

**XB Series Evaluation of International Compliance for General
Public Exposure to Electromagnetic Fields**



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Introduction

This report evaluates the requirement under the R&TTE Directive for the XB Series of Class B AIS transceivers with integrated 802.11b/g connectivity to comply to the levels for public exposure to electromagnetic radiation as defined in EN 50385. The exposure assessment has been performed according to EN 50383 Section 8 to show that the XB9000, XB8000 and XB6000 will not generate electromagnetic emissions above the reference level as specified in EC Council Recommendation (1999/519/EC) in both the VHF and UHF transmission bands used by the AIS and 802.11b/g transmitters respectively.

It also compares this to the US requirements under the FCC Rule Parts 1.1310, 2.1091 and 2.1093 for radio frequency exposure limits for the general public.

EUT Description

| | |
|--------------------------------|--|
| Products | <i>WatchMate</i> Vision, XB-8000, X-6000 |
| Trade Name | Vesper Marine Ltd |
| Model Numbers | XB9000, XB8000, XB6000 |
| Power Supply | 12-24V DC |
| VHF Frequency Range | 161.500 – 162.025 MHz |
| VHF Transmit Power | 33dBm (2W) |
| VHF Modulation Technique | FM GMSK |
| VHF Channel Spacing | 25kHz |
| VHF Antenna Gain Specification | 3dBi |
| Antenna Designation | Monopole |
| UHF Transmit Power | 15dBm (30mW) |
| VHF Antenna Gain Specification | 1.2dBi |
| Antenna Designation | PCB SMT |
| Temperature Range | -25 - +55 deg C |
| Intended Users | General Public |
| Equipment type | Fixed (non-portable) |
| Typical distance of use | 40cm |

For more details please refer to the user manual

VHF Limits

System must operate in Europe under the reference levels as outlined by the Council Recommendation 1999/519/EC and in the US under the FCC limits which can be summarized as follows:

Table 1 – International Exposure Limits

| Region | Frequency Range | E-Field Strength (V/m) | H-Field Strength (A/m) |
|--------|-----------------|------------------------|------------------------|
| Europe | 30 – 300 MHz | 28 | 0.07 |
| FCC | 30 – 300 MHz | 27.5 | 0.07 |

Furthermore EN 50385 stipulates that if the average power emitted by the system is less than 20mW, the system is deemed to comply with the standard without testing.

VHF Exposure Evaluation

Since the maximum average power at the antenna permitted by IEC 62287-1 for a TDMA Class B AIS Transponder can be calculated as 10.28dBm (33dBm, 5 second reporting interval, 26.67ms slot time), the XB series automatically complies with EN 50385 for a nominal antenna gain of 3dBi. However for completeness and user manual documentation the compliance boundary is also examined.

The compliance boundary can be determined from the following with the results shown in Table 2 below,

$$D = \text{sqrt} (30 \times G \times P) / E$$

where,

D = distance from the antenna (m)

G = numerical antenna gain

P = power at the antenna (W)

E = E-Field strength (V / m)

The assumptions are as follows,

- The far field model applies
- The antenna gain is typically 3dBi
- The antenna length is typically equal to half a wavelength
- Nominal operating frequency of 162MHz

Table 2 – Evaluation Results

| | |
|-------------------------------|-----------|
| Radiating Far Field boundary* | 0.93 m |
| E-Field at Far Field boundary | 11.77 V/m |
| H-Field at Far Field boundary | 0.03 A/m |
| EU Compliance Boundary | 0.39 m |
| US Compliance Boundary | 0.40 m |

* The boundary between the Near and Far Fields for which at distances greater than this the Far Field model can be applied

Under the Far-Field model the system E-Field and H-Field are well below the limits as shown in Table 1. An maximum permissible exposure (MPE) radius of 1m is practical for system installation and will ensure the limits are never breached.

UHF Limits and Exposure Evaluation

In accordance with the test reports covering EN 300 328 and FCC 15.247 compliance the maximum summed output power of the 802.11b/g transmitter is 16.9dBm (37.2mW) at 2452MHz. Exposure at a typical operating distance 40cm is well below the limits for both FCC and EU as can be seen in Table 4 below.

Table 3 – FCC Exposure Limits

| Region | Frequency Range | Power Density (mW/cm ²) |
|--------|-------------------|-------------------------------------|
| FCC | 1500 – 100000 MHz | 5 |
| EU | 2000-300000 MHz | 10 |

Table 4 – Evaluation Results

| | |
|-------------------------------|-------------------------|
| Radiating Far Field boundary | 0.06 m |
| E-Field at Far Field boundary | 20.20 V/m |
| Power Density at boundary | 0.11 mW/cm ² |

Results were calculated using the same equations as specified in VHF Exposure evaluation with the following differences:

- Antenna gain of 1.2dBi used
- Nominal operating frequency 2462MHz

User Manual Warnings

In addition to the installation instructions in the user manual and in accordance with Section 7 of EN 50385 the following has been included in the manual under General Warnings:

“RF Emissions

Caution: This device generates and radiates electromagnetic energy. This device must be installed and operated according to the instructions contained in this handbook. Failure to do so can result in product malfunction and / or exposure to potentially harmful levels of radio frequency radiation.

Caution: Never operate the this device unless it is connected to a VHF antenna.

The system has a Maximum Permissible exposure (MPE) radius of 1m from the antenna. This has been determined assuming the maximum power of the transponder and using a standard monopole VHF antenna with a maximum gain of 3dBi and termination impedance of 50 ohms.

When installing the antenna and operating the equipment consider the following,

- The antenna should be mounted as high above the deck as possible*
- Higher gain VHF antennas will require a larger MPE radius*
- Do not operate the unit when anyone is within the MPE radius of the antenna*
- The antenna should not be collocated or operated in conjunction with any other transmitting antenna”*

Conclusion

The XB Series complies with the international standards for general public exposure to electromagnetic fields.