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## FCC PART 80 TEST REPORT

<b>APPLICANT</b>	UNIDEN AMERICA CORPORATION
	3001 GATEWAY DRIVE SUITE 130 IRVING, TEXAS 75063 USA
<b>FCC ID</b>	AMWUT655
<b>MODEL NUMBER</b>	VHF490
<b>PRODUCT DESCRIPTION</b>	FIXED MOUNTED VHF MARINE TRANSCEIVER
<b>DATE SAMPLE RECEIVED</b>	2/28/2017
<b>FINAL TEST DATE</b>	03/10/2017
<b>TESTED BY</b>	FRANKLIN ROSE
<b>APPROVED BY</b>	Cory Leverett
<b>TEST RESULTS</b>	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL

Report Number	Version Number	Description	Issue Date
332AUT17	Rev.1	Initial Issue	3/10/2017

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

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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 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: 03/10/2017**



**Reviewed and approved by:**

Name and Title: Cory Leverett, Engineer

**Date: 03/10/2017**

## GENERAL INFORMATION

### EUT Specification

<b>EUT Description</b>	FIXED MOUNTED VHF MARINE TRANSCEIVER
<b>FCC ID</b>	AMWUT655
<b>Model Number</b>	VHF490
<b>Operating Frequency</b>	Tx: 156-162 MHz, Rx: 156-163 MHz
<b>Test Frequencies</b>	156.025 MHz, 161.60 MHz
<b>Type of Emission</b>	16K0G3E (FM), 16K0G2B (DSC)
<b>Modulation</b>	FM
<b>EUT Power Source</b>	<input type="checkbox"/> 110–120Vac/50– 60Hz
	<input checked="" type="checkbox"/> DC Power 13.8V
	<input type="checkbox"/> Battery Operated Exclusively
<b>Test Item</b>	<input type="checkbox"/> Prototype
	<input checked="" type="checkbox"/> Pre-Production
	<input type="checkbox"/> Production
<b>Type of Equipment</b>	<input type="checkbox"/> Fixed
	<input checked="" type="checkbox"/> Mobile
	<input type="checkbox"/> Portable
<b>Antenna Connector</b>	UHF
<b>Test Conditions</b>	The temperature was 26°C Relative humidity of 50%.
<b>Modification to the EUT</b>	None
<b>Test Exercise</b>	The EUT was placed in continuous transmit mode.
<b>Applicable Standards</b>	ANSI/TIA 603-D: 2010, FCC CFR 47 Part 80
<b>Test Facility</b>	<b>Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA.</b>

## RESULTS SUMMARY

<b>Rule Part No.</b>	<b>Test Item</b>	<b>Results</b>
2.1046(a), 80.215(e)(1)	RF Power Output	<b>Pass</b>
2.1033(c) (4), 80.205(a), 80.207	Modulation Characteristics	<b>Pass</b>
2.1047(a) (b), 80.213(e)	Audio Frequency Response and Low Filter	<b>Pass</b>
2.1047(b) & 80.213 (a)(2) & (b)	Audio Input Vs Modulation	<b>Pass</b>
2.1049(c), 80.211 (f)(1)(2)	Occupied Bandwidth	<b>Pass</b>
2.1051(a), 80.211(f)(3)	Spurious Emissions at Antenna Terminals	<b>Pass</b>
2.1053, 80.211(f)(3)	Field Strength of Spurious Emissions	<b>Pass</b>
2.1055, Part 80.209(a)	Frequency Stability	<b>Pass</b>

## TECHNICAL DATA

- 80.203 (b) **External Controls:** The transmitter is capable of changing frequency between 156.025 – 161.60 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 Un-modulated transmission. The transmitter turned off and the radio went to receive mode at **5 minutes, 0 seconds** as displayed by the external digital clock.
- 80.203 (n) This radio complies with the requirement for DSC capability in the 156 – 162 MHz band and in accordance with 80.225.
- 80.873; 80.956 Transmitter G3E emission capability: The transmitter was connected to 50 ohm resistive wattmeter and the frequency was set to 156.025 and to 161.60 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 previous 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 156.025 and 161.60 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 156.025 and 161.60 MHz with a measured reading, shown later in this report under normal speech modulation.

## RF POWER OUTPUT

**Rule Part No.:** FCC Part 2.1046(a), 80.215(e)(1)

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

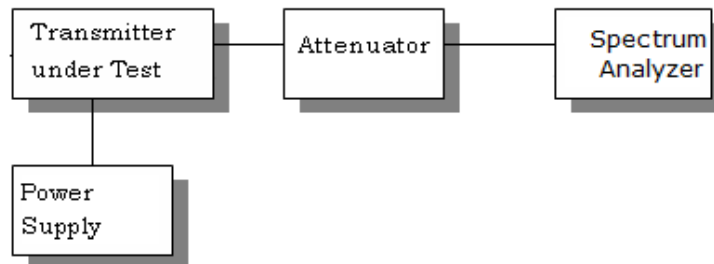
(1) Ship stations 156-162 MHz—25W<sup>6</sup> <sup>13</sup>

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

<sup>13</sup>The frequencies 156.775 and 156.825 MHz are available for navigation-related port operations or ship movement only, and all precautions must be taken to avoid harmful interference to channel 16. Transmitter output power is limited to 1 watt for ship stations, and 10 watts for coast stations.

**Method of Measurement:** ANSI/TIA-603

**Test Setup Diagram:**



**Test Data:** Measurement Table

Tuned Freq. MHz	Measured Output Power			
	dBm		Watts	
	High	Low	High	Low
156.0250	43.99	28.89	25.06	0.77
161.6000	43.59	28.63	22.86	0.73
156.525 (DSC)	43.17	31.49	20.75	1.41

### Part 2.1033 (C) (8) DC Input into the final amplifier

FOR LOW POWER SETTING INPUT POWER: (13.8V) (1.1A) = 15.18 Watts

FOR HIGH POWER SETTING INPUT POWER: (13.8V) (4.5A) = 62.1 Watts

## MODULATION CHARACTERISTICS

**Rule Part No.:** Part 2.1033(c) (4), 80.205(a), 80.207

80.205(a) ALLOWED AUTHORIZED BANDWIDTH – 20.00 kHz

**Test Data:** **16K0G3E Necessary Bandwidth Calculation**

$$B_n = 2M + 2DK$$

$$M = 3000$$

$$D = 5 \text{ kHz (Peak Deviation)}$$


$$K = 1$$

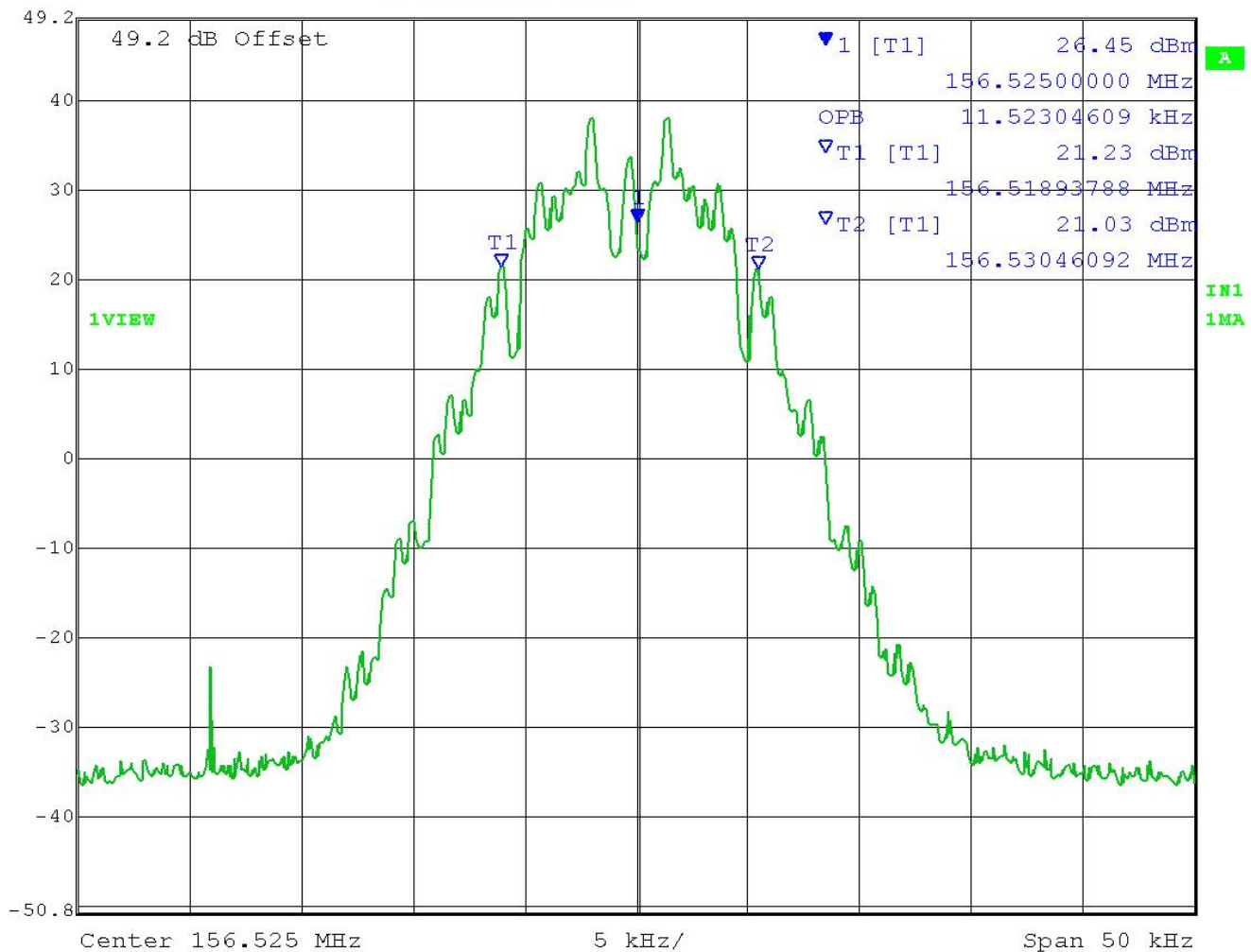
$$B_n = 2(3000) + 2(5K) (1) = 16.0K$$



### Test Data: 16K0G2B Necessary Bandwidth Measurement

The 99 % bandwidth for the DSC is 11.52 kHz. The necessary bandwidth is reported as 16K0G2B

	Marker 1 [T1]	RBW	300 Hz	RF Att	30 dB
	Ref Lvl	26.45 dBm	VBW	3 kHz	
	49.2 dBm	156.52500000 MHz	SWT	2.8 s	Unit dBm



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## AUDIO INPUT VERSUS MODULATION

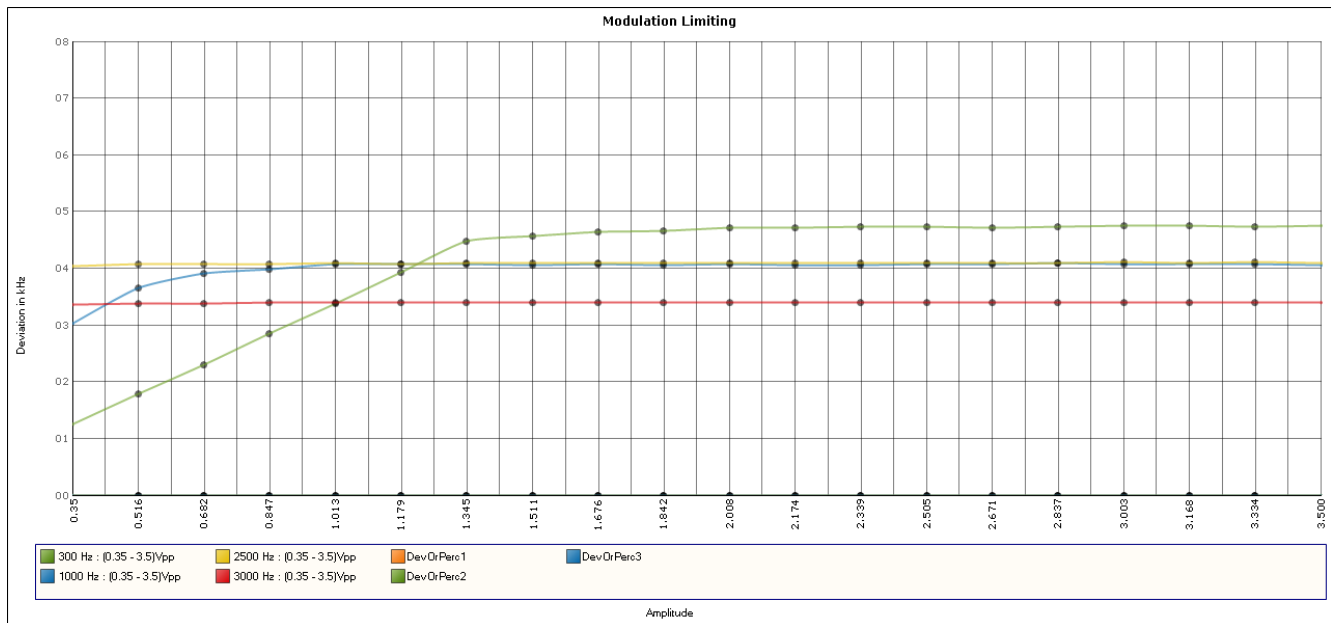
**Rule Part No.:** FCC Part 2.1047(b) & 80.213 (a)(2) & (b)

**Test Requirements:** The peak modulation must be maintained between 75 and 100 percent. A frequency deviation of  $\pm 5$  kHz is defined as 100 percent peak modulation.

Radiotelephone transmitters using A3E, F3E and G3E emission must have a modulation limiter to prevent any modulation over 100 percent.

**Method of Measurement:** ANSI/TIA-603

**Test data:** Measurement Plot



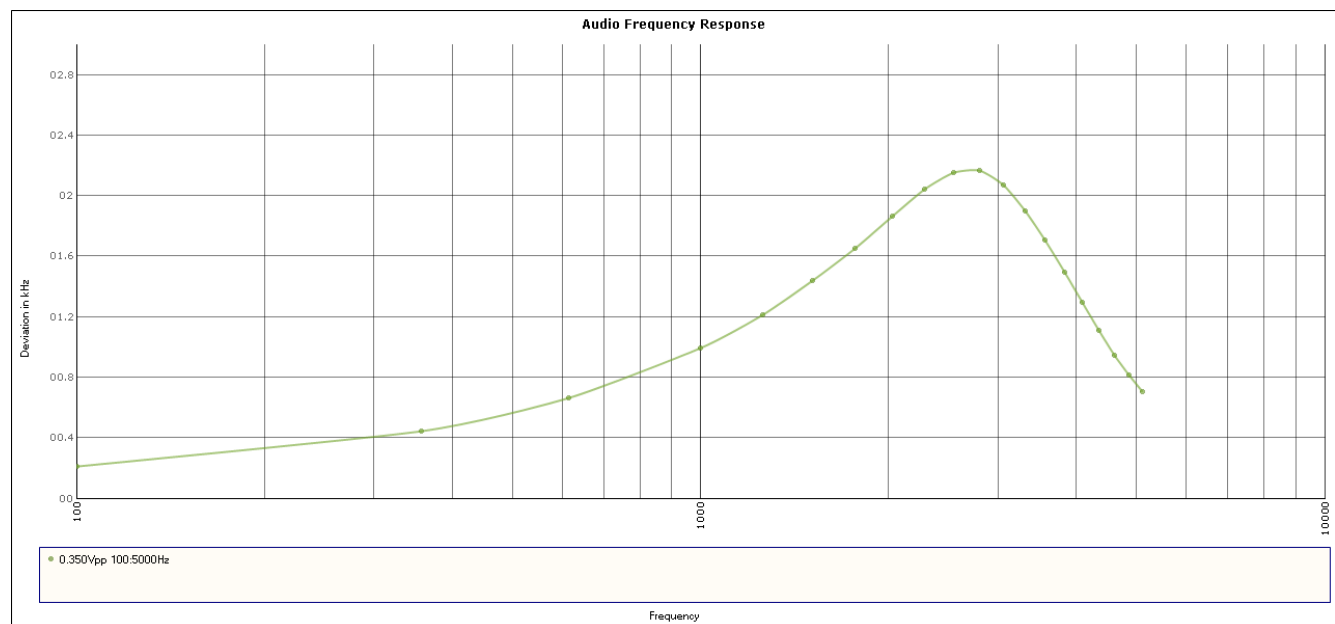
## AUDIO FREQUENCY RESPONSE

**Rule Part No.:** FCC Part 2.1047(a) (b)

**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

**Test Data:** Measurement Plot



## AUDIO LOW PASS FILTER

Rule Part No.: 2.1047(a), 80.213(e)

**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.

Coast station transmitters operated in the 156-162 MHz band must be equipped with an audio low-pass filter. The filter must be installed between the modulation limiter and the modulated radio frequency stage. At frequencies between 3 kHz and 20 kHz it must have an attenuation greater than at 1 kHz by at least  $60\log_{10}(f/3)$  dB where "f" is the audio frequency in kilohertz. At frequencies above 20 kHz the attenuation must be at least 50 dB greater than at 1 kHz.

**Method of Measurement:** ANSI/TIA-603

**Test Data:** Measurement Table

Audio Frequency (KHz)	Output Level (dB)	Att. Level (dB)	Output Limit (dB)	Margin (dB)
1	14.67	0 dB Reference		
3	9.35	5.32	0.0	5.3
4	-8.75	23.42	7.5	15.9
5	-28.23	42.90	13.3	29.6
6	-35.80	50.47	18.1	32.4
7	-36.28	50.95	22.1	28.9
8	-36.07	50.74	25.6	25.2
9	-36.20	50.87	28.6	22.2
12	-36.20	50.87	36.1	14.7
15	-36.20	50.87	41.9	8.9
20	-36.40	51.07	49.4	1.6
25	-36.50	51.17	50.0	1.2
30	-36.80	51.47	50.0	1.5
<b>Limit</b>	<b>Freq &gt; 3 KHz to &lt; 20 KHz <math>60 \log_{10} (f/3)</math> dB</b> <b>Freq &gt; 20 KHz 50 dB greater than the att. at 1 kHz.</b>			

**Results meet requirements**

## OCCUPIED BANDWIDTH

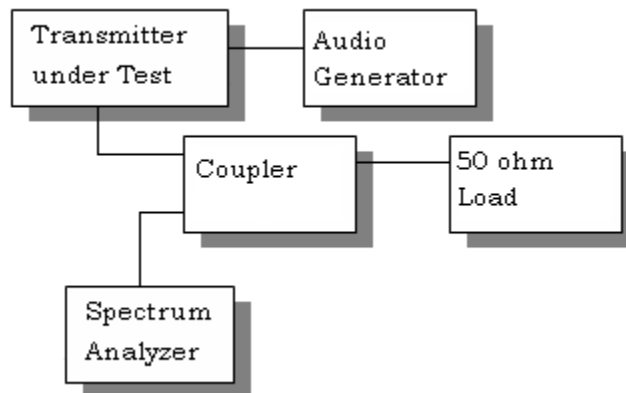
**Rule Part No.:** 2.1049(c), 80.211 (f)(1)(2)(3)

- Requirements:**
- (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
  - (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

**Test Setup Diagram:**


### OCCUPIED BANDWIDTH MEASUREMENT

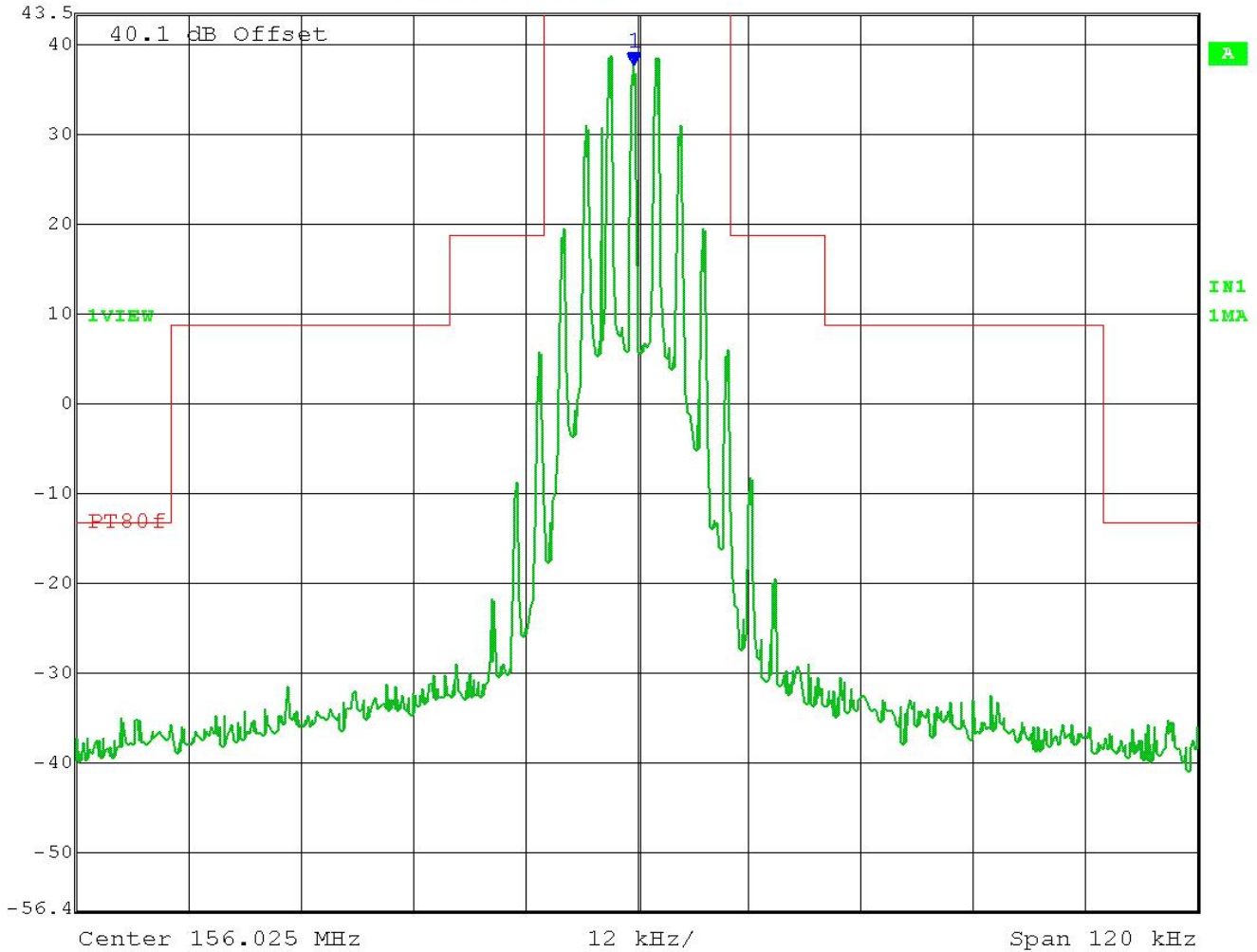


**Test Data:** See the following plots:

# OCCUPIED BANDWIDTH

Test Data: 16KOG3E Low end of band high power plot

	Ref Lvl	Marker 1 [T1]	RBW	300 Hz	RF Att	30 dB
	43.5 dBm	37.78 dBm	VBW	3 kHz		
		156.02462425 MHz	SWT	6.8 s	Unit	dBm




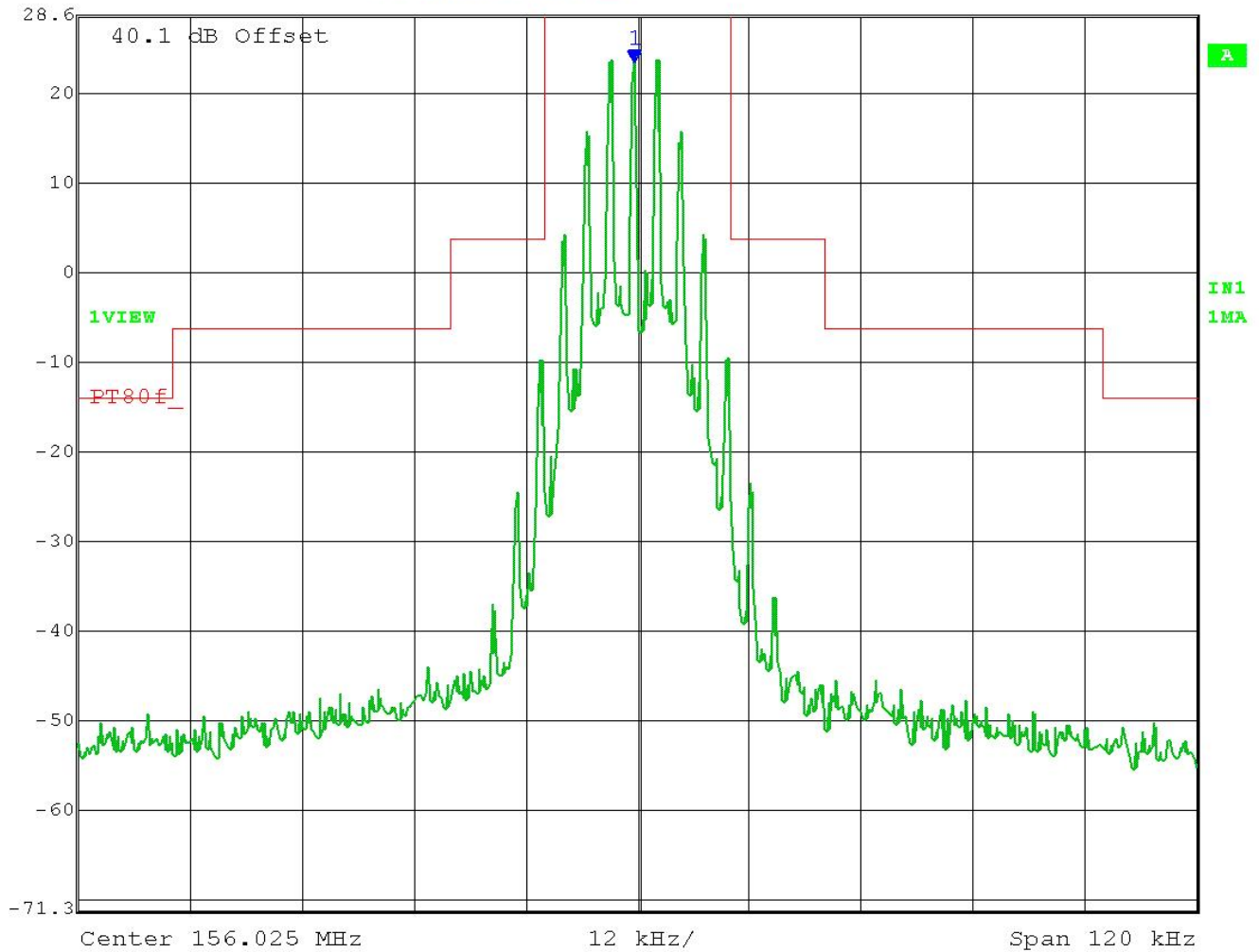
Date: 7.MAR.2017 14:05:03

**Results Meet Requirements**

# OCCUPIED BANDWIDTH

Test Data: 16KOG3E Low end of band low power plot

	Ref Lvl	Marker 1 [T1]	RBW	300 Hz	RF Att	10 dB
	28.7 dBm	23.21 dBm	VBW	3 kHz		
		156.02462425 MHz	SWT	6.8 s	Unit	dBm



Date: 7.MAR.2017 14:12:04

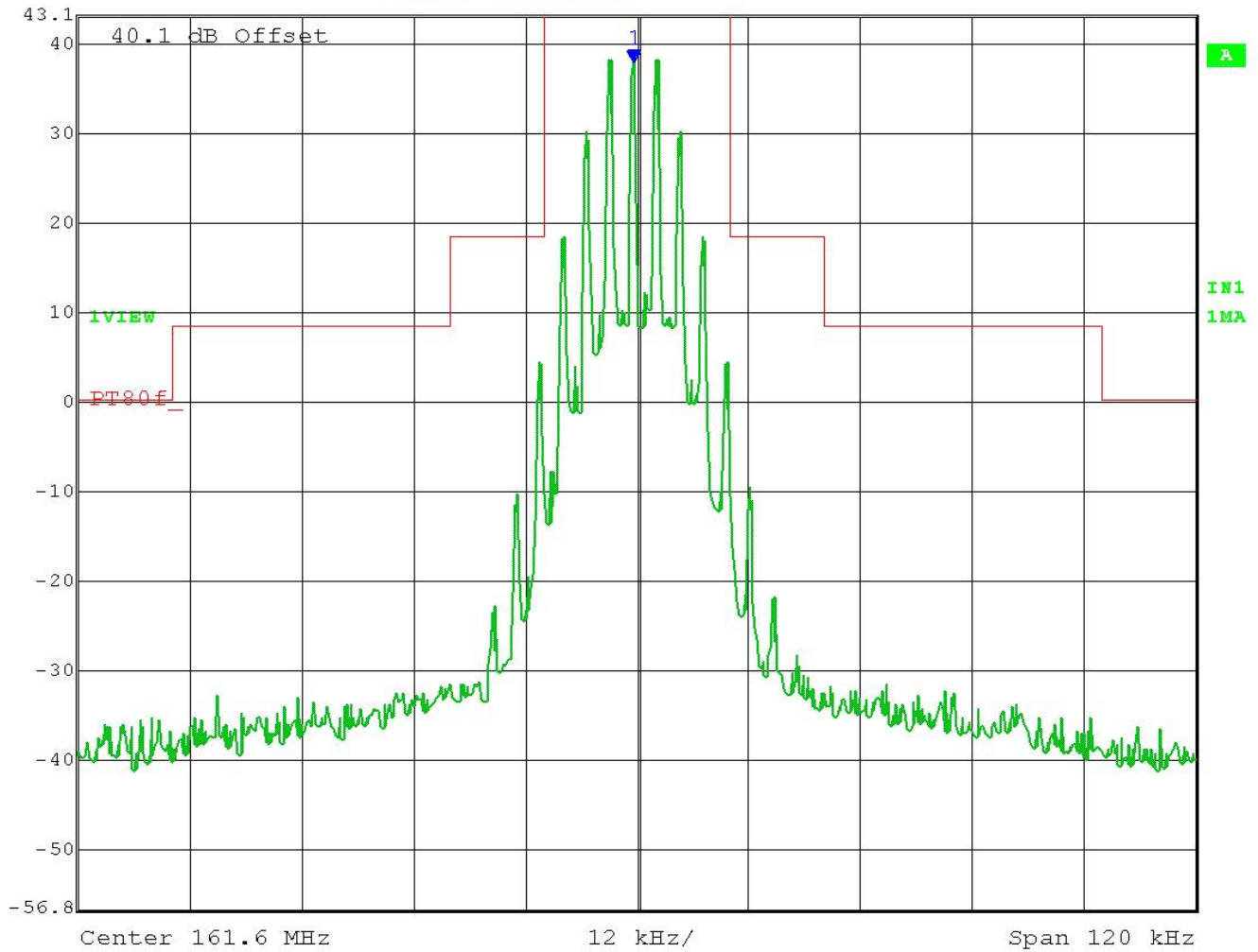
**Results Meet Requirements**

# OCCUPIED BANDWIDTH

## Test Data: 16KOG3E High end of band high power plot



Ref Lvl	Marker 1 [T1]	RBW	300 Hz	RF Att	30 dB
43.1 dBm	37.82 dBm	VBW	3 kHz		
	161.59960922 MHz	SWT	6.8 s	Unit	dBm



Date: 7.MAR.2017 14:17:57

### Results Meet Requirements

Applicant: UNIDEN AMERICA CORPORATION  
 FCC ID: AMWUT655  
 Report: 332AUT17TestReport\_Rev1

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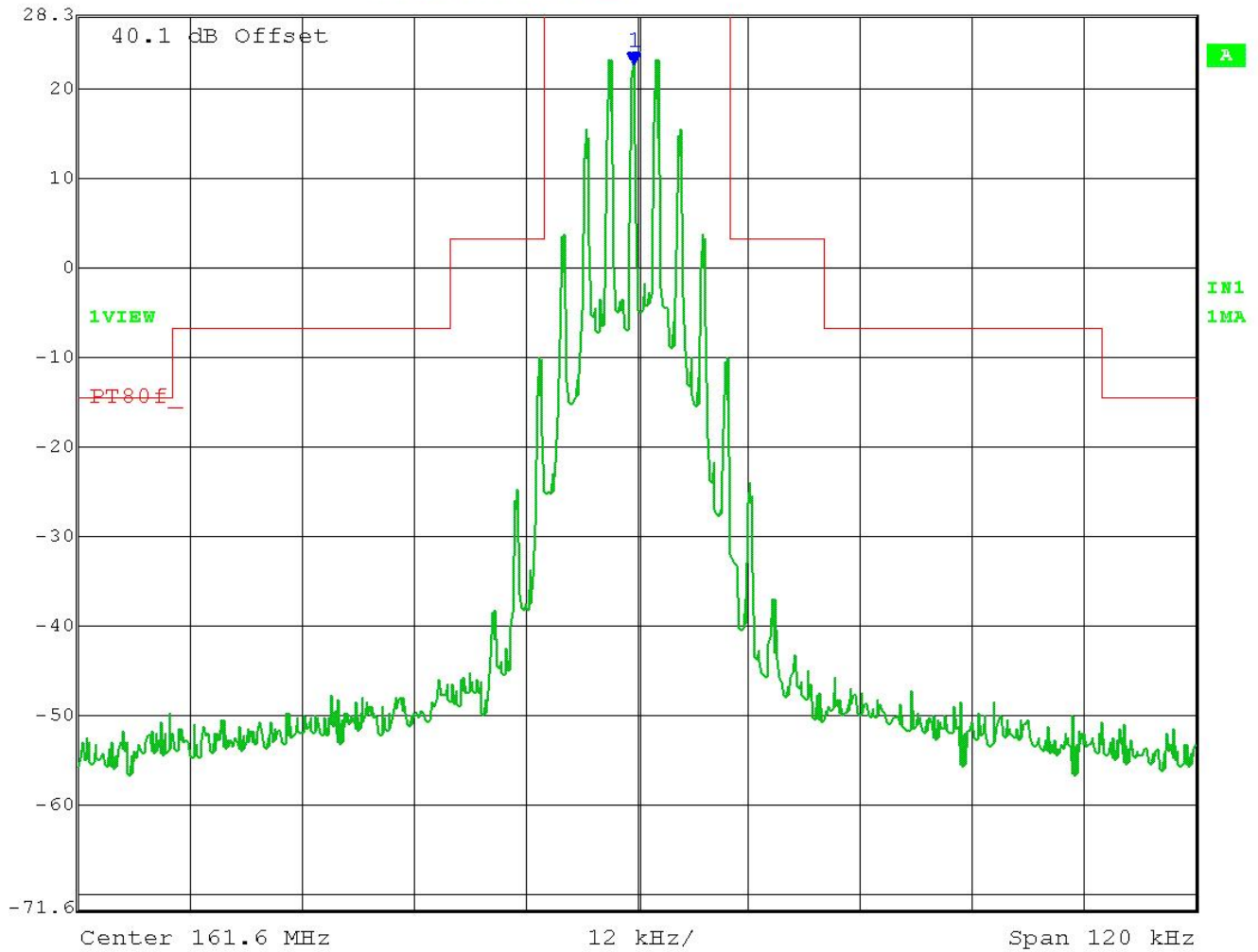


# OCCUPIED BANDWIDTH

## Test Data: 16KOG3E High end of band low power plot



Marker 1 [T1]	RBW	300 Hz	RF Att	10 dB
Ref Lvl	22.79 dBm	VBW	3 kHz	
28.4 dBm	161.59960922 MHz	SWT	6.8 s	Unit dBm



Date: 7.MAR.2017 14:15:07

### Results Meet Requirements

Applicant: UNIDEN AMERICA CORPORATION  
 FCC ID: AMWUT655  
 Report: 332AUT17TestReport\_Rev1

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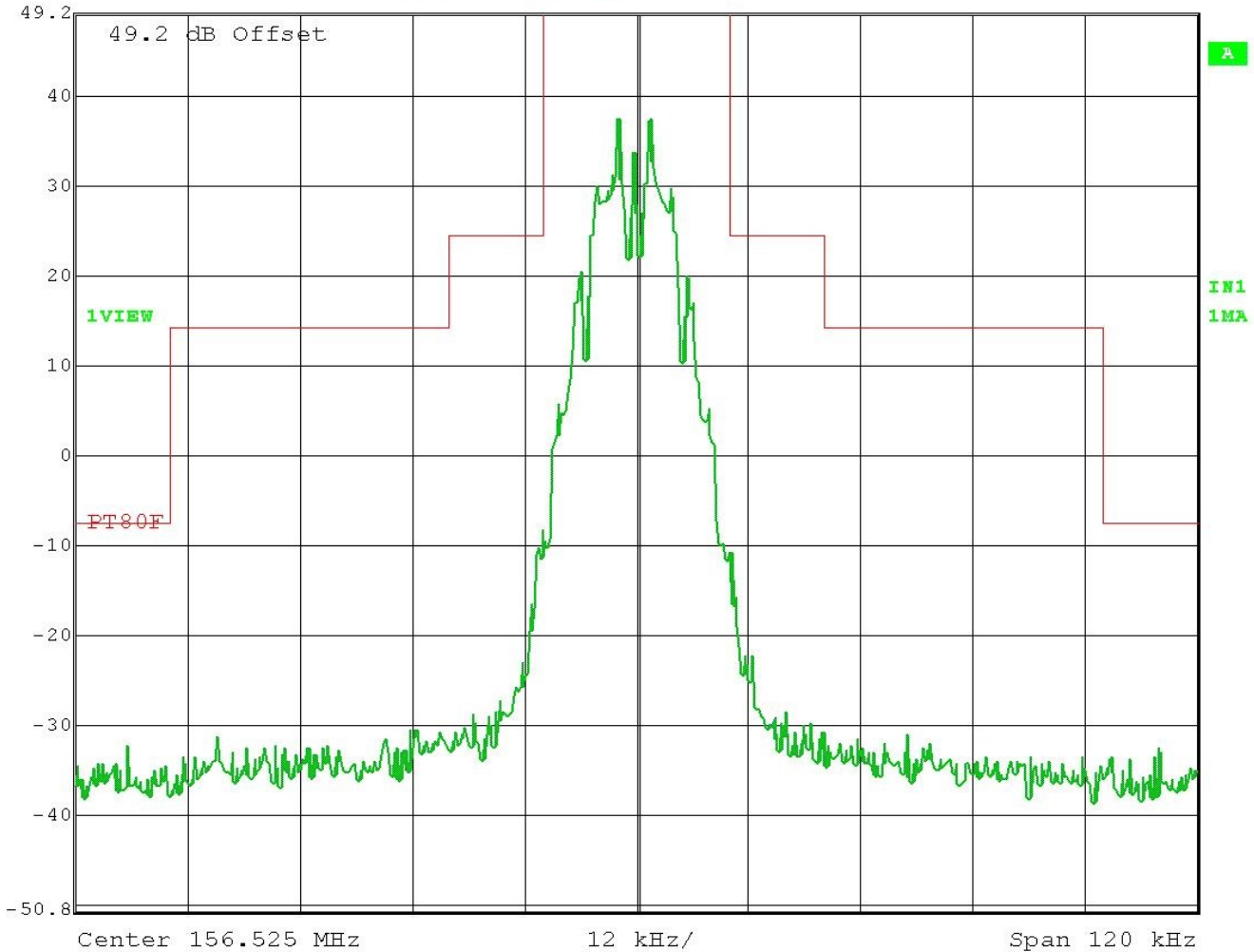
# OCCUPIED BANDWIDTH

Test Data: 16KOG2B DSC Ch 70 High power plot

DOT pattern alternated 1300 Hz & 2100 Hz Tones (Test Mode: Pulsed)



Ref Lvl	Marker 1 [T1]	RBW	300 Hz	RF Att	30 dB
49.2 dBm	-29.87 dBm	VBW	3 kHz		
	156.53940381 MHz	SWT	6.8 s	Unit	dBm



Date: 10.MAR.2017 08:36:04

**Results Meet Requirements**

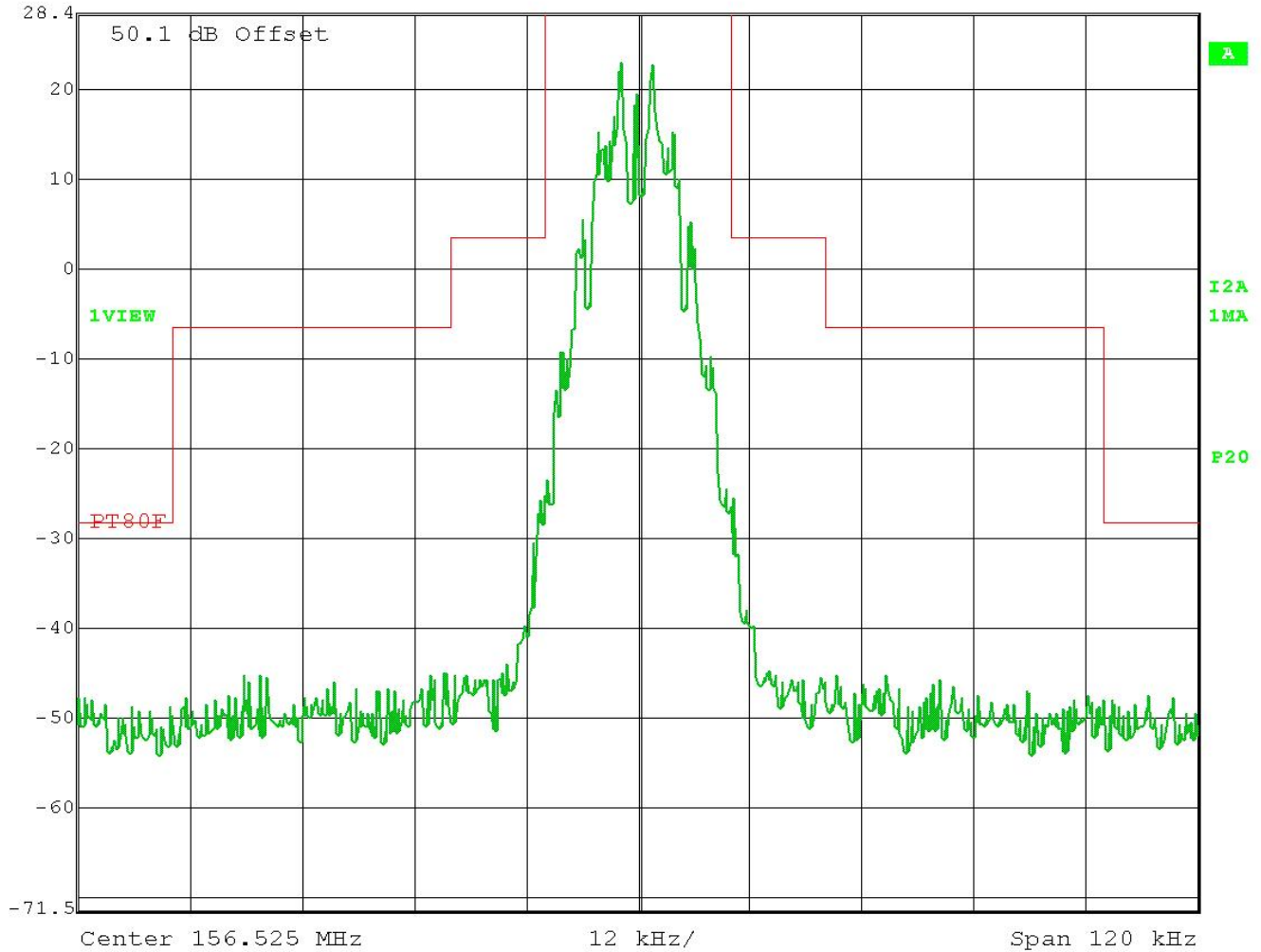
# OCCUPIED BANDWIDTH

Test Data: 16KOG2B DSC Ch 70 low power plot

DOT pattern alternated 1300 Hz & 2100 Hz Tones (Test Mode: Pulsed)



Ref Lvl	RBW	300 Hz	RF Att	30 dB
28.5 dBm	VBW	3 kHz	Unit	dBm
	SWT	6.8 s		



Date: 9.MAR.2017 15:08:55

## Results Meet Requirements

Applicant: UNIDEN AMERICA CORPORATION  
 FCC ID: AMWUT655  
 Report: 332AUT17TestReport\_Rev1

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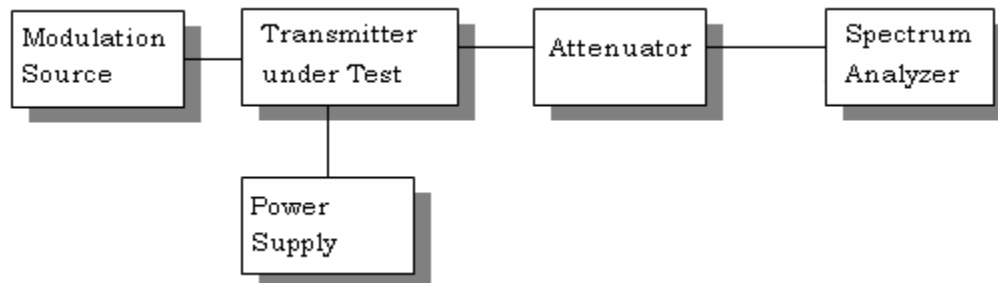
## SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

**Rule Part No.:** FCC Part 2.1051(a), 80.211(f)(3)

**Requirements:** (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

**Setup Diagram:**



## SPURIOUS EMISSIONS AT ANTENNA TERMINALS

### Test Data: High Power Low End of Band

	dBm	Watts	Limit
<b>Power Output</b>	44	25.12	57

	Frequency MHz	Level dBc	Margin dB
	156.025	0	0.0
	312.050	82.8	25.8
	468.075	92.4	35.4
	624.100	93.2	36.2
	780.125	80.4	23.4
*	936.150	103.0	46.0
*	1092.175	103.0	46.0
*	1248.200	103.0	46.0
*	1404.225	103.0	46.0
*	1560.250	103.0	46.0

\* Indicates Noise Floor

### Test Data: Low Power Low End of Band

	dBm	Watts	Limit
<b>Power Output</b>	29	0.79	42

	Frequency MHz	Level dBc	Margin dB
	156.025	0	0.0
	312.050	84.5	42.5
	468.075	91.7	49.7
*	624.100	90.9	48.9
	780.125	78.8	36.8
*	936.150	90.9	48.9
*	1092.175	90.9	48.9
*	1248.200	90.9	48.9
*	1404.225	90.9	48.9
*	1560.250	90.9	48.9

\* Indicates Noise Floor

### Results Meet Requirements

## SPURIOUS EMISSIONS AT ANTENNA TERMINALS

### Test Data: High Power High End of Band

	<b>dBm</b>	<b>Watts</b>	<b>Limit</b>
<b>Power Output</b>	44	25.12	57

	<b>Frequency MHz</b>	<b>Level dBc</b>	<b>Margin dB</b>
	161.60	0	0.0
	323.20	90.0	33.0
	484.80	94.9	37.9
*	646.40	96.9	39.9
	808.00	87.2	30.2
*	969.60	96.9	39.9
*	1131.20	96.9	39.9
*	1292.80	96.9	39.9
*	1454.40	96.9	39.9
*	1616.00	96.9	39.9

\*Indicates Noise Floor

### Test Data: Low Power High End of Band

	<b>dBm</b>	<b>Watts</b>	<b>Limit</b>
<b>Power Output</b>	29	0.79	42

	<b>Frequency MHz</b>	<b>Level dBc</b>	<b>Margin dB</b>
	161.60	0	0.0
	323.20	94.0	52.0
	484.80	97.2	55.2
*	646.40	91.8	49.8
	808.00	86.8	44.8
*	969.60	91.8	49.8
*	1131.20	91.8	49.8
*	1292.80	91.8	49.8
*	1454.40	91.8	49.8
*	1616.00	91.8	49.8

\*Indicates Noise Floor

### Results Meet Requirements

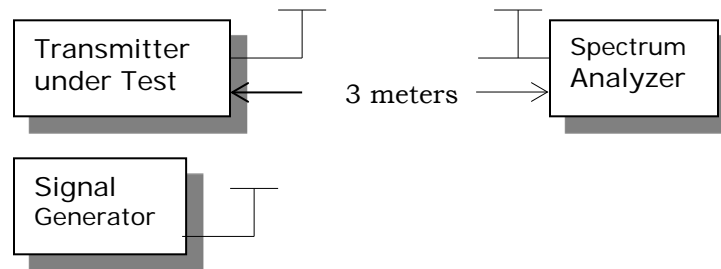
## FIELD STRENGTH OF SPURIOUS EMISSIONS

**Rule Parts. No.:** FCC Part 2.1053, 80.211(f)(3)

**Requirements:** (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

**Test Setup Diagram:**



**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.**

### Test Data: 16K0G3E Low end of band high power measurement table

This test data represents the worst case emission for all frequencies tested.

Tuned Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	FCC Requirement (dB)	Bandwidth (kHz)
156.025	High (25 W)	43.99	25.06	59.44	20
Emission Frequency (MHz)	Antenna Polarity	Below Carrier (dBc)	Margin (dB)		
312.050	V	87.94	28.50		
468.080	V	83.39	23.95		
624.090	V	89.27	29.83		
780.140	V	84.35	24.92		
1118.200	H	72.34	12.90		
1643.200	V	70.84	11.41		

### Results Meet Requirements

## FREQUENCY STABILITY

**Rule Parts. No.:** FCC Part 2.1055, Part 80.209(a)

**Requirements:** The frequency must remain within the .0010%, 10.0 ppm, specification limit, for 20 kHz spacing.

**Method of Measurements:** ANSI/TIA 603

The transmitter was placed in the temperature chamber at 25°C and allowed to stabilize for one hour. The transmitter was keyed ON for one minute during which four frequency readings were recorded at 15 second intervals. The worst-case number was taken for temperature plotting. The assigned channel frequency was considered to be the reference frequency. The temperature was then reduced to -20°C after which the transmitter was again allowed to stabilize for one hour. The transmitter was keyed ON for one minute and was again allowed to stabilize for one hour. The transmitter was keyed ON for one minute and again frequency readings were noted at 15 sec intervals. The worst-case number was recorded for temperature plotting. This procedure was repeated in 10-degree increments up to +50°C.

### Test Data: Measurement Table

Temperature	Frequency MHz	Cycles	PPM
<b>25°C (reference)</b>	<b>161599843</b>		
-20°C	161599623	-220000000	-1.361
-10°C	161600134	291000000	1.801
0°C	161600258	415000000	2.568
10°C	161600142	299000000	1.850
20°C	161599890	470000000	0.291
30°C	161599729	-114000000	-0.705
40°C	161599630	-213000000	-1.318
50°C	161599760	-830000000	-0.514

Battery Voltage	Frequency	Cycles	PPM
11.73	161599812	-310000000	-0.192
13.80	161599843	0	0.000
15.87	161599804	-390000000	-0.241



## EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
24 Volt Power Supply	Astron	VLS-25M	9510040	N/A	N/A
Antenna: Biconical 1096 Chamber	Eaton	94455-1	1096	07/14/15	07/14/17
Antenna: Log-Periodic 1243	Eaton	96005	1243	02/09/16	02/09/18
Temperature Chamber LARGE	Tenney Engineering	TTRC	11717-7	09/01/16	09/01/18
Digital Multimeter	Fluke	77	35053830	10/21/15	10/21/17
Antenna: Double-Ridged Horn/ETS Horn 2	ETS-Lindgren Chamber	3117	00041534	03/01/17	03/01/19
Frequency Counter Large Chamber	HP	5352B	2632A00165	07/01/15	07/01/17
Coaxial Cable - Chamber 3 cable set (Primary)	Micro-Coax	Chamber 3 cable set (Primary)	KMKM-0244-01 ; KMKM-0670-00; KFKF-0198-01	08/19/16	08/19/18
CHAMBER	Panashield	3M	N/A	04/25/16	12/31/17
Sweep/Signal Generator	Anritsu	68369B	985112	10/28/15	10/28/17
EMI Test Receiver R & S ESIB 40 Screen Room	Rohde & Schwarz	ESIB 40	100274	08/16/16	08/16/18
Software: Field Strength Program	Timco	N/A	Version 4.0	N/A	N/A
Antenna: Active Loop	ETS- Lindgren	6502	00062529	11/18/15	11/18/17
Coaxial Cable - NMNM-0300-00	Insulated Wire Inc.		NMNM-0300-00	08/05/15	08/05/17
Hygro-Thermometer	Extech	445703	0602	06/30/15	06/30/17
Modulation Analyzer	HP	8901A	3050A05856	04/16/15	04/16/17
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	04/01/16	04/01/18
Attenuator N 30dB 500W DC-2.5G	Bird	8325	1761	05/18/15	05/18/17
Function Generator	Standford	DS340	25200	02/02/16	02/02/18
Attenuator N 20dB 2W DC-13G	Narda	757C	30201	05/22/15	05/22/17
Tunable Notch Filter 100-350 MHz	Eagle	220BFBF	100-350 MHz (#43)	07/01/15	07/01/17
Bore-sight Antenna Positioning Tower	Sunol Sciences	TLT2	N/A	N/A	N/A
Attenuator N 30dB 10W DC-18G	Pasternack	PE7015-30	#24	06/22/15	06/22/17
Non Radiating 50 OHM Load	Sierra Elec	160B-600X	1038	09/13/16	09/13/18

### \*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

### END OF TEST REPORT

Applicant: UNIDEN AMERICA CORPORATION  
 FCC ID: AMWUT655  
 Report: 332AUT17TestReport\_Rev1

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