

## Electromagnetic Compatibility Test Report

### FCC test results of a Wireless Motion Tracker, model DOT

Customer : Xsens Technologies B.V.  
Pantheon 6A  
7521 PR Enschede  
The Netherlands

Customer's representative : Mr. R. Gielians  
In the capacity of : Manufacturer

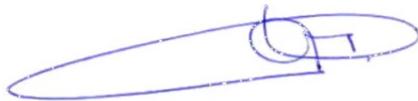
Reference number : 19C00443RPT01

Status test report : Final

Test engineer:

Author:

Released:



R. Boot  
Test engineer



M.J. Rommen  
Administrative assistant

A.S. Diks  
Senior test engineer

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## 1 Summary

A summary of the test results gained from testing the Wireless Motion Tracker is shown in the table below.

	Standard	Class / level	Result (Pass/Fail)
Emission	47 CFR 15 & ICES-003 (Issue 6)	B	Pass
Test plan	19C00442TPR02 dated 2019 October, 4		
<p>Note 1: The test results presented in this report relate only to the tested sample(s).</p> <p>Note 2: The test results are based on the tested mode of operation(s), the applicable performance criteria and the acceptance criteria as specified by the customer.</p>			

The following table gives a summary of the results of the tests that have been carried out on the Wireless Motion Tracker.

Test sequence	Test Description	Basic standard	EUT Modified during test (yes/no)	Result (Pass/Fail)
--	Conducted emission, test with a LISN	ANSI C63.4 (2014)	--	NA
--	Radiated emission up to 1 GHz (OATS)	ANSI C63.4 (2014)	--	Test performed in a SAC
1	Radiated emission up to 1 GHz (SAC)	ANSI C63.4 (2014)	No	Pass
--	Radiated emission above 1 GHz (FAC)	ANSI C63.4 (2014)	--	NA

The table below shows details about tests that are not applicable.

Phenomenon	Comment
Conducted emission, mains terminals, continue (LISN)	EUT is internally battery operated, EUT is not AC supplied
Radiated emission above 1 GHz (FAR)	The highest frequency of the internal sources of the EUT is less than 108MHz.

Cross reference table 47 CFR 15 – ICES 003

Test Description	Section 47 CFR 15	Section ICES 003
Conducted emission, test with a LISN	15.107	5. (a) (ii) & 6.1
Radiated emission up to 1 GHz (OATS/SAC)	15.109	5. (a) (ii) & 6.2.1
Radiated emission above 1 GHz (FAC)	15.109	5. (b) (ii) & 6.2.2

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### **3 Introduction**

DARE!! Measurements is requested by Xsens Technologies B.V., to perform Electromagnetic Compatibility (EMC) tests.

The objective of the test was to assess the Wireless Motion Tracker in accordance with the standards as mentioned in chapter 5 of this report. This report may only be used for this purpose.

At request of Xsens Technologies B.V., the EMC tests are carried out in order to find out whether the product complies with 47 CFR 15 of the FCC regulations for computers and other digital devices.

The test sample(s) were received on 2019 October, 7. Testing was performed on 2019 October, 7 and 8. The test report is issued on 2019 October, 15.

The tests are carried out at our facilities located in Woerden, The Netherlands.

The test results presented in this report relate only to the product tested.

In this report, the sample tested will be referred to as Equipment Under Test (EUT).

This report is in conformity with ISO 17025.

Opinions or interpretations mentioned in this report are excluded from accreditation.

All tests as described in the applied standard(s) are carried out, unless otherwise specified in this report.

### **4 Explanation Status Report**

- Final : Formally signed report, with a final conclusion. Changes in the report will lead to a new report with a new report number.
- Preliminary : Interim signed report, with a temporary conclusion. Test is not completed, for example due to missing information. Changes in the report will lead to an updated report with a new report number.

## 5 Standards and test plan

The EUT is assessed against the following requirements.

- Emission : 47 CFR 15 & ICES-003 (Issue 6)
- : FCC Public Notice DA 09-2478
- : KDB Publication 714737
- Test plan : 19C00442TPR02 dated 2019 October, 4

If available, a test plan is used as a supplement.

### 5.1 Test plan deviations

None.

## 6 Measurement Uncertainties

The reported expanded uncertainty of measurement is based on a standard uncertainty of measurement multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95%, but excluding the contribution of the EUT. The expanded uncertainty of measurement has been determined in accordance with EN 55016-4-2 (2011).

## 7 EUT details

### 7.1 Condition of EUT on receipt

The condition of the EUT during reception was undamaged and fully functional.

### 7.2 Purpose, functional and physical description

The Xsens DOT system can contain 1 and up to 5 Trackers (XS-T01) including a Charger (XS-C01) that can charge a maximum of 5 Trackers at the same time.

The XS-C01 can be powered via a micro USB cable that is delivered with the package.

The XS-T01 housing can differ in appearance (colour), but all variants are mechanically and electrically identical.

The XS-T01 is a miniature motion tracker, using advanced sensor fusion algorithms, that transmits its data wireless via a certified radio-chip to an external device where the data is collected and stored by an App. The XS-T01 can be charged via its micro USB connector.

To simulate the most demanding common customer application of the Xsens DOT system, the XS-T01 (5x), including the XS-C01 that is powered by the micro USB cable, is selected as Equipment Under Test (EUT)

The details for the EUT that is supplied for test, were as follows.

Description	Sample	
Name	Wireless Motion Tracker	
Manufacturer	Xsens Technologies B.V.	
Brand	Xsens	
Model number	DOT	
Serial number	Primary trackers (in charger): F3:72:4F:8C:28:9B C5:B5:DD:EB:70:7B DB:17:F7:7C:38:BC	C7:FA:AC:44:9B:5F F2:FB:E2:43:7F:0A Running tracker: D6:E8:0D:26:74:89
Rating power	~250mW at 5V DC (single tracker while charging); 1250mW (5 trackers charging on Charger)	
Rating amperage	Undefined	
Rating voltage	VDD can be set from 4.5V DC - 5.5V DC (both tracker and charger)	
Rating frequency	50/60 Hz	
Power supply during test	Mode 2: 1 tracker from the internal battery; Mode 1: 5 trackers on the 5V USB Charger, AC mains from a 110VAC 60 Hz source	
Dimensions (L*W*H)	Xsens DOT tracker: plastic housing (36.3 x 30.4 x 10.8 mm); Xsens DOT charger: plastic housing (183.6 x 53.5 x 21.1 mm)	
Software release	0.2.0 (XS-T01)	
Hardware release	XS-C01 (Charger) 1.3; XS-T01 (Tracker) 1.6	
Environment to be used	Industrial and non-industrial	

### 7.3 Equipment authorization

The EUT can be authorized as Supplier's Declaration of Conformity (SDoC).

### 7.4 Potential sources of emission

The highest generated or used frequency of the EUT is 64 MHz (Bluetooth excluded).

### 7.5 Interfaces to external objects

The cable connections to EUT and peripheral equipment during testing are displayed in the table below.

Description	Port type	Cable length	Max cable length	Type of cable	Fixing shield	Load at port
USB power and communication cable	DC supply	1m.	2.9m	Shielded	Both sides	Wall adapter / laptop

### 7.6 Test configuration

The EUT is tested as table top equipment.

According the specifications of the EUT, the upper frequency to be measured is 1 GHz. for Radiated emission.

According the information of the customer, the class of emission is B.

## 8 Operating conditions during test

### 8.1 Test considerations

The EUT has a certified radio chip uBlox ANNA B112 for radio communication (Bluetooth): 2402 – 2480 MHz (US (FCC/CFR 47 part 15 unlicensed modular transmitter approval), FCC ID: XPYANNAB1).

### 8.2 Mode(s) of operation

The test mode(s) during testing were defined as:

Mode of operation	Description
Mode 1	Measurement mode: the XS-T01 is continuously outputting data to the peripheral host/smartphone. The output configuration is fixed to a 60Hz sample rate. A set of 5 trackers needs to be running in measurement mode during the tests. The host/smartphone will log the data of all 5 trackers during the measurement.
Mode 2	Charging mode*: a maximum of 5 x XS-T01 trackers charging in the XS-C01 charger. The XS-T01 are in IDLE mode and not transmitting data.  * To reduce testing time operating mode 1 and 2 can be combined for the worst-case scenario (this is not a normal user scenario, then it is either operation mode 1 or operating mode 2).

The applicant's representative was present to witness the testing.

The Appendixes of this report shows pictures of the test configuration during the tests.

## 9 Possible test case verdicts

- NA or not applicable : test does not apply to the EUT
- P(ass) : EUT does meet the requirement
- F(ail) : EUT does not meet the requirement
- U(ndetermined) : Pass or Fail could not be established
- NR or not requested : test is not requested by customer

During pass or fail decisions, the measurement uncertainty is not taken into account.

## 10 Test equipment

The instruments used to perform the tests are displayed in the Appendix.

## 11 Measurement software

The measurement software during testing was DARE!! Instruments Radimation version 2019.1.5.

## 12 Test results

### 12.1 Radiated emission up to 1 GHz (SAC)

#### 12.1.1 Test method

The radiated emission tests are carried out in a Semi Anechoic Chamber (SAC). The tests are recorded with a Spectrum Analyzer / EMI Receiver. The test method is in accordance with the applied standard(s) (see chapter 5) and with the basic standard ANSI C63.4 (2014) and paragraph 15.31 (f) (1) of 47 CFR 15 & ICES-003 (Issue 6), where the first standard takes precedence. The measured value is calculated by the following formula:

$$E = V_r + a_c + F_a$$

Where:

- E = Field Strength (measured value) [dB $\mu$ V/m]
- V<sub>r</sub> = Receiver Indication (receiver reading) [dB $\mu$ V]
- a<sub>c</sub> = Cable Loss (coax cable) [dB]
- F<sub>a</sub> = Antenna Factor (antenna) [dB/m]

#### 12.1.2 Measurement Uncertainty

The measurement uncertainty during testing is displayed in the table below.

Frequency	U (log)	U (lin)
30 MHz – 200 MHz	± 5.0 dB	+85 % / -46.0 %
200 MHz – 1000 MHz	± 6.4 dB	+109.6 % / -52.3 %

### 12.1.3 Requirements

The requirements according CISPR 22 (Third edition) are laid down in the table below.

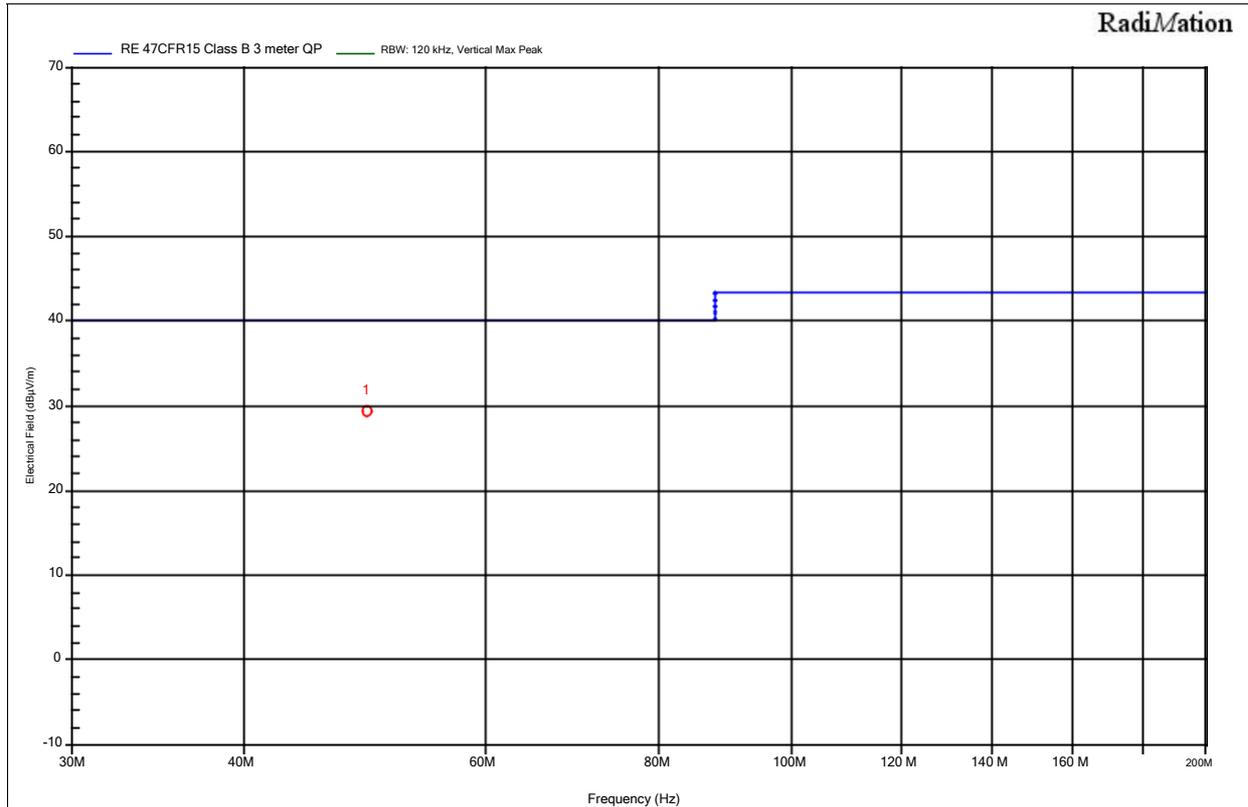
Frequency band	QP class A @ 3m	QP class B @ 3m
30 MHz - 230 MHz	50 dB $\mu$ V/m	40 dB $\mu$ V/m
230 MHz - 1 GHz	57 dB $\mu$ V/m	47 dB $\mu$ V/m

The requirements according 47CFR15 are laid down in the table below.

Frequency band	QP class A @ 3m	QP class B @ 3m
30 MHz - 88 MHz	49,5 dB $\mu$ V/m	40 dB $\mu$ V/m
	300 $\mu$ V/m	100 $\mu$ V/m
88 MHz - 216 MHz	54 dB $\mu$ V/m	43,5 dB $\mu$ V/m
	500 $\mu$ V/m	150 $\mu$ V/m
216 MHz - 960 MHz	56,9 dB $\mu$ V/m	46 dB $\mu$ V/m
	700 $\mu$ V/m	200 $\mu$ V/m
960 MHz - 1 GHz	60 dB $\mu$ V/m	54 dB $\mu$ V/m
	1000 $\mu$ V/m	500 $\mu$ V/m

### Result Radiated Emission Semi Anechoic Chamber 30 MHz to 200 MHz

PIN number:	19C00443	Resolution Bandwidth:	120 kHz
Test ID:	1	Video Bandwidth:	1 MHz
Mode of operation:	Mode 1, 2		
Antenna Distance:	3 m	Antenna Height:	1 - 4 m



### Detected Peaks

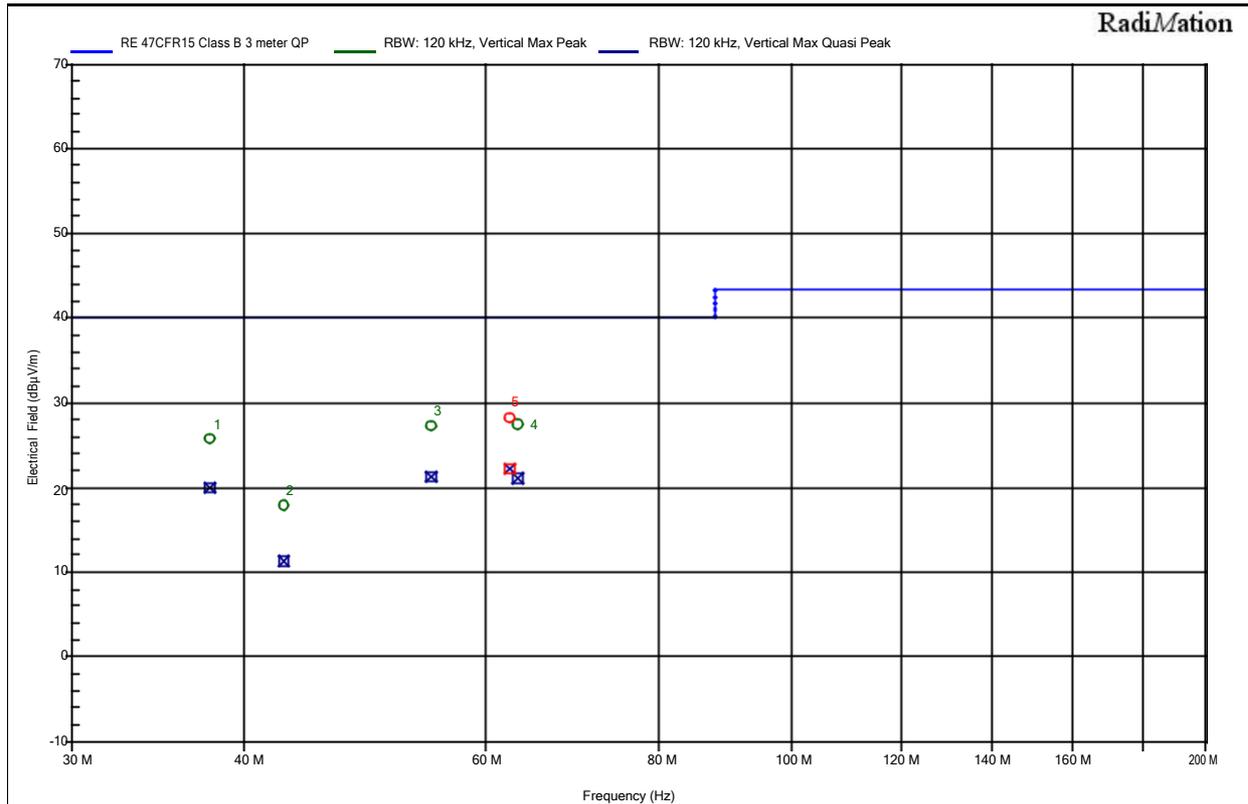
Peak Number	Frequency	Angle	Height	Polarization
1	49.128 MHz	0 degrees	99.2 cm	Vertical

### Remarks

Pre-scan

### Result Radiated Emission Semi Anechoic Chamber 30 MHz to 200 MHz

PIN number: 19C00443      Resolution Bandwidth: 120 kHz  
 Test ID: 2      Video Bandwidth: 300 kHz  
 Mode of operation: Mode 1, 2  
 Antenna Distance: 3 m      Antenna Height: 1 - 4 m



### Detected Peaks

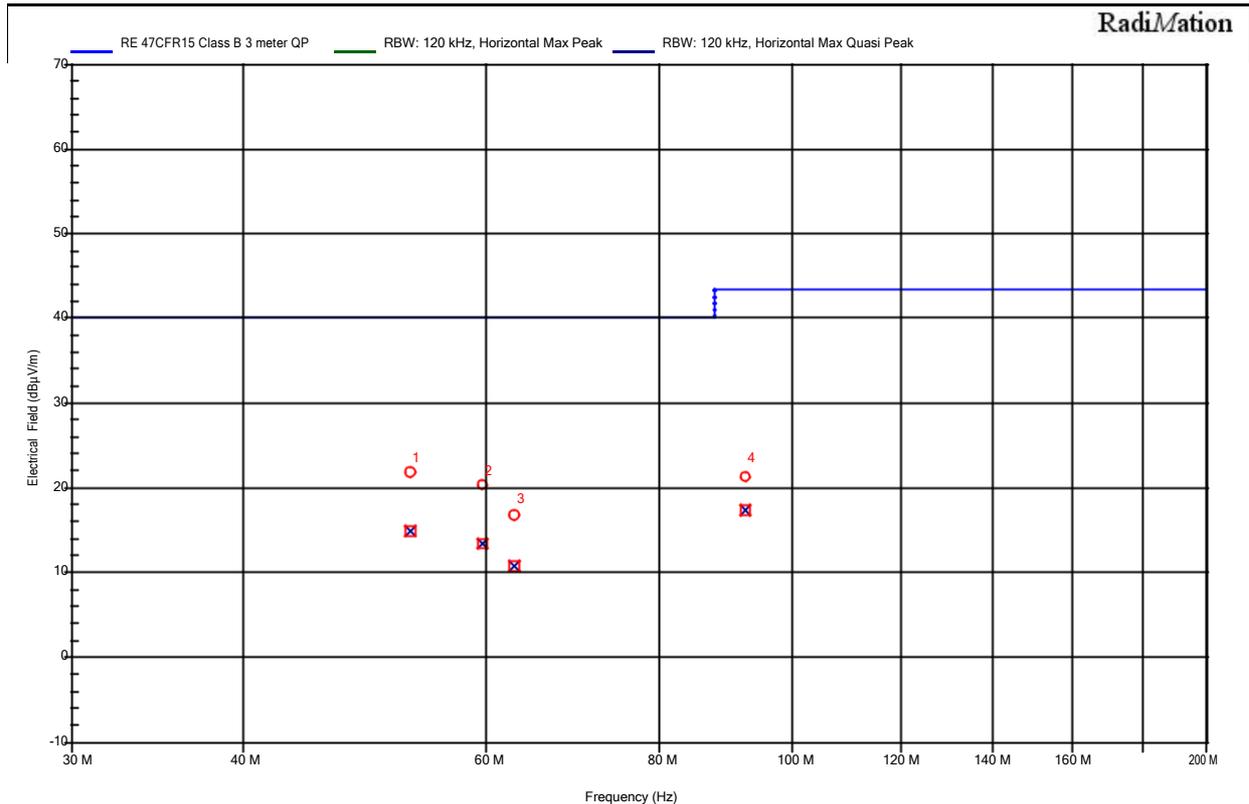
Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Angle	Height	Polarization	Status
1	37.854 MHz	20 dBµV/m	40 dBµV/m	206 degrees	98.3 cm	Vertical	Pass
2	42.798 MHz	11.3 dBµV/m	40 dBµV/m	271 degrees	98 cm	Vertical	Pass
3	54.731 MHz	21.4 dBµV/m	40 dBµV/m	225 degrees	98 cm	Vertical	Pass
4	63.337 MHz	21 dBµV/m	40 dBµV/m	0 degrees	98.1 cm	Vertical	Pass
5	62.427 MHz	22.2 dBµV/m	40 dBµV/m	21 degrees	98.2 cm	Vertical	Pass

### Remarks

Pass

### Result Radiated Emission Semi Anechoic Chamber 30 MHz to 200 MHz

PIN number: 19C00443      Resolution Bandwidth: 120 kHz  
 Test ID: 3      Video Bandwidth: 300 kHz  
 Mode of operation: Mode 1, 2  
 Antenna Distance: 3 m      Antenna Height: 1 - 4 m



### Detected Peaks

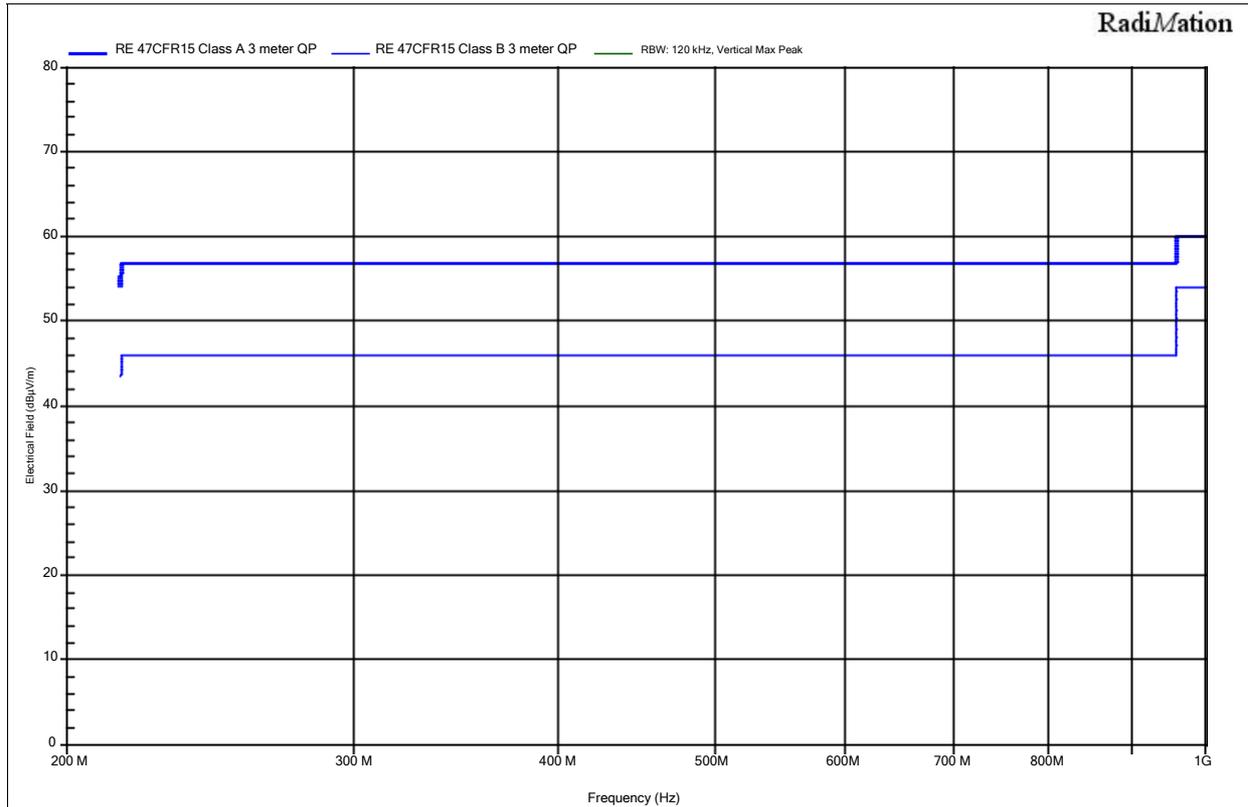
Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Angle	Height	Polarization	Status
1	52.892 MHz	14.9 dBµV/m	40 dBµV/m	19 degrees	3.3 m	Horizontal	Pass
2	59.572 MHz	13.4 dBµV/m	40 dBµV/m	-1 degrees	2.5 m	Horizontal	Pass
3	63.016 MHz	10.7 dBµV/m	40 dBµV/m	-137 degrees	3.5 m	Horizontal	Pass
4	92.564 MHz	17.3 dBµV/m	43.5 dBµV/m	110 degrees	3.5 m	Horizontal	Pass

### Remarks

Pass

### Result Radiated Emission Semi Anechoic Chamber 200 MHz to 1 GHz

PIN number:	19C00443	Resolution Bandwidth:	120 kHz
Test ID:	4	Video Bandwidth:	1 MHz
Mode of operation:	Mode 1, 2		
Antenna Distance:	3 m	Antenna Height:	1 - 4 m

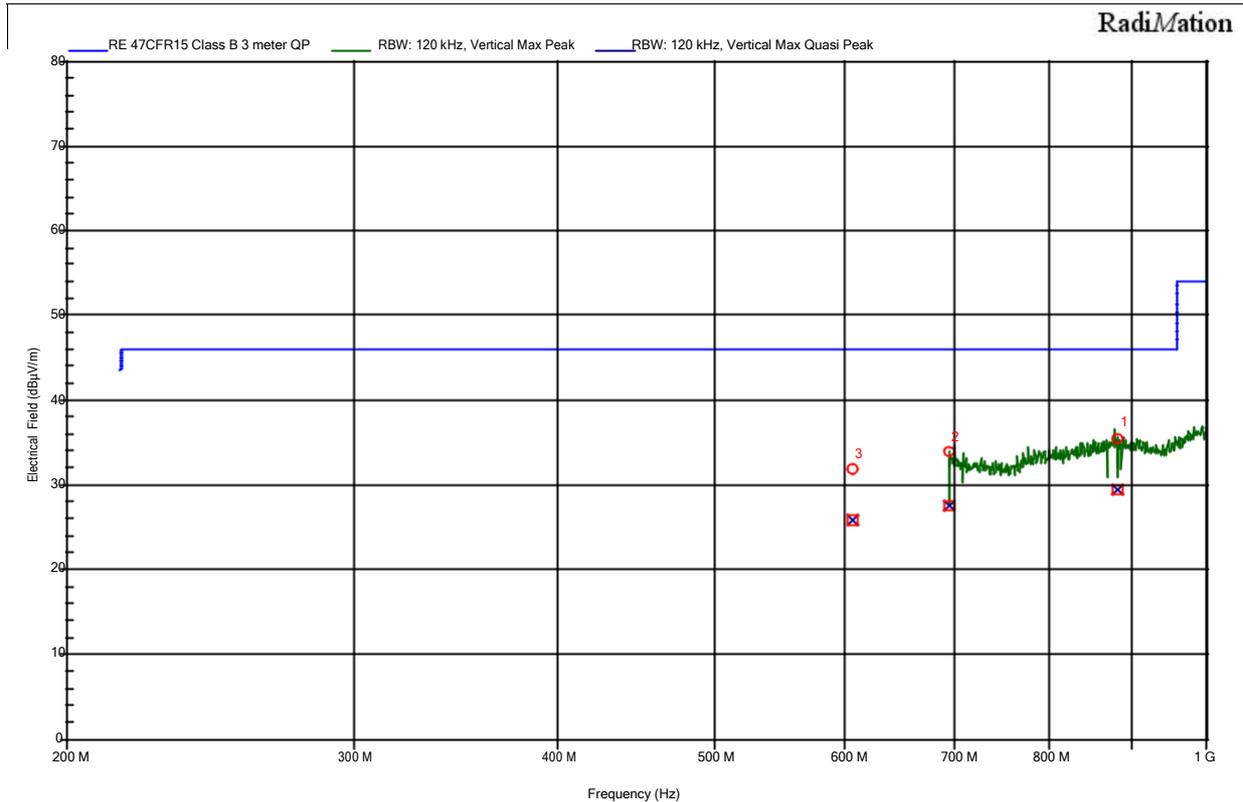


### Remarks

Pre-scan

### Result Radiated Emission Semi Anechoic Chamber 200 MHz to 1 GHz

PIN number:	19C00443	Resolution Bandwidth:	120 kHz
Test ID:	7	Video Bandwidth:	300 kHz
Mode of operation:	Mode 1, 2		
Antenna Distance:	3 m	Antenna Height:	1 - 4 m



### Detected Peaks

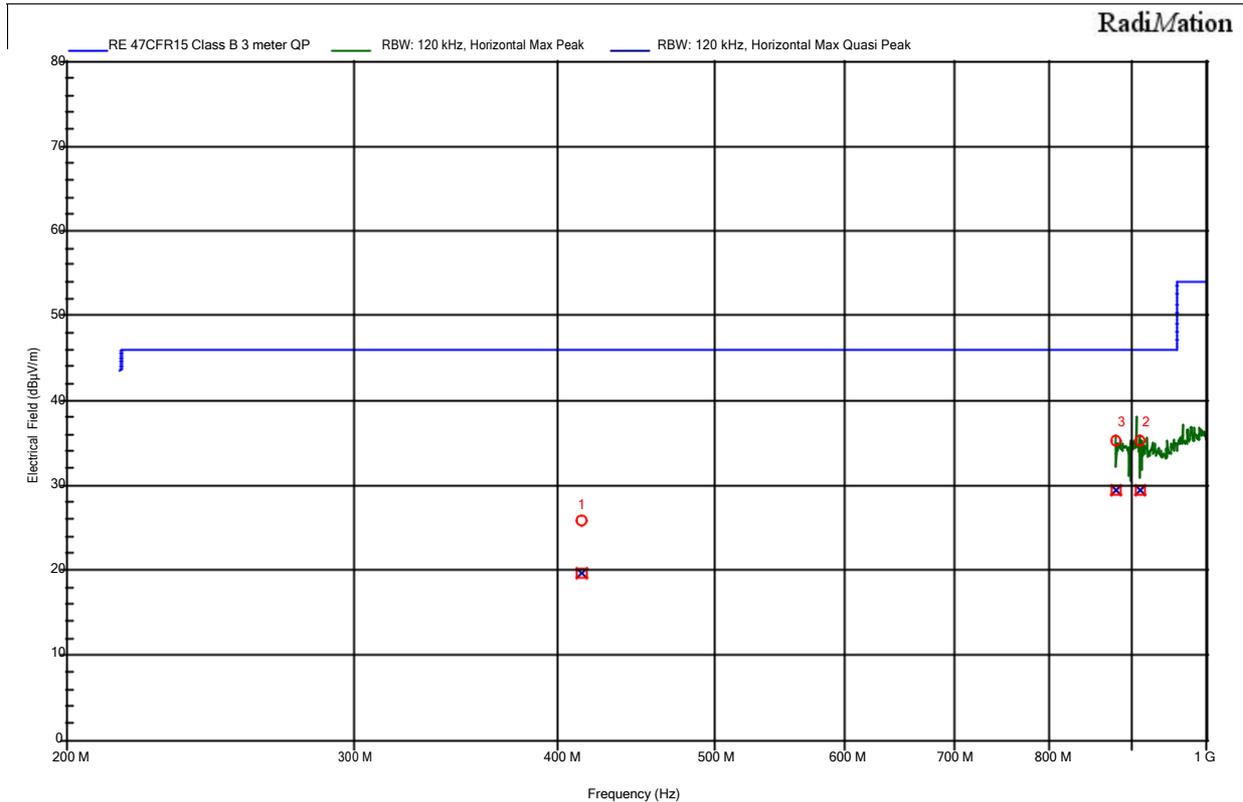
Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Angle	Height	Polarization	Status
1	881.525 MHz	29.5 dBµV/m	46 dBµV/m	158 degrees	2.8 m	Vertical	Pass
2	695.375 MHz	27.6 dBµV/m	46 dBµV/m	-23 degrees	3 m	Vertical	Pass
3	607.230 MHz	25.8 dBµV/m	46 dBµV/m	-137 degrees	1.5 m	Vertical	Pass

### Remarks

Pass

### Result Radiated Emission Semi Anechoic Chamber 200 MHz to 1 GHz

PIN number: 19C00443      Resolution Bandwidth: 120 kHz  
 Test ID: 6      Video Bandwidth: 300 kHz  
 Mode of operation: Mode 1, 2  
 Antenna Distance: 3 m      Antenna Height: 1 - 4 m



### Detected Peaks

Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Angle	Height	Polarization	Status
1	413.887 MHz	19.7 dBµV/m	46 dBµV/m	46 degrees	3.8 m	Horizontal	Pass
2	911.004 MHz	29.4 dBµV/m	46 dBµV/m	-137 degrees	3.5 m	Horizontal	Pass
3	880.163 MHz	29.5 dBµV/m	46 dBµV/m	23 degrees	3.5 m	Horizontal	Pass

### Remarks

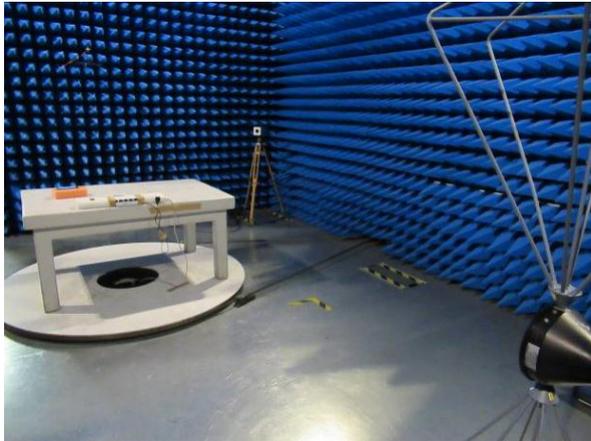
Pass, peak is measured manually and is a one-time transient.

### **13 Conclusion**

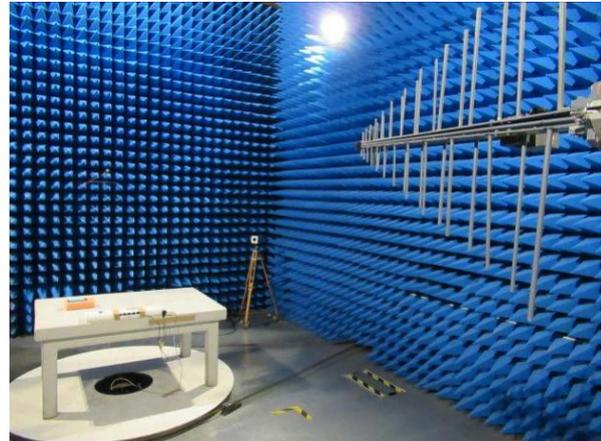
The Wireless Motion Tracker meets the emission limits of an Unintentional Radiator as described in 47 CFR 15 & ICES-003 (Issue 6), class B Digital Device.

It is the responsibility of the manufacturer to ensure, that all of the following products are equal to the measured sample. And as such ensure that all manufactured Wireless Motion Trackers are in compliance with the standards as mentioned above.

### 14 Appendix A: Pictures of EUT



Picture 1: Radiated emission 30-200MHz



Picture 2: Radiated emission 200-1000MHz



Picture 3: Radiated emission test setup



Picture 4: Peripheral host/smartphone

### 15 Appendix B: Equipment List

#### Radiated Emission Semi Anechoic Chamber 30 MHz to 1 GHz

Description	Brand	Model	Serial	ID	Last Calibration	Calibration interval
Anechoic room, semi	Siepel	Hermes 3	-	1494	2/5/2018	3 years
EMI Receiver	R&S	ESU8	100428	1556	12/12/2018	1 year
Antenna mast	DARE!! Instruments	Raditower	-	1496	-	-
Turn table	DARE!! Development	Raditurn	-	1367	-	-
Antenne 30 MHz – 200 MHz	Rohde & Schwarz	HK116	827601/014	1386	19/03/2019	2 years
Antenne 200 MHz – 1 GHz	Rohde & Schwarz	HL223	827154/008	1387	27/10/2017	2 years
Power Source	California Instruments	5001iX	55707	1325	20/8/2019	3 years
Cable RF-coaxial, set, RE Cavendish (EMC)	-	-	-	1478	20/4/2019	1 year