9. MAXIMUM PERMISSIBLE EXPOSURE

FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f²)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f²)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density
NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

EQUATIONS

Power density is given by:

$$S = EIRP / (4 * Pi * D\text{^}2)$$

where
S = Power density in mW/cm^2
EIRP = Equivalent Isotropic Radiated Power in mW
D = Separation distance in cm

Distance is given by:

$$D = SQRT (EIRP / (4 * Pi * S))$$

where
D = Separation distance in cm
EIRP = Equivalent Isotropic Radiated Power in mW
S = Power density in mW/cm^2

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

LIMITS

From FCC §1.1310 Table 1 (B), the maximum value of S = f/1500 mW/cm^2, where f is the operating frequency in MHz.

MEASUREMENT NOTES

The conducted output power was measured with the device operating at the only source-based TDD duty cycle, therefore no duty cycle correction is applied to the RF Exposure calculations.

RESULTS FOR FIXED OPERATION

In accordance with §15.709 (d), the minimum separation distance for a Fixed TVBD is 40 cm.

RF Exposure for Maximum Output Power, antenna gain <= 8 dBi

Frequency (MHz)	Mode	Separation Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm^2)	FCC Limit (mW/cm^2)
473.0	QPSK	40	26.40	8.00	0.14	0.315
581.0	QPSK	40	27.10	8.00	0.16	0.387
695.0	QPSK	40	27.00	8.00	0.16	0.463
473.0	16QAM	40	26.40	8.00	0.14	0.315
581.0	16QAM	40	27.00	8.00	0.16	0.387
695.0	16QAM	40	27.00	8.00	0.16	0.463
473.0	64QAM	40	26.80	8.00	0.15	0.315
581.0	64QAM	40	27.70	8.00	0.18	0.387
695.0	64QAM	40	27.30	8.00	0.17	0.463

RESULTS FOR PERSONAL OPERATION

The source-based time-averaged output for configuration as a Personal TVBD can be greater than 20 mW therefore the device is subject to routine RF exposure evaluation.

RF Exposure for Reduced Output Power, antenna gain <= 6 dBi
(Conducted output power is reduced to meet the Personal Device PSD and EIRP limits)

Frequency (MHz)	Mode	Separation Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm^2)	FCC Limit (mW/cm^2)
473.0	QPSK	20	14.00	6.00	0.02	0.315
581.0	QPSK	20	14.00	6.00	0.02	0.387
695.0	QPSK	20	14.00	6.00	0.02	0.463
473.0	16QAM	20	14.00	6.00	0.02	0.315
581.0	16QAM	20	14.00	6.00	0.02	0.387
695.0	16QAM	20	14.00	6.00	0.02	0.463
473.0	64QAM	20	14.00	6.00	0.02	0.315
581.0	64QAM	20	14.00	6.00	0.02	0.387
695.0	64QAM	20	14.00	6.00	0.02	0.463

RF Exposure for Reduced Output Power, antenna gain <= 2 dBi
(Conducted output power is reduced to meet the Personal Device PSD and EIRP limits)

Frequency (MHz)	Mode	Separation Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm^2)	FCC Limit (mW/cm^2)
473.0	QPSK	20	16.40	2.00	0.01	0.315
581.0	QPSK	20	17.10	2.00	0.02	0.387
695.0	QPSK	20	17.00	2.00	0.02	0.463
473.0	16QAM	20	16.40	2.00	0.01	0.315
581.0	16QAM	20	17.00	2.00	0.02	0.387
695.0	16QAM	20	17.00	2.00	0.02	0.463
473.0	64QAM	20	16.80	2.00	0.02	0.315
581.0	64QAM	20	17.70	2.00	0.02	0.387
695.0	64QAM	20	17.30	2.00	0.02	0.463