FCC PART 15, SUBPART B and C; FCC 15.247; RSS-247 and RSS-GEN TEST REPORT

For

900 MHz ACCESS POINT

Model: VIEWPOINT ACCESS POINT 1.1

HVIN: DS-VP-900-AP

Prepared for

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DATE: JULY 8, 2023

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NVLAP TESTING
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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.

The client must not use this report to claim product certification, approval or endorsement by NVLAP, NIST or any agency of the U.S. government.

Device Tested: 900 MHz Access Point
Models: ViewPoint Access Point 1.1
HVIN: DS-VP-900-AP
S/N: B6900004

Product Description: Line powered general purpose 902-928 MHz Access Point that communicates with 902-928 MHz wireless sensors which measure environmental conditions. The integrated MCU/radio clocks are: 32.768 kHz and 48 MHz. The dimensions of the EUT are 5.25" (L) x 5.25" (W) x 1.75" (H).

Modifications: The EUT was not modified to meet the specifications.

Customer: Mesa Laboratories, Inc.
12100 West 6th Avenue
Lakewood, Colorado 80228

Test Dates: June 6, 7, 8, 16, and 19, 2023

Test Specifications covered by accreditation:

Test Specifications: Emissions requirements
CFR Title 47, Part 15, Subpart B; and Subpart C, Sections 15.205, 15.207, 15.209, and 15.247; RSS-247 and RSS-GEN

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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	Complies with the **Class B** limits of CFR Title 47, Part 15, Subpart B; the limits of CFR Title 47, Part 15 Subpart C, section 15.207; and RSS-GEN Highest reading in relation to spec limit 41.52 dBuV (AVG) @ 0.178 MHz (*U = 2.72 dB)
2	Radiated RF Emissions, 9 kHz –9300 MHz	Complies with the **Class A** limits of CFR Title 47, Part 15, Subpart B; and the limits of CFR Title 47, Part 15 Subpart C; RSS-247 and RSS-GEN Highest reading in relation to spec limit 44.94 dBuV/m (QP) @ 660.60 MHz (*U = 3.30 dB)
3	20 dB Bandwidth	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a) (1) (i); RSS-247
4	Peak Power Output	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (b) (2); RSS-247
5	RF Conducted Antenna Test	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (d); RSS-247
6	Carrier Frequency Separation	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a) (1); RSS-247
7	Average Time of Occupancy	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a) (1) (i); RSS-247
9	99% Bandwidth	This test was performed to obtain the emission designator required by Innovation, Science and Economic Development Canada.
10	Number of Hopping Frequencies	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a) (1) (i); RSS-247

1. PURPOSE

This document is a qualification test report based on the emissions tests performed on the 900 MHz Access Point, Model: ViewPoint Access Point 1.1, HVIN: DS-VP-900-AP. The emissions measurements were performed according to the measurement procedures described in ANSI C63.4 and ANSI C63.10. The tests were performed in order to determine whether the electromagnetic emissions from the equipment under test referred to as EUT hereafter, are within the **Class A** specification limits defined by CFR Title 47, Part 15, Subpart B; and Subpart C, sections 15.205, 15.207, 15.209, and 15.247; RSS-247 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

Mesa Laboratories, Inc.

Joel Cunningham	Manager Hardware Electrical Design
Zachary Sparks	Systems Test Engineer

Compatible Electronics Inc.

James Ross	Senior Test Engineer
Kyle Fujimoto	Senior Test Engineer

2.4 Date Test Sample was Received

The test sample was received prior to the initial date of testing.

2.5 Disposition of the Test Sample

The test sample has not been returned to Mesa Laboratories, 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	Model
S/N	Serial Number
ITE	Information Technology Equipment
N/A	Not Applicable
RF	Radio Frequency
HP	Hewlett Packard
LISN	Line Impedance Stabilization Network
LO	Local Oscillator
TX	Transmit
RX	Receive

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 C	FCC Rules – Radio frequency devices (including digital devices) – Intentional Radiators
FCC Title 47, Part 15 Subpart B	FCC Rules – Radio frequency devices (including digital devices) – Unintentional Radiators
KDB 558074 D01 v05r02	Guidance for Performing Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.247 of the FCC Rules
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
RSS-GEN Issue 5: April 2018 + Amendment 1: March 2019 + Amendment 2: February 2021	General Requirements for Compliance of Radio Apparatus
RSS-247 Issue 2: February 2017	Digital Transmissions Systems (DTSs), Frequency Hopping Systems (FHSS) and License-Exempt Local Area Network (LE-LAN) Devices

4. DESCRIPTION OF TEST CONFIGURATION

4.1 Description of Test Configuration – Emissions

External Power Mode: The 900 MHz Access Point, Model: ViewPoint Access Ponit 1.1 (EUT) was connected to a router and power supply via its ethernet and power ports, respectively. The power was provided by the external power supply.

PoE Mode: The 900 MHz Access Point, Model: ViewPoint Access Ponit 1.1 (EUT) was connected to a router via the the ethernet port. The power was provided via the PoE router.

Note: The router was placed 50 feet away from the test site in an accessory room for radiated emisions. For conducted emissions in PoE mode, the router was placed on the turntable next to the EUT.

For configurating the EUT for the intentional radiator portion of the test: The EUT was connected to a laptop that had a program that locked one channel at a time so that the low, middle, and high channels could be tested. The EUT was tested in three orthogonal axis. The carrier was modulated in the same way it would be when the EUT was in its normal operating mode.

For configurating the EUT for the unintentional radiator and conducted emission portion of the test: The EUT was connected to a laptop that allowed the EUT to function as normal. The laptop also had a program that locked one channel at a time so that the low, middle, and high channels of the LO of the Rx could be tested.

Note: The laptop was only connected to the EUT to program the correct configuration and then was removed during the testing.

The X-Axis is when the EUT is parallel to the ground reference plane. The Y-Axis is when the EUT is perpendicular to the ground reference plane. The Z-Axis is when the front of the EUT is rotated 90 degrees and perpendicular to the ground reference plane.

The EUT was fully tested with an inverted F internal board trace antenna and a P/N: W1063 External Pulse antenna.

The firmware inside the EUT allowed the EUT to continuously transmit or receive at the low, middle, and high channels on a continuous basis.

The firmware is stored on the company's servers.

Description of Test Configuration – Emissions (Continued)

The radiated and conducted data were taken in the External Power Mode and PoE Mode.

For radiated emissions below 1 GHz, both the transmit and receive modes were investigated with the transmit mode determined to be the worst case.

Any emission above the Class B limit was then investigated for Class A by disabling the transmitter and re-maximizing the EUT.

All initial investigations were performed with the EMI Receiver in manual mode scanning the frequency range continuously. The cables were bundled and routed as shown in the photographs in Appendix D.

4.1.1 Cable Construction and Termination

Cable 1 **External Power Mode Only**
This is a 2-meter unshielded cable connecting the power supply to the EUT. The cable is hard wired at the power supply end and has a 1/8 inch power connector at the EUT end. The cable was bundled to a length of 1-meter. The cable has a molded ferrite at the power supply end.

Cable 2 **External Power Mode for Radiated and Conducted Emissions and PoE Mode for Radiated Emissions Only**
This is a 16.67-meter unshielded cable connecting the EUT to the PoE Router. The cable has an RJ-45 connector at each end.

Cable 3 **PoE Mode, Conducted Emissions Only**
This is a 2-meter unshielded cable connecting the EUT to the PoE Router. The cable has an RJ-45 connector at each end. The cable was bundled to a length of 1-meter.

Cable 4 This is a 2-meter unshielded cable connecting the PoE Router to the AC Adapter. The cable has a 1/8 inch power connector at the PoE Router end and is hard wired into the AC Adapter.

5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT

5.1 EUT and Accessory List

EQUIPMENT	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	WIRELESS ID
900 MHz ACCESS POINT (EUT)	MESA LABORATORIES, INC.	VIEWPOINT ACCESS POINT 1.1	B6900004	FCC ID: UUYVPFLXAP IC: 6891A-UPFLXAP
POWER SUPPLY FOR 900 MHz ACCESS POINT	CUI, INC.	SWI6-5-N	N/A	N/A
AC ADAPTER for PoE ROUTER	TP-LINK	T535131-2-DT	N/A	N/A
AC ADAPTER FOR LAPTOP*	HEWLETT PACKARD	PPP012D-S	WCNXF0ACX3OCXS	N/A
LAPTOP*	HEWLETT PACKARD	PROBOOK 6560B	N/A	N/A
PoE ROUTER	TP-LINK	TL-SG105PE	Y231006000341	DoC
FIRMWARE	MESA LABORATORES, INC.	00.26 RF 900 RELEASE	B59008AD	N/A
EXTERNAL ANTENNA FOR EUT	PULSE	P/N: W1063	N/A	N/A
INVERTED-F INTERNAL ANTENNA FOR EUT	MESA LABORATORIES, INC.	N/A	N/A	N/A

*Only used to program the EUT and then was removed during the testing.

5.2 Emissions Test Equipment

EQUIPMENT TYPE	MANU-FACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
RF RADIATED AND AC CONDUCTED EMISSIONS TEST EQUIPMENT					
TDK TestLab	TDK RF Solutions, Inc.	9.22	700145	N/A	N/A
EMI Receiver, 20 Hz – 26.5 GHz	Keysight Technologies, Inc.	N9038A	MY51210150	September 17, 2021	September 17, 2023
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	61093	December 14, 2021	December 14, 2023
Horn Antenna	Com-Power	AH-118	10050113	December 16, 2021	December 16, 2023
Preamplifier	Com-Power	PA-118	181653	March 7, 2022	March 7, 2024
Below 1 GHz Conducted Cable	N/A	N/A	Asset #: 0009	October 3, 2022	October 3, 2023
Below 1 GHz Radiated Cable	N/A	N/A	Asset #: 0006	October 3, 2022	October 3, 2023
Above 1 GHz Cable	Suhner	Sucoflex 102EA	2291	August 2, 2021	August 2, 2023
Above 1 GHz Cable	Suhner	Sucoflex 102EA	501393	August 2, 2021	August 2, 2023
Above 1 GHz Cable	Suhner	Sucoflex 102EA	501394	August 2, 2021	August 2, 2023
LISN	Com-Power	LI-215A	191951	August 16, 2022	August 16, 2023
10 dB Attenuator	SureCall	252A910	N/A	December 2, 2022	December 2, 2023
Variable Auto Transformer	Staco Energy Products	3PN1010	N/A	N/A	N/A
True RMS Multimeter	Fluke	115	36601149WS	November 21, 2021	November 21, 2023
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 1.0 by 1.5 meter non-conductive table 0.8 meters above the ground plane.

For frequencies above 1 GHz: The EUT was mounted on a 1.0 by 1.5 meter non-conductive table 1.5 meters above the ground plane.

The EUT was not grounded during testing.

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

7. CHARACTERISTICS OF THE TRANSMITTER

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

7.1 Channel Number and Frequencies

The FHSS uses at least a minimum of 50 channels minimum using a pseudo random technique. It uses GFSK modulation. The channels are separated by approximately 250 kHz.

The three subbands that the EUT can operate on are:
1. 906.12 MHz to 924.12 MHz, which contains 60 channels
2. 902.62 MHz to 914.87 MHz, which contains 50 channels
3. 914.87 MHz to 927.62 MHz, which contains 52 channels

See Appendix E for each plot showing the total number of channels in each sub-band.

7.2 Antenna Gain

Internal Antenna: Inverted F Internal Board Trace Antenna, 5.4 dBi gain.
External Antenna: PULSE, P/N: W1063, 3.0 dBi gain

8. TEST PROCEDURES

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

8.1 RF Emissions

8.1.1 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:

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, Section 15.207; and RSS-Gen for conducted emissions. Please see Appendix E for the data sheets.

8.1.2 Radiated Emissions Test

The EMI Receiver was used as the measuring meter. A built-in, internal preamplifier was used to increase the sensitivity of the instrument. 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. A quasi-peak reading was taken only for those readings, which are marked accordingly on the data sheets. The effective measurement bandwidth used for the radiated emissions test was according to the frequency measured (200 Hz for 10 kHz to 150 kHz, 9 kHz for 150 kHz to 30 MHz, 120 kHz for 30 MHz to 1 GHz and 1 MHz for 1 GHz to 9.3 GHz).

The frequencies above 1 GHz were averaged by using a duty cycle correction factor.

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 in order to ensure accurate results.

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

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 9.3 GHz	1 MHz	Horn Antenna

Test Results:

The EUT complies with the **Class A** limits of **CFR** Title 47, Part 15, Subpart B; and the limits of CFR Title 47, Part 15, Subpart C sections 15.205, 15.209 and 15.247 (d); and the limits of RSS-247 and RSS-Gen for radiated emissions.

8.1.3 RF Emissions Test Results

Table 1.0 CONDUCTED EMISSION RESULTS
900 MHz Access Point
Model: ViewPoint Access Point 1.1

Frequency MHz	Average EMI Reading* (dBuV)	Specification Limit (dBuV)	Delta (Cor. Reading – Spec. Limit) dB)
0.178 (WL)(Rx) (PoE) (Internal Antenna)	41.52	54.09	-12.57
0.178 (BL) (Rx) (PoE) (External Antenna)	41.22	54.09	-12.87
0.178 (WL) (Tx) (External Power) (External Antenna)	41.25	54.09	-12.84
0.174 (BL) (Tx) (External Power) (Internal Antenna)	41.16	54.09	-12.94
0.186 (BL) (Tx) (PoE) (Internal Antenna)	41.15	54.09	-12.94
0.154 (WL) (Tx) (PoE) (Internal Antenna)	42.17	55.15	-12.98

Notes:

* The complete emissions data is given in Appendix E of this report.
(BL) Black Lead
(WL) White Lead
(Tx) Transmit
(Rx) Receive
(PoE) Power Over Ethernet

RF Emissions Test Results (Continued)

Table 2.0 RADIATED EMISSION RESULTS
900 MHz Access Point
Model: ViewPoint Access Point 1.1; Part Number: DS-VP-ESS-900-S

Frequency MHz	Quasi-Peak EMI Reading* (dBuV/m)	Specification Limit (dBuV/m)	Delta (Cor. Reading – Spec. Limit) dB)
660.60 (H) (X-Axis) (External Power) (External Antenna)	44.94	40.00	-1.06
500.00 (H) (X-Axis) (External Power) (Internal Antenna)	55.79	56.89	-1.10
660.60 (H) (X-Axis) (PoE Power) (Internal Antenna)	44.88	46.00	-1.12
64.70 (V) (X-Axis) (PoE Power) (External Antenna)	38.68	40.00	-1.32
250.00 (V) (X-Axis) (External Power) (Internal Antenna)	44.52	46.00	-1.48
500.00 (V) (X-Axis) (External Power (Internal Antenna)	55.36	56.89	-1.53

Notes:

* The complete emissions data is given in Appendix E of this report.
(Tx) Transmit
(Rx) Receive
(V) Vertical
(H) Horizontal

8.1.4 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.

8.2 20 dB Bandwidth

The 20 dB Bandwidth was measured using the EMI Receiver. The bandwidth was measured using a direct connection from the RF output of the EUT. The resolution bandwidth was between 1% and 5% of the bandwidth and the video bandwidth was ≥ 3 X RBW.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a) (1) (i); and RSS-247. The 20 dB bandwidth is less than 500 kHz. Please see the data sheets located in Appendix E.

8.3 Peak Output Power

The Peak Output Power was measured using the EMI Receiver. The peak output power was measured using a direct connection from the RF output of the EUT. The resolution bandwidth was greater than the 20 dB bandwidth and the video bandwidth was ≥ 3 X RBW. The cable loss was also added back into the reading using the reference level offset.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (b) (2); and RSS-247. The maximum peak output power is less than 1 Watt. Please see the data sheets located in Appendix E.

8.4 RF Antenna Conducted Test

The RF antenna conducted test was performed using the EMI Receiver. The RF antenna conducted test measured using a direct connection from the RF out on the EUT into the input of the EMI Receiver. The resolution bandwidth was 100 kHz, and the video bandwidth was 300 kHz. The spans were wide enough to include all the harmonics and emissions that were produced by the intentional radiator.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (d); and RSS-247. The RF power that is produced by the intentional radiator is at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power. Please see the radiated emission data sheets located in Appendix E.

8.5 RF Band Edges

The RF band edges were taken at the edges of the ISM spectrum (902 MHz when the EUT was on the low channel and 928 MHz when the EUT was on the high channel) using the EMI Receiver. The RBW was set to 100 kHz and the VBW was set to 300 kHz. Plots of the fundamental were taken to ensure the amplitude at the band edges were at least 20 dB down from the peak of the fundamental emission. The plots were taken in both frequency hopping mode and single channel mode.

Test Results:
The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (d). The RF power at the band edges at 902 MHz and 928 MHz meet the requirements of FCC Title 47, Part 15, Subpart C section 15.247 (d); and RSS-247. Please see the data sheets located in Appendix E.

8.6 Carrier Frequency Separation

The Channel Hopping Separation Test was measured using the EMI Receiver. The EUT was operating in its normal operating mode. The resolution bandwidth was approximately 30% of the channel spacing, and the video bandwidth ≥ RBW. The frequency span was wide enough to include the peaks of two adjacent channels.

Test Results:
The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a) (1); and RSS-247. The Channel Hopping Separation is greater than the 20 dB bandwidth. Please see the data sheets located in Appendix E.

8.7 Number of Hopping Frequencies

The Number of Hopping Frequencies was measured using the EMI Receiver. The EUT was operating in its normal operating mode. The resolution bandwidth was set to approximately 30% of the channel spacing, and the video bandwidth was ≥ RBW. The frequency span was wide enough to include all of the peaks in the frequency band of operation.

Test Results:
The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a) (1) (i); and RSS-247. Please see the data sheets located in Appendix E.

8.8 Average Time of Occupancy Test

The Average Time of Occupancy Test was measured using the EMI Receiver. The EUT was operating in normal operating mode. The frequency span was taken to 0 Hz to determine the time for each transmission and the number of transmissions over a 20 second period. The RBW was set to be less than the channel spacing. Hop set 1 was determined to be the worst case because this mode results in the pulses appearing more frequently.

Test Results:
The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a) (1) (i); and RSS-247. Please see the data sheets located in Appendix E.

8.9 Fundamental Field Strength (Duty Cycle Calculations)

The Duty Cycle Correction was measured using the EMI Receiver. The 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

Note: Hop Set 1 was used because this is the worst case scenario.

Duty Cycle Correction Factor = -20.00dB

Pulse = 1 * 6 ms

Total On Time = 6 ms

Duty Cycle Train was longer than 100 ms; therefore 100ms span was used.

6 ms / 100 ms = 6 %

The maximum peak to average ratio of -20 dB can be utilized because the duty cycle is less than 10%.

8.10 Variation of the Input Power

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart A section 15.31 (e). The variation of the input voltage was varied from 85% to 115%. It was determined that this did not change the amplitude nor the frequency of the fundamental emissions.

8.11 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.

9. CONCLUSIONS

The 900 MHz Access Point, Model: ViewPoint Access Point 1.1 (EUT), as tested, meets all of the specification limits defined in FCC Title 47, Part 15, Subpart B; and Subpart C, sections 15.205, 15.207, 15.209, and 15.247; and RSS-GEN and RSS-247.

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 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"

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, FCC 15.247, RSS-GEN, and RSS-247 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

COMPATIBLE ELECTRONICS

MODELS COVERED UNDER THIS REPORT

USED FOR THE PRIMARY TEST	900 MHz Access Point Model: ViewPoint Access Point 1.1 Serial Number: B6900004

There are no additional models covered under this report.

APPENDIX D

DIAGRAMS AND CHARTS

FIGURE 1: CONDUCTED EMISSIONS TEST SETUP

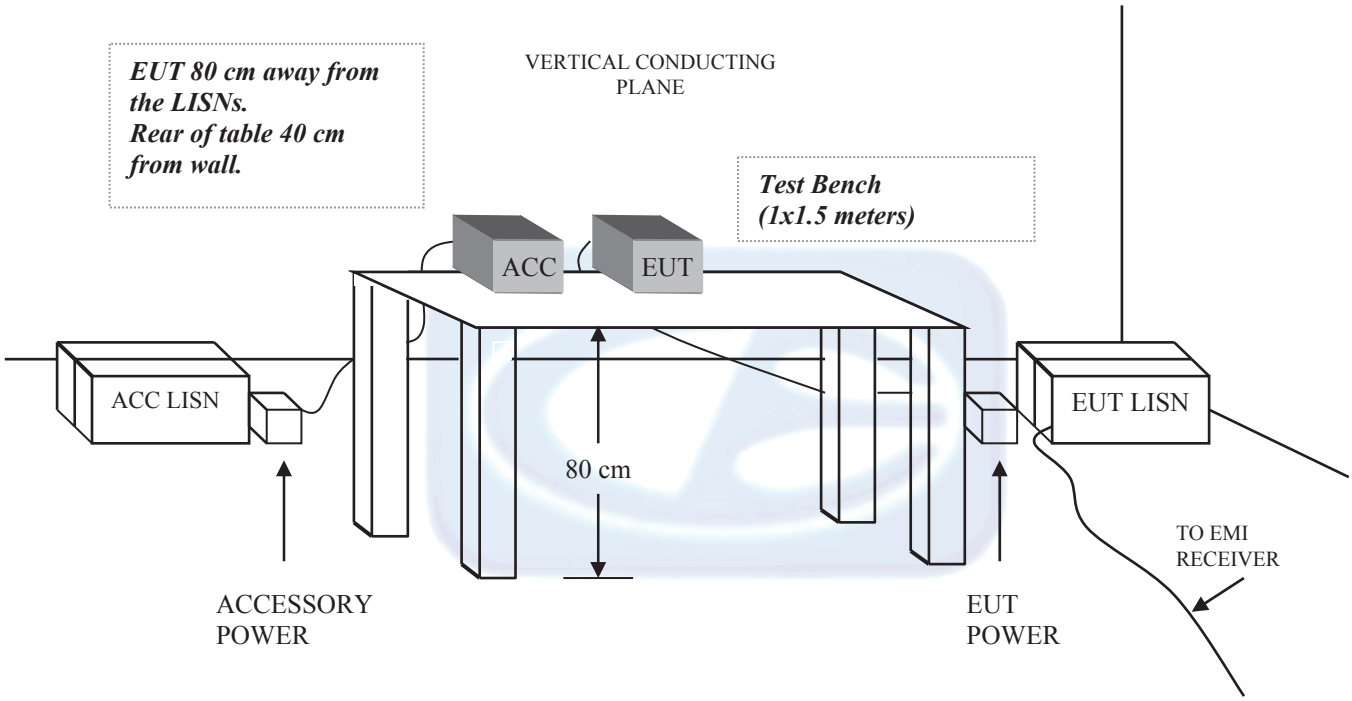
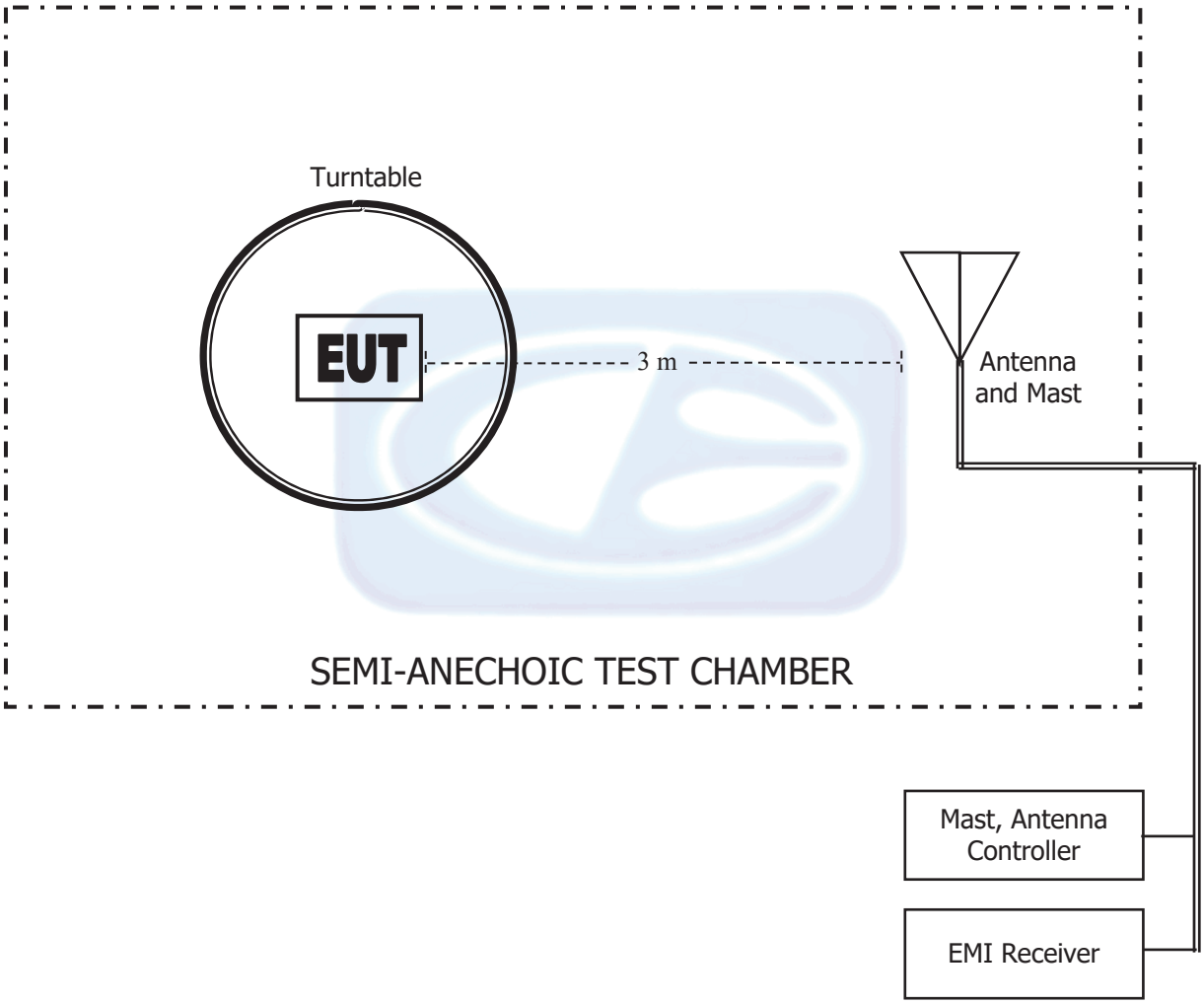


FIGURE 2: LAYOUT OF THE SEMI -ANECHOIC TEST CHAMBER



COMPATIBLE ELECTRONICS

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

COMPATIBLE ELECTRONICS

COM-POWER AC-220

COMBILOG ANTENNA

S/N: 061093

CALIBRATION DATE: DECEMBER 14, 2021

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
30	22.5	200	16.0
35	21.4	250	17.4
40	21.0	300	19.7
45	20.6	350	20.0
50	19.7	400	22.2
60	16.1	450	22.4
70	12.8	500	23.1
80	12.5	550	23.4
90	14.2	600	24.9
100	15.4	650	25.3
120	16.5	700	25.4
125	16.8	750	26.4
140	15.9	800	26.7
150	16.6	850	27.1
160	18.5	900	27.9
175	15.9	950	28.0
180	15.5	1000	28.0

COM POWER AH-118

HORN ANTENNA

S/N: 10050113

CALIBRATION DATE: DECEMBER 16, 2021

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	23.86	10.0	38.91
1.5	25.67	10.5	39.94
2.0	28.25	11.0	39.10
2.5	29.17	11.5	39.70
3.0	29.78	12.0	40.29
3.5	30.88	12.5	41.93
4.0	31.21	13.0	41.34
4.5	32.96	13.5	40.57
5.0	33.30	14.0	40.23
5.5	34.24	14.5	42.25
6.0	34.57	15.0	43.63
6.5	35.61	15.5	39.96
7.0	36.60	16.0	40.38
7.5	37.49	16.5	40.56
8.0	37.44	17.0	40.93
8.5	37.98	17.5	42.27
9.0	38.01	18.0	43.77
9.5	38.53		

COM-POWER PAM-118

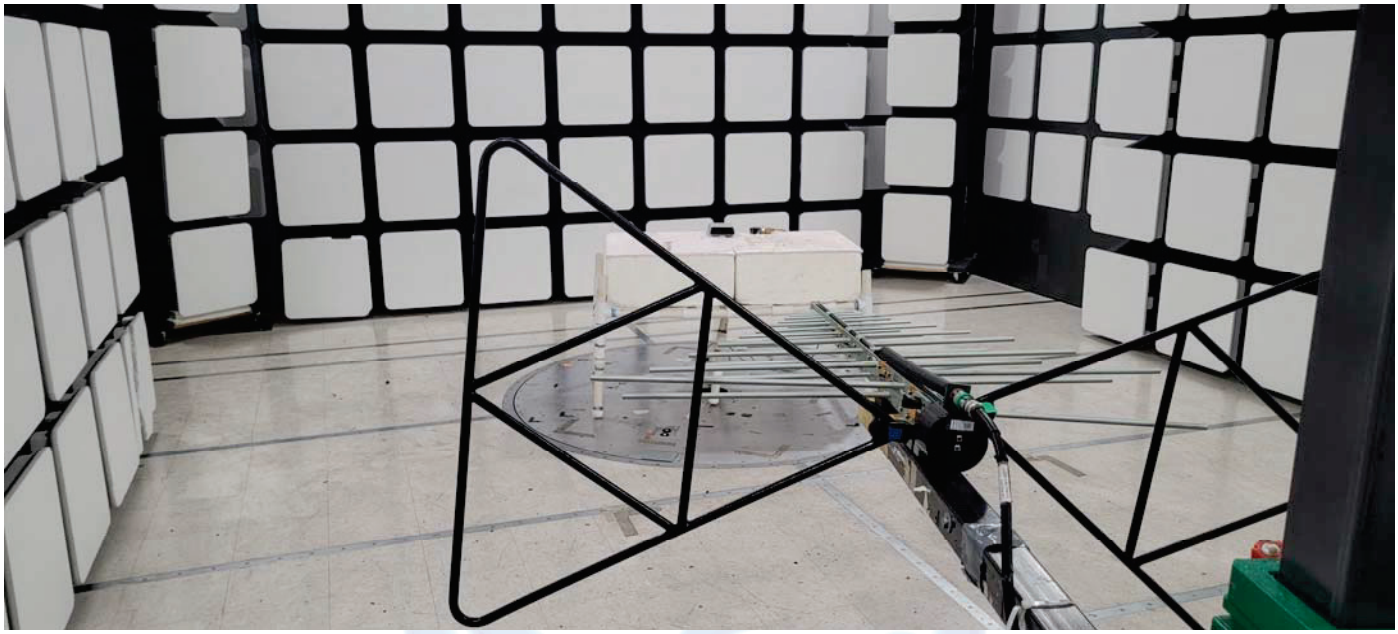
PREAMPLIFIER

S/N: 181653

CALIBRATION DATE: MARCH 7, 2022

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	40.02	6.0	38.84
1.1	39.72	6.5	39.20
1.2	39.93	7.0	39.46
1.3	39.98	7.5	39.67
1.4	39.99	8.0	39.28
1.5	40.20	8.5	38.63
1.6	40.05	9.0	38.96
1.7	40.15	9.5	39.33
1.8	40.20	10.0	39.58
1.9	40.33	11.0	38.25
2.0	40.33	12.0	40.03
2.5	40.60	13.0	40.55
3.0	40.76	14.0	40.36
3.5	40.87	15.0	39.34
4.0	40.39	16.0	37.34
4.5	39.55	17.0	42.14
5.0	40.34	18.0	42.54
5.5	39.45		

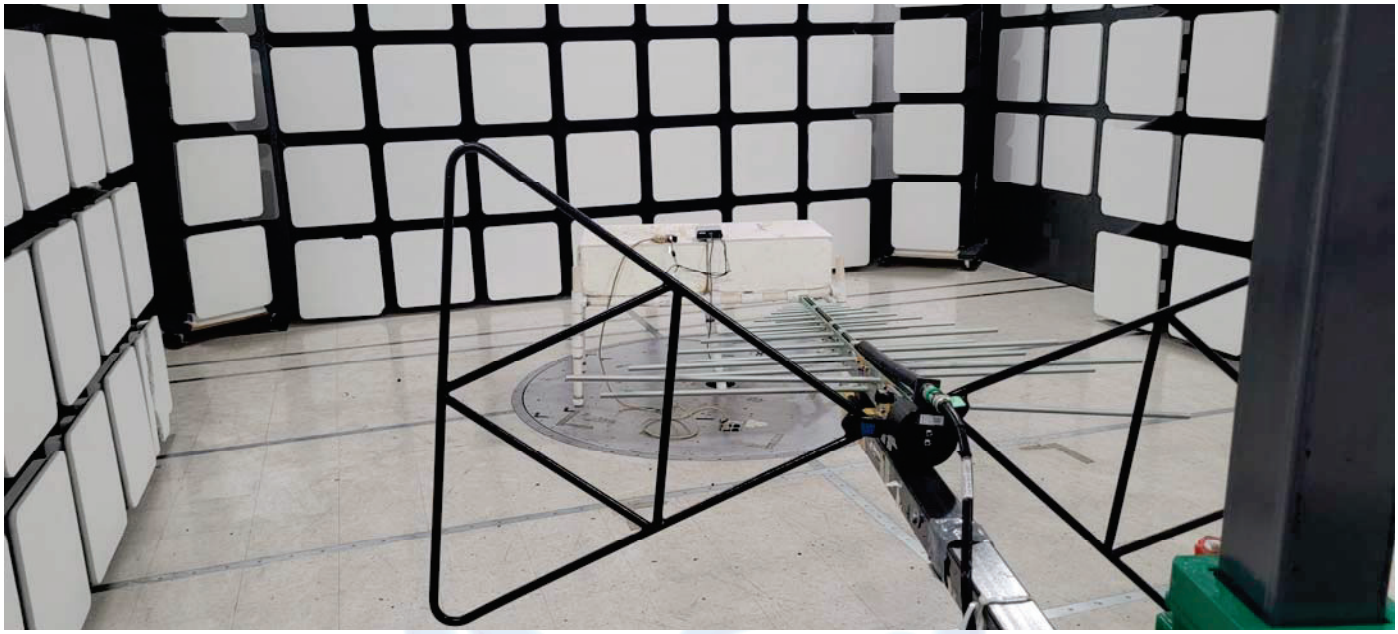
COMPATIBLE ELECTRONICS



FRONT VIEW

MESA LABORATORIES, INC.
900 MHz ACCESS POINT
MODEL: VIEWPOINT ACCESS POINT 1.1
EXTERNAL POWER – INTERNAL ANTENNA
FCC SUBPART B AND C; RSS-GEN and RSS-247 – RADIATED EMISSIONS – BELOW 1 GHz

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS



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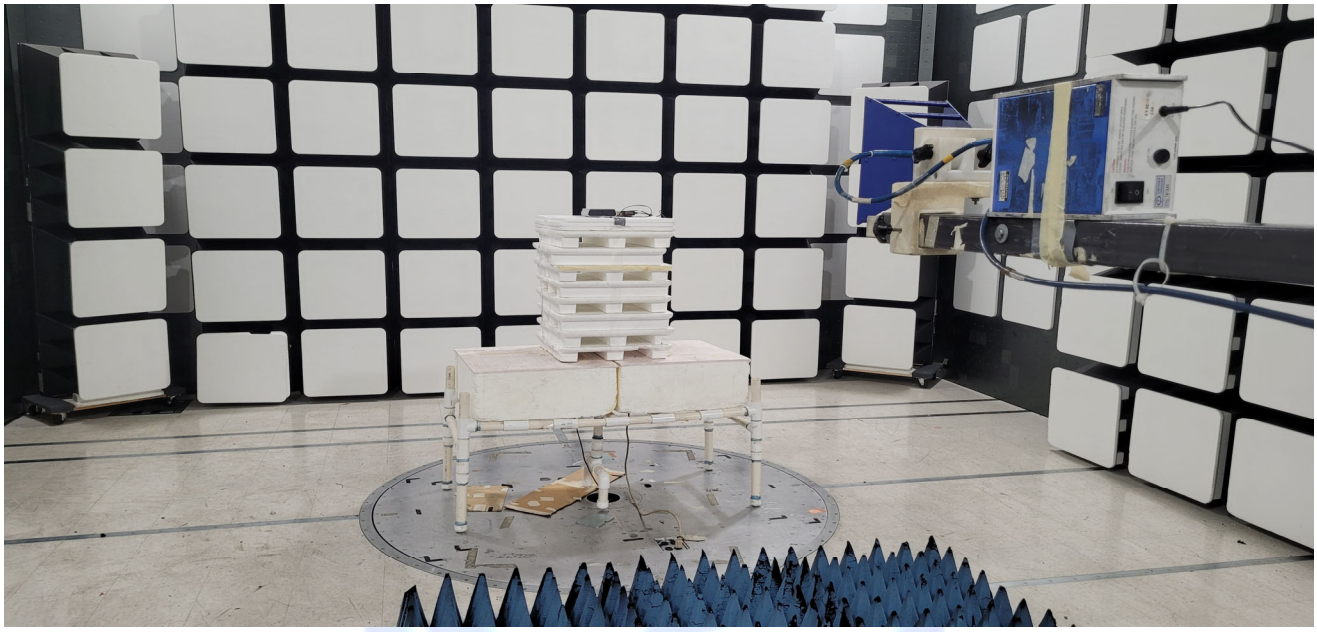

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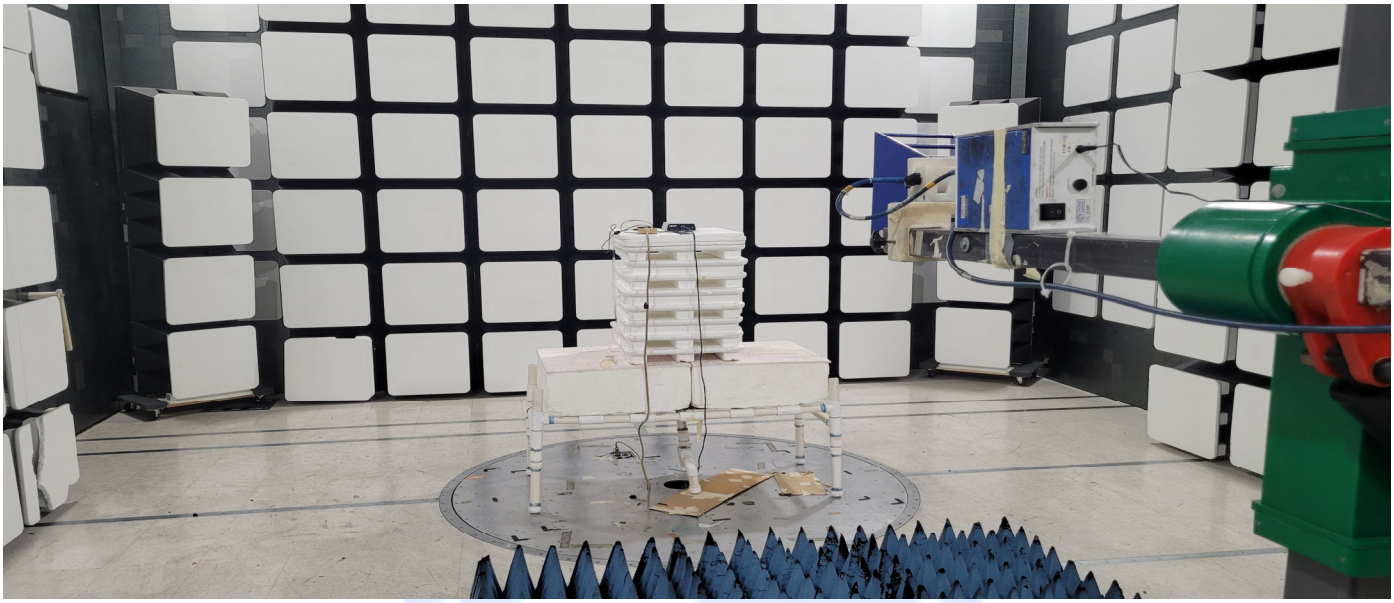

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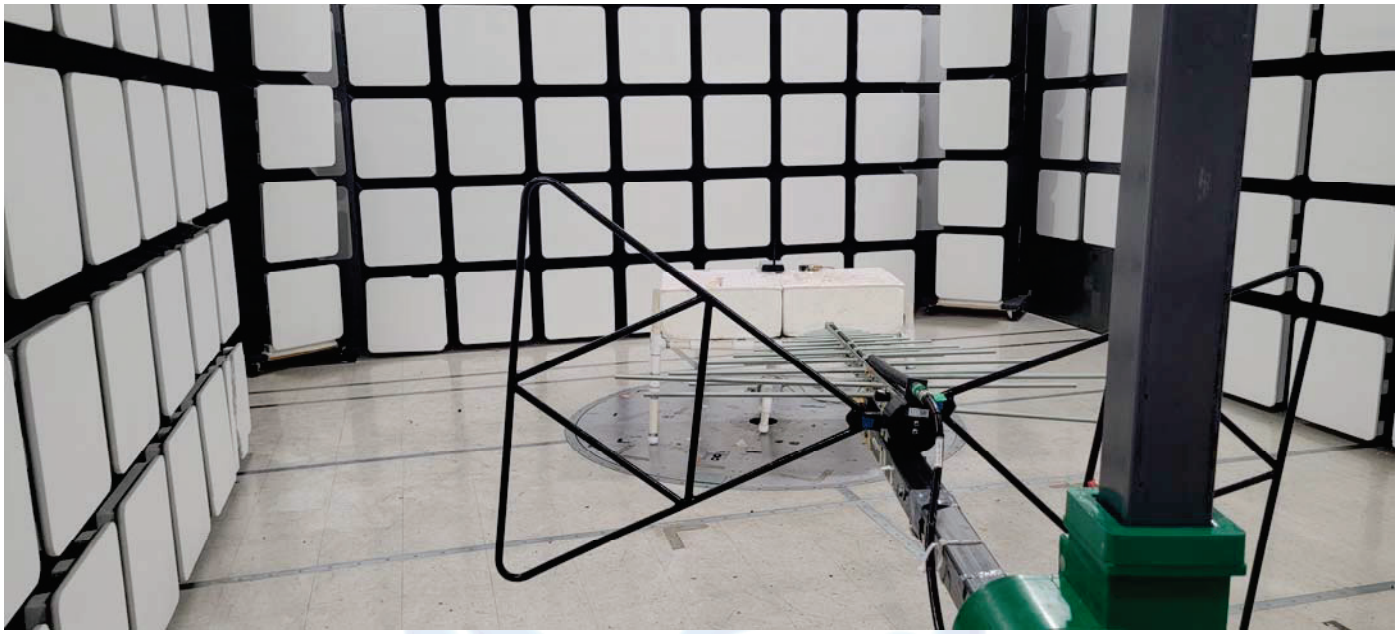

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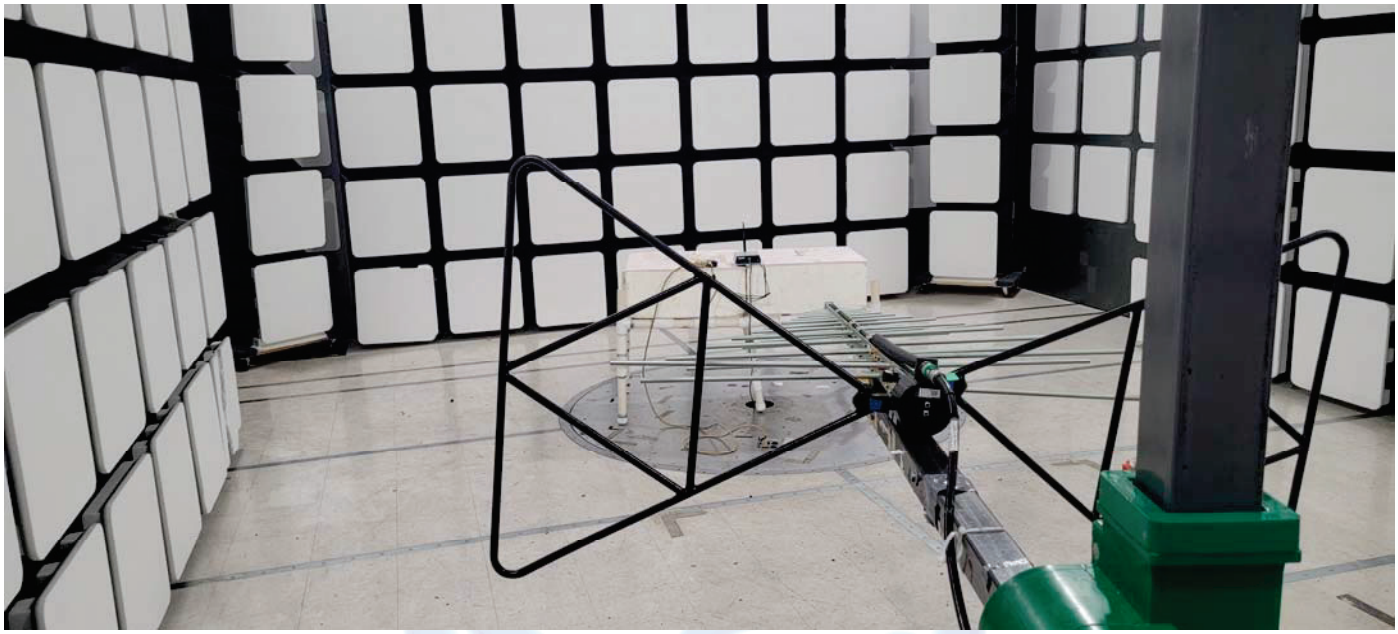

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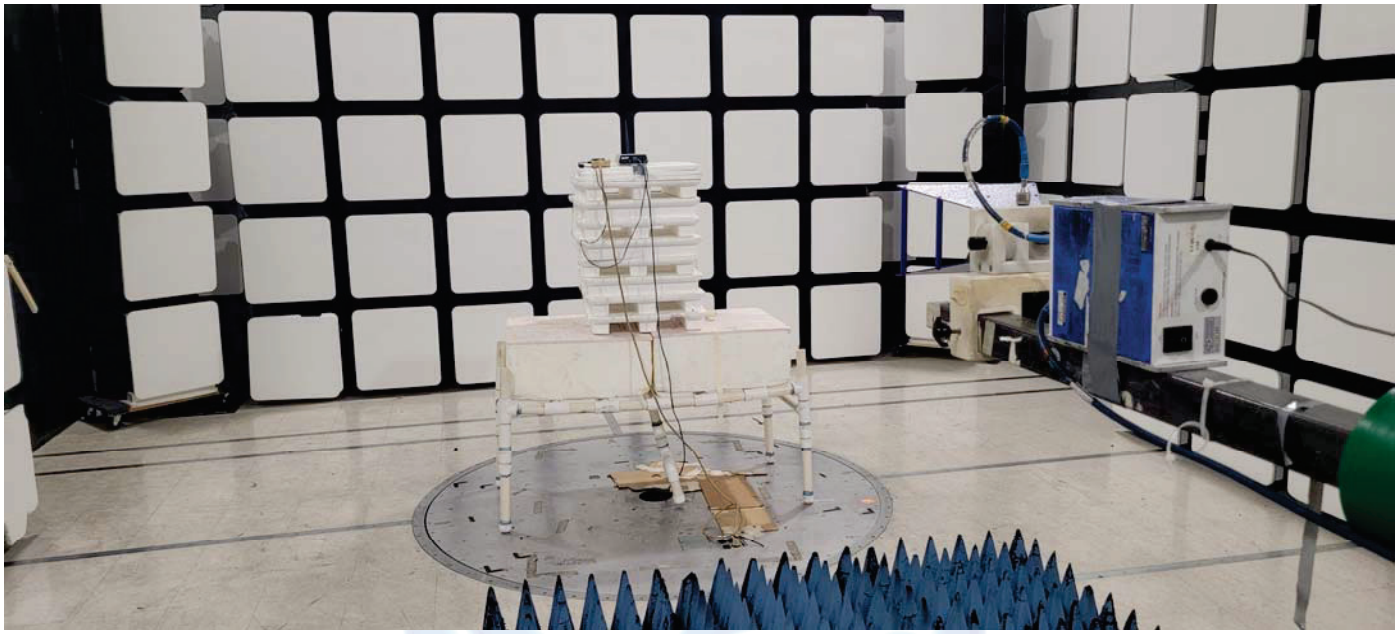

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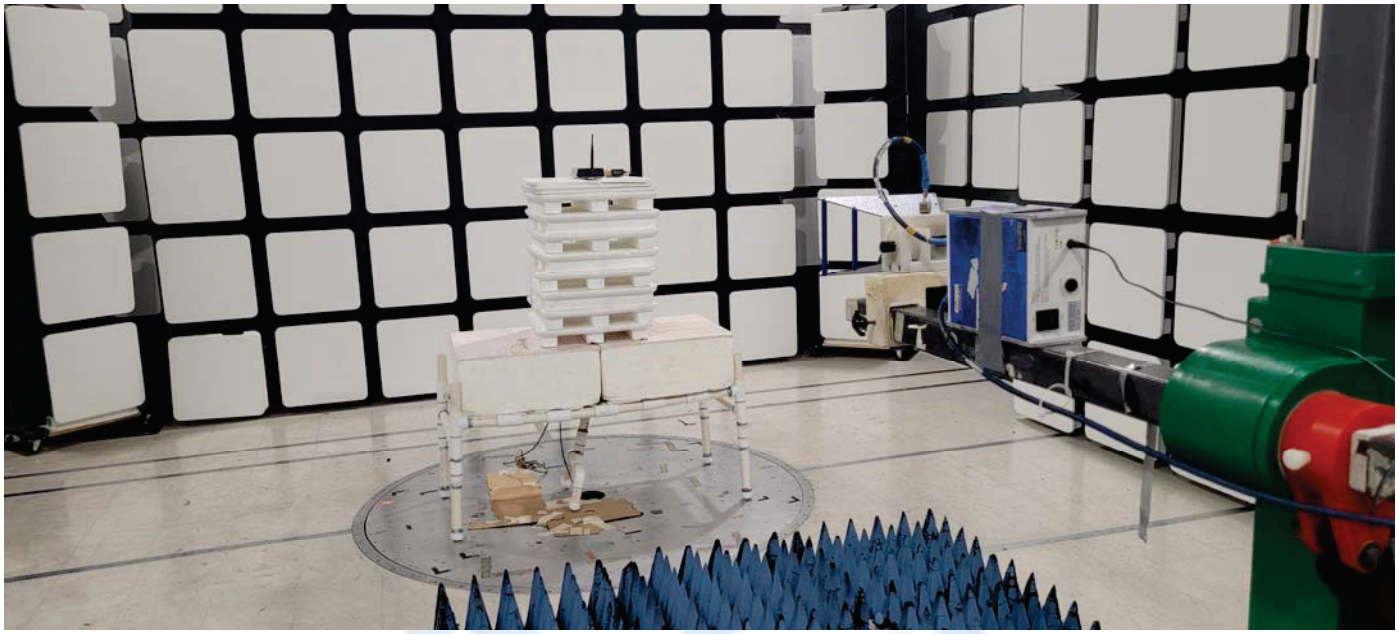

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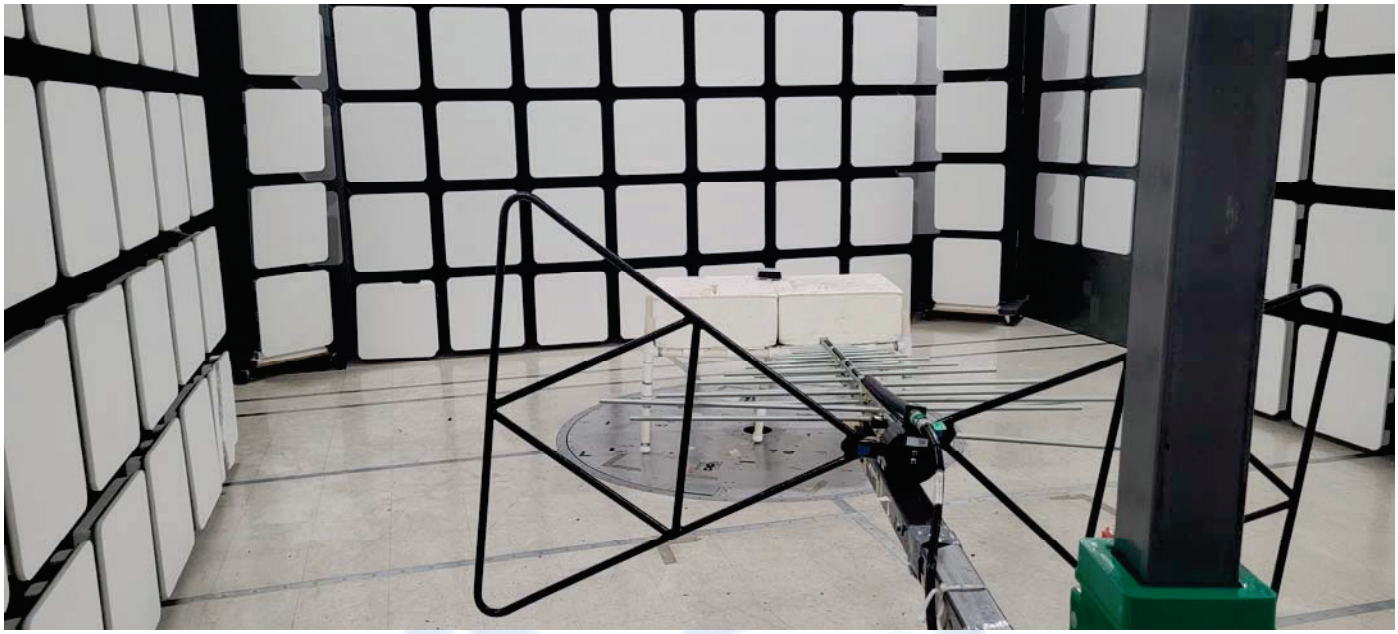

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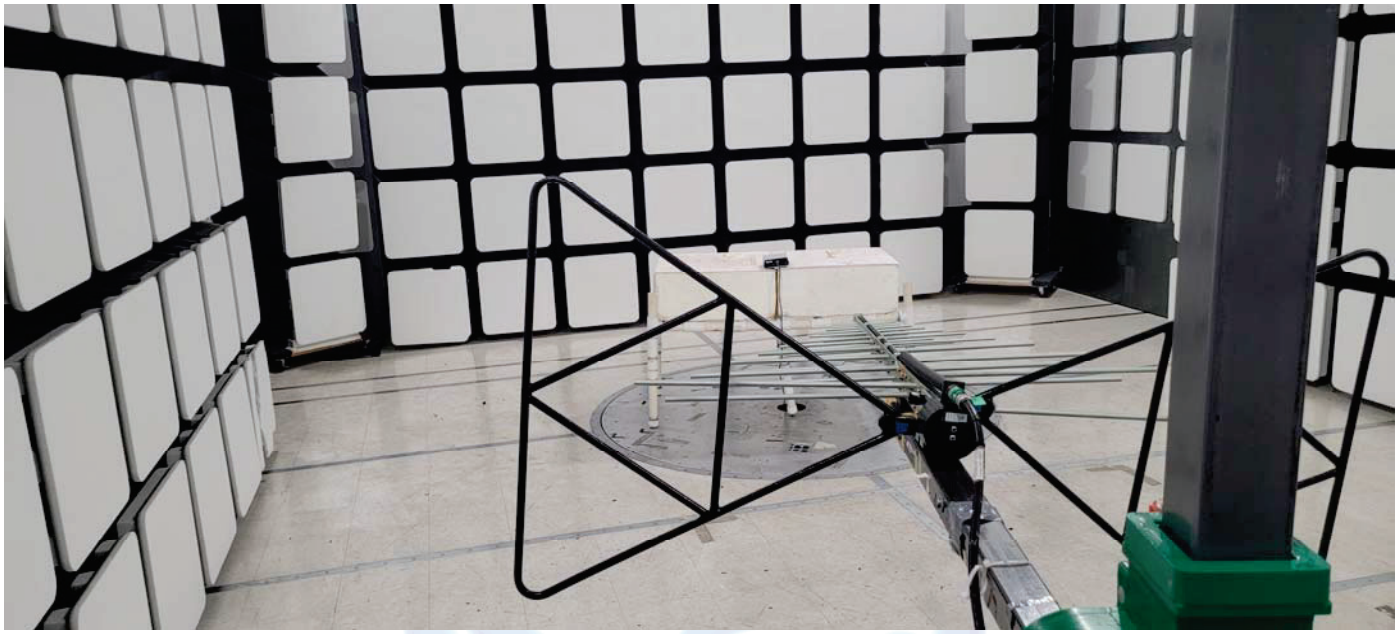

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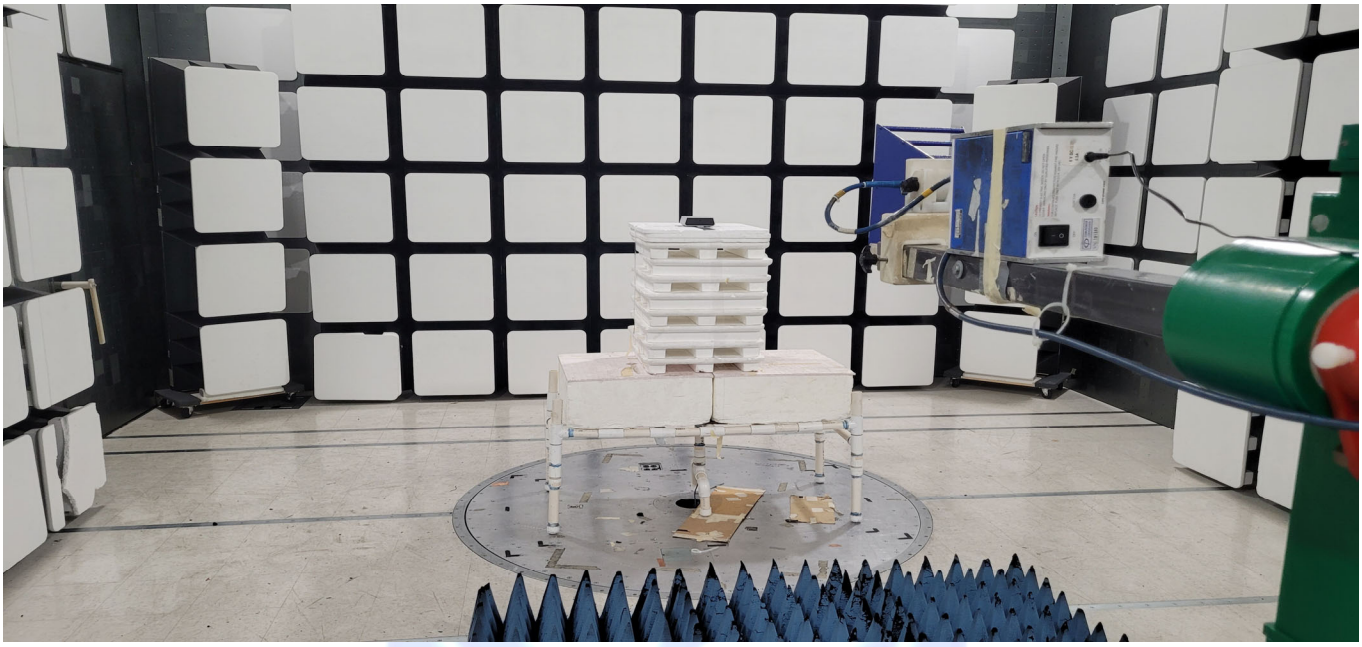

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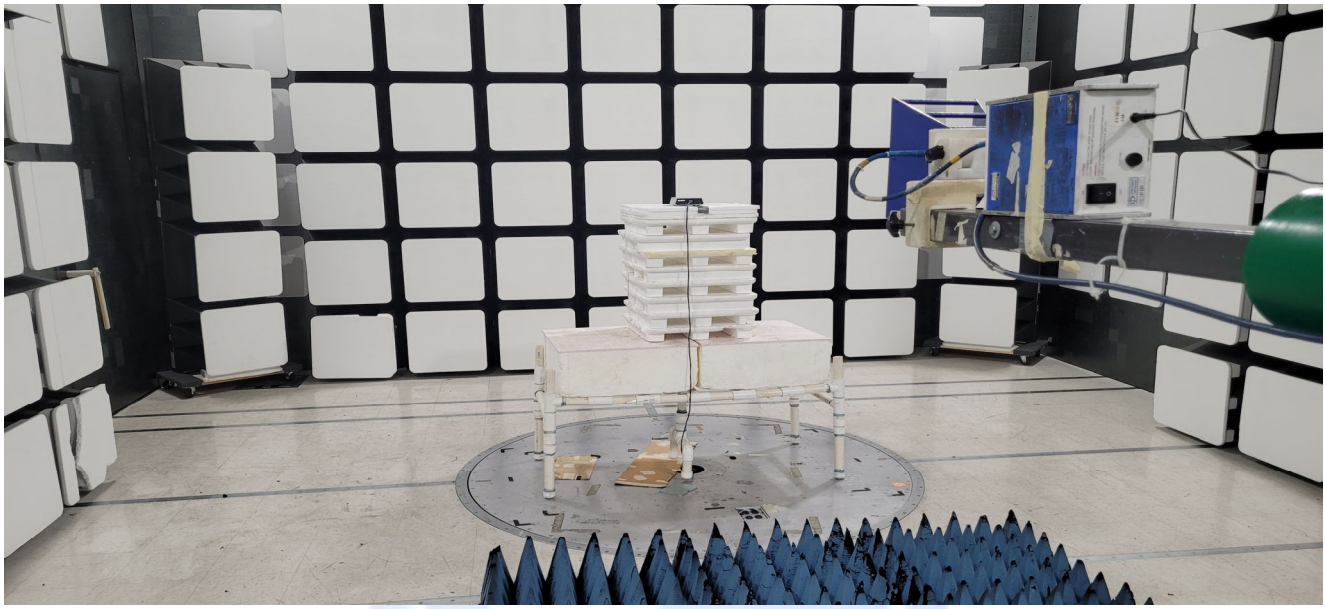

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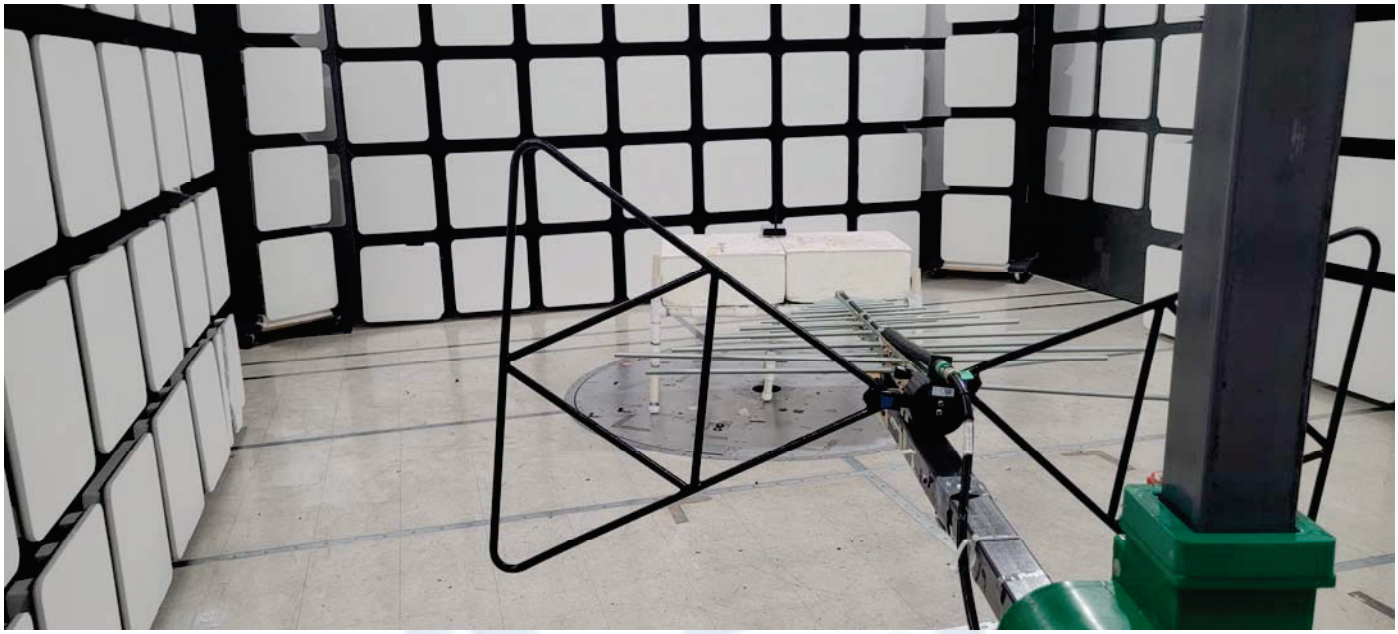

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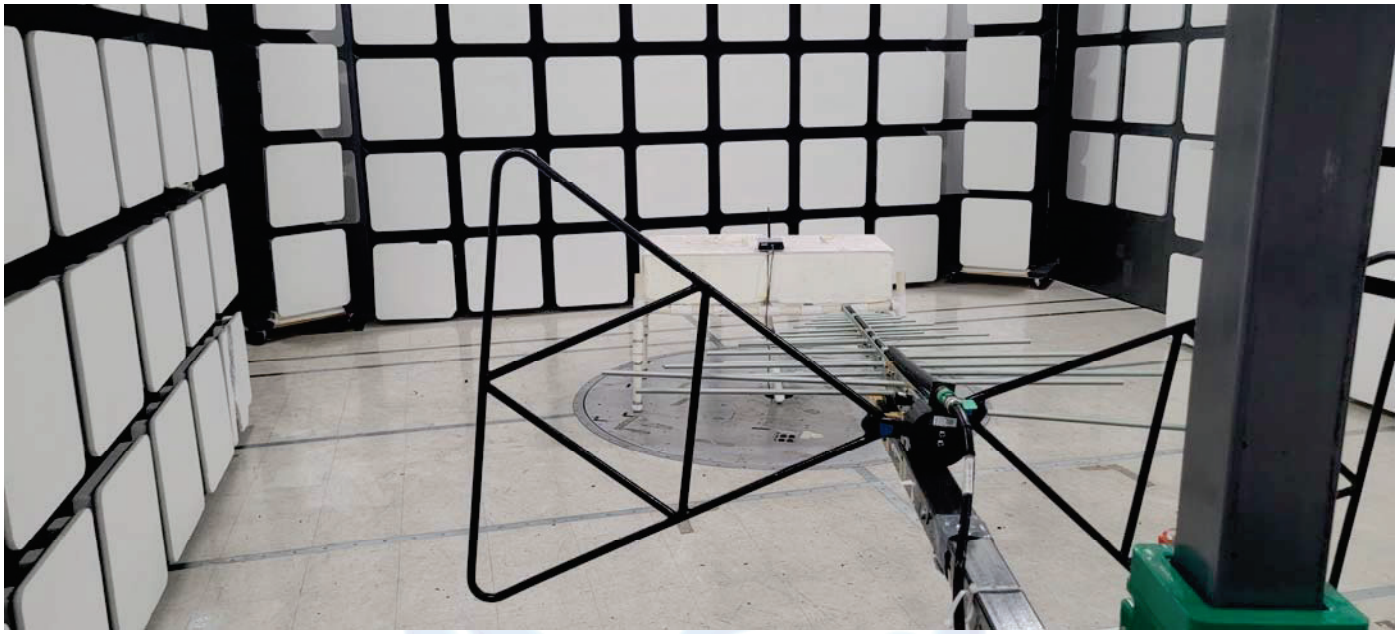

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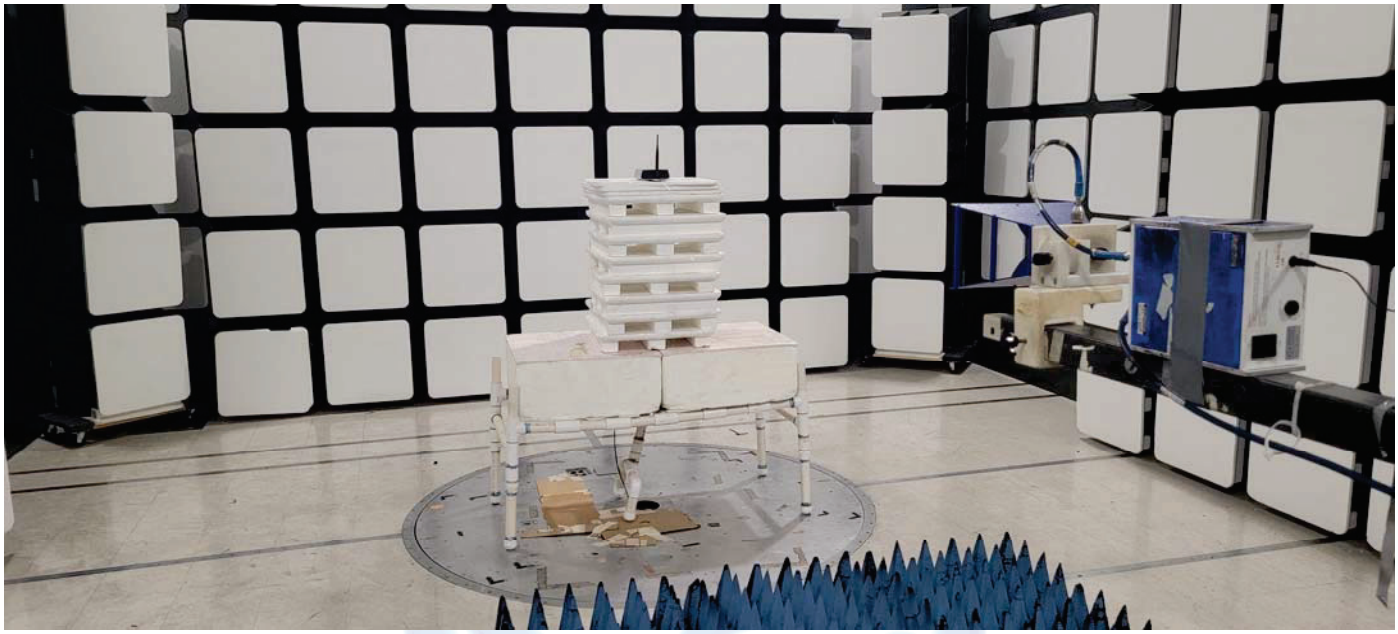

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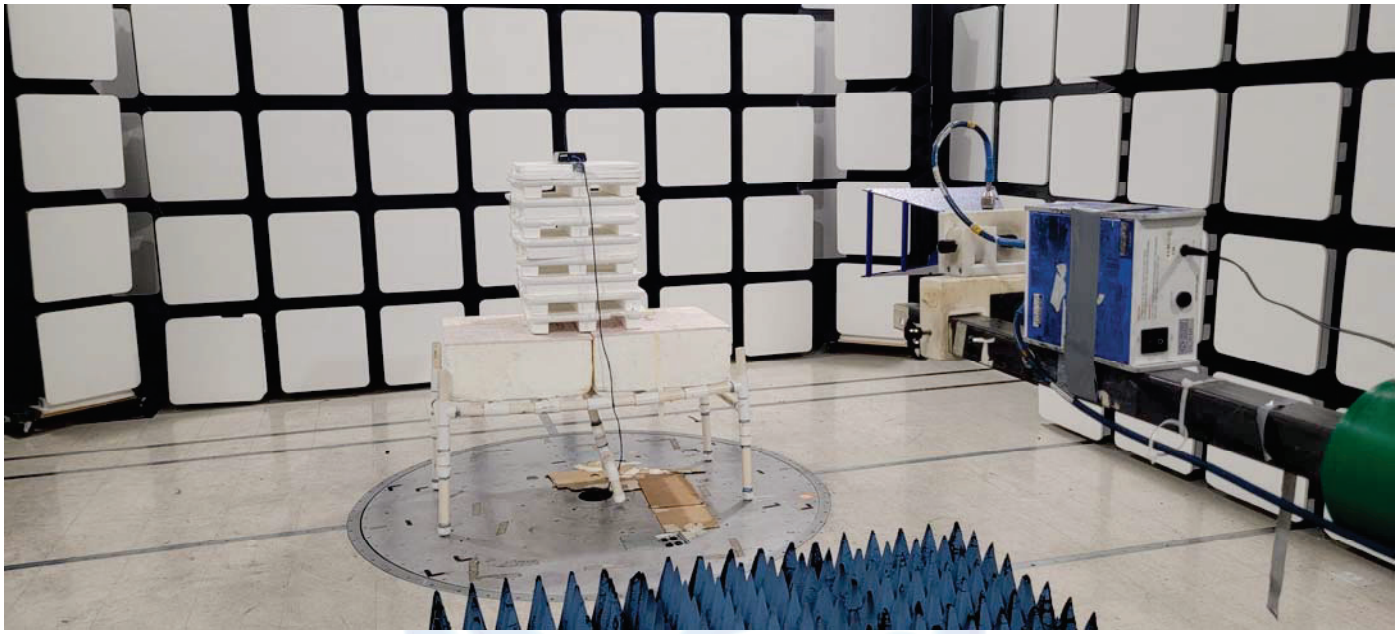

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MESA LABORATORIES, INC.
900 MHz ACCESS POINT
MODEL: VIEWPOINT ACCESS POINT 1.1
POE POWER – EXTERNAL ANTENNA
FCC SUBPART B AND C; RSS-GEN and RSS-247 – RADIATED EMISSIONS – ABOVE 1 GHz

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

COMPATIBLE ELECTRONICS

FRONT VIEW

MESA LABORATORIES, INC.
900 MHz ACCESS POINT
MODEL: VIEWPOINT ACCESS POINT 1.1
EXTERNAL POWER – EXTERNAL ANTENNA
FCC SUBPART B AND C; RSS-GEN and RSS-247 – CONDUCTED EMISSIONS

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

REAR VIEW

MESA LABORATORIES, INC.
900 MHz ACCESS POINT
MODEL: VIEWPOINT ACCESS POINT 1.1
EXTERNAL POWER – EXTERNAL ANTENNA
FCC SUBPART B AND C; RSS-GEN and RSS-247 – CONDUCTED EMISSIONS

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

COMPATIBLE ELECTRONICS

FRONT VIEW

MESA LABORATORIES, INC.
900 MHz ACCESS POINT
MODEL: VIEWPOINT ACCESS POINT 1.1
EXTERNAL POWER – INTERNAL ANTENNA
FCC SUBPART B AND C; RSS-GEN and RSS-247 – CONDUCTED EMISSIONS

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

REAR VIEW

MESA LABORATORIES, INC.
900 MHz ACCESS POINT
MODEL: VIEWPOINT ACCESS POINT 1.1
EXTERNAL POWER – INTERNAL ANTENNA
FCC SUBPART B AND C; RSS-GEN and RSS-247 – CONDUCTED EMISSIONS

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

FRONT VIEW

MESA LABORATORIES, INC.
900 MHz ACCESS POINT
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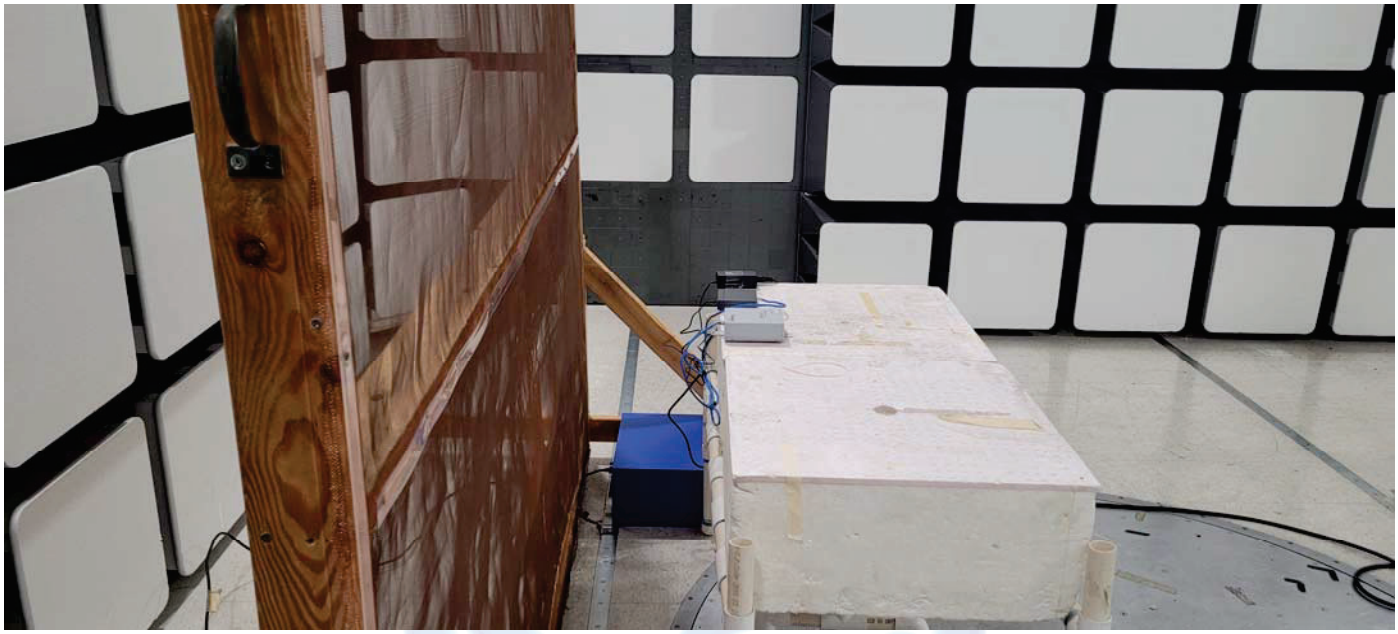
POE POWER – INTERNAL ANTENNA
FCC SUBPART B AND C; RSS-GEN and RSS-247 – CONDUCTED EMISSIONS

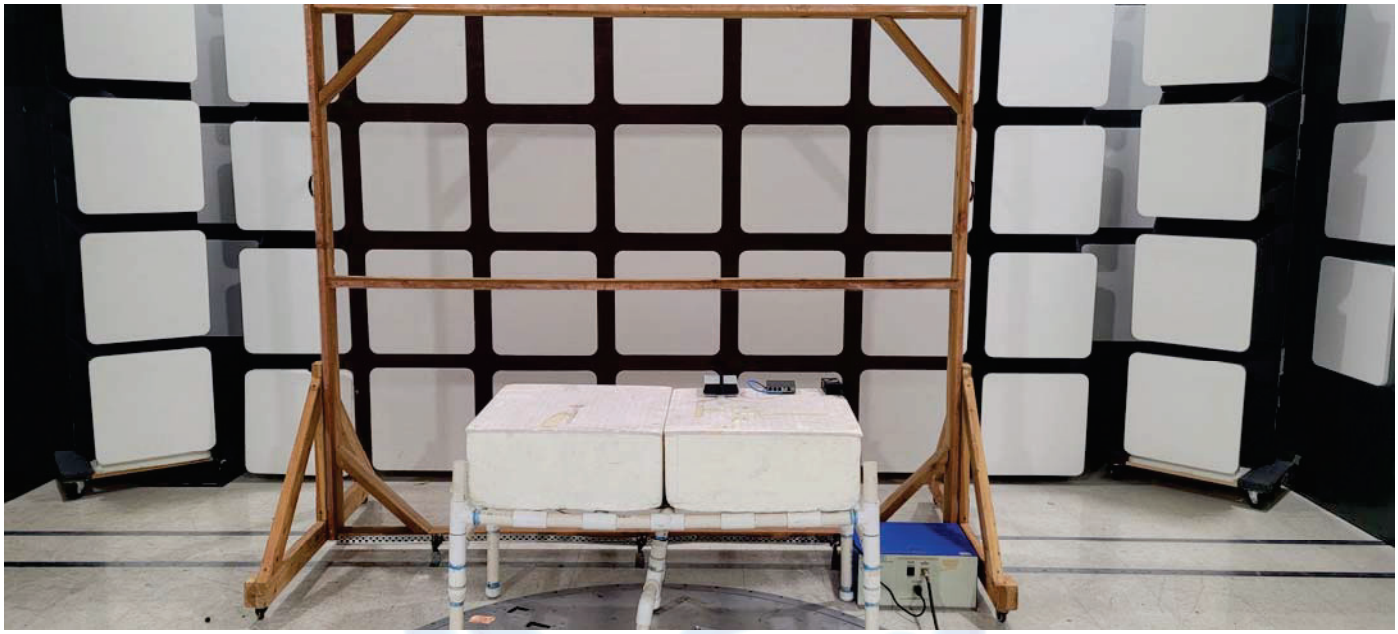
PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS



REAR VIEW

MESA LABORATORIES, INC.
900 MHz ACCESS POINT
MODEL: VIEWPOINT ACCESS POINT 1.1
POE POWER – INTERNAL ANTENNA
FCC SUBPART B AND C; RSS-GEN and RSS-247 – CONDUCTED EMISSIONS

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS



FRONT VIEW

MESA LABORATORIES, INC.
900 MHz ACCESS POINT
MODEL: VIEWPOINT ACCESS POINT 1.1
POE POWER – EXTERNAL ANTENNA
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REAR VIEW

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