Test report

Number:	**T251-0674/22**	Project file:	C20221441
		Date:	2022-10-19
		Pages:	6
Product:	**Avalanche Transciever**		
Type reference:	**Black Diamond: GUIDE BT, RECON X** **PIEPS: POWDER BT, PRO BT**		
Ratings:	3x Alkaline batteries (AAA) LR03 1,5 V or 3x Lithium batteries (AAA) FR03 1,5 V Protection class: III		
Trademark:	Black Diamond, PIEPS		
Applicant:	**Black Diamond Equipment Ltd.** **2084 East 3900 South Salt Lake City, Utah 84124, USA**		
Manufacturer:	Pieps GmbH Parkring 4, 8403 Lebring, Austria		
Place of manufacture:	Anton Paar ShapeTec BA d.o.o., Gornja Mocila, 74450 Brod, Bosnia and Herzegovina		

Summary of testing

Testing method:	47 CFR FCC Part 2.1093 KDB 447498 D01 General RF Exposure Guidance v06
Testing location:	SIQ Ljubljana, Mašera-Spasićeva ulica 10, SI-1000 Ljubljana, Slovenia
Remarks:	Date of receipt of test items: 2022-05-25 Number of items tested: 1 Date of performance of tests: 2022-09-08 - 2022-10-19 The test results presented in this report relate only to the items tested. The product complies with the requirements of the testing methods.

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1 GENERAL

History sheet			
Date	Report No.	Change	Revision
2022-10-19	T251-0674/22	Initial Test Report issued.	--

1.1 Equipment under test

Avalanche Transciever
Type: **Black Diamond: GUIDE BT, RECON X**
PIEPS: POWDER BT, PRO BT

Environment: Uncontrolled / General Public
Equipment falls under product for portable use.
FCC ID: **REMDSP04**

Hardware version :	2.1
Firmware version :	0.1.6.0
SIQ tested number :	S202204021
Dimensions of EUT (H*W*D)/mm:	28 x 75 x 117
Operating frequency:	457 kHz
One/two/three phase EUT:	Battery powered
Floor standing / table-top equipment or a combination:	Portable
Antenna type	Internal – Wire-wound ferrite

Adaptive / non-adaptive equipment	non-adaptive equipment
Modulation type	Other than FHSS
Operating mode	Single antenna
Operating temperature range	-20 °C to +45 °C
Maximum RF Output power	-0.1 dBm
Operating frequency	2402 MHz – 2480 MHz
Number of channels	40
Antenna type and gain	-3.67 dBi
Antenna Beamforming	/
Nominal channel bandwidth	1 MHz
Firmware:	0.1.6.0
Hardware:	2.1

Environment: Uncontrolled / General Public
Assessment frequency (f): 457 kHz and 2.4 GHz
Assessment distance: ≤5 mm

The product is an avalanche beacon that is a transmitter and receiver combined in one unit. The equipment is used for rescue operations, caused by an avalanche. It includes three wire-wound ferrite antennas to receive the 457 kHz signal from 3 directions. X antenna is also used to transmit the 457 kHz beacon signal, which is amplified over a transmitter amplifier circuit, the power is controlled over PWM. It provides 3 different modes:

- Search
- Scan
- Connection to mobile phone over Bluetooth

Aside from the three receiver/transmitter antenna there is also an accelerometer sensor and a Bluetooth LE module. Bluetooth connection is used for firmware update and configuration modification. Bluetooth LE module is not active when device is in 457kHz transmit or receive mode.

PIEPS POWDER BT contains the same circuit as Black Diamond RECON X and PIEPS PRO BT contains the same circuit as Black Diamond GUIDE BT. The only difference is the trademark and enclosure colour. POWDER BT and RECON X are truncated versions without vibra motor and some other components (M1, C33, C34, R28, D103, Q3). The tested was PIEPS PRO BT, which was marked as LVS8 – development marking name and due to that in the measurements LVS8 was used.

1.2 Reviewed / referenced documents

Reviewed documents:
- T251-0445/22 and T251-0448/22 created by SIQ Ljubljana, dated 2022-10-12

2 ASSESSMENT PROCEDURE

According to 1.1307(b)(1)(B):
Prepare an evaluation of the human exposure to RF radiation pursuant to § 1.1310 and include in the application a statement confirming compliance with the limits in § 1.1310.

According to 1.1310(d)(2):
For operations within the frequency range of 300 kHz and 6 GHz (inclusive), the limits for maximum permissible exposure (MPE), derived from whole-body SAR limits and listed in Table 1 in paragraph (e)(1) of this section, may be used instead of whole-body SAR limits as set forth in paragraphs (a) through (c) of this section to evaluate the environmental impact of human exposure to RF radiation as specified in § 1.1307(b) of this part, except for portable devices as defined in § 2.1093 of this chapter as these evaluations shall be performed according to the SAR provisions in § 2.1093.

According to 2.1093(d)(2):
Evaluation of compliance with the SAR limits can be demonstrated by either laboratory measurement techniques or by computational modeling. The latter must be supported by adequate documentation showing that the numerical method as implemented in the computational software has been fully validated; in addition, the equipment under test and exposure conditions must be modeled according to protocols established by FCC-accepted numerical computation standards or available FCC procedures for the specific computational method. Guidance regarding SAR measurement techniques can be found in the Office of Engineering and Technology (OET) Laboratory Division Knowledge Database (KDB).

KDB 447498 D01 General RF Exposure Guidance v06 Clause 4.3.1. Standalone SAR test exclusion considerations

SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition(s), listed below, is (are) satisfied. These test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring evaluation, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions.

For 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] ·
[$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR, where

- $f_{(GHz)}$ is the RF channel transmit frequency in GHz

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm, and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

3 CALCULATIONS

For 457 kHz transmitter:
For frequencies below 100 MHz, the following may be considered for SAR test exclusion:

Threshold = (((3.0 · 50 mm · 0,1) + ((test separation distance - 50 mm) · (100/150)) mW) · (1 + log(100/$f_{(MHz)}$))) · 0.5

Threshold = 792 mW

Max. allowed transmission power at 457 kHz for SAR exclusion at ≤50 mm distance is 792 mW. Device operates with less than 1 mW including 2dB tune-up and is with this excluded from evaluation.

For 2.4 GHz transmitter:
For frequencies above 100 MHz, the following is to be considered for SAR test exclusion:

Threshold ≤ 3.0 (Threshold) · (min. test separation distance, mm) / √f(GHz)]

Used minimum distance is 5 mm, according to KDB requirements.

Threshold = 9.53 mW

Max. allowed transmission power at 2480 MHz for SAR exclusion at 5 mm distance is 9.53 mW. Device operates with less than 1 mW including 2dB tune-up and is with this excluded from evaluation.

Conclusion: PASS