ITU Resolution 418 Impact to Operations in 5091-5150 MHz

Annex 1[1]

1. limit transmissions to those from aircraft stations only (see No. 1.83); the operation of aeronautical telemetry systems within the frequency band 5091-5150 MHz shall be coordinated with administrations operating microwave landing systems (MLS) and whose territory is located within a distance D of the AMT flight area, where D is determined by the following equation:
    a. $D = 43 + 10^{(127.55 - 20\log(f) + E)/20}$
    b. where:
        i. D : separation distance (km) triggering the coordination
        ii. f : minimum frequency (MHz) used by the AMT system
        iii. E : peak equivalent isotropically radiated power density (dBW in 150 kHz) of the aircraft transmitter
    c. Results is 371 km
2. For the protection of the fixed-satellite service (FSS), a telemetry aircraft station in the frequency band 5 091-5 250 MHz shall be operated in such a manner that one aircraft station transmitter power flux-density be limited to −198.9 dB(W/(m2 · Hz)) at the FSS satellite orbit for spacecraft using Earth coverage receive antennas. Such pfd limit per aircraft transmitter has been derived under the assumptions that the FSS satellite orbit is at 1 414 km altitude and that a total of 21 co-frequency AMT transmitters operate concurrently within the field of view of the FSS satellite. In case of fewer than 21 AMT co-frequency transmitters operating simultaneously in view of the satellite, the transmitter power can be adjusted so as not to exceed an aggregate pfd at the satellite of −185.7 dB(W/(m2 · Hz)), which corresponds to a 'Tsatellite/Tsatellite of 1%.
    a. FSS satellite orbit is at 1 414 km altitude
    b. One aircraft station transmitter power flux-density be limited to −198.9 dB(W/(m2 · Hz)) at the FSS satellite orbit
    c. Calculations show with even the aircraft antenna pointing at the satellite that the pfd is -188.8 dB(W/(m2 · Hz)) – meet 418 spec.

[1] http://www.ellipsis.co.za/wp-content/uploads/2015/07/Final-Acts-WRC-15.pdf

3. For the protection of the aeronautical mobile (R) service (AM(R)S) in the frequency band 5 091-5 150 MHz, the maximum pfd produced at the surface of the Earth, where AM(R)S may be deployed in accordance with No. 5.444B, by emissions from an aircraft station of an aeronautical mobile service system, limited to transmissions of telemetry for flight testing, shall not exceed: −89.4 dB(W/(m2 20 MHz)) − $G_r(\theta)$.
    a. $G_r(\theta)$ represents the mobile service receiver antenna gain versus elevation angle θ and is defined as follows:
    b. $G_r(\theta) = \max[G_1(\theta)\ , G_2(\theta)]$

$$G_1(\theta) = 6 - 12\left(\frac{\theta}{27}\right)^2$$

$$G_2(\theta) = -6 + 10\log\left[\left(\max\left\{\frac{|\theta|}{27}, .1\right\}\right)^{-1.5} + 0.7\right]$$

    c. where:
        i. G(θ) : gain relative to an isotropic antenna (dBi)
        ii. (θ) : absolute value of the elevation angle relative to the angle of maximum gain (degrees).
    d. Calculated threshold at 20,000 feet altitude and 70 km range (edge of 100 km radius) is -95 dB(W/(m2 20 MHz)); the calculated power flux density is -89.72 dB(W/(m2 20 MHz)). Thus the current license does not meet Resolution 418.
    e. Resolution 418 can be met by either longer standoff from Phoenix Airport (assumption is that is the location of the only AM(R)S system or different altitude.
        i. 140 km at 10 k-ft altitude meets criteria
        ii. 130 km at 20 k-ft altitude meets criteria
        iii. Use table on next page as guide.

Altitude (ft)	Range from Phoenix Airport										
	70	80	90	100	110	120	130	140	150	160	170
10000	-83.8	-85.0	-86.0	-86.9	-87.7	-88.4	-89.1	-89.8	-90.4	-90.9	-91.4
15000	-84.0	-85.1	-86.0	-86.9	-87.7	-88.5	-89.2	-89.8	-90.4	-90.9	-91.5
20000	-84.1	-85.2	-86.2	-87.0	-87.8	-88.5	-89.2	-89.8	-90.4	-91.0	-91.5
25000	-84.4	-85.4	-86.3	-87.1	-87.9	-88.6	-89.3	-89.9	-90.5	-91.0	-91.5
30000	-84.6	-85.6	-86.5	-87.3	-88.0	-88.7	-89.4	-90.0	-90.5	-91.1	-91.6
35000	-84.9	-85.8	-86.6	-87.4	-88.1	-88.8	-89.5	-90.1	-90.6	-91.1	-91.6
40000	-85.3	-86.1	-86.9	-87.6	-88.3	-89.0	-89.6	-90.1	-90.7	-91.2	-91.7
45000	-85.7	-86.4	-87.1	-87.8	-88.5	-89.1	-89.7	-90.3	-90.8	-91.3	-91.8
50000	-86.2	-86.8	-87.4	-88.0	-88.7	-89.3	-89.8	-90.4	-90.9	-91.4	-91.9
55000	-86.7	-87.2	-87.7	-88.3	-88.9	-89.4	-90.0	-90.5	-91.0	-91.5	-91.9
60000	-87.2	-87.6	-88.1	-88.6	-89.1	-89.6	-90.1	-90.6	-91.1	-91.6	-92.0
65000	-87.8	-88.0	-88.4	-88.9	-89.3	-89.8	-90.3	-90.8	-91.3	-91.7	-92.1
70000	-88.4	-88.5	-88.8	-89.2	-89.6	-90.1	-90.5	-91.0	-91.4	-91.8	-92.3
75000	-89.0	-89.0	-89.2	-89.5	-89.9	-90.3	-90.7	-91.1	-91.6	-92.0	-92.4