



Nemko Test Report: 1906RUS4

Applicant: Fiber-Span
111 Corporate Blvd, S.
Plainfield, NJ 07080
USA

**Equipment Under Test:
(E.U.T.)** FS31X-87-25-2-RM

In Accordance With: **CFR 47 Part 90, Subpart I**
Private Land Mobile Repeater

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

TESTED BY:

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

David Light, senior Wireless Engineer

DATE: 10 January 2007

APPROVED BY:

A handwritten signature in black ink, appearing to read 'Kevin Rose'.

Kevin Rose, Wireless Engineer

DATE: 12 January 2007

Number of Pages: 41

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EQUIPMENT: **FS31X-87-25-2-RM**

Section 1. Summary of Test Results

Manufacturer: **Fiber-Span**
Model No.: **FS31X-87-25-2-RM**
Serial No.: **A1937-4-1**

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 CFR 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.	SPEC.	RESULT
RF Power Output	90.205	1 kW	Complies
Occupied Bandwidth	90.210	Input/Output	Complies
Spurious Emissions at Antenna Terminals	90.210	Plots	Complies
Field Strength of Spurious Emissions	90.210	Mask	Complies
Frequency Stability	90.213	NA	NA

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.

Transmitter

Frequency Range:

Uplink:	896-901 MHz
Downlink:	935-940 MHz

Power Output Adjustment Capability:	Software
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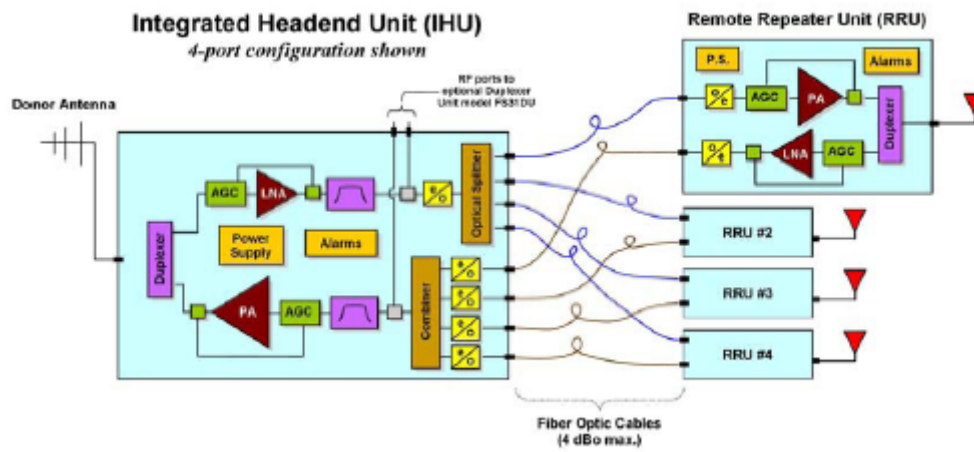
Band Selection:

Software	Duplexer Change	Full Band Coverage
☐	☐	☒

Description of EUT

Fiber optic bi-directional amplifier operating in the 900 MHz LMR band

System Diagram



EQUIPMENT: FS31X-87-25-2-RM

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.1047
TESTED BY: David Light	DATE: 08 January 2007

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

Direction	Modulation	Output per Channel (dBm)	Composite Power (dBm)	Composite Power (W)
Uplink	Analog	30	33	2
Downlink	Analog	30	33	2
Uplink	iDEN	30	33	2
Downlink	iDEN	30	33	2

Equipment Used: 1036-1469-1604-1064-1082-2071-2072**Measurement Uncertainty:** +/- 1.7 dB**Temperature:** 23 °C**Relative Humidity:** 36 %

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2. 1049
TESTED BY: David Light	DATE: 28 December 2006

Test Results: Complies.

Test Data: See attached plot(s).

Equipment Used: 1036-1469-1604-1064-1082

Measurement Uncertainty: 1X10⁻⁷ ppm

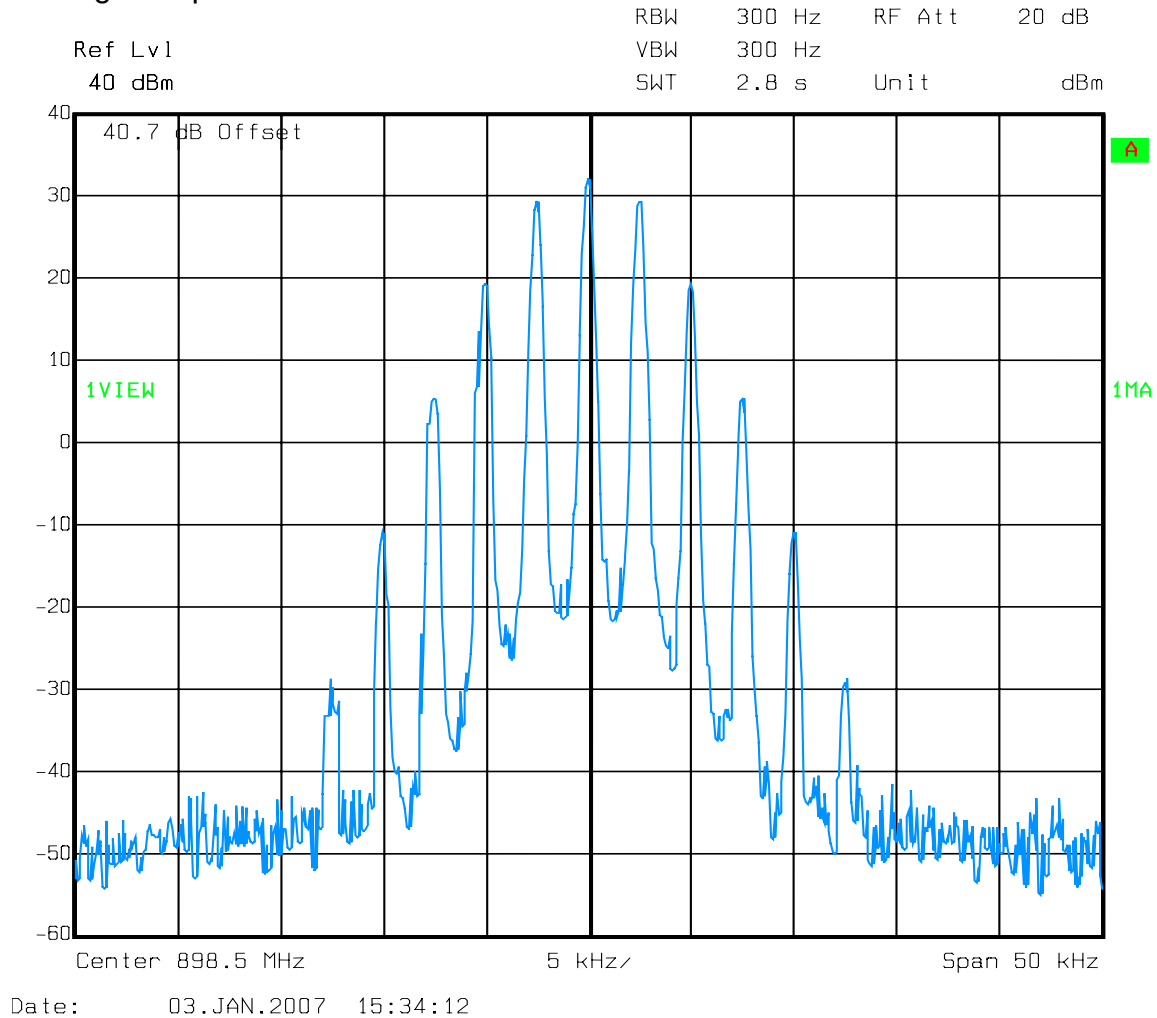
Temperature: 23 °C

Relative Humidity: 40 %

EQUIPMENT: **FS31X-87-25-2-RM**

Test Data – Occupied Bandwidth

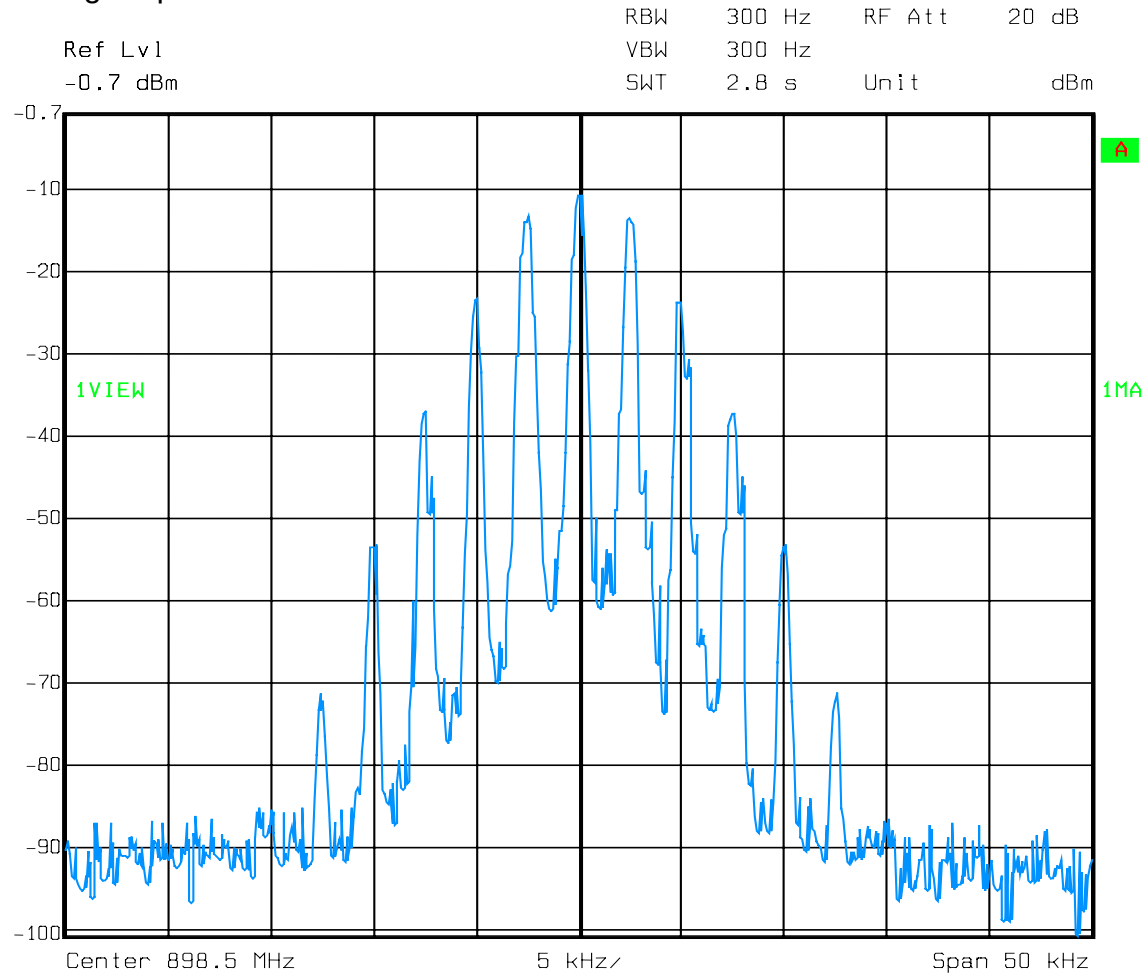
Analog - Output



EQUIPMENT: **FS31X-87-25-2-RM**

Test Data – Occupied Bandwidth

Analog - Input

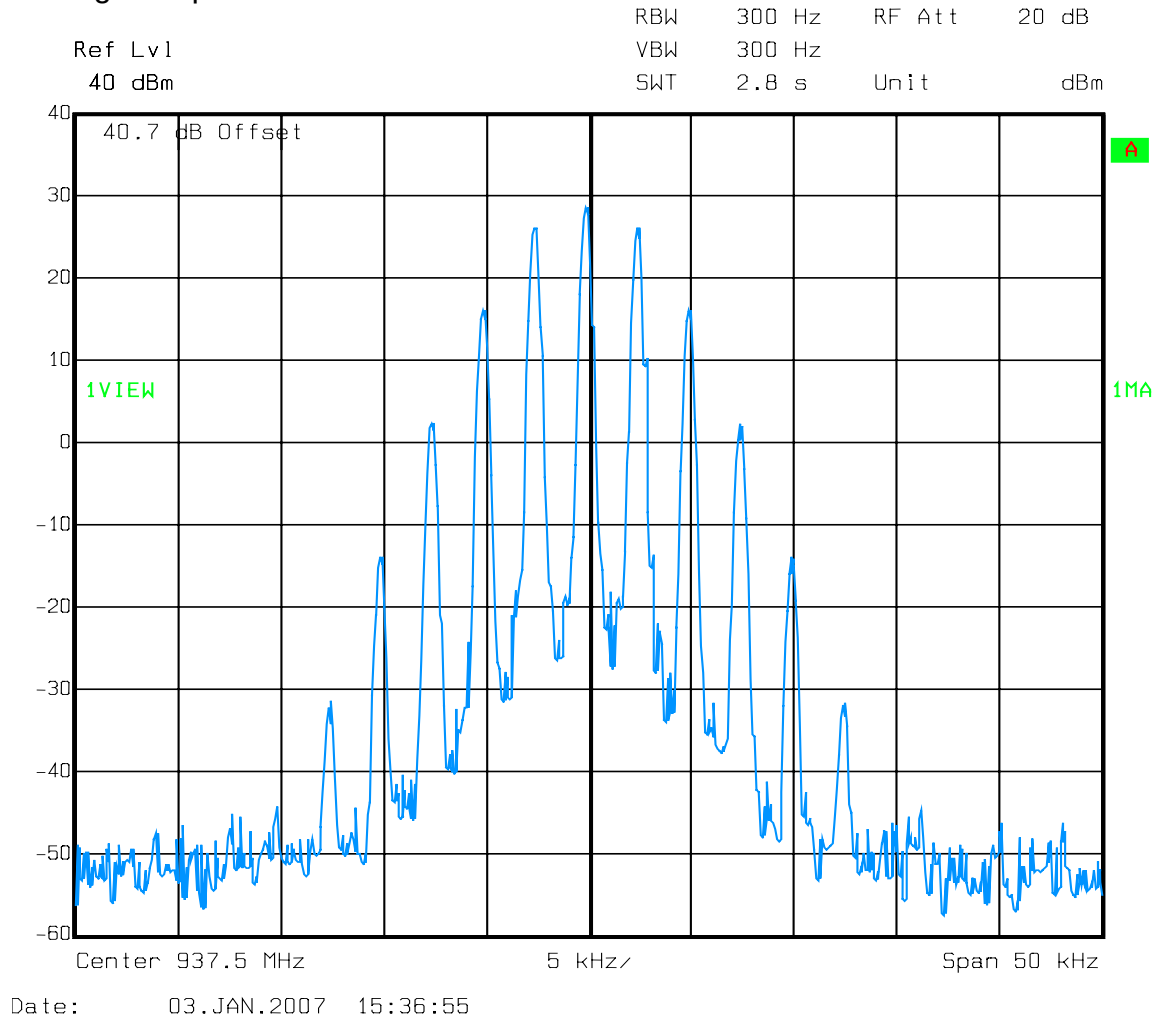


Date: 03.JAN.2007 15:35:11

EQUIPMENT: **FS31X-87-25-2-RM**

Test Data – Occupied Bandwidth

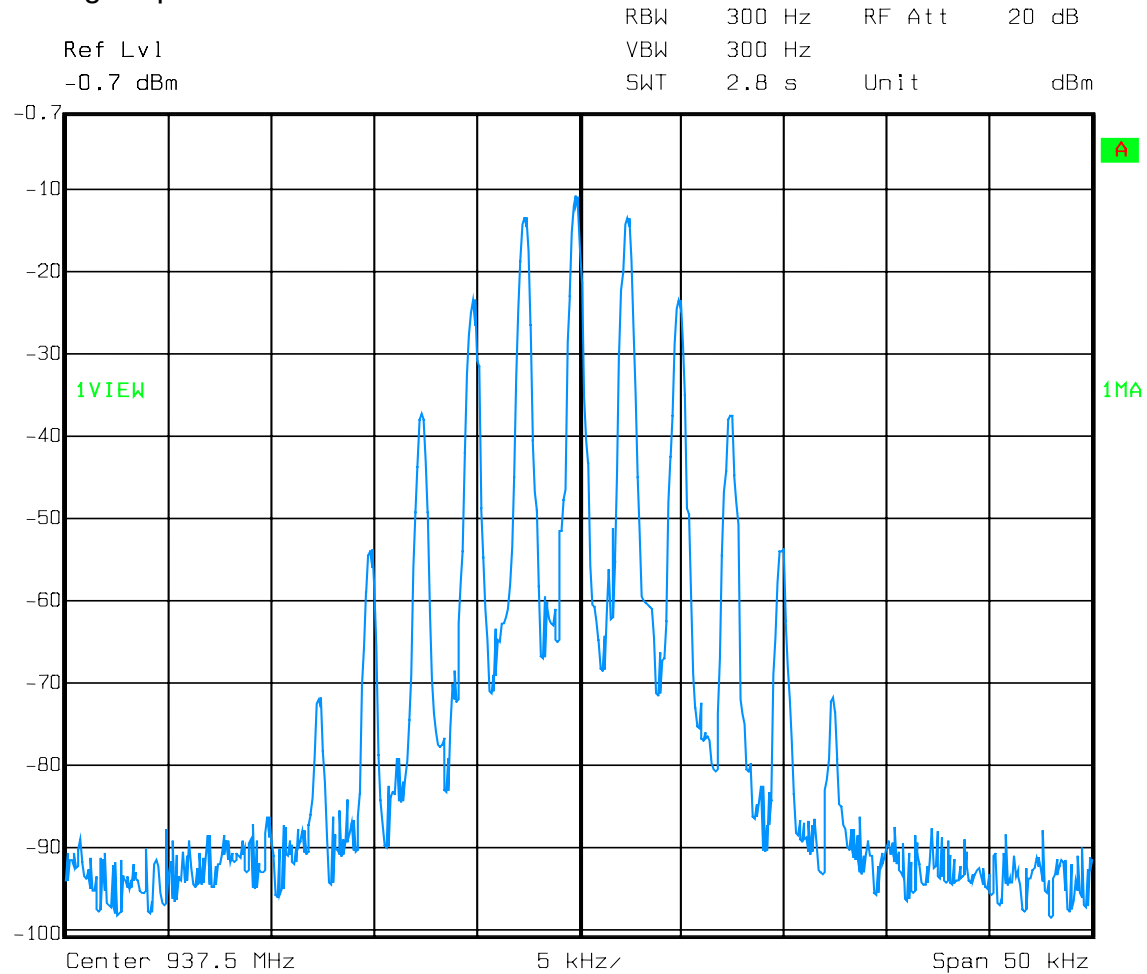
Analog - Output



EQUIPMENT: **FS31X-87-25-2-RM**

Test Data – Occupied Bandwidth

Analog - Input

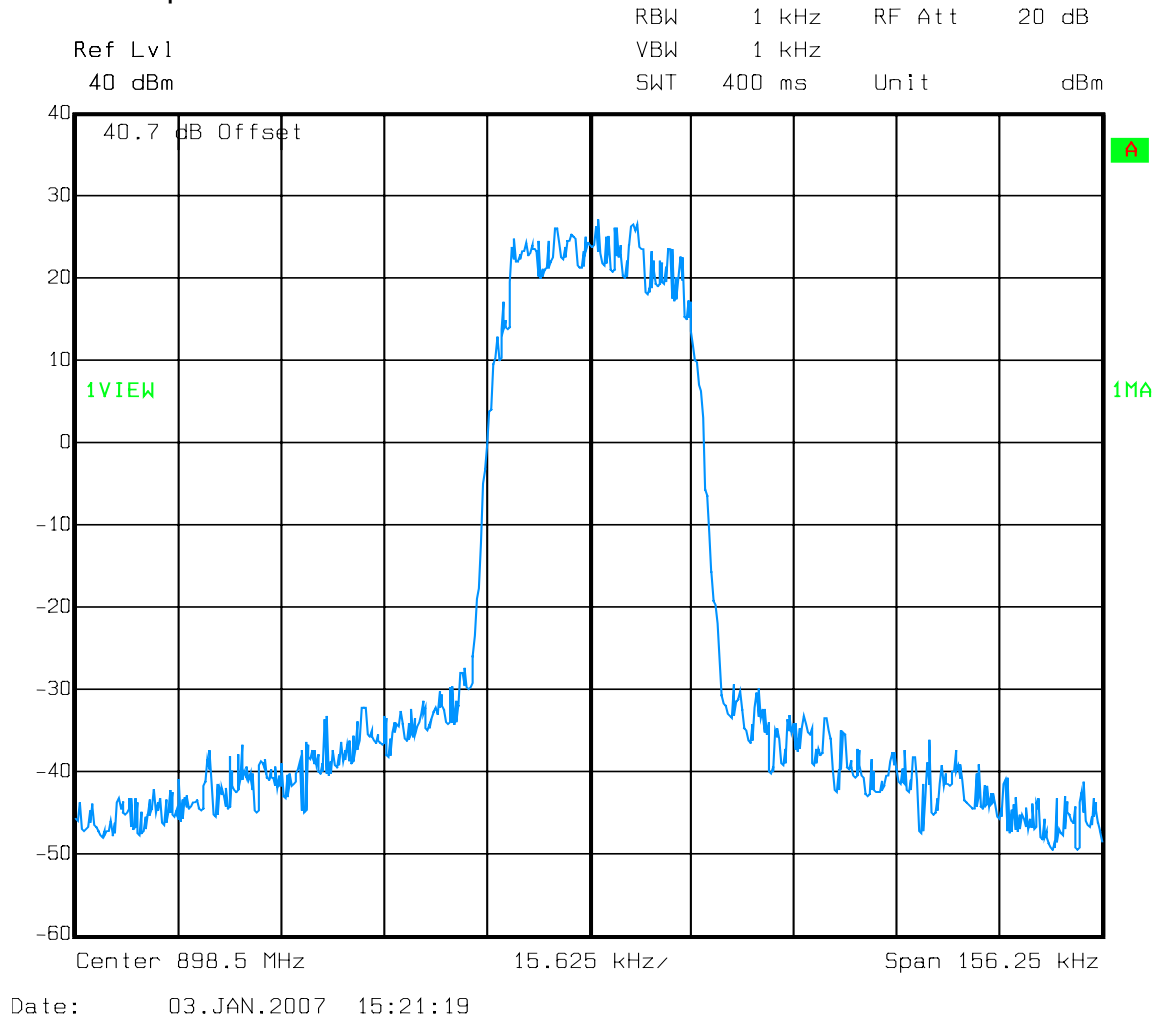


Date: 03.JAN.2007 15:36:05

EQUIPMENT: **FS31X-87-25-2-RM**

Test Data – Occupied Bandwidth

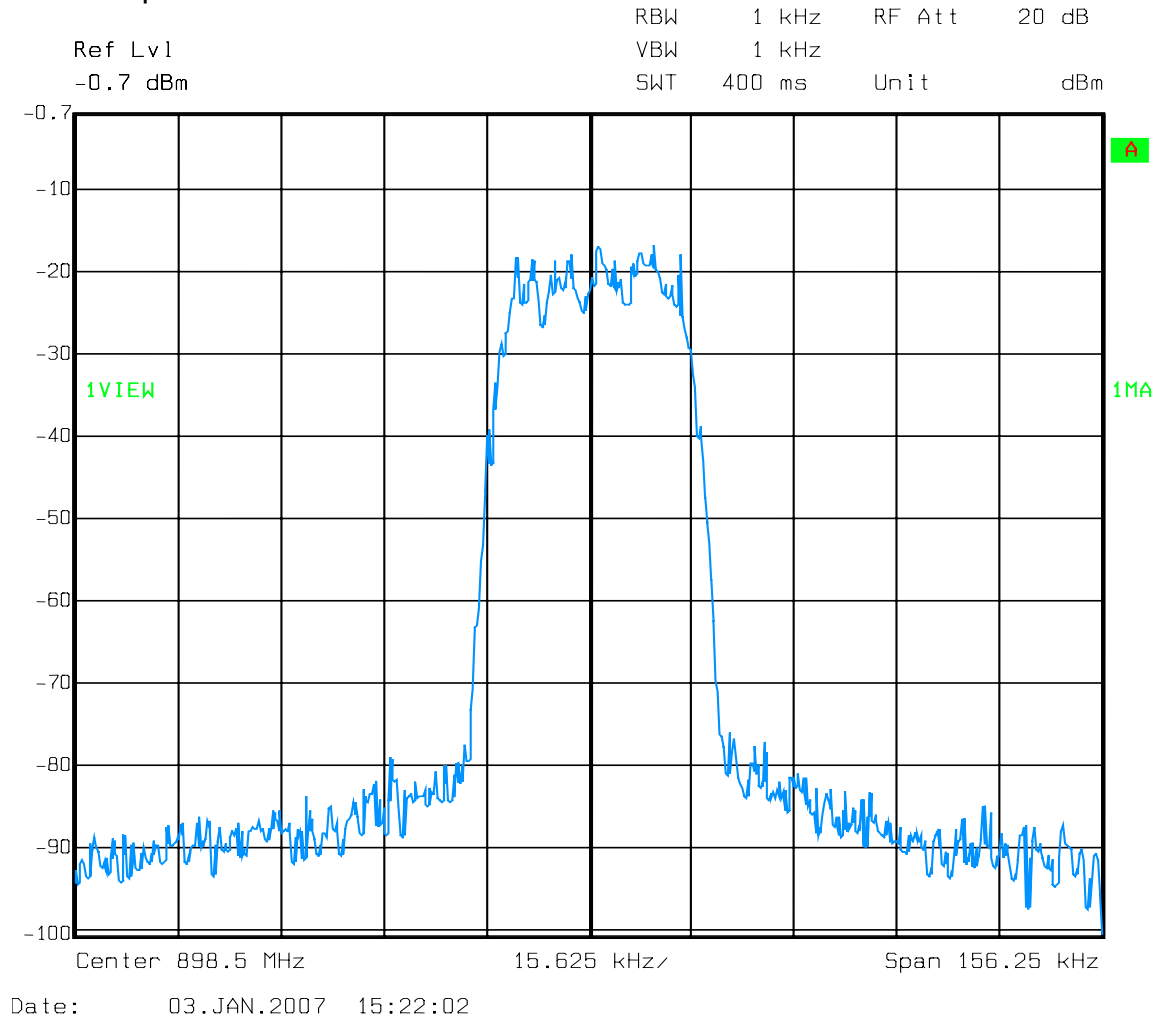
iDEN - Output



EQUIPMENT: **FS31X-87-25-2-RM**

Test Data – Occupied Bandwidth

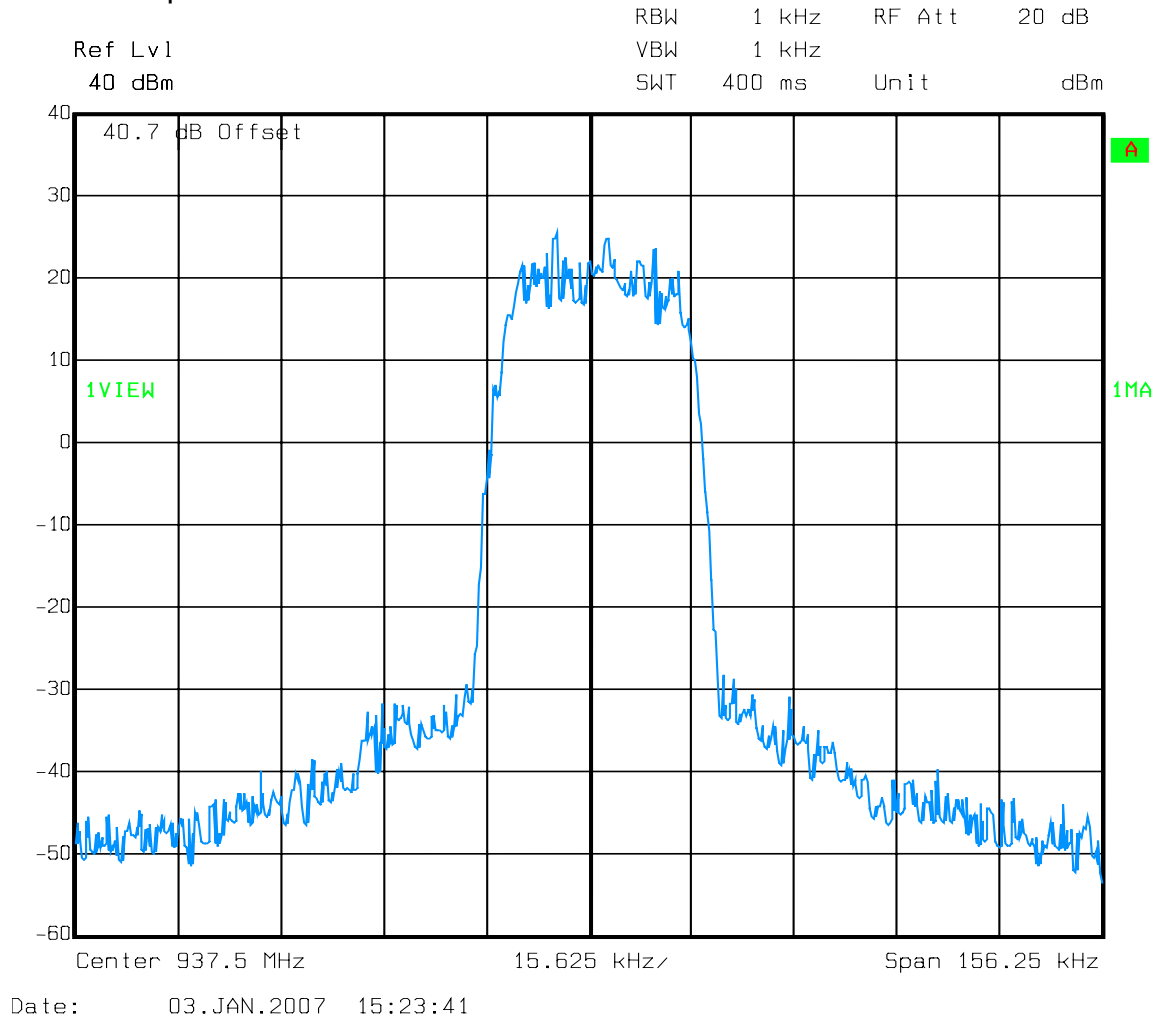
iDEN - Input



EQUIPMENT: **FS31X-87-25-2-RM**

Test Data – Occupied Bandwidth

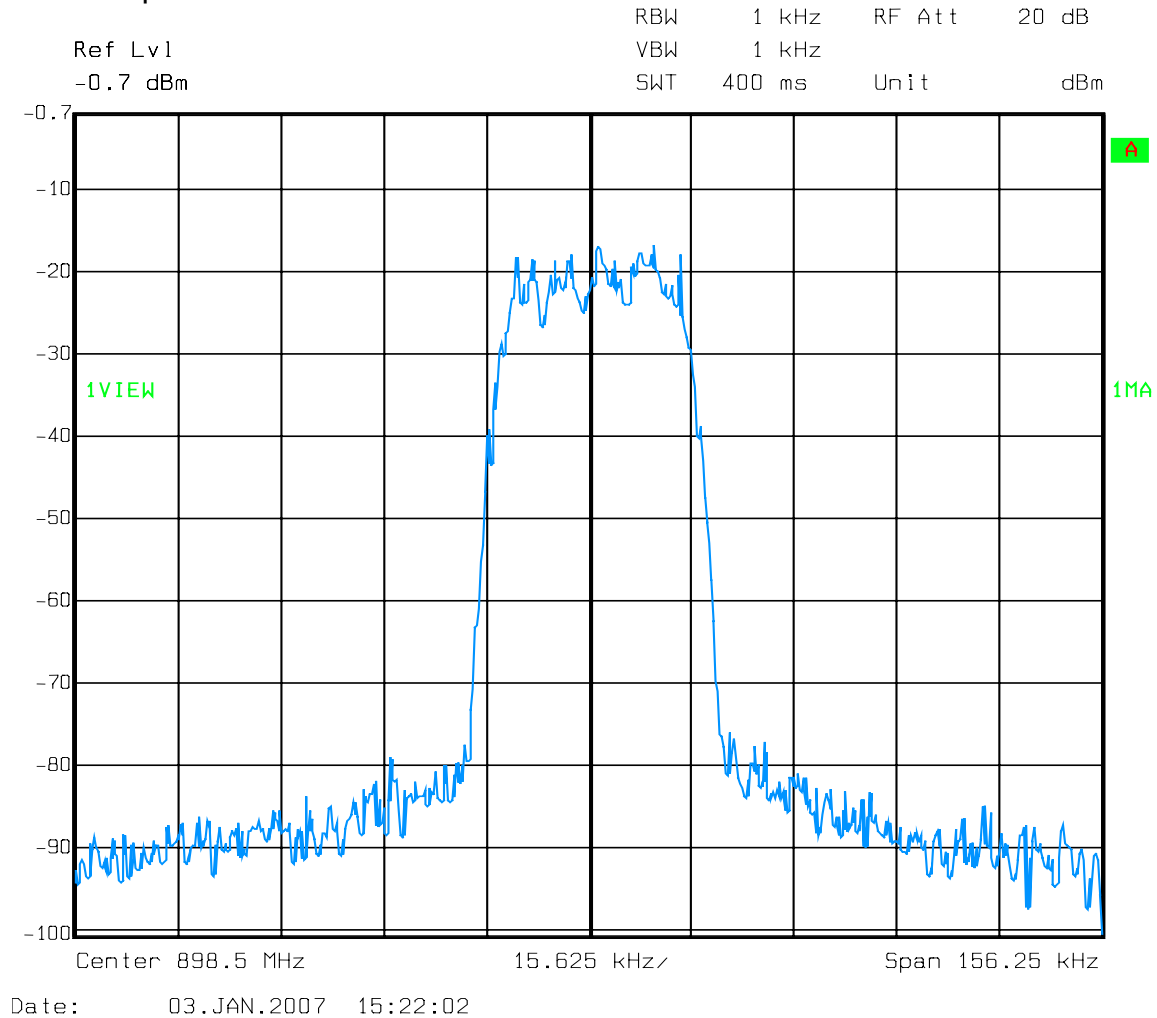
iDEN - Output



EQUIPMENT: **FS31X-87-25-2-RM**

Test Data – Occupied Bandwidth

iDEN - Input



Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.1051
TESTED BY: David Light	DATE: 03 January 07

Test Results: Complies.

Test Data: See attached plot(s).

Equipment Used: 1036-1469-1604-1064-1082

Measurement Uncertainty: +/- 1.7 dB

Temperature: 22 °C

Relative Humidity: 30 %

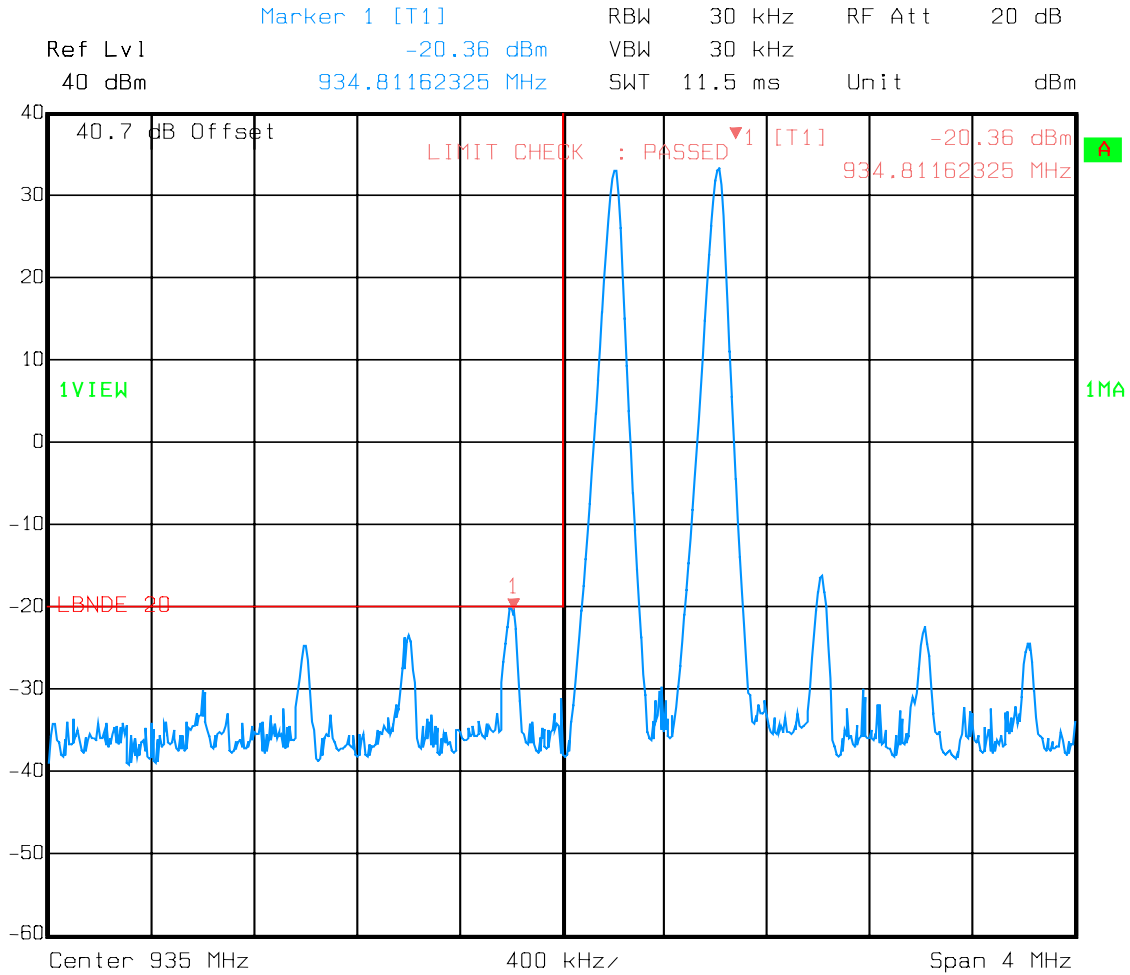
EQUIPMENT: **FS31X-87-25-2-RM**

Test Data – Spurious Emissions at Antenna Terminals

Lower Bandedge Intermodulation

Analog

Downlink



Date: 03.JAN.2007 15:45:57

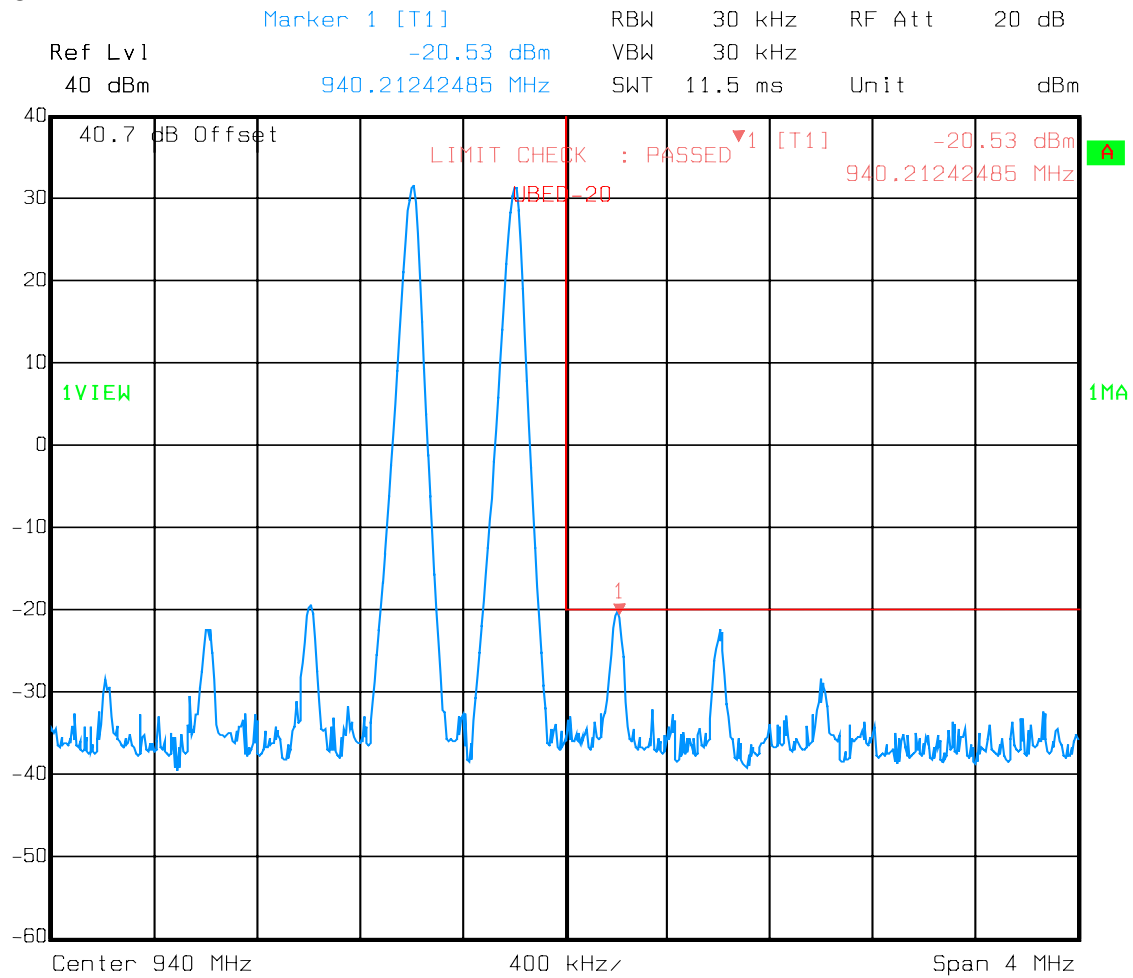
EQUIPMENT: **FS31X-87-25-2-RM**

Test Data – Spurious Emissions at Antenna Terminals

Upper Bandedge Intermodulation

Analog

Downlink



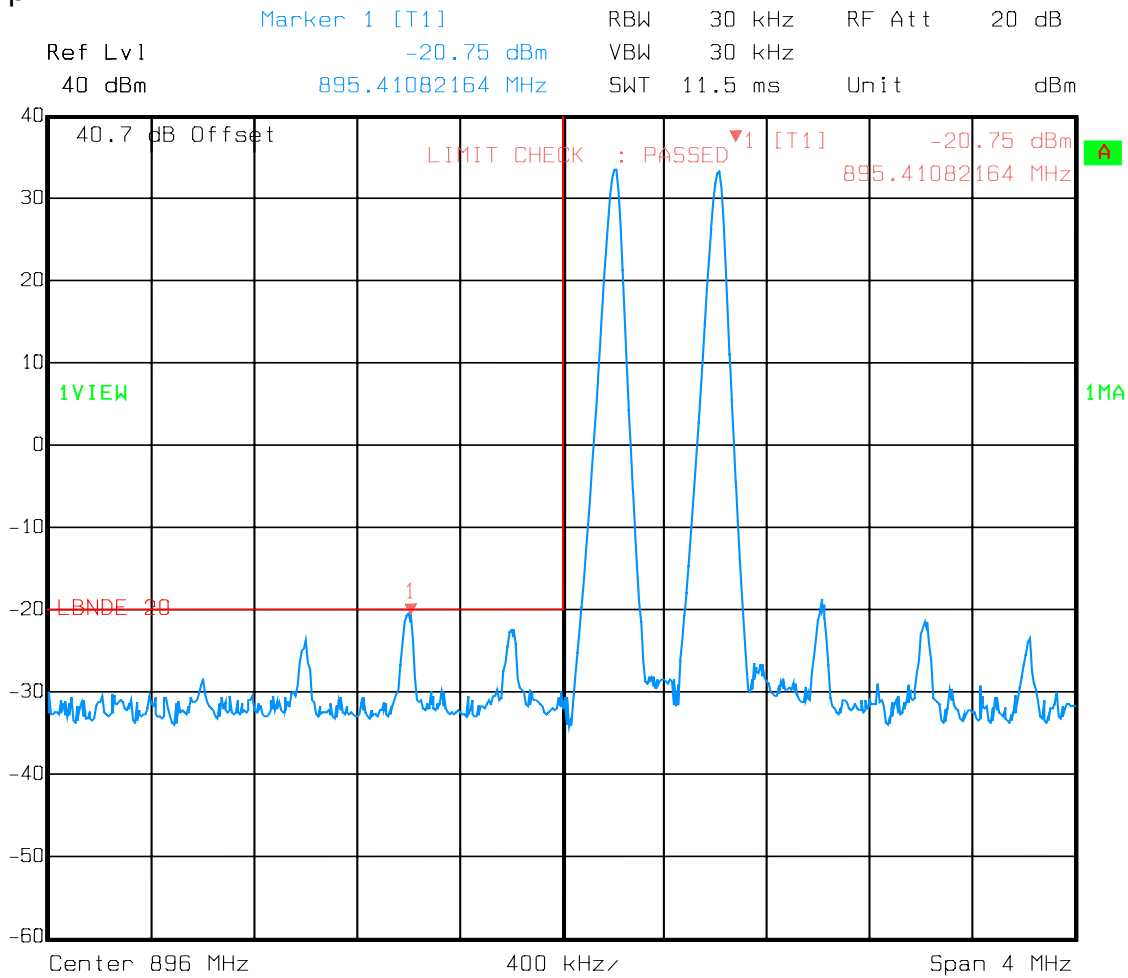
Date: 03.JAN.2007 15:48:58

EQUIPMENT: FS31X-87-25-2-RM**Test Data – Spurious Emissions at Antenna Terminals**

Lower Bandedge Intermodulation

Analog

Uplink



Date: 03.JAN.2007 15:43:40

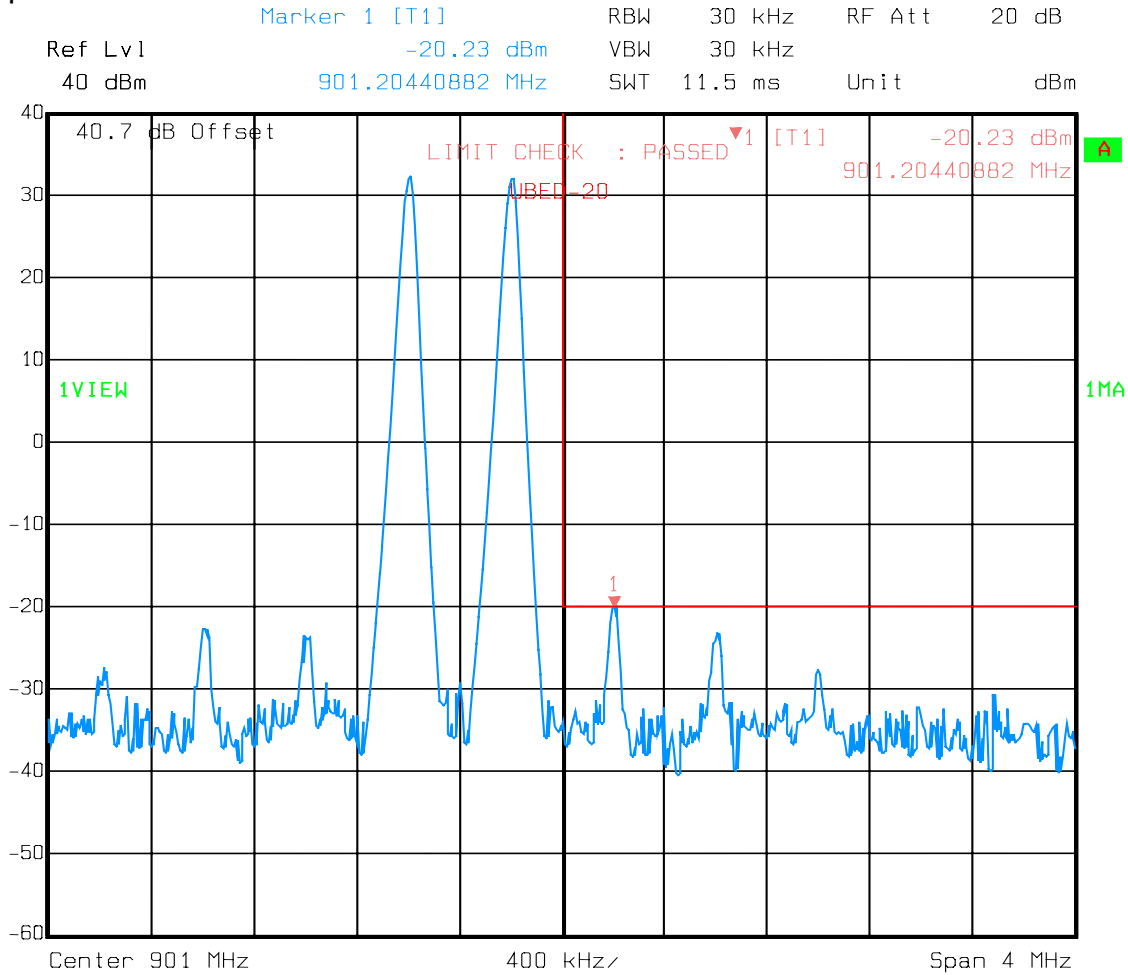
EQUIPMENT: **FS31X-87-25-2-RM**

Test Data – Spurious Emissions at Antenna Terminals

Upper Bandedge Intermodulation

Analog

Uplink

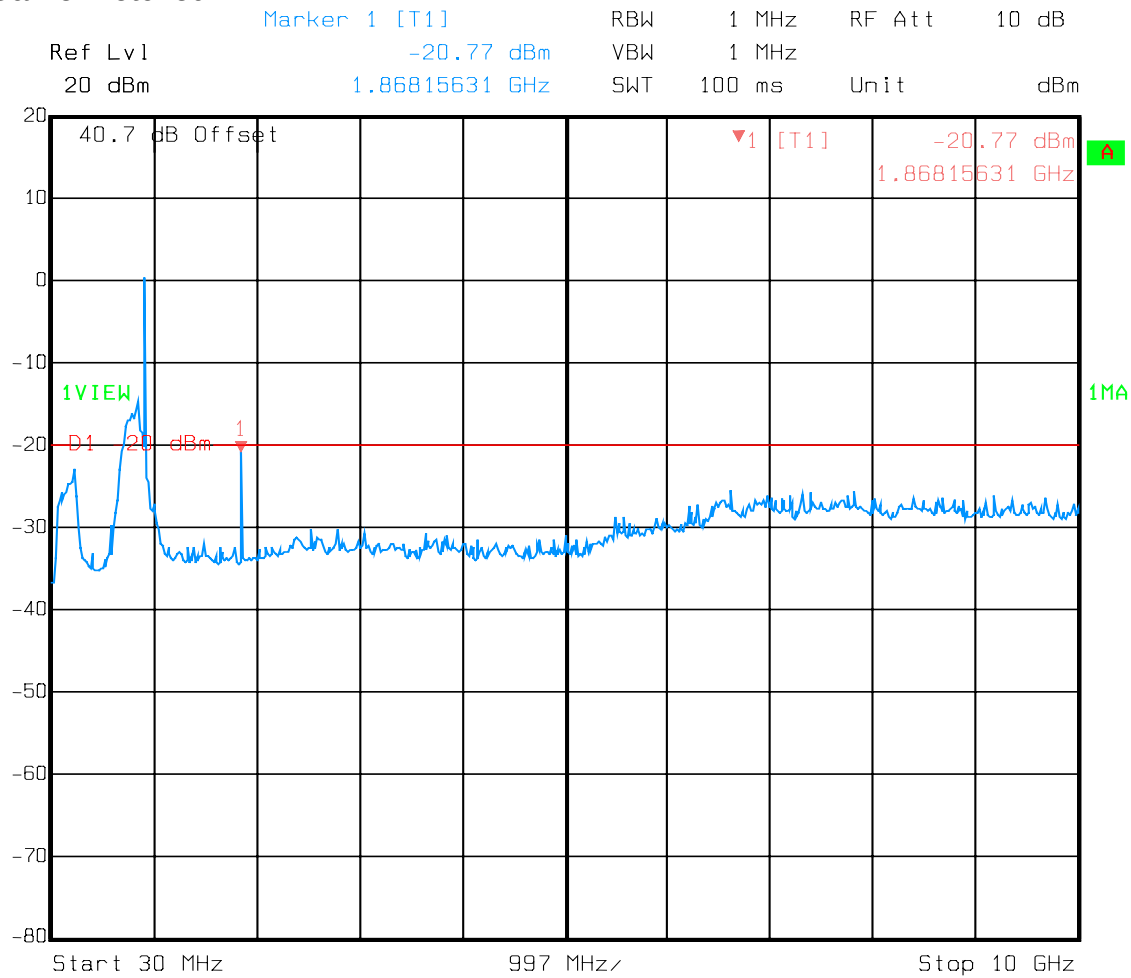


Date: 03.JAN.2007 15:51:55

EQUIPMENT: FS31X-87-25-2-RM**Test Data – Spurious Emissions at Antenna Terminals**

Spurs – Analog – Downlink

Carrier notched

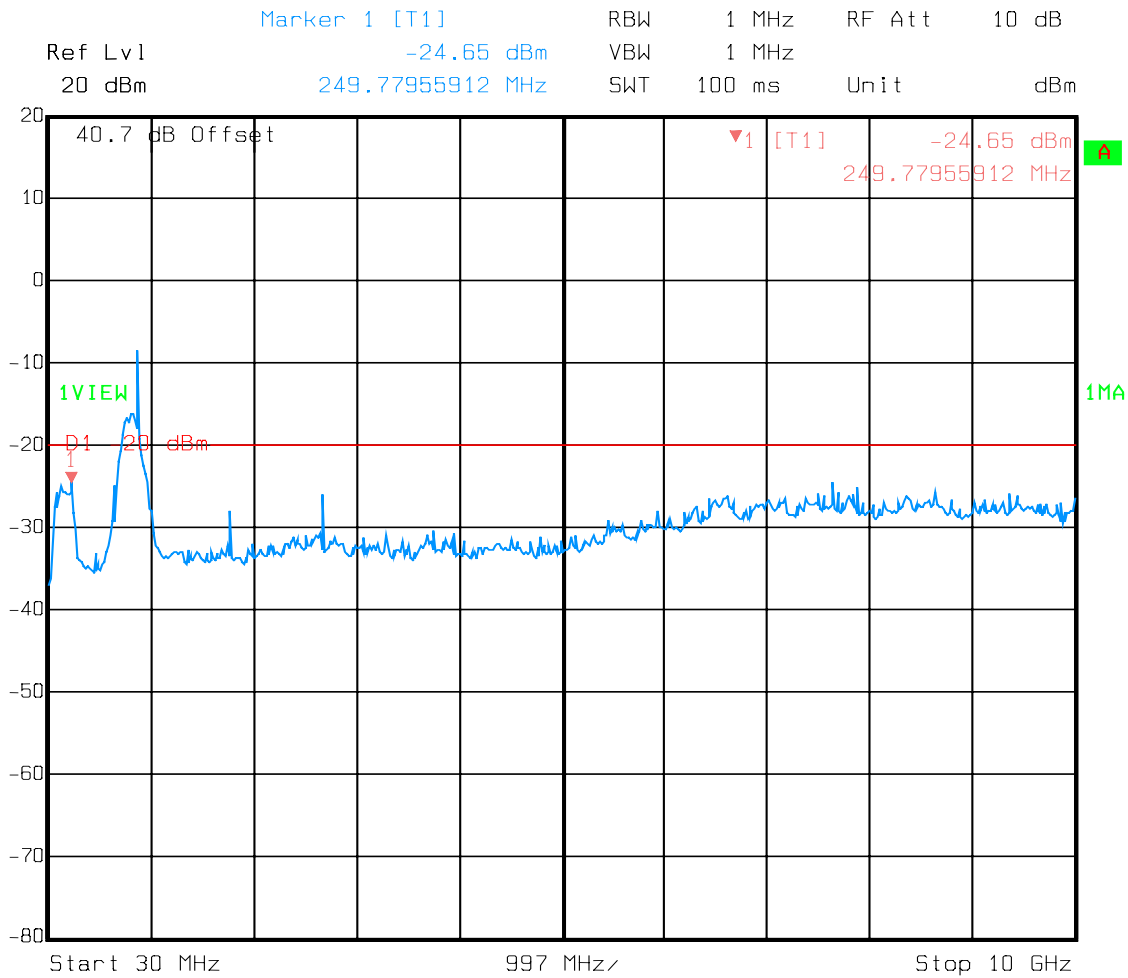


Date: 03.JAN.2007 15:56:51

EQUIPMENT: FS31X-87-25-2-RM**Test Data – Spurious Emissions at Antenna Terminals**

Spurs – Analog - Uplink

Carrier notched



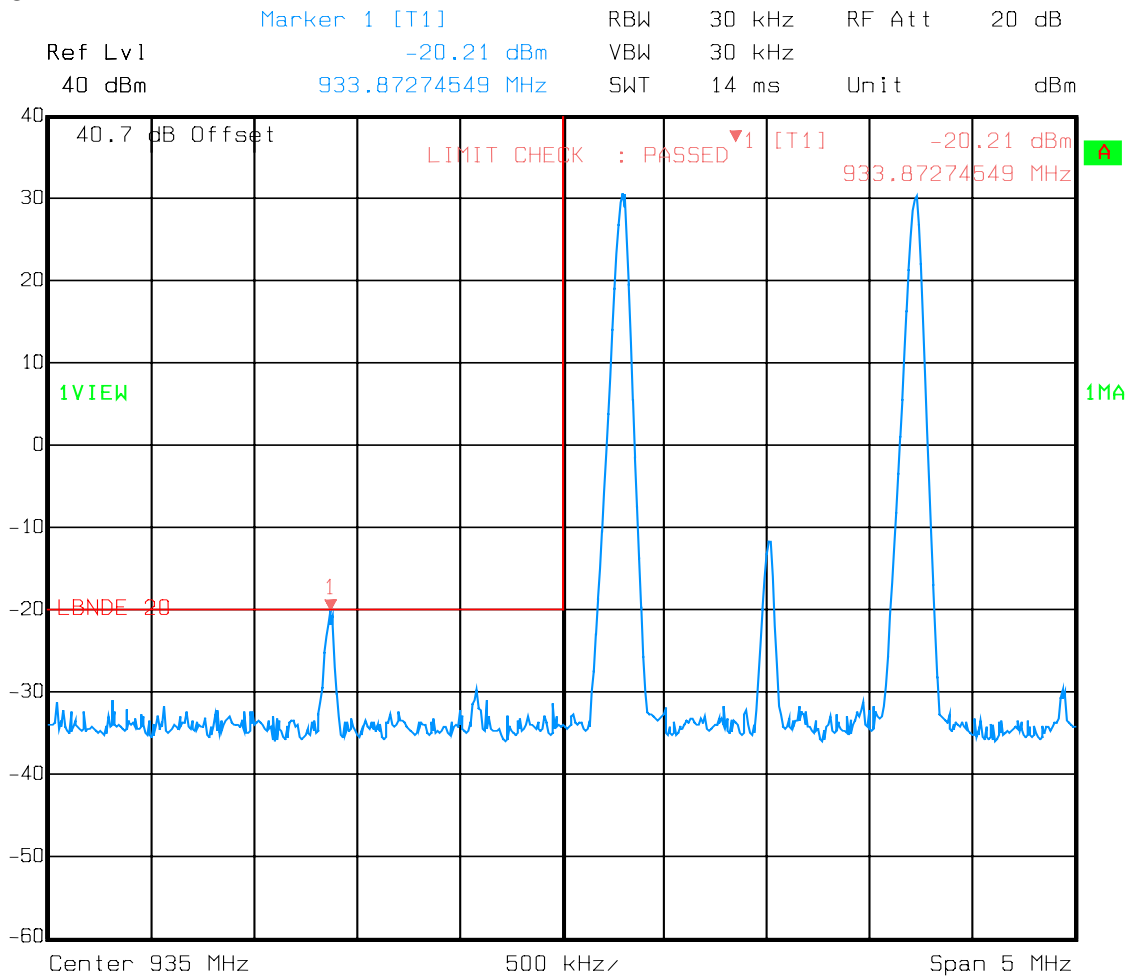
Date: 03.JAN.2007 15:55:28

EQUIPMENT: FS31X-87-25-2-RM**Test Data – Spurious Emissions at Antenna Terminals**

Lower Bandedge Intermodulation

iDEN

Downlink



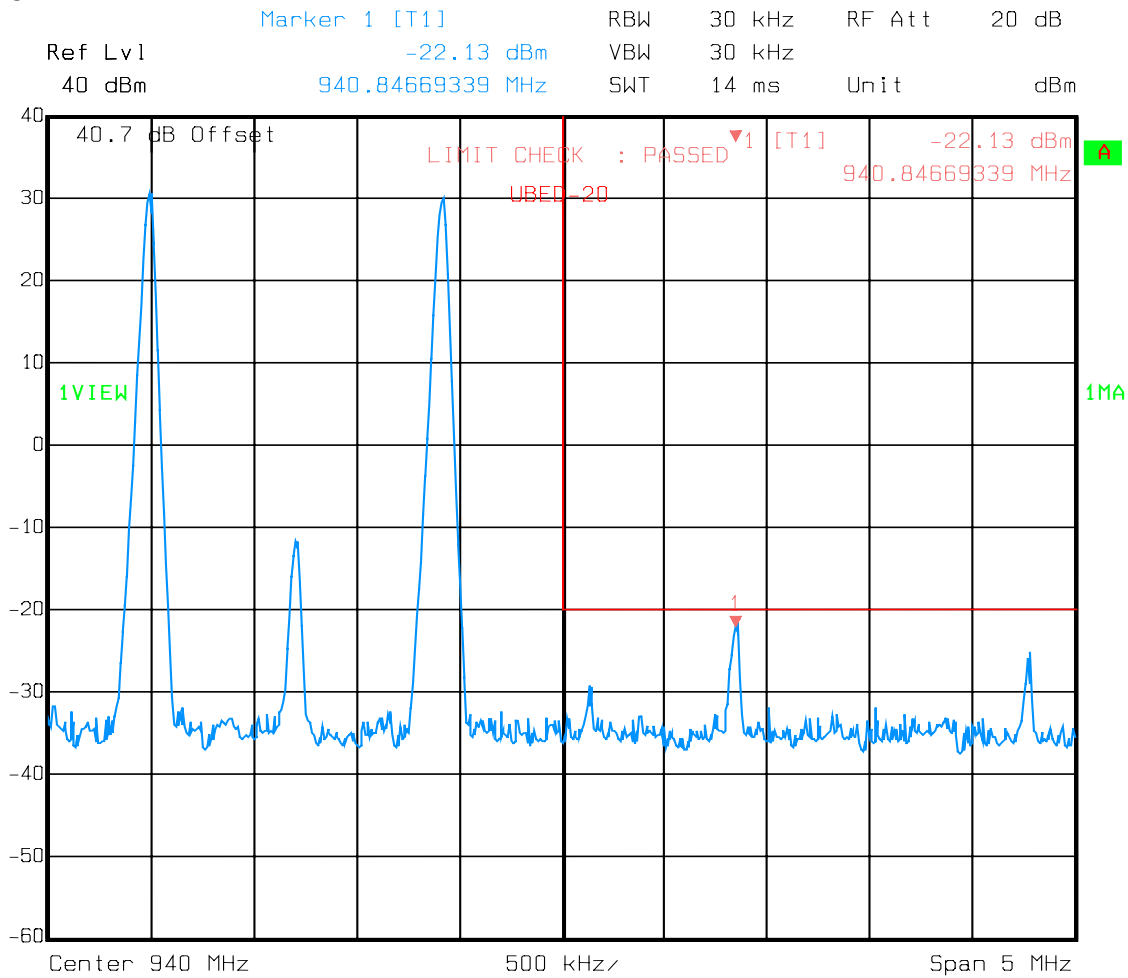
Date: 03.JAN.2007 15:14:08

EQUIPMENT: FS31X-87-25-2-RM**Test Data – Spurious Emissions at Antenna Terminals**

Upper Bandedge Intermodulation

iDEN

Downlink



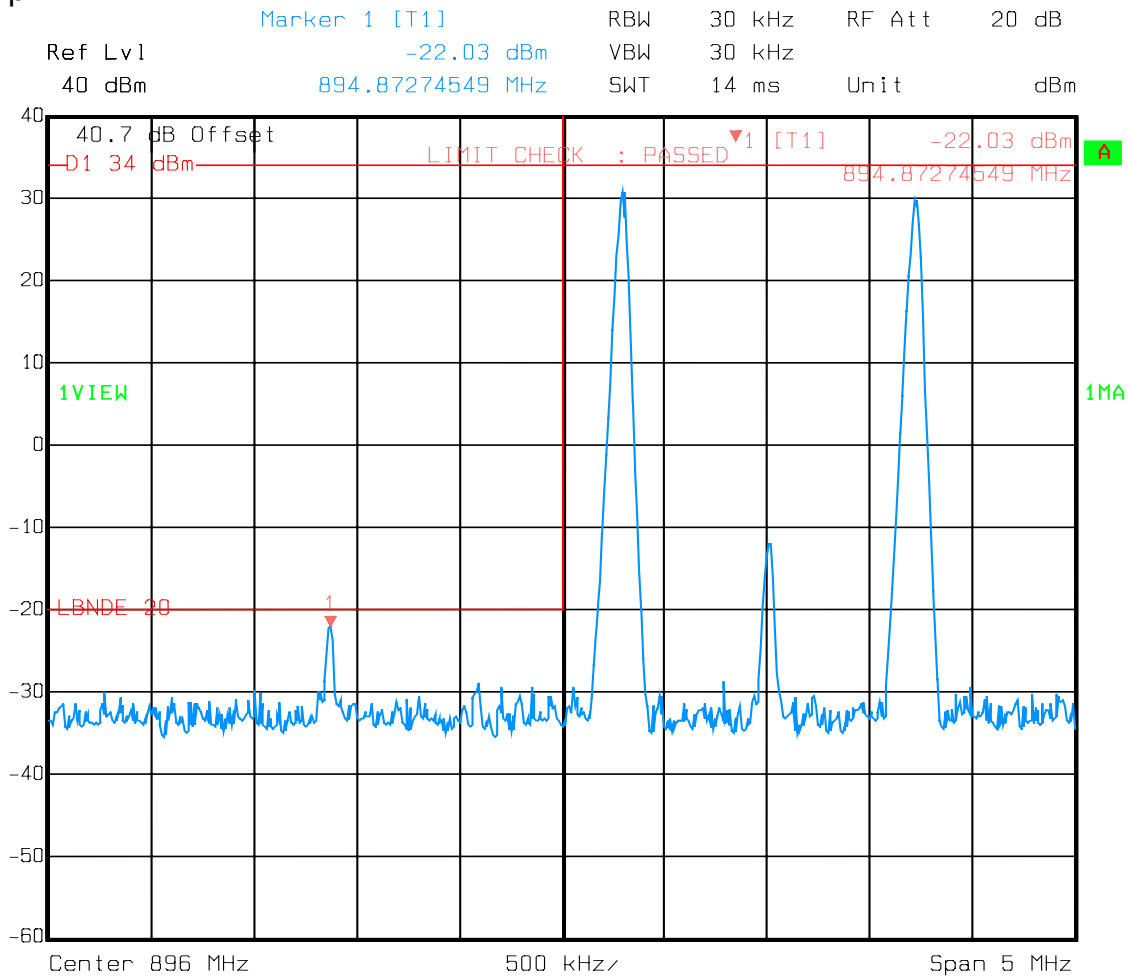
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EQUIPMENT: FS31X-87-25-2-RM**Test Data – Spurious Emissions at Antenna Terminals**

Lower Bandedge Intermodulation

iDEN

Uplink



Date: 03.JAN.2007 15:12:46

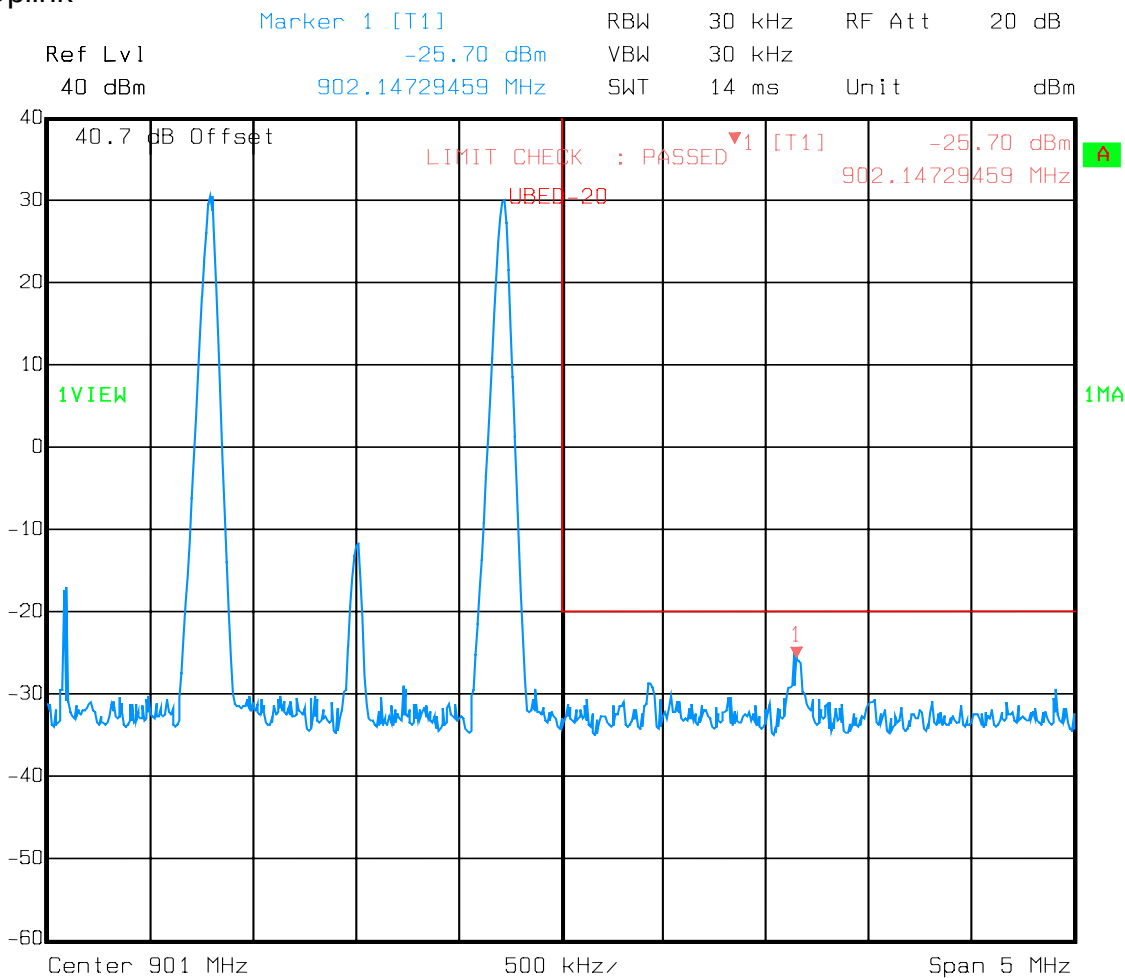
EQUIPMENT: **FS31X-87-25-2-RM**

Test Data – Spurious Emissions at Antenna Terminals

Upper Bandedge Intermodulation

iDEN

Uplink

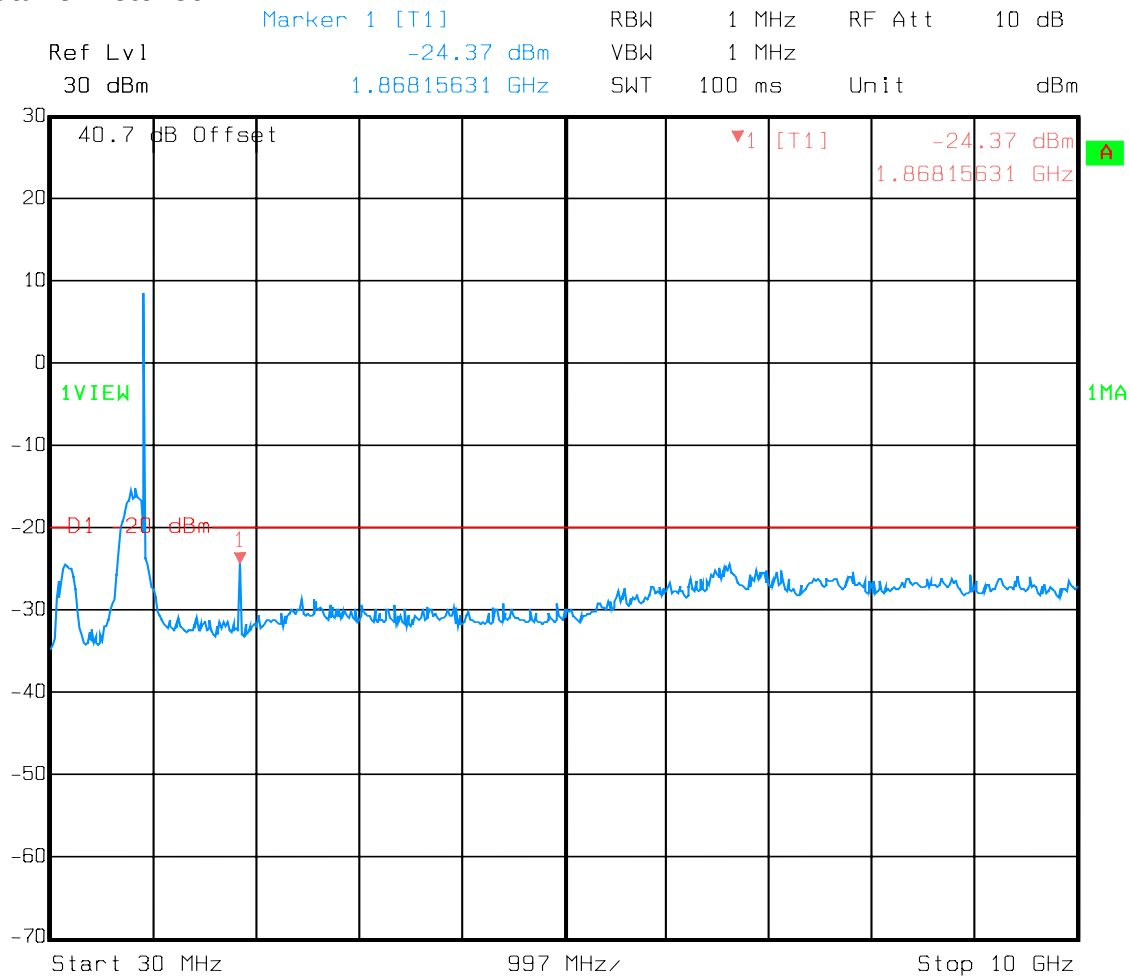


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EQUIPMENT: FS31X-87-25-2-RM**Test Data – Spurious Emissions at Antenna Terminals**

Spurs – iDEN - Downlink

Carrier notched



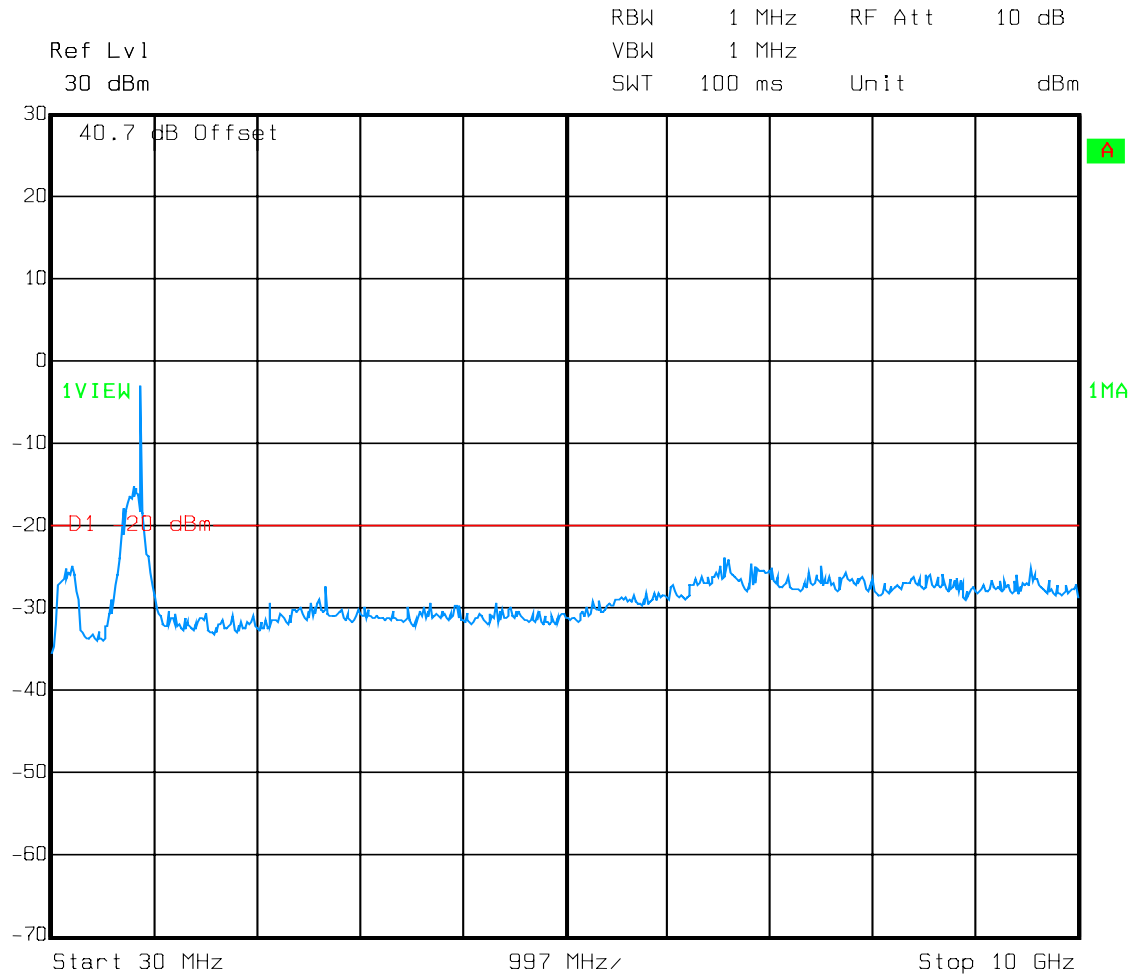
Date: 03.JAN.2007 15:28:41

EQUIPMENT: **FS31X-87-25-2-RM**

Test Data – Spurious Emissions at Antenna Terminals

Spurs – iDEN - Uplink

Carrier notched



Date: 03.JAN.2007 15:27:32

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 January 07

Test Results: Complies.

Test Data: The spectrum was searched from 30 MHz to the tenth harmonic of the carrier. There were no emissions detected above the noise floor which was at least 20 dB below the specification limit.

RBW=VBW=100 kHz below 1000 MHz
RBW=VBW=1 MHz above 1000 MHz

Equipment Used: 759-1195-791-1464-993-1016-1484-1485

Measurement Uncertainty: +/-1.7 dB

Temperature: 23 °C

Relative Humidity: 35 %

Note: See page A5 for applicable limit.

EQUIPMENT: FS31X-87-25-2-RM**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
1082	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	CBU	N/A
1469	10 db Attenuator DC 18 Ghz	MCL Inc. BW-S10W2 10db-2WDC	NONE	CBU	N/A
1604	ATTENUATOR	NARDA 776B-20	NONE	N/A	N/A
1064	ATTENUATOR	NARDA 776B-20	NONE	CBU	N/A
2071	Power Sensor	Agilent E9304A	MY41495174	11/14/06	11/14/07
2072	Power Meter	HP E4418B	GB39401848	11/13/06	11/13/07
759	ANTENNA, LOG PERIODIC	A.H. SYSTEMS SAS-200/510	556	02/13/06	02/13/07
1195	ANTENNA,BICONICAL	A.H. SYSTEMS SAS-200/542	235	02/10/06	02/10/07
791	PREAMP, 25dB	Nemko USA, Inc. LNA25	398	04/20/06	04/20/07
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	04/20/06	04/20/07
993	Horn antenna	A.H. Systems SAS-200/571	XXX	08/01/05	08/02/07
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/14/05	01/15/07
1484	Cable	Storm PR90-010-072	N/A	10/02/06	10/02/07
1485	Cable	Storm PR90-010-216	N/A	10/02/06	10/02/07
1659	Spectrum Analyzer	Rhode & Schwarz FSP	973353	01/10/06	01/10/07

ANNEX A - TEST METHODOLOGIES

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

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: FS31X-87-25-2-RM**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

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

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: **FS31X-87-25-2-RM**

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.1049
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Minimum Standard: Not defined. Input/Output

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

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.

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

EQUIPMENT: FS31X-87-25-2-RM**NAME OF TEST: Frequency Stability****PARA. NO.: 2.1055****Minimum Standard:** Para. No. 990.213. The transmitter carrier frequency shall remain

within the assigned frequency below in ppm.

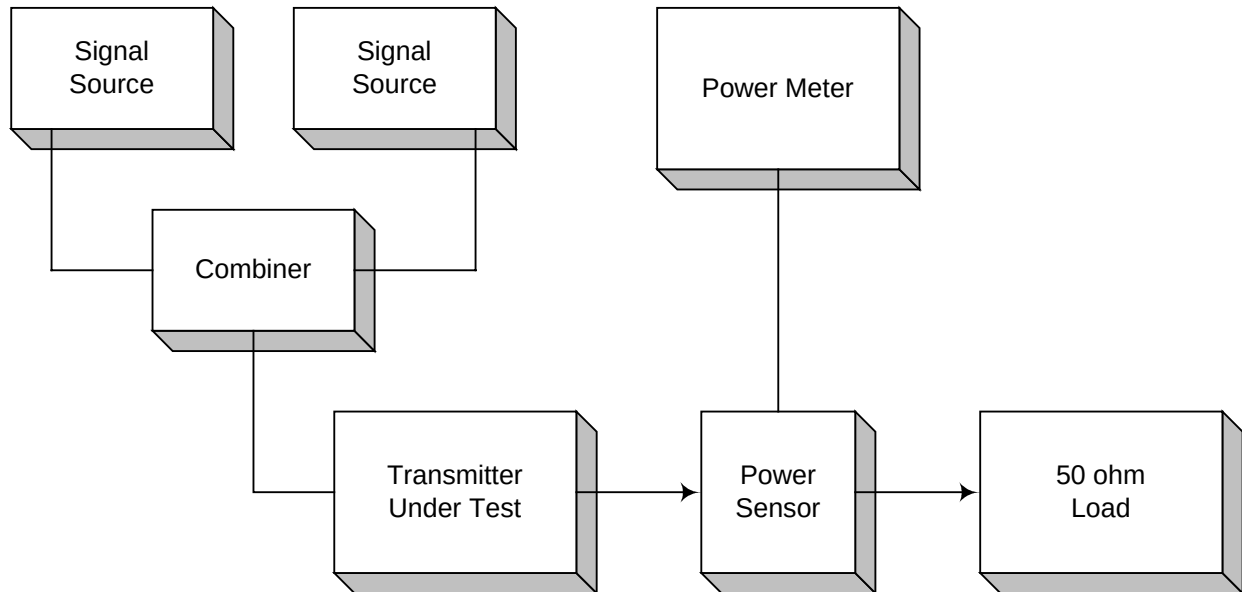
Table 2

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	-	-	-

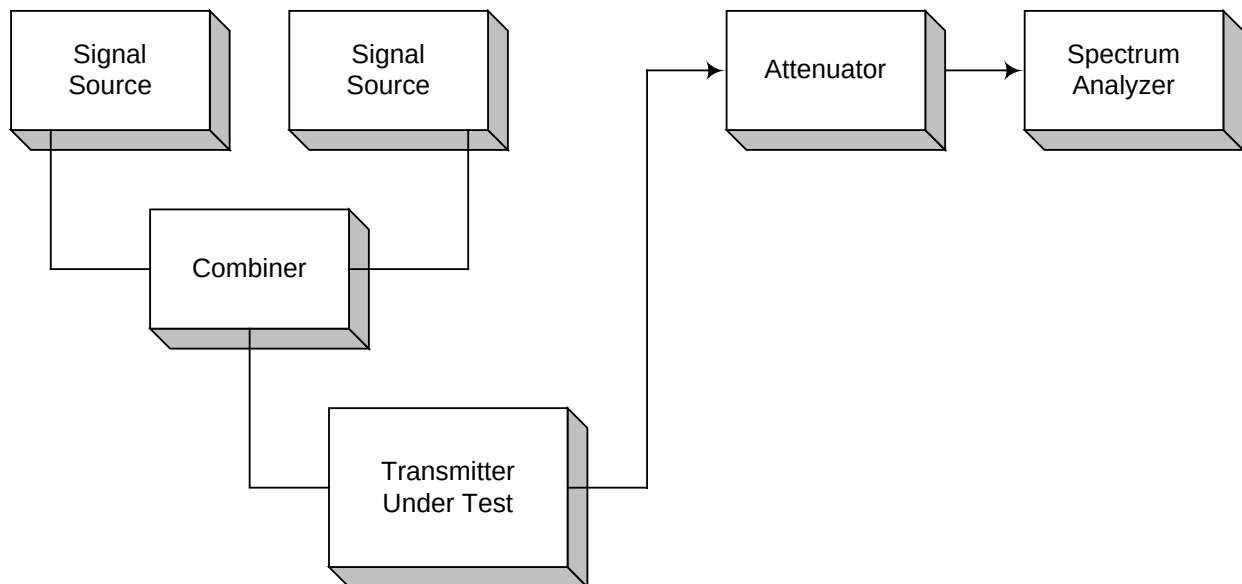
ANNEX B - TEST DIAGRAMS

EQUIPMENT: **FS31X-87-25-2-RM**

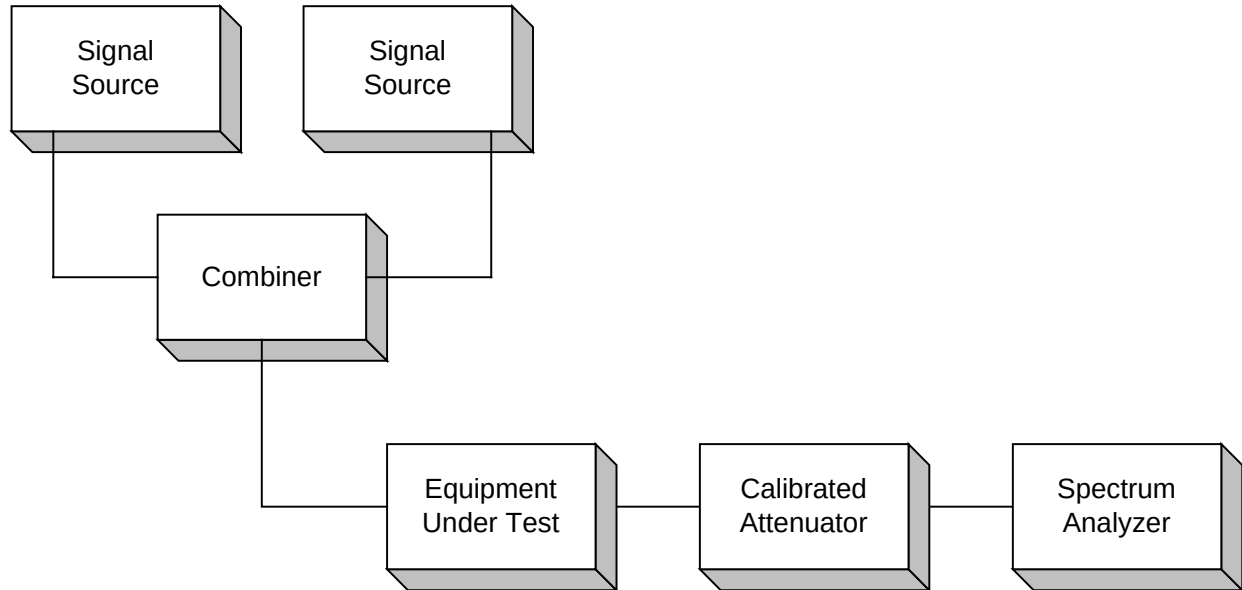
Para. No. 2.1046 - R.F. Power Output



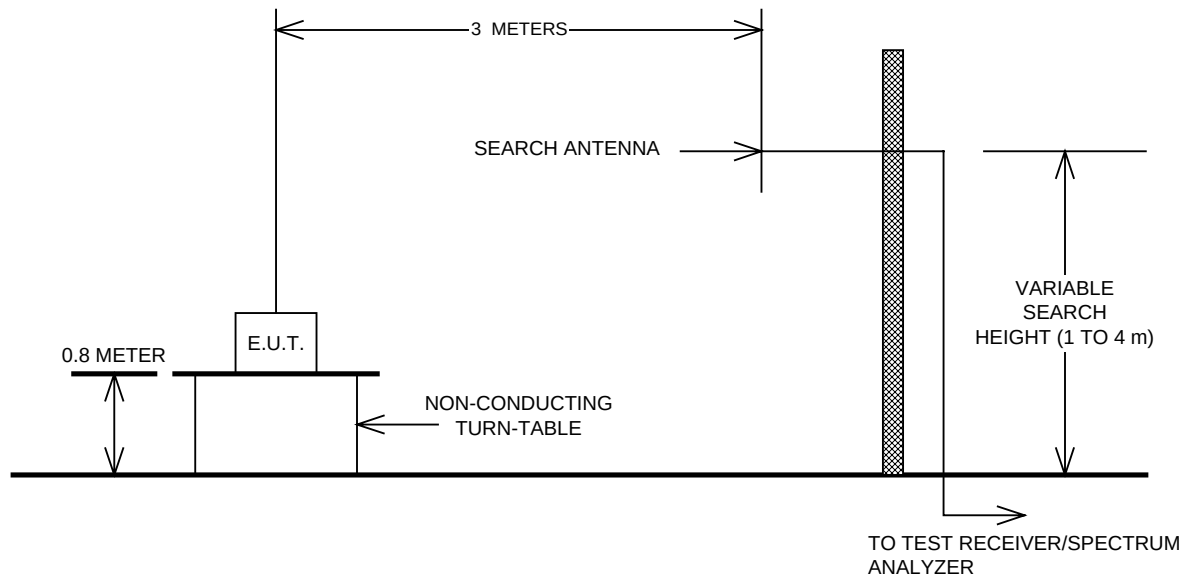
Para. No. 2.1049 - Occupied Bandwidth



Para. No. 2.1051 - Spurious Emissions at Antenna Terminals



Para. No. 2.1053 - Field Strength of Spurious Radiation



Para. No. 2.1055 Frequency Stability

