Bureau
International des
Poids et
Mesures

Approved by the CIPM in October 2015

RECOMMENDED VALUES OF STANDARD FREQUENCIES FOR APPLICATIONS INCLUDING THE PRACTICAL REALIZATION OF THE METRE AND SECONDARY REPRESENTATIONS OF THE DEFINITION OF THE SECOND

RUBIDIUM ($\lambda \approx 780$ nm)

^{87}Rb atom, crossover transition between the *d* and *f* hyperfine components of the saturated absorption at 780 nm (D2 transition)

1. **Recommended value [1] of the frequency:**

    $f\,(^{87}\text{Rb}_{d/f\ \text{crossover}}) = 384\ 227\ 981.9$ MHz

    equivalent to

    $\lambda(^{87}\text{Rb}_{d/f\ \text{crossover}}) = 780\ 246\ 291.6$ fm,

    with an estimated relative standard uncertainty of 5×10^{-10} applies to the radiation of a tunable Extended Cavity Diode Laser, stabilized to the *d/f* saturated absorption line in a well characterized magnetically shielded rubidium absorption cell by the third-harmonic technique,

    - cell temperature $(22.5 \pm 1)°$C
    - frequency modulation width, peak-to-peak, (5 ± 1) MHz;
    - saturating beam intensity of (120 ± 20) mW cm^{-2}

2. **Source data**

    Adopted value: $f = 384\ 227\ 981.9$ MHz $u_c/y = 5 \times 10^{-10}$

    calculated from

$f\,(^{87}\text{Rb}_{d/f\ \text{crossover}})$ / kHz	u_c/y	source data
384 227 981 877.3 (5.5)	1.5×10^{-11}	[2]
384 227 981 867.8 (165)	4.3×10^{-10}	[3]

as a weighted mean. The fractional uncertainty was evaluated to be approximately 4.3×10^{-10} for a 0.01 s averaging time [3]. For the recommendation this uncertainty was rounded to 5×10^{-10}.

3. **References**

[1] CIPM Recommendation 2 (CI-2015): Updates to the list of standard frequencies
http://www.bipm.org/jsp/en/CIPMRecommendations.jsp

[2] J. Ye, S. Swartz, P. Jungner, and J. L. Hall, "Hyperfine structure and absolute frequency of the ^{87}Rb 5P$_{3/2}$ state", Opt. Lett. **21**, 1280 (1996).

[3] Y. Bitou, K. Sasaki, H. Inaba, F.-L. Hong, A. Onae, "Rubidium-stabilized diode laser for high-precision interferometer", Opt. Eng. **43,** 900 (2004).