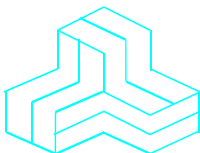


ENGINEERING TEST REPORT



Product: EMS Wireless Multi-Sensor
Model(s): EMS-ENV014
FCC ID: 2AG7TENVV00018
IC: 5857A-ENVV00018

Applicant:

Envisacor Technologies Inc.
726319 Sideroad 22B, RR4
Meaford, Ontario
Canada, N4L 1W7

In Accordance With
Federal Communications Commission (FCC) Part 15, Subpart C,
Sections 15.209 & 15.231 and
RSS-210, Issue 10 -Licence-Exempt Radio Apparatus: Category I Equipment (Annex A.1)

UltraTech's File No.: 22ETI012_FCC15C231A

This Test report is Issued under the Authority of
Tri M. Luu
Vice President of Engineering
UltraTech Group of Labs

Date: August 25, 2022

Report Prepared by: Santhosh Fernandez

Tested by: Angus Au

Issued Date: August 25, 2022

Test Dates: March 10- August 25, 2022

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by any agency of the US Government.*
- *This test report shall not be reproduced, except in full, without a written approval from UltraTech*

UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Tel.: (905) 829-1570 Fax.: (905) 829-8050

Website: www.ultratech-labs.com, Email: vic@ultratech-labs.com, Email: tri@ultratech-labs.com



1309



CA0001-2049



AT-1945



SL2-IN-E-1119R



Korea KCC-RRR

CA0001

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EXHIBIT 1. INTRODUCTION**1.1. SCOPE**

Reference:	FCC Part 15, Subpart C, Sections 15.209 and 15.231 ISED RSS-210, Issue 10
Title:	Code of Federal Regulations (CFR), Title 47, Telecommunication - Part 15
Purpose of Test:	Equipment Certification for FCC Parts 15C and 15.231and RSS 210
Test Procedures:	<ul style="list-style-type: none"> ▪ ANSI C63.4 ▪ ANSI C63.10
Environmental Classification:	Commercial, industrial or business environment

1.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

1.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC 47 CFR 15	2022	Code of Federal Regulations, Title 47 – Telecommunication, Part 15 - Radio Frequency Devices
ANSI C63.4	2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz
ANSI C63.10	2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
RSS-Gen, Issue 5	2018 Amendment 1 (March 2019) Amendment 2 (February 2021)	General Requirements for Compliance of Radio Apparatus
ICES-003, Issue 7	2020	Information Technology Equipment (including Digital Apparatus)

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

APPLICANT:	
Name:	Envisacor Technologies Inc.
Address:	726319 Sideroad 22B, RR4, Meaford, Ontario N4L 1W7
Contact Person:	Andrew Cullen
Email Address:	acullen@envisacor.com
Telephone No.:	(905) 660-1552

MANUFACTURER:	
Name:	Envisacor Technologies Inc.
Address:	726319 Sideroad 22B, RR4, Meaford, Ontario N4L 1W7
Contact Person:	Andrew Cullen
Email Address:	acullen@envisacor.com
Telephone No.:	(905) 660-1552

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Description of Product	Universal Wireless Sensor
Product Marketing Name:	EMS Wireless Multi-Sensor
Model Name or Number: <i>(HVIN)</i>	EMS-ENV014
Firmware Version Identification Number :	1V14
Serial Number:	Test sample
Oscillator Frequencies:	13.56 MHz
CPU Frequencies:	1MHz
Voltage and Current input ratings:	Battery 3Vdc, ~1.3uA
Equipment Environment / Type:	Wireless

2.3. FUNCTION/ description OF EQUIPMENT

EUT is an Environmental Sensor

2.4. SPECIFICATIONS OF WIRELESS RADIOS IF EQUIPPED

TRANSMITTER DETAILS	
Technical Specifications	
Equipment Type:	Fixed use
Intended Operating Environment:	Residential/Commercial
RF Output Power Rating:	87.74 dBµV/m peak (67.78 dBµV/m average)
Operating FrequencyRange:	433.92MHz
RF Output Impedance:	50ohm
Modulation Type(s)	OOK
Emission Designator(s)	P0B
Oscillator Frequency(ies):	13.56 MHz
Antenna Connector Type:	[X] Integral / Internal
Antenna Description (if more than one antenna, provide a separate list of all the antennas to be used with the device):	
Type:	WireAntenna
Model:	N/A
FrequencyRange:	300MHz – 700MHz
Gain (dBi):	< 1.6dBi
RECEIVER PART	
N/A	

2.5. LIST OF EUT'S PORTS

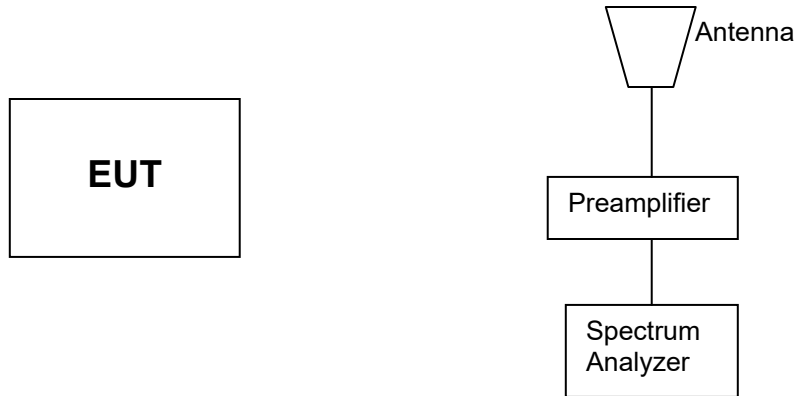
None

2.6. ANCILLARY EQUIPMENT

None

2.7. Test Setup And Equipment List

2.7.1. Radiated Emissions / Duty Cycle / Bandwidth Measurements



2.7.2. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSU26	100398	20Hz–26.5 GHz	20 Sep 2023
Attenuator	Hewlett Packard	8493C	0461	DC–26.5 GHz	Cal before use
Preamplifier	COM Power	PAM-118A	551052	500MHz – 18GHz	11 Sep 2022
Antenna	EMCO	3115	9911-5955	1GHz – 18GHz	12 Oct 2022
Biconilog Antenna	EMCO	3142C	34792	26 – 3000 MHz	16 Dec 2023

EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS**3.1. CLIMATE TEST CONDITIONS**

The climate conditions of the test environment are as follows:

Temperature:	21 to 23 °C
Humidity:	45 to 58%
Pressure:	102 kPa
Power input source:	3V battery

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	Device transmits continuously for emissions measurements.
Special Test Software:	Special software provided by the Applicant to operate the EUT at frequency continuously and in the range of typical modes of operation.
Special Hardware Used:	N/A
Transmitter Test Antenna:	Tx antenna is integral.

Transmitter Test Signals	
Frequency Band(s):	433.92 MHz
Test Frequency(ies):	433.92 MHz
RF Power Output:	433.92 MHz Tx: 87.74 dBµV/m peak (67.78 dBµV/m average) at 3m distance
Normal Test Modulation:	OOK
Modulating Signal Source:	Internal

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).
- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with ANAB File No.: AT-1945.

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC/RSS Section(s)	Test Requirements	Compliance (Yes/No)
15.203 RSS-Gen, Section 6.8	Antenna Requirement	Yes*
15.207(a) RSS-Gen, Section 8.8	AC Power Line Conducted Emissions	N/A
15.231 (a) (2) & (3) RSS-210, Annex A, A.1.1	Periodic Operation conditions	Yes**
15.231(b),(e) 15.209 RSS-210, Annex A, A.1.2 &1.4	Transmitter Radiated Emissions - Fundamental, Harmonic and Spurious Emissions	Yes
15.231(c) RSS-210, Annex A, A.1.3	20 dB Bandwidth	Yes
15.231(d)	Frequency Tolerance for Devices Operating within the Frequency Band 40.66-40.70 MHz	N/A

* The EUT complies with the requirement; it employs integral antenna.

**Compliant as per Operational Description of the device

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

EXHIBIT 5. TEST DATA

5.1. TRANSMITTER RADIATED EMISSIONS [47 CFR §§ 15.231(e), 15.209 & 15.205] [RSS-210, ANNEX A, A.1.4]

5.1.1. Limit(s)

RSS-210, Table A2 – Reduced Field Strength Limits for Momentarily Operated Devices & 47 CFR 15.231(b) (e)

15.231(e) limits is the tighter limit.

(e) Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this section, except the field strength table in paragraph (b) of this section is replaced by the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66-40.70	1,000	100
70-130	500	50
130-174	500 to 1,500 ¹	50 to 150 ¹
174-260	1,500	150
260-470	1,500 to 5,000 ¹	150 to 500 ¹
Above 470	5,000	500

¹Linear interpolations.

(b)(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(b)(2) Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in Section 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of Section 15.205 shall be demonstrated using the measurement instrumentation specified in that section.

(b)(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in Section 15.209, whichever limit permits a higher field strength.

47 CFR 15.205(a) Restricted Bands of Operation

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
¹ 0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	(²)
13.36–13.41			

¹ Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.

² Above 38.6

47 CFR 15.209(a) General Field Strength Limits

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100 **	3
88–216	150 **	3
216–960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 MHz, 76– 88 MHz, 174–216 MHz or 470–806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.

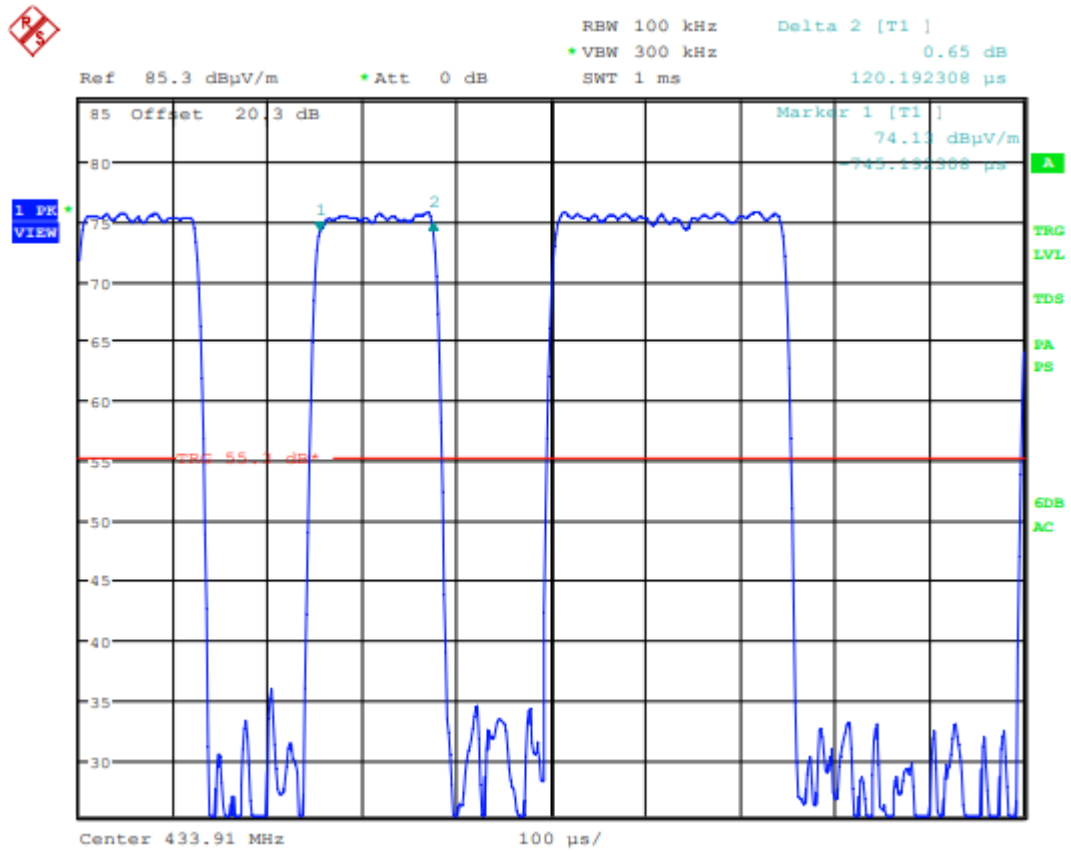
5.1.2. Method of Measurements

ANSI C63.4 and/or ANSI C63.10

5.1.3. Test Data

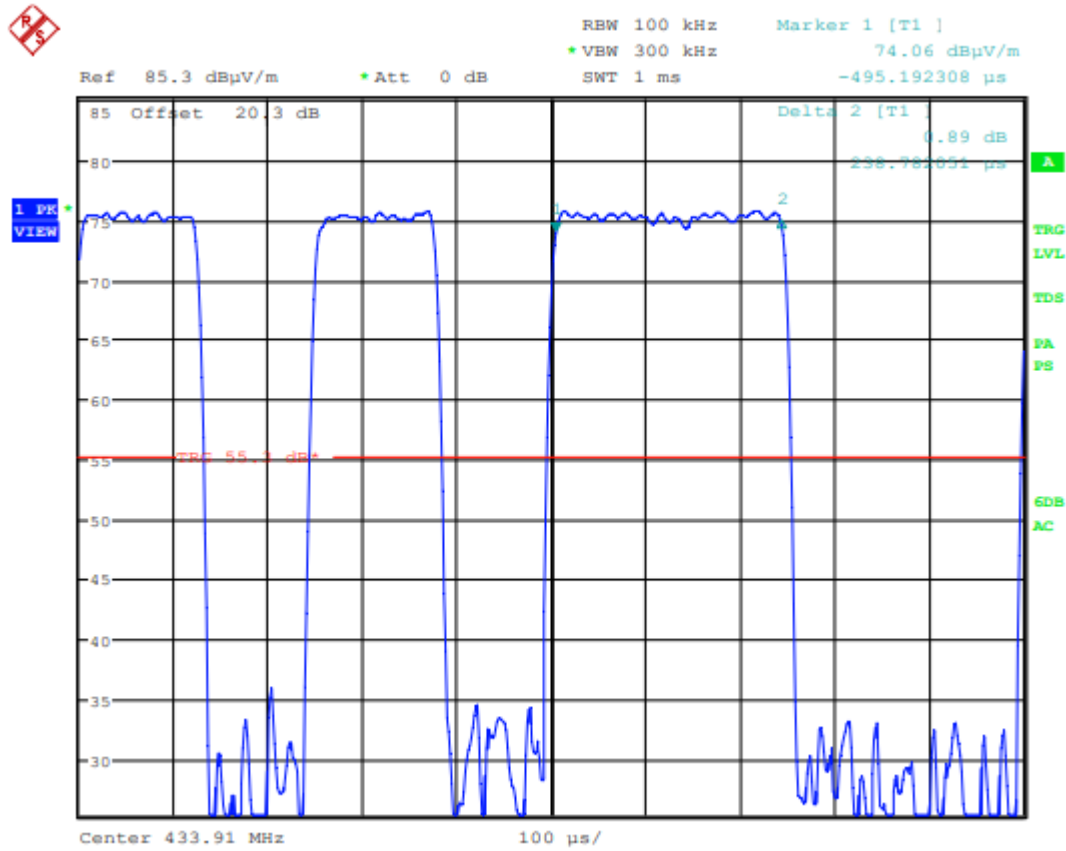
5.1.3.1. Duty-Cycle Correction Factor

Configuration: 433.92MHz
Smaller Pulse



$$T_{on(\\text{Small})}=120.2\\mu\\text{s}$$

Configuration: 433.92MHz
Bigger Pulse

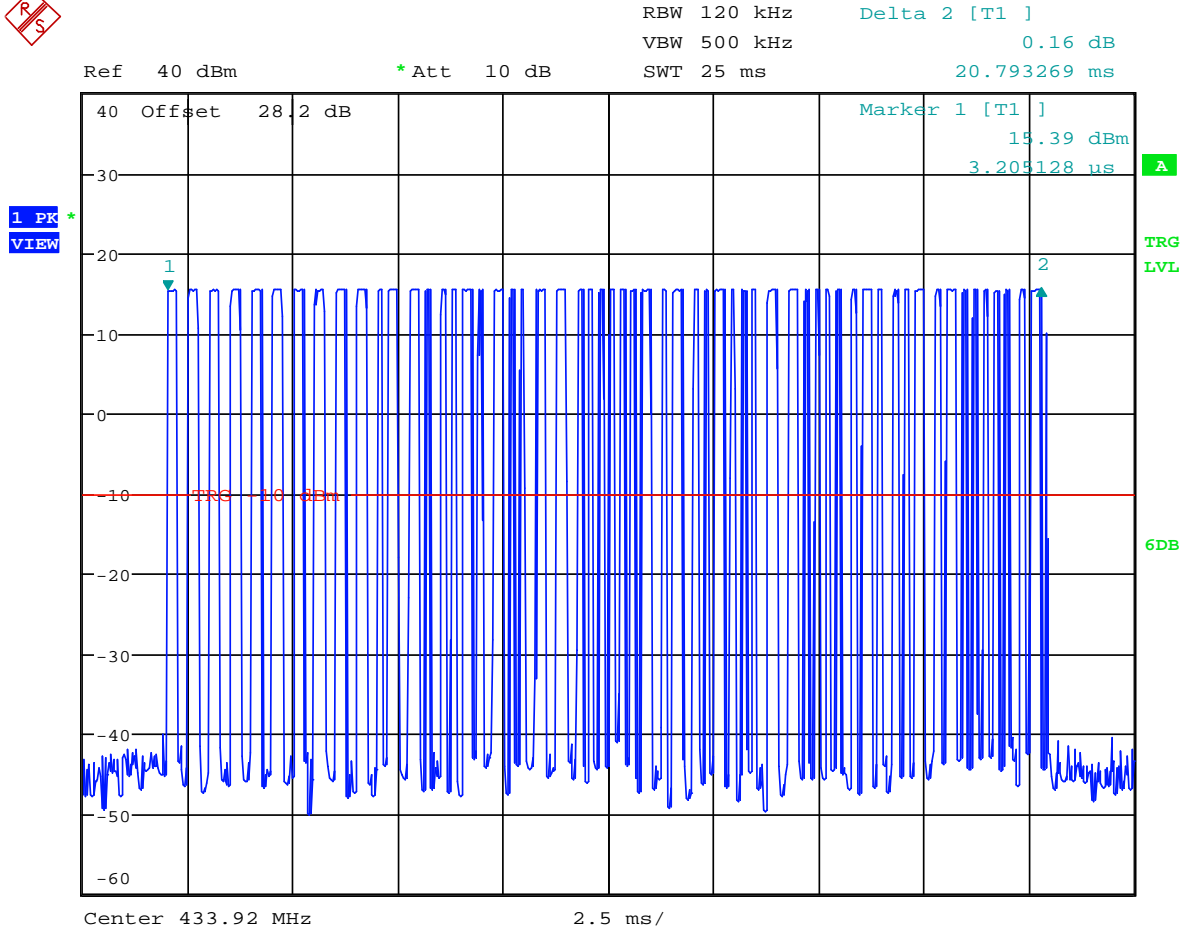


$$T_{on(large)}=238.78\mu s$$

Model:EMS-ENV014

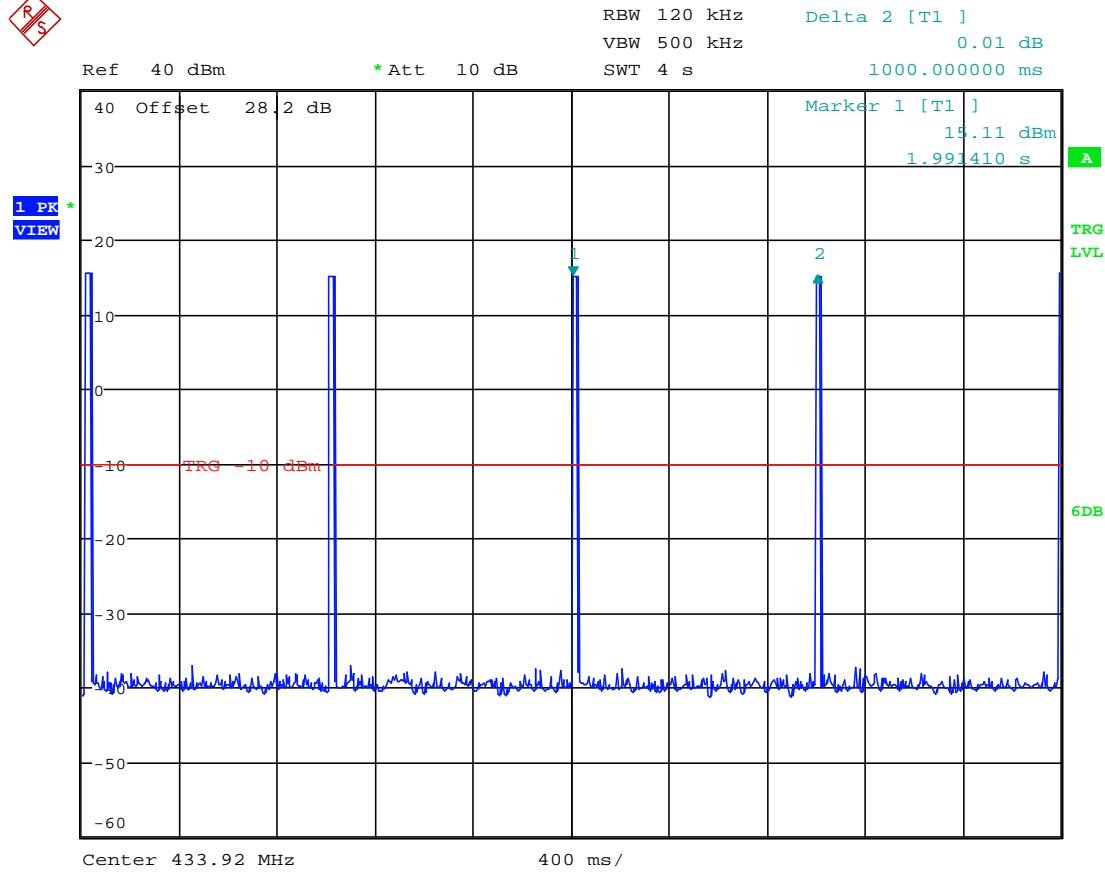
FCC ID: 2AG7TENVV00018

Duty cycle: 59 counts
Big pulse: 25 (25x338.78us= 5.97 ms)
Small pulse: 34(34x120.2us=4..08ms)

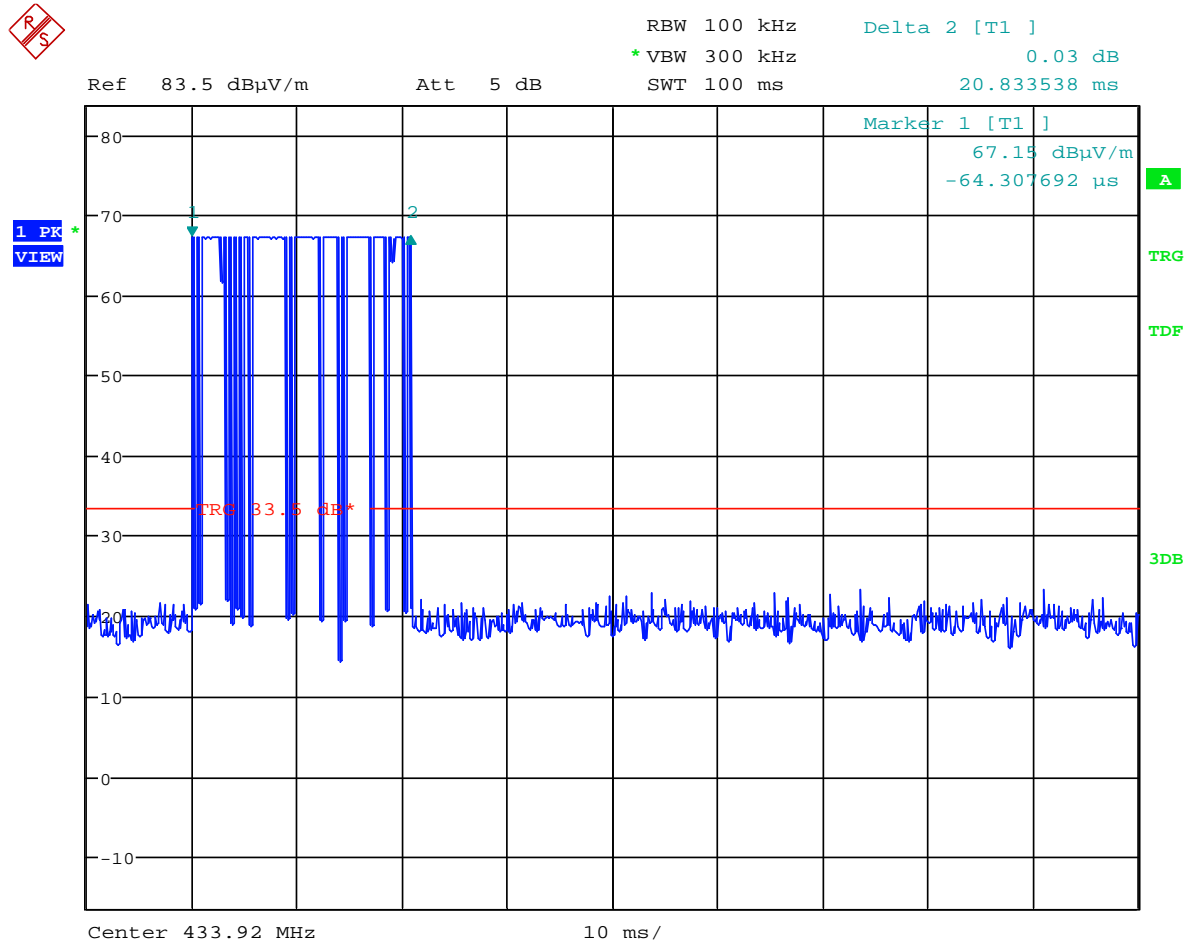


Date: 29.MAR.2022 09:17:17

Cycle pattern



Date: 29.MAR.2022 09:21:06



Date: 1.APR.2022 09:46:56

Duty Cycle (100ms)

The duty cycle correction factor is the total “on time” divided by the period of the pulse train (or 100 ms).

$$\text{Duty Cycle (x)} = T_{\text{on}} / 100\text{ms} = 10.05\%$$

$$T_{\text{ON}} = (25 * 238.78\mu\text{s}) + (34 * 120.2\mu\text{s}) = 5.97\text{ms} + 4.08\text{ms} = 10.05\text{ms}$$

$$\text{Duty cycle correction factor} = 20 * \log (T_{\text{ON}}/100 \text{ ms}) = -19.96 \text{ dB}$$

5.1.3.2. 433.92 MHz Transmitter

Remarks:

- EUT shall be tested in three orthogonal positions.
- The following test data represent the worst-case derived from exploratory tests.
- The measuring receiver shall be tuned over the frequency range of 30 MHz to the 10th harmonic of the highest fundamental frequency.
- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- In the restricted band per §15.205: 15.209 (a) limits applied
- Outside the restricted band per § 15.205: § 15.231 (e) limits or § 15.209 (a) applied, whichever allows higher field strength emission.
- Section 15.231(e) field strength limit of the fundamental at 433.92 MHz = $20 \log [(16.67 \times 433.92) - 2833.33] = 72.9 \text{ dB}\mu\text{V/m}$
- Spurious emissions limit is 20 dB below fundamental limit.
- Duty Cycle: measured maximum duty cycle is 10.05 %.
- The peak-average correction factor = -19.96 dB. See duty cycle plots for details.
- Equipment was tested in the normal orientation as specified by the manufacturer

Frequency (MHz)	Peak E-Field @ 3m (dBμV/m)	Average E-Field @ 3m (dBμV/m)	Antenna Plane (H/V)	§ 15.231 (e) Limits @ 3m (dBμV/m)	§ 15.209 (a) Limits @ 3m (dBμV/m)	Margin (dB)	Pass/Fail
Field strength of fundamental							
433.918	87.74	67.78	V	72.9	--	-5.12	PASS
433.918	85.15	65.19	H	72.9	--	-7.71	PASS
Field strength of spurious emission							
867.85	54.24	34.28	V	52.9	46	-11.72	PASS
867.85	56.08	36.12	H	52.9	46	-9.88	PASS
1301.76	48.24	*	V	52.9	54	-5.76	PASS
1301.76	57.06	37.1	H	52.9	54	-16.9	PASS
1735.68	58.26	38.3	V	52.9	54	-15.7	PASS
1735.68	56.76	36.8	H	52.9	54	-17.2	PASS
2169.6	43.32	*	V	52.9	54	-10.68	PASS
2169.6	48.27	*	H	52.9	54	-5.73	PASS
2603.52	39.82	*	V	52.9	54	-14.18	PASS
2603.52	42.14	*	H	52.9	54	-11.86	PASS
3037.44	43.58	*	V	52.9	54	-10.42	PASS
3037.44	40.9	*	H	52.9	54	-13.1	PASS
3471.36	41.46	*	H	52.9	54	-12.54	PASS

* Emissions are more than 20 dB below the applicable limits.

5.2. 20 dB BANDWIDTH [47 CFR §§ 15.215(c) & 15.231(c)] [RSS-Gen, SECTION 6.7 & RSS-210 SECTION A.1.3]

5.2.1. Limit(s)

The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

Emission bandwidth shall not be located in RSS-Gen, Table 7 - Restricted Frequency Bands or in TV bands.

15.215(c) Emission bandwidth shall not be located in the restricted bands in 15.205 and the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz.

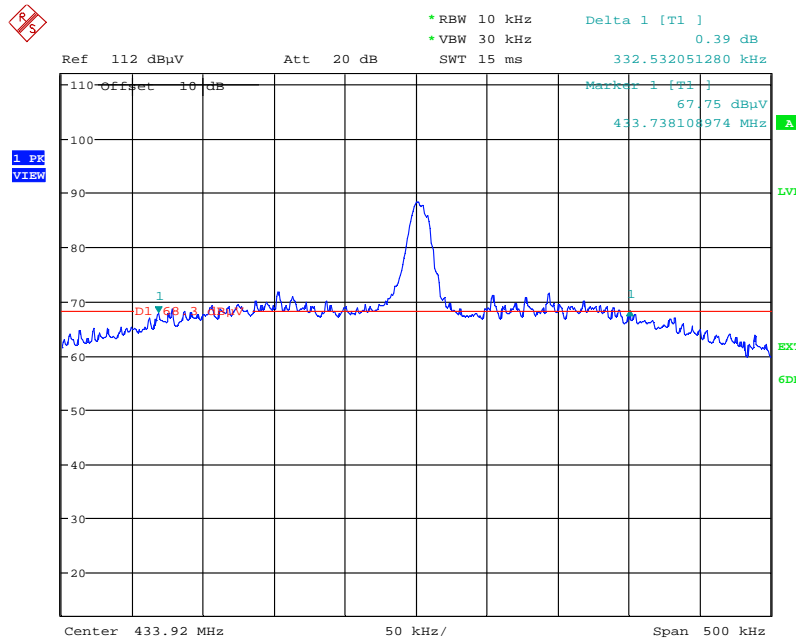
RSS 210 Annex A, A.1.3 Bandwidth of Momentary Signals

15.231 (c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

5.2.2. Method of Measurements

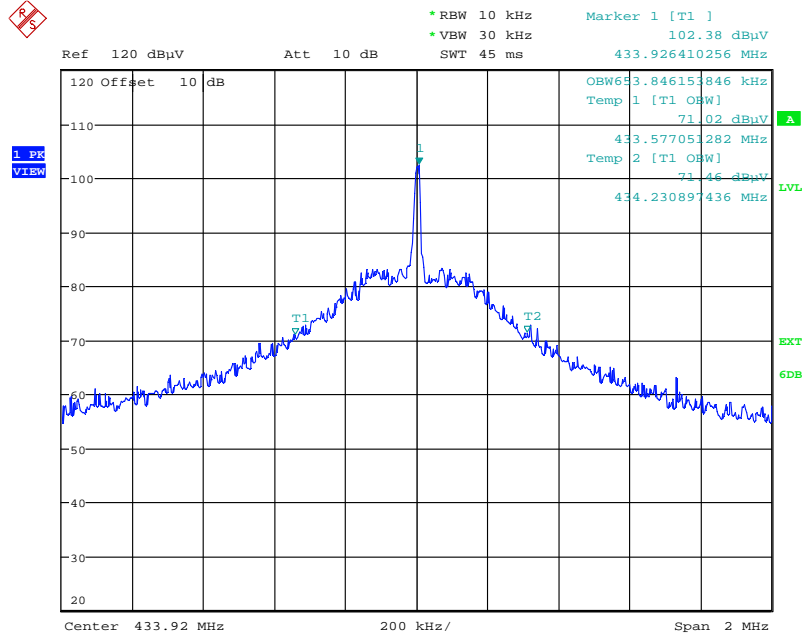
The measurements were performed in accordance with ANSI C63.4

5.2.3. Test Data



Date: 25.AUG.2022 12:35:07

20dB BW=332.53 kHz (<1084.8 kHz limit)



Date: 9.AUG.2022 16:12:44

99% OBW for RSS/ISED= 653.85 kHz

5.3. RADIATED EMISSIONS FROM UNINTENTIONAL RADIATORS [ICES-003, ISSUE 7 RSS-Gen §§ 4.10 & 6]

5.3.1. Limit(s)

The equipment shall meet the limits of the following tables:

Radiated emissions limits (30 MHz to 1 GHz)

Frequency range (MHz)	Class A (3 m) Quasi-peak (dBµV/m)	Class A (10 m) Quasi-peak (dBµV/m)	Class B (3 m) Quasi-peak (dBµV/m)	Class B (10 m) Quasi-peak (dBµV/m)
30 – 88	50.0	40.0	40.0	30.0
88 – 216	54.0	43.5	43.5	33.1
216 – 230	56.9	46.4	46.0	35.6
230 – 960	57.0	47.0	47.0	37.0
Above 960	60.0	49.5	54.0	43.5

Note: The more stringent limit applies at transition frequencies

5.3.2. Method of Measurements

ANSI C63.4

Test Data

Remarks:					
<ul style="list-style-type: none"> ▪ The measuring receiver shall be tuned over the frequency range 30 MHz to 18 GHz. ▪ All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded. 					
Frequency (MHz)	RF Level at 3m (dBµV/m)	Detector Used (Peak/QP/Avg)	Antenna Plane (H/V)	Limit at 3m (dBµV/m)	Margin (dB)
79.75	18.8	PEAK	V	40	-21.2
169.9	21.53	PEAK	V	43.5	-21.97
323.79	22.57	PEAK	V	46	-23.43
323.79	21.31	PEAK	H	46	-24.69
2441	40.28	PEAK	V	54	-13.72
2441	36.83	PEAK	H	54	-17.17

EXHIBIT 6. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

Test description		Uncertainty
Power Line Conducted Emissions		± 2.62
Transmitter/Spurious Radiated Emissions	<30 MHz	$\pm 2.69\text{dB}$
	30-1000 MHz	$\pm 4.20\text{dB}$
	>1 GHz	$\pm 2.70\text{dB}$

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

END OF REPORT