Element U.S. Space & Defense Test Report for RTCA/DO-160G Radiated RF Emissions Testing of the IoT Beacon Pallet Tag

Prepared For
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Performed By
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Date: 2025.02.19 14:22:15 -05'00'

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2025.02.19 12:40:57 -05'00'

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Sr. EMI/EMC Engineer

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Revision History

Rev.	Description	Issue Date
0	Initial Release	02/19/2025

Table of Contents

List of Tables

1.0 Introduction

This document presents the test procedures used and the results obtained during the performance of RTCA/DO-160G Radiated RF Emissions testing. The testing was conducted to assess the ability of the specified Equipment Under Test (EUT) to successfully satisfy the requirements listed in Section 2.0.

2.0 References

The following references listed below form a part of this document to the extent specified herein.

- Test Specification: Customer emails from Maria Vivas Suarez, dated 11/08/2024 and 01/07/2025 (RFQ emails), and RTCA/DO-160G, *Environmental Conditions and Test Procedures for Airborne Equipment,* dated 12/8/2010, Section 21.5, Category H
- Descartes Systems (USA) LLC Purchase Order 4500045275, dated 01/22/2025
- Element U.S. Space & Defense Quote OH000022972-1, dated 01/08/2025
- ISO/IEC 17025:2017(E) *General Requirements for the Competence of Testing and Calibration Laboratories,* dated 11/1/2017

3.0 Product Selection and Description

Descartes Systems (USA) LLC selected and provided the test sample to be used as the Equipment Under Test.

Table 3.0-1: Product Identification - Equipment Under Test (EUT)

Item	Qty.	Name/Description	Part/Model Number	Serial Number
1	1	IoT Beacon Pallet Tag	PLT005	2CDC7805A3A1

3.1 Security Classification

Unclassified

4.0 General Test Requirements

4.1 Test Equipment

The instrumentation used in the performance of these tests is periodically calibrated and standardized within manufacturer's rated accuracies and are traceable to the National Institute of Standards and Technology. The calibration procedures and practices are in accordance with ISO 17025:2017. Certification of calibration is on file subject to inspection by authorized personnel.

5.0 Test Description and Results

Table 5.0-1: Summary of Test Information & Results

Section	Test	Specification	Test Facility	Test Date	Part/Model #	Serial #	Test Result
5.1	Radiated RF Emissions	Customer emails from Maria Vivas Suarez, dated 11/08/2024 and 01/07/2025 (RFQ emails), and RTCA/DO-160G, Section 21.5, Category H	Orlando	02/12/2025	PLT005	2CDC7805A3A1	Complied

The decision rule for Test Results was based on the Test Specification used for testing.

5.1 Radiated RF Emissions

5.1.1 Test Procedure

The EUT was tested to Customer emails from Maria Vivas Suarez, dated 11/08/2024 and 01/07/2025 (RFQ emails), and RTCA/DO-160G, Section 21.5, Category H requirements.

5.1.2 Test Result

The EUT radiated emissions did not emit undesired RF noise in excess of the specified limits over the frequency range from 100 MHz to 6 GHz. The EUT was compliant with the RTCA/DO-160G, Section 21.5, Category H requirements.

5.1.3 Test Datasheets

Element U.S. Space & Defense					
Section 21 Radiated RF Emissions System Verification					
RE Limit:	**Category H**				
Frequency (MHz)	**Limit (dBµV/m)**	**Calibrated Signal Amplitude (dBµV)**	**Measured Signal Amplitude (dBµV)**	**Deviation (dB)**	**Result**
197	49.31	43.31	44.15	0.84	**Complied**
950	60.22	54.22	54.48	0.26	**Complied**
5500	72.40	66.40	66.20	-0.20	**Complied**
Test Performed By:	**Steve Horvath**		**Date:**	**2/12/2025**	

Element U.S. Space & Defense							
Section 21 Radiated RF Emissions Bandwidth, Measurement Time and Frequency Resolution							
Spectrum Analyzer Used:				**Agilent E4440A**			
Start Frequency (MHz)	**Stop Frequency (MHz)**	**Table II Minimum Measurement Time (sec/MHz)**	**Table II 6dB Resolution BW (MHz)**	**Minimum Measurement time for this band (sec)**	**Minimum Number of ranges needed**	**Minimum Measurement Time per Range (sec)**	**Frequency Resolution (MHz)**
100	200	1.5	0.01	150	20	7.50	0.00499500
200	400	1.5	0.01	300	40	7.50	0.00499500
400	960	0.15	0.1	84	12	7.00	0.04662005
960	1000	0.015	1	0.6	1	0.60	0.03996004
1000	6000	0.015	1	75	10	7.50	0.49950050

Element U.S. Space & Defense						
Section 21 Radiated RF Emissions Data Sheet						
Remarks: All operational scan data can be found in file -002.						
Service Branch: Aerospace				**Test Level: Category H**		
Tile Software Version:		**7.3.4.7**				
Start Frequency (MHz)	**Stop Frequency (MHz)**	**6dB Bandwidth (kHz)**	**Limit**	**Mode of Operation**	**Complied / Did Not Comply**	**Remarks**
100	6000	10/1000	Category H	N/A	Complied	Verification Scan. File-001
100	200	10	Category H	Active	Complied	Vertical; Antenna Height: 120 cm. File-002
100	200	10	Category H	Active	Complied	Horizontal; Antenna Height: 120 cm. File-002
200	400	10	Category H	Active	Complied	Vertical; Antenna Height: 120 cm. File-002
200	400	10	Category H	Active	Complied	Horizontal; Antenna Height: 120.5 cm. File-002
400	960	100	Category H	Active	Complied	Vertical; Antenna Height: 120 cm. File-002
400	960	100	Category H	Active	Complied	Horizontal; Antenna Height: 120.5 cm. File-002
960	1000	1000	Category H	Active	Complied	Vertical; Antenna Height: 120 cm. File-002
960	1000	1000	Category H	Active	Complied	Horizontal; Antenna Height: 120.5 cm. File-002
1000	6000	1000	Category H	Active	Complied	Vertical; Antenna Height: 119.5 cm. File-002
1000	6000	1000	Category H	Active	Complied	Horizontal; Antenna Height: 119.5 cm. File-002
Test Performed By:		**Steve Horvath**				

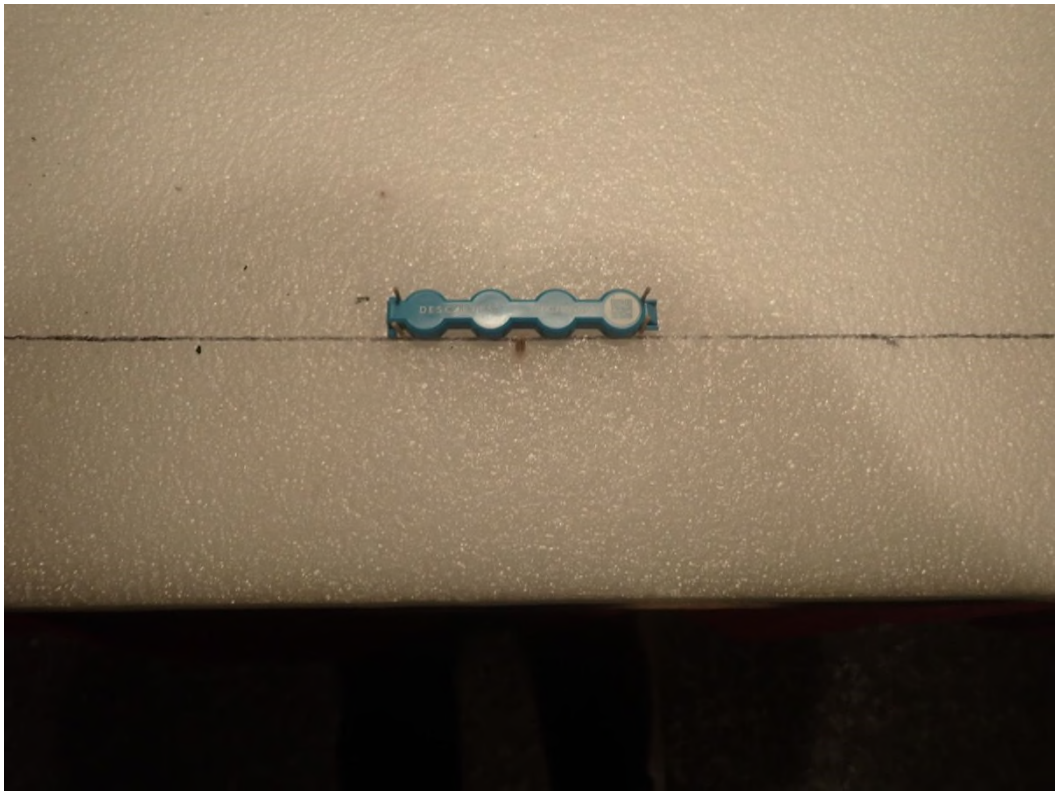
Element U.S. Space & Defense								
Section 21 Radiated Emissions Log								
Temperature:	**23.6**	**° C**	**Humidity:**	**57**	**% RH**	**Barometer:**	**Site Pressure**	
Date	**Time**	**Log Entries**						**Initials**
2/12/25	0900	Started equipment setup.						SH
	1006	Started Verification Scans. Reference file-001.						SH
	1010	Completed Verification. Complied.						SH
	1015	Testing on hold, waiting customer confirmation regarding current EUT operational mode. Starting EUT setup.						SH
	1050	EUT status confirmed, per Customer email from Maria Vivas Suarez on 2-12-2025 at 1050hrs. EUT Active.						SH
	1109	Started Operational Scan 100MHz-200MHz Biconical Antenna Vertical Polarization. Reference file-002.						SH
	1117	Completed Operational Scan. Complied.						SH
	1123	Started Operational Scan 100MHz-200MHz Biconical Antenna Horizontal Polarization. Reference file-002.						SH
	1132	Completed Operational Scan. Complied.						SH
	1242	Started Operational Scan 200MHz-1GHz LDRG Antenna Vertical Polarization. Reference file-002.						SH
	1301	Completed Operational Scan. Complied.						SH
	1316	Started Operational Scan 200MHz-1GHz LDRG Antenna Horizontal Polarization. Reference file-002.						SH
	1335	Completed Operational Scan. Complied.						SH
	1358	Started Operational Scan 1GHz-6GHz SDRG Antenna Vertical Polarization. Reference file-002.						SH
	1405	Completed Operational Scan. Complied.						SH
	1411	Started Operational Scan 1GHz-6GHz SDRG Antenna Horizontal Polarization. Reference file-002.						SH
	1418	Completed Operational Scan. Complied.						SH
	1420	Compiling Data						SH
	1500	Data Complete						SH
Witnessed By:		**None Present**						
Test Performed By:		**Steve Horvath**						

5.1.4 Test Photographs

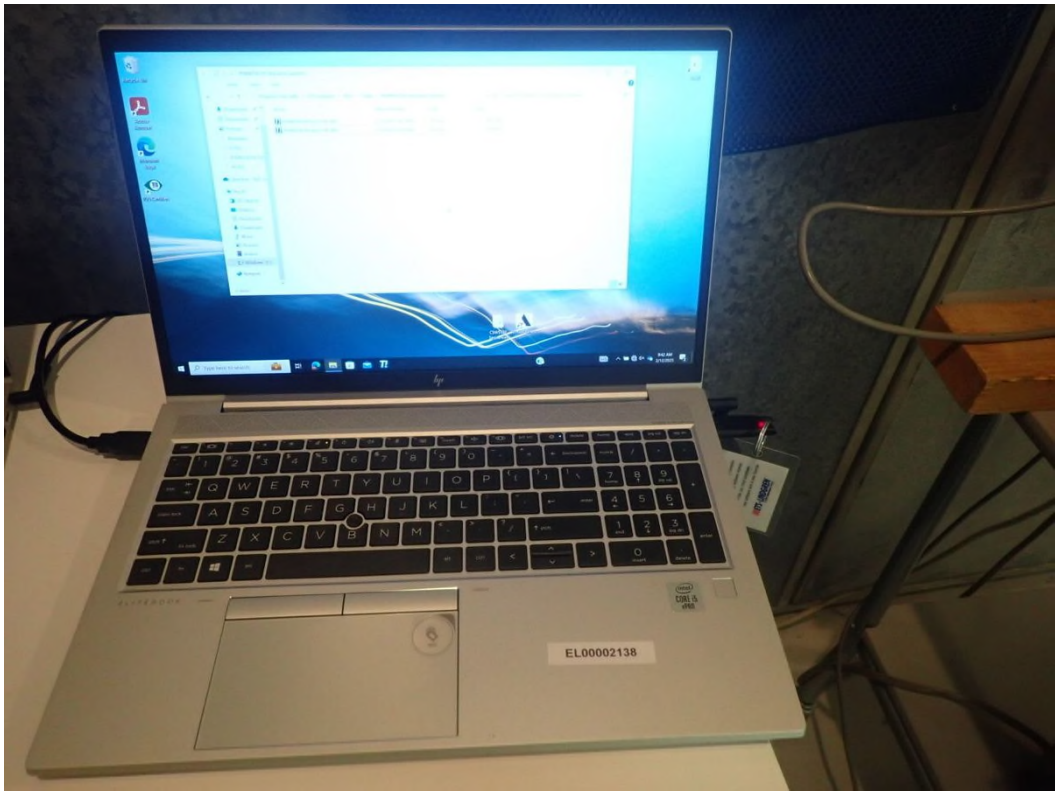
EUT Identification Labelling, View 1

EUT Identification Labelling, View 2

General Test Setup, EUT on Test Bench, View 1

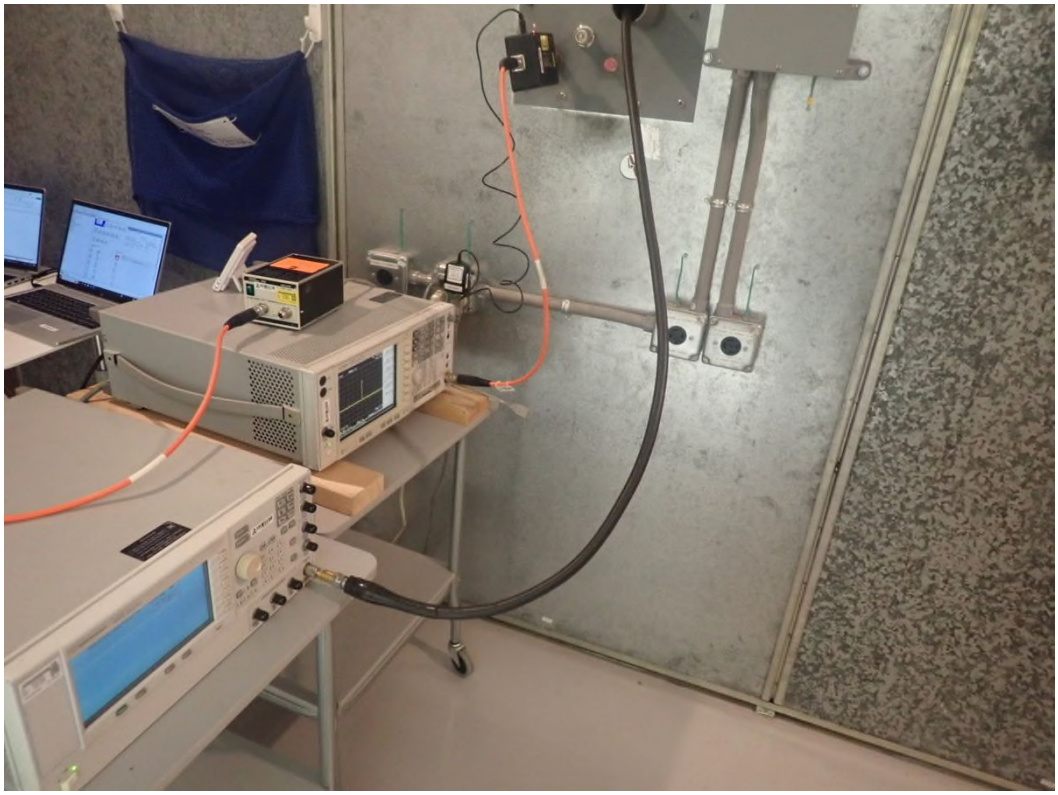


General Test Setup, EUT on Test Bench, View 2

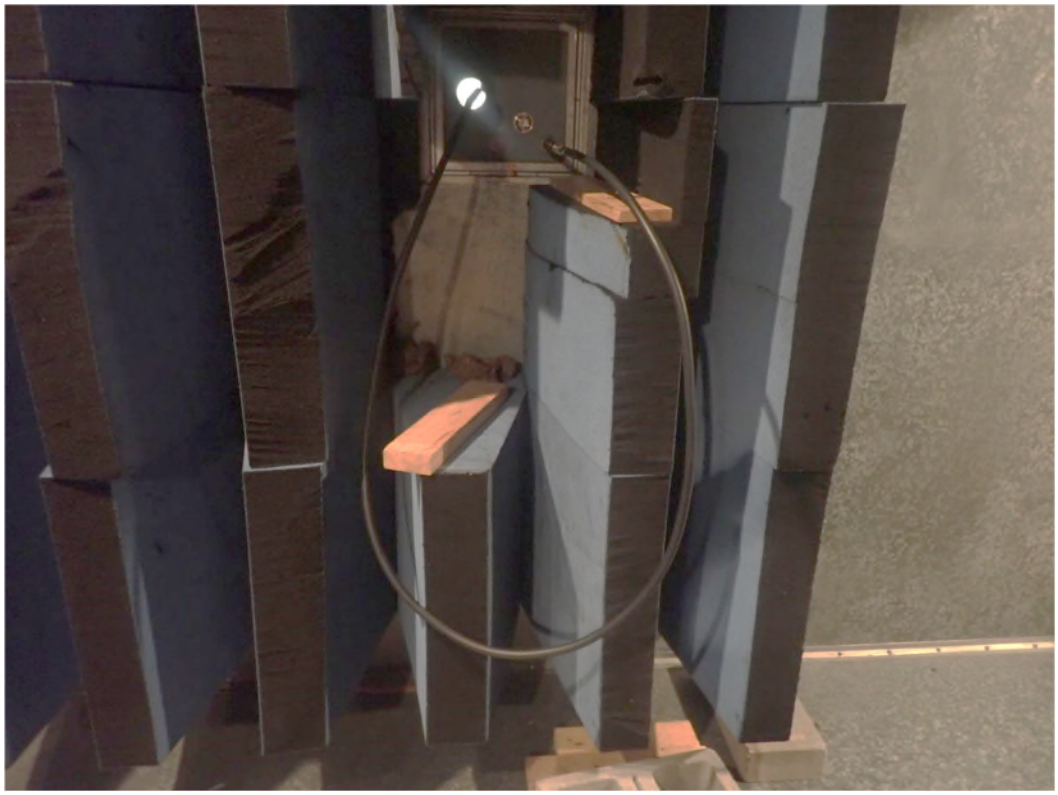


Section 21 RE Measurement and System Verification Test Equipment, 100 MHz-6 GHz

Section 21 RE System Verification Test Equipment, 100 MHz-1 GHz

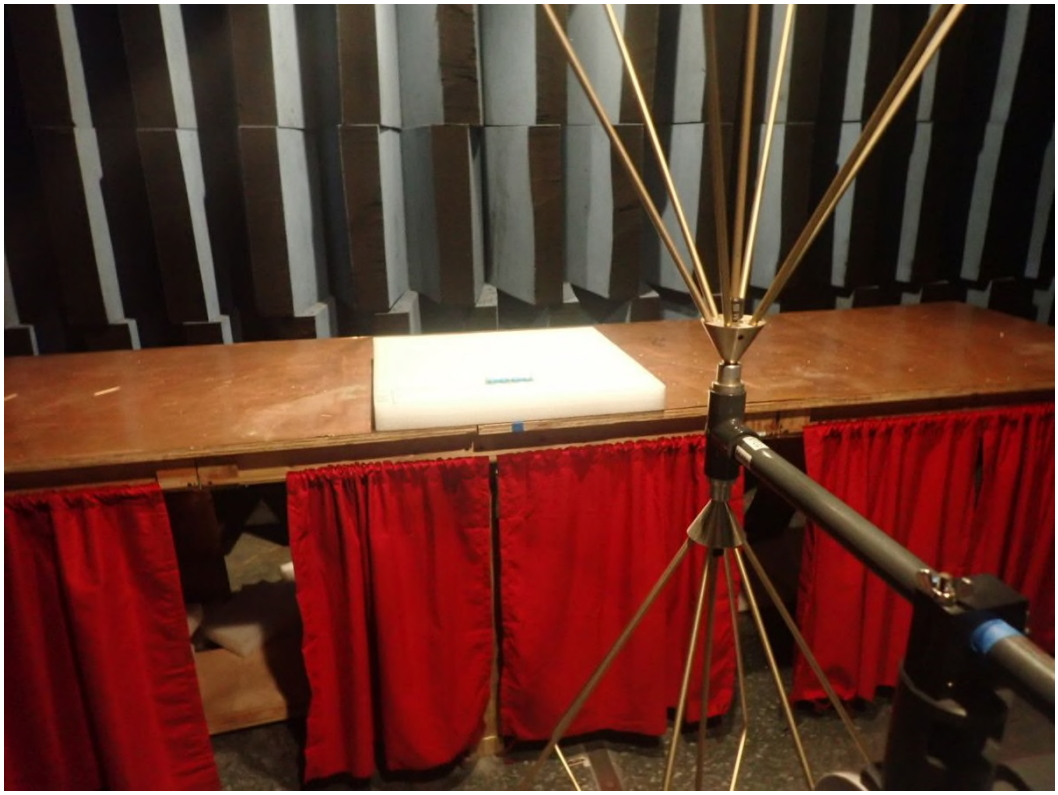


Section 21 RE System Verification Test Equipment, 1 GHz-6 GHz

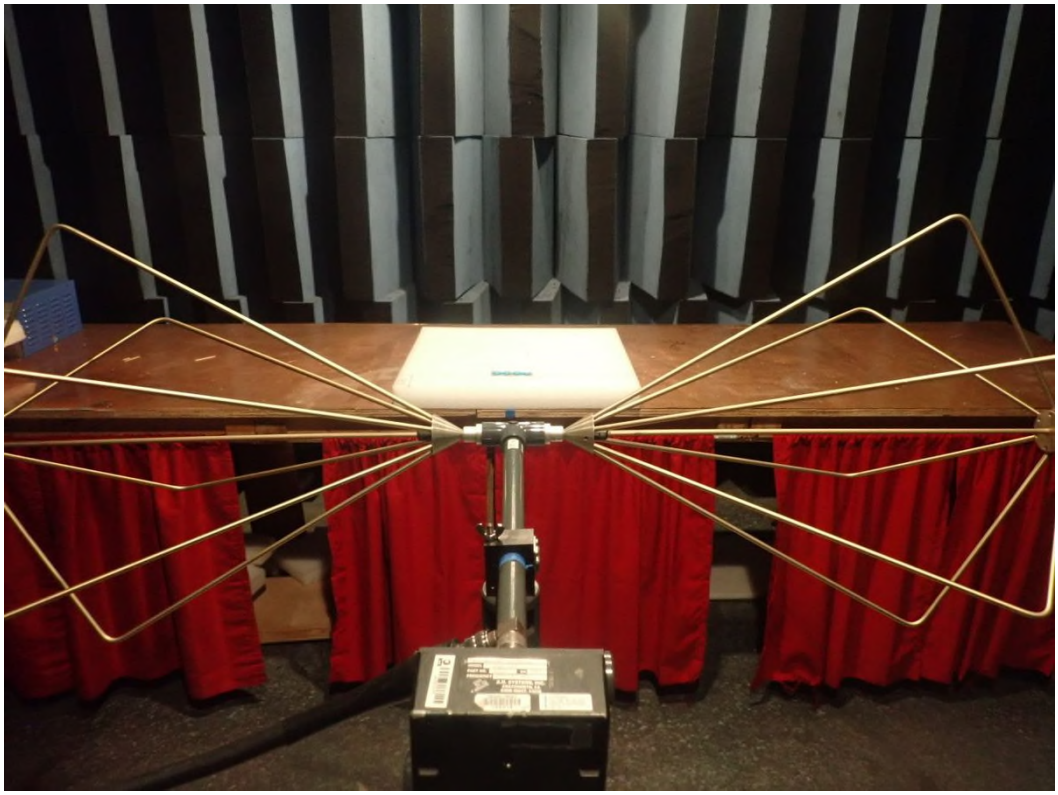


Section 21 RE System Verification Setup, Cable Loopback to Signal Source

Section 21 RE Measurement Test Equipment, 100 MHz-1 GHz

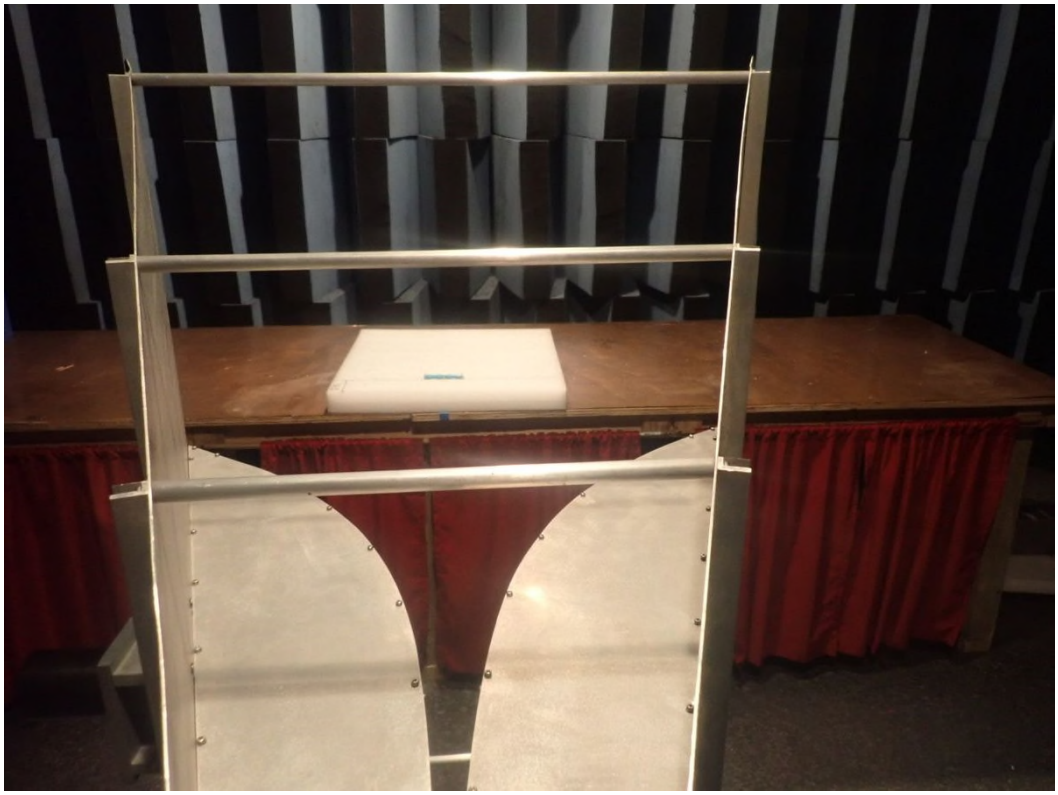


Section 21 RE Biconical Antenna Test Setup, 100 MHz-200 MHz, Vertical

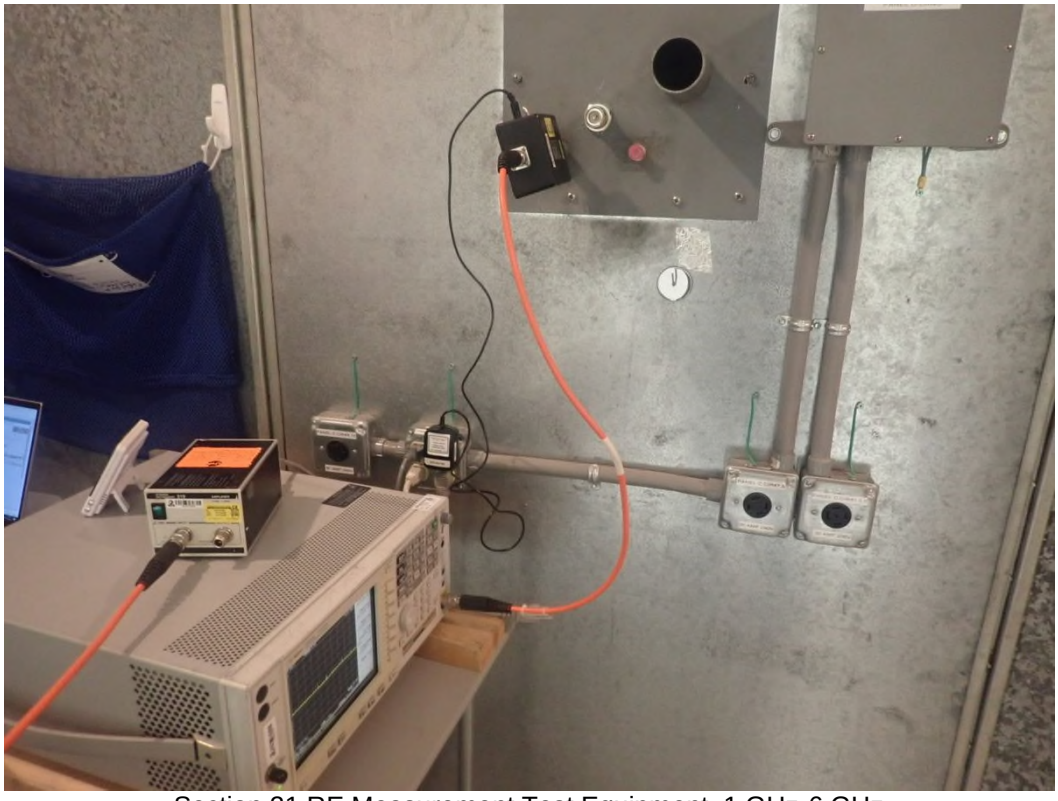


Section 21 RE Biconical Antenna Test Setup, 100 MHz-200 MHz, Horizontal

Section 21 RE Large DRG Antenna Test Setup, 200 MHz-1 GHz, Vertical



Section 21 RE Large DRG Antenna Test Setup, 200 MHz-1 GHz, Horizontal



Section 21 RE Measurement Test Equipment, 1 GHz-6 GHz

Section 21 RE Small DRG Antenna Test Setup, 1 GHz-6 GHz, Vertical

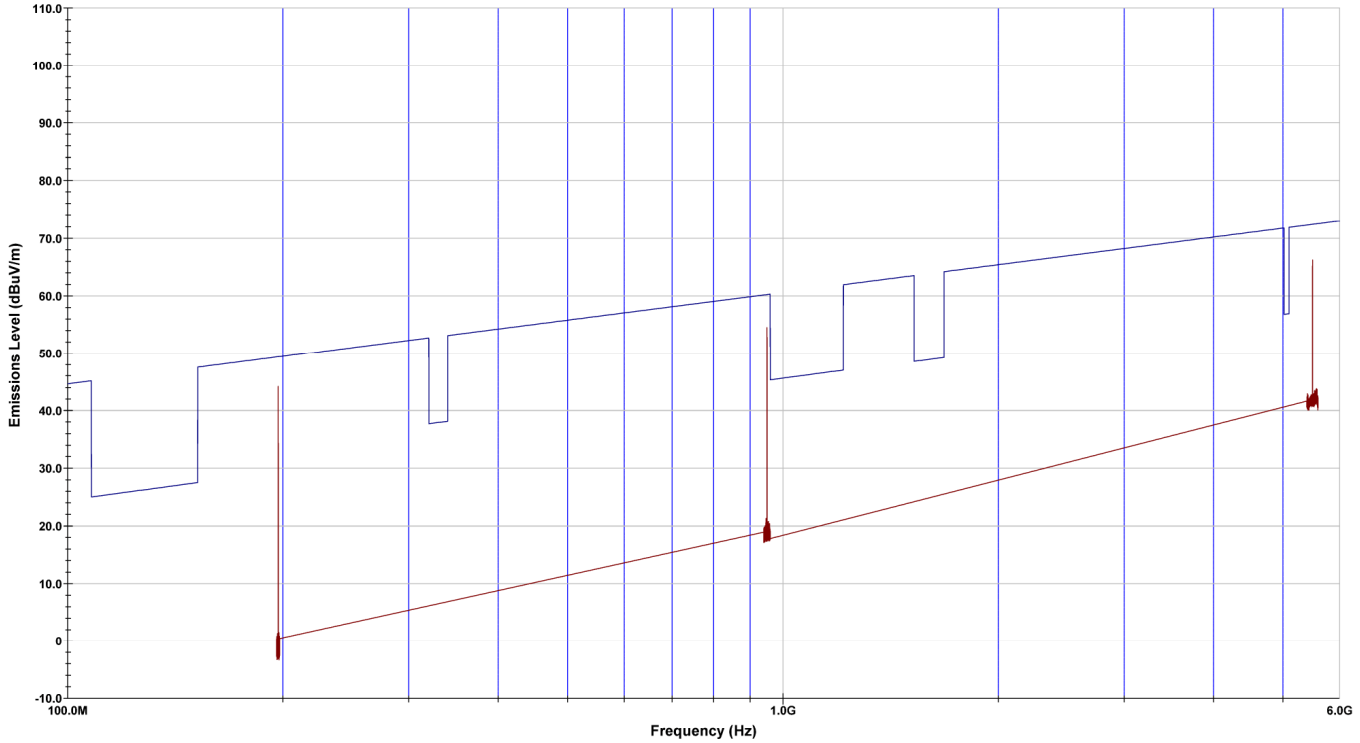
Section 21 RE Small DRG Antenna Test Setup, 1 GHz-6 GHz, Horizontal

5.1.5 Test Data

RTCA/DO-160G

Section 21 (RE)

System Verification



Operator: Steve Horvath

Project No.: PH00014239

PH00014239 Sec21 RE-001.til

Company: Descartes Systems (USA) LLC

Last Data Update 10:09:52 AM, Wednesday, February 12, 2025

Contact: Maria Vivas Suarez

RTCA/DO-160G
Section 21 (RE)
System Verification

Operator: Steve Horvath
PH00014239 Sec21 RE-001.til
10:09:52 AM, Wednesday, February 12, 2025

Project No.: PH00014239
Contact: Maria Vivas Suarez
Company: Descartes Systems (USA) LLC

Frequency (MHz)	Limit (dBuV/m)	Peaks (dBuV/m)	Delta (dB)
197.000 MHz	49.311	44.146	-5.165
950.000 MHz	60.221	54.484	-5.738
5.500 GHz	72.397	66.199	-6.198
5.500 GHz	72.397	66.199	-6.198

RTCA/DO-160G

Section 21 (RE)

Vertical Scan

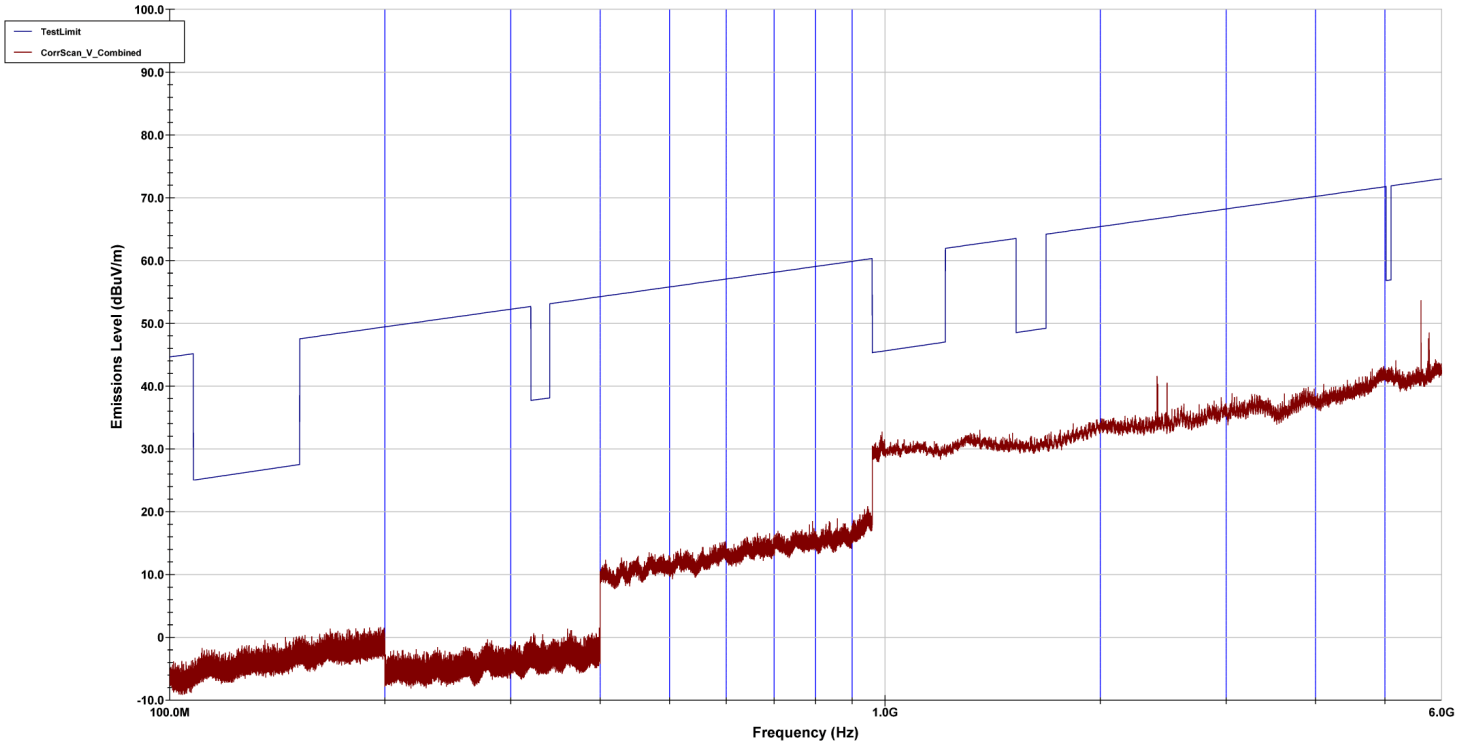
Project No. - PH00014239

Test Item - IoT Beacon Pallet Tag

Model/Part No. - PLT005

Serial No. - 2CDC7805A3A1

Mode of Operation - Active



Operator: Steve Horvath

PH00014239 Sec21 RE-002.til

Last Data Update 01:51:47 PM, Wednesday, February 12, 2025

Operational Scan

Company: Descartes System (USA) LLC

Contact: Maria Vivas Suarez

RTCA/DO-160G

Section 21 (RE)

Horizontal Scan

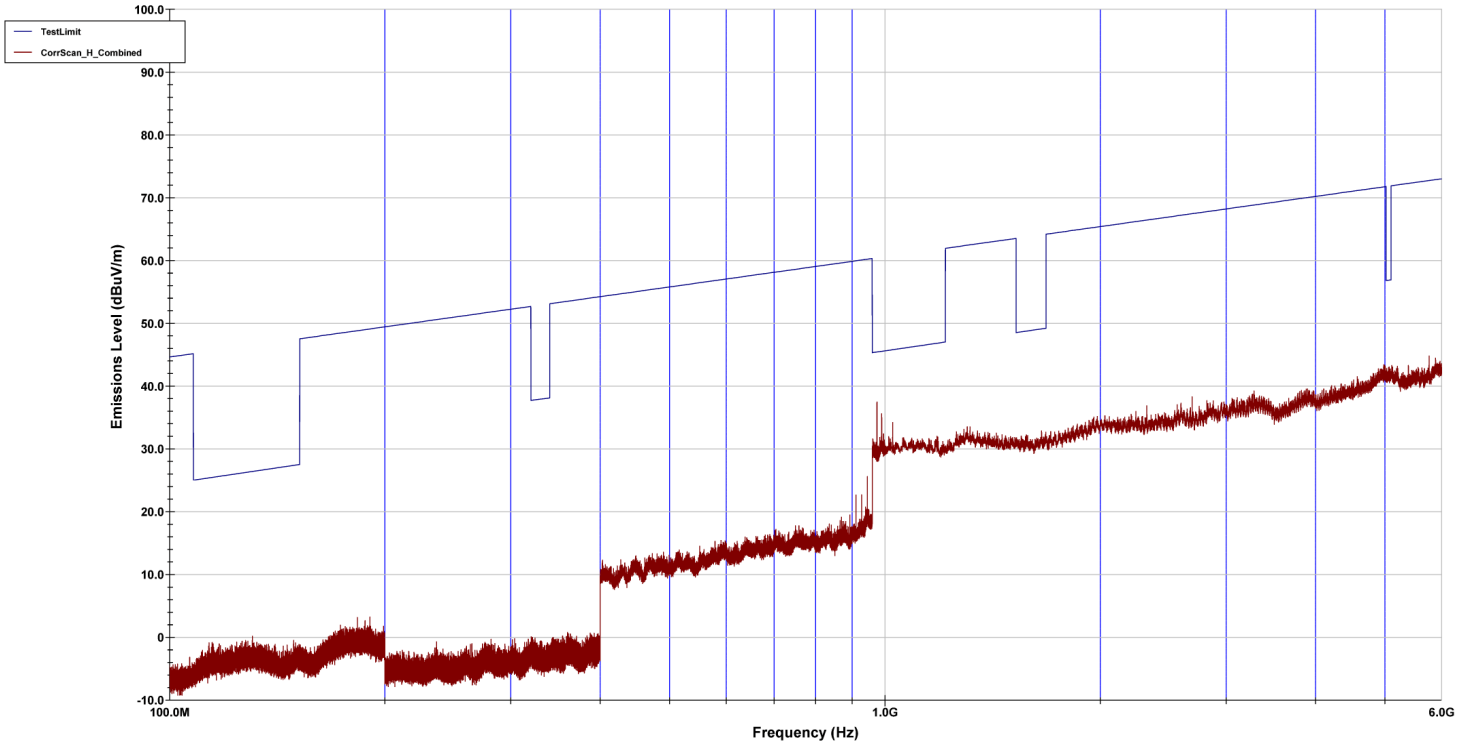
Project No. - PH00014239

Test Item - IoT Beacon Pallet Tag

Model/Part No. - PLT005

Serial No. - 2CDC7805A3A1

Mode of Operation - Active



Operator: Steve Horvath

PH00014239 Sec21 RE-002.til

Last Data Update 02:04:15 PM, Wednesday, February 12, 2025

Operational Scan

Company: Descartes System (USA) LLC

Contact: Maria Vivas Suarez

5.1.6 Test Equipment List

Table 5.1-1: Radiated RF Emissions Test Equipment List

Asset Number	Asset Type	Manufacturer	Model	Calibrated	Due
EL00002138	Software	ETS-Lindgren	7.3.4.7	NCR	NCR
WC057067	Antenna (Double Ridge Guide)	Com-Power	AH-220	09/20/2023	09/20/2025
WC057069	Amplifier (Pre/RF/Low Noise)	Sonoma Instrument	310N	01/17/2025	01/17/2026
WC057070	Generator (Signal)	Agilent Technologies	AT/E8257C/F	10/31/2024	10/31/2025
WC057204	Antenna (Double Ridge Guide)	A. H. Systems	SAS-571	05/03/2023	05/03/2025
WC057275	Antenna (Biconical)	A. H. Systems	SAS-540	09/25/2023	09/25/2025
WC057303	Amplifier (Pre/RF/Low Noise)	A. H. Systems	PAM-0118	06/10/2024	06/10/2025
WC057310	Chamber (EMI, Semi-Anechoic)	Unknown	CH 5 (PS16T20)	NCR	NCR
WC057662	Measurement Tools (Tape Measure)	L. S. Starrett	CH12-10DME	NCR	NCR
WC057830	Cable (Test)	Megaphase	EMC3-N1N1-180	06/07/2024	06/07/2025
WC067440	Analyzer (Spectrum)	Agilent Technologies	E4440A	11/11/2024	11/11/2025
WC067568	Monitor (Thermometer/Clock/Humidity)	Extech Instruments	445703	08/21/2024	08/21/2025
WC076396	Cable (Test)	Megaphase	TM18-N1N1-36-V	06/07/2024	06/07/2025
WC076397	Cable (Test)	Megaphase	TM18-N1N1-36-V	06/07/2024	06/07/2025

Calibration Abbreviation
NCR: No Calibration Required

End of Test Report