



FCC CFR 47 Part 80 Test Report

APPLICANT	INTERNATIONAL TECHNICAL MKTG. INC.
ADDRESS	P.O. BOX 23159 FEDERAL WAY WA 98093
FCC ID	XLTKTS-1GA
MODEL NUMBER	KTS-1GA
PRODUCT DESCRIPTION	GPS RADIO BUOY
DATE SAMPLE RECEIVED	07/12/2019
FINAL TEST DATE	07/24/2019
TESTED BY	Franklin Rose
APPROVED BY	Tim Royer
TEST RESULTS	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL

Report Number	Report Version	Description	Issue Date
1790UT19_PT80 TestReport_	Rev1	Initial Issue	07/24/2019
1790UT19_PT80 TestReport_	Rev2	Clerical Updates	10/07/2019
1790UT19_PT80 TestReport_	Rev3	Clerical Updates	10/14/2019

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

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GENERAL REMARKS

Summary

The device under test does:

- ☒ Fulfill the general approval requirements as identified in this test report and was selected by the customer.
- ☐ 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.

I attest that the necessary measurements were made at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, FL 32669
Designation #: US1070

Tested by:



Name and Title	Franklin Rose, Project Manager / EMC Specialist
Date	07/24/2019

Reviewed and Approved by:



Name and Title	Tim Royer, Project Manager / EMC Testing Engineer
Date	08/07/2019

GENERAL INFORMATION

Definitions: FCC Part 80.5

The EUT is an Open-water Radio Buoy capable of GPS location. The EUT is considered a Ship- Station operating in the Maritime Radiodetermination Service per 80.376.

§80.376 Radio buoy operations.

Frequencies in the 1900-2000 kHz band are authorized for radio buoy operations under a ship radio station license provided:

(a) The use of these frequencies is related to commercial fishing operations on the open sea and the Great Lakes; and

(b) The output power does not exceed 8 watts and the station antenna height does not exceed 4.6 meters above sea level in a buoy station or 6 meters above the mast of the ship on which it is installed.

Maritime radiodetermination service. A maritime radiocommunication service for determining the position, velocity, and/or other characteristics of an object, or the obtaining of information relating to these parameters, by the propagation properties of radio waves.

GENERAL INFORMATION

Testing Information

EUT Description	GPS RADIO BUOY		
FCC ID	XLTKTS-1GA		
Model Number	KTS-1GA		
Operating Band(s)	Band 1: 1900-2000 kHz		
Test Frequencies	Band 1: 1995 kHz		
FCC Emission Designator	160HA1A		
Modulation	AM/OOK		
EUT Power Source	<input type="checkbox"/> 110–120 VAC	<input type="checkbox"/> DC Power (12 V)	<input checked="" type="checkbox"/> Battery Operated
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
Antenna Connector	Monopole threaded connector		
Modification to the EUT	The EUT was tested without the antenna during conducted testing, which involved the addition of an appropriate antenna connector to the PCB. This was removed prior to Radiated testing.		
Test Exercise	The EUT was operated using instructions provided by the manufacturer in accordance with the user manual.		
Applicable Standards	FCC CFR 47 Part 2, Part 80, using ANSI C63.26-2015, TIA-603-E 2015.		
Test Conditions	Laboratory temperature: 26°C, Relative humidity: 50%		
Test Facility	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA. Designation #: US1070		

SUMMARY OF TESTING

FCC Rule Part No.	Test Performed	Result
2.1033(c)(4), 80.207(d), 80.205(a), 80.213(a)(1)	Modulation Characteristics	PASS
2.1046(a), 80.376(b), 80.215(a)(5)	RF Power Output	PASS
2.1049(i), 80.205(a)	Occupied Bandwidth	PASS
80.211(f)(1), (2)	Emission Masks	PASS
2.1051(a), 2.1057(a)(1), 80.211(f)(3)	Spurious Emissions at Antenna Terminals	PASS
2.1053(b)(2)	Field Strength of Spurious Emissions	N/A
2.1055(a)(2), 80.209(a)(2)(ii), (iv)	Frequency Stability	PASS

MODULATION CHARACTERISTICS

FCC Rule Parts: 2.1033(c)(4), 80.207(d), 80.205(a), 80.213(a)(1)

(d) The authorized classes of emission are as follows:

Types of stations	Classes of emission
Ship Stations¹	
1615-27500 kHz:	
Manual ^{15 16 17}	A1A, J2A, J2B, J2D.

(a) An emission designator shows the necessary bandwidth for each class of emission of a station except that in ship earth stations it shows the occupied or necessary bandwidth, whichever is greater. The following table gives the class of emission and corresponding emission designator and authorized bandwidth:

Class of emission	Emission designator	Authorized bandwidth (kHz)
A1A	160HA1A	0.4

§80.213 Modulation requirements.

(a) Transmitters must meet the following modulation requirements:

(1) When double sideband emission is used the peak modulation must be maintained between 75 and 100 percent;

FCC Bandwidth

Description of emission	Necessary bandwidth		Designation of emission
	Formula	Sample calculation	
II. AMPLITUDE MODULATION			
1. Signal With Quantized or Digital Information			
Continuous wave telegraphy	$B_n = BK$, K = 5 for fading circuits, K = 3 for non-fading circuits	25 words per minute; B = 20, K = 5, Bandwidth: 100 Hz	100HA1A

The EUT is assigned an emission designator of **160HA1A**

RF POWER OUTPUT

Rule Part No.: 2.1046(a), 80.376(b), 80.215(a)(5)

Requirements:

§80.376 Radio buoy operations.

Frequencies in the 1900-2000 kHz band are authorized for radio buoy operations under a ship radio station license provided:

(a) The use of these frequencies is related to commercial fishing operations on the open sea and the Great Lakes; and

(b) The output power does not exceed 8 watts and the station antenna height does not exceed 4.6 meters above sea level in a buoy station or 6 meters above the mast of the ship on which it is installed.

§80.215 Transmitter power.

(a) Transmitter power shown on the radio station authorization is the maximum power the licensee is authorized to use. Power is expressed in the following terms:

(1) For single sideband emission: Peak envelope power;

(2) For G3E emission: Carrier power;

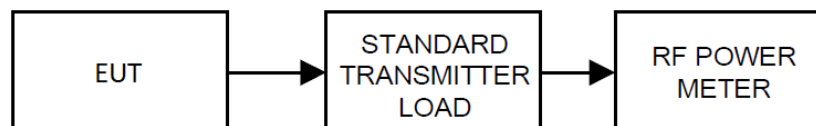
(3) For PON and F3N emission: Mean power;

(4) For all emissions in the 1626.5-1646.5 MHz band: equivalent isotropic radiated power.

(5) For all other emissions: the carrier power multiplied by 1.67.

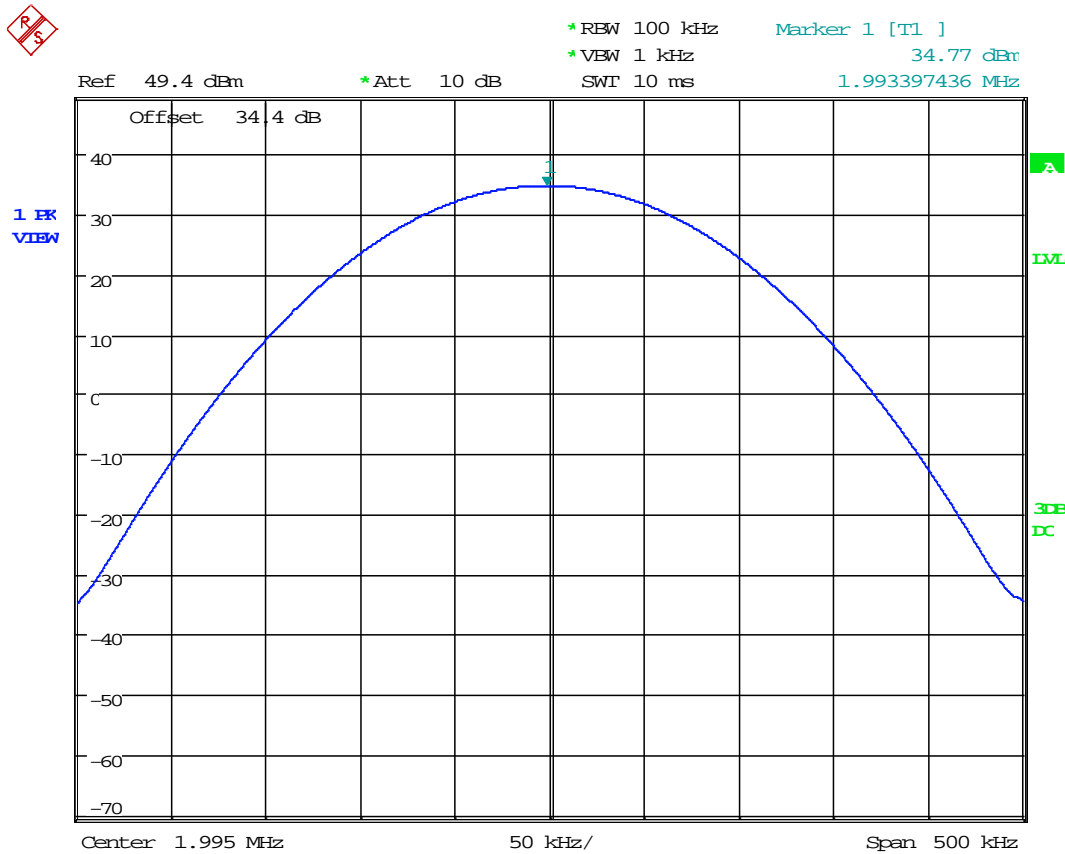
Test Procedure: ANSI C63.26

Test Setup Block Diagram:



RF POWER OUTPUT

Test Data: Power Measurement Plot



Date: 23.JUL.2019 15:02:12

Maximum Peak Power: **3.0 W**

POWER AT THE FINAL AMPLIFIER

Rule Part No.: FCC Part 2.1033(c)(8)

Requirement:

(c) Applications for equipment other than that operating under parts 15, 11 and 18 of this chapter shall be accompanied by a technical report containing the following information:

(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.

Test Data: Power at the Final Amplifier

INPUT POWER: (12 VDC) (0.8 A) = **10 Watts**

OCCUPIED BANDWIDTH

FCC Rule Parts: 2.1049(i), 80.205(a)

§2.1049 Measurements required: Occupied bandwidth.

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

(i) Transmitters designed for other types of modulation—when modulated by an appropriate signal of sufficient amplitude to be representative of the type of service in which used. A description of the input signal should be supplied.

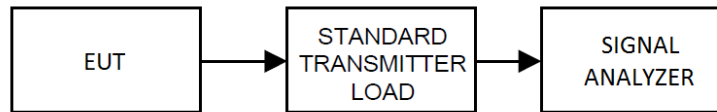
(a) An emission designator shows the necessary bandwidth for each class of emission of a station except that in ship earth stations it shows the occupied or necessary bandwidth, whichever is greater. The following table gives the class of emission and corresponding emission designator and authorized bandwidth:

Class of emission	Emission designator	Authorized bandwidth (kHz)
A1A	160HA1A	0.4

Test Procedure: ANSI C63.26, 5.4.4

Note: The receiver's automatic 99% Occupied Bandwidth function was used. The function is identical in operation to the measurement method of ANSI C63.26, 5.4.4, Step e).

Test Setup Block Diagram:

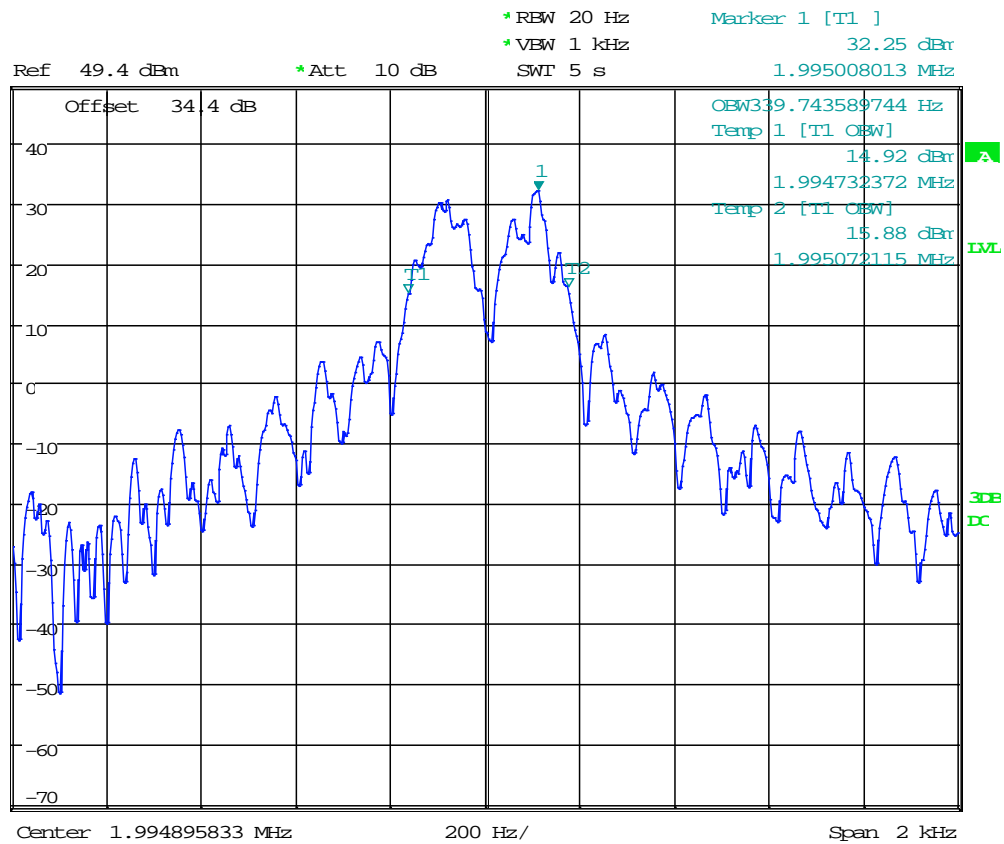


OCCUPIED BANDWIDTH

Test Data: 99% OBW Plot



1.33
VPP



Date: 23.JUL.2019 16:30:59

EMISSION MASK

FCC Rule Parts: 80.211(f)(1), (2)

§80.211 Emission limitations.

(f) The mean power when using emissions other than those in paragraphs (a), (b), (c) and (d) of this section:

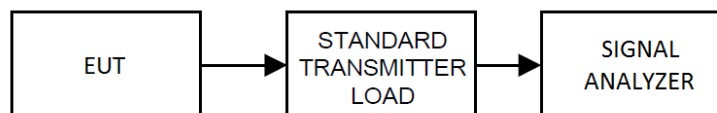
(1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;

(2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB; and

Test Procedure: ANSI C63.26, 5.4.4

Note: The receiver's automatic 99% Occupied Bandwidth function was used. The function is identical in operation to the measurement method of ANSI C63.26, 5.4.4, Step e).

Test Setup Block Diagram:



SPURIOUS EMISSIONS AT ANTENNA TERMINAL

FCC Rule Parts: 2.1051(a), 2.1057(a)(1), 80.211(f)(3)

§2.1057 Frequency spectrum to be investigated.

(a) In all of the measurements set forth in §§2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:

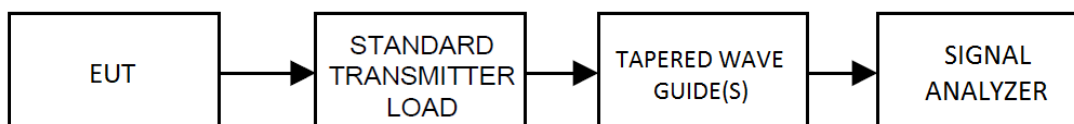
(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

§80.211 Emission limitations.

(f) The mean power when using emissions other than those in paragraphs (a), (b), (c) and (d) of this section:

(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus $10\log_{10}$ (mean power in watts) dB.

Test Setup Block Diagram:



Deviation from Test Standard: The EUT was retrofitted with an SMA antenna connector to facilitate conducted emissions testing. However, it was found that the necessary placement of these soldered connections created an excess of spurious emissions that would not otherwise exist within the EUT.

The antenna connector was removed, the EUT was fitted with its antenna, and spurious emissions were taken in the Semi-anechoic chamber during transmit.

The EUT is marketed and sold with only one antenna type. The following results are indicative of the actual level of spurious emissions found below the 10th harmonic.

Limit Calculation Part 80.211(f)(3)

$$43 + 10 \times \text{Log}(\text{Power, in Watts})$$

Frequency (kHz)	Measured Output (dBm)	43+10 x Log(P) Limit (dBm)
1995	34.77	-13.00

SPURIOUS EMISSIONS AT ANTENNA TERMINAL

Test Data: Spurious Emissions of the Transmitter Measurement Table

Emission Frequency (MHz)	Meter Reading (dBμV)	Antenna Polarity	Coax Loss (dB)	Correction Factor (dB/m)	Field Strength (dBμV/m)	Distance (m)	Field Strength (dBμV/m)	ERP (dBm)	Limit (dBm)	Margin (dB)
3.9800	25.7	V	10.9	11.2	47.8	3.000	47.793	-49.585	-13.00	36.58
5.9700	31.0	V	10.6	11.0	52.6	3.000	52.568	-44.810	-13.00	31.81
7.9600	45.6	V	10.5	10.8	66.9	3.000	66.901	-30.476	-13.00	17.48
9.9500	18.7	V	10.1	10.7	39.5	3.000	39.519	-57.858	-13.00	44.86
11.9400	27.1	V	10.1	10.6	47.8	3.000	47.777	-49.600	-13.00	36.60
13.9300	17.4	V	10.1	10.5	37.9	3.000	37.915	-59.463	-13.00	46.46
15.9200	12.1	V	9.9	10.4	32.4	3.000	32.355	-65.023	-13.00	52.02
17.9100	16.8	V	9.6	10.3	36.7	3.000	36.733	-60.644	-13.00	47.64
19.9000	13.8	V	9.4	10.1	33.4	3.000	33.367	-64.010	-13.00	51.01

FIELD STRENGTH OF SPURIOUS EMISSIONS

FCC Rule Parts: 2.1053(b)(2)

Requirements:

§2.1053 Measurements required: Field strength of spurious radiation.

(a) 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. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.

(2) All equipment operating on frequencies higher than 25 MHz.

Result: N/A. EUT does not operate above 25 MHz

FREQUENCY STABILITY

FCC Rule Parts: Part 2.1055(a)(2), 80.209(a)(ii), (iv)

§80.209 Transmitter frequency tolerances.

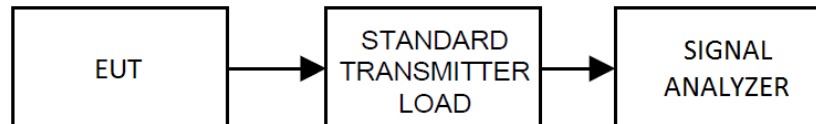
(a) The frequency tolerance requirements applicable to transmitters in the maritime services are shown in the following table. Tolerances are given as parts in 10^6 unless shown in Hz.

Frequency bands and categories of stations	Tolerances ¹
(2) Band 1600-4000 kHz:	
(ii) Ship stations:	
For transmitters with narrow-band direct printing and data emissions	10 Hz. ²
For transmitters with digital selective calling emissions	10 Hz. ³
For all other transmitters	20 Hz.
(iv) Radiodetermination stations:	
With power 200W or less	20.
With power above 200W	10.

Applied Limit: +/- 20 Hz

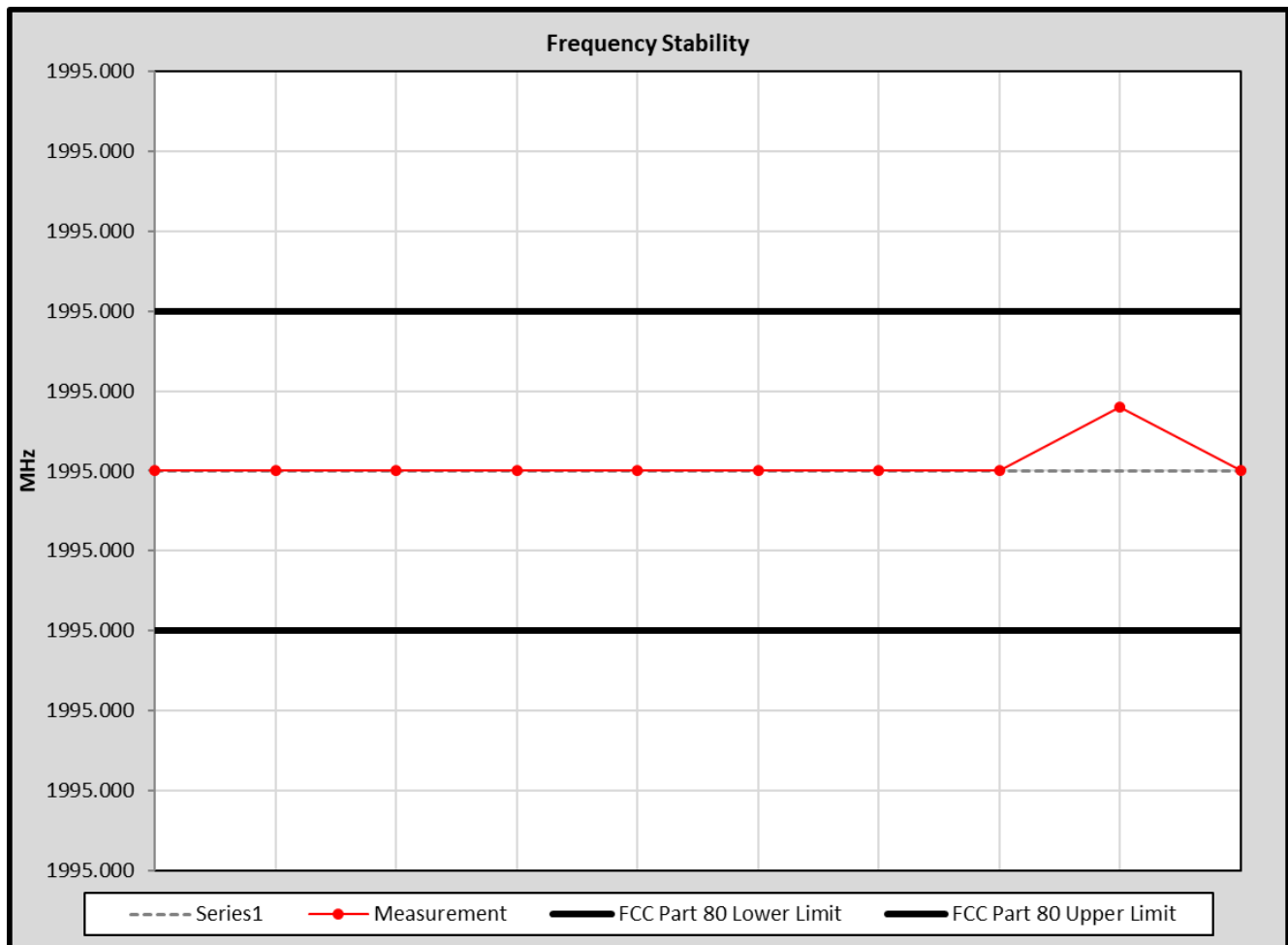
Test Procedure: TIA 603-E, 2.2.2

Test Setup Block Diagram:



FREQUENCY STABILITY

Test Data: Frequency Error Measurement Plot



FREQUENCY STABILITY

Test Data: Frequency Error Measurement Table

FCC Part 80 Limit	20.0	ppm	
FCC Part 80 Limit	39.900	Hz	
FCC Part 80 Lower Limit	1994.999960	MHz	
FCC Part 80 Upper Limit	1995.000040	MHz	
Rated Supply Voltage	12.0	<input type="radio"/> AC <input checked="" type="radio"/> DC	
Temperature / Voltage Variation			
Temperature (°C)	Supplied Voltage (V)	Frequency (kHz)	Deviation (kHz)
-20	12.0	1995.000	0.000
-10	12.0	1995.000	0.000
0	12.0	1995.000	0.000
+10	12.0	1995.000	0.000
+20 (reference)	12.0	1995.000	0.000
+20	10.2	1995.000	0.000
+20	13.8	1995.000	0.000
+30	12.0	1995.000	0.000
+40	12.0	1995.000016	-0.016
+50	12.0	1995.000	0.000

RESULT: Meets Requirements

STATEMENT OF MEASUREMENT UNCERTAINTY

The data and results referenced in this document are true and accurate. The measurement uncertainty was calculated for all measurements listed in this test report according To CISPR 16-4 or ENTR 100-028 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: “Uncertainty in EMC Measurements” and is documented in the Timco Engineering, Inc. quality system according to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Timco Engineering, Inc. is reported:

Test Items	Measurement Uncertainty	Notes
RF Frequency Accuracy	± 49.5 Hz	(1)
RF Conducted Power	± 0.93 dB	(1)
Conducted spurious emission of transmitter to 40GHz	± 1.86 dB	
Occupied Bandwidth	± 2.65 %	
Radiated RF Power	± 1.4 dB	
Rad Emissions of transmitter up to 26.5GHz	± 2.14 dB	
Rad Emissions of transmitter to 40GHz	± 2.36 dB	
Temperature	± 1.0 °C	(1)
Humidity	± 5.0 %	

Note: (1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=1.96$.

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
CHAMBER	Panashield	3M	N/A	03/15/19	03/15/21
Antenna: Active Loop	ETS-Lindgren	6502	00062529	12/11/17	12/11/19
Coaxial Cable - Chamber 3 cable set (backup)	Micro-Coax	Chamber 3 cable set (backup)	KMKM-0244-02 KMKM-0670-01 KFKF-0197-00	02/27/19	02/27/21
Software: Field Strength Program	Timco	N/A	Version 4.10.7.0	N/A	N/A
EMI Test Receiver R & S ESU 40	Rohde & Schwarz	ESU 40	100320	08/28/18	08/28/20
Comb Generator	Com-Power Corp	CGO-515	291728	NA	NA
Digital Multimeter	Fluke	77	35053830	11/06/17	11/06/19
Temperature Chamber LARGE	Tenney Engineering	TTRC	11717-7	NA	NA
Type K J Thermometer	Martel	303	080504494	11/06/17	11/06/19
Frequency Counter Small Chamber	HP	5385A	3242A07460	08/22/17	08/22/19
Attenuator N 30dB 100W DC-6G	Pasternack	PE7214-30	#110	07/16/19	07/16/21
Attenuator N 3dB 100W DC-6G	Pasternack	PE7015-3	#21	07/16/19	07/16/21
Coaxial Cable - BMBM-0122-01 RG400	Pasternack	PE3582LF-48	BMBM-0122-01	07/16/19	07/16/21

*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

END OF REPORT