Electromagnetic Compatibility Test Report

Tests Performed on a Fybr

Vehicle Sensor, Model Sensor IV

Radiometrics Document RP-9966

Product Detail:
FCC ID: 2ALBF5040 IC: 22374-5040 Equipment type: DTS Digital Transmission System
Test Standards:
ANSI C63.10-2013 2013; American National Standard for Testing Unlicensed Wireless Devices

Tests Performed For:	*Test Facility:*
Fybr, LLC 640 Cepi Dr., Suite C Chesterfield, MO 63005	**Radiometrics Midwest Corporation** 12 Devonwood Avenue Romeoville, IL 60446-1349 (815) 293-0772
Test Date(s):	
January 23-24, 2025	

Document RP-9966 Revisions:

Rev.	Issue Date	Revised By
0	January 24, 2025	

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1.0 ADMINISTRATIVE DATA

Equipment Under Test:	
A Fybr, Vehicle Sensor Model: Sensor IV; Serial Number: SMP1 This will be referred to as the EUT in this Report	
Date EUT Received at Radiometrics:	*Test Date(s):*
April 25, 2024	Jan 23-24, 2025
Test Report Written and Authorized By:	*Test Witnessed By:*
Joseph Strzelecki Senior EMC Engineer	The tests were not witnessed by personnel from Fybr
Radiometrics' Personnel Responsible for Test:	*EUT Checked By:*
Joseph Strzelecki 01/07/2025 Date Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE	Joseph Strzelecki Chris Dalessio Radiometrics

2.0 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a Transceiver, Model Sensor IV, manufactured by Fybr. The detailed test results are presented in a separate section. The following is a summary of the test results.

Transmitter Requirements

Environmental Phenomena	Frequency Range	Test Result
Max Gain Test	902 to 928 MHz	1.0 dBi

3.0 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a vehicle sensor for use in parking lots, Model Sensor IV, manufactured by Fybr. The EUT was in good working condition during the tests, with no known defects. The EUT broadcasts a location ping periodically, in order to facilitate tracking of staff within a facility equipped with one or more tracking receivers.

4.0 TESTED SYSTEM DETAILS

4.1 Tested System Configuration

The system was configured for testing in a typical fashion. The EUT was placed on an 80-cm high, nonconductive test stand. The testing was performed in conditions as close as possible to installed conditions. The EUT was tested as a stand-alone device. Power was supplied with a new battery.

Tested System Configuration List

Item	Description	Type*	Manufacturer	Model Number	Serial Number
1	Transceiver	E	Fybr, LLC	Sensor IV	SMP1

* Type: E = EUT, P = Peripheral, S = Support Equipment; H = Host Computer

4.2 EUT Operating Modes

The transmit mode for all tests was continuous. The EUT was in its normal GFSK modulation during the tests. It was tested as a stand-alone, battery powered device, since that is the configuration in the final installation.

Name and version of the test software used to exercise the device	Test 1.0
Power settings used for the purpose of exercising the device	15 dBm Nominal setting

4.3 Equipment Modifications

No modifications were made to the EUT at Radiometrics' test facility in order to comply with the standards listed in this report.

5.0 TEST PROCEDURE DOCUMENTS

The tests were performed using the procedures from the following specifications:

Document	Date	Title
ANSI C63.10-2013	2013	American National Standard for Testing Unlicensed Wireless Devices
FCC KDB 412172 DR01	2015	Guidelines for Determining the Effective Radiated Power (ERP) And Equivalent Isotropically Radiated Power (EIRP) of an RF Transmitting System; v01r01

6.0 RADIOMETRICS' TEST FACILITIES

The results of these tests were obtained at Radiometrics Midwest Corp. in Romeoville, Illinois, USA.

The following is a list of shielded enclosures located in Romeoville, Illinois used during the tests:

Chamber E: Is a custom-made anechoic chamber that measures 52' L X 30' W X 18' H. The walls and ceiling are fully lined with RF absorbers. Pro-shield of Collinsville, Oklahoma manufactured the chamber. The floor has a 9' x 9' section of microwave absorber for testing above 1 GHz.

A separate ten-foot long, brass plated, steel ground rod attached via a 6-inch copper braid grounds each of the above chambers. Each enclosure is also equipped with low-pass power line filters.

The FCC has accepted these sites as test site number US1065. The FCC test site Registration Number is 732175. Details of the site characteristics are on file with the Industry Canada as site number IC 3124A-1.

A complete list of the test equipment is provided herein. The calibration due dates are indicated on the equipment list. The equipment is calibrated in accordance with ANSI/NCSL Z540-1 with traceability to the National Institute of Standards and Technology (NIST).

7.0 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

8.0 CERTIFICATION

Radiometrics Midwest Corporation certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specification and the data contained herein was taken with calibrated test equipment. The results relate only to the EUT listed herein.

9.0 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
ANT-68	EMCO	Log-Periodic Ant.	93146	9604-4456	200-1000MHz	24 Mo.	01/30/24
ATT-53	Weinschel	Attenuator (20 dB)	23-20-34	CG7857	DC-18 GHz	24 Mo	05/03/24
ATT-66	Inmet	Attenuator (6dB)	6B10W-6dB	ATT-66	DC-3 GHz	24 Mo	05/03/24
CAB-210B	Teledyne	Coaxial Cable	N/A	CAB-160B	DC-18 GHz	24 Mo.	12/18/23
CAB-600D	Teledyne	Coaxial Cable	N/A	CAB-507A	DC-18 GHz	24 Mo.	12/18/23
REC-21	Agilent	Spectrum Analyzer	E7405A	MY45118341	9Hz-26.5 GHz	24 Mo.	04/24/24
THM-03	Fluke	Temp/Humid Meter	971	95850465	N/A	24 Mo.	04/14/23

REC-44 was only used after July 24, 2024.
THM-02 was only used before November 21, 2024.
Note: All calibrated equipment is subject to periodic checks.

Software Company	Test Software Name	Version	Applicable Tests
Radiometrics	REREC11D	07.21.22	RF Radiated Emissions (FCC Part 15 & EN 55032)

10.0 TEST SECTIONS

10.1 Peak Output Power

The power output test method from ANSI C63.10 section 11.9.1.1 was used for this test. The spectrum analyzer was set to the following settings:

Span = 30 MHz
RBW = 120 MHz
VBW = 300 kHz
Detector function = peak
Trace = max hold

The analyzer settings used for the direct peak power measurement was the same for the radiated emissions field strength. The EUT antenna port was connected to the Spectrum analyzer Via a coaxial cable.

Tested by: Joseph Strzelecki
Test Date: 01/23/2025
Test Equipment: Spectrum Analyzerl REC-21 & Attenuator ATT-66

Frequency (MHz)	Reading (dBm)	Cable Loss (dB)	Attenuator Loss (dB)	Total Power (dBm)
903	7.7	0.1	6.2	14.0
915	7.6	0.1	6.2	13.9
927	7.6	0.1	6.2	13.9

10.2 Radiated Emissions Fundamental Emissions

The procedures were in accordance to ANSI C63.10.

Radiated emission measurements were performed with a linearly polarized broadband antenna. The radiated emission measurements were performed with a spectrum analyzer. The bandwidth used was 120 kHz. A 10 dB linearity check is performed prior to start of testing in order to determine if an overload condition exists. Figure 4 herein lists the details of the test equipment used during radiated emissions tests.

Final radiated emissions measurements were performed inside of an anechoic chamber at a test distance of 3 meters. The anechoic chamber is designated as Chamber E. This Chamber meets the Site Attenuation requirements of ANSI C63.4. Chamber E is located at 12 Devonwood Ave. Romeoville, Illinois EMI test lab.

Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst-case emissions were recorded. All measurements may be performed using a peak detector functions. The detected emission levels were maximized by rotating the EUT, and by scanning the measurement antenna from 1 to 4 meters above the ground.

10.2.1 Radiated Emissions Field Strength Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation is as follows:

FS = RA + AF + CF

Where: FS = Field Strength in dBuV/m
RA = Receiver Amplitude in dBuV
AF = Antenna Factor in dB/m
CF = Cable Attenuation Factor in dB

10.3 Gain Calculation

The Gain was calculated using the procedures from FCC KDB 412172

Excerpt from FCC KDB 412172

1.3.1. Field Strength Approach (linear terms):

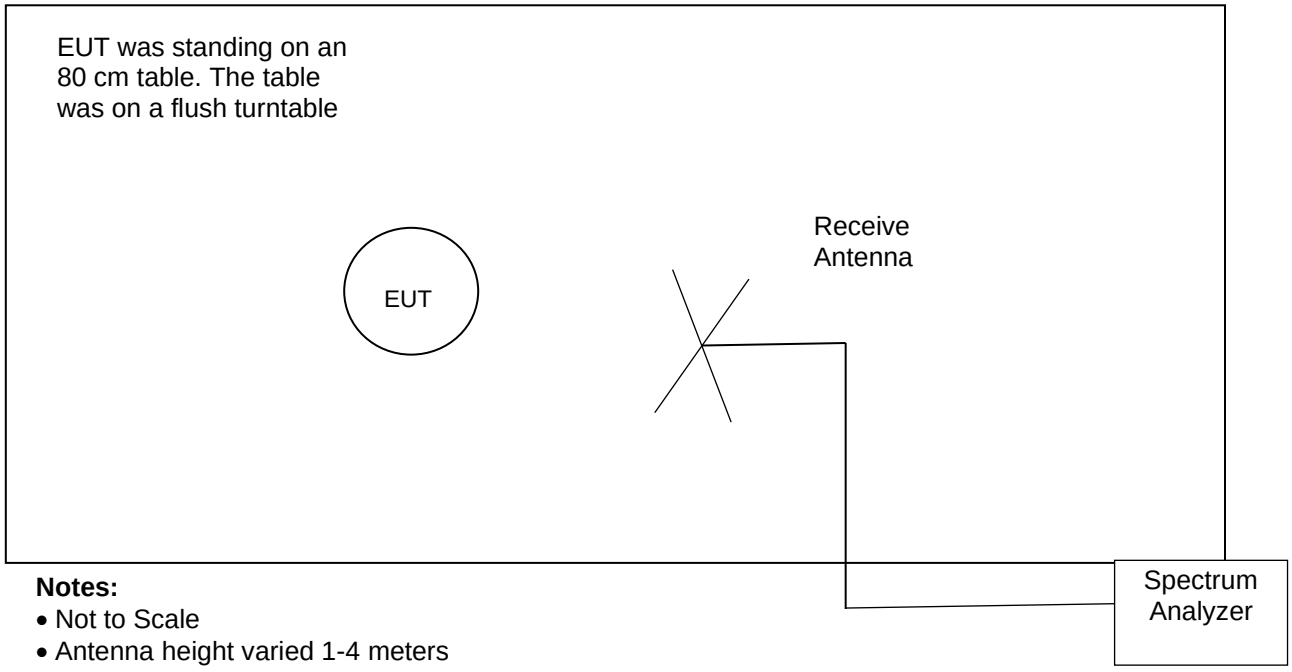
$$\mathbf{eirp} = p_t \times g_t = (E \times d)^2/30 \qquad (1)$$

where:

- p_t = transmitter output power in watts,
- g_t = numeric gain of the transmitting antenna (unitless),
- E = electric field strength in V/m,
- d = measurement distance in meters (m).

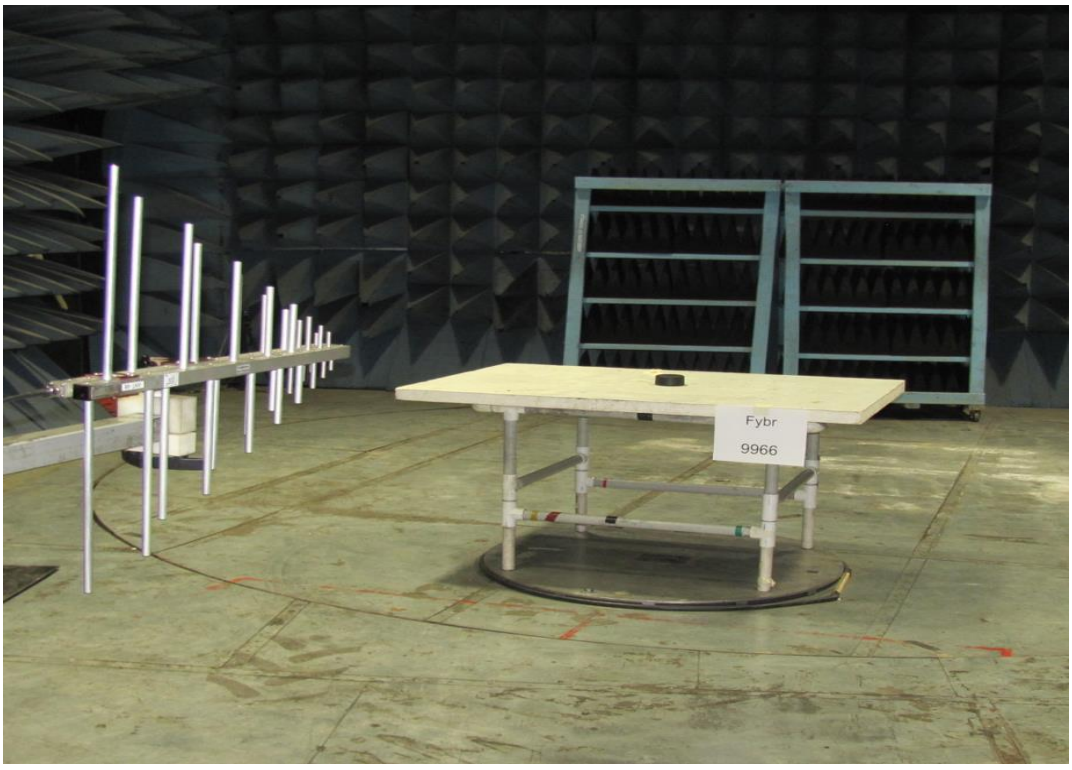
Figure 1. Drawing of Radiated Emissions Setup

Chamber E, anechoic



Notes:
- Not to Scale
- Antenna height varied 1-4 meters
- Distance from antenna to tested system is 3 meters

Frequency Range	Receive Antenna	Spectrum Analyzer
903-927 MHz	ANT-68	REC-21



10.3.1 Radiated Emissions Test Results

The following spectrum analyzer settings were used.

Span = wide enough to fully capture the emission being measured
RBW = 120 kHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

The EUT was in the highest power mode and the highest duty cycle for this test.

Manufacturer	Fybr	Specification	FCC Part 15 Subpart C & RSS-210
Model	Sensor IV	Test Date	January 24, 2025
Serial Number	SMP1	Test Distance	3 Meters
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; BC = Biconical (ANT-80); LP = Log-Periodic (ANT-68); HN = Horn (ANT-66) P = peak; Q = QP		
Notes	Test Equipment: See Figure 1		

Highest readings for each Frequency

Freq. MHz	Meter Reading dBuV	Ant Factor dB/m	Cable Loss dB	EUT dBuV/m
903	85.5	22.9	1.3	109.7
915	85.9	22.9	1.3	110.1
927	85.3	23.0	1.3	109.6

10.4 Gain Results

The results from the radiated emissions test and the direct measurement were entered below. The field strength was converted to EIRP using the formulas from FCC KDB 412172. The Antenna Gain was calculated by subtracting conducted Power in dBm from Radiated EIRP in dBm.

Freq	Peak	Field Strength	Meas	Radiated EIRP	Radiated EIRP	Conducted Power	Antenna Gain
MHz	dBuV/m	V/m	Dist	Watts	dBm	dBm	dBi
903	109.7	0.30549	3	2.80E-02	14.5	14.0	0.5
915	110.1	0.31989	3	3.07E-02	14.9	13.9	1.0
927	109.6	0.30200	3	2.74E-02	14.4	13.9	0.5

11.0 REVISION HISTORY

RP-9966 Revisions:			
Rev.	Affected Sections	Description	Rationale