

1031.1.a.9. con't.

- b. A typical "basic gate propagation delay time" of less than 0.1 ns; **or**
 - c. An operating frequency exceeding 3 GHz;
10. Digital integrated circuits, other than those described in 1031.1.a.3. to 1031.1.a.9. or 1031.1.a.11., based upon any compound semiconductor and having any of the following:
- a. An equivalent gate count of more than 3000 (2 input gates); **or**
 - b. A toggle frequency exceeding 1.2 GHz;
11. Fast Fourier Transform (FFT) processors having a rated execution time for an N-point complex FFT of less than $(N \log_2 N)/20,480$ ms, where N is the number of points;

Technical Note

When N is equal to 1,024 points, the formula in 1031.1.a.11. gives an execution time of 500 μ s.

1. b. Microwave or millimetre wave components, as follows:

1. Electronic vacuum tubes and cathodes, as follows:

Note 1:

1031.1.b.1. does not control tubes designed or rated for operation in any frequency band which meets all of the following characteristics:

- a. Does not exceed 31 GHz; **and**
- b. Is "allocated by the ITU" for radio-communications services, but not for radio-determination.

Note 2

1031.1.b.1. does not control non-"space-qualified" tubes which meet all of the following characteristics:

- a. An average output power equal to or less than 50 W; **and**
- b. Designed or rated for operation in any frequency band which meets all of the following characteristics:
 - 1. Exceeds 31 GHz but does not exceed 43.5 GHz; **and**
 - 2. Is "allocated by the ITU" for radio-communications services, but not for radio-determination;

a) Travelling wave tubes, pulsed or continuous wave, as follows:

- 1. Operating at frequencies higher than 31 GHz;
- 2. Having a cathode heater element with a turn on time to rated RF power of less than 3 seconds;
- 3. Coupled cavity tubes, or derivatives thereof, with a "fractional bandwidth" of more than 7% or a peak power exceeding 2.5 kW;
- 4. Helix tubes, or derivatives thereof, with any of the following characteristics:
 - a. An "instantaneous bandwidth" of more than one octave, and average power (expressed in kW) times frequency (expressed in GHz) of more than 0.5;
 - b. An "instantaneous bandwidth" of one octave or less, and average power (expressed in kW) times frequency (expressed in GHz) of more than 1; **or**
 - c. Being "space qualified";

b. Crossed-field amplifier tubes with a gain of more than 17 dB;

c. Impregnated cathodes designed for electronic tubes producing a continuous emission current density at rated operating conditions exceeding 5 A/cm²;

2. Microwave integrated circuits or modules having all of the following:

- a. Containing "monolithic integrated circuits" having one or more active circuit elements; **and**

b. Operating at frequencies exceeding 3 GHz;

Note 1:

1031.1.b.2. does not control circuits or modules for equipment designed or rated for operation in any frequency band which meets all of the following characteristics:

- a. Does not exceed 31 GHz; **and**
- b. Is "allocated by the ITU" for radio-communications services, but not for radio-determination.

Note 2:

1031.b.2. does not control broadcast satellite equipment designed or rated to operate in the frequency range of 40.5 to 42.5 GHz.

3. Microwave transistors rated for operation at frequencies exceeding 31 GHz;

4. Microwave solid state amplifiers, having any of the following:

- a. Operating frequencies exceeding 10.5 GHz and an "instantaneous bandwidth" of more than half an octave; **or**
- b. Operating frequencies exceeding 31 GHz;

5. Electronically or magnetically tunable band-pass or band-stop filters having more than 5 tunable resonators capable of tuning across a 1.5:1 frequency band (f_{max}/f_{min}) in less than 10 μ s having any of the following:

- a. A band-pass bandwidth of more than 0.5% of centre frequency; **or**
- b. A band-stop bandwidth of less than 0.5% of centre frequency;

6. Microwave assemblies capable of operating at frequencies exceeding 31 GHz;

7. Mixers and converters designed to extend the frequency range of equipment described in 1031.2.c., 1031.2.e. or 1031.2.f. beyond the limits stated therein;

8. Microwave power amplifiers containing tubes controlled by 1031.1.b. and having all of the following:

- a. Operating frequencies above 3 GHz;
- b. An average output power density exceeding 80 W/kg; **and**
- c. A volume of less than 400 cm³;

Note:

1031.1.b.8. does not control equipment designed or rated for operation in any frequency band which is "allocated by the ITU" for radio-communications services, but not for radio-determination.

1. c. Acoustic wave devices, as follows, and specially designed components therefore:

1. Surface acoustic wave and surface skimming (shallow bulk) acoustic wave devices (i.e., "signal processing" devices employing elastic waves in materials), having any of the following:

- a. A carrier frequency exceeding 2.5 GHz;
- b. A carrier frequency exceeding 1 GHz but not exceeding 2.5 GHz, and having any of the following:
 - 1. A frequency side-lobe rejection exceeding 55 dB;
 - 2. A product of the maximum delay time and the bandwidth (time in μ s and bandwidth in MHz) of more than 100;
 - 3. A bandwidth greater than 250 MHz; **or**
 - 4. A dispersive delay of more than 10 μ s; **or**

c) A carrier frequency 1 GHz or less, having any of the following:

- 1. A product of the maximum delay time and the bandwidth (time in μ s and bandwidth in MHz) of more than 100;