FREQUENCY BAND DESIGNATIONS

INTRODUCTION

The microwave band designations which emerged from World War II Radar Security considerations have never been officially blessed by any industrial, professional or government organization, but rather have settled into widely agreed (and sometimes disagreed) upon limits by usage and unofficial promulgation [1].

In August 1969, the United States Department of Defense, Office of Joint Chiefs of Staff, by message to all Services and to the Joint US-Canadian North American Air Defense Command[5], directed use of a new frequency band breakdown as shown in the chart, Figure 1. Most of the IEEE membership who deal with the US and Canadian Radar and ECM areas have been exposed to the new band designations. The purpose of this note is to further promulgate the JCS Band designations in the microwave community, discuss them in relation to the older band designations, and to recommend consideration for adoption of a modified version of the JCS Band designations by the IEEE.

BAND DESIGNATIONS

With reference to Figure 1, the two far left-hand columns present current Microwave, ECM and Radar usage in the United States and UK. The US usage is believed to fairly represent the band designations which have been in widest use, and d as they are now contained in most Handbooks[1, 2]. The UK usage is that derived by observation by the writer[3], as modified by limited attempts to unofficially standardize usage as have appeared in the literature[4, 5].

However, the United States Services, by Joint Service Regulations, and in conjunction with the Canadian Air Force through NORAD, adopted in 1964 the Band designation shown in the centermost of Figure 1 primarily for use in training activities[6]. In August 1969, the Joint Chiefs of Staff directed mandatory use of the bands designated by the Joint Service Regulations.

Each of the JCS Bands are further divided into ten equal parts, or "channels", and the channels are numbered one (1) through ten (10) from low to high end of the Band. For example, in D-Band (or "Delta" band using the current phonetics) which is 1000-2000 megahertz, Channel 4 is the subband 1300-1400 megahertz, and this subband would be identified as "D_4" or "Delta Four."

The Radio Regulations of the International Telecommunication Union[7] establish the official internationally accepted Band designations familiar to most Radio Engineers, and these Bands are included for comparison in Figure 1. The ITU band numbers are of course related to the Band limits in Hertz as powers of ten, i.e., Band number N extends from 0.3×10^N to 3.0×10^N Hertz.

Also included for comparison in Figure 1 are the series of Standard Waveguide bands as designated by the Electronic Industries Association (EIA). Some of these Waveguide Bands also bear Joint Army-Navy (JAN), British and IEC designations[8].

DISCUSSION

Of all the Band designations shown in Figure 1, the only breakdown which has a direct physical basis is the Waveguide Band. The Waveguide Bands, as they are associated with the physical dimensions of the guide and hence related to TE_{10} mode cutoff, rest upon firm engineering considerations. The Band edges are not in all cases round numbers of megacycles, however and with the exception of the 8.2 to 12.4, 12.4 to 13, and 18 to 26.5 Gigahertz ranges, engineering practice has not resulted in any widespread use of the waveguide band divisions.

The ITU Bands, on the other hand, are very easy to remember, but also have not gained wide usage among Microwave engineers. This is perhaps because the Bands are much too broad for day-to-day application.

The "usage" band breakdowns which have resulted from over 30 years of practice are perhaps the most representative of what Engineers will use as shorthand identification of a range of frequencies.

Like the names of the colors and the popular names of aircraft, the designations "L", "S", "C" and "X" convey instant mutual understanding of hardware and propagation characteristics and envoke a visual conception of the problem in question based on experience. A new band designation will require a mental transfer process.

What then of the official JCS Band designators? Advantages:

i.) The JCS designation clears up the P, L and K band usage inconsistancies.

ii.) The numbers are mostly octave or half-octave, with finer breakdowns of the densely signal-populated "S" and "X" bands.

iii.) The size of the bands roughly correspond to that size which has been demonstrated to be useful in practice.

There are perhaps changes which would improve the JCS Band breakdown; e.g., Band A, 0-250 MHz, carries the connotation "everything below 250 Megahertz", which is probably satisfactory for strictly microwave engineers but, at the least, is difficult to plot on a logarithmic scale. It may also be advisable to extend the Band designations above 100 Gigahertz into the "IR-Radio" gap.

References:

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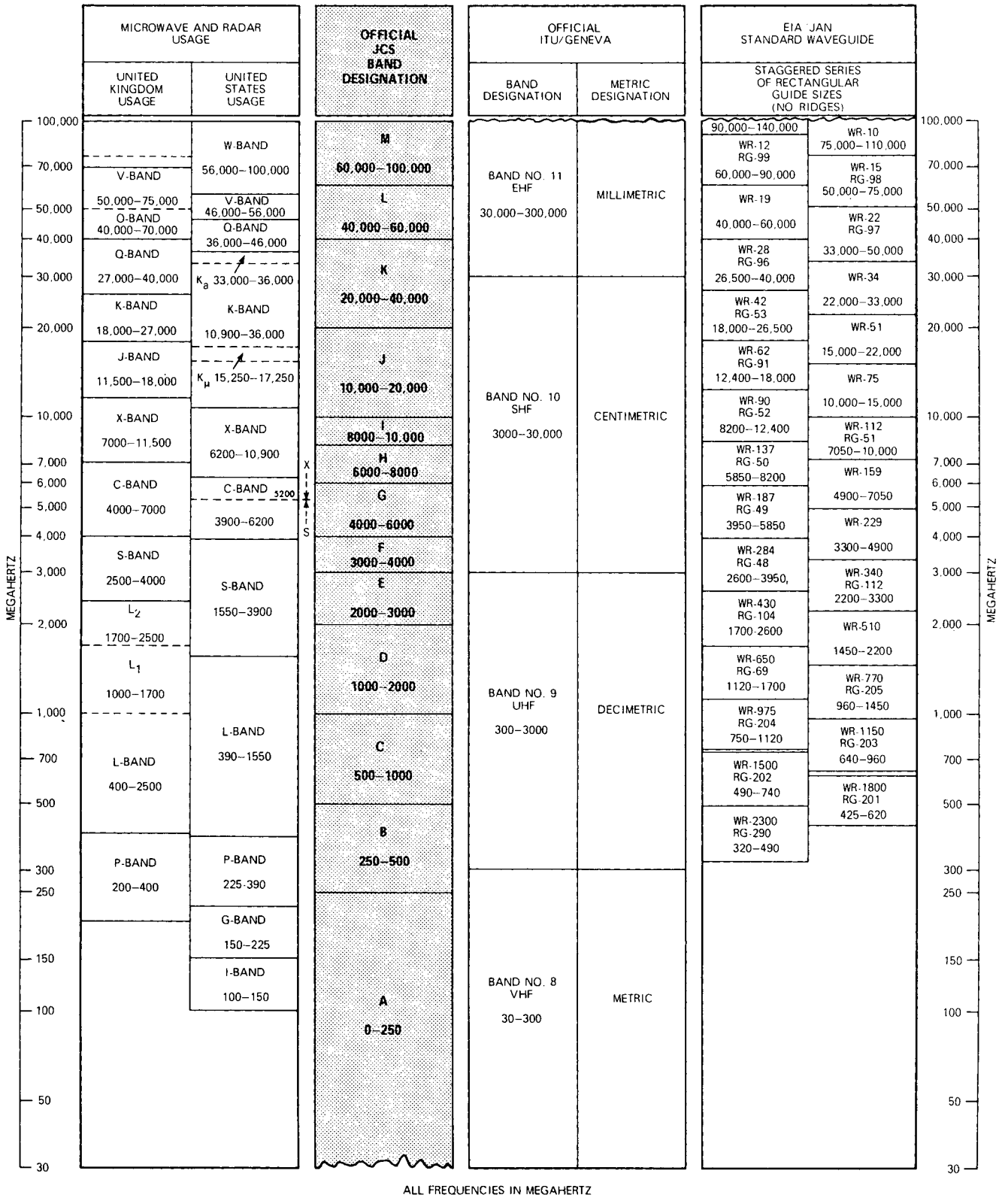

Figure 1. UK, US, ITU & JCS LETTER DESIGNATIONS FOR MICROWAVE BANDS