Advanced
Compliance Laboratory

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# ELECTROMAGNETIC EMISSION COMPLIANCE REPORT

of

**NX25**
**MODEL: NX25**
**FCC ID: QF7NX25 IC: 8498A-NX25**

**April 26, 2023**

This report concerns (check one): Original grant __x__ Class II change _____
Equipment type: Low Power Intentional Radiator

Deferred grant requested per 47 CF 0.457(d)(1)(ii)? yes _____ no __x__
If yes, defer until: _____ (date)
Company agrees to notify the Commission by _____ (date)
of the intended date of announcement of the product so that the grant can be issued on that date.

Transition Rules Request per 15.37? yes _____ no __x__
If no, assumed Part 15, Subpart B for unintentional radiators - the new 47 CFR [10-1-90 Edition] provision.

Report prepared for: GEOPHYSICAL SURVEY SYSTEMS, INC.
Report prepared by: Advanced Compliance Lab
Report number: 0048-230403-02-FCC-IC-NFC

NVLAP®

**Lab Code: 200101** **The test result in this report IS supported and covered by the NVLAP accreditation**

# Table of Contents

# Figures

# 1. GENERAL INFORMATION

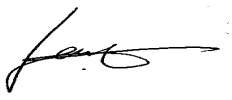
## 1.1 Verification of Compliance

| | |
|---|---|
| EUT: | NX25 |
| Model: | NX25 |
| Applicant: | GEOPHYSICAL SURVEY SYSTEMS, INC. |
| Test Type: | FCC Part 15C (15.225) & RSS-210 (issue 10) CERTIFICATION<br>FCC Part 15B & ICES-003, Class A ( for digital circuitry) |
| Result: | PASS |
| Tested by: | ADVANCED COMPLIANCE LABORATORY |
| Test Date: | April 3, 2023-April 26, 2023 |
| Report Number: | 0048-230403-02-FCC-IC-NFC |

The above equipment was tested by Compliance Laboratory, Advanced Technologies, Inc. for compliance with the requirement set forth in the FCC rules and regulations Part 15 subpart C. This said equipment in the configuration described in the report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

The estimated uncertainty of the test result is given as following. The method of uncertainty calculation is provided in Advanced Compliance Lab. Doc. No. 0048-01-01.

| | Prob. Dist. | Uncertainty(dB) | Uncertainty(dB) | Uncertainty(dB) |
|---|---|---|---|---|
| | | 30-1000MHz | 1-6.5GHz | Conducted |
| Combined Std. Uncertainty $u_c$ | norm. | ±2.36 | ±2.99 | ±1.83 |



Wei Li
Lab Manager
Advanced Compliance Lab

Date: April 26, 2023

## 1.2 Equipment Modifications

N/A

## 1.3 Product Information

**System Configuration**

| ITEM | DESCRIPTION | FCC ID | CABLE |
|---|---|---|---|
| Product | NX25 NX25 (1) | FCCID: QF7NX25<br>IC: 8498A-NX25 | |
| Housing | Plastic | | |
| Power Supply | 7.2V Smart Li-on Battery | | |
| Operation Freq. | 13.56MHz | | |
| Device Type | Sec. 15.225 & RSS-210 Operation | | |

(1) EUT submitted for grant.

## 1.4 Test Methodology

Radiated tests were performed according to the procedures in ANSI C63.4-2014 & ANSI C63.10-2013 at an antenna to EUT distance of 30 &3 meters.

## 1.5 Test Facility

The open area test site and conducted measurement facility used to collect the radiated and conducted data are located at Hillsborough, New Jersey. This site is accepted by FCC to perform measurements under Part 15 or 18 (US5347) and also designated by IC as " site IC 3130A". ACL is recognized by ISED as a wirless testing laboratory ( CAB ID: US0100) . The NVLAP Lab code for accreditation of FCC EMC Test Method is: 200101-0.

## 1.6 Test Equipment

| Manufacture | Model | | Serial No. | Description | Cal Due dd/mm/yy |
|---|---|---|---|---|---|
| Hewlett-Packard | HP8546A | | 3448A00290 | EMI Receiver | 25/09/23 |
| Agilent | E4440A | | US40420700 | 3Hz-26.5GHz Spectrum Analyzer | 17/06/23 |
| R &S | ESPI | | 100018 | 9KHz-7GHz EMI Receiver | 25/08/23 |
| EMCO | 3104C | | 9307-4396 | 20-300MHz Biconical Antenna | 15/01/24 |
| EMCO | 3146 | | 9008-2860 | 200-1000MHz Log-Periodic Antenna | 15/01/24 |
| ARA | MWH-1826/B | | 1013 | 18-26GHZ Horn Antena | 10/02/24 |
| EMCO | 3115 | | 49225 | Double Ridge Guide Horn Antenna | 15/01/24 |
| Electro-Meterics | ALR-25M/30 | | 289 | 10KHz-30MHz Active Loop Antenna | 28/05/23 |

All Test Equipment Used are Calibrated Traceable to NIST Standards.

### 1.7 Statement for the Document Use

This report shall not be reproduced except in full, without the written approval of the laboratory. And this report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

## 2. PRODUCT LABELING

GEOPHYSICAL **NX25**
**Model No.: NX25**
**FCC ID: QF7NX25 IC: 8498A-NX25**

*This device complies with part 15 of the FCC & RSS-210 Rules. Operating is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.*
Contains FCC ID: UAY-W8997-M1216 IC: 6549A-W8997M1216

**Figure 2.1 FCC ID Label ( statement shown in user manual)**


**Figure 2.2 FCC ID Label Location**

# 3. SYSTEM TEST CONFIGURATION

## 3.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it) . Testing was performed as EUT TX transmission was operated continuously.

## 3.2 Special Accessories

N/A

## 3.3 Configuration of Tested System

Figure 3.1 to Figure 3.3 illustrate the system setup for testing.

Figure 3.1 Radiated Emission Test Setup

N/A

Figure 3.2 Conducted Emission Test Setup


**Figure 3.3 Frequency Tolerance Test Setup**

# 4. SYSTEM SCHEMATICS

**See Attachment.**

**Figure 4.1 System Schematics**

# 5. CONDUCTED EMISSION DATA

## 5.1 Test Methods and Conditions

The EUT was under normal operational mode during the conducted emission test. EMI Receiver was scanned from 150KHz to 30MHz with maximum hold mode for maximum emission. Recorded data was sent to the plotter to generate output in linear format. At the input of the spectrum analyzer, a HP transient limiter is inserted for protective purpose. This limiter has a 10 dB attenuation in the range of 150KHZ to 30MHZ. That factor was automatically compensated by the receiver, so the readings are the corrected readings. The reference of the plot is the CISPR 22 Class B limit in Figure 5.1 through Figure 5.2.

| **Conducted Emission Technical Requirements** | | | | |
|---|---|---|---|---|
| | **Class A** | | **Class B** | |
| **Frequency Range** | **Quasi-Peak dBuV** | **Average dBuV** | **Quasi-Peak DBuV** | **Average dBuV** |
| 150kHz –0.5MHz | 79 (8912uV) | 66 (1995uV) | 66-56 | 56-46 |
| 0.5MHz-30MHz | 73 (4467uV) | 60 (1000uV) | --- | --- |
| 0.5MHz- 5MHz | --- | --- | 56 | 46 (250uV) |
| 5MHz-30MHz | --- | --- | 60 | 50 |

Emissions that have peak values close to the specification limit (if any) may be also measured in the quasi-peak mode to determine compliance.

## 5.2 Test Data

Figure 5.1-5.2 show the neutral and line conducted emissions for the standard operation with antenna output attenuated.

| Highest Data for AC Line Conducted Emissions, 120Vac Battery Charging Mode | | | | | | |
|---|---|---|---|---|---|---|
| Frequency (MHz) | (Line) | (Line) | (Line) | (Neutral) | (Neutral) | (Neutral) |
| Peak/QP Reading (dBuV)* | | | | | | |
| Average Reading (dBuV)* | | | | | | |
| Under FCC Part 15 Limit | | | | | | |

Test Personnel:

Tester Signature: _____ Date: _____

Typed/Printed Name: _____

Line Conducted Emission 150kHz-30MHz

N/A

Fig. 5.1 Conducted Emission-Line

Neutral Conducted Emission 150kHz-30MHz

N/A

Fig. 5.2 Conducted Emission- Neutral

**---------- Section 5 is not applicable to this EUT .**

# 6. RADIATED EMISSION DATA

## 6.1 Field Strength Calculation

The corrected field strength is automatically calculated by EMI Receiver using following:

$$FS = RA + AF + CF + AG$$

where FS: Corrected Field Strength in dBμV/m
RA: Amplitude of EMI Receiver before correction in dBμV
AF: Antenna Factor in dB/m
CF: Cable Attenuation Factor in dB
AG: Built-in Preamplifier Gain in dB (Stored in receiver as part of the calibration data)

## 6.2 Test Methods and Conditions

The initial step in collecting radiated data is a EMI Receiver scan of the measurement range below 30MHz using peak/quasi-peak detector and 9KHz IF bandwidth / 30KHz video bandwidth with loop antenna. For the range 30MHz - 1GHz, 120KHz IF bandwidth / 120KHz video bandwidth are used. Both bandwidths are 1MHz for above 1GHz measurement. Frequency range from EUT's lowest crystal frequency to 10th harmonics of fundamental was investigated.

EUT was rotated all around and cables and equipment were placed and moved within the range of positions likely to find their maximum emissions. Antenna must be rotated about its Horizontal and Vertical positions to maximize emissions.

## 6.3 Test Data

The following data lists the significant emission frequencies, polarity and position, peak reading of the EMI Receiver, the FCC limit, and the difference between the peak reading and the limit. Explanation of the correction and calculation are given in section 6.1.

Test Personnel: David Tu

Typed/Printed Name: David Tu Date: April 26, 2023

## Radiated Test Data

**Emissions from 13.56MHz Transmitter for Part 15C**

| Frequency (MHz) | Polarity [H or V] | Height (m) | Azimuth (Degree) | Quasi-Peak Reading (dBμV/m) | FCC 30m &3m Limit (dBμV/m) | Difference from limit (dB) |
|---|---|---|---|---|---|---|
| 13.56 | H/V | 1.0 | 000 | 40.4 | 84.0(1) | -43.6 |
| 27.12 | H/V | 1.0 | 000 | 15.7(3) | 29.5(2) | -13.8 |
| 40.6 | H | 1.8 | 090 | 31.8* | 40.0 | -8.2 |
| 67.7 | H | 1.8 | 045 | 21.9 | 40.0 | -18.1 |
| 94.9 | H | 1.8 | 045 | 29.7 | 40.0 | -10.3 |
| 122.1 | H | 1.8 | 090 | 20.8 | 40.0 | -19.2 |
| 149.2 | H | 1.8 | 090 | 28.0 | 40.0 | -12.0 |
| 176.3 | H | 1.8 | 045 | 23.2 | 40.0 | -16.8 |
| 40.6 | V | 1.2 | 225 | 24.6* | 40.0 | -15.4 |
| 67.7 | V | 1.2 | 225 | 22.3 | 40.0 | -17.7 |
| 94.9 | V | 1.1 | 270 | 35.4 | 40.0 | -4.6 |
| 122.1 | V | 1.1 | 225 | 23.9 | 40.0 | -16.1 |
| 149.2 | V | 1.1 | 270 | 33.2 | 40.0 | -6.8 |
| 176.3 | V | 1/.1 | 270 | 27.3 | 40.0 | -12.7 |

(1) Per 15.225(a): The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter (84dBuV/m) at 30 meters.
(2) Per 15.225(d): The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in 15.209.
(3) The distance factor 19.1dB was applied to the this testing value as the measurement was adjusted from 30m to 10m distance in order to obtain the significant reading per 15.31(f).

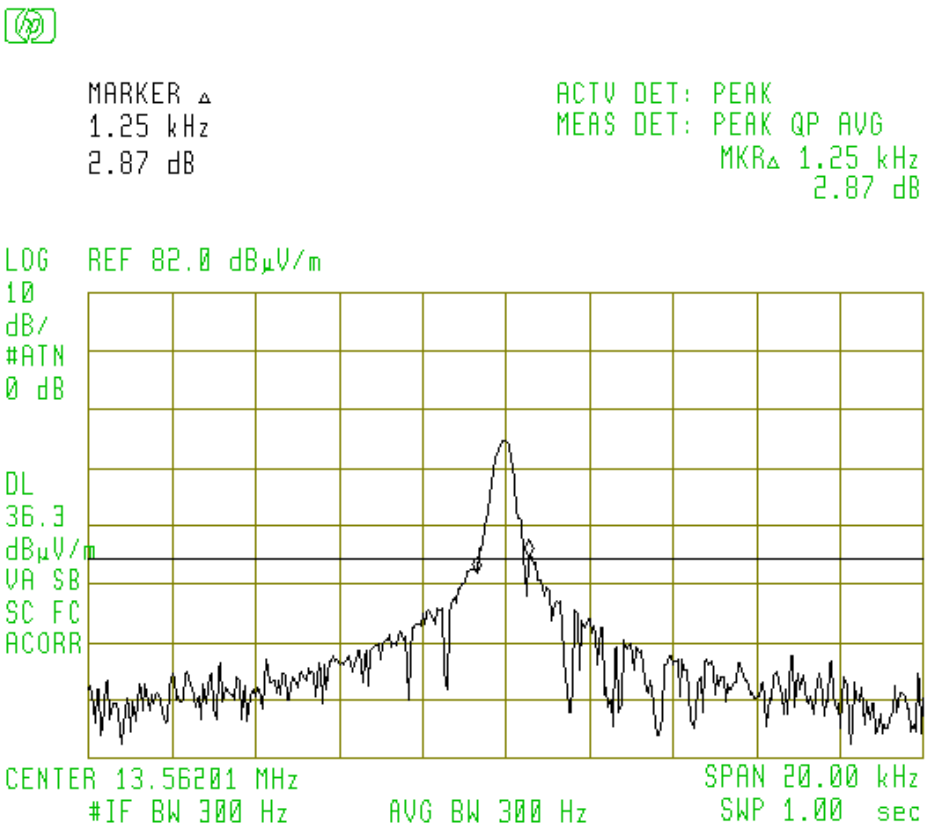
***Spurious Radiated Emissions from Digital Circuitry (RF off) complies with FCC Part 15.109 (Class A), measured per ANSI C63.4 with standard setup.***

| Freq.* (MHz) | H,V | SA QP Reading (dBuV/m) | Height (m) | Angle (degree) | Refer to Part 15.209 10m Limit (dBuV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|---|---|
| 250 | H | 24.5 | 1.0 | 180 | 46.0 | -21.5 | Pass |
| 350 | H | 25.9 | 1.0 | 180 | 46.0 | -20.1 | Pass |
| 434 | H | 27.0 | 1.0 | 180 | 46.0 | -19.0 | Pass |
| 450 | H | 26.8 | 1.0 | 135 | 46.0 | -19.2 | Pass |
| 1050 | H | 42.5 | 1.1 | 180 | 49.5 | -7.0 | Pass |
| 1150 | H | 38.3 | 1.1 | 180 | 49.5 | -11.2 | Pass |
| 1250 | H | 40.5 | 1.1 | 180 | 49.5 | -9.0 | Pass |
| 1300 | H | 35.8 | 1.1 | 135 | 49.5 | -13.7 | Pass |
| 1500 | H | 47.3 | 1.1 | 135 | 49.5 | -2.2 | Pass |
| 350 | V | 26.8 | 1.1 | 000 | 46.0 | -19.2 | Pass |
| 434 | V | 27.4 | 1.1 | 315 | 46.0 | -18.6 | Pass |
| 450 | V | 27.0 | 1.1 | 315 | 46.0 | -19.0 | Pass |
| 1050 | V | 41.5 | 1.1 | 315 | 49.5 | -8.0 | Pass |
| 1150 | V | 42.5 | 1.1 | 000 | 49.5 | -7.0 | Pass |
| 1250 | V | 40.3 | 1.1 | 000 | 49.5 | -9.2 | Pass |
| 1350 | V | 37.0 | 1.1 | 000 | 49.5 | -12.5 | Pass |
| 1450 | V | 40.1 | 1.1 | 000 | 49.5 | -9.4 | Pass |
| 1500 | V | 46.4 | 1.1 | 000 | 49.5 | -3.1 | Pass |
| 1548 | V | 37.0 | 1.1 | 000 | 49.5 | -12.5 | Pass |

*Quasi-peak reading. For emissions that have peak values close to ( or over) the specification limit (if any) will be also measured in the quasi-peak or average mode to determine the compliance.

## 6.4 Occupied Bandwidth

Bandwidth is determined at the points 20dB down from the modulated carrier. Figure 6.1 shows the occupied bandwidth plot.




From this plot, all near band emissions will be at least 30dB below the fundament peak, i.e. below 25.9dBuV/m, which even meets 15.209 limit. Therefore EUT complies with 15.225 near band mask compliance requirements.

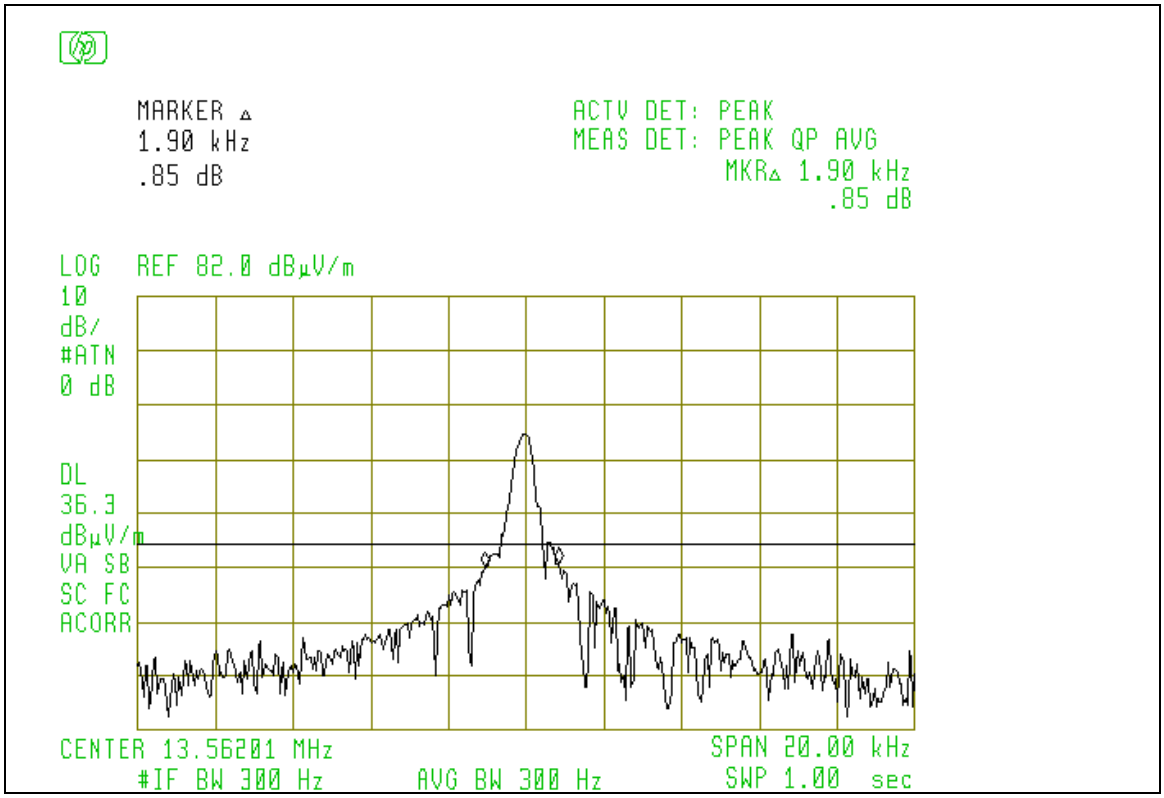



**Figure 6.1 Occupied Bandwidth**

# 7. FREQUENCY TOLERANCE

| Name of Test: | *Frequency Tolerance* | Test Standard: | *15.225* |
|---|---|---|---|
| Tested By: | WEI LI | Test Date: | 06/16/2017 |

**Minimum Standard:**

Para 15.225(e) The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of –20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

**Method of Measurement:**

Frequency Stability With Voltage Variation:
The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. Set SA resolution bandwidth low enough (30Hz) to obtain the desired frequency resolution. (Using frequency counter method: The frequency counter and signal generator are phase locked with the same 10 MHz reference frequency by connecting the 10 MHz ref. out of the counter to the 10MHz ref, in of the signal generator). With the voltage input to the E.U.T. set to 85% S.T.V., the frequency is measured in 30 second intervals for a period of 5 minutes. This procedure is repeated at 100% S.T.V. and 115% S.T.V.

Frequency Stability With Temperature Variation:
The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied from -20 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a
period of 5 minutes.

**Test Result:** **Complies**

**Test Data:** See Attached Table(s)

- temperature variation: -20°C to +50°C
- voltage variation 7.2 Vdc
- frequency tolerance: +/- 1.919 kHz (+/- 0.01%)

Frequency Stability versus Environmental Temperature

| Reference Frequency @ 8.5V & +20°C | | |
|---|---|---|
| Temperature & Direction (°C) | Frequency (MHz) | Deviation (Hz) |
| -20 | 13.561919240 | +2.6 |
| +20 | 13.561921980 | - |
| +50 | 13.561941810 | -19.5 |