



Nemko Test Report: 6L0172RUS2

Applicant: Andrew Corporation
108 Rand Park Drive
Garner, NC 27529

Equipment Under Test: TFAM80/92/19E
(E.U.T.)

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

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

Authorized By:

A handwritten signature in black ink, appearing to read 'Abe Cox', is written over a thin vertical red line.

Abe Cox, Key Account Manager

Date: July 7, 2006

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EQUIPMENT: TFAM80/92/19E

PROJECT NO.: 6L0172RUS2

Section 1. Summary of Test Results

Manufacturer: Andrew Corporation

Model No.: TFAM80/92/19E

Serial No.: 062200923

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.



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	Complies
Audio Frequency Response	TIA EIA-603.3.2.6	N/A
Audio Low-Pass Filter Response	TIA EIA-603.3.2.6	N/A
Modulation Limiting	TIA EIA-603.3.2.6	N/A
Occupied Bandwidth	90.210	Complies
Spurious Emissions at Antenna Terminals	90.210	Complies
Field Strength of Spurious Emissions	90.210	Complies
Frequency Stability	90.213	N/A
Transient Frequency Behavior	90.214	N/A

Footnotes For N/A's:

- (1) Since the E.U.T. does not contain modulation circuitry modulation testing was not performed.
 - (2) Since the E.U.T. is not a keyed carrier system, Transient Frequency Behavior was not performed.
- .

Section 2. General Equipment Specification**Transmitter****Supply Voltage Input:** 120 Vac**Frequency Range:** 851 to 869 MHz
935 to 940 MHz

Type(s) of Modulation:	F3E (Analog)	F1D (Analog)	GXW (iDEN)
	☒	☒	☒
Analog	30K0F3E and 30K0F1D		
iDEN	30K0GXW		

Gain: +13 dB**Output Impedance:** 50 ohms

RF Power Output (rated):	Output power per carrier @ each antenna port (dBm)				
	Number of Carriers	1	2	4	8
	CW800 and 900	16	13	.10	.7
	iDEN800	13	10	.7	.4
	Analog800	16	.13	.10	.7
	iDEN900	13	.10	.7	.4
	Analog900	16	.13	10	.7

Operator Selection of Operating Frequency: None**Power Output Adjustment Capability:** None

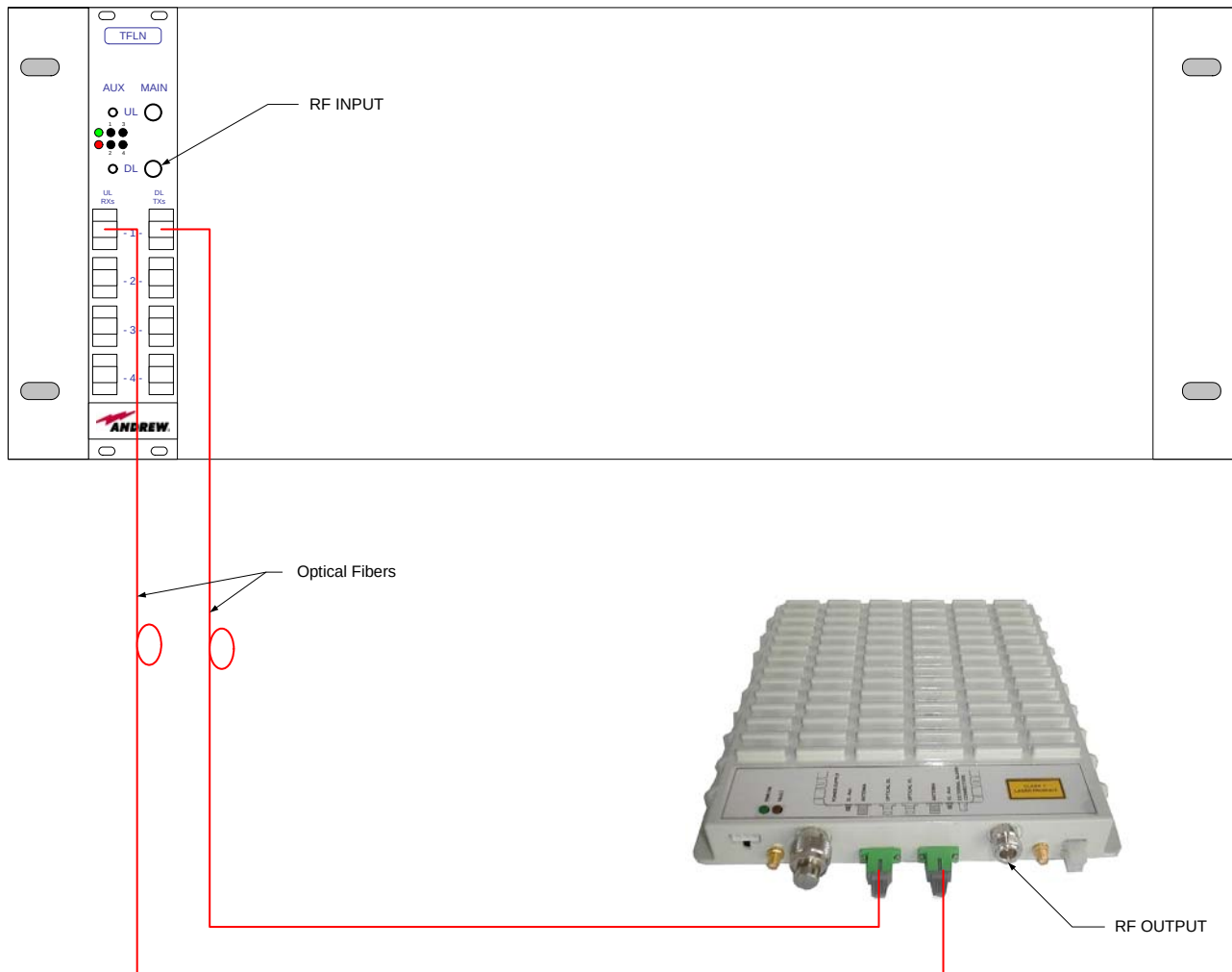
Frequency Translation:	F1-F1	F1-F2	N/A
	☐	☐	☒

Band Selection:	Software	Duplexer Change	Fullband Coverage
	☐	☐	☐

Description of Operation

The TFAM80/92/19E is a triple band remote unit designed to distribute LMR800, LMR900 and PCS1900 extended band signals along the same fiber.

System Diagram



Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: David Light	DATE: 28 June 2006

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

Frequency (MHz)	Modulation	Measured Power (dBm)
851.0125	Analog	16.11
860.0	Analog	16.1
868.987.5	Analog	16.13
851.03	iDEN	13.21
860.0	iDEN	13.07
868.97	iDEN	13.05
935.0125	Analog	16.03
937.5	Analog	16.31
939.9875	Analog	16.21
935.03	iDEN	13.14
937.0	iDEN	13.2
939.97	iDEN	13.04

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FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: TFAM80/92/19E

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Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
TESTED BY: David Light	DATE: 29 June 2006

Test Results: Complies.

Test Data: See attached graph(s).

EQUIPMENT: TFAM80/92/19E

PROJECT NO.: 6L0172RUS2

Test Data Occupied Bandwidth

Analog Output

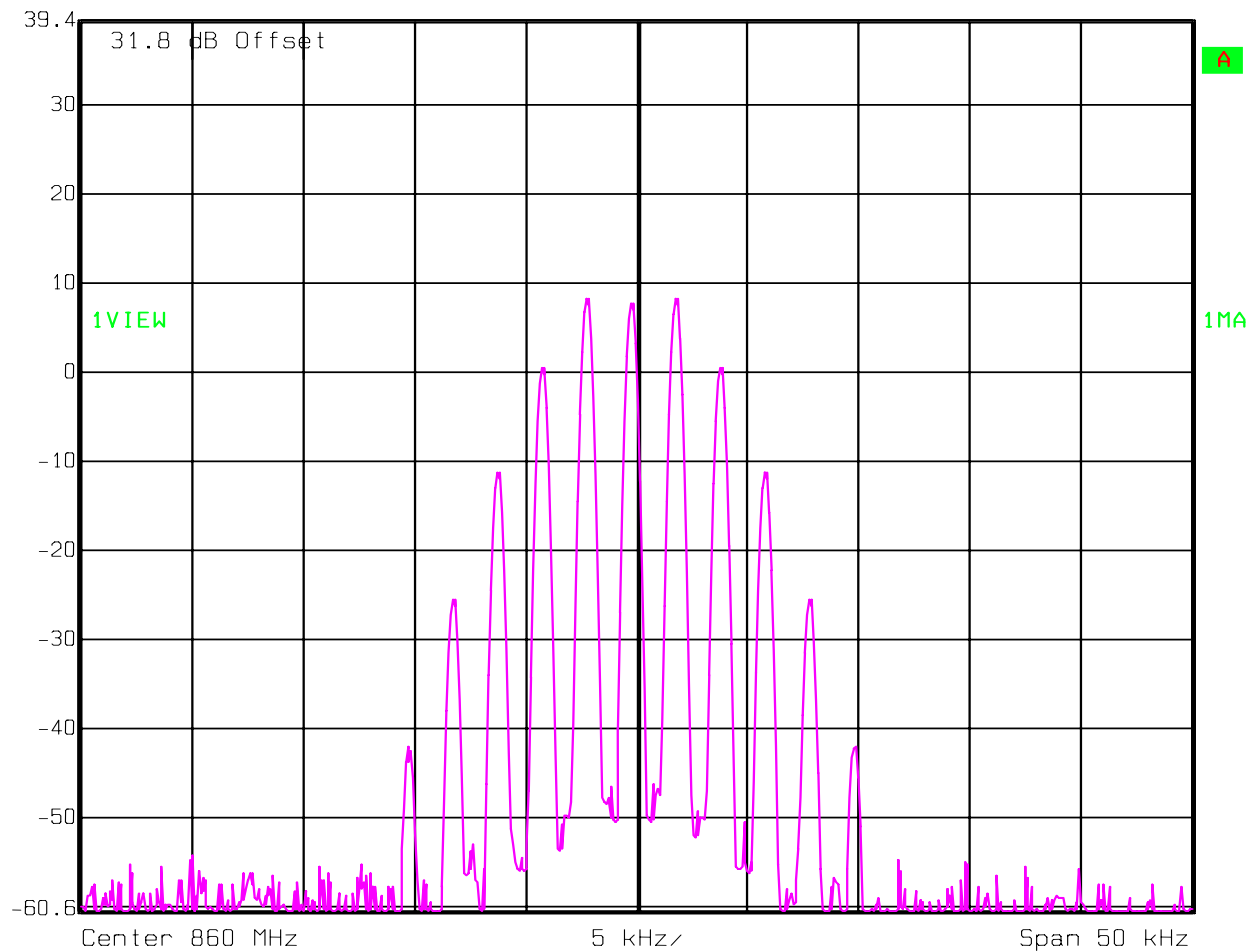
2 kHz tone/ 3 kHz Deviation

800 Band



Ref Lvl
39.4 dBm

RBW	300 Hz	RF Att	20 dB
VBW	300 Hz	Mixer	-10 dBm
SWT	2.8 s	Unit	dBm



Date: 29.JUN.2006 16:04:51

EQUIPMENT: TFAM80/92/19E

PROJECT NO.: 6L0172RUS2

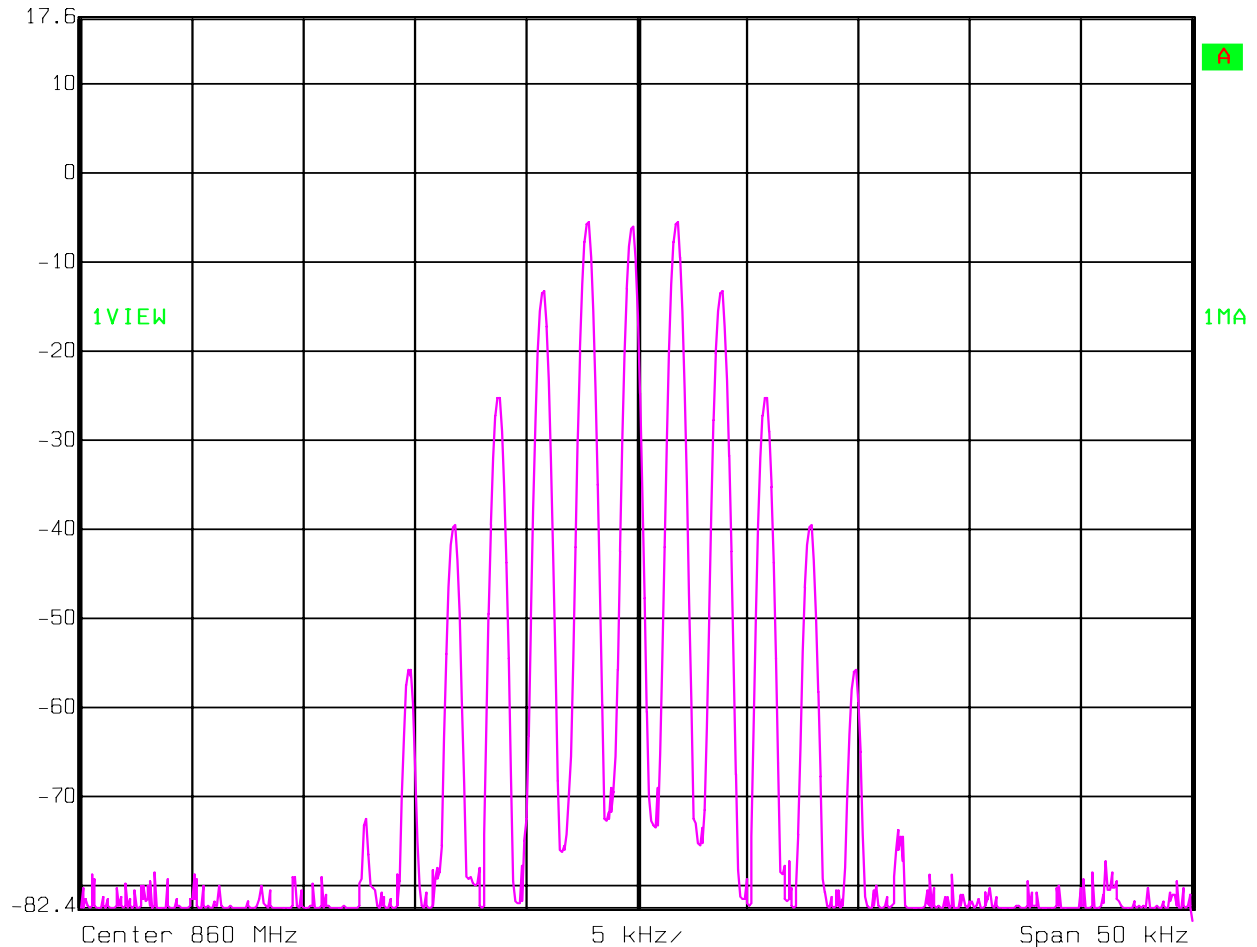
Test Data Occupied Bandwidth

Analog Input
800 Band



Ref Lvl
17.6 dBm

RBW	300 Hz	RF Att	30 dB
VBW	300 Hz	Mixer	-10 dBm
SWT	2.8 s	Unit	dBm



Date: 29.JUN.2006 16:06:03

EQUIPMENT: TFAM80/92/19E

PROJECT NO.: 6L0172RUS2

Test Data Occupied Bandwidth

Analog Output

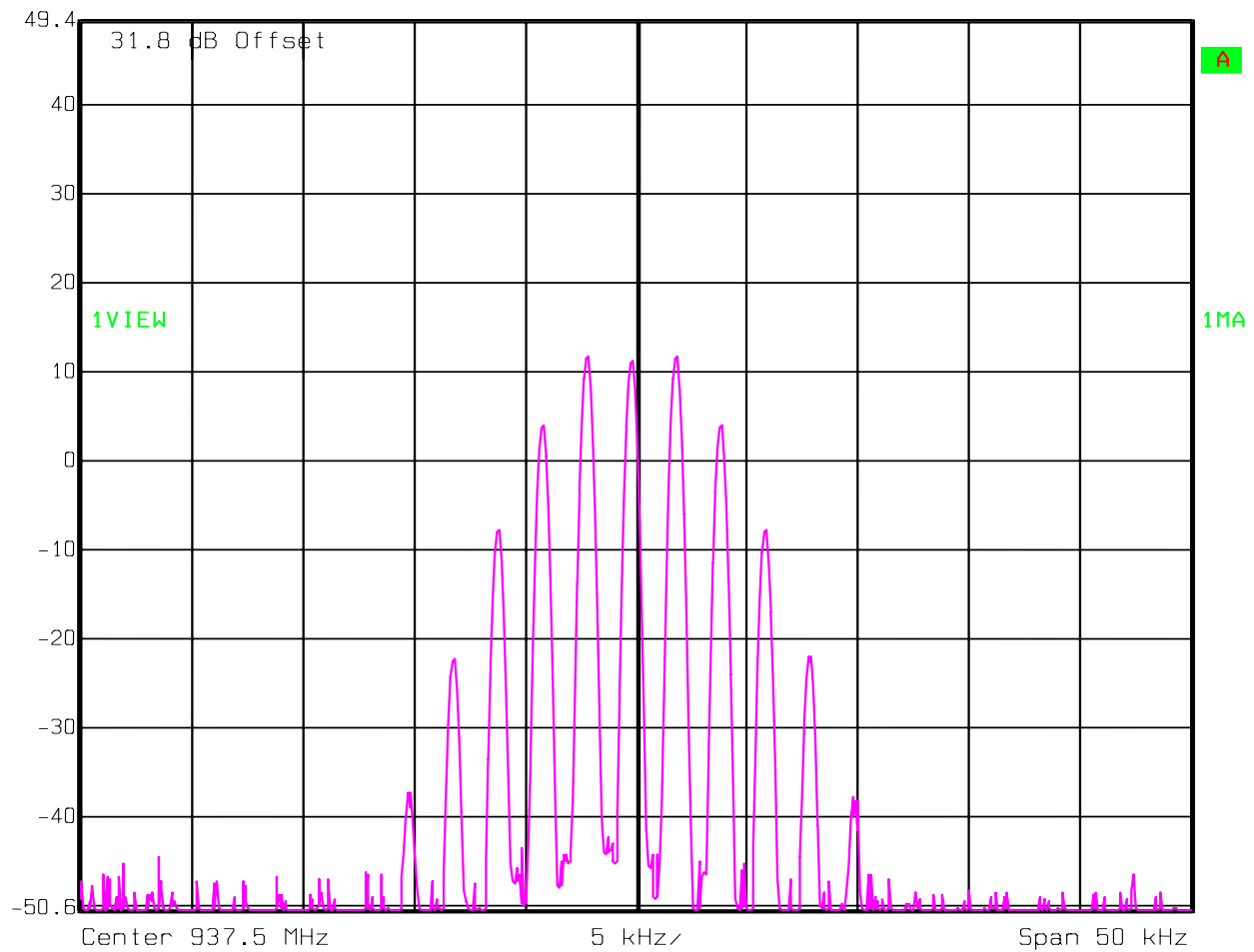
2 kHz Tone / 3 kHz Deviation

900 Band



Ref Lvl
49.4 dBm

RBW	300 Hz	RF Att	30 dB
VBW	300 Hz	Mixer	-10 dBm
SWT	2.8 s	Unit	dBm



Date: 29.JUN.2006 16:10:23

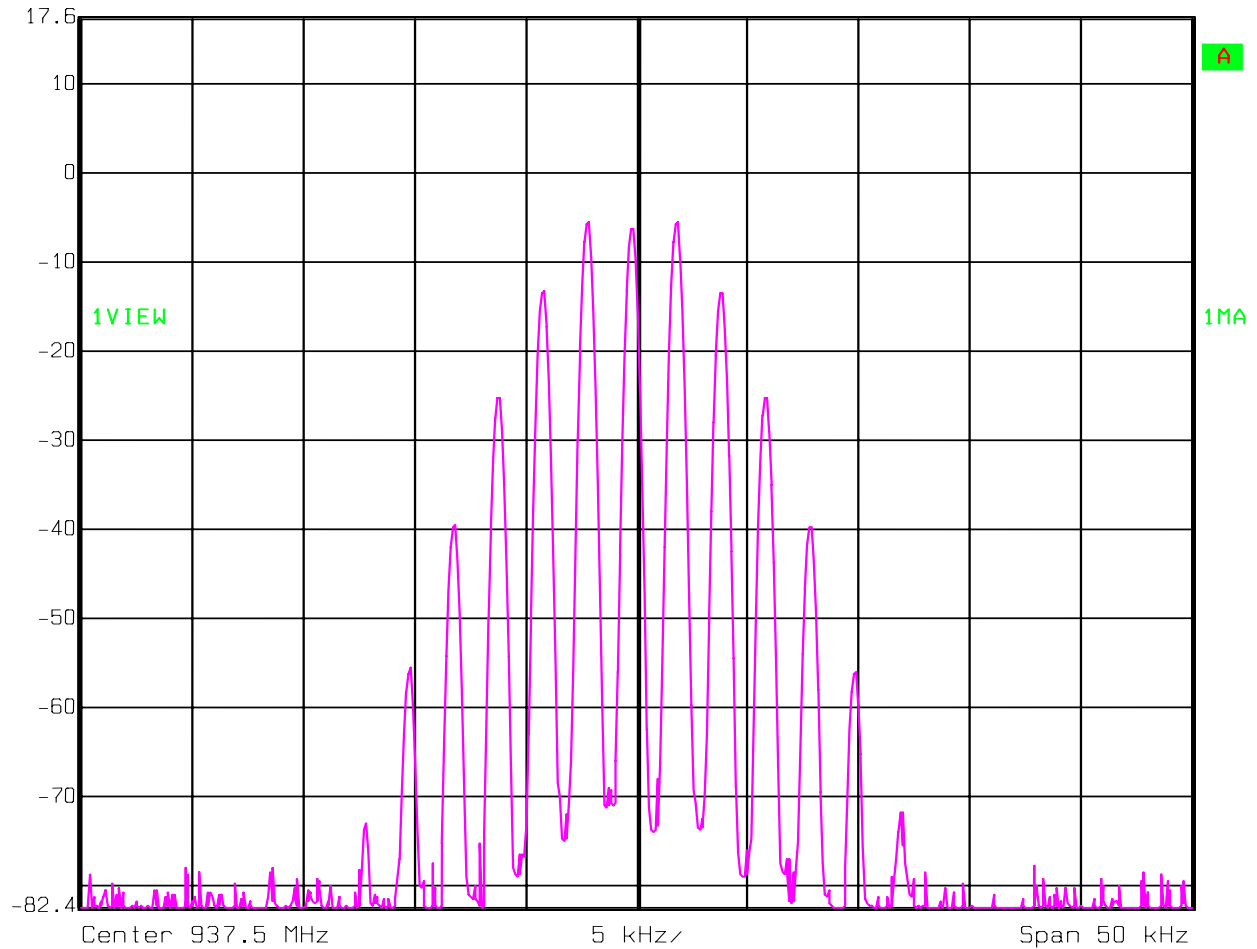
Test Data Occupied Bandwidth

Analog Input
900 Band



Ref Lvl
17.6 dBm

RBW	300 Hz	RF Att	30 dB
VBW	300 Hz	Mixer	-10 dBm
SWT	2.8 s	Unit	dBm



Date: 29.JUN.2006 16:08:36

EQUIPMENT: TFAM80/92/19E

PROJECT NO.: 6L0172RUS2

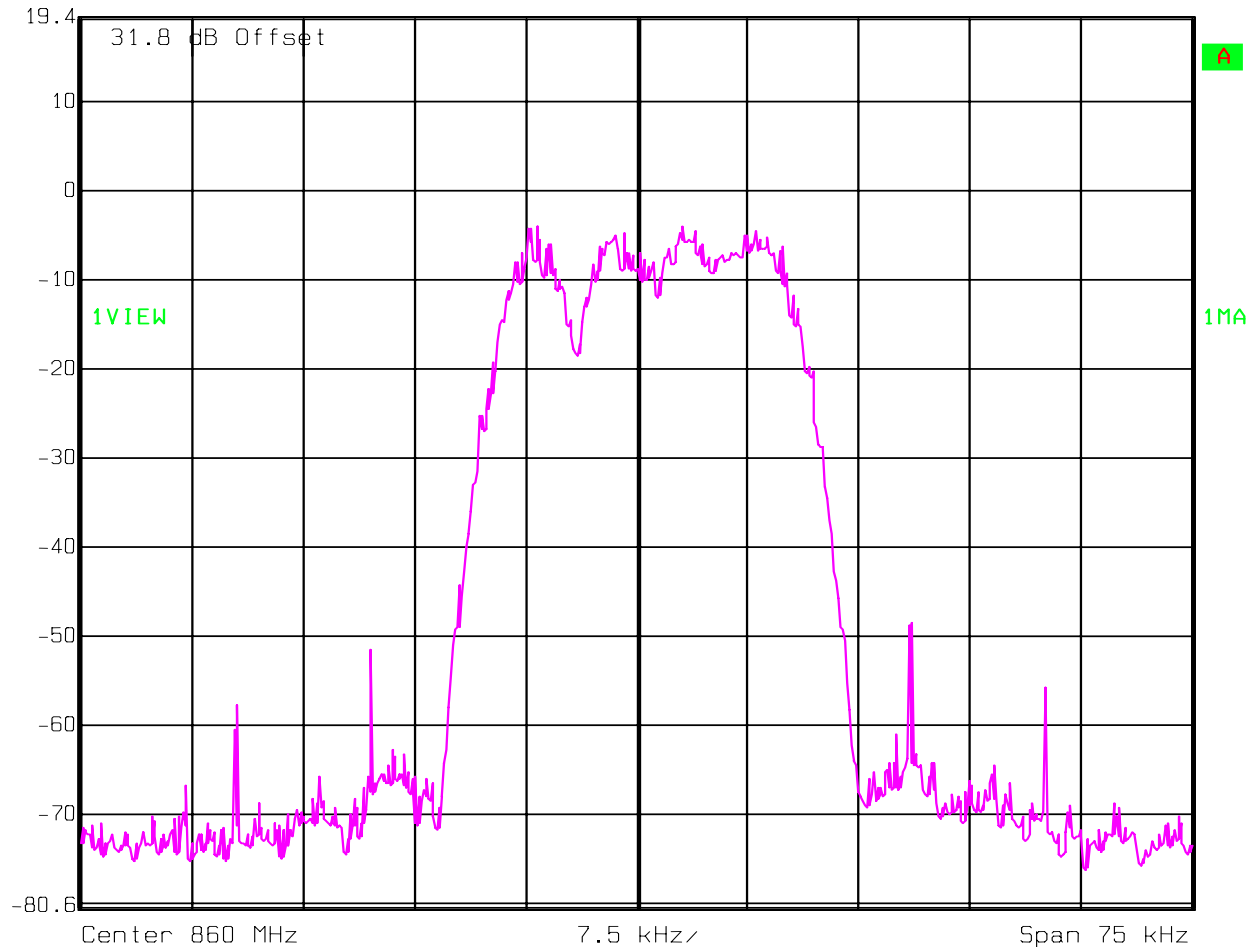
Test Data Occupied Bandwidth

IDEN Output
800 Band



Ref Lvl
19.4 dBm

RBW	300 Hz	RF Att	10 dB
VBW	300 Hz	Mixer	-10 dBm
SWT	4.2 s	Unit	dBm



Date: 30.JUN.2006 10:03:06

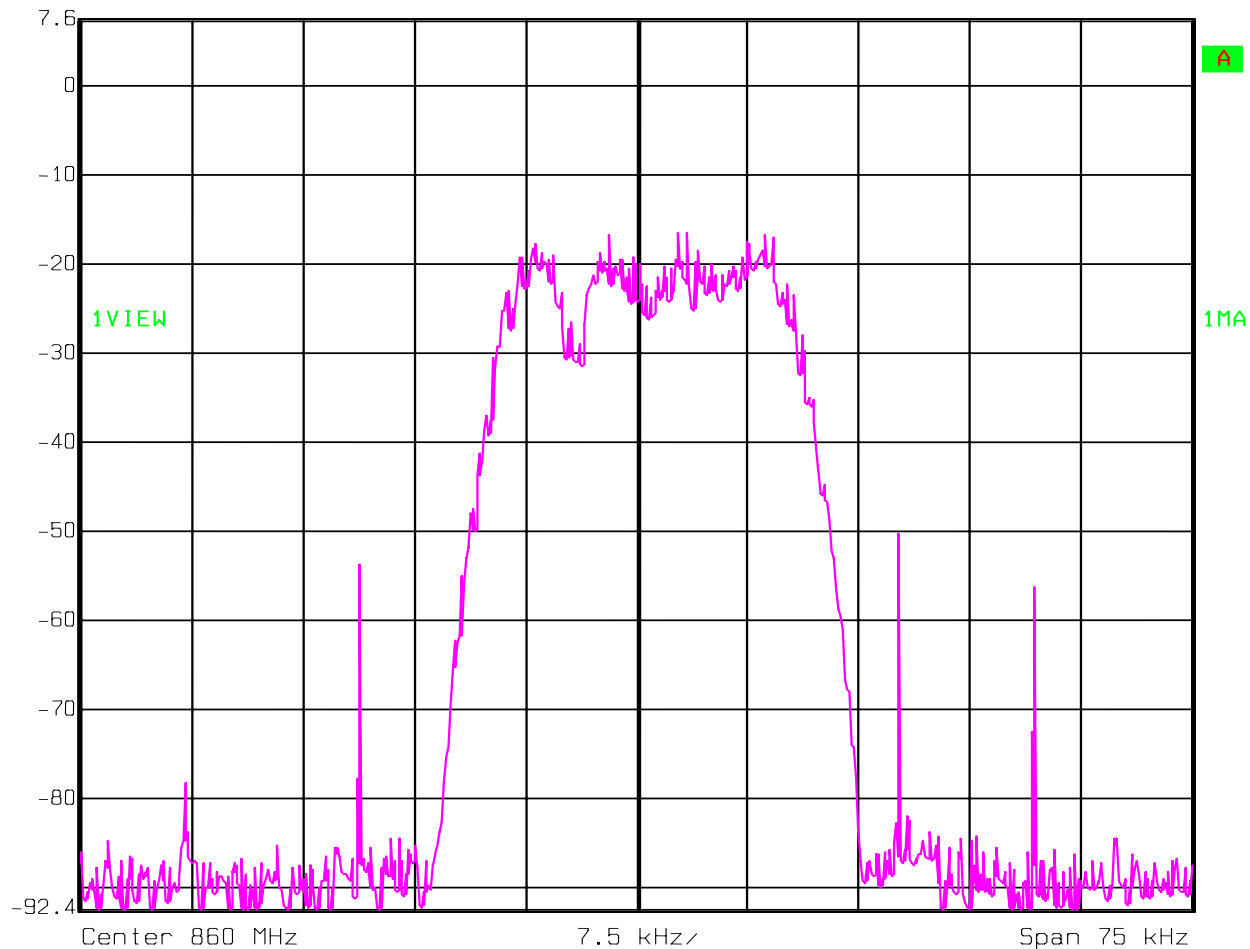
Test Data Occupied Bandwidth

iDEN Input
800 Band



Ref Lvl
7.6 dBm

RBW	300 Hz	RF Att	20 dB
VBW	300 Hz	Mixer	-10 dBm
SWT	4.2 s	Unit	dBm



Date: 30.JUN.2006 10:06:57

EQUIPMENT: TFAM80/92/19E

PROJECT NO.: 6L0172RUS2

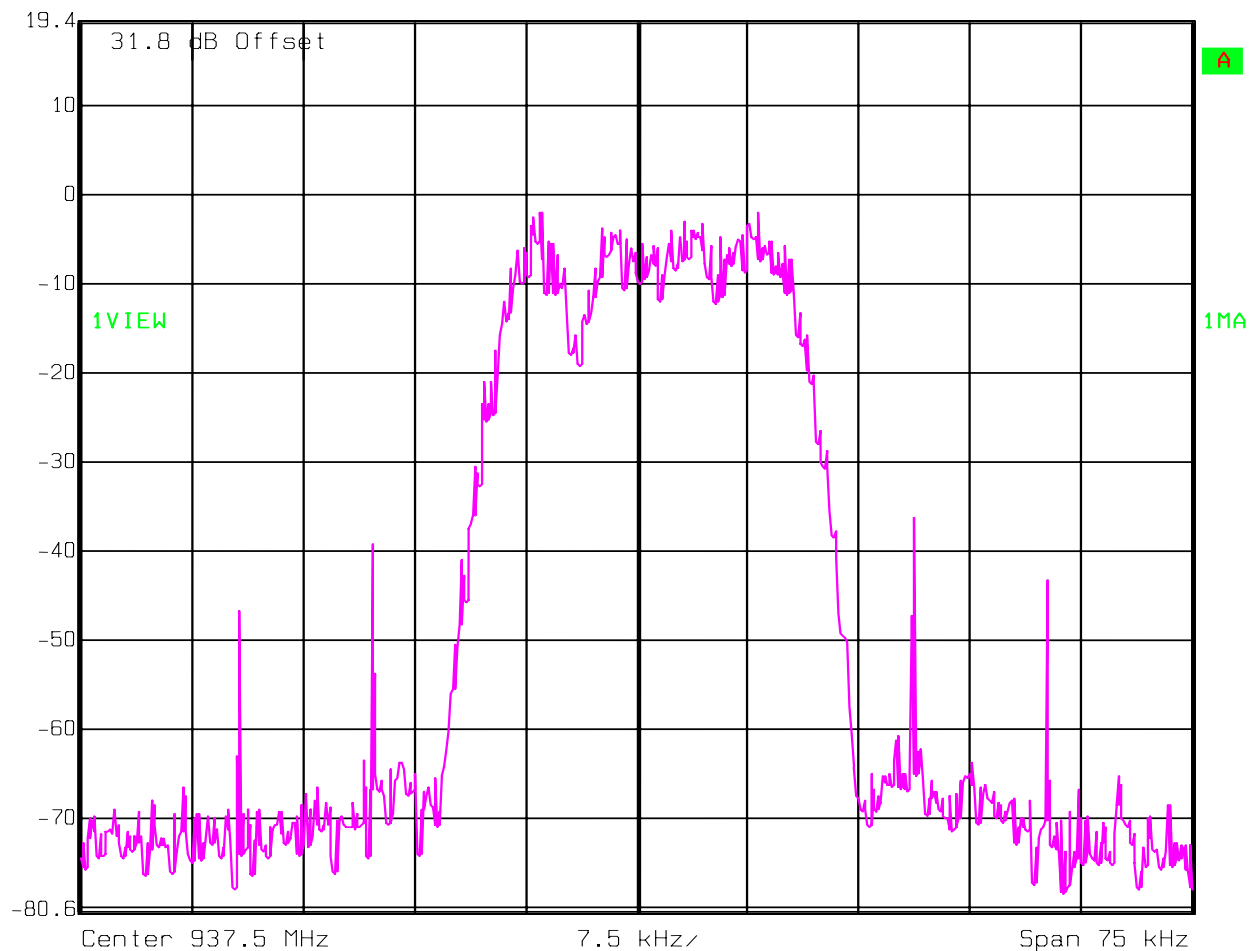
Test Data Occupied Bandwidth

IDEN Output
900 Band



Ref Lvl
19.4 dBm

RBW	300 Hz	RF Att	10 dB
VBW	300 Hz	Mixer	-10 dBm
SWT	4.2 s	Unit	dBm



Date: 30.JUN.2006 10:04:01

EQUIPMENT: TFAM80/92/19E

PROJECT NO.: 6L0172RUS2

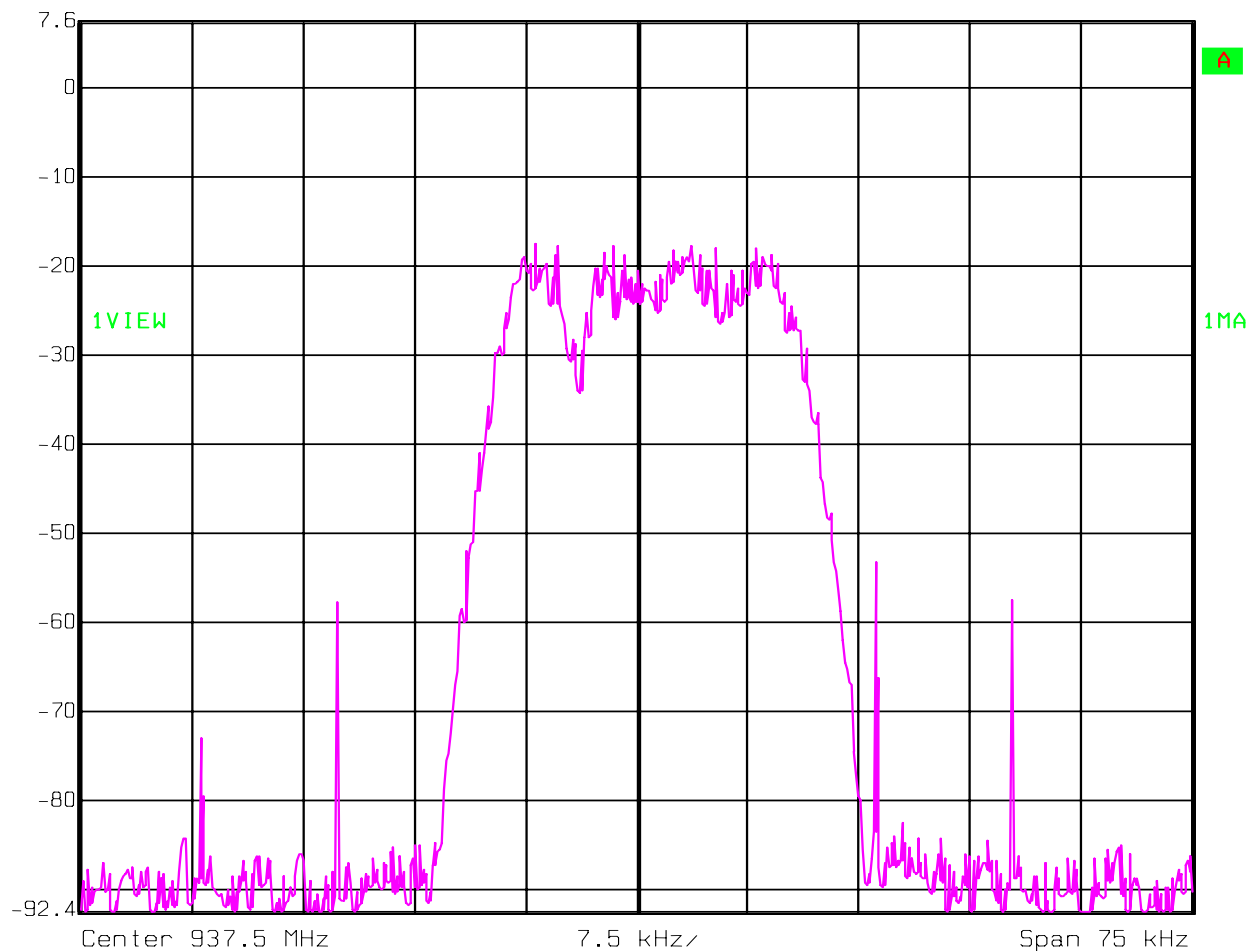
Test Data Occupied Bandwidth

IDEN Input
900 Band



Ref Lvl
7.6 dBm

RBW	300 Hz	RF Att	20 dB
VBW	300 Hz	Mixer	-10 dBm
SWT	4.2 s	Unit	dBm



Date: 30.JUN.2006 10:05:58

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.991
TESTED BY: David Light	DATE: 30 June 2006

Test Results: Complies.

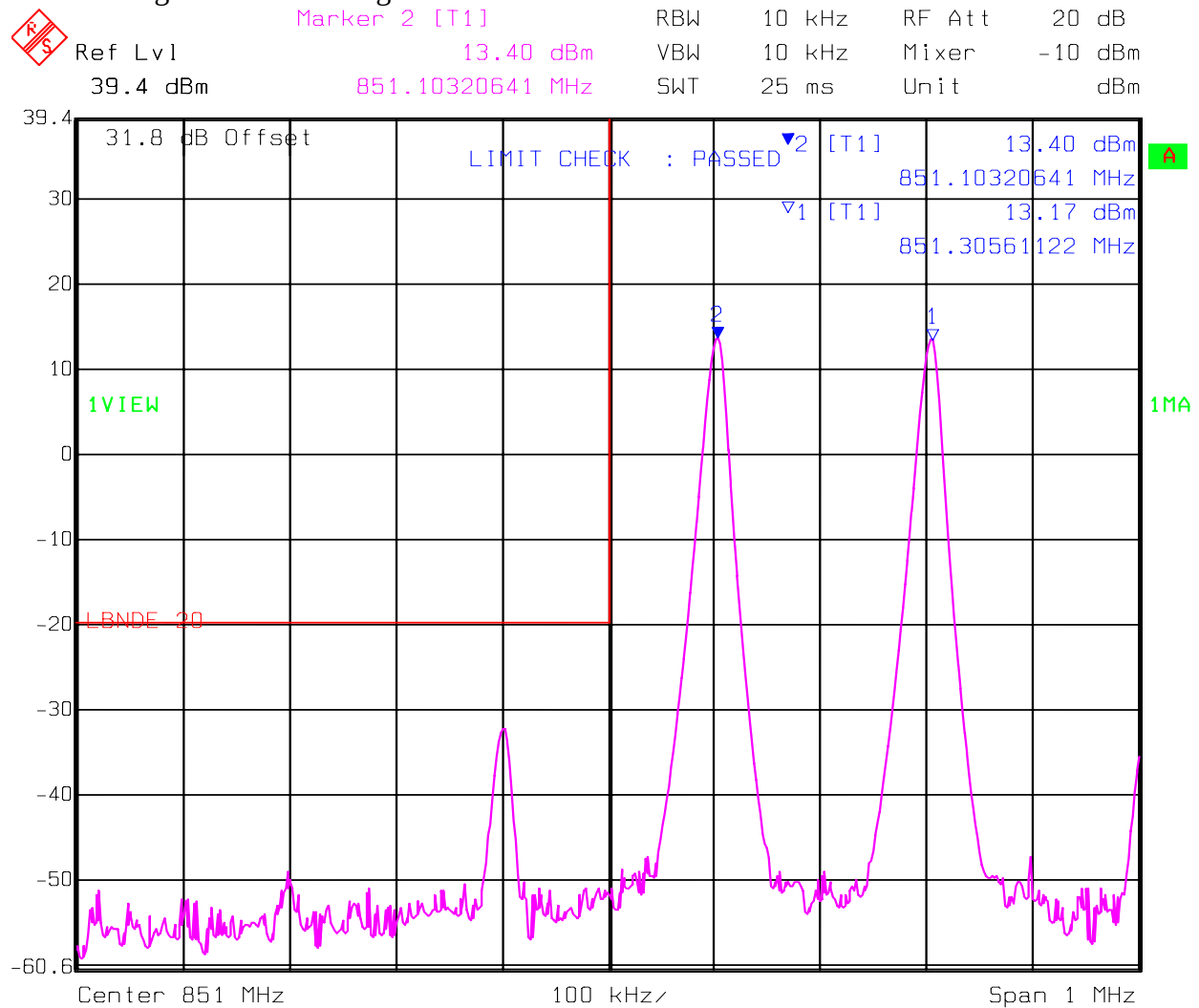
Test Data: See attached graph(s).

EQUIPMENT: TFAM80/92/19E

PROJECT NO.: 6L0172RUS2

Test Data – Spurious Emissions

IM – Analog – Lower bandedge



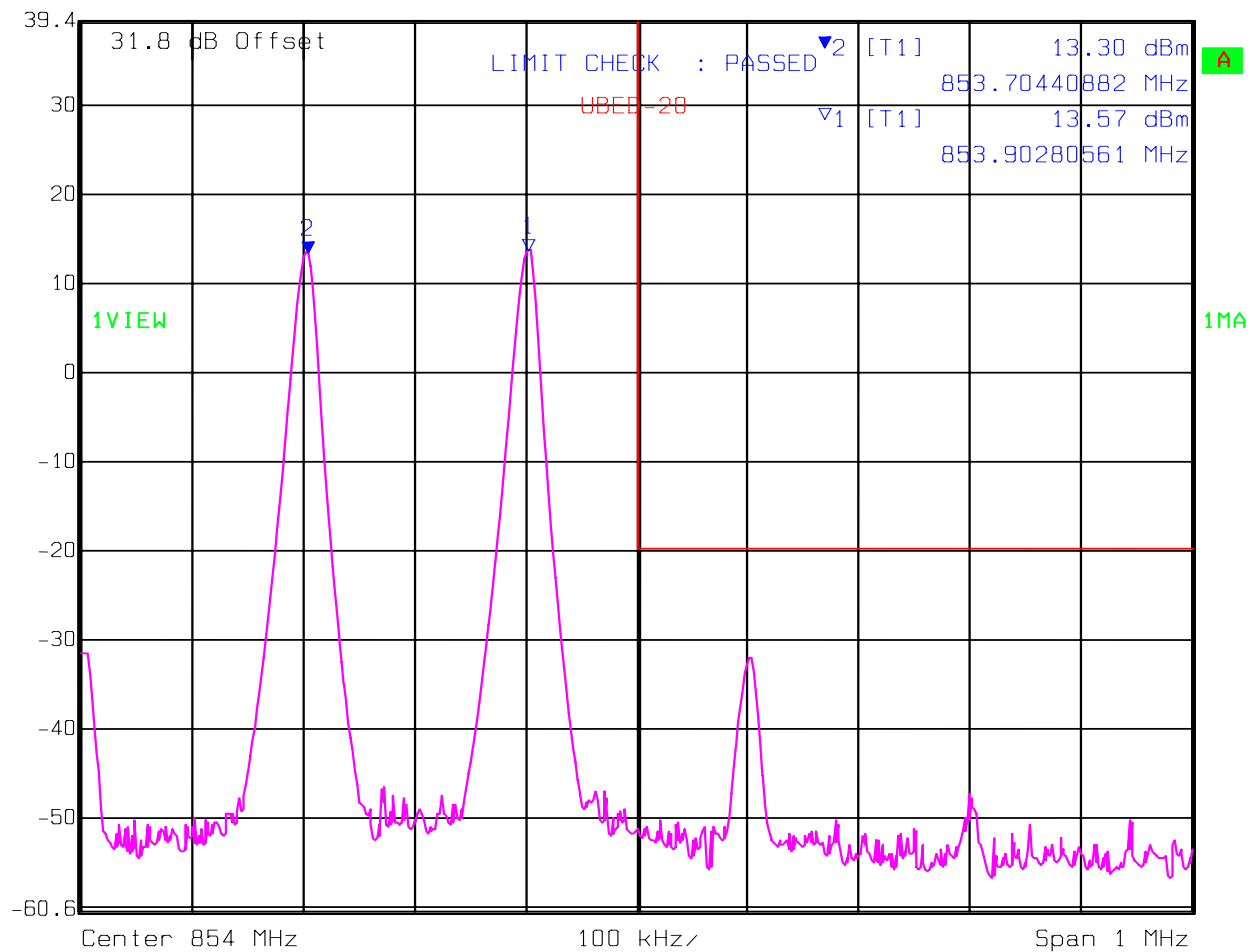
Date: 29.JUN.2006 15:51:47

Test Data – Spurious Emissions

IM – Upper bandedge - Analog



Ref Lvl	13.30 dBm	RBW	10 kHz	RF Att	20 dB
39.4 dBm	853.70440882 MHz	VBW	10 kHz	Mixer	-10 dBm
		SWT	25 ms	Unit	dBm



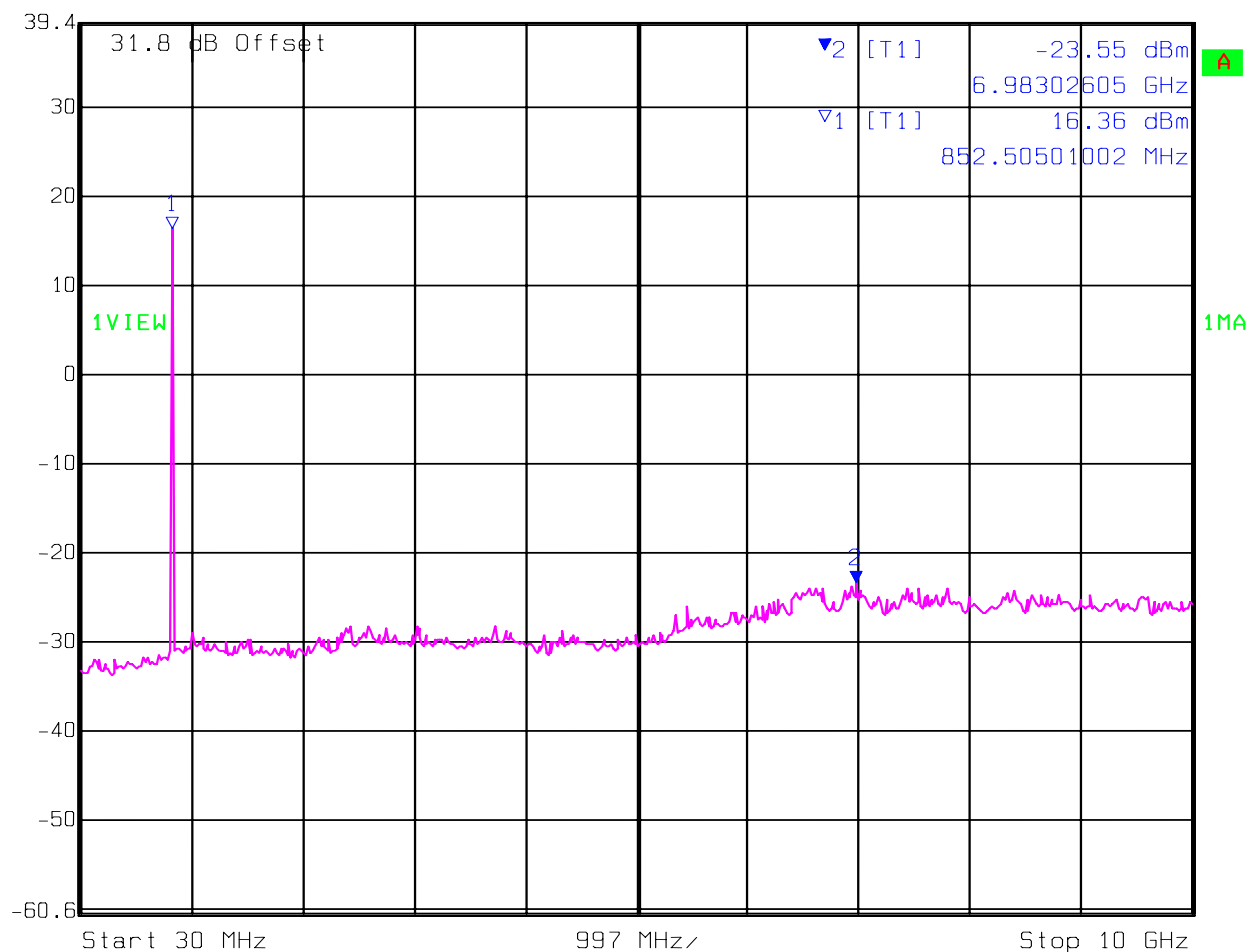
Date: 29.JUN.2006 15:53:38

Test Data – Spurious Emissions

Tx mid band Analog



Ref Lvl 39.4 dBm
Marker 2 [T1] -23.55 dBm
6.98302605 GHz
RBW 1 MHz
VBW 1 MHz
SWT 100 ms
RF Att 20 dB
Mixer -10 dBm
Unit dBm



Date: 29.JUN.2006 15:55:58

EQUIPMENT: TFAM80/92/19E

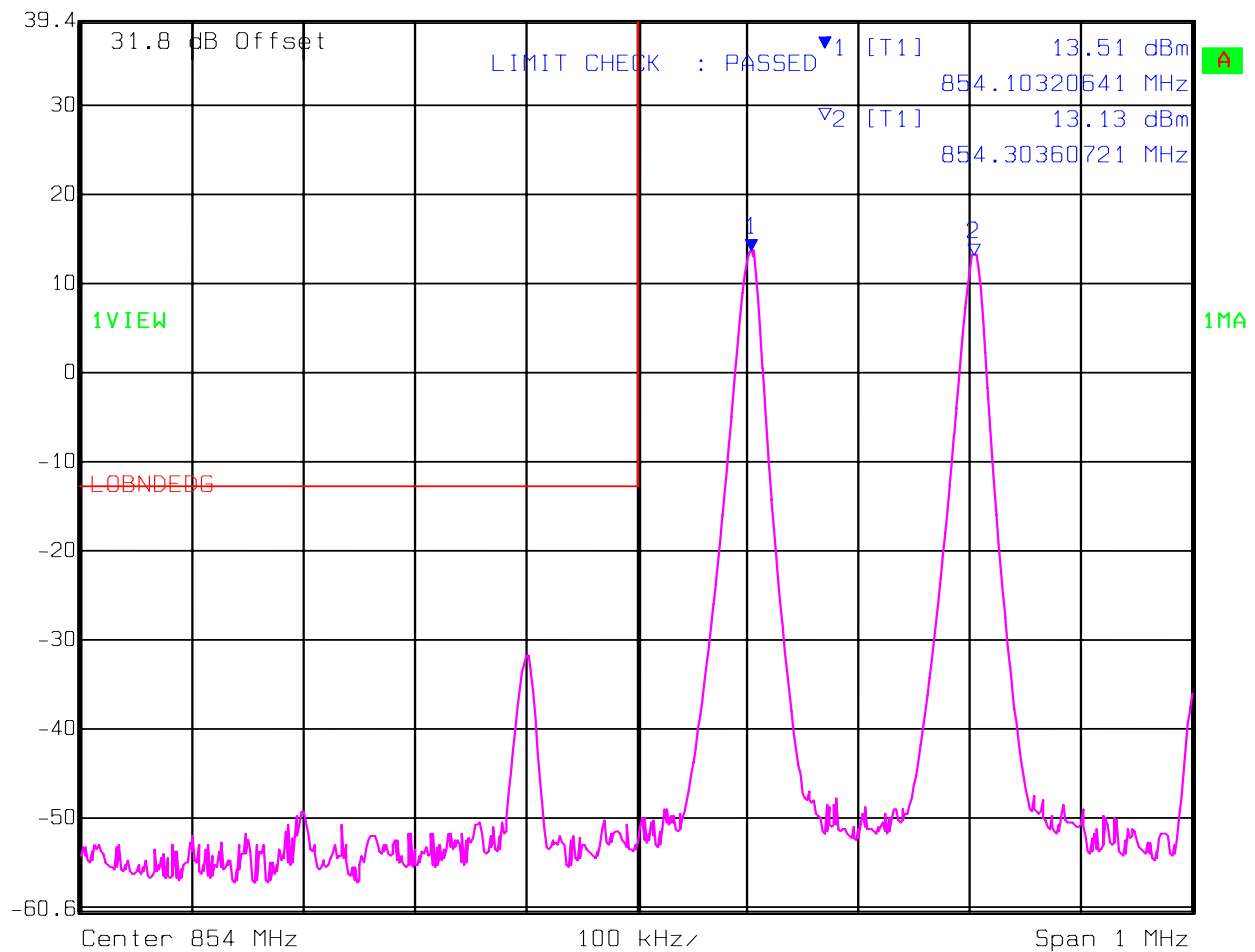
PROJECT NO.: 6L0172RUS2

Test Data – Spurious Emissions

IM Lower bandedge Analog



Ref Lvl	39.4 dBm	Marker 1 [T1]	13.51 dBm	RBW	10 kHz	RF Att	20 dB
			854.10320641 MHz	VBW	10 kHz	Mixer	-10 dBm
				SWT	25 ms	Unit	dBm

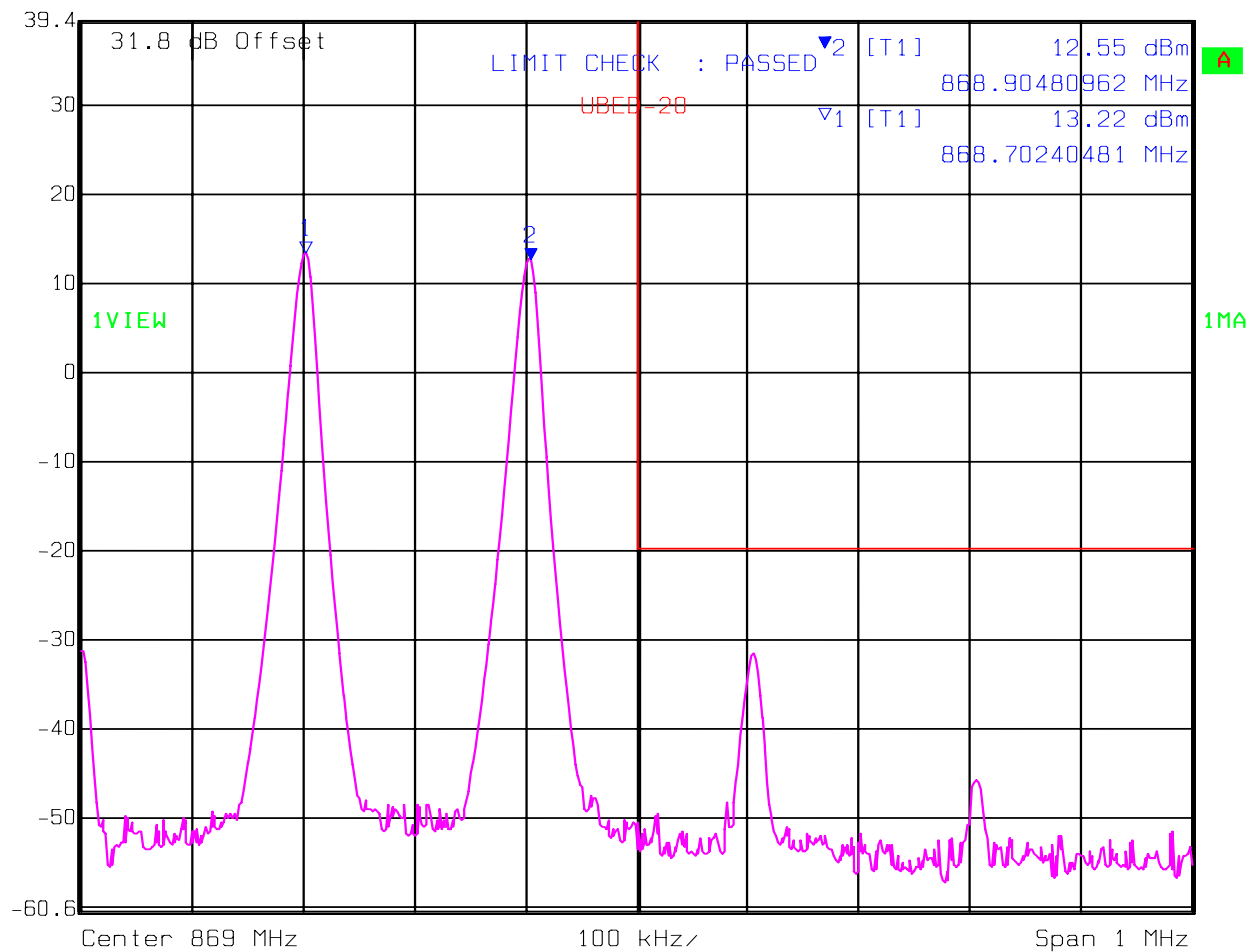


Date: 29.JUN.2006 15:58:27

Test Data – Spurious Emissions

IM Upper bandedge Analog


 Ref Lvl 39.4 dBm
 Marker 2 [T1] 12.55 dBm
 868.90480962 MHz
 RBW 10 kHz RF Att 20 dB
 VBW 10 kHz Mixer -10 dBm
 SWT 25 ms Unit dBm



Date: 29.JUN.2006 15:59:33

EQUIPMENT: TFAM80/92/19E

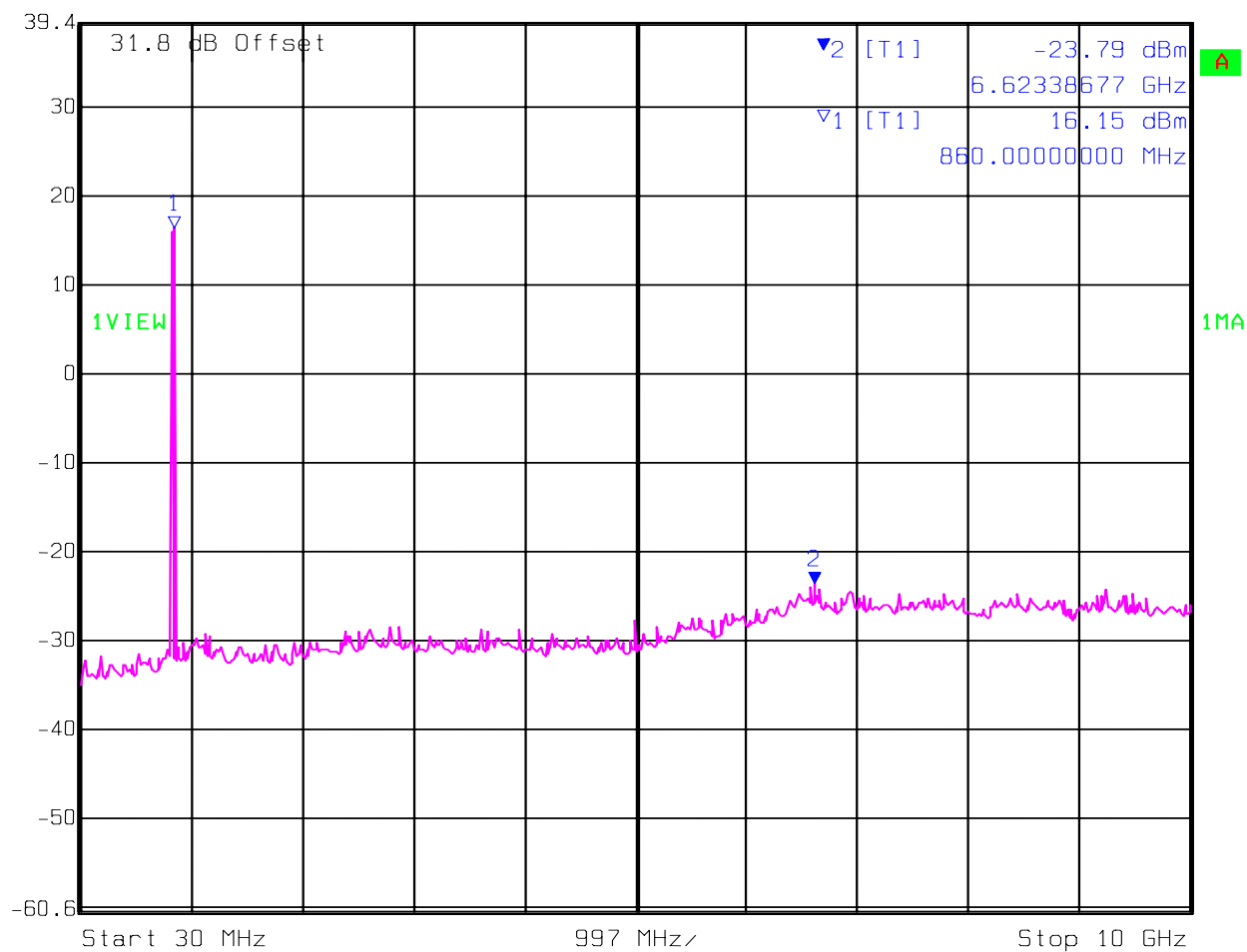
PROJECT NO.: 6L0172RUS2

Test Data – Spurious Emissions

Tx Mid band Analog



Ref Lvl 39.4 dBm
Marker 2 [T1] -23.79 dBm
6.62338677 GHz
RBW 1 MHz RF Att 20 dB
VBW 1 MHz Mixer -10 dBm
SWT 100 ms Unit dBm



Date: 29.JUN.2006 16:02:00

EQUIPMENT: TFAM80/92/19E

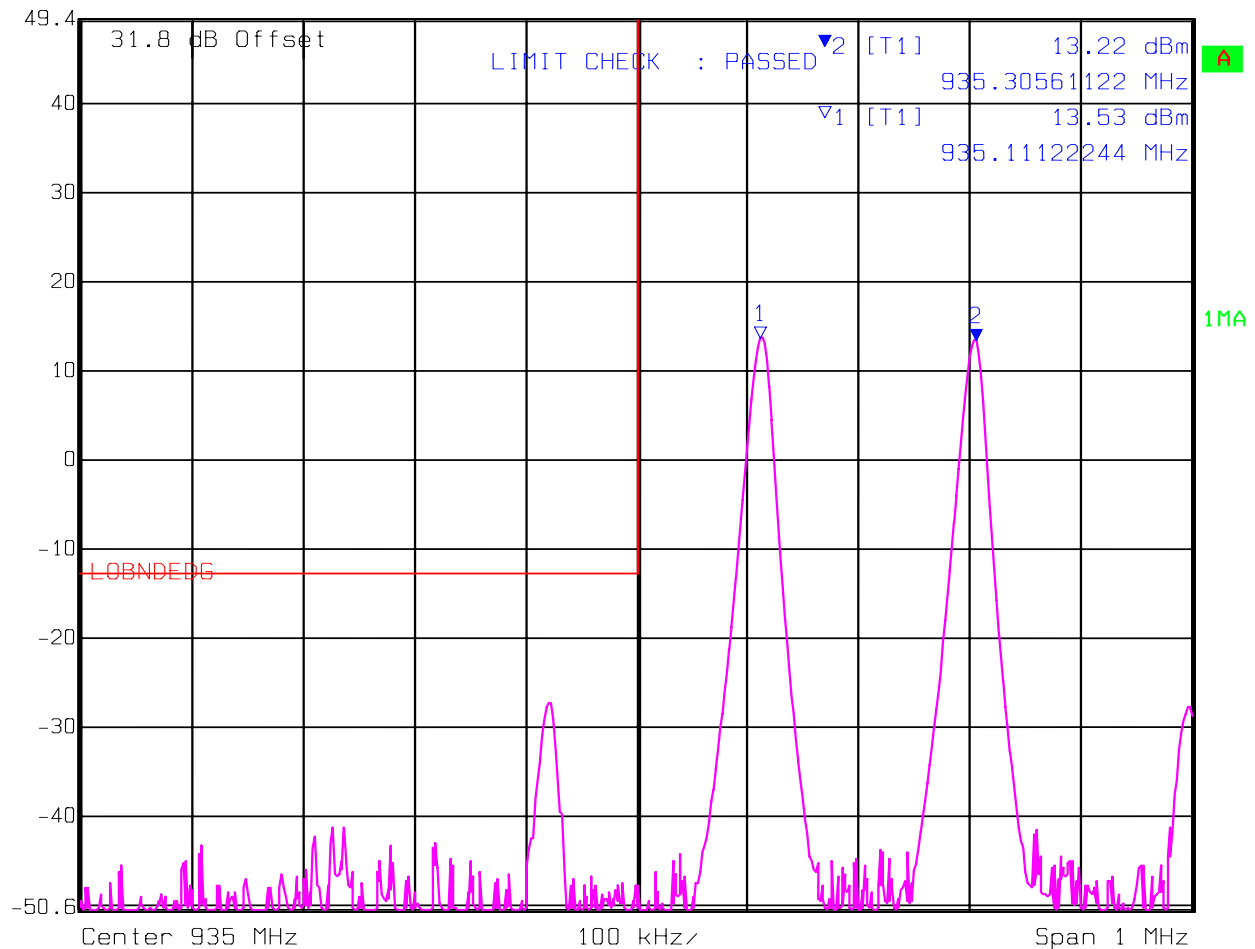
PROJECT NO.: 6L0172RUS2

Test Data – Spurious Emissions

IM Lower bandedge Analog

900 Band

 Ref Lvl 49.4 dBm Marker 2 [T1] 13.22 dBm RBW 10 kHz RF Att 30 dB
935.30561122 MHz VBW 10 kHz Mixer -10 dBm
SWT 25 ms Unit dBm



Date: 29.JUN.2006 16:19:40

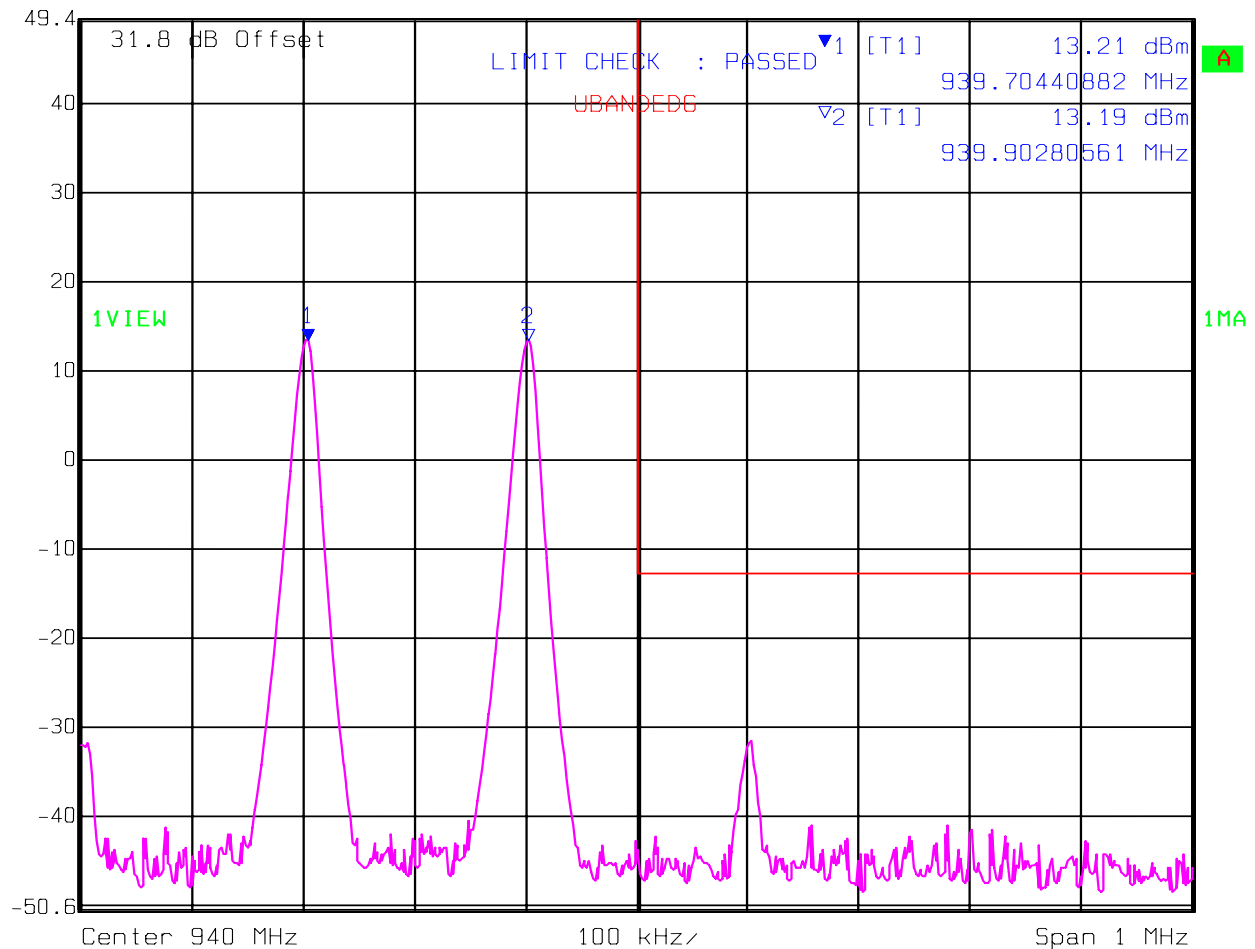
EQUIPMENT: TFAM80/92/19E

PROJECT NO.: 6L0172RUS2

Test Data – Spurious Emissions

IM Upper bandedge Analog

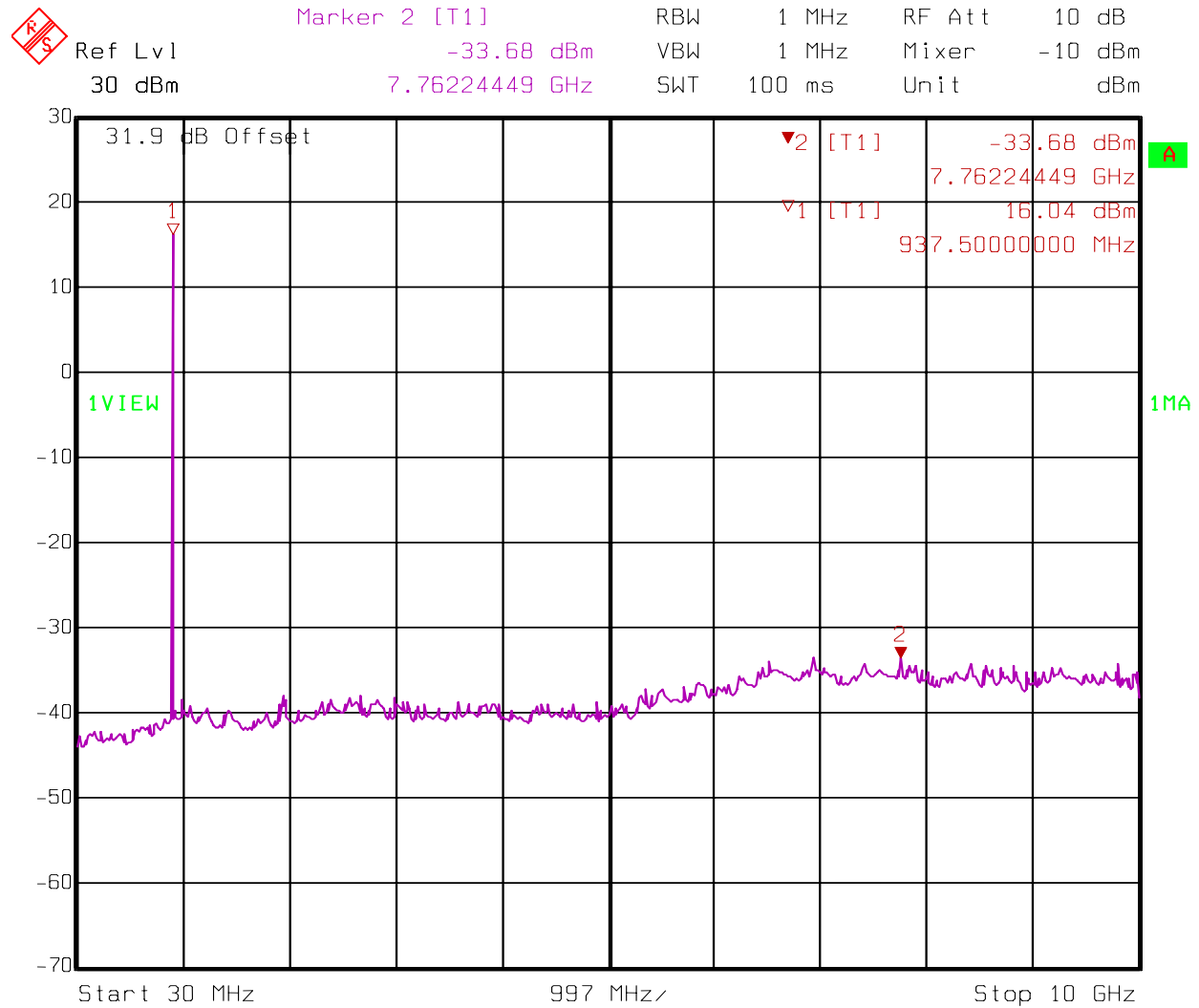
900 Band

Ref Lvl
49.4 dBmMarker 1 [T1]
13.21 dBm
939.70440882 MHzRBW 10 kHz RF Att 30 dB
VBW 10 kHz Mixer -10 dBm
SWT 25 ms Unit dBm

Date: 29.JUN.2006 16:21:31

EQUIPMENT: TFAM80/92/19E

PROJECT NO.: 6L0172RUS2

Test Data – Spurious EmissionsTx mid band Analog
900 Band

Date: 30.JUN.2006 15:31:22

EQUIPMENT: TFAM80/92/19E

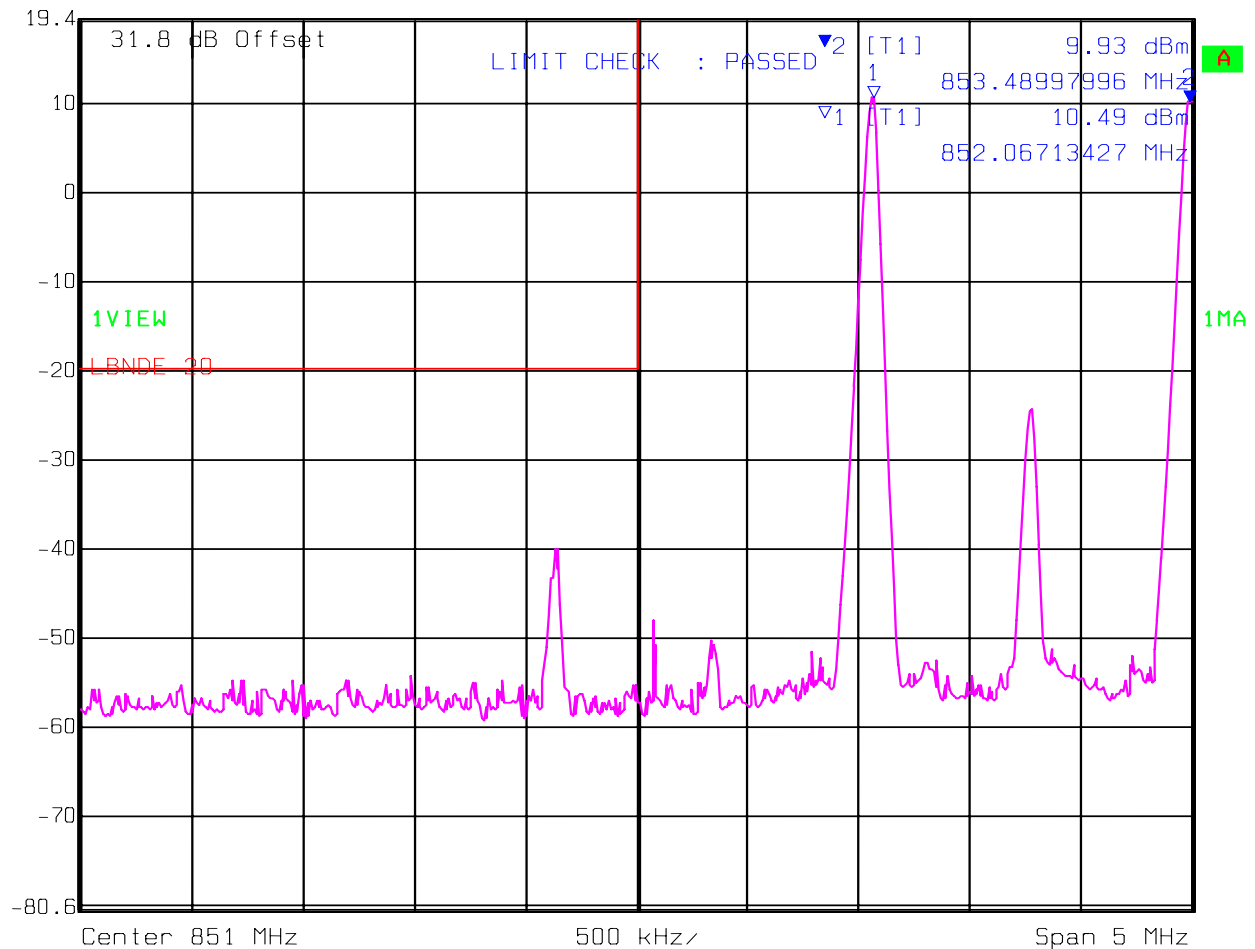
PROJECT NO.: 6L0172RUS2

Test Data – Spurious Emissions

IM Lower bandedge iDEN

800 Band

	Ref Lvl	Marker 2 [T1]	RBW	30 kHz	RF Att	10 dB
	19.4 dBm	9.93 dBm	VBW	30 kHz	Mixer	-10 dBm
		853.48997996 MHz	SWT	14 ms	Unit	dBm



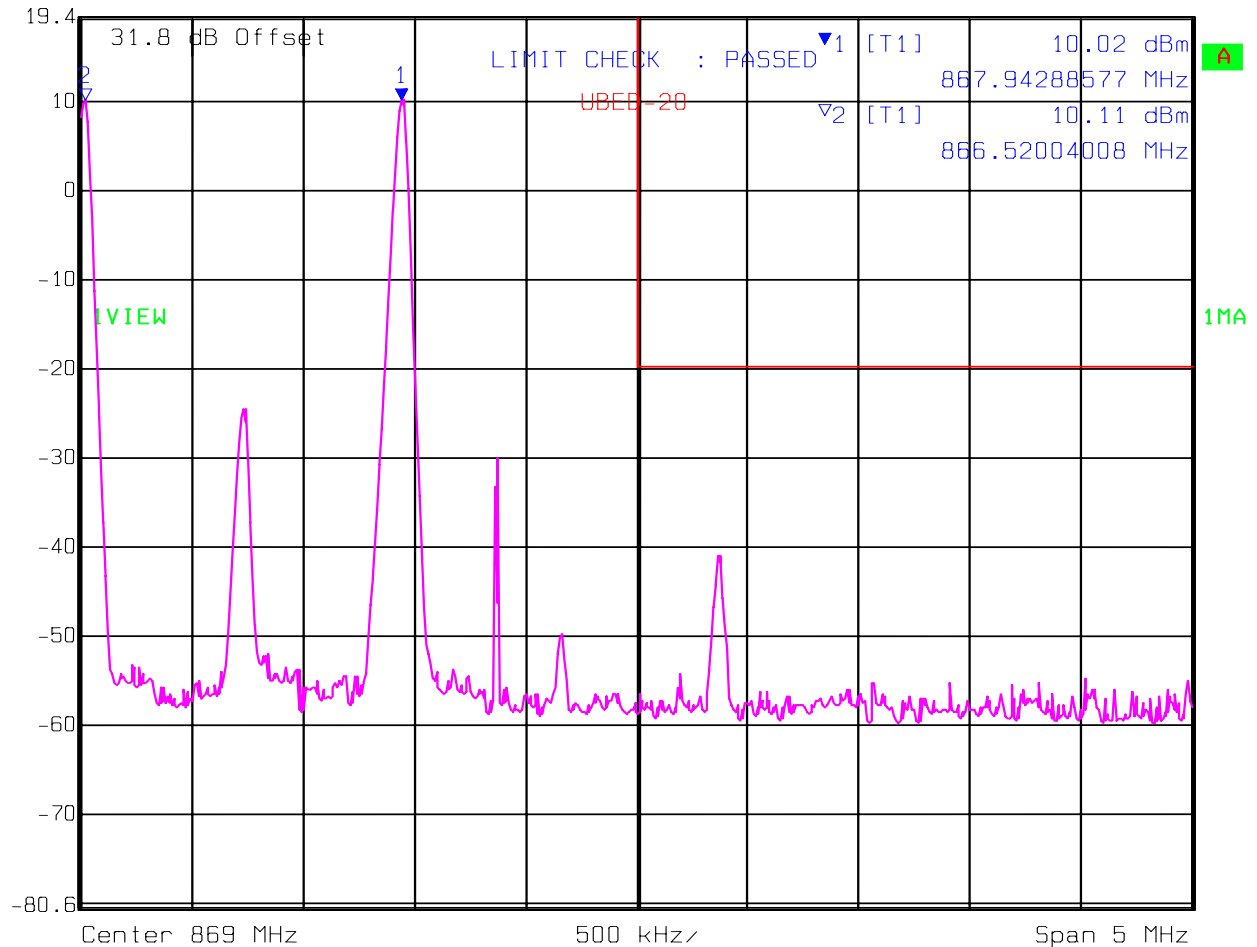
Date: 30.JUN.2006 09:46:45

Test Data – Spurious Emissions

IM Upper bandedge iDEN

800 band

	Ref Lvl	Marker 1 [T1]	RBW	30 kHz	RF Att	10 dB
	19.4 dBm	10.02 dBm	VBW	30 kHz	Mixer	-10 dBm
		867.94288577 MHz	SWT	14 ms	Unit	dBm



Date: 30.JUN.2006 09:49:03

EQUIPMENT: TFAM80/92/19E

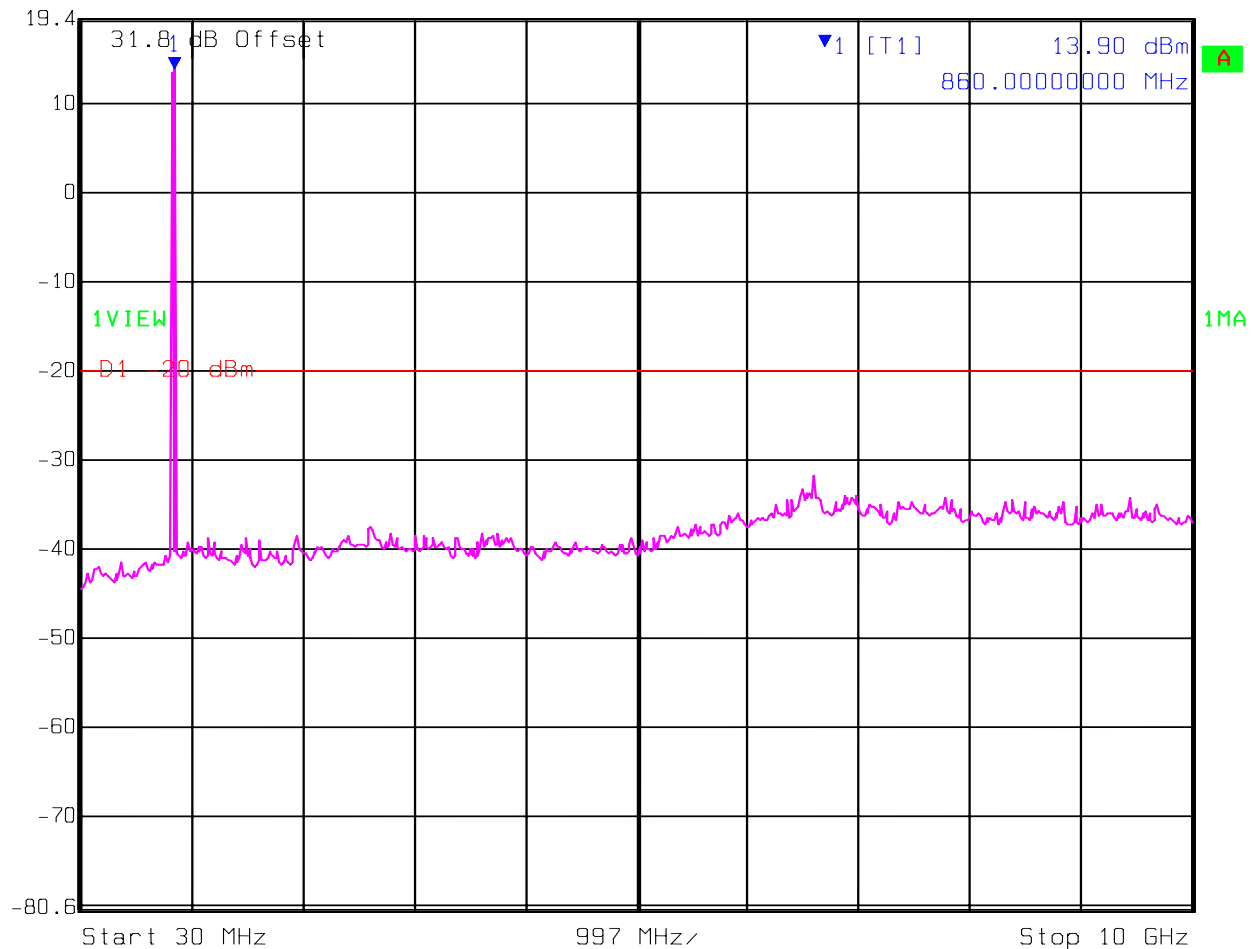
PROJECT NO.: 6L0172RUS2

Test Data – Spurious Emissions

Tx mid band iDEN

800 band

	Ref Lvl	Marker 1 [T1]	RBW	1 MHz	RF Att	10 dB
	19.4 dBm	13.90 dBm	VBW	1 MHz	Mixer	-10 dBm
		860.0000000 MHz	SWT	100 ms	Unit	dBm



Date: 30.JUN.2006 10:01:01

EQUIPMENT: TFAM80/92/19E

PROJECT NO.: 6L0172RUS2

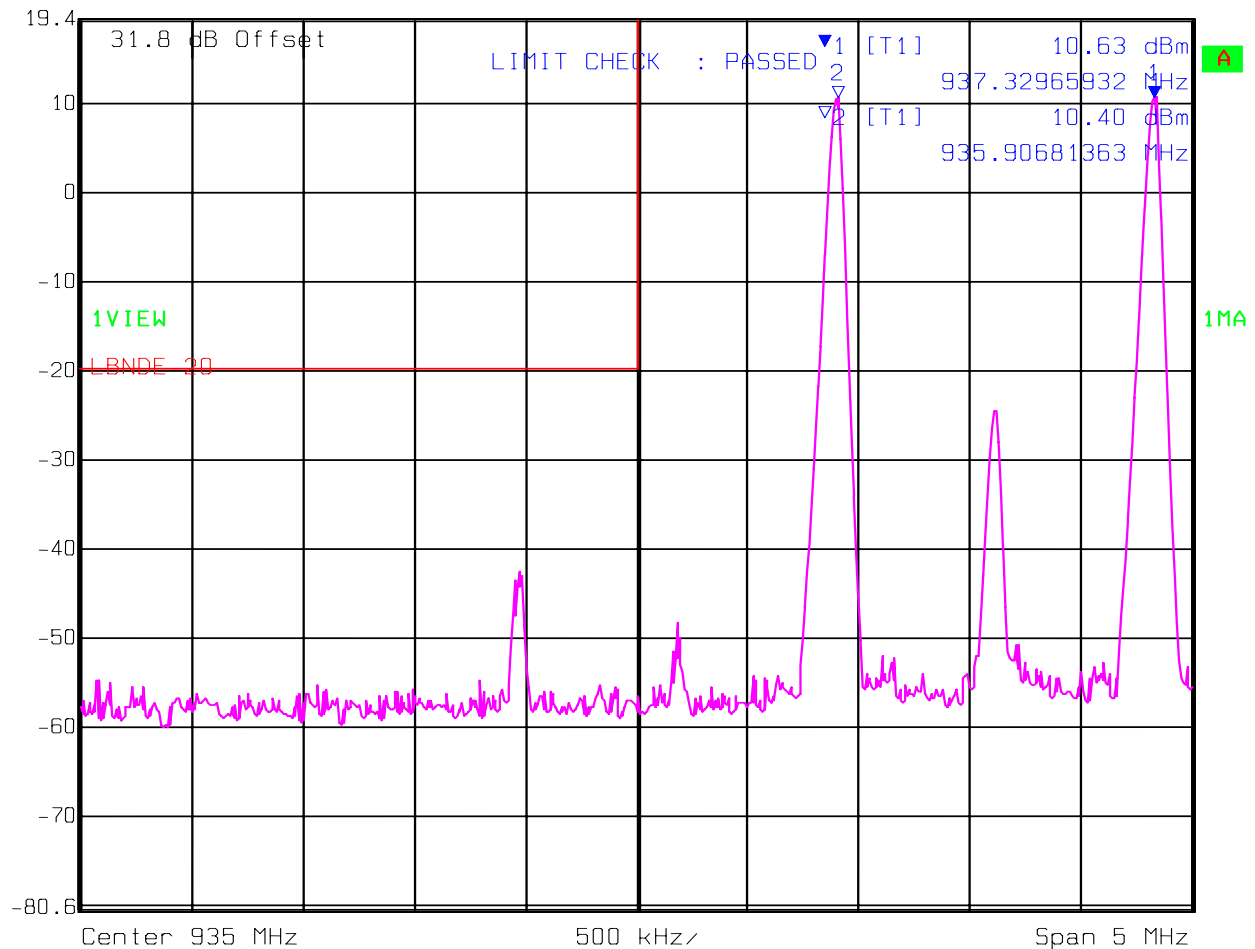
Test Data – Spurious Emissions

IM Lower bandedge iDEN

900 band



Ref Lvl	Marker 1 [T1]	RBW	30 kHz	RF Att	10 dB
19.4 dBm	10.63 dBm	VBW	30 kHz	Mixer	-10 dBm
	937.32965932 MHz	SWT	14 ms	Unit	dBm



Date: 30.JUN.2006 09:52:21

EQUIPMENT: TFAM80/92/19E

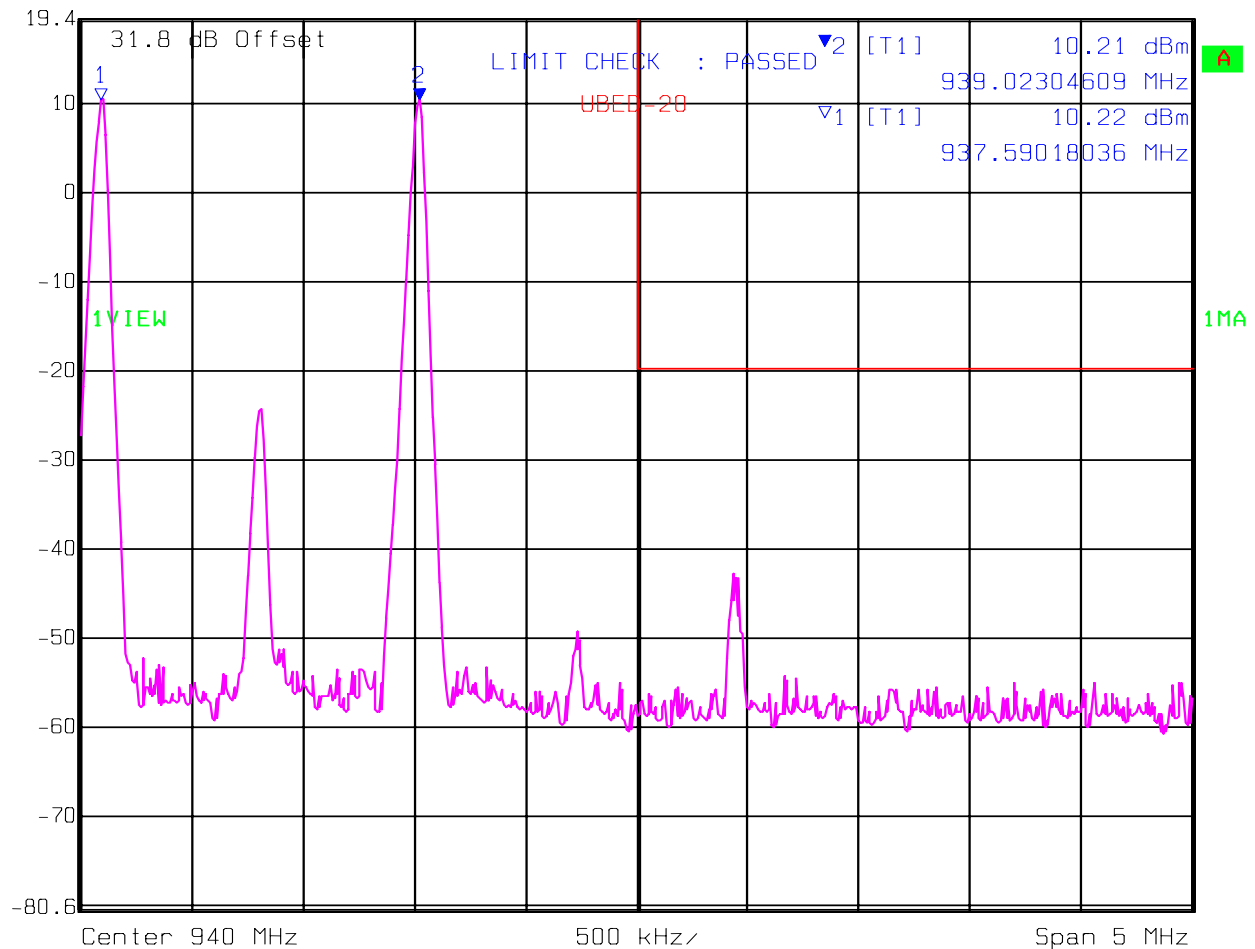
PROJECT NO.: 6L0172RUS2

Test Data – Spurious Emissions

IM Upper bandedge iDEN

900 band

 Ref Lvl 19.4 dBm Marker 2 [T1] 10.21 dBm RBW 30 kHz RF Att 10 dB
VBW 30 kHz Mixer -10 dBm
SWT 14 ms Unit dBm



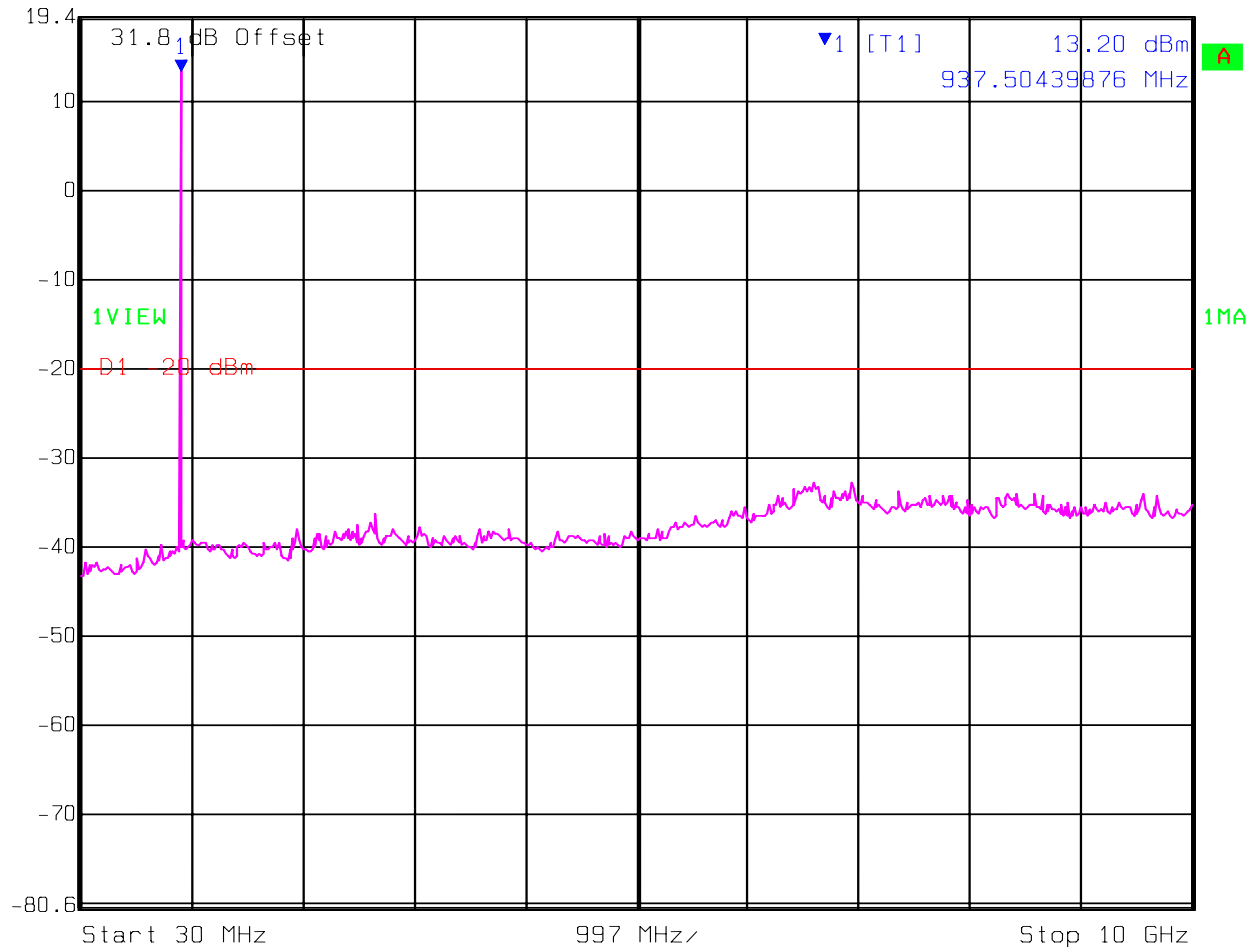
Date: 30.JUN.2006 09:54:18

Test Data – Spurious Emissions

Tx mid band iDEN

900 band

	Ref Lvl	Marker 1 [T1]	RBW	1 MHz	RF Att	10 dB
	19.4 dBm	13.20 dBm	VBW	1 MHz	Mixer	-10 dBm
		937.50439876 MHz	SWT	100 ms	Unit	dBm



Date: 30.JUN.2006 09:58:55

Section 6. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.993
TESTED BY: David Light	DATE: 30 June 2006

Test Results: Complies.

Test Data: No emissions were detected above the noise floor which was at least 20 dB below the specification limit. No emissions are reported per 2.1057(c).

Note: The spectrum was searched from 30 MHz to the tenth harmonic of the highest frequency generated.

RBW=VBW=1 MHz

Note: See page A5 for applicable limit.

Photographs of Test Setup



EQUIPMENT: TFAM80/92/19E

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Section 7. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	05/26/06	05/26/08
1042	CABLE, 4M	STORM PR90-010-144	N/A	06/15/06	06/15/07
1472	20db Attenuator	Omni Spectra 20600-20db	NONE	CBU	N/A
1469	10 db Attenuator	MCL Inc. BW-S10W2 10db-2WDC	NONE	CBU	N/A
759	ANTENNA, LOG PERIODIC	A.H. SYSTEMS SAS-200/510	556	02/13/06	02/13/07
760	Antenna biconical	Electro Metrics MFC-25	477	08/04/05	08/04/06
791	PREAMP, 25dB	Nemko USA, Inc. LNA25	398	04/20/06	04/20/07
1484	Cable	Storm PR90-010-072	N/A	08/26/05	08/26/06
1485	Cable	Storm PR90-010-216	N/A	08/26/05	08/26/06
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/14/05	01/15/07
993	Horn antenna	A.H. Systems SAS-200/571	XXX	08/01/05	08/02/07
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	04/20/06	04/20/07

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FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: TFAM80/92/19E

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ANNEX A - TEST METHODOLOGIES

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

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:

If the antenna is not detachable from the circuit then the Peak Power Output is derived from the peak radiated field strength of the fundamental emission by using the plane wave relation $GP/4\pi R^2 = E^2/120\pi$ and proceeding as follows:

$$P = \frac{E^2 R^2}{30G} = \frac{E^2 3^2}{30G}$$

where,

P = the equivalent isotropic radiated power in watts

E = the maximum measured field strength in V/m

R = the measurement range (3 meters)

G = the numeric gain of the transmit antenna in relation to an isotropic radiator

Nemko USA

FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: TFAM80/92/19E

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NAME OF TEST: Spurious Emissions at Antenna Terminals	PARA. NO.: 2.991
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Test Method: RBW: 1% of emission bandwidth in the 0 - 1 GHz range.
1 MHz at frequencies above 1 GHz.

VBW: $\Rightarrow$ RBW

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

EQUIPMENT: TFAM80/92/19E

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NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
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Minimum Standard: Para. No. 90.210

Analog

Spectrum analyzer settings:

RBW: 300 Hz

VBW: $\geq$ RBW

Span: 50 kHz

Sweep: Auto

Compare input signal to output signal

iDEN

RBW: 300 Hz

VBW: $\geq$ RBW

Span: 1 MHz

Sweep: Auto

Compare input signal to output signal

NAME OF TEST: Field Strength of Spurious**PARA. NO.: 2.993****Minimum Standard:** Para. No. 90.210, see table 1 for applicable mask.**Calculation of Field Strength Limit**

An example of attenuation requirement of $50 + 10 \log P$ is equivalent to -20 dBm (1×10^{-5} Watts) at the antenna terminal. We determine the field strength limit by using the plane wave relation.

$$GP/4\pi R^2 = E^2/120\pi$$

For emissions ≤ 1 GHz:

$G = 1.64$ (Dipole Gain)

$P = 10^{-5}$ Watts (Maximum spurious output power)

$R = 3\text{m}$ (Measurement Distance)

$$E = \frac{\sqrt{30GP}}{R} = E = \frac{\sqrt{30 \times 1.64 \times 10^{-5}}}{3} = 0.00739 \text{ V / m} = 77.4 \text{ dB}\mu\text{V / m}$$

For emissions > 1 GHz:

$G = 1$ (Isotropic Gain)

$P = 1 \times 10^{-5}$ Watts (Maximum spurious output power)

$R = 3\text{m}$ (Measurement Distance)

$$E = 77.4 - 20 \log \sqrt{1.64} = 75.2 \text{ dB}\mu\text{V / m@3m}$$

MASK	Spurious Limit	FS Limit Below 1 GHz	FS Limit Above 1 GHz
A,B,C,G,H,I	-13dBm	84.4 dB μ V/m@3m	82.2 dB μ V/m@3m
D,J	-20dBm	77.4 dB μ V/m@3m	75.2 dB μ V/m@3m
E,F,K	-25dBm	72.4 dB μ V/m@3m	70.2 dB μ V/m@3m

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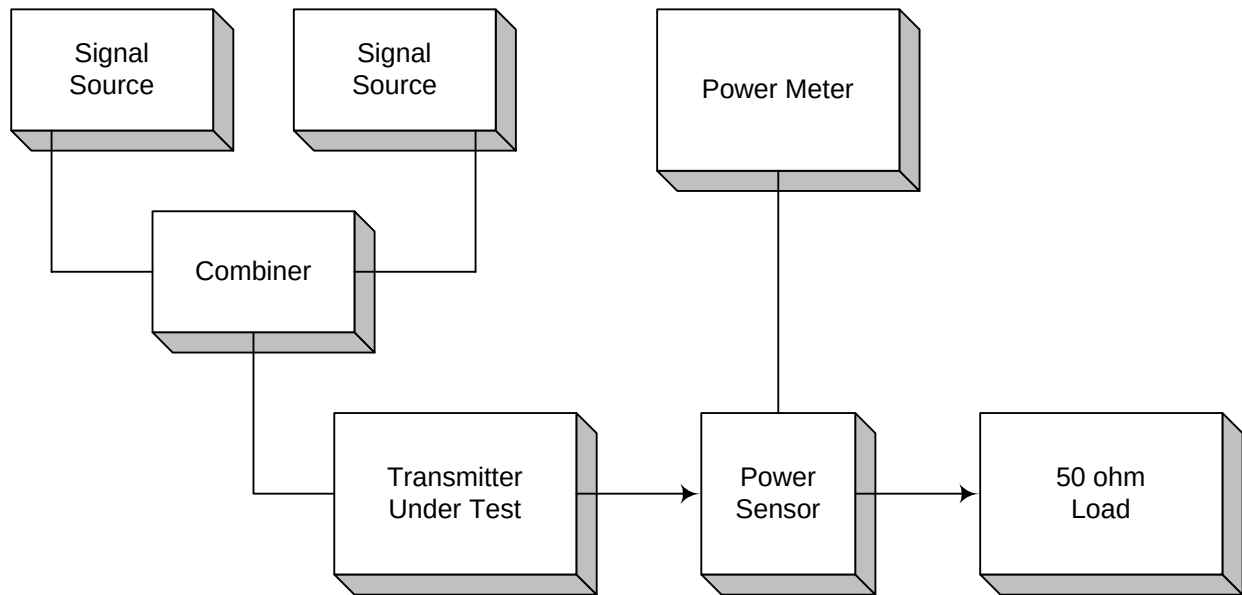
FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: TFAM80/92/19E

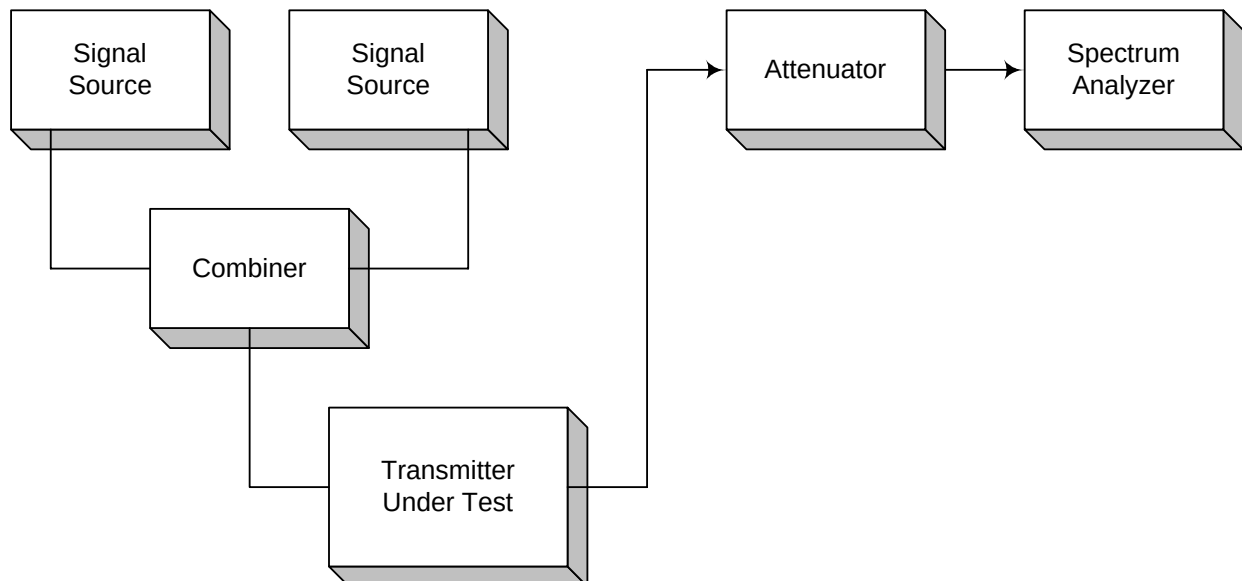
PROJECT NO.: 6L0172RUS2

ANNEX B - TEST DIAGRAMS

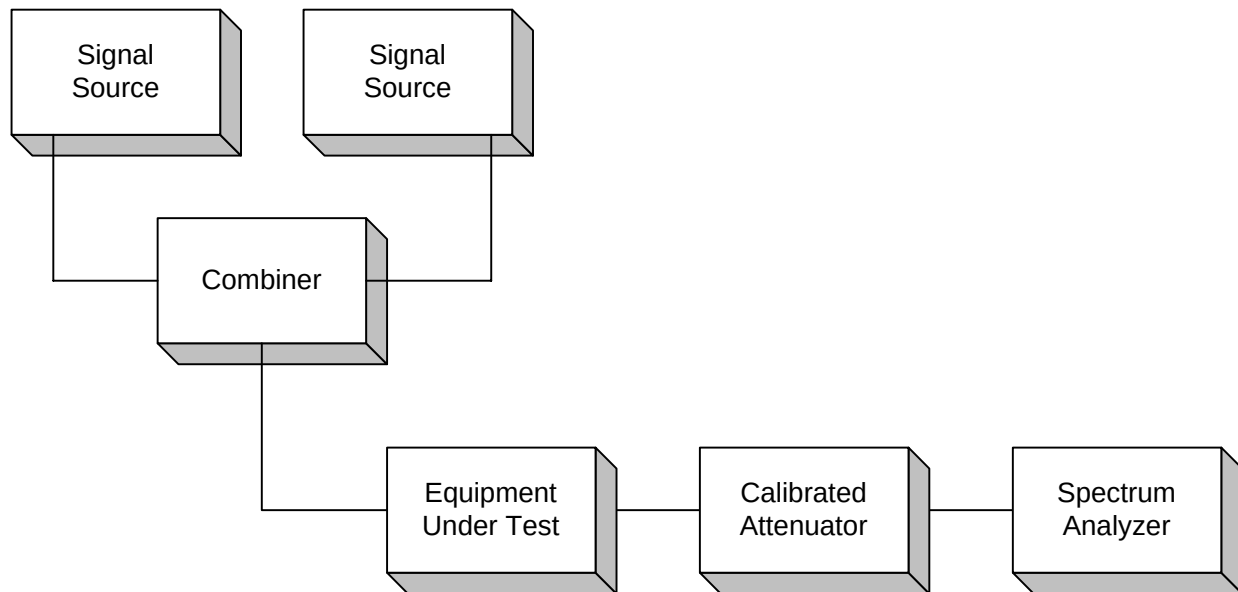
Para. No. 2.985 - R.F. Power Output



Para. No. 2.989 - Occupied Bandwidth



Para. No. 2.991 - Spurious Emissions at Antenna Terminals



Para. No. 2.993 - Field Strength of Spurious Radiation

