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## $^{12}\text{C}^{16}\text{O}$ Laser Frequency Tables for the 34.2 to 62.3 THz (1139 to 2079 $\text{cm}^{-1}$ ) Region

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**A. Stahn\***  
**W. Urban\***

Time and Frequency Division  
Center for Basic Standards  
National Measurement Laboratory  
National Bureau of Standards  
Boulder, Colorado 80303-3328

\*Institut für Angewandte Physik  
Universität Bonn  
Wegelerstr. 8  
5300 Bonn 1  
West Germany



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$^{12}\text{C}^{16}\text{O}$  Laser Frequency Tables for the  
34.2 to 62.3 THz (1139 to 2079  $\text{cm}^{-1}$ ) Region

M. Schneider\*, K.M. Evenson, M.D. Vanek,  
D.A. Jennings, J.S. Wells, A. Stahn\*, W. Urban\*  
National Bureau of Standards  
Boulder, Colorado 80303-3328

Frequencies for  $^{12}\text{C}^{16}\text{O}$  laser transitions are tabulated for the spectral range from 34.2 to 62.3 THz (1139 to 2079  $\text{cm}^{-1}$ ). The transition frequencies were calculated using molecular constants which were derived from heterodyne frequency measurements on the  $^{12}\text{C}^{16}\text{O}$  laser.

Key words: carbon monoxide laser;  $^{12}\text{C}^{16}\text{O}$  laser spectra; frequency tables; infrared; IR calibration frequencies.

Calculated CO laser frequencies are tabulated for transitions over a spectral range from 34.2 to 62.3 THz (1139 to 2079  $\text{cm}^{-1}$ ). They correspond to transitions with lower vibrational quantum numbers ranging from  $v'' = 2$  to  $v'' = 37$  and with lower rotational quantum numbers between  $J''=3$  and  $J''=26$ . The calculations are based on heterodyne frequency measurements of CO laser transitions [1]. A pair of  $\text{CO}_2$  lasers was used as references for these measurements. Altogether 140 CO laser frequencies were measured, 48 of them were Doppler-free. The transition frequencies were fitted to the Dunham expression in which the energy of any vibrational-rotational level is given by the expansion:

$$E(v,J) = \sum_{k,l} Y_{k,l} (v+1/2)^k (J(J+1))^l . \quad (1)$$

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\* from Institut für Angewandte Physik, Universität Bonn,  
Wegelerstr. 8, 5300 Bonn 1, W. Germany

In order to improve the fit, we also used a number of CO transition frequencies from previous works [2,3,4]. For further details about the heterodyne measurements of the CO laser frequencies and the data handling, refer to ref. [1].

The CO frequencies tabulated in this work are calculated using eq (1); they are based on the set of Dunham coefficients given in ref. [1] and reproduced in table 1.

The CO laser transition frequencies tabulated in table 2 are ordered with respect to the different vibrational bands. The assignment of a transition,  $P(J'')_{v''}$ , follows the convention where  $v''$  and  $J''$  are the vibrational and rotational quantum numbers of the lower state of the lasing transition.

The accuracy of the listed CO transitions varies according to the uncertainty and spectral distribution of the measurements which determine the constants of table 1. We estimate an absolute uncertainty in the frequencies of  $\pm 200$  kHz in the frequency region between 50.6 THz and 57.5 THz ( $1688 \text{ cm}^{-1}$  and  $1918 \text{ cm}^{-1}$ ).

The uncertainty in the rest of the tabulation is best described by breaking it into two parts. For the CO transitions which normally lase, we estimate an uncertainty of  $\pm 2$  MHz. (For example, this might include the  $7 \leq J'' \leq 16$  region for liquid-nitrogen-cooled operation and  $10 \leq J'' \leq 20$  for sealed-off operation with dry-ice and alcohol cooling.) However, for those transitions with rotational and vibrational quantum numbers outside the region covered by the fit in ref. [1], the corresponding accuracy becomes worse. For more detailed information, see ref. [1], especially figure 2.

Table 1. Dunham coefficients for  $^{12}\text{C}^{16}\text{O}$  laser lines

Coef.:	Value [MHz]	Uncertainty [MHz]
$Y_{01}$	0.5789834412D+05	(0.784D-02)
$Y_{02}$	-0.1835195249D+00	(0.216D-04)
$Y_{03}$	0.1730174733D-06	(0.228D-07)
$Y_{10}$	0.6504933627D+08	(0.116D+01)
$Y_{11}$	-0.5247559337D+03	(0.928D-03)
$Y_{12}$	0.2718413289D-04	(0.192D-05)
$Y_{13}$	-0.4534252199D-08 <sup>a</sup>	
$Y_{20}$	-0.3983542578D+06	(0.658D+00)
$Y_{21}$	0.1507565858D-01	(0.190D-03)
$Y_{22}$	-0.3793618583D-05	(0.214D-06)
$Y_{23}$	-0.4410831745D-10 <sup>a</sup>	
$Y_{30}$	0.3108285993D+03	(0.139D+00)
$Y_{31}$	0.4646472836D-03	(0.911D-05)
$Y_{32}$	-0.1076462931D-06	(0.577D-08)
$Y_{40}$	0.2217510379D+01	(0.154D-01)
$Y_{41}$	0.4092398185D-04	(0.123D-06)
$Y_{42}$	0.4978153305D-08 <sup>a</sup>	
$Y_{50}$	-0.3556930730D-02	(0.102D-02)
$Y_{51}$	-0.1747762292D-06 <sup>a</sup>	
$Y_{52}$	-0.1413396166D-09 <sup>a</sup>	
$Y_{60}$	0.3837288335D-03	(0.404D-04)
$Y_{61}$	-0.4299405019D-07 <sup>a</sup>	
$Y_{70}$	-0.3260895808D-04	(0.954D-06)
$Y_{80}$	0.4589172485D-06	(0.123D-07)
$Y_{90}$	-0.2917514858D-08	(0.668D-10)

<sup>a</sup>Fixed at the value indicated.

Table 2. Tables of  $^{12}\text{C}^{16}\text{O}$  laser transitions

Vibrational band: $\nu = 3 \rightarrow 2$			Vibrational band: $\nu = 4 \rightarrow 3$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_2$	62325278.44	2078.94751	$P(3)_3$	61538573.83	2052.70587
$P(4)_2$	62208984.59	2075.06837	$P(4)_3$	61423329.54	2048.86173
$P(5)_2$	62091659.05	2071.15481	$P(5)_3$	61307053.67	2044.98319
$P(6)_2$	61973306.23	2067.20698	$P(6)_3$	61189750.60	2041.07038
$P(7)_2$	61853930.54	2063.22504	$P(7)_3$	61071424.74	2037.12345
$P(8)_2$	61733536.36	2059.20912	$P(8)_3$	60952080.49	2033.14256
$P(9)_2$	61612128.11	2055.15938	$P(9)_3$	60831722.24	2029.12784
$P(10)_2$	61489710.17	2051.07595	$P(10)_3$	60710354.40	2025.07944
$P(11)_2$	61366286.96	2046.95900	$P(11)_3$	60587981.35	2020.99752
$P(12)_2$	61241862.86	2042.80866	$P(12)_3$	60464607.51	2016.88221
$P(13)_2$	61116442.28	2038.62508	$P(13)_3$	60340237.25	2012.73366
$P(14)_2$	60990029.59	2034.40840	$P(14)_3$	60214874.97	2008.55203
$P(15)_2$	60862629.21	2030.15878	$P(15)_3$	60088525.06	2004.33745
$P(16)_2$	60734245.52	2025.87637	$P(16)_3$	59961191.91	2000.09007
$P(17)_2$	60604882.90	2021.56129	$P(17)_3$	59832879.90	1995.81004
$P(18)_2$	60474545.74	2017.21371	$P(18)_3$	59703593.41	1991.49751
$P(19)_2$	60343238.43	2012.83377	$P(19)_3$	59573336.84	1987.15262
$P(20)_2$	60210965.34	2008.42162	$P(20)_3$	59442114.54	1982.77552
$P(21)_2$	60077730.86	2003.97739	$P(21)_3$	59309930.90	1978.36634
$P(22)_2$	59943539.36	1999.50125	$P(22)_3$	59176790.29	1973.92525
$P(23)_2$	59808395.22	1994.99332	$P(23)_3$	59042697.08	1969.45238
$P(24)_2$	59672302.79	1990.45377	$P(24)_3$	58907655.63	1964.94788
$P(25)_2$	59535266.45	1985.88273	$P(25)_3$	58771670.30	1960.41190

Table 2. (cont.)

Vibrational band: $\nu = 5 \rightarrow 4$			Vibrational band: $\nu = 6 \rightarrow 5$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_4$	60753944.71	2026.53346	$P(3)_5$	59971442.90	2000.43201
$P(4)_4$	60639749.94	2022.72433	$P(4)_5$	59858297.59	1996.65789
$P(5)_4$	60524523.69	2018.88080	$P(5)_5$	59744120.90	1992.84936
$P(6)_4$	60408270.34	2015.00300	$P(6)_5$	59628917.25	1989.00658
$P(7)_4$	60290994.30	2011.09110	$P(7)_5$	59512691.01	1985.12969
$P(8)_4$	60172699.97	2007.14522	$P(8)_5$	59395446.60	1981.21884
$P(9)_4$	60053391.75	2003.16553	$P(9)_5$	59277188.42	1977.27417
$P(10)_4$	59933074.02	1999.15216	$P(10)_5$	59157920.84	1973.29583
$P(11)_4$	59811751.20	1995.10527	$P(11)_5$	59037648.27	1969.28397
$P(12)_4$	59689427.66	1991.02499	$P(12)_5$	58916375.10	1965.23874
$P(13)_4$	59566107.80	1986.91149	$P(13)_5$	58794105.72	1961.16027
$P(14)_4$	59441796.01	1982.76489	$P(14)_5$	58670844.51	1957.04872
$P(15)_4$	59316496.68	1978.58535	$P(15)_5$	58546595.87	1952.90423
$P(16)_4$	59190214.19	1974.37302	$P(16)_5$	58421364.16	1948.72695
$P(17)_4$	59062952.92	1970.12805	$P(17)_5$	58295153.77	1944.51702
$P(18)_4$	58934717.26	1965.85056	$P(18)_5$	58167969.09	1940.27460
$P(19)_4$	58805511.58	1961.54073	$P(19)_5$	58039814.47	1935.99982
$P(20)_4$	58675340.25	1957.19868	$P(20)_5$	57910694.30	1931.69283
$P(21)_4$	58544207.64	1952.82457	$P(21)_5$	57780612.94	1927.35379
$P(22)_4$	58412118.13	1948.41853	$P(22)_5$	57649574.75	1922.98282
$P(23)_4$	58279076.08	1943.98073	$P(23)_5$	57517584.10	1918.58009
$P(24)_4$	58145085.84	1939.51129	$P(24)_5$	57384645.34	1914.14573
$P(25)_4$	58010151.78	1935.01038	$P(25)_5$	57250762.82	1909.67989



Table 2. (cont.)

Vibrational band: $\nu = 7 \rightarrow 6$			Vibrational band: $\nu = 8 \rightarrow 7$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_6$	59191119.45	1974.40322	$P(3)_7$	58413024.29	1948.44876
$P(4)_6$	59079023.52	1970.66410	$P(4)_7$	58301977.65	1944.74464
$P(5)_6$	58965896.35	1966.89059	$P(5)_7$	58189899.93	1941.00613
$P(6)_6$	58851742.34	1963.08282	$P(6)_7$	58076795.51	1937.23337
$P(7)_6$	58736565.89	1959.24095	$P(7)_7$	57962668.80	1933.42652
$P(8)_6$	58620371.39	1955.36511	$P(8)_7$	57847524.19	1929.58571
$P(9)_6$	58503163.24	1951.45547	$P(9)_7$	57731366.07	1925.71109
$P(10)_6$	58384945.84	1947.51216	$P(10)_7$	57614198.85	1921.80281
$P(11)_6$	58265723.57	1943.53534	$P(11)_7$	57496026.90	1917.86102
$P(12)_6$	58145500.82	1939.52514	$P(12)_7$	57376854.63	1913.88586
$P(13)_6$	58024281.99	1935.48171	$P(13)_7$	57256686.40	1909.87748
$P(14)_6$	57902071.45	1931.40521	$P(14)_7$	57135526.61	1905.83602
$P(15)_6$	57778873.59	1927.29577	$P(15)_7$	57013379.64	1901.76164
$P(16)_6$	57654692.79	1923.15354	$P(16)_7$	56890249.86	1897.65447
$P(17)_6$	57529533.43	1918.97868	$P(17)_7$	56766141.66	1893.51467
$P(18)_6$	57403399.88	1914.77131	$P(18)_7$	56641059.39	1889.34237
$P(19)_6$	57276296.51	1910.53160	$P(19)_7$	56515007.43	1885.13773
$P(20)_6$	57148227.68	1906.25969	$P(20)_7$	56387990.15	1880.90089
$P(21)_6$	57019197.78	1901.95571	$P(21)_7$	56260011.90	1876.63200
$P(22)_6$	56889211.14	1897.61982	$P(22)_7$	56131077.05	1872.33119
$P(23)_6$	56758272.14	1893.25217	$P(23)_7$	56001189.93	1867.99863
$P(24)_6$	56626385.12	1888.85289	$P(24)_7$	55870354.92	1863.63444
$P(25)_6$	56493554.43	1884.42214	$P(25)_7$	55738576.34	1859.23878

Table 2. (cont.)

Vibrational band: $\nu = 9 \rightarrow 8$			Vibrational band: $\nu = 10 \rightarrow 9$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_8$	57637205.74	1922.57024	$P(3)_9$	56863710.05	1896.76920
$P(4)_8$	57527208.30	1918.90112	$P(4)_9$	56754761.69	1893.13507
$P(5)_8$	57416179.94	1915.19761	$P(5)_9$	56644782.58	1889.46656
$P(6)_8$	57304125.04	1911.45986	$P(6)_9$	56533777.12	1885.76382
$P(7)_8$	57191048.01	1907.68802	$P(7)_9$	56421749.71	1882.02699
$P(8)_8$	57076953.25	1903.88223	$P(8)_9$	56308704.75	1878.25622
$P(9)_8$	56961845.15	1900.04263	$P(9)_9$	56194646.62	1874.45165
$P(10)_8$	56845728.10	1896.16939	$P(10)_9$	56079579.72	1870.61343
$P(11)_8$	56728606.50	1892.26263	$P(11)_9$	55963508.44	1866.74171
$P(12)_8$	56610484.72	1888.32251	$P(12)_9$	55846437.17	1862.83663
$P(13)_8$	56491367.15	1884.34918	$P(13)_9$	55728370.28	1858.89834
$P(14)_8$	56371258.17	1880.34277	$P(14)_9$	55609312.16	1854.92699
$P(15)_8$	56250162.17	1876.30344	$P(15)_9$	55489267.18	1850.92272
$P(16)_8$	56128083.51	1872.23134	$P(16)_9$	55368239.72	1846.88568
$P(17)_8$	56005026.58	1868.12660	$P(17)_9$	55246234.15	1842.81601
$P(18)_8$	55880995.73	1863.98938	$P(18)_9$	55123254.84	1838.71386
$P(19)_8$	55755995.34	1859.81981	$P(19)_9$	54999306.15	1834.57938
$P(20)_8$	55630029.77	1855.61805	$P(20)_9$	54874392.43	1830.41271
$P(21)_8$	55503103.37	1851.38425	$P(21)_9$	54748518.05	1826.21399
$P(22)_8$	55375220.50	1847.11853	$P(22)_9$	54621687.34	1821.98337
$P(23)_8$	55246385.51	1842.82106	$P(23)_9$	54493904.68	1817.72100
$P(24)_8$	55116602.75	1838.49197	$P(24)_9$	54365174.38	1813.42702
$P(25)_8$	54985876.55	1834.13142	$P(25)_9$	54235500.79	1809.10157

Table 2. (cont.)

Vibrational band: $\nu = 11 \rightarrow 10$			Vibrational band: $\nu = 12 \rightarrow 11$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{10}$	56092580.82	1871.04710	$P(3)_{11}$	55323858.41	1845.40528
$P(4)_{10}$	55984681.41	1867.44796	$P(4)_{11}$	55217007.78	1841.84112
$P(5)_{10}$	55875751.43	1863.81445	$P(5)_{11}$	55109126.80	1838.24260
$P(6)_{10}$	55765795.30	1860.14671	$P(6)_{11}$	55000219.87	1834.60986
$P(7)_{10}$	55654817.41	1856.44488	$P(7)_{11}$	54890291.39	1830.94304
$P(8)_{10}$	55542822.16	1852.70912	$P(8)_{11}$	54779345.75	1827.24229
$P(9)_{10}$	55429813.94	1848.93957	$P(9)_{11}$	54667387.34	1823.50776
$P(10)_{10}$	55315797.15	1845.13638	$P(10)_{11}$	54554420.57	1819.73959
$P(11)_{10}$	55200776.16	1841.29970	$P(11)_{11}$	54440449.81	1815.93794
$P(12)_{10}$	55084755.37	1837.42966	$P(12)_{11}$	54325479.46	1812.10294
$P(13)_{10}$	54967739.16	1833.52642	$P(13)_{11}$	54209513.88	1808.23474
$P(14)_{10}$	54849731.91	1829.59012	$P(14)_{11}$	54092557.47	1804.33350
$P(15)_{10}$	54730737.98	1825.62091	$P(15)_{11}$	53974614.59	1800.39935
$P(16)_{10}$	54610761.77	1821.61893	$P(16)_{11}$	53855689.61	1796.43244
$P(17)_{10}$	54489807.62	1817.58434	$P(17)_{11}$	53735786.91	1792.43291
$P(18)_{10}$	54367879.92	1813.51727	$P(18)_{11}$	53614910.84	1788.40092
$P(19)_{10}$	54244983.01	1809.41787	$P(19)_{11}$	53493065.77	1784.33661
$P(20)_{10}$	54121121.26	1805.28628	$P(20)_{11}$	53370256.04	1780.24012
$P(21)_{10}$	53996299.01	1801.12266	$P(21)_{11}$	53246486.00	1776.11159
$P(22)_{10}$	53870520.62	1796.92715	$P(22)_{11}$	53121760.01	1771.95118
$P(23)_{10}$	53743790.43	1792.69988	$P(23)_{11}$	52996082.40	1767.75903
$P(24)_{10}$	53616112.78	1788.44101	$P(24)_{11}$	52869457.51	1763.53528
$P(25)_{10}$	53487492.00	1784.15069	$P(25)_{11}$	52741889.67	1759.28007

Table 2. (cont.)

Vibrational band: $\nu = 13 \rightarrow 12$			Vibrational band: $\nu = 14 \rightarrow 13$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{12}$	54557579.29	1819.84496	$P(3)_{13}$	53793775.43	1794.36720
$P(4)_{12}$	54451777.29	1816.31578	$P(4)_{13}$	53689021.85	1790.87300
$P(5)_{12}$	54344945.14	1812.75225	$P(5)_{13}$	53583238.34	1787.34444
$P(6)_{12}$	54237087.25	1809.15449	$P(6)_{13}$	53476429.32	1783.78168
$P(7)_{12}$	54128208.02	1805.52267	$P(7)_{13}$	53368599.19	1780.18485
$P(8)_{12}$	54018311.86	1801.85693	$P(8)_{13}$	53259752.34	1776.55411
$P(9)_{12}$	53907403.15	1798.15742	$P(9)_{13}$	53149893.16	1772.88960
$P(10)_{12}$	53795486.29	1794.42427	$P(10)_{13}$	53039026.05	1769.19147
$P(11)_{12}$	53682565.66	1790.65764	$P(11)_{13}$	52927155.40	1765.45987
$P(12)_{12}$	53568645.64	1786.85768	$P(12)_{13}$	52814285.59	1761.69494
$P(13)_{12}$	53453730.62	1783.02453	$P(13)_{13}$	52700421.00	1757.89682
$P(14)_{12}$	53337824.98	1779.15833	$P(14)_{13}$	52585566.00	1754.06567
$P(15)_{12}$	53220933.08	1775.25924	$P(15)_{13}$	52469724.97	1750.20163
$P(16)_{12}$	53103059.30	1771.32739	$P(16)_{13}$	52352902.28	1746.30485
$P(17)_{12}$	52984208.00	1767.36294	$P(17)_{13}$	52235102.28	1742.37546
$P(18)_{12}$	52864383.55	1763.36603	$P(18)_{13}$	52116329.35	1738.41362
$P(19)_{12}$	52743590.29	1759.33680	$P(19)_{13}$	51996587.82	1734.41948
$P(20)_{12}$	52621832.58	1755.27540	$P(20)_{13}$	51875882.06	1730.39317
$P(21)_{12}$	52499114.77	1751.18197	$P(21)_{13}$	51754216.40	1726.33484
$P(22)_{12}$	52375441.19	1747.05667	$P(22)_{13}$	51631595.19	1722.24463
$P(23)_{12}$	52250816.20	1742.89962	$P(23)_{13}$	51508022.76	1718.12270
$P(24)_{12}$	52125244.12	1738.71099	$P(24)_{13}$	51383503.44	1713.96918
$P(25)_{12}$	51998729.27	1734.49091	$P(25)_{13}$	51258041.56	1709.78423

Table 2. (cont.)

Vibrational band: $\nu = 15 \rightarrow 14$			Vibrational band: $\nu = 16 \rightarrow 15$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{14}$	53032473.57	1768.97291	$P(3)_{15}$	52273694.57	1743.66276
$P(4)_{14}$	52928768.21	1765.51367	$P(4)_{15}$	52171037.20	1740.23848
$P(5)_{14}$	52824033.14	1762.02008	$P(5)_{15}$	52067350.35	1736.77986
$P(6)_{14}$	52718272.78	1758.49230	$P(6)_{15}$	51962638.43	1733.28705
$P(7)_{14}$	52611491.53	1754.93046	$P(7)_{15}$	51856905.83	1729.76019
$P(8)_{14}$	52503693.79	1751.33471	$P(8)_{15}$	51750156.96	1726.19943
$P(9)_{14}$	52394883.95	1747.70521	$P(9)_{15}$	51642396.22	1722.60492
$P(10)_{14}$	52285066.41	1744.04209	$P(10)_{15}$	51533628.00	1718.97680
$P(11)_{14}$	52174245.55	1740.34550	$P(11)_{15}$	51423856.68	1715.31522
$P(12)_{14}$	52062425.75	1736.61559	$P(12)_{15}$	51313086.65	1711.62033
$P(13)_{14}$	51949611.40	1732.85251	$P(13)_{15}$	51201322.29	1707.89227
$P(14)_{14}$	51835806.86	1729.05640	$P(14)_{15}$	51088567.97	1704.13119
$P(15)_{14}$	51721016.52	1725.22741	$P(15)_{15}$	50974828.06	1700.33724
$P(16)_{14}$	51605244.74	1721.36568	$P(16)_{15}$	50860106.94	1696.51056
$P(17)_{14}$	51488495.88	1717.47135	$P(17)_{15}$	50744408.95	1692.65129
$P(18)_{14}$	51370774.29	1713.54458	$P(18)_{15}$	50627738.46	1688.75958
$P(19)_{14}$	51252084.33	1709.58551	$P(19)_{15}$	50510099.81	1684.83557
$P(20)_{14}$	51132430.35	1705.59429	$P(20)_{15}$	50391497.35	1680.87942
$P(21)_{14}$	51011816.69	1701.57105	$P(21)_{15}$	50271935.43	1676.89127
$P(22)_{14}$	50890247.69	1697.51594	$P(22)_{15}$	50151418.37	1672.87125
$P(23)_{14}$	50767727.68	1693.42911	$P(23)_{15}$	50029950.50	1668.81952
$P(24)_{14}$	50644260.97	1689.31071	$P(24)_{15}$	49907536.15	1664.73621
$P(25)_{14}$	50519851.91	1685.16087	$P(25)_{15}$	49784179.63	1660.62148

Table 2. (cont.)

Vibrational band: $\nu = 17 \rightarrow 16$			Vibrational band: $\nu = 18 \rightarrow 17$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{16}$	51517452.72	1718.43725	$P(3)_{17}$	50763754.99	1693.29660
$P(4)_{16}$	51415843.10	1715.04792	$P(4)_{17}$	50663192.88	1689.94221
$P(5)_{16}$	51313204.22	1711.62425	$P(5)_{17}$	50561601.70	1686.55349
$P(6)_{16}$	51209540.47	1708.16640	$P(6)_{17}$	50458985.84	1683.13060
$P(7)_{16}$	51104856.26	1704.67451	$P(7)_{17}$	50355349.72	1679.67367
$P(8)_{16}$	50999155.99	1701.14873	$P(8)_{17}$	50250697.74	1676.18285
$P(9)_{16}$	50892444.06	1697.58921	$P(9)_{17}$	50145034.30	1672.65830
$P(10)_{16}$	50784724.87	1693.99608	$P(10)_{17}$	50038363.79	1669.10015
$P(11)_{16}$	50676002.79	1690.36950	$P(11)_{17}$	49930690.59	1665.50856
$P(12)_{16}$	50566282.22	1686.70962	$P(12)_{17}$	49822019.11	1661.88367
$P(13)_{16}$	50455567.53	1683.01657	$P(13)_{17}$	49712353.70	1658.22563
$P(14)_{16}$	50343863.11	1679.29051	$P(14)_{17}$	49601698.76	1654.53458
$P(15)_{16}$	50231173.30	1675.53159	$P(15)_{17}$	49490058.64	1650.81066
$P(16)_{16}$	50117502.49	1671.73994	$P(16)_{17}$	49377437.71	1647.05403
$P(17)_{16}$	50002855.03	1667.91571	$P(17)_{17}$	49263840.32	1643.26483
$P(18)_{16}$	49887235.28	1664.05905	$P(18)_{17}$	49149270.83	1639.44321
$P(19)_{16}$	49770647.58	1660.17010	$P(19)_{17}$	49033733.59	1635.58930
$P(20)_{16}$	49653096.27	1656.24901	$P(20)_{17}$	48917232.94	1631.70325
$P(21)_{16}$	49534585.70	1652.29593	$P(21)_{17}$	48799773.20	1627.78522
$P(22)_{16}$	49415120.19	1648.31099	$P(22)_{17}$	48681358.71	1623.83534
$P(23)_{16}$	49294704.07	1644.29434	$P(23)_{17}$	48561993.80	1619.85375
$P(24)_{16}$	49173341.66	1640.24612	$P(24)_{17}$	48441682.77	1615.84061
$P(25)_{16}$	49051037.27	1636.16649	$P(25)_{17}$	48320429.94	1611.79605

Table 2. (cont.)

Vibrational band: $\nu = 19 \rightarrow 18$			Vibrational band: $\nu = 20 \rightarrow 19$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{18}$	50012600.38	1668.24078	$P(3)_{19}$	49263979.19	1643.26946
$P(4)_{18}$	49913085.53	1664.92132	$P(4)_{19}$	49165511.34	1639.98493
$P(5)_{18}$	49812541.77	1661.56754	$P(5)_{19}$	49066014.70	1636.66608
$P(6)_{18}$	49710973.50	1658.17959	$P(6)_{19}$	48965493.70	1633.31306
$P(7)_{18}$	49608385.14	1654.75761	$P(7)_{19}$	48863952.74	1629.92602
$P(8)_{18}$	49504781.09	1651.30175	$P(8)_{19}$	48761396.24	1626.50510
$P(9)_{18}$	49400165.76	1647.81216	$P(9)_{19}$	48657828.59	1623.05046
$P(10)_{18}$	49294543.53	1644.28898	$P(10)_{19}$	48553254.18	1619.56223
$P(11)_{18}$	49187918.80	1640.73236	$P(11)_{19}$	48447677.42	1616.04057
$P(12)_{18}$	49080295.95	1637.14245	$P(12)_{19}$	48341102.68	1612.48562
$P(13)_{18}$	48971679.36	1633.51939	$P(13)_{19}$	48233534.34	1608.89752
$P(14)_{18}$	48862073.40	1629.86333	$P(14)_{19}$	48124976.78	1605.27643
$P(15)_{18}$	48751482.44	1626.17441	$P(15)_{19}$	48015434.36	1601.62249
$P(16)_{18}$	48639910.84	1622.45279	$P(16)_{19}$	47904911.44	1597.93584
$P(17)_{18}$	48527362.97	1618.69859	$P(17)_{19}$	47793412.38	1594.21664
$P(18)_{18}$	48413843.16	1614.91198	$P(18)_{19}$	47680941.53	1590.46501
$P(19)_{18}$	48299355.76	1611.09309	$P(19)_{19}$	47567503.23	1586.68112
$P(20)_{18}$	48183905.12	1607.24207	$P(20)_{19}$	47453101.81	1582.86510
$P(21)_{18}$	48067495.56	1603.35907	$P(21)_{19}$	47337741.60	1579.01709
$P(22)_{18}$	47950131.41	1599.44422	$P(22)_{19}$	47221426.93	1575.13725
$P(23)_{18}$	47831816.99	1595.49768	$P(23)_{19}$	47104162.10	1571.22572
$P(24)_{18}$	47712556.60	1591.51958	$P(24)_{19}$	46985951.43	1567.28264
$P(25)_{18}$	47592354.56	1587.51007	$P(25)_{19}$	46866799.22	1563.30815

Table 2. (cont.)

Vibrational band: $\nu = 21 \rightarrow 20$			Vibrational band: $\nu = 22 \rightarrow 21$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{20}$	48517872.29	1618.38202	$P(3)_{21}$	47774250.44	1593.57746
$P(4)_{20}$	48420451.19	1615.13240	$P(4)_{21}$	47677875.83	1590.36275
$P(5)_{20}$	48322001.38	1611.84847	$P(5)_{21}$	47580472.56	1587.11373
$P(6)_{20}$	48222527.30	1608.53037	$P(6)_{21}$	47482045.05	1583.83054
$P(7)_{20}$	48122033.36	1605.17825	$P(7)_{21}$	47382597.71	1580.51333
$P(8)_{20}$	48020523.97	1601.79226	$P(8)_{21}$	47282134.96	1577.16226
$P(9)_{20}$	47918003.52	1598.37255	$P(9)_{21}$	47180661.20	1573.77746
$P(10)_{20}$	47814476.43	1594.91926	$P(10)_{21}$	47078180.84	1570.35908
$P(11)_{20}$	47709947.07	1591.43253	$P(11)_{21}$	46974698.25	1566.90727
$P(12)_{20}$	47604419.83	1587.91252	$P(12)_{21}$	46870217.84	1563.42218
$P(13)_{20}$	47497899.10	1584.35937	$P(13)_{21}$	46764743.97	1559.90395
$P(14)_{20}$	47390389.25	1580.77323	$P(14)_{21}$	46658281.01	1556.35273
$P(15)_{20}$	47281894.63	1577.15424	$P(15)_{21}$	46550833.35	1552.76866
$P(16)_{20}$	47172419.61	1573.50255	$P(16)_{21}$	46442405.32	1549.15189
$P(17)_{20}$	47061968.55	1569.81830	$P(17)_{21}$	46333001.29	1545.50257
$P(18)_{20}$	46950545.79	1566.10163	$P(18)_{21}$	46222625.59	1541.82083
$P(19)_{20}$	46838155.66	1562.35270	$P(19)_{21}$	46111282.57	1538.10682
$P(20)_{20}$	46724802.51	1558.57165	$P(20)_{21}$	45998976.55	1534.36070
$P(21)_{20}$	46610490.65	1554.75861	$P(21)_{21}$	45885711.85	1530.58260
$P(22)_{20}$	46495224.41	1550.91375	$P(22)_{21}$	45771492.79	1526.77266
$P(23)_{20}$	46379008.09	1547.03719	$P(23)_{21}$	45656323.67	1522.93103
$P(24)_{20}$	46261846.00	1543.12908	$P(24)_{21}$	45540208.79	1519.05785
$P(25)_{20}$	46143742.44	1539.18957	$P(25)_{21}$	45423152.45	1515.15327



Table 2. (cont.)

Vibrational band: $v = 23 \rightarrow 22$			Vibrational band: $v = 24 \rightarrow 23$		
Transition $P(J'')_{v''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{v''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{22}$	47033073.51	1568.85446	$P(3)_{23}$	46294289.82	1544.21129
$P(4)_{22}$	46937745.18	1565.67465	$P(4)_{23}$	46200007.58	1541.06637
$P(5)_{22}$	46841388.15	1562.46053	$P(5)_{23}$	46104696.51	1537.88714
$P(6)_{22}$	46744006.84	1559.21223	$P(6)_{23}$	46008361.04	1534.67373
$P(7)_{22}$	46645605.68	1555.92993	$P(7)_{23}$	45911005.61	1531.42630
$P(8)_{22}$	46546189.08	1552.61374	$P(8)_{23}$	45812634.61	1528.14500
$P(9)_{22}$	46445761.44	1549.26384	$P(9)_{23}$	45713252.48	1524.82997
$P(10)_{22}$	46344327.16	1545.88036	$P(10)_{23}$	45612863.60	1521.48136
$P(11)_{22}$	46241890.64	1542.46344	$P(11)_{23}$	45511472.37	1518.09931
$P(12)_{22}$	46138456.27	1539.01324	$P(12)_{23}$	45409083.18	1514.68397
$P(13)_{22}$	46034028.42	1535.52990	$P(13)_{23}$	45305700.40	1511.23550
$P(14)_{22}$	45928611.46	1532.01357	$P(14)_{23}$	45201328.41	1507.75402
$P(15)_{22}$	45822209.77	1528.46439	$P(15)_{23}$	45095971.57	1504.23970
$P(16)_{22}$	45714827.68	1524.88251	$P(16)_{23}$	44989634.24	1500.69266
$P(17)_{22}$	45606469.56	1521.26808	$P(17)_{23}$	44882320.75	1497.11307
$P(18)_{22}$	45497139.74	1517.62123	$P(18)_{23}$	44774035.45	1493.50106
$P(19)_{22}$	45386842.56	1513.94211	$P(19)_{23}$	44664782.67	1489.85678
$P(20)_{22}$	45275582.35	1510.23087	$P(20)_{23}$	44554566.72	1486.18037
$P(21)_{22}$	45163363.41	1506.48765	$P(21)_{23}$	444443391.93	1482.47198
$P(22)_{22}$	45050190.06	1502.71259	$P(22)_{23}$	44331262.60	1478.73175
$P(23)_{22}$	44936066.61	1498.90584	$P(23)_{23}$	44218183.01	1474.95982
$P(24)_{22}$	44820997.33	1495.06754	$P(24)_{23}$	44104157.46	1471.15634
$P(25)_{22}$	44704986.53	1491.19784	$P(25)_{23}$	43989190.23	1467.32144

Table 2. (cont.)

Vibrational band: $\nu = 25 \rightarrow 24$ .			Vibrational band: $\nu = 26 \rightarrow 25$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{24}$	45557835.36	1519.64581	$P(3)_{25}$	44823633.00	1495.15546
$P(4)_{24}$	45464599.04	1516.53578	$P(4)_{25}$	44731442.50	1492.08031
$P(5)_{24}$	45370333.67	1513.39143	$P(5)_{25}$	44638222.61	1488.97083
$P(6)_{24}$	45275043.69	1510.21290	$P(6)_{25}$	44543977.76	1485.82716
$P(7)_{24}$	45178733.52	1507.00034	$P(7)_{25}$	44448712.41	1482.64945
$P(8)_{24}$	45081407.59	1503.75389	$P(8)_{25}$	44352430.95	1479.43785
$P(9)_{24}$	44983070.30	1500.47371	$P(9)_{25}$	44255137.82	1476.19250
$P(10)_{24}$	44883726.06	1497.15995	$P(10)_{25}$	44156837.42	1472.91355
$P(11)_{24}$	44783379.27	1493.81274	$P(11)_{25}$	44057534.14	1469.60115
$P(12)_{24}$	44682034.31	1490.43223	$P(12)_{25}$	43957232.37	1466.25544
$P(13)_{24}$	44579695.56	1487.01858	$P(13)_{25}$	43855936.48	1462.87658
$P(14)_{24}$	44476367.39	1483.57192	$P(14)_{25}$	43753650.86	1459.46470
$P(15)_{24}$	44372054.15	1480.09241	$P(15)_{25}$	43650379.85	1456.01995
$P(16)_{24}$	44266760.22	1476.58018	$P(16)_{25}$	43546127.80	1452.54247
$P(17)_{24}$	44160489.92	1473.03539	$P(17)_{25}$	43440899.06	1449.03242
$P(18)_{24}$	44053247.59	1469.45817	$P(18)_{25}$	43334697.96	1445.48993
$P(19)_{24}$	43945037.56	1465.84867	$P(19)_{25}$	43227528.82	1441.91515
$P(20)_{24}$	43835864.14	1462.20704	$P(20)_{25}$	43119395.95	1438.30823
$P(21)_{24}$	43725731.64	1458.53341	$P(21)_{25}$	43010303.66	1434.66930
$P(22)_{24}$	43614644.36	1454.82794	$P(22)_{25}$	42900256.22	1430.99851
$P(23)_{24}$	43502606.60	1451.09076	$P(23)_{25}$	42789257.93	1427.29601
$P(24)_{24}$	43389622.61	1447.32202	$P(24)_{25}$	42677313.06	1423.56193
$P(25)_{24}$	43275696.69	1443.52186	$P(25)_{25}$	42564425.86	1419.79642

Table 2. (cont.)

Vibrational band: $\nu = 27 \rightarrow 26$			Vibrational band: $\nu = 28 \rightarrow 27$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{26}$	44091591.75	1470.73719	$P(3)_{27}$	43361605.91	1446.38748
$P(4)_{26}$	44000447.02	1467.69693	$P(4)_{27}$	43271506.98	1443.38211
$P(5)_{26}$	43908272.42	1464.62232	$P(5)_{27}$	43180377.55	1440.34236
$P(6)_{26}$	43815072.40	1461.51350	$P(6)_{27}$	43088222.07	1437.26838
$P(7)_{26}$	43720851.40	1458.37062	$P(7)_{27}$	42995044.99	1434.16033
$P(8)_{26}$	43625613.84	1455.19384	$P(8)_{27}$	42900850.73	1431.01835
$P(9)_{26}$	43529364.14	1451.98330	$P(9)_{27}$	42805643.71	1427.84258
$P(10)_{26}$	43432106.71	1448.73914	$P(10)_{27}$	42709428.35	1424.63318
$P(11)_{26}$	43333845.95	1445.46151	$P(11)_{27}$	42612209.04	1421.39030
$P(12)_{26}$	43234586.24	1442.15056	$P(12)_{27}$	42513990.17	1418.11407
$P(13)_{26}$	43134331.96	1438.80644	$P(13)_{27}$	42414776.12	1414.80464
$P(14)_{26}$	43033087.48	1435.42929	$P(14)_{27}$	42314571.26	1411.46217
$P(15)_{26}$	42930857.15	1432.01925	$P(15)_{27}$	42213379.94	1408.08679
$P(16)_{26}$	42827645.33	1428.57648	$P(16)_{27}$	42111206.50	1404.67865
$P(17)_{26}$	42723456.35	1425.10111	$P(17)_{27}$	42008055.28	1401.23789
$P(18)_{26}$	42618294.53	1421.59329	$P(18)_{27}$	41903930.59	1397.76467
$P(19)_{26}$	42512164.20	1418.05316	$P(19)_{27}$	41798836.76	1394.25912
$P(20)_{26}$	42405069.66	1414.48087	$P(20)_{27}$	41692778.08	1390.72138
$P(21)_{26}$	42297015.21	1410.87656	$P(21)_{27}$	41585758.83	1387.15160
$P(22)_{26}$	42188005.12	1407.24038	$P(22)_{27}$	41477783.30	1383.54993
$P(23)_{26}$	42078043.67	1403.57246	$P(23)_{27}$	41368855.74	1379.91649
$P(24)_{26}$	41967135.12	1399.87295	$P(24)_{27}$	41258980.41	1376.25145
$P(25)_{26}$	41855283.73	1396.14198	$P(25)_{27}$	41148161.55	1372.55493

Table 2. (cont.)

Vibrational band: $\nu = 29 \rightarrow 28$			Vibrational band: $\nu = 30 \rightarrow 29$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{28}$	42633554.21	1422.10229	$P(3)_{29}$	41907298.90	1397.87702
$P(4)_{28}$	42544501.21	1419.13181	$P(4)_{29}$	41819292.06	1394.94143
$P(5)_{28}$	42454416.89	1416.12692	$P(5)_{29}$	41730252.88	1391.97140
$P(6)_{28}$	42363305.72	1413.08777	$P(6)_{29}$	41640185.84	1388.96709
$P(7)_{28}$	42271172.13	1410.01453	$P(7)_{29}$	41549095.39	1385.92864
$P(8)_{28}$	42178020.58	1406.90733	$P(8)_{29}$	41456985.96	1382.85620
$P(9)_{28}$	42083855.48	1403.76632	$P(9)_{29}$	41363861.99	1379.74992
$P(10)_{28}$	41988681.24	1400.59165	$P(10)_{29}$	41269727.89	1376.60994
$P(11)_{28}$	41892502.26	1397.38346	$P(11)_{29}$	41174588.07	1373.43642
$P(12)_{28}$	41795322.93	1394.14191	$P(12)_{29}$	41078446.90	1370.22950
$P(13)_{28}$	41697147.64	1390.86713	$P(13)_{29}$	40981308.77	1366.98932
$P(14)_{28}$	41597980.73	1387.55928	$P(14)_{29}$	40883178.05	1363.71603
$P(15)_{28}$	41497826.58	1384.21850	$P(15)_{29}$	40784059.07	1360.40978
$P(16)_{28}$	41396689.51	1380.84493	$P(16)_{29}$	40683956.18	1357.07070
$P(17)_{28}$	41294573.85	1377.43872	$P(17)_{29}$	40582873.70	1353.69895
$P(18)_{28}$	41191483.93	1374.00001	$P(18)_{29}$	40480815.94	1350.29467
$P(19)_{28}$	41087424.05	1370.52894	$P(19)_{29}$	40377787.19	1346.85801
$P(20)_{28}$	40982398.49	1367.02567	$P(20)_{29}$	40273791.76	1343.38909
$P(21)_{28}$	40876411.54	1363.49032	$P(21)_{29}$	40168833.89	1339.88807
$P(22)_{28}$	40769467.46	1359.92305	$P(22)_{29}$	40062917.85	1336.35509
$P(23)_{28}$	40661570.51	1356.32400	$P(23)_{29}$	39956047.88	1332.79030
$P(24)_{28}$	40552724.93	1352.69330	$P(24)_{29}$	39848228.22	1329.19382
$P(25)_{28}$	40442934.95	1349.03110	$P(25)_{29}$	39739463.07	1325.56580

Table 2. (cont.)

Vibrational band: $\nu = 31 \rightarrow 30$			Vibrational band: $\nu = 32 \rightarrow 31$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{30}$	41182684.77	1373.70650	$P(3)_{31}$	40459538.11	1349.58492
$P(4)_{30}$	41095724.45	1370.80581	$P(4)_{31}$	40373624.82	1346.71916
$P(5)_{30}$	41007730.55	1367.87065	$P(5)_{31}$	40286676.45	1343.81888
$P(6)_{30}$	40918707.54	1364.90117	$P(6)_{31}$	40198697.48	1340.88422
$P(7)_{30}$	40828659.90	1361.89750	$P(7)_{31}$	40109692.38	1337.91532
$P(8)_{30}$	40737592.05	1358.85980	$P(8)_{31}$	40019665.60	1334.91235
$P(9)_{30}$	40645508.44	1355.78822	$P(9)_{31}$	39928621.58	1331.87545
$P(10)_{30}$	40552413.47	1352.68291	$P(10)_{31}$	39836564.73	1328.80477
$P(11)_{30}$	40458311.57	1349.54401	$P(11)_{31}$	39743499.46	1325.70044
$P(12)_{30}$	40363207.10	1346.37167	$P(12)_{31}$	39649430.17	1322.56263
$P(13)_{30}$	40267104.45	1343.16603	$P(13)_{31}$	39554361.22	1319.39147
$P(14)_{30}$	40170007.99	1339.92724	$P(14)_{31}$	39458296.97	1316.18711
$P(15)_{30}$	40071922.05	1336.65544	$P(15)_{31}$	39361241.77	1312.94970
$P(16)_{30}$	39972850.96	1333.35079	$P(16)_{31}$	39263199.95	1309.67938
$P(17)_{30}$	39872799.06	1330.01341	$P(17)_{31}$	39164175.82	1306.37629
$P(18)_{30}$	39771770.64	1326.64347	$P(18)_{31}$	39064173.67	1303.04057
$P(19)_{30}$	39669769.98	1323.24109	$P(19)_{31}$	38963197.78	1299.67238
$P(20)_{30}$	39566801.37	1319.80643	$P(20)_{31}$	38861252.43	1296.27185
$P(21)_{30}$	39462869.07	1316.33962	$P(21)_{31}$	38758341.85	1292.83912
$P(22)_{30}$	39357977.32	1312.84081	$P(22)_{31}$	38654470.28	1289.37434
$P(23)_{30}$	39252130.35	1309.31013	$P(23)_{31}$	38549641.95	1285.87764
$P(24)_{30}$	39145332.37	1305.74774	$P(24)_{31}$	38443861.04	1282.34917
$P(25)_{30}$	39037587.59	1302.15376	$P(25)_{31}$	38337131.74	1278.78907

Table 2. (cont.)

Vibrational band: $\nu = 33 \rightarrow 32$			Vibrational band: $\nu = 34 \rightarrow 33$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{32}$	39737665.56	1325.50585	$P(3)_{33}$	39016852.89	1301.46212
$P(4)_{32}$	39652799.98	1322.67503	$P(4)_{33}$	38933035.91	1298.66629
$P(5)_{32}$	39566897.54	1319.80964	$P(5)_{33}$	38848179.96	1295.83580
$P(6)_{32}$	39479962.72	1316.90980	$P(6)_{33}$	38762289.53	1292.97080
$P(7)_{32}$	39392000.00	1313.97568	$P(7)_{33}$	38675369.11	1290.07145
$P(8)_{32}$	39303013.82	1311.00742	$P(8)_{33}$	38587423.16	1287.13789
$P(9)_{32}$	39213008.65	1308.00517	$P(9)_{33}$	38498456.12	1284.17027
$P(10)_{32}$	39121988.89	1304.96908	$P(10)_{33}$	38408472.43	1281.16874
$P(11)_{32}$	39029958.95	1301.89929	$P(11)_{33}$	38317476.49	1278.13344
$P(12)_{32}$	38936923.23	1298.79596	$P(12)_{33}$	38225472.70	1275.06452
$P(13)_{32}$	38842886.10	1295.65922	$P(13)_{33}$	38132465.42	1271.96213
$P(14)_{32}$	38747851.92	1292.48922	$P(14)_{33}$	38038459.02	1268.82642
$P(15)_{32}$	38651825.02	1289.28610	$P(15)_{33}$	37943457.82	1265.65752
$P(16)_{32}$	38554809.72	1286.05002	$P(16)_{33}$	37847466.15	1262.45558
$P(17)_{32}$	38456810.34	1282.78111	$P(17)_{33}$	37750488.29	1259.22075
$P(18)_{32}$	38357831.16	1279.47952	$P(18)_{33}$	37652528.54	1255.95316
$P(19)_{32}$	38257876.46	1276.14539	$P(19)_{33}$	37553591.15	1252.65297
$P(20)_{32}$	38156950.48	1272.77887	$P(20)_{33}$	37453680.37	1249.32030
$P(21)_{32}$	38055057.46	1269.38008	$P(21)_{33}$	37352800.41	1245.95531
$P(22)_{32}$	37952201.63	1265.94918	$P(22)_{33}$	37250955.48	1242.55813
$P(23)_{32}$	37848387.17	1262.48630	$P(23)_{33}$	37148149.76	1239.12890
$P(24)_{32}$	37743618.29	1258.99159	$P(24)_{33}$	37044387.43	1235.66776
$P(25)_{32}$	37637899.14	1255.46518	$P(25)_{33}$	36939672.62	1232.17485

Table 2. (cont.)

Vibrational band: $\nu = 35 \rightarrow 34$			Vibrational band: $\nu = 36 \rightarrow 35$		
Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{\nu''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
P(3) <sub>34</sub>	38296863.66	1277.44587	P(3) <sub>35</sub>	37577437.71	1253.44840
P(4) <sub>34</sub>	38214096.38	1274.68505	P(4) <sub>35</sub>	37495721.49	1250.72264
P(5) <sub>34</sub>	38130287.67	1271.88949	P(5) <sub>35</sub>	37412960.97	1247.96205
P(6) <sub>34</sub>	38045442.03	1269.05934	P(6) <sub>35</sub>	37329160.70	1245.16677
P(7) <sub>34</sub>	37959563.96	1266.19476	P(7) <sub>35</sub>	37244325.17	1242.33696
P(8) <sub>34</sub>	37872657.92	1263.29589	P(8) <sub>35</sub>	37158458.86	1239.47277
P(9) <sub>34</sub>	37784728.38	1260.36287	P(9) <sub>35</sub>	37071566.23	1236.57434
P(10) <sub>34</sub>	37695779.76	1257.39587	P(10) <sub>35</sub>	36983651.71	1233.64183
P(11) <sub>34</sub>	37605816.47	1254.39501	P(11) <sub>35</sub>	36894719.73	1230.67538
P(12) <sub>34</sub>	37514842.91	1251.36046	P(12) <sub>35</sub>	36804774.67	1227.67514
P(13) <sub>34</sub>	37422863.44	1248.29236	P(13) <sub>35</sub>	36713820.91	1224.64125
P(14) <sub>34</sub>	37329882.43	1245.19085	P(14) <sub>35</sub>	36621862.79	1221.57385
P(15) <sub>34</sub>	37235904.19	1242.05607	P(15) <sub>35</sub>	36528904.64	1218.47310
P(16) <sub>34</sub>	37140933.05	1238.88817	P(16) <sub>35</sub>	36434950.76	1215.33914
P(17) <sub>34</sub>	37044973.29	1235.68730	P(17) <sub>35</sub>	36340005.43	1212.17210
P(18) <sub>34</sub>	36948029.17	1232.45359	P(18) <sub>35</sub>	36244072.92	1208.97214
P(19) <sub>34</sub>	36850104.96	1229.18719	P(19) <sub>35</sub>	36147157.46	1205.73939
P(20) <sub>34</sub>	36751204.87	1225.88824	P(20) <sub>35</sub>	36049263.26	1202.47399
P(21) <sub>34</sub>	36651333.12	1222.55688	P(21) <sub>35</sub>	35950394.52	1199.17608
P(22) <sub>34</sub>	36550493.89	1219.19324	P(22) <sub>35</sub>	35850555.41	1195.84581
P(23) <sub>34</sub>	36448691.36	1215.79748	P(23) <sub>35</sub>	35749750.07	1192.48330
P(24) <sub>34</sub>	36345929.66	1212.36971	P(24) <sub>35</sub>	35647982.62	1189.08871
P(25) <sub>34</sub>	36242212.92	1208.91010	P(25) <sub>35</sub>	35545257.18	1185.66215

Table 2. (cont.)

Vibrational band: $v = 37 \rightarrow 36$			Vibrational band: $v = 38 \rightarrow 37$		
Transition $P(J'')_{v''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]	Transition $P(J'')_{v''}$	frequency [MHz]	frequency [ $\text{cm}^{-1}$ ]
$P(3)_{36}$	36858289.57	1229.46020	$P(3)_{37}$	36139106.65	1205.47084
$P(4)_{36}$	36777626.03	1226.76956	$P(4)_{37}$	36059497.73	1202.81537
$P(5)_{36}$	36695914.92	1224.04397	$P(5)_{37}$	35978837.51	1200.12484
$P(6)_{36}$	36613160.80	1221.28359	$P(6)_{37}$	35897130.54	1197.39939
$P(7)_{36}$	36529368.16	1218.48856	$P(7)_{37}$	35814381.35	1194.63917
$P(8)_{36}$	36444541.51	1215.65905	$P(8)_{37}$	35730594.44	1191.84434
$P(9)_{36}$	36358685.30	1212.79520	$P(9)_{37}$	35645774.28	1189.01504
$P(10)_{36}$	36271803.99	1209.89715	$P(10)_{37}$	35559925.33	1186.15143
$P(11)_{36}$	36183901.98	1206.96505	$P(11)_{37}$	35473052.00	1183.25365
$P(12)_{36}$	36094983.68	1203.99906	$P(12)_{37}$	35385158.69	1180.32184
$P(13)_{36}$	36005053.44	1200.99931	$P(13)_{37}$	35296249.76	1177.35616
$P(14)_{36}$	35914115.62	1197.96595	$P(14)_{37}$	35206329.57	1174.35675
$P(15)_{36}$	35822174.54	1194.89912	$P(15)_{37}$	35115402.41	1171.32374
$P(16)_{36}$	35729234.49	1191.79898	$P(16)_{37}$	35023472.59	1168.25729
$P(17)_{36}$	35635299.75	1188.66565	$P(17)_{37}$	34930544.37	1165.15754
$P(18)_{36}$	35540374.56	1185.49929	$P(18)_{37}$	34836621.98	1162.02463
$P(19)_{36}$	35444463.14	1182.30003	$P(19)_{37}$	34741709.62	1158.85869
$P(20)_{36}$	35347569.71	1179.06801	$P(20)_{37}$	34645811.49	1155.65988
$P(21)_{36}$	35249698.42	1175.80338	$P(21)_{37}$	34548931.74	1152.42832
$P(22)_{36}$	35150853.44	1172.50626	$P(22)_{37}$	34451074.50	1149.16415
$P(23)_{36}$	35051038.88	1169.17681	$P(23)_{37}$	34352243.86	1145.86751
$P(24)_{36}$	34950258.84	1165.81515	$P(24)_{37}$	34252443.91	1142.53855
$P(25)_{36}$	34848517.41	1162.42142	$P(25)_{37}$	34151678.68	1139.17738



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