TIMCO ENGINEERING, Inc.

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TEST REPORT
47 CFR Part 15.239
Vehicular FM Transmitter

Applicant	EXPERT TECHNOLOGY STUDIOS, LLC
Address	548 LAKE ASHLEY CIRCLE MELBOURNE FL 32904
FCC ID	2AF6KBST1
Product Description	Shortwave AM receiver with FM Transmitter for Vehicle
Date Sample Received	10/29/2015
Date Tested	11/16/2015
Tested By	Christian Pawlak
Approved By	Cory Leverett
Test Results	☒ PASS ☐ FAIL

Report Number	Version Number	Description	Issue Date
2278AUT15TestReport	Rev.1	Initial Issue	11/16/2015
2278AUT15TestReport	Rev.2	Typographical updates	12/11/2015

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GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

The test results only relate to the item tested.

Summary

The device under test does:
☒ Fulfill the general approval requirements as identified in this test report
☐ Not fulfill the general approval requirements as identified in this test report

Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with the ISO 17025:2005 requirements.

I attest that the necessary measurements were made, under my supervision, at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, FL 32669

Authorized Signatory Name:

Christian Pawlak
Engineering Project Manager

Date: 11/17/2015

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EUT SPECIFICATION

Regulatory Standards	FCC Title 47 CFR Part 15.239		
FCC ID	**2AF6KBST1**		
Model	**BST-1**		
EUT Description	Shortwave AM receiver with FM Transmitter for Vehicle		
Modulation Type	FM		
Operating Frequency	TX: 88.3 – 88.9 MHz	RX: 2 – 25 MHz	
EUT Power Source	☐ 110–120Vac/50– 60Hz		
	☒ 12 VDC Power		
	☐ Battery Operated Exclusively		
Test Item	☐ Prototype	☒ Pre-Production	☐ Production
Type of Equipment	☐ Fixed	☒ Mobile	☐ Portable
Antenna Connector	Fixed		
Antenna	Copper Wire Antenna		
Test Facility	**Timco Engineering Inc. located at 849 NW State Road 45 Newberry, FL 32669 USA.**		
Test Conditions	Temperature: 24-26ºC Relative humidity: 50-65%		
Measurement Standard	ANSI C63.10-2013 (Measurement Procedures) ANSI C63.4-2009 (Radiated Site Validation)		
Test Exercise	Continuously transmitting fully modulated carrier		

The EUT is a 2-25 MHz AM shortwave receiver and an 88.3-88.9 MHz FM transmitter intended for vehicular use. The FM transmitter allows the shortwave radio signals to be retransmitted onto receivable FM radio frequencies inside a vehicle. The EUT also has a 433 MHz data receiver to allow tuning by matching remote control key fob. This test report is only for the FM transmitter portion of the EUT.

RESULTS SUMMARY

Requirement	FCC Rule Part No.	Test Item	Limit	Result	Pass/Fail
RF Output Power	15.239(b)	Fundamental Field Strength	48 dBuV/M @ 3M	38.5 dBuV/M @ 3M	Pass
Occupied Bandwidth	15.239(a) 15.215(c)	20 dB Emission Bandwidth	200 KHz	179 KHz	Pass
Unwanted Emissions	15.239(c) 15.209(a)	Radiated Spurious Emissions	See 15.209(a)		Pass

Notes:

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RF POWER OUTPUT

RULES PART NO.: 15.239(b)

REQUIREMENTS: The field strength of any emissions within the permitted 200 kHz band shall not exceed 250 microvolts/meter (48 dBµV/m) at 3 meters.

MEASUREMENT PROCEDURES:

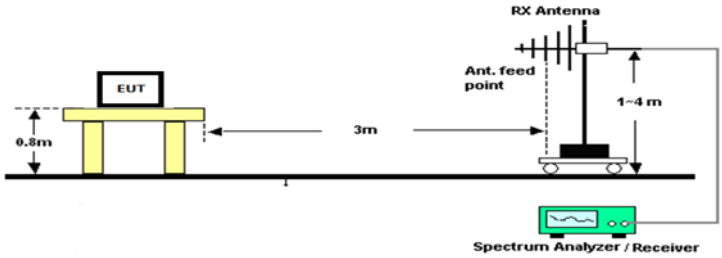
ANSI C63.4 § 5.1 General Test Facilities Requirements
ANSI C63.4 § 5.3- 5.7 Radiated Emission Test Facilities Requirements
ANSI C63.10 § 4 Measurement Instrumentation
ANSI C63.10 § 5 General Measurement and Setup considerations
ANSI C63.10 § 6 Standard Test Methods
ANSI C63.10 § 8.1 General FM Transmitter Emissions Procedure
ANSI C63.10 § 8.2 Wireless Transmission between FM source and vehicle antenna

NOTES:

The antenna was placed in both the horizontal and vertical planes and the worst case fundamental emission level were reported. The EUT was tested in 3 orthogonal planes and the wire antenna was manipulated (as necessary).

See Also the Radiated Spurious Emission Section of this Test Report for Radiated Setup Information

SETUP:



TEST DATA: **Output Power Measurement Table**

Emisison Frequency MHz	Meter Reading dBuV	Antenna Polarity	Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB	Result
88.50	27.71	V	0.53	10.26	38.50	9.50	Pass

Result Meets Requirements

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OCCUPIED BANDWIDTH

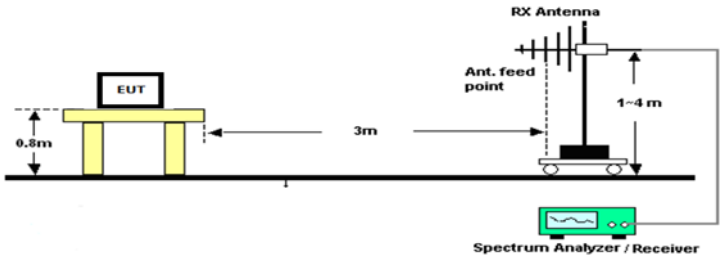
RULES PART NO.: 15.239(a), 15.215(c)

REQUIREMENTS: Emissions from the device shall be confined within a band 200 kHz wide centered on the operating frequency. The 200 kHz band shall lie wholly within the frequency range of 88-108 MHz.

MEASUREMENT PROCEDURE:

ANSI C63.10 § 6.9.2 Occupied Bandwidth- Relative Procedure
ANSI C63.10 § 8.7 Occupied Bandwidth of FM Transmitters

SETUP:



TEST DATA: **Occupied Bandwidth Measurement Table**

Tuned Frequency (MHz)	Measured 20 dBBW (KHz)	Margin (KHz)
88.3	179	21
20 dB Occupied Bandwidth Limit (KHz)		200

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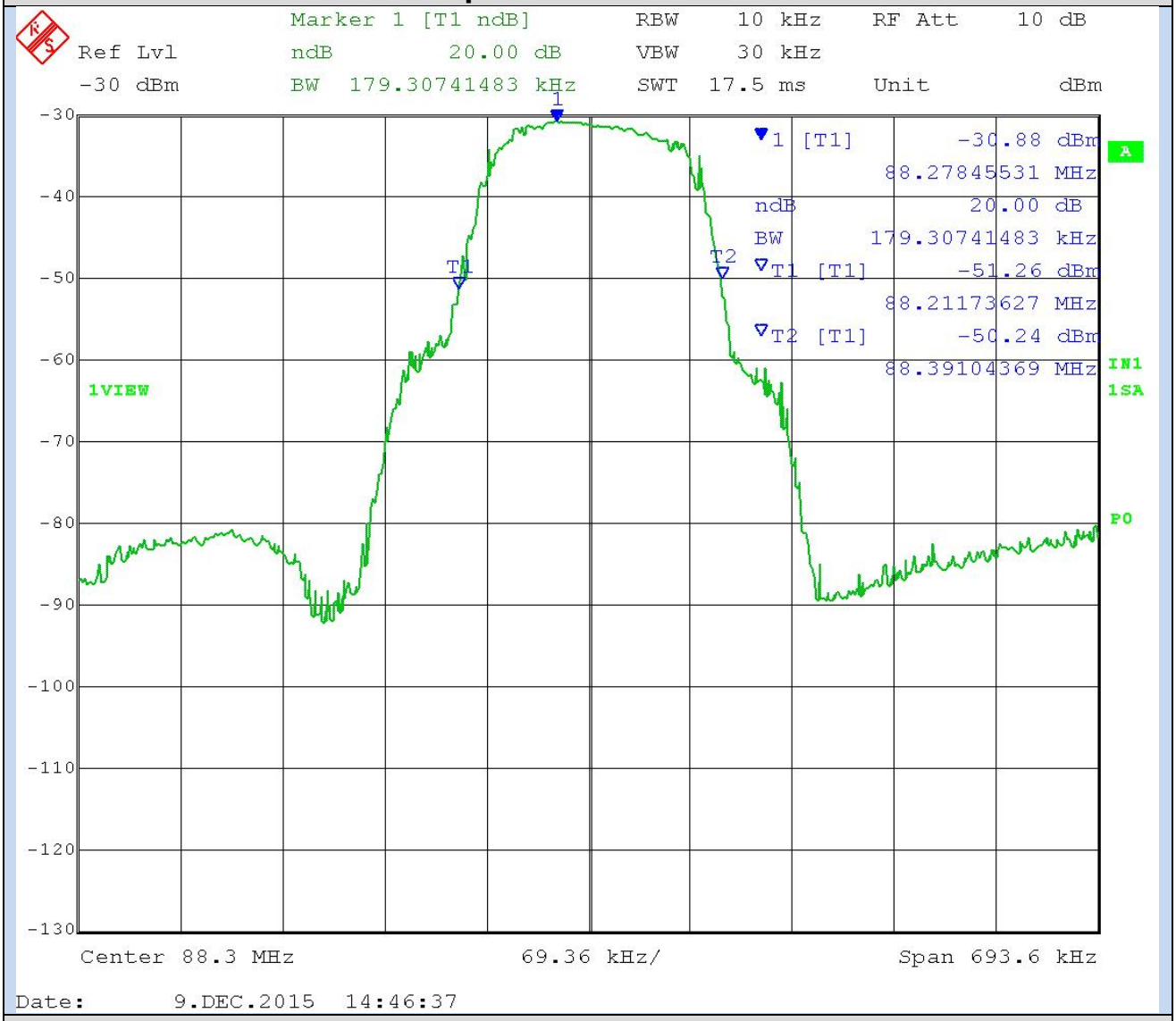
OCCUPIED BANDWIDTH

TEST DATA: Occupied Bandwidth Plot

20 dB Occupied Bandwidth = 179 KHz



Result Meets The Requirement

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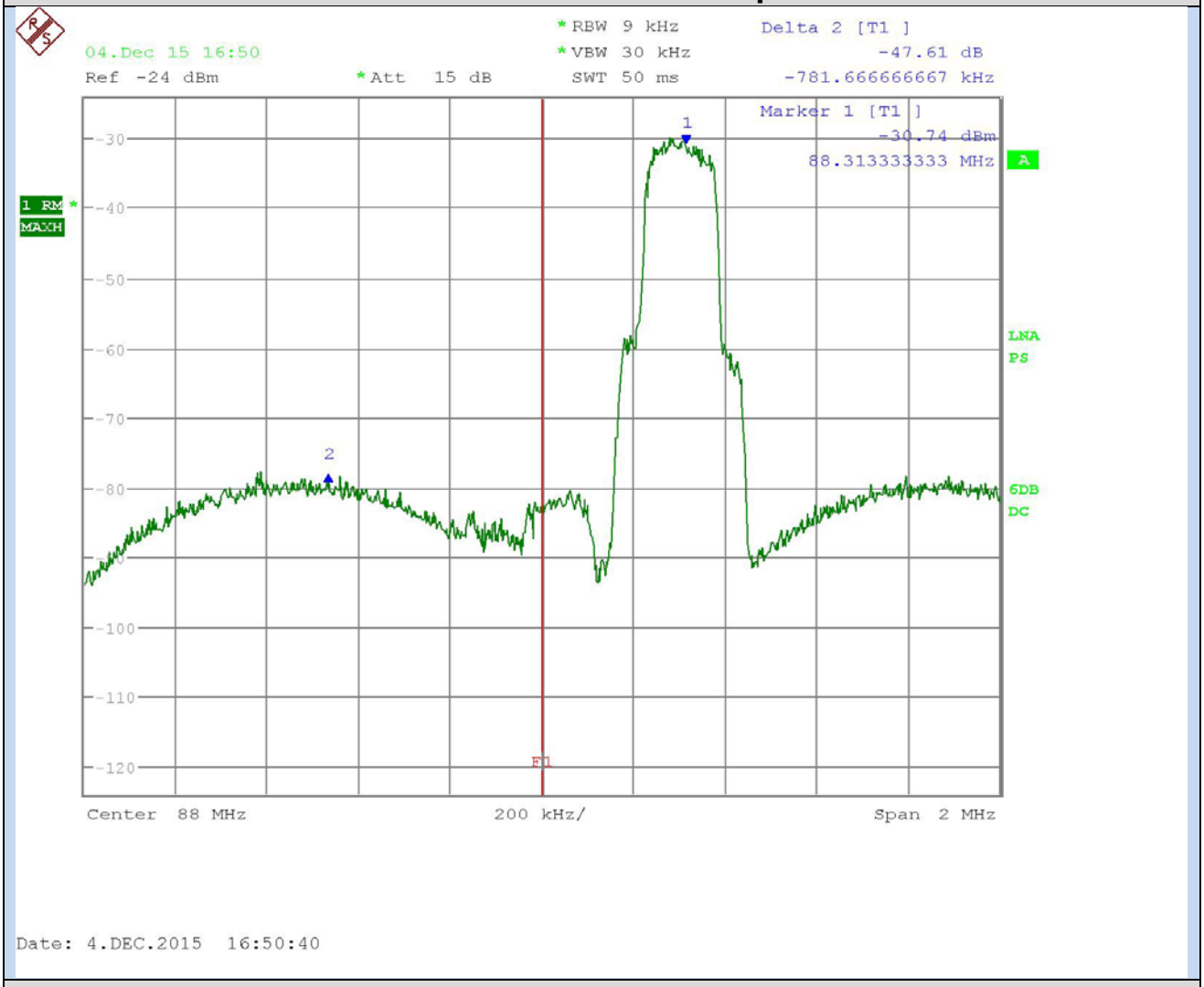
OCCUPIED BANDWIDTH

TEST DATA: Lower Band Edge Plot

20 dB BW Inside Band of Operation



Result Meets The Requirement

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RADIATED SPURIOUS EMISSIONS

RULES PART NO.: 15.239(c), 15.209(a), 15.205(c)

REQUIREMENTS: emissions outside of the band 88 – 108 MHz shall not exceed:

FCC Part 15.209, IC RSS-GEN 8.9 Radiated Limits Below 1 GHz	
Frequency Range	Quasi Peak Limits
9 to 490 kHz	2400/F (kHz) µV/m @ 300 meters
490 to 1705 kHz	24000/F (kHz) µV/m @ 30 meters
1705 kHz to 30 MHz	29.54 dBµV/m @ 30 meters
30 – 88 MHz	40.0 dBµV/m @ 3 meters
88 – 216 MHz	43.5 dBµV/m @ 3 meters
216 – 960 MHz	46.0 dBµV/m @ 3 meters
960 – 1000 MHz	54.0 dBµV/m @ 3 meters

FCC Part 15.209, IC RSS-GEN 8.9 Radiated Limits Above 1 GHz		
Frequency Range	Average Limit	Peak Limit
> 1 GHz	54.0 dBµV/m @ 3 meters	74.0 dBµV/m @ 3 meters

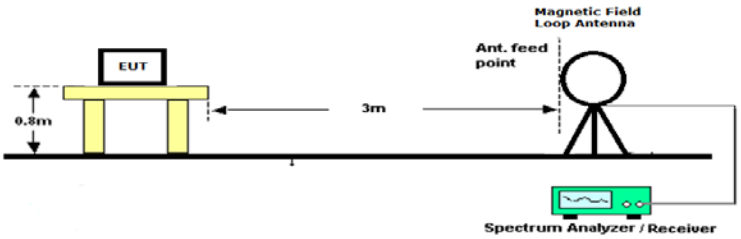
MEASUREMENT PROCEDURES:

ANSI C63.4 § 5.1 General Test Facilities Requirements
ANSI C63.4 § 5.3- 5.7 Radiated Emission Test Facilities Requirements
ANSI C63.10 § 4 Measurement Instrumentation
ANSI C63.10 § 5 General Measurement and Setup considerations
ANSI C63.10 § 6 Standard Test Methods
ANSI C63.10 § 8.1 General FM Transmitter Emissions Procedure
ANSI C63.10 § 8.2 Wireless Transmission between FM source and vehicle antenna

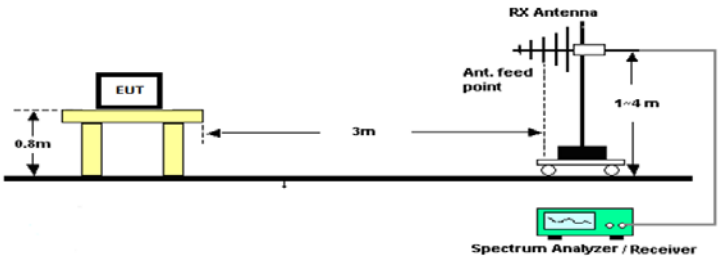
RADIATED SPURIOUS EMISSIONS

SETUP:

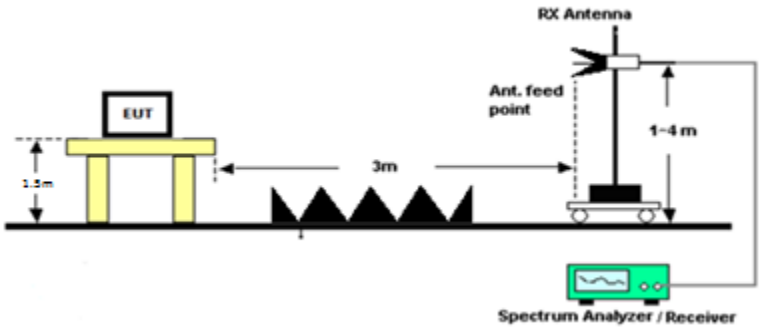
Emissions below 30 MHz



Emissions 30 – 1000 MHz



Emissions above 1 GHz



RADIATED SPURIOUS EMISSIONS

NOTES:

The unit under test was placed on a table in at least three different planes on a support table 80 cm high and with dimensions of 1 m by 1.5 m. The table used for radiated measurements is capable of continuous rotation. When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1 m to 4 m. The antenna was placed in both the horizontal and vertical planes.

FORMULA OF CONVERSION FACTORS: The Field Strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBµV) to the antenna correction factor supplied by the antenna manufacturer plus the coax loss. The antenna correction factors are stated in terms of dB. The gain of the Preselector was accounted for in the spectrum analyzer meter reading.

Example:
Freq (MHz) METER READING + ACF = FS
33 20 dBµV + 10.36 dB = 30.36 dBµV/m @ 3M

TEST DATA: Field Strength Table

Emisison Frequency MHz	Meter Reading dBuV	Antenna Polarity	Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB	Status
57.24	11.40	V	0.37	8.35	20.12	19.88	Pass
66.78	13.18	V	0.42	6.03	19.63	20.37	Pass
95.38	13.54	V	0.56	10.71	24.81	18.69	Pass
133.53	11.51	H	0.67	13.65	25.83	17.67	Pass
208.97	9.37	V	0.87	10.74	20.98	22.52	Pass
247.44	10.50	V	0.92	11.42	22.84	23.16	Pass
285.90	10.94	H	0.98	13.56	25.48	20.52	Pass
285.90	8.45	V	0.98	13.56	22.99	23.01	Pass
435.90	8.11	H	1.44	15.86	25.41	20.59	Pass
760.26	8.59	H	1.90	21.50	31.99	14.01	Pass

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TEST EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Antenna: Biconnical Chamber	Eaton Chamber	94455-1	1057	06/14/13	12/14/15
Antenna: Log-Periodic Chamber	Eaton	96005	1243	05/31/13	11/30/15
Antenna: Passive Loop	EMC Test Systems	EMCO 6512	9706-1211	07/09/15	07/09/17
LISN	Electro-Metrics	ANS-25/2	2604	07/15/15	07/15/17
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/13	12/31/15
Antenna: Double-Ridged Horn/ETS Horn 1	ETS-Lindgren Chamber	3117	00035923	06/13/14	06/13/16
EMI Test Receiver R & S ESIB 40 Screen Room	Rohde & Schwarz	ESIB 40	100274	08/12/14	08/12/16
Software: Field Strength Program	Timco	N/A	Version 4.0	NA	NA
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	03/11/14	03/11/16
Function Generator	Stanford Research Systems	DS340	25200	08/29/2013	02/29/2016

***EMI RECEIVER SOFTWARE VERSION:**
The receiver firmware used was version 4.43 Service Pack 3

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