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PERCOMM RESPONSE

TO FCC EMAIL FROM OCTOBER 21,2002

CORRESPONDENCE REFERENCE NUMBER: 24191

731 CONFIRMATION NUMBER: EA215226

REFLEX TELEMETRY DEVICE, OMNIDATA, MODEL PT1005-A

DATE OF ISSUE: NOVEMBER 5,2002

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This document contains a total of 5 pages.

1.) Please remove all shielding from printed circuit boards in the external photo exhibit.

A new file with external photos with all shields removed has been uploaded.

2.) What is the maximum antenna gain that is used for this device.

The device is sold without an antenna and PerComm is recommending a half wave dipole to be used with the device. As such the maximum gain is 0 dBd or 2.2dBi.

3.) Please submit an MPE evaluation.

OMNIDATA is marketed and sold for use in "fixed locations" as this is defined in §2.1091 (b) and as such MPE limits should not apply to it. Nonetheless we provide an MPE calculation.

The MPE evaluation is done making the following assumptions: OMNIDATA transmits at the maximum rated power of Pout =1 Watt, the antenna is a half dipole having the maximum gain of 2.2dBi, the transmitter duty cycle is the worst-case allowed under the ReFLEX protocol, the power density limits are for general population/ uncontrolled exposure.

The worst-case duty cycle for the OMNIDATA device transmitter occurs on a collapse rate of 1 when the device is sending messages to the infrastructure. For this calculation, we assume infinite messages are queued in the device; each message is the maximum length allowed (700 bytes) and the back channel is running at its slowest speed (800 bps).

The ReFLEX protocol is timed on frames, each being 1.875 seconds long. The sequence for transmitting a message from the device is shown in the following table. Also shown is transmitter on time and elapsed time in seconds.

Frame	Event	Transmitter on-time	Elapsed time
1	Device sends Request to Transmit to system	0.162	1.875
2	Request goes to system controller and is scheduled	0	1.875
3	Unusable Frame	0	1.875
4	Grant for data unit is sent to Device	0	1.875
5	Device sends first data unit (100 Bytes) to system	1.875	1.875
6	Data unit goes to system controller and next data unit is scheduled	0	1.875
7	Unused frame	0	1.875

8	Grant for next data unit is sent to Device	0	1.875
9	Device sends data unit to system	1.875	1.875
10 – 29	Repeat steps 6-9 until entire message is transmitted (5 more data units for a total of 7)	5 x 1.875	20 x 1.875
30	Last data unit goes to system controller, and End of Transmission is scheduled	0	1.875
31	Unusable frame	0	1.875
32	End of Transmission is send to Device	0	1.875
33	Device sends ACK to End of Transmission to system	0.162	1.875
	Totals	**13.449s**	**61.875s**

Thus, the maximum duty cycle for the Location Tag device transmitter is:

$$D = \frac{13.449}{61.875} = 21.74\%$$

Note: This is the theoretical maximum based on the protocol, but is not achievable in a real system due to computing delays and traffic delays.

According to FCC recommendations the RF power density is averaged over 30 minutes and this duration being much longer than 65.875 seconds it is correct to use the calculated duty cycle as the averaged maximum duty cycle.

The maximum gain of the half-wave dipole antenna on a linear scale is:

$$G = 10^{\frac{2.2}{10}} = 1.66$$

The minimum allowed distance between persons and the antenna (see OMNIDATA User guide, page 10) is:

$$R_{\min} = 20\ cm$$

The theoretical power flux density at this distant is:

$$S = \frac{P_{out} \cdot G \cdot D}{4 \cdot \pi \cdot R_{\min}^2} = \frac{1\,W \cdot 1.66 \cdot \frac{21.74}{100}}{4 \cdot \pi \cdot (20\ cm)^2} = 0.0702 \quad \frac{mW}{cm^2}$$

The MPE limit for general/uncontrolled exposures at the minimum transmit frequency of 901MHz is:

$$S_{MPE} = \frac{f(MHz)}{1500}\frac{mW}{cm^2} = \frac{901}{1500}\frac{mW}{cm^2} = 0.601\frac{mW}{cm^2}$$

As can be seen from these calculations the OMNIDATA device equipped with a half-wave dipole antenna is well below the FCC limits for MPE. The distance from the antenna for which the MPE limit is reached is:

$$R_{MPE} = \sqrt{\frac{P_{out}\cdot G\cdot D}{4\cdot\pi\cdot S_{MPE}}} = \sqrt{\frac{1W\cdot 1.66\cdot 0.2174}{4\cdot\pi\cdot 0.601\frac{mW}{cm^2}}} = 6.9\ cm$$

4.) Please submit audio filter response data.

Part 2.1047(a) is Not Applicable to OMNIDATA device.

5.) Please submit modulation limiting test data.

OMNIDATA does not employ modulation limiting. The samples of the complex envelope of the signal are generated by the DSP via software. Two D-to-As convert these samples in analog I/Q signals. These analog signals modulates an IF carrier that later on is up-converted to the transmit frequency. The over-modulation is prevented because the DSP is controlling the frequency deviation. The TIA/EIA-603-A method of measuring the modulation limiting is Not Applicable.

6.) Please justify your emission designator.

The emission designator is 10K0F1D.

Bandwidth calculation

Type of modulation: CPFSK continuous phase 4-level frequency shift keying.

Deviation: D= 2400 Hz maximum.

Maximum symbol rate = 9600 bits per second/2 bits per symbol = 4800 symbol per second.

Maximum modulation frequency: M = 4800 symbols/2symbols per cycle = 2400 Hz.

Necessary bandwidth: B_n is given by:

$$B_n = 2\cdot M + 2\cdot D = 2\cdot 2400\ Hz + 2\cdot 2400\ Hz = 9600\ Hz$$

Hence the bandwidth designator is 10K0.

The last three symbols are F for frequency modulation, 1 for a single channel containing digital information without the use of a modulating sub-carrier and D for data transmission.

7.) Please provide ERP RF output power and radiated spurious emission measurements using the substitution method.

A new measurement report has been uploaded that contains ERP and radiated spurious emissions measured using the substitution method.