Annex acc. to FCC Title 47 CFR Part 15
relating to
Mikrometal s.r.o.
BULLETSEEKER

Annex no. 5
User Manual
Functional Description

Title 47 - Telecommunication
Part 15 - Radio Frequency Devices
Subpart C – Intentional Radiators
ANSI C63.4-2014
ANSI C63.10-2013

TÜV NORD Hochfrequenztechnik GmbH & Co. KG
LESKANPARK, Gebäude 10, Waltherstr. 49-51, 51069 Köln, Germany
Tel.: +49 221 8888950

User Manual / Functional Description of the test equipment (EUT)

TÜV NORD Hochfrequenztechnik GmbH & Co. KG
LESKANPARK, Gebäude 10, Waltherstr. 49-51, 51069 Köln, Germany
Tel.: +49 221 8888950

Instructions

Manual

BULLETSEEKER mach4

By Longseeker sro

BULLETSEEKER is a LONGSEEKER.com brand

Introduction

The *BULLETSEEKER mach4* is the most advanced gun radar.

***BULLETSEEKER* mach4** for speeds up to 1200 m/s – 4000 fps

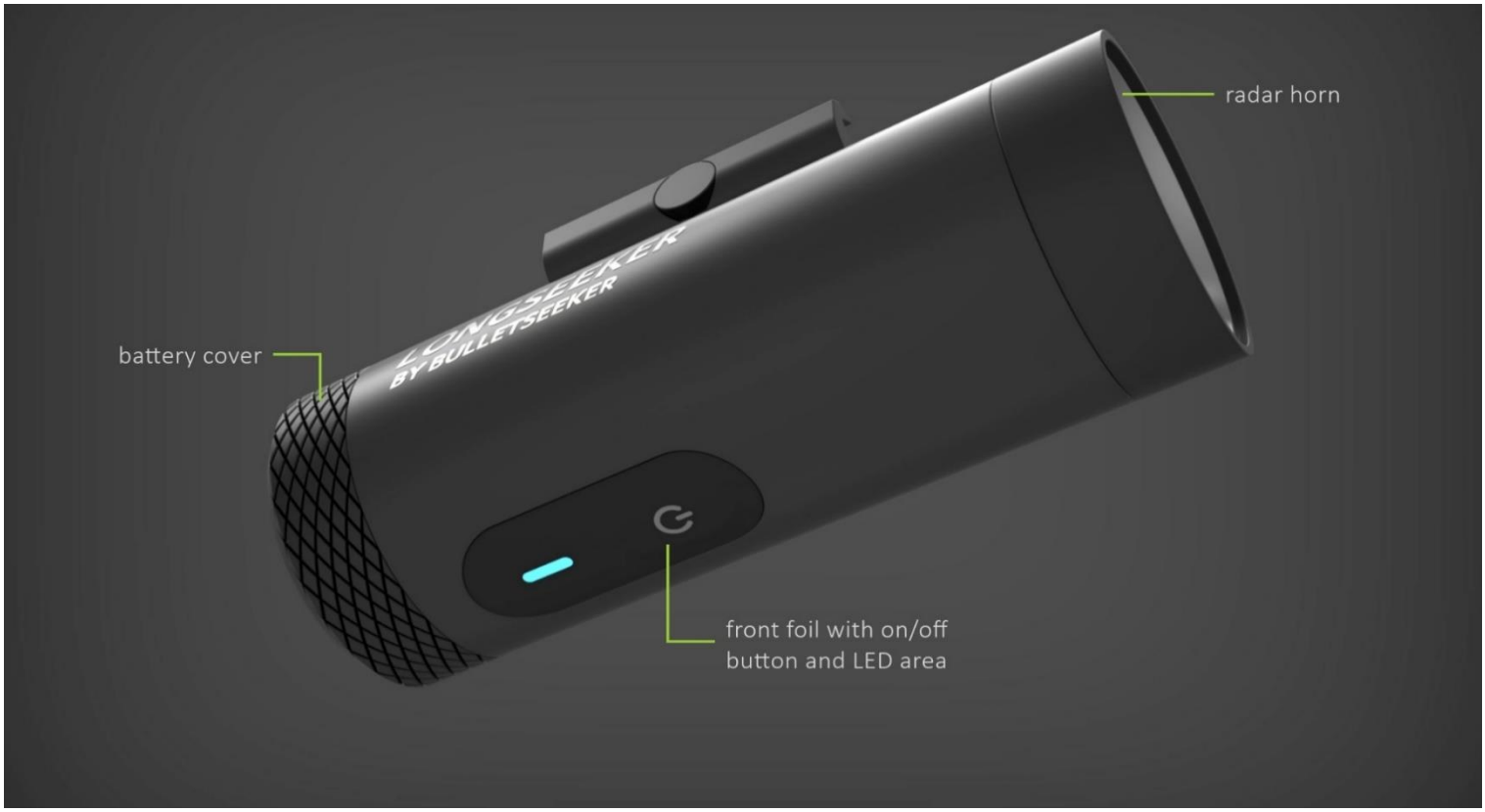
BULLETSEEKER is an amazing piece of technology. Developed by a team of German and Czech Engineers. Case design in the Netherlands, mathematics and programming in Berlin and Prague. Tested by gunners in the Czech Republic , Italy, Canada and the UK. The radar beam formed by incredible lenses with an aluminium foam filter (patented) in Bohemia. The heart is a 120 GHz radar SiR-chip – made in Germany.

All made in Europe

The core components, the 120 GHz radar chip and the beamforming lens, empower us to generate the biggest radar cross section of bullets and pellets on the market. This results in an extremely high accuracy and with a lot of detections in the first meter. The ***BULLETSEEKER mach4*** is detecting the bullet up 1000 times in the first 100 cm. This is the true muzzle speed and it is not affected much by wind and air pressure. The reason for this is the very short wavelength of only 2.5 mm - competitors are using 10 times longer radar waves.

Chronometers with light barriers have 2 measuring points only. The ***BULLETSEEKER mach4*** has 20 to 1000 measuring points. We are measuring up to 1000 detections with very high precision. The typical mistake of light barrier systems is the gun position and the firing angle as well as problems with light conditions. This is solved by the *BULLETSEEKER* mach4 due to the radar technology, the small size, its light weight and the ability to mount it on the gun like a flashlight.

Enjoy accuracy, enjoy ***BULLETSEEKER***

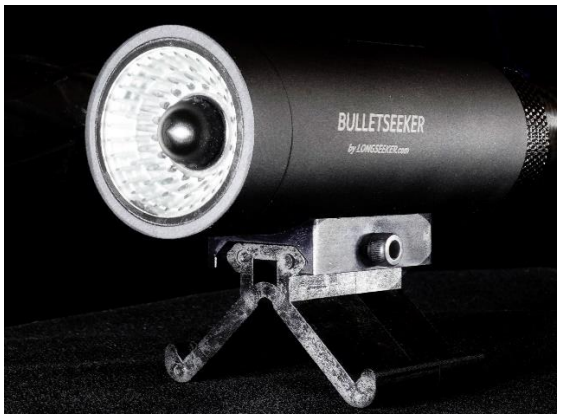


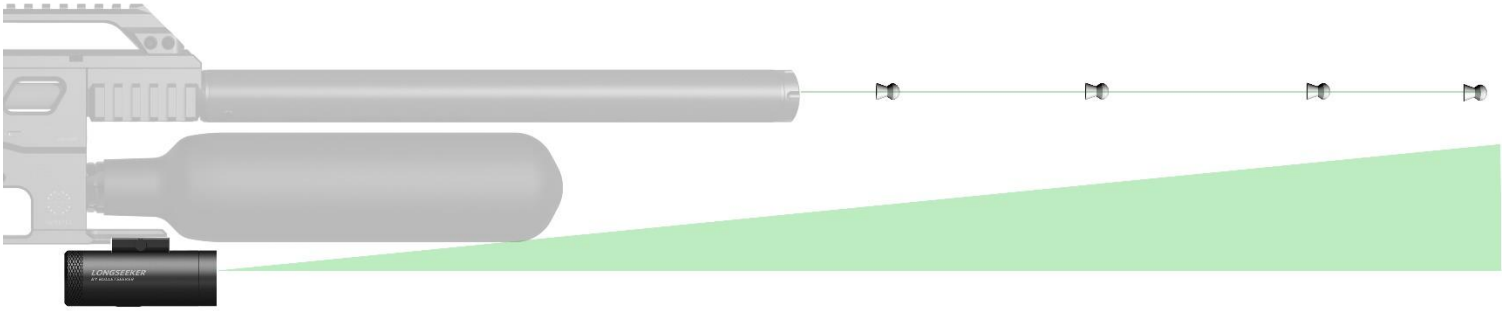
On / Off

- Press the switch for a second
- LED is flashing for 3x in orange
- LED flashing is changing to blue search for BLUETOOTH pairing
- LED is shining green, BT is established
- LED is switching between green and blue if target (bullet) is detected
- LED is switching to red by charging via USB-C
  - USB connector is for charging only, no data transfer
- Press the switch again to turn Off
  - switching OFF with the timer, set in the APP settings
  - Battery charging by USB-C connector on battery cover

Mounting

- a Picatinny rail counterpart is mounted on the *BULLETSEEKER*
- a universal V-holder is part of the delivery
- it can be attached to the barrel with an elastic band or stand alone beside the gun





Positioning

- Beware of radar shadow
- Closer to the muzzle is better
- Find the right position on your gun by testing
- Beam forming is set to 22 degrees mid of the lens
- Do not cover the lens and the aluminium foam filter

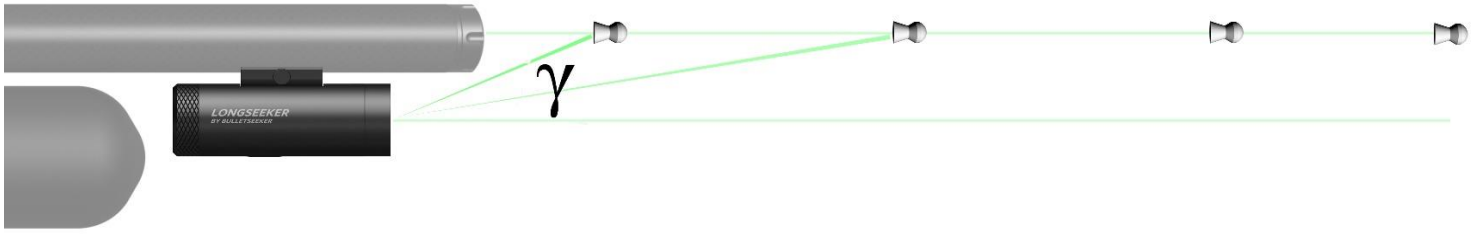
Picture by Michael Andrew Photography

Positioning *BULLETSEEKER* mach4

Explosive ammunition creates a muzzle cloud from hot gases and metallic abrasion. This cloud of plasma and metal splinters is electrically conductive. It can interfere with the radar waves and wipe out the signal.

We have tested different muzzle brakes. Muzzle brakes with a guided gas jet such as star or spiral shape allow the radar signals to pass through very well. Find the right position on your gun by testing.

$$R = K_\alpha \cdot \sqrt[4]{\frac{P_S \cdot G^2 \cdot \lambda^2 \cdot A_z \cdot t_i}{K \cdot T_0 \cdot n_R \cdot (4\pi)^3 \cdot d}} \cdot \sin\left(\frac{2\pi \cdot h_m}{\lambda} \cdot \sin\gamma\right) \cdot e^{-0{,}115\delta_R \cdot R_e}$$



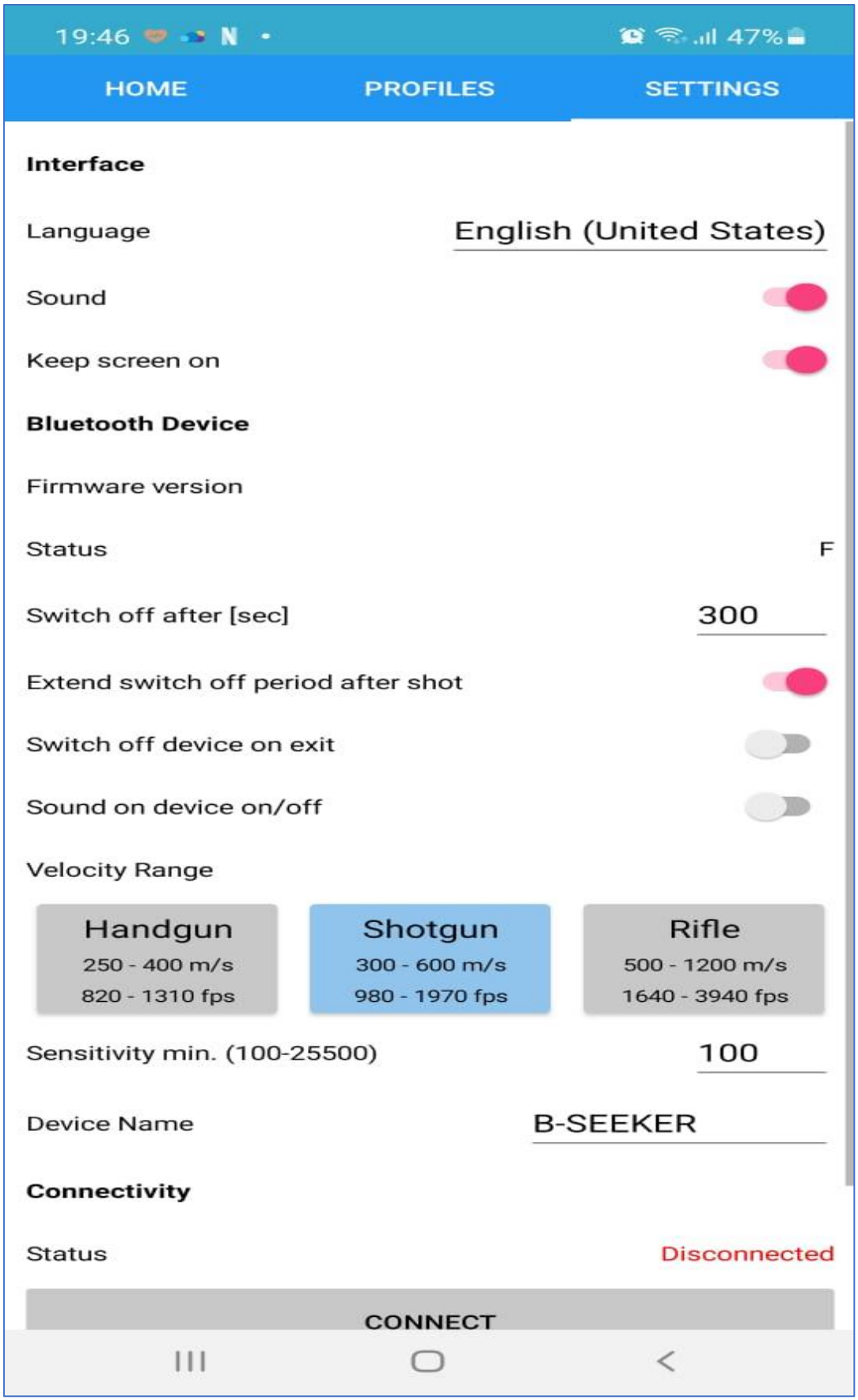
Data processing

- Data processing is fully automatic
- All data can be saved to your mobile phone and processed by yourself as well
- Data are saved in the folder “DOWNLOADS” with the file name “BS + time stamp” as a .log file, readable with a text editor
- The file name is a proposal only, you can rename it
- The angle γ between BULLETSEEKER and muzzle is important and falsifies the results of the first 3-10 detections (first 10 cm) per shot
- The initial speed is measured in the first meter
- You can evaluate and correct the data. In the app you can manage the data by scrolling with your finger tip

Application ***BULLETSEEKER*** **mach4** Android 9 and higher

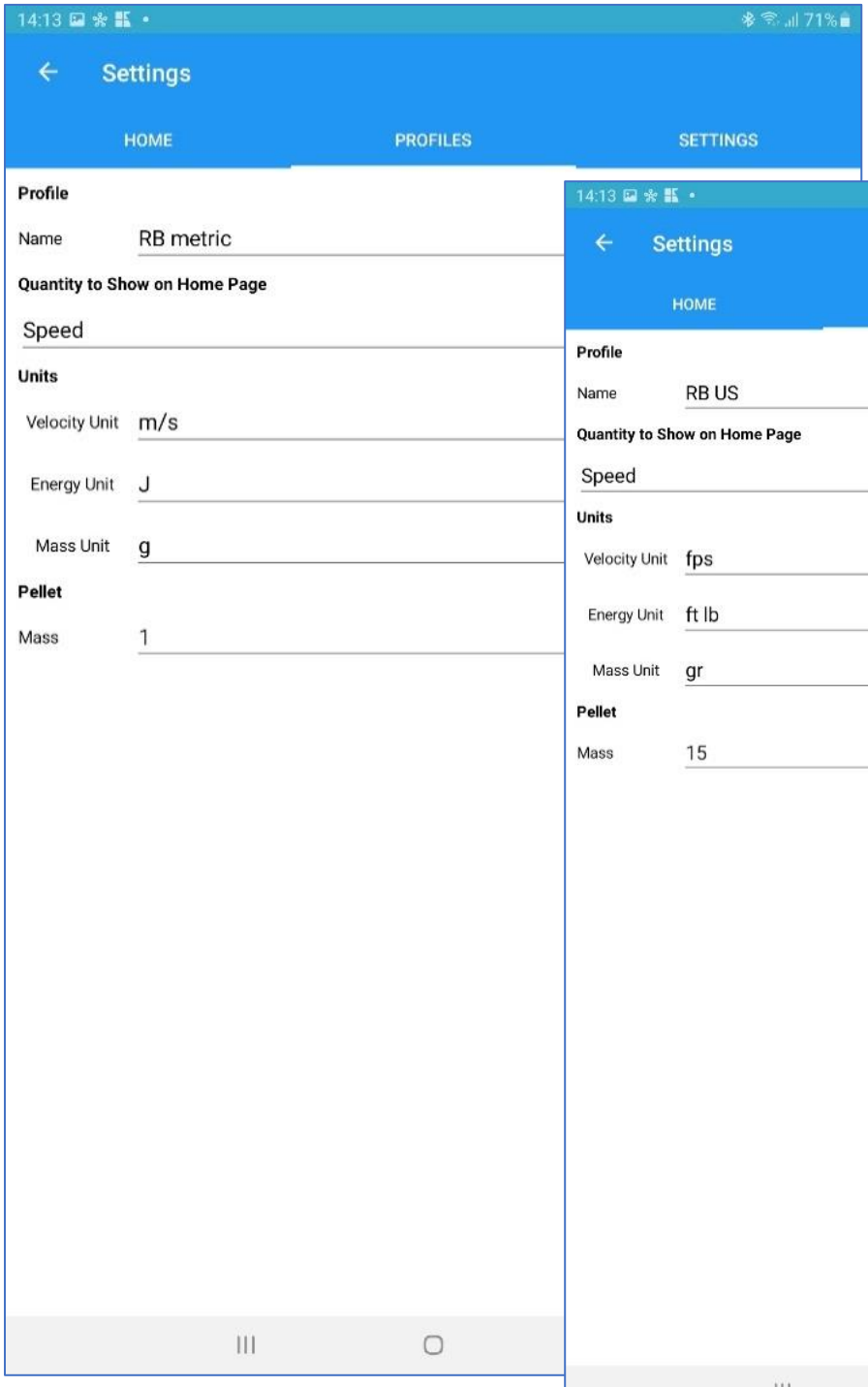
- **SETTINGS**
- adjust the time for switch off
- adjust velocity range for your gun for better detections.
- speed range is
  BULLETSEEKER **mach4** 250-1200 m/s , 820 – 4000 fps
- ***BULLETSEEKER*** **mach4** has 3 preset speed ranges
  Handgun 250 - 400 m/s , 820 – 1300 fps
  Shot gun 300 – 600 m/s , 1000 – 2000 fps
  Rifle 500 – 1200 m/s , 1600 - 4000 fps
- adjust the magnitude (sensitivity). Lower is more sensitive. The best detections are between 0 -300. It varies depending on your environment. For higher speeds it is better to use a higher sensitivity , beginning at 0 (zero) .
- Sound output is in the language of your cell phone
- Status F/N is showing connection status

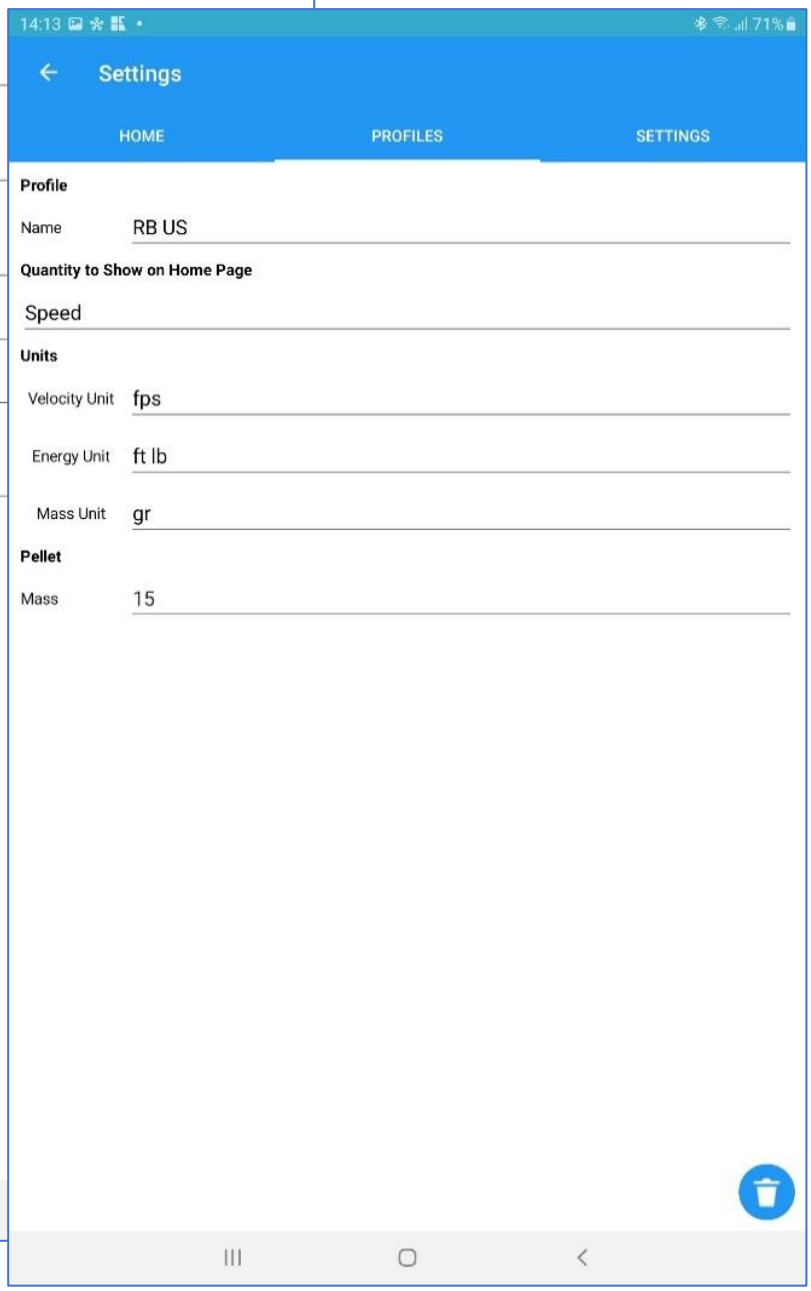
***BULLETSEEKER* mach4**



PROFILES

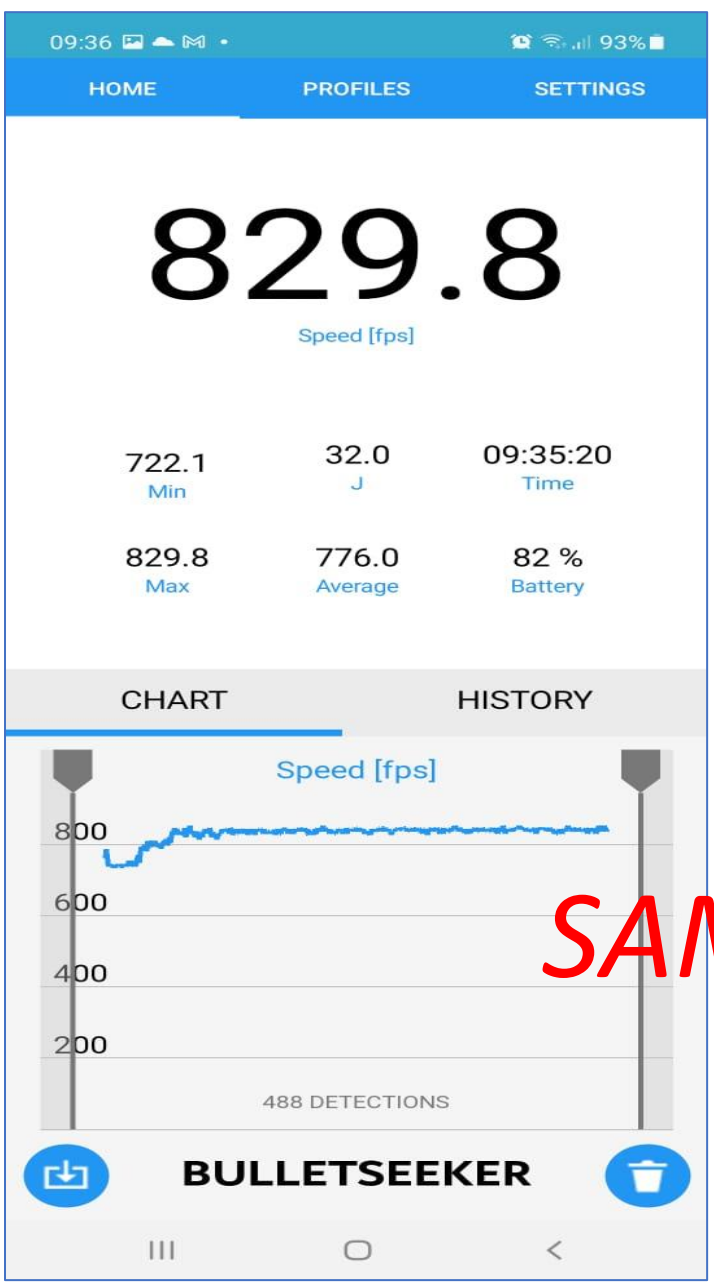
- Set your own profile
- Metric or US
- press **E** for edit
- press **+** for additional profile

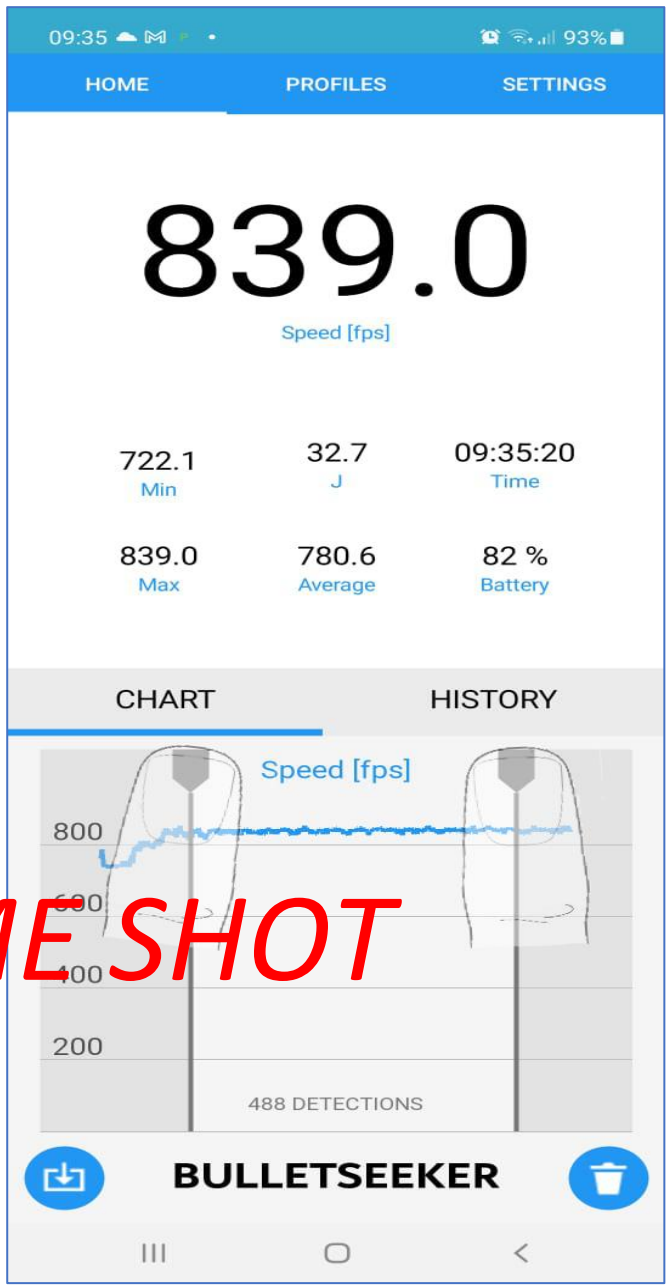




- **HOME**
- Press **CONNECT** for Bluetooth pairing
- After a shot, data will be shown on the screen
- Press **C** to clean all data from screen
- Press **S** to save all data to DOWNLOADS \BS+ time stamp

Data are saved in the folder DOWNLOADS with the file name "BS_ time stamp" as a .log file, readable and editable with a text editor. In the APP PRO version, you have a data diagram to handle the data with a finger tip slider. This enables you to evaluate and correct the data. (see angle γ between BULLETSEEKER and muzzle)

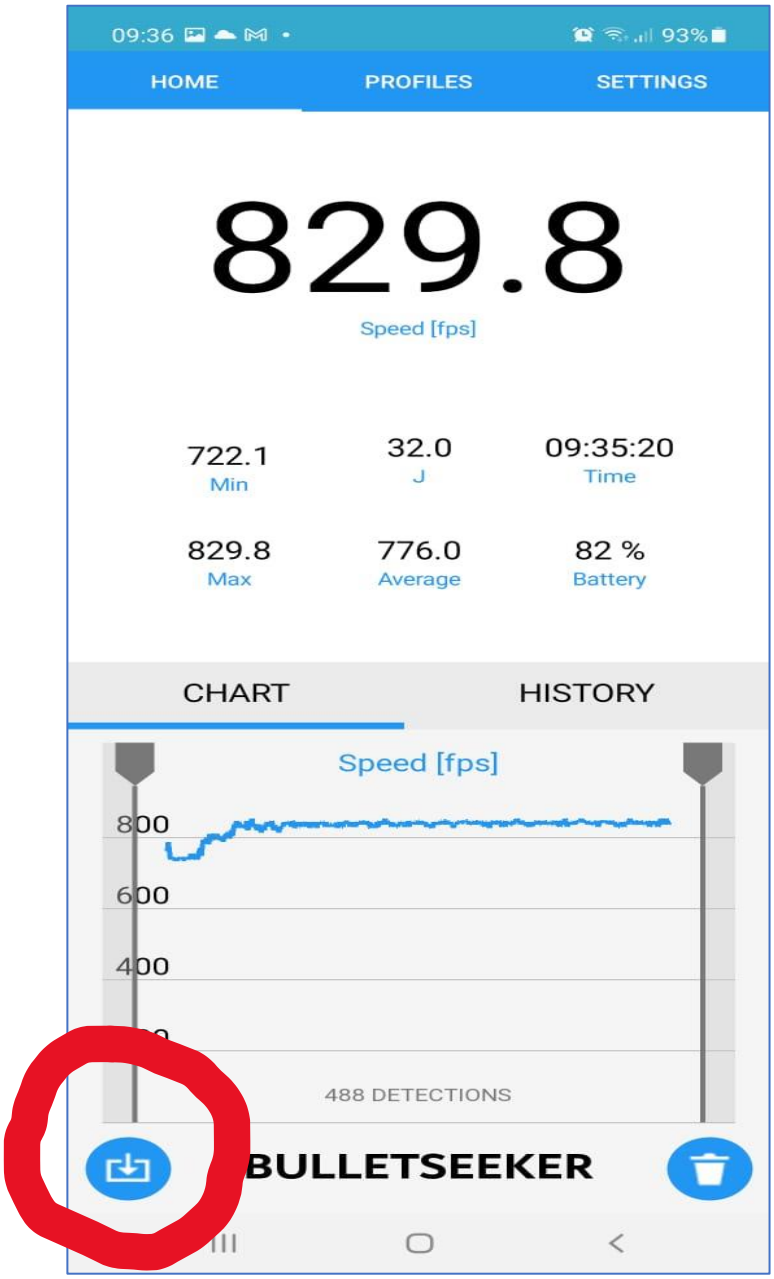




SAME SHOT

Data export

save data

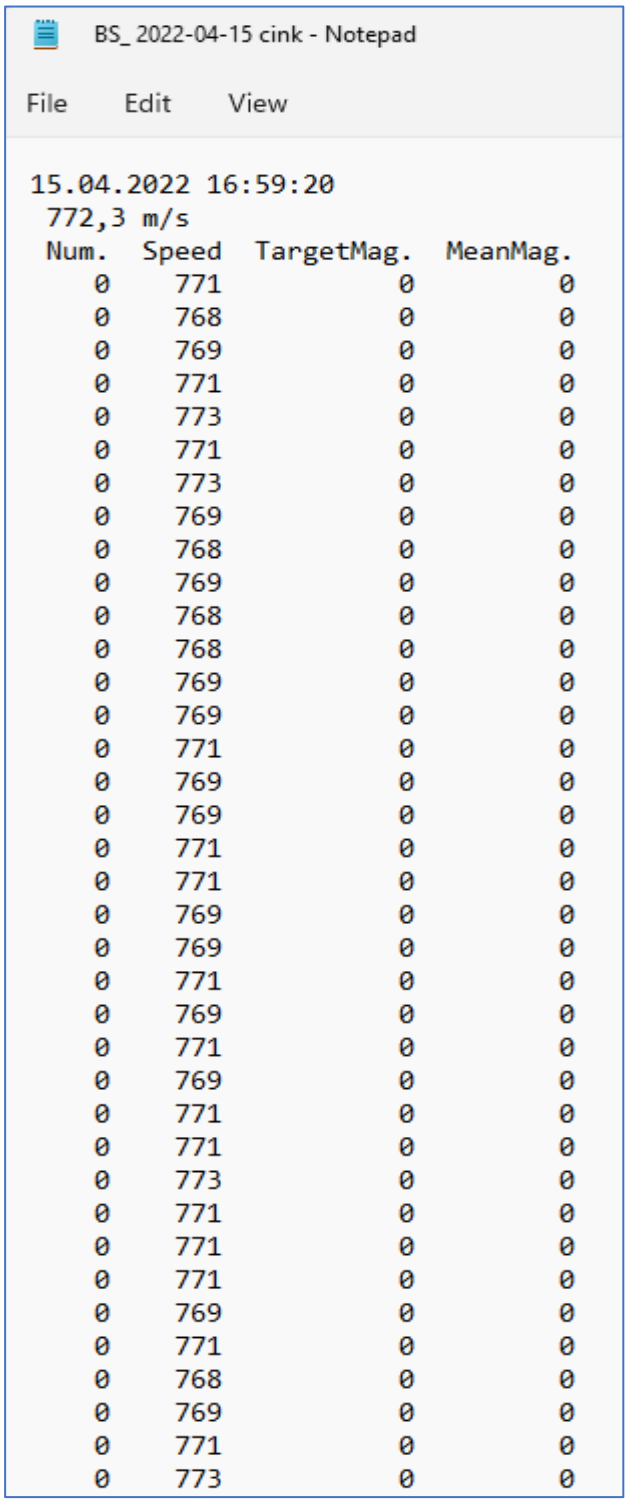


Press the data download button

Save it , standard file name is " BS _time stamp" . You can also enter a different name there. Data are saved in the folder DOWNLOADS with the file name "BS_ time stamp" as a .log file, readable and editable with a text editor.

Evaluate data ***BULLETSEEKER* mach4** version

Typical log file looks like below:

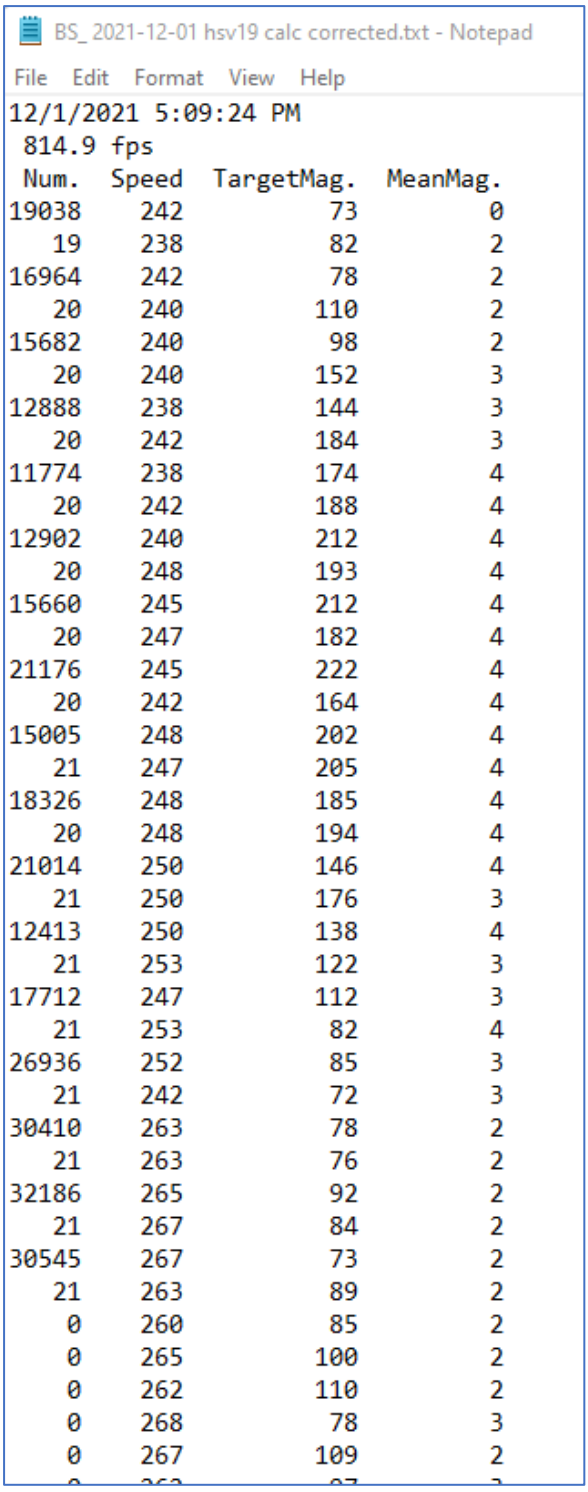


BS_ 2022-04-15 cink - Notepad

File Edit View

```
15.04.2022 16:59:20
 772,3 m/s
 Num.   Speed   TargetMag.   MeanMag.
    0     771            0          0
    0     768            0          0
    0     769            0          0
    0     771            0          0
    0     773            0          0
    0     771            0          0
    0     773            0          0
    0     769            0          0
    0     768            0          0
    0     769            0          0
    0     768            0          0
    0     768            0          0
    0     769            0          0
    0     769            0          0
    0     771            0          0
    0     769            0          0
    0     769            0          0
    0     771            0          0
    0     771            0          0
    0     769            0          0
    0     769            0          0
    0     771            0          0
    0     769            0          0
    0     771            0          0
    0     769            0          0
    0     771            0          0
    0     771            0          0
    0     773            0          0
    0     771            0          0
    0     771            0          0
    0     771            0          0
    0     769            0          0
    0     771            0          0
    0     768            0          0
    0     769            0          0
    0     771            0          0
    0     773            0          0
```

A special APP version with additional data such as signal strength etc. can be ordered for instructors, developers of weapons and ammunition.



BS_ 2021-12-01 hsv19 calc corrected.txt - Notepad

File Edit Format View Help

12/1/2021 5:09:24 PM
814.9 fps

Num.	Speed	TargetMag.	MeanMag.
19038	242	73	0
19	238	82	2
16964	242	78	2
20	240	110	2
15682	240	98	2
20	240	152	3
12888	238	144	3
20	242	184	3
11774	238	174	4
20	242	188	4
12902	240	212	4
20	248	193	4
15660	245	212	4
20	247	182	4
21176	245	222	4
20	242	164	4
15005	248	202	4
21	247	205	4
18326	248	185	4
20	248	194	4
21014	250	146	4
21	250	176	3
12413	250	138	4
21	253	122	3
17712	247	112	3
21	253	82	4
26936	252	85	3
21	242	72	3
30410	263	78	2
21	263	76	2
32186	265	92	2
21	267	84	2
30545	267	73	2
21	263	89	2
0	260	85	2
0	265	100	2
0	262	110	2
0	268	78	3
0	267	109	2

In the first two rows are the date and the average speed.

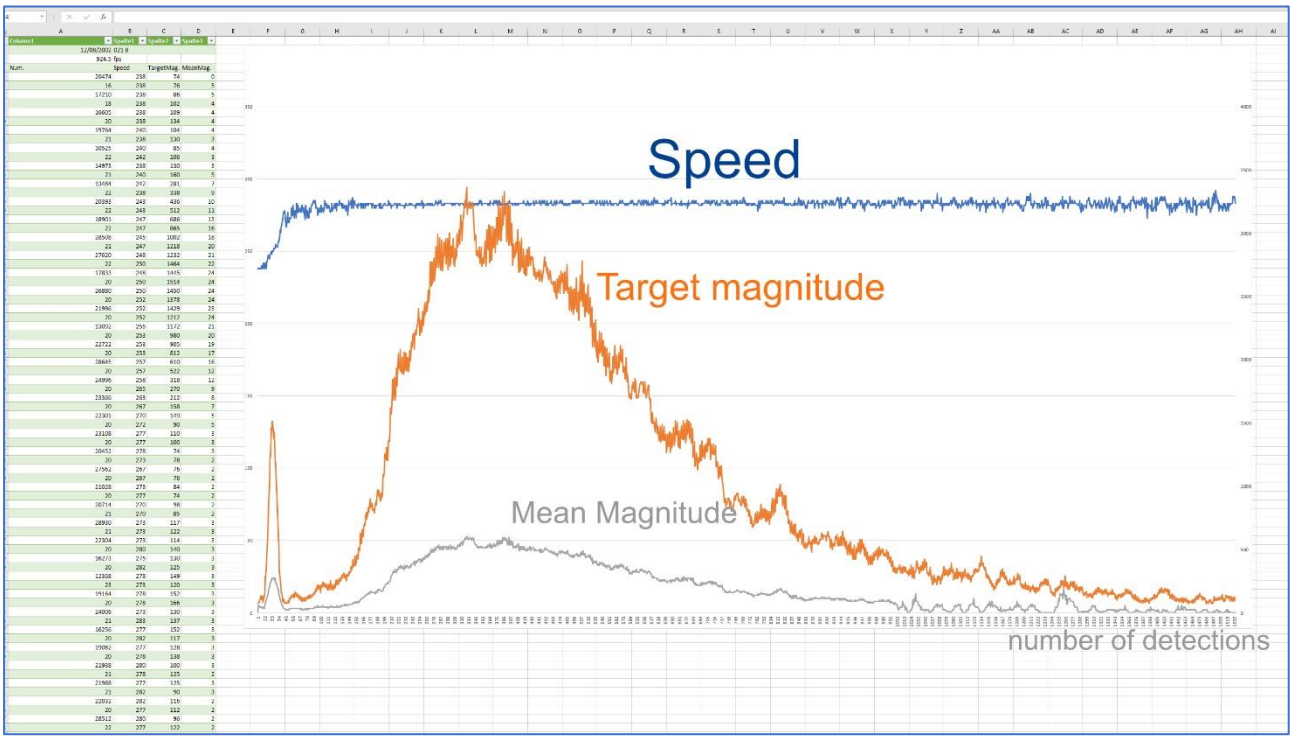
In the first column are in the airgun version a counter of detections. In the these version are there radar detection values to generate a fine detection calculation – for radar developer use only.

The second column shows the speed at each detection.

The third and fourth column shows data with which the quality of the signal acquisition can be assessed. This can be used to improve the positioning.

You can import this log file into a spreadsheet such as Excel.

A typical graph in Excel looks like below;



The rising graph, in the beginning, is a positioning issue as described in POSITIONING.

BULLETSEEKER detects and measures the shot in the first 80 cm and thus delivers the real V_0.

BULLETSEEKER is a brand of Longseeker.com

BULLETSEEKER is developed manufactured and produced by Longseeker sro

Longseeker sro

Všetatská 307, Chrást, 277 15 Tišice

Czech Republic

Certified with:

CE

FCC

Notice for USA

This device complies with Part 15 of the FCC Rules . Operation is subject to the following two conditions.

(1) this device may not cause harmful interference, and

(2) this device must accept any interference received,

including interference that may cause undesired operation.

Unauthorized modifications may void the authority granted under Federal communications Commission Rules permitting the operation of this device.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when

the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful

interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Notice for Canada

Operation is subject to the following two conditions:

(1) this device may not cause interference, and

(2) this device must accept any interference, including interference that may cause undesired operation of the device. Usually this is followed by the following RSS caution:

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

(1) l'appareil ne doit pas produire de brouillage, et

(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.