

Test Report

Product	Wireless Vibration Sensor		
Name and address of the applicant	EI-Watch AS Rindalsvegen 6 6657 Rindal, Norway		
Name and address of the manufacturer	EI-Watch AS Rindalsvegen 6 6657 Rindal, Norway		
Model	Vibration 915		
Rating	3.6V_{DC} (Primary Battery)		
Trademark	EI-Watch		
Serial number	30005549		
Additional information	Low Power Device		
Tested according to	FCC Part 15.249 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz Industry Canada RSS-210, Issue 10, Annex B10 Bands 902-928 MHz, 2400-2483.5 MHz and 5725-5875 MHz		
Order number	456847		
Tested in period	2022-03-25 to 2022-03-28 and 2023-02-02		
Issue date	2023-02-08		
Name and address of the testing laboratory	<div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="text-align: center;">  Instituttveien 6 Kjeller, Norway www.nemko.com </div> <div style="text-align: center;"> CAB Number: FCC: NO0001 ISED: NO0470 </div> <div style="text-align: center;">   </div> </div> <p style="text-align: center; color: red; font-size: small;">An accredited technical test executed under the Norwegian accreditation scheme</p>		
	 Prepared by [Frode Sveinsen]	 Approved by [G.Suhanthakumar]	
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Revision history

Revision	Date	Comment	Sign
00	2022-11-23	First edition	FS
01	2023-02-08	Added results for upper and lower frequencies	FS



THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.

Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".

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1 INFORMATION

1.1 Test Item

Name	EI-Watch
FCC ID	2A8NTEW10001
ISED ID	29286-EW10001
Model/version	Vibration 915
Serial number	30005549
Hardware identity and/or version	5
Software identity and/or version	422412_33_VIBRATION_915_v308
Frequency Range	902.3 to 927.7 MHz
Radiated Output Power	0.50 mW
Number of Channels	1
Type of Modulation	FSK
Type of Power Supply	Primary Battery
Antenna Connector	None (Integral antenna)
Number of Antennas	1

Description of Test Item

The tested item is a wireless vibration sensor with 915 MHz transmitter.

1.2 Normal test condition

Temperature	20 - 24 °C
Relative humidity	20 - 50 %
Normal test voltage	3.6 V DC (Nominal battery voltage)

The values are the limit registered during the test period.

1.3 Test Engineer

Frode Sveinsen

1.4 Description of modification for Modification Filing

Not applicable.

1.5 Family List Rational

Not Applicable.

1.6 Antenna Requirement

Is the antenna detachable?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
If detachable, is the antenna connector non-standard?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Type of antenna connector: N/A		

Ref. FCC §15.203

1.7 Worst-Case Configuration and Mode

All tests were performed with the EUT set to transmit a modulated signal continuously or with one burst per second.

In normal operation the EUT will transmit one burst every 30 second.

All tests were performed with Power level 32.

1.8 Comments

All measurements were done with the EUT powered by a new battery.

2 TEST REPORT SUMMARY

2.1 General

All measurements are traceable to national standards.

The tests were conducted for demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.249 and Industry Canada RSS-210 Issue 10 and RSS-GEN Issue 5.

Tests were performed in accordance with ANSI C63.4-2014 and and ANSI C63.10-2013.

Radiated tests were made in a semi-anechoic chamber at measuring distances of 3m.

A description of the test facility is on file with FCC and ISED.

<input checked="" type="checkbox"/> New Submission	<input checked="" type="checkbox"/> Production Unit
<input type="checkbox"/> Class II Permissive Change	<input type="checkbox"/> Pre-production Unit
DXX Equipment Code	<input type="checkbox"/> Family Listing

2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-210 Issue 10, RSS-GEN Issue 5 reference	ANSI C63.10-2013 Reference	Result
Supply Voltage Variations	15.31(e)	6.11 (RSS-GEN)	5.13	N/A
Number of Frequencies	15.31(m)	6.9 (RSS-GEN)	N/A	
Antenna Requirement	15.203	6.8 (RSS-GEN)	5.8	Complies
Power Line Conducted Emission	15.107(a) 15.207(a)	7.2 / 8.8 (RSS-GEN)	6.2	N/A
Occupied Bandwidth (99% BW)	15.215(c)	6.7 (RSS-GEN)	6.9.3	Complies
Field Strength of Fundamental	15.249(a)(c)(e)	B.10(a) (RSS-210)	6.6	Complies
Radiated Emissions	15.249(a)(c)(d)(e) 15.209(a)	B.10(a)(b) (RSS-210) 7.3 (RSS-GEN) 8.9 (RSS-GEN)	6.3, 6.5, 6.6 6.10	Comples

3 TEST RESULTS

3.1 Occupied Bandwidth (99% BW) and Emission Bandwidth

FCC Part 15.215 (c)

ISED Canada RSS-GEN Issue 5, Clause 6.7

Measurement procedure: ANSI C63.10-2013 Clause 6.9.3

Test Results: Complies

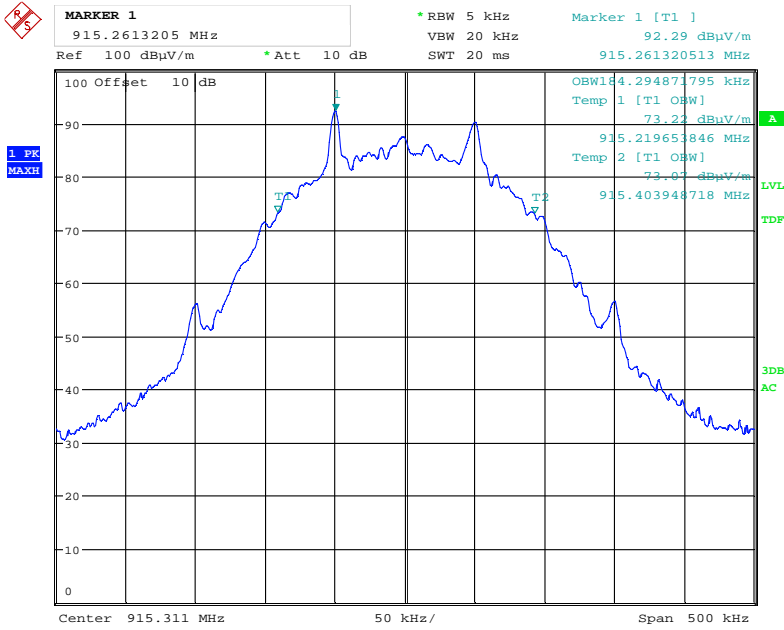
Measurement Data:

Carrier Frequency	Occupied Bandwidth (99% BW)
915.3 MHz	184 kHz

See attached plots.

Requirements:

No limit specified for 99% BW, reported for information only.



Date: 28.MAR.2022 12:11:05

99% Occupied Bandwidth

3.2 Field Strength of Fundamental

FCC 15.249 (a)(c)(e)

ISED Canada RSS-210 Issue 10, B.10(a)

Test Results: Complies

Measurement Data:

Fundamental Frequency (MHz)	902.3	915.3	927.7
Peak Field Strength (dBμV/m @3m)	91.7	92.2	90.7
Calculated EIRP (mW)	0.44	0.50	0.35

EIRP is calculated from Field Strength using the method described in KDB 412172.

Measurement was performed with Peak Detector.

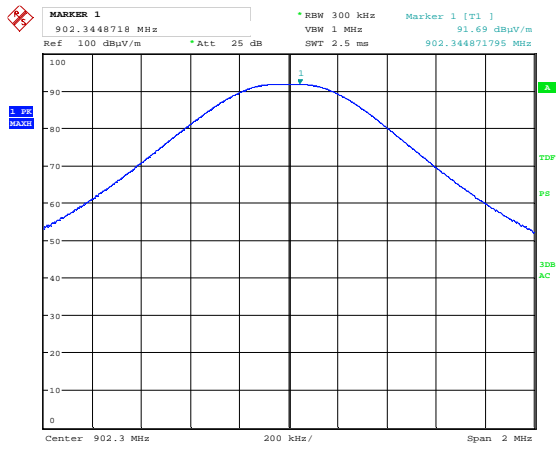
See attached plots.

Requirements:

The field strength of fundamental, measured at 3m, shall not exceed 50 mV/m (94 dB μ V/m).

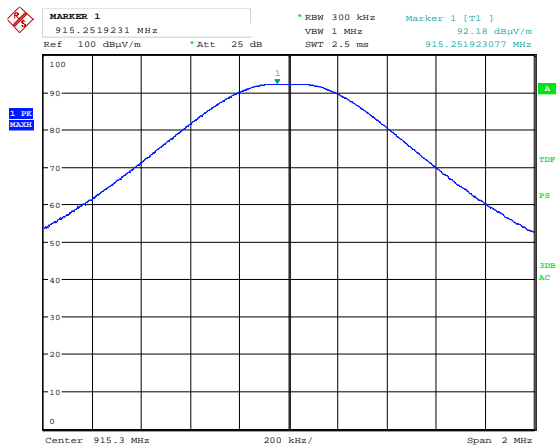
The field strength limits shall be measured using an average detector, except for the fundamental emission in the frequency band 902-928 MHz, which is based on measurements using a CISPR quasi-peak detector.

Maximum Field Strength of Fundamental



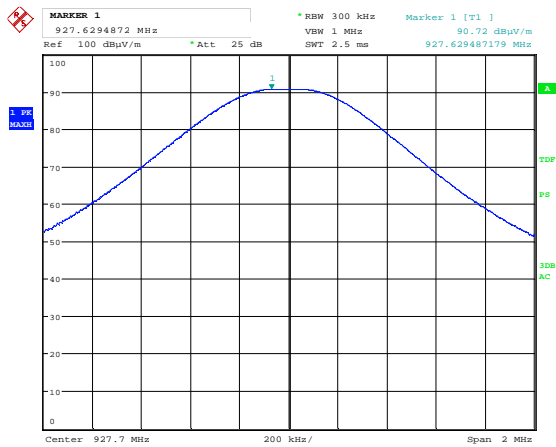
Date: 2.FEB.2023 10:06:46

902.3 MHz



Date: 2.FEB.2023 10:04:55

915.3 MHz



Date: 2.FEB.2023 10:05:52

927.7 MHz

3.3 Restricted Bands of operation

Restricted Bands of operation for FCC and ISED are defined in FCC Part 15.205 and ISED RSS-GEN, Issue 5 clause 8.10.

Generally, no fundamentals are allowed in the restricted bands and all emissions must comply with the limits in FCC 15.209 or RSS-GEN, Issue 5, clause 8.9.

FCC (MHz)	ISED Canada (MHz)	FCC (GHz)	ISED Canada (GHz)
0.090-0.110		0.96-1.24 1.3-1.427	0.96-1.427
0.495-0.505		1.435-1.6265	
2.1735-2.1905		1.6455-1.6465	
	3.020-3.026	1.660-1.710	
4.125-4.128		1.7188-1.7222	
4.17725-4.17775		2.2-2.3	
4.20725-4.20775		2.31-2.39	
	5.677-5.683	2.4835-2.5	
6.215-6.218		2.69-2.9	2.655-2.9
6.26775-6.26825		3.26-3.267	
6.31175-6.31225		3.332-3.339	
8.291-8.294		3.3458-3.358	
8.362-8.366		3.6-4.4	3.5-4.4
8.37625-8.38675		4.5-5.15	
8.41425-8.41475		5.35-5.46	
12.29-12.293		7.25-7.75	
12.51975-12.52025		8.025-8.5	
12.57675-12.57725		9.0-9.2	
13.36-13.41		9.3-9.5	
16.42-16.423		10.6-12.7	
16.69475-16.69525		13.25-13.4	
16.80425-16.80475		14.47-14.5	
25.5-25.67		15.35-16.2	
37.5-38.25		17.7-21.4	
73-74.6		22.01-23.12	
74.8-75.2		23.6-24.0	
108-121.94 123-138	108-138	31.2-31.8	
149.9-150.05		36.43-36.5	
156.52475-156.52525		Above 38.6	
156.7-156.9			
162.0125-167.17			
167.72-173.2			
240-285			
322-335.4			
399.9-410			
608-614			

Frequencies in **Bold** text are specific for FCC or ISED, all other frequencies are common.

3.4 Radiated Emissions, Band Edge

FCC Part 15.249 (a)(d)(e)

FCC Part 15.209 (a)

ISED Canada RSS-210 issue 10, B.10 (a)(b)

ISED Canada RSS-GEN Issue 5, Clause 7.3 / 8.9

Measurement procedure: ANSI C63.10-2013 Clause 6.10.4 / 6.10.5 / 6.10.6

Test Results: Complies

Measurement Data:

	Measured field strength (dB μ V/m)		QP Limit	Margin	
	902 MHz	928 MHz	dB μ V/m	dB	
Peak Detector	42.9	43.2	46.0	3.1	2.8

Peak values are below QP Limit.

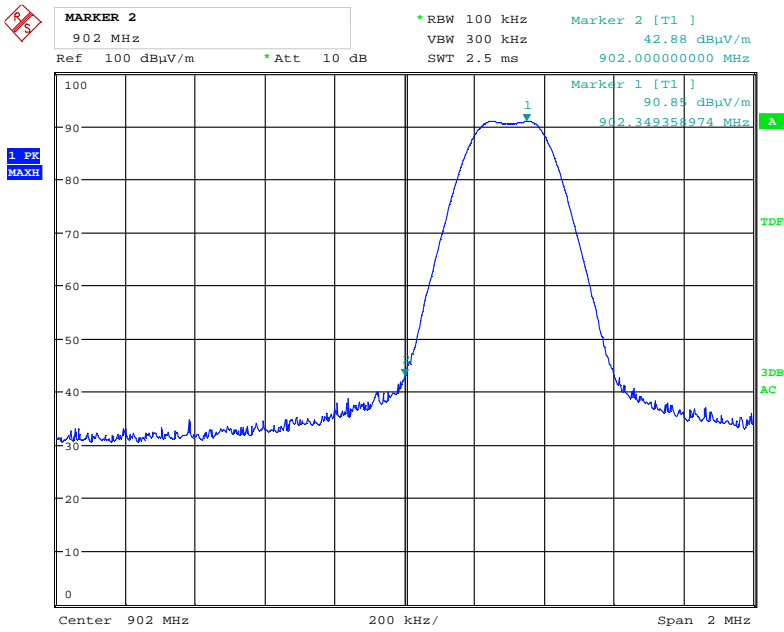
See attached plots.

Limit:

The field strength of harmonic emissions, measured at 3m, shall not exceed 0.5 mV/m (54 dB μ V/m).

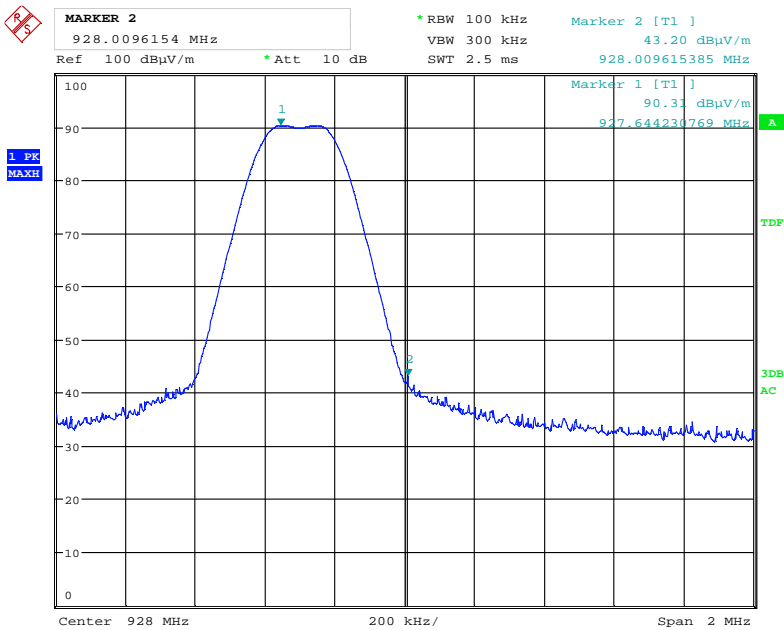
The field strength limits shall be measured using an average detector.

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 or §15.209, whichever is less stringent.



Date: 2.FEB.2023 12:45:56

Lower Band Edge, Peak



Date: 2.FEB.2023 12:48:05

Upper Band Edge, Peak

3.5 Radiated Emission, 30 – 1000 MHz

FCC Part 15.209(a) / 15.249(a)

ISED Canada RSS-210 issue 10, B.10 (a)(b)

ISED Canada RSS-GEN Issue 5, Clause 7.3 / 8.9

Measurement procedure: ANSI C63.10-2013 Clause 6.5

Test Results: Complies

Measurement Data:

Detector: Peak (found frequencies were measured with QP Detector)

Measuring distance: 3 m

Tested with continuous transmission of modulated signal

Frequency MHz	Dist. corr. Factor dB	Field strength @3m Peak Det, dB μ V/m	QP Limit dB μ V/m	Margin dB
30-88	0	< 34	40.0	> 6
88-216	0	< 33	43.5	> 10
216-960	0	< 34	46.0	> 12
960-1000	0	< 34	54.0	> 20

See attached plots

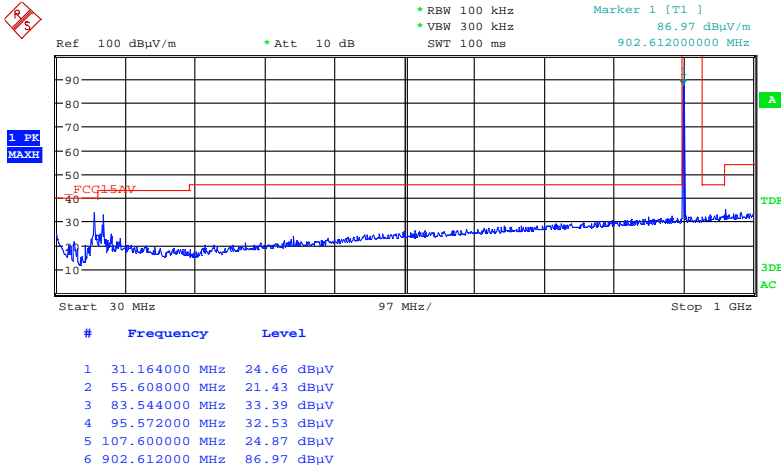
Requirements/Limit

The field strength of harmonic emissions, measured at 3 m, shall not exceed 0.5 mV/m (54 dB μ V/m).

The field strength limits shall be measured using an average detector.

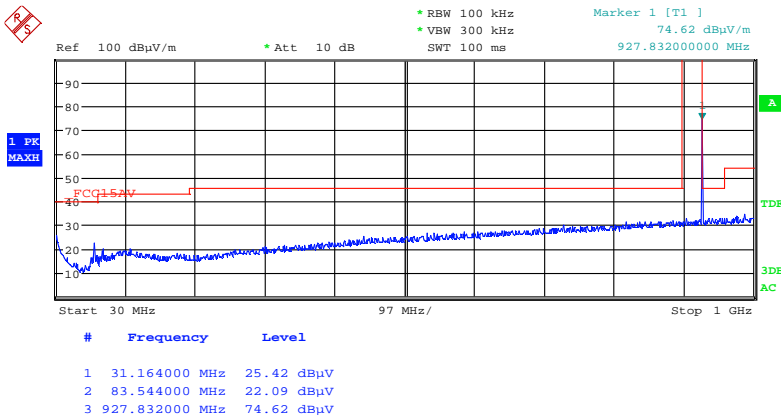
Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits listed in RSS-Gen or §15.209, whichever is less stringent.

FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
Frequency	Radiated emission limit @3 meters	
30 – 88 MHz	100 μ V/m	40.0 dB μ V/m
88 – 216 MHz	150 μ V/m	43.5 dB μ V/m
216 – 960 MHz	200 μ V/m	46.0 dB μ V/m
960 – 1000 MHz	500 μ V/m	54.0 dB μ V/m
Limits above are with Quasi Peak Detector		



Date: 2.FEB.2023 12:01:51

Radiated Emissions 30 – 1000 MHz, VP



Date: 2.FEB.2023 12:10:58

Radiated Emissions 30 – 1000 MHz, HP

3.6 Radiated Emissions, 1-10 GHz

FCC Part 15.209(a) / 15.249(a)

ISED Canada RSS-210 issue 10, B.10 (a)(b)

ISED Canada RSS-GEN Issue 5, Clause 7.3 / 8.9

Measurement procedure: ANSI C63.10-2013 Clause 6.6

Test Results: Complies

Measurement Data:

Measuring distance: 3m (1 – 10 GHz)

Frequency MHz	RF channel MHz	Distance corr. factor dB	Field strength, dB μ V/m @3m		Limit, dB μ V/m		Margin, dB	
			Peak	Average	Pk	Av	Pk	Av
1804.6	902.3	0	54.2	34.2	74	54	19.7	19.7
1855.4	927.7	0	50.4	/	74	54	23.6	/
5413.8	902.3	0	68.2	48.2	74	54	5.8	5.8
5491.8	915.3	0	66.2	46.2	74	54	7.8	7.8
5566.2	927.7	0	65.3	45.3	74	54	8.7	8.7
Other freqs	915.3	0	< 56	< 46	74	54	>18	>8

Average Detector values are calculated from Peak values by Duty Cycle Correction Factor.

A High Pass Filter was used for measurements from 1.5 GHz to 10 GHz.

Antenna factor, amplifier gain and cable loss are included in spectrum analyzer "Transducer factor".

See plots.

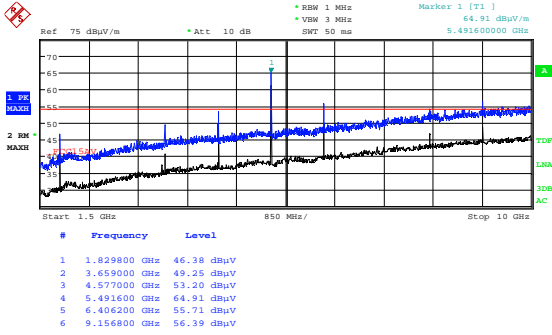
Requirements/Limit

The field strength of harmonic emissions, measured at 3 m, shall not exceed 0.5 mV/m (54 dB μ V/m).

The field strength limits shall be measured using an average detector.

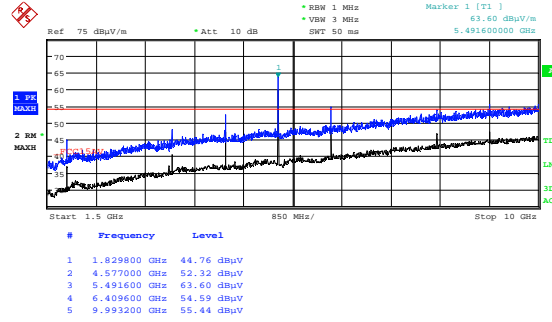
Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits listed in RSS-Gen or §15.209, whichever is less stringent.

FCC	Part 15.209 @ frequencies defined in §15.205	
ISED Canada	RSS-GEN Issue 5, clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency (MHz)	Average Detector (dB μ V/m)	Peak Detector (dB μ V/m)
1 – 40 GHz	54.0	74.0



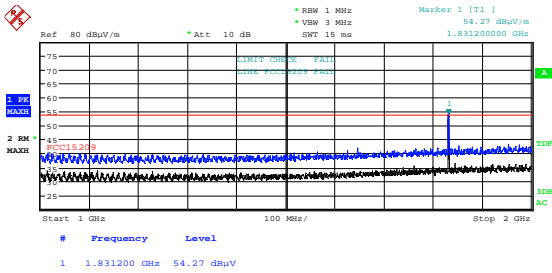
Date: 2.FEB.2023 16:11:33

Radiated Emissions 1.5 – 10 GHz, VP



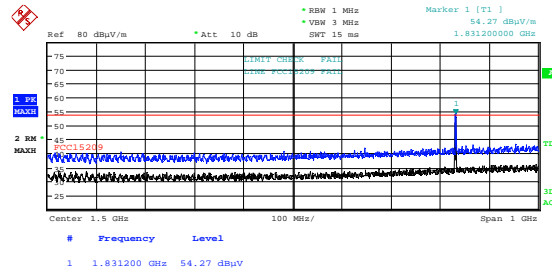
Date: 2.FEB.2023 16:13:30

Radiated Emissions 1.5 – 10 GHz, HP



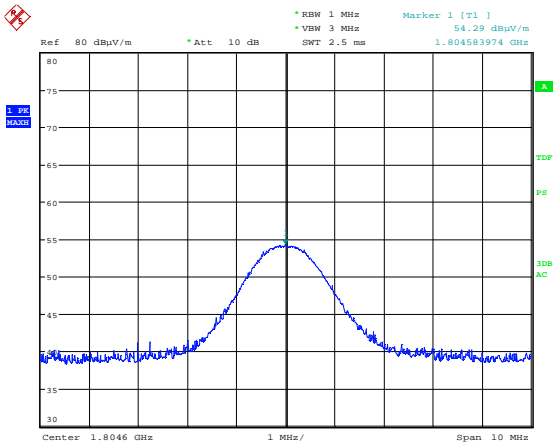
Date: 25.MAR.2022 09:14:25

Radiated Emissions 1 – 2 GHz, VP



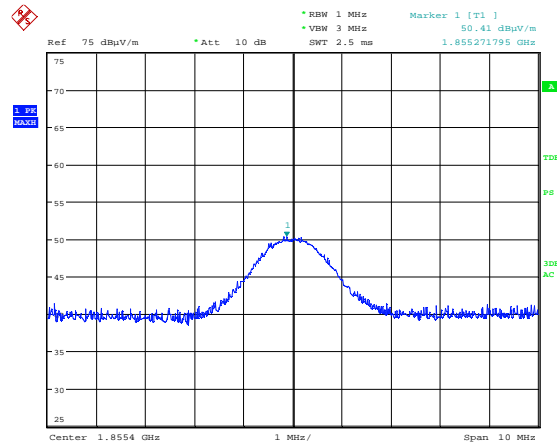
Date: 25.MAR.2022 09:16:15

Radiated Emissions 1 – 2 GHz, HP



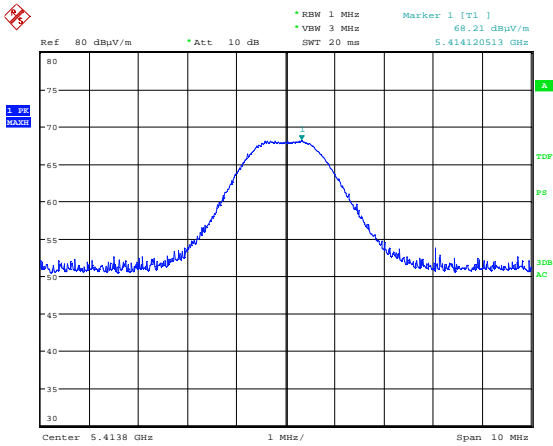
Date: 2.FEB.2023 13:19:33

Radiated Emissions 1804.6 MHz, Peak Det (Max: VP)



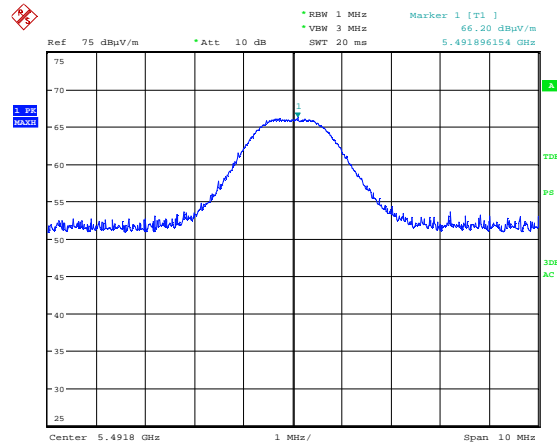
Date: 2.FEB.2023 13:28:53

Radiated Emissions 1855.4 MHz, Peak Det (Max: VP)



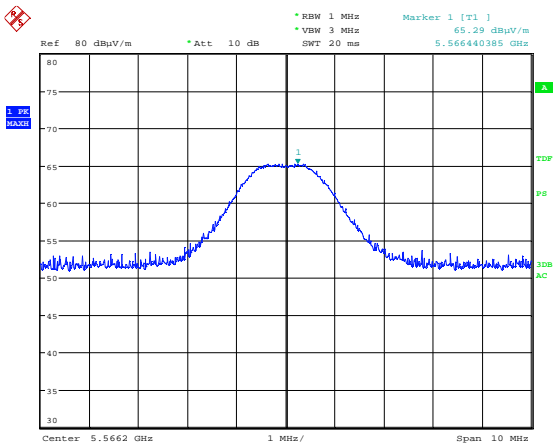
Date: 2.FEB.2023 13:59:30

Radiated Emissions 5413.8 MHz, Peak Det (Max: VP)



Date: 2.FEB.2023 16:17:35

Radiated Emissions 5491.8 MHz, Peak Det (Max: VP)



Date: 2.FEB.2023 13:50:39

Radiated Emissions 5566.2 MHz, Peak Det (Max: VP)

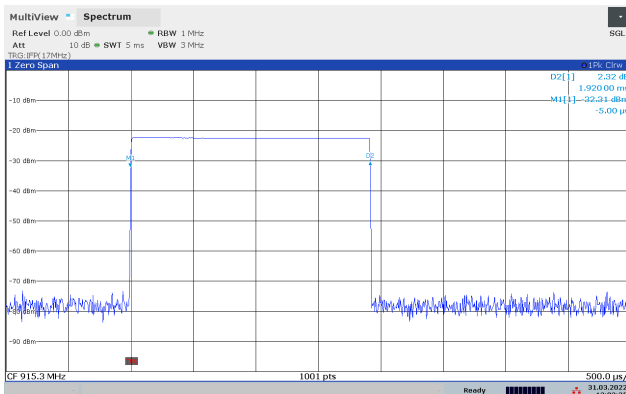
3.1 Duty Cycle Calculation

Burst Length	1.92 ms
Burst Period	1031.9 ms
Averaging Time¹	100 ms
Duty Cycle	1.92 %
Duty Cycle Correction Factor²	20 dB

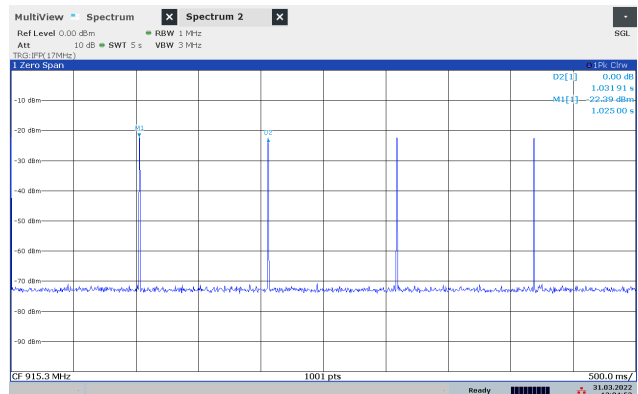
Duty Cycle Correction Factor = $-20 \times \log_{10}(\text{Burst Length} / 100\text{ms}^*)$

¹ Averaging Time is 100ms or burst period, whichever is shorter

² Maximum 20 dB



Burst Length



Burst Period

4 Measurement Uncertainty

Measurement Uncertainty Values		
Test Item		Uncertainty
Spurious Emissions, Radiated	< 1 GHz	±2.5 dB
	> 1 GHz	±2.2 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		+2.9 / -4.1 dB
Temperature Uncertainty		±1 °C

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2

5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	FSW43	Spectrum Analyzer	Rohde & Schwarz	LR 1690	2022-01	2023-01
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2022-01	2023-01
3	6810.17B	Attenuator	Suhner	LR 1669	2021-08	2022-08
4	6HC1500/18000	Highpass Filter	Trilithic	LR 1612	COU	
5	JB3	BiLog Antenna	Sunol Sciences	N-4525	2020-03	2023-03
6	310	Preamplifier	Sonoma	LR 1686	2021-08	2022-08
7	3115	Horn Antenna	EMCO	LR 1330	2016-10	2026-10
8	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2021-08	2022-08

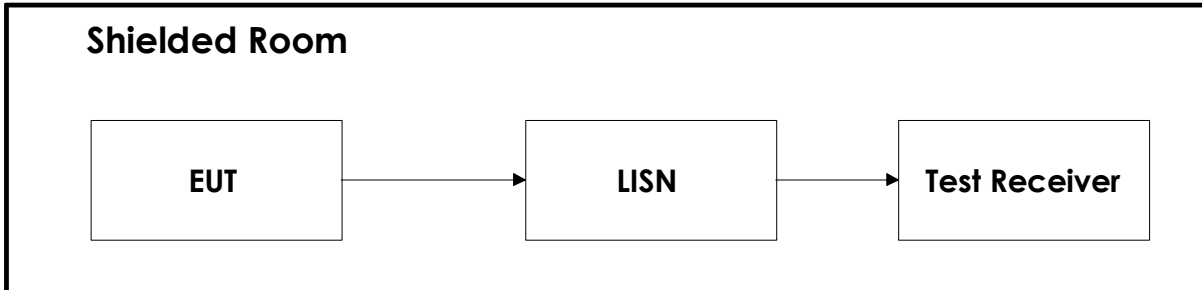
COU = Cal on Use

The software listed below has been used for one or more tests.

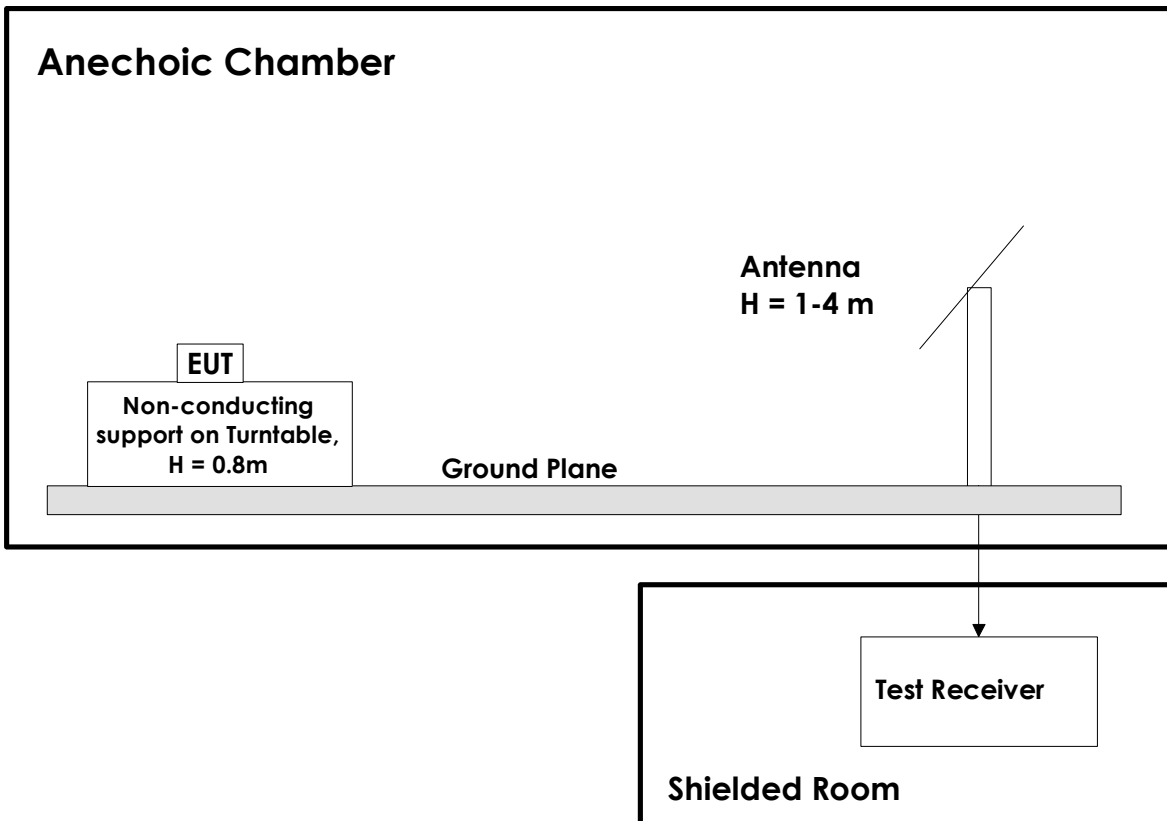
No.	Manufacturer	Name	Version	Comment
1	Nemko	RSPlot	1.0.8.0	Screenshots from R&S Spectrum Analyzers

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission



6.2 Test Site Radiated Emission



This test setup is used for all radiated emissions tests. For frequencies below 30 MHz the measuring distance is 10m, for all other frequencies it is 3m or 1m. Emissions above 1 GHz are measured with a Spectrum Analyzer and Horn Antenna. For measurements above 18 GHz the test receiver is moved inside the anechoic chamber and located next to the antenna to minimize the cable loss. All measurements at 1GHz and above were performed with turntable height 1.5m and with the ground plane covered by absorbers. A pre-amplifier is used for all measurements above 30 MHz, and High-Pass or Band-Pass filter is used for all harmonics.