# TRE Installation and user guide

Reference : TRE 35-TRE37-TRE38







# 1 TRACKERS DESCRIPTION

TRE trackers main functions:

- Shocks and tilt measurements on 3 axis, free fall and temperature (TRE35-TRE37-TRE38), humidity (TRE35-TRE37), opening of parcels and opening of trackers (TRE38)
- Measurements times-tamped and stored in a flash memory

TRE trackers characteristics:

Integrated sensors:

- TRE35 : 3 axis accelerometer and temperature sensor
- TRE37 : 3 axis accelerometer and temperature sensor + humidity sensor
- TRE38: 3 axis accelerometer and temperature sensor + humidity sensor + 2 brightness sensors

# 2 RF MONITOR INSTALLATION OVERVIEW



# 2.1 General description

At your measurement site, you need to have a dedicated PC with RF Monitor installed to :

- Configure the operating modes, the measurement periods, the thresholds and the alarms
- Display the measures, generate CSV or PDF files

- Collect your trackers measurements (using a RF-to-USB key)
- Fill the database

It is possible to access the database using the software **DB Monitor** provided.

# **3 INSTALLATION OF RF MONITOR**

PLEASE NOTE THAT YOU MUST HAVE ADMINISTRATOR RIGHTS ON THE COMPUTER TO INSTALL RF MONITOR



Connect the metallic USB storage key

Via Windows explorator, display the content of the USB key and double-click on **NewsteoKit\_vX.X.X\_00000000\_setup.exe**.

2<sup>ND</sup> SOLUTION : DOWNLOAD RF MONITOR FOLLOWING THE LINK

https://www.newsteo.com/en/help-center/softwares/

- On the first window select the language, then for a quick installation keep the default settings by validating the successive windows from the setup program. At the end of the installation, select the option « *Reboot now* » and click on « *Finish* ».
- Once the computer restarts, launch RFMonitor software by double-clicking on the shortcut created on the desktop or from the start Menu
- On the «*Home* » window of the configuration wizard, select the desired language and click on «*Next* »

Home	Welcome.
General	Name follow the share in families Mildenikes setup
icence	Prease ronow the steps to rinding environment study
Data storage	too with be able to incomy solutione preferences rated clough solutions.
Noot	
	Language,
	Before proceeding, please select software language in list above :

• On the « General » window of the configuration wizard click on « Next ».

**<u>Remark</u>**: Once the installation has been completed, the configuration may still be changed (right-click on the line of the tracker then click on « **Configuration** » on the RF Monitor program option

 When requested by the setup wizard, remove the label « install the software before inserting » and insert the RF-To-USB key preferably using the USB extension

🗩 RFMonitor : Configurati	on wizard X
RFMonitor f	rst run
Home	Licence
General	Please connect a RF-to-USB key .
Data storage	
About	
	• • Watting _
	🔶 <back. frain<="" neco="" th="" 🕪="" 🗶=""></back.>

- In the wizard window « Licence » click on « Next ».
- In the window « Data storage » click on « Next ».
- At the end of the configuration wizard, click on « *Finish* » to launch RF Monitor.
- The information concerning your RF-To-USB key is now displayed in the tab « Key control » on RF Monitor.

🛋 Key con	itrol 📝 Command lis	t Device Monitoring					
#COM	Key serial number	RF settings	Key hardware	Key firmware	Baud rate	License type	License number
COM9	KEY001E7C	ChIEU7 10dBm 30mA	KEY111	v19.0.9	625000	Premium	1H0T-HDM5A-6LPAM-MUK33-LRYNE

# 4 STARTING THE TRACKER WITH RF



# 4.1 RFM Launch – Starting the tracker

The tracker is delivered in Hibernating mode (sleeping mode).

- 1- Launch RF Monitor
- 2- Connect your RF-to-USB key, it will be appearing in channel 1

Key con	trol 💟 Command lis	t Device Monitoring					
#COM	Key serial number	RF settings	Key hardware	Key firmware	Baud rate	License type	License number
COM9	KEY001E7C	Chi EU <mark>1</mark> 10dBm 30mA	KEY111	v19.0.9	625000	Premium	1H0T-HDM5A-6LPAM-MUK33-LRYNE
		RADIO CHANNEL					

3- Activate your tracker by swiping the magnet on the magnet area:

Observe the following procedure:

- Swipe the magnet slowly on the magnet area: the LED lights up RED
- While the light is still RED, swipe the magnet a second time slowly on the magnet area: the LED lights up ORANGE
- While the LED is still ORANGE, swipe the magnet a third time slowly: the LED lights up **GREEN**
- Then the LED flashes GREEN three times
   (Watch the support video: <u>https://www.newsteo.com/en/help-center/tutoriels-videos/newsteo-tracker-tre-trp/</u>)
- The tracker is activated and starts recording
- If the LED doesn't flash green 3 times, it means that it's not activated please start the procedure from the beginning.

4- On RF Monitor, the tracker will automatically appear in the list of devices:

RFMonitor PREMIL	JM - 7.10.7	. 22 - w	/orkspac	e_2018-1	2-26.xml										
File View Databas	e Tools S	ettings	Sessio	n ?											
Description	Product t	Alerts	Confi	ID	Serial number	Battery	RF settings	Next transmi	measures	Device's commands	Current mode/status	Sensor: 1	Sensor: 2	Sensor: 3	Firmware
E TRE TEST	TRE35 - 2		X	2022	TRE0007E6	📔 84% / 3.46V	ull Canal 7 Europe	00s	12 measures	None	Live / Presence				1.4.45 Live/record
f Identification of I	the Track (	er Config (Start/	uratio Stop r	n mer ecord	iu )	Battery level	Radio channel	Time remaining before the next transmission	Num hold: trans	ber of command indicates wheth mission took pla	ts on S er the radio (L ace	tate of the Live/Recor	tracker d)		Firmware version

→ Right-click on the line of the device, click on « Stop recording » then « Download data »

# 5 CONFIGURATION OF THE TRACKER WITH RF MONITOR

#### 5.1 Configuration menu

- Click on the tool icon of the logger's line **Or** right-click on the logger's line
- Then click on "Configuration".

Serial number	Battery	RF settings	Next transmi	measures	Device's
TRE0007E6	🥫 86% / 3.47V	Canal 7 Europe	47s	19 measures	• None
				Display curves of mea	sures
				Configuration	

#### 5.2 Execution of the commands

For a command to be taken into account:

- Swipe the magnet on the tracker to execute the command
- **Or** Wait for the next radio transmission (<1 minute) The tracker sends a presence radio signal every minute

SRFMonitor PREMI	JM - 7.10.7	. 22 - w	orkspace	e_2018-1	12-26.xml				_	_					
File View Databas	e Tools S	ettings	Session	n ?											
Description	Product t	Alerts	Confi	ID	Serial number	Battery	RF settings	Next transmi	measures	Device's commands	Current mode/status	Sensor: 1	Sensor: 2	Sensor: 3	Firmware
E TRE TEST	TRE35 - 2		X	2022	TRE0007E6	📔 86% / 3.47V	III Canal 7 Europe	09s	19 measures	<ul> <li>1 command(s) waiting</li> </ul>	Live / Presence				1.4.45 Live/record

• The message « 1 command waiting » disappears as soon as the command has been taken into account.

Configuration	F3
Stop recording	
Start booster mode	
Set to hibemate mode	
Download data	
Erase data	
Refresh	
Reports root directory	
Other commands	
Delete Device	Suppr
Clean list	

# 5.3 Product identification

- Select the tab « Device identification»
- Select a personalised identifier (ID, number between 0 and 65535)
- Enter a description
- Click on "Send" to validate the modifications

TRE0007ED : Configuration				
Device identification	RFSettings 🚇 Time &	Period $\sqrt{f(x)}$ Formulas	🕂 Firmware	
Identification				
③ Serial Number:	TRII000 ED			
Oevice ID:	123			
Oevice Description:	DESCRIPTION			
Operation (1) Product type:	TF 352			
③ Firmware's type:	Live/record	(j)	Firmware version:	1.4.45

# 5.4 Changing the radio channel

Select the tab « *RF Settings*»

TRE0007E6 : Configu	ration		
Device identification	👔 RF Settings 🚇	Time & Period 🕡 Formulas 👎	Firmware
Badio channel			
	Localization:	Europe 868 MHz	○ 915 MHz
	Boot channel:	Chi EU1	
	Working channel:	Chl 1 (865.2MHz) ~	
Power consumption			
	Output power:	🚮 10dBm 30mA 🗸 🗸	Default is +10dBm
	Sensitivity:	High O Low	Default is High
Canal securization			
	Active		

- By default the trackers and the RF-To-USB key are set on channel 1 <u>Channel 1 properties</u>: When the key is set on Channel 1, you can detect the trackers which are on any other channel. The channel 1 is a detection channel.
- You can change the radio channel following these steps:
  - 1. First you need to change the channel of the tracker
  - 2. Wait for the next transmission or swipe the magnet on the tracker to execute the command
  - 3. Change the channel of the RF-To-USB key by right-clicking on the line of the key



4. Change the radio channel in « RF Settings »

# 5.6 Live/Record mode

# Select the tab « Time and Period »

	TRE0007E6 : Configura	tion	
	Device identification	Time & Period View F	ormulas 🔸 Firmware
	Firmware mode :		
	Live / record mode	Leds	On command 'start record', open silent mode confirmation how
	O Monitoring mode	Oversampling	commator box
1		Buffer restitution : 255	
2	Period settings		
	Live period		Seature 55
1	Live peliou.		6 Fast. 55 s
	Record period:	Normal: 00 h 10 min	○ Fast : 00 S

« Live period »: measurements recorded outside the recording period

The TRE takes a measure at the live period which has been configured (10s by default) and sends it to the PC. RF Monitor displays the measure without recording it. The user can also check the tracker functioning, set the thresholds and the measurement period for the coming measurement campaign.

« Record period »: measurement period recorded during the recording

- NORMAL: measurement period from 1 minute up to 4 hours
- FAST: measurement period from 1 second up to 59 seconds

# 5.7 Monitoring mode: monitoring in real time

- Select the tab « Time & Period ».
- This concerns real-time monitoring applications

TRE0007E6 : Configuration           Device identification         1           Firmware mode :         1	RF Settings Time & Period $\sqrt{f_{KA}}$ Form	nulas 👎 Firmware
<ul> <li>Live / record mode</li> <li>Monitoring mode</li> </ul>	Leds Oversampling Buffer restitution: 255	On command 'start record', open silent mode confirmation box
Period settings Live period:	O Normal : 00 h 00 min	

Operation principle :

- The tracker takes a measure according to the period defined by the user and sends it to the PC with a request for ackowledgement
  - Which mode should you choose ? Generally, the « Live/record mode » set-up by default on the tracker is perfectly suitable.

# Remark : the higher the frequency is, the faster the memory will be full

For information :

- For a period of 1 mn, the memory will be filled in 2 months with 20500 recorded shocks and temperatures
- For a period of 15 mn, the memory will be filled in 2 years with 29000 recorded shocks and temperatures

#### 5.8 Oversampling

- The oversampling option allows to have a higher frequency when the threshold are reached.
- Attention: this option increases the battery
- When the threshold is exceeded :
  - The measurement period changes to 1 measure / minute in NORMAL period
  - > The measurement period changes to 1 measure / second in FAST period

## 5.9 Recording campaign

#### 5.9.1 Start recording

- Once the mode *Live/record* has been selected
- Click on « Start recording »
- Wait for the next radio transmission or swipe

the magnet on the trackers magnet area to execute the command.

#### 5.9.2 Recording

- The tracker records and stores the measures in its memory
- Every minute the tracker sends a presence radio signal to indicate its status, the • thresholds which have been exceeded and the number of measures in memory.

The nun	nber	of	n	neas	ures	in	memory	are	Display curves of	measures	display	ed in the	column
"measure	es" or	n th	e li	ne of	f the o	devi	ice		Configuration Start recording Start booster mod Set to hibernate m Download data Erase data Refresh Benotts root direct	F3 le node			
									Other commands	•			
									Delete Device Clean list	Suppr			
RFMonitor PREMIL	IM - 7 . 10 . 7	. 22 - wo	orkspace	e_2018-12-26	6.xml								
File View Databas	e Tools S	ettings	Session	n ?									
Description	Product t	Alerts	Confi	ID Si	erial number		Battery	RF settings		Next transmi	measures	Device's commands	Current mode/status
TRE TEST	TBE35.2		X	2022 T	BE0007E6	00%	12.491/	Canal 7		9min 49s	Ameasures	None	Becord / Presence

# 5.9.3 End of recording

Click on « Stop recording » then « Download data »



## 5.10 Thresholds

- Right-click on the line of the device then on «Configuration»
- Select the tab «Thresholds » or « Formulas »



## 5.11 Configure the temperature thresholds

• Set the thresholds which correspond to the desired level of alerts for the tracker:



- 1. Dark blue range: triggers very low alerts
- 2. Light blue range: triggers low alerts
- 3. Green range: no alerts (normal range)
- 4. Orange range: triggers high alerts
- 5. Red range: triggers very high alerts

#### 5.12 Configure the shocks thresholds



- For the shocks you can't have shocks lower than zero
- The unit above is in mG
- In our example:

For any shock higher than 3G (3000mG), the TRP55 records the event (refer to section 9.3) For the shocks lower than 3G the TRP55 takes the measures regularly (refer to section 9.2)

# 5.13 Configure the height thresholds

Device identification     Provide identification     Providentification     Provide identification     Provide identificatio
Temperature Acc Nom Height Energy Nom Disable
Disable
00 299

- For the falls, you can't have a height lower than zero
- The unit above is in cm

In our example above:

For the falls higher than 30cm the TRP55 records the event (refer to section 9.4)

## 5.14 Configure the Energy Norm thresholds

TF 0007 : Configuration		×
Device identification î RF	Settings 🚇 Time & Period 🛕 Thresholds 🔸 Firmware	
I Temperature Acc Norm	Height Energy Norm	
Disable		
<i>2</i>	400.0	
Oms		1000ms

- The energy calculation takes into account the duration of the shock in ms, you can't have a fall lower than zero
- The unity above is in ms Example below:

For a shock with a duration higher than 400ms, the TRE records the shock and calculates the shock energy taking into account the shock duration and the measure of the shock.

# 5.15 Data recovery

# 5.15.1 Access the database

• Click on « Measures »

#### 5.15.2 Data file location

RFMonito	or PRE	MIUN	1 - 7.10	.7.22 - w	ork
File View	Data	base	Tools	Settings	S
Description	-	Meas	sures		F
	A	Logs	: events	and alerts	F
	_			-	

During the recording, the tracker generates 2 or 3 file types depending on the mode which has been selected:

.csv file -> Excel format .pdf file -> Campaign report (recording mode only) .bin file -> Database > Disque local (C:) > Utilisateurs > Public > Documents publics > NEWSTEO > RFMonitor Nom ^ Modifié le Type

	Nom	Modifié le	Туре
	graphs	02/10/2018 11:00	Dossier de fichiers
7	maps .pdf file	02/10/2018 11:00	Dossier de fichiers
R	reports CSV file	14/12/2018 16:08	Dossier de fichiers
*	RFDatabase 🛶 🏻 .bin file	26/12/2018 14:50	Dossier de fichiers
*	traces	26/12/2018 09:25	Dossier de fichiers

In *Record mode*: the tracker downloads its data in the folder « **RESTITUTION** » and generates a **PDF or CSV file** 

sque local (C:) > Utilisateurs	> Public >	Documents publics > NEWS	TEO > RFMonito	r > reports > logger
Nom		Modifié le	Туре	Taille
live		20/12/2018 14:59	Dossier de fich	iers
restitutions		13/12/2018 09:48	Dossier de fich	iers

#### 5.16 Silent mode

#### Activate the silent mode

If the products travel by air, it is essential to activate the silent mode so they do not emit any radio signal

TRE0007E6 : Configuration	ı	
🔵 Device identification 👔	RFSettings 🚇 Time & Period 🗸	🖟 Formulas 🦊 Firmware
Firmware mode :		
Live / record mode	🗹 Leds	On command 'start record', open silent mode
O Monitoring mode	Oversampling	Commadori box
	Buffer restitution : 255	

> Look for a device which has been set to silent mode

Select the tab « *Tools* »

• Click on « Scan for silent mode devices »



💽 Sil <u>(</u> ) - Pr	ent mode scanner : ress button <u>Search for</u>	silent devices to research all silent devices in the area. $ imes$
- Ti Be (	hen press button <u>Stop s</u> carreful, each device tha	silent mode devices. to stop silent mode on devices selected in the list above at quit silent mode will also quit recording mode !
	Sear	ch for silent devices
$\checkmark$	Serial number	device current state
	TRE0007E6	device in SILENT mode

- Select the trackers you wish to retrieve from the silent mode
- Click on « Stop silent mode devices » The trackers is set to « Live » mode
- Click on « Close »

#### 5.17 Alerts and Alarms

The alerts are related to: measures which are under or above the thresholds, incorrect date or time, transmission loss and battery levels.

There are different types of alarms. The alarms are at least visual (tracker line in red, warning triangle...)

The alarms can also be of sound types (can be configured for each type of alert), e-mail or alerts relay (with optional external equipment)

#### 5.18 Saving data in the tracker

- At any time, you can download the last 32000 recorded measurements of each device.
- All measurements are registered in the buffer and are only cleared when the tracker rewrites on these measurements.
- By clicking on « Full memory download » you can retrieve the last 32000 measures



#### 5.20 Deactivate the tracker

The tracker must be hibernated (sleeping mode) at the end of the campaign

or test measurements to preserve its batteries during storage.

- Right-click on the line of the tracker then « set to hibernate mode »
- Check that the status has been changed to « **Hibernating** »

RFMonitor PREMIL	JM - 7 . 10 . 7	. 22 - v	vorkspace	e_2018-1	2-26.xml							
File View Databas	e Tools S	ettings	Session	n ?								
Description	Product t	Alerts	Confi	ID	Serial number	Battery	RF settings	Next transmi	measures	Device's commands	Current mode/status	Sensor: 1
TRE TEST	TRE35 - 2		X	2022	TRE0007E6	🔋 88% / 3.49V	Canal 7	?	16 measures	None	Hibernating	

To reactivate the tracker, simply swipe the magnet on the magnet area. The RF-To USB key must be plugged in.

# 6 BATTERY REPLACEMENT

The user can change the batteries himself.

Open the device and change the battery in a dry environment. The device must be clean and free of dust. Clean it if necessary before opening it.

Use a PH2 cruciform screwdriver. Unscrew the 4 screws on the cover of device

You can then either use a Lithium Thionyl battery, size A with a special connector (recommended for a longer battery life), or an alkaline battery, size AA / LR6 (the autonomy and the operating temperature will be reduced).

After changing the battery, tighten the 4 screws of the cover.

-Please note that Newsteo also provides battery, do not hesitate to contact us-

# 7 INSTALLATION OF DB MONITOR TO ACCESS THE DATA

 Once RF Monitor has been installed, launch DB Monitor by double clicking on the shortcut created on the desktop or from the « Start menu »



Display curves of measure	5
Configuration	F3
Start recording	
Start booster mode	
Set to hibernate mode	
Download data	
Erase data	
Refresh	
Reports root directory	
Other commands	,
Delete Device	Suppr
Clean list	

•	On the first window of the configuration wizard,	Language,
	select the language then click on « <i>next</i> » .	Before proceeding, please select software language in list above :           English

➡ Next >

- In the database window of the configuration wizard, select « Local database »
- Enter the path of the local database, test the connection then « Save »

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ebmonitor.com
nection
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 On the finalisation window of the configuration wizard, click on « validate » then click on « Finish ».

# 8 TRACKER MEASUREMENTS

# 8.1 Measurements at regular intervals

Depending on the frequency set by the user, the tracker measures, timestamps and stores:

- Temperature
- The tilt of the device on each of the 3 axis
- Humidity (TRE37, TRE38)
- Brightness (TRE38)

#### Pdf extract report

Packet	Date	Time	Ax	Ay	Az	AngleX	AngleY	AngleZ
000004	2018/12/26	16:55:17	0.011 G	-0.008 G	1.010 G	0.645 °	-0.448 °	90.000 °
000006	2018/12/26	16:55:20	-0.000 G	0.000 G	1.002 G	-0.027 °	0.000 °	90.000 °
800000	2018/12/26	16:55:30	-0.000 G	0.008 G	1.014 G	-0.027 °	0.448 °	90.000 °
000010	2018/12/26	16:55:40	0.007 G	-0.004 G	1.010 G	0.421 °	-0.224 °	90.000 °

Packet	Date	Time	event	status	VCC	Alcaline	Lithium	Board Temp
000001	2018/12/26	16:55:13	erase_data	0.000	2.970 V	0.290 V	3.500 V	24.350 °C
000002	2018/12/26	16:55:14	start_camp	0.000	2.970 V	0.290 V	3.500 V	24.350 °C
000025	2018/12/26	16:56:44	stop_camp	1.000	2.970 V	0.300 V	3.500 V	24.350 °C

Packet	Date	Time	Temperature
000003	2018/12/26	16:55:17	24.350 °C
	2018/12/26	16:55:20	24.350 °C
	2018/12/26	16:55:30	24.350 °C
000009	2018/12/26	16:55:40	24.350 °C

#### 8.2 Measurements in case of shocks

In case of shocks when the acceleration data - Acc Norm - exceeds the threshold set by the user, the tracker measures, timestamps and stores the following values:

- Maximum acceleration on the 3 axis: Max Ax, Max Ay, Max Az
- Calculation of the vector acceleration norm: Acc Norm
- Calculation of energy on the 3 axis: Energy X, Energy Y, Energy Z
- Calculation of the energy vector norm: Energy Norm
- Shock duration

The measurements are made by a 3-axis accelerometer, the unit of measurement is in g (unit for gravitation).

The accelerometer takes measures at a frequency of 3200Hz which ensures that no shock can be missed.

#### Pdf extract report

Bloc : Shocks

Packet	Date	Time	Max Ax	Max Ay	Max Az	Duration	Acc Norm
000006	2018/12/28	11:09:23	0.840 G	0.801 G	1.578 G	25.000 ms	1.959 G
	2018/12/28	11:09:32	9.148 G	3.125 G	3.688 G	4262.00 ms	10.347 G
	2018/12/28	11:09:33	13.813 G	15.977 G	15.813 G	777.000 ms	26.383 G

#### 8.3 Measurements in case of free fall

In case of a **free fall** when the value exceeds the threshold set by the user, the tracker measures, timestamps and stores the following values:

- Free fall height
- Maximum acceleration on the 3 axis: Max Ax, Max Ay, Max Az
- Calculation of the norm of the vector acceleration: Acc Norm

- Calculation of the energy on the 3 axis : Energy X, Energy Y, Energy Z
- Calculation of the energy vector norm : Energy Norm

#### <u>Pdf extract report</u>

Bloc : FreeFall				
Packet	Date	Time	Height	Energy
000013	2018/12/28	11:09:42	36.556 cm	3.586 J/kg

#### 8.4 Measurements when a parcel or a tracker is opened

Thanks to its external brightness sensor

- When a parcel is opened, the trackers record the information
- When the tracker TRE38 is opened, the tracker records the information

#### 8.5 Energy measurements

The energy measurement is calculated from a function that takes into account the acceleration value and the duration of these accelerations.

# 8.6 Earth gravity

The 1g of Earth gravity is measured and displayed on RF Monitor when the TRE is in « LIVE » mode. In the event of a shock, the firmware deduces the 1g of Earth gravity from the acceleration measurements generated by the shock.

#### 8.7 Determination of shock thresholds

If the acceleration threshold is set too low (for example 1.5 g) the memory of the tracker will be quickly full.

To avoid such a situation, pre-tests must be carried out with the TRE, configured in « LIVE » mode and fixed on its final support, to determine the relevant threshold that should be used during registration campaigns.

# 8.9 Interpretation of shock and energy measurements

Shocks are accelerations of very high amplitude. For example, an accelerometer that falls from a height of 20 cm on a sheet of steel 5 cm thick will be subjected to an acceleration of 8000 g at impact, and on a notebook of 50 pages thick, it will be subjected to an acceleration of 90 g

The values of the acceleration measures depend on several physical parameters:

- Rigidity of the structure
- Flexibility of the TRE support
- Distance between the shock and the positioning of the TRE

The TRE measures the value, the duration and the energy of the shock, these 3 magnitudes, associated with a test campaign will allow users to interpret a part of the events which are at the origin of the shocks.

# 8.10 Acceleration measurements : Acc Norm

Acc Norm represents the norm of vector v (Ax,Ay,Az ) :



# 8.11 Tilt measurements: angle X, angle Y, angle Z

Angle X, angle Y, angle Z = angle of axis x, y and z on a horizontal plane

Case n° 1 : The TRE is placed on a horizontal plane



 $\theta Ay = 0^{\circ} \text{ or } 180^{\circ} \ \theta Ax = 0^{\circ} \text{ or } 180^{\circ} \ \theta Az = 90^{\circ}$ 

The axis Z of the TRE is perpendicular to the horizontal plane

Case n° 2 : Titling of the TRE toward the horizontal plane



# ANNEX : TECHNICAL DATA

MAIN FEATURES	
Operating temperature range	-40°C to 60°C with Thionyle lithium batteries , size A with a specific connector -10°C to +60°C with alkaline batteries, size AA / LR6 Recommended temperature range to maximize the device autonomy : +5°C to +35°C.
Batteries autonomy	@25°C 2 years, with the battery supplied (Thionyle Lithium battery, size A)
	User-replaceable battery
Flash memory	16 Mbits Flash equivalent to 129000 measurement blocks (a shock takes 2 blocs)
	For example, it allows a 2 years campaign :
	- With a periodic measurement (temperature and tilt) every 15 minutes (70080
	recordings)
	- And 29000 shocks
Radio communication	Operating on the ISM band
	This device is designed to be used on the European market (using the 868MHz band).
Radio frequence range	100 meters in free field
IP Level	IP54