COMPATIBLE ELECTRONICS

FCC PART 15, SUBPART B and C; FCC 15.231; and RSS-210 & RSS GEN TEST REPORT

for

CONTACT SENSOR

Model: CS-232

Prepared for

ECOLINK INTELLIGENT TECHNOLOGY, INC.
2055 CORTE DEL NOGAL
CARLSBAD, CALIFORNIA 92011

Prepared by:_____

KYLE FUJIMOTO

Approved by:_____

JAMES ROSS

COMPATIBLE ELECTRONICS INC.
114 OLINDA DRIVE
BREA, CALIFORNIA 92823
(714) 579-0500

DATE: SEPTEMBER 21, 2020

	REPORT BODY	APPENDICES					TOTAL
		A	***B***	***C***	***D***	***E***	
PAGES	21	2	2	2	10	25	**62**

NVLAP® TESTING
NVLAP LAB CODE 200528-0

ilac-MRA

TABLE OF CONTENTS

LIST OF APPENDICES

APPENDIX	TITLE
A	Laboratory Accreditations and Recognitions
B	Modifications to the EUT
C	Models Covered Under This Report
D	Diagrams, Charts, and Photos • Test Setup Diagrams • Antenna and Effective Gain Factors • Radiated Emissions Photos
E	Data Sheets

LIST OF FIGURES

FIGURE	TITLE
1	Layout of the Semi-Anechoic Test Chamber

LIST OF TABLES

TABLE	TITLE
1	Radiated Emission Results

GENERAL REPORT SUMMARY

This electromagnetic emission test report is generated by Compatible Electronics Inc., which is an independent testing and consulting firm. The test report is based on testing performed by Compatible Electronics personnel according to the measurement procedures described in the test specifications given below and in the "Test Procedures" section of this report.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced without the written permission of Compatible Electronics, unless done so in full.

This report must not be used by the client to claim product certification, approval or endorsement by NVLAP, NIST or any agency of the United States government.

Device Tested:	Contact Sensor Model: CS-232 S/N: N/A
Product Description:	The equipment under test is a battery powered Contact Sensor manufactured by Ecolink Intelligent Technology. The transmit frequency is 345 MHz. The clock frequencies are 4 MHz and 10.78125 MHz. Dimensions: 6.0 cm (L) x 2.5 cm (W) x 0.7 cm (H).
Modifications:	The EUT was not modified to meet the specifications.
Customer:	Ecolink Intelligent Technology, Inc. 2055 Corte Del Nogal Carlsbad, California 92011
Test Dates:	September 25, 2020 and October 22, 2020

Test Specifications covered by accreditation:

Test Specifications:	Emissions requirements CFR Title 47, Part 15, Subpart B; CFR Title 47, Part 15, Subpart C, sections 15.205, 15.209, and 15.231; RSS-210 and RSS-Gen

NVLAP TESTING
NVLAP LAB CODE 200528-0

ilac-MRA

Test Procedures:	ANSI C63.4 and ANSI C63.10
Test Deviations:	The test procedure was not deviated from during the testing.

SUMMARY OF TEST RESULTS

TEST	DESCRIPTION	RESULTS
1	Spurious Radiated RF Emissions, 9 kHz – 3.45 GHz (Transmitter and Digital portion)	Complies with the **Class B** limits of CFR Title 47, Part 15 Subpart B; the limits of CFR Title 47, Part 15 Subpart C, sections 15.205, 15.209, and 15.231; and the limits of RSS-210 and RSS-Gen Highest reading in relation to spec limit 76.53 dBuV/m (AVG) @ 345 MHz (*U = 3.19 dB)
2	-20 dB Bandwidth	Complies with limits of CFR Title 47, Part 15 Subpart C, section 15.231 (c); and the limits of RSS-210
3	Transmission Time	Complies with limits of CFR Title 47, Part 15 Subpart C, section 15.231 (a)(1) and (a)(2); and the limits of RSS-210

*U = Expanded Uncertainty with a coverage factor of k=2

1. PURPOSE

This document is a qualification test report based on the emissions tests performed on the Contact Sensor, Model: CS-232. The emissions measurements were performed according to the measurement procedure described in ANSI C63.4 and ANSI C63.10. The tests were performed to determine whether the electromagnetic emissions from the equipment under test, referred to as EUT hereafter, are within the **Class B** specification limits defined by CFR Title 47, Part 15 Subpart B section, 15.109; the specification limits defined by CFR Title 47, Part 15 Subpart C sections 15.205, 15.209 and 15.231; and the specifications limits defined by RSS-210 and RSS-Gen.

1.1 Decision Rule & Risk

If a measured value exceeds a specification limit it implies non-compliance. If the value is below a specification limit it implies compliance. Measurement uncertainty of the laboratory is reported with all measurement results but generally not taken into consideration unless a standard, rule or law requires it to be considered.

Qualification test reports are only produced for products that are in compliance with the test requirements, therefore results are always in conformity. Otherwise, an engineering report or just the data is provided to the customer.

When performing a measurement and making a statement of conformity, in or out-of-specification to manufacturer's specifications or Pass/Fail against a requirement, there are two possible outcomes:

- The result is reported as conforming with the specification
- The result is reported as not conforming with the specification

The decision rule is defined below.

When the test result is found to be below the limit but within our measurement uncertainty of the limit, it is our policy that the final acceptance decision is left to the customer, after discussing the implications and potential risks of the decision.

When the test result is found to be exactly on the specification, it is our policy, in the case of unwanted emissions measurements to consider the result non-compliant, however, the final decision is left to the customer, after discussing the implications and potential risks of the decision.

When the test result is found to be over the specification limit under any condition, it is our policy to consider the result non-compliant.

In terms of uncertainty of measurement, the laboratory is a calibrated and tightly controlled environment and generally exceptionally stable, the measurement uncertainties are evaluated without the considering of the test sample. When it comes to the test sample however, as most testing is performed on a single sample rather than a sample population, and that sample is often a pre-production representation of the final product, that test sample represents a significantly higher source of measurement uncertainty. We advise our customers of this and that when in doubt (small test to limit margins), they may wish to perform statistical sampling on a population to gain a higher confidence in the results. All lab reported results are that of a single sample in any event.

2. ADMINISTRATIVE DATA

2.1 Location of Testing

The emissions tests described herein were performed at the test facility of Compatible Electronics, 114 Olinda Drive, Brea, California 92823.

2.2 Traceability Statement

The calibration certificates of all test equipment used during the test are on file at the location of the test. The calibration is traceable to the National Institute of Standards and Technology (NIST).

2.3 Cognizant Personnel

Ecolink Intelligent Technology, Inc.

David Shepard	Engineer
Jay Stone	Director of Engineering

Compatible Electronics Inc.

Kyle Fujimoto	Test Engineer
James Ross	Test Engineer

2.4 Date Test Sample was Received

The test sample was received prior to the date of this report.

2.5 Disposition of the Test Sample

The test sample has not been returned to Ecolink Intelligent Technology, Inc. as of the date of this test report.

2.6 Abbreviations and Acronyms

The following abbreviations and acronyms may be used in this document.

EMI	Electromagnetic Interference
EUT	Equipment Under Test
P/N	Part Number
S/N	Serial Number
FCC	Federal Communications Commission
DoC	Declaration of Conformity
N/A	Not Applicable
Tx	Transmit
Rx	Receive
Inc.	Incorporated
RF	Radio Frequency
BLE	Bluetooth Low Energy
CFR	Code of Federal Regulations
N/A	Not Applicable
DC	Direct Current

3. APPLICABLE DOCUMENTS

The following documents are referenced or used in the preparation of this emission Test Report.

SPEC	TITLE
CFR Title 47, Part 15 Subpart C	FCC Rules – Radio frequency devices (including digital devices) – Intentional Radiators
CFR Title 47, Part 15 Subpart B	FCC Rules – Radio frequency devices (including digital devices) –Unintentional Radiators
RSS-210 Issue 10: 2019	License-exempt Radio Apparatus: Category I Equipment
RSS-Gen Issue 5: 2019 + Amendment 1	General Requirements for Compliance of Radio Apparatus
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 procedure for compliance testing of unlicensed wireless devices

4. DESCRIPTION OF TEST CONFIGURATION

4.1 Description of Test Configuration – Emissions

The Contact Sensor, Model: CS-232 (EUT) was connected to a normally closed external sensor via its J1 port and is internal battery powered by a 3 volt battery. The EUT was transmtting at 345 MHz on a continuous basis.

The EUT was tested for emissions while in the X, Y and Z axis. The X orientation is when the EUT is parallel to the ground. The Y orientation is when the EUT is perpendicular to the ground mounted vertically. The Z orientation is when the EUT is perpendicular to the ground mounted horizontally.

The EUT was tested with a new battery.

The final radiated emissions data for the EUT was taken in the configuration described above. Please see Appendix E for the data sheets.

4.1.1 Cable Construction and Termination

Cable 1 This is a 50-centimeter unshielded cable connecting the EUT to a normally closed external sensor. The cable has a 2-pin jumper connector at the EUT end and is hard wired into the normally closed external sensor.

5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT

5.1 EUT and Accessory List

EQUIPMENT	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID
CONTACT SENSOR (EUT)	ECOLINK INTELLIGENT TECHNOLOGY, INC.	CS-232	N/A	XQC-CS232 IC: 9863B-CS232
EXTERNAL SENSOR	ECOLINK INTELLIGENT TECHNOLOGY, INC.	N/A	N/A	N/A

5.2 Emissions Test Equipment

EQUIPMENT TYPE	MANU-FACTURER	MODEL NUMBER	SERIAL NUMBER	CALIBRATION DATE	CAL. CYCLE
RADIATED EMISSIONS TEST EQUIPMENT					
TDK TestLab	TDK RF Solutions, Inc.	9.22	700145	N/A	N/A
EMI Receiver, 20 Hz – 40GHz	Rohde & Schwarz	ESIB40	100172	July 15, 2020	1 Year
Loop Antenna	Com-Power	AL-130R	121090	February 5, 2019	2 Year
CombiLog Antenna	Com-Power	AC-220	061093	June 5, 2019	2 Year
Horn Antenna	Com-Power	AH-118	10050113	February 4, 2020	2 Year
Preamplifier	Com-Power	PA-118	181653	February 5, 2020	1 Year
System Controller	Sunol Sciences Corporation	SC110V	112213-1	N/A	N/A
Turntable	Sunol Sciences Corporation	2011VS	N/A	N/A	N/A
Antenna-Mast	Sunol Sciences Corporation	TWR95-4	112213-3	N/A	N/A
Computer	Hewlett Packard	p6716f	MXX1030PX0	N/A	N/A
LCD Monitor	Hewlett Packard	52031a	3CQ046N3MG	N/A	N/A

6. TEST SITE DESCRIPTION

6.1 Test Facility Description

Please refer to section 2.1 of this report for emissions test location.

6.2 EUT Mounting, Bonding and Grounding

For frequencies 1 GHz and below: The EUT was mounted on a 0.6 by 1.2 meter non-conductive table 0.8 meters above the ground plane.

For frequencies above 1 GHz: The EUT was mounted on a 0.6 by 1.2 meter non-conductive table 1.5 meters above the ground plane.

The EUT was not grounded.

6.3 Measurement Uncertainty

Compatible Electronics' U_{lab} value is less than U_{cispr}, thus based on this − compliance is deemed to occur if no measured disturbance exceeds the disturbance limit

$$u_c(y) = \sqrt{\sum_i c_i^2 \; u^2(x_i)}$$

Measurement		**U_{cispr}**	**U_{lab} = 2 uc (y)**
Conducted disturbance (mains port)	(150 kHz – 30 MHz)	3.4 dB	2.73 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(30 MHz – 1 000 MHz)	6.3 dB	3.27 dB (Vertical) 3.19 dB (Horizontal)
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(1 GHz - 6 GHz)	5.2 dB	3.95 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(6 GHz – 18 GHz)	5.5 dB	3.95 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(18 GHz – 26.5 GHz)	N/A	4.69 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(26.5 GHz – 40 GHz)	N/A	4.55 dB

7. TEST PROCEDURES

The following sections describe the test methods and the specifications for the tests. Test results are also included in this section.

7.1 RF Emissions

7.1.1 Conducted Emissions Test

The EMI Receiver was used as a measuring meter. A quasi-peak and/or average reading was taken only where indicated in the data sheets. A 10 dB attenuator was used for the protection of the EMI Receiver input stage, and the offset was adjusted accordingly to read the actual data measured. The LISN output was measured using the EMI Receiver. The output of the second LISN was terminated by a 50-ohm termination. The effective measurement bandwidth used for this test was 9 kHz.

Please see section 6.2 of this report for mounting, bonding, and grounding of the EUT. The EUT was powered through the LISN, which was bonded to the ground plane. The LISN power was filtered and the filter was bonded to the ground plane. The EUT was set up with the minimum distances from any conductive surfaces as specified in ANSI 63:4. The excess power cord was wrapped in a figure eight pattern to form a bundle not exceeding 0.4 meters in length.

The conducted emissions from the EUT were maximized for operating mode as well as cable placement. The final data was collected under program control by computer software. The final qualification data is located in Appendix E.

Test Results:

This test was not performed because the EUT operates on battery power only and cannot be connected to the AC public mains.

7.1.2 Radiated Emissions Test

The EMI Receiver was used as the measuring meter. An internal preamplifier was used to increase the sensitivity of the instrument during emissions tests up to 1000 MHz, and an external preamplifier was used to increase the sensitivity of the instrument during emissions tests above 1 GHz. The EMI Receiver was initially used with the Analyzer mode feature activated. In this mode, the EMI receiver can then record the actual frequency to be measured. This final reading is then taken accurately in the EMI Receiver mode, which takes into account the cable loss, amplifier gain and antenna factors, so that a true reading is compared to the true limit. The effective measurement bandwidth used for the radiated emissions test was according to the frequency measured.

The frequencies below 1 GHz, except for the fundamental frequency and the 2nd harmonic of the fundamental frequency, were quasi-peaked using the quasi-peak detector of the EMI Receiver.

The harmonic frequencies above 1 GHz, the fundamental frequency, and the 2nd harmonic were averaged using the duty cycle correction calculation.

All other frequencies above 1 GHz were averaged using the average detector of the EMI Receiver.

The EMI test chamber of Compatible Electronics, Inc. was used for radiated emissions testing. This test site is in full compliance with ANSI C63.4. Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst case (highest emission) configuration of the EUT. At each reading, the EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters (for E field radiated field strength). The gunsight method was used when measuring with the horn antenna to ensure accurate results.

The EUT was tested at a 3-meter test distance. The six highest emissions are listed in Table 1.

Radiated Emissions Test (Continued)

The measurement bandwidths and transducers used for the radiated emissions test were:

FREQUENCY RANGE	EFFECTIVE MEASUREMENT BANDWIDTH	TRANSDUCER
9 kHz to 150 kHz	200 Hz	Loop Antenna
150 kHz to 30 MHz	9 kHz	Loop Antenna
30 MHz to 1 GHz	120 kHz	CombiLog Antenna
1 GHz to 3.45 GHz	1 MHz	Horn Antenna

Test Results:

The EUT complies with the **Class B** limits of CFR Title 47, Part 15, Subpart B; the limits of CFR Title 47, Part 15, Subpart C sections 15.205, 15.209 and 15.231; and the limits of RSS-210 and RSS-Gen for radiated emissions.

7.1.3 RF Emissions Test Results

Table 1 RADIATED EMISSION RESULTS
Contact Sensor
Model: CS-232

Frequency (MHz)	EMI Reading (dBuV/m)	Specification Limit (dBuV/m)	Delta (Cor. Reading – Spec. Limit) (dB)
345.00 (H) (Z-Axis)	76.53 (AVG)	77.26	-0.73
345.00 (H) (Y-Axis)	76.33 (AVG)	77.26	-0.93
345.00 (V) (Y-Axis)	75.25 (AVG)	77.26	-2.01
345.00 (V) (Z-Axis)	74.79 (AVG)	77.26	-2.47
345.00 (H) (X-Axis)	74.75 (AVG)	77.26	-2.51
3105.00 (H) (Z-Axis)	50.23 (AVG)	57.26	-7.03

Notes:

* The complete emissions data is given in Appendix E of this report.
(V) Vertical Polarization
(H) Horizontal Polarization
(AVG) Average Reading

7.1.4 Sample Calculations

A correction factor for the antenna, cable and a distance factor (if any) must be applied to the meter reading before a true field strength reading can be obtained. This Corrected Meter Reading is then compared to the specification limit in order to determine compliance with the limits.

Conversion to logarithmic terms: Specification limit (μV/m) log x 20 = Specification Limit in dBuV/m

To correct for distance when measuring at a distance other than the specification

For measurements below 30 MHz: (Specification distance / test distance) log x 40 = distance factor

For measurements above 30 MHz: (Specification distance / test distance) log x 20 = distance factor

Note: When using an Active Antenna, the Antenna factor shall be subtracted due to the combination of the internal amplification and antenna loss.

Corrected Meter Reading = meter reading + F – A + C

where: F = antenna factor

A= amplifier gain

C = cable loss

The correction factors for the antenna and the amplifier gain are attached in Appendix D of this report. The data sheets are attached in Appendix E.

The distance factor D is 0 when the test is performed at the required specification distance.

7.1.5 Duty Cycle Calculation

The fundamental and harmonics were measured at a 3-meter test distance. The EMI Receiver was used to obtain the final test data. The final qualification data sheets are located in Appendix E.

Where

$$\delta(\mathrm{dB}) = 20\log\left[\sum\left(nt_1 + mt_2 + \ldots + \xi t_x\right)/T\right]$$

n is the number of pulses of duration *t*1
m is the number of pulses of duration *t*2
ξ is the number of pulses of duration *tx*
T is the period of the pulse train or 100 ms if the pulse train length is greater than 100 ms

Duty Cycle Correction Factor = -18.50 dB

Time of One Small Pulse = 150.300601 us

Time of One Large Pulse = 290.581162 us

Number of Small Pulses = 52

Number of Large Pulses = 14

Total On Time = 11883.76752 us = 11.88376752 ms

The time between pulses is greater than 100 ms

Duty Cycle = 11.88376752 ms / 100 ms = 11.88376752%

7.1.6 99% Bandwidth

The 99% bandwidth was measured using an EMI Receiver.

The following steps were performed for measuring the 99% bandwidth per RSS-GEN, Issue 5, clause 6.7:

1. Set RBW to 1 % to 5 % of the actual occupied bandwidth.
2. Set VBW to greater than 3 times the RBW.
3. Set the EMI Receiver to the occupied bandwidth Function set at 99%
4. Set the peak detector to max hold.
5. Set the sweep time to auto
6. Allow the trace to stabilize.

Please note that this was only used to determine the emission bandwidth and that there are no limits or pass/fail criteria for this test. Please see the data sheets located in Appendix E.

7.1.7 -20 dB Bandwidth

The -20 dB bandwidth was measured using an EMI Receiver.

The following steps were performed for measuring the -20 dB bandwidth:

1. Set RBW to at least 1% of the maximum occupied bandwidth allowed.
2. Set VBW to greater than 3 times the RBW.
3. Set the peak detector to max hold.
4. Set the sweep time to auto
5. Allow the trace to stabilize.
6. Set the markers to -20 dB of the peak fundamental emission

Test Results:

The EUT complies with limits of CFR Title 47, Part 15, Subpart C section 15.231 (c); and the limits of RSS-210.

7.1.8 Transmission Time

The transmission time was measured using an EMI Receiver.

The following steps were performed for measuring transmission time:

1. Set RBW = 120 kHz.
2. Set VBW = 500 kHz
3. Span = 0 Hz
4. Set the sweep time to 10 seconds
5. Push a button on the EUT, which automatically activated the transmitter.
6. Allow the trace to stabilize.
7. Set the 1st marker to start of the transmission
8. Set the 2nd marker for 5 seconds after the start of the transmission
9. Verify the transmission does not go beyond the 2nd marker.
10. Verify that the total number of transmissions is less than 2 seconds when the EUT is polling.

Test Results:

The EUT complies with limits of CFR Title 47, Part 15, Subpart C section 15.231 (a)(1) and (a)(2); and the limits of RSS-210.

8. CONCLUSIONS

The Contact Sensor, Model: CS-232 (EUT), as tested, meets all of the specification limits defined in RSS-210, RSS-Gen, the **Class B** specification limits defined in CFR Title 47, Part 15, Subpart B; and the specification limits defined in CFR Title 47, Part, 15, Subpart C, sections 15.205, 15.209 and 15.231.

APPENDIX A

LABORATORY ACCREDITATIONS AND RECOGNITIONS

LABORATORY ACCREDITATIONS AND RECOGNITIONS

NVLAP TESTING
NVLAP LAB CODE 200528-0

ilac-MRA

For US, Canada, Australia/New Zealand, Japan, Taiwan, Korea, and the European Union, Compatible Electronics is currently accredited by NVLAP to ISO/IEC 17025.
For the most up-to-date version of our scopes and certificates please visit http://celectronics.com/quality/scope/

Quote from ISO-ILAC-IAF Communiqué on 17025:
"A laboratory's fulfilment of the requirements of ISO/IEC 17025:2005 means the laboratory meets both the technical competence requirements and management system requirements that are necessary for it to consistently deliver technically valid test results and calibrations. The management system requirements in ISO/IEC 17025:2005 (Section 4) are written in language relevant to laboratory operations and meet the principles of ISO 9001:2008 Quality Management Systems — Requirements."

Innovation, Science and Economic Development Canada
Lab Code 2154A

APPENDIX B

MODIFICATIONS TO THE EUT

MODIFICATIONS TO THE EUT

The modifications listed below were made to the EUT to pass FCC Subpart B, FCC 15.231, RSS-210, and RSS-Gen specifications.

All the rework described below was implemented during the test in a method that could be reproduced in all the units by the manufacturer.

No modifications were made to the EUT during the testing.

APPENDIX C

MODELS COVERED UNDER THIS REPORT

MODELS COVERED UNDER THIS REPORT

USED FOR THE PRIMARY TEST	Contact Sensor Model: CS-232 S/N: N/A

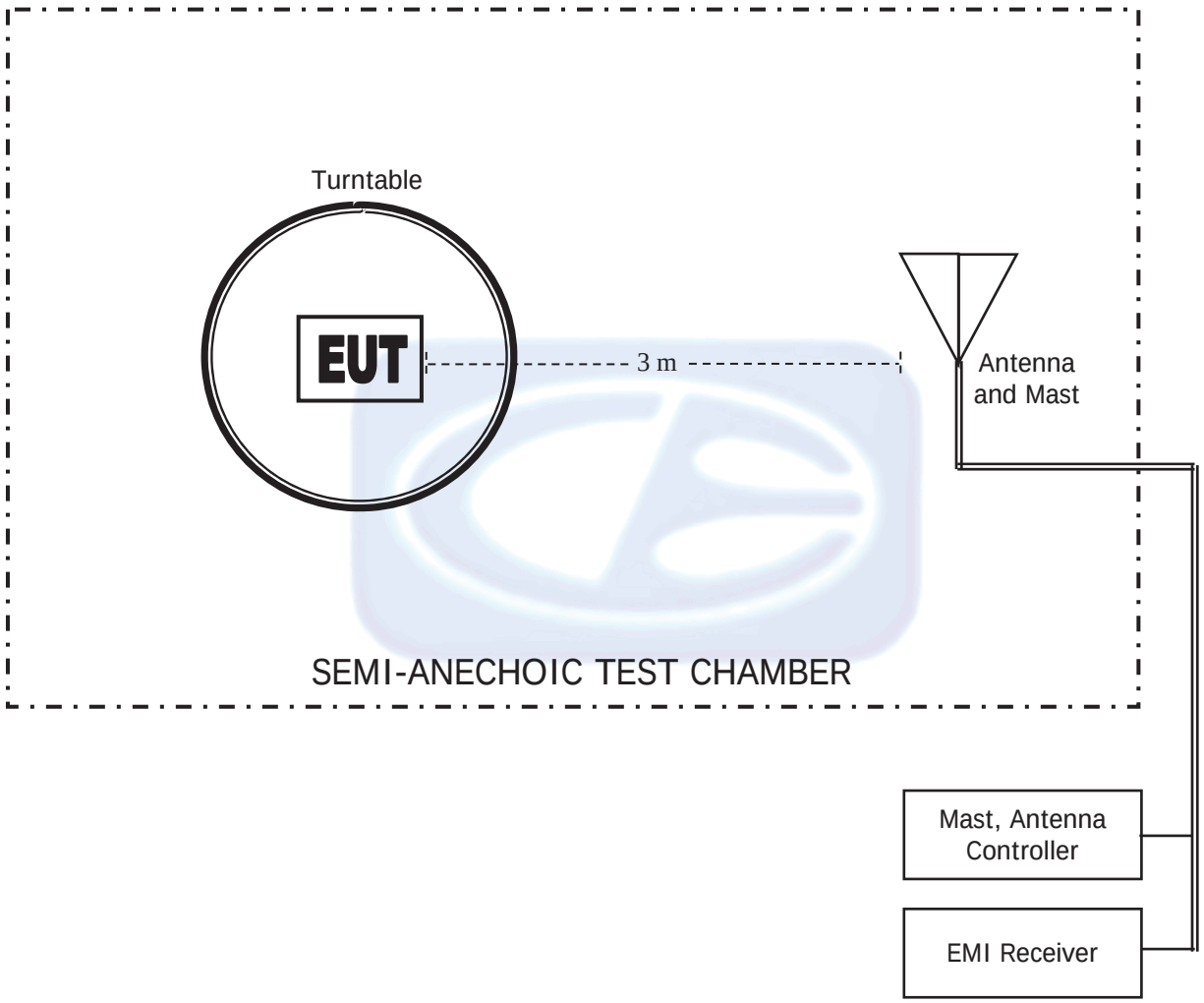
There are no additional models or part numbers covered under this report.

COMPATIBLE ELECTRONICS

APPENDIX D

DIAGRAMS, CHARTS, AND PHOTOS

FIGURE 1: LAYOUT OF THE SEMI -ANECHOIC TEST CHAMBER



COMPATIBLE ELECTRONICS

COM-POWER AL-130R

LOOP ANTENNA

S/N: 121090

CALIBRATION DATE: FEBRUARY 5, 2019

FREQUENCY (MHz)	MAGNETIC (dB/m)	ELECTRIC (dB/m)
0.009	16.1	-35.4
0.01	15.6	-35.9
0.02	14.8	-36.7
0.03	15.6	-35.9
0.04	15.1	-36.4
0.05	14.4	-37.0
0.06	14.6	-36.9
0.07	14.4	-37.1
0.08	14.3	-37.1
0.09	14.5	-36.9
0.10	14.1	-37.3
0.20	14.1	-37.3
0.30	14.0	-37.4
0.40	14.0	-37.4
0.50	14.2	-37.2
0.60	14.2	-37.2
0.70	14.2	-37.2
0.80	14.2	-37.3
0.90	14.3	-37.2
1.00	14.5	-37.0
2.00	14.5	-36.9
3.00	14.5	-36.9
4.00	14.7	-36.8
5.00	14.6	-36.9
6.00	14.6	-36.9
7.00	14.6	-36.9
8.00	14.6	-36.9
9.00	14.6	-36.9
10.00	14.8	-36.6
11.00	14.9	-36.6
12.00	14.8	-36.6
13.00	14.8	-36.7
14.00	14.6	-36.8
15.00	14.5	-36.9
16.00	14.5	-37.0
17.00	14.6	-36.9
18.00	14.7	-36.7
19.00	14.8	-36.6
20.00	14.9	-36.6
21.00	14.6	-36.8
22.00	14.2	-37.2
23.00	13.7	-37.7
24.00	13.3	-38.2
25.00	13.0	-38.5
26.00	12.9	-38.6
27.00	13.0	-38.5
28.00	13.1	-38.4
29.00	13.1	-38.4
30.00	12.9	-38.5

COM-POWER AC-220

COMBILOG ANTENNA

S/N: 61093

CALIBRATION DATE: JUNE 5, 2019

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
30	22.10	200	15.30
35	20.90	250	16.80
40	20.10	300	19.00
45	19.40	350	19.60
50	18.40	400	21.70
60	15.10	450	21.60
70	12.00	500	22.20
80	11.60	550	22.70
90	13.50	600	24.20
100	14.70	650	24.40
120	15.90	700	24.50
125	15.90	750	25.40
140	14.80	800	26.30
150	15.50	850	26.70
160	19.80	900	27.50
175	15.20	950	27.80
180	14.90	1000	27.90

COM POWER AH-118

HORN ANTENNA

S/N: 10050113

CALIBRATION DATE: FEBRUARY 4, 2020

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	24.343	10.0	38.826
1.5	25.419	10.5	39.102
2.0	28.838	11.0	38.259
2.5	28.971	11.5	39.920
3.0	29.919	12.0	40.149
3.5	30.674	12.5	40.576
4.0	31.670	13.0	40.264
4.5	32.437	13.5	40.364
5.0	33.414	14.0	40.424
5.5	34.003	14.5	41.677
6.0	34.799	15.0	43.010
6.5	35.381	15.5	39.799
7.0	37.024	16.0	40.187
7.5	37.403	16.5	40.155
8.0	37.445	17.0	40.507
8.5	37.390	17.5	41.963
9.0	38.076	18.0	43.196
9.5	38.809		

COM-POWER PA-118

PREAMPLIFIER

S/N: 181653

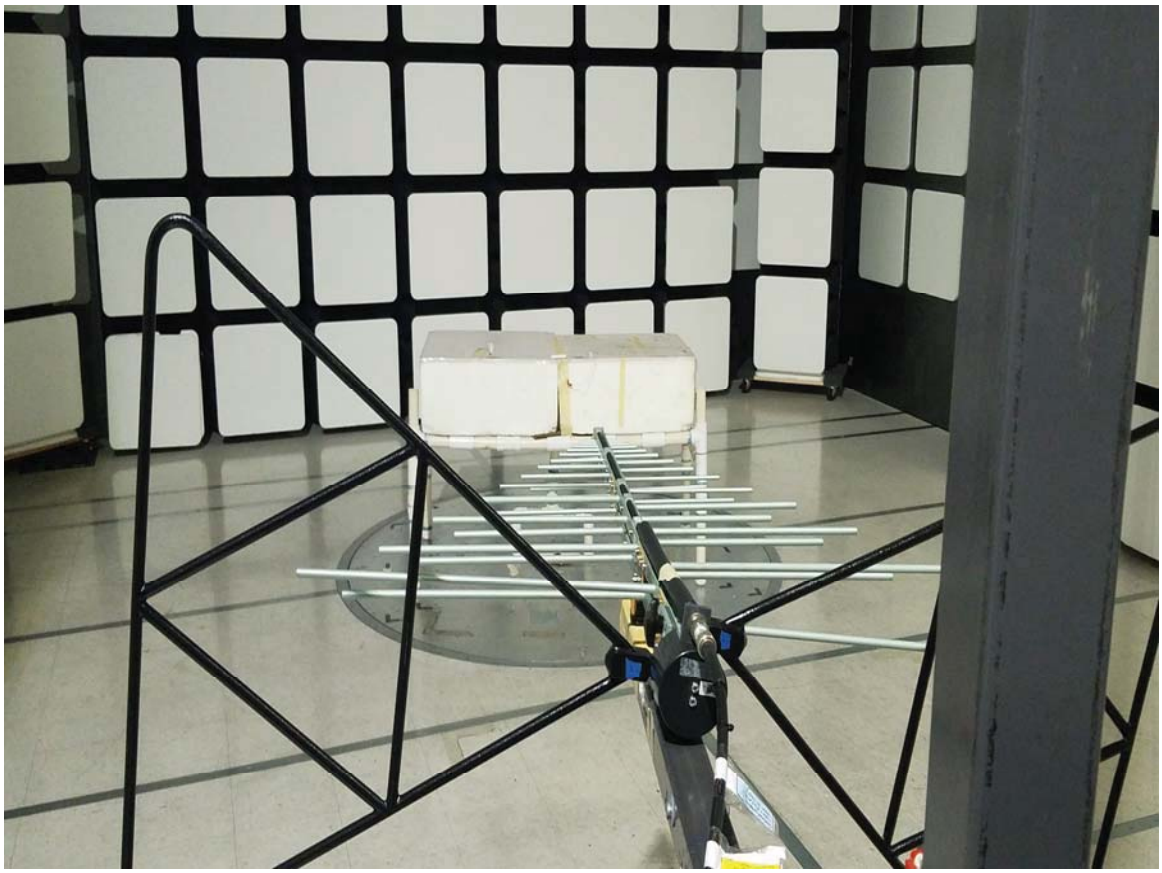
CALIBRATION DATE: FEBRUARY 5, 2020

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	40.10	6.0	40.60
1.1	40.10	6.5	39.50
1.2	40.00	7.0	39.40
1.3	39.70	7.5	39.30
1.4	39.60	8.0	39.20
1.5	39.90	8.5	40.50
1.6	40.00	9.0	39.60
1.7	39.70	9.5	39.50
1.8	39.50	10.0	38.80
1.9	39.60	11.0	38.70
2.0	39.90	12.0	42.20
2.5	40.10	13.0	40.00
3.0	40.80	14.0	40.30
3.5	40.60	15.0	40.20
4.0	40.50	16.0	41.00
4.5	41.60	17.0	39.70
5.0	39.20	18.0	40.90
5.5	40.00		

FRONT VIEW

ECOLINK INTELLIGENT TECHNOLOGY, INC.
CONTACT SENSOR
MODEL: CS-232
FCC SUBPART B AND C; RSS-210 AND RSS-GEN – RADIATED EMISSIONS – BELOW 1 GHz

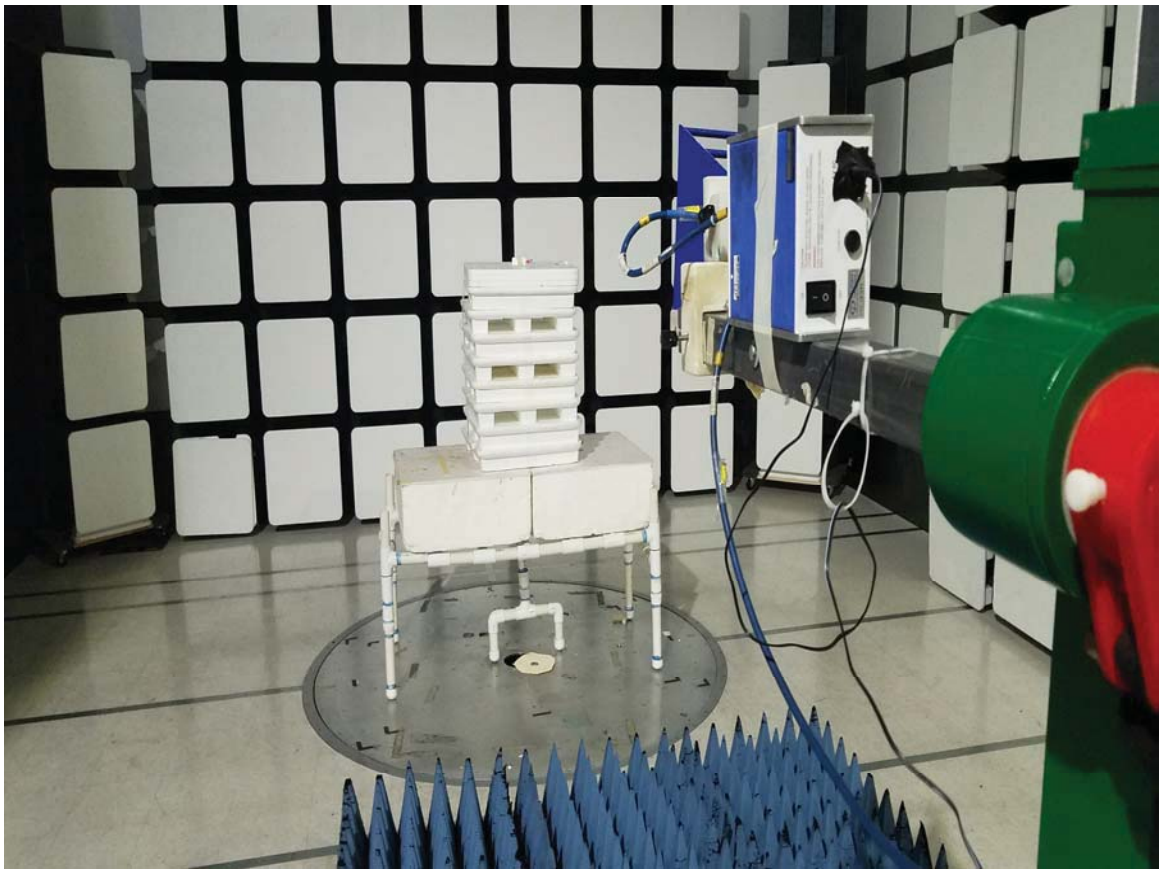
PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS



REAR VIEW

ECOLINK INTELLIGENT TECHNOLOGY, INC.
CONTACT SENSOR
MODEL: CS-232
FCC SUBPART B AND C; RSS-210 AND RSS-GEN – RADIATED EMISSIONS – BELOW 1 GHz

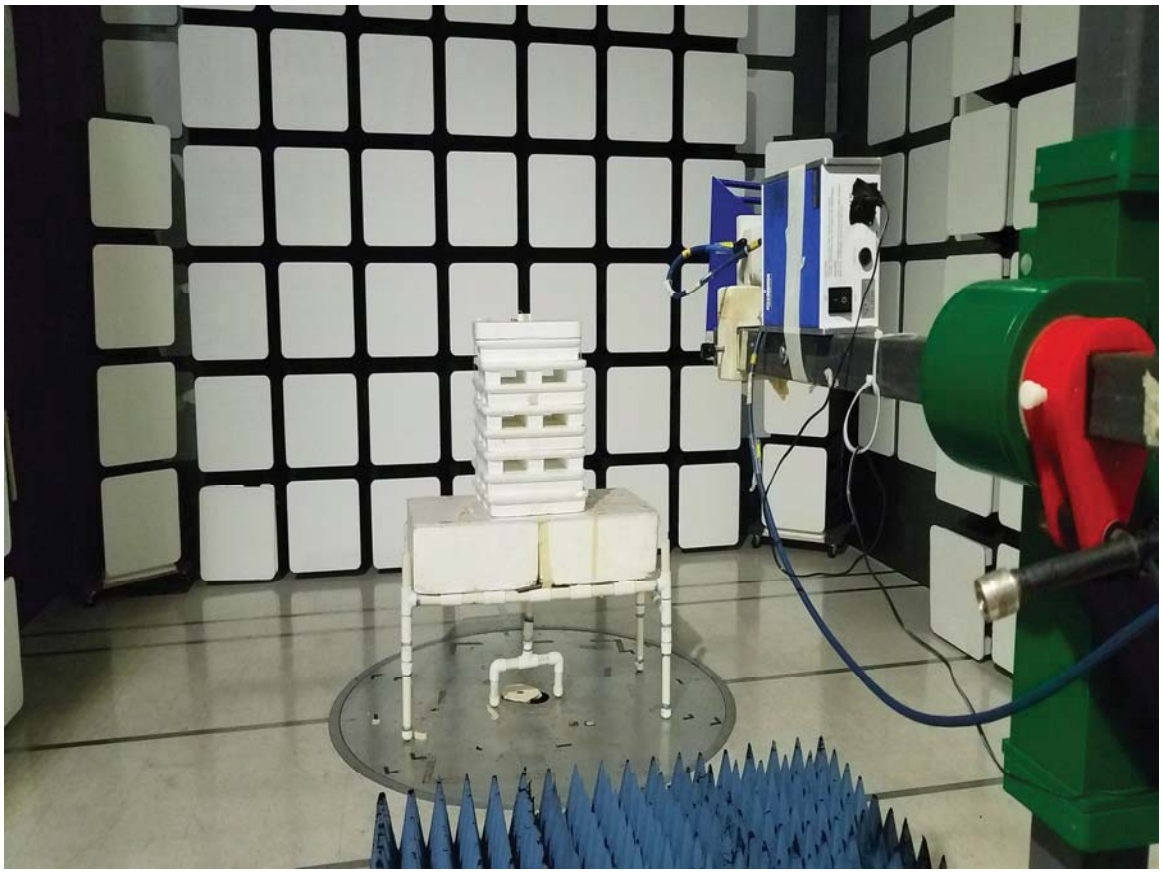
PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS



FRONT VIEW

ECOLINK INTELLIGENT TECHNOLOGY, INC.
CONTACT SENSOR
MODEL: CS-232
FCC SUBPART B AND C; RSS-210 AND RSS-GEN – RADIATED EMISSIONS – ABOVE 1 GHz

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS



REAR VIEW

ECOLINK INTELLIGENT TECHNOLOGY, INC.
CONTACT SENSOR
MODEL: CS-232
FCC SUBPART B AND C; RSS-210 AND RSS-GEN – RADIATED EMISSIONS – ABOVE 1 GHz

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONs

APPENDIX E

DATA SHEETS

RADIATED EMISSIONS

DATA SHEETS

Title: Pre-Scan - FCC Class B
File: 6 - LF - Pre-Scan - Contact Sensor with Cable - Z-Axis - FCC Class B - 10-22-2020.set
Operator: Kyle Fujimoto
EUT Type: Contact Sensor
EUT Condition: The EUT is continuously transmitting at 345 MHz
Company: Ecolink Intelligent Technology, Inc.
M/N: CS-232
S/N: N/A
Z-Axis (Worst Case)
Note: The Frequency at 345 MHz is from the intentional radiator and is subject to the limits of FCC 15.231 instead.

10/22/2020 1:10:09 PM
Sequence: Preliminary Scan

Title: Radiated Final - FCC Class B
File: 6 - LF - Final Scan - Contact Sensor with Cable - Z-Axis - FCC Class B - 10-22-2020.set
Operator: Kyle Fujimoto
EUT Type: Contact Sensor
EUT Condition: The EUT is continuously transmitting at 345 MHz
Company: Ecolink Intelligent Technology, Inc.
M/N: CS-232
S/N: N/A
Z-Axis (Worst Case)

10/22/2020 1:34:40 PM
Sequence: Final Measurements

FCC Class B

Freq (MHz)	Pol	(PEAK) EMI (dBµV/m)	(QP) EMI (dBµV/m)	(PEAK) Margin (dB)	(QP) Margin (dB)	Limit (dBµV/m)	Transducer (dB)	Cable (dB)	Ttbl Agl (deg)	Twr Ht (cm)
160.90	H	25.26	20.13	-18.24	-23.37	43.50	21.83	0.88	108.50	290.56
161.50	H	25.44	20.37	-18.06	-23.13	43.50	22.07	0.88	48.50	241.91
162.20	H	25.71	20.14	-17.79	-23.36	43.50	21.84	0.88	323.25	307.16
423.70	H	26.09	20.54	-19.91	-25.46	46.00	22.08	1.61	347.00	389.31
425.40	H	25.65	20.57	-20.35	-25.43	46.00	22.10	1.62	133.75	209.19
690.10	H	36.55	33.86	-9.45	-12.14	46.00	24.40	2.11	171.25	111.22
690.10	V	35.02	29.45	-10.98	-16.55	46.00	24.40	2.11	194.00	127.64

FUNDAMENTAL AND HARMONICS

DATA SHEETS

FCC 15.231

Ecolink Intelligent Technology, Inc.
Contact Sensor
Model: CS-232

Date: 10/22/2020
Lab: D
Tested By: Kyle Fujimoto

Fundamental

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
345.00	85.77	V	97.26	-11.49	Peak	225.75	133.61	**X-Axis**
345.00	67.27	V	77.26	-9.99	Avg	225.75	133.61	**Vertical Polarization**
345.00	93.75	V	97.26	-3.51	Peak	240.00	192.23	**Y-Axis**
345.00	75.25	V	77.26	-2.01	Avg	240.00	192.23	**Vertical Polarization**
345.00	93.29	V	97.26	-3.97	Peak	285.50	187.64	**Z-Axis**
345.00	74.79	V	77.26	-2.47	Avg	285.50	187.64	**Vertical Polarization**
345.00	93.25	H	97.26	-4.01	Peak	23.75	120.11	**X-Axis**
345.00	74.75	H	77.26	-2.51	Avg	23.75	120.11	**Horizontal Polarization**
345.00	94.83	H	97.26	-2.43	Peak	1.00	152.65	**Y-Axis**
345.00	76.33	H	77.26	-0.93	Avg	1.00	152.65	**Horizontal Polarization**
345.00	95.03	H	97.26	-2.23	Peak	8.00	146.56	**Z-Axis**
345.00	76.53	H	77.26	-0.73	Avg	8.00	146.56	**Horizontal Polarization**

COMPATIBLE ELECTRONICS

FCC 15.231

Ecolink Intelligent Technology, Inc.
Contact Sensor
Model: CS-232

Date: 10/22/2020
Lab: D
Tested By: Kyle Fujimoto

Harmonics
Transmit Mode - X-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
690.00	38.48	V	77.26	-38.78	Peak	350.00	100.14	
690.00	19.98	V	57.26	-37.28	Avg	350.00	100.14	
1035.00	38.76	V	73.97	-35.21	Peak	215.00	150.92	
1035.00	20.26	V	53.97	-33.71	Avg	215.00	150.92	
1380.00	47.40	V	73.97	-26.57	Peak	258.50	126.32	
1380.00	28.90	V	53.97	-25.07	Avg	258.50	126.32	
1725.00	45.43	V	77.26	-31.83	Peak	106.75	125.26	
1725.00	26.93	V	57.26	-30.33	Avg	106.75	125.26	
2070.00	46.62	V	77.26	-30.64	Peak	294.50	114.44	
2070.00	28.12	V	57.26	-29.14	Avg	294.50	114.44	
2415.00	46.67	V	77.26	-30.59	Peak	201.25	125.43	
2415.00	28.17	V	57.26	-29.09	Avg	201.25	125.43	
2760.00	48.69	V	73.97	-25.28	Peak	267.75	160.83	
2760.00	30.19	V	53.97	-23.78	Avg	267.75	160.83	
3105.00	58.21	V	77.26	-19.05	Peak	119.25	144.71	
3105.00	39.71	V	57.26	-17.55	Avg	119.25	144.71	
3450.00	55.15	V	77.26	-22.11	Peak	357.75	178.14	
3450.00	36.65	V	57.26	-20.61	Avg	357.75	178.14	

FCC 15.231

Ecolink Intelligent Technology, Inc.
Contact Sensor
Model: CS-232

Date: 10/22/2020
Lab: D
Tested By: Kyle Fujimoto

Harmonics
Transmit Mode - Y-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
690.00	41.67	V	77.26	-35.59	Peak	85.25	118.38	
690.00	23.17	V	57.26	-34.09	Avg	85.25	118.38	
1035.00	35.71	V	73.97	-38.26	Peak	129.25	152.23	
1035.00	17.21	V	53.97	-36.76	Avg	125.95	152.23	
1380.00	46.08	V	73.97	-27.89	Peak	243.00	177.97	
1380.00	27.58	V	53.97	-26.39	Avg	243.00	177.97	
1725.00	53.45	V	77.26	-23.81	Peak	73.25	158.62	
1725.00	34.95	V	57.26	-22.31	Avg	73.25	158.62	
2070.00	57.87	V	77.26	-19.39	Peak	137.25	180.53	
2070.00	39.37	V	57.26	-17.89	Avg	137.25	180.53	
2415.00	54.58	V	77.26	-22.68	Peak	265.50	141.40	
2415.00	36.08	V	57.26	-21.18	Avg	265.50	141.40	
2760.00	56.66	V	73.97	-17.31	Peak	76.75	186.50	
2760.00	38.16	V	53.97	-15.81	Avg	76.75	186.50	
3105.00	66.51	V	77.26	-10.75	Peak	208.50	181.31	
3105.00	48.01	V	57.26	-9.25	Avg	208.50	181.31	
3450.00	65.34	V	77.26	-11.92	Peak	318.75	162.98	
3450.00	46.84	V	57.26	-10.42	Avg	318.75	162.98	

FCC 15.231

Ecolink Intelligent Technology, Inc.
Contact Sensor
Model: CS-232

Date: 10/22/2020
Lab: D
Tested By: Kyle Fujimoto

Harmonics
Transmit Mode - Z-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
690.00	40.31	V	77.26	-36.95	Peak	10.00	100.25	
690.00	21.81	V	57.26	-35.45	Avg	10.00	100.25	
1035.00	40.03	V	73.97	-33.94	Peak	117.25	114.08	
1035.00	21.53	V	53.97	-32.44	Avg	117.25	114.08	
1380.00	41.08	V	73.97	-32.89	Peak	118.00	115.25	
1380.00	22.58	V	53.97	-31.39	Avg	118.00	115.25	
1725.00	48.03	V	77.26	-29.23	Peak	332.25	128.53	
1725.00	29.53	V	57.26	-27.73	Avg	332.25	128.53	
2070.00	49.47	V	77.26	-27.79	Peak	211.75	114.80	
2070.00	30.97	V	57.26	-26.29	Avg	211.75	114.80	
2415.00	52.25	V	77.26	-25.01	Peak	283.25	114.80	
2415.00	33.75	V	57.26	-23.51	Avg	283.25	114.80	
2760.00	50.68	V	73.97	-23.29	Peak	75.50	125.25	
2760.00	32.18	V	53.97	-21.79	Avg	75.50	125.25	
3105.00	57.42	V	77.26	-19.84	Peak	215.75	100.25	
3105.00	38.92	V	57.26	-18.34	Avg	215.75	100.25	
3450.00	63.43	V	77.26	-13.83	Peak	31.25	105.43	
3450.00	44.93	V	57.26	-12.33	Avg	31.25	105.43	

FCC 15.231

Ecolink Intelligent Technology, Inc.
Contact Sensor
Model: CS-232

Date: 10/22/2020
Lab: D
Tested By: Kyle Fujimoto

Harmonics
Transmit Mode - X-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
690.00	34.79	H	77.26	-42.47	Peak	57.25	141.67	
690.00	16.29	H	57.26	-40.97	Avg	57.25	141.67	
1035.00	39.37	H	73.97	-34.60	Peak	101.50	121.85	
1035.00	20.87	H	53.97	-33.10	Avg	101.50	121.85	
1380.00	46.81	H	73.97	-27.16	Peak	314.75	100.08	
1380.00	28.31	H	53.97	-25.66	Avg	314.75	100.08	
1725.00	54.01	H	77.26	-23.25	Peak	181.50	114.98	
1725.00	35.51	H	57.26	-21.75	Avg	181.50	114.98	
2070.00	56.06	H	77.26	-21.20	Peak	142.75	152.53	
2070.00	37.56	H	57.26	-19.70	Avg	142.75	152.53	
2415.00	56.87	H	77.26	-20.39	Peak	253.75	104.77	
2415.00	38.37	H	57.26	-18.89	Avg	253.75	104.77	
2760.00	57.16	H	73.97	-16.81	Peak	313.00	146.80	
2760.00	38.66	H	53.97	-15.31	Avg	313.00	146.80	
3105.00	67.36	H	77.26	-9.90	Peak	350.00	140.89	
3105.00	48.86	H	57.26	-8.40	Avg	350.00	140.89	
3450.00	62.79	H	77.26	-14.47	Peak	138.25	197.43	
3450.00	44.29	H	57.26	-12.97	Avg	138.25	197.43	

FCC 15.231

Ecolink Intelligent Technology, Inc.
Contact Sensor
Model: CS-232

Date: 10/22/2020
Lab: D
Tested By: Kyle Fujimoto

Harmonics
Transmit Mode - Y-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
690.00	41.06	H	77.26	-36.20	Peak	10.00	120.05	
690.00	22.56	H	57.26	-34.70	Avg	10.00	120.05	
1035.00	36.17	H	73.97	-37.80	Peak	343.50	117.43	
1035.00	17.67	H	53.97	-36.30	Avg	343.50	117.43	
1380.00	38.90	H	73.97	-35.07	Peak	92.00	100.02	
1380.00	20.40	H	53.97	-33.57	Avg	92.00	100.02	
1725.00	46.25	H	77.26	-31.01	Peak	350.25	102.20	
1725.00	27.75	H	57.26	-29.51	Avg	350.25	102.20	
2070.00	55.49	H	77.26	-21.77	Peak	193.25	141.49	
2070.00	36.99	H	57.26	-20.27	Avg	193.25	141.49	
2415.00	54.00	H	77.26	-23.26	Peak	358.00	164.77	
2415.00	35.50	H	57.26	-21.76	Avg	358.00	164.77	
2760.00	54.87	H	73.97	-19.10	Peak	222.50	149.85	
2760.00	36.37	H	53.97	-17.60	Avg	222.25	149.85	
3105.00	59.05	H	77.26	-18.21	Peak	238.50	156.71	
3105.00	40.55	H	57.26	-16.71	Avg	238.50	156.71	
3450.00	63.39	H	77.26	-13.87	Peak	187.50	180.95	
3450.00	44.89	H	57.26	-12.37	Avg	187.50	180.95	

FCC 15.231

Ecolink Intelligent Technology, Inc.
Contact Sensor
Model: CS-232

Date: 10/22/2020
Lab: D
Tested By: Kyle Fujimoto

Harmonics
Transmit Mode - Z-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
690.00	38.02	H	77.26	-39.24	Peak	168.50	104.11	
690.00	19.52	H	57.26	-37.74	Avg	168.50	104.11	
1035.00	40.53	H	73.97	-33.44	Peak	177.75	156.77	
1035.00	22.03	H	53.97	-31.94	Avg	177.75	156.77	
1380.00	41.83	H	73.97	-32.14	Peak	117.50	118.32	
1380.00	23.33	H	53.97	-30.64	Avg	117.50	118.32	
1725.00	63.47	H	77.26	-13.79	Peak	177.25	126.32	
1725.00	44.97	H	57.26	-12.29	Avg	177.25	126.32	
2070.00	58.01	H	77.26	-19.25	Peak	10.00	138.56	
2070.00	39.51	H	57.26	-17.75	Avg	10.00	138.56	
2415.00	57.86	H	77.26	-19.40	Peak	292.00	125.00	
2415.00	39.36	H	57.26	-17.90	Avg	292.00	125.00	
2760.00	57.88	H	73.97	-16.09	Peak	31.75	117.37	
2760.00	39.38	H	53.97	-14.59	Avg	31.75	117.37	
3105.00	68.73	H	77.26	-8.53	Peak	7.75	157.85	
3105.00	50.23	H	57.26	-7.03	Avg	7.75	157.85	
3450.00	67.31	H	77.26	-9.95	Peak	331.25	125.25	
3450.00	48.81	H	57.26	-8.45	Avg	331.25	125.25	

FCC Class B and FCC 15.231

Ecolink Intelligent Technology, Inc.
Contact Sensor
Model: CS-232

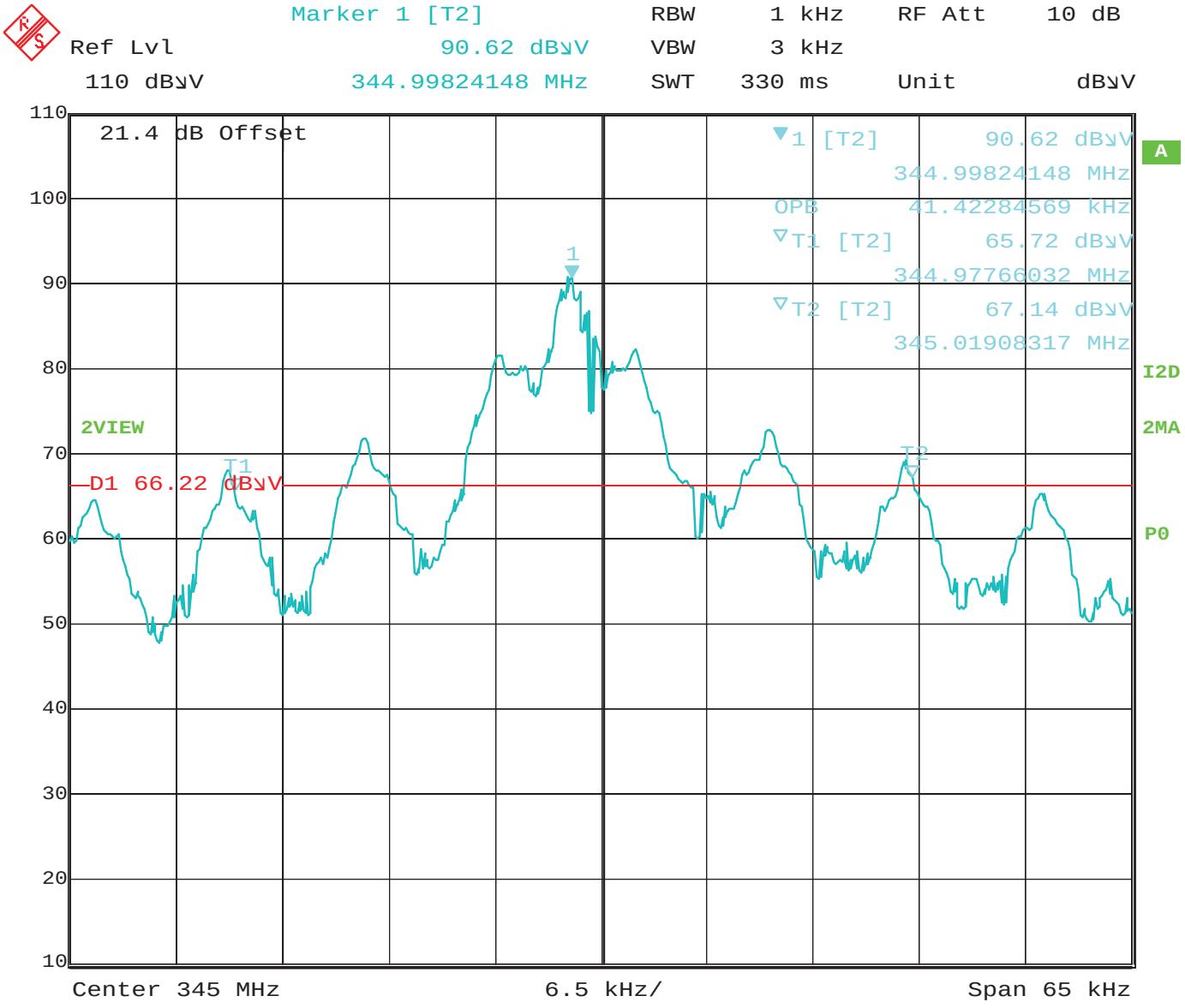
Date: 10/22/2020
Lab: D
Tested By: Kyle Fujimoto

Non Harmonic Emissions from the Tx and Digital Portion - 9 kHz to 30 MHz
Non Harmonic Emissions from the Tx and Digital Portion - 1 GHz To 3.45 GHz

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
								No Emissions Detected
								from 9 kHz to 30 MHz
								for the digital portion
								of the EUT
								No Emissions Detected
								from 1 GHz to 3.45 GHz
								for the digital portion
								of the EUT
								from 9 kHz to 30 MHz
								for the Non-Harmonic Emissions
								of the Transmitter for the EUT
								No Emissions Detected
								from 1 GHz to 3.45 GHz
								for the Non-Harmonic Emissions
								of the Transmitter for the EUT
								Investigated in the X-Axis,
								Y-Axis, and Z-Axis

99 % BANDWIDTH

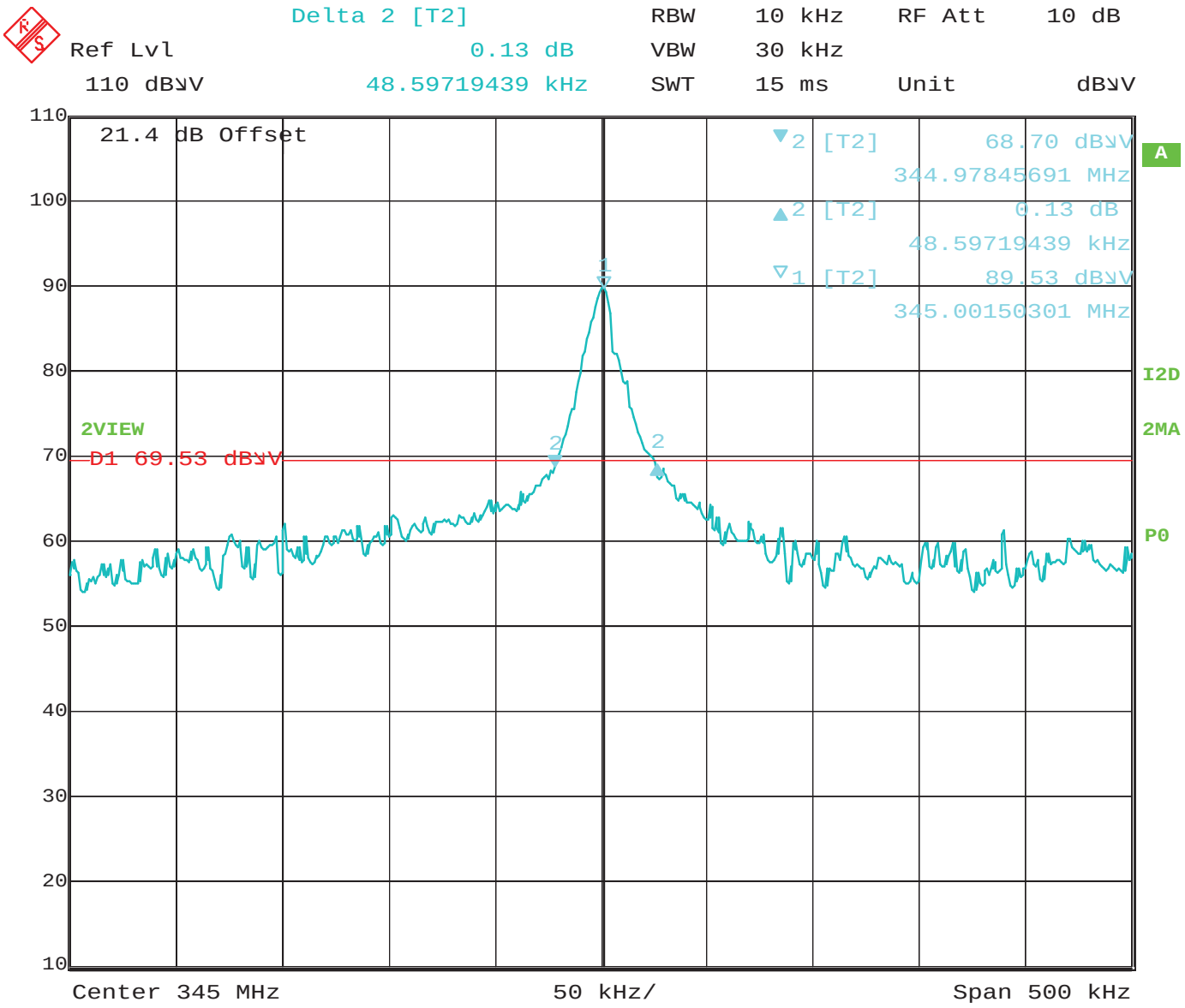
DATA SHEET



99 Percent Bandwidth Plot

-20 dB BANDWIDTH PLOT

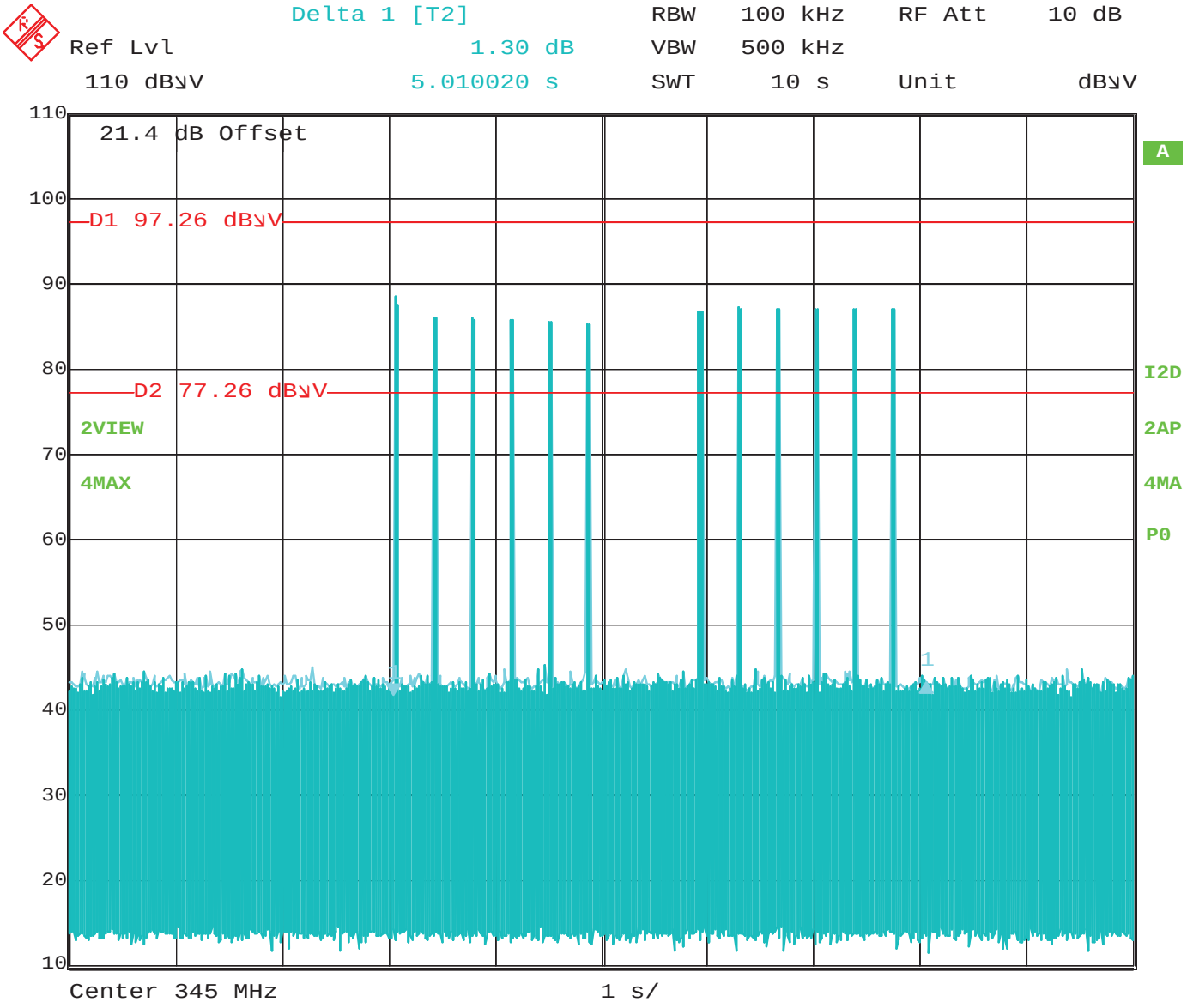
DATA SHEET



-20 dB Bandwidth Plot

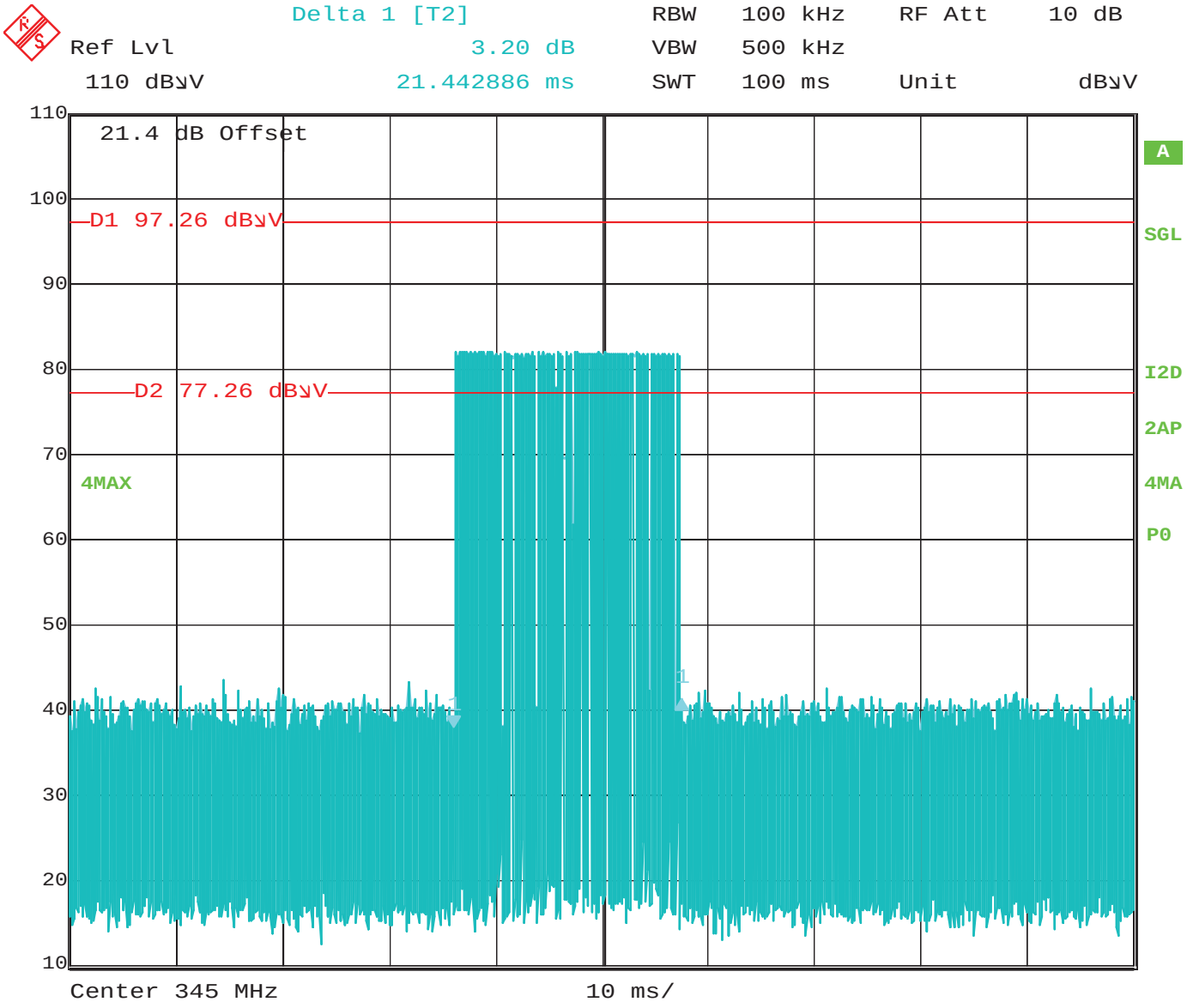
TRANSMISSION TIME

DATA SHEET



Date: 25.SEP.2020 08:49:05

The transmitter shuts off within 5 seconds of being activated



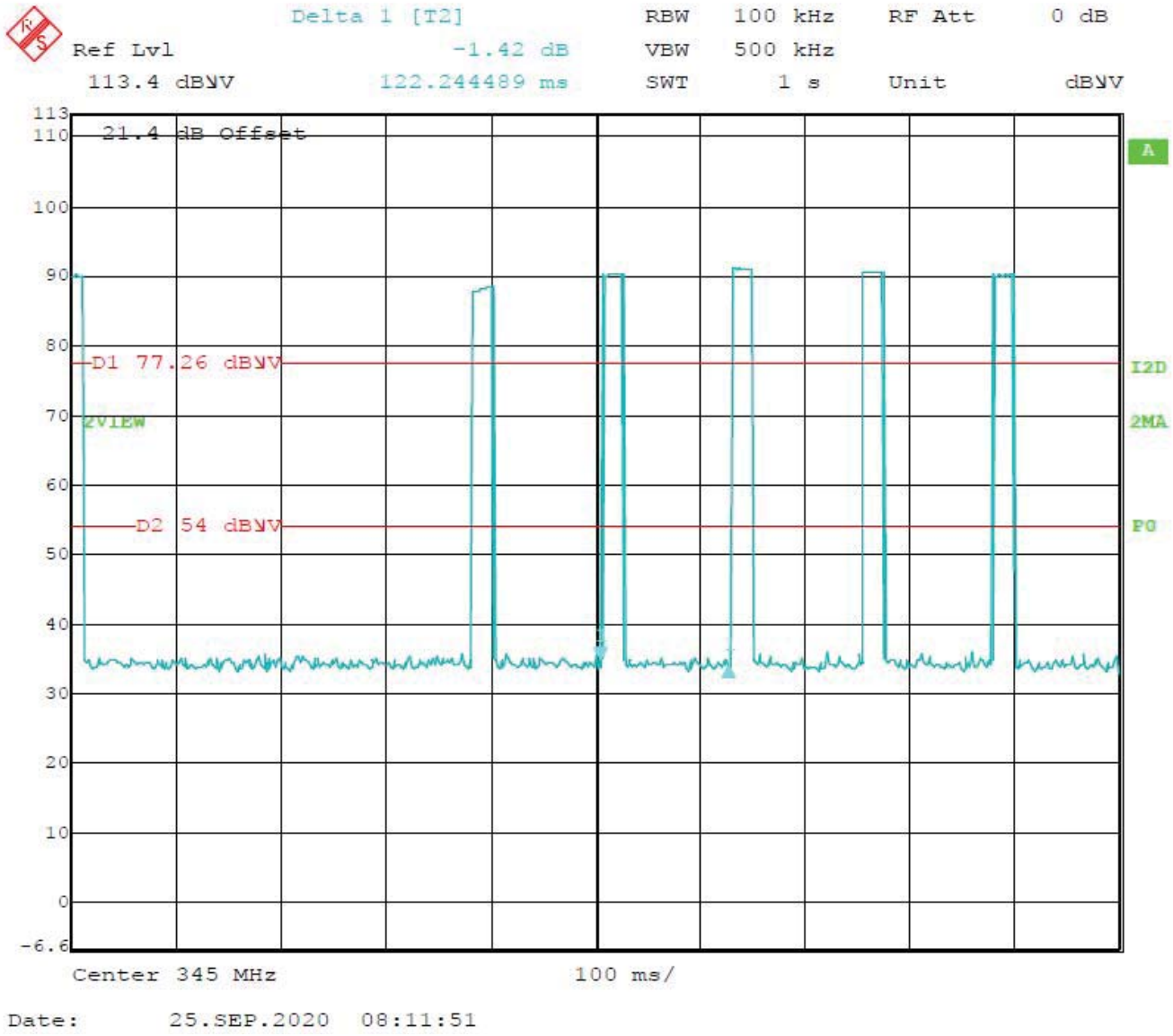
The individual pulse time is 21.442886 ms

When doing polling for system integrity, the pulses on the previous page will occur once per hour.

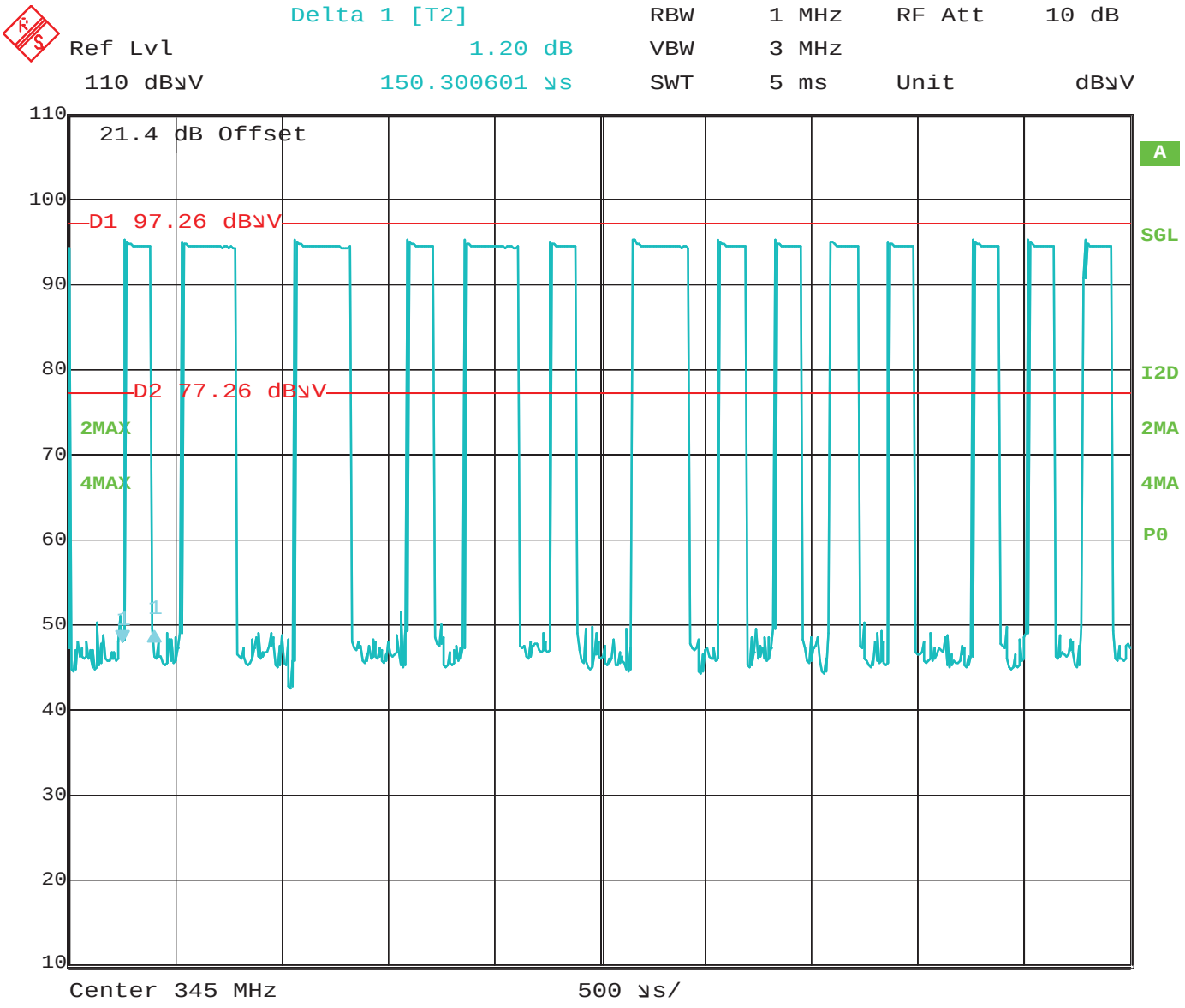
The total on time is 257.314632 ms which is less than 2 seconds (2000 ms) per hour.

DUTY CYCLE

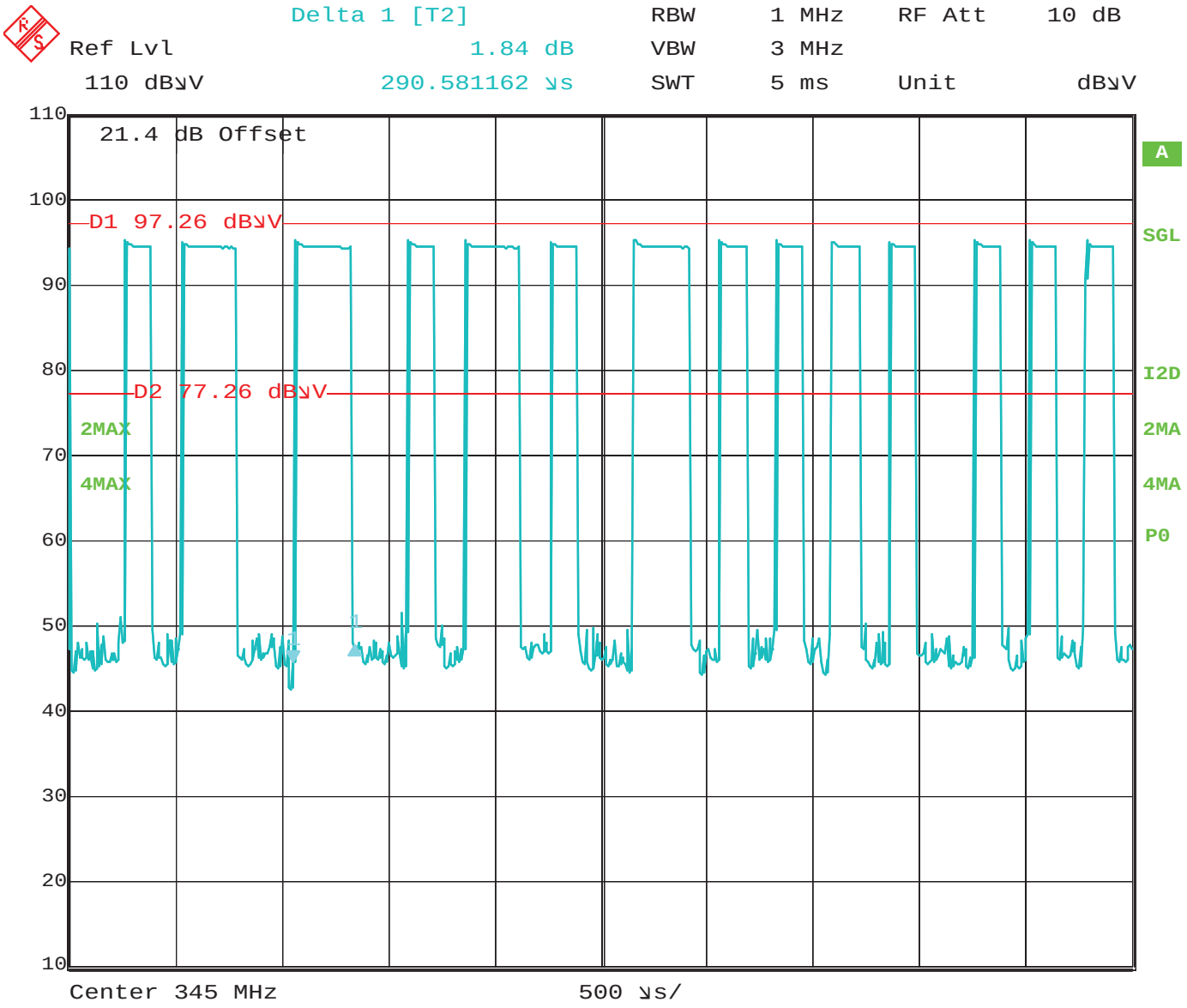
DATA SHEETS



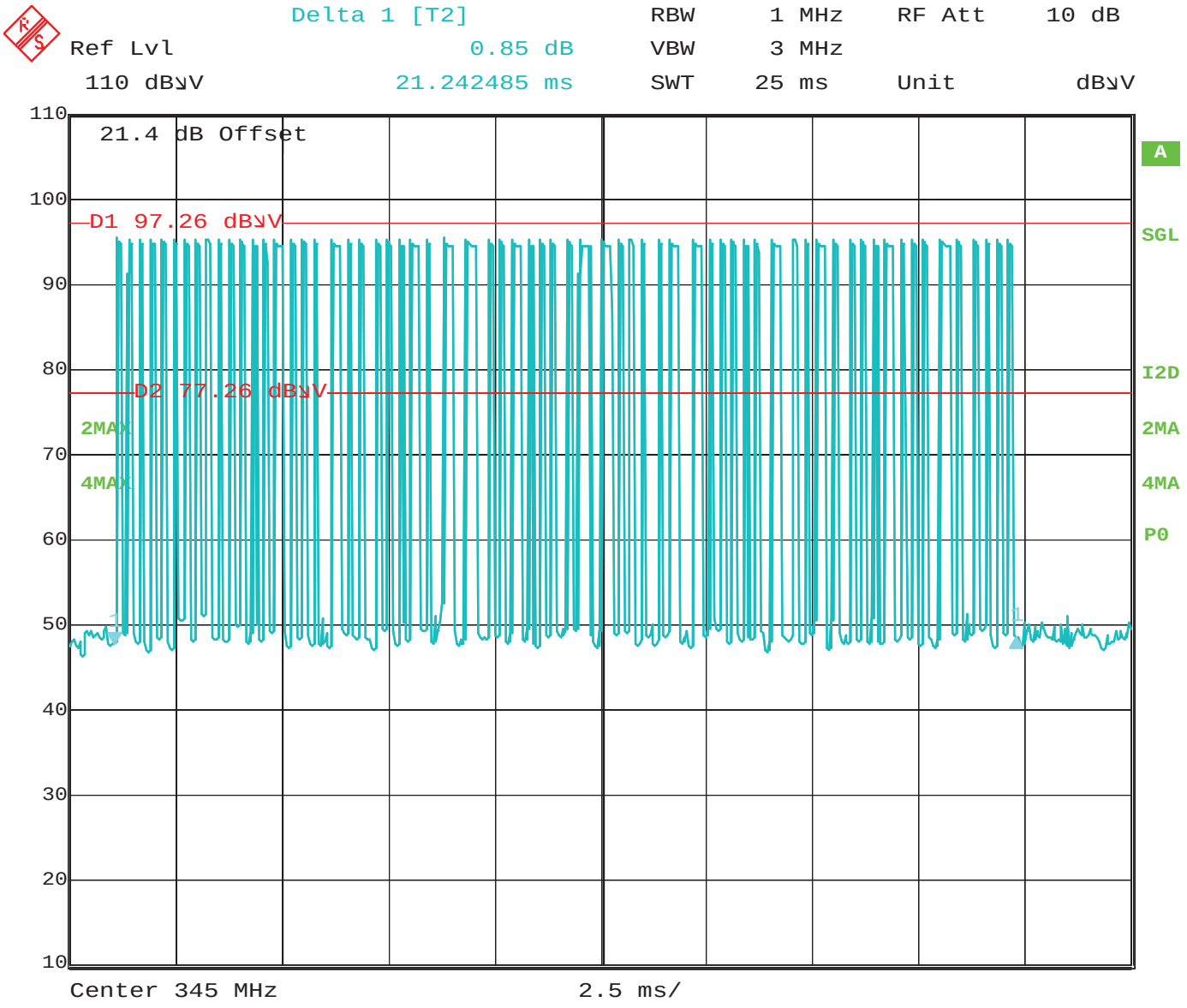
The pulse train only appears once every 100 ms



Time of Small Pulse = 150.300601 us



Time of Large Pulse = 290.581162 us



Date: 25.SEP.2020 08:20:49

Number of Small Pulses = 52 = (52*150.300601 us) = 7815.631252 us
Number of Large Pulses = 14 = (14*290.581162 us) = 4068.136268 us

Total On Time = 11883.76752 us = 11.88376752 ms

Duty Cycle = 11.88376752 ms / 100 ms = 11.88376752%

The peak to average ratio is -18.50 dB