



Nemko Test Report: 10243127RUS1rev2

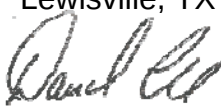
Applicant: E. F. Johnson
1440 Corporate Drive
Irving, TX 75038

**Equipment Under Test:
(E.U.T.)** VP900

In Accordance With: **FCC Part 90, Subpart I**
Private Land Mobile Transmitters

FCC ID.: ATH2425780

Tested By: Nemko USA Inc.
802 N. Kealy
Lewisville, TX 75057-3136

Tested By:  **DATE:** 28 June 2013
David Light, Senior Wireless Engineer

Approved By:  **DATE:** 22 July 2013
Tom Tidwell, Reviewer

Total Number of Pages: 38

Table of Contents

SECTION 1.	SUMMARY OF TEST RESULTS	3
SECTION 2.	GENERAL EQUIPMENT SPECIFICATION	5
SECTION 3.	RF POWER OUTPUT	6
SECTION 4.	MODULATION CHARACTERISTICS	7
SECTION 4.1	AUDIO FREQUENCY RESPONSE	8
SECTION 4.2	AUDIO LOW-PASS FILTER RESPONSE	9
SECTION 4.3	MODULATION LIMITING	10
SECTION 5.	SPURIOUS EMISSIONS AT ANTENNA TERMINALS	12
SECTION 6.	FIELD STRENGTH OF SPURIOUS EMISSIONS	24
SECTION 7.	FREQUENCY STABILITY	25
SECTION 8.	ADJACENT CHANNEL POWER	27
SECTION 9.	TRANSIENT FREQUENCY RESPONSE	29
SECTION 9.	TEST EQUIPMENT LIST	32
ANNEX A -	TEST METHODOLOGIES	33

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Section 1. Summary of Test Results

Manufacturer: E. F. Johnson

Model No.: VP900

Serial No.: None

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 90, Subpart I. EIA/TIA 603 and ANSI C63.4:2003 were used as a test method for these measurements.



New Submission



Production Unit



Class II Permissive Change



Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE
TEST SPECIFICATIONS HAVE BEEN MADE.

See " Summary of Test Data".



NVLAP Lab Code 100426-0

Nemko USA, Inc. authorizes the above named company to reproduce this report provided it is reproduced in its entirety, for use by the company's employees only.

This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government. Nemko USA, Inc. is a NVLAP accredited laboratory.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko USA, Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This report applies only to the items tested.

EQUIPMENT: VP900PROJECT NO.: 10243127RUS1rev2

Summary Of Test Data

NAME OF TEST	PARA. NO.	RESULT
RF Power Output	90.205 / 5.4.5	Complies
Audio Frequency Response	TIA EIA-603.3.2.6	Complies
Audio Low-Pass Filter Response	TIA EIA-603.3.2.6	Complies
Modulation Limiting	TIA EIA-603.3.2.6	Complies
Spurious Emissions at Antenna Terminals	90.210	Complies
Field Strength of Spurious Emissions	90.210	Complies
Frequency Stability	90.213	Complies
Transient Frequency Behavior	90.214	Complies
Adjacent Channel Power	90.543	Complies

Footnotes:

Revisions:

- 1) a) Repeated power and emission mask tests at 150 MHz. Previously at 162 MHz
- b) Removed emission mask plots in the 90R band.
- 2) Removed wideband data ACP table page 28.

EQUIPMENT: VP900PROJECT NO.: 10243127RUS1rev2

Section 2. General Equipment Specification

Supply Voltage Input:	7.5 Vdc
Frequency Range(FCC):	136 to 174 MHz 763 to 775 MHz 793 to 805 MHz 806 to 824 MHz 851 to 869 MHz
Emission Designator(s):	16K0F3E, 14K0F3E, 11K0F3E, 8K10F1E*, 8K10F1D*, 8K10F7E <i>* The two modulations have the same characteristics and need to be tested only once. The only difference is in the application of the bit stream, either data or vocoded voice.</i>
Output Impedance:	50 ohms
RF Power Output (rated):	5.0 Watts (136 to 174 MHz) 3.0 Watts (764 to 806 MHz) 3.5 Watts (806 to 869 MHz)
Channel Spacing(s):	12.5 kHz, 25 kHz
Selection of Operating Frequency:	Pre-programmed channel selection
Power Output Adjustment Capability:	None

System Description

VHF/UHF Land Mobile Radio transceiver.

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.1046
TESTED BY: David Light	DATE: 02 May 2013

Measurement Results: Complies.**Measurement Data:**

Channel (MHz)	Output Power (dBm)	Output Power (W)
150.0000	37.7	5.9
769.0125	34.3	2.7
814.5125	34.9	3.1

Test Equipment Used: 1036-1082-1472-1469**Temperature:** 23°C**Relative Humidity:** 47%**Spectrum analyzer setting:**RBW: 1 MHz
VBW: 1 MHz
Detector: Peak

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Section 4. Modulation Characteristics

NAME OF TEST: Modulation Characteristics	PARA. NO.: 2.1047
TESTED BY: David Light	DATE: 06 May 2013

Measurement Results: Complies.**Measurement Data:** See following pages

Description of modulation: Modulation input to the radio is voice via a microphone. The radio has three modes of operation:

- 1) Narrow band voice for 12.5 kHz channels
- 2) Wideband voice for 25 kHz channels
- 3) Data modulation. In this mode the voice input signal goes through a Vocoder to translate the audio to data.

Description of base band filters: The radio has a low-pass audio filter.

Equipment Used: 1767-1082-1064-1065**Necessary bandwidth:**

Modulation	Deviation	Necessary BW calculation
Narrowband analogue	± 2.5 kHz	$(2.5\text{k} \times 2) + (3\text{k} \times 2) = 11\text{K}0$
NPSPAC analogue	± 4.0 kHz	$(4.0\text{k} \times 2) + (3\text{k} \times 2) = 14\text{K}0$
P25 digital	± 2.5 kHz C4FM	$(2.5\text{k} \times 2) + ((2 \times 3.1\text{kbps}) / 2) = 8\text{K}10$
Wideband analogue	± 5.0 kHz	$(5.0\text{k} \times 2) + (3\text{k} \times 2) = 16\text{K}0$
P25 analogue	± 2.5 kHz	$(2.5\text{k} \times 2) + (1.55\text{k} \times 2) = 8\text{K}10$

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

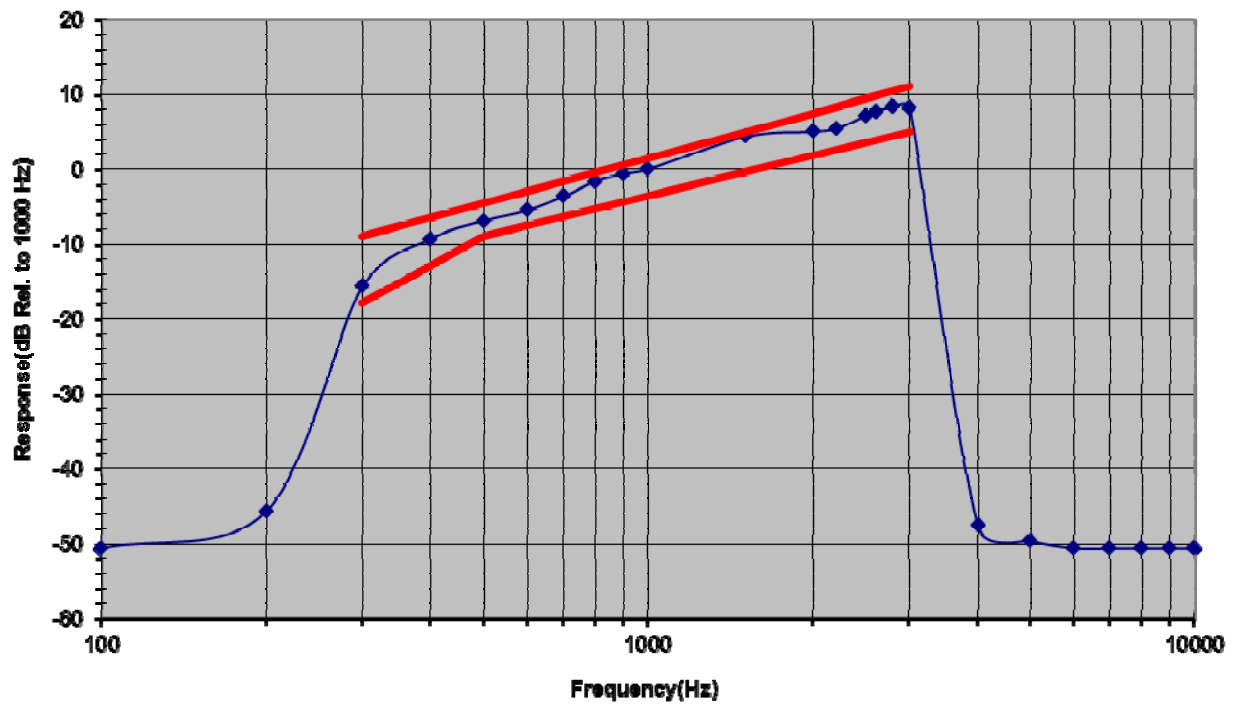
Section 4.1 Audio Frequency Response

NAME OF TEST: Audio Frequency Response

PARA. NO.: 2.1047(a)

TESTED BY: David Light

DATE: 06 May 2013



EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Section 4.2 Audio Low-Pass Filter Response

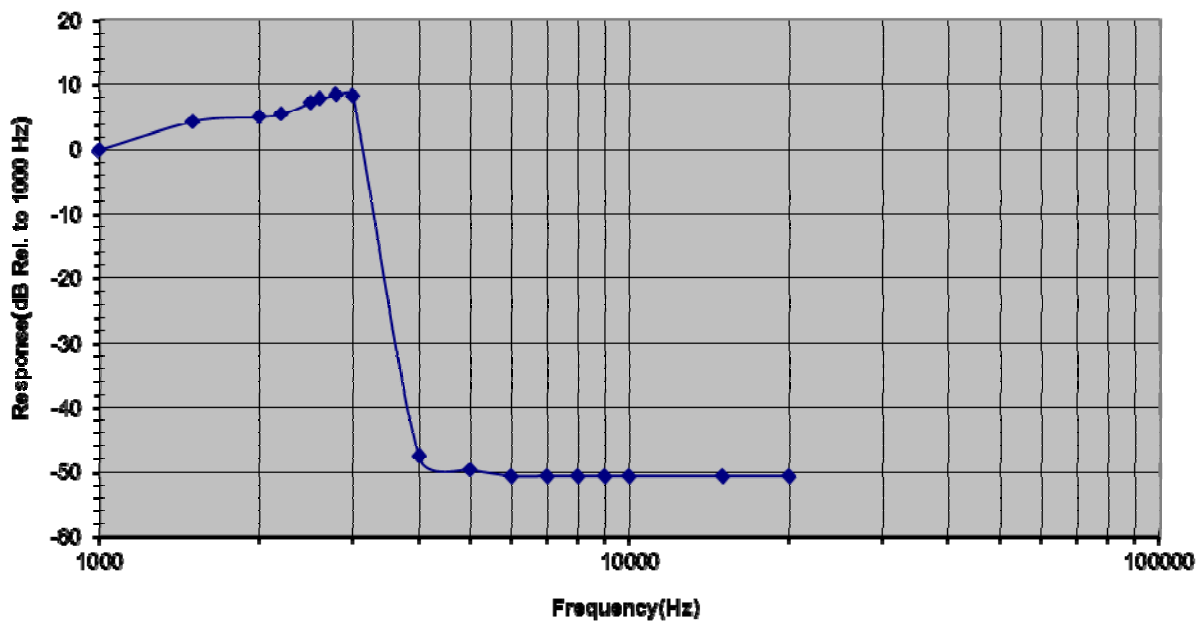
NAME OF TEST: Audio Low-Pass Filter Response

PARA. NO.: 2.1047(a)

TESTED BY: David Light

DATE: 06 May 2013

AF Low Pass Filter Response(dB Rel. to 1000 Hz)



EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Section 4.3 Modulation Limiting

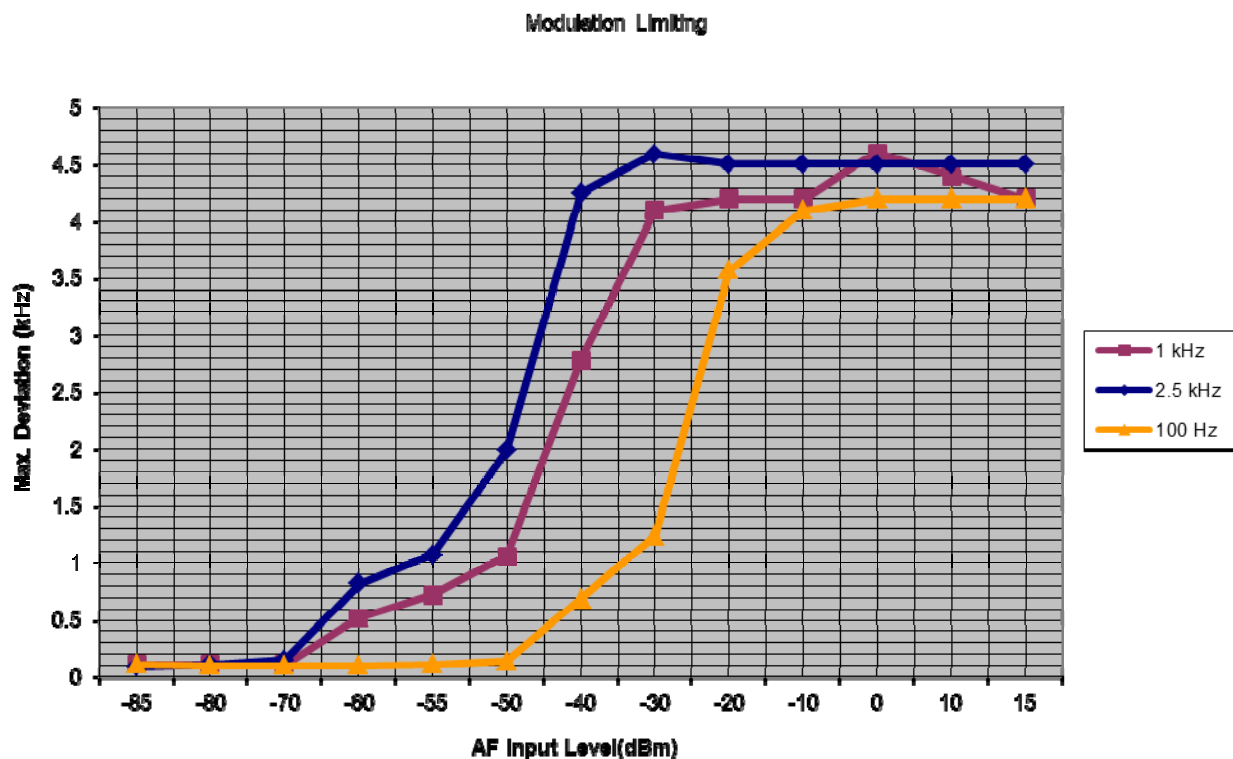
NAME OF TEST: Modulation Limiting

PARA. NO.: 2.1047(b)

TESTED BY: David Light

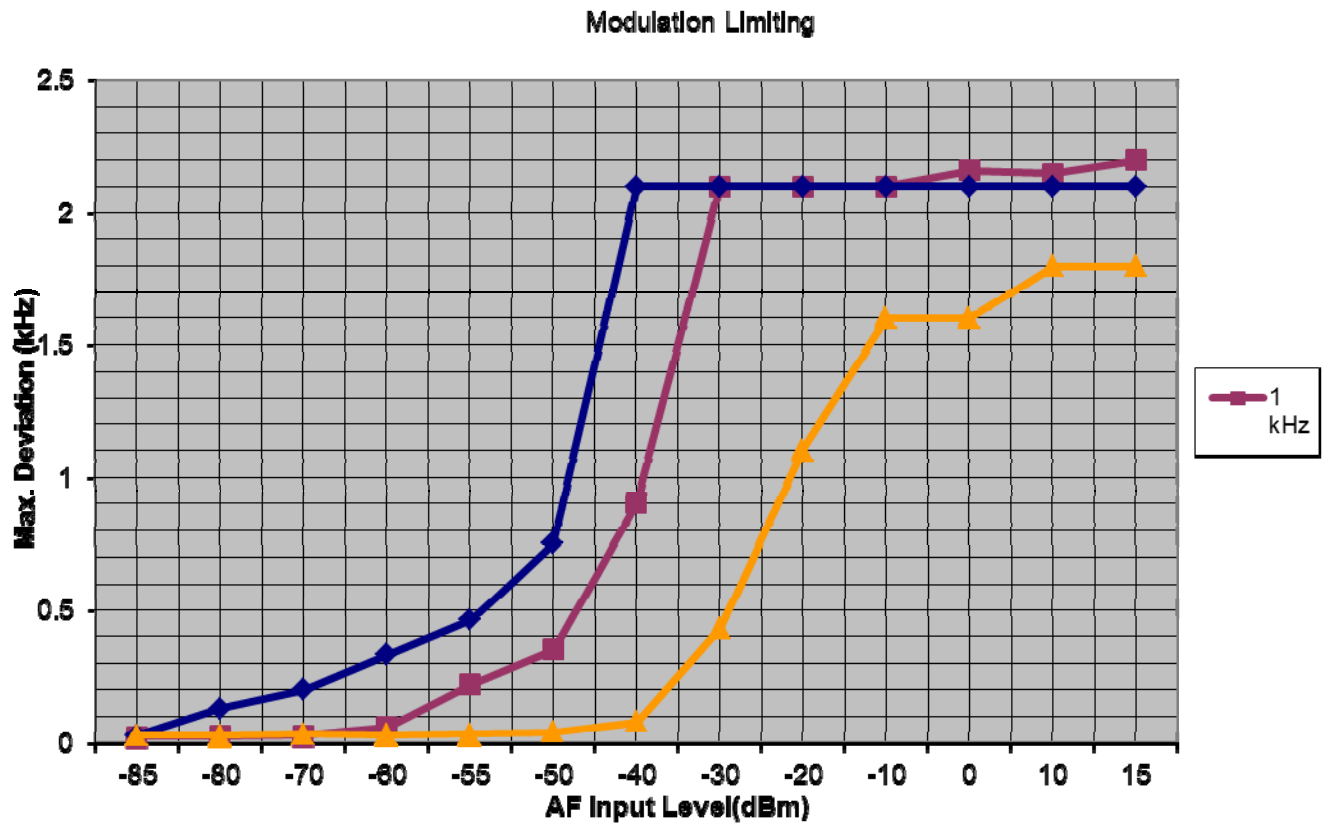
DATE: 06 May 2013

Test Data – Wide Band Analog



Maximum deviation for non-voice modulation: +/-3 kHz.

Test Data – Narrow Band Analog



EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.1051
TESTED BY: David Light	DATE: 30 May 2013

Measurement Results: Complies.

Measurement Data: See attached data

Equipment Used: 1036-1663-1082-1472-1469

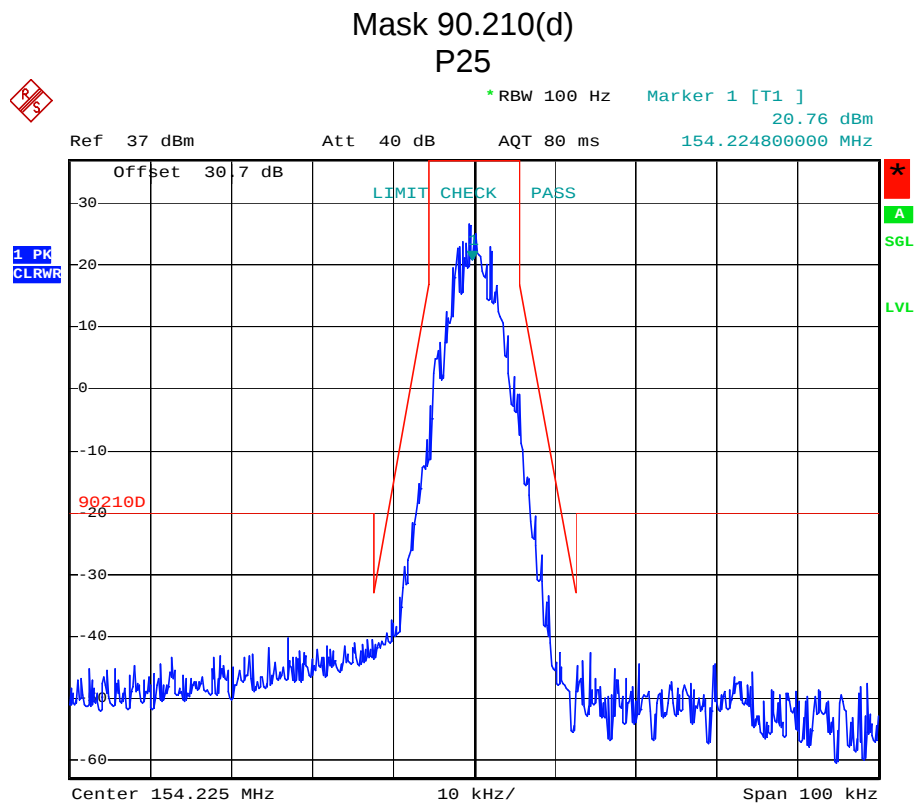
Temperature: 23°

Relative Humidity: 47%

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Test Data – Spurious Emissions

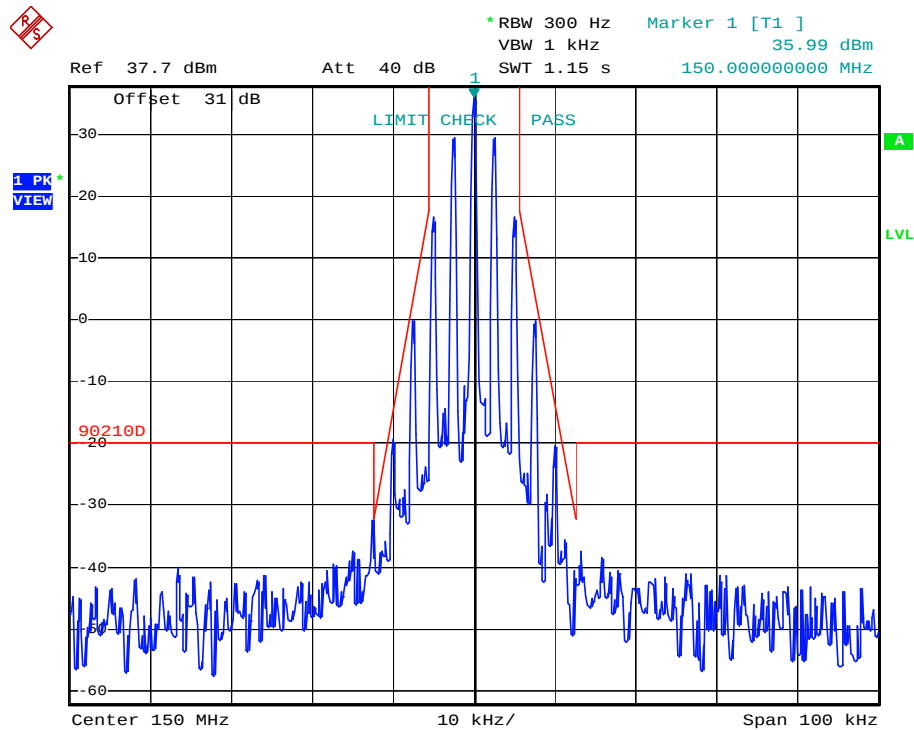


Date: 30.MAY.2013 02:49:03

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Test Data – Spurious Emissions

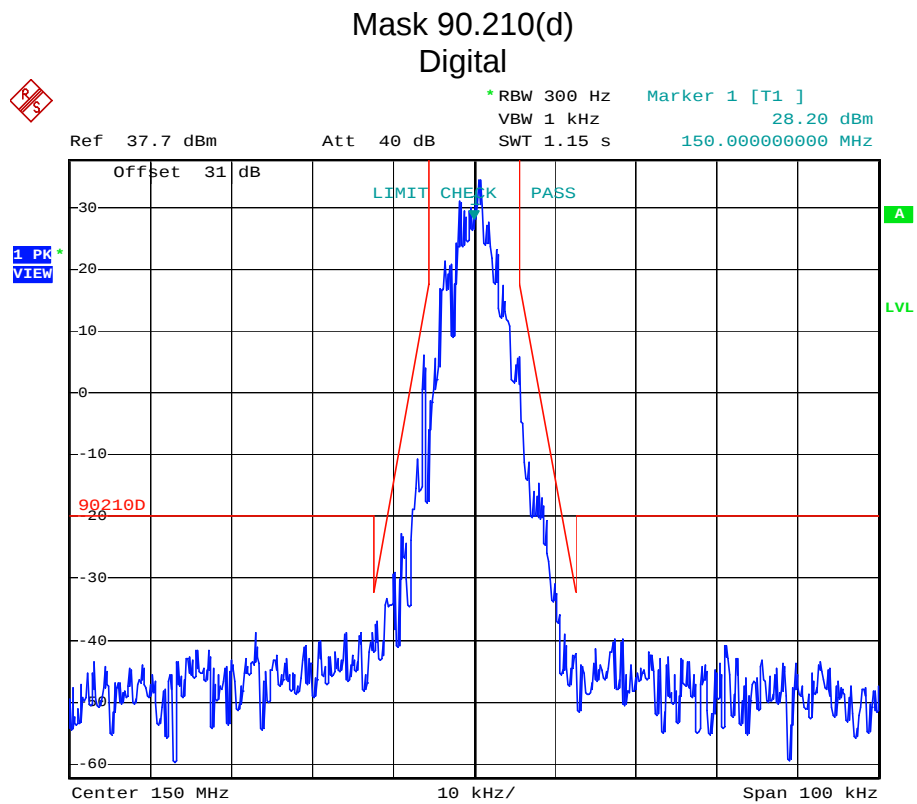
Narrow Band Analog
Mask 90.210d

Date: 28.JUN.2013 03:39:59

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Test Data – Spurious Emissions

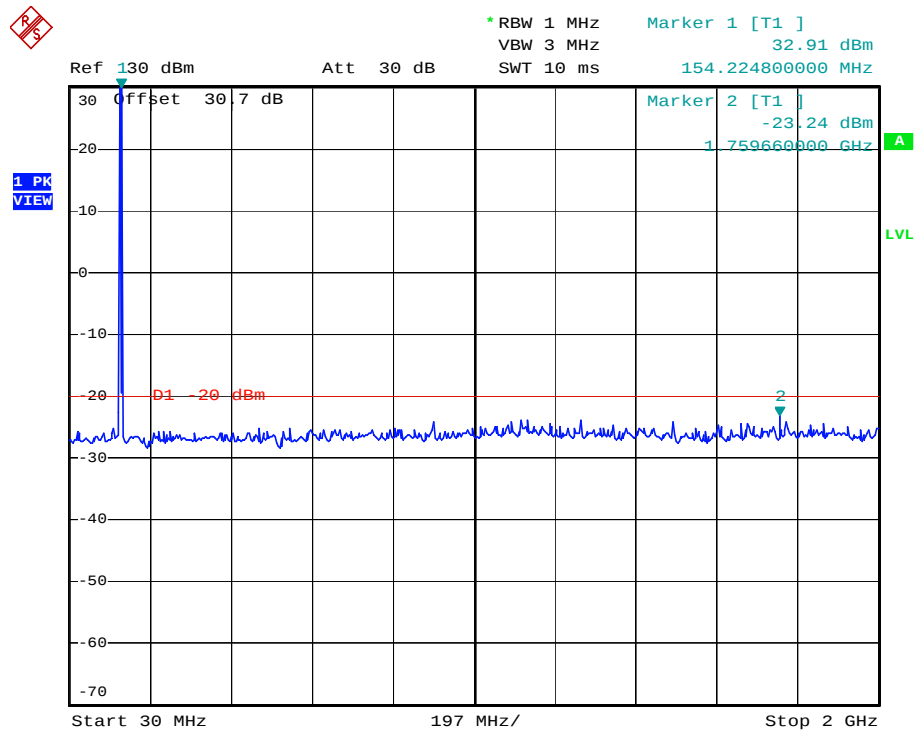


Date: 28.JUN.2013 03:40:59

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Test Data – Spurious Emissions

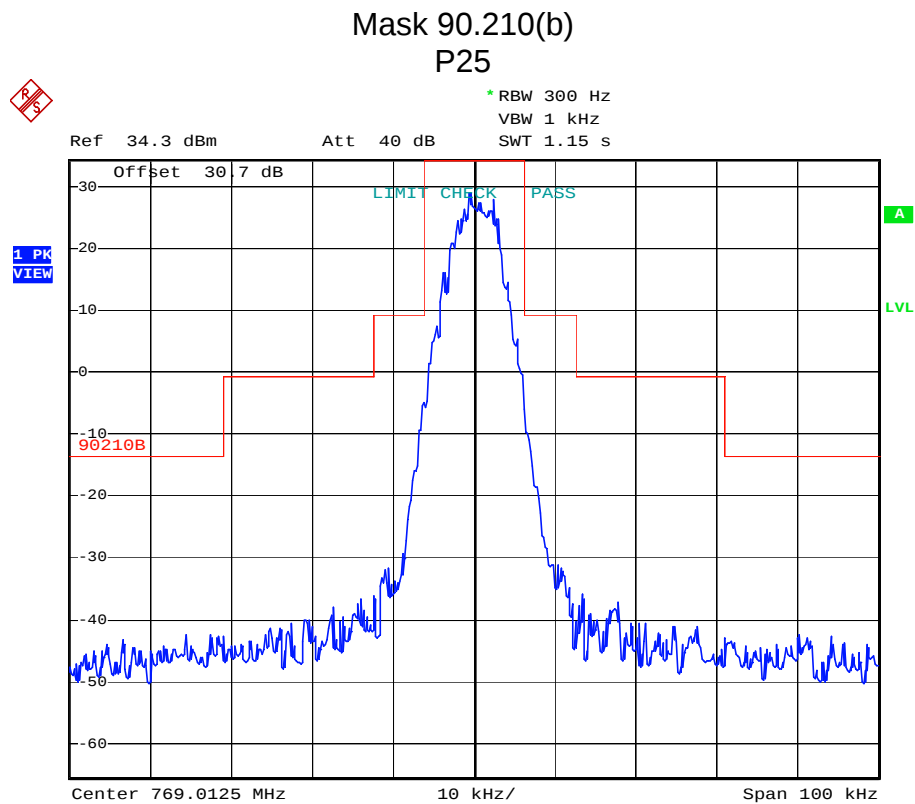
Spurious Emissions
VHF

Date: 30.MAY.2013 02:53:59

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Test Data – Spurious Emissions

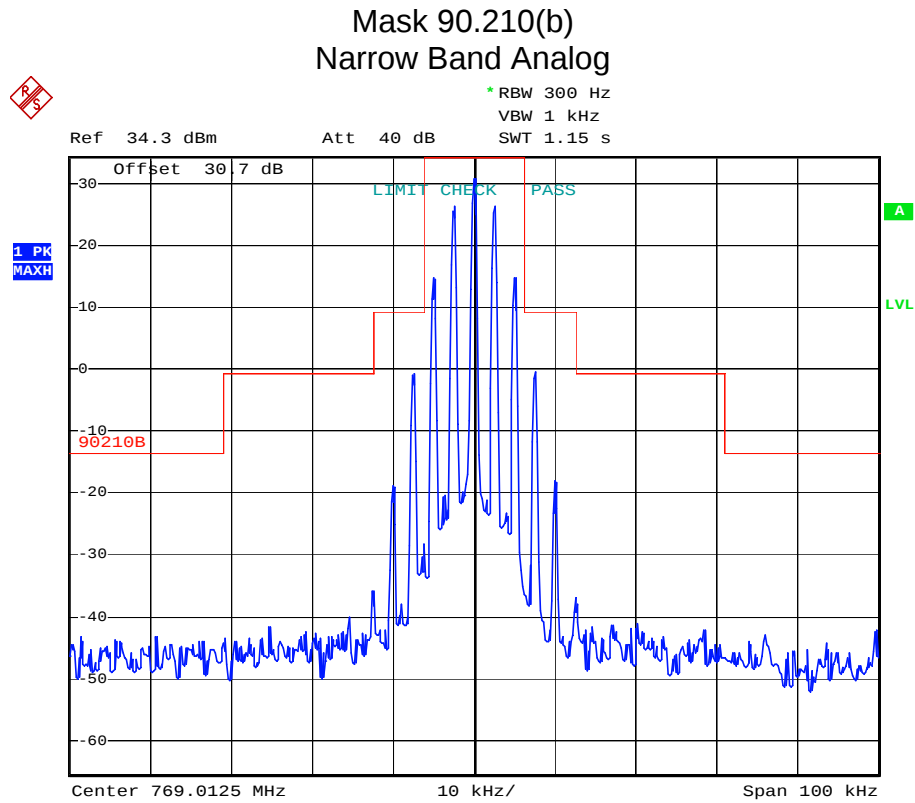


Date: 30.MAY.2013 23:50:16

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Test Data – Spurious Emissions

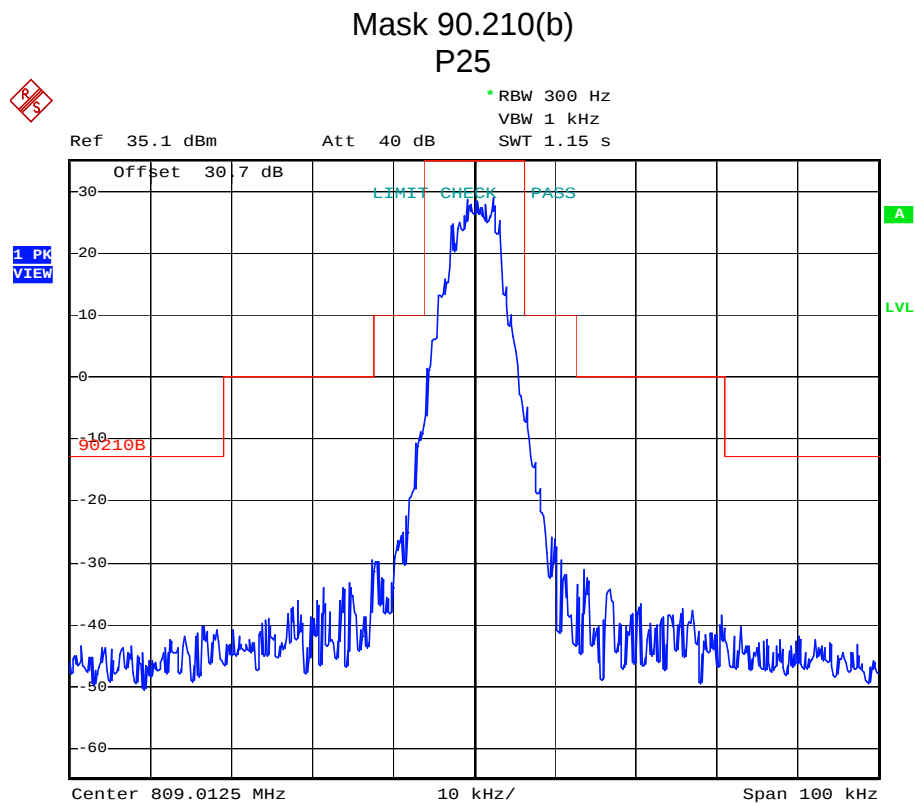


Date: 30.MAY.2013 23:53:12

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Test Data – Spurious Emissions



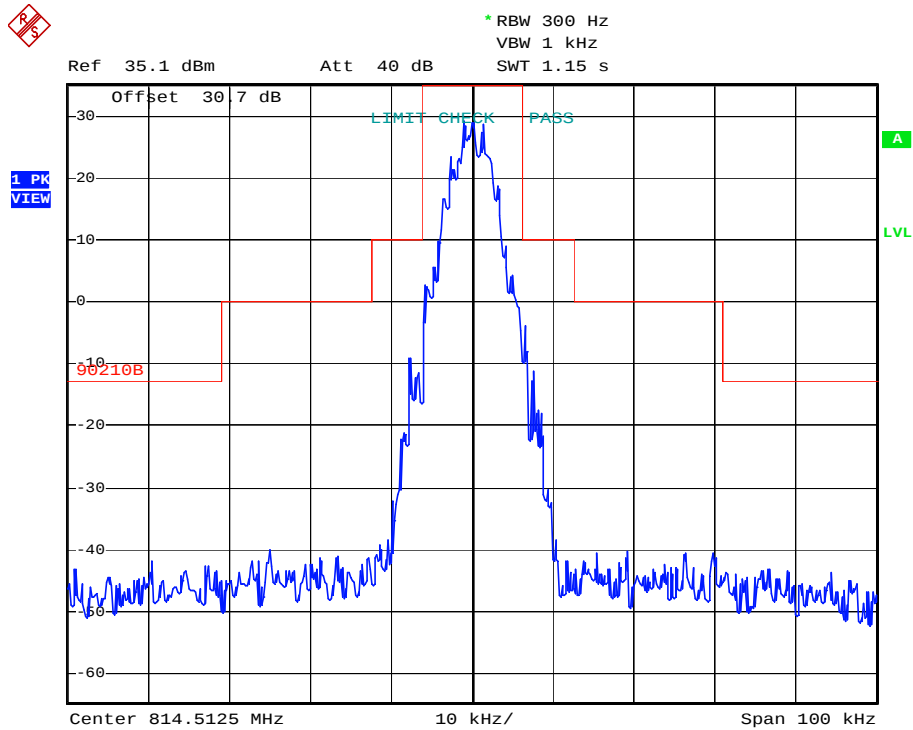
Date: 31.MAY.2013 00:03:36

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Test Data – Spurious Emissions

Digital
Mask90.210(b)

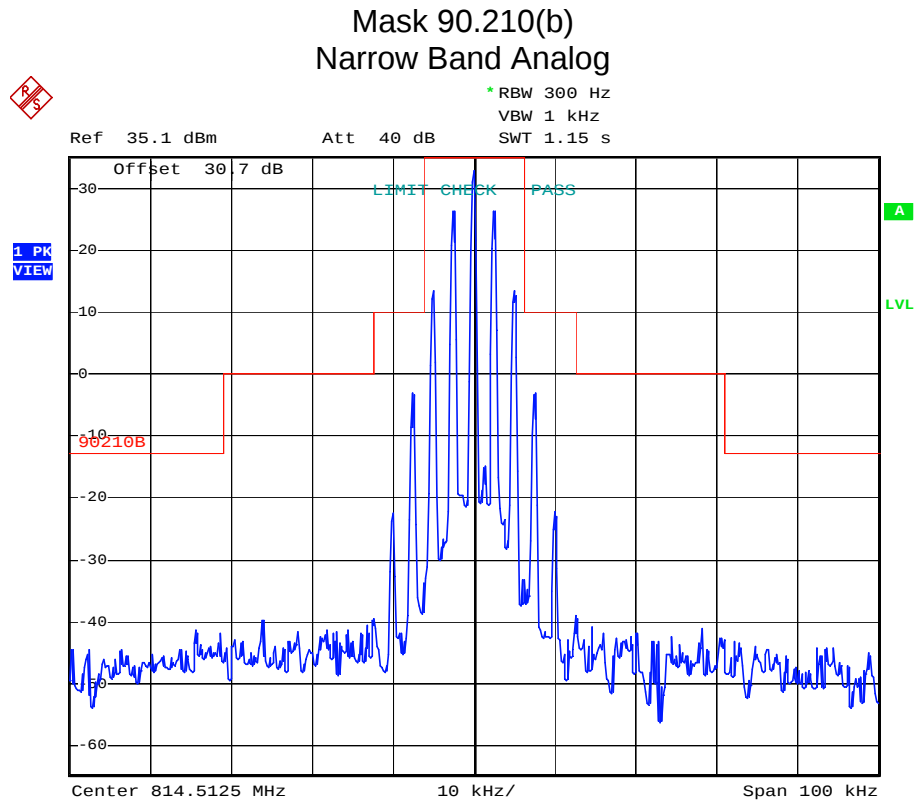


Date: 31.MAY.2013 00:06:05

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Test Data – Spurious Emissions

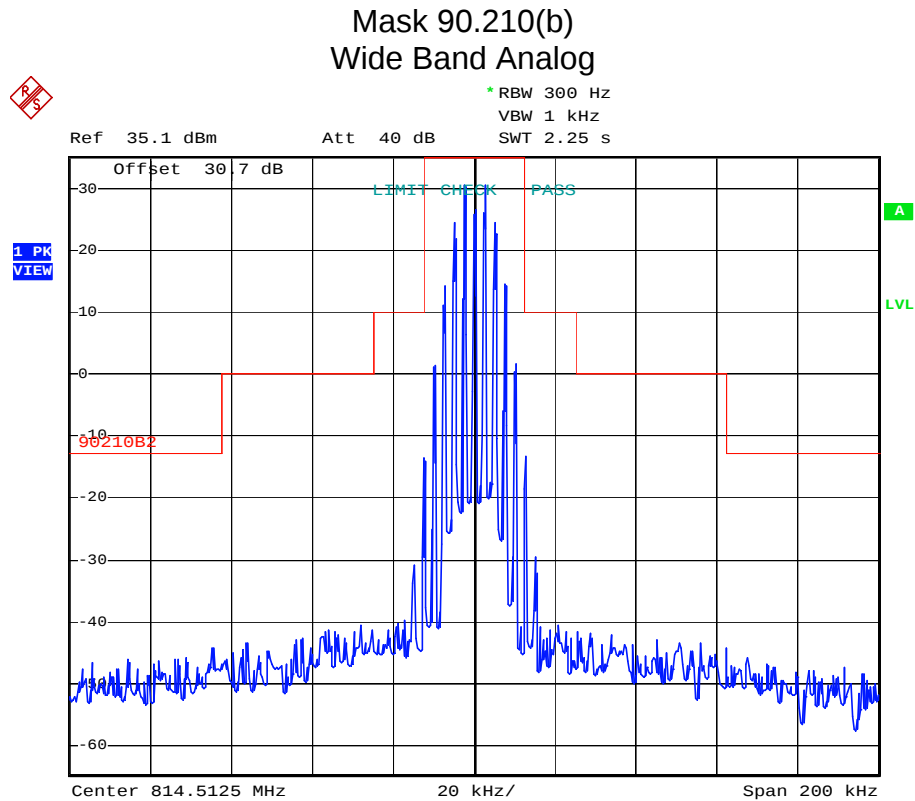


Date: 31.MAY.2013 00:07:08

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Test Data – Spurious Emissions

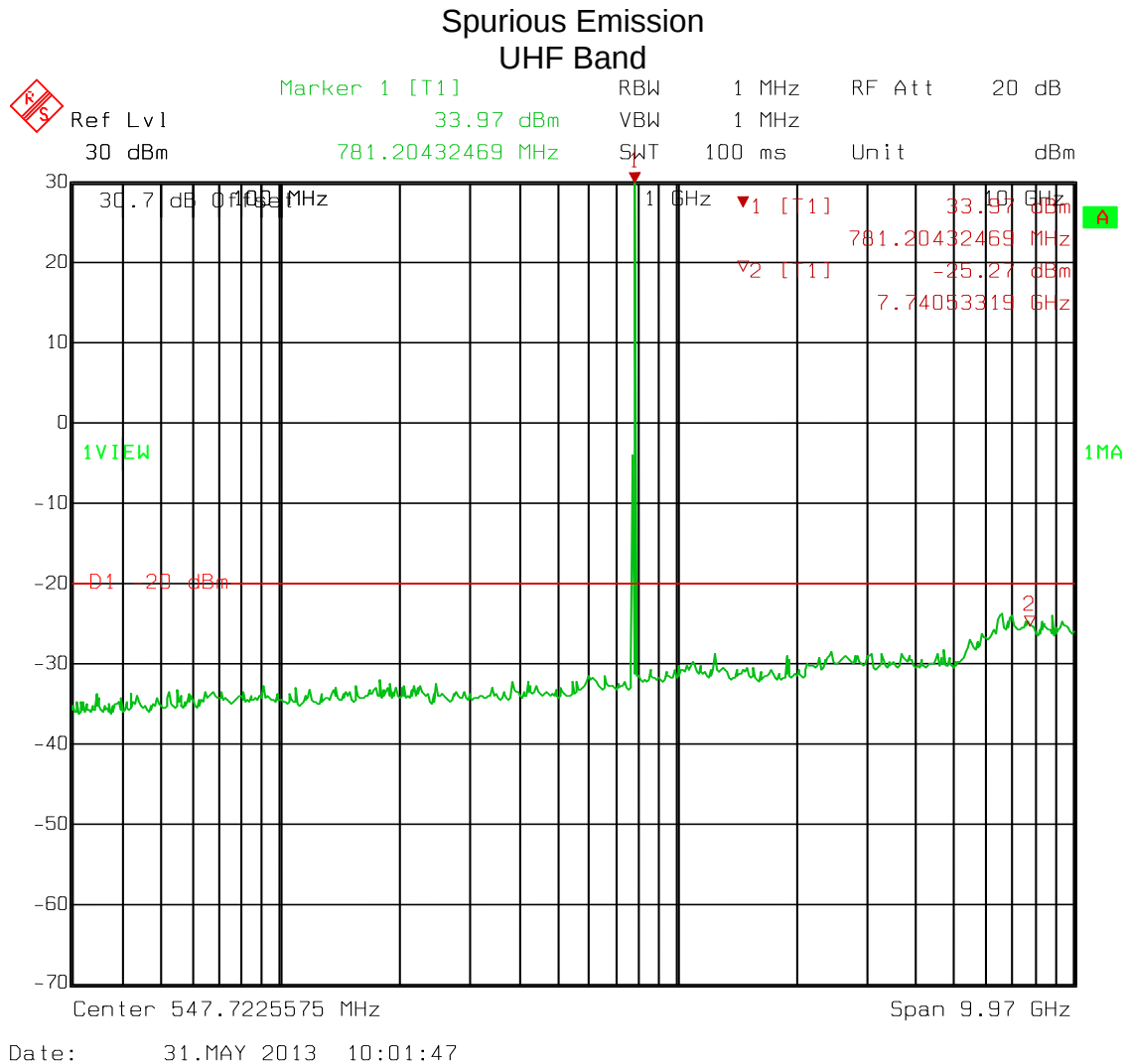


Date: 31.MAY.2013 02:10:23

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Test Data – Spurious Emissions



EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Section 6. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.1053
TESTED BY: David Light	DATE: 03 November 2011

Measurement Results: Complies.**Measurement Data:**

Note: The frequency spectrum was searched from 30 MHz to 10 GHz. No emissions within 20 dB of the specification limit were detected.

The spectrum was investigated in the 1559 to 1610 MHz band per 90.543. There were no emissions detected above the noise floor which was at least 20 dB below the specification limit of -70 dBW EIRP.

The device was measured on three orthogonal axis to determine the worst-case emission level at each emission.

Receiver Settings: RBW=VBW=100 kHz below 1000 MHz
RBW=VBW=1 MHz above 1000 MHz
Peak detector

Measurement Distance: 3 Meters**Equipment Used:** 1016-791-993-1480-1767-1783

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Section 7. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 90.213 / 90.539
TESTED BY: David Light	DATE: 31 May 2013

Measurement Results: Complies.

Measurement Data: See attached data

Limit: 1.5 ppm

Equipment Used: 1036-1082-1472-1469

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Test Data – Frequency Stability

Measurement Uncertainty:	1x10 ⁻⁷ ppm	Standard Test Frequency			775.987500	MHz	
Temp (°C)	Measured Frequency (MHz)		Test Voltage	Frequency Error (Hz)	Limit (+/-Hz)	Error (ppm)	Comment
20	775.987620		7.5	120	1164.0	0.15	
20	775.987400		6.2	-100	1164.0	-0.13	Battery cutoff
50	775.987376		7.5	-124	1164.0	-0.16	
40	775.987560		7.5	60	1164.0	0.08	
30	775.987556		7.5	56	1164.0	0.07	
10	775.987780		7.5	280	1164.0	0.36	
0	775.987540		7.5	40	1164.0	0.05	
-10	775.987500		7.5	0	1164.0	0.00	
-20	775.987542		7.5	42	1164.0	0.05	
-30	775.987500		7.5	0	1164.0	0.00	
Notes:							

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Section 8. Adjacent Channel Power

NAME OF TEST: Adjacent Channel Power	PARA. NO.: 90.543
TESTED BY: David Light	DATE: 03 June 2013

Measurement Results: Complies.

Measurement Data: See attached data

Limit:

Equipment Used: 1036-1082-1472-1469

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Test Data – Adjacent Channel PowerNarrow Band Analog
12.5 kHz Channel

Offset from center Frequency (kHz)	Measurement Bandwidth (kHz)	Maximum ACP (dBc)	Measured ACP Upper (dBc)	Measured ACP Lower (dBc)
9.375	6.25	-40	-40.3	-40.1
15.625	6.25	-60	-76.6	-74
21.875	6.25	-60	-77.9	-78.5
37.50	25.00	-60	-72.1	-72.1
62.50	25.00	-65	-71.2	-71.3
87.50	25.00	-65	-72.2	-72.5
150.00	100.00	-65	-73	-72.8
250.00	100.00	-65	-72.8	-72.2
350.00	100.00	-65	-74.2	-73.8
>400 to 12 MHz	30 (s)	-75	-88.2	-88.2
12 MHz to paired RX band	30 (s)	-75	-88.2	NA
In the paired RX band	30 (s)	-100	108.3	NA

Test Data – Adjacent Channel PowerProject 25 Digital
12.5 kHz Channel

Offset from center Frequency (kHz)	Measurement Bandwidth (kHz)	Maximum ACP (dBc)	Measured ACP Upper (dBc)	Measured ACP Lower (dBc)
9.375	6.25	-40	-43.0	-46.0
15.625	6.25	-60	-77	-76.1
21.875	6.25	-60	-77.8	-75.8
37.50	25.00	-60	-71.5	-72
62.50	25.00	-65	-70.9	-70.5
87.50	25.00	-65	-72.9	-73.3
150.00	100.00	-65	-74.5	-74.1
250.00	100.00	-65	-76.4	-75.4
350.00	100.00	-65	-73.5	-72.7
>400 to 12 MHz	30 (s)	-75	-88.2	-88.2
12 MHz to paired RX band	30 (s)	-75	-88.2	NA
In the paired RX band	30 (s)	-100	108.3	NA

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Section 9. Transient Frequency Response

NAME OF TEST: Transient Frequency Response	PARA. NO.: 2.1051
TESTED BY: David Light	DATE: 30 May 2013

Measurement Results: Complies.

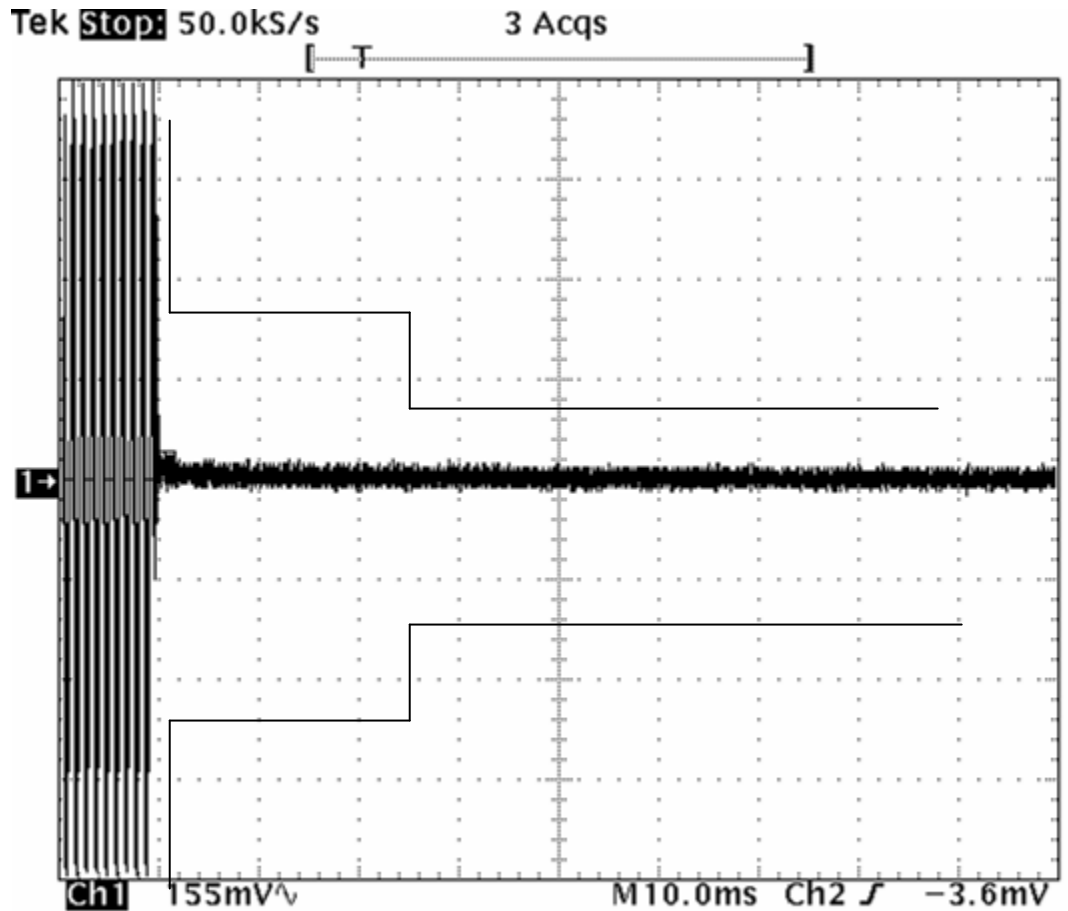
Measurement Data: See attached data

Equipment Used: 1036-1082-1472-1469

Temperature: 23°

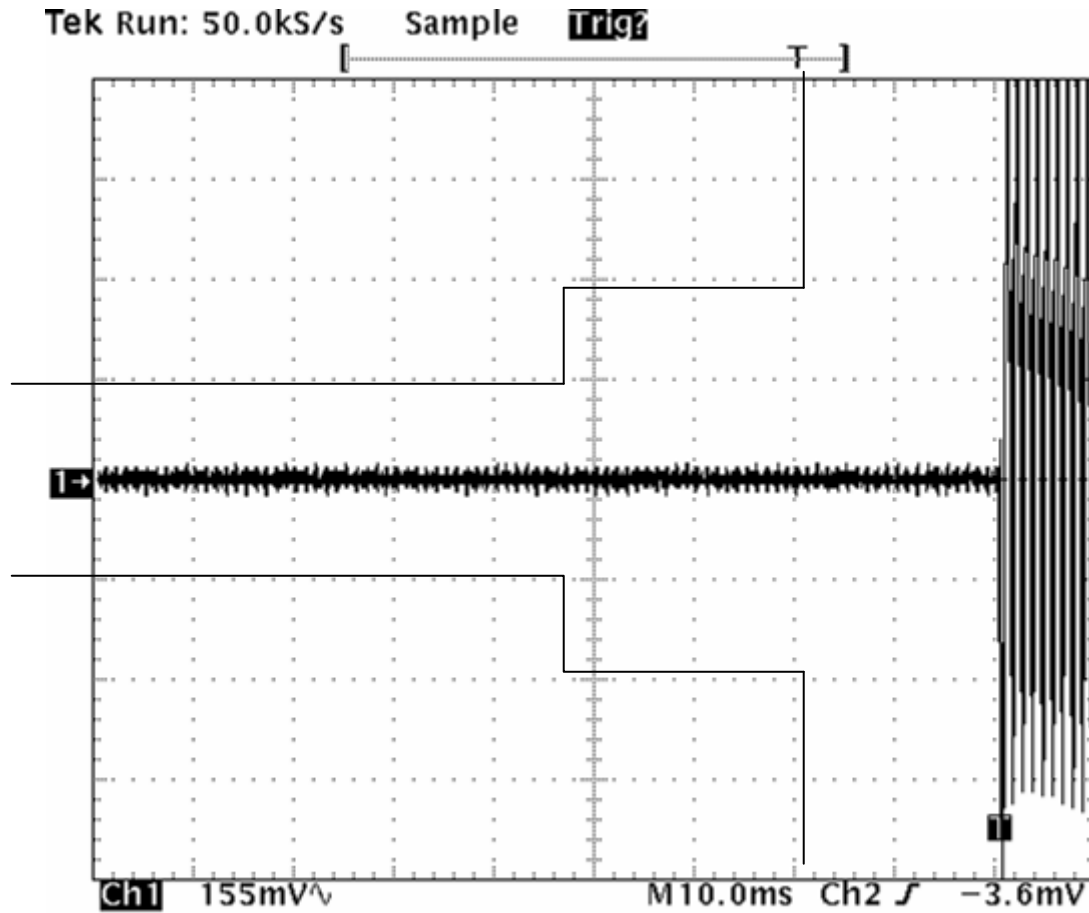
Relative Humidity: 47%

Test Data



Switch on Condition

Test Data



Switch off Condition

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

Section 9. Test Equipment List

Asset Tag	Description	Manufacturer	Model	Serial #	Last Cal	Next Cal
993	Antenna, Horn	A.H. Systems	SAS-200/571	162	22-Sep-2011	22-Sep-2013
1016	Preamplifier	Hewlett Packard	8449A	2749A00159	20-Jul-2011	20-Jul-2012
1064	Attenuator	Narda	776B-20		N/R	
1065	Attenuator	Narda	776B-10		N/R	
1082	Cable, 2m	Astrolab	32027-2- 29094-72TC		N/R	
1464	Spectrum Analyzer	Hewlett Packard	8563E	3551A04428	16-May-2011	16-May-2013
1783	Cable	Nemko			26-Sept-2011	26-Sept-2012
1767	Receiver	Rohde & Schwartz	ESIB26	837491/0002	01-Dec-2010	01-Dec-2011
1025	Preamplifier, 25dB	Nemko USA, Inc.	LNA25	399	23-Feb-2011	23-Feb-2012
1304	Antenna, Horn	Electro Metrics	RGA-60	6151	24-Nov-2010	24-Nov-2012
1763	Antenna, Bilog	Schaffner	CBL 6111D	22926	11-Feb-2011	11-Feb-2012
1783	Cable Assy, 3m Chamber	Nemko	Chamber		26-Sept-2011	26-Sept-2012

ANNEX A - TEST METHODOLOGIES

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

NAME OF TEST: RF Power Output**PARA. NO.: 2.1046**

Minimum Standard: Para. No. 90.205(a). The maximum allowable station ERP is dependent upon the stations HAAT and required service area and will be authorized in accordance with Table 1 of 90.205(d).

Method Of Measurement:Detachable Antenna:

The peak power at antenna terminals is measured using an in-line peak power meter. Power output is measured with the maximum rated input level.

Integral Antenna:

The antenna substitution method is used to determine the equivalent radiated power at spurious frequencies. The spurious emissions are measured at a distance of 3 meters. The EUT is then replaced with a reference substitution antenna with a known gain referenced to an isotropic radiator. This antenna is fed with a signal at the spurious frequency. The level of the signal is adjusted to repeat the previously measured level. The resulting eirp is the signal level fed to the reference antenna corrected for gain referenced to an isotropic radiator.

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

NAME OF TEST: Spurious Emissions at Antenna
Terminals

PARA. NO.: 2.1051

Minimum Standard:

90.210, Table 1

Table 1

Frequency Band (MHz)	Mask for equipment with Low Pass Filter	Mask for equipment without Low Pass Filter
Below 25	A or B	A or C
25 - 50	B	C
72 - 76	B	C
150 - 174	B, D or E	C, D or E
150 Paging only	B	C
220 - 222	F	F
421 - 512	B, D or E	C, D or E
450 paging only	B	H
806 - 821/ 851 - 866	B	G
821 - 824/ 866 - 869	B	H
896 - 901/ 935 - 940	I	J
902 - 928	K	K
929 - 930	B	G
Above 940	B	C
All other bands	B	C

Test Method:

RBW: 1% of emission bandwidth in the 0 - 1 GHz range.
1 MHz at frequencies above 1 GHz.
VBW: > RBW

The spectrum is searched up to 10 times the fundamental frequency.

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.1049
---	--------------------------

Method Of Measurement:

Analog

Spectrum analyzer settings:

RBW=VBW=300 Hz

Span: 100 kHz

Sweep: Auto

iDEN

RBW=VBW= 300 Hz

Span: 100 kHz

Sweep: Auto

EQUIPMENT: VP900PROJECT NO.: 10243127RUS1rev2

NAME OF TEST: Field Strength of Spurious**PARA. NO.: 2.1051****Minimum Standard:** Para. No. 90.210, see table 1 for applicable mask.**Method Of Measurement:** TIA/EIA-603-1992

The antenna substitution method is used to determine the equivalent radiated power at spurious frequencies. The spurious emissions are measured at a distance of 3 meters. The EUT is then replaced with a reference substitution antenna with a known gain referenced to an isotropic radiator. This antenna is fed with a signal at the spurious frequency. The level of the signal is adjusted to repeat the previously measured level. The resulting eirp is the signal level fed to the reference antenna corrected for gain referenced to an isotropic radiator.

EQUIPMENT: VP900

PROJECT NO.: 10243127RUS1rev2

NAME OF TEST: Frequency Stability**PARA. NO.: 2.1055**

Minimum Standard: Para. No. 90.213. The transmitter carrier frequency shall remain

within the assigned frequency below in ppm.

Table 2

Frequency Band (MHz)	Fixed And Base Stations	Mobile Stations	
		> 2 Watts o/p pwr	< 2 Watts o/p pwr
Below 25	100	100	200
25 - 50	20	20	50
72 - 76	5	-	50
150 - 174	5	5	5
220 - 222	0.1	1.5	1.5
421 - 512	2.5	5	5
806 - 821	1.5	2.5	2.5
821 - 824	1.0	1.5	15
851 - 866	1.5	2.5	2.5
866 - 869	1.0	1.5	1.5
869 - 901	0.1	1.5	1.5
902 - 928	2.5	2.5	2.5
929 - 930	1.5	-	-
935 - 940	0.1	1.5	1.5
1427 - 1435	300	300	300
Above 2450	-	-	-