Abstracts

Investigation of Telstar 4 Spacecraft Ku-Band and C-Band Antenna Components for Multipactor Breakdown

N. Rozario, H.F. Lenzing, K.F. Reardon, M.S. Zarro and C.G. Baran. "Investigation of Telstar 4 Spacecraft Ku-Band and C-Band Antenna Components for Multipactor Breakdown." 1994 Transactions on Microwave Theory and Techniques 42.4 (Apr. 1994, Part I [T-MTT]): 558-564.

Multipactor is an electron resonance phenomenon which occurs at radio frequencies in components and transmission lines operating in vacuum. Multipactor represents a possible payload failure mechanism for communications satellites since it can destroy RF components or transmission lines, or it can significantly raise noise levels. The Telstar 4 series of spacecraft presently being built for AT&T by Martin Marietta will carry 24 high-power transponders for Ku-band (~60 W/transponder) and 24 medium-power transponders for C-band (~25 W/transponder). The outputs of a number of transponders are frequency multiplexed prior to being input to the Ku-band or C-band antenna feed networks (AFN). Computation shows that instantaneous peak powers due to the combined signals can reach 4500 W at Ku-band and 3900 W at C-band. For the purpose of ensuring that the AFN would not suffer multipactor breakdown in orbit, each of the individual components in the C-band and Ku-band AFN were subjected to instantaneous peak powers well in excess of that which will be experienced in space. The high instantaneous peak powers required for this pre-flight testing were realized by phasor addition of the high-VSWR standing waves of two diplexed carriers of slightly different frequencies. This technique effectively provided an instantaneous peak power 32 times the average power output of each of the two input carriers. Test sets to accomplish this were constructed at both C-band and Ku-band. The ability to detect multipactor (by two independent means) was assured by measuring test cells which were specifically designed to break down for the test levels previously mentioned. Investigations of the separate AFN components for the Telstar 4 spacecraft showed that all components passed with substantial margin.

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