Working Paper

Analysis of operating and installation requirements to satisfy FCC Regulations for RF exposure compliance with respect to the PTP49600 Products

C.F.Fisher
Ref: phn-1308

MOTOROLA POINT TO POINT FIXED
WIRELESS SOLUTIONS GROUP

Abstract

This document analyses the exclusion zone required to ensure human radiation level limits are not exceeded by the PTP49600 range of products with integrated or external antennas. The guidelines in FCC Bulletin 65 are used to compute the safe distances.

Copyright Information

Revision History

Version	Date	Comments	Author
0.001	10 November 2008	Initial Issue	CF

Operational Parameters of the PTP49600 Product

1 Scope

The purpose of this brief working paper is to identify the mean RF power produced by the PTP49600 equipment under various operating conditions. This mean RF power plus the antenna gain used in specific installations identifies the effective power density (dBm/cm^2) 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 $1mW/cm^2$ 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 maximum transmitted power, subject to any allowance for source-based time-averaging.

4 PTP49600 Specific Issues

4.1 FCC Regulations

The PTP49600 is approved under section Part 90 and this regulation limits the peak transmitted power to 27/30/33dBm in 5/10/20MHz channel widths. As are two polarisations transmitted by PTP49600, this total power cannot be exceeded by the sum of the two powers transmitted. The PTP49600 ensures that this power cannot be exceeded and this has been demonstrated in formal testing.

4.2 Dual Polarisation

The PTP49600 products use either

a) an integrated dual polarised antenna with each polarisation connected to an identical transceiver circuit inside the unit, or
b) a connector plate to allow the connection of external dish antennas with each polarisation connected to an identical transceiver circuit inside the unit

In order to comply with the FCC limits, the design of the products reduces by 3dB the conducted power and EIRP of each of the two individual polarisations in each of the above cases. The maximum antenna gain allowed at full transmit power is 26dBi.

As the regulations effectively limit the total EIRP produced, then the calculations below apply equally in the case of both the integrated and external antennas.

4.3 Power Control

The power levelling loops in the product measure the transmitted power on each polarisation 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) for PTP49600 equipments in production is set to 24dBm to ensure that the regulatory requirement is met.
The PTP49600 equipments operate on a TDD basis using the same frequency for up/down link. The transmit duty cycle resulting from the TDD operation is normally <50%. However some modes of operation do allow a burst transmit duty cycle of 80% but this only happens for short bursts of highly asymmetric data.
The FCC regulations allow source-based time averaging to be used in working out the EIRP value for the exposure calculation. This reduces the effective mean conducted power and EIRP by 1dB (in the very worst of 80% Tx duty cycle) from the levels of conducted power and EIRP that would be applicable if the products were to transmit with a duty cycle of 100%.

4.4 FCC Testing

The testing has confirmed that the peak power requirements of Part 90 were not exceeded

4.5 Cable Losses

It is considered that a cable loss of less than 1dB is unlikely in the case of the connectorised version operating with external antennas.

4.6 Calculations

The following calculations identify the distance at which the radiated field falls to the limit for exposure for the General Population on the basis of the discussions above.

Total Transmit Power in burst	24		dBm
Less TDD duty cycle	-1		dB
Total Mean Transmit Power	199.53		mW
Total Mean Transmit Power with 1dB cable loss	158.49		mW
General Population Limit	1		mW/cm2
Antenna Type	Manufacturer's Gain (dBi)	Safe Distance for 0dB Cable Loss (m)	Safe Distance for 1.0dB Cable Loss (m)
Integrated	22	0.50	N/A
Connectorised	26	0.80	0.71

5 Summary

The analysis above shows that even with the largest antenna allowed by the regulations, a one metre spacing from the antenna face is sufficient to reduce the radiated fields below the regulated maximum limit for General Population exposure.

The PTP49600 is intended for fixed, professional installation and instructions will be included in the installation and operating manual to ensure that the installer is aware of the requirement to ensure that the minimum spacing requirements are met.