

RADIO TEST REPORT

No. 712808R1**EQUIPMENT UNDER TEST**

Equipment: Remote Head
Type / model: DDRxxx (DDR 100, 200, 300, 400 series)
Manufacturer: Deltanode Solutions AB
Tested by request of: Deltanode Solutions AB

SUMMARY

The equipment complies with the requirements of the following standards:

47CFR part 2 (2006)
47CFR part 22 (2006) Subpart H
47CFR part 24 (2006) Subpart E
47CFR part 27 (2006) Subpart C

Date of issue: 2007-11-12

Tested by:



Niklas Boström

Approved by:



Björn Utermöhl

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1. CLIENT INFORMATION

The EUT has been tested by request of

Company: Deltanode Solutions AB
Box 92184
120 09 Stockholm
Sweden

Name of contact: Daniel Kerek
+46 707 98 52 20

2. EQUIPMENT UNDER TEST (EUT)

2.1 Identification of the EUT according to the manufacturer/client declaration

Equipment:	Remote Head	
Type/Model:	DDR101, DDR201	
Brand name:	Deltanode	
Serial number:	Preproduction units, no serial visible on product.	
Manufacturer:	Deltanode Solutions AB	
Rating/Supplying voltage:	115 / 230 VAC, 50 / 60Hz	
Rating RF output power:	850 MHz band	CDMA 1 * 33dBm GSM 2 * 30dBm
	1900 MHz band	CDMA 1 * 33dBm GSM 2 * 30dBm
	AWS band	CDMA 1 * 33dBm GSM 2 * 30dBm WCDMA 1 * 30dBm
Frequency range:	850 MHz band	869- 894 MHz
	1900 MHz band	1930 – 1990 MHz
	AWS band	2110 – 2155 MHz
External antenna connector:	Yes	
Operating temperature range:	-25 to +55 °C	
Modulation characteristics:	850 MHz band	CDMA (QPSK) GSM (GMSK)
	1900 MHz band	CDMA (QPSK) GSM (GMSK)
	AWS band	WCDMA (QPSK)



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2.2 Additional hardware information about the EUT

DDR 100, 200, 300, 400 series are tested for the US frequency bands 800, 1900 and AWS. The product structure allows free configuration of the three bands up to four RF line-up's in one unit.

The part number DDR 100 is equipped with 1 RF line up and DDR 400 is equipped with four RF line up's.

The tested DDR 101 is a single band AWS, and DDR 201 is a dual band unit 850/1900.

This measurement report reflects the RF line up's regardless of number of line up's in one unit and accordingly any combination of the three bands up to totally four bands are covered.

The EUT's consists of the following units:

Unit	Type and version	Serial number
850 / 1900 unit	DDR201	102

With subunits	Type and version	Serial number
Fiber Optic Board	KS22.1	102
PA Board 1900	KS27.1	106
PA Board 850	KS28.1	104
VGA Board 1900	KS30.3	111
VGA Board 850	KS30.2	103
Duplex filter 1900	3F600301	7
Duplex filter 850	3F600501	1

Unit	Type and version	Serial number
AWS unit	DDR101	101

With subunits	Type and version	Serial number
Fiber Optic Board	KS22.1	115
Duplex filter AWS	3F600401	3
PA Board AWS	KS27.2	102
VGA Board AWS	KS30.5	101

2.3 Additional software information about the EUT

During the tests the EUT's supported the following software:

Software	Version
AM001001	2.6.16



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2.4 Peripheral equipment

Peripheral equipment is defined as equipment needed for correct operation of the EUT during the tests, but not included as a part of the testing and evaluation of the EUT.

Equipment	Manufacturer / Type	Type
Host unit	Deltanode Solutions AB	DOI301
Laptop	HP Compaq	NX6310

2.5 Modifications during the test

No modifications have been made during the tests



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3. TEST SPECIFICATIONS

3.1 Standards

FCC

47CFR part 2 (2006)

47CFR part 22 (2006) Subpart H

47CFR part 24 (2006) Subpart E

47CFR part 27 (2006) Subpart C

Measurement methods were according to ANSI C63.4-2003.

3.2 Additions, deviations and exclusions from standards

No additions, deviations or exclusions have been made from standards.

3.3 Test set-up

Measurement set-up for radiated measurement is described in Section 10. For conducted RF measurements the EUT was connected to the spectrum analyser by cable with a suitable power attenuator. During the tests the input signal was either CW or modulated signal/signals. Measurement results were corrected for attenuation in the set-up configuration. The EUT was supplied with 120 V, (50-60 Hz) during the tests.

3.4 Operating environment

If not additionally specified, the tests were performed under the following environmental conditions:

Air temperature: 20-25 °C
Relative humidity: 30-45 %



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4. TEST SUMMARY

The results in this report apply only to the sample tested.

4.1 Amplifier 850 MHz band

FCC reference	Test	Result	Note
2.1046 and 22.913(a)	RF output power	PASS	
2.1049	Occupied bandwidth	PASS	
-	Out of band rejection	PASS	
2.1051 and 22.917(a)	Intermodulation	PASS	
2.1051 and 22.917(a)	Out of band spurious emissions, conducted	PASS	
2.1053 and 22.917(a)	Out of band spurious emissions, radiated	PASS	
2.1055	Frequency stability	NA	1

NA = Not Applicable

Notes:

- The EUT is not a band translator

4.2 Amplifier 1900 MHz band

FCC reference	Test	Result	Note
2.1046 and 24.232	RF output power	PASS	
2.1049	Occupied bandwidth	PASS	
-	Out of band rejection	PASS	
2.1051 and 24.238	Intermodulation	PASS	
2.1051 and 24.238	Out of band spurious emissions, conducted	PASS	
2.1053 and 24.238	Out of band spurious emissions, radiated	PASS	
2.1055	Frequency stability	NA	1

NA = Not Applicable

Notes:

- The EUT is not a band translator



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4.3 Amplifier AWS band

FCC reference	Test	Result	Note
2.1046 and 27.50(d)(1)-(2)	RF output power	PASS	
2.1049	Occupied bandwidth	PASS	
-	Out of band rejection	PASS	
2.1051 and 27.53(g)	Intermodulation	PASS	
2.1051 and 27.53(g)	Out of band spurious emissions, conducted	PASS	
2.1053 and 27.53(g)	Out of band spurious emissions, radiated	PASS	
2.1055	Frequency stability	NA	1

NA = Not Applicable

Notes:

- The EUT is not a band translator



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5. RF OUTPUT POWER

Date of test: 2007-10-03

5.1 Test specifications

Amplifier	Rule	Limit
850	2.1046 and 22.913(a)	500 W (57 dBm)
1900	2.1046 and 24.232	1640 W (62 dBm)
AWS	2.1046 and 27.50(d)(1)	1640 W (62 dBm)

5.1 Test results

Amplifier	Input signal	RF Output Power (dBm)	Limit value (dBm)
850	CDMA (QPSK)	32.6	57
850	GSM (GMSK)	32.4	57
1900	CDMA (QPSK)	33.2	62
1900	GSM (GMSK)	33.3	62
AWS	WCDMA (QPSK)	32.8	62

Measurement results are corrected for attenuation in the set-up configuration.

Example calculation:

RF output power [dBm] = Power meter reading [dBm] + cable loss [dB] + attenuator loss [dB]

Fulfil requirements: YES



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6. OCCUPIED BANDWIDTH

Date of test: 2007-10-05

6.1 Test specification

47 CFR 2.1049

The spectral shape of the output should look similar to input for all modulations using 300 Hz RBW (or 1% of occupied bandwidth).

6.2 Test results

Amplifier	Input signal	26 dB bandwidth		Plots
		Input (kHz)	Output (kHz)	
850	CDMA (QPSK)	1426.854	1426.854	Plot 6.1
850	GSM (GMSK)	326.653	324.649	Plot 6.2
1900	CDMA (QPSK)	1430.862	1430.862	Plot 6.3
1900	GSM (GMSK)	328.657	326.653	Plot 6.4
AWS	WCDMA (QPSK)	4601.2	4617.2	Plot 6.5
				Plot 6.6
				Plot 6.7
				Plot 6.8
				Plot 6.9
				Plot 6.10

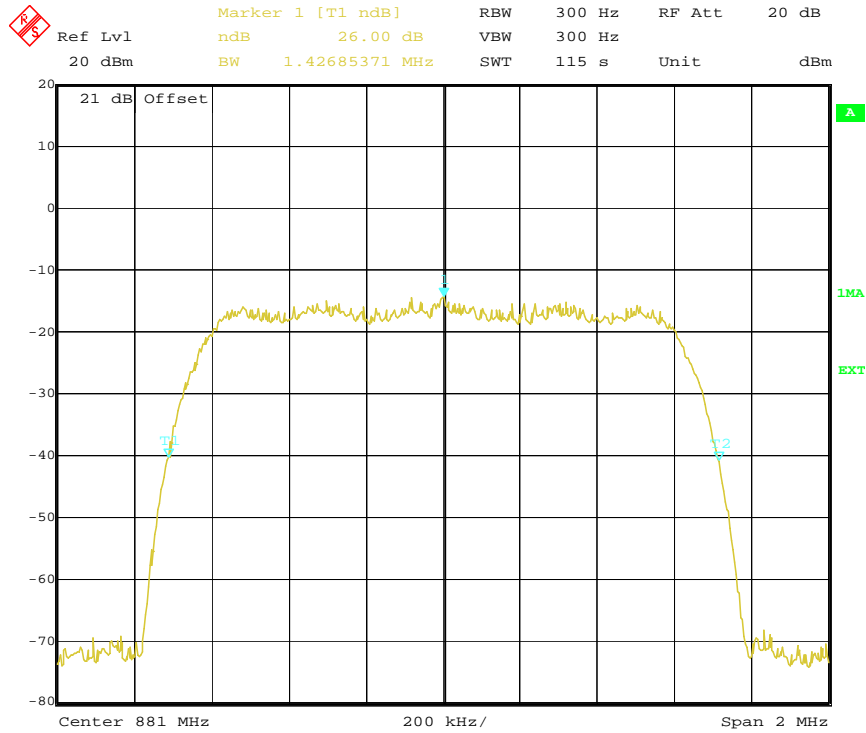
Fulfil requirements: YES



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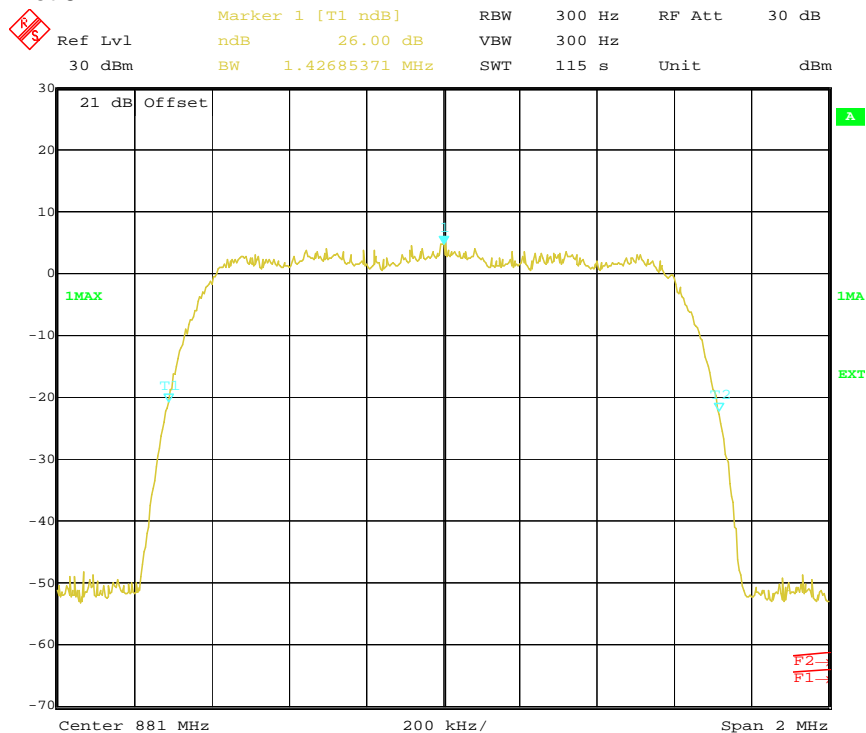
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Plot 6.1



Date: 5.OCT.2007 14:20:02

Plot 6.2



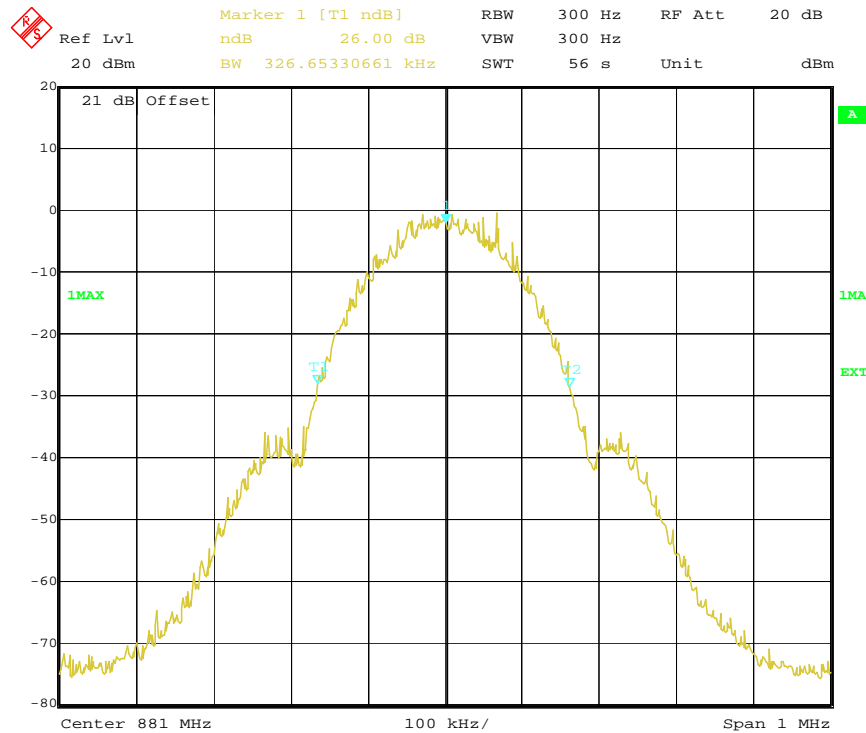
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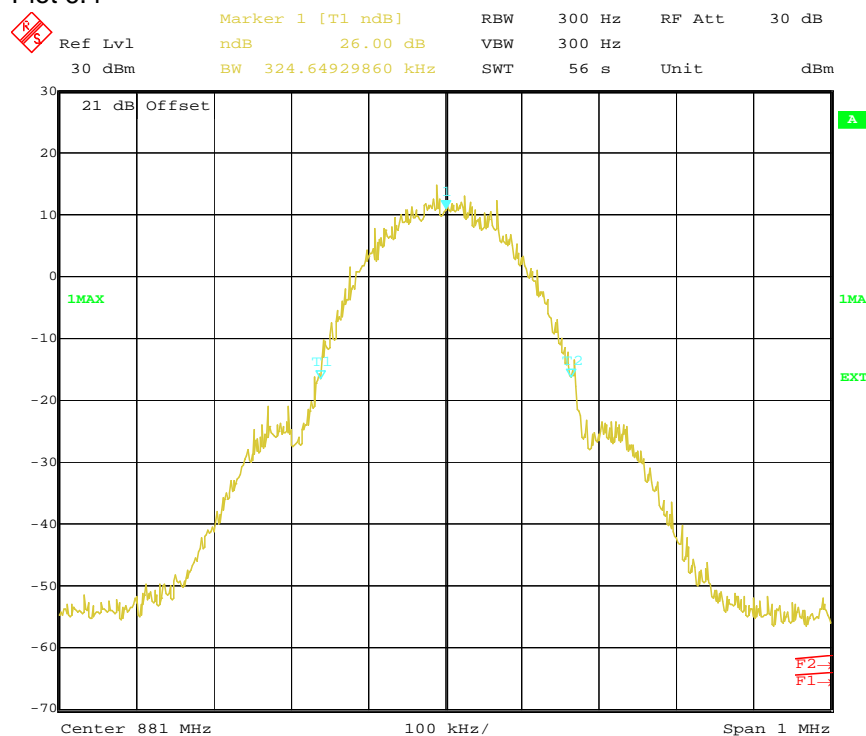
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Plot 6.3



Date: 5.OCT.2007 14:26:46

Plot 6.4



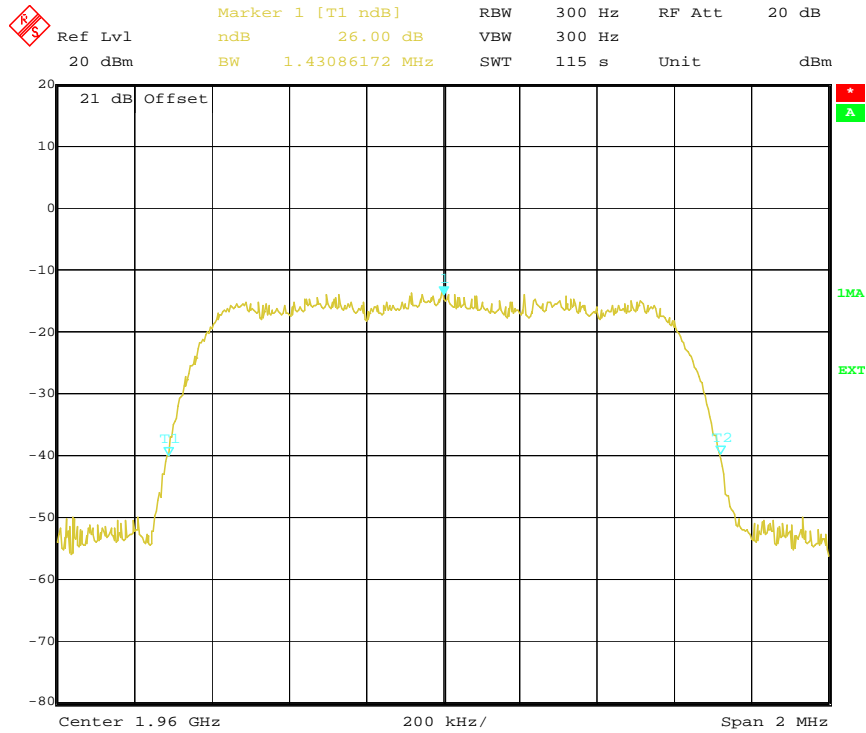
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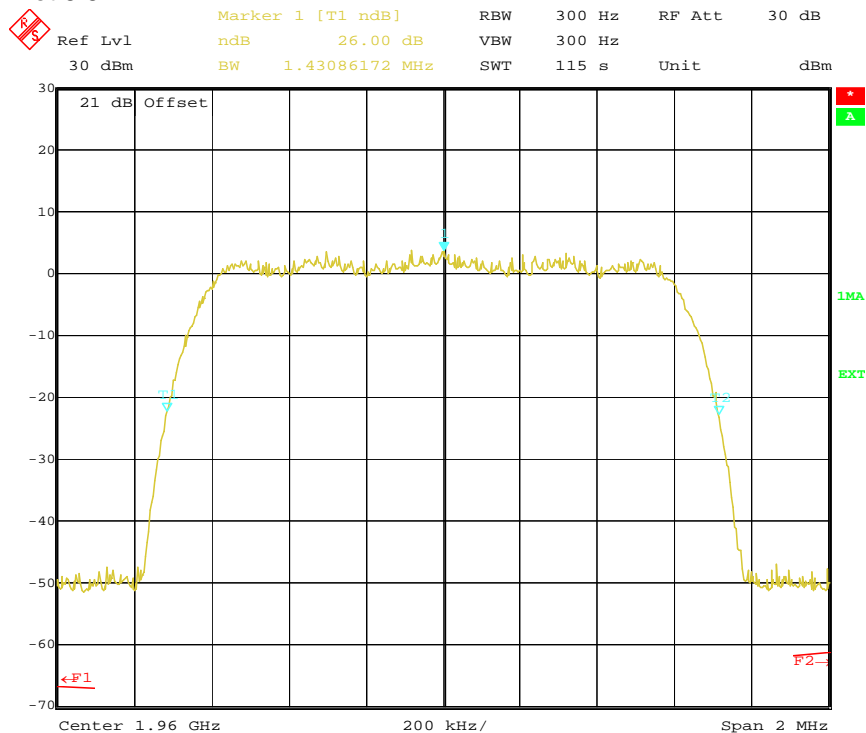
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Plot 6.5



Date: 5.OCT.2007 14:43:31

Plot 6.6



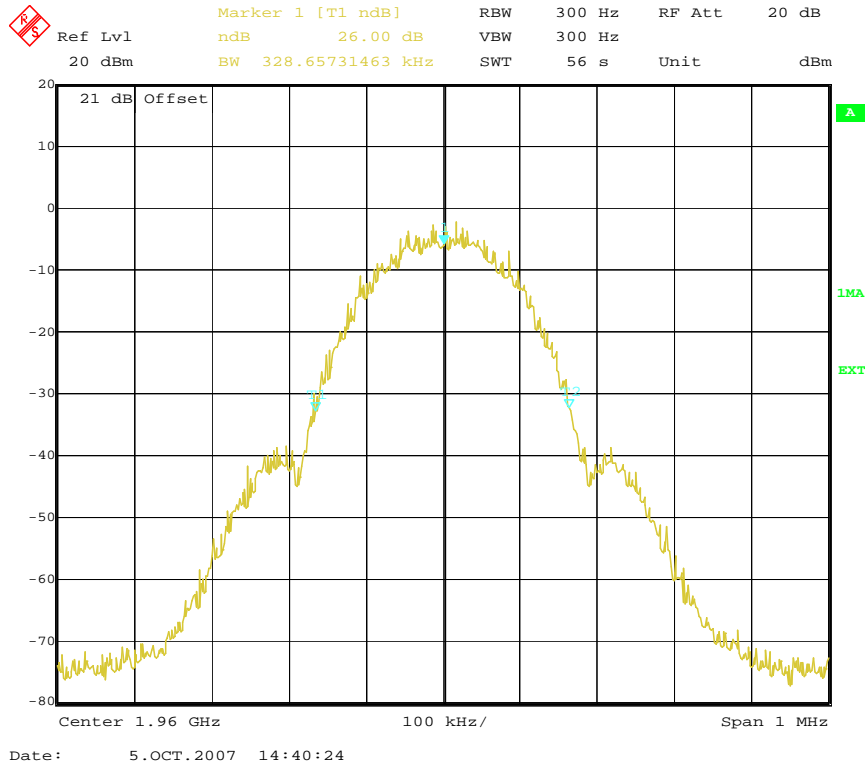
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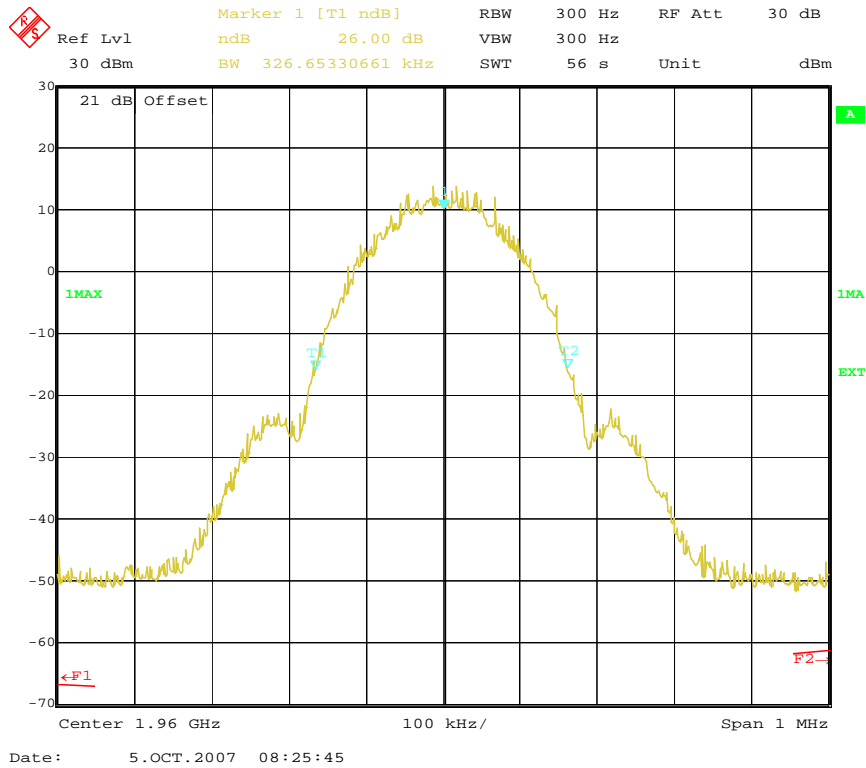
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Plot 6.7



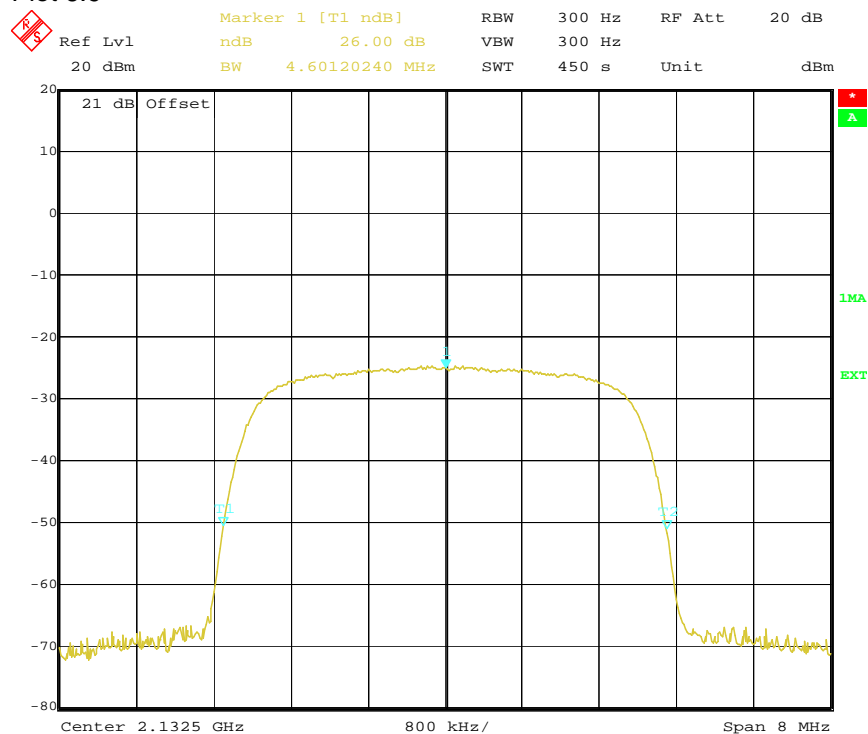
Plot 6.8



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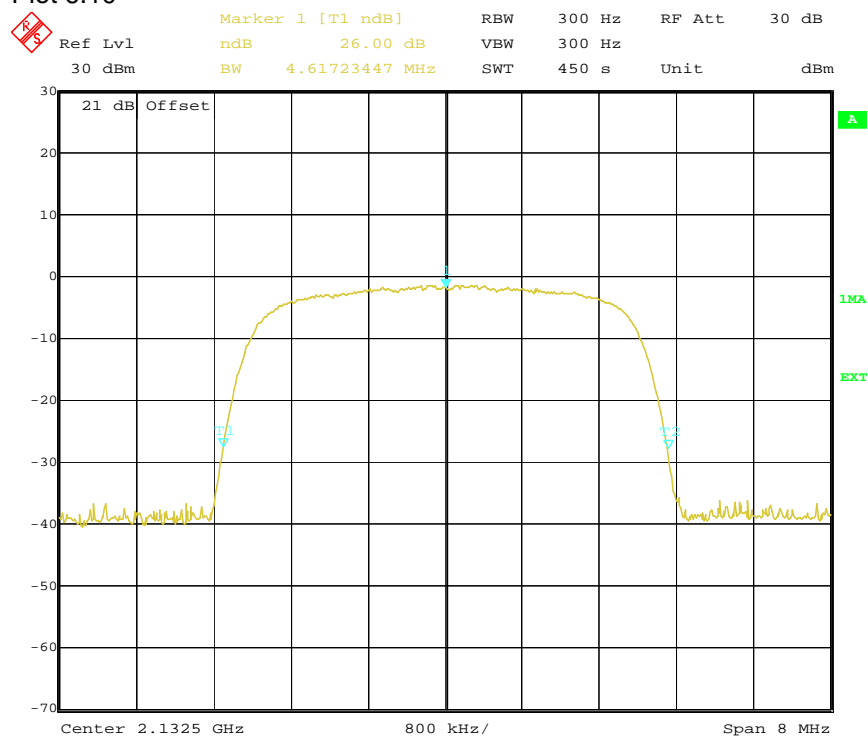
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Plot 6.9



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Plot 6.10



Date: 5.OCT.2007 14:05:44



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7. CONDUCTED SPURIOUS EMISSIONS AT ANTENNA PORT

Date of test: 2007-10-01 - 2007-10-05

7.1 Test specifications

47 CFR 2.1051 and 22.917(a)

47 CFR 2.1051 and 24.238

47 CFR 2.1051 and 27.53(g)

Spurious emissions should be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log (P)$

This gives a limit at -13 dBm at the antenna port.

The frequency range to be inspected is from 9 kHz up to the tenth harmonics of the highest fundamental frequency according to 47 CFR 2.1057.



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7.2 Test results 850 MHz band

Modulated carriers

Test signal	Frequency [MHz]	RBW [MHz]	Measured peak level (dBm)	Limit (dBm)	Plots	Comment
CDMA, low ch.	9kHz – 3 000	1	-25.61	-13	Plot 7.1	
CDMA, low ch.	3 000 – 10 000	1	-24.03	-13	Plot 7.2	
CDMA, mid. ch.	9kHz – 3 000	1	-25.86	-13	Plot 7.3	
CDMA, mid. ch.	3 000 – 10 000	1	-24.82	-13	Plot 7.4	
CDMA, high ch.	9kHz – 3 000	1	-26.12	-13	Plot 7.5	
CDMA, high ch.	3 000 – 10 000	1	-24.38	-13	Plot 7.6	
GSM, low ch.	9kHz – 3 000	1	-27.90	-13	Plot 7.7	
GSM, low ch.	3 000 – 10 000	1	-24.01	-13	Plot 7.8	
GSM, mid. ch.	9kHz – 3 000	1	-25.97	-13	Plot 7.9	
GSM, mid. ch.	3 000 – 10 000	1	-24.72	-13	Plot 7.10	
GSM, high ch.	9kHz – 3 000	1	-28.12	-13	Plot 7.11	
GSM, high ch.	3 000 – 10 000	1	-24.23	-13	Plot 7.12	

Intermodulation and band edge measurements

Test signal	Frequency [MHz]	RBW [kHz]	Measured peak level (dBm)	Limit (dBm)	Plots	Comment
3 CW tones at 871, 877 and 893 MHz	841 – 921	100	-15.54	-13	Plot 7.13	
2 CDMA carriers at 869.76 and 871.98 MHz	859 – 879	30	-17.53	-13	Plot 7.14	
2 CDMA carriers at 891.00 and 893.22 MHz	884 – 904	30	-24.66	-13	Plot 7.15	
CDMA carrier at 869.76 MHz	866.5 – 871.5	30	-15.53	-13	Plot 7.16	
CDMA carrier at 893.22 MHz	891.5 – 896.5	30	-19.32	-13	Plot 7.17	
GSM carrier at 869.2 MHz	866.5 – 871.5	3	-17.40	-13	Plot 7.18	
GSM carrier at 893.8 MHz	891.5 – 896.5	3	-16.90	-13	Plot 7.19	

Measurement results are corrected for attenuation in the set-up configuration.

Example calculation:

Measured level [dBm] = Analyser reading [dBm] + cable loss [dB] + attenuator loss [dB]

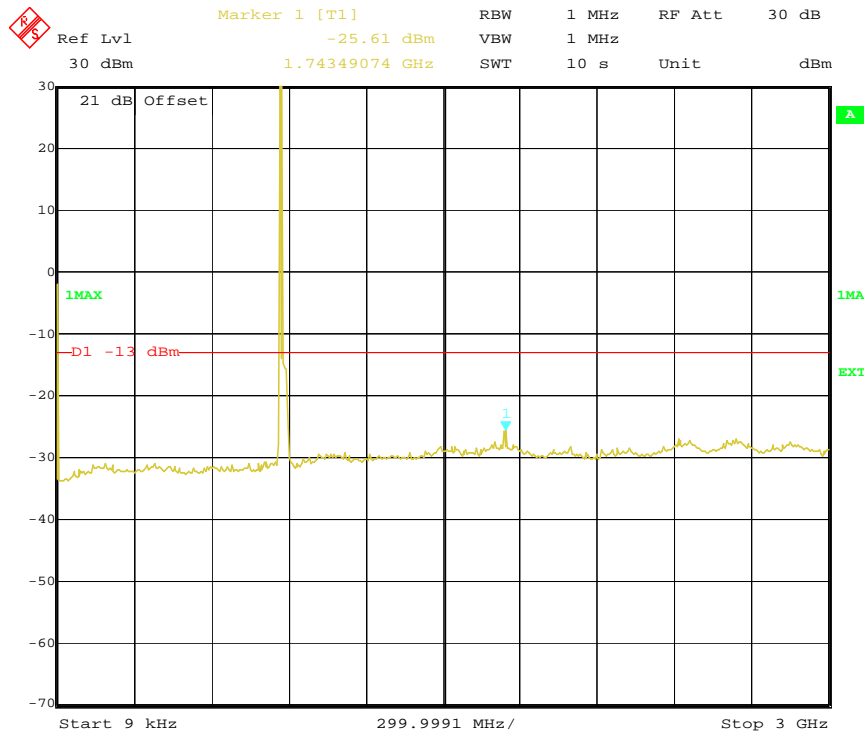
Fulfil requirements: YES



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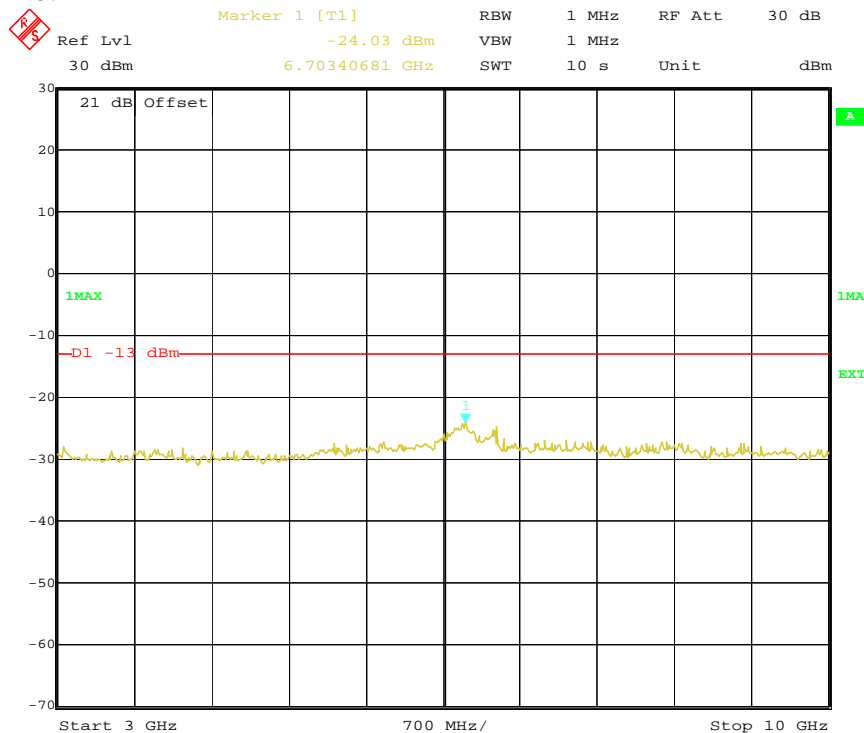
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Plot 7.1



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Plot 7.2



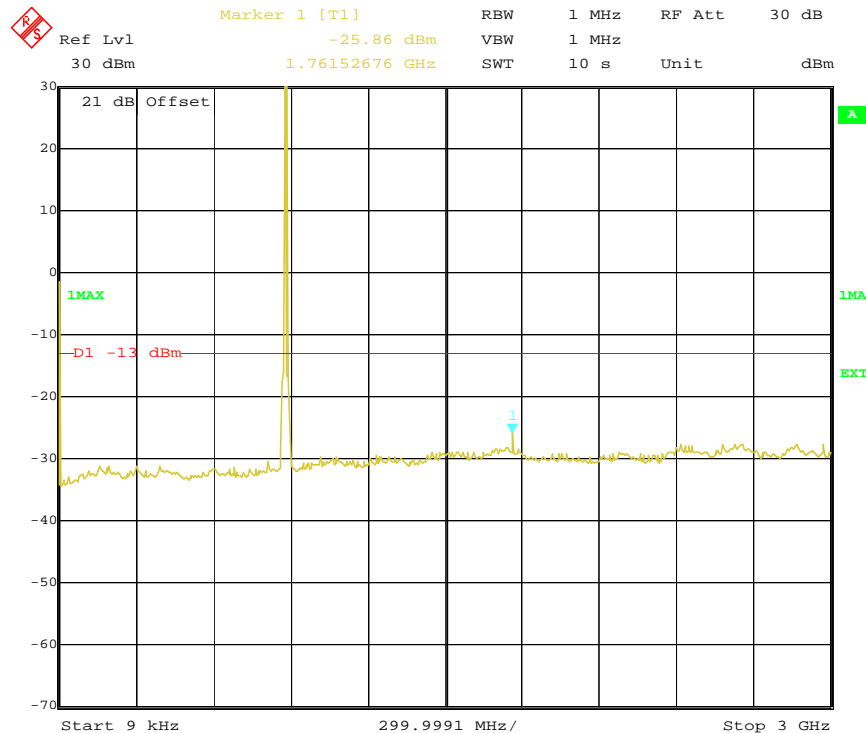
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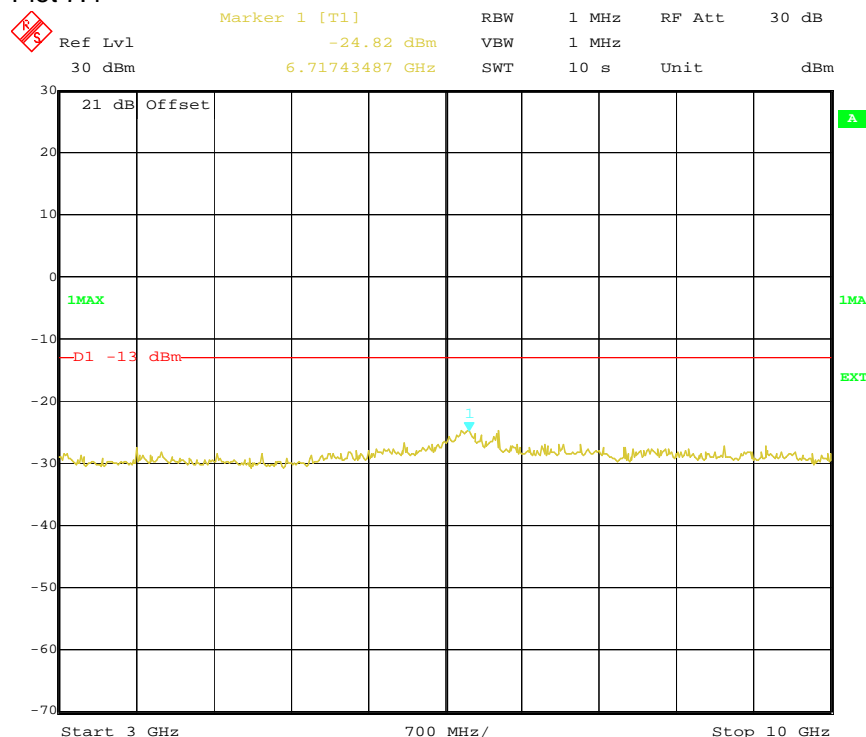
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Plot 7.3



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Plot 7.4



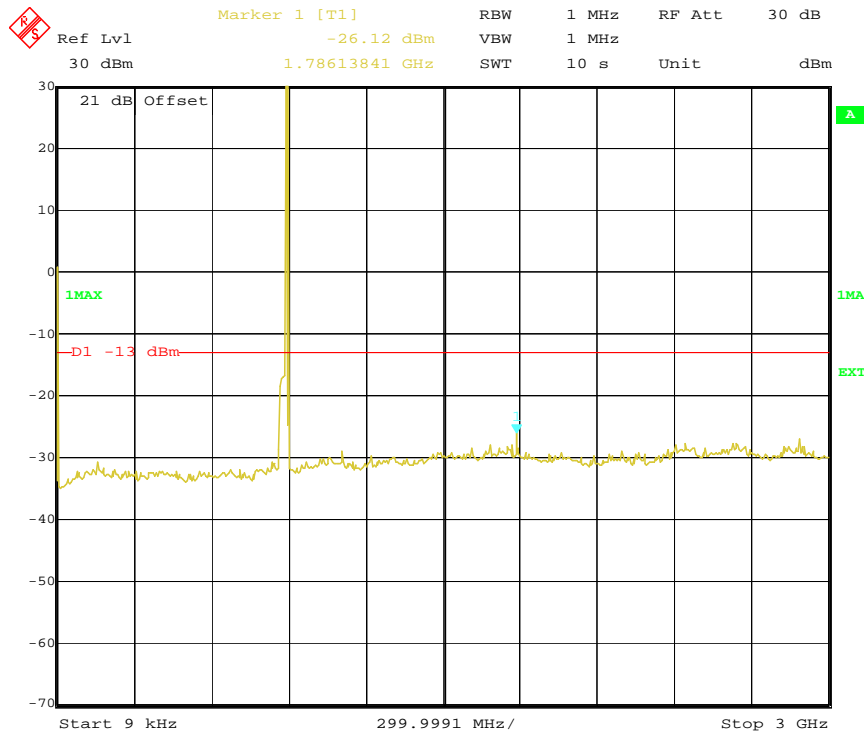
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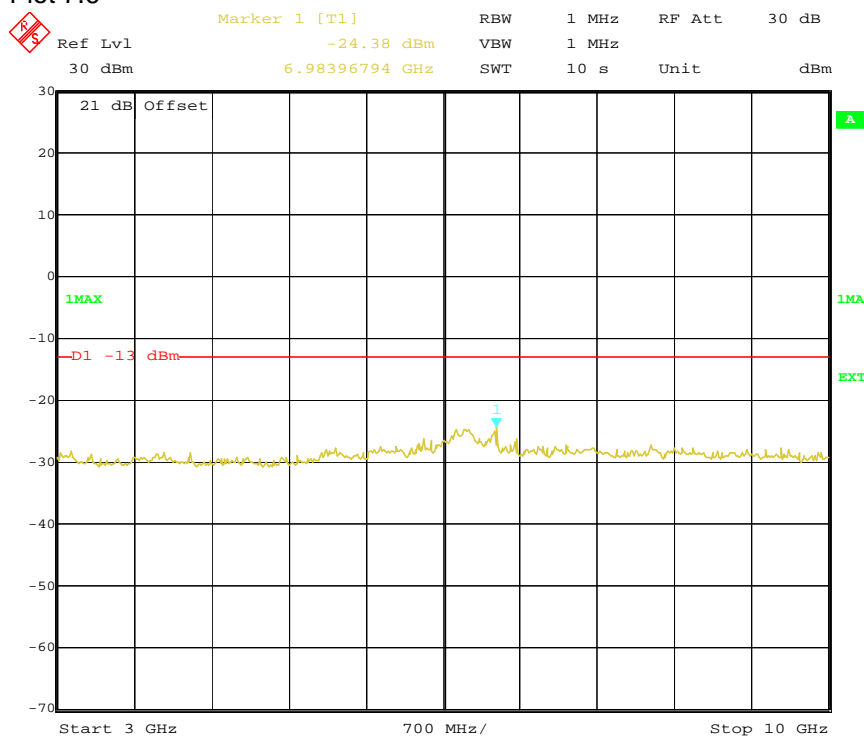
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Plot 7.5



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Plot 7.6



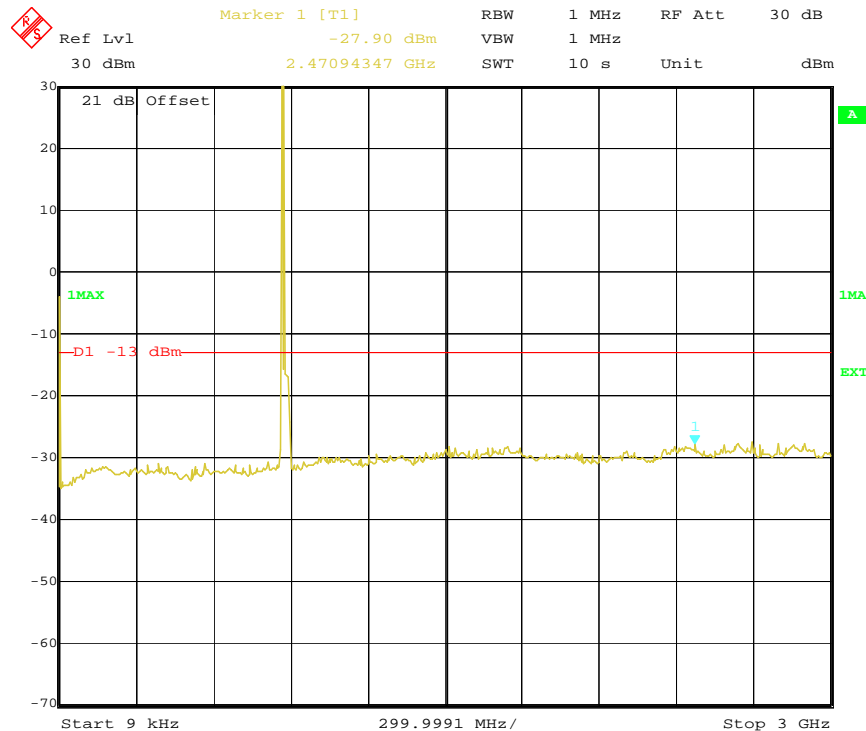
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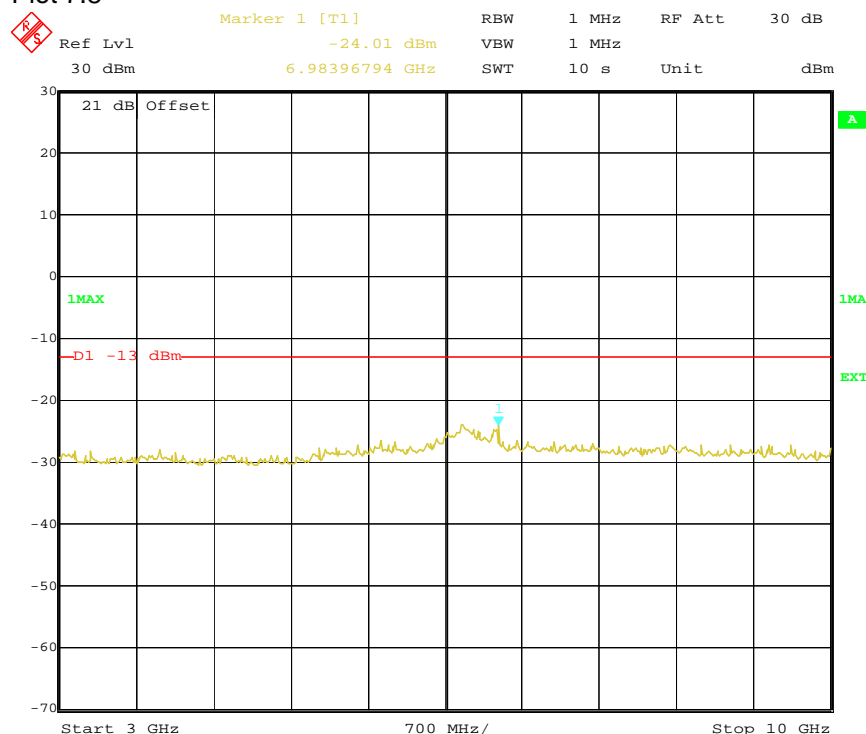
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Plot 7.7



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Plot 7.8



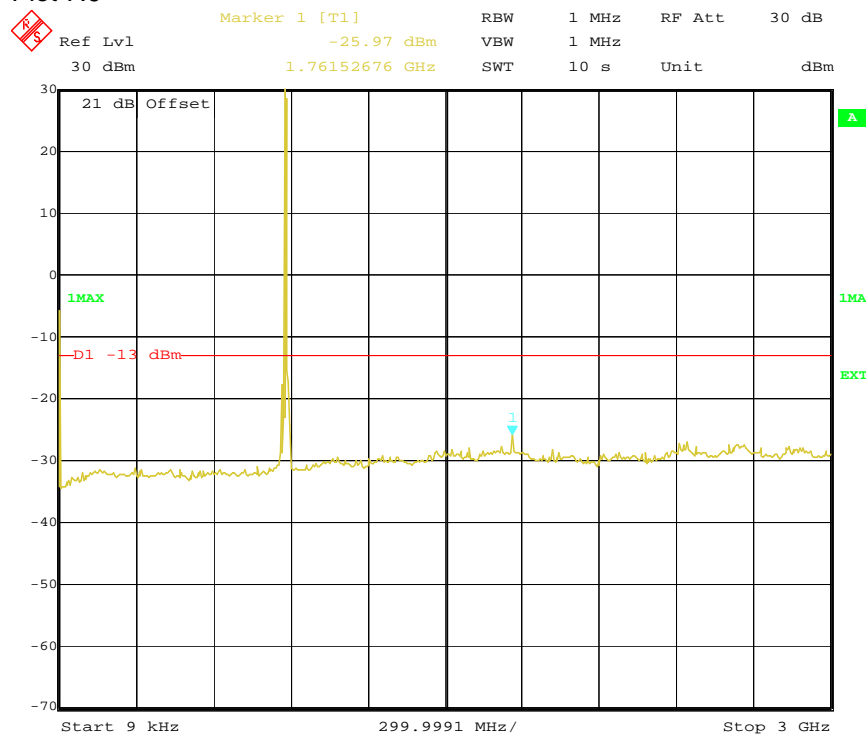
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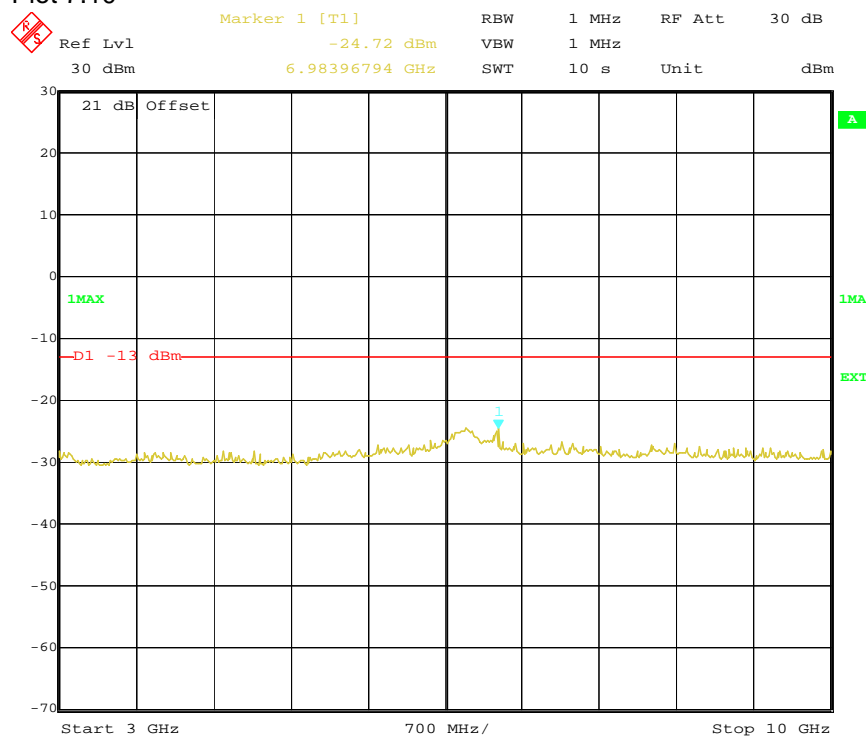
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Plot 7.9



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Plot 7.10



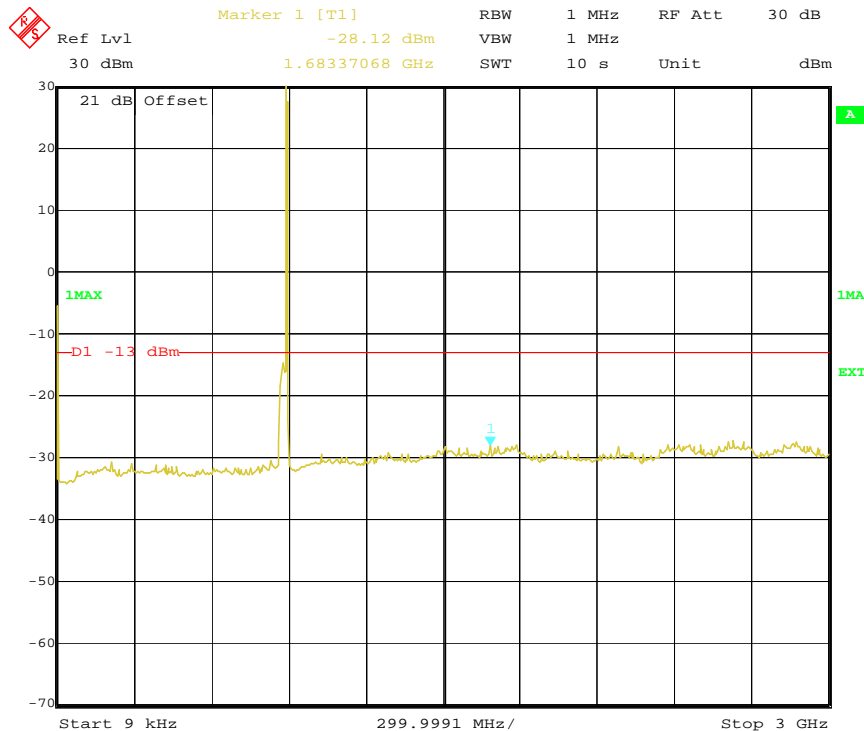
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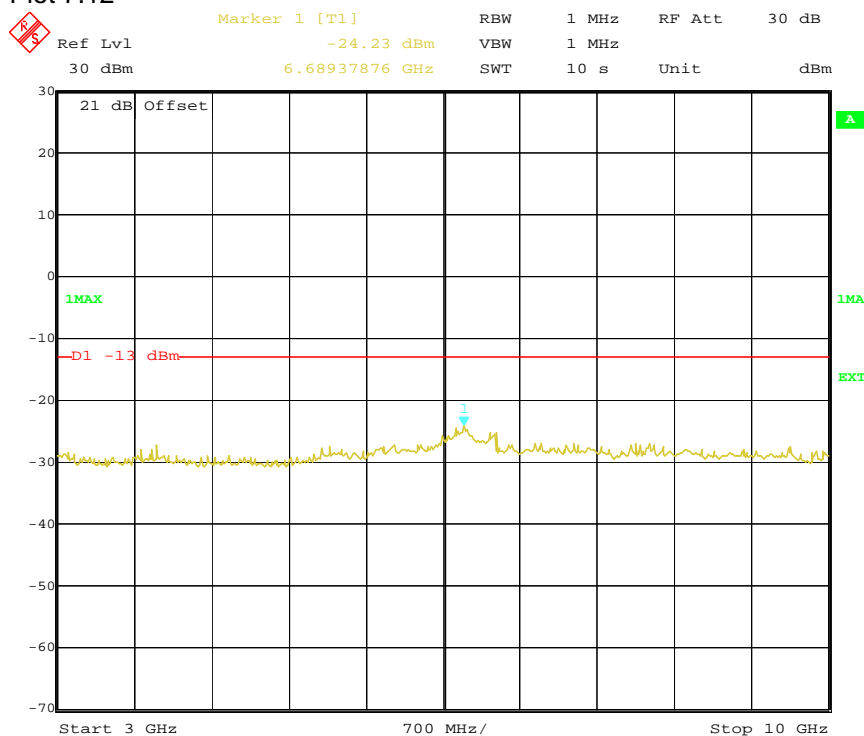
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Plot 7.11



Date: 4.OCT.2007 12:32:52

Plot 7.12



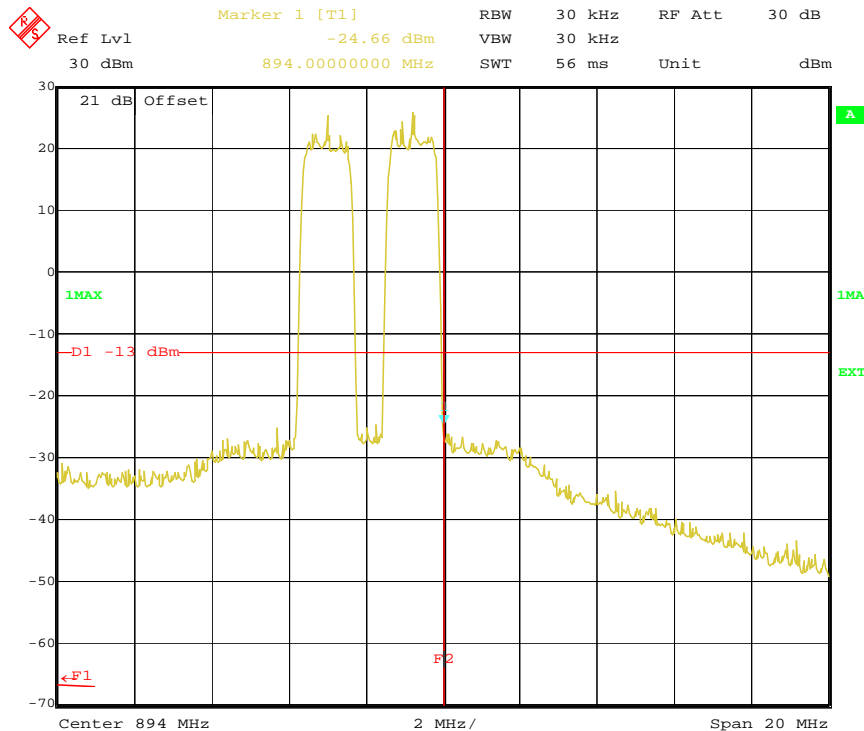
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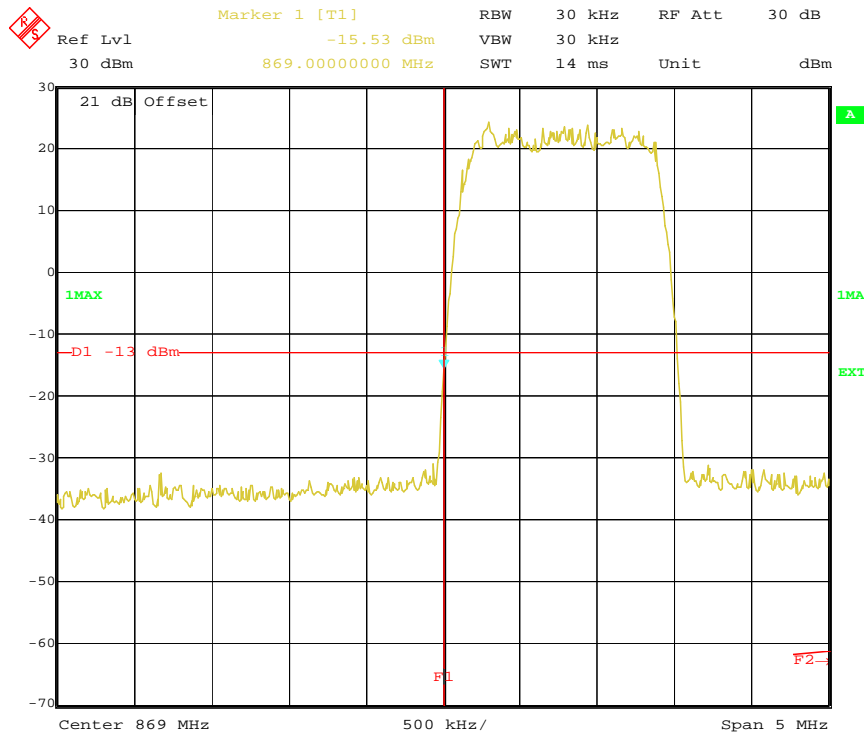
Torshamnsgatan 43, Box 1103, SE-164 22 Kista, Sweden
Telephone +46 8 750 00 00, Fax +46 8 750 60 30, www.sweden.intertek-etlsemko.com
Registered in Sweden: No SE556024059901, Registered office: As address

Plot 7.15



Date: 5.OCT.2007 09:11:03

Plot 7.16



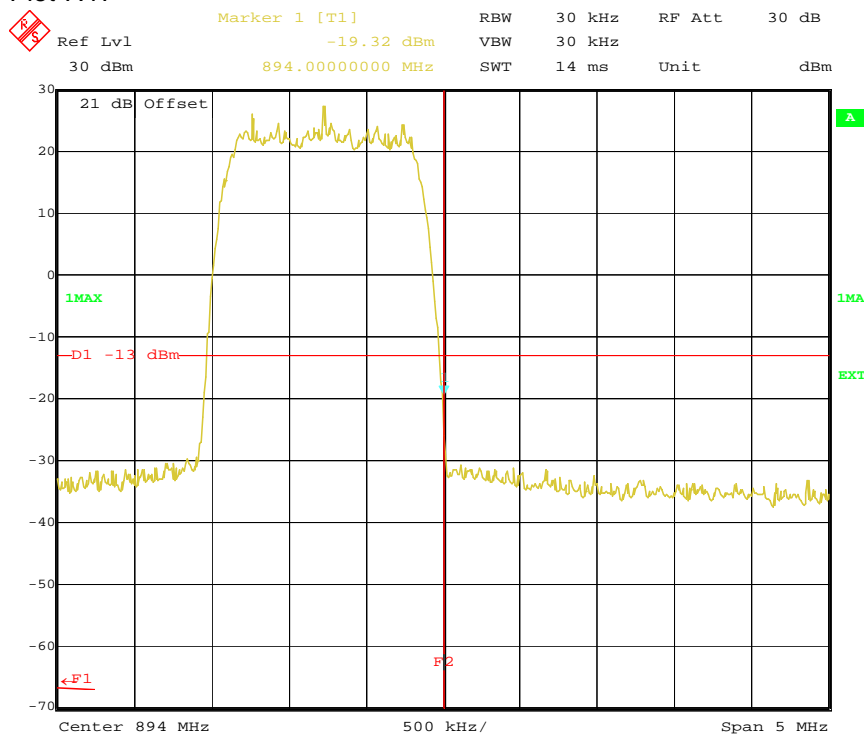
Date: 5.OCT.2007 08:54:27



Intertek Semko AB

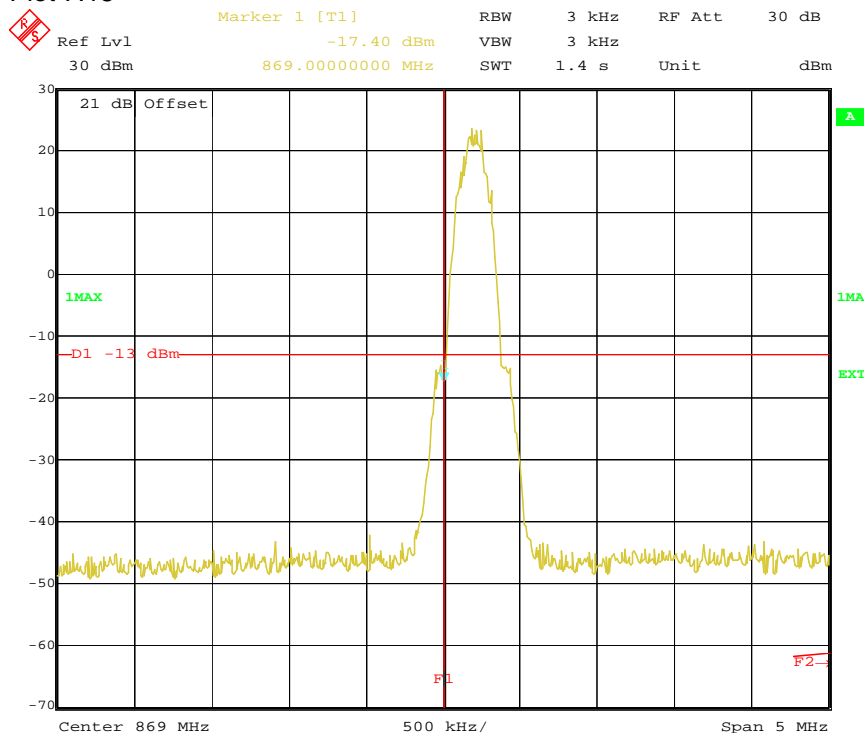
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Plot 7.17



Date: 5.OCT.2007 08:57:31

Plot 7.18



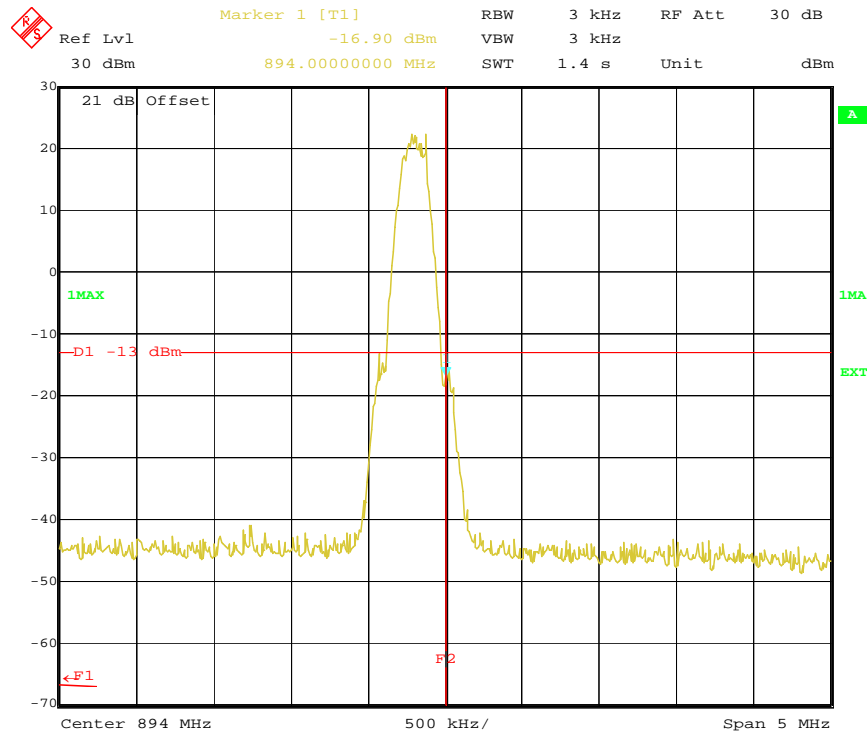
Date: 5.OCT.2007 09:00:13



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Plot 7.19



Date: 5.OCT.2007 08:58:59



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7.3 Test results 1900 MHz band

Modulated carriers

Test signal	Frequency [MHz]	RBW [MHz]	Measured peak level (dBm)	Limit (dBm)	Plots	Comment
CDMA, low ch.	9kHz – 3 000	1	-27.75	-13	Plot 7.20	
CDMA, low ch.	3 000 – 11 000	1	-24.06	-13	Plot 7.21	
CDMA, low ch.	11 000 – 20 000	1	-25.74	-13	Plot 7.22	
CDMA, mid. ch.	9kHz – 3 000	1	-27.50	-13	Plot 7.23	
CDMA, mid. ch.	3 000 – 11 000	1	-24.02	-13	Plot 7.24	
CDMA, mid. ch.	11 000 – 20 000	1	-25.29	-13	Plot 7.25	
CDMA, high ch.	9kHz – 3 000	1	-28.00	-13	Plot 7.26	
CDMA, high ch.	3 000 – 11 000	1	-24.04	-13	Plot 7.27	
CDMA, high ch.	11 000 – 20 000	1	-25.28	-13	Plot 7.28	
GSM, low ch.	9kHz – 3 000	1	-27.59	-13	Plot 7.29	
GSM, low ch.	3 000 – 11 000	1	-23.55	-13	Plot 7.30	
GSM, low ch.	11 000 – 20 000	1	-25.77	-13	Plot 7.31	
GSM, mid. ch.	9kHz – 3 000	1	-27.79	-13	Plot 7.32	
GSM, mid. ch.	3 000 – 11 000	1	-24.35	-13	Plot 7.33	
GSM, mid. ch.	11 000 – 20 000	1	-25.10	-13	Plot 7.34	
GSM, high ch.	9kHz – 3 000	1	-27.45	-13	Plot 7.35	
GSM, high ch.	3 000 – 11 000	1	-22.15	-13	Plot 7.36	
GSM, high ch.	11 000 – 20 000	1	-25.65	-13	Plot 7.37	

Intermodulation and band edge measurements

Test signal	Frequency [MHz]	RBW [kHz]	Measured peak level (dBm)	Limit (dBm)	Plots	Comment
3 CW tones at 1931, 1935 and 1988 MHz	1835 - 2085	100	-18.57	-13	Plot 7.38	
2 CDMA carriers at 1930.8 and 1933 MHz	1920 - 1940	30	-19.32	-13	Plot 7.39	
2 CDMA carriers at 1986 and 1989.2 MHz	1980 - 2000	30	-22.11	-13	Plot 7.40	
CDMA carrier at 1930.8 MHz	1927.5 – 1932.5	30	-28.89	-13	Plot 7.41	
CDMA carrier at 1989.2 MHz	1987.5 – 1992.5	30	-26.59	-13	Plot 7.42	
GSM carrier at 1930.2 MHz	1927.5 – 1932.5	3	-16.84	-13	Plot 7.43	
GSM carrier at 1989.8 MHz	1987.5 – 1992.5	3	-16.05	-13	Plot 7.44	

Measurement results are corrected for attenuation in the set-up configuration.

Example calculation:

Measured level [dBm] = Analyser reading [dBm] + cable loss [dB] + attenuator loss [dB]

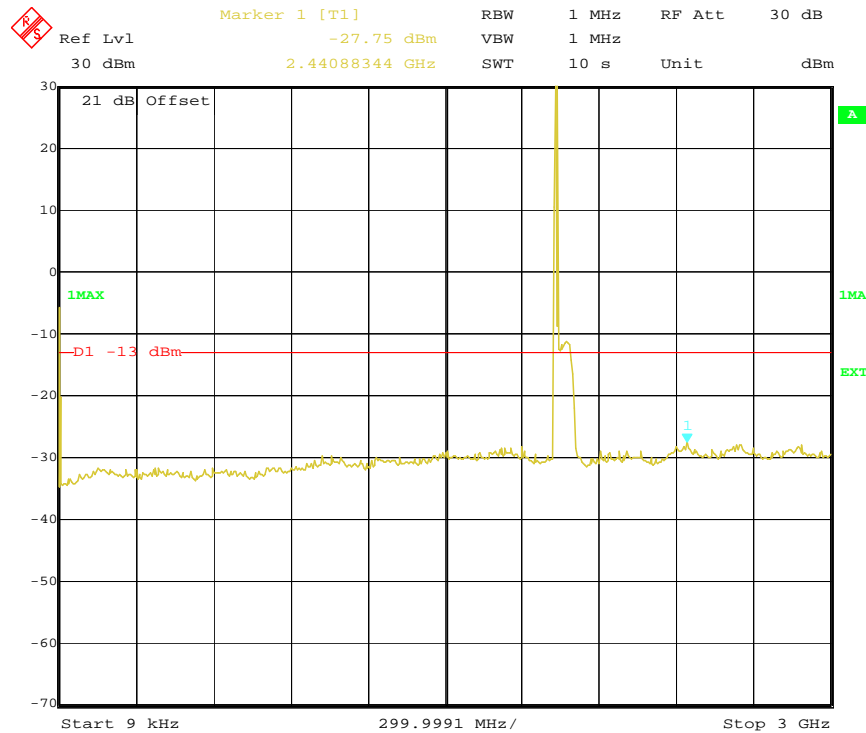
Fulfil requirements: YES



Intertek Semko AB

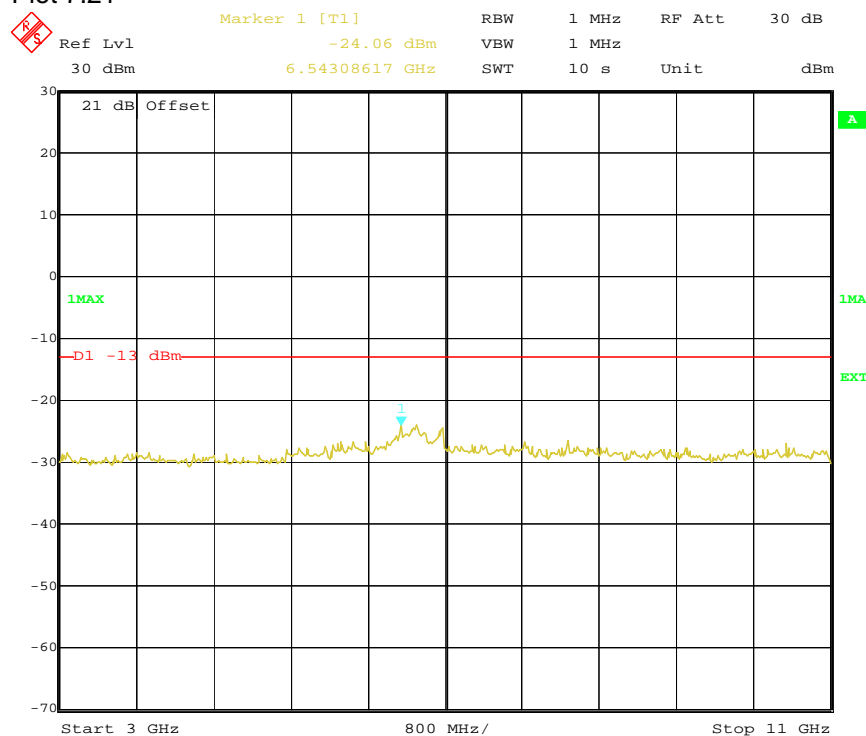
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Plot 7.20



Date: 4.OCT.2007 12:50:56

Plot 7.21



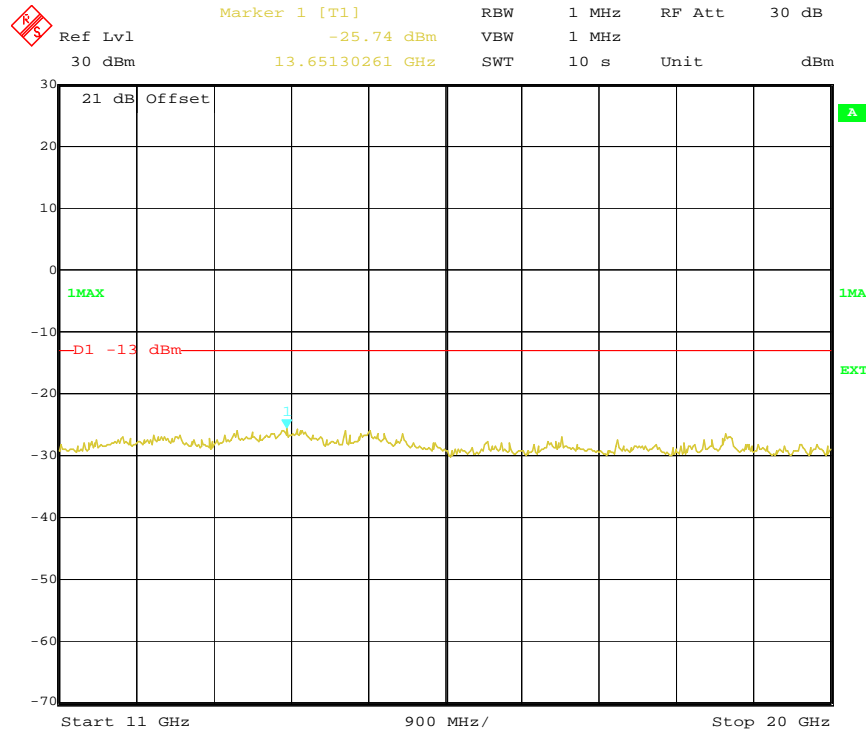
Date: 4.OCT.2007 12:51:48



Intertek Semko AB

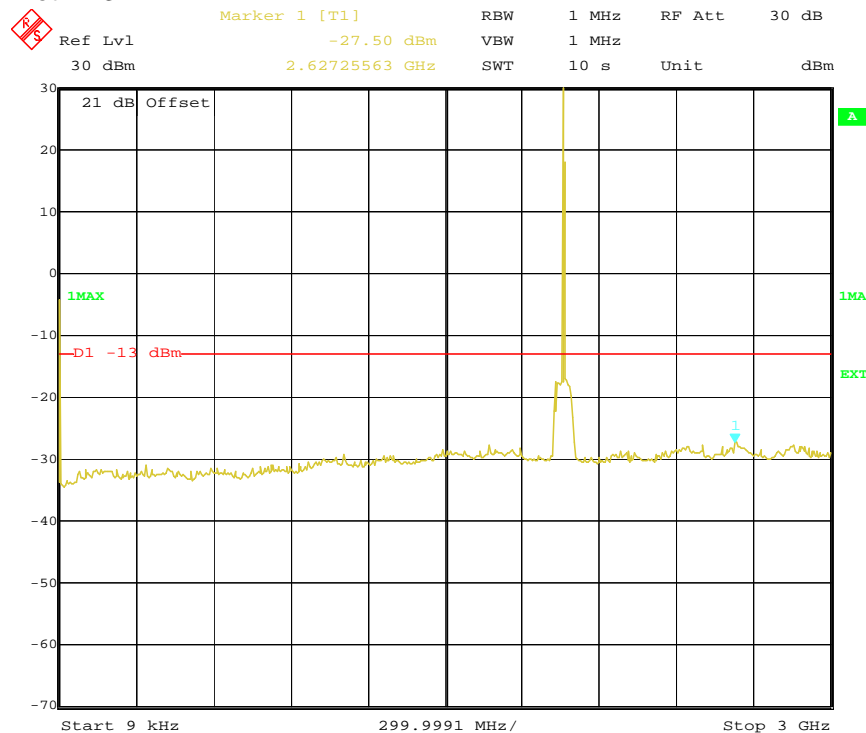
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Plot 7.22



Date: 4.OCT.2007 12:52:49

Plot 7.23



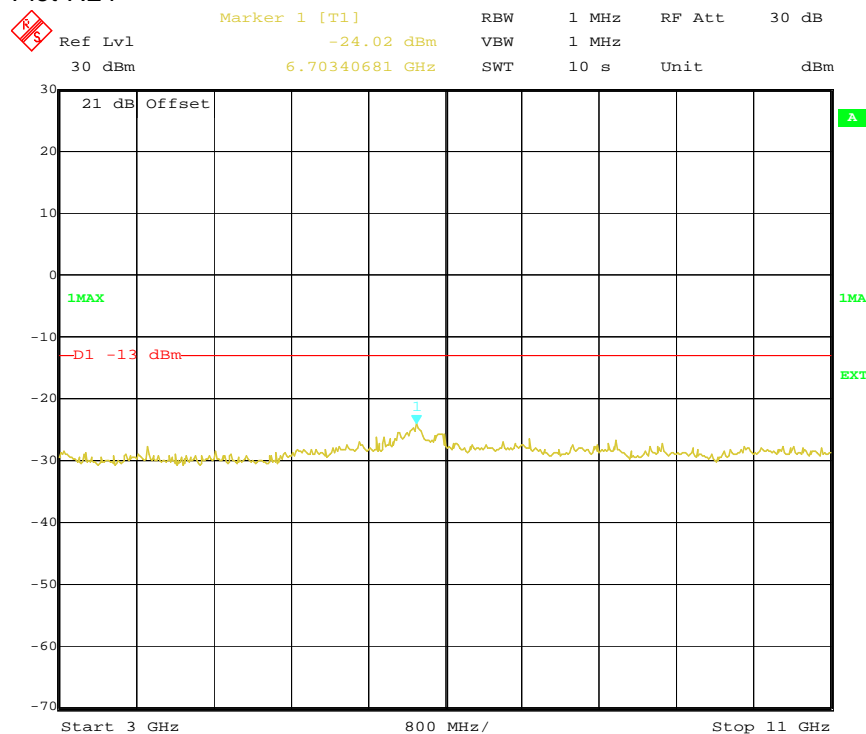
Date: 4.OCT.2007 13:18:36



Intertek Semko AB

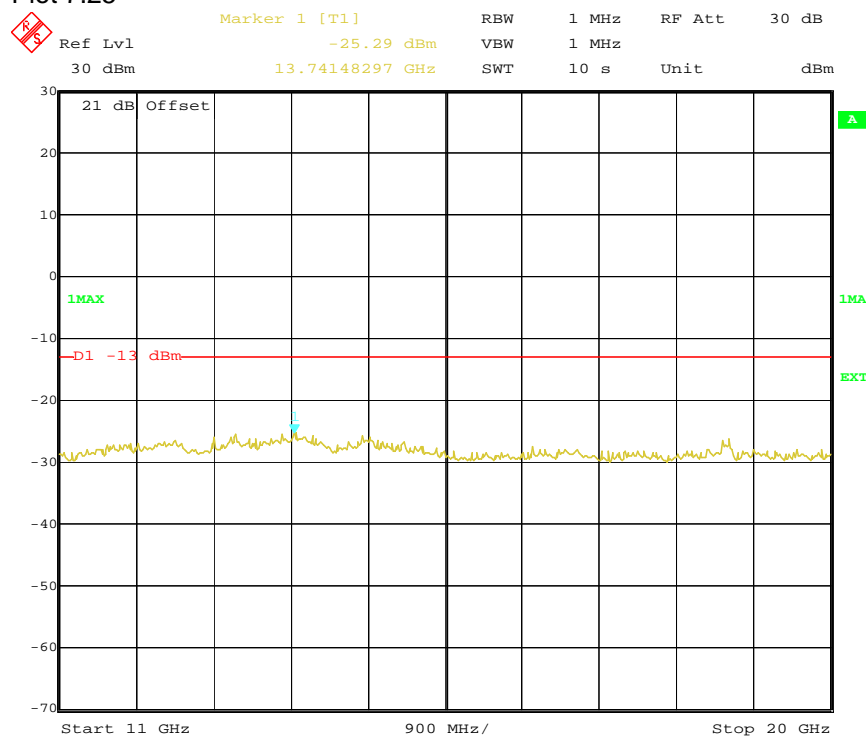
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Plot 7.24



Date: 4.OCT.2007 13:19:13

Plot 7.25



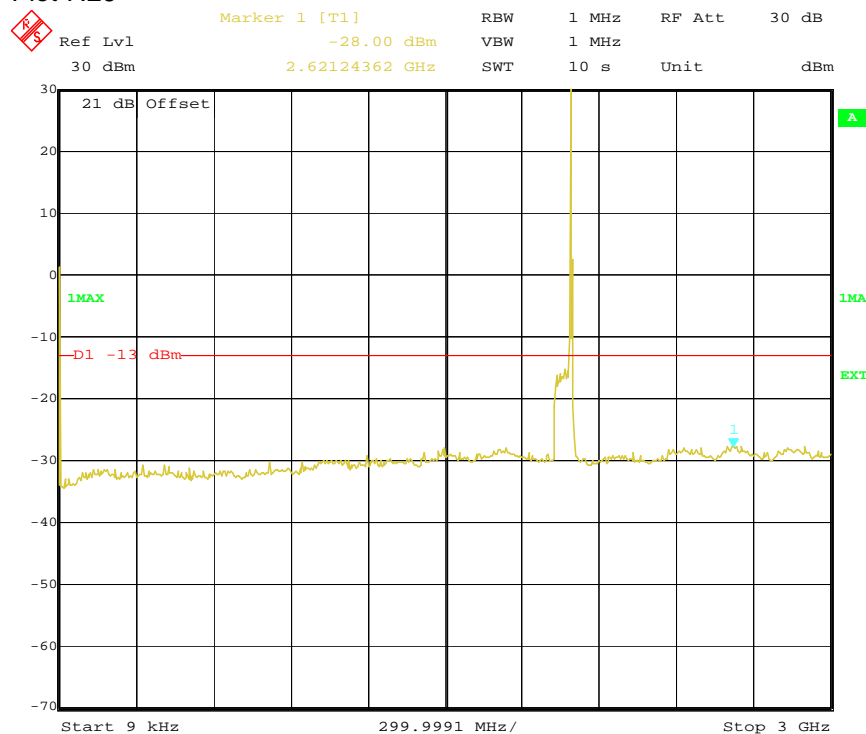
Date: 4.OCT.2007 13:19:52



Intertek Semko AB

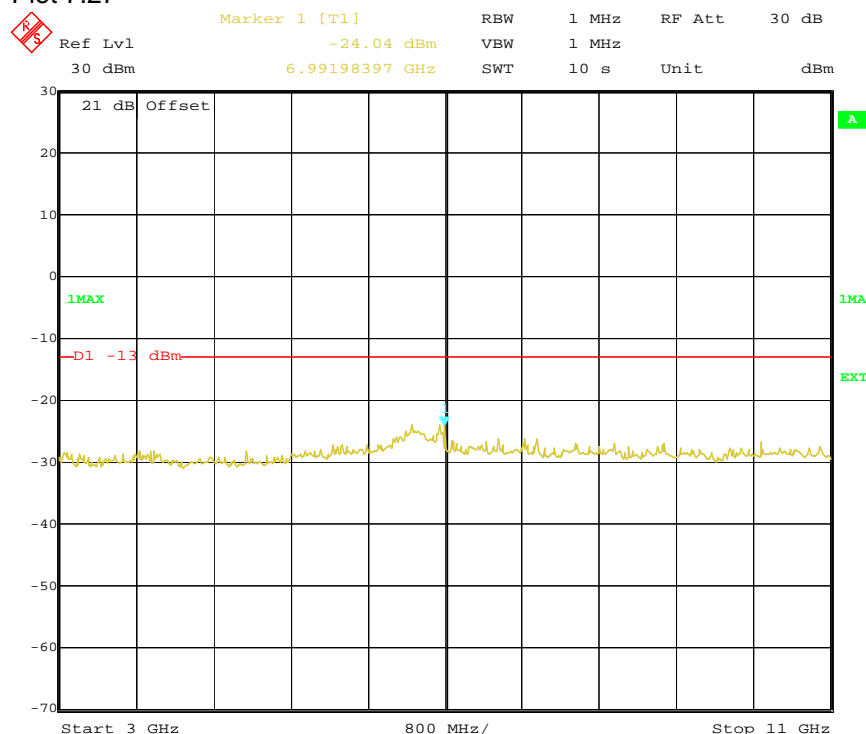
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Plot 7.26



Date: 4.OCT.2007 13:21:02

Plot 7.27



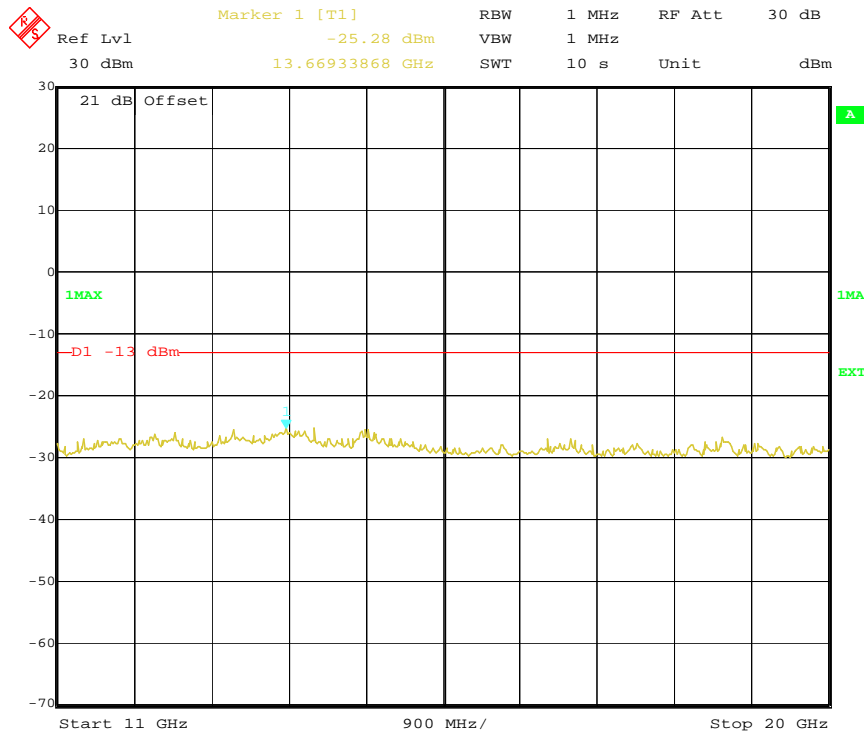
Date: 4.OCT.2007 13:21:39



Intertek Semko AB

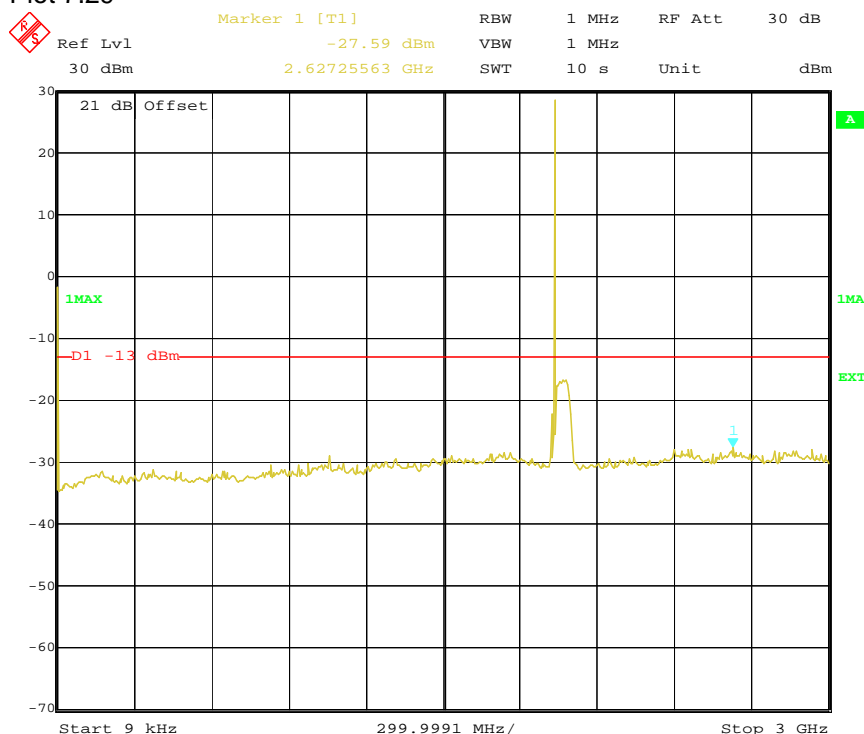
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Plot 7.28



Date: 4.OCT.2007 13:22:16

Plot 7.29



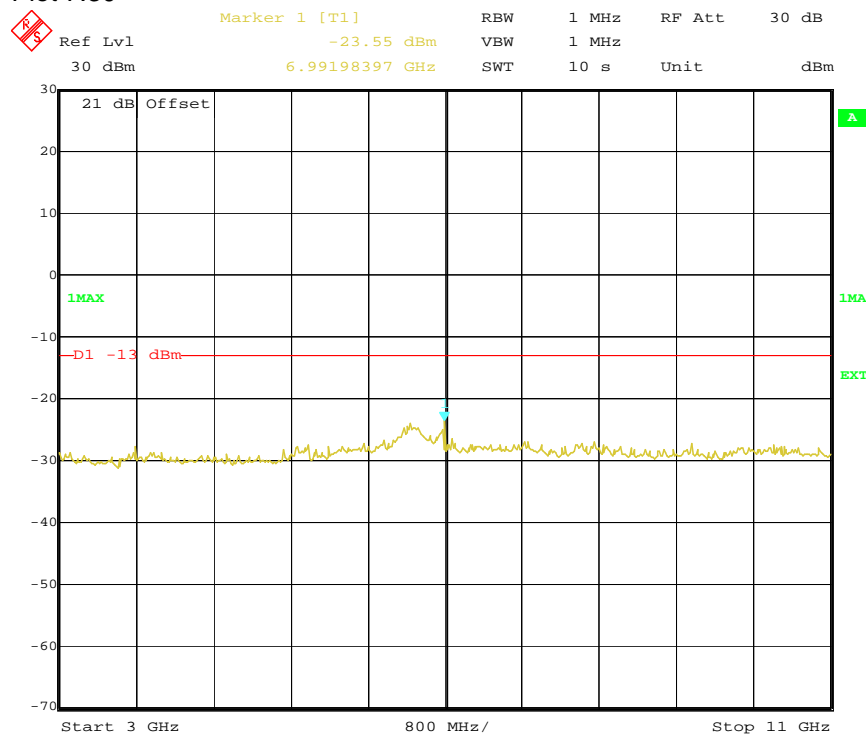
Date: 4.OCT.2007 13:38:46



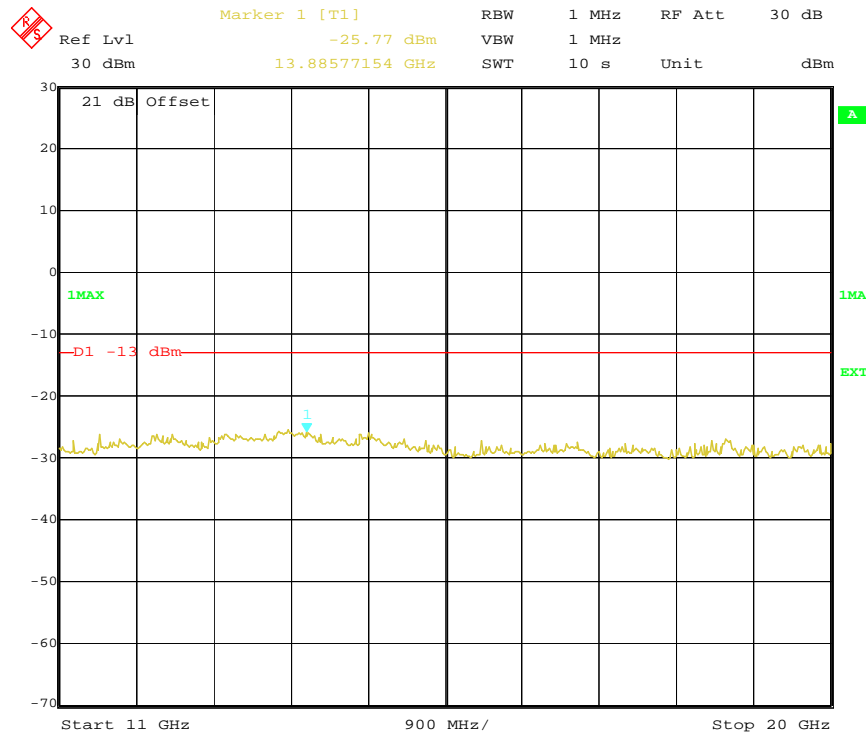
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Plot 7.30



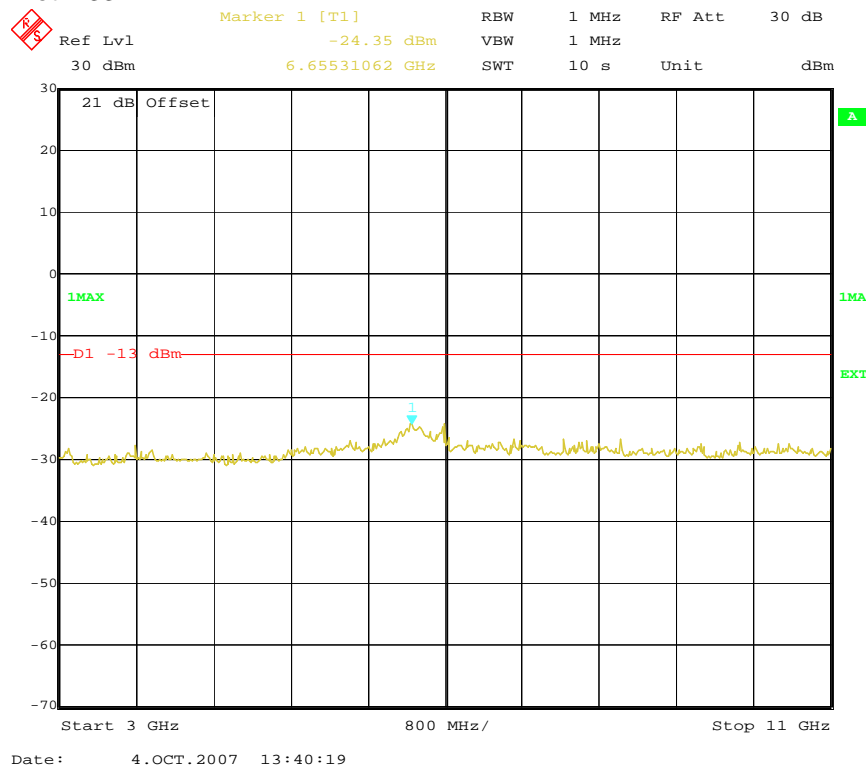
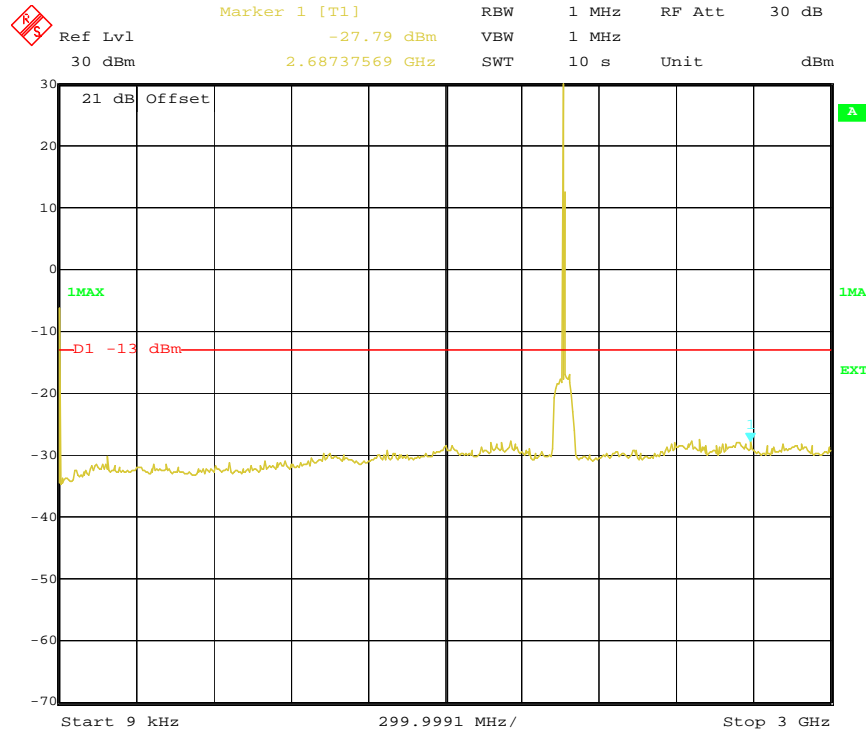
Plot 7.31



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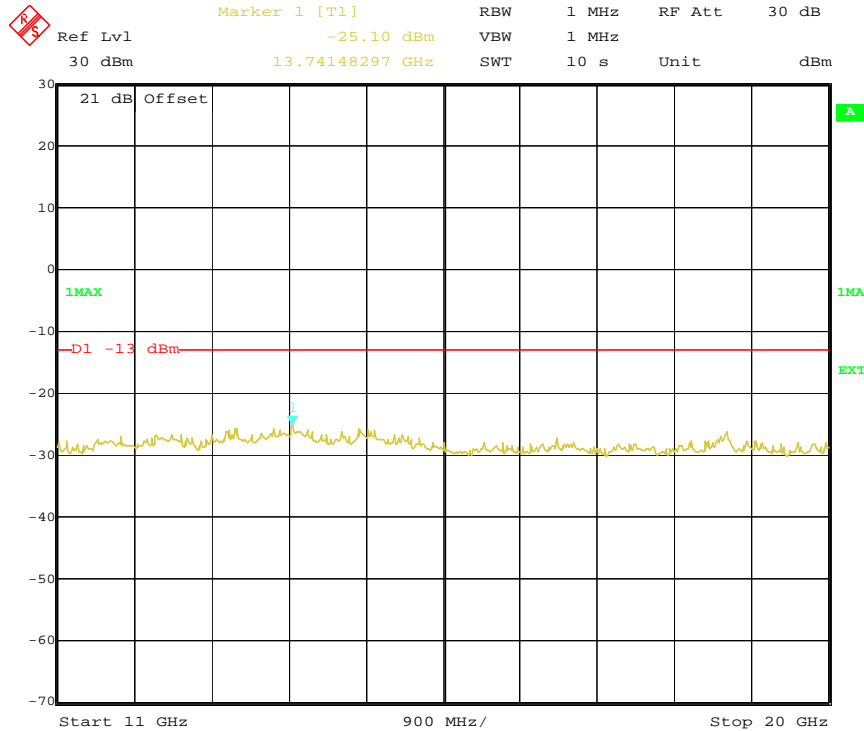
Plot 7.32



Intertek Semko AB

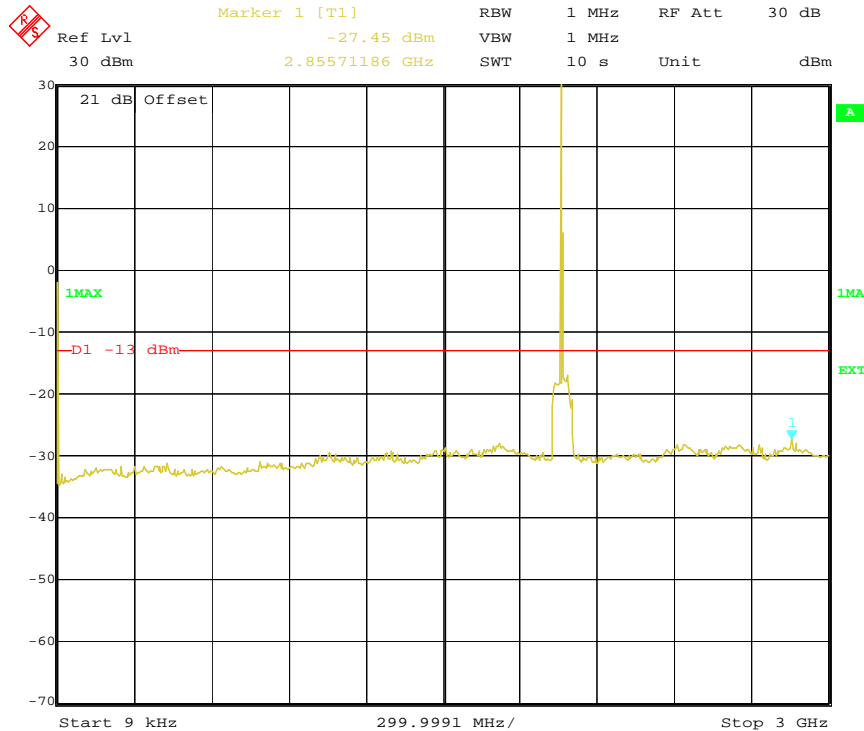
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Plot 7.34



Date: 4.OCT.2007 13:41:16

Plot 7.35



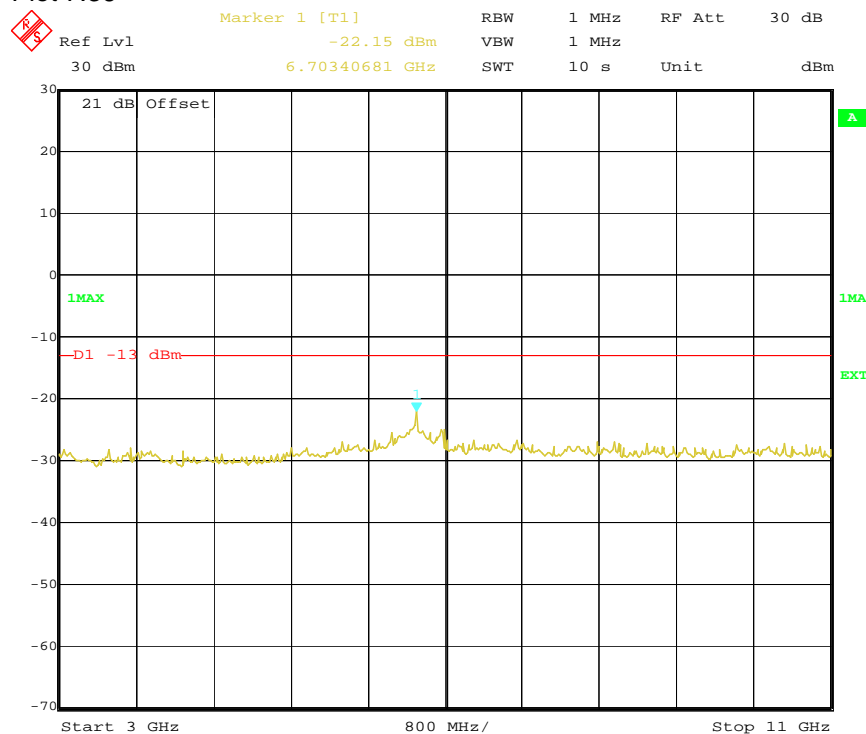
Date: 4.OCT.2007 13:41:49



Intertek Semko AB

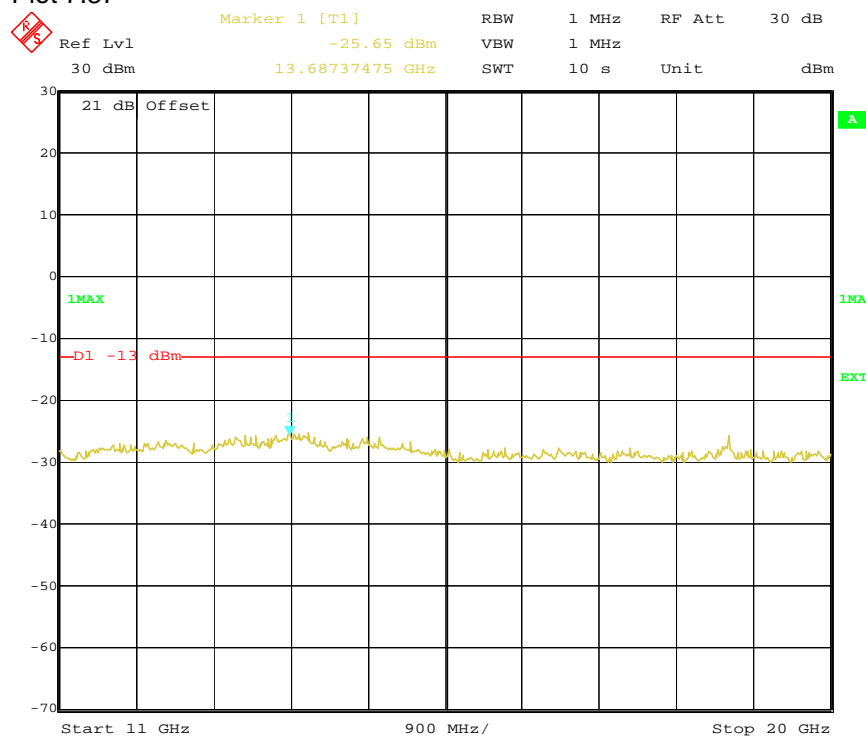
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 Registered in Sweden: No SE556024059901, Registered office: As address

Plot 7.36



Date: 4.OCT.2007 13:42:31

Plot 7.37



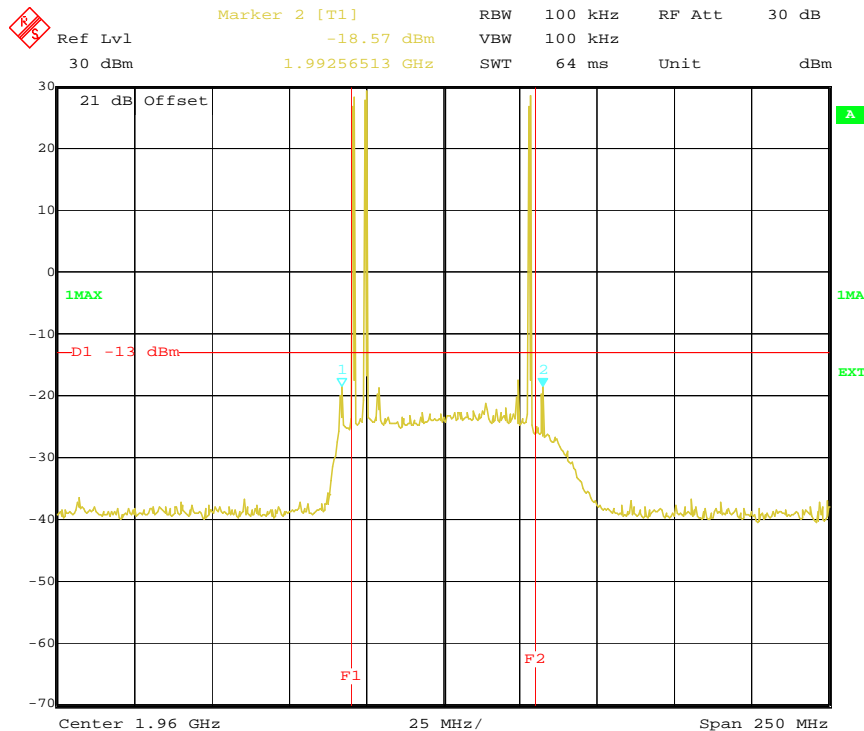
Date: 4.OCT.2007 13:43:37



Intertek Semko AB

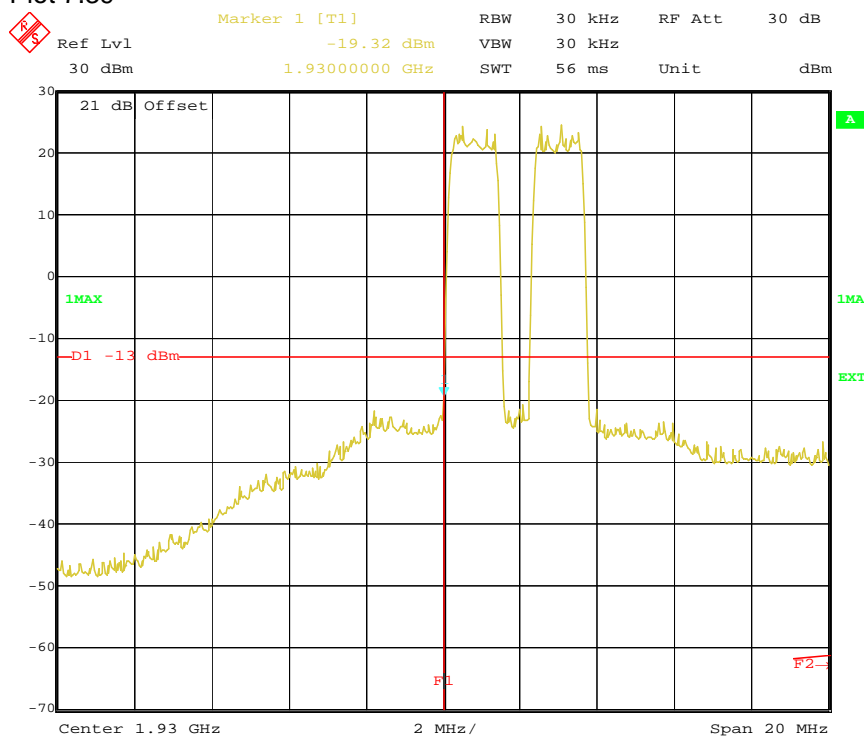
Torshamnsgatan 43, Box 1103, SE-164 22 Kista, Sweden
Telephone +46 8 750 00 00, Fax +46 8 750 60 30, www.sweden.intertek-etlsemko.com
Registered in Sweden: No SE556024059901, Registered office: As address

Plot 7.38



Date: 5.OCT.2007 08:14:44

Plot 7.39



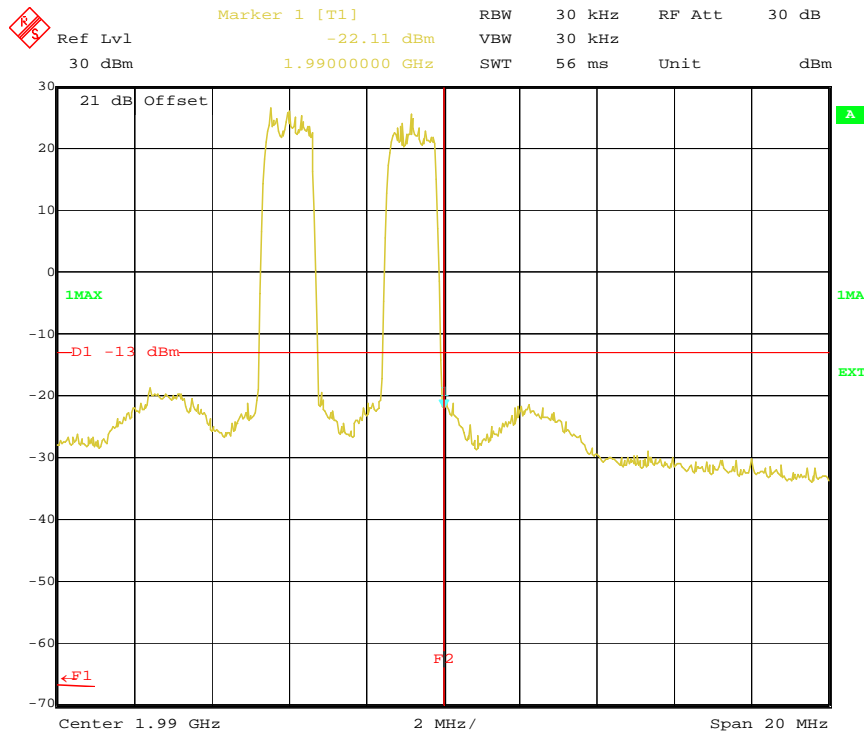
Date: 5.OCT.2007 08:02:05



Intertek Semko AB

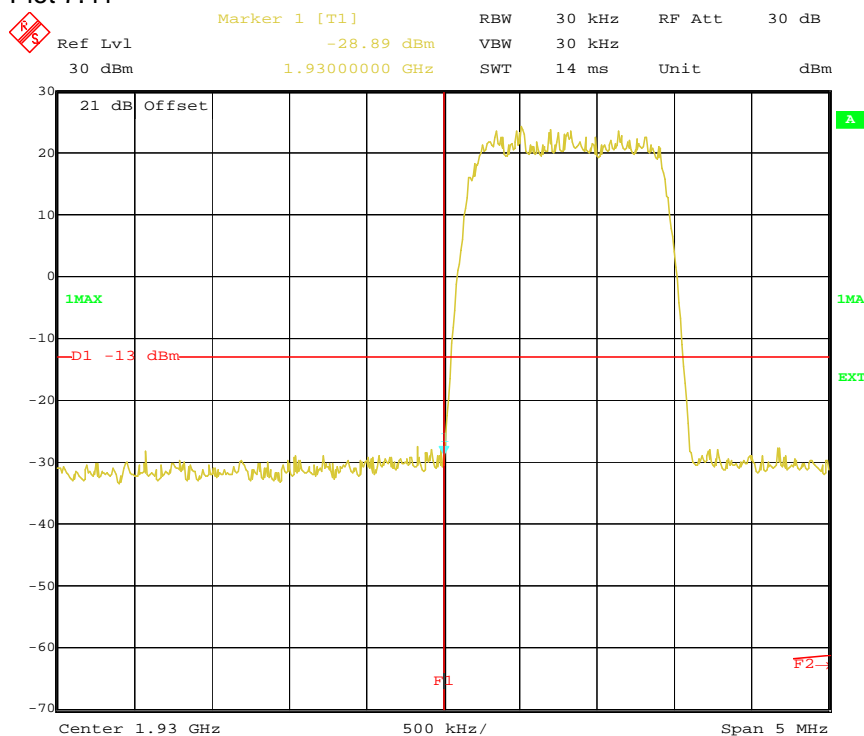
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Plot 7.40



Date: 5.OCT.2007 08:04:20

Plot 7.41



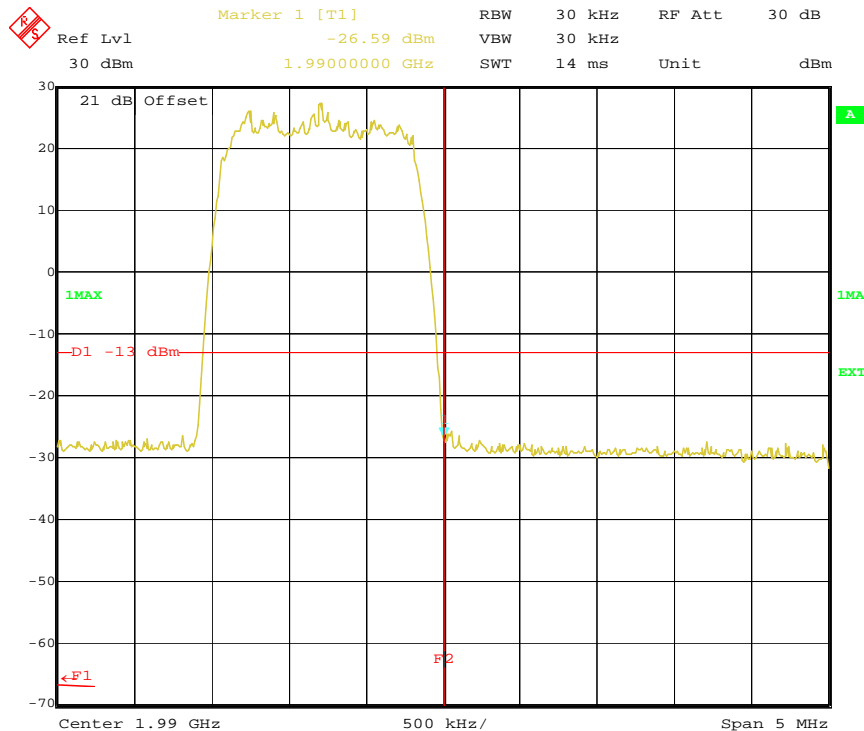
Date: 5.OCT.2007 07:52:28



Intertek Semko AB

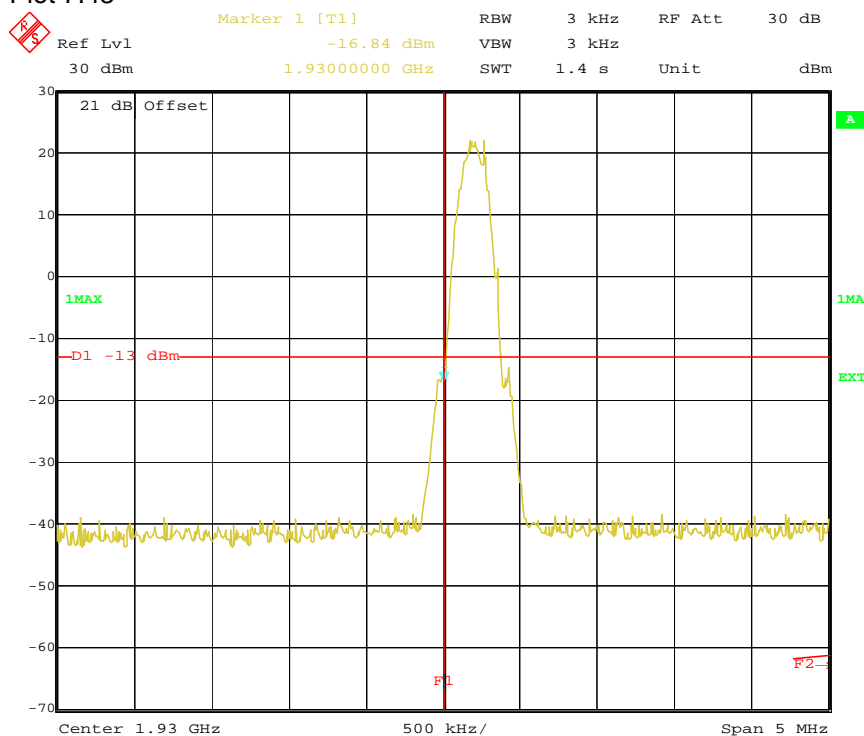
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Plot 7.42



Date: 5.OCT.2007 07:51:07

Plot 7.43



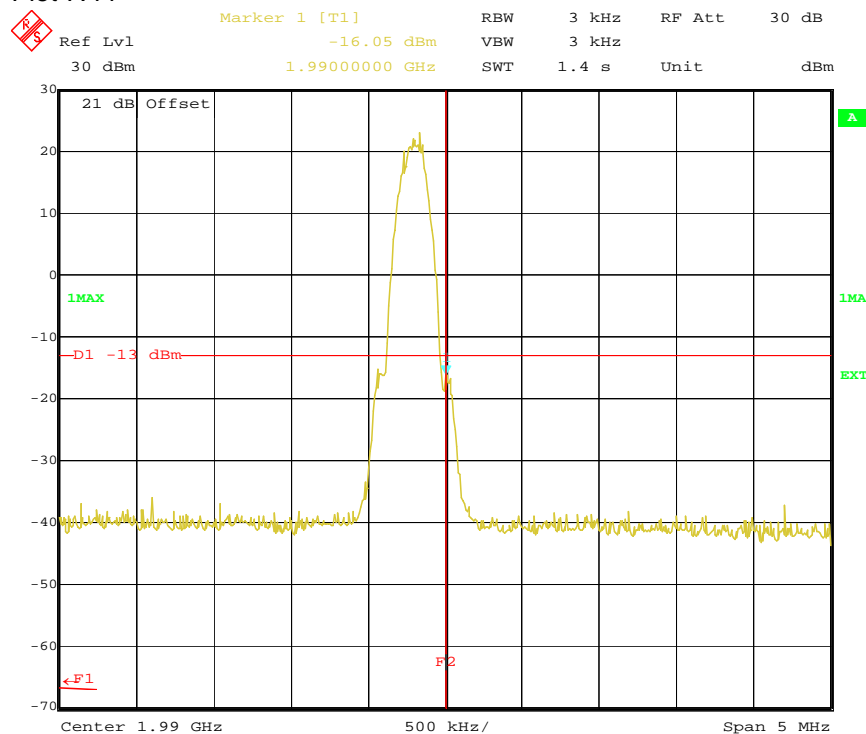
Date: 5.OCT.2007 07:47:06



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Plot 7.44



Date: 5.OCT.2007 07:48:27



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7.4 Test results AWS MHz band

Modulated carriers

Test signal	Frequency [MHz]	RBW [MHz]	Measured peak level (dBm)	Limit (dBm)	Plots	Comment
WCDMA, low ch.	9kHz – 3 000	1	-27.13	-13	Plot 7.45	
WCDMA, low ch.	3 000 – 12 000	1	-23.25	-13	Plot 7.46	
WCDMA, low ch.	12 000 – 22 000	1	-24.30	-13	Plot 7.47	
WCDMA, mid. ch.	9kHz – 3 000	1	-27.72	-13	Plot 7.48	
WCDMA, mid. ch.	3 000 – 12 000	1	-24.00	-13	Plot 7.49	
WCDMA, mid. ch.	12 000 – 22 000	1	-23.97	-13	Plot 7.50	
WCDMA, high ch.	9kHz – 3 000	1	-27.91	-13	Plot 7.51	
WCDMA, high ch.	3 000 – 12 000	1	-23.00	-13	Plot 7.52	
WCDMA, high ch.	12 000 – 22 000	1	-23.61	-13	Plot 7.53	

Intermodulation and band edge measurements

Test signal	Frequency [MHz]	RBW [kHz]	Measured peak level (dBm)	Limit (dBm)	Plots	Comment
2 WCDMA carriers at 2112.5 and 2117.5 MHz	2090 – 2130	30	-14.74	-13	Plot 7.54	
2 WCDMA carriers at 2147.5 and 2152.5 MHz	2135 – 2175	30	-13.56	-13	Plot 7.55	
WCDMA carrier at 2115.5 MHz	2090 – 2130	30	-15.18	-13	Plot 7.56	
WCDMA carrier at 2152.5 MHz	2135 – 2175	30	-13.65	-13	Plot 7.57	

Measurement results are corrected for attenuation in the set-up configuration.

Example calculation:

Measured level [dBm] = Analyser reading [dBm] + cable loss [dB] + attenuator loss [dB]

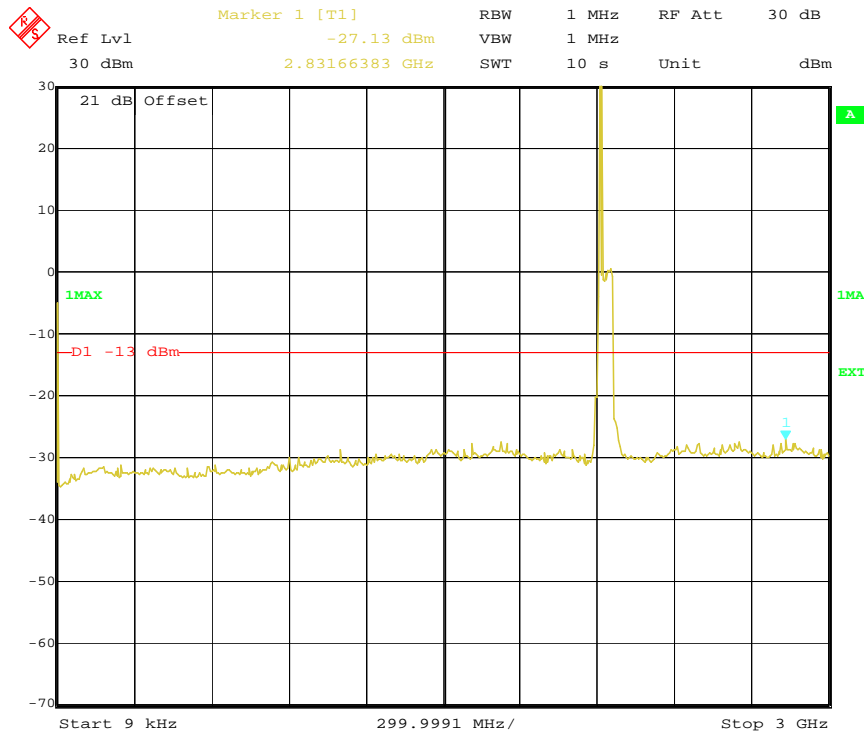
Fulfil requirements: YES



Intertek Semko AB

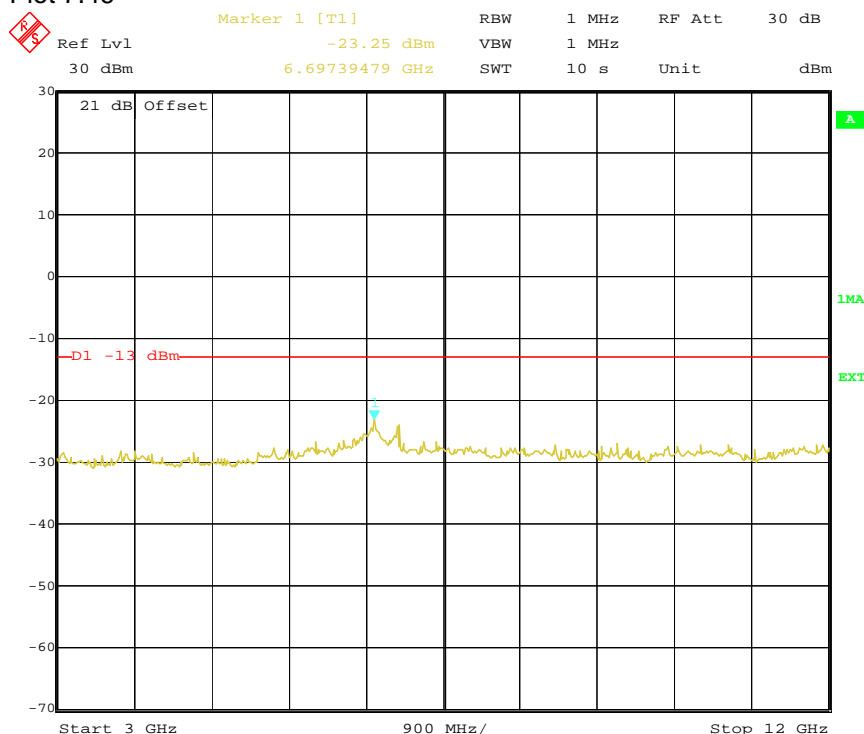
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Plot 7.45



Date: 5.OCT.2007 12:19:54

Plot 7.46



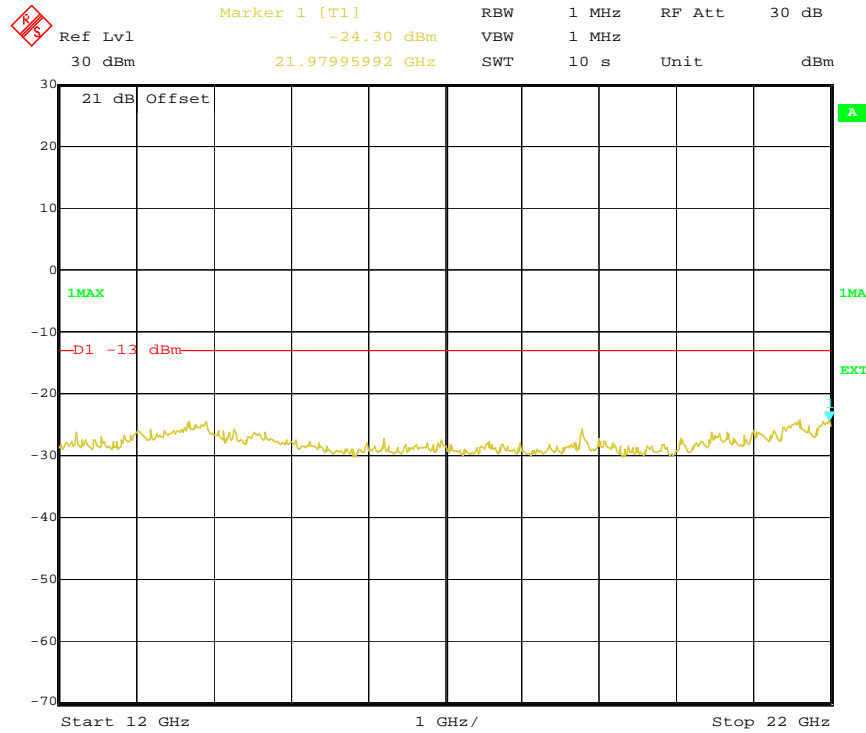
Date: 5.OCT.2007 12:17:19



Intertek Semko AB

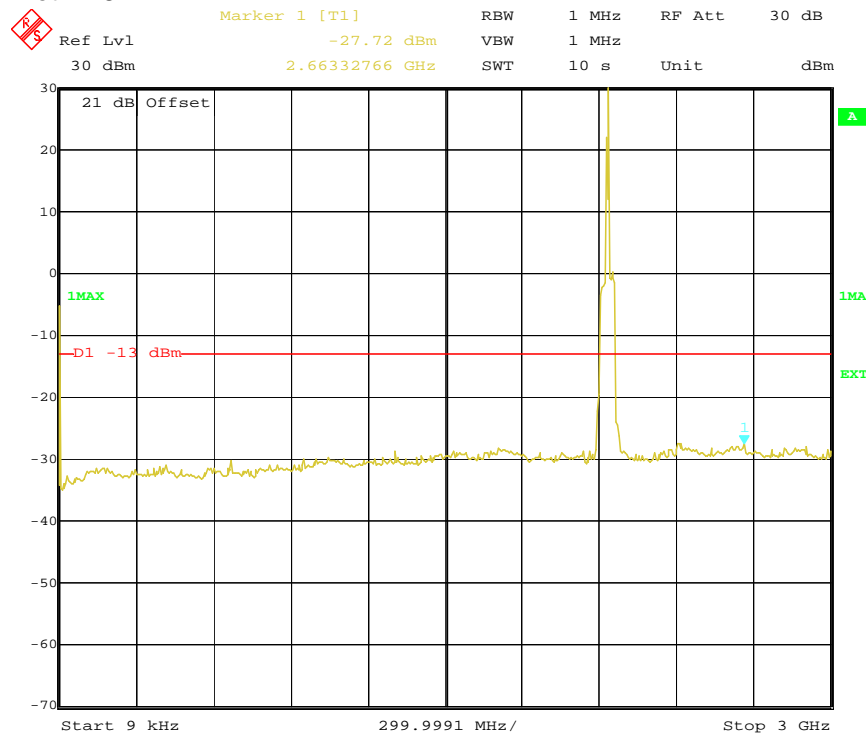
Torshamnsgatan 43, Box 1103, SE-164 22 Kista, Sweden
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Plot 7.47



Date: 5.OCT.2007 12:17:59

Plot 7.48



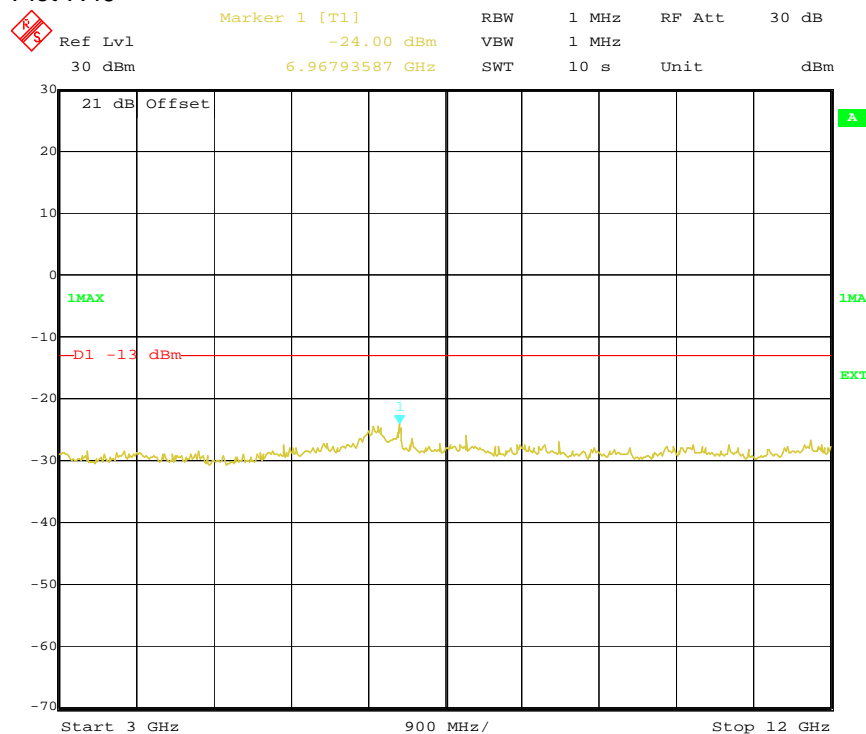
Date: 5.OCT.2007 12:19:01



Intertek Semko AB

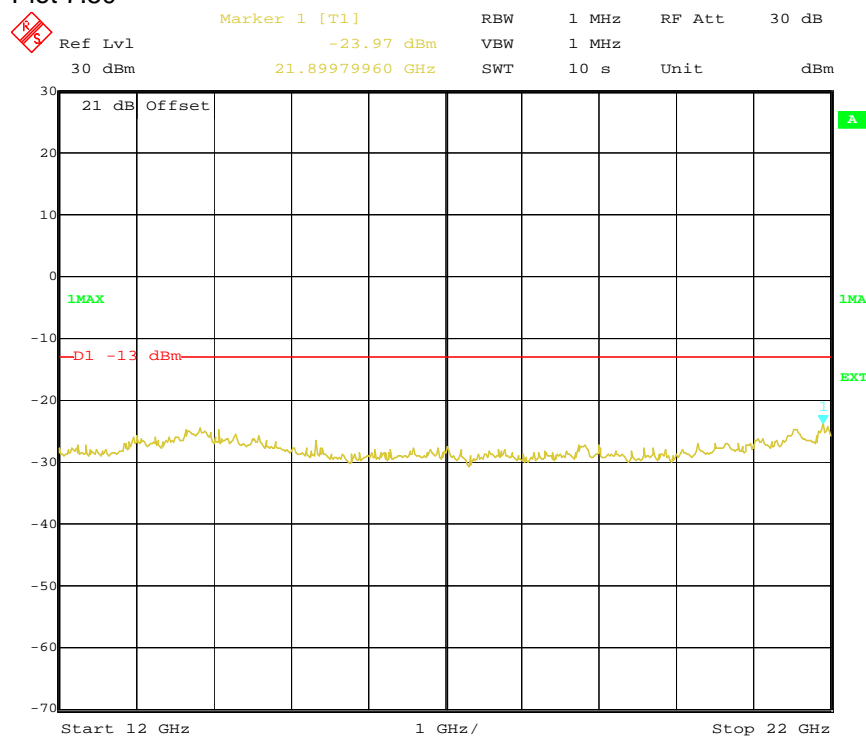
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Plot 7.49



Date: 5.OCT.2007 12:22:09

Plot 7.50



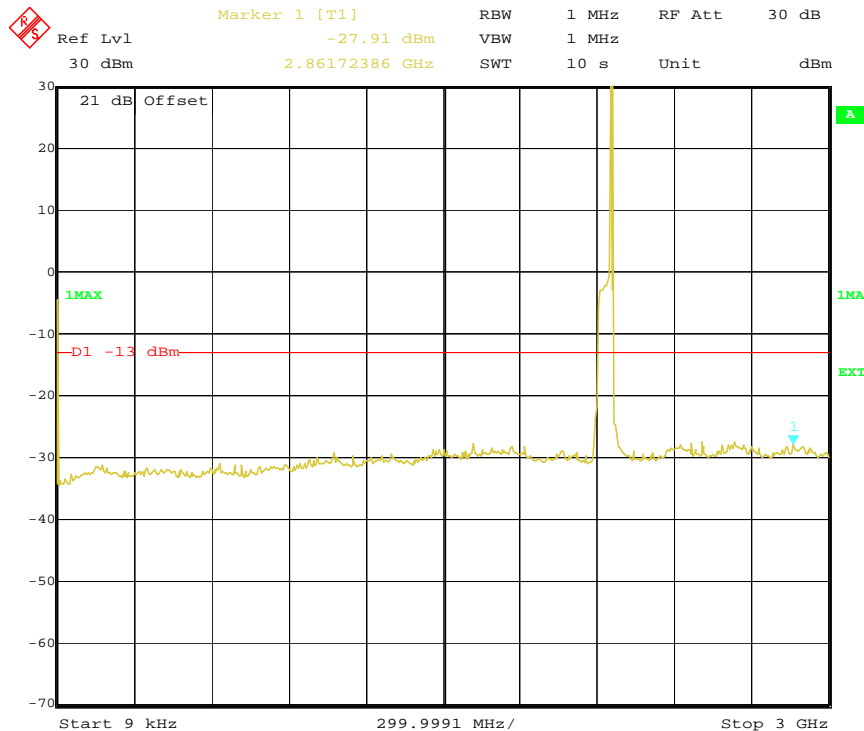
Date: 5.OCT.2007 12:22:56



Intertek Semko AB

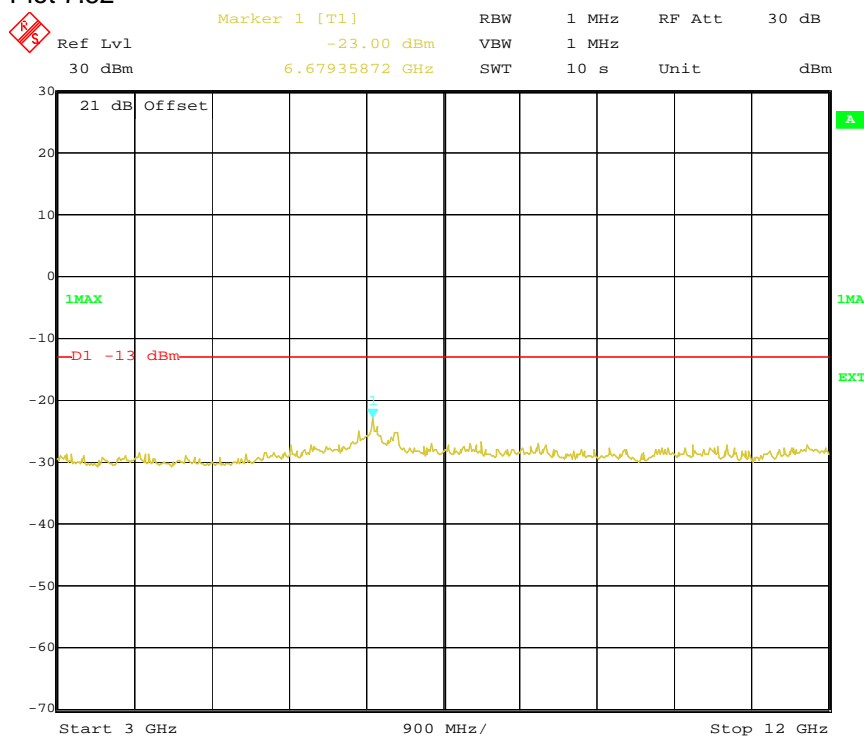
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Plot 7.51



Date: 5.OCT.2007 12:20:49

Plot 7.52



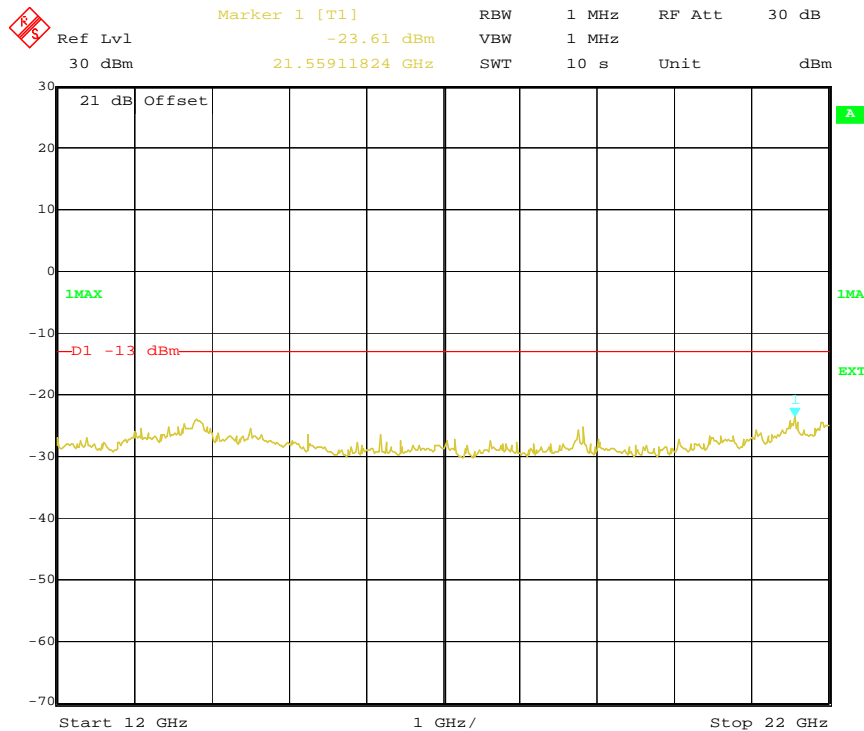
Date: 5.OCT.2007 12:21:28



Intertek Semko AB

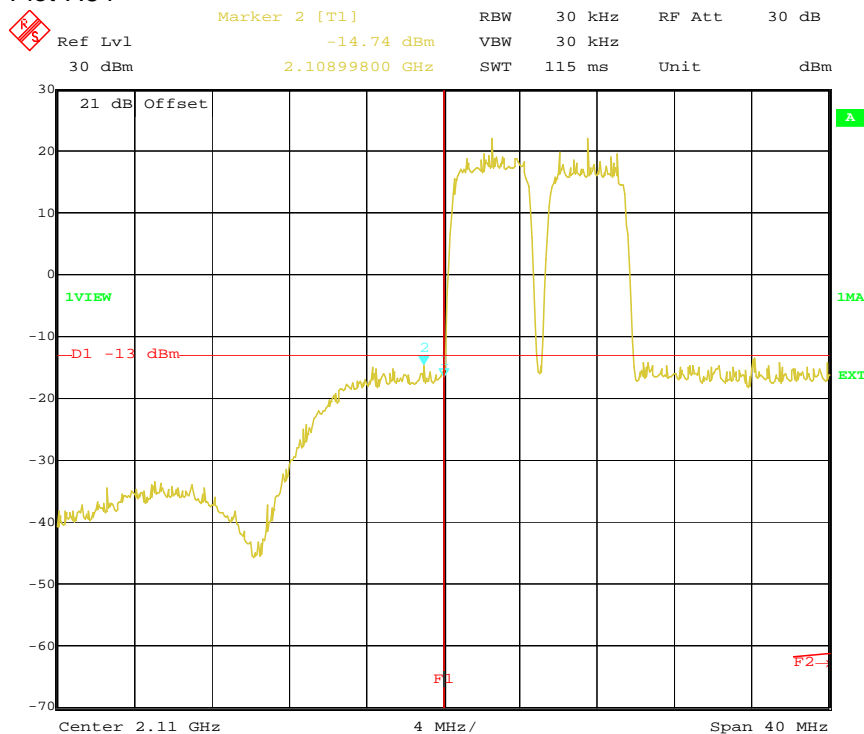
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Plot 7.53



Date: 5.OCT.2007 12:23:32

Plot 7.54



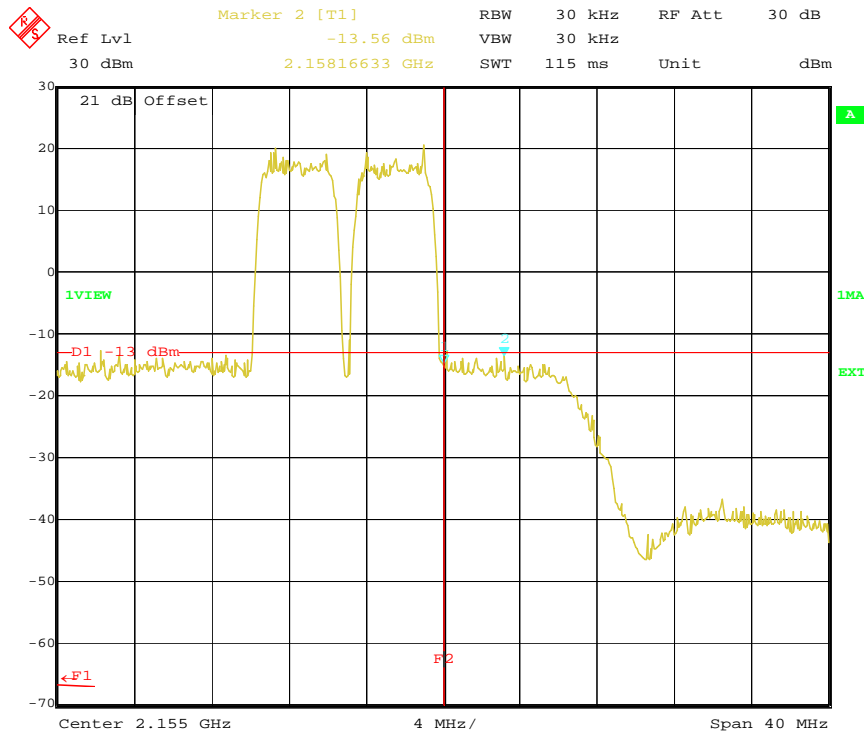
Date: 5.OCT.2007 10:31:22



Intertek Semko AB

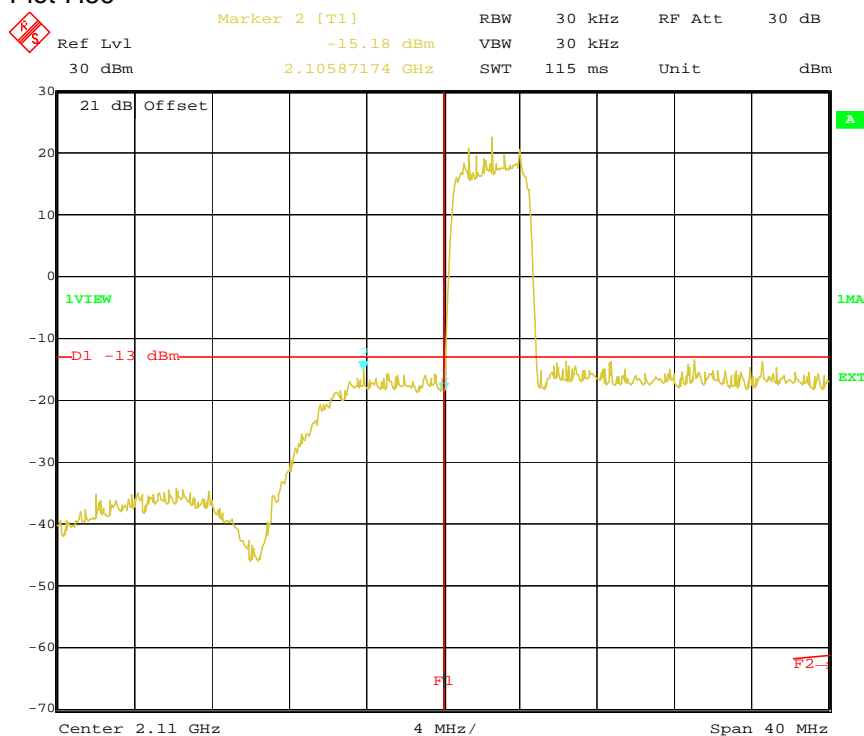
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Plot 7.55



Date: 5.OCT.2007 10:27:56

Plot 7.56



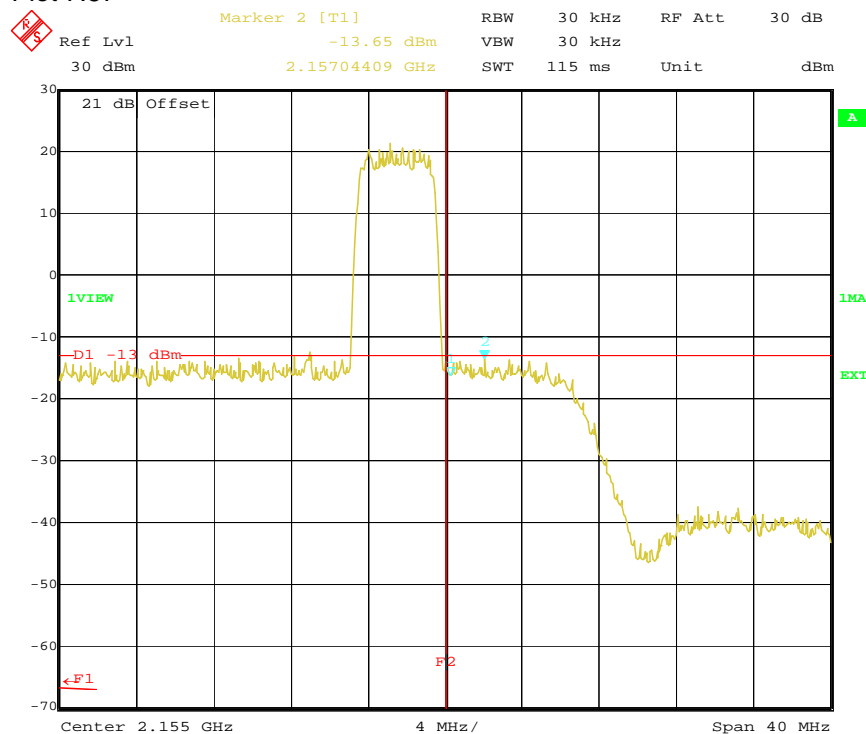
Date: 5.OCT.2007 10:30:04



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Plot 7.57



Date: 5.OCT.2007 10:29:00



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8. OUT OF BAND REJECTION

Date of test: 2007-10-02

8.1 Test results

The tracking generator in the spectrum analyzer was used to measure the frequency response of the EUT.

Amplifier	20 dB Bandwidth (MHz)	Plots
850	63.727	Plot 8.1
1900	87.775	Plot 8.2
AWS	41.683	Plot 8.3

Measurement results are corrected for attenuation in the set-up configuration.

Example calculation:

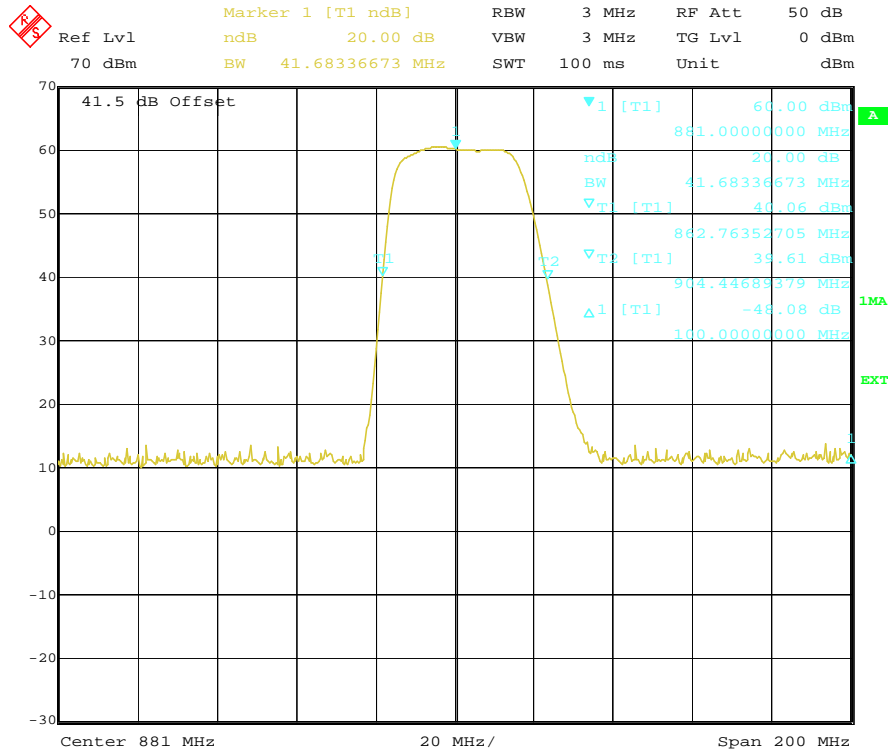
Measured level [dB] = Analyser reading [dBm] - Tracking Generator signal level [dBm] + cable loss [dB] + attenuator loss [dB]



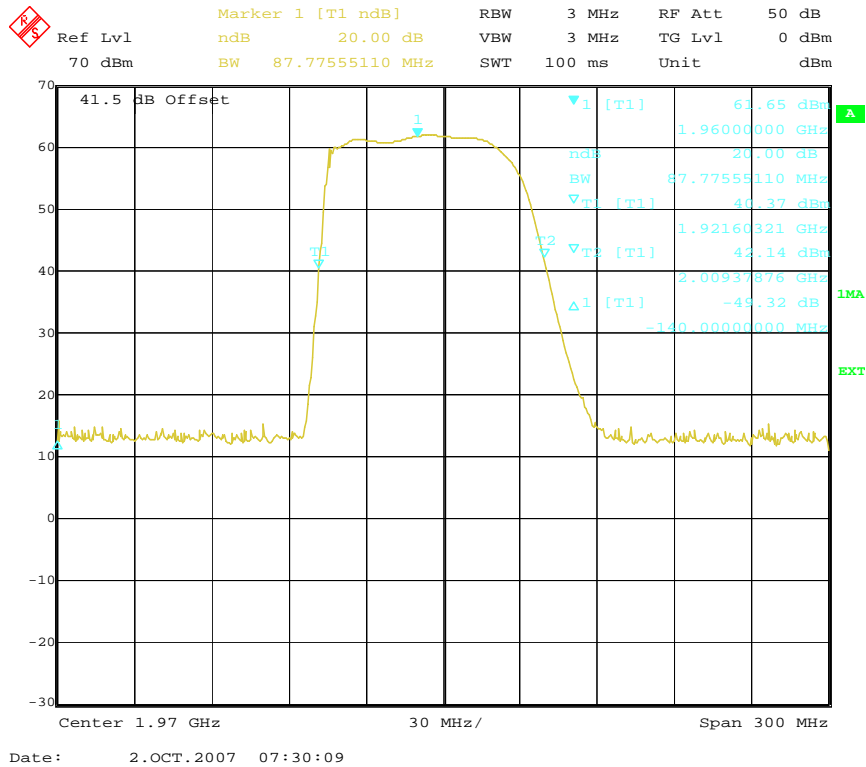
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Plot 8.1



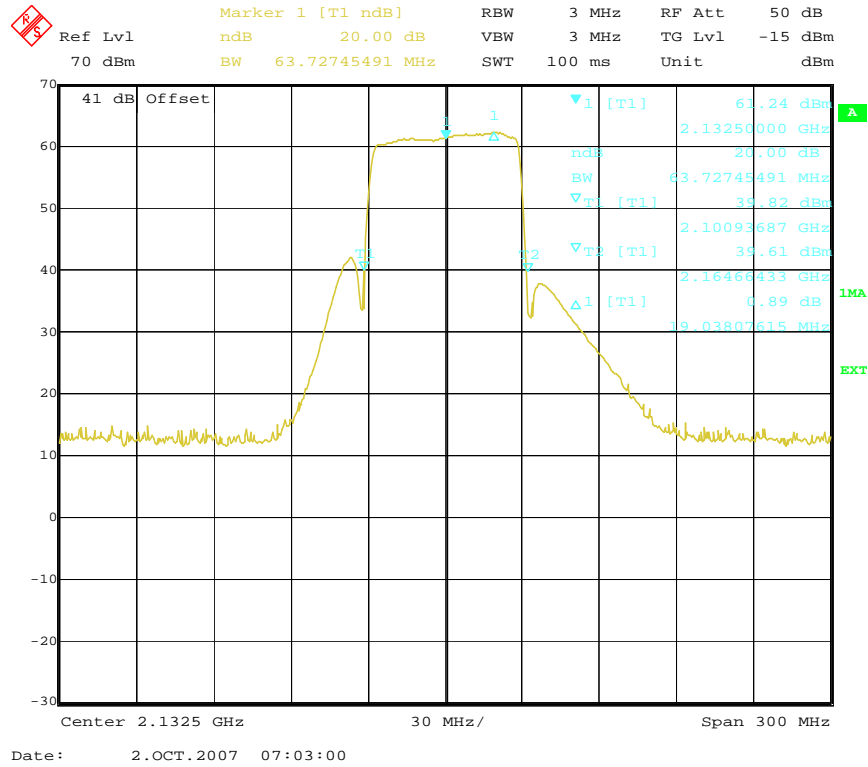
Plot 8.2



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Plot 8.3



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10. RADIATED SPURIOUS EMISSIONS

10.1 Test specifications

47 CFR 2.1051 and 22.917(a)

47 CFR 2.1051 and 24.238

47 CFR 2.1051 and 27.53(g)

Spurious emissions should be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log (P)$

This gives a limit at -13 dBm.

The frequency range to be inspected is from 9 kHz up to the tenth harmonics of the highest fundamental frequency according to 47 CFR 2.1057.

The field strength limit is calculated using the plane wave relation:

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

G: antenna gain

P: power (W)

R: measurement distance (m)

This gives a field strength limit of 84.4 dB μ V/m ERP or 82.2 dB μ V/m EIRP at a 3m measurement distance.



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10.2 Test equipment

Equipment	Manufacturer	Type	SEMKO No.
<i>Test site: "Björkhallen"</i>			
<i>Semi-anechoic shielded chamber, 6 x 9 x 6 m (W x L x H)</i>			30900, 30901
Software:	Rohde & Schwarz	EMC 32	
Measurement receiver:	Rohde & Schwarz	ESCI	12798
Antenna, bilog:	Rohde & Schwarz	HL-562	30711
<i>Test site: "Radiohallen"</i>			
<i>Anechoic shielded chamber, 3,7 x 7,0 x 2,4 m (W x L x H)</i>			12285
Software:	Rohde & Schwarz	ES-K1, V1.70	
Signal analyser:	Rohde & Schwarz	FSIQ 40	40023
Preamplifier:	MITEQ	AFS6/AFS44	12335
Antennas:			
Double Ridge Guide Horn:	EMCO	3115	4936
Transformer	Tufvassons	AFM-1500	30317



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10.3 Measurement set-up

Test site: "Björkhallen" Semi-anechoic shielded chamber (30 – 1000 MHz)

The radiated disturbance electric field intensity was measured in a semi-anechoic chamber at a distance of 3 m and the EUT was placed on a non-metallic table, 0.8 m above the reference ground plane. The specified test mode was enabled. Test set-up photos are given below.

An overview sweep with peak detection of the electric field intensity was performed with the measurement receiver in max-hold and with the antenna placed 1.5 m, 2.5 m and 3.5 m above the floor. The polarisation was horizontal and vertical. The measurements were repeated with the EUT rotated in 90-degree steps.

At the frequencies where high disturbance levels were found a search for max disturbance level was performed. With the EUT and antenna in the worst-case configuration new measurements with quasi-peak detector were carried out.

The EUT was supplied with 120 V AC (60 Hz) during the test.

Test set-up photo:



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Test site: Radio anechoic shielded chamber (1 – 26 GHz)

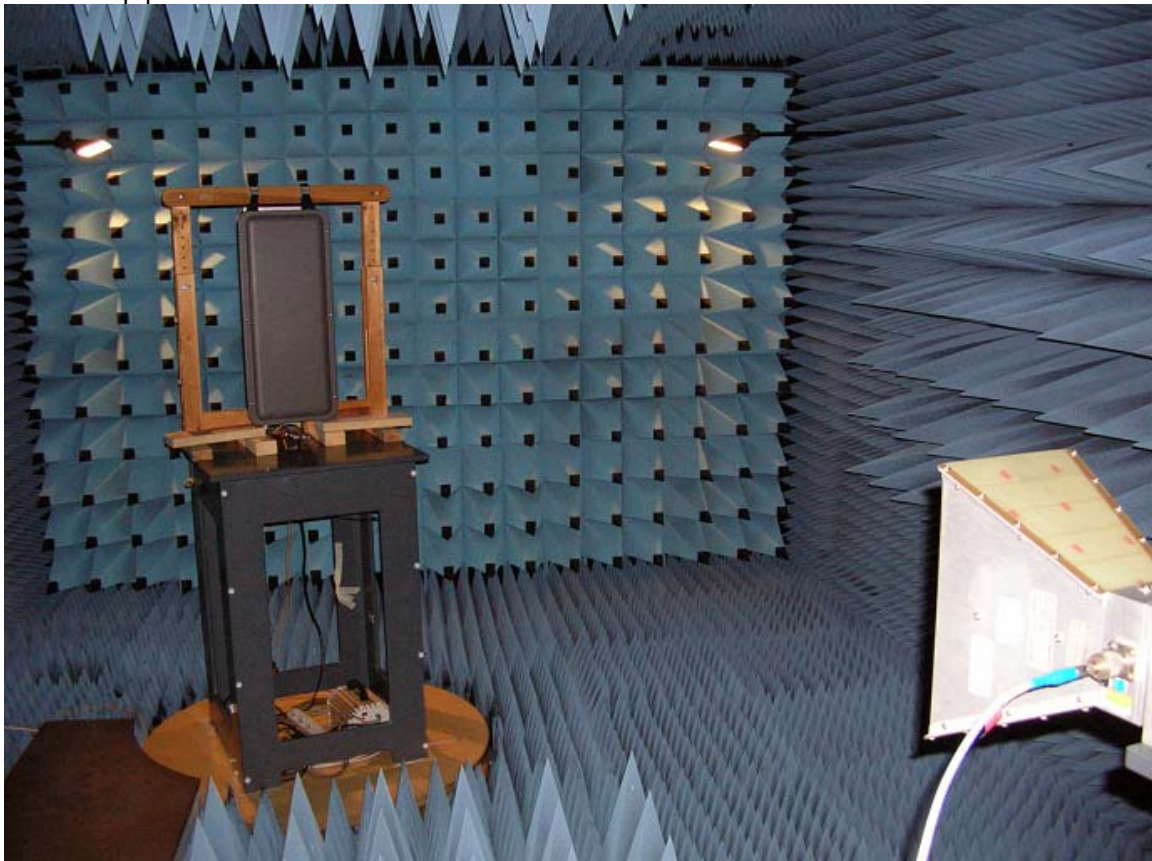
In the Radio anechoic chamber the EUT was placed on a non-metallic table, 1.3 m above the floor. The radiated disturbance electric field intensity was measured at a distance of 3 m. The specified test mode was enabled.

An overview sweep with peak detection of the electric field intensity was performed with the spectrum analyser in max-hold and with the antenna height adjusted at the level of the EUT center (placed 1.55 m above the floor). The polarisation was horizontal and vertical. The measurements were repeated with the EUT rotated in 90-degree steps.

At the frequencies where high disturbance levels were found a search for max disturbance level was performed. With the EUT and antenna in the worst-case configuration new measurements with peak and average detectors were carried out.

The EUT was supplied by 120 V AC (50 Hz) during the test.

Test set-up photo:



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10.4 Preview sweeps 30-1000 MHz

Semi-anechoic shielded chamber

Date of test: 2007-09-26

30 – 1000 MHz, max peak at a distance of 3 m. CW carrier in lower part of the 850MHz amplifier pass band



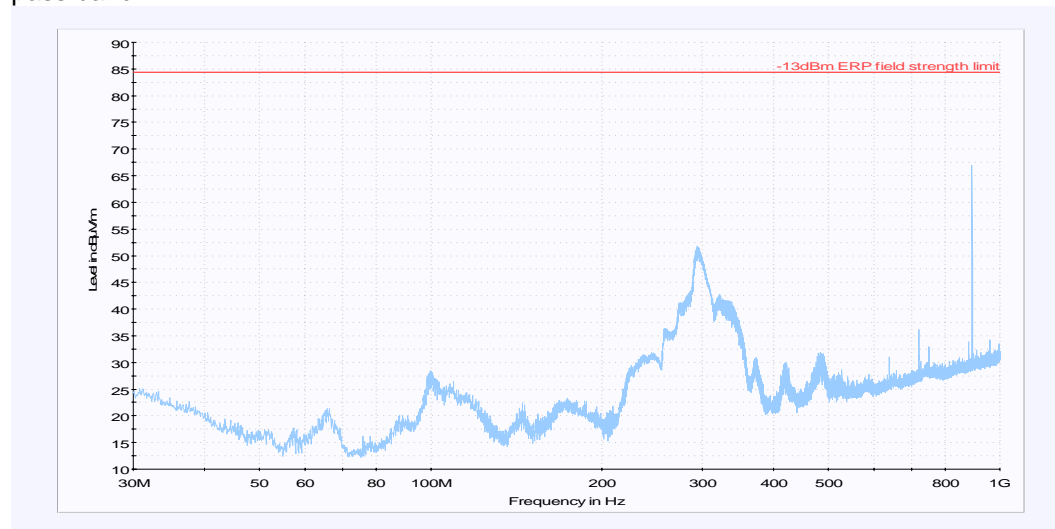
30 – 1000 MHz, max peak at a distance of 3 m. CW carrier in middle part of the 850MHz amplifier pass band



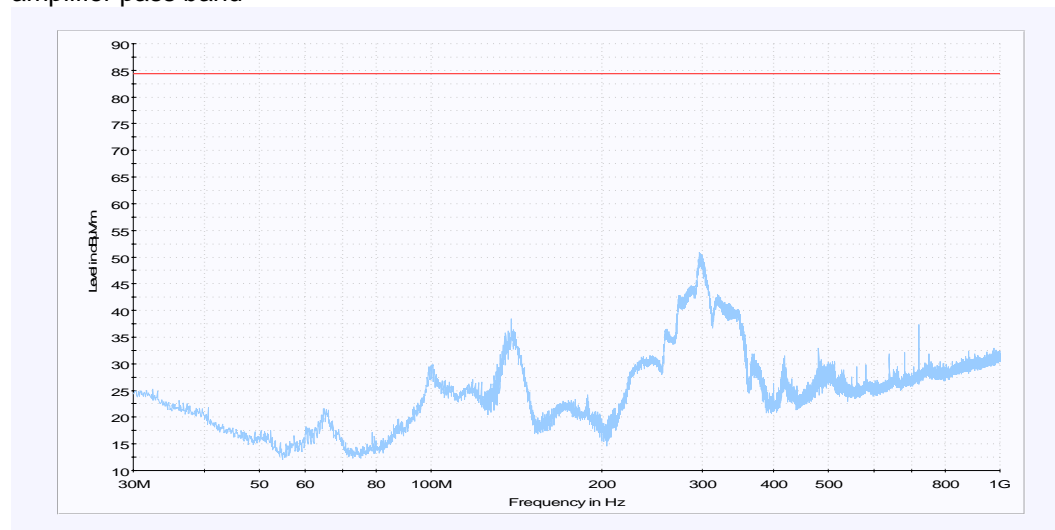
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30 – 1000 MHz, max peak at a distance of 3 m. CW carrier in upper part of the 850MHz amplifier pass band



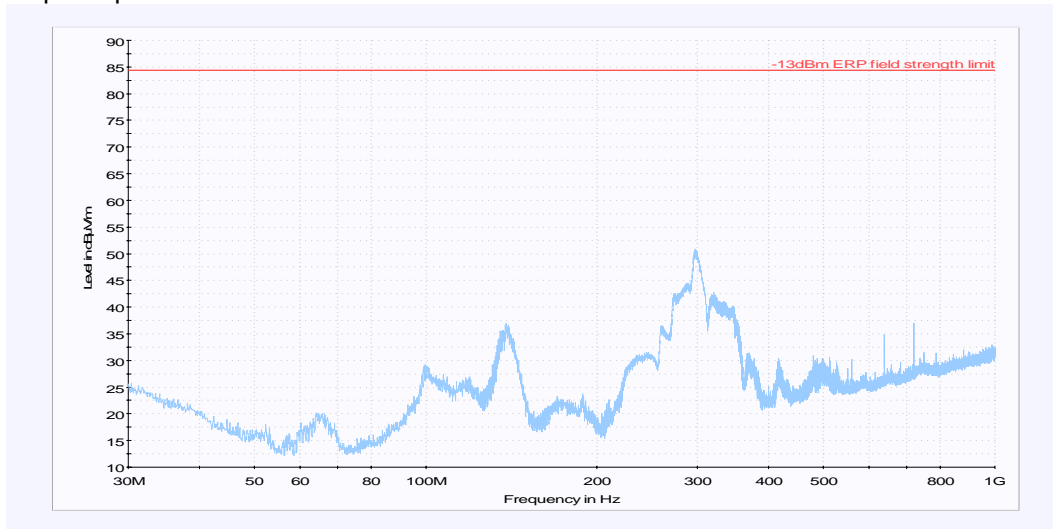
30 – 1000 MHz, max peak at a distance of 3 m. CW carrier in lower part of the 1900MHz amplifier pass band



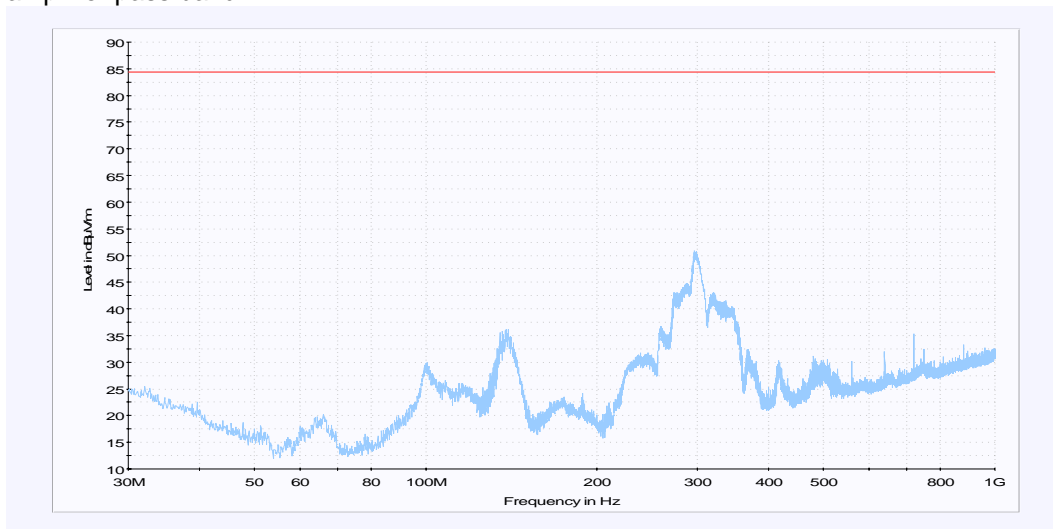
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30 – 1000 MHz, max peak at a distance of 3 m. CW carrier in middle part of the 1900MHz amplifier pass band



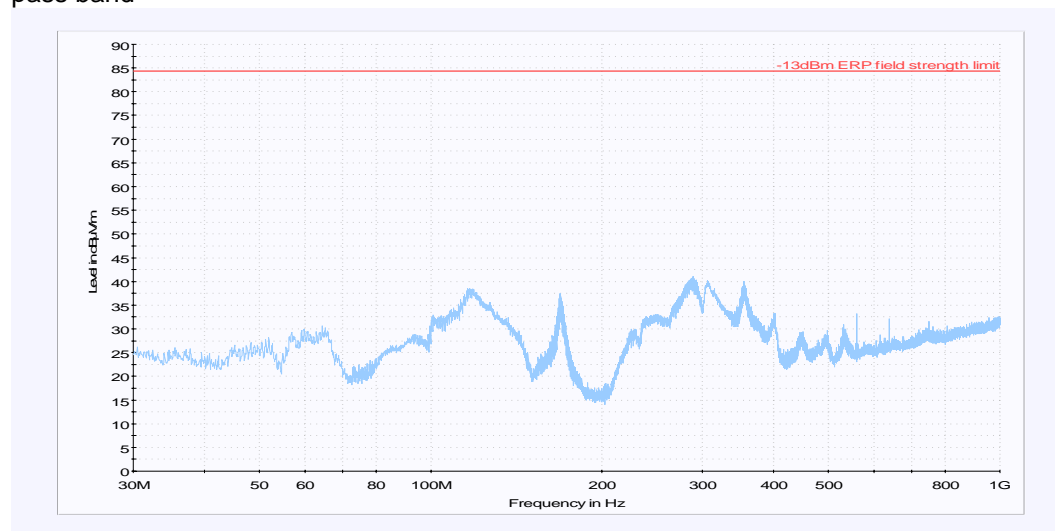
30 – 1000 MHz, max peak at a distance of 3 m. CW carrier in upper part of the 1900MHz amplifier pass band



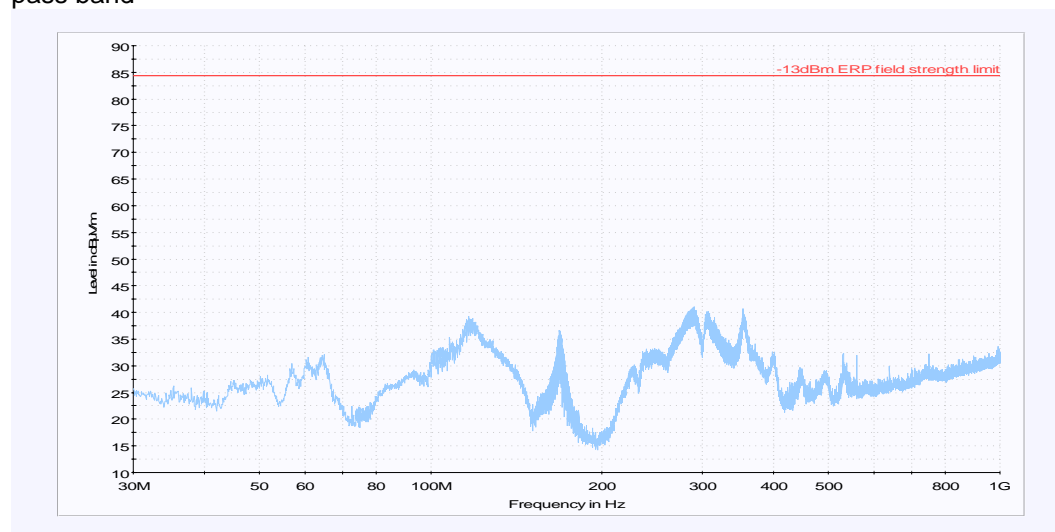
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30 – 1000 MHz, max peak at a distance of 3 m. CW carrier in lower part of the AWS amplifier pass band



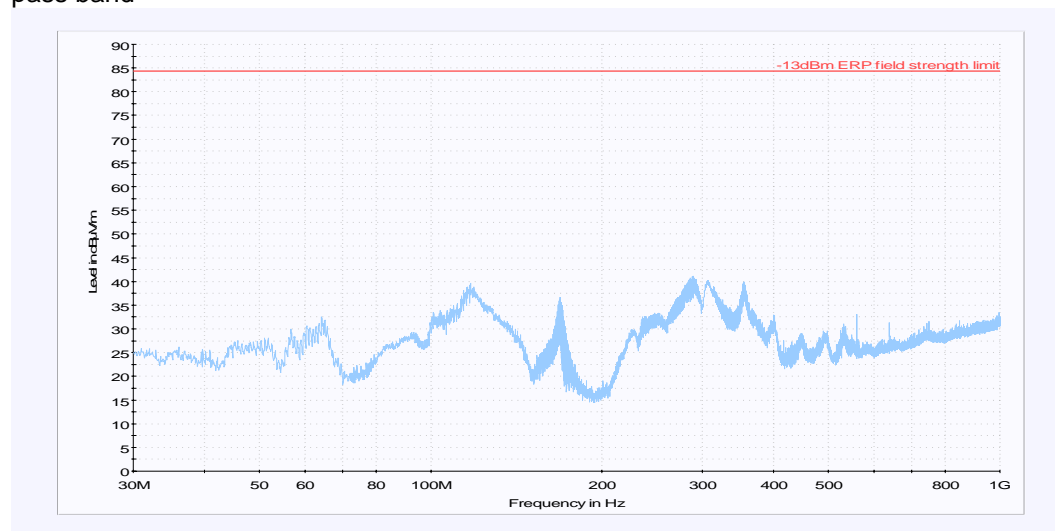
30 – 1000 MHz, max peak at a distance of 3 m. CW carrier in middle part of the AWS amplifier pass band



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30 – 1000 MHz, max peak at a distance of 3 m. CW carrier in upper part of the AWS amplifier pass band



Intertek Semko AB

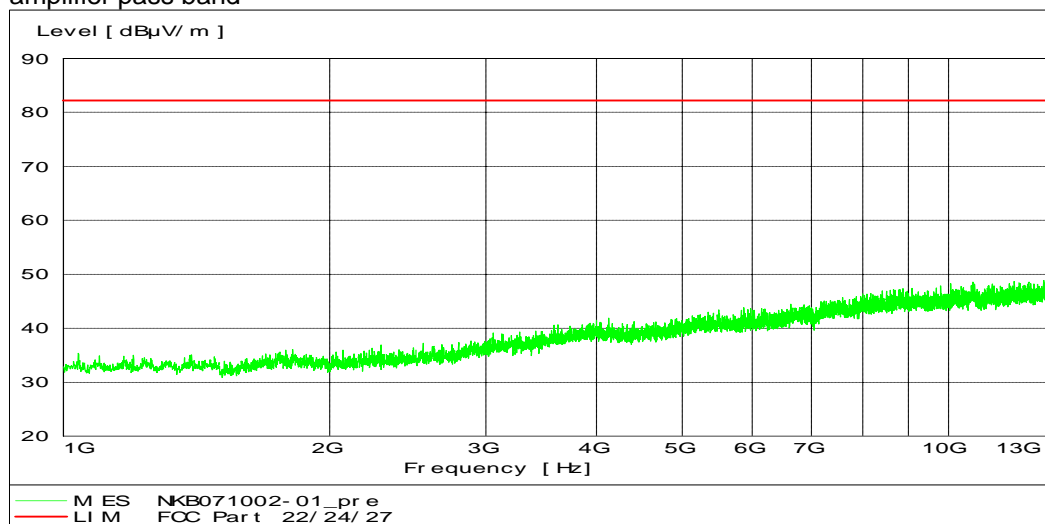
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10.5 Preview sweeps 1000-26000 MHz

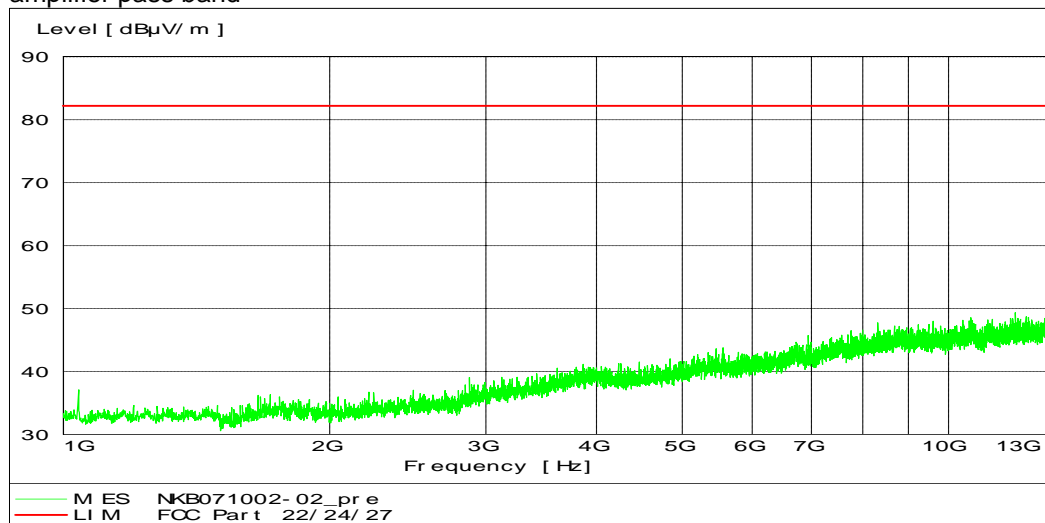
Radio anechoic shielded chamber

Date of test: 2007-07-29 and 2007-10-02

1000 – 13000 MHz, max peak at a distance of 3 m. CW carrier in lower part of the 850MHz amplifier pass band



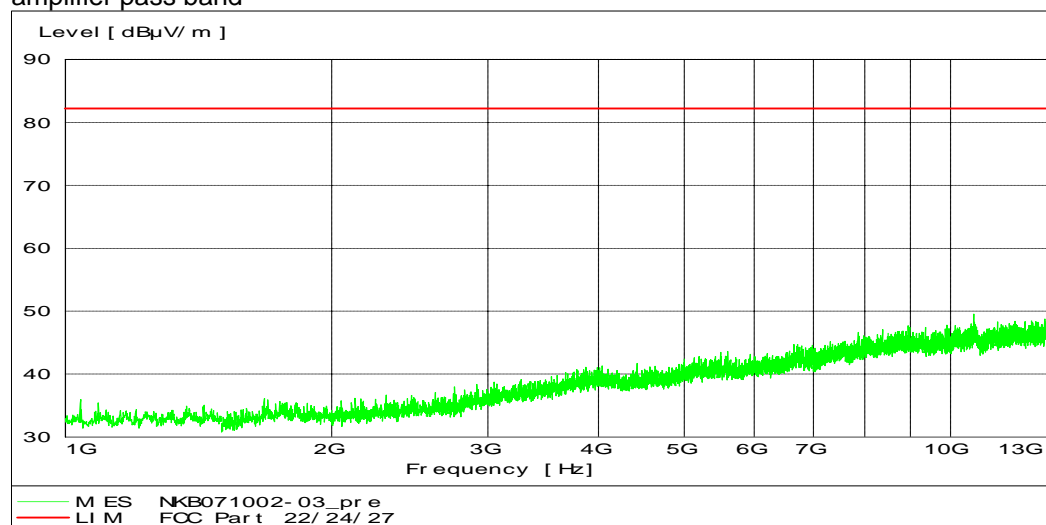
1000 – 13000 MHz, max peak at a distance of 3 m. CW carrier in middle part of the 850MHz amplifier pass band



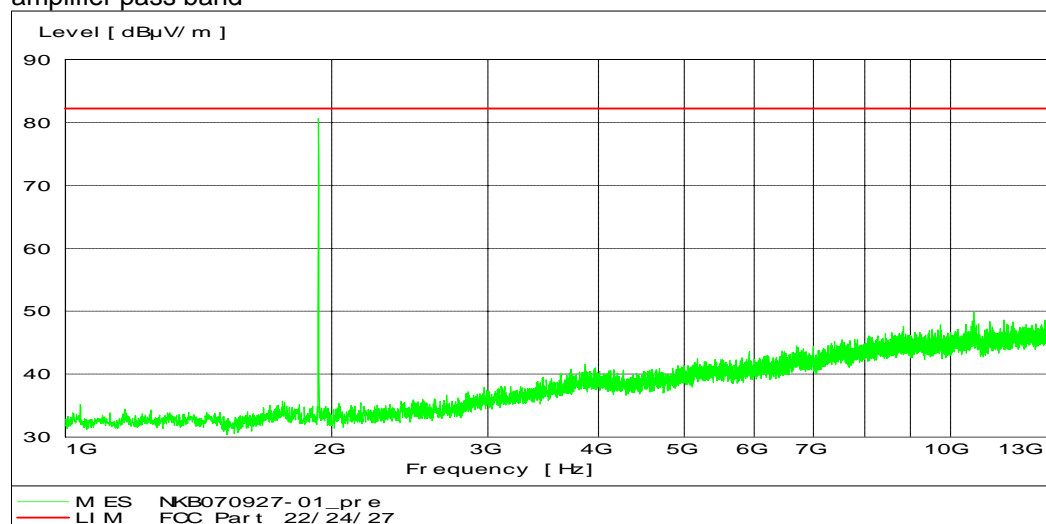
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1000 – 13000 MHz, max peak at a distance of 3 m. CW carrier in upper part of the 850MHz amplifier pass band



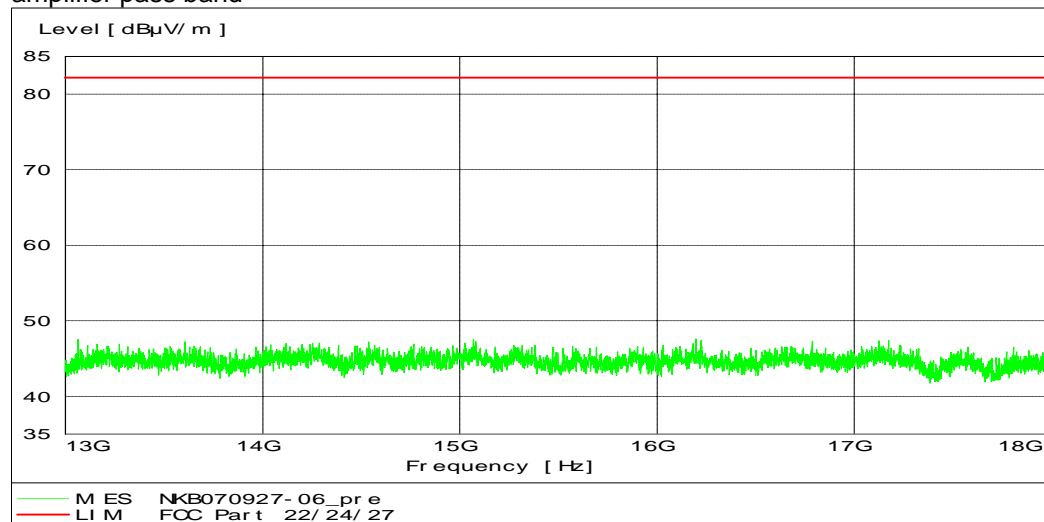
1000 – 13000 MHz, max peak at a distance of 3 m. CW carrier in lower part of the 1900MHz amplifier pass band



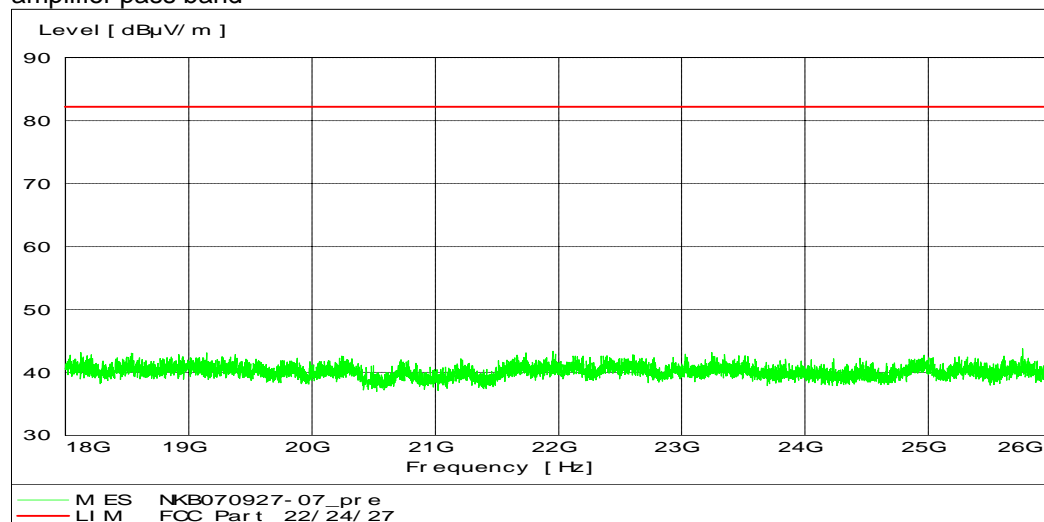
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13000 – 18000 MHz, max peak at a distance of 3 m. CW carrier in lower part of the 1900MHz amplifier pass band



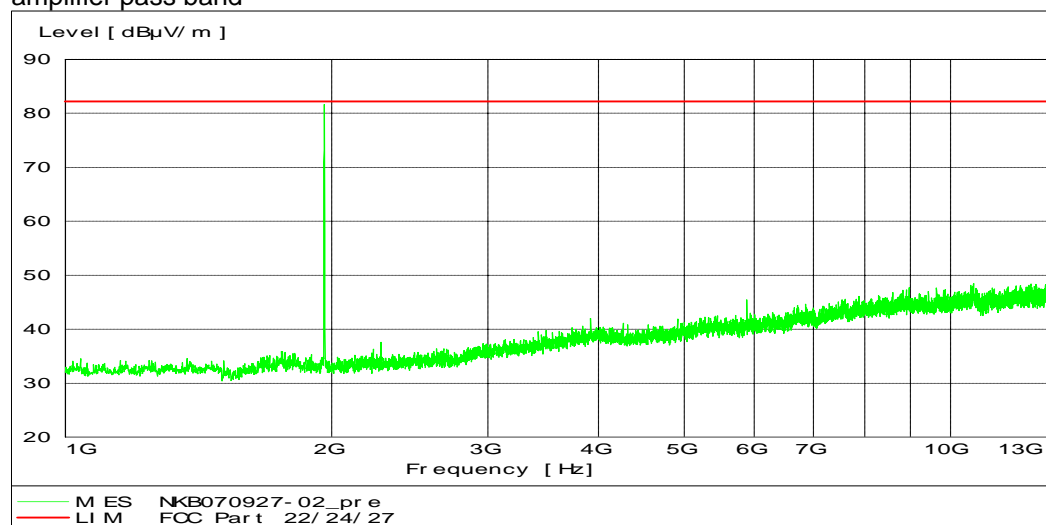
18000 – 26000 MHz, max peak at a distance of 3 m. CW carrier in lower part of the 1900MHz amplifier pass band



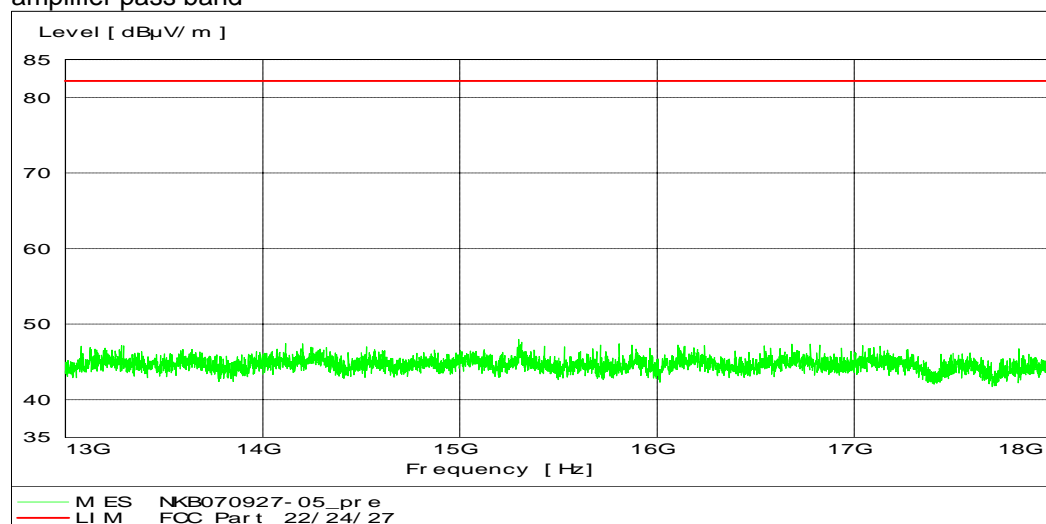
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1000 – 13000 MHz, max peak at a distance of 3 m. CW carrier in middle part of the 1900MHz amplifier pass band



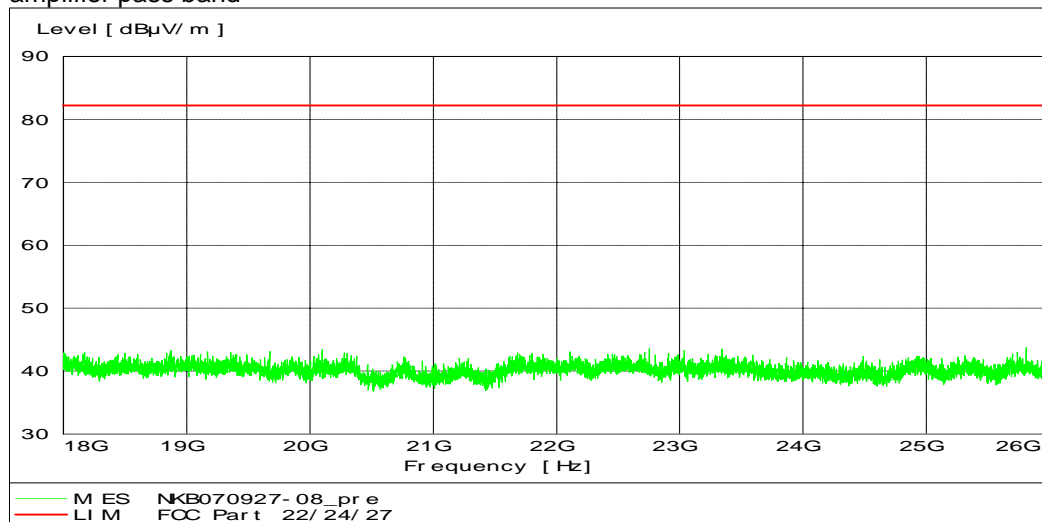
13000 – 18000 MHz, max peak at a distance of 3 m. CW carrier in middle part of the 1900MHz amplifier pass band



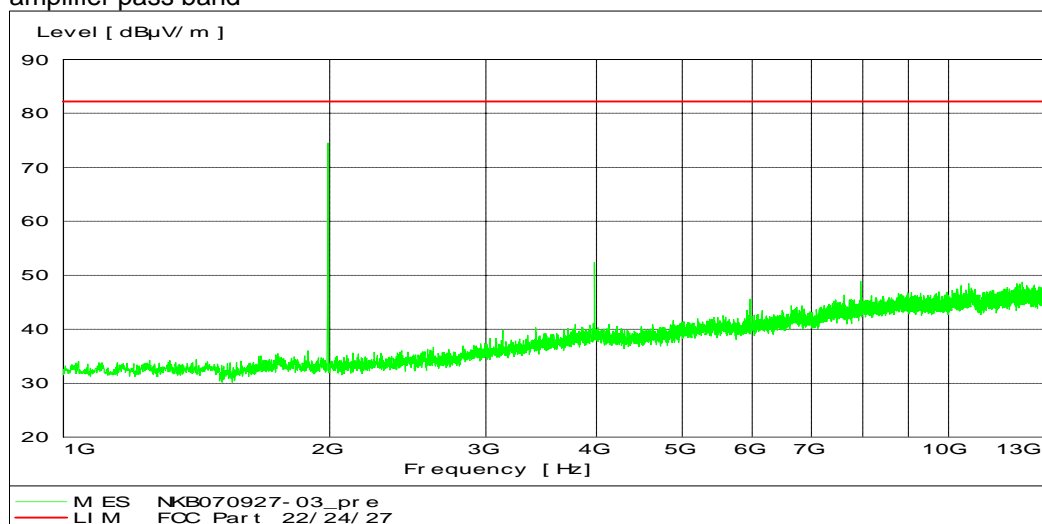
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18000 – 26000 MHz, max peak at a distance of 3 m. CW carrier in middle part of the 1900MHz amplifier pass band



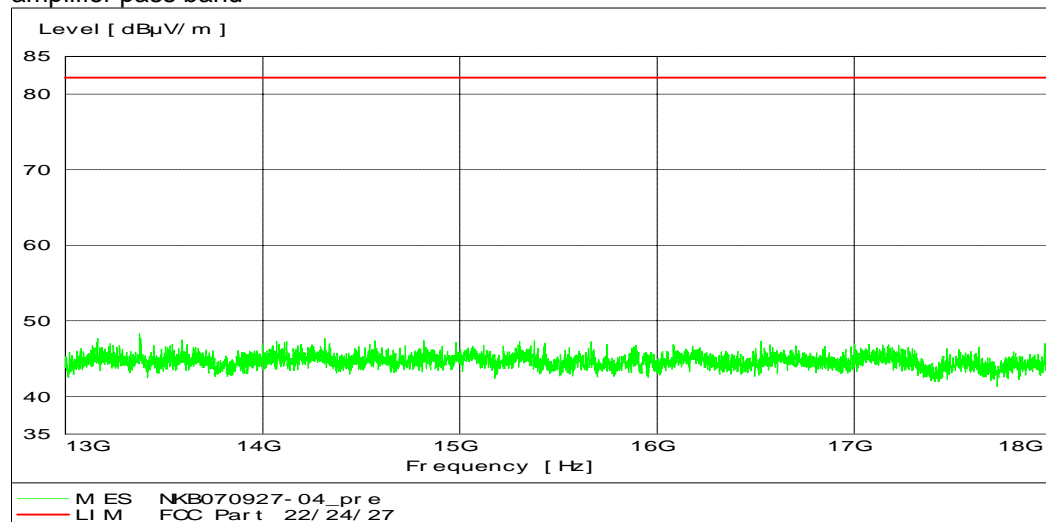
1000 – 13000 MHz, max peak at a distance of 3 m. CW carrier in upper part of the 1900MHz amplifier pass band



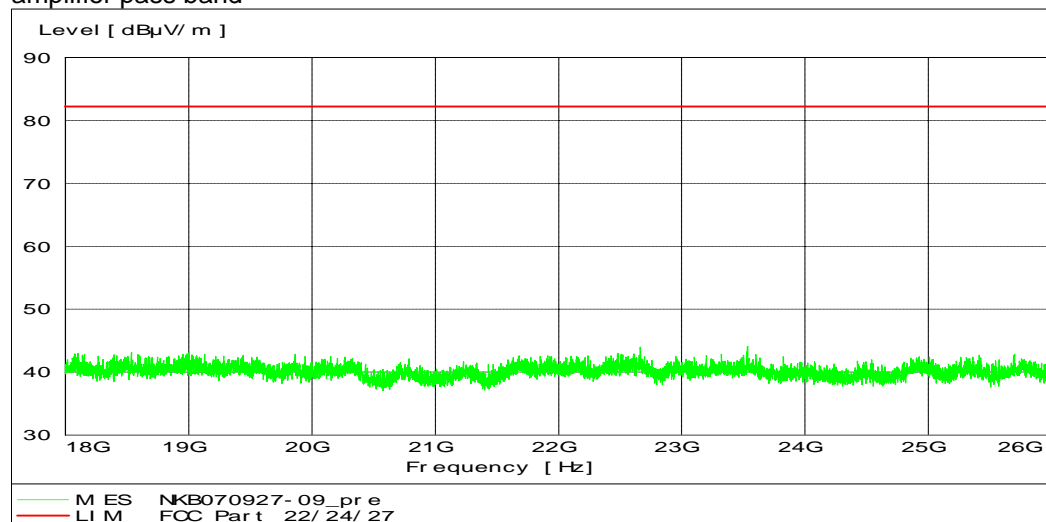
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13000 – 18000 MHz, max peak at a distance of 3 m. CW carrier in upper part of the 1900MHz amplifier pass band



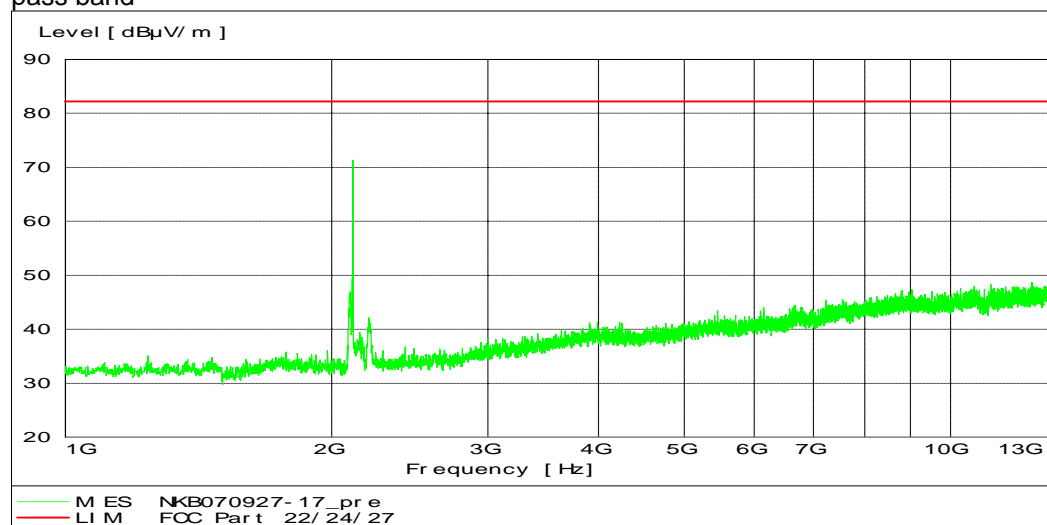
18000 – 26000 MHz, max peak at a distance of 3 m. CW carrier in upper part of the 1900MHz amplifier pass band



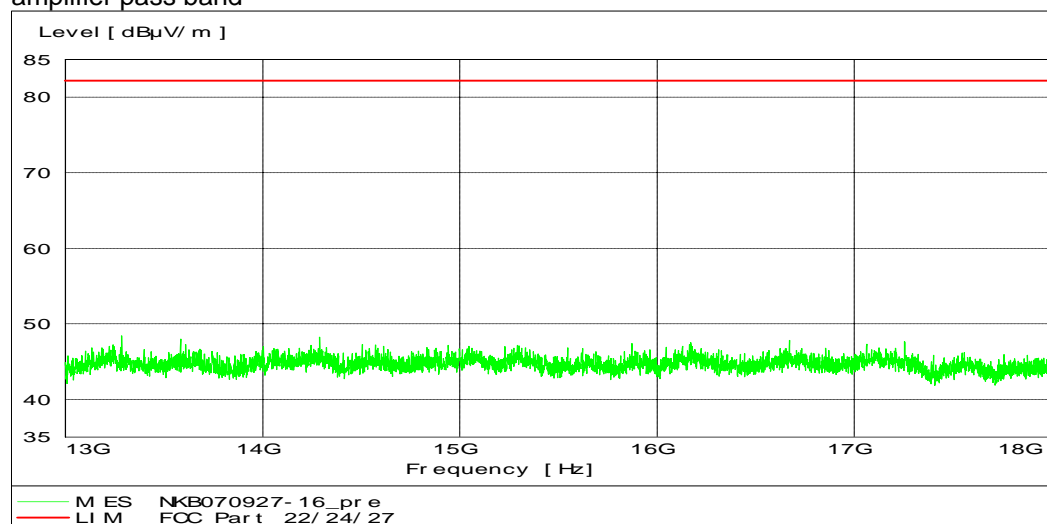
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1000 – 13000 MHz, max peak at a distance of 3 m. CW carrier in lower part of the AWS amplifier pass band



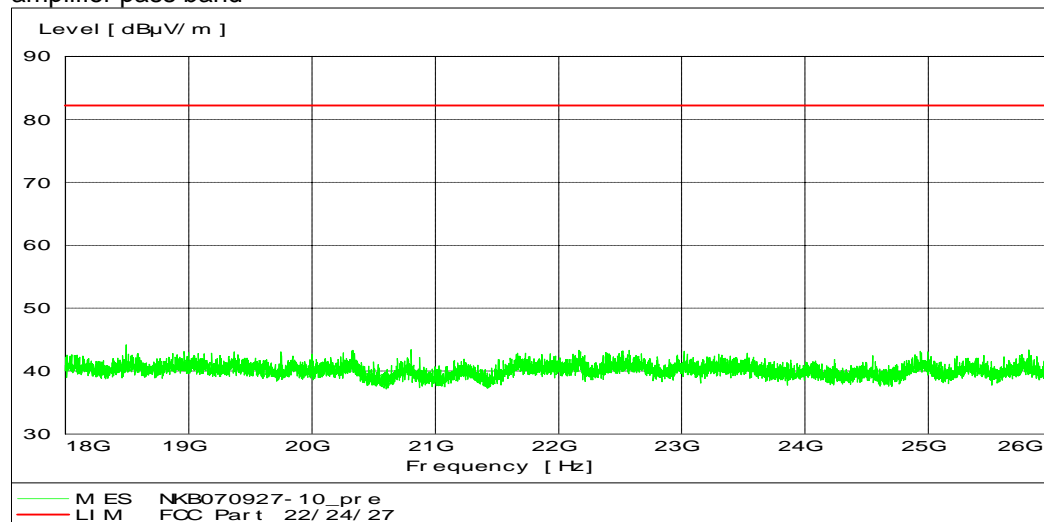
13000 – 18000 MHz, max peak at a distance of 3 m. CW carrier in lower part of the AWS amplifier pass band



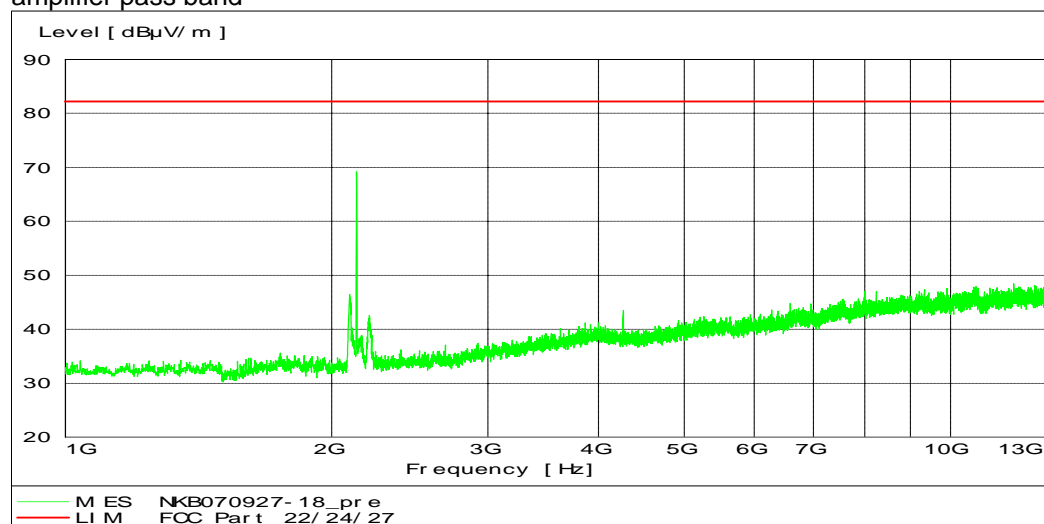
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18000 – 26000 MHz, max peak at a distance of 3 m. CW carrier in lower part of the AWS amplifier pass band



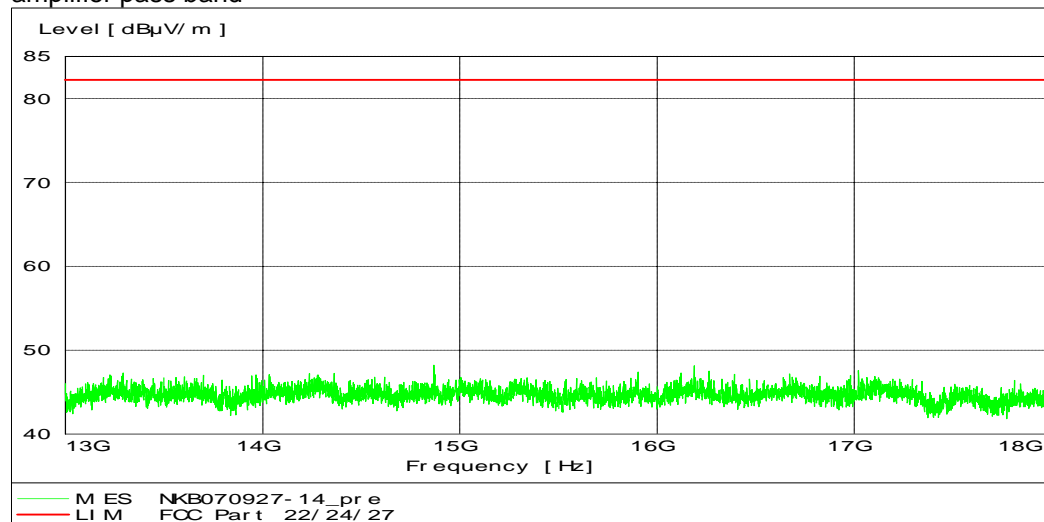
1000 – 13000 MHz, max peak at a distance of 3 m. CW carrier in middle part of the AWS amplifier pass band



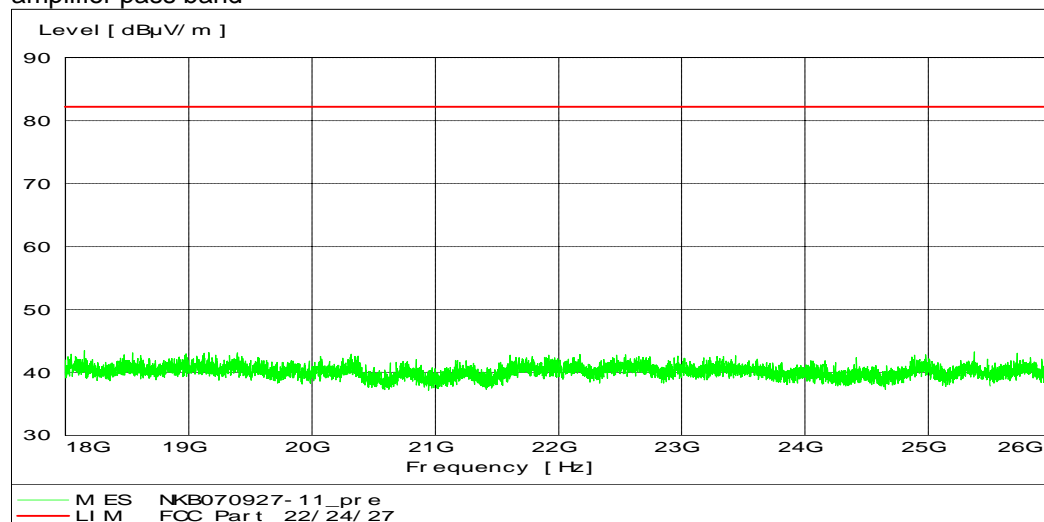
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13000 – 18000 MHz, max peak at a distance of 3 m. CW carrier in middle part of the AWS amplifier pass band



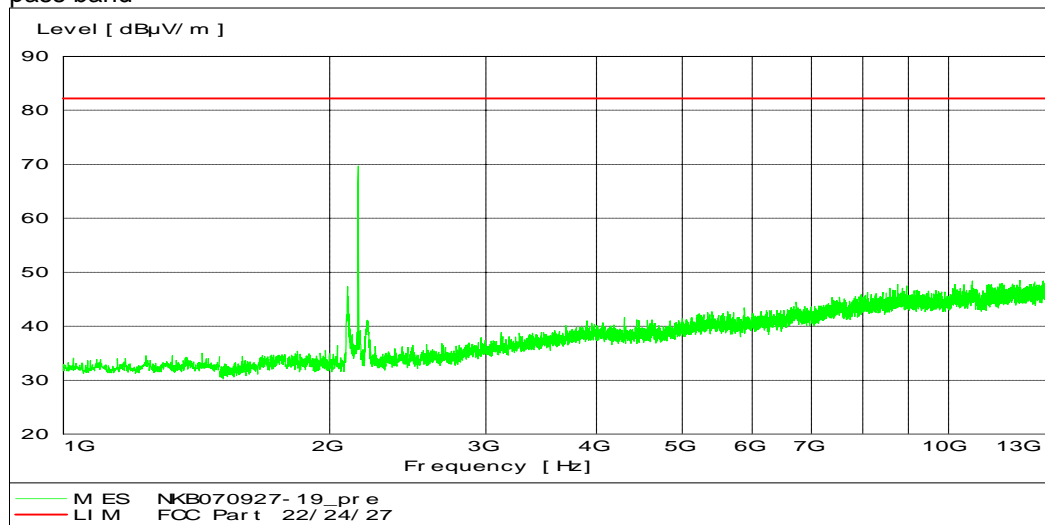
18000 – 26000 MHz, max peak at a distance of 3 m. CW carrier in middle part of the AWS amplifier pass band



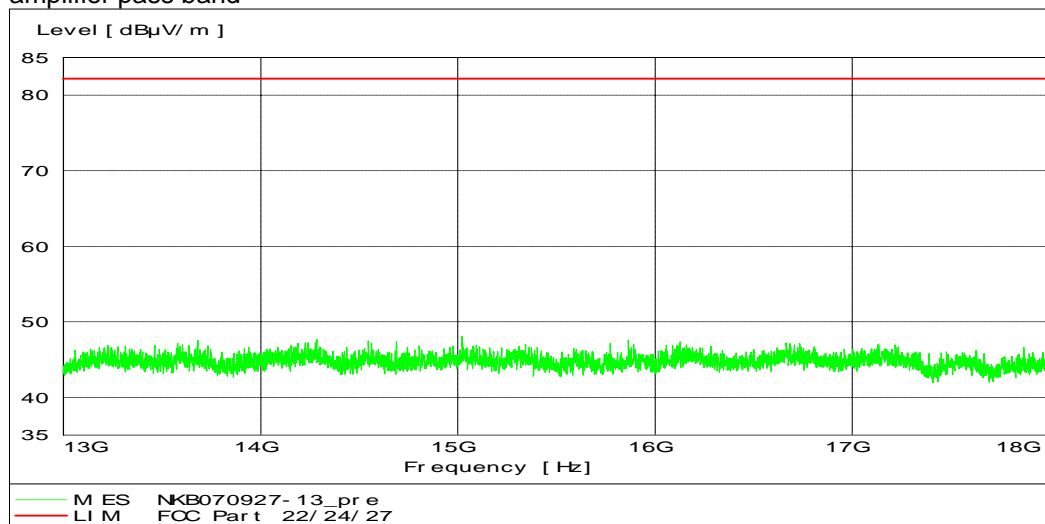
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1000 – 13000 MHz, max peak at a distance of 3 m. CW carrier in upper part of the AWS amplifier pass band



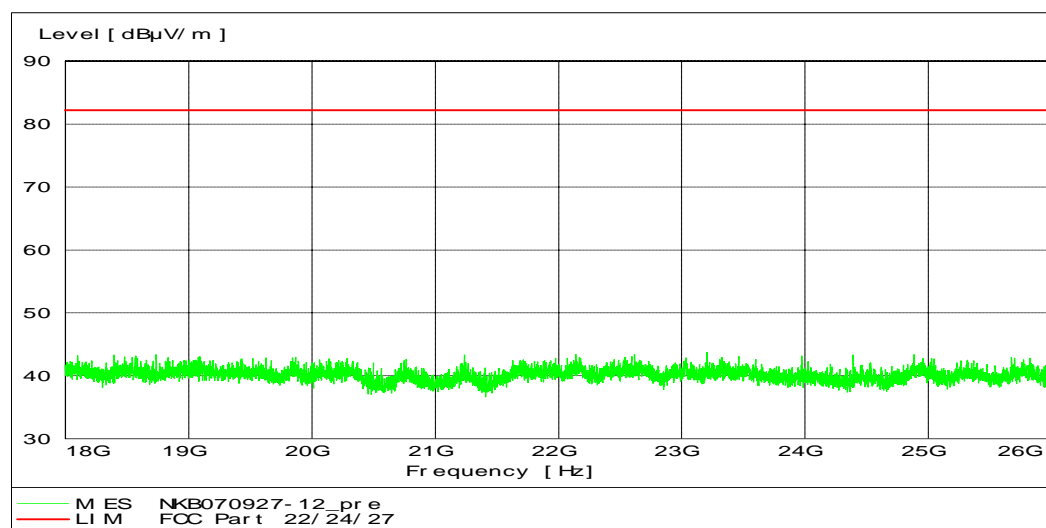
13000 – 18000 MHz, max peak at a distance of 3 m. CW carrier in upper part of the AWS amplifier pass band



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18000 – 26000 MHz, max peak at a distance of 3 m. CW carrier in upper part of the AWS amplifier pass band



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10.5 Data summary 850 MHz amplifier

Test signal: CW carrier in lower part of the amplifier pass band

Field strength of spurious emissions							
Frequency	Corrected amplitude QP	Bandwidth	Antenna height	Polarity	Turntable Position	Correction	Limit
(MHz)	(dB μ V/m)	(kHz)	(cm)		(deg)	(dB)	(dB μ V/m)
294.00875	46.4	120	242	V	36	14.8	84.40

No spurious emissions were found above 1GHz (noise floor below 50 dB μ V/m)

Test signal: CW carrier in middle part of the amplifier pass band

Field strength of spurious emissions							
Frequency	Corrected amplitude QP	Bandwidth	Antenna height	Polarity	Turntable Position	Correction	Limit
(MHz)	(dB μ V/m)	(kHz)	(cm)		(deg)	(dB)	(dB μ V/m)
294.62425	46.4	120	238	V	35	14.7	84.40

No spurious emissions were found above 1GHz (noise floor below 50 dB μ V/m)

Test signal: CW carrier in upper part of the amplifier pass band

Field strength of spurious emissions							
Frequency	Corrected amplitude QP	Bandwidth	Antenna height	Polarity	Turntable Position	Correction	Limit
(MHz)	(dB μ V/m)	(kHz)	(cm)		(deg)	(dB)	(dB μ V/m)
294.74375	46.3	120	229	V	44	14.7	84.40

No spurious emissions were found above 1GHz (noise floor below 50 dB μ V/m)

Example calculation:

Measured level [dB μ V/m] = Analyser reading [dB μ V] + cable loss [dB] – preamplifier gain [dB] + antenna factor [1/m]

Fulfil requirements: YES



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10.6 Data summary 1900 MHz amplifier

Test signal: CW carrier in lower part of the amplifier pass band

Field strength of spurious emissions							
Frequency	Corrected amplitude QP/Pk	Bandwidth	Antenna height	Polarity	Turntable Position	Correction	Limit
(MHz)	(dB μ V/m)	(kHz)	(cm)		(deg)	(dB)	(dB μ V/m)
296.95725	45.6	120	238	V	38	14.9	84.40
298.29600	45.8	120	248	V	44	14.9	84.40
10619.2	54.5	1000	155	H	0-360	3.7	82.20

No spurious emissions were found above 13GHz (noise floor below 50 dB μ V/m)

Test signal: CW carrier in middle part of the amplifier pass band

Field strength of spurious emissions							
Frequency	Corrected amplitude QP	Bandwidth	Antenna height	Polarity	Turntable Position	Correction	Limit
(MHz)	(dB μ V/m)	(kHz)	(cm)		(deg)	(dB)	(dB μ V/m)
297.36250	45.7	120	248	V	50	14.9	84.40

No spurious emissions were found above 1GHz (noise floor below 50 dB μ V/m)

Test signal: CW carrier in upper part of the amplifier pass band

Field strength of spurious emissions							
Frequency	Corrected amplitude QP/Pk	Bandwidth	Antenna height	Polarity	Turntable Position	Correction	Limit
(MHz)	(dB μ V/m)	(kHz)	(cm)		(deg)	(dB)	(dB μ V/m)
297.11725	45.8	120	236	V	53	14.9	84.40
5967.1	50.4	1000	155	V	0 – 360	-3.6	82.20
7956.0	57.8	1000	155	H	0 – 360	1.8	82.20

No spurious emissions were found above 13GHz (noise floor below 50 dB μ V/m)

Example calculation:

Measured level [dB μ V/m] = Analyser reading [dB μ V] + cable loss [dB] – preamplifier gain [dB] + antenna factor [1/m]

Fulfil requirements: YES



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10.7 Data summary AWS amplifier

Test signal: CW carrier in lower part of the amplifier pass band

Field strength of spurious emissions							
Frequency	Corrected amplitude QP/Pk	Bandwidth	Antenna height	Polarity	Turntable Position	Correction	Limit
(MHz)	(dB μ V/m)	(kHz)	(cm)		(deg)	(dB)	(dB μ V/m)
288.68075	35.3	120	237	V	327	14.6	84.40
306.80875	36.3	120	244	V	292	15.0	84.40
354.81950	39.3	120	201	V	200	16.6	84.40
2097.2	51.1	1000	155	H	0 – 360	-10.6	82.20
2162.9	46.4	1000	155	H	0 – 360	-10.4	82.20
2205.0	45.4	1000	155	H	0 – 360	-10.4	82.20

No spurious emissions were found above 13GHz (noise floor below 50 dB μ V/m)

Test signal: CW carrier in middle part of the amplifier pass band

Field strength of spurious emissions							
Frequency	Corrected amplitude QP/Pk	Bandwidth	Antenna height	Polarity	Turntable Position	Correction	Limit
(MHz)	(dB μ V/m)	(kHz)	(cm)		(deg)	(dB)	(dB μ V/m)
290.34100	35.0	120	224	V	296	14.8	84.40
306.81400	36.4	120	233	V	293	15.0	84.40
353.36150	38.5	120	222	V	201	16.5	84.40
2095.0	51.0	1000	155	H	0 – 360	-10.6	82.20
2205.0	45.1	1000	155	H	0 – 360	-10.4	82.20
4265.5	49.7	1000	155	H	0 – 360	-6.3	82.20

No spurious emissions were found above 13GHz (noise floor below 50 dB μ V/m)

Test signal: CW carrier in upper part of the amplifier pass band

Field strength of spurious emissions							
Frequency	Corrected amplitude QP/Pk	Bandwidth	Antenna height	Polarity	Turntable Position	Correction	Limit
(MHz)	(dB μ V/m)	(kHz)	(cm)		(deg)	(dB)	(dB μ V/m)
288.92600	35.5	120	243	V	315	14.6	84.40
306.48650	36.5	120	230	V	282	15.0	84.40
353.97350	38.5	120	201	V	231	16.5	84.40
2095.2	50.5	1000	155	H	0 – 360	-10.6	82.20
2205.5	44.6	1000	155	H	0 – 360	-10.4	82.20

No spurious emissions was found above 13GHz (noise floor below 50 dB μ V/m)

Example calculation:

Measured level [dB μ V/m] = Analyser reading [dB μ V] + cable loss [dB] – preamplifier gain [dB] + antenna factor [1/m]

Fulfil requirements: YES



Intertek Semko AB

Torshamnsgatan 43, Box 1103, SE-164 22 Kista, Sweden
Telephone +46 8 750 00 00, Fax +46 8 750 60 30, www.sweden.intertek-etlsemko.com
Registered in Sweden: No SE556024059901, Registered office: As address

11 INSTRUMENTATION LIST

Equipment	Manufacturer	Type	SEMKO No.
Spectrum analyser	Rohde & Schwarz	FSIQ40	12793
Measurement receiver	Rohde & Schwarz	ESCI	12798
Antenna, bilog	Rohde & Schwarz	HL-562	30711
Antenna horn	EMCO	3115	4936
Antenna horn	EMCO	3160-08	30099
Antenna horn	EMCO	3160-09	30101
Preamplifier	MITEQ	AFS6/AFS44	12335
Signal generator	Rohde & Schwarz	SMIQ03B	40017
Signal generator	Rohde & Schwarz	SMIQ03B	12792
Signal generator	Hewlett Packard	8642B	7007
Combiner	Anzac	DS-4-4	3551
Rubidium reference	Philips	PM6685R/071	40031
Rubidium reference	DATUM	8040 Class 1	40032
Power meter	Rohde & Schwarz	NRVD	12455
Power Detector	Rohde & Schwarz	NRV-Z51	7861
10 dB Attenuator	Aeroflex/Weinschel	46-10-34	9443
10 dB Attenuator	Hewlett Packard	8491A	7967
10 dB Attenuator	Hewlett Packard	8491A	30088
Transformer	Tufvassons	AFM-1500	30317



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12 UNCERTAINTIES SUMMARY

All uncertainties are given with a level of confidence of approximately 95% (k=2).

Measurement uncertainty for radiated disturbance

Uncertainty for the frequency range 30 to 300 MHz using a biconical or a combination antenna at 10 m	± 4,6 dB
Uncertainty for the frequency range 200 to 1000 MHz using a logperiodic or a combination antenna at 10 m	± 4,6 dB
Uncertainty for the frequency range 1000 to 18000 MHz using a horn antenna at 3 m	± 6,0 dB

Measurement uncertainty for conducted disturbances at the antenna port on radio equipment	± 3,6 dB
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Measurement uncertainty for Output power (Radio)

Digital signal, conducted	± 0,6 dB
Digital signals, radiated 1 - 18 GHz	± 3,3 dB



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APPENDIX I – PHOTOS OF THE EUT

Front side



Back side



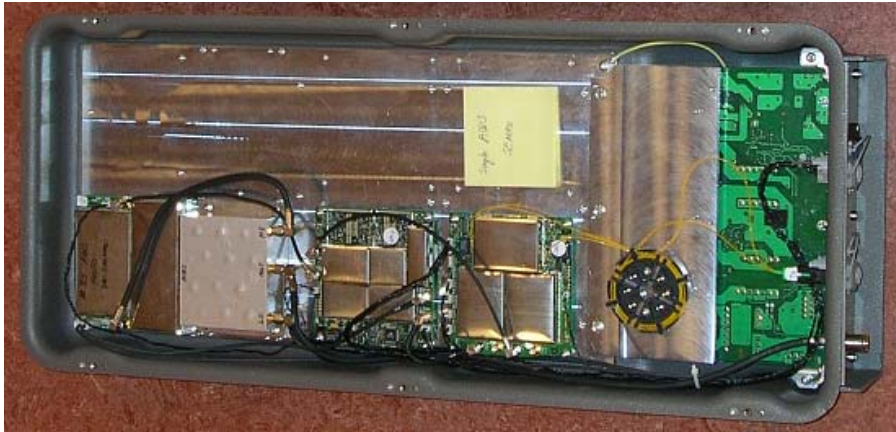
Bottom side with connectors



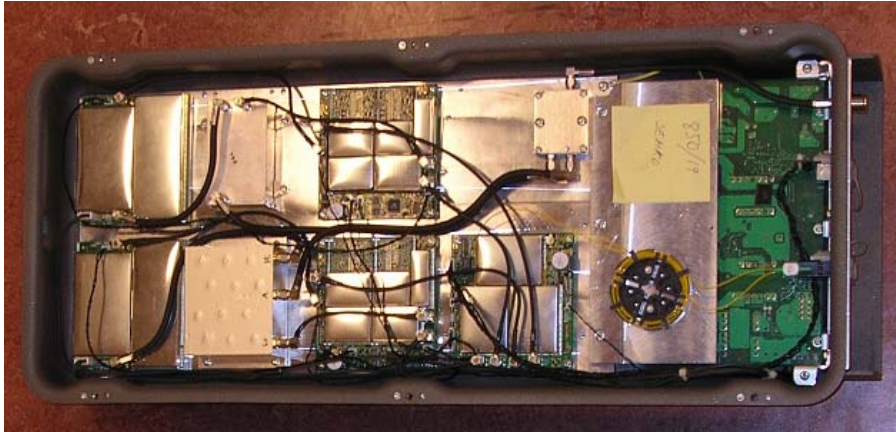
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AWS unit without front cover



850 unit without front cover



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