



Nemko Test Report: 10220021RUS1rev3

Applicant: EF Johnson Company
1440 Corporate Drive
Irving, TX 75308
USA

Equipment Under Test: Model Name: Viking VP 600
(E.U.T.) Model Number: 242-5710

FCC Identifier: ATH2425710

Industry Canada Identifier: 933B-2425710

In Accordance With: FCC Part 90, Subpart I and
Industry Canada, RSS-119, Issue 11
Private Land Mobile Transmitter

A handwritten signature in black ink, appearing to read "David Light".

TESTED BY: _____ **DATE:** 17 May 2012
David Light, Wireless Engineer

A handwritten signature in black ink, appearing to read "Michael Cantwell".

APPROVED BY: _____ **DATE:** 18 May 2012
Michael Cantwell

Total Number of Pages: 38

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Section 1. Summary of Test Results

Manufacturer: EF Johnson Company

Model Name: Viking VP 600

Model Number: 242-5710

Serial No.: 517001208720051

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 and Industry Canada RSS-119, Issue 11. EIA/TIA 603 was 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".



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Summary Of Test Data

NAME OF TEST	PARA. NO.	RESULT
RF Power Output	90.205 / 5.4.1	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
Occupied Bandwidth	90.210 // 5.5.8 Table 3	Complies
Spurious Emissions at Antenna Terminals	90.210 / 5.5.8 Table 3	Complies
Field Strength of Spurious Emissions	90.210 / 5.5.8 Table 3	Complies
Frequency Stability	90.213 / 5.3	Complies
Transient Frequency Behavior	90.214 / 5.9	Complies

Footnotes:

Section 2. General Equipment Specification**Transmitter**

Supply Voltage Input:	7.4 Vdc Lithium Ion Battery														
Frequency Range:	136 to 174 MHz USA: 136 MHz – 174 MHz Canada: 138 – 144 MHz and 148 – 174 MHz														
Type(s) of Modulation:	<table><tr><td>F3E (Voice)</td><td>F1D</td><td>F1E</td><td>D7W (QAM)</td><td>Other</td></tr><tr><td><input checked="" type="checkbox"/></td><td><input checked="" type="checkbox"/></td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr></table>					F3E (Voice)	F1D	F1E	D7W (QAM)	Other	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F3E (Voice)	F1D	F1E	D7W (QAM)	Other											
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>											
Internal/External Data Source:	Internal (Vocoded voice)														
Emission Designator:	11K0F3E, 8K10F1E, 8K10F1D														
Output Impedance:	50 ohms														
RF Power Output (rated):	5 watts														
Channel Spacing(s):	12.5 kHz														
Operator Selection of Operating Frequency:	Pre-programmed channel selection														

System Description

The VP 600 is a 5 watt VHF radio for mobile radio services. The radio functions as a normal Push-to-Talk type radio/

EQUIPMENT: 242-5710PROJECT NO.: 10220021RUS1rev3**Section 3. RF Power Output**

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: David Light	DATE: 10 May 2012

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

Frequency (MHz)	Peak Output Power (dBm)	Peak Output Power (Watts)
136	37.2	5.25
150	37.0	5.00
174	37.2	5.25

Rated Output Power: 5.0 watts**Spectrum Analyzer Setting:** RBW/VBW = 100 kHz
Peak Detector**Equipment Used:** 1036-1082-1064-1065**Measurement Uncertainty:** +/- 1.7 dB**Temperature:** 20 °C**Relative Humidity:** 45 %

Section 4. Modulation Characteristics

NAME OF TEST: Modulation Characteristics	PARA. NO.: 2.987
TESTED BY: David Light	DATE: 11 May 2012

Measurement Results: Complies.

Measurement Data: See following pages

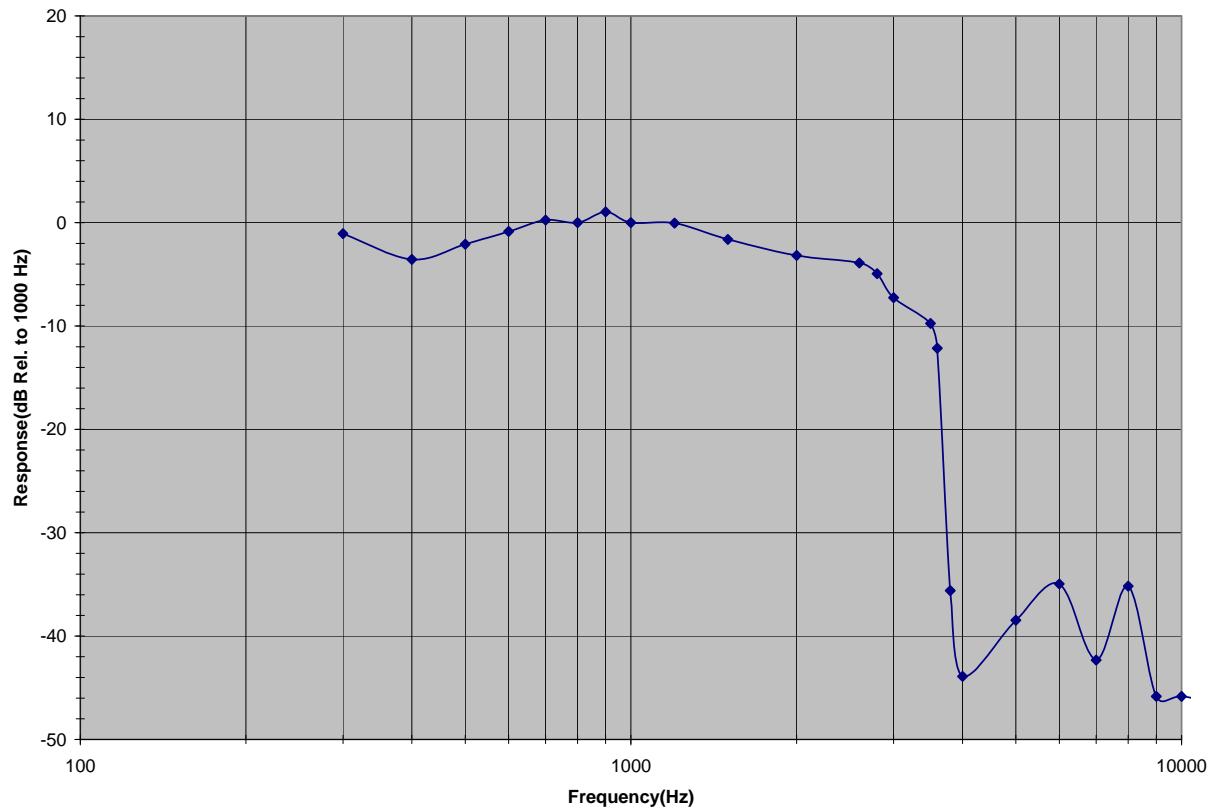
Description of modulation: Modulation input to the radio is voice via a microphone. The radio has three modes of operation:

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

Description of baseband filtering: The radio has a low-pass audio filter.

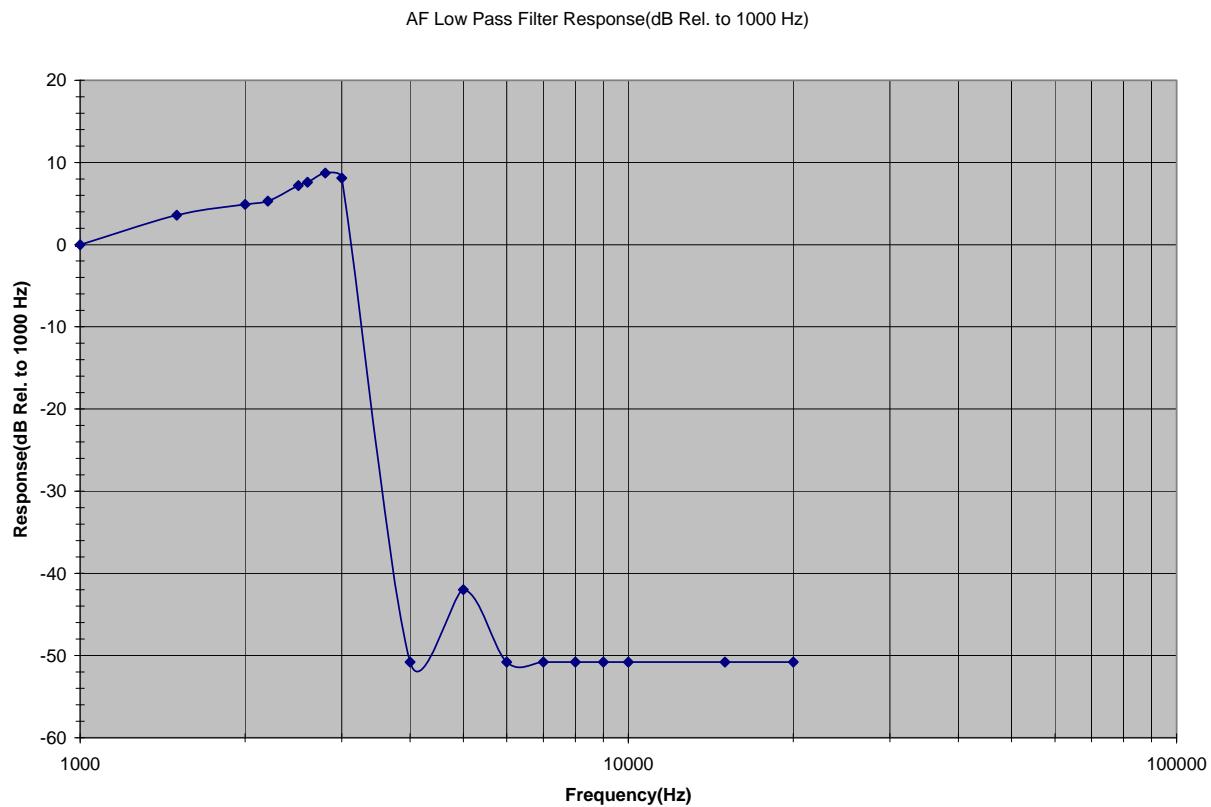
Section 4.1 Audio Frequency Response

NAME OF TEST: Audio Frequency Response	PARA. NO.: 2.987(a)
TESTED BY: David Light	DATE: 11 May 2012



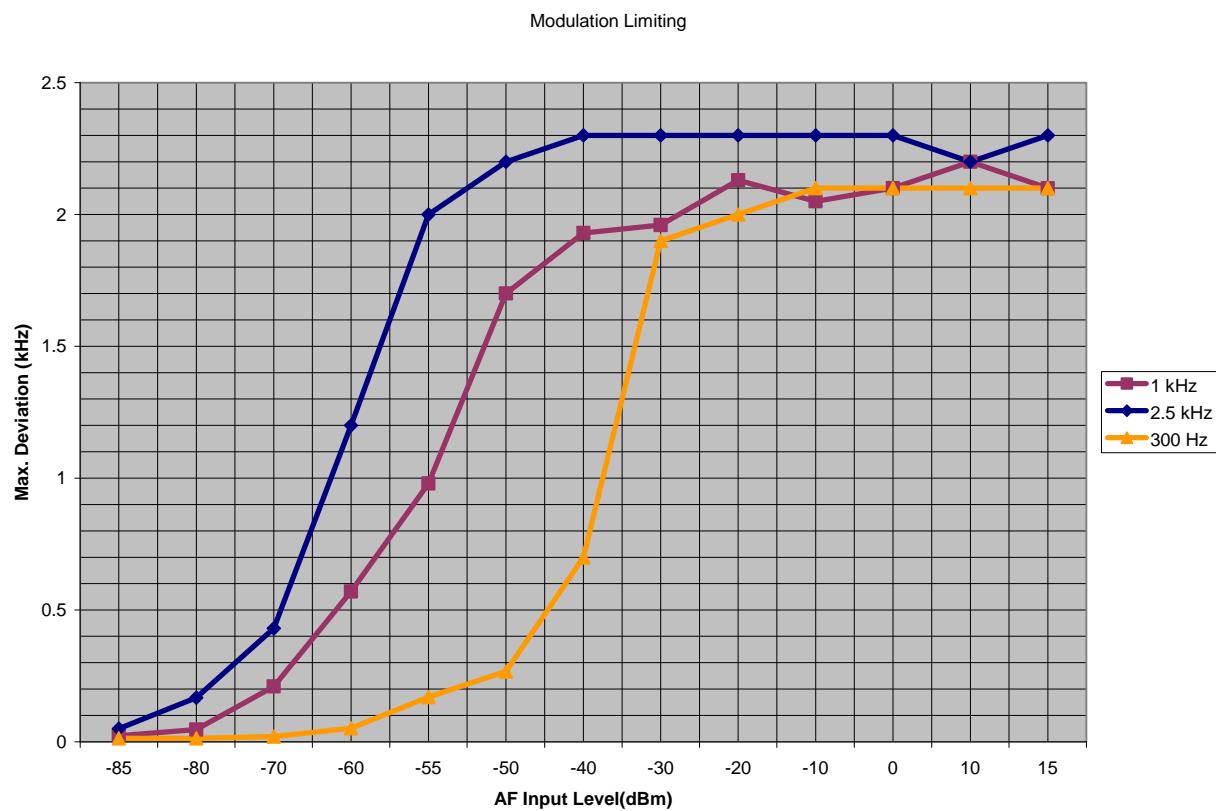
Section 4.2 Audio Low-Pass Filter Response

NAME OF TEST: Audio Low-Pass Filter Response	PARA. NO.: 2.987(a)
TESTED BY: David Light	DATE: 11 May 2012



Section 4.3 Modulation Limiting

NAME OF TEST: Modulation Limiting	PARA. NO.: 2.987(b)
TESTED BY: David Light	DATE: 11 May 2012



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

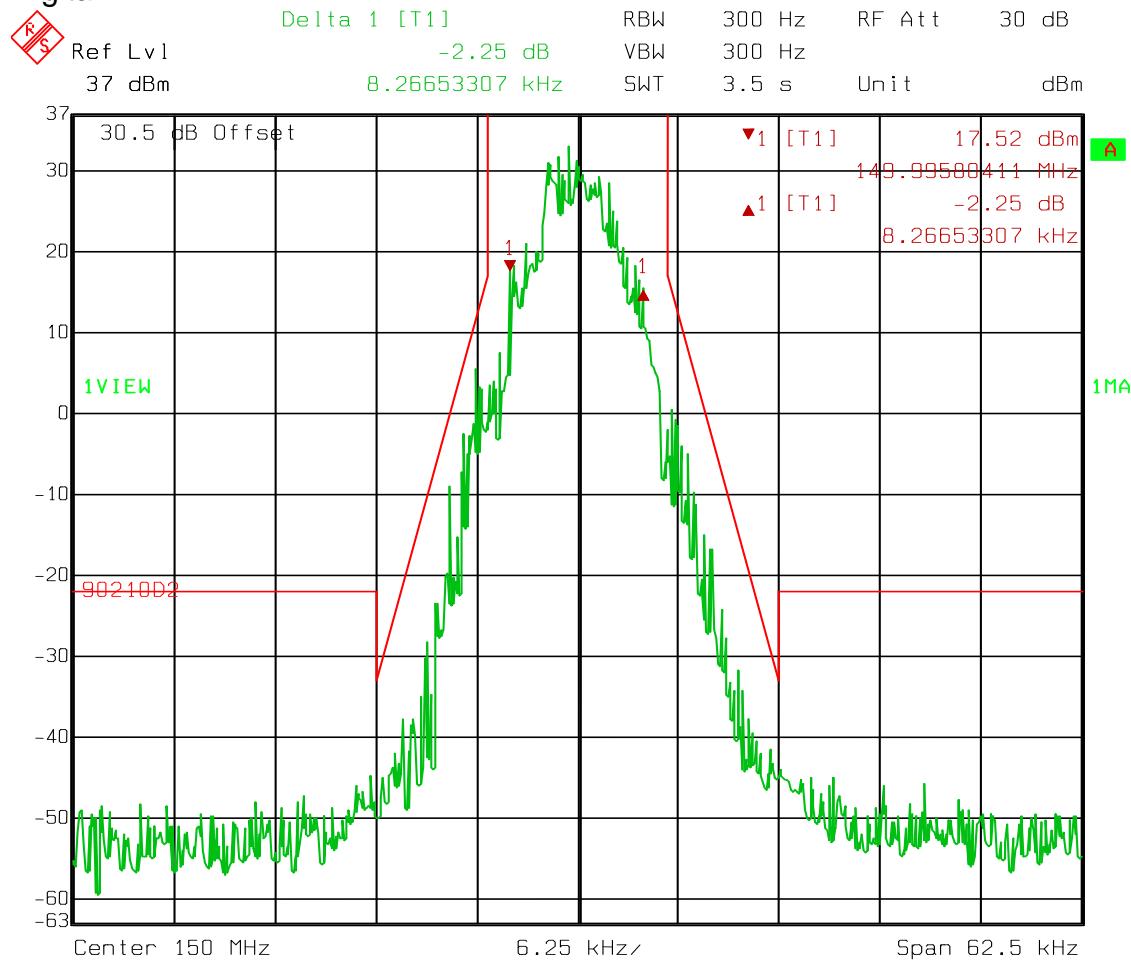
EQUIPMENT: 242-5710PROJECT NO.: 10220021RUS1rev3**Section 5. Occupied Bandwidth**

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
TESTED BY: David Light	DATE: 11 May 2012

Measurement Results: Complies.**Equipment Used:** 1036-1082-1064-1065**Measurement Uncertainty:** 1X10⁻⁷ ppm**Temperature:** 22 °C**Relative Humidity:** 45 %

EQUIPMENT: 242-5710

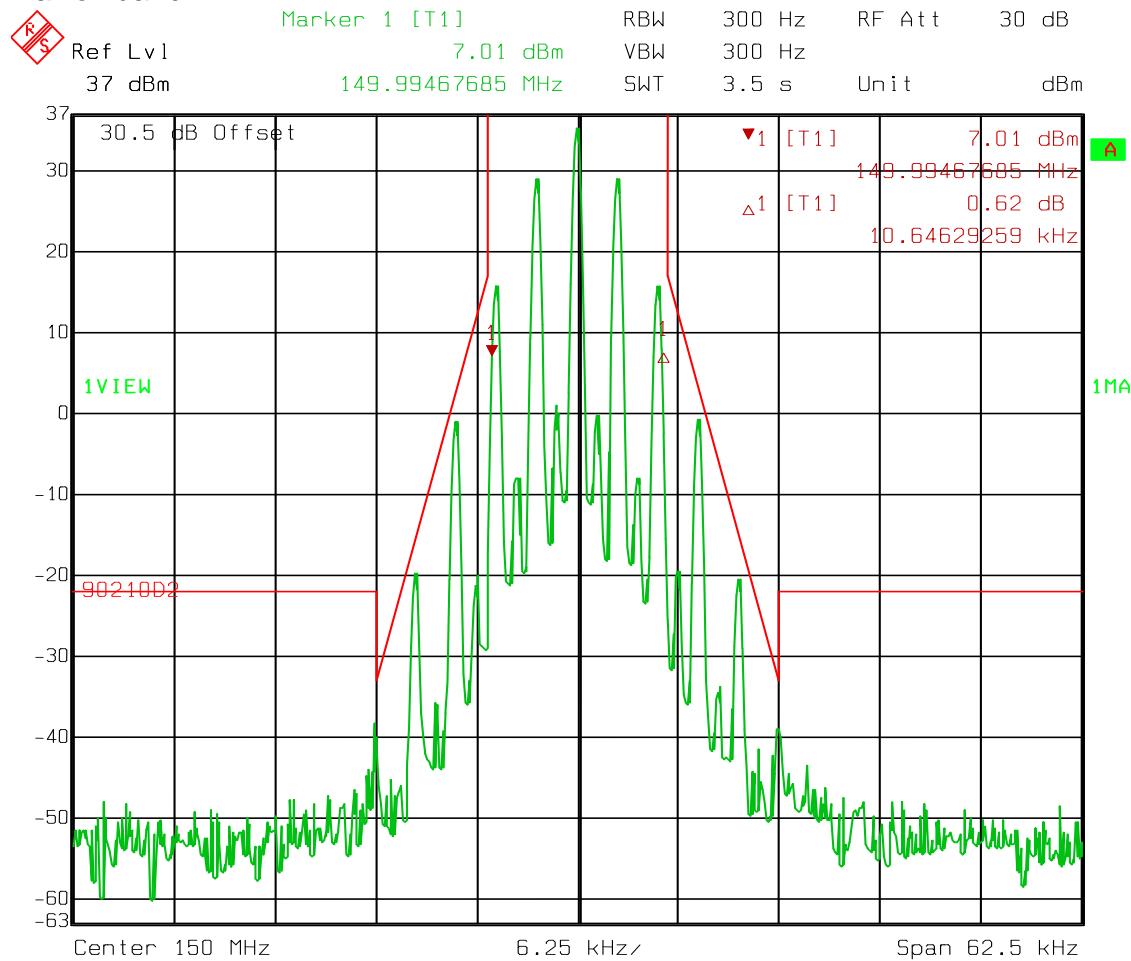
PROJECT NO.: 10220021RUS1rev3

Occupied Bandwidth
Digital

Date: 16.MAY 2012 12:43:13

EQUIPMENT: 242-5710

PROJECT NO.: 10220021RUS1rev3

Occupied Bandwidth
Narrowband FM

Date: 16.MAY 2012 12:44:20

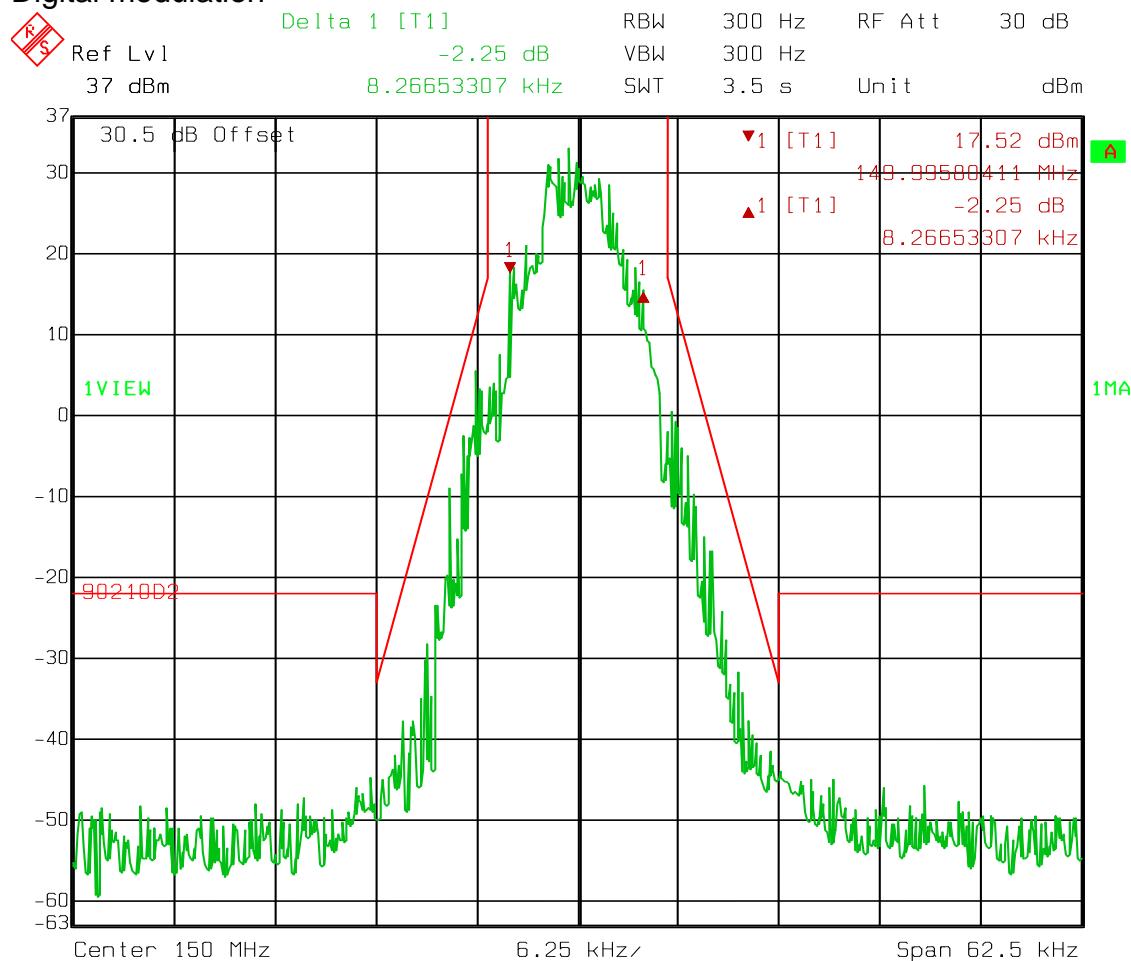
Section 6. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.991
TESTED BY: David Light	DATE: 10 May 2012

Measurement Results: Complies.**Test Data:** See attached plot(s).**Equipment Used:** 1036-1082-1064-1065**Measurement Uncertainty:** +/- 1.7 dB**Temperature:** 22 °C**Relative Humidity:** 45 %

EQUIPMENT: 242-5710

PROJECT NO.: 10220021RUS1rev3

Mask 90.210(d)
Digital modulation

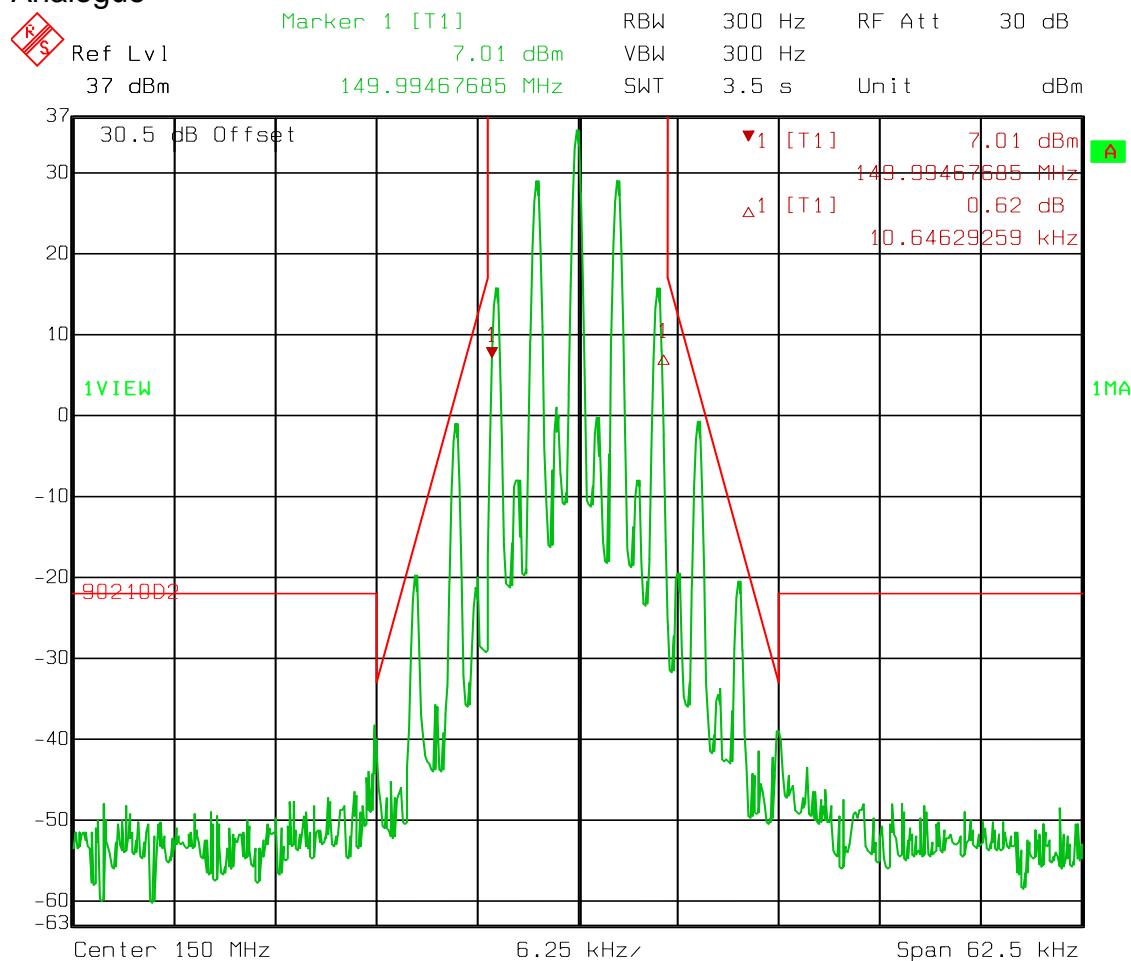
Date: 16.MAY 2012 12:43:13

EQUIPMENT: 242-5710

PROJECT NO.: 10220021RUS1rev3

Mask 90.210(d)

Analogue

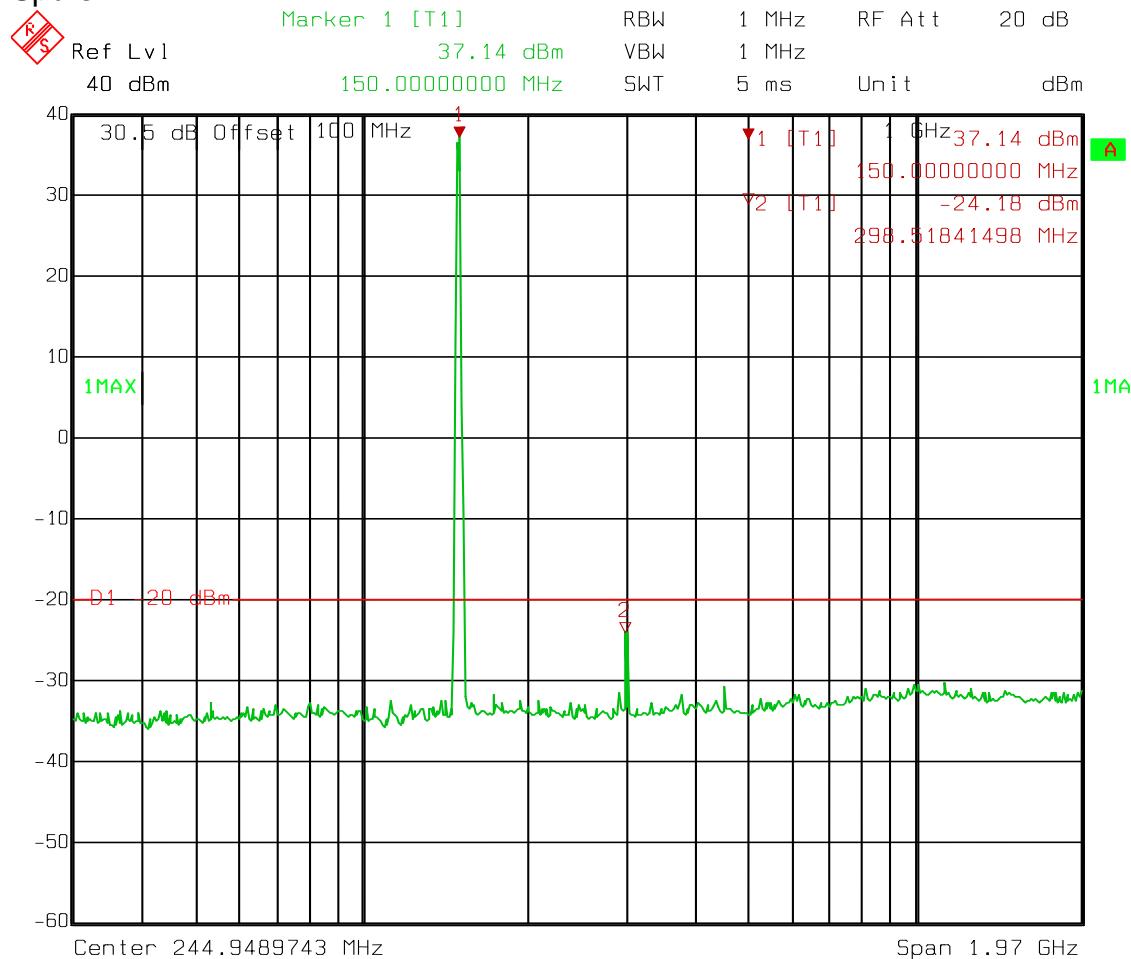


Date: 16.MAY 2012 12:44:20

EQUIPMENT: 242-5710

PROJECT NO.: 10220021RUS1rev3

Spurs



Date: 10.MAY 2012 06:06:10

Section 7. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions PARA. NO.: 2.993

TESTED BY: David Light DATE: 13 May 2012

Measurement Results: Complies.**Measurement Data:** There were no emissions within 20 dB of the specification limit.Analyzer Settings: <1 MHz RBW/VBW = 100 kHz
>1 MHz RBW/VBW = 1 MHz
Peak detector

The spectrum was searched from 30 MHz to the tenth harmonic of the carrier.

Equipment Used: 1783-1767-1763-993-1016-1025**Measurement Uncertainty:** +/-1.7 dB**Temperature:** 22 °C**Relative Humidity:** 54 %

Section 8. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 2.995
TESTED BY: David Light	DATE: 11 May 2012

Measurement Results: Complies.**Measurement Data:** See attached data**Measurement Data:** See attached table.

Standard Test Frequency: 150.00 MHz
Standard Test Voltage: 7.4 Vdc

Equipment Used: 1036-1082-1064-1065**Measurement Uncertainty:** 1×10^{-7} ppm**Lab Temperature:** 22 °C**Relative Humidity:** 45 %

EQUIPMENT: 242-5710PROJECT NO.: 10220021RUS1rev3

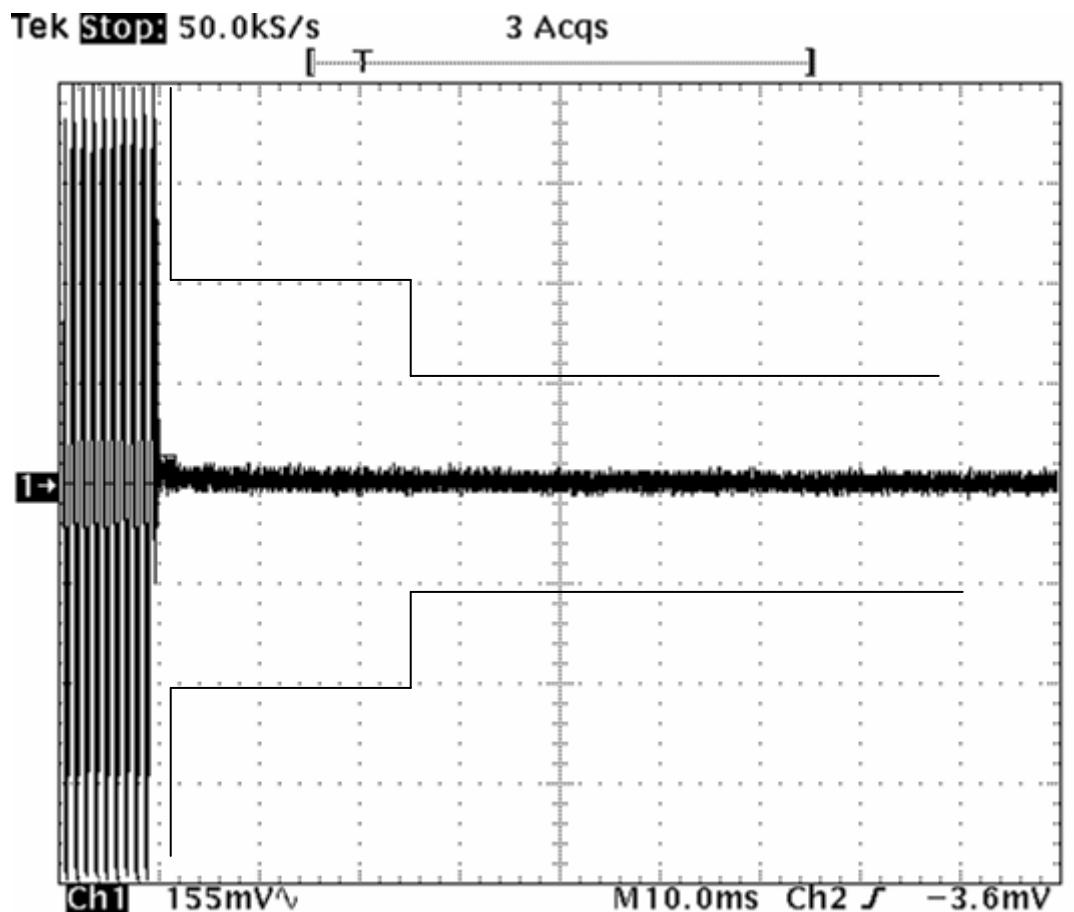
Test Data – Frequency Stability

		Standard Test Frequency		150.000000		MHz	
Temp (°C)	Measured Frequency (MHz)	Test Voltage	Frequency Error (Hz)	Limit (+/-Hz)	Error (ppm)	Comment	
20	149.999934		7.4	-66	150.0	-0.4	
20	149.999929		5.6	-71	150.0	-0.5	Battery cutoff
50	149.999930		7.4	-70	150.0	-0.5	
40	149.999926		7.4	-74	150.0	-0.5	
30	149.999929		7.4	-71	150.0	-0.5	
10	149.999927		7.4	-73	150.0	-0.5	
0	149.999933		7.4	-67	150.0	-0.4	
-10	149.999947		7.4	-53	150.0	-0.4	
-20	149.999953		7.4	-47	150.0	-0.3	
-30	149.999939		7.4	-61	150.0	-0.4	
Notes:							

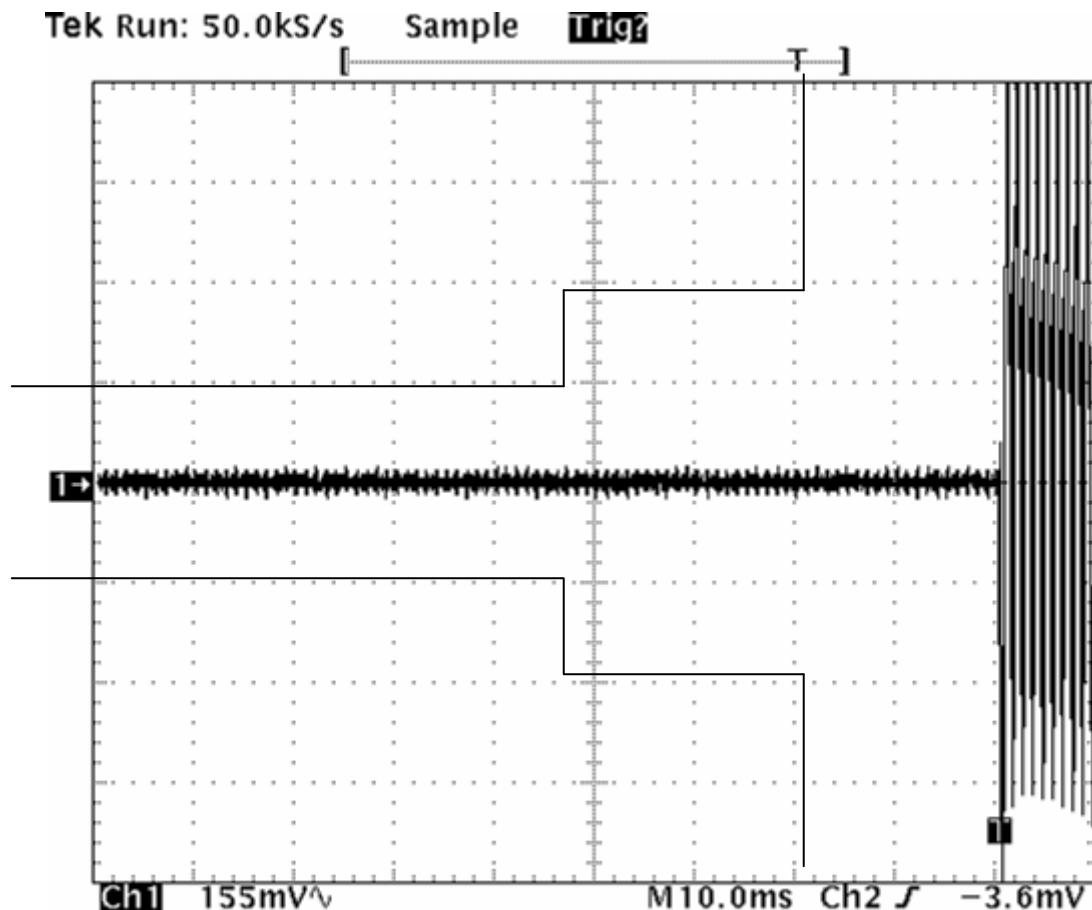
Section 9. Transient Frequency Behavior

NAME OF TEST: Transient Frequency Behavior	PARA. NO.: 90.214
TESTED BY: David Light	DATE: 12 May 2012

Measurement Results: Complies.**Measurement Data:** See attached data**Measurement Conditions:** Temperature: 21 °C
Humidity: 53 %



Switch on Condition



Switch off Condition

Section 10. Receiver Spurious Emissions

NAME OF TEST: Transient Frequency Behavior	PARA. NO.: RSS-119 5.11
TESTED BY: David Light	DATE: 17 May 2012

Measurement Results: Complies.

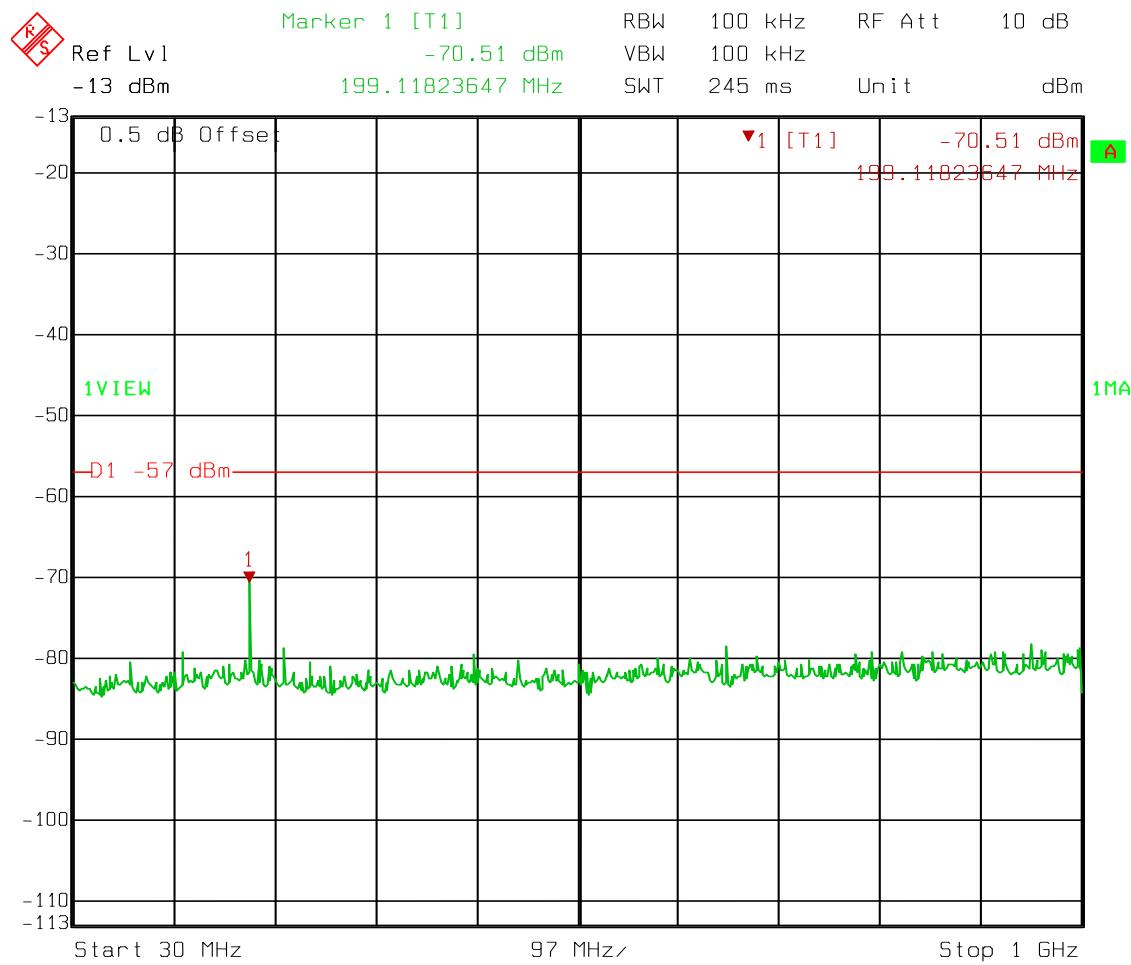
Measurement Data: See attached data

Measurement Conditions: Temperature: 21 °C
Humidity: 53 %

Test Equipment Used: 1036-1082

EQUIPMENT: 242-5710PROJECT NO.: 10220021RUS1rev3

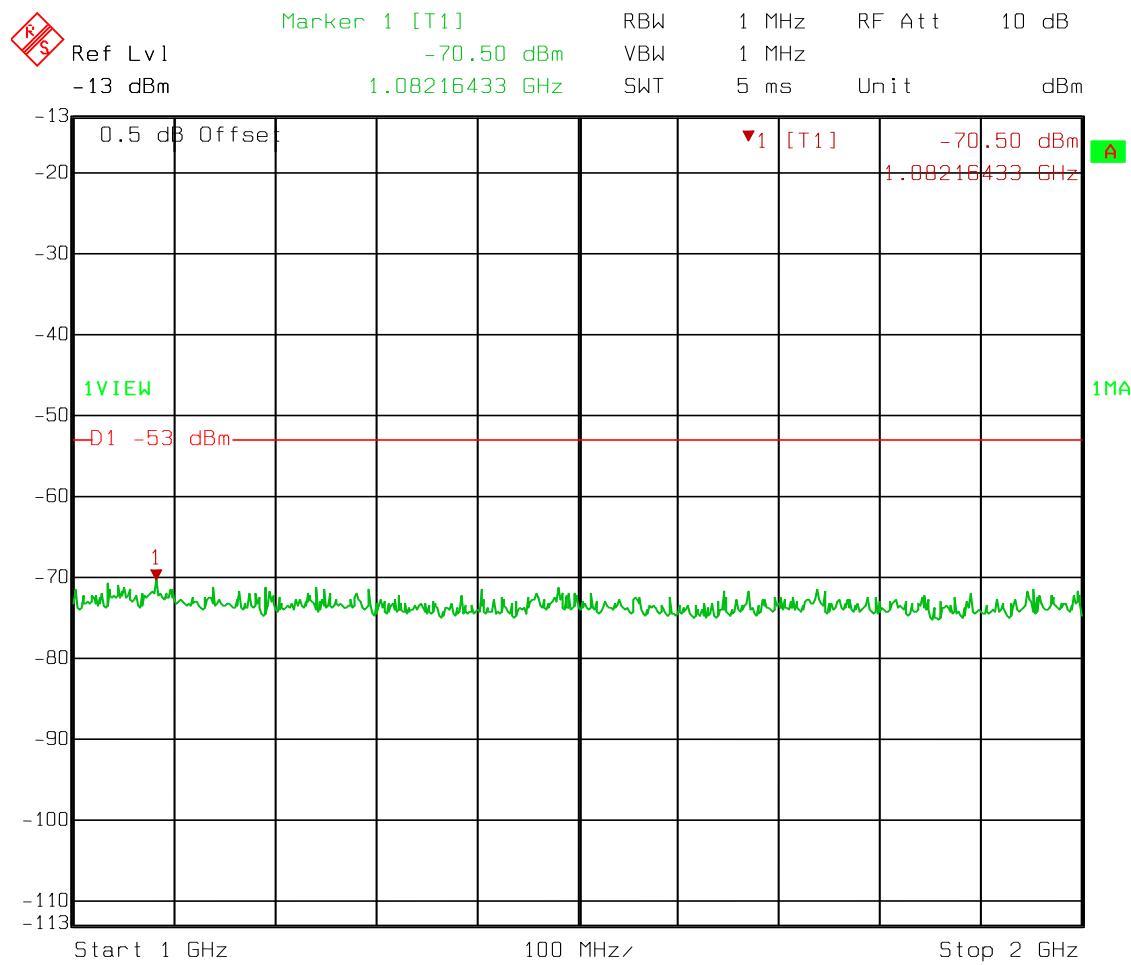
Receiver spurious Emissions



Date: 17.MAY 2012 07:54:44

EQUIPMENT: 242-5710PROJECT NO.: 10220021RUS1rev3

Receiver spurious Emissions



Date: 17.MAY 2012 07:55:25

Section 11. 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
1025	Preamplifier, 25dB	Nemko USA, Inc.	LNA25	399	27-Feb-2012	27-Feb-2013
1036	Spectrum Analyzer	Rohde & Schwartz	FSEK30	830844/006	23-Dec-2011	23-Dec-2013
1064	Attenuator	Narda	776B-20		N/R	
1065	Attenuator	Narda	776B-10		N/R	
1082	Cable, 2m	Astrolab	32027-2-29094-72TC		N/R	
1763	Antenna, Bilog	Schaffner	CBL 6111D	22926	21-Feb-2012	21-Feb-2013
1767	Receiver, EMI Test 20Hz - 26.5 GHz - 150 - +30 dBm LCD	Rohde & Schwartz	ESIB26	837491/0002	09-Dec-2011	09-Dec-2012
1783	Cable Assy, 3m Chamber	Nemko	Chamber		26-Sep-2011	26-Sep-2012

Nemko USA

FCC PART 90, SUBPART I and RSS-119
PRIVATE LAND MOBILE TRANSMITTER

EQUIPMENT: 242-5710

PROJECT NO.: **10220021RUS1rev3**

ANNEX A - TEST METHODOLOGIES

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
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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.

NAME OF TEST: Audio Frequency Response	PARA. NO.: 2.987(a)
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Test Method: TIA/EIA-603**Minimum Standard:** TIA/EIA-603, Para. 3.2.6 from 300 Hz to 3000 Hz.

The

transmitter audio frequency response shall have a nominal 6 dB per octave pre-emphasis characteristic.

NAME OF TEST: Audio Low-Pass Filter Frequency Response	PARA. NO.: 2.987(a)
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Test Method: TIA/EIA-603**Minimum Standard:** TIA/EIA-603

NAME OF TEST: Modulation Limiting	PARA. NO.: 2.987(a)
--	----------------------------

Test Method: TIA/EIA-603**Minimum Standard:** TIA/EIA-603

NAME OF TEST: Occupied Bandwidth**PARA. NO.: 2.989**

Minimum Standard: Para. No. 90.210, see table 1 below for applicable mask.

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 0 - 1 GHz range. 1 MHz at frequencies above 1 GHz.

VBW: \Rightarrow RBW

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

NAME OF TEST: Field Strength of Spurious**PARA. NO.: 2.993****Minimum Standard:** Para. No. 90.210, see table 1 for applicable mask.**Test Method:** The substitution antenna method was used to
measure erp of
spurious emissions. This method is described in EIA/TIA
603.

The field strength of the emission is measured and recorded. The EUT is then replaced with a substitution antenna of known gain against a dipole. The substitution antenna is fed with a calibrated signal which is adjusted until the previously recorded value is repeated. The erp of the spurious signal is the level required to repeat the previously measured level. If the substitution antenna gain is calibrated and expressed as dBi (referenced to an isotropic radiator instead of a dipole), the result is adjusted by 2.15 dB so that the result is erp not eirp.

NAME OF TEST: Frequency Stability

PARA. NO.: 2.995

Minimum Standard: Para. No. 990.213. 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	-	-	-

NAME OF TEST: Transient Frequency Behaviour

PARA. NO.: 2.214

Minimum Standard:

Transient Frequency Behaviour for Equipment Designed to Operate on 25 kHz Channels

Time intervals ^{1,2}	Maximum Frequency difference ³ (kHz)	Frequency ranges (MHz) All equipment					
		Base station and portable radios			Mobile Radios		
t ₁ ⁴	± 25	150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)	150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)
t ₂	± 12	20.0	25.0	50.0	20.0	25.0	20.0
t ₃ ⁴	± 25	5.0	10.0	10.0	5.0	10.0	5.0

Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz & 6.25 kHz Channels

Time intervals ^{1,2}	Maximum Frequency difference ³ (kHz)	Frequency ranges (MHz) All equipment		
		150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)
t ₁ ⁴	± 12.5 / ± 6.25	5.0	10.0	20.0
t ₂	± 6.25 / ± 3.125	20.0	25.0	50.0
t ₃ ⁴	± 12.5 / ± 6.25	5.0	10.0	10.0

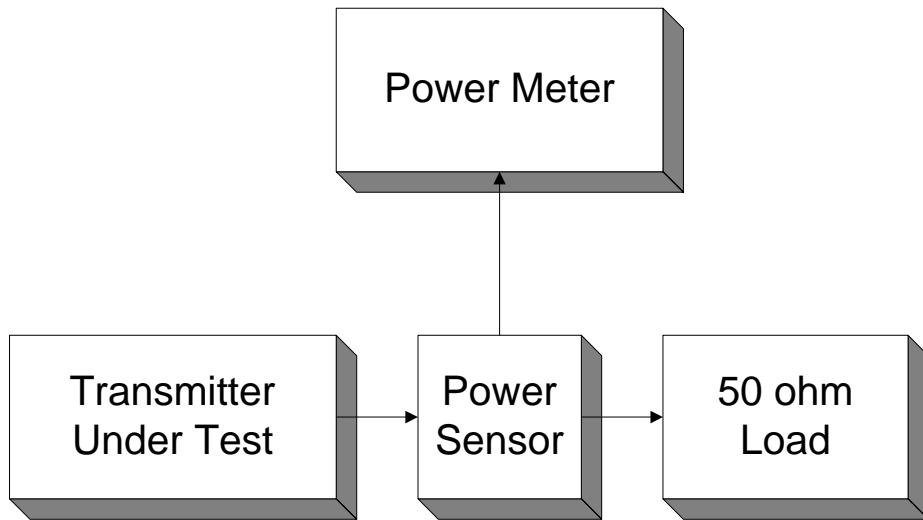
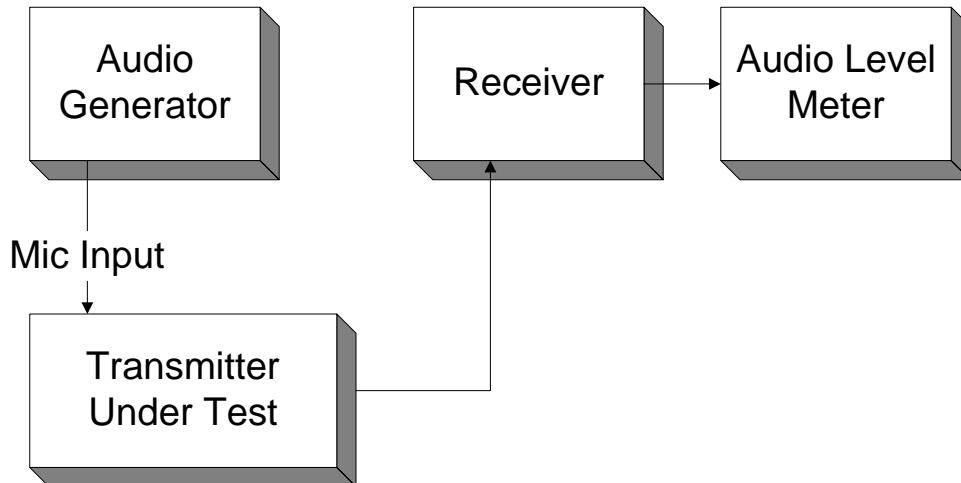
Nemko USA

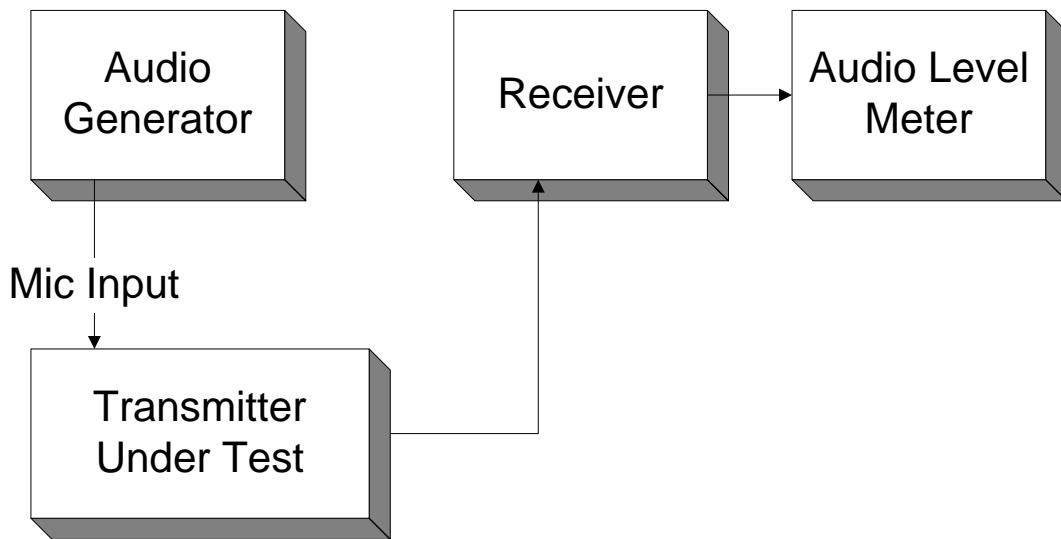
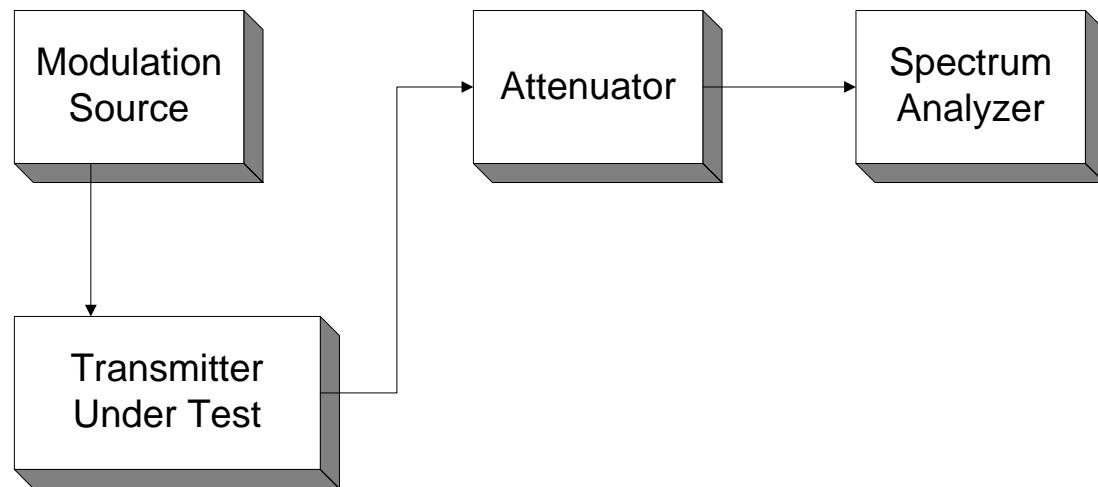
FCC PART 90, SUBPART I and RSS-119
PRIVATE LAND MOBILE TRANSMITTER

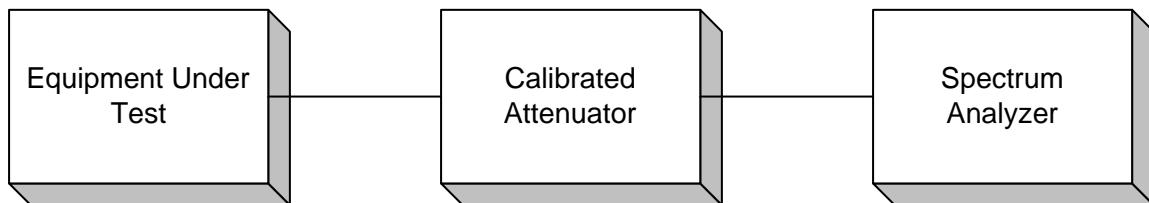
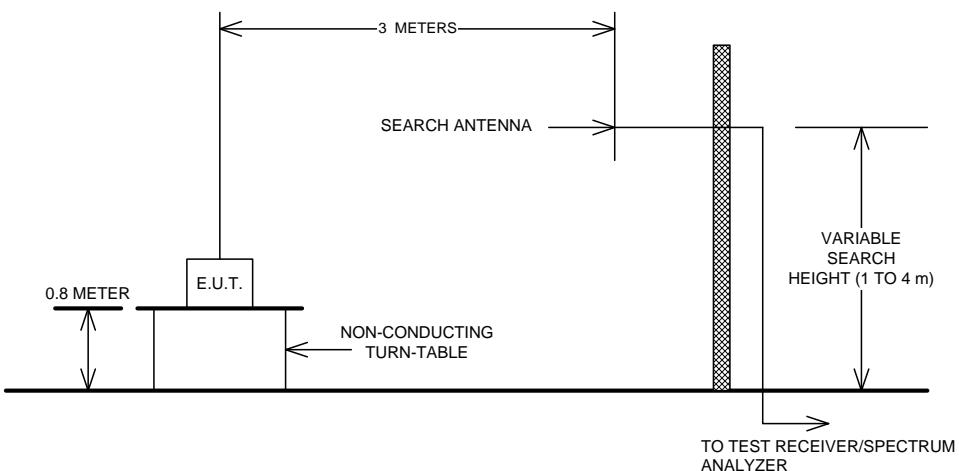
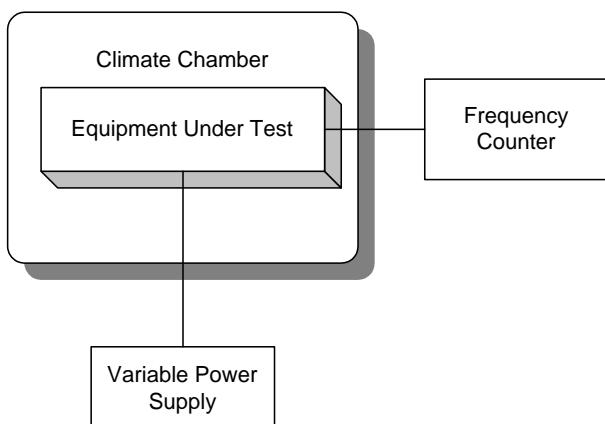
EQUIPMENT: 242-5710

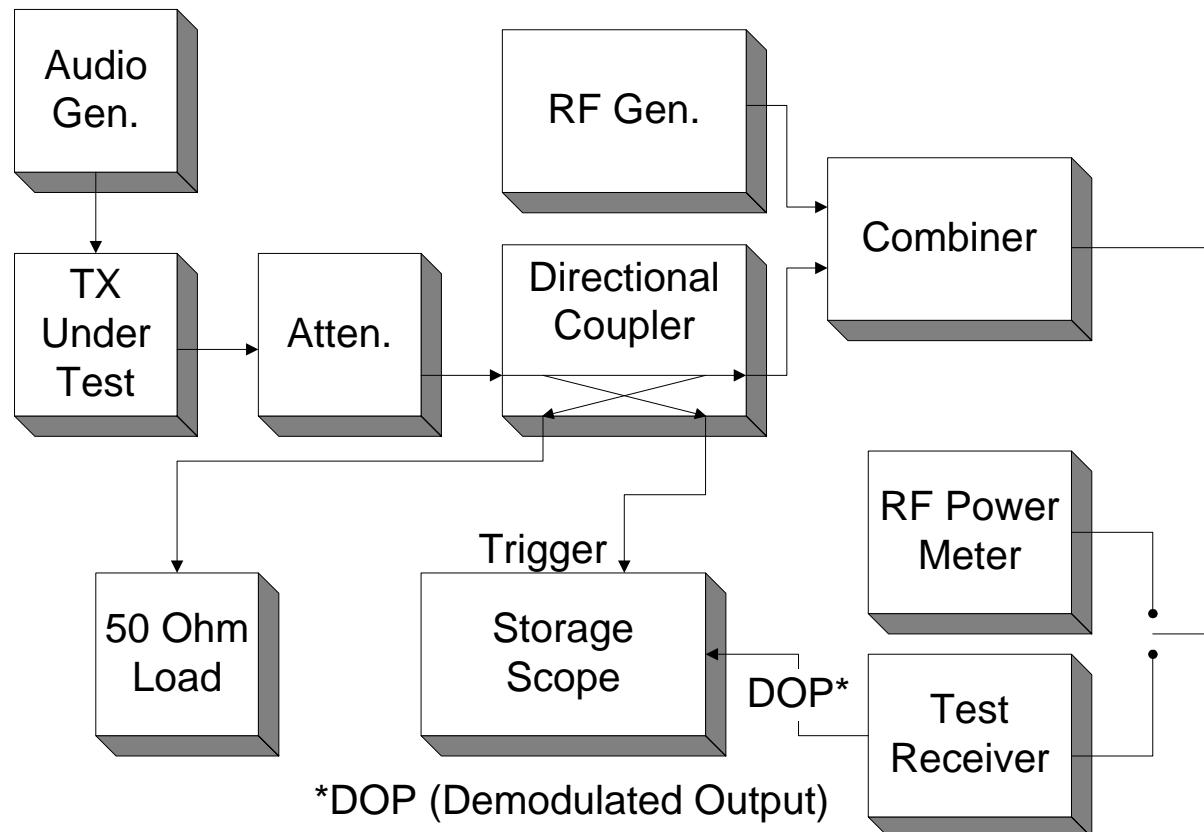
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ANNEX B - TEST DIAGRAMS

Para. No. 2.985 - R.F. Power Output**Para. No. 2.987(a) - Audio Frequency Response**

Para. No. 2.987(b) - Modulation Limiting**Para. No. 2.989 - Occupied Bandwidth**

Para. No. 2.991 - Spurious Emissions at Antenna Terminals**Para. No. 2.993 - Field Strength of Spurious Radiation****Para. No. 2.995 - Frequency Stability**

Para. No. 90.214 - Transient Frequency Behaviour**Voice**

This measurement was made using measurement procedure TIA/EIA Land Mobile FM or PM Communications Equipment Measurement and Performance Standards TIA/EIA-603 February 1993 Telecommunications Industry Association (American National Standard ANSI/TIA/EIA-603-1992 Approved: October 27, 1992) Para. no. 2.2 Methods of Measurement for Transmitters

Para. no. 2.2.19 Transient Frequency Behaviour (page no. 83).

Data

This measurement was made using measurement procedure TIA/EIA Digital C4FM/CQPSK Transceiver Measurement Methods TSB102.CAAA Para. no. 2.2.17 Transient Frequency Behaviour (page no. 74).