COMPATIBLE ELECTRONICS

FCC PART 15, SUBPART B and C; and FCC 15.231
TEST REPORT

for

LISTENING DEVICE

Model: CA011

Prepared for

SIMPLISAFE, INC.
100 SUMMER STREET, SUITE 300
BOSTON, MASSACHUSETTS 02110

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DATE: NOVEMBER 12, 2024

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NVLAP® TESTING
NVLAP LAB CODE 200528-0

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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: Listening Device
Model: CA011
S/N: N/A

Product Description: The equipment under test designed to listen to any smoke, carbon monoxide, or combo smoke/CO detectors.
Device's Maximum length Packet Type: Pairing (34 bytes total)
Pairing Packet Length (bytes) / (ms) : 34 bytes / ~60ms
Center Frequency: 433. 92 MHz
Modulation Type: FSK
Frequency Deviation: 13 kHz
Data Rate: 4.8 kbps
The clock oscillators are 4 MHz and 16 MHz.
Dimensions: 8.3 cm (H) x 8.3 cm (W) x 2.3 cm (L).

Modifications: The EUT was modified to meet the specifications. Please see the list located in Appendix B.

Customer: SimpliSafe, Inc.
100 Summer Street
Boston, Massachusetts 02110

Test Dates: July 20 and October 22, 2024

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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, 15.207, 15.209, and 15.231

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	Conducted RF Emissions, 150 kHz – 30 MHz	This test was not performed because the EUT operates on battery power only and cannot be plugged into the AC public mains.
2	Spurious Radiated RF Emissions, 9 kHz – 3.195 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 Highest reading in relation to spec limit 79.11 dBuV/m (AVG) @ 433.92 MHz (*U = 3.30 dB)
3	-20 dB Bandwidth	Complies with limits of CFR Title 47, Part 15 Subpart C, section 15.231 (c)
4	Transmission Time	Complies with limits of CFR Title 47, Part 15 Subpart C, section 15.231 (a)(1) and (a)(2)

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

TEST	DESCRIPTION	HW USED	FW USED
1	Conducted RF Emissions, 150 kHz – 30 MHz	Revision #2	ESW2028_XMIT_ALL-0XAAs_2-Drivers_v1.0.hex
2	Spurious Radiated RF Emissions, 9 kHz – 3.195 GHz (Transmitter and Digital portion)	Revision #2	ESW2028_XMIT_ALL-0XAAs_2-Drivers_v1.0.hex
3	-20 dB Bandwidth	Revision #1	Echo.0.21.0.0.hex
4	Transmission Time	Revision #1	Echo.0.21.0.0.hex

1. PURPOSE

This document is a qualification test report based on the emissions tests performed on the Listening Device, Model: CA011. 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.

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

SimpliSafe, Inc.

Dean Goodale	Compliance Manager

Compatible Electronics Inc.

Kyle Fujimoto	Senior Test Engineer
James Ross	Senior Test Engineer

2.4 Date Test Sample was Received

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

2.5 Disposition of the Test Sample

The test sample has not been returned to SimpliSafe, Inc. as of the date of this 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
RSS	Radio Standards Specification
RF	Radio Frequency
BLE	Bluetooth Low Energy
CFR	Code of Federal Regulations
PCB	Printed Circuit Board
DC	Direct Current
LED	Light Emitting Diode

3. APPLICABLE DOCUMENTS

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

SPEC	TITLE
FCC Title 47, Part 15 Subpart B	FCC Rules – Radio frequency devices (including digital devices) – Unintentional Radiators
FCC Title 47, Part 15 Subpart C	FCC Rules – Radio frequency devices (including digital devices) – Intentional Radiators
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: 2020	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 Listening Device, Model: CA011 (EUT) tested as a stand alone unit and placed in the middle of the turntable. The EUT was transmtting at 433.92 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 mounted horizontally. 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 had fresh batteries installed prior to the testing.

The firmware inside the EUT allowed the EUT to continuously transmit at 433.92 MHz.

The firmware is stored on the company's servers.

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

There were no external cables connected to the EUT.

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5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT

5.1 EUT and Accessory List

EQUIPMENT	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID
LISTENING DEVICE (EUT)	SIMPLISAFE, INC.	CA011	N/A	U9K-CA110
NORMAL OPERATION FIRMWARE*	SIMPLISAFE, INC.	echo.0.21.0.0.hex	0.21.0.0 FW File Hash (SHA256) 56C59DE90855EC1482D70EB49 7B08A941202872FDEC1347B993 8D0F1F35A86DA	N/A
**CONTINUOUS TX FW	UEI	ESW2028_XMIT_ALL-0xAAs_2-Drivers_v1.0.hex	FW Hash (SHA256): FBE2B5ACE8D6317F54FB35FD 4CD3AD76BD8F3036380C8E7E5 7027D29D8E017F9	N/A

*Normal operating FW, pressing the “pair” buttons sends a “pair message” Tx power: 3
**Configures the radio as used in the production code, but transmits ‘0xAA’, ‘0xAA’, ‘0xAA’ ‘forever’ upon power up. Tx power: 2

5.2 Emissions Test Equipment

EQUIPMENT TYPE	MANU-FACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
RF RADIATED EMISSIONS TEST EQUIPMENT					
TDK TestLab	TDK RF Solutions, Inc.	9.22	700145	N/A	N/A
EMI Receiver, 3 Hz – 26.5 GHz	Keysight Technologies, Inc.	N9038A	MY51210150	December 8, 2023	December 8, 2024
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
Loop Antenna	Com-Power	AL-130R	121090	February 10, 2022	February 10, 2025
CombiLog Antenna	Com-Power	AC-220	10030004	November 22, 2023	November 22, 2025
Horn Antenna	Com-Power	AH-118	10050192	November 30, 2023	November 30, 2025
Preamplifier	Com-Power	PA-118A	551024	March 22, 2024	March 22, 2026
Below 1 GHz Radiated Cable	N/A	N/A	Asset #: 0006	October 27, 2023	October 27, 2025
Above 1 GHz Cable	Suhner	Sucoflex 102EA	2291	August 22, 2023	August 22, 2025
Above 1 GHz Cable	Suhner	Sucoflex 102EA	501393	August 22, 2023	August 22, 2025
Above 1 GHz Cable	Suhner	Sucoflex 102EA	501394	August 22, 2023	August 22, 2025
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	2.72 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(30 MHz – 1 000 MHz)	6.3 dB	3.32 dB (Vertical) 3.30 dB (Horizontal)
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(1 GHz - 6 GHz)	5.2 dB	4.06 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(6 GHz – 18 GHz)	5.5 dB	4.06 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(18 GHz – 26.5 GHz)	N/A	4.43 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(26.5 GHz – 40 GHz)	N/A	4.57 dB

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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 plugged into 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 considers 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 and 3rd harmonic of the fundamental frequency, were quasi-peaked using the quasi-peak detector of the EMI Receiver.

The harmonic frequencies above 1 GHz 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 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 4.3392 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.

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7.1.3 RF Emissions Test Results

Table 1 RADIATED EMISSION RESULTS
Listening Device, Model: CA011

Frequency (MHz)	Corrected Reading* (dBµV/m)	Specification Limit (dBµV/m)	Delta (Cor. Reading – Spec. Limit) (dB)
433.92 (H) (Z-Axis)	79.11 (Avg)	80.82	-1.71
41.40 (H) (X-Axis)	23.40 (QP)	40.00	-16.60
162.10 (H) (X-Axis)	26.44 (QP)	43.50	-17.06
162.80 (H) (X-Axis)	26.30 (QP)	43.50	-17.20
387.80 (H) (X-Axis)	28.58 (QP)	46.00	-17.42
422.70 (H) (X-Axis)	27.75 (QP)	46.00	-18.25

Notes:

* The complete emissions data is given in Appendix E of this report.
(V) Vertical
(H) Horizontal
(QP) Quasi-Peak
(AV) Average

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.

When the limit is in terms of magnetic field, the following equation applies:

$$H[dB(\mu A/m)] = V[dB(\mu V)] + L_C\,[dB] - G_{PA}\,[dB] + AF^H\,[dB(S/m)]$$

where: H is the magnetic field strength (to be compared with the limit),
V is the voltage level measured by the receiver or spectrum analyzer,
L_C is the cable loss,
G_{PA} is the gain of the preamplifier (if used), and
AF^H is the magnetic antenna factor.

The G_{PA} term is only included in the equation when an external preamplifier is used in the measurement chain, in front of the receiver or spectrum analyzer. An external preamplifier is not usually necessary (or even advisable, due to risk of saturating the input mixer of the receiver) when an active loop antenna is used. In that case, the antenna factor of the loop already includes the gain of its built-in preamplifier.

If the "electrical" antenna factor is used instead, the above equation becomes:

$$H[dB(\mu A/m)] = V[dB(\mu V)] + L_C\,[dB] - G_{PA}[dB] + AF^E\,[dB(m^{-1})\,] - 51.5\,[dB\Omega]$$

where: AF^E is the "electric" antenna factor, as provided by the antenna calibration laboratory.

When the limit is in terms of electric field, the following equation applies:

$$E[dB(\mu V/m)] = V[dB(\mu V)] + L_C[dB] - G_{PA}[dB] + AF^E\,[dB(m^{-1})\,]$$

or, if the magnetic antenna factor is used:

$$E[dB(\mu V/m)] = V[dB(\mu V)] + L_C[dB] - G_{PA}[dB] + AF^H\,[dB(S/m)] + 51.5[dB\Omega]$$

The display of the receiver (or spectrum analyzer) **shall not** be configured in units of current, e.g. µA or dB(µA). That conversion is calculated inside the receiver (or spectrum analyzer) using its input impedance, which is 50 Ω, while the magnetic field calculation is based on the free-space impedance of 377 Ω.

7.1.5 Duty Cycle Calculation

The duty cycle calculation was measured using an EMI Receiver and was used to obtain the final data for the duty cycle calculation. The final qualification data sheets are 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 t_x
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 = -4.41 dB

Time of Pulse = 60.15 ms

Total On Time = 60.15 ms

The time between pulses is greater than 100 ms

Duty Cycle = 60.16 ms / 100 ms = 60.15 %

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 from 1% to 5% of the Occupied Bandwidth.
2. Set the span to 100 kHz.
3. Set VBW to greater than 3 times the RBW.
4. Set the peak detector to max hold.
5. Set the sweep time to auto
6. Allow the trace to stabilize.
7. 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).

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 = 510 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 to the end of the transmission
9. Verify the transmission does not go beyond 5 seconds

Test Results:

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

7.1.9 Variation of the Input Power

The variation of the input power test was performed using the EMI Receiver. The EUT input power was varied between 85% and 115% of the nominal rated supply voltage. The carrier frequency was monitored for any change in amplitude.

Test Results:

This test was not performed because the EUT is battery power only.

8. CONCLUSIONS

The Listening Device, Model: CA011 (EUT), as tested, 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, 15.207, 15.209 and 15.231.

APPENDIX A

LABORATORY ACCREDITATIONS AND RECOGNITIONS

LABORATORY ACCREDITATIONS AND RECOGNITIONS

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 the Management Systems Requirements of ISO/IEC 17025, General Requirements for the competence of testing and calibration laboratories:

"A laboratory's fulfilment of the requirements of ISO/IEC 17025 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 are written in language relevant to laboratory operations and operate generally in accordance with the principles of ISO 9001"

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 and C; and FCC 15.231 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.

HW Revision #1: SCH2028091 Revision A05 + C29 Modified to 330 pF
HW Revision #2: SCH2028-01 Revision A07

APPENDIX C

MODELS COVERED UNDER THIS REPORT

MODELS COVERED UNDER THIS REPORT

USED FOR THE PRIMARY TEST

Listening Device
Model: CA011
S/N: N/A

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

APPENDIX D

DIAGRAMS, CHARTS, AND PHOTOS

FIGURE 1: CONDUCTED EMISSIONS TEST SETUP

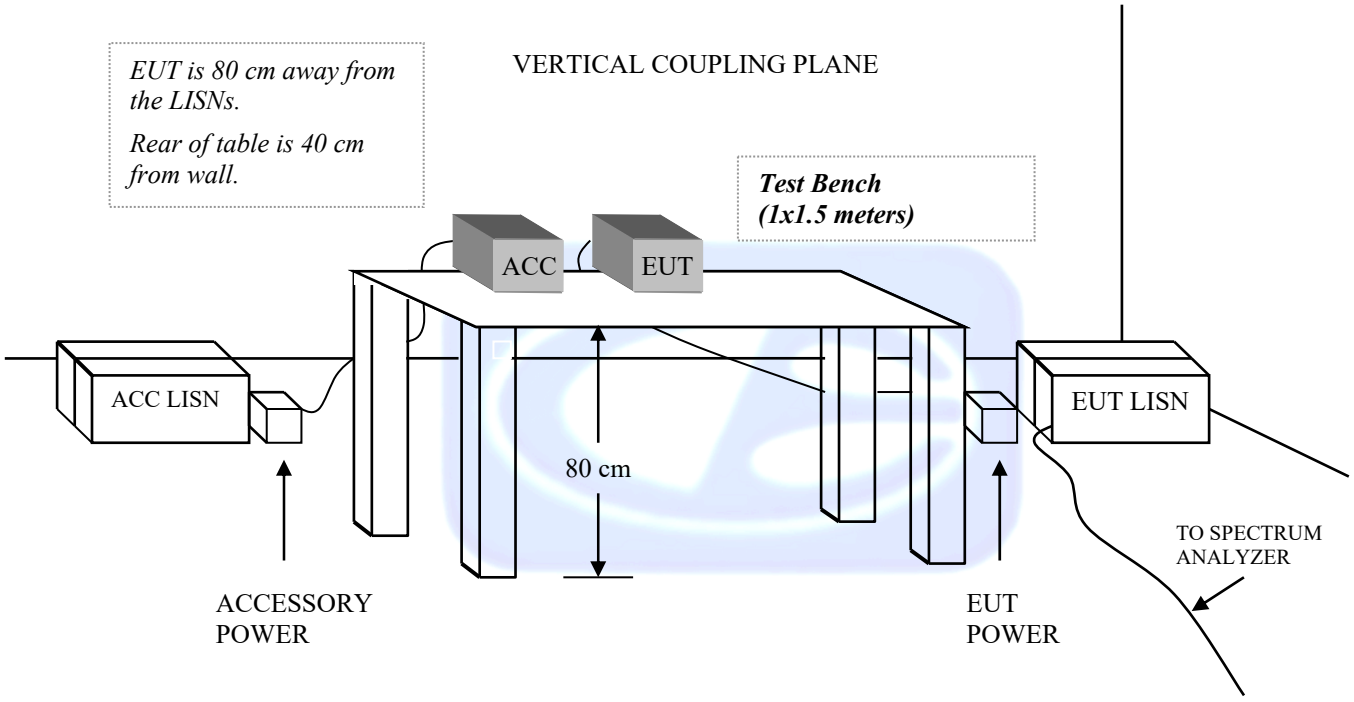
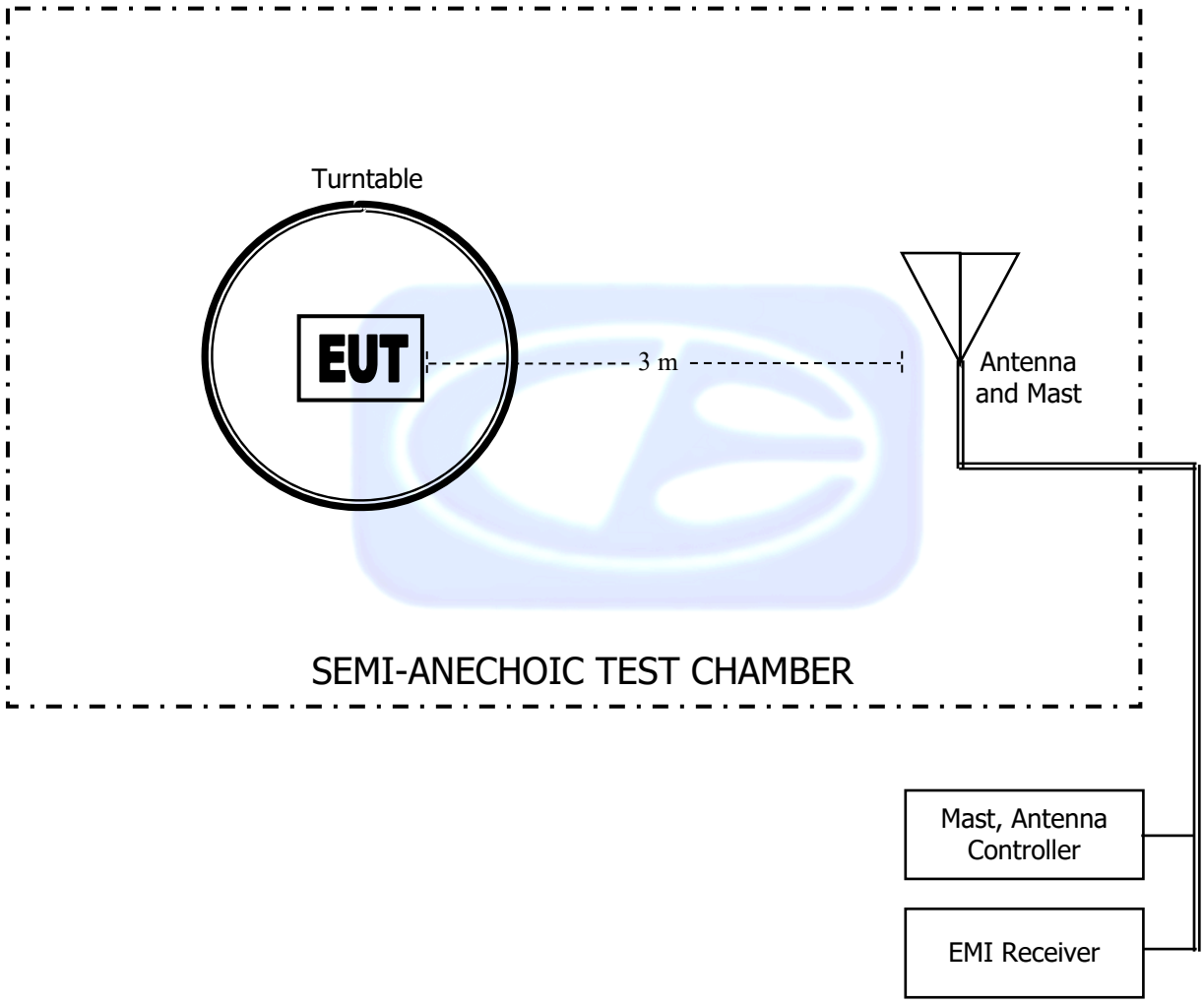


FIGURE 2: LAYOUT OF THE SEMI -ANECHOIC TEST CHAMBER



COM-POWER AL-130R

LOOP ANTENNA

S/N: 121090

CALIBRATION DATE: FEBRUARY 10, 2022

FREQUENCY (MHz)	MAGNETIC (dB/m)	ELECTRIC (dB/m)
0.009	15.6	-35.8
0.01	15.8	-35.6
0.02	14.8	-36.6
0.03	15.6	-35.9
0.04	15.0	-36.5
0.05	14.4	-37.1
0.06	14.6	-36.9
0.07	14.3	-37.2
0.08	14.3	-37.2
0.09	14.4	-37.0
0.10	14.1	-37.4
0.20	14.1	-37.4
0.30	14.0	-37.5
0.40	13.9	-37.6
0.50	14.1	-37.3
0.60	14.1	-37.3
0.70	14.2	-37.3
0.80	14.2	-37.3
0.90	14.2	-37.2
1.00	14.4	-37.0
2.00	14.6	-36.9
3.00	14.6	-36.8
4.00	14.9	-36.6
5.00	14.9	-36.7
6.00	14.8	-36.7
7.00	14.6	-36.8
8.00	14.5	-37.0
9.00	14.3	-37.2
10.00	14.5	-37.0
11.00	14.6	-36.9
12.00	14.7	-36.7
13.00	14.9	-36.6
14.00	15.0	-36.5
15.00	14.9	-36.6
16.00	14.9	-36.6
17.00	14.6	-36.8
18.00	14.4	-37.1
19.00	14.5	-37.0
20.00	14.5	-37.0
21.00	14.2	-37.3
22.00	13.9	-37.5
23.00	13.9	-37.5
24.00	13.8	-37.7
25.00	13.4	-38.0
26.00	13.2	-38.2
27.00	13.2	-38.3
28.00	12.7	-38.7
29.00	12.7	-38.8
30.00	12.4	-39.0

COM-POWER AC-220

COMBILOG ANTENNA

S/N: 10030004

CALIBRATION DATE: NOVEMBER 22, 2023

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
30	23.10	200	16.10
35	22.00	250	17.90
40	41.30	300	19.10
45	20.50	350	20.30
50	19.30	400	21.60
60	15.40	450	22.20
70	12.40	500	23.20
80	12.40	550	23.70
90	14.10	600	25.10
100	15.50	650	25.30
120	15.90	700	25.10
125	15.90	750	26.70
140	14.80	800	26.60
150	14.60	850	27.20
160	14.80	900	28.00
175	15.90	950	29.10
180	15.50	1000	28.90

COM POWER AH-118

HORN ANTENNA

S/N: 10050192

CALIBRATION DATE: NOVEMBER 30, 2023

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	24.01	10.0	38.78
1.5	25.25	10.5	39.29
2.0	27.21	11.0	39.30
2.5	27.42	11.5	39.87
3.0	28.89	12.0	39.77
3.5	30.58	12.5	40.21
4.0	31.78	13.0	40.01
4.5	32.48	13.5	40.06
5.0	33.13	14.0	40.63
5.5	34.27	14.5	41.41
6.0	34.92	15.0	41.53
6.5	35.58	15.5	40.59
7.0	36.83	16.0	41.63
7.5	37.02	16.5	40.93
8.0	36.93	17.0	41.27
8.5	37.67	17.5	41.69
9.0	37.53	18.0	44.00
9.5	38.76		

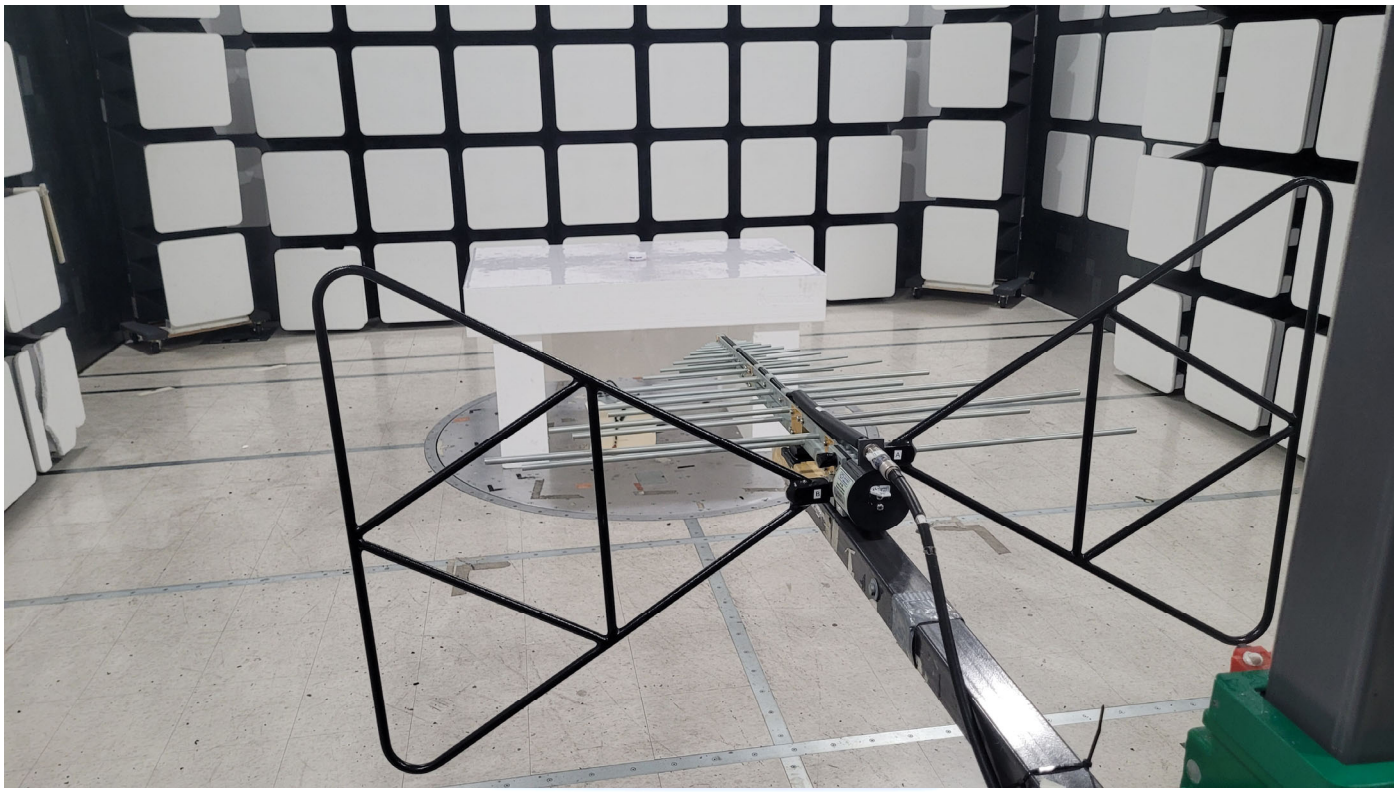
COM-POWER PAM-118A

PREAMPLIFIER

S/N: 551024

CALIBRATION DATE: MARCH 22, 2024

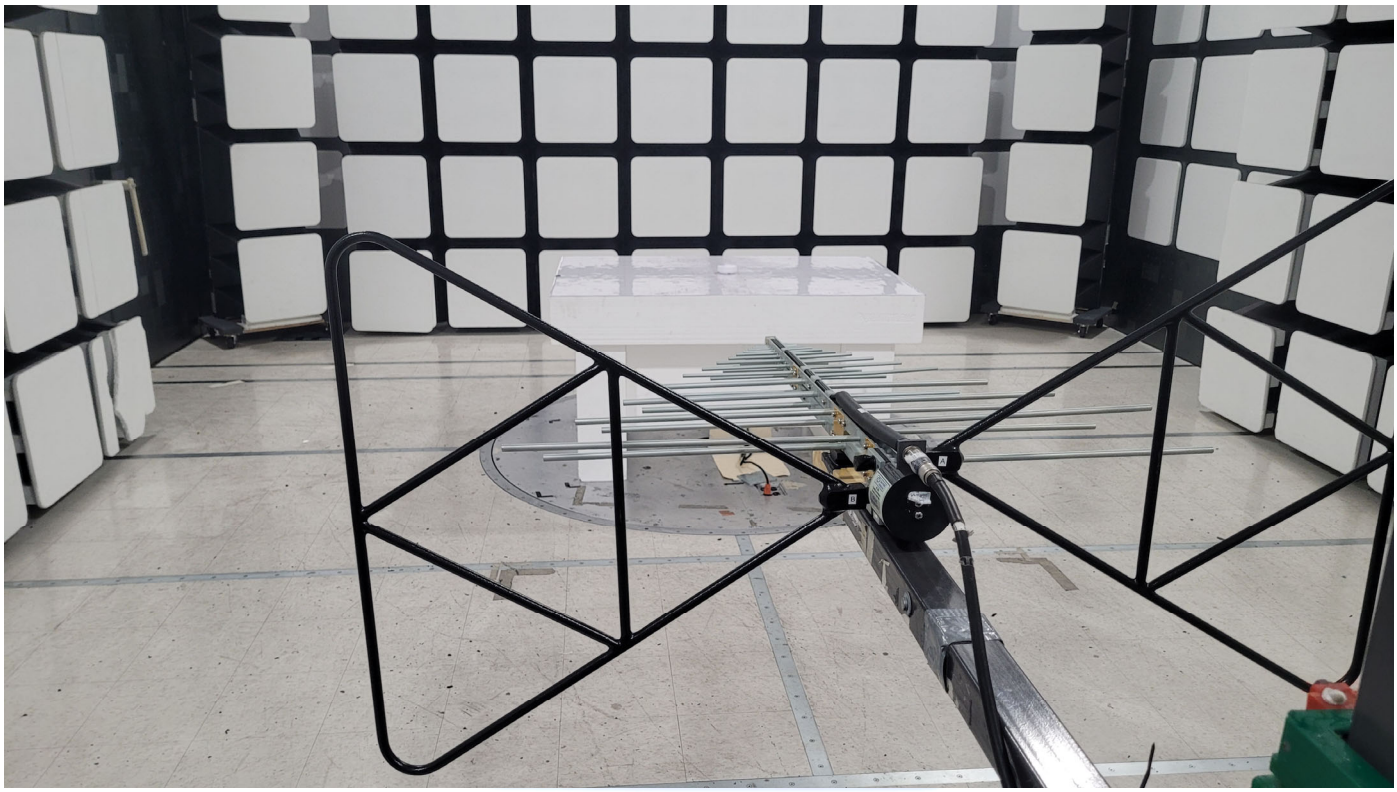
FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	40.53	6.0	40.59
1.1	40.26	6.5	40.36
1.2	40.38	7.0	40.71
1.3	41.05	7.5	40.66
1.4	41.10	8.0	40.69
1.5	41.15	8.5	40.09
1.6	41.28	9.0	39.58
1.7	41.35	9.5	41.42
1.8	41.44	10.0	40.04
1.9	41.45	11.0	39.30
2.0	41.68	12.0	37.84
2.5	41.57	13.0	38.98
3.0	42.16	14.0	38.03
3.5	42.41	15.0	38.12
4.0	42.20	16.0	40.38
4.5	41.47	17.0	39.45
5.0	41.24	18.0	41.66
5.5	40.70		



FRONT VIEW

SIMPLISAFE, INC.
LISTENING DEVICE
MODEL: CA011
FCC SUBPART B AND C – RADIATED EMISSIONS – BELOW 1 GHz

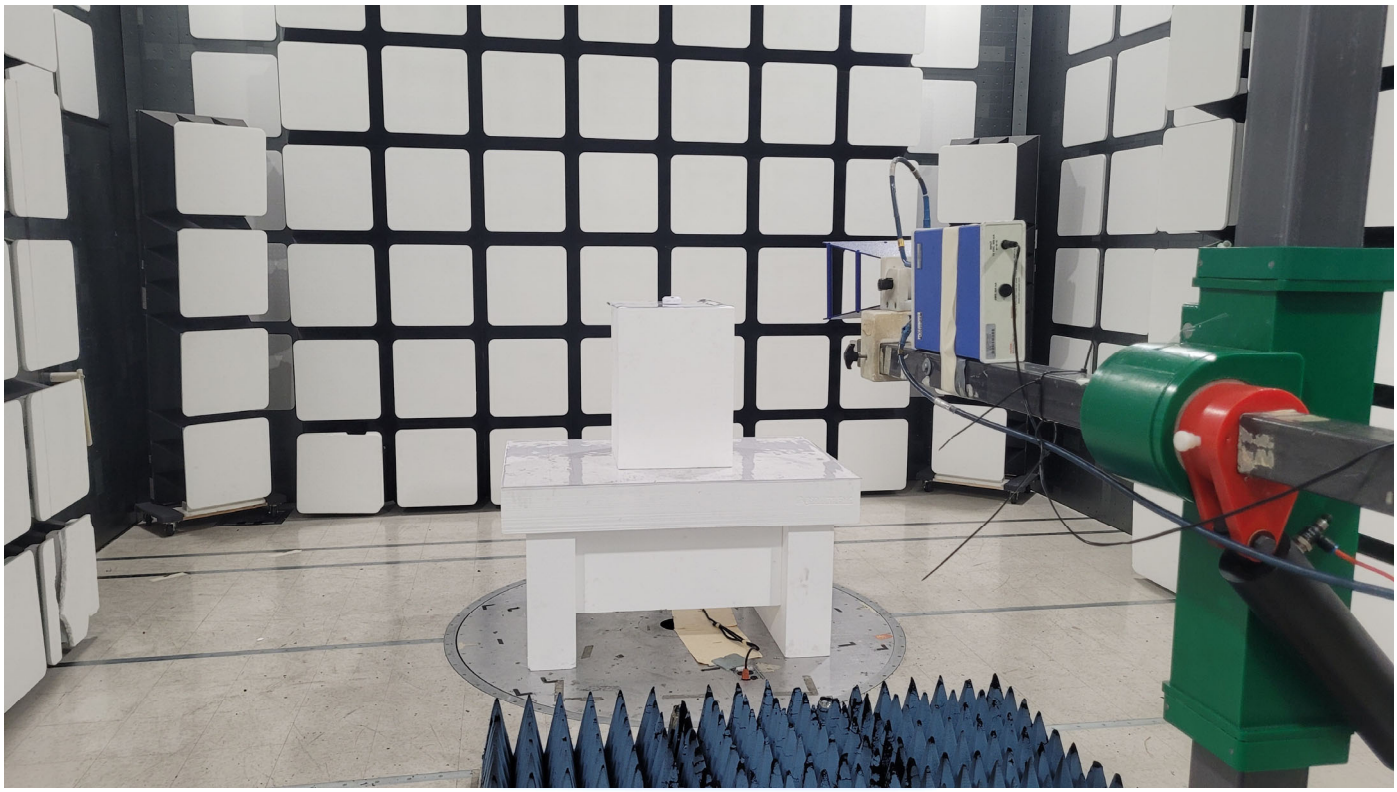
PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS



REAR VIEW

SIMPLISAFE, INC.
LISTENING DEVICE
MODEL: CA011
FCC SUBPART B AND C – RADIATED EMISSIONS – BELOW 1 GHz

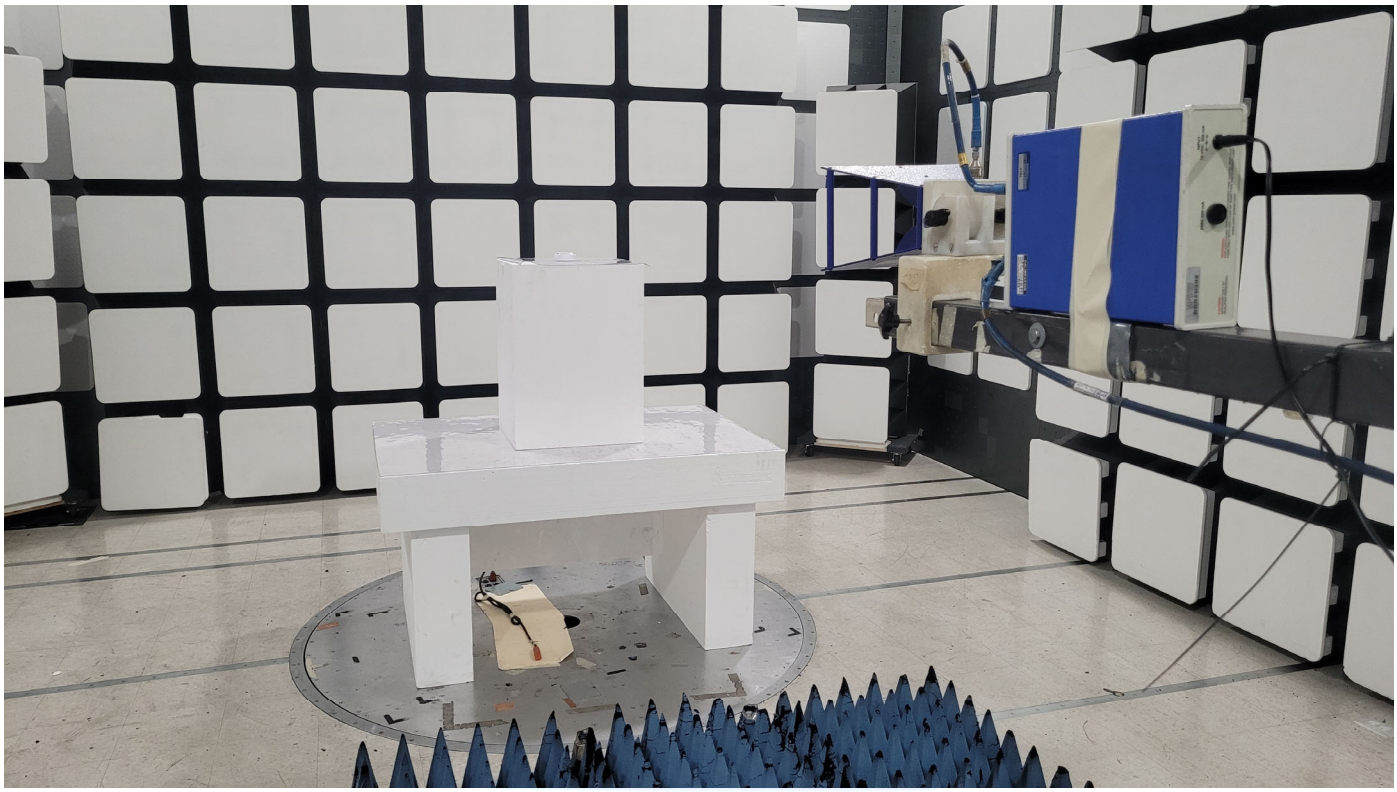
PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS



FRONT VIEW

SIMPLISAFE, INC.
LISTENING DEVICE
MODEL: CA011
FCC SUBPART B AND C – RADIATED EMISSIONS – ABOVE 1 GHz

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS



REAR VIEW

SIMPLISAFE, INC.
LISTENING DEVICE
MODEL: CA011
FCC SUBPART B AND C – RADIATED EMISSIONS – ABOVE 1 GHz

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

APPENDIX E

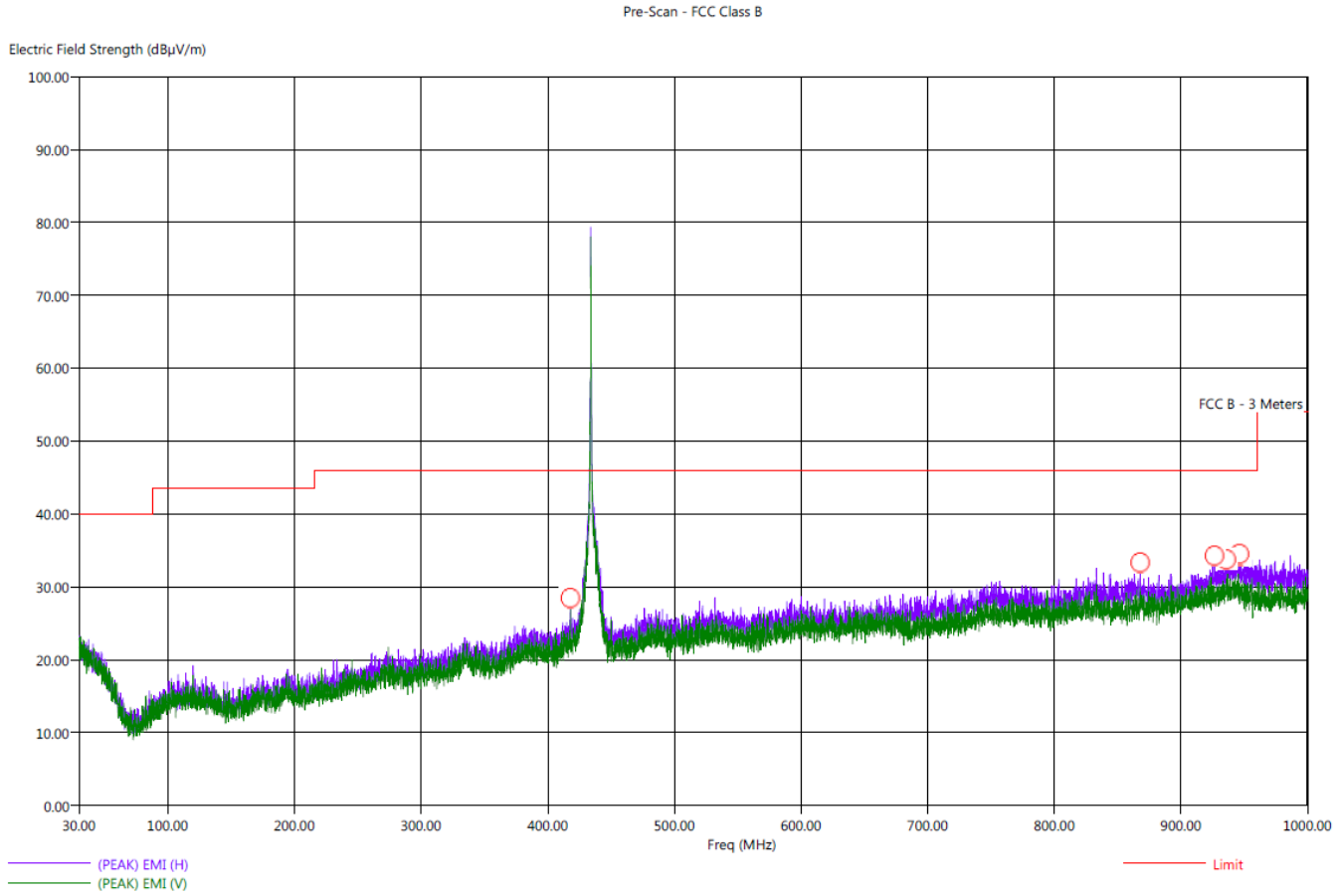
DATA SHEETS

RADIATED EMISSIONS

DATA SHEETS

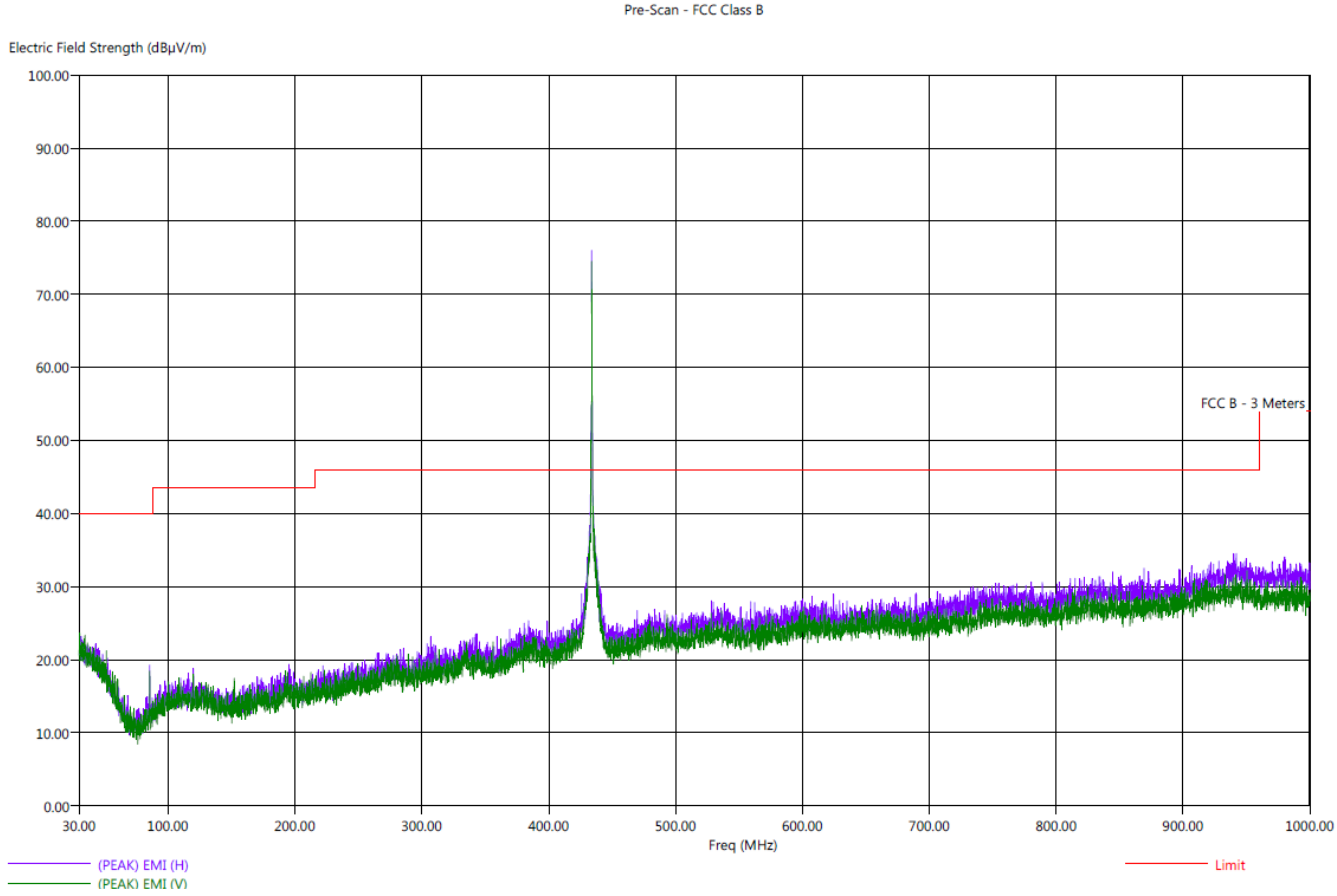
Title: Pre-Scan - FCC Class B
File: 1 - Pre-Scan - 433.92 MHz - X-Axis - 10-22-2024.set
Operator: Kyle Fujimoto
EUT Type: Listening Device
EUT Condition: The EUT is continuously transmitting at 433.92 MHz
Customer: SimpliSafe, Inc.
Model: CA011
S/N: Unit 1
X-Axis
Note: The Frequencies at 433.92 MHz and 867.84 MHz are subject to the limits of FCC 15.231 instead

10/22/2024 2:04:05 PM
Sequence: Preliminary Scan



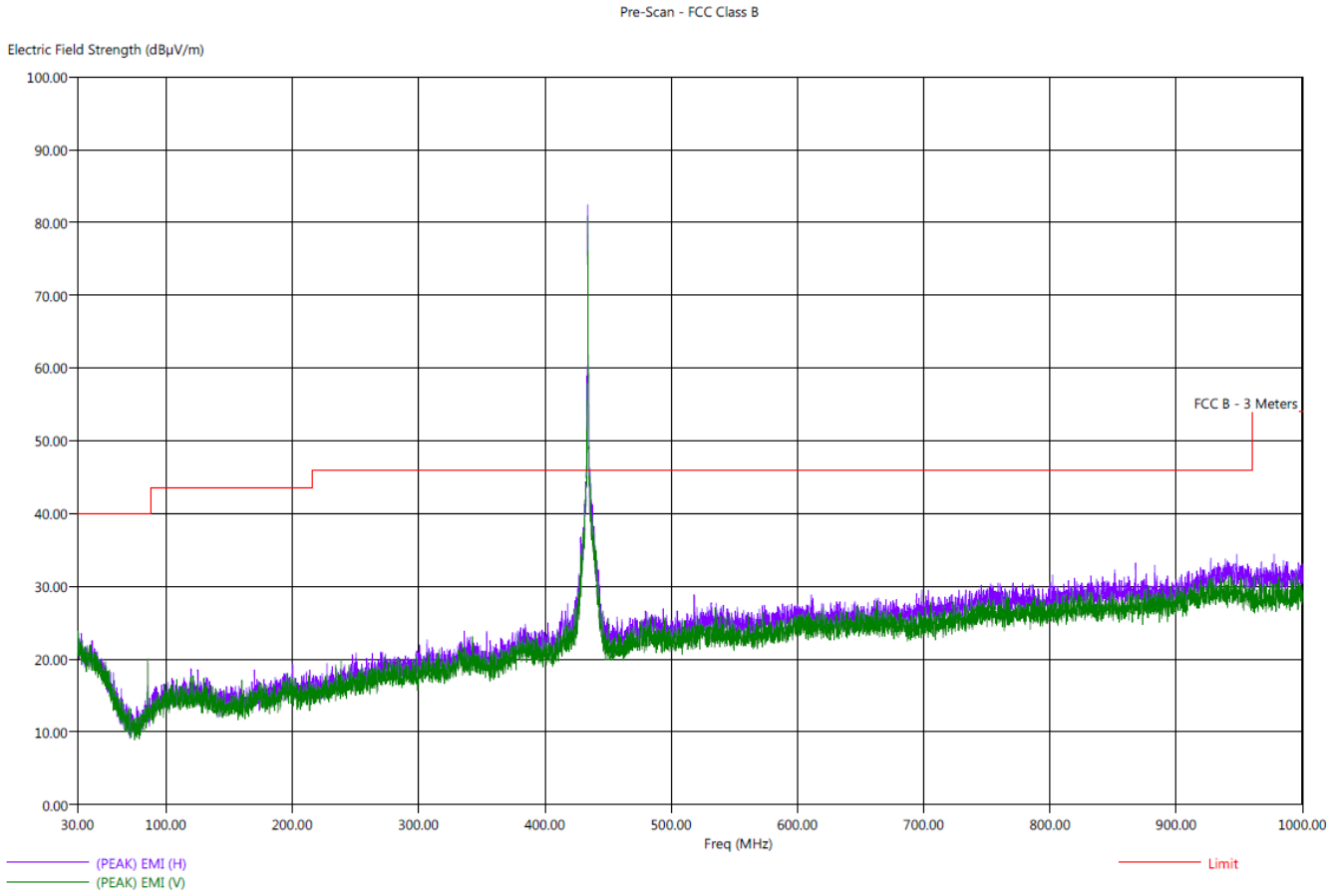
Title: Pre-Scan - FCC Class B
File: 1 - Pre-Scan - 433.92 MHz - Y-Axis - 10-22-2024.set
Operator: Kyle Fujimoto
EUT Type: Listening Device
EUT Condition: The EUT is continuously transmitting at 433.92 MHz
Customer: SimpliSafe, Inc.
Model: CA011
S/N: Unit 1
Y-Axis
Note: The Frequencies at 433.92 MHz and 867.84 MHz are subject to the limits of FCC 15.231 instead

10/22/2024 2:12:46 PM
Sequence: Preliminary Scan



Title: Pre-Scan - FCC Class B
File: 1 - Pre-Scan - 433.92 MHz - Z-Axis - 10-22-2024.set
Operator: Kyle Fujimoto
EUT Type: Listening Device
EUT Condition: The EUT is continuously transmitting at 433.92 MHz
Customer: SimpliSafe, Inc.
Model: CA011
S/N: Unit 1
Z-Axis
Note: The Frequencies at 433.92 MHz and 867.84 MHz are subject to the limits of FCC 15.231 instead

10/22/2024 2:22:31 PM
Sequence: Preliminary Scan



Title: Radiated Final - 30-1000 MHz - FCC Class B
File: 1 - Final Scan - 433.92 MHz - X-Axis - 10-22-2024.set
Operator: Kyle Fujimoto
EUT Type: Listening Device
EUT Condition: The EUT is continuously transmitting at 433.92 MHz
Customer: SimpliSafe, Inc.
Model: CA011
S/N: Unit 1
X-Axis

10/22/2024 2:34:38 PM
Sequence: Final Measurements

Final Scan - 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)
417.90	H	30.69	27.57	-15.31	-18.43	46.00	22.19	1.43	166.50	254.92
867.90	H	36.24	33.06	-9.76	-12.94	46.00	27.49	1.96	349.50	143.22
926.50	H	33.58	29.46	-12.42	-16.54	46.00	29.03	2.24	299.50	287.16
936.00	H	34.31	30.16	-11.69	-15.84	46.00	29.40	2.49	131.50	334.80
946.30	H	34.80	30.52	-11.20	-15.48	46.00	29.37	2.76	316.75	127.58
946.90	H	34.71	30.47	-11.29	-15.53	46.00	29.32	2.78	319.00	302.86

FUNDAMENTAL AND HARMONICS

DATA SHEETS

FCC 15.231
SimpliSafe, Inc.
Listening Device
Model: CA011

Date: 10/22/2024
Lab: D
Tested By: Kyle Fujimoto

Fundamental
Duty Cycle 60.15%

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
433.92	80.07	V	100.82	-20.75	Peak	174.25	108.59	**X-Axis**
433.92	75.65	V	80.82	-5.17	Avg	174.25	108.59	**Vertical Polarization**
433.92	83.48	V	100.82	-17.34	Peak	214.50	119.28	**Y-Axis**
433.92	79.06	V	80.82	-1.76	Avg	214.50	119.28	**Vertical Polarization**
433.92	73.97	V	100.82	-26.85	Peak	150.75	100.05	**Z-Axis**
433.92	69.56	V	80.82	-11.26	Avg	150.75	100.05	**Vertical Polarization**
433.92	82.11	H	100.82	-18.71	Peak	358.50	222.62	**X-Axis**
433.92	77.70	H	80.82	-3.12	Avg	358.50	222.62	**Horizontal Polarization**
433.92	81.72	H	100.82	-19.10	Peak	332.25	179.28	**Y-Axis**
433.92	77.31	H	80.82	-3.51	Avg	332.25	179.28	**Horizontal Polarization**
433.92	83.52	H	100.82	-17.30	Peak	37.25	221.56	**Z-Axis**
433.92	79.11	H	80.82	-1.71	Avg	37.25	221.56	**Horizontal Polarization**

FCC 15.231
SimpliSafe, Inc.
Listening Device
Model: CA011

Date: 10/22/2024
Lab: D
Tested By: Kyle Fujimoto

Harmonics
Transmit Mode - X-Axis
Duty Cycle 60.15%

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
867.84	35.69	V	80.82	-45.13	Peak	107.00	124.53	
867.84	31.28	V	60.82	-29.54	Avg	107.00	124.53	
1301.76	25.49	V	73.97	-48.48	Peak	353.00	127.22	
1301.76	21.08	V	53.97	-32.89	Avg	353.00	127.22	
1735.68	28.60	V	80.82	-52.22	Peak	207.50	206.86	
1735.68	26.67	V	60.82	-34.15	Avg	207.50	206.86	
2169.60	38.33	V	80.82	-42.49	Peak	317.25	142.92	
2169.60	33.92	V	60.82	-26.90	Avg	317.25	142.92	
2603.52	37.67	V	80.82	-43.15	Peak	148.50	111.34	
2603.52	33.26	V	60.82	-27.56	Avg	148.50	111.34	
3037.44	36.25	V	80.82	-44.57	Peak	330.00	111.40	
3037.44	31.84	V	60.82	-28.98	Avg	330.00	111.40	
3471.36	35.00	V	80.82	-45.82	Peak	105.25	143.04	
3471.36	30.59	V	60.82	-30.23	Avg	105.25	143.04	
3905.28	38.30	V	73.97	-35.67	Peak	333.50	111.46	
3905.28	33.89	V	53.97	-20.08	Avg	333.50	111.46	
4339.20	38.71	V	73.97	-35.26	Peak	207.00	223.52	
4339.20	34.30	V	53.97	-19.67	Avg	207.00	223.52	

FCC 15.231
SimpliSafe, Inc.
Listening Device
Model: CA011

Date: 10/22/2024
Lab: D
Tested By: Kyle Fujimoto

Harmonics
Transmit Mode - Y-Axis
Duty Cycle 60.15%

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
867.84	34.24	V	80.82	-46.58	Peak	130.50	142.80	
867.84	29.83	V	60.82	-30.99	Avg	130.50	142.80	
1301.76	27.88	V	73.97	-46.09	Peak	46.00	111.40	
1301.76	23.47	V	53.97	-30.50	Avg	46.00	111.40	
1735.68	27.72	V	80.82	-53.10	Peak	161.75	159.52	
1735.68	23.31	V	60.82	-37.51	Avg	161.75	159.52	
2169.60	36.33	V	80.82	-44.49	Peak	355.00	111.16	
2169.60	31.92	V	60.82	-28.90	Avg	355.00	111.16	
2603.52	34.58	V	80.82	-46.24	Peak	73.25	111.52	
2603.52	30.17	V	60.82	-30.65	Avg	73.25	111.52	
3037.44	33.08	V	80.82	-47.74	Peak	246.25	142.98	
3037.44	28.67	V	60.82	-32.15	Avg	246.25	142.98	
3471.36	35.13	V	80.82	-45.69	Peak	158.00	174.92	
3471.36	30.72	V	60.82	-30.10	Avg	158.00	174.92	
3905.28	37.62	V	73.97	-36.35	Peak	221.50	222.86	
3905.28	33.21	V	53.97	-20.76	Avg	221.50	222.86	
4339.20	38.46	V	73.97	-35.51	Peak	221.00	126.80	
4339.20	34.05	V	53.97	-19.92	Avg	221.00	126.80	

FCC 15.231
SimpliSafe, Inc.
Listening Device
Model: CA011

Date: 10/22/2024
Lab: D
Tested By: Kyle Fujimoto

Harmonics
Transmit Mode - Z-Axis
Duty Cycle 60.15%

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
867.84	30.77	V	80.82	-50.05	Peak	177.25	146.62	
867.84	26.36	V	60.82	-34.46	Avg	177.25	146.62	
1301.76	29.34	V	73.97	-44.63	Peak	324.00	143.88	
1301.76	24.93	V	53.97	-29.04	Avg	324.00	143.88	
1735.68	28.67	V	80.82	-52.15	Peak	316.50	159.10	
1735.68	24.26	V	60.82	-36.56	Avg	316.50	159.10	
2169.60	36.14	V	80.82	-44.68	Peak	42.00	111.16	
2169.60	31.73	V	60.82	-29.09	Avg	42.00	111.16	
2603.52	37.49	V	80.82	-43.33	Peak	340.50	111.10	
2603.52	33.08	V	60.82	-27.74	Avg	340.50	111.10	
3037.44	31.22	V	80.82	-49.60	Peak	249.75	191.52	
3037.44	26.81	V	60.82	-34.01	Avg	249.75	191.52	
3471.36	35.13	V	80.82	-45.69	Peak	162.75	142.98	
3471.36	30.72	V	60.82	-30.10	Avg	162.75	142.98	
3905.28	37.53	V	73.97	-36.44	Peak	30.00	223.22	
3905.28	33.12	V	53.97	-20.85	Avg	30.00	223.22	
4339.20	39.02	V	73.97	-34.95	Peak	295.50	142.86	
4339.20	34.61	V	53.97	-19.36	Avg	295.50	142.86	

FCC 15.231
SimpliSafe, Inc.
Listening Device
Model: CA011

Date: 10/22/2024
Lab: D
Tested By: Kyle Fujimoto

Harmonics
Transmit Mode - X-Axis
Duty Cycle 60.15%

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
867.84	35.83	H	80.82	-44.99	Peak	331.50	142.26	
867.84	31.42	H	60.82	-29.40	Avg	331.50	142.26	
1301.76	28.82	H	73.97	-45.15	Peak	24.50	110.74	
1301.76	24.41	H	53.97	-29.56	Avg	24.50	110.74	
1735.68	28.54	H	80.82	-52.28	Peak	267.50	191.22	
1735.68	24.13	H	60.82	-36.69	Avg	267.50	191.22	
2169.60	37.53	H	80.82	-43.29	Peak	159.75	142.98	
2169.60	33.12	H	60.82	-27.70	Avg	159.75	142.98	
2603.52	38.78	H	80.82	-42.04	Peak	65.00	158.92	
2603.52	34.37	H	60.82	-26.45	Avg	65.00	158.92	
3037.44	35.03	H	80.82	-45.79	Peak	250.00	111.40	
3037.44	30.62	H	60.82	-30.20	Avg	250.00	111.40	
3471.36	35.51	H	80.82	-45.31	Peak	174.75	159.58	
3471.36	31.10	H	60.82	-29.72	Avg	174.75	159.58	
3905.28	37.67	H	73.97	-36.30	Peak	326.25	175.40	
3905.28	33.26	H	53.97	-20.71	Avg	326.25	175.40	
4339.20	39.13	H	73.97	-34.84	Peak	186.25	239.34	
4339.20	34.72	H	53.97	-19.25	Avg	186.25	239.34	

FCC 15.231
SimpliSafe, Inc.
Listening Device
Model: CA011

Date: 10/22/2024
Lab: D
Tested By: Kyle Fujimoto

Harmonics
Transmit Mode - Y-Axis
Duty Cycle 60.15%

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
867.84	34.43	H	80.82	-46.39	Peak	102.50	127.58	
867.84	30.02	H	60.82	-30.80	Avg	102.50	127.58	
1301.76	28.33	H	73.97	-45.64	Peak	28.25	159.22	
1301.76	23.92	H	53.97	-30.05	Avg	28.25	159.22	
1735.68	26.85	H	80.82	-53.97	Peak	55.50	239.34	
1735.68	22.44	H	60.82	-38.38	Avg	55.50	239.34	
2169.60	39.61	H	80.82	-41.21	Peak	50.25	111.04	
2169.60	35.20	H	60.82	-25.62	Avg	50.25	111.04	
2603.52	39.33	H	80.82	-41.49	Peak	323.00	127.40	
2603.52	34.92	H	60.82	-25.90	Avg	323.00	127.40	
3037.44	35.84	H	80.82	-44.98	Peak	125.00	159.40	
3037.44	31.43	H	60.82	-29.39	Avg	125.00	159.40	
3471.36	35.02	H	80.82	-45.80	Peak	179.50	239.10	
3471.36	30.61	H	60.82	-30.21	Avg	179.50	239.10	
3905.28	38.13	H	73.97	-35.84	Peak	122.25	206.98	
3905.28	33.72	H	53.97	-20.25	Avg	122.25	206.98	
4339.20	39.83	H	73.97	-34.14	Peak	64.00	127.10	
4339.20	35.42	H	53.97	-18.55	Avg	64.00	127.10	

FCC 15.231
SimpliSafe, Inc.
Listening Device
Model: CA011

Date: 10/22/2024
Lab: D
Tested By: Kyle Fujimoto

Harmonics
Transmit Mode - Z-Axis
Duty Cycle 60.15%

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
867.84	34.86	H	80.82	-45.96	Peak	191.50	198.02	
867.84	30.45	H	60.82	-30.37	Avg	191.50	198.02	
1301.76	25.53	H	73.97	-48.44	Peak	28.50	127.28	
1301.76	21.12	H	53.97	-32.85	Avg	28.50	127.28	
1735.68	27.60	H	80.82	-53.22	Peak	314.25	127.34	
1735.68	23.19	H	60.82	-37.63	Avg	314.25	127.34	
2169.60	36.28	H	80.82	-44.54	Peak	145.75	142.86	
2169.60	31.87	H	60.82	-28.95	Avg	145.75	142.86	
2603.52	33.90	H	80.82	-46.92	Peak	87.25	159.40	
2603.52	29.49	H	60.82	-31.33	Avg	87.25	159.40	
3037.44	33.42	H	80.82	-47.40	Peak	62.50	143.40	
3037.44	29.01	H	60.82	-31.81	Avg	62.50	143.40	
3471.36	35.29	H	80.82	-45.53	Peak	100.50	223.10	
3471.36	30.88	H	60.82	-29.94	Avg	100.50	223.10	
3905.28	37.25	H	73.97	-36.72	Peak	308.75	191.46	
3905.28	32.84	H	53.97	-21.13	Avg	308.75	191.46	
4339.20	38.58	H	73.97	-35.39	Peak	324.75	159.22	
4339.20	34.17	H	53.97	-19.80	Avg	324.75	159.22	

FCC 15.231
SimpliSafe, Inc.
Listening Device
Model: CA011

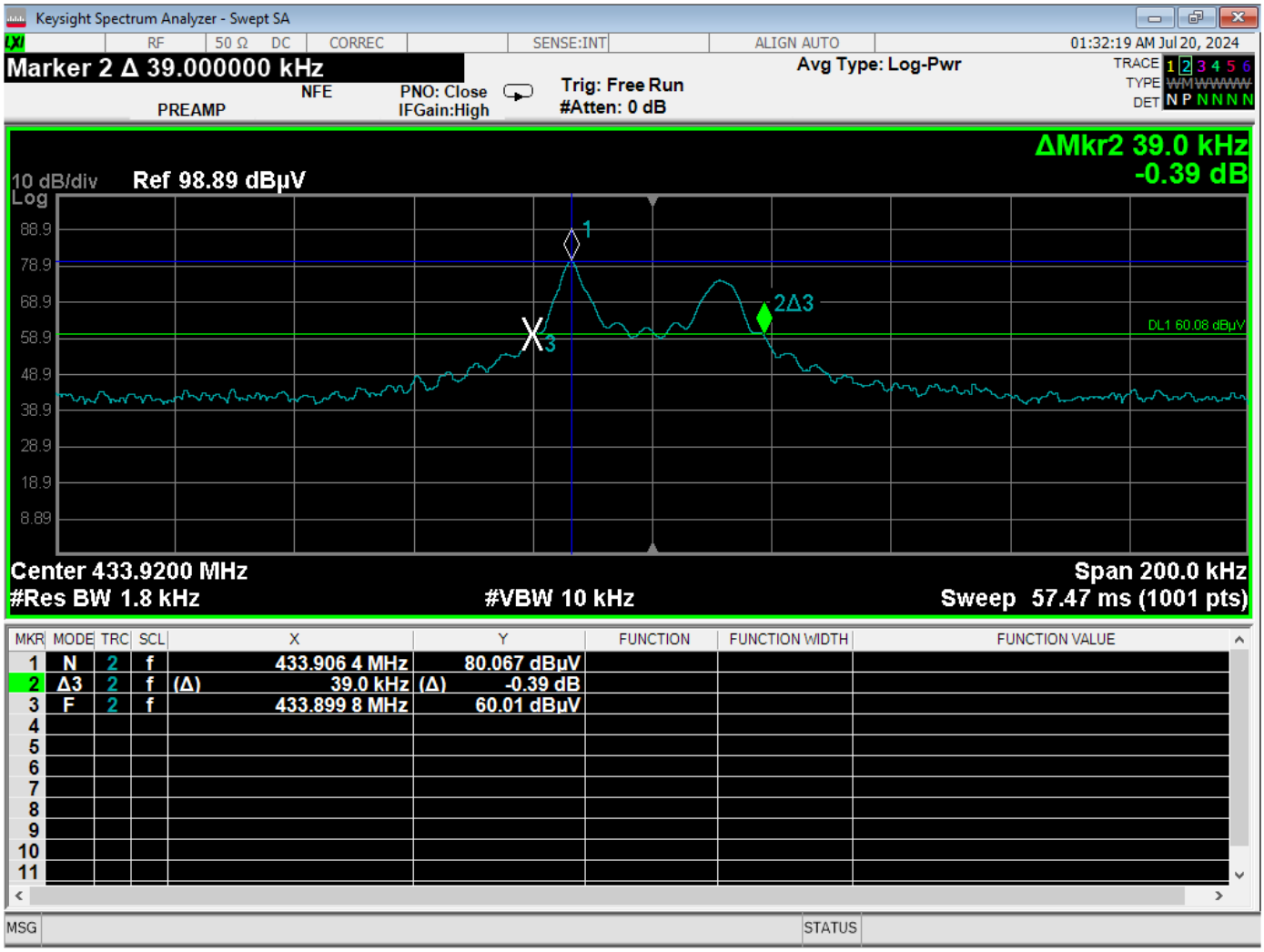
Date: 10/22/2024
Lab: D
Tested By: Kyle Fujimoto

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 4339.20 MHz

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 4339.20 MHz
								for the digital portion
								of the EUT
								No Emissions Detected
								from 9 kHz to 30 MHz
								for the Non-Harmonic Emissions
								of the Transmitter for the EUT
								No Emissions Detected
								from 1 GHz to 4339.20 MHz
								for the Non-Harmonic Emissions
								of the Transmitter for the EUT
								Investigated in the X-Axis,
								Y-Axis, and Z-Axis

-20 dB BANDWIDTH PLOT

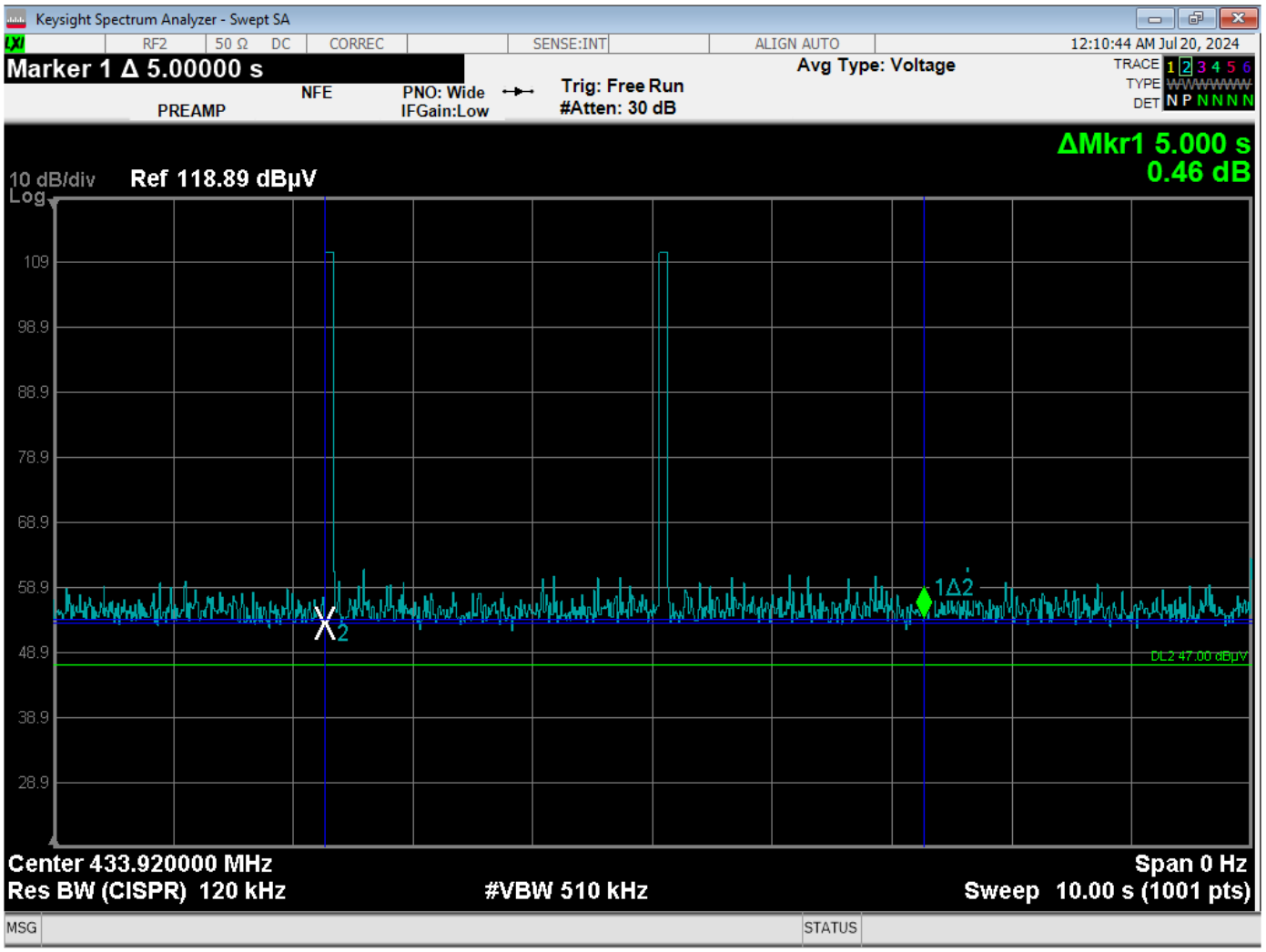
DATA SHEET



-20 dB Bandwidth Plot – 1.8 kHz RBW

TRANSMISSION TIME

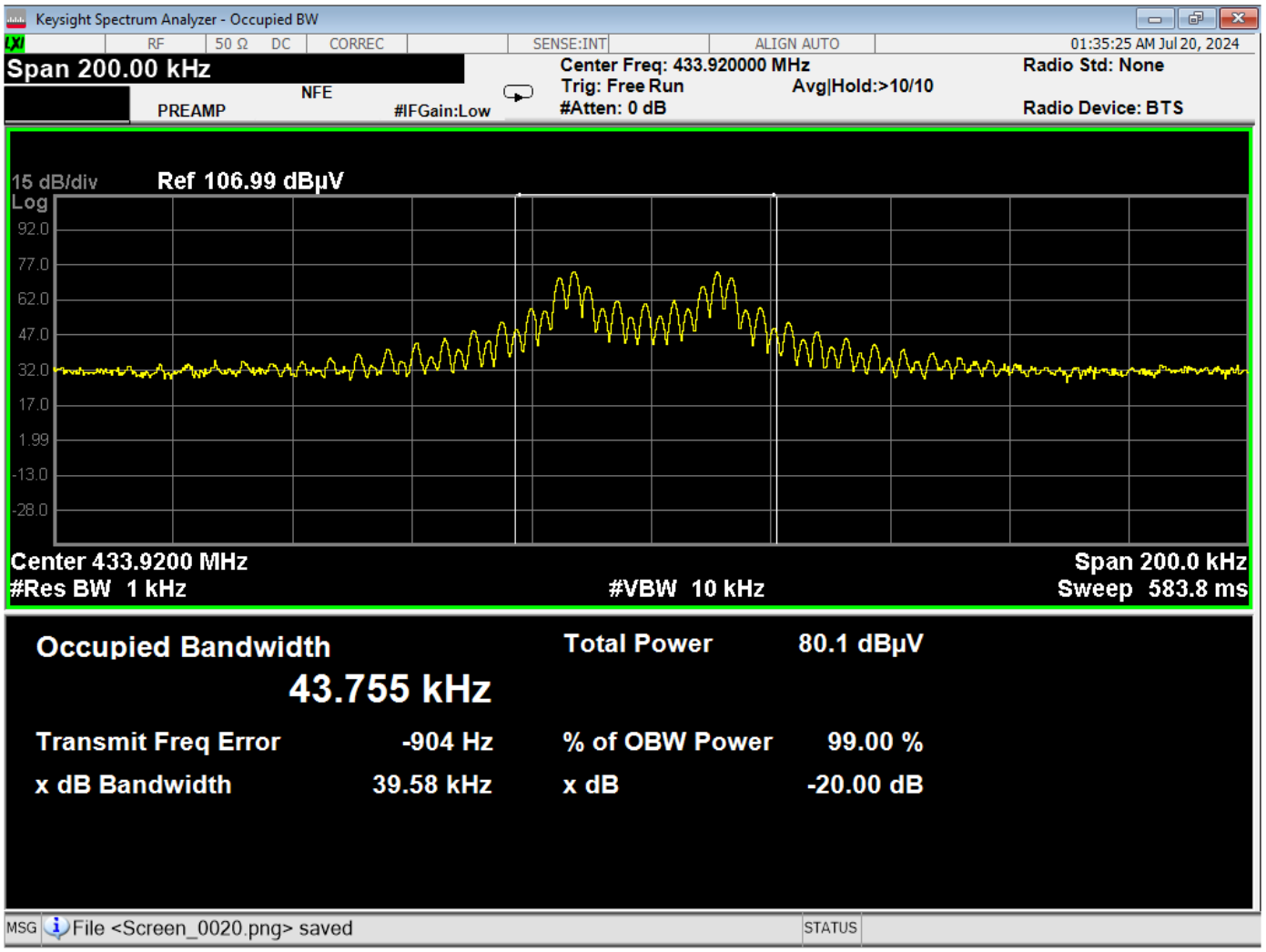
DATA SHEET



Plot Showing the Transmission time is less than 5 seconds

99% BANDWIDTH

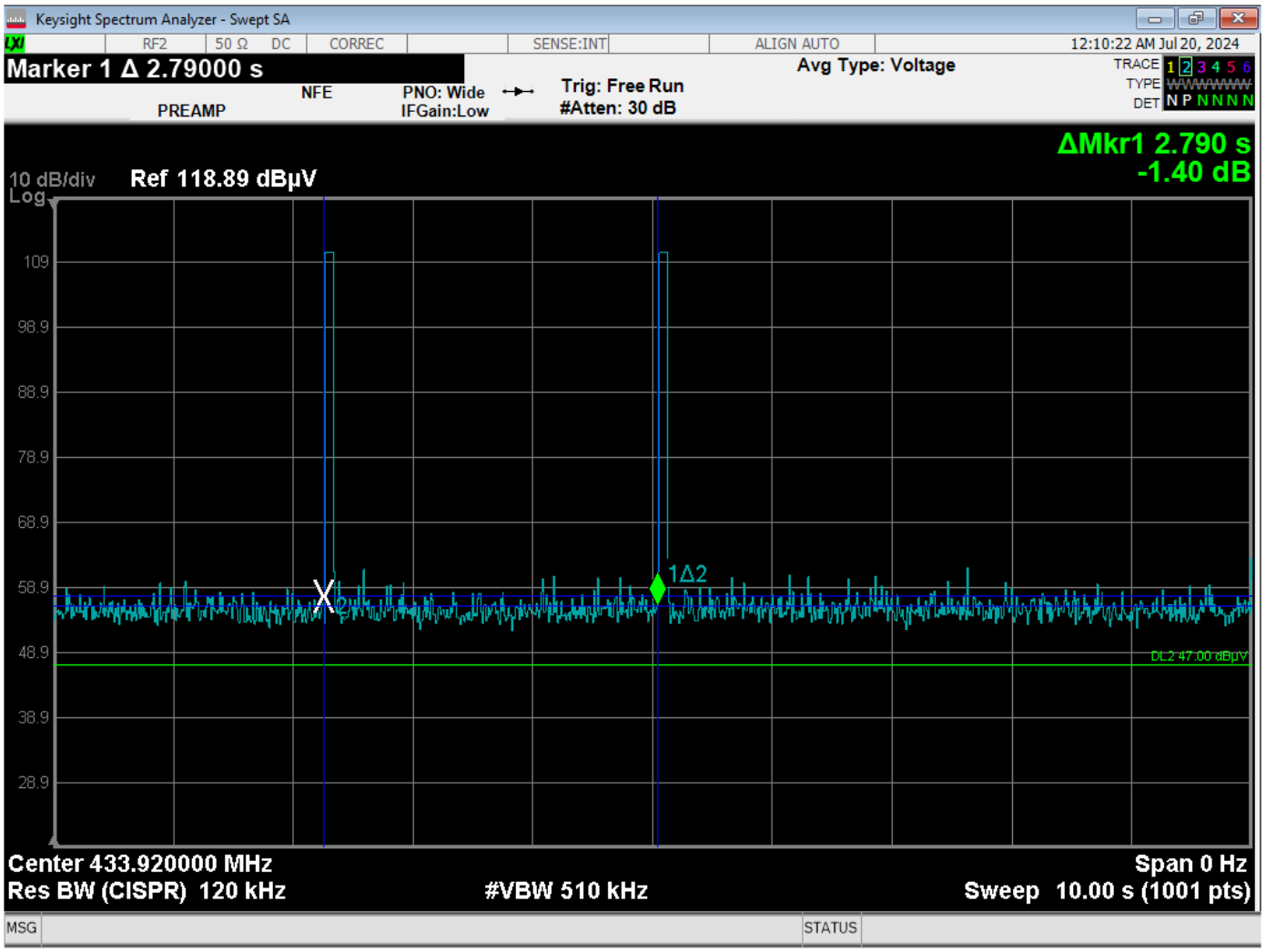
DATA SHEET



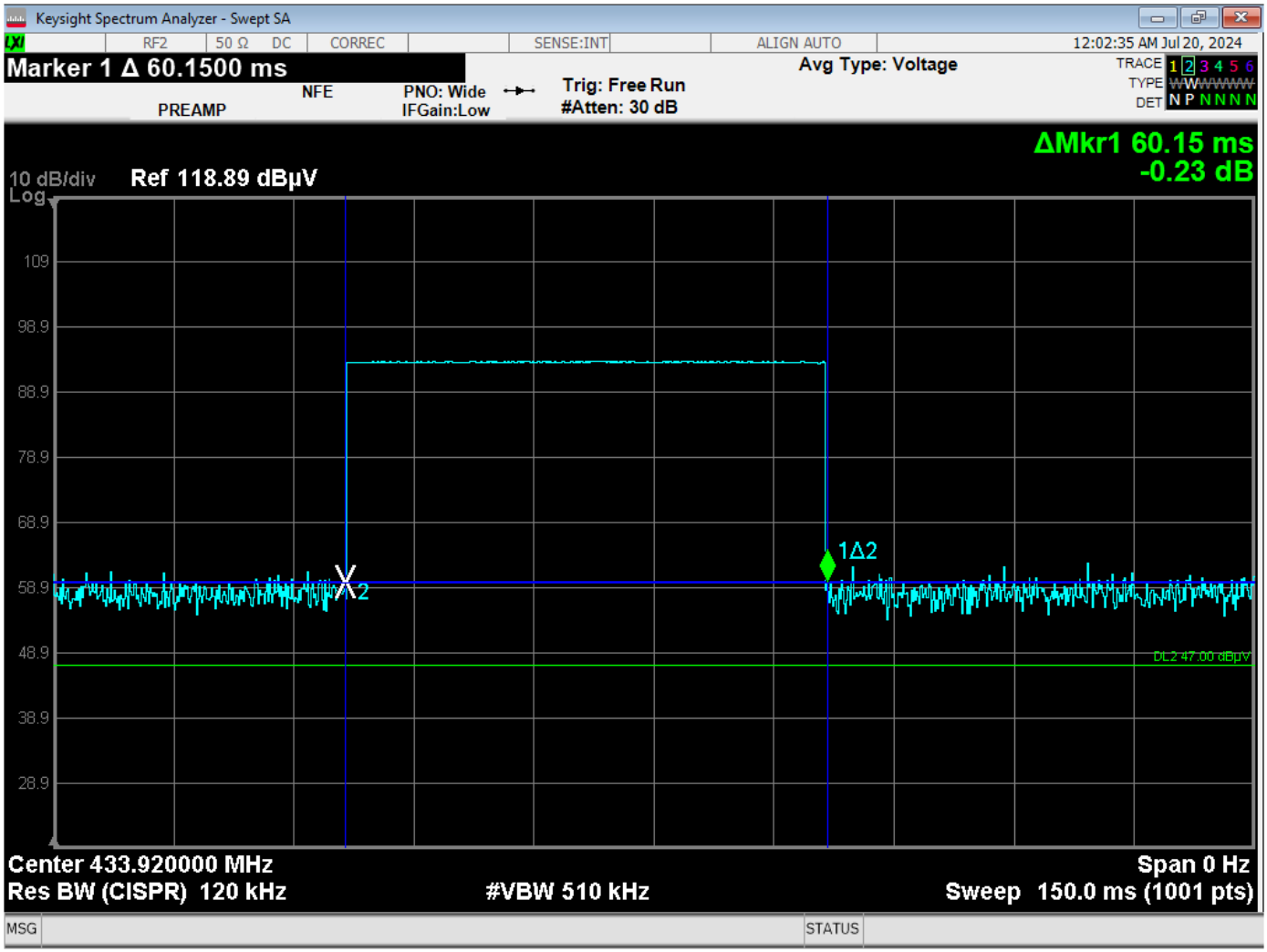
99% Bandwidth Plot

DUTY CYCLE

DATA SHEETS



Time Between Pulses for Learn Mode = 2.790 seconds



Time of Pulse in Learn mode = 60.15 ms
Duty Cycle = 60.15 ms / 100 ms = 60.15%
Peak to Average = 20 LOG (0.6015) = -4.41 dB