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SOLUTIONS GROUP



Working Paper

Analysis of the FCC Regulations for Radiation Safe Distance with respect to the OS54XX/PTP54400 Products

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Ref: phn-0952

Abstract

This document analyses the exclusion zone required to ensure human radiation level limits are not exceeded by the OS54XX/PTP54400 range of products with integrated or external antennas. The guidelines in FCC Bulletin 65 are used to compute the safe distances.

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Revision History

Version	Date	Comments	Author
0.001	10 Nov 2006	Initial Issue	CF
0.002	23 April 2007	Correct errors, remove reference to connectorised versions	CF
0.003	24 April 2007	Modify to show power density at 20cm	CF

Operational Parameters of the OS54XX/PTP54400 Product

1 Scope

The purpose of this brief working paper is to identify the mean RF power produced by the OS54XX/PTP54400 equipment under various operating conditions. The two part numbers reflect changes in product branding but the product performance is not affected. This mean RF power plus the antenna gain used in specific installations identifies the effective power density (dBm/cm²) that is to be compared against allowed limits for human exposure.

2 References

Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields:

OET Bulletin 65, Edition 97-01, August 1997 [1]

3 Background

Reference [1] identifies how the radiated power density should be calculated for different distances from the antenna. The variables used are Radiated Power Density (S), conducted power (P), Antenna Gain (G) and distance (R). The formula given is

$$S = (P * G) / (4 * \pi * R)^2$$

The limit allowed for S depends on whether the exposure risk is to a member of the public or not. The limits for public exposure are the lower, and so a power density limit of 1mW/cm² is used for S. This is used to compute a 'safe' distance from the antenna. It is clear from [1] that the power to be used should be the RMS power averaged over a period of 6 minutes.

Notes

- a) the FCC require that the power density be calculated at a minimum distance of 20cm
- b) the value of P * G is the same as the transmitted EIRP.

4 OS54XX/PTP54400 Specific Issues

4.1 FCC Regulations

The OS54XX/PTP54400 is approved under FCC Part 15.407 and this regulation limits the maximum EIRP to 27dBm in a 10MHz channel. As are two polarisations transmitted by OS54XX/PTP54400, this total power cannot be exceeded by the sum of the two powers transmitted. The OS54XX/PTP54400 ensures that this power cannot be exceeded.

4.2 Power Control

The power levelling loops in the product measure the transmitted power on both polarisations at all times and limit each to the Maximum Transmit Power –3dB. The Maximum RMS Transmit Power during the transmit period (total for both polarisations)

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for OS54XX/PTP54400 equipments in production is set to 4dBm to ensure that the 27dBm Maximum EIRP requirement is met with the supplied antenna (23dBi). The transmit duty cycle for the equipment is a normally <50%. However some modes of operation do allow a transmit duty cycle of 60%. As the regulations refer to mean radiation power density over a 6 minute averaging period, the duty cycle is likely to be 60% worst case. This reduces the effective EIRP (in the worst case) by 2.2dB from the Maximum RMS transmitted EIRP. It should be noted that this is very much a worst case as the product operates Receiver driven Transmit power control.

4.3 FCC Testing

The testing has confirmed that the maximum power was not exceeded.

5 Analysis

The table below shows the radiated power density at a distance of 20cm from the antenna and confirms that the power density level is below the safe limit at that distance.

Total EIRP in burst	27	dBm
Less TDD duty cycle	-2.2	dB
Total Mean EIRP	302	mW
Safety Power Density Limit	1	mW/cm2
Radiated Density at 20cm	0.060081	mW/cm2

6 Conclusion

The equipment meets the safe limit for general exposure at a distance of 20cm with a margin of over 12dB.