

"THE ENVIRONMENTAL IMPACT OF MICROWAVE SYSTEMS IN THE 70'S"

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Abstract

This paper will commence with a description of the present use and dependence upon microwave systems within the United States, particularly from the point of view of the Federal Government. Secondly, a description will be given of the kinds of advances projected in microwave technology during the 70's and the kind of new systems these advances will bring into use. The paper will then discuss the two major aspects of environmental impact that both present and proposed systems will make. These include the impact of new systems on existing systems and secondly, the impact of a microwave system on the biological environment. Finally, this paper will discuss the implications of environmental impacts insofar as adequacy of boundary conditions in each area.

Introduction

One of the principal battlegrounds for radio frequencies in the 1970's will be the microwave part of the spectrum. The microwave part of the spectrum, for purposes of this paper, is considered to fall between 1 and 10 GHz. This battleground looms for many reasons. Fifteen years ago, this part of the spectrum was already completely allocated for terrestrial types of systems including various kinds of microwave relay systems and radar systems. Then the space age burst on the scene and it was necessary to develop a set of sharing criteria to permit their compatible operation with the terrestrial systems. The impetus to put more and more space systems between 1 and 10 GHz continues. Now we are faced with the proposition of even further demands being made on the microwave part of the spectrum by virtue of breakthroughs in solid state technology and the development of microwave power. If the burgeoning information transfer needs to be met by these systems are to be satisfied, it is imperative that adequate boundary conditions be established so that they may coexist both with each other and with their biological environment.

Microwave System Use of the Spectrum

The first part of this paper will give the dimensions of the present use of microwave systems within the United States. These systems come under the dual management of the Office of Telecommunications Policy, managing Federal Government microwave systems, and the Federal Communications Commission, managing non-Government systems. This paper will document the number of users of such systems and the extent of their use throughout the indicated part of the spectrum in terms of the types of services they perform and the magnitude of powers employed. The second part of this paper will go into some detail in presenting the new opportunities ahead for development of the microwave spectrum. One of the forcing functions for such developments is the new spectrum for space services made available at the World Administrative Radio Conference for Space Telecommunications during the Summer of 1971. This spectrum includes frequencies for new types of services including broadcasting and earth resource satellites. The nature of these new allocations will be presented in some detail. Other forcing functions which will be discussed include the development of integrated circuit microwave components which will permit the development of inexpensive equipments, applicable to a number of different systems. The nature of these devices will be indicated along with a description of some of the kinds of systems in which they could be incorporated.

Environmental Impact

The third section of this paper will deal with the

problems posed by the juxtaposing of the previous two. These problems center on attempting to establish effective criteria which will on the one hand permit the maximum introduction of new services utilizing new technology, and on the other hand will protect existing services and systems from harmful interference, and furthermore will be done in such a fashion that the biological environment will not be damaged. In other words we are dealing with the two major forms of environmental impact in the microwave spectrum during the 1970's. The first concerns the impact that a new communication-electronic system has on the operation of existing communication-electronic systems. The second concerns how a communication-electronic system effects may impact on man.

The first type of environmental impact is termed electromagnetic compatibility. In this case the impacted environment consists of all other communication-electronic equipments which may be susceptible to functional modification by the radio energy of other communication-electronic equipments. The emissions from various radio transmitters may be received unintentionally by communication-electronic systems which were not intended to be receptors of such radio emissions. These unintended received emissions may be of sufficient magnitude or character to be dilatorious to the ability of the receptor to actually receive its intended information carrying signal. Therefore, the introduction of new systems increasingly demands that there be comprehensive and adequate studies of the impact of any new radio system on other equipments before it is introduced into the radio environment where it intends to operate. Such analyses may also include determinations as to whether the existing communication-electronic systems will do harm to the functioning of the new system. In the near future it will become a matter of policy that a new user of a radio system will not be permitted to operate until he has given conclusive proof that such compatibility does exist. This paper will illustrate various such analyses underway.

The second form of the environmental impact is biological. This of course concerns the potential of radio energy and biologically deleterious effects. This concern is increasingly being considered as one requiring environmental protection. As you may know, the Environmental Protection Act of 1970, Section 102, requires that Federal agencies file environmental impact statements. Already several such statements have been filed in connection with major Government communication-electronic systems and considerable research has been undertaken to ascertain the nature of these potential impacts. It has become a matter of some urgency to come to grips with the nature of this biological impact in order to establish the

necessary boundary conditions which on the one hand will be protective of health and on the other hand permit the functioning of telecommunication systems.

Conclusions

The conclusions of this paper will address the question of what boundary condition or conditions will establish the basis for a meaningful protection guide in the area of potential and real biological effects of nonionizing electromagnetic radiation, particularly as it affects microwave systems. Reference will be made to the already existing standards in this respect and also the kinds of boundary conditions in the form of sharing criteria which exist for systems to operate in a compatible fashion with other communication-electronic equipments.