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FCC PART 80 TEST REPORT

APPLICANT	UNIDEN AMERICA CORPORATION
	3001 GATEWAY DRIVE SUITE 130 IRVING, TEXAS 75063 USA
FCC ID	AMWUT655
MODEL NUMBER	VHF490
PRODUCT DESCRIPTION	FIXED MOUNTED VHF MARINE TRANSCEIVER
DATE SAMPLE RECEIVED	2/28/2017
FINAL TEST DATE	03/10/2017
TESTED BY	FRANKLIN ROSE
APPROVED BY	Cory Leverett
TEST RESULTS	☒ PASS ☐ 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

Applicant: UNIDEN AMERICA CORPORATION
FCC ID: AMWUT655
Report: U\UNIDEN AMW\332AUT17\332AUT17TestReport.docx

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GENERAL INFORMATION

EUT Specification

EUT Description	FIXED MOUNTED VHF MARINE TRANSCEIVER
FCC ID	AMWUT655
Model Number	VHF490
Operating Frequency	Tx: 156-162 MHz, Rx: 156-163 MHz
Test Frequencies	156.025 MHz, 161.60 MHz
Type of Emission	16K0G3E (FM), 16K0G2B (DSC)
Modulation	FM
EUT Power Source	☐ 110–120Vac/50– 60Hz
	☒ DC Power 13.8V
	☐ Battery Operated Exclusively
Test Item	☐ Prototype
	☒ Pre-Production
	☐ Production
Type of Equipment	☐ Fixed
	☒ Mobile
	☐ Portable
Antenna Connector	UHF
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.
Applicable Standards	ANSI/TIA 603-D:2010, FCC CFR 47 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
2.1046(a), 80.215(e)(1)	RF Power Output	Pass
2.1033(c) (4), 80.205(a), 80.207	Modulation Characteristics	Pass
2.1047(a) (b), 80.213(e)	Audio Frequency Response and Low Filter	Pass
2.1047(b) & 80.213 (a)(2) & (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, 80.211(f)(3)	Field Strength of Spurious Emissions	Pass
2.1055, Part 80.209(a)	Frequency Stability	Pass

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.

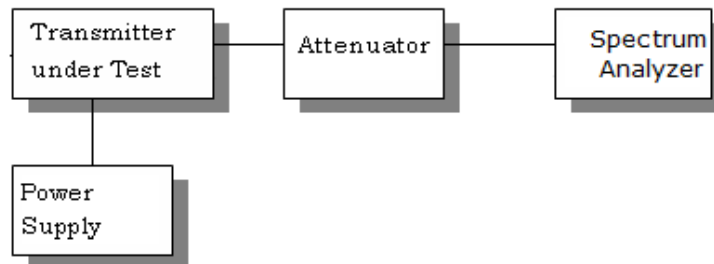
(1) Ship stations 156-162 MHz—25W⁶ ¹³

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

¹³The 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**

$$B_n = 2M + 2DK$$

$$M = 3000$$

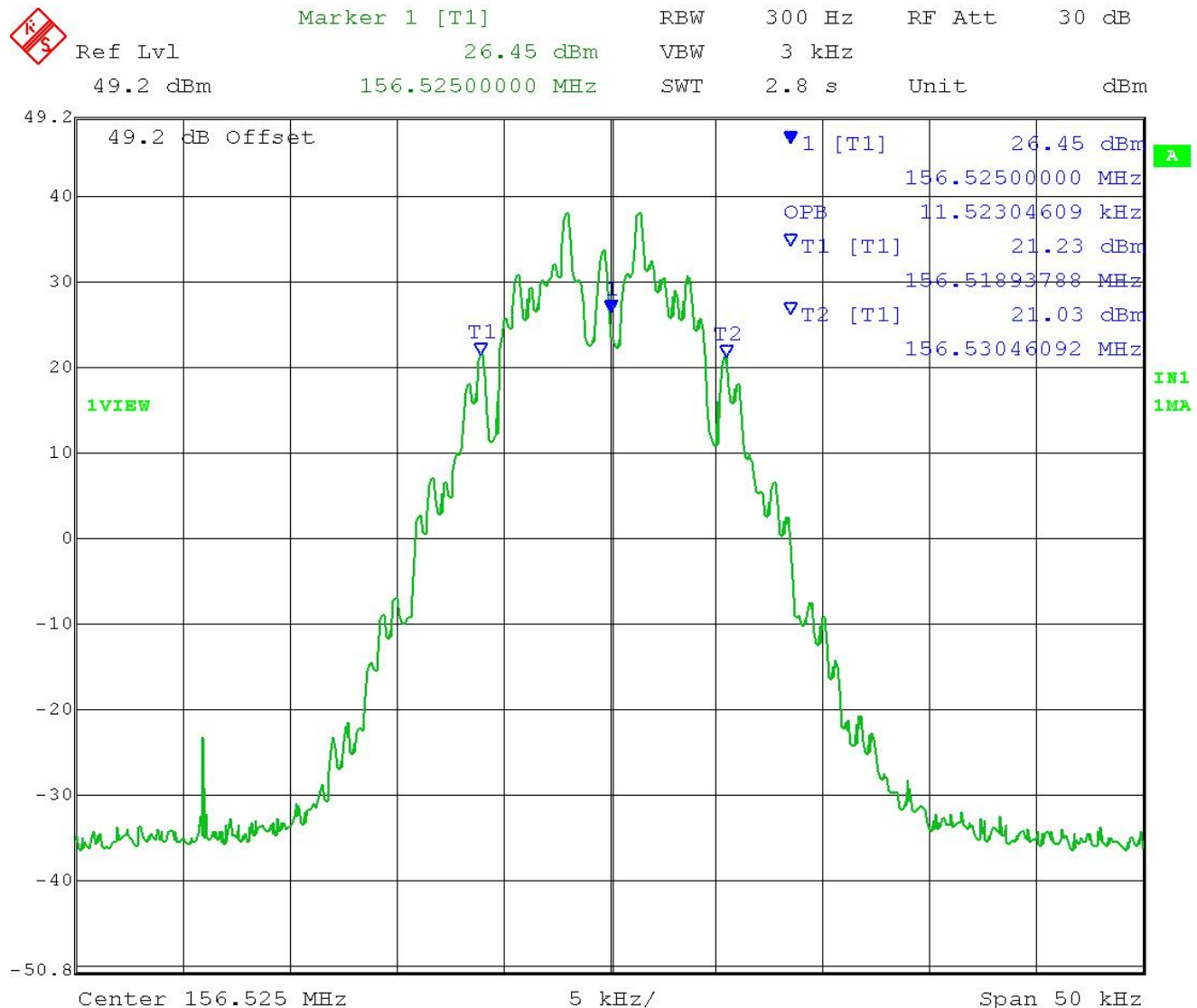
$$D = 5 \text{ kHz (Peak Deviation)}$$

$$K = 1$$

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

Test Data: 16K0G2B Necessary Bandwidth Measurement

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



Date: 10.MAR.2017 08:41:26

AUDIO INPUT VERSUS MODULATION

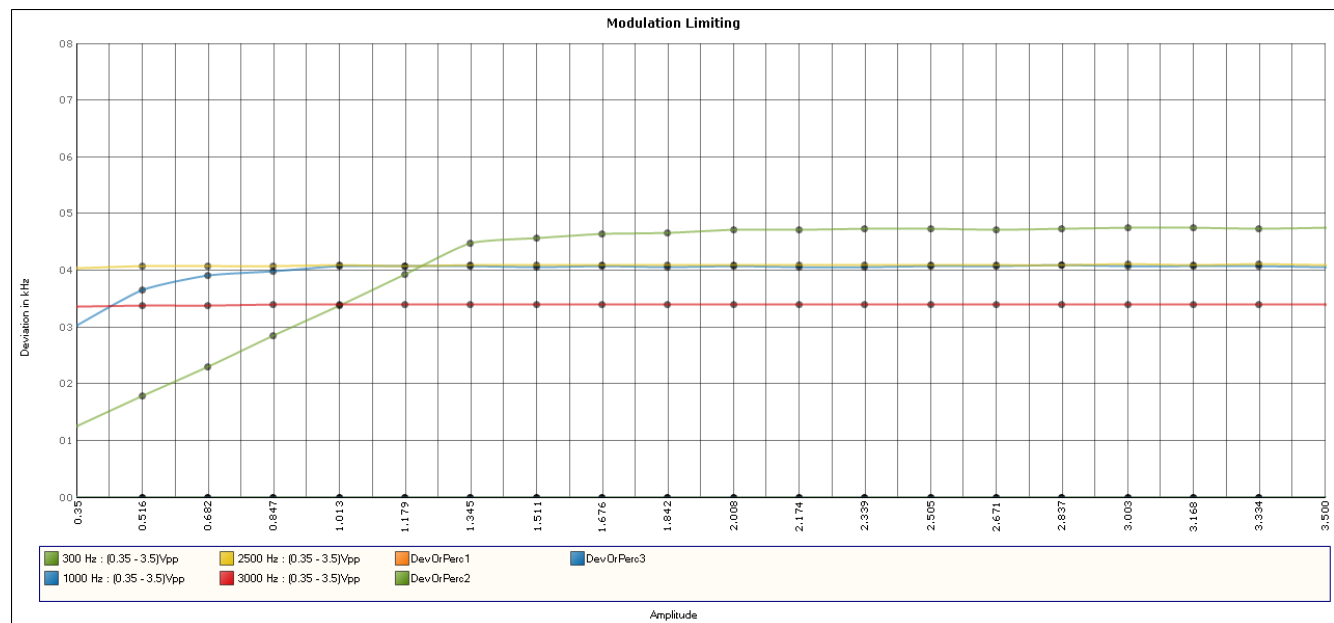
Rule Part No.: FCC Part 2.1047(b) & 80.213 (a)(2) & (b)

Test Requirements: The peak modulation must be maintained between 75 and 100 percent. A frequency deviation of ± 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: **Measurment Plot**



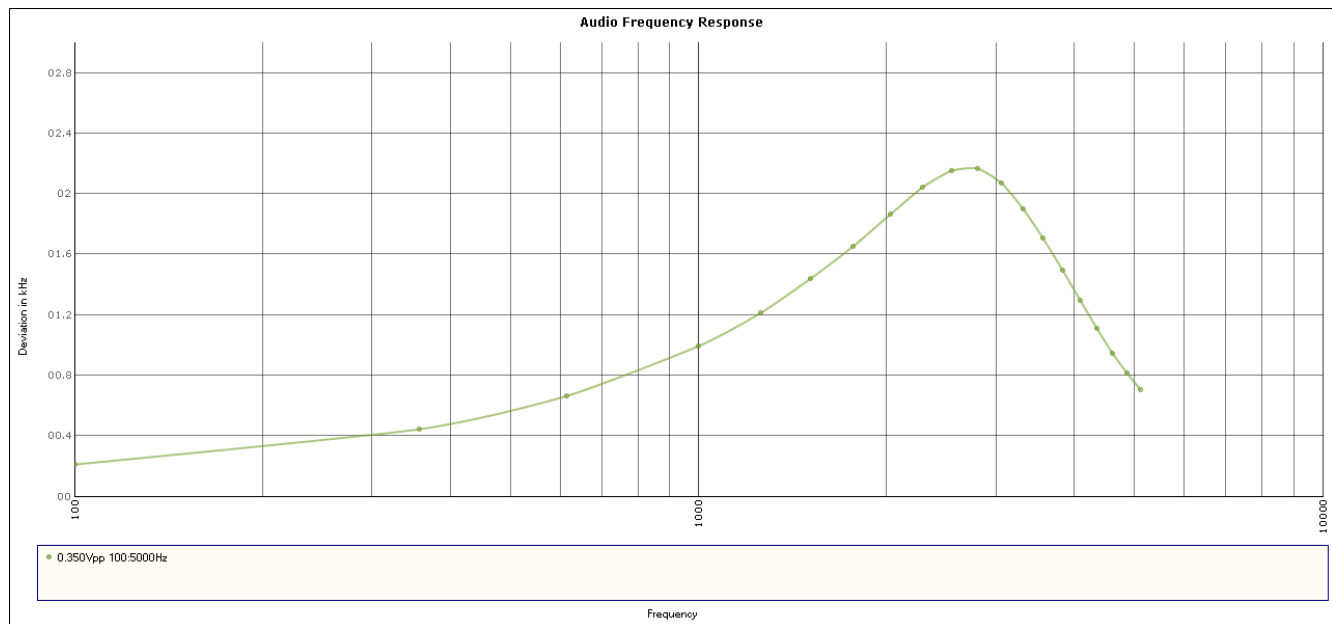
AUDIO FREQUENCY RESPONSE

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
Limit Freq > 3 KHz to < 20 KHz $60\log_{10}(f/3)$ dB Freq > 20 KHz 50 dB greater than the att. at 1 kHz.				

Results meet requirements

OCCUPIED BANDWIDTH

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

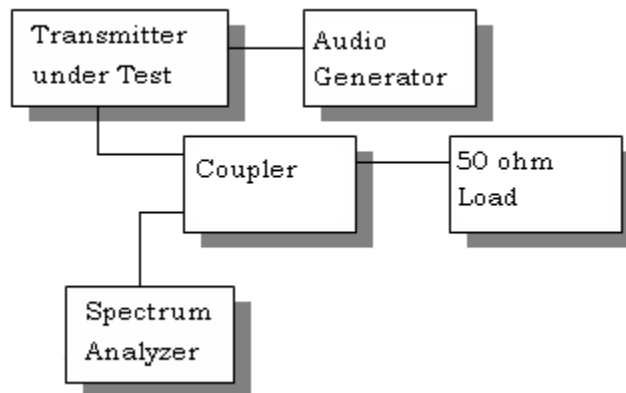
Requirements:

- (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:

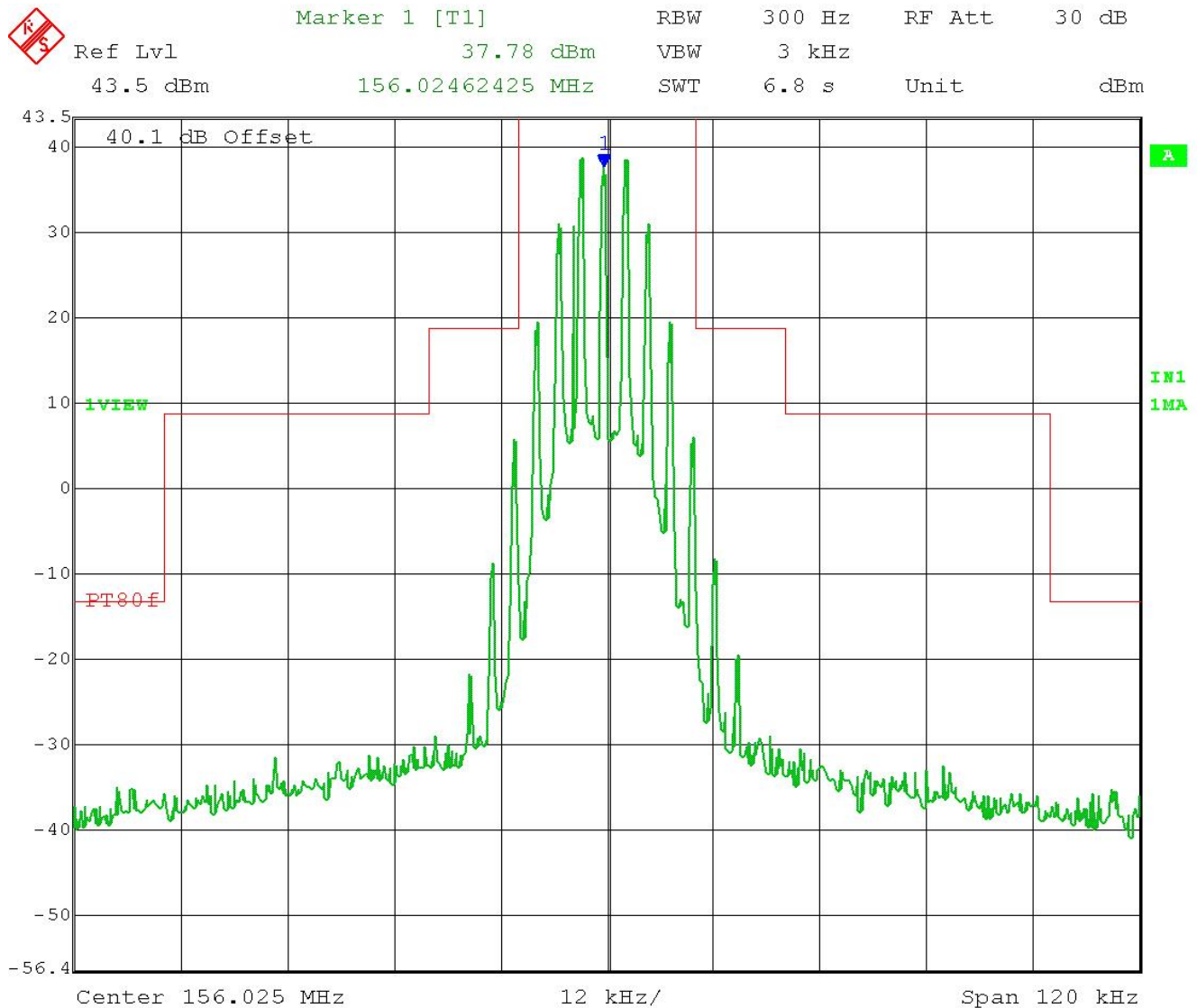
OCCUPIED BANDWIDTH MEASUREMENT



Test Data: See the following plots:

OCCUPIED BANDWIDTH

Test Data: 16K0G3E Low end of band high power plot

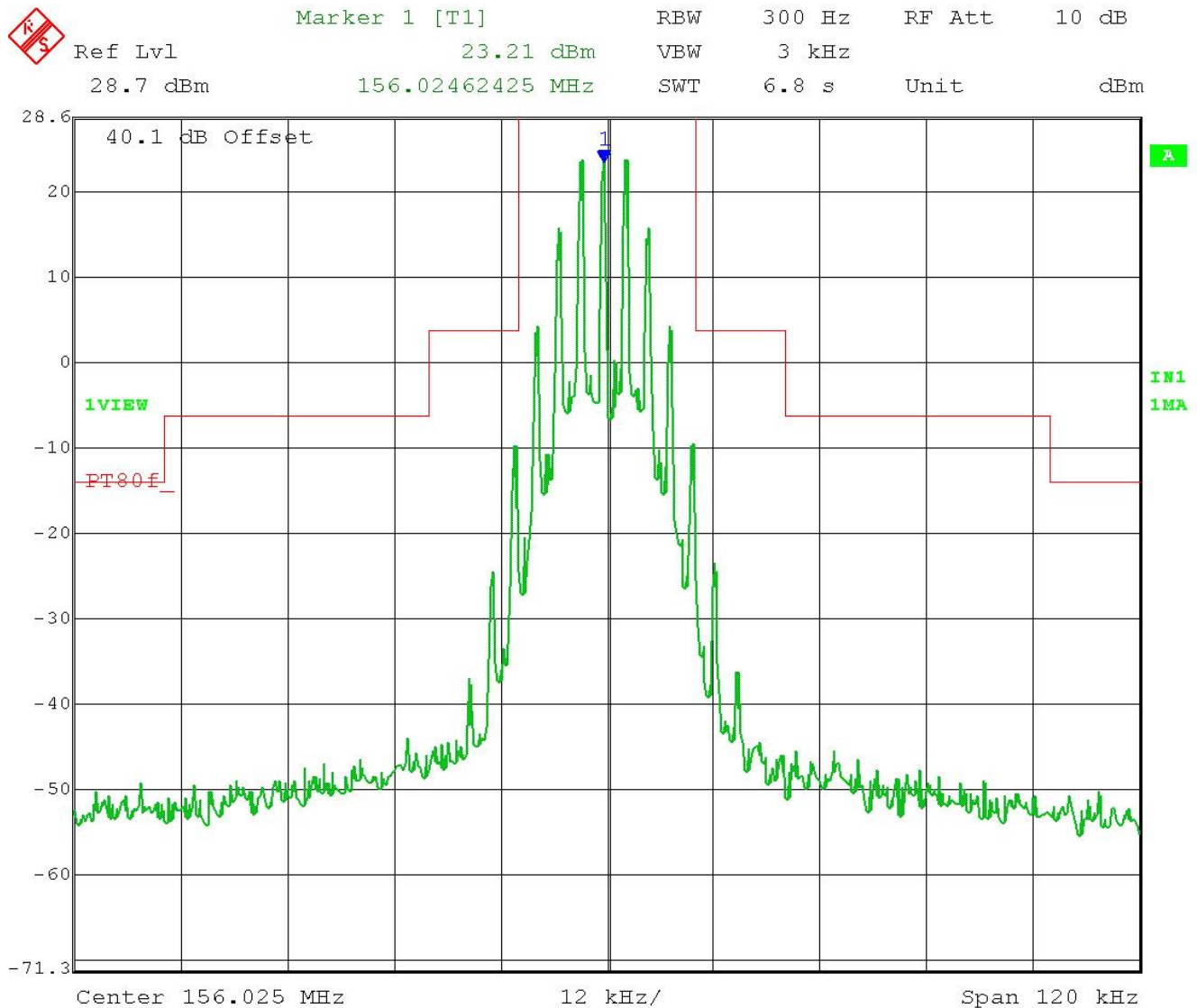


Date: 7.MAR.2017 14:05:03

Results Meet Requirements

OCCUPIED BANDWIDTH

Test Data: 16K0G3E Low end of band low power plot

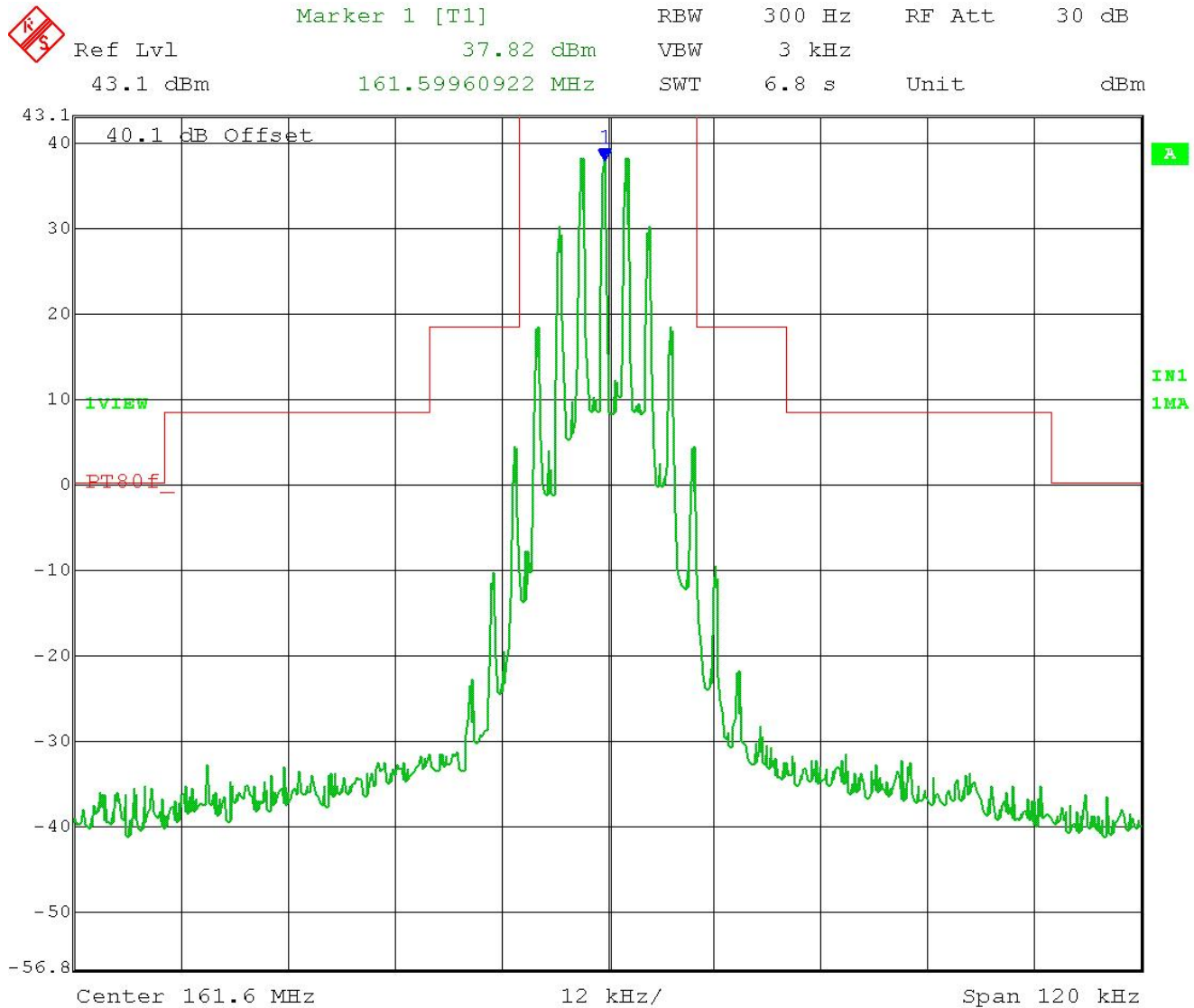


Date: 7.MAR.2017 14:12:04

Results Meet Requirements

OCCUPIED BANDWIDTH

Test Data: 16K0G3E High end of band high power plot

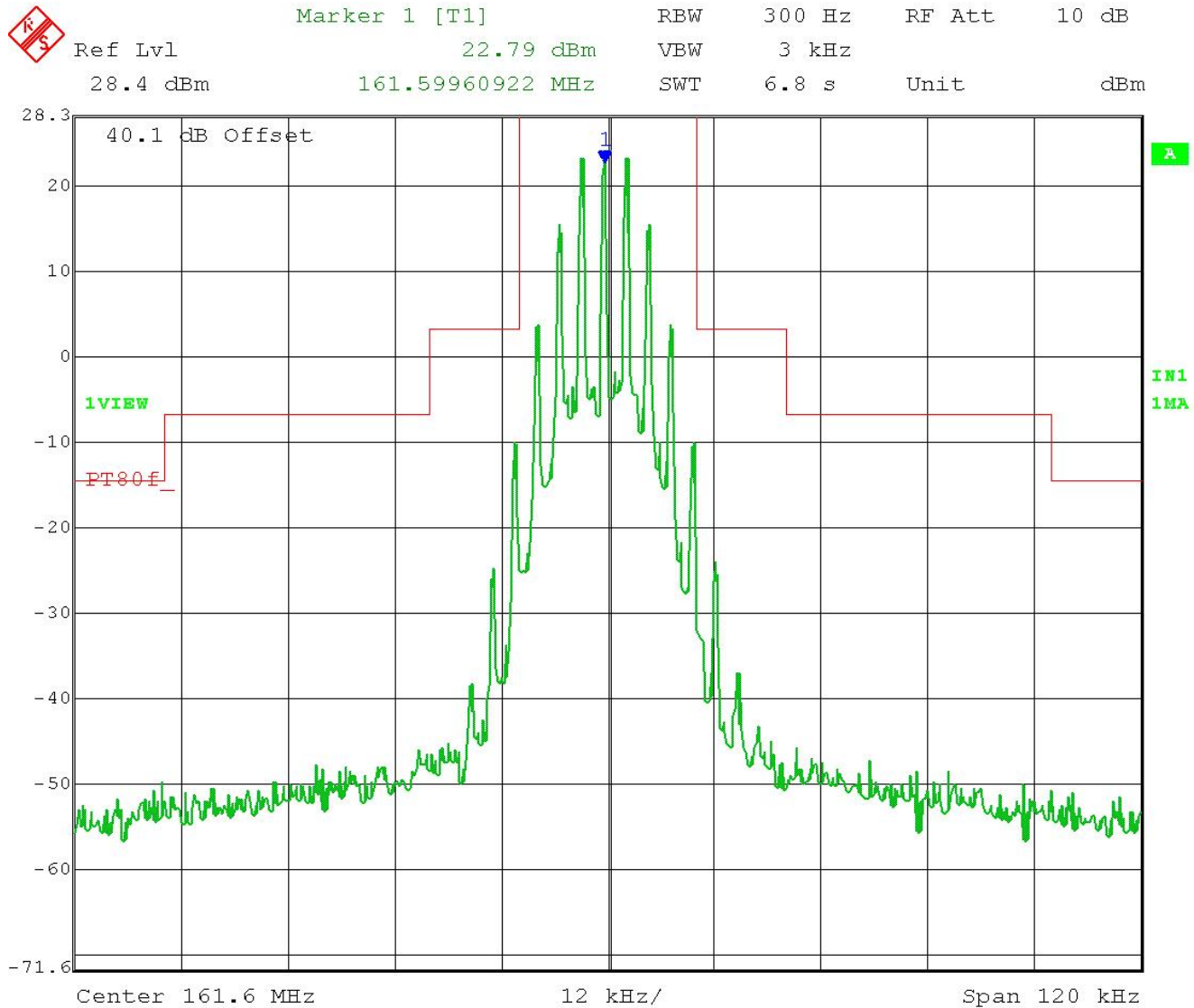


Date: 7.MAR.2017 14:17:57

Results Meet Requirements

OCCUPIED BANDWIDTH

Test Data: 16K0G3E High end of band low power plot



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

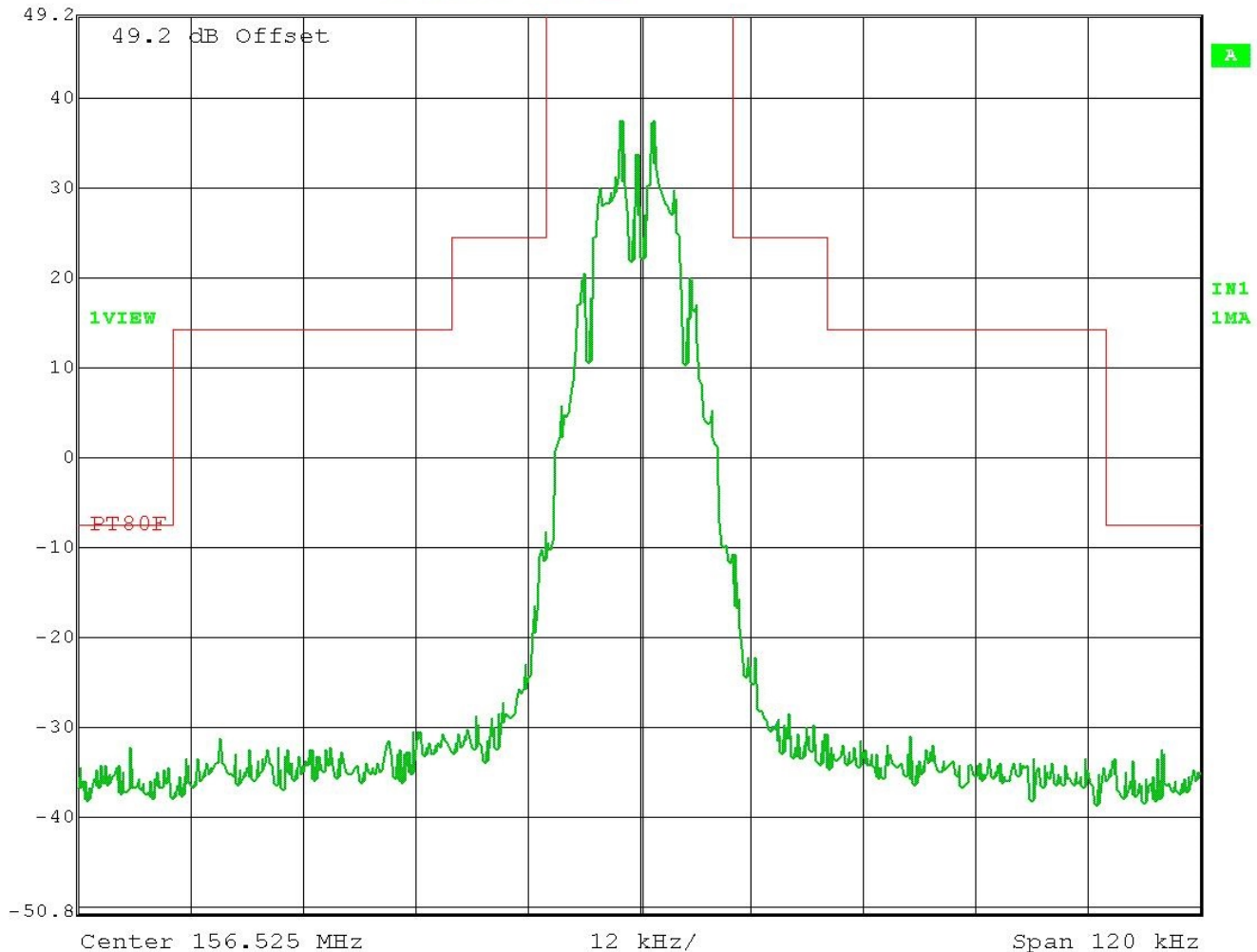
Results Meet Requirements

OCCUPIED BANDWIDTH

Test Data: 16K0G2B DSC Ch 70 High power plot

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


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



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

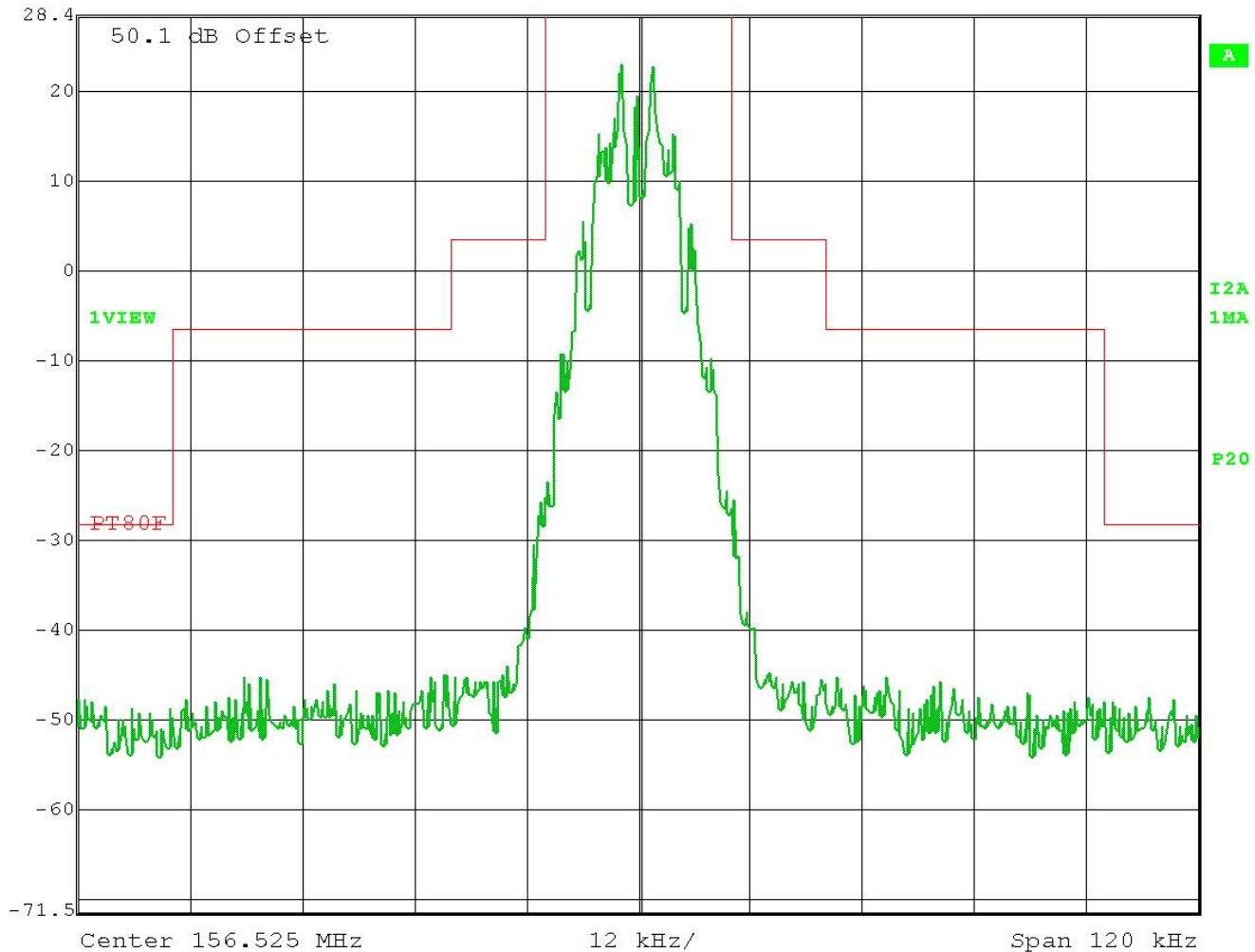
Results Meet Requirements

OCCUPIED BANDWIDTH

Test Data: 16K0G2B DSC Ch 70 low power plot

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


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



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

Results Meet Requirements

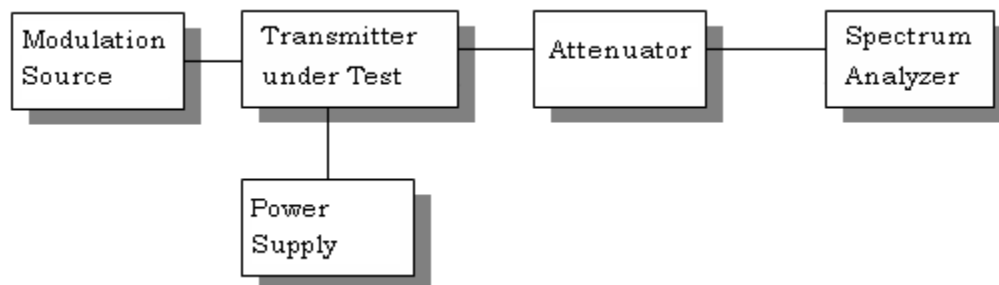
SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

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
Power Output	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
Power Output	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

	dBm	Watts	Limit
Power Output	44	25.12	57

	Frequency MHz	Level dBc	Margin dB
	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

	dBm	Watts	Limit
Power Output	29	0.79	42

	Frequency MHz	Level dBc	Margin dB
	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

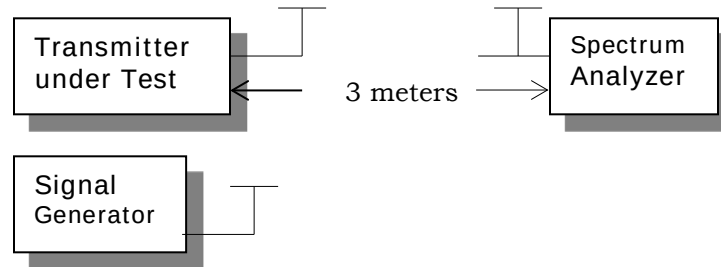
FIELD STRENGTH OF SPURIOUS EMISSIONS

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
25°C (reference)	161599843		
-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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