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**AMPLIFIER
FCC PT 90
TEST REPORT**

Applicant	CODAN RADIO COMMUNICATIONS
Address	43 ERIE STREET VICTORIA, BC V8V 1P8 CANADA
FCC ID	H4JAMP-4-800
Model Number	AMP-4-800-30
Product Description	30W AMPLIFIER
Standards Applied	CFR 47 Part 90 IC Standard RSS-131, Issue 2, July 2003 IC Standard RSS-GEN, Issue 3, December 2010
Date Sample Received	6/5/2014
Date Report Issued	6/11/2014
Date Tested	6/5-6/9/2014 Revised 8/12/14
Tested By	CORY LEVERETT
Approved By	Sid Sanders
Timco Report No.	945AUT14TestReport Rev1.docx
Test Results	☒ PASS ☐ FAIL

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

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Applicant: CODAN RADIO COMMUNICATIONS

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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
☐ 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, under my supervision, at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, FL 32669

Authorized Signatory Name:

Cory Leverett
Engineering Project Manager



Date: 6/11/2014

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EUT DESCRIPTION

EUT Description	800 MHz 30W AMPLIFIER
FCC ID	H4JAMP-4-800
Model Number	AMP-4-800-30
Operating Frequency	768-869MHz
No. of Channels	NA
Type of Emission	F1D, F1E, F1W, F2D, F3D, F3E, G2B, G3E
Modulation	N/A Amplifier
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
Test Conditions	The temperature was 26°C with a relative humidity of 50%.
Revision History to the EUT	None
Test Exercise	The EUT was operated in a normal mode.Using a Codan 800 MHz Transmitter and Amplifier Subrack
Applicable Standards	ANSI/TIA 603-D:2010, ANSI C63.4: 2009 FCC CFR 47 Part 90, IC Standard RSS-131
Test Facility	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA.
Manufactured by	CODAN RADIO COMMUNICATIONS

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RF EXPOSURE INFORMATION: 47CFR 2.1093

The requirements for this equipment are covered in the included SAR measurements report.

SUPPORTING EQUIPMENT

UHF Transmitter

Frequency Range	768-869MHz
Bandwidth	12.5KHz, 25KHz, and Digital
Power Output	30 watts rated power
Model#	UT-4E850-00-300
Serial#	126747
Manufactured Date	June 2014
FCC ID	H4JUT-4E850

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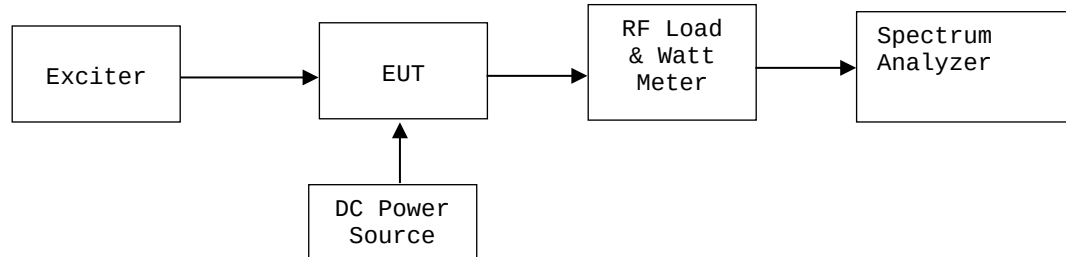
FCC ID: H4JAMP-4-800

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TEST PROCEDURES

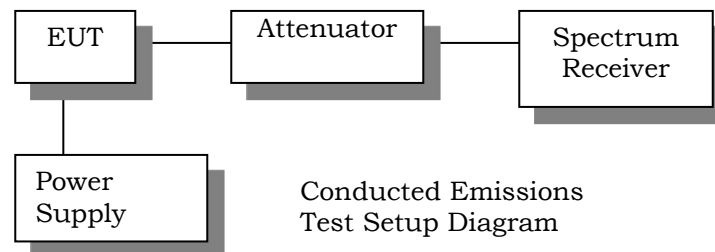
RF Power Output

The RF power output was measured at the antenna feed point using a peak power meter. A 50-ohm, resistive wattmeter was connected to the RF output connector. With a nominal battery voltage, and the transmitter properly adjusted the RF output measures:



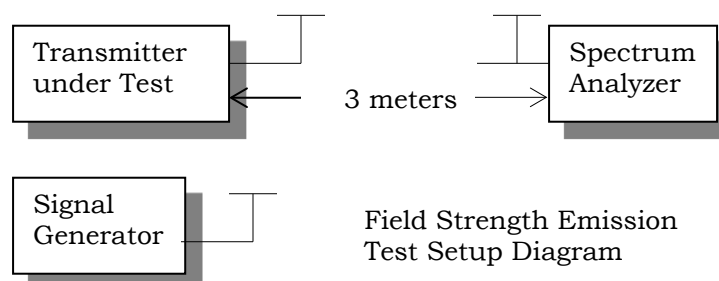
Spurious Emissions At Antenna Terminals Conducted

The spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz and the span to 50 MHz. The measurements were made in accordance with standard ANSI/TIA-603-D 9



Field Strength of Spurious Emissions

The test procedure used was ANSI/TIA-603-D: 2010 using the substitution method and ANSI C63.4-2009 using a spectrum analyzer receiver with pre-selector. The bandwidth (RBW) of the spectrum receiver was 100 kHz up to 1 GHz and 1 MHz above 1 GHz with an appropriate sweep speed. The VBW above 1 GHz was 3 MHz. The spectrum was scanned from 30 MHz to at least the tenth harmonic of the fundamental. This test was conducted per ANSI/TIA-603-D: 2010



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TEST RESULTS

RF POWER OUTPUT

Rule Part No.: Pt 2.1046(a), Pt 90.205, Pt 90.210

Requirements: Pt 2.1046(a), Pt 90, Pt 90.210

Test Data: Power Input = 122.4 Watts

DC Power Consumption

Vdc = 13.6 volts

Ic = 7.5-9 amps

Test Frquency (MHz)	DC Amps	DC Volts	RF Input (dBm)	RF Output (dBm)	RF Output (W)
768.12	8	13.6	34.6	44.9	31
775.97	8.5	13.6	34.7	45.7	37
798.02	9	13.6	34.7	46.2	42
805.97	9	13.6	34.8	46.2	42
808.87	9	13.6	34.8	46.2	42
868.87	7.5	13.6	34.6	45	32

Results: Meets Requirements

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SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED) LOW END OF BAND

Rule Part No.: FCC Pt 2.1051(a)

Requirements: $50 + 10\log(P_o) = 64.9$ dBc limit

Test Data: Conducted Emissions to the tenth harmonic

Low end of Band

dBc limit for 768.125MHz @ 31 Watts

$$50 + 10\log(31) = 50 + 14.9 = 64.9\text{dBc}$$

	dBm	Watts	dBc Limit
Power Output	44.9	31	64.9
Frequency	dBm	dBc	Margin
768.125	44.9	0	0
1536.25	-42	86.9	22
2304.375	-37.83	82.73	17.83
3072.5	-31.46	76.36	11.46
3840.625	-34.03	78.93	14.03
4608.75	-54.48	99.38	34.48
5376.875	-53.69	98.59	33.69
6145	-54.94	99.84	34.94
6913.125	-54.33	99.23	34.33
7681.25	-54.55	99.45	34.55

Results: Meets Requirements

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SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED) MIDDLE OF BAND

dBc limit for 798.025 MHz @ 42 Watts

$$50 + 10\log(42) = 50 + 16.23 = 66.2\text{dBc}$$

	dBm	Watts	dBc Limit
Power Output	46.2	42	66.2
Frequency	dBm	dBc	Margin
798.025	46.2	0	0
1596.05	-45.37	91.57	25.37
2394.075	-38.35	84.55	18.35
3192.1	-34.58	80.78	14.58
3990.125	-47.81	94.01	27.81
4788.15	-52.52	98.72	32.52
5586.175	-54.35	100.55	34.35
6384.2	-54.05	100.25	34.05
7182.225	-54.53	100.73	34.53
7980.25	-55.63	101.83	35.63

dBc limit for 805.975 MHz @ 42 Watts

$$50 + 10\log(42) = 50 + 16.23 = 66.2\text{dBc}$$

	dBm	Watts	dBc Limit
Power Output	46.2	42	66.2
Frequency	dBm	dBc	Margin
805.975	46.2	0	0
1611.95	-44.5	90.7	24.5
2417.925	-36.31	82.51	16.31
3223.9	-39.7	85.9	19.7
4029.875	-48.97	95.17	28.97
4835.85	-50.94	97.14	30.94
5641.825	-53.44	99.64	33.44
6447.8	-54.34	100.54	34.34
7253.775	-53.95	100.15	33.95
8059.75	-55.25	101.45	35.25

Results: Meets Requirements

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SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED) HIGH END OF BAND

dBc limit for 808.875 MHz @ 42 Watts

$$50 + 10\log(42) = 50 + 16.23 = 66.2\text{dBc}$$

	dBm	Watts	dBc Limit
Power Output	46.2	42	66.2
Frequency	dBm	dBc	Margin
808.875	46.2	0	0
1617.75	-45.29	91.49	25.29
2426.625	-35.07	81.27	15.07
3235.5	-44.65	90.85	24.65
4044.375	-52.38	98.58	32.38
4853.25	-55.71	101.91	35.71
5662.125	-54.53	100.73	34.53
6471	-59.5	105.7	39.5
7279.875	-63.85	110.05	43.85
8088.75	-63.72	109.92	43.72

dBc limit for 868.875 MHz @ 32 Watts

$$50 + 10\log(31) = 50 + 14.9 = 64.9\text{dBc}$$

	dBm	Watts	dBc Limit
Power Output	45	32	64.9
frequency	dBm	dBc	Margin
868.875	45	0	0
1737.75	-49.53	94.53	29.63
2606.625	-36.74	81.74	16.84
3475.5	-41.7	86.7	21.8
4344.375	-44.61	89.61	24.71
5213.25	-54.52	99.52	34.62
6082.125	-62.3	107.3	42.4
6951	-62.33	107.33	42.43
7819.875	-64.52	109.52	44.62
8688.75	-64.78	109.78	44.88

RESULTS: PASS

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OCCUPIED BANDWIDTH

Rule Parts No: Pt 2.1049, Pt 90.210(b)

Test Requirement:

Part 90.210(b) 25kHz Channel Spacing

Data in the plots show that on any frequency removed from the assigned frequency by more than 50%, but not more than 100%: At least 25dB. On any frequency removed from the assigned frequency by more than 100%, but not more than 250%: At least 35 dB. On any frequency removed from the assigned frequency by more than 250%, of the authorized bandwidth: At least $43 + 10\log(P)$ dB.

Part 90.210(c) 12.5kHz Channel Spacing Not Equipped with a Low Pass Filter

For transmitters that are not equipped with an audio low pass filter pursuant to S90.211 (b), the power of any emission must be attenuated below the un-modulated carrier output power as follows; (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5 kHz but not more than 10 kHz: At least $83 \log(f_d/5)$ dB; (2) ON any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 10 kHz, but not more than 250% of the authorized bandwidth: At least $29 \log(f_d^2/11)$ dB or 50 dB, whichever is the lesser attenuation; (3) On any frequency removed from the center of the authorized bandwidth by more than 250% of the authorized bandwidth: At least $43 + 10 \log(P_o)$ dB.

Part 90.210(h) Emission Mask H) NPSPAC Mutual aid

For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

(1). On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of 4kHz or less : Zero dB.

(2). On any frequency removed from the center of the authorized bandwidth by a displacement frequency of (f_d in kHz) of more than 4kHz, but no more than 8.5kHz: At least $107 \log(f_d/4)$ dB;

(3). On any frequency removed from the center of the authorized bandwidth by a displacement frequency of (f_d in kHz) of more than 8.5 kHz, but no more than 15 kHz; At least $40.5 \log(f_d/1.16)$ dB.

(4). On any frequency removed from the center of the authorized bandwidth by a displacement frequency of (f_d in kHz) of more than 15 kHz, but no more than 25 kHz; At least $116 \log(f_d/6.1)$ dB.

(5). On any frequency removed from the center of the authorized bandwidth by more than 25 kHz: At least $43 + \log(P)$ dB.

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EA EMISSION MASK

Part 90.691: Emission mask requirements for EA-based systems

(Under the Policies Governing The Licensing and Use of EA-Based SMR Systems in the 809–824/854–869 MHz Band rule part)

(a) Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $116 \log_{10} (f/6.1)$ decibels or $50 + 10 \log_{10} (P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

(b) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

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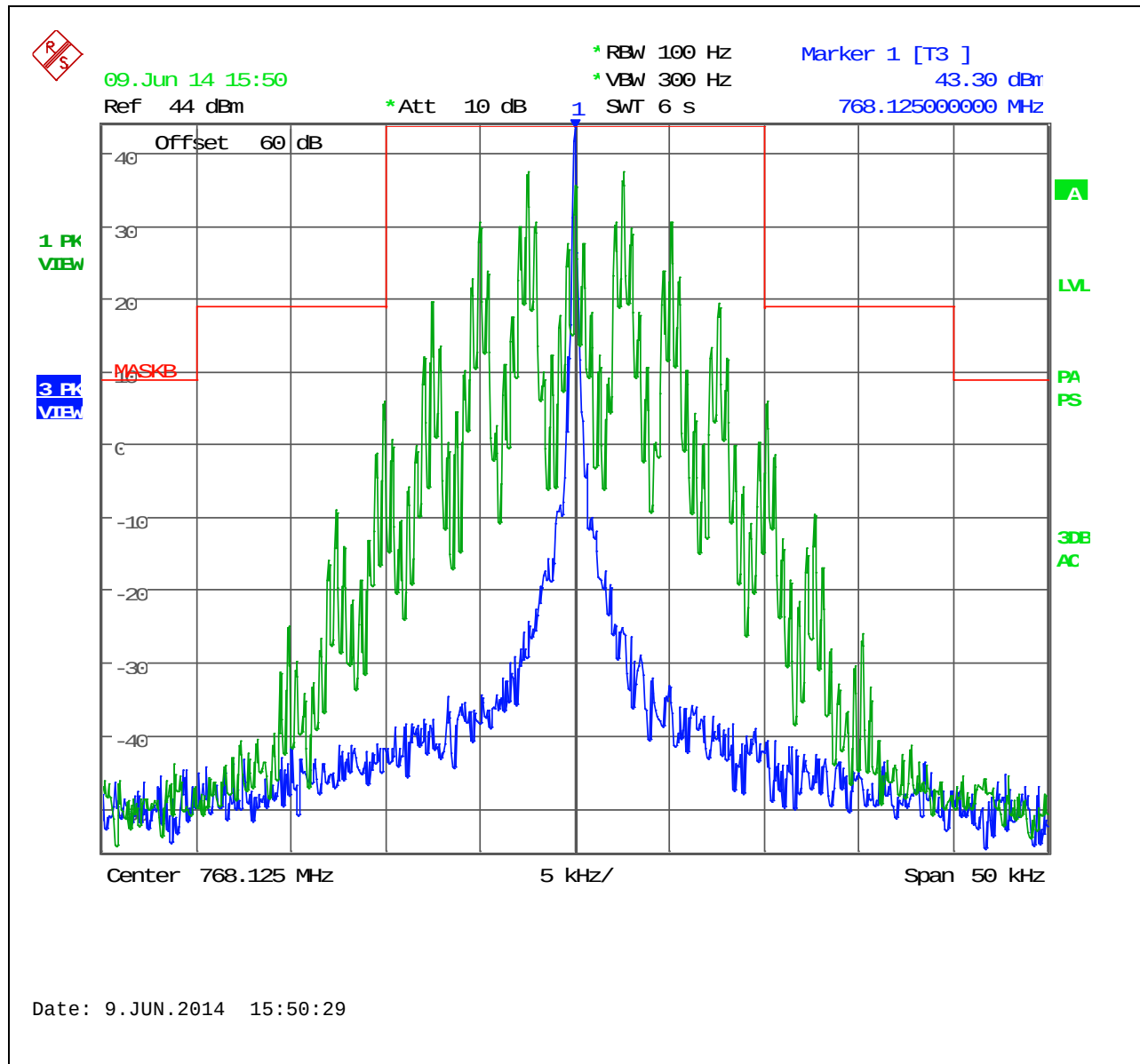
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OCCUPIED BANDWIDTH LOW END OF THE BAND 25KHZ ANALOG

Low End of the Band 25KHz Analog

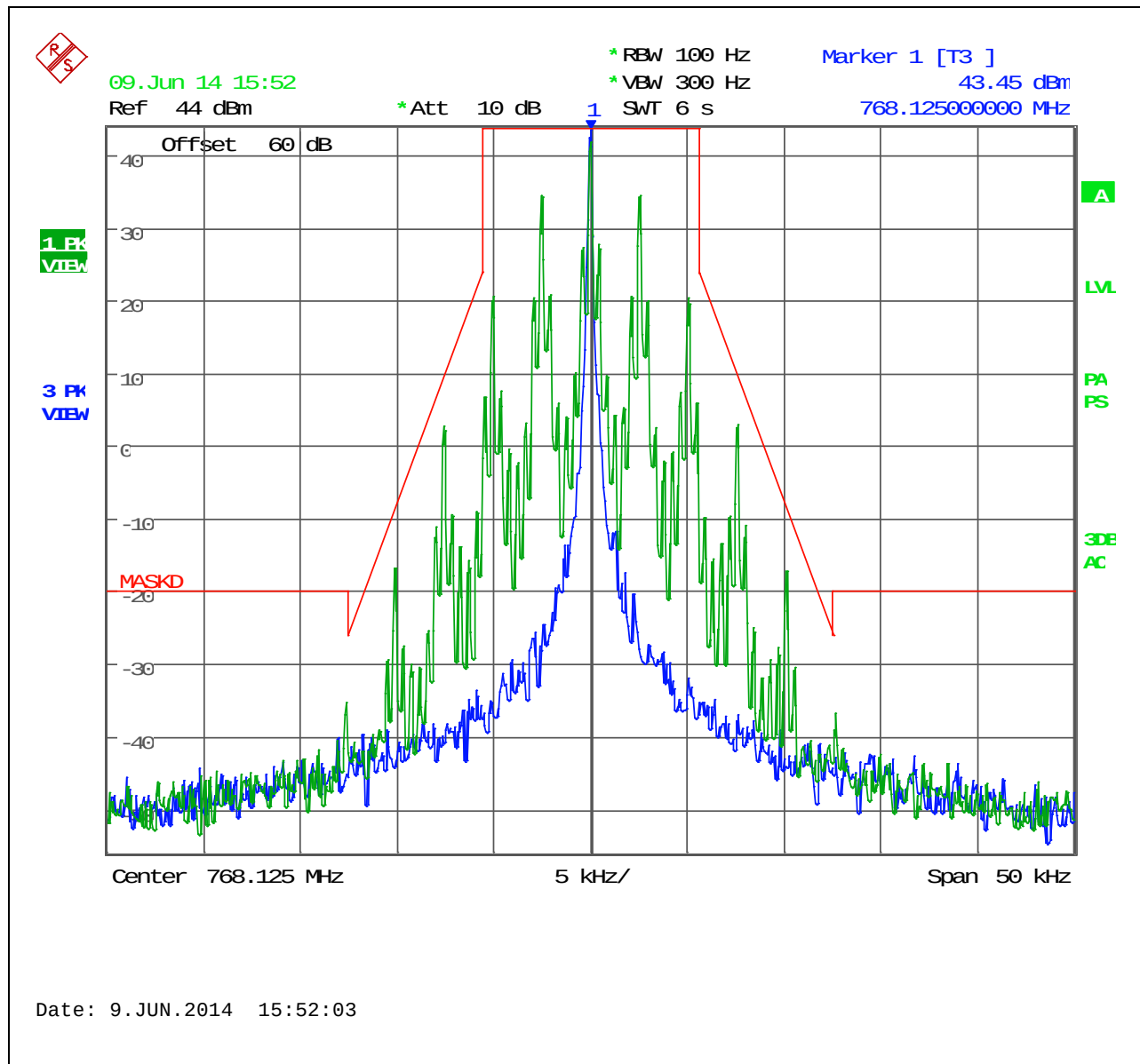


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OCCUPIED BANDWIDTH LOW END OF THE BAND 12.5KHZ ANALOG

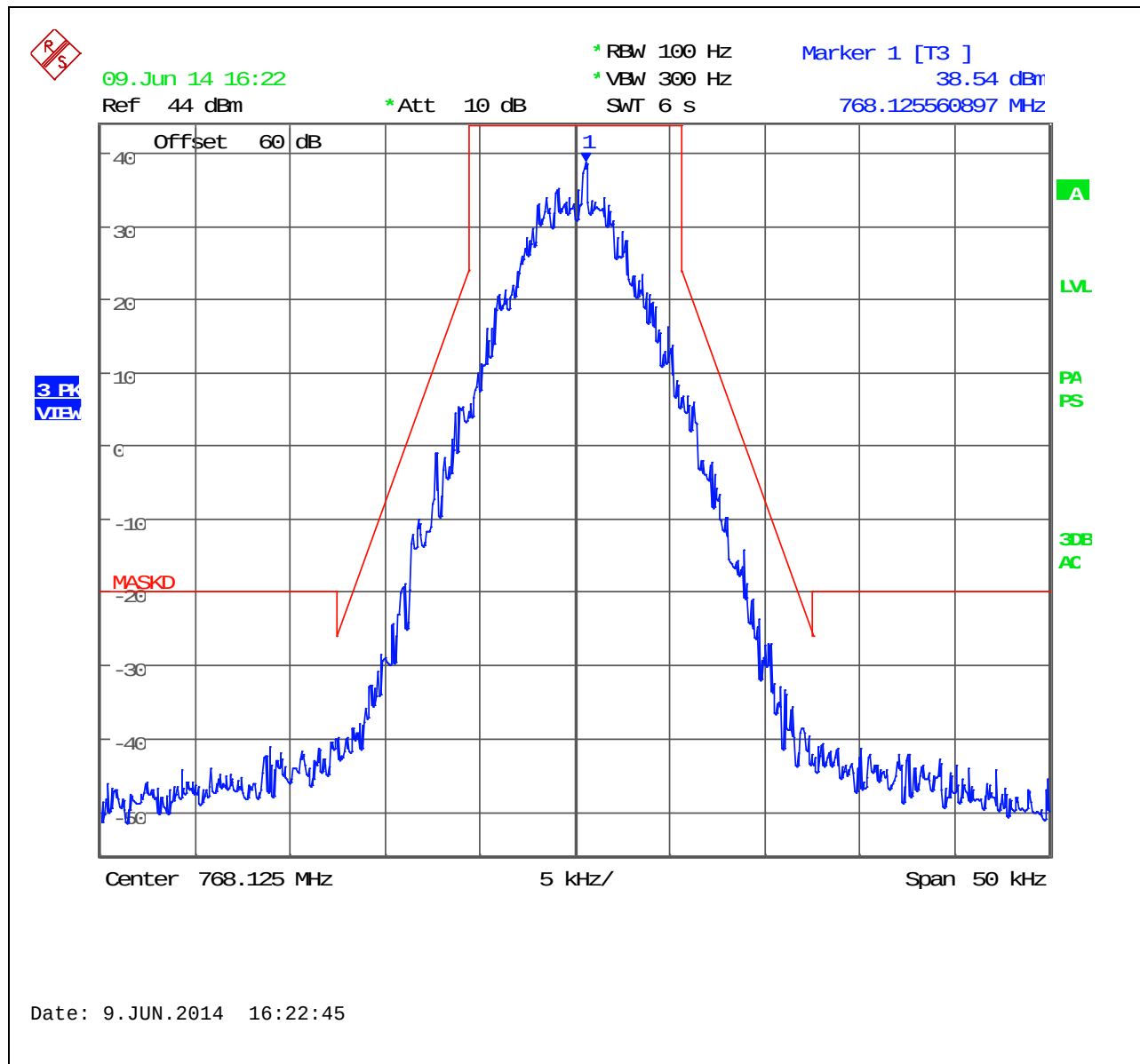
Low End of the Band 12.5KHz Analog



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OCCUPIED BANDWIDTH LOW END OF THE BAND 12.5KHZ DIGITAL

Low End of the Band Digital

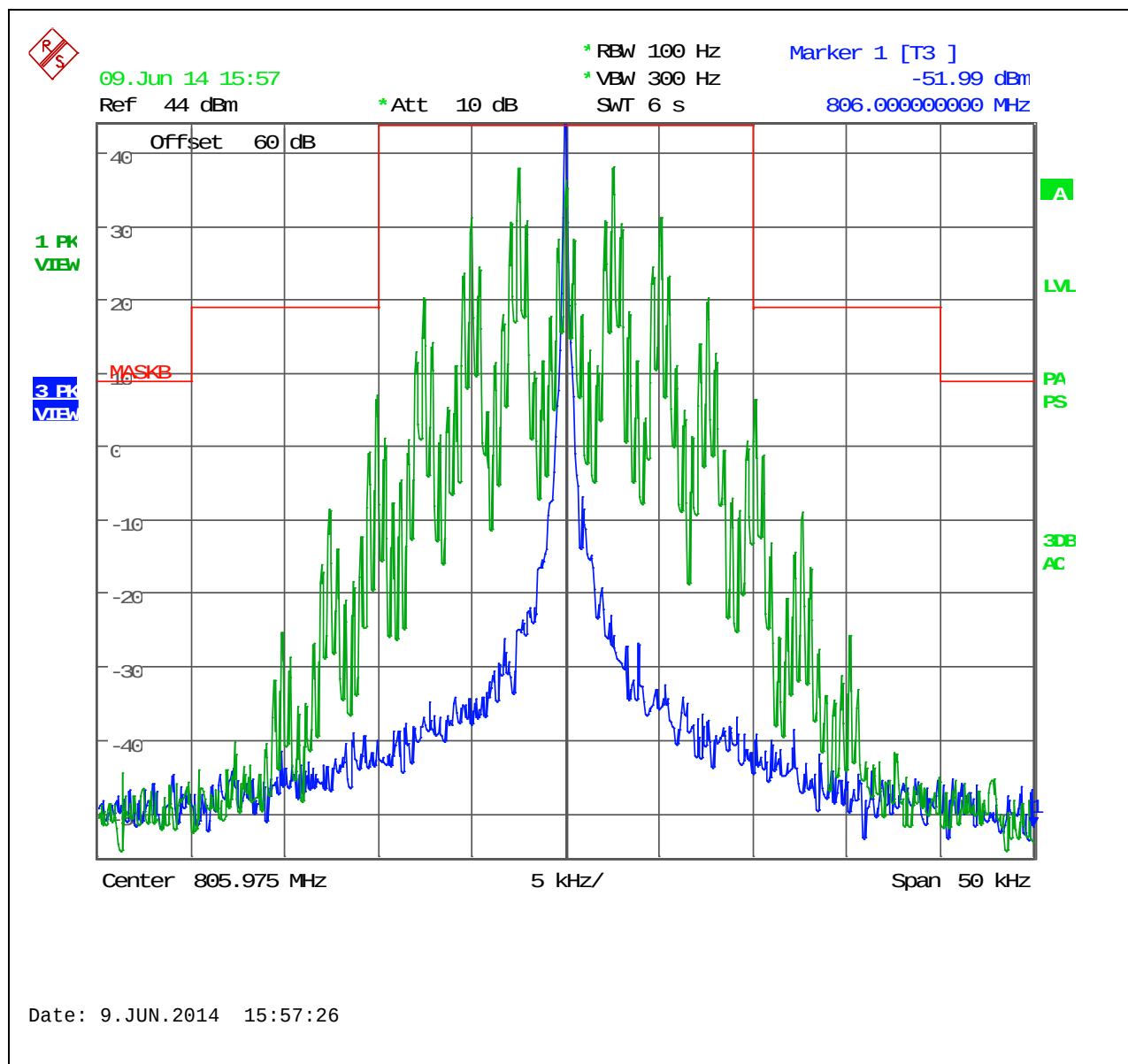


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OCCUPIED BANDWIDTH LOW END OF THE BAND 25KHZ ANALOG

Middle of the Band 25KHz Analog



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OCCUPIED BANDWIDTH MIDDLE OF THE BAND 12.5KHZ ANALOG

Middle of the Band 12.5KHz Analog

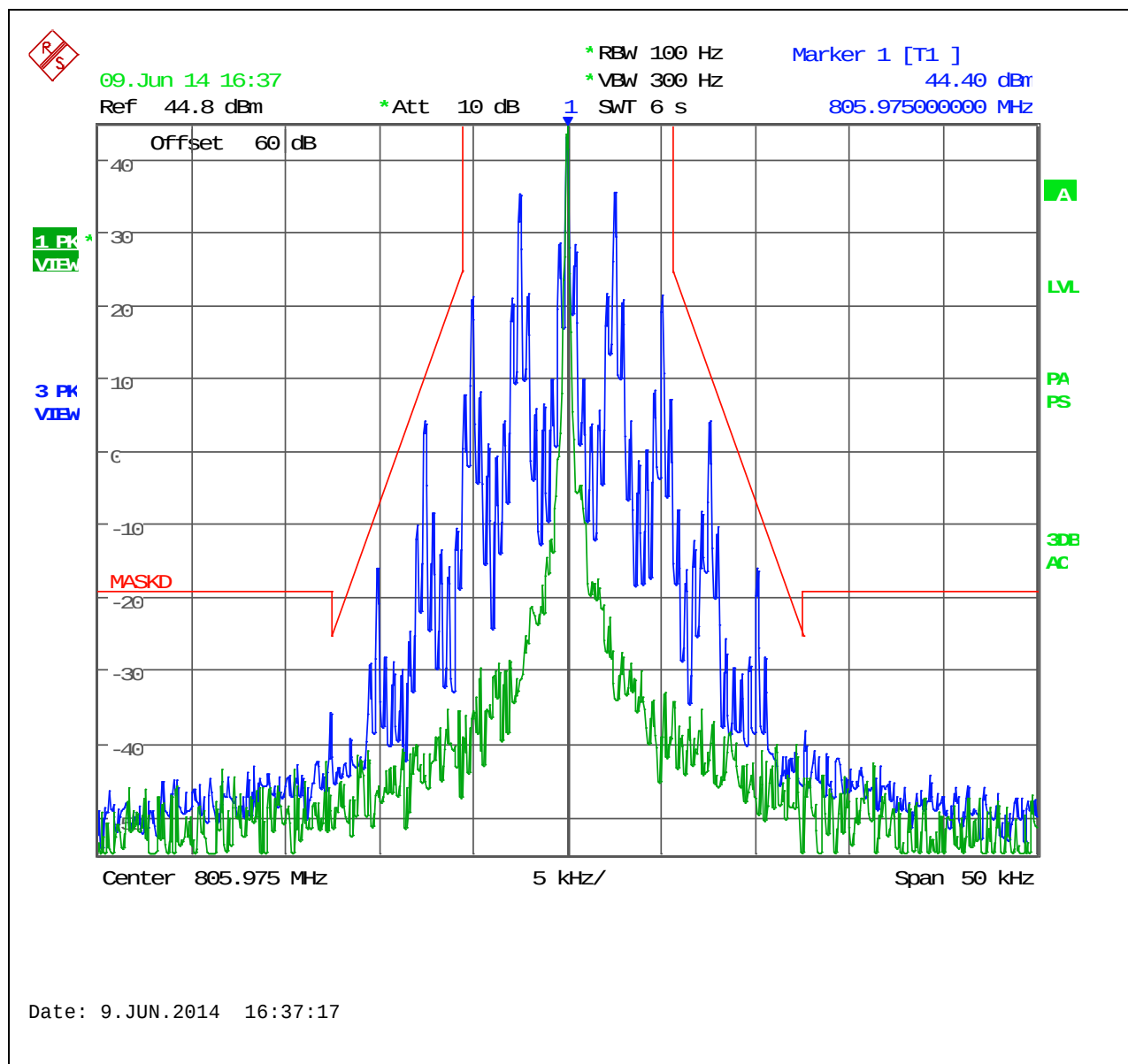


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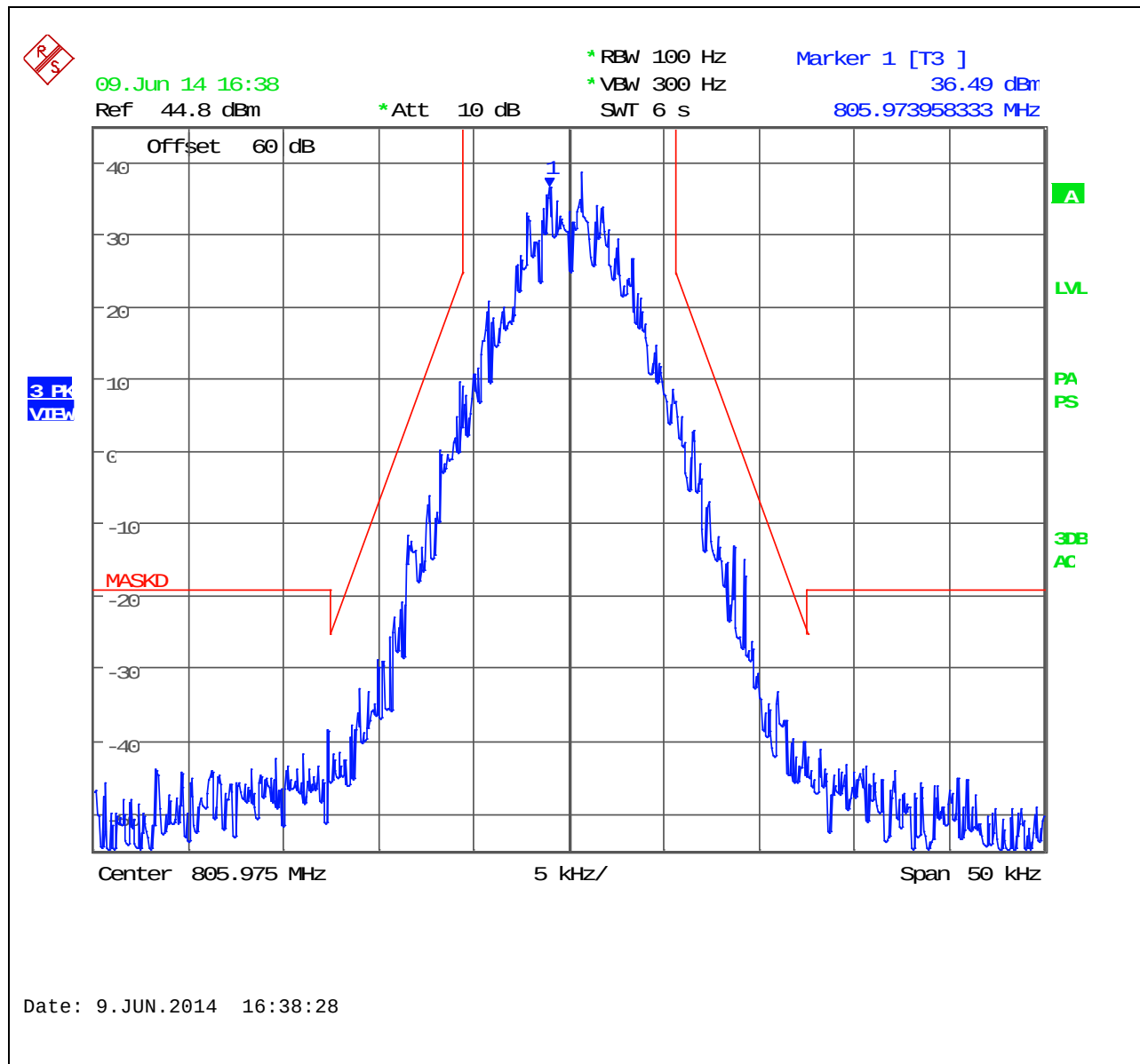
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OCCUPIED BANDWIDTH MIDDLE OF THE BAND 12.5KHZ DIGITAL

Middle of the Band Digital



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OCCUPIED BANDWIDTH HIGH END OF THE BAND 25KHZ ANALOG

High End of the Band 25KHz Analog

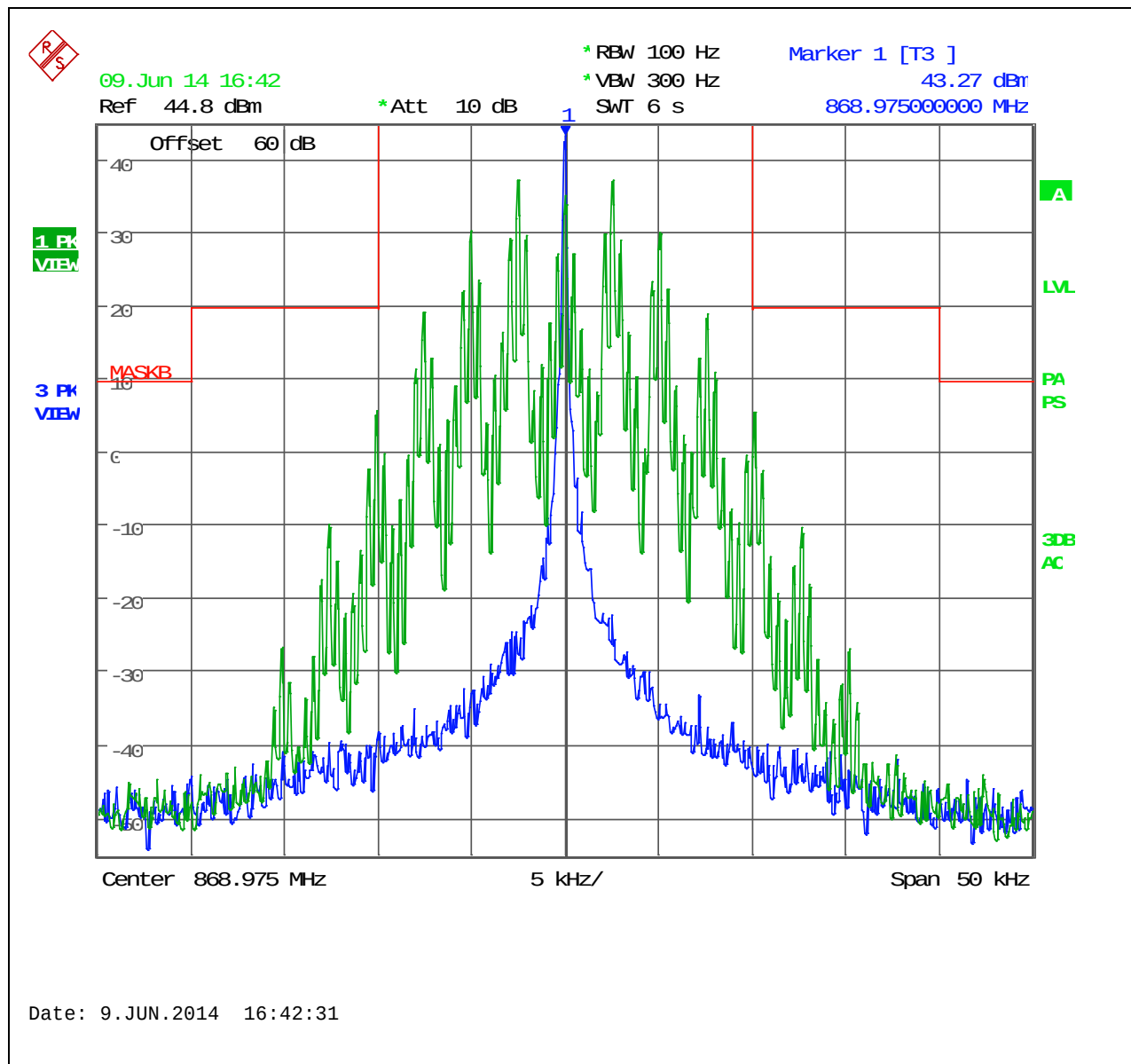
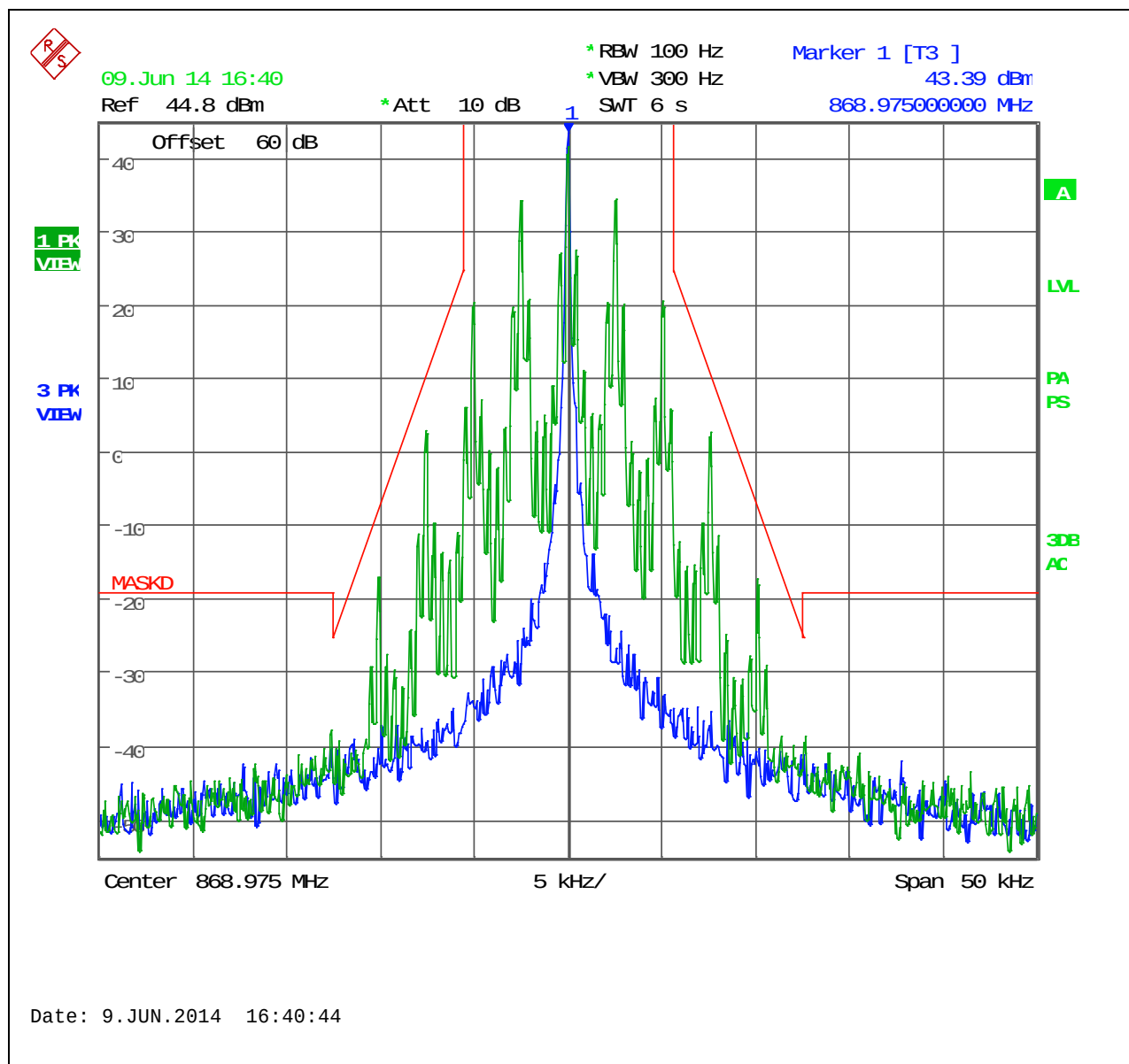


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OCCUPIED BANDWIDTH HIGH END OF THE BAND 12.5KHZ ANALOG

High End of the Band 12.5KHz Analog



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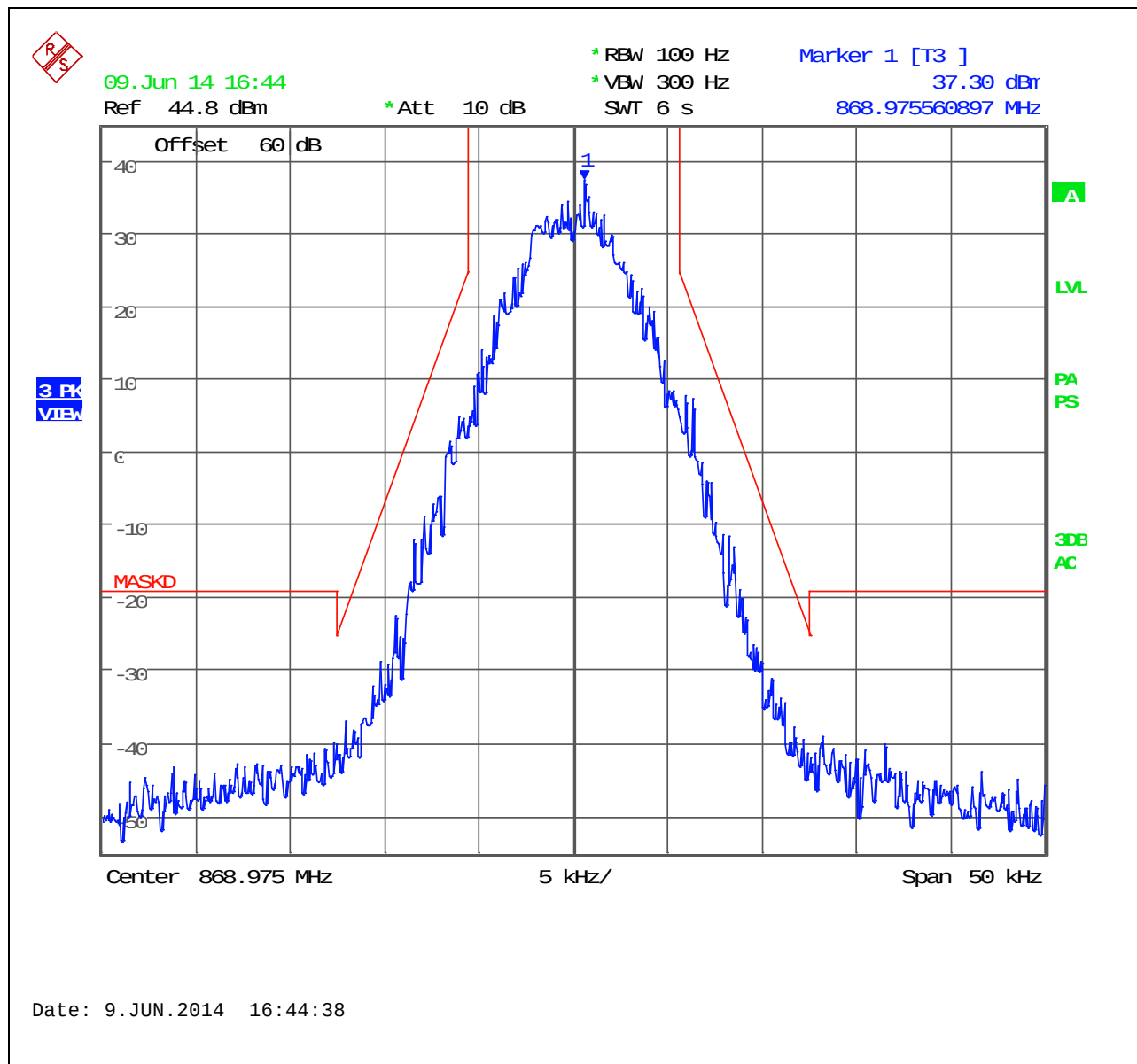
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OCCUPIED BANDWIDTH HIGH END OF THE BAND 12.5KHZ DIGITAL

High End of the Band Digital

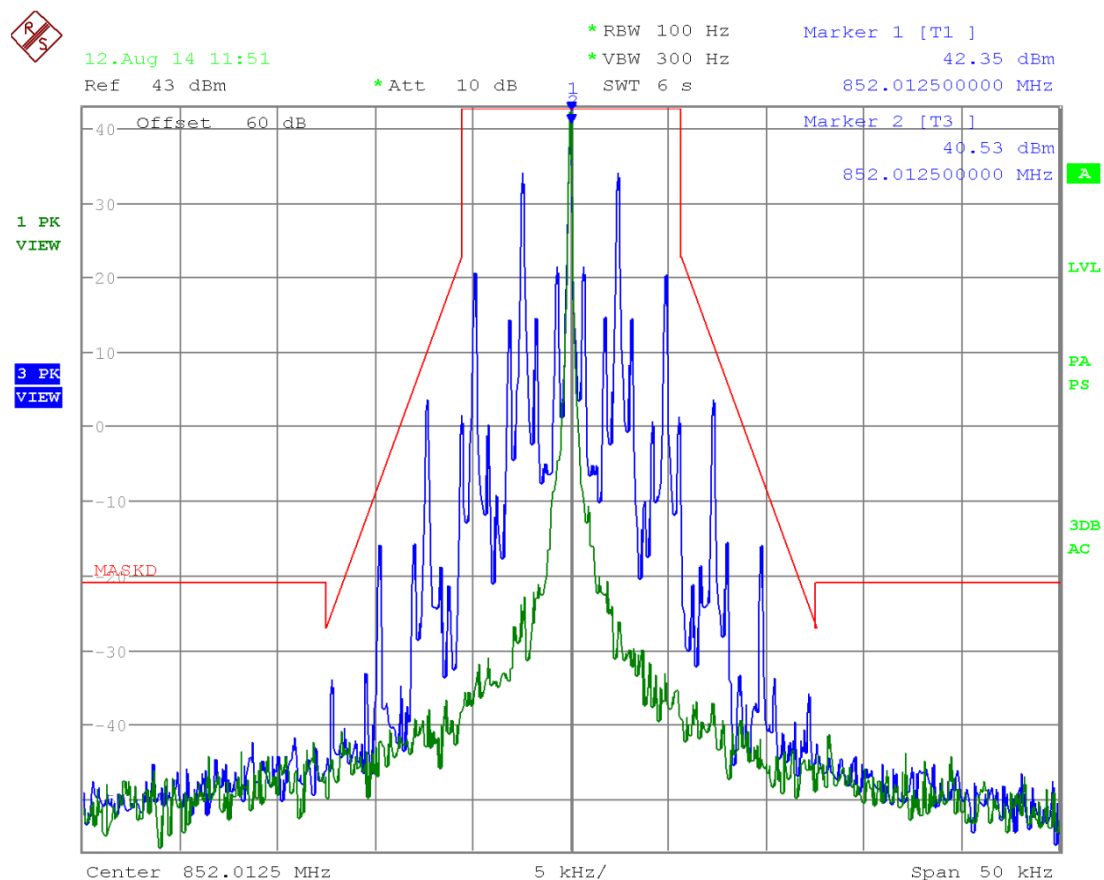


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OCCUPIED BANDWIDTH 852.0125 MHZ 12.5 KHZ ANALOG NPSPAC

OCCUPIED BANDWIDTH PLOTS (NPSPAC mutual aid channels)
Part 90.210(d) Emission Mask D - 12.5 kHz channel



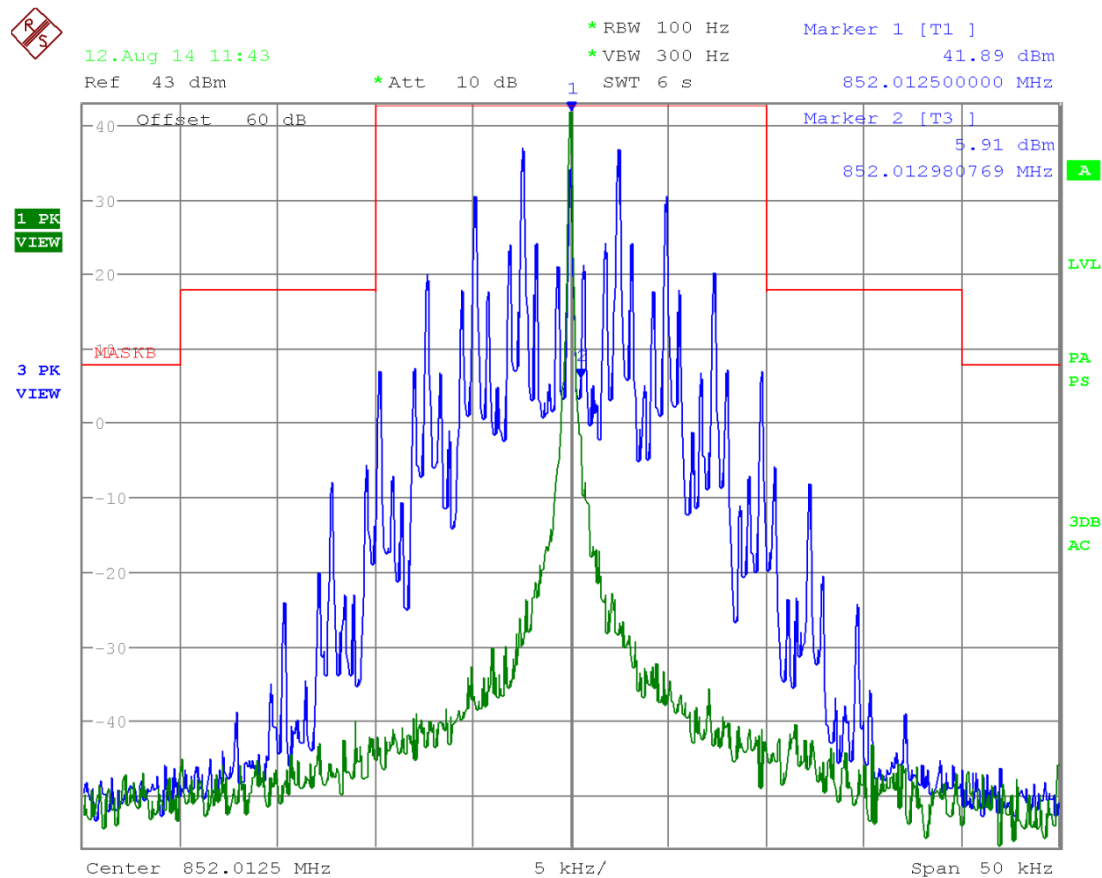
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OCCUPIED BANDWIDTH 852.0125MHz 12.5 KHZ ANALOG NPSPAC

OCCUPIED BANDWIDTH PLOTS (NPSPAC mutual aid channels)
Part 90.210(d) Emission Mask D - 12.5 kHz channel



Date: 12.AUG.2014 11:43:36

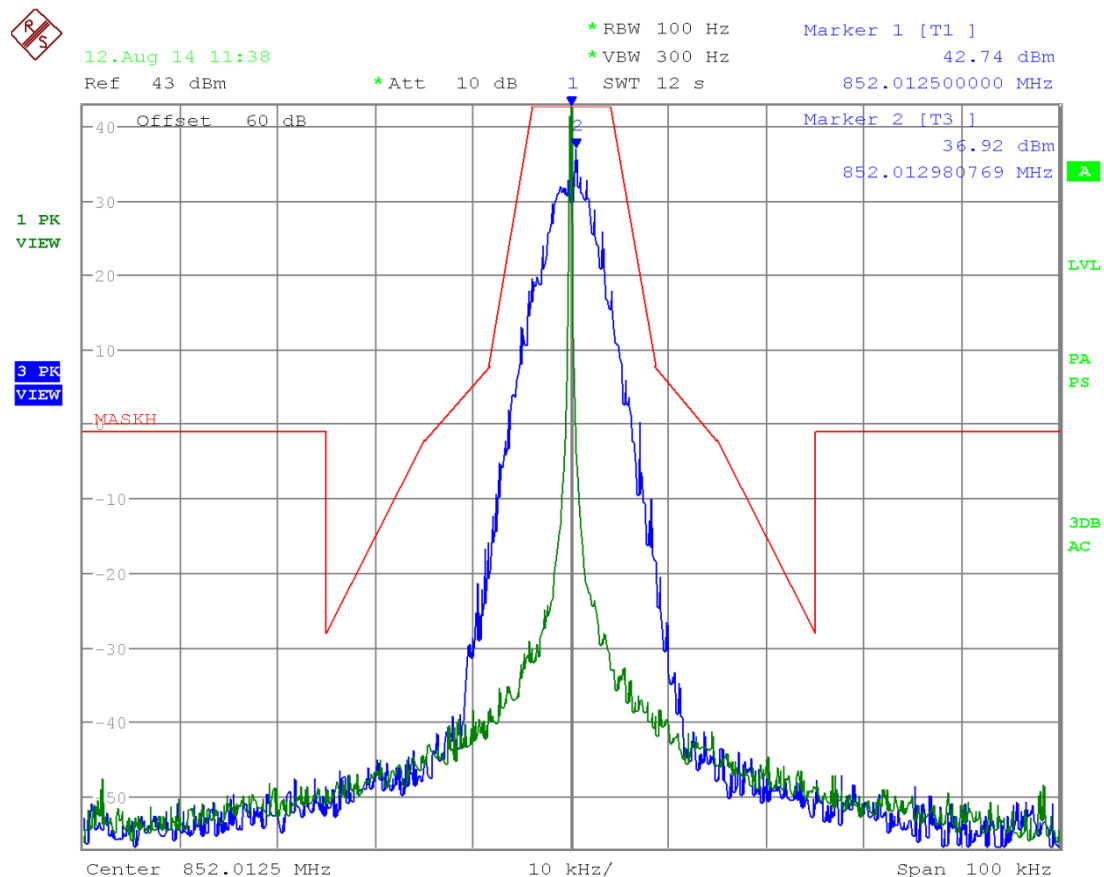
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OCCUPIED BANDWIDTH 852.0125 MHz 12.5 kHz Digital NPSPAC

OCCUPIED BANDWIDTH PLOTS (NPSPAC mutual aid channels)

Part 90.210(h) Emission Mask H



Date: 12.AUG.2014 11:38:43

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OCCUPIED BANDWIDTH 860.950 MHz EA Mask

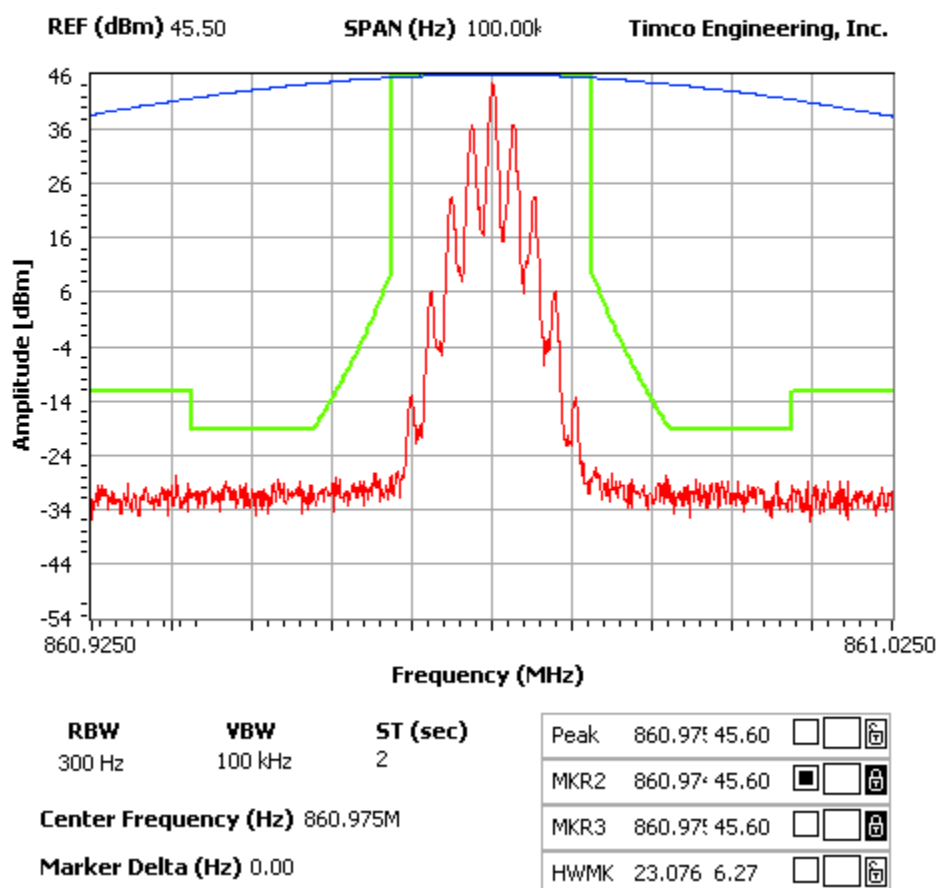
EA EMISSION MASK

Part 90.691: Emission mask requirements for EA-based systems
(Under the Policies Governing The Licensing and Use of EA-Based SMR Systems in the 809–824/854–869 MHz Band rule part)

806 – 824 MHz BAND

NOTES:

FCC 90.691 Mask



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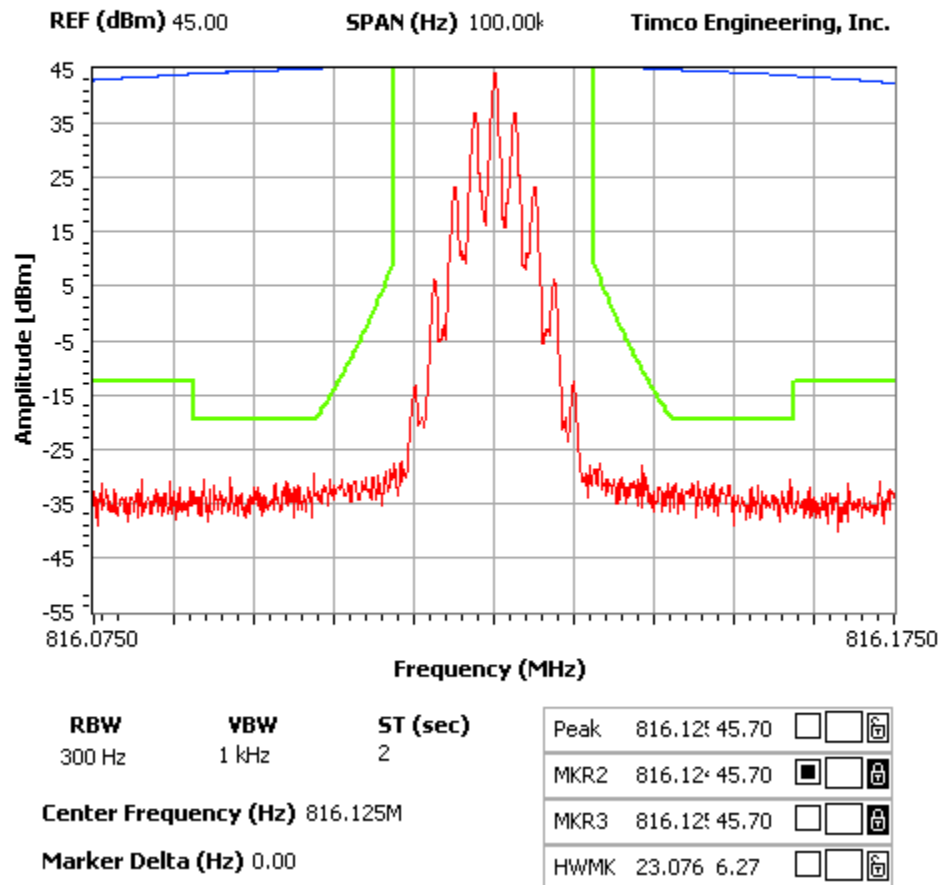
OCCUPIED BANDWIDTH 816.0750 MHZ EA MASK

EA EMISSION MASK

Part 90.691: Emission mask requirements for EA-based systems
(Under the Policies Governing The Licensing and Use of EA-Based SMR Systems in the 809–824/854–869 MHz Band rule part)

NOTES:

FCC 90.691 Mask



FIELD STRENGTH OF SPURIOUS EMISSIONS - RADIATED

Rule Parts. No.: Part 2.1053

Requirements: 12.5kHz Channel Spacing = $50 + 10\log(OP) = 64.8$ dBc

Test Data: Worst Case Radiated Emissions

Carrier Frequency (MHz)	Emission Frequency (MHz)	Ant. Polarity	Below Carrier (dBc)	Margin (dBm)
768.12	3,072.50	V	79.41	19.91
775.97	3,103.90	V	70.52	11.84
798.02	3,192.10	V	70.30	11.06
805.97	2,417.93	V	74.43	15.19
805.97	3,223.90	V	70.39	11.16
805.97	4,029.88	V	73.05	13.82
808.87	2,426.63	V	76.13	16.90
808.87	3,235.50	V	67.76	8.52
808.87	4,044.38	V	73.06	13.82
868.87	2,606.63	V	73.53	14.03
868.87	3,475.50	H	72.46	12.96

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FIELD STRENGTH OF SPURIOUS EMISSIONS - RADIATED

Rule Parts. No.: Part 2.1053

Test: Data Radiated Emissions to the tenth harmonic

HIGH POWER: Low End of the Band

Emission Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	FCC Requirement dBc	Bandwidth - BW - kHz
768.12	Hi	44.91	30.97	57.91	25.00
Emission Frequency (MHz)	Ant. Polarity	Below Carrier (dBc)		Margin	
1,536.25	H	87.91		30.00	
2,304.38	V	80.55		21.05	
3,072.50	V	79.41		19.91	
3,840.63	V	86.34		26.84	
4,608.75	H	91.17		31.67	
5,376.88	V	86.88		27.38	
6,145.00	H	85.71		26.21	
6,913.13	V	90.35		30.85	
7,681.25	H	87.87		28.37	

HIGH POWER: Middle of the Band

Emission Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	FCC Requirement dBc	Bandwidth - BW - kHz
775.97	Hi	45.68	36.98	58.68	25.00
Emission Frequency (MHz)	Ant. Polarity	Below Carrier (dBc)		Margin	
1,551.95	H	89.38		30.70	
2,327.93	V	78.69		20.01	
3,103.90	V	70.52		11.84	
3,879.88	V	85.49		26.80	
4,655.85	H	87.95		29.27	
5,431.83	V	86.08		27.40	
6,207.80	V	85.84		27.16	
6,983.78	H	88.89		30.20	
7,759.75	V	89.51		30.83	

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FIELD STRENGTH OF SPURIOUS EMISSIONS - RADIATED

Rule Parts. No.: Part 2.1053

Emission Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	FCC Requirement dBc	Bandwidth - BW - kHz
798.02	Hi	46.23	41.98	59.23	25.00
Emission Frequency (MHz)	Ant. Polarity	Below Carrier (dBc)		Margin	
1,596.05	V	83.80		24.56	
2,394.08	V	78.41		19.18	
3,192.10	V	70.30		11.06	
3,990.13	H	77.73		18.50	
4,788.15	H	88.88		29.64	
5,586.18	H	86.26		27.03	
6,384.20	H	89.14		29.91	
7,182.23	H	88.54		29.30	
7,980.25	V	89.02		29.78	

Emission Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	FCC Requirement dBc	Bandwidth - BW - kHz
805.97	Hi	46.23	41.98	59.23	25.00
Emission Frequency (MHz)	Ant. Polarity	Below Carrier (dBc)		Margin	
1,611.95	H	84.85		25.62	
2,417.93	V	74.43		15.19	
3,223.90	V	70.39		11.16	
4,029.88	V	73.05		13.82	
4,835.85	V	91.12		31.89	
5,641.83	V	85.06		25.83	
6,447.80	H	88.92		29.69	
7,253.78	H	88.26		29.03	
8,059.75	H	84.82		25.59	

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FIELD STRENGTH OF SPURIOUS EMISSIONS - RADIATED

Rule Parts. No.: Part 2.1053

Emission Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	FCC Requirement dBc	Bandwidth - BW - kHz
808.87	Hi	46.23	41.98	59.23	25.00
Emission Frequency (MHz)	Ant. Polarity	Below Carrier (dBc)		Margin	
1,617.75	H	83.90		24.67	
2,426.63	V	76.13		16.90	
3,235.50	V	67.76		8.52	
4,044.38	V	73.06		13.82	
4,853.25	H	92.69		33.46	
5,662.13	V	85.15		25.92	
6,471.00	V	89.10		29.87	
7,279.88	H	88.18		28.95	
8,088.75	V	85.41		26.17	

HIGH POWER: High End of the Band

Emission Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	FCC Requirement dBc	Bandwidth - BW - kHz
868.87	Hi	45.05	31.99	58.05	25.00
Emission Frequency (MHz)	Ant. Polarity	Below Carrier (dBc)		Margin	
1,737.75	V	82.91		23.41	
2,606.63	V	73.53		14.03	
3,475.50	H	72.46		12.96	
4,344.38	V	81.04		21.54	
5,213.25	V	86.10		26.60	
6,082.13	H	86.21		26.71	
6,951.00	V	90.33		30.83	
7,819.88	H	87.86		28.36	
8,688.75	H	84.75		25.25	

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TEST EQUIPMENT

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Antenna: Biconnical	Eaton	94455-1	1096	05/10/13	05/10/15
Antenna: Log-Periodic	Electro-Metrics	LPA-25	1122	05/09/13	05/09/15
Antenna: Dipole Kit	Electro-Metrics	TDA-30/1-4	152	N/A	N/A
Sweep/Signal Generator	Anritsu	68369B	985112	08/29/13	08/29/15
Hygro-Thermometer	Extech	445703	0602	06/20/13	06/20/15
Digital Multimeter	Fluke	77	35053830	08/22/13	08/22/15
Antenna: Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	12/07/13	12/07/15
Software: Field Strength Program	Timco	N/A	Version 4.0	N/A	N/A
EMI Test Receiver	Rhode & Schwarz	ESIB 40	100274	03/16/12	06/16/14
Antenna: Passive Loop	EMC Test Systems	EMCO 6512	9706-1211	06/14/12	06/14/14
*EMI Test Receiver	*Rhode & Schwarz	ESU 40	100320	03/21/13	03/21/15
Frequency Counter	HP	5385A	3242A07460	06/16/13	06/16/15
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/13	12/31/15
DC Power Supply	HP	6286A	1744A03842	N/A	N/A
Attenuator	Narda	766-30	N/A	8/1/13	8/1/15
Coaxial Cable # 65	N/A	E9917 RG233/U	Timco # 65	6/26/13	6/26/15
Coaxial Cable Chamber 3 pc Set	Semiflex	N/A	Chamber 3pc set	1/13/14	1/13/16
Amplifier Subrack	Codan Radio	SR-39-1	NA	NA	NA

*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

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