NVS Sensor User Guide

NVS-100 Manual

:: MANUAL ::

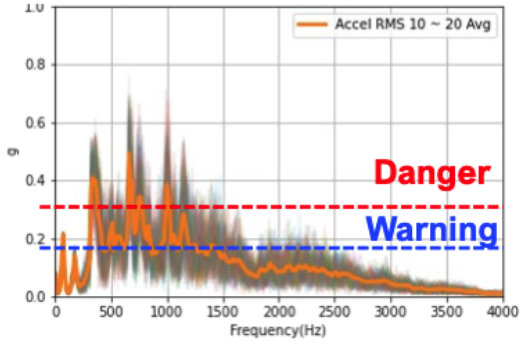
1. Product Introduction

The NVS-100 and NVS-150 are vehicle diagnostic sensors specifically designed for use by mechanics.

These devices attach to a vehicle to measure vibrations and noises, which help assess the condition of its parts. The NVS-150 connects to the NVS-100 via a USB cable and offers a broader range of vibration measurement capabilities, enhancing precision in data collection for specific vehicle components.

[Frequency Component Reading]

The NVS-100 and NVS-150 can store acceleration and noise data for up to 30 seconds at a sampling rate of 25600 Hz. They perform real-time frequency analysis and transmit amplitude values in meters per second squared (m/s^2) and decibels (dB). The diagnostic algorithm in the frequency domain enables users to customize the desired frequency band (0 to 10 kHz), set warning and danger thresholds, and track the number of times these thresholds are exceeded. Diagnostics are then classified into categories: Pass, Warning, or Danger, based on these configurations.



Reading List	Setting
Frequency band setting	Set the frequency band item to be detected(up to 10)
Warning threshold by frequency band	Set detection threshold for Warning by specified frequency band item
Danger threshold by frequency band	Set detection threshold for Danger by specified frequency band item

[Example of Distinguishing Warning and Danger Zones in Data Measured by NVS-100 and NVS-150]

[25k Vibration & 22k Noise Data Storage]

When the record button is pressed, the device saves the data from the 30 seconds immediately preceding the button press into a file. With support for both wired USB and wireless Bluetooth connectivity, the sensor's data files (csv, hex) can be easily transferred to a PC or mobile device for direct analysis.

💡 **Safety Warning**

- When charging, be sure to use a Standard USB 5V / DC power supply 5V/2A, 9V/1.67A, or PD (Power Delivery).
- Connect a data verification cable or a 5V charging cable to the DATA & CHARGE port, and connect the NVS-150 to the NVS-150 port.
- This product uses a semiconductor sensor, and exposure to external impacts or drops can cause product malfunction.

2. Product Components

- The product consists of the NVS-100 main unit, the probe-type NVS-150 sensor that connects to the main unit, an NVS-150 compatible mount, and a USB Type-C to C cable.

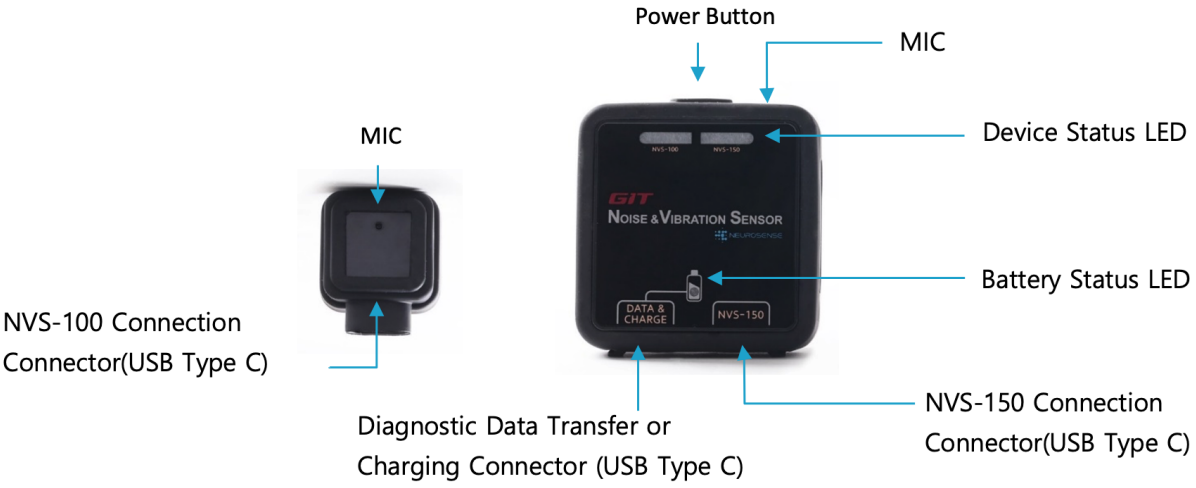
[NVS-100]

[NVS-150]

[USB C to C Cable(4m)]

[Mount bracket for NVS-150]

3. Device Overview



[**Power Button**]

Press and hold to turn the device on and off. Or press to check the battery level.

[**Device Status Indicator LED**]

The LED flashes or lights up depending on the status of the device. You can check the status of the device through the color of the LED, and whether it is on or flashing.

[**Battery Status Indicator LED**]

When the charging cable is connected, you can see the battery charging status of the device.

[**Microphone**]

This is a device for measuring noise.

[**NVS-150 Connector**]

This is a connector that connects the NVS-100 and NVS-150 using a USB type C to C cable.

[**DATA & CHARGE**]

Through the connection of USB type C, you can charge the device or load data from the device.

4. How to Use

1. Connect the VCI II to the OBD terminal and prepare the GDS tablet.
2. Press the NVS-100 power button for 5 seconds to turn it on. The red LED turns on.
3. Connect the tablet and NVS-100 according to the instructions in the GDS tablet.
   Once the wireless connection is complete, the left status LED turns green.
4. Select the vehicle type and the item you want to diagnose according to the instructions in the GDS tablet. Connect the NVS-100 and NVS-150 with a USB C to C cable if necessary according to the GDS instructions.
5. After the diagnosis is complete, press and hold the power button for 5 seconds to turn it off. The red LED flashes and then turns off.

5. Product Status Display LED

You can check the status of the device through the status display LED.

> 💡 **Note!**
> - If the LED background is white, it indicates that the LED is turned off.
> - If there is a light-colored background, it means the white LED is turned on.

Power ON/OFF

LED Status	Blinking/On Status	Device Status
	All LED off	Power OFF status
	White blinks 3 times	Turning ON power
	Left LED illuminates in red	Power ON, Bluetooth standby
	Left LED blinks in red	Bluetooth standby over 3 min
	Red blinks 3 times	Turning OFF power

Device Status

LED Status	Blinking/On Status	Device Status
	Left LED green on	Connecting to the Tablet
	Left LED green blinking	Collecting NVS-100 data
	Left LED blue on	Charging USB connection
	Left LED blue blinking	Transfer files via Bluetooth
	Right LED green on	Connecting NVS-150
	Right LED green blinking	Collecting NVS-150 data
	Right LED blue on for 1 min	Diagnostic mode result PASS
	Right LED red on for 1 min	Diagnostic mode result FAIL
	Right LED yellow on	FW update status
	Right LED white on	FW update failure

Charging status(press power button once)

LED Status	Blinking/On status	Device Status
	Right LED green blinks 3 times	Battery above 50%
	Right LED yellow blinks 3 times	Battery above 20-50%
	Right LED red blinks 3 times	Battery below 20%

5. Battery Status Display LED

You can know the battery charging status of the device when the charging cable is connected to DATA&CHARGE.

Battery Status LED

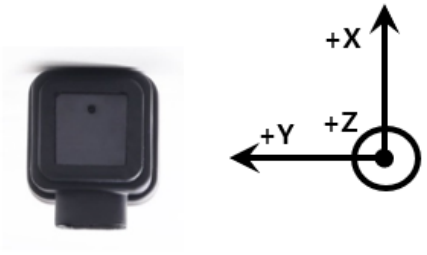
When connecting the charging cable

LED Status	Blinking/On Status	Device Status
	Green light on	Charging complete
	Red light on	Charging

6. Sensing Axis

The NVS-100 and NVS-150 collect data from x, y, z 3 axes.

[NVS-100]

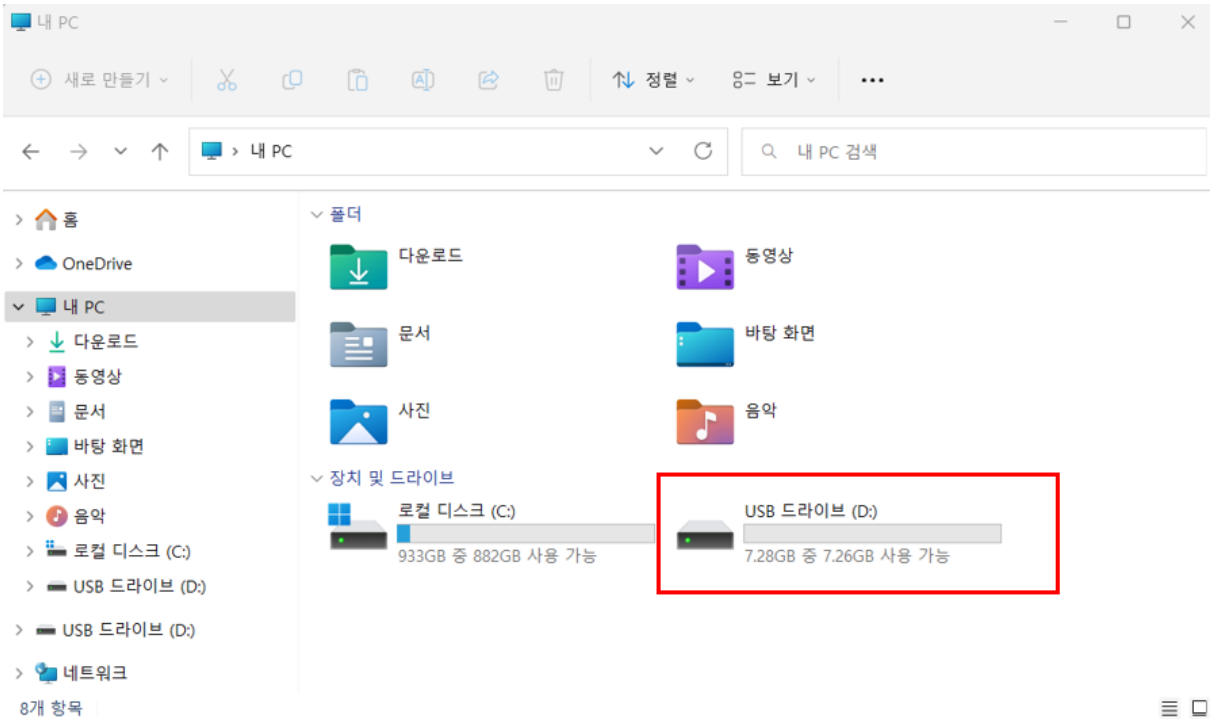


[NVS-150]

7. How to check raw data

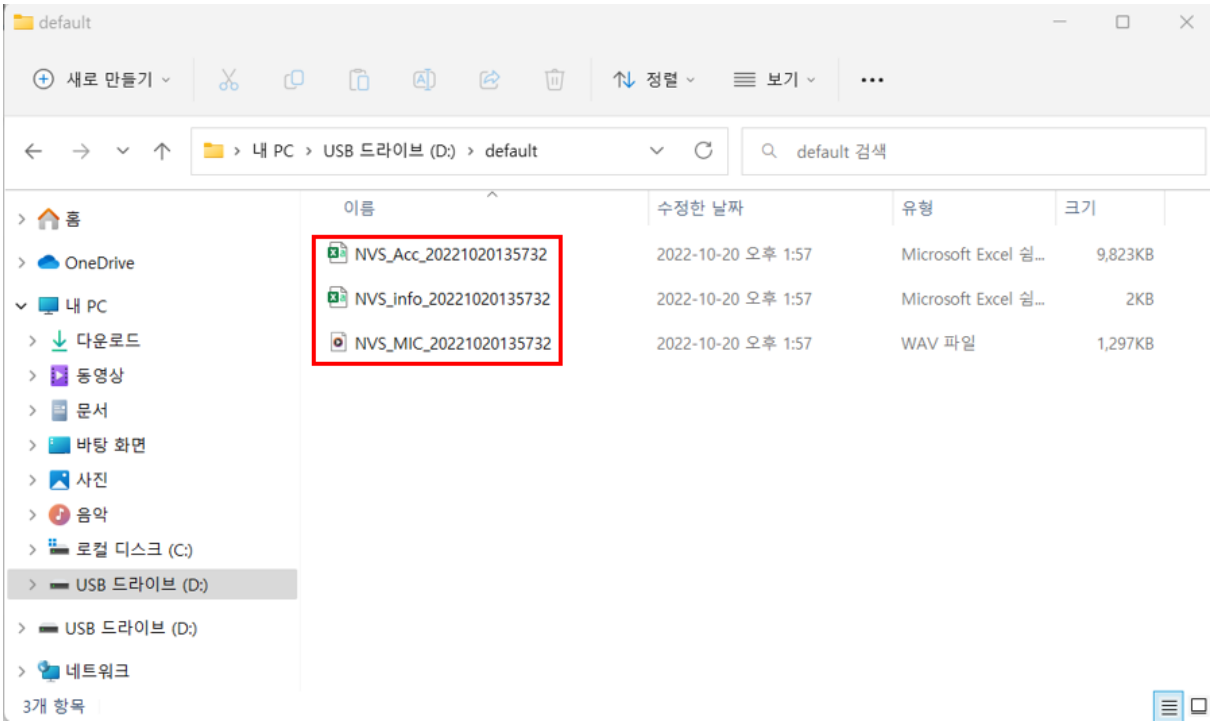
When you start the Accelerometer and MIC Recording on the NVS-100 and NVS-150, metadata, acceleration data, and noise data are stored in the sensor. These stored data files can be checked on the user's mobile device using Bluetooth LE wireless communication or USB communication.

Connect a USB C type cable to the Data & Charge port of the NVS-100 device and connect the other end to the PC. The NVS-100 is recognized like a regular USB storage device, and can be checked in My PC's devices and drives.



You can find three files inside when you access the drive.

NVSS_info_save date.csv
NVSS_Acc_save date.csv
NVSS_MIC_save date.wav



You can check the data even when the USB C type cable is connected to the Data & Charge port of the NVS-100 device and the other port is connected to a mobile device (Android mobile phone or tablet).

Check the files in SRM32 Mass Storage.

📎 NVSS_info_save date.csv
NVSS_Acc_save date.csv
NVSS_MIC_save date.wav

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8. Detailed Data File Format

- **Meta Data format**

In the case of Meta Data, it is saved with the file name NVSS_info_save date.csv, and the data contained within the file includes serial number, operation Mode, whether the Accelerometer sensor is On/Off, Accelerometer sensor settings (Range, Sensitivity, ODR), whether the MIC sensor is On/Off, MIC sensor settings (Bit information, Frequency), algorithm information, and BLE ASCII text.

1	NRF52840	f8cba905a2e3									
2	STMH745I	0049003c3139510f32393630									
3	NVS-100/150(Accel)	100									
4	NVS-100/150(Audio)	100									
5	SAVED TIME	2022-10-24 23:11									
6	Accel	1									
7	ACCEL_FILE_EXT	csv									
8	MAN_ID(0x00)	0x4b696f6e									
9	PART_ID(0x01)	0x3d01									
10	G-range Select	2g									
11	Output Data Rate (Hz)	25600									
12	gahz	1	21	22	30	40	50	160	10	11	42
13	gasw	34406.3984	34406.3984	34406.3984	34406.3984	34406.3984	34406.3984	34406.3984	34406.3984	34406.3984	34406.3984
14	gasd	47513.6016	47513.6016	47513.6016	47513.6016	47513.6016	47513.6016	47513.6016	47513.6016	47513.6016	47513.6016
15	gaco	10	10	10	10	10	10	10	10	10	10
16	accel_start_time	11:38.1									
17	accel_end_time	11:43.2									
18	accel_elapse_time	5.022									
19	accel_receive_cnt	129802									
20	accel_cal_odr	25846									
21	Audio	1									
22	AUDIO_FORMAT	PCM									
23	NUM_CHANNELS	1									
24	SAMPLE_RATE	22050									
25	BITS_PER_SAMPLE	16									
26	mahz	1	10	20	30	40	50	160	9	10	11
27	masw	40	40	40	40	40	40	40	40	40	40
28	masd	99	99	99	99	99	99	99	99	99	99
29	maco	10	10	10	10	10	10	10	10	10	10
30	audio_start_time	11:38.1									
31	audio_end_time	11:43.2									
32	audio_elapse_time	5.044									
33	audio_recive_cnt	112640									
34	audio_cal_odr	22331									
35	device info										

I have arbitrarily marked numbers on the left side of the example screen at the top. The numbers and the information written in the corresponding columns are as follows.

1	Nordic Serial Number	18	End of Measurement~Sensor Operation Time Difference
2	ST Serial Number	19	Amount of Received Data
3	ACCEL Sensor Selection (100/150)	20	Final SAMPLING RATE
4	MIC Sensor Selection (100/150)	21	MIC Sensor ON/OFF status (0: OFF/ 1: ON)
5	Storage Time	22	Storage Format
6	ACCELEROMETER SENSOR ON/OFF status (0: OFF/ 1: ON)	23	Number of Channels
7	Storage Format (CSV, HEX)	24	Set SAMPLING RATE
8	Sensor Manufacturer ID	25	BITS PER SAMPLE

9	Sensor Part ID	26	Setting of 10 Frequency Items of Algorithm
10	Set Measurement Range	27	WARNING SPEC per Frequency
11	Set SAMPLING RATE	28	DANGER SPEC per Frequency
12	Setting of 10 Frequency Items of Algorithm	29	Algorithm Judgment Criteria Count
13	Set WARNING SPEC per Frequency	30	Sensor Operation Start Time
14	Set DANGER SPEC per Frequency	31	End of Measurement Time
15	Set Count of Algorithm Judgment Criteria	32	End of Measurement~Sensor Operation Time Difference
16	Sensor Operation Start Time	33	Amount of Received Data
17	End of Measurement Time	34	Final SAMPLING RATE
		35	Set Test Information

- **Accelerometer Data Format**

In the case of Accel Data, it is saved with a file name of NVSS_Acc_Storage Date.csv, and the data included in the file is stored as Raw data detected for each x, y, z axis.

The conversion formula for Accel g value varies by Range (values that can be set by the user corresponding to Sensitivity 2, 4, 8, 16, 32, 64g) as follows.

$$Raw\ Amplitude \times \frac{(Range)}{32768\ digit} = G\ converted\ Amplitude$$

	A	B	C
1	-2076	-726	16083
2	-1547	121	16423
3	-770	32	16654
4	-408	15	16641
5	-287	345	16562
6	-254	403	16452
7	-215	575	16473
8	-318	462	16532
9	-510	385	16559
10	-671	228	16426
11	-723	154	16340
12	-530	71	16567
13	-272	-355	16698
14	-224	-529	16637
15	-249	-102	16681

$$EX) \ -2076 \times \frac{(2g)}{32768\ digit} = 0.126\ G$$

File Name	NVSS_Acc_save date.csv
Stored Information	- Raw data - X-axis / Y-axis / Z-axis

- **MIC Data Format**

In the case of MIC Data, it is saved as a file named NVSS_MIC_Storage Time.wav, and the Noise detected by NVS-100 or NVS-150 is saved. The MIC dB conversion formula is as follows.

$$20log_{10}\left(\frac{Raw\ Amplitude}{524288\ digit}\right) + 120dB = dB\ converted\ Amplitude$$

File Name	NVSS_MIC_save date.wav
Stored Information	- MIC data

9. How to Charge the Device

- Connect a 5V USB C cable to the DATA & CHARGE port to charge.
- It takes up to 3 hours to fully charge from a discharged state.
- Charging time and usage time can vary depending on the USB step output current and external temperature.
- If there is no remaining battery, the product's power will not turn on even if you connect a charger.
- Please charge the battery for a few minutes before turning on the power.

10. FAQ

- I can't turn on the device even if I press the power button

→ Please charge the battery with a charger and then turn on the device.

- How many hours can I use it if I charge it?

→ In the case of NVS100, it can be used for about 5 hours when fully charged. If you use NVS150 together, you can use it for about 3 hours.

11. Specification

- Power Specification

Item	Min	Typ	Max	Unit
Power Supply Voltage*		5.0		V
Power On Voltage**		3.1		V
Current consumption*** – sensor active mode (NVS-100)		120		mA
Current consumption – sensor active mode (NVS-150)		50		mA
Voltage at end of Discharge		2.7		V
Charging Current Limit		256		mA

* Recommended for use: Standard USB 5V / DC Power Supply 5V/2A, 9V/1.67A, PD(Power Delivery) charger.

** Power operation when internal battery voltage is 3.1V or higher.

***Current consumptiond may vary depending on firmware updates.

- NVS-100 Specification

Classification			Specification			Note
Mechanical	Size (mm)		55 x 54 x 19.5mm (Sensor + Rubber Bumper) 55 x 54 x 27.5mm (Sensor + Rubber Bumper + Magnet)			
	Weight		120g			
Electrical	Input Voltage, Current		5V DC, 256mA			Typ
	Cable Type		USB C Type			
Vibration	Measurement		Tri-Axis (X, Y, Z)			
	Acceleration Range		±2g, ±4g, ±8g, ±16g			
	Sensitivity	Conditions	Min	Typical	Max	counts/g
		FS = 2G	15401	16384	17367	
		FS = 4G	7700	8192	8684	
		FS = 8G	3850	4096	4342	
		FS = 16G	1925	2048	2171	
	Sampling Rate		0.781Hz, 1.563Hz, 3.125Hz, 6.25Hz, 12.5Hz, 25Hz, 50Hz, 100Hz, 200Hz, 400Hz, 800Hz, 1600Hz, 3200Hz, 6400Hz, 12800Hz, 25600Hz			
	Data Format		csv, hex			
	Signal processing resolution		2048 point			
Sound	Measurement		Max 94dB			
	Sensitivity		-26dBFS Condition : 94dB SPL@1KHz			Typ
	Signal to Noise Ratio (SNR)		64.5dB(A) Condition : 94dB SPL@1KHz, A-weighted			Typ
	Sampling Rate		22050Hz			
	Data Format		16bit wav			
	Signal processing resolution		2048 point			
Battery	Lithium Polymer		3.7V / 500mAh			
Environmental	Operating Temperature Range		-20℃ to +55℃			
Interface	Data Interface		Bluetooth® LE 5.0			

- NVS-150 Specification

Classification			Specification			Note
Mechanical	Size (mm)		32 x 26.8 x 21mm (Sensor + Rubber Bumper + Magnet)			
	Weight		24g			
Electrical	Input Voltage, Current		4.18V DC, 50mA			Typ
	Cable Type		USB C Type			
Vibration	Measurement		Tri-Axis (X, Y, Z)			
	Acceleration Range		±2g, ±4g, ±8g, ±16g, ±32g, ±64g			
	Sensitivity	Conditions	Min	Typical	Max	counts/g
		FS = 2G	15401	16384	17367	
		FS = 4G	7700	8192	8684	
		FS = 8G	3850	4096	4342	
		FS = 16G	1925	2048	2171	
		FS = 32G	942	1024	1106	
		FS = 64G	471	512	553	
	Sampling Rate		0.781Hz, 1.563Hz, 3.125Hz, 6.25Hz, 12.5Hz, 25Hz, 50Hz, 100Hz, 200Hz, 400Hz, 800Hz, 1600Hz, 3200Hz, 6400Hz, 12800Hz, 25600Hz			
	Data Format		csv, hex			
	Signal processing resolution		2048 point			
Sound	Measurement		Max 94dB			
	Sensitivity		-26dBFS Condition : 94dB SPL@1KHz			Typ
	Signal to Noise Ratio (SNR)		64.5dB(A) Condition : 94dB SPL@1KHz, A-weighted			Typ
	Output Data Rate		22050Hz			
	Data Format		16bit wav			
	Signal processing resolution		2048 point			
Environmental	Operating Temperature Range		-20℃ to +75℃			
Interface	Data Interface		USB CDC			

- Wireless Specification

Classification	Specification	Note
Bluetooth Version	BLE(Bluetooth Low Energy) v5.0	
Operating Frequency Range	2.400~2.4835 GHz	
Maximum Output Power	8dBm	
Bluetooth Channel	0~39ch	
Bluetooth Profile	Custom	

12. Certification Information

- Name of the equipment: Specified Low Power Radio Device (Wireless device for wireless data communication system)
- Model name: NVS-100, NVS-150
- KC Certification Number: R-C-nsa-NVS-100, R-C-nsa-NVS-150
- Manufacturing date: Separately marked
- Manufacturer / Country of manufacture: Neurosense / South Korea

- FCC Caution

  FCC Part 15.19
  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.

  FCC Part 15.21
  Any changes or modifications (including the antennas) to this device that are not expressly approved by the manufacturer may void the user's authority to operate the equipment.

  FCC RF Radiation Exposure Statement: This equipment complies with FCC RF Radiation exposure limits set forth for an uncontrolled environment.
  This device and its antenna must not be co-located or operating in conjunction with any other antenna or transmitter.

- FCC ID : 2BF76-NVS100

- CE Caution

  Declaration of Conformity
  Neurosense Co., Ltd. declares that this device complies with the essential requirements and relevant provisions of Directive 2014/53/EU and the UK Radio Equipment Regulation 2017.
  Go to
  http://neurosense.co.kr/ to view the Declaration of Conformity.