A.H. Bridle

Spectral Flux Densities of Radio Sources at 22.25 MHz. I

Contains revised data, (Roger, R.S., Bridle, A.H. and Costain, C.H. 1972)

By

R. S. ROGER, C. H. COSTAIN, AND J. D. LACEY

Reprinted from THE ASTRONOMICAL JOURNAL, Vol. 74, No. 3, pp. 366–372, April 1969

N.B. All flux densities except Cas H and Cyg A should be multiplied by 1.15. Those which have been revised are on new scale.

TABLE I.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Flux density			Notes following table			
			a	b	c		
Source designation	10^{-26} W m^{-2}Hz^{-1}	p.e. ±	Number of records	Confusing sources	Background complexity	Other notes	Spectrum to 22 MHz
3C2	55	7	5				S
3C9	85	10	4		×		C−
3C10, Tycho SNR	590	47	6	3C11.1	Cas A sl.		S
3C15	43	16	5	3C17			(C−)
3C16	65	7	4	(4C12.05)	4C12.04		S
3C17	177	52	7	3C15		1	C+
3C19	63	5	3	(4C32.02)			S
3C18	75	7	4	[4C10.01] [4C09.01]	×		S
3C20	134	10	3	3C22			S
3C22	54	3	4	3C20			–
4C17.07 } 3C23 4C17.08 }	65	15	3				–
3C28	146	15	5				S
3C29	~~154~~ 83	14	9				(C+)
3C31	~~94~~ 86	16	7	3C34		1	S
3C33	235	28	5		×		S
3C35	54	10	4		×		(C−)
3C40	220	19	3				(C+)
3C41	~~73~~ 72	15	4	(4C32.07)	3C48		C+
3C43	60	5	3				S
3C46	65	9	5	4C38.05 4C38.06			S
3C47	221	11	7				S
(3C48)	48	4	4		3C41	2	C−
(4C31.05)	62	4	4			3	–
3C54	62	6	3	4C44.05			S
4C39.05	77	11	3				–
HBH 3, HB 3	450	50	6	W3	W4	4	S
3C63	90	9	7				(C−)
3C64, 4C08.08	50	5	4		×		S
3C66, (Abell 347)	300	27	5	4C42.06		5	C+
3C65	89	10	6				S
3C68.1	69	6	6				S
3C69	131	7	4	NPC source		6	S
MSH 02−1/10, P0235−19	130	33	4			7	S
3C71, NGC 1068	72	7	4				(C+)
3C73, 4C39.10	72	5	3	4C39.09 4C38.08			S
3C75, (Abell 400)	125	9	3				S
(4C13.17), (P0255+13), (Abell 399/401)	109	31	11			8	S
3C78	71	6	4		×		S
3C79	104	9	4				S
3C84	713	53	6	3C83.1			C+
3C86	78	11	3	4C55.07	×		(C−)
4C55.07	36	6	3	3C86	×		S
3C88	77	7	6				S
3C89	166	14	6				S
3C93.1 (4C34.15)	39	4	14		×		–
3C98	271	26	4	(4C10.11)			(C+)
3C103	136	24	4				S
(3C105)	76	10	3			9	–
MSH 04−1/2, P0405−12	139	25	4				S
3C109	113	21	5				S
3C111	325	24	8				S
3C123	793	38	9				S
3C131	110	9	3		3C123		C+
3C132	49	8	4				S
3C133	77	11	6		×		S
3C134	411	30	6				C−
(3C135)	283	30	—	4C01.13		10	–
3C136.1	91	7	5		×		S
3C141	62	6	5	Tau A sl.			C−
3C142.1	72	11	7	[Tau A sl.]		11	S
Tau A, 3C144	2750	330	6				(C+)
3C147	<30		5				C−
(3C153), (Abell 553)	263	40	5			12	C+
3C154	93	8	5				S

TABLE I (*continued*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Flux density			Notes following table			
			a	b	c		
Source designation	10^{-26} W m^{-2}Hz^{-1}	p.e. ±	Number of records	Confusing sources	Background complexity	Other notes	Spectrum to 22 MHz
4C42.17	33	6	5		4C41.15		S
3C157, IC443	535	65	6			13	S
3C158	106	12	5	4C13.32 4C14.18			S
4C40.15 } 3C159 4C40.16 }	44	4	8				-
3C161, 4C−05.23	236	23	3				S
3C165	62	4	4		×		S
3C166	70	6	5				S
3C171	73	6	4	4C54.12			S
3C173	45	4	6	4C38.20 [4C37.18]			S
3C172	60	4	8				S
3C175	113	9	7		4C12.29 4C12.30		(C−)
3C180	83	8	7				S
4C24.15, P0726+24	85	15	5		×		S
3C184.1	52	4	6				S
3C186	47	3	11		4C37.21		C−
3C187	101	9	8		4C02.20 4C02.22		S
4C37.21	47	3	5		3C186		S
3C190	62	7	5			14	S
3C191	84	7	7				S
3C192	114	7	8		4C23.19		S
3C196	242	17	5	[Abell 637]	×	15	S
3C196.1	178	18	8				S
3C198	157	11	8	NPC source	×	16	S
4C11.28, P0830+11	66	5	5	NPC source		17	(C+)
3C201 } P0831+17.5 3C202 } P0831+17.2	30	4	6				S
4C14.27, P0832+14	77	6	5				C+
4C29.31	69	7	6				C+
3C210	54	4	5				S
3C216	103	21	5	4C42.28 (4C41.19)	4C42.29		S
Hyd A, 3C218	2010	260	6				(C−)
3C219	176	22	3				S
(4C14.31), (P0922+14) (Abell 795)	71	6	5	NPC source		18	S
3C225	85	6	5	3C228			C−
3C227	~~254~~ 205	63	5	(4C05.40)		19	(C+)
3C228	92	6	5	3C225			S
3C230	95	8	4		4C00.34		(C−)
3C231, M82	34	4	3		×		(S)
3C234	195	31	3	(4C29.36)			S
3C236, (Abell 924)	62	6	5	NPC source		20	C+
3C237	29	3	4	3C238			C−
3C238	103	9	8	3C237			S
3C239	71	6	5				(C−)
4C39.29 } (Abell 963) 4C39.30 }	38	4	5				(C+)
4C31.35	55	12	4				S
3C242, 4C20.22	51	4	4				S
3C243, 4C06.40	137	10	6	(4C07.31)		21	S
3C245	56	7	5	4C11.35			S
3C247	42	4	3				S
3C249	66	16	5				S
3C254	136	26	5	Cas A sl. 4C41.23			S
3C256	35	4	6				C−
4C23.28, P1139+234	48	5	3	(3C263.1)			S
4C21.33, (P1140+21)	106	10	5	(3C263.1)			S
3C263.1	<30		6	4C21.33 4C23.28			C−
3C264, (Abell 1367)	255	20	4			22	C+
3C265	111	13	3				C−
MSH 12+0/4, P1215+03 4C04.41	101	12	7		×		S

TABLE I (*continued*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Flux density			Notes following table			
			a	b	c		
Source designation	10^{-26} W m^{-2}Hz^{-1}	p.e. ±	Number of records	Confusing sources	Background complexity	Other notes	Spectrum to 22 MHz
3C270	176	12	5		Vir A sl.		S
3C270.1	53	6	5		Vir A sl.		S
3C272	30	3	4		×		S
Vir A, 3C274	4880	300	14				S
3C275	91	10	3				C+
3C276, 4C47.35	46	5	5	3C280			S
3C278, P1252−12	178	27	3				S
Coma Cluster, Abell 1656	180	36	15	3C277.3			C+
3C280	130	13	5	3C276 Abell 1682			S
WKB 1304/46.8, Abell 1682	95	9	5	3C280			S
3C284	76	5	7				S
3C285	45	5	4	(4C43.27)			S
3C286	52	8	5	4C29.48			S
3C287.1	67	6	6		4C02.38		S
3C288	65	7	6	4C39.40			S
3C293	57	7	7	4C32.46			S
(3C298), (Abell 1890)	177	35	9			23	(C+)
3C299	<35		4				C−
3C300	106	11	7	4C20.33			S
4C20.33, P1422+20	<30		6	3C300			–
3C300.1	<35		6				–
MSH 14+0/10, P1434+03 4C03.30	90	11	4		×		S
3C306.1	[illegible] 80	8	3				S
3C309.1	44	4	4	3C314.1			S
3C310	335	20	4		3C315		S
3C314.1	84	5	4	3C309.1			S
3C318	33	2	3				(C−)
3C319	70	5	4				S
3C320	52	4	5				S
3C321	96	8	9				S
3C327	283	25	3	3C327.1			S
3C327.1	174	15	6	3C327			S
3C330	79	5	4	4C65.20 [4C65.19]			S
3C334	75	5	5				S
3C336	72	4	4				S
3C338, NGC 6166	291	13	6				C−
3C337	[illegible]	8	6	4C43.38			(C+)
4C13.62, 4C13.63 } 3C347	69	5	5				S
Her A, 3C348	2690	190	15				S
3C351	43	3	6				C−
3C352	43	4	9	4C45.33			C−
3C353	1200	100	12				S
3C356	43	8	4		(4C50.43)		C−
3C357	49	3	5				S
3C368	113	11	11				S
3C370, 4C32.54	49	4	9				–
3C380	299	13	5		×		S
3C382	117	9	4				S
3C386	95	28	3				S
3C388	80	6	5				S
3C390.3	241	28	3				S
3C393, 4C52.44	57	5	3				S
3C394	107	9	7	[4C13.69]	×		S
3C399.1	42	6	3		×		C−
3C401	48	8	7		Cyg A sl.		C−
3C402	78	5	5			24	C+
Cyg A, 3C405	29 100	11 60	4			25	C−
3C409	483	29	3				S
3C410	123	10	3				S
3C415.2	58	5	14				S
3C422, 4C−02.80	70	21	7				S
3C424	73	10	4		×		S
3C427.1	145	10	12				S
3C430	192	12	5	NPC source		26	S
3C432	57	5	6		×		(C−)
3C433	166	10	5				C−

TABLE I (*continued*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Flux density			Notes following table			
Source designation	10^{-26} W m^{-2}Hz^{-1}	p.e. ±	a Number of records	b Confusing sources	c Background complexity	Other notes	Spectrum to 22 MHz
3C436	94	7	7				S
3C438	203	12	4				S
3C441	47	3	5				(C−)
3C442	141	9	8				S
3C444, P2211−17	701	139	3				S
3C446, 4C−05.92	97	10	4		×		S
3C452	288	13	7				S
3C454.1	78	6	5	4C70.24 [4C72.32]			S
3C454.2	158	21	6		Cas A sl.		C+
3C459	103	8	5		×		C−
Cas A, 3C461	51 400	2400	4			27	C−
3C465	203	32	3		Cas A sl.		S
3C470	50	3	7		Cas A sl.		S

Notes

a. Number of observations used to derive the flux density.
b. Confusion exists with the source listed in this column and the flux density has been corrected for it. If the identification of the confusing source is uncertain, the tentative identification is given in brackets [ ]. Not previously catalogued sources are listed NPC. Sources in parentheses ( ) may contribute to the flux density but are not apparent on the records and have therefore not been allowed for.
c. A cross (×) in this column indicates that the background emission in the neighborhood of the source has complex structure which may affect the accuracy of the flux density measurement. If the complexity is due to nearby sources or their sidelobes (sl.), these are listed in the column.
1. Large pointing correction on some observations contributes to the listed error.
2. Identification uncertain: Mean transit time 0.9 minutes later than 3C48; unlikely to be refraction.
3. Broad feature centered 2 minutes later than 4C31.05: Total flux given.
4. A 22-MHz map including this source is given by Roger (1969).
5. Broad emission centered 0.8 minutes earlier than 4C position: Estimated size 65′ NS by 60′ EW.
6. Confused with uncatalogued source ~12 minutes earlier.
7. Calibration uncertain at large zenith angles.
8. Centered 1.4 minutes earlier than 4C13.17: Caswell, Crowther, and Holden (1967) show elongated source centered 1 minute early; Abell 399/401 nearby, may be associated.
9. Transits on average 0.7 minutes early: May be refraction.
10. Broad object centered 1°.3 north of 3C135: 4C−01.15 may contribute.
11. Confused with uncatalogued sources following or Tau A sidelobe.
12. Broad object centered on 3C153 (estimated size 110′ EW by 90′ NS) or confusion of several sources: Total flux given.
13. May be broader in EW direction than at higher frequencies.
14. Transits 0.7 minutes early on average: May be refraction.
15. Confusing sources surrounding 3C196 or emission from broad region centered on source: Near Abell 637.
16. Confused with uncatalogued source ~5 minutes earlier.
17. Sometimes confused with uncatalogued source ~5½ minutes later.
18. Transits 0.8 minutes earlier than 4C14.31, near R.A. of Abell 795: Corrected for confusion with uncatalogued source ~5 minutes earlier.
19. Large pointing correction: 4C05.40 may contribute 20 f.u.
20. Corrected for confusion with uncatalogued source ~5 minutes later.
21. Possibility of up to 30 f.u. contribution from 4C07.31.
22. EW response broadened by ~20%.
23. Broad emission centered on 3C298 (~50′ EW). May be associated with cluster.
24. Probably two-thirds of 22-MHz flux density is due to most northerly component listed by Macdonald, Kenderdine, and Neville (1968).
25. Primary calibration source.
26. Corrected for confusion with uncatalogued source ~8 minutes later.
27. Epoch 1966.5.

of the source. This background is subtracted and a flux density is calculated by an integration of the residual intensity between polar diagram zeros. Because refraction may be present, the time corresponding to the half-integral is used as a corrected transit time. If the time correction is greater than 0.05 beamwidths, the fitting and subtracting of the background is continued in an iterative process until the time correction needed is less than this amount. Figure 4 shows a computer plot of the record in Fig. 3 with the background subtracted and with a polar diagram fitted. The rms deviation of the background values about the cubic fit, and of the source values about the polar-diagram fit, provide measures of the noise level on the records and of the severity of scintillation, respectively. For cases where there are nearby sources in the region used to estimate the background, or where the background structure is too complex to be fitted by a cubic equation, a direct estimate of the level beneath the source is specified for computer scaling.

Broad sources and confused pairs (i.e., ones within 2 beamwidths of each other) are scaled by hand from the analogue chart record.

IV. THE SPECTRAL FLUX DENSITIES

The flux densities are listed in Table I.

Column 1 shows the source identification and alternate designations. If more than one identification is possible, both are given, with doubtful identifications and possible associations parenthesized. Columns 2 and 3 list the flux densities for each source and the probable error of the flux density. For flux densities which are not affected by background complexity, confusion, beam pointing corrections, or suspected refraction errors, the probable error is a compounding of the probable error due to the deviation of the various measures about the mean and of that due to the uncertainty in the calibration. Where these other effects are present, an estimate of their contribution to the probable error has been included.

Columns 4, 5, and 6 are explained fully in Notes a, b, and c at the end of the table. Other notes are listed in column 7.

Column 8 shows the effect of the 22-MHz flux density on the spectrum defined by higher-frequency measurements. For this purpose, comparison has been restricted