



Test Report No. 7212326080

Applicant: E.N.G.S Systems LTD

Equipment Under Test:

Cow Leg Tag

Model: RF Transmitter (V2.00)

FCC ID: XBL-LEGTAG

***The Standards Institution of Israel
Industry Division
Electrical & Electronics Laboratory
EMC Branch***



Certificate Number: AT-1359

**Test Report No.:** 7212326080**Page 2 of 22 pages****Title:** Cow Leg Tag**Model:** RF Transmitter (V2.00)**FCC ID:** XBL-LEGTAG

Applicant:	E.N.G.S Systems LTD
Address:	ZAHAR industrial park, POB 666, Rosh-Pina , Israel
Sample for test selected by:	The customer
The date of tests:	29 September 2022 - 3 November 2022

Description of Equipment Under Test (EUT):	Cow Leg Tag
Model:	RF Transmitter (V2.00)
Software version of radio unit:	V-4.5
Hardware version of radio unit:	V2.00
Manufactured by:	<i>E.N.G.S Systems LTD</i>

Reference Documents:

- ❖ CFR 47 FCC: Rules and Regulations; Part 15. "Radio frequency devices";
Subpart C: "Intentional radiators"
Section 15.205. "Restricted bands of operations",
Section 15.207. "Conducted limits"
Section 15.209. "Radiated emission limits, general requirements".
"Radiated Emission Limits, Additional Provisions";
Section 15.231. "Periodic operation in the bands 40.66 – 40.70 MHz,
and above 70 MHz".

This Test Report contains 22 pages
and may be used only in full.

This Test Report applies only to the specimen tested and may not
be applied to other specimens of the same product.



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Model: RF Transmitter (V2.00)

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1. EUT Description and operation

1.1. General description:

* Note: the customer supplied all information in clause below.

The Equipment Under Test (hereinafter: EUT) is a Cow Leg Tag Model RF Transmitter (V2.00) (intended) to be used in a farm shed and in the parlor.

The tag is attached to a belt and worn around the leg of a cow. The main future of the Transceiver is to receive and transmit the cow tag data. A Cow tags used for Cow monitoring. The tag is counting steps and monitor cow behaviour.

Tag works in the transmitting at 433.92MHz.

Tag works with the battery a 3 Volt (CR123A BATTERY),

Type of modulation:	FSK
Antenna type:	Built-in internal antenna on the printed circuit board. Antenna gain 0 dBi.

The EUT external view is presented in photo 1.

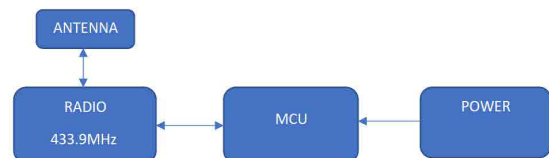


Photo 1. Transceiver view and block diagram.

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2. Test summary

Parameter	FCC Part 15 Reference paragraph	Verdict
Radiated emission from intentional radiators in restricted bands	Subpart C Section 15.205	Comply
AC line conducted emission test	Subpart C Section 15.207	N/A
Test of field strength emission from intentional radiators	"Radiated Emission Limits, Additional Provisions"; Section 15.231.	Comply
Occupied bandwidth	Subpart C section 15.231(c)	Comply

Electrical & Electronics
Laboratory

17 July 2023

Name: Eng. Yuri Rozenberg
Position: Head of BranchName: Alexander Konkov
Position: Test Engineer

Measurement uncertainty.

The test equipment has been calibrated according to its recommended procedures and is within the manufacturer's published limit of error.

The laboratory calibrates its standards by a third party (traceable to NIST, USA) on a regular basis according to equipment manufacturer requirements.

In the following table the uncertainty calculation is given.

Type of disturbance Test description	Calculated uncertainty U_{LAB}
Radiated disturbance electric field strength in a SAR at 3 m distance 30 MHz – 1.0 GHz	± 4.32 dB
electric field strength in a FAR at 3 m distance 1.0 – 18 GHz. 18 – 40 GHz.	± 4.47 dB ± 2.78 dB



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Normative References.

FCC 47 CFR Part 15, Subpart C	Radio Frequency Devices Subpart C – Intentional Radiators
ANSI C63.4: 2009	American National Standard for Method of Measurements 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.

**Test Report No.: 7212326080****Page 7 of 22 pages****Title: Cow Leg Tag****Model: RF Transmitter (V2.00)****FCC ID: XBL-LEGTAG****2.1. EUT setup and operation:**

Test was performed in continuous transmission mode.

The transmitter operated in test mode and transmitted a modulated FSK signal with a random transmission of zero or one.

3. Measurements and derived results**3.1. Location of the Test Site:**

Radiated test measurements were conducted in the Anechoic chamber at the EMC laboratory of the Standards Institution of Israel in Tel-Aviv.

3.2. Test condition:

Temperature: 24 °C. Humidity: 53 %. Atmospheric pressure: 1010 mbar.

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3.3. Radiated emission test.

3.3.1. General:

Per FCC Part 15 Subpart C Sections 15.209, 15.231.

- * Initial scans were made using a peak detector but still using the appropriate ANSI IF bandwidth.

3.3.2. Radiated emission measurements:

Preliminary investigation was performed from the lowest radio frequency signal generated in the equipment up to ten harmonics of a carrier frequency.

The final radiated emission measurements were performed in the semi Anechoic chamber at the 3 m test distances. The test was performed with a connected battery. The EUT was operated in continue transmission mode. The transmitter was installed on a turn - table. Biconilog and Double Ridged Guide antennas were used.

The measurements were performed at frequencies at which the signal level was 10 dB below the limit or less. The levels were maximized by rotating turntable through 360° and changing antenna-to-EUT polarization from vertical to horizontal. The worse case result was noted in tables.

3.3.3. Radiated emission test results:

Final measurements result are presented in tables and plots ## 1 - 6 in section 3.5.



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3.4. Common conditions for operation in the band above 70 MHz.

3.4.1. General:

Per FCC Part 15 Subpart C clause 15.231 (a).

3.4.2. Requirements:

15.231(a) – Transmitter is defined as operating 433.9 MHz..

15.231(a)(1) – Not applicable. Transmitter is not activated manually.

15.231(a)(2) - Transmission duration is limited by program and after activation is less than 5 second.

15.231(a)(3) – Duration of transmission used for determination of system integrity in security application is 0.638 second per hour that is less than limited 2 seconds per hour when without additional equipment, otherwise - the transfer time is less.

15.231(a)(4) – Transmitter is not designed to use during the emergencies.

15.231(a)(5) – Transmitter doesn't exceed the limits of this section.

3.4.3. Summary:

The verification tests according to 15.231(a) have been done and the EUT was found complies with the requirements of clause 15.231(a).

**Test Report No.: 7212326080****Page 10 of 22 pages****Title: Cow Leg Tag****Model: RF Transmitter (V2.00)****FCC ID: XBL-LEGTAG****3.5. Test of field strength emission from intentional radiator.****3.5.1. General:**

Per FCC Part 15 Subpart C clause 15.231(b).

3.5.2. Requirements:

The field strength emissions from intentional radiators operated on this frequency shall comply with the limit based on the average value.

Fundamental Frequency MHz	Calculated Field Strength limit of Fundamental dB μ V/m	Calculated Field Strength limit of Harmonics dB μ V/m
433.92	80.8	60.8

Note: Peak field strength shall not exceed the maximum permitted specified limit by more than 20 dB.

Field strength limits are specified at a distance of 3 meters.

3.5.3. Test procedure:

The test was conducted according to clause 15.231.

3.5.4. Test summary:

The tested unit meets the standard requirement.

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Freq.	Ant. Pol.	Emission level dBuV/m		Limit 3m dBuV/m		Marging	Verdict
MHz	H/V	Pk	AV	Pk	AV	dB	-
433.889	V	59.1	58.71	100.82	80.82	-22.11	Pass
867.800	V	37.06	16.00	80.8	60.8	-44.08	Pass

* Test was performed in continuous transmission mode in test mode!

For recorded Fundamental frequency result, see plot #1.

For second harmonic frequency result, see plot #2

All received spurious emissions were found below the specified limit.

Founded spurious emissions results presented in tables below.

Unwanted emissions test result.

Freq. MHz	Antenna Height (m)	Turn table Angle (°)	QP. Emission Level (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)	Reference to plot #
0.496	1.0	13	52.819	73.68	>20	3
21.27	1.0	348	29.013	69.51	>20	3

Spurious emission result.

Freq. MHz	Antenna pol. V/H	Peak Ampl dBμV/m	Peak Ampl limit, dBμV/m	Margin dB	Quasi Ampl. dBμV/m	Specified @3m limit, dBμV/m	Margin dB	Ref. to plot #
613.29	H	37.052	*74.0	>20	31.285	*46	-14.71	4
867.75	H	41.520	-	-	-	60.8	-19.28	4
1921.5	H	46.643	-	-	-	60.8	-14.15	5
2455.0	H	48.185	-	-	-	60.8	-12.61	5
3468.0	H	51.905	-	-	-	60.8	-8.89	5

Note:

*Limit 15.205 restricted bands.



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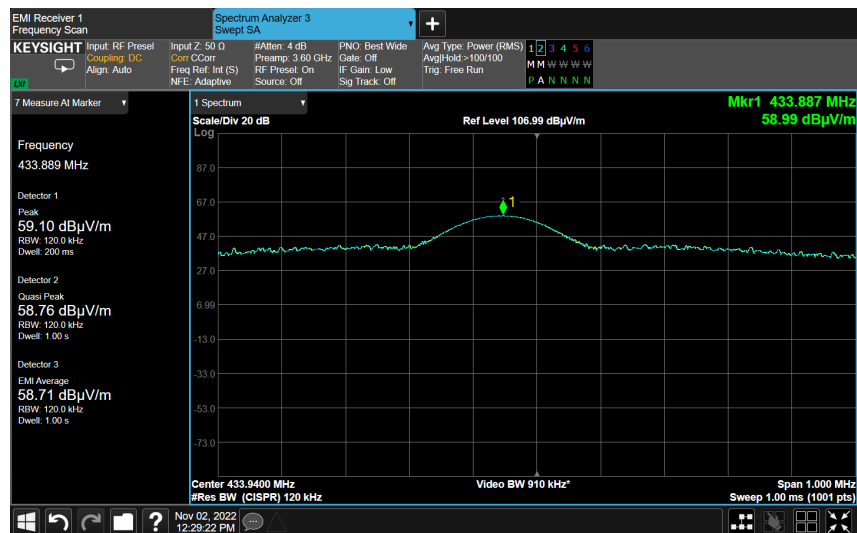
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Title: Cow Leg Tag

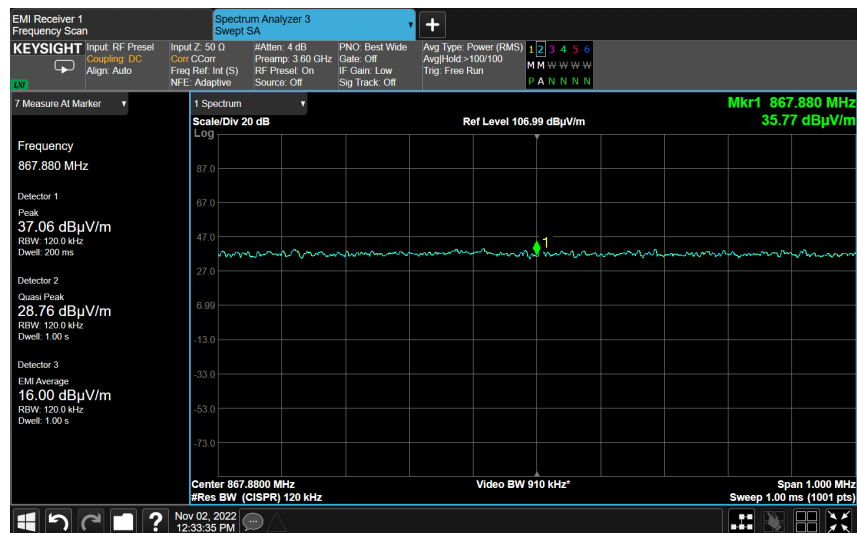
Model: RF Transmitter (V2.00)

FCC ID: XBL-LEGTAG

Fundamental frequency test.



Plot # 1. Carrier frequency 433.92 MHz.



Plot # 2. Second harmonic frequency 867.836 MHz.



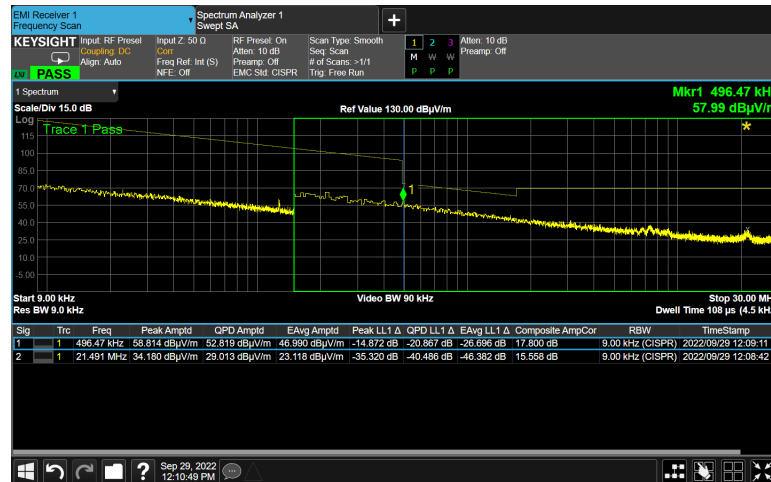
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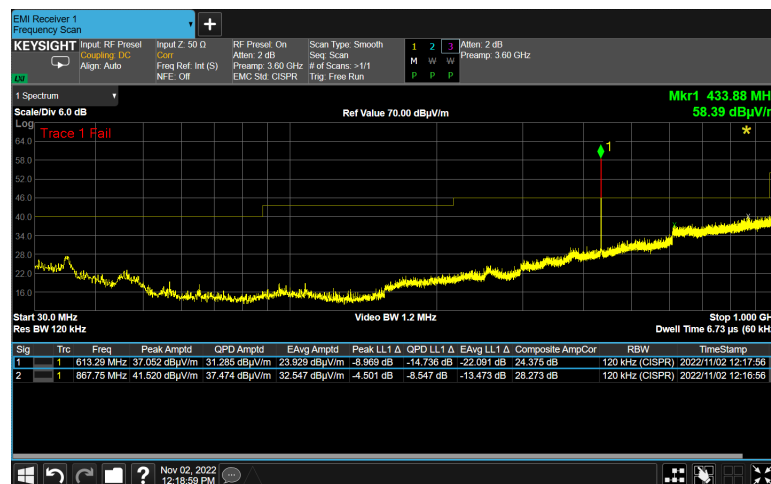
Title: Cow Leg Tag

Model: RF Transmitter (V2.00)

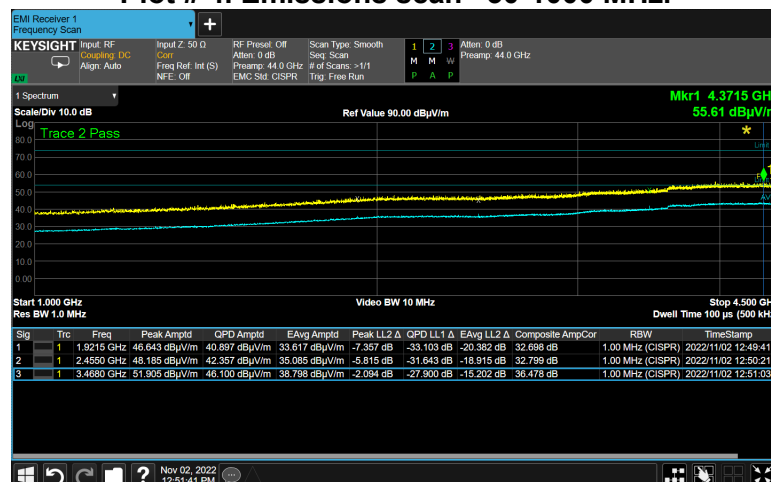
FCC ID: XBL-LEGTAG



Plot # 3. Emissions scan 9kHz – 30 MHz.



Plot # 4. Emissions scan– 30-1000 MHz.



Plot # 5. Emissions scan 1.0 – 4.5 GHz.



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3.6. Transmission activation.

3.6.1. Requirements:

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

A transmitter activated automatically shall cease transmission within 5 seconds after activation.

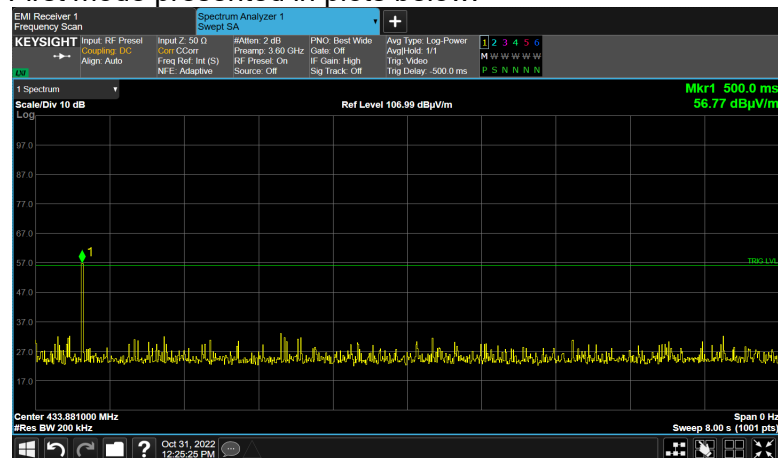
3.6.2. Test results:

There are 2 modes of operation, the first with a switch 125 kHz and the second automatically - three times in 15 minutes.

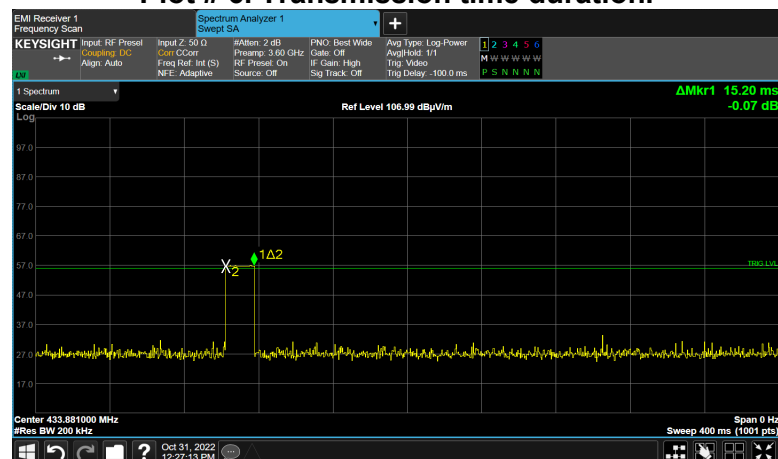
First mode worked with Parlor ID.

The second without additional equipment.

Test result of First mode presented in plots below.



Plot # 6. Transmission time duration.



Plot # 7



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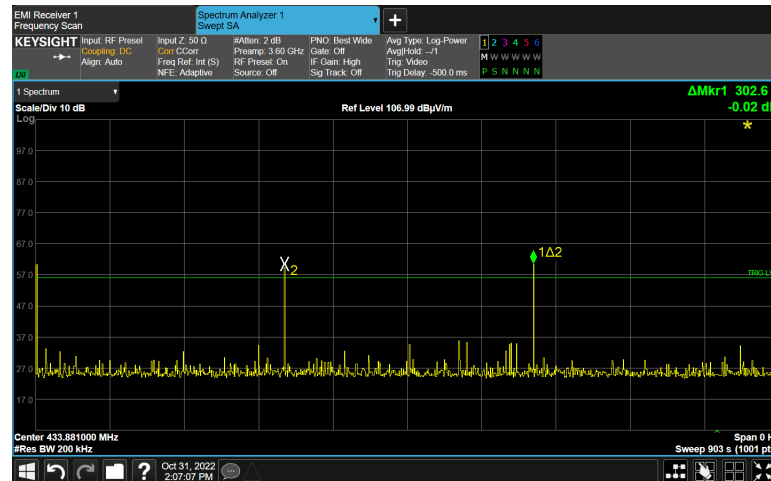
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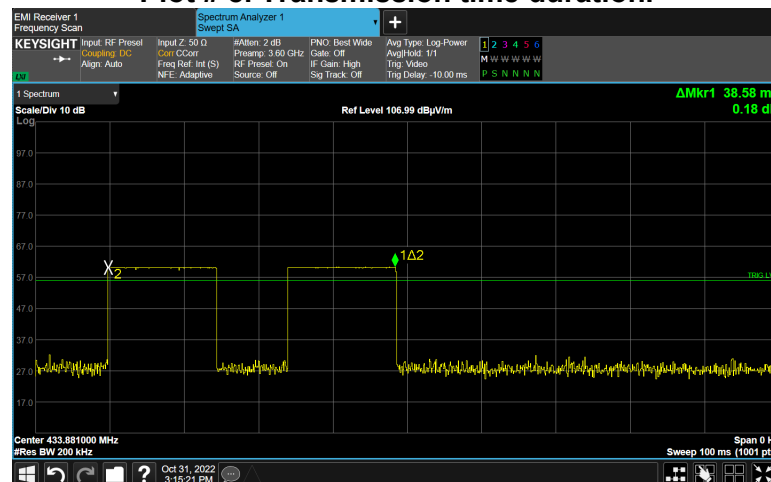
Model: RF Transmitter (V2.00)

FCC ID: XBL-LEGTAG

Test result of Second mode presented in plot below.



Plot # 8. Transmission time duration.



Plot # 9

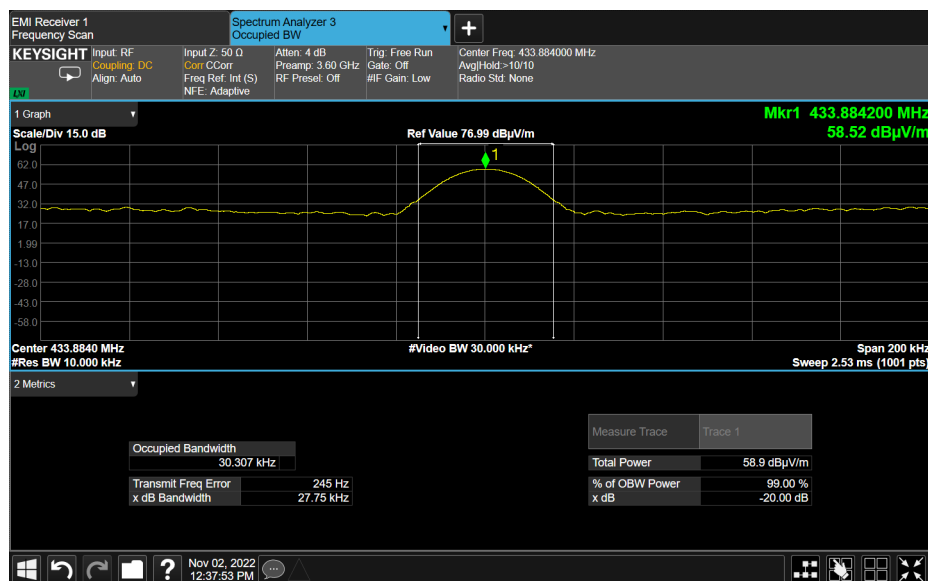
**Test Report No.: 7212326080****Page 16 of 22 pages****Title: Cow Leg Tag****Model: RF Transmitter (V2.00)****FCC ID: XBL-LEGTAG****3.7. Test of occupied bandwidth per 15.231(c)****3.7.1. Requirements:**

The bandwidth of the emissions shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

For 433.887 MHz center frequency allowed emission bandwidth shall be less than $(433.887/100) 0.25\% = 1.084$ MHz.

3.7.2. Test results:

Test result presented in plot below.

**Plot # 10. Occupied bandwidth test result****3.7.3. Test summary:**

Freq. MHz	Meas. Bandwidth kHz	Limit kHz	Verdict
433.884	27.75	Max 1084.8	Pass

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3.8. Antenna requirement

3.8.1. Requirements:

Excerpt from §15.203 of the FCC Rules/Regulations:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”

3.8.2. Test summary:

The antenna of the device is - inside case box and non-detachable antenna.
There are no provisions for connection to an external antenna.

Conclusion: The unit complies with the requirement of §15.203

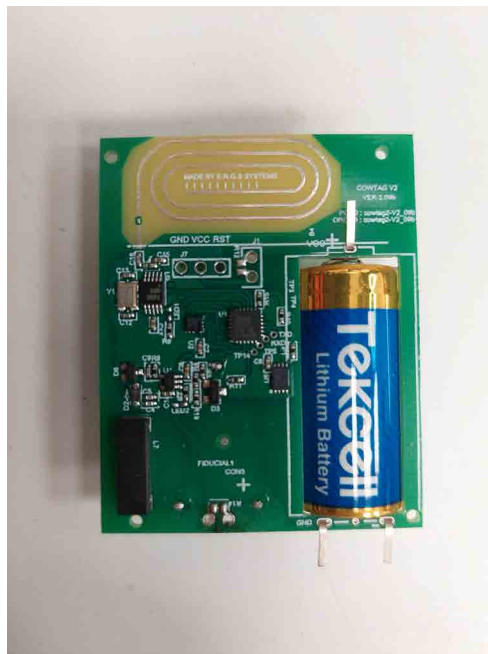


Photo 2. Antenna

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4. Appendix 1: Test equipment used

All measurements equipment is on SII calibration schedule with a recalibration interval not exceeding one year.

Instrument	Manufacturer	Model	SII No.	Last calibration date	Next calibration date
EMI RECEIVER-MXE 3Hz-44GHz	Agilent	N9038B	6505208	09/22	09/23
LISN 9 kHz – 30 MHz	Schwarbeck Mess Elektronik	NSLK 8128	6505753	08/22	08/23
Active Receiving Loop Antenna	ETS-Lindgren	6507	00144641	11/20	11/22
Bigonilog Antenna 20 MHz - 6000 MHz	ETS-Lindgren	3142D	146490	10/21	10/23
Double Ridged Waveguide Antenna 1-18 GHz	EMCO	3115	0143138	07/21	07/23
Antenna Broad-Band Horn, 14 GHz - 40 GHz	SCHWARBECK MESS- ELEKTRONIK	BBHA 9170	5854	07/21	07/23
Data +Power splitter	-	-	-	N/A	N/A
Semi Anechoic Chamber	ETS-Lindgren	RFSD-F/A-100	5002	N/A	N/A
Multi-Device Positioning Controller	ETS-Lindgren	2090	5002	N/A	N/A
Antenna Tower	ETS-Lindgren	2175	5002	N/A	N/A
Boresight Antenna Tower	ETS-Lindgren	2171B	5002	N/A	N/A
Turntable	ETS-Lindgren	2188	5002	N/A	N/A
Cable RF 1 m	SUCOFLEX	104PE	21325	04/22	04/23
Cable RF 3 m	VPO 2930	K30K30-5003- 300cm5VI	005	04/22	04/23
Cable RF 3 m	VPO 2930	K30K30-5003- 300cm6VI	006	04/22	04/23
Cable RF 3 m	VPO 2930	K30K30-5003- 300cm7VI	007	04/22	04/23
Cable RF 3 m	VPO 2930	K30K30-5003- 300cm8VI	008	04/22	04/23
Attenuator 10dB 5W	-	5W	6502986	04/22	04/23
Attenuator 20dB 5W	-	5W	6502992	04/22	04/23
USB preamplifier 2 GHz – 50 GHz	Keysight	U7227F	MY 55380004	11/20	11/22
Cable	EIM	RG 214/U	8 & 10	01/22	01/23

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5. Appendix 2: Antenna Factor and Cable Loss

Cable Loss (SAC, frequency range: 30 MHz-1.0 GHz)

No.	Frequency (MHz)	Attenuation (dB)	Frequency (MHz)	Attenuation (dB)	Frequency (MHz)	Attenuation (dB)
1	28.71	0.4	97.21	1.0	329.17	1.7
2	30.14	0.4	102.07	1.0	345.63	1.8
3	31.65	0.5	107.17	1.0	362.91	1.8
4	33.23	0.5	112.53	1.0	381.06	1.8
5	34.89	0.5	118.15	1.0	400.11	1.9
6	36.64	0.5	124.06	1.1	420.12	2.0
7	38.47	0.5	130.27	1.1	441.12	2.0
8	40.39	0.6	136.78	1.1	463.18	2.1
9	42.41	0.6	143.62	1.1	486.34	2.1
10	44.53	0.6	150.80	1.1	510.66	2.2
11	46.76	0.6	158.34	1.1	536.19	2.2
12	49.10	0.6	166.26	1.1	563.00	2.4
13	51.55	0.6	174.57	1.2	591.15	2.4
14	54.13	0.7	183.30	1.2	620.70	2.5
15	56.83	0.7	192.46	1.3	651.74	2.6
16	59.68	0.7	202.08	1.3	684.33	2.6
17	62.66	0.7	212.19	1.3	718.54	2.8
18	65.79	0.8	222.80	1.4	754.47	2.9
19	69.08	0.8	233.94	1.4	792.19	2.9
20	72.54	0.8	245.63	1.4	831.80	3.0
21	76.16	0.8	257.92	1.5	873.39	3.2
22	79.97	0.9	270.81	1.5	917.06	3.2
23	83.97	0.9	284.35	1.5	962.92	3.3
24	88.17	0.9	298.57	1.6	1011.06	3.4
25	92.58	0.9	313.50	1.6	--	--

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No.	Frequency (MHz)	Attenuation (dB)	Frequency (MHz)	Attenuation (dB)	Frequency (MHz)	Attenuation (dB)
1	962.92	3.3	1815.72	5.0	3423.81	7.2
2	1011.06	3.4	1906.51	5.1	3595.00	6.8
3	1061.61	3.4	2001.83	5.2	3774.75	7.0
4	1114.70	3.5	2101.92	5.3	3963.49	7.1
5	1170.43	3.7	2207.02	5.4	4161.67	7.6
6	1228.95	3.9	2317.37	5.5	4369.75	7.7
7	1290.4	3.9	2433.24	5.6	4588.24	7.7
8	1354.92	4.0	2554.90	5.9	4817.65	7.8
9	1422.67	4.2	2682.65	5.8	5058.53	8.1
10	1493.80	4.6	2816.78	5.8	5311.46	8.4
11	1568.49	4.7	2957.62	6.3	5577.03	8.6
12	1646.91	4.8	3105.50	6.2	5855.88	9.1
13	1729.26	4.9	3260.77	6.7	6000.00	9.3

Antenna Magnetic Factor
For Antenna Loop ETS LINDGREN Model 6507, SII S/N 00144641,
0.009 MHz to 30 MHz

No.	f / MHz	AF/ dBuA/m	f / MHz	AF/ dBuA/m
1	0.009	-21.2	1.00	-33.7
2	0.01	-22.1	2.00	-33.6
3	0.02	-27.7	3.00	-33.7
4	0.05	-32.1	4.00	-34.0
5	0.075	-33.0	5.00	-34.3
6	0.10	-33.3	10.00	-35.2
7	0.15	-33.5	15.00	-35.8
8	0.25	-33.7	20.00	-36.1
9	0.50	-33.8	25.00	-36.6
10	0.75	-33.8	30.00	-37.0

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No.	f / MHz	AF / dB/m	f / MHz	AF / dB/m	f / MHz	AF / dB/m
1	1000	23.6	7000	36.7	13000	39.7
2	1500	25.6	7500	37.3	13500	40.3
3	2000	28.2	8000	37.0	14000	41.0
4	2500	27.8	8500	37.6	14500	41.0
5	3000	29.3	9000	37.8	15000	39.6
6	3500	30.7	9500	38.0	15500	38.8
7	4000	31.8	10000	38.3	16000	39.1
8	4500	32.1	10500	38.6	16500	40.0
9	5000	32.9	11000	38.6	17000	40.9
10	5500	32.9	11500	38.9	17500	42.3
11	6000	34.0	12000	38.8	18000	42.5
12	6500	35.3	12500	38.9	--	--

Antenna Factor**Biconilog Antenna, Model Number: 3142D S/N: 00146488 SII No. 6503046****Frequency range: 30 MHz – 2.0 GHz****3 m distance**

No.	f / MHz	ACF / dB/m	f / MHz	AF / dB/m
1	30	22.7	200	16.7
2	35	20.4	250	18.0
3	40	17.8	300	19.8
4	45	15.7	400	22.7
5	50	14.2	500	25.8
6	60	13.0	600	27.4
7	70	13.0	700	28.4
8	80	12.4	800	30.0
9	90	13.3	900	31.3
10	100	14.2	1000	32.8
11	120	13.3	1250	35.8
12	140	13.3	1500	42.9
13	160	14.6	1750	36.1
14	180	16.3	2000	34.6

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6. Appendix 3: Test setups photo.



Photo 3.



Photo 4.

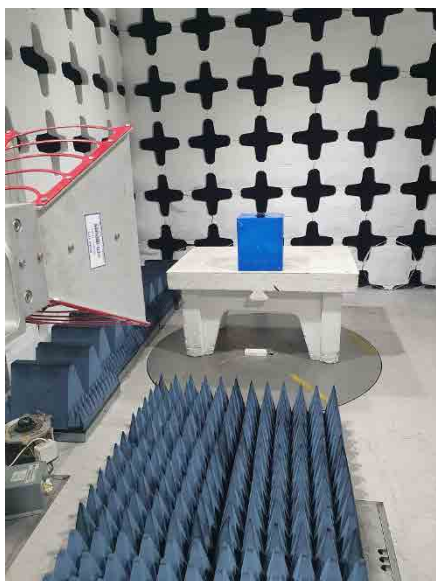


Photo 5.



Photo 6

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