Microwave Spectra of Molecules of Astrophysical Interest. XIX. Methyl Cyanide

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The microwave spectrum of methyl cyanide is critically reviewed for information applicable to radio-astronomy. Molecular data such as the derived rotational constants, centrifugal distortion parameters, hyperfine coupling constants, electric dipole moment and molecular structure are tabulated. The observed rotational transitions are presented for the astronomically interesting isotopic forms and the lowest lying vibrational state of methyl cyanide. Calculated rotational transitions are presented for the ground vibrational state of $^{12}CH_3{}^{12}C^{14}N$, $^{13}CH_3{}^{12}C^{14}N$, $^{12}CH_3{}^{13}C^{14}N$, $^{12}CH_3{}^{12}C^{15}N$, and for the vibrationally excited state ν_8 of $^{12}CH_3{}^{12}C^{14}N$.

Key words: Interstellar molecules; line strengths; methyl cyanide; microwave spectra; molecular constants; radio astronomy; rotational transitions.

Contents

1. Introduction

The present work is part of a series of critical reviews which are intended to update, revise and augment the existing literature on molecules which have been identified in interstellar molecular clouds. In order to provide complete coverage of the spectral regions where present and anticipated radio telescope receivers operate, all measured and predicted rotational transitions are included up to 300 GHz.

2. Organization of the Spectral Tables

The molecular constants for the ground vibrational state of the isotopic forms of methyl cyanide considered in this work are given in table 1; those for the ν_8 excited state of the most abundant isotopic species are given in table 6. The microwave spectral transitions of each of the methyl cyanide species are listed separately in table 2 through table 5; those for the ν_8 state are listed in tables 7 and 8. Table 9 contains a list of the strongest calculated transitions reported here, ordered by increasing frequency as an aid to the user. In table 2 ($^{12}CH_3{}^{12}C^{14}N$ ground state) and in table 7

($^{12}CH_3{}^{12}C^{14}N$ ν_8 excited state) the hyperfine splitting is also listed when the relative intensity of the components is more than about 0.01 and when its corresponding splitting is more than about 100 kHz.

The open literature relating to laboratory and astronomical studies of CH_3CN has been searched through December 1978. All pertinent references are given section 3.1.

2.1. Molecular Parameter Tables

The rotational and centrifugal distortion constants for $^{12}CH_3{}^{12}C^{14}N$, $^{13}CH_3{}^{12}C^{14}N$, $^{12}CH_3{}^{13}C^{14}N$ and $^{12}CH_3{}^{12}C^{15}N$ are given in table 1. Other pertinent molecular parameters are also found in table 1.

The rotational, centrifugal distortion and vibration-rotation interaction constants for the ν_8 degenerate vibrational excited state of $^{12}CH_3{}^{12}C^{14}N$ are given in table 6.

A full description of the theory of rotational spectra is given in a number of texts, but the books by Townes and Schawlow [1] [1], Gordy and Cook [2], Amat, Nielsen and Tarrago [3] and Kroto [4] are particularly thorough and the notation used here is generally consistent with these texts.

a. Parameters for the Ground State

The spectroscopic constants of the ground states of the various isotopic species were derived using the following expression for the frequency of a rotational $J+1, K \leftarrow J, K$ transition,

$$\nu_0=2B_0(J+1)-4D_J(J+1)^3-2D_{JK}(J+1)K^2 +H_{JJJ}(J+1)^3[(J+2)^3-J^3]+4H_{JJK}(J+1)^3K^2 +2H_{KKJ}(J+1)K^4.$$

For the $^{12}CH_3{}^{12}C^{14}N$ compound, the spin $I=1$ of the nitrogen introduces quadrupole and spin-rotation interaction.

The perturbed frequency for a $J+1, K, F \leftarrow J, K, F'$ transition is given by the following expression:

$$\nu=\nu_0+E_Q(J+1, K, F)-E_Q(J, K, F') +E_{SR}(J+1, K, F)-E_{SR}(J, K, F').$$

E_Q is the quadrupole interaction energy:

$$E_Q(J, K, F)=eqQ\left[\frac{3K^2}{J(J+1)}-1\right]f(I, J, F)$$

where

$$f(I, J, F)=\frac{3/4\, C(C+1)-I(I+1)J(J+1)}{2I(2I-1)(2J-1)(2J+3)}$$

with

$$F=J-1, J, J+1$$
$$C=F(F+1)-I(I+1)-J(J+1)$$

[1] Figures in brackets indicate literature references.

E_{SR} is the hyperfine energy for spin-rotation interaction:

$$E_{SR}(J, K, F)=-\frac{C}{2}\left[C_N+\frac{(C_K-C_N)K^2}{J(J+1)}\right]$$

where C_K is the principal value of the spin-rotation tensor along the symmetry axis and C_N the principal value normal to this axis.

For $^{12}CH_3{}^{12}C^{14}N$ a least-squares fitting of all observed transitions including hyperfine components was simultaneously carried out following closely the procedures suggested by Kirchhoff [5]. Because the data were obtained from a variety of sources, the assumption of equally probable errors for each of the transitions could not be made. Thus, each transition had to be weighted by the inverse square of its expected uncertainty. The reported estimates of measurements uncertainties were used. However, in certain isolated situations, the reported measurement uncertainty was judged to be underestimated by the criterion of its goodness of fit and it was necessary to assign a higher uncertainty to such transitions. Blended lines were assigned a higher uncertainty to such transitions. Blended lines were assigned zero weighting in the fitting. For the isotopic species ($^{13}CH_3{}^{12}C^{14}N$, $^{12}CH_3{}^{13}C^{14}N$, $^{12}CH_3{}^{12}C^{15}N$), the hyperfine splitting was neglected and only the unresolved lines were taken into account in the weighted least-squares fitting.

b. Parameters for ν_8 Excited Vibrational State

The lowest fundamental vibration of the methyl cyanide molecule is the $C-C\equiv N$ bending mode ($\nu_8=364.71$ cm^{-1} [78 B]). This vibration is doubly degenerate, having E vibrational symmetry. This introduces an internal vibrational angular momentum characterized by the ℓ quantum number, which removes the K degeneracy. For a $v_E=1$ state, $|\ell|=1$; higher order calculations of the energy introduce "ℓ type doubling" effects which involve splittings of all the K lines according to the positive or negative value of the $K\ell$ product, and a further splitting of those states for which $K=\ell=\pm1$.

For molecules with a threefold symmetry axis, the frequency of a rotational transition $J+1, K, \ell \leftarrow J, K, \ell$ is given by the following expression:

$$\nu=2B^*_v(J+1)-4D_J(J+1)^3-2D_{JK}(J+1)(K\ell-1)^2 +2\rho^*(J+1)(K\ell-1)$$

$$\pm 4[q_0+2\mu_J(J+1)^2](J+1) \quad \text{if } K\ell=+1$$

$$-\frac{4q^2_0(J+1)^3}{(K\ell-1)(B-A+A\zeta)} \quad \text{if } K\ell\neq+1.$$

The convention of Amat, Nielsen and Tarrago [3] has been adopted, where

$$B^*=B_v-D_{JK}+\eta_J+12\frac{q_{12}}{B-A-2A\zeta^2}$$

$$\rho^*=\eta_J-2D_{JK}+\frac{2q^2_0}{B-A+A\zeta^2}+\frac{8(q_{12})^2}{B-A-2A\zeta^2}$$

as proposed by Grenier Besson [6]. These authors use for the ℓ type doubling constant q_0 a definition different from that given in standard text books [1] [2], the q_0 constant given by Amat et al. [3] being four times smaller.

As in the ground vibrational state, the spin of the ^{14}N atom introduces a quadrupole interaction. For a degenerate excited state, the quadrupole energy E_Q is [7]:

$$E_Q(J,K,F)=eqQ\left[\frac{3K^2}{J(J+1)}-1\right]f(I,J,F) \quad \text{if } K\ell\neq 1$$

$$E^{\pm}{}_Q(J,K,F)=\left\{eqQ\left[\frac{3}{J(J+1)}-1\right]\pm 2eqQ\eta\right\}f(I,J,K) \quad \text{if } K=\ell=\pm 1$$

An additional higher order "asymmetry parameter" η has to be taken into account for the $K=\ell=\pm 1$ doublets. Since $f(I, J, F)$ decreases rapidly when J increases, the influence of the quadrupole interaction and especially of the $eqQ\eta$ term is greatest for the low J rotational states.

Direct "ℓ type doubling" transitions can occur between $\Delta J=0$, $K=\ell=\pm 1$ levels. The frequencies of such transitions are given by the following formula:

$$\nu=4[q_0+\mu_J J(J+1)]J(J+1)$$

As this type of transitions is generally observed for high J values, the μ_J corrective term becomes more significant; on the other hand the quadrupole interaction can be neglected.

2.2. Microwave Spectral Tables

The results of the statistical analysis of the rotational spectrum of the various isotopic species of methyl cyanide and the lowest lying vibrational state of the most abundant isotopic species are given in tables 2, 3, 4, 5 and 7. The frequencies included in these tables include all transitions with sufficient intensity over the range 17 to 300 GHz. The first columns give the upper and lower state rotational quantum numbers of the transition in question. If vibrational angular momentum exists, the ℓ quantum numbers are also included. The observed line frequency follows next. The calculated frequencies and statistical uncertainty (one standard deviation) follow in the next column. For $^{12}CH_3{}^{12}C^{14}N$ in the ground state and in the ν_8 excited vibrational state, the hyperfine components were limited to those with relative intensities ≥ 0.01 and with splitting ≥ 100 kHz for each rotational transition.

Since the $\Delta J=0$ ℓ-doublet transitions are extremely weak at room temperature, table 8 includes only the range of transitions observed in the laboratory [68 A].

Values of the line strength of each transition included in the tables are calculated using the following expression:

$$S(J',J'')=\frac{J'^2-K^2}{J'}.$$

In first approximation, this formula is also valid in the case of transitions in a degenerate vibrational state.

For those transitions where the frequencies of the quadrupole hyperfine components are given, the line strength of each separate component is also included. The relative intensities of the various possible hyperfine component transitions are derived from tables given in references [1] and [2].

Moreover, for a comparison of the relative intensities of the K structure components, the effects of spin weight degeneracy has to be taken into account. For a molecule of threefold symmetry the degeneracy due to spin for each value of J and K is proportional [1], [2] to:

for K a multiple of 3, but not zero:

$$S(I,K)=\frac{2}{3}(4I^2+4I+3)(2I+1)$$

for $K=0$

$$S(I,K)=\frac{1}{3}(4I^2+4I+3)(2I+1)$$

for K not a multiple of 3:

$$S(I,K)=\frac{2}{3}(4I^2+4I)(2I+1)$$

where I is the spin of the three identical nuclei, i.e., $I=1/2$ in the case of CH_3CN.

In a degenerate vibrational state, the same formulas hold according to the values of $K-\ell$ instead of K.

Thus the line strengths given in the tables have to be multiplied by a factor 2 when K or $K-\ell$ is a multiple of 3, not zero.

For the ground state transitions, the approximate energy of the lowest level has been derived from the constants of table 1. For these computations, the A axial rotational constant, which could not be obtained experimentally, has been calculated from the structure [74A]. For the same reason, the D_K centrifugal distortion constant has been obtained from the force field [78B]. The sextic centrifugal distortion constants have been neglected.

For the energy calculations of the ν_8 state of CH_3CN, the $x_{\ell\ell}$ anharmonic constant used is that derived from the value of $A-x_{\ell\ell}$ obtained in the analysis of the $2\nu_8$ state [8]: $x_{\ell\ell}\simeq 167800$ MHz.

For the convenience of the user, the frequencies of the strongest transitions calculated in this work are arranged in numerical order in table 9; this tabulation has been arbitrarily limited to the $K \leq 3$ transitions, which are supposed to be the strongest for each isotopic species. The weak $\Delta J=0$ ℓ-doublet transitions given in table 8 are not repeated in table 9.

2.3. List of Symbols

A_v, B_v — Rotational constants for the ground ($v=0$) or excited state ($v \neq 0$)

D_J, D_{JK}, D_K — Quartic centrifugal distortion constants.

H_{JJJ}, H_{JJK}, H_{JKK} — Sextic centrifugal distortion constants.

eqQ — Nuclear quadrupole coupling constant.

η — "Asymmetry parameter" for the nuclear quadrupole coupling constant.

C_K — Principal value of the spin-rotation tensor along the symmetry axis.

C_N — Principal value of the spin-rotation tensor normal to symmetry axis.

q_0 — ℓ-type doubling constant. Coefficient of the $\langle K, \ell|H|K\pm 2, \ell\pm 2\rangle$ element in the energy matrix.

μ_J — Coefficient giving the variation of the ℓ-type doubling constant with the J quantum number.

q_{12} — Coefficient of the $\langle K, \ell|H|K\pm 1, \ell\mp 2\rangle$ element in the energy matrix.

η_J — Coefficient of the $J(J+1)$ K diagonal contribution in the energy matrix.

ζ^z — Coriolis coupling constant.

$x_{\ell\ell}$ — Anharmonic vibrational constant (ℓ^2 term).

J — Total rotational quantum number.

K — Projection of J on the symmetry axis.

F — Total angular momentum quantum number which includes nuclear spin.

ℓ — Quantum number for vibrational angular momentum.

v_t — Quantum number for the t^{th} vibrational state.

μ_0 — Electric dipole moment in the ground vibrational state.

$g_\perp$, $g_\parallel$ — Components of the molecular g tensor which are respectively perpendicular and parallel to the symmetry axis.

$\chi_\perp$, $\chi_\parallel$ — Components of the magnetic susceptibility tensor which are respectively perpendicular and parallel to the symmetry axis.

$\theta_\parallel$ — Component of the molecular quadrupole tensor which is parallel to the symmetry axis.

r°(X–Y) — Distance between centers of mass of atoms X and Y (Å).

α°(XYZ) — Angle formed by atoms X, Y, and Z (degrees).

(. . .) — Parentheses in the numerical listings contain measured uncertainties or standard deviations for calculated quantities.

2.4. References

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3. CH_3CN Spectral Tables

Table 1 Molecular Constants for Methyl Cyanide (Ground State).

	$^{12}CH_3{}^{12}C^{14}N$	$^{13}CH_3{}^{12}C^{14}N$	$^{12}CH_3{}^{13}C^{14}N$	$^{12}CH_3{}^{12}C^{15}N$
A(GHz)	157.3 [74 A]	157.3 [74 A]	157.3 [74 A]	157.3 [74 A]
B_0(MHz)	9198.899299 (80)	8933.3139 (23)	9194.3490 (22)	8922.04343 (97)
D_J(kHz)	3.8048 (15)	3.674 (16)	3.817 (17)	3.5788 (48)
D_{JK}(kHz)	177.417 (5)	167.650 (55)	176.146 (80)	169.043 (6)
D_K(kHz)[a]	2840 [78 B]	2850 [78 B]	2840 [78 B]	2850 [78 B]
H_{JJJ}(Hz)	- 0.0140 (56)			- 0.041 (26)
H_{JJK}(Hz)	1.071 (19)			0.586 (72)
H_{JKK}(Hz)	6.006 (52)			2.107 (76)
eqQ(kHz)	- 4225.34 (73)			
C_N(kHz)	- 1.85 (19)			
C_K(kHz)	- 0.7(fixed value)			

Dipole moment[b] for $^{12}CH_3{}^{12}C^{14}N$

μ_0 (Debyes) = 3.913 (2) [66 A]

Magnetic constants for $^{12}CH_3{}^{12}C^{14}N$

$g_\perp$ = - 0.0338 (8) [70 B]

$g_\parallel$ = 0.310 (30) [70 B]

$\chi_\perp - \chi_\parallel$ (erg/G^2.mole) = 10.5 (5) x 10^{-6} [70 B]

$\Theta_\parallel$ (esu.cm^2) = - 1.8 (12) x 10^{-26}

Structure [78 A]

r_z(C-C) = 1.4616 (6) Å ; r_z(C ≡ N) = 1.1567 (6) Å ;

r_z(C - H) = 1.0947 (24) Å

α(C - C - H) = 109°51' (6) ; α(H - C - H) = 109°05'

a Calculated from the force field

b Polarity determined to be $^{+}CH_3CN^{-}$ [70 B]

TABLE 2 · Microwave Spectrum of $^{12}C\ H_3\ ^{12}C\ ^{14}N$ in the Ground Vibrational State

Transition J'-J"	K	F'-F"	Obs. Freq. in MHz	(Est. Unc.)	Calc. Freq. in MHz	(Est. Unc.)	Line Strength	Approximate Energy in cm^{-1} Lower State	Ref.
1–0	0				18397.783		1.000	0.00	
		1–1	18396.7254	(5)	18396.7252	(7)	0.333		73 A
		2–1	18397.9948	(10)	18397.9965	(6)	0.555		73 A
		0–1	18399.8924	(2)	18399.8924	(3)	0.111		73 A
2–1	0				36795.475		2.000	0.61	
		2–2 }	36794.323	(150)	36794.2042	(11)	0.167		70 A
		1–0 }			36794.4173	(8)	0.222		
		2–1 }	36795.563	(30)	36795.4754	(6)	0.500		70 A
		3–2 }			36795.5678	(8)	0.932		
		1–2			36796.3132	(12)	0.011		
		1–1	36797.574	(30)	36797.5844	(4)	0.167		70 A
	1				36794.766		1.500	5.55	
		2–1	36793.739	(30)	36793.7092	(8)	0.375		70 A
		2–2			36794.3404	(12)	0.075		
		1–1			36794.7623	(8)	0.125		
		3–2	36795.013	(30)	36795.0244	(9)	0.644		70 A
		1–2			36795.3935	(17)	0.002		
		1–0	36796.344	(30)	36796.3480	(8)	0.166		70 A
3–2	0				55192.985		3.000	1.84	
		3–3			55191.6212	(15)	0.111		
		2–1			55192.7717	(7)	0.600		
		3–2			55192.9849	(7)	0.888		
		4–3	55193.026	(60)	55193.0370	(9)	1.287		70 A
		2–3			55193.5170	(20)	0.003		
		2–2			55194.8807	(6)	0.111		
	1				55191.921		2.666	6.78	
		3–3			55190.9723	(14)	0.098		
		3–2	55191.662	(60)	55191.6563	(7)	0.789		70 A
		2–1 }	55192.042	(60)	55192.0241	(7)	0.533		70 A
		4–3 }			55192.0356	(10)	1.144		
		2–3			55192.3931	(20)	0.003		
		2–2			55193.0771	(8)	0.098		
	2				55188.728		1.666	21.60	
		2–2			55187.6668	(16)	0.062		
		3–2	55187.702	(60)	55187.6712	(10)	0.493		
		2–3			55189.0217	(39)	0.017		
		3–3			55189.0261	(24)	0.062		
		4–3	55189.062	(60)	55189.0319	(13)	0.715		70 A
		2–1	55189.822	(60)	55189.7816	(11)	0.333		70 A

TABLE 2 Microwave Spectrum of $^{12}C\ H_3\ ^{12}C\ ^{14}N$ in the Ground Vibrational State (continued)

Transition J'-J"	K	F'-F"	Obs. Freq. in MHz	(Est. Unc.)	Calc. Freq. in MHz	(Est. Unc.)	Line Strength	Approximate Energy in cm^{-1} Lower State	Ref.
4-3	0				73590.220		4.000	3.68	
		3-2	73590.127	(2)	73590.1279	(7)	0.952		77 A
		4-3	73590.221	(2)	73590.2203	(7)	1.252		77 A
		5-4	73590.254	(2)	73590.2541	(9)	1.628		77 A
	1				73588.801		3.750	8.62	
		4-3	73588.695	(3)	73588.6956	(8)	1.173		77 A
		3-2	73588.804	(3)	73588.8068	(7)	0.925		77 A
		5-4	73588.864	(3)	73588.8656	(10)	1.526		77 A
	2				73584.545		3.000	23.44	
		4-3	73584.101	(30)	73584.1221	(9)	0.939		70 A
		5-4	73584.748	(30)	73584.7005	(12)	1.221		70 A
		3-2			73584.8444	(9)	0.714		
	3				73577.453		1.750	48.13	
		4-3	73576.501	(30)	73576.5016	(12)	0.548		70 A
		5-4	73577.768	(30)	73577.7607	(16)	0.712		70 A
		3-2	73578.256	(30)	73578.2422	(14)	0.416		70 A
5-4	0				91987.090		5.000	6.14	
		4-3			91987.0382	(8)	1.295		
		5-4	91987.054	(60)	91987.0903	(8)	1.600		70 A
		6-5			91987.1143	(9)	1.970		
	1				91985.317		4.800	11.07	
		5-4			91985.2639	(7)	1.536		
		4-3	91985.284	(60)	91985.3073	(8)	1.243		70 A
		6-5			91985.3578	(9)	1.891		
	2		91980.000	(250)	91979.997		4.200	25.89	61 A
		5-4			91979.7854	(8)	1.344		
		6-5			91980.0889	(10)	1.655		
		4-3			91980.1154	(8)	1.088		
	3				91971.132		3.200	50.59	
		5-4	91970.642	(60)	91970.6570	(11)	1.024		70 A
		6-5	91971.374	(60)	91971.3098	(14)	1.261		70 A
		4-3			91971.4646	(12)	0.829		
	4				91958.728		1.800	85.15	
		5-4	91957.908	(60)	91957.8822	(16)	0.576		70 A
		6-5	91959.206	(200)	91959.0240	(20)	0.709		70 A
		4-3			91959.3586	(18)	0.466		
6-5	0				110383.504		6.000	9.20	
		5-4			110383.4697	(11)	1.638		
		6-5	110383.494	(60)	110383.5036	(10)	1.944		70 A
		7-6			110383.5217	(10)	2.310		

TABLE 2 Microwave Spectrum of $^{12}C\ H_3\ ^{12}C\ ^{14}N$ in the Ground Vibrational State (continued)

Transition J'-J"	K	F'-F"	Obs. Freq. in MHz	(Est. Unc.)	Calc. Freq. in MHz	(Est. Unc.)	Line Strength	Approximate Energy in cm^{-1} Lower State	Ref.
	1				110381.376		5.833	14.15	
		6–5			110381.3454	(9)	1.879		
		5–4			110381.3641	(10)	1.583		
		7–6	110381.4054	(2)	110381.4042	(10)	2.233		77 A
	2				110374.992		5.333	28.96	
		6–5	110374.874	(4)	110374.8717	(8)	1.717		77 A
		5–4	110374.986	(60)	110375.0480	(9)	1.447		70 A
		7–6			110375.0524	(10)	2.041		
	3				110364.357		4.500	53.66	
		6–5	110364.084	(5)	110364.0850	(10)	1.458		77 A
		7–6	110364.470	(5)	110364.4691	(12)	1.733		77 A
		5–4			110364.5242	(11)	1.229		
	4				110349.473		3.333	88.22	
		6–5	110348.972	(60)	110348.9897	(14)	1.069		70 A
		7–6	110349.706	(100)	110349.6585	(17)	1.271		70 A
		5–4			110349.7968	(16)	0.901		
	5				110330.347		1.833	132.65	
		6–5	110329.608	(60)	110329.5919	(21)	0.583		70 A
		7–6	110330.728	(100)	110330.6266	(25)	0.693		70 A
		5–4			110330.8720	(23)	0.491		
7–6	0		128779.404	(60)	128779.369	(40)	7.000	12.89	70 A
	1		128776.928	(60)	128776.886	(40)	6.857	17.83	70 A
	2		128769.440	(60)	128769.440	(60)	6.429	32.65	70 A
	3				128757.034		5.714	57.34	
		7–6	128757.140	(60)	128756.8642	(11)	1.864		70 A
		8–7			128757.1105	(12)	2.155		
		6–5			128757.1285	(13)	1.607		
	4				128739.672		4.714	91.90	
		7–6	128739.852	(60)	128739.3703	(14)	1.537		70 A
		8–7			128739.7969	(16)	1.777		
		6–5			128739.8588	(15)	1.325		
	5				128717.362		3.430	136.33	
		7–6	128716.860	(60)	128716.8902	(20)	1.112		70 A
		8–7	128717.628	(100)	128717.5487	(22)	1.285		70 A
		6–5			128717.6670	(21)	0.959		
	6				128690.112		1.857	190.60	
		7–6	128689.476	(60)	128689.4330	(27)	0.589		70 A
		8–7	128690.538	(150)	128690.3750	(30)	0.680		70 A
		6–5			128690.5622	(29)	0.507		

TABLE 2 Microwave Spectrum of $^{12}C\ H_3\ ^{12}C\ ^{14}N$ in the Ground Vibrational State (continued)

Transition J'-J"	K	F'-F"	Obs. Freq. in MHz	(Est. Unc.)	Calc. Freq. in MHz	(Est. Unc.)	Line Strength	Approximate Energy in cm^{-1} Lower State	Ref.
8–7	0		147174.596	(60)	147174.594	(30)	8.000	17.18	70 A
	1		147171.768	(60)	147171.757	(30)	7.875	22.12	70 A
	2		147163.300	(60)	147163.249	(60)	7.500	36.94	70 A
	3				147149.073		6.875	61.63	
		8–7	147148.959	(5)	147148.9600	(16)	2.263		77 A
		9–8	147149.128	(60)	147149.1280	(16)	2.574		70 A
		7–6			147149.1307	(18)	1.994		
	4				147129.235		6.000	96.20	
		8–7			147129.0334	(16)	1.968		
		9–8	147129.248	(60)	147129.3230	(17)	2.238		70 A
		7–6			147129.3509	(18)	1.734		
	5				147103.742		4.875	140.62	
		8–7			147103.4274	(20)	1.607		
		9–8	147103.902	(60)	147103.8732	(21)	1.828		70 A
		7–6			147103.9336	(22)	1.416		
	6				147 072.605		3.500	194.89	
		8–7	147072.110	(60)	147072.1522	(26)	1.148		70 A
		9–8	147072.868	(60)	147072.7890	(28)	1.306		70 A
		7–6			147072.8892	(27)	1.012		
	7				147035.837		1.875	259.01	
		8–7	147035.206	(60)	147035.2206	(32)	0.623		70 A
		9–8	147036.206	(60)	147036.0832	(35)	0.709		70 A
		7–6			147036.2303	(34)	0.549		
9–8	0		165568.950	(500)	165569.088	(20)	9.000	22.09	61 A
	1		165565.710	(500)	165565.897	(20)	8.899	27.03	61 A
	2		165556.180	(500)	165556.328	(40)	8.556	41.85	61 A
	3		165540.310	(500)	165540.383		8.000	66.54	61 A
		9–8			165540.3037	(22)	2.632		
		8–7			165540.4197	(23)	2.352		
		10–9			165540.4238	(21)	2.944		
	4		165517.930	(500)	165518.069		7.222	101.10	61 A
		9–8			165517.9282	(21)	2.369		
		10–9			165518.1342	(20)	2.650		
		8–7			165518.1457	(22)	2.117		
	5		165489.390	(500)	165489.396		6.222	145.53	61 A
		9–8			165489.1754	(23)	2.040		
		10–9			165489.4917	(23)	2.282		
		8–7			165489.5233	(24)	1.823		

TABLE 2 Microwave Spectrum of $^{12}C\ H_3\ ^{12}C\ ^{14}N$ in the Ground Vibrational State (continued)

Transition J'-J"	K	F'-F"	Obs.Freq. in MHz	(Est. Unc.)	Calc. Freq. in MHz	(Est. Unc.)	Line Strength	Approximate Energy in cm^{-1} Lower State	Ref.
	6				165454.374		5.000	199.80	
		9-8			165454.0569	(26)	1.645		
		10-9			165454.5081	(27)	1.840		
		8-7			165454.5641	(27)	1.470		
	7				165413.018		3.556	263.92	
		9-8			165412.5869	(29)	1.152		
		10-9			165413.1974	(31)	1.288		
		8-7			165413.2824	(31)	1.029		
	8				165365.346		1.889	337.86	
		9-8			165364.7823	(34)	0.625		
		10-9			165365.5768	(37)	0.699		
		8-7			165365.6951	(36)	0.559		
10-9	0		183962.620	(500)	183962.758	(15)	10.000	27.61	61 A
	1		183959.080	(500)	183959.214	(20)	9.600	32,55	61 A
	2		183948.490	(500)	183 948.584	(40)	9.600	47.37	61 A
	3				183930.872		9.100	72.06	
		10-9	183930.804	(10)	183930.8139	(27)	3.003		77 A
		9-8			183930.8961	(29)	2.712		
		11-10			183930.9032	(26)	3.321		
	4				183906.084		8.400	106.62	
		10-9	183905.989	(10)	183905.9817	(25)	2.772		77 A
		11-10			183906.1338	(24)	3.066		
		9-8			183906.1369	(27)	2.503		
	5				183874.232		7.500	151.05	
		10-9	183874.073	(10)	183874.0719	(26)	2.475		77 A
		11-10			183874.3048	(26)	2.738		
		9-8			183874.3209	(27)	2.235		
	6				183835.328		6.400	205.32	
		10-9			183835.0974	(28)	2.112		
		11-10			183835.4291	(28)	2.336		
		9-8			183835.4611	(29)	1.907		
	7				183789.388		5.100	269.43	
		10-9	183789.075	(10)	183789.0742	(29)	1.683		77 A
		11-10			183789.5226	(30)	1.862		
		9-8			183789.5733	(30)	1.520		
	8				183736.431		3.600	343.37	
		10-9	183736.020	(10)	183736.0208	(29)	1.188		77 A
		11-10	183736.607	(10)	183736.6040	(31)	1.314		77 A
		9-8	183736.668	(10)	183736.6764	(31)	1.073		77 A

TABLE 2 Microwave Spectrum of $^{12}C\ H_3\ ^{12}C\ ^{14}N$ in the Ground Vibrational State (continued)

Transition J'-J"	K	F'-F"	Obs. Freq. in MHz (Est. Unc.)		Calc. Freq. in MHz (Est. Unc.)		Line Strength	Approximate Energy in cm^{-1} Lower State	Ref.
	9				183676.478		1.900	427.12	
		10-9	183675.962	(10)	183675.9591	(38)	0.627		77 A
		11-10	183676.697	(10)	183676.6949	(41)	0.694		77 A
		9-8	183676.792	(10)	183676.7919	(40)	0.566		77 A
11-10	0		202355.610	(500)	202355.514	(15)	11.000	33.75	61 A
	1		202351.450	(500)	202351.617	(15)	10.900	38.69	61 A
	2		202340.100	(500)	202339.926	(25)	10.636	53.50	61 A
	3		202321.540	(500)	202320.448	(50)	10.180	78.20	61 A
	4		202293.780	(500)	202293.189		9.545	112.76	61 A
		11-10			202293.1117	(28)	3.145		
		10-9			202293.2259	(29)	2.869		
		12-11			202293.2274	(27)	3.439		
	5		202257.870	(500)	202258.160		8.727	157.18	61 A
		11-10			202258.0399	(28)	2.880		
		12-11			202258.2167	(28)	3.149		
		10-9			202258.2240	(30)	2.627		
	6				202215.376		7.728	211.45	
		11-10			202215.2035	(30)	2.548		
		12-11			202215.4548	(30)	2.787		
		10-9			202215.4729	(31)	2.325		
	7				202164.855		6.545	275.56	
		11-10			202164.6200	(30)	2.166		
		12-11			202164.9593	(31)	2.369		
		10-9			202164.9901	(32)	1.977		
	8				202106.617		5.182	349.50	
		11-10			202106.3098	(27)	1.715		
		12-11			202106.7507	(28)	1.876		
		10-9			202106.7962	(29)	1.565		
	9				202040.686		3.636	433.24	
		11-10			202040.2968	(31)	1.204		
		12-11			202040.8529	(33)	1.316		
		10-9			202040.9150	(33)	1.098		
	10				201967.088		1.909	526.78	
		11-10			201966.6079	(63)	0.632		
		12-11			201967.2928	(64)	0.691		
		10-9			201967.3735	(64)	0.576		
12-11	0		220747.240	(500)	220747.263	(20)	12.000	40.50	61 A
	1		220742.990	(500)	220743.013	(20)	11.917	45.44	61 A
	2		220730.270	(500)	220730.263	(20)	11.667	60.26	61 A
	3		220709.080	(500)	220709.020	(50)	11.250	84.95	61 A

TABLE 2 Microwave Spectrum of $^{12}C\ H_3\ ^{12}C\ ^{14}N$ in the Ground Vibrational State (continued)

Transition J'-J"	K	F'-F"	Obs. Freq. in MHz	(Est. Unc.)	Calc. Freq. in MHz	(Est. Unc.)	Line Strength	Approximate Energy in cm^{-1} Lower State	Ref.
	4		220679.320	(500)	220679.291	(70)	10.667	119.51	61 A
	5		220641.120	(500)	220641.088	(100)	9.917	163.93	61 A
	6				220594.428		9.000	218.20	
		12-11			220594.2954	(33)	2.979		
		13-12			220594.4905	(33)	3.240		
		11-10			220594.5002	(34)	2.739		
	7				220539.330		7.917	282.31	
		12-11			220539.1488	(34)	2.621		
		13-12			220539.4119	(34)	2.850		
		11-10			220539.4306	(35)	2.410		
	8				220475.815		6.667	356.24	
		12-11			220475.5786	(30)	2.207		
		13-12			220475.9203	(31)	2.400		
		11-10			220475.9492	(32)	2.029		
	9				220403.910		5.250	439.98	
		12-11			220403.6107	(31)	1.738		
		13-12			220404.0415	(32)	1.890		
		11-10			220404.0821	(33)	1.598		
	10				220323.644		3.367	533.51	
		12-11			220323.2747	(61)	1.115		
		13-12			220323.8050	(61)	1.212		
		11-10			220323.8586	(62)	1.025		
	11				220235.050		1.917	636.81	
		12-11			220234.6034	(123)	0.635		
		13-12			220235.2436	(124)	0.690		
		11-10			220235.3116	(124)	0.583		
13-12	0				239137.914	(20)	13.000	47.86	
	1				239133.311	(20)	12.923	52.80	
	2				239119.503	(20)	12.692	67.62	
	3				239096.496	(50)	12.308	92.31	
	4				239064.299	(70)	11.769	126.87	
	5				239022.926	(100)	11.077	171.29	
	6				238972.393		10.231	225.56	
		13-12	238972.281	(10)	238972.2883	(44)	3.390		77 A
		14-13			238972.4429	(45)	3.663		
		12-11			238972.4475	(44)	3.138		
	7				238912.721		9.231	289.66	
		13-12	238972.580	(10)	238912.5785	(44)	3.059		77 A
		14-13			238912.7868	(45)	3.305		
		12-11			238912.7978	(44)	2.831		

TABLE 2 Microwave Spectrum of $^{12}C\ H_3\ ^{12}C\ ^{14}N$ in the Ground Vibrational State (continued)

Transition J'-J"	K	F'-F"	Obs. Freq. in MHz (Est: Unc.)		Calc. Freq. in MHz (Est. Unc)		Line Strength	Approximate Energy in cm^{-1} Lower State	Ref
	8				238843.934		8.077	363.60	
		13-12	238843.754	(10)	238843.7481	(42)	2.676		77 A
		14-13			238844.0185	(43)	2.892		
		12-11			238844.0369	(42)	2.477		
	9				238766.060		6.769	447.34	
		13-12	238765.827	(10)	238765.8253	(43)	2.243		77 A
		14-13			238766.1660	(44)	2.424		
		12-11			238766.1927	(44)	2.076		
	10				238679.132		5.308	540.86	
		13-12	238678.839	(10)	238678.842	(69)	1.759		77 A
		14-13			238679.2611	(69)	1.900		
		12-11			238679.2973	(70)	1.628		
	11				238583.185		3.692	644.16	
		13-12			238582.8337	(130)	1.223		
		14-13			238583.3396	(130)	1.322		
		12-11			238583.3862	(131)	1.132		
	12				238478.258		1.923	757.20	
		13-12			238477.8398	(229)	0.637		
		14-13			238478.4408	(229)	0.688		
		12-11			238478.4987	(230)	0.590		
14-13	0				257527.374	(20)	14.000	55.84	
	1				257522.418	(20)	13.929	60.78	
	2				257507.553	(50)	13.714	75.60	
	3				257482.784	(50)	13.357	100.29	
	4				257448.122	(80)	12.857	134.84	
	5				257403.581	(100)	12.214	179.26	
	6				257349.178		11.429	233.53	
		14-13			257349.0946	(76)	3.790		
		15-14			257349.2196	(77)	3.072		
		13-12			257349.2208	(75)	3.527		
	7				257284.937		10.500	297.63	
		14-13			257284.8234	(71)	3.482		
		15-14			257284.9914	(73)	3.741		
		13-12			257284.9973	(71)	3.241		
	8				257210.883		9.429	371.56	
		14-13			257210.7347	(68)	3.127		
		15-14			257210.9525	(69)	3.360		
		13-12			257210.9639	(67)	2.910		

TABLE 2 Microwave Spectrum of $^{12}C\ H_3\ ^{12}C\ ^{14}N$ in the Ground Vibrational State (continued)

Transition J'-J"	K	F'-F"	Obs. Freq. in MHz (Est. Unc.)	Calc. Freq. in MHz (Est. Unc)		Line Strength	Approximate Energy in cm^{-1} Lower State	Ref.
	9			257127.047		8.214	455.30	
		14-13		257126.8591	(69)	2.724		
		15-14		257127.1332	(70)	2.927		
		13-12		257127.1509	(69)	2.535		
	10			257033.463		6.857	548.83	
		14-13		257033.2307	(90)	2.274		
		15-14		257033.5680	(90)	2.443		
		13-12		257033.5925	(90)	2.116		
	11			256930.169		5.357	652.12	
		14-13		256929.8881	(147)	1.777		
		15-14		256930.2950	(147)	1.909		
		13-12		256930.3272	(147)	1.653		
	12			256817.208		3.714	765.15	
		14-13		256816.8734	(246)	1.249		
		15-14		256817.3566	(246)	1.323		
		13-12		256817.3973	(246)	1.146		
	13			256694.626		1.929	887.91	
		14-13		256694.2332	(392)	0.639		
		15-14		256694.7994	(392)	0.687		
		13-12		256694.8492	(393)	0.595		
15-14	0			275915.550	(50)	15.000	64.43	
	1			275910.243	(50)	14.933	69.37	
	2			275894.321	(50)	14.733	84.18	
	3			275867.792	(50)	14.400	108.87	
	4			275830.668	(80)	13.933	143.43	
	5			275782.962	(100)	13.333	187.85	
	6			275724.694		12.600	242.11	
		15-14		275724.6259	(136)	4.813		
		14-13		275724.7273	(135)	3.910		
		16-15		275724.7283	(137)	4.471		
	7			275655.888		11.733	306.22	
		15-14		275655.7958	(125)	3.894		
		16-15		275655.9333	(127)	4.163		
		14-13		275655.9359	(124)	3.641		
	8			275576.573		10733	380.14	
		15-14		275576.4520	(117)	3.562		
		16-15		275576.6301	(118)	3.331		
		14-13		275576.6369	(116)	3.331		
	9			275486.780		9.600	463.88	
		15-14		275486.6272	(114)	3.186		
		16-15		275486.8512	(116)	3.406		
		14-13		275486.8627	(113)	2.963		

TABLE 2 Microwave Spectrum of $^{12}C\ H_3\ ^{12}C\ ^{14}N$ in the Ground Vibrational State (continued)

Transition J'-J"	K	F'-F"	Obs. Freq. in MHz (Est. Unc.)	Calc. Freq. in MHz (Est. Unc.)		Line Strength	Approximate Energy in cm^{-1} Lower State	Ref.
	10			275386.547		8.333	557.40	
		15-14		275386.3579	(128)	2.765		
		16-15		275386.6334	(129)	2.957		
		14-13		275386.6500	(128)	2.586		
	11			275275.914		6.933	660.69	
		15-14		275275.6854	(178)	2.301		
		16-15		275276.0176	(178)	2.460		
		14-13		275276.0401	(178)	2.152		
	12			275154.927		5.400	773.72	
		15-14		275154.6549	(273)	1.792		
		16-15		275155.0494	(273)	1.916		
		14-13		275155.0782	(274)	1.676		
	13			275023.635		3.733	896.47	
		15-14		275023.3163	(421)	1.239		
		16-15		275023.7784	(421)	1.325		
		14-13		275023.8141	(422)	1.159		
	14			274882.093		1.933	1028.92	
		15-14		274881.7236	(628)	0.641		
		16-15		274882.2588	(627)	0.686		
		14-13		274882.3018	(628)	0.600		
16-15	0			294302.352	(50)	16.000	73.63	
	1			294296.692	(50)	15.937	78.57	
	2			294279.716	(80)	15.750	93.38	
	3			294251.429	(80)	15.437	118.07	
	4			294211.844	(100)	15.000	152.63	
	5			294160.977	(100)	14.437	197.04	
	6			294098.848	(100)	13.750	251.31	
	7			294025.483		12.937	315.41	
		16-15		294025.4067	(212)	4.295		
		17-16		294025.5207	(212)	4.574		
		15-14		294025.5211	(211)	4.034		
	8			293940.912		12.000	389.33	
		16-15		293940.8121	(196)	3.984		
		17-16		293940.9597	(198)	4.242		
		15-14		293940.9632	(195)	3.742		
	9			293845.169		10.937	473.06	
		16-15		293845.0428	(187)	3.631		
		17-16		293845.2284	(188)	3.867		
		15-14		293845.2355	(186)	3.410		

TABLE 2 Microwave Spectrum of $^{12}C\ H_3\ ^{12}C\ ^{14}N$ in the Ground Vibrational State (continued)

Transition J'-J"	K	F'-F"	Obs. Freq. in MHz (Est. Unc.)	Calc. Freq. in MHz (Est. Unc.)		Line Strength	Approximate Energy in cm^{-1} Lower State	Ref.
	10			293738.293		9.750	566.58	
		16–15		293738.1380	(192)	3.237		
		17–16		293738.3660	(194)	3.447		
		15–14		293738.3771	(191)	3.040		
	11			293620.330		8.437	669.87	
		16–15		293620.1415	(230)	2.801		
		17–16		293620.4164	(231)	2.983		
		15–14		293620.4320	(229)	2.631		
	12			293491.326		7.000	782.90	
		16–15		293491.1018	(317)	2.324		
		17–16		293491.4281	(317)	2.475		
		15–14		293491.4485	(317)	2.183		
	13			293351.334		5.437	905.65	
		16–15		293351.0719	(462)	1.805		
		17–16		293351.4540	(462)	1.922		
		15–14		293351.4797	(463)	1.695		
	14			293200.414		3.750	1038.08	
		16–15		293200.1094	(673)	1.245		
		17–16		293200.5519	(673)	1.326		
		15–14		293200.5833	(673)	1.169		
	15			293038.626		1.937	1180.18	
		16–15		293038.2767	(956)	0.643		
		17–16		293038.7839	(956)	0.685		
		15–14		293038.8214	(957)	0.604		

TABLE 3 Microwave Spectrum of $^{13}C H_3$ ^{12}C ^{14}N in the Ground Vibrational State

Transition J'K' ←	J"K"	Obs. Freq. in MHz (Est. Unc.)		Calc. Freq. in MHz (Est. Unc.)		Line Strength	Approximate Energy in cm^{-1} Lower State	Ref.
1,0	0,0	17866.600	(60)	17866.613	(9)	1.000	0.00	78 A
2,0	1,0			35733.138	(18)	2.000	0.50	
2,1	1,1			35732.467	(18)	1.500	5.58	
3,0	2,0			53599.487	(25)	3.000	1.79	
3,1	2,1			53598.481	(25)	2.667	6.77	
3,2	2,2			53595.463	(25)	1.667	21.73	
4,0	3,0	71465.520	(100)	71465.571	(30)	4.000	3.57	78 A
4,1	3,1	71464.140	(100)	71464.229	(30)	3.750	8.56	78 A
4,2	3,2			71460.206	(30)	3.000	23.51	
4,3	3,3			71453.500	(30)	1.750	48.43	
5,0	4,0			89331.302	(33)	5.000	5,96	
5,1	4,1			89329.625	(32)	4.800	10.94	
5,2	4,2			89324.596	(32)	4.200	25.90	
5,3	4,3			89316.213	(32)	3.200	50.82	
5,4	4,4			89304.478	(33)	1.800	85.70	
6,0	5,0	107196.570	(100)	107196.592	(32)	6.000	8.94	78 A
6,1	5,1	107194.550	(100)	107194.580	(32)	5.883	13.92	78 A
6,2	5,2	107188.500	(100)	107188.545	(31)	5.333	28.88	78 A
6,3	5,3	107178.500	(100)	107178.486	(31)	4.500	53.80	78 A
6,4	5,4	107164.480	(120)	107164.403	(32)	3.333	88.68	78 A
6,5	5,5			107146.297	(38)	1.833	133.52	
7,0	6,0	125061.300	(100)	125061.353	(30)	7.000	12.52	78 A
7,1	6,1	125058.980	(100)	125059.006	(30)	6.857	17.50	78 A
7,2	6,2	125051.900	(100)	125051.965	(28)	6.429	32.46	78 A
7,3	6,3	125040.200	(100)	125040.229	(27)	5.714	57.38	78 A
7,4	6,4	125023.860	(120)	125023.800	(28)	4.714	92.25	78 A
7,5	6,5	125002.800	(120)	125002.676	(36)	3.429	137.09	78 A
7,6	6,6			124976.858	(49)	1.857	191.87	
8,0	7,0	142925.600	(120)	142925.497	(30)	8.000	16.69	70 A
8,1	7,1	142922.844	(120)	142922.815	(29)	7.875	21.67	70 A
8,2	7,2	142914.850	(120)	142914.768	(26)	7.500	36.62	70 A
8,3	7,3	142901.396	(120)	142901.356	(23)	6.875	61.55	70 A
8,4	7,4	142882.626	(120)	142882.579	(24)	6.000	96.43	70 A
8,5	7,5	142858.466	(120)	142858.437	(33)	4.875	141.26	70 A
8,6	7,6	142828.900	(120)	142828.931	(49)	3.500	196.04	70 A
8,7	7,7			142794.060	(70)	1.875	260.74	
9,0	8,0	160788.950	(100)	160788.935	(38)	9.000	21.45	78 A
9,1	8,1	160785.900	(100)	160785.918	(37)	8.889	26.44	78 A
9,2	8,2	160776.820	(100)	160776.865	(33)	8.556	41.39	78 A
9,3	8,3	160761.790	(100)	160761.776	(29)	8.000	66.31	78 A
9,4	8,4	160740.520	(150)	160740.652	(28)	7.222	101.19	78 A

TABLE 3 Microwave Spectrum of $^{13}C\ H_3\ ^{12}C\ ^{14}N$ in the Ground Vibrational State (continued)

Transition J'K' ←	J"K"	Obs. Freq. in MHz (Est. Unc.)	Calc. Freq. in MHz (Est. Unc.)	Line Strength	Approximate Energy in cm^{-1} Lower State	Ref.
9,5	8,5	160713.370 (150)	160713.493 (36)	6.222	146.03	78 A
9,6	8,6	160680.300 (150)	160680.298 (52)	5.000	200.80	78 A
9,7	8,7	160641.150 (150)	160641.068 (75)	3.556	265.50	78 A
9,8	8,8		160595.803 (103)	1.889	340.12	
10,0	9,0	178651.620 (100)	178651.580 (59)	10.000	26.82	78 A
10,1	9,1	178648.240 (100)	178648.227 (58)	9.900	31.80	78 A
10,2	9,2	178638.240 (100)	178638.168 (54)	9.600	46.76	78 A
10,3	9,3	178621.390 (100)	178621.403 (50)	9.100	71.67	78 A
10,4	9,4	178597.980 (150)	178597.932 (48)	8.400	106.56	78 A
10,5	9,5	178567.690 (150)	178567.755 (52)	7.500	151.38	78 A
10,6	9,6	178530.840 (150)	178530.872 (65)	6.400	206.16	
10,7	9,7		178487.283 (87)	5.100	270.86	
10,8	9,8		178436.988 (116)	3.600	345.48	
10,9	9,9		178379.987 (151)	1.900	429.99	
11,0	10,0		196513.343 (91)	11.000	32.78	
11,1	10,1		196509.655 (89)	10.909	37.76	
11,2	10,2		196498.590 (86)	10.636	52.71	
11,3	10,3		196480.148 (82)	10.182	77.63	
11,4	10,4		196454.330 (79)	9.545	112.51	
11,5	10,5		196421.135 (80)	8.727	157.34	
11,6	10,6		196380.564 (90)	7.727	212.12	
11,7	10,7		196332.616 (108)	6.545	276.82	
11,8	10,8		196277.292 (135)	5.182	351.43	
11,9	10,9		196214.591 (170)	3.636	435.94	
11,10	10,10		196144.513 (212)	1.909	530.33	
12,0	11,0		214374.136 (132)	12.000	39.33	
12,1	11,1		214370.112 (131)	11.917	44.32	
12,2	11,2		214358.041 (128)	11.667	59.27	
12,3	11,3		214337.923 (124)	11.250	84.19	
12,4	11,4		214309.758 (121)	10.667	119.07	
12,5	11,5		214273.546 (120)	9.917	163.90	
12,6	11,6		214229.286 (126)	9.000	218.67	
12,7	11,7		214176.979 (140)	7.917	283.37	
12,8	11,8		214116.625 (164)	6.667	357.98	
12,9	11,9		214048.224 (198)	5.250	442.49	
12,10	11,10		213971.776 (240)	3.667	536.87	
12,11	11,11		213887.280 (289)	1.917	641.12	
13,0	12,0		232233.870 (184)	13.000	46.48	
13,1	12,1		232229.511 (183)	12.923	51.47	
13,2	12,2		232216.434 (180)	12.692	66.42	
13,3	12,3		232194.640 (176)	12.308	91.34	

TABLE 3 Microwave Spectrum of $^{13}C\ H_3\ ^{12}C\ ^{14}N$ in the Ground Vibrational State (continued)

Transition J'K' ←	J"K"	Obs. Freq. in MHz (Est. Unc.)	Calc. Freq. in MHz (Est. Unc.)	Line Strength	Approximate Energy in cm^{-1} Lower State	Ref.
13,4	12,4		232164.128 (172)	11.769	126.21	
13,5	12,5		232124.898 (171)	11.077	171.04	
13,6	12,6		232076.950 (174)	10.231	225.81	
13,7	12,7		232020.284 (185)	9.231	290.51	
13,8	12,8		231954.900 (205)	8.077	365.12	
13,9	12,9		231880.799 (235)	6.769	449.63	
13,10	12,10		231797.980 (275)	5.308	544.01	
13,11	12,11		231706.443 (324)	3.692	648.25	
13,12	12,12		231606.188 (382)	1.923	762.32	
14,0	13,0		250092.458 (247)	14.000	54.22	
14,1	13,1		250087.764 (246)	13.929	59.21	
14,2	13,2		250073.681 (243)	13.714	74.17	
14,3	13,3		250050.210 (239)	13.357	99.08	
14,4	13,4		250017.351 (235)	12.857	133.96	
14,5	13,5		249975.103 (232)	12.214	178.79	
14,6	13,6		249923.467 (233)	11.429	233.65	
14,7	13,7		249862.442 (241)	10.500	298.25	
14,8	13,8		249792.029 (257)	9.429	372.86	
14,9	13,9		249712.228 (284)	8.214	457.36	
14,10	13,10		249623.038 (321)	6.857	551.71	
14,11	13,11		249524.460 (369)	5.357	655.93	
14,12	13,12		249416.493 (426)	3.714	770.0[illegible]	
14,13	13,13		249299.138 (492)	1.929	893.91	
15,0	14,0		267949.811 (321)	15.000	62.57	
15,1	14,1		267944.782 (320)	14.933	67.55	
15,2	14,2		267929.693 (317)	14.733	82.51	
15,3	14,3		267904.546 (313)	14.400	107.42	
15,4	14,4		267869.339 (308)	13.933	142.30	
15,5	14,5		267824.074 (305)	13.333	187.12	
15,6	14,6		267768.749 (304)	12.600	241.89	
15,7	14,7		267703.366 (310)	11.733	306.58	
15,8	14,8		267627.923 (322)	10.733	381.19	
15,9	14,9		267542.422 (345)	9.600	465.69	
15,10	14,10		267446.861 (379)	8.333	560.07	
15,11	14,11		267341.242 (424)	6.933	664.30	
15,12	14,12		267225.563 (480)	5.400	778.37	
15,13	14,13		267099.826 (546)	3.733	902.24	
15,14	14,14		266964.029 (622)	1.933	1035.88	
16,0	15,0		285805.842 (407)	16.000	71.51	
16,1	15,1		285800.477 (406)	15.937	76.49	
16,2	15,2		285784.383 (403)	15.750	91.44	
16,3	15,3		285757.559 (399)	15.437	116.36	

TABLE 3 Microwave Spectrum of $^{13}C\,H_3\,^{12}C\,^{14}N$ in the Ground Vibrational State (continued)

Transition J'K' ←	J"K"	Obs. Freq. in MHz (Est. Unc.)	Calc. Freq. in MHz (Est. Unc.)	Line Strength	Approximate Energy in cm^{-1} Lower State	Ref.
16,4	15,4		285720.005 (394)	15.000	151.23	
16,5	15,5		285671.722 (390)	14.437	196.06	
16,6	15,6		285612.709 (388)	13.750	250.82	
16,7	15,7		285542.967 (391)	12.937	315.51	
16,8	15,8		285462.495 (401)	12.000	390.11	
16,9	15,9		285371.293 (420)	10.937	474.61	
16,10	15,10		285269.362 (450)	9.750	568.99	
16,11	15,11		285156.701 (491)	8.437	673.22	
16,12	15,12		285033.311 (545)	7.000	787.28	
16,13	15,13		284899.191 (609)	5.437	911.15	
16,14	15,14		284754.341 (685)	3.750	1044.79	
16,15	15,15		284598.762 (771)	1.937	1188.17	

TABLE 4 Microwave Spectrum of $^{12}C\ H_3\ ^{13}C\ ^{14}N$ in the Ground Vibrational State

Transition J'K' ←	J"K"	Obs. Freq. in MHz (Est. Unc.)		Calc. Freq. in MHz (Est. Unc.)		Line Strength	Approximate Energy in cm^{-1} Lower State	Ref.
1,0	0,0			18388.683	(9)	1.000	0.00	
2,0	1,0	36777,18	(3)	36777.274	(17)	2.000	0.61	50 A
2,1	1,1			36776.569	(17)	1.500	5.59	
3,0	2,0			55165.682	(23)	3.000	1.84	
3,1	2,1			55164.625	(23)	2.667	6.82	
3,2	2,2			55161.454	(23)	1.667	21.74	
4,0	3,0	73553.82	(3)	73553.815	(28)	4.000	3.68	78 A
4,1	3,1	73552.36	(3)	73552.406	(28)	3.750	8.66	78 A
4,2	3,2			73548.178	(28)	3.000	23.59	
4,3	3,3			73541.133	(28)	1.750	48.46	
5,0	4,0	91941.58	(3)	91941.582	(31)	5.000	6.13	78 A
5,1	4,1	91939.79	(3)	91939.820	(30)	4.800	11.11	78 A
5,2	4,2	91934.60	(3)	91934.536	(30)	4.200	26.04	78 A
5,3	4,3			91925.729	(30)	3.200	50.91	
5,4	4,4			91913.398	(35)	1.800	85.74	
6,0	5,0			110328.890	(31)	6.000	9.20	
6,1	5,1	110326.87	(6)	110326.777	(30)	5.833	14.18	78 A
6,2	5,2	110320.40	(6)	110320.435	(29)	5.333	29.11	78 A
6,3	5,3	110309.80	(6)	110309.867	(29)	4.500	53.98	78 A
6,4	5,4	110295.20	(6)	110295.070	(34)	3.333	88.80	78 A
6,5	5,5			110276.047	(46)	1.833	133.56	
7,0	6,0	128715.65	(6)	128715.649	(32)	7.000	12.88	78 A
7,1	6,1	128713.11	(6)	128713.183	(30)	6.857	17.85	78 A
7,2	6,2	128705.74	(6)	128705.785	(28)	6.429	32.79	78 A
7,3	6,3	128693.38	(6)	128693.455	(27)	5.714	57.66	78 A
7,4	6,4	128676.29	(6)	128676.193	(32)	4.714	92.48	78 A
7,5	6,5			128653.998	(47)	3.429	137.24	
7,6	6,6			128626.872	(68)	1.857	191.92	
8,0	7,0	147101.78	(6)	147101.767	(37)	8.000	17.17	70 A
8,1	7,1	147099.04	(6)	147098.949	(35)	7.875	22.15	70 A
8,2	7,2	147090.54	(6)	147090.494	(31)	7.500	37.07	70 A
8,3	7,3	147076.40	(6)	147076.402	(27)	6.875	6[illegible].96	70 A
8,4	7,4	147056.56	(6)	147056.673	(32)	6.000	96.78	70 A
8,5	7,5	147031.29	(6)	147031.308	(48)	4.875	141.54	70 A
8,6	7,6	147000.35	(6)	147000.307	(73)	3.500	196.21	70 A
8,7	7,7			146963.668	(104)	1.875	260.80	
9,0	8,0			165487.152	(51)	9.000	22.08	
9,1	8,1			165483.981	(49)	8.889	27.05	
9,2	8,2			165474.469	(44)	8.556	41.99	
9,3	8,3			165458.616	(39)	8.000	66.86	
9,4	8,4			165436.422	(40)	7.222	101.68	

TABLE 4 Microwave Spectrum of $^{12}C\ H_3\ ^{13}C\ ^{14}N$ in the ground Vibrational State (continued)

Transition J'K' ←	J"K"	Obs. Freq. in MHz (Est. Unc.)		Calc. Freq. in MHz (Est. Unc.)		Line Strength	Approximate Energy in cm^{-1} Lower State	Ref.
9,5	8,5			165407.886	(54)	6.222	146.44	
9,6	8,6			165373.009	(80)	5.000	201.11	
9,7	8,7			165331.791	(114)	3.556	265.70	
9,8	8,8			165284.231	(156)	1.889	340.19	
10,0	9,0	183871.74	(6)	183871.712	(76)	10.000	27.60	78 A
10,1	9,1	183868.24	(6)	183868.189	(74)	9.900	32.57	78 A
10,2	9,2	183857.59	(6)	183857.620	(69)	9.600	47.50	78 A
10,3	9,3	183839.98	(6)	183840.006	(64)	9.100	72.38	78 A
10,4	9,4	183815.28	(6)	183815.345	(62)	8.400	107.20	78 A
10,5	9,5	183783.60	(6)	183783.639	(71)	7.500	151.95	78 A
10,6	9,6	183744.89	(6)	183744.887	(94)	6.400	206.63	78 A
10,7	9,7			183699.089	(128)	5.100	271.22	
10,8	9,8			183646.245	(172)	3.600	345.70	
10,9	9,9			183586.355	(223)	1.900	430.07	
11,0	10,0			202255.356	(111)	11.000	33.73	
11,1	10,1			202251.481	(110)	10.909	38.71	
11,2	10,2			202239.855	(105)	10.636	53.64	
11,3	10,3			202220.479	(99)	10.182	78.51	
11,4	10,4			202193.353	(95)	9.545	113.31	
11,5	10,5			202158.476	(100)	8.727	158.08	
11,6	10,6			202115.848	(117)	7.727	212.76	
11,7	10,7			202065.471	(149)	6.545	277.35	
11,8	10,8			202007.342	(193)	5.182	351.83	
11,9	10,9			201941.464	(246)	3.636	436.19	
11,10	10,10			201867.835	(309)	1.909	530.42	
12,0	11,0			220637.992	(157)	12.000	40.48	
12,1	11,1			220633.765	(155)	11.917	45.45	
12,2	11,2			220621.082	(150)	11.667	60.38	
12,3	11,3			220599.945	(144)	11.250	85.26	
12,4	11,4			220570.352	(139)	10.667	120.08	
12,5	11,5			220532.305	(140)	9.917	164.83	
12,6	11,6			220485.802	(153)	9.000	219.50	
12,7	11,7			220430.845	(180)	7.917	284.08	
12,8	11,8			220367.432	(221)	6.667	358.57	
12,9	11,9			220295.564	(275)	5.250	442.93	
12,10	11,10			220215.242	(340)	3.667	537.15	
12,11	11,11			220126.464	(415)	1.917	641.21	
13,0	12,0			239019.529	(213)	13.000	47.84	
13,1	12,1			239014.949	(211)	12.923	52.81	
13,2	12,2			239001.210	(206)	12.692	67.74	
13,3	12,3			238978.311	(200)	12.308	92.62	

TABLE 4 Microwave Spectrum of $^{12}C\ H_3\ ^{13}C\ ^{14}N$ in the Ground Vibrational State (continued)

Transition J'K' ← J"K"		Obs. Freq. in MHz (Est. Unc.)	Calc. Freq. in MHz (Est. Unc.)	Line Strength	Approximate Energy in cm^{-1} Lower State	Ref.
13,4	12,4		238946.253 (194)	11.769	127.43	
13,5	12,5		238905.034 (192)	11.077	172.18	
13,6	12,6		238854.657 (200)	10.231	226.86	
13,7	12,7		238795.119 (222)	9.231	291.44	
13,8	12,8		238726.422 (259)	8.077	365.92	
13,9	12,9		238648.566 (311)	6.769	450.28	
13,10	12,10		238561.550 (376)	5.308	544.50	
13,11	12,11		238465.374 (453)	3.692	648.56	
13,12	12,12		238360.039 (542)	1.923	762.43	
14,0	13,0		257399.875 (280)	14.000	55.81	
14,1	13,1		257394.943 (279)	13.929	60.79	
14,2	13,2		257380.147 (274)	13.714	75.72	
14,3	13,3		257355.486 (266)	13.357	100.59	
14,4	13,4		257320.962 (259)	12.857	135.40	
14,5	13,5		257276.573 (256)	12.214	180.15	
14,6	13,6		257222.320 (260)	11.429	234.83	
14,7	13,7		257158.203 (276)	10.500	299.40	
14,8	13,8		257084.222 (308)	9.429	373.88	
14,9	13,9		257000.376 (357)	8.214	458.24	
14,10	13,10		256906.666 (420)	6.857	552.46	
14,11	13,11		256803.093 (499)	5.357	656.51	
14,12	13,12		256689.655 (589)	3.714	770.38	
14,13	13,13		256566.352 (692)	1.929	894.03	
15,0	14,0		275778.939 (359)	15.000	64.40	
15,1	14,1		275773.654 (358)	14.933	69.37	
15,2	14,2		275757.801 (352)	14.733	84.30	
15,3	14,3		275731.379 (350)	14.400	109.17	
15,4	14,4		275694.389 (337)	13.933	143.99	
15,5	14,5		275646.829 (332)	13.333	188.73	
15,6	14,6		275588.701 (333)	12.600	243.40	
15,7	14,7		275520.004 (345)	11.733	307.98	
15,8	14,8		275440.738 (371)	10.733	382.46	
15,9	14,9		275350.904 (415)	9.600	466.81	
15,10	14,10		275250.501 (475)	8.333	561.02	
15,11	14,11		275139.529 (552)	6.933	665.07	
15,12	14,12		275017.988 (644)	5.400	778.94	
15,13	14,13		274885.879 (749)	3.733	902.59	
15,14	14,14		274743.200 (868)	1.933	1036.00	
16,0	15,0		294156.628 (451)	16.000	73.60	
16,1	15,1		294150.991 (449)	15.937	78.57	
16,2	15,2		294134.081 (444)	15.750	93.50	
16,3	15,3		294105.898 (436)	15.437	118.37	

TABLE 4 Microwave Spectrum of $^{12}C\ H_3\ ^{13}C\ ^{14}N$ in the Ground Vibrational State (continued)

Transition J'K' ← J"K"		Obs. Freq. in MHz (Est.Unc.)	Calc. Freq. in MHz (Est. Unc.)	Line Strength	Approximate Energy in cm^{-1} Lower State	Ref.
16,4	15,4		294066.441 (428)	15.000	153.18	
16,5	15,5		294015.711 (421)	14.437	197.93	
16,6	15,6		293953.708 (419)	13.750	252.59	
16,7	15,7		293880.431 (427)	12.937	317.17	
16,8	15,8		293795.881 (448)	12.000	391.64	
16,9	15,9		293700.058 (486)	10.937	476.00	
16,10	15,10		293592.961 (542)	9.750	570.21	
16,11	15,11		293474.591 (616)	8.437	674.25	
16,12	15,12		293344.947 (707)	7.000	788.11	
16,13	15,13		293204.030 (814)	5.437	911.76	
16,14	15,14		293051.840 (935)	3.750	1045.17	
16,15	15,15		292888.377 (1070)	1.937	1188.30	

TABLE 5 Microwave Spectrum of $^{12}C\,H_3\,^{12}C\,^{15}N$ in the Ground Vibrational State

Transition J'K' ←	J"K"	Obs. Freq. in MHz	(Est. Unc.)	Calc. Freq. in MHz	(Est. Unc.)	Line Strength	Approximate Energy in cm^{-1} Lower State	Ref.
1,0	0,0	17844.170	(100)	17844.011	(7)	1.000	0.00	70 A
2,0	1,0	35688.077	(30)	35688.056	(13)	2.000	0.59	70 A
2,1	1,1	35687.368	(30)	35687.379	(13)	1.500	5.58	70 A
3,0	2,0	53531.916	(60)	53531.87[illegible]	(17)	3.000	1.79	70 A
3,1	2,1	53530.884	(60)	53530.855	(17)	2.667	6.77	70 A
3,2	2,2	53527.874	(60)	53527.813	(17)	1.667	21.73	70 A
4,0	3,0	71375.447	(30)	71375.427	(19)	4.000	3.57	70 A
4,1	3,1	71374.068	(30)	71374.075	(19)	3.750	8.56	70 A
4,2	3,2	71370.028	(30)	71370.019	(19)	3.000	23.51	70 A
4,3	3,3	71363.256	(30)	71363.262	(19)	1.750	48.44	70 A
5,0	4,0	89218.700	(60)	89218.642	(19)	5.000	5.95	70 A
5,1	4,1	89216.972	(60)	89216.952	(18)	4.800	10.94	70 A
5,2	4,2	89211.974	(60)	89211.883	(17)	4.200	25.89	70 A
5,3	4,3	89203.406	(60)	89203.437	(17)	3.200	50.82	70 A
5,4	4,4	89191.592	(60)	89191.619	(20)	1.800	85.70	70 A
6,0	5,0	107061.410	(90)	107061.429	(18)	6.000	8.93	70 A
6,1	5,1	107059.340	(90)	107059.401	(17)	5.833	13.91	70 A
6,2	5,2	107053.270	(90)	107053.318	(16)	5.333	28.87	70 A
6,3	5,3	107043.140	(90)	107043.185	(15)	4.500	53.79	70 A
6,4	5,4	107028.940	(90)	107029.004	(17)	3.333	88.68	70 A
6,5	5,5	107010.770	(90)	107010.785	(22)	1.833	133.52	70 A
7,0	6,0	124903.658	(60)	124903.701	(21)	7.000	12.50	70 A
7,1	6,1	124901.292	(60)	124901.335	(20)	6.857	17.49	70 A
7,2	6,2	124894.254	(60)	124894.240	(17)	6.429	32.44	70 A
7,3	6,3	124882.408	(60)	124882.419	(15)	5.714	57.36	70 A
7,4	6,4	124865.860	(60)	124865.878	(1[illegible])	4.714	92.25	70 A
7,5	6,5	124844.600	(60)	124844.626	(20)	3.429	137.08	70 A
7,6	6,6	124818.664	(60)	124818.673	(29)	1.857	191.87	70 A
8,0	7,0	142745.356	(60)	142745.372	(28)	8.000	16.6	70 A
8,1	7,1	142742.670	(60)	142742.669	(27)	7.875	21.65	70 A
8,2	7,2	142734.570	(60)	142734.562	(24)	7.500	36.61	70 A
8,3	7,3	142721.098	(60)	142721.054	(22)	6.875	61.53	70 A
8,4	7,4	142702.180	(60)	142702.154	(21)	6.000	96.42	70 A
8,5	7,5	142677.884	(60)	142677.869	(23)	4.875	141.25	70 A
8,6	7,6	142648.234	(60)	142648.213	(28)	3.500	196.03	70 A
8,7	7,7	142613.210	(60)	142613.202	(44)	1.875	260.74	70 A
9,0	8,0			160586.356	(38)	9.000	21.43	
9,1	8,1			160583.316	(36)	8.889	26.41	
9,2	8,2			160574.197	(34)	8.556	41.37	
9,3	8,3			160559.004	(31)	8.000	66.29	
9,4	8,4			160537.745	(30)	7.222	101.17	
9,5	8,5			160510.430	(31)	6.222	146.01	
9,6	8,6			160477.073	(33)	5.000	200.79	

TABLE 5 Microwave Spectrum of $^{12}C\ H_3\ ^{12}C\ ^{15}N$ in the Ground Vibrational State (continued)

Transition J'K' ←	J"K"	Obs. Freq. in MHz (Est. Unc.)		Calc. Freq. in MHz (Est. Unc.)		Line Strength	Approximate Energy in cm^{-1} Lower State	Ref.
9,7	8,7			160437.693	(43)	3.556	265.49	
9,8	8,8			160392.308	(73)	1.889	340.12	
10,0	9,0			178426.566	(45)	10.000	26.78	
10,1	9,1			178423.189	(44)	9.900	31.77	
10,2	9,2			178413.059	(41)	9.600	46.72	
10,3	9,3			178396.181	(38)	9.100	71.64	
10,4	9,4			178372.564	(38)	8.400	106.53	
10,5	9,5			178342.221	(39)	7.500	151.37	
10,6	9,6			178305.166	(40)	6.400	206.14	
10,7	9,7			178261.419	(44)	5.100	270.85	
10,8	9,8			178211.002	(69)	3.600	345.47	
10,9	9,9			178153.942	(130)	1.900	429.99	
11,0	10,0			196265.914	(48)	11.000	32.74	
11,1	10,1			196262.200	(47)	10.909	37.72	
11,2	10,2			196251.060	(43)	10.636	52.68	
11,3	10,3			196232.499	(40)	10.182	77.60	
11,4	10,4			196206.526	(40)	9.545	112.48	
11,5	10,5			196173.156	(44)	8.727	157.31	
11,6	10,6			196132.406	(46)	7.727	212.09	
11,7	10,7			196084.295	(48)	6.545	276.79	
11,8	10,8			196028.850	(66)	5.182	351.41	
11,9	10,9			195966.098	(124)	3.636	435.93	
11,10	10,10			195896.071	(230)	1.909	530.33	
12,0	11,0			214104.313	(46)	12.000	39.28	
12,1	11,1			214100.263	(44)	11.917	44.27	
12,2	11,2			214088.112	(38)	11.667	59.22	
12,3	11,3			214067.869	(33)	11.250	84.14	
12,4	11,4	214039.640	(90)	214039.543	(35)	10.667	119.02	70 A
12,5	11,5			214003.149	(43)	9.917	163.85	
12,6	11,6			213958.705	(50)	9.000	218.63	
12,7	11,7			213906.234	(54)	7.917	283.33	
12,8	11,8			213845.764	(68)	6.667	357.95	
12,9	11,9			213777.324	(121)	5.250	442.47	
12,10	11,10			213700.952	(226)	3.667	536.86	
12,11	11,11			213616.685	(393)	1.917	641.11	
13,0	12,0	231941.710	(100)	231941.675	(54)	13.000	46.42	78 A
13,1	12,1	231937.280	(100)	231937.288	(51)	12.923	51.41	78 A
13,2	12,2	231924.100	(100)	231924.129	(42)	12.692	66.36	78 A
13,3	12,3	231902.230	(100)	231902.205	(34)	12.308	91.28	78 A
13,4	12,4	231871.490	(100)	231871.527	(36)	11.769	126.16	78 A
13,5	12,5	231832.010	(100)	231832.111	(49)	11.077	170.99	78 A
13,6	12,6	231784.030	(100)	231783.976	(62)	10.231	225.77	78 A

TABLE 5 Microwave Spectrum of $^{12}C H_3 {}^{12}C {}^{15}N$ in the Ground Vibrational State (continued)

Transition J'K' ←	J"K"	Obs. Freq. in MHz (Est. Unc)		Calc. Freq. in MHz (Est. Unc.)		Line Strength	Approximate Energy in cm^{-1} Lower State	Ref.
13,7	12,7			231727.149	(71)	9.231	290.47	78 A
13,8	12,8			231661.658	(83)	8.077	365.09	
13,9	12,9	231587.520	(100)	231587.536	(127)	6.769	449.60	
13,10	12,10			231504.822	(228)	5.308	543.99	
13,11	12,11			231413.559	(396)	3.692	648.24	
13,12	12,12			231313.793	(641)	1.923	762.32	
14,0	13,0			249777.910	(100)	14.000	54.16	
14.1	13,1			249773.187	(97)	13.929	59.14	
14,2	13,2			249759.020	(89)	13.714	74.10	
14,3	13,3			249735.417	(82)	13.357	99.02	
14,4	13,4			249702.389	(80)	12.857	133.90	
14,5	13,5			249659.954	(89)	12.214	178.73	
14,6	13,6			249608.132	(102)	11.429	233.50	
14,7	13,7			249546.952	(114)	10.500	298.20	
14,8	13,8			249476.444	(127)	9.429	372.81	
14,9	13,9			249396.645	(160)	8.214	457.32	
14,10	13,10			249307.595	(247)	6.857	551.71	
14,11	13,11			249209.342	(408)	5.357	655.96	
14,12	13,12			249101.935	(656)	3.714	770.03	
14,13	13,13			249985.430	(1003)	1.929	893.91	
15,0	14,0			267612.931	(193)	15.000	62.49	
15,1	14,1			267607.872	(190)	14.933	67.47	
15,2	14,2			267592.698	(183)	14.733	82.43	
15,3	14,3			267567.417	(175)	14.400	107.35	
15,4	14,4			267532.041	(171)	13.933	142.23	
15,5	14,5			267486.589	(174)	13.333	187.05	
15,6	14,6			267431.085	(184)	12.600	241.82	
15,7	14,7			267365.556	(196)	11.733	306.52	
15,8	14,8			267290.036	(209)	10.733	381.13	
15,9	14,9			267204.564	(234)	9.600	465.64	
15,10	14,10			267109.185	(302)	8.333	560.03	
15,11	14,11			267003.948	(445)	6.933	664.27	
15,12	14,12			266888.906	(685)	5.400	778.34	
15,13	14,13			266764.121	(1035)	3.733	902.22	
15,14	14,14			266629.6[illegible]6	(1512)	1.933	1035.87	
16,0	15,0			285446.647	(338)	16.000	71.41	
16,1	15,1			285441.252	(335)	15.937	76.40	
16,2	15,2			285425.073	(327)	15.750	91.36	
16,3	15,3			285398.115	(318)	15.437	116.27	
16,4	15,4			285360.394	(311)	15.000	151.15	
16,5	15,5			285311.929	(310)	14.437	195.98	

TABLE 5 Microwave Spectrum of $^{12}C\ H_3\ ^{12}C\ ^{15}N$ in the Ground Vibrational State (continued)

Transition J'K' ←	J"K"	Obs. Freq. in MHz (Est. Unc.)	Calc. Freq. in MHz (Est. Unc.)	Line Strength	Approximate Energy in cm^{-1} Lower State	Ref.
16,6	15,6		285252.744 (315)	13.750	250.74	
16,7	15,7		285182.871 (325)	12.937	315.44	
16,8	15,8		285102.345 (338)	12.000	390.05	
16,9	15,9		285011.207 (359)	10.937	474.55	
16,10	15,10		284909.504 (410)	9.750	568.94	
16,11	15,11		284797.290 (527)	8.437	673.17	
16,12	15,12		284674.622 (746)	7.000	787.24	
16,13	15,13		284541.564 (1086)	5.437	911.12	
16,14	15,14		284398.185 (1567)	3.750	1044.77	
16,15	15,15		284244.559 (2206)	1.937	1188.16	

<u>Table 6</u> - Molecular constants for CH_3CN (ν_8 vibrational state)

B^*	= 9226.6402 (11)	MHz	
D_J	= 3.886 (15)	kHz	
D_{JK}	= 177.972 (61)	kHz	
ρ^*	= 28.86 (3)	kHz	
q_o	= 4.44940(3)	MHz	[68 A]
μ_J	= 0.01583(3)	kHz	[68 A]
ζ_8^z	= 0.877 (1)[a]		
eQq	= 4.359 (28)	MHz	
eQqη	= 0.114 (32)	MHz	

a Derived with data from reference [74 A]

A_o = 157 300 MHz (calculated from the structure)

TABLE 7 : Microwave spectrum of $^{12}CH_3\,^{12}C^{14}N$ in the ν_8 vibrational state.

J' ← J"	K	ℓ'	F' ← F"	Observed frequency in MHz (Estimated uncertainty)	Calculated frequency in MHz (Estimated uncertainty)	Line Strength	Energy level of lower state (in cm^{-1})	Ref.
1 - 0	0	±1			18 452.843	1.0	370.31	70 A
			1 - 1		18 451.753 (4)	0.3		
			2 - 1	18 453.11 (5)	18 453.061 (3)	0.6		70 A
			0 - 1		18 455.022 (2)	0.1		
2 - 1	±1	±1			36 942.027	1.5	366.66	
			1 - 0	36 943.596 (30)	36 943.604 (19)	0.2		70 A
			3 - 2	36 942.282 (30)	36 942.296 (6)	0.6		70 A
			2 - 1	36 940.943 (30)	36 940.937 (9)	0.4		70 A
	0	±1			36 905.547	2.0	370.92	
			3 - 2		36 905.640 (3)	0.9		
				36 905.643 (30)				70 A
			2 - 1		36 905.547 (4)	0.5		
			1 - 0	36 904.391 (30)	36 904.457 (8)	0.2		70 A
	±1	∓1			36 903.327	1.5	385.06	
			1 - 0		36 904.961 (11)	0.2		
			3 - 2	36 903.561 (30)	36 903.592 (5)	0.6		70 A
			2 - 1	36 902.223 (30)	36 902.237 (7)	0.4		70 A
	±1	±1			36 870.846	1.5	366.66	
			1 - 0	36 872.530 (30)	36 872.538 (19)	0.2		70 A
			3 - 2	36 871.117 (30)	36 871.106 (7)	0.6		70 A
			2 - 1	36 869.788 (30)	36 869.757 (9)	0.4		70 A
3 - 2	±1	±1			55 412.807	2.7	367.90	
			4 - 3		55 412.926 (9)	1.1		
				55 412.874 (60)				70 A
			2 - 1		55 412.904 (9)	0.5		
			3 - 2		55 412.534 (9)	0.8		
	±2	±1			55 358.736	1.7	373.51	
			2 - 1	55 359.864 (60)	55 359.826 (9)	0.3		70 A
			4 - 3	55 359.066 (60)	55 359.048 (9)	0.7		70 A
			3 - 2		55 357.646 (9)	0.5		
	0	±1			55 357.971	3.0	372.15	
			4 - 3		55 358.023 (5)	1.3		
				55 357.992 (60)				70 A
			3 - 2		55 357.971 (5)	0.9		
			2 - 1		55 357.753 (5)	0.6		
	±1	∓1			55 354.699	2.7	386.29	
			4 - 3		55 354.816 (5)	1.1		
			2 - 1	55 354.680 (100)	55 354.808 (5)	0.5		70 A
			3 - 2		55 354.427 (5)	0.8		
	±2	∓1			55 349.222	1.7	410.31	
			2 - 1		55 350.312 (10)	0.3		
			4 - 3	55 349.512 (60)	55 349.533 (7)	0.7		70 A
			3 - 2	55 348.158 (60)	55 348.132 (8)	0.5		70 A
	±1	±1			55 306.036	2.7	367.89	
			2 - 1		55 306.157 (9)	0.5		
				55 306.024 (60)				70 A
			4 - 3		55 306.150 (9)	1.1		
			3 - 2		55 305.764 (9)	0.8		

TABLE 7 : Microwave spectrum of $^{12}CH_3\,^{12}C^{14}N$ in the ν_8 vibrational state (continued)

J' ← J"	K	ℓ'	F' ← F"	Observed frequency in MHz (Estimated uncertainty)	Calculated frequency in MHz (Estimated uncertainty)	Line Strength	Energy level of lower state (in cm⁻¹)	Ref.
4 - 3	±1	±1			73 883.307	3.8	369.75	
			5 - 4	73 883.391 (30)	73 883.373 (11)	1.5		70 A
			3 - 2		73 883.310 (11)	0.9		
			4 - 3		73 883.198 (11)	1.2		
	±2	±1			73 811.431	3.0	375.36	
			3 - 2	73 811.729 (60)	73 811.742 (8)	0.7		70 A
			5 - 4		73 811.589 (8)	1.2		
			4 - 3	73 811.014 (30)	73 810.995 (8)	0.9		70 A
	0	±1			73 809.975	4.0	374.00	
			5 - 4	73 810.017 (30)	73 810.008 (7)	1.6		70 A
			4 - 3		73 809.975 (7)	1.2		
			3 - 2		73 809.882 (7)	1.0		
	±3	±1			73 807.142	1.8	390.85	
			3 - 2	73 807.627 (60)	73 807.959 (10)	0.4		70 A
			5 - 4		73 807.457 (9)	0.7		
			4 - 3		73 806.161 (10)	0.5		
	±1	∓1			73 805.722	3.8	388.14	
			5 - 4	73 805.755 (30)	73 805.786 (7)	1.5		70 A
			3 - 2		73 805.729 (6)	0.9		
			4 - 3		73 805.613 (6)	1.2		
	±2	∓1			73 798.455	3.0	412.15	
			3 - 2		73 798.767 (7)	0.7		
			5 - 4	73 798.688 (60)	73 798.614 (7)	1.2		70 A
			4 - 3	73 798.004 (30)	73 798.019 (7)	0.9		70 A
	±3	∓1			73 788.299	1.8	446.04	
			3 - 2	73 788.765 (60)	73 789.116 (10)	0.5		70 A
			5 - 4		73 788.614 (9)	0.7		
			4 - 3	73 787.336 (30)	73 787.318 (9)	0.5		70 A
	±1	±1			73 740.947	3.8	369.74	
			5 - 4	73 740.985 (30)	73 741.009 (11)	1.5		70 A
			3 - 2		73 740.959 (11)	1.2		
			4 - 3		73 740.838 (11)	0.9		
5 - 4	±1	±1		92 353.516 (60)	92 353.434 (100)	4.8	372.21	70 A
	±2	±1			92 263.938	4.2	377.82	
			4 - 3	92 363.992 (60)	92 264.062 (11)	1.1		70 A
			6 - 5		92 264.031 (11)	1.7		
			5 - 4		92 263.720 (11)	1.3		
	0	±1		92 261.440 (60)	92 261.420 (80)	5.0	376.46	70 A
	±3	±1			92 258.402	3.2	393.31	
			4 - 3	92 258.412 (150)	92 258.747 (10)	0.8		70 A
			6 - 5		92 258.583 (10)	1.3		
			5 - 4		92 257.912 (10)	1.0		

TABLE 7 : *Microwave spectrum of* $^{12}CH_3\,^{12}C^{14}N$ *in the* ν_8 *vibrational state* (continued)

J' ← J"	K	ℓ'	F' ← F"	Observed frequency in MHz (Estimated uncertainty)	Calculated frequency in MHz (Estimated uncertainty)	Line Strength	Energy level of lower state (in cm^{-1})	Ref.
	±1	∓1		92 256.288 (60)	92 256.278 (100)	4.8	390.60	70 A
	±4	±1			92 249.629	1.8	418.67	
			4 ← 3		92 250.283 (13)	0.5		
				92 250.142 (100)				70 A
			6 ← 5		92 249.932 (13)	0.7		
			5 ← 4	92 248.754 (60)	92 248.757 (13)	0.6		70 A
	±2	∓1			92 247.254	4.2	414.61	
			4 ← 3		92 247.378 (8)	1.1		
				92 247.240 (60)				70 A
			6 ← 5		92 247.346 (8)	1.7		
			5 ← 4		92 247.036 (8)	1.3		
	±3	∓1			92 234.587	3.2	448.50	
			4 ← 3		92 234.932 (10)	0.8		
				92 234.812 (100)				70 A
			6 ← 5		92 234.767 (10)	1.3		
			5 ← 4	92 234.048 (60)	92 234.096 (10)	1.0		70 A
	±4	∓1			92 218.330	1.8	492.25	
			4 ← 3		92 218.983 (15)	4.7		
				92 218.728 (100)				70 A
			6 ← 5		92 218.632 (14)	0.7		
			5 ← 4	92 217.422 (60)	92 217.457 (14)	0.6		70 A
	±1	±1		92 175.524 (60)	92 175.484 (100)	4.8	372.20	70 A
6 ← 5	±1	±1		110 823.126 (60)	110 823.095 (60)	5.8	375.29	70 A
	±2	±1			110 716.212	5.3	380.90	
			7 ← 6		110 716.272 (17)	2.0		
				110 716.278 (60)				70 A
			5 ← 4		110 716.271 (17)	1.4		
			6 ← 5		110 716.087 (17)	1.7		
	0	±1		110 712.220 (60)	110 712.166 (50)	6.0	379.54	70 A
	±3	±1			110 709.313	4.5	396.39	
			5 ← 4		110 709.488 (11)	1.2		
				110 709.552 (100)				70 A
			7 ← 6		110 709.427 (11)	1.7		
			6 ← 5		110 709.033 (11)	1.5		
	±1	∓1		110 706.340 (60)	110 706.251 (60)	5.8	393.68	70 A
	±4	±1			110 698.701	3.3	421.75	
			5 ← 4		110 699.038 (13)	0.9		
				110 699.060 (100)				70 A
			7 ← 6		110 698.891 (13)	1.3		
			6 ← 5	110 698.264 (60)	110 698.203 (13)	1.1		70 A
	±2	∓1			110 695.506	5.3	417.69	
			7 ← 6		110 695.566 (9)	2.0		
				110 695.592 (60)				70 A
			5 ← 4		110 695.565 (9)	1.4		
			6 ← 5		110 695.381 (9)	1.7		
	±5	±1			110 683.959	1.8	456.97	
			5 ← 4		110 684.503 (19)	0.5		
				110 684.442 (100)				70 A
			7 ← 6		110 684.244 (19)	0.7		
			6 ← 5	110 683.282 (60)	110 683.180 (19)	0.6		70 A

TABLE 7 : Microwave spectrum of $^{12}CH_3\,^{12}C^{14}N$ in the ν_8 vibrational state (continued)

J' ← J"	K	ℓ'	F' ← F"	Observed frequency in MHz (Estimated uncertainty)	Calculated frequency in MHz (Estimated uncertainty)	Line Strength	Energy level of lower state (in cm^{-1})	Ref.
	±3	∓1			110 680.350	4.5	451.58	
			5 - 4		110 680.525 (11)	1.2		
				110 680.438 (100)				70 A
			7 - 6		110 680.463 (11)	1.7		
			6 - 5		110 680.069 (11)	1.5		
	±4	∓1			110 660.869	3.3	495.33	
			5 - 4		110 661.205 (16)	0.9		
				110 661.124 (100)				70 A
			7 - 6		110 661.057 (15)	1.3		
			6 - 5	110 660.292 (60)	110 660.370 (15)	1.1		70 A
	±5	∓1			110 637.085	1.8	548.94	
			5 - 4		110 637.628 (22)	0.5		
				110 637.520 (60)				70 A
			7 - 6		110 637.370 (21)	0.7		
			6 - 5	110 636.278 (60)	110 636.305 (21)	0.6		70 A
	±1	±1		110 609.594 (60)	110 609.554 (60)	5.8	375.27	70 A
7 - 6	±1	±1		129 292.248 (60)	129 292.196 (40)	6.9	378.99	70 A
	±2	±1			129 168.206	6.4	384.59	
			8 - 7		129 168.247 (27)	2.4		
				129 168.298 (60)				70 A
			6 - 5		129 168.237 (27)	1.8		
			7 - 6		129 168.128 (27)	2.1		
	0	±1		129 162.126 (60)	129 162.073 (40)	7.0	383.23	70 A
	±3	±1			129 159.804	5.7	400.08	
			6 - 5		129 159.903 (16)	1.6		
				129 159.870 (60)				70 A
			8 - 7		129 159.880 (16)	2.2		
			7 - 6		129 159.628 (16)	1.9		
	±1	∓1		129 155.552 (60)	129 155.525 (40)	6.9	397.37	70 A
	±4	±1				4.7	425.44	
			6 - 5		129 147.500 (16)	1.5		
				129 147.512 (100)				70 A
			8 - 7		129 147.431 (16)	1.8		
			7 - 6		129 146.994 (16)	1.3		
	±2	∓1			129 147.305	6.4	421.38	
			8 - 7		129 143.149 (14)	2.4		
			6 - 5	129 143.132 (60)	129 143.139 (14)	1.8		70 A
			7 - 6		129 143.030 (14)	2.1		
	±5	±1			129 130.047	3.4	460.66	
			6 - 5		129 130.364 (21)	1.0		
				129 130.338 (100)				70 A
			8 - 7		129 130.237 (21)	1.3		
			7 - 6	129 129.558 (60)	129 129.560 (21)	1.1		
	±3	∓1			129 125.484	5.7	455.27	
			6 - 5		129 125.583 (15)	1.6		
				129 125.528 (60)				70 A
			8 - 7		129 125.560 (15)	2.2		
			7 - 6		129 125.308 (15)	1.9		

TABLE 7 : *Microwave spectrum of* $^{12}CH_3\,^{12}C^{14}N$ *in the* ν_8 *vibrational state (continued)*

J' ← J"	K	ℓ'	F' ← F"	Observed frequency in MHz (Estimated uncertainty)	Calculated frequency in MHz (Estimated uncertainty)	Line Strength	Energy level of lower state (in cm^{-1})	Ref
	±6	±1			129 107.893	1.9	505.72	
			6 - 5		129 108.359 (29)	0.5		
			8 - 7	129 108.254 (100)	129 108.160 (29)	0.7		70 A
			7 - 6		129 107.192 (29)	0.6		
	±4	∓1			129 102.790	4.7	499.02	
			6 - 5		129 102.984 (18)	1.3		
				129 102.868 (100)				70 A
			8 - 7		129 102.915 (18)	1.8		
			7 - 6		129 102.478 (18)	1.5		
	±5	∓1			129 075.068	3.4	552.63	
			6 - 5		129 075.384 (24)	1.0		
			8 - 7	129 075.276 (60)	129 075.256 (24)	1.3		70 A
			7 - 6	129 074.526 (60)	129 074.580 (24)	1.1		
	±1	±1		129 043.162 (60)	129 043.065 (40)	6.9	378.96	70 A
	±6	∓1			129 042.335	1.9	616.09	
			6 - 5		129 042.800 (33)	0.5		
			8 - 7		129 042.602 (32)	0.7		
			7 - 6		129 041.633 (31)	0.6		
8 - 7	±1	±1		147 760.654 (60)	147 760.644 (30)	7.9	383.30	70 A
	±2	±1		147 619.916 (60)	147 619.872 (80)	7.5	388.90	70 A
	0	±1		147 611.034 (60)	147 611.000 (40)	8.0	387.54	70 A
	±3	±1			147 609.804	6.9	404.39	
			7 - 6		147 609.866 (25)	2.0		
				147 609.788 (60)				70 A
			9 - 8		147 609.859 (25)	2.6		
			8 - 7		147 609.686 (25)	2.3		
	±1	∓1		147 603.998 (60)	147 603.983 (30)	7.9	401.68	70 A
	±4	±1			147 595.365	6.0	429.75	
			7 - 6		147 595.487 (25)	1.7		
				147 595.408 (60)				70 A
			9 - 8		147 595.453 (21)	2.2		
			8 - 7		147 595.157 (22)	2.0		
	±2	∓1		147 589.934 (60)	147 589.948 (90)	7.5	425.69	70 A
	±5	±1			147 575.564	4.9	464.97	
			7 - 6		147 575.764 (24)	1.4		
				147 575.716 (100)				70 A
			9 - 8		147 575.697 (24)	1.8		
			8 - 7		147 575.239 (24)	1.6		
	±3	∓1			147 569.883	6.9	459.58	
			7 - 6		147 569.944 (21)			
			9 - 8	147 569.858 (60)	147 569.937 (21)	2.6		70 A
			8 - 7		147 569.766 (21)	2.3		
	±6	±1			147 550.198	3.5	510.028	
			7 - 6		147 550.493 (32)	1.0		
				147 550.436 (100)				70 A
			9 - 8		147 550.385 (32)	1.3		
			8 - 7	147 549.664 (60)	147 549.730 (32)	1.1		
	±4	∓1			147 543.994	6.0	503.33	
			7 - 6		147 544.115 (24)	1.7		
			9 - 8	147 544.000 (60)	147 544.082 (24)	2.2		70 A
			8 - 7		147 543.786 (24)	2.0		

TABLE 7 : Microwave spectrum of $^{12}CH_3\,^{12}C^{14}N$ in the ν_8 vibrational state (continued)

J' ← J"	K	ℓ'	F' ← F"	Observed frequency in MHz (Estimated uncertainty)	Calculated frequency in MHz (Estimated uncertainty)	Line Strength	Energy level of lower state (in cm^{-1})	Ref
	7	±1			147 519.205	1.9	564.9	
			7 − 6		147 519.613 (43)	0.5		
				147 519.544 (100)				70 A
			9 − 8		147 519.455 (43)	0.7		
			8 − 7	147 518.540 (60)	147 518.568 (43)	0.6		70 A
	±5	∓1			147 512.341	4.9	556.94	
			7 − 6		147 512.541 (29)	1.4		70 A
				147 512.368 (100)				
			9 − 8		147 512.473 (28)	1.8		
			8 − 7		147 512.016 (28)	1.6		
	±1	±1		147 476.038 (60)	147 475.924 (30)	7.9	383.27	70 A
	±6	∓1			147 474.957	3.5	620.40	
			7 − 6		147 475.251 (37)	1.0		
			9 − 8		147 475.143 (37)	1.3		
			8 − 7		147 474.488 (37)	1.1		
	±7	∓1			147 431.852	1.9	693.69	
			7 − 6		147 432.259 (48)	0.5		
				147 432.372 (100)				70 A
			9 − 8		147 432.101 (48)	0.7		
			8 − 7	147 431.342 (60)	147 431.215 (48)	0.6		70 A
9 − 8	±1	±1		166 228.53 (40)	166 228.346 (40)	8.9	388.23	61 A
	±2	±1		166 071.30 (40)	166 071.166 (60)	8.6	393.83	61 A
	±3	±1			166 059.245	8.0	409.32	
			10 − 9		166 059.285 (38)	2.9		
			8 − 7	166 059.13 (40)	166 059.285 (38)	2.4		61 A
			9 − 8		166 059.163 (38)	2.6		
	0	±1		166 059.13 (40)	166 058.809 (60)	9.0	392.47	61 A
	±1	∓1		166 051.73 (40)	166 051.509 (40)	8.9	406.60	61 A
	±4	±1			166 042.804	7.2	434.67	
			8 − 7		166 042.885 (32)	2.1		
			10 − 9	166 042.93 (40)	166 042.869 (32)	2.7		61 A
			9 − 8		166 042.659 (32)	2.4		
	±2	∓1		166 036.03 (40)	166 035.915 (60)	8.6	430.61	61 A
	±5	±1			166 020.428	6.2	469.89	
			8 − 7		166 020.561 (31)	1.8		
			10 − 9	166 020.50 (40)	166 020.524 (31)	2.3		61 A
			9 − 8		166 020.200 (31)	2.0		
	±3	∓1			166 013.443	8.0	464.50	
			10 − 9		166 013.483 (32)	2.9		
			8 − 7	166 013.38 (40)	166 013.483 (32)	2.4		61 A
			9 − 8		166 013.361 (32)	2.6		
	±6	±1			165 991.833	5.0	514.95	
			8 − 7		165 992.031 (37)	1.5		
			10 − 9	166 992.06 (40)	165 991.968 (37)	1.8		61 A
			9 − 8		165 991.505 (37)	1.6		
	±4	∓1			165 984.376	7.2	508.25	
			8 − 7		165 984.456 (32)	2.1		
			10 − 9	165 983.98 (40)	165 984.440 (32)	2.7		61 A
			9 − 8		165 984.230 (32)	2.4		

TABLE 7 : Microwave spectrum of $^{12}CH_3\,^{12}C^{14}N$ in the ν_8 vibrational state (continued)

J' ← J"	K	ℓ'	F' ← F"	Observed frequency in MHz (Estimated uncertainty)	Calculated frequency in MHz (Estimated uncertainty)	Line Strength	Energy level of lower state (in cm^{-1})	Ref.
	±7	±1			165 956.926	3.6	569.85	
			8 - 7		165 957.200 (47)	1.0		
				165 957.03 (40)				61 A
			10 - 9		165 957.107 (47)	1.3		
			9 - 8		165 956.480 (47)	1.2		
	±5	∓1			165 948.807	6.2	561.86	
			8 - 7		165 948.940 (36)	1.8		
			10 - 9	165 948.85 (40)	165 948.903 (36)	2.3		61 A
			9 - 8		165 948.579 (36)	2.0		
	±8	±1			165 915.664	1.9	634.56	
			8 - 7		165 916.026 (62)	0.6		
			10 - 9		165 915.898 (62)	0.7		
			9 - 8		165 915.081 (62)	0.6		
	±1	±1		165 908.28 (40)	165 908.036 (40)	8.9	388.19	61 A
	±6	∓1			165 906.778	5.0	625.32	
			8 - 7		165 906.975 (44)	1.5		
			10 - 9		165 906.912 (44)	1.8		
			9 - 8		165 906.450 (44)	1.6		
	±7	∓1			165 858.308	3.6	698.61	
			8 - 7		165 858.581 (55)	1.0		
			10 - 9		165 858.488 (55)	1.3		
			9 - 8		165 857.861 (55)	1.2		
	±8	∓1			165 803.407	1.9	781.72	
			8 - 7		165 803.768 (69)	0.6		
			10 - 9		165 803.640 (69)	0.7		
			9 - 8		165 802.823 (68)	0.6		
10 - 9	±1	±1		184 695.21 (50)	184 695.209 (53)	9.9	393.77	61 A
	±2	±1		184 522.32 (50)	184 522.039 (90)	9.6	399.36	61 A
	±3	±1		184 508.45 (50)	184 508.056 (90)	9.1	414.85	61 A
	0	±1		184 505.64 (50)	184 505.360 (80)	10.0	398.00	61 A
	±1	∓1		184 498.20 (50)	184 497.986 (60)	9.9	412.14	61 A
	±4	±1			184 489.542	8.4	440.21	
			9 - 8		184 489.598 (46)	2.5		
			11 - 10	184 489.56 (50)	184 489.591 (46)	3.1		61 A
			10 - 9		184 489.436 (46)	2.8		
	±2	∓1		184 481.06 (50)	184 480.906 (50)	9.6	436.15	61 A
	±5	±1			184 464.557	7.5	475.42	
			9 - 8		184 464.650 (43)	2.2		
			11 - 10	184 464.84 (50)	184 464.629 (43)	2.7		61 A
			10 - 9		184 464.391 (43)	2.5		
	±3	∓1		184 456.00 (50)	184 456.059 (90)	9.1	470.03	61 A
	±6	±1			184 432.712	6.4	520.49	
			9 - 8		184 432.850 (46)	1.9		
				184 433.11 (50)				61 A
			11 - 10		184 432.813 (46)	2.3		
			10 - 9		184 432.473 (46)	2.1		
	±4	∓1			184 423.836	8.4	513.79	
			9 - 8		184 423.891 (45)	2.5		
			11 - 10	184 424.19 (50)	184 423.884 (45)	3.1		61 A
			10 - 9		184 423.729 (45)	2.8		

TABLE 7 : Microwave spectrum of $^{12}CH_3\,^{12}C^{14}N$ in the ν_8 vibrational state.

J' ← J"	K	ℓ'	F' ← F"	Observed frequency in MHz (Estimated uncertainty)	Calculated frequency in MHz (Estimated uncertainty)	Line Strength	Energy level of lower state (in cm⁻¹)	Ref.
	±7	±1			184 393.875	5.1	575.38	
			9 - 8		184 394.067 (54)	1.5		
				184 394.25 (50)				61 A
			11 - 10		184 394.010 (54)	1.9		
			10 - 9		184 393.550 (54)	1.7		
	±5	∓1			184 384.365	7.5	567.39	
			9 - 8		184 384.458 (47)	2.2		
			11 - 10	184 384.64 (50)	184 384.437 (47)	2.7		61 A
			10 - 9		184 384.198 (47)	2.5		
	±8	±1			184 347.996	3.6	640.10	
			9 - 8		184 348.250 (68)	1.1		
			11 - 10		184 348.170 (68)	1.3		
			10 - 9		184 347.571 (68)	1.2		
	±1	±1		184 339.70 (50)	184 339.308 (60)	9.9	393.72	61 A
	±6	∓1			184 337.700	6.4	630.85	
			9 - 8		184 337.838 (53)	1.9		
			11 - 10		184 337.800 (53)	2.3		
			10 - 9		184 337.460 (53)	2.1		
	±9	±1			184 295.044	1.9	714.61	
			9 - 8		184 295.368 (86)	0.6		
			11 - 10		184 295.262 (86)	0.7		
			10 - 9		184 294.506 (86)	0.6		
	±7	∓1			184 283.870	5.1	704.14	
			9 - 8		184 284.061 (63)	1.5		
			11 - 10		184 284.004 (63)	1.9		
			10 - 9		184 283.544 (63)	1.7		
	±8	∓1			184 222.892	3.6	787.25	
			9 - 8		184 223.144 (77)	1.1		
			11 - 10		184 223.064 (77)	1.3		
			10 - 9		184 222.466 (77)	1.2		
	±9	∓1			184 154.771	1.9	880.15	
			9 - 8		184 155.094 (95)	0.6		
			11 - 10		184 154.988 (95)	0.7		
			10 - 9		184 154.232 (94)	0.6		
11 - 10	±1	±1		203 161.23 (50)	203 161.139 (70)	10.9	399.93	61 A
	±2	±1		202 972.63 (50)	202 972.445 (120)	10.6	405.52	61 A
	±3	±1		202 956.31 (50)	202 956.168 (80)	10.2	421.01	61 A
	0	±1		202 950.97 (50)	202 950.512 (110)	11.0	404.16	61 A
	±1	∓1		202 943.39 (50)	202 943.297 (80)	10.9	418.29	61 A
	±4	±1			202 935.502	9.6	446.36	
			10 - 9		202 935.543 (65)			
			12 - 11	202 935.67 (50)	202 935.540 (65)			61 A
			11 - 10		202 935.423 (65)			
	±2	∓1		202 924.94 (50)	202 924.808 (70)	10.6	442.31	61 A
	±5	±1			202 907.870	8.7	481.58	
			10 - 9		202 907.938 (60)	2.6		
			12 - 11	202 907.98 (50)	202 907.926 (60)	3.1		61 A
			11 - 10		202 907.746 (60)	2.9		
	±3	∓1		202 897.68 (50)	202 897.626 (70)	10.2	476.19	61 A
	±6	±1			202 872.749	7.7	526.64	
			10 - 9		202 872.849 (60)	2.3		
			12 - 11	202 872.91 (50)	202 872.826 (60)	2.8		61 A
			11 - 10		202 872.569 (60)	2.5		

TABLE 7 : Microwave spectrum of $^{12}CH_3\,^{12}C^{14}N$ in the ν_8 vibrational state (continued)

J' ← J"	K	ℓ'	F' ← F"	Observed frequency in MHz (Estimated uncertainty)	Calculated frequency in MHz (Estimated uncertainty)	Line Strength	Energy level of lower state (in cm⁻¹)	Ref.
	±4	∓1			202 862.271	9.6	519.94	
			10 - 9		202 862.311 (62)	3.4		
			12 - 11	202 862.38 (50)	202 862.308 (62)	2.9		61 A
			11 - 10		202 862.191 (62)	3.1		
	±7	±1			202 829.971	6.5	581.53	
			10 - 9		202 830.111 (65)	2.0		
			12 - 11	202 830.05 (50)	202 830.074 (65)	2.4		61 A
			11 - 10		202 829.727 (65)	2.2		
	±5	∓1			202 818.911	8.7	573.54	
			10 - 9		202 818.978 (63)	2.6		
			12 - 11	202 819.06 (50)	202 818.966 (63)	3.1		61 A
			11 - 10		202 818.786 (63)	2.9		
	±8	±1			202 779.460	5.2	646.24	
			10 - 9		202 779.643 (77)	1.6		
				202 779.70 (50)				61 A
			12 - 11		202 779.593 (77)	1.9		
			11 - 10		202 779.141 (77)	1.7		
	±1	±1		202 769.94 (50)	202 769.648 (70)	10.9	399.87	61 A
	±6	∓1			202 767.623	7.7	637.00	
			10 - 9		202 767.723 (67)	2.3		
			12 - 11	202 768.06 (50)	202 767.699 (67)	2.8		61 A
			11 - 10		202 767.443 (67)	2.5		
	±9	±1			202 721.181	3.6	720.76	
			10 - 9		202 721.417 (94)	1.1		
				202 721.62 (50)				61 A
			12 - 11		202 721.347 (94)	1.3		
			11 - 10		202 720.776 (94)	1.2		
	±7	∓1			202 708.443	6.5	710.28	
			10 - 9		202 708.581 (75)	2.0		
				202 709.07 (50)				61 A
			12 - 11		202 708.545 (75)	2.4		
			11 - 10		202 708.197 (75)	2.2		
	±10	±1			202 655.111	1.9	805.05	
			10 - 9		202 655.405 (116)	0.6		
				202 655.71 (50)				61 A
			12 - 11		202 655.316 (116)	0.7		
			11 - 10		202 654.612 (116)	0.6		
	±8	∓1			202 641.391	5.2	793.3	
			10 - 9		202 641.574 (88)	1.6		
				202 642.27 (50)				61 A
			12 - 11		202 641.522 (88)	1.9		
			11 - 10		202 641.070 (88)	1.7		
	±9	∓1			202 566.479	3.6	886.29	
			10 - 9		202 566.713 (106)	1.1		
			12 - 11		202 566.650 (106)	1.3		
			11 - 10		202 566.073 (106)	1.2		
	±10	∓1			202 483.715	1.9	988.98	
			10 - 9		202 484.007 (127)	0.6		
			12 - 11		202 483.918 (127)	0.7		
			11 - 10		202 483.214 (127)	0.6		

TABLE 7 : Microwave spectrum of $^{12}CH_3\,^{12}C^{14}N$ in the ν_8 vibrational state. (continued)

J' ← J"	K	ℓ	F' ← F"	Observed frequency in MHz (Estimated uncertainty)	Calculated frequency in MHz (Estimated uncertainty)	Line Strength	Energy level of lower state (in cm^{-1})	Ref.
12 - 11	±1	±1		221 625.91 (60)	221 626.043 (90)	11.9	406.71	61 A
	±2	±1		221 422.37 (50)	221 422.337 (160)	11.7	412.29	61 A
	±3	±1		221 403.82 (50)	221 403.509 (110)	11.3	427.78	61 A
	0	±1		221 394.15 (50)	221 394.125 (150)	12.0	410.93	61 A
	±1	∓1		221 387.30 (50)	221 387.325 (100)	11.9	425.06	61 A
	±4	±1		221 380.74 (50)	221 380.609 (100)	10.7	453.13	61 A
	±2	∓1		221 367.67 (50)	221 367.512 (90)	11.7	449.07	61 A
	±5	±1			221 350.285	9.9	488.34	
			11 - 10		221 350.335 (81)	3.0		
			13 - 12	221 350.37 (50)	221 350.329 (81)	3.6		61 A
			12 - 11		221 350.189 (81)	3.3		
	±3	∓1		221 338.22 (50)	221 338.038 (90)	11.3	482.95	61 A
	±6	±1			221 311.865	9.0	533.41	
			11 - 10		221 311.940 (78)	2.7		
			13 - 12	221 311.95 (50)	221 311.925 (78)	3.2		61 A
			12 - 11		221 311.726 (78)	3.0		
	±4	∓1		221 299.88 (50)	221 299.576 (80)	10.7	526.70	61 A
	±7	±1			221 265.127	7.9	588.30	
			11 - 10		221 265.231 (81)	2.4		
				221 265.54 (50)				61 A
			13 - 12		221 265.208 (81)	2.9		
			12 - 11		221 264.938 (81)	2.6		
	±5	∓1			221 252.346	9.9	580.31	
			11 - 10		221 252.395 (83)	3.0		
			13 - 12	221 252.93 (50)	221 252.388 (83)	3.6		61 A
			12 - 11		221 252.248 (83)	3.3		
	±8	±1			221 209.973	6.7	653.01	
			11 - 10		221 210.111 (90)	2.0		
			13 - 12		221 210.076 (90)	2.4		
			12 - 11		221 209.726 (90)	2.2		
	±1	±1		221 200.23 (50)	221 198.962 (90)	11.9	406.63	61 A
	±6	∓1			221 196.447	9.0	643.76	
			11 - 10		221 196.520 (85)	2.7		
			13 - 12		221 196.506 (85)	3.2		
			12 - 11		221 196.307 (85)	3.0		
	±9	±1			221 146.357	5.3	727.52	
			11 - 10		221 146.534 (106)	1.6		
			13 - 12		221 146.487 (106)	1.9		
			12 - 11		221 146.045 (106)	1.7		
	±7	∓1			221 131.924	7.9	717.05	
			11 - 10		221 132.026 (91)	2.4		
			13 - 12		221 132.003 (91)	2.9		
			12 - 11		221 131.734 (91)	2.6		
	±10	±1			221 074.252	3.4	811.81	
			11 - 10		221 074.472 (127)	1.0		
			13 - 12		221 074.410 (127)	1.2		
			12 - 11		221 073.867 (127)	1.1		
	±8	∓1			221 058.806	6.7	800.15	
			11 - 10		221 058.942 (103)	2.0		
			13 - 12		221 058.908 (103)	2.4		
			12 - 11		221 058.558 (103)	2.2		

TABLE 7 : Microwave spectrum of $^{12}CH_3\,^{12}C^{14}N$ in the ν_8 vibrational state (continued)

J' ← J"	K	ℓ	F' ← F"	Observed frequency in MHz (Estimated uncertainty)	Calculated frequency in MHz (Estimated uncertainty)	Line Strength	Energy level of lower state (in cm^{-1})	Ref.
	±11	±1			220 993.640	1.9	905.86	
			11 - 10		220 993.908 (153)	0.6		
			13 - 12		220 993.832 (153)	0.7		
			12 - 11		220 993.174 (153)	0.6		
	±9	∓1			220 977.108	5.3	893.05	
			11 - 10		220 977.283 (119)	1.6		
			13 - 12		220 977.236 (119)	1.9		
			12 - 11		220 976.794 (119)	1.7		
	±10	∓1			220 886.841	3.4	995.73	
			11 - 10		220 887.059 (140)	1.0		
			13 - 12		220 886.998 (140)	1.2		
			12 - 11		220 886.454 (140)	1.1		
	±11	∓1			220 788.010	1.9	1108.17	
			11 - 10		220 788.275 (166)	0.6		
			13 - 12		220 788.199 (166)	0.7		
			12 - 11		220 787.541 (165)	0.6		
13 - 12	±1	±1			240 089.827 (120)	12.9	414.10	
	±2	±1			239 871.669 (200)	12.7	419.67	
	±3	±1			239 850.010 (140)	12.3	435.16	
	0	±1			239 836.060 (180)	13.0	418.31	
	±1	∓1			239 829.956 (130)	12.9	432.45	
	±4	±1			239 824.782 (120)	11.8	460.52	
	±2	∓1			239 808.912 (120)	12.7	456.46	
	±5	±1			239 791.721	11.1	495.73	
			12 - 11		239 791.759 (108)	3.4		
			14 - 13		239 791.756 (108)	4.0		
			13 - 12		239 791.645 (108)	3.7		
	±3	∓1			239 777.192 (110)	12.3	490.34	
	±6	±1			239 749.972	10.2	540.79	
			12 - 11		239 750.029 (102)	3.1		
			14 - 13		239 750.020 (102)	3.7		
			13 - 12		239 749.863 (102)	3.4		
	±4	∓1			239 735.651 (110)	11.8	534.09	
	±7	±1			239 699.254	9.2	595.69	
			12 - 11		239 699.334 (102)	2.8		
			14 - 13		239 699.318 (102)	3.3		
			13 - 12		239 699.106 (102)	3.1		
	±5	∓1			239 684.570	11.1	587.69	
			12 - 11		239 684.607 (107)	3.4		
			14 - 13		239 684.603 (107)	4.0		
			13 - 12		239 684.493 (107)	3.7		
	±8	±1			239 639.445	8.1	660.39	
			12 - 11		239 639.551 (108)	2.5		
			14 - 13		239 639.527 (108)	2.9		
			13 - 12		239 639.251 (108)	2.7		
	±1	±1			239 627.156 (120)	12.9	414.01	
	±6	∓1			239 624.071	10.2	651.14	
			14 - 13		239 624.127 (108)	3.1		
			12 - 11		239 624.118 (108)	3.7		
			13 - 12		239 623.961 (108)	3.4		

TABLE 7. Microwave spectrum of $^{12}CH_3{}^{12}C^{14}N$ in the ν_8 vibrational state (continued).

J' ← J"	K	ℓ'	F' ← F"	Observed frequency in MHz (Estimated uncertainty)	Calculated frequency in MHz (Estimated uncertainty)	Line Strength	Energy level of lower state (in cm^{-1})	Ref
	±9	±1			239 570.482	6.8	734.90	
			12 - 11		239 570.618 (121)	2.1		
			14 - 13		239 570.585 (121)	2.4		
			13 - 12		239 570.236 (121)	2.2		
	±7	∓1			239 554.217	9.2	724.42	
			12 - 11		239 554.296 (112)	2.8		
			14 - 13		239 554.280 (112)	3.3		
			13 - 12		239 554.067 (112)	3.1		
	±10	±1			239 492.333	5.3	819.18	
			12 - 11		239 492.502 (141)	1.6		
			14 - 13		239 492.459 (141)	1.9		
			13 - 12		239 492.029 (141)	1.8		
	±8	∓1			239 475.041	8.1	807.52	
			12 - 11		239 475.145 (122)	2.5		
			14 - 13		239 475.121 (122)	2.9		
			13 - 12		239 474.845 (122)	2.7		
	±11	±1			239 404.976	3.7	913.23	
			12 - 11		239 405.181 (166)	1.1		
			14 - 13		239 405.127 (166)	1.3		
			13 - 12		239 404.608 (166)	1.2		
	±9	∓1			239 386.564	6.8	900.42	
			12 - 11		239 386.697 (136)	2.1		
			14 - 13		239 386.664 (136)	2.4		
			13 - 12		239 386.316 (136)	2.2		
	±12	±1			239 308.399	1.9	1017.00	
			12 - 11		239 308.644 (197)	0.6		
			14 - 13		239 308.579 (197)	0.7		
			13 - 12		239 307.962 (197)	0.6		
	±10	∓1			239 288.797	5.3	1003.10	
			12 - 11		239 288.963 (157)	1.6		
			14 - 13		239 288.921 (157)	1.9		
			13 - 12		239 288.491 (157)	1.8		
	±11	∓1			239 181.749	3.7	1115.54	
			12 - 11		239 181.951 (182)	1.1		
			14 - 13		239 181.898 (182)	1.3		
			13 - 12		239 181.379 (182)	1.2		
	±12	∓1			239 065.427	1.9	1237.70	
			12 - 11		239 065.669 (213)	0.6		
			14 - 13		239 065.603 (213)	0.7		
			13 - 12		239 064.986 (213)	0.6		
14 - 13	±1	±1			258 552.399 (150)	13.9	422.11	
	±2	±1			258 320.394 (250)	13.7	427.67	
	±3	±1			258 295.602 (180)	13.4	443.16	
	0	±1			258 276.178 (230)	14.0	426.31	
	±1	∓1			258 271.070 (160)	13.9	440.45	
	±4	±1			258 267.943	12.9	468.52	
	±2	∓1			258 248.898 (150)	13.7	464.46	
	±5	±1			258 232.095 (140)	12.2	503.73	
	±3	∓1			258 214.982 (150)	13.4	498.34	

TABLE 7 : Microwave spectrum of $^{12}CH_3\,^{12}C^{14}N$ in the ν_8 vibrational state (continued)

J' ← J"	K	ℓ'	F' ← F"	Observed frequency in MHz (Estimated uncertainty)	Calculated frequency in MHz (Estimated uncertainty)	Line Strength	Energy level of lower state (in cm^{-1})	Ref.
	±6	±1			258 186.989 (130)	11.4	548.78	
			13 - 12		258 187.034 (132)	3.5		
			15 - 14		258 187.028 (132)	4.1		
			14 - 13		258 186.901 (132)	3.8		
	±4	∓1			258 170.391 (140)	12.9	542.08	
	±7	±1			258 132.272	10.5	603.67	
			13 - 12		258 132.334 (129)	3.2		
			15 - 14		258 132.324 (129)	3.7		
			14 - 13		258 132.152 (129)	3.5		
	±5	∓1			258 115.478 (140)	12.2	595.68	
	±8	±1			258 067.793	9.4	668.38	
			13 - 12		258 067.875 (132)	2.9		
			15 - 14		258 067.859 (132)	3.4		
			14 - 13		258 067.636 (132)	3.1		
	±1	±1			258 054.138 (150)	13.9	422.00	
	±6	∓1			258 050.396	11.4	659.13	
			15 - 14		258 050.439 (136)	3.5		
			13 - 12		258 050.433 (136)	4.1		
			14 - 13		258 050.306 (136)	3.8		
	±9	±1			258 993.473	8.2	742.89	
			13 - 12		258 993.578 (142)	2.5		
			15 - 14		258 993.555 (142)	2.9		
			14 - 13		258 993.275 (142)	2.7		
	±7	∓1			258 975.221	10.5	732.41	
			13 - 12		257 975.281 (139)	3.2		
			15 - 14		257 975.270 (139)	3.7		
			14 - 13		257 975.100 (139)	3.5		
	±10	±1			257 909.270	6.9	827.17	
			13 - 12		257 909.401 (159)	2.1		
			15 - 14		257 909.371 (159)	2.4		
			14 - 13		257 909.026 (159)	2.3		
	±8	∓1			257 889.996	9.4	815.51	
			13 - 12		257 890.076 (146)	2.9		
			15 - 14		257 890.060 (146)	3.4		
			14 - 13		257 889.838 (146)	3.1		
	±11	±1			257 815.161	5.4	921.21	
			13 - 12		257 815.321 (183)	1.7		
			15 - 14		257 815.282 (183)	1.9		
			14 - 13		257 814.865 (183)	1.8		
	±9	∓1			257 794.745	8.2	908.41	
			13 - 12		257 794.848 (158)	2.5		
			15 - 14		257 794.825 (158)	2.9		
			14 - 13		257 794.544 (158)	2.7		
	±12	±1			257 711.129	3.7	1024.98	
			13 - 12		257 711.320 (213)	1.1		
			15 - 14		257 711.272 (213)	1.3		
			14 - 13		257 710.777 (213)	1.2		
	±10	∓1			257 689.484	6.9	1011.08	
			13 - 12		257 689.613 (177)	2.1		
			15 - 14		257 689.583 (177)	2.4		
			14 - 13		257 689.238 (177)	2.3		

TABLE 7 : Microwave spectrum of $^{12}CH_3\,^{12}C^{14}N$ in the ν_8 vibrational state (continued)

Ref.	J' ← J"	K	ℓ'	F' ← F"	Observed frequency in MHz (Estimated uncertainty)	Calculated frequency in MHz (Estimated uncertainty)	Line Strength	Energy level of lower state (in cm⁻¹)	Ref.
		±13	±1			257 597.163	1.9	1138.46	
				13 – 12		257 597.388 (249)	0.6		
				15 – 14		257 597.331 (249)	0.7		
				14 – 13		257 596.750 (249)	0.6		
		±11	∓1			257 574.225	5.4	1123.52	
				13 – 12		257 574.382 (201)	1.7		
				15 – 14		257 574.344 (201)	1.9		
				14 – 13		257 573.927 (201)	1.8		
		±12	∓1			257 448.974	3.7	1245.68	
				13 – 12		257 449.162 (232)	1.1		
				15 – 14		257 449.114 (232)	1.3		
				14 – 13		257 448.619 (232)	1.2		
		±13	∓1			257 313.737	1.9	1377.54	
				13 – 12		257 313.959 (267)	0.6		
				15 – 14		257 313.901 (267)	0.7		
				14 – 13		257 313.320 (267)	0.6		
	15 – 14	±1	±1			277 013.666 (190)	14.9	430.73	
		±2	±1			276 768.465 (310)	14.7	436.29	
		±3	±1			276 740.214 (220)	14.4	451.78	
		0	±1			276 714.337 (280)	15.0	434.93	
		±1	∓1			276 710.553 (200)	14.9	449.06	
		±4	±1			276 710.018 (190)	13.9	477.13	
		±2	∓1			276 687.359 (190)	14.7	473.07	
		±5	±1			276 671.327 (180)	13.3	512.34	
		±3	∓1			276 651.302 (180)	14.4	506.95	
		±6	±1			276 622.831	12.6	557.40	
				14 – 13		276 622.866 (167)	4.5		
				16 – 15		276 622.862 (167)	3.9		
				15 – 14		276 622.759 (167)	4.8		
		±4	∓1			276 603.695 (180)	13.9	550.69	
		±7	±1			276 564.093	11.7	612.28	
				14 – 13		276 564.142 (162)	3.6		
				16 – 15		276 564.135 (162)	4.2		
				15 – 14		276 563.995 (162)	3.9		
		±5	∓1			276 544.972 (170)	13.3	604.29	
		±8	±1			276 494.925	10.7	676.99	
				14 – 13		276 494.991 (162)	3.3		
				16 – 15		276 494.979 (162)	3.8		
				15 – 14		276 494.798 (162)	3.6		
		±1	±1			276 479.815 (190)	14.9	430.61	
		±6	∓1			276 475.323	12.6	667.74	
				14 – 13		276 475.357 (170)	3.9		
				16 – 15		276 475.353 (170)	4.5		
				15 – 14		276 475.250 (170)	4.8		
		±9	±1			276 415.237	9.6	751.49	
				14 – 13		276 415.320 (169)	3.0		
				16 – 15		276 415.304 (169)	3.4		
				15 – 14		276 415.075 (169)	3.2		
		±7	∓1			276 394.839	11.7	741.02	
				14 – 13		276 394.886 (171)	3.6		
				16 – 15		276 394.879 (171)	4.1		
				15 – 14		276 394.739 (171)	3.9		

TABLE 7 : Microwave spectrum of $^{12}CH_3\,^{12}C^{14}N$ in the ν_8 vibrational state (continued)

J' ← J"	K	ℓ'	F' ← F"	Observed frequency in MHz (Estimated uncertainty)	Calculated frequency in MHz (Estimated uncertainty)	Line Strength	Energy level of lower state (in cm^{-1})	Ref.
	±10	±1			276 324.975	8.3	835.77	
			14 - 13		276 325.079 (182)	2.6		
			16 - 15		276 325.057 (182)	3.0		
			15 - 14		276 324.775 (182)	2.8		
	±8	∓1			276 303.571	10.7	824.11	
			14 - 13		276 303.634 (175)	3.3		
			16 - 15		276 303.623 (175)	3.8		
			15 - 14		276 303.442 (175)	3.6		
	±11	±1			276 224.106	6.9	929.81	
			14 - 13		276 224.233 (204)	2.2		
			16 - 15		276 224.205 (204)	2.5		
			15 - 14		276 223.865 (204)	2.3		
	±9	∓1			276 201.554	9.6	917.01	
			14 - 13		276 201.635 (186)	3.0		
			16 - 15		276 201.619 (186)	3.4		
			15 - 14		276 201.390 (186)	3.2		
	±12	±1			276 112.612	5.4	1033.58	
			14 - 13		276 112.764 (233)	1.7		
			16 - 15		276 112.729 (233)	1.9		
			15 - 14		276 112.324 (233)	1.8		
	±10	∓1			276 088.806	8.3	1019.68	
			14 - 13		276 088.907 (202)	2.6		
			16 - 15		276 088.885 (202)	3.0		
			15 - 14		276 088.603 (202)	2.8		
	±13	±1			275 990.481	3.7	1147.05	
			14 - 13		275 990.659 (268)	1.2		
			16 - 15		275 990.616 (268)	1.3		
			15 - 14		275 990.143 (268)	1.2		
	±11	∓1			275 965.339	6.9	1132.11	
			14 - 13		275 965.462 (225)	2.2		
			16 - 15		275 965.434 (225)	2.5		
			15 - 14		275 965.094 (225)	2.3		
	±14	±1			275 857.700	1.9	1270.19	
			14 - 13		275 857.907 (310)	0.6		
			16 - 15		275 857.857 (310)	0.7		
			15 - 14		275 857.308 (310)	0.6		
	±12	∓1			275 831.164	5.4	1254.26	
			14 - 13		275 831.313 (254)	1.7		
			16 - 15		275 831.278 (254)	1.9		
			15 - 14		275 830.873 (254)	1.8		
	±13	∓1			275 686.287	3.7	1386.13	
			14 - 13		275 686.462 (289)	1.2		
			16 - 15		275 686.419 (289)	1.3		
			15 - 14		275 685.943 (289)	1.2		
	±14	∓1			275 530.711	1.9	1527.66	
			14 - 13		275 530.915 (330)	0.6		
			16 - 15		275 530.864 (330)	0.7		
			15 - 14		275 530.315 (330)	0.6		

TABLE 7. Microwave spectrum of $^{12}CH_3\,^{12}C^{14}N$ in the ν_8 vibrational state (continued)

J' ← J"	K	ℓ'	F' ← F"	Observed frequency in MHz (Estimated uncertainty)	Calculated frequency in MHz (Estimated uncertainty)	Line Strength	Energy level of lower state (in cm^{-1})	Ref.
16 − 15	±1	±1			295 473.533 (230)	15.9	439.97	
	±2	±1			295 215.835 (380)	15.8	445.52	
	±3	±1			295 183.776 (270)	15.4	461.01	
	±4	±1			295 150.925 (230)	15.0	486.36	
	0	±1			295 150.399 (350)	16.0	444.16	
	±1	∓1			295 148.288 (250)	15.9	458.29	
	±2	∓1			295 124.189 (230)	15.8	482.30	
	±5	±1			295 109.334 (220)	14.4	521.57	
	±3	∓1			295 086.050 (220)	15.4	516.18	
	±6	±1			295 057.410 (210)	13.8	566.62	
	±4	∓1			295 035.462 (220)	15.0	559.92	
	±7	±1			294 994.629	12.9	621.52	
			15 − 14		294 994.668 (202)	4.0		
			17 − 16		294 994.663 (202)	4.6		
			16 − 15		294 994.548 (202)	4.3		
	±5	∓1			294 972.953 (210)	14.4	613.52	
	±8	±1			294 920.760	12.0	686.21	
			15 − 14		294 920.812 (199)	3.7		
			17 − 16		294 920.804 (199)	4.2		
			16 − 15		294 920.654 (199)	4.0		
	±1	±1			294 904.092 (230)	15.9	439.83	
	±6	∓1			294 898.751 (210)	13.8	676.96	
	±9	±1			294 835.691	10.9	760.71	
			15 − 14		294 835.758 (202)	3.4		
			17 − 16		294 835.746 (202)	3.9		
			16 − 15		294 835.557 (202)	3.6		
	±7	∓1			294 812.968	12.9	750.24	
			15 − 14		294 813.006 (209)	4.0		
			17 − 16		294 813.001 (209)	4.6		
			16 − 15		294 812.886 (209)	4.3		
	±10	±1			294 739.356	9.8	844.99	
			15 − 14		294 739.440 (212)	3.0		
			17 − 16		294 739.423 (212)	3.4		
			16 − 15		294 739.190 (212)	3.2		
	±8	∓1			294 715.672	12.0	833.33	
			15 − 14		294 715.722 (211)	3.7		
			17 − 16		294 715.714 (211)	4.2		
			16 − 15		294 715.570 (211)	4.0		
	±11	±1			294 631.721	8.4	939.02	
			15 − 14		294 631.822 (230)	2.6		
			17 − 16		294 631.801 (230)	3.0		
			16 − 15		294 631.520 (230)	2.8		
	±9	∓1			294 606.896	10.9	926.22	
			15 − 14		294 606.960 (219)	3.4		
			17 − 16		294 606.948 (219)	3.9		
			16 − 15		294 606.759 (218)	3.6		
	±12	±1			294 512.759	7.0	1042.79	
			15 − 14		294 512.881 (256)	2.2		
			17 − 16		294 512.854 (256)	2.4		
			16 − 15		294 512.520 (256)	2.3		

TABLE 7 : Microwave spectrum of $^{12}CH_3\,^{12}C^{14}N$ in the ν_8 vibrational state (continued)

J' ← J"	K	ℓ'	F' ← F"	Observed frequency in MHz (Estimated uncertainty)	Calculated frequency in MHz (Estimated uncertainty)	Line Strength	Energy level of lower state (in cm^{-1})	Ref.
	±10	∓1			294 486.666	9.8	1028.89	
			15 - 14		294 486.747 (232)	3.0		
			17 - 16		294 486.730 (232)	3.4		
			16 - 15		294 486.497 (232)	3.2		
	±13	±1			294 382.456	5.4	1156.26	
			15 - 14		294 382.599 (291)	1.7		
			17 - 16		294 382.567 (291)	1.9		
			16 - 15		294 382.175 (291)	1.8		
	±11	∓1			294 354.997	8.4	1141.31	
			15 - 14		294 355.096 (253)	2.6		
			17 - 16		294 355.075 (253)	3.0		
			16 - 15		294 354.794 (253)	2.8		
	±14	±1			294 240.799	3.8	1279.40	
			15 - 14		294 240.965 (332)	1.2		
			17 - 16		294 240.927 (332)	1.3		
			16 - 15		294 240.474 (332)	1.2		
	±12	∓1			294 211.902	7.0	1263.47	
			15 - 14		294 212.020 (281)	2.2		
			17 - 16		294 211.993 (281)	2.4		
			16 - 15		294 211.659 (281)	2.3		
	±15	±1			294 087.782	1.9	1412.17	
			15 - 14		294 087.973 (379)	0.6		
			17 - 16		294 087.928 (379)	0.7		
			16 - 15		294 087.408 (379)	0.6		
	±13	∓1			294 057.387	5.4	1395.32	
			15 - 14		294 057.526 (315)	1.7		
			17 - 16		294 057.494 (315)	1.9		
			16 - 15		294 057.103 (315)	1.8		
	±14	∓1			293 891.459	3.8	1536.85	
			15 - 14		293 891.621 (356)	1.2		
			17 - 16		293 891.583 (356)	1.3		
			16 - 15		293 891.129 (356)	1.2		
	±15	∓1			293 714.121	1.9	1688.02	
			15 - 14		293 714.308 (403)	0.6		
			17 - 16		293 714.263 (403)	0.7		
			16 - 15		293 713.743 (403)	0.6		

Table 8 - Direct ℓ-type doubling transitions from ν_8 of $^{12}CH_3{}^{12}C^{14}N$ [Ref. 68 A]

J	Obs. freq. (MHz) (Est. uncertainty)	Calc. freq. (MHz) (Est. uncertainty)
21	8208.98	8208.96
22	8989.38	8989.36
23	9805.01	9804.97
24	10655.81	10655.75
25	11541.67	11541.67
26	12462.64	12462.70
27	13418.82	13418.78
28	14409.93	14409.89
29	15435.97	15435.98
30	16496.80	16496.99
34	21089.56	21089.48

TABLE [illegible]. Calculated Microwave Spectrum of CH_3CN in Order of Frequency.

Calculated frequency (Est. uncertainty) in MHz		Vibr. State	Transition $J' \leftarrow J''$	K	ℓ'	$F' \leftarrow F''$	Isotopic Species		
17844.071	(7)		1 ← 0	0	0		12	12	15
17866.613	(9)		1 ← 0	0	0		13	12	14
18388.683	(9)		1 ← 0	0	0		12	13	14
18396.725	(1)		1 ← 0	0	0	1 ← 1	12	12	14
18397.997	(1)		1 ← 0	0	0	2 ← 1	12	12	14
18399.892	(1)		1 ← 0	0	0	0 ← 1	12	12	14
18451.753	(4)	ν_8	1 ← 0	0	±1	1 ← 1	12	12	14
18453.061	(3)	ν_8	1 ← 0	0	±1	2 ← 1	12	12	14
18455.022	(2)	ν_8	1 ← 0	0	±1	0 ← 1	12	12	14
35687.379	(13)		2 ← 1	1	0		12	12	15
35688.056	(13)		2 ← 1	0	0		12	12	15
35732.467	(18)		2 ← 1	1	0		13	12	14
35733.138	(18)		2 ← 1	0	0		13	12	14
36776.569	(17)		2 ← 1	1	0		12	13	14
36777.274	(17)		2 ← 1	0	0		12	13	14
36793.709	(1)		2 ← 1	1	0	2 ← 1	12	12	14
36794.204	(1)		2 ← 1	0	0	2 ← 2	12	12	14
36794.340	(1)		2 ← 1	1	0	2 ← 2	12	12	14
36794.417	(1)		2 ← 1	0	0	1 ← 0	12	12	14
36794.762	(1)		2 ← 1	1	0	1 ← 1	12	12	14
36795.024	(1)		2 ← 1	1	0	3 ← 2	12	12	14
36795.394	(2)		2 ← 1	1	0	1 ← 2	12	12	14
36795.475	(1)		2 ← 1	0	0	2 ← 1	12	12	14
36795.568	(1)		2 ← 1	0	0	3 ← 2	12	12	14
36796.313	(1)		2 ← 1	0	0	1 ← 2	12	12	14
36796.348	(1)		2 ← 1	1	0	1 ← 0	12	12	14
36797.584	(1)		2 ← 1	0	0	1 ← 1	12	12	14
36869.757	(9)	ν_8	2 ← 1	±1	±1	2 ← 1	12	12	14
36871.106	(7)	ν_8	2 ← 1	±1	±1	3 ← 2	12	12	14
36872.538	(19)	ν_8	2 ← 1	±1	±1	1 ← 0	12	12	14
36902.237	(7)	ν_8	2 ← 1	±1	∓1	2 ← 1	12	12	14
36903.592	(5)	ν_8	2 ← 1	±1	∓1	3 ← 2	12	12	14
36904.457	(8)	ν_8	2 ← 1	0	±1	1 ← 0	12	12	14
36904.961	(11)	ν_8	2 ← 1	±1	∓1	1 ← 0	12	12	14

TABLE 9 : Calculated microwave Spectrum of CH_3CN in Order of Frequency (continued)

Calculated frequency (Est. uncertainty) in MHz		Vibr. State	Transition J' ← J"	K	ℓ'	F' ← F"	Isotopic Species		
36905.547	(4)	ν_8	2 – 1	0	±1	2 – 1	12	12	14
36905.640	(3)	ν_8	2 – 1	0	±1	3 – 2	12	12	14
36940.937	(9)	ν_8	2 – 1	±1	±1	2 – 1	12	12	14
36942.296	(6)	ν_8	2 – 1	±1	±1	3 – 2	12	12	14
36943.604	(19)	ν_8	2 – 1	±1	±1	1 – 0	12	12	14
53527.813	(17)		3 – 2	2	0		12	12	15
53530.855	(17)		3 – 2	1	0		12	12	15
53531.870	(17)		3 – 2	0	0		12	12	15
53595.463	(25)		3 – 2	2	0		13	12	14
53598.481	(25)		3 – 2	1	0		13	12	14
53599.487	(25)		3 – 2	0	0		13	12	14
55161.454	(23)		3 – 2	2	0		12	13	14
55164.625	(23)		3 – 2	1	0		12	13	14
55165.682	(23)		3 – 2	0	0		12	13	14
55187.667	(2)		3 – 2	2	0	2 – 2	12	12	14
55187.671	(2)		3 – 2	2	0	3 – 2	12	12	14
55189.022	(4)		3 – 2	2	0	2 – 3	12	12	14
55189.026	(3)		3 – 2	2	0	3 – 3	12	12	14
55189.032	(2)		3 – 2	2	0	4 – 3	12	12	14
55189.782	(2)		3 – 2	2	0	2 – 1	12	12	14
55190.972	(2)		3 – 2	1	0	3 – 3	12	12	14
55191.621	(2)		3 – 2	0	0	3 – 3	12	12	14
55191.656	(1)		3 – 2	1	0	3 – 2	12	12	14
55192.024	(1)		3 – 2	1	0	2 – 1	12	12	14
55192.036	(1)		3 – 2	1	0	4 – 3	12	12	14
55192.393	(1)		3 – 2	1	0	2 – 3	12	12	14
55192.772	(1)		3 – 2	0	0	2 – 1	12	12	14
55192.985	(1)		3 – 2	0	0	3 – 2	12	12	14
55193.037	(1)		3 – 2	0	0	4 – 3	12	12	14
55193.077	(1)		3 – 2	1	0	2 – 2	12	12	14
55193.517	(2)		3 – 2	0	0	2 – 3	12	12	14
55194.881	(1)		3 – 2	0	0	2 – 2	12	12	14
55305.764	(9)	ν_8	3 – 2	±1	±1	3 – 2	12	12	14
55306.150	(9)	ν_8	3 – 2	±1	±1	4 – 3	12	12	14
55306.157	(9)	ν_8	3 – 2	±1	±1	2 – 1	12	12	14
55348.132	(8)	ν_8	3 – 2	±2	∓1	3 – 2	12	12	14
55349.533	(7)	ν_8	3 – 2	±2	∓1	4 – 3	12	12	14
55350.312	(10)	ν_8	3 – 2	±2	∓1	2 – 1	12	12	14
55354.427	(5)	ν_8	3 – 2	±1	∓1	3 – 2	12	12	14

TABLE 9 : Calculated Microwave Spectrum of CH_3CN in Order of Frequency (continued)

Calculated frequency (Est. uncertainty) in MHz		Vibr. State	Transition J' ← J"	K	ℓ'	F' ← F"	Isotopic Species		
55354.808	(5)	ν_8	3 - 2	±1	∓1	2 - 1	12	12	14
55354.816	(5)	ν_8	3 - 2	±1	∓1	4 - 3	12	12	14
55357.646	(9)	ν_8	3 - 2	±2	±1	3 - 2	12	12	14
55357.753	(5)	ν_8	3 - 2	0	±1	2 - 1	12	12	14
55357.971	(5)	ν_8	3 - 2	0	±1	3 - 2	12	12	14
55358.023	(5)	ν_8	3 - 2	0	±1	4 - 3	12	12	14
55359.048	(9)	ν_8	3 - 2	±2	±1	4 - 3	12	12	14
55359.826	(9)	ν_8	3 - 2	±2	±1	2 - 1	12	12	14
55412.534	(9)	ν_8	3 - 2	±1	±1	3 - 2	12	12	14
55412.904	(9)	ν_8	3 - 2	±1	±1	2 - 1	12	12	14
55412.926	(9)	ν_8	3 - 2	±1	±1	4 - 3	12	12	14
71363.262	(19)		4 - 3	3	0		12	12	15
71370.019	(19)		4 - 3	2	0		12	12	15
71374.075	(19)		4 - 3	1	0		12	12	15
71375.427	(19)		4 - 3	0	0		12	12	15
71453.500	(30)		4 - 3	3	0		13	12	14
71460.206	(30)		4 - 3	2	0		13	12	14
71464.229	(30)		4 - 3	1	0		13	12	14
71465.571	(30)		4 - 3	0	0		13	12	14
73541.133	(28)		4 - 3	3	0		12	13	14
73548.178	(28)		4 - 3	2	0		12	13	14
73552.406	(28)		4 - 3	1	0		12	13	14
73553.815	(28)		4 - 3	0	0		12	13	14
73576.502	(2)		4 - 3	3	0	4 - 3	12	12	14
73577.761	(2)		4 - 3	3	0	5 - 4	12	12	14
73578.242	(2)		4 - 3	3	0	3 - 2	12	12	14
73584.122	(1)		4 - 3	2	0	4 - 3	12	12	14
73584.701	(2)		4 - 3	2	0	5 - 4	12	12	14
73584.844	(1)		4 - 3	2	0	3 - 2	12	12	14
73588.696	(1)		4 - 3	1	0	4 - 3	12	12	14
73588.807	(1)		4 - 3	1	0	3 - 2	12	12	14
73588.866	(2)		4 - 3	1	0	5 - 4	12	12	14
73590.128	(1)		4 - 3	0	0	3 - 2	12	12	14
73590.220	(1)		4 - 3	0	0	4 - 3	12	12	14
73590.254	(1)		4 - 3	0	0	5 - 4	12	12	14
73740.838	(11)	ν_8	4 - 3	±1	±1	4 - 3	12	12	14
73740.959	(11)	ν_8	4 - 3	±1	±1	3 - 2	12	12	14
73741.009	(11)	ν_8	4 - 3	±1	±1	5 - 4	12	12	14
73787.318	(9)	ν_8	4 - 3	±3	∓1	4 - 3	12	12	14
73788.614	(9)	ν_8	4 - 3	±3	∓1	5 - 4	12	12	14

TABLE 9 : Calculated Microwave Spectrum of CH_3CN in Order of Frequency (continued)

Calculated frequency (Est. uncertainty) in MHz		Vibr. State	Transition J' ← J"	K	ℓ'	F' ← F"	Isotopic Species		
73789.116	(10)	ν_8	4 − 3	±3	∓1	3 − 2	12	12	14
73798.019	(7)	ν_8	4 − 3	±2	∓1	4 − 3	12	12	14
73798.614	(7)	ν_8	4 − 3	±2	∓1	5 − 4	12	12	14
73798.767	(7)	ν_8	4 − 3	±2	∓1	3 − 2	12	12	14
73805.613	(6)	ν_8	4 − 3	±1	∓1	4 − 3	12	12	14
73805.729	(6)	ν_8	4 − 3	±1	∓1	3 − 2	12	12	14
73805.786	(7)	ν_8	4 − 3	±1	∓1	5 − 4	12	12	14
73806.161	(10)	ν_8	4 − 3	±3	±1	4 − 3	12	12	14
73807.457	(9)	ν_8	4 − 3	±3	±1	5 − 4	12	12	14
73807.959	(10)	ν_8	4 − 3	±3	±1	3 − 2	12	12	14
73809.882	(7)	ν_8	4 − 3	0	±1	3 − 2	12	12	14
72809.975	(7)	ν_8	4 − 3	0	±1	4 − 3	12	12	14
73810.008	(7)	ν_8	4 − 3	0	±1	5 − 4	12	12	14
73810.995	(8)	ν_8	4 − 3	±2	±1	4 − 3	12	12	14
73811.589	(8)	ν_8	4 − 3	±2	±1	5 − 4	12	12	14
73811.742	(8)	ν_8	4 − 3	±2	±1	3 − 2	12	12	14
73883.198	(11)	ν_8	4 − 3	±1	±1	4 − 3	12	12	14
73883.310	(11)	ν_8	4 − 3	±1	±1	3 − 2	12	12	14
73883.373	(11)	ν_8	4 − 3	±1	±1	5 − 4	12	12	14
89203.437	(17)		5 − 4	3	0		12	12	15
89211.883	(17)		5 − 4	2	0		12	12	15
89216.952	(18)		5 − 4	1	0		12	12	15
89218.642	(19)		5 − 4	0	0		12	12	15
89316.213	(32)		5 − 4	3	0		13	12	14
89324.596	(32)		5 − 4	2	0		13	12	14
89329.625	(32)		5 − 4	1	0		13	12	14
89331.302	(33)		5 − 4	0	0		13	12	14
91925.729	(30)		5 − 4	3	0		12	13	14
91934.536	(30)		5 − 4	2	0		12	13	14
91939.820	(30)		5 − 4	1	0		12	13	14
91941.582	(31)		5 − 4	0	0		12	13	14
91970.657	(2)		5 − 4	3	0	5 − 4	12	12	14
91971.310	(2)		5 − 4	3	0	6 − 5	12	12	14
91971.465	(2)		5 − 4	3	0	4 − 3	12	12	14
91979.785	(2)		5 − 4	2	0	5 − 4	12	12	14
91980.089	(2)		5 − 4	2	0	6 − 5	12	12	14
91980.115	(2)		5 − 4	2	0	4 − 3	12	12	14
91985.264	(1)		5 − 4	1	0	5 − 4	12	12	14
91985.307	(2)		5 − 4	1	0	4 − 3	12	12	14
91985.358	(2)		5 − 4	1	0	6 − 5	12	12	14

TABLE 9 : Calculated Microwave Spectrum of CH_3CN in Order of Frequency (continued)

Calculated frequency (Est. uncertainty) in MHz		Vibr. State	Transition $J' \leftarrow J''$	K	ℓ'	$F' \leftarrow F''$	Isotopic Species		
91987.038	(1)		5 - 4	0	0	4 - 3	12	12	14
91987.090	(2)		5 - 4	0	0	5 - 4	12	12	14
91987.114	(2)		5 - 4	0	0	6 - 5	12	12	14
92175.484	(100)	ν_8	5 - 4	±1	±1		12	12	14
92234.096	(10)	ν_8	5 - 4	±3	∓1	5 - 4	12	12	14
92234.767	(10)	ν_8	5 - 4	±3	∓1	6 - 5	12	12	14
92234.932	(10)	ν_8	5 - 4	±3	∓1	4 - 3	12	12	14
92247.036	(8)	ν_8	5 - 4	±2	∓1	5 - 4	12	12	14
92247.346	(8)	ν_8	5 - 4	±2	∓1	6 - 5	12	12	14
92247.378	(7)	ν_8	5 - 4	±2	∓1	4 - 3	12	12	14
92256.278	(100)	ν_8	5 - 4	±1	∓1		12	12	14
92257.912	(10)	ν_8	5 - 4	±3	±1	5 - 4	12	12	14
92258.583	(10)	ν_8	5 - 4	±3	±1	6 - 5	12	12	14
92258.747	(10)	ν_8	5 - 4	±3	±1	4 - 3	12	12	14
92261.420	(80)	ν_8	5 - 4	0	±1		12	12	14
92263.720	(11)	ν_8	5 - 4	±2	±1	5 - 4	12	12	14
92264.031	(11)	ν_8	5 - 4	±2	±1	6 - 5	12	12	14
92264.062	(11)	ν_8	5 - 4	±2	±1	4 - 3	12	12	14
92353.434	(100)	ν_8	5 - 4	±1	±1		12	12	14
107043.185	(15)		6 - 5	3	0		12	12	15
107053.318	(16)		6 - 5	2	0		12	12	15
107059.401	(17)		6 - 5	1	0		12	12	15
107061.429	(18)		6 - 5	0	0		12	12	15
107178.486	(31)		6 - 5	3	0		13	12	14
107188.545	(31)		6 - 5	2	0		13	12	14
107194.580	(32)		6 - 5	1	0		13	12	14
107196.592	(32)		6 - 5	0	0		13	12	14
110309.867	(29)		6 - 5	3	0		12	13	14
110320.435	(29)		6 - 5	2	0		12	13	14
110326.777	(30)		6 - 5	1	0		12	13	14
110328.890	(31)		6 - 5	0	0		12	13	14
110364.085	(1)		6 - 5	3	0	6 - 5	12	12	14
110364.469	(2)		6 - 5	3	0	7 - 6	12	12	14
110364.524	(2)		6 - 5	3	0	5 - 4	12	12	14
110374.872	(2)		6 - 5	2	0	6 - 5	12	12	14
110375.048	(1)		6 - 5	2	0	5 - 4	12	12	14
110375.052	(2)		6 - 5	2	0	7 - 6	12	12	14
110381.345	(2)		6 - 5	1	0	6 - 5	12	12	14
110381.364	(2)		6 - 5	1	0	5 - 4	12	12	14
110381.404	(2)		6 - 5	1	0	7 - 6	12	12	14

TABLE 9 : Calculated Microwave Spectrum of CH_3CN in Order of Frequency (continued)

Calculated frequency (Est. uncertainty) in MHz		Vibr. State	Transition J' ← J"	K	ℓ'	F' ← F"	Isotopic Species		
110383.470	(2)		6 − 5	0	0	5 − 4	12	12	14
110383.504	(2)		6 − 5	0	0	6 − 5	12	12	14
110383.522	(2)		6 − 5	0	0	7 − 6	12	12	14
110609.554	(60)	ν_8	6 − 5	±1	±1		12	12	14
110680.069	(11)	ν_8	6 − 5	±3	∓1	6 − 5	12	12	14
110680.463	(11)	ν_8	6 − 5	±3	∓1	7 − 6	12	12	14
110680.525	(11)	ν_8	6 − 5	±3	∓1	5 − 4	12	12	14
110695.381	(9)	ν_8	6 − 5	±2	∓1	6 − 5	12	12	14
110695.565	(9)	ν_8	6 − 5	±2	∓1	5 − 4	12	12	14
110695.566	(9)	ν_8	6 − 5	±2	∓1	7 − 6	12	12	14
110706.251	(60)	ν_8	6 − 5	±1	∓1		12	12	14
110709.033	(11)	ν_8	6 − 5	±3	±1	6 − 5	12	12	14
110709.427	(11)	ν_8	6 − 5	±3	±1	7 − 6	12	12	14
110709.488	(11)	ν_8	6 − 5	±3	±1	5 − 4	12	12	14
110712.166	(50)	ν_8	6 − 5	0	±1		12	12	14
110716.087	(17)	ν_8	6 − 5	±2	±1	6 − 5	12	12	14
110716.271	(17)	ν_8	6 − 5	±2	±1	5 − 4	12	12	14
110716.272	(17)	ν_8	6 − 5	±2	±1	7 − 6	12	12	14
110823.095	(60)	ν_8	6 − 5	±1	±1		12	12	14
124882.419	(15)		7 − 6	3	0		12	12	15
124894.240	(17)		7 − 6	2	0		12	12	15
124901.335	(20)		7 − 6	1	0		12	12	15
124903.701	(21)		7 − 6	0	0		12	12	15
125040.229	(27)		7 − 6	3	0		13	12	14
125051.965	(28)		7 − 6	2	0		13	12	14
125059.006	(30)		7 − 6	1	0		13	12	14
125061.353	(30)		7 − 6	0	0		13	12	14
128693.455	(27)		7 − 6	3	0		12	13	14
128705.785	(28)		7 − 6	2	0		12	13	14
128713.183	(30)		7 − 6	1	0		12	13	14
128715.649	(32)		7 − 6	0	0		12	13	14
128756.864	(2)		7 − 6	3	0	7 − 6	12	12	14
128757.110	(2)		7 − 6	3	0	8 − 7	12	12	14
128757.128	(2)		7 − 6	3	0	6 − 5	12	12	14
128769.440	(60)		7 − 6	2	0		12	12	14
128776.886	(40)		7 − 6	1	0		12	12	14
128779.369	(40)		7 − 6	0	0		12	12	14
129043.065	(40)	ν_8	7 − 6	±1	±1		12	12	14
129125.308	(15)	ν_8	7 − 6	±3	∓1	7 − 6	12	12	14

TABLE 9 : Calculated Microwave Spectrum of CH_3CN in Order of Frequency (continued)

Calculated frequency (Est. uncertainty) in MHz		Vibr. State	Transition J' ← J"	K	ℓ'	F' ← F"	Isotopic Species		
129125.560	(15)	ν_8	7 − 6	±3	∓1	8 − 7	12	12	14
129125.583	(15)	ν_8	7 − 6	±3	∓1	6 − 5	12	12	14
129143.030	(14)	ν_8	7 − 6	±2	∓1	7 − 6	12	12	14
129143.139	(14)	ν_8	7 − 6	±2	∓1	6 − 5	12	12	14
129143.149	(14)	ν_8	7 − 6	±2	∓1	8 − 7	12	12	14
129155.525	(40)	ν_8	7 − 6	±1	∓1		12	12	14
129159.628	(16)	ν_8	7 − 6	±3	±1	7 − 6	12	12	14
129159.880	(16)	ν_8	7 − 6	±3	±1	8 − 7	12	12	14
129159.903	(16)	ν_8	7 − 6	±3	±1	6 − 5	12	12	14
129162.073	(40)	ν_8	7 − 6	0	±1		12	12	14
129168.128	(27)	ν_8	7 − 6	±2	±1	7 − 6	12	12	14
129168.237	(27)	ν_8	7 − 6	±2	±1	6 − 5	12	12	14
129168.247	(27)	ν_8	7 − 6	±2	±1	8 − 7	12	12	14
129292.196	(40)	ν_8	7 − 6	±1	±1		12	12	14
142721.054	(22)		8 − 7	3	0		12	12	15
142734.562	(24)		8 − 7	2	0		12	12	15
142742.669	(27)		8 − 7	1	0		12	12	15
142745.372	(28)		8 − 7	0	0		12	12	15
142901.356	(23)		8 − 7	3	0		13	12	14
142914.768	(26)		8 − 7	2	0		13	12	14
142922.815	(29)		8 − 7	1	0		13	12	14
142925.497	(30)		8 − 7	0	0		13	12	14
147076.402	(27)		8 − 7	3	0		12	13	14
147090.494	(31)		8 − 7	2	0		12	13	14
147098.949	(35)		8 − 7	1	0		12	13	14
147101.767	(37)		8 − 7	0	0		12	13	14
147148.960	(2)		8 − 7	3	0	8 − 7	12	12	14
147149.128	(2)		8 − 7	3	0	9 − 8	12	12	14
147149.131	(2)		8 − 7	3	0	7 − 6	12	12	14
147163.249	(50)		8 − 7	2	0		12	12	14
147171.757	(30)		8 − 7	1	0		12	12	14
147174.594	(30)		8 − 7	0	0		12	12	14
147475.924	(30)	ν_8	8 − 7	±1	±1		12	12	14
147569.760	(21)	ν_8	8 − 7	±3	∓1	8 − 7	12	12	14
147569.937	(21)	ν_8	8 − 7	±3	∓1	9 − 8	12	12	14
147569.944	(21)	ν_8	8 − 7	±3	∓1	7 − 6	12	12	14
147589.948	(90)	ν_8	8 − 7	±2	∓1		12	12	14
147603.983	(30)	ν_8	8 − 7	±1	∓1		12	12	14
147609.686	(25)	ν_8	8 − 7	±3	±1	8 − 7	12	12	14

TABLE 9 : Calculated Microwave Spectrum of CH_3CN in Order of Frequency (continued)

Calculated frequency (Est. uncertainty) in MHz		Vibr. State	Transition J' ← J"	K	ℓ'	F' ← F"	Isotopic Species		
147609.859	(25)	ν_8	8 − 7	±3	±1	9 − 8	12	12	14
147609.866	(25)	ν_8	8 − 7	±3	±1	7 − 6	12	12	14
147611.000	(40)	ν_8	8 − 7	0	±1		12	12	14
147619.872	(80)	ν_8	8 − 7	±2	±1		12	12	14
147760.644	(30)	ν_8	8 − 7	±1	±1		12	12	14
160559.004	(31)		9 − 8	3	0		12	12	15
160574.197	(34)		9 − 8	2	0		12	12	15
160583.316	(36)		9 − 8	1	0		12	12	15
160586.356	(38)		9 − 8	0	0		12	12	15
160761.776	(29)		9 − 8	3	0		13	12	14
160776.865	(33)		9 − 8	2	0		13	12	14
160785.918	(37)		9 − 8	1	0		13	12	14
160788.935	(38)		9 − 8	0	0		13	12	14
165458.616	(39)		9 − 8	3	0		12	13	14
165474.469	(44)		9 − 8	2	0		12	13	14
165483.981	(49)		9 − 8	1	0		12	13	14
165487.152	(51)		9 − 8	0	0		12	13	14
165540.304	(3)		9 − 8	3	0	9 − 8	12	12	14
165540.420	(3)		9 − 8	3	0	8 − 7	12	12	14
165540.424	(3)		9 − 8	3	0	10 − 9	12	12	14
165556.328	(40)		9 − 8	2	0		12	12	14
165565.897	(20)		9 − 8	1	0		12	12	14
165569.088	(20)		9 − 8	0	0		12	12	14
165908.036	(40)	ν_8	9 − 8	±1	±1		12	12	14
166013.361	(32)	ν_8	9 − 8	±3	∓1	9 − 8	12	12	14
166013.483	(32)	ν_8	9 − 8	±3	∓1	10 − 9	12	12	14
166013.483	(32)	ν_8	9 − 8	±3	∓1	8 − 7	12	12	14
166035.915	(50)	ν_8	9 − 8	±2	∓1		12	12	14
166051.509	(40)	ν_8	9 − 8	±1	∓1		12	12	14
166058.809	(60)	ν_8	9 − 8	0	±1		12	12	14
166059.163	(38)	ν_8	9 − 8	±3	±1	9 − 8	12	12	14
166059.285	(38)	ν_8	9 − 8	±3	±1	8 − 7	12	12	14
166059.285	(38)	ν_8	9 − 8	±3	±1	10 − 9	12	12	14
166071.166	(60)	ν_8	9 − 8	±2	±1		12	12	14
166228.346	(40)	ν_8	9 − 8	±1	±1		12	12	14
178396.181	(38)		10 − 9	3	0		12	12	15
178413.059	(41)		10 − 9	2	0		12	12	15
178423.189	(44)		10 − 9	1	0		12	12	15
178426.566	(45)		10 − 9	0	0		12	12	15

TABLE 9 : Calculated Microwave Spectrum of CH_3CN in Order of Frequency (continued)

Calculated frequency (Est. uncertainty) in MHz		Vibr. State	Transition				Isotopic Species		
			J' ← J"	K	ℓ'	F' ← F"			
178621.403	(50)		10 − 9	3	0		13	12	14
178638.168	(54)		10 − 9	2	0		13	12	14
178648.227	(58)		10 − 9	1	0		13	12	14
178651.403	(59)		10 − 9	0	0		13	12	14
183840.006	(64)		10 − 9	3	0		12	13	14
183857.620	(69)		10 − 9	2	0		12	13	14
183868.189	(74)		10 − 9	1	0		12	13	14
183871.712	(76)		10 − 9	0	0		12	13	14
183930.814	(3)		10 − 9	3	0	11 − 10	12	12	14
183930.896	(3)		10 − 9	3	0	9 − 8	12	12	14
183930.903	(3)		10 − 9	3	0	10 − 9	12	12	14
183948.584	(40)		10 − 9	2	0		12	12	14
183959.214	(20)		10 − 9	1	0		12	12	14
183962.758	(15)		10 − 9	0	0		12	12	14
184339.308	(60)	ν_8	10 − 9	±1	±1		12	12	14
184456.059	(90)	ν_8	10 − 9	±3	∓1		12	12	14
184480.906	(50)	ν_8	10 − 9	±2	∓1		12	12	14
184497.986	(60)	ν_8	10 − 9	±1	∓1		12	12	14
184505.360	(80)	ν_8	10 − 9	0	±1		12	12	14
184508.056	(90)	ν_8	10 − 9	±3	±1		12	12	14
184522.039	(90)	ν_8	10 − 9	±2	±1		12	12	14
184695.209	(53)	ν_8	10 − 9	±1	±1		12	12	14
196232.499	(40)		11 − 10	3	0		12	12	15
196251.060	(43)		11 − 10	2	0		12	12	15
196262.200	(47)		11 − 10	1	0		12	12	15
196265.914	(48)		11 − 10	0	0		12	12	15
196480.148	(82)		11 − 10	3	0		13	12	14
195498.590	(86)		11 − 10	2	0		13	12	14
196509.655	(89)		11 − 10	1	0		13	12	14
196513.343	(91)		11 − 10	0	0		13	12	14
202220.479	(99)		11 − 10	3	0		12	13	14
202239.855	(105)		11 − 10	2	0		12	13	14
202251.481	(110)		11 − 10	1	0		12	13	14
202255.356	(111)		11 − 10	0	0		12	13	14
202320.448	(50)		11 − 10	3	0		12	12	14
202339.926	(25)		11 − 10	2	0		12	12	14
202351.617	(15)		11 − 10	1	0		12	12	14
202355.514	(15)		11 − 10	0	0		12	12	14

TABLE 9 : Calculated Microwave Spectrum of CH_3CN in Order of Frequency (continued)

Calculated frequency (Est. uncertainty) in MHz	Vibr. State	Transition J' ← J"	K	ℓ'	F' ← F"	Isotopic Species		
202769.648 (70)	ν_8	11 - 10	±1	±1		12	12	14
202897.626 (70)	ν_8	11 - 10	±3	∓1		12	12	14
202924.808 (70)	ν_8	11 - 10	±2	∓1		12	12	14
202943.297 (80)	ν_8	11 - 10	±1	∓1		12	12	14
202950.512 (110)	ν_8	11 - 10	0	±1		12	12	14
202956.168 (80)	ν_8	11 - 10	±3	±1		12	12	14
202972.445 (120)	ν_8	11 - 10	±2	±1		12	12	14
203161.139 (70)	ν_8	11 - 10	±1	±1		12	12	14
214067.869 (33)		12 - 11	3	0		12	12	15
214088.112 (38)		12 - 11	2	0		12	12	15
214100.263 (44)		12 - 11	1	0		12	12	15
214104.313 (46)		12 - 11	0	0		12	12	15
214337.923 (124)		12 - 11	3	0		13	12	14
214358.041 (128)		12 - 11	2	0		13	12	14
214370.112 (131)		12 - 11	1	0		13	12	14
214374.136 (132)		12 - 11	0	0		13	12	14
220599.945 (144)		12 - 11	3	0		12	13	14
220621.082 (150)		12 - 11	2	0		12	13	14
220633.765 (155)		12 - 11	1	0		12	13	14
220637.992 (157)		12 - 11	0	0		12	13	14
220709.020 (50)		12 - 11	3	0		12	12	14
220730.263 (20)		12 - 11	2	0		12	12	14
220743.013 (20)		12 - 11	1	0		12	12	14
220747.263 (20)		12 - 11	0	0		12	12	14
221198.962 (90)	ν_8	12 - 11	±1	±1		12	12	14
221338.038 (90)	ν_8	12 - 11	±3	∓1		12	12	14
221367.512 (90)	ν_8	12 - 11	±2	∓1		12	12	14
221387.325 (100)	ν_8	12 - 11	±1	∓1		12	12	14
221394.125 (150)	ν_8	12 - 11	0	±1		12	12	14
221403.509 (110)	ν_8	12 - 11	±3	±1		12	12	14
221422.337 (160)	ν_8	12 - 11	±2	±1		12	12	14
221626.043 (90)	ν_8	12 - 11	±1	±1		13	12	14
231902.205 (34)		13 - 12	3	0		12	12	15
231924.129 (42)		13 - 12	2	0		12	12	15
231937.288 (51)		13 - 12	1	0		12	12	15
231941.675 (54)		13 - 12	0	0		12	12	15
232194.640 (176)		13 - 12	3	0		13	12	14
232216.434 (180)		13 - 12	2	0		13	12	14
232229.511 (183)		13 - 12	1	0		13	12	14

TABLE 9 : Calculated Microwave Spectrum of CH_3CN in Order of Frequency (continued)

Calculated frequency (Est. uncertainty) in MHz	Vibr. State	Transition J' ← J"	K	ℓ'	F' ← F"	Isotopic Species		
232233.870 (184)		13 - 12	0	0		13	12	14
238978.311 (200)		13 - 12	3	0		12	13	14
239001.210 (206)		13 - 12	2	0		12	13	14
239014.949 (211)		13 - 12	1	0		12	13	14
239019.529 (213)		13 - 12	0	0		12	13	14
239096.496 (50)		13 - 12	3	0		12	12	14
239119.503 (20)		13 - 12	2	0		12	12	14
239133.311 (20)		13 - 12	1	0		12	12	14
239137.914 (20)		13 - 12	0	0		12	12	14
239627.156 (120)	ν_8	13 - 12	±1	±1		12	12	14
239777.192 (110)	ν_8	13 - 12	±3	∓1		12	12	14
239808.912 (120)	ν_8	13 - 12	±2	∓1		12	12	14
239829.956 (130)	ν_8	13 - 12	±1	∓1		12	12	14
239836.060 (180)	ν_8	13 - 12	0	±1		12	12	14
239850.010 (140)	ν_8	13 - 12	±3	±1		12	12	14
239871.669 (200)	ν_8	13 - 12	±2	±1		12	12	14
240089.827 (120)	ν_8	13 - 12	±1	±1		12	12	14
249735.417 (82)		14 - 13	3	0		12	12	15
249759.020 (89)		14 - 13	2	0		12	12	15
249773.187 (97)		14 - 13	1	0		12	12	15
249777.910 (100)		14 - 13	0	0		12	12	15
250050.210 (239)		14 - 13	3	0		13	12	14
250073.681 (243)		14 - 13	2	0		13	12	14
250087.764 (246)		14 - 13	1	0		13	12	14
250092.458 (247)		14 - 13	0	0		13	12	14
257355.486 (266)		14 - 13	3	0		12	13	14
257380.147 (274)		14 - 13	2	0		12	13	14
257394.943 (279)		14 - 13	1	0		12	13	14
257399.875 (280)		14 - 13	0	0		12	13	14
257482.784 (50)		14 - 13	3	0		12	12	14
257507.553 (50)		14 - 13	2	0		12	12	14
257522.418 (20)		14 - 13	1	0		12	12	14
257527.374 (20)		14 - 13	0	0		12	12	14
258054.138 (150)	ν_8	14 - 13	±1	±1		12	12	14
258214.982 (150)	ν_8	14 - 13	±3	∓1		12	12	14
258248.898 (150)	ν_8	14 - 13	±2	∓1		12	12	14
258271.070 (160)	ν_8	14 - 13	±1	∓1		12	12	14
258276.178 (230)	ν_8	14 - 13	0	±1		12	12	14
258295.602 (180)	ν_8	14 - 13	±3	±1		12	12	14

TABLE 9 : Calculated Microwave Spectrum of CH_3CN in Order of Frequency (continued)

Calculated frequency (Est. uncertainty) in MHz	Vibr. State	Transition J' ← J"	K	ℓ'	F' ← F"	Isotopic Species		
258320.394 (250)	ν_8	14 - 13	±2	±1		12	12	14
258552.399 (150)	ν_8	14 - 13	±1	±1		12	12	14
267567.417 (175)		15 - 14	3	0		12	12	15
267592.698 (183)		15 - 14	2	0		12	12	15
267607.872 (190)		15 - 14	1	0		12	12	15
267612.931 (193)		15 - 14	0	0		12	12	15
267904.546 (313)		15 - 14	3	0		13	12	14
267929.693 (317)		15 - 14	2	0		13	12	14
267944.782 (320)		15 - 14	1	0		13	12	14
267949.811 (321)		15 - 14	0	0		13	12	14
275731.379 (350)		15 - 14	3	0		12	13	14
275757.801 (352)		15 - 14	2	0		12	13	14
275773.654 (358)		15 - 14	1	0		12	13	14
275778.939 (359)		15 - 14	0	0		12	13	14
275867.792 (50)		15 - 14	3	0		12	12	14
275894.321 (50)		15 - 14	2	0		12	12	14
275910.243 (50)		15 - 14	1	0		12	12	14
275915.550 (50)		15 - 14	0	0		12	12	14
276479.815 (190)	ν_8	15 - 14	±1	±1		12	12	14
276651.302 (180)	ν_8	15 - 14	±3	∓1		12	12	14
276687.359 (190)	ν_8	15 - 14	±2	∓1		12	12	14
276710.553 (200)	ν_8	15 - 14	±1	∓1		12	12	14
276714.337 (280)	ν_8	15 - 14	0	±1		12	12	14
276740.214 (220)	ν_8	15 - 14	±3	±1		12	12	14
276768.465 (310)	ν_8	15 - 14	±2	±1		12	12	14
277013.666 (190)	ν_8	15 - 14	±1	±1		12	12	14
285398.115 (318)		16 - 15	3	0		12	12	15
285425.073 (327)		16 - 15	2	0		12	12	15
285441.252 (335)		16 - 15	1	0		12	12	15
285446.647 (338)		16 - 15	0	0		12	12	15
285757.559 (399)		16 - 15	3	0		13	12	14
285784.383 (403)		16 - 15	2	0		13	12	14
285800.477 (406)		16 - 15	1	0		13	12	14
285805.842 (407)		16 - 15	0	0		13	12	14
294105.898 (436)		16 - 15	3	0		12	13	14
294134.081 (444)		16 - 15	2	0		12	13	14
294150.991 (449)		16 - 15	1	0		12	13	14
294156.628 (451)		16 - 15	0	0		12	13	14
294251.429 (80)		16 - 15	3	0		12	12	14

TABLE 9 : Calculated Microwave Spectrum of CH_3CN in Order of Frequency (continued)

Calculated frequency (Est. uncertainty) in MHz	Vibr. State	Transition J' ← J"	K	ℓ'	F' ← F"	Isotopic Species		
294279.716 (80)		16 - 15	2	0		12	12	14
294296.692 (50)		16 - 15	1	0		12	12	14
294302.352 (50)		16 - 15	0	0		12	12	14
294904.092 (230)	ν_8	16 - 15	±1	±1		12	12	14
295086.050 (220)	ν_8	16 - 15	±3	∓1		12	12	14
295124.189 (230)	ν_8	16 - 15	±2	∓1		12	12	14
295148.288 (250)	ν_8	16 - 15	±1	∓1		12	12	14
295150.399 (350)	ν_8	16 - 15	0	±1		12	12	14
295183.776 (270)	ν_8	16 - 15	±3	±1		12	12	14
295215.835 (380)	ν_8	16 - 15	±2	±1		12	12	14
295473.533 (230)	ν_8	16 - 15	±1	±1		12	12	14

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