



## REGULATORY COMPLIANCE TEST REPORT

FCC Part 15 Subpart F 15.517 UWB Device

Report No.: CATA18-U59 Rev A (UWB)

**Company:** Catapult Sports Pty Ltd

**Model Name:** RE-V8-SR-V1



## REGULATORY COMPLIANCE TEST REPORT

**Company:** Catapult Sports Pty Ltd

**Model Name:** RE-V8-SR-V1

**To:** FCC Part 15 Subpart F 15.517 UWB Device

**Test Report Serial No.:** CATA18-U59 Rev A (UWB)

This report supersedes: NONE

Applicant: Catapult Sports Pty Ltd Company  
10 Post Office Square, Floor 9  
Boston, Massachusetts 02109  
USA

Issue Date: 11<sup>th</sup> April 2025

**This Test Report is Issued Under the Authority of:**

**MiCOM Labs, Inc.**  
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MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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## **1. ACCREDITATION, LISTINGS & RECOGNITION**

### **1.1. TESTING ACCREDITATION**

MiCOM Labs, Inc. is an accredited Electrical testing laboratory per the international standard ISO/IEC 17025:2017. The company is accredited by the American Association for Laboratory Accreditation (A2LA) [www.a2la.org](http://www.a2la.org) test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; <http://www.a2la.org/scopepdf/2381-01.pdf>



### ***Accredited Laboratory***

A2LA has accredited

**MICOM LABS**

Pleasanton, CA

for technical competence in the field of

**Electrical Testing**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

Presented this 28<sup>th</sup> day of February 2024.



Mr. Trace McInturff, Vice President, Accreditation Services  
For the Accreditation Council  
Certificate Number 2381.01  
Valid to November 30, 2025



*For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.*

## 1.2. RECOGNITION

MiCOM Labs, Inc is widely recognized for its wireless testing and certification capabilities. In addition to being recognized for Testing and Certification under Phase 2 Mutual Recognition Agreements (MRA) with Canada, Europe, United Kingdom and Japan, our international recognition includes Conformity Assessment Body (CAB) designation status under agreements with Asia Pacific (APEC) MRA Phase 1 countries giving acceptance of MiCOM Labs test reports. MiCOM Labs test reports are accepted globally.

Country	Recognition Body	Status	MRA Phase	Identification No.
USA	Federal Communications Commission (FCC)	TCB	-	US0159 Test Firm Designation#: US1084
Canada	Industry Canada (ISED)	FCB	APEC MRA 2	US0159 ISED#: 4143A
Japan	MIC (Ministry of Internal Affairs and Communication)	CAB	Japan MRA 2	RCB 210
	Japan Approvals Institute for Telecommunication Equipment (JATE)			
	VCCI	--	--	A-0012
Europe	European Commission	NB	EU MRA 2	NB 2280
United Kingdom	Department for Business, Energy & Industrial Strategy (BEIS)	AB	UK MRA 2	AB 2280
Mexico	Instituto Federal de Telecomunicaciones (IFT)	CAB	Mexico MRA 1	US0159
Australia	Australian Communications and Media Authority (ACMA)	CAB	APEC MRA 1	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)			
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)			
Singapore	Infocomm Development Authority (IDA)			
Taiwan	National Communications Commission (NCC) Bureau of Standards, Metrology and Inspection (BSMI)			
Vietnam	Ministry of Communication (MIC)			

TCB – Telecommunications Certification Bodies (TCB)

FCB – Foreign Certification Body

CAB – Conformity Assessment Body

NB – Notified Body

AB – Approved Body

MRA – Mutual Recognition Agreement

MRA Phase I - recognition for product testing

Phase II – recognition for both product testing and certification

### **1.3. PRODUCT CERTIFICATION**

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard ISO/IEC 17065:2012. The company is accredited by the American Association for Laboratory Accreditation (A2LA) [www.a2la.org](http://www.a2la.org) test laboratory number 2381.02. MiCOM Labs test schedule is available at the following URL; <http://www.a2la.org/scopepdf/2381-02.pdf>



### **Accredited Product Certification Body**

A2LA has accredited

**MiCOM LABS**

Pleasanton, CA

This product certification body is accredited in accordance with the recognized International Standard ISO/IEC 17065:2012 Requirements for bodies certifying products, processes and services. This product certification body also meets the A2LA R322 – Specific Requirements – Notified Body Accreditation Requirements and A2LA R308 – Specific Requirements - ISO-IEC 17065 - Telecommunication Certification Body Accreditation Program. This accreditation demonstrates technical competence for a defined scope and the operation of a management system.

Presented this 28<sup>th</sup> day of February 2024.



Mr. Trace McInturff, Vice President, Accreditation Services  
For the Accreditation Council  
Certificate Number 2381.02  
Valid to November 30, 2025



*For the product certification schemes to which this accreditation applies, please refer to the organization's Product Certification Scope of Accreditation.*

United States of America – Telecommunication Certification Body (TCB)  
Industry Canada – Certification Body, CAB Identifier – US0159  
Europe – Notified Body (NB), NB Identifier - 2280  
UK – Approved Body (AB), AB Identifier - 2280  
Japan – Recognized Certification Body (RCB), RCB Identifier - 210

## **2. DOCUMENT HISTORY**

Document History		
Revision	Date	Comments
Draft	19th March 2025	Draft report for client review.
Rev A	31 <sup>st</sup> March 2025	Initial Release

In the above table the latest report revision will replace all earlier versions.

### **3. TEST RESULT CERTIFICATE**

**Manufacturer:** Catapult Sports Pty Ltd  
10 Post Office Square, Floor 9  
Boston, Massachusetts 02109  
USA

**Tested By:** MiCOM Labs, Inc.  
575 Boulder Court  
Pleasanton California 94566  
USA

**Model:** RE-V8-SR-V1

**Telephone:** +1 925 462 0304

**Equipment Type:** Indoor Device

**Fax:** +1 925 462 0306

**S/N's:** 19

**Test Date(s):** 30<sup>th</sup>-31<sup>st</sup> January & 3<sup>rd</sup> February 2025

**Website:** [www.micomlabs.com](http://www.micomlabs.com)

#### **STANDARD(S)**

FCC CFR 47 Part 15 Subpart F 15.517

#### **TEST RESULTS**

EQUIPMENT COMPLIES

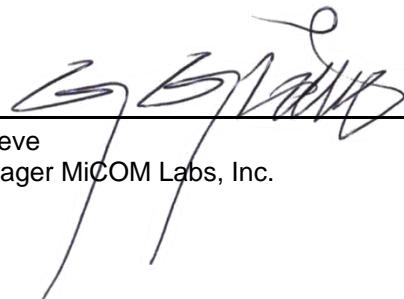
MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

#### **Notes:**

1. This document reports conditions under which testing was conducted and the results of testing performed.
2. Details of test methods used have been recorded and kept on file by the laboratory.
3. Test results apply only to the item(s) tested.

**Approved & Released for MiCOM Labs, Inc. by:**

Graeme Grieve  
Quality Manager MiCOM Labs, Inc.



Gordon Hurst  
President & CEO MiCOM Labs, Inc.



## 4. REFERENCES AND MEASUREMENT UNCERTAINTY

### 4.1. Normative References

REF.	PUBLICATION	YEAR	TITLE
I	FCC 47 CFR Part F	2018	Radio Frequency Devices; Subpart F – Ultra Wide Band Devices
II	A2LA	16 <sup>th</sup> April 2024	R105 - Requirement's When Making Reference to A2LA Accreditation Status
III	ANSI C63.10	2020	American National Standard for Testing Unlicensed Wireless Devices
IV	ANSI C63.4	2014 + 2017 Amendment	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
V	ETSI TR 100 028	2001-12	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
VI	M 3003	Edition 4 Oct.2019	Expression of Uncertainty and Confidence in Measurements
VII	KDB 393764 D01 UWB FAQ v02	January 29, 2018	Ultra-Wideband (UWB) Devices frequently asked questions

#### **4.2. Test and Uncertainty Procedure**

Conducted and radiated emission measurements were conducted in accordance with American National Standards Institute ANSI C63.4, listed in the Normative References section of this report.

Measurement uncertainty figures are calculated in accordance with ETSI TR 100 028 Parts 1 and 2.

Measurement uncertainties stated are based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95 % in accordance with UKAS document M 3003 listed in the Normative References section of this report.

## 5. PRODUCT DETAILS AND TEST CONFIGURATIONS

### 5.1. Technical Details

Details	Description
Purpose:	Test of the Catapult Sports Pty Ltd RE-V8-SR-V1 to FCC CFR 47 Part 15 Subpart F 15.517.
Applicant:	Catapult Sports Pty Ltd 10 Post Office Square, Floor 9 Boston, Massachusetts 02109 USA
Manufacturer:	As applicant
Laboratory performing the tests:	MiCOM Labs, Inc. 575 Boulder Court Pleasanton California 94566 USA
Test report reference number:	CATA18-U59
Date EUT received:	30 <sup>th</sup> January 2025
Standard(s) applied:	FCC Part 15 Subpart F 15.517 UWB Device
Dates of test (from - to):	30th – 31st January & 3rd February 2025
No of Units Tested:	1
Product Family Name:	Vector 8 Stadium Relay
Model(s):	RE-V8-SR-V1
Location for use:	Indoors
Declared Frequency Range(s):	6489.60, 7987.2 MHz;
Type of Modulation:	BPM/BPSK
EUT Modes of Operation:	Ultra Wideband
Declared Nominal Output Power (dBm):	-41.3 dBm
Rated Input Voltage and Current:	48.0 VDC 0.35 A
Operating Temperature Range:	-20C to + 85C
Equipment Dimensions:	130mm(W)x59.5mm(H)x175mm(L)
Weight:	1.146lbs/0.52Kg
Hardware Rev:	B2
Software Rev:	8.8.0

## 5.2. Scope Of Test Program

### Catapult Sports Pty Ltd Company

The scope of the test program was to test the Catapult Sports Pty Ltd Company RE-V8-SR-V1 for compliance against the following specifications:

#### FCC CFR 47 Part 15 Subpart F – Ultra-Wideband Operation; 15.517, 15.521

Compliance Measurement Procedures for Unlicensed National Information Infrastructure devices operating in the 3100 - 10600 MHz bands.

## 5.3. Equipment Model(s) and Serial Number(s)

Type (EUT/ Support)	Equipment Description	Manufacturer	Model No.	Serial No.
EUT	Mobile & Portable Client Device	Catapult Sports Pty Ltd	RE-V8-SR-V1	19

## 5.4. Antenna Details

Type	Manufacturer	Model	Family	Gain (dBi)	BF Gain	Dir BW	X-Pol (dB)	Frequency Band (MHz)
Integral	Catapult	-	Patch	4.28	0	HPBW: 108° (Azimuth), 102° (Elevation)	-1	6250 – 6750
Integral	Catapult	-	Patch	7.65	0	HPBW: 88° (Azimuth) 48° (Elevation)	-5	7750-8250

BF Gain - Beamforming Gain  
 Dir BW - Directional BeamWidth  
 X-Pol - Cross Polarization

## 5.5. Cabling and I/O Ports

Port Type	Max Cable Length	# of Ports	Screened	Connector Type	Data Type	Data Rate(s)
POE	5m	1	Yes	Data/Power	Digital	Unknown

## 5.6. Test Configurations

Results for the following configurations are provided in this report:

Operational Mode(s)	Data Rate with Highest Power MBit/s	Channel Frequency (MHz)			
		Low	Mid	High	
		4750 - 10600 MHz			
WB	--	6489.6	--	7987.2	

## **5.7. Equipment Modifications**

The following modifications were required to bring the equipment into compliance:

1. NONE

## **5.8. Deviations from the Test Standard**

The following deviations from the test standard were required in order to complete the test program:

1. NONE

## **6. TEST SUMMARY**

### List of Measurements

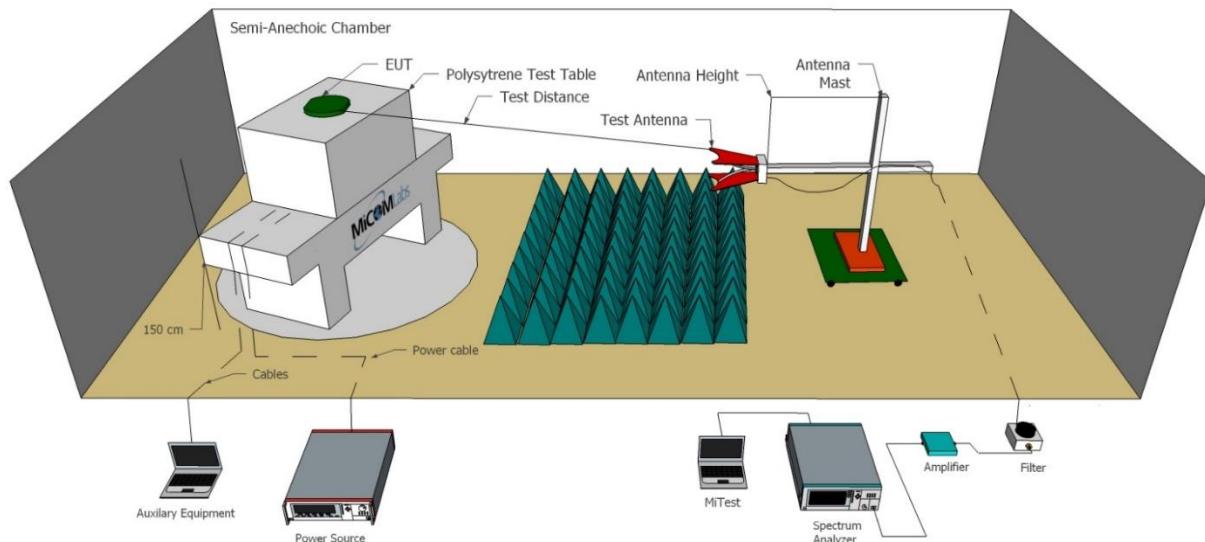
Test Header	Result	Data Link
WB Bandwidth	Complies	<a href="#">View Data</a>
Average Output Power	Complies	<a href="#">View Data</a>
Peak Power Density	Complies	<a href="#">View Data</a>
Spurious Radiated Emissions	Complies	<a href="#">View Data</a>
Spurious Radiated Emissions in GPS Bands	Complies	<a href="#">View Data</a>
Comments: None		

## 7. TEST EQUIPMENT CONFIGURATION(S)

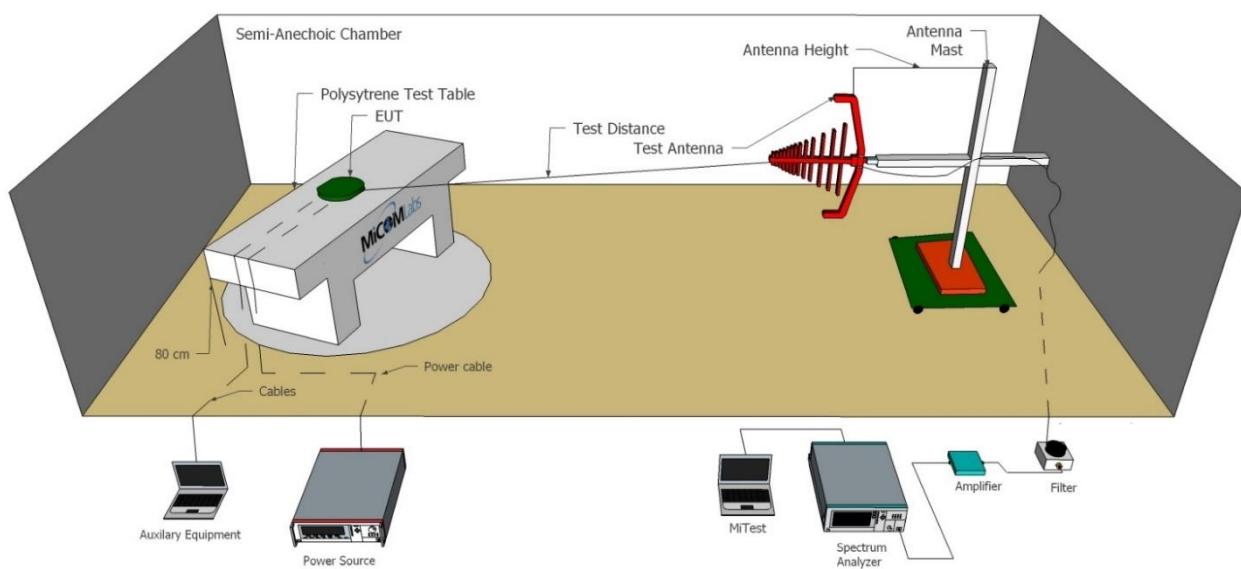
### 7.1. Radiated Emissions - 3m Chamber

The following tests were performed using the radiated test set-up shown in the diagram below. Radiated emissions above and below 1GHz.

Radiated Emissions Above 1GHz Test Setup



Radiated Emissions Below 1GHz Test Setup



A full system calibration was performed on the test station and any resulting system losses (or gains) were considered in the production of all final measurement data.

Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
170	Video System Controller for Semi Anechoic Chamber	Panasonic	WV-CU101	04R08507	Not Required
266	10 Hz to 50GHz MXA Signal Analyzer	Keysight	N9020B	MY60110791	25 Jul 2025
298	3M Radiated Emissions Chamber Maintenance Check	MiCOM	3M Chamber	298	11 Mar 2025
330	Variac 0-280 Vac	Staco Energy Co	3PN1020B	0546	Cal when used
336	Active loop Ant 10kHz to 30 MHz	EMCO	EMCO 6502	00060498	7 Dec 2025
338	Sunol 30 to 3000 MHz Antenna	Sunol	JB3	A052907	5 Dec 2025
373	26III RMS Multimeter	Fluke	Fluke 26 series III	76080720	29 Sep 2025
382	Tunable Notch Filter	Wainwright Instruments GmbH	WRCT800/960-0.2/40-8EEK	64	Cal when used
397	Amp 10 - 2500MHz	MiCOM Labs	Amp 10 - 2500 MHz	NA	27 Feb 2025
399	ETS 1-18 GHz Horn Antenna	ETS	3117	00154575	7 Dec 2025
406	Amplifier for Radiated Emissions	MiCOM Labs	40dB 1 to 18GHz Amp	0406	2 Apr 2025
410	Desktop Computer	Dell	Inspiron 620	WS38	Not Required
411	Mast/Turntable Controller	Sunol Sciences	SC98V	060199-1D	Not Required
412	USB to GPIB Interface	National Instruments	GPIB-USB HS	11B8DC2	Not Required
413	Mast Controller	Sunol Science	TWR95-4	030801-3	Not Required
415	Turntable Controller	Sunol Sciences	Turntable Controller	None	Not Required
416	Gigabit ethernet filter	ETS-Lingren	Gigafoil 260366	None	Not Required
447	MiTest Rad Emissions Test Software	MiCOM	Rad Emissions Test Software Version 1.0	447	Not Required
462	Schwarzbeck cable from Antenna to Amplifier.	Schwarzbeck	AK 9513	462	18 Apr 2025
463	Schwarzbeck cable from Amplifier to Bulkhead.	Schwarzbeck	AK 9513	463	18 Apr 2025
464	Schwarzbeck cable from Bulkhead to Receiver	Schwarzbeck	AK 9513	464	16 Apr 2025
465	Low Pass Filter DC-1000 MHz	Mini-Circuits	NLP-1200+	VUU01901402	14 Apr 2025

480	Cable - Bulkhead to Amp	SRC Haverhill	157-3050360	480	18 Apr 2025
481	Cable - Bulkhead to Receiver	SRC Haverhill	151-3050787	481	18 Apr 2025
510	Barometer/Thermometer	Digi Sense	68000-49	170871375	4 Jan 2026
554	Precision SMA Cable	Fairview Microwave	SCE18060101-400CM	554	18 Apr 2025
555	Rhode & Schwarz Receiver (Firmware Version : 3.10 SP1)	Rhode & Schwarz	ESW 44	101893	28 Jun 2025
701	DC Power Supply	Keysight	E36155A	MY63000671	6 Nov 2025
87	Uninterruptible Power Supply	Falcon Electric	ED2000-1/2LC	F3471 02/01	Cal when used
CC05	Confidence Check	MiCOM	CC05	None	5 Mar 2025

## 8. MEASUREMENT AND PRESENTATION OF TEST DATA

The measurement and graphical data presented in this test report was generated automatically using state-of-the-art technology creating an easy-to-read report structure. Numerical measurement data is separated from supporting graphical data (plots) through hyperlinks. Numerical measurement data can be reviewed without scrolling through numerous graphical pages to arrive at the next data matrix.

Plots have been relegated into the Appendix 'Graphical Data'.

Test and report automation was performed by [MiTest](#). [MiTest](#) is an automated test system developed by MiCOM Labs. [MiTest](#) is the first cloud based modular test system enabling end-to-end automation of regulatory compliance testing for conducted RF testing.



The MiCOM Labs "[MiTest](#)" Automated Test System" (Patent Pending)

## **9. TEST RESULTS**

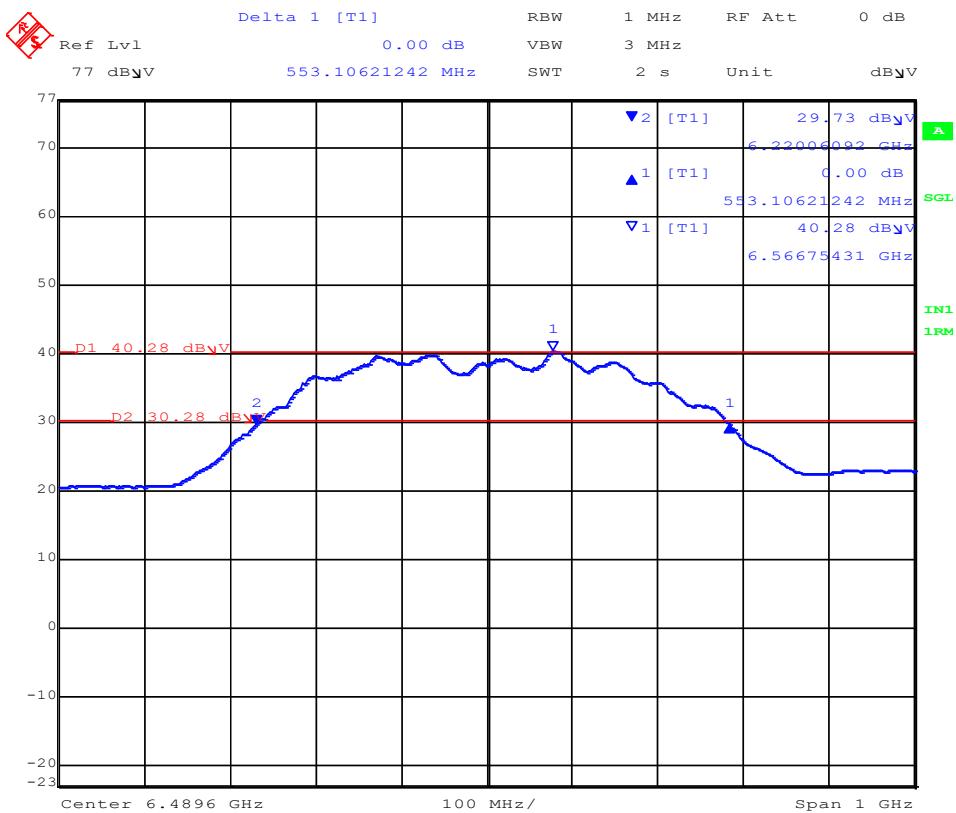
### **9.1. WB Bandwidth**

Conducted Test Conditions for WB Bandwidth						
<b>Standard:</b>	FCC Part 15 Subpart F 15.517 UWB Device	<b>Ambient Temp. (°C):</b>	24.0 - 27.5			
<b>Test Heading:</b>	WB Bandwidth	<b>Rel. Humidity (%):</b>	32 - 45			
<b>Standard Section(s):</b>	ANSI C63.10 Section 10.1; 5.1(a)(b)	<b>Pressure (mBars):</b>	999 - 1001			
<b>Reference Document(s):</b>	See Normative References					
<b>Test Procedure for WB Bandwidth Measurement</b> The WB Bandwidth is measured radiated, at a 1-meter distance, while EUT is operating in transmission mode at the appropriate center frequency. The Resolution Bandwidth was set to 1MHz RBW IAW ANSI C63.10. Testing was performed under ambient conditions at nominal voltage.						
Test configuration and setup used for the measurement was per the Radiated Test Set-up section specified in this document.						

Equipment Configuration for WB Bandwidth

<b>Variant:</b>	WB	<b>Duty Cycle (%):</b>	99
<b>Data Rate:</b>	--	<b>Antenna Gain (dBi):</b>	4.28
<b>Modulation:</b>	--	<b>Beam Forming Gain (Y)(dB):</b>	Not Applicable
<b>TPC:</b>	Not Applicable	<b>Tested By:</b>	SB
<b>Engineering Test Notes:</b>			

Test Frequency	Measured 10 dB Bandwidth (MHz)	10 dB Bandwidth Frequencies (MHz)		
		Lowest	Highest	
MHz	Port A			
6489.60	553.10	6220.06	6773.17	



Date: 4.FEB.2025 08:43:06

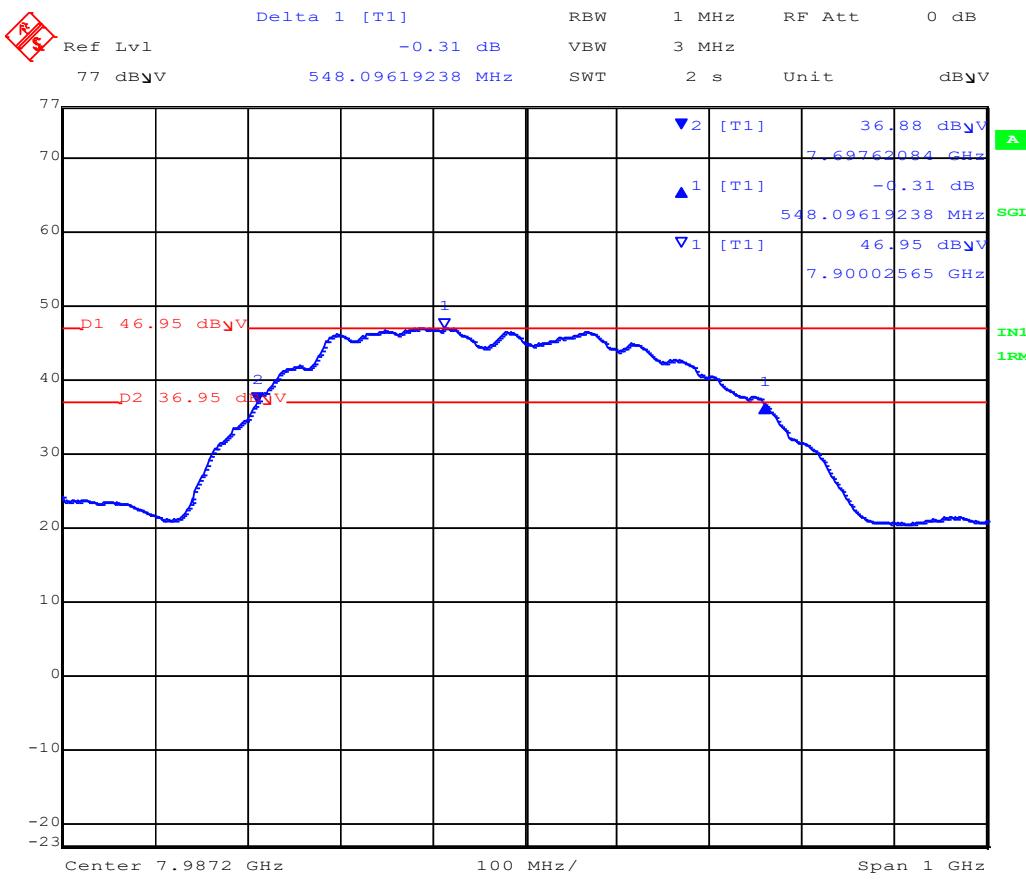
Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

The above values are representative of the worst-case value between polarities and based on power measurements.

Equipment Configuration for WB Bandwidth

<b>Variant:</b>	WB	<b>Duty Cycle (%):</b>	99
<b>Data Rate:</b>	--	<b>Antenna Gain (dBi):</b>	7.65
<b>Modulation:</b>	--	<b>Beam Forming Gain (Y)(dB):</b>	Not Applicable
<b>TPC:</b>	Not Applicable	<b>Tested By:</b>	SB
<b>Engineering Test Notes:</b>			

Test Frequency	Measured 10 dB Bandwidth (MHz)	10 dB Bandwidth Frequencies (MHz)	
		Lowest	Highest
7987.2	548.09	548.09	548.09



Date: 4.FEB.2025 08:40:04

<b>Traceability to Industry Recognized Test Methodologies</b>	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

The above values are representative of the worst-case value between polarities and based on power measurements.

## 9.2. Transmit Power

Conducted Test Conditions for Maximum Radiated Output Power			
<b>Standard:</b>	FCC Part 15 Subpart F 15.517 UWB Device	<b>Ambient Temp. (°C):</b>	24.0 - 27.5
<b>Test Heading:</b>	Radiated Emissions WB Transmission	<b>Rel. Humidity (%):</b>	32 - 45
<b>Standard Section(s):</b>	ANSI C63.10 Section 10.3.5; 5.3.1; Section 4 Annex	<b>Pressure (mBars):</b>	999 - 1001
<b>Reference Document(s):</b>	None		

**Test Procedure for WB Transmission**

Testing was performed under ambient conditions at nominal voltage.

15.517 (c) The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in § 15.209. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

**Operating Frequency Band:**  
3100 - 10600 MHz

**Limits Maximum EIRP (dBm)**

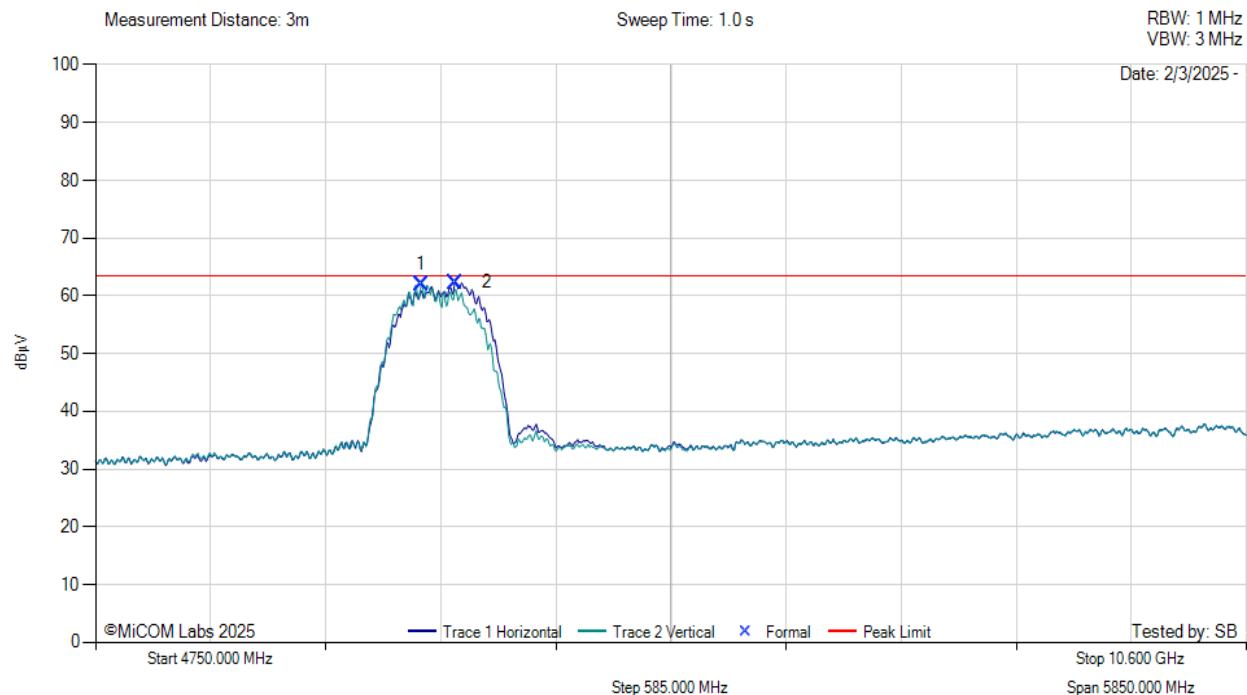
Frequency (MHz)	EIRP Limit (dBm)	EIRP at 3 Meters (dBuv/m)	EIRP at 1 Meters (dBuv/m)
3100 - 10600	-41.3	53.9	63.4

#### Equipment Configuration for RF Output Power

<b>Variant:</b>	WB	<b>Duty Cycle (%):</b>	99
<b>Data Rate:</b>	--	<b>Antenna Gain (dBi):</b>	4.28
<b>Modulation:</b>	--	<b>Beam Forming Gain (Y)(dB):</b>	Not Applicable
<b>TPC:</b>	Not Applicable	<b>Tested By:</b>	SB
<b>Engineering Test Notes:</b>			

#### Test Measurement Results

Test Frequency MHz	Measured Radiated Output Power (dB $\mu$ V/m)	Limit (dB $\mu$ V/n)	Margin (dB)	EUT Power Setting
6489.60	62.36	63.4	-1.04	28.0



4750.00 - 10600.00 MHz													
Num	Frequency MHz	Raw dB $\mu$ V	Cable Loss dB	AF dB/m	Level dB $\mu$ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB $\mu$ V/m	Margin dB	Pass /Fail	
1	6405.55	67.52	3.36	-8.95	61.94	AVG	Vertical	150	210	63.5	-1.5	Pass	
2	6581.05	67.74	3.41	-8.79	62.36	AVG	Horizontal	150	270	63.5	-1.1	Pass	

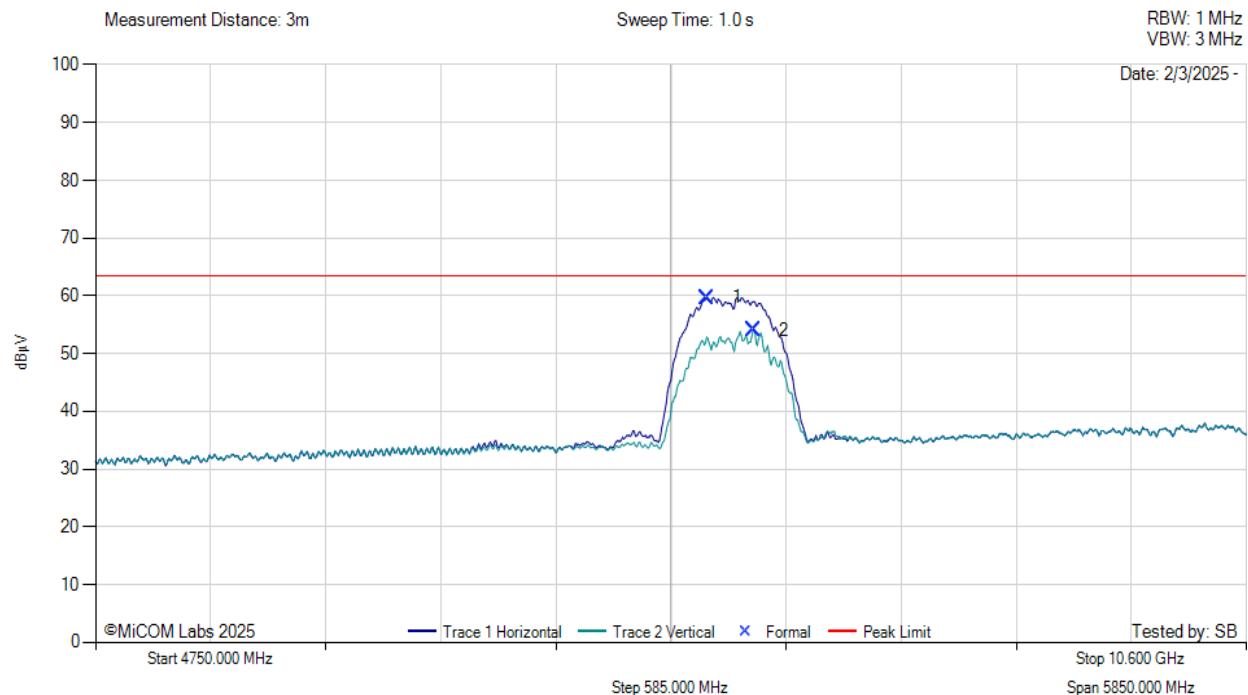
**Test Notes:** PoE powered. Antenna connected to EUT, CF mode active. 6.5GHz, PS 28.0

#### Equipment Configuration for RF Output Power

<b>Variant:</b>	WB	<b>Duty Cycle (%):</b>	99
<b>Data Rate:</b>	--	<b>Antenna Gain (dBi):</b>	7.65
<b>Modulation:</b>	--	<b>Beam Forming Gain (Y)(dB):</b>	Not Applicable
<b>TPC:</b>	Not Applicable	<b>Tested By:</b>	SB
<b>Engineering Test Notes:</b>			

#### Test Measurement Results

Test Frequency MHz	Measured Radiated Output Power (dB $\mu$ V/m)	Limit (dB $\mu$ V/n)	Margin (dB)	EUT Power Setting
7987.2	59.68	63.4	-3.72	28.0



4750.00 - 10600.00 MHz													
Num	Frequency MHz	Raw dB $\mu$ V	Cable Loss dB	AF dB/m	Level dB $\mu$ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB $\mu$ V/m	Margin dB	Pass /Fail	
1	7856.35	63.57	3.92	-7.81	59.68	AVG	Horizontal	150	270	63.5	-3.8	Pass	
2	8096.20	58.41	3.83	-8.15	54.09	AVG	Vertical	150	180	63.5	-9.4	Pass	

**Test Notes:** PoE powered. Antenna connected to EUT, CF mode active. 8GHz, PS 28.0

### 9.3. Peak Power Density

Test Conditions for Maximum Peak Power Density			
<b>Standard:</b>	FCC Part 15 Subpart F 15.517 UWB Device	<b>Ambient Temp. (°C):</b>	24.0 - 27.5
<b>Test Heading:</b>	Radiated Emissions WB Transmission	<b>Rel. Humidity (%):</b>	32 - 45
<b>Standard Section(s):</b>	ANSI C63.10 Section 10.3.6; 5.3.1; Section 4 Annex	<b>Pressure (mBars):</b>	999 - 1001
<b>Reference Document(s):</b>	None		

#### Test Procedure for WB Transmission

Testing was performed under ambient conditions at nominal voltage.

Test configuration and setup used for the measurement was per the Radiated Test Set-up section specified in this document.

If measurements were gathered with a RBW less than 50MHz then formula below was used to convert to the correct limit. (example shown is 1MHz):

$$\text{EIRP}_{1\text{ MHz}} = \text{EIRP}_{50\text{ MHz}} + 20\log(1\text{ MHz}/50\text{ MHz}) = 0\text{ dBm} + (-34\text{ dBm}) = -34\text{ dBm}$$

dBuv/m to EIRP

$$\text{EIRP} = E + 20 \cdot \log(d/m) - 104.77$$

Where:

E = Field Strength

D = Distance in Meters

#### Operating Frequency Band:

4750-10600 MHz

#### Limits Maximum EIRP (dBm)

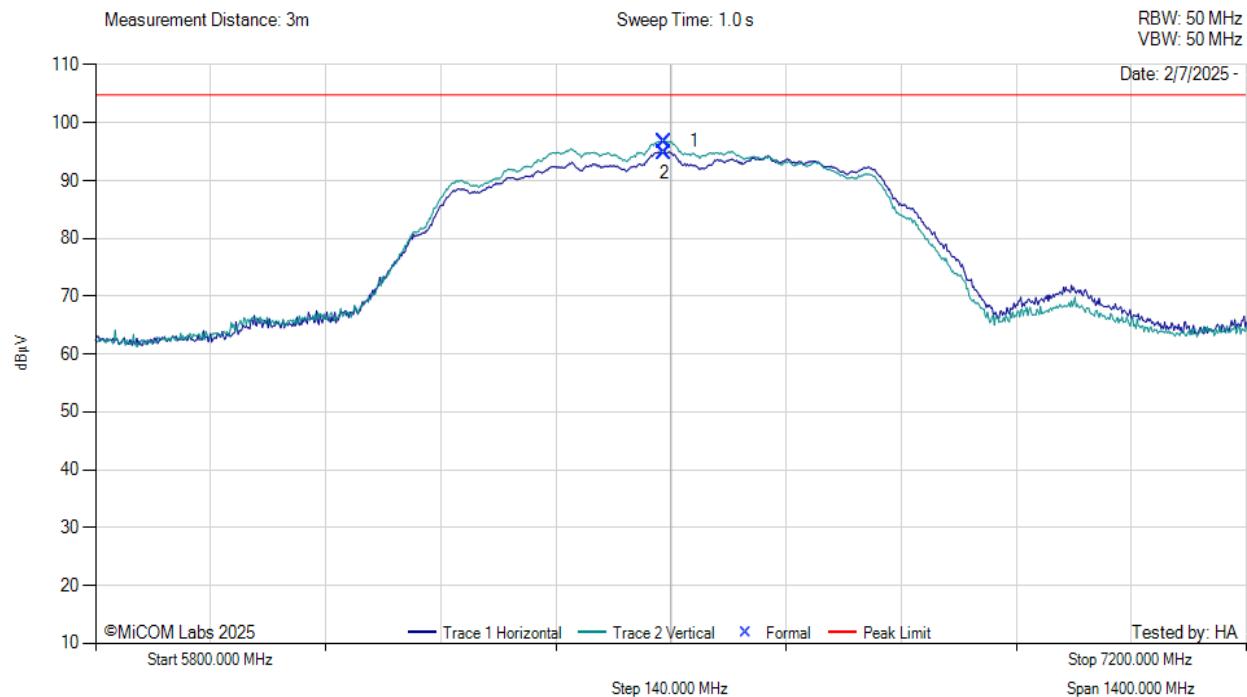
Frequency (MHz)	EIRP Limit (dBm/50MHz)	EIRP at 1 Meters (dBuv/m) (50MHz RBW)	EIRP at 1 Meters (dBuv/m) (30MHz RBW)
3100 - 10600	0	104.77	100.77

#### Equipment Configuration for Peak Power Density

<b>Variant:</b>	WB	<b>Duty Cycle (%):</b>	99
<b>Data Rate:</b>	--	<b>Antenna Gain (dBi):</b>	4.28
<b>Modulation:</b>	--	<b>Beam Forming Gain (Y)(dB):</b>	Not Applicable
<b>TPC:</b>	Not Applicable	<b>Tested By:</b>	SB
<b>Engineering Test Notes:</b>			

#### Test Measurement Results

Test Frequency MHz	Measured Radiated Output Power (dB $\mu$ V/m)	Limit (dB $\mu$ V/n)	Margin (dB)	EUT Power Setting
6489.60	96.78	104.8	-7.99	28.0



5800.00 - 7200.00 MHz													
Num	Frequency MHz	Raw dB $\mu$ V	Cable Loss dB	AF dB/m	Level dB $\mu$ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB $\mu$ V/m	Margin dB	Pass /Fail	
1	6491.60	102.28	3.41	-8.92	96.78	MaxP	Vertical	149	209	104.8	-8.0	Pass	
2	6491.60	100.33	3.41	-8.92	94.82	MaxP	Horizontal	149	270	104.8	-10.0	Pass	

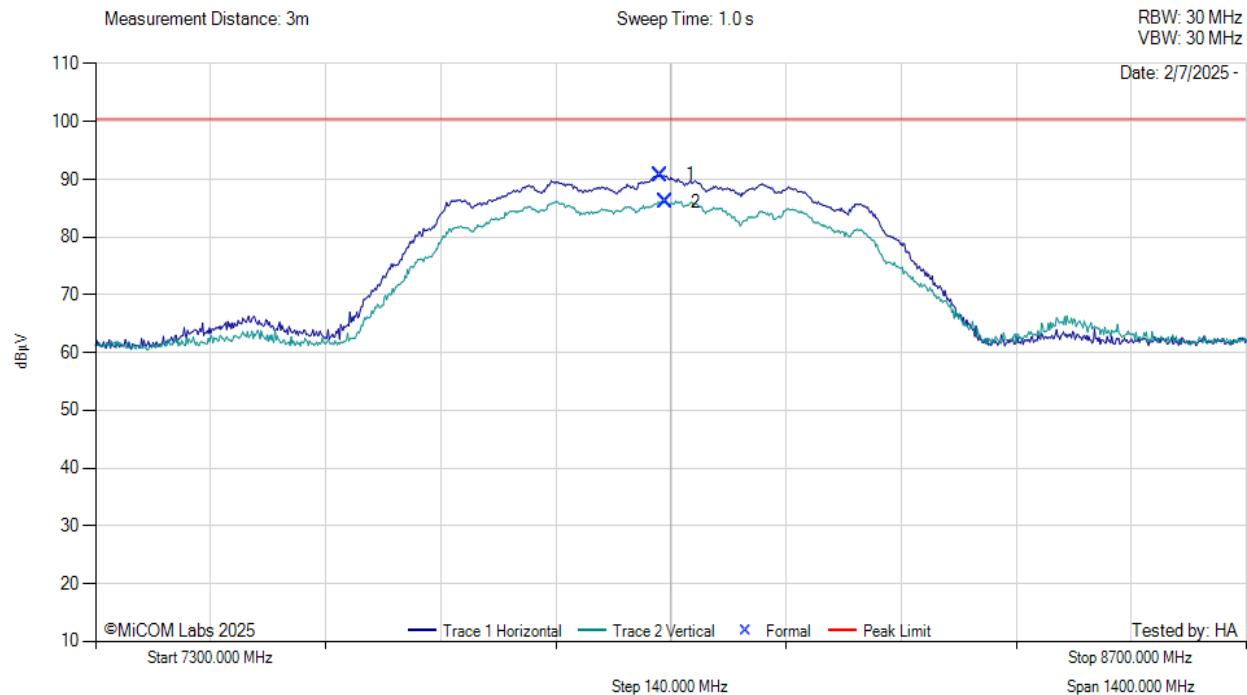
**Test Notes:** Channel 5 6489.6, power setting 28, 1 Meter measurement distance

#### Equipment Configuration for RF Output Power

<b>Variant:</b>	WB	<b>Duty Cycle (%):</b>	99
<b>Data Rate:</b>	--	<b>Antenna Gain (dBi):</b>	7.65
<b>Modulation:</b>	--	<b>Beam Forming Gain (Y)(dB):</b>	Not Applicable
<b>TPC:</b>	Not Applicable	<b>Tested By:</b>	SB
<b>Engineering Test Notes:</b>			

#### Test Measurement Results

Test Frequency MHz	Measured Radiated Output Power (dB $\mu$ V/m)	Limit (dB $\mu$ V/n)	Margin (dB)	EUT Power Setting
7987.2	90.73	100.77	-10.04	28.0



7300.00 - 8700.00 MHz												
Num	Frequency MHz	Raw dB $\mu$ V	Cable Loss dB	AF dB/m	Level dB $\mu$ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB $\mu$ V/m	Margin dB	Pass /Fail
1	7987.40	94.91	3.87	-8.05	90.73	MaxP	Horizontal	149	270	100.4	-9.7	Pass
2	7993.00	90.43	3.80	35.85	86.15	MaxP	Vertical	149	180	100.4	-14.3	Pass

**Test Notes:** Channel 9 7987.2, power setting 28 1 Meter measurement distance

## 9.4. Transmitter Spurious Band Emissions

Radiated Test Conditions for Radiated Spurious and Band-Edge Emissions			
<b>Standard:</b>	FCC Part 15 Subpart F 15.517 UWB Device	<b>Ambient Temp. (°C):</b>	20.0 - 24.5
<b>Test Heading:</b>	Radiated Spurious Emissions	<b>Rel. Humidity (%):</b>	32 - 45
<b>Standard Section(s):</b>	ANSI C63.10 Section 10.2 + 10.3; 5.3.1	<b>Pressure (mBars):</b>	999 - 1001
<b>Reference Document(s):</b>	See Normative References		

### Test Procedure for Radiated Spurious and Band-Edge Emissions

Radiated emissions for restricted bands above 1 GHz are measured in the anechoic chamber at a 1-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in max hold mode. Depending on the frequency band spanned a notch filter was used to remove the fundamental frequency. The highest emissions relative to the limit are listed for each frequency spanned. Measurements on any restricted band frequency or frequencies above 1 GHz are based on the use of measurement instrumentation employing peak and average detectors. All measurements were performed using a resolution bandwidth of 1 MHz.

### Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.

$$FS = R + AF + CORR - FO$$

where:

FS = Field Strength

R = Measured Spectrum analyzer Input Amplitude

AF = Antenna Factor

CORR = Correction Factor = CL - AG + NFL

CL = Cable Loss

AG = Amplifier Gain

FO = Distance Falloff Factor

NFL = Notch Filter Loss

### Emissions 30MHz to 1GHz 15.517(c)

The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in § 15.209.

### Measurements made at 1 & 3 meter to meet noise floor to limit requirements

Frequency Range		Average Limit		
MHz	MHz	EIRP (dBm)	EIRP at 1 Meters (dBuV/m)	EIRP at 3 Meters (dBuV/m)
960	1610	-75.3	29.47	19.93
1610	1990	-53.3	51.47	41.93
1990	3100	-51.3	53.47	43.93
3100	10600	-41.3	63.47	53.93
10600	18000	-51.3	53.47	43.93

No Emissions were observed from 18GHz to 40GHz

Radiated Spurious Emissions in the GPS Bands 15.517 (d)

Frequency Range		Average Limit	
MHz	MHz	EIRP (dBm)	EIRP at 1 Meters (dBuV/m)
1164	1240	-85.3	19.47
1559	1610	-85.3	19.47

50 MHz Peak Emissions 15.517(e)

There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs,  $f_M$ . That limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described in §15.521

Within 50 MHz bandwidth centered on highest radiated emissions  $f_M$ , Limit is 0.0 dBm EIRP. At 1-meter distance the equivalent level is 104.80 dBuV/m

#### 9.4.1. Transmitter Spurious Emissions

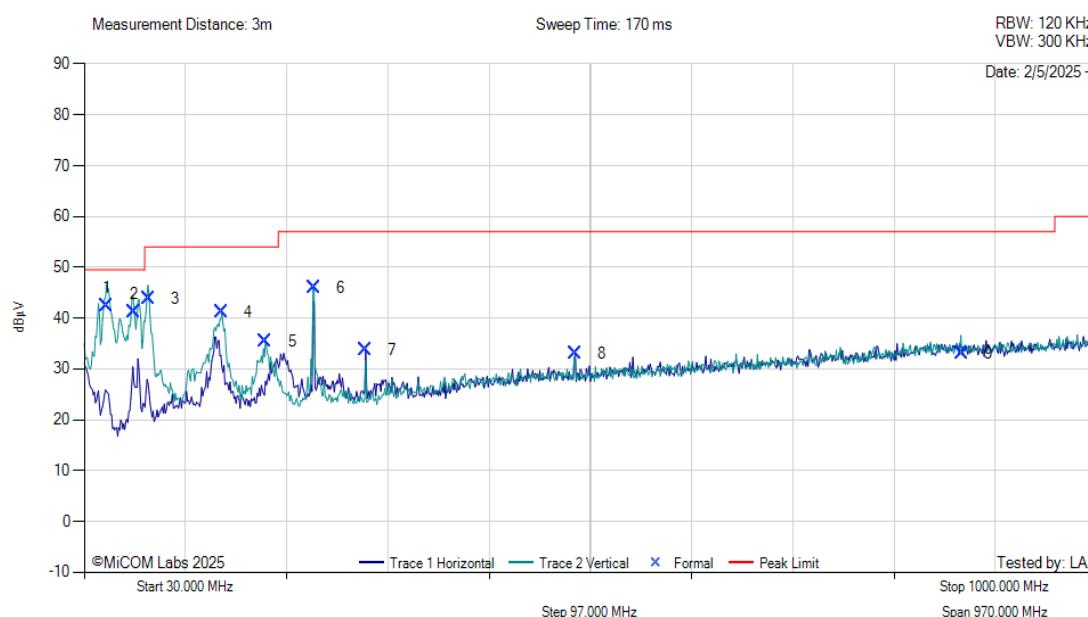
##### Equipment Configuration for 30 MHZ TO 1 GHZ CLASS A

<b>Antenna:</b>	Integral	<b>Variant:</b>	UWB
<b>Antenna Gain (dBi):</b>	4.28	<b>Modulation:</b>	--
<b>Beam Forming Gain (Y):</b>	Not Applicable	<b>Duty Cycle (%):</b>	99
<b>Channel Frequency (MHz):</b>	6489.6	<b>Data Rate:</b>	--
<b>Power Setting:</b>	28.0	<b>Tested By:</b>	LA

##### Test Measurement Results



##### 30 MHz to 1 GHz Class A



##### 30.00 - 1000.00 MHz

Num	Frequency MHz	Raw dB $\mu$ V	Cable Loss dB	AF dB/m	Level dB $\mu$ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB $\mu$ V/m	Margin dB	Pass /Fail
1	51.66	55.73	3.73	-17.06	42.40	MaxQP	Vertical	103	249	49.5	-7.1	Pass
2	77.35	54.28	3.94	-16.97	41.25	MaxQP	Vertical	100	209	49.5	-8.2	Pass
3	91.74	56.49	4.05	-16.77	43.77	MaxQP	Vertical	99	241	54.0	-10.2	Pass
4	161.92	49.66	4.41	-12.93	41.14	MaxP	Vertical	100	0	54.0	-12.9	Pass
5	203.63	44.22	4.61	-13.36	35.46	MaxP	Vertical	100	0	54.0	-18.5	Pass
6	250.19	54.21	4.80	-12.98	46.02	MaxP	Vertical	100	0	57.0	-11.0	Pass
7	299.66	40.05	5.00	-11.25	33.81	MaxP	Horizontal	100	90	57.0	-23.2	Pass
8	500.45	34.33	5.69	-7.01	33.00	MaxP	Horizontal	199	268	57.0	-24.0	Pass
9	870.99	28.31	6.87	-2.17	33.01	MaxP	Vertical	100	299	57.0	-24.0	Pass

**Test Notes:** PoE powered .6,5GHz Active. PS 19.

#### 9.4.1.1. 6489.6 MHz

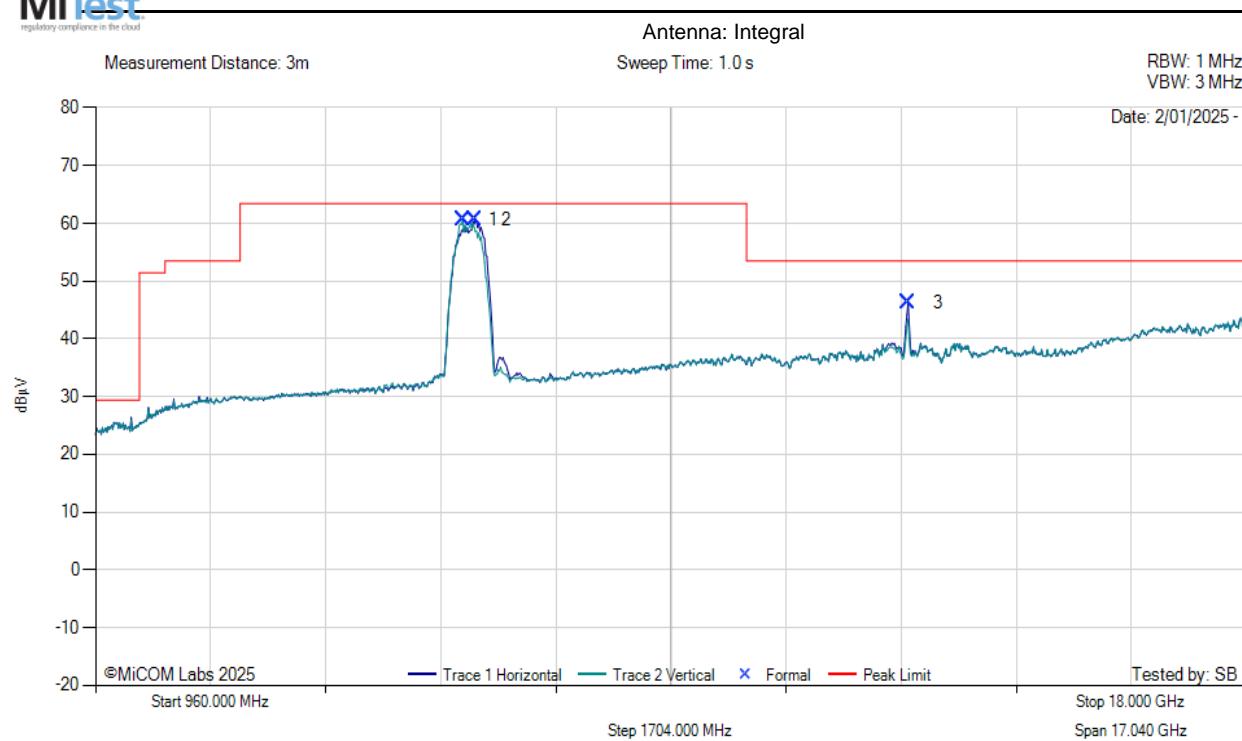
##### Equipment Configuration for Radiated Spurious 960 MHz - 18 GHz

<b>Antenna:</b>	Integral	<b>Variant:</b>	UWB
<b>Antenna Gain (dBi):</b>	4.28	<b>Modulation:</b>	--
<b>Beam Forming Gain (Y):</b>	Not Applicable	<b>Duty Cycle (%):</b>	99
<b>Channel Frequency (MHz):</b>	6489.6	<b>Data Rate:</b>	--
<b>Power Setting:</b>	28.0	<b>Tested By:</b>	SB

##### Test Measurement Results



##### Radiated Spurious 960 MHz - 18 GHz



960.00 - 18000.00 MHz													
Num	Frequency MHz	Raw dB $\mu$ V	Cable Loss dB	AF dB/m	Level dB $\mu$ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB $\mu$ V/m	Margin dB	Pass /Fail	
1	6395.76	66.74	3.35	-8.91	60.68	AVG	Vertical	150	210	63.4	-2.8	Pass	
2	6583.20	66.52	3.41	-8.79	60.64	AVG	Horizontal	150	270	63.4	-2.8	Pass	
3	12990.24	49.10	5.15	-7.47	46.28	AVG	Horizontal	150	330	53.5	-7.2	Pass	

**Test Notes:** PoE powered. Antenna connected to EUT. CF mode active. 6.5GHz, PS 28.0

#### 9.4.1.2. 7987.2 MHz

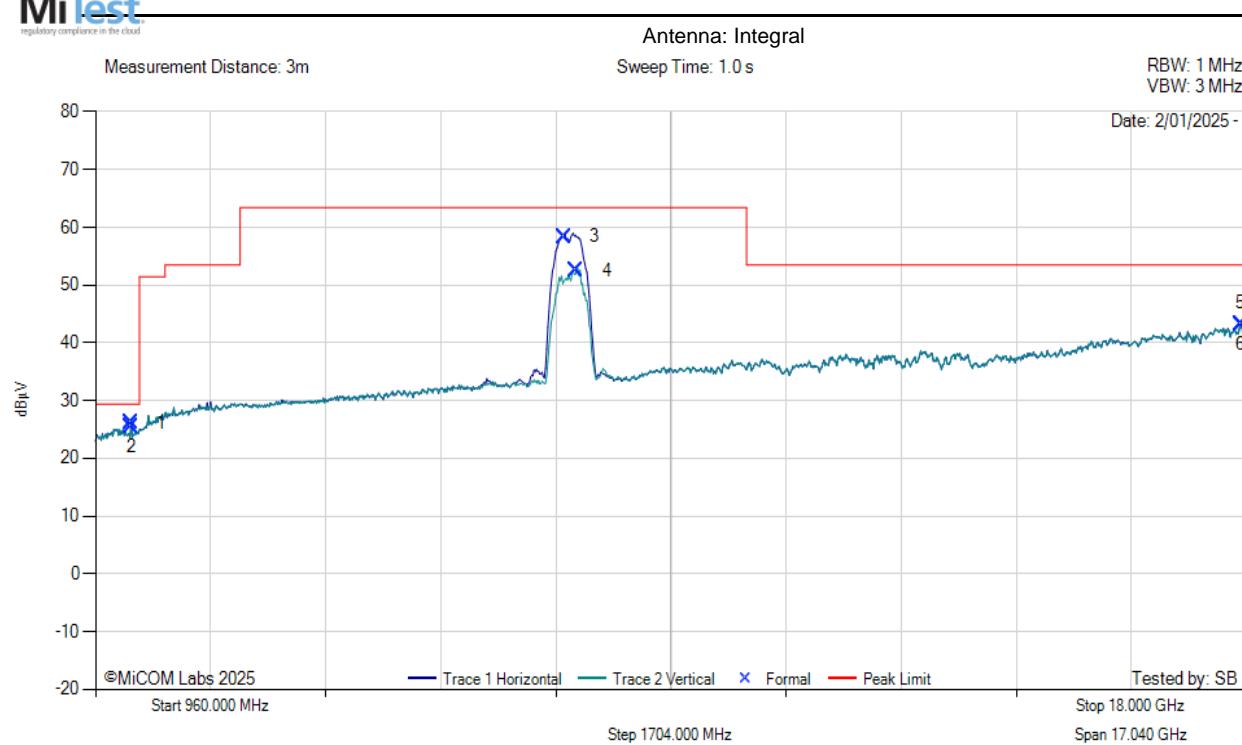
##### Equipment Configuration for Radiated Spurious 960 MHz - 18 GHz

<b>Antenna:</b>	Integral	<b>Variant:</b>	UWB
<b>Antenna Gain (dBi):</b>	7.65	<b>Modulation:</b>	--
<b>Beam Forming Gain (Y):</b>	Not Applicable	<b>Duty Cycle (%):</b>	99
<b>Channel Frequency (MHz):</b>	7987.2	<b>Data Rate:</b>	--
<b>Power Setting:</b>	28.0	<b>Tested By:</b>	SB

##### Test Measurement Results



##### Radiated Spurious 960 MHz - 18 GHz



960.00 - 18000.00 MHz													
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail	
1	1488.24	42.14	1.56	-16.89	26.21	AVG	Horizontal	150	180	29.4	-3.2	Pass	
2	1488.24	41.44	1.56	-16.89	25.51	AVG	Vertical	150	330	29.4	-3.9	Pass	
3	7895.28	63.26	3.77	-8.01	58.42	AVG	Horizontal	150	270	63.4	-5.0	Pass	
4	8082.72	57.39	3.79	-8.13	52.46	AVG	Vertical	150	179	63.4	-11.0	Pass	
5	17914.80	35.95	6.68	1.28	43.31	AVG	Vertical	150	239	43.4	-0.1	Pass	
6	17914.80	35.92	6.68	1.28	43.28	AVG	Horizontal	150	270	43.4	-0.1	Pass	

**Test Notes:** PoE powered. Antenna connected to EUT, CF mode active. 8GHz, PS 28.0

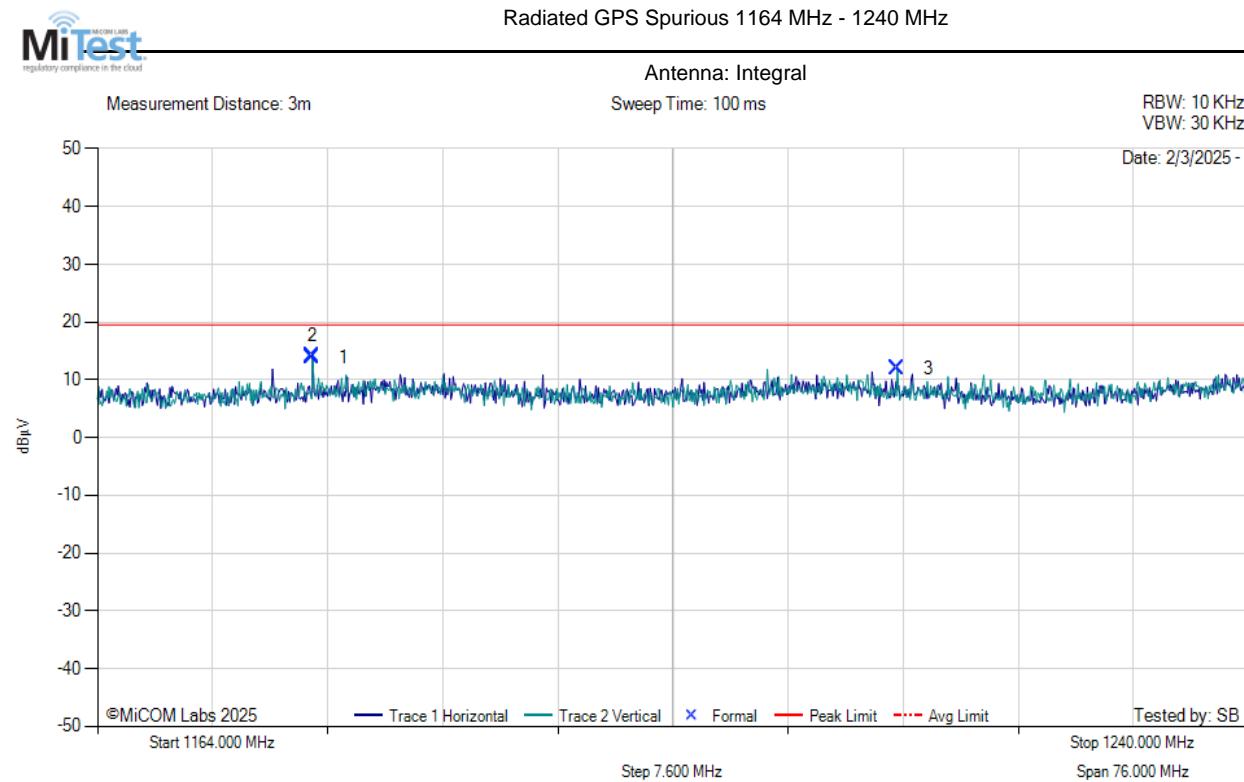
#### 9.4.2. GPS Band Emissions

##### 9.4.2.3. 6489.6 MHz

###### Equipment Configuration for Spurious Emissions

<b>Antenna:</b>	Integral	<b>Variant:</b>	UWB
<b>Antenna Gain (dBi):</b>	4.28	<b>Modulation:</b>	--
<b>Beam Forming Gain (Y):</b>	Not Applicable	<b>Duty Cycle (%):</b>	99
<b>Channel Frequency (MHz):</b>	6489.6	<b>Data Rate:</b>	--
<b>Power Setting:</b>	28.0	<b>Tested By:</b>	SB

###### Test Measurement Results



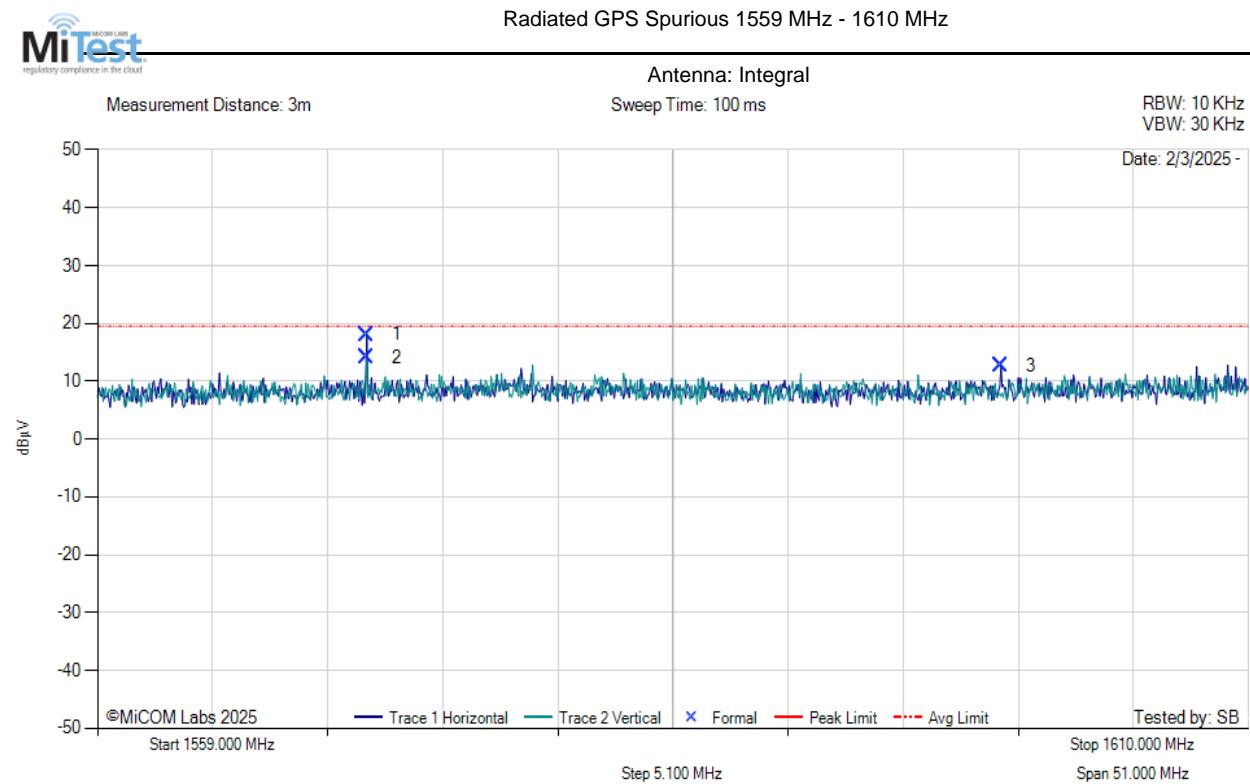
1164.00 - 1240.00 MHz													
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB/m	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail	
1	1178.21	28.55	1.41	-16.76	13.91	AVG	Vertical	150	330	19.5	-5.6	Pass	
2	1178.21	29.46	1.41	-16.76	14.10	AVG	Horizontal	150	300	19.5	-5.4	Pass	
3	1216.82	27.09	1.40	-16.51	11.98	AVG	Vertical	150	299	19.5	-7.5	Pass	

**Test Notes:** PoE powered. Antenna connected to EUT. GPS Band 1164-1240, CF mode active. 6.5GHz, PS 28.0

#### Equipment Configuration for Spurious Emissions

<b>Antenna:</b>	Integral	<b>Variant:</b>	UWB
<b>Antenna Gain (dBi):</b>	4.28	<b>Modulation:</b>	--
<b>Beam Forming Gain (Y):</b>	Not Applicable	<b>Duty Cycle (%):</b>	99
<b>Channel Frequency (MHz):</b>	6489.6	<b>Data Rate:</b>	--
<b>Power Setting:</b>	28.0	<b>Tested By:</b>	SB

#### Test Measurement Results



1559.00 - 1610.00 MHz													
Num	Frequency MHz	Raw dB $\mu$ V	Cable Loss dB	AF dB/m	Level dB $\mu$ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB $\mu$ V/m	Margin dB	Pass /Fail	
1	1570.93	32.97	1.64	-16.57	18.05	AVG	Horizontal	150	270	19.5	-1.5	Pass	
2	1570.93	29.09	1.64	-16.57	14.17	AVG	Vertical	150	328	19.5	-5.3	Pass	
3	1599.04	27.44	1.62	-16.34	12.72	AVG	Horizontal	150	150	19.5	-6.8	Pass	

**Test Notes:** PoE powered. Antenna connected to EUT. GPS Band 1559-1610, CF mode active. 6.5GHz, PS 28.0

#### 9.4.2.4. 7987.2 MHz

##### Equipment Configuration for Spurious Emissions

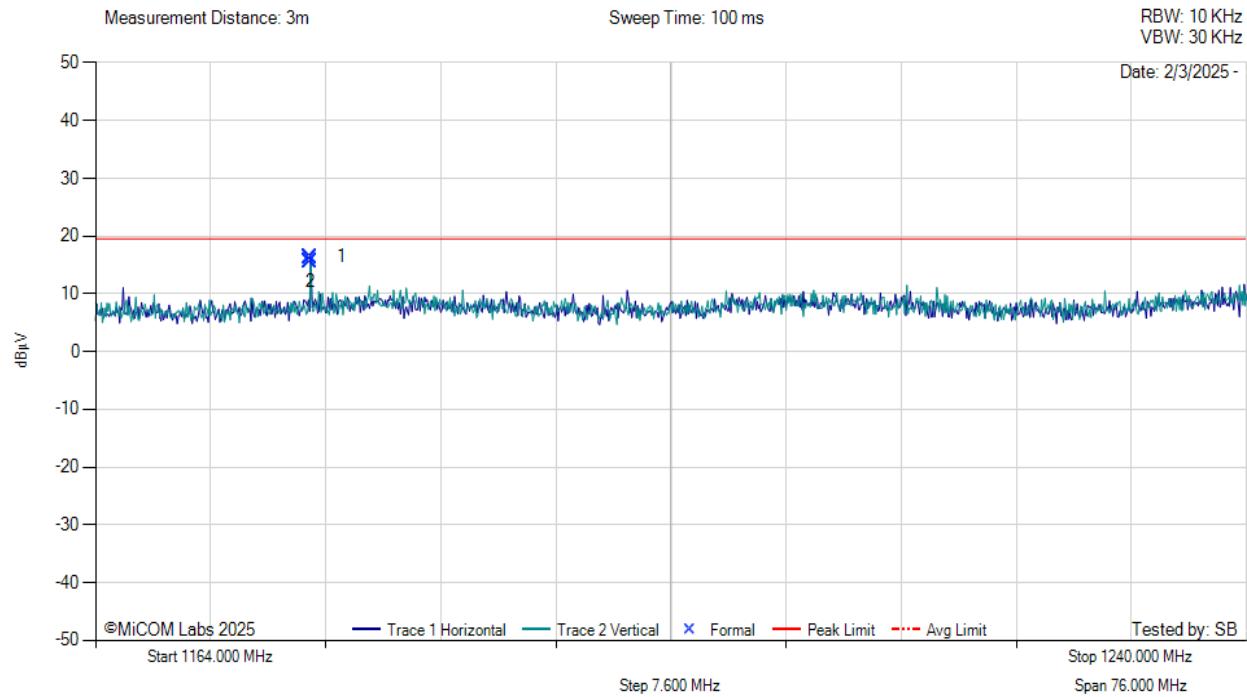
<b>Antenna:</b>	Integral	<b>Variant:</b>	UWB
<b>Antenna Gain (dBi):</b>	7.65	<b>Modulation:</b>	--
<b>Beam Forming Gain (Y):</b>	Not Applicable	<b>Duty Cycle (%):</b>	99
<b>Channel Frequency (MHz):</b>	7987.2	<b>Data Rate:</b>	--
<b>Power Setting:</b>	28.0	<b>Tested By:</b>	SB

##### Test Measurement Results



##### Radiated GPS Spurious 1164 MHz - 1240 MHz

Antenna: Integral



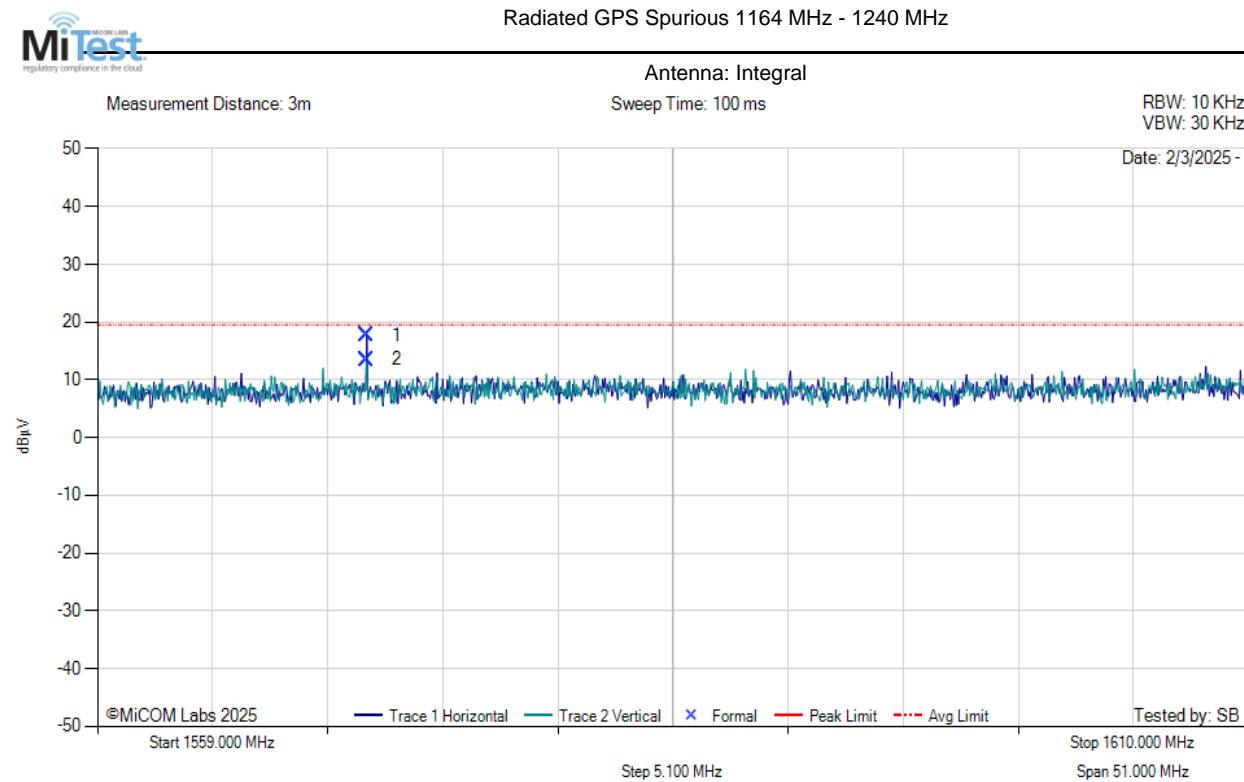
1164.00 - 1240.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	1178.21	30.29	1.41	-16.76	16.41	AVG	Vertical	150	330	19.5	-3.1	Pass
2	1178.21	31.03	1.41	-16.76	15.67	AVG	Horizontal	150	330	19.5	-3.8	Pass

**Test Notes:** PoE powered. Antenna connected to EUT. GPS Band 1164-1240, CF mode active. 8GHz, PS 28.0

### Equipment Configuration for Spurious Emissions

<b>Antenna:</b>	Integral	<b>Variant:</b>	UWB
<b>Antenna Gain (dBi):</b>	7.65	<b>Modulation:</b>	--
<b>Beam Forming Gain (Y):</b>	Not Applicable	<b>Duty Cycle (%):</b>	99
<b>Channel Frequency (MHz):</b>	7987.2	<b>Data Rate:</b>	--
<b>Power Setting:</b>	28.0	<b>Tested By:</b>	SB

### Test Measurement Results



1559.00 - 1610.00 MHz													
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB/m	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail	
1	1570.93	32.61	1.64	-16.57	17.68	AVG	Horizontal	150	270	19.5	-1.8	Pass	
2	1570.93	28.44	1.64	-16.57	13.52	AVG	Vertical	150	330	19.5	-6.0	Pass	

**Test Notes:** PoE powered. Antenna connected to EUT. GPS Band 1159-1610, CF mode active. 8GHz, PS 28.0



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