



849 NW STATE ROAD 45
NEWBERRY, FL 32669 USA
PH: 888.472.2424 OR
352.472.5500
FAX: 352.472.2030
EMAIL: INFO@TIMCOENGR.COM
[HTTP://WWW.TIMCOENGR.COM](http://WWW.TIMCOENGR.COM)

FCC PART 80 TEST REPORT

APPLICANT	YAESU MUSEN CO., LTD.
	TENNOZU PARKSIDE BUILDING 2-5-8 HIGASHI-SHINAGAWA, SHINAGAWA-KU, TOKYO, 140-0002 JAPAN
FCC ID	K6630623X30
MODEL NUMBER	HX40
PRODUCT DESCRIPTION	PORTABLE MARINE TRANSCEIVER
DATE SAMPLE RECEIVED	12/27/2017
FINAL TEST DATE	01/26/2018
TESTED BY	Franklin Rose
APPROVED BY	Tim Royer
TEST RESULTS	☒ PASS ☐ FAIL

Report Number	Version Number	Description	Issue Date
2221AUT17TestReport_	Rev1	Initial Issue	01/26/2018
2221AUT17TestReport_	Rev2	Updated High Channel Data w/ 161.6 MHz	01/30/2018
2221AUT17TestReport_	Rev3	Updated Low Channel Data w/ 156.025 MHz. Updated DSC capability statement & data.	02/01/2018

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

TABLE OF CONTENTS

GENERAL REMARKS.....	2
GENERAL INFORMATION	3
RESULTS SUMMARY.....	4
TECHNICAL DATA.....	5
RF POWER OUTPUT	6
Test Data: Power Measurement Table	6
Part 2.1033 (c)(8) DC Input into Final Amplifier	6
MODULATION CHARACTERISTICS OF 16K0G3E.....	7
16K0G3E (Voice) Bandwidth Calculation	7
AUDIO FREQUENCY RESPONSE & LOW PASS FILTER RESPONSE	8
Test Data: Audio Frequency & Low Pass Filter Response.....	8
AUDIO INPUT VERSUS MODULATION.....	9
Test data: Modulation Limiting Plot.....	9
OCCUPIED BANDWIDTH.....	10
Test Data: 16K0G3E (Voice) – Low End of Band 156.025 MHz, High Power.....	10
Test Data: 16K0G3E (Voice) – Low End of Band 156.025 MHz, Low Power.....	11
Test Data: 16K0G3E (Voice) – Middle of Band 157.425 MHz, High Power.....	12
Test Data: 16K0G3E (Voice) – Middle of Band 157.425 MHz, Low Power	13
Test Data: 16K0G3E (Voice) – High End of Band 161.60 MHz, High Power.....	14
Test Data: 16K0G3E (Voice) – High End of Band 161.60 MHz, Low Power.....	15
SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED).....	16
Test Data: 16K0G3E (Voice) – Low End of Band 156.025 MHz.....	16
Test Data: 16K0G3E (Voice) – Middle of Band 157.425 MHz	17
Test Data: 16K0G3E (Voice) – High End of Band 161.60 MHz (International)	18
FIELD STRENGTH OF SPURIOUS EMISSIONS	19
Test Data: 16K0G3E (Voice) – Low End of Band 156.025 MHz, High Power.....	20
Test Data: 16K0G3E (Voice) – Low End of Band 156.025 MHz, Low Power.....	20
Test Data: 16K0G3E (Voice) – Middle of Band 157.425 MHz, High Power.....	21
Test Data: 16K0G3E (Voice) – Middle of Band 157.425 MHz, Low Power	21
Test Data: 16K0G3E (Voice) – High End of Band 161.60 MHz, High Power.....	22
Test Data: 16K0G3E (Voice) – High End of Band 161.60 MHz, Low Power.....	22
FREQUENCY STABILITY.....	23
Test Data: Frequency Error Measurement Plot	23
Test Data: Frequency Error Measurement Table	24
STATEMENT OF MEASUREMENT UNCERTAINTY	25
EMC EQUIPMENT LIST	26

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 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



Tested by:

Name and Title: Franklin Rose, Project Manager/Testing Technician

Date: 02/01/2018



Reviewed and approved by:

Name and Title: Tim Royer, Engineer

Date: 01/29/2018

Applicant: YAESU MUSEN CO., LTD.
FCC ID: K6630623X30
Report: 2221AUT17TestReport_Rev1

[Table of Contents](#)

Page 2 of 29

GENERAL INFORMATION

EUT Specification

EUT Description	PORTABLE MARINE TRANSCEIVER
FCC ID	K6630623X30
Model Number	HX40
Operating Frequency	156.025-161.600 MHz
Maritime Device Type	SHIP STATION
Test Frequencies	156.025, 156.3, 156.65, 156.8, 157.425, 161.6 MHz
Type of Emission	16K0G3E
Modulation	FM
EUT Power Source	☐ 110–120Vac/50– 60Hz
	☐ DC Power (13.8 V)
	☒ Battery Operated Exclusively (7.4 VDC)
Test Item	☐ Prototype
	☒ Pre-Production
	☐ Production
Type of Equipment	☐ Fixed
	☐ Mobile
	☒ Portable
Antenna Connector	SMA
Test Conditions	The temperature was 26°C Relative humidity of 50%.
Modification to the EUT	None
Test Exercise	The EUT was placed in continuous transmit mode. The EUT was operated in “Test Mode” for digital emissions tests.
Applicable Standards	ANSI/TIA 603-E:2016, FCC CFR 47 Part 2, Part 80
Test Facility	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA.

RESULTS SUMMARY

Rule Part No.	Test Item	Results
80.203(b)	External Control Requirements	PASS
80.203(c)	< 5 min. Tx maximum	PASS
80.873, 80.956	G3E emission capability	PASS
80.911(a)	G3E on 156.3 & 156.8 MHz	PASS
80.911(c)	< 5 min. Tx maximum	PASS
2.1046(a), 80.215(e)(1)	RF Power Output < 25 W	PASS
2.1033(c)(4), 80.205(b), 80.213(a), 80.207	Modulation Characteristics	PASS
2.1047(a)(b)	Audio Frequency Response and Low Filter	PASS
2.1047(b), 80.213 (b)	Audio Input Vs Modulation	PASS
2.1049(c), 80.211 (f)(1)(2)	Occupied Bandwidth	PASS
2.1051(a), 80.211(f)(3)	Spurious Emissions at Antenna Terminals	PASS
2.1053(a), 80.211(f)(3)	Field Strength of Spurious Emissions	PASS
2.1055(a)(2), 80.209(a)	Frequency Stability < 5 ppm	PASS

TECHNICAL DATA

- 80.203 (b)** **External Controls:** The transmitter is capable of changing frequency between 156.025 – 157.425 MHz by external control. The available channels are shown in the User Manual description Channel List. These channels are preprogrammed by the manufacturer and change of frequency is inaccessible to the station operator.
- 80.203 (c)** **Five minutes continuous transmission test:** The antenna was connected to a dummy load and the radio was locked in a transmit PTT mode. An external timer digital clock was used to observe the duration of the Unmodulated transmission. The transmitter turned off and the radio went to receive mode at **5 minutes, 0 seconds** as displayed by an external digital clock.
- 80.203 (n)** This radio is not required to comply with the requirement for DSC capability in the 156 – 162 MHz band per 80.203(n).
- 80.873; 80.956** **Transmitter G3E emission capability:** The transmitter was connected to 50 ohm resistive wattmeter and the frequency was set to 156.300 and to 156.800 MHz. With normal modulation, the output power displayed was 25 Watts at the high power setting and 1 watt at low power setting, consistent with test measurements.
- The transmitter has been demonstrated to be capable, with normal operating voltages applied, of delivering 25 watts of carrier power into a 50 ohm resistive load over the specified frequencies.
- 80.911 (a)** **80.956 G3E Transmissions:** This radio is capable of G3E emission on 156.300 and 156.800 MHz.
- 80.911 (c)** With 13.6 VDC applied and with the radio connected to a 50 ohm resistive wattmeter, the output power was measured at 156.300 and 156.800 MHz with a measured reading, shown later in this report under normal speech modulation.

Result: Meets Requirements

RF POWER OUTPUT

FCC Rule Parts: FCC Part 2.1046(a), 80.215(e)(1)

Test Requirements: The maximum power must not exceed the values listed below.

(e) Ship stations frequencies above 27500 kHz. The maximum power must not exceed the values listed below.

(1) Ship stations 156-162 MHz—25W⁶

⁶Reducible to 1 watt or less, except for transmitters limited to public correspondence channels and used in an automated system.

Method of Measurement: ANSI/TIA-603-E

Test Data: Power Measurement Table

Peak Output Power					
Tuned Freq. MHz	Channel	dBm		Watts	
		High	Low	High	Low
156.0250	60	37.78	29.19	6.00	0.83
156.3000	6	37.74	29.29	5.94	0.85
156.6500	13	37.76	29.16	5.97	0.82
156.8000	16	37.78		6.00	
157.4250	88	37.78	29.30	6.00	0.85
161.6000	2020	37.78	29.17	6.00	0.83

Note: Channel 16 "Distress" is not intended to operate at Low Power

80.211(f)(3) – 250 % of the Authorized Bandwidth may not exceed $43 + 10 \log(\text{Mean Power in Watts})$. The Mean Power Output was found equal to Peak in all test cases.

Result: Mean Power was found equal to Peak power at all test frequencies.

Part 2.1033 (c)(8) DC Input into Final Amplifier

FOR LOW POWER SETTING INPUT POWER: (7.4 V) (1.03 A) = **7.622 Watts**

FOR HIGH POWER SETTING INPUT POWER: (7.4 V) (1.51 A) = **11.174 Watts**

Result: Meets Requirements

MODULATION CHARACTERISTICS OF 16K0G3E

FCC Rule Parts: Part 2.1033(c)(4), 80.205(a), 80.205(b)(1), 80.207(a)

Compliance with 80.207(a)

Types of stations	Classes of emission
Ship Stations ¹	
Radiotelegraphy:	
156-162 MHz ²	F1B, F2B, F2C, F3C, F1D, F2D.
DSC	G2B.
Radiotelephony:	
27.5-470 MHz ⁶	G3D, G3E.

80.205(a) – Authorized Bandwidth

Class of emission	Emission designator	Authorized bandwidth (kHz)
G3E ⁸	16K0G3E	20.0

Note 8 – Not applicable to deviations below 5 kHz.

80.205(b)(1) – Maximum Authorized Frequency Deviation

(b) For land stations the maximum authorized frequency deviation for F3E or G3E emission is as follows:

(1) 5 kHz in the 72.0-73.0 MHz, 75.4-76.0 MHz and 156-162 MHz bands;

16K0G3E (Voice) Bandwidth Calculation

$$B_n = 2M + 2DK$$

$$B_n = 2(3000 \text{ Hz}) + 2(5 \text{ kHz})(1) = \mathbf{16.0 \text{ kHz}}$$

Where:

M = 3000 (Highest Modulation Frequency, Hz)

D = 5 kHz (Peak Deviation, kHz)

K = 1 (FM Constant)

RESULT: 80.205(a) AUTHORIZED BANDWIDTH for 16K0G3E = 20.00 kHz

AUDIO FREQUENCY RESPONSE & LOW PASS FILTER RESPONSE

FCC Rule Parts: FCC Part 2.1047(a)

Test Requirements: A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 – 5000Hz shall be submitted.

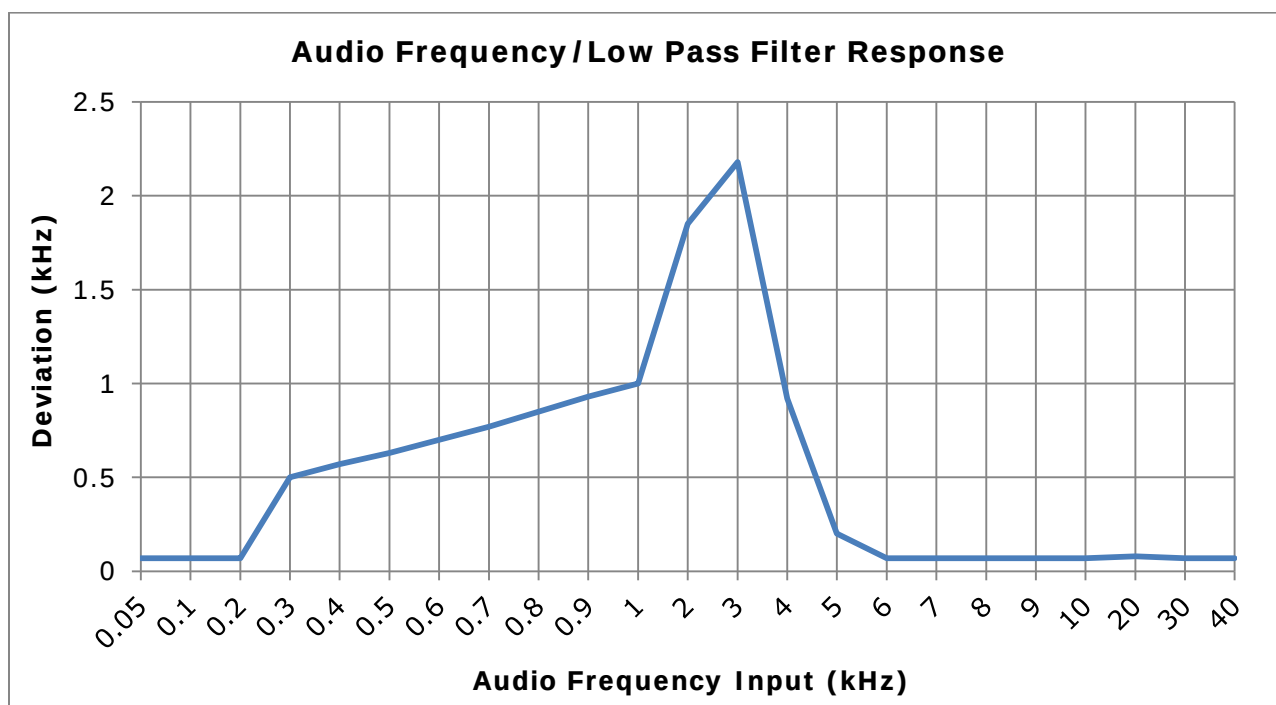
Method of Measurement: ANSI/TIA-603-E

FCC Rule Parts: 2.1047(a)

Test Requirements: For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter or of all the circuitry installed between the modulation limiter and the modulated stage shall be submitted.

Method of Measurement: ANSI/TIA-603-E

Test Data: Audio Frequency & Low Pass Filter Response



Frequency of Maximum Response: 3 kHz

RESULT: Meets Requirements

AUDIO INPUT VERSUS MODULATION

FCC Rule Parts: FCC Part 2.1047(b), 80.213(a)

(a) Transmitters must meet the following modulation requirements:

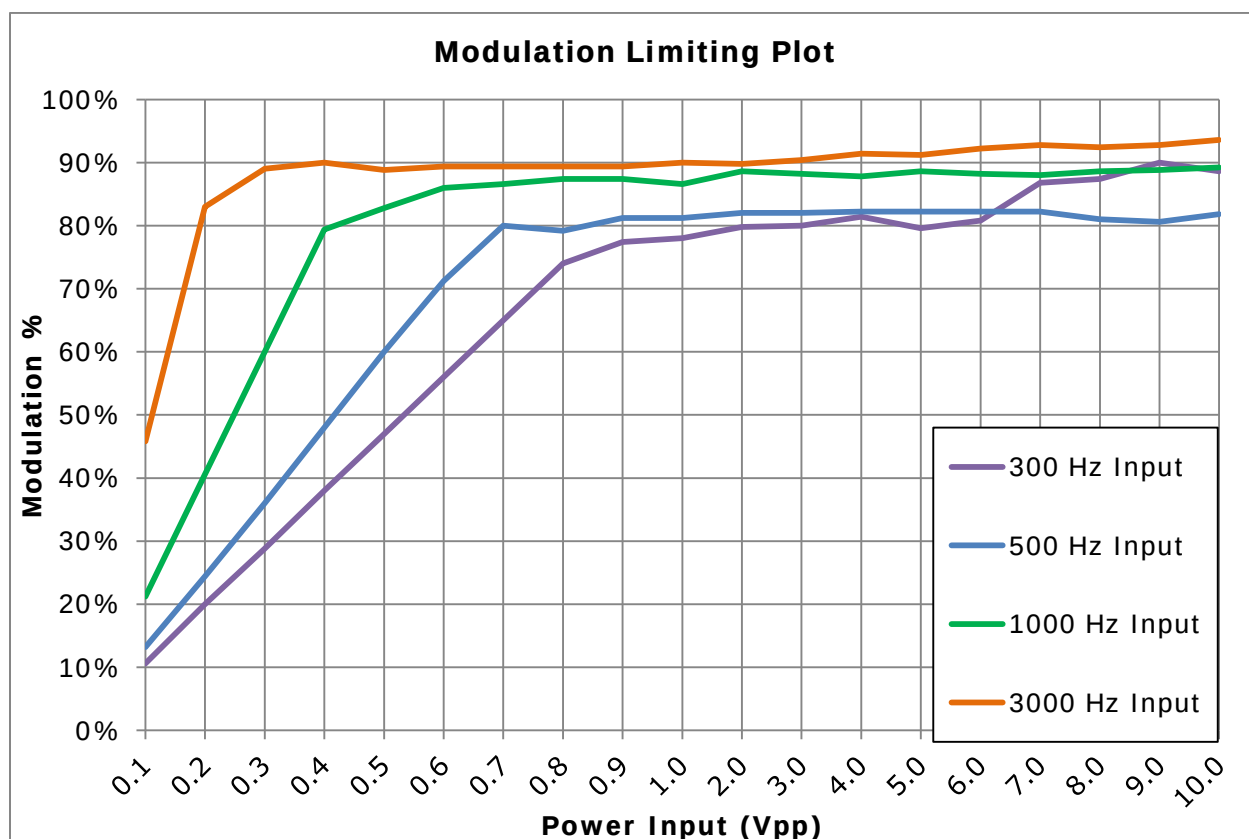
(2) When phase or frequency modulation is used in the 156-162 MHz band the peak modulation must be maintained between 75 and 100 percent. A frequency deviation of ± 5 kHz is defined as 100 percent peak modulation; and

(b) Radiotelephone transmitters using A3E, F3E and G3E emission must have a modulation limiter to prevent any modulation over 100 percent. This requirement does not apply to survival craft transmitters, to transmitters that do not require a license or to transmitters whose output power does not exceed 3 watts.

(d) Ship and coast station transmitters operating in the 156-162 MHz and 216-220 bands must be capable of proper operation with a frequency deviation that does not exceed ± 5 kHz when using any emission authorized by §80.207.

Method of Measurement: ANSI/TIA-603-E

Test data: Modulation Limiting Plot



Note: 100% Modulation is defined as 5 kHz

Frequency of Maximum Response: 3 kHz

RESULT: Meets Requirements

OCCUPIED BANDWIDTH

FCC Rule Parts: 2.1049 (c), 80.211(f)(1)(2)

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

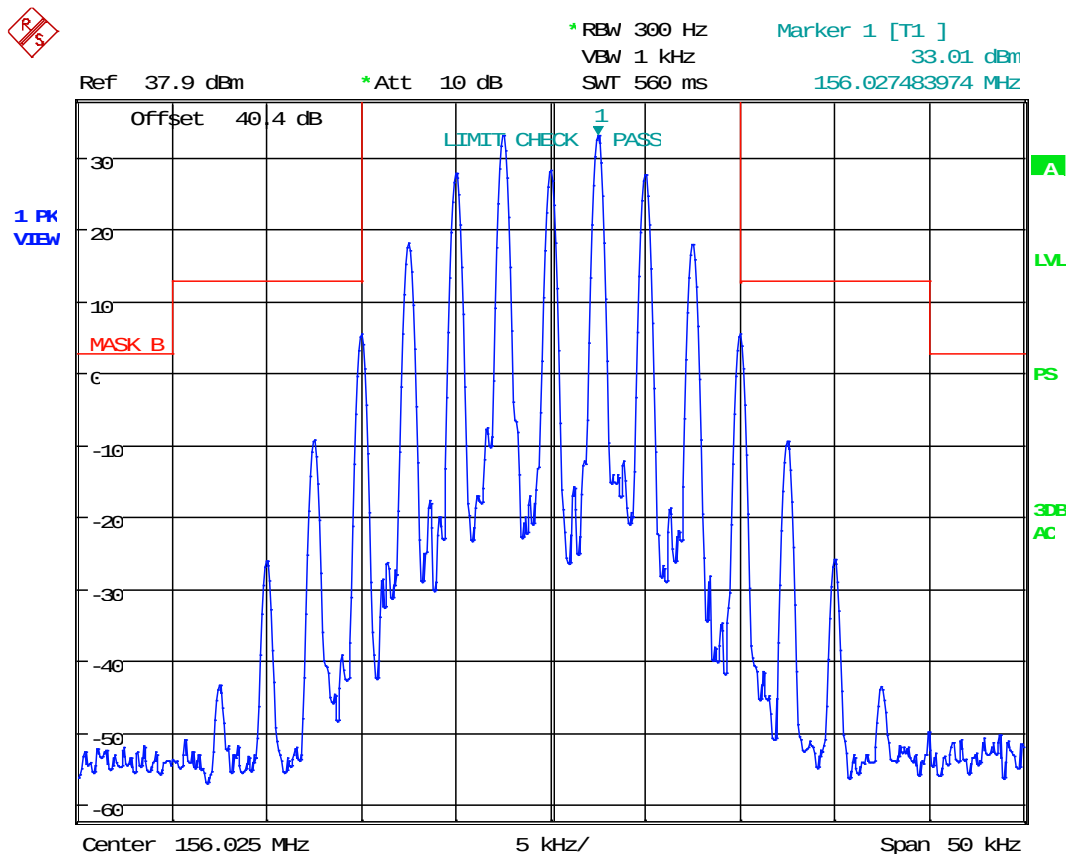
(1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;

(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

Note: The emission mask specified is identical to FCC Pt. 90.210(b), or "Mask B" in plot data.

Method of Measurement: ANSI/TIA-603-E

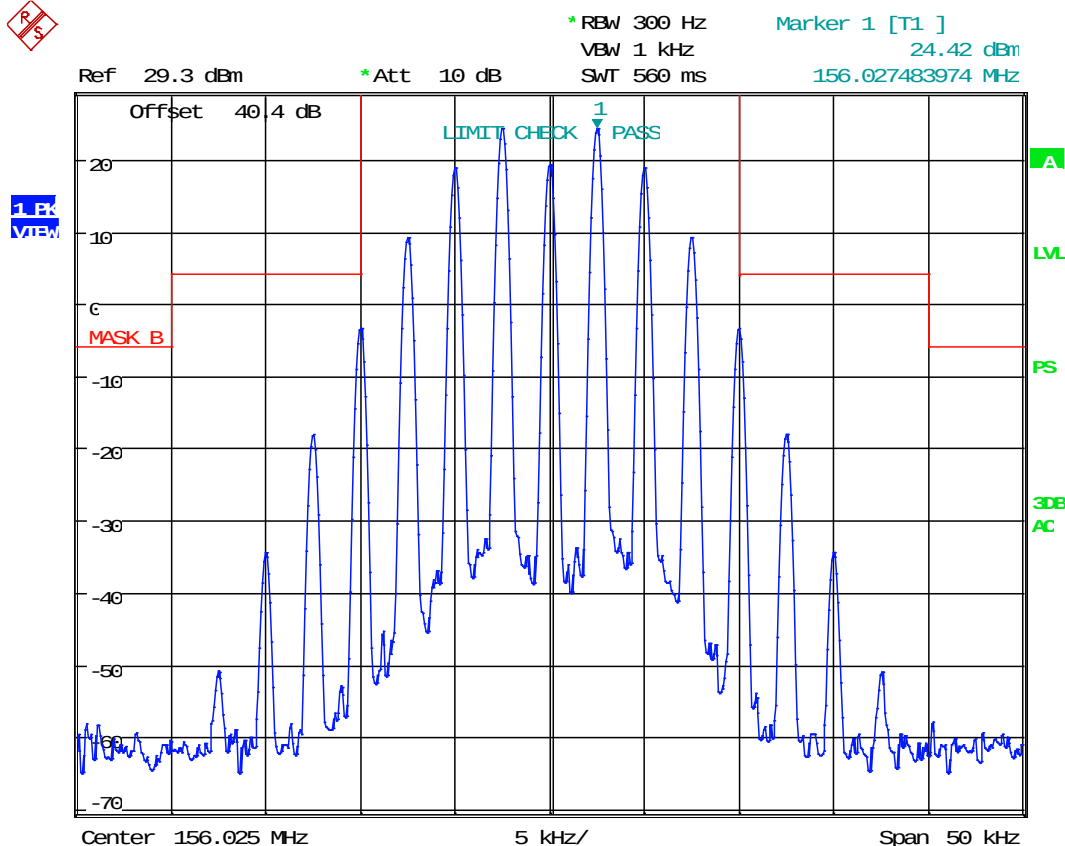
Test Data: 16K0G3E (Voice) – Low End of Band 156.025 MHz, High Power



Date: 1.FEB.2018 12:55:18

OCCUPIED BANDWIDTH

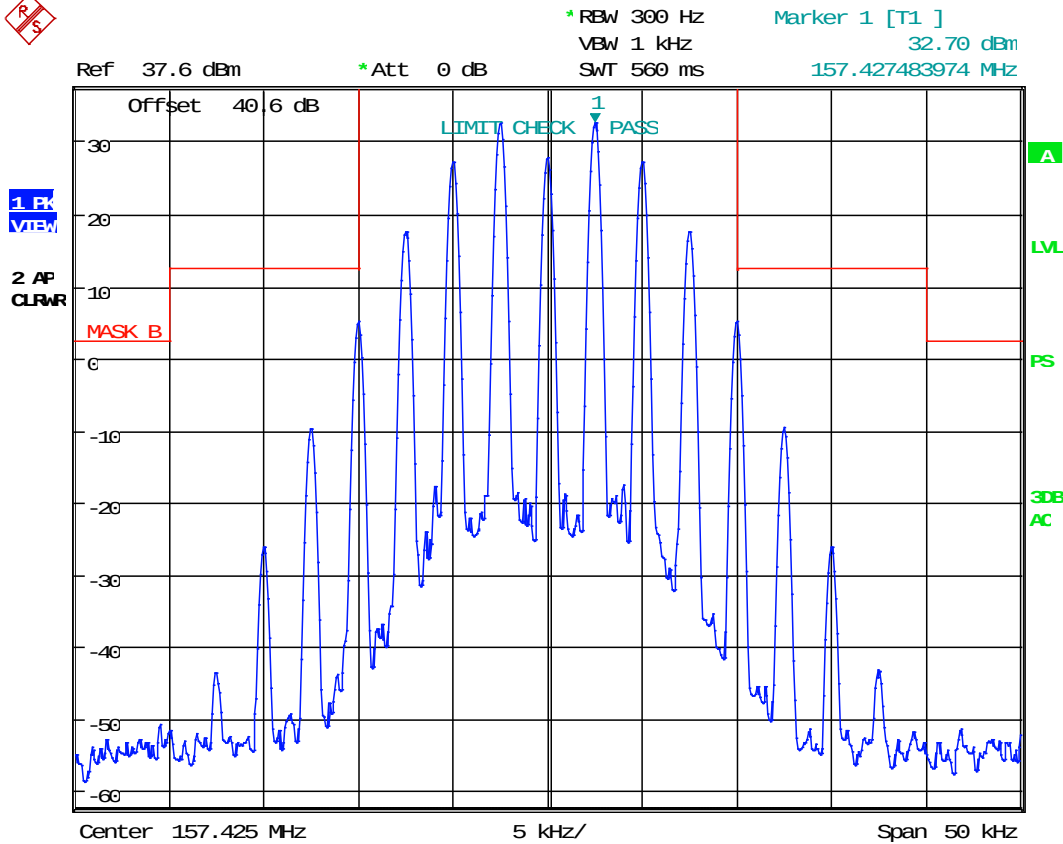
Test Data: 16K0G3E (Voice) – Low End of Band 156.025 MHz, Low Power



Date: 1.FEB.2018 12:58:41

OCCUPIED BANDWIDTH

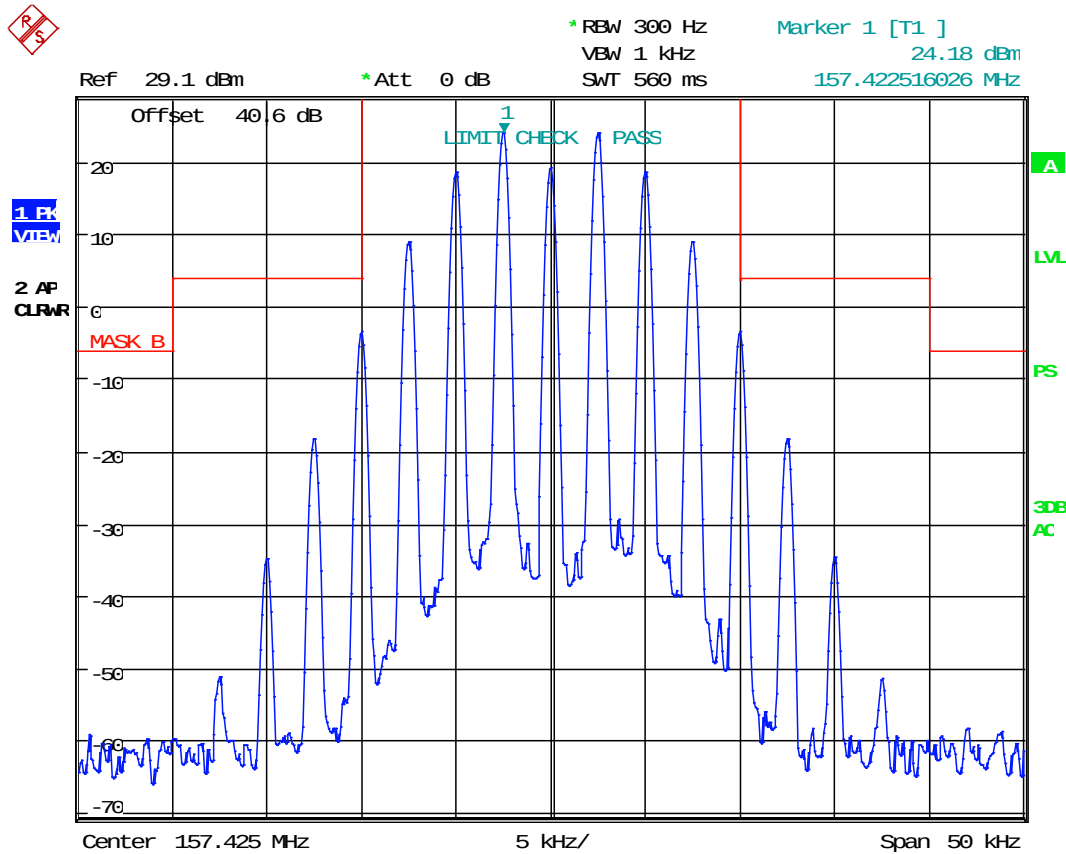
Test Data: 16K0G3E (Voice) – Middle of Band 157.425 MHz, High Power



Date: 31.JAN.2018 11:55:56

OCCUPIED BANDWIDTH

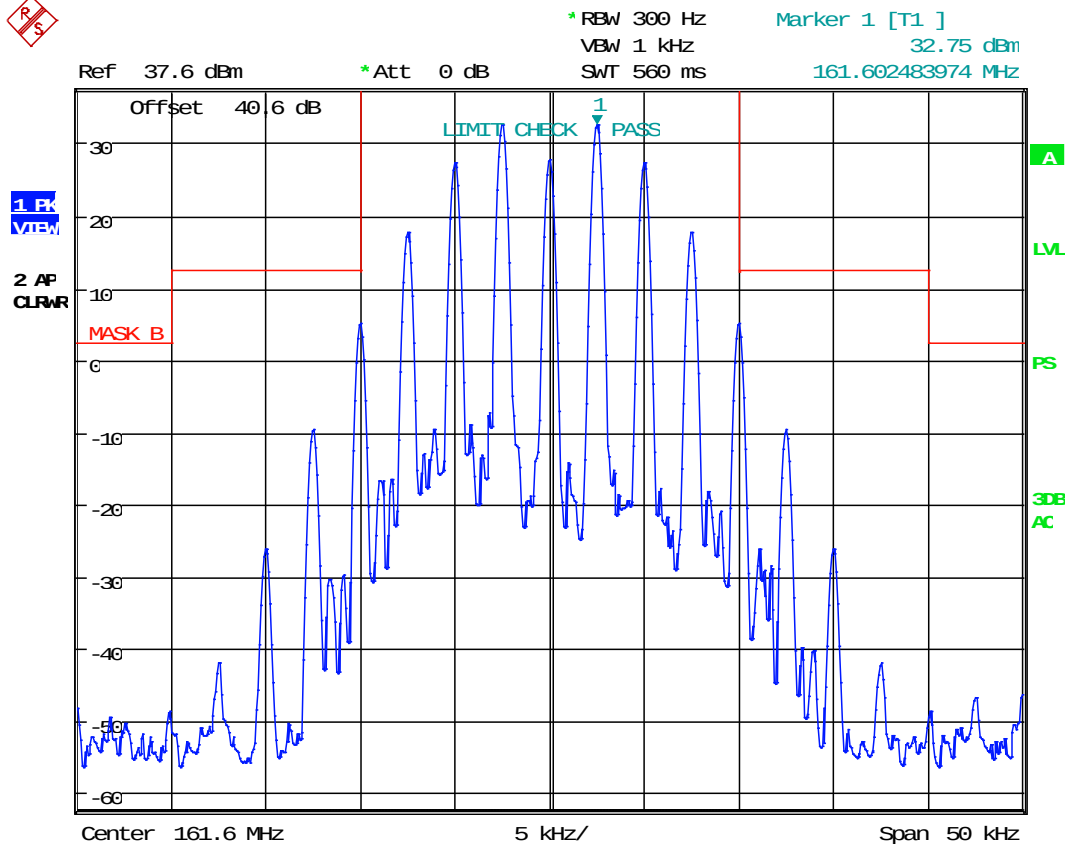
Test Data: 16K0G3E (Voice) – Middle of Band 157.425 MHz, Low Power



Date: 31.JAN.2018 11:57:20

OCCUPIED BANDWIDTH

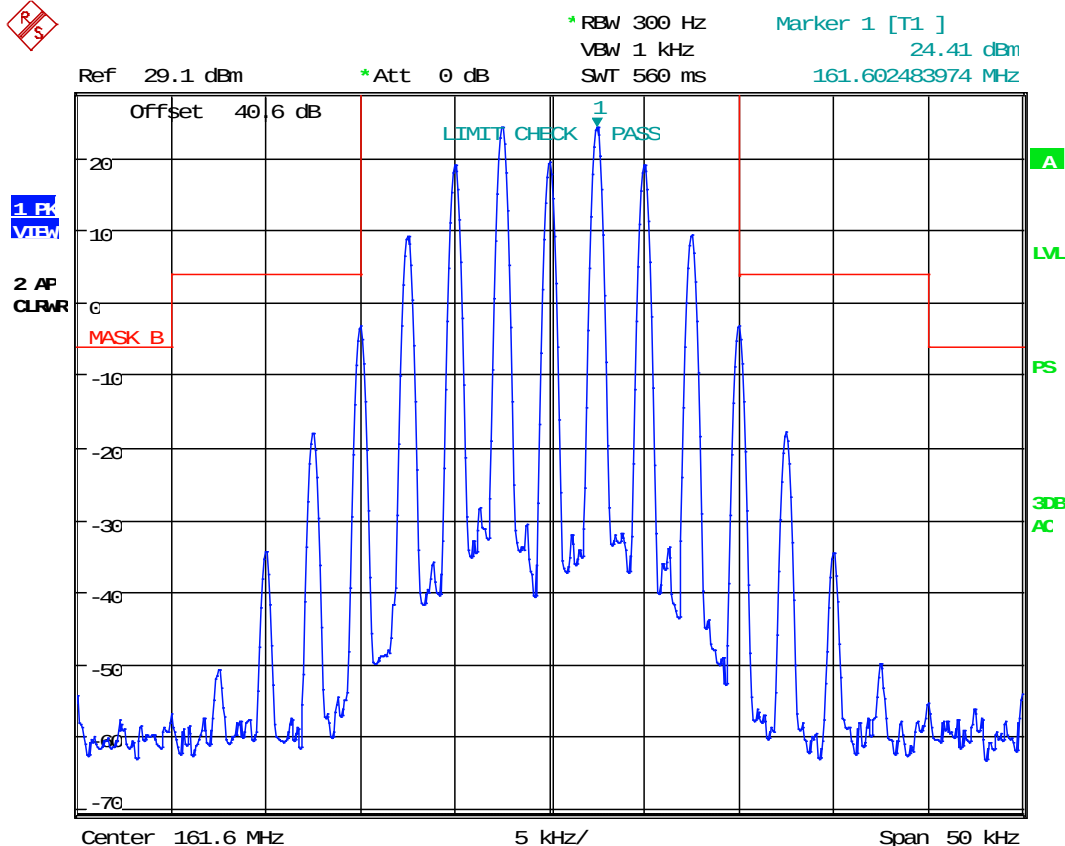
Test Data: 16K0G3E (Voice) – High End of Band 161.60 MHz, High Power



Date: 31.JAN.2018 11:52:45

OCCUPIED BANDWIDTH

Test Data: 16K0G3E (Voice) – High End of Band 161.60 MHz, Low Power



Date: 31.JAN.2018 12:00:10

Result: Meets Requirements

SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

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

Requirements: (3) On any frequency removed from the assigned frequency by more than 250% of the authorized bandwidth: At least $43 + 10 \log$ (Mean Power in Watts) dB

Method of Measurement: ANSI/TIA-603-E

Test Data: 16K0G3E (Voice) – Low End of Band 156.025 MHz

	(dBm)	(Watts)	Limit (dBc)
Mean High Power (dBm)	37.78	6.00	50.78
Mean Low Power (dBm)	29.19	0.83	42.19

			High Power	
Frequency			Peak (dBm)	Margin (dB)
(fundamental)		156.025	0.00	0.00
2nd Harmonic		312.050	-45.00	32.00
3rd Harmonic		468.075	-45.74	32.74
4th Harmonic		624.100	-66.96	53.96
5th Harmonic		780.125	-57.35	44.35
6th Harmonic		936.150	-63.82	50.82
7th Harmonic		1092.175	-63.48	50.48
8th Harmonic		1248.200	-65.14	52.14
9th Harmonic		1404.225	-65.36	52.36
10th Harmonic		1560.250	-59.23	46.23

Low Power	
Peak (dBm)	Margin (dB)
8.59	0.00
-38.05	25.05
-59.13	46.13
-58.77	45.77
-59.05	46.05
-62.49	49.49
-64.67	51.67
-61.81	48.81
-64.99	51.99
-64.49	51.49

* Indicates Noise Floor of Measurement

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Data: 16K0G3E (Voice) – Middle of Band 157.425 MHz

	(dBm)	(Watts)	Limit (dBc)
Mean High Power (dBm)	37.78	6.00	50.78
Mean Low Power (dBm)	29.3	0.85	42.3

			High Power		Low Power	
Frequency			Peak (dBm)	Margin (dB)	Peak (dBm)	Margin (dB)
(fundamental)		157.425	0.00	0.00	8.48	0.00
2nd Harmonic		314.850	-46.70	33.70	-40.35	27.35
3rd Harmonic		472.275	-46.29	33.29	-59.71	46.71
4th Harmonic		629.700	-67.25	54.25	-61.55	48.55
5th Harmonic		787.125	-59.69	46.69	-60.98	47.98
6th Harmonic		944.550	-65.17	52.17	-62.51	49.51
7th Harmonic		1101.975	-62.24	49.24	-63.61	50.61
8th Harmonic		1259.400	-63.15	50.15	-60.86	47.86
9th Harmonic		1416.825	-61.30	48.30	-62.98	49.98
10th Harmonic		1574.250	-58.94	45.94	-60.92	47.92

* Indicates Noise Floor of Measurement

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Data: 16K0G3E (Voice) – High End of Band 161.60 MHz (International)

	(dBm)	(Watts)	Limit (dBc)
Mean High Power (dBm)	37.78	6.00	50.78
Mean Low Power (dBm)	29.17	0.83	42.17

			High Power		Low Power	
Frequency			Peak (dBm)	Margin (dB)	Peak (dBm)	Margin (dB)
(fundamental)		161.600	0.00	0.00	0.00	0.00
2nd Harmonic		323.200	-56.90	43.90	-44.45	31.45
3rd Harmonic		484.800	-50.89	37.89	-63.74	50.74
4th Harmonic		646.400	-63.13	50.13	-66.96	53.96
5th Harmonic		808.000	-59.21	46.21	-68.10	55.10
6th Harmonic		969.600	-65.35	52.35	-69.38	56.38
7th Harmonic		1131.200	-60.38	47.38	-71.82	58.82
8th Harmonic		1292.800	-64.21	51.21	-70.50	57.50
9th Harmonic		1454.400	-62.18	49.18	-73.79	60.79
10th Harmonic		1616.000	-57.51	44.51	-68.87	55.87

* Indicates Noise Floor of Measurement

Worst-Case Emission Findings:

16K0G3E (Voice) – Low End of Band 156.025 MHz, Low Power

Result: Meets Requirements

FIELD STRENGTH OF SPURIOUS EMISSIONS

FCC Rule Parts: FCC Part 2.1053(a), 80.211(f)(3)

(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.

Method of Measurement: ANSI/TIA-603-E

Note: The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from 9 KHz MHz to at least the tenth harmonic of the fundamental. This test was conducted in accordance with the standard listed above 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. The measurements below represent the worst case of all the frequencies tested.

Note: The six (6) highest emissions or more of each worst-case settings of 16K0G3E (Voice) are represented below. Emissions below 20 dB below the limit are not required to be reported.

FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Data: 16K0G3E (Voice) – Low End of Band 156.025 MHz, High Power

Power Output		Limit		
dBm	Watts	dBc	dBm	
37.78	6.00	50.78	-13.00	
156.025 MHz, Low Power				
Emission Frequency (MHz)	Antenna Polarity	ERP (dBm)	Limit (dBm)	Margin (dB)
312.05	V	-43.27	-13.00	30.27
1560.25	H	-44.48	-13.00	31.48
1404.22	H	-46.01	-13.00	33.01
1248.20	H	-46.70	-13.00	33.70
1092.18	V	-47.44	-13.00	34.44
468.08	H	-50.32	-13.00	37.32
624.10	V	-53.28	-13.00	40.28
780.13	V	-55.04	-13.00	42.04
936.15	V	-57.48	-13.00	44.48
53.16	V	-58.43	-13.00	45.43

Test Data: 16K0G3E (Voice) – Low End of Band 156.025 MHz, Low Power

Power Output		Limit		
dBm	Watts	dBc	dBm	
29.19	0.83	42.19	-13.00	
156.025 MHz, Low Power				
Emission Frequency (MHz)	Antenna Polarity	ERP (dBm)	Limit (dBm)	Margin (dB)
1560.25	V	-43.54	-13.00	30.54
1404.22	V	-44.16	-13.00	31.16
468.08	V	-44.40	-13.00	31.40
1248.20	V	-45.39	-13.00	32.39
1092.18	V	-45.74	-13.00	32.74
312.05	V	-48.60	-13.00	35.60
780.13	V	-55.37	-13.00	42.37
624.10	H	-56.19	-13.00	43.19
936.15	V	-57.10	-13.00	44.10
92.39	V	-59.69	-13.00	46.69

FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Data: 16K0G3E (Voice) – Middle of Band 157.425 MHz, High Power

Power Output		Limit		
dBm	Watts	dBc	dBm	
37.78	6.00	50.78	-13.00	
157.425 MHz, High Power				
Emission Frequency (MHz)	Antenna Polarity	ERP (dBm)	Limit (dBm)	Margin (dB)
0.15	H	-38.14	-13.00	25.14
314.85	H	-43.70	-13.00	30.70
472.27	V	-49.25	-13.00	36.25
0.14	H	-49.45	-13.00	36.45
472.27	H	-50.26	-13.00	37.26
314.85	V	-50.63	-13.00	37.63
1574.25	V	-53.99	-13.00	40.99
1259.40	V	-54.27	-13.00	41.27
1416.82	H	-54.36	-13.00	41.36
1416.82	V	-54.45	-13.00	41.45

Test Data: 16K0G3E (Voice) – Middle of Band 157.425 MHz, Low Power

Power Output		Limit		
dBm	Watts	dBc	dBm	
29.3	0.85	42.3	-13.00	
157.425 MHz, Low Power				
Emission Frequency (MHz)	Antenna Polarity	ERP (dBm)	Limit (dBm)	Margin (dB)
0.15	H	-39.19	-13.00	26.19
314.85	H	-39.87	-13.00	26.87
314.85	V	-47.37	-13.00	34.37
0.13	H	-47.94	-13.00	34.94
629.70	H	-50.35	-13.00	37.35
1574.25	V	-53.17	-13.00	40.17
1416.82	V	-53.82	-13.00	40.82
1574.25	H	-54.37	-13.00	41.37
1416.82	H	-54.50	-13.00	41.50
1259.40	V	-54.64	-13.00	41.64

FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Data: 16K0G3E (Voice) – High End of Band 161.60 MHz, High Power

Power Output		Limit		
dBm	Watts	dBc	dBm	
37.78	6.00	50.78	-13.00	
161.600 MHz, High Power				
Emission Frequency (MHz)	Antenna Polarity	ERP (dBm)	Limit (dBm)	Margin (dB)
323.20	H	-46.59	-13.00	33.59
484.80	V	-49.43	-13.00	36.43
1454.40	V	-53.02	-13.00	40.02
1616.00	V	-53.16	-13.00	40.16
1616.00	H	-53.24	-13.00	40.24
1292.80	V	-53.51	-13.00	40.51
646.40	H	-53.53	-13.00	40.53
1292.80	H	-53.70	-13.00	40.70
1454.40	H	-54.44	-13.00	41.44
484.81	H	-55.08	-13.00	42.08

Test Data: 16K0G3E (Voice) – High End of Band 161.60 MHz, Low Power

Power Output		Limit		
dBm	Watts	dBc	dBm	
29.17	0.83	42.17	-13.00	
161.600 MHz, Low Power				
Emission Frequency (MHz)	Antenna Polarity	ERP (dBm)	Limit (dBm)	Margin (dB)
843.59	H	-41.91	-13.00	28.91
843.59	V	-46.77	-13.00	33.77
323.20	H	-50.13	-13.00	37.13
1616.00	H	-52.40	-13.00	39.40
1616.00	V	-53.31	-13.00	40.31
1454.40	H	-53.50	-13.00	40.50
1454.40	V	-53.66	-13.00	40.66
848.72	V	-53.81	-13.00	40.81
323.20	V	-54.02	-13.00	41.02

RESULT: Meets Requirements

FREQUENCY STABILITY

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

Requirements: The frequency stability must remain within 10 ppm from -20 C to +50 C.

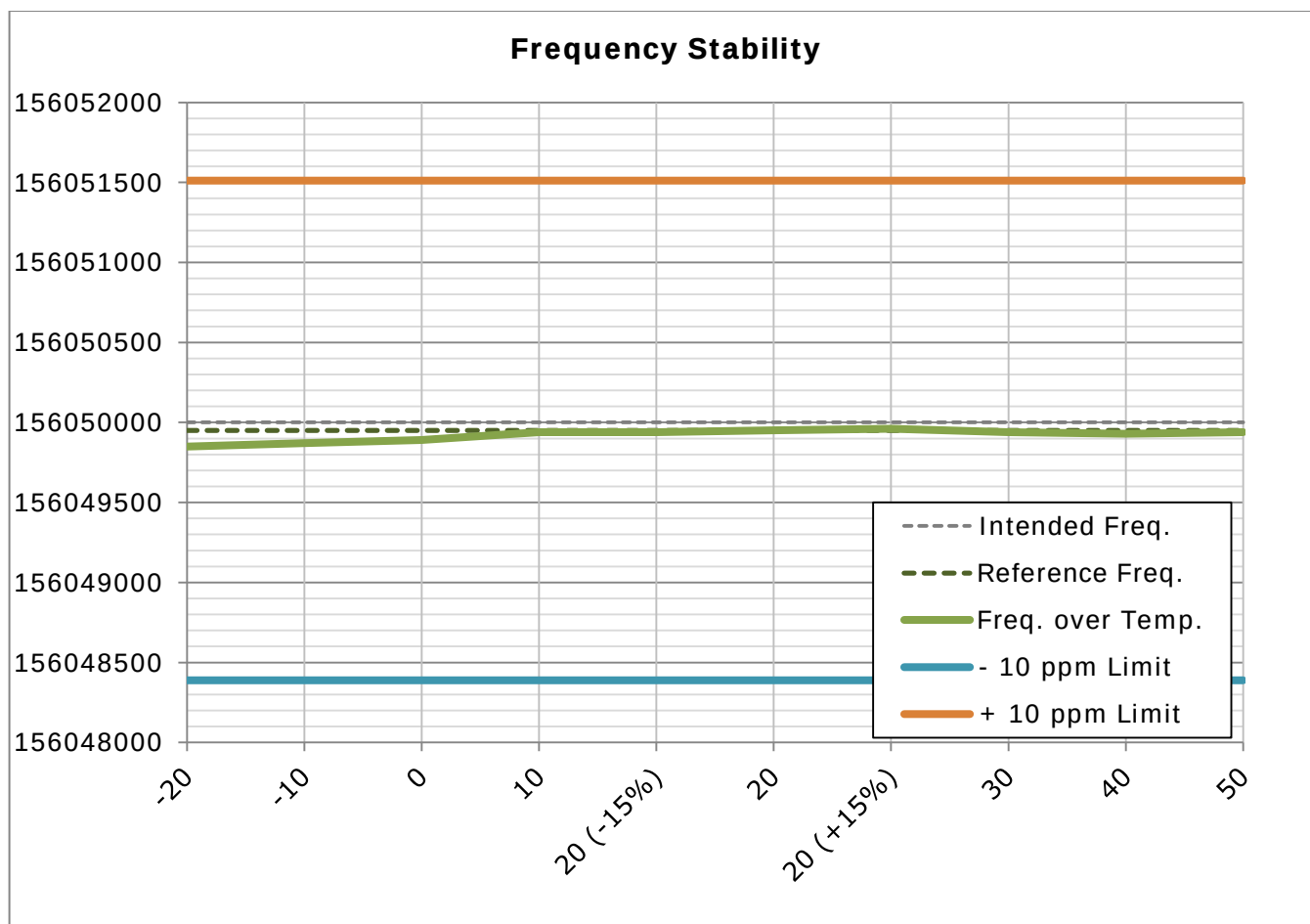
Compliance with 80.209(a)

Frequency bands and categories of stations	Tolerances ¹
(5) Band 156-162 MHz:	
(ii) Ship stations	10. ⁴

⁴For transmitters in the radiolocation and associated telecommand service operating on 154.584 MHz, 159.480 MHz, 160.725 MHz and 160.785 MHz the frequency tolerance is 15 parts in 10⁶.

Method of Measurements: ANSI/TIA 603-E

Test Data: Frequency Error Measurement Plot



FREQUENCY STABILITY

Test Data: Frequency Error Measurement Table

156.0250 MHz, CH 1, High Power				
Limit:		10	ppm	
Temperature (°C)	Supplied Voltage (VDC)	Intended Frequency (Hz)	Measured Reference Frequency (Hz)	Deviation (Hz)
20°C (reference)	7.4	156050000	156049950	50

@ 20°C (reference)				
Supplied Voltage (%)	Supplied Voltage (VDC)	Frequency (Hz)	Deviation (Hz)	PPM
-15%	6.29	156049940	10	0.064
15%	8.51	156049960	-10	-0.064

Temperature (°C)	Supplied Voltage (VDC)	Frequency (Hz)	Deviation (Hz)	PPM
50	7.4	156049940	10	0.064
40	7.4	156049930	20	0.128
30	7.4	156049940	10	0.064
20	7.4	156049950	0	0.000
10	7.4	156049940	10	0.064
0	7.4	156049890	60	0.384
-10	7.4	156049870	80	0.513
-20	7.4	156049850	100	0.641

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 valid up to 40GHz	± 1.86 dB	
Occupied Bandwidth	± 2.65 %	
Audio Frequency Response	± 1.86 dB	
Modulation limiting	± 1.88 %	
Radiated RF Power	± 1.4 dB	
Maximum frequency deviation: Within 300 Hz and 6kHz of audio freq.	± 1.88 %	
Within 6kHz and 25kHz of audio Freq.	± 2.04 %	
Rad Emissions Sub Meth up to 26.5GHz	± 2.14 dB	
Adjacent channel power	± 1.47 dB	(1)
Transient Frequency Response	± 1.88 %	
Temperature	± 1.0 °C	(1)
Humidity	± 5.0 %	

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
Coaxial Cable - BMBM-0065-01 Black DC-2G	Belden		BMBM-0065-01	07/18/16	07/18/18
Antenna: Biconical 1096	Eaton	94455-1	1096	08/01/17	08/01/19
Antenna: Log-Periodic 1122	Electro-Metrics	LPA-25	1122	07/26/17	07/26/19
Temperature Chamber LARGE	Tenney Engineering	TTRC	11717-7	09/01/16	09/01/18
Frequency Counter Small Chamber	HP	5385A	3242A07460	08/22/17	08/22/19
Coaxial Cable - Chamber 3 cable set (backup)	Micro-Coax	Chamber 3 cable set (backup)	KMKM-0244-02 ; KMKM-0670-01; KFKF-0197-00	N/A	N/A
CHAMBER	Panashield	3M	N/A	04/25/16	1/31/18
Antenna: Double-Ridged Horn/ETS Horn 2	ETS-Lindgren	3117	00041534	03/01/17	03/01/19
Software: Field Strength Program	Timco	N/A	Version 4.10.7.0	N/A	N/A
Antenna: Passive Loop	EMCO	6512	9706-1211	07/26/17	07/26/19
Type K J Thermometer	Martel	303	080504494	11/02/17	11/02/19
EMI Test Receiver R & S ESIB 40	Rohde & Schwarz	ESIB 40	100274	08/18/16	08/18/18
EMI Test Receiver R & S ESU 40	Rohde & Schwarz	ESU 40	100320	04/01/16	04/01/18
Attenuator N 30dB 100W DC-6G	Pasternack	PE7214-30	#109	05/24/17	05/24/19
Attenuator BNC 10dB DC-2G	MiniCircuits	HAT-10+	#54	07/14/17	07/14/19
Bore-sight Antenna Positioning Tower	Sunol Sciences	TLT2	N/A	N/A	N/A
Tuneable Notch Filter 15-30 MHz	Eagle	TNF-200	250-850MHz	11/19/17	11/19/19

*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

END OF TEST REPORT