SHURE

ELECTROMAGNETIC COMPATIBILITY LABORATORY
TEST REPORT

TEST REPORT TITLE: Electromagnetic Compatibility Tests of the Shure PA411 Antenna Combiner

TEST ITEM DESCRIPTION:

The Shure PA411 Antenna Combiner distributes DC power and RF signal for up to four transmitters. The compact half-rack system significantly reduces the amount of antennas and power supplies needed when using multiple systems. This product is designed to be used primarily by stage musicians and performers.

For:	Shure Incorporated 5800 West Touhy Avenue Niles, IL 60714
Project ID Number:	SEL-016
Date Tested:	May 1, 2014 – May 23, 2014 and July 22, 2014
Test Personnel:	Juan Castrejon, Lovell Cueto
Test Specification:	FCC Part 74, Subpart H – Low Power Auxiliary Stations IC RSS-Gen – General Requirements and Information for the Certification of Radio Apparatus IC RSS-123 – Spectrum Management and Telecommunications Radio Standards Specification: Licensed Low-Power Radio Apparatus

TEST REPORT BY:	Juan Castrejon SIGNATURE	EMC Senior Engineer POSITION	8/19/14 DATE
APPROVED BY:	Juan Castrejon SIGNATURE	EMC Senior Engineer POSITION	8/19/14 DATE

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REPORT REVISION HISTORY

Revision	Date	Description
0		Initial Release

Report Title:

1. INTRODUCTION

1.1. Scope of Tests

This document presents the results of a series of electromagnetic compatibility (EMC) tests performed on the Shure PA411 antenna combiner. The test items were manufactured and submitted for testing by Shure Incorporated located in Niles, IL. The data was taken following the measurement methods as described in the test specifications listed in the individual appendices of this document. This document provides the data for the test samples, including a summary of the measurements made and descriptions of the measurement setup. The equipment under test (EUT) contained an antenna combiner that was designed to operate in the following UHF frequency range(s):

Model	Frequency (MHz)
PA411	488-698

1.2. Purpose

This series of tests was performed to determine if the test items would meet the specifications of FCC Part 74 Subpart H, and IC RSS-123.

1.3. Deviations, Additions and Exclusions

None.

1.4. EMC Laboratory Identification

The electromagnetic compatibility tests were performed at the Shure Electromagnetic Laboratory, Shure Incorporated, 5800 West Touhy Ave, Niles, Illinois 60714-4608. The Shure Electromagnetic Laboratory is accredited by the National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP). The NVLAP Lab Code is: 200946-0.

1.5. Summary of Tests Performed

The following electromagnetic compatibility tests (Table 1) were performed on the EUT in accordance with FCC Part 74 and RSS-123.

Table 1: Summary of tests performed

Test Spec (STD)	Description	Tested Range	Described in Appendix	Test Results
FCC Part 74.861(e)(1)(ii) RSS-123 Section 5	**RF Power Output**	**488 – 638 MHz**	**A**	**PASS**
FCC Part 74.861(e)(4) RSS-123 Section 5.4	**Frequency Stability**	**488 – 638 MHz -30°C to +50°C**	**B**	**PASS**
FCC Part 74.861(e)(5) RSS-123 Section 5	**Occupied Bandwidth**	**488 – 638 MHz**	**C**	**PASS**
FCC Part 74.861(e)(6) RSS-123 Section 5.5.1	**Spurious Emissions - Radiated**	**30 MHz – 10 GHz**	**D**	**PASS**
	Conducted Emissions - AC Mains	**488 – 698 MHz**	**E**	**PASS**
FCC Part 74.861(e)(6) RSS-123 Section 5.5.1	**Spurious Emissions at Antenna**	**488 – 698 MHz**	**F**	**PASS**
FCC Part 74.861(e)(3) RSS-123 Section 5.2	**Modulation Characteristics**	**488 – 698 MHz**	**G**	**PASS**

2. APPLICABLE DOCUMENTS

The following documents of the exact issue designated form part of this document to the extent specified herein:

- FCC Part 74, Subpart H – Low Power Auxiliary Stations
- IC RSS-Gen, Issue 3 – General Requirements and Information for the Certification of Radio Apparatus
- IC RSS-123, Issue 2 – Spectrum Management and Telecommunications Radio Standards Specification: Licensed Low-Power Radio Apparatus
- ANSI C63.4-2003, "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"
- TIA-603-C-2004, “Land Mobile FM or PM Communications Equipment Measurement and Performance Standard”

3. EUT SET-UP AND OPERATION

3.1. General Description

The test sample used is an antenna combiner, model number PA411, designed to operate in the UHF frequency range. The antenna combiner is supplied with an external switching power supply (PS45US). The individual EUT arrangements in which the testing was conducted can be found in Appendix H.

3.2. Test Samples

The following product samples were tested:

Model	Frequency (MHz)	Serial #
PA411	488-698	#1

3.3. Test Setup

3.3.1. Power Input

The PA411 antenna combiner obtained power from a Shure PS45US switch mode power supply. The Shure PS45US power supply has an unshielded AC mains input cable and an unshielded DC output cable, which attaches to the PA411 antenna combiner. The Shure PS45US was powered with an input of 120V, 60Hz.

3.3.2. Signal Input /Output Ports

Four BNC shielded cables were connected to the RF antenna input ports of the EUT. The end of each cable was terminated with a representative test load as described in the individual appendices.

3.3.3. Antenna Ports

The antenna output port was terminated with a ½ wave antenna.

3.3.4. Test Frequency Range

Per FCC Part 2.1057 and IC RSS-GEN section 4.9, for spurious radiated emissions measurements the frequency spectrum shall be investigated from 30 MHz to 7 GHz to accommodate 10x the highest frequency.

3.3.5. Grounding Considerations

The EUT was not grounded during testing.

3.4. Operational Mode

Tests were performed on the EUT tuned to either the Low, Mid, or High frequency within the band tested. The EUT was powered up and the frequency of the auxiliary equipment (transmitter) was selected using a laptop. The line voltage to the EUT was checked after turn-on and adjusted to the nominal level. The EUT was checked for proper operation after it was setup for testing.

4. TEST INSTRUMENTATION

A list of the test equipment used can be found in Table 10-1. All equipment used was within calibration terms during and throughout the duration of the tests. All calibrations are traceable to the National Institute of Standards and Technology (NIST).

5. TEST PROCEDURES

The specific test procedures are presented in the individual appendices.

6. OTHER TEST CONDITIONS

6.1. Test Personnel

All EMC tests were performed by qualified personnel from the Shure EMC Laboratory.

6.2. Disposition of the EUT

The EUTs and all associated equipment were returned to Shure Incorporated upon completion of the tests.

7. RESULTS OF TESTS

The results are presented in the individual test appendices. In general, it was found that the Shure Incorporated PA411 met the radiated and conducted RF emission specifications of FCC Part 74, Subpart H and Industry Canada RSS-123.

8. CONCLUSIONS

It was determined that the Shure Incorporated PA411 did fully comply with the radiated and conducted RF emissions requirements of FCC Part 74, Subpart H, and Industry Canada RSS-123.

9. CERTIFICATION

Shure EMC Laboratory certifies that the information contained in this report was obtained under conditions which meet or exceed those specified in the test specifications.

The data presented in this test report pertains to the EUTs at the test date. Any electrical or mechanical modification made to the EUTs subsequent to the specified test date will serve to invalidate the data and void this certification.

This report must not be used to claim product endorsement by NVLAP or any agency of the US Government.

10. EQUIPMENT LIST

Table 10-1: Test Equipment

L# or ID	Description	Manufacturer	Model #	Serial #	Range	Cal Date	Due Date
L23-011-01	3 meter RF Chamber	ETS Lindgren	FACT-3	AJ640	25MHz - 18GHz	10/1/2013	9/30/2014
L23-011-02	Electric Powered Turntable	ETS Lindgren	2088	N/A	N/A	N/A	N/A
L23-011-08	Controller	EMCO	2090	29799	N/A	N/A	N/A
L23-011-09	Antenna Positioner	ETS Lindgren	2071-2	35500	N/A	N/A	N/A
L23-011-15	BiConiLog Antenna	ETS Lindgren	3142C	34790	25MHz-1GHz	3/17/2014	3/17/2015
L23-011-16	Waveguide Horn Ant	ETS Lindgren	3115	29851	1-18 GHz	5/21/2013	5/21/2014
L23-011-19	PreAmp	Rohde & Schwarz	TS-PR18	100015	1-18 GHz	6/20/2013	6/20/2014
L23-011-25	EMI Test Receiver	Rohde & Schwarz	ESIB 40	100220	20Hz-40GHz	3/14/2014	3/14/2015
L23-011-31	EMI/EMS Test Software	Rohde & Schwarz	EMC32	V.4.04 100061	20Hz - 40GHz	N/A	N/A
L23-022-01	Spectrum Analyzer	Rohde & Schwarz	FSU 1166.1660. K26	201043	20Hz – 26.5GHz	1/28/2014	1/28/2015
L23-011-26	Artificial Mains	Rohde & Schwarz	ESH3-Z5	100324	9kHz - 30MHz	3/25/2014	3/25/2015
L23-040-03	20dB Attenuator	Mini Circuits	BW-N20W5+	N/A	DC-18GHz	3/24/2014	3/24/2015
L23-040-07	15dB Attenuator	Mini Circuits	BW-S15W2+	N/A	DC-18GHz	10/16/2013	10/16/2014
L23-031-01	Power Meter	AR	PM2003	0335363	10kHz – 40GHz	1/06/2014	1/06/2015
L23-032-01	Power Head	AR	PH2008	336213	100 kHz - 18GHz -40 to +33 dBm	1/06/2014	1/06/2015
L19-06-01	Temp. Chamber	ESPEC	SU-24	91004211	-40C - +130C	3/19/2014	3/19/2015
L23-011-41	Waveguide Horn Antenna	EMCO	3117	123511	1GHz -18GHz	10/24/2013	10/24/2014
L23-011-36D	Tuned Dipole Antenna	ETS Lindgren	312D-DB-4	123695	400-1000MHz	4/08/2014	4/08/2015
L23-023-01	Signal Generator	Rohde & Schwarz	SMF100A	101553	100kHz-22GHz	1/23/2014	1/23/2015
L23-026-01	Tunable Notch Filter	Trilithic	3VNF500/1000-50-AA	200908026	500-1000 MHz	9/26/2013	9/26/2014
L23-027-01	Tunable Notch Filter	Trilithic	3VNF300/600-50-AA	20100453	300-600 MHz	9/26/2013	9/26/2014
L23-011-37	High Pass Filter	K&L	11SH10-940/X10000	1	940MHz-10000GHz	9/26/2013	9/26/2014
L23-034-08	Digital Thermometer	Extech	TM100/ TP870	13018733/ TE701576	-----	8/19/2013	8/19/2014
L13-062-02	Power Supply	California Instruments	801RP	L06369	N/A	3/18/2014	3/18/2015
L05-068-02	Modulation Analyzer	Boonton	8200	24602BH	N/A	9/9/2013	9/9/2014
L23-021-01	Audio Signal Generator	Audio Precision	2722-192k	SYS2-32230	N/A	6/25/2013	6/25/2014

A. RF POWER OUTPUT MEASUREMENTS

A.1. PURPOSE:

This test was performed to determine if the EUT meets the RF power output requirements of FCC Part 74.861 and IC RSS-123.

A.2. REQUIREMENTS:

As stated in FCC Part 74.861(d)(1) and IC RSS-123, Section 5.1, the power of the measured carrier power may not exceed 250mW.

A.3. MEASUREMENT UNCERTAINTY

All measurements are an estimate of their true value. The measurement uncertainty characterizes, with a specified confidence level, the spread of values which may be possible for a given measurement system.

Values of Expanded Measurement Uncertainty (95% Confidence):

Measurement Type	U_{LAB}
RF Power Output	**±0.354 dB**

U_{lab} = Determined for Shure EMC Laboratory

Since U_{LAB} is less than or equal to U_{ETSI}:

- Compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- Non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

A.4. TEST SETUP AND INSTRUMENTATION:

A photograph of the test setup is shown as Figure H.2. The test instrumentation can be determined from Table 10-1.

A.5. EUT OPERATION:

The EUT was powered up and the frequency of the auxiliary equipment (transmitter) was selected using a laptop. The line voltage to the EUT was checked after turn-on and adjusted to 120VAC 60Hz. The EUT was checked for proper operation after it was setup for the test. Testing was conducted with the EUT input RF signal set to the frequencies and power levels shown in the following table.

EUT	Input Freq. (MHz)	Input Power Level (mW)
PA411	488.125	30mW
	584.125	
	697.875	

A.6. TEST PROCEDURES:

a. The EUT was connected to an RF power meter through a calibrated power measurement head.
b. The power meter was set to the operating frequency of the EUT.
c. The RF power meter was allowed to stabilize and then the output power measurement was recorded.
d. Steps a thru c were repeated for the remaining frequencies found in the table above.

A.7. RESULTS:

The output power measurement data is presented below. As shown by the test data, the power output of the EUT is within the requirements of FCC Part 74.861 and RSS-123.

Frequency (MHz)	Nominal Power (mW)	Measured Power (dBm)	Measured Power (mW)	FCC Limit (mW)	RSS-123 Limit (mW)
488.125	30	12.67	18.49	250	250
584.125	30	13.53	22.54	250	250
697.875	30	11.48	14.06	250	250

Conducted Power Output: PA411

B. FREQUENCY STABILITY

B.1. PURPOSE:

This test was performed to determine if the EUT meets the frequency stability requirements of FCC Part 74.861(e)(4) and RSS-123 section 5.4 over the operating range of 488-698 MHz.

B.2. REQUIREMENTS:

As stated in FCC Part 74.861(e)(4) and RSS-123, Section 5.1, the tolerance of the transmitter shall be 0.005%.

B.3. MEASUREMENT UNCERTAINTY:

All measurements are an estimate of their true value. The measurement uncertainty characterizes, with a specified confidence level, the spread of values which may be possible for a given measurement system.

Values of Expanded Measurement Uncertainty (95% Confidence):

Measurement Type	U_{lab}
Frequency Error (Stability)	35.15 Hz Or ±3.95 X 10^{-8}

- Compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- Non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

B.4. TEST SETUP AND INSTRUMENTATION:

The EUT was heated and cooled in an Espec temperature chamber over a temperature range of -30°C to +50°C in 10°C increments. The temperature around the EUT was measured and monitored by an Extech digital thermometer. The EUT's frequency was measured with a spectrum analyzer set to measure signal count at 0.1Hz resolution. Photographs of the test setup are shown as Figure H.3. The test instrumentation can be determined from Table 10-1.

B.5. EUT OPERATION:

The antenna port of the EUT was connected to the 50 Ohm input of a spectrum analyzer. The line voltage to the EUT was checked after turn-on and adjusted to 120VAC 60Hz. The EUT was checked for proper operation after it was setup for the test. The RF input signal to the EUT was set to a low, mid or high frequency within its operating band.

B.6. TEST PROCEDURES:

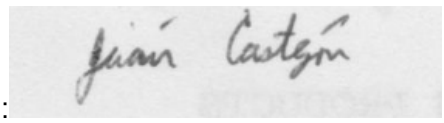
a. The nominal frequency of the EUT was measured at ambient temperature with the frequency counter function of the spectrum analyzer. The value was recorded.
b. The temperature chamber was set to -30C with the EUT inside and powered off.
c. The EUT was allowed to soak for ~30 minutes after the temperature chamber reached the set temperature.
d. The EUT was then powered on and allowed to stabilize for ~ 1 minute.
e. The frequency of the EUT was measured with the frequency counter function of the spectrum analyzer. The value was recorded.
f. The temperature chamber was incremented by 10°C with the EUT inside.
g. The EUT was allowed to soak for ~30 minutes after the temperature chamber reached the set temperature.
h. The EUT was then powered on and allowed to stabilize for ~ 1 minute.
i. The measured frequency of the EUT was captured with the frequency counter function of the spectrum analyzer. The value was recorded.
j. Steps f. through I. were repeated up to +50°C
k. Steps a. through J. were repeated for the representative low, mid and high frequencies within the EUT's operational range.
l. The test item was then removed from the temperature chamber and allowed to stabilize at 20°C.
m. The input voltage was checked and adjusted to the nominal level. The frequency was measured and recorded.
n. The input voltage was then adjusted to 85% of its nominal level. The frequency was measured and recorded.
o. The input voltage was then varied to 115% of its nominal level. The frequency was measured and recorded.

B.7. RESULTS:

The frequency stability measurements are presented in table B-1. As shown by the test data, the test frequency deviation was within the 0.005% limit specified in FCC Part 74.861(e)(4) and RSS-123, Section 5.1

	Temperature (°C)	Voltage	Nominal Frequency (MHz)	Measured Frequency (MHz)	Deviation (%)	Frequency Stability (%)	Deviation (Hz)	Frequency Stability (Hz)	Pass/Fail
488.125MHz, 30mW									
	-30	120VAC, 60Hz	488.125	488.1249872	-0.0000026	0.005	-12.800000	24406.25	PASS
	-20	120VAC, 60Hz	488.125	488.1249793	-0.0000042	0.005	-20.700000	24406.25	PASS
	-10	120VAC, 60Hz	488.125	488.1250159	0.0000033	0.005	15.900000	24406.25	PASS
	0	120VAC, 60Hz	488.125	488.1249935	-0.0000013	0.005	-6.500000	24406.25	PASS
	10	120VAC, 60Hz	488.125	488.1249731	-0.0000055	0.005	-26.900000	24406.25	PASS
	20	120VAC, 60Hz	488.125	488.1249653	-0.0000071	0.005	-34.700000	24406.25	PASS
	30	120VAC, 60Hz	488.125	488.1249834	-0.0000034	0.005	-16.600000	24406.25	PASS
	40	120VAC, 60Hz	488.125	488.1249839	-0.0000033	0.005	-16.100000	24406.25	PASS
	50	120VAC, 60Hz	488.125	488.1250072	0.0000015	0.005	7.200000	24406.25	PASS
584.125MHz, 30mW									
	-30	120VAC, 60Hz	584.125	584.1247187	-0.0000482	0.005	-281.300000	29206.25	PASS
	-20	120VAC, 60Hz	584.125	584.1246976	-0.0000518	0.005	-302.400000	29206.25	PASS
	-10	120VAC, 60Hz	584.125	584.1246938	-0.0000524	0.005	-306.200000	29206.25	PASS
	0	120VAC, 60Hz	584.125	584.1247363	-0.0000451	0.005	-263.700000	29206.25	PASS
	10	120VAC, 60Hz	584.125	584.1247170	-0.0000484	0.005	-283.000000	29206.25	PASS
	20	120VAC, 60Hz	584.125	584.1247916	-0.0000357	0.005	-208.400000	29206.25	PASS
	30	120VAC, 60Hz	584.125	584.1247586	-0.0000413	0.005	-241.400000	29206.25	PASS
	40	120VAC, 60Hz	584.125	584.1247540	-0.0000421	0.005	-246.000000	29206.25	PASS
	50	120VAC, 60Hz	584.125	584.1247812	-0.0000375	0.005	-218.800000	29206.25	PASS
697.875MHz, 30mW									
	-30	120VAC, 60Hz	697.875	697.8750677	0.0000097	0.005	67.700000	34893.75	PASS
	-20	120VAC, 60Hz	697.875	697.8750688	0.0000099	0.005	68.800000	34893.75	PASS
	-10	120VAC, 60Hz	697.875	697.8751121	0.0000161	0.005	112.100000	34893.75	PASS
	0	120VAC, 60Hz	697.875	697.8750236	0.0000034	0.005	23.600000	34893.75	PASS
	10	120VAC, 60Hz	697.875	697.8750163	0.0000023	0.005	16.300000	34893.75	PASS
	20	120VAC, 60Hz	697.875	697.8749677	-0.0000046	0.005	-32.300000	34893.75	PASS
	30	120VAC, 60Hz	697.875	697.8750321	0.0000046	0.005	32.100000	34893.75	PASS
	40	120VAC, 60Hz	697.875	697.8750224	0.0000032	0.005	22.400000	34893.75	PASS
	50	120VAC, 60Hz	697.875	697.8750664	0.0000095	0.005	66.400000	34893.75	PASS
	Temperature (°C)	Voltage	Nominal Frequency (MHz)	Measured Frequency (MHz)	Deviation (%)	Freqency Stability (%)	Deviation (Hz)	Frequency Stability (Hz)	Pass/Fail
488.125MHz, 30mW									
	20	120VAC, 60Hz (100%)	488.125	488.124965	-0.0000071	0.005	-34.700000	24406.25	PASS
	20	102VAC, 60Hz (85%)	488.125	488.125009	0.0000019	0.005	9.100000	24406.25	PASS
	20	138VAC, 60Hz (115%)	488.125	488.124933	-0.0000138	0.005	-67.300000	24406.25	PASS
584.125MHz, 30mW									
	20	120VAC, 60Hz (100%)	584.125	584.124792	-0.0000357	0.005	-208.400000	29206.25	PASS
	20	102VAC, 60Hz (85%)	584.125	584.124789	-0.0000362	0.005	-211.200000	29206.25	PASS
	20	138VAC, 60Hz (115%)	584.125	584.124772	-0.0000391	0.005	-228.300000	29206.25	PASS
697.875MHz, 30mW									
	20	120VAC, 60Hz (100%)	697.875	697.874968	-0.0000046	0.005	-32.300000	34893.75	PASS
	20	102VAC, 60Hz (85%)	697.875	697.875009	0.0000013	0.005	9.300000	34893.75	PASS
	20	138VAC, 60Hz (115%)	697.875	697.875023	0.0000033	0.005	23.200000	34893.75	PASS

Table B-1. PA411 Frequency Stability Data

Checked: 

C. OCCUPIED BANDWIDTH MEASUREMENTS

C.1. PURPOSE:

This test was performed to determine if the EUT meets the occupied bandwidth requirements of FCC Part 74.861(e)(5), and RSS-123 Section 5.3.

C.2. REQUIREMENTS:

As stated in paragraph 74.861(e)(5), for low power auxiliary stations operating in the bands allocated for TV broadcasting, the following technical requirements apply:

a. The operating bandwidth shall not exceed 200 kHz.
b. The mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:
    i. On any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB;
    ii. On any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB;
    iii. On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least 43+10log10 (mean output power in watts) dB.

Per the specifications set out in RSS-123 section 5.3 and 5.5.1, the following technical requirements apply:

a. The authorized bandwidth shall not exceed 200 kHz.
b. The power of unwanted emissions shall be attenuated below the mean transmitter power in accordance with the following schedule:
    i. On any frequency removed from the carrier frequency by more than 50% up to and including 100% of the authorized bandwidth: at least 25 dB.
    ii. On any frequency removed from the carrier frequency by more than 100% up to and including 250% of the authorized bandwidth: at least 35 dB.
    iii. On any frequency removed from the carrier frequency by more than 250% of the authorized bandwidth: at least 55 + 10 Log (P) dB.

C.3. TEST SETUP AND INSTRUMENTATION:

Photographs of the test setup are shown as Figure H.4. The test instrumentation can be determined from Table 10-1.

C.4. MEASUREMENT UNCERTAINTY

All measurements are an estimate of their true value. The measurement uncertainty characterizes, with a specified confidence level, the spread of values which may be possible for a given measurement system.

Values of Expanded Measurement Uncertainty (95% Confidence):

Measurement Type	U_{LAB}
Occupied Bandwidth	**±0.130 %**

U_{lab} = Determined for Shure EMC Laboratory

Since U_{LAB} is less than or equal to U_{ETSI}:

- Compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- Non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

C.5. EUT OPERATION:

The EUT was powered up and the frequency of the auxiliary equipment (transmitter) was selected using a laptop. The line voltage to the EUT was checked after turn-on and adjusted to 120VAC 60Hz. The EUT was checked for proper operation after it was setup for the test. The RF input signal to the EUT was set to a low, mid or high frequency within its operating band. The RF input signal and power output terminal were terminated with a representative transmitter. The representative transmitter supplied the RF input signal to the EUT. The auxiliary transmitter audio input ports were connected to an audio signal source using shielded cables.

C.6. TEST PROCEDURES:

a. The EUT was connected to the 50 ohm input of a spectrum analyzer through 20dB of attenuation; the reference offset of the spectrum analyzer was set to the measured value of the attenuation path.
b. The unmodulated carrier signal level was recorded and used to set the reference level on the spectrum analyzer.
c. The spectrum analyzer span was then set to 1.5 MHz and the resolution bandwidth set to 2 kHz (1% of Authorized BW).
d. The FCC and RSS-123 emission limits were overlaid on the spectrum analyzer display and the trace was recorded.
e. The test item was modulated with a 2500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50% of the rated system deviation.
f. The test item was modulated with a 15 kHz sine wave at an input level necessary to produce 85% of the rated system deviation.
g. Steps (a) through (f) were repeated at the high, medium, and low frequencies of the EUT's frequency range.

C.7. RESULTS:

The occupied bandwidth data is presented on pages 17-28. Data is shown on the figures at each frequency (Low, Mid, or High). The first figure shows the reference carrier power while the remaining figures show the maximum relative level within the emission mask (with and without modulation). The limits, shown on the plots, are referenced to the power measured from the un-modulated carrier.

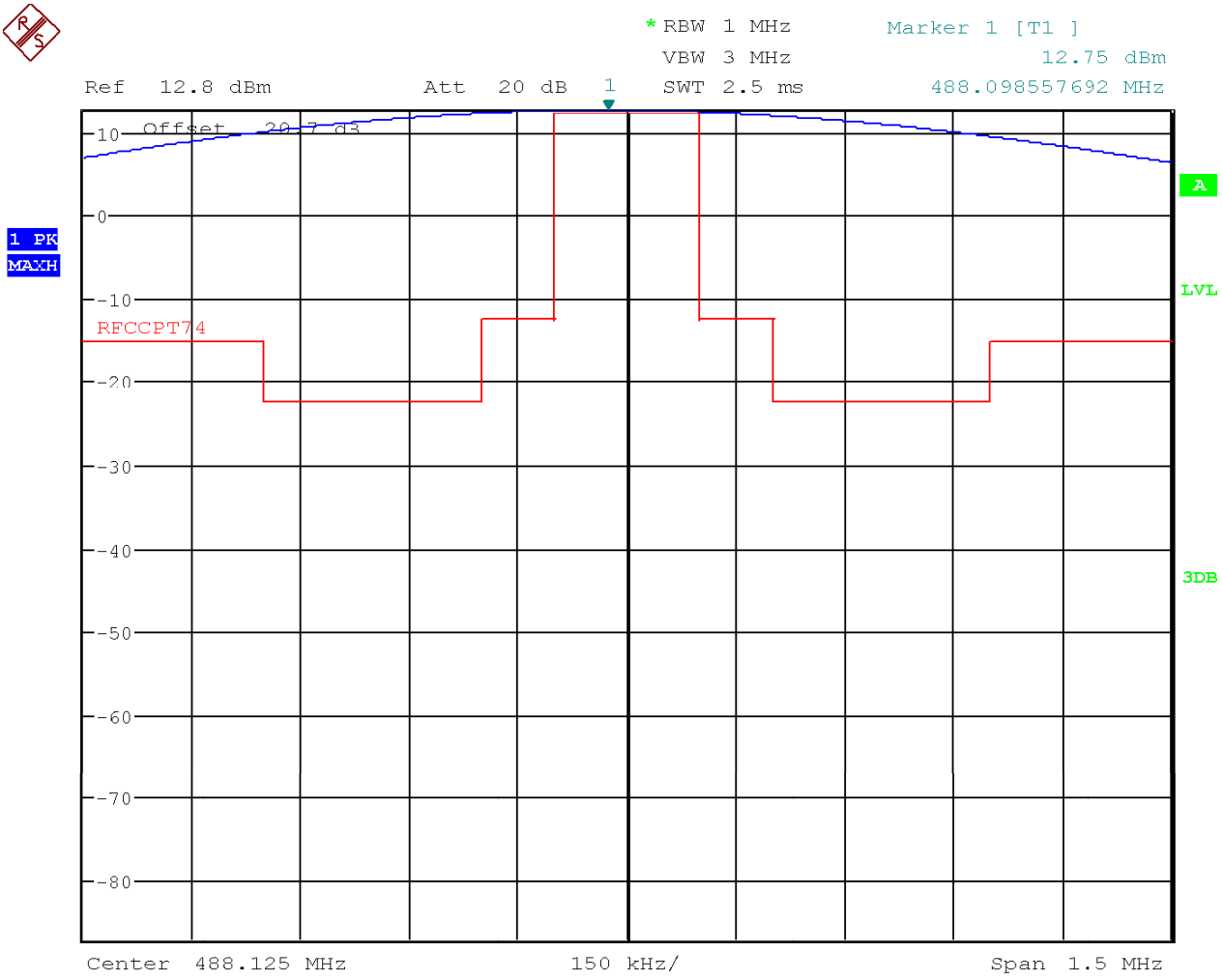
The operating bandwidth was determined using Carson's rule:
Bn = 2M + 2DK where Bn = bandwidth, M= Maximum modulating frequency and D = Peak Deviation. With K = 1, M = 8kHz and D = 74kHz resulting in an operating bandwidth of 164kHz.

The maximum Industry Canada 99% bandwidth measurement was 122.600 kHz.

As shown by the test data, the occupied bandwidth of the EUT meets the requirements of FCC Part 74.861 and RSS-123. A photograph of the test set-up is shown in Figure H.4.

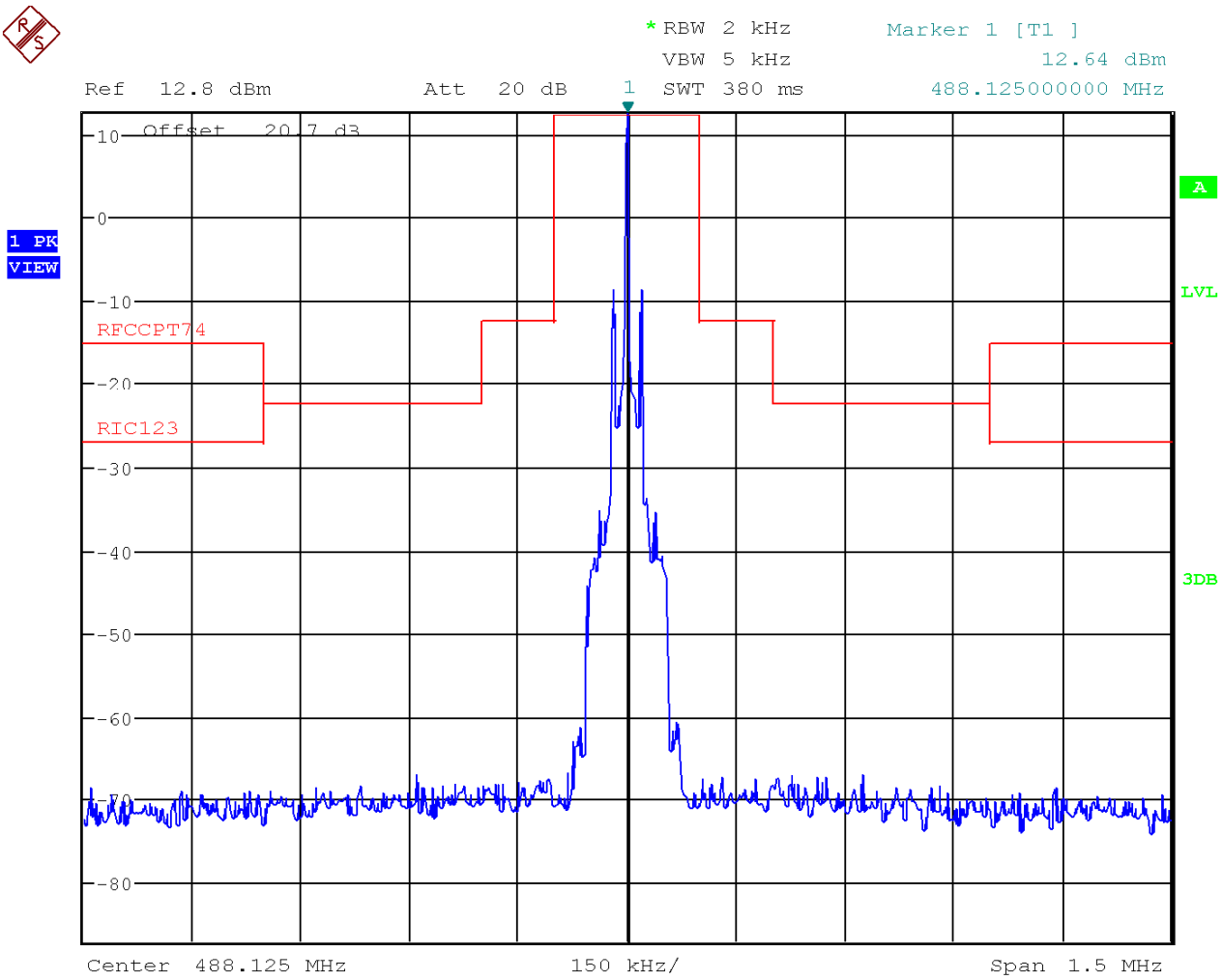
PA411 Occupied Bandwidth Data

EUT	PA411
Serial Number:	#1
Test Description:	OBW RF Power Output at 30mW
Date of Test:	May 22, 2014
Operating Conditions:	Low Frequency (488.125 MHz)
Operator Name:	Lovell Cueto
Comment:	Reference Power Level Measurement



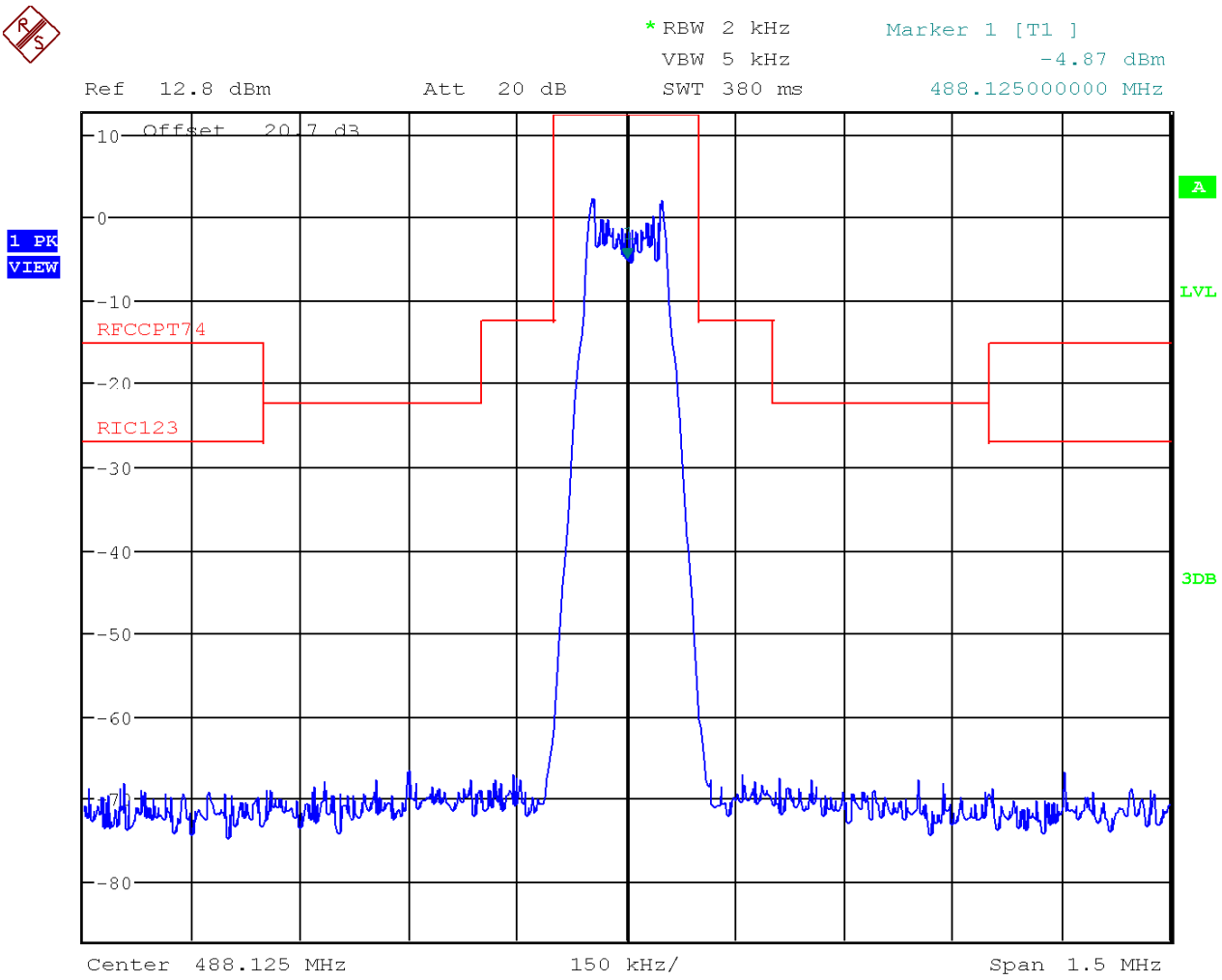
Date: 22.MAY.2014 14:36:48

EUT	PA411
Serial Number:	#1
Test Description:	OBW RF Power Output at 30mW
Date of Test:	May 22, 2014
Operating Conditions:	Low Frequency (488.125 MHz)
Operator Name:	Lovell Cueto
Comment:	Unmodulated Carrier



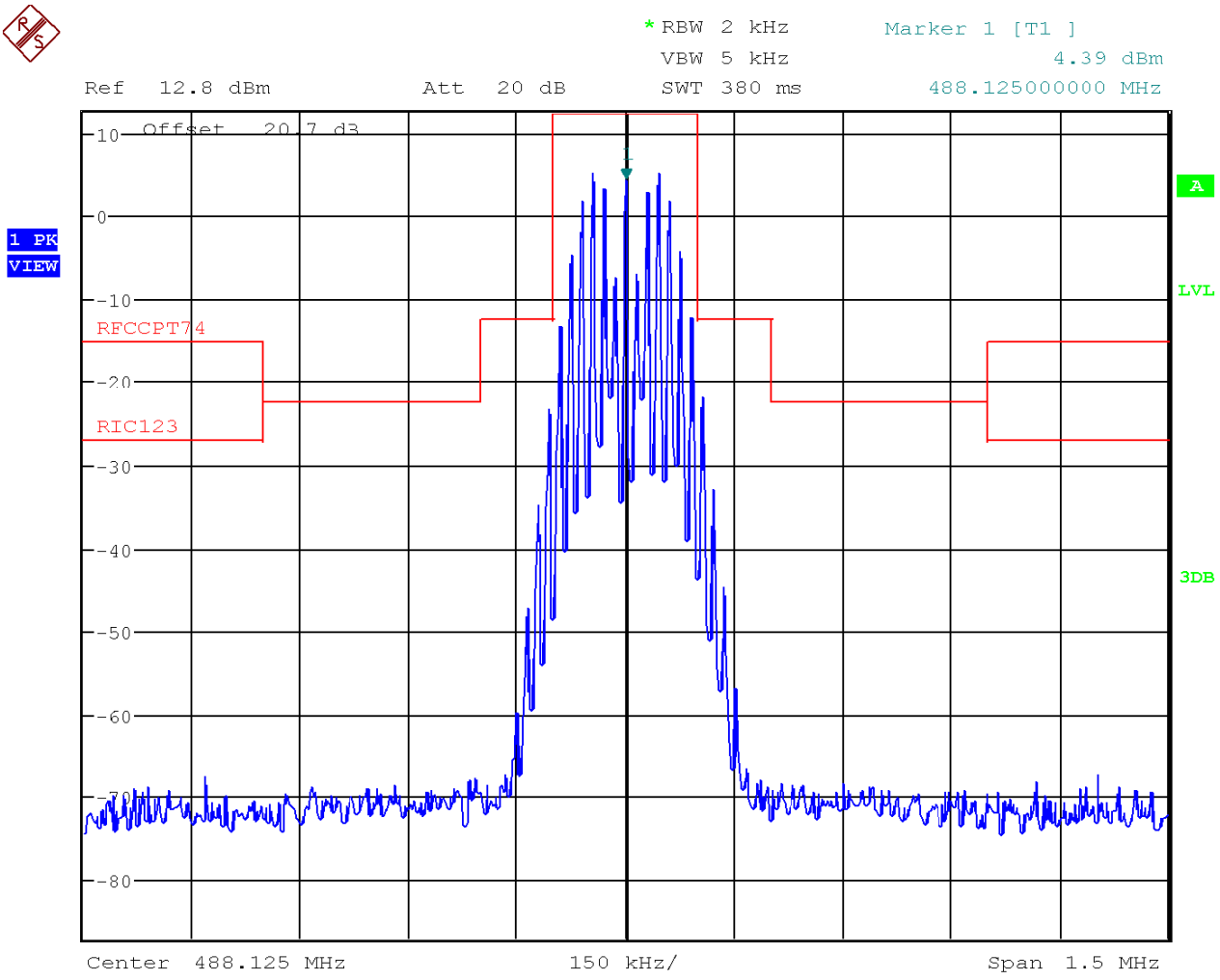
Date: 22.MAY.2014 14:42:18

EUT	PA411
Serial Number:	#1
Test Description:	OBW RF Power Output at 30mW
Date of Test:	May 22, 2014
Operating Conditions:	Low Frequency (488.125 MHz)
Operator Name:	Lovell Cueto
Comment:	2500 Hz at 16dB over 50%



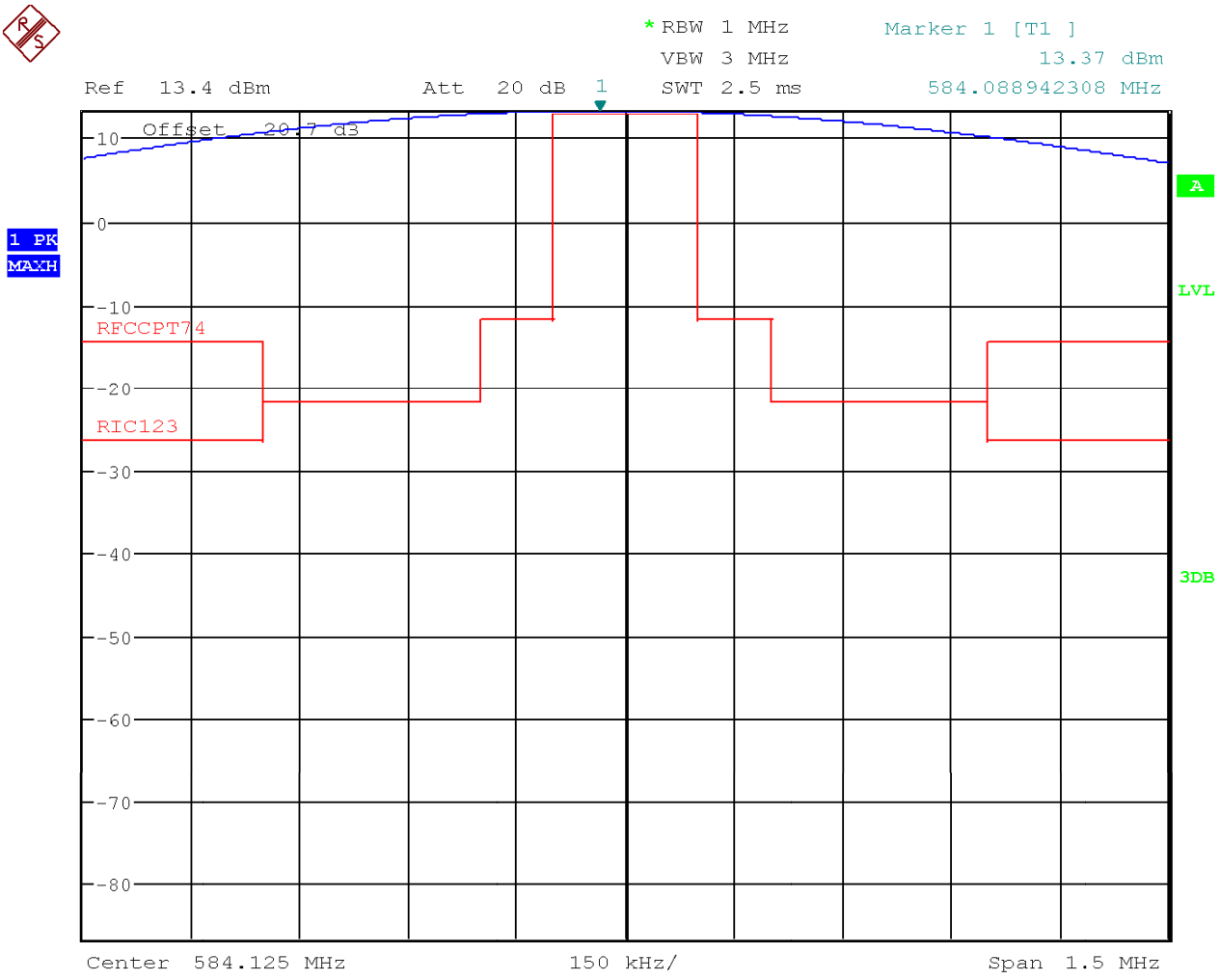
Date: 22.MAY.2014 14:41:36

EUT	PA411
Serial Number:	#1
Test Description:	OBW RF Power Output at 30mW
Date of Test:	May 22, 2014
Operating Conditions:	Low Frequency (488.125 MHz)
Operator Name:	Lovell Cueto
Comment:	15 kHz at 85% Modulation



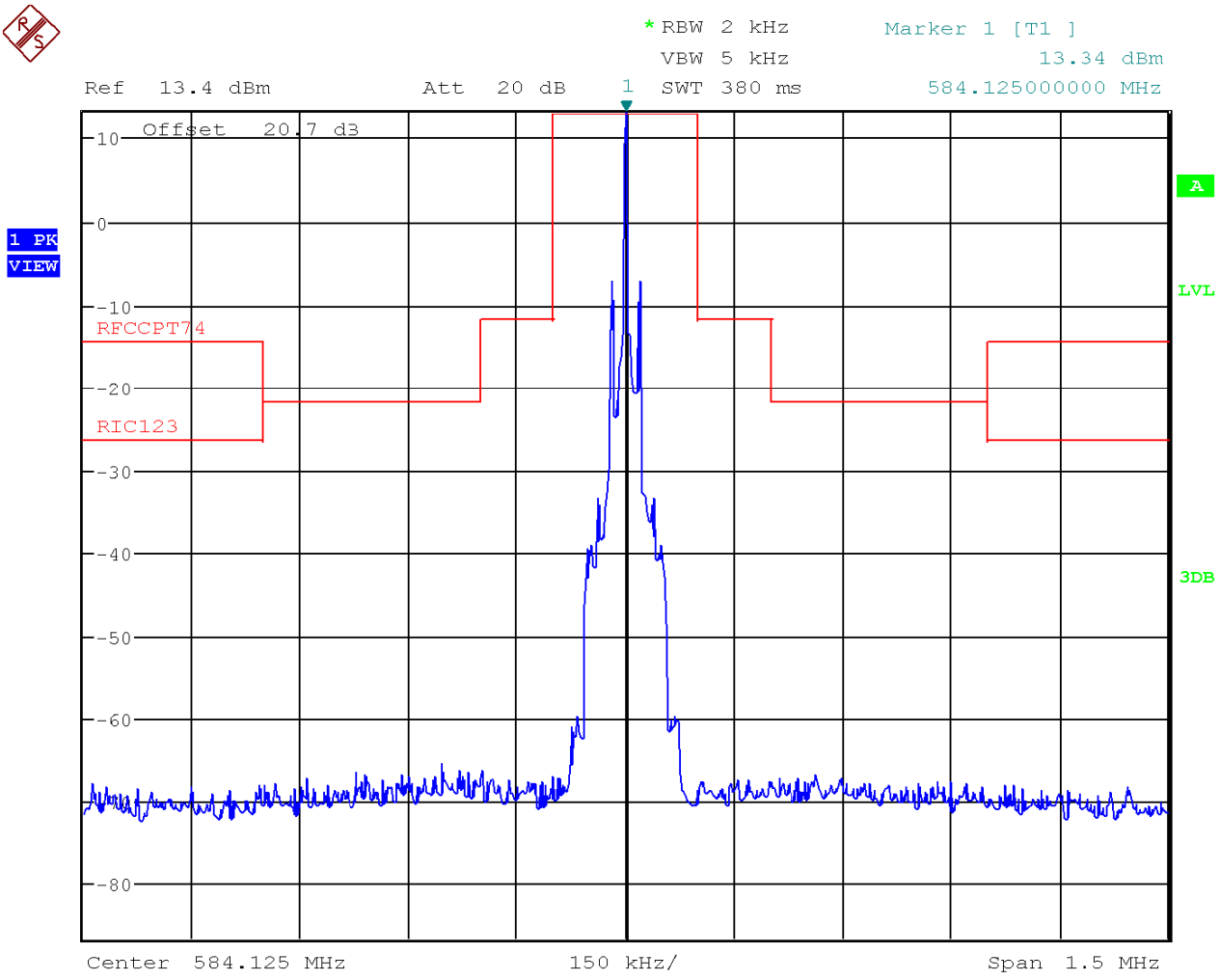
Date: 22.MAY.2014 14:51:07

EUT	PA411
Serial Number:	#1
Test Description:	OBW RF Power Output at 30mW
Date of Test:	May 22, 2014
Operating Conditions:	Mid Frequency (584.125 MHz)
Operator Name:	Lovell Cueto
Comment:	Reference Power Level Measurement



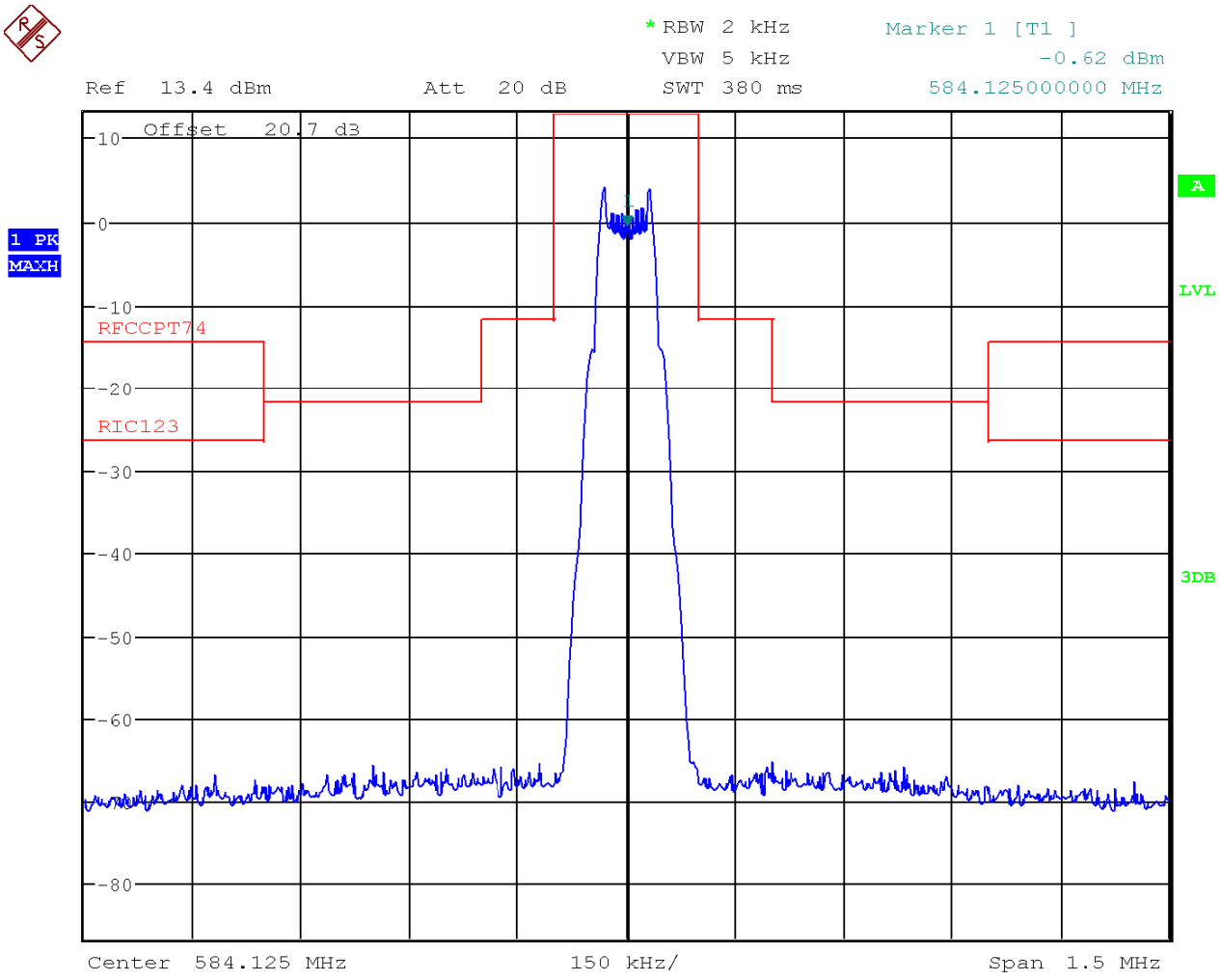
Date: 22.MAY.2014 15:07:50

EUT	PA411
Serial Number:	#1
Test Description:	OBW RF Power Output at 30mW
Date of Test:	May 22, 2014
Operating Conditions:	Mid Frequency (584.125 MHz)
Operator Name:	Lovell Cueto
Comment:	Unmodulated Carrier



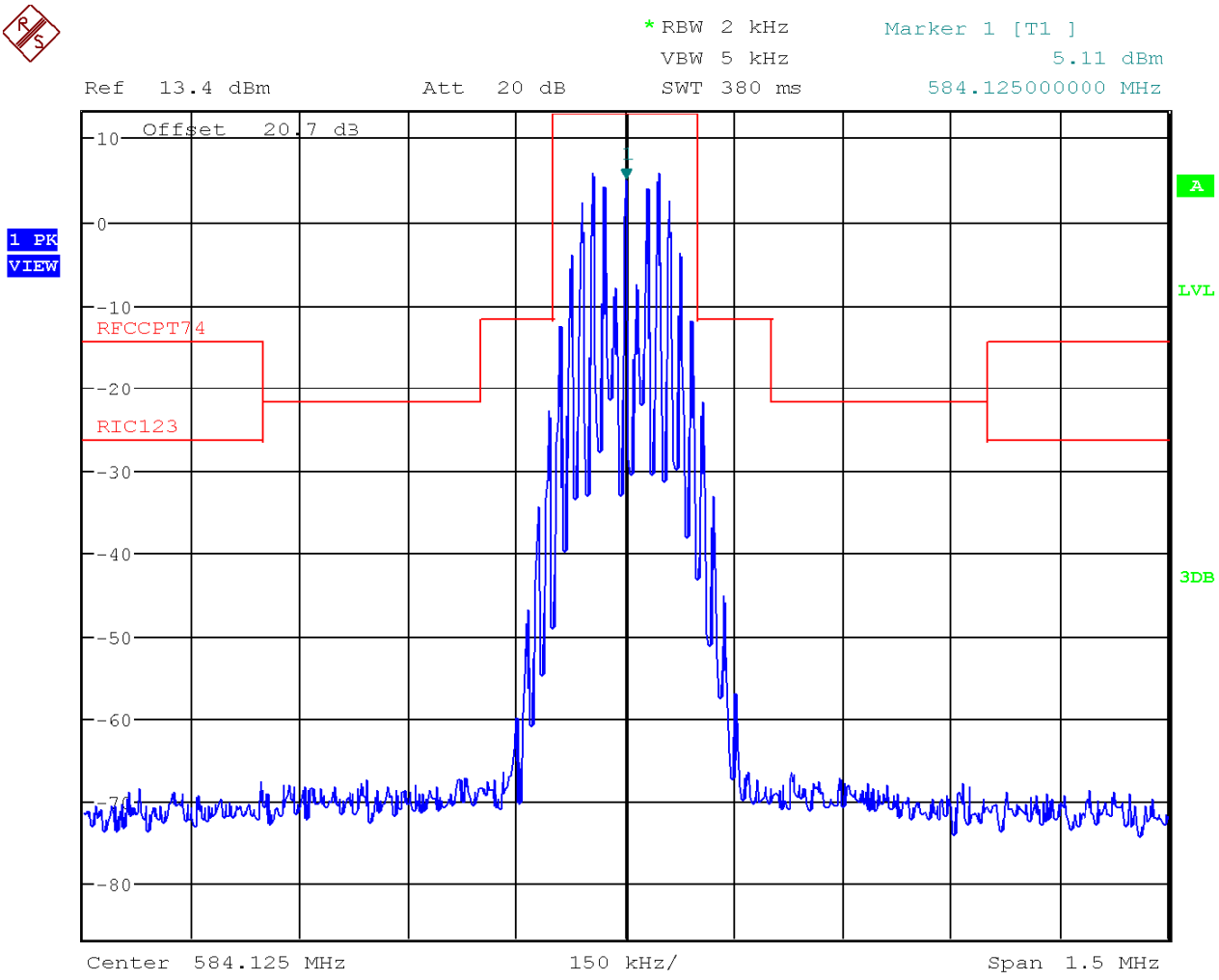
Date: 22.MAY.2014 15:09:06

EUT	PA411
Serial Number:	#1
Test Description:	OBW RF Power Output at 30mW
Date of Test:	May 22, 2014
Operating Conditions:	Mid Frequency (584.125 MHz)
Operator Name:	Lovell Cueto
Comment:	2500 Hz at 16dB over 50%



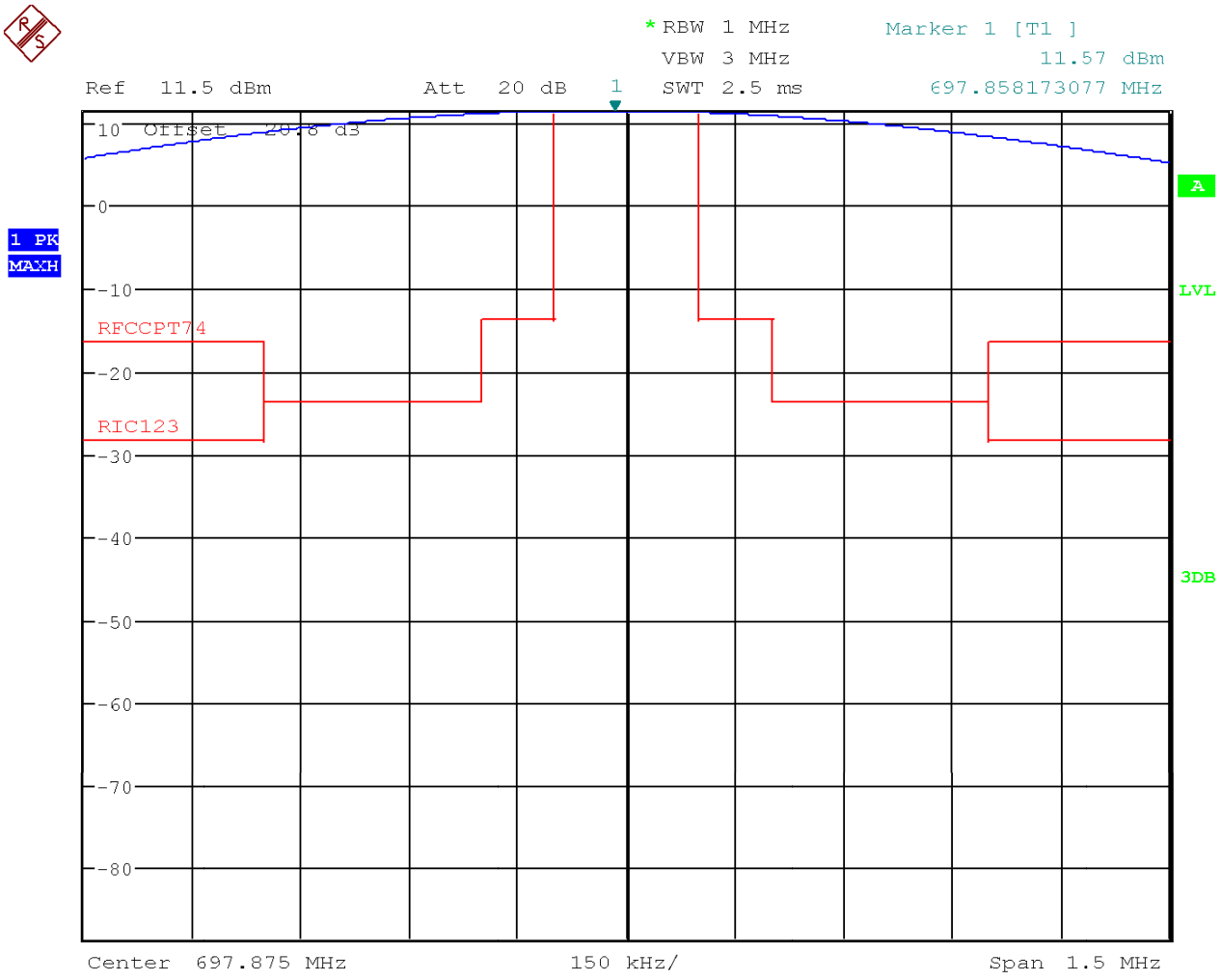
Date: 22.MAY.2014 15:10:02

EUT	PA411
Serial Number:	#1
Test Description:	OBW RF Power Output at 30mW
Date of Test:	May 22, 2014
Operating Conditions:	Mid Frequency (584.125 MHz)
Operator Name:	Lovell Cueto
Comment:	15 kHz at 85% Modulation



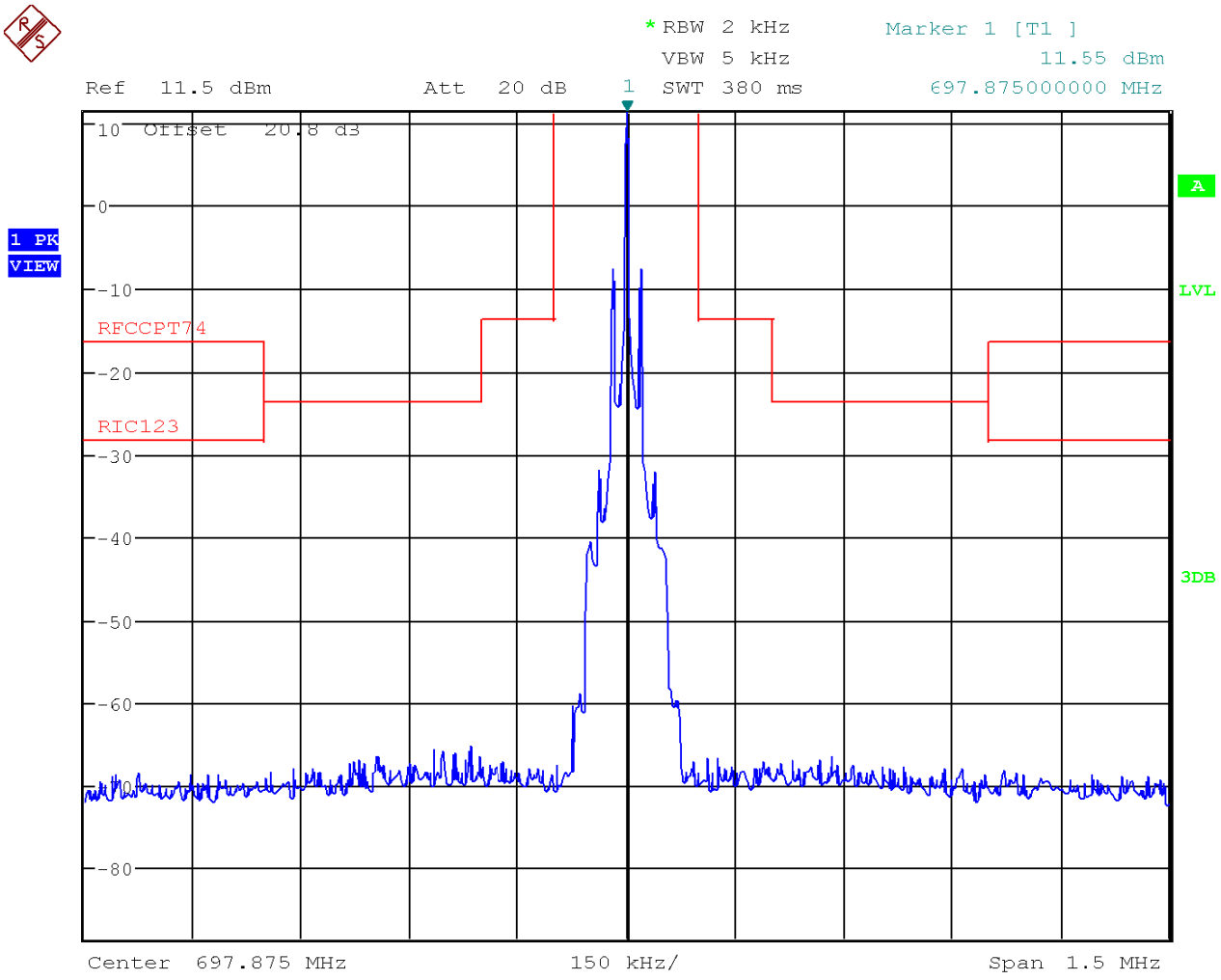
Date: 22.MAY.2014 15:18:12

EUT	PA411
Serial Number:	#1
Test Description:	OBW RF Power Output at 30mW
Date of Test:	May 22, 2014
Operating Conditions:	High Frequency (697.875 MHz)
Operator Name:	Lovell Cueto
Comment:	Reference Power Level Measurement



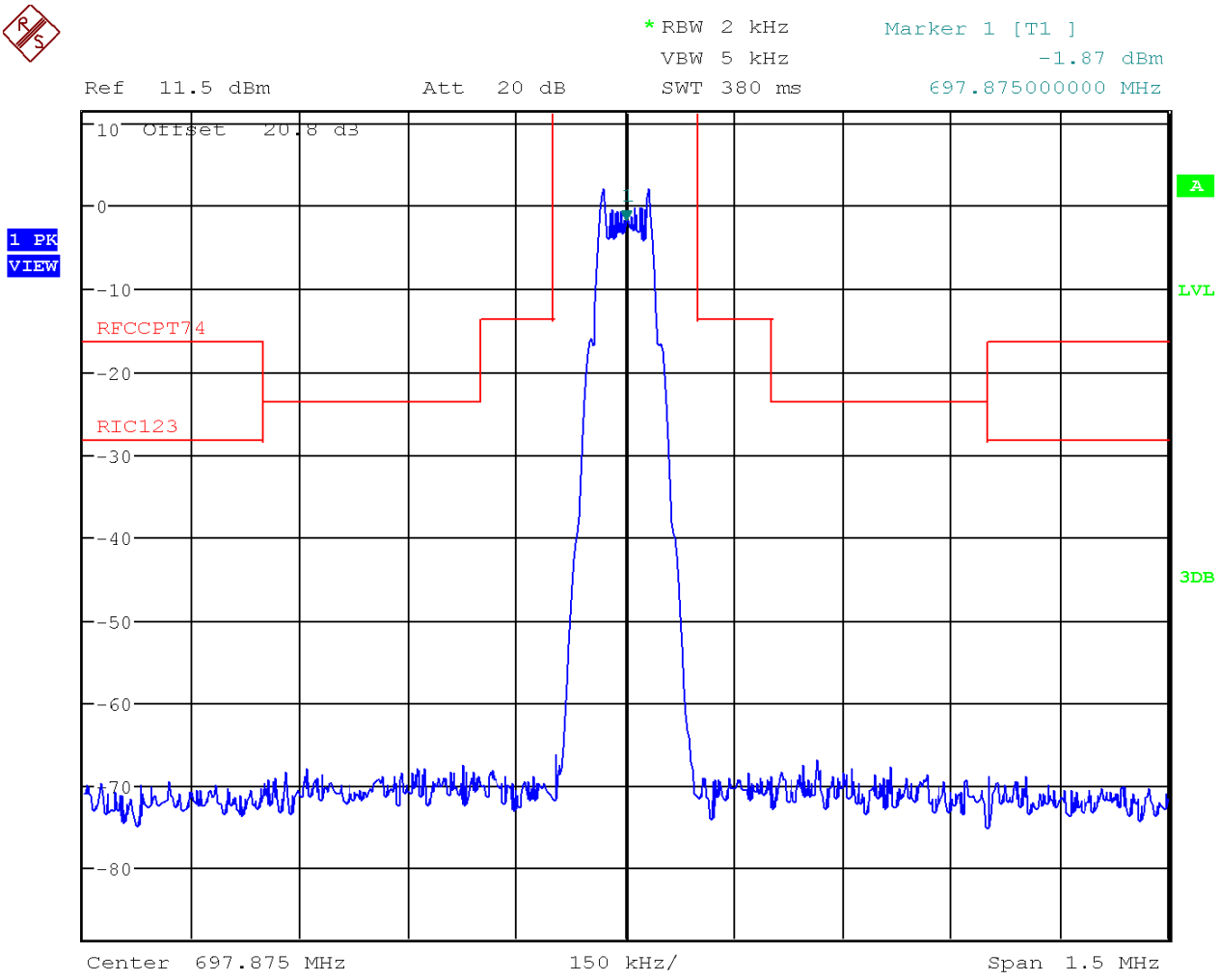
Date: 22.MAY.2014 15:24:21

EUT	PA411
Serial Number:	#1
Test Description:	OBW RF Power Output at 30mW
Date of Test:	May 22, 2014
Operating Conditions:	High Frequency (697.875 MHz)
Operator Name:	Lovell Cueto
Comment:	Unmodulated Carrier



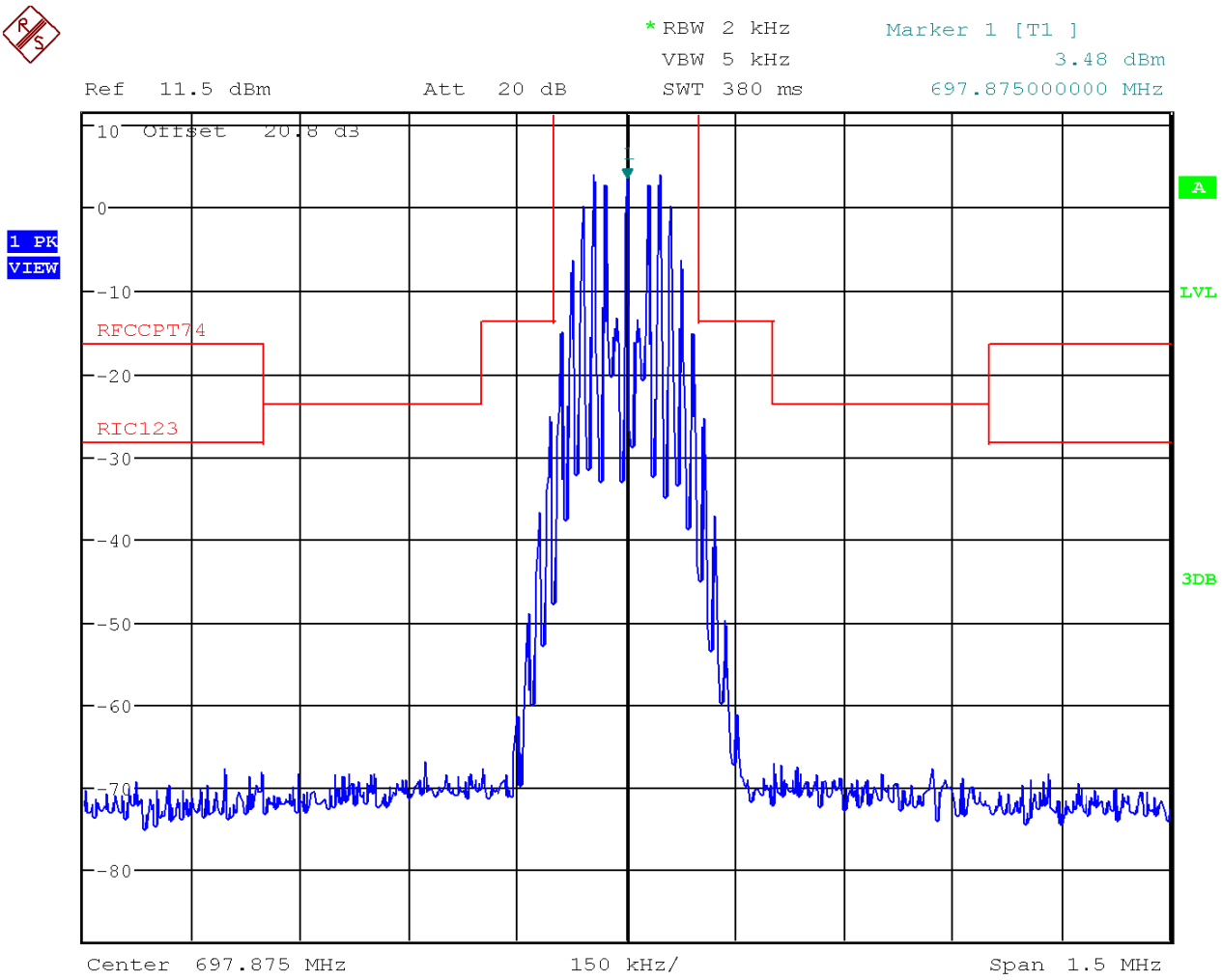
Date: 22.MAY.2014 15:25:25

EUT	PA411
Serial Number:	#1
Test Description:	OBW RF Power Output at 30mW
Date of Test:	May 22, 2014
Operating Conditions:	High Frequency (697.875 MHz)
Operator Name:	Lovell Cueto
Comment:	2500 Hz at 16dB over 50%



Date: 22.MAY.2014 15:26:05

EUT	PA411
Serial Number:	#1
Test Description:	OBW RF Power Output at 30mW
Date of Test:	May 22, 2014
Operating Conditions:	High Frequency (697.875 MHz)
Operator Name:	Lovell Cueto
Comment:	15 kHz at 85% Modulation



Date: 22.MAY.2014 15:30:07

D. FIELD STRENGTH OF SPURIOUS EMISSIONS

D.1. PURPOSE:

This test was performed to determine if the PA411 (EUT) meets the radiated RF emission requirements of the FCC Part 74 and RSS-123 over the frequency range from 30MHz to 7GHz.

D.2. REQUIREMENTS:

As stated in FCC Part 74, spurious emissions must fall below the limits given below.

i. On any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB;
ii. On any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB;
iii. On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least 43+10log10 (mean output power in watts) dB.

And as stated in RSS-123, Clause 5.5.1:

The power of unwanted emissions (measured with a resolution bandwidth of 1% of the authorized bandwidth) shall be attenuated below the mean output power, P_{MEAN} in dBW, of the transmitter as follows:

i. at least 25 dB on any frequency removed from the operating frequency by more than 50% up to and including 100% of the authorized bandwidth; and
ii. at least 35 dB on any frequency removed from the operating frequency by more than 100% up to and including 250% of the authorized bandwidth.

The power of unwanted emissions (measured with a resolution bandwidth of 30 kHz) shall be attenuated below the mean output power, PMEAN in dBW, of the transmitter as follows:

i. at least 55 + $10\log_{10}$ (P_{MEAN} in watts) dB: on any frequency removed from the operating frequency by more than 250% of the authorized bandwidth.

D.3. MEASUREMENT UNCERTAINTY

All measurements are an estimate of their true value. The measurement uncertainty characterizes, with a specified confidence level, the spread of values which may be possible for a given measurement system.

Values of Expanded Measurement Uncertainty (95% Confidence):

Measurement Type	U_{LAB}
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	**4.18 dB**
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 12.75 GHz)	**4.61 dB**

U_{lab} = Determined for Shure EMC Laboratory

- Compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- Non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

D.4. TEST SETUP AND INSTRUMENTATION:

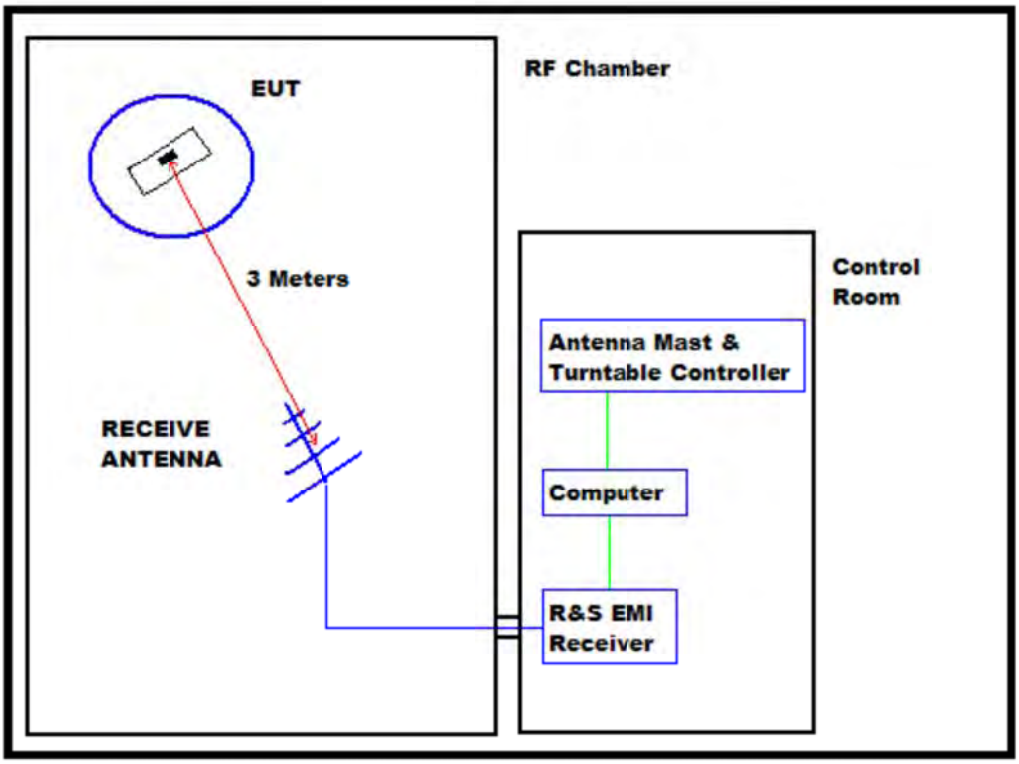
Photographs of the test setup are shown in Figures H.1 and H.5. The test instrumentation can be determined from Table 10-1.

D.5. EUT OPERATION:

The EUT was powered up the line voltage to the EUT was checked after turn-on and adjusted to 120VAC 60Hz. The EUT was checked for proper operation after it was setup for the test. The RF input signal to the EUT was set to a low, mid and high frequency within its operating band. The RF input signal and power output terminal were terminated with a representative transmitter. The representative transmitter supplied the RF input signal to the EUT. The EUT antenna output terminal was connected to a ½ wave antenna.

D.6. SPECIFIC TEST PROCEDURES:

All tests were performed in a 28ft. x 20ft. x 18.5ft. 3m semi-anechoic test chamber. The walls and ceiling of the shielded chamber are lined with ferrite tiles. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2003 for site attenuation.
The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All power lines and signal lines entering the enclosure pass through filters on the enclosure wall. The power line filters prevent extraneous signals from entering the enclosure on these leads.



BLOCK DIAGRAM OF SHIELDED ENCLOSURE

Preliminary radiated measurements were performed to determine the frequencies where the significant emissions might be found. Several different orientations of the EUT with respect to the antenna measurement antenna at a set height (i.e. without maximizing), the radiated emissions were measured using a peak detector and automatically plotted. The broadband measuring antenna was positioned at a 3 meter distance from the EUT. This data was then automatically plotted up through 7GHz.

All significant broadband and narrowband signals found in the preliminary sweeps were then measured using a peak detector at a test distance of 3 meters. The measurements were made with a BiConiLog antenna over the frequency range of 30 MHz to 1 GHz, and a double ridged waveguide antenna over the frequency range of 1 GHz to 7 GHz.
The resultant field strength (FS) is a summation in decibels (dB) of the EMI receiver measurement (ERM), the antenna correction factor (AF), and the cable loss factor (CF). If an external pre-amplifier is used, the total is reduced by its gain (-PA).

Formula 1: FS (dBµV/m) = MTR (dBµV) + AF (dB/m) + CF (dB) + (- PA (dB))

To convert the Field Strength dBµV/m term to µV/m, the dBµV/m is first divided by 20. The Base 10 AntiLog is taken of this quotient. The result is the Field Strength value in µV/m terms.

Formula 2: FS (µV/m) = AntiLog [(FS (dBµV/m))/20]

Final radiated RF emissions were performed on all significant broadband and narrowband emissions found in the preliminary sweeps using the following methods:

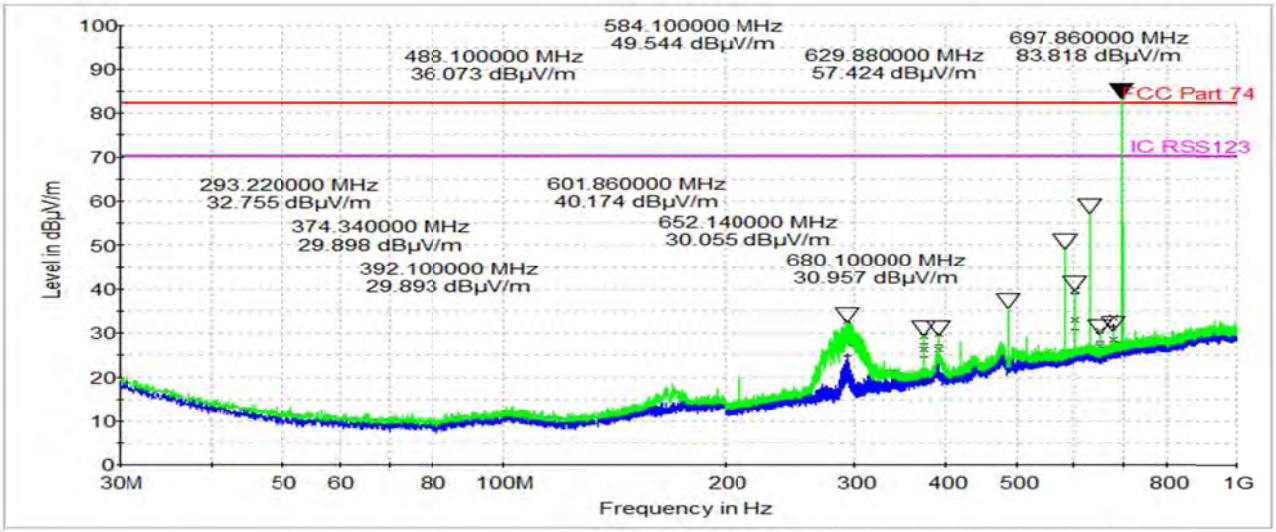
1) Measurements of all significant broadband and narrowband signals from 30MHz to 1GHz were made using a peak detector and a BiConiLog antenna. Measurements above 1GHz were made using a peak detector and a broadband double ridged waveguide antenna.
2) To ensure that maximum or worst case, emission levels were measured, the following steps were taken:
    i. The EUT was rotated so that all of its sides were exposed to the receiving antenna.
    ii. Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
    iii. The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.
3) Once the significant narrowband emissions were defined and their measurements maximized, the measurement s were confirmed by matching the field strength of the maximized signal from the EUT by substituting the EUT with a dipole antenna below 1GHz and a waveguide horn antenna above 1GHz and reproducing the field strength measurement.
    i. The substitution antenna was positioned in the same orientation as the EUT.
    ii. The output of a signal generator set at the same frequency as the significant narrow band emission was fed into the substitution antenna.
    iii. The test antenna was raised or lowered as necessary to ensure that the maximum signal was still received.
    iv. The output power level (in dBm) of the signal generator was increased until the corresponding reading on the test receiver matched the maximized field strength measurement.
    v. The output power level of the signal generator was recorded as the absolute level of the spurious radiated emission in dBm taking into account any cable loss and antenna gain inherent in the substitution test setup.

D.7. RESULTS:

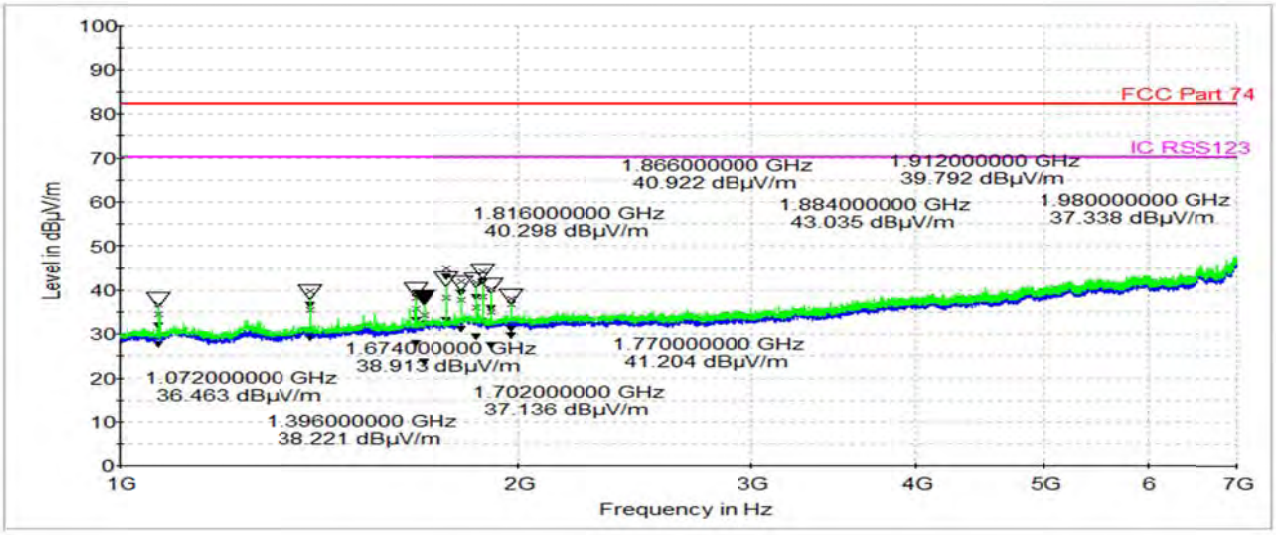
The plots of the peak preliminary radiated voltage levels are presented on page 33. The plots are presented in pairs, with the first figure showing the emissions scan below 1GHz and the second figure showing the emissions scan above 1GHz. The maximized peak voltage level results are presented on page 34. All emissions measured from the PA411 were within the limits set in FCC Part 74.861 and RSS-123, Clause 5.5.1.

Test Information

EUT Name:	PA411
Serial Number:	#1
Test Description:	Radiated RF Emissions
Operating Conditions:	120VAC, 60Hz, AE: 488.125MHz, 584.125MHz, 629.875MHz, 697.875MHz
Operator Name:	Lovell Cueto
Date:	May 1-2, 2014
Comment:	PreScan Measurements, Horizontal and Vertical Antenna



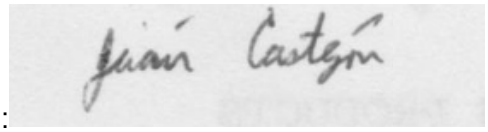
Radiated Emission - 30MHz to 1GHz



Radiated Emission - 1GHz to 7GHz

Date: May 08, 2014
EUT: PA411
Tested By: Lovell Cueto
Serial Number: #1
Specification: FCC Pt74 and RSS-123, Spurious Radiated Emissions
Comments: 120VAC, 50Hz

Spurious Freq (MHz)	Polarity	Measured Value (dBµV)	Equivalent Measured from Sig Gen (dBm)	Cable Loss (dB)	Antenna Gain (dB)	ERP Total (dBm)	Atten (dBm)	FCC Limit Min Atten (dBm)	IC Limit Min Atten (dBm)
976.260	H	39.7	-58.80	-2.15	0.0	-56.65	71.42	27.77	39.77
976.260	V	41.9	-56.56	-2.15	0.0	-54.41	69.18	27.77	39.77
1770.000	H	38.3	-64.63	-3.05	5.6	-55.98	70.75	27.77	39.77
1770.000	V	44.9	-56.67	-3.05	5.6	-48.02	62.79	27.77	39.77
1816.000	H	37.9	-66.44	-3.13	5.6	-57.71	72.48	27.77	39.77
1816.000	V	42.1	-59.80	-3.13	5.6	-51.07	65.84	27.77	39.77
1866.000	H	36.1	-72.05	-3.15	5.6	-63.30	78.07	27.77	39.77
1866.000	V	41.7	-61.07	-3.15	5.6	-52.32	67.09	27.77	39.77
1884.000	H	38.6	-65.80	-3.19	5.6	-57.01	71.78	27.77	39.77
1884.000	V	44.2	-57.04	-3.19	5.6	-48.25	63.02	27.77	39.77
1912.000	H	35.0	-70.92	-3.23	5.6	-62.09	76.86	27.77	39.77
1912.000	V	40.4	-61.48	-3.23	5.6	-52.65	67.42	27.77	39.77

Checked: 

E. CONDUCTED RF EMISSIONS – AC Mains – 150 KHz TO 30 MHz

E.1. PURPOSE:

This test was performed to determine if the PA411 meets the conducted RF emission requirements of the FCC Part 15, Subpart B and the RSS-GEN Section 7.2.4 specifications over the frequency range from 150 KHz to 30 MHz.

E.2. REQUIREMENTS:

All radio frequency voltages on the power lines of a EUT shall be below the values shown below when using a quasi-peak/average detector:

Frequency Range In MHz	Limits in dB(µV) Quasi-Peak	Limits in dB(µV) Average
0.15 to 0.5	66-56*	56-46*
0.5 to 5	56	46
5 to 30	60	50

* - The limit decreases linearly with the logarithm of the frequency

Note 1: The lower limit shall apply at the transition frequency.

Note 2: If the levels measured using the QP detector meet both the QP and the Average limits, the EUT is considered to have met both requirements and measurements do not need to be performed using the Average detector.

E.3. MEASUREMENT UNCERTAINTY

All measurements are an estimate of their true value. The measurement uncertainty characterizes, with a specified confidence level, the spread of values which may be possible for a given measurement system.

Values of Expanded Measurement Uncertainty (95% Confidence)

Measurement Type	U_{lab}
Conducted disturbance on AC Mains port, 150 kHz to 30 MHz	±2.02 dB

U_{lab} = Determined for Shure EMC Laboratory

E.4. TEST SETUP AND INSTRUMENTATION:

Photograph of the test setup are shown as Figure H.6. The test instrumentation can be determined from Table 10-1.

E.5. EUT OPERATION:

The EUT was powered up the line voltage to the EUT was checked after turn-on and adjusted to 120VAC 60Hz. The EUT was checked for proper operation after it was setup for the test. The RF input signal to the EUT was set to a low, mid and high frequency within its operating band. The RF input signal and power output terminal were terminated with a representative transmitter. The representative transmitter supplied the RF input signal to the EUT. The EUT antenna output terminal was connected to a ½ wave antenna.

E.6. SPECIFIC TEST PROCEDURES:

The interference on the power line of the EUT was measured by connecting the measuring equipment to the "TO TEST RECEIVER" terminal of the Artificial Mains Network (AMN).

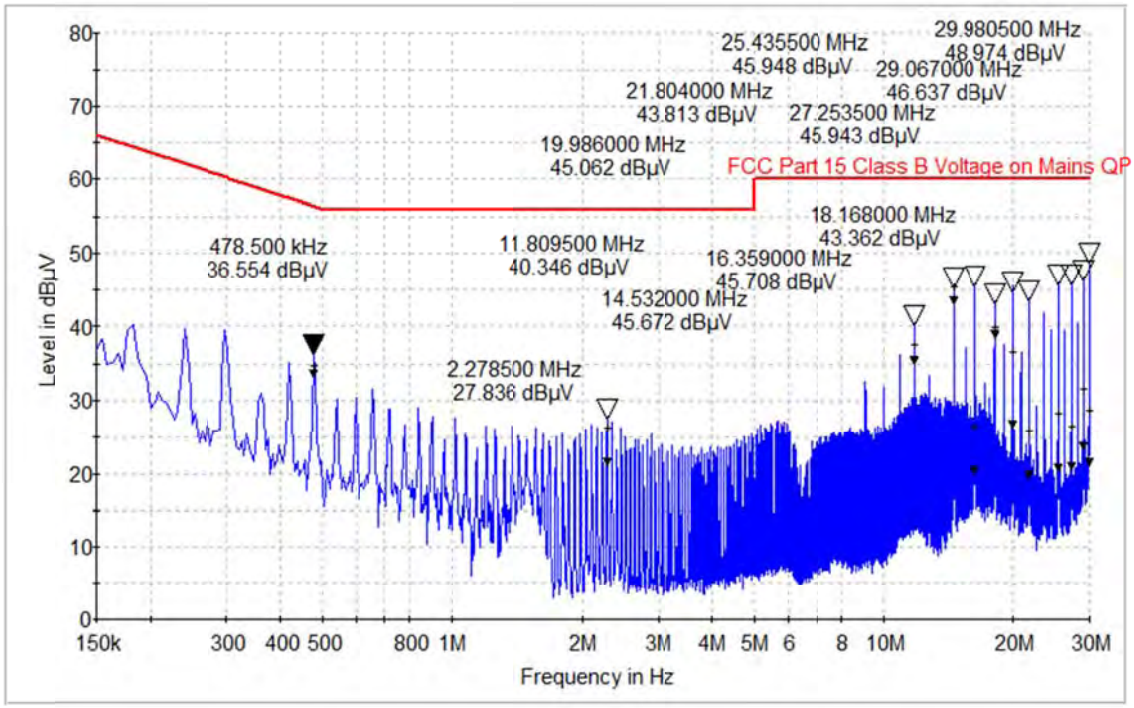
a) Measurements were first made on the Line Lead. The frequency of 150 KHz to 30 MHz was measured using a peak detector.
b) The data was then searched for a minimum of 10 of the highest levels. Any emissions levels that were within 10dB of the average limit were then measured again using both a quasi-peak detector and an average detector. (If no peak readings were within 10dB of the average limit, quasi-peak and average readings were taken on the highest emissions levels measured during the peak detector scan.). A table showing the quasi-peak and average readings was generated. This tabular data compares the quasi-peak and average conducted emissions to the applicable conducted emissions limits.
c) Measurements were then made on the Neutral Lead.

E.7. RESULTS:

The EUT plots of the peak conducted voltage levels acquired from each AC Mains line are shown on pages 37 and 38. The tabular quasi-peak results from each AC Mains line are shown after each plot. All emissions measured from the PA411 were within both the FCC "Code of Federal Regulations" Title 47 Part 15, Subpart B and Industry Canada RSS-GEN Sections 7.2.4 specification limits.

Test Information

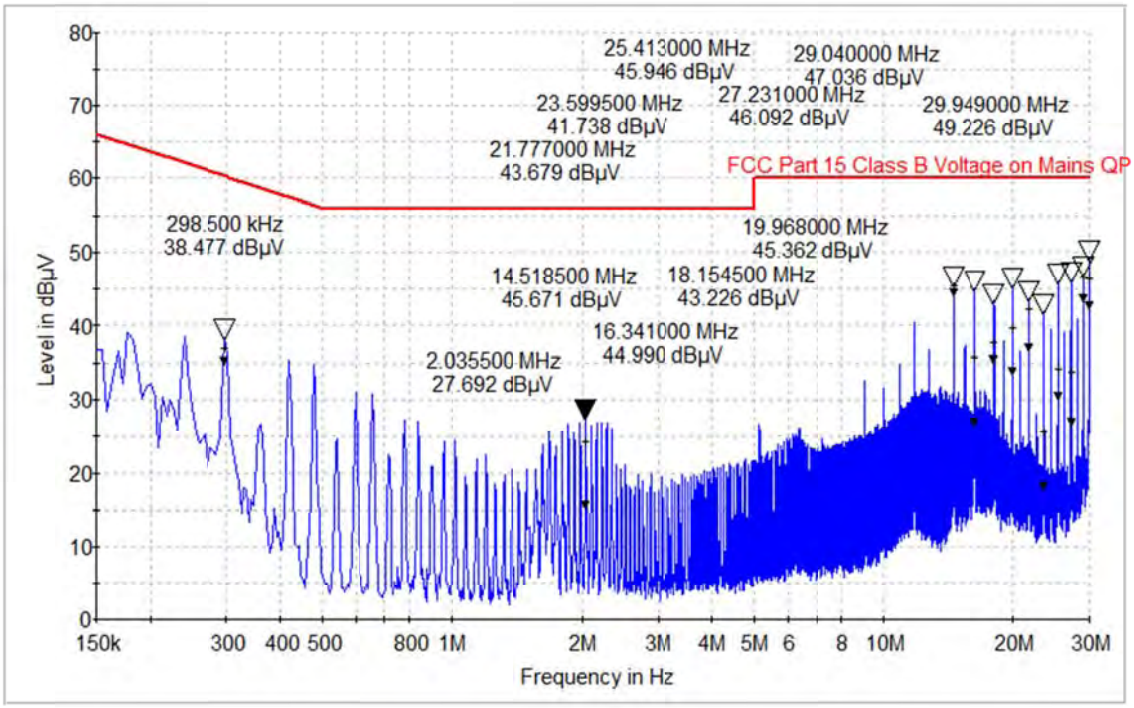
EUT Name:	PA411
Serial Number:	#1
Test Description:	Conducted RF Emissions - AC Mains
Operating Conditions:	120VAC, 60Hz, AE: 488.125MHz, 584.125MHz, 629.875MHz, 697.875MHz
Operator Name:	Lovell Cueto
Date:	May 9, 2014
Comment:	L- Line



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	PE	Line	Comment
0.478500	34.8	33.6	GND	L1	
2.278500	26.3	21.4	GND	L1	
11.809500	37.6	35.5	GND	L1	
14.532000	45.4	43.3	GND	L1	
16.359000	26.4	20.3	GND	L1	
18.168000	39.8	38.9	GND	L1	
19.986000	36.7	26.7	GND	L1	
21.804000	25.8	19.7	GND	L1	
25.435500	28.3	20.7	GND	L1	
27.253500	26.4	20.9	GND	L1	
29.067000	31.7	23.6	GND	L1	
29.980500	28.7	21.5	GND	L1	

Test Information

EUT Name:	PA411
Serial Number:	#1
Test Description:	Conducted RF Emissions - AC Mains
Operating Conditions:	120VAC, 60Hz, AE: 488.125MHz, 584.125MHz, 629.875MHz, 697.875MHz
Operator Name:	Lovell Cueto
Date:	May 9, 2014
Comment:	N- Line



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	PE	Line	Comment
0.298500	37.0	35.3	GND	N	
2.035500	24.2	15.5	GND	N	
14.518500	45.3	44.5	GND	N	
16.341000	35.9	26.9	GND	N	
18.154500	37.9	35.4	GND	N	
19.968000	39.5	33.9	GND	N	
21.777000	42.2	36.9	GND	N	
23.599500	25.7	18.2	GND	N	
25.413000	34.2	30.4	GND	N	
27.231000	33.8	26.8	GND	N	
29.040000	46.5	43.7	GND	N	
29.949000	46.5	42.5	GND	N	

F. SPURIOUS EMISSIONS AT ANTENNA TERMINAL

F.1. PURPOSE:

This test was performed to determine if the PA411 (EUT) meets the RF spurious emission requirements at the antenna terminal per FCC Part 74 and RSS-123, over the frequency range from 30MHz to 7GHz.

F.2. REQUIREMENTS:

This test determines whether the test item produces excessive spurious emissions. In accordance with paragraph 74.861, on any frequency remove from the operating frequency by more than 250 percent of the authorized bandwidth shall attenuated by at least 43 + 10 log (P) dB which is equivalent to -13dBm. The emissions shall be measured from 30MHz up to the 10th harmonic of the fundamental frequency.

In accordance with RSS-123 paragraph 5.5.1 on any frequency remove from the operating frequency by more than 250 percent of the authorized bandwidth: at least 55 + 10 log (P) dB which is equivalent to -25dBm. In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz or the lowest radio frequency signal generated in the equipment, whichever is lower, without going below 9 kHz, up to at least the frequency given in (a) and (b):

a) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
b) If the equipment operates at or above 10 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

F.3. MEASUREMENT UNCERTAINTY

All measurements are an estimate of their true value. The measurement uncertainty characterizes, with a specified confidence level, the spread of values which may be possible for a given measurement system.

Values of Expanded Measurement Uncertainty (95% Confidence):

Measurement Type	U_{LAB}
Conducted Spurious Emission (25 MHz – 18000 MHz)	**±1.31 dB**

U_{lab} = Determined for Shure EMC Laboratory

- Compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- Non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

F.4. TEST SETUP AND INSTRUMENTATION:

Photographs of the test setup are shown as Figure H.7. The test instrumentation can be determined from Table 10-1.

F.5. EUT OPERATION:

The EUT was powered up and the frequency of the auxiliary equipment (transmitter) was selected using a laptop. The line voltage to the EUT was checked after turn-on and adjusted to 120VAC 60Hz. The EUT was checked for proper operation after it was setup for the test. The RF input signal to the EUT was set to a low, mid and high frequency within its operating band. The RF input signal and power output terminal were terminated with a representative transmitter. The representative transmitter supplied the RF input signal to the EUT. The auxiliary transmitter audio input ports were connected to an audio signal source using shielded cables.

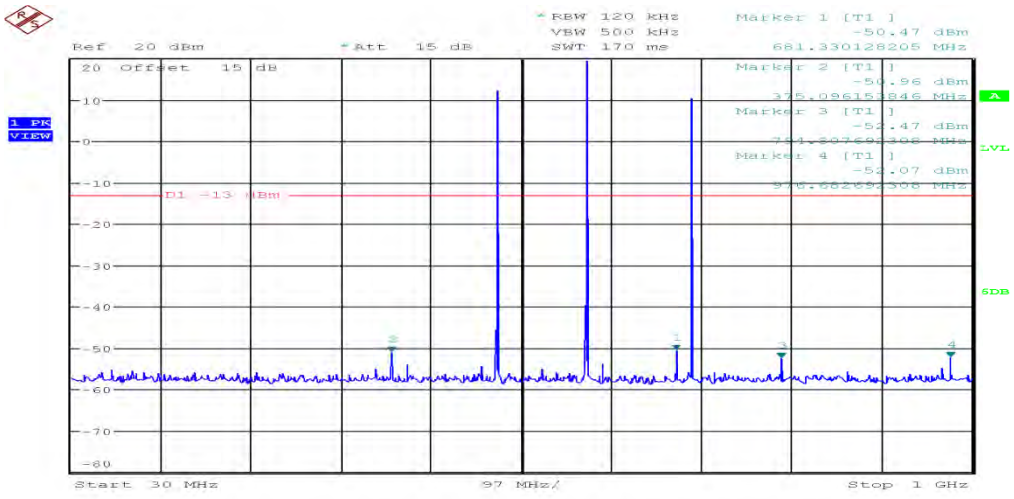
F.6. TEST PROCEDURES:

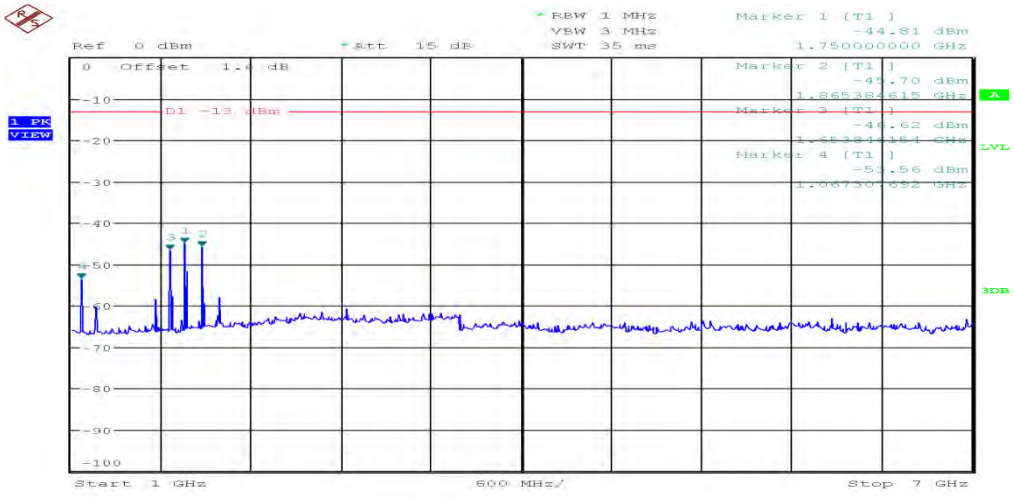
a. The EUT was connected to the 50 ohm input of a spectrum analyzer through either an attenuator (below 1GHz) or a highpass filter (above 1GHz); the reference offset of the spectrum analyzer was set to the measured value of the attenuation path.
b. The spectrum analyzer frequency range was adjusted to cover the range to be tested and the resolution bandwidth set to that required by the specifications. For the FCC measurements the resolution bandwidth was set to 100 kHz for spurious emissions below 1GHz and 1MHz for spurious emissions above 1GHz. For the RSS-123 measurements the resolution bandwidth was set to 30 kHz.
c. The antenna conducted emission limits were overlaid on the spectrum analyzer display and the trace was recorded.
d. The test item was modulated with a 2500 Hz sine wave at an input level as is specified by the requirements. For the FCC measurements the test item was modulated with a 2500 Hz sine wave at an input level 16dB greater than that necessary to produce 50% of rated system deviation. For the RSS-123 measurements the test item was modulated with signals representative of those encountered in a real system operation (2500Hz at 80% rated deviation).
e. Steps (a) through (d) were repeated at the high, medium, and low frequencies of the EUT's frequency range.

F.7. RESULTS:

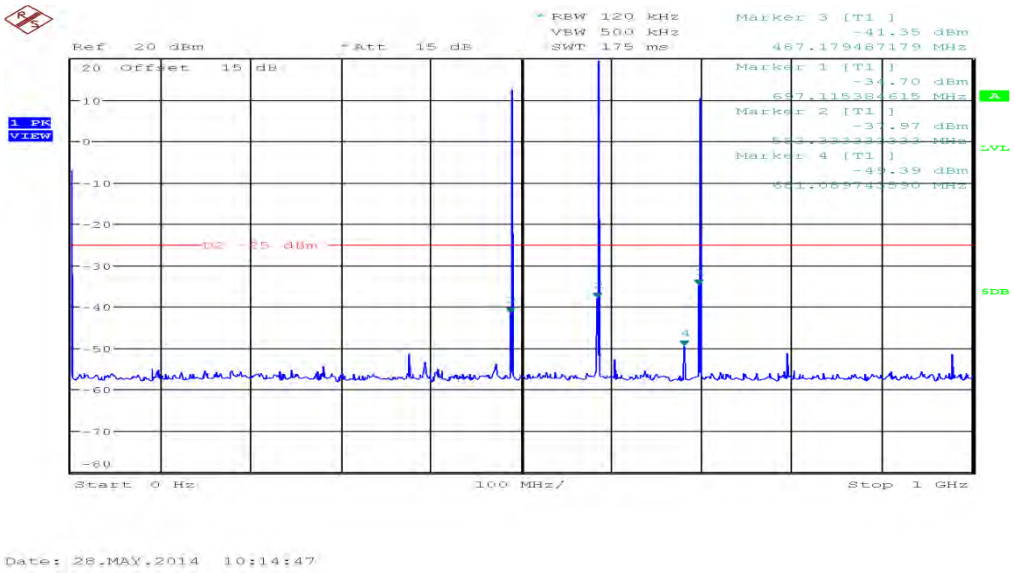
The spurious emissions data found at the antenna terminals are presented on pages 41-42. Data is shown on the figures at each frequency (Low, Mid, or High). The figures show the spurious emissions levels found for each frequency tested. The limits, shown on the plots, are set for based on the requirements found in section F.2. As can be seen from the data presented in the section, the PA411 did not produce spurious emissions in excess of the limits.

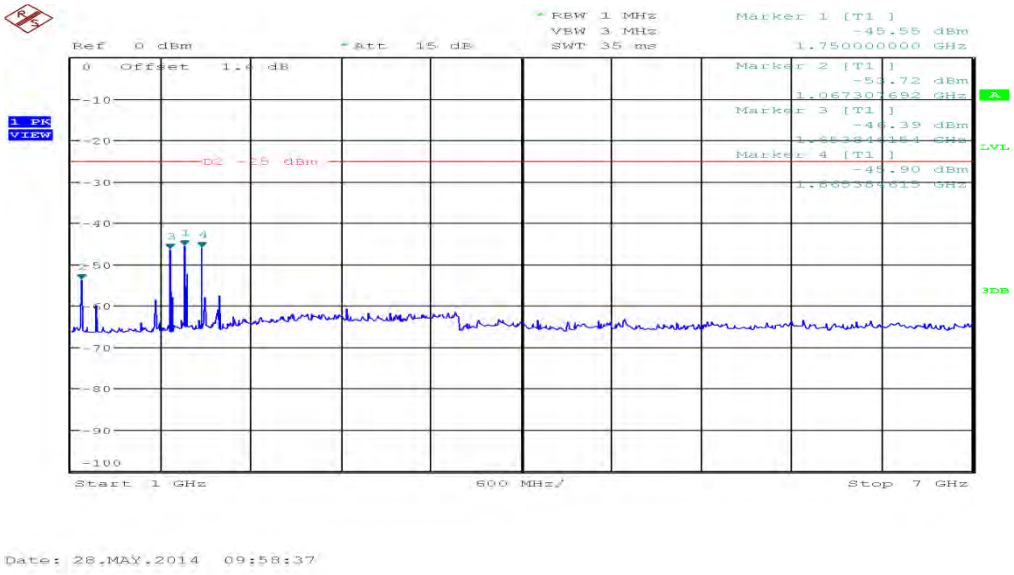
EUT	PA411
Serial Number:	#1
Test Description:	Antenna Conducted Emissions - FCC
Date of Test:	May 27, 2014
Operating Conditions:	RF Input @ 488.125 MHz, 584.125MHz, 697.875MHz
Operator Name:	Lovell Cueto
Comment:	2500 Hz at 16dB over 50% rated deviation





EUT	PA411
Serial Number:	#1
Test Description:	Antenna Conducted Emissions - RSS-123
Date of Test:	May 28, 2014
Operating Conditions:	RF Input @ 488.125 MHz, 584.125MHz, 697.875MHz
Operator Name:	Lovell Cueto
Comment:	2500 Hz at 80% rated deviation





G. MODULATION CHARACTERISTICS

G.1. PURPOSE:

This test was performed to determine if the PA411 (EUT) meets the deviation requirements per FCC Part 74 and RSS-123.

G.2. REQUIREMENTS:

In accordance with paragraph 74.861(e)(3) and section 5.2 of RSS-123, for low power auxiliary stations operating in the bands allocated for TV broadcasting, any form of modulation may be used. A maximum deviation of ±75kHz is permitted when frequency modulation is employed.

G.3. TEST SETUP AND INSTRUMENTATION:

Photographs of the test setup are shown as Figure H.8. The test instrumentation can be determined from Table 10-1.

G.4. EUT OPERATION:

The EUT was powered up and the frequency of the auxiliary equipment (transmitter) was selected using a laptop. The line voltage to the EUT was checked after turn-on and adjusted to 120VAC 60Hz. The EUT was checked for proper operation after it was setup for the test. The RF input signal to the EUT was set to a low, mid or high frequency within its operating band. The RF input signal and power output terminal were terminated with a representative transmitter. The representative transmitter supplied the RF input signal to the EUT. The auxiliary transmitter audio input ports were connected to an audio signal source using shielded cables.

G.5. TEST PROCEDURES:

The output of the antenna port of the test item was connected to a modulation analyzer. An audio signal generator was connected to the audio input port of the auxiliary transmitter.

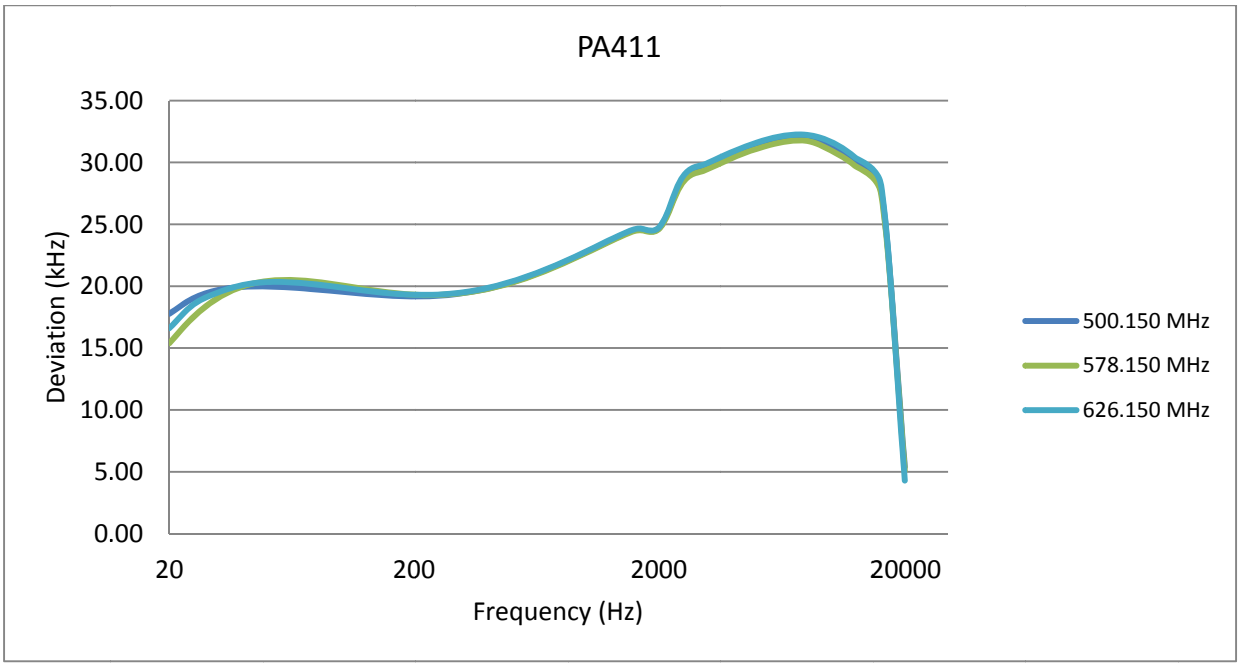
a) The test item was modulated with a 1000 Hz modulating signal at 60% of the test items rated frequency deviation.
b) With input level held constant the audio signal generator was varied from 20 Hz to 20 kHz.
c) The positive and negative peak deviations were recorded and plotted.

The output of the antenna port of the test item was connected to a modulation analyzer. An audio signal generator was connected to the audio input port of the auxiliary transmitter.

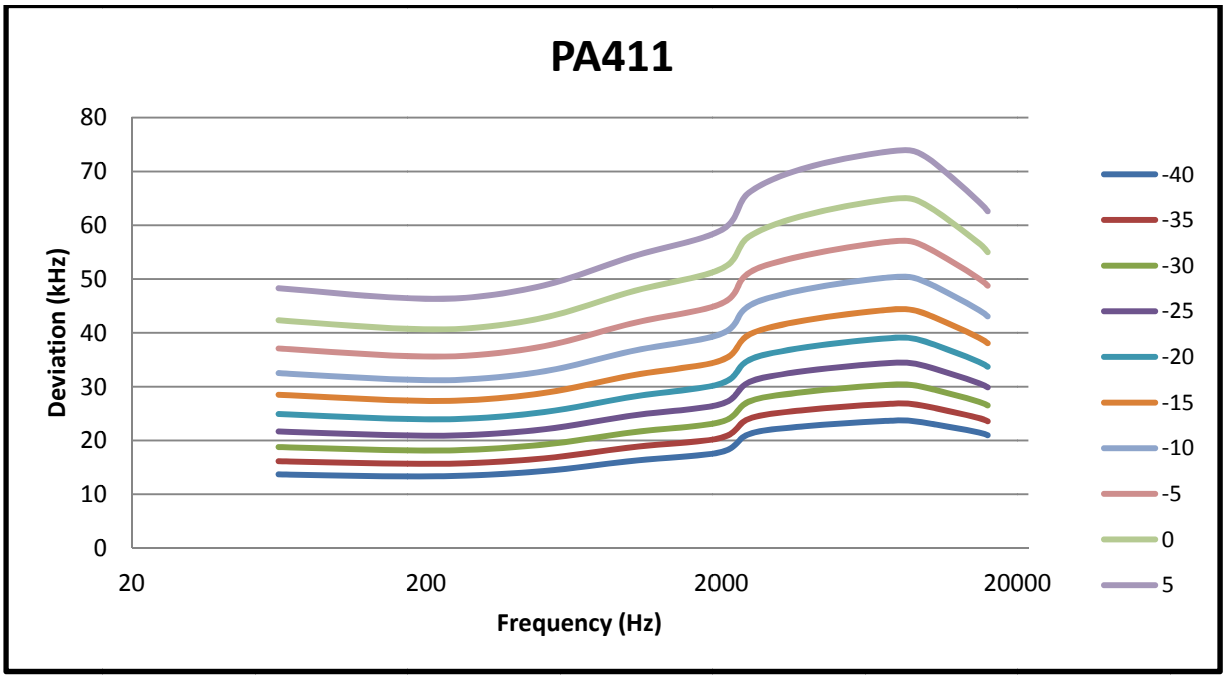
a) The modulation response was measured separately for each of five frequencies (100Hz, 500Hz, 2500Hz, 10000Hz and 15000Hz).
b) The input voltage of the audio signal generator was varied and frequency deviation was observed on the modulation analyzer.
c) The frequency deviations were recorded and plotted.

G.6. RESULTS:

The plots of the modulation characteristics are presented on page 45. Data is shown on the figures at each frequency. As can be seen from the data presented in the section, the PA411 did meet the permitted maximum deviation requirements.



Deviation vs Frequency



Deviation vs Input