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## **CERTIFICATION TEST REPORT**

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**Manufacturer:** Environmental Express, Inc.  
5350 SW 1<sup>st</sup> Lane  
Ocala, Florida 34474 USA

**Applicant:** Same As Above

**Product Name:** IAQ 15 Connect Air Sampling Pump

**Product Description:** The IAQ 15 Connect is an advanced portable, battery powered air sampling pump designed for the exclusive use with air-o-cell and via-cell cassettes.

**Operating Voltage/Freq. of EUT During Testing:** 120V/60 Hz; Battery-Operated (12VDC)

**Model:** IAQ 15 Connect

**FCC ID:** 2A7DH-IAQ15

**Testing Commenced:** 2022-05-23

**Testing Ended:** 2022-06-15

**Summary of Test Results:** In Compliance

**Standards:**

- ❖ FCC Part 15 Subpart C, Section 15.209
- ❖ FCC Part 15 Subpart C, Section 15.215(c) – Additional provisions to the general radiated emission limitations
- ❖ FCC Part 15 Subpart A, Section 15.31(e) – Measurement Standards
- ❖ FCC15.207 - Conducted Limits
- ❖ ANSI C63.10:2013



Order Number: F2P26844-C1

Applicant: Environmental Express, Inc.  
Model: IAQ 15 Connect

**Evaluation Conducted by:**

Julius Chiller, EMC/Wireless Engineer

**Report Reviewed by:**

Ken Littell, Vice President of EMC

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## TABLE OF CONTENTS

Section	Title	Page
1	ADMINISTRATIVE INFORMATION	4
2	SUMMARY OF TEST RESULTS/MODIFICATIONS	7
3	TABLE OF MEASURED RESULTS	8
4	ENGINEERING STATEMENT	9
5	EUT INFORMATION AND DATA	10
6	LIST OF MEASUREMENT INSTRUMENTATION	11
7	FIELD STRENGTH OF EMISSIONS/ RADIATED SPURIOUS EMISSIONS	12
8	VOLTAGE VARIATIONS	17
9	CONDUCTED EMISSIONS	20
10	PHOTOGRAPHS	25



## **1 ADMINISTRATIVE INFORMATION**

### **1.1 Measurement Location:**

F2 Labs in Middlefield, Ohio. Site description and attenuation data are on file with the FCC's Sampling and Measurement Branch at the FCC Laboratory in Columbia, MD.

### **1.2 Measurement Procedure:**

All measurements were performed according to the 2013 version of ANSI C63.10 and recommended FCC procedure of measurement of equipment operating under Section 15.209. A list of the measurement equipment can be found in Section 6.



### 1.3 Uncertainty Budget:

The uncertainty in EMC measurements arises from several factors which affect the results, some associated with environmental conditions in the measurement room, the test equipment being used, and the measurement techniques adopted.

The measurement uncertainty budgets detailed below are calculated from the test and calibration data and are expressed with a 95% confidence factor using a coverage factor of  $k=2$ . The Uncertainty for a laboratory is referred to as  $U_{lab}$ . For Radiated and Conducted Emissions, the Expanded Uncertainty is compared to the  $U_{cispr}$  values to determine if a specific margin is required to deem compliance.

#### $U_{lab}$

Measurement Range	Combined Uncertainty	Expanded Uncertainty
Radiated Emissions <1 GHz @ 3m	2.54	5.07dB
Radiated Emissions <1 GHz @ 10m	2.55	5.09dB
Radiated Emissions 1 GHz to 2.7 GHz	1.81	3.62dB
Radiated Emissions 2.7 GHz to 18 GHz	1.55	3.10dB
AC Power Line Conducted Emissions, 150kHz to 30 MHz	1.38	2.76dB
AC Power Line Conducted Emissions, 9kHz to 150kHz	1.66	3.32dB

#### $U_{cispr}$

Measurement Range	Expanded Uncertainty
Radiated Emissions <1 GHz @ 3m	5.2dB
Radiated Emissions <1 GHz @ 10m	5.2dB
Radiated Emissions 1 GHz to 2.7 GHz	Under Consideration
Radiated Emissions 2.7 GHz to 18 GHz	Under Consideration
AC Power Line Conducted Emissions, 150kHz to 30 MHz	3.6dB
AC Power Line Conducted Emissions, 9kHz to 150kHz	4.0dB

If  $U_{lab}$  is less than or equal to  $U_{cispr}$ , then:

- compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

If  $U_{lab}$  is greater than  $U_{cispr}$  in table 1, then:

- compliance is deemed to occur if no measured disturbance, increased by ( $U_{lab} - U_{cispr}$ ), exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance, increased by ( $U_{lab} - U_{cispr}$ ), exceeds the disturbance limit.

Note: Only measurements listed in the tables above that relate to tests included in this Test Report are applicable.



Order Number: F2P26844-C1

Applicant: Environmental Express, Inc.  
Model: IAQ 15 Connect

**1.4 Document History:**

Document Number	Description	Issue Date	Approved By
F2P26844-C1-01E	First Issue	2022-06-15	K. Littell

**2 SUMMARY OF TEST RESULTS**

Test Name	Standard(s)	Results
Field Strength of Emissions	CFR 47 Part 15.209	Complies
Radiated Spurious Emissions	CFR 47 Part 15.209	Complies
Variation of the Input Power	CFR 47 Part 15.31(e)	Complies
Conducted Emissions	CFR 47, Part 15.207	Complies

Modifications Made to the Equipment
No modifications were made to the EUT.



### 3 TABLE OF MEASURED RESULTS

Test		13.56 MHz
Limit for Fundamental at 30 meters		29.5dB $\mu$ V/m
Field Strength of Fundamental corrected for 40dB/decade for 30-meter distance		-18.5dB $\mu$ V/m
Field Strength of Fundamental at 3-meter distance		21.5 dB $\mu$ V/m / 0.12 mV/m
Voltage Variations	Nominal @110VAC	-30 dB $\mu$ A/m = 21.5 dB $\mu$ V/m @3m = -18.5dB $\mu$ V/m @30m
	+15%	-29.8 dB $\mu$ A/m = 21.7 dB $\mu$ V/m @3m = -18.3dB $\mu$ V/m @30m
	-15%	-30 dB $\mu$ A/m = 21.5 dB $\mu$ V/m @3m = -18.5dB $\mu$ V/m @30m

The 13.56 MHz field strength of -30 was measured in dB $\mu$ A/m at 3 meters and converted to dB $\mu$ V/m by adding 51.5dB.

*Conversion to dB $\mu$ V/m: dB $\mu$ A/m + 51.5dB = dB $\mu$ V/m    -30 dB $\mu$ A/m + 51.5= 21.5 dB $\mu$ V/m*





#### **4 ENGINEERING STATEMENT**

This report has been prepared on behalf of Environmental Express, Inc. to provide documentation for the testing described herein. This equipment has been tested and found to comply with Part 15.209 of the FCC Rules using ANSI C63.10 2013 and Part 15 standards. The test results found in this test report relate only to the items tested.



## 5 EUT INFORMATION AND DATA

### 5.1 Equipment Under Test:

Product: 13.56 MHz RFID Radio  
Serial Number: IAQ15 RFID Rev. A1 #31  
Firmware Version: 1.0  
Software Version: N/A  
Host: IAQ 15 Connect Air Sampling Pump  
Host Model: IAQ 15 Connect  
Host Serial No.: None Specified  
FCC ID: **2A7DH-IAQ15**

### 5.2 Trade Name:

**environmental express®**

### 5.3 Power Supply:

Triad model WS8U150-1200; Battery-Operated (12VDC)

### 5.4 Applicable Rules:

CFR 47, Part 15.209

### 5.5 Equipment Category:

Radio Transmitter – RFID Reader

### 5.6 Antenna:

0dBi Integral Antenna

### 5.7 Accessories:

Device	Manufacturer	Model Number	Serial Number
Power Supply	Triad	WS8U150-1200	None Specified
Air-O-Cell	Zefon International	None Specified	None Specified

### 5.8 Test Item Condition:

The equipment to be tested was received in good condition.

### 5.9 Testing Algorithm:

EUT was tested with 13.56 MHz RFID radio on.

**5 LIST OF MEASUREMENT INSTRUMENTATION**

Equipment Type	Asset Number	Manufacturer	Model	Serial Number	Calibration Due Date
Shielded Chamber	CL166-E	AlbatrossProjects	B83117-DF435-T261	US140023	2022-06-09
Temp/Hum. Recorder	CL294	Thermpro	TP50	2	2023-04-15
Receiver	CL151	Rohde & Schwarz	ESU40	100319	2023-03-31
Preamplifier	CL285	A.H. Systems, Inc.	PAM-0207	322	2023-03-30
Preamplifier	CL285	A.H. Systems, Inc.	PAM-0207	322	2023-03-30
Amplifier w/Monopole & 18" Loop	CL163-Loop	A.H. Systems, Inc.	EHA-52B	100	2022-09-14
Software:	Tile Version 3.4.B.3.		Software Verified: 2022-05-23		
Software:	EMC 32, Version 8.53.0		Software Verified: 2022-05-23		
Temp/Hum. Rec.	CL296	ThermPro	TP50	4	2023-04-15
Spectrum Analyzer	0204	Hewlett Packard	HP8591A	3149A02546	2023-03-29
Software:	EMC Analyzer 85712D Rev. A.00.01			Date Verified:	2022-05-23
Transient Limiter	0202	Hewlett Packard	11947A	3107A00729	2023-03-29
LISN	CL181	Com-Power	LI-125A	191226	2023-12-01
LISN	CL182	Com-Power	LI-125A	191225	2023-12-01



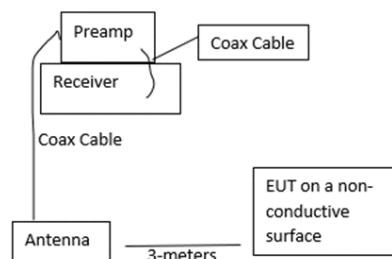
## 7 FIELD STRENGTH OF EMISSIONS FROM INTENTIONAL RADIATORS

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009-0.490	$2400/F(\text{kHz})$	300
0.490-1.705	$24000/F(\text{kHz})$	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

### Notes:

During the pre-scan evaluation, the EUT was rotated in all possible directions and all three orthogonal positions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. The antenna was raised between 1 and 4 meters and the EUT turntable was rotated 360 degrees to maximize the emissions. The following plots are just prescan plots and do not necessarily reflect the actual limits. The measurement table has the correct limits.





## 7.1 Test Data - Field Strength of Emissions from Intentional Radiators

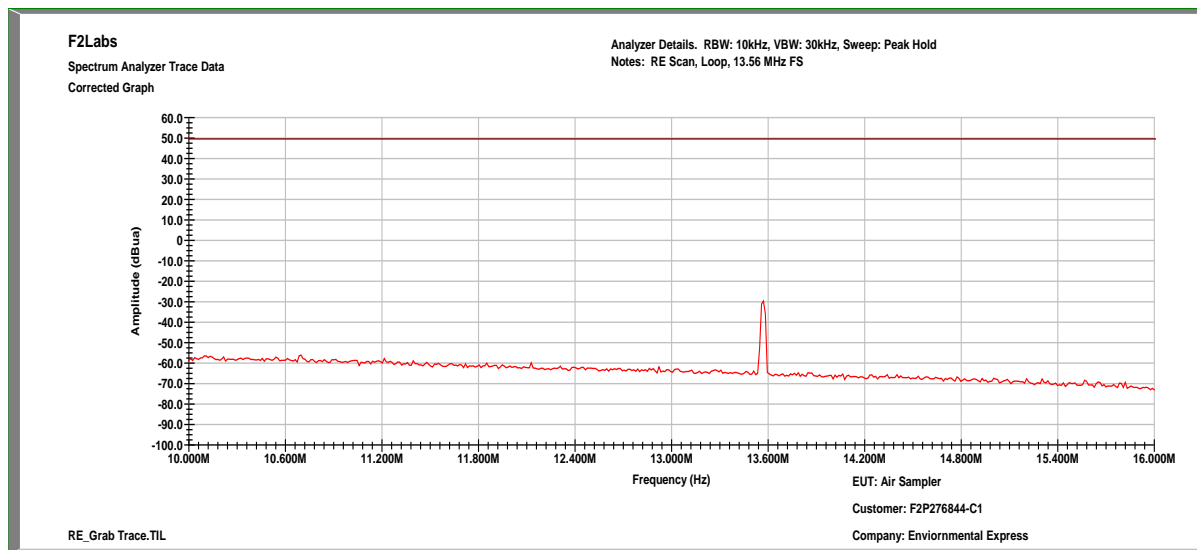
Test Date(s):	2022-05-23	Test Engineer(s):	J. Chiller
Standards:	CFR 47 Part 15.209	Air Temperature:	21.5°C
Results:	Complies	Relative Humidity:	46%

The 13.56 MHz field strength of -30 was measured in dBuA/m at 3 meters and converted to dBuV/m by adding 51.5dB.

*Conversion to dBuV/m:  $\text{dBuA/m} + 51.5\text{dB} = \text{dBuV/m}$     $-30 \text{ dBuA/m} + 51.5 = 21.5 \text{ dBuV/m}$*

*$21.5 \text{ dBuV/m @3m} = -18.5 \text{ dBuV/m @30m}$ .*

### 13.56 MHz RFID: Field Strength





## 7.2 Test Data – Spurious Emissions

Notes: Plots are peak, max hold pre-scan data included only to determine what frequencies to investigate and measure. During the pre-scan evaluation, the EUT was rotated in all possible directions and three orthogonal positions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. At some frequencies, no emissions from the EUT were measurable over the ambient noise floor. The readings did not change with EUT on and EUT off.

At least 6 of the highest frequencies were measured per ANSI 63.4 in a 3-meter anechoic chamber. Frequencies below 1GHz were measured using a quasi-peak detector. The antenna was raised between 1 and 4 meters and the EUT turntable was rotated 360 degrees to maximize the emissions. Some of the frequencies did not change with the EUT on or off. At those frequencies, the test distance was shortened to 1 meter and still no emissions from the EUT were visible or over the ambient or limit. Frequencies were scanned from 9kHz to 1000 MHz and the highest emissions are presented.

In the following plots, the red line indicates the measurement with the EUT on. Emissions to be found by the EUT were measured and listed in tables below.



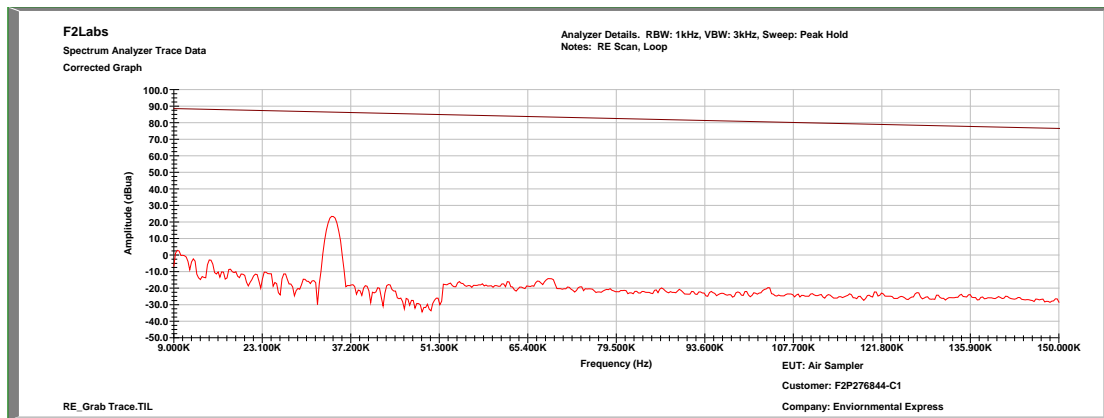
Order Number: F2P26844-C1

Applicant: Environmental Express, Inc.

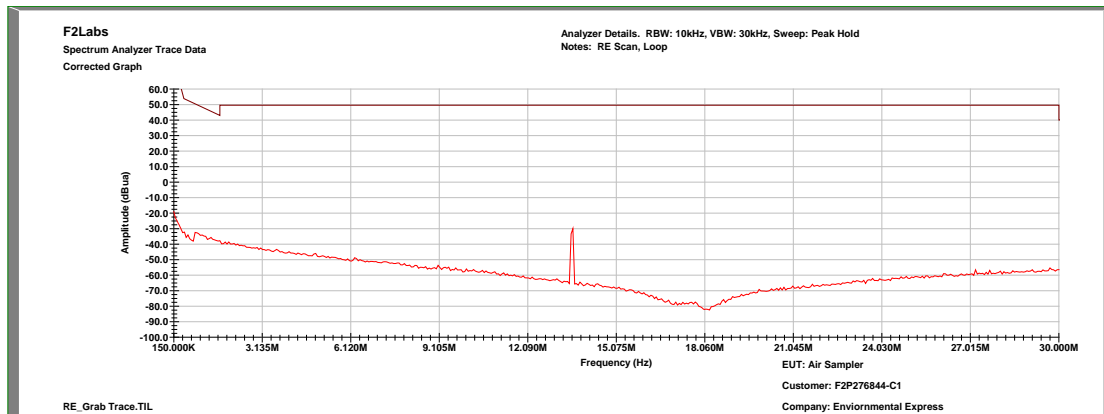
Model: IAQ 15 Connect

Test Date(s):	2022-05-23	Test Engineer(s):	J. Chiller
Standards:	CFR 47 Part 15.209	Air Temperature:	21.5°C
Results:	Complies	Relative Humidity:	46%

### 13.56 MHz RFID: Characterization Scan, 0.009 MHz to 0.15 MHz (Loop Antenna)



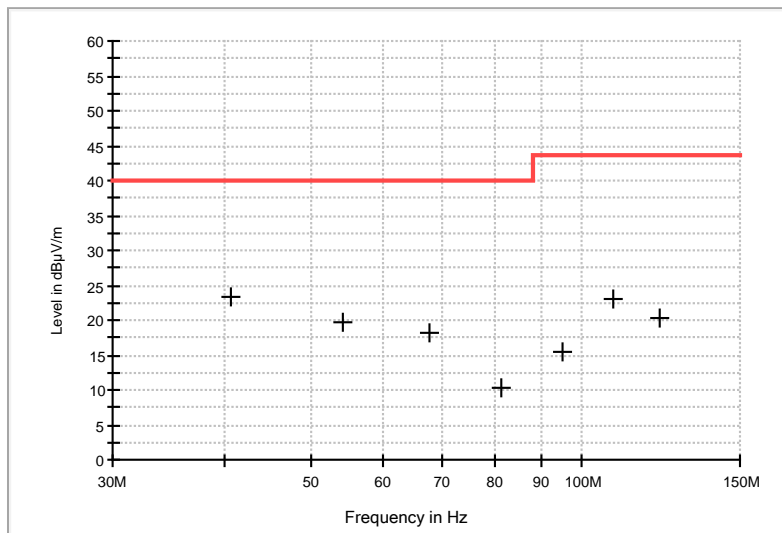
### 13.56 MHz RFID: Characterization Scan, 0.15 MHz to 30 MHz (Loop Antenna)





## 13.56 MHz RFID: 30 MHz to 1000 MHz

Frequency (MHz)	Antenna Polarization	Azimuth (degrees)	Reading (dBμV)	Cable Loss & Antenna Factor (dB)	Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
40.680000	V	100.00	32.4	-9.2	23.20	40.0	-16.8
54.240000	V	100.00	34.4	-14.8	19.60	40.0	-20.4
67.800000	V	100.00	32.9	-14.6	18.30	40.0	-21.7
81.360000	V	100.00	25.0	-14.8	10.20	40.0	-29.8
94.920000	V	100.00	29.3	-13.7	15.60	43.5	-27.9
108.480000	V	100.00	32.8	-9.7	23.10	43.5	-20.4
122.040000	V	100.00	28.5	-8.3	20.20	43.5	-23.3







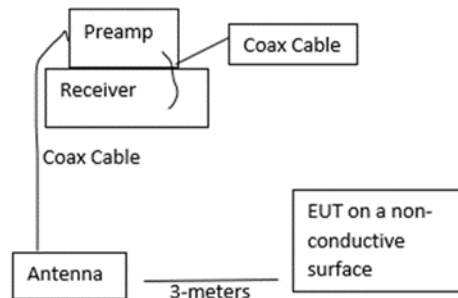
## 8 VOLTAGE VARIATIONS

### 8.1 Requirements

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

### 8.2 Procedure

A nominal voltage of 110VAC was used, and then 85% and 115% variations.



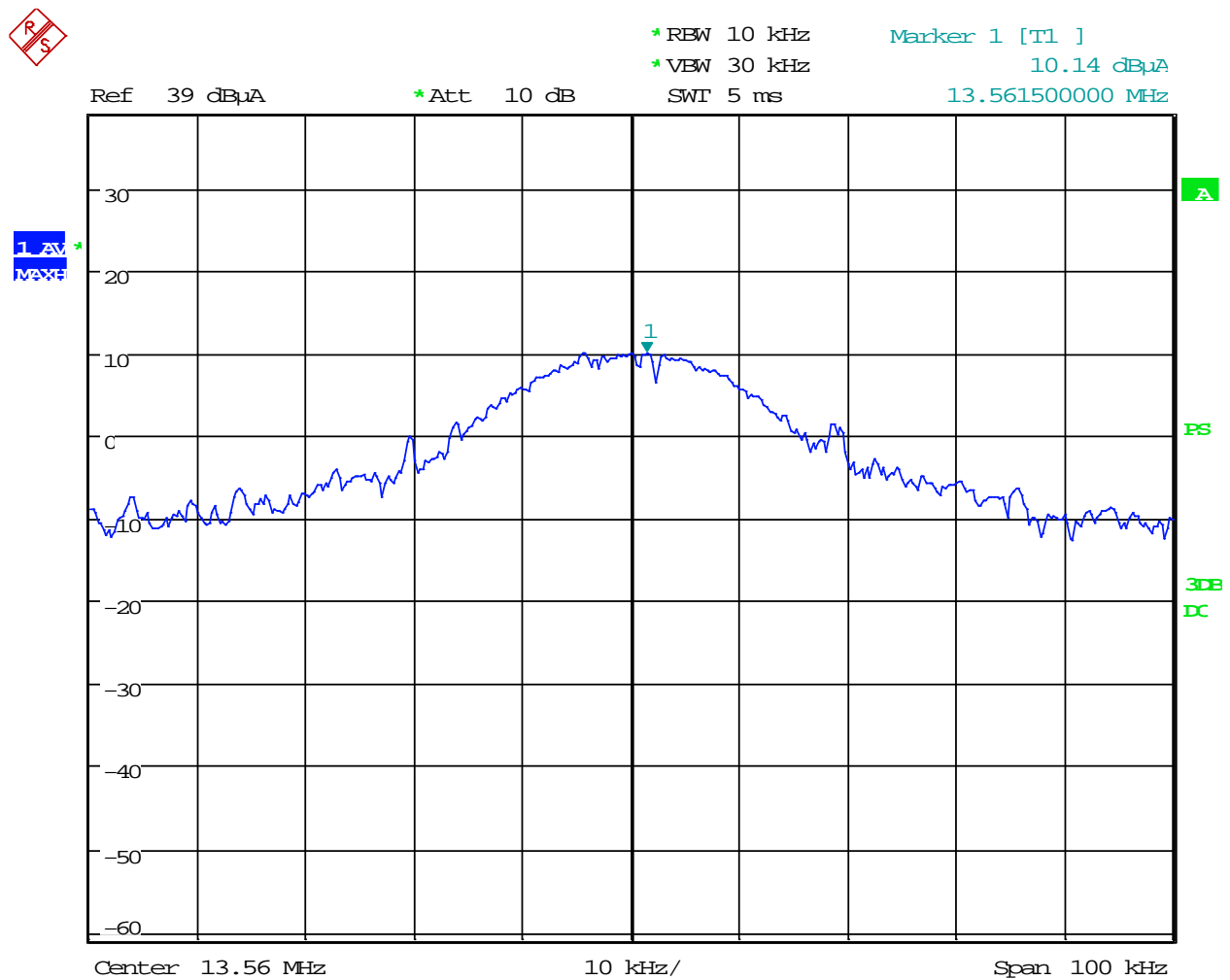
Deviations: Measured at 1 meter.

### 8.3 Voltage Variations Test Data

<b>Test Date:</b>	2022-06-15	<b>Test Engineer:</b>	J. Chiller
<b>Rule:</b>	CFR 47 Part 15.31(e)	<b>Air Temperature:</b>	21.9° C
<b>Test Results:</b>	Pass	<b>Relative Humidity:</b>	50%

**RESULTS:** The results showed that the fundamental frequency did not move outside the frequency band and the field strength did not increase above the limit during the variations.

### Nominal at 110VAC



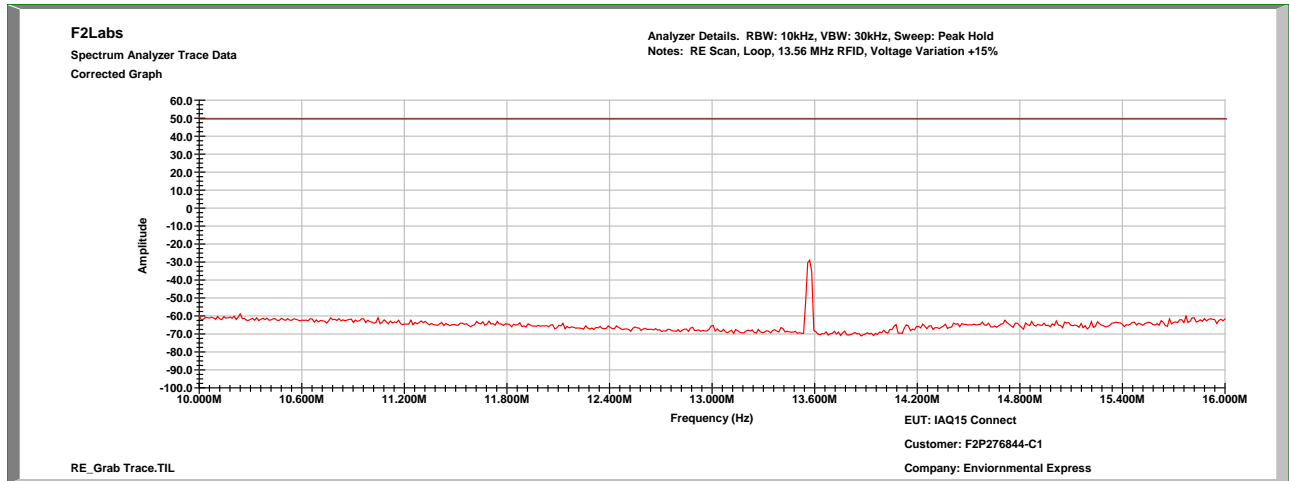
Date: 15.JUN.2022 12:57:31



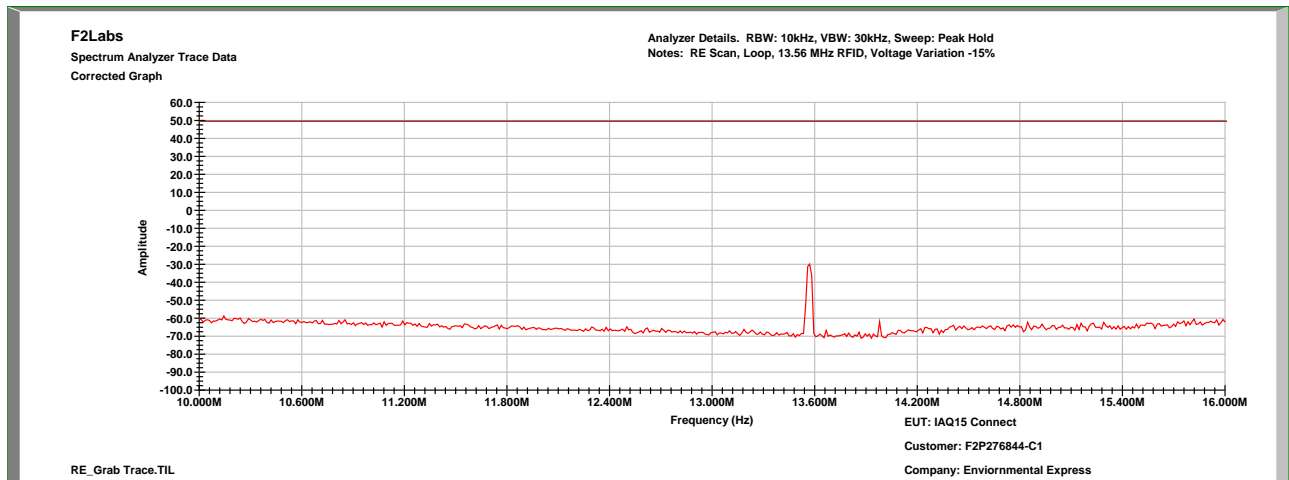
Order Number: F2P26844-C1

Applicant: Environmental Express  
Model: IAQ 15 Connect

+15%



-15%





## 9 CONDUCTED EMISSIONS

### 9.1 Requirements

In accordance with FCC CFR 47 Part 15.207(a), "Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted Limit (dB $\mu$ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

\*Decreases with the logarithm of the frequency.

### 9.2 Procedure

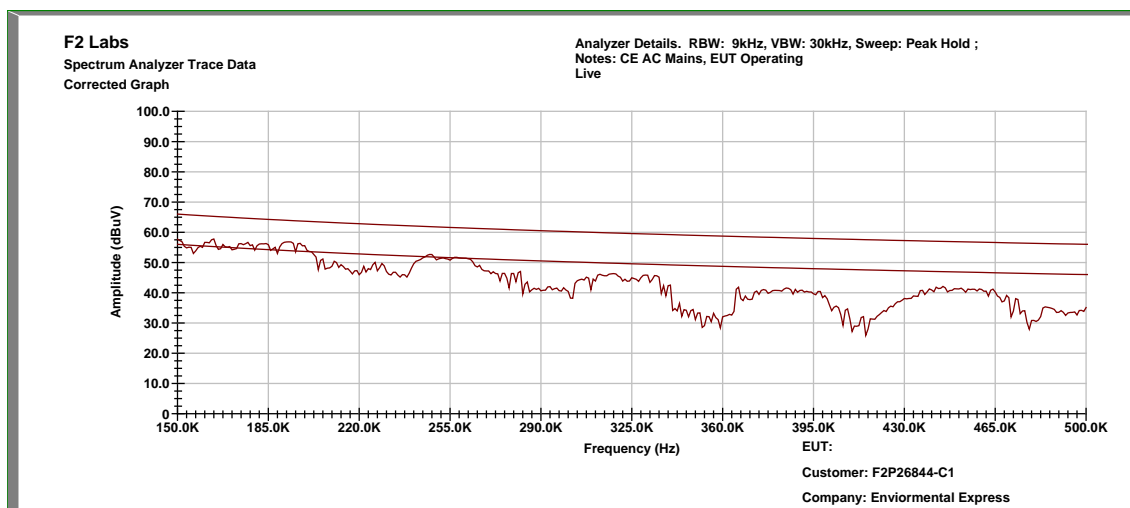
The EUT was placed on a 1.0 x 1.5 meter non-conductive table, 0.8 meter above a horizontal ground plane and 0.4 meter from a vertical ground plane. Power was provided to the EUT through a LISN bonded to a 3 x 2 meter ground plane. The LISN and peripherals were supplied power through a filtered AC power source. The output of the LISN was connected to the input of the receiver via a transient limiter, and emissions in the range 150 kHz to 30 MHz were measured. The measurements were recorded using the quasi-peak and average detectors as directed by the standard, and the resolution bandwidth during testing was 9 kHz. The raw measurements were corrected to allow for attenuation from the LISN, transient limiter and cables.



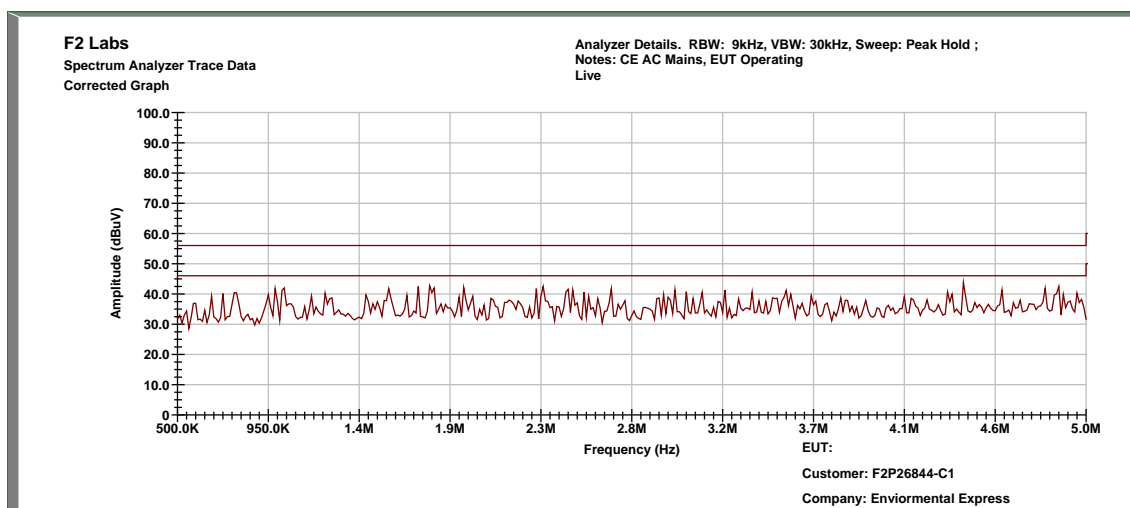
## 9.3 Conducted Emissions Test Data

Test Date:	2022-05-23	Test Engineer:	J. Chiller
Rule:	15.207	Air Temperature:	22.0° C
Test Results:	Pass	Relative Humidity:	42%

## Conducted Test – Live: 0.15 MHz to 0.5 MHz

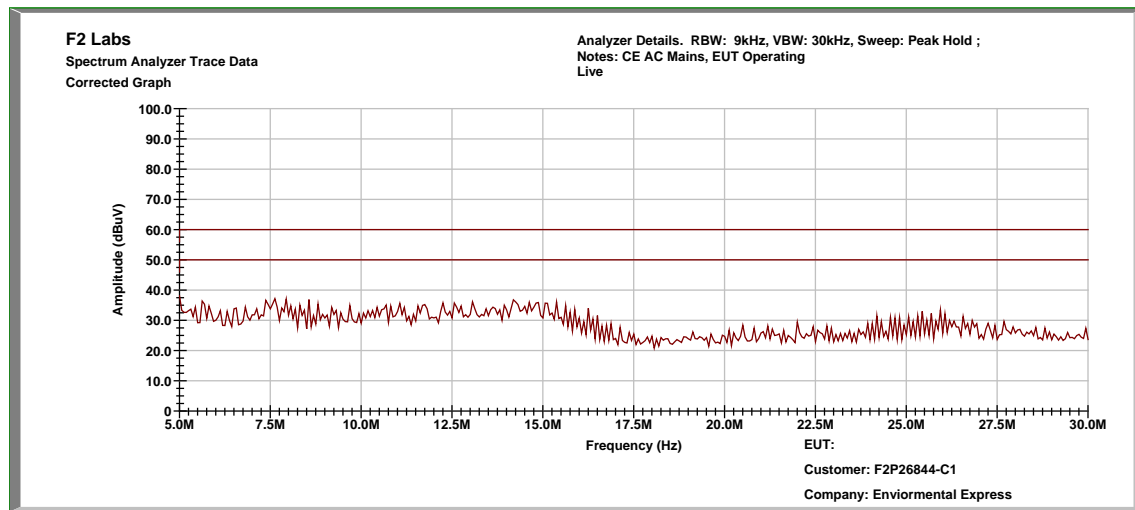


## Conducted Test – Live: 0.5 MHz to 5.0 MHz





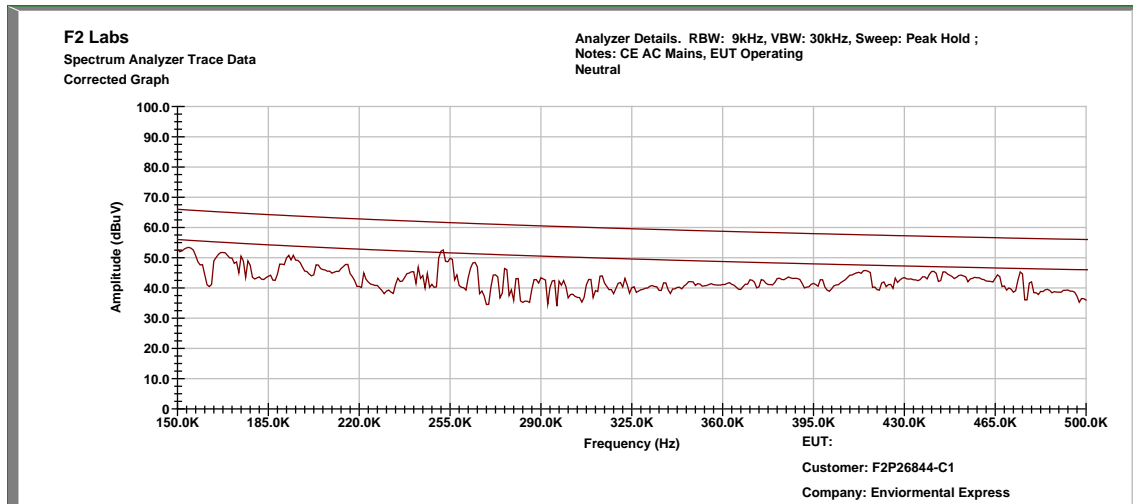
## Conducted Test – Live: 5.0 MHz to 30.0 MHz



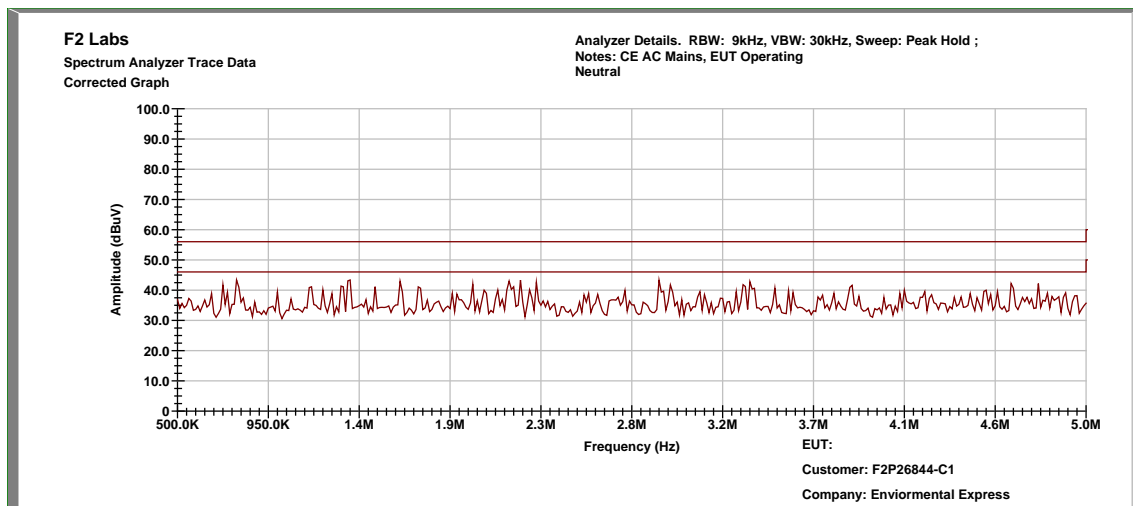
Top Discrete Measurements								
No.	Conductor	Frequency (MHz)	Detector	Level (dBμV)	Adjustment (dB)	Results (dBμV)	Limit (dBμV)	Margin (dB)
1	Live	0.151	Quasi-Peak	43.37	11.125	54.50	65.9	-11.4
			Average	29.25	11.125	40.38	55.9	-15.5
2	Live	0.164	Quasi-Peak	46.78	11.022	57.80	65.3	-7.5
			Average	26.92	11.022	37.94	55.3	-17.3
3	Live	0.177	Quasi-Peak	40.85	10.912	51.76	64.6	-12.9
			Average	29.0	10.912	39.91	54.6	-14.7
4	Live	0.185	Quasi-Peak	41.56	10.846	52.41	64.3	-11.9
			Average	26.45	10.846	37.30	54.3	-17.0
5	Live	0.192	Quasi-Peak	40.49	10.787	51.28	64.0	-12.7
			Average	27.01	10.787	37.80	54.0	-16.2
6	Live	0.200	Quasi-Peak	39.13	10.72	49.85	63.6	-13.8
			Average	23.21	10.72	33.93	53.6	-19.7
7	Live	0.247	Quasi-Peak	37.2	10.418	47.62	61.9	-14.2
			Average	19.8	10.418	30.22	61.9	-31.6



### Conducted Test – Neutral: 0.15 MHz to 0.5 MHz

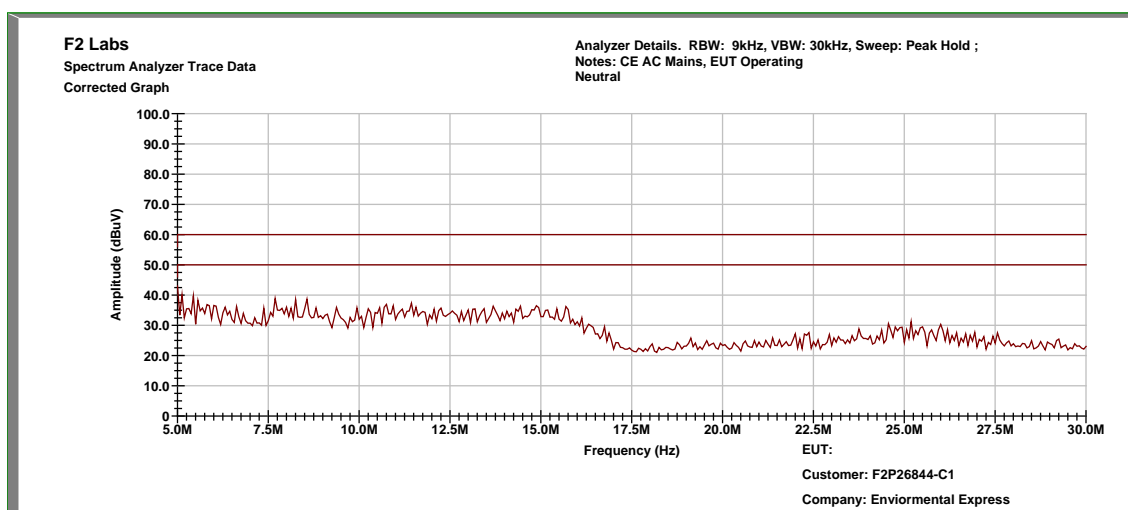


### Conducted Test – Neutral: 0.5 MHz to 5.0 MHz





## Conducted Test – Neutral: 5.0 MHz to 30.0 MHz



Top Discrete Measurements								
No.	Conductor	Frequency (MHz)	Detector	Level (dBμV)	Adjustment (dB)	Results (dBμV)	Limit (dBμV)	Margin (dB)
1	Neutral	0.154	Quasi-Peak	39.15	11.077	50.23	65.762	-15.54
			Average	22.86	11.077	33.94	55.762	-21.83
2	Neutral	0.167	Quasi-Peak	37.55	10.948	48.50	65.085	-16.59
			Average	24.19	10.948	35.14	55.085	-19.95
3	Neutral	0.252	Quasi-Peak	37.62	10.238	47.86	61.679	-13.82
			Average	19.3	10.238	29.54	51.679	-22.14
4	Neutral	0.255	Quasi-Peak	37.5	10.234	47.73	61.565	-13.83
			Average	19.95	10.234	30.18	51.565	-21.38
5	Neutral	0.416	Quasi-Peak	34.22	10.112	44.33	57.528	-13.20
			Average	23.51	10.112	33.62	47.528	-13.91
6	Neutral	0.474	Quasi-Peak	28.51	10.083	38.59	56.433	-17.84
			Average	16.51	10.083	26.59	46.433	-19.84



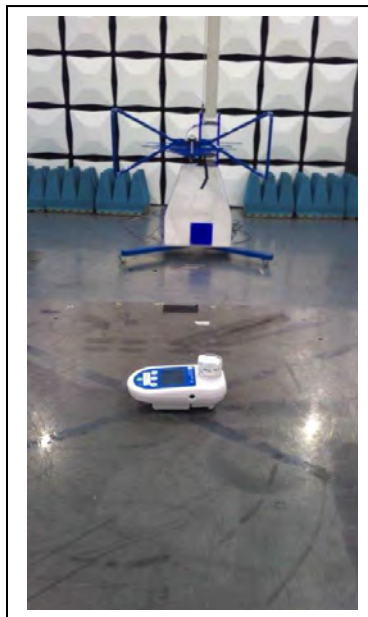


## 10 TEST SETUP PHOTOGRAPHS

**Field Strength /Radiated Spurious Emissions: Less than 30 MHz**

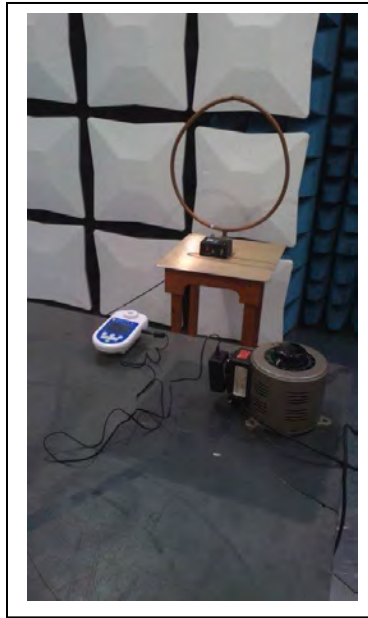


**Radiated Spurious Emissions: 30 MHz to 1000 MHz**





### Voltage Variations



### Conducted Emissions

