



19:32:39 13-08-25

#### **Experiment Information**

| Parameter                   | F1  | F2             |
|-----------------------------|-----|----------------|
| Nucleus                     | N/A | <sup>1</sup> H |
| Transmitter Frequency (MHz) | N/A | 499.86         |
| Sweep Width (Hz)            | 50  | 5000           |
| Sweep Width (ppm)           | N/A | 10.003         |
| Transmitter Offset (Hz)     | 0   | 2500           |
| Transmitter Offset (ppm)    | N/A | 5.0014         |

#### 8.140 - 8.050 ppm

| Osc. | а  | φ (°)                 | f <sub>1</sub> (Hz)                   | f <sub>2</sub> (Hz)                                   | f <sub>2</sub> (ppm)                  | $\eta_1$ (s $^{-1}$ )                 | $\eta_2~(\mathrm{s}^{-1})$            | ſ      |
|------|--|-----------------------|---------------------------------------|---|---------------------------------------|---------------------------------------|---------------------------------------|--------|
| 1    | $6.4472 \times 10^{-2}$<br>$\pm 1.0756 \times 10^{-4}$ | 0.28126<br>±0.10737   | $-4.4435$ $\pm 4.8867 \times 10^{-4}$ | $4.0405 \times 10^{3}$<br>$\pm 2.1403 \times 10^{-3}$ | $8.0832$ $\pm 4.2818 \times 10^{-6}$  | $1.6626 \\ \pm 2.4958 \times 10^{-3}$ | $4.3656 \\ \pm 1.3239 \times 10^{-2}$ | 4.8259 |
| 2    | $6.4707 \times 10^{-2}$<br>$\pm 1.0812 \times 10^{-4}$ | $-1.4842 \pm 0.10769$ | $-3.4394$ $\pm 4.9129 \times 10^{-4}$ | $4.0415 \times 10^{3}$<br>$\pm 2.1488 \times 10^{-3}$ | $8.0851$ $\pm 4.2988 \times 10^{-6}$  | $1.6673 \\ \pm 2.518 \times 10^{-3}$  | $4.4635$ $\pm 1.343 \times 10^{-2}$   | 4.7497 |
| 3    | $6.4494 \times 10^{-2}$<br>$\pm 1.0824 \times 10^{-4}$ | 0.51408<br>±0.10803   | $3.441$ $\pm 4.9293 \times 10^{-4}$   | $4.0484 \times 10^{3}$<br>$\pm 2.1653 \times 10^{-3}$ | $8.099$ $\pm 4.3318 \times 10^{-6}$   | $1.6585 \\ \pm 2.5117 \times 10^{-3}$ | 4.5406<br>$\pm 1.353 \times 10^{-2}$  | 4.7174 |
| 4    | $6.5485 \times 10^{-2}$<br>$\pm 1.0876 \times 10^{-4}$ | $-1.4104 \pm 0.10597$ | $4.4468 \\ \pm 4.8677 \times 10^{-4}$ | $4.0493 \times 10^{3}$<br>$\pm 2.1301 \times 10^{-3}$ | $8.1009 \\ \pm 4.2613 \times 10^{-6}$ | $1.6624 \\ \pm 2.4845 \times 10^{-3}$ | $4.5459 \\ \pm 1.3356 \times 10^{-2}$ | 4.8842 |

# 7.300 - 7.050 ppm

| Osc. | а                           | φ (°)                    | f <sub>1</sub> (Hz)         | f <sub>2</sub> (Hz)         | f <sub>2</sub> (ppm)        | $\eta_1$ (s $^{-1}$ )       | $\eta_2~(s^{-1})$           | $\int$ |
|------|-----------------------------|--------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|--------|
| 1    | $3.0074 \times 10^{-2}$     | $-7.9415 \times 10^{-2}$ | -7.9111                     | $3.5395 \times 10^{3}$      | 7.081                       | 1.1776                      | 4.3932                      | 0.4000 |
| 1    | $\pm 1.6329 \times 10^{-4}$ | $\pm 0.3057$             | $\pm 1.0295 \times 10^{-3}$ | $\pm 7.1094 \times 10^{-3}$ | $\pm 1.4223 \times 10^{-5}$ | $\pm 6.4825 \times 10^{-3}$ | $\pm 4.4576 \times 10^{-2}$ | 2.4089 |
| 2    | $2.8997 \times 10^{-2}$     | $-8.2623 \times 10^{-2}$ | -6.9247                     | $3.5405 \times 10^{3}$      | 7.083                       | 1.1434                      | 4.2716                      | 0.2507 |
| 2    | $\pm 1.5777 \times 10^{-4}$ | $\pm 0.317$              | $\pm 1.0339 \times 10^{-3}$ | $\pm 7.2159 \times 10^{-3}$ | $\pm 1.4436 \times 10^{-5}$ | $\pm 6.3397 \times 10^{-3}$ | $\pm 4.4782 \times 10^{-2}$ | 2.3527 |
| 3    | $5.858 \times 10^{-2}$      | 0.627 18                 | -0.49465                    | $3.5469 \times 10^{3}$      | 7.0958                      | 1.3132                      | 4.2685                      | 4.5025 |
| 3    | $\pm 1.7391 \times 10^{-4}$ | $\pm 0.17564$            | $\pm 6.4112 \times 10^{-4}$ | $\pm 3.8856 \times 10^{-3}$ | $\pm 7.7733 \times 10^{-6}$ | $\pm 3.7966 \times 10^{-3}$ | $\pm 2.4139 \times 10^{-2}$ | 4.3023 |
| 4    | $5.8586 \times 10^{-2}$     | $-5.4887 \times 10^{-2}$ | 0.49566                     | $3.5479 \times 10^{3}$      | 7.0978                      | 1.3185                      | 4.2518                      | 4.4994 |
| 4    | $\pm 1.7428 \times 10^{-4}$ | $\pm 0.17555$            | $\pm 6.43 \times 10^{-4}$   | $\pm 3.857 \times 10^{-3}$  | $\pm 7.7162 \times 10^{-6}$ | $\pm 3.8146 \times 10^{-3}$ | $\pm 2.4317 \times 10^{-2}$ | 4.4994 |
| 5    | $3.0467 \times 10^{-2}$     | 1.3665                   | 6.9248                      | $3.5543 \times 10^{3}$      | 7.1106                      | 1.1789                      | 4.1874                      | 2.4645 |
| 5    | $\pm 1.5994 \times 10^{-4}$ | $\pm 0.31279$            | $\pm 1.0196 \times 10^{-3}$ | $\pm 6.9397 \times 10^{-3}$ | $\pm 1.3883 \times 10^{-5}$ | $\pm 6.3314 \times 10^{-3}$ | $\pm 4.3351 \times 10^{-2}$ | 2.4043 |
| 6    | $3.1055 \times 10^{-2}$     | 0.954 03                 | 7.9056                      | $3.5553 \times 10^{3}$      | 7.1126                      | 1.2204                      | 4.2335                      | 2.4724 |
| U    | $\pm 1.6732 \times 10^{-4}$ | $\pm 0.30263$            | $\pm 1.0252 \times 10^{-3}$ | $\pm 6.9266 \times 10^{-3}$ | $\pm 1.3857 \times 10^{-5}$ | $\pm 6.671 \times 10^{-3}$  | $\pm 4.3444 \times 10^{-2}$ | 2.4724 |
| 7    | $5.9317 \times 10^{-2}$     | -0.15483                 | -4.3307                     | $3.5786 \times 10^{3}$      | 7.1591                      | 1.6307                      | 4.1037                      | 4.3566 |
| ,    | $\pm 1.8726 \times 10^{-4}$ | $\pm 0.20323$            | $\pm 9.3061 \times 10^{-4}$ | $\pm 4.2644 \times 10^{-3}$ | $\pm 8.5312 \times 10^{-6}$ | $\pm 4.6871 \times 10^{-3}$ | $\pm 2.6036 \times 10^{-2}$ | 4.5500 |
| 8    | $6.4474 \times 10^{-2}$     | $-5.9375 \times 10^{-2}$ | -3.154                      | $3.5798 \times 10^{3}$      | 7.1615                      | 1.6392                      | 4.2021                      | 4.8336 |
| O    | $\pm 1.891 \times 10^{-4}$  | $\pm 0.18852$            | $\pm 8.6659 \times 10^{-4}$ | $\pm 3.9616 \times 10^{-3}$ | $\pm 7.9254 \times 10^{-6}$ | $\pm 4.392 \times 10^{-3}$  | $\pm 2.4438 \times 10^{-2}$ | 4.0550 |
| 9    | $6.3538 \times 10^{-2}$     | 0.315 62                 | 3.1522                      | $3.586 \times 10^{3}$       | 7.174                       | 1.5952                      | 4.4086                      | 4.7669 |
| 9    | $\pm 1.8752 \times 10^{-4}$ | $\pm 0.18819$            | $\pm 8.6255 \times 10^{-4}$ | $\pm 4.0168 \times 10^{-3}$ | $\pm 8.0358 \times 10^{-6}$ | $\pm 4.2724 \times 10^{-3}$ | $\pm 2.4966 \times 10^{-2}$ | 4.7009 |
| 10   | $5.8831 \times 10^{-2}$     | 0.133 14                 | 4.332                       | $3.5872 \times 10^3$        | 7.1764                      | 1.5861                      | 4.3913                      | 4.3092 |
| 10   | $\pm 1.8546 \times 10^{-4}$ | $\pm 0.20346$            | $\pm 9.2867 \times 10^{-4}$ | $\pm 4.3166 \times 10^{-3}$ | $\pm 8.6356 \times 10^{-6}$ | $\pm 4.5437 \times 10^{-3}$ | $\pm 2.6769 \times 10^{-2}$ | 7.5092 |
| 11   | $3.1421 \times 10^{-2}$     | 0.19079                  | -8.2061                     | $3.6184 \times 10^3$        | 7.2389                      | 1.1859                      | 4.2319                      | 2.3364 |
| 11   | $\pm 1.5233 \times 10^{-4}$ | $\pm 0.27736$            | $\pm 9.3548 \times 10^{-4}$ | $\pm 6.5962 \times 10^{-3}$ | $\pm 1.3196 \times 10^{-5}$ | $\pm 5.9074 \times 10^{-3}$ | $\pm 4.1237 \times 10^{-2}$ | 2.5504 |
| 12   | $2.8857 \times 10^{-2}$     | -0.33534                 | -7.0273                     | $3.6196 \times 10^3$        | 7.2412                      | 1.1475                      | 4.125                       | 2.2668 |
| 12   | $\pm 1.4767 \times 10^{-4}$ | $\pm 0.30216$            | $\pm 9.8764 \times 10^{-4}$ | $\pm 6.9863 \times 10^{-3}$ | $\pm 1.3977 \times 10^{-5}$ | $\pm 6.0252 \times 10^{-3}$ | $\pm 4.3977 \times 10^{-2}$ | 2.2000 |
| 13   | $2.8564 \times 10^{-2}$     | 0.599 15                 | -0.85506                    | $3.6257 \times 10^3$        | 7.2535                      | 1.1677                      | 4.0418                      | 2.2928 |
| 15   | $\pm 3.9054 \times 10^{-4}$ | $\pm 0.93063$            | $\pm 2.342 \times 10^{-3}$  | $\pm 9.3628 \times 10^{-3}$ | $\pm 1.8731 \times 10^{-5}$ | $\pm 1.2967 \times 10^{-2}$ | $\pm 5.7672 \times 10^{-2}$ | 2.2320 |
| 14   | $3.0003 \times 10^{-2}$     | 0.473 94                 | -0.32052                    | $3.6263 \times 10^3$        | 7.2546                      | 1.1857                      | 3.8913                      | 2.3091 |
| 1-1  | $\pm 6.8619 \times 10^{-4}$ | $\pm 1.2504$             | $\pm 3.0797 \times 10^{-3}$ | $\pm 9.732 \times 10^{-3}$  | $\pm 1.9469 \times 10^{-5}$ | $\pm 1.9755 \times 10^{-2}$ | $\pm 6.0459 \times 10^{-2}$ | 2.5051 |
| 15   | $3.0397 \times 10^{-2}$     | 0.44951                  | 0.32031                     | $3.6269 \times 10^3$        | 7.2559                      | 1.1956                      | 3.9946                      | 2.3365 |
| 10   | $\pm 6.5937 \times 10^{-4}$ | $\pm 1.2851$             | $\pm 3.1816 \times 10^{-3}$ | $\pm 9.7537 \times 10^{-3}$ | $\pm 1.9513 \times 10^{-5}$ | $\pm 1.9082 \times 10^{-2}$ | $\pm 5.9911 \times 10^{-2}$ | 2.0000 |
| 16   | $2.7673 \times 10^{-2}$     | 0.255 09                 | 0.85451                     | $3.6275 \times 10^3$        | 7.257                       | 1.1411                      | 3.9705                      | 2.228  |
| 10   | $\pm 3.9673 \times 10^{-4}$ | $\pm 0.90518$            | $\pm 2.3127 \times 10^{-3}$ | $\pm 9.5118 \times 10^{-3}$ | $\pm 1.9029 \times 10^{-5}$ | $\pm 1.2866 \times 10^{-2}$ | $\pm 5.7706 \times 10^{-2}$ | 2.220  |

| 17 | $2.7894 \times 10^{-2}$     | 0.64631       | 7.0267                      | $3.6336 \times 10^{3}$     | 7.2693                      | 1.1556                      | 3.8933                      | 2 2007 |
|----|-----------------------------|---------------|-----------------------------|----------------------------|-----------------------------|-----------------------------|-----------------------------|--------|
| 17 | $\pm 1.4647 \times 10^{-4}$ | $\pm 0.30841$ | $\pm 1.007 \times 10^{-3}$  | $\pm 7.154 \times 10^{-3}$ | $\pm 1.4312 \times 10^{-5}$ | $\pm 6.2023 \times 10^{-3}$ | $\pm 4.3996 \times 10^{-2}$ | 2.2007 |
| 10 | $3.0306 \times 10^{-2}$     | 0.50105       | 8.2047                      | $3.6348 \times 10^{3}$     | 7.2716                      | 1.1737                      | 4.0715                      | 0.0502 |
| 18 | $\pm 1.5004 \times 10^{-4}$ | $\pm 0.28391$ | $\pm 9.4888 \times 10^{-4}$ | $\pm 6.686 \times 10^{-3}$ | $\pm 1.3376 \times 10^{-5}$ | $\pm 5.9449 \times 10^{-3}$ | $\pm 4.1873 \times 10^{-2}$ | 2.2583 |

# 5.960 - 5.870 ppm

| Osc. | а  | φ (°)                 | f <sub>1</sub> (Hz)                     | f <sub>2</sub> (Hz)                                   | f <sub>2</sub> (ppm)                  | $\eta_1$ (s $^{-1}$ )                 | $\eta_2~(\mathrm{s}^{-1})$            | ſ      |
|------|--|-----------------------|---|---|---------------------------------------|---------------------------------------|---------------------------------------|--------|
| 1    | $3.3592 \times 10^{-2}$<br>$\pm 3.3463 \times 10^{-4}$ | $-2.707 \pm 1.0309$   | $-7.4422$ $\pm 8.6557 \times 10^{-3}$   | $2.9493 \times 10^{3}$<br>$\pm 9.8905 \times 10^{-3}$ | 5.9001<br>$\pm 1.9787 \times 10^{-5}$ | $2.6656$ $\pm 1.1089 \times 10^{-2}$  | 4.0068<br>$\pm 3.9454 \times 10^{-2}$ | 2.3251 |
| 2    | $3.5377 \times 10^{-2}$<br>$\pm 4.016 \times 10^{-5}$  | $-2.6856 \pm 1.2919$  | $-5.6344$ $\pm 1.0613 \times 10^{-2}$   | $2.9511 \times 10^{3}$<br>$\pm 1.153 \times 10^{-2}$  | $5.9038$ $\pm 2.3066 \times 10^{-5}$  | $2.693$ $\pm 5.0858 \times 10^{-3}$   | 4.2373<br>$\pm 3.4905 \times 10^{-2}$ | 2.4353 |
| 3    | $7.1318 \times 10^{-2}$<br>$\pm 2.7898 \times 10^{-4}$ | 5.3313<br>±0.29368    | -0.97488<br>$\pm 1.3315 \times 10^{-3}$ | $2.9558 \times 10^{3}$<br>$\pm 2.9064 \times 10^{-3}$ | $5.9132 \\ \pm 5.8144 \times 10^{-6}$ | $4.4311 \\ \pm 1.5277 \times 10^{-2}$ | 6.3278<br>$\pm 3.6807 \times 10^{-2}$ | 4.303  |
| 4    | $7.3921 \times 10^{-2}$<br>$\pm 2.2135 \times 10^{-4}$ | $-6.0622 \pm 0.14271$ | $0.98054$ $\pm 1.3751 \times 10^{-3}$   | $2.9576 \times 10^{3}$<br>$\pm 4.2738 \times 10^{-3}$ | 5.9168<br>$\pm 8.5499 \times 10^{-6}$ | 4.5083<br>$\pm 1.4508 \times 10^{-2}$ | 6.4407<br>$\pm 3.5636 \times 10^{-2}$ | 4.4387 |
| 5    | $3.4456 \times 10^{-2}$<br>$\pm 9.4585 \times 10^{-5}$ | 1.4589<br>±1.048      | 5.6406<br>$\pm 8.6039 \times 10^{-3}$   | $2.9623 \times 10^{3}$<br>$\pm 8.7617 \times 10^{-3}$ | $5.9262$ $\pm 1.7528 \times 10^{-5}$  | $2.6844$ $\pm 7.3881 \times 10^{-3}$  | $4.0691 \\ \pm 3.7094 \times 10^{-2}$ | 2.3901 |
| 6    | $3.3203 \times 10^{-2}$<br>$\pm 2.4875 \times 10^{-4}$ | 1.3906<br>±0.80537    | $7.4489 \\ \pm 6.7939 \times 10^{-3}$   | $2.9642 \times 10^{3}$<br>$\pm 6.9629 \times 10^{-3}$ | $5.9299 \\ \pm 1.393 \times 10^{-5}$  | $2.6512 \\ \pm 7.6941 \times 10^{-3}$ | $3.8924 \\ \pm 4.0176 \times 10^{-2}$ | 2.31   |

# 4.350 - 4.000 ppm

| Osc. | а                           | φ (°)                   | $f_1$ (Hz)                  | f <sub>2</sub> (Hz)         | $f_2$ (ppm)                 | $\eta_1~(\mathrm{s}^{-1})$  | $\eta_2~(\mathrm{s}^{-1})$  | ſ      |
|------|-----------------------------|-------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|--------|
| 1    | $5.6224 \times 10^{-2}$     | -0.16174                | -9.9663                     | $2.0213 \times 10^{3}$      | 4.0438                      | 1.1816                      | 4.3923                      | 4 E003 |
| 1    | $\pm 2.367 \times 10^{-4}$  | $\pm 0.23856$           | $\pm 8.4246 \times 10^{-4}$ | $\pm 6.226 \times 10^{-3}$  | $\pm 1.2455 \times 10^{-5}$ | $\pm 5.2844 \times 10^{-3}$ | $\pm 3.9225 \times 10^{-2}$ | 4.5983 |
| 2    | $5.5525 \times 10^{-2}$     | $5.8755 \times 10^{-2}$ | -3.8348                     | $2.0275 \times 10^{3}$      | 4.056                       | 1.1699                      | 4.2431                      | 4 4040 |
| 2    | $\pm 2.3259 \times 10^{-4}$ | $\pm 0.24045$           | $\pm 8.3536 \times 10^{-4}$ | $\pm 6.1993 \times 10^{-3}$ | $\pm 1.2402 \times 10^{-5}$ | $\pm 5.2141 \times 10^{-3}$ | $\pm 3.8769 \times 10^{-2}$ | 4.4248 |
| 2    | $5.6538 \times 10^{-2}$     | $1.8776 \times 10^{-2}$ | 3.835                       | $2.0351 \times 10^{3}$      | 4.0714                      | 1.2015                      | 4.0823                      | 4 5075 |
| 3    | $\pm 2.3293 \times 10^{-4}$ | $\pm 0.23767$           | $\pm 8.3033 \times 10^{-4}$ | $\pm 6.0631 \times 10^{-3}$ | $\pm 1.213 \times 10^{-5}$  | $\pm 5.2919 \times 10^{-3}$ | $\pm 3.7944 \times 10^{-2}$ | 4.5075 |

| 4  | $5.5353 \times 10^{-2}$<br>$\pm 2.3003 \times 10^{-4}$ | 0.172 95<br>±0.241 46                     | 9.966<br>$\pm 8.3612 \times 10^{-4}$    | $2.0412 \times 10^{3}$<br>$\pm 6.1429 \times 10^{-3}$ | 4.0836<br>$\pm 1.2289 \times 10^{-5}$ | 1.1886<br>$\pm 5.285 \times 10^{-3}$                               | 4.0276<br>$\pm 3.8145 \times 10^{-2}$ | 4.5652 |
|----|--|---|---|---|---------------------------------------|--|---------------------------------------|--------|
| 5  | $5.4926 \times 10^{-2}$<br>$\pm 2.2893 \times 10^{-4}$ | $-0.87291 \pm 0.24225$                    | $-10.384$ $\pm 8.3289 \times 10^{-4}$   | $2.0642 \times 10^{3} $ $\pm 6.1773 \times 10^{-3}$   | $4.1295 \\ \pm 1.2358 \times 10^{-5}$ | $1.179 \\ \pm 5.2603 \times 10^{-3}$                               | $4.0089 \\ \pm 3.8073 \times 10^{-2}$ | 4.4879 |
| 6  | $5.6284 \times 10^{-2}$<br>$\pm 2.3443 \times 10^{-4}$ | $-0.5606 \pm 0.23932$                     | -3.4147<br>$\pm 8.3896 \times 10^{-4}$  | $2.0711 \times 10^{3}$<br>$\pm 6.1519 \times 10^{-3}$ | $4.1434 \\ \pm 1.2307 \times 10^{-5}$ | $\begin{array}{c} 1.2006 \\ \pm 5.3544 \times 10^{-3} \end{array}$ | 4.1827<br>$\pm 3.8476 \times 10^{-2}$ | 4.3867 |
| 7  | $5.5014 \times 10^{-2}$<br>$\pm 2.3216 \times 10^{-4}$ | $-0.50176 \pm 0.24245$                    | 3.4163<br>$\pm 8.4188 \times 10^{-4}$   | $2.078 \times 10^{3}$ $\pm 6.2283 \times 10^{-3}$     | $4.1571 \\ \pm 1.246 \times 10^{-5}$  | $1.1712 \\ \pm 5.2506 \times 10^{-3}$                              | $4.1994 \\ \pm 3.9016 \times 10^{-2}$ | 4.3002 |
| 8  | $5.7923 \times 10^{-2}$<br>$\pm 2.3947 \times 10^{-4}$ | -0.69313<br>$\pm 0.23292$                 | 10.385<br>$\pm 8.3236 \times 10^{-4}$   | $2.0849 \times 10^{3}$<br>$\pm 6.0906 \times 10^{-3}$ | $4.171$ $\pm 1.2185 \times 10^{-5}$   | $\begin{array}{c} 1.1932 \\ \pm 5.2471 \times 10^{-3} \end{array}$ | $4.4961 \\ \pm 3.8927 \times 10^{-2}$ | 4.657  |
| 9  | $3.0019 \times 10^{-2}$<br>$\pm 2.2934 \times 10^{-4}$ | $-0.2571 \pm 0.44674$                     | $-7.554$ $\pm 1.5195 \times 10^{-3}$    | $2.1359 \times 10^{3}$ $\pm 1.1242 \times 10^{-2}$    | $4.2729 \\ \pm 2.2491 \times 10^{-5}$ | $1.1682 \\ \pm 9.4937 \times 10^{-3}$                              | $3.9644$ $\pm 6.948 \times 10^{-2}$   | 2.4186 |
| 10 | $6.1545 \times 10^{-2}$<br>$\pm 2.3866 \times 10^{-4}$ | $-8.7922 \times 10^{-2}$<br>$\pm 0.22408$ | $-4.2321$ $\pm 7.7737 \times 10^{-4}$   | $2.1392 \times 10^{3}$<br>$\pm 5.6445 \times 10^{-3}$ | $4.2796 \\ \pm 1.1292 \times 10^{-5}$ | $1.1879 \\ \pm 4.8233 \times 10^{-3}$                              | 4.1537<br>$\pm 3.5415 \times 10^{-2}$ | 4.6781 |
| 11 | $3.0133 \times 10^{-2}$<br>$\pm 2.4486 \times 10^{-4}$ | $-0.18545 \pm 0.47168$                    | -0.91063<br>$\pm 1.5861 \times 10^{-3}$ | $2.1425 \times 10^{3}$<br>$\pm 1.1552 \times 10^{-2}$ | $4.2863$ $\pm 2.311 \times 10^{-5}$   | $1.1653 \\ \pm 9.8811 \times 10^{-3}$                              | $4.0864$ $\pm 7.1943 \times 10^{-2}$  | 2.4769 |
| 12 | $3.0088 \times 10^{-2}$<br>$\pm 2.4491 \times 10^{-4}$ | $-0.24889 \pm 0.47154$                    | 0.90968<br>$\pm 1.5872 \times 10^{-3}$  | $2.1443 \times 10^{3}$<br>$\pm 1.1525 \times 10^{-2}$ | $4.2899 \\ \pm 2.3057 \times 10^{-5}$ | $1.1685 \\ \pm 9.913 \times 10^{-3}$                               | 4.0459<br>$\pm 7.1892 \times 10^{-2}$ | 2.4678 |
| 13 | $6.1229 \times 10^{-2}$<br>$\pm 2.3886 \times 10^{-4}$ | $-0.20647$ $\pm 0.22522$                  | $4.2321$ $\pm 7.7976 \times 10^{-4}$    | $2.1477 \times 10^{3}$<br>$\pm 5.6942 \times 10^{-3}$ | $4.2965$ $\pm 1.1392 \times 10^{-5}$  | $1.1823 \\ \pm 4.836 \times 10^{-3}$                               | $4.2039 \\ \pm 3.5683 \times 10^{-2}$ | 4.6558 |
| 14 | $3.0296 \times 10^{-2}$<br>$\pm 2.3057 \times 10^{-4}$ | 0.117 09<br>±0.443 32                     | $7.5564 \\ \pm 1.5145 \times 10^{-3}$   | $2.151 \times 10^{3} \\ \pm 1.1219 \times 10^{-2}$    | $4.3031 \\ \pm 2.2445 \times 10^{-5}$ | $1.1603 \\ \pm 9.3567 \times 10^{-3}$                              | $4.0826 \\ \pm 6.9653 \times 10^{-2}$ | 2.4409 |

# 4.000 - 3.640 ppm

| Osc. | а  | φ (°)                     | f <sub>1</sub> (Hz)                    | f <sub>2</sub> (Hz)                                   | f <sub>2</sub> (ppm)                  | $\eta_1$ (s $^{-1}$ )                 | $\eta_2~(\mathrm{s}^{-1})$            | ſ      |
|------|--|---------------------------|--|---|---------------------------------------|---------------------------------------|---------------------------------------|--------|
| 1    | $3.062 \times 10^{-2}$<br>$\pm 7.3793 \times 10^{-5}$  | −0.121 96<br>±0.139 29    | -9.0991<br>$\pm 4.6425 \times 10^{-4}$ | $1.8485 \times 10^{3}$<br>$\pm 3.3326 \times 10^{-3}$ | $3.698$ $\pm 6.667 \times 10^{-6}$    | $1.1743 \\ \pm 2.9101 \times 10^{-3}$ | $4.0829 \\ \pm 2.0822 \times 10^{-2}$ | 2.4264 |
| 2    | $3.1849 \times 10^{-2}$<br>$\pm 5.7597 \times 10^{-5}$ | -0.15917<br>$\pm 0.13159$ | $-7.4861$ $\pm 2.9092 \times 10^{-4}$  | $1.8501 \times 10^{3}$ $\pm 7.3619 \times 10^{-3}$    | $3.7012 \\ \pm 1.4728 \times 10^{-5}$ | $1.1857 \\ \pm 6.5331 \times 10^{-3}$ | $4.0122 \\ \pm 4.7208 \times 10^{-2}$ | 2.4289 |
| 3    | $2.8921 \times 10^{-2}$<br>$\pm 9.2085 \times 10^{-5}$ | -0.14127<br>$\pm 2.4252$  | $-7.3084$ $\pm 8.3701 \times 10^{-3}$  | $1.8503 \times 10^{3}$ $\pm 7.1104 \times 10^{-2}$    | 3.7017<br>$\pm 1.4225 \times 10^{-4}$ | $1.1467 \\ \pm 7.8319 \times 10^{-2}$ | 4.0616<br>±0.4176                     | 2.3025 |
| 4    | $3.1018 \times 10^{-2}$<br>$\pm 7.4255 \times 10^{-5}$ | −0.271 33<br>±0.138 65    | $-5.6985$ $\pm 4.6697 \times 10^{-4}$  | $1.8519 \times 10^{3}$<br>$\pm 3.3551 \times 10^{-3}$ | $3.7048$ $\pm 6.712 \times 10^{-6}$   | $1.1818 \\ \pm 2.9146 \times 10^{-3}$ | $4.2289 \\ \pm 2.0872 \times 10^{-2}$ | 2.5169 |

| 5  | $3.0471 \times 10^{-2}$<br>$\pm 7.2285 \times 10^{-5}$              | 0.181 06<br>±0.138 78                                   | 5.6989<br>$\pm 4.6164 \times 10^{-4}$   | $1.8633 \times 10^{3}$<br>$\pm 3.3441 \times 10^{-3}$ | 3.7276<br>$\pm 6.69 \times 10^{-6}$   | $1.1549 \\ \pm 2.8245 \times 10^{-3}$ | $4.1804$ $\pm 2.0863 \times 10^{-2}$  | 2.4829 |
|----|---|---|---|---|---------------------------------------|---------------------------------------|---------------------------------------|--------|
| 6  | $3.0219 \times 10^{-2}$<br>$\pm 1.2775 \times 10^{-4}$              | 0.15057<br>$\pm 0.32228$                                | $7.306 \\ \pm 1.3709 \times 10^{-3}$    | $1.8649 \times 10^{3} $ $\pm 7.5799 \times 10^{-3}$   | $3.7308 \\ \pm 1.5164 \times 10^{-5}$ | $1.1322 \\ \pm 5.7448 \times 10^{-3}$ | $4.0588 \\ \pm 4.3289 \times 10^{-2}$ | 2.4135 |
| 7  | $2.9971 \times 10^{-2}$<br>$\pm 8.3472 \times 10^{-5}$              | $0.13899 \\ \pm 0.19336$                                | 7.4913<br>$\pm 9.6266 \times 10^{-4}$   | $1.8651 \times 10^{3}$ $\pm 7.2892 \times 10^{-3}$    | 3.7313<br>$\pm 1.4582 \times 10^{-5}$ | $1.1223 \\ \pm 8.133 \times 10^{-3}$  | 4.0993<br>$\pm 4.565 \times 10^{-2}$  | 2.305  |
| 8  | $3.0547 \times 10^{-2}$<br>$\pm 7.3134 \times 10^{-5}$              | $7.689 \times 10^{-2} \\ \pm 0.137$                     | 9.0992<br>$\pm 4.5824 \times 10^{-4}$   | $1.8667 \times 10^{3}$<br>$\pm 3.3343 \times 10^{-3}$ | $3.7344$ $\pm 6.6704 \times 10^{-6}$  | $1.1563 \\ \pm 2.8541 \times 10^{-3}$ | $4.2221 \\ \pm 2.0972 \times 10^{-2}$ | 2.4197 |
| 9  | $\begin{array}{c} 0.12445 \\ \pm 6.6391 \times 10^{-5} \end{array}$ | $-7.9889 \times 10^{-2}$<br>$\pm 3.0653 \times 10^{-2}$ | $-5.2047$ $\pm 1.0722 \times 10^{-4}$   | $1.9243 \times 10^{3} $ $\pm 7.9068 \times 10^{-4}$   | $3.8496$ $\pm 1.5818 \times 10^{-6}$  | $1.1798 \\ \pm 6.733 \times 10^{-4}$  | $4.2369 \\ \pm 4.9527 \times 10^{-3}$ | 9.8846 |
| 10 | 0.12426<br>$\pm 6.6295 \times 10^{-5}$                              | $0.15857 \\ \pm 3.0687 \times 10^{-2}$                  | $5.2049 \\ \pm 1.0727 \times 10^{-4}$   | $1.9347 \times 10^{3} $ $\pm 7.9035 \times 10^{-4}$   | $3.8704 \\ \pm 1.5811 \times 10^{-6}$ | $1.1786 \\ \pm 6.7192 \times 10^{-4}$ | $4.2221 \\ \pm 4.9526 \times 10^{-3}$ | 9.8944 |
| 11 | $6.2465 \times 10^{-2}$<br>$\pm 6.884 \times 10^{-5}$               | 0.25258<br>$\pm 6.3404 \times 10^{-2}$                  | $-3.3754$ $\pm 2.178 \times 10^{-4}$    | $1.9776 \times 10^{3}$<br>$\pm 1.6036 \times 10^{-3}$ | 3.9562<br>$\pm 3.2081 \times 10^{-6}$ | $1.1691 \\ \pm 1.3573 \times 10^{-3}$ | $4.3143 \\ \pm 1.0096 \times 10^{-2}$ | 5.0131 |
| 12 | $6.2179 \times 10^{-2}$<br>$\pm 7.1926 \times 10^{-5}$              | $0.17639 \\ \pm 6.6572 \times 10^{-2}$                  | -0.95487<br>$\pm 2.2621 \times 10^{-4}$ | $1.98 \times 10^3$<br>$\pm 1.6379 \times 10^{-3}$     | 3.9611<br>$\pm 3.2768 \times 10^{-6}$ | $1.177 \\ \pm 1.4144 \times 10^{-3}$  | $4.2355$ $\pm 1.0238 \times 10^{-2}$  | 5.1168 |
| 13 | $6.1615 \times 10^{-2}$<br>$\pm 7.1695 \times 10^{-5}$              | 0.22154<br>$\pm 6.6961 \times 10^{-2}$                  | 0.95455<br>$\pm 2.2701 \times 10^{-4}$  | $1.9819 \times 10^{3}$<br>$\pm 1.6432 \times 10^{-3}$ | 3.9649<br>$\pm 3.2872 \times 10^{-6}$ | $1.1718 \\ \pm 1.4146 \times 10^{-3}$ | $4.2149 \\ \pm 1.0303 \times 10^{-2}$ | 5.0659 |
| 14 | $6.084 \times 10^{-2} \\ \pm 6.8017 \times 10^{-5}$                 | $0.14567 \\ \pm 6.4577 \times 10^{-2}$                  | $3.3751 \\ \pm 2.2037 \times 10^{-4}$   | $1.9843 \times 10^{3} \\ \pm 1.6227 \times 10^{-3}$   | 3.9697<br>$\pm 3.2464 \times 10^{-6}$ | $1.1672 \\ \pm 1.3709 \times 10^{-3}$ | $4.1368 \\ \pm 1.0111 \times 10^{-2}$ | 4.8931 |

# 3.300 - 3.050 ppm

| Osc. | а                           | φ (°)                       | f <sub>1</sub> (Hz)         | f <sub>2</sub> (Hz)         | f <sub>2</sub> (ppm)        | $\eta_1 \; (s^{-1})$        | $\eta_2~(s^{-1})$           | ſ      |
|------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|--------|
| 1    | $6.1842 \times 10^{-2}$     | -0.6152                     | -10.342                     | $1.5556 \times 10^{3}$      | 3.112                       | 1.1828                      | 4.2346                      | E 0744 |
| 1    | $\pm 9.4564 \times 10^{-5}$ | $\pm 8.7276 \times 10^{-2}$ | $\pm 3.0315 \times 10^{-4}$ | $\pm 2.234 \times 10^{-3}$  | $\pm 4.4693 \times 10^{-6}$ | $\pm 1.9092 \times 10^{-3}$ | $\pm 1.3999 \times 10^{-2}$ | 5.0744 |
| 2    | $6.0853 \times 10^{-2}$     | -0.84239                    | -6.9951                     | $1.5589 \times 10^{3}$      | 3.1186                      | 1.1764                      | 4.0676                      | 4 7000 |
| 2    | $\pm 9.6647 \times 10^{-5}$ | $\pm 8.6615 \times 10^{-2}$ | $\pm 3.034 \times 10^{-4}$  | $\pm 2.2018 \times 10^{-3}$ | $\pm 4.4048 \times 10^{-6}$ | $\pm 1.9217 \times 10^{-3}$ | $\pm 1.4131 \times 10^{-2}$ | 4.7998 |
| 2    | $1.3962 \times 10^{-2}$     | -0.71928                    | -5.508                      | $1.5691 \times 10^{3}$      | 3.139                       | 2.4445                      | 3.4572                      | 1      |
| 3    | $\pm 1.7085 \times 10^{-4}$ | $\pm 1.4256$                | $\pm 1.1157 \times 10^{-2}$ | $\pm 7.2513 \times 10^{-3}$ | $\pm 1.4507 \times 10^{-5}$ | $\pm 1.903 \times 10^{-2}$  | $\pm 9.2825 \times 10^{-2}$ | 1      |
| 1    | $2.765 \times 10^{-2}$      | -0.87193                    | -3.7147                     | $1.5709 \times 10^{3}$      | 3.1426                      | 2.4041                      | 4.2538                      | 1 0470 |
| 4    | $\pm 1.4813 \times 10^{-4}$ | $\pm 0.63026$               | $\pm 3.4557 \times 10^{-3}$ | $\pm 9.3747 \times 10^{-3}$ | $\pm 1.8755 \times 10^{-5}$ | $\pm 1.0978 \times 10^{-2}$ | $\pm 5.7152 \times 10^{-2}$ | 1.9478 |
| 5    | $4.1381 \times 10^{-2}$     | -0.27305                    | -1.9161                     | $1.5727 \times 10^{3}$      | 3.1463                      | 3.2843                      | 5.5686                      | 2 6677 |
| 5    | $\pm 3.4202 \times 10^{-4}$ | $\pm 1.3453$                | $\pm 8.9799 \times 10^{-3}$ | $\pm 1.1527 \times 10^{-2}$ | $\pm 2.306 \times 10^{-5}$  | $\pm 1.939 \times 10^{-2}$  | $\pm 5.8007 \times 10^{-2}$ | 2.6677 |

| 6   | $5.9966 \times 10^{-2}$     | -0.965 32                   | 6.9995                      | $1.5729 \times 10^3$        | 3.1466                      | 1.1603                      | 4.0581                      | 4.7149    |
|-----|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------|
|     | $\pm 9.96 \times 10^{-5}$   | $\pm 0.15667$               | $\pm 3.6393 \times 10^{-4}$ | $\pm 3.1526 \times 10^{-3}$ | $\pm 6.3069 \times 10^{-6}$ | $\pm 2.0246 \times 10^{-3}$ | $\pm 1.5098 \times 10^{-2}$ |           |
| 7   | $9.285 \times 10^{-2}$      | -1.1916                     | $7.9001 \times 10^{-3}$     | $1.5746 \times 10^3$        | 3.1501                      | 5.8934                      | 8.3653                      | 5.1542    |
|     | $\pm 2.6273 \times 10^{-3}$ | $\pm 0.63408$               | $\pm 8.4533 \times 10^{-3}$ | $\pm 1.1056 \times 10^{-2}$ | $\pm 2.2119 \times 10^{-5}$ | $\pm 8.9921 \times 10^{-2}$ | $\pm 9.8365 \times 10^{-2}$ |           |
| 8   | $6.0081 \times 10^{-2}$     | -1.0637                     | 10.344                      | $1.5762 \times 10^3$        | 3.1534                      | 1.1637                      | 4.1066                      | 4.9713    |
| O   | $\pm 1.062 \times 10^{-4}$  | $\pm 9.7299 \times 10^{-2}$ | $\pm 3.3183 \times 10^{-4}$ | $\pm 2.2874 \times 10^{-3}$ | $\pm 4.5761 \times 10^{-6}$ | $\pm 1.949 \times 10^{-3}$  | $\pm 1.5949 \times 10^{-2}$ | 1.5710    |
| 9   | $4.1446 \times 10^{-2}$     | -1.6481                     | 1.9187                      | $1.5765 \times 10^3$        | 3.1538                      | 3.3416                      | 5.2742                      | 2.6792    |
| 9   | $\pm 8.8654 \times 10^{-4}$ | $\pm 2.9083$                | $\pm 1.8017 \times 10^{-2}$ | $\pm 2.8958 \times 10^{-2}$ | $\pm 5.7932 \times 10^{-5}$ | $\pm 4.2761 \times 10^{-2}$ | $\pm 7.2641 \times 10^{-2}$ | 2.0192    |
| 10  | $2.9081 \times 10^{-2}$     | -1.0427                     | 3.7248                      | $1.5783 \times 10^3$        | 3.1574                      | 2.4258                      | 4.5623                      | 2.0294    |
| 10  | $\pm 1.3838 \times 10^{-3}$ | $\pm 0.84464$               | $\pm 4.8871 \times 10^{-3}$ | $\pm 1.3879 \times 10^{-2}$ | $\pm 2.7765 \times 10^{-5}$ | $\pm 7.8366 \times 10^{-2}$ | $\pm 7.0813 \times 10^{-2}$ | 2.0294    |
| 11  | $1.5008 \times 10^{-2}$     | -1.0805                     | 5.5542                      | $1.58 \times 10^{3}$        | 3.1608                      | 2.4888                      | 3.7351                      | 1 0655    |
| 11  | $\pm 3.0856 \times 10^{-4}$ | $\pm 5.9242$                | $\pm 4.7055 \times 10^{-2}$ | $\pm 5.325 \times 10^{-2}$  | $\pm 1.0653 \times 10^{-4}$ | $\pm 5.8379 \times 10^{-2}$ | $\pm 0.13707$               | 1.0655    |
| 10  | $3.1258 \times 10^{-2}$     | -0.70782                    | -11.306                     | $1.5981 \times 10^{3}$      | 3.197                       | 1.1925                      | 4.2908                      | 0.2061    |
| 12  | $\pm 9.2975 \times 10^{-5}$ | $\pm 0.1745$                | $\pm 6.0699 \times 10^{-4}$ | $\pm 4.4698 \times 10^{-3}$ | $\pm 8.9421 \times 10^{-6}$ | $\pm 3.8078 \times 10^{-3}$ | $\pm 2.7719 \times 10^{-2}$ | 2.3261    |
| 10  | $2.5355 \times 10^{-2}$     | -1.0027                     | -7.0984                     | $1.6022 \times 10^{3}$      | 3.2053                      | 1.0764                      | 3.7033                      | 0.0507    |
| 13  | $\pm 6.669 \times 10^{-4}$  | $\pm 1.2454$                | $\pm 3.8636 \times 10^{-3}$ | $\pm 3.5891 \times 10^{-3}$ | $\pm 7.1802 \times 10^{-6}$ | $\pm 1.078 \times 10^{-2}$  | $\pm 5.0274 \times 10^{-2}$ | 2.0597    |
| 1.4 | $3.5088 \times 10^{-2}$     | -1.074                      | -6.8164                     | $1.6026 \times 10^{3}$      | 3.206                       | 1.2705                      | 4.13                        | 0.0004    |
| 14  | $\pm 5.5697 \times 10^{-4}$ | $\pm 1.1382$                | $\pm 1.7529 \times 10^{-3}$ | $\pm 7.0723 \times 10^{-3}$ | $\pm 1.4149 \times 10^{-5}$ | $\pm 2.2572 \times 10^{-2}$ | $\pm 3.0231 \times 10^{-2}$ | 2.8224    |
| 1 - | $3.1007 \times 10^{-2}$     | -0.67683                    | -2.5866                     | $1.6068 \times 10^{3}$      | 3.2144                      | 1.1737                      | 4.2383                      | 0.5006    |
| 15  | $\pm 9.3332 \times 10^{-5}$ | $\pm 0.1741$                | $\pm 5.9852 \times 10^{-4}$ | $\pm 4.4524 \times 10^{-3}$ | $\pm 8.9073 \times 10^{-6}$ | $\pm 3.7491 \times 10^{-3}$ | $\pm 2.7827 \times 10^{-2}$ | 2.5026    |
| 1.0 | $3.0314 \times 10^{-2}$     | -0.78093                    | 2.5921                      | $1.612 \times 10^{3}$       | 3.2248                      | 1.179                       | 4.001                       | 0.4400    |
| 16  | $\pm 9.4569 \times 10^{-5}$ | $\pm 0.17746$               | $\pm 6.0973 \times 10^{-4}$ | $\pm 4.4926 \times 10^{-3}$ | $\pm 8.9877 \times 10^{-6}$ | $\pm 3.7761 \times 10^{-3}$ | $\pm 2.8265 \times 10^{-2}$ | 2.4423    |
| 4 - | $6.6885 \times 10^{-2}$     | $-4.6314 \times 10^{-2}$    | 6.9499                      | $1.6163 \times 10^{3}$      | 3.2335                      | 1.8027                      | 4.4341                      | 4 0 4 4 7 |
| 17  | $\pm 1.1211 \times 10^{-4}$ | $\pm 0.11239$               | $\pm 5.8868 \times 10^{-4}$ | $\pm 2.7424 \times 10^{-3}$ | $\pm 5.4864 \times 10^{-6}$ | $\pm 2.8905 \times 10^{-3}$ | $\pm 1.6211 \times 10^{-2}$ | 4.9417    |
|     | $3.0024 \times 10^{-2}$     | $5.5964 \times 10^{-2}$     | 11.309                      | $1.6206 \times 10^{3}$      | 3.2422                      | 1.1616                      | 4.1071                      |           |
| 18  | $\pm 9.1565 \times 10^{-5}$ | ±0.17753                    | $\pm 6.0687 \times 10^{-4}$ | $\pm 4.5171 \times 10^{-3}$ | $\pm 9.0368 \times 10^{-6}$ | $\pm 3.7562 \times 10^{-3}$ | $\pm 2.793 \times 10^{-2}$  | 2.2388    |
|     |                             |                             |                             |                             |                             |                             |                             |           |

# 3.000 - 2.560 ppm

| Osc. | а   | φ (°)  | $f_1$ (Hz)                            | f <sub>2</sub> (Hz)                                   | $f_2$ (ppm)                          | $\eta_1 \; (s^{-1})$                  | $\eta_2~(\mathrm{s}^{-1})$            | $\int$ |
|------|---|--|---------------------------------------|---|--------------------------------------|---------------------------------------|---------------------------------------|--------|
| 1    | $6.0339 \times 10^{-2}$<br>+8.1333 × 10 <sup>-5</sup> | $9.8642 \times 10^{-2}$<br>$\pm 7.7863 \times 10^{-2}$ | $-12.902$ $\pm 2.6868 \times 10^{-4}$ | $1.3214 \times 10^{3}$<br>$\pm 1.9991 \times 10^{-3}$ | $2.6435$ $\pm 3.9993 \times 10^{-6}$ | $1.1595 \\ \pm 1.6725 \times 10^{-3}$ | $4.1606$ $\pm 1.2459 \times 10^{-2}$  | 4.4794 |
| 2    | $6.1176 \times 10^{-2}$<br>+8 207 × 10 <sup>-5</sup>  | 0.228 15   | -4.4398                               | $1.3298 \times 10^{3}$<br>$\pm 1.9879 \times 10^{-3}$ | 2.6604                               | $1.18$ $\pm 1.69 \times 10^{-3}$      | 4.1457<br>$\pm 1.2366 \times 10^{-2}$ | 4.9173 |

| 3  | $6.178 \times 10^{-2}$<br>$\pm 8.2436 \times 10^{-5}$  | 0.18298<br>$\pm 7.6626 \times 10^{-2}$  | 4.4379<br>$\pm 2.6806 \times 10^{-4}$  | $1.3387 \times 10^{3}$<br>$\pm 1.971 \times 10^{-3}$                              | $2.6782$ $\pm 3.9431 \times 10^{-6}$   | $1.179 \\ \pm 1.6816 \times 10^{-3}$                                 | 4.2097<br>$\pm 1.2386 \times 10^{-2}$ | 4.9599 |
|----|--|---|--|---|--|--|---------------------------------------|--------|
| 4  | $6.2241 \times 10^{-2} $ $\pm 8.2627 \times 10^{-5}$   | $0.13222 \\ \pm 7.6312 \times 10^{-2}$  | $12.903 \\ \pm 2.6747 \times 10^{-4}$  | $1.3472 \times 10^3 \\ \pm 1.9728 \times 10^{-3}$                                 | $\begin{array}{c} 2.6951 \\ \pm 3.9466 \times 10^{-6} \end{array}$                       | $\begin{array}{c} 1.1786 \\ \pm 1.6757 \times 10^{-3} \end{array}$   | $4.2799 \\ \pm 1.2365 \times 10^{-2}$ | 4.6115 |
| 5  | 0.12371<br>$\pm 8.2484 \times 10^{-5}$                 | -0.21115<br>$\pm 3.8314 \times 10^{-2}$ | $-7.399$ $\pm 1.3371 \times 10^{-4}$   | $1.3646 \times 10^{3}$<br>$\pm 9.8726 \times 10^{-4}$                             | $2.73$ $\pm 1.9751 \times 10^{-6}$   | 1.1775<br>$\pm 8.3883 \times 10^{-4}$                                | 4.2132<br>$\pm 6.1826 \times 10^{-3}$ | 9.233  |
| 6  | 0.12417<br>$\pm 8.2567 \times 10^{-5}$                 | 0.18268<br>$\pm 3.8211 \times 10^{-2}$  | 7.3995<br>$\pm 1.3348 \times 10^{-4}$  | $1.3794 \times 10^{3}$<br>$\pm 9.8573 \times 10^{-4}$                             | $2.7596$ $\pm 1.972 \times 10^{-6}$  | 1.1795<br>$\pm 8.3849 \times 10^{-4}$                                | $4.2234$ $\pm 6.1697 \times 10^{-3}$  | 9.2585 |
| 7  | $3.0754 \times 10^{-2}$<br>$\pm 8.2135 \times 10^{-5}$ | 0.1763<br>±0.15382                      | $-15.888$ $\pm 5.3586 \times 10^{-4}$  | $1.4225 \times 10^{3}$<br>$\pm 3.9438 \times 10^{-3}$                             | $2.8458$ $\pm 7.8898 \times 10^{-6}$   | $1.1801 \\ \pm 3.3732 \times 10^{-3}$                                | $4.1491 \\ \pm 2.4692 \times 10^{-2}$ | 2.4483 |
| 8  | $3.3261 \times 10^{-2}$<br>$\pm 5.7363 \times 10^{-4}$ | 0.274 56<br>±1.4755                     | -7.0877<br>$\pm 2.2104 \times 10^{-3}$ | $1.4312 \times 10^{3}$<br>$\pm 6.7909 \times 10^{-3}$                             | $2.8632$ $\pm 1.3586 \times 10^{-5}$   | $1.2307 \\ \pm 2.0359 \times 10^{-2}$                                | 4.2452<br>$\pm 5.1858 \times 10^{-2}$ | 2.6068 |
| 9  | $2.8041 \times 10^{-2}$<br>$\pm 6.2267 \times 10^{-4}$ | 0.240 84<br>±1.6262                     | $-6.8002$ $\pm 3.7005 \times 10^{-3}$  | $1.4317 \times 10^{3}$<br>$\pm 9.2865 \times 10^{-3}$                             | $2.8641 \\ \pm 1.8578 \times 10^{-5}$  | $ \begin{array}{c} 1.1265 \\ \pm 1.2458 \times 10^{-2} \end{array} $ | $4.1573 \\ \pm 4.7474 \times 10^{-2}$ | 2.3059 |
| 10 | $3.0635 \times 10^{-2}$<br>$\pm 8.3764 \times 10^{-5}$ | 0.351 93<br>±0.158 27                   | -1.9913<br>$\pm 5.4298 \times 10^{-4}$ | $1.4364 \times 10^{3}$<br>$\pm 4.0488 \times 10^{-3}$                             | 2.8736<br>$\pm 8.0998 \times 10^{-6}$  | 1.1702<br>$\pm 3.3864 \times 10^{-3}$                                | 4.2518<br>$\pm 2.5136 \times 10^{-2}$ | 2.2962 |
| 11 | $2.9378 \times 10^{-2}$<br>$\pm 8.0962 \times 10^{-5}$ | 0.429 61<br>±0.160 41                   | 1.9881<br>$\pm 5.4105 \times 10^{-4}$  | $1.4404 \times 10^{3}$<br>$\pm 4.0243 \times 10^{-3}$                             | $2.8816$ $\pm 8.0509 \times 10^{-6}$   | $1.1355 \\ \pm 3.2949 \times 10^{-3}$                                | 4.0183<br>$\pm 2.5277 \times 10^{-2}$ | 2.214  |
| 12 | $2.9758 \times 10^{-2}$<br>$\pm 1.6836 \times 10^{-4}$ | 0.396 28<br>±0.440 01                   | $6.8093$ $\pm 1.4037 \times 10^{-3}$   | $1.4452 \times 10^{3}$<br>$\pm 6.8275 \times 10^{-3}$                             | $2.8912$ $\pm 1.3659 \times 10^{-5}$   | $1.182$ $\pm 9.9209 \times 10^{-3}$                                  | 3.8343<br>$\pm 4.0085 \times 10^{-2}$ | 2.449  |
| 13 | $2.9299 \times 10^{-2}$<br>$\pm 2.5182 \times 10^{-4}$ | 0.403 36<br>±0.282 84                   | $7.0884$ $\pm 1.5133 \times 10^{-3}$   | $1.4455 \times 10^{3}$<br>$\pm 6.2977 \times 10^{-3}$                             | $2.8917 \\ \pm 1.2599 \times 10^{-5}$  | $ \begin{array}{c} 1.1678 \\ \pm 8.7023 \times 10^{-3} \end{array} $ | 3.6717<br>$\pm 3.9487 \times 10^{-2}$ | 2.3588 |
| 14 | $3.0957 \times 10^{-2}$<br>$\pm 8.2645 \times 10^{-5}$ | 0.209 36<br>±0.153 33                   | 15.889<br>$\pm 5.3722 \times 10^{-4}$  | $ \begin{array}{c} 1.4543 \times 10^{3} \\ \pm 3.963 \times 10^{-3} \end{array} $ | $ \begin{array}{c} 1.2399 \times 10 \\ 2.9094 \\ \pm 7.9282 \times 10^{-6} \end{array} $ | $ \begin{array}{c} 1.1918 \\ \pm 3.4175 \times 10^{-3} \end{array} $ | $4.1741 \pm 2.4592 \times 10^{-2}$    | 2.4551 |

# 2.450 - 2.250 ppm

| Osc. | а                           | φ (°)                    | $f_1$ (Hz)                  | f <sub>2</sub> (Hz)         | $f_2$ (ppm)                 | $\eta_1~(s^{-1})$           | $\eta_2~(\mathrm{s}^{-1})$  | ſ      |
|------|-----------------------------|--------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|--------|
| 1    | $3.0941 \times 10^{-2}$     | -0.44138                 | -11.394                     | $1.1684 \times 10^{3}$      | 2.3374                      | 1.1746                      | 4.2731                      | 2.3548 |
| 1    | $\pm 6.0439 \times 10^{-5}$ | $\pm 0.11575$            | $\pm 4.1554 \times 10^{-4}$ | $\pm 2.9971 \times 10^{-3}$ | $\pm 5.9958 \times 10^{-6}$ | $\pm 2.5599 \times 10^{-3}$ | $\pm 1.8986 \times 10^{-2}$ |        |
| 2    | $2.8339 \times 10^{-2}$     | $-5.341 \times 10^{-2}$  | -7.2882                     | $1.1724 \times 10^{3}$      | 2.3455                      | 1.1205                      | 4.0558                      | 0.0000 |
| 2    | $\pm 2.0865 \times 10^{-3}$ | $\pm 5.9039$             | $\pm 1.1976 \times 10^{-2}$ | $\pm 1.6962 \times 10^{-2}$ | $\pm 3.3933 \times 10^{-5}$ | $\pm 6.632 \times 10^{-3}$  | $\pm 2.7012 \times 10^{-2}$ | 2.2922 |
| 3    | $3.2634 \times 10^{-2}$     | $-9.2074 \times 10^{-2}$ | -7.07                       | $1.1727 \times 10^{3}$      | 2.3461                      | 1.1898                      | 3.9833                      | 2 570  |
|      | $\pm 1.8636 \times 10^{-3}$ | $\pm 5.4003$             | $\pm 1.8956 \times 10^{-3}$ | $\pm 6.3935 \times 10^{-3}$ | $\pm 1.279 \times 10^{-5}$  | $\pm 6.931 \times 10^{-2}$  | $\pm 8.8222 \times 10^{-2}$ | 2.578  |

| 4 | $3.0742 \times 10^{-2}$<br>$\pm 6.3667 \times 10^{-5}$ | $6.9511 \times 10^{-2} \\ \pm 0.10898$ | $-2.9561$ $\pm 4.0448 \times 10^{-4}$ | $1.1768 \times 10^{3}$<br>$\pm 3.0125 \times 10^{-3}$ | $2.3543 \\ \pm 6.0267 \times 10^{-6}$ | $1.1668 \\ \pm 2.5979 \times 10^{-3}$ | $4.2488$ $\pm 1.8927 \times 10^{-2}$  | 2.5344 |
|---|--|--|---------------------------------------|---|---------------------------------------|---------------------------------------|---------------------------------------|--------|
| 5 | $3.0357 \times 10^{-2}$<br>$\pm 6.3746 \times 10^{-5}$ | -0.512 08                              | 2.9566                                | $1.1827 \times 10^3$<br>$\pm 3.0929 \times 10^{-3}$   | 2.3661                                | 1.1603                                | $4.1567 \\ \pm 1.9372 \times 10^{-2}$ | 2.5132 |
| C | $\pm 6.3746 \times 10^{-2}$ 6.552 × 10 <sup>-2</sup>   | ±0.121 07<br>0.2367                    | $\pm 4.1641 \times 10^{-4}$ 7.1739    | $\pm 3.0929 \times 10^{-9}$ $1.1869 \times 10^{3}$    | ±0.1876 × 10 ° 2.3745                 | ±2.5895 × 10 ° 1.565                  | ±1.9372 × 10 = 4.2908                 |        |
| 6 | $\pm 7.28 \times 10^{-5}$                              | $\pm 6.6696 \times 10^{-2}$            | $\pm 3.1203 \times 10^{-4}$           |   | $\pm 3.3879 \times 10^{-6}$           | $\pm 1.7276 \times 10^{-3}$           | $\pm 1.0531 \times 10^{-2}$           | 5.0145 |
| 7 | $3.1202 \times 10^{-2}$<br>$\pm 6.451 \times 10^{-5}$  | 0.622 07<br>+0 119 42                  | 11.393<br>$\pm 4.1517 \times 10^{-4}$ | $1.1912 \times 10^3$<br>$\pm 3.0783 \times 10^{-3}$   | $2.383$ $\pm 6.1583 \times 10^{-6}$   | 1.1836 +2 6144 × 10 <sup>-3</sup>     | 4.2266<br>+1 9057 × 10 <sup>-2</sup>  | 2.3747 |
|   | _U. IUI / IU   | ±0.115 +2                              | _ 1.1011 × 10                         | ±0.0100 × 10  | ±0.1303 × 10                          | ±2.0111 × 10                          | ±1.5051 × 10                          |        |

#### 2.000 - 1.740 ppm

| Osc. | а   | φ (°)  | f <sub>1</sub> (Hz)                   | f <sub>2</sub> (Hz)                   | <i>f</i> <sub>2</sub> (ppm)  | $\eta_1$ (s $^{-1}$ )  | $\eta_2~(\mathrm{s}^{-1})$            | ſ      |
|------|---|--|---------------------------------------|---------------------------------------|--|--|---------------------------------------|--------|
| 1    | $0.12441$ $\pm 6.4826 \times 10^{-5}$                               | -0.18344<br>$\pm 3.024 \times 10^{-2}$                 | $-6.6488$ $\pm 1.0446 \times 10^{-4}$ | $938.04 \\ \pm 7.7242 \times 10^{-4}$ | $1.8766 \\ \pm 1.5453 \times 10^{-6}$                              | $1.1782 \\ \pm 6.5108 \times 10^{-4}$                              | 4.2677<br>$\pm 4.8173 \times 10^{-3}$ | 9.2184 |
| 2    | $6.3585 \times 10^{-2}$<br>$\pm 3.8503 \times 10^{-4}$              | 0.156 62<br>±0.469 93                                  | $-2.4349$ $\pm 7.9846 \times 10^{-4}$ | $942.21 \\ \pm 2.5369 \times 10^{-3}$ | $1.8849 \\ \pm 5.0753 \times 10^{-6}$                              | $1.1948 \\ \pm 6.5657 \times 10^{-3}$                              | $4.0622 \\ \pm 1.7265 \times 10^{-2}$ | 5.1208 |
| 3    | $5.5414 \times 10^{-2}$<br>$\pm 4.0903 \times 10^{-4}$              | $8.8805 \times 10^{-2} \\ \pm 0.50511$                 | $-2.1362$ $\pm 1.1783 \times 10^{-3}$ | $942.61 \\ \pm 3.0575 \times 10^{-3}$ | $1.8858 \\ \pm 6.1168 \times 10^{-6}$                              | $1.0997 \\ \pm 4.5718 \times 10^{-3}$                              | $4.0314$ $\pm 1.718 \times 10^{-2}$   | 4.6499 |
| 4    | $6.0592 \times 10^{-2}$<br>$\pm 4.3442 \times 10^{-4}$              | $0.13519\ \pm 0.45979$                                 | $2.1405 \\ \pm 7.9006 \times 10^{-4}$ | $946.83$ $\pm 2.5688 \times 10^{-3}$  | $1.8942 \\ \pm 5.139 \times 10^{-6}$                               | $1.1614 \\ \pm 6.97 \times 10^{-3}$                                | $4.2332 \\ \pm 1.6934 \times 10^{-2}$ | 4.9797 |
| 5    | $5.9868 \times 10^{-2}$<br>$\pm 4.6163 \times 10^{-4}$              | 0.118 16<br>±0.438 83                                  | $2.4393 \\ \pm 1.1305 \times 10^{-3}$ | $947.1 \\ \pm 2.7193 \times 10^{-3}$  | $1.8947 \\ \pm 5.4402 \times 10^{-6}$                              | $1.1638 \\ \pm 4.8113 \times 10^{-3}$                              | $4.0425 \\ \pm 1.5984 \times 10^{-2}$ | 4.8575 |
| 6    | $\begin{array}{c} 0.12518 \\ \pm 6.5484 \times 10^{-5} \end{array}$ | $8.1265 \times 10^{-2}$<br>$\pm 2.9899 \times 10^{-2}$ | $6.6487 \\ \pm 1.0415 \times 10^{-4}$ | $951.34 \\ \pm 7.6764 \times 10^{-4}$ | $\begin{array}{c} 1.9032 \\ \pm 1.5357 \times 10^{-6} \end{array}$ | $\begin{array}{c} 1.1896 \\ \pm 6.5821 \times 10^{-4} \end{array}$ | $4.2412 \\ \pm 4.8074 \times 10^{-3}$ | 9.2963 |

#### 1.550 - 1.350 ppm

| Osc. | а  | φ (°)                 | $f_1$ (Hz)                            | f <sub>2</sub> (Hz)             | <i>f</i> <sub>2</sub> (ppm)         | $\eta_1~(\mathrm{s}^{-1})$            | $\eta_2~(\mathrm{s}^{-1})$           | ſ      |
|------|--|-----------------------|---------------------------------------|---------------------------------|-------------------------------------|---------------------------------------|--------------------------------------|--------|
| 1    | $3.0558 \times 10^{-2}$<br>$\pm 6.7171 \times 10^{-5}$ | 0.175 11<br>±0.127 61 | $-9.3665$ $\pm 4.2517 \times 10^{-4}$ | $721.32 +3.0807 \times 10^{-3}$ | $1.443$ $\pm 6.1631 \times 10^{-6}$ | 1.1598<br>$\pm 2.6322 \times 10^{-3}$ | $4.1608$ $\pm 1.9333 \times 10^{-2}$ | 2.3951 |

| 2 | $3.0215 \times 10^{-2}$<br>$\pm 1.6381 \times 10^{-4}$ | 0.283 54<br>±0.322 51                     | $-7.4047$ $\pm 8.9629 \times 10^{-4}$  | $723.27$ $\pm 4.0331 \times 10^{-3}$  | $1.4469$ $\pm 8.0683 \times 10^{-6}$                               | $\begin{array}{c} 1.1772 \\ \pm 5.3245 \times 10^{-3} \end{array}$ | 3.9657<br>$\pm 2.4802 \times 10^{-2}$ | 2.2569 |
|---|--|---|--|---------------------------------------|--|--|---------------------------------------|--------|
| 3 | $2.9827 \times 10^{-2}$<br>$\pm 1.6032 \times 10^{-4}$ | $-1.8584 \times 10^{-3}$<br>$\pm 0.32914$ | -6.9456<br>$\pm 8.8552 \times 10^{-4}$ | $723.74$ $\pm 4.0686 \times 10^{-3}$  | 1.4479<br>$\pm 8.1394 \times 10^{-6}$                              | $1.1583 \\ \pm 5.3234 \times 10^{-3}$                              | 3.9685<br>$\pm 2.4812 \times 10^{-2}$ | 2.4146 |
| 4 | $3.0731 \times 10^{-2}$<br>$\pm 6.7421 \times 10^{-5}$ | $-5.3767 \times 10^{-2} \\ \pm 0.12741$   | $-4.9841$ $\pm 4.265 \times 10^{-4}$   | $725.69 \\ \pm 3.0788 \times 10^{-3}$ | $1.4518 \\ \pm 6.1592 \times 10^{-6}$                              | $1.1658 \\ \pm 2.6367 \times 10^{-3}$                              | 4.176<br>$\pm 1.9299 \times 10^{-2}$  | 2.3874 |
| 5 | $3.0256 \times 10^{-2}$<br>$\pm 6.7118 \times 10^{-5}$ | $0.3603 \pm 0.1289$                       | 4.9818<br>$\pm 4.2812 \times 10^{-4}$  | 735.67<br>$\pm 3.1044 \times 10^{-3}$ | $1.4717 \\ \pm 6.2105 \times 10^{-6}$                              | $1.166 \\ \pm 2.6689 \times 10^{-3}$                               | $4.0521 \\ \pm 1.9267 \times 10^{-2}$ | 2.3671 |
| 6 | $3.0453 \times 10^{-2}$<br>$\pm 1.6411 \times 10^{-4}$ | $0.55268 \pm 0.33055$                     | 6.9453<br>$\pm 8.7757 \times 10^{-4}$  | $737.59 \\ \pm 4.0507 \times 10^{-3}$ | $1.4756 \\ \pm 8.1037 \times 10^{-6}$                              | $\begin{array}{c} 1.1822 \\ \pm 5.5247 \times 10^{-3} \end{array}$ | $4.0044 \\ \pm 2.4946 \times 10^{-2}$ | 2.4549 |
| 7 | $3.0372 \times 10^{-2}$<br>$\pm 1.7145 \times 10^{-4}$ | $0.45466 \\ \pm 0.31693$                  | 7.4044<br>$\pm 8.9191 \times 10^{-4}$  | $738.08 \\ \pm 4.0721 \times 10^{-3}$ | $1.4766 \\ \pm 8.1465 \times 10^{-6}$                              | $1.1792 \\ \pm 5.4154 \times 10^{-3}$                              | 3.9902<br>$\pm 2.4828 \times 10^{-2}$ | 2.2722 |
| 8 | $3.034 \times 10^{-2}$<br>$\pm 6.7035 \times 10^{-5}$  | $0.10893\ \pm 0.12894$                    | 9.3663<br>$\pm 4.2874 \times 10^{-4}$  | $740.03 \\ \pm 3.0965 \times 10^{-3}$ | $\begin{array}{c} 1.4805 \\ \pm 6.1946 \times 10^{-6} \end{array}$ | $1.1754 \\ \pm 2.6852 \times 10^{-3}$                              | $4.0105 \\ \pm 1.9195 \times 10^{-2}$ | 2.3857 |

# 1.350 - 1.200 ppm

| Osc. | а                           | φ (°)                       | $f_1$ (Hz)                  | f <sub>2</sub> (Hz)         | <i>f</i> <sub>2</sub> (ppm) | $\eta_1~(\mathrm{s}^{-1})$  | $\eta_2~(\mathrm{s}^{-1})$  | $\int$ |
|------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|--------|
| 1    | $3.0525 \times 10^{-2}$     | 0.40003                     | -8.5024                     | 629.31                      | 1.259                       | 1.1625                      | 4.1912                      | 0.4506 |
| 1    | $\pm 6.1043 \times 10^{-5}$ | $\pm 0.11549$               | $\pm 3.9777 \times 10^{-4}$ | $\pm 2.9419 \times 10^{-3}$ | $\pm 5.8854 \times 10^{-6}$ | $\pm 2.4631 \times 10^{-3}$ | $\pm 1.842 \times 10^{-2}$  | 2.4526 |
| 2    | $6.1701 \times 10^{-2}$     | 0.37253                     | -5.2044                     | 632.58                      | 1.2655                      | 1.1779                      | 4.167                       | 4 0202 |
| 2    | $\pm 6.2112 \times 10^{-5}$ | $\pm 5.8143 \times 10^{-2}$ | $\pm 2.0015 \times 10^{-4}$ | $\pm 1.4734 \times 10^{-3}$ | $\pm 2.9477 \times 10^{-6}$ | $\pm 1.2527 \times 10^{-3}$ | $\pm 9.1825 \times 10^{-3}$ | 4.9202 |
| 3    | $3.0036 \times 10^{-2}$     | 0.73453                     | -1.9116                     | 635.89                      | 1.2721                      | 1.1437                      | 4.1451                      | 2.2635 |
| 3    | $\pm 6.079 \times 10^{-5}$  | $\pm 0.11798$               | $\pm 3.9873 \times 10^{-4}$ | $\pm 2.9741 \times 10^{-3}$ | $\pm 5.9499 \times 10^{-6}$ | $\pm 2.4408 \times 10^{-3}$ | $\pm 1.8536 \times 10^{-2}$ |        |
| 4    | $3.0811 \times 10^{-2}$     | 0.65548                     | 1.9082                      | 639.71                      | 1.2798                      | 1.1664                      | 4.2597                      | 2.3174 |
| 4    | $\pm 6.1995 \times 10^{-5}$ | $\pm 0.11616$               | $\pm 3.992 \times 10^{-4}$  | $\pm 2.9559 \times 10^{-3}$ | $\pm 5.9134 \times 10^{-6}$ | $\pm 2.4777 \times 10^{-3}$ | $\pm 1.8512 \times 10^{-2}$ |        |
| 5    | $6.2105 \times 10^{-2}$     | 0.505 18                    | 5.2037                      | 643                         | 1.2863                      | 1.1837                      | 4.1873                      | 4.9409 |
| 5    | $\pm 6.2455 \times 10^{-5}$ | $\pm 5.7868 \times 10^{-2}$ | $\pm 1.9996 \times 10^{-4}$ | $\pm 1.4682 \times 10^{-3}$ | $\pm 2.9371 \times 10^{-6}$ | $\pm 1.2578 \times 10^{-3}$ | $\pm 9.1811 \times 10^{-3}$ |        |
| 6    | $3.0573 \times 10^{-2}$     | 0.605 54                    | 8.5006                      | 646.27                      | 1.2929                      | 1.1643                      | 4.1993                      | 0.4505 |
| 6    | $\pm 6.1039 \times 10^{-5}$ | $\pm 0.11559$               | $\pm 3.9789 \times 10^{-4}$ | $\pm 2.9553 \times 10^{-3}$ | $\pm 5.9122 \times 10^{-6}$ | $\pm 2.4672 \times 10^{-3}$ | $\pm 1.8339 \times 10^{-2}$ | 2.4585 |

Estimation performed using NMR-EsPy.

Author: Simon Hulse For more information:



https://foroozandehgroup.github.io/NMR-EsPy



https://github.com/foroozandehgroup/NMR-EsPy



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