Subject:Cloud radar
From:"A. Richard Thompson" <athompso@nrao.edu>
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To:Barry Clark <bclark@nrao.edu>, "R. Sramek" <rsramek@nrao.edu>,
"Emerson, Darrel" <demerson@nrao.edu>, "L. R. Daddario" <ldaddari@nrao.edu>,
Peter Napier <pnapier@nrao.edu>, John Payne <jpayne@nrao.edu>,
Art Symmes <asymmes@nrao.edu>
CC:hlistz@nrao.edu, Dick Thompson <athompso@nrao.edu>

To ANATAC

Some further points following the discussion in the ANATAC meeting of 7/7/04.

(1) Far sidelobe interaction. Assume 0 dBi sidelobes for radar and RA antennas. For 705 km spacing, and 94 GHz, the propagation loss (between isotropic antennas) is 188.9 dB. For transmitter (peak) power of 1.8 kW = 32.5 dBW, the power picked up in the receiving antenna is 32.5-188.9 = -156.4 dBW. Compare this with the system noise power in a receiver with bandwidth 4 GHz and T_sys = 20 K, which is 1.38x10^-23 x 4x109 x 20 = 1.10x10^-12W = -119.6 dBW. Thus the sidelobe-to-sidelobe peak signal is 37 dB below the system noise. Thus no overloading, even for sidelobes somewhat above 0 dBi.

(2) Far sidelobe to main beam interaction. The main beam gain of the radar antenna is given as 63 dB. The main beam gain of a 12 m antenna at 94 GHz, assuming 70% aperture efficiency, is 80 dB. The power picked up in the receiving antenna is:
-156.4 + 63 = -93.4 dBW = -63.4 dBm, if the main beam is that of the radar, or
-156.4 + 80 = -76.4 dBW = -48.4 dBm, if the main beam is that of the RA antenna. This may cause saturation, but not damage. Because of the motion of the satellite (footprint velocity approx 7 km/sec), such interactions would last for less than one second for any single antenna, or about 2 sec if one considers the 14 km distribution in the large configuration.

(3) Main beam to main beam interaction. From figures used above, the power received is -156 + 63 + 80 = -13 dBW = 17 dBm = 50 mW. (In the meeting yesterday I said 57 mW, but here I have been rounding off to the nearest dB).

(4) I will forward an e-mail from Tony Kerr. The figure that he uses for burnout of an SIS mixer is 1 mW per square micrometer of junction area. This is for DC power, and results from tests that were made a few

years ago. Taking details of the band 3 mixer into account, Tony calculates that 60 mW of input results in 2 mW per sq. micrometer, i.e. just a factor of two above the burnout figure. He says that the burnout level for pulsed power would depend on the thermal time constant of the junction, which is not known. The level for the 3.3 microsec pulses could be measured, but would not be trivial because a special Dewar setup allowing DC pulses to be injected would be necessary. Tony also said that for band five and higher, the cutoff of the wavguide at the throat of the feed horn should provide protection from signals at 94 GHz.

(5) I recieved an e-mail from Steve Durden of NASA giving some information on the cloud radar, which I will forward to ANATAC. This contains an attachment that gives details of the radar, which include the fact that at 60 dB down, the emission bandwidth is 80 MHz. Second and third harmonics are estimated to be -50 dBc and
-60 dBc, respectively.

Dick
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A. Richard Thompson
NRAO, 520 Edgemont Road, Charlottesville, VA, 22903
Phone: (434) 296-0285   Fax: (434) 296-0278
athompso@nrao.edu
Web site at http://www.cv.nrao.edu/~athompso contains
corrections and supplementary notes to INTERFEROMETRY
AND SYNTHESIS...(Thompson, Moran, and Swenson).