

Nemko Test Report: 6L0003RUS1

Applicant: Andrew Corporation

Equipment Under Test: MR803D
(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: 
Kevin Rose
Wireless Engineer

Date: February 8, 2006

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EQUIPMENT: MR803D

PROJECT NO.: 6L0003RUS1

Section 1. Summary of Test Results

Manufacturer: Andrew Corporation

Model No.: MR803D

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.



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	90.635	100W	Complies
Occupied Bandwidth	90.210	Input/Output	Complies
Spurious Emissions at Antenna Terminals	90.210	-13 to -20 dBm	Complies
Field Strength of Spurious Emissions	90.210	-13 to -20 dBm	Complies
Frequency Stability	90.213	N/A	N/A
Transient Frequency Behavior	90.214	N/A	N/A
Out of Band Rejection	NA	None	

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.
 - (3) The E.U.T. does not translate frequency, Frequency stability was nor performed.
 - (4) Input level was adjusted for maximum RF input level for all tests.
- .

EQUIPMENT: MR803D

PROJECT NO.: 6L0003RUS1

Section 2. General Equipment Specification**Transmitter**

Supply Voltage Input: 120 Vac

Frequency Range: 806.0125 to 823.9875 MHz Uplink
851.0125 to 868.9875 MHz Downlink

Tunable Bands:

20 dB Passband:

Type(s) of Modulation:	F3E/ F1D (Analog)	GXW (iDEN)
	☒	☒

Gain: 60

Output Impedance: 50 ohms

RF Power Output (rated):	Output Power per Carrier, dBm			
Technology	1	2	4	8
Analog	18	15	12	9
iDEN	16	13	10	7

Channel Spacing(s): 12.5 kHz

Operator Selection of Operating Frequency: None

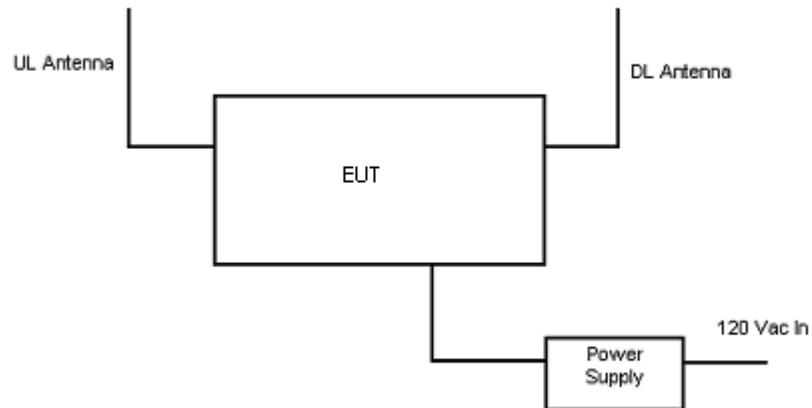
Frequency Translation:	F1-F1	F1-F2	N/A
	☒	☐	☐

Band Selection:	Software	Duplexer Change	Fullband Coverage
	☐	☐	☒

Theory of Operation

The MR803D band selective mini repeater is a bi-directional amplifier used to enhance signals between a mobile and base station in a wireless network.

System Diagram



EQUIPMENT: MR803D**PROJECT NO.: 6L0003RUS1**

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 90.635
TESTED BY: David Light	DATE: 08 February 2006

Test Results: Complies**Measurement Data:**

Frequency (MHz)	Measured Power (dBm)	Rated Power (dBm)	Technology
806.0125	+18.14	+18	Analog
815	+18.09	+18	Analog
823.9875	+18.20	+18	Analog
806.0125	+16.08	+16	iDEN
815	+16.02	+16	iDEN
823.9875	+16.06	+16	iDEN
851.0125	+18.04	+18	Analog
860	+18.07	+18	Analog
868.9875	+18.0	+18	Analog
851.0125	+16.18	+16	iDEN
860	+16.03	+16	iDEN
868.9875	+16.1	+16	iDEN

Equipment Used: 1036-1472-1626-1053-1052-1081**Measurement Uncertainty:** $\pm 1.7 \text{ dB}$ dB
 1×10^{-7} ppm**Temperature:** 22 °C**Relative Humidity:** 45 %

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 90.210
TESTED BY: David Light	DATE: 08 February 2006

Test Results: Complies.

Test Data: See attached graph(s).

Equipment Used: 1036-1472-1626-1053-1052-1081

Measurement Uncertainty: +/- 1.7 dB dB
1x10⁻⁷ ppm

Temperature: 22 °C

Relative Humidity: 45 %

Note: Analog test were performed using a 2.5 kHz tone with 3 kHz peak deviation.

Test Data – Occupied Bandwidth

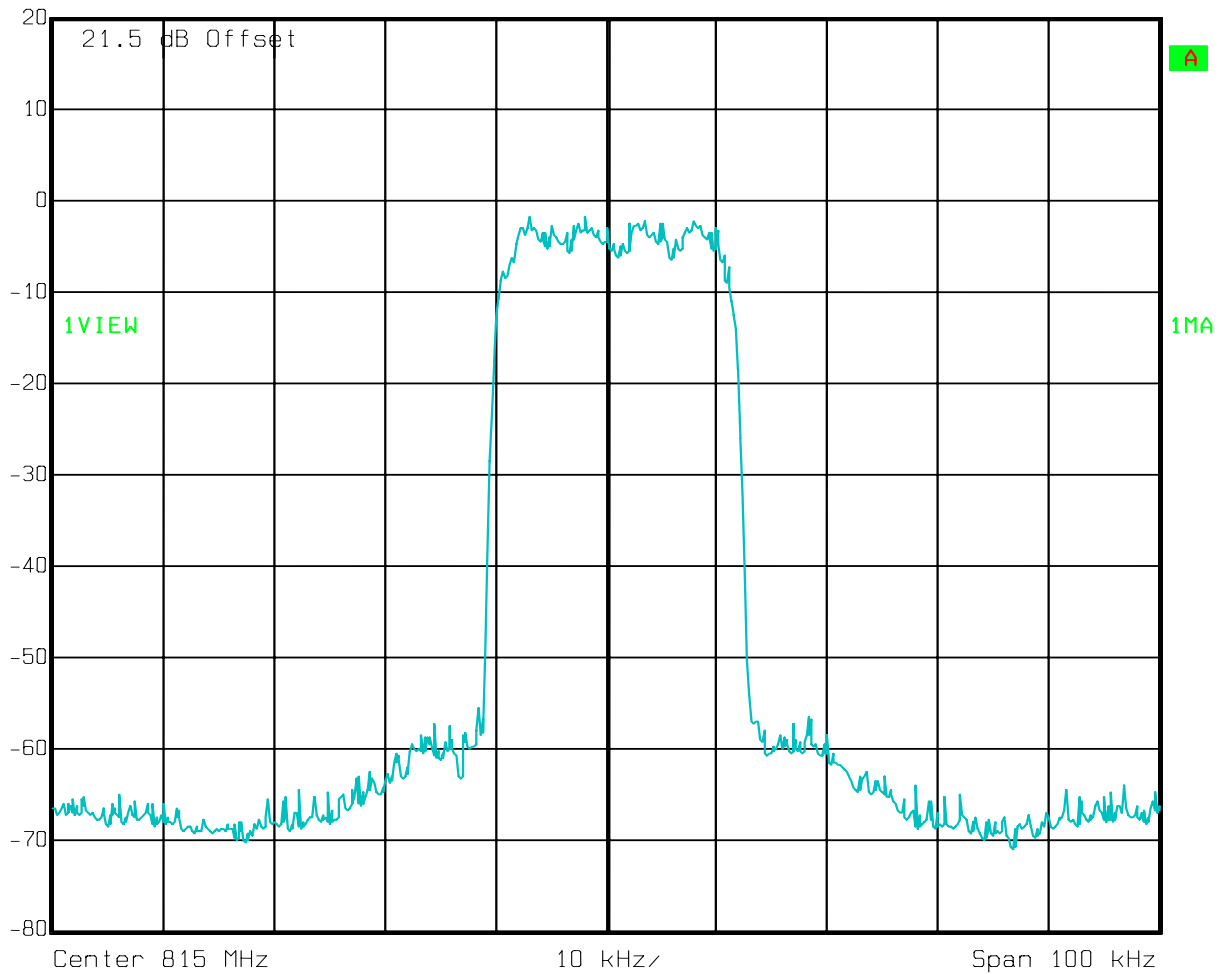
Uplink - Output

iDEN



Ref Lvl
20 dBm

RBW	300 Hz	RF Att	20 dB
VBW	300 Hz		
SWT	5.6 s	Unit	dBm



Date: 08.FEB.2006 14:13:14

EQUIPMENT: MR803D

PROJECT NO.: 6L0003RUS1

Test Data – Occupied Bandwidth

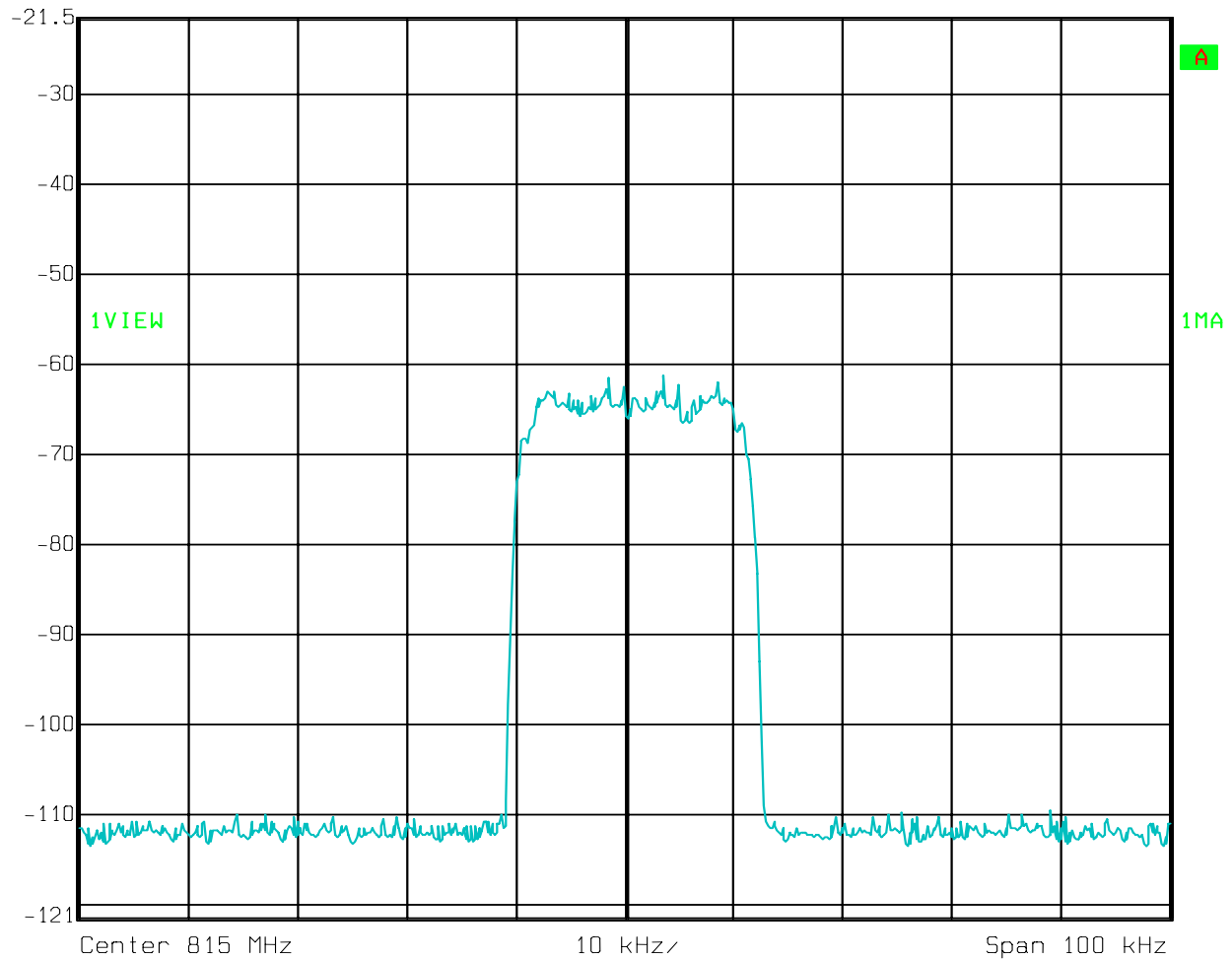
Uplink - Input

iDEN



Ref Lvl
-21.5 dBm

RBW	300 Hz	RF Att	10 dB
VBW	300 Hz		
SWT	5.6 s	Unit	dBm



Date: 08.FEB.2006 14:15:13

Test Data – Occupied Bandwidth

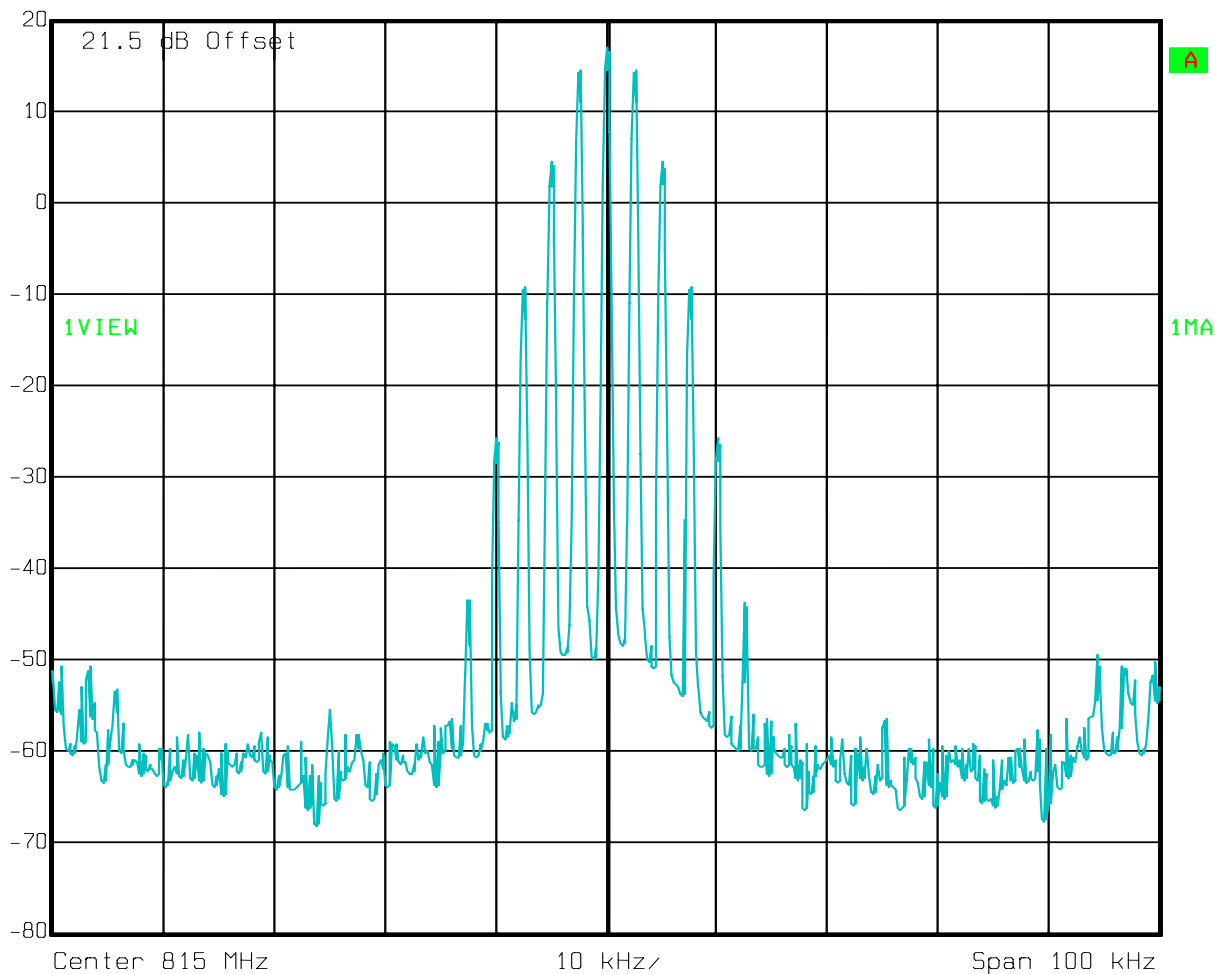
Uplink - Output

Analog



Ref Lvl
20 dBm

RBW	300 Hz	RF Att	20 dB
VBW	300 Hz		
SWT	5.6 s	Unit	dBm



Date: 08.FEB.2006 14:52:26

EQUIPMENT: MR803D

PROJECT NO.: 6L0003RUS1

Test Data – Occupied Bandwidth

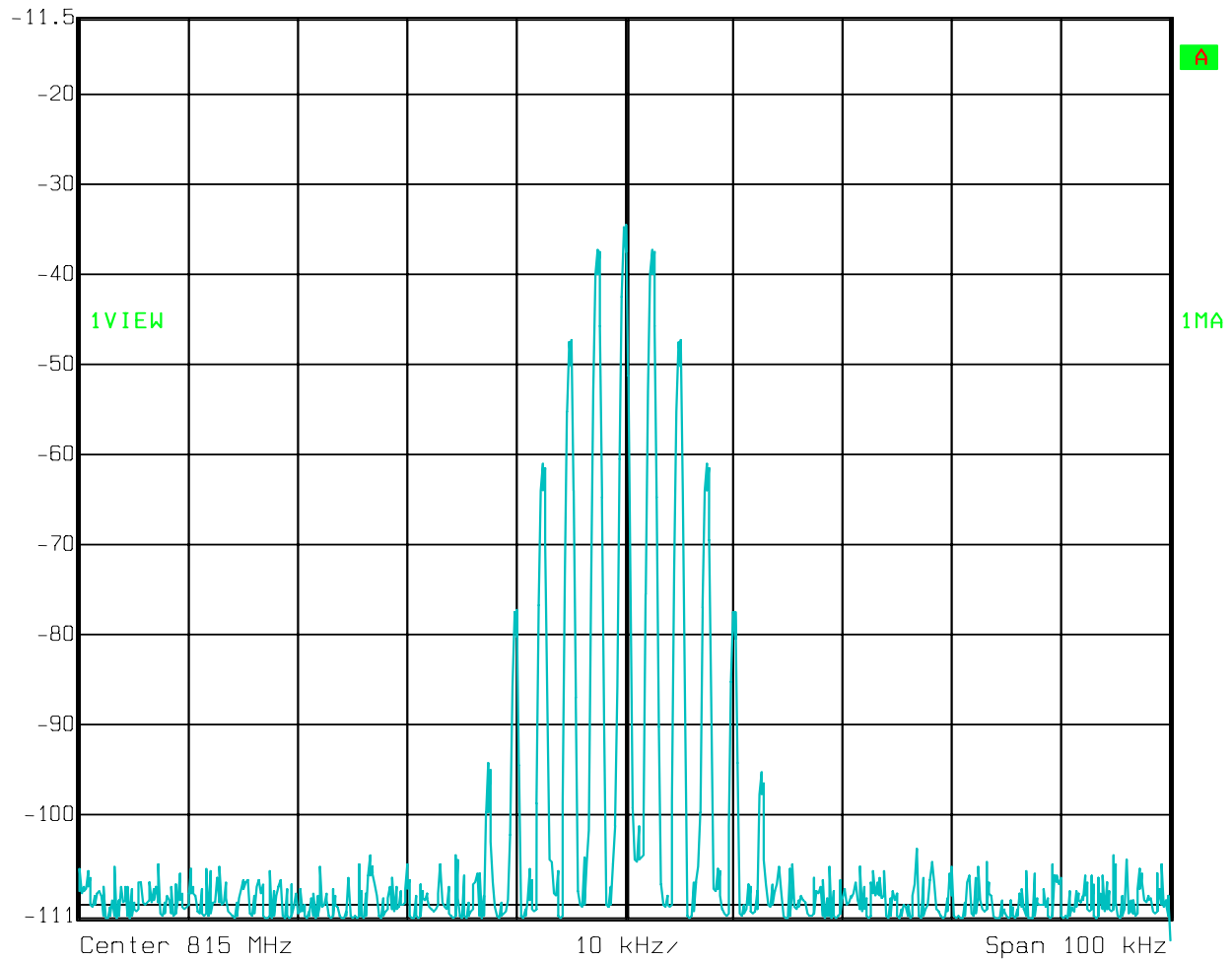
Uplink - Input

Analog



Ref Lvl
-11.5 dBm

RBW	300 Hz	RF Att	10 dB
VBW	300 Hz		
SWT	5.6 s	Unit	dBm



Date: 08.FEB.2006 14:54:47

EQUIPMENT: MR803D

PROJECT NO.: 6L0003RUS1

Test Data – Occupied Bandwidth

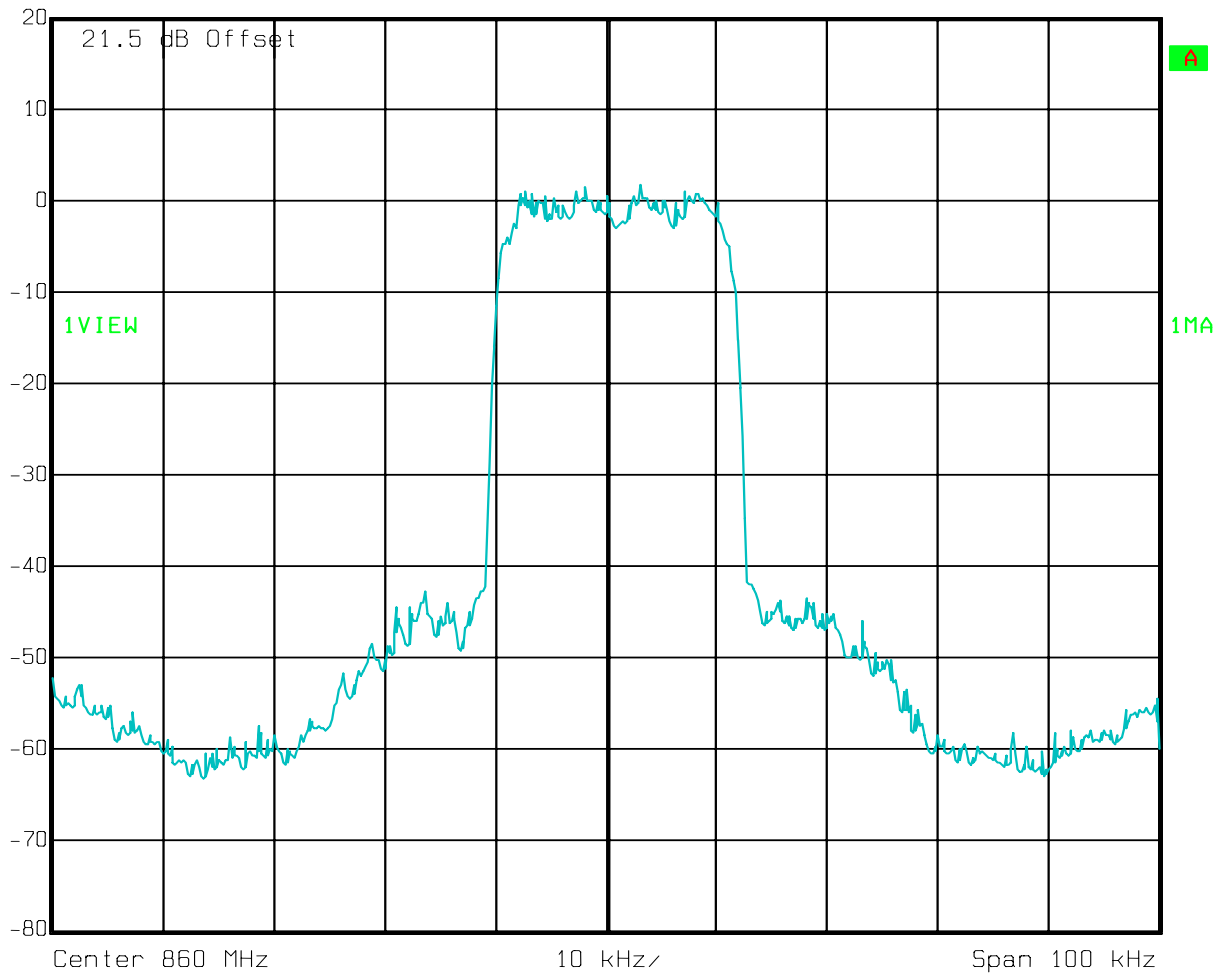
Downlink - Output

iDEN



Ref Lvl
20 dBm

RBW	300 Hz	RF Att	20 dB
VBW	300 Hz		
SWT	5.6 s	Unit	dBm

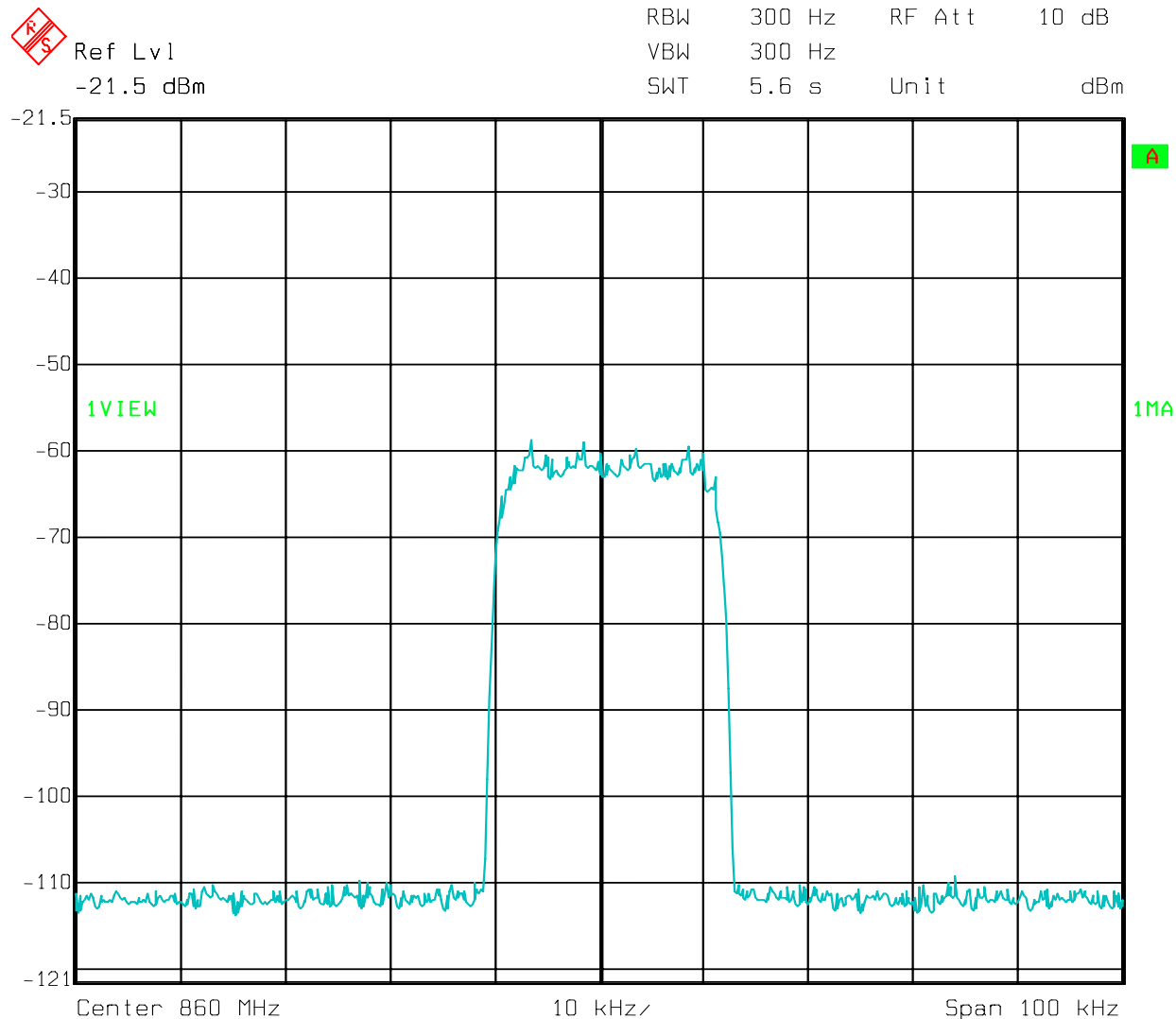


Date: 08.FEB.2006 13:52:21

Test Data – Occupied Bandwidth

Downlink - Input

iDEN



Date: 08.FEB.2006 13:54:38

Test Data – Occupied Bandwidth

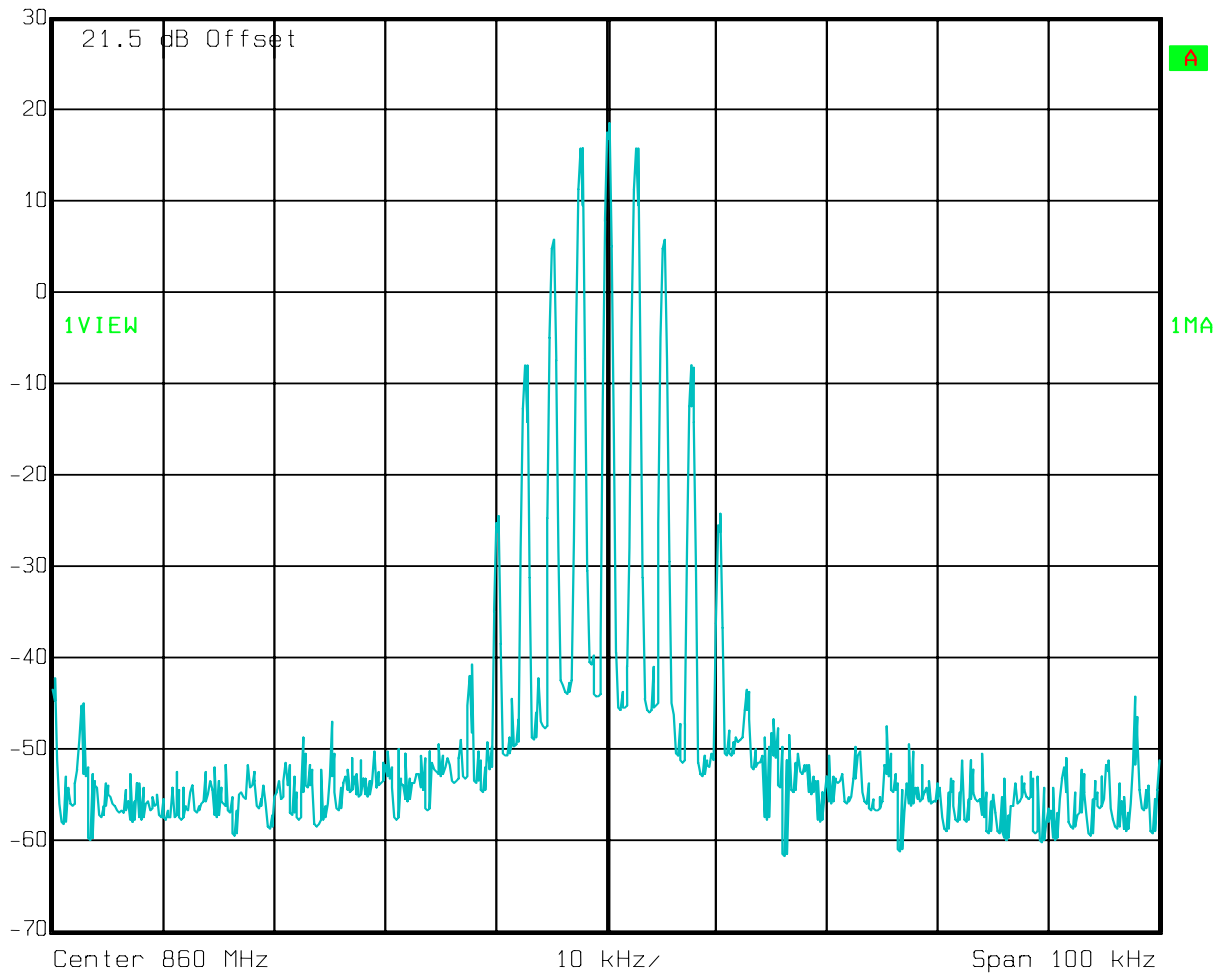
Downlink - Output

Analog



Ref Lvl
30 dBm

RBW	300 Hz	RF Att	30 dB
VBW	300 Hz		
SWT	5.6 s	Unit	dBm



Date: 08.FEB.2006 14:58:44

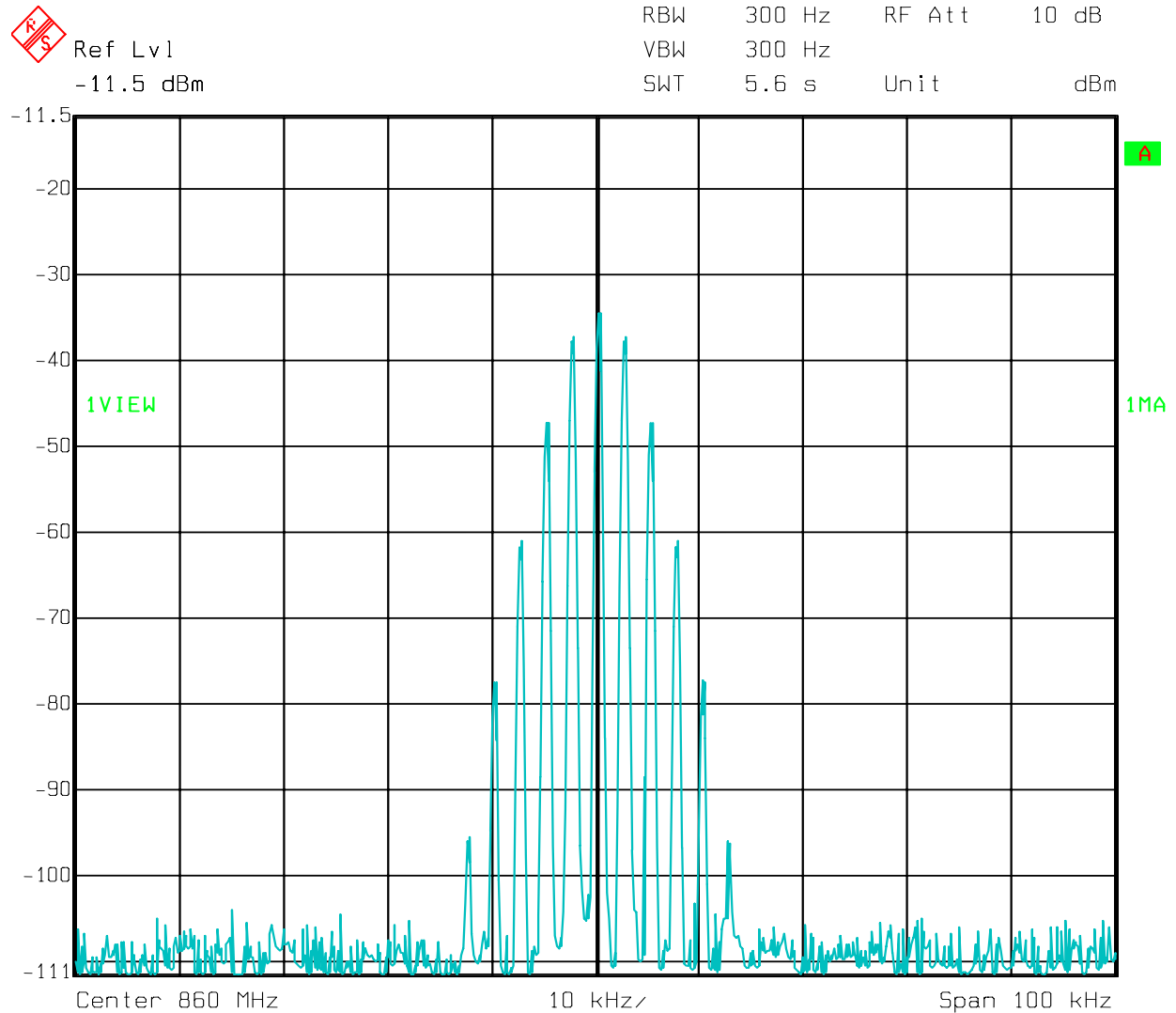
EQUIPMENT: MR803D

PROJECT NO.: 6L0003RUS1

Test Data – Occupied Bandwidth

Downlink - Input

Analog



Date: 08.FEB.2006 14:56:46

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 90.210
TESTED BY: David Light	DATE: 08 February 2006

Test Results: Complies.

Test Data: See attached graph(s).

Equipment Used: 1036-1472-1626-1053-1052-1081

Measurement Uncertainty: +/- 1.7 dB

Temperature: 22 °C

Relative Humidity: 45 %

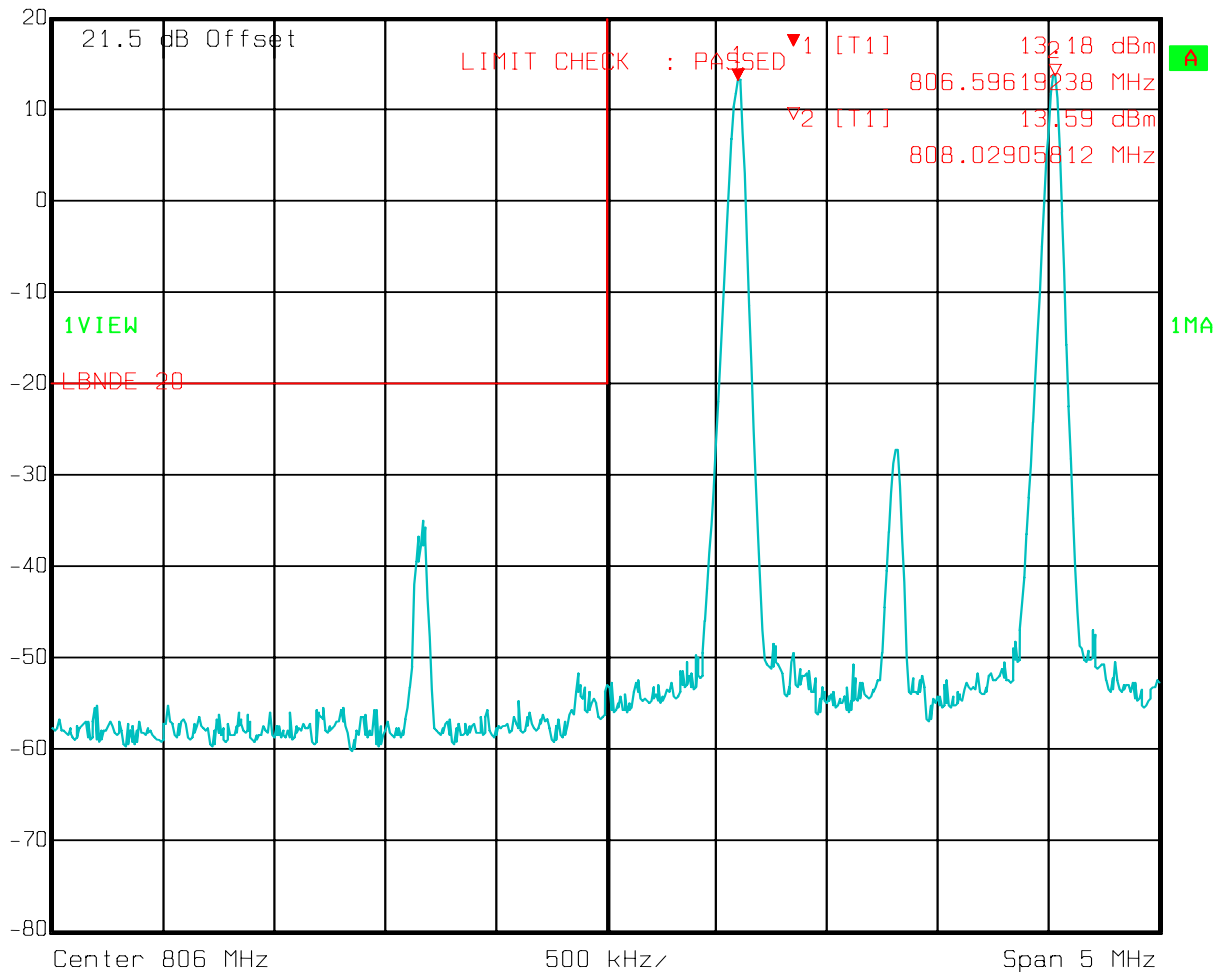
Test Data – Spurious Emissions at Antenna Terminals

Uplink

iDEN



Marker 1 [T1] RBW 30 kHz RF Att 20 dB
13.18 dBm VBW 30 kHz
20 dBm 806.59619238 MHz SWT 14 ms Unit dBm



Date: 08.FEB.2006 14:27:16

EQUIPMENT: MR803D

PROJECT NO.: 6L0003RUS1

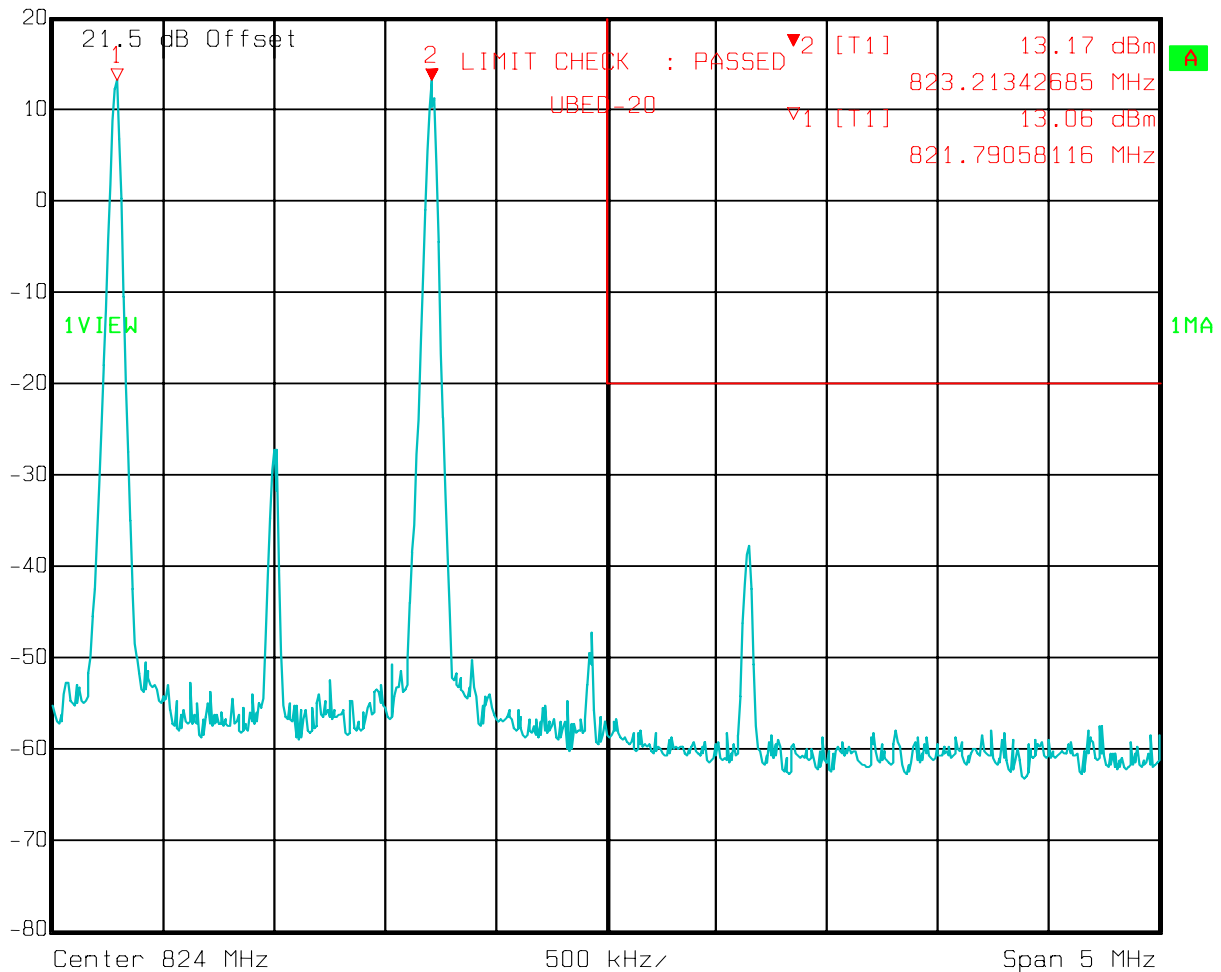
Test Data – Spurious Emissions at Antenna Terminals

Uplink

iDEN



Marker 2 [T1]
Ref Lvl 13.17 dBm
20 dBm 823.21342685 MHz
RBW 20 kHz RF Att 20 dB
VBW 20 kHz
SWT 32 ms Unit dBm



Date: 08.FEB.2006 14:29:51

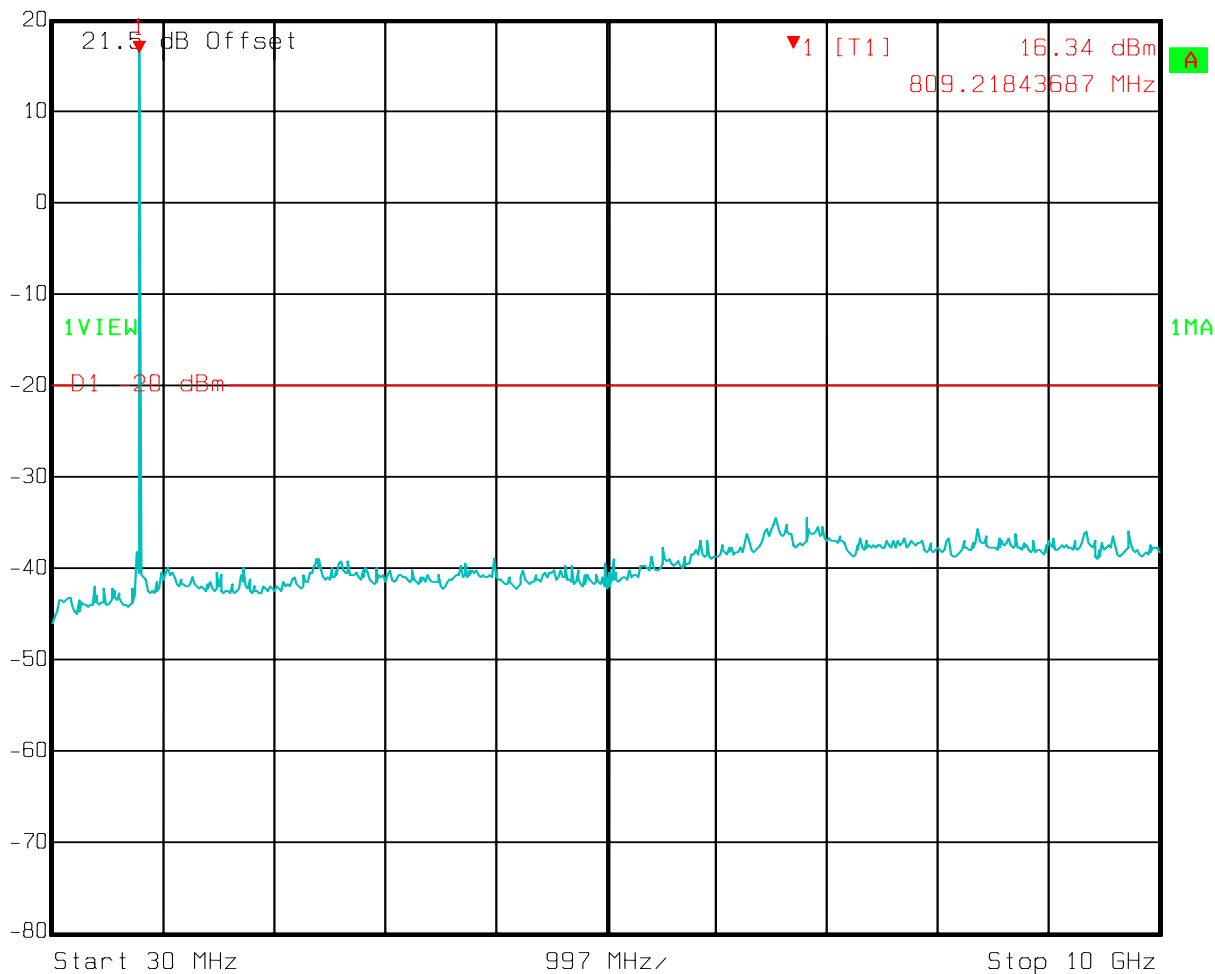
Test Data – Spurious Emissions at Antenna Terminals

Uplink

iDEN



Marker 1 [T1] RBW 1 MHz RF Att 20 dB
16.34 dBm VBW 1 MHz
809.21843687 MHz SWT 100 ms Unit dBm

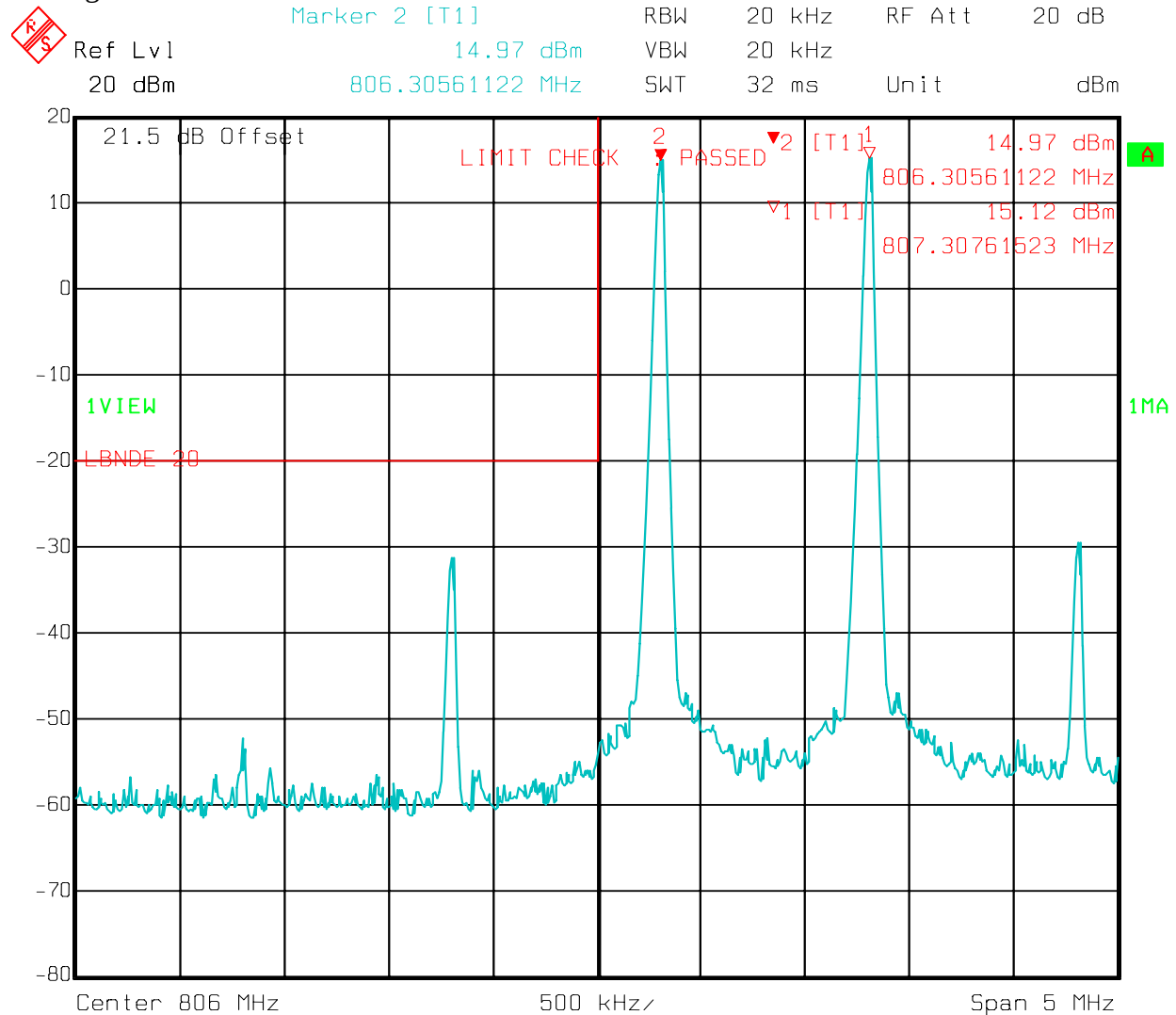


Date: 08.FEB.2006 14:17:09

EQUIPMENT: MR803D

PROJECT NO.: 6L0003RUS1

Test Data – Spurious Emissions at Antenna Terminals

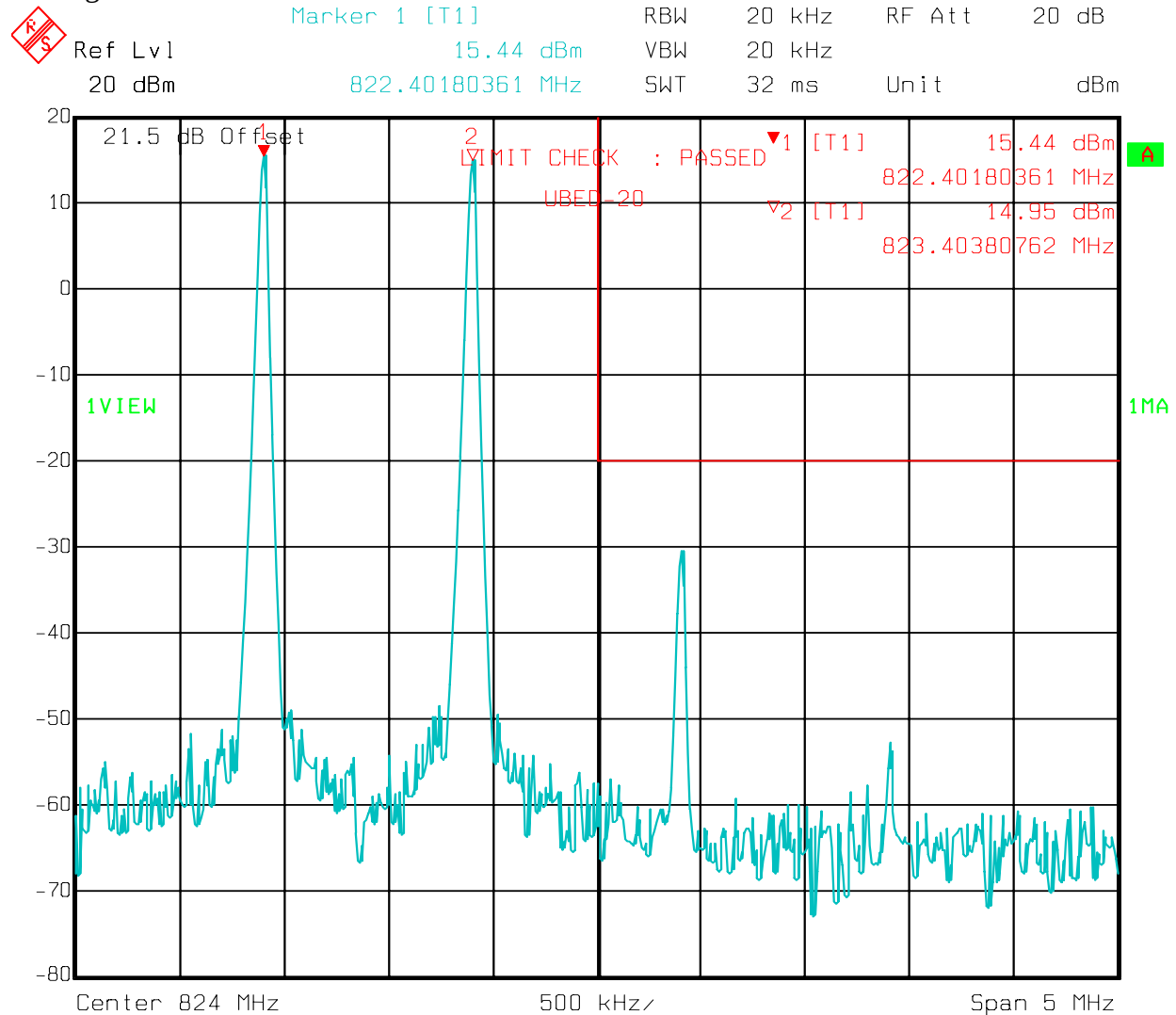
Uplink
Analog

Date: 08.FEB.2006 14:23:45

EQUIPMENT: MR803D

PROJECT NO.: 6L0003RUS1

Test Data – Spurious Emissions at Antenna Terminals

Uplink
Analog

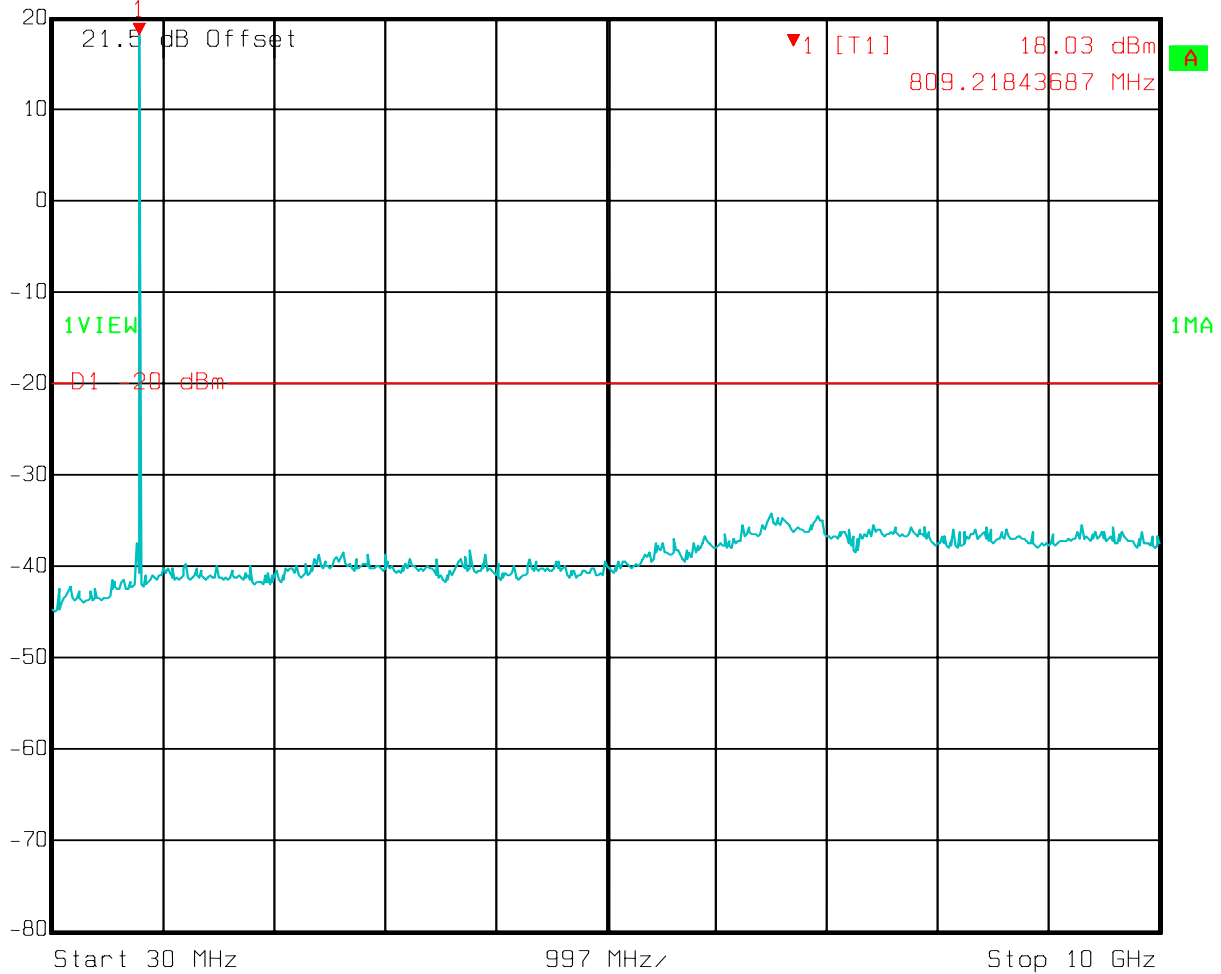
Date: 08.FEB.2006 14:22:07

Test Data – Spurious Emissions at Antenna Terminals

Uplink
Analog



Marker 1 [T1] RBW 1 MHz RF Att 20 dB
18.03 dBm VBW 1 MHz
809.21843687 MHz SWT 100 ms Unit dBm

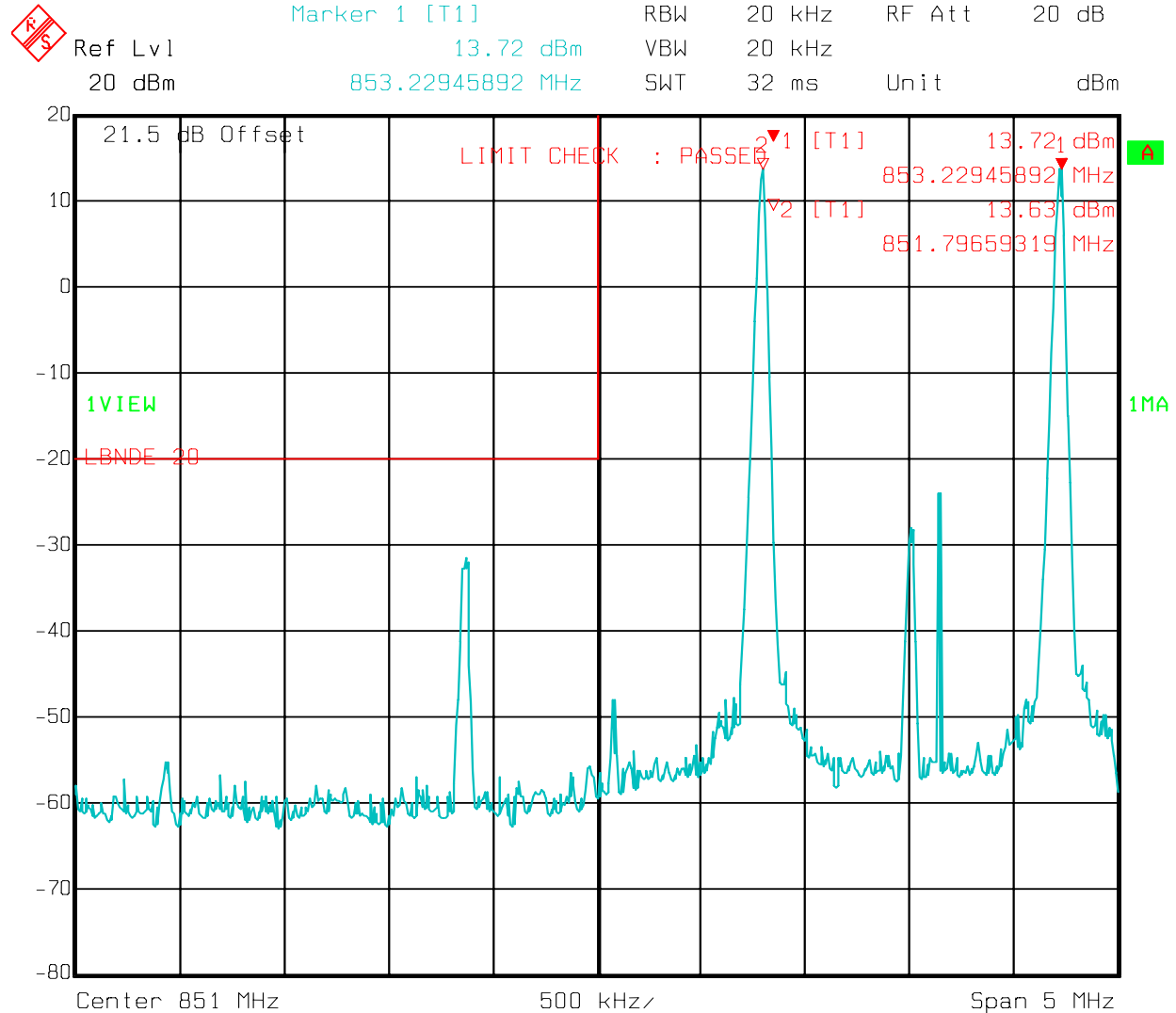


Date: 08.FEB.2006 14:18:13

Test Data – Spurious Emissions at Antenna Terminals

Downlink

iDEN



Date: 08.FEB.2006 13:36:56

EQUIPMENT: MR803D

PROJECT NO.: 6L0003RUS1

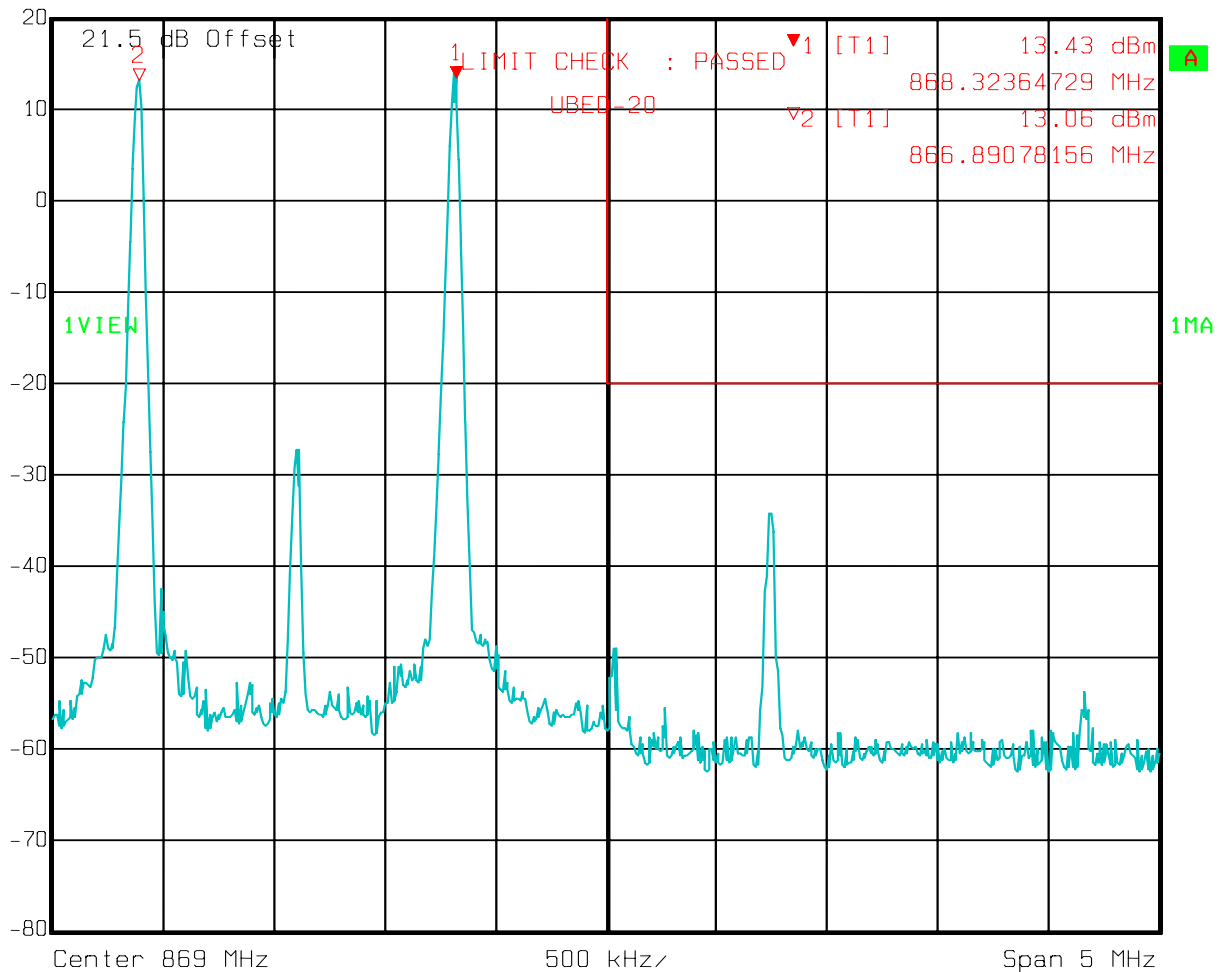
Test Data – Spurious Emissions at Antenna Terminals

Downlink

iDEN



Marker 1 [T1] RBW 20 kHz RF Att 20 dB
13.43 dBm VBW 20 kHz
868.32364729 MHz SWT 32 ms Unit dBm



Date: 08.FEB.2006 13:40:38

EQUIPMENT: MR803D

PROJECT NO.: 6L0003RUS1

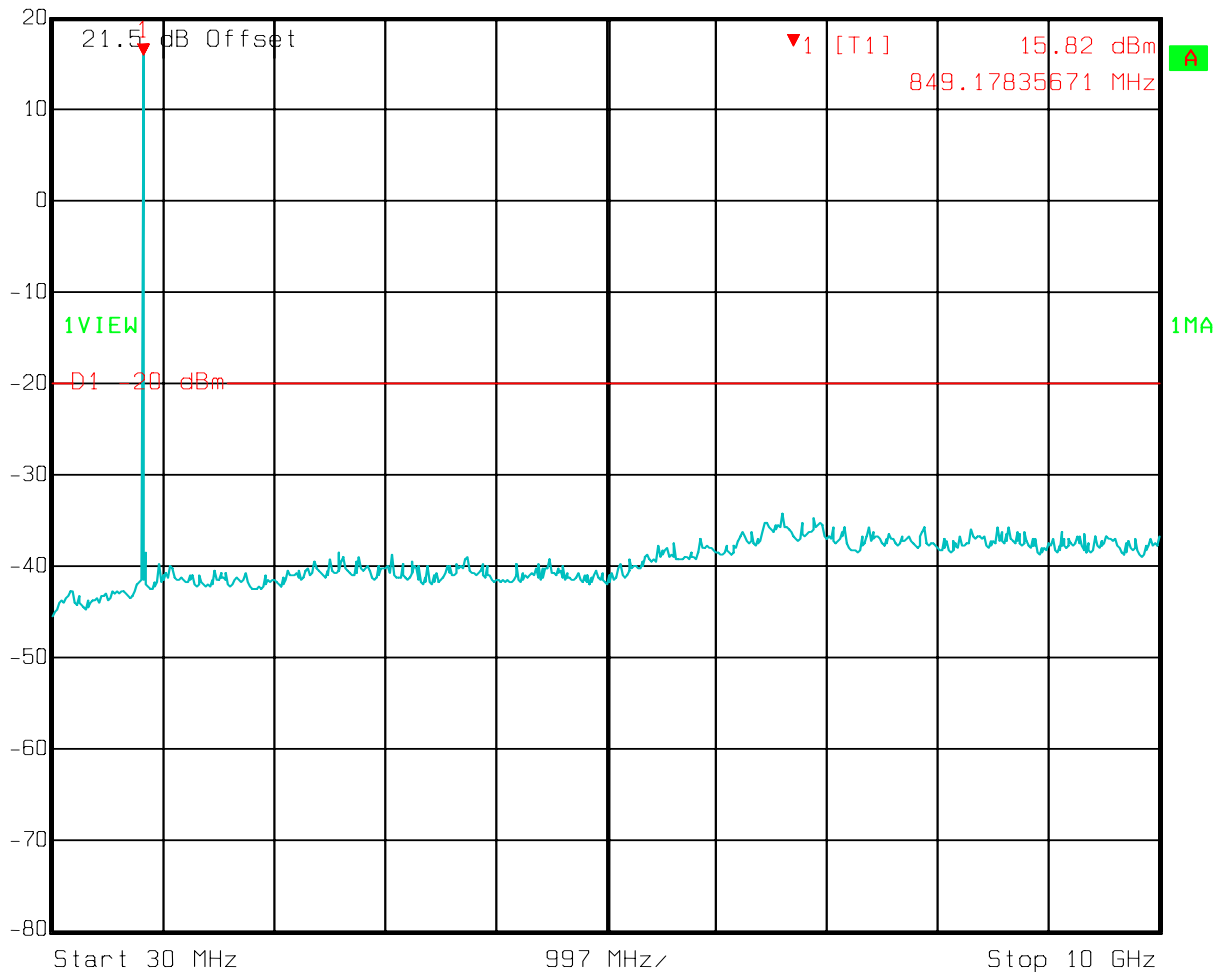
Test Data – Spurious Emissions at Antenna Terminals

Downlink

iDEN



Marker 1 [T1] RBW 1 MHz RF Att 20 dB
15.82 dBm VBW 1 MHz
20 dBm 849.17835671 MHz SWT 100 ms Unit dBm



Date: 08.FEB.2006 13:57:36

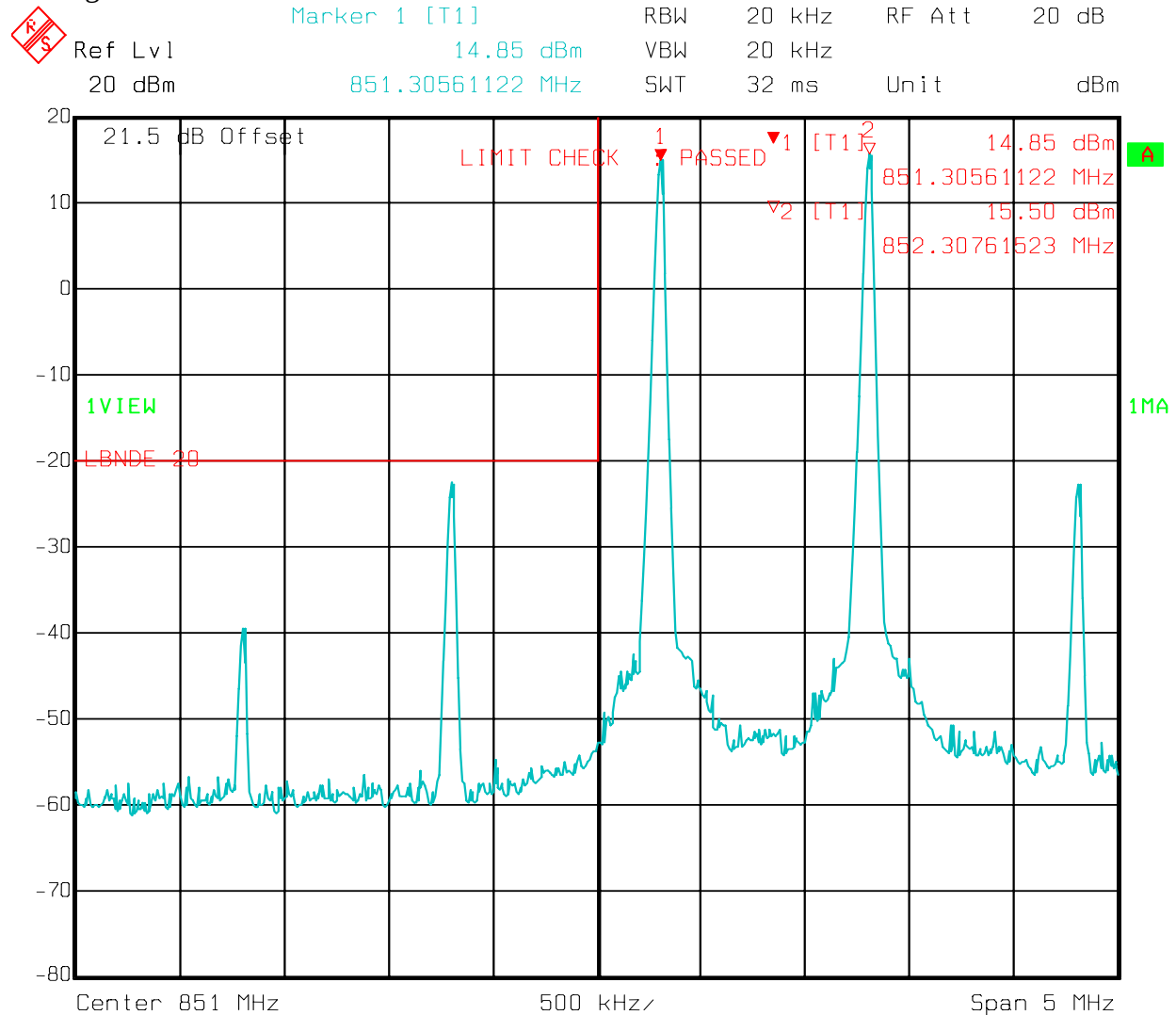
EQUIPMENT: MR803D

PROJECT NO.: 6L0003RUS1

Test Data – Spurious Emissions at Antenna Terminals

Downlink

Analog



Date: 08.FEB.2006 13:45:46

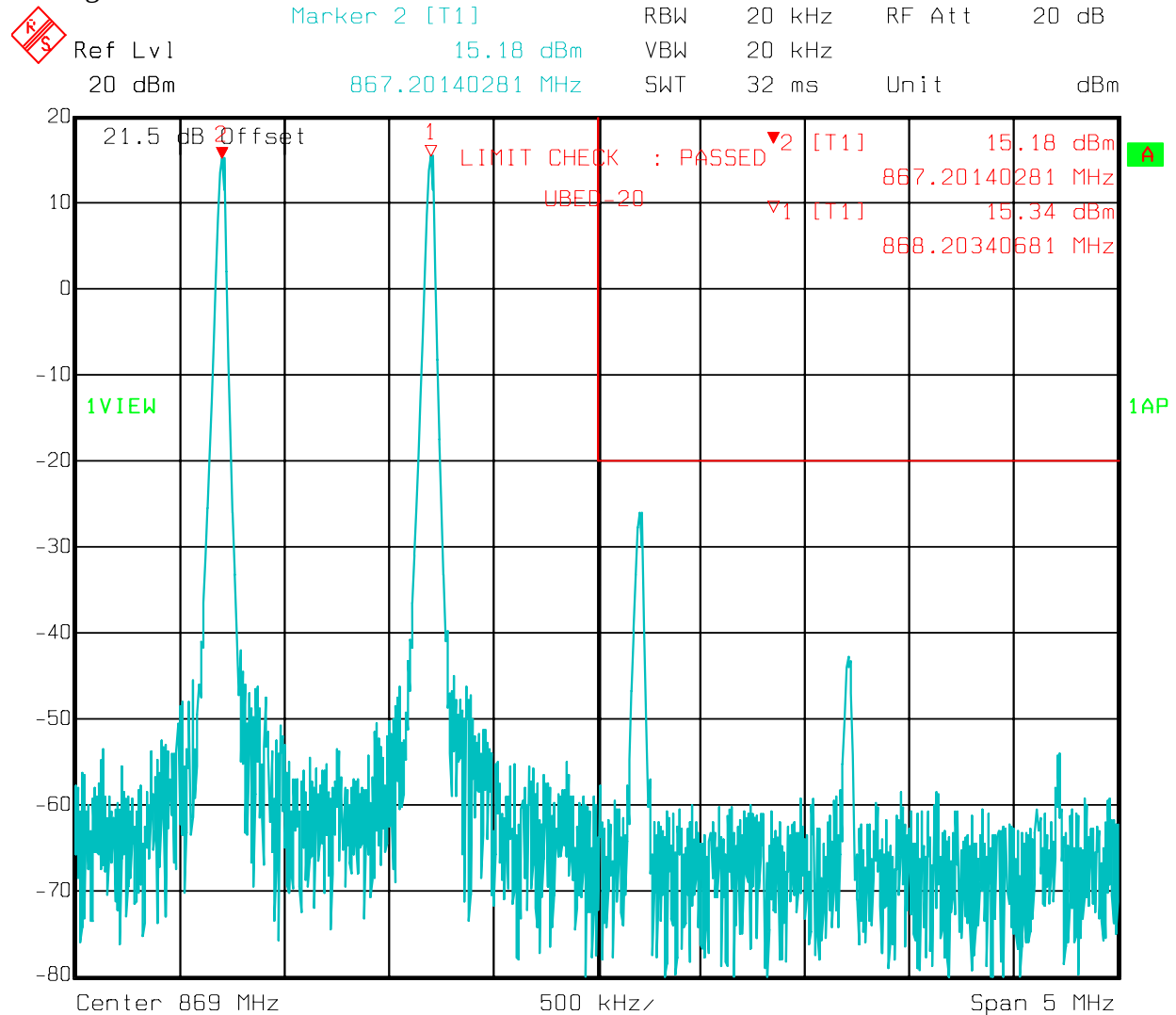
EQUIPMENT: MR803D

PROJECT NO.: 6L0003RUS1

Test Data – Spurious Emissions at Antenna Terminals

Downlink

Analog

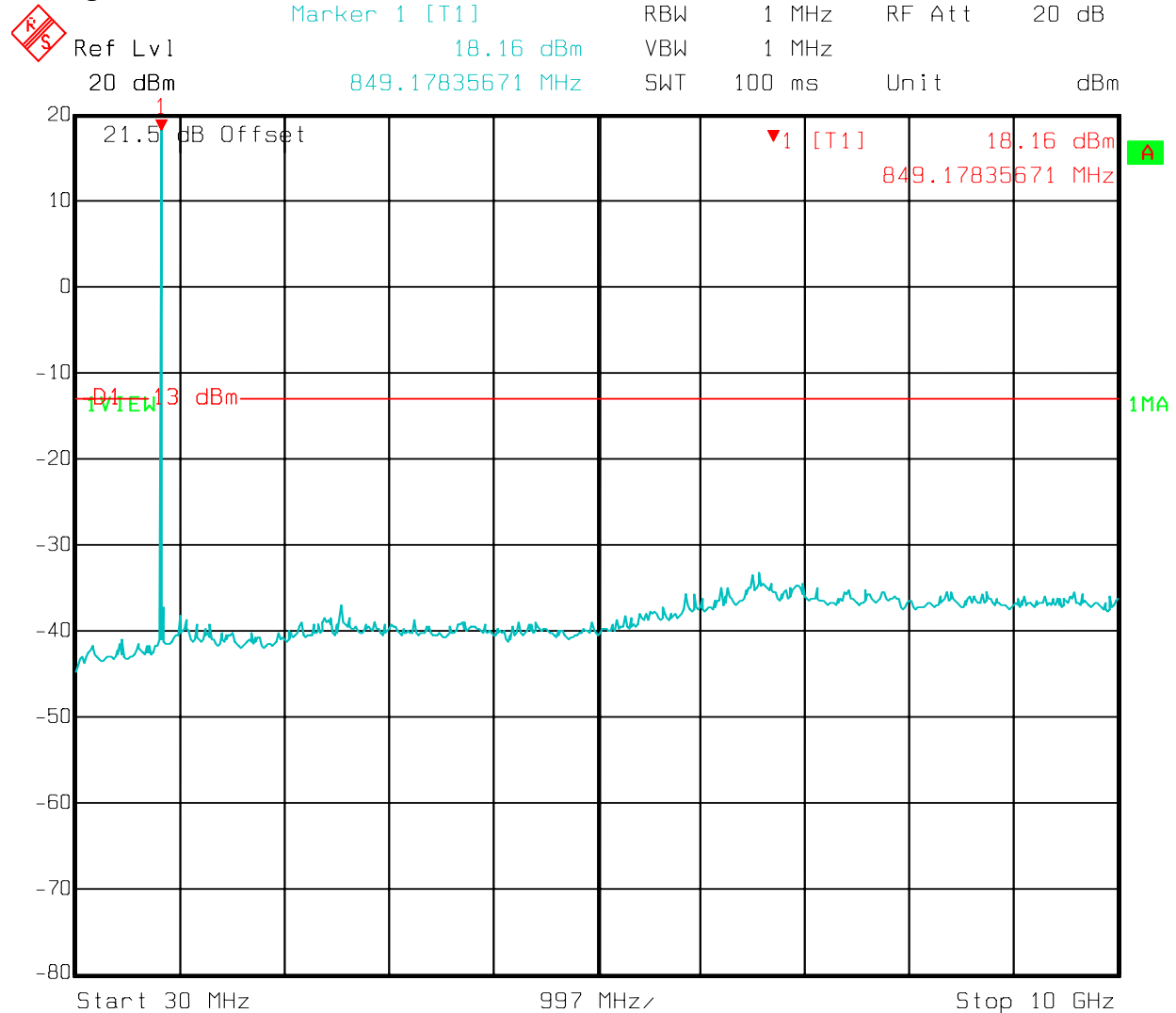


Date: 08.FEB.2006 13:43:14

Test Data – Spurious Emissions at Antenna Terminals

Downlink

Analog



Date: 08.FEB.2006 14:00:02

Section 6. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.993
TESTED BY: David Light	DATE: 08 February 2006

Test Results: Complies.**Test Data:** There were no emissions detected above the noise floor, which was at least 20 db below the specification limit. The spectrum was searched from 30 MHz to 10 GHz.**Equipment Used:** 1464-1484-1485-993-1016-791-759-760**Measurement Uncertainty:** +/- 1.7 dB**Temperature:** 22 °C**Relative Humidity:** 45 %

Photographs of Test Setup



Section 7 Out of Band Rejection

NAME OF TEST: Out of Band Rejection	PARA. NO.: NA
TESTED BY: David Light	DATE: 08 February 2006

Test Results: Complies.

Test Data: See attached.

Equipment Used: 1036-1472-1626-1053-1052-1081

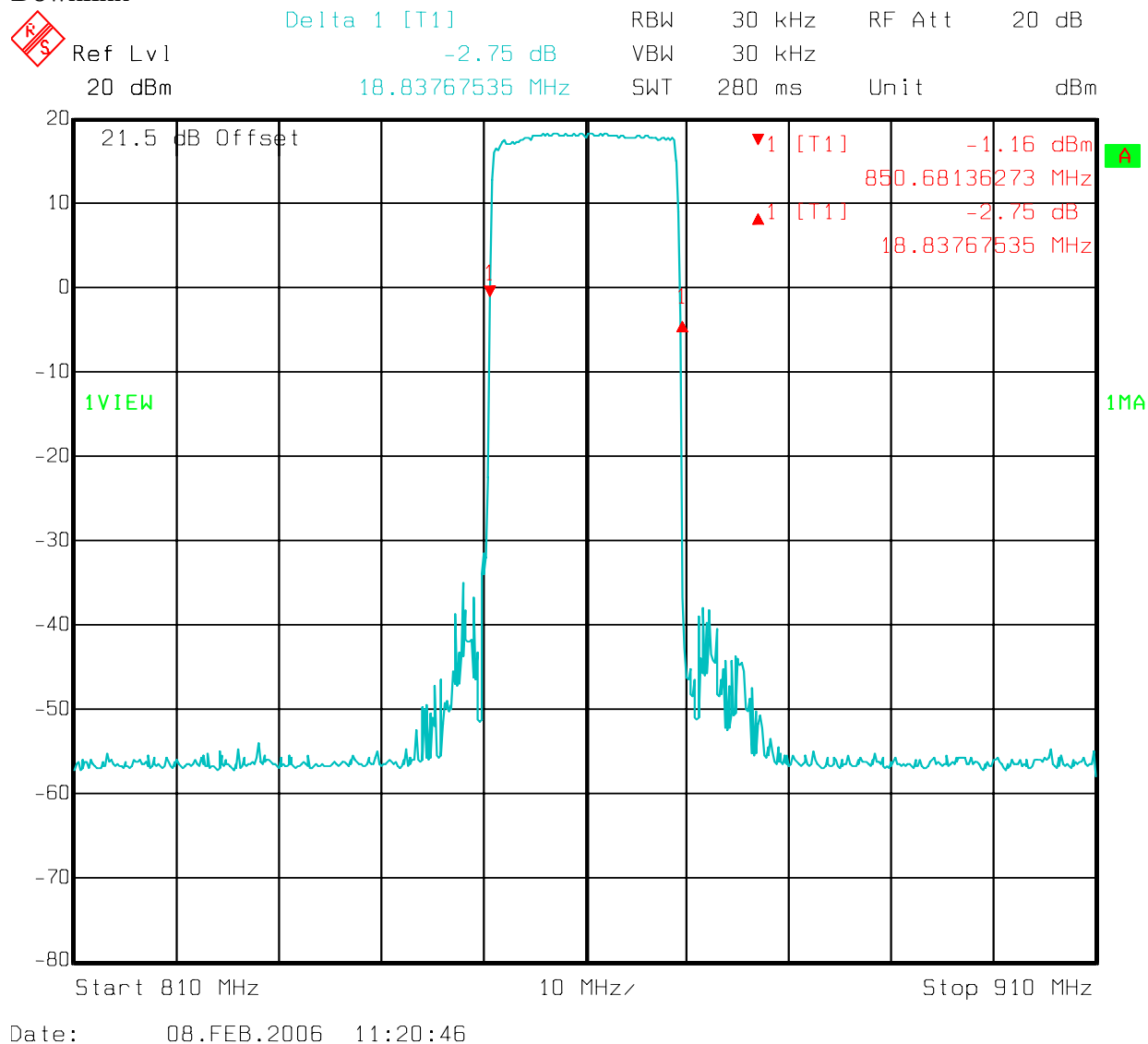
Measurement Uncertainty: +/- 1.7 dB dB
1x10⁻⁷ ppm

Temperature: 22 °C

Relative Humidity: 45 %

Test Data – Out of Band Rejection

Downlink

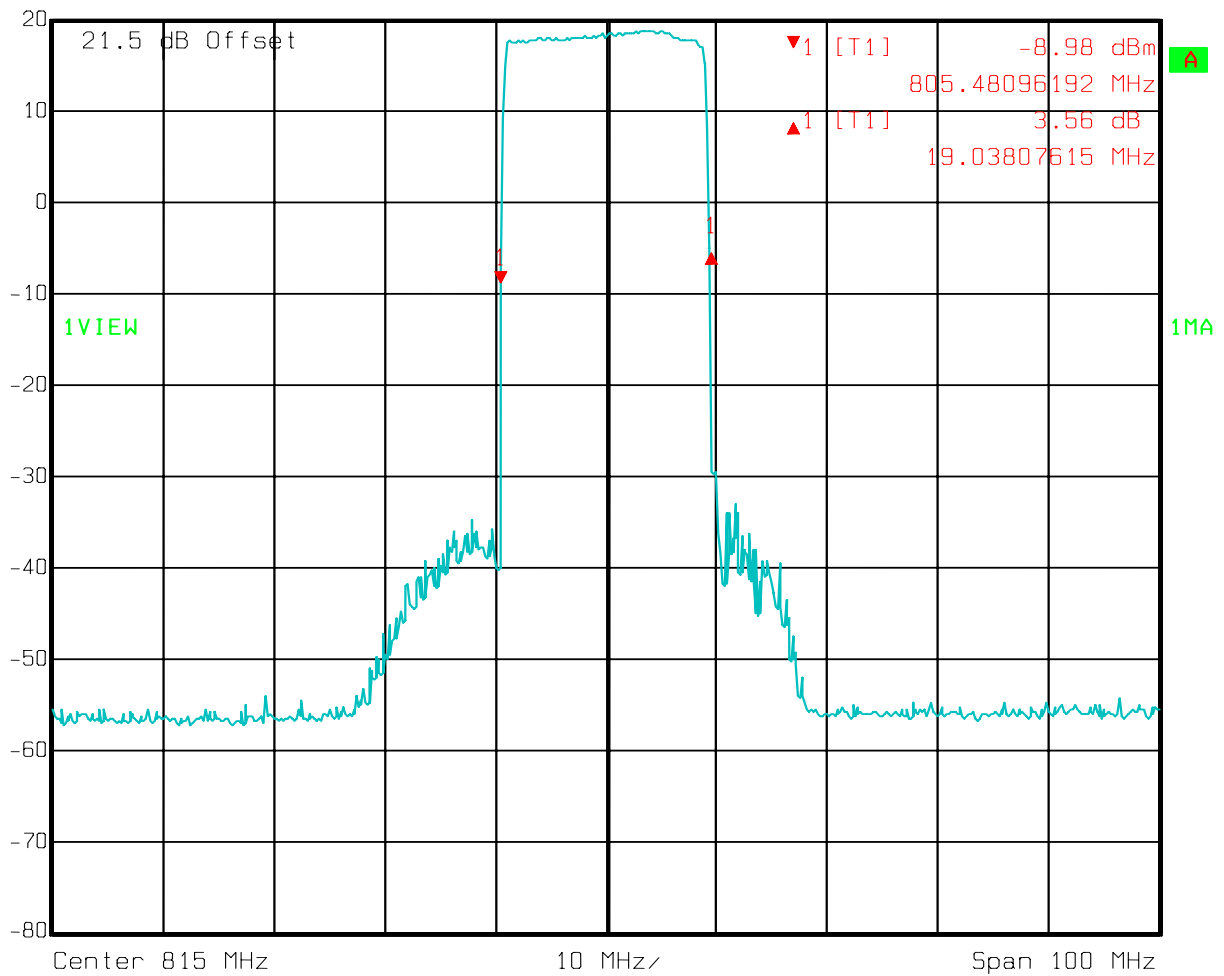


Test Data – Out of Band Rejection

Uplink



Delta 1 [T1] RBW 30 kHz RF Att 20 dB
Ref Lvl 3.56 dB VBW 30 kHz
20 dBm 19.03807615 MHz SWT 280 ms Unit dBm



Date: 08.FEB.2006 10:55:18

EQUIPMENT: MR803D

PROJECT NO.: 6L0003RUS1

Section 8. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	03/22/04	03/23/06
1472	20db Attenuator DC 18 Ghz	Omni Spectra 20600-20db	NONE	CBU	N/A
1626	CABLE, 5 ft	MEGAPHASE 10311 1GVT4	N/A	CBU	N/A
1053	VECTOR SIGNAL GENERATOR 300 KHz	ROHDE & SCHWARZ SMIQ 03	DE22081	09/29/05	09/30/08
1052	I/Q MODULATION GENERATOR	Rhode & Schwarz AMIQ	DE30619	CNR	N/A
1081	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	CBU	N/A
791	PREAMP, 25dB	ICC LNA25	398	11/12/05	11/12/06
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	11/12/05	11/12/06
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	09/28/05	09/28/06
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	09/28/05	09/28/06
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/14/05	01/15/07
759	ANTENNA, LOG PERIODIC	A.H. SYSTEMS SAS-200/510	556	08/04/05	08/04/06
760	Antenna biconical	Electro Metrics MFC-25	477	08/04/05	08/04/06

Nemko USA

FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: **MR803D**

PROJECT NO.: **6L0003RUS1**

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 or spectrum analyzer. 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

FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

PROJECT NO.: 6L0003RUS1

PARA. NO.: 2.991

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: MR803D

PROJECT NO.: 6L0003RUS1

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

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

EQUIPMENT: MR803D

PROJECT NO.: 6L0003RUS1

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	-	-	-

Nemko USA

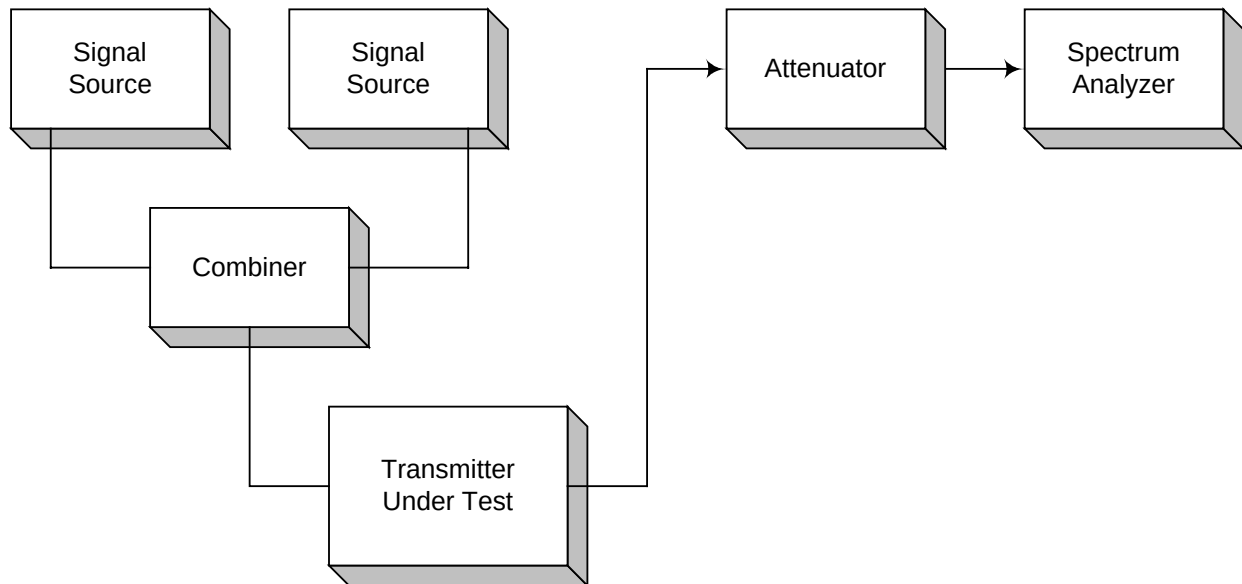
FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: **MR803D**

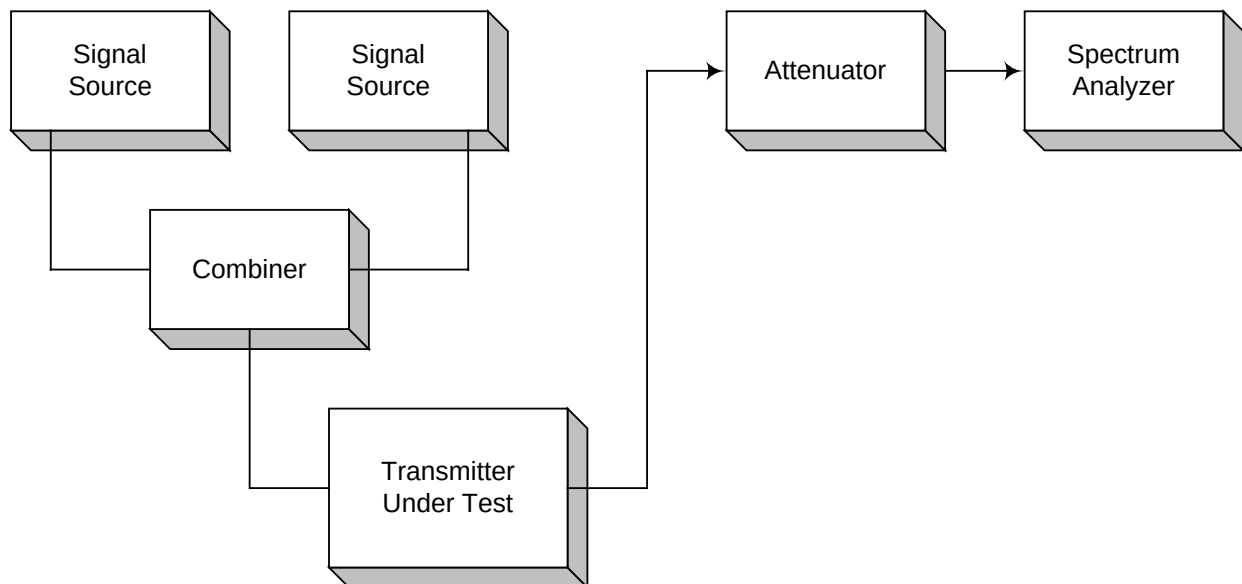
PROJECT NO.: **6L0003RUS1**

ANNEX B - TEST DIAGRAMS

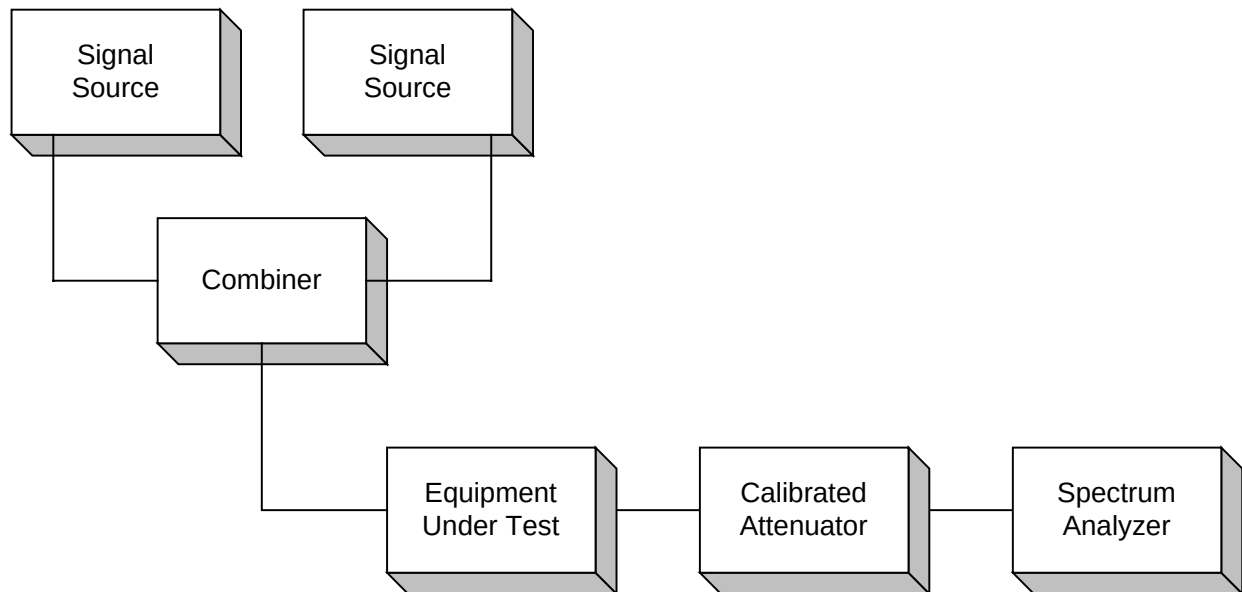
Para. No. 2.985 - R.F. Power Output



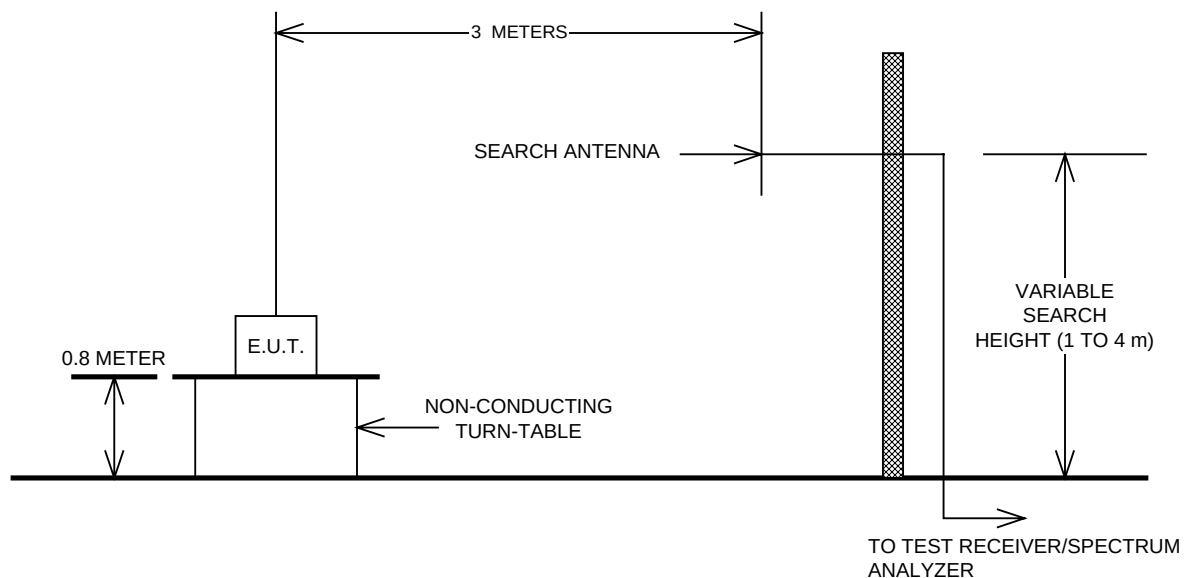
Para. No. 2.989 - Occupied Bandwidth



Para. No. 2.991 - Spurious Emissions at Antenna Terminals



Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability

