Supplimentary data

Four-point measurement

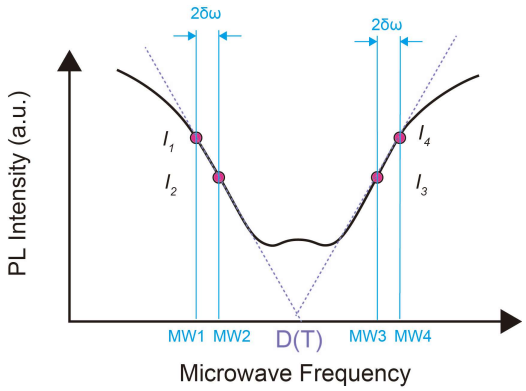

Figure S1 Four point measurement

The fluorescence intensities for four frequency points were acquired to estimate the ODMR shift. The center frequency and temperature change can be estimated as follows[1]:

$$\delta\Omega = \delta\omega \frac{(I_1 + I_2) - (I_3 + I_4)}{(I_1 - I_2) - (I_3 - I_4)},$$

$$\delta T_{NV} = \frac{1}{dD/dT}\delta\Omega,$$

where I_1 to I_4 denote photon count at four microwave points, $\delta\Omega$ is ODMR frequency shift, $2\delta\omega$ is the separation of microwave frequency between MW1 and MW2, MW3 and MW4 as shown in Fig .S1, and δT_{NV} is the temperature change.

Residual magnetic field

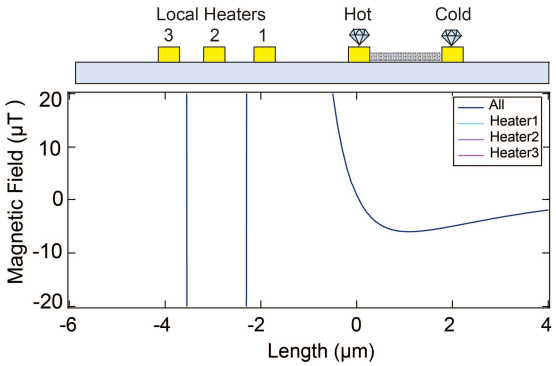

Figure S2 Calculated magnetic field (Magnified view of Fig.2(a))

In this study, the magnetic field was canceled out. However, calculations show that a residual field of approximately 5 μT remains. This field was smaller than the geomagnetic field (~46 μT). The magnetic field splits the ODMR symmetrically and does not affect the center frequency shift. The splitting width [2] due to weak magnetic field (B) and zero field splitting (E) is given by $\nu_{\pm} = \sqrt{E^2 + (g\mu_B B/h)^2}$ if the magnetic field is parallel to the NV axis. Substituting E = 5 MHz and B = 5 μT results in a difference of about 4 kHz compared to B = 0 T, and this value was sufficiently small.

The effect of magnetic field with zigzag type local heater

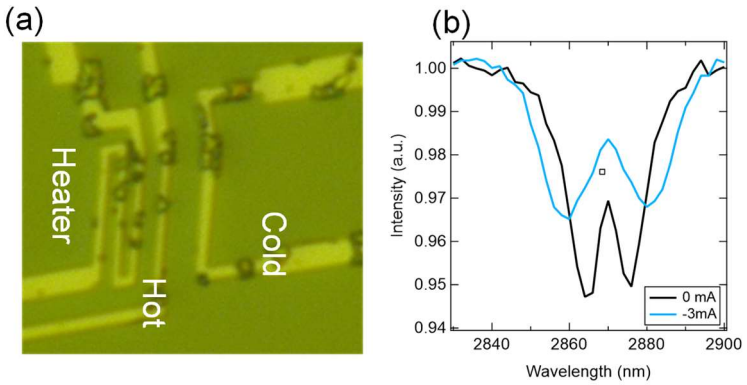

Figure S3 (a) Optical image of the sample with zigzag type local heater. (b)ODMR spectra

Fig. 2 shows the magnetic field cancellation by the three heaters. An example of a Zigzag heater is shown in Fig. S3(a). A Zigzag-type heater was placed near the hot electrode. When current was applied to the heater, the ODMR signal split significantly as shown in Fig. S3(b). Four-point measurement was not applicable as the selected four points were out of the range and linear approximation was no longer possible due to the Zeeman splitting.

[1] M. Fujiwara, A. Dohms, K. Suto, Y. Nishimura, K. Oshimi, Y. Teki, K. Cai, O. Benson and Y. Shikano, Phys. Rev. Res. **2**, 1 (2020).

[2] L. Rondin, J. P. Tetienne, T. Hingant, J. F. Roch, P. Maletinsky and V. Jacques, Reports Prog. Phys. **77**, 056503 (2014).