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The microwave spectra of ethanol (C_2H_5OH) and propionitrile (ethyl cyanide, C_2H_5CN) are critically reviewed and supplemented with spectral frequency calculations which include rotational and centrifugal distortion terms in the molecular Hamiltonian. The primary objective of this review is to provide the microwave transition frequencies applicable to molecular radio astronomy for the ground vibrational state of the most abundant isotopic forms, namely, $^{12}C_2H_5{}^{16}OH$ and $^{12}C_2H_5{}^{12}C^{14}N$. Since the internal rotation and hyperfine splittings for these species have not been resolved in most of the reported laboratory studies and also not detected in the molecular clouds observed by radio astronomers, these splittings have been ignored in the present calculations. All measured rotational transitions are included, however, the predicted transition frequencies were limited to $J=25$ for ethanol and $J=30$ for propionitrile over the range of 1 GHz to 300 GHz. A complete summary of the laboratory studies of both species is included for all isotopic forms with references to all prior studies.

Key words: ethanol; intensities; interstellar molecules; microwave spectra; molecular constants; propionitrile; radio astronomy; rotational spectrum.

Contents

1. Introduction

This review is part of a continuing series of a thorough review and analysis of the microwave spectra of interstellar molecules identified in the radio (microwave) spectral region. The goal of these reviews is to update and augment the existing spectral data on the known interstellar molecules by providing both measured and predicted rotational transitions over the spectral range covered by existing radio telescopes. In this paper the spectra of the most abundant isotopic form of ethanol (C_2H_5OH) and propionitrile (C_2H_5CN) are treated. In order to provide complete coverage of the laboratory literature, the molecular constants for the less abundant isotopic forms, e.g., deuterated and ^{13}C species and vibrationally or torsionally excited states, are tabulated. The references given in sections 3.2 and 4.2 cover all of the relevant literature.

2. Organization of Tables

Since this review treats two interstellar species, the tables are divided into two sections. The molecular constants and spectra of ethanol are presented in section 3 and those for propionitrile are given in section 4.

For *trans*-ethanol, tables 1–4 and 6 contain molecular constants derived from the laboratory spectra. Table 5 lists the measured internal rotation splittings for *trans*-$^{12}CH_3{}^{12}CH_2{}^{16}OH$. Table 7 contains the predicted rotational spectrum of *trans*-$^{12}CH_3{}^{12}CH_2{}^{16}OH$ based on analysis of measurements from the references cited which includes some new measurements at NBS. Table 8 contains the rotational constants of four isotopic forms of *gauche*-ethanol, and table 9 lists the measured spectrum of the ground state of *gauche*-$^{12}CH_3{}^{12}CH_2{}^{16}OH$. Since this conformer has not yet been observed in interstellar clouds, reanalysis and spectral predictions have not been carried out.

The best available data have been gathered for both species and least squares fitted to the Watson centrifugal distortion Hamiltonian [1][1] and statistical analysis developed by Kirchhoff [2]. The analysis provides not only the molecular constants, but also a check on the reliability of the measured transitions, and provides uncertainty limits for the unobserved transitions which are predicted here. Thus, the spectral information presented in the following tables includes the laboratory measurements, derived molecular constants, and predicted transitions for the most abundant isotopic forms of ethanol and propionitrile. The reported transitions have been limited to some extent by fixing the maximum value of the rotational quantum number, J, and transition frequency. It is felt that these limits are sufficiently generous to allow for all transitions which might be observed by existing radio telescopes.

The rotational and centrifugal distortion constants were obtained from a least-squares analysis of the observed spectral data using techniques published elsewhere [2]. Measurements were excluded from the final calculation when they differed from the calculated frequencies by more than 3.5 times the standard deviation of this difference. The probability that the difference between the calculated and observed frequency will exceed 3.5 standard deviations is on the order of one in one thousand.

Because the data used in the analysis of each of the molecular species reported in this paper were obtained from a variety of sources, the assumption of equally probable errors for each of the transitions included in the fit could not be made. In the analysis, therefore, each transition was weighted by the inverse square of its uncertainty. When available, the reported estimates of the measurement uncertainties were used. In some instances these were not available. In these instances, the uncertainties were estimated by the author. Whenever possible, a uniform uncertainty was assigned to all such transitions from a single source.

The tables of spectra and molecular parameters are organized by molecule in sections 3 and 4. The details of the tables will be described separately because the reporting format varies with each molecule. For all species, the line strengths have been calculated for all the calculated transitions. The line strengths, denoted by ${}^xS(J'_{K'_p,K'_o};J''_{K''_p,K''_o})$, are defined for all molecules treated in this review as:

$$ {}^xS(J'_{K'_p,K'_o};J''_{K''_p,K''_o}) = \frac{(2J'+1)|\mu_{J'-J''}|^2}{\mu_x^2}, $$

where the superscript x refers to one of the principal axes of the molecule ($x=a,b,$ or c); $|\mu_{J'-J''}|$ is the dipole moment matrix element connecting the upper $J'_{K'_p,K'_o}$ and lower $J''_{K''_p,K''_o}$ rotational levels involved in the transition, and μ_x is the magnitude of the component of μ along the x axis. Thus, the line strength as defined is independent of the absolute magnitude of the dipole moment. The line strength may be related to the Einstein coefficient, A, in the following manner. The probability, $A(J'_{K'_p,K'_o};\ J''_{K''_p,K''_o})$, of a spontaneous transition in one second from the higher state, $J'_{K'_p,K'_o}$, to the lower state, $J''_{K''_p,K''_o}$, is

$$ A(J'_{K'_p,K'_o};J''_{K''_p,K''_o}) = \frac{1.1639\times10^{-20}\nu^3\mu_x^2}{2J'+1}\,{}^xS(J'_{K'_p,K'_o};J''_{K''_p,K''_o}), $$

where ν is the transition frequency in MHz and μ_x the electric dipole component as defined above in Debye units.

2.1. List of Symbols and Conversion Factors

a. Symbols

A,B,C	Rotational constants (MHz). $A \geqslant B \geqslant C$ ($A=h/8\pi^2 I_a$, etc.)
I_a,I_b,I_c	Moments of inertia in the principal axes system (Å)
τ	Quartic centrifugal distortion constant (MHz)

[1]Numbers in brackets indicate literature references throughout this paper.

H_K, h_K, h_{JK}	Sextic centrifugal distortion constants (MHz)
a,b,c	Principal axes corresponding to A, B, and C, respectively
$\mu_{a,b,c}$	Components of the dipole moment along the principal axes (Debye)
D	Abbreviation for Debye units ($1D = 10^{-18}$ electrostatic units of charge x centimeters, or $1D = 3.33564 \times 10^{30}$ coulomb-meter)
$eQq_{aa}, \ldots$	Nuclear electric quadrupole coupling constant
$\chi_{aa}, \ldots$	along indicated principal axis (MHz)
I_τ	Moment of inertia of the methyl top around internal rotation axis (Å)
ρ	Internal rotation interaction constant $\rho = \Sigma_x[(\lambda_x I_\tau / I_x)^2]^{\frac{1}{2}}$
β	Second Eulerian angle for transformation from the principal axes system to the internal rotational axes system
Δ_o	Internal rotation interaction constant (MHz) $\Delta_o = 3F \quad \alpha_1(s)/2 =$ energy difference between 0(0,0) A and 0(0,0) E state
$\lambda_a, \lambda_b, \lambda_c$	Direction cosines between the internal rotation axis and the principal axes, a, b, and c, respectively
Θ	Angle between the internal rotation axis and the a principal axis
τ	Angle of rotation around internal rotation axis
F	Internal rotation dynamical constant (GHz) [4,5]. $F = h/8\Delta^2 r I_\tau$
V_3	Threefold component of torsional barrier potential (cm^{-1}). $V = V_3(1 - \cos 3\tau)/2$
s	Reduced barrier height. $s = 4V_3/9F$
r	$r = 1 - \Sigma_x(\lambda_x^2 I_\tau / I_x)$
A,E	Torsional symmetry substates of the irreducible representations of the symmetry group of the rotation-internal rotation Hamiltonian
F	Total angular momentum quantum number which includes the nucleus with largest χ or eQq
J	Total rotational angular momentum quantum number
K_p	Projection of J on the symmetry axis in the limiting prolate symmetric top
K_o	Projection of J on the symmetry axis in the limiting oblate symmetric top
(...)	Parentheses in the numerical listings contain measured or estimated uncertainties. These should be interpreted as: 26756.35(5) = 26756.35±0.05 MHz

b. Useful Conversion Factors

The following fundamental constants and conversion factors may be useful in converting values presented here to other units:

$A \cdot I_a$	=	$5.0537905(85) \times 10^5$ MHz·u·Å^2,
h	=	$6.626176(36) \times 10^{-34}$ J·s,
c	=	$2.99792458(1) \times 10^8$ m·s^{-1},
1 cm^{-1}	=	$1.986478(11) \times 10^{-23}$ J,
	=	11.96266 J·mol^{-1},
1 kcal	=	4.1868 kJ,
1 u	=	$1.6605655(86) \times 10^{-27}$ kg,
1 Å	=	10^{-10} m.

2.2. References to Section 2

[1] J. K. G. Watson, J. Chem. Phys. **46**, 1935 (1967).
[2] W. H. Kirchhoff, J. Mol. Spectrosc. **41**, 333 (1972).

3. Rotational Analysis and Derived Constants for Ethanol

The rotational spectrum of ethanol has been rather extensively measured and analyzed as evidenced by the references in section 3.2. However, much of the most precise laboratory data has not been published in the open literature, most notably that of J. Culot cited and employed in this review.

The present analysis of the most abundant form of ethanol required some judgment and an irrevocable decision regarding which data set to employ in fitting for the most applicable predictive value to radio-astronomical observations. The problem in question relates to the fact that ethanol is an asymmetric rotor with internal rotation interactions due to the CH_3 group. The internal rotation barrier is rather high which means that the splitting on the measured transition is small; i.e., on the order of tenths of megahertz, and was only observed for perhaps one-third of the total data base. Since this magnitude of splitting remains much smaller than the intrinsic line width (due to Doppler broadening) of the known interstellar sources containing ethanol, we ignore this splitting in the present analysis aimed at calculating the spectrum of ethanol as it applies to molecular radio astronomy observations. Not without consideration was the reduction in tabular information which this decision afforded; if frequencies for both A and E substates due to internal rotation were reported here, table 9 would be twice the length.

The analysis of the rotational spectrum of *trans*-$^{12}CH_3{}^{12}CH_2{}^{16}OH$ employed two data sets. One was the unresolved internal rotation measurements as shown in table 9 which resulted in the predictions given therein. A second set of data, which best replicated the A sublevel, employed the measured A sublevel frequencies in table 5 in place of the corresponding values as listed in table 9. No predicted spectra are presented from this analysis but the derived molecular parameters are shown along with those from the unresolved spectrum in table 1. In both cases 15 parameters were fit; i.e., all the quadratic, quartic and sextic terms of the Hamiltonian. It is obvious from the values given in table 1 that several sextic parameters are not well determined, but these were included so as not to overly bias the predictions by arbitrary zeroing of values. For the most part, the poorly determined constants only seriously affect the accuracy of the weak transitions from high energy rotational levels which are not particularly important for astronomical observations.

3.1. Ethanol Spectral Tables

The derived molecular constants are shown in tables 1–4, 6, and 8. The measured transitions are presented in tables 5 and 7 for *trans*-C_2H_5OH and table 9 for the higher energy *gauche*-form. Table 7 also contains the statistical analysis of $^{12}C_2H_5{}^{16}OH$ from 1 GHz to 300 GHz for rotational levels up to $J=25$ presented according to increasing frequency. For each spectral line the first column of table 7 contains the upper state and lower state quantum numbers in the form $J(K_pK_o)$ for an asymmetric rotor. The quantum numbers are followed by the observed line frequency and, in parentheses, the experimentally estimated uncertainty in MHz. References to the laboratory measurements are shown in the last column of the table. The third column contains the calculated frequency and estimated uncertainty in MHz. These calculated uncertainties, representing 95 percent confidence levels, are twice the standard deviation obtained from the least-squares analysis. The Einstein A values are given in the form $-\log A$ in the fourth column. The line strengths for the rotational transitions are shown in column five of table 7. The rotational energy of the lower state is given in column six in units of cm^{-1} rounded to three figures after the decimal.

TABLE 1. Rotational and centrifugal distortion constants for the vibrational ground state of *trans*-$^{12}C_2H_5{}^{16}OH$ from the present analysis

Parameter	Constants for the unresolved spectrum of table 7[a] (MHz)	Constants for the A sublevel (MHz)
Fit constants		
A''	34 891.7718(190)	34 891.7847(194)
B''	9 350.6443(60)	9 350.6388(54)
C''	8 135.2404(61)	8 135.2344(57)
τ_1	0.01130(357)	0.01192(241)
τ_2	-0.014272(695)	-0.014231(469)
τ_3[b]	1.63(3)	1.61(17)
τ_{aaaa}	-0.92656(260)	-0.92626(197)
τ_{bbbb}	-0.048116(325)	-0.048033(202)
τ_{cccc}	-0.020295(301)	-0.020303(203)
H_J	$0.1050(2417) \times 10^{-6}$	$0.0065(1636) \times 10^{-6}$
H_{JK}	$0.1365(720) \times 10^{-4}$	$0.401(544) \times 10^{-5}$
H_{KJ}	$-0.4842(1317) \times 10^{-4}$	$-0.2764(996) \times 10^{-4}$
H_K	$0.5685(1286) \times 10^{-4}$	$0.308(85) \times 10^{-4}$
h_J	$0.102(72) \times 10^{-6}$	$0.015(59) \times 10^{-7}$
h_{JK}	$-0.404(521) \times 10^{-5}$	$-0.088(438) \times 10^{-5}$
h_K	$0.3020(1139) \times 10^{-3}$	$0.137(87) \times 10^{-3}$
Derived constants		
A'	34 891.755(19)	34 891.767(19)
B'	9 350.675(6)	9 350.668(5)
C'	8 135.232(6)	8 135.228(6)
τ_{bbcc}	-0.03420(30)	-0.03417(19)
τ_{ccaa}	0.0623(35)	0.0591(26)
τ_{aabb}	-0.0168(51)	-0.0130(33)

[a] Uncertainties in parentheses are one standard deviation and refer to the last corresponding significant figures.
[b] Value fixed by setting $R_6=0$. See discussion by Kirchhoff (ref. [2] in section 2.2).

TABLE 2. Rotational constants for isotopically substituted forms of *trans*-ethanol [72A][a]

Isotopic species	A (MHz)	B (MHz)	C (MHz)
CH_3CH_2OH	34 891.731(66)	9 350.653(18)	8 135.216(19)
$^{13}CH_3CH_2OH$	34 748.893(76)	9 087.665(21)	7 927.892(20)
$CH_3{}^{13}CH_2OH$	34 125.120(75)	9 351.546(23)	8 093.051(20)
$CH_3CH_2{}^{18}OH$	34 446.097(80)	8 953.244(22)	7 809.797(21)
CH_3CH_2OD	34 773.728(50)	8 768.857(14)	7 687.881(12)
CH_3CHDOH	30 209.040(100)	9 239.112(33)	7 930.497(30)
s-CH_2DCH_2OH	34 547.162(83)	8 627.614(21)	7 568.099(22)
a-CH_2DCH_2OH	31 635.680(53)	8 956.248(16)	7 818.315(15)
CH_3CD_2OH	26 672.330(65)	9 081.908(22)	7 773.831(25)
CD_3CH_2OH	28 489.602(85)	7 999.264(23)	7 085.076(29)
CD_3CD_2OH	22 641.389(42)	7 994.967(14)	6 792.716(14)
CD_3CD_2OD	22 613.484(41)	7 346.455(14)	6 449.136(15)
CH_3CHDOD	30 132.9(4)	8 670.8(1)	7 506.0(1)
CD_3CH_2OH $v=1$[b]	28 351.0(4)	7 970.43(10)	7 081.50(10)
CD_3CD_2OH $v=1$[b]	22 566.05(40)	7 770.24(10)	6 787.85(10)

[a] Values in parentheses are uncertainties and refer to the last digits given. The prefix *s* and *a* refer to symmetric and asymmetric forms.
[b] First excited torsional state values.

TABLE 3. Centrifugal distortion constants for isotopically substituted forms of *trans*-ethanol [72A][a]

Isotopic species	τ_{aaaa} (MHz)	τ_{bbbb} (MHz)	τ_{cccc} (MHz)	τ_1 (MHz)	τ_2 (MHz)
CH_3CH_2OH	−0.9289(59)	−0.0484(9)	−0.0196(9)	0.007(10)	−0.707(27)
$^{13}CH_3CH_2OH$	−0.9224(68)	−0.0451(12)	−0.0189(10)	0.019(14)	−0.690(33)
$CH_3{}^{13}CH_2OH$	−0.9242(67)	−0.0481(11)	−0.0191(7)	0.011(12)	−0.644(27)
$CH_3CH_2{}^{18}OH$	−0.9142(83)	−0.0459(13)	−0.0189(15)	0.008(15)	−0.711(44)
CH_3CH_2OD	−0.8518(35)	−0.0380(7)	−0.0171(5)	0.020(9)	−0.642(20)
CH_3CHDOH	−0.6444(98)	−0.0449(12)	−0.0193(9)	−0.008(13)	−0.483(26)
s-CH_2DCH_2OH	−0.8298(55)	−0.0362(12)	−0.0161(9)	0.005(14)	−0.624(33)
a-CH_2DCH_2OH	−0.6882(32)	−0.0481(4)	−0.0199(3)	−0.018(5)	−0.680(10)
CH_3CH_2OH	−0.4617(66)	−0.0428(7)	−0.0157(11)	−0.016(8)	−0.385(16)
CD_3CH_2OH	−0.4333(47)	−0.0335(6)	−0.0149(9)	−0.040(7)	−0.599(20)
CD_3CD_2OH	−0.2515(20)	−0.0302(2)	−0.0130(2)	−0.035(2)	−0.350(5)
CD_3CD_2OD	−0.2424(36)	−0.0248(4)	−0.0116(5)	−0.029(5)	−0.332(11)
$^{13}CH_3{}^{13}CH_2OH$	−0.9172(117)	−0.0448(20)	−0.0186(14)	0.022(22)	−0.632(47)

[a] Uncertainties shown in parentheses refer to the last digits given.

TABLE 4. Internal rotation parameters for isotopically substituted forms of *trans*-ethanol [72A]

Molecule	ρ	Θ	β	F(GHz)	s	Δ_0 (MHz)	V_3 (kJ mol^{-1})[b]
CH_3CH_2OH	33.09°	0.186214	0.172891	192.272896	80.80	−1.1672	13.95(10)
$^{13}CH_3CH_2OH$	32.66°	0.186137	0.166093	192.268440	80.71	−1.1780	13.93(10)
CH_3CHDOH	33.00°	0.162088	0.196063	187.599901	82.93	−0.9189	13.95(10)
$CH_3CH_2{}^{18}OH$	34.05°	0.181835	0.173875	191.079633	81.26	−1.1069	13.97(10)
CH_3CH_2OD	32.50°	0.186395	0.159288	192.254844	80.40	−1.2161	13.87(10)
CH_3CD_2OH	32.91°	0.143884	0.216897	184.186140	83.87	−0.8204	13.88(10)
$^{13}CH_3{}^{13}CH_2OH$	32.63°	0.182162	0.169625	191.490620	81.15	−1.1220	13.94(10)

[a] The moment of inertia employed for the methyl top is $I_T=3.171(9)$ Å.
[b] The equivalent of 1 kJ mol^{-1} is 83.593 cm^{-1} per molecule.

TABLE 5. Measured internal rotation split transitions for *trans*-$^{12}CH_3{}^{12}CH_2{}^{16}OH$ [72A]

Transition	Sym. state[a]	Observed frequency (MHz)	Transition	Sym. state[a]	Observed frequency (MHz)
3(1,2) – 2(2,1)	*A*	22 367.40	13(5,9) – 14(4,10)	*A*	12 726.15
	E	22 367.20		*E*	12 726.50
3(1,3) – 2(2,0)	*A*	29 700.75	13(5,8) – 14(4,11)	*A*	12 016.80
	E	29 700.55		*E*	12 017.15
4(2,3) – 5(1,4)	*A*	17 818.50	14(5,10) – 15(4,11)	*A*	31 258.00
	E	17 818.70		*E*	31 258.40
5(2,4) – 6(1,5)	*A*	38 674.60	14(5,9) – 15(4,12)	*A*	30 044.50
	E	38 674.80		*E*	30 044.80
5(2,3) – 6(1,6)	*A*	11 770.85	15(5,10) – 16(4,13)	*A*	48 102.50
	E	11 771.10		*E*	48 102.90
6(2,4) – 7(1,7)	*A*	23 263.45	14(5,9) – 13(6,8)	*A*	41 048.80
	E	23 263.70		*E*	41 048.10
7(2,5) – 8(1,8)	*A*	33 260.70	14(5,9) – 13(6,7)	*E*°	41 049.00
	E	33 261.00			
8(2,6) – 9(1,9)	*A*	41 580.05	14(5,10) – 13(6,7)	*A*	41 073.60
	E	41 580.35		*E*	41 073.60
5(2,3) – 4(3,2)	*A*	42 076.25	14(5,10) – 13(6,8)	*E*°	41 072.75
	E	42 075.85			
6(2,4) – 5(3,3)	*A*	23 493.95	15(5,10) – 14(6,9)	*A*	23 128.10
	E	23 493.60		*E*	23 127.60
6(2,5) – 5(3,2)	*A*	26 409.70	15(5,10) – 14(6,8)	*E*°	23 128.50
	E	26 409.40			
7(3,5) – 8(2,6)	*A*	15 518.40	15(5,11) – 14(6,8)	*A*	23 177.60
	E	15 518.75		*E*	23 177.60
8(3,6) – 9(2,7)	*A*	36 143.20	15(5,11) – 14(6,9)	*E*°	23 176.70
	E	36 143.50			
8(3,5) – 9(2,8)	*A*	23 130.10	16(6,11) – 17(5,12)	*A*	13 014.05
	E	23 130.45		*E*	13 014.40
10(3,7) – 11(2,10)	*A*	53 359.20	16(6,10) – 17(5,13)	*A*	12 843.25
	E	53 359.50		*E*	12 843.50
8(3,5) – 7(4,4)	*A*	42 050.05	17(6,12) – 18(5,13)	*A*	31 276.50
	E	42 049.50		*E*	31 276.80
8(3,5) – 7(4,3)	*E*°	42 052.55	17(6,11) – 18(5,14)	*A*	30 976.85
				E	30 977.10
8(3,6) – 7(4,3)	*A*	42 473.10	18(6,13) – 19(5,14)	*A*	49 702.20
	E	42 472.80		*E*	49 702.50
9(3,6) – 8(4,5)	*A*	23 947.80	18(6,12) – 19(5,15)	*A*	49 193.80
	E	23 947.35		*E*	49 194.10
9(3,7) – 8(4,4)	*A*	24 789.65	17(6,11) – 16(7,10)	*A*	40 432.30
	E	24 789.25		*E*	40 431.90
10(4,7) – 11(3,8)	*A*	13 214.10	17(6,11) – 16(7,9)	*E*°	40 432.30
	E	13 214.50			
10(4,6) – 11(3,9)	*A*	10 528.95	17(6,12) – 16(7,9)	*A*	40 437.80
	E	10 529.35		*E*	40 437.80
11(4,8) – 12(3,9)	*A*	32 483.70	17(6,12) – 16(7,10)	*E*°	40 437.30
	E	32 484.00			
11(4,7) – 12(3,10)	*A*	28 075.20	18(6,12) – 17(7,11)	*A*	22 520.85
	E	28 075.60		*E*	22 520.45
12(4,9) – 13(3,10)	*A*	52 372.30	18(6,12) – 17(7,10)	*E*°	22 520.85
	E	52 372.70			
12(4,8) – 13(3,11)	*A*	45 459.60	18(6,13) – 17(7,10)	*A*	22 531.80
	E	45 460.00		*E*	22 531.80
11(4,7) – 10(5,6)	*A*	41 620.90	18(6,13) – 17(7,11)	*E*°	22 531.35
	E	41 620.20			
11(4,7) – 10(5,5)	*E*°	41 621.65	19(7,13) – 20(6,14)	*A*	13 528.20
				E	13 528.40
11(4,8) – 10(5,5)	*A*	41 727.10	19(7,12) – 20(6,15)	*A*	13 489.30
	E	41 727.10		*E*	13 489.50
11(4,8) – 10(5,6)	*E*°	41 725.70	20(7,14) – 21(6,15)	*A*	31 686.60
				E	31 686.85
12(4,8) – 11(5,7)	*A*	23 665.65	20(7,13) – 21(6,16)	*A*	31 616.90
	E	23 665.20		*E*	31 617.10
12(4,9) – 11(5,6)	*A*	23 877.05			
	E	23 876.85			

[a] *E*° indicates transitions which are forbidden to first order.

TABLE 6. Electric dipole moments for *trans-* and *gauche*-ethanol in debye

Species	μ_a	μ_b	μ_c	References
trans-CH_3CH_2OH	0.046(14)	1.438(19)	0	[68A]
trans-CH_3CHDOH	0.067(58)	1.519(6)	0.083(69)	[71A]
trans-CH_3CD_2OH	0±0.05	1.480(50)	0	[71B]
trans-CH_3CD_2OH	0±0.05	1.473(50)	0	[71B]
gauche-CH_3CH_2OH	1.264(10)	0.104(8)	1.101(16)	[80A]
gauche-I-CH_3CHDOH	1.267(8)	0.086(78)	1.004(3)	[71A]
gauche-II-CH_3CHDOH	1.285(11)	0.055(118)	1.039(4)	[71A]

TABLE 7. The microwave spectrum of ground state *trans*-$^{12}CH_3{}^{12}CH_2{}^{16}OH$

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log *A*	Line strength	Energy lower state	Ref.
4(2, 2) - 5(1, 5)		1015.320(5)	11.8652	0.487	9.308	
15(4,11) - 15(4,12)		1188.570(8)	14.5756	1.993	84.167	
1(1, 0) - 1(1, 1)		1215.400(0)	13.6555	1.500	1.435	
21(5,16) - 21(5,17)		1303.830(33)	14.5531	2.205	157.045	
5(2, 3) - 5(2, 4)		1463.090(1)	13.9935	1.448	12.233	
10(3, 7) - 10(3, 8)		1529.830(4)	14.1535	1.673	40.002	
16(4,12) - 16(4,13)		1947.700(12)	13.9914	1.851	93.553	
22(5,17) - 22(5,18)		2028.220(54)	14.0221	2.082	169.967	
3(2, 2) - 4(1, 3)		2540.070(4)	10.6223	0.423	6.904	
11(3, 8) - 11(3, 9)		2635.670(6)	13.5293	1.508	46.441	
6(2, 4) - 6(2, 5)		2890.200(3)	13.2577	1.208	15.726	
23(5,18) - 23(5,19)		3079.810(90)	13.5217	1.966	183.482	
17(4,13) - 17(4,14)		3081.860(18)	13.4507	1.720	103.528	
24(9,16) - 25(8,17)		3327.150(76)	10.3065	2.727	245.730	
24(9,15) - 25(8,18)		3328.120(76)	10.3061	2.727	245.730	
2(1, 1) - 2(1, 2)		3646.110(2)	12.7013	0.833	2.561	
21(8,14) - 22(7,15)		3932.790(28)	10.0888	2.392	190.602	
21(8,13) - 22(7,16)		3937.370(28)	10.0873	2.392	190.602	
12(3, 9) - 12(3,10)		4303.000(8)	12.9704	1.364	53.466	
6(3, 4) - 7(2, 5)		4333.820(5)	9.9616	0.725	19.968	
18(7,12) - 19(6,13)		4537.020(8)	9.9029	2.057	142.464	
18(7,11) - 19(6,14)		4558.090(8)	9.8969	2.057	142.464	
24(5,19) - 24(5,20)		4571.040(147)	13.0507	1.854	197.590	
18(4,14) - 18(4,15)		4722.710(29)	12.9504	1.599	114.094	
7(2, 5) - 7(2, 6)		5105.980(5)	12.6486	1.028	19.798	
15(6,10) - 16(5,11)		5113.060(6)	9.7475	1.722	101.322	
15(6, 9) - 16(5,12)		5206.820(5)	9.7239	1.722	101.318	
9(4, 6) - 10(3, 7)		5558.660(4)	9.6396	1.054	40.053	
12(5, 8) - 13(4, 9)		5563.550(5)	9.6379	1.388	67.180	
12(5, 7) - 13(4,10)		5960.700(4)	9.5484	1.387	67.167	
25(5,20) - 25(5,21)		6637.700(239)	12.6080	1.746	212.290	
13(3,10) - 13(3,11)		6703.530(11)	12.4689	1.237	61.075	
19(4,15) - 19(4,16)		7024.910(51)	12.4879	1.486	125.248	
8(2, 7) - 7(3, 4)		7035.630(6)	9.3513	0.903	24.212	
9(4, 5) - 10(3, 8)		7109.780(4)	9.3206	1.050	40.002	
3(1, 2) - 3(1, 3)		7291.050(3)	12.0992	0.584	4.249	
8(2, 6) - 8(2, 7)		8290.860(7)	12.1359	0.886	24.446	
2(0, 2) - 1(1, 1)	9388.25(5)	9388.280(2)	8.6712	0.535	1.435	[72A]
6(3, 3) - 7(2, 6)		9516.940(5)	8.9493	0.704	19.798	
14(3,11) - 14(3,12)		10016.540(16)	12.0191	1.121	69.268	
20(4,16) - 20(4,17)		10160.340(87)	12.0615	1.378	136.991	
11(3, 9) - 10(4, 6)	10529.22(5)	10529.150(5)	8.8126	1.260	46.090	[72A]
6(1, 6) - 5(2, 3)	11771.02(5)	11771.050(7)	8.7395	0.603	12.282	[72A]
14(4,11) - 13(5, 8)	12017.03(5)	12017.010(5)	8.6374	1.600	74.971	[72A]
4(1, 3) - 4(1, 4)		12146.270(5)	11.6554	0.451	6.499	
9(2, 7) - 9(2, 8)		12592.920(9)	11.7000	0.771	29.670	
14(4,10) - 13(5, 9)	12726.38(5)	12726.390(5)	8.5622	1.602	74.971	[72A]
17(5,13) - 16(6,10)	12843.45(5)	12843.550(6)	8.5497	1.936	110.852	[72A]
17(5,12) - 16(6,11)	13014.25(5)	13014.300(6)	8.5324	1.937	110.852	[72A]
11(3, 8) - 10(4, 7)	13214.37(5)	13214.280(5)	8.5138	1.269	46.088	[72A]
20(6,15) - 19(7,12)	13489.37(5)	13489.440(8)	8.4851	2.271	153.730	[72A]
20(6,14) - 19(7,13)	13528.27(5)	13528.310(8)	8.4814	2.271	153.730	[72A]
23(7,17) - 22(8,14)		14089.030(30)	8.4281	2.606	203.601	
23(7,16) - 22(8,15)		14097.550(30)	8.4273	2.606	203.601	
21(4,17) - 21(4,18)		14307.620(147)	11.6699	1.275	149.321	
15(3,12) - 15(3,13)		14412.600(25)	11.6165	1.017	78.043	
3(2, 1) - 4(1, 4)	14897.85(5)	14897.730(4)	8.4221	0.333	6.499	[72A]
8(2, 6) - 7(3, 5)	15518.63(5)	15518.610(6)	8.2988	0.950	24.205	[72A]
20(1,20) - 19(2,17)		17172.330(743)	9.4031	0.133	117.022	
1(0, 1) - 0(0, 0)		17485.870(2)	10.3576	1.000	0.000	
5(1, 4) - 4(2, 3)	17818.63(5)	17818.640(5)	8.0590	0.705	9.320	[72A]
10(2, 8) - 10(2, 9)		18114.710(12)	11.3265	0.677	35.466	
5(1, 4) - 5(1, 5)		18202.260(7)	11.3029	0.369	9.308	

TABLE 7. The microwave spectrum of ground state *trans*-$^{12}CH_3{}^{12}CH_2{}^{16}OH$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log *A*	Line strength	Energy lower state	Ref.
22(4,18) - 22(4,19)		19637.630(237)	11.3116	1.177	162.235	
16(3,13) - 16(3,14)		20035.920(41)	11.2570	0.922	87.397	
23(9,15) - 24(8,16)		21273.640(74)	7.9069	2.513	231.099	
23(9,14) - 24(8,17)		21274.140(74)	7.9069	2.513	231.099	
20(8,13) - 21(7,14)		21897.350(27)	7.8720	2.178	177.722	
20(8,12) - 21(7,15)		21899.740(27)	7.8719	2.178	177.722	
2(2, 1) - 3(1, 2)	22367.27(5)	22367.130(4)	8.0092	0.182	4.493	[72A]
17(7,11) - 18(6,12)	22520.67(5)	22520.680(7)	7.8391	1.844	131.338	[72A]
17(7,10) - 18(6,13)	22531.69(5)	22531.700(7)	7.8385	1.844	131.337	[72A]
14(6, 9) - 15(5,10)	23127.90(5)	23128.000(5)	7.8097	1.509	91.948	[72A]
9(2, 8) - 8(3, 5)	23130.33(5)	23130.390(7)	7.7676	1.089	28.898	[72A]
14(6, 8) - 15(5,11)	23177.42(5)	23177.390(5)	7.8069	1.509	91.947	[72A]
7(1, 7) - 6(2, 4)	23263.62(5)	23263.590(8)	7.8677	0.671	15.823	[72A]
5(3, 3) - 6(2, 4)	23493.72(5)	23493.600(5)	7.8406	0.509	15.823	[72A]
11(5, 7) - 12(4, 8)	23665.43(5)	23665.330(5)	7.7878	1.175	59.559	[72A]
11(5, 6) - 12(4, 9)	23876.85(5)	23876.830(5)	7.7764	1.175	59.552	[72A]
8(4, 5) - 9(3, 6)	23947.64(5)	23947.770(5)	7.7864	0.841	34.178	[72A]
8(4, 4) - 9(3, 7)	24789.47(5)	24789.330(5)	7.7422	0.839	34.150	[72A]
11(2, 9) - 11(2,10)		24909.920(16)	11.0040	0.599	41.833	
6(1, 5) - 6(1, 6)		25440.360(9)	11.0101	0.313	12.675	
19(1,19) - 18(2,16)		26276.300(522)	8.7744	0.150	105.681	
23(4,19) - 23(4,20)		26297.160(369)	10.9854	1.085	175.733	
5(3, 2) - 6(2, 5)	26409.50(5)	26409.580(4)	7.6949	0.501	15.726	[72A]
1(1, 0) - 1(0, 1)	26756.35(5)	26756.310(2)	6.6373	1.500	0.583	[72A]
17(3,14) - 17(3,15)		26990.000(67)	10.9365	0.837	97.330	
3(0, 3) - 2(1, 2)	27919.65(5)	27919.740(3)	7.0778	1.117	2.561	[72A]
2(1, 1) - 2(0, 2)	28014.10(5)	28014.130(2)	6.5878	2.441	1.748	[72A]
12(3,10) - 11(4, 7)	28075.47(5)	28075.410(6)	7.5049	1.468	52.529	[72A]
2(2, 0) - 3(1, 3)	29700.62(5)	29700.530(4)	7.7013	0.158	4.249	[72A]
3(1, 2) - 3(0, 3)	29979.40(5)	29979.320(3)	6.5154	3.295	3.493	[72A]
15(4,12) - 14(5, 9)	30044.70(5)	30044.910(7)	7.4182	1.813	83.165	[72A]
18(5,14) - 17(6,11)	30977.02(5)	30977.050(7)	7.3812	2.150	120.800	[72A]
15(4,11) - 14(5,10)	31258.27(5)	31258.080(7)	7.3659	1.816	83.164	[72A]
18(5,13) - 17(6,12)	31276.70(5)	31276.650(6)	7.3685	2.151	120.800	[72A]
21(6,16) - 20(7,13)	31616.97(5)	31617.040(11)	7.3568	2.486	165.432	[72A]
21(6,15) - 20(7,14)	31686.69(5)	31686.460(11)	7.3540	2.486	165.432	[72A]
24(7,18) - 23(8,15)		32185.030(38)	7.3354	2.821	217.056	
24(7,17) - 23(8,16)		32200.450(38)	7.3348	2.821	217.056	
12(3, 9) - 11(4, 8)	32483.90(5)	32483.810(7)	7.3098	1.485	52.526	[72A]
4(1, 3) - 4(0, 4)	32742.80(5)	32742.760(4)	6.4225	4.027	5.811	[72A]
12(2,10) - 12(2,11)		32987.970(23)	10.7233	0.535	48.769	
8(1, 8) - 7(2, 5)	33260.90(5)	33260.820(9)	7.4442	0.690	19.968	[72A]
2(1, 2) - 1(1, 1)		33756.300(3)	9.5464	1.500	1.435	
7(1, 6) - 7(1, 7)		33828.500(10)	10.7592	0.274	16.599	
24(4,20) - 24(4,21)		34394.060(549)	10.6897	0.999	189.811	
18(1,18) - 17(2,15)		34533.220(362)	8.3363	0.172	94.910	
2(0, 2) - 1(0, 1)		34929.190(4)	9.3771	1.999	0.583	
18(3,15) - 18(3,16)		35329.810(105)	10.6510	0.761	107.837	
9(2, 7) - 8(3, 6)	36143.40(5)	36143.480(7)	7.1498	1.184	28.884	[72A]
2(1, 1) - 1(1, 0)		36187.010(3)	9.4558	1.500	1.476	
5(1, 4) - 5(0, 5)	36417.10(5)	36417.140(5)	6.3123	4.611	8.700	[72A]
10(2, 9) - 9(3, 6)	38626.30(5)	38626.560(8)	7.0819	1.254	34.178	[72A]
6(1, 5) - 5(2, 4)	38674.73(5)	38674.500(6)	6.9591	1.026	12.233	[72A]
22(9,14) - 23(8,15)		39169.200(74)	7.1312	2.300	217.056	
22(9,13) - 23(8,16)		39169.450(74)	7.1312	2.300	217.056	
19(8,12) - 20(7,13)		39802.270(26)	7.1164	1.966	165.432	
19(8,11) - 20(7,14)		39803.460(26)	7.1163	1.966	165.432	
16(7,10) - 17(6,11)	40432.15(5)	40432.200(7)	7.1042	1.632	120.800	[72A]
16(7, 9) - 17(6,12)	40437.65(5)	40437.730(7)	7.1040	1.632	120.800	[72A]
13(6, 8) - 14(5, 9)	41048.55(5)	41048.600(6)	7.0966	1.298	83.165	[72A]
13(6, 7) - 14(5,10)	41073.39(5)	41073.410(6)	7.0958	1.298	83.164	[72A]
6(1, 5) - 6(0, 6)	41124.95(5)	41125.010(6)	6.1887	5.029	12.152	[72A]

TABLE 7. The microwave spectrum of ground state *trans*-$^{12}CH_3{}^{12}CH_2{}^{16}OH$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log *A*	Line strength	Energy lower state	Ref.
9(1, 9) - 8(2, 6)	41580.25(5)	41580.180(11)	7.2164	0.667	24.723	[72A]
10(5, 6) - 11(4, 7)	41620.62(5)	41620.690(6)	7.0981	0.965	52.529	[72A]
17(1,17) - 16(2,14)		41721.600(250)	8.0004	0.200	84.718	
10(5, 5) - 11(4, 8)	41726.90(5)	41726.900(6)	7.0948	0.965	52.526	[72A]
7(4, 4) - 8(3, 5)	42049.78(5)	42049.840(6)	7.1214	0.634	28.898	[72A]
4(3, 2) - 5(2, 3)	42076.02(5)	42075.990(5)	7.2148	0.306	12.282	[72A]
13(2,11) - 13(2,12)		42322.090(34)	10.4767	0.483	56.270	
7(4, 3) - 8(3, 6)	42472.80(5)	42472.760(6)	7.1088	0.633	28.884	[72A]
1(1, 1) - 0(0, 0)	43026.60(5)	43026.780(4)	6.1945	1.000	0.000	[72A]
8(1, 7) - 8(1, 8)		43316.550(11)	10.5396	0.245	21.078	
4(3, 1) - 5(2, 4)	43545.50(5)	43545.540(5)	7.1733	0.304	12.233	[72A]
25(4,21) - 25(4,22)		43987.520(787)	10.4222	0.920	204.467	
19(3,16) - 19(3,17)		45061.780(157)	10.3963	0.695	118.918	
13(3,11) - 12(4, 8)	45459.87(5)	45459.670(8)	6.8548	1.668	59.559	[72A]
4(0, 4) - 3(1, 3)	46832.80(5)	46832.830(5)	6.3153	1.761	4.249	[72A]
7(1, 6) - 7(0, 7)	46980.15(5)	46980.100(8)	6.0563	5.279	16.160	[72A]
16(1,16) - 15(2,13)		47638.210(172)	7.7315	0.235	75.112	
10(1,10) - 9(2, 7)		48079.350(16)	7.1070	0.614	30.090	
16(4,13) - 15(5,10)	48102.77(5)	48102.720(9)	6.7845	2.023	91.948	[72A]
19(5,15) - 18(6,12)	49194.00(5)	49194.040(9)	6.7604	2.363	131.338	[72A]
19(5,14) - 18(6,13)	49702.40(5)	49702.590(10)	6.7468	2.364	131.337	[72A]
22(6,17) - 21(7,14)		49830.320(19)	6.7480	2.700	177.722	
22(6,16) - 21(7,15)		49950.720(20)	6.7448	2.700	177.722	
16(4,12) - 15(5,11)		50099.290(9)	6.7303	2.029	91.947	
25(7,19) - 24(8,16)		50356.320(55)	6.7378	3.035	231.099	
25(7,18) - 24(8,17)		50383.500(56)	6.7371	3.035	231.099	
3(1, 3) - 2(1, 2)		50608.020(5)	8.9151	2.666	2.561	
15(1,15) - 14(2,12)		52101.510(119)	7.5132	0.279	66.098	
3(0, 3) - 2(0, 2)		52287.760(5)	8.8218	2.997	1.748	
13(3,10) - 12(4, 9)	52372.57(5)	52372.530(9)	6.6620	1.701	59.552	[72A]
3(2, 2) - 2(2, 1)		52457.480(5)	9.0724	1.667	5.239	
3(2, 1) - 2(2, 0)		52626.520(5)	9.0682	1.667	5.240	
11(1,11) - 10(2, 8)		52670.380(25)	7.0805	0.543	36.071	
14(2,12) - 14(2,13)		52856.630(47)	10.2579	0.440	64.334	
11(2,10) - 10(3, 7)	53359.40(5)	53359.320(11)	6.6563	1.388	40.053	[72A]
9(1, 8) - 9(1, 9)		53831.760(13)	10.3440	0.224	26.110	
8(1, 7) - 8(0, 8)		54064.630(9)	5.9194	5.381	20.719	
3(1, 2) - 2(1, 1)		54252.960(5)	8.8245	2.666	2.683	
14(1,14) - 13(2,11)		54953.550(82)	7.3385	0.333	57.682	
12(1,12) - 11(2, 9)		55323.430(38)	7.1173	0.468	42.664	
13(1,13) - 12(2,10)		56061.930(56)	7.2056	0.397	49.869	
20(3,17) - 20(3,18)		56149.120(224)	10.1684	0.638	130.568	
24(10,15) - 25(9,16)		56379.210(165)	6.6710	2.423	260.461	
24(10,14) - 25(9,17)		56379.230(165)	6.6710	2.423	260.461	
21(9,13) - 22(8,14)		57017.970(75)	6.6641	2.089	203.601	
21(9,12) - 22(8,15)		57018.090(75)	6.6641	2.089	203.601	
10(2, 8) - 9(3, 7)	57574.40(5)	57574.620(9)	6.5045	1.431	34.150	[72A]
18(8,11) - 19(7,12)		57653.130(27)	6.6600	1.755	153.730	
18(8,10) - 19(7,13)		57653.710(27)	6.6599	1.755	153.730	
15(7, 9) - 16(6,10)	58279.90(5)	58279.900(9)	6.6603	1.422	110.852	[72A]
15(7, 8) - 16(6,11)	58282.70(5)	58282.560(9)	6.6602	1.422	110.852	[72A]
12(6, 7) - 13(5, 8)		58889.520(9)	6.6686	1.091	74.971	
12(6, 6) - 13(5, 9)		58901.310(9)	6.6683	1.091	74.971	
2(1, 2) - 1(0, 1)		59297.210(6)	5.8223	1.500	0.583	
9(5, 5) - 10(4, 6)		59461.870(9)	6.6931	0.761	46.090	
9(5, 4) - 10(4, 7)		59511.600(9)	6.6920	0.761	46.088	
6(4, 3) - 7(3, 4)		59943.630(8)	6.7596	0.436	24.212	
7(1, 6) - 6(2, 5)		59982.280(7)	6.3177	1.390	15.726	
6(4, 2) - 7(3, 5)		60136.490(8)	6.7555	0.436	24.205	
3(3, 1) - 4(2, 2)		60214.270(7)	7.0179	0.128	9.341	
3(3, 0) - 4(2, 3)		60846.890(7)	7.0056	0.127	9.320	

TABLE 7. The microwave spectrum of ground state *trans*-$^{12}CH_3{}^{12}CH_2{}^{16}OH$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log *A*	Line strength	Energy lower state	Ref.
9(1, 8) - 9(0, 9)		62407.690(11)	5.7820	5.366	25.824	
14(3,12) - 13(4, 9)		62593.480(11)	6.4225	1.857	67.180	
15(2,13) - 15(2,14)		64511.560(63)	10.0619	0.407	72.960	
10(1, 9) - 10(1,10)		65274.970(16)	10.1677	0.208	31.694	
9(2, 7) - 9(1, 8)		65484.570(17)	5.5800	7.394	27.906	
10(2, 8) - 10(1, 9)		65937.690(19)	5.5587	8.407	33.871	
8(2, 6) - 8(1, 7)		65964.260(16)	5.5906	6.317	22.523	
5(0, 5) - 4(1, 4)		65997.260(6)	5.8069	2.480	6.499	
17(4,14) - 16(5,11)		66159.220(14)	6.3527	2.229	101.322	
12(2,11) - 11(3, 8)		67140.560(16)	6.3643	1.483	46.529	
7(2, 5) - 7(1, 6)		67186.570(13)	5.5937	5.237	17.727	
4(1, 4) - 3(1, 3)		67429.320(6)	8.5023	3.749	4.249	
11(2, 9) - 11(1,10)		67485.020(19)	5.5244	9.295	40.413	
20(5,16) - 19(6,13)		67490.810(16)	6.3330	2.574	142.464	
23(6,18) - 22(7,15)		68133.920(34)	6.3264	2.912	190.602	
20(5,15) - 19(6,14)		68328.420(19)	6.3166	2.576	142.464	
23(6,17) - 22(7,16)		68337.200(38)	6.3224	2.913	190.602	
21(3,18) - 21(3,19)		68519.260(307)	9.9635	0.590	142.784	
6(2, 4) - 6(1, 5)		68934.870(11)	5.5931	4.208	13.523	
17(4,13) - 16(5,12)		69333.640(13)	6.2896	2.240	101.318	
4(0, 4) - 3(0, 3)		69521.110(6)	8.4353	3.992	3.493	
4(2, 3) - 3(2, 2)		69909.420(6)	8.5521	3.000	6.988	
4(3, 2) - 3(3, 1)		70025.470(9)	8.7839	1.750	11.350	
4(3, 1) - 3(3, 0)		70031.000(9)	8.7838	1.750	11.350	
12(2,10) - 12(1,11)		70262.020(20)	5.4760	10.008	47.525	
4(2, 2) - 3(2, 1)		70329.730(6)	8.5443	3.000	6.995	
5(2, 3) - 5(1, 4)		70976.810(9)	5.5930	3.263	9.915	
10(1, 9) - 10(0,10)		71971.610(14)	5.6470	5.276	31.470	
4(1, 3) - 3(1, 2)		72284.540(6)	8.4118	3.749	4.493	
14(3,11) - 13(4,10)		73001.940(12)	6.2084	1.917	67.167	
4(2, 2) - 4(1, 3)		73081.190(8)	5.5992	2.411	6.904	
23(10,14) - 24(9,15)		74183.110(170)	6.3348	2.212	245.841	
23(10,13) - 24(9,16)		74183.120(170)	6.3348	2.212	245.841	
13(2,11) - 13(1,12)		74380.580(21)	5.4137	10.516	55.201	
20(9,12) - 21(8,13)		74823.860(78)	6.3352	1.879	190.733	
20(9,11) - 21(8,14)		74823.920(78)	6.3352	1.879	190.733	
3(1, 3) - 2(0, 2)		74976.040(8)	5.5328	2.023	1.748	
3(2, 1) - 3(1, 2)		75036.000(7)	5.6237	1.637	4.493	
17(8,10) - 18(7,11)		75455.120(30)	6.3400	1.547	142.616	
17(8, 9) - 18(7,12)		75455.390(30)	6.3399	1.547	142.616	
14(7, 8) - 15(6, 9)		76071.170(14)	6.3520	1.217	101.492	
14(7, 7) - 15(6,10)		76072.380(14)	6.3520	1.217	101.492	
2(2, 0) - 2(1, 1)		76662.440(7)	5.7134	0.892	2.683	
11(6, 6) - 12(5, 7)		76662.910(14)	6.3777	0.889	67.366	
11(6, 5) - 12(5, 8)		76668.160(14)	6.3776	0.889	67.366	
16(2,14) - 16(2,15)		77184.060(79)	9.8847	0.380	82.144	
8(5, 4) - 9(4, 5)		77213.810(13)	6.4335	0.566	40.240	
8(5, 3) - 9(4, 6)		77235.170(13)	6.4331	0.566	40.239	
11(1,10) - 11(1,11)		77518.860(20)	10.0073	0.197	37.827	
5(4, 2) - 6(3, 3)		77690.540(11)	6.5820	0.255	20.115	
5(4, 1) - 6(3, 4)		77767.840(11)	6.5807	0.255	20.113	
15(3,13) - 14(4,10)		79367.600(16)	6.1034	2.031	75.395	
13(2,12) - 12(3, 9)		79762.900(25)	6.1588	1.534	53.609	
11(2, 9) - 10(3, 8)		79799.070(11)	6.0453	1.695	40.002	
14(2,12) - 14(1,13)		79925.940(23)	5.3390	10.812	63.432	
2(2, 1) - 2(1, 2)		80266.200(7)	5.6831	0.833	2.561	
8(1, 7) - 7(2, 6)		81683.350(8)	5.8565	1.803	19.798	
22(3,19) - 22(3,20)		82070.510(407)	9.7781	0.551	155.566	
3(2, 2) - 3(1, 3)		82115.660(7)	5.5640	1.433	4.249	
11(1,10) - 11(0,11)		82650.150(17)	5.5168	5.150	37.656	
18(4,15) - 17(5,12)		84170.120(20)	6.0259	2.429	111.286	
5(1, 5) - 4(1, 4)		84212.140(8)	8.1928	4.798	6.499	

TABLE 7. The microwave spectrum of ground state *trans*-$^{12}CH_3{}^{12}CH_2{}^{16}OH$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log A	Line strength	Energy lower state	Ref.
4(2, 3) - 4(1, 4)		84595.760(7)	5.5018	1.945	6.499	
6(0, 6) - 5(1, 5)	85265.43(15)	85265.470(7)	5.4244	3.279	9.308	[76A]
21(5,17) - 20(6,14)	85858.29(10)	85858.090(27)	6.0064	2.782	154.181	[76A]
24(6,19) - 23(7,16)		86530.940(58)	6.0027	3.123	204.071	
5(0, 5) - 4(0, 4)		86593.740(7)	8.1399	4.985	5.811	
24(6,18) - 23(7,17)		86865.770(65)	5.9975	3.124	204.071	
15(2,13) - 15(1,14)	86947.13(7)	86947.120(27)	5.2543	10.912	72.211	[76A]
21(5,16) - 20(6,15)		87200.210(35)	5.9856	2.785	154.180	
5(2, 4) - 4(2, 3)		87332.360(8)	8.2033	4.199	9.320	
5(4, 2) - 4(4, 1)		87523.870(17)	8.5682	1.800	19.787	
5(4, 1) - 4(4, 0)		87524.010(17)	8.5682	1.800	19.787	
5(3, 3) - 4(3, 2)		87563.890(11)	8.3178	3.200	13.686	
5(3, 2) - 4(3, 1)		87583.210(11)	8.3175	3.200	13.686	
5(2, 4) - 5(1, 5)		87715.980(9)	5.4510	2.397	9.308	
5(2, 3) - 4(2, 2)		88163.740(8)	8.1909	4.199	9.341	
18(4,14) - 17(5,13)	89060.81(8)	89060.930(21)	5.9490	2.448	111.281	[76A]
4(1, 4) - 3(0, 3)		90117.600(9)	5.2957	2.586	3.493	
5(1, 4) - 4(1, 3)		90268.130(8)	8.1024	4.797	6.904	
12(1,11) - 12(1,12)		90409.460(26)	9.8606	0.189	44.510	
17(2,15) - 17(2,16)		90748.440(96)	9.7232	0.360	91.883	
14(2,13) - 13(3,10)		91008.120(41)	6.0174	1.536	61.299	
6(2, 5) - 6(1, 6)		91485.030(11)	5.4019	2.796	12.675	
22(10,13) - 23(9,14)		91952.060(176)	6.0791	2.004	231.809	
22(10,12) - 23(9,15)		91952.070(176)	6.0791	2.004	231.809	
19(9,11) - 20(8,12)		92590.540(84)	6.0864	1.673	178.453	
19(9,10) - 20(8,13)		92590.560(84)	6.0864	1.673	178.453	
16(8, 9) - 17(7,10)	93213.00(15)	93213.030(36)	6.1005	1.343	132.089	[79A]
16(8, 8) - 17(7,11)		93213.150(36)	6.1005	1.343	132.089	
13(7, 7) - 14(6, 8)		93812.630(22)	6.1261	1.016	92.720	
13(7, 6) - 14(6, 9)		93813.150(22)	6.1261	1.016	92.720	
12(1,11) - 12(0,12)	94278.32(8)	94278.150(23)	5.3926	5.019	44.381	[76A]
10(6, 5) - 11(5, 6)		94379.030(20)	6.1747	0.694	60.348	
10(6, 4) - 11(5, 7)		94381.200(20)	6.1747	0.694	60.348	
15(3,12) - 14(4,11)		94477.850(17)	5.8546	2.135	75.372	
7(5, 3) - 8(4, 4)		94895.920(17)	6.2801	0.383	34.977	
7(5, 2) - 8(4, 5)		94904.150(17)	6.2800	0.383	34.977	
4(4, 1) - 5(3, 2)		95336.910(14)	6.6253	0.102	16.607	
4(4, 0) - 5(3, 3)		95362.710(14)	6.6249	0.102	16.607	
16(2,14) - 16(1,15)		95443.850(33)	5.1623	10.853	81.534	
16(3,14) - 15(4,11)		95650.480(25)	5.8561	2.182	84.207	
7(2, 6) - 7(1, 7)		95909.080(13)	5.3513	3.146	16.599	
23(3,20) - 23(3,21)		96676.360(523)	9.6094	0.519	168.908	
17(3,14) - 17(2,15)		99525.130(226)	5.0355	13.592	94.910	
18(3,15) - 18(2,16)		99977.030(271)	5.0222	14.618	105.681	
16(3,13) - 16(2,14)		100359.880(183)	5.0379	12.431	84.718	
15(2,14) - 14(3,11)		100660.700(67)	5.9281	1.490	69.602	
6(1, 6) - 5(1, 5)		100950.120(9)	7.9445	5.829	9.308	
8(2, 7) - 8(1, 8)		100989.940(16)	5.2987	3.447	21.078	
19(3,16) - 19(2,17)		101874.340(315)	4.9965	15.451	117.022	
19(4,16) - 18(5,13)		102075.960(33)	5.7646	2.620	121.844	
15(3,12) - 15(2,13)		102284.350(143)	5.0312	11.202	75.112	
12(2,10) - 11(3, 9)		102764.200(15)	5.6837	1.983	46.441	
6(0, 6) - 5(0, 5)		103480.350(9)	7.9016	5.974	8.700	
9(1, 8) - 8(2, 7)		103702.810(10)	5.4928	2.276	24.446	
13(1,12) - 13(1,13)		103772.390(34)	9.7261	0.184	51.739	
22(5,18) - 21(6,15)		104279.460(46)	5.7422	2.985	166.489	
7(0, 7) - 6(1, 6)		104487.220(9)	5.1186	4.158	12.675	
2(2, 1) - 2(0, 2)		104634.210(10)	11.1186	0.001	1.748	
6(2, 5) - 5(2, 4)		104719.170(11)	7.9356	5.331	12.233	
3(2, 2) - 3(0, 3)		104803.940(9)	10.7207	0.005	3.493	
5(1, 5) - 4(0, 4)		104808.620(11)	5.0929	3.205	5.811	
25(6,20) - 24(7,17)		105022.190(91)	5.7397	3.331	218.130	
6(5, 2) - 5(5, 1)		105022.430(27)	8.3954	1.834	30.551	

TABLE 7. The microwave spectrum of ground state *trans*-$^{12}CH_3{}^{12}CH_2{}^{16}OH$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log *A*	Line strength	Energy lower state	Ref.
6(5, 1) - 5(5, 0)		105022.440(27)	8.3954	1.834	30.551	
18(2,16) - 18(2,17)		105056.080(110)	9.5752	0.345	102.177	
6(4, 3) - 5(4, 2)		105057.250(20)	8.1353	3.334	22.707	
6(4, 2) - 5(4, 1)		105057.850(20)	8.1353	3.334	22.707	
14(3,11) - 14(2,12)		105064.950(109)	5.0178	9.972	66.098	
6(3, 4) - 5(3, 3)		105118.870(14)	8.0042	4.500	16.607	
6(3, 3) - 5(3, 2)		105170.230(14)	8.0036	4.500	16.607	
4(2, 3) - 4(0, 4)		105192.250(10)	10.4656	0.011	5.811	
20(3,17) - 20(2,18)		105338.630(358)	4.9581	16.052	128.927	
17(2,15) - 17(1,16)		105355.400(38)	5.0660	10.682	91.396	
25(6,19) - 24(7,18)		105561.170(105)	5.7329	3.333	218.129	
5(2, 4) - 5(0, 5)		105930.860(11)	10.2740	0.020	8.700	
6(2, 4) - 5(2, 3)		106146.280(11)	7.9179	5.332	12.282	
22(5,17) - 21(6,16)		106375.910(60)	5.7153	2.992	166.487	
13(1,12) - 13(0,13)		106649.440(31)	5.2755	4.904	51.643	
9(2, 8) - 9(1, 9)		106723.410(18)	5.2441	3.702	26.110	
6(2, 5) - 6(0, 6)		107169.680(14)	10.1196	0.033	12.152	
6(1, 5) - 5(1, 4)		108188.210(9)	7.8544	5.828	9.915	
13(3,10) - 13(2,11)		108439.070(80)	5.0001	8.795	57.682	
16(2,15) - 15(3,12)		108525.290(105)	5.8833	1.403	78.524	
24(11,13) - 25(10,16)		109039.300(344)	5.8676	2.130	276.954	
24(11,14) - 25(10,15)		109039.300(344)	5.8676	2.130	276.954	
7(2, 6) - 7(0, 7)		109060.690(16)	9.9898	0.048	16.160	
19(4,15) - 18(5,14)		109394.990(35)	5.6690	2.652	121.834	
21(10,12) - 22(9,13)		109688.840(186)	5.8765	1.799	218.362	
21(10,11) - 22(9,14)		109688.850(186)	5.8765	1.799	218.362	
18(9,10) - 19(8,11)		110321.480(92)	5.8915	1.470	166.760	
18(9, 9) - 19(8,12)		110321.490(92)	5.8915	1.470	166.760	
21(3,18) - 21(2,19)		110453.530(399)	4.9075	16.406	141.386	
15(8, 8) - 16(7, 9)		110931.360(45)	5.9164	1.144	122.149	
15(8, 7) - 16(7,10)		110931.410(45)	5.9164	1.144	122.149	
17(3,15) - 16(4,12)		111287.350(44)	5.6605	2.305	93.618	
12(7, 6) - 13(6, 7)		111510.340(31)	5.9595	0.822	84.534	
12(7, 5) - 13(6, 8)		111510.550(31)	5.9595	0.822	84.534	
8(2, 7) - 8(0, 8)		111738.020(19)	9.8776	0.066	20.719	
9(6, 4) - 10(5, 5)		112046.760(26)	6.0415	0.510	53.918	
9(6, 3) - 10(5, 6)		112047.570(26)	6.0415	0.510	53.918	
12(3, 9) - 12(2,10)		112129.910(57)	4.9805	7.707	49.869	
24(3,21) - 24(3,22)		112188.000(654)	9.4549	0.494	182.809	
6(5, 2) - 7(4, 3)		112523.540(22)	6.2383	0.219	30.301	
6(5, 1) - 7(4, 4)		112526.280(22)	6.2383	0.219	30.301	
2(2, 1) - 1(1, 0)	112807.06(5)	112807.100(11)	4.9844	1.500	1.476	[79A]
10(2, 9) - 10(1,10)		113097.950(20)	5.1877	3.915	31.694	
22(2,21) - 21(3,18)		113312.010(926)	6.2970	0.649	145.070	
2(2, 0) - 1(1, 1)	114064.86(5)	114064.850(11)	4.9803	1.465	1.435	[79A]
17(2,16) - 16(3,13)		114445.020(162)	5.8776	1.286	88.066	
9(2, 8) - 9(0, 9)		115299.330(21)	9.7781	0.084	25.824	
11(3, 8) - 11(2, 9)		115866.380(41)	4.9610	6.721	42.664	
18(2,16) - 18(1,17)		116556.530(42)	4.9679	10.452	101.793	
16(3,13) - 15(4,12)		116874.980(25)	5.5615	2.358	84.167	
22(3,19) - 22(2,20)		117259.620(440)	4.8462	16.525	154.392	
14(1,13) - 14(1,14)		117424.330(49)	9.6030	0.181	59.515	
21(2,20) - 20(3,17)		117500.820(687)	6.1639	0.755	132.440	
7(1, 7) - 6(1, 6)		117638.820(12)	7.7373	6.851	12.675	
18(2,17) - 17(3,14)		118316.150(243)	5.9065	1.151	98.230	
6(1, 6) - 5(0, 5)		119165.000(13)	4.9140	3.891	8.700	
10(3, 7) - 10(2, 8)	119404.93(15)	119405.020(32)	4.9436	5.836	36.071	[79A]
14(1,13) - 14(0,14)	119539.11(15)	119539.320(47)	5.1660	4.813	59.444	[79A]
10(2, 9) - 10(0,10)		119794.590(23)	9.6883	0.102	31.470	
20(4,17) - 19(5,14)		119800.100(56)	5.5490	2.799	132.995	
20(2,19) - 19(3,16)		119800.330(498)	6.0529	0.877	120.421	
19(2,17) - 19(2,18)		119937.250(120)	9.4389	0.334	113.022	

TABLE 7. The microwave spectrum of ground state *trans*-$^{12}CH_3{}^{12}CH_2{}^{16}OH$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log *A*	Line strength	Energy lower state	Ref.
11(2,10) - 11(1,11)		120093.960(23)	5.1302	4.088	37.827	
19(2,18) - 18(3,15)		120095.600(352)	5.9661	1.011	109.016	
7(0, 7) - 6(0, 6)		120171.860(12)	7.7025	6.962	12.152	
7(2, 6) - 6(2, 5)		122062.870(14)	7.7170	6.425	15.726	
7(6, 2) - 6(6, 1)		122522.420(37)	8.2511	1.857	43.641	
7(6, 1) - 6(6, 0)		122522.420(37)	8.2511	1.857	43.641	
7(5, 3) - 6(5, 2)		122549.830(30)	7.9846	3.429	34.054	
7(5, 2) - 6(5, 1)		122549.850(30)	7.9846	3.429	34.054	
9(3, 6) - 9(2, 7)		122550.750(26)	4.9300	5.039	30.090	
7(4, 4) - 6(4, 3)		122605.920(23)	7.8456	4.715	26.211	
7(4, 3) - 6(4, 2)		122607.910(23)	7.8456	4.715	26.211	
7(3, 5) - 6(3, 4)		122689.210(17)	7.7613	5.714	20.113	
23(5,19) - 22(6,16)		122729.560(76)	5.5209	3.184	179.389	
7(3, 4) 6(3, 3)		122804.170(18)	7.7600	5.714	20.115	
8(0, 8) - 7(1, 7)		123527.810(12)	4.8658	5.104	16.599	
7(2, 5) - 6(2, 4)		124278.650(14)	7.6934	6.428	15.823	
8(3, 5) - 8(2, 6)	125173.11(9)	125173.200(22)	4.9222	4.308	24.723	[76A]
11(2,10) - 11(0,11)		125225.250(26)	9.6055	0.118	37.656	
23(3,20) - 23(2,21)		125745.730(489)	4.7761	16.446	167.938	
23(5,18) - 22(6,17)	125927.48(25)	125927.420(97)	5.4859	3.194	179.385	[76A]
10(1, 9) - 9(2, 8)	125947.34(9)	125947.250(13)	5.1905	2.817	29.670	[76A]
7(1, 6) - 6(1, 5)		126026.960(12)	7.6477	6.848	13.523	
18(3,16) - 17(4,13)	126099.83(25)	126100.070(77)	5.5055	2.394	103.631	[76A]
13(2,11) - 12(3,10)		126387.990(18)	5.3824	2.304	53.466	
23(11,12) - 24(10,15)		126749.360(359)	5.6972	1.926	262.342	
23(11,13) - 24(10,14)		126749.360(359)	5.6972	1.926	262.342	
7(3, 4) - 7(2, 5)	127215.04(14)	127215.130(18)	4.9220	3.622	19.968	[76A]
20(10,11) - 21(9,12)		127396.070(198)	5.7125	1.597	205.503	
20(10,10) - 21(9,13)		127396.070(198)	5.7125	1.597	205.503	
12(2,11) - 12(1,12)		127683.510(30)	5.0721	4.227	44.510	
17(9, 8) - 18(8,11)		128019.960(103)	5.7365	1.271	155.653	
17(9, 9) - 18(8,10)		128019.960(103)	5.7365	1.271	155.653	
25(3,22) - 25(3,23)		128435.890(795)	9.3128	0.476	197.266	
14(8, 7) - 15(7, 8)		128614.280(57)	5.7751	0.950	112.796	
14(8, 6) - 15(7, 9)		128614.300(57)	5.7751	0.950	112.796	
6(3, 3) - 6(2, 4)		128689.620(15)	4.9322	2.962	15.823	
19(2,17) - 19(1,18)		128863.080(46)	4.8704	10.207	112.724	
3(2, 2) - 2(1, 1)		129077.570(12)	4.9092	1.667	2.683	
11(7, 5) - 12(6, 6)		129169.820(41)	5.8424	0.637	76.936	
11(7, 4) - 12(6, 7)		129169.890(41)	5.8424	0.637	76.936	
5(3, 2) - 5(2, 3)		129665.660(12)	4.9582	2.308	12.282	
8(6, 3) - 9(5, 4)		129673.850(34)	5.9783	0.341	48.073	
8(6, 2) - 9(5, 5)		129674.120(34)	5.9783	0.341	48.073	
5(5, 1) - 6(4, 2)		130109.010(27)	6.3863	0.085	26.211	
5(5, 0) - 6(4, 3)		130109.760(27)	6.3863	0.085	26.211	
4(3, 1) - 4(2, 2)		130246.190(10)	5.0150	1.635	9.341	
20(4,16) - 19(5,15)		130458.090(59)	5.4294	2.854	132.979	
3(3, 0) - 3(2, 1)		130544.920(10)	5.1617	0.901	6.995	
3(3, 1) - 3(2, 2)		130755.390(10)	5.1600	0.900	6.988	
4(3, 2) - 4(2, 3)		130871.440(10)	5.0100	1.630	9.320	
5(3, 3) - 5(2, 4)		131102.971(12)	4.9469	2.292	12.233	
15(1,14) - 15(1,15)		131188.580(77)	9.4906	0.180	67.835	
6(3, 4) - 6(2, 5)		131502.670(15)	4.9101	2.921	15.726	
12(2,11) - 12(0,12)		131552.199(33)	9.5283	0.132	44.381	
7(3, 5) - 7(2, 6)		132129.000(19)	4.8838	3.531	19.798	
15(1,14) - 15(0,15)		132728.240(75)	5.0645	4.748	67.784	
3(2, 1) - 2(1, 2)		132935.070(12)	4.9025	1.550	2.561	
8(3, 6) - 8(2, 7)		133043.891(23)	4.8616	4.125	24.446	
7(1, 7) - 6(0, 6)		133323.471(16)	4.7524	4.650	12.152	
8(1, 8) - 7(1, 7)		134275.891(16)	7.5593	7.866	16.599	
9(3, 7) - 9(2, 8)		134310.320(26)	4.8406	4.703	29.670	
20(2,18) - 20(2,19)		135206.289(130)	9.3132	0.327	124.417	

TABLE 7. The microwave spectrum of ground state *trans*-$^{12}CH_3{}^{12}CH_2{}^{16}OH$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	-log A	Line strength	Energy lower state	Ref.
13(2,12) - 13(1,13)		135830.891(43)	5.0138	4.337	51.739	
24(3,21) - 24(2,22)		135840.350(552)	4.6997	16.219	182.020	
10(3, 8) - 10(2, 9)		135989.891(30)	4.8191	5.262	35.466	
8(0, 8) - 7(0, 7)		136679.410(16)	7.5316	7.949	16.160	
21(4,18) - 20(5,15)		137246.830(94)	5.3678	2.963	144.743	
11(3, 9) - 11(2,10)		138140.619(35)	4.7962	5.796	41.833	
13(2,12) - 13(0,13)		138707.930(46)	9.4554	0.144	51.643	
8(2, 7) - 7(2, 6)		139356.750(17)	7.5319	7.494	19.798	
2(2, 0) - 1(0, 1)		139605.750(13)	10.9648	0.001	0.583	
19(3,17) - 18(4,14)		139888.881(132)	5.3846	2.442	114.251	
8(7, 2) - 7(7, 1)		140023.529(53)	8.1273	1.875	59.054	
8(7, 1) - 7(7, 0)		140023.529(53)	8.1273	1.875	59.054	
8(6, 3) - 7(6, 2)		140045.750(42)	7.8561	3.500	47.727	
8(6, 2) - 7(6, 1)		140045.750(42)	7.8561	3.500	47.727	
8(5, 4) - 7(5, 3)		140088.141(33)	7.7118	4.876	38.142	
8(5, 3) - 7(5, 2)		140088.199(33)	7.7118	4.876	38.142	
8(4, 5) - 7(4, 4)		140171.980(26)	7.6208	6.001	30.301	
8(4, 4) - 7(4, 3)		140177.449(26)	7.6208	6.001	30.301	
17(3,14) - 16(4,13)	140225.22(15)	140225.039(34)	5.3087	2.591	93.553	[79A]
8(3, 6) - 7(3, 5)		140271.641(21)	7.5608	6.875	24.205	
8(3, 5) - 7(3, 4)		140499.699(21)	7.5587	6.875	24.212	
12(3,10) - 12(2,11)		140814.881(43)	4.7713	6.299	48.769	
24(5,20) - 23(6,17)		141172.109(120)	5.3312	3.375	192.881	
20(2,18) - 20(1,19)	142046.58(15)	142046.590(61)	4.7750	9.979	124.189	[79A]
9(0, 9) - 8(1, 8)		142285.061(17)	4.6523	6.103	21.078	
8(2, 6) - 7(2, 5)		142541.631(18)	7.5021	7.500	19.968	
8(1, 7) - 7(1, 6)		143763.939(16)	7.4706	7.860	17.727	
13(3,11) - 13(2,12)		144057.631(57)	4.7440	6.766	56.270	
22(11,12) - 23(10,13)		144434.711(378)	5.5560	1.725	248.316	
22(11,11) - 23(10,14)		144434.711(378)	5.5560	1.725	248.316	
14(2,13) - 14(1,14)		144493.641(66)	4.9559	4.421	59.515	
4(2, 3) - 3(1, 2)		144734.029(13)	4.8155	1.886	4.493	
16(1,15) - 16(1,16)		144911.650(126)	9.3884	0.180	76.701	
19(10, 9) - 20(9,12)		145076.250(214)	5.5789	1.399	193.229	
19(10,10) - 20(9,11)		145076.250(214)	5.5789	1.399	193.229	
16(9, 7) - 17(8,10)		145689.090(118)	5.6140	1.078	145.132	
16(9, 8) - 17(8, 9)		145689.090(118)	5.6140	1.078	145.132	
24(5,19) - 23(6,18)		145941.910(151)	5.2857	3.393	192.875	
16(1,15) - 16(0,16)		146023.211(125)	4.9712	4.706	76.664	
13(8, 5) - 14(7, 8)		146265.721(71)	5.6709	0.765	104.030	
13(8, 6) - 14(7, 7)		146265.721(71)	5.6709	0.765	104.030	
20(4,16) - 20(3,17)		146589.010(874)	4.6050	13.430	132.440	
14(2,13) - 14(0,14)		146608.631(70)	9.3859	0.154	59.444	
10(7, 4) - 11(6, 5)		146796.150(52)	5.7739	0.464	69.923	
10(7, 3) - 11(6, 6)		146796.180(52)	5.7739	0.464	69.923	
7(6, 2) - 8(5, 3)		147267.211(41)	6.0076	0.192	42.815	
7(6, 1) - 8(5, 4)		147267.289(41)	6.0076	0.192	42.815	
25(3,22) - 25(2,23)		147407.449(640)	4.6191	15.903	196.633	
8(1, 8) - 7(0, 7)		147427.490(20)	4.6042	5.483	16.160	
14(3,12) - 14(2,13)		147905.029(78)	4.7142	7.191	64.334	
11(1,10) - 10(2, 9)		148303.949(16)	4.9309	3.435	35.466	
14(2,12) - 13(3,11)		150568.279(21)	5.1219	2.666	61.075	
21(2,19) - 21(2,20)		150671.100(152)	9.1975	0.324	136.360	
9(1, 9) - 8(1, 8)		150860.990(21)	7.4033	8.876	21.078	
19(4,15) - 19(3,16)		151759.449(703)	4.5788	12.229	120.421	
21(4,17) - 20(5,16)		152371.250(95)	5.2184	3.054	144.715	
15(3,13) - 15(2,14)		152383.320(107)	4.6818	7.573	72.960	
20(3,18) - 19(4,15)		152436.689(216)	5.2942	2.442	125.483	
4(2, 2) - 3(1, 3)		152656.779(13)	4.8109	1.624	4.249	
9(0, 9) - 8(0, 8)		153033.141(21)	7.3818	8.937	20.719	
15(2,14) - 15(1,15)		153624.131(104)	4.8987	4.486	67.835	
22(4,19) - 21(5,16)		154299.609(156)	5.2143	3.108	157.088	

TABLE 7. The microwave spectrum of ground state *trans*-$^{12}CH_3{}^{12}CH_2{}^{16}OH$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log *A*	Line strength	Energy lower state	Ref.
15(2,14) – 15(0,15)		155163.789(107)	9.3196	0.161	67.784	
21(2,19) – 21(1,20)		155855.250(106)	4.6832	9.787	136.187	
9(2, 8) – 8(2, 7)		156594.449(21)	7.3712	8.546	24.446	
18(4,14) – 18(3,15)		156956.520(551)	4.5526	11.139	109.016	
3(2, 1) – 2(0, 2)		157303.090(14)	10.4356	0.003	1.748	
16(3,14) – 16(2,15)		157508.020(145)	4.6470	7.909	82.144	
9(8, 2) – 8(8, 1)		157525.670(93)	8.0190	1.889	76.791	
9(8, 1) – 8(8, 0)		157525.670(93)	8.0190	1.889	76.791	
9(7, 3) – 8(7, 2)		157543.801(69)	7.7441	3.556	63.725	
9(7, 2) – 8(7, 1)		157543.801(69)	7.7441	3.556	63.725	
9(6, 4) – 8(6, 3)		157577.119(52)	7.5958	5.001	52.399	
9(6, 3) – 8(6, 2)		157577.119(52)	7.5958	5.001	52.399	
9(5, 5) – 8(5, 4)		157638.910(40)	7.5003	6.223	42.815	
9(5, 4) – 8(5, 3)		157639.100(40)	7.5003	6.223	42.815	
9(4, 6) – 8(4, 5)		157757.180(31)	7.4346	7.223	34.977	
9(4, 5) – 8(4, 4)		157770.250(31)	7.4345	7.223	34.977	
9(3, 7) – 8(3, 6)		157860.881(25)	7.3894	8.000	28.884	
9(3, 6) – 8(3, 5)		158274.051(25)	7.3860	8.000	28.898	
17(1,16) – 17(1,17)		158476.330(203)	9.2959	0.181	86.110	
17(1,16) – 17(0,17)		159273.141(203)	4.8859	4.681	86.083	
25(5,21) – 24(6,18)		159557.930(186)	5.1662	3.558	206.968	
5(2, 4) – 4(1, 3)		159781.850(16)	4.7193	2.138	6.904	
10(0,10) – 9(1, 9)		160699.039(22)	4.4694	7.134	26.110	
9(2, 7) – 8(2, 6)		160896.510(21)	7.3353	8.558	24.723	
9(1, 8) – 8(1, 7)		161376.199(20)	7.3161	8.866	22.523	
24(12,12) – 25(11,15)		161434.570(660)	5.4170	1.853	295.197	
24(12,13) – 25(11,14)		161434.570(660)	5.4170	1.853	295.197	
9(1, 9) – 8(0, 8)		161609.070(25)	4.4670	6.381	20.719	
17(4,13) – 17(3,14)		161919.369(421)	4.5280	10.157	98.230	
21(11,11) – 22(10,12)		162097.279(400)	5.4387	1.527	234.876	
21(11,10) – 22(10,13)		162097.279(400)	5.4387	1.527	234.876	
18(10, 8) – 19(9,11)		162731.750(233)	5.4708	1.207	181.541	
18(10, 9) – 19(9,10)		162731.750(233)	5.4708	1.207	181.541	
16(2,15) – 16(1,16)		163171.439(160)	4.8425	4.535	76.701	
17(3,15) – 17(2,16)		163283.570(191)	4.6101	8.199	91.883	
15(9, 7) – 16(8, 8)		163331.801(135)	5.5202	0.892	135.198	
15(9, 6) – 16(8, 9)		163331.801(135)	5.5202	0.892	135.198	
21(3,19) – 20(4,16)		163517.189(341)	5.2322	2.394	137.330	
12(8, 4) – 13(7, 7)		163889.350(86)	5.6027	0.589	95.849	
12(8, 5) – 13(7, 6)		163889.350(86)	5.6027	0.589	95.849	
16(2,15) – 16(0,16)		164283.000(163)	9.2560	0.168	76.664	
9(7, 3) – 10(6, 4)		164394.029(63)	5.7630	0.307	63.496	
9(7, 2) – 10(6, 5)		164394.039(63)	5.7630	0.307	63.496	
18(3,15) – 17(4,14)		164511.740(47)	5.0846	2.841	103.528	
6(6, 1) – 7(5, 2)		164832.990(48)	6.2175	0.073	38.142	
6(6, 0) – 7(5, 3)		164833.010(48)	6.2175	0.073	38.142	
22(2,20) – 22(2,21)		166146.430(214)	9.0913	0.323	148.850	
16(4,12) – 16(3,13)		166441.240(313)	4.5062	9.270	88.066	
25(5,20) – 24(6,19)		166522.061(226)	5.1070	3.587	206.957	
10(1,10) – 9(1, 9)		167395.680(26)	7.2646	9.884	26.110	
10(0,10) – 9(0, 9)		169274.971(26)	7.2482	9.927	25.824	
18(3,16) – 18(2,17)		169703.301(246)	4.5711	8.444	102.177	
22(2,20) – 22(1,21)		170037.520(194)	4.5961	9.640	148.720	
15(4,11) – 15(3,12)		170382.830(227)	4.4883	8.460	78.524	
12(1,11) – 11(2,10)		170642.811(21)	4.7034	4.138	41.833	
23(4,20) – 22(5,17)		170819.750(251)	5.0842	3.227	170.035	
18(1,17) – 18(1,18)		171807.600(317)	9.2122	0.182	96.062	
18(1,17) – 18(0,18)		172375.270(316)	4.8082	4.668	96.043	
22(3,20) – 21(4,17)		172907.189(521)	5.1970	2.298	149.798	
17(2,16) – 17(1,17)		173083.301(243)	4.7878	4.572	86.110	
5(2, 3) – 4(1, 4)		173391.211(16)	4.7240	1.655	6.499	
14(4,10) – 14(3,11)		173676.420(160)	4.4748	7.708	69.602	

TABLE 7. The microwave spectrum of ground state *trans*-$^{12}CH_3{}^{12}CH_2{}^{16}OH$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log A	Line strength	Energy lower state	Ref.
10(2, 9) - 9(2, 8)		173770.230(26)	7.2292	9.587	29.670	
17(2,16) - 17(0,17)		173880.100(245)	9.1950	0.173	86.083	
6(2, 5) - 5(1, 4)		174232.881(19)	4.6252	2.420	9.915	
15(3,13) - 15(1,14)		174818.869(173)	9.2688	0.127	72.211	
14(3,12) - 14(1,13)		174974.340(130)	9.3357	0.101	63.432	
10(9, 1) - 9(9, 0)		175028.820(184)	7.9226	1.900	96.850	
10(9, 2) - 9(9, 1)		175028.820(184)	7.9226	1.900	96.850	
10(8, 2) - 9(8, 1)		175043.420(136)	7.6450	3.600	82.046	
10(8, 3) - 9(8, 2)		175043.420(136)	7.6450	3.600	82.046	
10(7, 3) - 9(7, 2)		175070.170(99)	7.4935	5.101	68.980	
10(7, 4) - 9(7, 3)		175070.170(99)	7.4935	5.101	68.980	
10(6, 5) - 9(6, 4)		175117.539(72)	7.3946	6.401	57.655	
10(6, 4) - 9(6, 3)		175117.551(72)	7.3946	6.401	57.655	
15(2,13) - 14(3,12)		175188.811(23)	4.8909	3.080	69.268	
10(5, 6) - 9(5, 5)		175203.670(53)	7.3250	7.501	48.073	
10(5, 5) - 9(5, 4)		175204.211(53)	7.3250	7.501	48.073	
22(4,18) - 21(5,17)		175241.070(148)	5.0283	3.255	157.045	
4(2, 2) - 3(0, 3)		175345.061(15)	10.0593	0.006	3.493	
10(4, 7) - 9(4, 6)		175362.680(39)	7.2747	8.401	40.239	
10(4, 6) - 9(4, 5)		175390.850(39)	7.2744	8.401	40.240	
10(3, 8) - 9(3, 7)		175449.801(30)	7.2393	9.099	34.150	
16(3,14) - 16(1,15)		175767.801(223)	9.2057	0.154	81.534	
10(1,10) - 9(0, 9)		175971.609(31)	4.3393	7.331	25.824	
13(3,11) - 13(1,12)		176116.119(97)	9.4072	0.079	55.201	
10(3, 7) - 9(3, 6)		176146.289(31)	7.2341	9.099	34.178	
13(4, 9) - 13(3,10)		176319.670(111)	4.4660	6.998	61.299	
19(3,17) - 19(2,18)		176749.801(312)	4.5306	8.648	113.022	
17(3,15) - 17(1,16)		177890.529(280)	9.1457	0.181	91.396	
12(3,10) - 12(1,11)		178088.930(73)	9.4844	0.059	47.525	
12(4, 8) - 12(3, 9)		178360.869(76)	4.4620	6.318	53.609	
11(0,11) - 10(1,10)		178751.750(28)	4.3107	8.181	31.694	
10(1, 9) - 9(1, 8)		178838.891(25)	7.1792	9.867	27.906	
23(12,12) - 24(11,13)		179079.801(692)	5.3125	1.656	280.591	
23(12,11) - 24(11,14)		179079.801(692)	5.3125	1.656	280.591	
10(2, 8) - 9(2, 7)		179292.020(26)	7.1875	9.606	30.090	
20(11, 9) - 21(10,12)		179738.961(426)	5.3420	1.335	222.021	
20(11,10) - 21(10,11)		179738.961(426)	5.3420	1.335	222.021	
11(4, 7) - 11(3, 8)		179880.039(53)	4.4627	5.657	46.529	
17(10, 7) - 18(9,10)		180364.850(255)	5.3856	1.020	170.440	
17(10, 8) - 18(9, 9)		180364.850(255)	5.3856	1.020	170.440	
23(3,21) - 22(4,18)		180402.570(770)	5.1876	2.160	162.890	
11(3, 9) - 11(1,10)		180715.721(57)	9.5682	0.043	40.413	
14(9, 6) - 15(8, 7)		180950.859(155)	5.4542	0.715	125.849	
14(9, 5) - 15(8, 8)		180950.859(155)	5.4542	0.715	125.849	
10(4, 6) - 10(3, 7)		180970.801(39)	4.4681	5.010	40.053	
18(3,16) - 18(1,17)		181203.750(345)	9.0879	0.206	101.793	
23(2,21) - 23(2,22)		181468.779(336)	8.9941	0.324	161.885	
11(8, 4) - 12(7, 5)		181488.600(102)	5.5745	0.426	88.254	
11(8, 3) - 12(7, 6)		181488.600(102)	5.5745	0.426	88.254	
9(4, 5) - 9(3, 6)		181726.230(31)	4.4787	4.369	34.178	
8(7, 2) - 9(6, 3)		181967.779(74)	5.8373	0.171	57.655	
8(7, 1) - 9(6, 4)		181967.789(74)	5.8373	0.171	57.655	
8(4, 4) - 8(3, 5)		182230.039(25)	4.4957	3.727	28.898	
11(4, 8) - 11(3, 9)		182410.301(53)	4.4470	5.625	46.441	
10(4, 7) - 10(3, 8)		182451.170(40)	4.4589	4.994	40.002	
12(4, 9) - 12(3,10)		182454.529(75)	4.4366	6.257	53.466	
9(4, 6) - 9(3, 7)		182538.301(32)	4.4736	4.361	34.150	
7(4, 3) - 7(3, 4)		182552.289(20)	4.5222	3.078	24.212	
13(4,10) - 13(3,11)		182631.279(106)	4.4270	6.890	61.075	
8(4, 5) - 8(3, 6)		182642.000(26)	4.4932	3.724	28.884	
7(4, 4) - 7(3, 5)		182741.650(21)	4.5210	3.077	24.205	
6(4, 2) - 6(3, 3)		182748.539(16)	4.5650	2.410	20.115	

TABLE 7. The microwave spectrum of ground state *trans*-$^{12}CH_3{}^{12}CH_2{}^{16}OH$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log A	Line strength	Energy lower state	Ref.
6(4, 3) – 6(3, 4)		182824.939(16)	4.5645	2.409	20.113	
5(4, 1) – 5(3, 2)		182860.930(13)	4.6423	1.703	16.607	
5(4, 2) – 5(3, 3)		182886.561(13)	4.6422	1.703	16.607	
4(4, 0) – 4(3, 1)		182920.141(13)	4.8200	0.925	13.686	
4(4, 1) – 4(3, 2)		182926.580(13)	4.8200	0.925	13.686	
14(4,11) – 14(3,12)		182995.301(150)	4.4174	7.520	69.268	
3(3, 1) – 2(2, 0)		183170.529(15)	4.2797	2.485	5.240	
3(3, 0) – 2(2, 1)		183213.801(15)	4.2795	2.485	5.239	
18(2,17) – 18(1,18)		183308.051(358)	4.7346	4.599	96.062	
15(4,12) – 15(3,13)		183606.850(207)	4.4074	8.145	78.043	
10(3, 8) – 10(1, 9)		183812.869(48)	9.6602	0.030	33.871	
18(2,17) – 18(0,18)		183875.721(360)	9.1366	0.176	96.043	
11(1,11) – 10(1,10)		183883.039(33)	7.1397	10.889	31.694	
23(2,21) – 23(1,22)		184364.721(334)	4.5144	9.534	161.789	
20(3,18) – 20(2,19)		184395.801(393)	4.4889	8.815	124.417	
16(4,13) – 16(3,14)		184529.471(279)	4.3963	8.761	87.397	
19(1,18) – 19(1,19)		184870.500(475)	9.1365	0.183	106.557	
19(1,18) – 19(0,19)		185272.760(474)	4.7376	4.663	106.544	
11(0,11) – 10(0,10)		185448.391(33)	7.1274	10.918	31.470	
19(3,17) – 19(1,18)		185675.631(417)	9.0320	0.230	112.724	
17(4,14) – 17(3,15)		185827.510(367)	4.3840	9.361	97.330	
24(4,21) – 23(5,18)		186645.510(393)	4.9750	3.317	183.585	
9(3, 7) – 9(1, 8)		187201.961(42)	9.7620	0.020	27.906	
18(4,15) – 18(3,16)		187563.619(473)	4.3699	9.939	107.837	
7(2, 6) – 6(1, 5)		188107.539(24)	4.5345	2.735	13.523	
19(3,16) – 18(4,15)		189673.369(63)	4.8818	3.117	114.094	
19(4,16) – 19(3,17)		189796.320(597)	4.3540	10.490	118.918	
11(1,11) – 10(0,10)		190579.680(37)	4.2201	8.317	31.470	
8(3, 6) – 8(1, 7)		190717.289(37)	9.8764	0.013	22.523	
11(2,10) – 10(2, 9)		190879.051(34)	7.1019	10.619	35.466	
20(3,18) – 20(1,19)		191236.109(499)	8.9774	0.251	124.189	
11(10, 2) – 10(10, 1)		192532.990(349)	7.8359	1.909	119.229	
11(10, 1) – 10(10, 0)		192532.990(349)	7.8359	1.909	119.229	
11(9, 2) – 10(9, 1)		192544.359(264)	7.5560	3.637	102.688	
11(9, 3) – 10(9, 2)		192544.359(264)	7.5560	3.637	102.688	
11(8, 3) – 10(8, 2)		192565.859(197)	7.4020	5.182	87.884	
11(8, 4) – 10(8, 3)		192565.859(197)	7.4020	5.182	87.884	
20(4,17) – 20(3,18)		192577.779(740)	4.3358	11.008	130.568	
11(7, 5) – 10(7, 4)		192603.320(145)	7.3003	6.546	74.820	
11(7, 4) – 10(7, 3)		192603.320(145)	7.3003	6.546	74.820	
21(3,19) – 21(2,20)		192605.369(492)	4.4463	8.948	136.360	
11(6, 6) – 10(6, 5)		192668.029(105)	7.2278	7.728	63.496	
11(6, 5) – 10(6, 4)		192668.051(105)	7.2278	7.728	63.496	
11(5, 7) – 10(5, 6)		192783.920(74)	7.1741	8.728	53.918	
11(5, 6) – 10(5, 5)		192785.270(74)	7.1741	8.728	53.918	
13(1,12) – 12(2,11)		192822.289(27)	4.5017	4.929	48.769	
11(4, 8) – 10(4, 7)		192988.910(53)	7.1339	9.546	46.088	
11(3, 9) – 10(3, 8)		193029.779(39)	7.1057	10.180	40.002	
11(4, 7) – 10(4, 6)		193044.859(53)	7.1335	9.546	46.090	
19(2,18) – 19(1,19)		193796.320(516)	4.6830	4.619	106.557	
5(2, 3) – 4(0, 4)		193987.689(18)	9.7612	0.011	5.811	
11(3, 8) – 10(3, 7)		194135.609(39)	7.0982	10.181	40.053	
19(2,18) – 19(0,19)		194198.590(517)	9.0806	0.180	106.544	
7(3, 5) – 7(1, 6)		194209.590(31)	10.0076	0.008	17.727	
6(2, 4) – 5(1, 5)		195325.350(20)	4.6479	1.630	9.308	
21(4,18) – 21(3,19)		195952.010(901)	4.3154	11.486	142.784	
11(1,10) – 10(1, 9)		196126.930(31)	7.0567	10.862	33.871	
12(0,12) – 11(1,11)		196458.619(37)	4.1714	9.233	37.827	
24(2,22) – 24(2,23)		196509.529(530)	8.9056	0.326	175.465	
22(12,11) – 23(11,12)		196707.260(728)	5.2249	1.463	266.570	
22(12,10) – 23(11,13)		196707.260(728)	5.2249	1.463	266.570	
19(11, 8) – 20(10,11)		197361.529(455)	5.2639	1.148	209.752	

TABLE 7. The microwave spectrum of ground state *trans*-$^{12}CH_3{}^{12}CH_2{}^{16}OH$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log *A*	Line strength	Energy lower state	Ref.
19(11, 9) - 20(10,10)		197361.529(455)	5.2639	1.148	209.752	
6(3, 4) - 6(1, 5)		197547.340(26)	10.1623	0.005	13.523	
20(1,19) - 20(1,20)		197662.029(687)	9.0678	0.184	117.595	
11(2, 9) - 10(2, 8)		197674.250(31)	7.0552	10.647	36.071	
21(3,19) - 21(1,20)		197789.529(595)	8.9241	0.269	136.187	
20(1,19) - 20(0,20)		197945.740(687)	4.6732	4.662	117.586	
16(10, 6) - 17(9, 9)		197977.689(280)	5.3225	0.841	159.923	
16(10, 7) - 17(9, 8)		197977.689(280)	5.3225	0.841	159.923	
13(9, 5) - 14(8, 6)		198548.881(176)	5.4180	0.547	117.086	
13(9, 4) - 14(8, 7)		198548.881(176)	5.4180	0.547	117.086	
24(2,22) - 24(1,23)		198648.910(537)	4.4385	9.463	175.394	
10(8, 3) - 11(7, 4)		199066.689(118)	5.5983	0.279	81.244	
10(8, 2) - 11(7, 5)		199066.689(118)	5.5983	0.279	81.244	
23(4,19) - 22(5,18)		199145.131(223)	4.8540	3.461	169.967	
7(7, 0) - 8(6, 3)		199521.369(85)	6.0887	0.064	52.399	
7(7, 1) - 8(6, 2)		199521.369(85)	6.0887	0.064	52.399	
16(2,14) - 15(3,13)		200121.949(28)	4.6823	3.555	78.043	
12(1,12) - 11(1,11)		200327.311(41)	7.0260	11.893	37.827	
4(3, 2) - 3(2, 1)		200569.471(16)	4.2545	2.579	6.995	
5(3, 3) - 5(1, 4)		200616.689(21)	10.3533	0.002	9.915	
4(3, 1) - 3(2, 2)		200787.311(16)	4.2535	2.577	6.988	
22(3,20) - 22(2,21)		201335.539(616)	4.4032	9.053	148.850	
8(2, 7) - 7(1, 6)		201437.330(29)	4.4469	3.088	17.727	
12(0,12) - 11(0,11)		201589.910(41)	7.0171	11.913	37.656	
25(4,22) - 24(5,19)		201592.289(601)	4.8852	3.369	197.743	
4(3, 2) - 4(1, 3)		203320.930(18)	10.6087	0.001	6.904	
20(2,19) - 20(1,20)		204502.340(726)	4.6333	4.634	117.595	
20(2,19) - 20(0,20)		204786.051(726)	9.0269	0.182	117.586	
22(3,20) - 22(1,21)		205226.631(713)	8.8717	0.284	148.720	
12(1,12) - 11(0,11)		205458.600(46)	4.1087	9.325	37.656	
3(3, 1) - 3(1, 2)		205580.000(17)	11.0146	0.000	4.493	
12(2,11) - 11(2,10)		207916.859(44)	6.9867	11.644	41.833	
12(11, 1) - 11(11, 0)		210038.211(616)	7.7570	1.917	143.927	
12(11, 2) - 11(11, 1)		210038.211(616)	7.7570	1.917	143.927	
12(10, 3) - 11(10, 2)		210046.510(480)	7.4752	3.667	125.651	
12(10, 2) - 11(10, 1)		210046.510(480)	7.4752	3.667	125.651	
12(9, 4) - 11(9, 3)		210063.500(369)	7.3192	5.251	109.111	
12(9, 3) - 11(9, 2)		210063.500(369)	7.3192	5.251	109.111	
12(8, 4) - 11(8, 3)		210093.461(279)	7.2153	6.668	94.308	
12(8, 5) - 11(8, 4)		210093.461(279)	7.2153	6.668	94.308	
12(7, 5) - 11(7, 4)		210143.939(208)	7.1404	7.918	81.244	
12(7, 6) - 11(7, 5)		210143.939(208)	7.1404	7.918	81.244	
21(1,20) - 21(1,21)		210200.711(965)	9.0052	0.186	129.175	
12(6, 7) - 11(6, 6)		210229.609(151)	7.0841	9.001	69.923	
12(6, 6) - 11(6, 5)		210229.660(151)	7.0841	9.001	69.923	
12(5, 8) - 11(5, 7)		210381.090(107)	7.0411	9.918	60.348	
12(5, 7) - 11(5, 6)		210384.160(107)	7.0410	9.918	60.348	
21(1,20) - 21(0,21)		210399.971(964)	4.6143	4.663	129.169	
23(3,21) - 23(2,22)		210538.150(776)	4.3600	9.135	161.885	
12(3,10) - 11(3, 9)		210591.109(53)	6.9851	11.247	46.441	
12(4, 9) - 11(4, 8)		210635.340(75)	7.0079	10.667	52.526	
12(4, 8) - 11(4, 7)		210739.270(75)	7.0072	10.667	52.529	
25(2,23) - 25(2,24)		211182.631(806)	8.8252	0.329	189.588	
12(3, 9) - 11(3, 8)		212258.449(52)	6.9748	11.249	46.529	
25(2,23) - 25(1,24)		212752.811(817)	4.3685	9.420	189.536	
12(1,11) - 11(1,10)		213217.910(39)	6.9462	11.853	40.413	
23(3,21) - 23(1,22)		213434.090(862)	8.8203	0.297	161.789	
6(2, 4) - 5(0, 5)		213540.230(23)	9.5176	0.016	8.700	
13(0,13) - 12(1,12)		213856.359(49)	4.0475	10.282	44.510	
9(2, 8) - 8(1, 7)		214267.850(35)	4.3621	3.486	22.523	
21(12,10) - 22(11,11)		214318.391(767)	5.1530	1.276	253.134	
21(12, 9) - 22(11,12)		214318.391(767)	5.1530	1.276	253.134	

TABLE 7. The microwave spectrum of ground state *trans*-$^{12}CH_3{}^{12}CH_2{}^{16}OH$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	-log *A*	Line strength	Energy lower state	Ref.
14(1,13) - 13(2,12)		214699.971(41)	4.3217	5.805	56.270	
18(11, 8) - 19(10, 9)		214966.689(488)	5.2040	0.967	198.068	
18(11, 7) - 19(10,10)		214966.689(488)	5.2040	0.967	198.068	
21(2,20) - 21(1,21)		215384.859(999)	4.5854	4.646	129.175	
15(10, 5) - 16(9, 8)		215572.320(307)	5.2827	0.671	149.992	
15(10, 6) - 16(9, 7)		215572.320(307)	5.2827	0.671	149.992	
21(2,20) - 21(0,21)		215584.119(999)	8.9756	0.184	129.169	
20(3,17) - 19(4,16)		215610.721(89)	4.6953	3.428	125.248	
12(2,10) - 11(2, 9)		215994.910(39)	6.9357	11.680	42.664	
12(9, 3) - 13(8, 6)		216128.340(198)	5.4176	0.393	108.908	
12(9, 4) - 13(8, 5)		216128.340(198)	5.4176	0.393	108.908	
9(8, 1) - 10(7, 4)		216626.590(134)	5.7041	0.153	74.820	
9(8, 2) - 10(7, 3)		216626.590(134)	5.7041	0.153	74.820	
13(1,13) - 12(1,12)		216733.400(54)	6.9217	12.895	44.510	
13(0,13) - 12(0,12)		217725.051(54)	6.9153	12.908	44.381	
5(3, 3) - 4(2, 2)		217803.631(20)	4.2121	2.714	9.341	
5(3, 2) - 4(2, 3)		218461.109(20)	4.2095	2.706	9.320	
7(2, 5) - 6(1, 6)		218653.881(26)	4.5850	1.550	12.675	
24(3,22) - 24(2,23)		220161.881(984)	4.3169	9.198	175.465	
13(1,13) - 12(0,12)		220602.100(59)	4.0044	10.343	44.381	
24(4,20) - 23(5,19)		224119.391(325)	4.6919	3.676	183.482	
13(2,12) - 12(2,11)		224880.779(62)	6.8815	12.664	48.769	
19(5,14) - 19(4,15)		225214.369(885)	4.1334	10.435	125.483	
17(2,15) - 16(3,14)		225229.381(47)	4.4918	4.102	87.397	
10(2, 9) - 9(1, 8)		226661.869(42)	4.2794	3.938	27.906	
13(11, 3) - 12(11, 2)		227549.811(814)	7.4013	3.693	150.933	
13(11, 2) - 12(11, 1)		227549.811(814)	7.4013	3.693	150.933	
13(10, 3) - 12(10, 2)		227562.760(643)	7.2437	5.308	132.658	
13(10, 4) - 12(10, 3)		227562.760(643)	7.2437	5.308	132.658	
13(9, 5) - 12(9, 4)		227586.590(501)	7.1379	6.770	116.118	
13(9, 4) - 12(9, 3)		227586.590(501)	7.1379	6.770	116.118	
18(5,13) - 18(4,14)		227609.240(688)	4.1270	9.731	114.251	
13(8, 6) - 12(8, 5)		227626.699(385)	7.0610	8.078	101.316	
13(8, 5) - 12(8, 4)		227626.699(385)	7.0610	8.078	101.316	
13(7, 6) - 12(7, 5)		227692.721(290)	7.0026	9.232	88.254	
13(7, 7) - 12(7, 6)		227692.721(290)	7.0026	9.232	88.254	
13(6, 8) - 12(6, 7)		227803.289(213)	6.9573	10.232	76.936	
13(6, 7) - 12(6, 6)		227803.420(213)	6.9573	10.232	76.936	
13(5, 9) - 12(5, 8)		227996.510(153)	6.9217	11.078	67.366	
13(5, 8) - 12(5, 7)		228002.990(153)	6.9217	11.078	67.366	
13(3,11) - 12(3,10)		228123.529(76)	6.8754	12.303	53.466	
13(4,10) - 12(4, 9)		228300.279(107)	6.8936	11.769	59.552	
13(4, 9) - 12(4, 8)		228482.869(108)	6.8926	11.770	59.559	
17(5,12) - 17(4,13)		229493.580(527)	4.1238	9.047	103.631	
13(1,12) - 12(1,11)		230096.340(54)	6.8456	12.840	47.525	
13(3,10) - 12(3, 9)		230524.061(73)	6.8616	12.307	53.609	
16(5,11) - 16(4,12)		230955.631(398)	4.1233	8.378	93.618	
14(0,14) - 13(1,13)		230991.539(70)	3.9361	11.325	51.739	
19(5,15) - 19(4,16)		231741.641(873)	4.1002	10.337	125.248	
20(12, 8) - 21(11,11)		231914.551(810)	5.0961	1.095	240.283	
20(12, 9) - 21(11,10)		231914.551(810)	5.0961	1.095	240.283	
18(5,14) - 18(4,15)		232037.830(685)	4.1045	9.673	114.094	
15(5,10) - 15(4,11)		232077.230(294)	4.1254	7.721	84.207	
17(5,13) - 17(4,14)		232407.330(529)	4.1090	9.013	103.528	
17(11, 6) - 18(10, 9)		232556.061(524)	5.1628	0.795	186.970	
17(11, 7) - 18(10, 8)		232556.061(524)	5.1628	0.795	186.970	
16(5,12) - 16(4,13)		232810.770(400)	4.1139	8.359	93.553	
14(5, 9) - 14(4,10)		232929.539(214)	4.1297	7.072	75.395	
14(1,14) - 13(1,13)		233106.529(76)	6.8254	13.897	51.739	
14(10, 5) - 15(9, 6)		233150.670(337)	5.2694	0.511	140.646	
14(10, 4) - 15(9, 7)		233150.670(337)	5.2694	0.511	140.646	
15(5,11) - 15(4,12)		233216.930(297)	4.1196	7.710	84.167	

TABLE 7. The microwave spectrum of ground state *trans*-$^{12}CH_3{}^{12}CH_2{}^{16}OH$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log *A*	Line strength	Energy lower state	Ref.
13(5, 8) - 13(4, 9)		233571.770(152)	4.1365	6.429	67.180	
14(5,10) - 14(4,11)		233602.600(216)	4.1263	7.066	75.372	
11(9, 3) - 12(8, 4)		233691.539(221)	5.4665	0.256	101.316	
11(9, 2) - 12(8, 5)		233691.539(221)	5.4665	0.256	101.316	
14(0,14) - 13(0,13)		233868.590(75)	6.8209	13.906	51.643	
13(5, 9) - 13(4,10)		233951.980(153)	4.1346	6.426	67.167	
12(5, 7) - 12(4, 8)		234051.650(107)	4.1459	5.790	59.559	
8(8, 1) - 9(7, 2)		234171.090(150)	5.9855	0.057	68.980	
8(8, 0) - 9(7, 3)		234171.090(150)	5.9855	0.057	68.980	
13(2,11) - 12(2,10)		234214.900(54)	6.8270	12.706	49.869	
12(5, 8) - 12(4, 9)		234255.750(108)	4.1448	5.789	59.552	
7(2, 5) - 6(0, 6)		234338.529(29)	9.3189	0.023	12.152	
11(5, 6) - 11(4, 7)		234406.770(75)	4.1585	5.151	52.529	
11(5, 7) - 11(4, 8)		234510.010(75)	4.1579	5.150	52.526	
10(5, 5) - 10(4, 6)		234666.350(53)	4.1754	4.508	46.090	
10(5, 6) - 10(4, 7)		234715.000(54)	4.1752	4.508	46.088	
6(3, 4) - 5(2, 3)		234758.750(25)	4.1636	2.864	12.282	
9(5, 4) - 9(4, 5)		234852.990(39)	4.1988	3.856	40.240	
9(5, 5) - 9(4, 6)		234874.010(40)	4.1987	3.856	40.239	
8(5, 3) - 8(4, 4)		234984.141(30)	4.2324	3.188	34.977	
8(5, 4) - 8(4, 5)		234992.270(30)	4.2323	3.188	34.977	
7(5, 2) - 7(4, 3)		235073.391(24)	4.2844	2.493	30.301	
7(5, 3) - 7(4, 4)		235076.109(24)	4.2844	2.493	30.301	
6(5, 1) - 6(4, 2)		235131.449(20)	4.3747	1.753	26.211	
6(5, 2) - 6(4, 3)		235132.199(20)	4.3747	1.753	26.211	
5(5, 0) - 5(4, 1)		235166.859(20)	4.5723	0.941	22.707	
5(5, 1) - 5(4, 2)		235167.010(20)	4.5723	0.941	22.707	
14(1,14) - 13(0,13)		235983.570(81)	3.9067	11.366	51.643	
15(1,14) - 14(2,13)		236146.721(66)	4.1606	6.757	64.334	
6(3, 3) - 5(2, 4)		236298.990(26)	4.1584	2.842	12.233	
11(2,10) - 10(1, 9)		238702.029(52)	4.1981	4.453	33.871	
14(2,13) - 13(2,12)		241769.279(89)	6.7847	13.679	56.270	
21(3,18) - 20(4,17)		242196.789(132)	4.5217	3.783	136.991	
8(2, 6) - 7(1, 7)		243556.689(32)	4.5354	1.425	16.599	
14(10, 4) - 13(10, 3)		245081.980(843)	7.0668	6.858	140.248	
14(10, 5) - 13(10, 4)		245081.980(843)	7.0668	6.858	140.248	
14(9, 5) - 13(9, 4)		245113.939(665)	6.9882	8.215	123.709	
14(9, 6) - 13(9, 5)		245113.939(665)	6.9882	8.215	123.709	
14(8, 7) - 13(8, 6)		245166.051(517)	6.9281	9.430	108.908	
14(8, 6) - 13(8, 5)		245166.051(517)	6.9281	9.430	108.908	
14(7, 7) - 13(7, 6)		245250.330(394)	6.8809	10.501	95.849	
14(7, 8) - 13(7, 7)		245250.330(394)	6.8809	10.501	95.849	
14(6, 9) - 13(6, 8)		245390.109(295)	6.8433	11.430	84.534	
14(6, 8) - 13(6, 7)		245390.420(295)	6.8433	11.430	84.534	
14(3,12) - 13(3,11)		245616.680(109)	6.7747	13.350	61.075	
14(5,10) - 13(5, 9)		245631.330(215)	6.8132	12.215	74.971	
14(5, 9) - 13(5, 8)		245644.211(215)	6.8131	12.215	74.971	
14(4,11) - 13(4,10)		245980.699(153)	6.7891	12.857	67.167	
14(4,10) - 13(4, 9)		246286.439(153)	6.7875	12.857	67.180	
14(1,13) - 13(1,12)		246758.471(79)	6.7535	13.824	55.201	
15(0,15) - 14(1,14)		247912.119(103)	3.8349	12.362	59.515	
14(3,11) - 13(3,10)		248929.689(105)	6.7570	13.357	61.299	
15(1,15) - 14(1,14)		249451.779(109)	6.7358	14.898	59.515	
19(12, 8) - 20(11, 9)		249497.070(857)	5.0546	0.920	228.017	
19(12, 7) - 20(11,10)		249497.070(857)	5.0546	0.920	228.017	
15(0,15) - 14(0,14)		250027.109(109)	6.7327	14.904	59.444	
16(11, 6) - 17(10, 7)		250131.199(562)	5.1421	0.632	176.456	
16(11, 5) - 17(10, 8)		250131.199(562)	5.1421	0.632	176.456	
25(4,21) - 24(5,20)		250150.850(458)	4.5394	3.910	197.590	
18(2,16) - 17(3,15)		250362.221(88)	4.3164	4.728	97.330	
12(2,11) - 11(1,10)		250491.961(67)	4.1178	5.039	40.413	
13(10, 3) - 14(9, 6)		250714.570(367)	5.2896	0.365	131.885	

TABLE 7. The microwave spectrum of ground state *trans*-$^{12}CH_3{}^{12}CH_2{}^{16}OH$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log *A*	Line strength	Energy lower state	Ref.
13(10, 4) - 14(9, 5)		250714.570(367)	5.2896	0.365	131.885	
10(9, 1) - 11(8, 4)		251240.641(243)	5.5957	0.140	94.308	
10(9, 2) - 11(8, 3)		251240.641(243)	5.5957	0.140	94.308	
7(3, 5) - 6(2, 4)		251301.670(32)	4.1142	3.019	15.823	
15(1,15) - 14(0,14)		251566.770(115)	3.8149	12.389	59.444	
18(4,15) - 18(2,16)		252210.840(817)	9.0862	0.077	105.681	
14(2,12) - 13(2,11)		252303.820(78)	6.7276	13.726	57.682	
4(4, 1) - 3(3, 0)		252951.119(18)	3.8213	3.486	11.350	
4(4, 0) - 3(3, 1)		252952.061(18)	3.8213	3.486	11.350	
7(3, 4) - 6(2, 5)		254383.980(33)	4.1052	2.971	15.726	
8(2, 6) - 7(0, 7)		256708.301(35)	9.1598	0.028	16.160	
16(1,15) - 15(2,14)		257061.420(110)	4.0166	7.769	72.960	
17(4,14) - 17(2,15)		258362.641(642)	9.1396	0.060	94.910	
15(2,14) - 14(2,13)		258582.279(130)	6.6951	14.691	64.334	
3(3, 0) - 2(1, 1)		259833.881(22)	10.6662	0.000	2.683	
13(2,12) - 12(1,11)		262154.828(93)	4.0382	5.703	47.525	
15(9, 7) - 14(9, 6)		262645.879(864)	6.8595	9.601	131.885	
15(9, 6) - 14(9, 5)		262645.879(864)	6.8595	9.601	131.885	
15(8, 8) - 14(8, 7)		262711.969(679)	6.8107	10.735	117.086	
15(8, 7) - 14(8, 6)		262711.969(679)	6.8107	10.735	117.086	
15(7, 9) - 14(7, 8)		262817.469(525)	6.7715	11.735	104.030	
15(7, 8) - 14(7, 7)		262817.480(525)	6.7715	11.735	104.030	
15(6,10) - 14(6, 9)		262991.109(398)	6.7397	12.601	92.720	
15(6, 9) - 14(6, 8)		262991.789(398)	6.7397	12.601	92.720	
15(3,13) - 14(3,12)		263060.559(157)	6.6817	14.389	69.268	
15(1,14) - 14(1,13)		263216.031(118)	6.6685	14.806	63.432	
15(5,11) - 14(5,10)		263286.441(295)	6.7137	13.334	83.164	
15(5,10) - 14(5, 9)		263310.711(296)	6.7135	13.334	83.165	
3(3, 1) - 2(1, 2)		263479.070(22)	10.6783	0.000	2.561	
15(4,12) - 14(4,11)		263672.109(214)	6.6927	13.933	75.372	
15(4,11) - 14(4,10)		264163.020(215)	6.6903	13.933	75.395	
16(0,16) - 15(1,15)		264662.340(152)	3.7421	13.392	67.835	
16(4,13) - 16(2,14)		264853.422(492)	9.1952	0.046	84.718	
16(1,16) - 15(1,15)		265773.898(159)	6.6522	15.899	67.835	
16(0,16) - 15(0,15)		266202.000(159)	6.6500	15.902	67.784	
18(12, 6) - 19(11, 9)		267067.180(907)	5.0297	0.754	216.335	
18(12, 7) - 19(11, 8)		267067.180(907)	5.0297	0.754	216.335	
8(3, 6) - 7(2, 5)		267294.660(39)	4.0663	3.175	19.968	
16(1,16) - 15(0,15)		267313.559(165)	3.7286	13.410	67.784	
15(3,12) - 14(3,11)		267456.609(149)	6.6597	14.403	69.602	
15(11, 4) - 16(10, 7)		267693.578(602)	5.1461	0.480	166.527	
15(11, 5) - 16(10, 6)		267693.578(602)	5.1461	0.480	166.527	
12(10, 3) - 13(9, 4)		268265.750(398)	5.3575	0.236	123.709	
12(10, 2) - 13(9, 5)		268265.750(398)	5.3575	0.236	123.709	
9(9, 0) - 10(8, 3)		268777.680(265)	5.8999	0.051	87.884	
9(9, 1) - 10(8, 2)		268777.680(265)	5.8999	0.051	87.884	
22(3,19) - 21(4,18)		269285.309(203)	4.3587	4.192	149.321	
9(2, 7) - 8(1, 8)		270177.320(38)	4.4982	1.271	21.078	
15(2,13) - 14(2,12)		270237.211(115)	6.6362	14.740	66.098	
5(4, 2) - 4(3, 1)		270443.988(23)	3.8126	3.557	13.686	
5(4, 1) - 4(3, 2)		270450.602(23)	3.8125	3.557	13.686	
15(4,12) - 15(2,13)		271478.602(367)	9.2533	0.035	75.112	
8(3, 5) - 7(2, 6)		272820.809(41)	4.0528	3.080	19.798	
14(2,13) - 13(1,12)		273827.770(130)	3.9591	6.448	55.201	
16(2,15) - 15(2,14)		275321.211(187)	6.6117	15.700	72.960	
19(2,17) - 18(3,16)		275362.660(158)	4.1542	5.441	107.837	
4(3, 1) - 3(1, 2)		275611.930(23)	10.2648	0.001	4.493	
17(1,16) - 16(2,15)		277382.000(177)	3.8877	8.825	82.144	
14(4,11) - 14(2,12)		278043.711(266)	9.3144	0.027	66.098	
16(1,15) - 15(1,14)		279496.969(175)	6.5896	15.789	72.211	
16(8, 9) - 15(8, 8)		280264.941(877)	6.7051	12.001	125.849	
16(8, 8) - 15(8, 7)		280264.941(877)	6.7051	12.001	125.849	

TABLE 7. The microwave spectrum of ground state *trans*-$^{12}CH_3{}^{12}CH_2{}^{16}OH$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log *A*	Line strength	Energy lower state	Ref.
16(7,10) - 15(7, 9)		280394.859(686)	6.6719	12.939	112.796	
16(7, 9) - 15(7, 8)		280394.891(686)	6.6719	12.939	112.796	
16(3,14) - 15(3,13)		280445.910(223)	6.5954	15.423	78.043	
16(6,11) - 15(6,10)		280607.301(527)	6.6444	13.751	101.492	
16(6,10) - 15(6, 9)		280608.738(527)	6.6444	13.751	101.492	
9(2, 7) - 8(0, 8)		280925.391(42)	9.0362	0.032	20.719	
16(5,12) - 15(5,11)		280962.359(398)	6.6216	14.439	91.947	
16(5,11) - 15(5,10)		281006.051(398)	6.6214	14.439	91.948	
17(0,17) - 16(1,16)		281280.289(223)	3.6563	14.417	76.701	
16(4,13) - 15(4,12)		281368.520(294)	6.6032	14.999	84.167	
17(1,17) - 16(1,16)		282077.102(229)	6.5737	16.899	76.701	
16(4,12) - 15(4,11)		282127.648(295)	6.5997	14.999	84.207	
17(0,17) - 16(0,16)		282391.859(229)	6.5721	16.901	76.664	
9(3, 7) - 8(2, 6)		282613.910(46)	4.0211	3.332	24.723	
4(3, 2) - 3(1, 3)		282896.520(23)	10.2913	0.001	4.249	
17(1,17) - 16(0,16)		283188.660(236)	3.6471	14.429	76.664	
13(4,10) - 13(2,11)		284366.828(188)	9.3791	0.020	57.682	
18(6,12) - 18(5,13)		284623.551(880)	3.8629	9.142	121.844	
17(12, 6) - 18(11, 7)		284626.102(959)	5.0238	0.597	205.239	
17(12, 5) - 18(11, 8)		284626.102(959)	5.0238	0.597	205.239	
18(6,13) - 18(5,14)		284906.770(884)	3.8617	9.140	121.834	
17(6,11) - 17(5,12)		285230.898(686)	3.8678	8.496	111.286	
14(11, 4) - 15(10, 5)		285244.590(642)	5.1823	0.341	157.183	
14(11, 3) - 15(10, 6)		285244.590(642)	5.1823	0.341	157.183	
17(6,12) - 17(5,13)		285393.520(688)	3.8672	8.495	111.281	
15(2,14) - 14(1,13)		285651.578(183)	3.8807	7.272	63.432	
16(6,10) - 16(5,11)		285723.000(526)	3.8742	7.854	101.322	
11(10, 1) - 12(9, 4)		285805.840(428)	5.5049	0.128	116.118	
11(10, 2) - 12(9, 3)		285805.840(428)	5.5049	0.128	116.118	
16(6,11) - 16(5,12)		285812.922(528)	3.8738	7.853	101.318	
16(3,13) - 15(3,12)		286069.230(209)	6.5689	15.445	78.524	
15(6, 9) - 15(5,10)		286120.309(397)	3.8821	7.215	91.948	
15(6,10) - 15(5,11)		286167.980(398)	3.8819	7.214	91.947	
14(6, 8) - 14(5, 9)		286439.230(295)	3.8919	6.576	83.165	
14(6, 9) - 14(5,10)		286463.309(295)	3.8918	6.576	83.164	
13(6, 7) - 13(5, 8)		286693.020(215)	3.9042	5.935	74.971	
13(6, 8) - 13(5, 9)		286704.520(215)	3.9042	5.935	74.971	
12(6, 6) - 12(5, 7)		286892.590(155)	3.9199	5.290	67.366	
12(6, 7) - 12(5, 8)		286897.738(155)	3.9199	5.290	67.366	
11(6, 5) - 11(5, 6)		287047.090(112)	3.9403	4.635	60.348	
11(6, 6) - 11(5, 7)		287049.219(112)	3.9403	4.635	60.348	
10(6, 4) - 10(5, 5)		287164.309(81)	3.9679	3.967	53.918	
10(6, 5) - 10(5, 6)		287165.109(81)	3.9679	3.967	53.918	
9(6, 3) - 9(5, 4)		287250.969(61)	4.0069	3.278	48.073	
9(6, 4) - 9(5, 5)		287251.238(61)	4.0069	3.278	48.073	
8(6, 2) - 8(5, 3)		287312.961(49)	4.0661	2.558	42.815	
8(6, 3) - 8(5, 4)		287313.031(49)	4.0661	2.558	42.815	
7(6, 1) - 7(5, 2)		287355.410(43)	4.1663	1.791	38.142	
7(6, 2) - 7(5, 3)		287355.430(43)	4.1663	1.791	38.142	
6(6, 1) - 6(5, 2)		287382.840(41)	4.3782	0.953	34.054	
6(6, 0) - 6(5, 1)		287382.840(41)	4.3782	0.953	34.054	
3(3, 1) - 2(0, 2)		287847.090(25)	7.6737	0.000	1.748	
6(4, 3) - 5(3, 2)		287918.031(30)	3.7897	3.672	16.607	
6(4, 2) - 5(3, 3)		287944.559(30)	3.7897	3.672	16.607	
16(2,14) - 15(2,13)		287993.711(171)	6.5517	15.748	75.112	
12(4, 9) - 12(2,10)		290281.441(132)	9.4487	0.015	49.869	
5(3, 2) - 4(1, 3)		290910.602(27)	9.9793	0.002	6.904	
9(3, 6) - 8(2, 7)		291738.121(49)	4.0027	3.159	24.446	
17(2,16) - 16(2,15)		291988.961(266)	6.5336	16.706	82.144	
11(4, 8) - 11(2, 9)		295641.012(94)	9.5249	0.011	42.664	
17(1,16) - 16(1,15)		295641.781(255)	6.5157	16.773	81.534	
23(3,20) - 22(4,19)		296716.559(313)	4.2048	4.665	162.235	

TABLE 7. The microwave spectrum of ground state *trans*-$^{12}CH_3{}^{12}CH_2{}^{16}OH$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	–log *A*	Line strength	Energy lower state	Ref.
18(1,17) - 17(2,16)		297089.262(272)	3.7722	9.905	91.883	
10(3, 8) - 9(2, 7)		297167.199(55)	3.9784	3.494	30.090	
16(2,15) - 15(1,14)		297756.762(254)	3.8034	8.168	72.211	
17(3,15) - 16(3,14)		297764.512(311)	6.5148	16.451	87.397	
18(0,18) - 17(1,17)		297797.281(318)	3.5764	15.438	86.110	
17(7,11) - 16(7,10)		297983.199(882)	6.5802	14.119	122.149	
17(7,10) - 16(7, 9)		297983.270(882)	6.5802	14.119	122.149	
17(6,12) - 16(6,11)		298239.711(687)	6.5562	14.884	110.852	
17(6,11) - 16(6,10)		298242.559(687)	6.5562	14.884	110.852	
18(1,18) - 17(1,17)		298364.961(325)	6.4997	17.899	86.110	
18(0,18) - 17(0,17)		298594.090(325)	6.4986	17.901	86.083	
10(2, 8) - 9(1, 9)		298608.340(43)	4.4716	1.106	26.110	
17(5,13) - 16(5,12)		298659.109(526)	6.5359	15.530	101.318	
17(5,12) - 16(5,11)		298734.660(528)	6.5356	15.530	101.322	
17(4,14) - 16(4,13)		299062.551(398)	6.5197	16.057	93.553	
18(1,18) - 17(0,17)		299161.762(332)	3.5702	15.446	86.083	

TABLE 8. Rotational constants for isotopic forms of *gauche*-ethanol [80A]. Values in megahertz

Parameter	CH_3CH_2OH	CH_3CH_2OD	*s*–CH_2DCH_2OH	*a*–CH_2DCH_2OH	*a*–CH_2DCH
A+	34 015.81	31 765.0	33 466.3	31 145.58	28 989.79
B+	9 188.637	8 897.06	8 483.52	8 807.33	8 550.29
C+	8 099.983	7 833.64	7 532.63	7 768.23	7 507.13
A–	34 331.86	31 687.1	33 515.4	30 951.84	29 017.79
B–	9 194.421	8 894.40	8 490.00	8 795.96	8 503.69
C–	8 100.850	7 833.96	7 535.79	7 783.41	7 542.14
Δ	96 739.27	17 096.8	97 273.0		
|*Dg*+–|	25.24	20.6			
|*Eg*+–|	159.00	235.2			

TABLE 9. Observed rotational transitions of *gauche*-ethanol in the ground vibrational state [80A]

Transition		Observed frequency[a] (MHz)	Transition		Observed frequency[a] (MHz)
$1_{01} - 0_{00}$	+	17 288.41	$4_{22}(+) - 4_{14}(-)$		15 063.96
	−	17 295.79			
$2_{12} - 1_{11}$	+	33 487.51	$4_{23}(+) - 4_{13}(-)$		26 501.78
	−	33 508.45			
$2_{02} - 1_{01}$	+	34 541.53	$5_{24}(+) - 5_{14}(-)$		29 255.85
	−	34 555.18			
$2_{11} - 1_{10}$	+	35 663.88	$6_{25}(+) - 6_{15}(-)$		32 570.91
	−	35 694.54			
$3_{13} - 2_{12}$	+	50 209.14	$7_{26}(+) - 7_{16}(-)$		36 566.19
	−	50 244.59			
$3_{03} - 2_{02}$	+	51 724.33	$3_{22}(-) - 3_{30}(+)$		28 912.36
	−	51 742.14			
$3_{22} - 2_{21}$	+	51 847.75	$3_{21}(-) - 3_{31}(+)$		28 737.60
	−	51 854.64			
$1_{10}(-) - 2_{20}(+)$		13 111.57	$4_{23}(-) - 4_{31}(+)$		29 067.89
$1_{11}(-) - 2_{21}(+)$		14 169.92	$4_{22}(-) - 4_{32}(+)$		28 543.07
$2_{11}(-) - 1_{01}(+)$		35 166.81	$5_{24}(-) - 5_{32}(+)$	*E*	29 345.37
				A	29 345.50
$2_{11}(-) - 3_{21}(+)$		29 406.89	$5_{23}(-) - 5_{33}(+)$	*E*	28 120.17
				A	28 120.31
$2_{12}(-) - 3_{22}(+)$		32 509.18	$6_{25}(-) - 6_{33}(+)$	*E*	29 804.49
				A	29 804.61
$3_{12}(+) - 2_{02}(-)$		16 249.49	$6_{24}(-) - 6_{34}(+)$	*E*	27 359.73
				A	27 359.86
$2_{20}(+) - 2_{12}(-)$		19 302.93	$7_{26}(-) - 7_{34}(+)$	*E*	30 521.53
				A	30 521.66
$2_{21}(+) - 2_{11}(-)$		22 618.68	$7_{25}(0) - 7_{35}(+)$	*E*	26 148.19
				A	26 148.33
$3_{21}(+) - 3_{12}(-)$		17 557.39	$8_{27}(-) - 8_{35}(+)$	*E*	31 592.19
				A	31 592.33
$3_{22}(+) - 3_{12}(-)$		24 288.62	$8_{26}(-) - 8_{36}(+)$	*E*	24 383.18
				A	24 383.32

[a] Estimated measurement uncertainty is 0.01–0.05 MHz.

3.2. CH_3CH_2OH References

[62A] J. Michielsen-Effinger, Bull. Acad. Roy. Belg. **48**, 438 (1962). "Spectre de Rotation de l'alcool Éthylique en Microondes."

[63A] L. M. Imanov and Ch. O. Kadzhar, Opt. Spectrosc. **14**, 156 (1963). "Superhigh-Frequency Spectrum and Dipole Moment of the Ethyl Alcohol Molecule."

[64A] J. Michielsen-Effinger, Ann. Soc. Sci. Brux. **78**, 223 (1964). "Isomeres de Rotation de l'alcool Éthylique Spectre microonde de CH_3CD_2OH."

[64B] J. Michielsen-Effinger, Bull. Acad. Roy. Belg. **50**, 645 (1964). "Spectre Microonde et Mouvements de Rotation Interne de l'alcool Éthylique."

[64C] L. M. Imanov, A. A. Abdurkhmanov, and R. A. Ragimova, Opt. Spectrosc. **17**, 162 (1964). "The Microwave Spectrum and Effective Rotational Constants of the Molecule CD_3CH_2OH."

[65A] J. Michielsen-Effinger, Ann. Soc. Sci. Brux. **79**, 253 (1965). "Analyse du Spectre de Rotation dans la Region Centimetrique de la Molecule d'alcool Éthylique."

65B] L. M. Imanov, Ch. O. Kadzhar, and I. D. Isaev, Opt. Spectrosc. **18**, 194 (1965). "Microwave Rotational Spectrum of the CH_3CH_2OH and CH_3CHDOH Molecules."

[65C] L. M. Imanov, Ch. O. Kadzhar, and I. D. Isaev, Opt. Spectrosc. **18**, 508 (1965). "Microwave Rotational Spectrum of the Molecules CD_3CD_2OD and CD_3CD_2OH."

[67A] J. Michielsen-Effinger, Bull. Acad. Roy. Belg. **53**, 226 (1967). "Spectre de Rotation en Microondes de la Molecule C_2H_5OH."

[67B] L. M. Imanov, Ch. O. Kadzhar, and I. D. Isaev, Opt. Spectrosc. **22**, 454 (1967). "Microwave Spectrum of CH_3CH_2OD and $CH_3CH_2{}^{18}OH$ Molecules."

[67C] J. P. Culot, Ann. Soc. Sci. Brux. **81**, 272 (1967). "Spectre Microonde de la Molécule d'alcool Éthylique."

[67D] J. P. Culot, Bull. Belg. Phys. Soc., Ser. V. 324 (1967). "Spectre Microonde de l'isotope C_2D_5OH de l'alcool Éthylique"

[68A] M. Takano, Y. Sasada, and T. Satoh, J. Mol. Spectrosc. **26**, 157 (1968). "Microwave Spectrum of Ethyl Alcohol—The *trans* Rotamer."

[68B] Ch. O. Kadzhar, I. D. Isaev, and L. M. Imanov, J. Struct. Chem. **9**, 375 (1968). "Radio-Spectroscopic Structure Determination of the Ethanol Molecule."

[68C] L. M. Imanov, A. M. Abdurakhmanov, and R. A. Ragimova, Opt. Spectrosc. Suppl. **3**, 169 (1968). "Microwave Spectrum of the CH_3CD_2OH and CH_3CH_2OD Molecules."

[69A] J. Michielsen-Effinger, J. Phys. **30**, 336 (1969). "Spectre de Rotation en Microondes de la Molécule d'alcool Éthylique CH_3CH_2OH."
[69B] J. P. Culot, Ann. Soc. Sci. Brux. **83**, 65 (1969). "Contribution a l'etude de la Molécule d'alcool Éthylique en Spectroscopie Hertzienne."
[71A] Y. Sasada, M. Takana, and T. Satoh, J. Mol. Spectrosc. **38**, 33 (1971). "Microwave Spectrum and Rotational Isomerism in 1-d_1, Ethyl Alcohol."
[71B] J. P. Culot, Ph.D. Thesis, Université Catholique de Louvain, Belgium, 1971.
[72A] J. P. Culot, Université Catholique de Louvain, Belgium, unpublished work, 1972.
[72B] R. K. Kakar and P. J. Seibt, J. Chem. Phys. **57**, 4060 (1972). "Microwave Spectrum of *gauche*-Ethyl Alcohol."
[72C] P. J. Seibt, J. Chem. Phys. **57**, 1343 (1972). "Microwave Double Resonance Studies of Collision-Induced Transitions in C_2H_5OH, CH_2DCH_2OH and C_2H_5OH—He*."
[74A] I. Ya. Zemlyanukhina and L. M. Sverdlov, Opt. Spectrosc. **36**, 391 (1974). "Centrifugal Stretching Constants of the Ethanol Molecule."
[75A] B. Zuckerman, B. E. Turner, D. R. Johnson, F. O. Clark, F. J. Lovas, N. Fourikis, P. Palmer, M. Morris, A. E. Lilley, J. A. Ball, C. A. Gottlieb, M. M. Litvak, and H. Penfield, Astrophys. J. (Letters) **196**, L99 (1975). "Detection of Interstellar *trans*-Ethyl Alcohol."
[76A] F. J. Lovas and R. Pearson, Jr., unpublished measurements, 1976.
[79A] E. R. Cohen, private communication, 1979.
[80A] R. K. Kakar and C. R. Quade, J. Chem. Phys. **76**, 4300 (1980). "Microwave Rotational Spectrum and Internal Rotation in *gauche*-Ethyl Alcohol."

4. Rotational Analysis and Derived Constants for Propionitrile

The rotational spectrum of propionitrile(ethyl cyanide, C_2H_5CN) has been thoroughly measured and analyzed to derive fundamental molecular constants. The current analysis, aimed at providing accurate prediction of the unobserved transitions, does not treat the effects of internal rotation and hyperfine structure which have been resolved for some of the measured transitions. This approximation was employed to limit the extent of the tables here to the data most applicable to astronomical observations. To date, C_2H_5CN has been detected only toward the Orion A and Sagittarius B2 molecular clouds whose intrinsic Doppler broadened line widths preclude resolving splittings due to these effects. However, the molcular parameters for internal rotation and hyperfine interactions derived by other workers are presented here for completeness. The current analysis paralleled that described in section 3.

Due to very limited laboratory data, as well as a perceived lack of significance to astronomical observations, the less abundant isotopic forms (^{13}C, ^{15}N, and deuterated) are not treated here. For completeness, however, the derived molecular constants and references are presented for all isotopic species reported in the literature.

4.1. Propionitrile Spectral Tables

The derived molecular constants are shown in tables 10–12. The measured transition frequencies for only the most abundant form, $^{12}C_2H_5{}^{12}C^{14}N$, are presented in table 13. In some cases these values are the hypothetical rotational transition frequencies which were calculated from the analysis of internal rotation or hyperfine splittings by the authors of the references cited.

Table 13 also contains the statistical analysis of $^{12}C_2H_5{}^{12}C^{14}N$ over the range from 1 GHz to 300 GHz for rotational levels up to $J=30$, listed according to increasing transition frequency. For each spectral line, the first column of table 13 contains the upper state and lower state quantum numbers in the $J(K_p,K_o)$ for an asymmetric rotor. The second column gives the measured (or hypothetical) rotational transition frequency and, in parentheses, the experimentally estimated uncertainty in MHz. References to these values are shown in the last column. The third column contains the calculated frequency and estimated uncertainty in MHz. These calculated uncertainties, representing ~95 percent confidence levels, are twice the standard deviation obtained from the least-squares analysis. The Einstein A values are given in the form $-\log A$ in the fourth column. The line strengths are listed in column five and the rotational energy of the lower state is given in column six in units cm^{-1} rounded to three figures after the decimal.

TABLE 10. Rotational, centrifugal distortion, and internal rotation constants for the vibrational ground state of propionitrile ($^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$) from the present analysis

Parameter	Present work (MHz)		Burie et al. [78A] (MHz)
A''	27 663.6877(31)	A'	27 663.68273(221)
B''	4 714.14543(45)	B'	4 714.18782(36)
C''	4 235.04545(45)	C'	4 235.08521(36)
τ_1	0.1537084(202)	D'_J	3.008281(445) $\times 10^{-3}$
τ_2	0.0117004(34)	D'_{JK}	−0.04726068(375)
τ_3 [b]	1.107(3)	D'_K	0.5477751(585)
τ_{aaaa}	−2.01354(35)	Δ_J	0.6857343 $\times 10^{-3}$
τ_{bbbb}	−0.01778302(223)	R_6	0.327961(363) $\times 10^{-4}$
τ_{cccc}	−0.00680860(241)	H'_J	0.9340(163) $\times 10^{-8}$
H_J	0.1042(19) $\times 10^{-7}$	H'_{JK}	−0.11811(214) $\times 10^{-6}$
H_{JK}	−0.6404(992) $\times 10^{-7}$	H'_{KJ}	−1.54516(525) $\times 10^{-6}$
H_{KJ}	−0.1729(32) $\times 10^{-5}$	H'_K	30.823(285) $\times 10^{-6}$
H_K	0.3028(39) $\times 10^{-4}$	H'_5	0.35876(461) $\times 10^{-8}$
h_J	0.7597(130) $\times 10^{-8}$	H'_6	0.2201(109) $\times 10^{-8}$
h_{JK}	0.1268(135) $\times 10^{-6}$	H'_{10}	0.4149(516) $\times 10^{-9}$
h_K	0.369(63) $\times 10^{-5}$		
Derived constants		Internal rotation parameters Boucher et al. [80A]	
A'	27 663.6816(31)	s	79.72
B'	4 714.21373(44)	V_3	3007±90 cal/mol
C'	4 235.06010(45)	Θ	48.65°
τ_{bbcc}	−0.012296(2)	I_r	3.167 Å
τ_{ccaa}	0.13671(6)		
τ_{aabb}	0.02929(6)		

[a] Uncertainties in parentheses are one standard deviation and refer to the last corresponding significant figures. Fit was weighted by the inverse square of the measured uncertainty.
[b] Value fixed by setting $R_6=0$. See discussion by Kirchhoff [2] in section 2.4.

TABLE 11. Rotational constants for isotopically substituted forms of propionitrile in the ground and vibrationally excited states

Isotopic species	(v_1,v_2)[a]	A (MHz)	B (MHz)	C (MHz)	Ref.
Ground state					
$^{13}CH_3CH_2CN$	(0,0)	27 342.259(50)	4 598.057(27)	4 133.767(20)	[74A]
$CH_3{}^{13}CH_2CN$	(0,0)	27 045.499(51)	4 697.959(28)	4 207.070(20)	[74A]
$CH_3CH_2{}^{13}CN$	(0,0)	27 635.046(57)	4 689.914(31)	4 214.797(23)	[74A]
$CH_3CH_2C^{15}N$	(0,0)	27 541.550(49)	4 574.825(27)	4 119.468(19)	[74A]
s-CH_2DCH_2CN	(0,0)	27 650.897(49)	4 425.142(27)	4 000.821(19)	[73A]
a-CH_2DCH_2CN	(0,0)	25 022.652(41)	4 583.476(22)	4 110.264(16)	[73A]
CH_3CD_2CN	(0,0)	21 942.980(27)	4 600.231(15)	4 087.830(14)	[73A]
CD_3CH_2CN	(0,0)	22 865.104(53)	4 204.788(29)	3 800.247(21)	[74A]
CD_3CHDCN	(0,0)	(20 492.005)[b]	4 169.499(62)	3 736.824(62)	[73A]
CD_3CD_2CN	(0,0)	18 584.64(53)	4 126.94(8)	3 682.72(7)	[75A]
Vibrational States					
CH_3CH_2CN	(1,0)	29 794.20(148)	4 713.81(38)	4 239.66(27)	[73A]
	(0,1)	25 656.24(33)	4 717.47(9)	4 296.95(6)	[73A]
$CH_3CH_2C^{15}N$	(1,0)	29 161.55(48)	4 573.59(12)	4 121.18(8)	[76A]
	(0,1)	26 044.19(11)	4 582.83(3)	4 128.53(2)	[76A]
CH_3CD_2CN	(1,0)	23 021.49(7)	4 599.55(2)	4 088.84(1)	[76A]
	(0,1)	20 296.07(10)	4 607.78(3)	4 095.17(2)	[76A]
CD_3CD_2CN	(1,0)	–	4 121.73(21)	3 682.11(19)	[75A]
	(2,0)	–	4 117.03(10)	3 681.22(9)	[75A]
	(3,0)	–	4 112.33(16)	3 680.13(14)	[75A]
	(0,1)	–	4 142.12(15)	3 686.94(14)	[75A]
	(0,2)	–	4 157.07(13)	3 691.00(11)	[75A]
	(1,1)	–	4 135.69(21)	3 686.52(19)	[75A]

[a] Here v_1 represents the torsional state and v_2 is the CCN in—plane vibration.
[b] Calculated value.

TABLE 12. Nuclear quadrupole coupling constants and dipole moments of propionitrile

Isotopic species	χ_{aa}	χ_{bb}	χ_{cc}	Ref.
Nuclear quadrupole coupling constants (MHz)				
CH_3CH_2CN	-3.309(33)	1.265(13)	2.044(20)	[69A]
$^{13}CH_3CH_2CN$	-3.290(11)	1.150(16)	2.059(18)	[74A]
$CH_3{}^{13}CH_2CN$	-3.377(21)	1.334(17)	2.043(19)	[74A]
$CH_3CH_2{}^{13}CN$	-3.349(11)	1.297(10)	2.052(12)	[74A]
CH_3CD_2CN	-3.449(16)	1.399(15)	2.050(17)	[73A]
CD_3CH_2CN	-3.209(17)	1.150(16)	2.059(18)	[74A]
s-CH_2DCH_2CN	-3.326(15)	1.319(17)	2.007(16)	[73A]
a-CH_2DCH_2CN	-3.290(19)	1.180(18)	2.110(22)	[73A]
CD_3CD_2CN	-3.213	1.168	2.045	[75A]
Dipole moments (debye)	μ_a	μ_b		Ref.
CH_3CH_2CN	3.85(1)	1.23(1)		[74A]
CH_3CD_2CN	3.92(2)	1.19(1)		[74A]
CD_3CH_2CN	3.84(1)	1.37(1)		[74A]

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log A	Line strength	Energy lower state	Ref.
27(6,22) - 28(5,23)		1013.355(51)	11.8332	4.358	140.795	
23(4,19) - 23(4,20)		1192.518(5)	11.0888	1.311	94.947	
15(3,12) - 15(3,13)		1286.951(4)	10.8718	1.134	42.838	
27(6,21) - 28(5,24)		1379.528(51)	11.4329	4.357	140.783	
2(1, 1) - 2(1, 2)		1437.259(1)	10.0688	0.833	1.645	
8(2, 6) - 8(2, 7)		1534.182(3)	10.4675	0.931	13.833	
24(4,20) - 24(4,21)		1649.526(6)	10.7055	1.248	102.140	
8(2, 6) - 9(1, 9)		1676.915(22)	11.2671	1.108	13.829	
16(3,13) - 16(3,14)		1862.500(5)	10.4478	1.057	47.625	
25(4,21) - 25(4,22)		2246.942(8)	10.3414	1.189	109.633	
12(3, 9) - 13(2,12)		2368.943(23)	10.7377	1.952	30.205	
9(2, 7) - 9(2, 8)		2390.725(4)	9.9898	0.826	16.515	
17(3,14) - 17(3,15)		2629.306(7)	10.0537	0.987	52.712	
3(1, 2) - 3(1, 3)		2874.347(2)	9.4668	0.583	2.516	
26(4,22) - 26(4,23)		3016.819(10)	9.9952	1.133	117.427	
18(3,15) - 17(4,14)		3258.753(23)	10.3350	2.815	58.111	
11(3, 9) - 12(2,10)		3367.851(22)	10.2653	1.852	26.571	
10(2, 8) - 10(2, 9)		3546.433(6)	9.5675	0.739	19.494	
18(3,15) - 18(3,16)		3629.156(9)	9.6868	0.924	58.099	
10(1,10) - 9(2, 7)		3881.495(25)	10.2417	1.168	16.595	
27(4,23) - 27(4,24)		3995.363(13)	9.6664	1.079	125.521	
3(0, 3) - 2(1, 2)		4340.242(6)	9.6650	1.052	1.645	
4(1, 3) - 4(1, 4)		4789.976(4)	9.0231	0.450	3.678	
19(3,16) - 19(3,17)		4906.908(11)	9.3452	0.865	63.784	
11(2, 9) - 11(2,10)		5050.368(8)	9.1915	0.666	22.769	
1(1, 1) - 2(0, 2)		5058.016(6)	9.4071	0.516	0.895	
28(4,24) - 28(4,25)		5222.566(15)	9.3541	1.028	133.916	
26(2,24) - 27(1,27)		5294.701(61)	10.8538	0.287	109.629	
25(1,25) - 24(2,22)		5354.081(53)	10.7277	0.350	94.265	
14(2,13) - 13(3,10)		5571.482(24)	9.6523	2.121	34.180	
20(3,17) - 20(3,18)		6509.084(14)	9.0271	0.810	69.767	
16(4,13) - 17(3,14)		6706.646(23)	9.3780	2.599	52.800	
29(4,25) - 29(4,26)		6741.537(18)	9.0578	0.978	142.611	
12(2,10) - 12(2,11)		6947.444(11)	8.8551	0.604	26.340	
5(1, 4) - 5(1, 5)		7183.297(6)	8.6709	0.367	5.130	
13(2,11) - 12(3,10)		7261.272(23)	9.2835	2.087	30.273	
7(2, 5) - 8(1, 8)		7751.937(20)	9.2563	1.014	11.221	
29(5,25) - 28(6,22)		7938.542(51)	9.1668	4.568	149.208	
19(3,17) - 18(4,14)		8370.572(23)	9.1027	2.983	63.504	
29(5,24) - 28(6,23)		8453.209(50)	9.0847	4.570	149.208	
21(3,18) - 21(3,19)		8482.072(16)	8.7310	0.759	76.049	
30(4,26) - 30(4,27)		8597.465(21)	8.7772	0.930	151.605	
24(4,21) - 23(5,18)		8691.149(30)	9.0496	3.785	101.850	
21(5,17) - 22(4,18)		8866.070(30)	9.0165	3.370	88.084	
11(1,11) - 10(2, 8)		8870.619(27)	9.1953	1.193	19.612	
1(0, 1) - 0(0, 0)	8949.26(5)	8949.262(1)	7.3849	1.000	0.000	[74A]
13(2,11) - 13(2,12)	9276.24(5)	9276.249(14)	8.5527	0.549	30.205	[78A]
16(4,12) - 17(3,15)		9407.153(23)	8.9407	2.579	52.712	
21(5,16) - 22(4,19)		9735.688(31)	8.8953	3.365	88.056	
24(1,24) - 23(2,21)		9947.476(50)	9.8591	0.389	86.944	
6(1, 5) - 6(1, 6)		10052.712(9)	8.3786	0.310	6.871	
8(1, 7) - 7(2, 6)		10381.690(17)	8.7563	1.513	11.448	
24(4,20) - 23(5,19)		10393.246(30)	8.8155	3.795	101.848	
26(6,21) - 27(5,22)		10413.499(52)	8.8078	4.145	132.402	
11(3, 8) - 12(2,11)		10528.569(23)	8.8017	1.767	26.340	
26(6,20) - 27(5,23)		10670.520(52)	8.7762	4.143	132.394	
22(3,19) - 22(3,20)		10870.103(19)	8.4558	0.712	82.629	
5(2, 4) - 6(1, 5)		10932.312(16)	8.7183	0.914	7.206	
27(2,25) - 28(1,28)		11244.095(67)	9.9250	0.263	117.645	
14(2,12) - 14(2,13)		12067.491(17)	8.2803	0.502	34.366	
12(1,12) - 11(2, 9)		13240.384(30)	8.7123	1.186	22.937	
15(2,14) - 14(3,11)		13252.088(24)	8.5227	2.270	38.378	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log A	Line strength	Energy lower state	Ref.
7(1, 6) - 7(1, 7)		13395.525(11)	8.1287	0.269	8.901	
19(3,16) - 18(4,15)		13456.455(23)	8.4775	3.030	63.499	
10(3, 8) - 11(2, 9)		13698.344(22)	8.4566	1.621	22.937	
23(3,20) - 23(3,21)		13713.170(22)	8.2002	0.667	89.506	
4(0, 4) - 3(1, 3)	13937.93(5)	13937.862(7)	8.0674	1.616	2.516	[78A]
23(1,23) - 22(2,20)		13988.981(49)	9.3493	0.435	79.923	
6(2, 4) - 7(1, 7)		14291.001(19)	8.4556	0.886	8.901	
15(2,13) - 15(2,14)		15343.255(20)	8.0340	0.460	38.820	
15(4,12) - 16(3,13)		16471.883(23)	8.2186	2.380	47.687	
13(1,13) - 12(2,10)		16946.019(33)	8.4373	1.151	26.571	
24(3,21) - 24(3,22)		17045.159(24)	7.9632	0.625	96.679	
20(3,18) - 19(4,15)		17136.977(23)	8.1639	3.173	69.196	
8(1, 7) - 8(1, 8)		17207.524(14)	7.9102	0.238	11.221	
30(5,26) - 29(6,23)		17282.007(50)	8.1481	4.776	157.889	
2(1, 2) - 1(1, 1)	17419.56(5)	17419.559(3)	6.5629	1.500	1.064	[74A]
22(1,22) - 21(2,19)		17435.131(48)	8.9943	0.487	73.205	
28(2,26) - 29(1,29)		17534.218(73)	9.3968	0.242	125.944	
2(0, 2) - 1(0, 1)	17891.00(5)	17891.028(3)	6.4032	2.000	0.299	[74A]
25(4,22) - 24(5,19)		17901.868(31)	8.1026	3.988	109.036	
30(5,25) - 29(6,24)		17996.233(50)	8.0950	4.779	157.888	
14(2,12) - 13(3,11)		18202.331(23)	8.0697	2.327	34.161	
20(5,16) - 21(4,17)		18330.685(31)	8.0786	3.153	81.485	
15(4,11) - 16(3,14)		18377.269(24)	8.0783	2.368	47.625	
2(1, 1) - 1(1, 0)	18377.71(5)	18377.721(3)	6.4932	1.500	1.080	[74A]
10(3, 7) - 11(2,10)		18870.984(23)	8.0536	1.568	22.769	
20(5,15) - 21(4,18)		18936.603(31)	8.0366	3.150	81.465	
16(2,14) - 16(2,15)		19117.018(22)	7.8107	0.424	43.569	
25(6,20) - 26(5,21)		19755.775(52)	7.9803	3.928	124.311	
25(6,19) - 26(5,22)		19933.595(52)	7.9687	3.928	124.306	
14(1,14) - 13(2,11)		19950.401(36)	8.2777	1.094	30.515	
25(4,21) - 24(5,20)		20228.546(30)	7.9418	4.003	109.033	
21(1,21) - 20(2,18)		20246.669(48)	8.7297	0.547	66.791	
16(2,15) - 15(3,12)		20628.056(25)	7.9498	2.396	42.881	
25(3,22) - 25(3,23)		20892.402(26)	7.7435	0.586	104.149	
5(2, 3) - 6(1, 6)		21244.045(18)	7.9510	0.729	6.871	
4(2, 3) - 5(1, 4)	21270.96(5)	21270.974(15)	7.9156	0.645	5.369	[74A]
9(1, 8) - 8(2, 7)	21339.85(5)	21339.775(18)	7.7796	1.845	13.833	[78A]
9(1, 8) - 9(1, 9)	21482.60(5)	21482.509(17)	7.7160	0.214	13.829	[78A]
15(1,15) - 14(2,12)		22225.726(39)	8.1957	1.021	34.768	
20(1,20) - 19(2,17)		22388.826(47)	8.5277	0.615	60.684	
17(2,15) - 17(2,16)		23394.265(25)	7.6075	0.391	48.610	
1(1, 0) - 1(0, 1)	23428.14(5)	23428.141(5)	6.9461	1.500	0.299	[74A]
5(0, 5) - 4(1, 4)	23710.84(5)	23710.817(8)	7.3252	2.217	3.678	[74A]
9(3, 7) - 10(2, 8)		23751.409(22)	7.7626	1.391	19.612	
16(1,16) - 15(2,13)		23754.344(41)	8.1723	0.940	39.332	
19(1,19) - 18(2,16)		23831.731(46)	8.3750	0.689	54.883	
2(1, 1) - 2(0, 2)	23914.84(5)	23914.834(5)	6.9238	2.474	0.895	[74A]
20(3,17) - 19(4,16)		23918.817(23)	7.7202	3.242	69.187	
29(2,27) - 30(1,30)		24105.158(78)	9.0299	0.224	134.524	
17(1,17) - 16(2,14)		24528.767(44)	8.1973	0.854	44.206	
18(1,18) - 17(2,15)		24551.038(45)	8.2655	0.770	49.390	
3(1, 2) - 3(0, 3)	24658.73(5)	24658.700(6)	6.8908	3.409	1.790	[74A]
26(3,23) - 26(3,24)		25272.813(28)	7.5400	0.549	111.914	
4(1, 3) - 4(0, 4)	25676.18(5)	25676.154(6)	6.8475	4.290	2.981	[74A]
21(3,19) - 20(4,16)		25788.478(24)	7.6283	3.352	75.189	
14(4,11) - 15(3,12)		26067.605(24)	7.6339	2.159	42.881	
3(1, 3) - 2(1, 2)	26124.68(5)	26124.595(5)	5.9311	2.667	1.645	[74A]
10(1, 9) - 10(1,10)		26211.780(20)	7.5412	0.194	16.725	
3(0, 3) - 2(0, 2)	26817.80(5)	26817.817(5)	5.8459	2.999	0.895	[74A]
3(2, 2) - 2(2, 1)	26848.69(5)	26848.633(4)	6.0996	1.667	3.989	[74A]
3(2, 1) - 2(2, 0)	26878.23(5)	26878.306(4)	6.0982	1.667	3.990	[74A]
5(1, 4) - 5(0, 5)	26988.67(5)	26988.679(7)	6.7945	5.101	4.469	[74A]

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log A	Line strength	Energy lower state	Ref.
26(4,23) - 25(5,20)		27097.084(31)	7.5581	4.186	116.523	
9(3, 6) - 10(2, 9)		27363.848(22)	7.5877	1.361	19.494	
14(4,10) - 15(3,13)		27379.467(24)	7.5715	2.152	42.838	
3(1, 2) - 2(1, 1)	27561.61(5)	27561.683(5)	5.8614	2.667	1.693	[74A]
17(2,16) - 16(3,13)		27650.558(27)	7.5760	2.496	47.687	
19(5,15) - 20(4,16)		27707.860(31)	7.5499	2.935	75.189	
19(5,14) - 20(4,17)		28122.130(32)	7.5308	2.933	75.176	
18(2,16) - 18(2,17)		28173.422(27)	7.4219	0.363	53.943	
4(2, 2) - 5(1, 5)		28565.458(17)	7.6006	0.550	5.130	
6(1, 5) - 6(0, 6)	28622.29(5)	28622.276(8)	6.7326	5.828	6.251	[74A]
24(6,19) - 25(5,20)		29047.467(53)	7.4856	3.710	116.523	
24(6,18) - 25(5,21)		29168.606(53)	7.4802	3.710	116.519	
15(2,13) - 14(3,12)		29460.278(24)	7.4275	2.574	38.350	
27(3,24) - 27(3,25)		30195.644(29)	7.3515	0.516	119.974	
26(4,22) - 25(5,21)		30232.674(30)	7.4132	4.208	116.519	
29(7,23) - 30(6,24)		30304.213(83)	7.4286	4.486	166.870	
29(7,22) - 30(6,25)		30337.897(83)	7.4271	4.486	166.869	
7(1, 6) - 7(0, 7)	30606.46(5)	30606.530(9)	6.6627	6.460	8.327	[78A]
11(1,10) - 11(1,11)	31383.55(5)	31383.592(23)	7.3822	0.179	19.908	[78A]
3(2, 2) - 4(1, 3)	31388.43(5)	31388.426(15)	7.5115	0.396	3.838	[74A]
1(1, 1) - 0(0, 0)	31898.29(5)	31898.305(6)	6.7201	1.000	0.000	[74A]
10(1, 9) - 9(2, 8)	32484.04(5)	32484.000(18)	7.1986	2.203	16.515	[78A]
8(1, 7) - 8(0, 8)	32973.25(5)	32973.209(11)	6.5860	6.986	10.695	[78A]
19(2,17) - 19(2,18)		33446.863(29)	7.2518	0.338	59.568	
8(3, 6) - 9(2, 7)		33554.894(22)	7.3418	1.163	16.595	
6(0, 6) - 5(1, 5	33629.96(5)	33629.956(9)	6.8319	2.859	5.130	[74A]
18(2,17) - 17(3,14		34267.215(28)	7.3087	2.565	52.800	
22(3,20) - 21(4,17		34295.490(25)	7.2556	3.517	81.485	
21(3,18) - 20(4,17)		34676.809(23)	7.2296	3.453	75.176	
4(1, 4) - 3(1, 3)	34824.07(5)	34824.040(6)	5.5178	3.750	2.516	[74A]
13(4,10) - 14(3,11)		35522.064(25)	7.2469	1.937	38.378	
28(3,25) - 28(3,26)		35661.782(31)	7.1769	0.485	128.328	
4(0, 4) - 3(0, 3)	35722.20(5)	35722.215(6)	5.4567	3.998	1.790	[74A]
9(1, 8) - 9(0, 9)		35754.318(13)	6.5038	7.401	13.353	
4(2, 3) - 3(2, 2)	35792.07(5)	35792.069(6)	5.5789	3.000	4.885	[74A]
4(3, 2) - 3(3, 1)		35814.358(6)	5.8122	1.750	8.751	
4(3, 1) - 3(3, 0)		35814.789(6)	5.8122	1.750	8.751	
4(2, 2) - 3(2, 1)	35866.10(5)	35866.162(6)	5.5762	3.000	4.886	[74A]
8(3, 5) - 9(2, 8)		35978.685(22)	7.2572	1.147	16.515	
3(2, 1) - 4(1, 4)		36215.496(16)	7.3707	0.356	3.678	
27(4,24) - 26(5,21)		36263.474(32)	7.1751	4.377	124.311	
13(4, 9) - 14(3,12)		36400.877(25)	7.2160	1.933	38.350	
4(1, 3) - 3(1, 2)	36739.67(5)	36739.669(6)	5.4480	3.750	2.612	[74A]
12(1,11) - 12(1,12)		36982.617(25)	7.2363	0.166	23.379	
18(5,14) - 19(4,15)		37011.484(32)	7.1837	2.714	69.196	
18(5,13) - 19(4,16)		37288.929(32)	7.1742	2.713	69.187	
23(6,18) - 24(5,19)		38294.790(54)	7.1339	3.491	109.036	
23(6,17) - 24(5,20)		38375.953(54)	7.1312	3.491	109.033	
10(1, 9) - 10(0,10)		38979.683(15)	6.4173	7.705	16.299	
20(2,18) - 20(2,19)		39201.790(30)	7.0952	0.317	65.484	
28(7,22) - 29(6,23		39524.298(84)	7.0893	4.267	157.889	
28(7,21) - 29(6,24		39546.883(84)	7.0885	4.267	157.888	
2(1, 2) - 1(0, 1)	40368.59(5)	40368.603(7)	6.4590	1.500	0.299	[74A]
19(2,18) - 18(3,15)		40422.903(30)	7.1100	2.602	58.220	
27(4,23) - 26(5,22)		40432.814(31)	7.0302	4.410	124.306	
16(2,14) - 15(3,13)		41032.026(24)	6.9816	2.831	42.838	
2(2, 1) - 3(1, 2)		41279.461(15)	7.3674	0.173	2.612	
29(3,26) - 29(3,27)		41664.441(32)	7.0148	0.457	136.975	
23(3,21) - 22(4,18)		42624.527(27)	6.9730	3.668	88.094	
11(1,10) - 11(0,11)		42674.221(18)	6.3278	7.902	19.532	
13(1,12) - 13(1,13)		42989.424(28)	7.1014	0.156	27.137	
7(3, 5) - 8(2, 6)		43141.407(22)	7.0535	0.938	13.885	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log *A*	Line strength	Energy lower state	Ref.
5(1, 5) – 4(1, 4)		43516.200(8)	5.2074	4.800	3.678	
7(0, 7) – 6(1, 6)		43661.613(11)	6.4600	3.549	6.871	
11(1,10) – 10(2, 9)		43800.644(19)	6.7784	2.590	19.494	
2(2, 0) – 3(1, 3)		44161.230(16)	7.3066	0.163	2.516	
5(0, 5) – 4(0, 4)		44596.995(8)	5.1579	4.997	2.981	
7(3, 4) – 8(2, 7)		44690.640(22)	7.0114	0.929	13.833	
5(2, 4) – 4(2, 3)		44730.273(8)	5.2295	4.200	6.079	
5(4, 2) – 4(4, 1)		44768.916(7)	5.5963	1.800	15.357	
5(4, 1) – 4(4, 0)		44768.921(7)	5.5963	1.800	15.357	
5(3, 3) – 4(3, 2)		44773.875(7)	5.3463	3.200	9.946	
5(3, 2) – 4(3, 1)		44775.383(7)	5.3463	3.200	9.946	
12(4, 9) – 13(3,10)		44860.579(25)	6.9624	1.715	34.180	
5(2, 3) – 4(2, 2)		44878.106(8)	5.2252	4.200	6.082	
28(4,25) – 27(5,22)		45384.996(33)	6.8004	4.561	132.402	
21(2,19) – 21(2,20)		45420.884(30)	6.9504	0.298	71.690	
12(4, 8) – 13(3,11)		45431.301(26)	6.9466	1.712	34.161	
22(3,19) – 21(4,18)		45758.214(24)	6.8623	3.664	81.465	
5(1, 4) – 4(1, 3)		45909.520(8)	5.1377	4.799	3.838	
20(2,19) – 19(3,16)		46060.935(32)	6.9610	2.606	63.947	
17(5,13) – 18(4,14)		46253.314(33)	6.9062	2.493	63.504	
17(5,12) – 18(4,15)		46434.948(33)	6.9012	2.492	63.499	
12(1,11) – 12(0,12)		46855.223(20)	6.2367	8.004	23.050	
22(6,17) – 23(5,18)		47503.061(54)	6.8626	3.270	101.850	
22(6,16) – 23(5,19)		47556.473(54)	6.8612	3.270	101.848	
30(3,27) – 30(3,28)		48190.034(33)	6.8642	0.432	145.914	
3(1, 3) – 2(0, 2)		48602.170(8)	6.2361	2.010	0.895	
27(7,21) – 28(6,22)		48715.663(85)	6.8244	4.047	149.208	
27(7,20) – 28(6,23)		48730.583(85)	6.8240	4.047	149.208	
14(1,13) – 14(1,14)		49380.055(29)	6.9759	0.148	31.180	
24(3,22) – 23(4,19)		50738.090(28)	6.7487	3.800	94.987	
28(4,24) – 27(5,23)		50858.467(31)	6.7277	4.608	132.394	
21(2,20) – 20(3,17)		51124.647(34)	6.8507	2.576	69.985	
13(1,12) – 13(0,13)		51530.015(23)	6.1451	8.024	26.852	
22(2,20) – 22(2,21)		52082.712(30)	6.8159	0.282	78.186	
6(1, 6) – 5(1, 5)		52199.520(9)	4.9583	5.832	5.130	
6(3, 4) – 7(2, 5)		52546.089(22)	6.8512	0.717	11.479	
17(2,15) – 16(3,14)		52907.322(25)	6.6364	3.101	47.625	
6(0, 6) – 5(0, 5)		53435.339(9)	4.9159	5.995	4.469	
6(3, 3) – 7(2, 6)		53478.219(22)	6.8306	0.713	11.448	
6(2, 5) – 5(2, 4)		53661.945(9)	4.9611	5.333	7.571	
6(5, 1) – 5(5, 0)		53725.769(8)	5.4233	1.833	23.805	
6(5, 2) – 5(5, 1)		53725.769(8)	5.4233	1.833	23.805	
6(4, 3) – 5(4, 2)		53727.330(9)	5.1636	3.333	16.851	
6(4, 2) – 5(4, 1)		53727.351(9)	5.1636	3.333	16.851	
6(3, 4) – 5(3, 3)		53736.955(9)	5.0331	4.500	11.440	
6(3, 3) – 5(3, 2)		53740.971(9)	5.0330	4.500	11.440	
8(0, 8) – 7(1, 7)		53768.625(12)	6.1607	4.290	8.901	
6(2, 4) – 5(2, 3)		53919.574(9)	4.9549	5.333	7.579	
11(4, 8) – 12(3, 9)		54105.299(26)	6.7425	1.492	30.284	
29(4,26) – 28(5,23)		54442.653(34)	6.6419	4.737	140.795	
11(4, 7) – 12(3,10)		54462.954(26)	6.7343	1.491	30.273	
6(1, 5) – 5(1, 4)		55068.935(9)	4.8885	5.832	5.369	
12(1,11) – 11(2,10)		55273.368(20)	6.4463	3.009	22.769	
16(5,12) – 17(4,13)		55443.251(34)	6.6851	2.270	58.115	
16(5,11) – 17(4,14)		55559.202(34)	6.6824	2.270	58.111	
22(2,21) – 21(3,18)		55559.332(36)	6.7726	2.515	76.332	
15(1,14) – 15(1,15)		56125.717(31)	6.8587	0.141	35.510	
4(1, 4) – 3(0, 3)		56608.393(9)	6.0453	2.539	1.790	
21(6,16) – 22(5,17)		56676.855(55)	6.6434	3.049	94.965	
14(1,13) – 14(0,14)		56694.349(25)	6.0540	7.982	30.936	
21(6,15) – 22(5,18)		56711.325(55)	6.6426	3.048	94.964	
23(3,20) – 22(4,19)		57185.805(25)	6.5663	3.875	88.056	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	-log A	Line strength	Energy lower state	Ref.
26(7,20) - 27(6,21)		57880.779(86)	6.6081	3.826	140.829	
26(7,19) - 27(6,22)		57890.479(86)	6.6079	3.826	140.828	
14(2,12) - 14(1,13)	58189.89(5)	58189.858(12)	5.8655	11.391	32.827	[78A]
13(2,11) - 13(1,12)	58287.74(5)	58287.729(12)	5.8742	10.343	28.570	[78A]
15(2,13) - 15(1,14)	58470.98(5)	58470.993(13)	5.8517	12.390	37.382	[78A]
25(3,23) - 24(4,20)		58594.617(31)	6.5659	3.912	102.195	
12(2,10) - 12(1,11)		58717.600(12)	5.8786	9.274	24.613	
23(2,21) - 23(2,22)		59161.910(30)	6.6905	0.268	84.970	
16(2,14) - 16(1,15)	59173.08(5)	59173.036(14)	5.8322	13.312	42.233	[78A]
23(2,22) - 22(3,19)		59314.383(38)	6.7222	2.424	82.992	
11(2, 9) - 11(1,10)		59427.305(13)	5.8797	8.210	20.955	
17(2,15) - 17(1,16)		60333.189(15)	5.8064	14.134	47.378	
10(2, 8) - 10(1, 9)		60360.084(13)	5.8783	7.176	17.599	
7(1, 7) - 6(1, 6)		60872.618(10)	4.7499	6.856	6.871	
9(2, 7) - 9(1, 8)		61455.847(14)	5.8755	6.191	14.545	
29(4,25) - 28(5,24)		61540.808(32)	6.4763	4.802	140.783	
5(3, 3) - 6(2, 4)		61804.381(22)	6.7209	0.503	9.378	
18(2,16) - 18(1,17)		61984.389(17)	5.7744	14.835	52.815	
7(0, 7) - 6(0, 6)		62231.177(10)	4.7127	6.991	6.251	
5(3, 2) - 6(2, 5)		62323.040(22)	6.7113	0.502	9.361	
15(1,14) - 15(0,15)		62331.737(27)	5.9643	7.894	35.303	
24(2,23) - 23(3,20)		62345.449(39)	6.6964	2.309	89.963	
7(2, 6) - 6(2, 5)		62585.792(10)	4.7418	6.428	9.361	
8(2, 6) - 8(1, 7)		62653.022(14)	5.8723	5.266	11.795	
7(5, 2) - 6(5, 1)		62683.644(10)	5.0127	3.429	25.597	
7(5, 3) - 6(5, 2)		62683.644(10)	5.0127	3.429	25.597	
7(6, 2) - 6(6, 1)		62685.368(10)	5.2789	1.857	34.094	
7(6, 1) - 6(6, 0)		62685.368(10)	5.2789	1.857	34.094	
7(4, 4) - 6(4, 3)		62688.256(10)	4.8743	4.714	18.643	
7(4, 3) - 6(4, 2)		62688.326(10)	4.8743	4.714	18.643	
7(3, 5) - 6(3, 4)		62703.927(10)	4.7904	5.714	13.232	
7(3, 4) - 6(3, 3)		62712.952(10)	4.7902	5.714	13.232	
7(2, 5) - 6(2, 4)		62995.247(10)	4.7333	6.428	9.378	
16(1,15) - 16(1,16)	63192.73(5)	63192.698(31)	6.7487	0.135	40.125	[78A]
10(4, 7) - 11(3, 8)		63275.206(26)	6.5688	1.270	26.691	
30(4,27) - 29(5,24)		63414.275(35)	6.4427	4.902	149.490	
10(4, 6) - 11(3, 9)		63490.204(27)	6.5646	1.270	26.684	
7(2, 5) - 7(1, 6)		63890.723(14)	5.8697	4.408	9.348	
9(0, 9) - 8(1, 8)		63911.822(13)	5.9101	5.084	11.221	
30(2,29) - 29(3,26)		64005.889(47)	6.9658	1.428	138.365	
19(2,17) - 19(1,18)		64155.456(18)	5.7360	15.404	58.544	
7(1, 6) - 6(1, 5)		64215.431(10)	4.6803	6.855	7.206	
5(1, 5) - 4(0, 4)		64402.377(11)	5.8786	3.092	2.981	
15(5,11) - 16(4,12)		64589.612(35)	6.5038	2.048	53.026	
25(2,24) - 24(3,21)		64616.351(40)	6.6930	2.176	97.248	
15(5,10) - 16(4,13)		64661.576(35)	6.5024	2.048	53.024	
18(2,16) - 17(3,15)		65069.943(25)	6.3526	3.387	52.712	
6(2, 4) - 6(1, 5)		65110.907(15)	5.8690	3.616	7.206	
29(2,28) - 28(3,25)	65725.08(5)	65725.040(45)	6.8753	1.572	129.517	[78A]
20(6,15) - 21(5,16)		65820.133(56)	6.4607	2.826	88.381	
20(6,14) - 21(5,17)		65841.911(56)	6.4603	2.826	88.380	
26(2,25) - 25(3,22)		66100.542(41)	6.7104	2.029	104.846	
26(3,24) - 25(4,21)		66148.534(33)	6.4149	4.000	109.708	
5(2, 3) - 5(1, 4)		66260.268(15)	5.8720	2.883	5.369	
24(2,22) - 24(2,23)		66629.214(29)	6.5731	0.257	92.043	
28(2,27) - 27(3,24)		66655.164(43)	6.8023	1.722	120.981	
27(2,26) - 26(3,23)		66781.950(42)	6.7471	1.876	112.757	
20(2,18) - 20(1,19)		66870.742(20)	5.6918	15.834	64.561	
13(1,12) - 12(2,11)		66882.887(20)	6.1700	3.465	26.340	
25(7,19) - 26(6,20)		67021.881(87)	6.4263	3.604	132.749	
25(7,18) - 26(6,21)		67028.081(87)	6.4262	3.604	132.749	
4(2, 2) - 4(1, 3)		67291.682(15)	5.8826	2.198	3.838	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log A	Line strength	Energy lower state	Ref.
3(2, 1) - 3(1, 2)		68165.189(15)	5.9118	1.538	2.612	
16(1,15) - 16(0,16)	68413.73(5)	68413.775(28)	5.8765	7.779	39.950	[78A]
2(2, 0) - 2(1, 1)		68848.566(15)	6.0054	0.859	1.693	
24(3,21) - 23(4,20)		68975.767(27)	6.3167	4.090	94.947	
8(1, 8) - 7(1, 7)	69534.35(5)	69534.310(12)	4.5709	7.873	8.901	[78A]
21(2,19) - 21(1,20)	70149.28(5)	70149.243(21)	5.6423	16.124	70.865	[78A]
2(2, 1) - 2(1, 2)		70278.403(16)	5.9920	0.833	1.645	
17(1,16) - 17(1,17)		70542.545(32)	6.6453	0.131	45.025	
33(3,30) - 33(3,31)	70684.56(5)	70684.565(38)	6.4705	0.372	174.481	[78A]
4(3, 2) - 5(2, 3)		70950.079(22)	6.6749	0.302	7.579	
8(0, 8) - 7(0, 7)		70979.630(11)	4.5378	7.987	8.327	
3(2, 2) - 3(1, 3)		71002.442(16)	5.8850	1.447	2.516	
4(3, 1) - 5(2, 4)		71209.603(22)	6.6708	0.302	7.571	
8(2, 7) - 7(2, 6)		71500.531(11)	4.5557	7.499	11.448	
8(5, 4) - 7(5, 3)		71643.169(11)	4.7401	4.875	27.688	
8(5, 3) - 7(5, 2)		71643.170(11)	4.7401	4.875	27.688	
8(6, 3) - 7(6, 2)		71643.197(11)	4.8840	3.500	36.185	
8(6, 2) - 7(6, 1)		71643.197(11)	4.8840	3.500	36.185	
8(7, 2) - 7(7, 1)		71648.120(11)	5.1550	1.875	46.221	
8(7, 1) - 7(7, 0)		71648.120(11)	5.1550	1.875	46.221	
8(4, 5) - 7(4, 4)		71652.095(11)	4.6498	6.000	20.734	
8(4, 4) - 7(4, 3)		71652.285(11)	4.6498	6.000	20.734	
8(3, 6) - 7(3, 5)		71674.927(11)	4.5902	6.875	15.324	
8(3, 5) - 7(3, 4)		71692.942(11)	4.5899	6.875	15.324	
4(2, 3) - 4(1, 4)		71970.470(16)	5.8384	1.989	3.678	
6(1, 6) - 5(0, 5)	72004.91(5)	72004.902(12)	5.7304	3.679	4.469	[78A]
8(2, 6) - 7(2, 5)		72108.609(11)	4.5446	7.499	11.479	
9(4, 6) - 10(3, 7)		72386.280(27)	6.4323	1.051	23.398	
9(4, 5) - 10(3, 8)		72509.293(27)	6.4302	1.051	23.394	
30(4,26) - 29(5,25)		72511.734(34)	6.2601	4.994	149.473	
5(2, 4) - 5(1, 5)	73184.52(5)	73184.544(16)	5.8064	2.489	5.130	[78A]
8(1, 7) - 7(1, 6)	73346.31(5)	73346.309(11)	4.5014	7.872	9.348	[78A]
27(3,25) - 26(4,22)		73350.453(35)	6.2897	4.062	117.527	
36(5,32) - 35(6,29)	73629.97(5)	73629.915(43)	6.2430	5.936	216.293	[78A]
14(5,10) - 15(4,11)		73699.372(36)	6.3528	1.826	48.238	
14(5, 9) - 15(4,12)		73742.641(36)	6.3521	1.826	48.237	
22(2,20) - 22(1,21)		74003.261(22)	5.5881	16.283	77.454	
10(0,10) - 9(1, 9)	74051.95(5)	74051.948(13)	5.6948	5.930	13.829	[78A]
25(2,23) - 25(2,24)		74451.437(28)	6.4629	0.247	99.403	
6(2, 5) - 6(1, 6)	74646.86(5)	74646.970(16)	5.7784	2.956	6.871	[78A]
17(1,16) - 17(0,17)	74901.36(5)	74901.348(29)	5.7912	7.653	44.879	[78A]
19(6,14) - 20(5,15)	74936.10(5)	74936.352(57)	6.3056	2.604	82.097	[78A]
19(6,13) - 20(5,16)	74950.05(5)	74949.794(57)	6.3054	2.604	82.097	[78A]
24(7,18) - 25(6,19)		76141.010(88)	6.2704	3.382	124.971	
24(7,17) - 25(6,20)		76144.900(88)	6.2703	3.382	124.970	
7(2, 6) - 7(1, 7)	76360.20(5)	76360.144(17)	5.7511	3.394	8.901	[78A]
29(8,22) - 30(7,23)		77340.746(120)	6.2408	4.159	176.854	
29(8,21) - 30(7,24)		77341.820(120)	6.2408	4.159	176.854	
19(2,17) - 18(3,16)	77498.88(5)	77498.922(26)	6.1099	3.695	58.099	[78A]
36(5,31) - 35(6,30)	77667.98(5)	77667.895(45)	6.1714	5.964	216.286	[78A]
18(1,17) - 18(1,18)		78132.604(32)	6.5478	0.127	50.209	
9(1, 9) - 8(1, 8)	78183.61(5)	78183.631(12)	4.4139	8.886	11.221	[78A]
8(2, 7) - 8(1, 8)	78326.28(5)	78326.364(17)	5.7230	3.802	11.221	[78A]
23(2,21) - 23(1,22)	78436.86(5)	78436.851(23)	5.5301	16.324	84.327	[78A]
14(1,13) - 13(2,12)	78606.72(5)	78606.704(21)	5.9324	3.962	30.205	[78A]
34(3,31) - 34(3,32)	79058.78(5)	79058.746(39)	6.3555	0.357	184.583	[78A]
7(1, 7) - 6(0, 6)	79442.16(5)	79442.182(13)	5.5963	4.304	6.251	[78A]
9(0, 9) - 8(0, 8)	79677.51(5)	79677.507(12)	4.3845	8.983	10.695	[78A]
3(3, 1) - 4(2, 2)		80013.828(22)	6.7887	0.126	6.082	
3(3, 0) - 4(2, 3)		80125.087(22)	6.7872	0.126	6.079	
28(3,26) - 27(4,23)		80147.556(38)	6.1863	4.094	125.654	
9(2, 8) - 8(2, 7)		80404.898(12)	4.3939	8.554	13.833	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log A	Line strength	Energy lower state	Ref.
9(2, 8) - 9(1, 9)		80547.631(18)	5.6937	4.180	13.829	
9(6, 4) - 8(6, 3)		80602.135(11)	4.6239	5.000	38.575	
9(6, 3) - 8(6, 2)		80602.135(11)	4.6239	5.000	38.575	
9(5, 5) - 8(5, 4)		80604.577(12)	4.5289	6.222	30.078	
9(5, 4) - 8(5, 3)		80604.580(12)	4.5289	6.222	30.078	
9(7, 3) - 8(7, 2)		80606.211(12)	4.7719	3.556	48.611	
9(7, 2) - 8(7, 1)		80606.211(12)	4.7719	3.556	48.611	
9(8, 1) - 8(8, 0)		80614.477(12)	5.0465	1.889	60.183	
9(8, 2) - 8(8, 1)		80614.477(12)	5.0465	1.889	60.183	
9(4, 6) - 8(4, 5)		80619.233(12)	4.4639	7.222	23.124	
9(4, 5) - 8(4, 4)		80619.689(12)	4.4639	7.222	23.124	
9(3, 7) - 8(3, 6)		80649.873(12)	4.4190	8.000	17.714	
9(3, 6) - 8(3, 5)		80682.813(12)	4.4185	8.000	17.716	
25(3,22) - 24(4,21)		81136.544(28)	6.0997	4.311	102.140	
9(2, 7) - 8(2, 6)		81261.441(12)	4.3801	8.555	13.885	
8(4, 5) - 9(3, 6)		81451.764(27)	6.3295	0.837	20.407	
8(4, 4) - 9(3, 7)		81518.055(27)	6.3285	0.836	20.405	
18(1,17) - 18(0,18)		81746.513(29)	5.7086	7.525	50.088	
9(1, 8) - 8(1, 7)		82458.616(12)	4.3445	8.885	11.795	
26(2,24) - 26(2,25)		82591.455(28)	6.3590	0.239	107.051	
13(5, 9) - 14(4,10)		82778.395(37)	6.2264	1.605	43.751	
13(5, 8) - 14(4,11)		82803.488(37)	6.2261	1.605	43.750	
10(2, 9) - 10(1,10)		83025.430(19)	5.6629	4.529	16.725	
24(2,22) - 24(1,23)		83444.352(23)	5.4691	16.266	91.482	
18(6,13) - 19(5,14)		84028.555(57)	6.1723	2.381	76.114	
18(6,12) - 19(5,15)		84036.641(57)	6.1722	2.381	76.113	
11(0,11) - 10(1,10)		84151.854(14)	5.5067	6.825	16.725	
23(7,17) - 24(6,18)		85240.040(89)	6.1348	3.159	117.492	
23(7,16) - 24(6,19)		85242.433(89)	6.1348	3.159	117.492	
11(2,10) - 11(1,11)		85760.529(19)	5.6306	4.840	19.908	
19(1,18) - 19(1,19)		85916.964(32)	6.4558	0.125	55.678	
28(8,21) - 29(7,22)		86439.013(121)	6.1048	3.937	167.881	
28(8,20) - 29(7,23)		86439.683(121)	6.1048	3.937	167.881	
29(3,27) - 28(4,24)		86484.230(40)	6.1020	4.095	134.090	
8(1, 8) - 7(0, 7)		86745.315(15)	5.4733	4.973	8.327	
10(1,10) - 9(1, 9)		86819.851(13)	4.2741	9.896	13.829	
2(2, 1) - 1(1, 0)		87218.865(17)	5.4553	1.500	1.080	
2(2, 0) - 1(1, 1)		87705.384(17)	5.4526	1.484	1.064	
10(0,10) - 9(0, 9)		88323.757(13)	4.2481	9.977	13.353	
26(3,23) - 26(2,24)		88478.447(22)	5.3222	20.690	109.806	
25(3,22) - 25(2,23)		88713.185(20)	5.3260	19.581	101.887	
12(2,11) - 12(1,12)		88752.773(20)	5.5970	5.137	23.379	
27(3,24) - 27(2,25)		88758.409(23)	5.3135	21.704	118.020	
19(1,18) - 19(0,19)		88894.868(30)	5.6292	7.407	55.578	
25(2,23) - 25(1,24)		89009.317(23)	5.4060	16.129	98.918	
10(2, 9) - 9(2, 8)		89297.651(13)	4.2507	9.597	16.515	
24(3,21) - 24(2,22)		89415.349(19)	5.3253	18.405	94.265	
10(6, 4) - 9(6, 3)		89562.317(12)	4.4228	6.400	41.263	
10(6, 5) - 9(6, 4)		89562.317(12)	4.4228	6.400	41.263	
10(7, 3) - 9(7, 2)		89565.031(12)	4.5214	5.100	51.299	
10(7, 4) - 9(7, 3)		89565.031(12)	4.5214	5.100	51.299	
10(5, 6) - 9(5, 5)		89568.101(12)	4.3538	7.500	32.767	
10(5, 5) - 9(5, 4)		89568.109(12)	4.3538	7.500	32.767	
10(8, 3) - 9(8, 2)		89573.052(13)	4.6725	3.600	62.872	
10(8, 2) - 9(8, 1)		89573.052(13)	4.6725	3.600	62.872	
10(9, 1) - 9(9, 0)		89584.904(14)	4.9499	1.900	75.979	
10(9, 2) - 9(9, 1)		89584.904(14)	4.9499	1.900	75.979	
10(4, 7) - 9(4, 6)		89590.035(12)	4.3043	8.400	25.813	
10(4, 6) - 9(4, 5)		89591.019(12)	4.3043	8.400	25.813	
28(3,25) - 28(2,26)		89593.651(24)	5.2993	22.596	126.529	
10(3, 8) - 9(3, 7)		89628.451(13)	4.2690	9.100	20.405	
10(3, 7) - 9(3, 6)	89684.76(17)	89684.718(13)	4.2682	9.100	20.407	[77A]

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	-log A	Line strength	Energy lower state	Ref.
20(2,18) - 19(3,17)		90169.633(26)	5.8970	4.027	63.784	
15(1,14) - 14(2,13)		90418.935(21)	5.7232	4.505	34.366	
10(2, 8) - 9(2, 7)	90453.26(17)	90453.358(13)	4.2339	9.599	16.595	[77A]
7(4, 4) - 8(3, 5)		90482.482(28)	6.2622	0.629	17.716	
7(4, 3) - 8(3, 6)		90515.644(28)	6.2617	0.629	17.714	
23(3,20) - 23(2,21)		90530.926(19)	5.3206	17.192	86.944	
27(2,25) - 27(2,26)	91008.34(5)	91008.335(28)	6.2610	0.232	114.985	[78A]
29(3,26) - 29(2,27)	91018.22(5)	91018.234(25)	5.2796	23.346	135.329	[78A]
10(1, 9) - 9(1, 8)	91549.18(13)	91549.122(13)	4.2050	9.894	14.545	[77A]
12(5, 8) - 13(4, 9)		91831.629(37)	6.1215	1.386	39.564	
12(5, 7) - 13(4,10)		91845.588(37)	6.1213	1.386	39.563	
22(3,19) - 22(2,20)	91999.46(5)	91999.488(18)	5.3128	15.971	79.923	[78A]
13(2,12) - 13(1,13)	92000.93(5)	92000.905(21)	5.5621	5.397	27.137	[78A]
30(3,28) - 29(4,25)		92303.004(42)	6.0351	4.063	142.835	
38(5,34) - 37(6,31)	92317.03(5)	92316.999(40)	5.9474	6.274	238.174	[78A]
2(2, 1) - 2(0, 2)		92755.978(21)	8.1342	0.000	0.895	
3(2, 2) - 3(0, 3)		92786.795(21)	7.7362	0.001	1.790	
4(2, 3) - 4(0, 4)		92856.648(21)	7.4810	0.002	2.981	
5(2, 4) - 5(0, 5)		92989.927(21)	7.2893	0.004	4.469	
30(3,27) - 30(2,28)		93059.788(25)	5.2542	23.941	144.418	
17(6,12) - 18(5,13)		93099.443(58)	6.0571	2.159	70.431	
17(6.11) - 18(5.14)		93104.171(58)	6.0570	2.159	70.430	
6(2, 5) - 6(0, 6)		93216.534(21)	7.1345	0.007	6.251	
7(2, 6) - 7(0, 7)		93571.149(20)	7.0044	0.011	8.327	
26(3,23) - 25(4,22)		93668.289(30)	5.9068	4.540	109.633	
21(3,18) - 21(2,19)	93755.00(5)	93755.053(18)	5.3024	14.768	73.205	[78A]
20(1,19) - 20(1,20)		93847.812(32)	6.3690	0.123	61.430	
9(1, 9) - 8(0, 8)		93949.316(16)	5.3592	5.691	10.695	
8(2, 7) - 8(0, 8)		94092.049(20)	6.8921	0.015	10.695	
12(0,12) - 11(1,11)	94178.68(5)	94178.675(14)	5.3403	7.764	19.908	[78A]
22(7,16) - 23(6,17)		94320.705(89)	6.0158	2.937	110.313	
22(7,15) - 23(6,18)		94322.146(89)	6.0158	2.937	110.313	
9(2, 8) - 9(0, 9)		94819.440(20)	6.7931	0.021	13.353	
26(2,24) - 26(1,25)	95104.15(5)	95104.066(23)	5.3416	15.937	106.634	[78A]
11(1,11) - 10(1,10)		95442.482(14)	4.1481	10.904	16.725	
14(2,13) - 14(1,14)	95502.40(5)	95502.421(21)	5.5262	5.629	31.180	[78A]
27(8,20) - 28(7,21)		95521.315(123)	5.9844	3.714	159.207	
27(8,19) - 28(7,22)		95521.726(123)	5.9844	3.714	159.207	
3(2, 2) - 2(1, 1)		95689.778(17)	5.4349	1.667	1.693	
20(3,17) - 20(2,18)	95727.52(5)	95727.525(18)	5.2902	13.606	66.791	[78A]
31(3,28) - 31(2,29)	95739.38(5)	95739.304(26)	5.2235	24.375	153.794	[78A]
10(2, 9) - 10(0,10)		95793.334(20)	6.7047	0.027	16.299	
20(1,19) - 20(0,20)	96288.10(5)	96288.204(30)	5.5530	7.302	61.349	[78A]
36(3,33) - 36(3,34)	96905.47(5)	96905.424(43)	6.1451	0.333	205.652	[78A]
11(0,11) - 10(0,10)		96919.757(14)	4.1254	10.972	16.299	
11(2,10) - 11(0,11)		97051.158(20)	6.6247	0.035	19.532	
3(2, 1) - 2(1, 2)		97164.131(17)	5.4287	1.615	1.645	
19(3,16) - 19(2,17)		97844.655(19)	5.2767	12.500	60.684	
11(2,10) - 10(2, 9)		98177.581(14)	4.1222	10.633	19.494	
11(6, 5) - 10(6, 4)		98523.880(13)	4.2562	7.727	44.251	
11(6, 6) - 10(6, 5)		98523.880(13)	4.2562	7.727	44.251	
11(7, 4) - 10(7, 3)		98524.661(13)	4.3283	6.546	54.287	
11(7, 5) - 10(7, 4)		98524.661(13)	4.3283	6.546	54.287	
11(8, 3) - 10(8, 2)		98532.070(14)	4.4297	5.182	65.860	
11(8, 4) - 10(8, 3)		98532.070(14)	4.4297	5.182	65.860	
11(5, 7) - 10(5, 6)		98533.974(13)	4.2032	8.727	35.754	
11(5, 6) - 10(5, 5)	98534.02(10)	98533.995(13)	4.2032	8.727	35.754	[77A]
11(9, 2) - 10(9, 1)	98544.22(10)	98544.145(15)	4.5833	3.636	78.967	[77A]
11(9, 3) - 10(9, 2)		98544.145(15)	4.5833	3.636	78.967	
11(10, 1) - 10(10, 0)		98559.869(16)	4.8630	1.909	93.604	
11(10, 2) - 10(10, 1)	98559.73(10)	98559.869(16)	4.8630	1.909	93.604	[77A]
11(4, 8) - 10(4, 7)	98564.93(20)	98564.834(13)	4.1639	9.546	28.801	[77A]

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log A	Line strength	Energy lower state	Ref.
11(4, 7) - 10(4, 6)		98566.799(13)	4.1639	9.546	28.801	
11(3, 9) - 10(3, 8)	98610.25(19)	98610.108(13)	4.1353	10.182	23.394	[77A]
12(2,11) - 12(0,12)		98625.379(20)	6.5515	0.042	23.050	
11(3, 8) - 10(3, 7)	98701.07(19)	98701.109(13)	4.1341	10.182	23.398	[77A]
15(2,14) - 15(1,15)		99253.455(22)	5.4094	5.035	35.510	
6(4, 3) - 7(3, 4)		99487.168(28)	6.2395	0.432	15.324	
6(4, 2) - 7(3, 5)		99502.245(28)	6.2393	0.432	15.324	
28(2,26) - 28(2,27)		99657.653(29)	6.1682	0.227	123.205	
11(2, 9) - 10(2, 8)		99681.516(14)	4.1023	10.636	19.612	
18(3,15) - 18(2,16)		100034.385(19)	5.2628	11.460	54.883	
13(2,12) - 13(0,13)		100541.496(20)	6.4840	0.051	26.852	
11(1,10) - 10(1, 9)		100614.295(14)	4.0794	10.901	17.599	
11(5, 7) - 12(4, 8)		100863.268(38)	6.0365	1.170	35.677	
11(5, 6) - 12(4, 9)		100870.665(38)	6.0364	1.170	35.676	
10(1,10) - 9(0, 9)		101091.660(17)	5.2522	6.458	13.353	
27(2,25) - 27(1,26)		101689.999(23)	5.2767	15.712	114.628	
21(1,20) - 21(1,21)		101877.144(32)	6.2872	0.122	67.467	
16(6,11) - 17(5,12)		102151.440(59)	5.9575	1.939	65.047	
16(6,10) - 17(5,13)		102154.117(59)	5.9574	1.939	65.047	
17(3,14) - 17(2,15)		102227.394(20)	5.2488	10.490	49.390	
16(1,15) - 15(2,14)		102290.297(21)	5.5360	5.097	38.820	
14(2,13) - 14(0,14)		102816.716(20)	6.4212	0.059	30.936	
21(2,19) - 20(3,18)		103054.614(27)	5.7064	4.387	69.767	
16(2,15) - 16(1,16)		103248.716(22)	5.4520	6.015	40.125	
21(7,15) - 22(6,16)		103384.621(90)	5.9107	2.714	103.434	
21(7,14) - 22(6,17)		103385.468(90)	5.9106	2.714	103.434	
21(1,20) - 21(0,21)	103867.74(11)	103867.292(31)	5.4802	7.214	67.400	[77A]
4(2, 3) - 3(1, 2)		103920.163(18)	5.3843	1.880	2.612	
12(1,12) - 11(1,11)		104051.281(14)	4.0334	11.910	19.908	
13(0,13) - 12(1,12)	104105.82(19)	104105.645(15)	5.1918	8.738	23.379	[77A]
16(3,13) - 16(2,14)	104359.66(11)	104359.677(20)	5.2354	9.589	44.206	[77A]
26(8,19) - 27(7,20)		104588.825(124)	5.8770	3.492	150.833	
26(8,18) - 27(7,21)		104589.073(124)	5.8770	3.492	150.833	
15(2,14) - 15(0,15)		105459.475(21)	6.3622	0.067	35.303	
12(0,12) - 11(0,11)		105469.303(14)	4.0138	11.966	19.532	
15(3,12) - 15(2,13)		106375.003(20)	5.2229	8.753	39.332	
27(3,24) - 26(4,23)		106562.916(32)	5.7323	4.782	117.427	
4(2, 2) - 3(1, 3)		106905.698(18)	5.3752	1.763	2.516	
12(2,11) - 11(2,10)		107043.524(14)	4.0056	11.662	22.769	
17(2,16) - 17(1,17)		107481.468(23)	5.4140	6.171	45.025	
12(7, 5) - 11(7, 4)		107485.178(13)	4.1685	7.917	57.573	
12(7, 6) - 11(7, 5)		107485.178(13)	4.1685	7.917	57.573	
12(6, 7) - 11(6, 6)		107486.961(13)	4.1128	9.000	47.537	
12(6, 6) - 11(6, 5)		107486.962(13)	4.1128	9.000	47.537	
12(8, 4) - 11(8, 3)		107491.573(14)	4.2431	6.667	69.147	
12(8, 5) - 11(8, 4)		107491.573(14)	4.2431	6.667	69.147	
12(5, 8) - 11(5, 7)		107502.426(13)	4.0705	9.917	39.041	
12(5, 7) - 11(5, 6)		107502.474(13)	4.0705	9.917	39.041	
12(9, 4) - 11(9, 3)		107503.597(15)	4.3467	5.250	82.254	
12(9, 3) - 11(9, 2)		107503.597(15)	4.3467	5.250	82.254	
12(10, 2) - 11(10, 1)		107519.934(17)	4.5024	3.667	96.891	
12(10, 3) - 11(10, 2)		107519.934(17)	4.5024	3.667	96.891	
12(11, 1) - 11(11, 0)		107539.843(19)	4.7838	1.917	113.054	
12(11, 2) - 11(11, 1)		107539.843(19)	4.7838	1.917	113.054	
12(4, 9) - 11(4, 8)		107543.926(13)	4.0383	10.667	32.089	
12(4, 8) - 11(4, 7)		107547.601(13)	4.0383	10.667	32.089	
12(3,10) - 11(3, 9)		107594.049(14)	4.0146	11.250	26.684	
12(3, 9) - 11(3, 8)		107734.741(14)	4.0129	11.250	26.691	
11(1,11) - 10(0,10)		108210.386(17)	5.1513	7.276	16.299	
14(3,11) - 14(2,12)		108227.093(20)	5.2119	7.975	34.768	
16(2,15) - 16(0,16)		108469.793(21)	6.3064	0.074	39.950	
5(4, 2) - 6(3, 3)		108472.789(28)	6.2878	0.252	13.232	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log A	Line strength	Energy lower state	Ref.
5(4, 1) - 6(3, 4)		108478.821(28)	6.2877	0.252	13.232	
29(2,27) - 29(2,28)		108492.104(31)	6.0803	0.223	131.710	
28(2,26) - 28(1,27)		108718.673(25)	5.2118	15.472	122.902	
12(2,10) - 11(2, 9)		108940.601(14)	3.9826	11.667	22.937	
12(1,11) - 11(1,10)		109650.305(14)	3.9653	11.906	20.955	
10(5, 6) - 11(4, 7)		109876.895(39)	5.9718	0.959	32.089	
10(5, 5) - 11(4, 8)		109880.596(39)	5.9718	0.959	32.089	
13(3,10) - 13(2,11)		109881.340(20)	5.2027	7.247	30.515	
22(1,21) - 22(1,22)		109958.705(34)	6.2103	0.121	73.787	
2(2, 0) - 1(0, 1)		110654.428(22)	8.1261	0.000	0.299	
15(6,10) - 16(5,11)		111186.733(60)	5.8719	1.720	59.964	
15(6, 9) - 16(5,12)		111188.196(60)	5.8719	1.720	59.964	
12(3, 9) - 12(2,10)		111315.867(20)	5.1957	6.559	26.571	
22(1,21) - 22(0,22)		111574.622(33)	5.4110	7.143	73.733	
17(2,16) - 17(0,17)		111840.272(22)	6.2533	0.081	44.879	
5(2, 4) - 4(1, 3)		111910.768(18)	5.3234	2.117	3.838	
18(2,17) - 18(1,18)	111943.85(18)	111943.571(23)	5.3757	6.306	50.209	[77A]
20(7,14) - 21(6,15)		112433.298(91)	5.8176	2.493	96.855	
20(7,13) - 21(6,16)		112433.783(91)	5.8176	2.493	96.855	
11(3, 8) - 11(2, 9)	112521.72(9)	112521.726(20)	5.1912	5.903	22.937	[77A]
13(1,13) - 12(1,12)	112646.35(9)	112646.236(15)	3.9283	12.915	23.379	[77A]
10(3, 7) - 10(2, 8)	113502.34(9)	113502.133(20)	5.1894	5.273	19.612	[77A]
25(8,18) - 26(7,19)		113642.662(125)	5.7807	3.269	142.759	
25(8,17) - 26(7,20)		113642.809(125)	5.7807	3.269	142.759	
14(0,14) - 13(1,13)	113913.39(9)	113913.259(15)	5.0584	9.740	27.137	[77A]
13(0,13) - 12(0,12)	113978.27(5)	113978.251(15)	3.9114	12.960	23.050	[78A]
17(1,16) - 16(2,15)	114188.45(9)	114188.329(20)	5.3665	5.741	43.569	[77A]
9(3, 6) - 9(2, 7)		114270.773(21)	5.1909	4.659	16.595	
8(3, 5) - 8(2, 6)		114849.401(21)	5.1961	4.058	13.885	
7(3, 4) - 7(2, 5)		115265.067(21)	5.2061	3.460	11.479	
12(1,12) - 11(0,11)		115341.909(17)	5.0556	8.140	19.532	
6(3, 3) - 6(2, 4)		115547.362(22)	5.2235	2.860	9.378	
18(2,17) - 18(0,18)		115557.481(22)	6.2024	0.087	50.088	
5(3, 2) - 5(2, 3)		115725.965(22)	5.2538	2.247	7.579	
4(3, 1) - 4(2, 2)		115828.688(22)	5.3126	1.601	6.082	
3(3, 0) - 3(2, 1)		115880.061(23)	5.4597	0.886	4.886	
13(2,12) - 12(2,11)	115894.32(5)	115894.368(14)	3.8990	12.686	26.340	[78A]
3(3, 1) - 3(2, 2)		115917.084(23)	5.4594	0.886	4.885	
4(3, 2) - 4(2, 3)		115939.373(22)	5.3116	1.600	6.079	
5(3, 3) - 5(2, 4)		115982.975(22)	5.2516	2.243	7.571	
6(3, 4) - 6(2, 5)		116057.985(22)	5.2190	2.852	9.361	
22(2,20) - 21(3,19)		116124.116(27)	5.5333	4.781	76.049	
29(2,27) - 29(1,28)		116133.542(27)	5.1475	15.235	131.455	
7(3, 5) - 7(2, 6)		116176.120(22)	5.1980	3.443	11.448	
8(3, 6) - 8(2, 7)		116350.516(21)	5.1827	4.024	13.833	
13(7, 7) - 12(7, 6)	116446.66(5)	116446.663(13)	4.0309	9.231	61.159	[78A]
13(7, 6) - 12(7, 5)		116446.663(13)	4.0309	9.231	61.159	
13(8, 5) - 12(8, 4)		116451.605(14)	4.0888	8.077	72.732	
13(8, 6) - 12(8, 5)	116451.67(5)	116451.605(14)	4.0888	8.077	72.732	[78A]
13(6, 8) - 12(6, 7)	116451.67(5)	116451.695(13)	3.9862	10.231	51.122	[78A]
13(6, 7) - 12(6, 6)		116451.696(13)	3.9862	10.231	51.122	
13(9, 5) - 12(9, 4)	116463.38(5)	116463.279(16)	4.1654	6.769	85.840	[78A]
13(9, 4) - 12(9, 3)		116463.279(16)	4.1654	6.769	85.840	
13(5, 9) - 12(5, 8)	116473.72(5)	116473.687(13)	3.9514	11.077	42.627	[78A]
13(5, 8) - 12(5, 7)		116473.788(13)	3.9514	11.077	42.627	
13(10, 4) - 12(10, 3)		116480.015(17)	4.2709	5.308	100.478	
13(10, 3) - 12(10, 2)		116480.015(17)	4.2709	5.308	100.478	
13(11, 3) - 12(11, 2)		116500.874(19)	4.4282	3.692	116.641	
13(11, 2) - 12(11, 1)		116500.874(19)	4.4282	3.692	116.641	
13(12, 2) - 12(12, 1)		116525.293(22)	4.7113	1.923	134.326	
13(12, 1) - 12(12, 0)		116525.293(22)	4.7113	1.923	134.326	
13(4,10) - 12(4, 9)	116527.60(5)	116527.552(13)	3.9245	11.769	35.676	[78A]

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	-log *A*	Line strength	Energy lower state	Ref.
13(4, 9) - 12(4, 8)	116534.10(5)	116534.065(13)	3.9244	11.769	35.677	[78A]
13(3,11) - 12(3,10)	116579.28(5)	116579.254(14)	3.9045	12.307	30.273	[78A]
9(3, 7) - 9(2, 8)		116595.492(21)	5.1703	4.599	16.515	
19(2,18) - 19(1,19)		116625.557(24)	5.3373	6.422	55.670	
13(3,10) - 12(3, 9)	116788.71(20)	116788.646(14)	3.9022	12.307	30.284	[77A]
10(3, 8) - 10(2, 9)		116926.293(21)	5.1593	5.170	19.494	
5(2, 3) - 4(1, 4)		116959.764(19)	5.3129	1.899	3.678	
11(3, 9) - 11(2,10)		117358.819(20)	5.1488	5.736	22.769	
4(4, 1) - 5(3, 2)		117444.844(28)	6.4947	0.101	11.440	
4(4, 0) - 5(3, 3)		117446.855(28)	6.4947	0.101	11.440	
30(2,28) - 30(2,29)		117462.431(34)	5.9971	0.220	140.500	
12(3,10) - 12(2,11)		117909.344(20)	5.1384	6.298	26.340	
23(1,22) - 23(1,23)		118049.949(36)	6.1379	0.121	80.389	
13(2,11) - 12(2,10)		118223.172(14)	3.8728	12.693	26.571	
13(3,11) - 13(2,12)	118594.25(10)	118594.231(20)	5.1276	6.853	30.205	[77A]
13(1,12) - 12(1,11)	118653.26(13)	118653.043(14)	3.8608	12.909	24.613	[77A]
9(5, 5) - 10(4, 6)		118875.593(39)	5.9299	0.755	28.801	
9(5, 4) - 10(4, 7)		118877.321(39)	5.9299	0.755	28.801	
23(1,22) - 23(0,23)		119356.908(35)	5.3454	7.088	80.346	
14(3,12) - 14(2,13)		119429.649(20)	5.1161	7.400	34.366	
19(2,18) - 19(0,19)		119603.461(23)	6.1534	0.093	55.578	
3(2, 1) - 2(0, 2)		119641.706(23)	7.6483	0.001	0.895	
6(2, 5) - 5(1, 4)		119663.193(19)	5.2595	2.371	5.369	
28(3,25) - 27(4,24)		119804.701(34)	5.5724	5.039	125.521	
14(6, 9) - 15(5,10)		120207.316(61)	5.7997	1.504	55.181	
14(6, 8) - 15(5,11)		120208.083(61)	5.7997	1.504	55.181	
15(3,13) - 15(2,14)		120431.307(20)	5.1038	7.935	38.820	
14(1,14) - 13(1,13)		121227.554(15)	3.8311	13.919	27.137	
19(7,13) - 20(6,14)		121468.154(92)	5.7354	2.273	90.576	
19(7,12) - 20(6,15)		121468.424(92)	5.7354	2.273	90.576	
20(2,19) - 20(1,20)		121516.764(25)	5.2990	6.520	61.430	
16(3,14) - 16(2,15)		121614.196(20)	5.0906	8.457	43.569	
14(0,14) - 13(0,13)		122453.851(15)	3.8169	13.955	26.852	
13(1,13) - 12(0,12)		122518.842(18)	4.9645	9.046	23.050	
24(8,17) - 25(7,18)		122683.892(126)	5.6941	3.047	134.985	
24(8,16) - 25(7,19)		122683.977(126)	5.6941	3.047	134.985	
17(3,15) - 17(2,16)		122992.353(20)	5.0763	8.962	48.610	
15(0,15) - 14(1,14)		123589.619(14)	4.9378	10.763	31.180	
30(2,28) - 30(1,29)		123872.224(30)	5.0844	15.012	140.286	
29(9,21) - 30(8,22)		123875.651(151)	5.6636	3.824	188.403	
29(9,20) - 30(8,23)		123875.675(151)	5.6636	3.824	188.403	
20(2,19) - 20(0,20)		123957.156(25)	6.1061	0.098	61.349	
18(3,16) - 18(2,17)		124578.651(20)	5.0608	9.448	53.943	
14(2,13) - 13(2,12)		124729.070(14)	3.8007	13.707	30.205	
14(7, 8) - 13(7, 7)		125409.193(13)	3.9094	10.500	65.043	
14(7, 7) - 13(7, 6)		125409.193(13)	3.9094	10.500	65.043	
14(8, 7) - 13(8, 6)		125412.206(14)	3.9561	9.429	76.617	
14(8, 6) - 13(8, 5)		125412.206(14)	3.9561	9.429	76.617	
14(6, 9) - 13(6, 8)		125418.218(13)	3.8725	11.429	55.007	
14(6, 8) - 13(6, 7)		125418.220(13)	3.8725	11.429	55.007	
14(9, 6) - 13(9, 5)		125423.208(16)	4.0158	8.214	89.725	
14(9, 5) - 13(9, 4)		125423.208(16)	4.0158	8.214	89.725	
14(10, 5) - 13(10, 4)		125440.114(17)	4.0941	6.857	104.363	
14(10, 4) - 13(10, 3)		125440.114(17)	4.0941	6.857	104.363	
14(5,10) - 13(5, 9)		125447.982(13)	3.8433	12.215	46.512	
14(5, 9) - 13(5, 8)		125448.183(13)	3.8433	12.215	46.512	
14(11, 3) - 13(11, 2)		125461.753(20)	4.2011	5.357	120.527	
14(11, 4) - 13(11, 3)		125461.753(20)	4.2011	5.357	120.527	
14(12, 2) - 13(12, 1)		125487.423(22)	4.3599	3.714	138.213	
14(12, 3) - 13(12, 2)		125487.423(22)	4.3599	3.714	138.213	
14(4,11) - 13(4,10)		125515.888(13)	3.8203	12.857	39.563	
14(13, 1) - 13(13, 0)		125516.682(25)	4.6442	1.929	157.416	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log A	Line strength	Energy lower state	Ref.
14(13, 2) - 13(13, 1)		125516.682(25)	4.6442	1.929	157.416	
14(4,10) - 13(4, 9)		125526.921(13)	3.8202	12.857	39.564	
14(3,12) - 13(3,11)		125564.489(14)	3.8033	13.356	34.161	
14(3,11) - 13(3,10)		125866.066(14)	3.8001	13.356	34.180	
18(1,17) - 17(2,16)		126077.907(20)	5.2116	6.442	48.610	
24(1,23) - 24(1,24)		126113.761(39)	6.0701	0.121	87.275	
19(3,17) - 19(2,18)		126384.610(20)	5.0441	9.911	59.568	
21(2,20) - 21(1,21)		126605.502(27)	5.2607	6.603	67.467	
24(1,23) - 24(0,24)		127167.156(38)	5.2834	7.047	87.240	
7(2, 6) - 6(1, 5)		127180.050(20)	5.1954	2.641	7.206	
6(2, 4) - 5(1, 5)		127363.139(20)	5.2500	2.010	5.130	
14(2,12) - 13(2,11)		127520.313(14)	3.7716	13.717	30.515	
14(1,13) - 13(1,12)		127618.185(15)	3.7645	13.911	28.570	
8(5, 4) - 9(4, 5)		127862.036(40)	5.9164	0.560	25.813	
8(5, 3) - 9(4, 6)		127862.777(40)	5.9164	0.560	25.813	
20(3,18) - 20(2,19)		128420.231(20)	5.0262	10.351	65.484	
21(2,20) - 21(0,21)		128595.651(26)	6.0603	0.102	67.400	
4(2, 2) - 3(0, 3)		128690.051(23)	7.3120	0.001	1.790	
13(6, 8) - 14(5, 9)		129215.012(62)	5.7408	1.291	50.697	
13(6, 7) - 14(5,10)		129215.396(62)	5.7407	1.291	50.697	
23(2,21) - 22(3,20)		129346.396(27)	5.3742	5.212	82.629	
14(1,14) - 13(0,13)		129768.145(17)	4.8777	9.989	26.852	
15(1,15) - 14(1,14)		129795.638(15)	3.7409	14.922	31.180	
18(7,12) - 19(6,13)		130490.524(93)	5.6631	2.054	84.597	
18(7,11) - 19(6,14)		130490.670(93)	5.6631	2.054	84.597	
21(3,19) - 21(2,20)		130693.865(20)	5.0070	10.763	71.690	
15(0,15) - 14(0,14)		130903.913(15)	3.7290	14.951	30.936	
30(4,26) - 30(3,27)		131013.553(26)	4.8873	19.968	147.522	
23(8,16) - 24(7,17)		131713.533(126)	5.6162	2.826	127.510	
23(8,15) - 24(7,18)		131713.582(126)	5.6162	2.826	127.510	
22(2,21) - 22(1,22)		131879.254(30)	5.2227	6.672	73.787	
28(9,20) - 29(8,21)		132905.377(153)	5.5829	3.602	179.434	
28(9,19) - 29(8,22)		132905.391(153)	5.5829	3.602	179.434	
16(0,16) - 15(1,15)		133129.977(14)	4.8282	11.798	35.510	
22(3,20) - 22(2,21)		133212.098(20)	4.9867	11.148	78.186	
29(3,26) - 28(4,25)		133371.236(36)	5.4244	5.317	133.916	
22(2,21) - 22(0,22)		133495.172(29)	6.0159	0.106	73.733	
15(2,14) - 14(2,13)		133546.674(14)	3.7096	14.724	34.366	
29(4,25) - 29(3,26)		134035.070(25)	4.8696	18.784	138.365	
25(1,24) - 25(1,25)		134119.738(42)	6.0066	0.121	94.444	
15(7, 8) - 14(7, 7)		134372.848(13)	3.8002	11.734	69.226	
15(7, 9) - 14(7, 8)		134372.848(13)	3.8002	11.734	69.226	
15(8, 7) - 14(8, 6)		134373.420(14)	3.8388	10.734	80.800	
15(8, 8) - 14(8, 7)		134373.420(14)	3.8388	10.734	80.800	
15(9, 7) - 14(9, 6)		134383.400(16)	3.8872	9.600	93.908	
15(9. 6) - 14(9. 5)		134383.400(16)	3.8872	9.600	93.908	
15(6,10) - 14(6, 9)		134386.664(13)	3.7691	12.600	59.190	
15(6, 9) - 14(6, 8)		134386.670(13)	3.7691	12.600	59.190	
15(10, 5) - 14(10, 4)		134400.230(18)	3.9485	8.334	108.547	
15(10, 6) - 14(10, 5)		134400.230(18)	3.9485	8.334	108.547	
15(11, 5) - 14(11, 4)		134422.467(20)	4.0281	6.934	124.712	
15(11, 4) - 14(11, 3)		134422.467(20)	4.0281	6.934	124.712	
15(5,11) - 14(5,10)		134425.533(13)	3.7441	13.334	50.697	
15(5,10) - 14(5, 9)		134425.914(13)	3.7441	13.334	50.697	
15(12, 3) - 14(12, 2)		134449.252(22)	4.1364	5.400	142.399	
15(12, 4) - 14(12, 3)		134449.252(22)	4.1364	5.400	142.399	
8(2, 7) - 7(1, 6)		134465.148(21)	5.1324	2.927	9.348	
15(13, 2) - 14(13, 1)		134480.039(25)	4.2964	3.733	161.602	
15(13, 3) - 14(13, 2)		134480.039(25)	4.2964	3.733	161.602	
15(4,12) - 14(4,11)		134509.029(13)	3.7242	13.933	43.750	
15(14, 1) - 14(14, 0)		134514.471(28)	4.5819	1.933	182.317	
15(14, 2) - 14(14, 1)		134514.471(28)	4.5819	1.933	182.317	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log A	Line strength	Energy lower state	Ref.
15(4,11) - 14(4,10)		134527.006(13)	3.7240	13.933	43.751	
15(3,13) - 14(3,12)		134548.330(14)	3.7096	14.399	38.350	
25(1,24) - 25(0,25)		134966.105(41)	5.2250	7.019	94.416	
15(3,12) - 14(3,11)		134970.348(14)	3.7055	14.399	38.378	
23(3,21) - 23(2,22)		135979.664(20)	4.9651	11.505	84.970	
15(1,14) - 14(1,13)	136541.27(5)	136541.301(14)	3.6752	14.911	32.827	[78A]
15(2,13) - 14(2,12)	136822.40(5)	136822.436(14)	3.6776	14.737	34.768	[78A]
7(5, 3) - 8(4, 4)		136838.555(40)	5.9439	0.378	23.124	
7(5, 2) - 8(4, 5)		136838.840(40)	5.9439	0.378	23.124	
28(4,24) - 28(3,25)	137086.75(5)	137086.707(24)	4.8518	17.672	129.517	[78A]
15(1,15) - 14(0,14)	137109.87(5)	137109.934(17)	4.7946	10.959	30.936	[78A]
23(2,22) - 23(1,23)		137324.891(33)	5.1851	6.731	80.389	
5(2, 3) - 4(0, 4)		137845.941(24)	7.0421	0.002	2.981	
19(1,18) - 18(2,17)	137922.13(5)	137922.117(19)	5.0692	7.199	53.943	[78A]
7(2, 5) - 6(1, 6)		138158.865(22)	5.1898	2.087	6.871	
12(6, 7) - 13(5, 8)		138211.500(62)	5.6960	1.083	46.512	
12(6, 6) - 13(5, 9)		138211.682(62)	5.6960	1.083	46.512	
16(1,16) - 15(1,15)	138351.05(5)	138351.055(14)	3.6567	15.925	35.510	[78A]
23(2,22) - 23(0,23)		138631.850(32)	5.9727	0.109	80.346	
24(3,22) - 24(2,23)	138999.39(5)	138999.404(20)	4.9424	11.831	92.043	[78A]
16(0,16) - 15(0,15)	139335.92(5)	139335.996(15)	3.6468	15.947	35.303	[78A]
17(7,11) - 18(6,12)		139501.668(93)	5.6004	1.837	78.917	
17(7,10) - 18(6,13)		139501.742(93)	5.6004	1.837	78.917	
27(4,23) - 27(3,24)	140097.18(5)	140097.131(23)	4.8343	16.634	120.981	[78A]
22(8,15) - 23(7,16)		140732.562(127)	5.5463	2.606	120.335	
22(8,14) - 23(7,17)		140732.588(127)	5.5463	2.606	120.335	
40(4,37) - 39(5,34)	140943.28(5)	140943.330(46)	5.4714	5.548	253.221	[78A]
9(2, 8) - 8(1, 7)	141523.67(5)	141523.738(22)	5.0710	3.233	11.795	[78A]
27(9,19) - 28(8,20)		141925.418(154)	5.5095	3.380	170.764	
27(9,18) - 28(8,21)		141925.426(154)	5.5095	3.380	170.764	
26(1,25) - 26(1,26)		142044.848(46)	5.9472	0.121	101.895	
25(3,23) - 25(2,24)		142272.219(20)	4.9187	12.128	99.403	
16(2,15) - 15(2,14)	142346.33(5)	142346.314(14)	3.6247	15.739	38.820	[78A]
17(0,17) - 16(1,16)	142535.75(5)	142535.697(14)	4.7280	12.840	40.125	[78A]
24(2,22) - 23(3,21)	142687.80(5)	142687.834(28)	5.2267	5.684	89.506	[78A]
26(1,25) - 26(0,26)	142722.91(5)	142722.955(45)	5.1701	7.000	101.873	[78A]
3(3, 1) - 2(2, 0)		142758.295(24)	4.7387	2.494	3.990	
3(3, 0) - 2(2, 1)		142765.789(24)	4.7387	2.493	3.989	
24(2,23) - 24(1,24)	142928.92(5)	142928.898(36)	5.1480	6.779	87.275	[78A]
26(4,22) - 26(3,23)	143002.61(5)	143002.598(23)	4.8174	15.668	112.757	[78A]
16(8, 9) - 15(8, 8)		143335.285(14)	3.7334	12.000	85.282	
16(8, 8) - 15(8, 7)	143335.30(5)	143335.285(14)	3.7334	12.000	85.282	[78A]
16(7, 9) - 15(7, 8)	143337.68(5)	143337.701(13)	3.7007	12.938	73.708	[78A]
16(7,10) - 15(7, 9)		143337.701(13)	3.7007	12.938	73.708	
16(9, 7) - 15(9, 6)	143343.84(5)	143343.877(15)	3.7736	10.938	98.391	[78A]
16(9, 8) - 15(9, 7)		143343.877(15)	3.7736	10.938	98.391	
16(6,11) - 15(6,10)	143357.11(5)	143357.172(13)	3.6741	13.750	63.673	[78A]
16(6,10) - 15(6, 9)		143357.182(13)	3.6741	13.750	63.673	
16(10, 7) - 15(10, 6)		143360.363(17)	3.8234	9.750	113.030	
16(10, 6) - 15(10, 5)	143360.36(5)	143360.363(17)	3.8234	9.750	113.030	[78A]
16(11, 6) - 15(11, 5)		143383.002(20)	3.8860	8.438	129.196	
16(11, 5) - 15(11, 4)	143383.03(5)	143383.002(20)	3.8860	8.438	129.196	[78A]
16(5,12) - 15(5,11)	143406.56(5)	143406.557(13)	3.6525	14.438	55.181	[78A]
16(5,11) - 15(5,10)		143407.248(13)	3.6525	14.438	55.181	
16(12, 4) - 15(12, 3)	143410.76(5)	143410.752(22)	3.9668	7.000	146.884	[78A]
16(12, 5) - 15(12, 4)		143410.752(22)	3.9668	7.000	146.884	
16(13, 3) - 15(13, 2)	143443.05(5)	143442.953(25)	4.0762	5.438	166.088	[78A]
16(13, 4) - 15(13, 3)		143442.953(25)	4.0762	5.438	166.088	
16(14, 2) - 15(14, 1)		143479.176(28)	4.2373	3.750	186.804	
16(14, 3) - 15(14, 2)		143479.176(28)	4.2373	3.750	186.804	
16(4,13) - 15(4,12)	143506.97(5)	143506.979(13)	3.6350	15.000	48.237	[78A]
16(15, 2) - 15(15, 1)		143519.113(31)	4.5237	1.938	209.026	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	–log *A*	Line strength	Energy lower state	Ref.
16(15, 1) - 15(15, 0)	143519.12(5)	143519.113(31)	4.5237	1.938	209.026	[78A]
16(3,14) - 15(3,13)	143529.20(5)	143529.203(14)	3.6223	15.436	42.838	[78A]
16(4,12) - 15(4,11)	143535.29(5)	143535.295(13)	3.6347	15.000	48.238	[78A]
24(2,23) - 24(0,24)		143982.293(35)	5.9307	0.112	87.240	
16(3,13) - 15(3,12)	144104.74(5)	144104.752(13)	3.6171	15.436	42.881	[78A]
16(1,16) - 15(0,15)	144557.08(5)	144557.074(16)	4.7152	11.952	35.303	[78A]
42(5,37) - 41(6,36)	145002.32(5)	145002.420(83)	5.3537	7.014	285.533	[78A]
16(1,15) - 15(1,14)	145418.01(5)	145418.035(14)	3.5922	15.909	37.382	[78A]
25(4,21) - 25(3,22)	145749.11(5)	145749.096(22)	4.8017	14.767	104.846	[78A]
26(3,24) - 26(2,25)	145797.10(5)	145797.088(21)	4.8940	12.396	107.051	[78A]
6(5, 2) - 7(4, 3)		145807.195(41)	6.0417	0.216	20.734	
6(5, 1) - 7(4, 4)		145807.291(41)	6.0417	0.216	20.734	
41(3,38) - 41(3,39)	145821.92(5)	145821.926(50)	5.7099	0.303	263.343	[78A]
16(2,14) - 15(2,13)	146120.04(5)	146120.078(14)	3.5901	15.756	39.332	[78A]
41(4,38) - 40(5,35)	146473.28(5)	146473.291(53)	5.4388	5.461	265.291	[78A]
17(1,17) - 16(1,16)		146894.500(14)	3.5776	16.927	40.125	
6(2, 4) - 5(0, 5)		147168.521(25)	6.8141	0.004	4.469	
11(6, 6) - 12(5, 7)		147198.326(63)	5.6674	0.881	42.627	
11(6, 5) - 12(5, 8)		147198.406(63)	5.6674	0.881	42.627	
30(3,27) - 29(4,26)		147234.574(39)	5.2860	5.619	142.611	
17(0,17) - 16(0,16)		147756.773(14)	3.5696	16.944	39.950	
24(4,20) - 24(3,21)		148293.953(22)	4.7873	13.924	97.248	
10(2, 9) - 9(1, 8)	148362.76(5)	148362.773(22)	5.0112	3.559	14.545	[78A]
16(7,10) - 17(6,11)		148502.773(94)	5.5472	1.623	73.536	
16(7, 9) - 17(6,12)		148502.811(94)	5.5472	1.623	73.536	
25(2,24) - 25(1,25)		148677.619(39)	5.1114	6.819	94.444	
8(2, 6) - 7(1, 7)		149394.855(23)	5.1342	2.126	8.901	
25(2,24) - 25(0,25)		149523.986(39)	5.8898	0.114	94.416	
27(3,25) - 27(2,26)	149571.06(5)	149571.100(22)	4.8685	12.636	114.985	[78A]
20(1,19) - 19(2,18)	149683.47(5)	149683.502(19)	4.9378	8.013	59.568	[78A]
21(8,14) - 22(7,15)		149741.906(128)	5.4838	2.387	113.459	
21(8,13) - 22(7,16)		149741.920(128)	5.4838	2.387	113.459	
27(1,26) - 27(1,27)		149873.434(49)	5.8917	0.122	109.629	
27(1,26) - 27(0,27)	150415.37(5)	150415.344(49)	5.1185	6.988	109.611	[78A]
23(4,19) - 23(3,20)	150606.80(5)	150606.764(22)	4.7745	13.132	89.963	[78A]
26(9,18) - 27(8,19)		150936.512(155)	5.4425	3.159	162.393	
26(9,17) - 27(8,20)		150936.516(155)	5.4425	3.159	162.393	
17(2,16) - 16(2,15)		151127.254(14)	3.5451	16.751	43.569	
42(4,39) - 41(5,36)	151380.16(5)	151380.107(63)	5.4158	5.340	277.673	[78A]
4(3, 2) - 3(2, 1)		151694.348(25)	4.7498	2.605	4.886	
4(3, 1) - 3(2, 2)		151731.945(25)	4.7496	2.604	4.885	
18(0,18) - 17(1,17)	151812.85(5)	151812.861(14)	4.6360	13.885	45.025	[78A]
17(1,17) - 16(0,16)	152115.55(5)	152115.578(16)	4.6392	12.960	39.950	[78A]
17(8, 9) - 16(8, 8)		152297.846(14)	3.6374	13.236	90.063	
17(8,10) - 16(8, 9)		152297.846(14)	3.6374	13.236	90.063	
17(7,10) - 16(7, 9)		152303.836(13)	3.6093	14.118	78.490	
17(7,11) - 16(7,10)		152303.836(13)	3.6093	14.118	78.490	
17(9, 8) - 16(9, 7)		152304.648(15)	3.6715	12.236	103.172	
17(9, 9) - 16(9, 8)		152304.648(15)	3.6715	12.236	103.172	
17(10, 7) - 16(10, 6)		152320.512(17)	3.7129	11.118	117.812	
17(10, 8) - 16(10, 7)		152320.512(17)	3.7129	11.118	117.812	
17(6,12) - 16(6,11)		152329.873(12)	3.5862	14.883	68.455	
17(6,11) - 16(6,10)		152329.893(12)	3.5862	14.883	68.455	
17(11, 6) - 16(11, 5)		152343.346(20)	3.7639	9.883	133.979	
17(11, 7) - 16(11, 6)		152343.346(20)	3.7639	9.883	133.979	
17(12, 6) - 16(12, 5)		152371.904(22)	3.8276	8.530	151.667	
17(12, 5) - 16(12, 4)		152371.904(22)	3.8276	8.530	151.667	
17(5,13) - 16(5,12)		152391.262(12)	3.5672	15.530	59.964	
17(5,12) - 16(5,11)		152392.465(12)	3.5672	15.530	59.964	
17(13, 5) - 16(13, 4)		152405.398(25)	3.9095	7.059	170.873	
17(13, 4) - 16(13, 3)		152405.398(25)	3.9095	7.059	170.873	
17(14, 4) - 16(14, 3)		152443.311(28)	4.0199	5.471	191.590	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	–log A	Line strength	Energy lower state	Ref.
17(14, 3) – 16(14, 2)		152443.311(28)	4.0199	5.471	191.590	
17(15, 3) – 16(15, 2)		152485.281(30)	4.1818	3.765	213.813	
17(15, 2) – 16(15, 1)		152485.281(30)	4.1818	3.765	213.813	
17(3,15) – 16(3,14)		152505.410(13)	3.5407	16.468	47.625	
17(4,14) – 16(4,13)		152509.621(13)	3.5516	16.059	53.024	
17(16, 1) – 16(16, 0)		152531.059(33)	4.4691	1.941	237.537	
17(16, 2) – 16(16, 1)		152531.059(33)	4.4691	1.941	237.537	
17(4,13) – 16(4,12)		152552.918(13)	3.5512	16.059	53.026	
22(4,18) – 22(3,19)	152669.55(5)	152669.521(21)	4.7634	12.381	82.992	[78A]
17(3,14) – 16(3,13)		153272.217(13)	3.5342	16.469	47.687	
28(3,26) – 28(2,27)		153589.521(23)	4.8422	12.848	123.205	
17(1,16) – 16(1,15)		154244.348(14)	3.5146	16.906	42.233	
41(12,29) – 42(11,32)	154424.80(5)	154424.797(101)	5.3678	5.487	363.210	[78A]
21(4,17) – 21(3,18)	154475.98(5)	154475.939(21)	4.7543	11.665	76.332	[78A]
26(2,25) – 26(1,26)	154557.36(5)	154557.459(43)	5.0755	6.852	101.895	[78A]
5(5, 1) – 6(4, 2)		154769.754(41)	6.3014	0.084	18.643	
5(5, 0) – 6(4, 3)		154769.779(41)	6.3014	0.084	18.643	
11(2,10) – 10(1, 9)		154991.232(23)	4.9530	3.909	17.599	
22(3,20) – 22(1,21)		155132.646(25)	5.9574	0.077	77.454	
26(2,25) – 26(0,26)		155235.566(42)	5.8501	0.116	101.873	
23(3,21) – 23(1,22)		155254.605(24)	5.9146	0.089	84.327	
17(2,15) – 16(2,14)		155404.500(14)	3.5083	16.772	44.206	
21(3,19) – 21(1,20)		155422.225(26)	6.0019	0.066	70.865	
18(1,18) – 17(1,17)		155426.771(14)	3.5032	17.928	45.025	
24(3,22) – 24(1,23)		155814.543(24)	5.8734	0.100	91.482	
42(3,39) – 42(3,40)	155939.36(5)	155939.307(58)	5.6358	0.301	275.736	[78A]
20(4,16) – 20(3,17)	156030.08(5)	156030.033(21)	4.7470	10.976	69.985	[78A]
41(3,38) – 41(2,39)	156049.14(5)	156049.187(46)	4.7354	22.818	263.002	[78A]
20(3,18) – 20(1,19)		156089.184(26)	6.0485	0.056	64.561	
25(2,23) – 24(3,22)		156112.947(28)	5.0890	6.202	96.679	
43(5,38) – 43(4,39)	156146.18(5)	156146.254(46)	4.6315	30.314	298.172	[78A]
18(0,18) – 17(0,17)		156171.664(14)	3.4967	17.941	44.879	
10(6, 5) – 11(5, 6)		156176.920(64)	5.6586	0.687	39.041	
10(6, 4) – 11(5, 7)		156176.953(64)	5.6586	0.687	39.041	
7(2, 5) – 6(0, 6)		156728.430(25)	6.6166	0.005	6.251	
25(3,23) – 25(1,24)		156830.100(24)	5.8335	0.112	98.918	
19(3,17) – 19(1,18)		157093.201(27)	6.0973	0.047	58.544	
19(4,15) – 19(3,16)	157344.13(5)	157344.187(21)	4.7415	10.310	63.947	[78A]
15(7, 9) – 16(6,10)		157494.965(95)	5.5037	1.413	68.455	
15(7, 8) – 16(6,11)		157494.982(95)	5.5037	1.413	68.455	
28(1,27) – 28(1,28)		157596.648(52)	5.8398	0.122	117.645	
29(3,27) – 29(2,28)		157845.896(25)	4.8153	13.036	131.710	
28(1,27) – 28(0,28)		158028.713(52)	5.0700	6.982	117.631	
26(3,24) – 26(1,25)		158309.699(24)	5.7947	0.124	106.634	
18(3,16) – 18(1,17)		158389.617(28)	6.1487	0.038	52.815	
18(4,14) – 18(3,15)	158436.93(5)	158436.941(21)	4.7378	9.663	58.220	[78A]
20(8,13) – 21(7,14)		158742.455(129)	5.4284	2.170	106.883	
20(8,12) – 21(7,15)		158742.463(129)	5.4284	2.170	106.883	
17(4,13) – 17(3,14)	159330.80(5)	159330.766(21)	4.7357	9.030	52.800	[78A]
18(1,18) – 17(0,17)	159785.54(5)	159785.574(15)	4.5664	13.977	44.879	[78A]
18(2,17) – 17(2,16)		159888.873(13)	3.4704	17.762	48.610	
17(3,15) – 17(1,16)		159931.277(28)	6.2028	0.031	47.378	
25(9,17) – 26(8,18)		159939.369(156)	5.3817	2.939	154.322	
25(9,16) – 26(8,19)		159939.371(156)	5.3817	2.939	154.322	
16(4,12) – 16(3,13)		160050.062(21)	4.7352	8.409	47.687	
27(3,25) – 27(1,26)		160252.766(24)	5.7569	0.136	114.628	
27(2,26) – 27(1,27)		160555.098(46)	5.0403	6.879	109.629	
5(3, 3) – 4(2, 2)		160602.061(25)	4.7372	2.762	6.082	
15(4,11) – 15(3,12)		160619.521(22)	4.7362	7.799	42.881	
5(3, 2) – 4(2, 3)		160715.260(25)	4.7366	2.760	6.079	
19(0,19) – 18(1,18)		160970.820(13)	4.5510	14.930	50.209	
14(4,10) – 14(3,11)		161062.863(22)	4.7386	7.196	38.378	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log A	Line strength	Energy lower state	Ref.
27(2,26) - 27(0,27)		161097.010(46)	5.8114	0.118	109.611	
9(2, 7) - 8(1, 8)		161121.986(25)	5.0840	2.126	11.221	
18(8,10) - 17(8, 9)		161261.141(13)	3.5491	14.445	95.144	
18(8,11) - 17(8,10)		161261.141(13)	3.5491	14.445	95.144	
18(9,10) - 17(9, 9)		161265.734(15)	3.5784	13.500	108.253	
18(9, 9) - 17(9, 8)		161265.734(15)	3.5784	13.500	108.253	
18(7,12) - 17(7,11)		161271.324(12)	3.5246	15.278	83.570	
18(7,11) - 17(7,10)		161271.324(12)	3.5246	15.278	83.570	
18(10, 8) - 17(10, 7)		161280.676(17)	3.6136	12.445	122.893	
18(10, 9) - 17(10, 8)		161280.676(17)	3.6136	12.445	122.893	
18(11, 7) - 17(11, 6)		161303.484(19)	3.6562	11.278	139.060	
18(11, 8) - 17(11, 7)		161303.484(19)	3.6562	11.278	139.060	
18(6,13) - 17(6,12)		161304.902(12)	3.5043	16.000	73.536	
18(6,12) - 17(6,11)		161304.941(12)	3.5043	16.000	73.536	
21(1,20) - 20(2,19)		161325.604(18)	4.8161	8.882	65.484	
18(12, 6) - 17(12, 5)		161332.684(22)	3.7082	10.000	156.750	
18(12, 7) - 17(12, 6)		161332.684(22)	3.7082	10.000	156.750	
18(13, 6) - 17(13, 5)		161367.340(24)	3.7728	8.611	175.957	
18(13, 5) - 17(13, 4)		161367.340(24)	3.7728	8.611	175.957	
18(5,14) - 17(5,13)		161379.840(12)	3.4874	16.611	65.047	
18(5,13) - 17(5,12)		161381.869(12)	3.4874	16.611	65.047	
13(4, 9) - 13(3,10)		161402.008(23)	4.7424	6.599	34.180	
18(14, 4) - 17(14, 3)		161406.840(27)	3.8556	7.111	196.675	
18(14, 5) - 17(14, 4)		161406.840(27)	3.8556	7.111	196.675	
12(2,11) - 11(1,10)		161420.461(24)	4.8962	4.286	20.955	
18(15, 3) - 17(15, 2)		161450.760(30)	3.9669	5.500	218.900	
18(15, 4) - 17(15, 3)		161450.760(30)	3.9669	5.500	218.900	
18(3,16) - 17(3,15)		161475.172(13)	3.4641	17.497	52.712	
18(16, 2) - 17(16, 1)		161498.805(32)	4.1296	3.778	242.625	
18(16, 3) - 17(16, 2)		161498.805(32)	4.1296	3.778	242.625	
18(4,15) - 17(4,14)		161516.719(12)	3.4734	17.111	58.111	
18(17, 2) - 17(17, 1)		161550.750(35)	4.4176	1.944	267.843	
18(17, 1) - 17(17, 0)		161550.750(35)	4.4176	1.944	267.843	
18(4,14) - 17(4,13)		161581.197(12)	3.4729	17.111	58.115	
12(4, 8) - 12(3, 9)		161656.590(24)	4.7478	6.006	30.284	
16(3,14) - 16(1,15)		161670.215(29)	6.2601	0.025	42.233	
16(4,13) - 16(3,14)		161841.361(22)	4.7227	8.372	47.625	
11(4, 7) - 11(3, 8)		161843.729(25)	4.7551	5.415	26.691	
17(4,14) - 17(3,15)		161845.574(21)	4.7181	8.972	52.712	
15(4,12) - 15(3,13)		161863.588(22)	4.7275	7.775	42.838	
18(4,15) - 18(3,16)		161887.121(21)	4.7137	9.575	58.099	
14(4,11) - 14(3,12)		161902.887(23)	4.7327	7.181	38.350	
13(4,10) - 13(3,11)		161951.488(23)	4.7385	6.590	34.161	
10(4, 6) - 10(3, 7)		161978.039(25)	4.7647	4.824	23.398	
19(4,16) - 19(3,17)		161978.342(21)	4.7092	10.181	63.784	
12(4, 9) - 12(3,10)		162003.191(24)	4.7454	6.001	30.273	
11(4, 8) - 11(3, 9)		162053.314(25)	4.7536	5.413	26.684	
9(4, 5) - 9(3, 6)		162071.738(26)	4.7778	4.228	20.407	
10(4, 7) - 10(3, 8)		162098.588(25)	4.7639	4.822	23.394	
20(4,17) - 20(3,18)		162132.857(21)	4.7045	10.788	69.767	
8(4, 4) - 8(3, 5)		162134.863(27)	4.7959	3.624	17.716	
9(4, 6) - 9(3, 7)		162137.004(26)	4.7773	4.227	20.405	
8(4, 5) - 8(3, 6)		162167.645(27)	4.7957	3.624	17.714	
7(4, 3) - 7(3, 4)		162175.520(27)	4.8226	3.005	15.324	
7(4, 4) - 7(3, 5)		162190.477(27)	4.8225	3.005	15.324	
6(4, 2) - 6(3, 3)		162200.146(28)	4.8651	2.360	13.232	
6(4, 3) - 6(3, 4)		162206.146(28)	4.8650	2.360	13.232	
5(4, 1) - 5(3, 2)		162213.766(28)	4.9418	1.674	11.440	
5(4, 2) - 5(3, 3)		162215.771(28)	4.9417	1.673	11.440	
4(4, 0) - 4(3, 1)		162220.227(29)	5.1187	0.911	9.946	
4(4, 1) - 4(3, 2)		162220.730(29)	5.1187	0.911	9.946	
30(3,28) - 30(2,29)		162332.186(28)	4.7879	13.199	140.500	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log A	Line strength	Energy lower state	Ref.
21(4,18) - 21(3,19)		162365.391(21)	4.6995	11.396	76.049	
18(3,15) - 17(3,14)		162475.021(13)	3.4560	17.499	52.800	
28(3,26) - 28(1,27)		162650.541(25)	5.7199	0.146	122.902	
22(4,19) - 22(3,20)		162691.518(21)	4.6941	12.001	82.629	
18(1,17) - 17(1,16)		163016.830(14)	3.4418	17.901	47.378	
23(4,20) - 23(3,21)		163127.416(22)	4.6883	12.604	89.506	
15(3,13) - 15(1,14)		163559.045(30)	6.3210	0.020	37.382	
24(4,21) - 24(3,22)		163689.588(22)	4.6818	13.200	96.679	
19(1,19) - 18(1,18)		163948.725(14)	3.4330	18.929	50.209	
25(4,22) - 25(3,23)		164394.557(23)	4.6747	13.788	104.149	
19(0,19) - 18(0,18)		164584.730(14)	3.4277	18.940	50.088	
18(2,16) - 17(2,15)		164668.031(13)	3.4315	17.786	49.390	
9(6, 4) - 10(5, 5)		165148.598(64)	5.6767	0.504	35.754	
9(6, 3) - 10(5, 6)		165148.609(64)	5.6767	0.504	35.754	
29(1,28) - 29(1,29)		165211.471(54)	5.7913	0.123	125.944	
26(4,23) - 26(3,24)		165258.592(23)	4.6668	14.365	111.914	
29(3,27) - 29(1,28)		165487.336(26)	5.6835	0.156	131.455	
14(3,12) - 14(1,13)		165552.016(31)	6.3859	0.015	32.827	
29(1,28) - 29(0,29)		165555.227(54)	5.0246	6.979	125.932	
27(4,24) - 27(3,25)		166297.410(24)	4.6580	14.928	119.974	
14(7, 8) - 15(6, 9)		166479.299(96)	5.4709	1.207	63.673	
14(7, 7) - 15(6,10)		166479.307(96)	5.4709	1.207	63.673	
8(2, 6) - 7(0, 7)		166605.861(26)	6.4437	0.008	8.327	
28(2,27) - 28(1,28)		166657.668(49)	5.0058	6.902	117.645	
28(2,27) - 28(0,28)		167089.732(48)	5.7739	0.119	117.631	
28(4,25) - 28(3,26)		167525.924(24)	4.6483	15.474	128.328	
19(1,19) - 18(0,18)		167562.635(14)	4.4967	15.000	50.088	
13(3,11) - 13(1,12)		167605.711(32)	6.4554	0.012	28.570	
13(2,12) - 12(1,11)		167664.523(24)	4.8407	4.695	24.613	
19(8,12) - 20(7,13)		167735.059(129)	5.3801	1.956	100.606	
19(8,11) - 20(7,14)		167735.062(129)	5.3801	1.956	100.606	
19(2,18) - 18(2,17)		168630.711(13)	3.3999	18.771	53.943	
30(3,28) - 30(1,29)		168741.979(28)	5.6477	0.166	140.286	
24(9,16) - 25(8,17)		168934.678(157)	5.3266	2.721	146.550	
24(9,15) - 25(8,18)		168934.680(157)	5.3266	2.721	146.550	
29(4,26) - 29(3,27)		168957.975(25)	4.6377	16.000	136.975	
6(3, 4) - 5(2, 3)		169460.908(25)	4.7128	2.939	7.579	
26(2,24) - 25(3,23)		169584.398(29)	4.9599	6.770	104.149	
12(3,10) - 12(1,11)		169679.500(33)	6.5304	0.009	24.613	
6(3, 3) - 5(2, 4)		169725.957(26)	4.7114	2.935	7.571	
20(0,20) - 19(1,19)		170020.854(13)	4.4722	15.972	55.678	
29(10,20) - 30(9,21)		170096.135(164)	5.2899	3.492	201.502	
29(10,19) - 30(9,22)		170096.135(164)	5.2899	3.492	201.502	
19(8,12) - 18(8,11)		170225.211(13)	3.4671	15.632	100.523	
19(8,11) - 18(8,10)		170225.211(13)	3.4671	15.632	100.523	
19(9,11) - 18(9,10)		170227.152(14)	3.4927	14.737	113.632	
19(9,10) - 18(9, 9)		170227.152(14)	3.4927	14.737	113.632	
19(7,13) - 18(7,12)		170240.246(12)	3.4456	16.421	88.949	
19(7,12) - 18(7,11)		170240.246(12)	3.4456	16.421	88.949	
19(10, 9) - 18(10, 8)		170240.855(16)	3.5231	13.737	128.273	
19(10,10) - 18(10, 9)		170240.855(16)	3.5231	13.737	128.273	
19(11, 8) - 18(11, 7)		170263.406(19)	3.5594	12.632	144.441	
19(11, 9) - 18(11, 8)		170263.406(19)	3.5594	12.632	144.441	
19(6,14) - 18(6,13)		170282.398(11)	3.4276	17.106	78.917	
19(6,13) - 18(6,12)		170282.469(11)	3.4276	17.106	78.917	
19(12, 7) - 18(12, 6)		170293.068(21)	3.6029	11.421	162.131	
19(12, 8) - 18(12, 7)		170293.068(21)	3.6029	11.421	162.131	
19(13, 7) - 18(13, 6)		170328.748(24)	3.6558	10.106	181.339	
19(13, 6) - 18(13, 5)		170328.748(24)	3.6558	10.106	181.339	
19(14, 6) - 18(14, 5)		170369.727(26)	3.7213	8.684	202.059	
19(14, 5) - 18(14, 4)		170369.727(26)	3.7213	8.684	202.059	
19(5,15) - 18(5,14)		170372.471(11)	3.4124	17.684	70.430	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	-log A	Line strength	Energy lower state	Ref.
19(5,14) - 18(5,13)		170375.793(11)	3.4124	17.684	70.431	
19(15, 4) - 18(15, 3)		170415.508(29)	3.8049	7.158	224.285	
19(15, 5) - 18(15, 4)		170415.508(29)	3.8049	7.158	224.285	
19(3,17) - 18(3,16)		170436.668(13)	3.3918	18.523	58.099	
19(16, 3) - 18(16, 2)		170465.746(31)	3.9169	5.526	248.012	
19(16, 4) - 18(16, 3)		170465.746(31)	3.9169	5.526	248.012	
19(17, 3) - 18(17, 2)		170520.182(34)	4.0803	3.790	273.232	
19(17, 2) - 18(17, 1)		170520.182(34)	4.0803	3.790	273.232	
19(4,16) - 18(4,15)		170527.889(12)	3.3998	18.158	63.499	
19(18, 2) - 18(18, 1)		170578.621(36)	4.3690	1.947	299.940	
19(18, 1) - 18(18, 0)		170578.621(36)	4.3690	1.947	299.940	
30(4,27) - 30(3,28)		170606.121(25)	4.6260	16.505	145.914	
19(4,15) - 18(4,14)		170621.670(12)	3.3991	18.158	63.504	
19(3,16) - 18(3,15)		171714.422(12)	3.3820	18.525	58.220	
19(1,18) - 18(1,17)		171733.086(14)	3.3733	18.896	52.815	
11(3, 9) - 11(1,10)		171735.756(33)	6.6118	0.006	20.955	
20(1,20) - 19(1,19)		172461.246(13)	3.3663	19.930	55.678	
30(1,29) - 30(1,30)		172719.488(55)	5.7458	0.123	134.524	
22(1,21) - 21(2,20)		172814.721(18)	4.7035	9.801	71.690	
29(2,28) - 29(1,29)		172852.908(51)	4.9720	6.921	125.944	
30(1,29) - 30(0,30)		172992.459(55)	4.9818	6.979	134.515	
20(0,20) - 19(0,19)		172998.758(13)	3.3621	19.938	55.578	
29(2,28) - 29(0,29)		173196.666(51)	5.7374	0.121	125.932	
10(2, 8) - 9(1, 9)		173391.715(27)	5.0397	2.088	13.829	
10(3, 8) - 10(1, 9)		173739.943(34)	6.7010	0.005	17.599	
14(2,13) - 13(1,12)		173740.551(25)	4.7862	5.138	28.570	
19(2,17) - 18(2,16)		173904.152(13)	3.3592	18.798	54.883	
8(6, 3) - 9(5, 4)		174114.572(65)	5.7353	0.336	32.767	
8(6, 2) - 9(5, 5)		174114.576(65)	5.7353	0.336	32.767	
20(1,20) - 19(0,19)		175439.150(14)	4.4298	16.026	55.578	
13(7, 7) - 14(6, 8)		175456.775(96)	5.4501	1.007	59.190	
13(7, 6) - 14(6, 9)		175456.779(96)	5.4501	1.007	59.190	
9(3, 7) - 9(1, 8)		175660.613(35)	6.7998	0.003	14.545	
18(8,11) - 19(7,12)		176720.527(130)	5.3390	1.744	94.628	
18(8,10) - 19(7,13)		176720.529(130)	5.3390	1.744	94.628	
9(2, 7) - 8(0, 8)		176887.672(27)	6.2917	0.010	10.695	
20(2,19) - 19(2,18)		177352.453(13)	3.3332	19.779	59.568	
8(3, 6) - 8(1, 7)		177469.357(35)	6.9111	0.002	11.795	
23(9,15) - 24(8,16)		177923.094(157)	5.2771	2.504	139.077	
23(9,14) - 24(8,17)		177923.094(157)	5.2771	2.504	139.077	
7(3, 5) - 6(2, 4)		178245.262(26)	4.6825	3.125	9.378	
7(3, 4) - 6(2, 5)		178776.963(26)	4.6799	3.116	9.361	
21(0,21) - 20(1,20)		178975.074(13)	4.3986	17.011	61.430	
28(10,18) - 29(9,21)		179081.967(165)	5.2361	3.273	192.535	
28(10,19) - 29(9,20)		179081.967(165)	5.2361	3.273	192.535	
30(2,29) - 30(1,30)		179129.281(52)	4.9390	6.936	134.524	
7(3, 5) - 7(1, 6)		179140.738(36)	7.0390	0.001	9.348	
20(9,12) - 19(9,11)		179188.914(14)	3.4132	15.950	119.310	
20(9,11) - 19(9,10)		179188.914(14)	3.4132	15.950	119.310	
20(8,12) - 19(8,11)		179190.098(12)	3.3907	16.800	106.201	
20(8,13) - 19(8,12)		179190.098(12)	3.3907	16.800	106.201	
20(10,11) - 19(10,10)		179201.047(16)	3.4398	15.000	133.952	
20(10,10) - 19(10, 9)		179201.047(16)	3.4398	15.000	133.952	
20(7,14) - 19(7,13)		179210.678(11)	3.3716	17.550	94.628	
20(7,13) - 19(7,12)		179210.680(11)	3.3716	17.550	94.628	
20(11, 9) - 19(11, 8)		179223.094(18)	3.4712	13.950	150.120	
20(11,10) - 19(11, 9)		179223.094(18)	3.4712	13.950	150.120	
20(12, 8) - 19(12, 7)		179253.033(21)	3.5083	12.800	167.812	
20(12, 9) - 19(12, 8)		179253.033(21)	3.5083	12.800	167.812	
20(6,15) - 19(6,14)		179262.492(11)	3.3554	18.200	84.597	
20(6,14) - 19(6,13)		179262.615(11)	3.3554	18.200	84.597	
20(13, 7) - 19(13, 6)		179289.594(23)	3.5527	11.550	187.021	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log A	Line strength	Energy lower state	Ref.
20(13, 8) - 19(13, 7)		179289.594(23)	3.5527	11.550	187.021	
20(14, 6) - 19(14, 5)		179331.936(25)	3.6064	10.200	207.742	
20(14, 7) - 19(14, 6)		179331.936(25)	3.6064	10.200	207.742	
20(5,16) - 19(5,15)		179369.314(11)	3.3417	18.750	76.113	
20(5,15) - 19(5,14)		179374.602(11)	3.3417	18.750	76.114	
20(15, 6) - 19(15, 5)		179379.484(27)	3.6726	8.750	229.970	
20(15, 5) - 19(15, 4)		179379.484(27)	3.6726	8.750	229.970	
20(3,18) - 19(3,17)		179388.074(12)	3.3235	19.545	63.784	
30(2,29) - 30(0,30)		179402.252(52)	5.7020	0.122	134.515	
20(16, 5) - 19(16, 4)		179431.840(30)	3.7569	7.200	253.698	
20(16, 4) - 19(16, 3)		179431.840(30)	3.7569	7.200	253.698	
20(17, 3) - 19(17, 2)		179488.701(32)	3.8695	5.550	278.920	
20(17, 4) - 19(17, 3)		179488.701(32)	3.8695	5.550	278.920	
20(4,17) - 19(4,16)		179542.592(12)	3.3302	19.200	69.187	
20(18, 3) - 19(18, 2)		179549.848(34)	4.0336	3.800	305.629	
20(18, 2) - 19(18, 1)		179549.848(34)	4.0336	3.800	305.629	
20(19, 2) - 19(19, 1)		179615.104(37)	4.3229	1.950	333.819	
20(19, 1) - 19(19, 0)		179615.104(37)	4.3229	1.950	333.819	
15(2,14) - 14(1,13)		179669.039(25)	4.7325	5.619	32.827	
20(4,16) - 19(4,15)		179676.094(12)	3.3292	19.200	69.196	
20(1,19) - 19(1,18)		180392.094(13)	3.3087	19.889	58.544	
6(3, 4) - 6(1, 5)		180652.242(37)	7.1904	0.001	7.206	
21(1,21) - 20(1,20)		180965.223(13)	3.3030	20.931	61.430	
20(3,17) - 19(3,16)		180990.250(12)	3.3119	19.549	63.947	
21(0,21) - 20(0,20)		181415.467(13)	3.2997	20.937	61.349	
5(3, 3) - 5(1, 4)		181984.223(37)	7.3783	0.000	5.369	
27(2,25) - 26(3,24)		183063.098(30)	4.8382	7.391	111.914	
7(6, 2) - 8(5, 3)		183075.955(65)	5.8652	0.189	30.078	
7(6, 1) - 8(5, 4)		183075.955(65)	5.8652	0.189	30.078	
20(2,18) - 19(2,17)		183107.379(13)	3.2910	19.809	60.684	
4(3, 2) - 4(1, 3)		183119.867(38)	7.6308	0.000	3.838	
21(1,21) - 20(0,20)		183405.615(14)	4.3657	17.052	61.349	
3(3, 1) - 3(1, 2)		184045.180(38)	8.0343	0.000	2.612	
23(1,22) - 22(2,21)		184121.643(18)	4.5990	10.766	78.186	
12(7, 6) - 13(6, 7)		184428.332(97)	5.4441	0.814	55.007	
12(7, 5) - 13(6, 8)		184428.334(97)	5.4441	0.814	55.007	
16(2,15) - 15(1,14)		185474.053(25)	4.6795	6.144	37.382	
17(8,10) - 18(7,11)		185699.635(131)	5.3056	1.536	88.949	
17(8, 9) - 18(7,12)		185699.635(131)	5.3056	1.536	88.949	
21(2,20) - 20(2,19)		186053.961(13)	3.2699	20.785	65.484	
11(2, 9) - 10(1,10)		186253.379(29)	5.0014	2.015	16.725	
22(9,14) - 23(8,15)		186905.248(158)	5.2331	2.288	131.904	
22(9,13) - 23(8,16)		186905.248(158)	5.2331	2.288	131.904	
8(3, 6) - 7(2, 5)		186924.943(26)	4.6493	3.314	11.479	
10(2, 8) - 9(0, 9)		187663.523(28)	6.1588	0.013	13.353	
22(0,22) - 21(1,21)		187845.600(14)	4.3297	18.046	67.467	
8(3, 5) - 7(2, 6)		187884.113(26)	4.6450	3.296	11.448	
27(10,17) - 28(9,20)		188061.971(166)	5.1868	3.054	183.867	
27(10,18) - 28(9,19)		188061.971(166)	5.1868	3.054	183.867	
21(9,13) - 20(9,12)		188151.037(14)	3.3390	17.143	125.287	
21(9,12) - 20(9,11)		188151.037(14)	3.3390	17.143	125.287	
21(8,13) - 20(8,12)		188155.838(12)	3.3189	17.953	112.178	
21(8,14) - 20(8,13)		188155.838(12)	3.3189	17.953	112.178	
21(10,11) - 20(10,10)		188161.248(16)	3.3625	16.239	139.929	
21(10,12) - 20(10,11)		188161.248(16)	3.3625	16.239	139.929	
21(11,11) - 20(11,10)		188182.535(18)	3.3899	15.238	156.099	
21(11,10) - 20(11, 9)		188182.535(18)	3.3899	15.238	156.099	
21(7,15) - 20(7,14)		188182.697(11)	3.3018	18.667	100.606	
21(7,14) - 20(7,13)		188182.699(11)	3.3018	18.667	100.606	
21(12,10) - 20(12, 9)		188212.559(20)	3.4221	14.143	173.791	
21(12, 9) - 20(12, 8)		188212.559(20)	3.4221	14.143	173.791	
21(6,16) - 20(6,15)		188245.320(11)	3.2872	19.286	90.576	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	-log A	Line strength	Energy lower state	Ref.
21(6,15) - 20(6,14)		188245.533(11)	3.2872	19.286	90.576	
21(13, 9) - 20(13, 8)		188249.846(22)	3.4601	12.953	193.001	
21(13, 8) - 20(13, 7)		188249.846(22)	3.4601	12.953	193.001	
21(14, 7) - 20(14, 6)		188293.430(24)	3.5052	11.667	213.724	
21(14, 8) - 20(14, 7)		188293.430(24)	3.5052	11.667	213.724	
21(3,19) - 20(3,18)		188327.596(12)	3.2587	20.566	69.767	
21(15, 7) - 20(15, 6)		188342.650(26)	3.5595	10.286	235.953	
21(15, 6) - 20(15, 5)		188342.650(26)	3.5595	10.286	235.953	
21(5,17) - 20(5,16)		188370.498(11)	3.2747	19.810	82.097	
21(5,16) - 20(5,15)		188378.713(11)	3.2747	19.810	82.097	
21(16, 5) - 20(16, 4)		188397.041(28)	3.6264	8.810	259.683	
21(16, 6) - 20(16, 5)		188397.041(28)	3.6264	8.810	259.683	
21(17, 4) - 20(17, 3)		188456.264(29)	3.7113	7.238	284.907	
21(17, 5) - 20(17, 4)		188456.264(29)	3.7113	7.238	284.907	
21(18, 3) - 20(18, 2)		188520.059(32)	3.8246	5.572	311.619	
21(18, 4) - 20(18, 3)		188520.059(32)	3.8246	5.572	311.619	
21(4,18) - 20(4,17)		188560.127(12)	3.2641	20.237	75.176	
21(19, 2) - 20(19, 1)		188588.229(35)	3.9892	3.810	339.811	
21(19, 3) - 20(19, 2)		188588.229(35)	3.9892	3.810	339.811	
21(20, 1) - 20(20, 0)		188660.615(40)	4.2790	1.952	369.475	
21(20, 2) - 20(20, 1)		188660.615(40)	4.2790	1.952	369.475	
21(4,17) - 20(4,16)		188746.488(12)	3.2628	20.238	75.189	
21(1,20) - 20(1,19)		188994.555(13)	3.2475	20.882	64.561	
22(1,22) - 21(1,21)		189461.518(14)	3.2427	21.931	67.467	
22(0,22) - 21(0,21)		189835.748(14)	3.2401	21.936	67.400	
21(3,18) - 20(3,17)		190300.584(12)	3.2451	20.571	69.985	
17(2,16) - 16(1,15)		191183.271(25)	4.6269	6.715	42.233	
22(1,22) - 21(0,21)		191451.664(14)	4.3042	18.077	67.400	
6(6, 1) - 7(5, 2)		192033.758(66)	6.1598	0.072	27.688	
6(6, 0) - 7(5, 3)		192033.758(66)	6.1598	0.072	27.688	
21(2,19) - 20(2,18)		192273.055(13)	3.2265	20.817	66.791	
11(7, 5) - 12(6, 6)		193394.852(98)	5.4571	0.630	51.122	
11(7, 4) - 12(6, 7)		193394.852(98)	5.4571	0.630	51.122	
16(8, 9) - 17(7,10)		194673.113(132)	5.2805	1.332	83.570	
16(8, 8) - 17(7,11)		194673.113(132)	5.2805	1.332	83.570	
22(2,21) - 21(2,20)		194735.270(13)	3.2098	21.791	71.690	
24(1,23) - 23(2,22)		195223.146(18)	4.5022	11.768	84.970	
9(3, 7) - 8(2, 6)		195466.207(26)	4.6153	3.504	13.885	
21(9,13) - 22(8,14)		195881.752(159)	5.1946	2.076	125.029	
21(9,12) - 22(8,15)		195881.752(159)	5.1946	2.076	125.029	
28(2,26) - 27(3,25)		196508.461(31)	4.7233	8.068	119.974	
23(0,23) - 22(1,22)		196643.988(14)	4.2648	19.077	73.787	
18(2,17) - 17(1,16)		196827.799(24)	4.5747	7.337	47.378	
26(10,17) - 27(9,18)		197036.652(167)	5.1421	2.837	175.498	
26(10,16) - 27(9,19)		197036.652(167)	5.1421	2.837	175.498	
9(3, 6) - 8(2, 7)		197066.396(26)	4.6086	3.472	13.833	
22(9,14) - 21(9,13)		197113.537(14)	3.2693	18.319	131.563	
22(9,13) - 21(9,12)		197113.537(14)	3.2693	18.319	131.563	
22(10,13) - 21(10,12)		197121.459(15)	3.2902	17.455	146.205	
22(10,12) - 21(10,11)		197121.459(15)	3.2902	17.455	146.205	
22(8,15) - 21(8,14)		197122.473(12)	3.2513	19.091	118.454	
22(8,14) - 21(8,13)		197122.473(12)	3.2513	19.091	118.454	
22(11,11) - 21(11,10)		197141.715(17)	3.3145	16.500	162.376	
22(11,12) - 21(11,11)		197141.715(17)	3.3145	16.500	162.376	
22(7,16) - 21(7,15)		197156.379(11)	3.2359	19.773	106.883	
22(7,15) - 21(7,14)		197156.387(11)	3.2359	19.773	106.883	
22(12,11) - 21(12,10)		197171.615(19)	3.3428	15.455	180.069	
22(12,10) - 21(12, 9)		197171.615(19)	3.3428	15.455	180.069	
22(13,10) - 21(13, 9)		197209.471(21)	3.3757	14.319	199.281	
22(13, 9) - 21(13, 8)		197209.471(21)	3.3757	14.319	199.281	
22(6,17) - 21(6,16)		197231.016(11)	3.2226	20.364	96.855	
22(6,16) - 21(6,15)		197231.373(11)	3.2226	20.364	96.855	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log A	Line strength	Energy lower state	Ref.
22(3,20) - 21(3,19)		197253.502(13)	3.1972	21.584	76.049	
22(14, 8) - 21(14, 7)		197254.170(23)	3.4143	13.091	220.005	
22(14, 9) - 21(14, 8)		197254.170(23)	3.4143	13.091	220.005	
22(15, 7) - 21(15, 6)		197304.961(24)	3.4601	11.773	242.236	
22(15, 8) - 21(15, 7)		197304.961(24)	3.4601	11.773	242.236	
22(16, 6) - 21(16, 5)		197361.305(26)	3.5151	10.364	265.967	
22(16, 7) - 21(16, 6)		197361.305(26)	3.5151	10.364	265.967	
22(5,18) - 21(5,17)		197376.119(11)	3.2111	20.864	88.380	
22(5,17) - 21(5,16)		197388.600(11)	3.2110	20.864	88.381	
22(17, 5) - 21(17, 4)		197422.816(27)	3.5826	8.864	291.193	
22(17, 6) - 21(17, 5)		197422.816(27)	3.5826	8.864	291.193	
22(18, 4) - 21(18, 3)		197489.201(29)	3.6680	7.273	317.907	
22(18, 5) - 21(18, 4)		197489.201(29)	3.6680	7.273	317.907	
22(1,21) - 21(1,20)		197543.078(13)	3.1895	21.874	70.865	
22(19, 4) - 21(19, 3)		197560.236(32)	3.7818	5.591	346.101	
22(19, 3) - 21(19, 2)		197560.236(32)	3.7818	5.591	346.101	
22(4,19) - 21(4,18)		197579.627(12)	3.2013	21.272	81.465	
22(20, 2) - 21(20, 1)		197635.742(37)	3.9469	3.818	375.769	
22(20, 3) - 21(20, 2)		197635.742(37)	3.9469	3.818	375.769	
22(21, 2) - 21(21, 1)		197715.572(45)	4.2372	1.955	406.901	
22(21, 1) - 21(21, 0)		197715.572(45)	4.2372	1.955	406.901	
30(5,25) - 30(4,26)		197752.932(30)	4.4242	16.865	151.892	
22(4,18) - 21(4,17)		197835.113(12)	3.1997	21.272	81.485	
23(1,23) - 22(1,22)		197950.947(14)	3.1851	22.932	73.787	
4(4, 1) - 3(3, 0)		198035.016(30)	4.2750	3.494	8.751	
4(4, 0) - 3(3, 1)		198035.088(30)	4.2750	3.494	8.751	
23(0,23) - 22(0,22)		198259.904(14)	3.1830	22.935	73.733	
11(2, 9) - 10(0,10)		199021.283(29)	6.0434	0.015	16.299	
29(5,24) - 29(4,25)		199494.850(30)	4.4170	16.155	142.835	
23(1,23) - 22(0,22)		199566.865(15)	4.2450	19.101	73.733	
22(3,19) - 21(3,18)		199641.531(12)	3.1813	21.592	76.332	
12(2,10) - 11(1,11)		199751.498(32)	4.9689	1.914	19.908	
28(5,23) - 28(4,24)		200999.551(30)	4.4112	15.465	134.090	
22(2,20) - 21(2,19)		201397.098(13)	3.1653	21.824	73.205	
27(5,22) - 27(4,23)		202288.482(30)	4.4067	14.789	125.654	
10(7, 3) - 11(6, 6)		202357.152(98)	5.4966	0.459	47.537	
10(7, 4) - 11(6, 5)		202357.152(98)	5.4966	0.459	47.537	
19(2,18) - 18(1,17)		202441.678(24)	4.5227	8.011	52.815	
26(5,21) - 26(4,22)		203384.391(30)	4.4035	14.128	117.527	
23(2,22) - 22(2,21)		203396.582(13)	3.1524	22.795	78.186	
15(8, 8) - 16(7, 9)		203641.664(132)	5.2649	1.133	78.490	
15(8, 7) - 16(7,10)		203641.664(132)	5.2649	1.133	78.490	
10(3, 8) - 9(2, 7)		203833.219(26)	4.5814	3.692	16.595	
25(5,20) - 25(4,21)		204310.043(30)	4.4013	13.478	109.708	
20(9,11) - 21(8,14)		204853.186(159)	5.1619	1.866	118.454	
20(9,12) - 21(8,13)		204853.186(159)	5.1619	1.866	118.454	
24(5,19) - 24(4,20)		205087.305(30)	4.4001	12.838	102.195	
24(0,24) - 23(1,23)		205380.881(15)	4.2035	20.105	80.389	
30(5,26) - 30(4,27)		205658.350(32)	4.3791	16.637	151.605	
29(5,25) - 29(4,26)		205736.395(31)	4.3813	15.991	142.611	
23(5,18) - 23(4,19)		205736.527(30)	4.3998	12.207	94.987	
28(5,24) - 28(4,25)		205865.498(31)	4.3834	15.346	133.916	
25(10,16) - 26(9,17)		206006.490(168)	5.1017	2.621	167.428	
25(10,15) - 26(9,18)		206006.490(168)	5.1017	2.621	167.428	
27(5,23) - 27(4,24)		206032.941(31)	4.3853	14.705	125.521	
23(1,22) - 22(1,21)		206042.191(14)	3.1342	22.866	77.454	
23(9,15) - 22(9,14)		206076.428(14)	3.2036	19.479	138.138	
23(9,14) - 22(9,13)		206076.428(14)	3.2036	19.479	138.138	
23(10,14) - 22(10,13)		206081.676(15)	3.2224	18.653	152.781	
23(10,13) - 22(10,12)		206081.676(15)	3.2224	18.653	152.781	
23(8,15) - 22(8,14)		206090.041(13)	3.1873	20.218	125.029	
23(8,16) - 22(8,15)		206090.041(13)	3.1873	20.218	125.029	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log *A*	Line strength	Energy lower state	Ref.
23(11,13) - 22(11,12)		206100.619(17)	3.2441	17.740	168.952	
23(11,12) - 22(11,11)		206100.619(17)	3.2441	17.740	168.952	
25(1,24) - 24(2,23)		206103.033(19)	4.4124	12.800	92.043	
23(12,11) - 22(12,10)		206130.182(19)	3.2691	16.740	186.646	
23(12,12) - 22(12,11)		206130.182(19)	3.2691	16.740	186.646	
23(7,17) - 22(7,16)		206131.805(12)	3.1733	20.870	113.459	
23(7,16) - 22(7,15)		206131.816(12)	3.1733	20.870	113.459	
23(3,21) - 22(3,20)		206164.150(13)	3.1385	22.600	82.629	
23(13,11) - 22(13,10)		206168.437(20)	3.2980	15.653	205.859	
23(13,10) - 22(13, 9)		206168.437(20)	3.2980	15.653	205.859	
23(14, 9) - 22(14, 8)		206214.123(22)	3.3316	14.479	226.584	
23(14,10) - 22(14, 9)		206214.123(22)	3.3316	14.479	226.584	
23(6,18) - 22(6,17)		206219.707(12)	3.1611	21.435	103.434	
23(6,17) - 22(6,16)		206220.295(12)	3.1611	21.435	103.434	
26(5,22) - 26(4,23)		206227.232(30)	4.3872	14.068	117.427	
23(15, 9) - 22(15, 8)		206266.373(23)	3.3708	13.218	248.817	
23(15, 8) - 22(15, 7)		206266.373(23)	3.3708	13.218	248.817	
22(5,17) - 22(4,18)		206276.180(30)	4.4003	11.584	88.084	
23(16, 8) - 22(16, 7)		206324.584(23)	3.4172	11.870	272.550	
23(16, 7) - 22(16, 6)		206324.584(23)	3.4172	11.870	272.550	
10(3, 7) - 9(2, 8)		206346.217(27)	4.5718	3.638	16.515	
23(5,19) - 22(5,18)		206386.227(12)	3.1505	21.913	94.964	
23(17, 6) - 22(17, 5)		206388.312(24)	3.4727	10.435	297.779	
23(17, 7) - 22(17, 6)		206388.312(24)	3.4727	10.435	297.779	
23(5,18) - 22(5,17)		206404.811(12)	3.1504	21.913	94.965	
24(1,24) - 23(1,23)	206434.34(5)	206434.275(15)	3.1300	23.932	80.389	[78A]
25(5,21) - 25(4,22)		206438.213(30)	4.3892	13.436	109.633	
23(18, 5) - 22(18, 4)		206457.227(26)	3.5407	8.913	324.494	
23(18, 6) - 22(18, 5)		206457.227(26)	3.5407	8.913	324.494	
23(19, 4) - 22(19, 3)		206531.074(30)	3.6267	7.305	352.691	
23(19, 5) - 22(19, 4)		206531.074(30)	3.6267	7.305	352.691	
23(4,20) - 22(4,19)		206600.051(12)	3.1415	22.303	88.056	
23(20, 4) - 22(20, 3)		206609.654(36)	3.7409	5.609	382.361	
23(20, 3) - 22(20, 2)		206609.654(36)	3.7409	5.609	382.361	
24(5,20) - 24(4,21)		206657.094(30)	4.3912	12.809	102.140	
24(0,24) - 23(0,23)	206687.81(5)	206687.842(15)	3.1284	23.935	80.346	[78A]
23(21, 3) - 22(21, 2)		206692.801(45)	3.9065	3.826	413.496	
23(21, 2) - 22(21, 1)		206692.801(45)	3.9065	3.826	413.496	
21(5,16) - 21(4,17)		206722.693(31)	4.4014	10.968	81.485	
23(22, 2) - 22(22, 1)		206780.379(57)	4.1972	1.957	446.090	
23(22, 1) - 22(22, 0)		206780.379(57)	4.1972	1.957	446.090	
23(5,19) - 23(4,20)		206876.475(30)	4.3933	12.187	94.947	
23(4,19) - 22(4,18)		206944.461(12)	3.1393	22.304	88.084	
5(4, 2) - 4(3, 1)		206989.143(31)	4.2938	3.581	9.946	
5(4, 1) - 4(3, 2)		206989.650(31)	4.2938	3.581	9.946	
22(5,18) - 22(4,19)		207090.299(30)	4.3956	11.571	88.056	
20(5,15) - 20(4,16)		207090.473(31)	4.4032	10.359	75.189	
21(5,17) - 21(4,18)		207293.807(31)	4.3982	10.960	81.465	
19(5,14) - 19(4,15)		207391.965(31)	4.4057	9.755	69.196	
20(5,16) - 20(4,17)		207483.434(31)	4.4010	10.354	75.176	
18(5,13) - 18(4,14)		207637.842(32)	4.4088	9.156	63.504	
19(5,15) - 19(4,16)		207656.711(31)	4.4042	9.752	69.187	
24(1,24) - 23(0,23)		207741.234(15)	4.1882	20.123	80.346	
18(5,14) - 18(4,15)		207812.127(32)	4.4078	9.154	63.499	
17(5,12) - 17(4,13)		207837.172(32)	4.4126	8.561	58.115	
17(5,13) - 17(4,14)		207949.008(32)	4.4120	8.560	58.111	
16(5,11) - 16(4,12)		207997.623(33)	4.4172	7.968	53.026	
20(2,19) - 19(1,18)		208061.045(22)	4.4710	8.739	58.544	
16(5,12) - 16(4,13)		208067.369(33)	4.4168	7.968	53.024	
15(5,10) - 15(4,11)		208125.670(34)	4.4227	7.378	48.238	
15(5,11) - 15(4,12)		208167.791(34)	4.4225	7.377	48.237	
14(5, 9) - 14(4,10)		208226.760(35)	4.4294	6.787	43.751	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log *A*	Line strength	Energy lower state	Ref.
14(5,10) – 14(4,11)		208251.287(35)	4.4292	6.787	43.750	
13(5, 8) – 13(4, 9)		208305.498(35)	4.4375	6.195	39.564	
13(5, 9) – 13(4,10)		208319.193(35)	4.4374	6.195	39.563	
12(5, 7) – 12(4, 8)		208365.775(36)	4.4475	5.600	35.677	
12(5, 8) – 12(4, 9)		208373.059(36)	4.4475	5.600	35.676	
11(5, 6) – 11(4, 7)		208410.902(37)	4.4603	5.000	32.089	
11(5, 7) – 11(4, 8)		208414.559(37)	4.4603	5.000	32.089	
10(5, 5) – 10(4, 6)		208443.705(38)	4.4771	4.390	28.801	
10(5, 6) – 10(4, 7)		208445.418(38)	4.4771	4.390	28.801	
9(5, 4) – 9(4, 5)		208466.615(38)	4.5000	3.766	25.813	
9(5, 5) – 9(4, 6)		208467.352(38)	4.5000	3.766	25.813	
8(5, 3) – 8(4, 4)		208481.725(39)	4.5331	3.122	23.124	
8(5, 4) – 8(4, 5)		208482.010(39)	4.5331	3.122	23.124	
7(5, 2) – 7(4, 3)		208490.842(40)	4.5845	2.447	20.734	
7(5, 3) – 7(4, 4)		208490.936(40)	4.5845	2.447	20.734	
6(5, 1) – 6(4, 2)		208495.521(40)	4.6742	1.725	18.643	
6(5, 2) – 6(4, 3)		208495.549(40)	4.6742	1.725	18.643	
5(5, 0) – 5(4, 1)		208497.104(41)	4.8711	0.927	16.851	
5(5, 1) – 5(4, 2)		208497.109(41)	4.8711	0.927	16.851	
23(3,20) – 22(3,19)		209007.219(13)	3.1205	22.611	82.992	
29(2,27) – 28(3,26)	209878.91(5)	209878.926(32)	4.6146	8.803	128.328	[78A]
23(2,21) – 22(2,20)		210475.781(14)	3.1072	22.828	79.923	
12(2,10) – 11(0,11)		211042.127(30)	5.9444	0.018	19.532	
9(7, 3) – 10(6, 4)		211316.002(99)	5.5770	0.303	44.251	
9(7, 2) – 10(6, 5)		211316.002(99)	5.5770	0.303	44.251	
35(2,34) – 35(1,35)	211383.70(5)	211383.646(63)	4.7862	6.986	181.657	[78A]
3(3, 0) – 2(1, 1)		211606.934(40)	7.8012	0.000	1.693	
11(3, 9) – 10(2, 8)		211989.969(27)	4.5484	3.878	19.612	
24(2,23) – 23(2,22)	212038.27(5)	212038.283(14)	3.0975	23.799	84.970	[78A]
14(8, 7) – 15(7, 8)		212605.947(133)	5.2606	0.940	73.708	
14(8, 6) – 15(7, 9)		212605.947(133)	5.2606	0.940	73.708	
3(3, 1) – 2(1, 2)		213044.119(40)	7.8058	0.000	1.645	
21(2,20) – 20(1,19)		213722.912(21)	4.4195	9.522	64.561	
19(9,11) – 20(8,12)		213820.107(160)	5.1353	1.659	112.178	
19(9,10) – 20(8,13)		213820.107(160)	5.1353	1.659	112.178	
13(2,11) – 12(1,12)		213923.389(34)	4.9419	1.790	23.379	
25(0,25) – 24(1,24)		214065.826(16)	4.1453	21.129	87.275	
24(1,23) – 23(1,22)	214498.09(5)	214498.088(15)	3.0814	23.859	84.327	[78A]
25(1,25) – 24(1,24)	214912.18(5)	214912.193(16)	3.0772	24.932	87.275	[78A]
24(10,14) – 25(9,17)		214971.955(169)	5.0657	2.407	159.657	
24(10,15) – 25(9,16)		214971.955(169)	5.0657	2.407	159.657	
24(9,16) – 23(9,15)	215039.70(5)	215039.723(14)	3.1414	20.626	145.012	[78A]
24(9,15) – 23(9,14)		215039.723(14)	3.1414	20.626	145.012	
24(10,15) – 23(10,14)	215041.87(5)	215041.896(16)	3.1584	19.834	159.655	[78A]
24(10,14) – 23(10,13)		215041.896(16)	3.1584	19.834	159.655	
24(3,22) – 23(3,21)	215058.07(5)	215058.023(14)	3.0825	23.615	89.506	[78A]
24(8,17) – 23(8,16)	215058.60(5)	215058.582(13)	3.1266	21.334	131.904	[78A]
24(8,16) – 23(8,15)		215058.582(13)	3.1266	21.334	131.904	
24(11,13) – 23(11,12)		215059.230(17)	3.1779	18.959	175.826	
24(11,14) – 23(11,13)	215059.20(5)	215059.230(17)	3.1779	18.959	175.826	[78A]
24(12,13) – 23(12,12)	215088.21(5)	215088.234(19)	3.2002	18.000	193.522	[78A]
24(12,12) – 23(12,11)		215088.234(19)	3.2002	18.000	193.522	
24(7,18) – 23(7,17)	215109.05(5)	215109.047(13)	3.1138	21.959	120.335	[78A]
24(7,17) – 23(7,16)		215109.068(13)	3.1138	21.959	120.335	
25(0,25) – 24(0,24)	215119.21(5)	215119.221(16)	3.0759	24.934	87.240	[78A]
24(13,12) – 23(13,11)	215126.71(5)	215126.719(20)	3.2259	16.959	212.736	[78A]
24(13,11) – 23(13,10)		215126.719(20)	3.2259	16.959	212.736	
24(14,10) – 23(14, 9)		215173.248(21)	3.2554	15.834	233.463	
24(14,11) – 23(14,10)	215173.24(5)	215173.248(21)	3.2554	15.834	233.463	[78A]
24(6,19) – 23(6,18)	215211.58(5)	215211.529(13)	3.1026	22.500	110.313	[78A]
24(6,18) – 23(6,17)	215212.36(5)	215212.469(13)	3.1026	22.500	110.313	[78A]
24(15, 9) – 23(15, 8)		215226.850(21)	3.2896	14.625	255.697	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log A	Line strength	Energy lower state	Ref.
24(15,10) - 23(15, 9)	215226.86(5)	215226.850(21)	3.2896	14.625	255.697	[78A]
24(16, 8) - 23(16, 7)		215286.834(22)	3.3294	13.334	279.433	
24(16, 9) - 23(16, 8)	215286.80(5)	215286.834(22)	3.3294	13.334	279.433	[78A]
24(17, 7) - 23(17, 6)		215352.703(22)	3.3762	11.959	304.663	
24(17, 8) - 23(17, 7)	215352.66(5)	215352.703(22)	3.3762	11.959	304.663	[78A]
24(5,20) - 23(5,19)	215400.79(5)	215400.814(13)	3.0927	22.958	101.848	[78A]
24(18, 7) - 23(18, 6)	215424.07(5)	215424.082(24)	3.4323	10.500	331.381	[78A]
24(18, 6) - 23(18, 5)		215424.082(24)	3.4323	10.500	331.381	
24(5,19) - 23(5,18)	215427.99(5)	215427.980(13)	3.0925	22.958	101.850	[78A]
30(4,27) - 30(2,28)		215475.877(39)	5.6483	0.079	144.418	
24(19, 5) - 23(19, 4)		215500.687(28)	3.5008	8.959	359.580	
24(19, 6) - 23(19, 5)	215500.75(5)	215500.687(28)	3.5008	8.959	359.580	[78A]
24(20, 5) - 23(20, 4)	215582.34(5)	215582.293(35)	3.5872	7.334	389.253	[78A]
24(20, 4) - 23(20, 3)		215582.293(35)	3.5872	7.334	389.253	
24(4,21) - 23(4,20)	215620.19(5)	215620.193(13)	3.0843	23.332	94.947	[78A]
24(21, 4) - 23(21, 3)	215668.75(5)	215668.717(45)	3.7019	5.625	420.391	[78A]
24(21, 3) - 23(21, 2)		215668.717(45)	3.7019	5.625	420.391	
11(3, 8) - 10(2, 9)		215749.676(27)	4.5354	3.791	19.494	
24(22, 3) - 23(22, 2)		215759.805(59)	3.8679	3.833	452.987	
24(22, 2) - 23(22, 1)		215759.805(59)	3.8679	3.833	452.987	
24(23, 1) - 23(23, 0)		215855.430(76)	4.1590	1.958	487.033	
24(23, 2) - 23(23, 1)		215855.430(76)	4.1590	1.958	487.033	
6(4, 3) - 5(3, 2)		215941.092(31)	4.2951	3.716	11.440	
6(4, 2) - 5(3, 3)		215943.127(31)	4.2951	3.716	11.440	
25(1,25) - 24(0,24)		215965.588(17)	4.1335	21.143	87.240	
36(1,35) - 36(0,36)	215975.63(5)	215975.656(78)	4.7694	6.999	191.926	[78A]
29(11,19) - 30(10,20)		216076.193(148)	5.0203	3.170	216.142	
29(11,18) - 30(10,21)		216076.193(148)	5.0203	3.170	216.142	
24(4,20) - 23(4,19)	216077.24(5)	216077.201(13)	3.0816	23.332	94.987	[78A]
26(1,25) - 25(2,24)		216752.553(20)	4.3291	13.855	99.403	
29(4,26) - 29(2,27)		218311.768(38)	5.6806	0.069	135.329	
24(3,21) - 23(3,20)	218389.97(5)	218390.014(14)	3.0622	23.630	89.963	[78A]
22(2,21) - 21(1,20)		219463.627(20)	4.3682	10.356	70.865	
24(2,22) - 23(2,21)	219505.59(5)	219505.590(15)	3.0519	23.831	86.944	[78A]
4(3, 1) - 3(1, 2)		219860.039(40)	7.4348	0.000	2.612	
12(3,10) - 11(2, 9)		219902.502(27)	4.5167	4.063	22.937	
8(7, 1) - 9(6, 4)		220272.107(99)	5.7297	0.168	41.263	
8(7, 2) - 9(6, 3)		220272.107(99)	5.7297	0.168	41.263	
25(2,24) - 24(2,23)		220660.914(15)	3.0451	24.802	92.043	
28(4,25) - 28(2,26)		221457.793(38)	5.7135	0.059	126.529	
13(8, 5) - 14(7, 8)		221566.588(133)	5.2704	0.756	69.226	
13(8, 6) - 14(7, 7)		221566.588(133)	5.2704	0.756	69.226	
26(0,26) - 25(1,25)		222707.215(18)	4.0899	22.151	94.444	
4(3, 2) - 3(1, 3)		222733.885(40)	7.4448	0.000	2.516	
18(9, 9) - 19(8,12)		222783.053(161)	5.1155	1.456	106.201	
18(9,10) - 19(8,11)		222783.053(161)	5.1155	1.456	106.201	
25(1,24) - 24(1,23)		222918.172(16)	3.0309	24.851	91.482	
30(2,28) - 29(3,27)		223132.762(34)	4.5119	9.596	136.975	
26(1,26) - 25(1,25)	223385.35(5)	223385.324(18)	3.0264	25.932	94.444	[78A]
26(0,26) - 25(0,25)	223553.61(5)	223553.582(18)	3.0254	25.934	94.416	[78A]
13(2,11) - 12(0,12)		223795.994(32)	5.8608	0.019	23.050	
23(10,14) - 24(9,15)		223933.494(169)	5.0343	2.196	152.185	
23(10,13) - 24(9,16)		223933.494(169)	5.0343	2.196	152.185	
25(3,23) - 24(3,22)		223933.729(15)	3.0289	24.627	96.679	
25(10,15) - 24(10,14)		224002.117(16)	3.0977	21.001	166.828	
25(10,16) - 24(10,15)		224002.117(16)	3.0977	21.001	166.828	
25(9,17) - 24(9,16)		224003.436(15)	3.0823	21.761	152.185	
25(9,16) - 24(9,15)		224003.436(15)	3.0823	21.761	152.185	
25(11,15) - 24(11,14)		224017.535(18)	3.1154	20.161	183.000	
25(11,14) - 24(11,13)		224017.535(18)	3.1154	20.161	183.000	
25(8,18) - 24(8,17)		224028.137(14)	3.0688	22.441	139.077	
25(8,17) - 24(8,16)		224028.139(14)	3.0688	22.441	139.077	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	-log A	Line strength	Energy lower state	Ref.
25(12,13) - 24(12,12)		224045.746(19)	3.1355	19.241	200.696	
25(12,14) - 24(12,13)		224045.746(19)	3.1355	19.241	200.696	
25(13,12) - 24(13,11)		224084.277(20)	3.1585	18.240	219.912	
25(13,13) - 24(13,12)		224084.277(20)	3.1585	18.240	219.912	
25(7,19) - 24(7,18)		224088.187(14)	3.0570	23.041	127.510	
25(7,18) - 24(7,17)		224088.225(14)	3.0570	23.041	127.510	
25(14,12) - 24(14,11)		224131.512(20)	3.1847	17.160	240.640	
25(14,11) - 24(14,10)		224131.512(20)	3.1847	17.160	240.640	
25(15,11) - 24(15,10)		224186.348(20)	3.2148	16.000	262.876	
25(15,10) - 24(15, 9)		224186.348(20)	3.2148	16.000	262.876	
25(6,20) - 24(6,19)		224206.602(14)	3.0466	23.560	117.492	
25(6,19) - 24(6,18)		224208.076(14)	3.0466	23.560	117.492	
26(1,26) - 25(0,25)		224231.691(18)	4.0808	22.161	94.416	
25(16, 9) - 24(16, 8)		224248.010(21)	3.2494	14.760	286.614	
25(16,10) - 24(16, 9)		224248.010(21)	3.2494	14.760	286.614	
25(17, 9) - 24(17, 8)		224315.939(21)	3.2897	13.440	311.846	
25(17, 8) - 24(17, 7)		224315.939(21)	3.2897	13.440	311.846	
25(18, 7) - 24(18, 6)		224389.719(24)	3.3371	12.040	338.567	
25(18, 8) - 24(18, 7)		224389.719(24)	3.3371	12.040	338.567	
25(5,21) - 24(5,20)		224419.816(14)	3.0373	24.000	109.033	
25(5,20) - 24(5,19)		224458.852(14)	3.0371	24.000	109.036	
25(19, 7) - 24(19, 6)		224469.023(28)	3.3936	10.560	366.769	
25(19, 6) - 24(19, 5)		224469.023(28)	3.3936	10.560	366.769	
25(20, 6) - 24(20, 5)		224553.605(36)	3.4625	9.000	396.444	
25(20, 5) - 24(20, 4)		224553.605(36)	3.4625	9.000	396.444	
25(4,22) - 24(4,21)		224638.699(15)	3.0296	24.358	102.140	
25(21, 4) - 24(21, 3)		224643.262(48)	3.5494	7.360	427.585	
25(21, 5) - 24(21, 4)		224643.262(48)	3.5494	7.360	427.585	
25(22, 3) - 24(22, 2)		224737.822(63)	3.6644	5.640	460.184	
25(22, 4) - 24(22, 3)		224737.822(63)	3.6644	5.640	460.184	
25(23, 3) - 24(23, 2)		224837.148(82)	3.8308	3.840	494.233	
25(23, 2) - 24(23, 1)		224837.148(82)	3.8308	3.840	494.233	
27(4,24) - 27(2,25)		224860.176(38)	5.7471	0.050	118.020	
7(4, 4) - 6(3, 3)		224888.377(31)	4.2861	3.876	13.232	
7(4, 3) - 6(3, 4)		224894.498(31)	4.2861	3.876	13.232	
25(24, 2) - 24(24, 1)		224941.111(105)	4.1223	1.960	529.723	
25(24, 1) - 24(24, 0)		224941.111(105)	4.1223	1.960	529.723	
28(11,18) - 29(10,19)		225031.922(149)	4.9830	2.954	207.176	
28(11,17) - 29(10,20)		225031.922(149)	4.9830	2.954	207.176	
25(4,21) - 24(4,20)		225236.115(15)	3.0262	24.359	102.195	
12(3, 9) - 11(2,10)		225306.836(27)	4.4997	3.928	22.769	
23(2,22) - 22(1,21)		225317.133(19)	4.3172	11.239	77.454	
27(1,26) - 26(2,25)		227170.187(21)	4.2517	14.924	107.051	
13(3,11) - 12(2,10)		227541.154(27)	4.4863	4.248	26.571	
25(3,22) - 24(3,21)		227780.973(15)	3.0064	24.647	97.248	
5(3, 2) - 4(1, 3)		227895.754(40)	7.1832	0.000	3.838	
26(4,23) - 26(2,24)		228464.225(37)	5.7816	0.043	109.806	
25(2,23) - 24(2,22)		228483.137(16)	2.9991	24.832	94.265	
14(2,12) - 13(1,13)		228797.467(37)	4.9200	1.653	27.137	
7(7, 1) - 8(6, 2)		229226.121(99)	6.0493	0.063	38.575	
7(7, 0) - 8(6, 3)		229226.121(99)	6.0493	0.063	38.575	
26(2,25) - 25(2,24)	229265.16(5)	229265.162(17)	2.9947	25.805	99.403	[78A]
12(8, 4) - 13(7, 7)		230524.178(134)	5.2991	0.582	65.043	
12(8, 5) - 13(7, 6)		230524.178(134)	5.2991	0.582	65.043	
26(1,25) - 25(1,24)	231310.42(5)	231310.434(17)	2.9825	25.845	98.918	[78A]
27(0,27) - 26(1,26)		231312.303(19)	4.0371	23.170	101.895	
24(2,23) - 23(1,22)		231313.225(19)	4.2667	12.166	84.327	
17(9, 8) - 18(8,11)		231742.529(161)	5.1034	1.259	100.523	
17(9, 9) - 18(8,10)		231742.529(161)	5.1034	1.259	100.523	
27(1,27) - 26(1,26)		231854.213(19)	2.9776	26.932	101.895	
27(0,27) - 26(0,26)		231990.410(19)	2.9768	26.934	101.873	
25(4,22) - 25(2,23)		232215.340(37)	5.8168	0.036	101.887	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	-log A	Line strength	Energy lower state	Ref.
27(1,27) - 26(0,26)		232532.322(20)	4.0301	23.178	101.873	
5(3, 3) - 4(1, 4)		232683.719(41)	7.2009	0.000	3.678	
26(3,24) - 25(3,23)	232790.02(5)	232790.033(17)	2.9777	25.639	104.149	[78A]
22(10,12) - 23(9,15)		232891.543(170)	5.0076	1.988	145.012	
22(10,13) - 23(9,14)		232891.543(170)	5.0076	1.988	145.012	
26(10,16) - 25(10,15)		232962.336(18)	3.0401	22.154	174.300	
26(10,17) - 25(10,16)	232962.32(5)	232962.336(18)	3.0401	22.154	174.300	[78A]
26(9,18) - 25(9,17)	232967.57(5)	232967.582(17)	3.0260	22.885	159.657	[78A]
26(9,17) - 25(9,16)		232967.582(17)	3.0260	22.885	159.657	
26(11,15) - 25(11,14)		232975.520(19)	3.0562	21.347	190.472	
26(11,16) - 25(11,15)	232975.51(5)	232975.520(19)	3.0562	21.347	190.472	[78A]
26(8,19) - 25(8,18)	232998.74(5)	232998.742(16)	3.0136	23.539	146.550	[78A]
26(8,18) - 25(8,17)		232998.744(16)	3.0136	23.539	146.550	
26(12,15) - 25(12,14)	233002.70(5)	233002.695(20)	3.0744	20.462	208.170	[78A]
26(12,14) - 25(12,13)		233002.695(20)	3.0744	20.462	208.170	
26(13,14) - 25(13,13)	233041.09(5)	233041.086(20)	3.0951	19.501	227.386	[78A]
26(13,13) - 25(13,12)		233041.086(20)	3.0951	19.501	227.386	
26(7,20) - 25(7,19)		233069.307(15)	3.0027	24.116	134.985	
26(7,19) - 25(7,18)		233069.367(15)	3.0027	24.116	134.985	
26(14,12) - 25(14,11)		233088.873(21)	3.1186	18.462	248.116	
26(14,13) - 25(14,12)	233088.86(5)	233088.873(21)	3.1186	18.462	248.116	[78A]
26(15,11) - 25(15,10)		233144.822(21)	3.1453	17.347	270.354	
26(15,12) - 25(15,11)	233144.77(5)	233144.822(21)	3.1453	17.347	270.354	[78A]
26(6,21) - 25(6,20)	233205.09(5)	233205.045(15)	2.9930	24.616	124.970	[78A]
26(6,20) - 25(6,19)	233207.38(5)	233207.316(15)	2.9930	24.616	124.971	[78A]
26(16,10) - 25(16, 9)		233208.066(21)	3.1759	16.154	294.094	
26(16,11) - 25(16,10)		233208.066(21)	3.1759	16.154	294.094	
26(17, 9) - 25(17, 8)		233277.975(22)	3.2111	14.885	319.329	
26(17,10) - 25(17, 9)	233277.94(5)	233277.975(22)	3.2111	14.885	319.329	[78A]
26(18, 8) - 25(18, 7)		233354.080(25)	3.2518	13.539	346.052	
26(18, 9) - 25(18, 8)	233354.02(5)	233354.080(25)	3.2518	13.539	346.052	[78A]
26(19, 7) - 25(19, 6)		233436.029(31)	3.2996	12.116	374.256	
26(19, 8) - 25(19, 7)	233436.06(5)	233436.029(31)	3.2996	12.116	374.256	[78A]
26(5,22) - 25(5,21)	233443.10(5)	233443.088(16)	2.9843	25.038	116.519	[78A]
26(5,21) - 25(5,20)	233498.30(5)	233498.293(16)	2.9840	25.038	116.523	[78A]
26(20, 7) - 25(20, 6)	233523.50(5)	233523.537(40)	3.3565	10.616	403.934	[78A]
26(20, 6) - 25(20, 5)		233523.537(40)	3.3565	10.616	403.934	
26(21, 5) - 25(21, 4)		233616.383(52)	3.4258	9.039	435.078	
26(21, 6) - 25(21, 5)	233616.38(5)	233616.383(52)	3.4258	9.039	435.078	[78A]
26(4,23) - 25(4,22)	233654.02(5)	233654.066(16)	2.9772	25.382	109.633	[78A]
26(22, 5) - 25(22, 4)		233714.377(69)	3.5130	7.385	467.680	
26(22, 4) - 25(22, 3)		233714.377(69)	3.5130	7.385	467.680	
26(23, 4) - 25(23, 3)		233817.365(89)	3.6285	5.654	501.733	
26(23, 3) - 25(23, 2)		233817.365(89)	3.6285	5.654	501.733	
8(4, 5) - 7(3, 4)		233827.520(31)	4.2706	4.050	15.324	
8(4, 4) - 7(3, 5)		233842.855(31)	4.2705	4.049	15.324	
26(24, 3) - 25(24, 2)		233925.215(113)	3.7952	3.846	537.226	
26(24, 2) - 25(24, 1)		233925.215(113)	3.7952	3.846	537.226	
27(11,17) - 28(10,18)		233984.400(150)	4.9493	2.740	198.509	
27(11,16) - 28(10,19)		233984.400(150)	4.9493	2.740	198.509	
26(25, 1) - 25(25, 0)		234037.803(143)	4.0870	1.962	574.152	
26(25, 2) - 25(25, 1)		234037.803(143)	4.0870	1.962	574.152	
26(4,22) - 25(4,21)	234423.96(5)	234423.945(16)	2.9729	25.383	109.708	[78A]
14(3,12) - 13(2,11)		234882.471(27)	4.4573	4.434	30.515	
13(3,10) - 12(2,11)		235051.955(27)	4.4653	4.044	26.340	
3(3, 1) - 2(0, 2)		235521.695(45)	8.7798	0.000	0.895	
6(3, 3) - 5(1, 4)		235727.203(40)	6.9792	0.001	5.369	
24(4,21) - 24(2,22)		236059.777(37)	5.8530	0.030	94.265	
26(3,23) - 25(3,22)	237170.45(5)	237170.443(17)	2.9529	25.664	104.846	[78A]
14(2,12) - 13(0,13)		237338.059(35)	5.7912	0.020	26.852	
28(1,27) - 27(2,26)		237360.889(22)	4.1798	16.002	114.985	
26(2,24) - 25(2,23)	237405.17(5)	237405.182(17)	2.9488	25.831	101.887	[78A]

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	-log A	Line strength	Energy lower state	Ref.
25(2,24) - 24(1,23)		237476.053(19)	4.2167	13.130	91.482	
27(2,26) - 26(2,25)		237851.852(18)	2.9463	26.807	107.051	
11(8, 4) - 12(7, 5)		239479.268(134)	5.3543	0.421	61.159	
11(8, 3) - 12(7, 6)		239479.268(134)	5.3543	0.421	61.159	
27(1,26) - 26(1,25)		239682.799(18)	2.9358	26.839	106.634	
28(0,28) - 27(1,27)		239887.271(21)	3.9865	24.186	109.629	
23(4,20) - 23(2,21)		239945.172(37)	5.8901	0.025	86.944	
28(1,28) - 27(1,27)		240319.338(21)	2.9306	27.933	109.629	
28(0,28) - 27(0,27)		240429.184(21)	2.9299	27.933	109.611	
16(9, 8) - 17(8, 9)		240699.020(162)	5.1002	1.067	95.144	
16(9, 7) - 17(8,10)		240699.020(162)	5.1002	1.067	95.144	
28(1,28) - 27(0,27)		240861.248(21)	3.9811	24.193	109.611	
27(3,25) - 26(3,24)		241625.863(18)	2.9284	26.649	111.914	
21(10,12) - 22(9,13)		241846.510(170)	4.9860	1.783	138.138	
21(10,11) - 22(9,14)		241846.510(170)	4.9860	1.783	138.138	
15(3,13) - 14(2,12)		241910.488(27)	4.4296	4.625	34.768	
27(10,18) - 26(10,17)		241922.547(19)	2.9852	23.297	182.071	
27(10,17) - 26(10,16)		241922.547(19)	2.9852	23.297	182.071	
27(9,19) - 26(9,18)		241932.176(18)	2.9722	24.001	167.428	
27(9,18) - 26(9,17)		241932.176(18)	2.9722	24.001	167.428	
27(11,16) - 26(11,15)		241933.164(20)	2.9999	22.519	198.244	
27(11,17) - 26(11,16)		241933.164(20)	2.9999	22.519	198.244	
27(12,15) - 26(12,14)		241959.055(21)	3.0165	21.667	215.942	
27(12,16) - 26(12,15)		241959.055(21)	3.0165	21.667	215.942	
27(8,20) - 26(8,19)		241970.439(18)	2.9608	24.630	154.322	
27(8,19) - 26(8,18)		241970.441(18)	2.9608	24.630	154.322	
27(13,15) - 26(13,14)		241997.109(22)	3.0353	20.741	235.160	
27(13,14) - 26(13,13)		241997.109(22)	3.0353	20.741	235.160	
27(14,13) - 26(14,12)		242045.297(22)	3.0565	19.741	255.891	
27(14,14) - 26(14,13)		242045.297(22)	3.0565	19.741	255.891	
27(7,21) - 26(7,20)		242052.479(17)	2.9506	25.186	142.759	
27(7,20) - 26(7,19)		242052.578(17)	2.9506	25.186	142.759	
27(15,13) - 26(15,12)		242102.236(22)	3.0804	18.667	278.131	
27(15,12) - 26(15,11)		242102.236(22)	3.0804	18.667	278.131	
27(16,12) - 26(16,11)		242166.955(23)	3.1077	17.519	301.873	
27(16,11) - 26(16,10)		242166.955(23)	3.1077	17.519	301.873	
27(6,22) - 26(6,21)		242206.969(17)	2.9416	25.667	132.749	
27(6,21) - 26(6,20)		242210.408(17)	2.9416	25.667	132.749	
27(17,11) - 26(17,10)		242238.758(25)	3.1387	16.297	327.110	
27(17,10) - 26(17, 9)		242238.758(25)	3.1387	16.297	327.110	
27(18,10) - 26(18, 9)		242317.121(29)	3.1743	15.000	353.836	
27(18, 9) - 26(18, 8)		242317.121(29)	3.1743	15.000	353.836	
27(19, 9) - 26(19, 8)		242401.648(35)	3.2154	13.630	382.043	
27(19, 8) - 26(19, 7)		242401.648(35)	3.2154	13.630	382.043	
27(5,23) - 26(5,22)		242470.393(17)	2.9333	26.074	124.306	
27(20, 8) - 26(20, 7)		242492.031(45)	3.2636	12.186	411.724	
27(20, 7) - 26(20, 6)		242492.031(45)	3.2636	12.186	411.724	
27(5,22) - 26(5,21)		242547.320(17)	2.9329	26.074	124.311	
27(21, 7) - 26(21, 6)		242588.020(59)	3.3209	10.667	442.871	
27(21, 6) - 26(21, 5)		242588.020(59)	3.3209	10.667	442.871	
27(4,24) - 26(4,23)		242664.684(18)	2.9268	26.405	117.427	
27(22, 5) - 26(22, 4)		242689.406(77)	3.3906	9.074	475.476	
27(22, 6) - 26(22, 5)		242689.406(77)	3.3906	9.074	475.476	
9(4, 6) - 8(3, 5)		242753.811(31)	4.2510	4.231	17.716	
9(4, 5) - 8(3, 6)		242787.617(31)	4.2509	4.231	17.714	
27(23, 4) - 26(23, 3)		242796.025(98)	3.4781	7.408	509.532	
27(23, 5) - 26(23, 4)		242796.025(98)	3.4781	7.408	509.532	
6(3, 4) - 5(1, 5)		242904.475(41)	7.0073	0.001	5.130	
27(24, 4) - 26(24, 3)		242907.725(124)	3.5939	5.667	545.029	
27(24, 3) - 26(24, 2)		242907.725(124)	3.5939	5.667	545.029	
26(11,16) - 27(10,17)		242933.984(150)	4.9194	2.527	190.140	
26(11,15) - 27(10,18)		242933.984(150)	4.9194	2.527	190.140	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log A	Line strength	Energy lower state	Ref.
27(25, 3) - 26(25, 2)		243024.377(155)	3.7609	3.852	581.959	
27(25, 2) - 26(25, 1)		243024.377(155)	3.7609	3.852	581.959	
27(26, 1) - 26(26, 0)		243145.865(191)	4.0530	1.963	620.312	
27(26, 2) - 26(26, 1)		243145.865(191)	4.0530	1.963	620.312	
7(3, 4) - 6(1, 5)		243371.221(40)	6.8023	0.001	7.206	
27(4,23) - 26(4,22)		243643.227(18)	2.9215	26.406	117.527	
22(4,19) - 22(2,20)		243820.900(38)	5.9282	0.021	79.923	
26(2,25) - 25(1,24)		243823.045(19)	4.1673	14.124	98.918	
15(2,13) - 14(1,14)		244392.350(40)	4.9025	1.510	31.180	
4(3, 2) - 3(0, 3)		244518.236(46)	8.1206	0.000	1.790	
14(3,11) - 13(2,12)		245023.654(27)	4.4324	4.136	30.205	
27(2,25) - 26(2,24)		246268.732(19)	2.9007	26.829	109.806	
28(2,27) - 27(2,26)		246421.908(20)	2.8998	27.808	114.985	
27(3,24) - 26(3,23)		246548.693(19)	2.9016	26.680	112.757	
29(1,28) - 28(2,27)		247334.904(23)	4.1127	17.083	123.205	
21(4,18) - 21(2,19)		247638.371(38)	5.9676	0.018	73.205	
28(1,27) - 27(1,26)		248042.553(20)	2.8909	27.834	114.628	
10(8, 3) - 11(7, 4)		248432.375(135)	5.4509	0.275	57.573	
10(8, 2) - 11(7, 5)		248432.375(135)	5.4509	0.275	57.573	
29(0,29) - 28(1,28)		248437.346(23)	3.9381	25.201	117.645	
16(3,14) - 15(2,13)		248617.256(28)	4.4028	4.823	39.332	
29(1,29) - 28(1,28)		248781.104(23)	2.8852	28.933	117.645	
29(0,29) - 28(0,28)		248869.410(23)	2.8847	28.933	117.631	
29(1,29) - 28(0,28)		249213.170(23)	3.9339	25.206	117.631	
15(9, 7) - 16(8, 8)		249652.990(162)	5.1081	0.882	90.063	
15(9, 6) - 16(8, 9)		249652.990(162)	5.1081	0.882	90.063	
27(2,26) - 26(1,25)		250364.463(20)	4.1187	15.142	106.634	
28(3,26) - 27(3,25)		250440.328(20)	2.8811	27.658	119.974	
20(10,10) - 21(9,13)		250798.801(171)	4.9700	1.581	131.563	
20(10,11) - 21(9,12)		250798.801(171)	4.9700	1.581	131.563	
8(3, 5) - 7(1, 6)		250848.732(40)	6.6434	0.001	9.348	
28(10,18) - 27(10,17)		250882.748(21)	2.9327	24.429	190.140	
28(10,19) - 27(10,18)		250882.748(21)	2.9327	24.429	190.140	
28(11,18) - 27(11,17)		250890.453(22)	2.9462	23.679	206.314	
28(11,17) - 27(11,16)		250890.453(22)	2.9462	23.679	206.314	
28(9,19) - 27(9,18)		250897.229(20)	2.9207	25.108	175.498	
28(9,20) - 27(9,19)		250897.229(20)	2.9207	25.108	175.498	
28(12,16) - 27(12,15)		250914.801(23)	2.9614	22.858	224.013	
28(12,17) - 27(12,16)		250914.801(23)	2.9614	22.858	224.013	
28(8,21) - 27(8,20)		250943.266(19)	2.9101	25.715	162.393	
28(8,20) - 27(8,19)		250943.270(19)	2.9101	25.715	162.393	
28(13,16) - 27(13,15)		250952.318(24)	2.9785	21.965	243.232	
28(13,15) - 27(13,14)		250952.318(24)	2.9785	21.965	243.232	
28(14,15) - 27(14,14)		251000.744(25)	2.9978	21.001	263.965	
28(14,14) - 27(14,13)		251000.744(25)	2.9978	21.001	263.965	
28(7,22) - 27(7,21)		251037.787(19)	2.9007	26.251	150.833	
28(7,21) - 27(7,20)		251037.949(19)	2.9007	26.251	150.833	
28(15,13) - 27(15,12)		251058.543(25)	3.0194	19.965	286.207	
28(15,14) - 27(15,13)		251058.543(25)	3.0194	19.965	286.207	
28(16,13) - 27(16,12)		251124.635(27)	3.0439	18.858	309.951	
28(16,12) - 27(16,11)		251124.635(27)	3.0439	18.858	309.951	
28(17,12) - 27(17,11)		251198.242(30)	3.0715	17.679	335.190	
28(17,11) - 27(17,10)		251198.242(30)	3.0715	17.679	335.190	
28(6,23) - 27(6,22)		251212.477(19)	2.8921	26.715	140.828	
28(6,22) - 27(6,21)		251217.596(19)	2.8921	26.715	140.829	
30(6,24) - 30(5,25)		251271.342(52)	4.1341	16.033	158.488	
28(18,11) - 27(18,10)		251278.787(35)	3.1030	16.429	361.918	
28(18,10) - 27(18, 9)		251278.787(35)	3.1030	16.429	361.918	
20(4,17) - 20(2,18)		251351.299(38)	6.0084	0.015	66.791	
28(19, 9) - 27(19, 8)		251365.832(43)	3.1389	15.108	390.128	
28(19,10) - 27(19, 9)		251365.832(43)	3.1389	15.108	390.128	
28(20, 9) - 27(20, 8)		251459.033(54)	3.1804	13.715	419.812	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	-log A	Line strength	Energy lower state	Ref.
28(20, 8) - 27(20, 7)		251459.033(54)	3.1804	13.715	419.812	
28(5,24) - 27(5,23)		251501.400(19)	2.8843	27.107	132.394	
28(21, 7) - 27(21, 6)		251558.115(69)	3.2290	12.250	450.963	
28(21, 8) - 27(21, 7)		251558.115(69)	3.2290	12.250	450.963	
28(5,23) - 27(5,22)		251607.113(19)	2.8838	27.107	132.402	
10(4, 7) - 9(3, 6)		251661.033(30)	4.2289	4.417	20.407	
28(22, 6) - 27(22, 5)		251662.855(87)	3.2866	10.715	483.572	
28(22, 7) - 27(22, 6)		251662.855(87)	3.2866	10.715	483.572	
28(4,25) - 27(4,24)		251668.842(19)	2.8784	27.425	125.521	
15(2,13) - 14(0,14)		251706.643(37)	5.7343	0.021	30.936	
10(4, 6) - 9(3, 7)		251728.764(30)	4.2286	4.416	20.405	
28(23, 6) - 27(23, 5)		251773.064(110)	3.3566	9.107	517.631	
28(23, 5) - 27(23, 4)		251773.064(110)	3.3566	9.107	517.631	
29(6,23) - 29(5,24)		251790.617(52)	4.1345	15.400	149.490	
25(11,14) - 26(10,17)		251881.014(151)	4.8932	2.318	182.071	
25(11,15) - 26(10,16)		251881.014(151)	4.8932	2.318	182.071	
28(24, 4) - 27(24, 3)		251888.584(137)	3.4445	7.429	553.132	
28(24, 5) - 27(24, 4)		251888.584(137)	3.4445	7.429	553.132	
30(6,25) - 30(5,26)		251930.369(52)	4.1310	16.024	158.465	
28(25, 4) - 27(25, 3)		252009.271(170)	3.5605	5.679	590.065	
28(25, 3) - 27(25, 2)		252009.271(170)	3.5605	5.679	590.065	
28(26, 3) - 27(26, 2)		252135.002(208)	3.7279	3.857	628.423	
28(26, 2) - 27(26, 1)		252135.002(208)	3.7279	3.857	628.423	
28(6,22) - 28(5,23)		252240.506(53)	4.1352	14.773	140.795	
28(27, 2) - 27(27, 1)		252265.658(251)	4.0202	1.964	668.195	
28(27, 1) - 27(27, 0)		252265.658(251)	4.0202	1.964	668.195	
29(6,24) - 29(5,25)		252268.434(53)	4.1322	15.393	149.473	
28(6,23) - 28(5,24)		252582.449(53)	4.1336	14.769	140.783	
27(6,21) - 27(5,22)		252630.023(53)	4.1363	14.152	132.402	
27(6,22) - 27(5,23)		252871.373(54)	4.1352	14.149	132.394	
28(4,24) - 27(4,23)		252896.045(20)	2.8720	27.427	125.654	
26(6,20) - 26(5,21)		252966.936(54)	4.1378	13.537	124.311	
26(6,21) - 26(5,22)		253134.797(54)	4.1370	13.535	124.306	
25(6,19) - 25(5,20)		253257.910(54)	4.1396	12.927	116.523	
5(5, 1) - 4(4, 0)		253266.025(42)	3.9323	4.494	15.357	
5(5, 0) - 4(4, 1)		253266.025(42)	3.9323	4.494	15.357	
25(6,20) - 25(5,21)		253372.840(54)	4.1391	12.925	116.519	
7(3, 5) - 6(1, 6)		253408.881(41)	6.8435	0.001	6.871	
24(6,18) - 24(5,19)		253508.686(55)	4.1418	12.321	109.036	
5(3, 3) - 4(0, 4)		253569.896(46)	7.6569	0.001	2.981	
24(6,19) - 24(5,20)		253586.055(55)	4.1415	12.320	109.033	
23(6,17) - 23(5,18)		253724.195(55)	4.1444	11.719	101.850	
23(6,18) - 23(5,19)		253775.342(55)	4.1441	11.719	101.848	
22(6,16) - 22(5,17)		253908.711(55)	4.1473	11.121	94.965	
22(6,17) - 22(5,18)		253941.859(55)	4.1471	11.121	94.964	
21(6,15) - 21(5,16)		254065.936(56)	4.1506	10.526	88.381	
21(6,16) - 21(5,17)		254086.963(56)	4.1505	10.526	88.380	
20(6,14) - 20(5,15)		254199.113(56)	4.1544	9.933	82.097	
20(6,15) - 20(5,16)		254212.143(56)	4.1544	9.933	82.097	
19(6,13) - 19(5,14)		254311.098(57)	4.1588	9.342	76.114	
19(6,14) - 19(5,15)		254318.965(57)	4.1588	9.341	76.113	
18(6,12) - 18(5,13)		254404.422(57)	4.1638	8.751	70.431	
18(6,13) - 18(5,14)		254409.035(57)	4.1638	8.751	70.430	
17(6,11) - 17(5,12)		254481.350(58)	4.1696	8.160	65.047	
17(6,12) - 17(5,13)		254483.973(58)	4.1696	8.160	65.047	
16(6,10) - 16(5,11)		254543.924(58)	4.1765	7.568	59.964	
16(6,11) - 16(5,12)		254545.359(58)	4.1765	7.568	59.964	
15(6, 9) - 15(5,10)		254593.988(59)	4.1846	6.974	55.181	
15(6,10) - 15(5,11)		254594.744(59)	4.1846	6.974	55.181	
14(6, 8) - 14(5, 9)		254633.234(60)	4.1944	6.375	50.697	
14(6, 9) - 14(5,10)		254633.613(60)	4.1944	6.375	50.697	
13(6, 7) - 13(5, 8)		254663.197(60)	4.2066	5.769	46.512	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log A	Line strength	Energy lower state	Ref.
13(6, 8) - 13(5, 9)		254663.377(60)	4.2066	5.769	46.512	
12(6, 6) - 12(5, 7)		254685.287(61)	4.2219	5.155	42.627	
12(6, 7) - 12(5, 8)		254685.367(61)	4.2219	5.155	42.627	
11(6, 5) - 11(5, 6)		254700.801(62)	4.2420	4.528	39.041	
11(6, 6) - 11(5, 7)		254700.832(62)	4.2420	4.528	39.041	
10(6, 4) - 10(5, 5)		254710.914(62)	4.2690	3.884	35.754	
10(6, 5) - 10(5, 6)		254710.928(62)	4.2690	3.884	35.754	
9(6, 3) - 9(5, 4)		254716.707(63)	4.3075	3.216	32.767	
9(6, 4) - 9(5, 5)		254716.711(63)	4.3075	3.216	32.767	
6(6, 0) - 6(5, 1)		254717.400(65)	4.6773	0.939	25.597	
6(6, 1) - 6(5, 2)		254717.400(65)	4.6773	0.939	25.597	
7(6, 1) - 7(5, 2)		254719.125(64)	4.4659	1.763	27.688	
7(6, 2) - 7(5, 3)		254719.125(64)	4.4659	1.763	27.688	
8(6, 2) - 8(5, 3)		254719.152(64)	4.3662	2.514	30.078	
8(6, 3) - 8(5, 4)		254719.152(64)	4.3662	2.514	30.078	
19(4,16) - 19(2,17)		254916.088(39)	6.0508	0.012	60.684	
29(2,28) - 28(2,27)		254976.344(22)	2.8550	28.809	123.205	
17(3,15) - 16(2,14)		255002.588(28)	4.3769	5.033	44.206	
28(2,26) - 27(2,25)		255071.227(20)	2.8546	27.825	118.020	
15(3,12) - 14(2,13)		255264.932(27)	4.4013	4.201	34.366	
28(3,25) - 27(3,24)		255906.469(20)	2.8524	27.695	120.981	
29(1,28) - 28(1,27)		256395.926(22)	2.8474	28.830	122.902	
30(0,30) - 29(1,29)		256966.885(25)	3.8914	26.215	125.944	
28(2,27) - 27(1,26)		257103.572(21)	4.0709	16.177	114.628	
30(1,29) - 29(2,28)		257106.434(25)	4.0500	18.164	131.710	
30(1,30) - 29(1,29)		257239.855(25)	2.8413	29.933	125.944	
30(0,30) - 29(0,29)		257310.641(25)	2.8409	29.933	125.932	
9(8, 2) - 10(7, 3)		257383.982(135)	5.6208	0.152	54.287	
9(8, 1) - 10(7, 4)		257383.982(135)	5.6208	0.152	54.287	
30(1,30) - 29(0,29)		257583.611(25)	3.8882	26.218	125.932	
9(3, 6) - 8(1, 7)		258185.236(40)	6.4975	0.002	11.795	
18(4,15) - 18(2,16)		258292.352(39)	6.0953	0.010	54.883	
14(9, 6) - 15(8, 7)		258604.873(163)	5.1299	0.706	85.282	
14(9, 5) - 15(8, 8)		258604.873(163)	5.1299	0.706	85.282	
29(3,27) - 28(3,26)		259232.721(21)	2.8356	28.666	128.328	
19(10, 9) - 20(9,12)		259748.793(171)	4.9603	1.385	125.287	
19(10,10) - 20(9,11)		259748.793(171)	4.9603	1.385	125.287	
29(10,19) - 28(10,18)		259842.936(23)	2.8824	25.552	198.509	
29(10,20) - 28(10,19)		259842.936(23)	2.8824	25.552	198.509	
29(11,18) - 28(11,17)		259847.373(24)	2.8949	24.828	214.682	
29(11,19) - 28(11,18)		259847.373(24)	2.8949	24.828	214.682	
29(9,21) - 28(9,20)		259862.754(22)	2.8713	26.208	183.867	
29(9,20) - 28(9,19)		259862.754(22)	2.8713	26.208	183.867	
29(12,17) - 28(12,16)		259869.904(25)	2.9089	24.035	232.382	
29(12,18) - 28(12,17)		259869.904(25)	2.9089	24.035	232.382	
29(13,17) - 28(13,16)		259906.678(27)	2.9246	23.173	251.603	
29(13,16) - 28(13,15)		259906.678(27)	2.9246	23.173	251.603	
29(8,22) - 28(8,21)		259917.262(21)	2.8615	26.794	170.764	
29(8,21) - 28(8,20)		259917.268(21)	2.8615	26.794	170.764	
29(14,15) - 28(14,14)		259955.178(28)	2.9421	22.242	272.338	
29(14,16) - 28(14,15)		259955.178(28)	2.9421	22.242	272.338	
29(15,14) - 28(15,13)		260013.701(30)	2.9618	21.242	294.581	
29(15,15) - 28(15,14)		260013.701(30)	2.9618	21.242	294.581	
29(7,23) - 28(7,22)		260025.312(21)	2.8526	27.311	159.207	
29(7,22) - 28(7,21)		260025.566(21)	2.8526	27.311	159.207	
29(16,14) - 28(16,13)		260081.055(33)	2.9839	20.173	318.327	
29(16,13) - 28(16,12)		260081.055(33)	2.9839	20.173	318.327	
29(17,13) - 28(17,12)		260156.377(37)	3.0088	19.035	343.569	
29(17,12) - 28(17,11)		260156.377(37)	3.0088	19.035	343.569	
29(6,24) - 28(6,23)		260221.648(21)	2.8446	27.759	149.208	
29(6,23) - 28(6,22)		260229.152(21)	2.8445	27.759	149.208	
29(18,12) - 28(18,11)		260239.027(43)	3.0368	17.828	370.300	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log *A*	Line strength	Energy lower state	Ref.
29(18,11) - 28(18,10)		260239.027(43)	3.0368	17.828	370.300	
29(19,10) - 28(19, 9)		260328.523(52)	3.0686	16.552	398.513	
29(19,11) - 28(19,10)		260328.523(52)	3.0686	16.552	398.513	
29(20,10) - 28(20, 9)		260424.486(64)	3.1049	15.207	428.200	
29(20, 9) - 28(20, 8)		260424.486(64)	3.1049	15.207	428.200	
29(21, 8) - 28(21, 7)		260526.615(80)	3.1468	13.793	459.354	
29(21, 9) - 28(21, 8)		260526.615(80)	3.1468	13.793	459.354	
29(5,25) - 28(5,24)		260535.664(21)	2.8371	28.138	140.783	
11(4, 8) - 10(3, 7)		260541.148(30)	4.2053	4.604	23.398	
29(22, 8) - 28(22, 7)		260634.664(100)	3.1956	12.311	491.966	
29(22, 7) - 28(22, 6)		260634.664(100)	3.1956	12.311	491.966	
29(4,26) - 28(4,25)		260664.770(21)	2.8318	28.444	133.916	
11(4, 7) - 10(3, 8)		260667.111(30)	4.2048	4.602	23.394	
29(5,24) - 28(5,23)		260679.039(21)	2.8364	28.138	140.795	
16(2,14) - 15(1,15)		260716.787(42)	4.8887	1.366	35.510	
29(23, 7) - 28(23, 6)		260748.428(124)	3.2536	10.759	526.029	
29(23, 6) - 28(23, 5)		260748.428(124)	3.2536	10.759	526.029	
24(11,14) - 25(10,15)		260825.812(151)	4.8710	2.111	174.300	
24(11,13) - 25(10,16)		260825.812(151)	4.8710	2.111	174.300	
29(24, 5) - 28(24, 4)		260867.730(153)	3.3239	9.138	561.534	
29(24, 6) - 28(24, 5)		260867.730(153)	3.3239	9.138	561.534	
29(25, 5) - 28(25, 4)		260992.424(187)	3.4121	7.448	598.471	
29(25, 4) - 28(25, 3)		260992.424(187)	3.4121	7.448	598.471	
18(3,16) - 17(2,15)		261073.260(29)	4.3514	5.258	49.390	
29(26, 4) - 28(26, 3)		261122.365(227)	3.5284	5.690	636.833	
29(26, 3) - 28(26, 2)		261122.365(227)	3.5284	5.690	636.833	
29(27, 3) - 28(27, 2)		261257.437(272)	3.6960	3.862	676.610	
29(27, 2) - 28(27, 1)		261257.437(272)	3.6960	3.862	676.610	
29(28, 2) - 28(28, 1)		261397.525(324)	3.9886	1.966	717.792	
29(28, 1) - 28(28, 0)		261397.525(324)	3.9886	1.966	717.792	
17(4,14) - 17(2,15)		261443.662(39)	6.1421	0.008	49.390	
29(12,17) - 30(11,20)		261848.066(129)	4.8147	2.859	232.316	
29(12,18) - 30(11,19)		261848.066(129)	4.8147	2.859	232.316	
29(4,25) - 28(4,24)		262183.742(22)	2.8241	28.447	134.090	
6(5, 2) - 5(4, 1)		262222.871(42)	3.9527	4.565	16.851	
6(5, 1) - 5(4, 2)		262222.879(42)	3.9527	4.565	16.851	
6(3, 4) - 5(0, 5)		262709.855(46)	7.2884	0.002	4.469	
30(2,29) - 29(2,28)		263516.227(24)	2.8117	29.810	131.710	
29(2,27) - 28(2,26)		263810.797(22)	2.8105	28.819	126.529	
29(2,28) - 28(1,27)		264037.363(23)	4.0240	17.223	122.902	
8(3, 6) - 7(1, 7)		264211.191(42)	6.7007	0.001	8.901	
16(4,13) - 16(2,14)		264338.539(40)	6.1920	0.007	44.206	
30(1,29) - 29(1,28)		264747.871(24)	2.8054	29.826	131.455	
29(3,26) - 28(3,25)		265235.379(22)	2.8051	28.709	129.517	
10(3, 7) - 9(1, 8)		265411.340(39)	6.3615	0.003	14.545	
16(3,13) - 15(2,14)		265823.012(28)	4.3722	4.235	38.820	
8(8, 1) - 9(7, 2)		266334.535(136)	5.9593	0.056	51.299	
8(8, 0) - 9(7, 3)		266334.535(136)	5.9593	0.056	51.299	
19(3,17) - 18(2,16)		266841.898(29)	4.3261	5.501	54.883	
16(2,14) - 15(0,15)		266922.809(40)	5.6885	0.021	35.303	
15(4,12) - 15(2,13)		266951.641(40)	6.2454	0.005	39.332	
13(9, 5) - 14(8, 6)		267555.086(163)	5.1705	0.541	80.800	
13(9, 4) - 14(8, 7)		267555.086(163)	5.1705	0.541	80.800	
30(3,28) - 29(3,27)		268002.516(23)	2.7917	29.673	136.975	
18(10, 8) - 19(9,11)		268696.852(172)	4.9580	1.193	119.310	
18(10, 9) - 19(9,10)		268696.852(172)	4.9580	1.193	119.310	
30(10,20) - 29(10,19)		268803.102(26)	2.8342	26.667	207.176	
30(10,21) - 29(10,20)		268803.102(26)	2.8342	26.667	207.176	
30(11,19) - 29(11,18)		268803.906(27)	2.8458	25.967	223.350	
30(11,20) - 29(11,19)		268803.906(27)	2.8458	25.967	223.350	
30(12,19) - 29(12,18)		268824.344(29)	2.8587	25.201	241.051	
30(12,18) - 29(12,17)		268824.344(29)	2.8587	25.201	241.051	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log A	Line strength	Energy lower state	Ref.
30(9,22) - 29(9,21)		268828.766(24)	2.8239	27.301	192.535	
30(9,21) - 29(9,20)		268828.766(24)	2.8239	27.301	192.535	
30(13,18) - 29(13,17)		268860.152(31)	2.8731	24.367	260.272	
30(13,17) - 29(13,16)		268860.152(31)	2.8731	24.367	260.272	
30(8,23) - 29(8,22)		268892.469(23)	2.8147	27.867	179.434	
30(8,22) - 29(8,21)		268892.480(23)	2.8147	27.867	179.434	
30(14,16) - 29(14,15)		268908.559(33)	2.8892	23.467	281.009	
30(14,17) - 29(14,16)		268908.559(33)	2.8892	23.467	281.009	
30(15,16) - 29(15,15)		268967.668(36)	2.9072	22.501	303.254	
30(15,15) - 29(15,14)		268967.668(36)	2.9072	22.501	303.254	
30(7,24) - 29(7,23)		269015.133(23)	2.8063	28.367	167.881	
30(7,23) - 29(7,22)		269015.527(23)	2.8063	28.367	167.881	
30(16,14) - 29(16,13)		269036.172(40)	2.9273	21.467	327.003	
30(16,15) - 29(16,14)		269036.172(40)	2.9273	21.467	327.003	
30(17,14) - 29(17,13)		269113.113(45)	2.9497	20.367	352.247	
30(17,13) - 29(17,12)		269113.113(45)	2.9497	20.367	352.247	
30(18,12) - 29(18,11)		269197.789(53)	2.9749	19.201	378.981	
30(18,13) - 29(18,12)		269197.789(53)	2.9749	19.201	378.981	
30(6,25) - 29(6,24)		269234.555(23)	2.7987	28.800	157.888	
30(6,24) - 29(6,23)		269245.398(23)	2.7987	28.800	157.889	
14(4,11) - 14(2,12)		269265.047(41)	6.3033	0.004	34.768	
30(19,12) - 29(19,11)		269289.672(63)	3.0033	17.967	407.197	
30(19,11) - 29(19,10)		269289.672(63)	3.0033	17.967	407.197	
12(4, 9) - 11(3, 8)		269383.965(30)	4.1808	4.790	26.691	
30(20,10) - 29(20, 9)		269388.336(77)	3.0355	16.667	436.887	
30(20,11) - 29(20,10)		269388.336(77)	3.0355	16.667	436.887	
30(21, 9) - 29(21, 8)		269493.461(94)	3.0721	15.300	468.044	
30(21,10) - 29(21, 9)		269493.461(94)	3.0721	15.300	468.044	
30(5,26) - 29(5,25)		269572.617(23)	2.7916	29.166	149.473	
12(4, 8) - 11(3, 9)		269604.605(30)	4.1800	4.787	26.684	
30(22, 8) - 29(22, 7)		269604.773(115)	3.1143	13.867	500.660	
30(22, 9) - 29(22, 8)		269604.773(115)	3.1143	13.867	500.660	
30(4,27) - 29(4,26)		269650.664(23)	2.7868	29.462	142.611	
30(23, 7) - 29(23, 6)		269722.051(141)	3.1635	12.367	534.727	
30(23, 8) - 29(23, 7)		269722.051(141)	3.1635	12.367	534.727	
30(5,25) - 29(5,24)		269764.672(23)	2.7906	29.166	149.490	
23(11,13) - 24(10,14)		269768.699(151)	4.8531	1.907	166.828	
23(11,12) - 24(10,15)		269768.699(151)	4.8531	1.907	166.828	
30(24, 7) - 29(24, 6)		269845.105(171)	3.2217	10.800	570.235	
30(24, 6) - 29(24, 5)		269845.105(171)	3.2217	10.800	570.235	
30(25, 5) - 29(25, 4)		269973.770(207)	3.2923	9.167	607.177	
30(25, 6) - 29(25, 5)		269973.770(207)	3.2923	9.167	607.177	
30(26, 4) - 29(26, 3)		270107.898(248)	3.3807	7.467	645.543	
30(26, 5) - 29(26, 4)		270107.898(248)	3.3807	7.467	645.543	
30(27, 3) - 29(27, 2)		270247.359(296)	3.4973	5.700	685.324	
30(27, 4) - 29(27, 3)		270247.359(296)	3.4973	5.700	685.324	
30(28, 3) - 29(28, 2)		270392.031(350)	3.6652	3.867	726.511	
30(28, 2) - 29(28, 1)		270392.031(350)	3.6652	3.867	726.511	
30(29, 2) - 29(29, 1)		270541.801(412)	3.9581	1.967	769.093	
30(29, 1) - 29(29, 0)		270541.801(412)	3.9581	1.967	769.093	
28(12,17) - 29(11,18)		270782.066(129)	4.7893	2.648	223.350	
28(12,16) - 29(11,19)		270782.066(129)	4.7893	2.648	223.350	
30(2,29) - 29(1,28)		271157.664(25)	3.9781	18.275	131.455	
7(5, 3) - 6(4, 2)		271179.164(42)	3.9601	4.682	18.643	
7(5, 2) - 6(4, 3)		271179.191(42)	3.9601	4.682	18.643	
13(4,10) - 13(2,11)		271269.469(42)	6.3666	0.003	30.515	
30(4,26) - 29(4,25)		271506.590(23)	2.7778	29.466	142.835	
7(3, 5) - 6(0, 6)		271978.445(46)	6.9796	0.004	6.251	
20(3,18) - 19(2,17)		272325.820(29)	4.3007	5.768	60.684	
30(2,28) - 29(2,27)		272486.555(24)	2.7681	29.812	135.329	
11(3, 8) - 10(1, 9)		272563.324(39)	6.2335	0.004	17.599	
12(4, 9) - 12(2,10)		272965.090(43)	6.4367	0.003	26.571	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	−log A	Line strength	Energy lower state	Ref.
11(4, 8) - 11(2, 9)		274361.766(44)	6.5150	0.002	22.937	
30(3,27) - 29(3,26)		274528.109(24)	2.7597	29.721	138.365	
9(3, 7) - 8(1, 8)		275326.754(42)	6.5738	0.001	11.221	
10(4, 7) - 10(2, 8)		275478.449(45)	6.6036	0.001	19.612	
9(4, 6) - 9(2, 7)		276341.770(46)	6.7055	0.001	16.595	
12(9, 4) - 13(8, 5)		276504.012(164)	5.2379	0.388	76.617	
12(9, 3) - 13(8, 6)		276504.012(164)	5.2379	0.388	76.617	
17(3,14) - 16(2,15)		276748.910(28)	4.3453	4.234	43.569	
8(4, 5) - 8(2, 6)		276983.977(47)	6.8250	0.001	13.885	
7(4, 4) - 7(2, 5)		277440.492(48)	6.9695	0.000	11.479	
21(3,19) - 20(2,18)		277546.035(29)	4.2751	6.061	66.791	
17(10, 7) - 18(9,10)		277643.328(172)	4.9644	1.008	113.632	
17(10, 8) - 18(9, 9)		277643.328(172)	4.9644	1.008	113.632	
6(4, 3) - 6(2, 4)		277747.480(49)	7.1524	0.000	9.378	
17(2,15) - 16(1,16)		277770.234(44)	4.8780	1.228	40.125	
5(4, 2) - 5(2, 3)		277939.727(50)	7.4035	0.000	7.579	
4(4, 1) - 4(2, 2)		278048.914(51)	7.8132	0.000	6.082	
13(4,10) - 12(3, 9)		278176.777(29)	4.1560	4.973	30.284	
13(4, 9) - 12(3,10)		278544.621(29)	4.1547	4.969	30.273	
22(11,12) - 23(10,13)		278709.977(152)	4.8399	1.706	159.655	
22(11,11) - 23(10,14)		278709.977(152)	4.8399	1.706	159.655	
12(3, 9) - 11(1,10)		279683.773(38)	6.1123	0.005	20.955	
27(12,15) - 28(11,18)		279714.641(129)	4.7671	2.440	214.682	
27(12,16) - 28(11,17)		279714.641(129)	4.7671	2.440	214.682	
8(5, 4) - 7(4, 3)		280134.008(41)	3.9590	4.827	20.734	
8(5, 3) - 7(4, 4)		280134.105(41)	3.9590	4.827	20.734	
8(3, 6) - 7(0, 7)		281422.195(46)	6.7133	0.008	8.327	
22(3,20) - 21(2,19)		282526.480(30)	4.2491	6.385	73.205	
17(2,15) - 16(0,16)		282991.312(42)	5.6522	0.020	39.950	
11(9, 3) - 12(8, 4)		285452.020(164)	5.3472	0.252	72.732	
11(9, 2) - 12(8, 5)		285452.020(164)	5.3472	0.252	72.732	
16(10, 6) - 17(9, 9)		286588.551(173)	4.9816	0.831	108.253	
16(10, 7) - 17(9, 8)		286588.551(173)	4.9816	0.831	108.253	
10(3, 8) - 9(1, 9)		286771.574(42)	6.4598	0.002	13.829	
13(3,10) - 12(1,11)		286822.113(38)	5.9969	0.007	24.613	
14(4,11) - 13(3,10)		286904.020(29)	4.1313	5.154	34.180	
23(3,21) - 22(2,20)		287293.535(30)	4.2224	6.744	79.923	
14(4,10) - 13(3,11)		287492.285(29)	4.1293	5.146	34.161	
21(11,11) - 22(10,12)		287649.937(152)	4.8320	1.510	152.781	
21(11,10) - 22(10,13)		287649.937(152)	4.8320	1.510	152.781	
18(3,15) - 17(2,16)		288096.680(29)	4.3209	4.197	48.610	
26(12,14) - 27(11,17)		288646.039(129)	4.7484	2.234	206.314	
26(12,15) - 27(11,16)		288646.039(129)	4.7484	2.234	206.314	
9(5, 5) - 8(4, 4)		289086.301(41)	3.9519	4.988	23.124	
9(5, 4) - 8(4, 5)		289086.590(41)	3.9519	4.988	23.124	
9(3, 7) - 8(0, 8)		291092.437(45)	6.4795	0.015	10.695	
24(3,22) - 23(2,21)		291875.777(29)	4.1951	7.141	86.944	
14(3,11) - 13(1,12)		294035.137(37)	5.8868	0.009	28.570	
10(9, 2) - 11(8, 3)		294399.445(165)	5.5306	0.138	69.147	
10(9, 1) - 11(8, 4)		294399.445(165)	5.5306	0.138	69.147	
15(10, 6) - 16(9, 7)		295532.840(173)	5.0129	0.662	103.172	
15(10, 5) - 16(9, 8)		295532.840(173)	5.0129	0.662	103.172	
18(2,16) - 17(1,17)		295543.766(45)	4.8696	1.099	45.025	
15(4,12) - 14(3,11)		295546.980(28)	4.1069	5.331	38.378	
25(3,23) - 24(2,22)		296303.918(29)	4.1669	7.580	94.265	
15(4,11) - 14(3,12)		296454.805(28)	4.1040	5.318	38.350	
20(11, 9) - 21(10,12)		296588.859(152)	4.8302	1.319	146.205	
20(11,10) - 21(10,11)		296588.859(152)	4.8302	1.319	146.205	
25(12,14) - 26(11,15)		297576.508(129)	4.7333	2.031	198.244	
25(12,13) - 26(11,16)		297576.508(129)	4.7333	2.031	198.244	
10(5, 6) - 9(4, 5)		298034.715(41)	3.9409	5.161	25.813	
10(5, 5) - 9(4, 6)		298035.465(41)	3.9409	5.161	25.813	

TABLE 13. The microwave spectrum of ground state $^{12}CH_3{}^{12}CH_2{}^{12}C^{14}N$–Continued

Transition	Obs. freq. (Est. unc.) MHz	Calc. freq. (Est. unc.) MHz	$-\log A$	Line strength	Energy lower state	Ref.
11(3, 9) – 10(1,10)		298561.832(43)	6.3567	0.002	16.725	
30(7,23) – 30(6,24)		299320.402(85)	3.9210	15.495	166.870	
30(7,24) – 30(6,25)		299352.367(85)	3.9209	15.495	166.869	
29(7,22) – 29(6,23)		299550.273(86)	3.9229	14.888	157.889	
29(7,23) – 29(6,24)		299571.789(86)	3.9228	14.888	157.888	
28(7,21) – 28(6,22)		299753.859(87)	3.9250	14.284	149.208	
28(7,22) – 28(6,23)		299768.125(87)	3.9249	14.284	149.208	
18(2,16) – 17(0,17)		299902.566(43)	5.6238	0.019	44.879	
19(3,16) – 18(2,17)		299922.227(31)	4.2991	4.123	53.943	
27(7,20) – 27(6,21)		299933.504(88)	3.9273	13.684	140.829	
27(7,21) – 27(6,22)		299942.812(88)	3.9273	13.684	140.828	

4.2. CH_3CH_2CN References

[57A] R. G. Lerner and B. P. Dailey, J. Chem. Phys. **26**, 678 (1957). "Microwave Spectrum and Structure of Propionitrile."

[59A] V. W. Laurie, J. Chem. Phys. **31**, 1500 (1959). "Microwave Spectrum and Internal Rotation of Ethyl Cyanide."

[69A] Y. S. Li and M. D. Harmony, J. Chem. Phys. **50**, 3674 (1969). "Nitrogen Quadrupole Coupling Constants in Ethyl Cyanide Coupling Constant of the Cyano Group."

[73A] H. Mader, H. M. Heise, and H. Dreizler, Z. Naturforsch. **29**a, [illegible] (1973). "Microwave Spectrum of Ethyl Cyanide; r_0-structure, Nitrogen Quadrupole Coupling Constants and Rotation-Torsion-Vibration Interaction."

[74A] H. M. Heise, H. Lutz, and H. Dreizler, Z. Naturforsch. **29**a, 1345 (1974). "Molecular Structure Quadrupole Coupling Tensor and Dipole Moment of Ethyl Cyanide."

[75A] Y. S. Li, and J. R. Durig, J. Mol. Spectrosc. **54**, 296 (1975). "The ^{14}N Quadrupole Coupling Constants and Barrier to Internal Rotation of Ethyl Cyanide-d_5."

[76A] H. M. Heise, H. Mader, and H. Dreizler, Z. Naturforsch. **31**a 1228 (1976). "Rotation-Torsion-Vibration Interaction in the Rotational Spectra of Isotopic Species of Ethyl Cyanide."

[77A] D. R. Johnson, F. J. Lovas, C. A. Gottlieb, E. W. Gottlieb, M. M. Litvak, M. Guelin, and P. Thaddeus, Astrophys. J. **218**, 370 (1977). "Detection of Interstellar Ethyl Cyanide."

[78A] J. Burie, J. Demaison, A. Dubrulle, and D. Boucher, J. Mol. Spectrosc. **72**, 275 (1978). "Microwave Spectrum of Propionitrile. Determination of the Quartic and Sextic Centrifugal Distortion Constants."

[80A] D. Boucher, A. Dubrulle, J. Demaison, and H. Dreizler, Z. Naturforsch. **35**a, 1136 (1980). "Determination of a High Potential Barrier Hindering Internal Rotation from the Analaysis of the Ground State Spectrum: The Case of Ethyl Cyanide."

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