



Nemko Test Report: 32513RUS3

Applicant: Andrew Corporation
620 N. Greenfield Parkway
Garner, NC 27529
USA

**Equipment Under Test:
(E.U.T.)** TFAH-US6B

FCC Identifier: BCR-TFAHUS6

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: 28 August 2009

APPROVED BY:

A handwritten signature in black ink, appearing to read 'Tom Tidwell'.

Tom Tidwell, Telecom Direct

DATE: 31 August 2009

Number of Pages: 51

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EQUIPMENT: TFAH-US6B

PROJECT NO.: 32513RUS3

Section 1. Summary of Test Results

Manufacturer: Andrew Corporation

Model No.: TFAH-US6B

Serial No.: 7640480

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	90.635	1 kW ERP	Complies
Occupied Bandwidth	90.210	Input/Output	Complies
Spurious Emissions at Antenna Terminals	90.210	Plots	Complies
Field Strength of Spurious Emissions	90.210	-20 dBm 50 + 10logP(W)	Complies
Frequency Stability	90.213	1 ppm	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.

Section 2. General Equipment Specification**Transmitter**

Supply Voltage Input: 120 Vac

Frequency Range: Downlink: 769 to 775 MHz
851 to 869 MHz
935 to 941 MHz

Uplink: NA

Tunable Bands:Type(s) of Modulation: F9W (CQPSK) F1D (C4FM) F2D D7W (iDEN) Other
☒ ☐ ☐ ☒ ☐

Output Impedance: 50 ohms

RF Power Output (rated): 27 dBm / 0.5 W (700 MHz band)
31 dBm / 1.25 W (800 MHz band)
29 dBm / 0.79 W (900 MHz band)

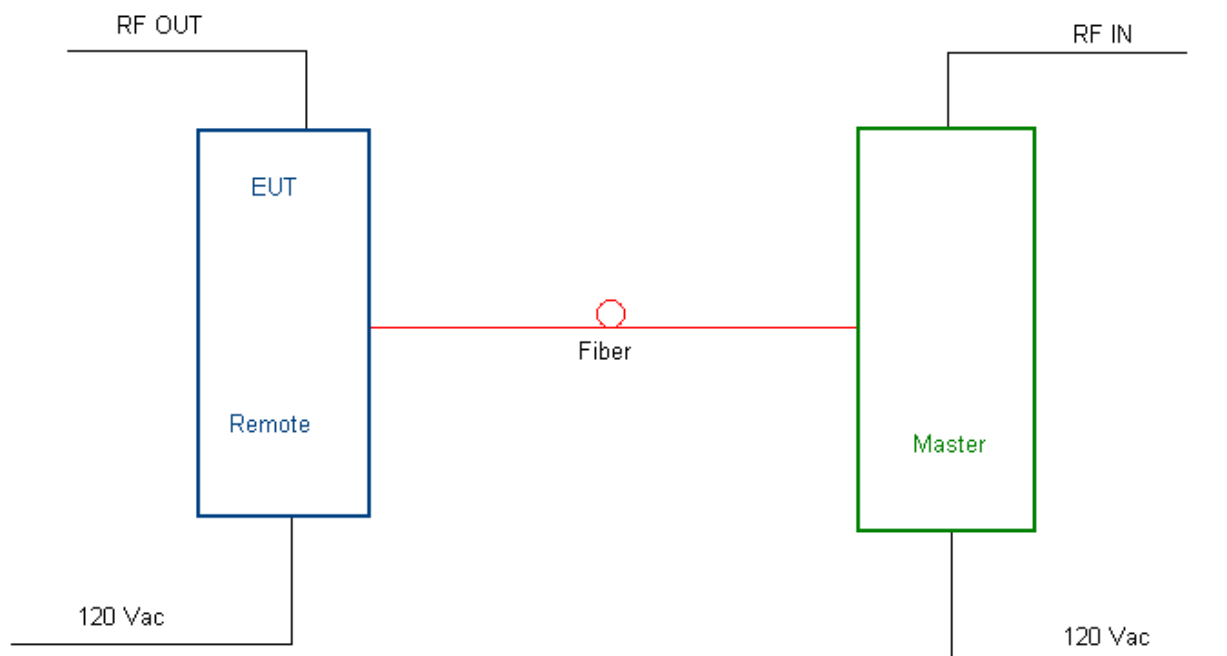
Operator Selection of Operating Frequency: Software

Power Output Adjustment Capability: Software

Frequency Translation: F1-F1 F1-F2 N/A
☒ ☐ ☐Band Selection: Software Duplexer Change Fullband Coverage
☐ ☐ ☒

Description of EUT

The TFAH-US6B is a five band high power remote unit designed to distribute LMR700, LMR800, Cell850, LMR900, AWS and Extended PCS1900 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: 26 August 2009

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

Band	Modulation	Output per Channel (dBm)	Composite Power (dBm)	Composite Power (W)
700 LMR	C4FM	24.0	27.0	0.50
700 LMR	APCO CQPSK	24.0	27.0	0.50
800 LMR	C4FM	31.0	31.0	1.25
800 LMR	iDEN	31.0	31.0	1.25
900 LMR	C4FM	29.0	29.0	0.79
900 LMR	iDEN	29.0	29.0	0.79

Equipment Used: 1036-1469-1082-1472**Measurement Uncertainty:** +/- 1.7 dB**Temperature:** 22 °C**Relative Humidity:** 35 %

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
TESTED BY: David Light	DATE: 26 August 2009

Test Results: Complies.

Test Data: See attached plot(s).

Equipment Used: 1036-1469-1082-1472

Measurement Uncertainty: 1X10⁻⁷ ppm

Temperature: 22 °C

Relative Humidity: 35 %

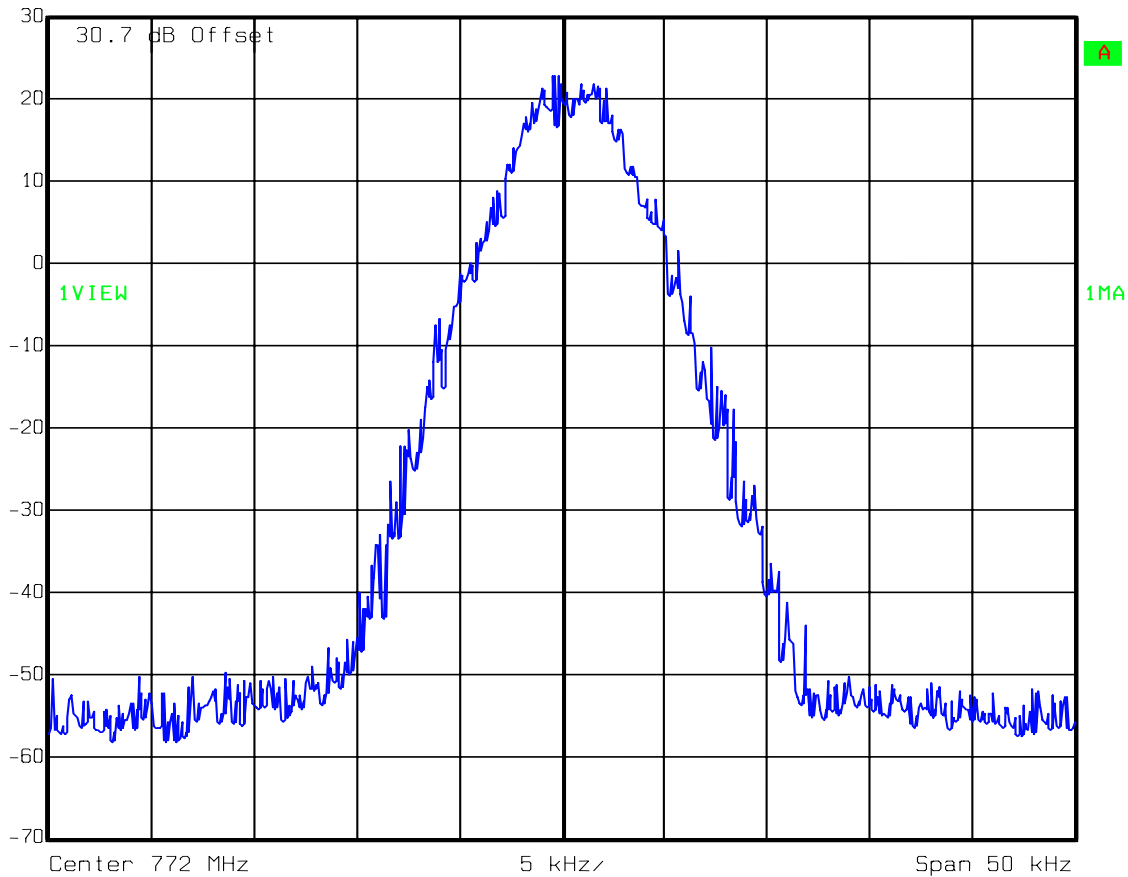
Test Data – Occupied Bandwidth

700 LMR
OBW
Output
APCO C4FM



Ref Lvl
30 dBm

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



Date: 26.AUG.2009 09:27:28

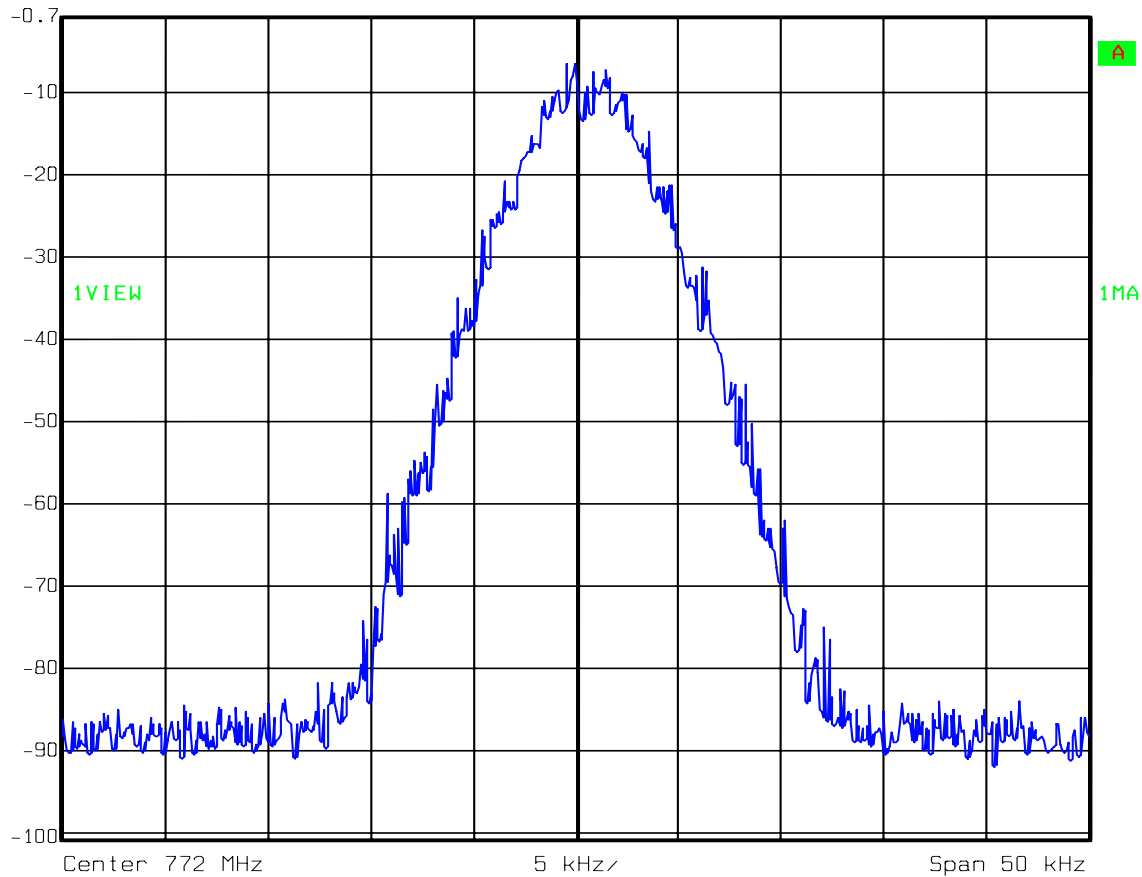
Test Data – Occupied Bandwidth

700 LMR
OBW
Input
APCO F4FM



Ref Lvl
-0.7 dBm

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

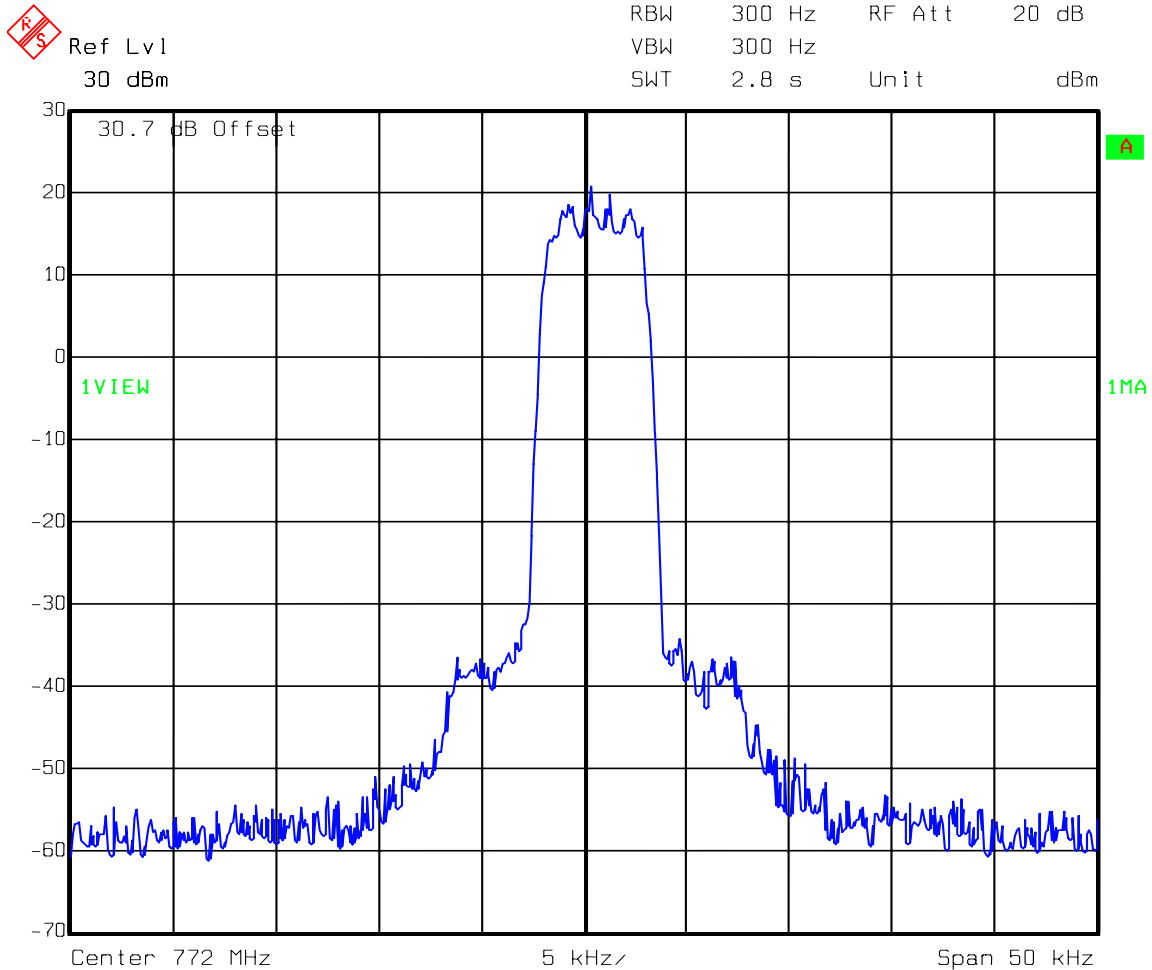


Date: 26.AUG.2009 09:28:36

Analo

Test Data – Occupied Bandwidth

700 LMR
OBW
Output
APCO 25



Date: 26.AUG.2009 12:55:25

Test Data – Occupied Bandwidth

700 LMR

OBW

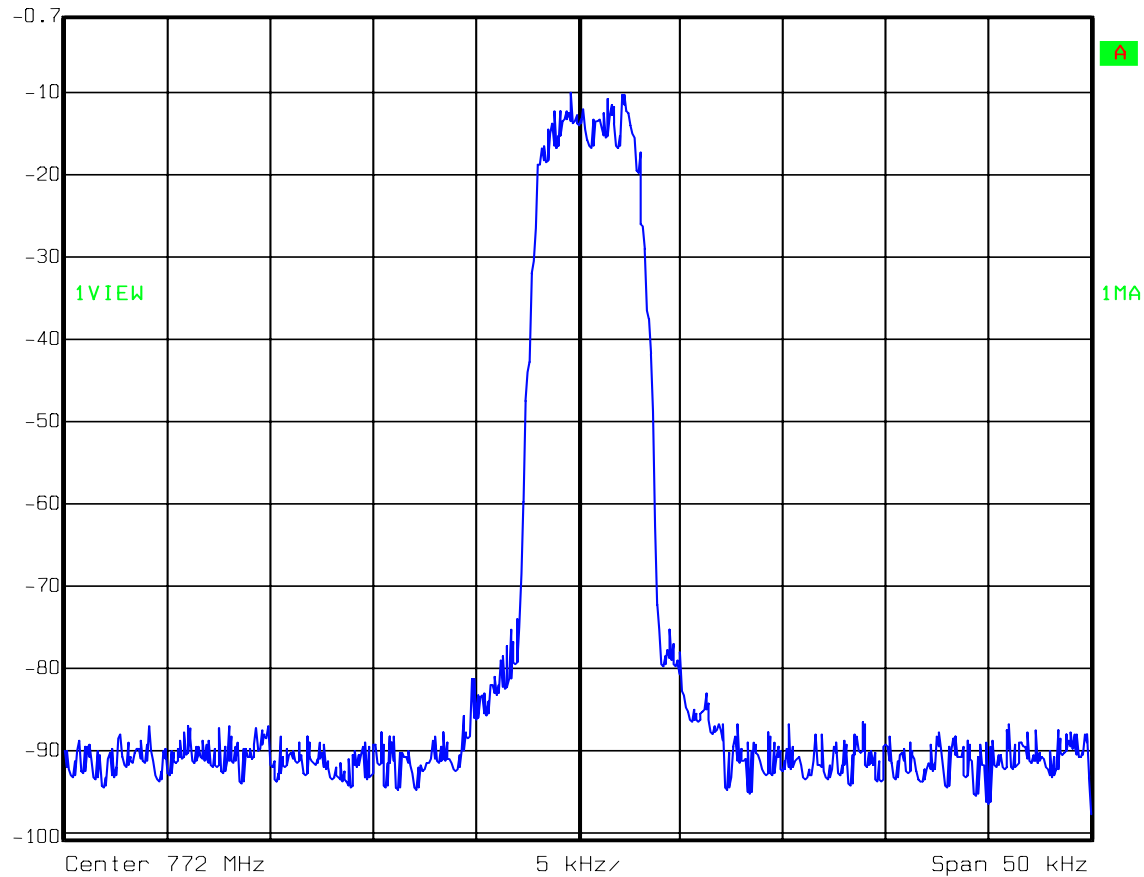
Input

APCO 25



Ref Lvl
-0.7 dBm

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



Date: 26.AUG.2009 12:56:44

Test Data – Occupied Bandwidth

800 LMR

OBW

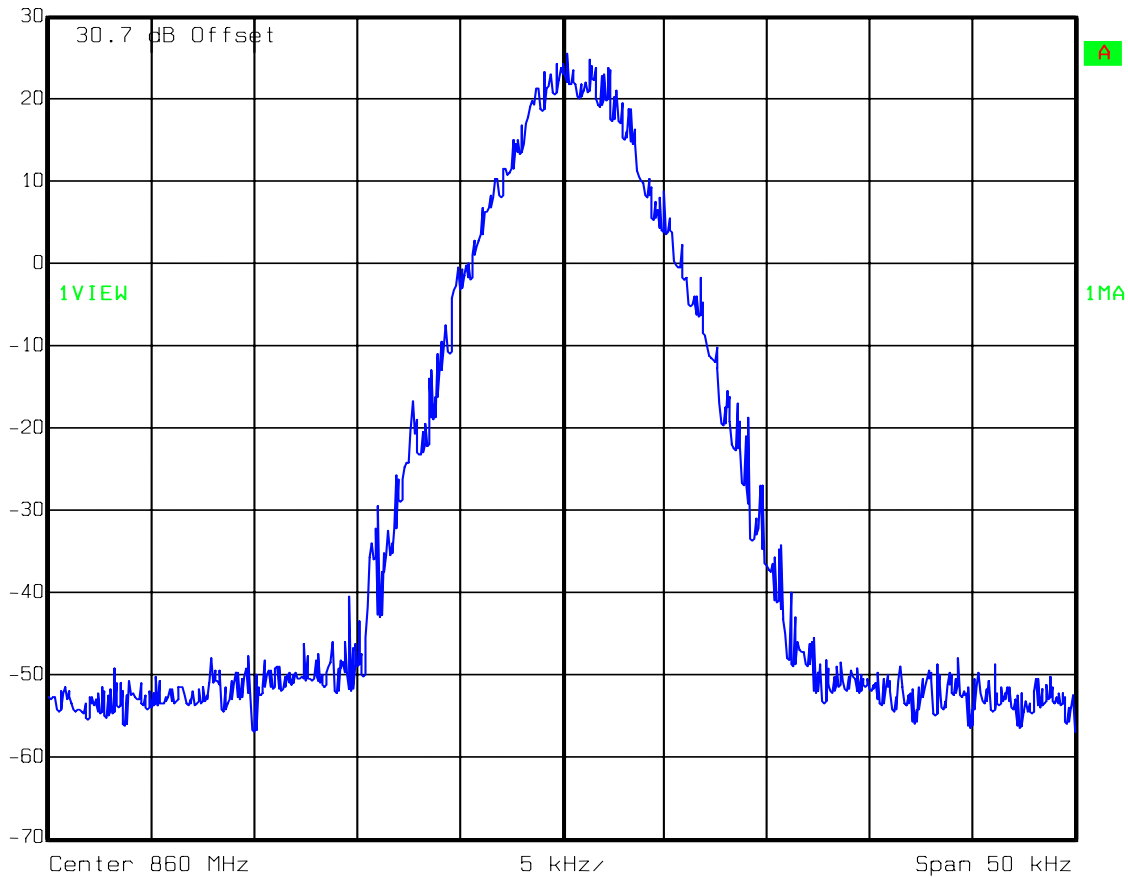
Output

C4FM



Ref Lvl
30 dBm

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



Date: 26.AUG.2009 14:15:03

Test Data – Occupied Bandwidth

800 LMR

OBW

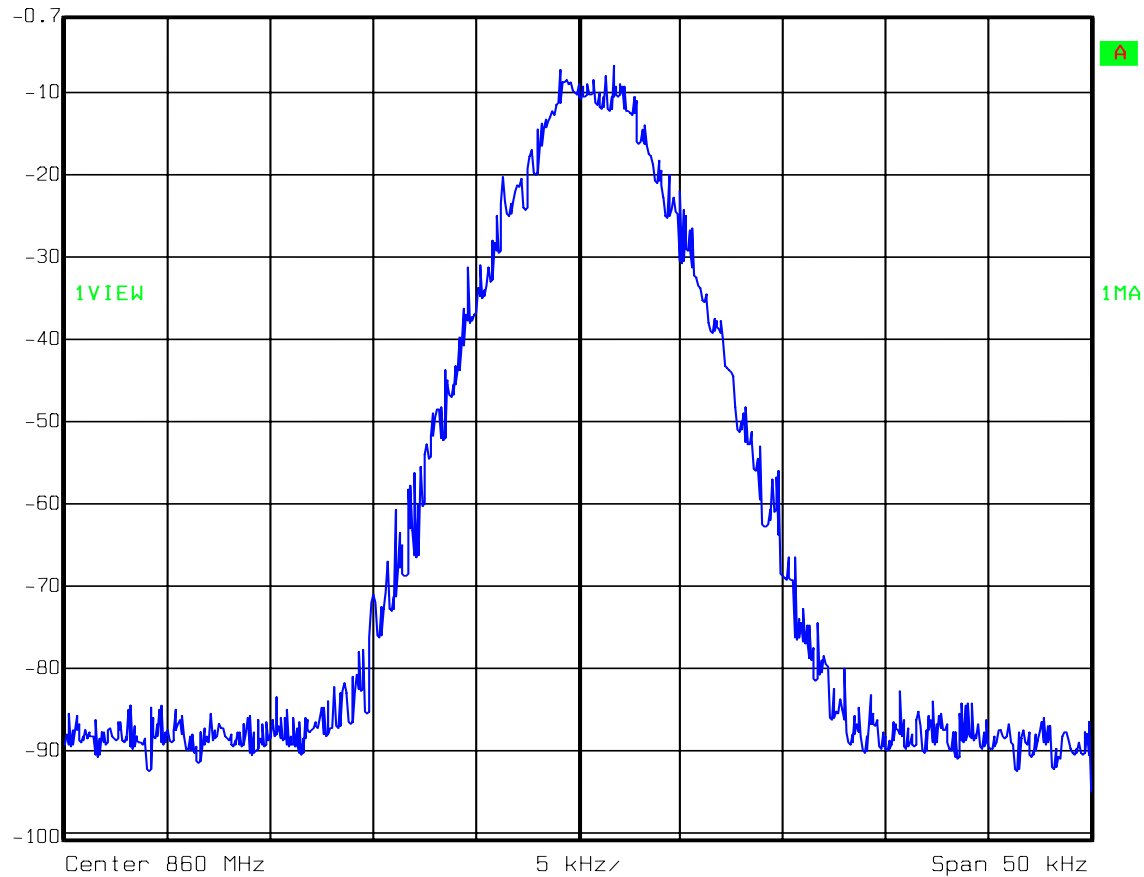
Input

C4FM



Ref Lvl
-0.7 dBm

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



Date: 26.AUG.2009 14:16:08

Test Data – Occupied Bandwidth

800 LMR

OBW

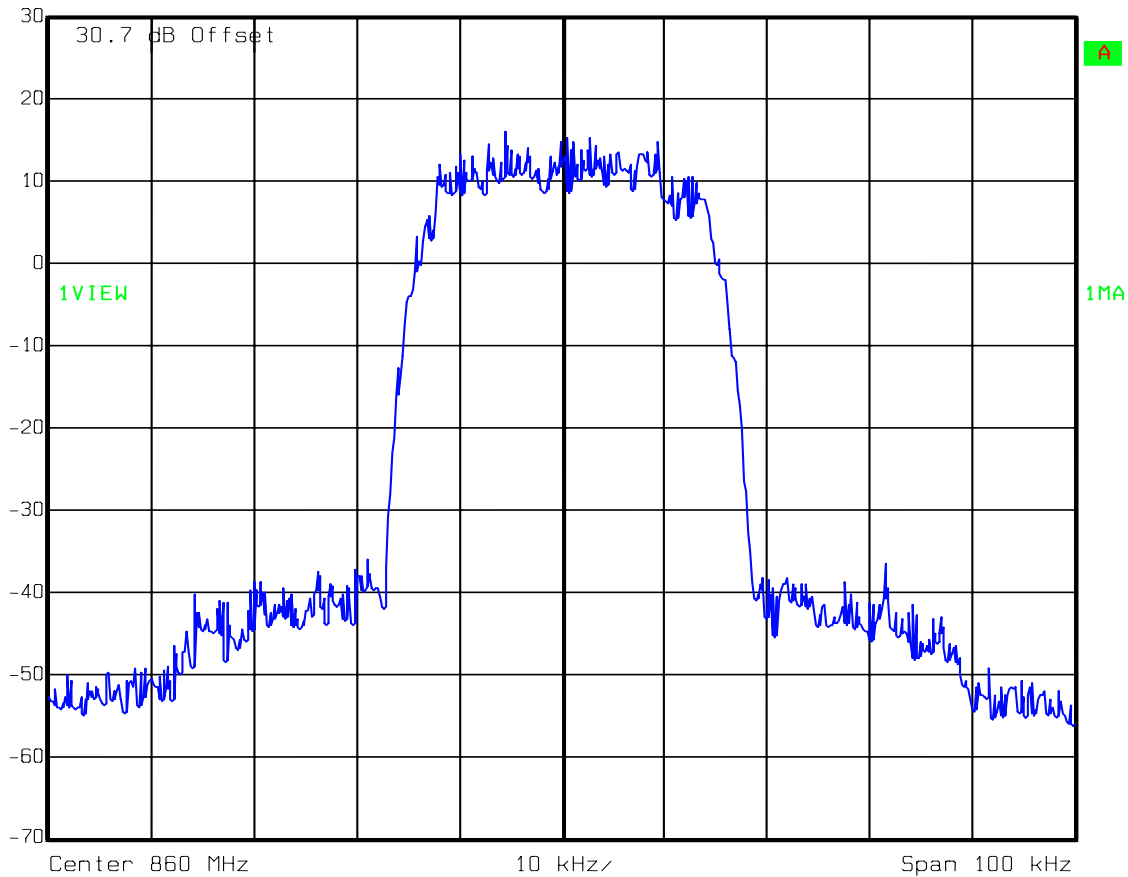
Output

iDEN



Ref Lvl
30 dBm

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



Date: 26.AUG.2009 14:25:21

Test Data – Occupied Bandwidth

800 LMR

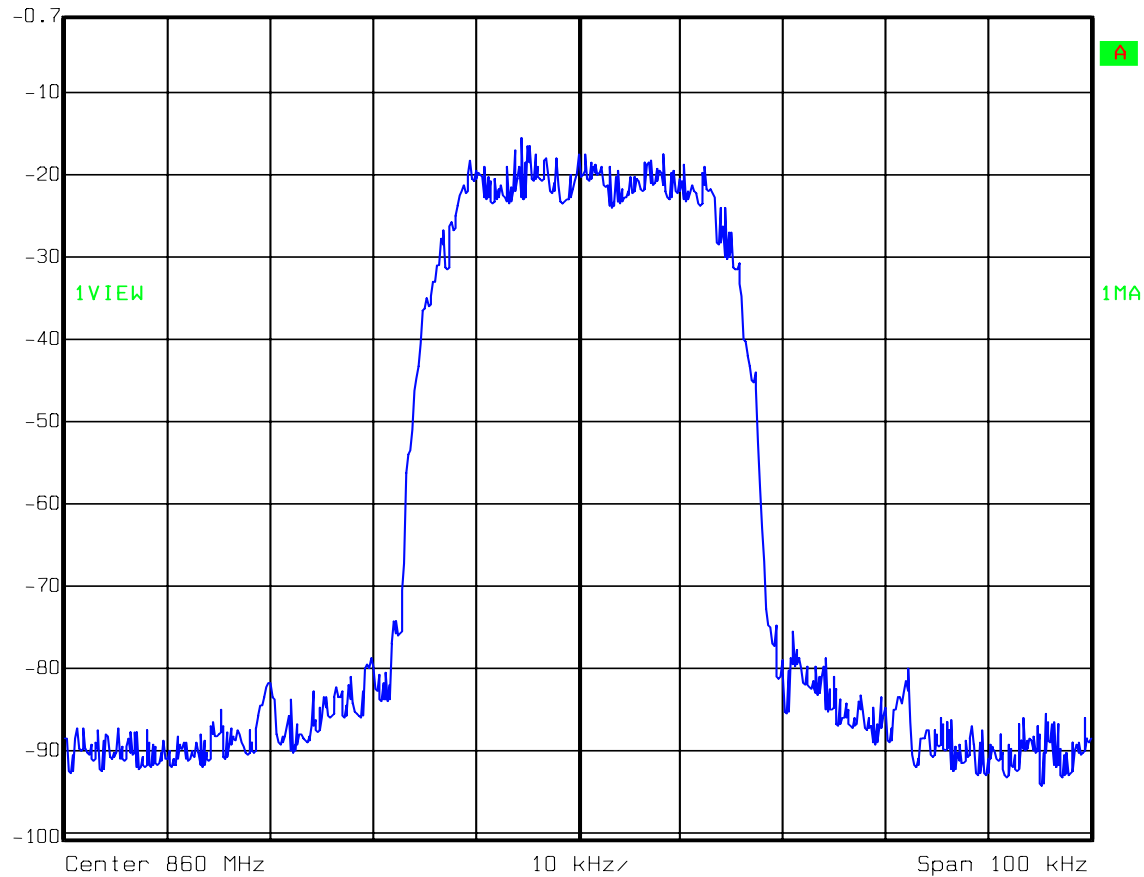
OBW

Input

iDEN

Ref Lvl
-0.7 dBm

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



Date: 26.AUG.2009 14:26:31

Test Data – Occupied Bandwidth

900 LMR

OBW

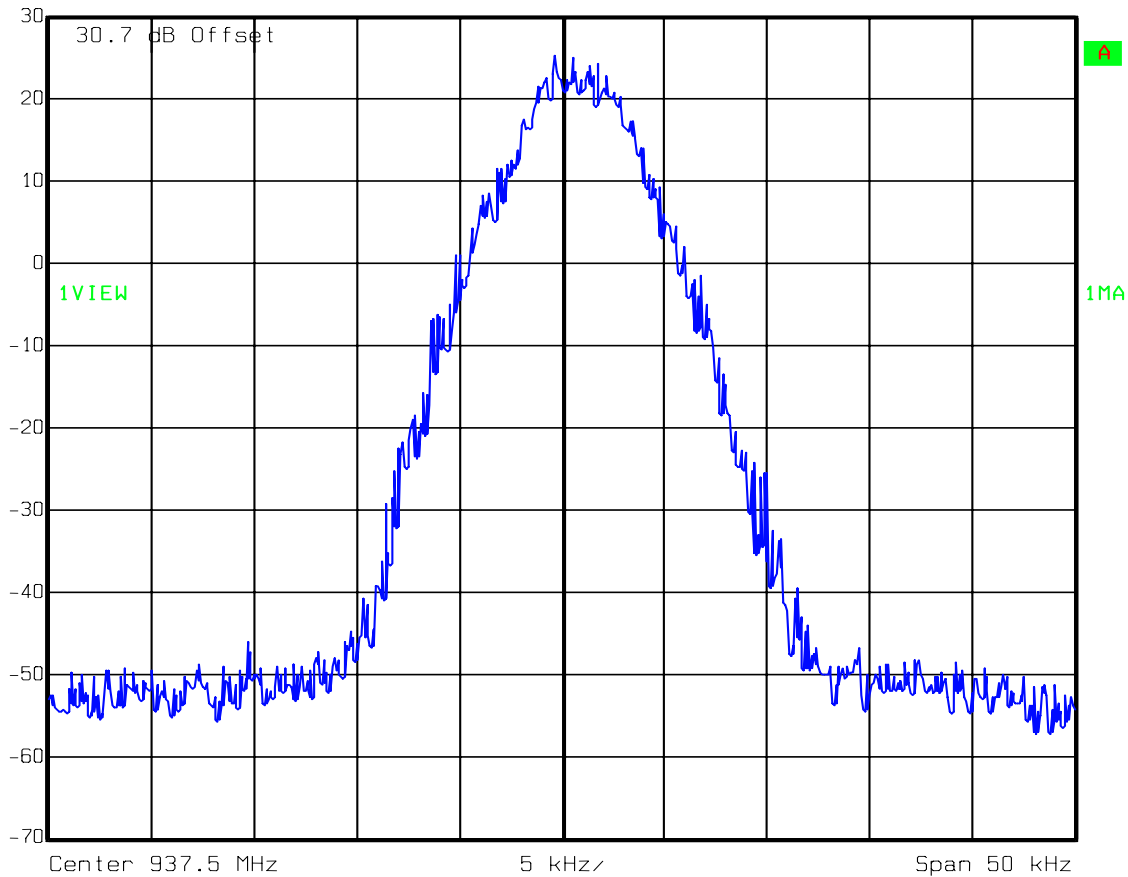
Output

C4FM



Ref Lvl
30 dBm

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



Date: 26.AUG.2009 14:37:18

Test Data – Occupied Bandwidth

900 LMR

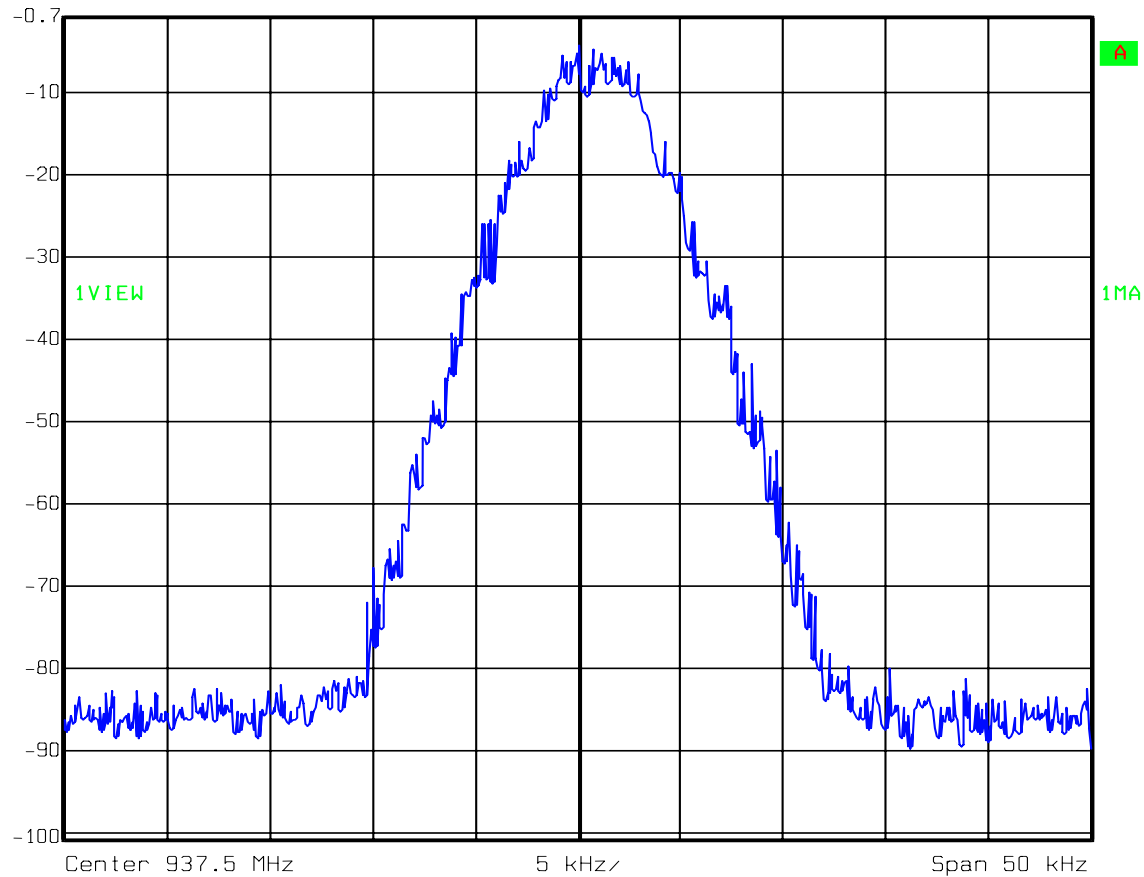
OBW

Input

C4FM

Ref Lvl
-0.7 dBm

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



Date: 26.AUG.2009 14:38:25

Test Data – Occupied Bandwidth

900 LMR

OBW

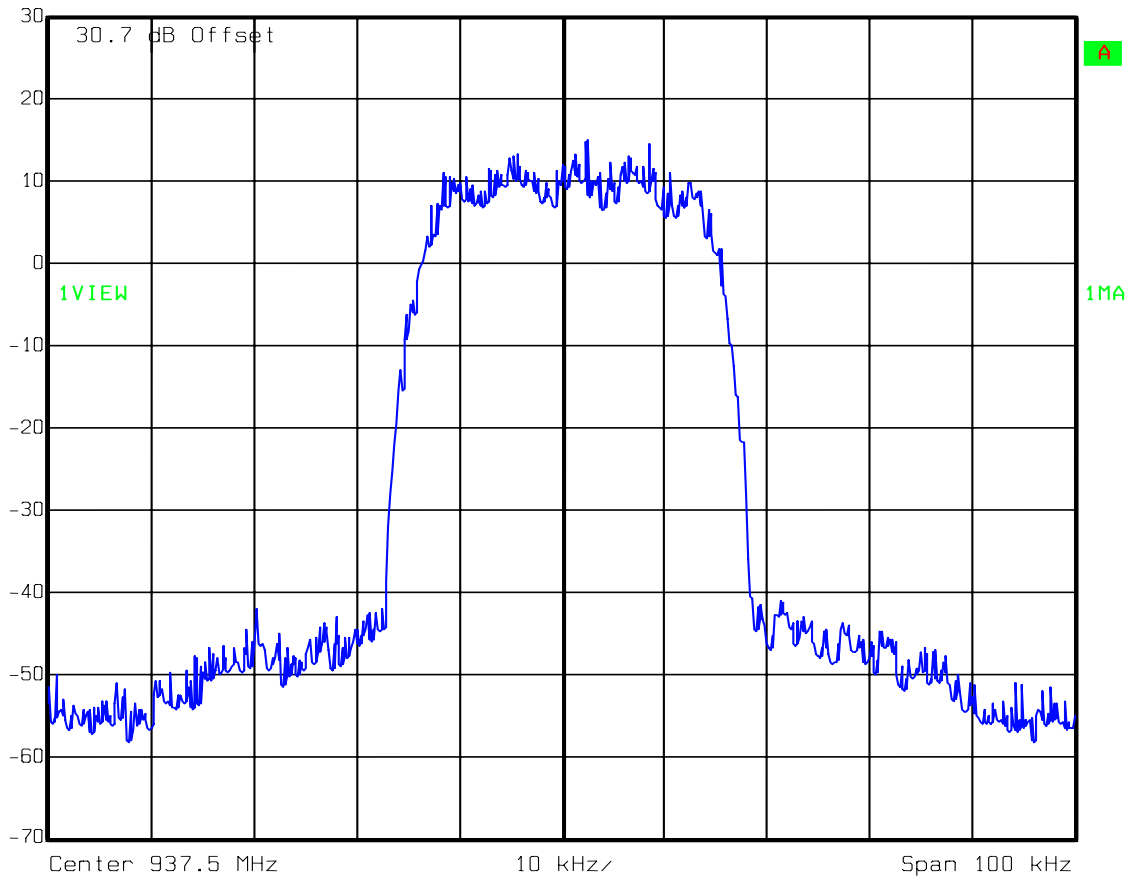
Output

iDEN



Ref Lvl
30 dBm

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



Date: 26.AUG.2009 14:41:12

Test Data – Occupied Bandwidth

900 LMR

OBW

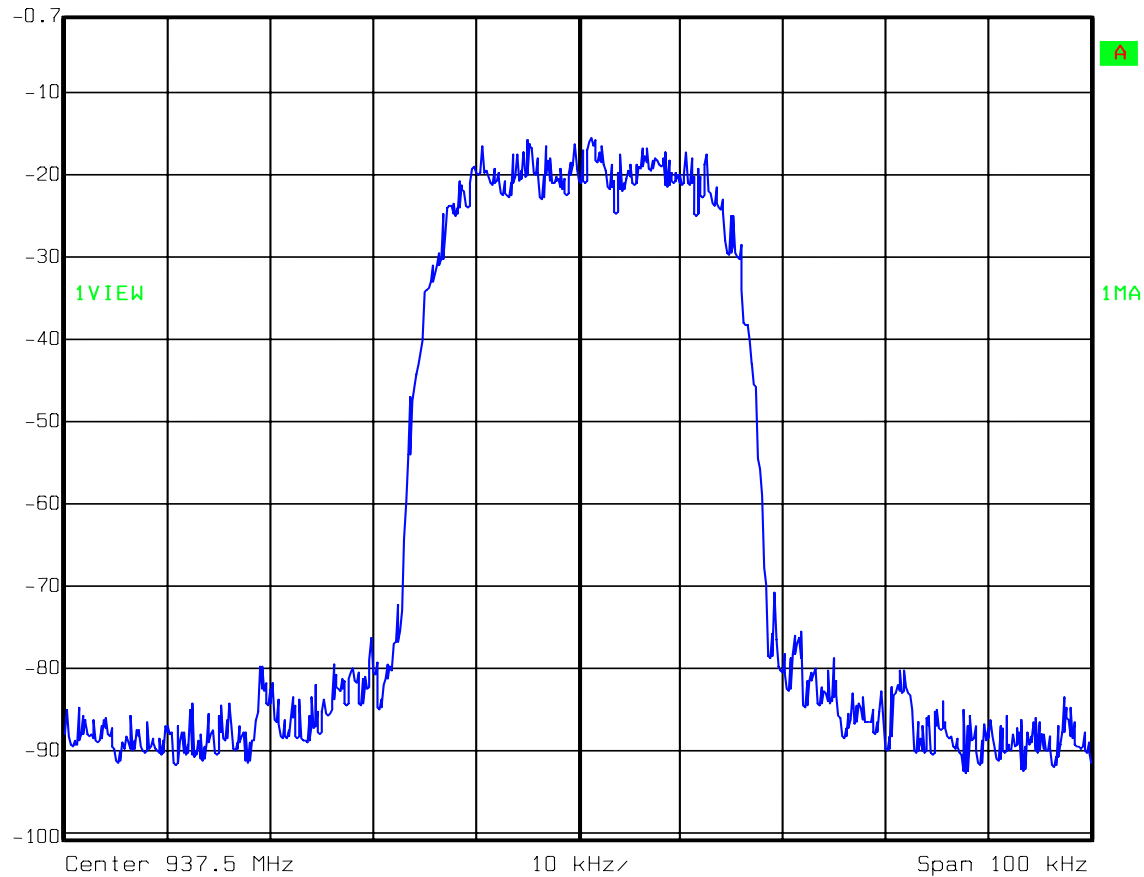
Input

iDEN



Ref Lvl
-0.7 dBm

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



Date: 26.AUG.2009 14:42:17

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.991
TESTED BY: David Light	DATE: 26 August 2009

Test Results: Complies.

Test Data: See attached plot(s).

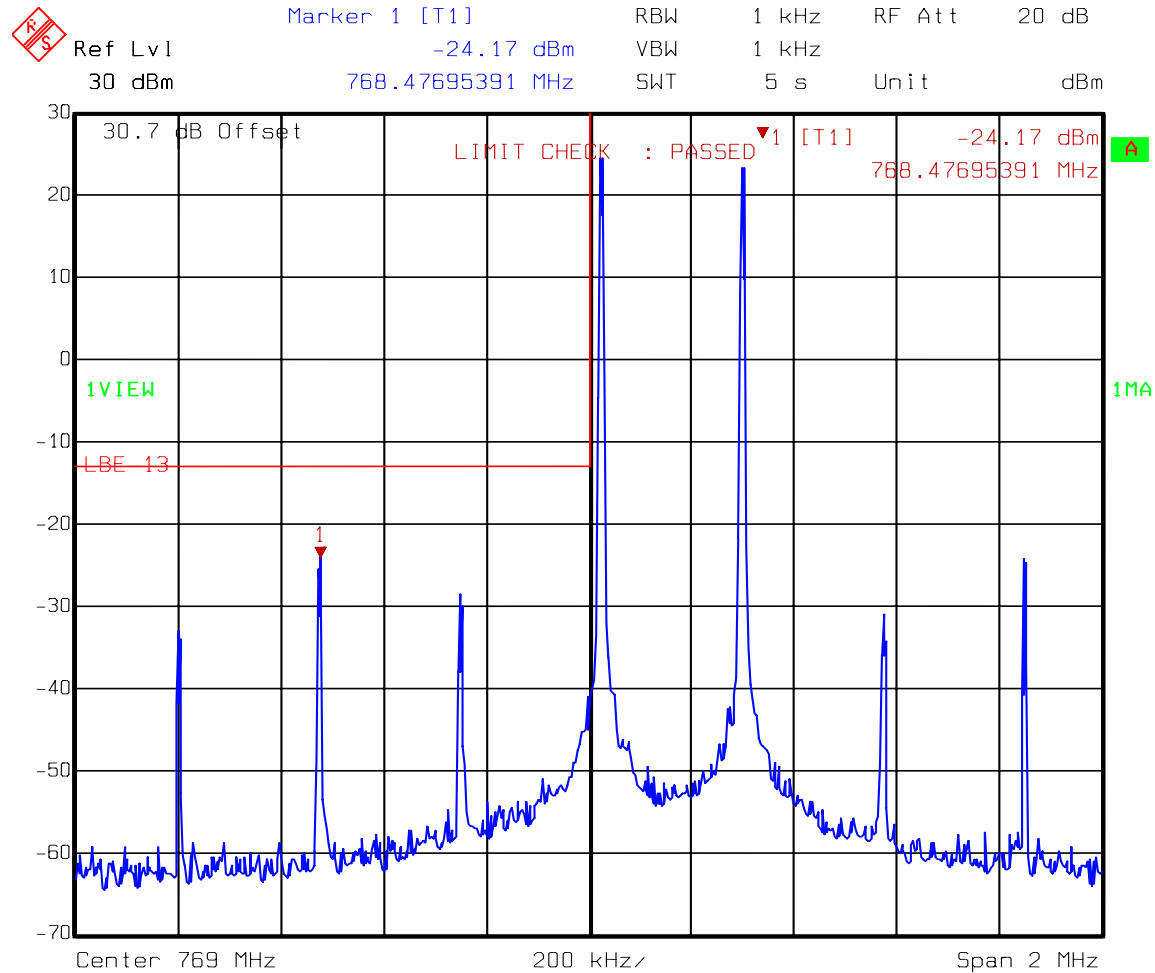
Equipment Used: 1036-1082-1469-1472

Measurement Uncertainty: +/- 1.7 dB

Temperature: 22 °C

Relative Humidity: 35 %

Test Data – Spurious Emissions at Antenna Terminals

700 LMR
Low Edge
C4FM

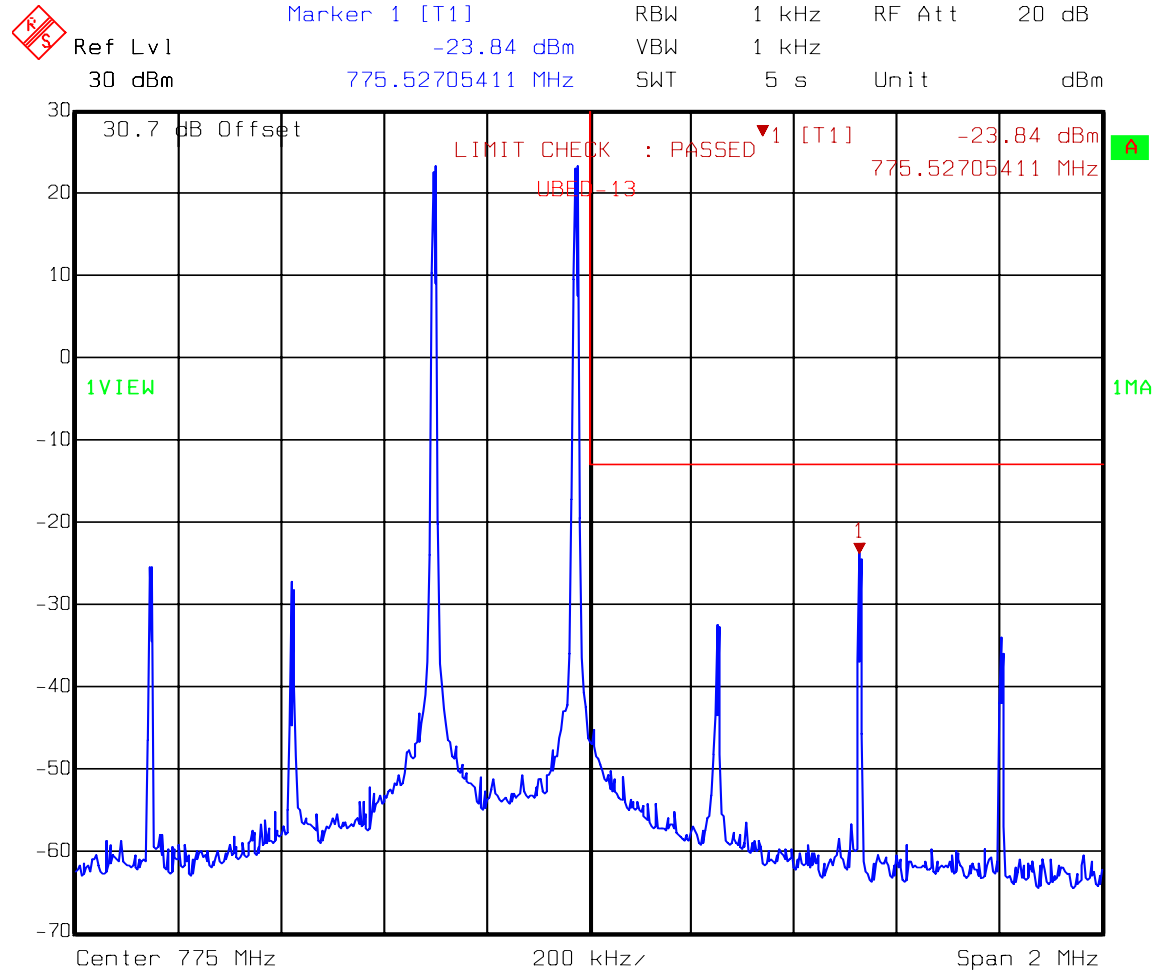
Date: 26.AUG.2009 09:18:21

Test Data – Spurious Emissions at Antenna Terminals

700 LMR

Upper Band Edge

APCO C4FM



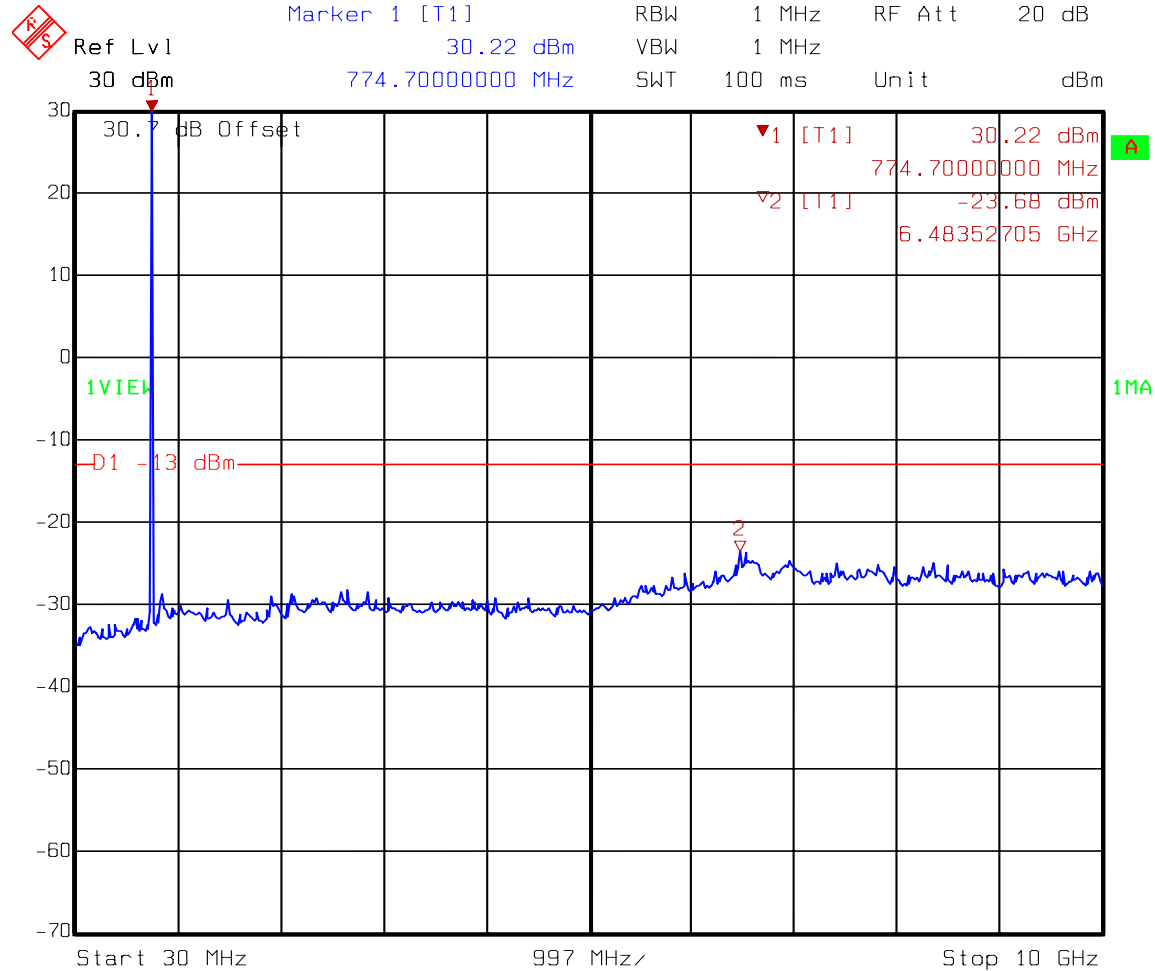
Date: 26.AUG.2009 09:20:57

Test Data – Spurious Emissions at Antenna Terminals

700 LMR

Spurs

APCO C4FM



Date: 26.AUG.2009 09:23:17

Test Data – Spurious Emissions at Antenna Terminals

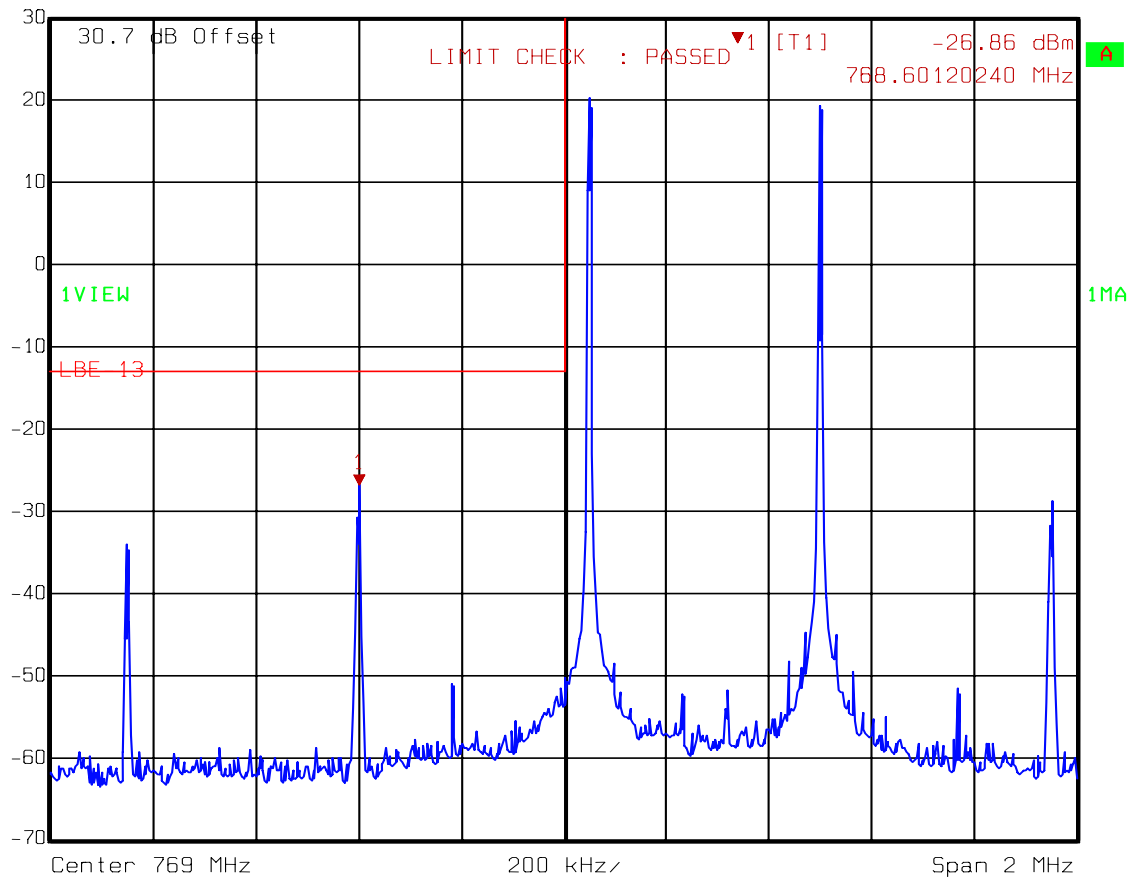
700 LMR

Low Edge

APCO 25 (CQPSK)

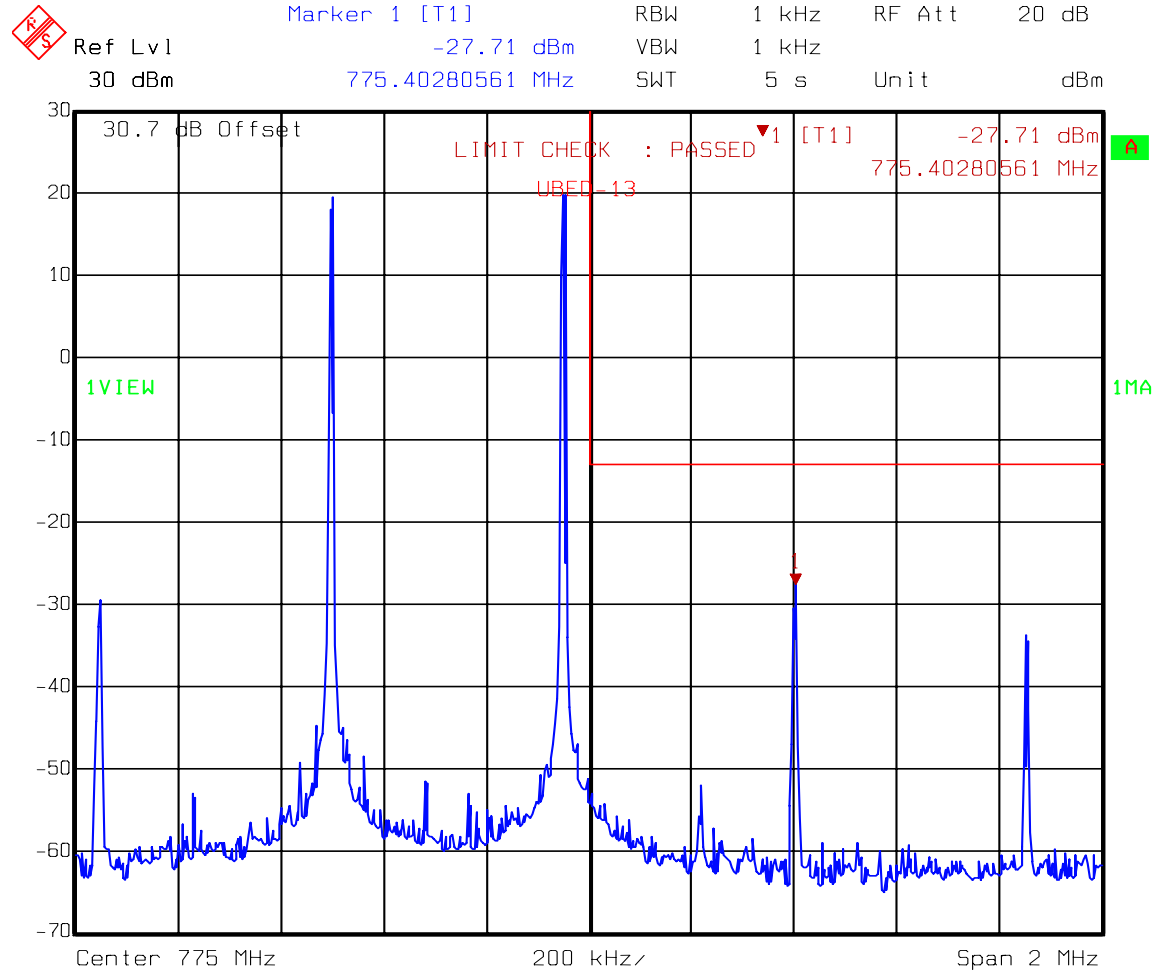


Marker 1 [T1] RBW 1 kHz RF Att 20 dB
Ref Lvl -26.86 dBm VBW 1 kHz
30 dBm 768.60120240 MHz SWT 5 s Unit dBm



Date: 26.AUG.2009 12:50:27

Test Data – Spurious Emissions at Antenna Terminals

700 LMR
Upper Edge
APCO 25

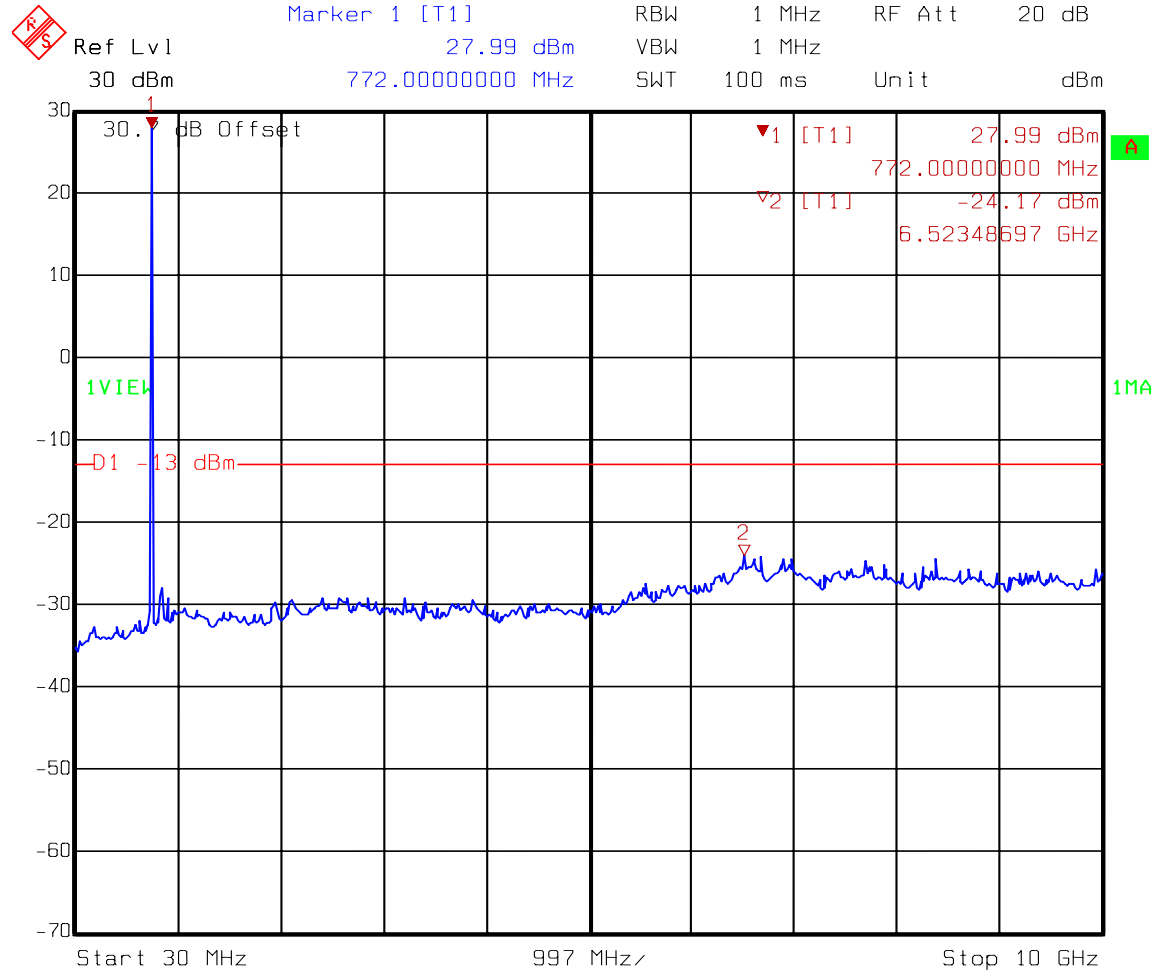
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Test Data – Spurious Emissions at Antenna Terminals

700 LMR

Spurs

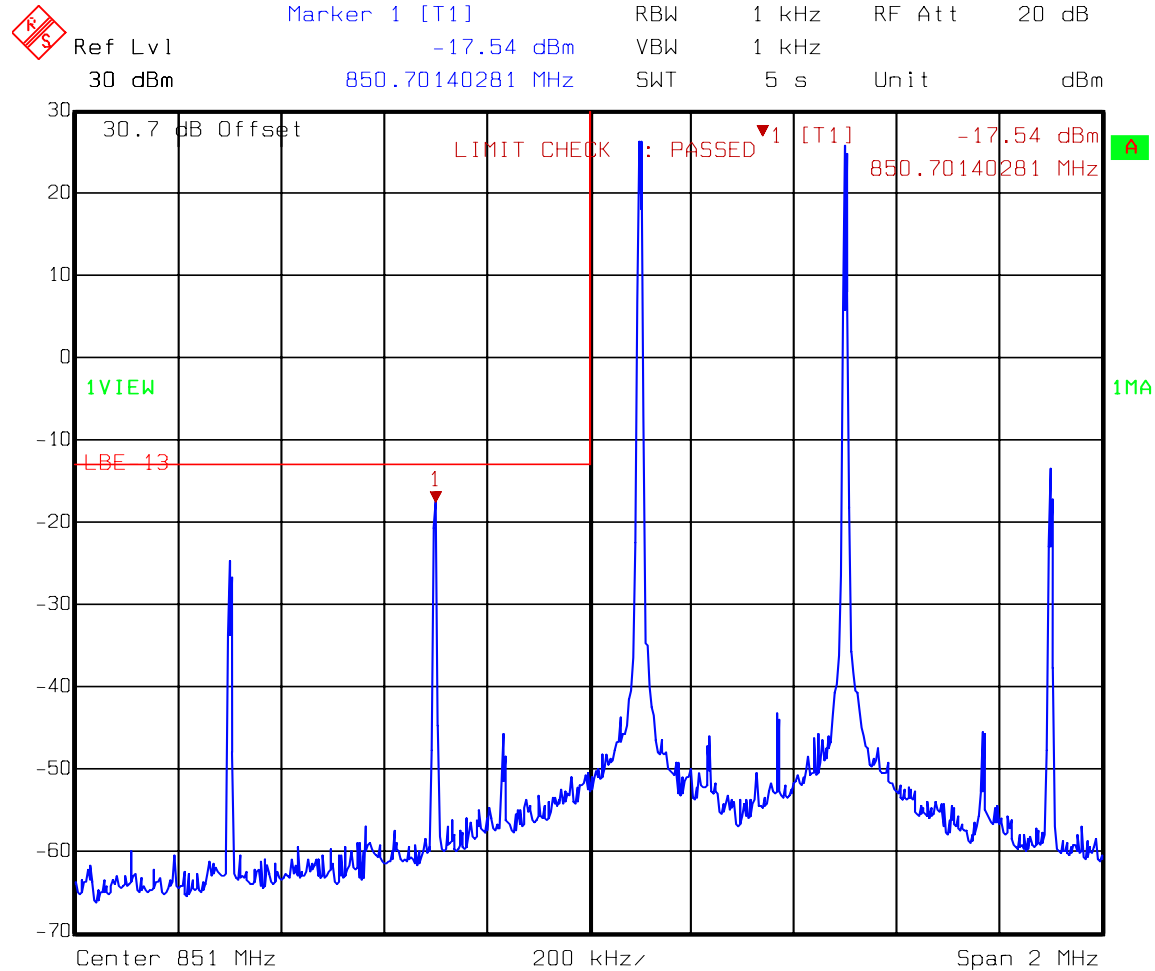
APCO 25



Date: 26.AUG.2009 12:58:11

Test Data – Spurious Emissions at Antenna Terminals

800 LMR
Low Edge
C4FM



Date: 26.AUG.2009 14:11:23

Test Data – Spurious Emissions at Antenna Terminals

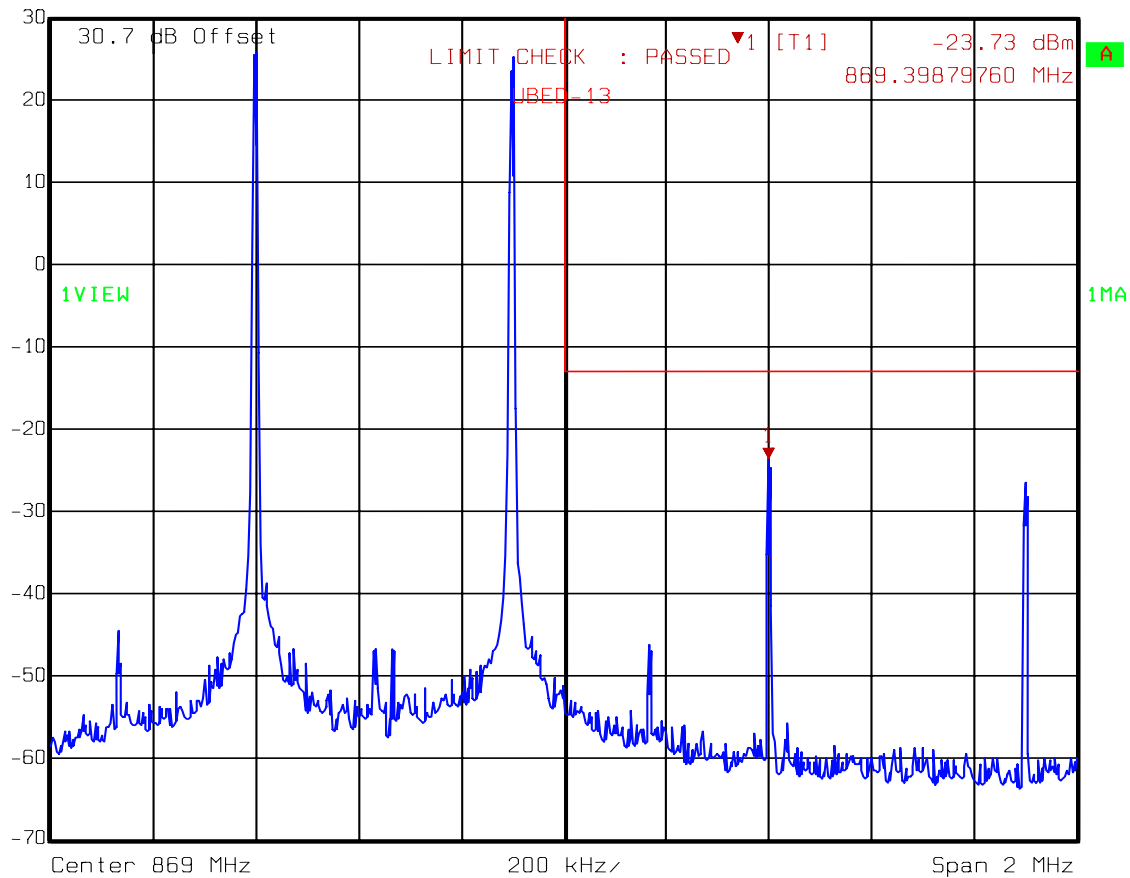
800 LMR

Upper Band Edge

C4FM



Marker 1 [T1] RBW 1 kHz RF Att 20 dB
Ref Lvl -23.73 dBm VBW 1 kHz
30 dBm 869.39879760 MHz SWT 5 s Unit dBm



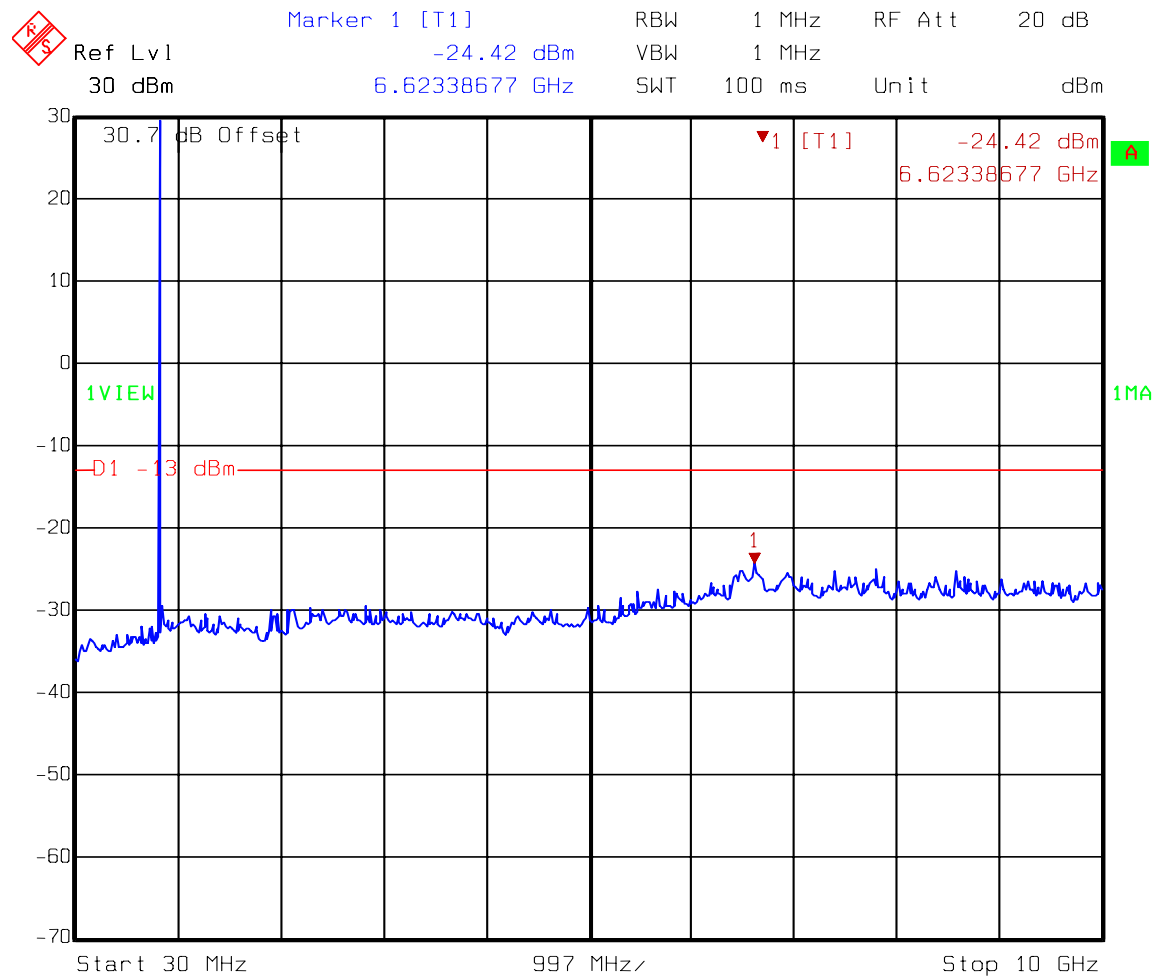
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Test Data – Spurious Emissions at Antenna Terminals

800 LMR

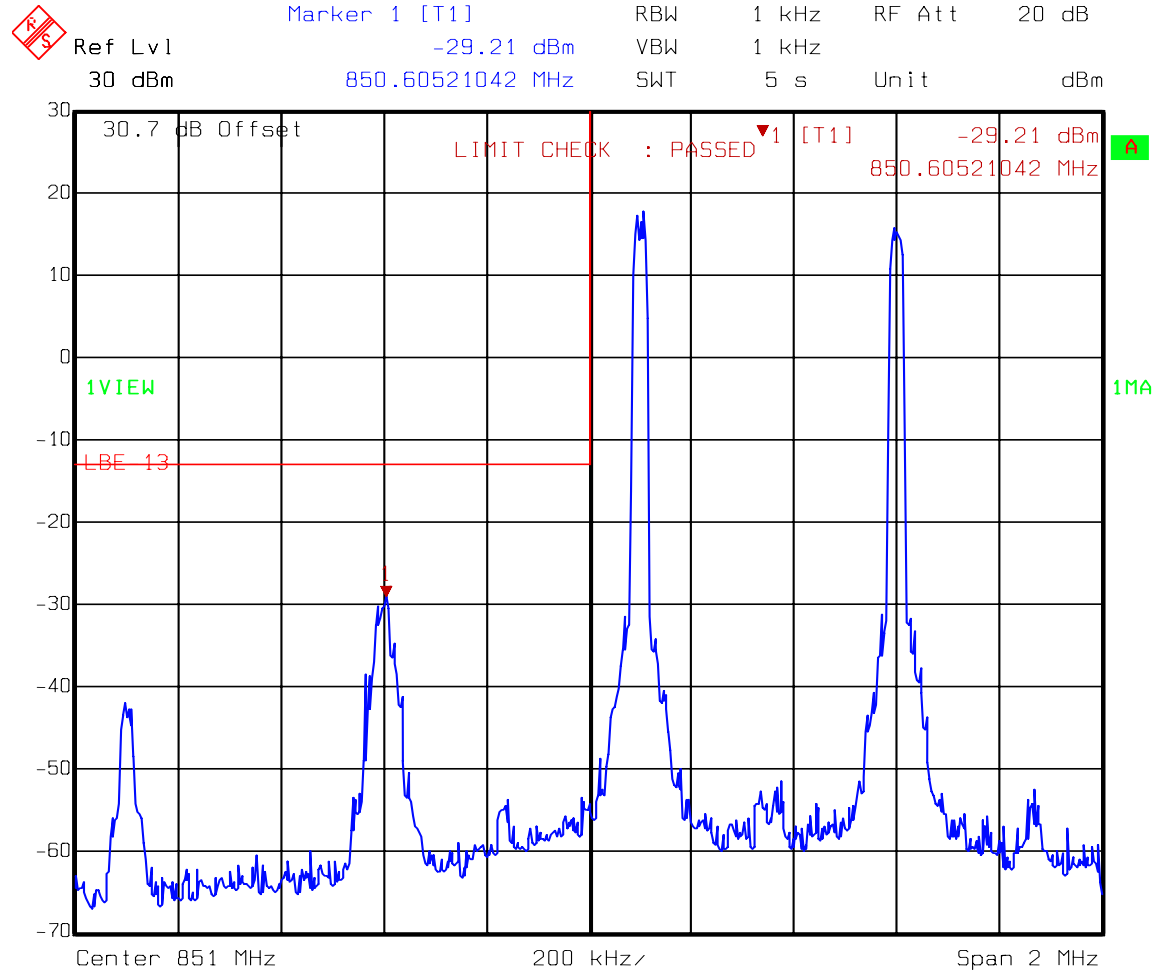
Spurs

C4FM



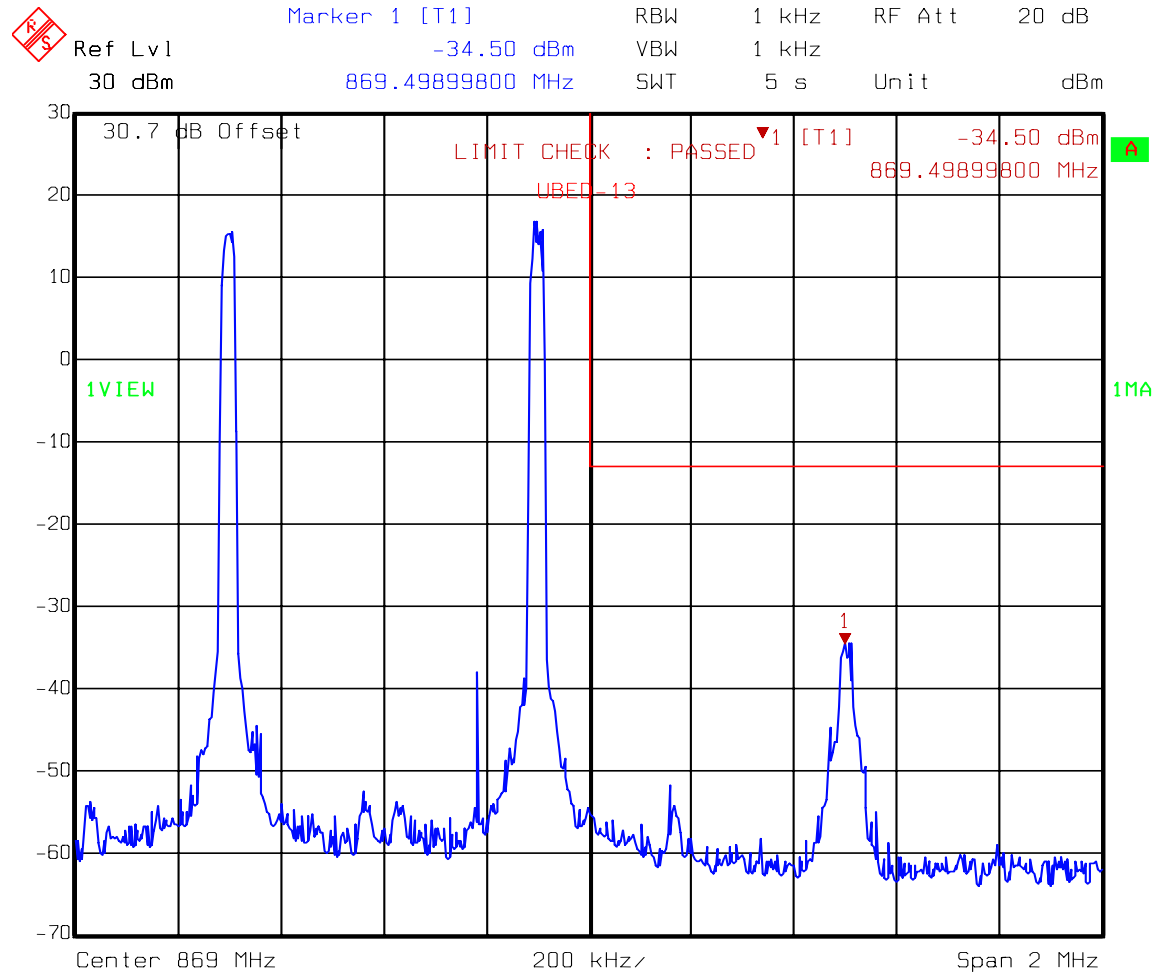
Date: 26.AUG.2009 14:17:16

Test Data – Spurious Emissions at Antenna Terminals

800 LMR
Low Edge
iDEN

Date: 26.AUG.2009 14:20:36

Test Data – Spurious Emissions at Antenna Terminals

800 LMR
Upper Edge
iDEN

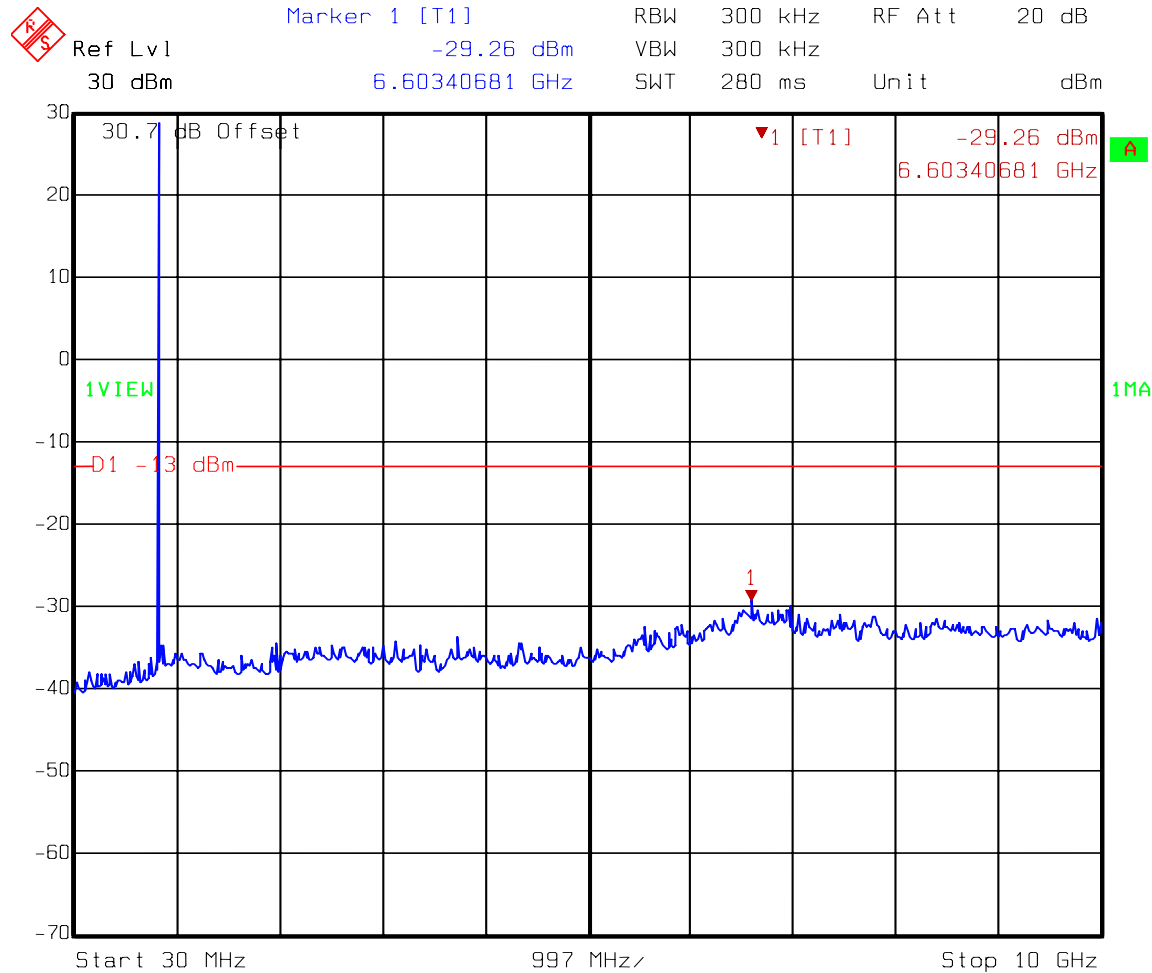
Date: 26.AUG.2009 14:23:09

Test Data – Spurious Emissions at Antenna Terminals

800 LMR

Spurs

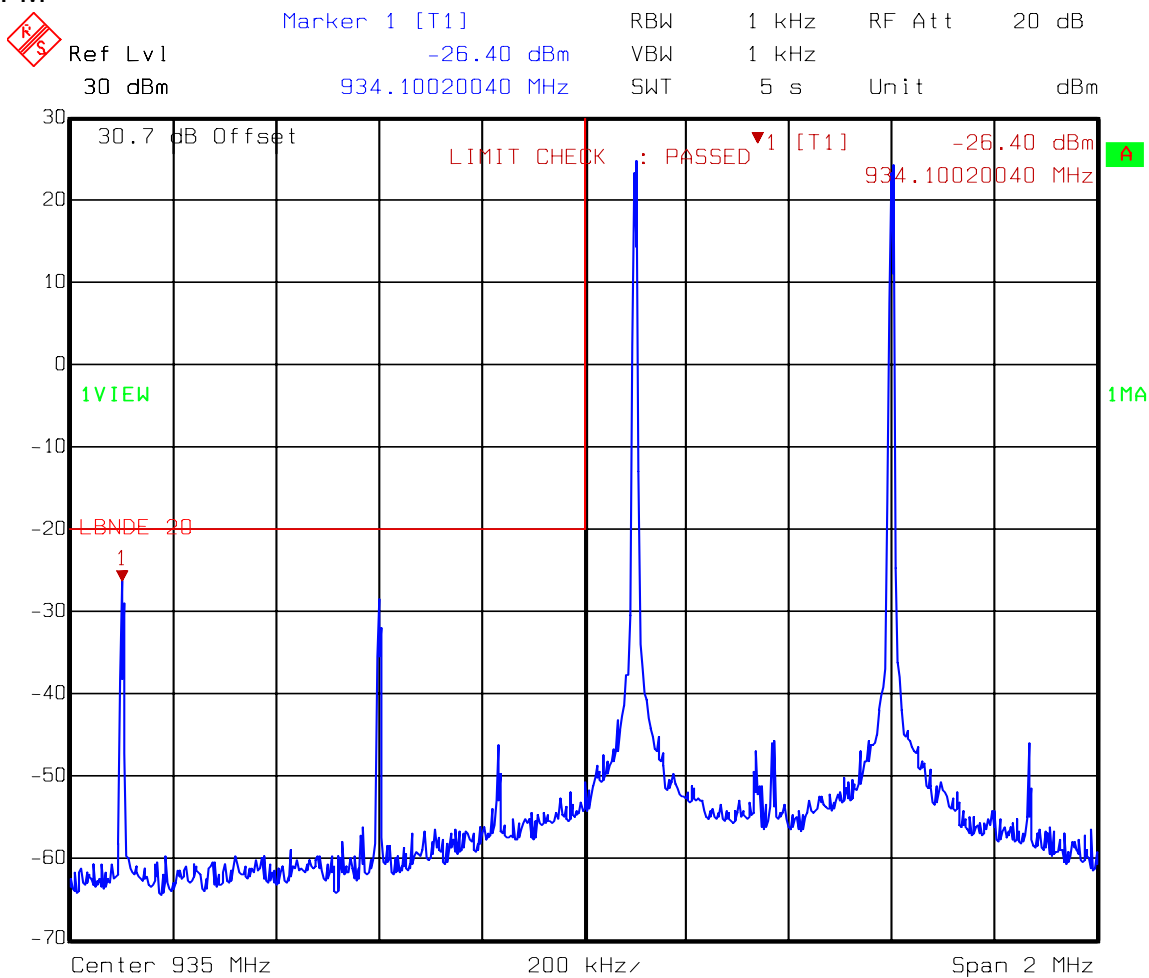
iDEN



Date: 26.AUG.2009 14:24:25

Test Data – Spurious Emissions at Antenna Terminals

900 LMR
Low Edge
C4FM



Date: 26.AUG.2009 14:33:34

Test Data – Spurious Emissions at Antenna Terminals

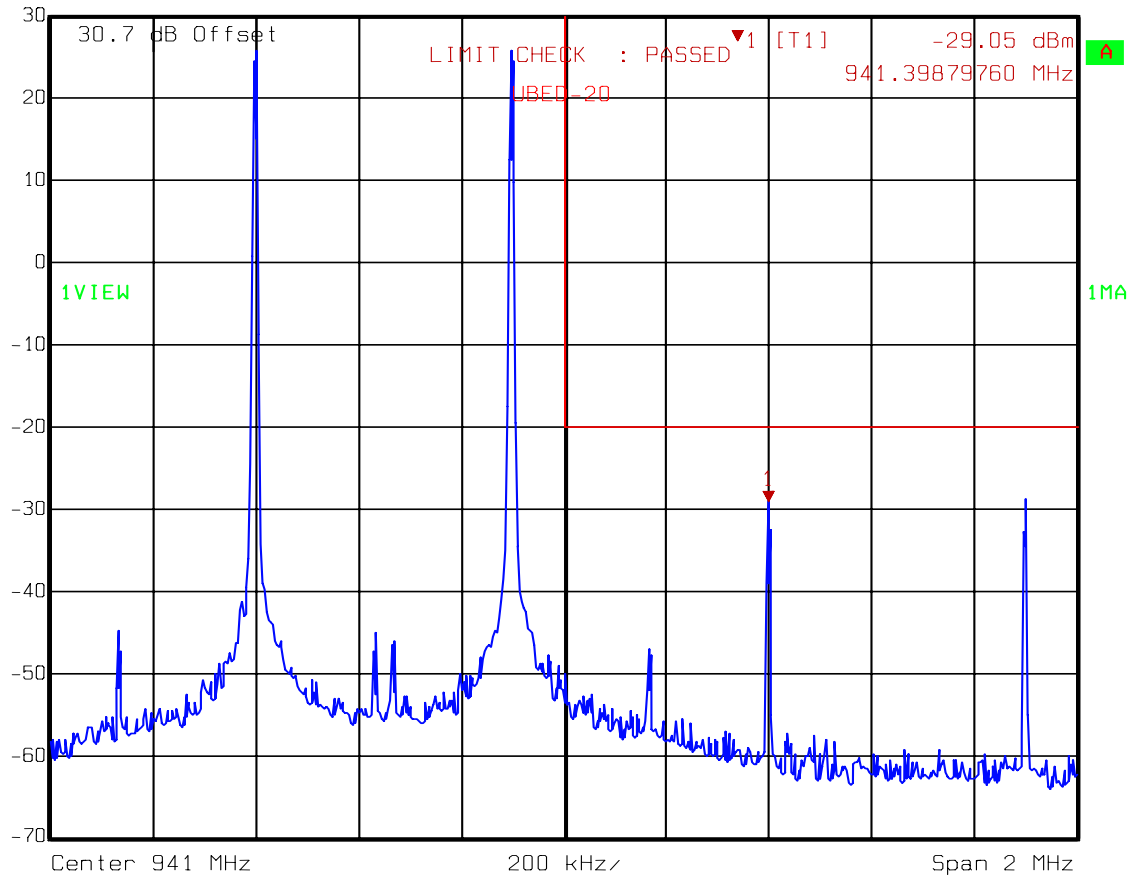
900 LMR

Upper Band Edge

C4FM



Marker 1 [T1] RBW 1 kHz RF Att 20 dB
Ref Lvl -29.05 dBm VBW 1 kHz
30 dBm 941.39879760 MHz SWT 5 s Unit dBm



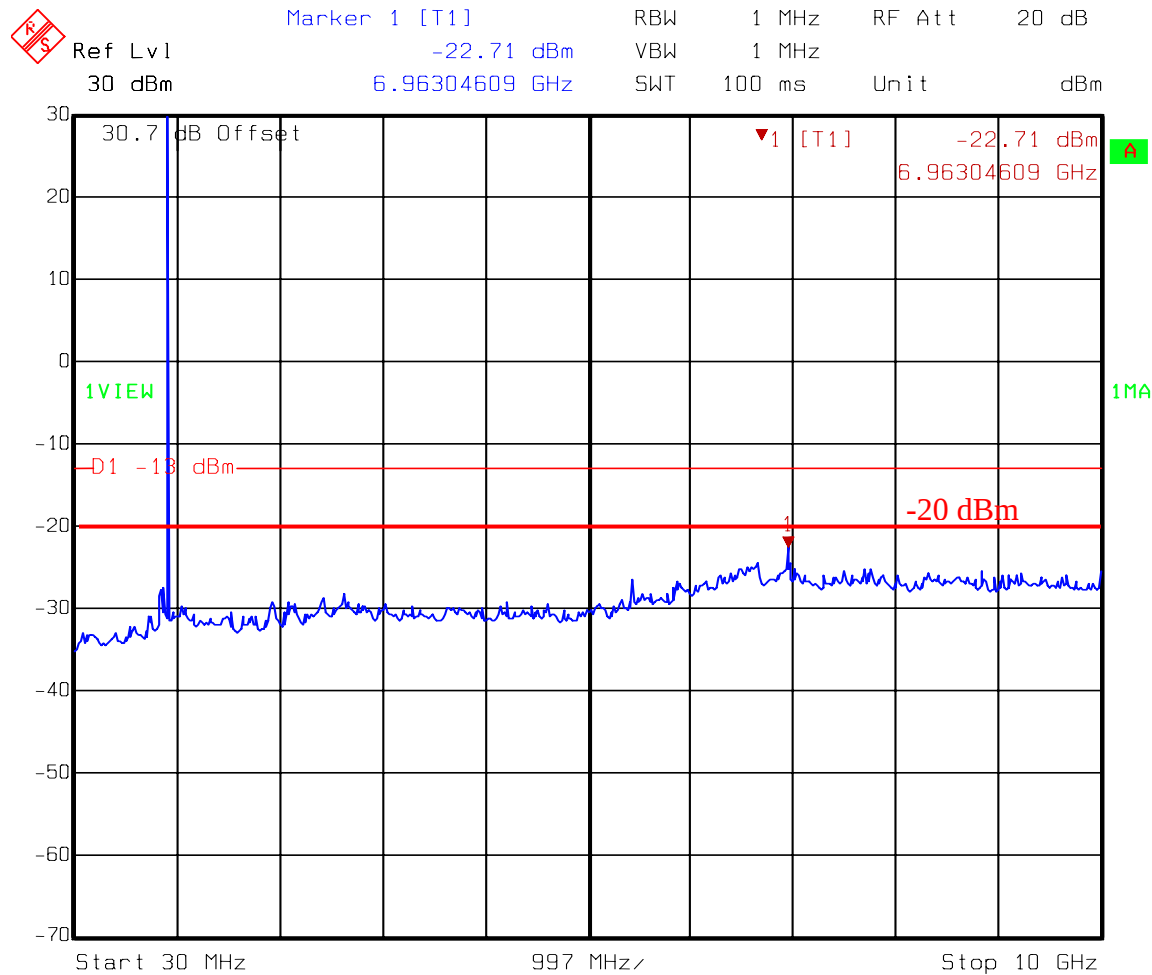
Date: 26.AUG.2009 14:34:57

Test Data – Spurious Emissions at Antenna Terminals

900 LMR

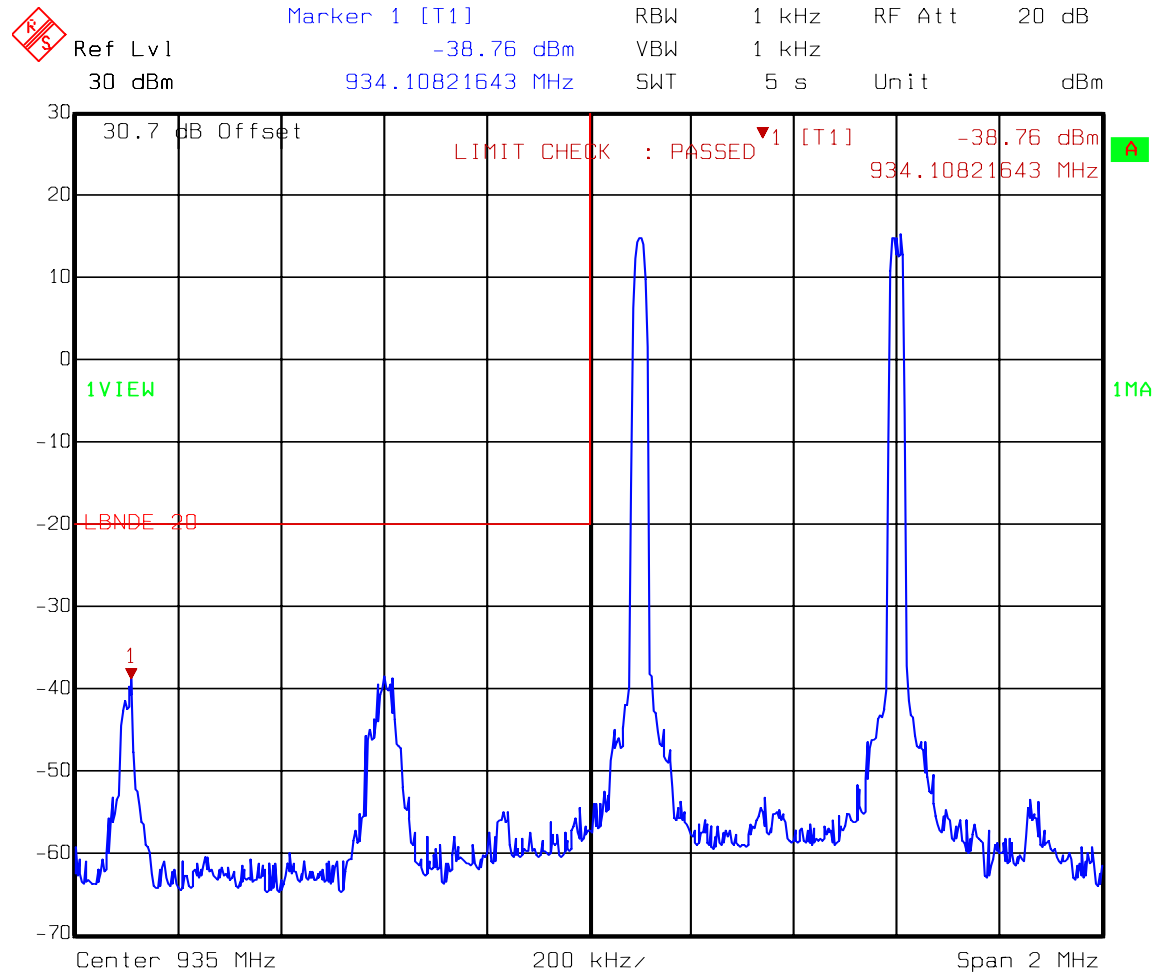
Spurs

C4FM



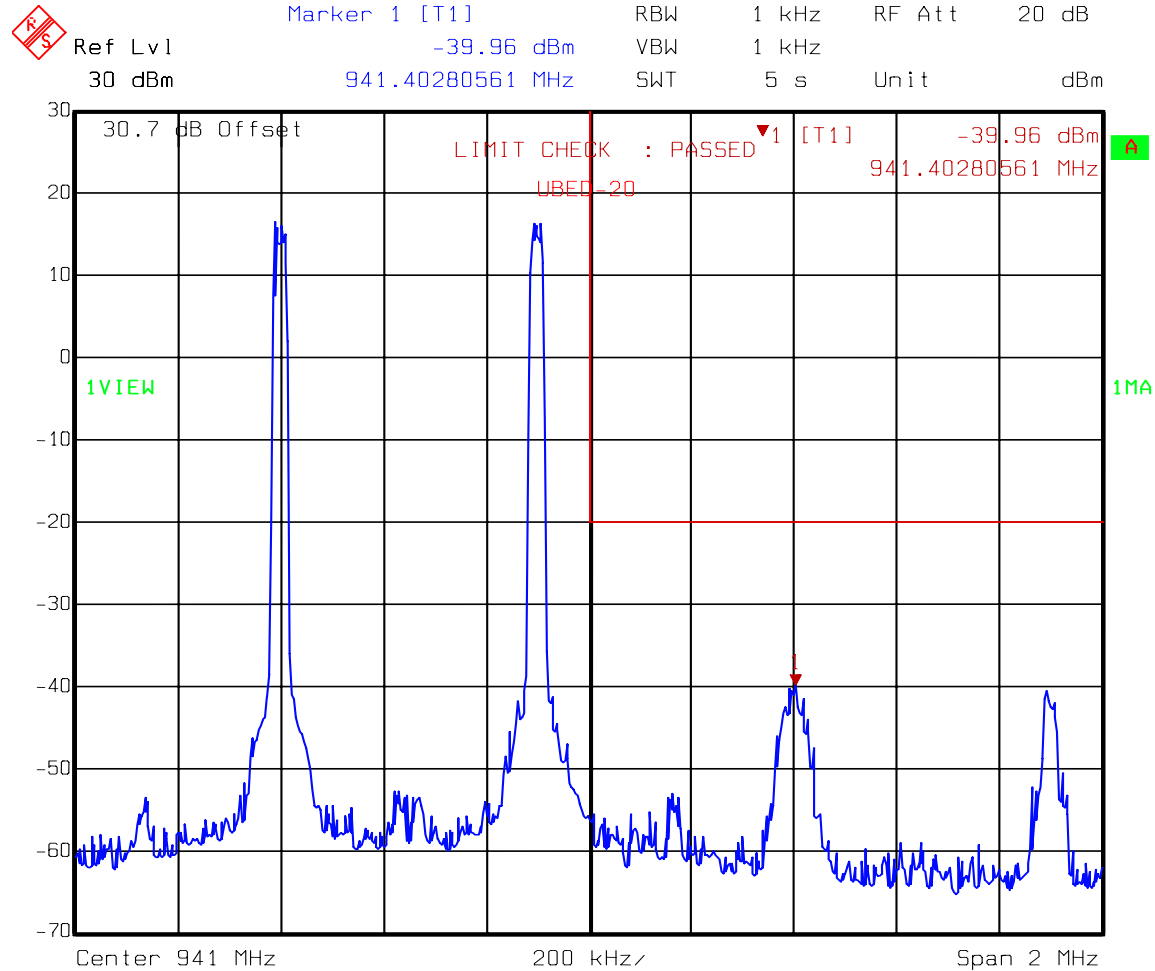
Date: 26.AUG.2009 14:36:24

Test Data – Spurious Emissions at Antenna Terminals

900 LMR
Low Edge
iDEN

Date: 26.AUG.2009 14:45:07

Test Data – Spurious Emissions at Antenna Terminals

900 LMR
Upper Edge
iDEN

Date: 26.AUG.2009 14:46:07

iDEN



Section 6. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.993
TESTED BY: David Light	DATE: 26 August 2009

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 of -20 dBm.

Equipment Used: 1464-1484-1485-1016-993-791-1763

Measurement Uncertainty: +/-1.7 dB

Temperature: 22 °C

Relative Humidity: 35 %

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	01/19/09	01/20/11
1082	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	CBU	N/A
1472	20db Attenuator DC 18 Ghz	Omni Spectra 20600-20db	NONE	CBU	N/A
1469	10 db Attenuator DC 18 Ghz	MCL Inc. BW-S10W2 10db-2WDC	NONE	CBU	N/A
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	02/27/09	02/28/11
1484	Cable	Storm PR90-010-072	N/A	06/23/09	06/23/10
1485	Cable	Storm PR90-010-216	N/A	06/23/09	06/23/10
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	06/23/09	06/23/10
791	PREAMP, 25dB	Nemko USA, Inc. LNA25	398	05/28/09	05/28/10
993	Horn antenna	A.H. Systems SAS-200/571	XXX	08/31/07	08/31/09
1763	Bilog Antenna	Schaffner CBL 6111D	22926	11/04/08	11/04/09

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:

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.

**NAME OF TEST: Spurious Emissions at Antenna
Terminals**

PARA. NO.: 2.991

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: $\geq$ RBW

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

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

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.: 2.993
---	-------------------------

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.

NAME OF TEST: Frequency Stability**PARA. NO.: 2.995**

Minimum Standard: Para. No. 990.213. The transmitter carrier frequency shall remain

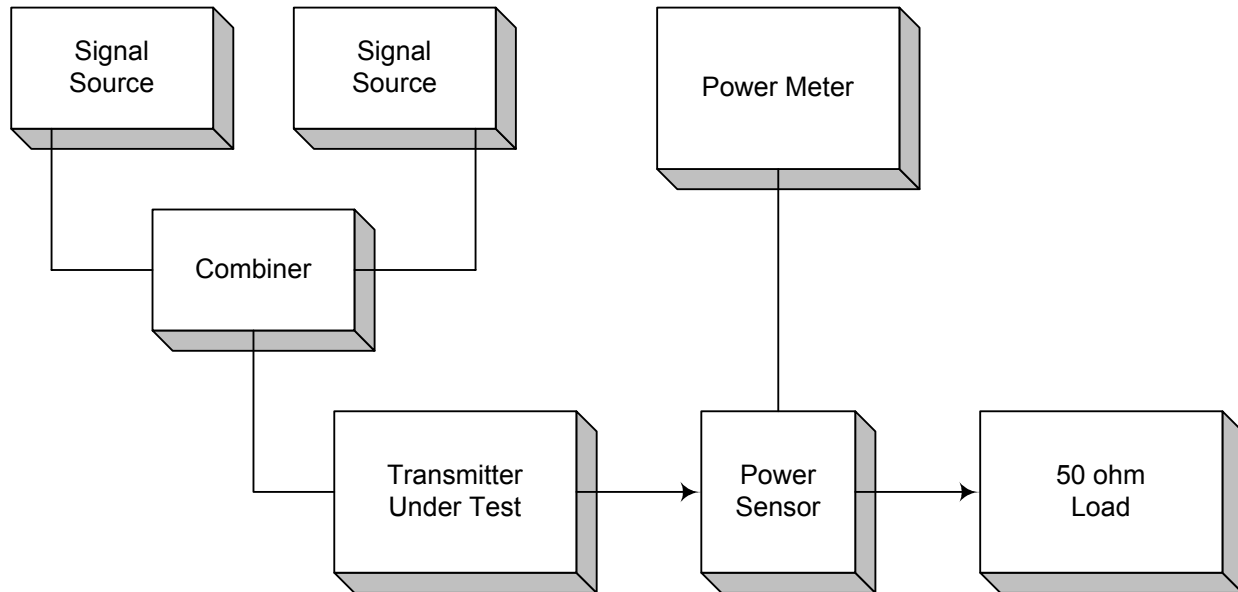
within the assigned frequency below in ppm.

Table 2

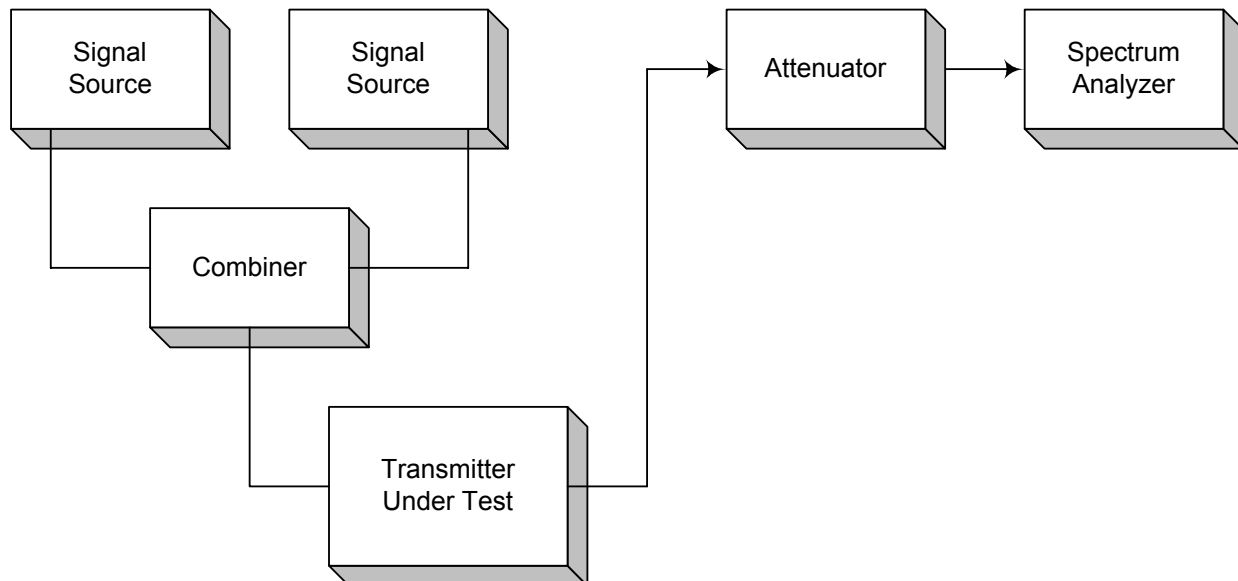
Frequency Band (MHz)	Fixed And Base Stations	Mobile Stations	
		> 2 Watts o/p pwr	< 2 Watts o/p pwr
Below 25	100	100	200
25 - 50	20	20	50
72 - 76	5	-	50
150 - 174	5	5	5
220 - 222	0.1	1.5	1.5
421 - 512	2.5	5	5
806 - 821	1.5	2.5	2.5
821 - 824	1.0	1.5	15
851 - 866	1.5	2.5	2.5
866 - 869	1.0	1.5	1.5
869 - 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	-	-	-

ANNEX B - TEST DIAGRAMS

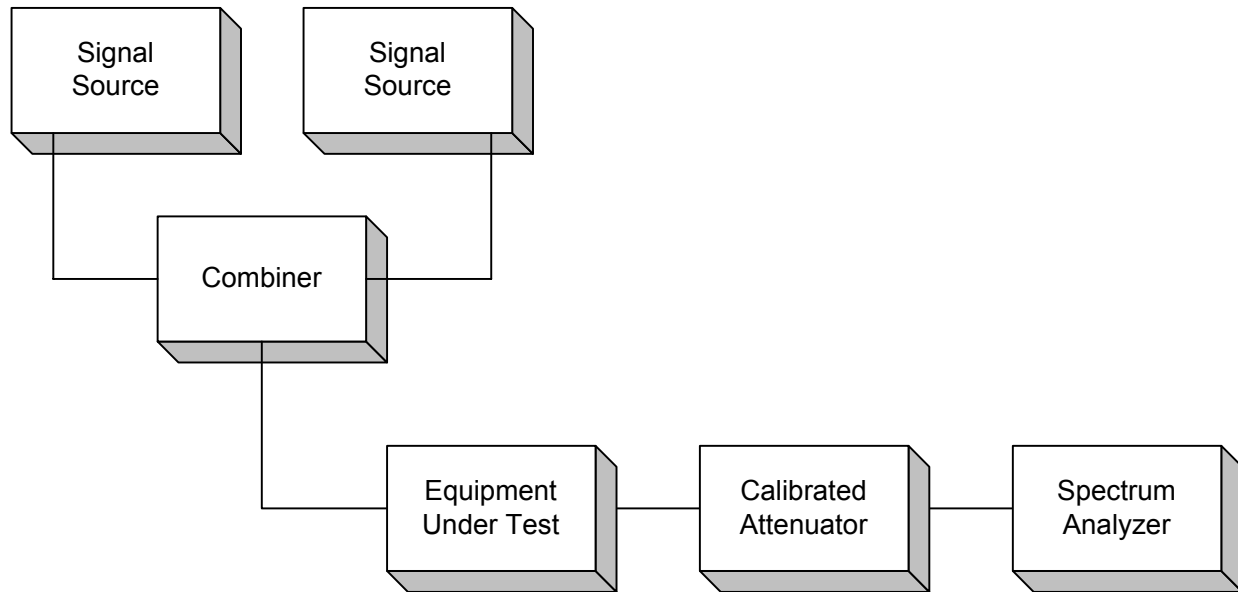
Para. No. 2.985 - R.F. Power Output



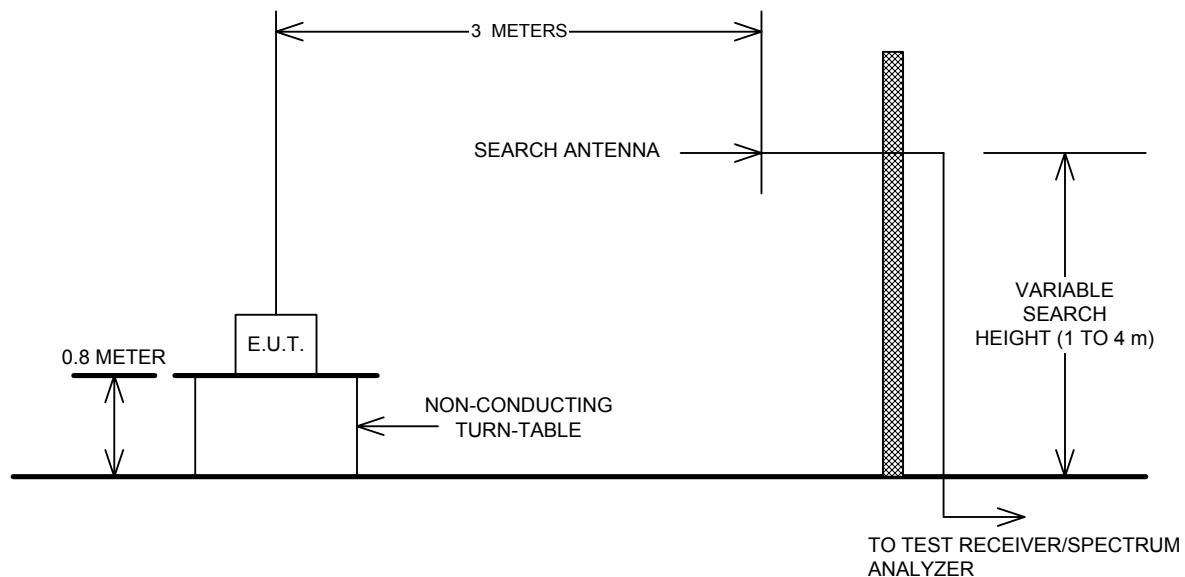
Para. No. 2.989 - Occupied Bandwidth



Para. No. 2.991 - Spurious Emissions at Antenna Terminals



Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability

