



Measurement of RF Interference from an Ventis Pro 5 Gas Monitor

For	Industrial Scientific Corporation 1 Life Way Pittsburgh, PA 150205
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THIS REPORT SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE WRITTEN APPROVAL OF ELITE ELECTRONIC ENGINEERING INCORPORATED.

REVISION HISTORY

Revision	Date	Description
—	11 AUG 2020	Initial release
A	19 AUG 2020 by TMJ	<ul style="list-style-type: none">- Test report number updated from 2003435-01 to 2003435-01 Rev. A throughout report.- Section 1.1: Updated wording for Band 13.- Updated EUT picture.

Measurement of RF Emissions from a Gas Monitor, Model No. Ventis Pro 5 Transceiver

1. INTRODUCTION

1.1 Scope of Tests

This document represents the results of the series of radio interference measurements performed on an Industrial Scientific Corporation Gas Monitor, Model No. Ventis Pro 5, Serial No. VzW 6, (hereinafter referred to as the EUT). The transceiver was designed to communicate over LTE Band 13 using an IFA antenna. The EUT was manufactured and submitted for testing by Industrial Scientific Corporation located in Pittsburgh, PA.

The EUT has an integrated LTE cell module, FCC ID XPY2AGQN4NNN, IC: 8595A-2AGQN4NNN. The original testing was documented in the TUV test report, report no. SD72128174-0517B.

1.2 Purpose

The test series was performed to determine if the EUT meets the Class 2 Permissive Change requirements of the FCC.

The test series was also performed to determine if the EUT meets the Class 4 Permissive Change requirements of Innovation, Science and Economic Development Canada.

Testing was performed in accordance with ANSI C63.26-2015.

1.3 Deviations, Additions and Exclusions

There were no deviations, additions to or exclusions from the test specification during this test series.

1.4 EMC Laboratory Identification

This series of tests was performed by Elite Electronic Engineering Incorporated of Downers Grove, Illinois. The laboratory is accredited by the American Association for Laboratory Accreditation (A2LA), A2LA Lab Code: 1786-01.

1.5 Laboratory Conditions

The temperature at the time of the test was 21°C and the relative humidity was 24%.

2. APPLICABLE DOCUMENTS

The following documents of the exact issue designated form part of this document to the extent specified herein:

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 27, Subparts C
- ANSI C63.26 2015, " American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services"
- ANSI C63.5 2017, "American National Standard for Electromagnetic Compatibility— Radiated Emission Measurements in Electromagnetic Interference (EMI) Control—Calibration and Qualification of Antennas (9 kHz to 40 GHz)"
- Industry Canada RSS-130, Issue 2, February 2019, "Equipment Operating in the Frequency Bands 617-652 MHz, 663-698 MHz, 698-756 MHz and 777-787 MHz"
- Industry Canada RSS-GEN, Issue 5, March 2019, "General Requirements for Compliance of Radio Apparatus"
- Industry Canada RSP-100, Issue 12, 2019, "Certification of Radio Apparatus and Broadcasting Equipment"

3. EUT SETUP AND OPERATION

3.1 General Description

The EUT is a Gas Monitor, Model No. Ventis Pro 5. A block diagram of the EUT setup is shown as Figure 1 and photographs of the unit are included on pages 9 and 10.

3.1.1 Power Input

The EUT was powered by internal batteries.

3.1.2 Peripheral Equipment

No peripheral equipment was submitted with the EUT.

3.1.3 Interconnect Cables

No interconnect cables were submitted with the EUT.

3.1.4 Grounding

The EUT was ungrounded during the tests.

3.2 Operational Mode

3.2.1 Transmitting

The EUT was energized. The unit was attached to a call box simulator in the following modes:

Mode	Description
Transmitting	The EUT was attached to a CMW500 and set to transmit at one of the following channels in Band 13 with a 10MHz channel bandwidth: <ul style="list-style-type: none">- UL Channel 23190 = 778MHz- UL Channel 23230 = 782MHz- UL Channel 23279 = 786.5MHz

3.3 EUT Modifications

No modifications were required for compliance.

4. TEST FACILITY AND TEST INSTRUMENTATION

4.1 Shielded Enclosure

All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. With the exception of the floor, the reflective surfaces of the shielded chamber are lined with ferrite tiles on the walls and ceiling. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2014 for site attenuation.

The receive antennas were calibrated per and meet the requirements of C63.5:2017.

4.2 Test Instrumentation

The test instrumentation and auxiliary equipment used during the tests are listed in Table 9-1.

Conducted and radiated emission tests were performed with an EMI receiver utilizing the bandwidths and detectors specified in the requirements.

4.3 Calibration Traceability

Test equipment is maintained and calibrated on a regular basis. All calibrations are traceable to the National Institute of Standards and Technology (NIST).

4.4 Measurement Uncertainty

All measurements are an estimate of their true value. The measurement uncertainty characterizes, with a specified confidence level, the spread of values which may be possible for a given measurement system.

Values of Expanded Measurement Uncertainty (95% Confidence) are presented below:

Measurement Type	Expanded Measurement Uncertainty
Conducted disturbance (mains port) (150 kHz – 30 MHz)	2.7
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 6 GHz)	3.1
Radiated disturbance (electric field strength on an open area test site or alternative test site) (6 GHz – 18 GHz)	3.2

5. TEST PROCEDURES

5.1 Radiated Spurious Emissions Measurements

5.1.1 Requirements

Per section FCC 27.53(c)(2) the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

$$\text{Minimum Attenuation} = 43 + 10 \log 0.2W$$

* The maximum rated power of the EUT is 200mW (23dBm)

The emissions shall be attenuated by a minimum of 36dB.

Per section FCC27.53(f), for operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.

5.1.2 Procedures

Radiated measurements were performed in a 32ft. x 20ft. x 14ft. high shielded enclosure. The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads.

Preliminary radiated emissions tests were performed to determine the emission characteristics of the EUT. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the EUT.

The final open field emission tests were then manually performed with the following steps:

- 1) The EUT was configured in the Transmitting mode.
- 2) The emission levels were measured with a spectrum analyzer.
- 3) The EIRP of all the emissions was measured using the substitution method.

- 4) To ensure that maximum or worst case emission levels of the emissions were measured, the following steps were taken:
 - a) The EUT was rotated so that all of its sides were exposed to the receiving antenna.
 - b) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
 - c) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.
 - d) In instances where it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer, the measuring antenna was not raised or lowered to ensure maximized readings, instead the EUT was rotated through all axes to ensure the maximum readings were recorded for the EUT.

5.1.3 Results

Final radiated emissions data are presented on data pages 14 through 16. As can be seen from the data, all emissions measured from the EUT were within the specification limits. Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown in Figure 2 and Figure 3.

6. CONCLUSIONS

It was determined that the Industrial Scientific Corporation Gas Monitor, Model No. Ventis Pro 5, Serial No. VzW 6 did fully meet the Class 2 Permissive Change requirements of the FCC, when tested per the FCC "Code of Federal Regulations" Title 47, Part 27, Subpart C and ANSI C63.4-2014. The emissions data recorded does not exceed the values originally measured and documented for the original grant.

It was also determined that the Industrial Scientific Corporation Gas Monitor, Model No. Ventis Pro 5, Serial No. VzW 6 did fully meet the Class 4 Permissive Change requirements of the Innovation, Science and Economic Development Canada, when tested per RSS-GEN, RSS-130, and ANSI C63.4-2014.

7. CERTIFICATION

Elite Electronic Engineering Incorporated certifies that the information contained in this report was obtained under conditions which meet or exceed those specified in the test specifications.

The data presented in this test report pertains to the EUT at the test date. Any electrical or mechanical modification made to the EUT subsequent to the specified test date will serve to invalidate the data and void this certification.

8. ENDORSEMENT DISCLAIMER

This report must not be used to claim product certification, approval, or endorsement by A2LA, NIST or any agency of the Federal Government.

9. EQUIPMENT LIST

Table 9-1 Equipment List

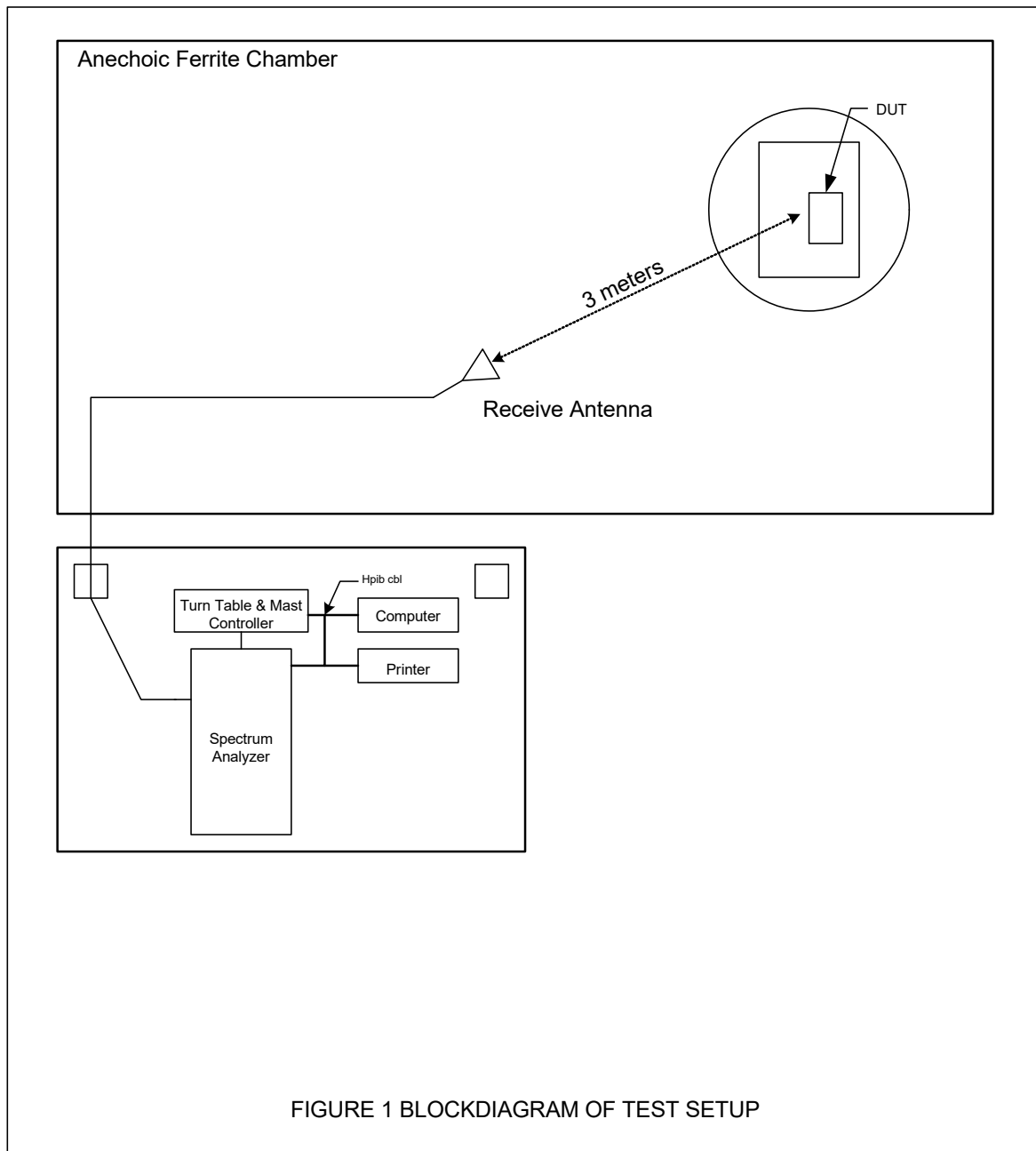
Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
CDX8	COMPUTER	ELITE	WORKSTATION			N/A	
GRE2	SIGNAL GENERATOR	AGILENT	E4438C	MY42081749	250KHZ-6GHZ	3/20/2020	3/20/2021
NTA4	BILOG ANTENNA	TESEQ	6112D	46660	20-2000GHZ	9/23/2019	9/23/2020
NWQ0	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66657	1GHZ-18GHZ	5/13/2020	5/13/2022
NWQ2	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66659	1GHZ-18GHZ	4/7/2020	4/7/2022
RBF2	WIDEBAND RADIO COMM. TESTER	ROHDE & SCHWARZ	CMW500	121396	---	2/21/2020	2/11/2024
RBG2	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101591	2HZ-44GHZ	3/23/2020	3/23/2021
WKA1	SOFTWARE, UNIVERSAL RCV EMI	ELITE	UNIV_RCV_EMI	1	---	I/O	

N/A: Not Applicable

I/O: Initial Only

CNR: Calibration Not Required

NOTE 1: For the purpose of this test, the equipment was calibrated over the specified frequency range, pulse rate, or modulation prior to the test or monitored by a calibrated instrument.



DATA PAGE

MANUFACTURER	Industrial Scientific Corporation
EUT	Gas Monitor
MODEL NO.	Ventis Pro 5
SERIAL NO.	VzW 6
TEST	FCC §27, RSS-130 – Radiated Spurious Emissions
MODE	Transmitting – LTE Band 13, Channel 23190 (10MHz BW)
DATE TESTED	July 27 & 28, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	In accordance with FCC §27.53(c)(2), the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB

Freq. (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	ERP (dBm)	Attenuation Below Output Power (dB)	Minimum Attenuation (dB)
1556.00	H	22.9		-43.0	2.8	2.2	-42.3	65.2	36.0
1556.00	V	21.4		-43.6	2.8	2.2	-42.9	65.8	36.0
2334.00	H	22.5	Ambient	-39.3	2.9	2.7	-39.1	62.1	36.0
2334.00	V	22.4	Ambient	-39.7	2.9	2.7	-39.5	62.5	36.0
3112.00	H	23.8	Ambient	-37.6	4.3	3.2	-36.5	59.5	36.0
3112.00	V	23.8	Ambient	-37.9	4.3	3.2	-36.8	59.8	36.0
3890.00	H	23.5	Ambient	-37.0	5.0	3.5	-35.5	58.5	36.0
3890.00	V	23.8	Ambient	-37.3	5.0	3.5	-35.8	58.8	36.0

$EIRP \text{ (dBm)} = \text{Matched Sig Gen Reading (dBm)} + \text{Equivalent Antenna Gain} - \text{Cable Loss}$

DATA PAGE	
MANUFACTURER	Industrial Scientific Corporation
EUT	Gas Monitor
MODEL NO.	Ventis Pro 5
SERIAL NO.	VzW 6
TEST	FCC §27, RSS-130 – Radiated Spurious Emissions
MODE	Transmitting – LTE Band 13, Channel 23230 (10MHz BW)
DATE TESTED	July 27 & 28, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	<p>In accordance with FCC §27.53(f), emissions in the 1559 – 1610MHz band shall be limited to -70dBW/MHz EIRP. This has been converted into a dBm value of -40dBm.</p> <p>In accordance with FCC §27.53(c)(2), the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB</p>

Freq. (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
1564.00	H	22.3		-43.3	2.8	2.2	-42.7	-40.0	-2.7
1564.00	V	24.4		-44.7	2.8	2.2	-44.1	-40.0	-4.1

Freq. (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	ERP (dBm)	Attenuation Below Output Power (dB)	Minimum Attenuation (dB)
2346.00	H	22.7	Ambient	-38.7	2.9	2.7	-38.4	61.4	36.0
2346.00	V	22.9	Ambient	-38.5	2.9	2.7	-38.2	61.2	36.0
3128.00	H	23.2	Ambient	-38.3	4.0	3.2	-37.4	60.4	36.0
3128.00	V	23.4	Ambient	-38.3	4.0	3.2	-37.4	60.4	36.0

EIRP (dBm) = Matched Sig Gen Reading (dBm) + Equivalent Antenna Gain – Cable Loss

DATA PAGE	
MANUFACTURER	Industrial Scientific Corporation
EUT	Gas Monitor
MODEL NO.	Ventis Pro 5
SERIAL NO.	VzW 6
TEST	FCC §27, RSS-130 – Radiated Spurious Emissions
MODE	Transmitting – LTE Band 13, Channel 23279 (10MHz BW)
DATE TESTED	July 27 & 28, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	<p>In accordance with FCC §27.53(f), emissions in the 1559 – 1610MHz band shall be limited to -70dBW/MHz EIRP. This has been converted into a dBm value of -40dBm.</p> <p>In accordance with FCC §27.53(c)(2), the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB</p>

Freq. (MHz)	Ant Pol	Meter Reading (dBm)	Ambient	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	ERP (dBm)	EIRP Limit (dBm)	Margin (dB)
1573.00	H	24.1		-47.9	2.7	2.2	-47.4	-40.0	-7.4
1573.00	V	24.1		-48.7	2.7	2.2	-48.1	-40.0	-8.1

Freq. (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	ERP (dBm)	Attenuation Below Output Power (dB)	Minimum Attenuation (dB)
2359.50	H	22.8	Ambient	-38.3	3.0	2.7	-38.0	61.0	36.0
2359.50	V	22.2	Ambient	-39.7	3.0	2.7	-39.4	62.4	36.0
3146.00	H	23.2	Ambient	-37.7	3.8	3.2	-37.0	60.0	36.0
3146.00	V	23.5	Ambient	-38.6	3.8	3.2	-38.0	61.0	36.0

EIRP (dBm) = Matched Sig Gen Reading (dBm) + Equivalent Antenna Gain – Cable Loss