

# **ROGERS LABS, INC.**

4405 West 259<sup>th</sup> Terrace  
Louisburg, KS 66053  
Phone / Fax (913) 837-3214

## Engineering Test Report for Grant of Certification of Application 47CFR Part 90 and Industry Canada RSS-137 Location and Monitoring Service Transmitter

**Model: 051064B**

915 MHz

FCC ID: FIH051064B

IC: 1584A-FIH051064B

## Transcore

Amtech Technology Center  
8600 Jefferson Street, NE  
Albuquerque, NM 87113

FCC Designation: US5305  
ISED Registration: 3041A-1

Test Report Number: 200116

Test Date: January 16, 2020

Authorized Signatory: *Scot D. Rogers*  
Scot D. Rogers

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Rogers Labs, Inc.  
4405 West 259<sup>th</sup> Terrace  
Louisburg, KS 66053  
Phone/Fax: (913) 837-3214  
Revision 1

Transcore  
Model: 051064B, Basic IAG Tag  
Test: 200116  
Test to: 47CFR Parts 2, 90 and RSS-137  
File: Transcore 051064B TstRpt 200116

SN: 061003-01  
FCC ID: FIH051064B  
IC: 1584A-FIH051064B  
Date: February 4, 2020  
Page 1 of 31

## Table of Contents

<b>TABLE OF CONTENTS.....</b>	<b>2</b>
<b>REVISION HISTORY .....</b>	<b>4</b>
<b>EXECUTIVE SUMMARY .....</b>	<b>5</b>
<b>OPINION / INTERPRETATION OF RESULTS .....</b>	<b>5</b>
<b>EQUIPMENT UNDER TEST .....</b>	<b>5</b>
Equipment Function and Configuration .....	6
Equipment Configuration .....	6
<b>APPLICATION FOR CERTIFICATION.....</b>	<b>7</b>
<b>APPLICABLE STANDARDS AND TEST PROCEDURES.....</b>	<b>9</b>
<b>UNITS OF MEASUREMENTS .....</b>	<b>9</b>
<b>TEST SITE LOCATIONS .....</b>	<b>10</b>
<b>ENVIRONMENTAL CONDITIONS.....</b>	<b>10</b>
<b>LIST OF TEST EQUIPMENT .....</b>	<b>11</b>
<b>TRANSMITTER POWER OUTPUT .....</b>	<b>12</b>
Measurements Required .....	12
Test Arrangement.....	12
Table 1 Transmitter Power Results.....	13
Figure 1 Transmitter Output Across Frequency Band.....	14
<b>MODULATION CHARACTERISTICS.....</b>	<b>15</b>
Measurements Required .....	15
Test Arrangement.....	15
Results Modulation Characteristics .....	15

<b>OCCUPIED BANDWIDTH .....</b>	<b>16</b>
Measurements Required .....	16
Test Arrangement.....	16
<b>Table 2 Occupied Bandwidth Results .....</b>	<b>16</b>
Figure 2 Occupied Bandwidth.....	17
<b>SPURIOUS EMISSIONS.....</b>	<b>18</b>
Measurements Required .....	18
Test Arrangement.....	18
<b>Table 3 Spurious Emissions Results .....</b>	<b>19</b>
<b>EMISSION MASK .....</b>	<b>20</b>
Measurements Required .....	20
Test Arrangement.....	20
Results Emission Mask .....	20
Figure 3 Emissions Mask .....	21
Figure 4 Emissions Mask .....	22
<b>FIELD STRENGTH OF SPURIOUS RADIATION.....</b>	<b>23</b>
Measurements Required .....	23
Test Arrangement.....	23
<b>Table 4 General Radiated Emission Results (worst-case) .....</b>	<b>24</b>
<b>FREQUENCY STABILITY .....</b>	<b>25</b>
Measurements Required .....	25
Test Arrangement.....	25
<b>ANNEX.....</b>	<b>27</b>
<b>Annex A Measurement Uncertainty Calculations .....</b>	<b>28</b>
<b>Annex B Additional Test Equipment List.....</b>	<b>29</b>

Rogers Labs, Inc.	Transcore	SN: 061003-01
4405 West 259 <sup>th</sup> Terrace	Model: 051064B, Basic IAG Tag	FCC ID: FIH051064B
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Revision 1	File: Transcore 051064B TstRpt 200116	Page 3 of 31

<b>Annex C Rogers Qualifications.....</b>	<b>30</b>
<b>Annex D Laboratory Certificate of Accreditation .....</b>	<b>31</b>

## **Revision History**

Revision 1 Issued February 4, 2020

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IC: 1584A-FIH051064B  
Date: February 4, 2020  
Page 4 of 31

## Executive Summary

The following information is submitted for consideration in obtaining Grant of Certification of 47CFR Paragraph 90 (M) and Industry Canada RSS-137 Location Monitoring Service (LMS) transmitter equipment.

Name of Applicant: Transcore  
 Amtech Technology Center 8600 Jefferson Street, NE  
 Albuquerque, NM 87113  
 Phone: (505) 856-8000

Model: 051064B

FCC ID: FIH051064B      IC: 1584A-FIH051064B

Frequency of Operation: 915 MHz

Transmit Power: 0.001 watts, occupied bandwidth 7,307.7 kHz

## Opinion / Interpretation of Results

Tests Performed	Results
Requirements per 47CFR paragraphs 2.1031-2.1057 and RSS-137, Issue 2	Complies
Requirements per 47CFR paragraphs 90.205 and RSS-137	Complies
Requirements per 47CFR paragraphs 90.207 and RSS-137	Complies
Requirements per 47CFR paragraphs 90.209 and RSS-137	Complies
Requirements per 47CFR paragraphs 90.210 and RSS-137	Complies
Requirements per 47CFR paragraphs 90.213 and RSS-137	Complies

## Equipment Under Test

<u>Equipment</u>	<u>Model / PN</u>	<u>Serial Number</u>
EUT	051064B	061003-01

Test results in this report relate only to the items tested

Software Version: 99.08. The software does not provide ability to change power as it is hardcoded in the firmware. The power level in the design is 0.001 watts (902-928 MHz).

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Revision 1	File: Transcore 051064B TstRpt 200116	Page 5 of 31

## ***Equipment Function and Configuration***

The EUT is a mobile Non-Multilateral transponder Operating as functioning as location and monitoring Radio Frequency Identification (RFID) transmitter. The EUT documented in this report is an active mobile transponder operating at 915 MHz frequency band transmitting information to compatible Location and Monitoring Service equipment. The unit operates from internal direct current power provided from non-removable battery and provides no provision for alternative power source. The design utilizes internal fixed antenna systems and offers no provision for antenna replacement or modification. Operation of the design utilizes basic standardized RFID modulation scheme offering the ability to interface and respond with Industry Standard Radio Frequency Identification (RFID) interrogation systems. The test sample was modified from production equipment for testing purposes. The modifications involved the addition of slide switch used to enable the transmitter and test software for testing purposes. The test sample transmits bursts of OOK modulated signal resembling actual packet data in the test mode. Activation of the switch placed the EUT in a test mode operating the transmitter at a high duty cycle. The testing mode of operation exceeds typical duty cycle operation of production equipment. Test results in this report relate only to the products described in this report.

## ***Equipment Configuration***

**EUT**

Rogers Labs, Inc.  
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FCC ID: FIH051064B  
IC: 1584A-FIH051064B  
Date: February 4, 2020  
Page 6 of 31

## Application for Certification

1. Manufacturer: Transcore  
 Amtech Technology Center  
 8600 Jefferson Street, NE  
 Albuquerque, NM 87113
2. Identification: **Model:** 051064B **FCC ID:** FIH051064B **IC:** 1584A-FIH051064B
3. A copy of the installation and operating instructions furnished to the end user. Refer to the instruction manual furnished with this application for details.
4. Emission Types: Modulated in width/duration/data – L1D
 

Frequency (MHz)	Emission Designator
915	7M31L1D
5. Frequency Range: 915 MHz
6. Range of operating power values or specific operating power levels, and description of any means provided for variation of operating power. Approximately 0.001 watts.
7. Maximum power rating as defined in the applicable part(s) of the rules. As stated in 47CFR, 90.205(k) the maximum permissible output power allowed is 30 watts.
8. The dc voltages applied to and dc currents into the several elements of the final radio frequency amplifying device for normal operation over the power range. The maximum operating mode runs at 3.0 volts consuming 0.0006 amps.
9. Provide the tune-up procedure over the power range, or at specific operating power levels. Refer to the tune-up procedure furnished with this application for details.
10. A schematic diagram and a description of all circuitry and devices provided for determining and stabilizing frequency, for suppression of spurious radiation, for limiting modulation, and for limiting power. Refer to the schematics and technical exhibits furnished with this application for details.
11. A photograph or drawing of the equipment identification plate, or label showing the information to be placed thereon shall be provided. Refer to the identification label exhibit and information furnished with this application for details.
12. Photographs (8" x 10") of the equipment of sufficient clarity to reveal equipment construction and layout, including meters, if any, and labels for controls and meters and sufficient views of the internal construction to define component placement and chassis assembly. Insofar as these requirements are met by photographs or drawings contained in instruction manuals supplied with the certification request, additional photographs are necessary only to complete the required showing. Refer to the exhibits of this report and or additional information furnished with the application for details.
13. For equipment employing digital modulation techniques, a detailed description of the modulation system to be used, including the response characteristics (frequency, phase, and amplitude) of any filters provided, and a description of the modulating wave train, shall be submitted for the maximum rated conditions under which the equipment will be operated. Information about modulation is contained in Operational description exhibit.

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Revision 1	File: Transcore 051064B TstRpt 200116	Page 7 of 31

14. The data required by Sections 2.1046 through 2.1057, inclusive, measured in accordance with the procedures set out in Section 2.1041.
15. The application for certification of an external radio frequency power amplifier under Part 97 of this chapter need not be accompanied by the data required by Paragraph (b)(14) of this section. In lieu thereof, measurements shall be submitted to show compliance with the technical specifications in Subpart C of Part 97 of this chapter and such information as required by Section 2.1060 of this part. This paragraph does not apply to this equipment.
16. An application for certification of an AM broadcast stereophonic exciter generator intended for interfacing with existing certified, or formerly type accepted or notified transmitters must include measurements made on a complete stereophonic transmitter. The instruction book must include complete specifications and circuit requirements for interconnecting with existing transmitters. The instruction book must also provide a full description of the equipment and measurement procedures to monitor modulation and to verify that the combination of stereo exciter generator and transmitter meets the emission limitations of section 73.44. This paragraph does not apply to this equipment.
17. A single application may be filed for a composite system that incorporates devices subject to certification under multiple rule parts; however, the appropriate fee must be included for each device. Separate applications must be filed if different FCC Identifiers will be used for each device.
18. The device is not a software-defined radio and requirements of 2.944 do not apply to this application.
19. Applications for certification of equipment operating under part 27 of this chapter, that a manufacturer is seeking to certify for operation in the:
  - (i) 1755-1780 MHz, 2155-2180 MHz, or both bands shall include a statement indicating compliance with the pairing of 1710-1780 and 2110-2180 MHz specified in §§27.5(h) and 27.75 of this chapter.
  - (ii) 1695-1710 MHz, 1755-1780 MHz, or both bands shall include a statement indicating compliance with §27.77 of this chapter.
  - (iii) 600 MHz band shall include a statement indicating compliance with §27.75 of this chapter.
20. Applications for certification of equipment operating under part 90 of this chapter and capable of operating on the 700 MHz interoperability channels (See §90.531(b)(1) of this chapter) shall include a Compliance Assessment Program Supplier's Declaration of Conformity and Summary Test Report or, alternatively, shall include a document detailing how the applicant determined that its equipment complies with §90.548 of this chapter and that the equipment is interoperable across vendors.
21. Contain at least one drawing or photograph showing the test set-up for each of the required types of tests applicable to the device for which certification is requested. These drawings or photographs must show enough detail to confirm other information contained in the test report. Any photographs used must be focused originals without glare or dark spots and must clearly show the test configuration used.

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SN: 061003-01  
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 IC: 1584A-FIH051064B  
 Date: February 4, 2020  
 Page 8 of 31

## Applicable Standards and Test Procedures

In accordance with the Federal Communications Code of Federal Regulations, 47CFR dated January 16, 2020, Part 2 Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.925, 2.926, 2.1031 through 2.1057; 90.201 through 90.217, 90.350 through 90.363 and RSS-137 Issue 2 the following information is submitted. Test procedures used were the established Methods of Measurement of Radio-Noise Emissions as described in ANSI C63.26-2015 and ANSI 63.4-2014.

## Units of Measurements

Conducted EMI      Data presented in dB $\mu$ V; dB referenced to one microvolt

Antenna port Conducted      Data is in dBm; dB referenced to one milliwatt

Radiated EMI      Data presented in dB $\mu$ V/m; dB referenced to one microvolt per meter

Note: Radiated limit may be expressed for measurement in dB $\mu$ V/m when the measurement is taken at a distance of 3 or 10 meters. Data taken for this report was taken at distance of 3 meters. Sample calculation demonstrates corrected field strength reading for Open Area Test Site using the measurement reading and correcting for receive antenna factor, cable losses, and amplifier gains.

### Sample Calculation:

RFS = Radiated Field Strength, FSM = Field Strength Measured

A.F. = Receive antenna factor, Losses = attenuators/cable losses, Gain = amplification gains

RFS (dB $\mu$ V/m @ 3m) = FSM (dB $\mu$ V) + A.F. (dB/m) + Losses (dB) - Gain (dB)

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IC: 1584A-FIH051064B  
Date: February 4, 2020  
Page 9 of 31

## Test Site Locations

Conducted EMI	AC line conducted emissions testing performed in a shielded screen room located at Rogers Labs, Inc., 4405 West 259 <sup>th</sup> Terrace, Louisburg, KS
Radiated EMI	The radiated emissions tests were performed at the 3 meters, Open Area Test Site (OATS) located at Rogers Labs, Inc., 4405 West 259 <sup>th</sup> Terrace, Louisburg, KS

Registered Site information: FCC Site: US5305, ISED: 3041A, CAB Identifier: US0096

NVLAP Accreditation      Lab code 200087-0

## Environmental Conditions

Ambient Temperature	19.4° C
Relative Humidity	29%
Atmospheric Pressure	1043.2 mb

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IC: 1584A-FIH051064B  
Date: February 4, 2020  
Page 10 of 31

## List of Test Equipment

<u>Equipment</u>	<u>Manufacturer</u>	<u>Model (SN)</u>	<u>Band</u>	<u>Cal Date(m/d/y)</u>	<u>Due</u>
<input type="checkbox"/> LISN	FCC	FCC-LISN-50-25-10(1PA) (160611)	.15-30MHz	4/18/2019	4/18/2020
<input type="checkbox"/> LISN	Compliance Design	FCC-LISN-2.Mod.cd,(126)	.15-30MHz	10/14/2019	10/14/2020
<input checked="" type="checkbox"/> Cable	Huber & Suhner Inc.	Sucoflex102ea(L10M)(303073)9kHz-40 GHz	10/14/2019	10/14/2020	
<input checked="" type="checkbox"/> Cable	Huber & Suhner Inc.	Sucoflex102ea(1.5M)(303069)9kHz-40 GHz	10/14/2019	10/14/2020	
<input checked="" type="checkbox"/> Cable	Huber & Suhner Inc.	Sucoflex102ea(1.5M)(303071)9kHz-40 GHz	10/14/2019	10/14/2020	
<input type="checkbox"/> Cable	Belden	RG-58 (L1-CAT3-11509)	9kHz-30 MHz	10/14/2019	10/14/2020
<input type="checkbox"/> Cable	Belden	RG-58 (L2-CAT3-11509)	9kHz-30 MHz	10/14/2019	10/14/2020
<input checked="" type="checkbox"/> Antenna	Com Power	AL-130 (121055)	.001-30 MHz	10/14/2019	10/14/2020
<input type="checkbox"/> Antenna:	EMCO	6509	.001-30 MHz	10/16/2018	10/16/2020
<input type="checkbox"/> Antenna	ARA	BCD-235-B (169)	20-350MHz	10/14/2019	10/14/2020
<input type="checkbox"/> Antenna:	Schwarzbeck Model: BBA 9106/VHBB 9124 (9124-627)			4/18/2019	4/18/2021
<input checked="" type="checkbox"/> Antenna	Sunol	JB-6 (A100709)	30-1000 MHz	10/14/2019	10/14/2020
<input type="checkbox"/> Antenna	ETS-Lindgren	3147 (40582)	200-1000MHz	10/14/2019	10/14/2020
<input type="checkbox"/> Antenna:	Schwarzbeck Model: VULP 9118 A (VULP 9118 A-534)			4/18/2019	4/18/2021
<input checked="" type="checkbox"/> Antenna	ETS-Lindgren	3117 (200389)	1-18 GHz	5/02/2019	5/2/2020
<input type="checkbox"/> Antenna	Com Power	AH-118 (10110)	1-18 GHz	10/14/2019	10/14/2020
<input type="checkbox"/> Antenna	Com Power	AH-840 (101046)	18-40 GHz	4/18/2019	4/18/2021
<input checked="" type="checkbox"/> Analyzer	Rohde & Schwarz	ESU40 (100108)	20Hz-40GHz	4/18/2019	4/18/2020
<input checked="" type="checkbox"/> Analyzer	Rohde & Schwarz	ESW44 (101534)	20Hz-44GHz	1/31/2019	1/31/2020
<input type="checkbox"/> Analyzer	Rohde & Schwarz	FS-Z60, 90, 140, and 220	40GHz-220GHz	12/22/2017	12/22/2027
<input checked="" type="checkbox"/> Amplifier	Com-Power	PA-010 (171003)	100Hz-30MHz	10/14/2019	10/14/2020
<input checked="" type="checkbox"/> Amplifier	Com-Power	CPPA-102 (01254)	1-1000 MHz	10/14/2019	10/14/2020
<input checked="" type="checkbox"/> Amplifier	Com-Power	PAM-118A (551014)	0.5-18 GHz	10/14/2019	10/14/2020
<input checked="" type="checkbox"/> Amplifier	Com-Power	PAM-840A (461328)	18-40 GHz	10/14/2019	10/14/2020
<input type="checkbox"/> Power Meter	Agilent	N1911A with N1921A	0.05-40 GHz	4/18/2019	4/18/2020
<input type="checkbox"/> Generator	Rohde & Schwarz	SMB100A6 (100150)	20Hz-6 GHz	4/18/2019	4/18/2020
<input type="checkbox"/> Generator	Rohde & Schwarz	SMBV100A6 (260771)	20Hz-6 GHz	4/18/2019	4/18/2020
<input type="checkbox"/> RF Filter	Micro-Tronics	BR50722 (009).9G notch	30-18000 MHz	4/18/2019	4/18/2020
<input type="checkbox"/> RF Filter	Micro-Tronics	HPM50114 (017)1.5G HPF	30-18000 MHz	4/18/2019	4/18/2020
<input type="checkbox"/> RF Filter	Micro-Tronics	HPM50117 (063) 3G HPF	30-18000 MHz	4/18/2019	4/18/2020
<input type="checkbox"/> RF Filter	Micro-Tronics	HPM50105 (059) 6G HPF	30-18000 MHz	4/18/2019	4/18/2020
<input type="checkbox"/> RF Filter	Micro-Tronics	BRM50702 (172) 2G notch	30-18000 MHz	4/18/2019	4/18/2020
<input type="checkbox"/> RF Filter	Micro-Tronics	BR50703 (G102) 5G notch	30-18000 MHz	4/18/2019	4/18/2020
<input type="checkbox"/> RF Filter	Micro-Tronics	BR50705 (024) 5G notch	30-18000 MHz	4/18/2019	4/18/2020
<input type="checkbox"/> Attenuator	Fairview	SA6NFNF100W-40 (1625)	30-18000 MHz	4/18/2019	4/18/2020
<input type="checkbox"/> Attenuator	Mini-Circuits	VAT-3W2+ (1436)	30-6000 MHz	4/18/2019	4/18/2020
<input type="checkbox"/> Attenuator	Mini-Circuits	VAT-3W2+ (1445)	30-6000 MHz	4/18/2019	4/18/2020
<input type="checkbox"/> Attenuator	Mini-Circuits	VAT-3W2+ (1735)	30-6000 MHz	4/18/2019	4/18/2020
<input type="checkbox"/> Attenuator	Mini-Circuits	VAT-6W2+ (1438)	30-6000 MHz	4/18/2019	4/18/2020
<input type="checkbox"/> Attenuator	Mini-Circuits	VAT-6W2+ (1736)	30-6000 MHz	4/18/2019	4/18/2020
<input checked="" type="checkbox"/> Weather station	Davis	6312 (A81120N075)		11/4/2019	11/4/2020

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 FCC ID: FIH051064B  
 IC: 1584A-FIH051064B  
 Date: February 4, 2020  
 Page 11 of 31

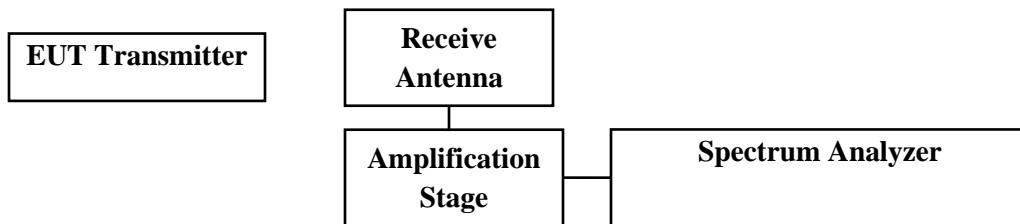
## Transmitter Power Output

### Measurements Required

Measurements shall be made to establish the radio frequency power delivered by the transmitter into the standard output termination. The power output shall be monitored and recorded, and no adjustment shall be made to the transmitter after the test has begun, except as noted below:

If the power output is adjustable, measurements shall be made for the highest and lowest power levels.

### Test Arrangement



The radio frequency power output was measured on the Open Area Test Site (OATS). The design offers no provision for connection to antenna port. The substitution method was used to predict the transmitter output power level. The EUT was placed on a rotatable platform elevated as required above the ground plane at a distance of 3 meters from the FSM antenna. The platform was rotated through 360 degrees to locate the position registering the highest amplitude emission. The frequency spectrum was searched for maximum emission generated. Emission level was measured and recorded for the maximum amplitude. The EUT transmitter was then removed and replaced with a substitution antenna, which was powered from a signal generator. The output signal from the generator was then adjusted such that the amplitude received was the same as that previously recorded for each frequency. This step was repeated for both horizontal and vertical polarizations. The power in dBm required to produce the desired signal level was then recorded from the signal generator. The power in dBm was then calculated by reducing the previous readings by the gain in the substitution antenna. The testing procedures used conform to the procedures stated in the ANSI C63.26-2015 document. Data was taken per 47CFR Paragraph 2.1046(a) and applicable paragraphs of Part 90 and RSS-137.

P <sub>dBm</sub>	= power in dB above 1 milliwatt
Milliwatts	= $10^{(P_{dBm}/10)}$
Watts	= (Milliwatts)(0.001)(W/mW)
Milliwatts	= $10^{(1/10)}$
	= 1.3 mW
	= 0.001 Watts power

**Table 1 Transmitter Power Results**

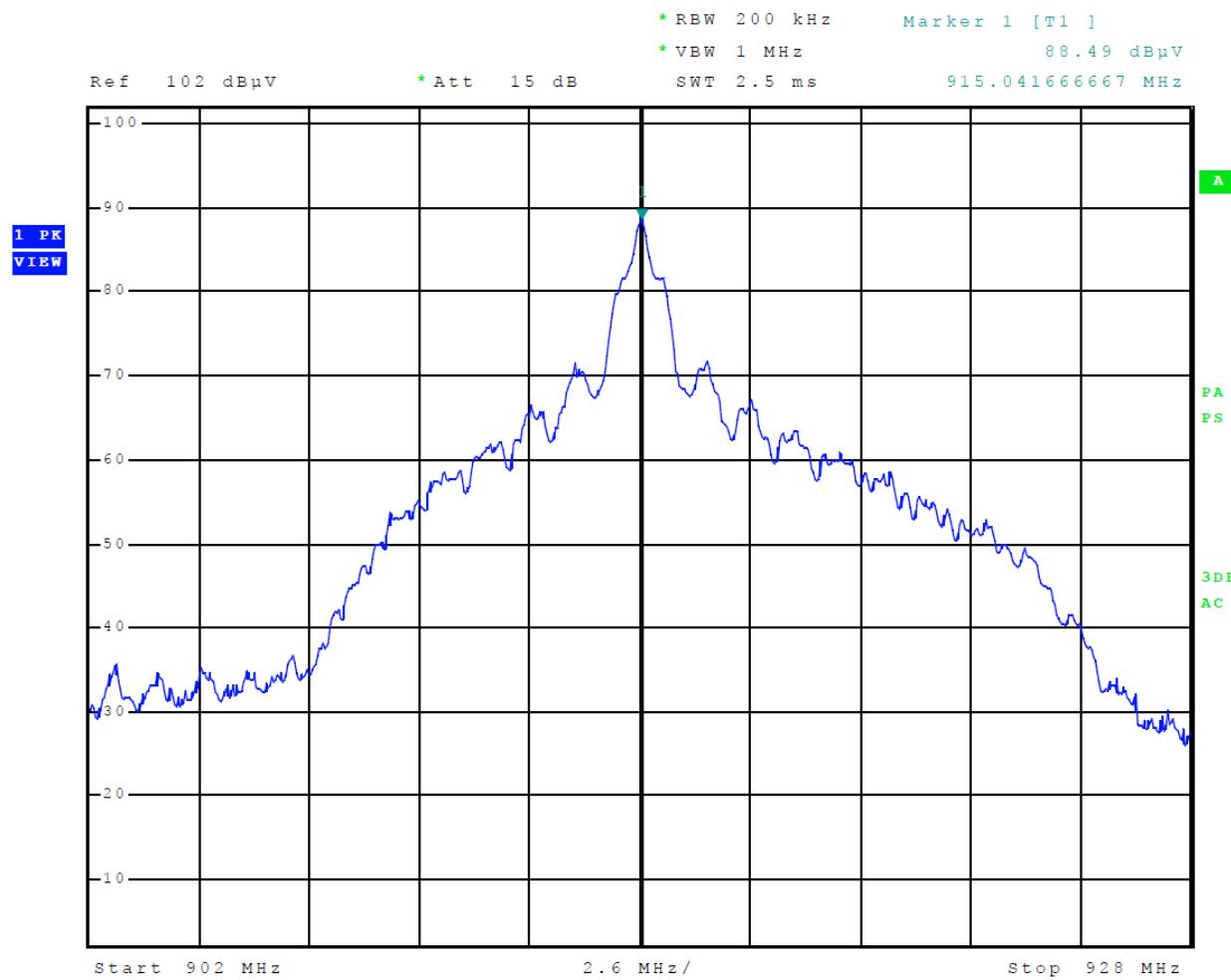
Frequency (MHz)	P <sub>dBm</sub>	P <sub>mw</sub>	P <sub>w</sub>
915	1	1.3	0.00

The EUT demonstrated compliance with specifications of 47CFR Paragraph 2.1046(a) and applicable Parts of 2 and 90.205 and RSS-137. There are no deviations to the specifications.

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 Page 13 of 31



**Figure 1 Transmitter Output Across Frequency Band**

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 File: Transcore 051064B TstRpt 200116

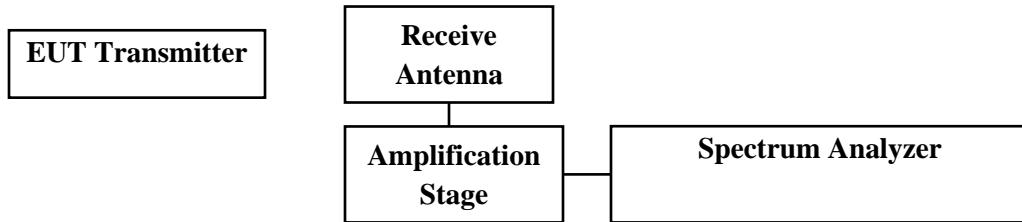
SN: 061003-01  
 FCC ID: FIH051064B  
 IC: 1584A-FIH051064B  
 Date: February 4, 2020  
 Page 14 of 31

## Modulation Characteristics

### ***Measurements Required***

A curve or equivalent data that shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed shall be submitted.

### ***Test Arrangement***



The radio frequency output was coupled to a Rohde & Schwarz ESU40 Spectrum Analyzer. The spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating in its normal mode.

### ***Results Modulation Characteristics***

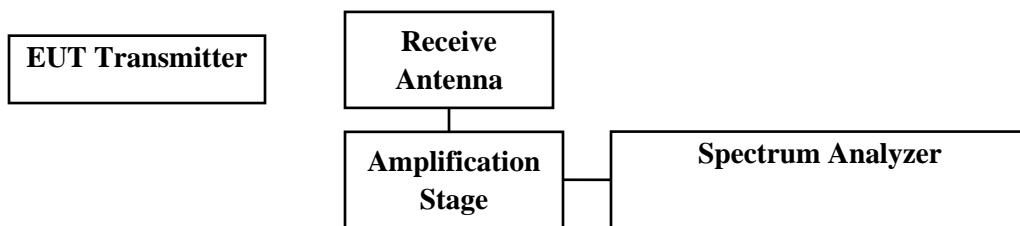
The transmitter operates providing digital data, transmitted signals modulated in amplitude/width/duration. The EUT demonstrated compliance with the specifications of Paragraphs 2.1046(a), 90.205 and RSS-137. There are no deviations to the specifications.

## Occupied Bandwidth

### Measurements Required

The occupied bandwidth, that is the frequency bandwidth such that below its lower and above its upper frequency limits, the mean powers radiated are equal to 0.5 percent of the total mean power radiated by a given emission. Refer to figure two displaying plot of the occupied bandwidth measurement.

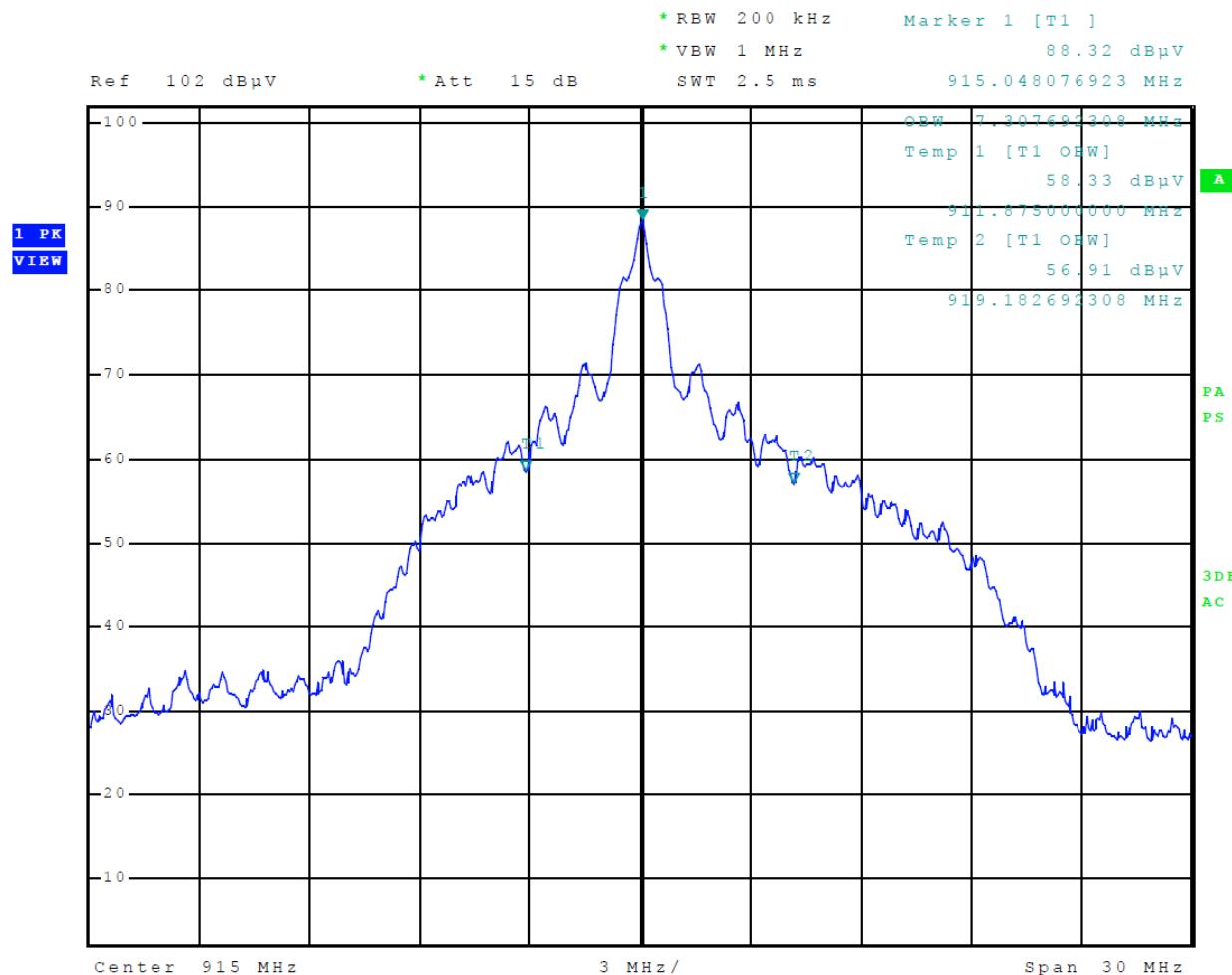
### Test Arrangement



**Table 2 Occupied Bandwidth Results**

Operational Frequency Band (MHz)	Occupied Bandwidth (kHz)
915.00	7,307.7

The EUT demonstrated compliance with the requirements of Paragraphs 2.1046(a) 90.209 and RSS-137 paragraph 6.1.2. There are no deviations to the specifications.



**Figure 2 Occupied Bandwidth**

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 Revision 1

Transcore  
 Model: 051064B, Basic IAG Tag  
 Test: 200116  
 Test to: 47CFR Parts 2, 90 and RSS-137  
 File: Transcore 051064B TstRpt 200116

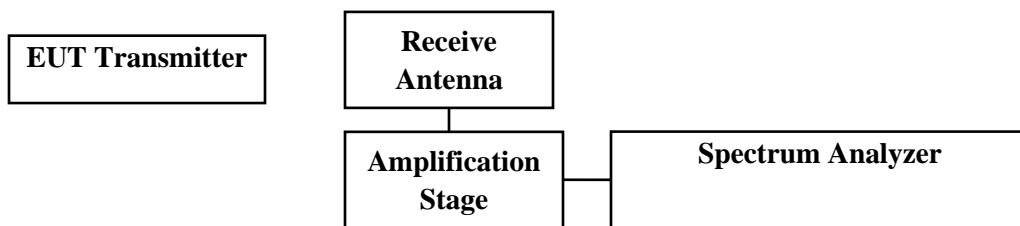
SN: 061003-01  
 FCC ID: FIH051064B  
 IC: 1584A-FIH051064B  
 Date: February 4, 2020  
 Page 17 of 31

## Spurious Emissions

### Measurements Required

The radio frequency voltage or power generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. To gain dynamic range in the test equipment, a high pass filter attenuated the fundamental frequency of operation was used to observe the harmonic emissions.

### Test Arrangement



The radio frequency output was passively coupled to a Rohde & Schwarz ESU40 Spectrum Analyzer. The spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating in its normal mode. The frequency spectrum from 9 kHz to 10 GHz was observed. Data was taken per 47CFR 2.1051 and applicable paragraphs of Part 90 and RSS-137.

Limit: Spurious emissions must be attenuated below the peak output power by the at least  $55 + 10 \log(P_o)$  dB.

0.001-watt transmitter limit requires the out of band emissions must be suppressed by at least 25.0 dBc

$$\begin{aligned}
 \text{Attenuation} &= 55 + 10 \log_{10}(P_w) \\
 &= 55 + 10 \log_{10}(0.001) \\
 &= 25.0 \text{ dBc}
 \end{aligned}$$

**Table 3 Spurious Emissions Results**

Channel MHz	Spurious Freq. (MHz)	Measured Level (dBm)	Level Below Carrier (dBc)
915.00	1830.0	-55.9	51.4
	2745.0	-57.9	53.4
	3660.0	-60.8	56.3
	4575.0	-61.3	56.8
	5490.0	-59.4	54.9
	6405.0	-55.8	51.3

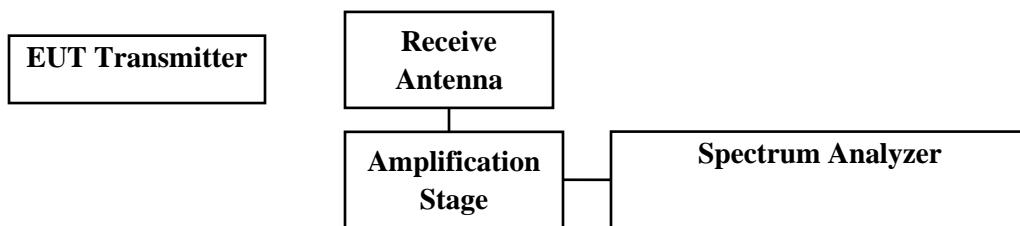
Data was taken per 2.1051 and applicable parts of 47CFR 90.210 and RSS-137. The EUT demonstrated compliance with the specifications of Paragraphs 47CFR 2.1051, 2.1057 and 90.210(k) and RSS-137 paragraph 6.5. There are no deviations to the specifications.

## Emission Mask

### **Measurements Required**

Transmitters used in the radio services governed by this part must comply with the emissions masks outlined in this section. Paragraph 90.210(K) specifies the out of band emission limitations for this equipment. The spurious emissions for the device were measured at the maximum output power condition.

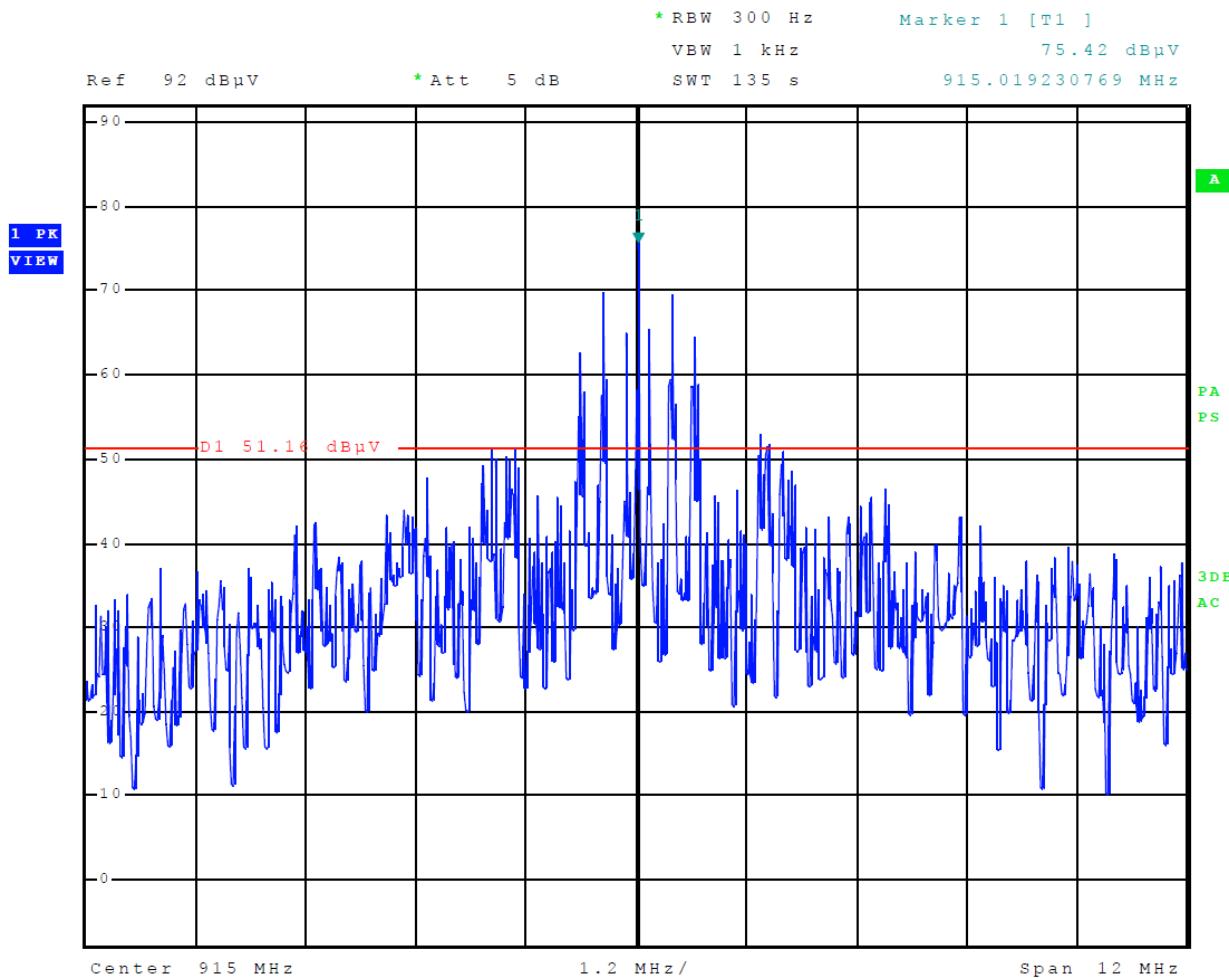
### **Test Arrangement**



The radio frequency output was passively coupled to a Rohde & Schwarz ESU40 Spectrum Analyzer. The spectrum analyzer was used to observe the radio frequency spectrum with the transmitter operating through normal modes with maximum output power. The frequency spectrum at the band edges were observed and plots produced. Refer to figures three and four for plots presenting compliance with emission mask requirements at the band edges. Data was taken per 47CFR 2.1051 and applicable parts of Part 90.210 (k) and RSS-137.

### **Results Emission Mask**

The EUT demonstrated compliance with the specifications of Paragraphs 47CFR 2.1051, 2.1057 and 90.210(k) and RSS-137 paragraph 6.5. There are no deviations to the specifications.

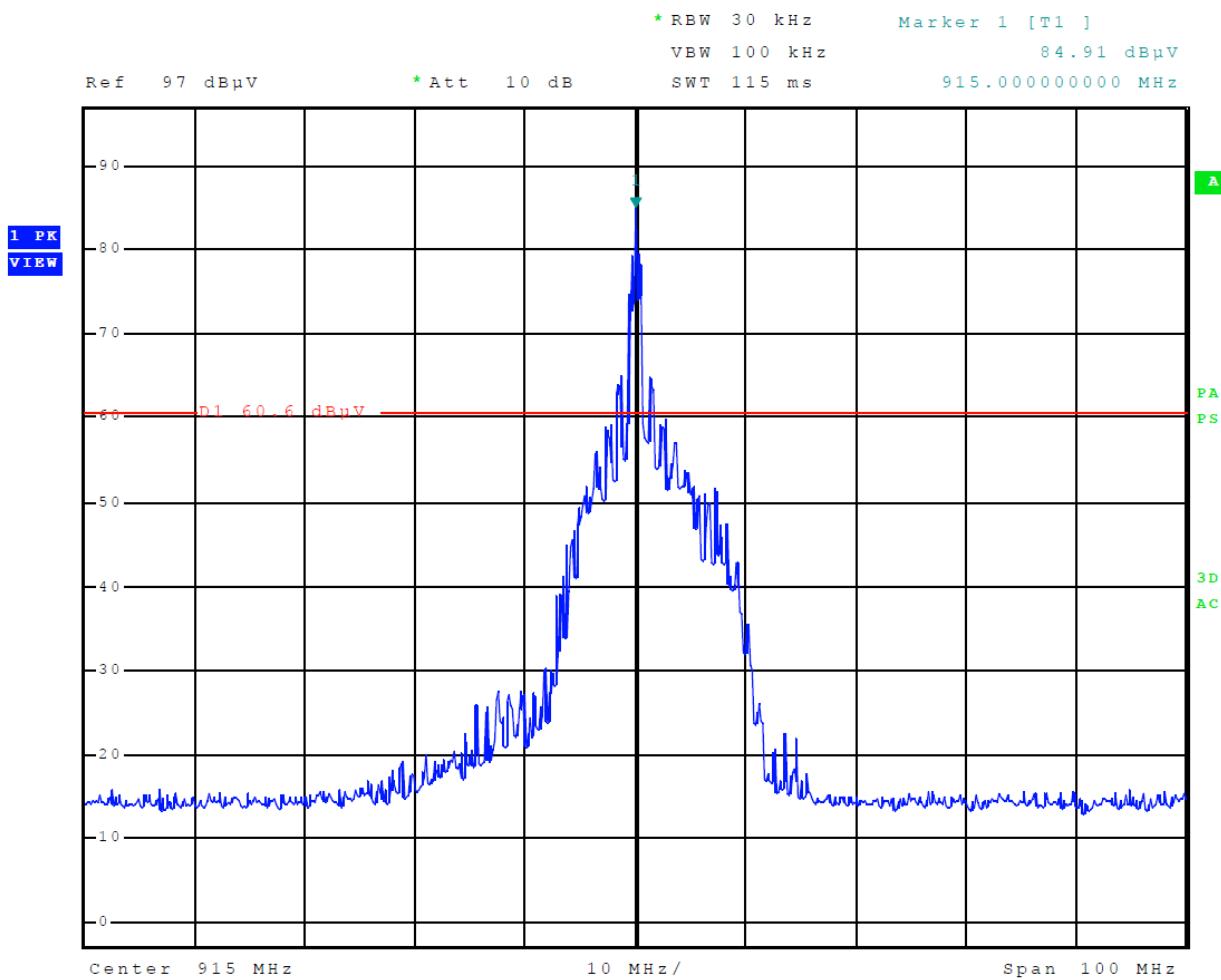


**Figure 3 Emissions Mask**

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Revision 1

Transcore  
Model: 051064B, Basic IAG Tag  
Test: 200116  
Test to: 47CFR Parts 2, 90 and RSS-137  
File: Transcore 051064B TstRpt 200116

SN: 061003-01  
FCC ID: FIH051064B  
IC: 1584A-FIH051064B  
Date: February 4, 2020  
Page 21 of 31



**Figure 4 Emissions Mask**

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 Revision 1

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 Model: 051064B, Basic IAG Tag  
 Test: 200116  
 Test to: 47CFR Parts 2, 90 and RSS-137  
 File: Transcore 051064B TstRpt 200116

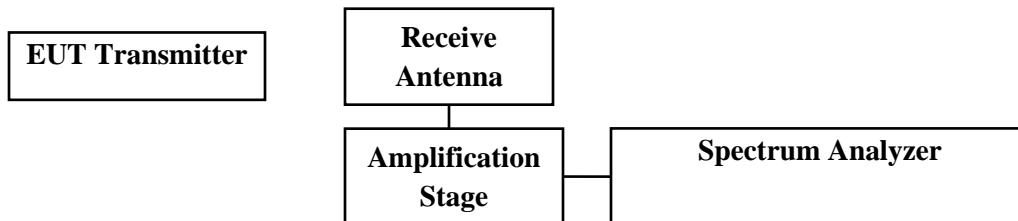
SN: 061003-01  
 FCC ID: FIH051064B  
 IC: 1584A-FIH051064B  
 Date: February 4, 2020  
 Page 22 of 31

## Field Strength of Spurious Radiation

### **Measurements Required**

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation.

### **Test Arrangement**



Preliminary radiated emissions investigation was made in a screen room to determine frequencies of emissions for investigation on the Open Area Test Site (OATS). The transmitter spurious emissions were measured on the OATS. The EUT was placed on a turntable elevated as required above the ground plane at a distance of 3 meters from the FSM antenna. The turntable was rotated through 360 degrees to locate the position registering the highest amplitude emission. The frequency spectrum was then searched for spurious emissions generated from the transmitter. Raising and lowering the FSM antenna and rotating the turntable to maximize the emission. Data was measured and recorded for the maximum amplitude of each spurious emission. A Loop antenna was used for measuring emissions from 0.009 to 30 MHz, Biconilog Antenna for 30 to 1000 MHz, Double-Ridge, and/or Pyramidal Horn Antennas above 1 GHz. Emissions were measured in dB $\mu$ V/m @ 3 meters. The substitution method was used to measure harmonic emissions. Harmonic emission levels from the EUT were measured and amplitude levels were recorded. The EUT transmitter was then removed and replaced with a substitution antenna, which was powered from a signal generator. The output signal from the generator was then adjusted such that the amplitude received was the same as that previously recorded for each frequency. This step was repeated for both horizontal and vertical polarizations. The power in

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 Revision 1

Transcore  
 Model: 051064B, Basic IAG Tag  
 Test: 200116  
 Test to: 47CFR Parts 2, 90 and RSS-137  
 File: Transcore 051064B TstRpt 200116

SN: 061003-01  
 FCC ID: FIH051064B  
 IC: 1584A-FIH051064B  
 Date: February 4, 2020  
 Page 23 of 31

dBm required to produce the desired signal level was then recorded from the signal generator. The power in dBm was then calculated by reducing the previous readings by the gain in the substitution antenna.

The limits for the spurious radiated emissions are defined by the following equation.

Limit = Amplitude of the spurious emission must be attenuated by this amount below the level of the fundamental. On any frequency removed from the assigned frequency outside the assigned sub-band edges: at least  $55 + 10 \log(P_w)$  dB.

Emission requirement for 0.001-watt transmitter power requires spurious emissions be attenuated at least 25.0 dBc below the carrier.

$$\begin{aligned}
 \text{Attenuation} &= 55 + 10 \log_{10}(P_w) \\
 &= 55 + 10 \log_{10}(0.001) \\
 &= 25.0 \text{ dBc}
 \end{aligned}$$

Data was taken per 2.1051 and applicable parts of 47CFR 90. The EUT demonstrated compliance with the specifications of Paragraphs 47CFR 2.1051, 2.1057 and 90.210(k) and RSS-137 paragraph 6.5. There are no deviations to the specifications.

**Table 4 General Radiated Emission Results (worst-case)**

Frequency	Amplitude of Emission (dB $\mu$ V)		Signal Level to dipole required to Reproduce(dBm)		Emission level below carrier (dBc)		Limit (dBc)
	MHz	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
50.3	21.7	29.3	-73.5	-65.9	69.0	61.4	25
57.9	19.4	25.0	-75.8	-70.2	71.3	65.7	25
65.3	17.5	21.7	-77.7	-73.5	73.2	69.0	25
87.1	17.2	18.9	-78.0	-76.3	73.5	71.8	25
115.9	19.7	20.0	-75.5	-75.2	71.0	70.7	25
300.0	18.0	17.2	-77.2	-78.0	72.7	73.5	25

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded above for frequency range of 30-1000 MHz. Peak and Average amplitude emissions are recorded above for frequency range above 1000 MHz.

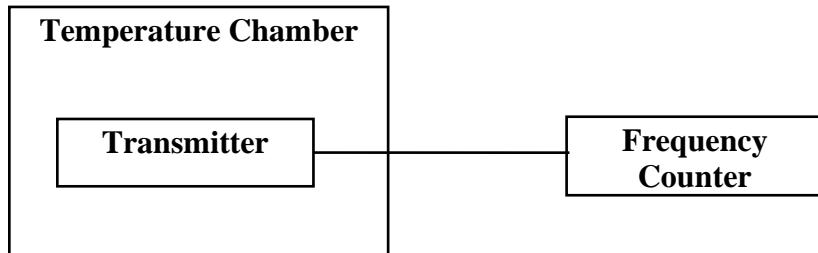
## Frequency Stability

### Measurements Required

The frequency stability shall be measured with variations of ambient temperature from -30° to +50° centigrade. Measurements shall be made at the extremes of the temperature range and at intervals of not more than 10° centigrade through the range. A period sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. In addition to temperature stability, the frequency stability shall be measured with variation of primary supply voltage as follows:

- (1) Vary primary supply voltage from 85 to 115 percent of the nominal value.
- (2) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided.

### Test Arrangement



The measurement procedure outlined below shall be followed for frequency stability testing.

Step 1: The transmitter shall be installed in an environmental test chamber whose temperature is controllable. Provision shall be made to measure the frequency of the transmitter.

Step 2: With the transmitter inoperative (power switched “OFF”), the temperature of the test chamber shall be adjusted to +25°C. After a temperature stabilization period of one hour at +25°C, the transmitter shall be switched “ON” with standard test voltage applied.

Step 3: The carrier shall be keyed “ON”, and the transmitter shall be operated at full radio frequency power output at the duty cycle, for which it is rated, for duration of at least 5 minutes. The radio frequency carrier frequency shall be monitored, and measurements shall be recorded.

Rogers Labs, Inc.  
 4405 West 259<sup>th</sup> Terrace  
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 Phone/Fax: (913) 837-3214  
 Revision 1

Transcore  
 Model: 051064B, Basic IAG Tag  
 Test: 200116  
 Test to: 47CFR Parts 2, 90 and RSS-137  
 File: Transcore 051064B TstRpt 200116

SN: 061003-01  
 FCC ID: FIH051064B  
 IC: 1584A-FIH051064B  
 Date: February 4, 2020  
 Page 25 of 31

**Step 4:** The test procedures outlined in Steps 2 and 3, shall be repeated after stabilizing the transmitter at the environmental temperatures specified, -30°C to +50°C in 10-degree increments.

Frequency stability is not required for this mobile transponder device per 47CFR 90.213 and RSS-137. Therefore, no frequency stability testing was performed.

The EUT demonstrated compliance with specifications of 47CFR Paragraph 2.1046(a) and applicable Parts of 90.213 and RSS-137. There are no deviations or exceptions to the specifications.

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Revision 1

Transcore  
Model: 051064B, Basic IAG Tag  
Test: 200116  
Test to: 47CFR Parts 2, 90 and RSS-137  
File: Transcore 051064B TstRpt 200116

SN: 061003-01  
FCC ID: FIH051064B  
IC: 1584A-FIH051064B  
Date: February 4, 2020  
Page 26 of 31

## Annex

- Annex A Measurement Uncertainty Calculations
- Annex B Additional Test Equipment List
- Annex C Rogers Qualifications
- Annex D Rogers Labs Certificate of Accreditation

Rogers Labs, Inc.  
4405 West 259<sup>th</sup> Terrace  
Louisburg, KS 66053  
Phone/Fax: (913) 837-3214  
Revision 1

Transcore  
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Test to: 47CFR Parts 2, 90 and RSS-137  
File: Transcore 051064B TstRpt 200116

SN: 061003-01  
FCC ID: FIH051064B  
IC: 1584A-FIH051064B  
Date: February 4, 2020  
Page 27 of 31

## Annex A Measurement Uncertainty Calculations

The measurement uncertainty was calculated for all measurements listed in this test report according To CISPR 16-4. Result of measurement uncertainty calculations are recorded below. Component and process variability of production devices similar to those tested may result in additional deviations. The manufacturer has the sole responsibility of continued compliance.

Measurement	Expanded Measurement Uncertainty $U_{(lab)}$
3 Meter Horizontal 0.009-1000 MHz Measurements	4.16
3 Meter Vertical 0.009-1000 MHz Measurements	4.33
3 Meter Measurements 1-18 GHz	5.14
3 Meter Measurements 18-40 GHz	5.16
10 Meter Horizontal Measurements 0.009-1000 MHz	4.15
10 Meter Vertical Measurements 0.009-1000 MHz	4.32
AC Line Conducted	1.75
Antenna Port Conducted power	1.17
Frequency Stability	1.00E-11
Temperature	1.6°C
Humidity	3%

## ***Annex B Additional Test Equipment List***

## List of Test Equipment

List of Test Equipment		Calibration	Date (m/d/y)	Due
<input type="checkbox"/> Frequency Counter: Leader LDC-825 (8060153)			4/18/2019	4/18/2021
<input type="checkbox"/> LISN: Com-Power Model LI-220A			10/14/2019	10/14/2020
<input type="checkbox"/> LISN: Com-Power Model LI-550C			10/14/2019	10/14/2020
<input type="checkbox"/> LISN: Compliance Eng. Model 240/20			4/18/2019	4/18/2020
<input type="checkbox"/> LISN: Fischer Custom Communications Model: FCC-LISN-50-16-2-08			4/18/2019	4/18/2020
<input type="checkbox"/> Cable	Huber & Suhner Inc. Sucoflex 102ea(1.5M)(303070) 9kHz-40 GHz	10/14/2019	10/14/2020	
<input type="checkbox"/> Cable	Huber & Suhner Inc. Sucoflex 102ea(1.5M)(303072) 9kHz-40 GHz	10/14/2019	10/14/2020	
<input type="checkbox"/> Cable	Huber & Suhner Inc. Sucoflex 102ea(L4M)(281184) 9kHz-40 GHz	10/14/2019	10/14/2020	
<input type="checkbox"/> Cable	Huber & Suhner Inc. Sucoflex 102ea(L10M)(317546) 9kHz-40 GHz	10/14/2019	10/14/2020	
<input type="checkbox"/> Cable	Time Microwave 4M-750HF290-750 (4M) 9kHz-24 GHz	10/14/2019	10/14/2020	
<input type="checkbox"/> RF Filter	Micro-Tronics BRC17663 (001) 9.3-9.5 notch 30-1800 MHz	4/18/2019	4/18/2020	
<input type="checkbox"/> RF Filter	Micro-Tronics BRC19565 (001) 9.2-9.6 notch 30-1800 MHz	10/16/2018	4/18/2020	
<input type="checkbox"/> Attenuator	Mini-Circuits VAT-3W2+ (1735)	30-6000 MHz	4/18/2019	4/18/2020
<input type="checkbox"/> Analyzer	HP 8562A (3051A05950)	9kHz-125GHz	4/18/2019	4/18/2020
<input type="checkbox"/> Analyzer	HP External Mixers 11571, 11970	25GHz-110GHz	4/18/2015	4/18/2025
<input type="checkbox"/> Analyzer	HP 8591EM (3628A00871)		5/2/2018	5/2/2020
<input type="checkbox"/> Antenna: Solar 9229-1 & 9230-1			2/22/2019	2/22/2020
<input type="checkbox"/> R.F. Generator: SMB100A6 s/n 100623			4/18/2019	4/18/2020
<input type="checkbox"/> R.F. Generator: SBMBV100A s/n: 260771			4/18/2019	4/18/2020
<input type="checkbox"/> CDN: Com-Power Model CDN325E			10/14/2019	10/14/2020
<input type="checkbox"/> Injection Clamp Luthi Model EM101			10/14/2019	10/14/2020
<input type="checkbox"/> R.F. Power Amp ACS 230-50W			10/14/2019	10/14/2020
<input type="checkbox"/> R.F. Power Amp EIN Model: A301			2/22/2019	2/22/2020
<input type="checkbox"/> R.F. Power Amp A.R. Model: 10W 1010M7			2/22/2019	2/22/2020
<input type="checkbox"/> Oscilloscope Scope: Tektronix MDO 4104			2/22/2019	2/22/2020
<input type="checkbox"/> EMC Transient Generator HVT TR 3000			2/22/2019	2/22/2020
<input type="checkbox"/> AC Power Source (Ametech, California Instruments)			2/22/2019	2/22/2020
<input type="checkbox"/> Field Intensity Meter: EFM-018			2/22/2019	2/22/2020
<input type="checkbox"/> ESD Simulator: MZ-15			2/22/2019	2/22/2020
<input checked="" type="checkbox"/> Shielded Room not required				
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## **Annex C Rogers Qualifications**

### **Scot D. Rogers, Engineer**

#### **Rogers Labs, Inc.**

Mr. Rogers has approximately 33 years' experience in the field of electronics. Work experience includes six years working in the automated controls industry and remaining years working with the design, development and testing of radio communications and electronic equipment.

#### Positions Held:

Systems Engineer: A/C Controls Mfg. Co., Inc. 6 Years

Electrical Engineer: Rogers Consulting Labs, Inc. 5 Years

Electrical Engineer: Rogers Labs, Inc. Current

#### Educational Background:

- 1) Bachelor of Science Degree in Electrical Engineering from Kansas State University
- 2) Bachelor of Science Degree in Business Administration Kansas State University
- 3) Several Specialized Training courses and seminars pertaining to Microprocessors and Software programming.

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Revision 1

Transcore  
Model: 051064B, Basic IAG Tag  
Test: 200116  
Test to: 47CFR Parts 2, 90 and RSS-137  
File: Transcore 051064B TstRpt 200116

SN: 061003-01  
FCC ID: FIH051064B  
IC: 1584A-FIH051064B  
Date: February 4, 2020  
Page 30 of 31

**Annex D Laboratory Certificate of Accreditation**

**United States Department of Commerce  
National Institute of Standards and Technology**



**Certificate of Accreditation to ISO/IEC 17025:2017**

**NVLAP LAB CODE: 200087-0**

**Rogers Labs, Inc.**  
Louisburg, KS

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services,  
listed on the Scope of Accreditation, for:*

**Electromagnetic Compatibility & Telecommunications**

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.  
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality  
management system (refer to joint ISO-ILAC-IAF Communiqué dated January 2009).*

2019-11-07 through 2020-03-31

*Effective Dates*



*For the National Voluntary Laboratory Accreditation Program*

A handwritten signature in blue ink that reads "Anna G. Lammann".

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Test to: 47CFR Parts 2, 90 and RSS-137  
File: Transcore 051064B TstRpt 200116

SN: 061003-01  
FCC ID: FIH051064B  
IC: 1584A-FIH051064B  
Date: February 4, 2020  
Page 31 of 31