

FCC and Industry Canada Testing of the
SenseAnywhere B.V.
AiroSensor, Model: 20-20-20
In accordance with FCC 47 CFR Part 15C,
Industry Canada RSS-210 and
Industry Canada RSS-GEN

Prepared for: SenseAnywhere B.V.
Emmerblok 18
4751 XE
Oud Gastel
NETHERLANDS

FCC ID: 2ANN201
IC: 2242601



Product Service

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Date: November 2017
Document Number: 75937736-04 | Issue: 01

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Steven White	06 November 2017	
Authorised Signatory	Simon Bennett	06 November 2017	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15C, Industry Canada RSS-210 and Industry Canada RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Graeme Lawler	06 November 2017	

FCC Accreditation

90987 Octagon House, Fareham Test Laboratory

Industry Canada Accreditation

IC2932B-1 Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY

A sample of this product was tested and found to be in compliance with FCC 47 CFR Part 15C: 2016, Industry Canada RSS-210: Issue 09 (08-2016) and Industry Canada RSS-GEN: Issue 04 (11-2014).



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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	06 November 2017

Table 1

1.2 Introduction

Applicant	SenseAnywhere B.V.
Manufacturer	SenseAnywhere B.V.
Model Number(s)	20-20-20
Serial Number(s)	Not Serialised (75937736-TSR0018)
Hardware Version(s)	3
Software Version(s)	0.1
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2016 Industry Canada RSS-210: Issue 09 (08-2016) Industry Canada RSS-GEN: Issue 04 (11-2014)
Order Number	Proforma
Date	27-January-2017
Date of Receipt of EUT	24-February-2017
Start of Test	08-March-2017
Finish of Test	10-July-2017
Name of Engineer(s)	Graeme Lawler
Related Document(s)	ANSI C63.10 (2013)



1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C, Industry Canada RSS-210 and Industry Canada RSS-GEN is shown below.

Section	Specification Clause			Test Description	Result	Comments/Base Standard
	Part 15C	RSS-210	RSS-GEN			
Configuration and Mode: Access Point						
2.1	15.249 (a) and	B.10(a)	-	Field Strength of Fundamental	Pass	ANSI C63.10
2.2	15.249 (a)(d) and	B.10	-	Field Strength of Emissions	Pass	ANSI C63.10
2.3	15.249 (a) and	B.10(b)	-	Authorised Band Edges	Pass	ANSI C63.10

Table 2



1.4 Application Form

EQUIPMENT DESCRIPTION	
Model Name/Number	Asset / AiroSensor (normal range)
Part Number	20-10-10 / 20-10-20 / 20-10-30 / 20-20-10 / 20-20-20 / 20-20-22 / 20-20-24 / 20-11-20 / 20-20-30 / 20-20-32 / 20-FF-20 / 20-FF-30 / 20-10-40 / 20-20-40 / 20-FF-50
Hardware Version	3
Software Version	0.1
FCC ID (if applicable)	2ANN201
Industry CanadaID (if applicable)	2242601
Technical Description (Please provide a brief description of the intended use of the equipment)	Wireless sensor with 3-axis accelerometer, temperature/humidity, magnetic reed and/or external switch contact

INTENTIONAL RADIATORS									
Technology	Frequency Band (MHz)	Conducted Declared Output Power (dBm)	Antenna Gain (dBi)	Supported Bandwidth (s) (MHz)	Modulation Scheme(s)	ITU Emission Designator	Test Channels (MHz)		
							Bottom	Middle	Top
Sense Anywhere SWP (ISM SRD proprietary)	902 – 928	+12dBm peak, <1% duty cycle, <-8dBm avg	-1dBi	0.1	GFSK 19.2 kbaud	19K2F1D		915.3	

UN-INTENTIONAL RADIATOR	
Highest frequency generated or used in the device or on which the device operates or tunes	26 MHz

Power Source			
AC	Single Phase	Three Phase	Nominal Voltage
External DC	Nominal Voltage		Maximum Current
Battery	Nominal Voltage		Battery Operating End Point Voltage
	3.0V (fixed, non-rechargeable)		2.0V
Can EUT transmit whilst being charged?			Yes ☐ No ☒



EXTREME CONDITIONS			
Maximum temperature	+85	°C	Minimum temperature
			-40 °C

Ancillaries
Please list all ancillaries which will be used with the device.

ANTENNA CHARACTERISTICS			
☐	Antenna connector	State impedance	Ohm
☐	Temporary antenna connector	State impedance	Ohm
☒	Integral antenna	Type	ceramic chip on PCB
☐	External antenna	Type	

I hereby declare that the information supplied is correct and complete

Name: W.E.S. Couzijn

Position held: Designer

Date: Feb. 11th 2017

1.5 Product Information

1.5.1 Technical Description

Wireless sensor with 3-axis accelerometer, temperature/humidity, magnetic reed and/or external switch contact and internal Antenna.

1.6 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.7 EUT Modification Record

The table below details modifications made to the EUT during the test programme.
The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Serial Number: Not Serialised (75937736-TSR0018)			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

1.8 Test Location

TÜV SÜD Product Service conducted the following tests at our Fareham Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration: Continuous Transmit		
Field Strength of Fundamental	Graeme Lawler	UKAS
Field Strength of Emissions	Graeme Lawler	UKAS
Authorised Band Edges	Graeme Lawler	UKAS

Table 4

Office Address:

Octagon House
Concorde Way
Segensworth North
Fareham
Hampshire
PO15 5RL
United Kingdom

2 Test Details

2.1 Field Strength of Fundamental

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.249 (a)
Industry Canada RSS-210, Clause B.10 (a)

2.1.2 Equipment Under Test and Modification State

AiroSensor, Model: 20-20-20, S/N: Not Serialised (75937736-TSR0018) - Modification State 0

2.1.3 Date of Test

08-March-2017

2.1.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.3 and 6.5.

The following procedure was applied as per the PAG (Tracking Number 891445):

A duty cycle correction factor was applied to the peak value of the fundamental, which was used in lieu of the Quasi-Peak detector as the emission duty cycle over a 100 ms is very short as specified in FCC 47 CFR Part 15.35. The maximum transmit period was calculated in accordance with ANSI C63.10, clause 7.5.

The duty cycle correction factor was calculated using the following formula:
 $-20\text{LOG}_{10}(5/100)$ where 5 is the maximum transmit time within any 100 ms period.

The following conversion can be applied to convert from dB μ V/m to μ V/m:
 $10^{(\text{Field Strength in dB}\mu\text{V/m}/20)}$.

2.1.5 Environmental Conditions

Ambient Temperature 17.2 °C
Relative Humidity 50.0 %

2.1.6 Test Results

Continuous Transmit

Frequency	Field Strength (dB μ V/m)
915.3	69.80

Table 5 - 915.3 MHz

FCC 47 CFR Part 15, Limit Clause 15.249 (a)

Fundamental Frequency (MHz)	Field Strength of Fundamental (mV/m)
902 to 928	50
2400 to 2483.5	50
5725 to 5875	50
24000 to 24250	250

Table 6

Industry Canada RSS-210, Limit Clause B.10(a)

The field strength of fundamental, measured at 3 m, shall not exceed 50 mV/m.

Note: Measurements are reported in dBμV/m, the formula for conversion of the limit to dBμV/m = 20log(V /m) + 120.

e.g. 20log(0.050) + 120 = 94 dBμV/m

2.1.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Hygromer	Rotronic	A1	2138	12	02-Feb-2018
Hygrometer	Rotronic	HYGROPALM 1	2338	12	21-Sep-2017
Antenna (Bilog)	Chase	CBL6143	2904	24	11-Jun-2017
Cable (N-N, 8m)	Rhophase	NPS-2302-8000-NPS	3248	-	O/P Mon
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	12-Nov-2017
Tilt Antenna Mast	mature GmbH	TAM 4.0-P	3916	-	TU
Mast Controller	mature GmbH	NCD	3917	-	TU
Cable (Yellow, Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4527	-	O/P Mon

Table 7

TU - Traceability Unscheduled

O/P Mon - Output Monitored Using Calibrated Equipment

2.2 Field Strength of Emissions

2.2.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.249 (a)(d)
Industry Canada RSS-210, Clause F.1(e)

2.2.2 Equipment Under Test and Modification State

AiroSensor, Model: 20-20-20, S/N: Not Serialised (75937736-TSR0018) - Modification State 0

2.2.3 Date of Test

20-April-2017

2.2.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.3, 6.5 and 6.6.

To determine the average level of transmitter harmonics and spurious emissions that exhibit the same pulse timing as the transmitter, a duty cycle correction factor was applied to the peak value of the harmonic or spurious emission in accordance with ANSI C63.10, clause 7.5.

No duty cycle correction has been applied to emissions below 1GHz, which may exhibit the same pulse timing as the transmitter

2.2.5 Environmental Conditions

Ambient Temperature 17.8 - 19.3 °C
Relative Humidity 33.0 - 39.0 %

2.2.6 Test Results

Continuous Transmit

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle(Deg)	Height(m)	Polarity
31.297	30.2	40.0	-9.8	270	1.00	Vertical
33.786	28.4	40.0	-11.6	0	1.00	Vertical
863.953	33.2	46.0	-12.8	201	1.00	Vertical
902.000	33.8	46.0	-12.2	137	1.08	Vertical
928.000	33.5	46.0	-12.5	175	1.00	Vertical
960.000	33.8	46.0	-12.2	255	1.00	Vertical

Table 8 - 915.3 MHz - 30 MHz to 1 GHz

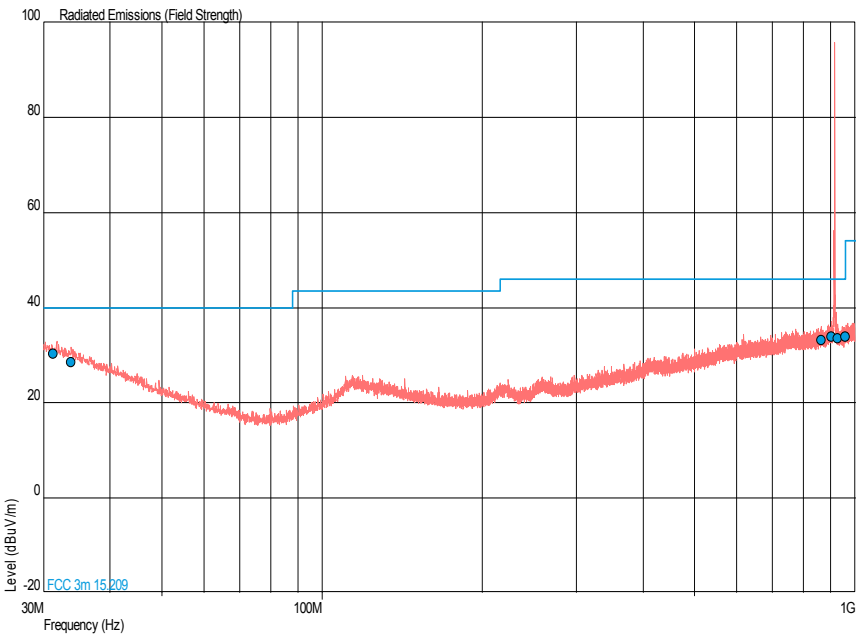


Figure 1 - 915.3 MHz - 30 MHz to 1 GHz

Frequency (MHz)	Final Peak (dBµV/m)	Final Average (dBµV/m)	Final Peak (µV/m)	Final Average (µV/m)	Angle (°)	Height (m)	Polarisation
2745.847	68.41	42.41	2633.30	131.98	258	1.50	Vertical
3661.178	70.10	44.10	3198.90	160.32	267	1.25	Vertical

Table 9 - 915.3 MHz - 1 GHz to 10 GHz

No other emissions were detected within 10 dB of the limit.

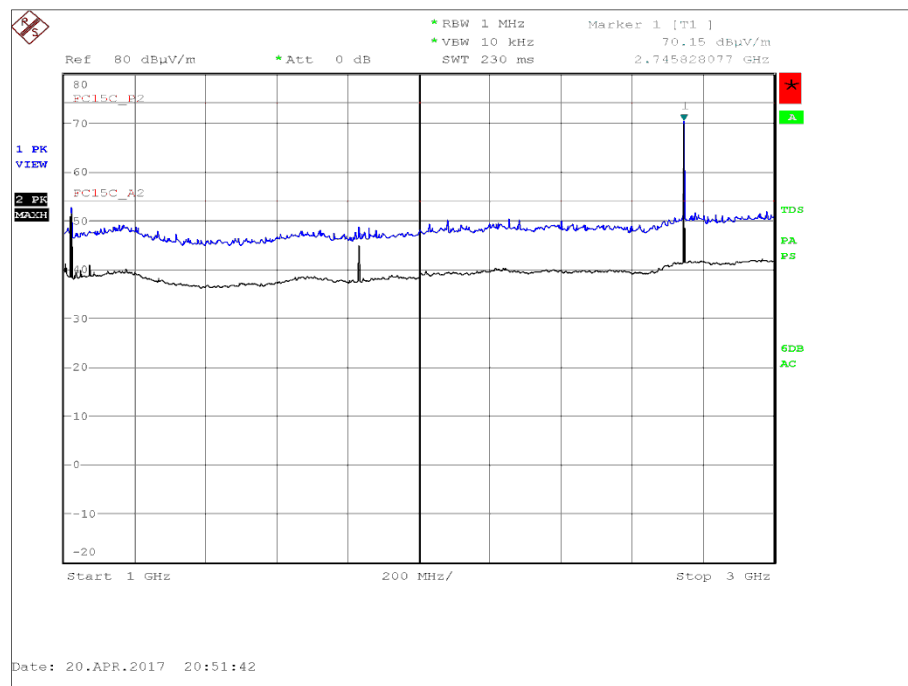


Figure 2 - 915.3 MHz - 1 GHz to 3 GHz

*The emission shown by the marker on the plot above is the 3rd harmonic of the fundamental frequency. Therefore in order to demonstrate compliance with the average emission limit, the peak value of 58.41 dBµV/m + 20*LOG(5/100) = 32.39 dBµV/m, where 5 ms is the maximum transmit time within a 100 ms period.

The calculated peak value of 32.39 dBµV/m, can therefore be shown to comply with both the peak and average test limits

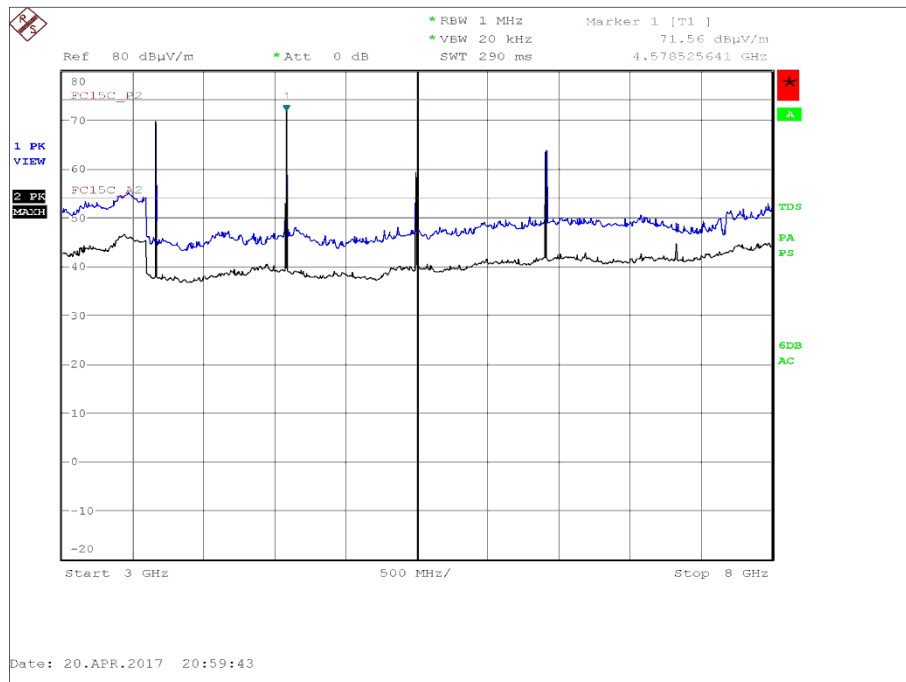


Figure 3 - 915.3 MHz - 3 GHz to 8 GHz

*The emission shown on the above plot are harmonics of the fundamental, therefore in order to demonstrate compliance with the average emission limit, the peak value of is used but reduced by - $20 \cdot \log(5/100) = 26.02$ dBμV/m, where 5 ms is the maximum transmit time within a 100 ms period.

The calculated peak value of 26.02 dBμV/m, can therefore be shown to comply with both the peak and average test limits



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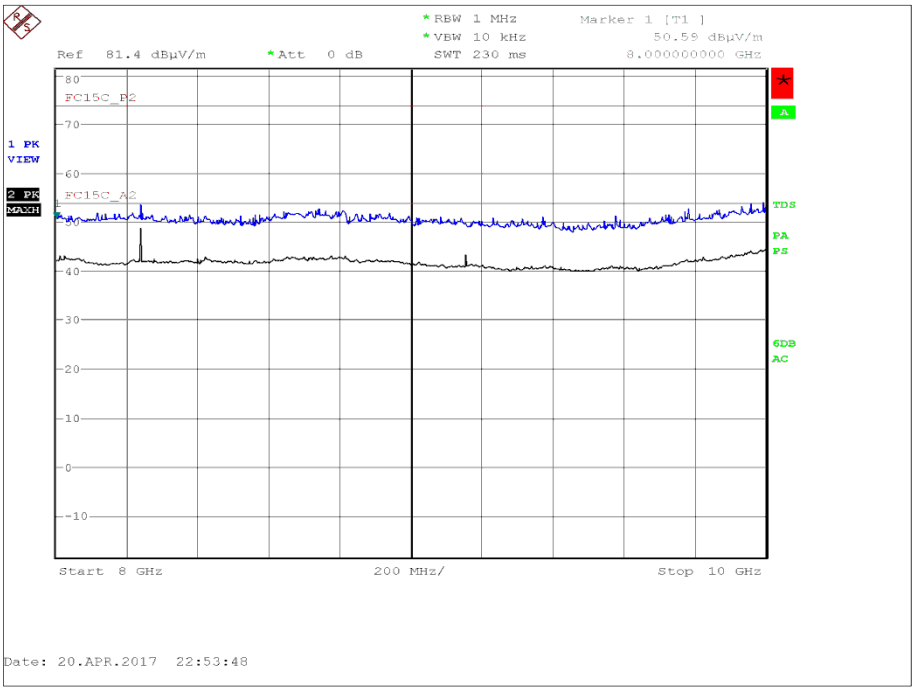


Figure 4 - 915.3 MHz - 8 GHz to 10 GHz

FCC 47 CFR Part 15, Limit Clause 15.249 (d)

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength ($\mu\text{V/m}$ at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

Table 10

Industry Canada RSS-210, Limit Clause B.10

Devices shall comply with the following requirements:

- (a) The field strength of fundamental and harmonic emissions, measured at 3 m, shall not exceed 50 mV/m and 0.5 mV/m respectively.

The field strength limits shall be measured using an average detector, except for the fundamental emission in the frequency band 902-928 MHz, which is based on measurements using an International Special Committee on Radio Interference (CISPR) quasi-peak detector.

- (b) Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

Industry Canada RSS-GEN, Limit Clause 8.9

Frequency (MHz)	Field Strength ($\mu\text{V/m}$ at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

Table 11

2.2.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Hygrometer	Rotronic	A1	1388	12	13-Apr-2017
Pre-Amplifier	Phase One	PS04-0086	1533	12	29-Jul-2017
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Hygrometer	Rotronic	A1	2138	12	02-Feb-2018
Hygrometer	Rotronic	HYGROPALM 1	2338	12	21-Sep-2017
Filter	Daden Anthony Ass	MH-1500-7SS	2778	12	06-Feb-2018
Antenna (Bilog)	Chase	CBL6143	2904	24	11-Jun-2017
Cable (N-N, 8m)	Rhophase	NPS-2302-8000-NPS	3248	-	O/P Mon
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	12-Nov-2017
Multimeter	Fluke	177	3813	12	14-Sep-2017
Tilt Antenna Mast	maturo GmbH	TAM 4.0-P	3916	-	TU
Mast Controller	maturo GmbH	NCD	3917	-	TU
TRUE RMS MULTIMETER	Fluke	179	4006	12	13-Dec-2017
1GHz to 8GHz Low Noise Amplifier	Wright Technologies	APS04-0085	4365	12	17-Oct-2017
Suspended Substrate Highpass Filter	Advance Power Components	11SH10-3000/X18000-O/O	4412	12	23-Mar-2017
Cable (Yellow, Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4527	-	O/P Mon
Cable (Rx, SMAM-SMAM 0.5m)	Scott Cables	SLSLL18-SMSM-00.50M	4528	6	03-Feb-2017
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	17-Feb-2018
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	17-Feb-2018

Table 12

TU - Traceability Unscheduled

O/P Mon - Output Monitored Using Calibrated Equipment



2.3 Authorised Band Edges

2.3.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.249 (a)
Industry Canada RSS-210, Clause B.10(b)

2.3.2 Equipment Under Test and Modification State

AiroSensor, Model: 20-20-20, S/N: Not Serialised (75937736-TSR0018) - Modification State 0

2.3.3 Date of Test

23-April-2017

2.3.4 Test Method

Testing was performed in accordance with ANSI C63.10, clause 6.10.4

2.3.5 Environmental Conditions

Ambient Temperature 19.2 - 19.3 °C
Relative Humidity 24.0 - 37.0 %

2.3.6 Test Results

Continuous Transmit

Frequency (MHz)	Measured Frequency (MHz)	Peak Level (dBµV/m)
915.3	902	36.33
915.3	928	36.45

Table 13 - Authorised Band Edge Results



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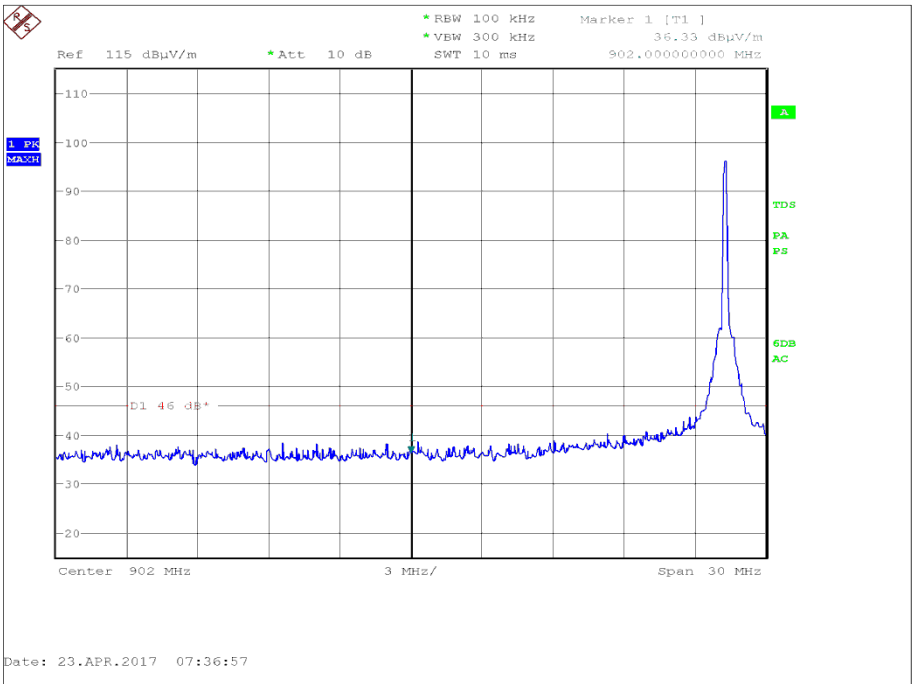


Figure 5 - 915.3 MHz, Measured Frequency: 902 MHz

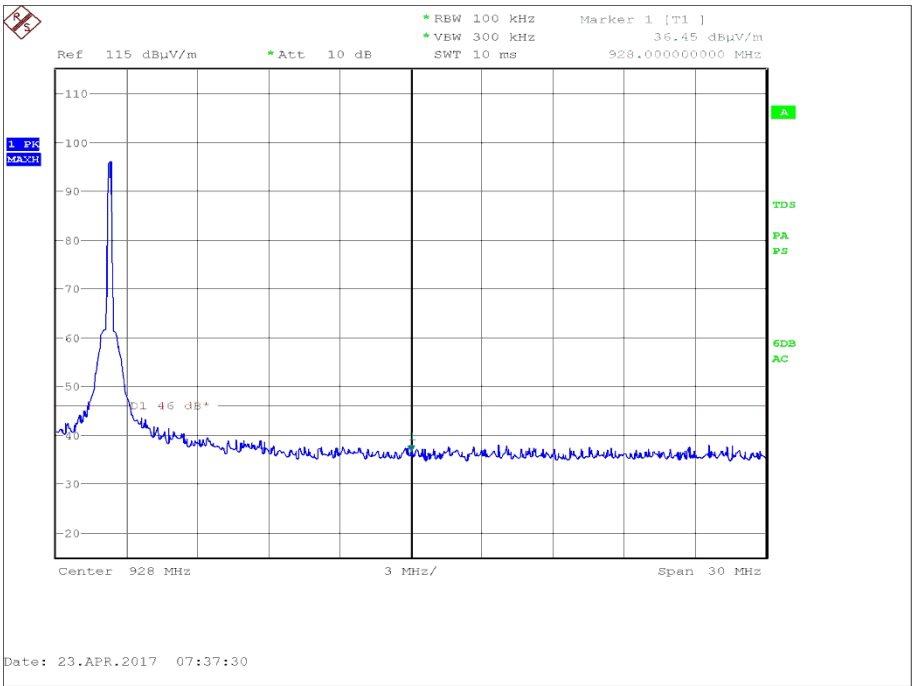


Figure 6 - 915.3 MHz, Measured Frequency: 928 MHz

FCC 47 CFR Part 15, Limit Clause 15.249 (d)

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength ($\mu\text{V}/\text{m}$ at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

Table 14

Industry Canada RSS-210, Limit Clause B.10

Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

Industry Canada RSS-GEN, Limit Clause 8.9

Frequency (MHz)	Field Strength ($\mu\text{V}/\text{m}$ at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

Table 15



2.3.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Hygromer	Rotronic	A1	2138	12	02-Feb-2018
Hygrometer	Rotronic	HYGROPALM 1	2338	12	21-Sep-2017
Antenna (Bilog)	Chase	CBL6143	2904	24	11-Jun-2017
Cable (N-N, 8m)	Rhophase	NPS-2302-8000-NPS	3248	-	O/P Mon
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	12-Nov-2017
Tilt Antenna Mast	maturo GmbH	TAM 4.0-P	3916	-	TU
Mast Controller	maturo GmbH	NCD	3917	-	TU
TRUE RMS MULTIMETER	Fluke	179	4006	12	13-Dec-2017
Cable (Yellow, Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4527	-	O/P Mon

Table 16

TU - Traceability Unscheduled

O/P Mon - Output Monitored Using Calibrated Equipment



3 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Name	Measurement Uncertainty
Field Strength of Fundamental	30 MHz to 1 GHz: ± 5.1 dB 1 GHz to 40 GHz: ± 6.3 dB
Field Strength of Emissions	30 MHz to 1 GHz: ± 5.1 dB 1 GHz to 40 GHz: ± 6.3 dB
Authorised Band Edges	Conducted: ± 3.08 dB Radiated: 30 MHz to 1 GHz: ± 5.1 dB Radiated: 1 GHz to 40 GHz: ± 6.3 dB

Table 17