Maximum Allowed EIRP Density for Ku-Band Transmissions

1) \( EIRP = P_{\text{IN}} + G_{\text{TX}} \)  \( \Rightarrow \)  \( P_{\text{IN}} = EIRP - G_{\text{TX}} \)

CASE A
The cross polarisation discrimination of the transmit antenna at the -1 dB contour of the main lobe is \( > 35 \) dB

2) EESS 502 Specification for Transmit Gain (\( G_{\text{TX}} \), expressed in dBi, Para. 4.1 refers):

\[
\begin{align*}
29 - 25 \log \theta & \quad \alpha^{\circ} < \theta \leq 7^\circ \\
+8 & \quad 7^\circ < \theta \leq 9.2^\circ \\
32 - 25 \log \theta & \quad 9.2^\circ < \theta \leq 48^\circ \\
-10 & \quad 48^\circ < \theta 
\end{align*}
\]

Note: \( *\alpha = 1^\circ \) or \( 100\lambda/D \) whichever is the greater, where \( D \) is the antenna diameter and \( \lambda \) is the carrier wavelength

3) EESS 502 Specification for maximum off-axis EIRP density at the 0 dB/K satellite reference contour and in the direction of an adjacent satellite (EIRP0 density expressed in dBW/40 KHz, Para. 6.2 refers):

\[
\begin{align*}
31 - 25 \log \theta & \quad \alpha^{\circ} < \theta \leq 7^\circ \\
+10 & \quad 7^\circ < \theta \leq 9.2^\circ \\
34 - 25 \log \theta & \quad 9.2^\circ < \theta \leq 48^\circ \\
-8 & \quad 48^\circ < \theta 
\end{align*}
\]

4) Maximum Allowed Input Power Density to Antenna (for any antenna diameter)

\[
\text{Pin density} = (31 - 25 \log \theta) \text{dBW/40kHz} - (29 - 25 \log \theta) \text{dBi} = 2 \text{dBW/40kHz}
\]
5) **Example**

For an antenna with a gain of 49 dBi (corresponding approximately to a 2.4 m dish-size) the maximum allowed EIRP density at the 0 dB/K satellite reference contour (EIRP0 density) is:

\[
2 \text{ dBW/40 KHz} + 49 \text{ dBi} = 51 \text{ dBW/40 KHz}
\]

*Note: An antenna side lobe exceeding the specified transmit gain mask by e.g.: 3 dB, would lead to a reduction of the above EIRP0 density value by 3 dB etc.*

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**Case B**

The cross polarisation discrimination of the transmit antenna at the -1 dB contour of the main lobe is < 35 dB

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6) **EESS 502 Specification for maximum allowed EIRP density at the 0 dB/K satellite reference contour (EIRP0 density expressed in dBW/4 KHz, Para. 4.2 refers):**

<table>
<thead>
<tr>
<th>Cross polarisation discrimination [dB]</th>
<th>EIRP0 density [dBW/4 KHz]</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;35</td>
<td>39</td>
</tr>
<tr>
<td>34</td>
<td>38.6</td>
</tr>
<tr>
<td>33</td>
<td>38.2</td>
</tr>
<tr>
<td>32</td>
<td>37.8</td>
</tr>
<tr>
<td>31</td>
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<tr>
<td>26</td>
<td>34.6</td>
</tr>
<tr>
<td>25</td>
<td>34</td>
</tr>
</tbody>
</table>

7) If Case B applies, the maximum allowed EIRP density will be determined by the lower of the values calculated under case A and case B.

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8) **Example**

For an antenna with a cross polarisation of 30 dB, for any antenna diameter, the maximum allowed EIRP density at the 0 dB/K satellite reference contour (EIRP0 density) is:

\[
37 \text{ dBW/4 KHz} = 47 \text{ dBW/40 KHz}
\]

For an antenna with a gain of 49 dBi (corresponding approximately to a 2.4 m dish-size)

\[
\text{Pin density} = 47 - 49 = -2 \text{ dBW/40 KHz}
\]