



Nemko Test Report: 29285RUS1

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

Equipment Under Test: TFAH70/80
(E.U.T.)

FCC Identifier: BCR-TFAH7080

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:  **DATE:** 16 June 2009
David Light, Senior Wireless Engineer

APPROVED BY:  **DATE:** 16 June 2009
Tom Tidwell, Telecom Direct

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EQUIPMENT: TFAH70/80

Section 1. Summary of Test Results

Manufacturer: Andrew Corporation

Model No.: TFAH70/80

Serial No.: 884005750

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

Supply Voltage Input: 120 Vac

Frequency Range: Downlink: 758 to 776 MHz and 851 to 869 MHz

Uplink: NA

Tunable Bands:

Type(s) of Modulation:	F3E (Voice)	F1D	F2D	D7W (QAM)	DXW (TDMA)
	☒	☒	☐	☒	☐

Gain: 31 dB

Output Impedance: 50 ohms

RF Power Output (rated):

1.25	W
31.0	dBm

Operator Selection of
Operating Frequency: NonePower Output Adjustment
Capability: ALC

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

Band Selection:	Software	Duplexer Change	Fullband Coverage
	☐	☐	☒

The TFAH70/80 is a dual band high power remote unit designed to distribute LMR700 and LMR800 band signals along the same fiber.

The diagram illustrates the connection of an Andrew L-Series antenna to an RF amplifier. The antenna, shown at the top, has a panel with various ports: TFLN, AUX, MAIN, U/L, D/L, L/R RX, and L/R TX. The RF INPUT is connected to the amplifier's input. Two optical fibers are connected between the antenna and the amplifier. The amplifier, shown at the bottom, has a panel with various ports: RF INPUT, RF OUTPUT, and several other ports. The RF OUTPUT is connected to the antenna's output.

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: David Light	DATE: 15 June 2009

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

Band	Modulation	Output per Channel (dBm)	Composite Power (dBm)	Composite Power (W)
700	Analog	28	31	1.25
70	IDEN	28	31	1.25
700	TDMA	28	31	1.25
800	Analog	28	31	1.25
800	IDEN	28	31	1.25
800	TDMA	28	31	1.25

Equipment Used: 1036-1082-1472-1469**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: 15 June 2009

Test Results: Complies.

Test Data: See attached plot(s).

Equipment Used: 1036-1082-1472-1469

Measurement Uncertainty: 1X10⁻⁷ ppm

Temperature: 22 °C

Relative Humidity: 35 %

EQUIPMENT: TFAH70/80

Test Data – Occupied Bandwidth

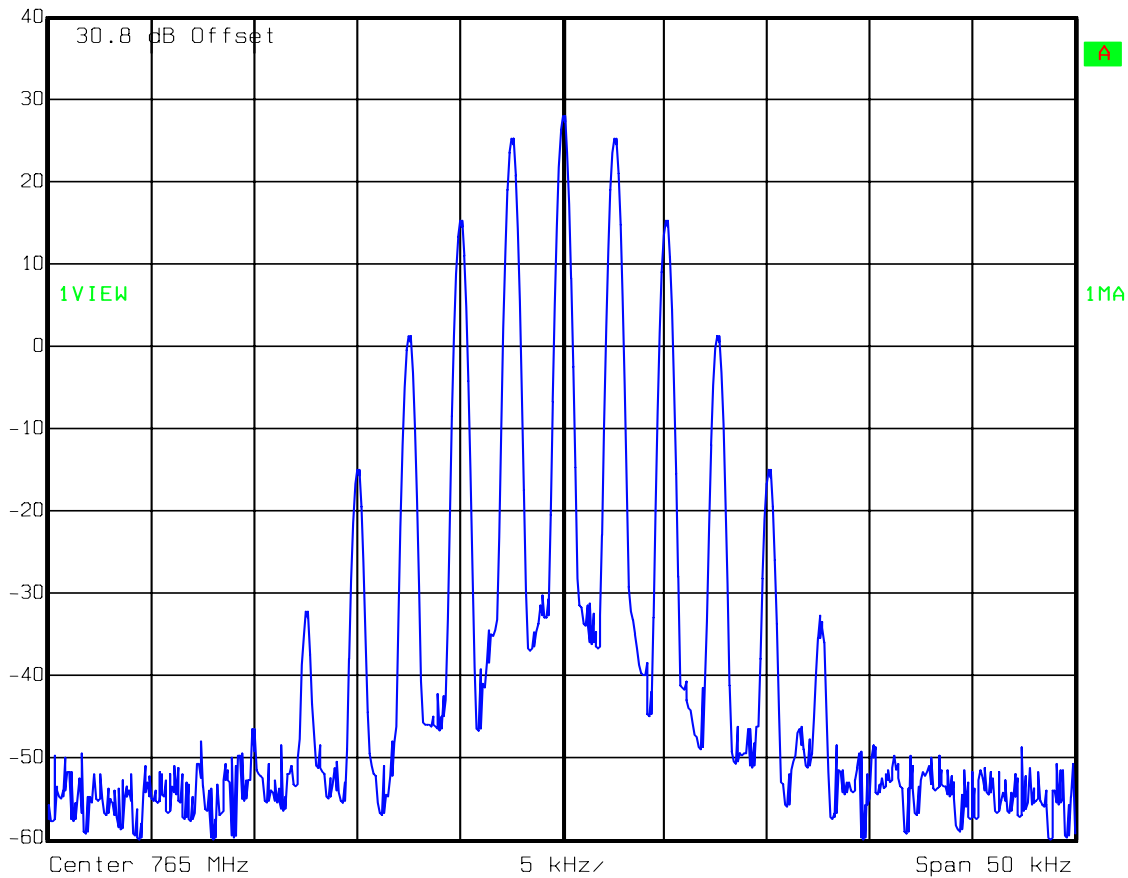
Analog - Output

2.5 kHz Tone / 3 kHz Deviation



Ref Lvl
40 dBm

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



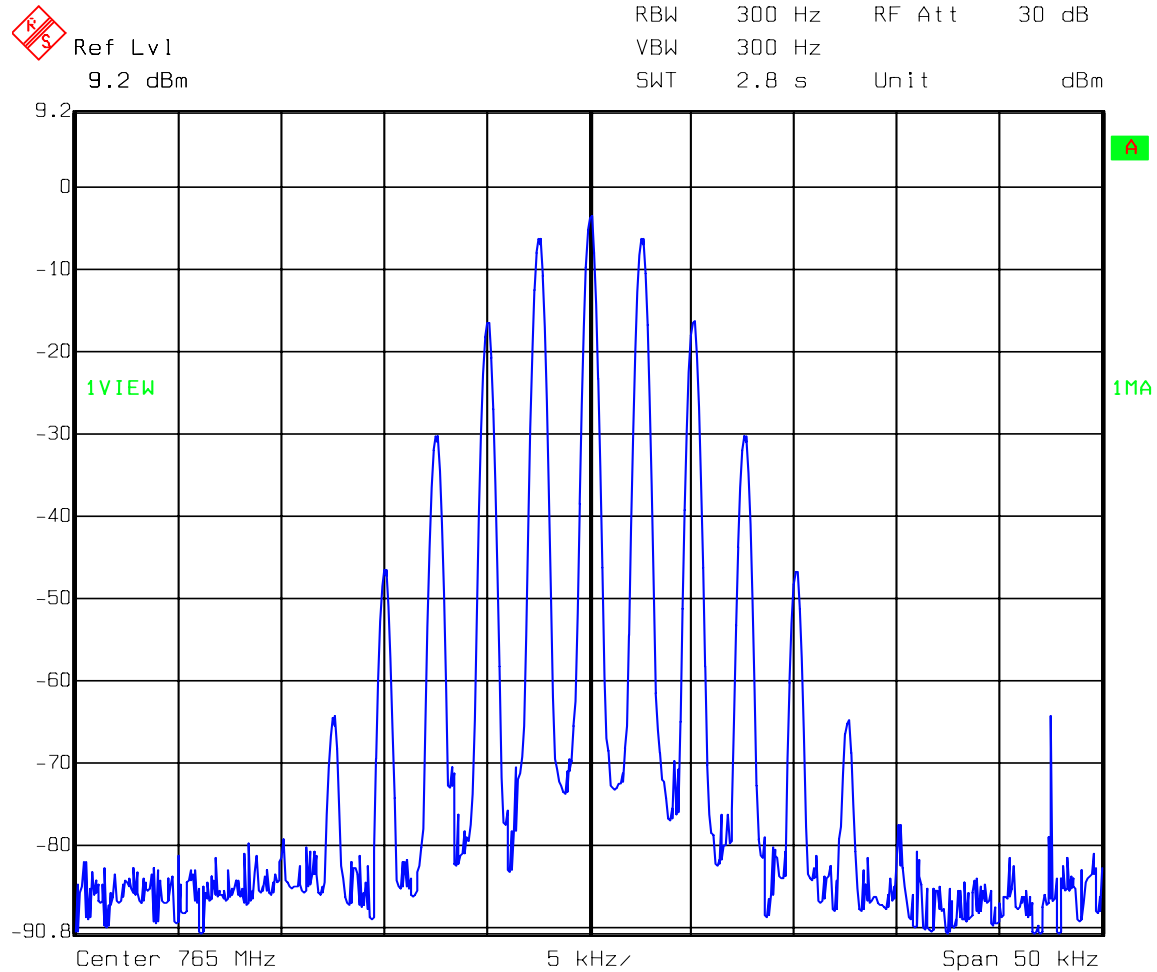
Date: 15.JUN.2009 14:12:16

EQUIPMENT: TFAH70/80

Test Data – Occupied Bandwidth

Analog - Input

2.5 kHz Tone / 3 kHz Deviation



Date: 15.JUN.2009 14:13:30

EQUIPMENT: TFAH70/80

Test Data – Occupied Bandwidth

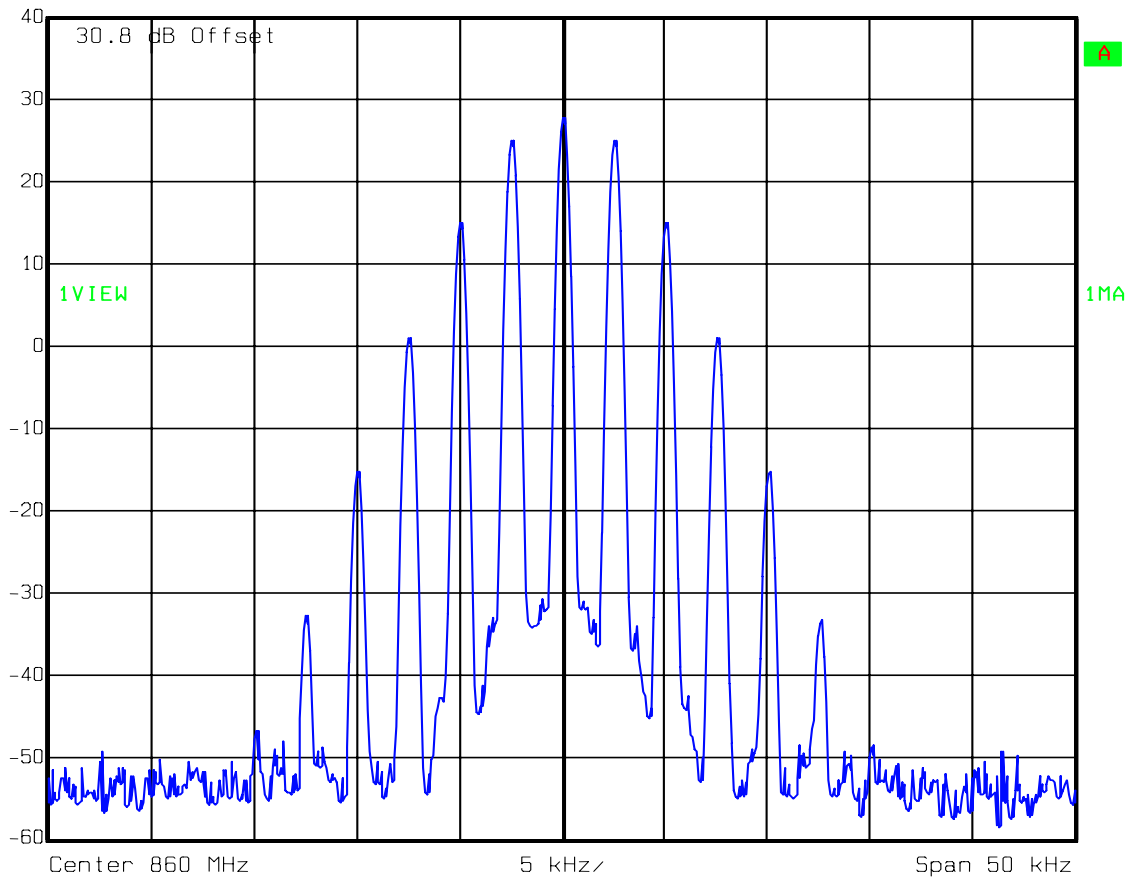
Analog – Output

2.5 kHz Tone / 3 kHz Deviation



Ref Lvl
40 dBm

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



Date: 16.JUN.2009 09:06:59

EQUIPMENT: TFAH70/80

Test Data – Occupied Bandwidth

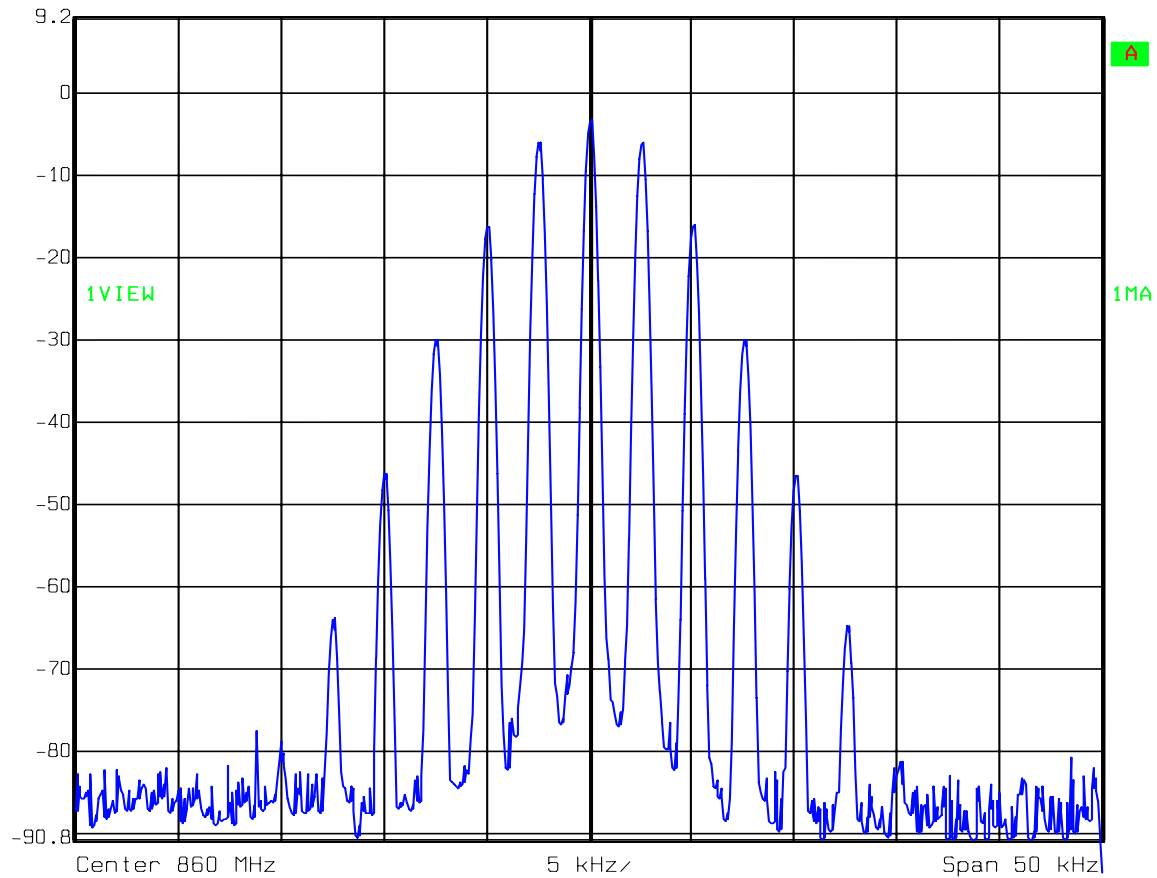
Analog - Input

2.5 kHz Tone / 3 kHz Deviation



Ref Lvl
9.2 dBm

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



Date: 16.JUN.2009 09:07:58

EQUIPMENT: TFAH70/80

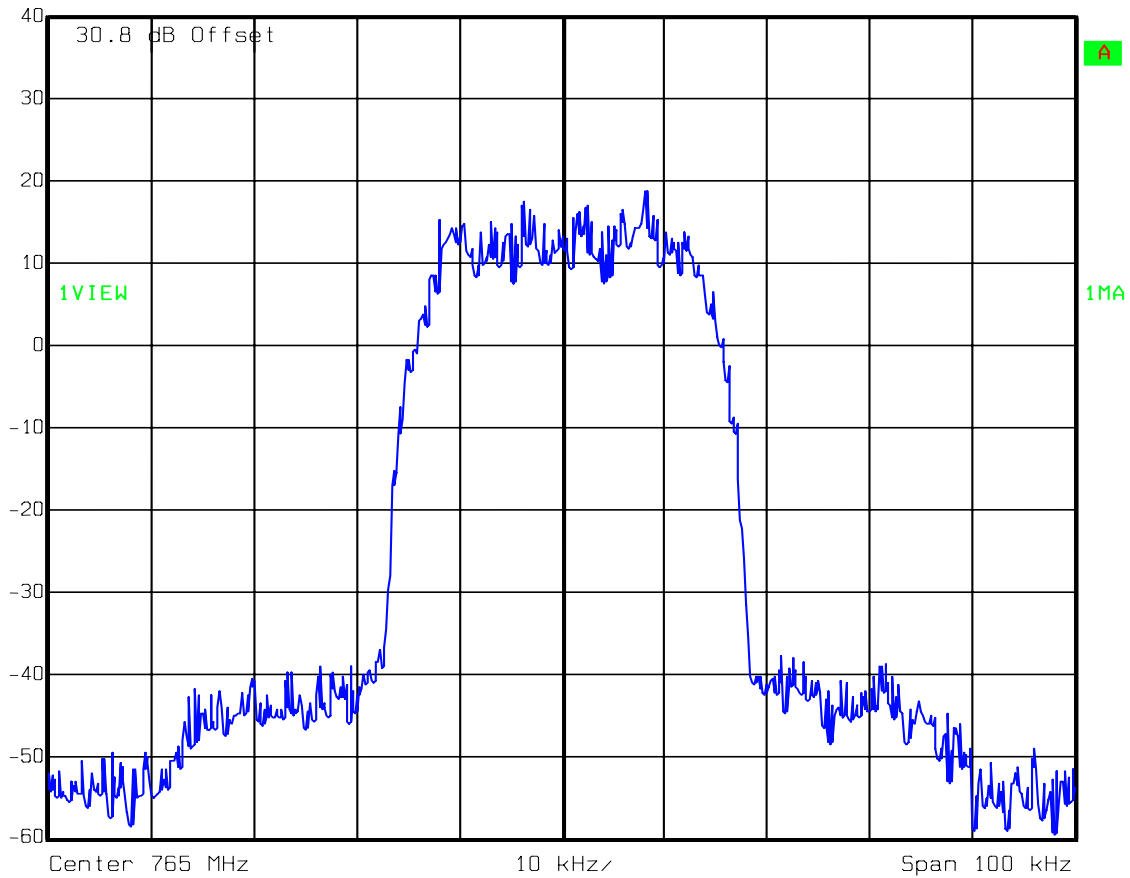
Test Data – Occupied Bandwidth

iDEN - Output



Ref Lvl
40 dBm

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



Date: 15.JUN.2009 14:23:31

EQUIPMENT: TFAH70/80

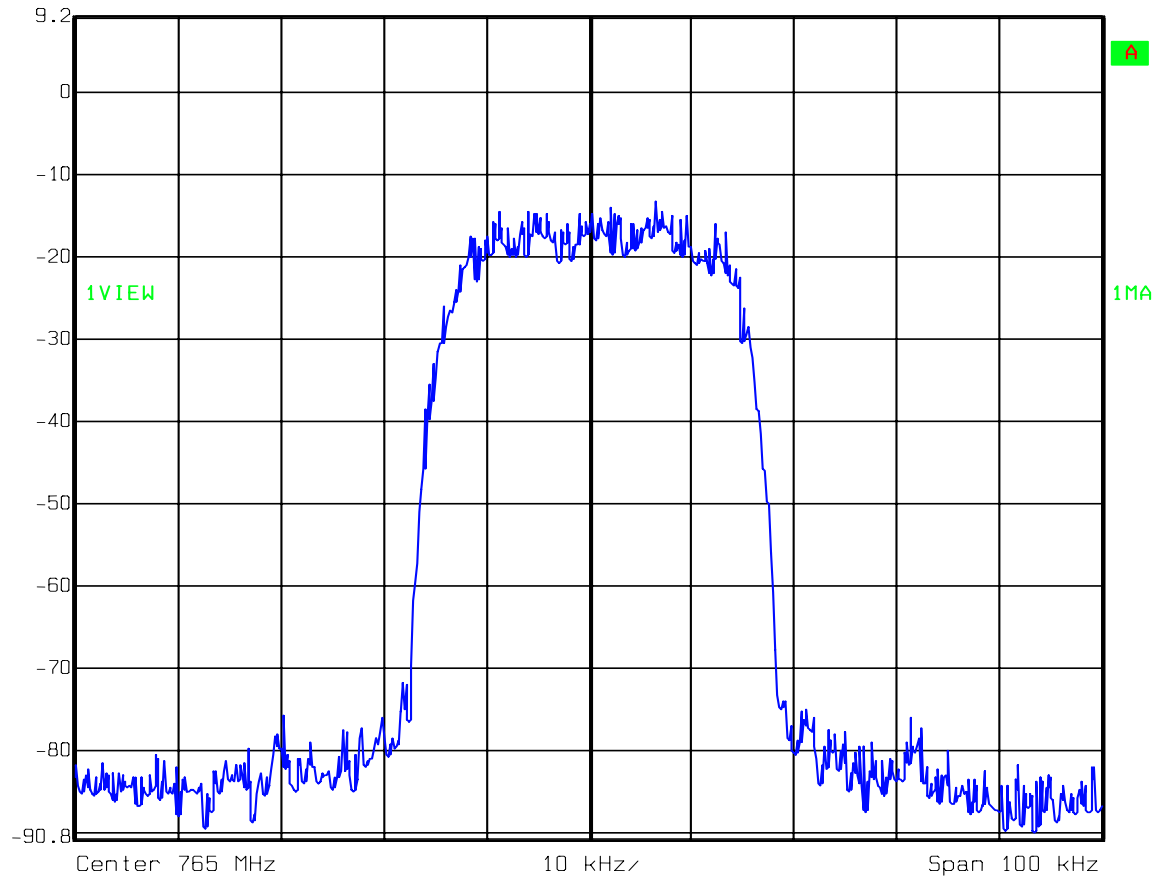
Test Data – Occupied Bandwidth

iDEN - Input



Ref Lvl
9.2 dBm

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



Date: 15.JUN.2009 14:24:46

EQUIPMENT: TFAH70/80

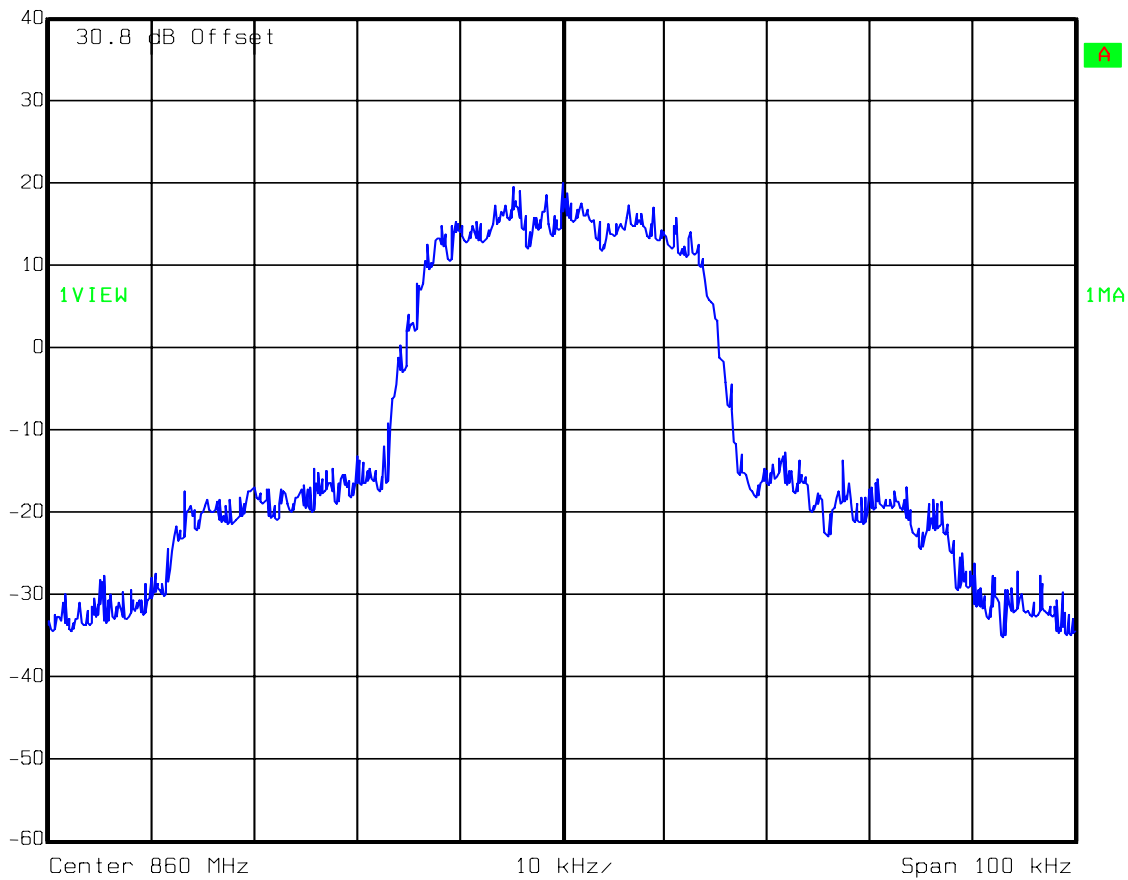
Test Data – Occupied Bandwidth

iDEN - Output



Ref Lvl
40 dBm

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



Date: 16.JUN.2009 09:11:02

EQUIPMENT: TFAH70/80

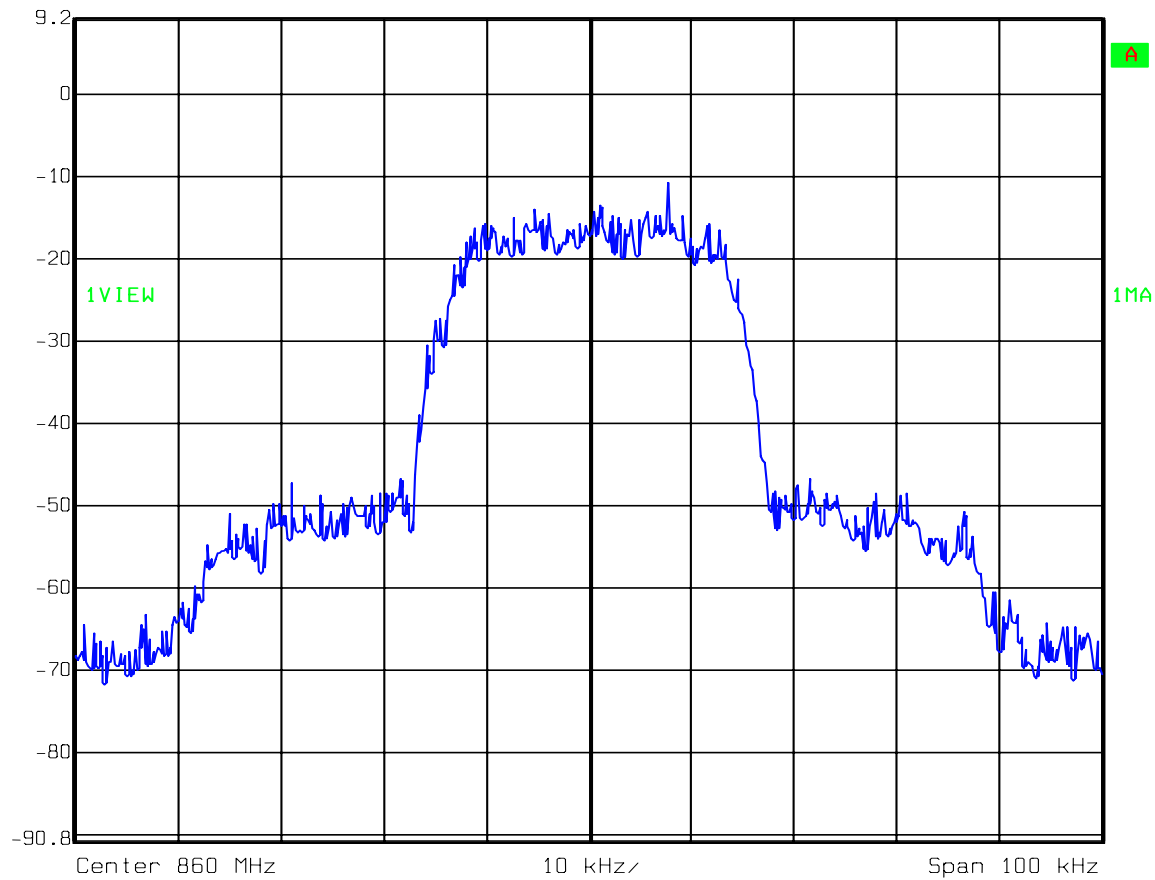
Test Data – Occupied Bandwidth

iDEN - Input



Ref Lvl
9.2 dBm

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



Date: 16.JUN.2009 09:12:20

EQUIPMENT: TFAH70/80

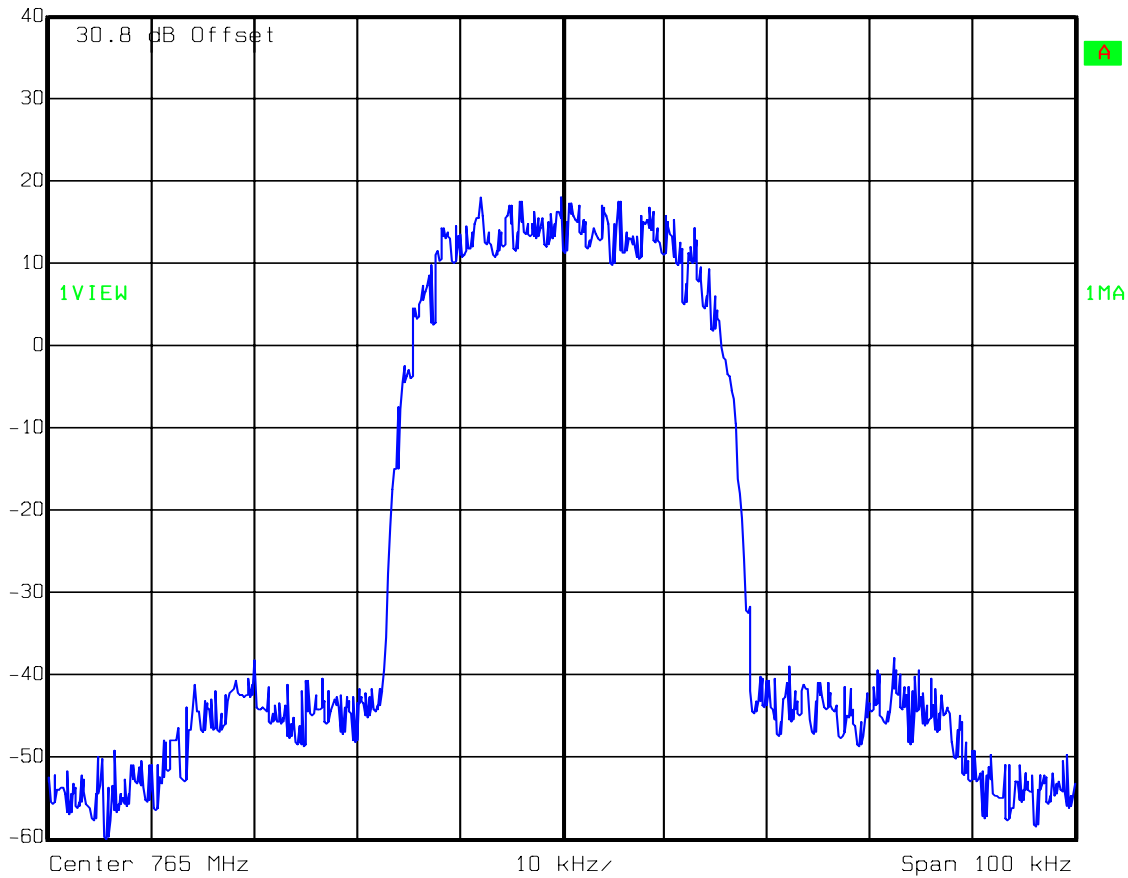
Test Data – Occupied Bandwidth

TDMA - Output



Ref Lvl
40 dBm

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



Date: 15.JUN.2009 14:34:15

EQUIPMENT: TFAH70/80

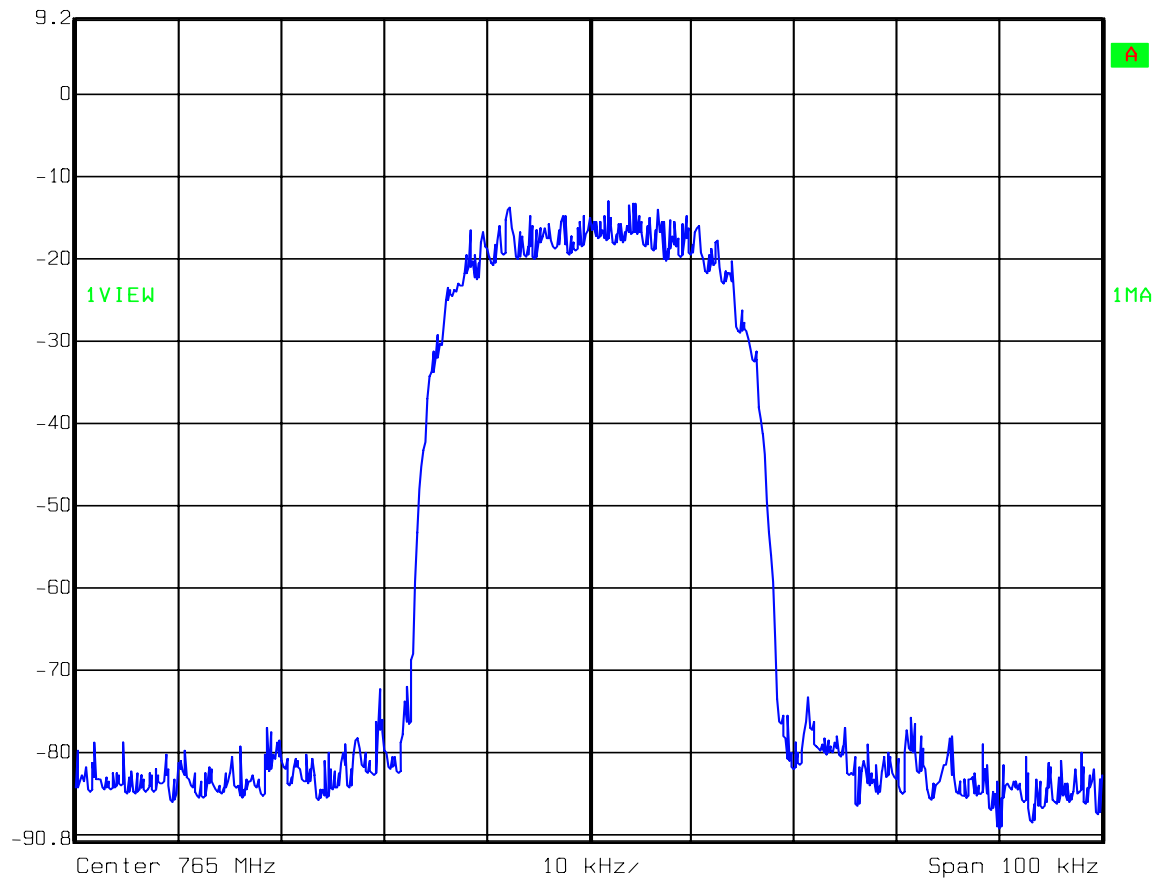
Test Data – Occupied Bandwidth

TDMA - Input



Ref Lvl
9.2 dBm

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



Date: 15.JUN.2009 14:35:22

EQUIPMENT: TFAH70/80

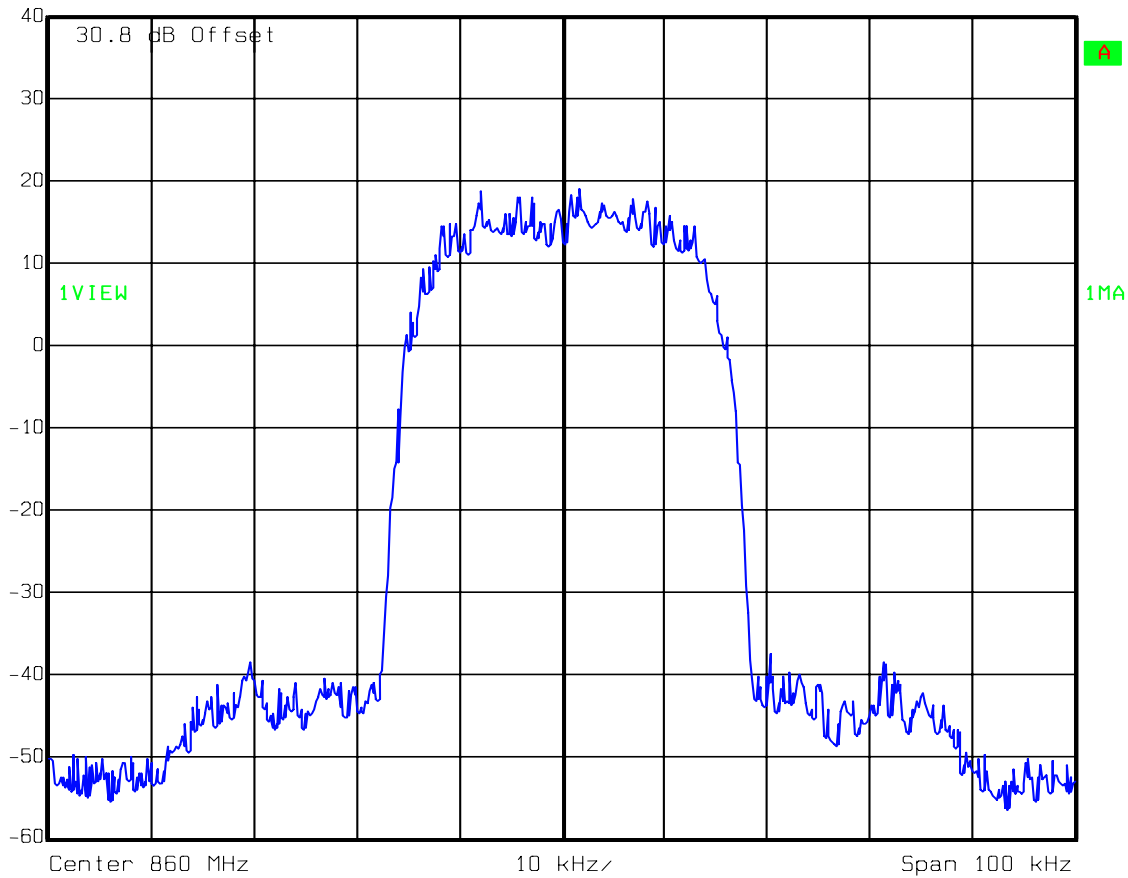
Test Data – Occupied Bandwidth

TDMA - Output



Ref Lvl
40 dBm

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



Date: 16.JUN.2009 09:22:26

EQUIPMENT: TFAH70/80

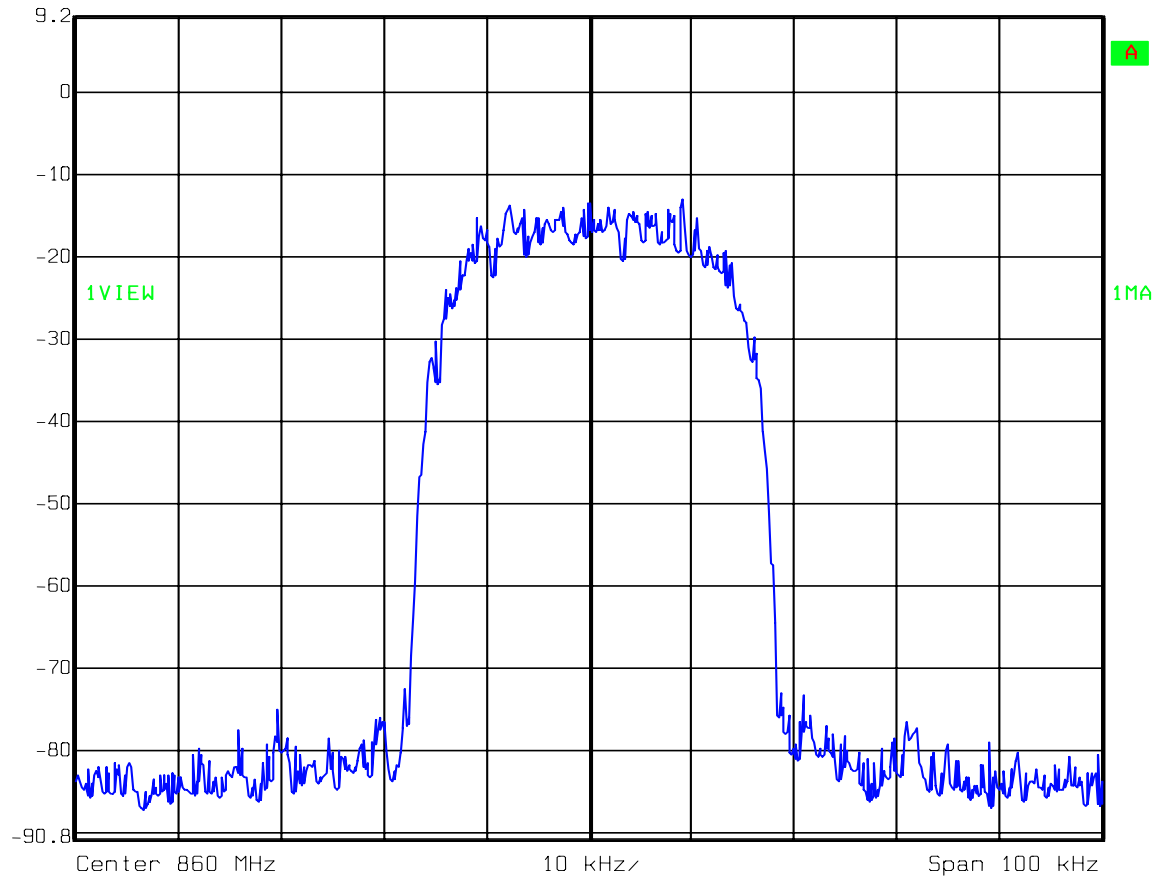
Test Data – Occupied Bandwidth

TDMA - Input



Ref Lvl
9.2 dBm

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



Date: 16.JUN.2009 09:25:25

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.991
TESTED BY: David Light	DATE: 15 June 2009

Test Results: Complies.

Test Data: See attached plot(s).

Equipment Used: 1036-1469-1082-1472

Measurement Uncertainty: +/- 1.7 dB

Temperature: 22 °C

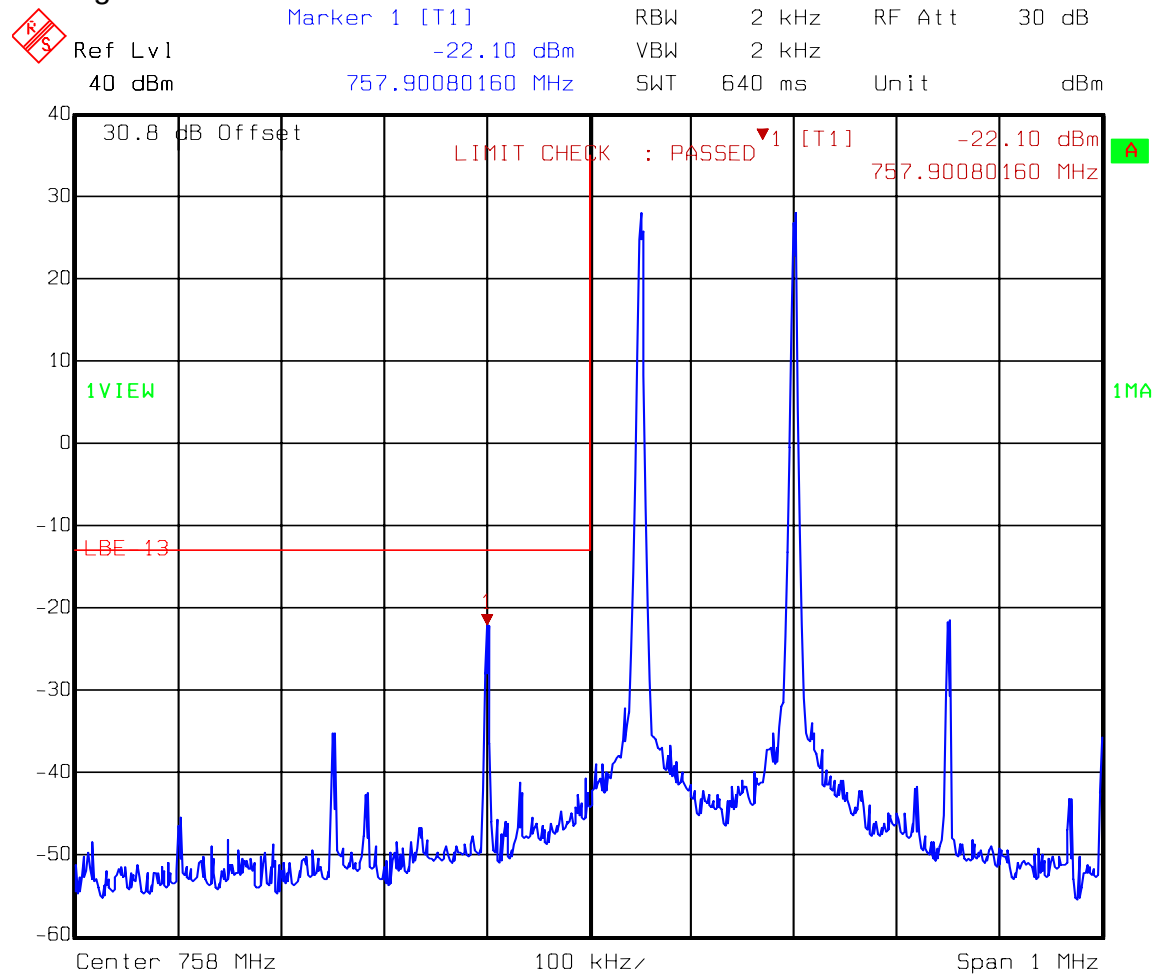
Relative Humidity: 35 %

EQUIPMENT: TFAH70/80

Test Data – Spurious Emissions at Antenna Terminals

Lower Bandedge Intermodulation

Analog



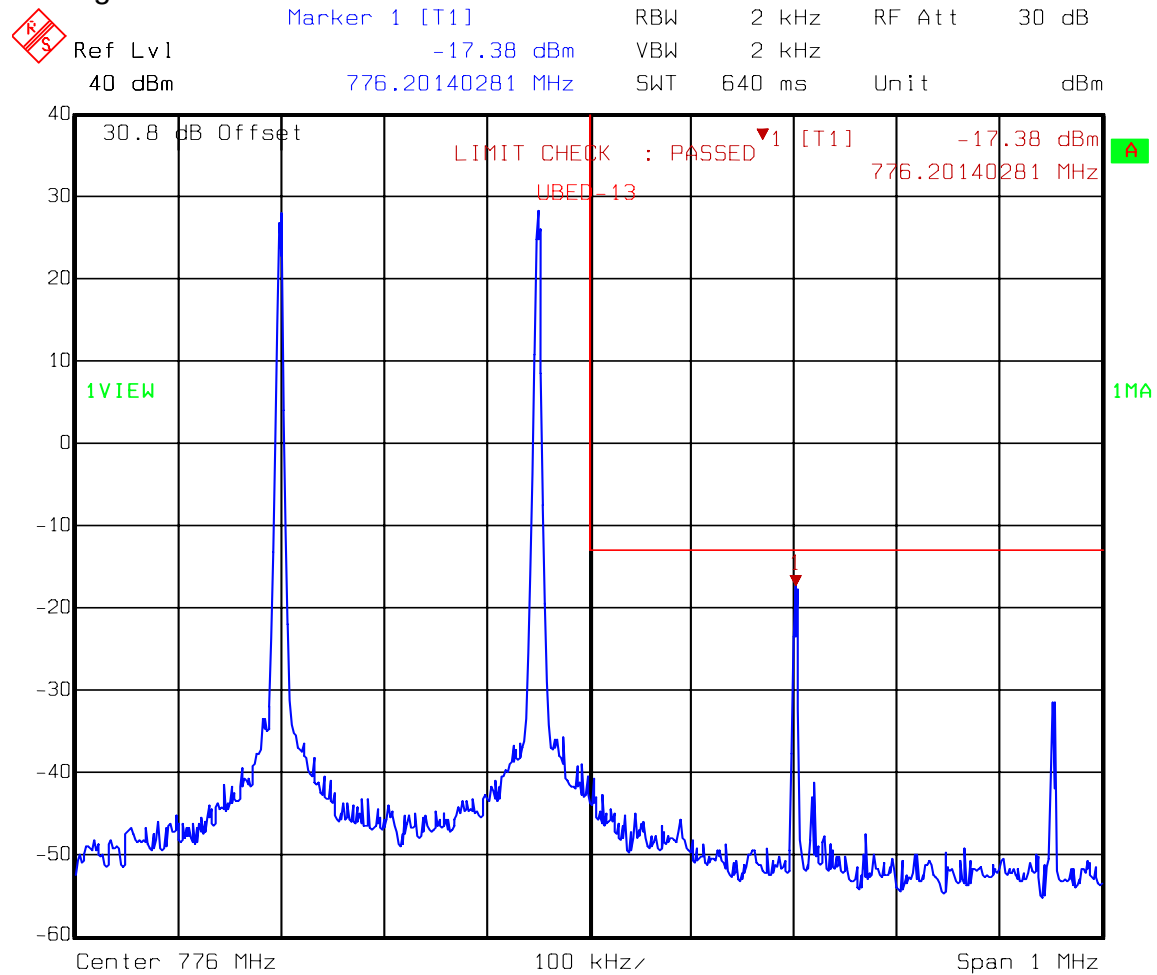
Date: 15.JUN.2009 14:07:22

EQUIPMENT: TFAH70/80

Test Data – Spurious Emissions at Antenna Terminals

Upper Bandedge Intermodulation

Analog



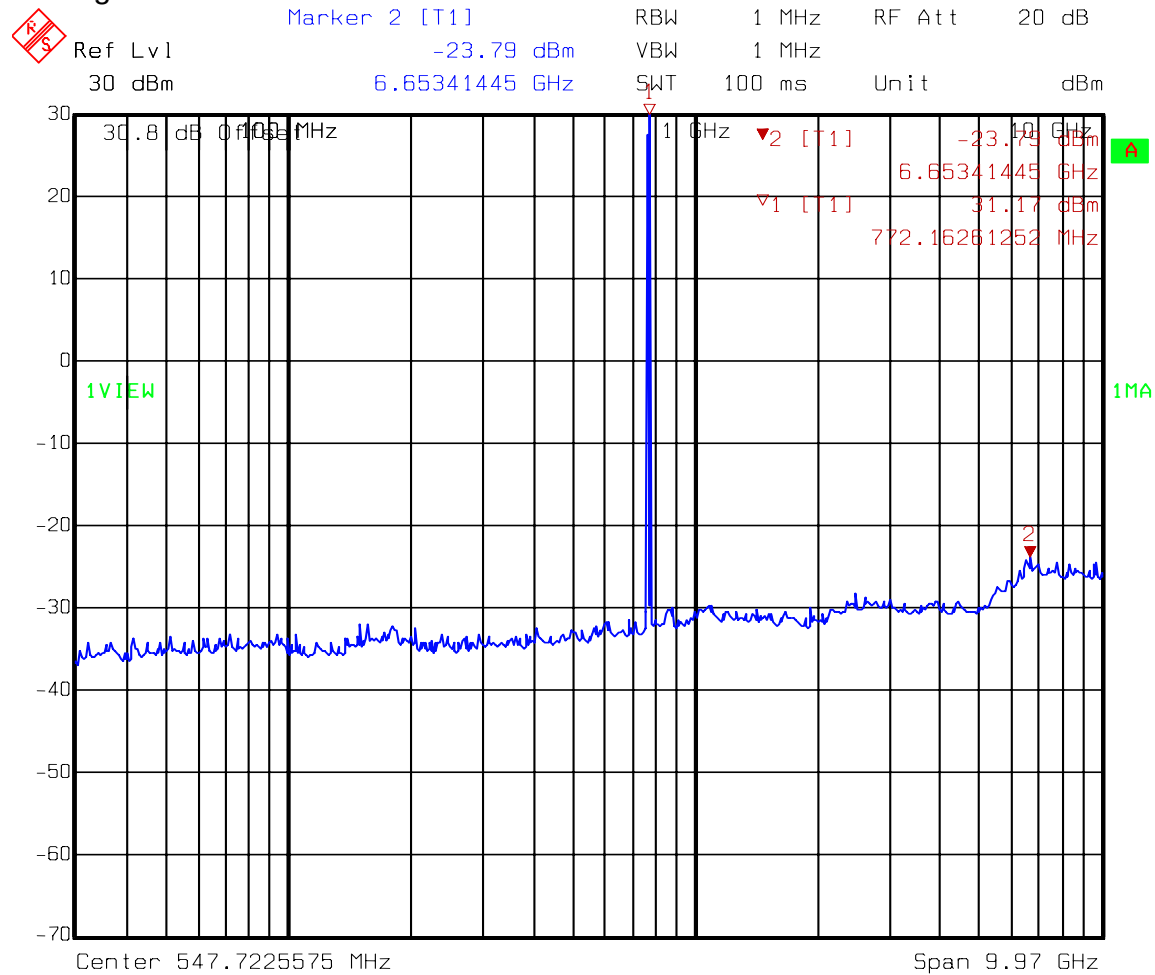
Date: 15.JUN.2009 14:05:57

EQUIPMENT: TFAH70/80

Test Data – Spurious Emissions at Antenna Terminals

Spurs – 700 MHz Band

Analog



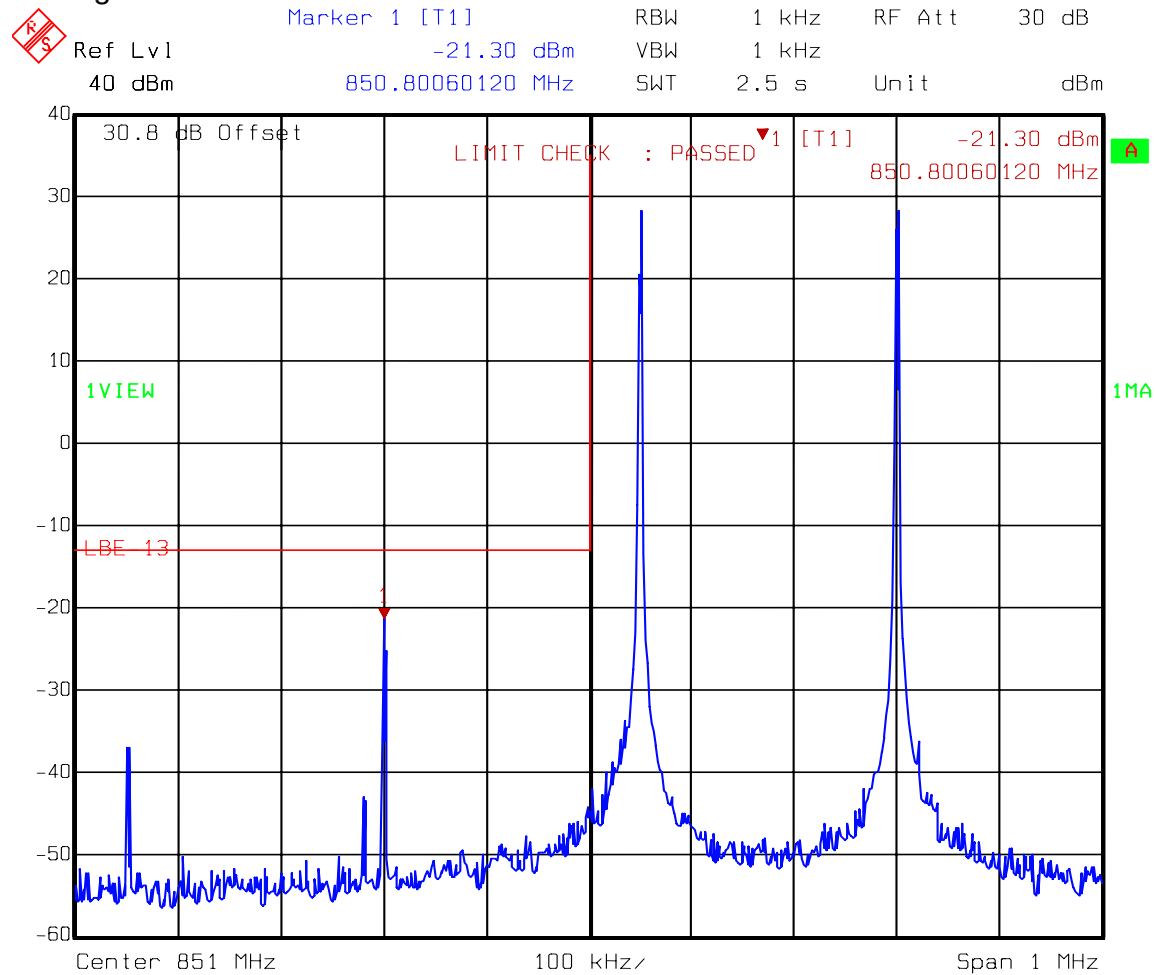
Date: 15.JUN.2009 14:11:04

EQUIPMENT: TFAH70/80

Test Data – Spurious Emissions at Antenna Terminals

Low band edge

Analog



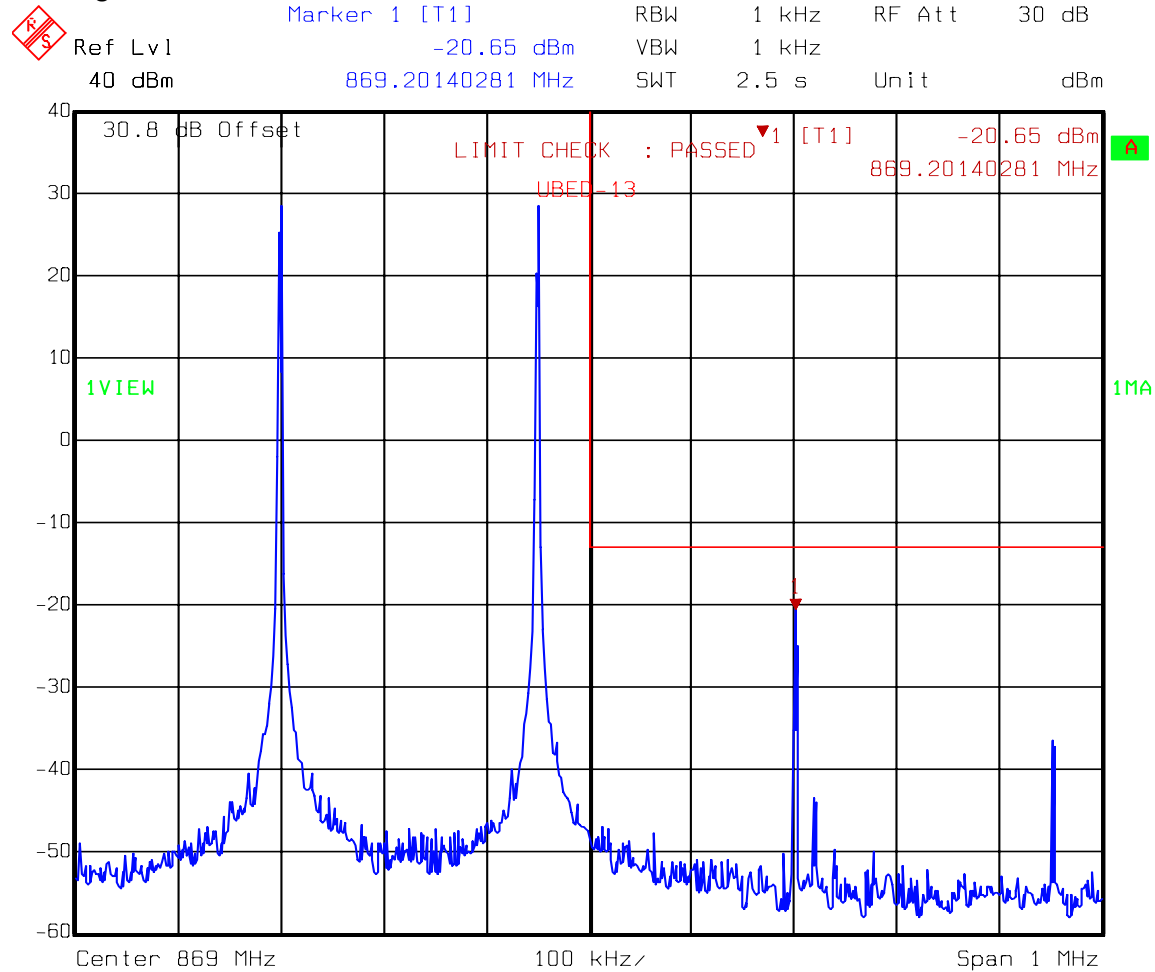
Date: 16.JUN.2009 09:02:09

EQUIPMENT: TFAH70/80

Test Data – Spurious Emissions at Antenna Terminals

Upper Band edge

Analog



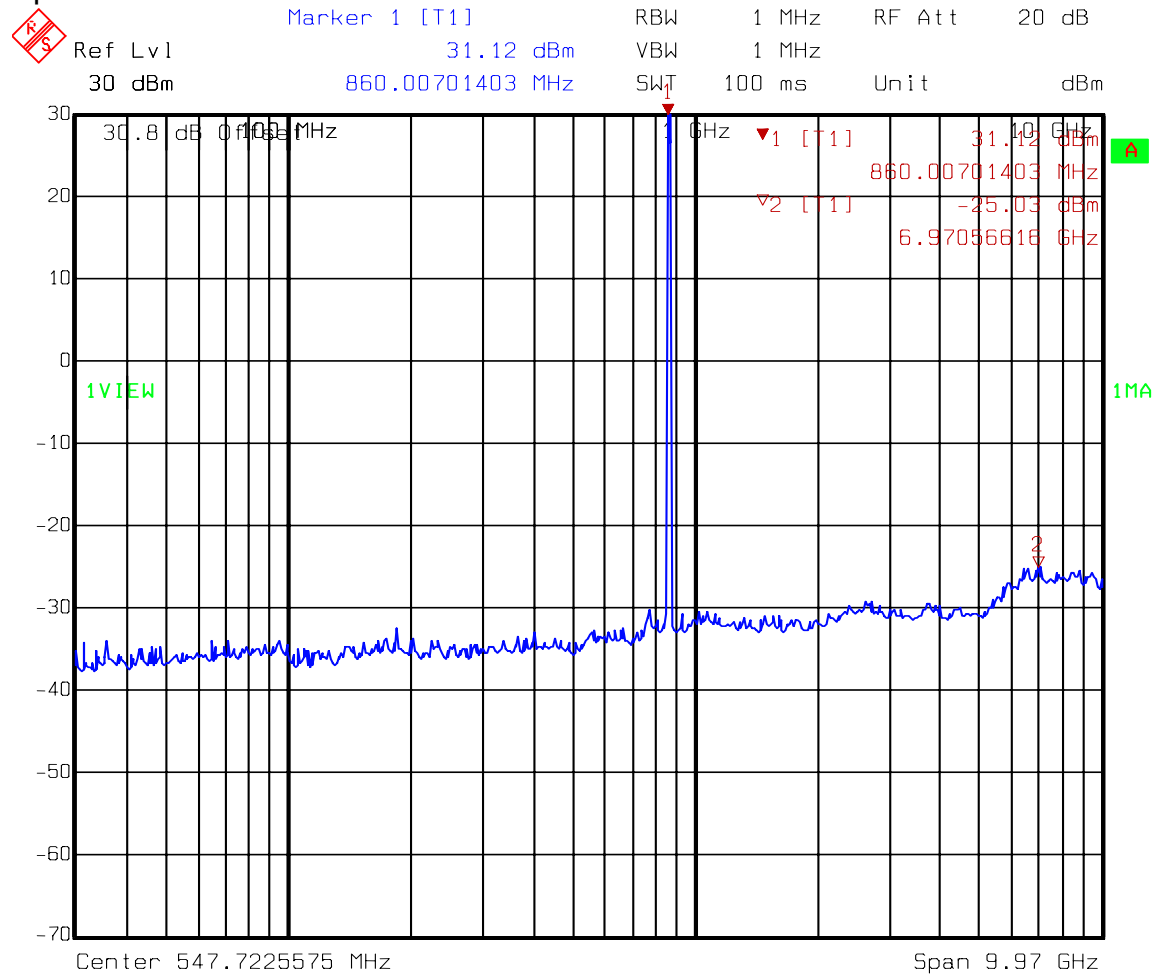
Date: 16.JUN.2009 09:03:50

EQUIPMENT: TFAH70/80

Test Data – Spurious Emissions at Antenna Terminals

Analog

Spurs – 800 MHz Band



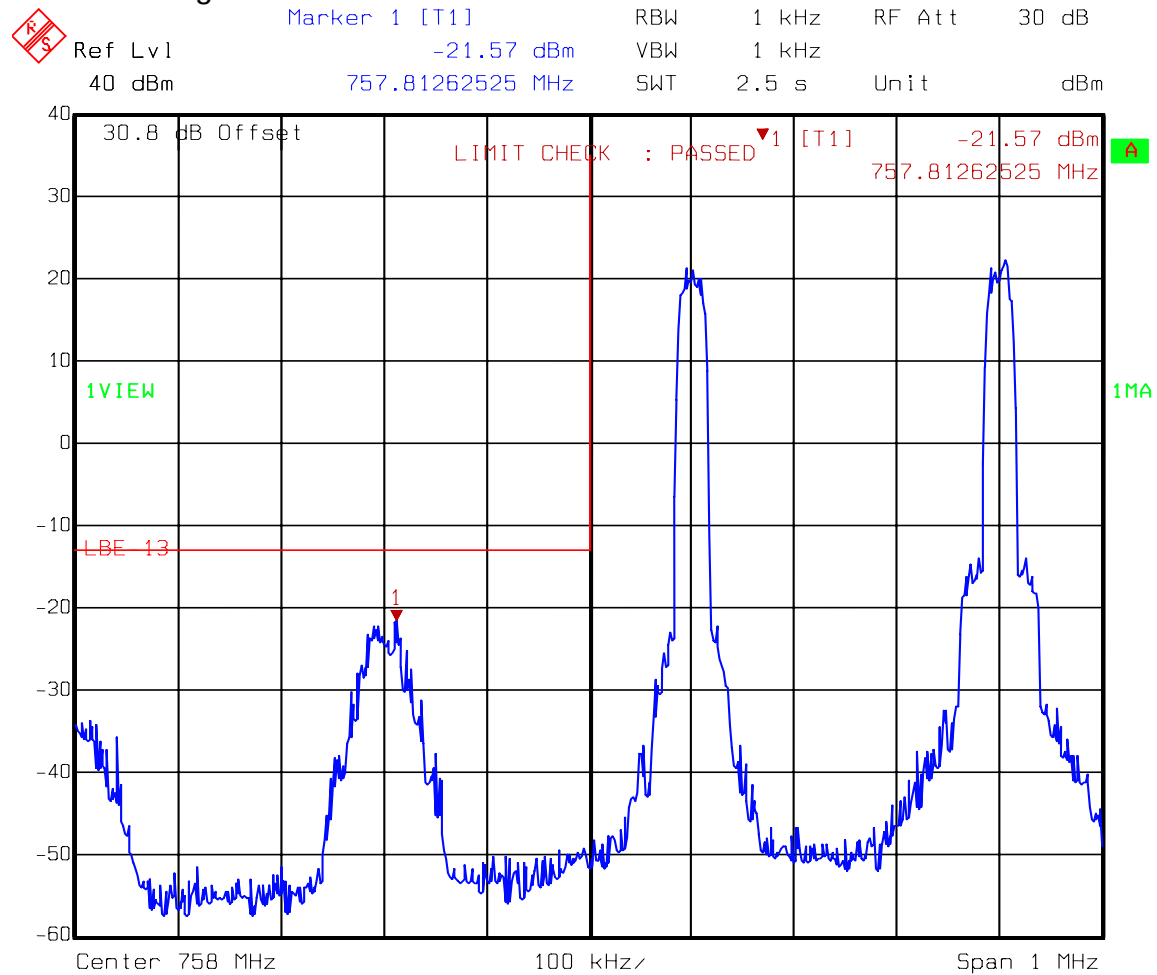
Date: 16.JUN.2009 09:05:23

EQUIPMENT: TFAH70/80

Test Data – Spurious Emissions at Antenna Terminals

iDEN

Low band edge



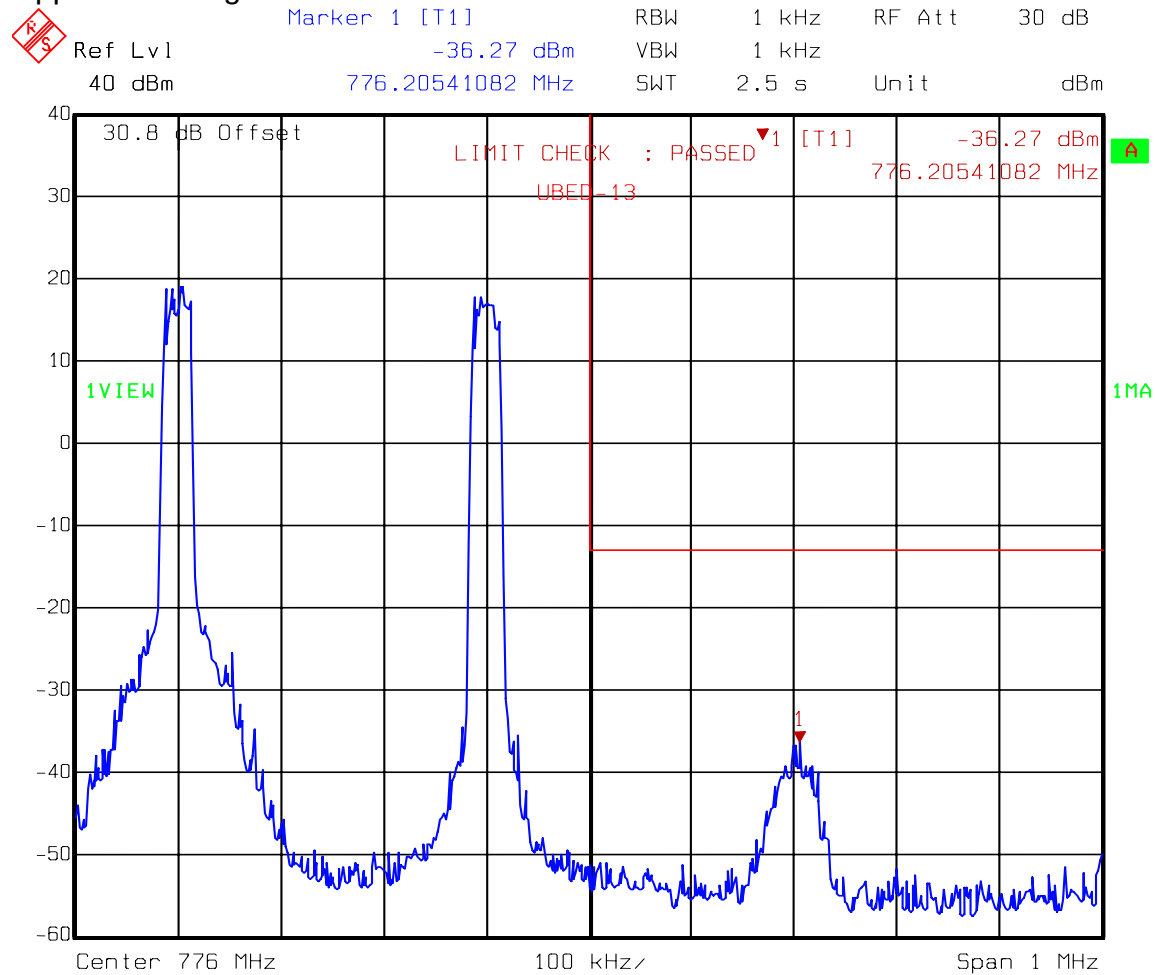
Date: 15.JUN.2009 14:17:37

EQUIPMENT: TFAH70/80

Test Data – Spurious Emissions at Antenna Terminals

iDEN

Upper band edge



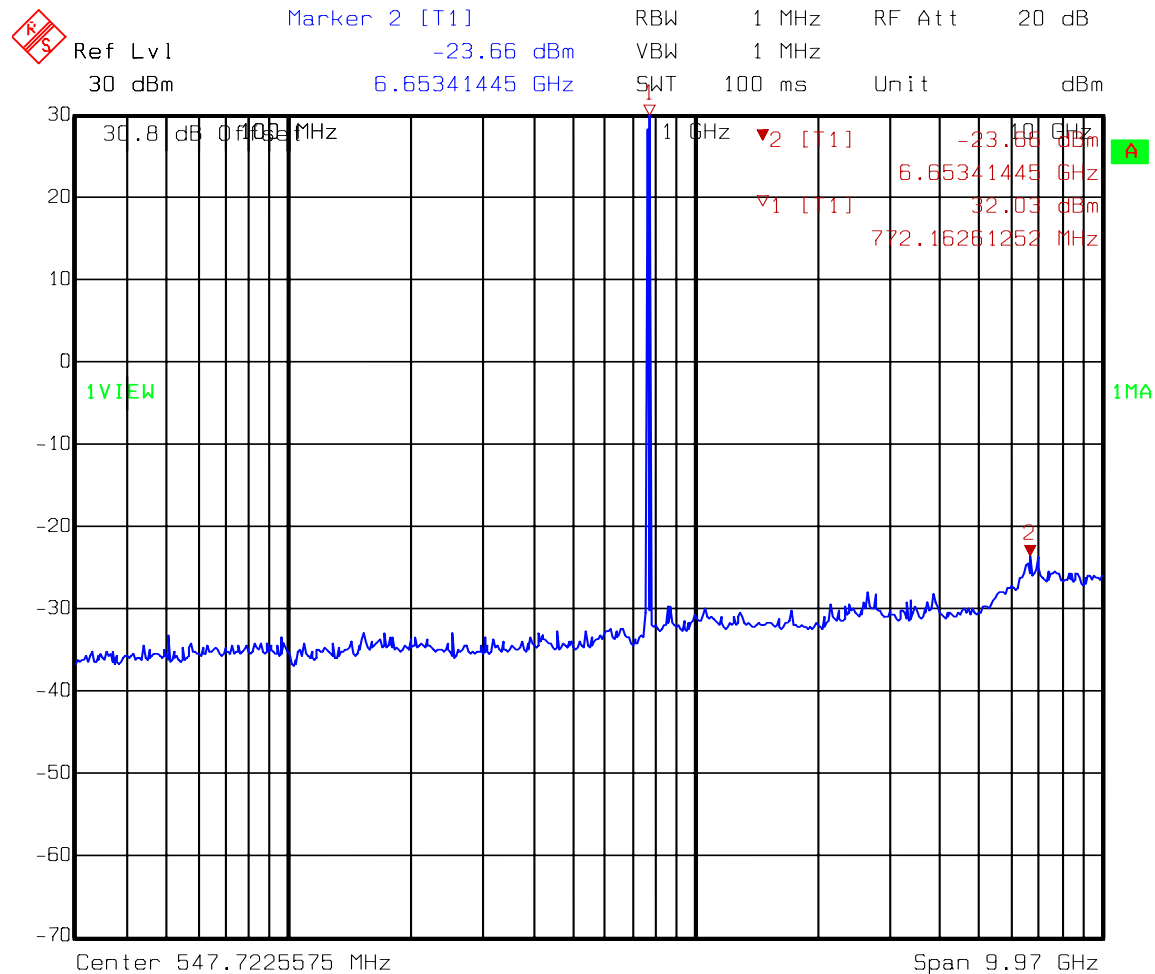
Date: 15.JUN.2009 14:20:31

EQUIPMENT: TFAH70/80

Test Data – Spurious Emissions at Antenna Terminals

iDEN

Spurs – 700 MHz Band



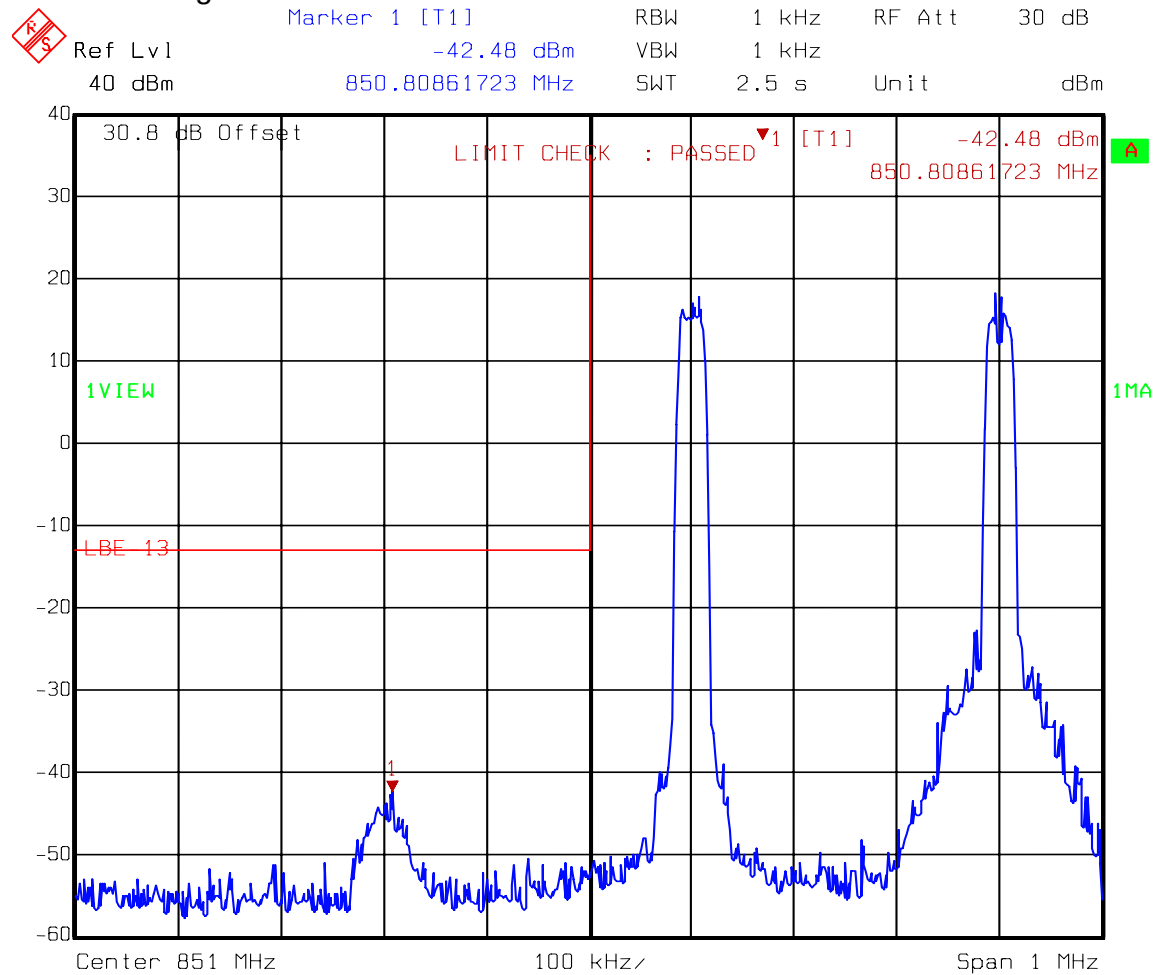
Date: 15.JUN.2009 14:22:18

EQUIPMENT: TFAH70/80

Test Data – Spurious Emissions at Antenna Terminals

iDEN

Low band edge



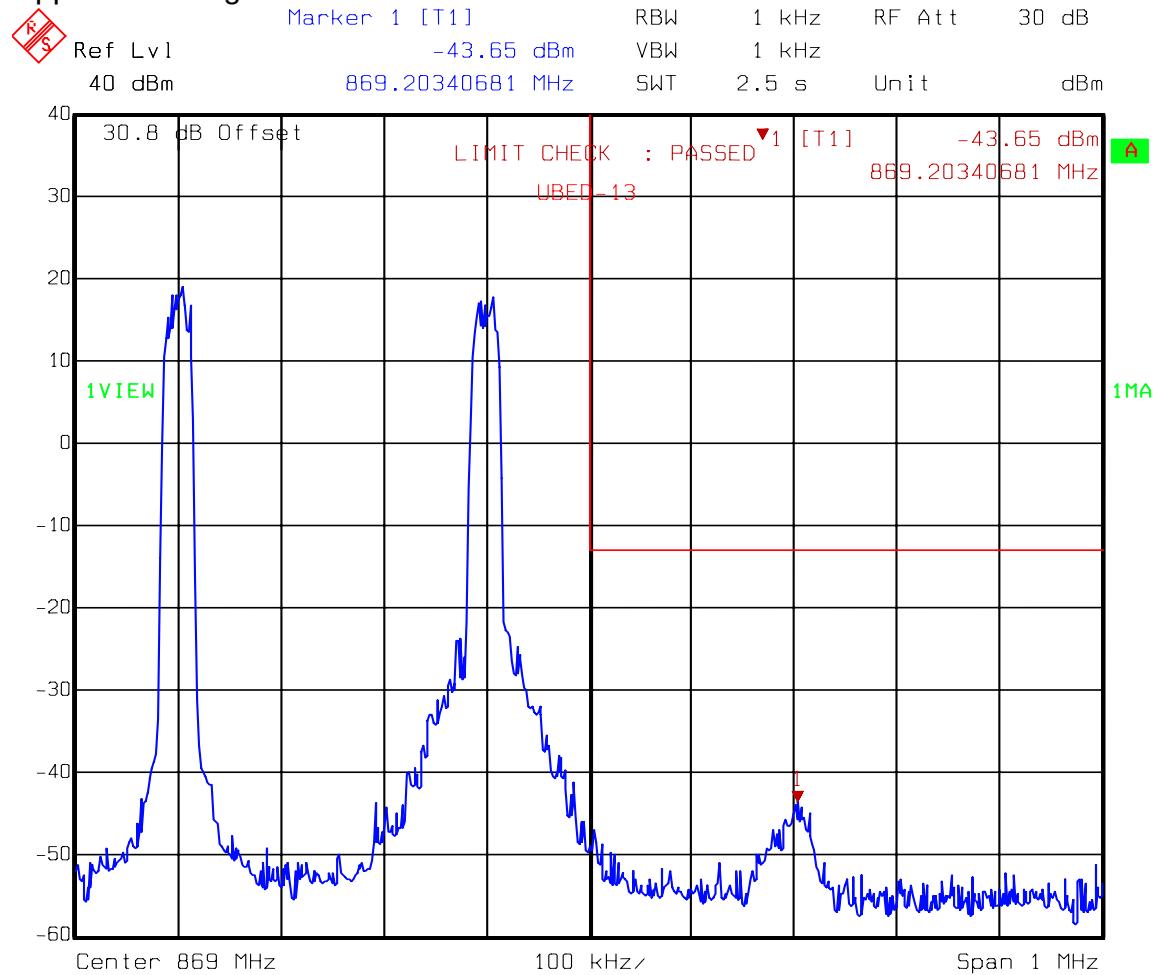
Date: 16.JUN.2009 09:17:53

EQUIPMENT: TFAH70/80

Test Data – Spurious Emissions at Antenna Terminals

iDEN

Upper band edge



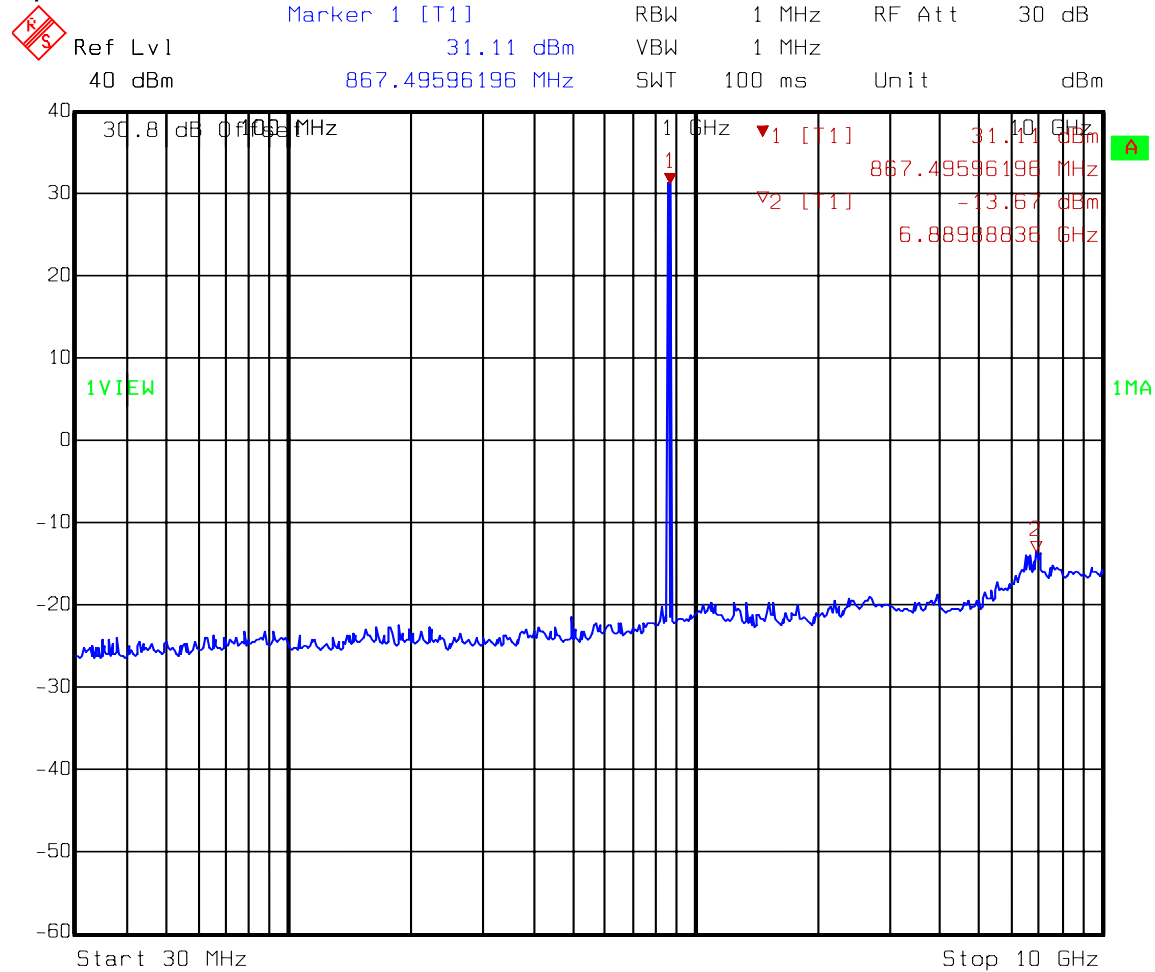
Date: 16.JUN.2009 09:16:33

EQUIPMENT: TFAH70/80

Test Data – Spurious Emissions at Antenna Terminals

iDEN

Spurs – 800 MHz Band



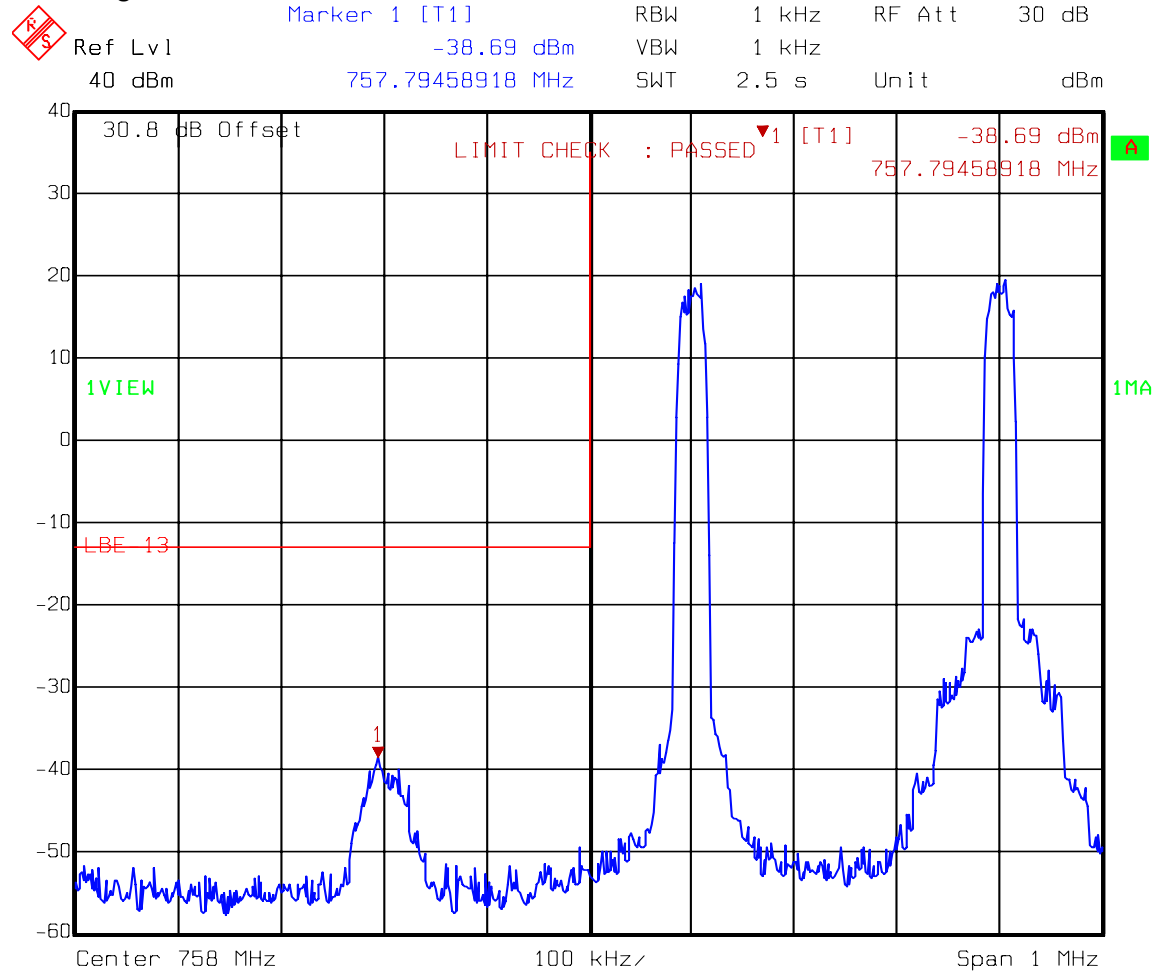
Date: 16.JUN.2009 09:14:13

EQUIPMENT: TFAH70/80

Test Data – Spurious Emissions at Antenna Terminals

TDMA

Low edge



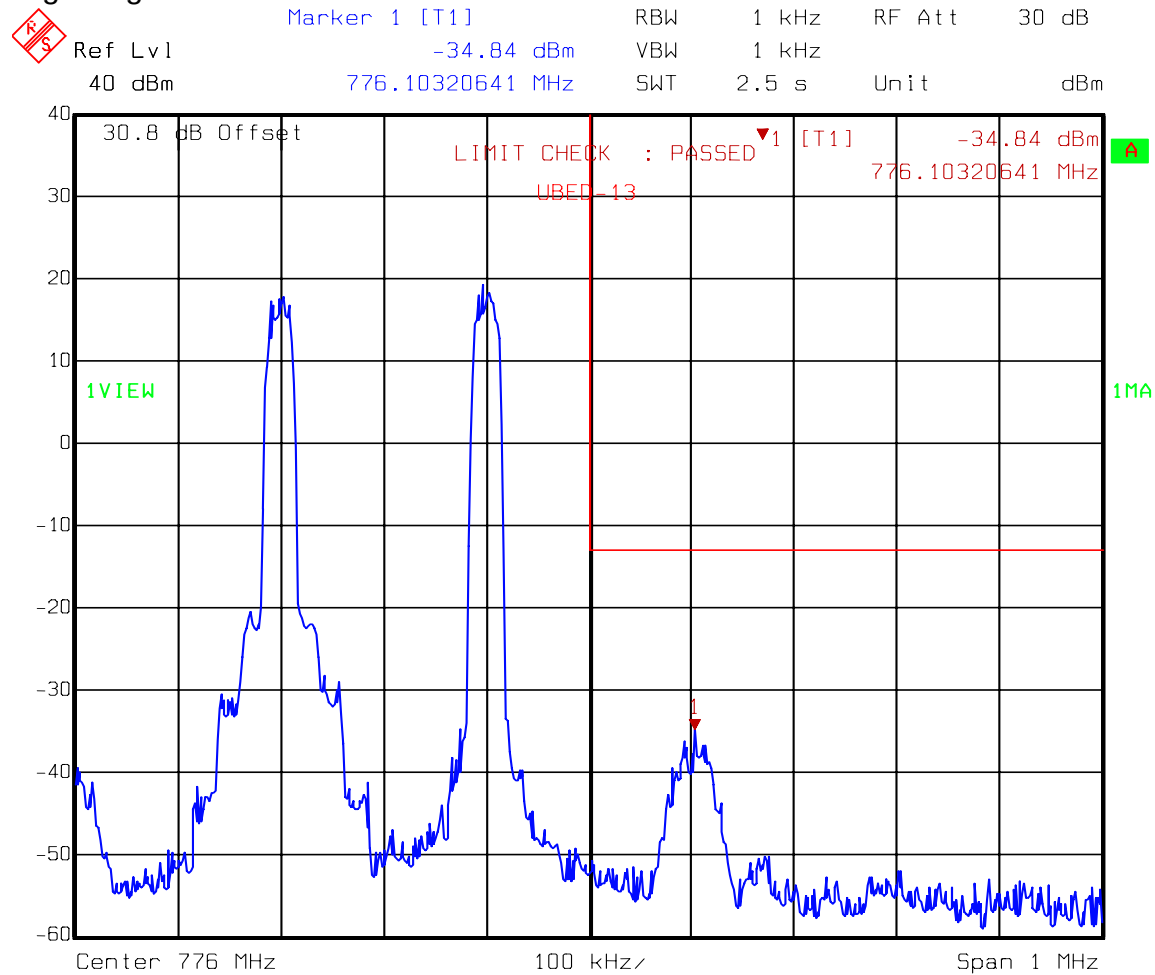
Date: 15.JUN.2009 14:29:38

EQUIPMENT: TFAH70/80

Test Data – Spurious Emissions at Antenna Terminals

TDMA

High Edge



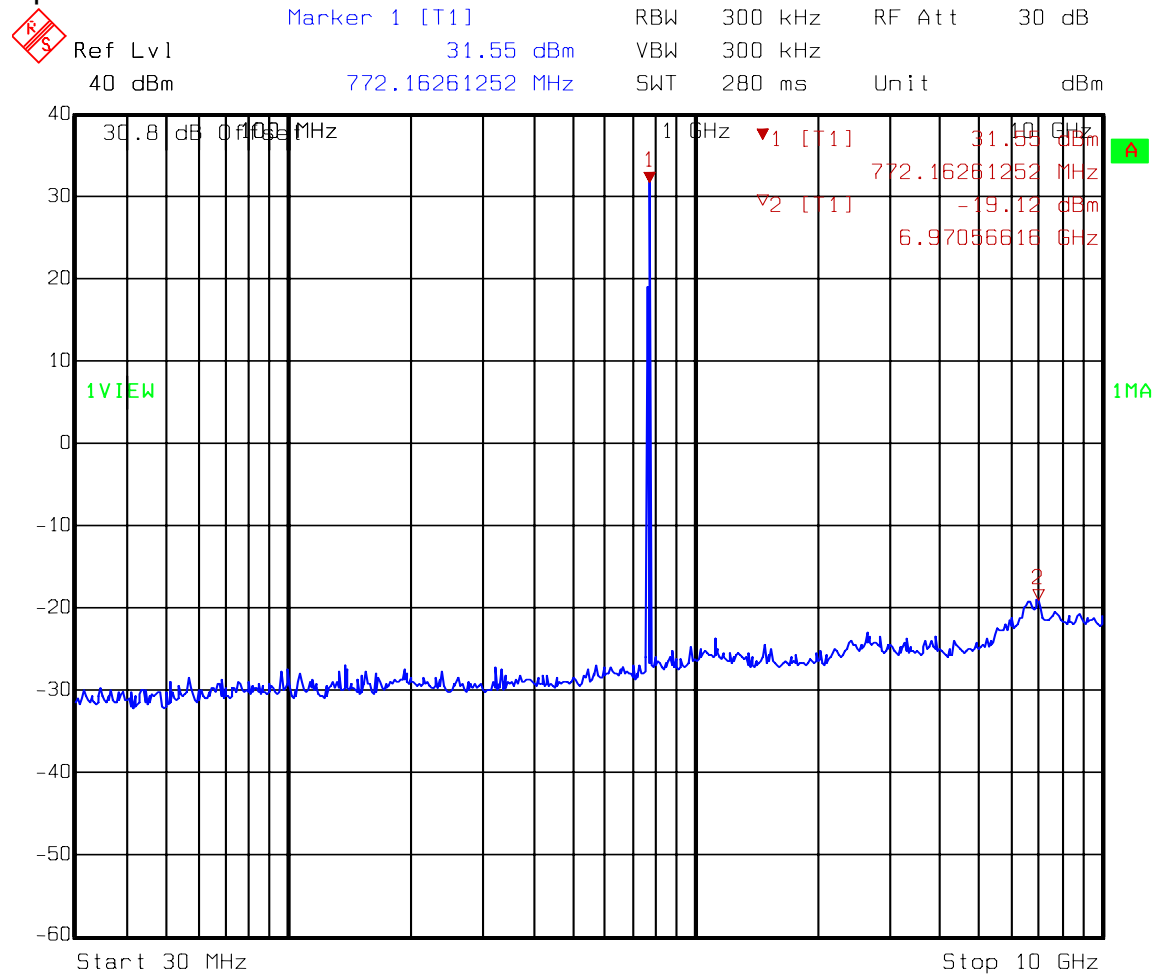
Date: 15.JUN.2009 14:31:44

EQUIPMENT: TFAH70/80

Test Data – Spurious Emissions at Antenna Terminals

TDMA

Spurs – 700 MHz Band



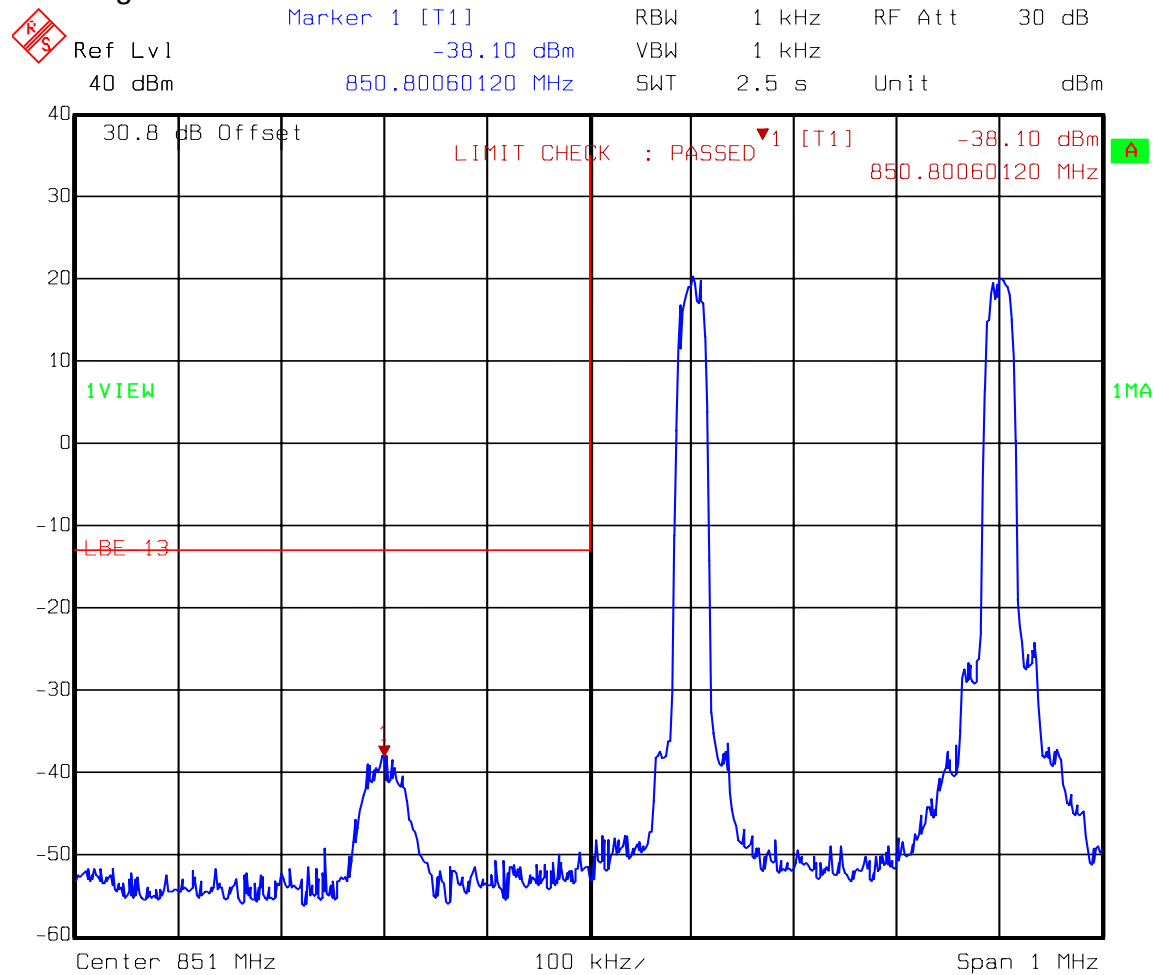
Date: 15.JUN.2009 14:33:11

EQUIPMENT: TFAH70/80

Test Data – Spurious Emissions at Antenna Terminals

TDMA

Low edge



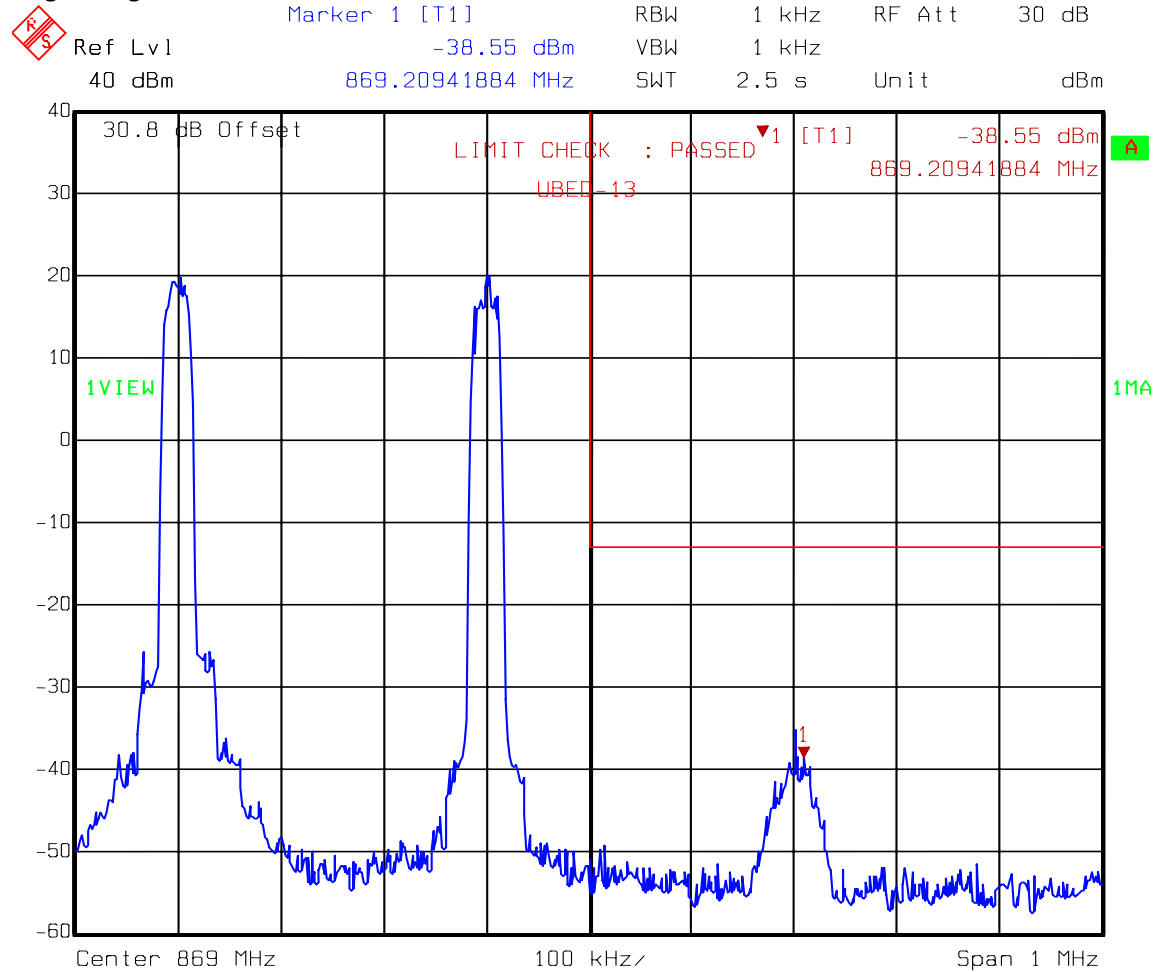
Date: 16.JUN.2009 09:20:09

EQUIPMENT: TFAH70/80

Test Data – Spurious Emissions at Antenna Terminals

TDMA

High Edge

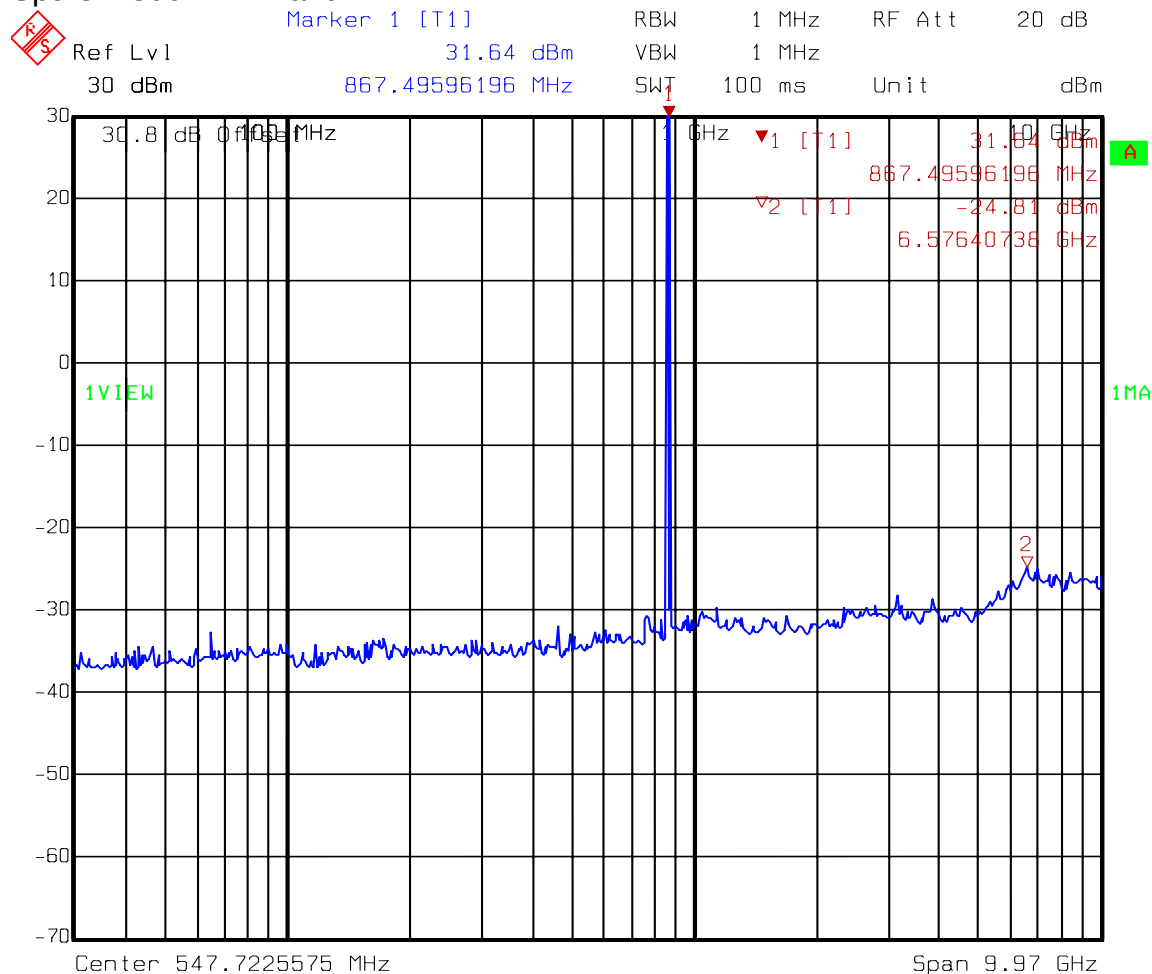


Date: 16.JUN.2009 09:21:06

Test Data – Spurious Emissions at Antenna Terminals

TDMA

Spurs – 800 MHz Band



Date: 16.JUN.2009 09:23:55

Section 6. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.993
TESTED BY: David Light	DATE: 16 June 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: 1767-1785-1763-1304-1783

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
1767	MI Test Receiver 20Hz - 26.5 GHz - 150 - +30 dBm LC	ROHDE & SCHWARZ ESIB26	837491/0002	09/20/07	09/20/09
1785	Preamplifier	A.H. SYSTEMS PAM-0126	143	04/06/09	04/06/10
1763	Bilog Antenna	Schaffner CBL 6111D	22926	11/04/08	11/04/09
1304	HORN ANTENNA	ELECTRO METRICS RGA-60	6151	09/09/08	09/10/10
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
1783	Cable	Nemko 0	0	07/12/08	07/12/09

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.

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: $\Rightarrow$ RBW

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

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
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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.: 2.993****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.

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

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

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

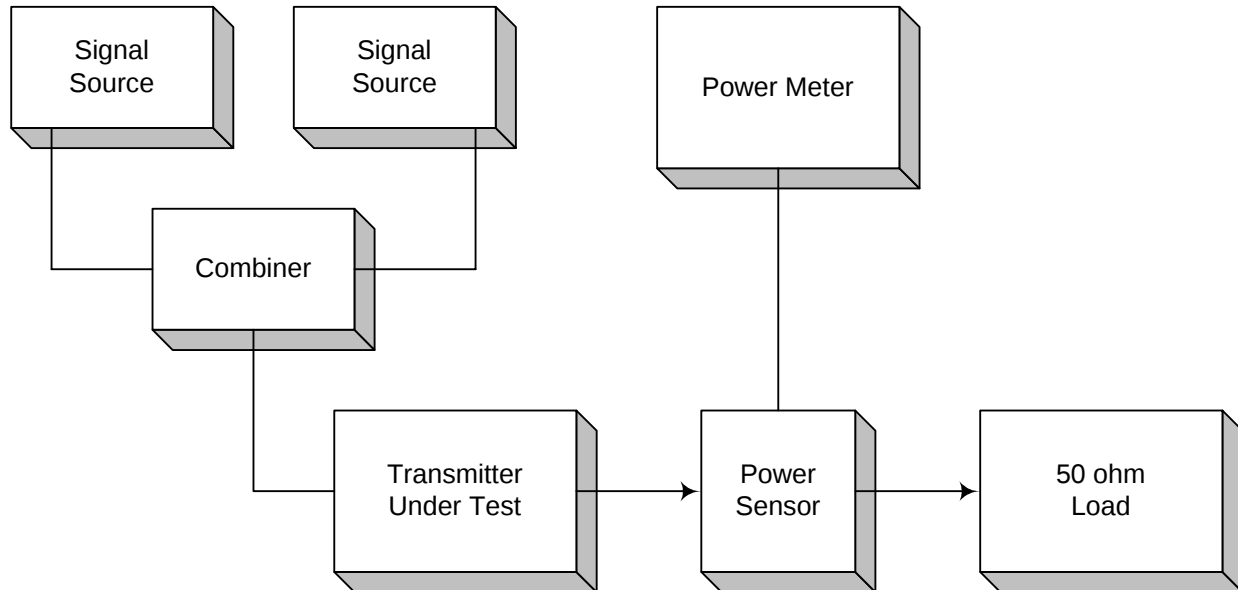
within the assigned frequency below in ppm.

Table 2

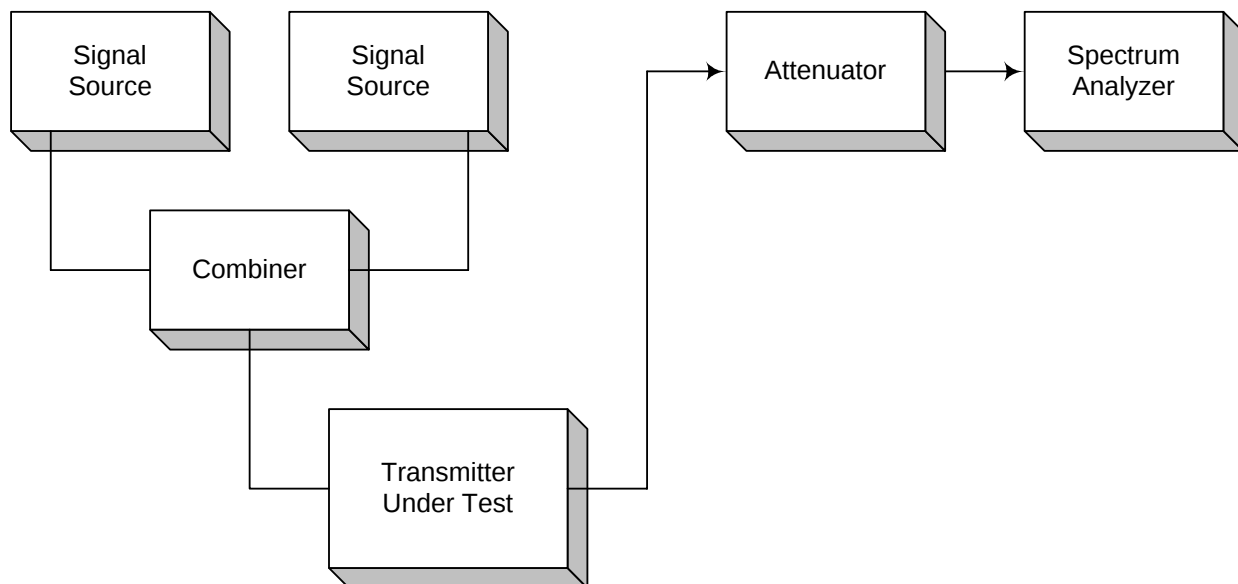
Frequency Band (MHz)	Fixed And Base Stations	Mobile Stations	
		> 2 Watts o/p pwr	< 2 Watts o/p pwr
Below 25	100	100	200
25 - 50	20	20	50
72 - 76	5	-	50
150 - 174	5	5	5
220 - 222	0.1	1.5	1.5
421 - 512	2.5	5	5
806 - 821	1.5	2.5	2.5
821 - 824	1.0	1.5	15
851 - 866	1.5	2.5	2.5
866 - 869	1.0	1.5	1.5
869 -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

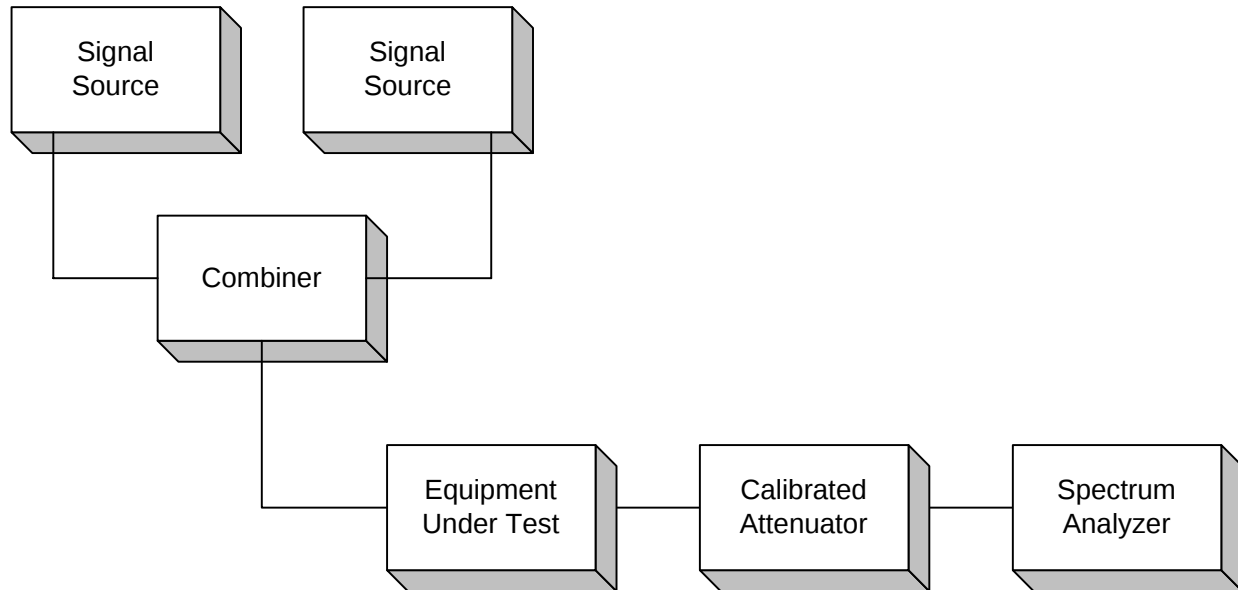
Para. No. 2.985 - R.F. Power Output



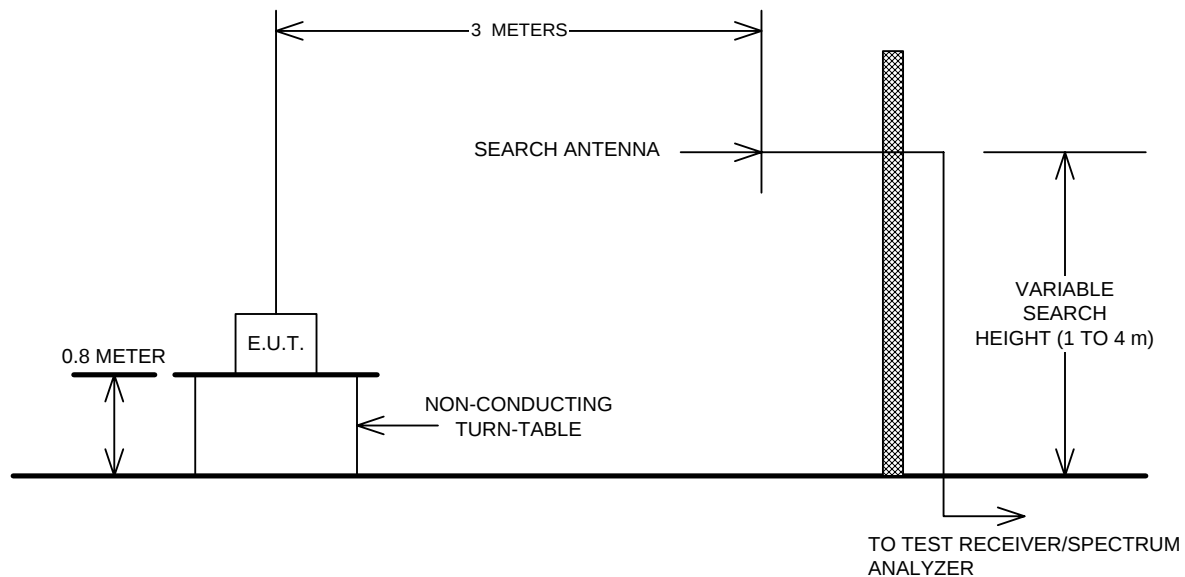
Para. No. 2.989 - Occupied Bandwidth



Para. No. 2.991 - Spurious Emissions at Antenna Terminals



Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability

