Test report issued under the responsibility of:
EMITECH MONTPELLIER laboratory
MRA US-EU Designation Number: FR0006
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RADIO TEST REPORT

FCC part 15.247
RSS-247_Issue 2, February 2017

Company ..... :	**SENSeOR SAS**
Address..... :	LE NAVIGATOR - BÂTIMENT B 505, ROUTE DES LUCIOLES 06560 VALBONNE SOPHIA ANTIPOLIS FRANCE

Test item description. ..... :	**Transceiver for SAW sensors**
Trade Mark. ..... :	HTR01 Transceiver for SAW sensors
Manufacturer. ..... :	SENSeOR
Model/Type reference..... :	HTR01-2AW
FCC ID..... :	2AEGUHTR01-2AW
IC. ..... :	20049-HTR01-2AW
Ratings..... :	24Vdc

Testing Laboratory ..... :	**EMITECH MONTPELLIER laboratory**
Address..... :	145 rue de Massacan 34740 VENDARGUES FRANCE

Report Reference No..... :	**R412-18-105367-1A**
Test procedure. ..... :	FCC IC Certification
Diffusion..... :	Mr PAUC
Applicant's name. ..... :	SENSEOR
Date of issue..... :	The December 10th of 2018
Total number of pages..... :	17
Revision. ..... :	0
Modified page(s)..... :	Creation
Compiled by..... :	Olivier AELBRECHT
Approved by (+ signature)..... :	David MONTAULON (Technical Manager)

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REPORT INDEX:

1. GENERAL INFORMATIONS

This document submits the results of Radio tests performed on the equipment **Transceiver for SAW sensors** (denominated hereafter E.U.T.: equipment under test) according to document(s) listed in §2 of this test report.

TESTING PROCEDURE AND TESTING LOCATION:

Testing Laboratory	EMITECH MONTPELLIER laboratory & Open Area Test Site in SALINELLES (30)
Address	145 rue de Massacan 34740 VENDARGUES FRANCE
Test procedure.	FCC IC Certification
Tested by	Olivier AELBRECHT
Test supervisor	David MONTAULON
Date of receipt of test item	The December 6th of 2018
Date (s) of performance of tests	The December 6th of 2018

APPLICANT'S GENERAL INFORMATIONS:

Company name	SENSeOR SAS
Company address.	Le Navigator - Bâtiment B 505, route des Lucioles 06560 VALBONNE SOPHIA ANTIPOLIS FRANCE
Person(s) present during the tests.	Mr. JENDRZEJCZAK
Responsible.	Mr. PAUC

GENERAL REMARKS:

The test results presented in this report relate only to the object tested.
The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

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Throughout this report the decimal separator is point.

POSSIBLE TEST CASE VERDICTS:

Test case does not apply to the test object.	N/A
Information not communicated.	N/C
Test case not performed	N/P
Test object does meet the requirement.	P (Pass)
Test object does not meet the requirement.	F (Fail)
Test object was not subjected to all tests.	I (Inconclusive)

DEFINITIONS AND ABBREVIATIONS:

E.U.T.	Equipement under test	AE	Ancillary equipment
RBW	Resolution bandwidth	VBW	Video bandwidth
OATS	Open area test site	FAR	Full anechoic room
RF	Radio frequency	NTR	Nothing to report
SRD	Short Range Device	GPS	Global Positioning System

2. REFERENCE DOCUMENT(S)

NORMATIVE REFERENCES:

The following referenced documents are necessary for the application of the present test report.

FCC part 15
Code of federal regulations. Title 47- Telecommunication Chapter 1- Federal Communication Commission. Part 15- Radio frequency devices Subpart B- Unintentional Radiators. Limits and methods of measurement of radio disturbance. Characteristic of information technology equipment.

FCC part 15.231
Periodic operation in the band 40.66-40.70 MHz and above 70 MHz.

ANSI C 63.10:2013
American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

ANSI C 63.4:2014
American National Standard for Methods of measurement of Radio-Noise from low-voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

INFORMATIVE REFERENCES:

The following referenced documents are not necessary for the application of the present test report but they assist the user with regard to a particular subject area.

662911 D01 Multiple Transmitter Output v02r01
Emissions Testing of Transmitters with Multiple Outputs in the Same Band

412172 D01 Determining ERP and ERIP v01
Guidelines for Determining the Effective Radiated Power (ERP) and Equivalent Isotropically Radiated Power (EIRP) of a RF Transmitting System

3. EQUIPMENT TECHNICAL DESCRIPTION

3.1. Test Conditions

Test item description.	:	Transceiver for SAW sensors
Model/Type reference.	:	HTR01-2AW
Trade Mark.	:	SENSEOR
Serial number (S/N).	:	N/C
Part number (P/N).	:	N/C
Software version.	:	N/A
Firmware version.	:	N/C
Type of sample.	:	Serial
Function(s).	:	Transceiver for SAW sensors
Manufacturer name.	:	SENSeOR
Address.	:	Le Navigator - Bâtiment B 505, route des Lucioles 06560 VALBONNE SOPHIA ANTIPOLIS FRANCE

General product information:

The device allows to make a statement of temperature in several point of the cell and to send these information to a gateway.

3.2. EUT Picture

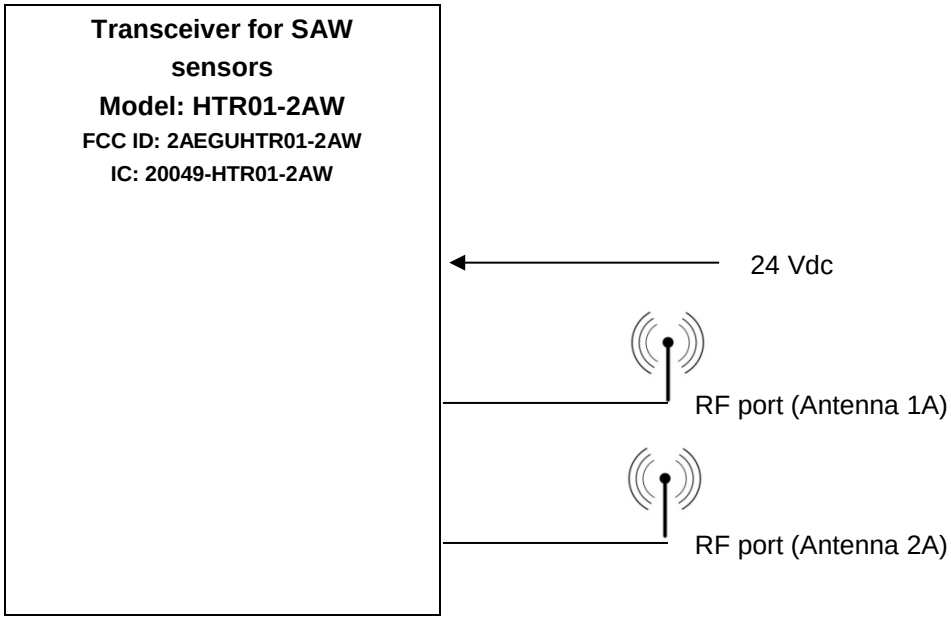
3.3. EUT Mechanical and Electrical Design

Power supply. ..... : 24Vdc
Power supply range. ..... : Not communicated
Power type. ..... : Power supply 24Vdc
Power (W). ..... : Not communicated
Nominal current (A). ..... : Not communicated
Dimensions (L x W x H) (cm) ..... : 10x10x2
Weight (kg). ..... : <0.5
Temperature range (°C). ..... : -20°C, 70°C
Ground bounding strap. ..... : No

Comments:

N/A

3.4. EUT Input/Output ports



PORT	NAME	TYPE	LENGHT	CABLE TYPE	COMMENTS
0	Main frame	Plastic	N/A	N/A	
1	Power Supply (24Vdc)	DC	N/A	N/A	-
2	RF port (Antenna 1)	I/O	<3m	Shielded	-
3	RF port (Antenna 2)	I/O	<3m	Shielded	-

AC/DC : AC/DC Converter port
I/O.....: Input or Output port
N/E .....: Non Electrical port

AC.....: Alternative current port
TP .....: Telecommunication port

DC.....: Discontinuous current port
RF.....: Radio frequency port

3.5. EUT Radio Specifications

a) GENERAL INFORMATIONS
According to manufacturer's declarations : EUT type..... : Transceiver Technology ..... : - Environmental profile..... : Data transmission Temperature range..... : -20°C, +70°C Antenna type ..... : External antenna Antenna Gain..... : -3.15 to 1.45dBi (depends of frequency) **Comments:** N/A
b) TRANSMITTER PARAMITTERS (TX)
Frequency bands..... : From 430MHz to 450MHz RF Power..... : N/C Number of channels / Separation..... : N/C Modulation type ..... : N/C Duty cycle ..... : N/C Tested frequency..... : 430MHz 440MHz 450MHz

4. RESULT SUMMARY

TEST DESIGNATION	SEVERITY	VERDICT	BASIC STANDARDS / COMMENTS
SUBPART A - GENERAL			
Labeling requirements		N/P	15.19 / See certification documents
Information to user		N/P	15.21 / See certification documents
Home-built devices		N/A	15.23
Kits		N/A	15.25
Special Accessories		N/A	15.27
Inspection by the Commission		N/A	15.29
Measurement standards		N/P	15.31
Test procedure for CPU boards and computer power supplies		N/A	15.32
Frequency range of radiated measurements		N/P	15.33
Measurement detector functions and bandwidths		N/P	15.35
Transition provisions for compliance with the rules		N/P	15.37 / See certification documents
SUBPART B – UNINTENTIONAL RADIATORS			
Equipment authorization			15.101
- Verification		N/A	
- Declaration of Conformity		N/A	
CPU boards and power supplies used in personal computers		N/A	15.102
Exempted device		N/A	15.103
Information to the user		N/P	15.105 / See certification documents
Conducted limits		N/P	15.107 / See original certification
Radiated emission limits	Class B	N/P	15.109
Antenna power conduction limits for receivers		N/A	15.111
Power line carrier systems		N/A	15.113
TV interface devices, including cable system terminal devices		N/A	15.115
TV broadcast receivers		N/A	15.117
Cable ready consumer electronics equipment		N/A	15.118
Program blocking technology requirements for TV receivers		N/A	15.120
Scanning receivers and frequency converters used with scanning receivers		N/A	15.121
Labeling of digital cable ready products		N/A	15.123
SUBPART C –INTENTIONAL RADIATORS			
Equipment authorization requirement		N/P	15.201 / Transmitter part is subject to

TEST DESIGNATION	SEVERITY	VERDICT	BASIC STANDARDS / COMMENTS
			Certification procedure
Certified operating frequency range		**N/A**	**15.202**
Antenna requirement		**N/P**	**15.203 / Antenna gain limitation to 6dBi**
External radio frequency power amplifiers and antenna modifications		**N/A**	**15.204**
Restricted bands of operation		**N/P**	**15.204**
Conducted limits	**Class B**	**N/P**	**15.207**
Radiated emission limits; general requirements	**Class B**	**N/P**	**15.209**
Tunnel radio systems		**N/A**	**15.211**
Modular transmitters		**N/A**	**15.212**
Cable locating equipment		**N/A**	**15.213**
Cordless telephones		**N/A**	**15.214**
Additional provisions to the general radiated emission limits		**N/P**	**15.215**
Operation in the band 40.66-40.70MHz, and above 70MHz			**15.231**
- **Automatically desactivate**		N/A	**a)(1)**
- **Automatically activate**		N/A	**a)(2)**
- **Alarm condition**		N/A	**a)(3)**
- **Duration of transmission for security systems**		N/A	**a)(4)**
- **Maximum Field Strength**		N/A	**b)**
- **Bandwidth for devices above 70MHz**		N/P	**c)**
- **Bandwidth for devices above within 40.66 to 40.70MHz**		N/A	**d)**
- **Maximum Field Strength for devices with a periodic operating rate other than a)**		PASS	**e) only the Field Strength of fundamental was measured**

Sample subject to the test complies with the requirements of the reference document(s) listed in §2 of this test report and, where applicable, with deviation(s) specified in this document.

To declare, or not, the compliance with the specifications, it was not explicitly taken account of uncertainty associated with the results.

Opinion(s) and interpretation(s): N/A

5. MEASUREMENT UNCERTAINTY

PARAMETER	MAXIMAL EMITECH UNCERTAINTY	MINIMAL STANDARD UNCERTAINTY
Radio frequency	± 1 x 10^{-7}	±1 x 10^{-7}
RF power, conducted		
RF power	± 0.8dB	± 1 dB
Power spectral density	± 2.3dB	± 3 dB
Occuped bandwidth		
RF power	± 1.2 %	± 5 %
Conducted emission (spurious)		
f ≤ 1 GHz	± 0.8 dB	± 3 dB
1 GHz - 12.75 GHz	± 1.6 dB	
Radiated emission (PAR / PIRE / RNE)		
f ≤ 62.5 MHz	± 5.1 dB	± 6 dB
62.5 MHz - 1 GHz	± 5.1 dB	± 6 dB
1 GHz - 18 GHz	± 5.2 dB	± 6 dB
18 GHz – 26 GHz	± 5.1 dB	± 6 dB
26 GHz – 40 GHz	± 5.4 dB	± 6 dB
PIRE and power spectral density with diode	± 5.4 dB	± 6 dB
Radiated emission (magnetic field)		
9kHz – 30MHz	± 2.7 dB	± 6 dB
Supply voltages	± 3 %	± 3 %
Temperature	± 1 °C	± 1°C
Humidity	± 5 %	± 5 %
Time / Duty cycle	± 4.4 %	± 5 %
Radiated emission (electric field for FCC standard)		
9kHz – 30MHz	± 2.7 dB	/
30MHz – 1GHz	± 5.2 dB	/
1GHz – 18GHz	± 5.3 dB	/
18GHz – 26GHz	± 5.5 dB	/
26GHz – 40GHz	± 5.5 dB	/

For the calcul of expanded uncertainty, the confidence interval is 95 % (k=2).

6. TEST CONDITIONS AND RESULTS

6.1. Maximum peak conducted power of the intentional radiator

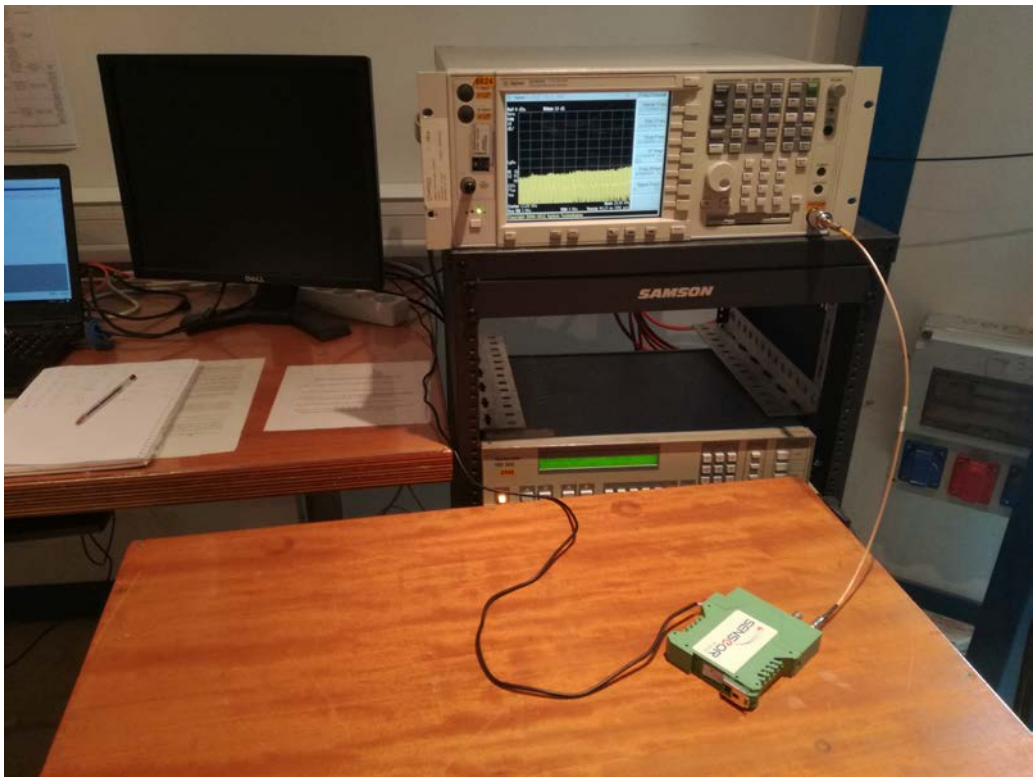
Reference standard:	FCC part 15 Radio part 15.231
Test method:	FCC part 15.231
Test description: EUT is connected to the measuring receiver via 50Ω attenuator(s).Only the highest levels are recorded.	

TESTED CONFIGURATION	RESULTS (dBm)	SEVERITY	RESULT TAB.	VERDICT
Low Channel- Antenna 1	-26.2	-	EMI6021	**PASS**
Low channel – Antenna 2	--26.0	-	EMI6022	**PASS**
Mid channel – Antenna 1	-25.8	-	EMI6021	**PASS**
Mid channel – Antenna 2	-25.8	-	EMI6022	**PASS**
High channel – Antenna 1	-26.9	-	EMI6021	**PASS**
High channel – Antenna 2	-26.0	-	EMI6022	**PASS**

LABORATORY PARAMETERS:	REQUIRED PRIOR TO THE TEST	DURING THE TEST
Ambient Temperature	15 to 35 °C	21.9 °C
Relative Humidity	20 to 75 %	43.9 %
Atmospheric pressure	N/A	1019 hPa
Test method deviation: N/A		
Supplementary information: N/A		

TEST EQUIPMENT USED					
CATEGORY	**BRAND**	**TYPE**	**IDENTIFIER**	**CAL. DATE**	**CAL. DUE**
Attenuator	Techniwave	TWSMA-10dB-18G-SMA	14671	21/09/2017	21/11/2019
Cable	Atem	SMA-0.3m	10268	29/10/2018	29/12/2020
Spectrum analyzer	Agilent Technologies	E4440A	5824	18/04/2018	18/06/2020
Software	Nexio		0000		
Thermohygrometer	Bioblock Scientific	Météostar	0963	27/12/2016	27/02/2019
Thermohygrometer	Testo	608-H1	7562	27/12/2016	27/02/2019

Blank cells = Permanent validity

TEST SETUP PHOTO(S)


MAXIMUM PEAK CONDUCTED POWER - GRAPH				
RF PORT (ANTENNA 1)				EMI6021
Test Case	**Power supply (Vdc)**	**Frequency (MHz)**	**Conducted Power (dBm)**	**Conducted Power (mW)**
Low Channel	24	430.0	-26.2	0.0024
Mid Channel	24	440.0	-25.8	0.0026
High Channel	24	450.0	-26.9	0.0020

MAXIMUM PEAK CONDUCTED POWER - GRAPH				
RF PORT (ANTENNA 2)				EMI6022
Test Case	**Power supply (Vdc)**	**Frequency (MHz)**	**Conducted Power (dBm)**	**Conducted Power (mW)**
Low Channel	24	430.0	-26.0	0.0025
Mid Channel	24	440.0	-25.8	0.0026
High Channel	24	450.0	-26.0	0.0025

6.2. Antenna Gain Measurement

Reference standard:	FCC part 15 Radio part 15.231
Test method:	412172 Determining ERP and ERIP DR01
Test description: 6) The Equivalent Isotropically Radiated Power (EIRP) of the device is measured in a radiated test configuration using the signal/antenna substitution techniques to compute the antenna gain.	

TESTED CONFIGURATION	PARAMETER	SEVERITY	RESULT TAB.	VERDICT
Low Channel- Antenna 1	see graph	-	EMI6023	**PASS**
Low channel – Antenna 2	see graph	-	EMI6024	**PASS**
Mid channel – Antenna 1	see graph	-	EMI6023	**PASS**
Mid channel – Antenna 2	see graph	-	EMI6024	**PASS**
High channel – Antenna 1	see graph	-	EMI6023	**PASS**
High channel – Antenna 2	see graph	-	EMI6024	**PASS**

LABORATORY PARAMETERS:	REQUIRED PRIOR TO THE TEST	DURING THE TEST
Ambient Temperature	15 to 35 °C	21.9 °C
Relative Humidity	20 to 75 %	43.9 %
Atmospheric pressure	N/A	1019 hPa
Test method deviation: N/A		
Supplementary information: N/A		

TEST EQUIPMENT USED					
CATEGORY	**BRAND**	**TYPE**	**IDENTIFIER**	**CAL. DATE**	**CAL. DUE**
Antenna	Rohde & Schwarz	HL223	1137	13/06/2018	13/08/2021
Attenuator	EMITECH	SUB.V1-H	14780	11/10/2017	11/12/2018
Attenuator	EMITECH	SUB.V1-V	14781	11/10/2017	11/12/2018
Cable	MegaPhase	TM18-N1N1-197	12840	09/05/2018	09/07/2020
Cable	MegaPhase	TM18-N1N1-118	12842	09/05/2018	09/07/2020
Cable	TechniWAVE	N-0.23m	14891	23/02/2018	23/04/2020
Receiver	Agilent Technologies	E4440A	5824	18/04/2018	18/06/2020
Shielded enclosure	RAY PROOF	C.V1	1123		
Software	Nexio		0000		
Thermohygrometer	Bioblock Scientific	Météostar	0963	27/12/2016	27/02/2019
Thermohygrometer	Testo	608-H1	7561	27/12/2016	27/02/2019

Blank cells = Permanent validity

TEST SETUP PHOTO(S) – ANTENNA GAIN MEASUREMNT

MAXIMUM PEAK CONDUCTED POWER - GRAPH					
ANTENNA 1					EMI6023
Test Case	**Power supply (Vdc)**	**Frequency (MHz)**	**EIRP (dBm)**	**Conducted Power (dBm)**	**Antenna Gain (dBi)**
Low Channel	24	430.0	-29.15	-26.2	-2.95
Mid Channel	24	440.0	-25.65	-25.8	0.15
High Channel	24	450.0	-25.45	-26.9	1.45

MAXIMUM PEAK CONDUCTED POWER - GRAPH					
ANTENNA 2					EMI6024
Test Case	**Power supply (Vdc)**	**Frequency (MHz)**	**EIRP (dBm)**	**Conducted Power (dBm)**	**Antenna Gain (dBi)**
Low Channel	24	430.0	-29.15	-26.0	-3.15
Mid Channel	24	440.0	-25.55	-25.8	0.25
High Channel	24	450.0	-24.55	-26.0	1.45

The Antenna Gain in dBi is computed using the formula : $G_{(dBi)} = EIRP_{(dBm)} – Conducted\ Power_{(dBm)}$

6.3. Total Radiated Field Strength Calculation.

Reference standard:	FCC part 15 Radio part 15.231
Test method:	662911 D01 Multiple Transmitter Output v02r01
Test description: E) a) The measure-and-sum technique shall be used for measuring in-band transmit power of a device. Total power is the sum of the conducted power levels measured at the various output ports	

TOTAL RADIATED FIELD STRENGTH CALCULATION									
								EMI6024	
Test Case	**Frequency** (MHz)	**Conducted Power (dBm)**	**Antenna Gain (dBi)**	**EIRP (dBm)**	**EIRP (mW)**	**∑ EIRP (mW)**	**E-field (V/m) @3m**	**E-field (dBµV/m)**	**E-field Limit (dBµV/m)**
Antenna 1	430.0	-26.2	-2.95	-29.15	0.0012161	0.00246	0.00286	69.14	72.74
Antenna 2		-26	-3.15	-29.05	0.0012445				
Antenna 1	440.0	-25.8	0.15	-25.65	0.0027227	0.00551	0.00429	72.64	73.06
Antenna 2		-25.8	0.25	-25.55	0.0027861				
Antenna 1	450.0	-26.9	1.45	-25.45	0.0028510	0.00636	0.00460	73.26	73.98
Antenna 2		-26	1.45	-24.55	0.0035075				

The EIRP in dBm is computed using the formula : $EIRP_{(dBm)} = Conducted\ Power_{(dBm)} + Antenna\ Gain_{(dBi)}$
The EIRP in mW is computed using the formula : $EIRP_{(mW)} = 1mW \times 10^{(EIRP(dBm)/10)}$
The Field Strength in V/m is computed using the formula : $E_{(V/m)} = \sqrt{(30 \times EIRP_{(w)})}/d_{(m)}$
The Field Strength in dBµV/m is computed using the formula : $E_{(dBµV/m)} = 20 \times Log(E_{(V/m)}) + 120$

End of test report