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FCC PART 90 TEST DATA

APPLICANT	KOOS TECHNICAL SERVICES 1025 GREENWOOD BLVD SUITE 391 LAKE MARY FLORIDA 32746
FCC ID	ZBG-ATRVHF-2
MODEL NUMBER	ATR-US-VHF-120
PRODUCT DESCRIPTION	TELEMETRY RADIO
DATE SAMPLE RECEIVED	12/19/2012
DATE TESTED	1/25/2013
TESTED BY	Joe Scoglio
APPROVED BY	Mario R. de Aranzeta
TIMCO REPORT NO.	576UT13Test Report.doc
TEST RESULTS	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL

**THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL
WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.**



Certificate # 0955-01

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GENERAL REMARKS

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

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 ISO 17025 requirements.



Testing Certificate # 0955-01

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:

Joe Scoglio
Project Manager/Tester

Date: 1/25/2013

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GENERAL INFORMATION

DUT Specification

DUT Description	AGILITY TELEMETRY RADIO
FCC ID	ZBG-ATRVHF-2
Model Number	ATR-US-VHF-120
Operating Frequency	217-220 MHz
Type of Emission	16K0F3E/11K0F3E
Modulation	FM
DUT Power Source	<input type="checkbox"/> 110-120Vac/50- 60Hz
	<input checked="" type="checkbox"/> DC Power 12V
	<input type="checkbox"/> Battery Operated Exclusively
Test Item	<input type="checkbox"/> Prototype
	<input checked="" type="checkbox"/> Pre-Production
	<input type="checkbox"/> Production
Type of Equipment	<input checked="" type="checkbox"/> Fixed
	<input type="checkbox"/> Mobile
	<input type="checkbox"/> Portable
Test Conditions	The temperature was 26°C Relative humidity of 50%.
Modification to the DUT	None
Test Exercise	The DUT was placed in continuous transmit mode.
Applicable Standards	ANSI/TIA 603-C:2004, FCC CFR 47 Part 90
Test Facility	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA.

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TEST PROCEDURES

Antenna Conducted Emissions: The RBW = 100 kHz, VBW = 300 kHz and the span set to 10.0 MHz and the spectrum was scanned from 30 MHz to the 10th harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz and the span to 50 MHz.

Radiation Interference: The test procedure used was ANSI/TIA 603-C: 2004 using an Agilent spectrum receiver with pre-selector. The bandwidth (RBW) of the spectrum receiver was 100 kHz up to 1 GHz and 1 MHz above 1 GHz with an appropriate sweep speed. The VBW above 1 GHz was 3 MHz. The analyzer was calibrated in dB above a micro volt at the output of the antenna.

Bandwidth 20 dB: The measurements were made with the spectrum analyzer's resolution bandwidth (RBW) = 1 MHz and the video bandwidth (VBW) = 3 MHz and the span set as shown on plot.

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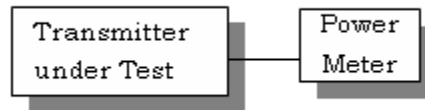
RF POWER OUTPUT

Rule Part No.: FCC Part 2.1046(a), IC RSS-119 4.1 and 5.4, RSS-GEN 4.8

Test Requirements:

Method of Measurement: RF power is measured by connecting a 50-ohm, resistive wattmeter to the RF output connector. With a nominal battery voltage, and the transmitter properly adjusted the RF output measures:

Test Setup Diagram:



Test Data:

OUTPUT POWER: HIGH – 3.3 Watts Conducted
LOW - 0.010 Watts Conducted

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SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: FCC Part 2.1051(a), RSS-GEN 7.1.4

Requirements: 12.5 kHz CH spacing- $50 + 10\log(3.3) = 55.2$
 6.25 kHz CH spacing - $55 + 10\log(3.3) = 60.2$

12.5 kHz CH spacing- $50 + 10\log(0.010) = 30$
 6.25 kHz CH spacing - $55 + 10\log(0.010) = 35$

Method of Measurement: The spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard ANSI/TIA 603-C: 2004.

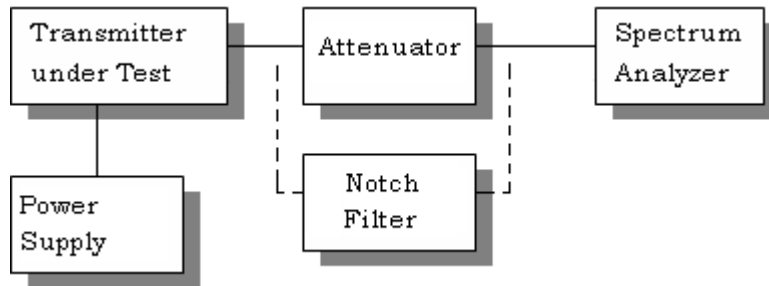
Test Data:

TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
217.1	217.1	0		217.1	217.1	0
	434.2	100.4			434.2	81.8
	651.3	87.6			651.3	82.7
	868.4	87.3			868.4	83
	1085.5	84.7			1085.5	83.2
	1302.6	76			1302.6	49
	1519.7	72.9			1519.7	48.6
	1736.8	75			1736.8	50.5
	1953.9	68.7			1953.9	50.1
	2171	101.5			2171	50.3

TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
219.9	219.9	0		219.9	219.9	0
	439.8	102.3			439.8	82.2
	659.7	86.5			659.7	82.4
	879.6	86.6			879.6	82.7
	1099.5	83.2			1099.5	82.4
	1319.4	77.3			1319.4	50.3
	1539.3	81.1			1539.3	48.4
	1759.2	82.7			1759.2	49.7
	1979.1	67.1			1979.1	49.3
	2199	101.3			2199	49.5

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Method of Measuring Conducted Spurious Emissions



METHOD OF MEASUREMENT: The procedure used was ANSI/TIA 603-C:2004. The measurements were made at TIMCO ENGINEERING INC. 849 N.W. State Road 45, Newberry, Florida 32669.

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FIELD STRENGTH OF SPURIOUS EMISSIONS

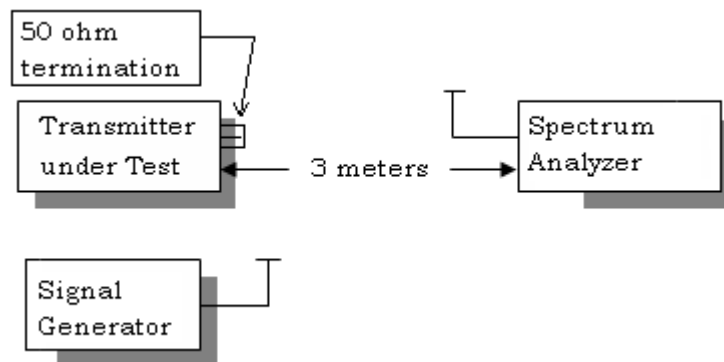
Rule Parts. No.: FCC Part 2.1053, RSS-GEN 4.9

Requirements:

12.5 kHz CH spacing–	$50 + 10\log(3.3) = 55.2$
6.25 kHz CH spacing -	$55 + 10\log(3.3) = 60.2$
12.5 kHz CH spacing–	$50 + 10\log(0.010) = 30$
6.25 kHz CH spacing -	$55 + 10\log(0.010) = 35$

METHOD OF MEASUREMENT: The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from 30 MHz to at least the tenth harmonic of the fundamental. This test was conducted per ANSI/TIA 603-C: 2004 using the substitution method. Measurements were made at the test site of TIMCO ENGINEERING, INC. located at 849 NW State Road 45, Newberry, FL 32669.

Test Setup Diagram:



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Test Data:

High Power

Low Power

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)		Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
217.10	V	0		217.10	V	0
434.20	V	66.6		434.20	H	81.2
651.30	H	76.9		651.30	V	77.2
868.40	H	80.9				
1085.50	V	80.6				
1302.60	H	81.3				
1519.70	H	81.9				
1736.80	V	73.2				

High Power

Low Power

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)		Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
219.90	V	0		219.90	V	0
439.80	H	72.9		439.80	H	81.9
659.70	H	70.9		659.70	V	79.1
879.60	H	78.1				
1099.50	H	86.2				
1319.40	H	81.0				
1539.30	V	74.1				
1759.20	V	72.4				

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FREQUENCY STABILITY

Rule Parts. No.: FCC Part 2.1055, Part 90.213, RSS-119 5.3, RSS-GEN 7.2.4

Requirements: Temperature range requirements: -30 to +50° C.
Voltage Variation +, -15%
±1.5 PPM

Method of Measurements: ANSI/TIA 603-C:2004

Test Data:

Assigned Frequency (Ref. Frequency) (MHz)		
Temperature (°C)	Frequency (MHz)	Frequency Stability (PPM)
-30	219.900085	-0.06
-20	219.900110	0.05
-10	219.900104	0.02
0	219.900102	0.01
+10	219.900098	0.00
+20	219.900094	-0.02
+30	219.90008	-0.09
+40	219.900069	-0.14
+50	219.900064	-0.16

Assigned Frequency (Ref. Frequency) (MHz)		
% Battery (%)	Frequency (MHz)	Frequency Stability (PPM)
-15%	219.900098	0.00
+15%	219.900098	0.00

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OCCUPIED BANDWIDTH

Part 2.1049(c) EMISSION BANDWIDTH:

Part 90.210(b) 25kHz Channel Spacing

Data in the plots show that on any frequency removed from the assigned frequency by more than 50%, but not more than 100%: At least 25dB. On any frequency removed from the assigned frequency by more than 100%, but not more than 250%: At least 35 dB. On any frequency removed from the assigned frequency by more than 250%, of the authorized bandwidth: At least $43 + 10\log(P)$ dB.

Part 90.210(c) 12.5kHz Channel Spacing Not Equipped with a Low Pass Filter

For transmitters that are not equipped with an audio low pass filter pursuant to S90.211 (b), the power of any emission must be attenuated below the un-modulated carrier output power as follows; (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5 kHz but not more than 10 kHz: At least $83 \log(f_d/5)$ dB; (2) ON any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 10 kHz, but not more than 250% of the authorized bandwidth: At least $29 \log(f_d/11)$ dB or 50 dB, whichever is the lesser attenuation; (3) On any frequency removed from the center of the authorized bandwidth by more than 250% of the authorized bandwidth: At least $43 + 10 \log(P_o)$ dB.

Part 90.210(d) Emission Mask D - 12.5 kHz channel BW equipment.

For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- (1) On any frequency from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0 : Zero dB.
- (2) On any frequency from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least $7.27 (f_d - 2.88 \text{ kHz})$ dB.
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10\log(P)$ dB or 70 dB, whichever is the lesser attenuation.

Part 90.210(e) Emission Mask E – 6.25 kHz channel BW equipment.

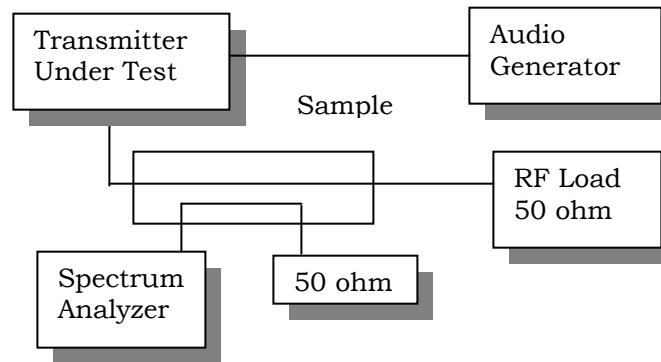
For transmitters designed to operate with a 6.25 kHz bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- (1) On any frequency from the center of the authorized bandwidth f_0 to 3.0 kHz removed from f_0 : Zero dB.
- (2) On any frequency from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least $30 + 16.67(f_d - 3.0 \text{ kHz})$ or $55 + 10 \log(P)$ or 65, whichever is the lesser attenuation.
- (3) On any frequency removed from the center of the authorized bandwidth by more than 4.6kHz: At least $55 + 10\log(P)$ dB or 65 dB, whichever is the lesser attenuation.

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Method of Measurement: ANSI/TIA 603-C: 2004

Test Setup Diagram:

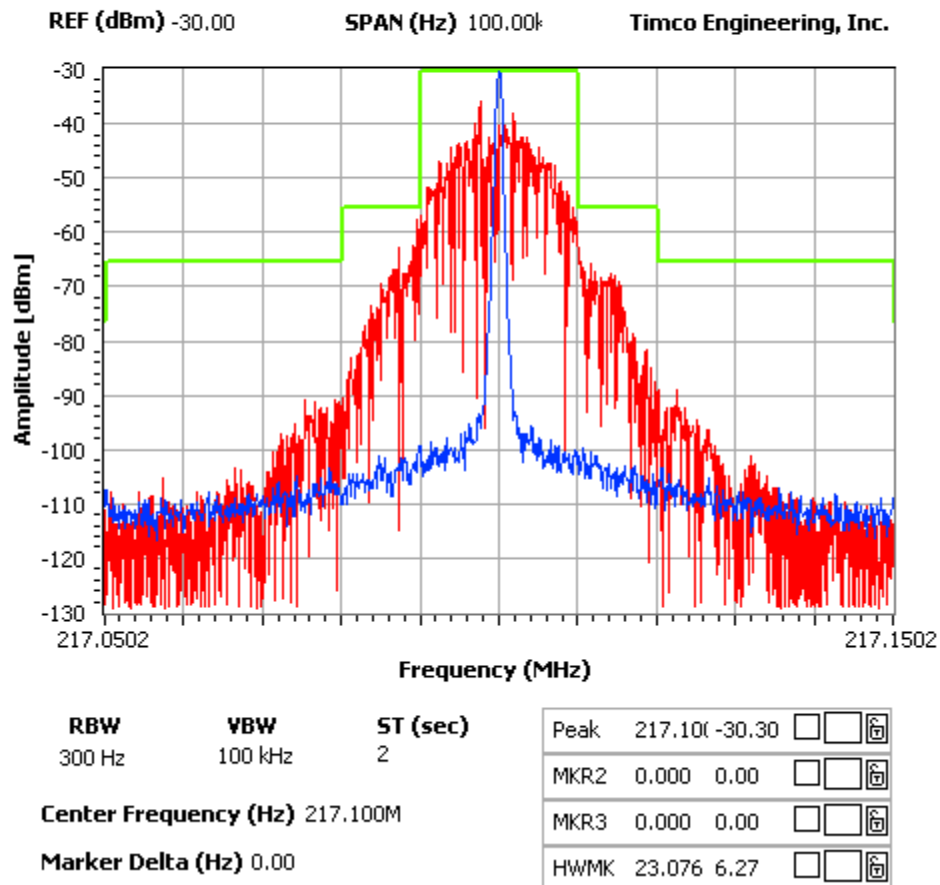


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OCCUPIED BANDWIDTH PLOTS

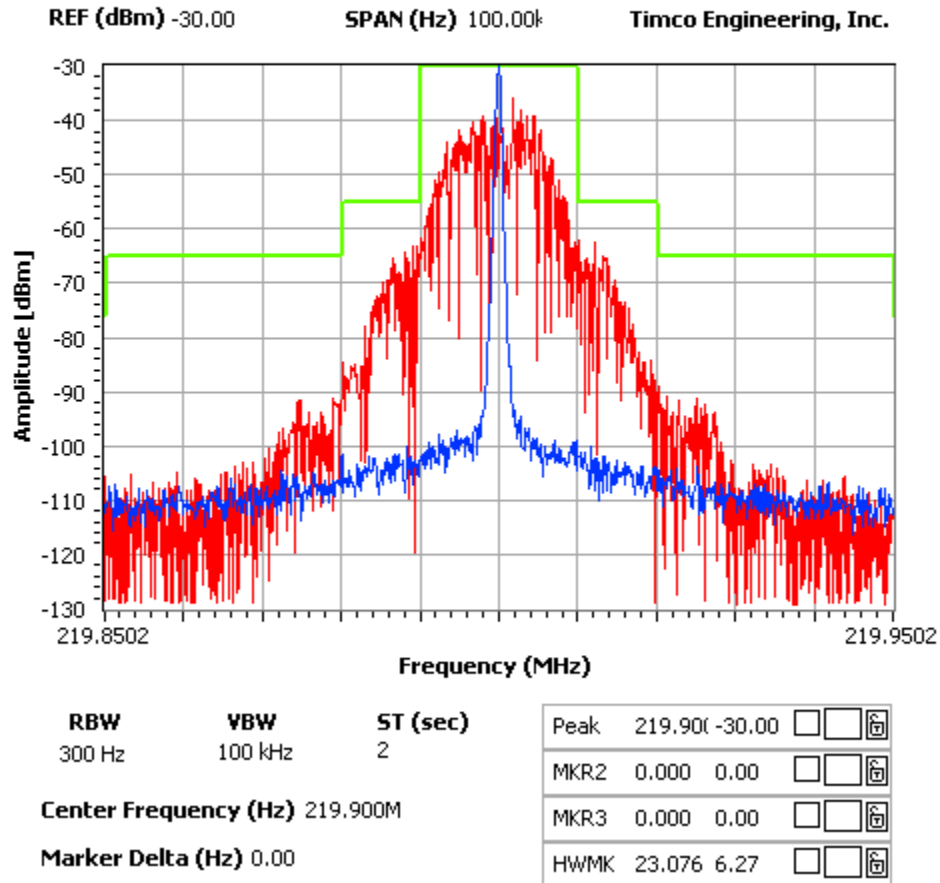
Part 90.210(b) Emission Mask B - 25 kHz channel

NOTES:



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NOTES:



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EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	11/24/09	10/28/13
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	11/21/09	10/28/13
Antenna: Biconnical	Electro-Metrics	BIA-25	1171	06/13/12	06/13/14
Antenna: Biconnical	Eaton	94455-1	1096	05/04/11	05/04/13
Antenna: Log-Periodic	Electro-Metrics	LPA-25	1122	05/04/11	05/04/13
Frequency Counter	HP	5352B	2632A00165	06/22/11	06/22/13
Frequency Counter	HP	5385A	2730A03025	08/17/11	08/17/13
Signal Generator	HP	8640B	2308A21464	02/23/12	02/23/14
Hygro-Thermometer	Extech	445703	0602	06/15/11	06/15/13
Digital Multimeter	Fluke	77	35053830	09/09/11	09/09/13
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	11/21/09	10/28/13
Antenna: Passive Loop	EMC Test Systems	EMCO 6512	9706-1211	06/14/12	06/14/14
Modulation Analyzer	HP	8901A	3435A06868	07/18/11	07/18/13
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	11/22/09	10/28/13
Temperature Chamber	Tenney Engineering	TTRC	11717-7	07/03/12	07/03/14
Frequency Counter	HP	5385A	3242A07460	06/22/11	06/22/13
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/11	12/31/13

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