Excellence in Compliance Testing

Certification Test Report

FCC ID: 2AAZL-GTCU-001

FCC Rule Part: 15.231

ACS Report Number: 13-2133.W03.2A

Manufacturer: Globe Tracker, Inc.
Model: GTCU-001

Test Begin Date: **September 19, 2013**
Test End Date: **October 8, 2013**

Report Issue Date: October 28, 2013

ACCREDITED TESTING

FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER AT-1533

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

Project Manager:

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This report contains 18 pages

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1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations.

1.2 Product description

The Globe Tracker Communication Unit (GTCU), Model GTCU-001 is a composite transceiver which has been designed specifically for the transportation industry with its initial emphasis on dry bulk and refrigerated cargo containers.

The two primary components of the GTCU system are the Globe Tracker Communication Module (GTCM) and the Globe Tracker Antenna Module (GTAM) connected together using RF cables with SMB (snap on) connectors on both ends of the cables.

The GTCM consists of a 433 MHz transceiver and encloses a Telit GSM (FCC ID: RI7GE865, IC: 5131A-GE865) and an 802.11b WLAN (FCC ID: 2AAZL-GTCU-GS-001) radio module. Only one transceiver transmits at a given period of time.

The 433 MHz transceiver is connected to a PCB antenna internal to the GTCM and to another PCB antenna enclosed within the GTAM. The 433 MHz transceiver uses one antenna at the time.

Technical Details
Frequency of Operation: 433.26 MHz - 434.371 MHz
Number of Channels: 3
Modulation: GFSK
Data Rate: 79.925 kBd
Antenna: PCB (GTCM and GTAM antenna)
Input Voltage: 3 VDC and 7.5 VDC

Manufacturer Information:
Globe Tracker, Inc.
304 E Strawbridge Ave
Melbourne, FL 32901

Test Sample Serial Number(s): FLC323000136

Test Sample Condition: Good

1.3 Test Methodology and Considerations

The GTCU-001 was evaluated for the 433 MHz transceiver. The radiated emissions were performed for the EUT transmitting for the GTCM and GTAM antennas. Additional preliminary evaluations were performed for the EUT set in three orthogonal orientations. The results are reported for the worst case orientation.

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions, Inc.
3998 FAU Blvd, Suite 310
Boca Raton, Florida 33431
Phone: (561) 961-5585
Fax: (561) 961-5587
www.acstestlab.com

FCC Test Firm Registration #: 475089
Industry Canada Lab Code: 4175C

2.2 Laboratory Accreditations/Recognitions/Certifications

ACS is accredited to ISO/IEC 17025 by ANSI-ASQ National Accreditation Board under their ACLASS program and has been issued certificate number AT-1533 in recognition of this accreditation. Unless otherwise specified, all test methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

2.3 Radiated & Conducted Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The EMC radiated test facility consists of an RF-shielded enclosure. The interior dimensions of the indoor semi-anechoic chamber are approximately 48 feet (14.6 m) long by 36 feet (10.8 m) wide by 24 feet (7.3 m) high and consist of rigid, 1/8 inch (0.32 cm) steel-clad, wood core modular panels with steel framing. In the shielded enclosure, the faces of the panels are galvanized and the chamber is self-supporting. 8-foot RF absorbing cones are installed on 4 walls and the ceiling. The steel-clad ground plane is covered with vinyl floor.

The turntable is driven by pneumatic motor, which is capable of supporting a 2000 lb. load. The turntable is flushed with the chamber floor which it is connected to, around its circumference, with a continuous metallic loaded spring. An EMCO Model 1050 Multi-device Controller controls the turntable position.

A pneumatic motor is used to control antenna polarizations and height relative to the ground. The height information is displayed on the control unit EMCO Model 1050.

The control room is an RF shielded enclosure attached to the semi-anechoic chamber with two bulkhead panels for connecting RF, and control cables. The dimension of the room is 7.3 m x 4.9 m x 3 m high and the entrance doors of both control and conducted rooms are 3 feet (0.91 m) by 7 feet (2.13 m).

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3.1-1 below:

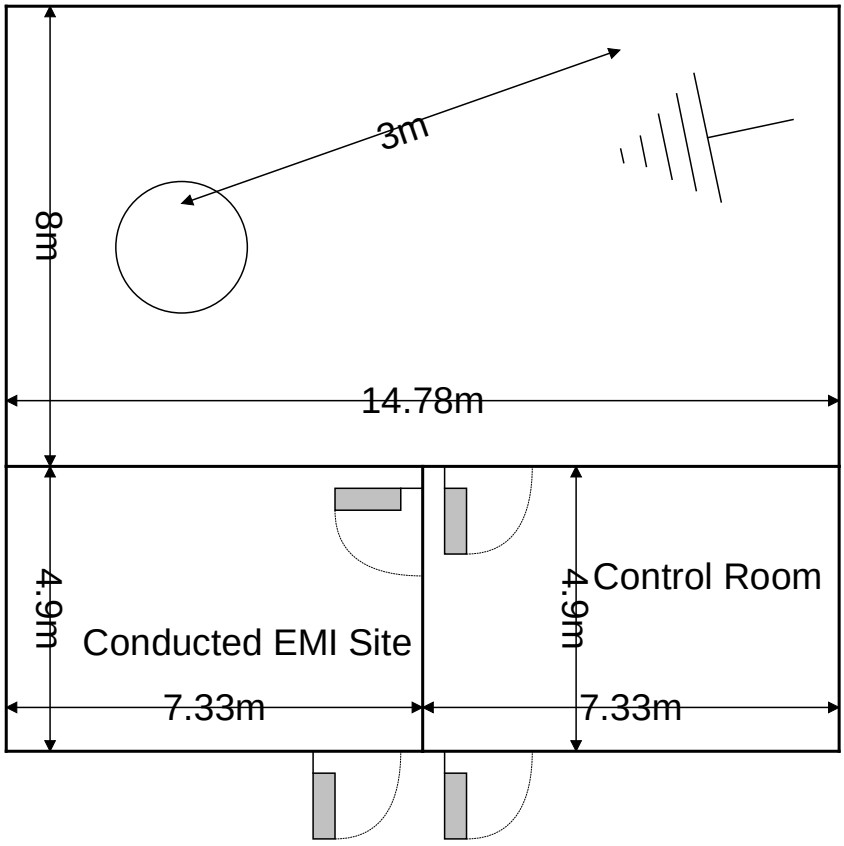


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are 7.3 x 4.9 x 3 m^3. As per ANSI C63.4 2003 requirements, the data were taken using two LISNs; a Solar Model 8028-50 50 Ω/50 µH and an EMCO Model 3825, which are installed as shown in Photograph 3. For 220 V, 50 Hz, a Polarad LISN (S/N 879341/048) is used in conjunction with a 1 kVA, 50 Hz/220 V EDGAR variable frequency generator, Model 1001B, to filter conducted noise from the generator.

A diagram of the room is shown below in figure 2.3.2-1:

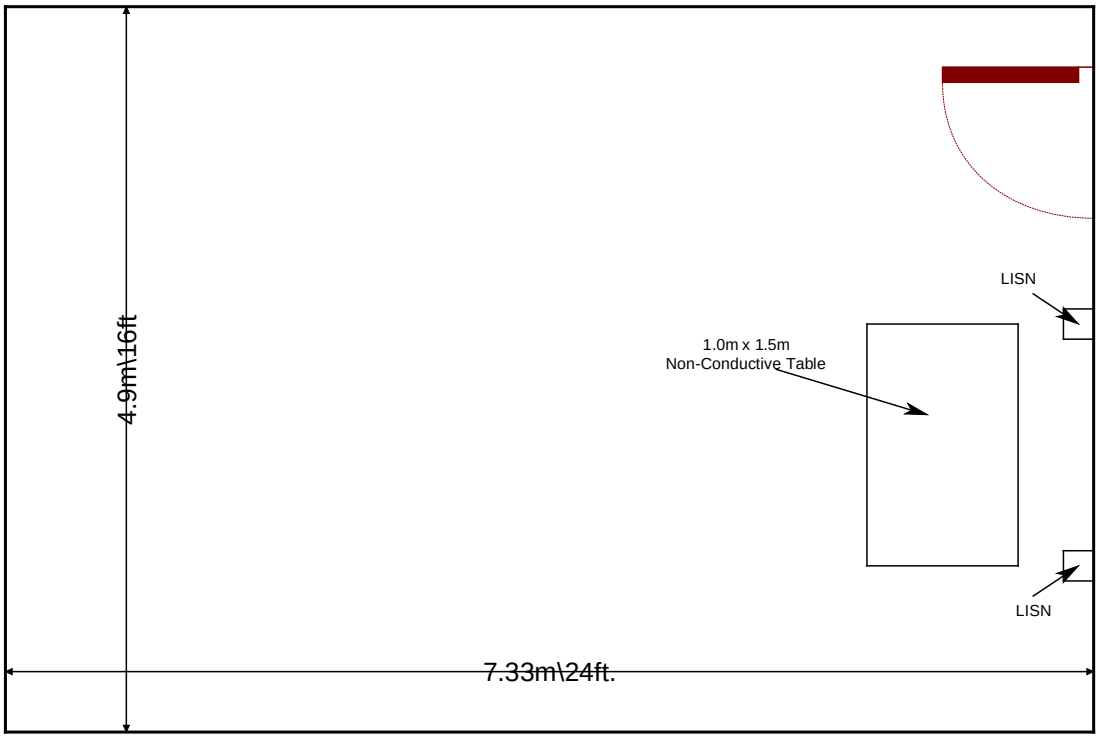


Figure 2.3.2-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- ANSI C63.10-2009: American National Standard for Testing Unlicensed Wireless Devices
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2013
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2013

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
523	Agilent	E7405	Spectrum Analyzers	MY45103293	1/8/2013	1/8/2015
524	Chase	CBL6111	Antennas	1138	1/7/2013	1/7/2015
2006	EMCO	3115	Antennas	2573	4/24/2013	4/24/2015
2011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	12/31/2012	12/31/2013
2037	ACS Boca	Chamber EMI Cable Set	Cable Set	2037	1/1/2013	1/1/2014
2073	Mini Circuits	NHP-800	Filter	10247	12/31/2012	12/31/2013
2082	Teledyne Storm Products	90-010-048	Cables	2082	5/31/2013	5/31/2014
2086	Merrimac	FAN-6-10K	Attenuators	23148-83-1	12/29/2012	12/29/2013
2089	Agilent Technologies, Inc.	83017A	Amplifiers	3123A00214	12/20/2012	12/20/2013
2094	Mini Circuits	SHP-1000+	Filter	R UU27401137	3/26/2013	3/26/2014
2095	ETS Lindgren	TILE4! - Version 4.2.A	Software	85242	NCR	NCR
RE361	Agilent	AT/E7405A	Analyzers	MY42000089	5/28/2013	5/28/2014

NCR=No Calibration Required

5 SUPPORT EQUIPMENT

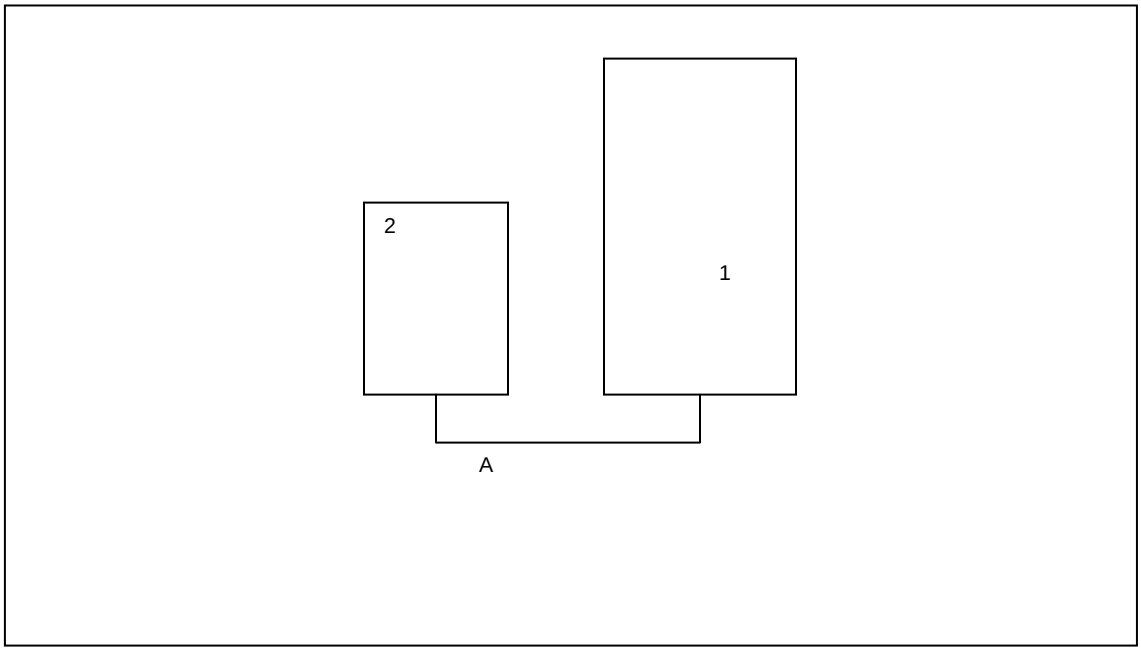
Table 5-1: EUT and Support Equipment Description

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	Communications Module of GTCU system	Globe Tracker	GTCM-001	FLC323000136
2	Antenna Module of GTCU System	Globe Tracker	GTAM-001	JCE-4

Table 5-2: Cable Description

Cable #	Cable Type	Length	Shield	Termination
C	4 x Coaxial	0.3 m	Yes	GTCM to GTAM

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM



7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC: Section 15.203

The 433 MHz radio connects to both GTCM and GTAM antennas via SMB connectors, thus meeting the requirements of 15.203.

7.2 20dB / 99% Bandwidth: FCC: Section 15.231 (c)(1)

7.2.1 Measurement Procedure

The span of the spectrum analyzer display was set between two times and five times the occupied bandwidth (OBW) of the emission. The RBW of the spectrum analyzer was set to approximately 1 % to 5 % of the OBW. The trace was set to max hold with a peak detector active. The Delta function of the analyzer was utilized to determine the 20 dB bandwidth of the emission.

The 99% occupied bandwidth was measured with the spectrum analyzer span set to fully display the emission, including the emissions skirts. The RBW was greater or equal to 1% of the span. The occupied 99% bandwidth was measured by using a delta marker at the lower and upper frequencies leading to 0.5% of the total power.

7.2.2 Measurement Results

Results are shown below:

Table 7.2.2-1: 20dB / 99% Bandwidth

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
433.26	169.0	169.0
434.37	169.0	170.0

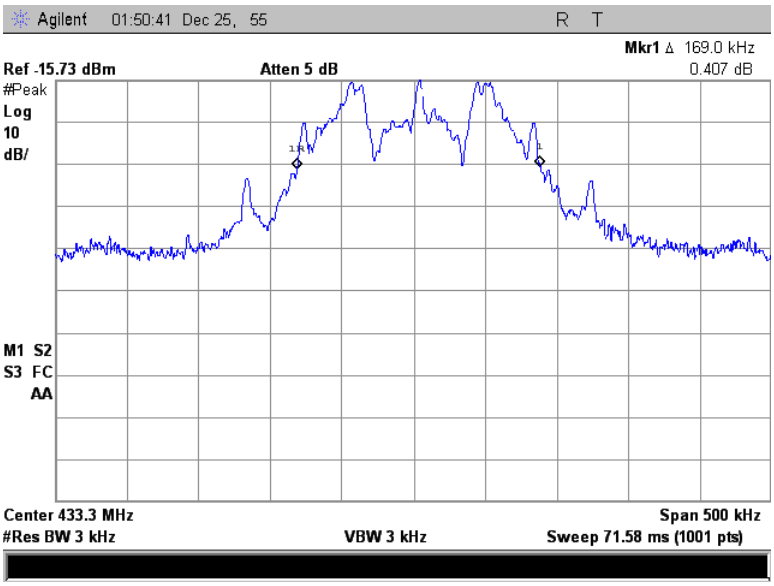


Figure 7.2.2-1: 20dB BW – Low Channel

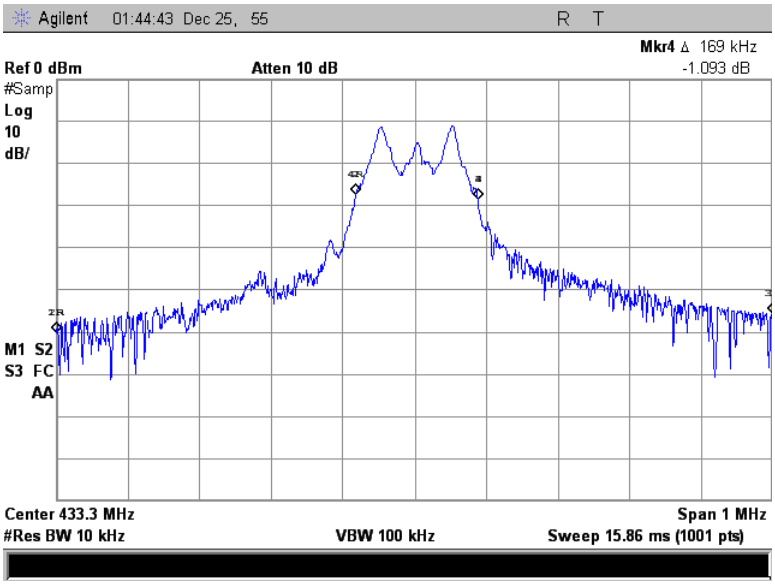


Figure 7.2.2-2: 99% OBW – Low Channel

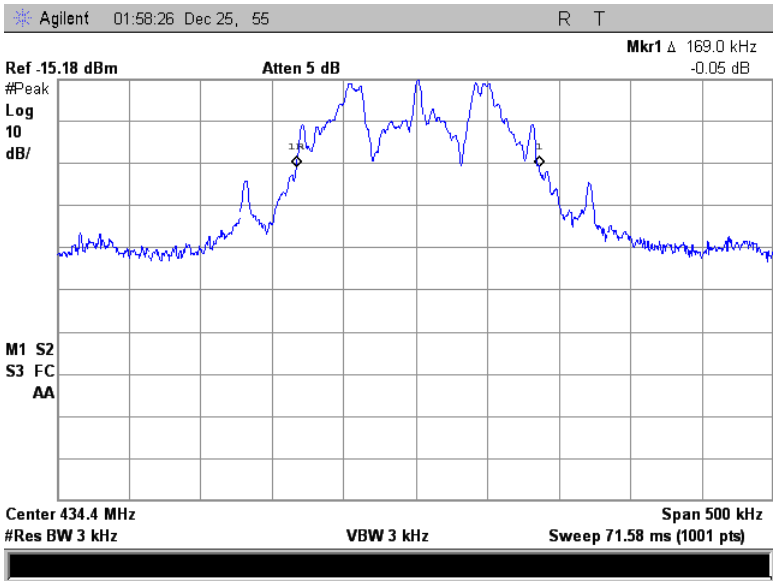


Figure 7.2.2-3: 20dB BW – High Channel

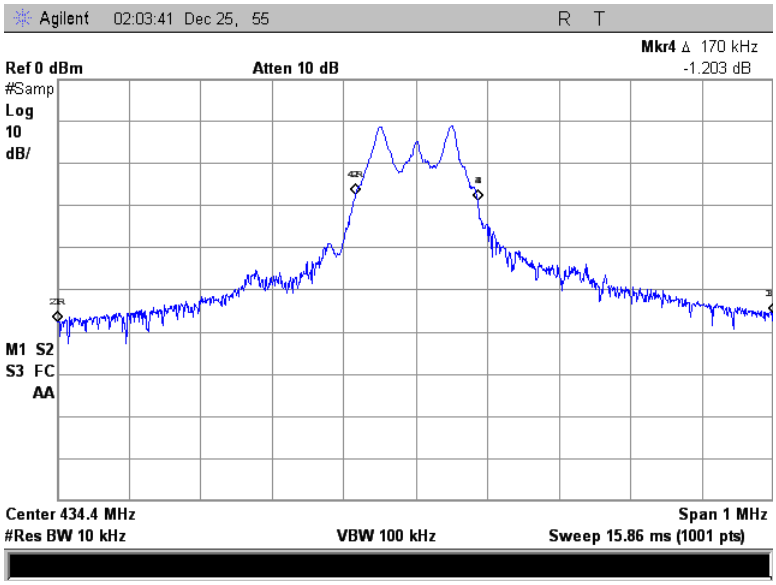


Figure 7.2.2-4: 99% OBW – High Channel

7.3 Radiated Spurious Emissions – FCC: Section 15.231 (e)

7.3.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 30MHz to 4.5GHz, 10 times the highest fundamental frequency.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000MHz, peak and average measurements made with RBW and VBW of 1 MHz and 3MHz respectively.

A Duty Cycle Correction corresponding to the logarithm of dwell time over a 100 ms period (20*log(12.11/100) = -18.34 dB) was applied to the average measurements are provided in Section 7.4.

7.3.2 Measurement Results

Radiated spurious emissions found in the band of 30MHz to 4.5GHz are reported below.

Table 7.3.2-1: Radiated Spurious Emissions Tabulated Data – GTAM Antenna

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	avg	(H/V)	(dB)	pk	avg	pk	avg	pk	avg
Low Channel										
Fundamental Frequency										
433.26	90.57	90.15	H	-7.55	83.02	64.26	92.8	72.8	9.8	8.5
433.26	87.45	86.86	V	-7.55	79.90	60.97	92.8	72.8	12.9	11.8
Spurious Emissions										
866.52	27.53	17.05	H	0.41	27.94	-0.87	72.8	52.8	44.9	53.7
866.52	27.99	16.00	V	0.41	28.40	-1.92	72.8	52.8	44.4	54.7
1299.78	49.28	36.67	H	-10.15	39.13	8.18	74	54	34.9	45.8
1733.04	49.62	39.45	H	-6.48	43.14	14.64	74	54	30.9	39.4
1733.04	49.34	38.51	V	-6.48	42.86	13.70	74	54	31.1	40.3
3466.08	45.67	32.46	H	3.45	49.12	17.58	74	54	24.9	36.4
3466.08	45.76	32.35	V	3.45	49.21	17.47	74	54	24.8	36.5
3899.34	44.57	32.25	H	5.82	50.39	19.73	74	54	23.6	34.3
3899.34	44.50	31.50	V	5.82	50.32	18.98	74	54	23.7	35.0
4332.6	44.46	32.10	H	6.74	51.20	20.50	74	54	22.8	33.5
4332.6	43.21	30.44	V	6.74	49.95	18.84	74	54	24.1	35.2
High Channel										
Fundamental Frequency										
434.37	85.47	84.87	H	-7.51	77.96	59.03	92.9	72.9	14.9	13.9
434.37	90.11	89.61	V	-7.51	82.60	63.77	92.9	72.9	10.3	9.1
Spurious Emissions										
868.74	28.98	18.42	H	0.38	29.36	0.46	72.9	52.9	43.5	52.4
868.74	31.44	22.05	V	0.38	31.82	4.09	72.9	52.9	41.1	48.8
1303.11	49.02	35.74	H	-10.12	38.90	7.28	74	54	35.1	46.7
1303.11	48.98	35.99	V	-10.12	38.86	7.53	74	54	35.1	46.5
1737.48	49.59	39.07	H	-6.44	43.15	14.30	74	54	30.8	39.7
1737.48	48.48	37.01	V	-6.44	42.04	12.24	74	54	32.0	41.8
3474.96	44.47	32.02	H	3.50	47.97	17.18	74	54	26.0	36.8
3474.96	44.88	32.46	V	3.50	48.38	17.62	74	54	25.6	36.4
3909.33	44.45	31.58	H	5.88	50.33	19.12	74	54	23.7	34.9
3909.33	44.22	31.26	V	5.88	50.10	18.80	74	54	23.9	35.2
4343.7	43.95	32.36	H	6.75	50.70	20.77	74	54	23.3	33.2
4343.7	43.89	31.60	V	6.75	50.64	20.01	74	54	23.4	34.0

Notes:

- **The average measurements were further corrected using a duty cycle of 20*log(12.11/100) = -18.34 dB.**
- **The fundamental emissions was measured using RBW = 300 kHz, which is greater than the 99% emission bandwidth.**

Table 7.3.2-2: Radiated Spurious Emissions Tabulated Data – GTCM Antenna

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	avg	(H/V)	(dB)	pk	avg	pk	avg	pk	avg
Low Channel										
Fundamental Frequency										
433.26	98.48	98.02	H	-7.55	90.93	72.13	92.8	72.8	1.9	0.7
433.26	91.31	90.81	V	-7.55	83.76	64.92	92.8	72.8	9.0	7.9
Spurious Emissions										
1299.78	49.16	36.34	H	-10.15	39.01	7.85	74	54	35.0	46.1
1299.78	49.28	36.42	V	-10.15	39.13	7.93	74	54	34.9	46.1
1733.04	49.12	36.06	H	-6.48	42.64	11.25	74	54	31.4	42.8
1733.04	49.11	37.20	V	-6.48	42.63	12.39	74	54	31.4	41.6
3466.08	45.35	32.60	H	3.45	48.80	17.72	74	54	25.2	36.3
3466.08	44.49	30.95	V	3.45	47.94	16.07	74	54	26.1	37.9
3899.34	44.96	31.84	H	5.82	50.78	19.32	74	54	23.2	34.7
4332.6	44.61	32.81	H	6.74	51.35	21.21	74	54	22.7	32.8
4332.6	43.11	29.90	V	6.74	49.85	18.30	74	54	24.2	35.7
High Channel										
Fundamental Frequency										
434.37	94.74	94.32	H	-7.51	87.23	68.48	92.9	72.9	5.7	4.4
434.37	87.72	87.18	V	-7.51	80.21	61.34	92.9	72.9	12.7	11.6
Spurious Emissions										
1303.11	49.32	36.69	V	-10.12	39.20	8.23	74	54	34.8	45.8
1737.48	48.45	35.52	H	-6.44	42.01	10.75	74	54	32.0	43.3
1737.48	48.88	37.40	V	-6.44	42.44	12.63	74	54	31.6	41.4
3474.96	45.51	32.88	H	3.50	49.01	18.04	74	54	25.0	36.0
3474.96	43.80	30.80	V	3.50	47.30	15.96	74	54	26.7	38.0
3909.33	44.31	31.55	H	5.88	50.19	19.09	74	54	23.8	34.9
3909.33	43.69	30.56	V	5.88	49.57	18.10	74	54	24.4	35.9
4343.7	45.02	33.55	H	6.75	51.77	21.96	74	54	22.2	32.0
4343.7	43.45	30.36	V	6.75	50.20	18.77	74	54	23.8	35.2

Notes:

- **The average measurements were further corrected using a duty cycle of 20*log(12.11/100) = -18.34 dB.**
- **The fundamental emissions was measured using RBW = 300 kHz, which is greater than the 99% emission bandwidth.**

7.3.3 Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation: Peak
Corrected Level: 49.28 + (-10.15) = 39.13dBµV/m
Margin: 74 dBµV/m – 39.13 dBµV/m = 34.9 dB

Example Calculation: Average
Corrected Level: 36.67 + (-10.15) – 18.34= 8.18 dBµV
Margin: 54 dBµV – 8.18 dBµV = 45.8dB

7.4 Periodic Operation – FCC: CFR 47 15.231(e)

7.4.1 Test Methodology

The devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds. The transmitter was activated automatically and was evaluated using a spectrum analyzer at zero span with a 100 millisecond and a 5 second sweep time, respectively.

7.4.2 Test Results

The results are shown below.

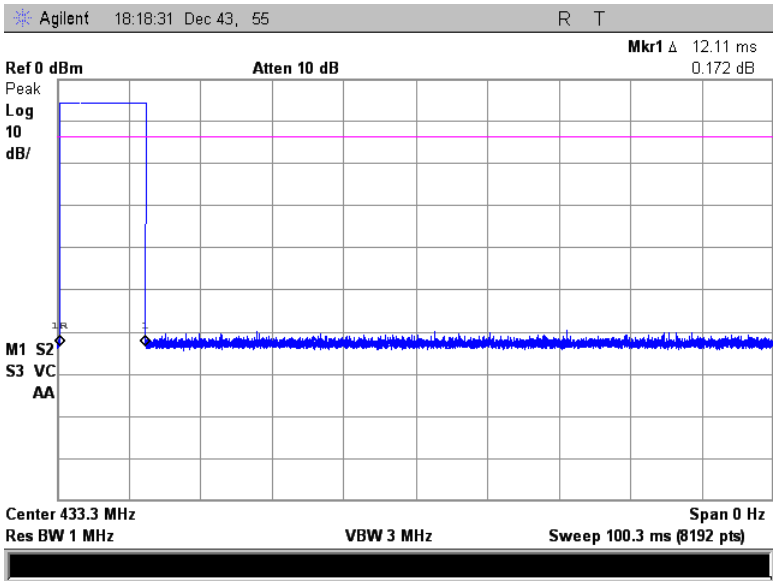


Figure 7.4.2-1: Transmission Duration

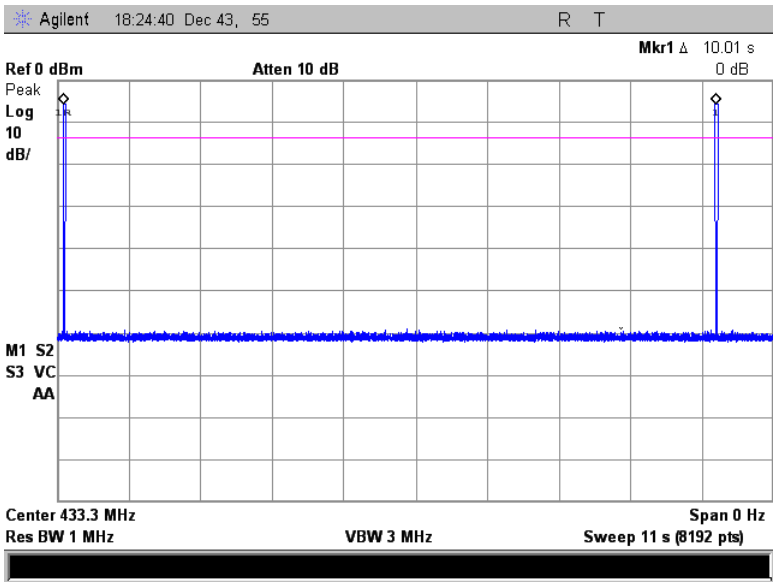


Figure 7.4.2-2: Periodic Operation

Duty Cycle Correction = 20 * log(12.11/100) = 18.34 dB.

8 CONCLUSION

In the opinion of ACS, Inc. the model GTCU-001, manufactured by Globe Tracker, Inc. meets the requirements of FCC Part 15 subpart C.

END REPORT