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RF Exposure and Transmitter Power Considerations for the BeoVision 11 television

FCC ID: TTULBWA1ZZPD

The FCC requires that the calculated MPE be equal to or less than a given limit dependent on frequency at a distance of 20cm from a device to the body of a user.

The MPE calculation as given in FCC OET Bulletin 65, page 19 is used to calculate the safe operating distance for the user.

The BeoVision 11 is a television that contains a WLAN device that operates at 2400.0-2483.5MHz, 5150.0-5250.0MHz, 5250.0-5350.0MHz, 5470-5725.0MHz and 5725.0-5850.0MHz

This device supports MIMO operation for 802.11 a/n.

The following FCC Rule Parts are applicable:

Part 1.1310 – Radiofrequency radiation exposure limits

Part 2.1091(c) – Radiofrequency radiation exposure evaluation: mobile devices (>1.5GHz, Max Tx = 3W ERP)

Maximum Transmitter Power for the BeoVision 11

The maximum transmitter power for each frequency band is calculated below. The highest measured conducted output power, combined with the highest applicable antenna gain was chosen as being representative of the worst case operating condition.

2400-2483.5MHz: 802.11 b/g/n

Max. Conducted Transmitter Power = 22.7dBm (186mW) *(measured).*

Maximum specified antenna gain = 4.0dBi

$EIRP_{eff}$ = 22.7 + 4.0 = 26.7dBm

ERP_{eff} = $EIRP_{eff}$ – 2.1dB (half wave dipole gain)

ERP_{eff} = 26.7 – 2.1 = 24.6dBm

i.e.: ERP_{eff} = 0.288W (3W limit)

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5725-5850MHz: 802.11 a/n

Max. Conducted Transmitter Power = 21.4dBm (138mW) *(measured).*

Maximum specified antenna gain = 4.0dBi

$EIRP_{eff}$ = 21.4 + 4.0 = 25.4dBm

ERP_{eff} = $EIRP_{eff}$ – 2.1dB (half wave dipole gain)

ERP_{eff} = 25.4 – 2.1 = 23.3dBm

i.e.: ERP_{eff} = 0.214W (3W limit)

5150-5250MHz: 802.11 a/n

Max. Conducted Transmitter Power = 14.9dBm (31mW) *(measured).*

Maximum specified antenna gain = 4.0dBi

$EIRP_{eff}$ = 14.9 + 4.0 = 18.9dBm

ERP_{eff} = $EIRP_{eff}$ – 2.1dB (half wave dipole gain)

ERP_{eff} = 18.9 – 2.1 = 16.8dBm

i.e.: ERP_{eff} = 0.048W (3W limit)

5250-5350MHz: 802.11 a/n

Max. Conducted Transmitter Power = 15.4dBm (35mW) *(measured).*

Maximum specified antenna gain = 4.0dBi

$EIRP_{eff}$ = 15.4 + 4.0 = 19.4dBm

ERP_{eff} = $EIRP_{eff}$ – 2.1dB (half wave dipole gain)

ERP_{eff} = 19.4 – 2.1 = 17.1dBm

i.e.: ERP_{eff} = 0.051W (3W limit)

5470-5725MHz: 802.11 a/n

Max. Conducted Transmitter Power = 15.7dBm (37mW) *(measured).*

Maximum specified antenna gain = 4.0dBi

$EIRP_{eff}$ = 15.7 + 4.0 = 19.7dBm

ERP_{eff} = $EIRP_{eff}$ – 2.1dB (half wave dipole gain)

ERP_{eff} = 19.7 – 2.1 = 17.6dBm

i.e.: ERP_{eff} = 0.058W (3W limit)

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MPE Calculation for the BeoVision 11

The MPE calculation as given in FCC OET Bulletin 65, page 19 is used to calculate the safe operating distance for the user.

$$S = EIRP/4 \pi R^2$$

Where S = Power density

EIRP = Effective Isotropic Radiated Power (EIRP = P x G)

P = Conducted Transmitter Power

G = Antenna Gain (relative to an isotropic radiator)

R = distance to the centre of radiation of the antenna (safe operating distance)

2400-2483.5MHz: 802.11 b/g/n

From the maximum transmitter power calculations above,
max. $EIRP_{eff}$ = 26.7dBm (468mW)

Power Density Requirement

From table 1 (b) - Limit for General Population/ Uncontrolled Exposure of FCC Rule Part 1.1310 for frequencies above 1500MHz

S_{req} = 1.0 mW/cm^2

Calculation:

$S = EIRP/4 \pi R^2$

$1.0= 468/(12.56 \times R^2)$

$R^2 = 468/(12.56 \times 1.0)$

R = 6.1cm (<20cm)

5725-5850MHz: 802.11 a/n

From the maximum transmitter power calculations above,
max. $EIRP_{eff}$ = 25.4dBm (347mW)

Power Density Requirement

From table 1 (b) - Limit for General Population/ Uncontrolled Exposure of FCC Rule Part 1.1310 for frequencies above 1500MHz

S_{req} = 1.0 mW/cm^2

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Calculation:

$S = EIRP/4 \pi R^2$

$1.0= 347/(12.56 \times R^2)$

$R^2 = 347/(12.56 \times 1.0)$

R = 5.3cm (<20cm)

5150-5250MHz: 802.11 a/n

From the maximum transmitter power calculations above,
max. $EIRP_{eff}$ = 18.9dBm (78mW)

Power Density Requirement

From table 1 (b) - Limit for General Population/ Uncontrolled Exposure of FCC Rule Part 1.1310 for frequencies above 1500MHz

S_{req} = 1.0 mW/cm^2

Calculation:

$S = EIRP/4 \pi R^2$

$1.0= 78/(12.56 \times R^2)$

$R^2 = 78/(12.56 \times 1.0)$

R = 2.5cm (<20cm)

5250-5350MHz: 802.11 a/n

From the maximum transmitter power calculations above,
max. $EIRP_{eff}$ = 19.4dBm (87mW)

Power Density Requirement

From table 1 (b) - Limit for General Population/ Uncontrolled Exposure of FCC Rule Part 1.1310 for frequencies above 1500MHz

S_{req} = 1.0 mW/cm^2

Calculation:

$S = EIRP/4 \pi R^2$

$1.0= 87/(12.56 \times R^2)$

$R^2 = 87/(12.56 \times 1.0)$

R = 2.6cm (<20cm)

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5470-5725MHz: 802.11 a/n

From the maximum transmitter power calculations above,
max. $EIRP_{eff}$ = 19.7dBm (93mW)

Power Density Requirement

From table 1 (b) - Limit for General Population/ Uncontrolled Exposure of FCC Rule Part 1.1310 for frequencies above 1500MHz

S_{req} = 1.0 mW/cm^2

Calculation:

$S = EIRP/4 \pi R^2$

$1.0= 93/(12.56 \times R^2)$

$R^2 = 93/(12.56 \times 1.0)$

R = 2.7cm (<20cm)

Conclusion

This confirms compliance to the required FCC Part 1.1310 Radiofrequency radiation exposure limit of 1.0mW/cm^2 at 20cm operation.