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CERTIFICATION TEST REPORT

Manufacturer: Hum Industrial Technology Inc.
4220 Duncan Avenue, Suite 201
St. Louis, Missouri 63110 USA

Applicant: Same as Above

Product Name: ValveSense

Product Description: Sensor for monitoring the position of valves open/close

**Operating Voltage/Freq.
of EUT During Testing:** Battery-Operated (3.3V)

Model: Hum-Valve-V5-R2

Part No.: HI24030101

FCC ID: 2BUPV-VS01

Testing Commenced: 2026-05-26

Testing Ended: 2026-05-27

Summary of Test Results: In Compliance

The EUT complies with the EMC requirements when manufactured identically as the unit tested in this report, including any required modifications and/or manufacturer's statement. Any changes to the design or build of this unit subsequent to this testing may deem it non-compliant.

Standards:

- ❖ **FCC Part 15 Subpart C, Section 15.249**
- ❖ **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**
- ❖ **ANSI C63.10-2020+Cor. 1-2023**



Order No(s): F2P28727A-1-C1

Applicant: Hum Industrial Technology Inc.
EUT: Model Hum-Valve-V5-R2 / Part No. HI24030101

Evaluation Conducted by:

Erik Tobin, EMC Engineer

Report Reviewed by:

Ken Littell, Vice President of Operations

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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 ANSI C63.10 and recommended FCC procedure of measurement for devices operating under Section 15.249. 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	2.54dB	5.07dB
Radiated Emissions <1 GHz @ 10m	2.55dB	5.09dB
Radiated Emissions 1 GHz to 2.7 GHz	1.81dB	3.62dB
Radiated Emissions 2.7 GHz to 18 GHz	1.55dB	3.10dB
AC Power Line Conducted Emissions, 150kHz to 30 MHz	1.38dB	2.76dB
AC Power Line Conducted Emissions, 9kHz to 150kHz	1.66dB	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 above tables that relate to tests included in this Test Report are applicable.



Order No(s): F2P28727A-1-C1

Applicant: Hum Industrial Technology Inc.
EUT: Model Hum-Valve-V5-R2 / Part No. HI24030101

1.4 Document History:

Document Number	Description	Issue Date	Approved By
F2X28727A-1-C1-01E	First Issue	2026-05-27	K. Littell
F2X28727A-1-C1-01E Rev1	Minor revision to add HUM Part No. to product identification.	2026-08-07	K. Littell

**2 SUMMARY OF TEST RESULTS**

Test Name	Standard(s)	Results
99% Occupied Bandwidth	CFR 47 Part 15.215(c)	Complies
-20dB Occupied Bandwidth	CFR 47 Part 15.215(c)	Complies
Field Strength of Emissions	CFR 47 Part 15.249(a)(d)	Complies
Variation of the Input Power	CFR 47 Part 15.231(e)	Complies*
Conducted Emissions	CFR 47 Part 15.207(a)	Not Applicable

**Requirements of 15.31(e) were met by using new batteries.*

Modifications Made to the Equipment
None



3 TABLES OF MEASURED RESULTS

Occupied Bandwidth			
Test	903 MHz	915 MHz	927 MHz
-20dB	0.5321 MHz	0.5336 MHz	0.5360 MHz
99%	0.4944 MHz	0.4937 MHz	0.4960 MHz

Field Strength					
Mod	Frequency (MHz)	Measured Power		Limit	
		mV/m	dBuV/m	mV/m	dBuV/m
V	902	0.088	38.9	0.200	46
	903	37.584	91.5	50.0	93.98
	915	32.359	90.2	50.0	93.98
	927	33.497	90.5	50.0	93.98
	928	0.123	41.8	0.200	46
H	902	0.073	37.3	0.200	46
	903	29.174	89.3	50.0	93.98
	915	19.953	86	50.0	93.98
	927	21.135	86.5	50.0	93.98
	928	0.080	38.1	0.200	46



4 ENGINEERING STATEMENT

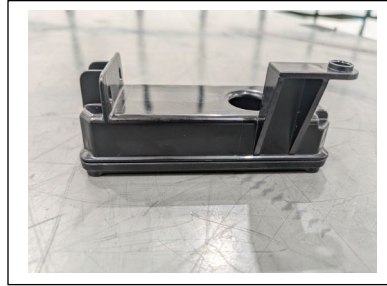
This report has been prepared on behalf of Hum Industrial Technology Inc., to provide documentation for the testing described herein. This equipment has been tested and found to comply with part 15.249 of the FCC Rules using ANSI C63.10 standard. The test results found in this test report relate only to the items tested.



5 EUT INFORMATION AND DATA

5.1 Equipment Under Test:

Product: ValveSense
Model: Hum-Valve-V5-R2
Part No.: HI24030101
Serial No.: 1216930828
Firmware Version: 2.4.1
Hardware Version: V5R2
FCC ID: 2BUPV-VS01



5.2 Trade Name:

Hum Industrial Technology Inc.

5.3 Power Supply:

Battery-Operated (3.3V)

5.4 Applicable Rules:

CFR 47, Part 15.249

5.5 Antenna:

Chip Antenna, -1.0dBi Gain

5.6 Accessories:

None

5.7 Test Item Condition:

The equipment to be tested was received in good condition.

5.8 Testing Algorithm:

EUT was set to continuously transmit the modulated carrier at maximum power.
Channels: 903, 915, 927 MHz.

**6 LIST OF MEASUREMENT INSTRUMENTATION**

Equipment Type	Asset Number	Manufacturer	Model	Serial Number	Calibration Due Date
Shielded Chamber	CL166-E	Albatross Projects	B83117-DF435-T261	US140023	2027-05-07
Receiver	CL151	Rohde & Schwarz	ESU40	100319	2027-04-08
Low Loss Cable Set	CL315 / CL318	Fairview Microwave	FMC0202914-72/FMC0202914-240	None Spec.	2027-04-10
Receiver	CL204	Rohde & Schwarz	ESR7	101714	2027-04-09
Horn Antenna	CL333	ETS Lindgren	DRHA18G	J203061349	2026-07-09
Preamplifier	CL284	A.H. Systems, Inc.	PAM-0101	131	2027-04-09
Pre-Amplifier	CL153	Agilent	83006-69007	MY57280115	2027-04-10
Antenna, JB3 Combination	CL175	Sunol Sciences	JB3	A030315	2026-09-02
Software:	Tile Version 3.4.B.3.		Software Verified: 2026-05-26 to 2026-05-27		
Software:	EMC 32, Version 8.53.0		Software Verified: 2026-05-26 to 2026-05-27		
Temp/Hum Rec	CL327	Thermpro	TP50	8	2028-03-20



7 OCCUPIED BANDWIDTH

7.1 Requirements:

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the -20dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

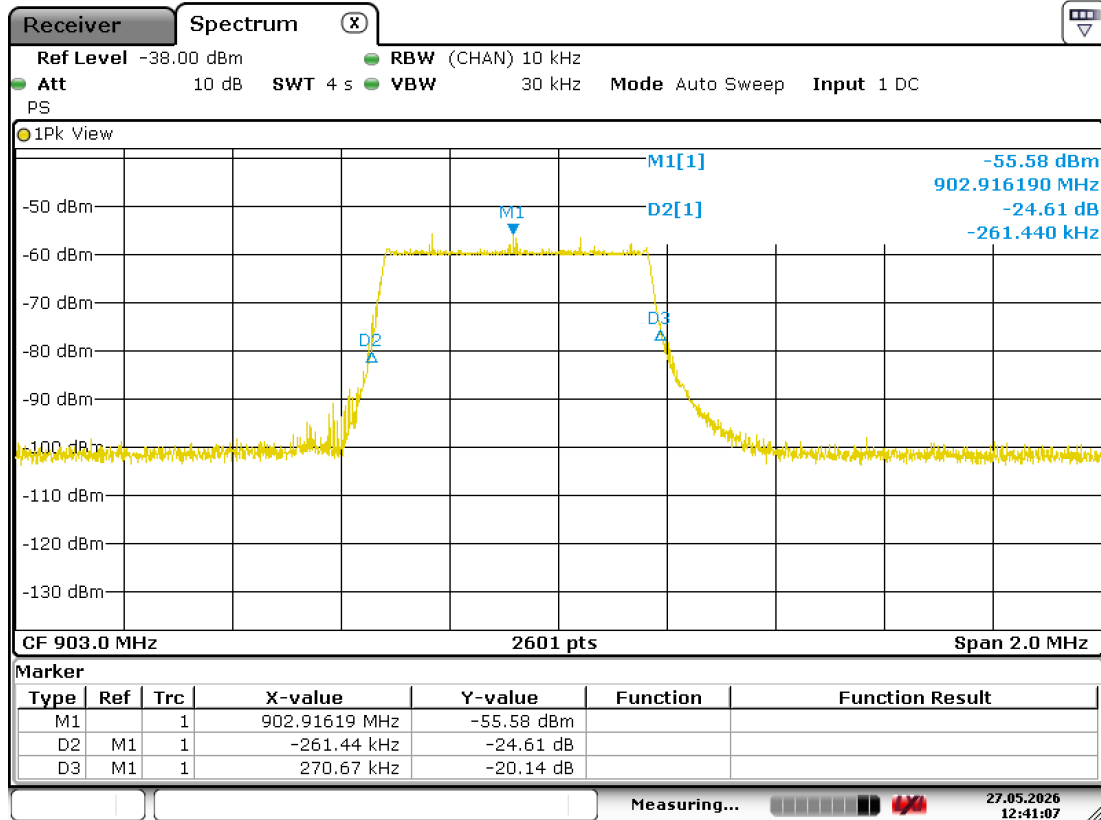
Bandwidth measurements were made at low, mid and high channels. The bandwidth was measured using the marker delta method.



7.2 Occupied Bandwidth Test Data

Test Date(s):	2026-05-27	Test Engineer(s):	E. Tobin
Standards:	CFR 47 Part 15.215(c)	Air Temperature:	22.6°C
		Relative Humidity:	47%

903 MHz: -20dB



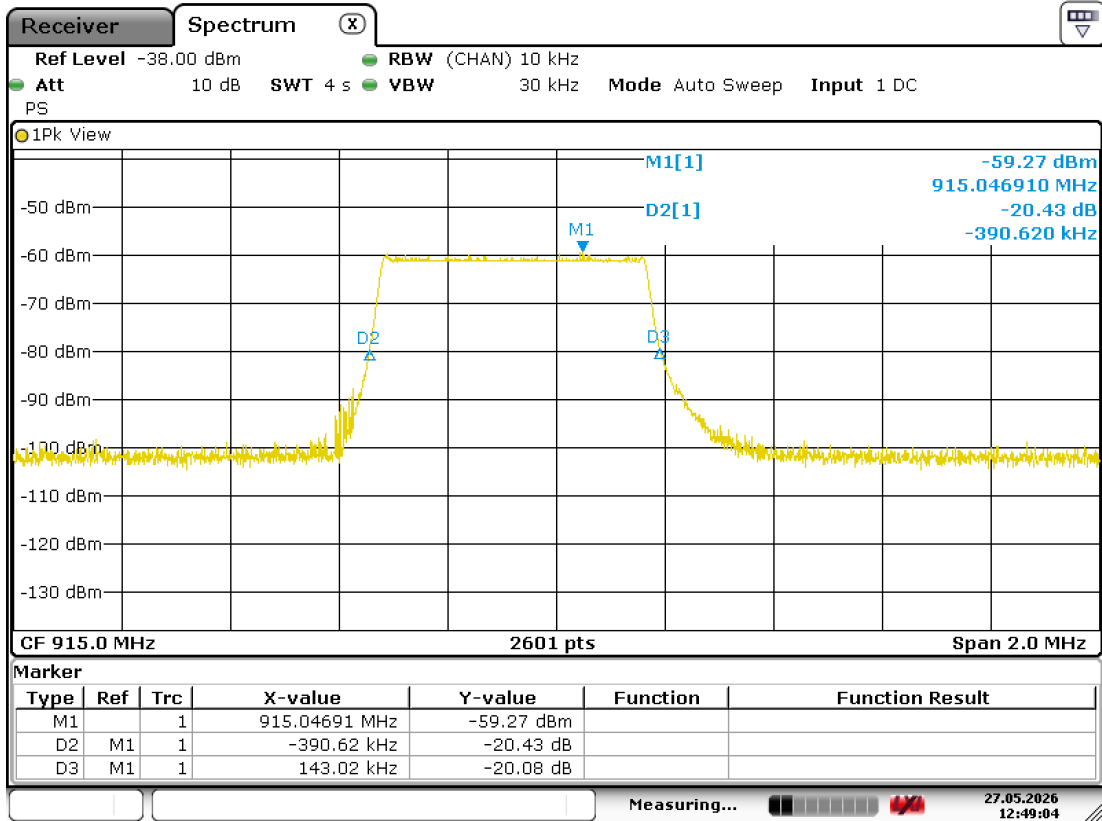
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Order No(s): F2P28727A-1-C1

Applicant: Hum Industrial Technology Inc.
EUT: Model Hum-Valve-V5-R2 / Part No. HI24030101

915 MHz: -20dB



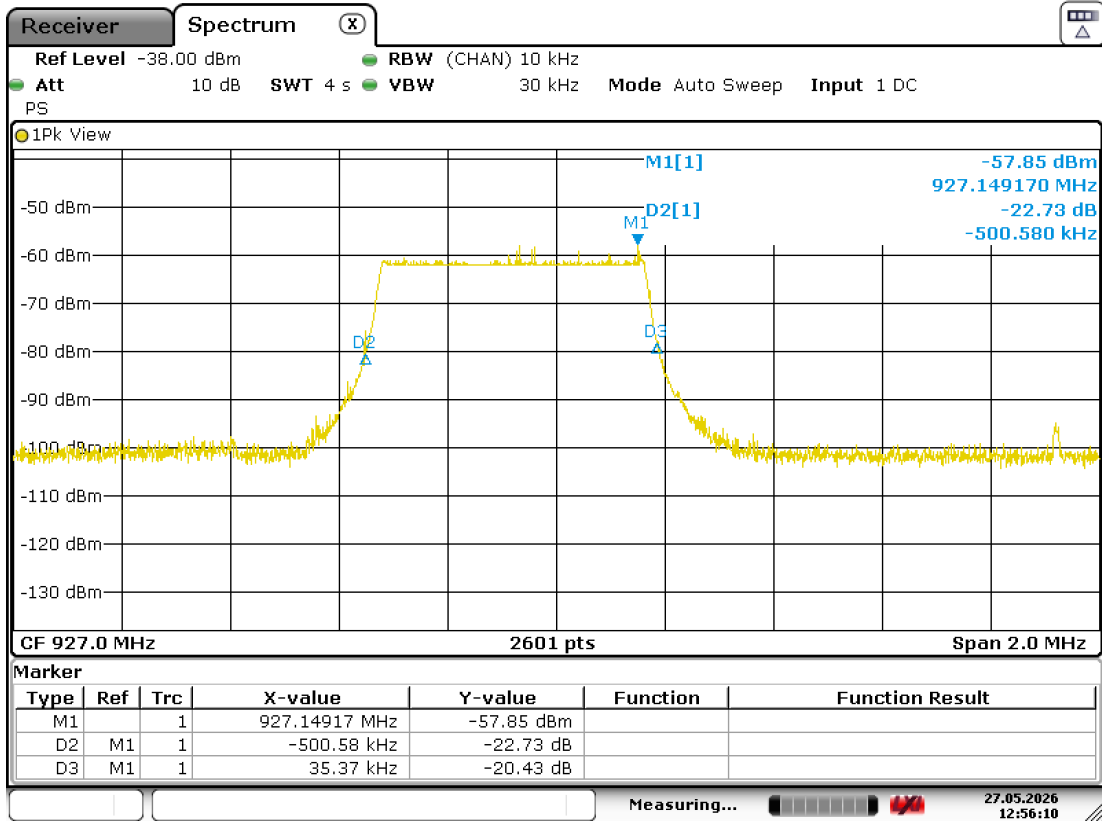
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Order No(s): F2P28727A-1-C1

Applicant: Hum Industrial Technology Inc.
EUT: Model Hum-Valve-V5-R2 / Part No. HI24030101

927 MHz: -20dB



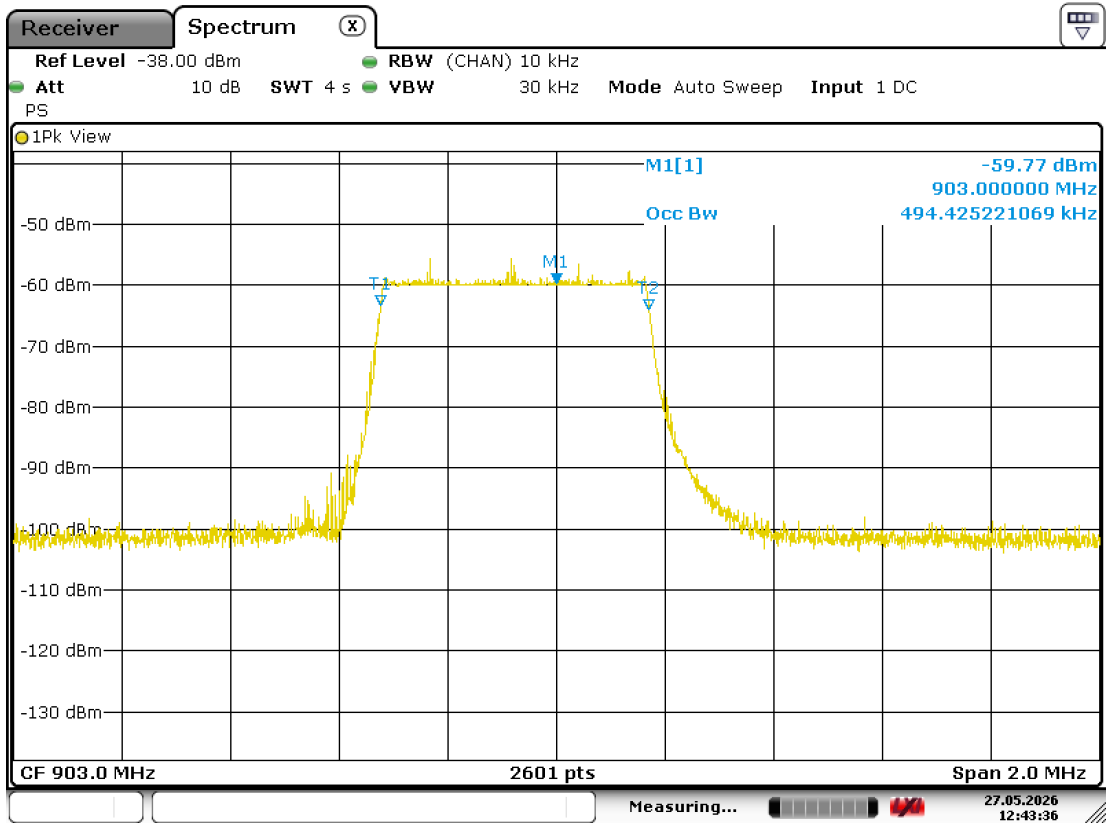
Date: 27.MAY.2026 12:56:10



Order No(s): F2P28727A-1-C1

Applicant: Hum Industrial Technology Inc.
EUT: Model Hum-Valve-V5-R2 / Part No. HI24030101

903 MHz: 99%



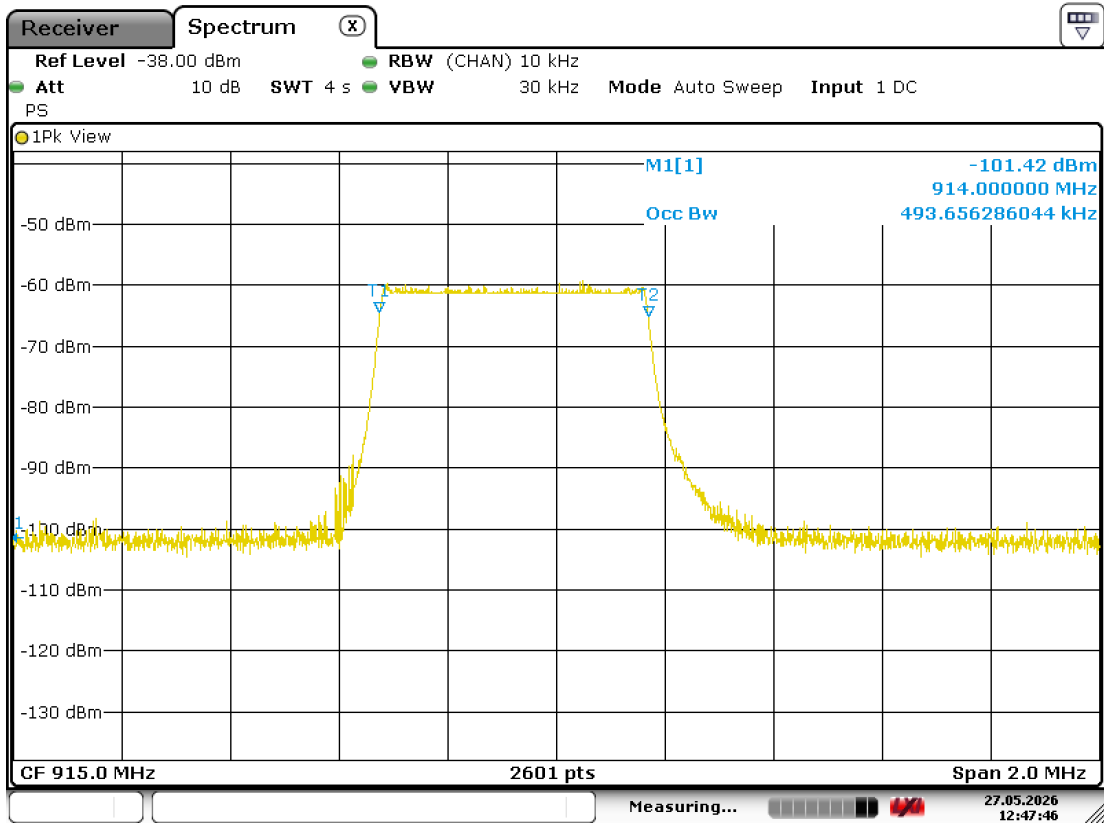
Date: 27.MAY.2026 12:43:36



Order No(s): F2P28727A-1-C1

Applicant: Hum Industrial Technology Inc.
EUT: Model Hum-Valve-V5-R2 / Part No. HI24030101

915 MHz: 99%



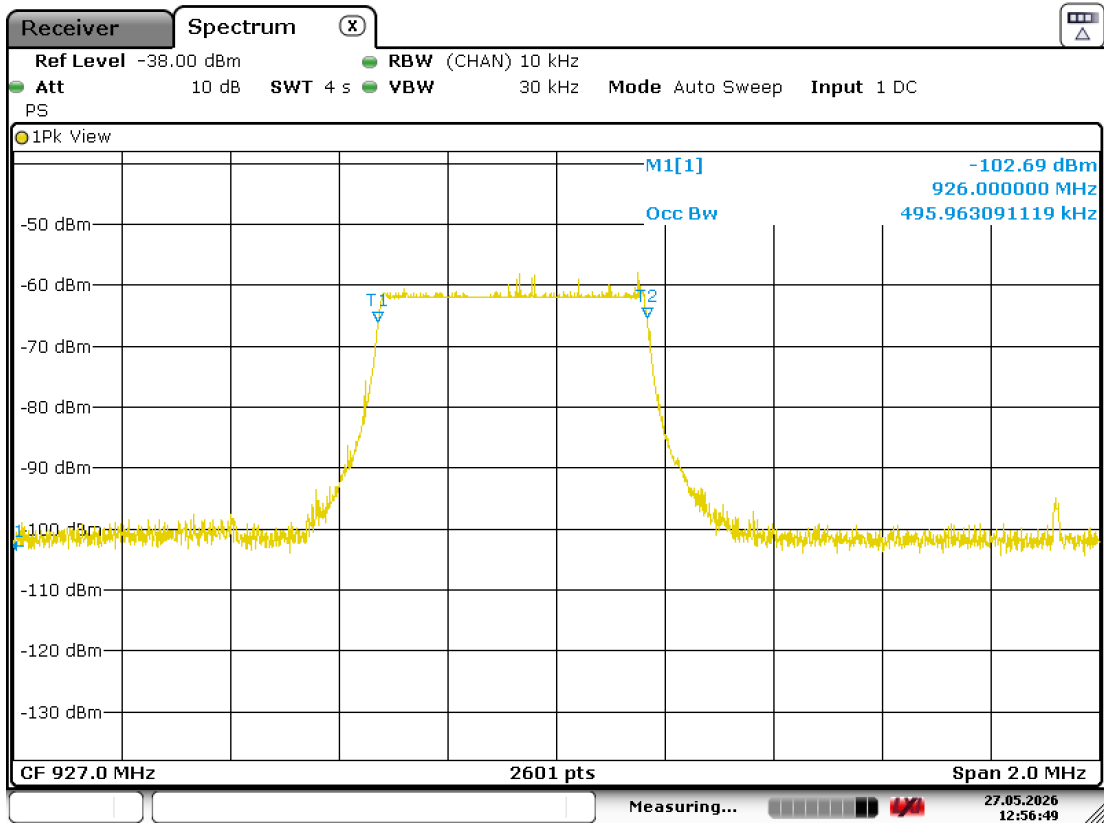
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Order No(s): F2P28727A-1-C1

Applicant: Hum Industrial Technology Inc.
EUT: Model Hum-Valve-V5-R2 / Part No. HI24030101

927 MHz: 99%



Date: 27.MAY.2026 12:56:49



8 FIELD STRENGTH OF EMISSIONS FROM INTENTIONAL RADIATORS

- (a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

- (d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

NOTE: During the pre-scan evaluation, the EUT was rotated in all possible directions 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.

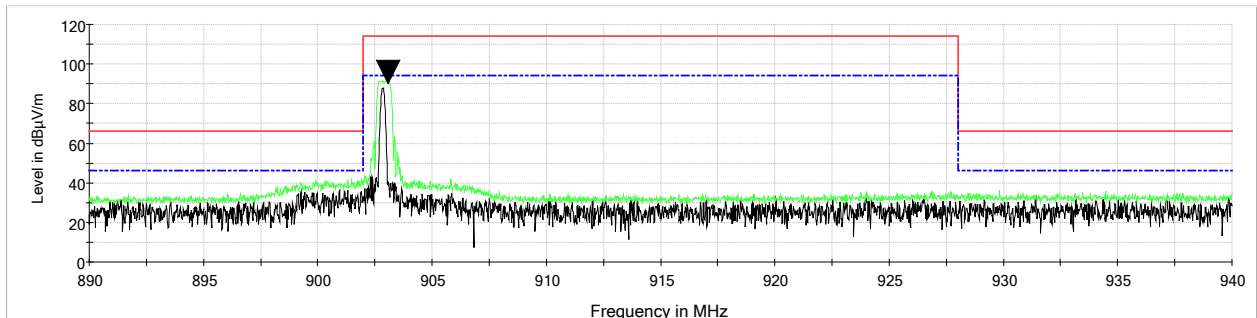


8.1 Test Data - Field Strength of Emissions from Intentional Radiators

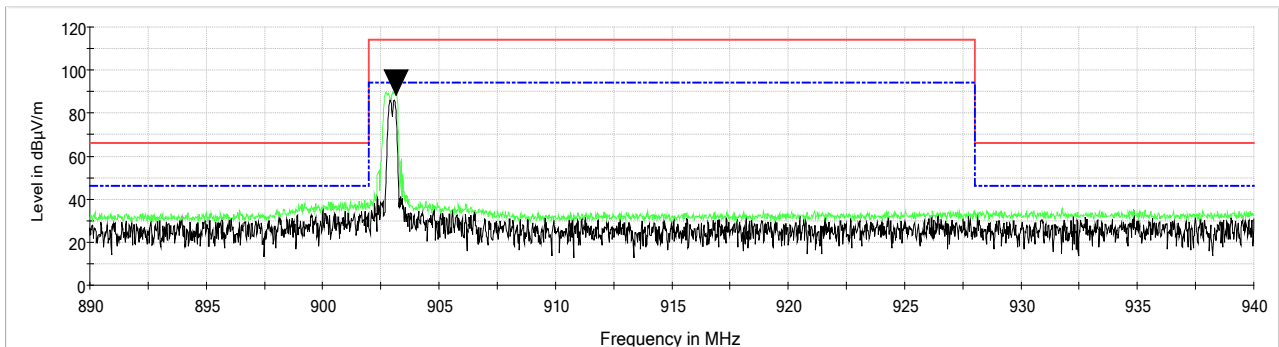
Test Date(s):	2026-05-26	Test Engineer(s):	E. Tobin
Standards:	CFR 47 Part 15.249(a)	Air Temperature:	22.6°C
		Relative Humidity:	47%

100kHz LORA

903 MHz: Characterization Scan, In Band, Vertical



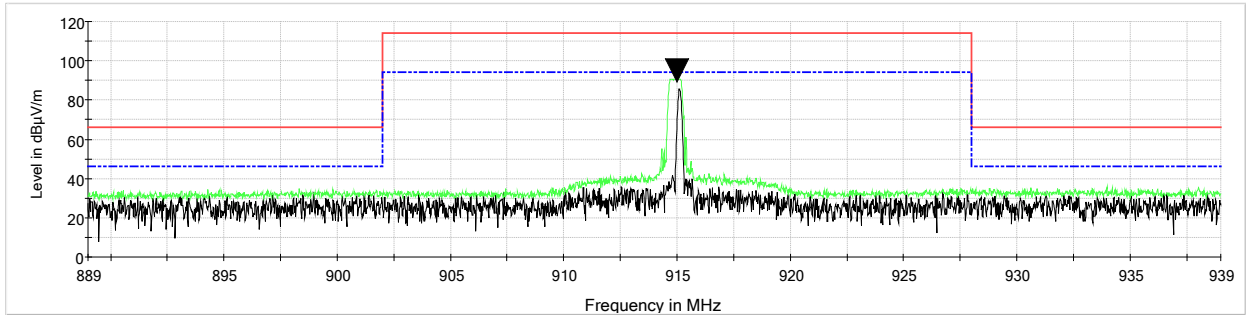
903 MHz: Characterization Scan, In Band, Horizontal



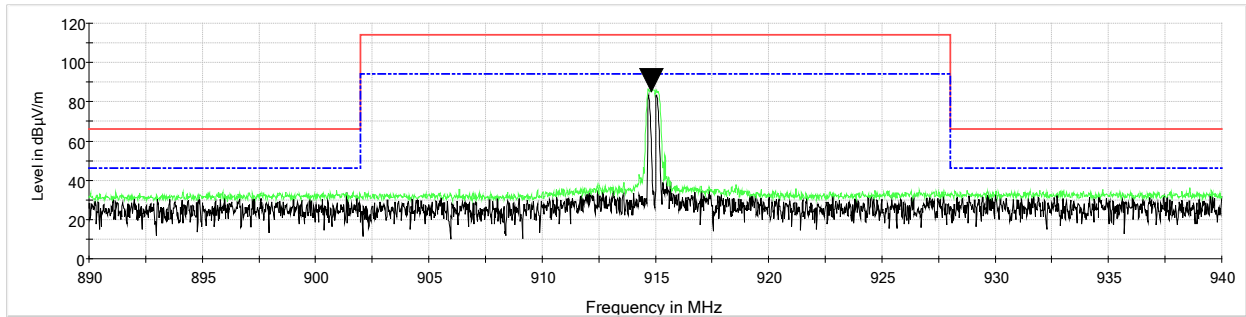


100kHz LORA

915 MHz: Characterization Scan, In Band, Vertical



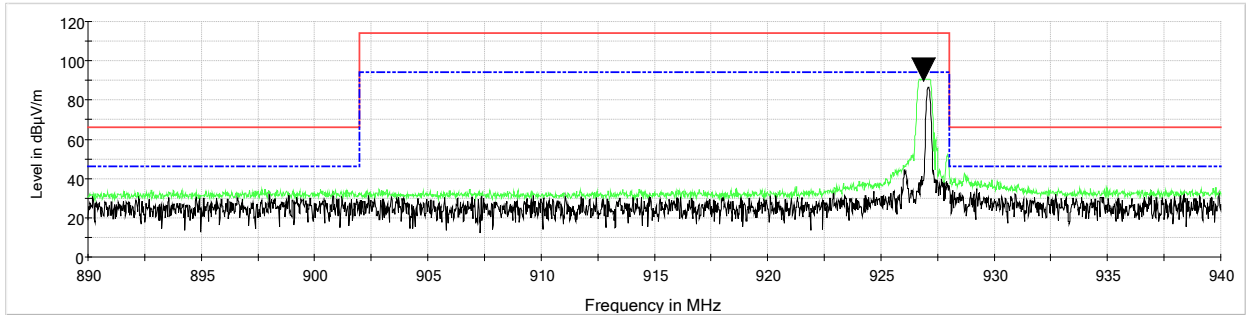
915 MHz: Characterization Scan, In Band, Horizontal



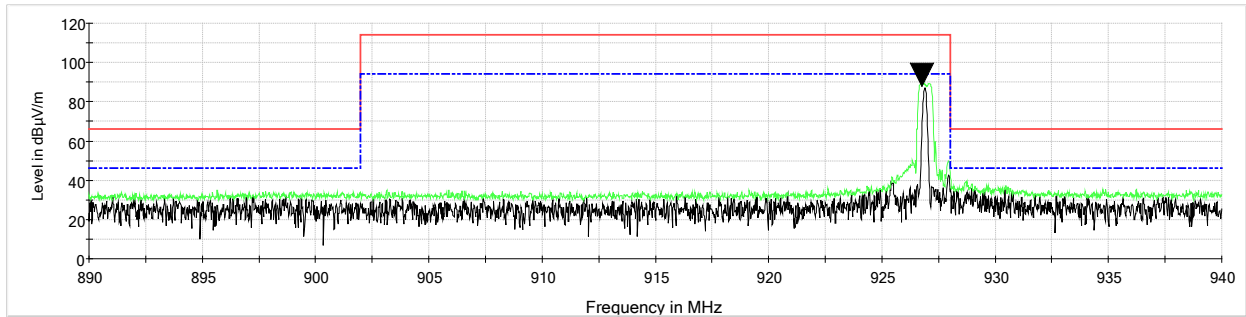


100kHz LORA

927 MHz: Characterization Scan, In Band, Vertical



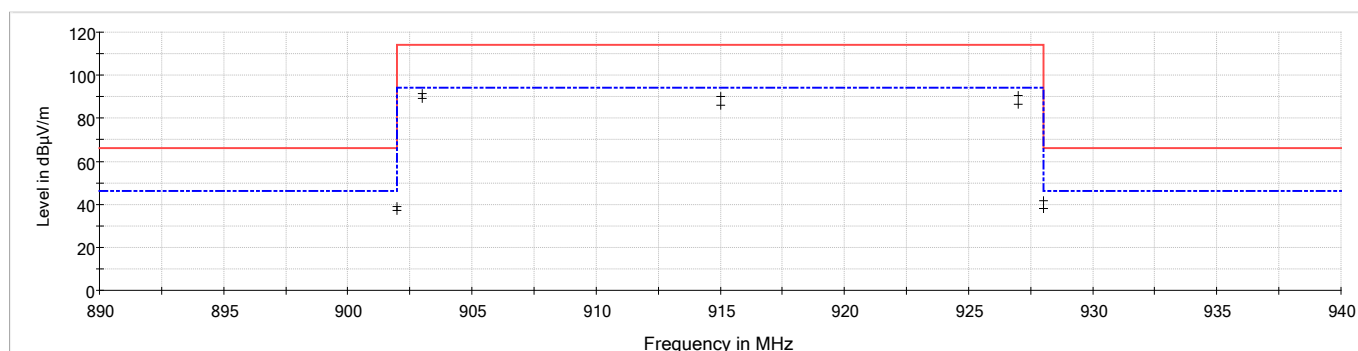
927 MHz: Characterization Scan, In Band, Horizontal





Band Edge Measurements

Frequency MHz	QuasiPeak dBμV/m	Bandwidth kHz	Height cm	Pol.	Azimuth deg	Corr. dB	Margin - QPK dB	Limit - QPK dBμV/m
902.000000	38.9	120.000	100.0	V	152.0	-13.6	7.1	46.0
902.000000	37.3	120.000	100.0	H	330.0	-13.6	8.7	46.0
903.000000	91.5	120.000	100.0	V	152.0	-13.6	2.5	94.0
903.000000	89.3	120.000	100.0	H	330.0	-13.6	4.7	94.0
915.000000	86.0	120.000	100.0	H	23.0	-13.3	8.0	94.0
915.000000	90.2	120.000	100.0	V	190.0	-13.3	3.8	94.0
927.000000	86.5	120.000	100.0	H	0.0	-12.9	7.5	94.0
927.000000	90.5	120.000	100.0	V	154.0	-12.9	3.5	94.0
928.000000	38.1	120.000	100.0	H	0.0	-12.9	8.0	46.0
928.000000	41.8	120.000	100.0	V	154.0	-12.9	4.2	46.0





8.2 Test Data – Spurious Emissions

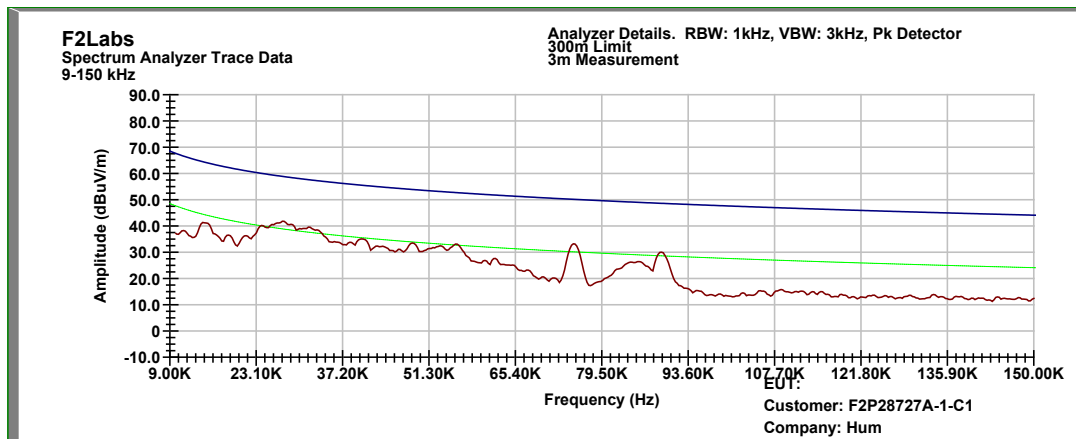
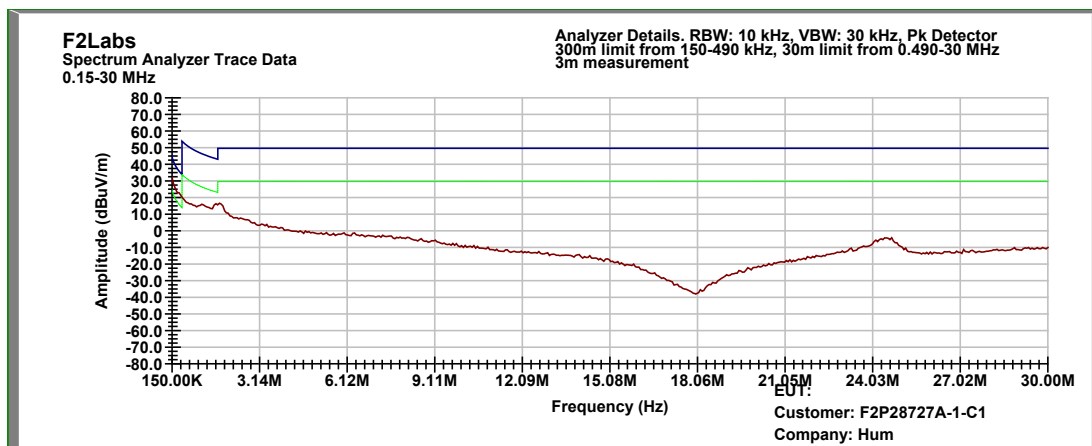
Notes: Plots are peak, max hold pre-scan data included only to determine what frequencies to investigate and measure. During the pre-scan evaluation, the EUT was rotated in all possible directions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. At some 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 1 GHz 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. Frequencies were scanned from 9kHz to 13 GHz and the highest emissions are listed below.

In the following plots, the black line indicates ambient noise and the red line indicates the measurement with the EUT on. Emissions to be found by the EUT were measured and listed in tables below. The following graphs represent scans at the 920.8 MHz frequency.



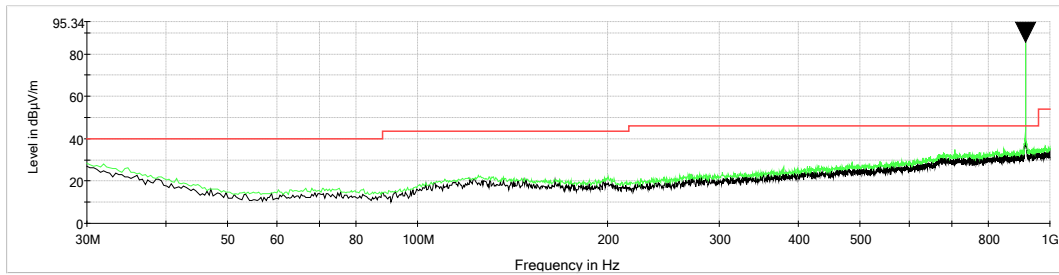
Test Date(s):	2026-05-26	Test Engineer(s):	E. Tobin
Standards:	CFR 47 Part 15.249(d) / Part 15.209	Air Temperature:	22.6°C
		Relative Humidity:	47%

Characterization Scan, 0.009 MHz to 0.15 MHz (Loop)**Characterization Scan, 0.15 MHz to 30 MHz (Loop)**

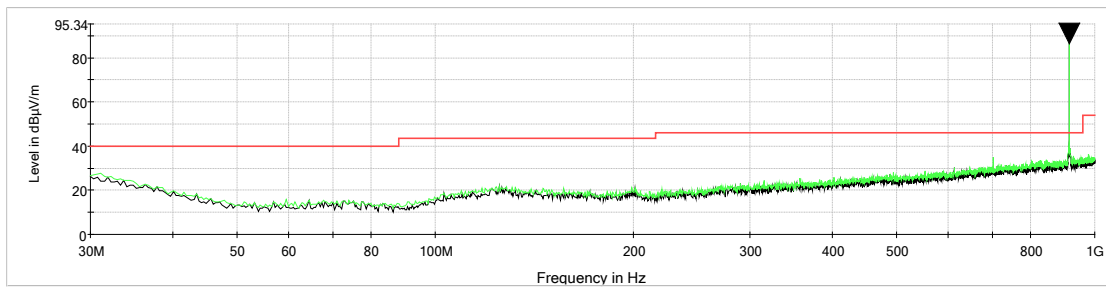
Note: Plots display 3m measurements with 30m and 300m limits. Measurement to be extrapolated by subtracting 40dB per decade. Peak trace below AVG/QP limit.



Characterization Scan, 30 MHz to 1000 MHz, Vertical

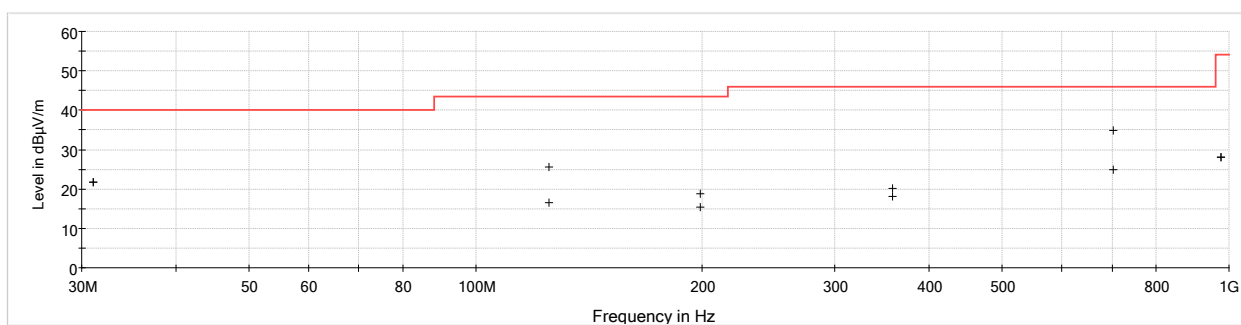


Characterization Scan, 30 MHz to 1000 MHz, Horizontal



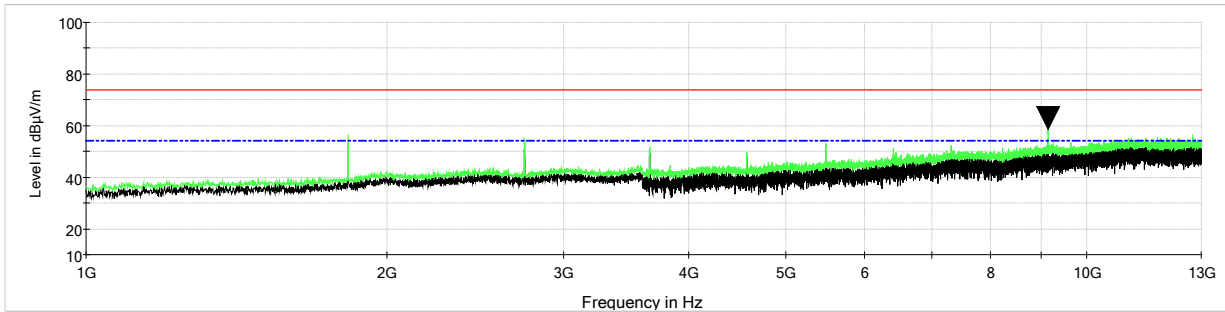


Frequency MHz	QuasiPeak dBμV/m	Bandwidth kHz	Height cm	Pol.	Azimuth deg	Corr. dB	Margin - QPK dB	Limit - QPK dBμV/m
31.119231	21.7	120.000	100.0	V	2.0	-20.0	18.3	40.0
31.119231	21.8	120.000	100.0	H	0.0	-20.0	18.2	40.0
125.134615	25.7	120.000	100.0	V	356.0	-25.5	17.8	43.5
125.134615	16.5	120.000	100.0	H	0.0	-25.5	27.0	43.5
198.630769	18.8	120.000	100.0	V	4.0	-26.2	24.7	43.5
198.630769	15.3	120.000	100.0	H	0.0	-26.2	28.2	43.5
357.561538	18.1	120.000	100.0	H	358.0	-23.6	27.9	46.0
357.561538	20.1	120.000	100.0	V	359.0	-23.6	25.9	46.0
701.911538	24.8	120.000	100.0	H	0.0	-17.5	21.2	46.0
701.911538	34.8	120.000	100.0	V	0.0	-17.5	11.2	46.0
975.003846	28.0	120.000	100.0	V	0.0	-11.7	26.0	54.0
975.003846	28.1	120.000	100.0	H	0.0	-11.7	25.9	54.0

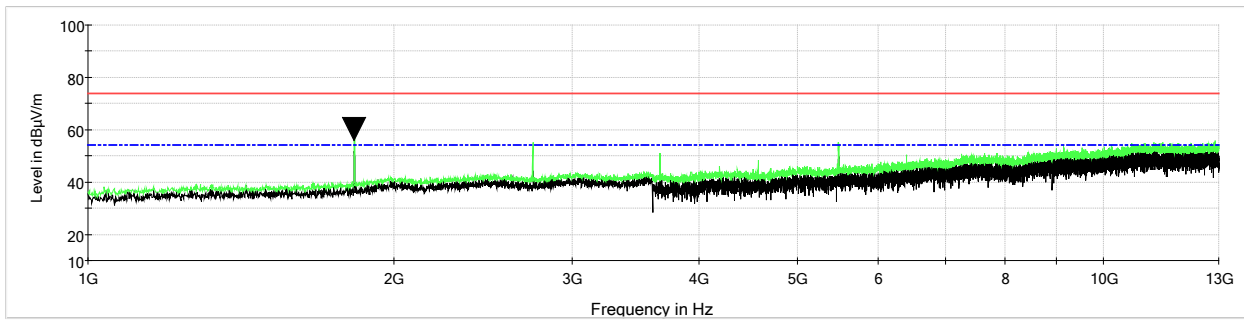




Characterization Scan, 1 GHz to 13 GHz, Vertical



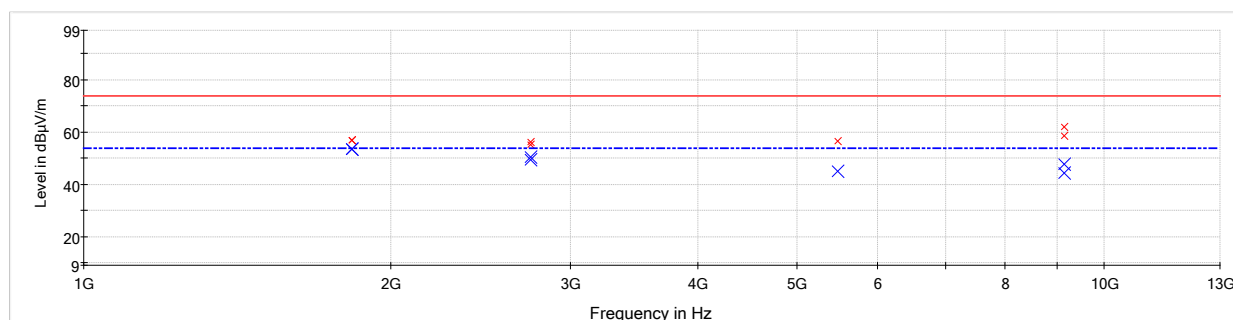
Characterization Scan, 1 GHz to 13 GHz, Horizontal





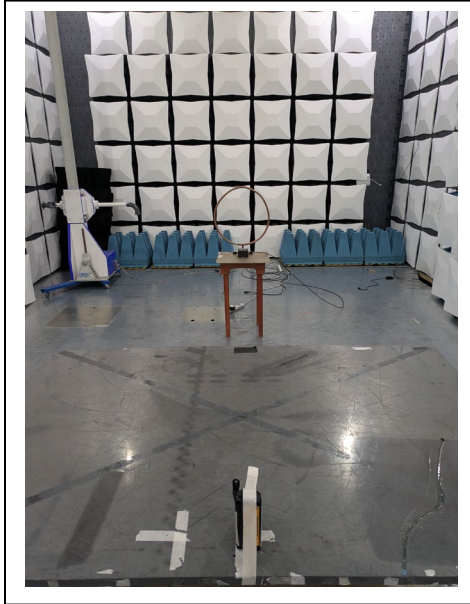
Measurements

Frequency MHz	MaxPeak dB μ V/m	Average dB μ V/m	Bandwidth kHz	Height cm	Pol.	Azimuth deg	Corr. dB	Margin - AVG dB	Limit - AVG dB μ V/m
1830.000000	57.0	53.6	1000.000	150.0	H	5.0	1.4	0.4	54.0
1830.000000	56.8	53.4	1000.000	150.0	V	6.0	1.4	0.6	54.0
2745.000000	56.1	50.4	1000.000	150.0	H	347.0	3.5	3.6	54.0
2745.000000	55.1	49.3	1000.000	150.0	V	358.0	3.5	4.7	54.0
5490.000000	56.6	45.1	1000.000	150.0	H	4.0	8.6	8.9	54.0
9150.000000	58.4	44.4	1000.000	150.0	H	354.0	14.7	9.6	54.0
9150.000000	62.0	47.8	1000.000	150.0	V	0.0	14.7	6.2	54.0

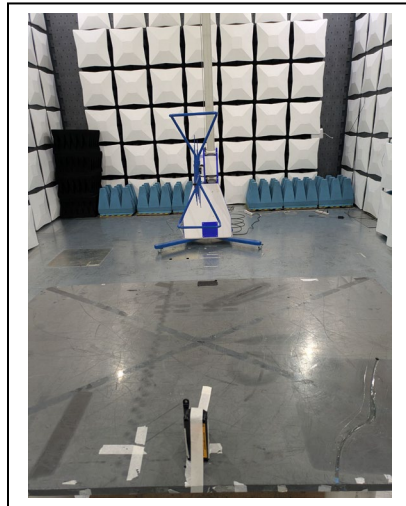


9 PHOTOGRAPHS – TEST SETUP

9kHz to 30 MHz



30 MHz to 1000 MHz





1 GHz to 13 GHz

