



COMPLIANCE WORLDWIDE INC. TEST REPORT 315-23RF

In Accordance with the Requirements of

**Federal Communications Commission CFR Title 47 Part 2.1091:2020
Radio Frequency Exposure Evaluation: Mobile Devices**

**Innovation, Science and Economic Development Canada
RSS-102, Issue 5 + Amendment 1:2021**

Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus

Issued to

**SPH Engineering SIA
Dzirnavu iela 62-9
Riga, LV-1050 Latvia**

For the

**Ground Penetrating Radar
Model: Zond Aero 500 NG**

**FCC ID: 2AUQQ-AERO500NG
IC: 25515-AERO500NG**

Report Issued on January 31, 2024

Tested by

Sean P. Defelice

Sean P. Defelice

Reviewed by

Larry K. Stillings

Larry K. Stillings

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1. Scope

This test report certifies that the SPH Engineering Zond Aero 500 NG, as tested, meets the FCC Part 2.1091 requirements and the ISED RSS-102, Issue 5 Section 2.5.2 requirements exempting the device from a SAR Evaluation.

The scope of this test report is limited to the test sample provided by the client, only in as much as that sample represents other production units. If any significant changes are made to the unit, the changes shall be evaluated and a retest may be required.

2. Product Details

2.1. Manufacturer:	SPH Engineering SIA.
2.2. Model Number:	Zond Aero 500 NG
2.3. Serial Number:	Pre-production
2.4. Description:	The Zond Aero 500 NG is a 500 MHz GPR antenna used for analyzing various below surface environments.
2.5. Power Source:	11.1 VDC Battery Powered, rechargeable using the supplied Mascot Charger.
2.6. Hardware Revision:	Rev B
2.7. Software Revision:	N/A
2.8. Modulation Type:	Pulse
2.9. Operating Frequency:	500 MHz, nominal
2.10. EMC Modifications:	None

3. Product Configuration

3.1 Operational Characteristics & Software

1. Turn on the notebook and start up the Prism 2 software.
2. Turn on the GPR antenna and allow the unit to boot up.
3. Configure the GPR antenna to perform a scan

3.2. EUT Hardware

Manufacturer	Model	Serial Number	Description/Function
SPH Engineering	Zond Aero 500 NG	Pre production	Ground Penetrating Radar

3.3. EUT Cables/Transducers

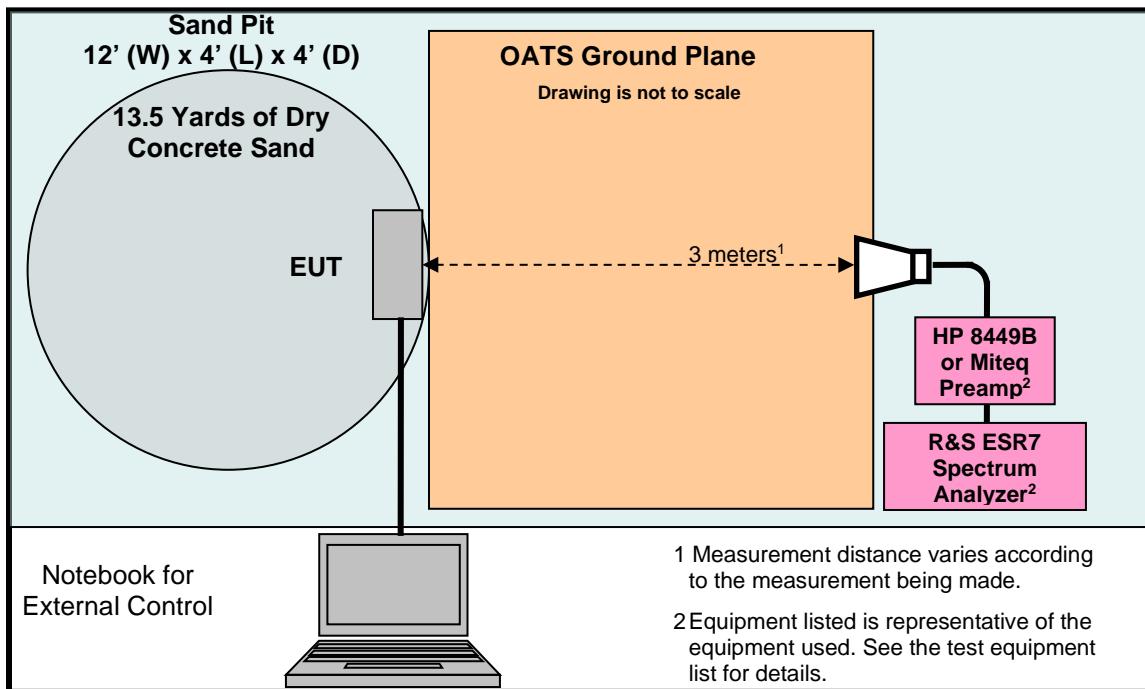
Manufacturer	Model/Part #	Length (m)	Shield Y/N	Description/Function
Any	Ethernet Cable	6	N	Cable from control notebook to GPR Antenna
Any	Power Cable	2M	N	Power Cable for Charger (conducted only)

3. Product Configuration (continued)

3.4. Support Equipment

Device	Manufacturer	Model	Serial No.	Comment
Laptop	Lenovo	P50	PC0MHJ8Y	For setting up EUT

3.5. Test Setup Diagram



4. Measurements Parameters

4.1. Measurement Equipment Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due	Cal Interval
EMI Test Receiver, 9kHz to 7GHz ¹	Rohde & Schwarz	ESR7	101156	10/26/2024	3 years
EMI Test Receiver, 10 Hz to 7GHz ¹	Rohde & Schwarz	ESR7	101770	7/23/2024	3 years
Spectrum Analyzer 20 Hz to 40 GHz	Rohde & Schwarz	FSV40	100899	8/12/2024	4 years
Spectrum Analyzer 9 kHz to 40 GHz	Rohde & Schwarz	FSVR40	100909	9/18/2024	4 years
Preamp 100 MHz – 7 GHz	Miteq	AFS3-01000200-10-15P-4	988773	9/28/2024	1 year
Preamplifier 100 MHz to 18 GHz	Miteq	AMF-7D-00101800-30-10P	1953081	9/27/2024	1 year
Bilog Antenna 30 to 2000 MHz	Com-Power	AC-220	25509	12/13/2024	4 years
Horn Antenna 960 MHz to 18 GHz	ETS-Lindgren	3117	00227631	4/21/2025	3 years
Horn Antenna 960 MHz to 18 GHz	ETS-Lindgren	3117	00143292	5/11/2025	3 years
Barometric Pressure / Humidity / Temperature Data Logger	Extech Instruments	SD700	Q590483	10/14/2024	3 years

¹ ESR7 Firmware revision: V3.48 SP3, Date installed: 09/30/2020

Previous V3.48 SP2, installed 07/23/2020.

² FSV40 Firmware revision: V2.30 SP4, Date installed: 05/04/2016

Previous V2.30 SP1, installed 10/22/2014.

³ FSVR40 Firmware revision: V2.23 SP1, Date installed: 08/19/2016

Previous V2.23, installed 10/22/2014.

4.2. Measurement & Equipment Setup

Test Date: 10/9/2023, 10/12/2023,
 11/13/2023, 11/14/2023,
 1/12/2024

Test Engineer: Sean Defelice

Normal Site Temperature (15 - 35°C): 24

Relative Humidity (20 - 75%RH): 35

Frequency Range: 30 MHz to 5 GHz

Measurement Distance: 3 Meters

EMI Receiver IF Bandwidth: 120 kHz - 30 MHz to 960 MHz
 1 MHz - Above 960 MHz

EMI Receiver Avg Bandwidth: $\geq 3 * \text{RBW or IF(BW)}$

Detector Function: Peak, Quasi-Peak, EMI
 Average and RMS Average

4. Measurements Parameters (continued)

4.3. Measurement Procedures

Test measurements were made in accordance FCC Part 15.509, 15.521, ISED RSS-220 Issue I, RSS-Gen, Issue 5, ANSI C63.10:2013 Clause 10 and KDB Publication 393764 D01 UWB FAG v01, dated July 31, 2015.

The test methods used to generate the data in this test report is in accordance with ANSI C63.10:2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

In accordance with ANSI C63.10:2013, Section 10.2.2, the device under test was placed on a bed of dry sand and rotated through 16 azimuth angles (per Clause 5.4) to determine which produced the highest emission relative to the limit. The azimuth that produced the highest emission relative to the limit was used for all radiated emission measurements.

In addition, FCC KDB 447498 D01 General RF Exposure Guidance v06, October 23, 2015 are referenced for the testing and requirements detailed in this report.

ISED RSS-102, Issue 5, Amendment 1 (February 2, 2021) are referenced for the testing and requirements detailed in this report.

4.4. Measurement Uncertainty

The following uncertainties are expressed for an expansion/coverage factor of K=2.

RF Frequency (out of band)	$\pm 1 \times 10^{-8}$
Radiated Emission of Transmitter to 10 GHz	± 4.55 dB
Radiated Emission of Receiver	± 4.55 dB
Temperature	$\pm 0.91^\circ$ C
Humidity	$\pm 5\%$

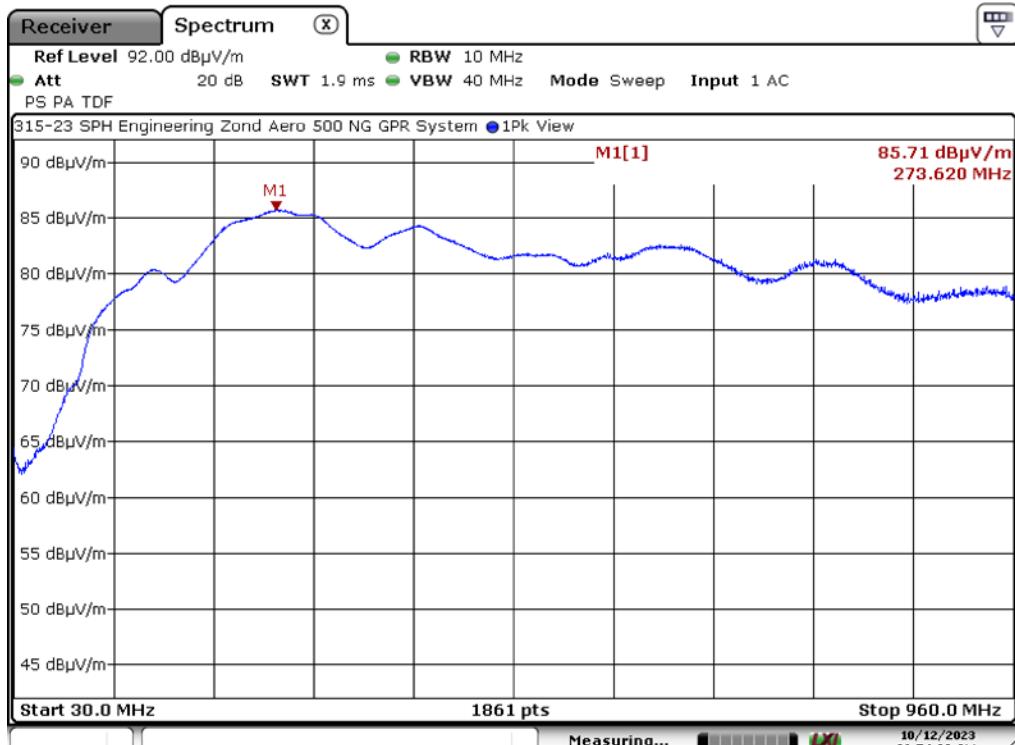
5. Measurement Data (continued)

5.1. Peak Emissions in a 50 MHz Bandwidth (15.509 (f), RSS-220 Section 6.2.1 (g))

Requirement: For UWB devices where the frequency at which the highest radiated emissions occurs, f_M , is above 960 MHz, there is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency 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 Section 15.521. The 0 dBm limit was converted to -13.98 dBm limit when using a 10 MHz RBW. The limit was then converted to a 3 meter field strength limit of 81.22 dB μ V/m by using a conversion factor of 95.2.

Result: Compliant, the highest radiated emission occurs below 960 MHz and is not subject to the 0 dBm EIRP limit.

6.6.1 Plot of Peak Power below 960 MHz



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5. Measurement Data (continued)

5.2. Public Exposure to Radio Frequency Energy Levels (FCC Part 2.1091:2020)

5.2.1. 2.1091 Requirements

Requirement: Reference CFR 2.1091: For purposes of this section, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.

RF Exposure of simultaneously operated radios within the host which is considered a Mobile Device.

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in a host device is ≤ 1.0 , according to calculated/estimated, numerically modeled, or measured field strengths or power density. The MPE ratio of each antenna is determined at the minimum *test separation distance* required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to the MPE limit at the test frequency

FCC Part 1.1310:2020 Table 1 Limits for General Population / Uncontrolled Exposure

Power Density Limit from 30 to 300 MHz is 1.0

Power Density (S) = $(P^*G) / 4\pi R^2$, where S = mW/cm², P is power to antenna (mW), G = Gain of the Antenna (numeric), $\pi = 3.1416$ and R is the distance in cm to the antenna

Frequency (MHz)	MPE Distance (cm)	DUT Field Strength at 3M (dB μ V/m)	DUT Output Power (dBm)	DUT Antenna Gain (dBi)	DUT Output Power (mW)	Power Density	Limit (mW/cm ²)	Result
						(1)		
(1)	(2)	(3)	(4)	(5)				
273.62	20	85.71	-9.49	0	0.112	0.0000224	1.0	Compliant

Result: Compliant - The device under test meets the exclusion requirement detailed in FCC OET 447498, dated October 23, 2015 Clause 7.2 for simultaneous operation.

5. Measurement Data (continued)

5.3. Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (RSS-102, Issue 5 + A1:2021)

5.3.1. RSS-102 Issue 5 Requirements

Requirement: RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance)

All transmitters are exempt from routine SAR and RF exposure evaluations provided that they comply with the requirements of sections 2.5.2. If the equipment under test (EUT) meets the requirements of sections 2.5.2, applicants are only required to submit a properly signed declaration of compliance (see Annex C).

Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power.

Frequency (MHz)	Separation Distance (cm)	Maximum Power (mW)	Maximum Power (W)	RSS-102 Exemption Limit (W)	Result
273.62	≥ 20	0.112	0.000112	0.6	Compliant

Result: Compliant.