

Test report No:  
 NIE: 64009RAN.002

## Assessment report

### RF EXPOSURE REPORT ACCORDING TO FCC 47 CFR Part 2.1091 ISED RSS-102 Issue 5:2015

(*) Identification of item under evaluation	Pressure and Temperature measurement sensor
(*) Trademark	Intuitu
(*) Model and /or type reference	Intuitu Sensor 9Bar V001
Other identification of the product	HW version: SNS_08 B8 SW Version: 1.0.0
(*) Features	BLE, 433MHz RF transmitter, 125kHz LF receiver
Manufacturer	NOKIAN TYRES PLC PIRKKALAISTIE 7, 37101 NOKIA, FINLAND
Test method requested, standard	FCC 47 CFR Part 2.1091 Radiofrequency radiation exposure evaluation: mobile devices. ISED RSS-102 Issue 5 (2015-03) – Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) IEEE Std C95.3™ -2002 (R2008). IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields With Respect to Human Exposure to Such Fields, 100 kHz–300 GHz
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Miguel Lacave Antennas Lab Manager
Date of issue	2020-08-25
Report template No	FAN36_01 (*) "Data provided by the client"

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## Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested", "General description of the device").
2. Maximum output power, maximum antenna gain and use distance information.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

## Identification of the client

Company name: NOKIAN TYRES PLC

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## Document history

Report number	Date	Description
64009RAN.002	2020-08-25	First release

## General description of the device under evaluation

The device under evaluation consists of a tire pressure and temperature sensor with BLE interface to mobile application.

According to the manufacturer, during its normal use, the separation distance between the radiating structures of the device and nearby users will be greater than 20cm. In order to perform the assessment a conservative evaluation distance of 20 cm has been used.

The equipment specifications declared by the manufacturer for each supported technology and band are:

Technology / Mode	Band	Frequency (MHz)	Maximum Conducted Output Power RMS Burst (dBm)	Antenna peak gain (dBi)	Maximum E.I.R.P. (dBm)	Maximum E.I.R.P. (mW)
BTLE	ISM	2400 - 2483.5	5.10	-0.60	4.50	2.82
Proprietary	ISM	433MHz	8.00	-22.60	-14.60	0.03

**Table 1:** Equipment specifications

## RF Exposure Assessment result and verdict

### FCC assessment:

Limits for Maximum Permissible Exposure (MPE) to comply with FCC 47 CFR § 2.1091 are defined in “§1.1310 Radiation Exposure limits, paragraph (e)”:

Technology / Mode	Band	Frequency (MHz)	Distance (cm)	Power density (mW/cm <sup>2</sup> )	FCC General Population Limit (mW/cm <sup>2</sup> )	Verdict
BTLE	ISM	2400 - 2483.5	20.00	0.000561	1.00	<b>Pass</b>
Proprietary	ISM	433MHz	20.00	0.000007	0.29	<b>Pass</b>

**Table 2:** Assessment result and verdict

### ISED assessment:

Limits for RF Field Strength to comply with RSS-102 Issue 5 are defined in “Health Canada’s RF exposure guideline, Safety code 6”:

Technology / Mode	Band	Frequency (MHz)	Distance (cm)	Power density (W/m <sup>2</sup> )	ISED General Public Limit (W/m <sup>2</sup> )	Verdict
BTLE	ISM	2400 - 2483.5	20.00	0.005607	5.35	<b>Pass</b>
Proprietary	ISM	433MHz	20.00	0.000069	1.66	<b>Pass</b>

**Table 3:** Assessment result and verdict

## Appendix A: FCC RF Exposure information

## FCC RF Exposure evaluation for mobile devices

Devices operating in standalone mobile device exposure conditions may contain a single transmitter or multiple transmitters that do not transmit simultaneously. A minimum test separation distance  $\geq 20$  cm is required between the antenna and radiating structures of the device and nearby persons to apply mobile device exposure limits. The distance must be at least 20 cm and fully supported by the operating and installation configurations of the transmitter and its antenna(s), according to the source-based time-averaged maximum power requirements of § 2.1091(d)(2). In cases where cable losses or other attenuations are applied to determine compliance, the most conservative operating configurations and exposure conditions must be evaluated. The minimum test separation distance required for a device to comply with mobile device exposure conditions must be clearly identified in the installation and operating instructions, for all installation and exposure conditions, to enable users and installers to comply with RF exposure requirements. For mobile devices that have the potential to operate in portable device exposure conditions, similar to the configurations described in § 2.1091(d)(4), a KDB inquiry is required to determine the SAR test requirements for demonstrating compliance.

When a device qualifies for the categorical exclusion provision of § 2.1091(c), the minimum test separation distance may be estimated, when applicable, by simple calculations according to plane-wave equivalent conditions, to ensure the transmitter and its antenna(s) can operate in manners that meet or exceed the estimated distance. The source-based time-averaged maximum radiated power, according to the maximum antenna gain, must be applied to calculate the field strength and power density required to establish the minimum test separation distance. When the estimated test separation distance becomes overly conservative and does not support compliance, MPE measurement or computational modeling may be used to determine the required minimum separation distance.

According to §1.1310 Radiofrequency radiation exposure limits, paragraph (e), the limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields are:

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
<b>(A) Limits for Occupational/Controlled Exposure</b>				
0.3–3.0 .....	614	1.63	* 100	6
3.0–30 .....	1842/f	4.89/f	* 900/f <sup>2</sup>	6
30–300 .....	61.4	0.163	1.0	6
300–1,500 .....	.....	.....	f/300	6
1,500–100,000 .....	.....	.....	5	6
<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
0.3–1.34 .....	614	1.63	* 100	30
1.34–30 .....	824/f	2.19/f	* 180/f <sup>2</sup>	30
30–300 .....	27.5	0.073	0.2	30
300–1,500 .....	.....	.....	f/1500	30
1,500–100,000 .....	.....	.....	1.0	30

f = frequency in MHz \* = Plane-wave equivalent power density

## FCC MPE Evaluation

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Each supported transmission technology will be evaluated to determine if it is in compliance with limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields.

In order to perform the assessment, the following equations have been used for the calculations; these equations are accurate in the far-field of an antenna and will over-predict power density in the near field, where they could be used for making a "worst-case" or conservative prediction:

$$\text{Power density: } S[mW / cm^2] = \frac{P_{E.I.R.P.}[mW]}{4\pi R[cm]^2}$$

Where:

$S$  = power density

$P_{E.I.R.P.}$  = Equivalent isotropically radiated power

$R$  = distance to the center of radiation of the antenna (evaluation distance)



## Appendix B: ISED RF Exposure information

## ISED RF Exposure evaluation for mobile devices

According to RSS-102 Issue 5, Paragraph “4. Exposure Limits”, Industry of Canada has adopted the RF field strength limits established in Health Canada’s RF exposure guideline, Safety code 6:

**Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)**

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m <sup>2</sup> )	Reference Period (minutes)
0.003-10 <sup>21</sup>	83	90	-	Instantaneous*
0.1-10	-	0.73/ <i>f</i>	-	6**
1.1-10	87/ <i>f</i> <sup>0.5</sup>	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ <i>f</i> <sup>0.25</sup>	0.1540/ <i>f</i> <sup>0.25</sup>	8.944/ <i>f</i> <sup>0.5</sup>	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 <i>f</i> <sup>0.3417</sup>	0.008335 <i>f</i> <sup>0.3417</sup>	0.02619 <i>f</i> <sup>0.6834</sup>	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ <i>f</i> <sup>1.2</sup>
150000-300000	0.158 <i>f</i> <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> <i>f</i> <sup>0.5</sup>	6.67 x 10 <sup>-3</sup> <i>f</i>	616000/ <i>f</i> <sup>1.2</sup>
Note: <i>f</i> is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).				

**Table 6: RF Field Strength Limits for Controlled Use Devices (Controlled Environment)**

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m <sup>2</sup> )	Reference Period (minutes)
0.003-10 <sup>23</sup>	170	180	-	Instantaneous*
0.1-10	-	1.6/ <i>f</i>	-	6**
1.29-10	193/ <i>f</i> <sup>0.5</sup>	-	-	6**
10-20	61.4	0.163	10	6
20-48	129.8/ <i>f</i> <sup>0.25</sup>	0.3444/ <i>f</i> <sup>0.25</sup>	44.72/ <i>f</i> <sup>0.5</sup>	6
48-100	49.33	0.1309	6.455	6
100-6000	15.60 <i>f</i> <sup>0.25</sup>	0.04138 <i>f</i> <sup>0.25</sup>	0.6455 <i>f</i> <sup>0.5</sup>	6
6000-15000	137	0.364	50	6
15000-150000	137	0.364	50	616000/ <i>f</i> <sup>1.2</sup>
150000-300000	0.354 <i>f</i> <sup>0.5</sup>	9.40 x 10 <sup>-4</sup> <i>f</i> <sup>0.5</sup>	3.33 x 10 <sup>-4</sup> <i>f</i>	616000/ <i>f</i> <sup>1.2</sup>
Note: <i>f</i> is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).				

## ISED MPE Evaluation

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Each supported transmission technology will be evaluated to determine if it is in compliance with RSS-102 Issue 5, RF Field Strength Limits.

In order to perform the assessment, the following equations have been used for the calculations; these equations are accurate in the far-field of an antenna and will over-predict power density in the near field, where they could be used for making a "worst-case" or conservative prediction:

$$\text{Power density: } S[W/m^2] = \frac{P_{E.I.R.P.}[W]}{4\pi R[m]^2}$$

Where:

$S$  = power density

$P_{E.I.R.P.}$  = Equivalent isotropically radiated power

$R$  = distance to the center of radiation of the antenna (evaluation distance)