

## 1 Attachment Report Exposure of Humans to RF Fields

Rules and specifications:	IC RSS-Gen Issue 4, section 3.2
Guide:	IC RSS-102 Issue 5, section 2.5

Exposure of Humans to RF Fields	Applicable	Declared by applicant	Measured	Exemption
The antenna is				
<input type="checkbox"/> detachable				
<p>The conducted output power (CP in watts) is measured at the antenna connector:</p> <p style="text-align: center;"><math>CP = \dots\dots\dots \text{ W}</math></p> <p>The effective isotropic radiated power (EIRP in watts) is calculated using</p> <p><input type="checkbox"/> the numerical antenna gain: <math>G = \dots\dots\dots</math></p> <p style="text-align: center;"><math>EIRP = G \cdot CP \Rightarrow EIRP = \dots\dots\dots \text{ W}</math></p> <p><input type="checkbox"/> the field strength<sup>1</sup> in V/m: <math>FS = \dots\dots\dots \text{ V/m}</math></p> <p style="text-align: center;"><math>EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP = \dots\dots\dots \text{ W}</math></p> <p>with:</p> <p>Distance between the antennas in m: <math>D = \dots\dots\dots \text{ m}</math></p>			<input type="checkbox"/>	
<input checked="" type="checkbox"/> not detachable				
<p>A field strength measurement is used to determine the effective isotropic radiated power (EIRP in watts) given by<sup>1</sup>:</p> <p style="text-align: center;"><math>EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP = 1.3 \mu\text{W}</math></p> <p>with:</p> <p>Field strength in V/m: <math>FS = 2074.91 \mu\text{V/m}</math></p> <p>Distance between the two antennas in m: <math>D = 3 \text{ m}</math></p>			<input checked="" type="checkbox"/>	
Selection of output power				
<p>The output power TP is the higher of the conducted or effective isotropic radiated power (e.i.r.p.):</p> <p style="text-align: center;"><math>TP = 1.3 \mu\text{W}</math></p>				

<sup>1</sup> The conversion formula is valid only for properly matched antennas. In other cases the transmitter output power may have to be measured by a terminated measurement when applying the exemption clauses.  
If an open area test site is used for field strength measurement, the effect due to the metal ground reflecting plane should be subtracted from the maximum field strength value in order to reference it to free space, before calculating TP.

Exposure of Humans to RF Fields (continued)	Applicable	Declared by applicant	Measured	Exemption
Separation distance between the user and the transmitting device is				
<input type="checkbox"/> less than or equal to 20 cm	<input checked="" type="checkbox"/> greater than 20 cm	<input type="checkbox"/>		
Transmitting device is				
<input type="checkbox"/> in the vicinity of the human head	<input type="checkbox"/> body-worn	<input type="checkbox"/>		

SAR evaluation										
<p>SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in the table.</p> <p>For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in the table, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required.</p> <p>For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.</p>										
Frequency (MHz)	Exemption limits (mW) <sup>2</sup> at separation distance of									
	≤5 mm	10 mm	15 mm	20 mm	25 mm	30 mm	35 mm	40 mm	45 mm	≥50 mm
≤300 <sup>3</sup>	71	101	132	162	193	223	254	284	315	345
450	52	70	88	106	123	141	159	177	195	213
835	17	30	42	55	67	80	92	105	117	130
1900	7	10	18	34	60	99	153	225	316	431
2450	4	7	15	30	52	83	123	173	235	309
3500	2	6	16	32	55	86	124	170	225	290
5800	1	6	15	27	41	56	71	85	97	106
Carrier frequency:	$f$	= ..... MHz								
Distance:	$d$	= ..... mm								
Transmitter output power:	$TP$	= ..... mW								
Limit:	$TP_{limit}$	= ..... mW								
<input type="checkbox"/> SAR evaluation is documented in test report no. ....										

<sup>2</sup> The exemption limit in the table are based on measurements and simulations on half-wave dipole antennas at separation distances of 5 mm to 25 mm from a flat phantom, providing a SAR value of approximately 0.4 W/kg for 1 g of tissue. For low frequencies (300 MHz to 835 MHz), the exemption limits are derived from a linear fit. For high frequencies (1900 MHz and above), the exemption limits are derived from a third order polynomial fit.

<sup>3</sup> Transmitters operating between 3 kHz and 10 MHz, meeting the exemption from routine SAR evaluation, shall demonstrate compliance to the instantaneous limits in IC RSS-102, issue 5, section 4.

Exposure of Humans to RF Fields (continued)	Applicable	Declared by applicant	Measured	Exemption
RF exposure evaluation				
<p>RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:</p> <p><input checked="" type="checkbox"/> below 20 MHz<sup>4</sup> and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance).</p> <p><input type="checkbox"/> between 3 kHz and 10 MHz exposure limits apply as following:</p> <p><input type="checkbox"/> In a uncontrolled environment the basic restriction for the instantaneous internal electric field strength is equal to or less than <math>2.7 \cdot 10^{-4} f \text{ V/m}_{\text{rms}}</math> at any part of the body where <math>f</math> is in Hz. The instantaneous RF field strength is equal or less than <math>83 \text{ V/m}_{\text{rms}}</math> and equal or less than <math>90 \text{ A/m}_{\text{rms}}</math>.</p> <p><input type="checkbox"/> In a controlled environment the basic restriction for the instantaneous internal electric field strength is equal to or less than <math>1.35 \cdot 10^{-4} f \text{ V/m}_{\text{rms}}</math> at any part of the body where <math>f</math> is in Hz. The instantaneous RF field strength is equal or less than <math>170 \text{ V/m}_{\text{rms}}</math> and equal or less than <math>180 \text{ A/m}_{\text{rms}}</math>.</p> <p><input type="checkbox"/> at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than <math>4.49/f^{0.5} \text{ W}</math> (adjusted for tune-up tolerance, where <math>f</math> is in MHz).</p> <p><input type="checkbox"/> at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance).</p> <p><input type="checkbox"/> at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than <math>1.31 \cdot 10^{-2} f^{0.6834} \text{ W}</math> (adjusted for tune-up tolerance), where <math>f</math> is in MHz.</p> <p><input type="checkbox"/> at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).</p> <p>In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.</p>				
<p>Carrier frequency: <math>f = 13.56 \text{ MHz}</math></p> <p>Transmitter output power: <math>TP = 1.3 \mu\text{W}</math></p> <p>Limit: <math>TP_{\text{limit}} = 1000 \text{ mW}</math></p>				<input checked="" type="checkbox"/>
<input type="checkbox"/> RF exposure evaluation is documented in test report no. ....				

<sup>4</sup> Transmitters operating between 3 kHz and 10 MHz, meeting the exemption from routine RF Exposure evaluation, shall demonstrate compliance to the instantaneous limits in IC RSS-102, issue 5, section 4.