RECOMMENDATION ITU-R SA.1028-1

PERFORMANCE CRITERIA FOR SATELLITE PASSIVE REMOTE SENSING

(Question ITU-R 140/7)

(1994-1997)

The ITU Radiocommunication Assembly,

considering

a)   that certain frequency bands, including some absorption bands of atmospheric gases (O_2 and H_2O), have been allocated for spaceborne passive microwave remote sensing;

b)   that some of these bands are also allocated to other radio services;

c)   that performance criteria are a necessary prerequisite to the establishment of interference and sharing criteria;

d)   that surface brightness temperature, the atmospheric temperature at points along a path, and absorption coefficients can be determined from measurements of the sensor antenna temperature, T_A;

e)   that the surface brightness temperature and the absorption coefficients, in turn, depend upon the physical properties of the surface or atmosphere that are to be sensed;

f)   that studies have established measurement sensitivity requirements;

g)   that studies have established that measurements in absorption bands are extremely vulnerable to interference because, in general, there is no possibility to detect and to reject data that are contaminated by interference, and because propagation of undetected contaminated data into numerical weather prediction (NWP) models may have a destructive impact on the reliability/quality of weather forecasting;

h)   that passive microwave remote sensing is performed in absorption bands to obtain important three-dimensional atmospheric data that are used in particular to initialize NWP models;

j)   that performance requirements for passive sensors can be stated in terms of measurement sensitivity, ΔT_e, and availability, measured at the satellite, assuming that degradation from other elements in the system will be small;

k)   that three-dimensional measurements of atmospheric temperature or gas concentration are performed in the absorption bands including those in the range 50.2-61.3 GHz and bands near 118 GHz and 183 GHz,

recommends

1   that the measurement sensitivities suitable for passive sensing of the Earth's land, oceans and atmosphere are as in Table 1;

2   that in shared frequency bands (except absorption bands), availability of passive sensor data as enumerated above shall exceed 95% from all locations in the sensor service area in the case where the loss occurs randomly, and shall exceed 99% from all locations in the case where the loss occurs systematically at the same locations;

3   that the availability of passive sensor data shall be 99.99% from all locations in the sensor service area for three-dimensional measurements of atmospheric temperature or gas concentration, as noted in § k).

TABLE 1

Frequency (GHz)	Necessary bandwidth (MHz)	Measurements	Required ΔT_e (K)
Near 1.4	100	Soil moisture, salinity, sea temperature, vegetation index	0.1
Near 2.7	60	Salinity, soil moisture	0.1
Near 4	200	Ocean surface temperature	0.3
Near 6	400	Ocean surface temperature	0.3
Near 11	100	Rain, snow, ice, sea state, ocean wind	1.0
Near 15	200	Water vapour, rain	0.2
Near 18	200	Rain, sea state, ocean ice, water vapour	1.0
Near 21	200	Water vapour, liquid water	0.2
22.235	300	Water vapour, liquid water	0.4
Near 24	400	Water vapour, liquid water	0.2
Near 31	500	Ocean ice, water vapour, oil spills, clouds, liquid water	0.2
Near 37	1 000	Rain, snow, ocean ice, water vapour	1.0
50.2-50.4	200	Temperature profiling	0.3/0.1[1]
52.6-59.0	6 400[2]	Temperature profiling	0.3/0.1[1]
60.3-61.3	1 000[2]	Temperature profiling (upper atmosphere)	0.3/0.1[1]
Near 90	6 000	Clouds, oil spills, ice, snow	1.0
100.49	2 000	Nitrous oxide	0.2
110.80	2 000	Ozone	0.2
115-122	7 000[2]	Temperature, carbon monoxide	0.2
125.61	2 000	Nitrous oxide	0.2
150.74	2 000	Nitrous oxide	0.2
155.5-158.5	3 000	Earth and cloud parameters	0.2
164-168	4 000	Cloud water and ice, rain	0.2
167.20	2 000	Chlorine oxide	0.2
175-192	17 000[2]	Water vapour, nitrous oxide, ozone	0.2
200.98	2 000	Nitrous oxide	0.2
217-231	2 000	Clouds, humidity, nitrous oxide	0.2
230.54	2 000	Carbon monoxide	0.2
235.71	2 000	Ozone	0.2
237.15	2 000	Ozone	0.2
251.21	2 000	Nitrous oxide	0.2
276.33	2 000	Nitrous oxide	0.2
301.44	2 000	Nitrous oxide	0.2
325.10	2 000	Water vapor	0.2
345.80	2 000	Carbon monoxide	0.2
364.32	2 000	Ozone	0.2
380.20	2 000	Water vapour	0.2

[1]   Second number for pushbroom sensors.

[2]   This bandwidth is occupied by multiple channels.