The All Sky Celestial Reference Frame at X/Ka-band (8.4/32 GHz)

S. Horiuchi (1), J. E. Clark (2), C. García-Miró (3), C. E. Goodhart (2),
C.S. Jacobs (2), R. Maddè (4), M. Mercolino (4), L. Snedeker (5),
I. Sotuela (3), L.A. White (2)

(1) Canberra Deep Space Communications Complex/NASA, C.S.I.R.O., Australia
(2) Jet Propulsion Laboratory, California Institute of Technology/NASA
(3) Madrid Deep Space Communications Complex/NASA, INSA, Spain
(4) ESOC, ESA, Darmstadt, Germany
(5) ITT-Exelis/NASA, Goldstone, CA

We have constructed an X/Ka-band (8.4/32 GHz) celestial reference frame using over seventy ~24-hour sessions with the Deep Space Network. We detected 631 sources covering the full 24 hours of right ascension and the full range of declinations. Comparison of 520 X/Ka sources in common with the S/X-band (2.3/8.4 GHz) ICRF2 shows wRMS agreement of 180 micro-arcsec μas in RA cos(dec) and 215 μas in Dec. There is evidence for systematic errors at the 100 μas level. Known errors include limited SNR, lack of phase calibration, troposphere mismodelling. We recently began a collaboration with ESA using their Malargüe, Argentina antenna. This site greatly improves our geometry in the south.

Compared to X-band, Ka-band allows access to more compact source morphology and reduced core shift. Existing X/Ka data and simulated Gaia data predict a frame tie precision of 10 μas (1-sigma, per 3-D rotation component) with anticipated improvements reducing that to ~5 μas per component.