RF Exposure and Transmitter Power Considerations for the MBF 40 Dual Band Signal Booster; FCC ID: NEOA218SERIES

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The MBF 40 is an Indoor, Distributed Antenna System (DAS), fibre optic fed signal booster which provides localised bi-directional SMR radio coverage to remote sites up to 20km from the hub base station site. The device operates using a (downlink) service antenna for communication with user devices, the RF exposure compliance of which this MPE calculation is intended to address. The uplink is a low power fibre optic link hence no MPE calculation is required.

The device is a fixed piece of equipment.

The transmitter operation of the MBF 40 covers the SMR 700 MHz (763-775 MHz) and SMR 800 MHz (851-862 MHz) operating bands.

The following FCC rule parts are applicable:

FCC rule part §Part 1.1310 – Radiofrequency radiation exposure limits

FCC rule part §Part 90.219(b)(b) – Use of signal boosters.

Class B broadband signal boosters are limited to 5 watts ERP for each authorized frequency that the booster is designed to amplify.

For the MPE calculation, $S = EIRP/4 \pi R^2$ is used to calculate the safe operating distance for the user.

Maximum Transmitter Power Consideration

The conducted output power at the service antenna terminal of the MBF 40 is limited by automatic level control circuitry to 37 dBm (5 Watts) per operating band. The MBF 40 is not a consumer device and is designed for installation by FCC Licensees and qualified installers only. It is the installer's responsibility to ensure that the FCC Part 90.219(b) specified 5 Watts ERP limit is not exceeded in each specific installation.

Ensuring compliance with FCC rule part §90.219(b)

Max. $EIRP_{eff}$ = ERP + 2.15 dB (half wave dipole gain)

$EIRP_{eff}$ = ERP + 2.15 dB

$EIRP_{eff}$ = 36.99 dBm (5 W ERP limit) + 2.15 dB = 39.14dBm (**8.204 W**)

Antenna cable loss as specified by the manufacturer: 2dB (minimum)

From the above calculated $EIRP_{eff}$ value and the manufacturer supplied cable losses, the maximum antenna gain can be calculated by:

Antenna Gain (dBi) = $EIRP_{eff}$ (dBm) - Conducted Output Power (dBm) + Cable Loss (dB)

Therefore, the maximum antenna gain for Indoor DAS Antenna = 39.14 - 37 + 2 = **4.14 dBi**

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MPE Calculations

The following MPE calculation is used to calculate the safe operating distance for the user's in each operating band.

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

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)

For 700 MHz Operation (worst case 763MHz)

Values:

Transmitter frequency range = 763 MHz - 775 MHz

Max. $EIRP_{eff}$ = 8204 mW

Power Density Requirement

From FCC Rule Part 1.1310 Table 1 - Limits for General Population/ Uncontrolled Exposure for 700 MHz

$S = f/1500$ mW/cm^2 (f = operating frequency)

$S = 763/1500 = 0.51$ mW/cm^2 (worst case)

Calculation:

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

$S = EIRP_{eff} /4 \pi R^2$

$0.51 = 8204/(12.56 \times R^2)$

$R^2 = 8204/(12.56 \times 0.51)$

R = 35.8 cm

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For 800 MHz Operation (worst case 851MHz)

Values:

Transmitter frequency range = 851 MHz - 862 MHz

Max. $EIRP_{eff}$ = 8204 mW

Power Density Requirement

From FCC Rule Part 1.1310 Table 1 - Limits for General Population/ Uncontrolled Exposure for 800 MHz

$S = f/1500$ mW/cm^2 (f = operating frequency)

$S = 851/1500 = 0.57$ mW/cm^2 (worst case)

Calculation:

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

$S = EIRP_{eff} /4 \pi R^2$

$0.57 = 8204/(12.56 \times R^2)$

$R^2 = 8204/(12.56 \times 0.57)$

R = 33.9 cm

Conclusion

It is the installer's responsibility to ensure that the MBF 40 is correctly installed such that the FCC Part 90.219(b) specified 5 Watts ERP limit is not exceeded.

The MPE value of the MBF 40, when correctly installed, meets the applicable power density RF exposure limit for an uncontrolled environment at a minimum safe operating distance of 36 cm. This is achieved with an antenna having a maximum gain of 4.14 dBi with 2 dB minimum cable loss. Antennas having gains higher than those stated above should not be used.

A warning about the safe operating distance is contained in the User Manual / Installation Guide.