (dd, J = 7.8, 1.2 Hz, 3H), 7.51 (td, J = 7.5, 1.4 Hz, 3H), 7.40 (td, J = 7.6, 1.2 Hz, 3H), 7.27 – 7.20 (m, 8H), 6.91 (d, J = 8.3 Hz, 3H), 6.75 (d, J = 7.6 Hz, 3H), 6.45 (dd, J = 17.9, 11.8 Hz, 3H), 5.43 (dd, J = 17.9, 2.2 Hz, 3H), 5.18 (dd, J = 11.9, 2.2 Hz, 3H), 3.89 (s, 9H), 3.62 (s, 9H). $^{13}$C NMR (101 MHz, CDCl$_3$) δ 167.8, 157.5, 142.6, 142.3, 131.4, 131.4, 131.1, 130.7, 129.9, 127.3, 127.1, 124.7, 121.9, 119.6, 109.7, 55.5, 51.9.

Methyl 2'-ethenyl-3'-(trifluoromethyl)biphenyl-2-carboxylate (6f) was synthesized following the GP 4 from 1-iodo-2-(trifluoromethyl)benzene (1f, 136 mg), methyl 2-bromo benzoate (4a, 108 mg) and ethylene (5a). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as colorless oil (57 mg, 37% yield, 84% conversion). $^1$H NMR (400 MHz, CDCl$_3$) δ 7.96 (dd, J = 7.8, 1.3 Hz, 1H), 7.68 (dd, J = 7.5, 1.4 Hz, 1H), 7.53 (td, J = 7.5, 1.3 Hz, 1H), 7.39 (dt, J = 12.0, 7.7, 1.4 Hz, 3H), 7.22 (dd, J = 7.6, 1.1 Hz, 1H), 6.72 – 6.55 (m, 1H), 5.22 (dd, J = 11.6, 1.5 Hz, 1H), 4.93 (dd, J = 17.8, 1.0 Hz, 1H), 3.63 (s, 3H). $^{13}$C NMR (101 MHz, CDCl$_3$) δ 167.4, 142.4, 142.0, 136.2, 132.7, 131.9, 131.6, 131.5, 130.3, 130.2, 128.4, 128.1, 127.4, 126.4, 125.7, 124.8 (q, J = 5.7 Hz), 122.9, 122.3, 51.9. $^{19}$F NMR (377 MHz, CDCl$_3$) δ -58.55 (d, J = 1.3 Hz).
Methyl 2’-ethenyl-3’,5’-dimethylbiphenyl-2-carboxylate (6g) was synthesized following the GP 4 from 1-iodo-2,4-dimethylbenzene (1i, 116 mg), methyl 2-bromo benzoate (4a, 108 mg) and ethylene (5a). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as colorless oil (88 mg, 66% yield). $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.88 (dd, $J = 7.8$, 1.2 Hz, 1H), 7.49 (td, $J = 7.5$, 1.3 Hz, 1H), 7.37 (td, $J = 7.6$, 1.2 Hz, 1H), 7.25 (dd, $J = 8.8$, 1.1 Hz, 1H), 7.02 (s, 1H), 6.82 (s, 1H), 6.42 (dd, $J = 17.9$, 11.5 Hz, 1H), 5.16 (dd, $J = 11.5$, 1.9 Hz, 1H), 4.92 (dd, $J = 17.9$, 1.9 Hz, 1H), 3.64 (s, 3H), 2.36 (s, 3H), 2.32 (s, 3H). $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 167.9, 143.5, 140.6, 135.8, 135.3, 134.5, 133.2, 131.6, 131.2, 130.8, 130.3, 129.7, 127.5, 126.7, 119.5, 51.8, 21.0, 21.0.

Methyl 2’-ethenyl-3’,5’-dimethoxybiphenyl-2-carboxylate (6h) was synthesized following the GP 4 from 1-iodo-2,4-dimethoxybenzene (1j, 132 mg), methyl 2-bromo benzoate (4a, 108 mg) and ethylene (5a). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as white solid (78 mg, 53% yield). Mp 41.3 – 42.7 °C. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.91 (d, $J = 7.8$ Hz, 1H), 7.51 (t, $J = 7.5$ Hz, 1H), 7.40 (t, $J = 7.6$ Hz, 1H), 7.25 (s, 1H), 6.49 (d, $J = 2.1$ Hz, 1H), 6.35 (dd, $J = 17.8$, 11.9 Hz, 1H), 6.29 (d, $J = 2.3$ Hz, 1H), 5.38 (dd, $J = 17.8$, 2.2 Hz, 1H), 5.07 (dd, $J = 11.9$, 2.1 Hz, 1H), 3.87 (s, 3H), 3.79 (s, 3H), 3.63 (s, 3H). $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 167.8, 158.8, 158.7, 143.1, 142.7, 131.4, 131.3, 130.8, 130.8, 129.8, 127.2, 118.0, 117.6, 105.9, 97.7, 55.5, 55.3, 52.0.

Dimethyl 6’-ethenyl-5’-methylbiphenyl-2,3’-dicarboxylate (6i) was synthesized following the GP 4 from methyl 4-iodo-3-methylbenzoate (1k, 138 mg), methyl 2-bromo benzoate (4a, 108 mg) and ethylene (5a). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as white solid (107 mg, 69% yield). Mp 81.4 – 82.5 °C. $^1$H NMR (399 MHz, CDCl$_3$) $\delta$ 7.95 (d, $J = 7.8$ Hz, 1H), 7.88 (s, 1H), 7.67 (s, 1H), 7.52 (t, $J = 7.5$ Hz, 1H), 7.41 (t, $J = 7.6$ Hz, 1H), 7.22 (d, $J = 7.6$ Hz, 1H), 6.44 (dd, $J = 17.9$, 11.7 Hz, 1H), 5.26 (d, $J = 11.7$ Hz, 1H), 5.01 (d, $J = 17.9$ Hz, 1H), 3.88 (s, 3H), 3.62 (s, 3H), 2.43 (s, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 167.5, 167.1, 142.6, 141.1, 140.9, 135.8, 134.0, 131.6, 131.6, 130.5, 130.3, 130.1, 127.9, 127.8, 127.3, 121.2, 52.0, 51.9, 21.0.
Methyl 2′-ethenyl-6′-fluoro-3′-methylbiphenyl-2-carboxylate (6j) was synthesized following the GP 4 from 4-fluoro-2-iodo-1-methylbenzene (1l, 132 mg), methyl 2-bromo benzoate (4a, 108 mg) and ethylene (5a). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as yellow oil (100 mg, 74% yield). $^1$H NMR (399 MHz, CDCl$_3$) $\delta$ 8.02 (d, $J = 7.8$ Hz, 1H), 7.54 (t, $J = 7.5$ Hz, 1H), 7.43 (t, $J = 7.6$ Hz, 1H), 7.21 (d, $J = 7.6$ Hz, 1H), 7.18 – 7.12 (m, 1H), 6.36 (dd, $J = 17.9$, 11.6 Hz, 1H), 5.21 (d, $J = 11.6$ Hz, 1H), 4.96 (d, $J = 17.9$ Hz, 1H), 3.68 (s, 3H), 2.35 (s, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 167.1, 158.9, 156.5, 137.8, 137.7, 136.6, 134.1, 134.0, 132.2, 131.7, 131.1, 131.1, 130.8, 130.3, 130.2, 130.2, 128.0, 127.9, 127.6, 126.0, 113.3, 113.0, 51.9, 20.5. $^{19}$F NMR (376 MHz, CDCl$_3$) $\delta$ -118.44 – -118.58 (m).

Methyl 2′-ethenyl-3′-methylbiphenyl-4-carboxylate (6k) was synthesized following the GP 4 from 2-iodo toluene (1b, 109 mg), methyl 4-bromo benzoate (4b, 108 mg) and ethylene (5a) with 3 hours of residence time. Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as colorless oil (73 mg, 58% yield). $^1$H NMR (399 MHz, CDCl$_3$) $\delta$ 8.06 (d, $J = 7.8$ Hz, 2H), 7.43 (d, $J = 7.8$ Hz, 2H), 7.28 – 7.25 (m, 2H), 7.15 (dd, $J = 5.9$, 2.8 Hz, 1H), 6.60 (dd, $J = 17.9$, 11.5 Hz, 1H), 5.34 (d, $J = 11.5$ Hz, 1H), 5.06 (d, $J = 17.9$ Hz, 1H), 3.96 (s, 3H), 2.44 (s, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 167.1, 147.1, 140.3, 136.4, 136.2, 134.7, 130.0, 130.0, 129.1, 128.3, 127.7, 126.8, 120.8, 52.1, 21.1.

2-ethenyl-3-ethyl-4′-(trifluoromethyl)biphenyl (6l) was synthesized following the GP 4 from 2-ethyl-1-iodo benzene (1c, 116 mg), 4-bromo benzo trifluoride (4c, 113 mg) and ethylene (5a), with a 3 hours of residence time. Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as deliquescent white solid (70 mg, 51% yield). $^1$H NMR (399 MHz, CDCl$_3$) $\delta$ 7.60 (d, $J = 8.1$ Hz, 2H), 7.42 (d, $J = 8.0$ Hz, 2H), 7.30 – 7.22 (m, 2H), 7.14 – 7.06 (m, 1H), 6.63 (dd, $J = 17.9$, 11.5 Hz, 1H), 5.30 (d, $J = 11.5$ Hz, 1H), 4.97 (d, $J = 17.9$ Hz, 1H), 2.75 (q, $J = 7.5$ Hz, 2H), 1.23 (t, $J = 7.5$ Hz, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 146.2, 142.7, 139.9, 136.1, 134.3, 130.3, 128.3, 127.7, 127.7, 124.7 (q, $J = 3.8$ Hz), 121.2, 26.8, 15.3. $^{19}$F NMR (376 MHz, CDCl$_3$) $\delta$ -62.32.
2'-ethynyl-3'-ethylbiphenyl-4-carbonitrile (6m) was synthesized following the GP 4 from 2-ethyl-1-iodo benzene (1c, 116 mg), 4-bromo benzonitrile (4d, 91 mg) and ethylene (5a), with a 3 hours of residence time. Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as yellowish solid (81 mg, 70% yield). Mp 45.6 – 46.7 °C. \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 7.62 (d, \(J = 8.1\) Hz, 2H), 7.41 (d, \(J = 8.1\) Hz, 2H), 7.30 – 7.22 (m, 2H), 7.08 (dd, \(J = 5.3, 3.6\) Hz, 1H), 6.63 (dd, \(J = 17.9, 11.5\) Hz, 1H), 5.29 (dd, \(J = 11.4, 1.3\) Hz, 1H), 4.92 (dd, \(J = 17.9, 1.3\) Hz, 1H), 2.73 (d, \(J = 7.5\) Hz, 2H), 1.22 (t, \(J = 7.5\) Hz, 3H). \(^{13}\)C NMR (101 MHz, CDCl\(_3\)) \(\delta\) 147.4, 142.8, 139.4, 135.9, 134.1, 131.6, 130.8, 128.6, 127.5, 127.3, 121.5, 119.0, 110.2, 26.7, 15.2.

Dimethyl 2'-[(1E)-prop-1-en-1-yl]biphenyl-2,3'-dicarboxylate (6n) was synthesized following the GP 4 from methyl 2-iodo benzoate (1a, 262 mg) and propylene (5b). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as yellowish oil. The combined yield of 6n and 6n' is 83% (128 mg) with a 6n:6n' ratio of 1:2.3. \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 7.91 (d, \(J = 7.8\) Hz, 1H), 7.70 (dd, \(J = 6.3, 2.3\) Hz, 1H), 7.51 (t, \(J = 7.5\) Hz, 1H), 7.39 (t, \(J = 7.5\) Hz, 1H), 7.32 – 7.26 (m, 2H), 7.22 (d, \(J = 7.6\) Hz, 1H), 6.34 (d, \(J = 15.9\) Hz, 1H), 5.32 (dq, \(J = 13.1, 6.5\) Hz, 1H), 3.85 (s, 3H), 3.60 (s, 3H), 1.57 (d, \(J = 6.6\) Hz, 3H). \(^{13}\)C NMR (101 MHz, CDCl\(_3\)) \(\delta\) 169.4, 167.8, 142.3, 141.6, 137.2, 132.2, 131.8, 131.5, 131.5, 130.9, 130.6, 129.9, 128.5, 127.7, 127.1, 125.9, 52.0, 51.9, 18.7.

Dimethyl 2'-prop-2-en-1-ylbiphenyl-2,3'-dicarboxylate (6n') was synthesized following the GP 4 from methyl 2-iodo benzoate (1a, 262 mg) and propylene (5b). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as colorless oil. \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 8.00 (d, \(J = 7.8\) Hz, 1H), 7.83 (d, \(J = 7.6\) Hz, 1H), 7.55 – 7.48 (m, 1H), 7.47 – 7.40 (m, 1H), 7.31 – 7.18 (m, 3H), 5.76 (ddt, \(J = 12.2, 10.2, 3.9\) Hz, 1H), 4.81 (d, \(J = 10.1\) Hz, 1H), 4.57 (dd, \(J = 17.2, 1.6\) Hz, 1H), 3.87 (d, \(J = 1.9\) Hz, 3H), 3.66 – 3.54 (m, 4H), 3.41 – 3.28 (m, 1H). \(^{13}\)C NMR (101 MHz, CDCl\(_3\)) \(\delta\) 167.8, 167.2, 166.4, 143.4, 142.0, 141.4, 134.8, 133.0, 131.8, 131.3, 130.3, 130.2, 129.3, 127.7, 127.7, 123.5, 52.3, 51.9, 51.5.
Methyl (E)-3'-ethyl-2'-{(prop-1-en-1-yl)-[1,1'-biphenyl]-2-carboxylate (6o) and methyl 2'-allyl-3'-ethyl-[1,1'-biphenyl]-2-carboxylate (6o') were synthesized following the GP 4 from 2-ethyl-1-iodo benzene (1c, 116 mg), methyl 2-bromo benzoate (4a, 108 mg) and propylene (5b). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as colorless oil (73 mg, 52% yield), with a 6o:6o' ratio of 1:3.3. ¹H NMR (399 MHz, CDCl₃) δ 8.00 (d, J = 7.7 Hz, 1H), 7.91 (d, J = 7.8 Hz, 0.3H), 7.54 (t, J = 7.5 Hz, 1.3H), 7.46 (t, J = 7.6 Hz, 1.3H), 7.42 – 7.38 (m, 0.3H), 7.35 – 7.20 (m, 4H), 7.09 – 7.03 (m, 0.3H), 6.99 (d, J = 6.9 Hz, 1H), 6.18 (d, J = 16.0 Hz, 0.3H), 5.78 (dq, J = 10.9, 5.7 Hz, 1H), 5.34 (dq, J = 13.0, 6.6 Hz, 0.3H), 4.93 (d, J = 10.2 Hz, 1H), 4.73 (d, J = 17.1 Hz, 1H), 3.65 (d, J = 10.2 Hz, 4H), 3.32 (dd, J = 15.8, 5.5 Hz, 1H), 3.18 (dd, J = 16.1, 5.5 Hz, 1H), 2.81 – 2.71 (m, 2.6H), 1.63 (d, J = 6.5 Hz, 1H), 1.35 – 1.26 (m, 4H). ¹³C NMR (100 MHz, CDCl₃) δ 168.2, 167.8, 143.8, 143.2, 142.6, 142.0, 141.7, 140.8, 136.9, 135.8, 134.2, 131.7, 131.3, 131.1, 131.1, 130.4, 129.9, 129.6, 128.1, 127.4, 127.4, 127.1, 126.8, 126.8, 126.5, 126.2, 125.6, 114.9, 112.7, 89.7, 89.1, 51.8, 51.7, 34.1, 26.8, 25.7, 18.7, 15.2.

Methyl (E)-3',5'-dimethyl-2'-{(prop-1-en-1-yl)-[1,1'-biphenyl]-2-carboxylate (6p) and methyl 2'-allyl-3',5'-dimethyl-[1,1'-biphenyl]-2-carboxylate (6p') were synthesized following the GP 4 from 1-iodo-2,4-dimethylbenzene (1i, 116 mg), methyl 2-bromo benzoate (4a, 108 mg) and propylene (5b). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as colorless oil (66 mg, 47% yield), with a 6p:6p' ratio of 1:2. ¹H NMR (400 MHz, CDCl₃) δ 7.93 (dd, J = 7.8, 1.2 Hz, 1H), 7.84 (dd, J = 7.8, 1.2 Hz, 0.35H), 7.51 – 7.46 (m, 1.35H), 7.40 (td, J = 7.6, 1.4 Hz, 1H), 7.34 (td, J = 7.6, 1.3 Hz, 0.35H), 7.25 – 7.21 (m, 1.35H), 6.99 (s, 1.35H), 6.83 (s, 0.35H), 6.76 (s, 1H), 6.03 (d, J = 14.6 Hz, 0.35H), 5.69 (ddt, J = 16.0, 10.2, 5.8 Hz, 1H), 5.31 (dq, J = 16.0, 6.5 Hz, 0.35H), 4.88 (dd, J = 10.2, 1.8 Hz, 1H), 4.71 (dd, J = 17.1, 1.9 Hz, 1H), 3.64 – 3.61 (m, 4.05H), 3.19 (dd, J = 16.0, 5.9 Hz, 1H), 3.07 (dd, J = 16.0, 5.7 Hz, 0.35H), 2.33 – 2.29 (m, 8.1H), 1.59 (dd, J = 6.5, 1.7 Hz, 1H). ¹³C NMR (101 MHz, CDCl₃) δ 168.2, 167.7, 143.7, 143.3, 141.7, 140.5, 136.6, 136.3, 135.3, 134.7, 133.3, 131.9, 131.7, 131.3, 131.2, 131.1, 130.4, 130.3, 130.3, 129.8, 129.5, 127.8, 127.6, 127.5, 127.0, 126.5, 114.8, 51.8, 34.5, 21.0, 21.0, 20.9, 19.8, 18.8.
Dimethyl 2'-[(1E)-3,3,3-trifluoroprop-1-en-1-yl]biphenyl-2,3'-dicarboxylate (6q) was synthesized following the GP 4 from methyl 2-iodo benzoate (1b, 262 mg) and 3,3,3-trifluoroprop-1-ene (5c). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as colorless oil (156 mg, 86% yield). $^1$H NMR (399 MHz, CDCl$_3$) $\delta$ 7.96 (t, $J$ = 8.4 Hz, 2H), 7.54 (t, $J$ = 7.5 Hz, 1H), 7.44 (t, $J$ = 7.8 Hz, 2H), 7.36 (dd, $J$ = 11.4, 4.7 Hz, 2H), 7.17 (d, $J$ = 7.6 Hz, 1H), 5.29 (dq, $J$ = 16.3, 6.4 Hz, 1H), 3.88 (s, 3H), 3.66 (s, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 121.9, 124.0, 128.3, 135.1 Hz, 7.36 to 5.73 (m, 3H), 7.28 to 7.17 (m, 1H). $^{19}$F NMR (376 MHz, CDCl$_3$) $\delta$ -64.93 (dd, $J$ = 6.4, 2.0 Hz).

Methyl 3'-ethyl-2'-[(1E)-3,3,3-trifluoroprop-1-en-1-yl]biphenyl-2-carboxylate (6r) was synthesized following the GP 4 from 2-ethyl-1-iodo benzene (1c, 116 mg), methyl 2-bromo benzoate (4a, 108 mg) and 3,3,3-trifluoroprop-1-ene (5c). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as colorless oil (102 mg, 61% yield). $^1$H NMR (399 MHz, CDCl$_3$) $\delta$ 7.92 (d, $J$ = 7.8 Hz, 1H), 7.51 (t, $J$ = 7.5 Hz, 1H), 7.41 (t, $J$ = 7.6 Hz, 1H), 7.31 (t, $J$ = 7.5 Hz, 1H), 7.25 (d, $J$ = 7.1 Hz, 1H), 7.19 (d, $J$ = 7.6 Hz, 1H), 7.05 (t, $J$ = 13.9 Hz, 2H), 5.38 (dq, $J$ = 12.9, 6.3 Hz, 1H), 3.65 (s, 3H), 2.72 (q, $J$ = 7.5 Hz, 2H), 1.24 (t, $J$ = 7.5 Hz, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 167.6, 142.3, 142.2, 141.0, 135.1 (q, $J$ = 7.2 Hz), 131.5, 131.4, 130.5, 130.0, 128.2, 127.7, 127.4, 127.1, 126.8, 124.1, 122.5, 122.2, 121.9, 121.6, 121.4, 51.9, 26.7, 15.0. $^{19}$F NMR (376 MHz, CDCl$_3$) $\delta$ -64.75 (d, $J$ = 6.3 Hz).

Methyl (E)-2-(1-(3,3,3-trifluoroprop-1-en-1-yl)naphthalen-2-yl)benzoate (6s) synthesized following the GP 4 from 1-iodo naphtalene (1d, 127 mg), methyl 2-bromo benzoate (4a, 108 mg) and 3,3,3-trifluoroprop-1-ene (5c). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as yellowish oil (111 mg, 62% yield). $^1$H NMR (399 MHz, CDCl$_3$) $\delta$ 8.04 (dd, $J$ = 18.3, 7.9 Hz, 2H), 7.90 (dd, $J$ = 17.0, 8.1 Hz, 2H), 7.62 to 7.52 (m, 3H), 7.48 (t, $J$ = 7.6 Hz, 1H), 7.37 (t, $J$ = 13.8 Hz, 2H), 7.28 to 7.23 (m, 1H), 5.73 (dq, $J$ = 16.3, 6.4 Hz, 1H), 3.63 (s, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 167.5, 142.1, 138.7, 134.8 (q, $J$ = 7.1 Hz), 132.8, 131.7, 131.5, 131.0, 130.5, 130.3, 128.9, 128.6, 128.3, 127.7, 127.4, 127.0, 126.0, 124.6, 124.1, 123.9, 123.5, 123.2, 122.9, 121.5, 52.0. $^{19}$F NMR (376 MHz, CDCl$_3$) $\delta$ -64.62 (d, $J$ = 6.3 Hz).
Methyl 3',5'-dimethyl-2'-(1E)-3,3,3-trifluoroprop-1-ene-1-yl)biphenyl-2-carboxylate (6t) was synthesized following the GP 4 from 1-iodo-2,4-dimethylbenzene (1i, 116 mg), methyl 2-bromo benzoate (4a, 108 mg) and 3,3,3-trifluoroprop-1-ene (5c). Purification by flash chromatography (Biotage KP SIL, gradient: 1-10 % Ethyl acetate in hexanes) to afford the product as colorless oil (110 mg, 66% yield). $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.93 (d, $J =$ 7.6 Hz, 1H), 7.52 (t, $J =$ 7.4 Hz, 1H), 7.41 (t, $J =$ 7.5 Hz, 1H), 7.20 (d, $J =$ 7.5 Hz, 1H), 7.06 (s, 1H), 6.97 (d, $J =$ 16.4 Hz, 1H), 6.86 (s, 1H), 5.55 – 5.25 (m, 1H), 3.67 (s, 3H), 2.36 (d, $J =$ 14.1 Hz, 6H). $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 167.5, 142.3, 141.3, 137.9, 136.0, 135.2 (q, $J =$ 7.1 Hz), 131.6, 131.3, 130.6, 130.0, 128.8, 127.9, 127.4, 124.4, 121.7, 121.0 (q, $J =$ 33.1 Hz), 51.9, 21.1, 20.7. $^{19}$F NMR (377 MHz, CDCl$_3$) $\delta$ -64.43 (d, $J =$ 6.2 Hz).
7. References

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8. **NMR spectra**
