



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

RADIATED SPURIOUS EMISSIONS TEST REPORT

Manufacturer: Traffic and Parking Control Co., Inc.
5100 W Brown Deer Road
Brown Deer, WI 53223

Applicant: Same as Above

Product Name: Radio 136377

Product Description: Transceiver capable of 1W conducted output power in the 902-928 MHz ISM band.

Model: Radio 136377

FCC ID: 2ANWN-02ANWN

Testing Commenced: 2022-09-16

Testing Ended: 2022-09-17

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 15.247**
- **ANSI C63.10:2020**



Evaluation Conducted by:

Michael Toth, Senior EMC Engineer

Report Reviewed by:

Ken Littell, Vice President of EMC

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

This test report may be reproduced in full; partial reproduction only may be made with the written consent of F2 Labs. The results in this report apply only to the equipment tested.



TABLE OF CONTENTS

Section	Title	Page
1	ADMINISTRATIVE INFORMATION	4
2	SUMMARY OF TEST RESULTS/MODIFICATIONS	5
3	ENGINEERING STATEMENT	6
4	EUT INFORMATION AND DATA	7
5	LIST OF MEASUREMENT INSTRUMENTATION	8
6	RADIATED SPURIOUS EMISSIONS	9
7	PHOTOGRAPHS – TEST SETUP	19



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 DTS operating under Section 15.247 and in KDB558074. 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. Note: Only measurements listed below which relate to tests included in this Test Report are applicable to it.

Measurement Range	Expanded Uncertainty	Combined Uncertainty
Radiated Emissions <1 GHz @ 3m	$\pm 5.07\text{dB}$	± 2.54
Radiated Emissions <1 GHz @10m	$\pm 5.09\text{dB}$	± 2.55
Radiated Emissions 1 GHz to 2.7 GHz	$\pm 3.62\text{dB}$	± 1.81
Radiated Emissions 2.7 GHz to 18 GHz	$\pm 3.10\text{dB}$	± 1.55
AC Power Line Conducted Emissions, 150kHz to 30 MHz	$\pm 2.76\text{dB}$	± 1.38

This Uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

1.4 Document History

Document Number	Description	Issue Date	Approved By
F2P28572-01E	First Issue	2022-10-07	K. Littell



2 SUMMARY OF TEST RESULTS

Test Name	Standard(s)	Results
Radiated Spurious Emission	CFR 47 Part 15.247(d) / Part 15.209 / KDB558074 / ANSI C63.10	Complies

Modifications Made to the Equipment
None



3 ENGINEERING STATEMENT

This report has been prepared on behalf of Traffic and Parking Control Co., Inc. to provide documentation for the testing described herein. This equipment has been tested and found to comply with Part 15.247 of the FCC Rules using ANSI C63.10 and KDB558074 standards. The test results found in this test report relate only to the items tested.



4 EUT INFORMATION AND DATA

4.1 Equipment Under Test:

Product: **Transceiver**

Model: **Radio 136377**

Serial No.: **0811-c**

Firmware: **v06.03.000**

FCC ID: **2ANWN-02ANWN**

4.2 Trade Name:

Traffic and Parking Control Co., Inc.

4.3 Power Supply:

BK Precision 1685B

4.4 Applicable Rules:

CFR 47, Part 15.247, subpart C

4.5 Equipment Category:

Radio Transmitter-FHSS

4.6 Antenna:

WPANT30026-SE Omni Directional, 4dBi Gain

4.7 Accessories:

N/A

4.8 Test Item Condition:

The equipment to be tested was received in good condition.

4.9 Testing Algorithm:

EUT was powered on and transmitting radio frequencies between 902-928 MHz. The EUT was set on the highest power setting using a data rate of 234k Baud and set to transmit at > 98% Duty Cycle. The highest emissions were recorded in the data tables.

**5 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	2023-08-22
Receiver	CL151	Rohde & Schwarz	ESU40	100319	2023-03-31
Antenna, Bilog	CL211	Sunol Sciences, Inc.	JB1	A021017	2022-09-28
Low Loss Cable Set	--	Pasternack	PE3C0666-252 / PE3C066-50CM	None Spec.	2023-10-12
Pre-Amplifier	CL153	Keysight Tech.	83006A	MY39500791	2022-10-12
Pre-Amplifier	CL285	Com-Power	PAM-0207	322	2023-03-30
Antenna, Horn	CL098	Emco	3115	9809-5580	2023-01-26
18" Active Loop	CL194	AH Systems, Inc.	SAS-562B	281	2022-11-30
Software:	Tile Version 3.4.B.3		Software Verified: 2022-09-16 to 2022-09-17		
Software:	EMC 32, Version 8.53.0		Software Verified: 2022-09-16 to 2022-09-17		
Temp/Hum. Recorder	CL293	Thermpro	TP50	1	2023-04-15



6 RADIATED SPURIOUS EMISSION

Radiated emissions were measured in a Semi-Anechoic Chamber. All generated emissions that fall in the restricted bands per FCC Part 15.205 were examined.

6.1 Requirements:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30dB instead of 20dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).



6.2 Radiated Spurious Emission Test Data

Test Date(s):	2022-09-16	Test Engineer:	M. Toth
Standards:	CFR 47 Part 15.247(d); Part 15.209 / KDB558074	Air Temperature:	21.1°C
		Relative Humidity:	51%

Notes: Plots are peak, max hold prescan data included only to determine what frequencies to investigate and measure. The EUT was initially placed in a semi-anechoic chamber and rotated in all three orthogonal positions to maximize the emissions. Characterization measurements were then performed to determine at which frequencies significant emissions occurred. These graphs are shown below.

The equipment was fully exercised with all cabling attached to the EUT. While the equipment was energized, the receiving antenna was scanned from 1.0 meter to 4.0 meters in both vertical and horizontal polarities while the turntable was adjusted 360 degrees to determine the maximum field strength. The tables of measured results can be found below.

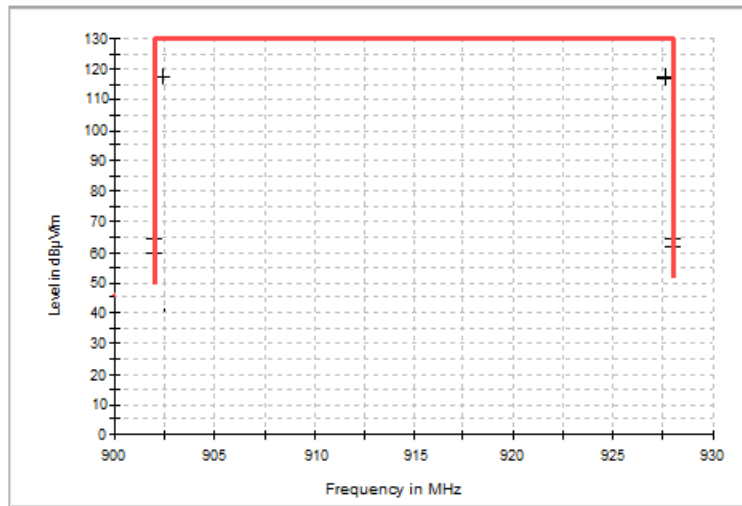
Some of the frequencies did not change with the EUT on or off. At those frequencies, the test distance was shortened to 1 meter and still no emissions from the EUT were visible or over the ambient or limit.

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. The plots are for reference only and the limit lines are not actual limit lines but merely a guide.

Note: Antenna connector on the PCB is a U.FL connector. There is an internal U.FL to RPSMA connected and going to the antenna.

**902 to 928 MHz Radiated Band Edges**

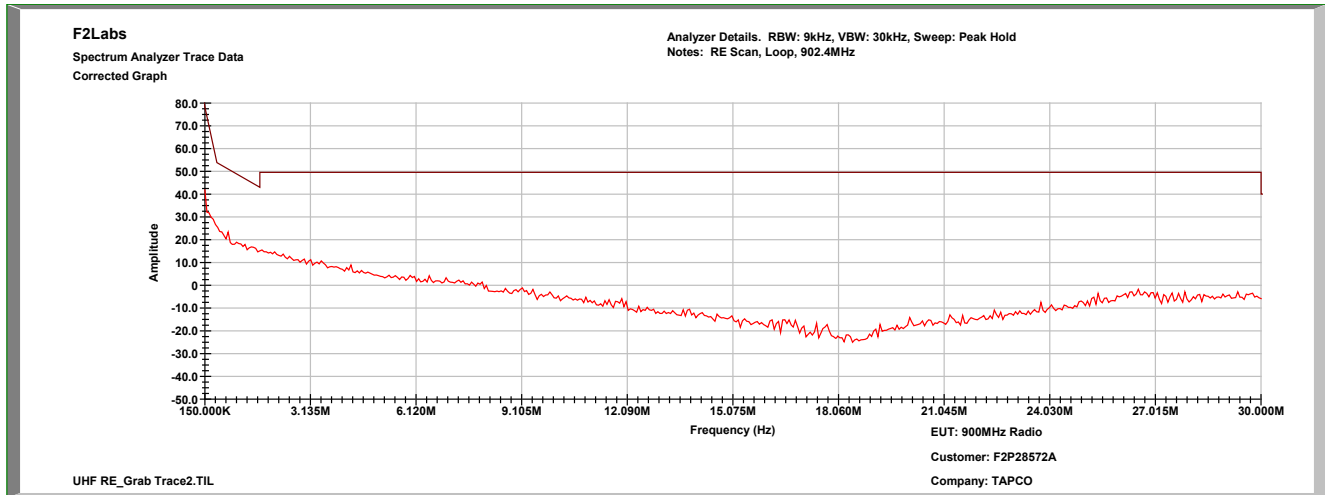
Frequency (MHz)	QuasiPeak (dBμV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit
902.000000	64.1	120.000	140.0	H	20.0	4.4	53.4	>20dB
902.000000	59.9	120.000	100.0	V	0.0	4.4	57.9	>20dB
902.400000	117.5	120.000	140.0	H	20.0	4.4	-----	-----
902.400000	117.8	120.000	140.0	V	0.0	4.4	-----	-----
927.600000	117.4	120.000	140.0	H	0.0	4.9	-----	-----
927.600000	116.9	120.000	125.0	V	340.0	4.9	-----	-----
928.000000	64.3	120.000	140.0	H	260.0	4.9	53.1	>20dB
928.000000	61.6	120.000	140.0	V	20.0	4.9	55.3	>20dB



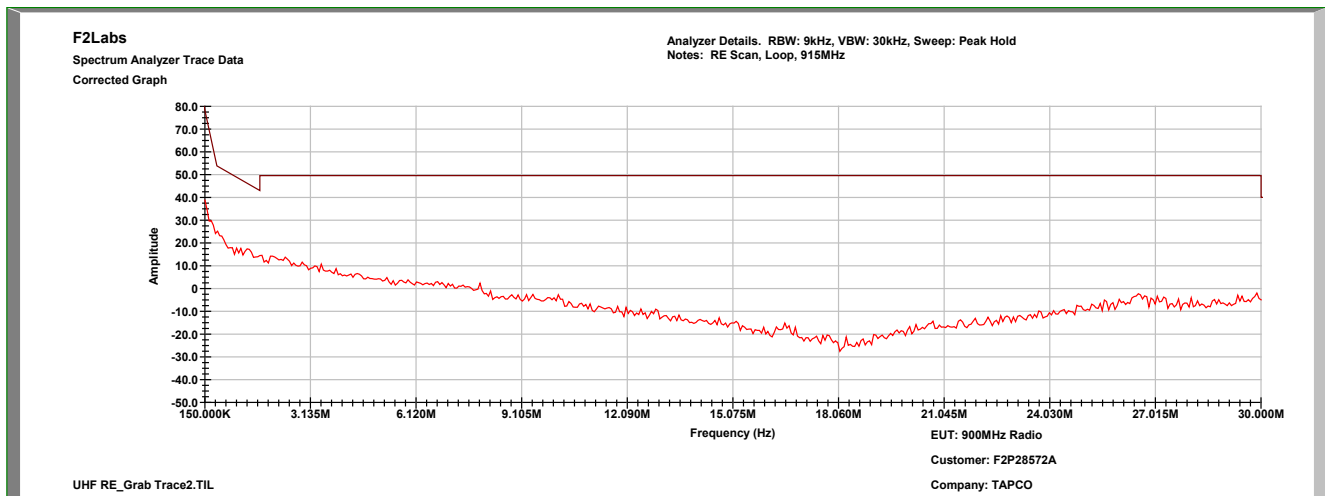
Note: Band edge measurements are more than 20dB down from fundamental.



Low Channel: Characterization Scan, 0.15 MHz to 30 MHz

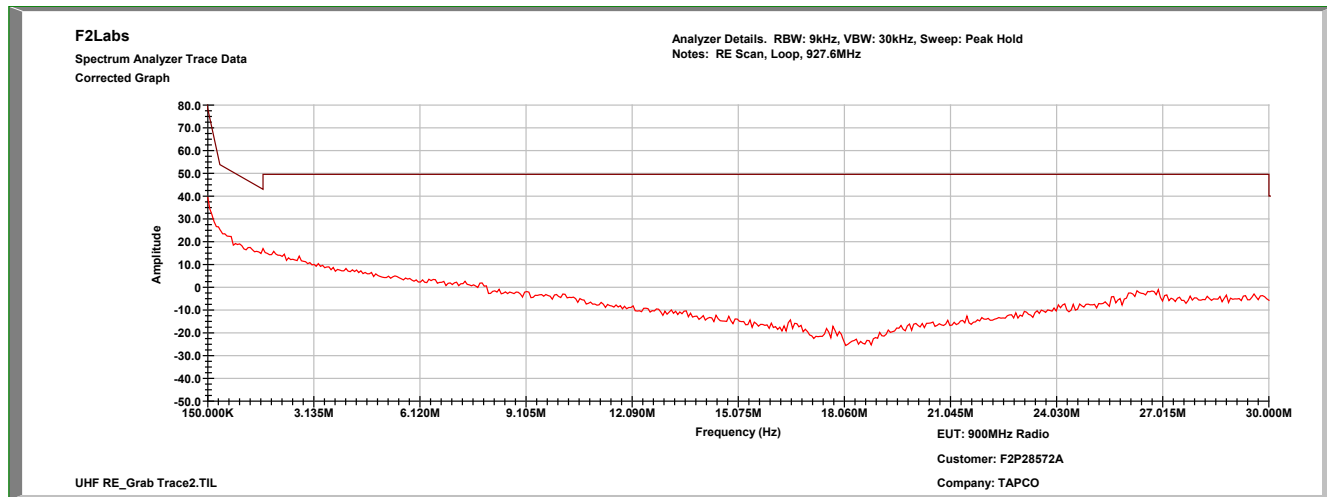


Mid Channel: Characterization Scan, 0.15 MHz to 30 MHz





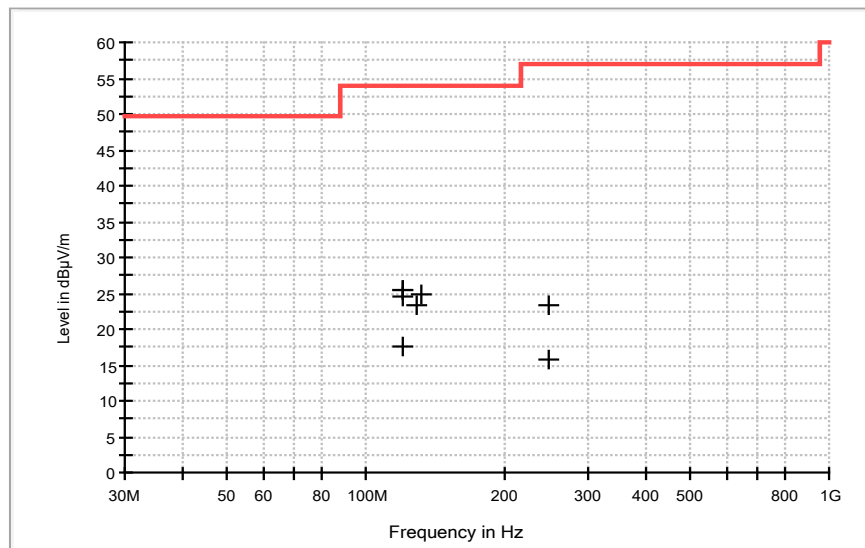
High Channel: Characterization Scan, 0.15 MHz to 30 MHz





All Channels - QuasiPeak

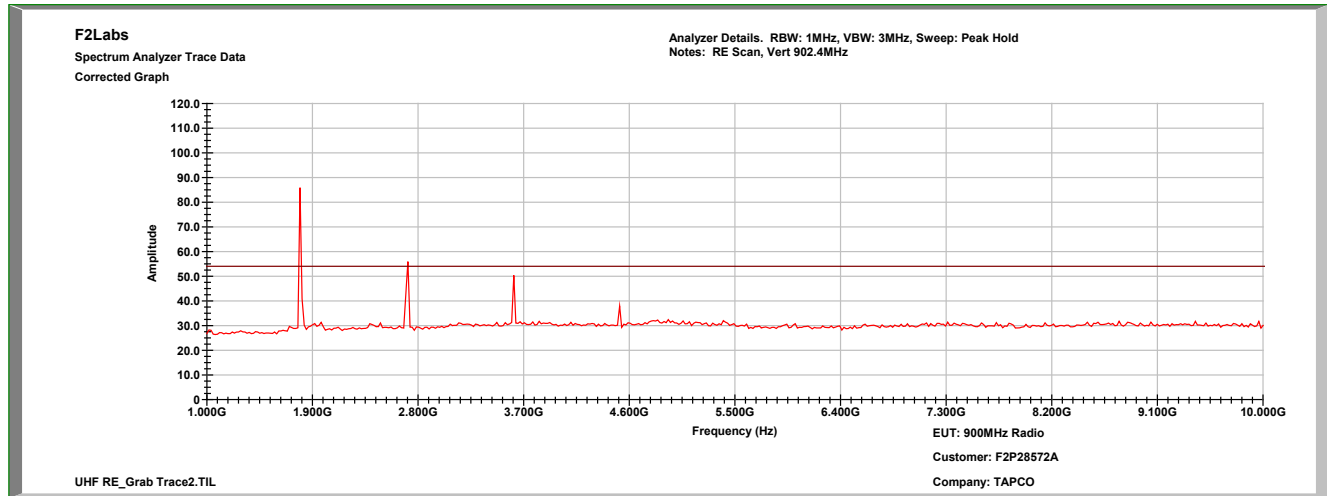
Frequency (MHz)	Antenna Polarization	Reading (dBμV)	Cable Loss & Antenna Factor (dB)	Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
119.820000	H	26.2	-8.5	17.70	54.0	-36.3
120.020000	V	34.0	-8.5	25.50	54.0	-28.5
120.020000	V	34.0	-8.5	25.50	54.0	-28.5
120.020000	H	33.1	-8.5	24.60	54.0	-29.4
127.970000	H	31.6	-8.3	23.30	54.0	-30.7
131.660000	V	33.0	-8.3	24.70	54.0	-29.3
247.860000	H	25.2	-9.5	15.70	56.9	-41.2
248.060000	H	32.9	-9.5	23.40	56.9	-33.5



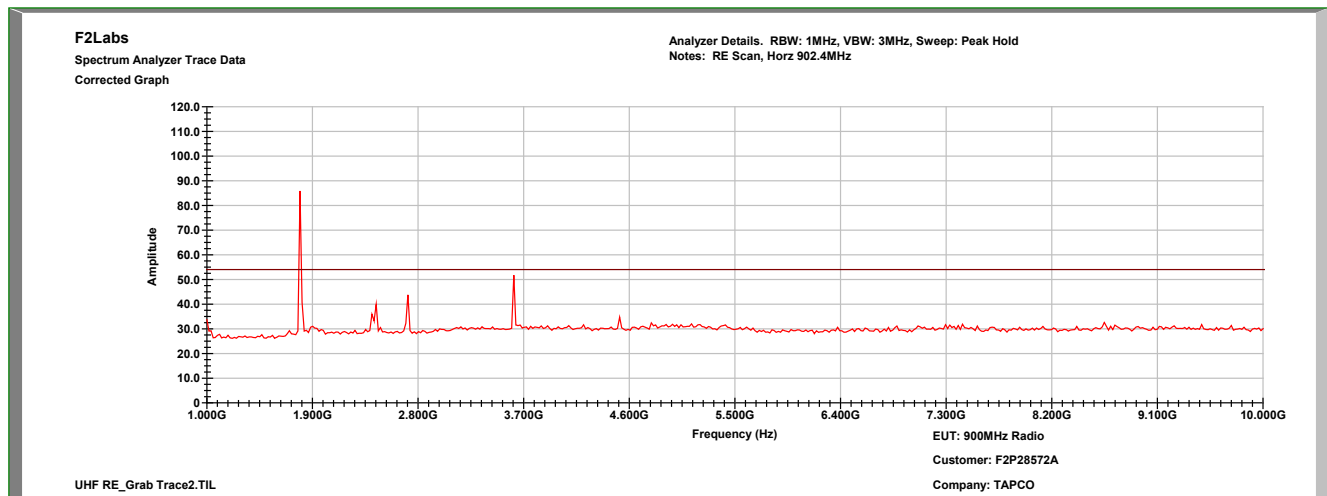


Note: In the following graph(s), the 1.8 GHz is a harmonic of the fundamental, but was not measured because it is not in the restricted band.

Low Channel: Characterization Scan, 1 GHz to 10 GHz, Vertical

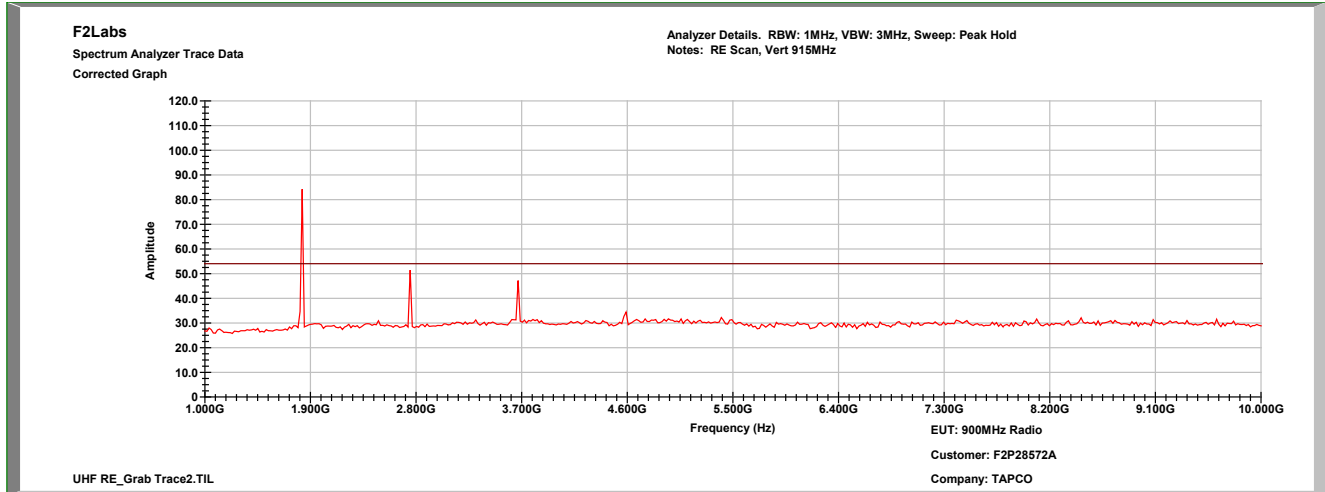


Low Channel: Characterization Scan, 1 GHz to 10 GHz, Horizontal

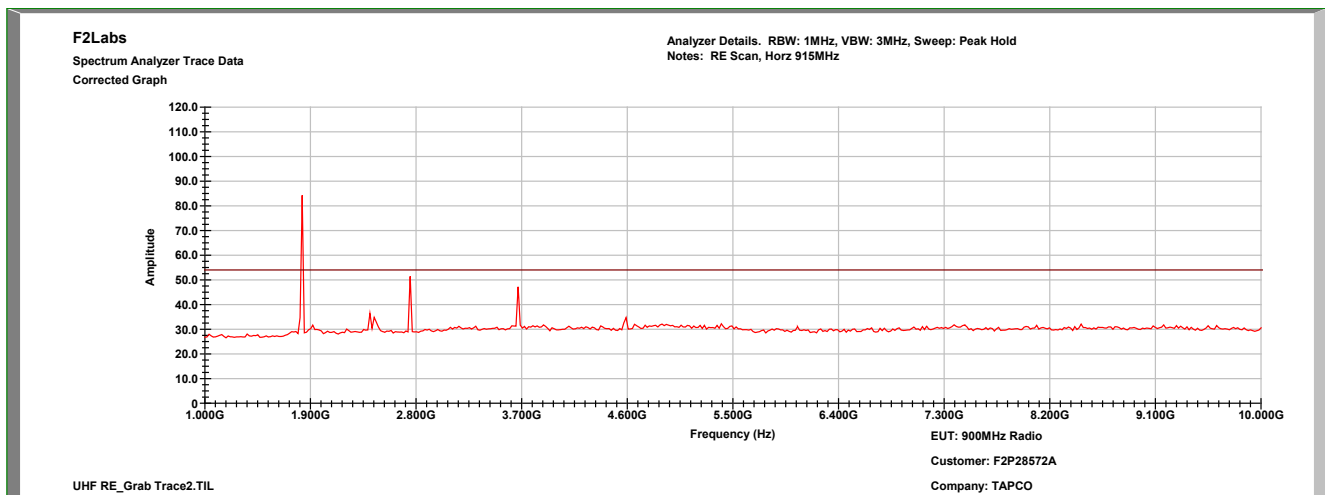




Mid Channel: Characterization Scan, 1 GHz to 10 GHz, Vertical

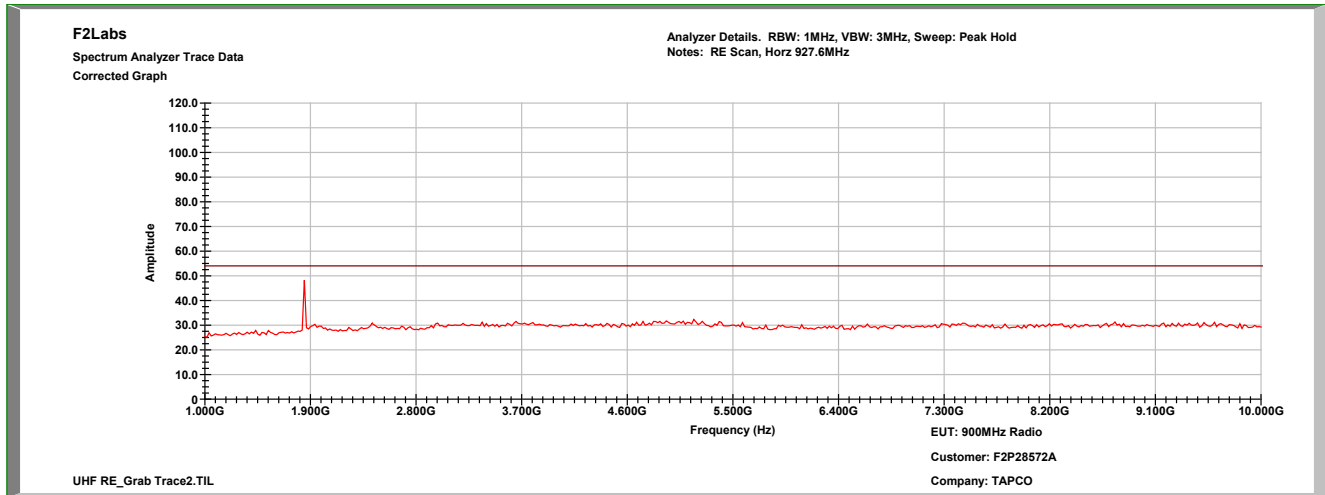


Mid Channel: Characterization Scan, 1 GHz to 10 GHz, Horizontal

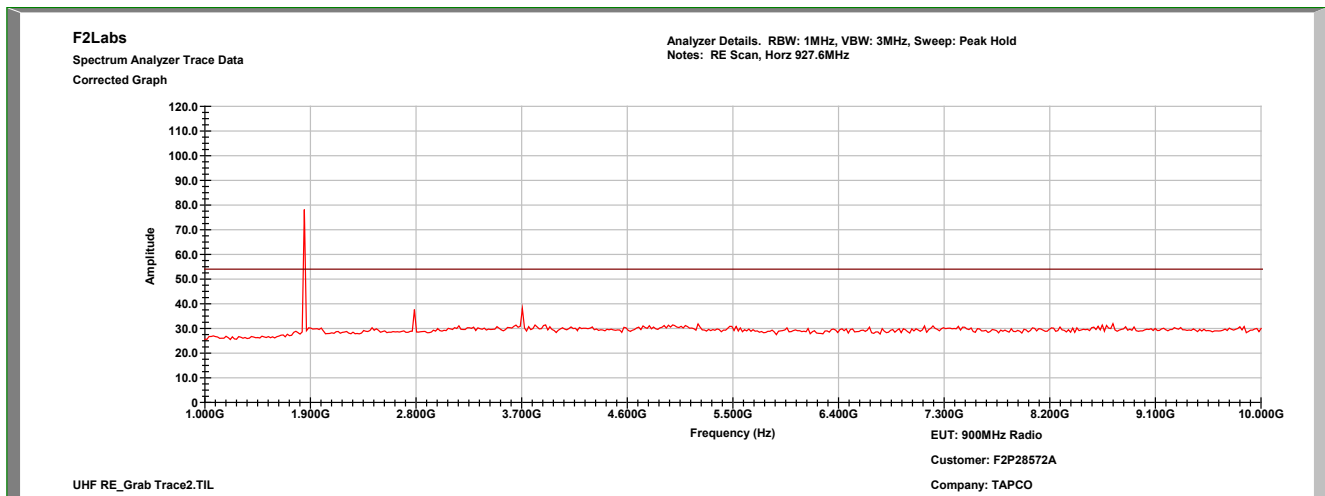




High Channel: Characterization Scan, 1 GHz to 10 GHz, Vertical

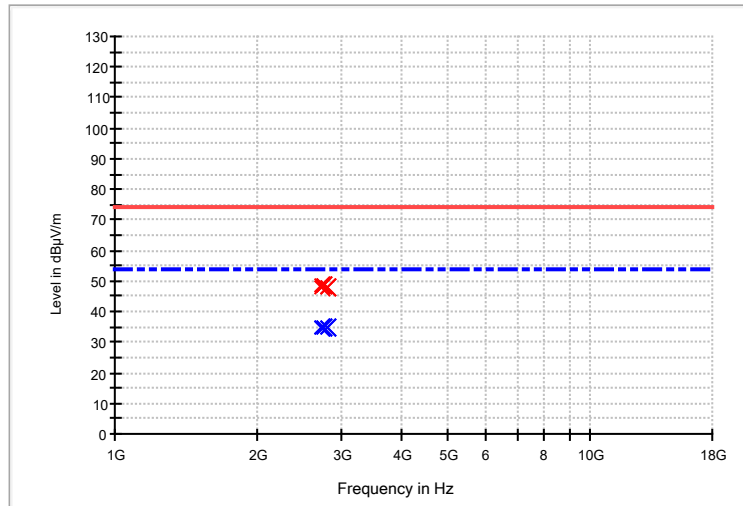


High Low Channel: Characterization Scan, 1 GHz to 10 GHz, Horizontal





Measurements

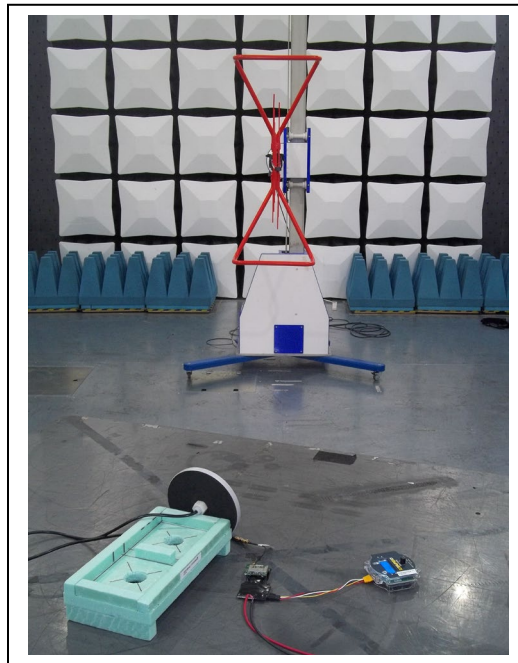


Frequency (MHz)	AVG Reading (dBμV/m)	Bandwidth (kHz)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBμV/m)
2707.000000	35.0	1000.000	H	0.0	11.4	19.0	54.0
2707.200000	34.9	1000.000	V	0.0	11.4	19.1	54.0
2745.000000	35.0	1000.000	V	0.0	11.4	19.0	54.0
2745.000000	34.9	1000.000	H	0.0	11.4	19.1	54.0
2782.800000	35.0	1000.000	H	0.0	11.4	19.0	54.0
2782.800000	35.0	1000.000	V	0.0	11.4	19.0	54.0

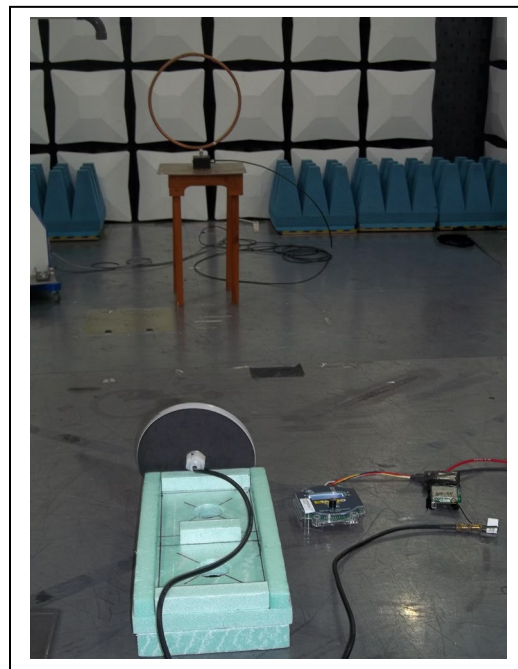


7 PHOTOGRAPHS – TEST SETUP

Radiated Spurious Emissions: 0.15 MHz to 30 MHz



Radiated Spurious Emissions: 30 MHz to 1000 MHz





Radiated Spurious Emissions: 1 GHz to 10 GHz

