RADIO FREQUENCY EXPOSURE EVALATION

Evaluation Method

KDB 447498 D04 Interim General RF Exposure Guidance v01

Applicable Standard:

FCC CFR 47 §1.1307(b)(3):Determination of exemption.

(i)A single RF source is exempt if:

(A): The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);

(B): or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by:

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20\,cm}(d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20\,cm} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\,cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20\,cm} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

d = the separation distance (cm);

(C): Or using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

Table 1 to § 1.1307(b)(3)(i)(C)—Single RF Sources Subject to Routine Environmental Evaluation

RF Source frequency (MHz)	Threshold ERP (watts)
0.3–1.34	1,920 R^2.
1.34–30	3,450 R^2/f^2.
30–300	3.83 R^2.
300–1,500	0.0128 R^2f.
1,500–100,000	19.2R^2.

FCC CFR 47 §1.1307(b)(3)(ii)(B):

For multiple RF sources: Multiple RF sources are exempt if:

in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum_{i=1}^{a} \frac{P_i}{P_{th,i}} + \sum_{j=1}^{b} \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

According to KDB 412172 D01 Determining ERP and EIRP v01r01:

For Field Strength Approach(linear terms):

eirp = p_t x g_t = $(E \times d)^2/30$

where p_t = transmitter output power in watts, g_t = numeric gain of the transmitting antenna (unitless), E = electric field strength in V/m, d = measurement distance in meters (m).

Relationship Between ERP and EIRP:

ERP = EIRP – 2.15 dB.

RF Exposure evaluation:

Separated check:

Module	Mode	Max output power		Ant. Gain	Max E.R.P		P$_{th}$
		dBm	mW	dBi	dBm	mW	mW
WLT5283M	BLE	-7.439	0.18	3	-6.589	0.219	821
SKI.WB668BS.3	BREDR	10.199	10.469	3	11.049	12.732	821
	WIFI2.4G	20.71	117.85	3	21.56	143.219	821
	WIFI5G	20.15	103.528	3	21	125.893	821
ICT-M	BLE	10	10.00	3.26	11.11	12.912	821
	WIFI2.4G	20.5	112.20	3.26	21.61	144.877	821

Module	Mode	Measured value		d	E.I.R.P	P$_{th}$
		dBuV/m @3m	V/m @3m	m	mW	mW
GEM3NFC	NFC	64.68	0.0017	3	0.0008	1

Sum limit check:

Module	WLT5283M	SKI.WB668BS.3			ICT-M		GEM3NFC
Technology	BLE	BREDR	WIFI2.4	WIFI5	BLE	WIFI2.4	NFC
Result	0.219	12.732	143.219	125.893	12.912	144.877	0.0008
Limit	821	821	821	821	821	821	1
Ratio (Result/Limit)	0.0003	0.0155	0.1744	0.1533	0.0157	0.1765	0.0008
Sum	0.5365						

Note1: For this EUT, it is one fixed device, and the separation distance is <u>10 cm</u>.
Note2: The Sum = 0.5365 < 1, that meets the exemption of multiple transmit, the RF exposure evaluation is not required.
Note3: The "ICT-M" was one single modular which FCC ID is "2AC7Z-ESPS3WROOM1". And the "GEM3NFC" was also one single modular which FCC ID is "XRH-NPE109". The RF power were come from original RF report.

-END-