8. Radio Frequency Exposure

8.1. Applicable Standards

$ \begin{array}{c} \S 1.1307(b)(3)(i)(A) & \text{regardless of separation distance.} \\ & \text{ERP is below a threshold calculated based on the distance }, \ R \ \text{between the person antenna / radiating structure, where R > λ / 2 π.} \\ & \begin{array}{c} \text{TABLE B.1-THRESHOLDS FOR SINGLE RF SOURCES} \\ \text{SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION} \\ \hline \textbf{RF Source} & \textbf{Minimum Distance} \\ \hline \textbf{Frequency} & \textbf{Minimum Distance} \\ \hline \textbf{S1.1307(b)(3)(i)(c)} & \textbf{MHz} & \textbf{MHz}$		The available n	The available maximum time-averaged power is no more than 1 mW,							
antenna / radiating structure, where R > λ /2 π . TABLE B.1—THRESHOLDS FOR SINGLE RF SOURCES SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION RF Source Minimum Distance Threshold ERP fr. MHz fil $\lambda_L/2\pi$ $\lambda_H/2\pi$ W 0.3 - 1.34 159 m - 35.6 m 1.920 R² 1.34 - 30 35.6 m - 1.6 m 3,450 R²/2 3.0 - 300 1.6 m 159 mm 3.83 R² 300 - 1,500 159 mm - 31.8 mm 0.0128 R²f 1,500 - 100,00 31.8 mm - 0.5 mm 19.2R² Subscripts L and H are low and high; λ is wavelength. From § 1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns. Device operates between 300 MHz and 6 GHz and the maximum time-averaged power or effective radiated power (ERP), whichever is greater, <= Pth $P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$ Where	§1.1307(b)(3)(i)(A)	regardless of separation distance.								
$ \begin{array}{ c c c c }\hline \S 1.1307(b)(3)(i)(c) & \hline Frequency & FRP \\\hline f_LMHz & f_H & \lambda_L/2\pi & \lambda_H/2\pi & W \\\hline 0.3 & -1.34 & 159\mathrm{m} & 35.6\mathrm{m} & 1.920\mathrm{R}^2 \\\hline 1.34 & -30 & 35.6\mathrm{m} & -1.6\mathrm{m} & 3,450\mathrm{R}^2/f^2 \\\hline 30 & -300 & 1.6\mathrm{m} & -159\mathrm{mm} & 3.83\mathrm{R}^2 \\\hline 300 & -1.590 & 159\mathrm{mm} & -31.8\mathrm{mm} & 0.0128\mathrm{R}^2/f \\\hline 1,500 & -100,000 & 31.8\mathrm{mm} & -0.5\mathrm{mm} & 19.2\mathrm{R}^2 \\\hline Subscripts L and H are low and high; \lambda is wavelength. From \S 1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns. \\\hline \\ Device operates between 300 MHz and 6 GHz and the maximum time-averaged power or effective radiated power (ERP), whichever is greater, <= Pth \\\hline \\ P_{th}(\mathrm{mW}) = \begin{cases} ERP_{20cm}(d/20\mathrm{cm})^x & d \leq 20\mathrm{cm} \\ ERP_{20cm} & 20\mathrm{cm} < d \leq 40\mathrm{cm} \end{cases} \\ \\ \Psi_{th}(\mathrm{mW}) = \begin{cases} ERP_{20cm}(d/20\mathrm{cm})^x & d \leq 20\mathrm{cm} \\ ERP_{20cm} & 20\mathrm{cm} < d \leq 40\mathrm{cm} \end{cases} \\ \\ \Psi_{th}(\mathrm{mW}) = \begin{cases} ERP_{20cm}(d/20\mathrm{cm})^x & d \leq 20\mathrm{cm} \\ ERP_{20cm} & 20\mathrm{cm} < d \leq 40\mathrm{cm} \end{cases} \\ \\ \Psi_{th}(\mathrm{mW}) = \begin{cases} ERP_{20cm}(d/20\mathrm{cm})^x & d \leq 20\mathrm{cm} \\ ERP_{20cm} & 20\mathrm{cm} < d \leq 40\mathrm{cm} \end{cases} \\ \\ \Psi_{th}(\mathrm{mW}) = \begin{cases} ERP_{20cm}(d/20\mathrm{cm})^x & d \leq 20\mathrm{cm} \\ ERP_{20cm} & 20\mathrm{cm} < d \leq 40\mathrm{cm} \end{cases} \\ \\ \Psi_{th}(\mathrm{mW}) = \begin{cases} ERP_{20cm}(d/20\mathrm{cm})^x & d \leq 20\mathrm{cm} \\ ERP_{20cm} & 20\mathrm{cm} < d \leq 40\mathrm{cm} \end{cases} \\ \\ \Psi_{th}(\mathrm{mW}) = \begin{cases} ERP_{20cm}(d/20\mathrm{cm})^x & d \leq 20\mathrm{cm} \\ ERP_{20cm} & 20\mathrm{cm} < d \leq 40\mathrm{cm} \end{cases} \\ \\ \Psi_{th}(\mathrm{mW}) = \begin{cases} ERP_{20cm}(d/20\mathrm{cm})^x & d \leq 20\mathrm{cm} \\ ERP_{20cm} & 20\mathrm{cm} < d \leq 40\mathrm{cm} \end{cases} \\ \\ \Psi_{th}(\mathrm{mW}) = \begin{cases} ERP_{20cm}(d/20\mathrm{cm})^x & d \leq 20\mathrm{cm} \\ ERP_{20cm}(d/20\mathrm{cm})^x & d \leq 20\mathrm{cm} \end{cases} \\ \\ \Psi_{th}(\mathrm{mW}) = \begin{cases} ERP_{20cm}(d/20\mathrm{cm})^x & d \leq 20\mathrm{cm} \\ ERP_{20cm}(d/20\mathrm{cm})^x & d \leq 20\mathrm{cm} \end{cases} \\ \\ \Psi_{th}(\mathrm{mW}) = \begin{cases} ERP_{20cm}(d/20\mathrm{cm})^x & d \leq 20\mathrm{cm} \\ ERP_{20cm}(d/20\mathrm{cm})^x & d \leq 20\mathrm{cm} \end{cases} \\ \\ \Psi_{th}(\mathrm{mW}) = \begin{cases} ERP_{20cm}(d/20\mathrm{cm})^x & d \leq 20\mathrm{cm} \\ ERP_{20cm}(d/20\mathrm{cm})^x & d \leq 20\mathrm{cm} \end{cases} \\ \\ \Psi_{th}(\mathrm{mW}) = \begin{cases} ERP_{20cm}(d/20\mathrm{cm})^x & d \leq 20\mathrm{cm} \\ ERP_{20cm}(d/20\mathrm{cm})^x & d \leq 20c$		ERP is below a threshold calculated based on the distance , R between the person antenna / radiating structure, where R > λ / 2 π . TABLE B.1—THRESHOLDS FOR SINGLE RF SOURCES								
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$				ıcy	f	2 /2 1 2 /2			ERP	
$\frac{0.3 - 1.34 + 159 \text{ m} - 35.6 \text{ m}}{1,344 - 30} + \frac{35.6 \text{ m}}{3,450 \text{ R}^2/f^2}$ $\frac{30 - 300 + 1.6 \text{ m}}{3,450 \text{ m}} + \frac{35.6 \text{ m}}{3,450 \text{ R}^2/f^2}$ $\frac{30 - 300 + 1.59 \text{ mm}}{3,500 + 1.59 \text{ mm}} + \frac{31.8 \text{ mm}}{3,18 \text{ mm}} + \frac{31.8 \text{ mm}}{0.0128 \text{ R}^2 f}$ $\frac{1,500 - 100,00}{0} + \frac{31.8 \text{ mm}}{0} + \frac{0.5 \text{ mm}}{19.2 \text{ R}^2}$ Subscripts L and H are low and high; λ is wavelength. From § 1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns. Device operates between 300 MHz and 6 GHz and the maximum time-averaged power or effective radiated power (ERP), whichever is greater, <= Pth $P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \end{cases}$ Where $x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}}\right) \text{ and } f \text{ is in GHz};$ and	□		JL WIFIZ			ΛL / Zπ		Λ _H / Δλ	W	
$\frac{30 - 300}{300 - 1,500} \frac{1.6 \text{ m}}{159 \text{ mm}} = \frac{3.83 \text{ R}^2}{31.8 \text{ mm}} = \frac{3.00128 \text{ R}^2 f}{1,500 - 100,00} \frac{1.59 \text{ mm}}{10,000} = \frac{31.8 \text{ mm}}{19.2 \text{ R}^2} = \frac{1.307 \text{ (b)}(3)(i)(C), \text{ modified by adding Minimum Distance columns.}}{19.2 \text{ R}^2}$ Device operates between 300 MHz and 6 GHz and the maximum time-averaged power or effective radiated power (ERP), whichever is greater, <= Pth $P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$ Where $x = -\log_{10}\left(\frac{60}{ERP_{20 \text{ cm}}\sqrt{f}}\right) \text{ and } f \text{ is in GHz};$ and	§1.1307(b)(3)(1)(c)		0.3	-		159 m	_	35.6 m	1,920 R ²	
$\frac{300 - 1,500}{1,500} = \frac{159 \text{ mm}}{10,000} = \frac{31.8 \text{ mm}}{19.2 \text{R}^2} = \frac{0.0128 \text{ R}^2 f}{1,500} = \frac{100,00}{0} = \frac{31.8 \text{ mm}}{19.2 \text{R}^2} = \frac{10.2 \text{ R}^2}{19.2 \text{ R}^2}$ Subscripts L and H are low and high; λ is wavelength. From $\S 1.1307(\text{b})(3)(\text{i})(\text{C})$, modified by adding Minimum Distance columns. Device operates between 300 MHz and 6 GHz and the maximum time-averaged power or effective radiated power (ERP), whichever is greater, <= Pth $P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \end{cases}$ Where $x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz};$ and				_			_			
$\frac{1,500 - 100,00}{0} \frac{31.8 \text{ mm} - 0.5 \text{ mm}}{19.2 \text{R}^2}$ Subscripts L and H are low and high; λ is wavelength. From $\S 1.1307(b)(3)(i)(C)$, modified by adding Minimum Distance columns. Device operates between 300 MHz and 6 GHz and the maximum time-averaged power or effective radiated power (ERP), whichever is greater, <= Pth $P_{th} \text{ (mW)} = \begin{cases} ERP_{20\ cm}(d/20\ \text{cm})^x & d \leq 20\ \text{cm} \\ ERP_{20\ cm} & 20\ \text{cm} < d \leq 40\ \text{cm} \end{cases}$ Where $x = -\log_{10}\left(\frac{60}{ERP_{20\ cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz};$ and				_			_			
Subscripts L and H are low and high; λ is wavelength. From § 1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns. Device operates between 300 MHz and 6 GHz and the maximum time-averaged power or effective radiated power (ERP), whichever is greater, <= Pth $P_{th} \text{ (mW)} = \begin{cases} ERP_{20\ cm} (d/20\ cm)^x & d \leq 20\ cm \\ ERP_{20\ cm} & 20\ cm < d \leq 40\ cm \end{cases}$ Where $x = -\log_{10}\left(\frac{60}{ERP_{20\ cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz};$ and				_			_		$0.0128 \text{ R}^2 f$	
From § 1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns. Device operates between 300 MHz and 6 GHz and the maximum time-averaged power or effective radiated power (ERP), whichever is greater, <= Pth $P_{th} \text{ (mW)} = \begin{cases} ERP_{20\ cm} (d/20\ cm)^x & d \leq 20\ cm \\ ERP_{20\ cm} & 20\ cm < d \leq 40\ cm \end{cases}$ Where $x = -\log_{10}\left(\frac{60}{ERP_{20\ cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz};$ and			1,500	_		31.8 mm	_	0.5 mm	19.2R ²	
power or effective radiated power (ERP), whichever is greater, <= Pth $P_{th} \text{ (mW)} = \begin{cases} ERP_{20} cm (d/20 \text{cm})^x & d \leq 20 \text{cm} \\ ERP_{20} cm & 20 \text{cm} < d \leq 40 \text{cm} \end{cases}$ Where $x = -\log_{10} \left(\frac{60}{ERP_{20} cm \sqrt{f}} \right) \text{ and } f \text{ is in GHz};$ and		From § 1.1307(b)(3)(i)(C), modified by adding Minimum Distance								
$P_{th} \; (\text{mW}) = \begin{cases} ERP_{20\;cm} (d/20\;\text{cm})^x & d \leq 20\;\text{cm} \\ ERP_{20\;cm} & 20\;\text{cm} < d \leq 40\;\text{cm} \end{cases}$ Where $x = -\log_{10} \left(\frac{60}{ERP_{20\;cm}\sqrt{f}}\right) \; \text{and} \; f \; \text{is in GHz};$ and		Device operates	between	300	MHz ar	nd 6 GHz a	and	the maxim	num time-average	ed
		power or effective radiated power (ERP), whichever is greater, <= Pth								
		$(ERP_{20},, (d/20 \text{ cm})^x d \le 20 \text{ cm}$								
		$P_{th} (\text{mW}) = \begin{cases} P_{th} (\text{mW}) & \text{so } t \leq 40 \text{ cm} \end{cases}$								
§ 1.1307(b)(3)(i)(B). $ x = -\log_{10}\left(\frac{60}{ERP_{20~cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz}; $ and						20 cm		20 011	~ a 2 TO GIII	
and	\[\tag{1.1307(b)(3)(i)(B).}	Where								
		$x = -\log_{10}\left(\frac{60}{ERP_{20\ cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz};$								
$ERP_{20\ cm}\ (\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases}$		and								
					ERP_{20}	_{cm} (mW) =	204 306	0.3 GH	$z \le f < 1.5 \text{GHz}$ $z \le f \le 6 \text{GHz}$	
d = the separation distance (cm);		d = the separation distance (cm):								

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EUT Specification 8.1.

Frequency band (Operating)	13.553MHz~13.567MHz			
Device category	☐ Portable (<20cm separation)☑ Mobile (>20cm separation)			
Antenna diversity	 Single antenna Multiple antennas ☐ Tx diversity ☐ Rx diversity ☐ Tx/Rx diversity 			
Evaluation applied	☑ Blanket 1 mW Blanket Exemption☐ MPE-based Exemption☐ SAR-based Exemption			
Remark: 1.The maximum conductantenna gain.)	cted output power is <u>51.88(dBuV/m) at 13.56 MHz</u> at (with <u>0 dBi</u>			

8.2. Result

Channel	Fundamental	Antenna	Conducted	Max. Tune up	Fundamental	Limit
Frequency	Emission	Gain	Power	power	Emission	
(MHz)	(dBm)	(dBi)	(dBm)	(dBm)	(mW)	(mW)
13.56	-43.35	0.00	-43.35	-42.85	0.0000519	1

Antenna Gain (dBi) (linear)	Antonno Coin	Dieterres	Fundamental	Fundamental	Fundamental	Fundamental
		Emission	Emission	Emission	Emission	
	(linear)	(m)	(dBuV/m)	(V/m)	(W)	(dBm)
0	1	3	51.88	0.000393	0.0000000463	-43.35

No non-compliance noted.

-----THE END OF REPORT-----

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