F2 Labs
16740 Peters Road
Middlefield, Ohio 44062
United States of America
www.f2labs.com

CERTIFICATION TEST REPORT

Manufacturer:	**Total Product Solutions BV** **Industrieweg 4731 SB Oudenbosch NL zone 14**
Applicant:	**Zehnder America** **6 Merrill Industrial Drive, Suite 7** **Hampton, New Hampshire 03842 USA**
Product Name:	**TMR-SNS-925MHz-CO2**
Product Description:	Timer for ventilation unit
Operating Voltage/Frequency:	Battery-Operated
Model:	**RF Timer**
FCC ID:	**2A8X810019108**
Testing Commenced:	2022-08-24
Testing Ended:	2022-08-26
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**

Evaluation Conducted by:

Julius Chiller, Senior Wireless Project Engineer

Report Reviewed by:

Ken Littell, Vice President of Operations

F2 Labs
26501 Ridge Road
Damascus, MD 20872
Ph 301.253.4500

F2 Labs
16740 Peters Road
Middlefield, OH 44062
Ph 440.632.5541

F2 Labs
8583 Zionsville Road
Indianapolis, IN 46268
Ph 317.610.0611

TABLE OF CONTENTS

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 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	2.54	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.

1.4 Document History:

Document Number	Description	Issue Date	Approved By
F2P27922-01E	First Issue	2022-09-30	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: Power setting: -2dBm	CFR 47 Part 15.249(a)(d)	Complies
Variation of the Input Power	CFR 47 Part 15.31(e)	Complies*
Conducted Emissions	CFR 47 Part 15.207(a)	N/A

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

Modifications Made to the Equipment
None

3 TABLE OF MEASURED RESULTS

Test	925 MHz
Quasi-Peak Field Strength of Fundamental: Power setting, -2dBm	86.1dBµV/m, 20.1mV/m
Average Limit for Fundamental	93.97dBµV/m. 50 mV/meter
-20dB Occupied Bandwidth	0.209 MHz
99% Occupied Bandwidth (MHz)	0.187 MHz
Voltage Variations	N/A

The -20dB bandwidth of the emission shall be contained within the frequency band designated in the rule section under which the equipment is operated.

4 ENGINEERING STATEMENT

This report has been prepared on behalf of Zehnder America 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: **TMR-SNS-925MHz-CO2**
Model: **RF Timer**
Serial No.: 121A22510001
Firmware: RF_Timer_FCC_US_v0.03.hex
Hardware: V1.1
FCC ID: 2A8X810019108

5.2 Trade Name:

Zehnder America

5.3 Power Supply:

Battery-Operated

5.4 Applicable Rules:

CFR 47, Part 15.249, subpart C

5.5 Antenna:

Dipole PCB

5.6 Accessories:

Device	Manufacturer	Model Number	Serial Number
Battery	Panasonic	CR2032	346F17303

5.7 Test Item Condition:

The equipment to be tested was received in good condition.

5.8 Testing Algorithm:

EUT was set up to transmit a continuously modulated signal at 925 MHz using GFSK modulation with a data rate of 100kbps.

6 LIST OF MEASUREMENT INSTRUMENTATION

Equipment Type	Asset Number	Manufacturer	Model	Serial Number	Calibration Due Date
Shielded Chamber 2014	CL166-E	AlbatrossProjects	B83117-DF435-T261	US140023	2023-08-22
Shielded Chamber 2018	CL251-E-10m	AlbatrossProjects	US170028	B83117-FG639-T261	2023-08-22
Receiver	CL151	Rohde & Schwarz	ESU40	100319	2023-03-31
Receiver	CL204	Rohde & Schwarz	ESR7	101714	2023-03-30
Antenna, Bilog	CL211	Sunol Sciences, Inc.	JB1	A021017	2022-09-28
Active 18” Loop Antenna	CL163-Loop	A.H. Systems, Inc.	EHA-52B	100	2022-09-14
Pre-Amplifier	CL153	Agilent	83006-69007	MY57280115	2022-10-12
Pre-Amplifier	CL136	Hewlett Packard	8447E	1937A01894	2023-03-30
Horn Antenna	CL098	Emco	3115	9809-5580	2023-01-26
Temp/Hum. Recorder	CL293	Thermpro	TP50	1	2023-04-15
Temp/Hum. Recorder	CL294	Thermpro	TP50	2	2023-04-15
Software:	Tile Version 3.4.B.3.		Software Verified: 2022-08-22 to 2022-08-26		
Software:	EMC 32, Version 8.53.0		Software Verified: 2022-08-22 to 2022-08-26		
Software:	EMC 32, Version 10.60.20		Software Verified: 2022-08-22 to 2022-08-26		

7 FCC PART 15.215(e), OCCUPIED BANDWIDTH

7.1 Requirements:

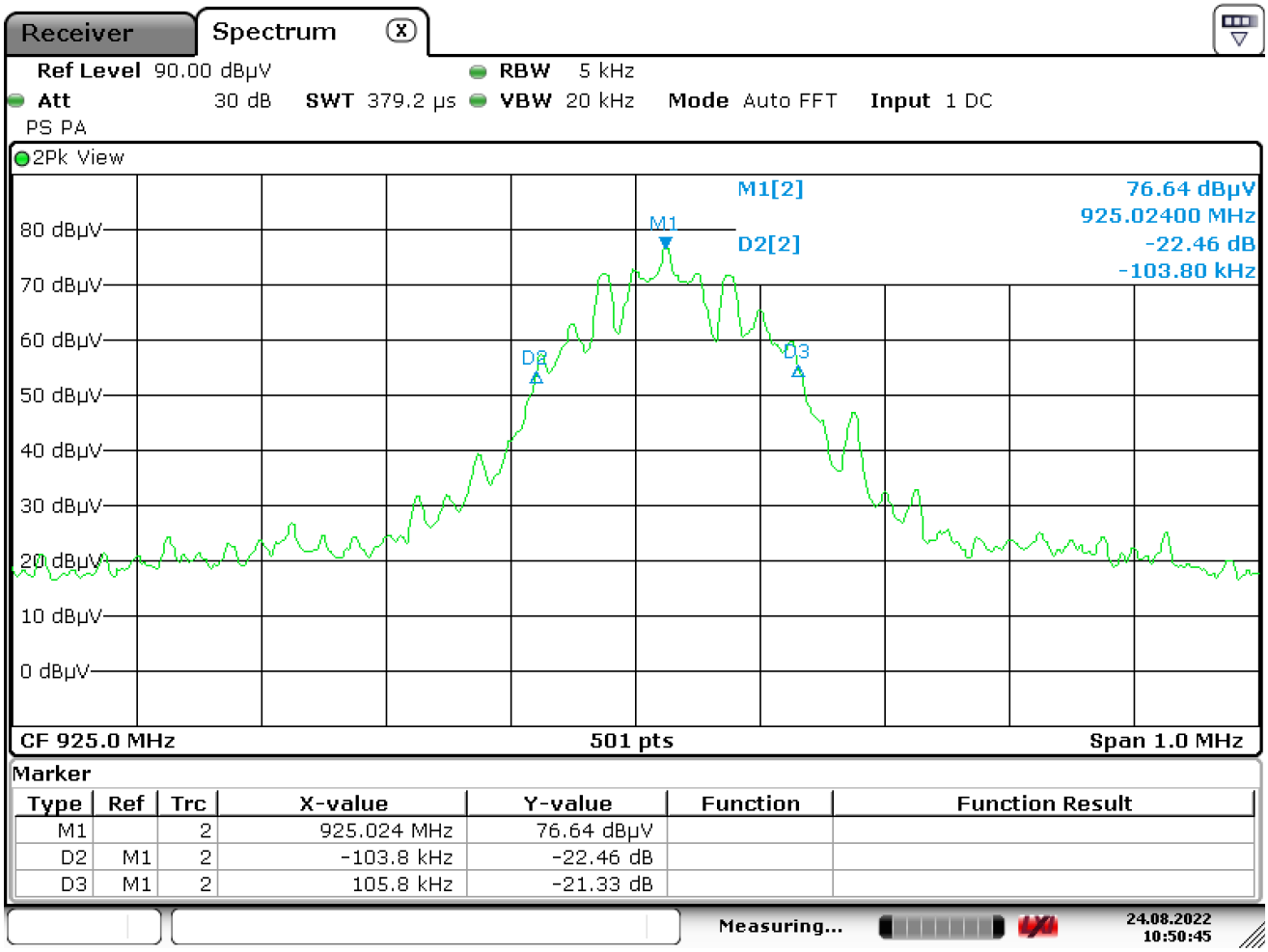
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the -20dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific 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 925 MHz. The bandwidth was measured using the analyzer's marker function.

7.2 Occupied Bandwidth Test Data

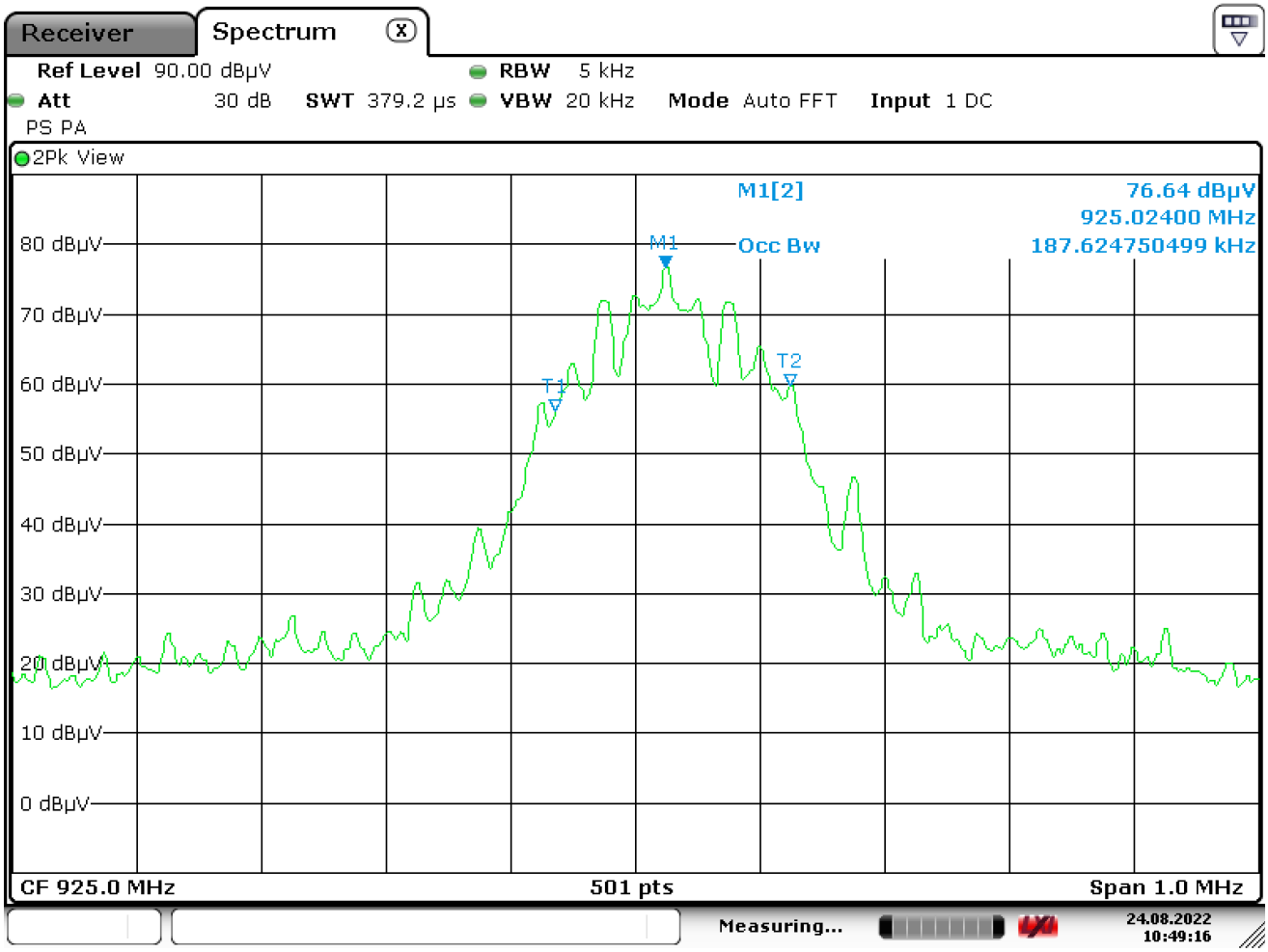
Test Date(s):	2022-08-24	Test Engineer(s):	J. Chiller
Standards:	CFR 47 Part 15.215(c)	Air Temperature:	22.2ºC
		Relative Humidity:	43%

-20dB



Date: 24.AUG.2022 10:50:45

99%



Date: 24.AUG.2022 10:49:15

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 50dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

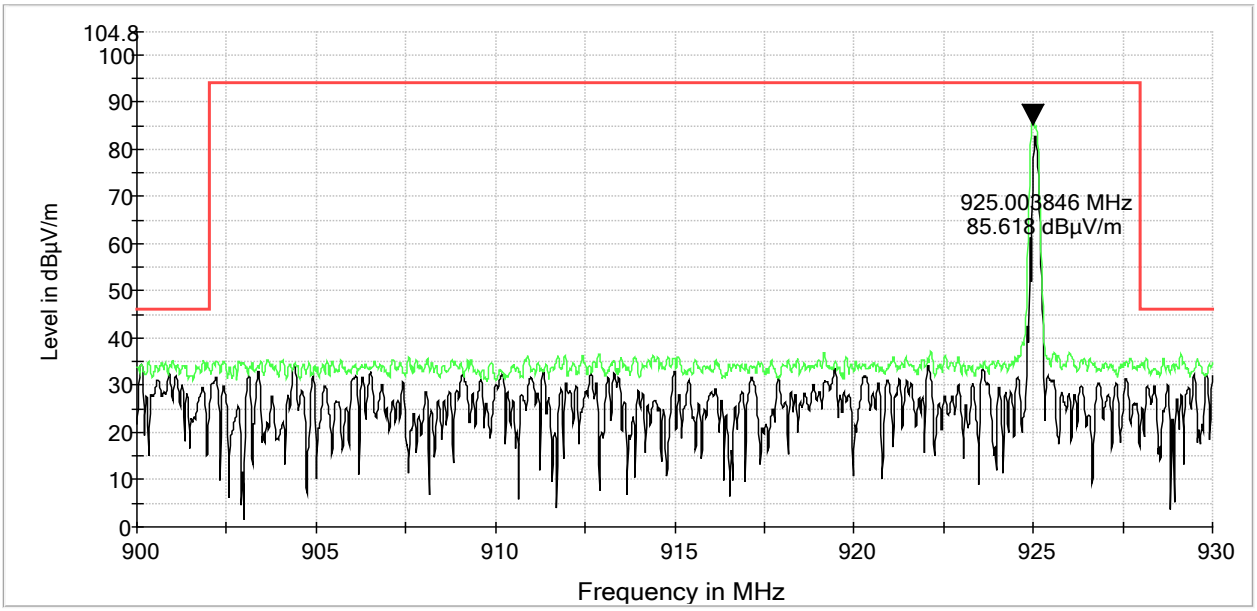
NOTE: During the pre-scan evaluation, the EUT was rotated in all possible directions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. The antenna was raised between 1 and 4 meters and the EUT turntable was rotated 360 degrees to maximize the emissions.

Power setting was set at -2dBm to meet Field Strength requirements.

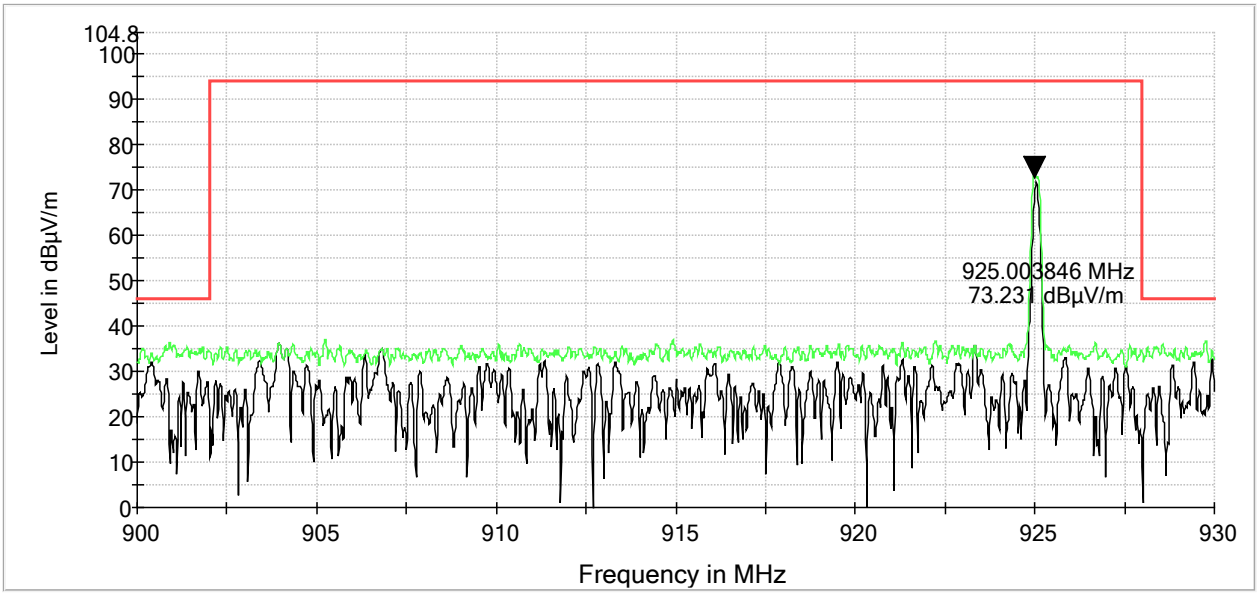
8.1 Test Data - Field Strength of Emissions from Intentional Radiators

Test Date(s):	2022-08-24	**Test Engineer(s):**	J. Chiller
Standards:	CFR 47 Part 15.249(a)	**Air Temperature:**	23.6ºC
		Relative Humidity:	40%

Band Edges: Vertical



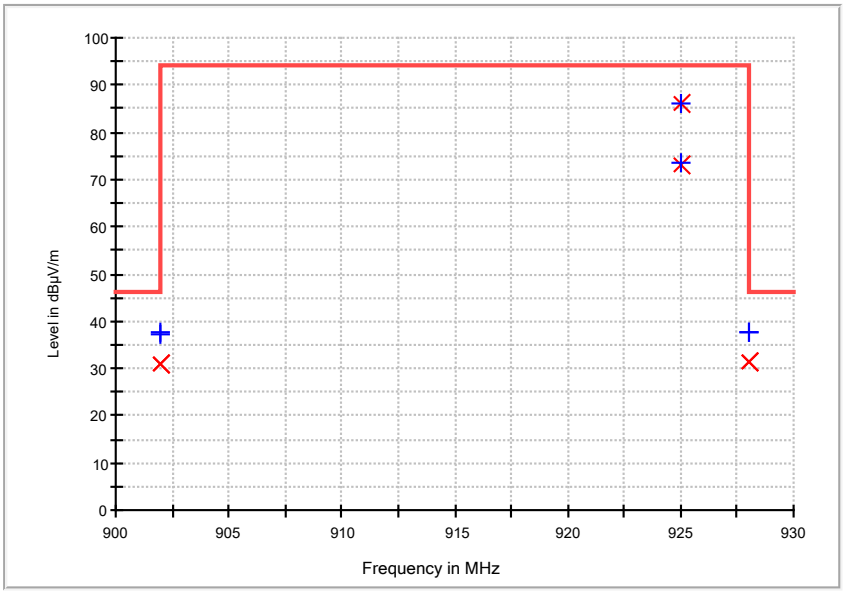
Band Edges: Horizontal



Band Edge and Field Strength of the Fundamentals

QP

Frequency (MHz)	Antenna Polarization	Bandwidth (kHz)	Antenna Height (cm)	Azimuth (deg)	Reading (dBµV)	Cable Loss & Antenna Factor (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
902.00	V	120.00	110.00	259.00	13.8	17.4	31.20	46.0	-14.8
902.00	H	120.00	110.00	354.00	13.7	17.4	31.10	46.0	-14.9
925.00	V	120.00	110.00	259.00	68.4	17.7	86.10	94.0	-7.9
925.00	H	120.00	110.00	354.00	55.6	17.7	73.30	94.0	-20.7
928.00	V	120.00	110.00	259.00	13.8	17.7	31.50	46.0	-14.5
928.00	H	120.00	110.00	354.00	13.7	17.7	31.40	46.0	-14.6



8.2 Test Data – Spurious Emissions

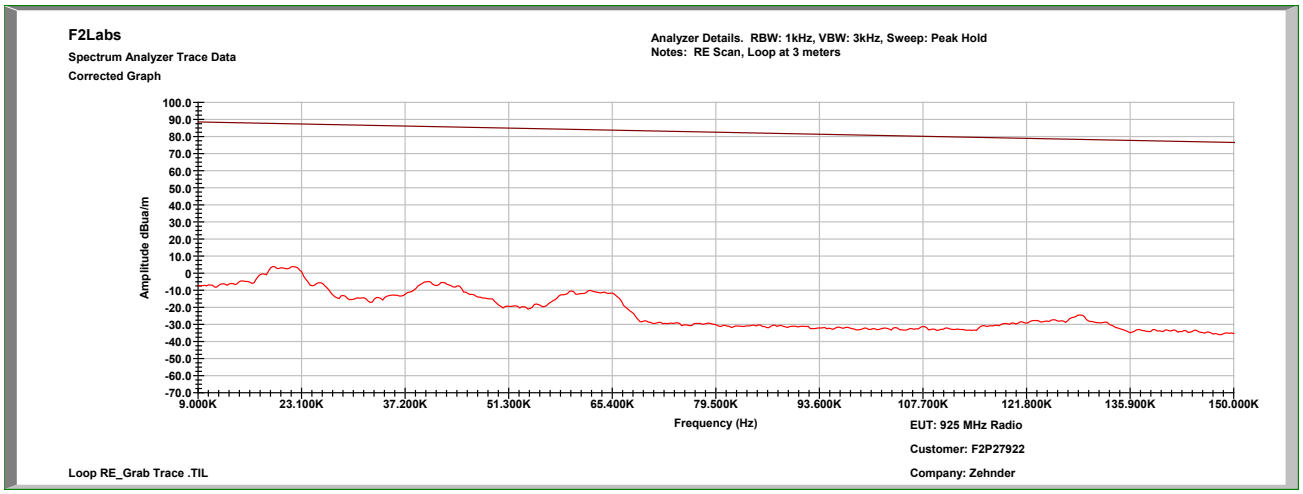
Notes: Plots are peak, max hold pre-scan data included only to determine what frequencies to investigate and measure. During the pre-scan evaluation, the EUT was rotated in all possible directions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. At some 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. 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 10 GHz and the highest emissions are listed below.

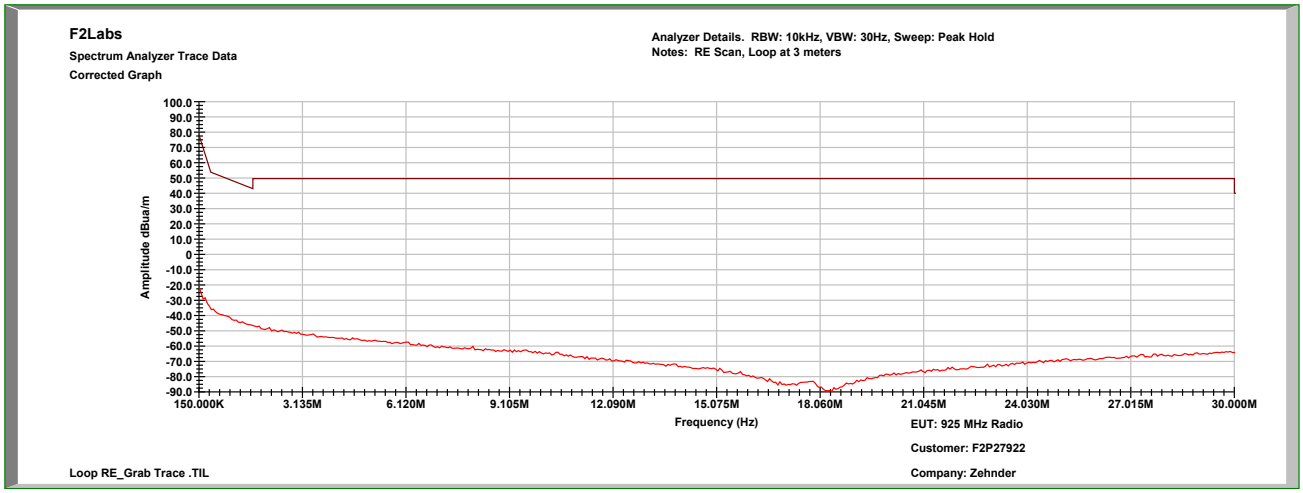
In the following plots, the black line indicates ambient noise and the red line indicates the measurement with the EUT on. Emissions to be found by the EUT were measured and listed in tables below.

Test Date(s):	2022-08-24	**Test Engineer(s):**	J. Chiller
Standards:	CFR 47 Part 15.249(d) / Part 15.209	**Air Temperature:**	23.6ºC
		Relative Humidity:	40

Characterization Scan, 9 kHz to 150 kHz

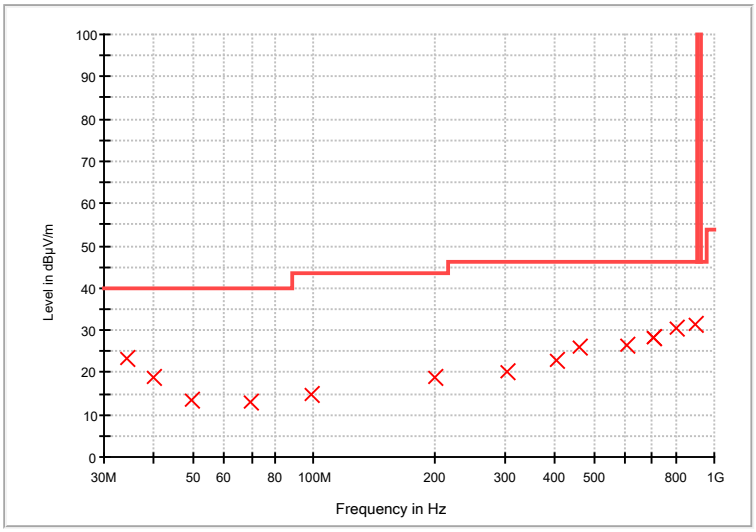


Characterization Scan, 150 kHz to 30 MHz

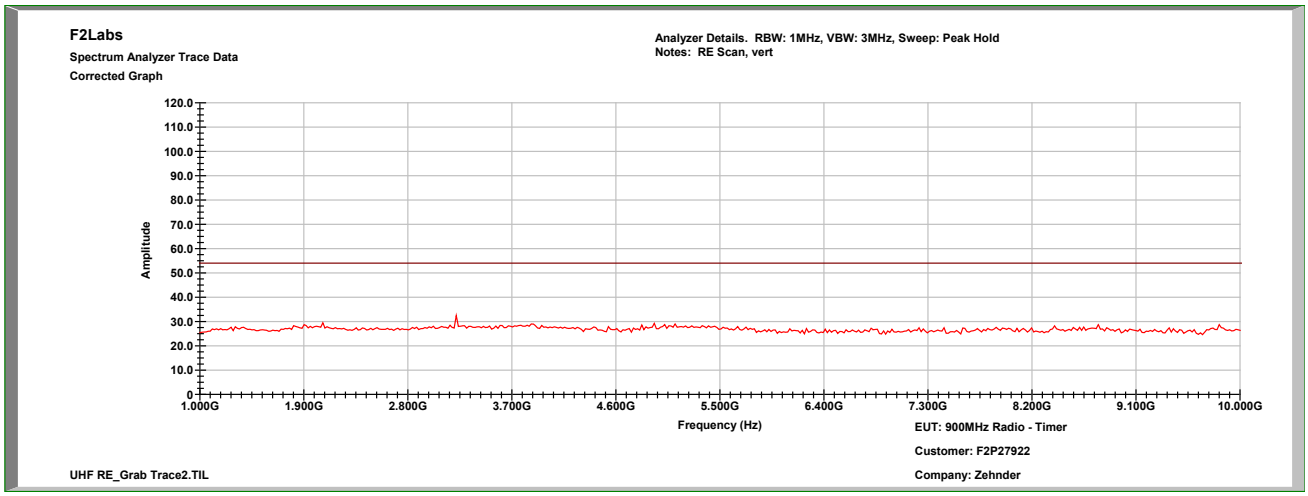


30 MHz to 1000 MHz

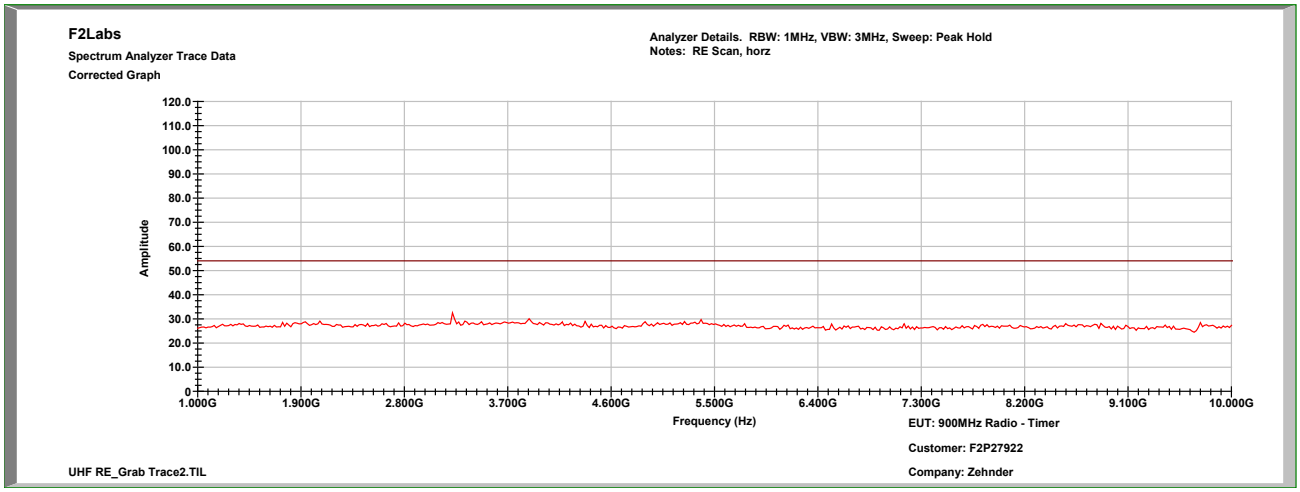
Frequency (MHz)	Ant. Pol.	Ant. Height (cm)	Azimuth (degrees)	Reading (dBµV)	Correction Factors (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
34.120000	V	100.00	0.00	14.1	9.0	23.10	40.0	-16.9
39.680000	H	100.00	0.00	14.2	4.9	19.10	40.0	-20.9
49.400000	V	100.00	0.00	14.4	-0.8	13.60	40.0	-26.4
69.920000	H	100.00	0.00	14.1	-1.0	13.10	40.0	-26.9
99.000000	V	100.00	0.00	13.9	0.8	14.70	43.5	-28.8
201.240000	H	100.00	0.00	14.1	4.6	18.70	43.5	-24.8
302.360000	V	100.00	0.00	14.4	5.6	20.00	46.0	-26.0
401.960000	H	100.00	0.00	14.6	8.2	22.80	46.0	-23.2
462.400000	V	100.00	4.00	16.4	9.8	26.20	46.0	-19.8
602.280000	H	100.00	0.00	14.7	11.9	26.60	46.0	-19.4
701.160000	V	100.00	254.00	14.6	13.7	28.30	46.0	-17.7
702.280000	H	100.00	0.00	14.5	13.7	28.20	46.0	-17.8
805.240000	H	100.00	0.00	14.5	16.0	30.50	46.0	-15.5
900.000000	V	100.00	340.00	13.9	17.3	31.20	46.0	-14.8



1 GHz to 10 GHz, Vertical

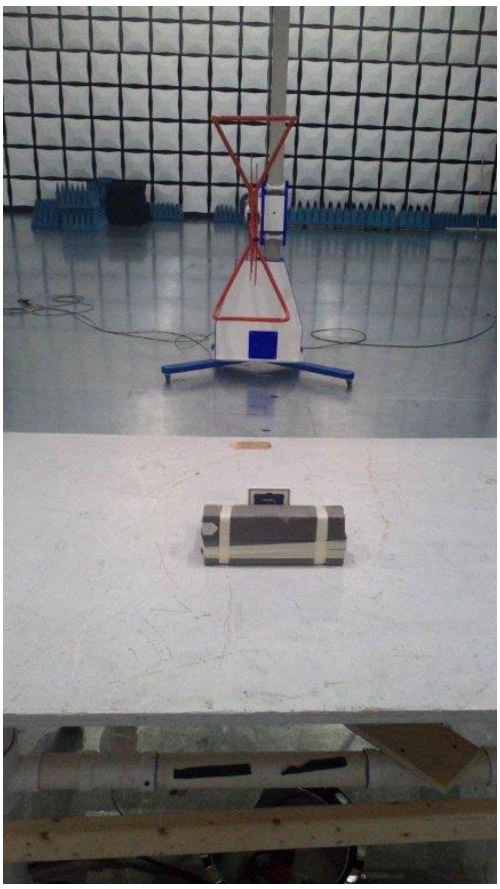


1 GHz to 10 GHz, Horizontal

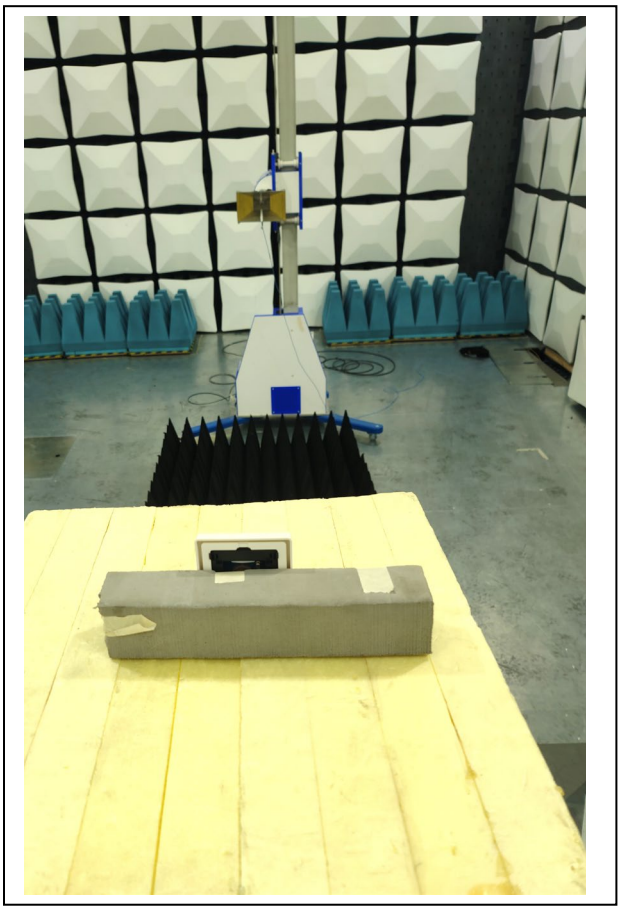


9 TEST SETUP PHOTOGRAPHS

OBW, Field Strength,
Radiated Spurious Emissions Less Than 1 GHz



Radiated Spurious Emissions Greater than 1 GHz



Loop Antenna