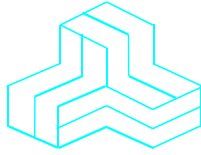


# ENGINEERING TEST REPORT



**Wireless Emergency Stop**

**Model: WES-001-901**

**FCC ID: 2A818-1000350**

*Applicant:*

**Fort Robotics Inc.**

1608 Walnut Street Floor 12

Philadelphia, PA 19103

USA

*In Accordance With*

**Federal Communications Commission (FCC)**

**Part 15, Subpart C, Section 15.247 Frequency Hopping Spread Spectrum (FHSS)**

**UltraTech's File No.: 23FORT003\_F15C247DSS**

This Test report is Issued under the Authority of  
Tri M. Luu  
Vice President of Engineering  
UltraTech Group of Labs

Date: April 19, 2023

Report Prepared by: Dan Huynh

Tested by: Angus Au

Test Dates:

January 26, 2023

February 1-3, 2023

March 3, 21 & 23, 2023

Issued Date: April 19, 2023

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by any agency of the US Government.*
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## UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4

Tel.: (905) 829-1570 Fax.: (905) 829-8050

Website: [www.ultratech-labs.com](http://www.ultratech-labs.com), Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Email: [tri@ultratech-labs.com](mailto:tri@ultratech-labs.com)



APEC TEL CA0001



1309



CA0001-2049



AT-1945



SL2-IN-E-1119R



Korea KCC-RRA

CA0001

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## EXHIBIT 1. INTRODUCTION

### 1.1. SCOPE

<b>Reference:</b>	FCC Part 15, Subpart C, Section 15.247
<b>Title:</b>	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 15
<b>Purpose of Test:</b>	Class II Permissive Change Equipment Authorization Certification for Integration of a Certified Radio Module into a new Portable Host Product (Wireless Emergency Stop)
<b>Test Procedures:</b>	<ul style="list-style-type: none"><li>▪ ANSI C63.4</li><li>▪ ANSI C63.10</li></ul>
<b>Environmental Classification:</b>	<input checked="" type="checkbox"/> Commercial, industrial or business environment <input type="checkbox"/> Residential environment

### 1.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

### 1.3. NORMATIVE REFERENCES

Publication	Year	Title
47 CFR Parts 0-19	2023	Code of Federal Regulations (CFR), Title 47 – Telecommunication
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 Procedures for Compliance Testing of Unlicensed Wireless Devices

## EXHIBIT 2. PERFORMANCE ASSESSMENT

### 2.1. CLIENT INFORMATION

Applicant	
<b>Name:</b>	Fort Robotics Inc.
<b>Address:</b>	1608 Walnut Street Floor 12 Philadelphia, PA 19103 USA

Manufacturer	
<b>Name:</b>	Fort Robotics Inc.
<b>Address:</b>	1608 Walnut Street Floor 12 Philadelphia, PA 19103 USA

### 2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

<b>Brand Name:</b>	Fort Robotics Inc.
<b>Product Name:</b>	Wireless Emergency Stop
<b>Model Name or Number:</b>	WES-001-901
<b>Serial Number:</b>	Test Sample
<b>Type of Equipment:</b>	Spread Spectrum Transmitter
<b>Input Power Supply Type:</b>	Battery
<b>Primary User Functions of EUT:</b>	Wireless Emergency Stop (WES) is a handheld remote emergency stop to enable the safe operation of remote and automated systems.

## 2.3. EUT'S TECHNICAL SPECIFICATIONS

Transmitter	
Equipment Type:	Portable
Intended Operating Environment:	Commercial, industrial or business environment
Power Supply Requirement:	5 VDC, Battery
RF Output Power Rating:	10 dBm to 30 dBm
Operating Frequency Range:	902.4 – 927.6 MHz at 230400 kbps data rate
RF Output Impedance:	50 $\Omega$
Duty Cycle:	Continuous
Modulation Type:	GFSK
Antenna Connector Type:	RP-SMA

## 2.4. ASSOCIATED ANTENNA DESCRIPTIONS

1. Linx Technologies Inc ¼ wave whip, straight antenna, model: ANT-868-CW-QW, 1.6 dBi peak gain.

## 2.5. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	Antenna	1	RP-SMA	Direct Connection
2	USB mini	1	USB mini socket	Shielded

## 2.6. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

EDACPOWER ELEC. AC Adaptor, Model EA1012AHUU-050, S/N 205000425

## EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

### 3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power Input Source:	5 VDC

### 3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

<b>Operating Modes:</b>	<ul style="list-style-type: none"><li>Each of lowest, middle and highest channel frequencies transmits continuously for emissions measurements.</li><li>The EUT operates in normal Frequency Hopping mode/Single Channel mode for applicable tests.</li></ul>
<b>Special Test Software &amp; Hardware:</b>	Special software provided by the Applicant is installed to allow the EUT to operate in hopping mode or at each channel frequency continuously. For example, the transmitter will be operated at each of lowest, middle and highest frequencies individually continuously during testing.
<b>Transmitter Test Antenna:</b>	The EUT is tested with the antenna fitted in a manner typical of normal intended use as a non-integral antenna equipment as described with the test results.

Transmitter Test Signals	
<b>Frequency Band(s):</b>	902.40 - 927.60 MHz
<b>Frequency(ies) Tested:</b> (Near lowest, near middle & near highest frequencies in the frequency range of operation.)	902.40 MHz, 914.625 MHz and 927.60 MHz
<b>RF Power Output:</b> (measured maximum output power at antenna terminals)	1 Watt (conducted)
<b>Normal Test Modulation:</b>	GFSK
<b>Modulating Signal Source:</b>	Internal

## EXHIBIT 4. SUMMARY OF TEST RESULTS

### 4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).
- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with ANAB File No.: AT-1945.

### 4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Compliance (Yes/No)
15.203	Antenna requirements	Yes
15.207(a)	AC Power Line Conducted Emissions	N/A
15.247(a)	Provisions for Frequency Hopping Systems	N/A
15.247(b)(1)	Peak Conducted Output Power	Yes
15.247(d)	Band-Edge and RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	N/A
15.247(d), 15.209 & 15.205	Transmitter Spurious Radiated Emissions	Yes
15.247(i), 1.1307, 1.1310, 2.1091 & 2.1093,	RF Exposure	Yes*

\*Refer to SAR test report

### 4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

## EXHIBIT 5. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

### 5.1. PEAK CONDUCTED OUTPUT POWER [§ 15.247(b)(2)]

#### 5.1.1. Limits

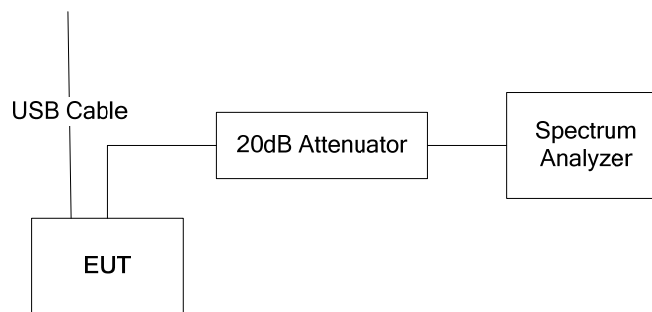
**§15.247(b)(2):** For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

**§15.247(b)(4):** The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### 5.1.2. Method of Measurements

ANSI C63.10.

#### 5.1.3. Test Arrangement





#### 5.1.4. Test Data

Maximum Peak Conducted Output Power for High and Low Power Settings

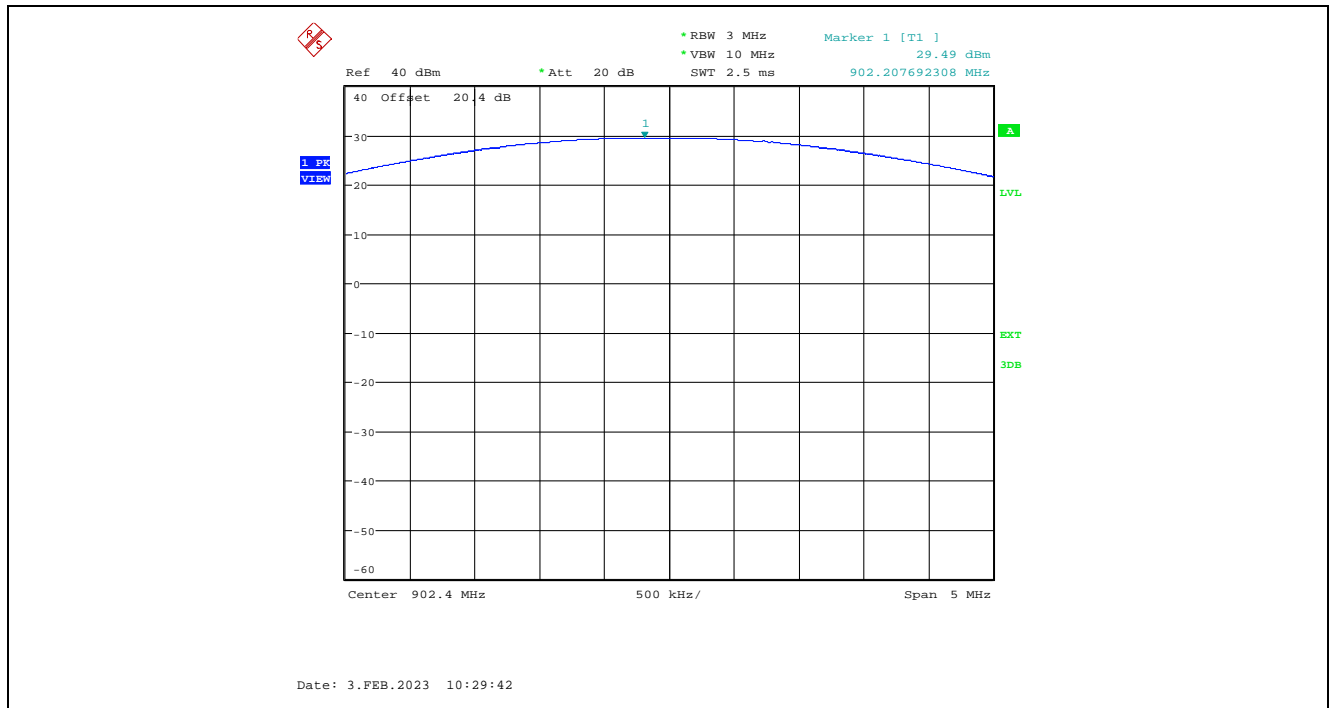
Operating Power Setting	Data Rate (kbps)	Frequency (MHz)	Maximum Peak Output Power at Antenna Terminal (dBm)	Peak Conducted Output Power Limit (dBm)
High Power (30 dBm)	230400	902.4	29.49	30
		914.625	29.48	30
		927.6	29.55	30

Maximum Peak Conducted Output Power and EIRP for 1.6 dBi ¼ Wave Whip, Straight Antenna

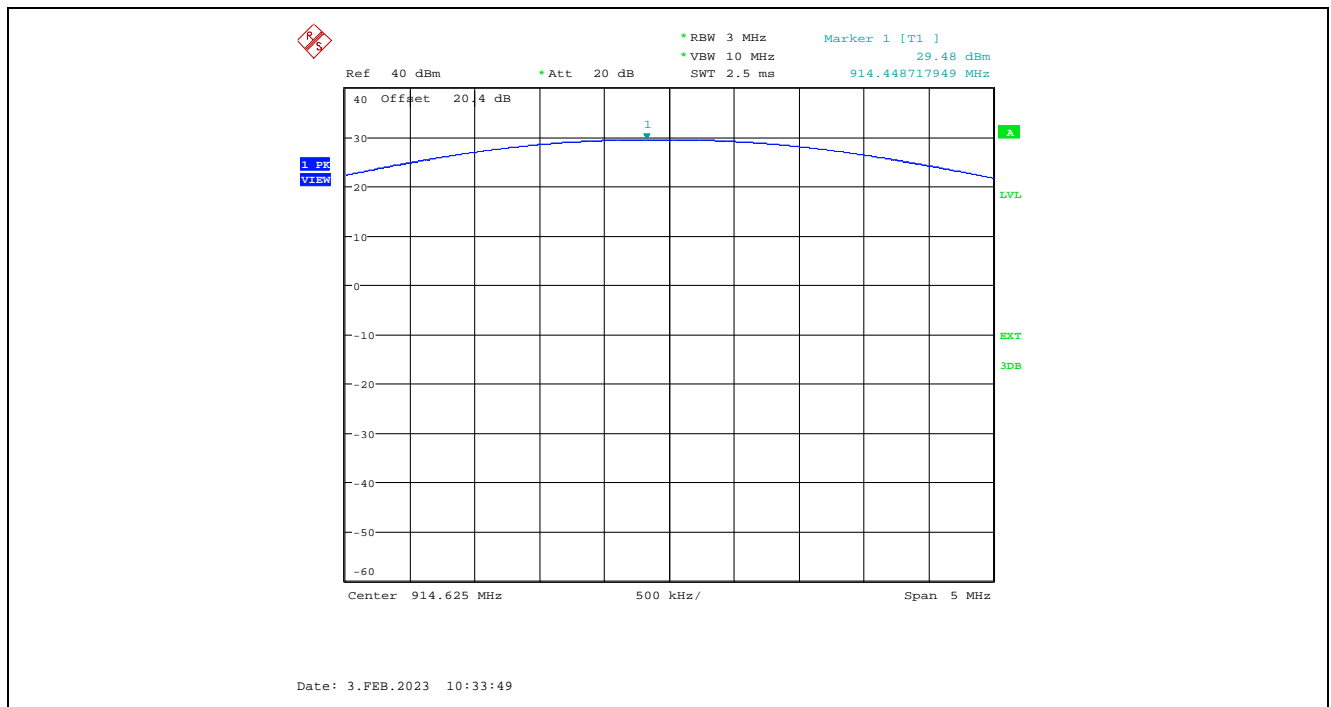
Operating Power Setting (dBm)	Data Rate (kbps)	Frequency (MHz)	Maximum Peak Output Power at Antenna Terminal (dBm)	*Calculated EIRP (dBm)	Limit (dBm)	
					Peak Conducted Output Power	EIRP
30	230400	902.4	29.49	31.09	30	36
		914.625	29.48	31.08	30	36
		927.6	29.55	31.15	30	36

\* The EIRP shall be calculated based on the transmitter antenna gain ( $G_{dBi}$ ), cable loss ( $CL_{dB}$ ) and peak output power at antenna terminal ( $P_{dBm}$ ). Calculated EIRP =  $P_{dBm} + G_{dBi} - CL_{dB}$

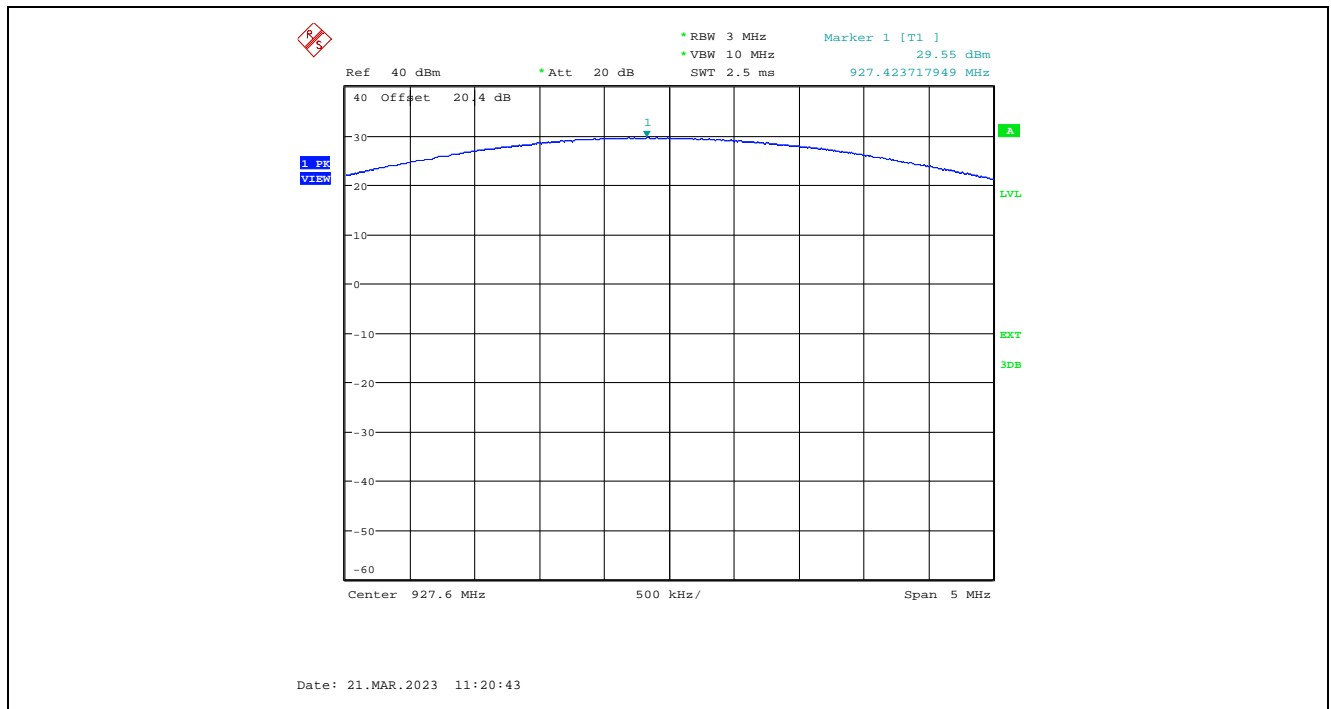
**Plot 5.1.4.1.** Maximum Peak Conducted Output Power, High Power, 230400 kbps, 902.4 MHz



**Plot 5.1.4.2.** Maximum Peak Conducted Output Power, High Power, 230400 kbps, 914.625 MHz



Plot 5.1.4.3. Maximum Peak Conducted Output Power, High Power, 230400 kbps, 927.6 MHz



**ULTRATECH GROUP OF LABS**

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: 23FORT003\_F15C247DSS

April 19, 2023

*All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

## 5.2. TRANSMITTER SPURIOUS RADIATED EMISSIONS AT 3 METERS [§§ 15.247(d), 15.209 & 15.205]

### 5.2.1. Limit

**§ 15.247 (d):** 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 20 dB 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 30 dB instead of 20 dB. 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)).

### Section 15.205(a) - Restricted Bands of Operation

MHz	MHz	MHz	GHz
0.090–0.110 .....	16.42–16.423	399.9–410	4.5–5.15
<sup>1</sup> 0.495–0.505 .....	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905 .....	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128 .....	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775 .....	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775 .....	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218 .....	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825 .....	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225 .....	123–138	2200–2300	14.47–14.5
8.291–8.294 .....	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366 .....	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675 .....	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475 .....	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293 .....	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025 .....	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725 .....	322–335.4	3600–4400	( <sup>2</sup> )
13.36–13.41 .....			

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.

<sup>2</sup> Above 38.6

### Section 15.209(a) - Field Strength Limits within Restricted Frequency Bands

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2,400 / F (kHz)	300
0.490 - 1.705	24,000 / F (kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

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3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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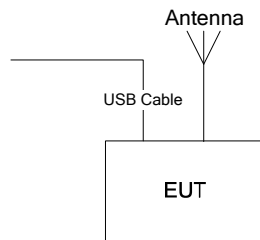
April 19, 2023

*All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

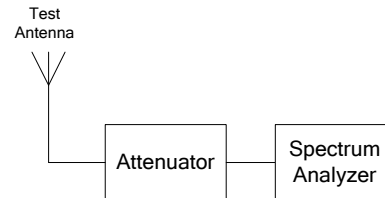
### 5.2.2. Method of Measurements

ANSI C63.10 and ANSI 63.4 procedures.

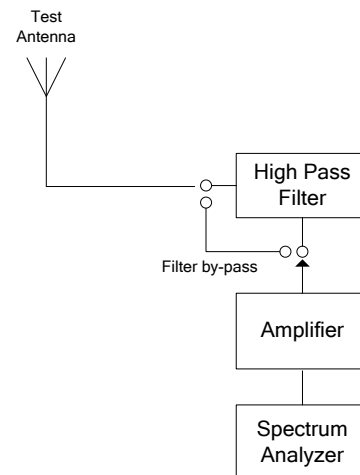
### 5.2.3. Test Arrangement



For Band-Edge



For Spurious and Harmonics



#### 5.2.4. Test Data

##### Remark(s):

- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- EUT shall be tested in three orthogonal positions.
- The following test results are the final worst-case measurements.

##### 5.2.4.1. Spurious Radiated Emissions

Fundamental Frequency:		902.4 MHz					
Power Setting:		High Power					
Measured Conducted Power:		29.49 dBm					
Frequency Test Range:		30 MHz – 10 GHz					
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
902.4	126.32	--	V	--	--	--	--
902.4	126.13	--	H	--	--	--	--
2707.2	52.60	48.68	V	54.0	106.3	-5.3	Pass*
2707.2	55.01	51.88	H	54.0	106.3	-2.1	Pass*
3609.6	48.40	38.80	V	54.0	106.3	-15.2	Pass*
3609.6	46.21	37.11	H	54.0	106.3	-16.9	Pass*
4512.0	47.07	41.11	V	54.0	106.3	-12.9	Pass*
4512.0	50.21	41.58	H	54.0	106.3	-12.4	Pass*
8121.6	52.73	38.16	V	54.0	106.3	-15.8	Pass*
8121.6	52.44	37.81	H	54.0	106.3	-16.2	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

\*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

Fundamental Frequency:		914.625 MHz					
Power Setting:		High Power					
Measured Conducted Power:		29.48 dBm					
Frequency Test Range:		30 MHz – 10 GHz					
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
914.625	125.84	--	V	--	--	--	--
914.625	125.29	--	H	--	--	--	--
2743.875	56.80	52.46	V	54.0	105.8	-1.5	Pass*
2743.875	54.97	51.60	H	54.0	105.8	-2.4	Pass*
3658.500	47.10	37.43	V	54.0	105.8	-16.6	Pass*
3658.500	48.28	40.24	H	54.0	105.8	-13.8	Pass*
4573.125	49.47	41.72	V	54.0	105.8	-12.3	Pass*
7317.000	50.79	36.87	V	54.0	105.8	-17.1	Pass*
7317.000	51.75	37.01	H	54.0	105.8	-17.0	Pass*
8231.625	52.43	38.48	V	54.0	105.8	-15.5	Pass*
8231.625	53.97	41.11	H	54.0	105.8	-12.9	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

\*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

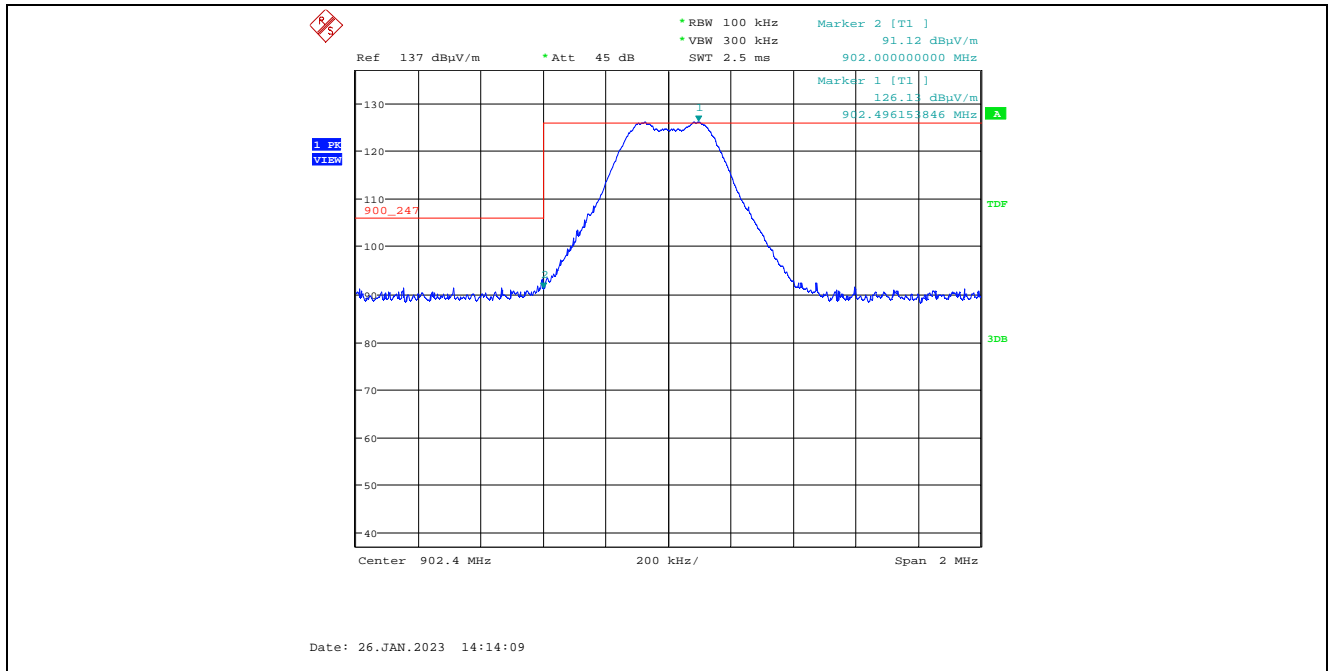
Fundamental Frequency:		927.6 MHz					
Power Setting:		High Power					
Measured Conducted Power:		29.55 dBm					
Frequency Test Range:		30 MHz – 10 GHz					
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
927.6	125.41	--	V	--	--	--	--
927.6	125.54	--	H	--	--	--	--
2782.8	54.20	51.19	V	54.0	105.5	-2.8	Pass*
2782.8	52.18	48.59	H	54.0	105.5	-5.4	Pass*
3710.4	52.43	49.27	V	54.0	105.5	-4.7	Pass*
3710.4	49.36	43.67	H	54.0	105.5	-10.3	Pass*
4638.0	47.53	37.02	V	54.0	105.5	-17.0	Pass*
4638.0	48.80	39.19	H	54.0	105.5	-14.8	Pass*
7420.8	51.34	37.72	V	54.0	105.5	-16.3	Pass*
7420.8	50.46	36.47	H	54.0	105.5	-17.5	Pass*
8348.4	54.35	41.77	V	54.0	105.5	-12.2	Pass*
8348.4	55.34	43.17	H	54.0	105.5	-10.8	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

\*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

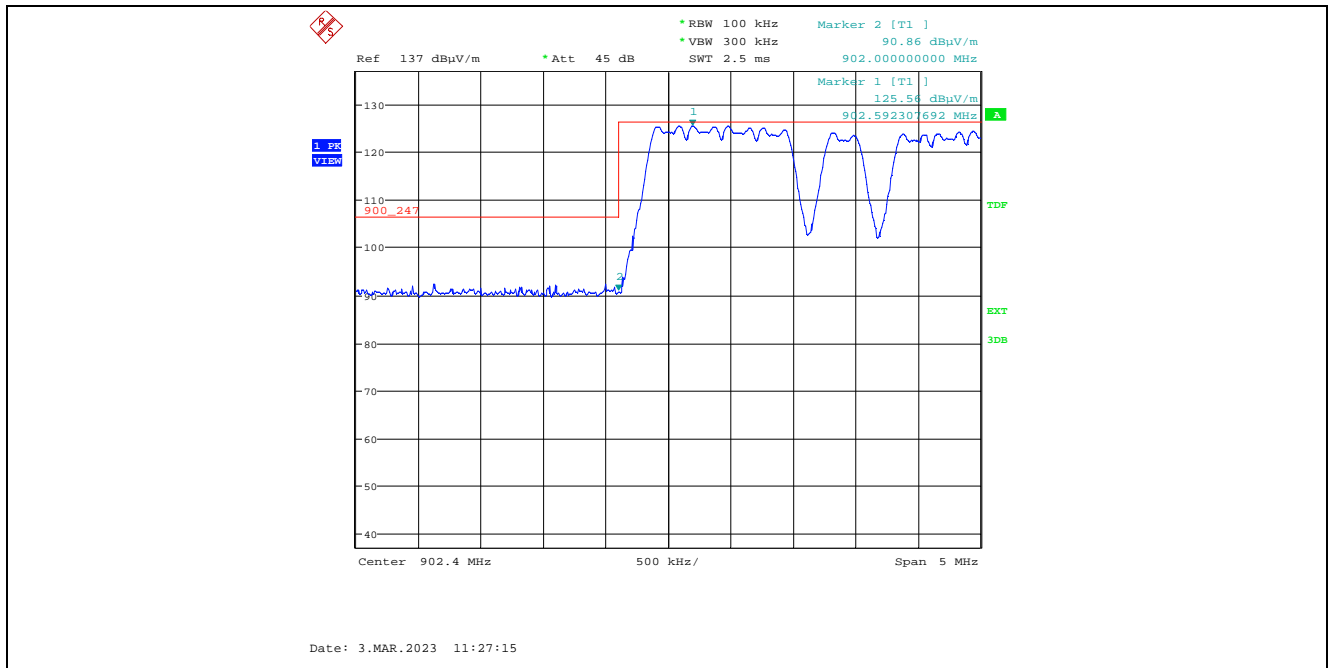


## 5.2.4.2. Band-Edge RF Radiated Emissions

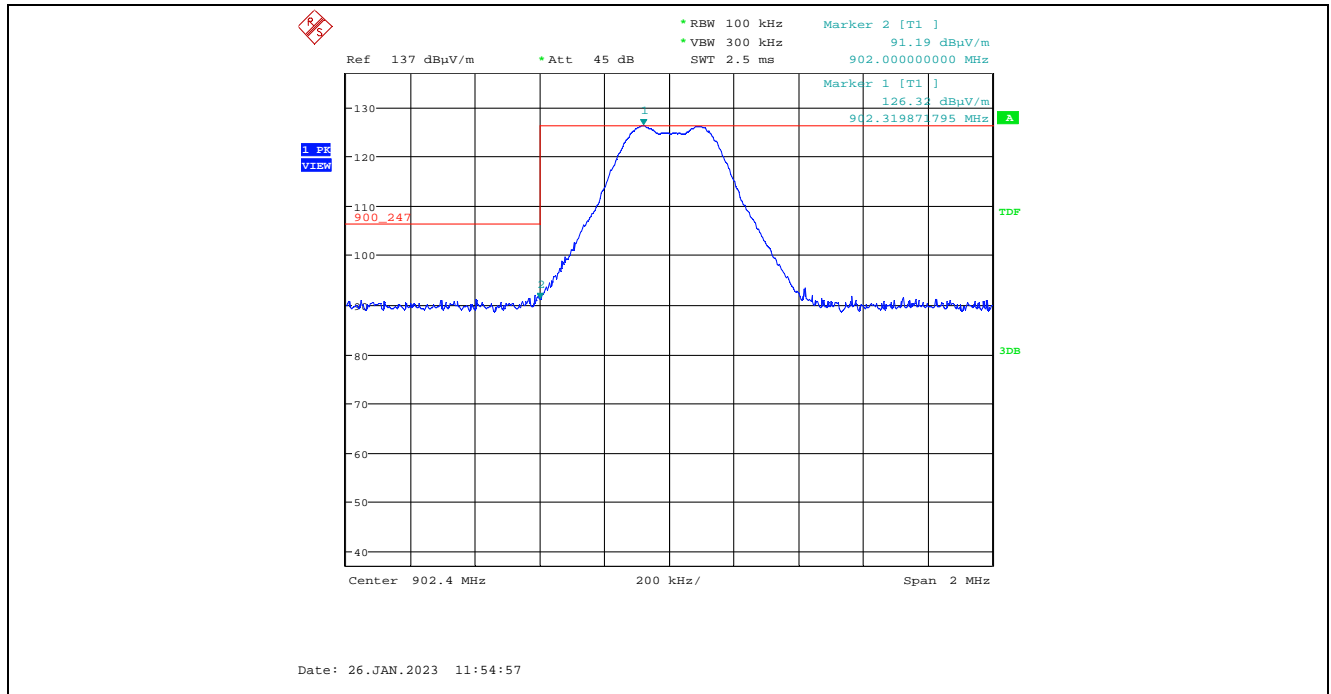
**Plot 5.2.4.2.1.** Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization  
Single Frequency Mode, Low End of Frequency Band, High Power, 230400 kbps Data Rate



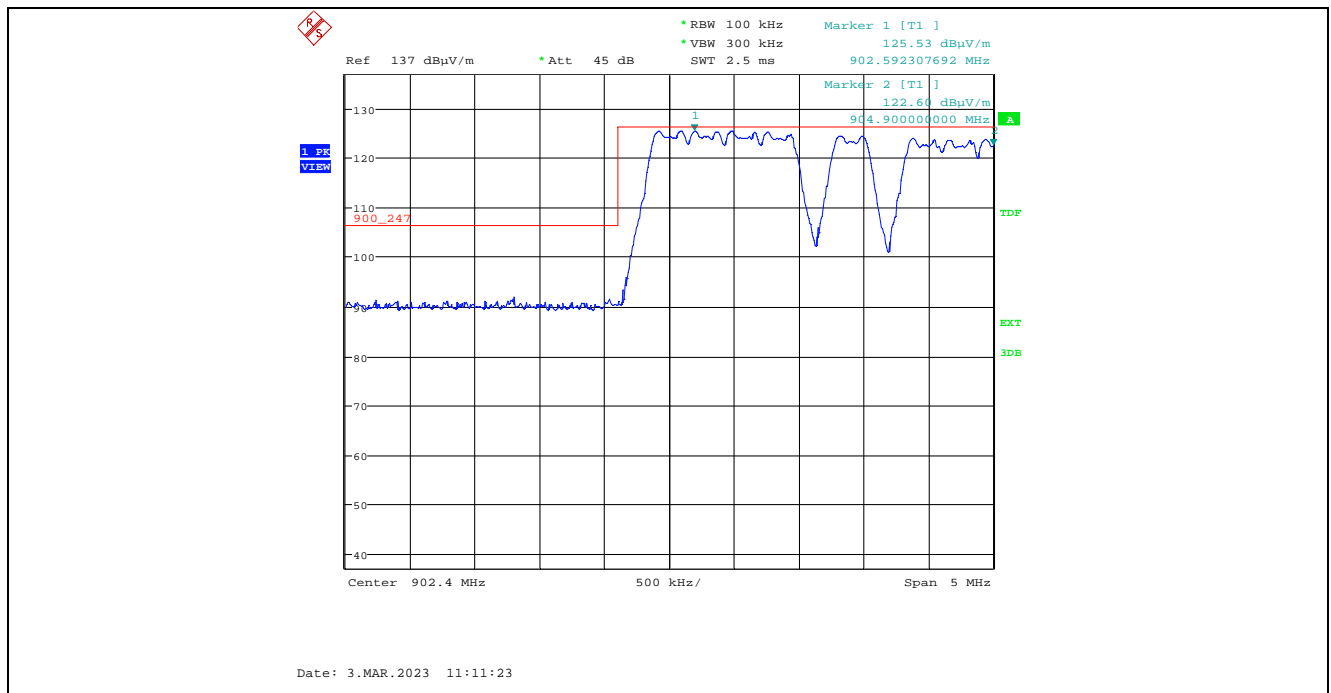
**Plot 5.2.4.2.2.** Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization  
Pseudorandom Channel Hopping Mode, Low End of Frequency Band, High Power, 230400 kbps Data Rate



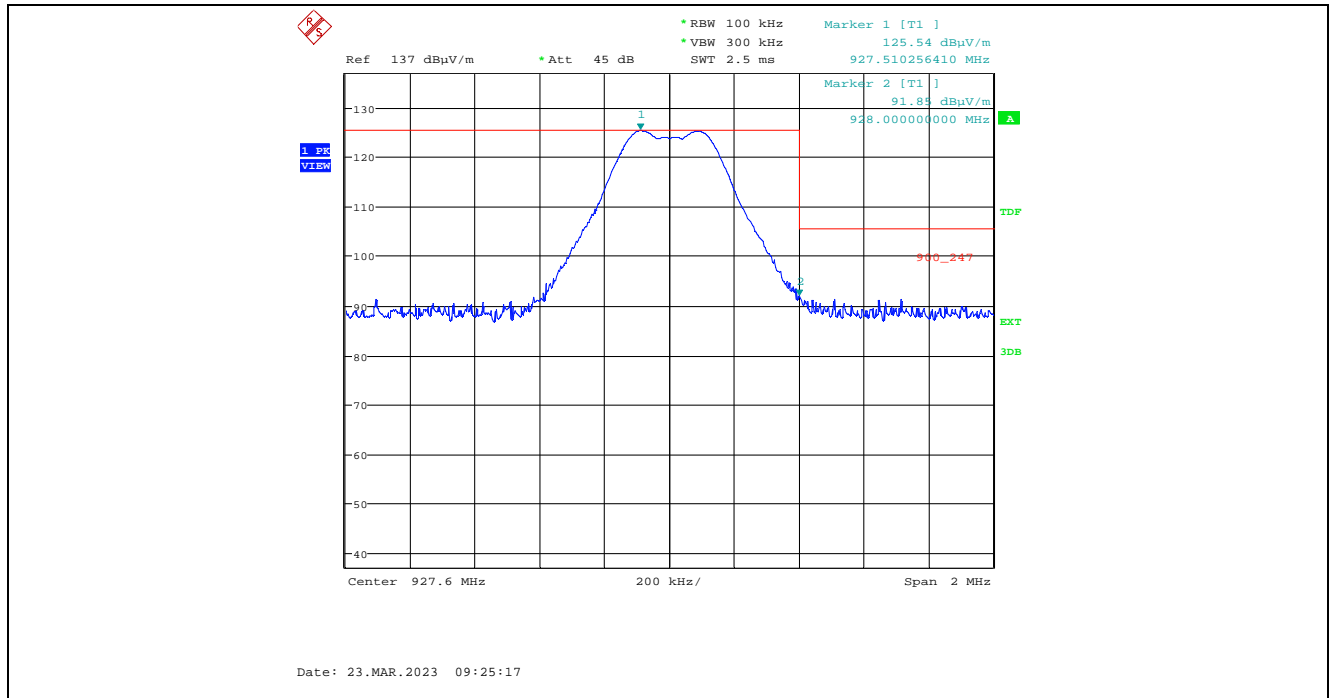
**Plot 5.2.4.2.3.** Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization  
Single Frequency Mode, Low End of Frequency Band, High Power, 230400 kbps Data Rate



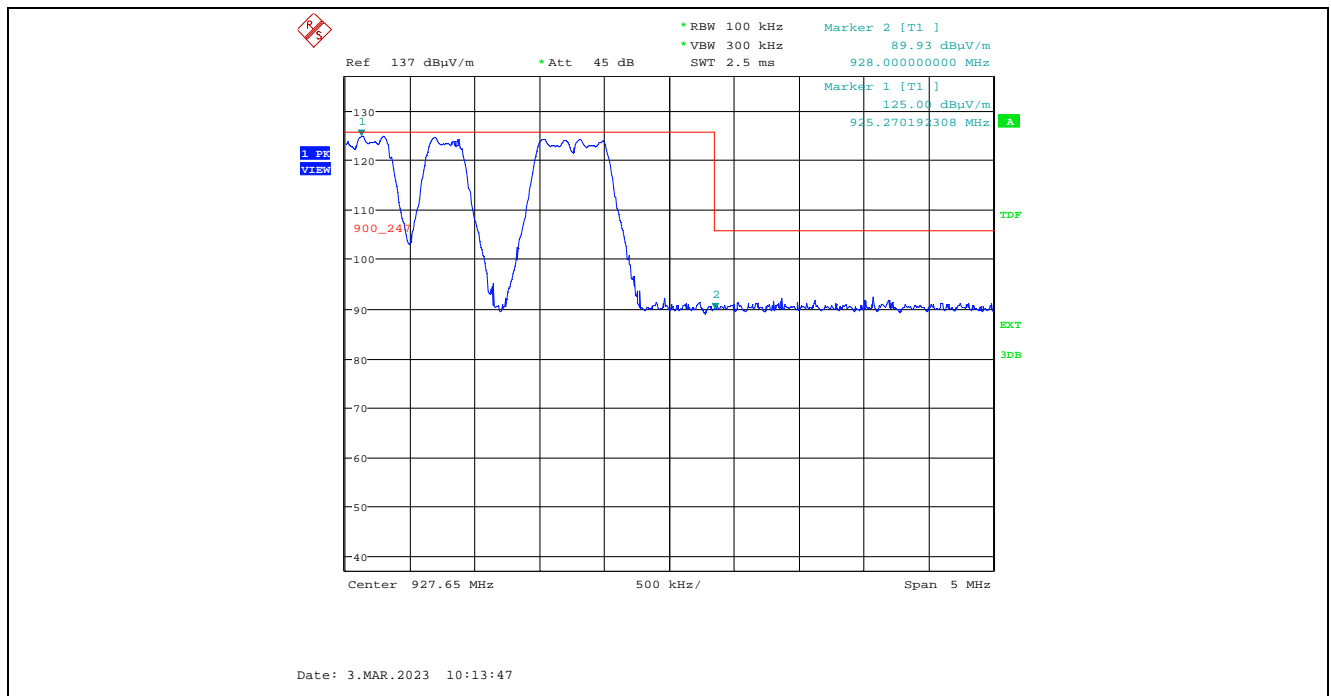
**Plot 5.2.4.2.4.** Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization  
Pseudorandom Channel Hopping Mode, Low End of Frequency Band, High Power, 230400 kbps Data Rate



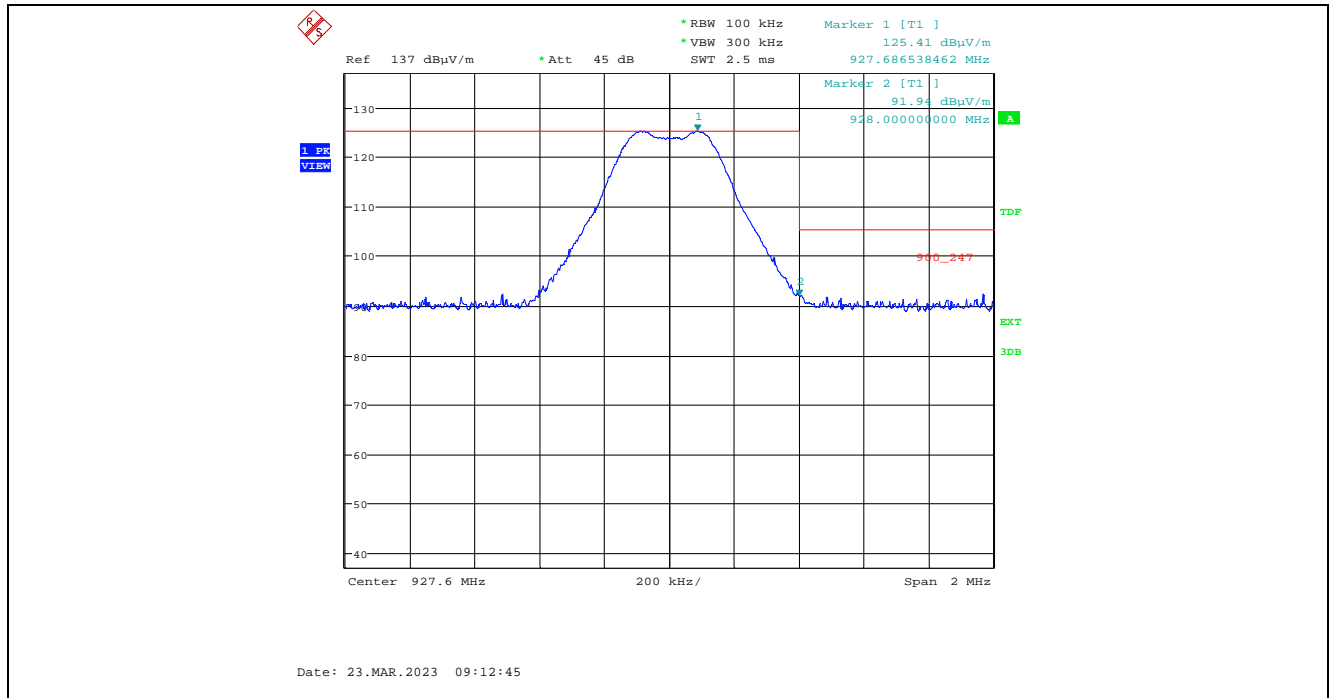
**Plot 5.2.4.2.5.** Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization  
Single Frequency Mode, High End of Frequency Band, High Power, 230400 kbps Data Rate



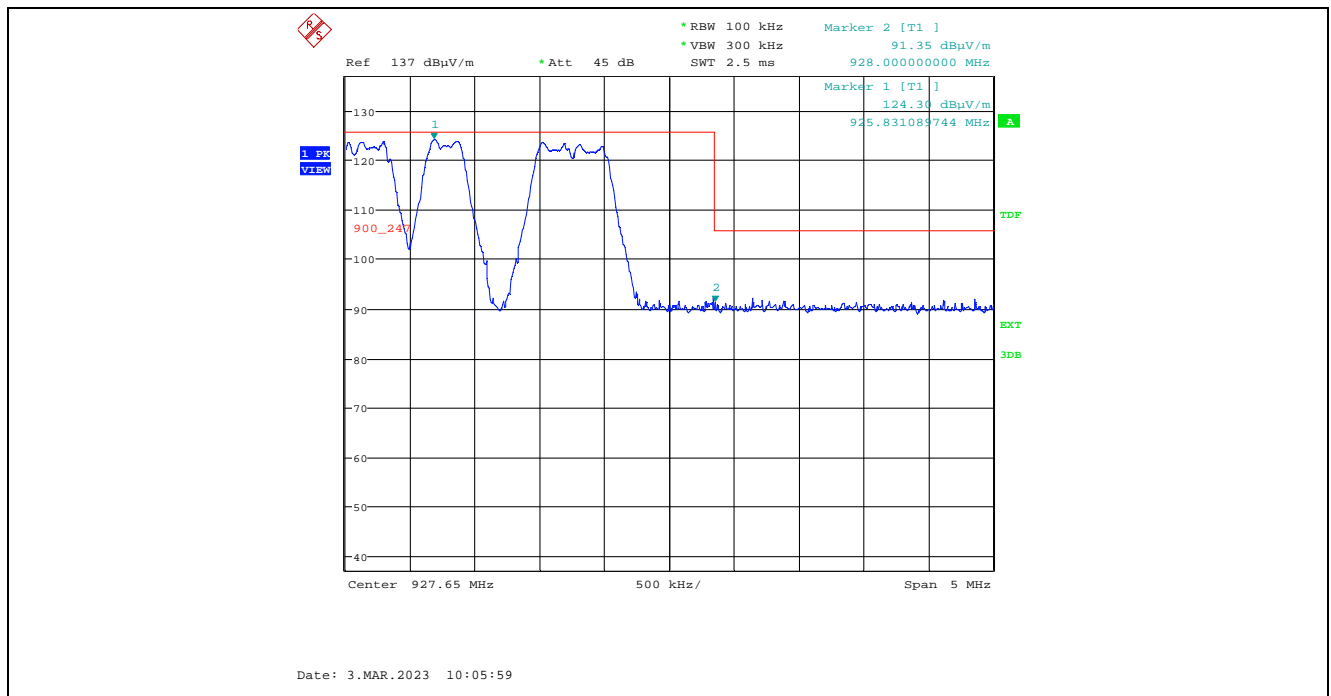
**Plot 5.2.4.2.6.** Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization  
Pseudorandom Channel Hopping Mode, High End of Frequency Band, High Power, 230400 kbps Data Rate



**Plot 5.2.4.2.7. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization**  
Single Frequency Mode, High End of Frequency Band, High Power, 230400 kbps Data Rate



**Plot 5.2.4.2.8. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization**  
Pseudorandom Channel Hopping Mode, High End of Frequency Band, High Power, 230400 kbps Data Rate



## EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Spectrum Analyzer	Rohde & Schwarz	FSU26	100398	20Hz–26.5 GHz	20 Sep 2023
Attenuator	Pasternack Enterprises Inc.	PE 7024-20	6	DC–26.5 GHz	See Note 1
Spectrum Analyzer	Rohde & Schwarz	FSU26	100398	20Hz–26.5 GHz	20 Sep 2023
Attenuator	Pasternack Enterprises Inc.	PE 7024-20	6	DC–26.5 GHz	See Note 1
Horn Antenna	ETS	3115	9701-5061	1-18GHz	08 Aug 2024
Spectrum Analyzer	Rohde & Schwarz	FSU26	200946	20Hz–26.5 GHz	11 Mar 2024
EMI Receiver	Rohde & Schwarz	ESU40	100037	20Hz–40 GHz	26 Sep 2023
Biconilog Antenna	EMCO	3142C	00026873	26-2000MHz	16 Dec 2023
Horn Antenna	ETS	3115	9701-5061	1-18GHz	08 Aug 2024
Preamp	Com-Power	PAM-118A	551052	500MHz-18GHz	24 Sep 2023
High Pass Filter	K & L	11SH10-1500/T8000	2	Cut off 900MHz	See Note 1

Note 1: Internal Verification/Calibration Check

## ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: 23FORT003\_F15C247DSS

April 19, 2023

*All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

## EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

Test Description	Expanded Uncertainty, K=2 for 95% Confidence Level
Conducted Output Power	$\pm 0.62$ dB
Transmitter Spurious Radiated Emissions	$\pm 4.20$ dB (30 MHz – 1 GHz)
	$\pm 2.70$ dB (1 – 18 GHz)
Transmitter Radiated Band-edge Emissions	$\pm 2.76$ dB

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3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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