RADIO TEST REPORT

No. 1009590-1

EQUIPMENT UNDER TEST

Equipment:	Remote Head
Type / model:	DDHxxx (DDH 100, 200 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 (2009)	
47CFR part 22 (2009)	Subpart H
47CFR part 24 (2009)	Subpart E
47CFR part 27 (2009)	Subpart C

Date of issue: 2010-05-04

Tested by: Niklas Boström

Approved by: Stefan Andersson

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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:	DDH101, DDH202	
Brand name:	Deltanode	
Serial number:	DDH101 : 1418 DDH202 : 1377	
Manufacturer:	Deltanode Solutions AB	
Rating/Supplying voltage:	85-260 VAC, 50 / 60Hz	
Rating RF output power:	850 MHz band 1900 MHz band AWS band	43 dBm (RMS) 43 dBm (RMS) 43 dBm (RMS)
Frequency range:	850 MHz band 1900 MHz band AWS band	869- 894 MHz 1930 – 1990 MHz 2110 – 2155 MHz
External antenna connector:	Yes	
Operating temperature range:	-25 to +55 °C	
Modulation characteristics:	850 MHz band 1900 MHz band AWS band	CDMA (QPSK) GSM (GMSK) CDMA (QPSK) GSM (GMSK) WCDMA (QPSK)

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2.2 Additional hardware information about the EUT

DDH 100, 200, series are tested for the US frequency bands 850, 1900 and AWS. The product structure allows free configuration of the three bands up to two RF line-up's in one unit.

The part number DDH 1xx is equipped with 1 RF line up and DDH 2xx is equipped with two RF line up's.

The tested DDH 101 is a single band 850, and DDR 202 is a dual band unit 1900/AWS.

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 two bands are covered.

The EUT's consists of the following units:

Unit	**Type and version**	**Serial number**
850 unit	DDH101	1418
With subunits	**Type and version**	**Serial number**
Power supply	KS23.1 R1B	LJ00752
Power supply (broke during tests)	KS23.1 R1B	LJ00652
Fiber Optic Board	KS22.1 R1C	LH00593
Duplex filter 850	AA3	35
PA Board 850	KS45.3 P1A	DH00138
VGA Board 850	KS30.9 P1A	LH00140
MCPA Unit 850	3U400101	LPA0800028SC011544

Unit	**Type and version**	**Serial number**
1900 / aws unit	DDH202	1377
With subunits	**Type and version**	**Serial number**
Power supply	KS23.1 R1B	LJ00657
Power supply	KS23.1 R1B	LJ00637
Fiber Optic Board	KS22.1 R1C	LH00584
PA Board 1900	KS45.3 P1A	DH00125
PA Board AWS	KS45.3 P1A	DH00120
VGA Board 1900	KS30.3 R1B	LH00215
VGA Board AWS	KS30.11 P1A	LH00361
Duplex filter 1900	3F601101	27
Duplex filter AWS	3F600401	251
MCPA Unit 1900	3U400201	LPA190040SG011325
MCPA Unit AWS	3U400001	LPA2100030SW080101

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2.3 Additional software information about the EUT

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

Software	Version
AM001001	R3-r3.5.12.9

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	DOI302
Laptop	Acer Travelmate	6252

2.5 Modifications during the test

During the tests the power supply of the DDH 101 broke and was replaced with a new power supply. The radiated emissions in this report were made with the first power supply that broke. All other tests were done with the new power supply.

No other modifications have been made during the tests

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3. TEST SPECIFICATIONS

3.1 Standards

FCC
47CFR part 2 (2009)

47CFR part 22 (2009) Subpart H

47CFR part 24 (2009) Subpart E

47CFR part 27 (2009) 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 measurement instrument 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: 20-26 °C
Relative humidity: 20-30 %

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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	1
2.1051 and 22.917(a)	Out of band spurious emissions, conducted	PASS	1
2.1053 and 22.917(a)	Out of band spurious emissions, radiated	PASS	
2.1055	Frequency stability	PASS	

Note 1: The measured result is below the upper limit, but by a margin less than half of the uncertainty interval; it is therefore not possible to state compliance based on the 95% level of confidence. However, the result indicates that compliance is more probable than noncompliance.

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	1
2.1051 and 24.238	Out of band spurious emissions, conducted	PASS	1
2.1053 and 24.238	Out of band spurious emissions, radiated	PASS	
2.1055	Frequency stability	PASS	

Note 1: The measured result is below the upper limit, but by a margin less than half of the uncertainty interval; it is therefore not possible to state compliance based on the 95% level of confidence. However, the result indicates that compliance is more probable than noncompliance.

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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	1
2.1053 and 27.53(g)	Out of band spurious emissions, radiated	PASS	
2.1055	Frequency stability	PASS	

Note 1: The measured result is below the upper limit, but by a margin less than half of the uncertainty interval; it is therefore not possible to state compliance based on the 95% level of confidence. However, the result indicates that compliance is more probable than noncompliance.

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5. RF OUTPUT POWER

Date of test: 2010-03-31

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)

5.2 Test results

Amplifier	Input signal	RF Output Power (dBm)	Limit value (dBm)
850	CDMA (QPSK)	42.5	57
850	GSM (GMSK)	42.6	57
1900	CDMA (QPSK)	42.3	62
1900	GSM (GMSK)	42.3	62
AWS	WCDMA (QPSK)	41.4	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: 2010-03-31 and 2010-04-07 and 2010-04-27

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	1434.870	Plot 6.1 Plot 6.2
850	GSM (GMSK)	326.653	322.645	Plot 6.3 Plot 6.4
1900	CDMA (QPSK)	1434.870	1434.870	Plot 6.5 Plot 6.6
1900	GSM (GMSK)	328.657	324.649	Plot 6.7 Plot 6.8
AWS	WCDMA (QPSK)	4633.267	4633.267	Plot 6.9 Plot 6.10

Fulfil requirements: YES

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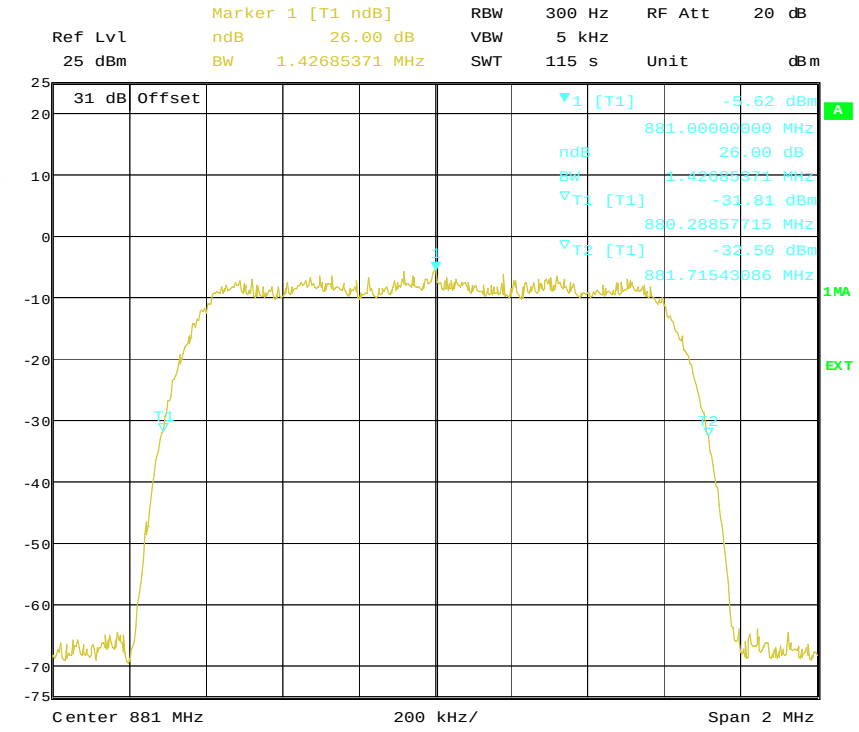
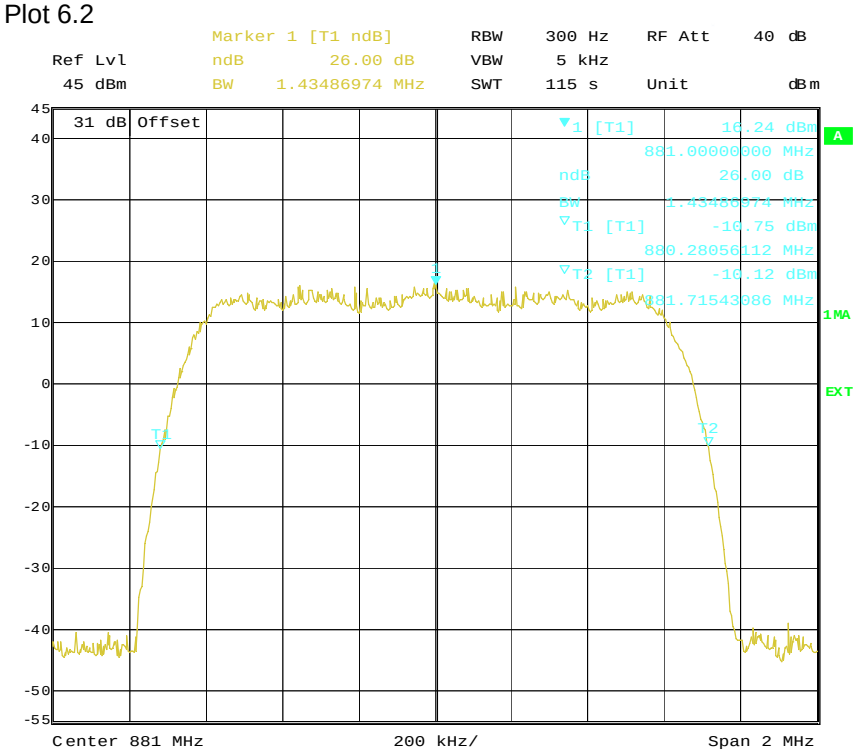
Plot 6.1



Date: 7.APR.2010 10:11:28

Plot 6.2



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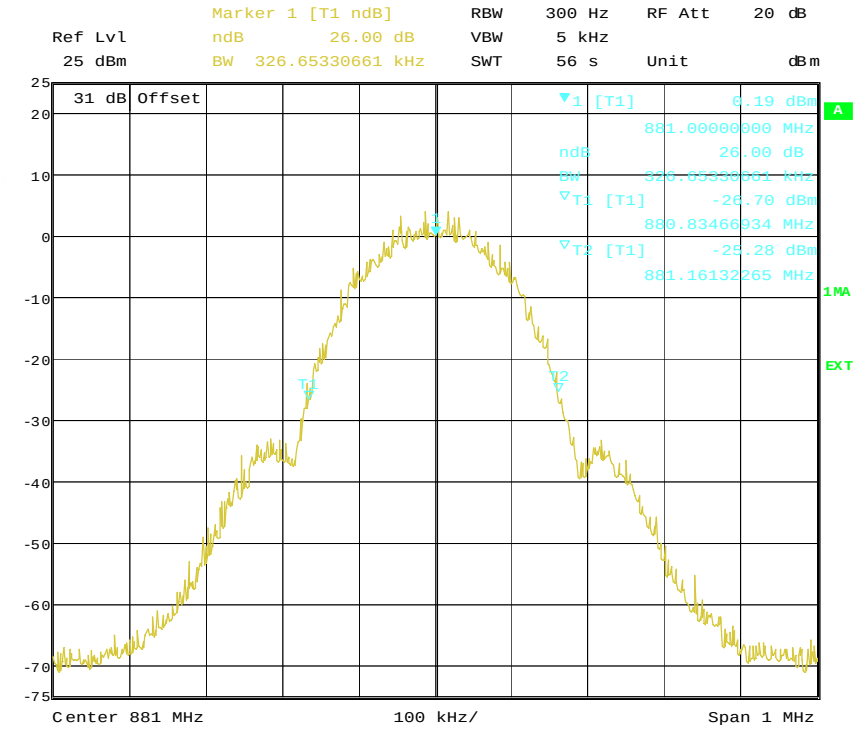
Plot 6.3



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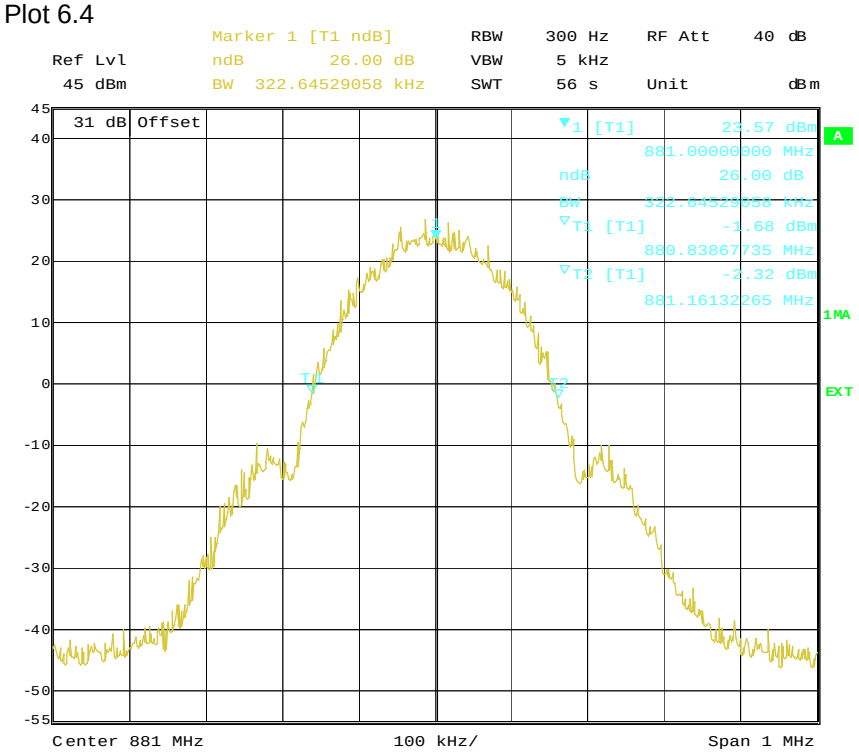
Plot 6.4



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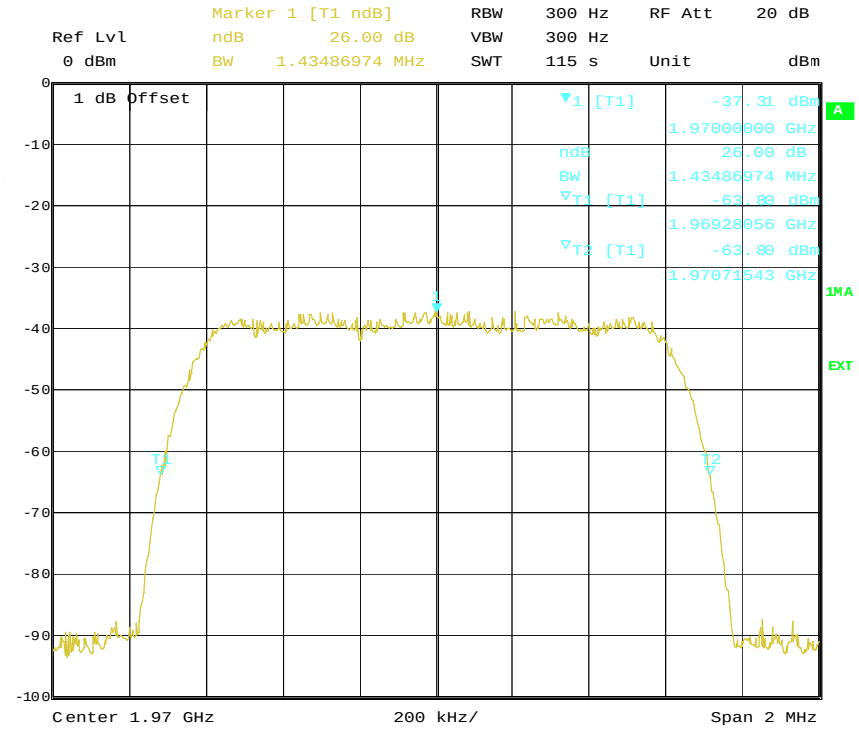
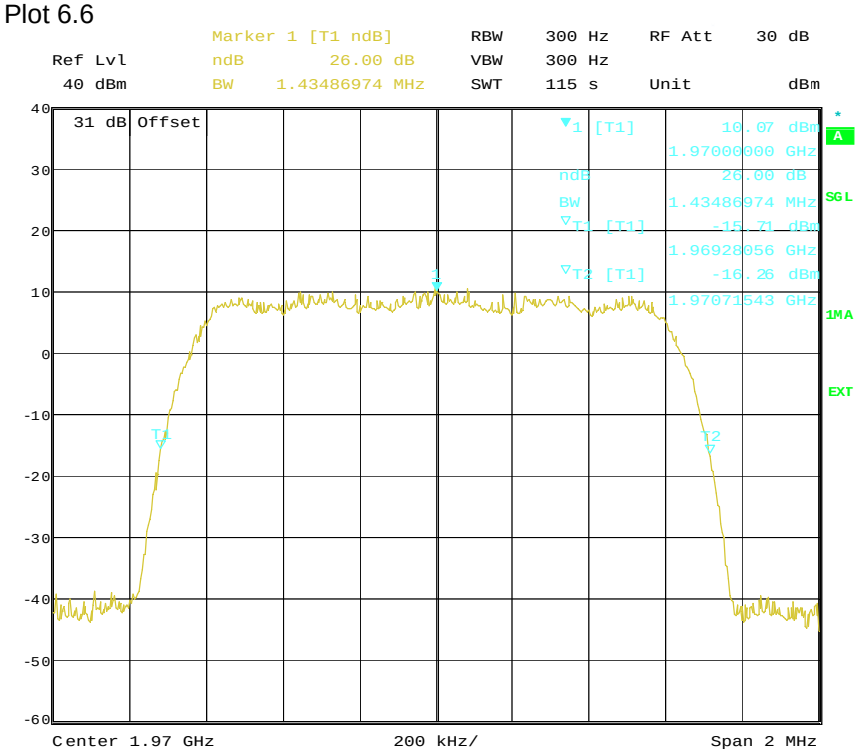
Plot 6.5



Plot 6.6



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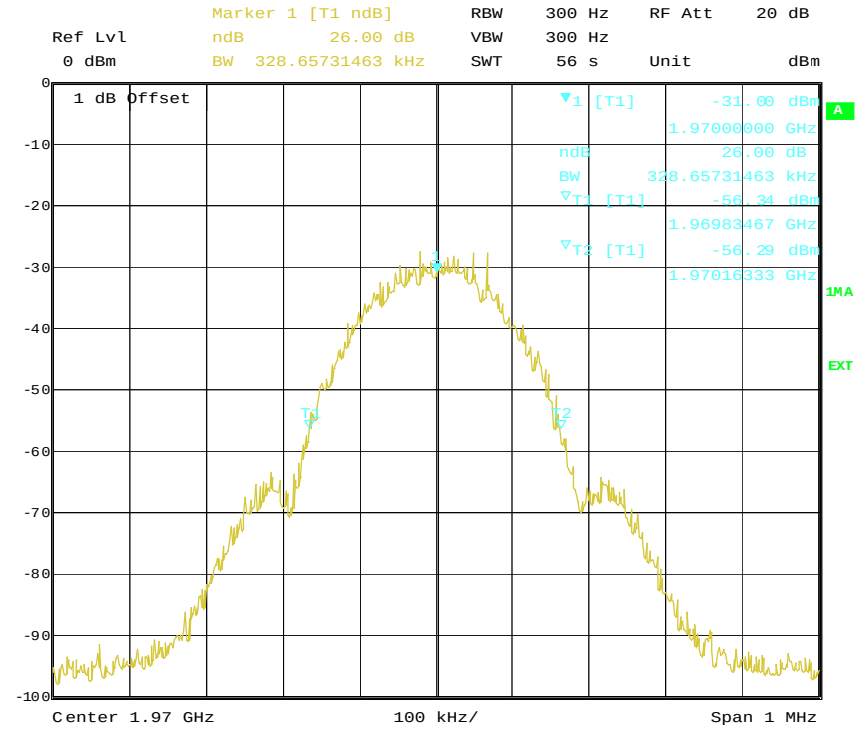
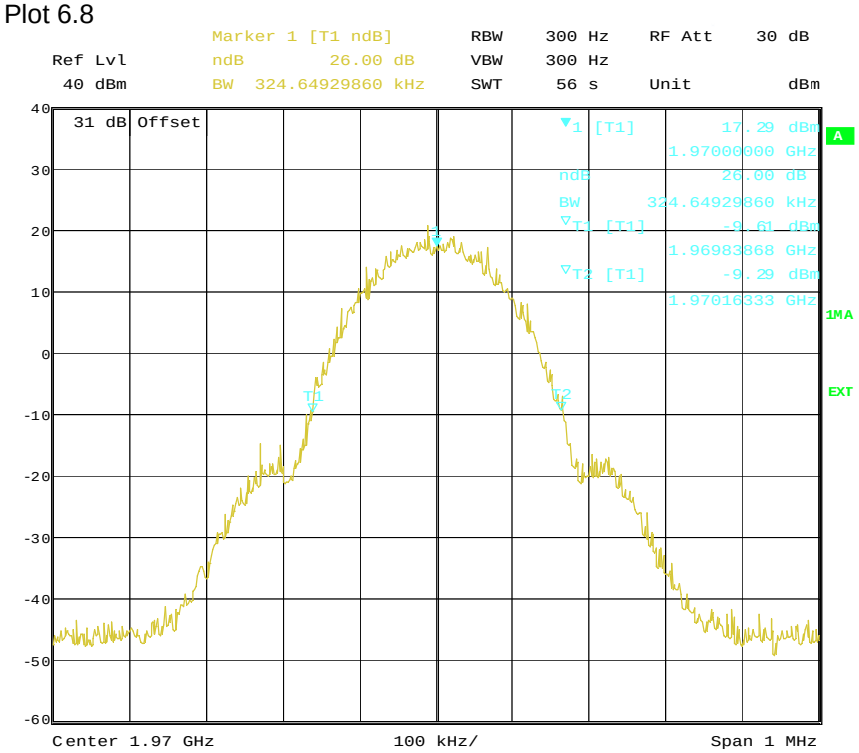
Plot 6.7



Plot 6.8



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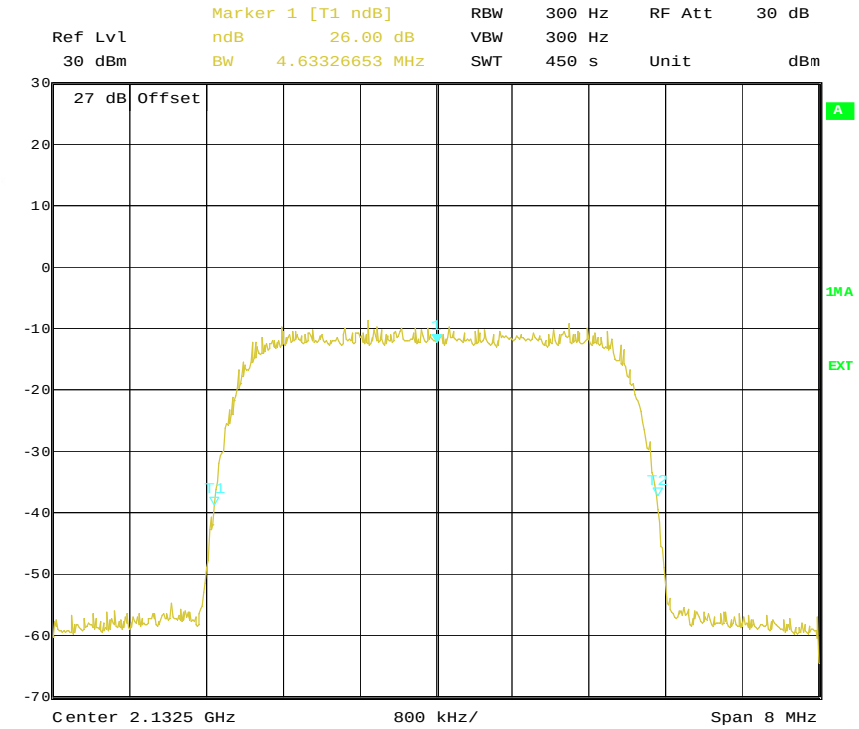
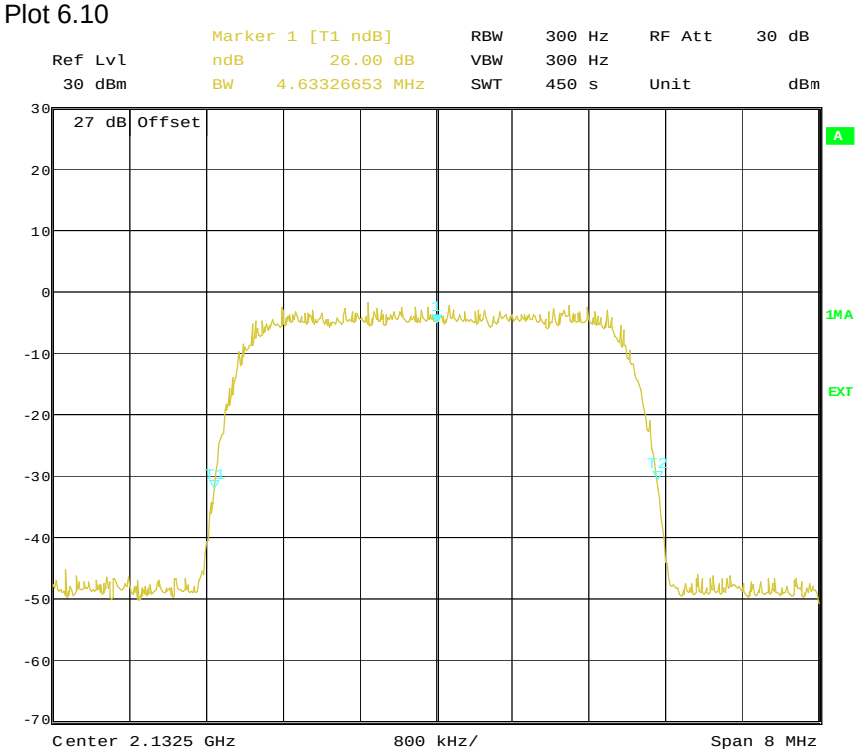
Plot 6.9



Plot 6.10



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7. CONDUCTED SPURIOUS EMISSIONS AT ANTENNA PORT

Date of test: 2010-03-30, 2010-03-31, 2010-04-07 and 2010-04-08

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	-17.7	-13	Plot 7.1	
CDMA, low ch.	3 000 – 10 000	1	-23.7	-13	Plot 7.2	
CDMA, mid. ch.	9kHz – 3 000	1	-17.1	-13	Plot 7.3	
CDMA, mid. ch.	3 000 – 10 000	1	-24.0	-13	Plot 7.4	
CDMA, high ch.	9kHz – 3 000	1	-17.7	-13	Plot 7.5	
CDMA, high ch.	3 000 – 10 000	1	-24.2	-13	Plot 7.6	
GSM, low ch.	9kHz – 3 000	1	-16.7	-13	Plot 7.7	
GSM, low ch.	3 000 – 10 000	1	-24.1	-13	Plot 7.8	
GSM, mid. ch.	9kHz – 3 000	1	-17.2	-13	Plot 7.9	
GSM, mid. ch.	3 000 – 10 000	1	-24.9	-13	Plot 7.10	
GSM, high ch.	9kHz – 3 000	1	-17.1	-13	Plot 7.11	
GSM, high ch.	3 000 – 10 000	1	-24.0	-13	Plot 7.12	

Intermodulation and band edge measurements

Test signal(s)	Frequency [MHz]	RBW [kHz]	Measured peak level (dBm)	Limit (dBm)	Plots	Comment
2 CDMA carriers at 869.76 and 872.04 MHz	859 – 879	30	-14.7	-13	Plot 7.13	Note 1
2 CDMA carriers at 891.00 and 893.22 MHz	884 – 904	30	-14.8	-13	Plot 7.14	Note 1
CDMA carrier at 869.82 MHz	859 – 879	30	-15.3	-13	Plot 7.15	Note 1
CDMA carrier at 893.22 MHz	884 – 904	30	-15.8	-13	Plot 7.16	
2 GSM carriers at 869.4 and 870 MHz	859 – 879	3	-14.7	-13	Plot 7.17	Note 1
2 GSM carriers at 893.6 and 893 MHz	884 – 904	3	-18.7	-13	Plot 7.18	
GSM carrier at 869.4 MHz	866.5 – 871.5	3	-32.9	-13	Plot 7.19	
GSM carrier at 893.6 MHz	891.5 – 896.5	3	-38.2	-13	Plot 7.20	
GSM carrier at 869.2 MHz	866.5 – 871.5	3	-15.5	-13	Plot 7.21	Note 2
GSM carrier at 893.8 MHz	891.5 – 896.5	3	-15.0	-13	Plot 7.22	Notes 1, 2

Note 1: The measured result is below the upper limit, but by a margin less than half of the uncertainty interval; it is therefore not possible to state compliance based on the 95% level of confidence. However, the result indicates that compliance is more probable than noncompliance.
Note 2: The output power of the first and last ARFCN was reduced by 10 dB to fulfil band edge requirements

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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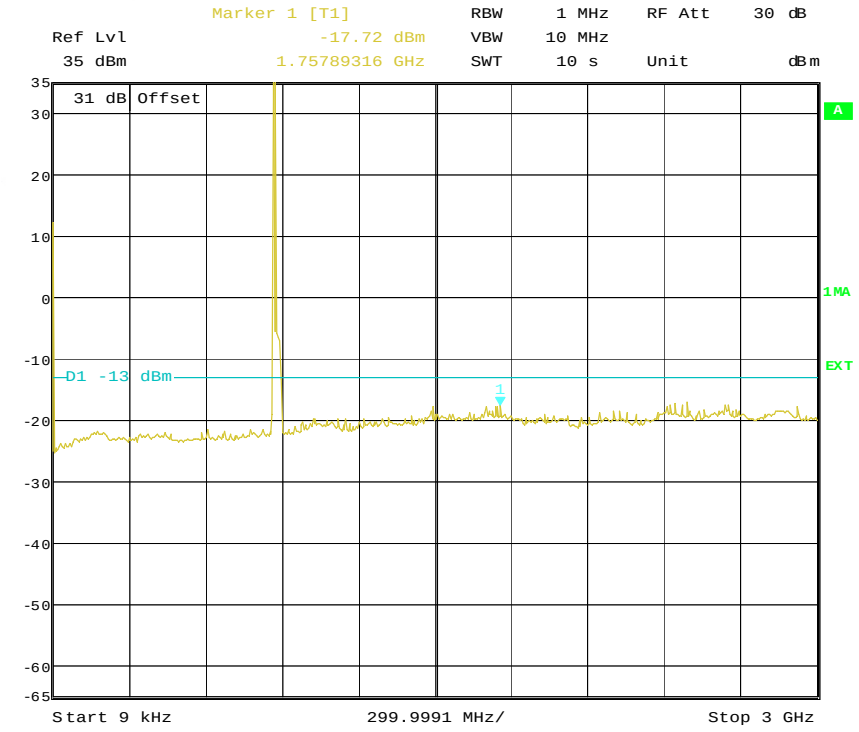
Plot 7.1



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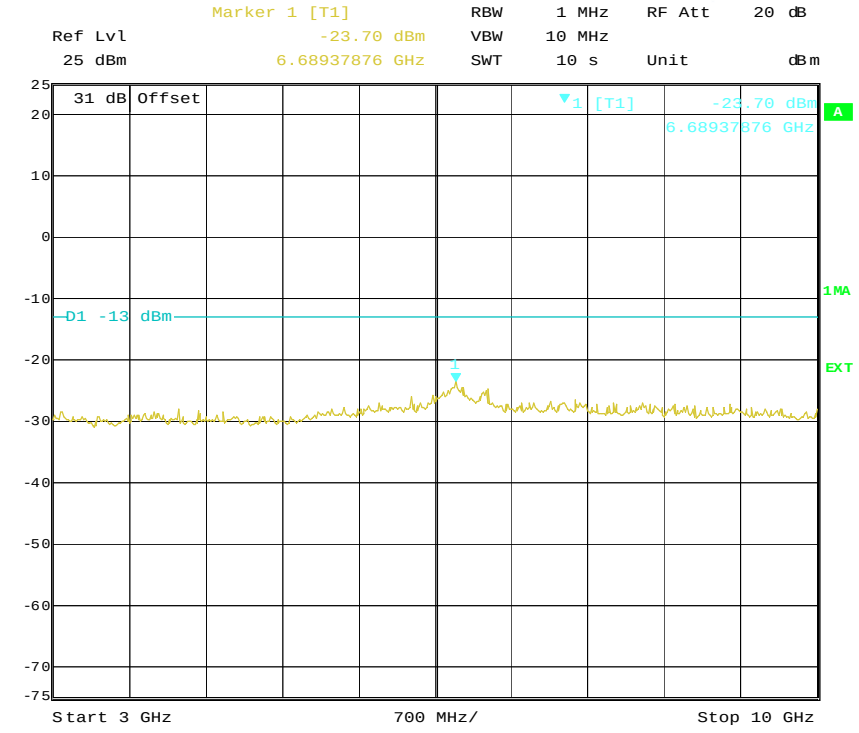
Plot 7.2



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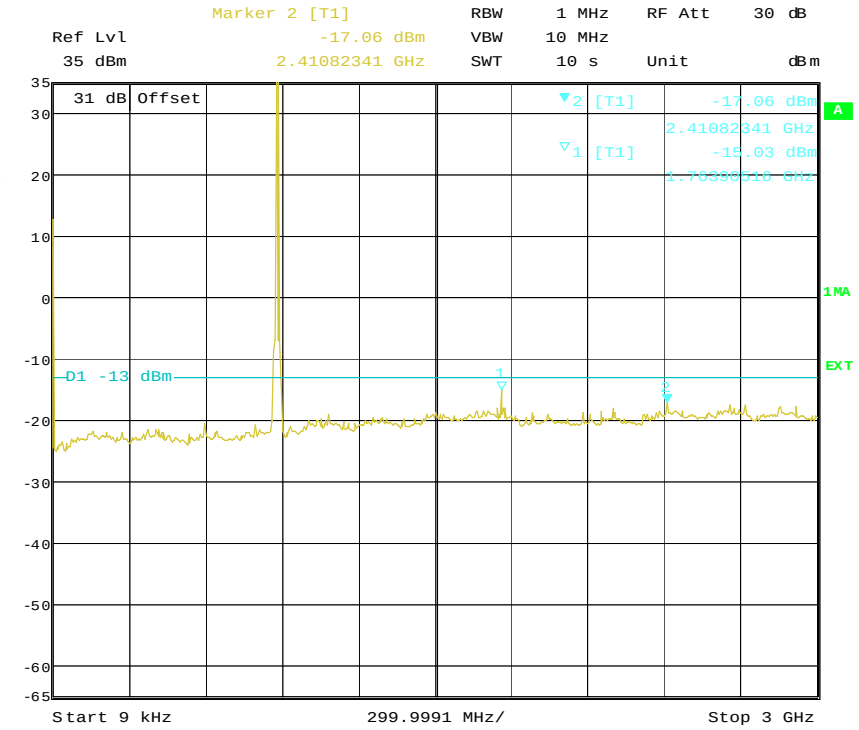
Plot 7.3



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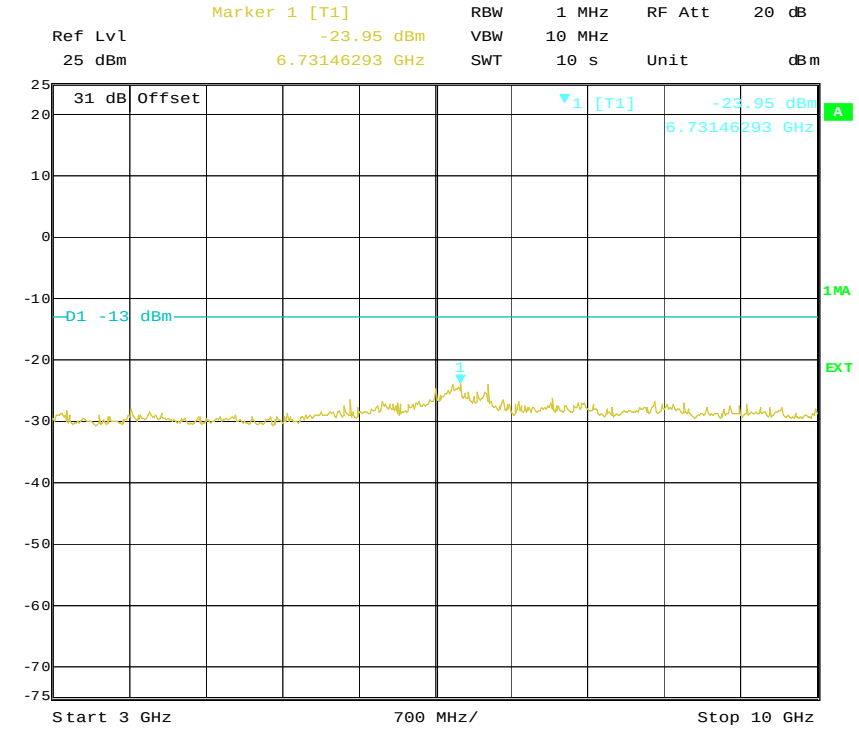
Plot 7.4



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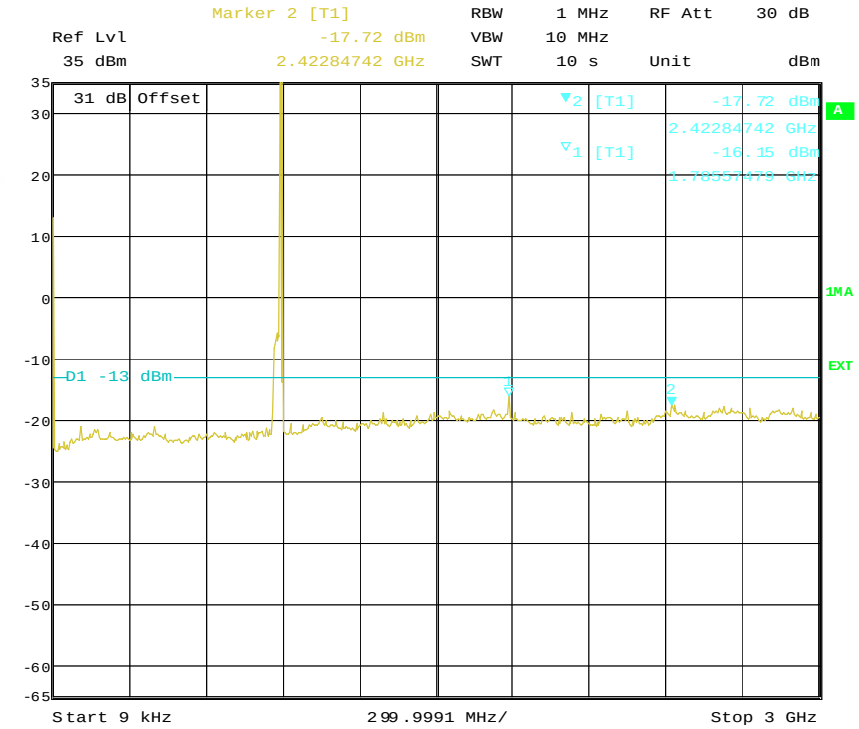
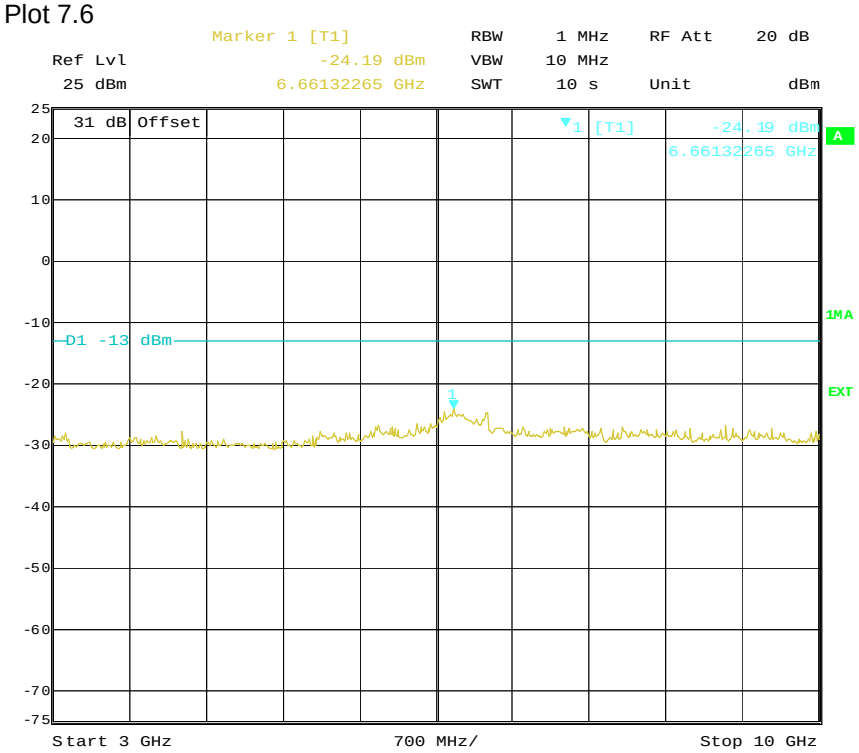
Plot 7.5



Date: 7.APR.2010 09:10:18

Plot 7.6



Date: 7.APR.2010 09:28:02

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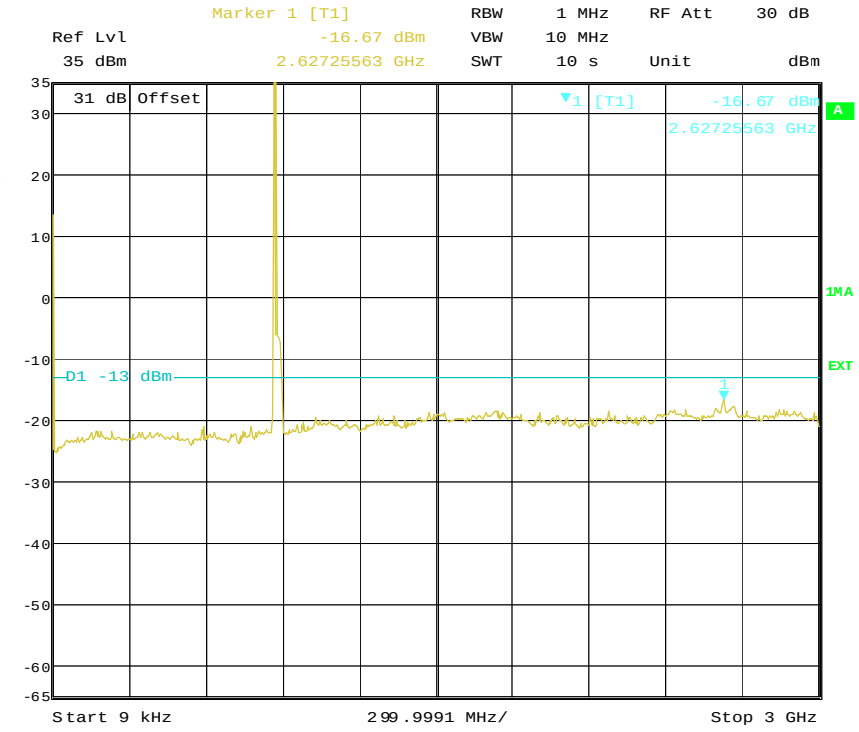
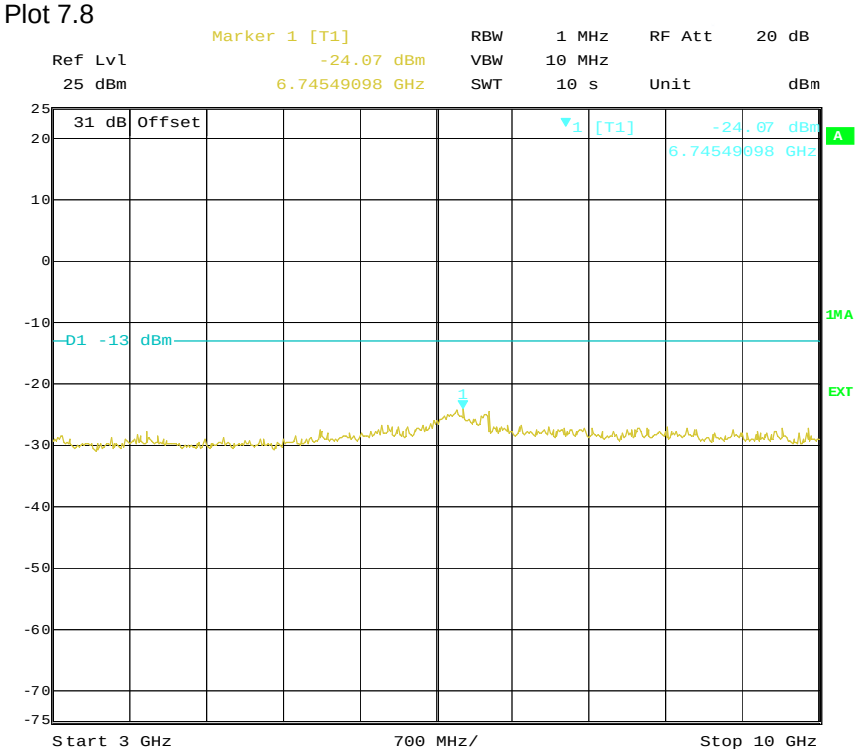
Plot 7.7



Date: 7.APR.2010 09:12:49

Plot 7.8



Date: 7.APR.2010 09:26:17

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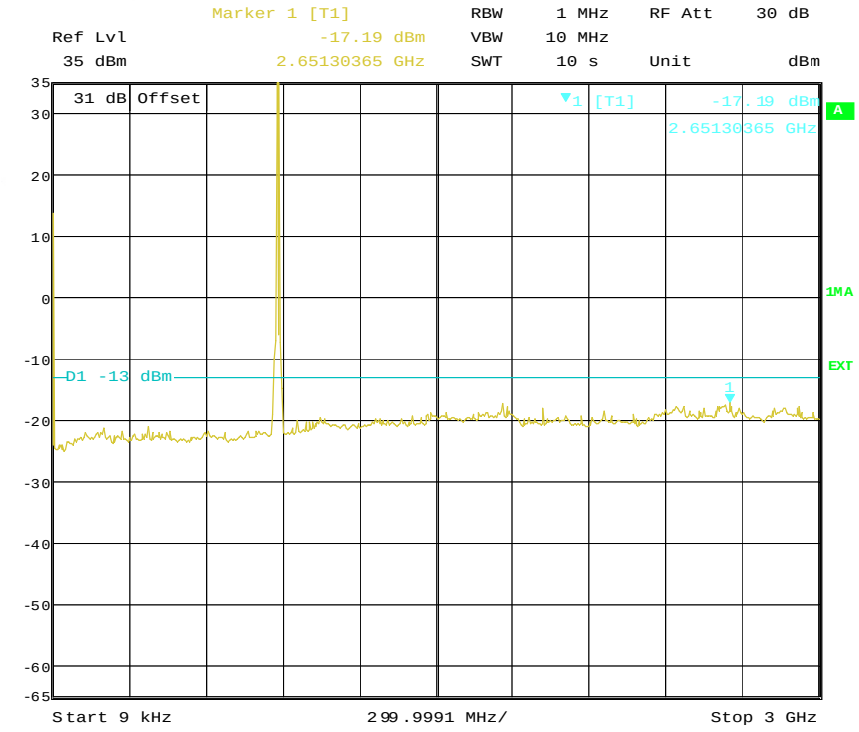
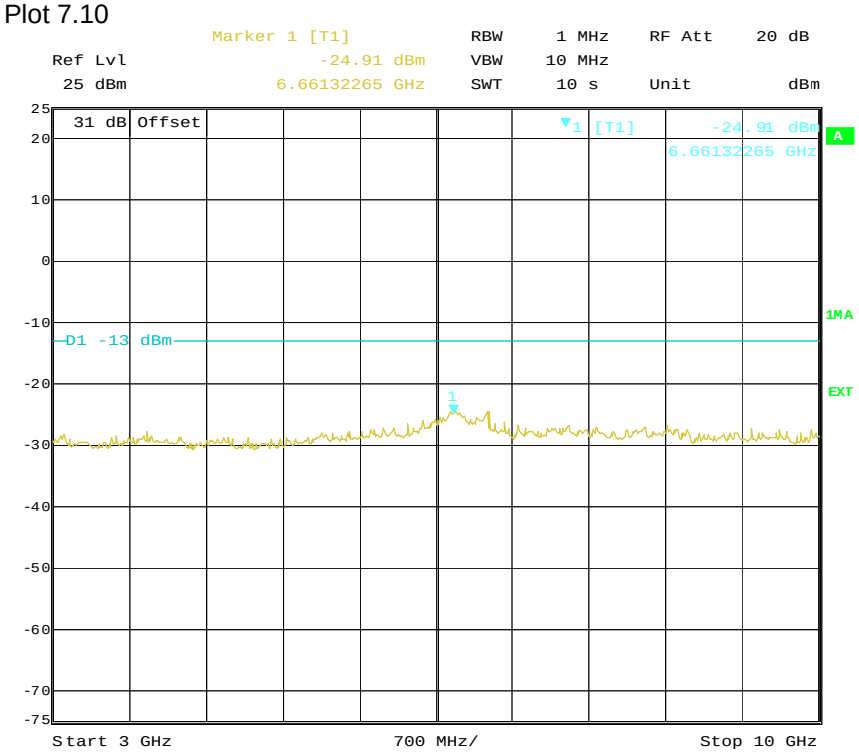
Plot 7.9



Date: 7.APR.2010 09:13:31

Plot 7.10



Date: 7.APR.2010 09:14:48

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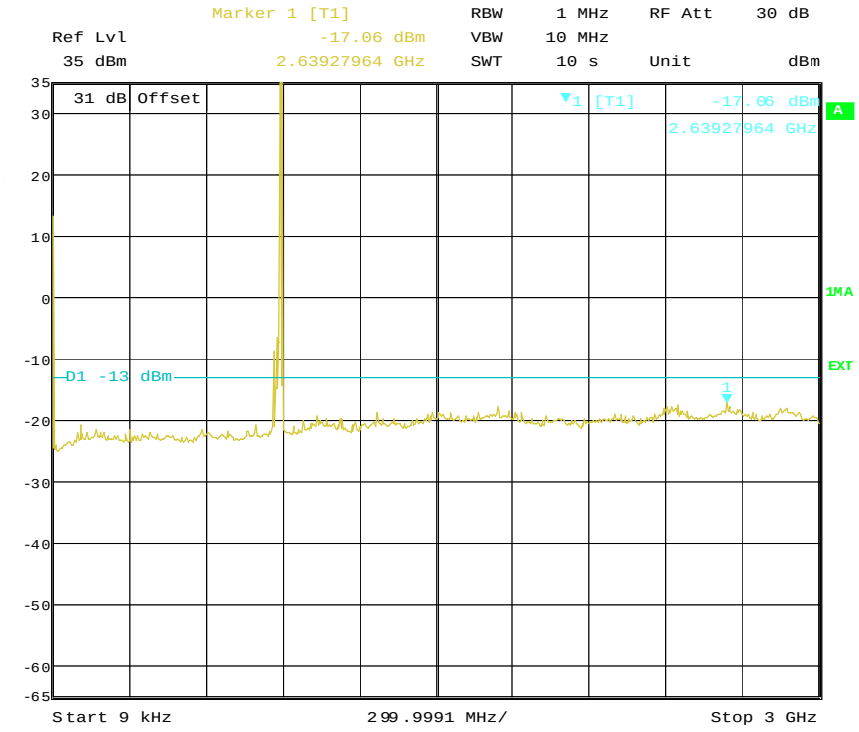
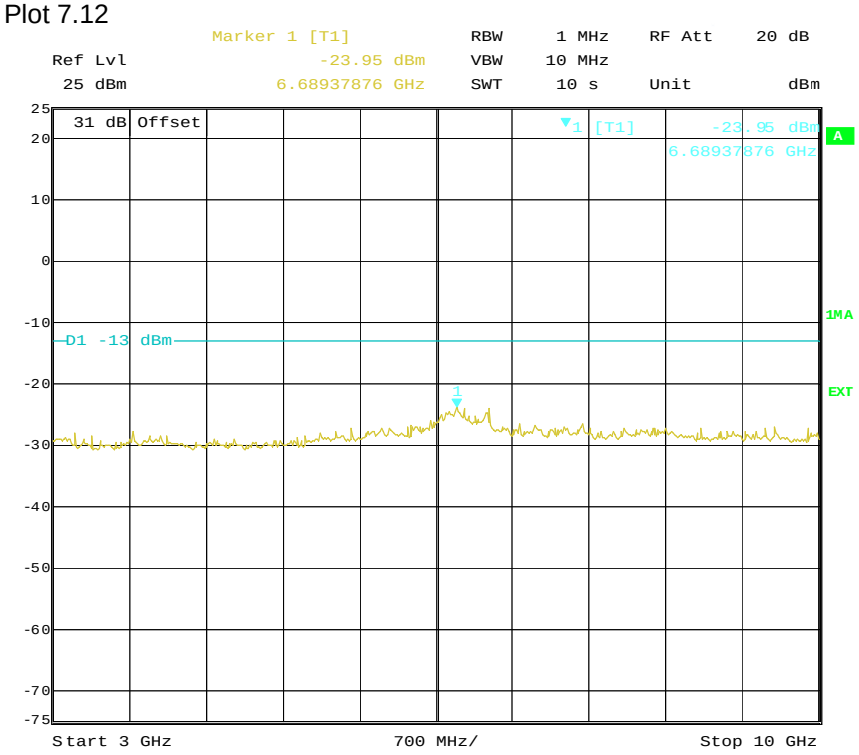
Plot 7.11



Date: 7.APR.2010 09:11:52

Plot 7.12



Date: 7.APR.2010 09:15:40

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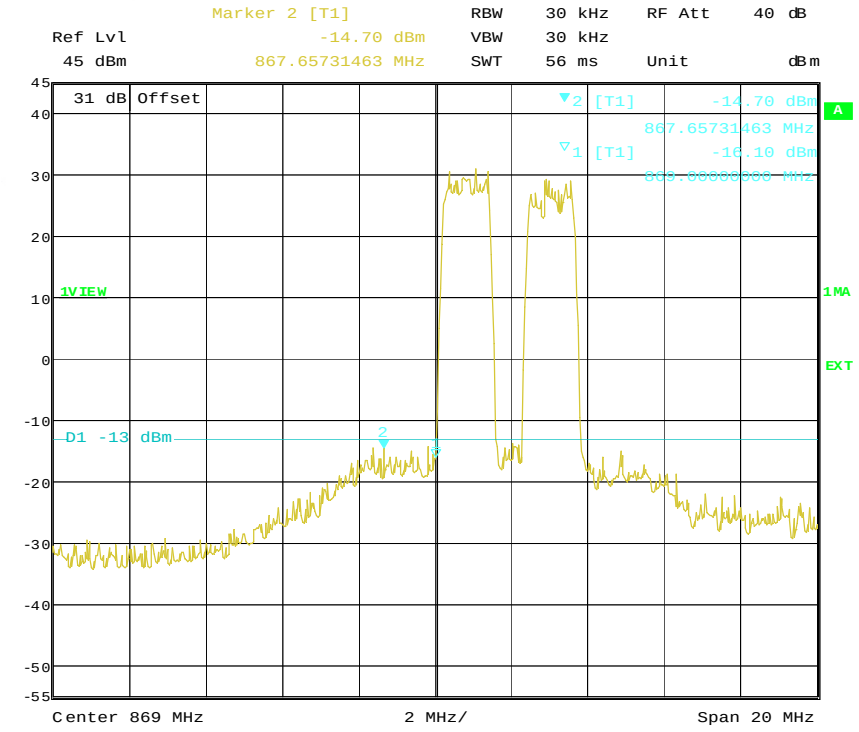
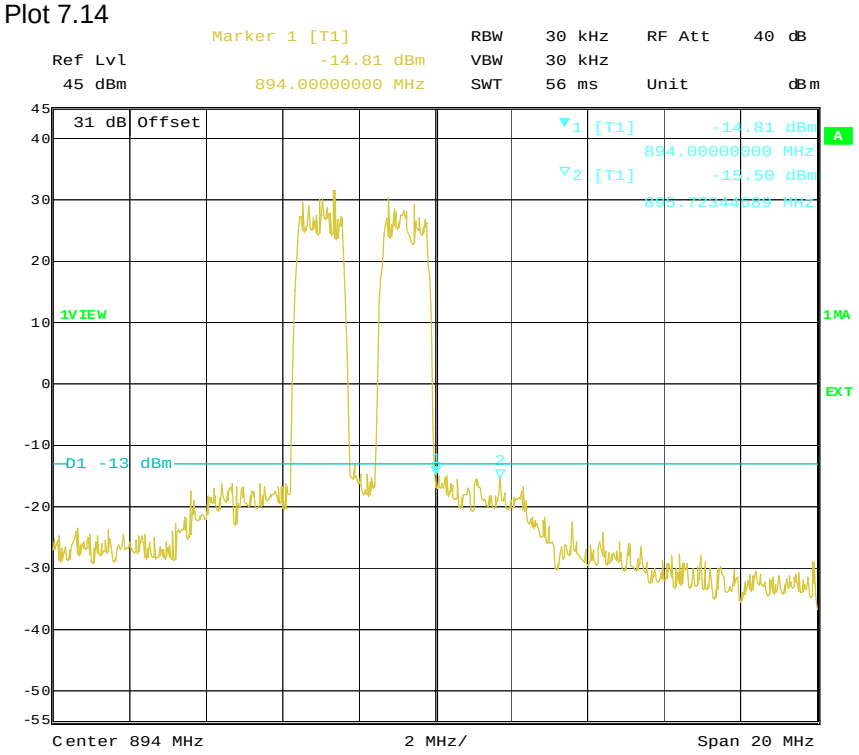
Plot 7.13



Date: 8.APR.2010 16:36:36

Plot 7.14



Date: 8.APR.2010 16:40:41

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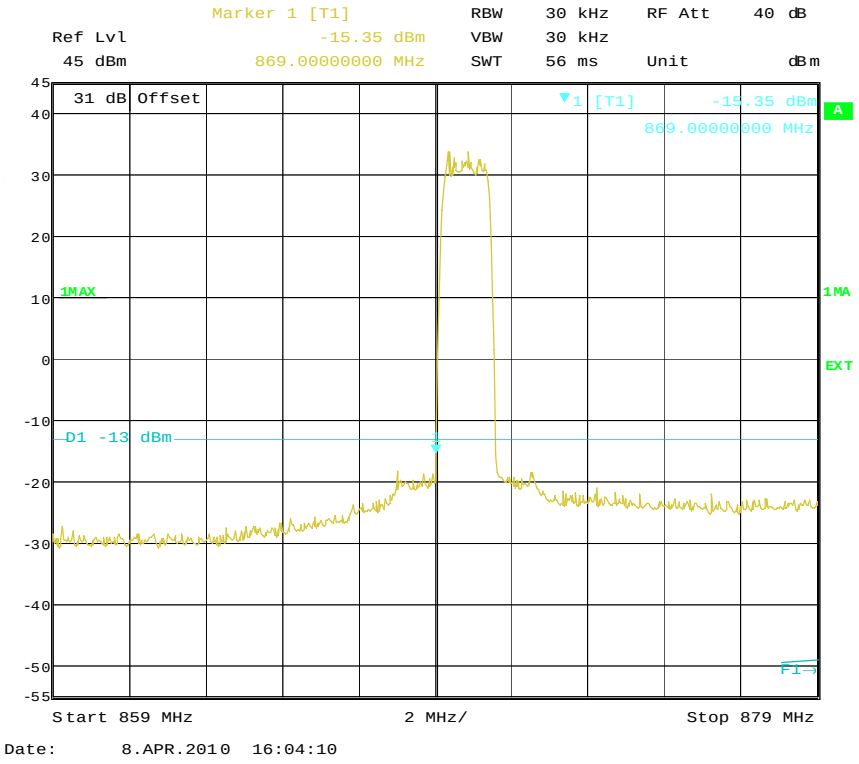
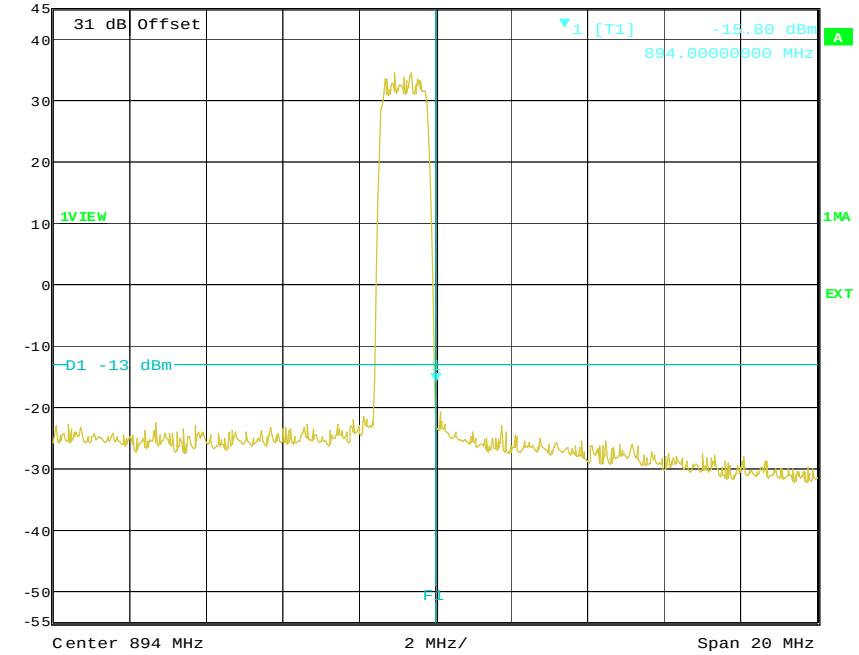
Plot 7.15



Date: 8.APR.2010 16:04:10

Plot 7.16



Date: 8.APR.2010 16:05:52

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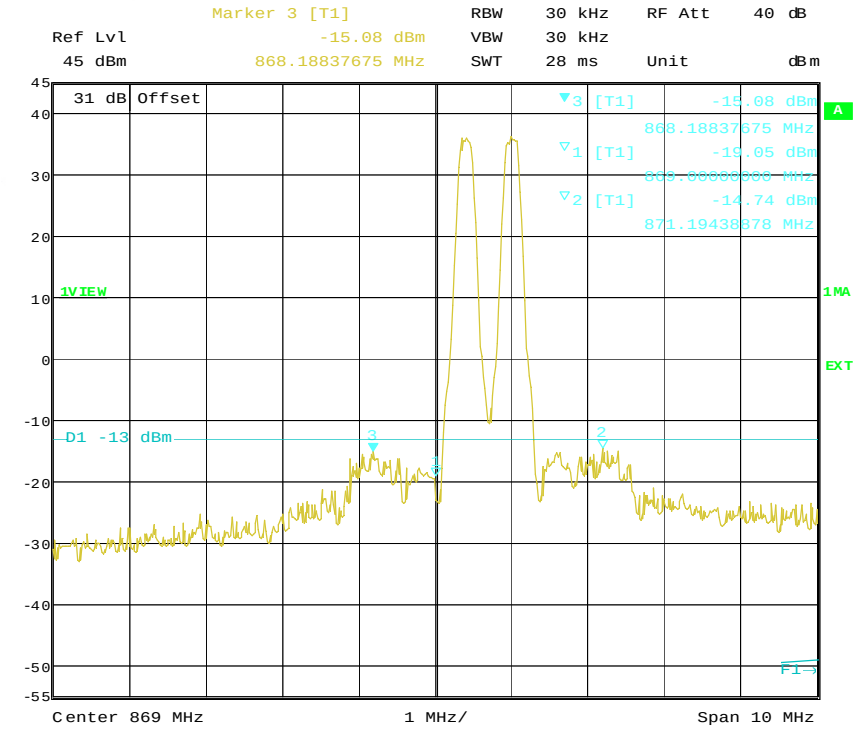
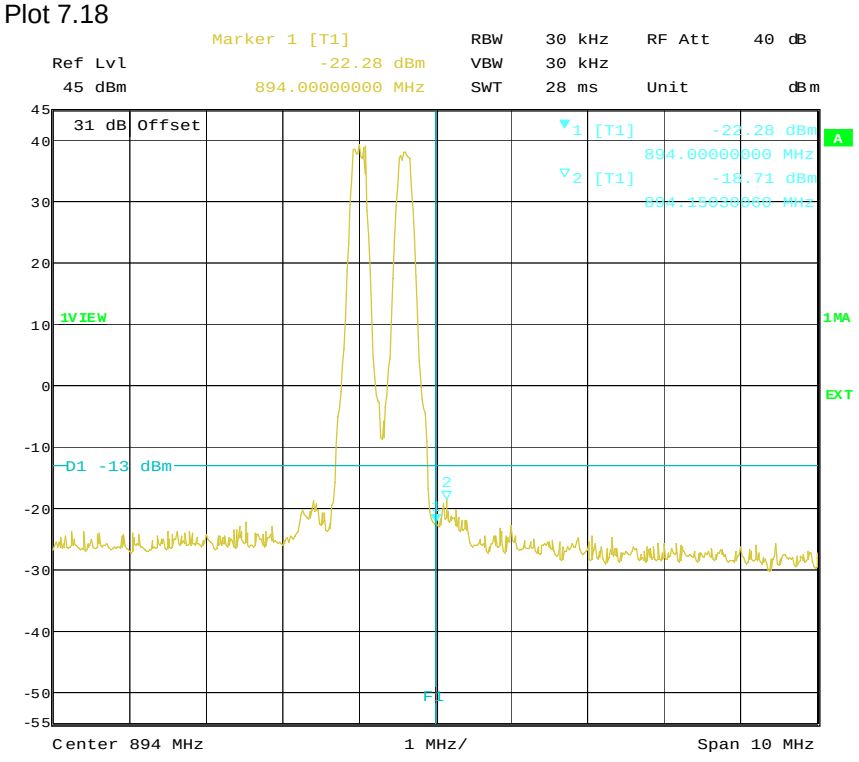
Plot 7.17



Plot 7.18



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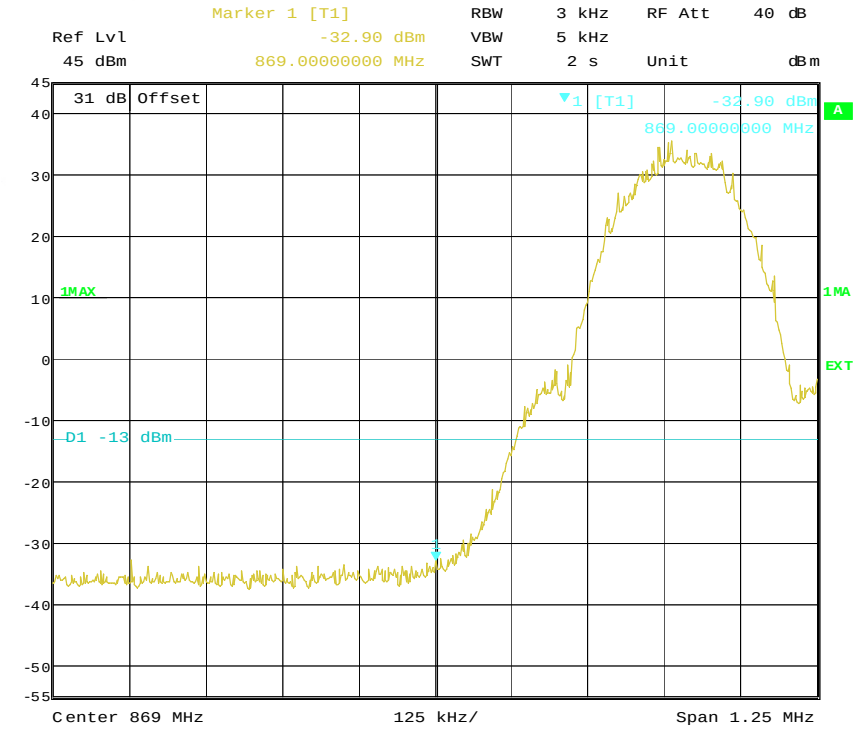
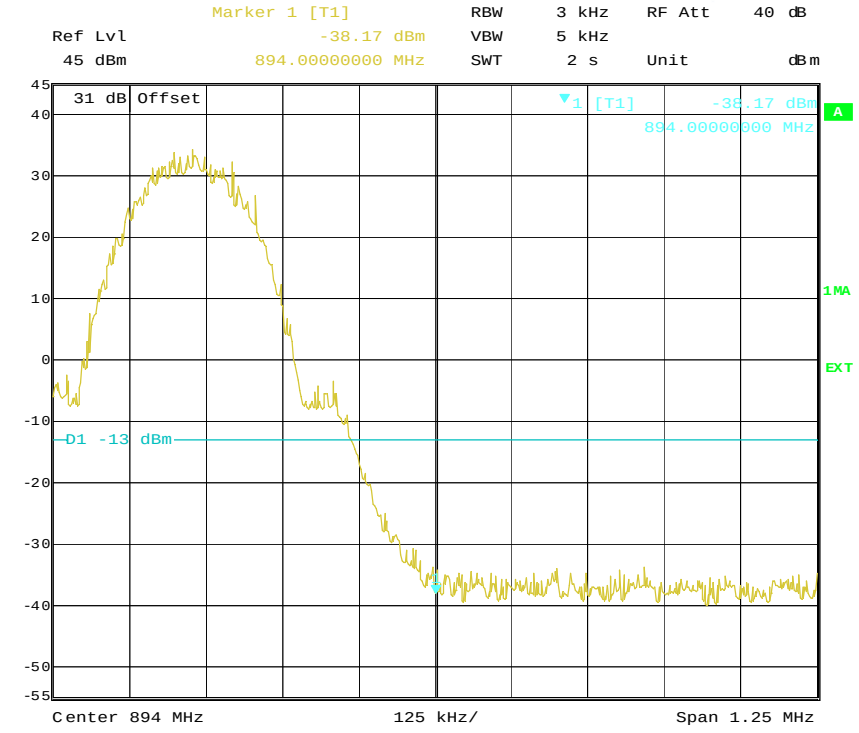
Plot 7.19



Date: 7.APR.2010 10:23:54

Plot 7.20



Date: 7.APR.2010 10:35:25

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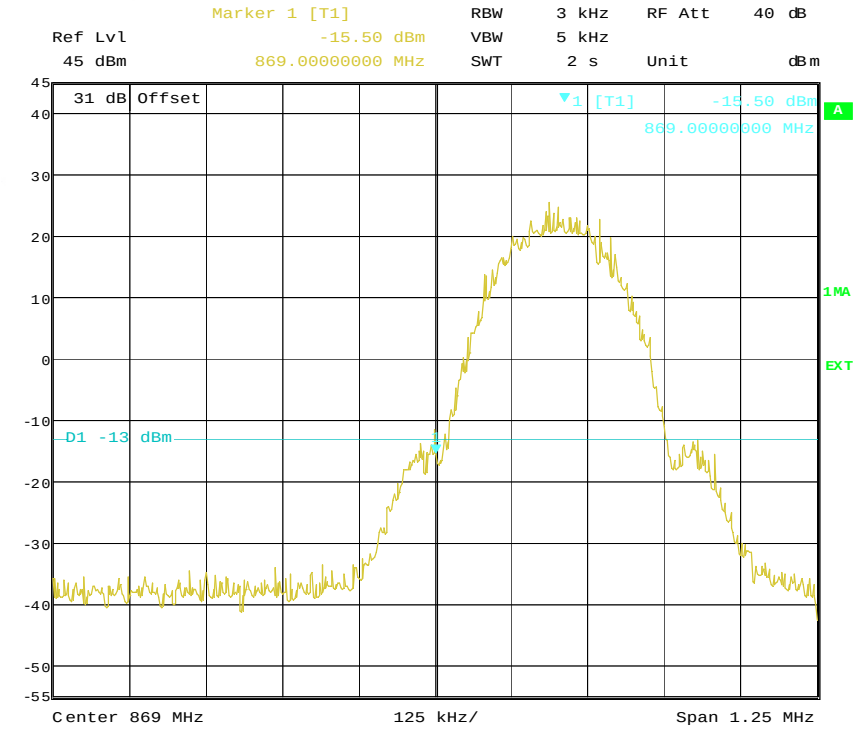
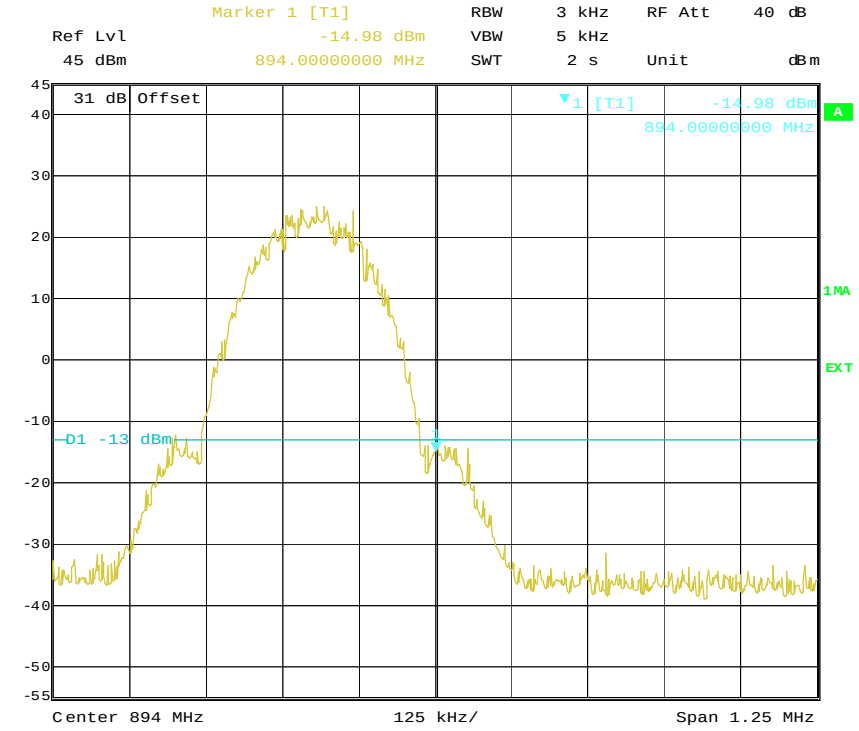
Plot 7.21



Date: 7.APR.2010 10:26:00

Plot 7.22



Date: 7.APR.2010 10:36:28

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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	-28.9	-13	Plot 7.23	
CDMA, low ch.	3 000 – 11 000	1	-23.1	-13	Plot 7.24	
CDMA, low ch.	11 000 – 20 000	1	-25.2	-13	Plot 7.25	
CDMA, mid. ch.	9kHz – 3 000	1	-28.4	-13	Plot 7.26	
CDMA, mid. ch.	3 000 – 11 000	1	-19.1	-13	Plot 7.27	
CDMA, mid. ch.	11 000 – 20 000	1	-26.1	-13	Plot 7.28	
CDMA, high ch.	9kHz – 3 000	1	-28.3	-13	Plot 7.29	
CDMA, high ch.	3 000 – 11 000	1	-18.0	-13	Plot 7.30	
CDMA, high ch.	11 000 – 20 000	1	-26.1	-13	Plot 7.31	
GSM, low ch.	9kHz – 3 000	1	-28.2	-13	Plot 7.32	
GSM, low ch.	3 000 – 11 000	1	-25.4	-13	Plot 7.33	
GSM, low ch.	11 000 – 20 000	1	-26.1	-13	Plot 7.34	
GSM, mid. ch.	9kHz – 3 000	1	-28.2	-13	Plot 7.35	
GSM, mid. ch.	3 000 – 11 000	1	-22.3	-13	Plot 7.36	
GSM, mid. ch.	11 000 – 20 000	1	-26.0	-13	Plot 7.37	
GSM, high ch.	9kHz – 3 000	1	-28.1	-13	Plot 7.38	
GSM, high ch.	3 000 – 11 000	1	-20.5	-13	Plot 7.39	
GSM, high ch.	11 000 – 20 000	1	-26.5	-13	Plot 7.40	

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	-31.0	-13	Plot 7.41	
2 CDMA carriers at 1930.8 and 1933 MHz	1925 - 1935	30	-14.1	-13	Plot 7.42	1
2 CDMA carriers at 1986 and 1989.2 MHz	1975 - 1995	30	-16.1	-13	Plot 7.43	
CDMA carrier at 1930.8 MHz	1927.5 – 1932.5	30	-14.4	-13	Plot 7.44	1
CDMA carrier at 1989.2 MHz	1987.5 – 1992.5	30	-14.8	-13	Plot 7.45	1
GSM carrier at 1930.4 MHz	1927.5 – 1932.5	3	-32.8	-13	Plot 7.46	
GSM carrier at 1989.6 MHz	1987.5 – 1992.5	3	-31.2	-13	Plot 7.47	

Note 1: The measured result is below the upper limit, but by a margin less than half of the uncertainty interval; it is therefore not possible to state compliance based on the 95% level of confidence. However, the result indicates that compliance is more probable than noncompliance.

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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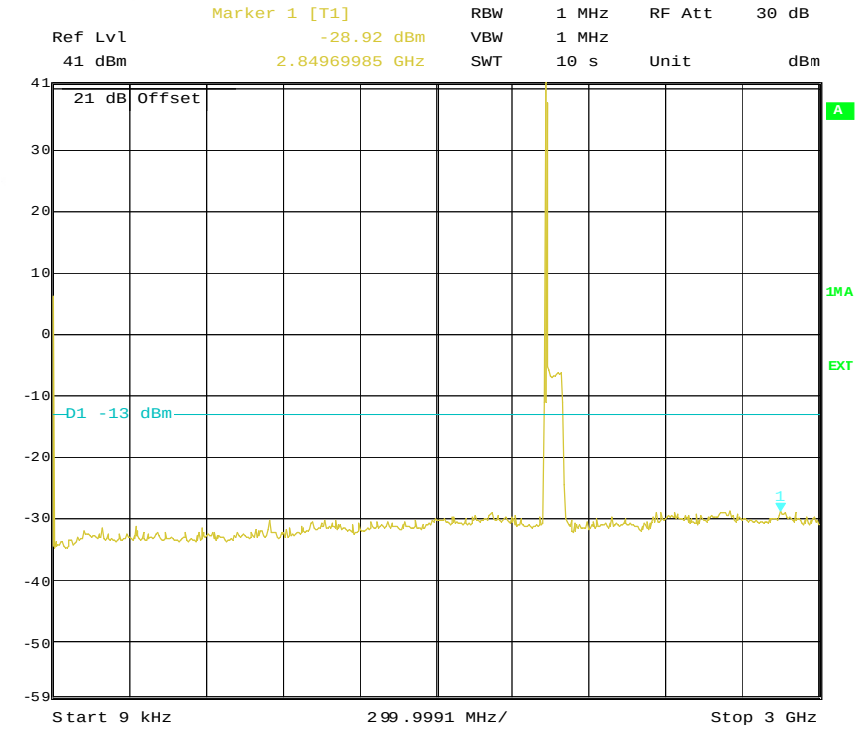
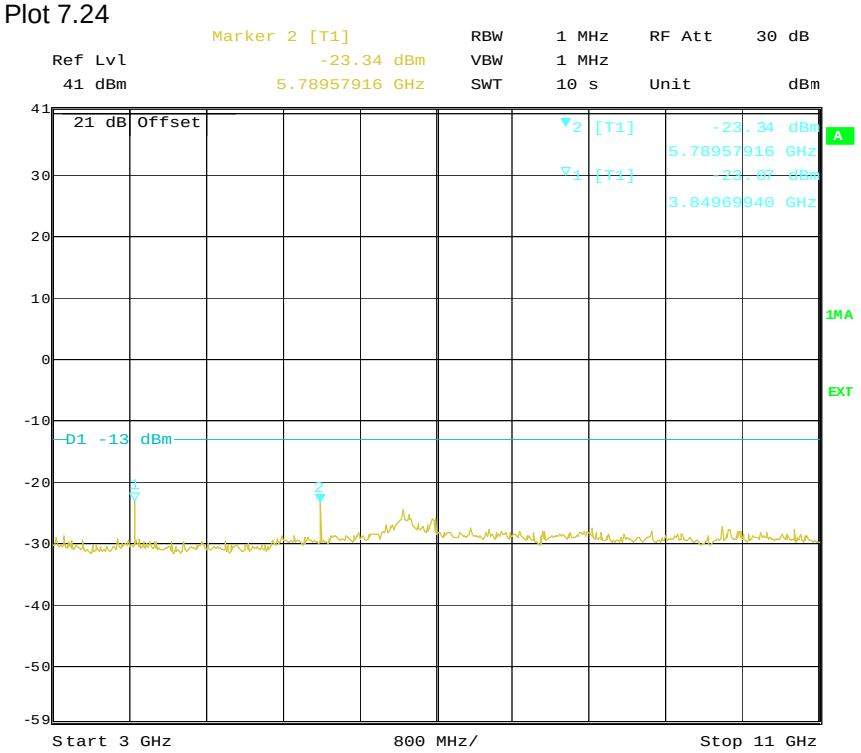
Plot 7.23



Date: 30.MAR.2010 15:11:01

Plot 7.24



Date: 30.MAR.2010 15:13:09

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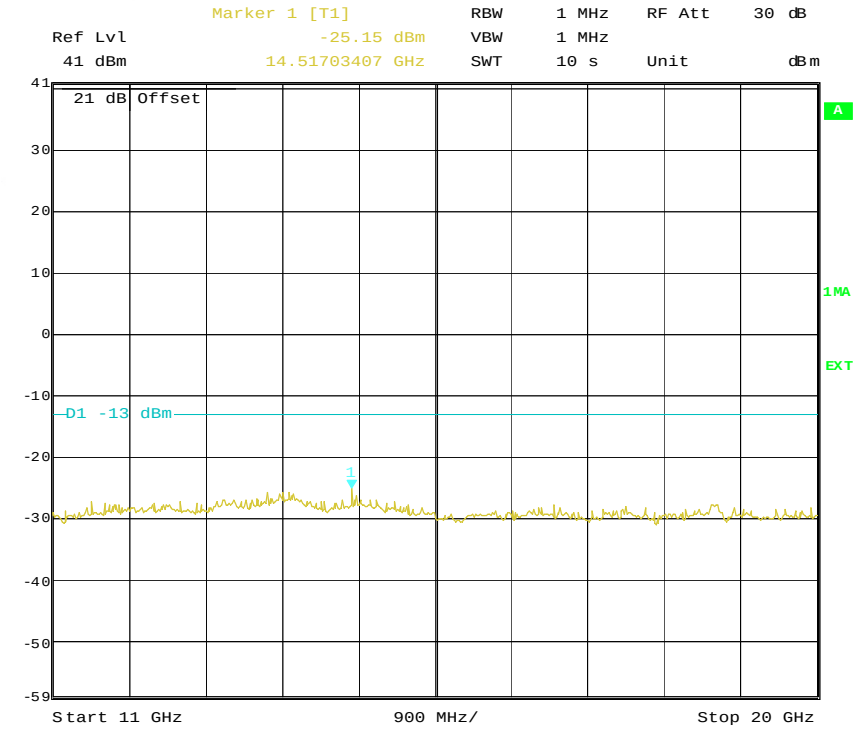
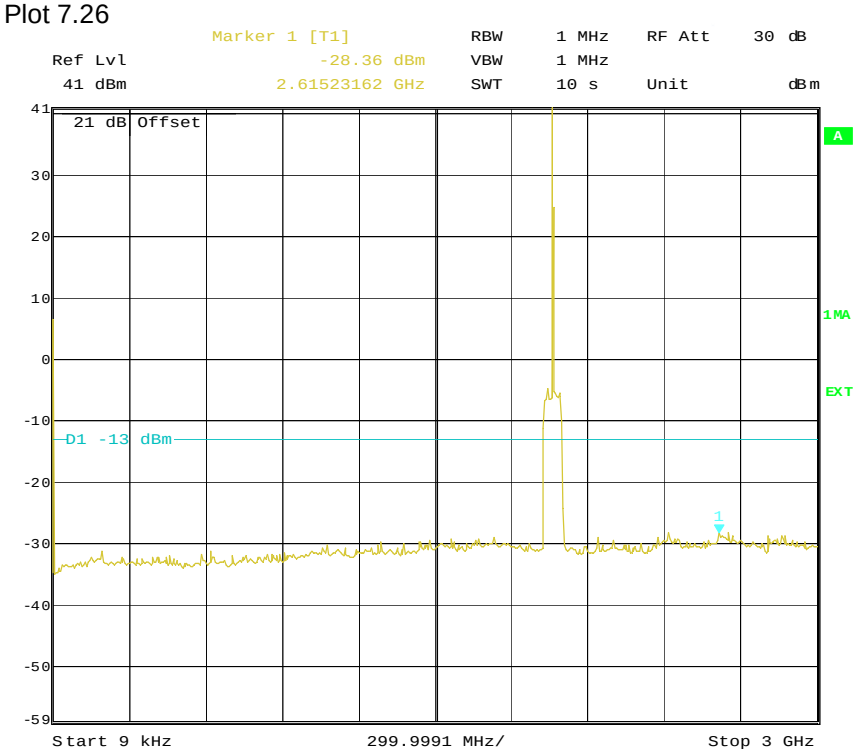
Plot 7.25



Date: 30.MAR.2010 15:13:53

Plot 7.26



Date: 30.MAR.2010 15:14:57

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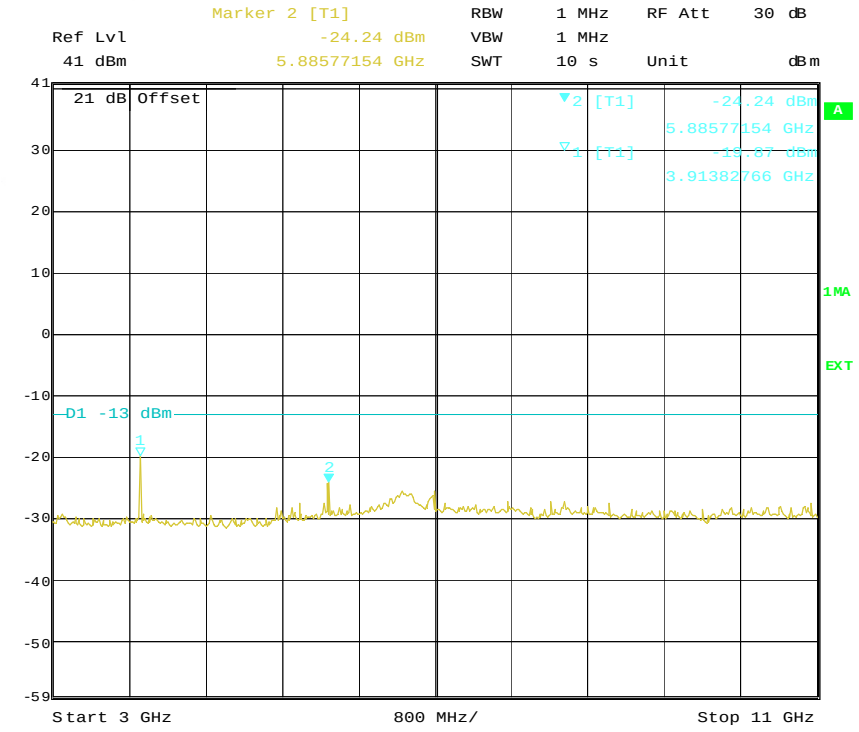
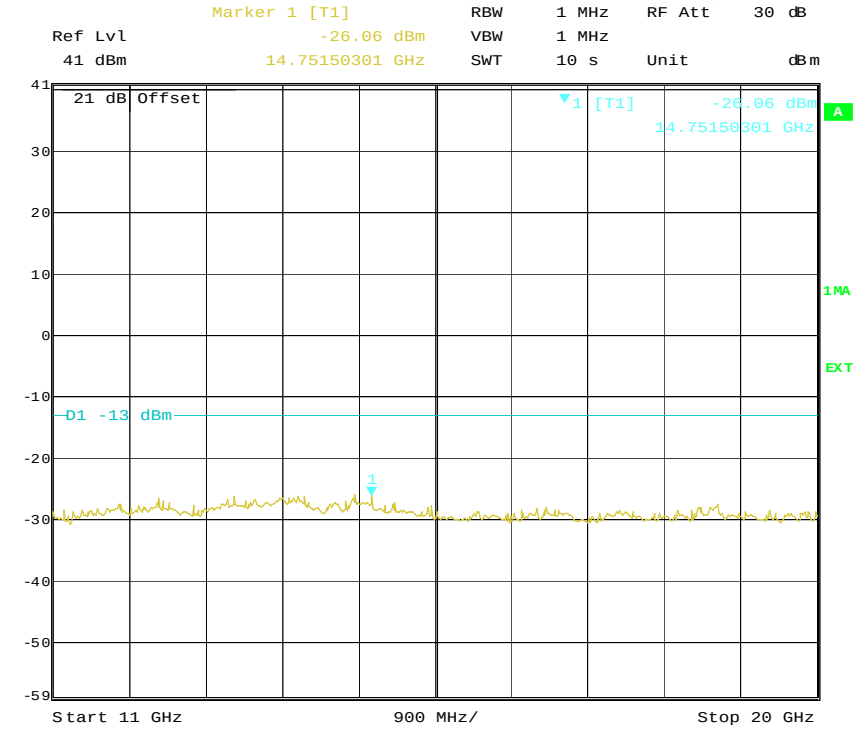
Plot 7.27



Date: 30.MAR.2010 15:15:52

Plot 7.28



Date: 30.MAR.2010 15:16:29

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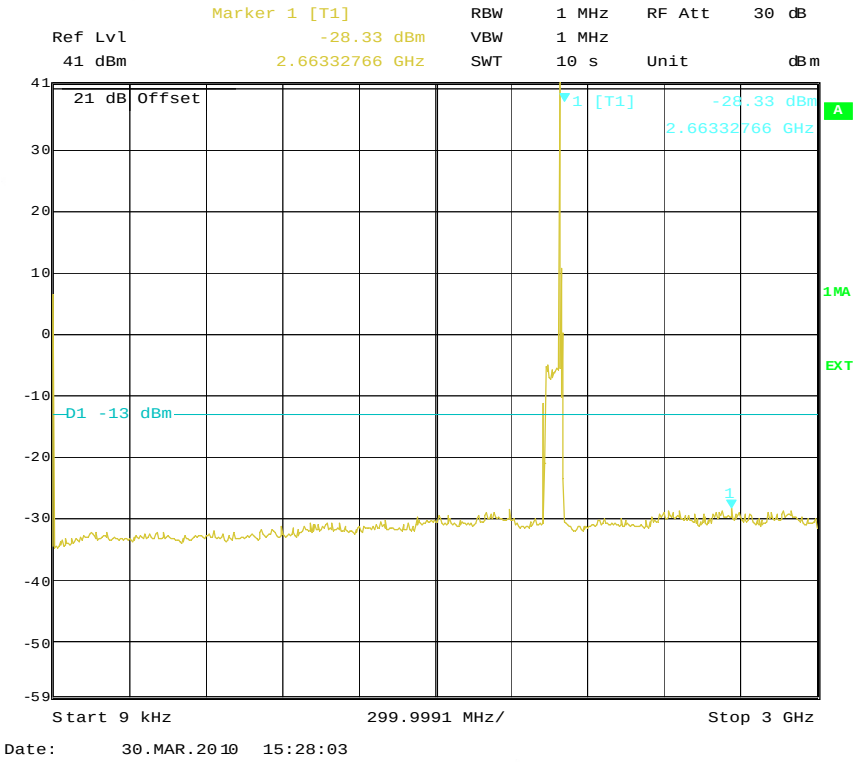
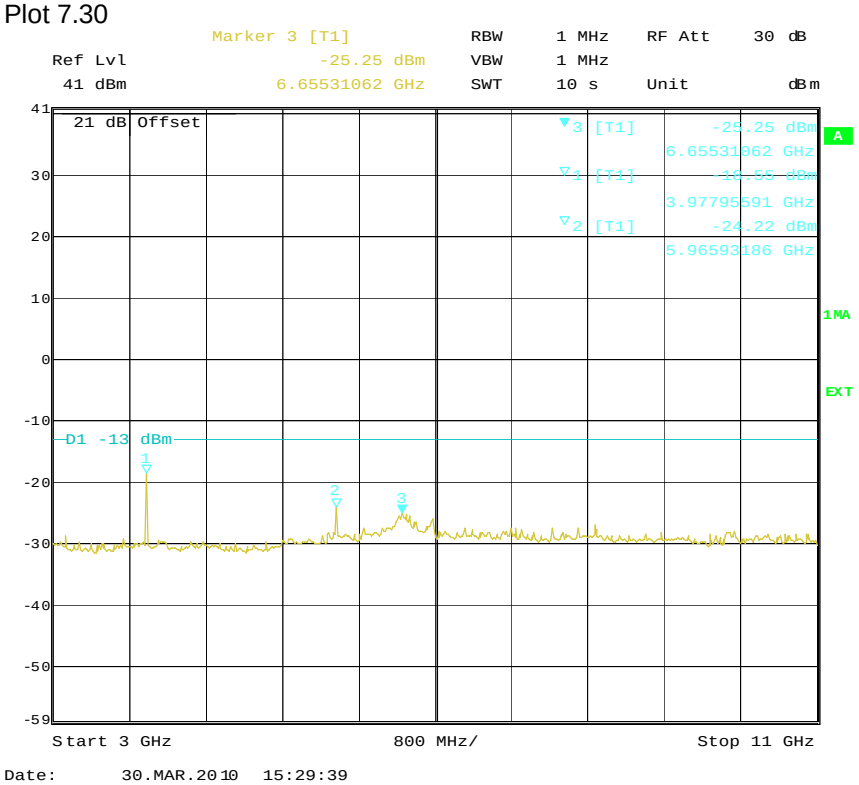
Plot 7.29



Date: 30.MAR.2010 15:28:03

Plot 7.30



Date: 30.MAR.2010 15:29:39

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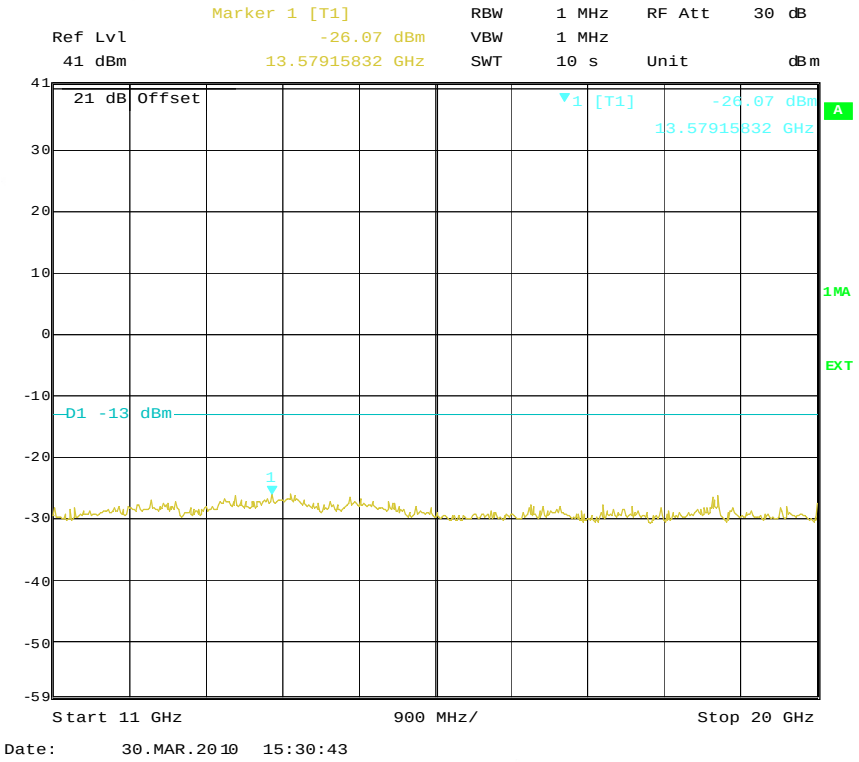
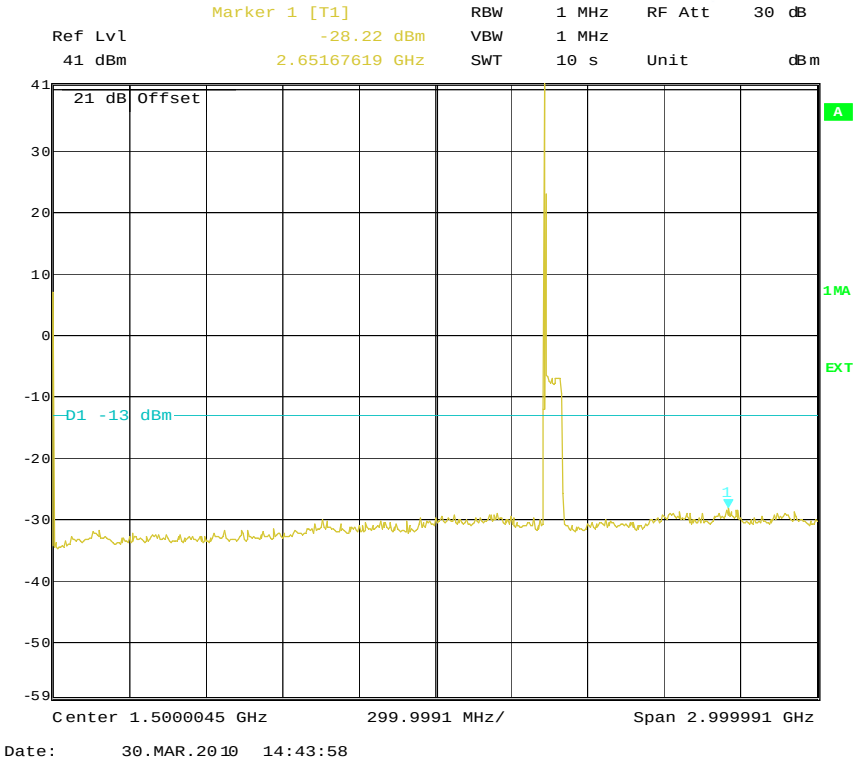
Plot 7.31



Date: 30.MAR.2010 15:30:43

Plot 7.32



Date: 30.MAR.2010 14:43:58

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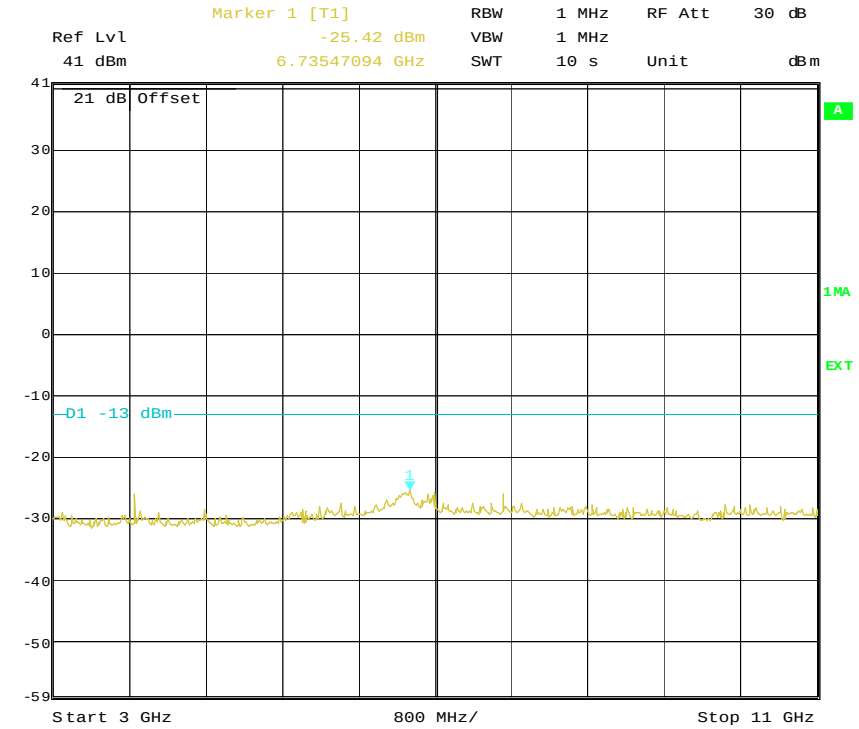
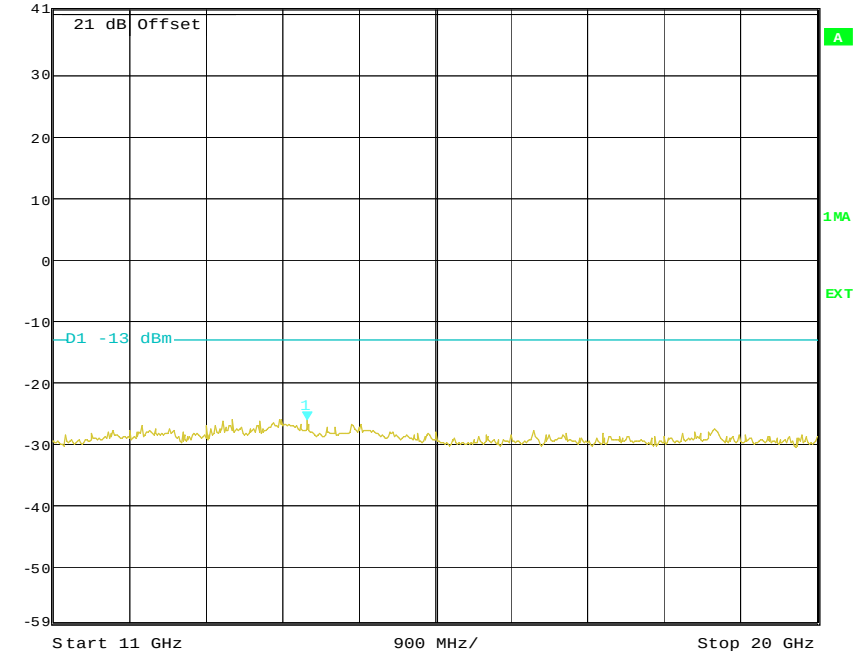
Plot 7.33



Date: 30.MAR.2010 14:45:21

Plot 7.34



Date: 30.MAR.2010 14:46:19

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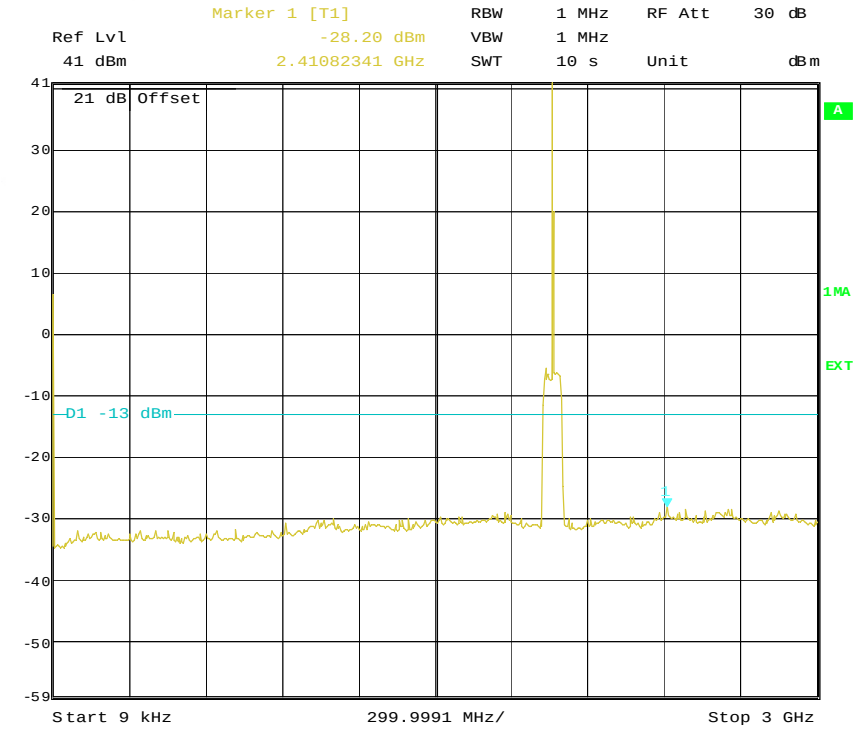
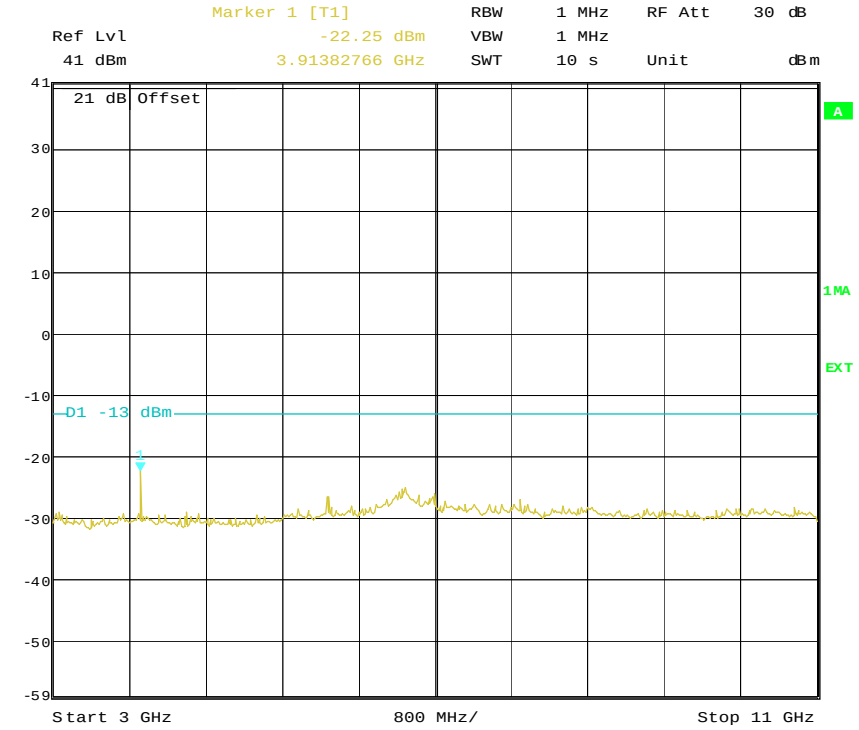
Plot 7.35



Date: 30.MAR.2010 14:47:49

Plot 7.36



Date: 30.MAR.2010 14:49:07

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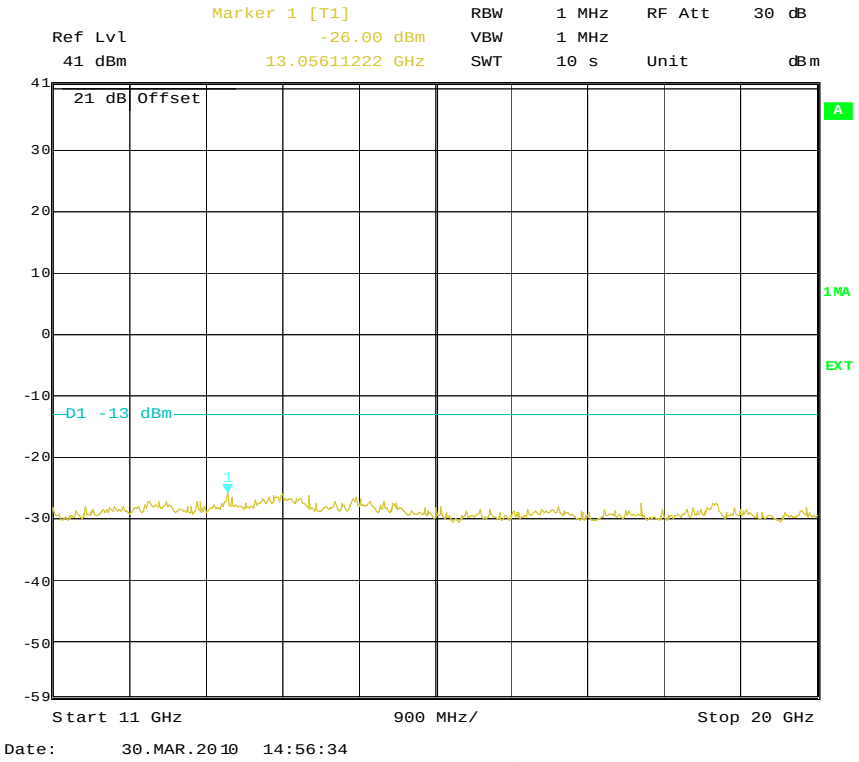
Plot 7.37



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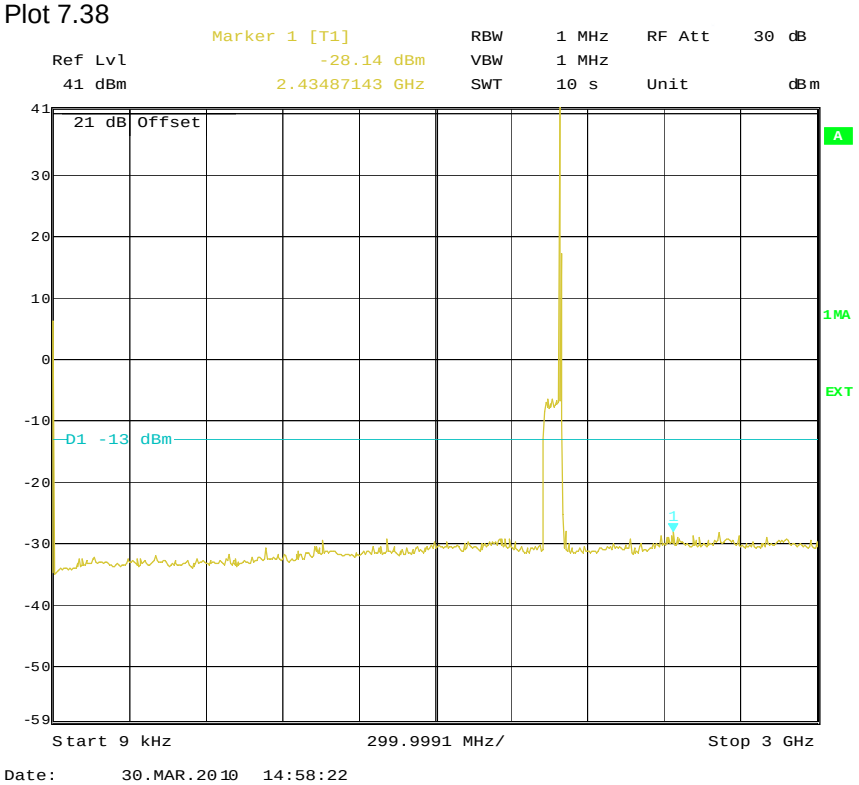
Plot 7.38



Date: 30.MAR.2010 14:58:22

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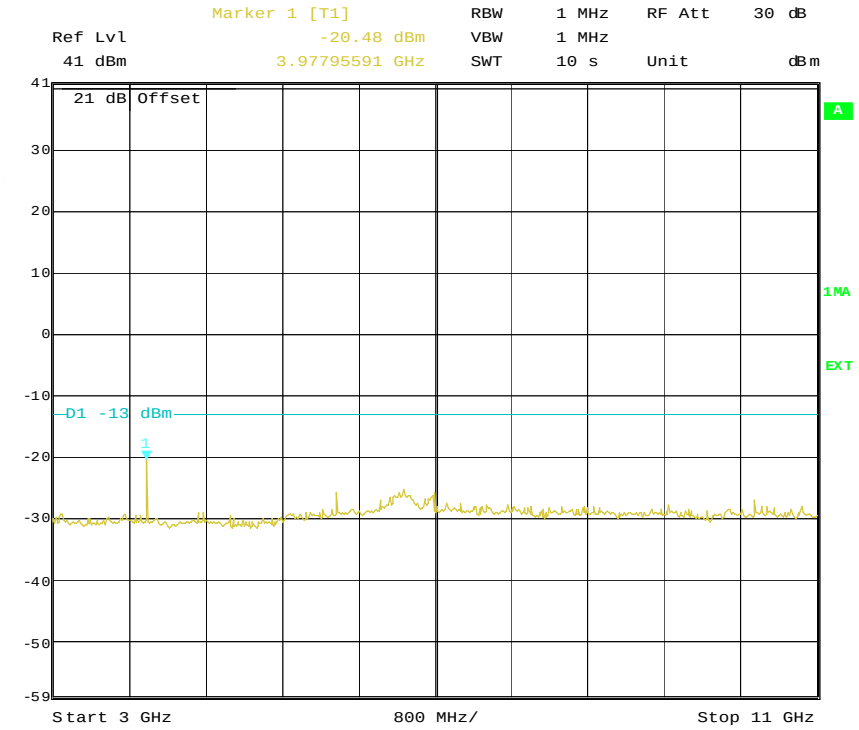
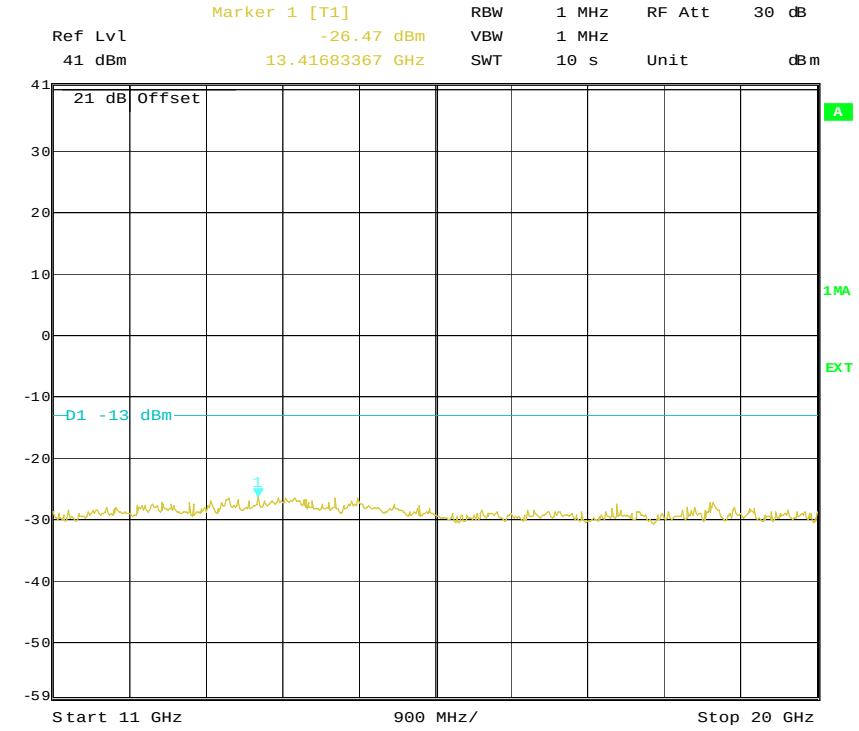
Plot 7.39



Date: 30.MAR.2010 15:00:19

Plot 7.40



Date: 30.MAR.2010 15:00:51

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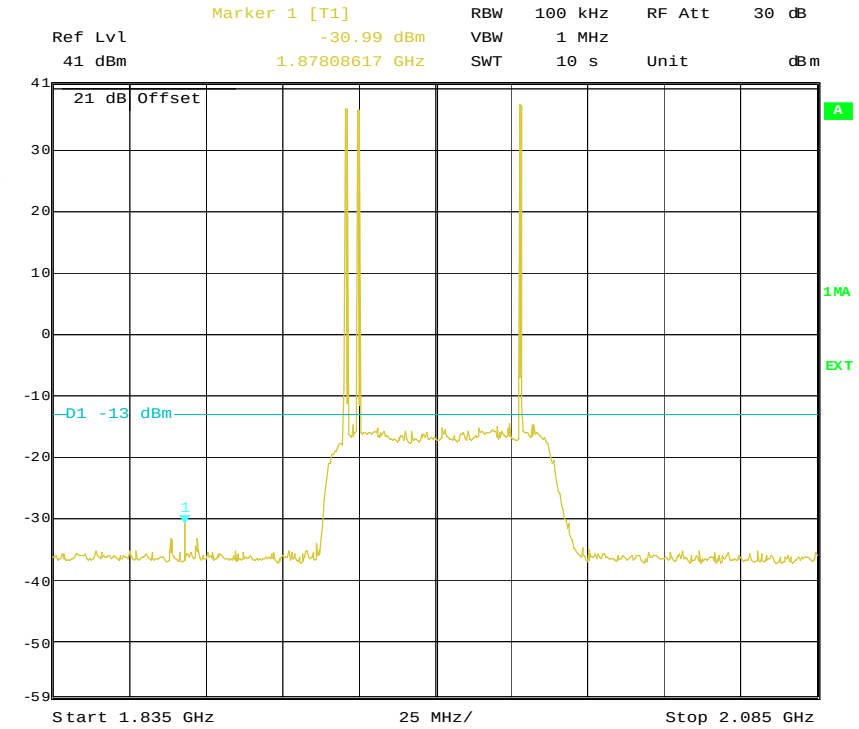
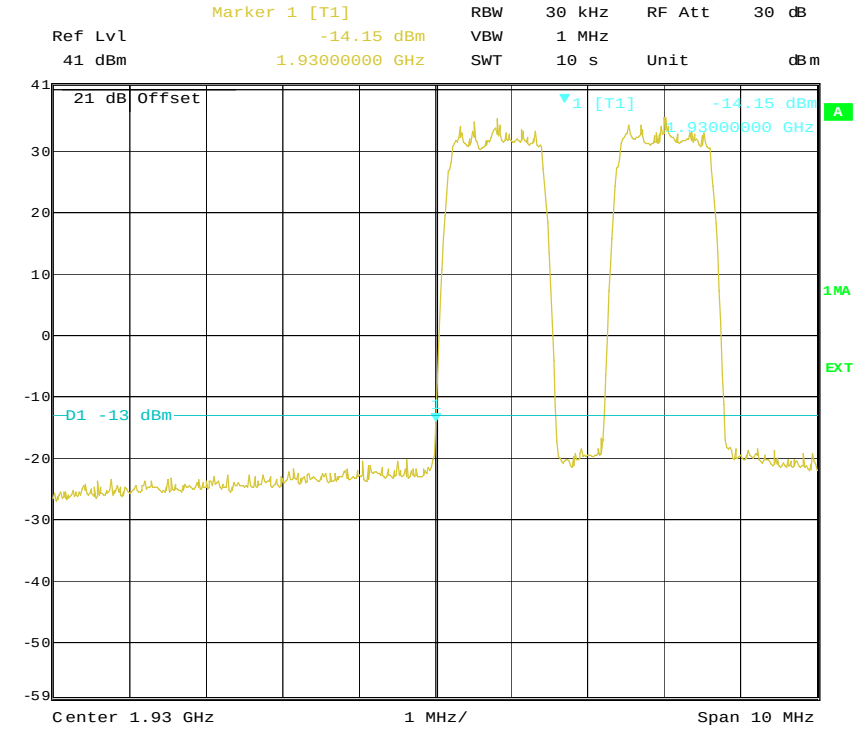
Plot 7.41



Date: 30.MAR.2010 16:26:47

Plot 7.42



Date: 30.MAR.2010 16:10:56

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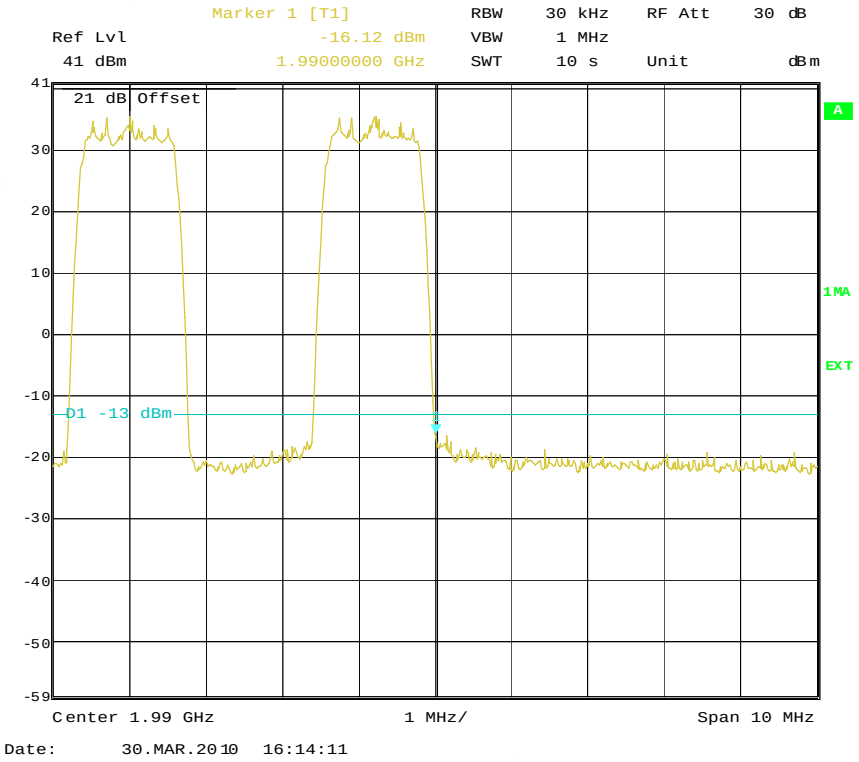
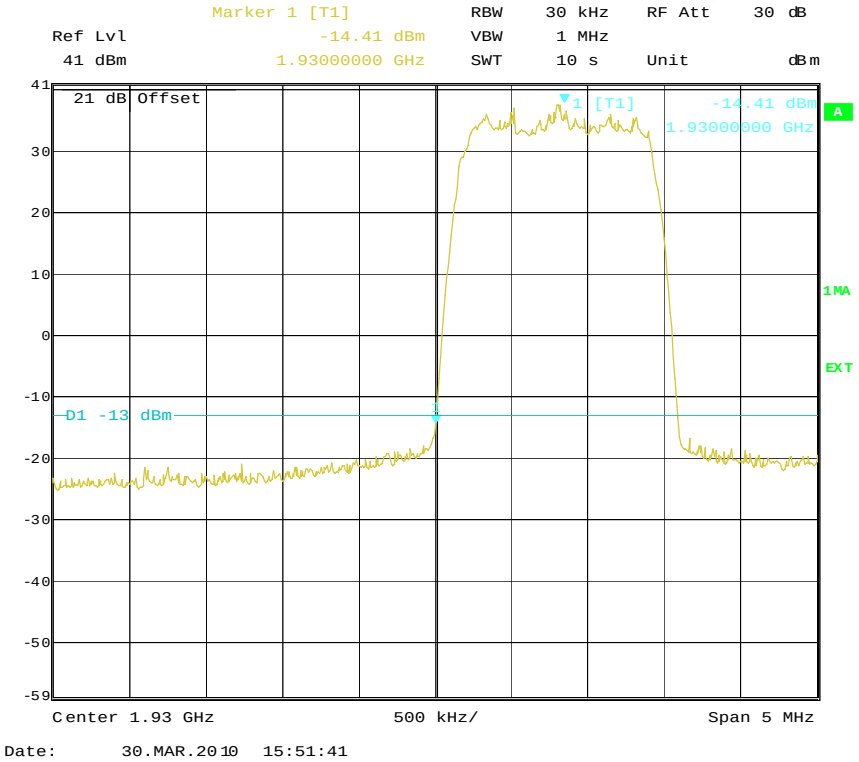
Plot 7.43



Plot 7.44



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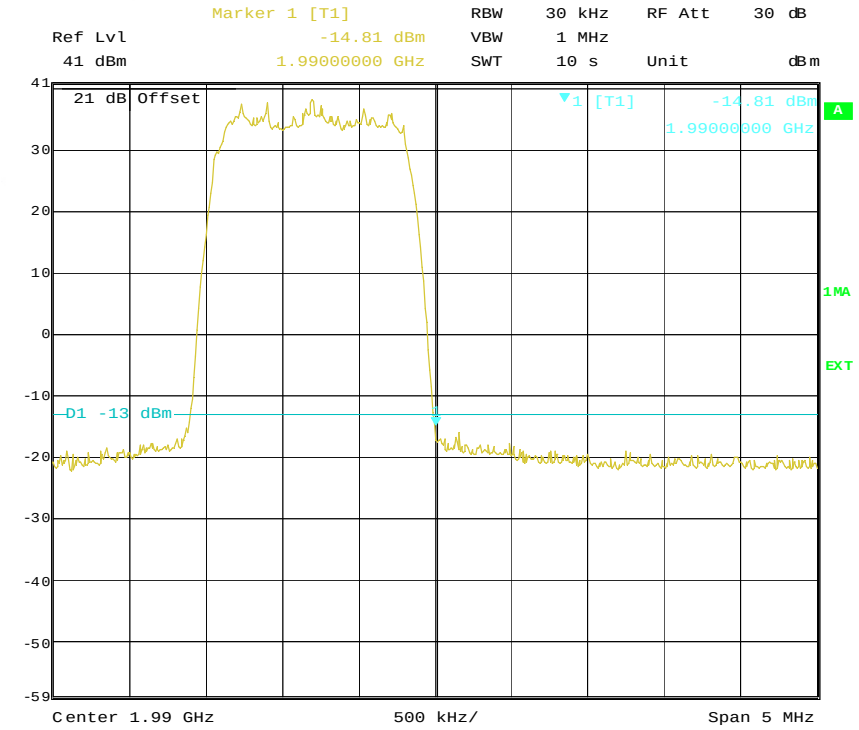
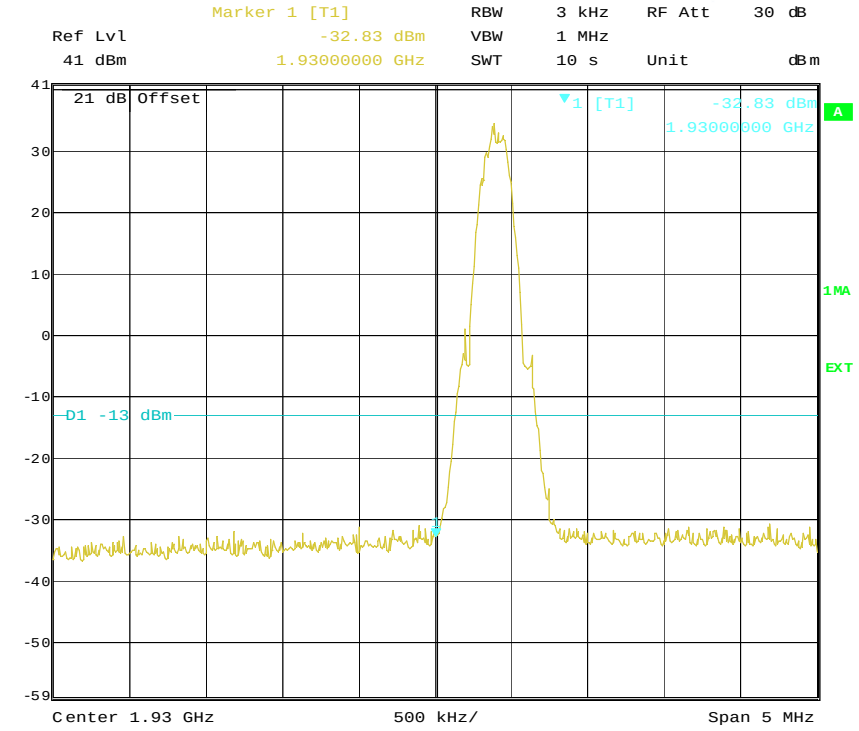
Plot 7.45



Date: 30.MAR.2010 15:53:08

Plot 7.46



Date: 30.MAR.2010 15:58:33

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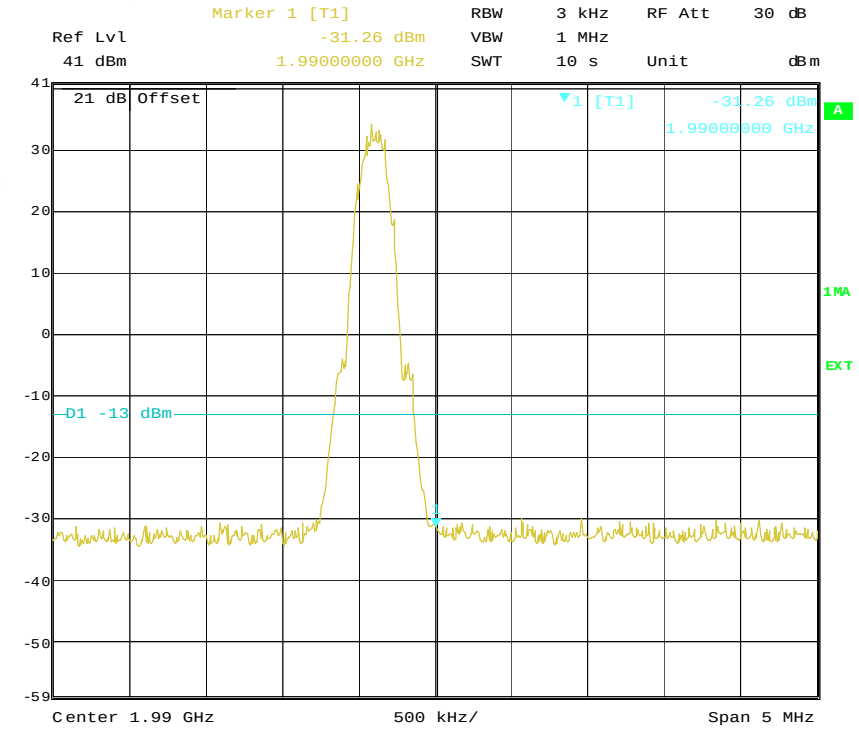
Plot 7.47



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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	-28.4	-13	Plot 7.48	
WCDMA, low ch.	3 000 – 12 000	1	-19.0	-13	Plot 7.49	
WCDMA, low ch.	12 000 – 22 000	1	-25.3	-13	Plot 7.50	
WCDMA, mid. ch.	9kHz – 3 000	1	-28.0	-13	Plot 7.51	
WCDMA, mid. ch.	3 000 – 12 000	1	-18.6	-13	Plot 7.52	
WCDMA, mid. ch.	12 000 – 22 000	1	-24.5	-13	Plot 7.53	
WCDMA, high ch.	9kHz – 3 000	1	-28.4	-13	Plot 7.54	
WCDMA, high ch.	3 000 – 12 000	1	-19.2	-13	Plot 7.55	
WCDMA, high ch.	12 000 – 22 000	1	-24.1	-13	Plot 7.56	

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	-19.1	-13	Plot 7.57	
2 WCDMA carriers at 2147.5 and 2152.5 MHz	2135 – 2175	30	-24.1	-13	Plot 7.58	
WCDMA carrier at 2112.5 MHz	2090 – 2130	30	-14.7	-13	Plot 7.59	1
WCDMA carrier at 2152.5 MHz	2135 – 2175	30	-19.6	-13	Plot 7.60	
3 CW tones at 2112, 2114 and 2152 MHz	2072.5 – 2192.5	100	-18.3	-13	Plot 7.61	

Note 1: The measured result is below the upper limit, but by a margin less than half of the uncertainty interval; it is therefore not possible to state compliance based on the 95% level of confidence. However, the result indicates that compliance is more probable than noncompliance.

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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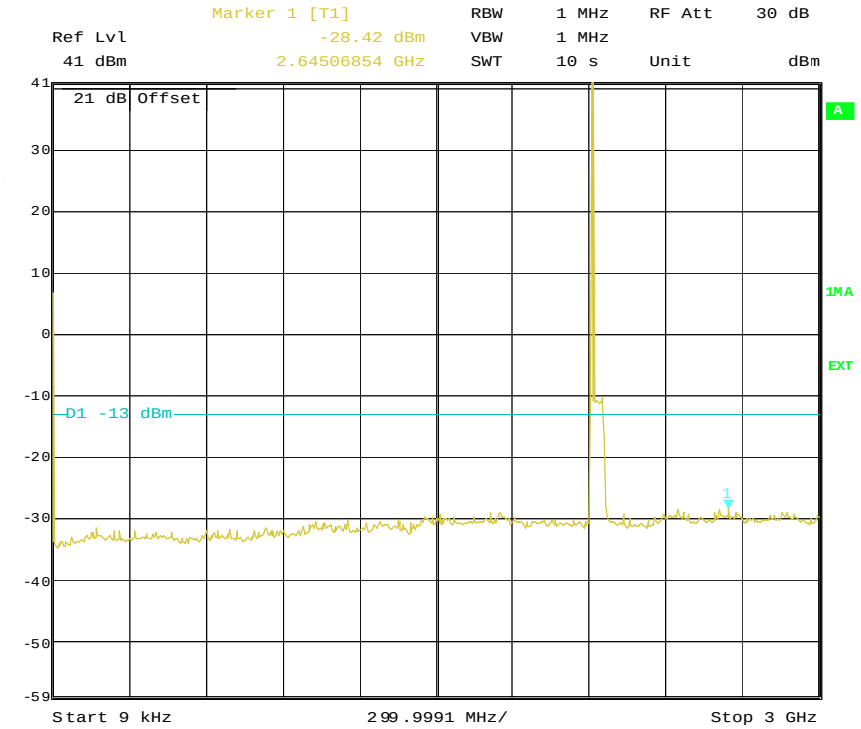
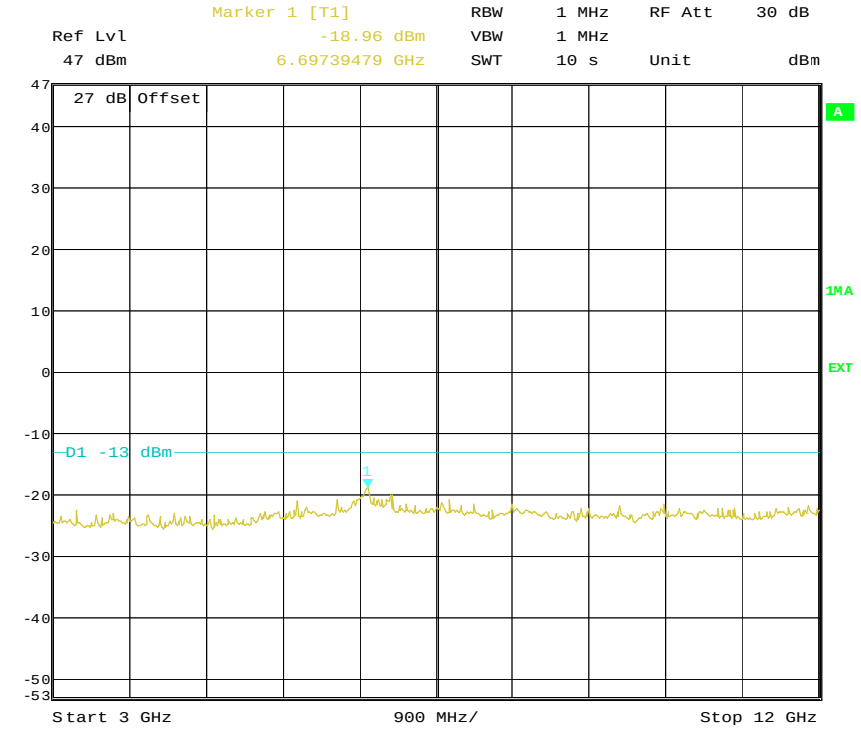
Plot 7.48



Date: 31.MAR.2010 10:32:26

Plot 7.49



Date: 31.MAR.2010 10:50:04

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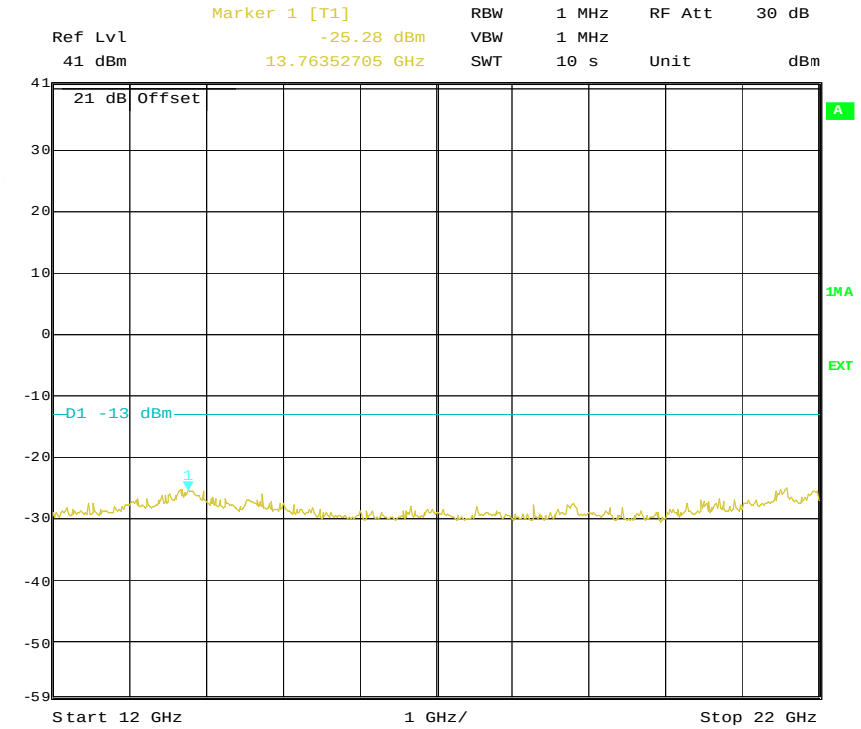
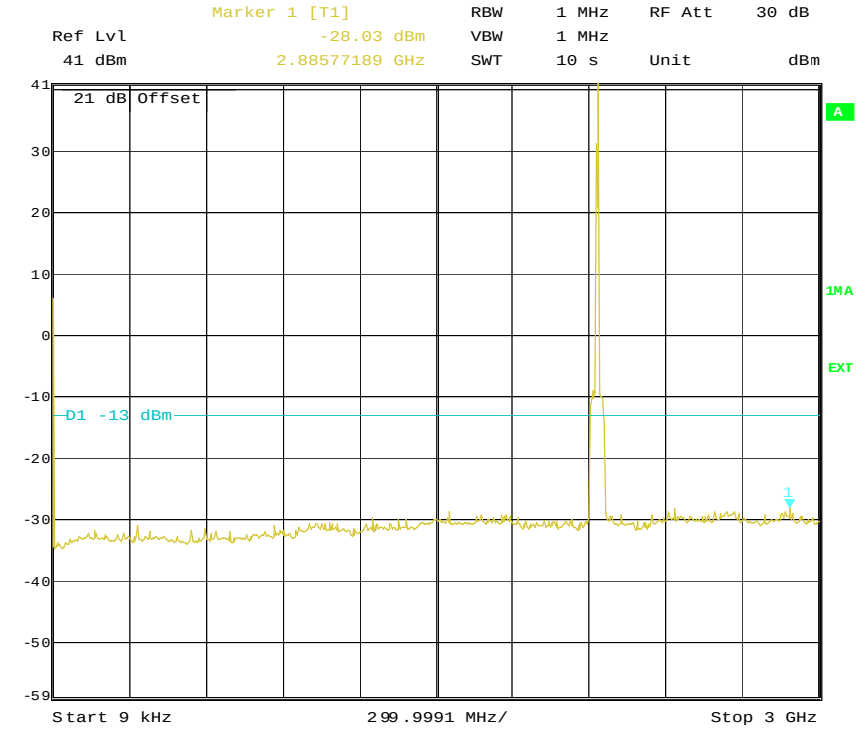
Plot 7.50



Date: 31.MAR.2010 10:35:15

Plot 7.51



Date: 31.MAR.2010 10:44:48

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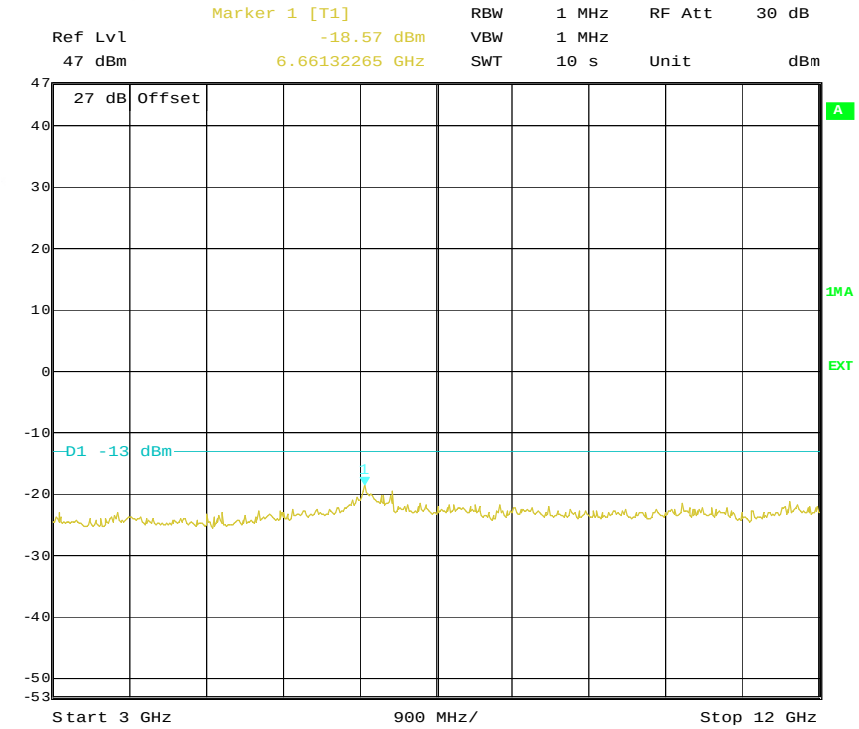
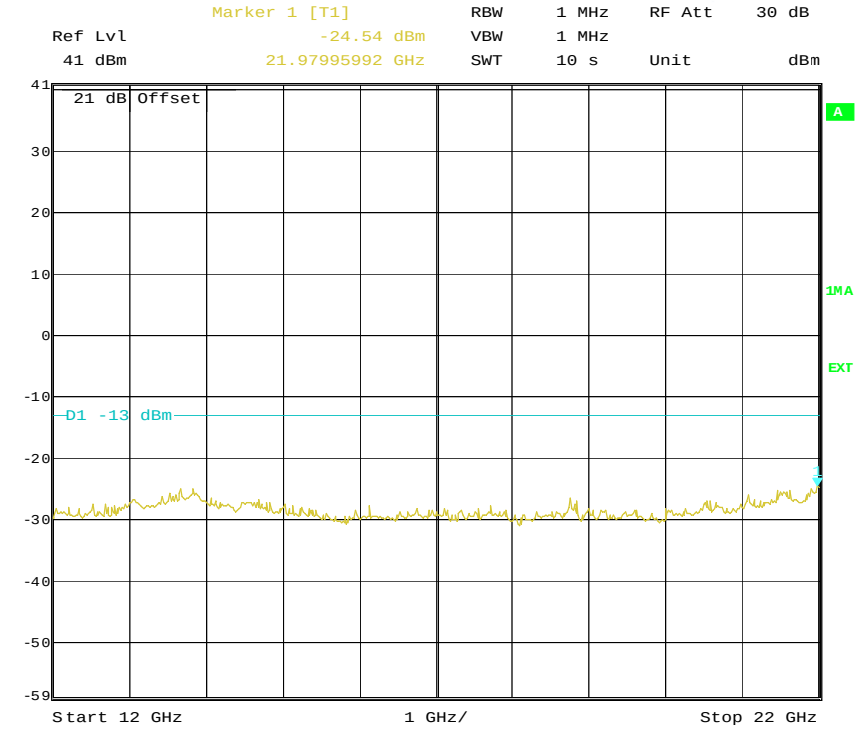
Plot 7.52



Date: 31.MAR.2010 10:48:52

Plot 7.53



Date: 31.MAR.2010 10:36:02

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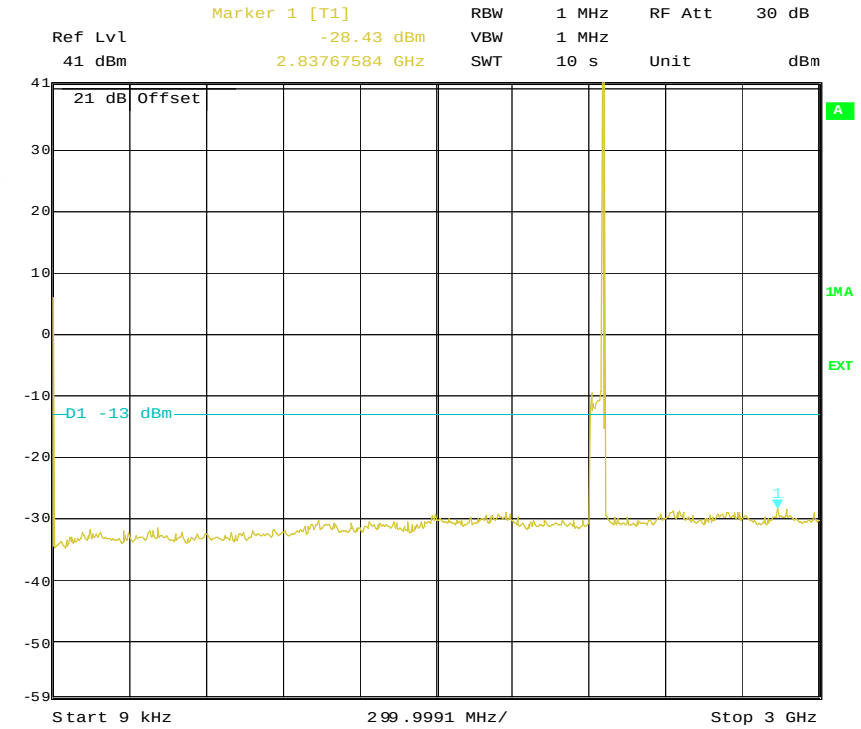
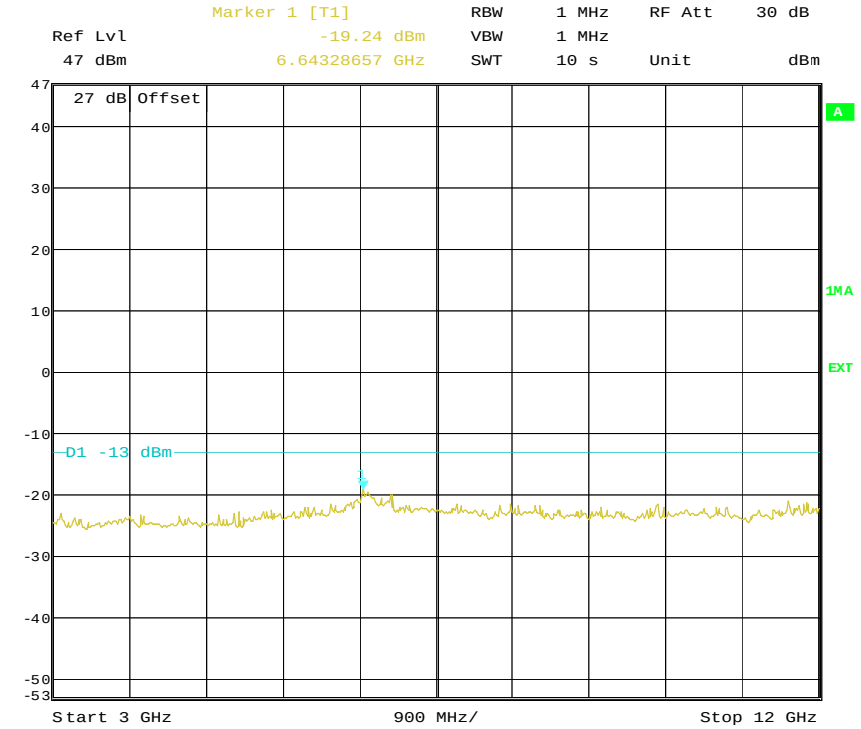
Plot 7.54



Date: 31.MAR.2010 10:43:58

Plot 7.55



Date: 31.MAR.2010 10:50:53

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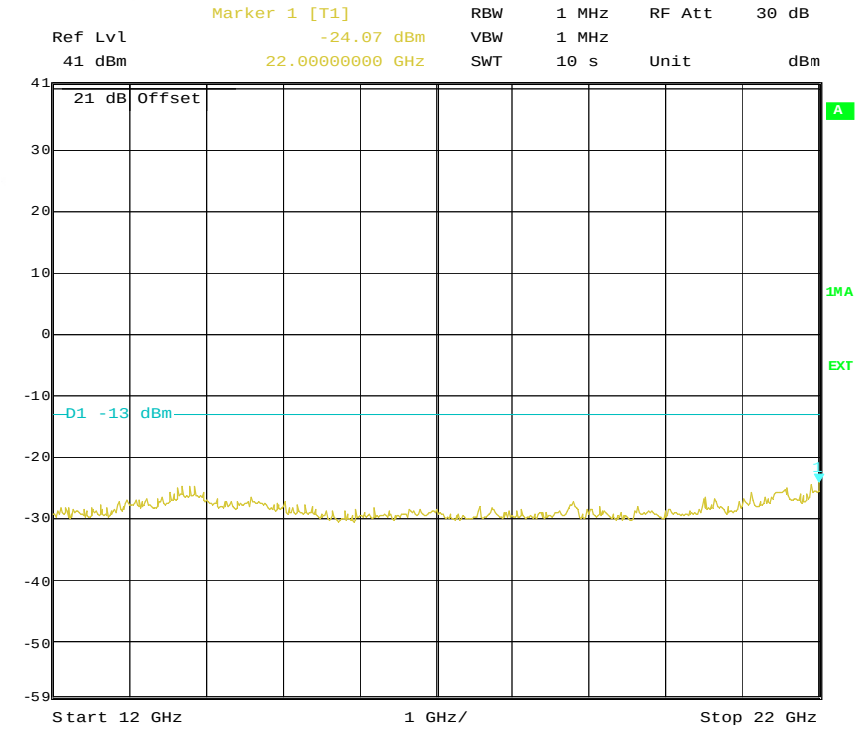
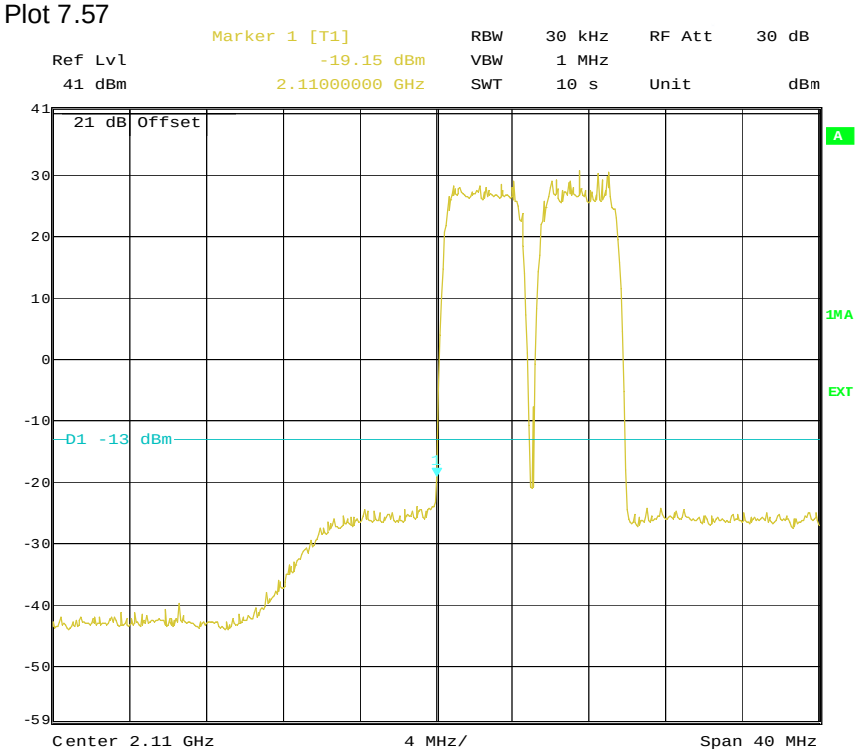
Plot 7.56



Date: 31.MAR.2010 10:36:42

Plot 7.57



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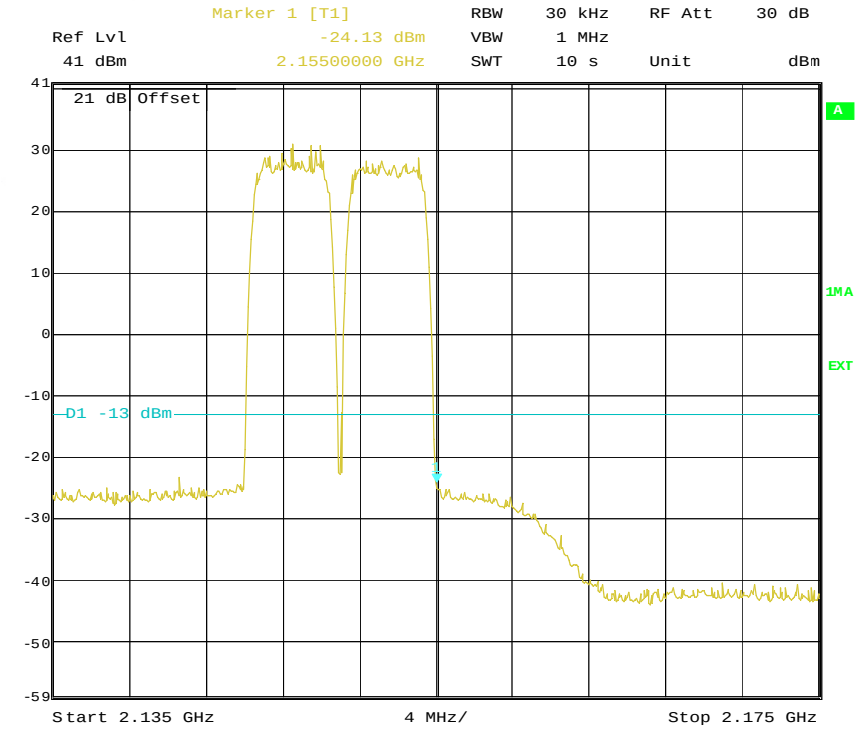
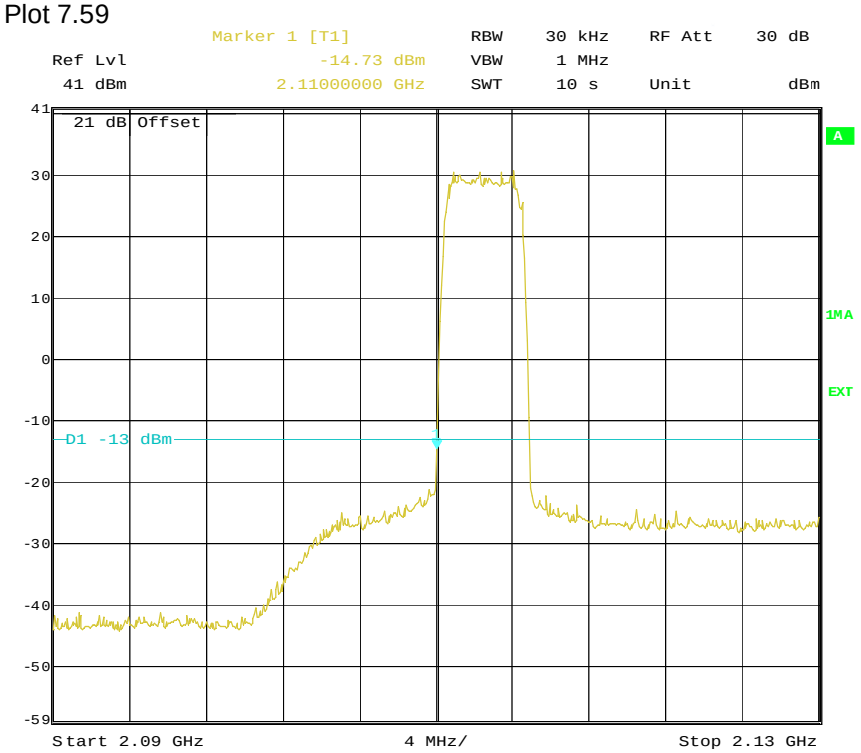
Plot 7.58



Date: 31.MAR.2010 10:23:58

Plot 7.59



Date: 31.MAR.2010 10:18:15

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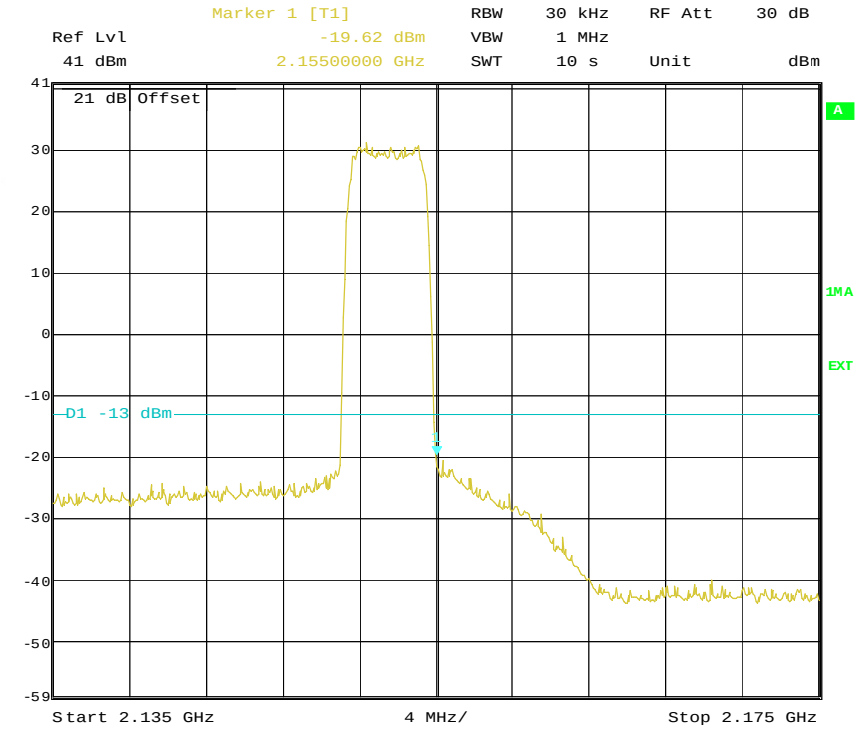
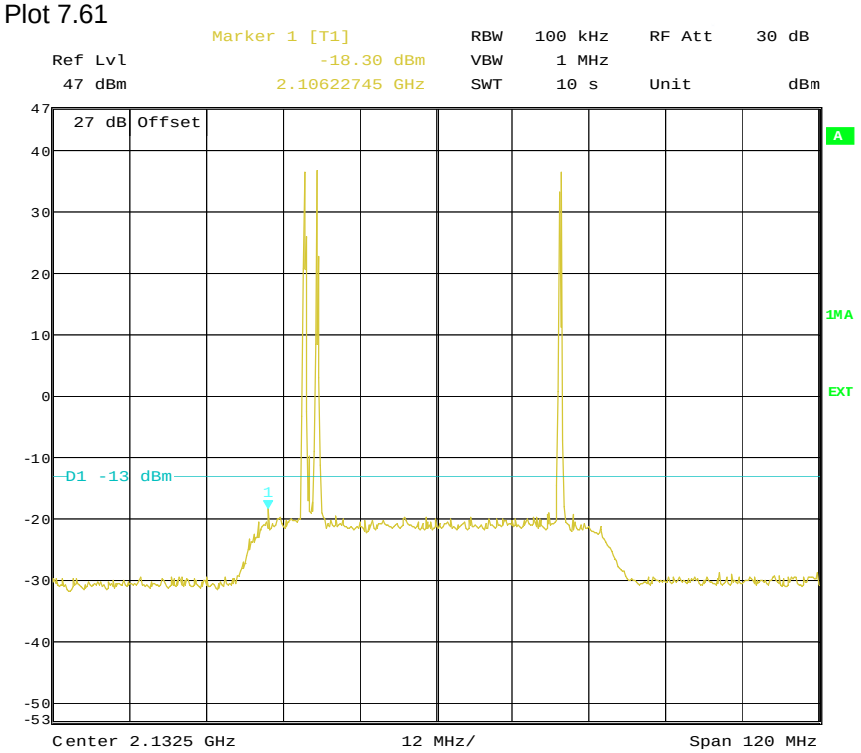
Plot 7.60



Date: 31.MAR.2010 10:19:57

Plot 7.61



Date: 31.MAR.2010 11:03:11

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8. OUT OF BAND REJECTION

Date of test: 2007-04-09

8.1 Test results

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

Amplifier	20 dB Bandwidth (MHz)	Plots
850	49.299	Plot 8.1
1900	82.966	Plot 8.2
AWS	63.126	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]

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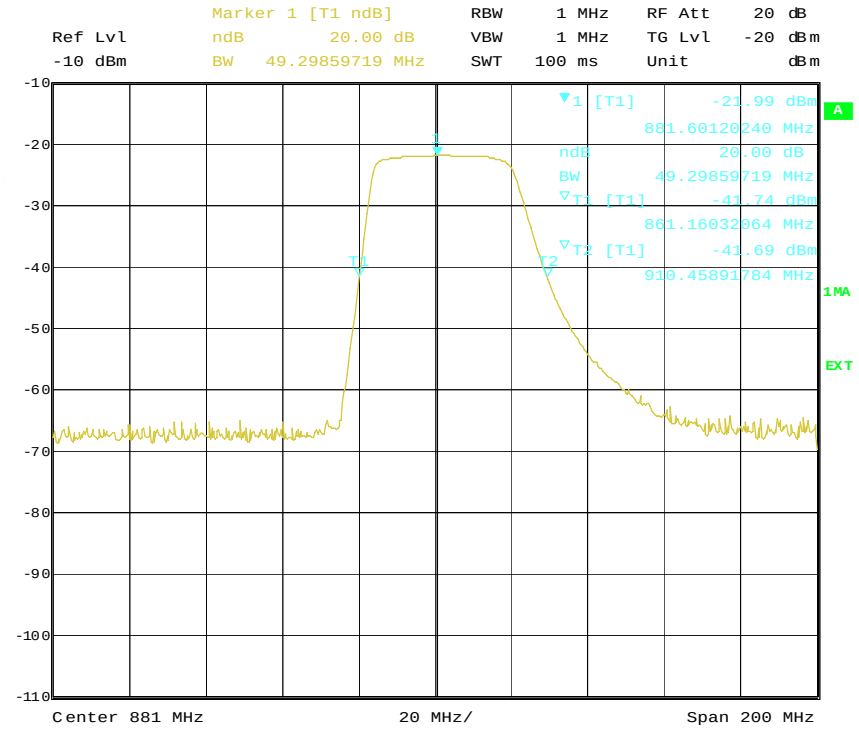
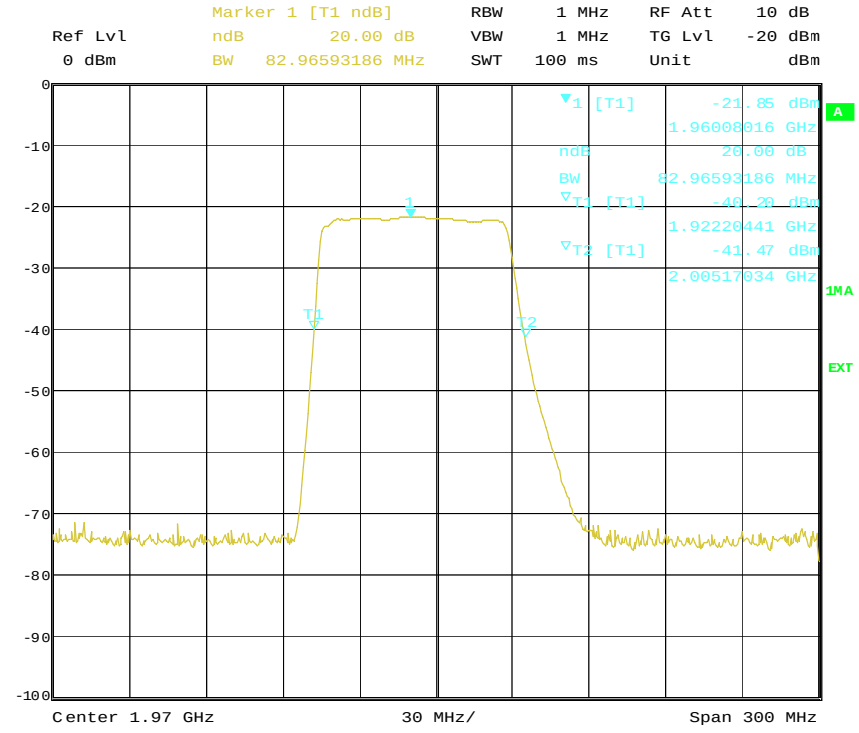
Plot 8.1



Date: 9.APR.2010 08:42:12

Plot 8.2



Date: 9.APR.2010 09:10:39

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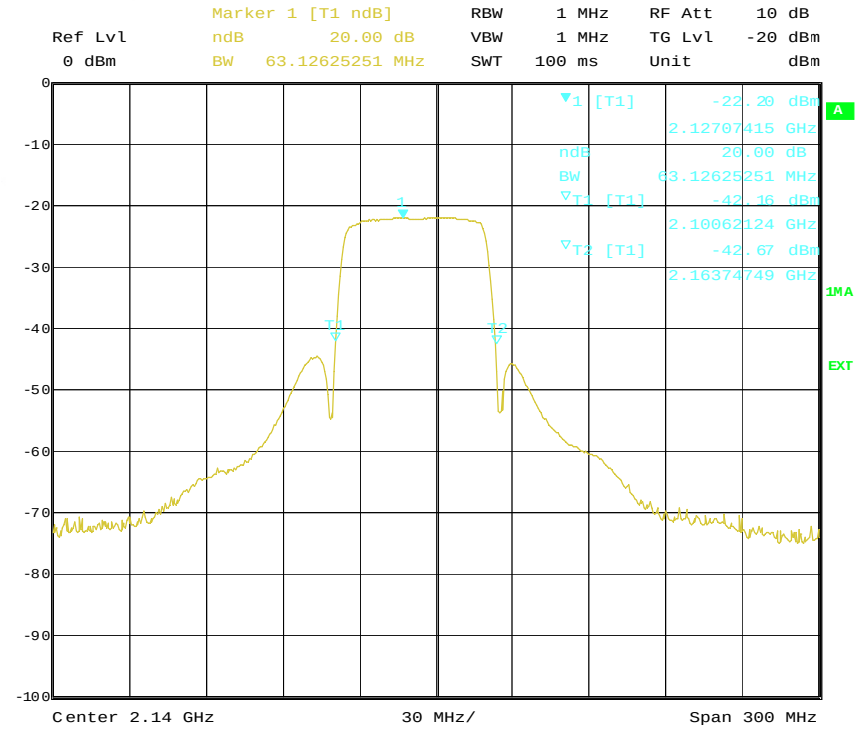
Plot 8.3



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9. RADIATED SPURIOUS EMISSIONS

9.1 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 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)

-13 dBm EIRP gives a field strength limit of 77.8 dBμV/m at a 10m measurement distance in an semi anechoic chamber, assuming 6dB addition from the reflection in the ground floor.

-13 dBm EIRP gives a field strength limit of 82.2 dBμV/m at a 3m measurement distance in an anechoic chamber.

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9.2 Test equipment

Equipment	Manufacturer	Type	SEMKO No.
Test site: "Big Chamber" *Semi-anechoic shielded chamber, 10 x 20 x 8,5 m (W x L x H)*			
Software:	Rohde & Schwarz	EMC 32	
Measurement receiver:	Rohde & Schwarz	ESU 8	12866
Antenna:	Chase	CBL 6111	8578
Preamplifier:	Chase	CBL 6111	8578
Test site: "Radiohallen" *Anechoic shielded chamber, 3,7 x 7,0 x 2,4 m (W x L x H)*			
Software:	Rohde & Schwarz	ES-K1, V1.70	
Signal analyser:	Rohde & Schwarz	FSIQ 40	12793
Preamplifier:	MITEQ	AFS6/AFS44	12335
Antennas:			
Horn:	EMCO	3115	4936
Horn:	EMCO	3160-08	30099
Horn:	EMCO	3160-09	30101

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9.3 Measurement set-up

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

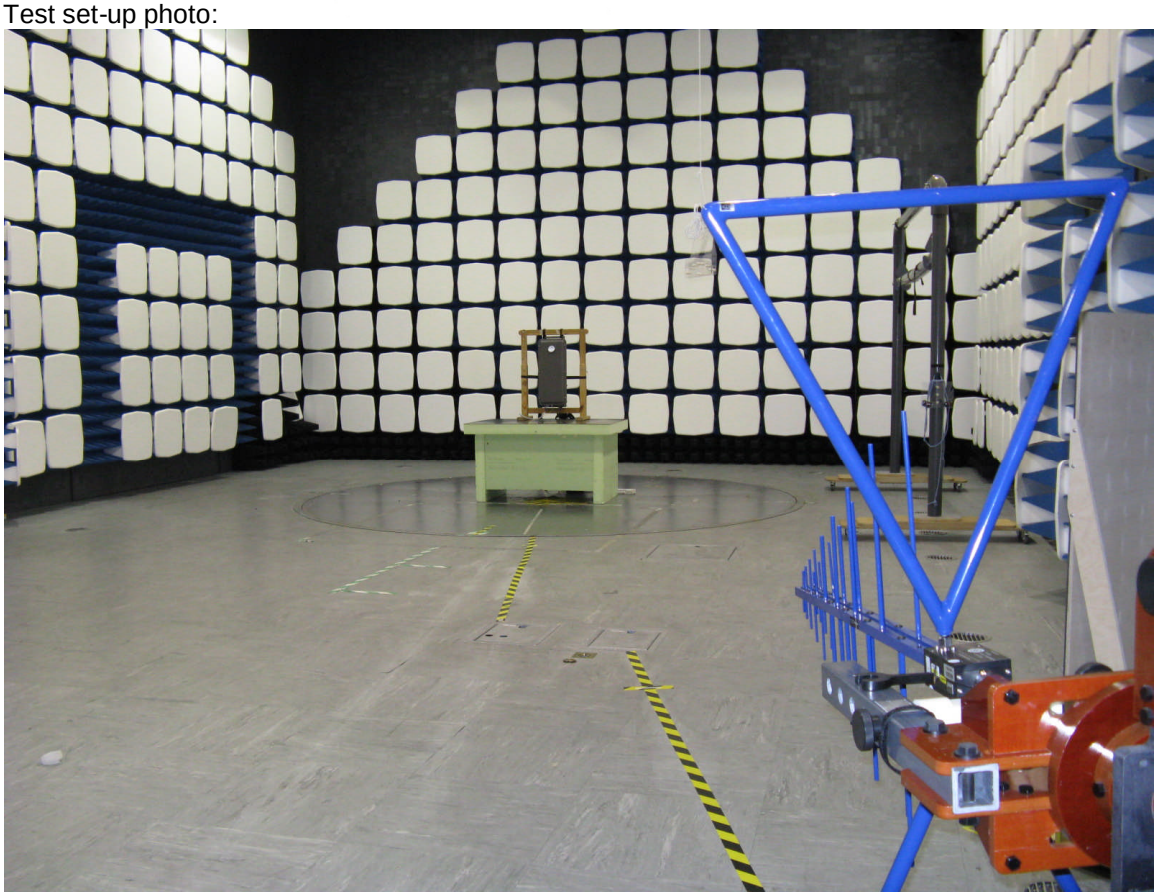
The radiated disturbance electric field intensity was measured in a semi-anechoic chamber at a distance of 10 m and the EUT was placed on a non-metallic table, 0.8 m above the reference ground plane. The specified test mode was enabled. Test set-up photos are given below.

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)

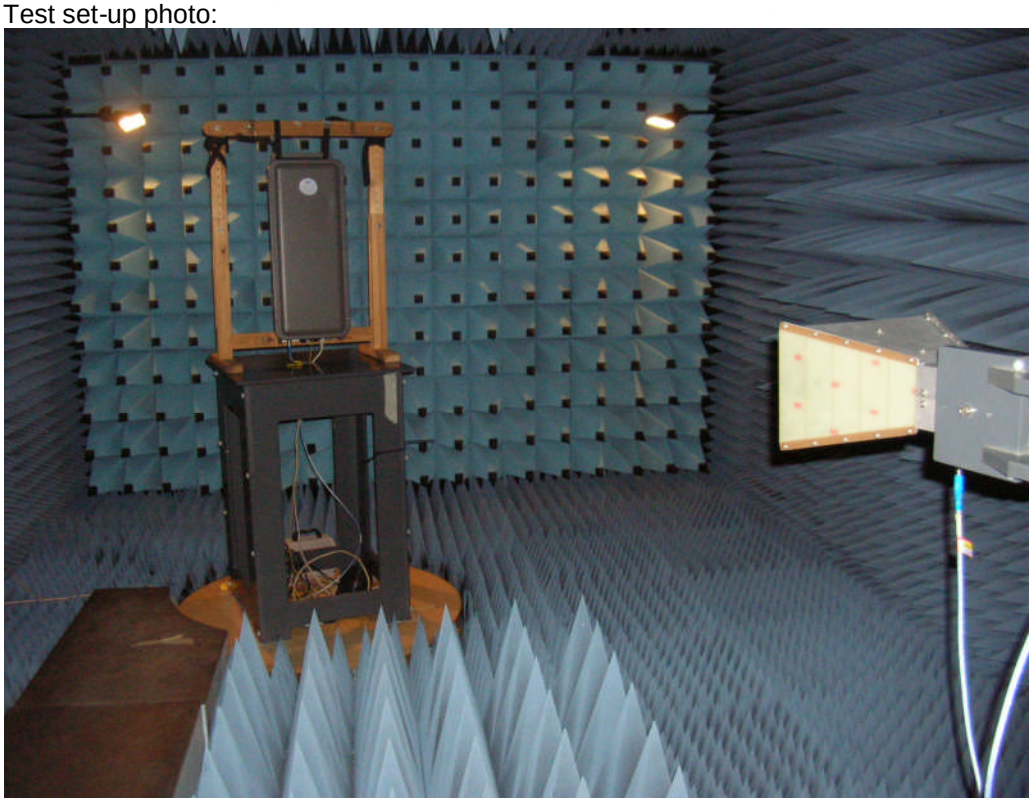
In the Radio anechoic chamber the EUT was placed on a non-metallic table, 1.3 m above the floor. The radiated disturbance electric field intensity was measured at a distance of 3 m. The specified test mode was enabled.

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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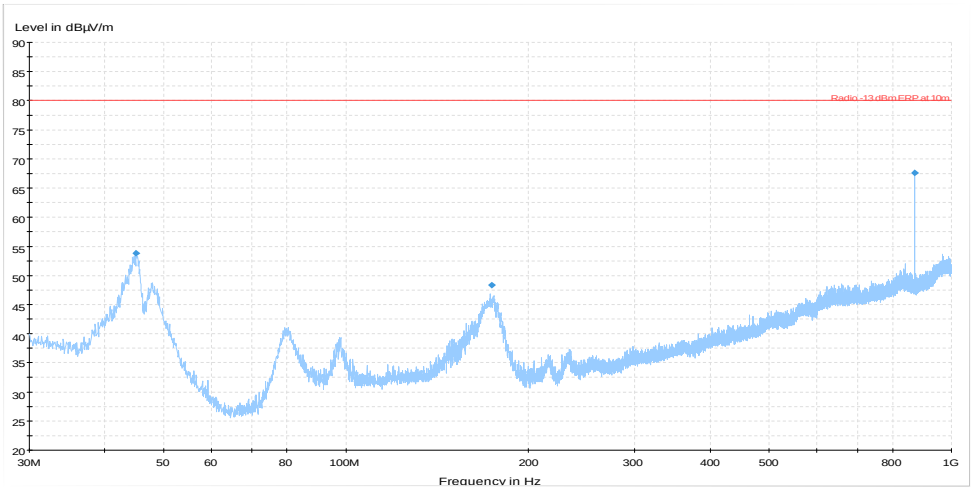
9.4 Preview sweeps 30-1000 MHz

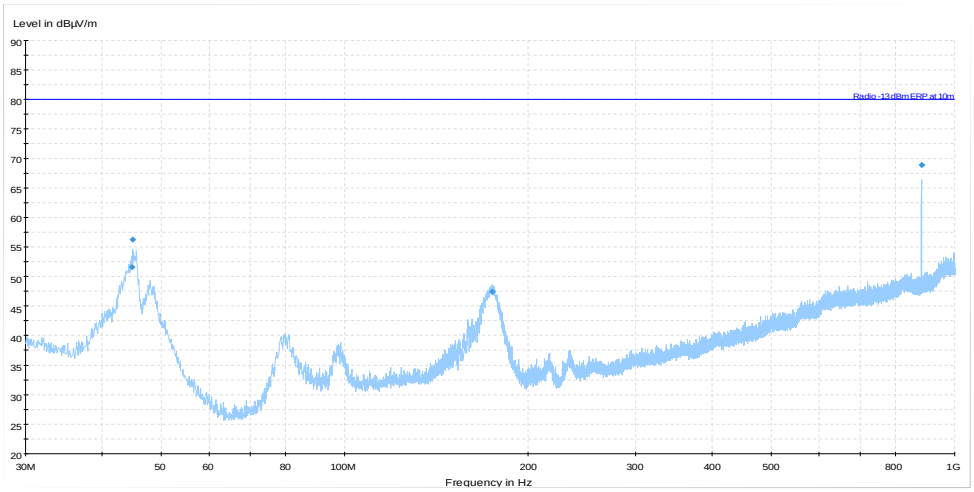
Semi-anechoic shielded chamber

Date of test: 2010-03-03 and 2010-03-04

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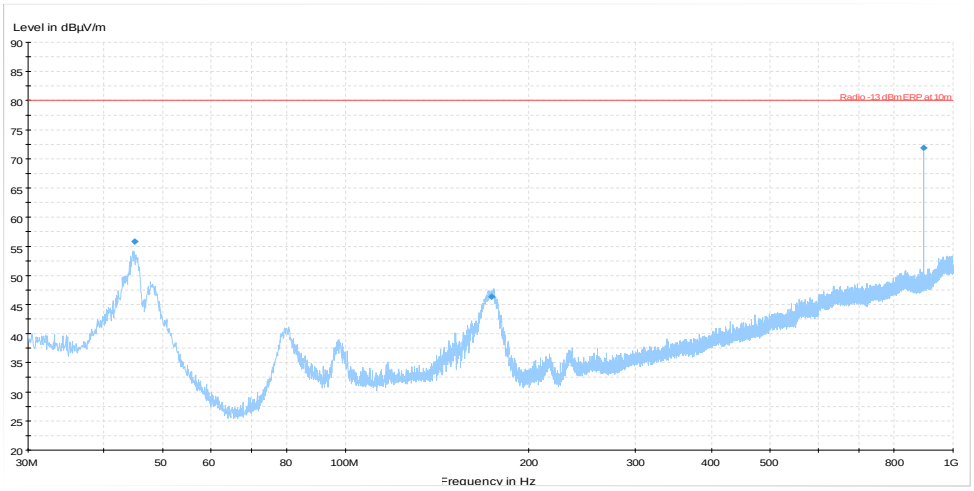
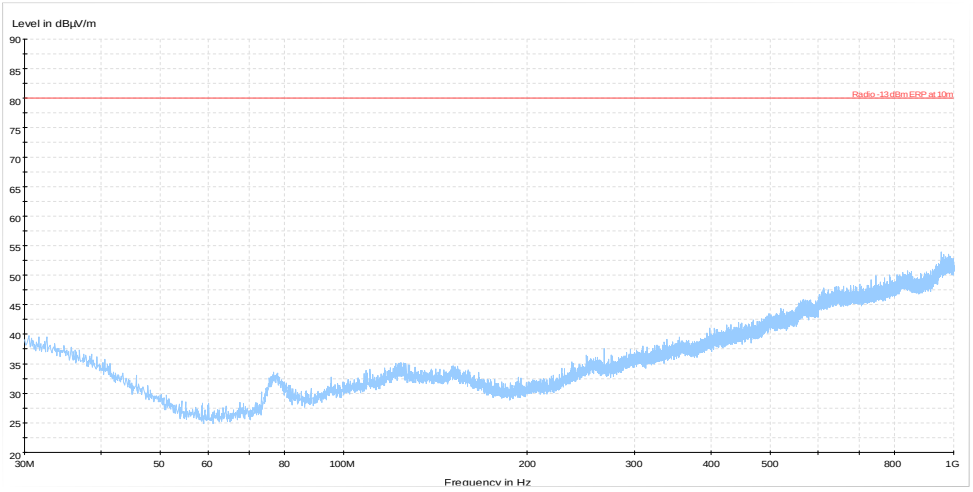
30 – 1000 MHz, max peak at a distance of 3 m. CW carrier in upper part of the 850MHz amplifier pass band



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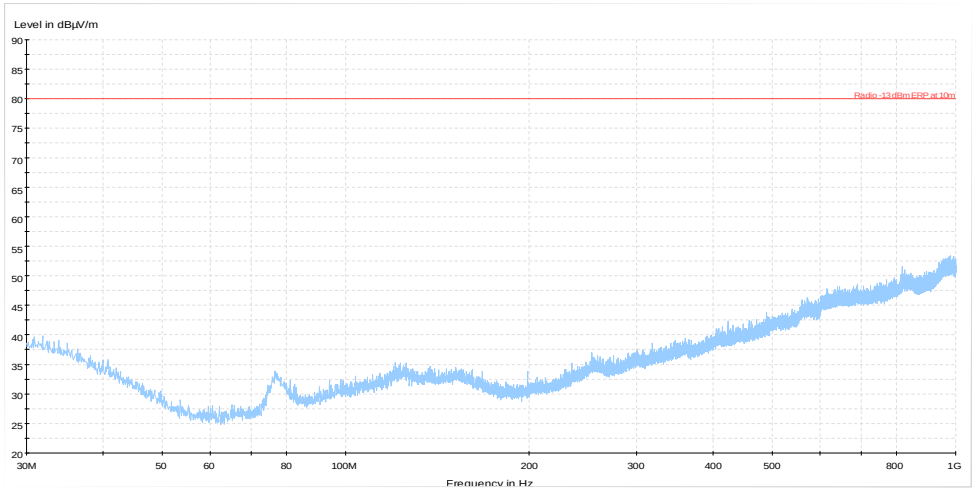
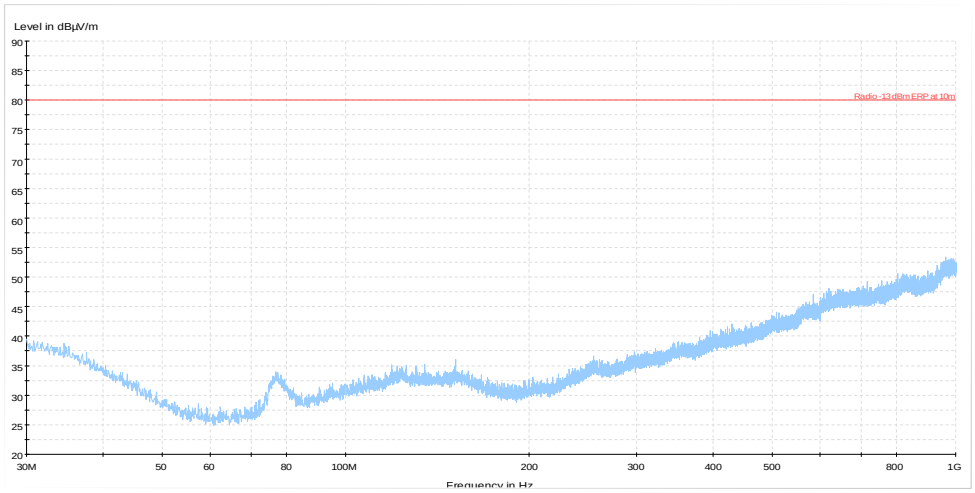
30 – 1000 MHz, max peak at a distance of 3 m. CW carrier in middle part of the 1900MHz amplifier pass band



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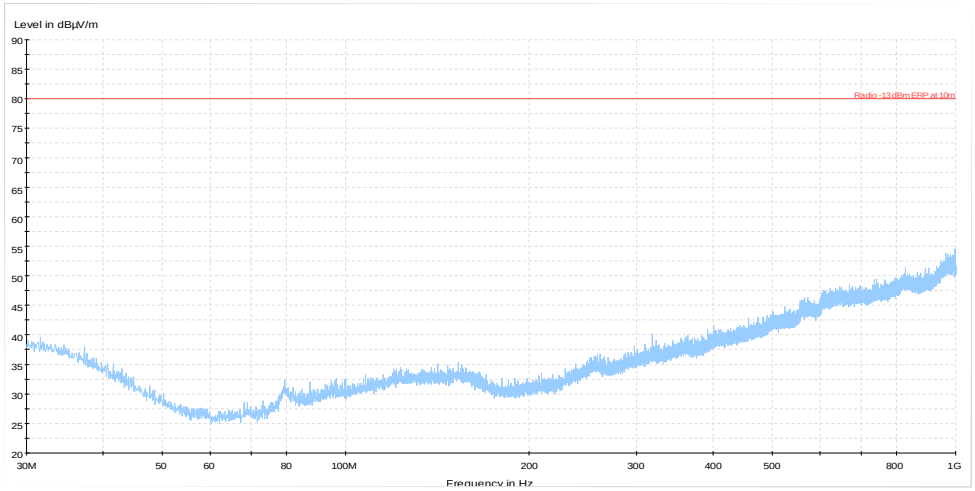
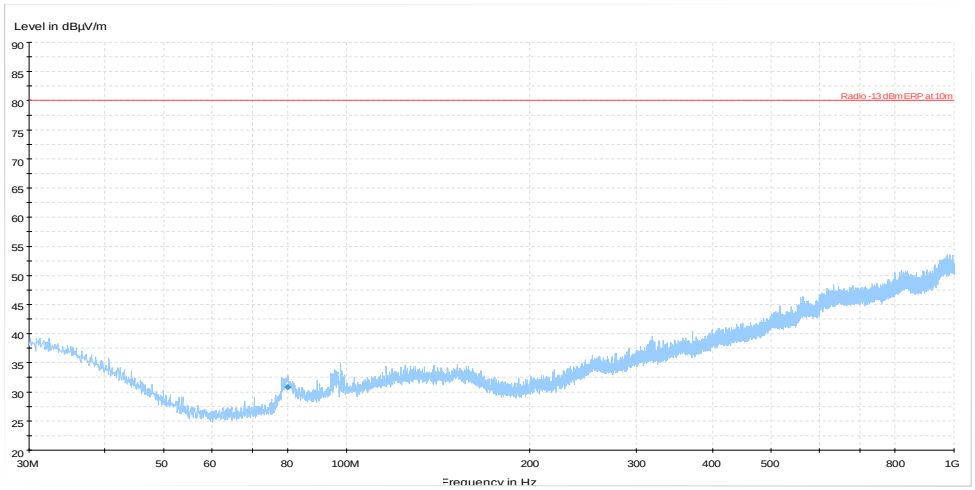
30 – 1000 MHz, max peak at a distance of 3 m. CW carrier in lower part of the AWS amplifier pass band



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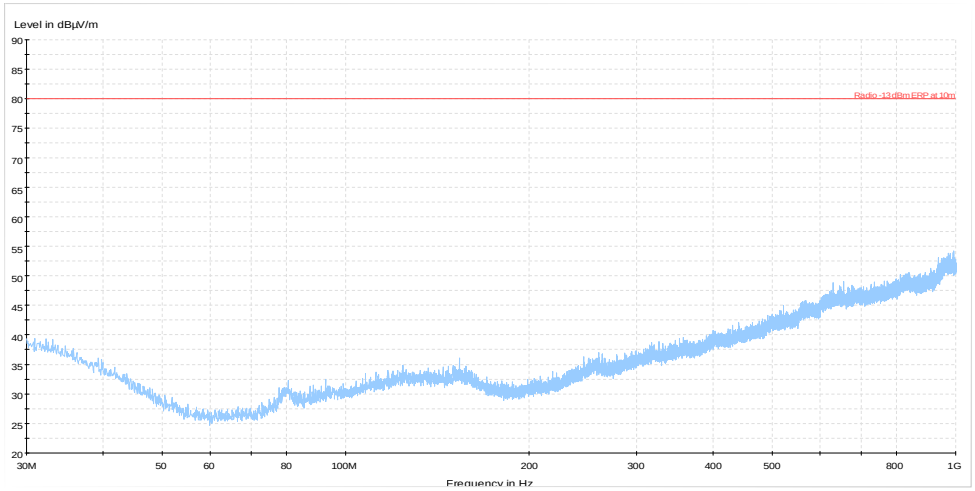
30 – 1000 MHz, max peak at a distance of 3 m. CW carrier in upper part of the AWS amplifier pass band



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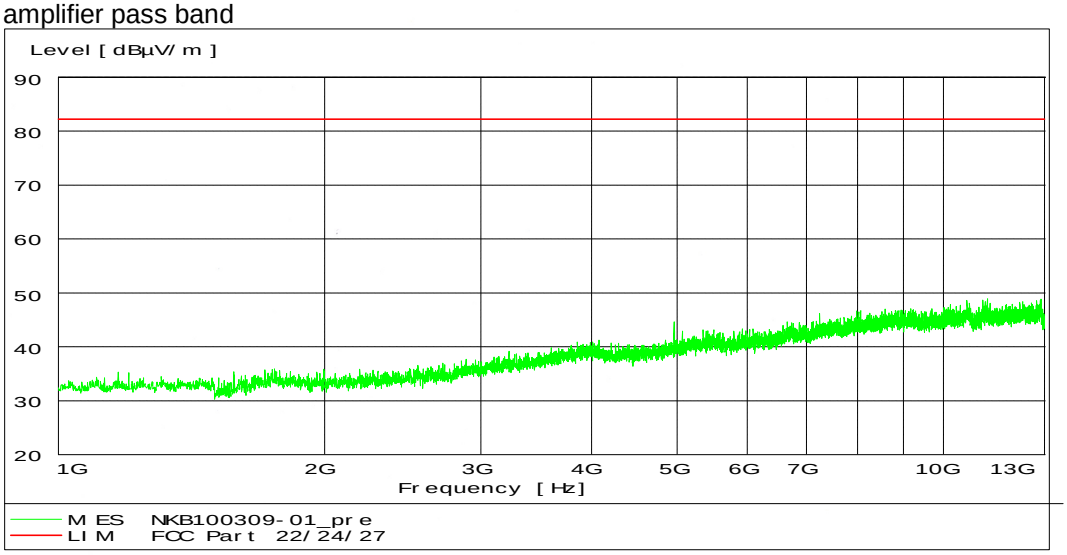
9.5 Preview sweeps 1000-26000 MHz

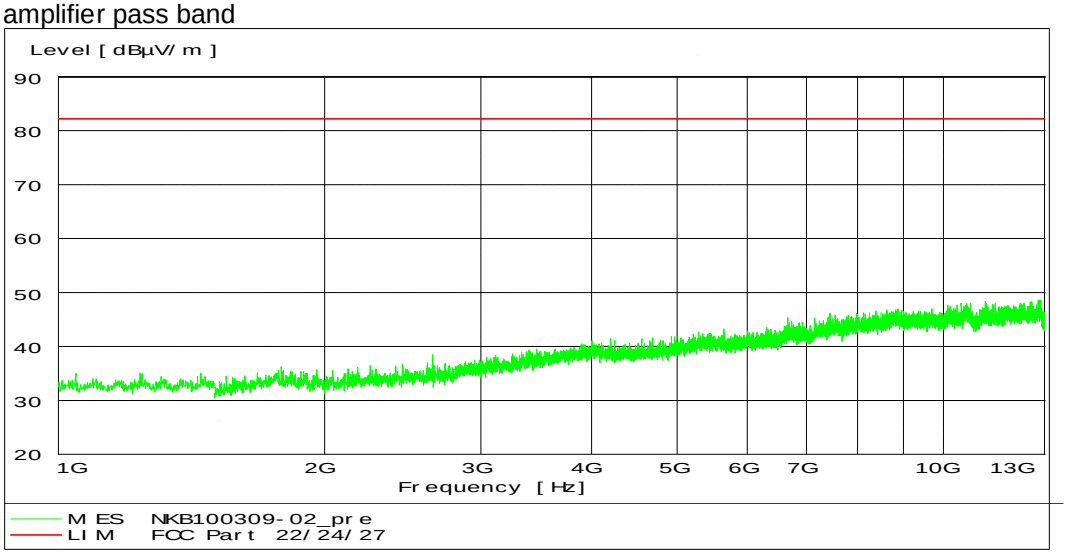
Radio anechoic shielded chamber

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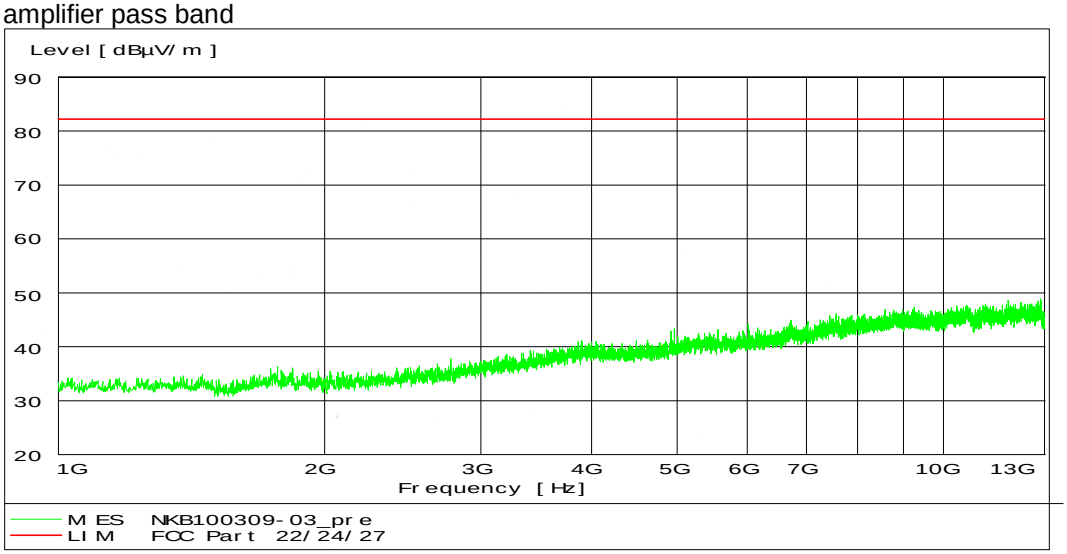
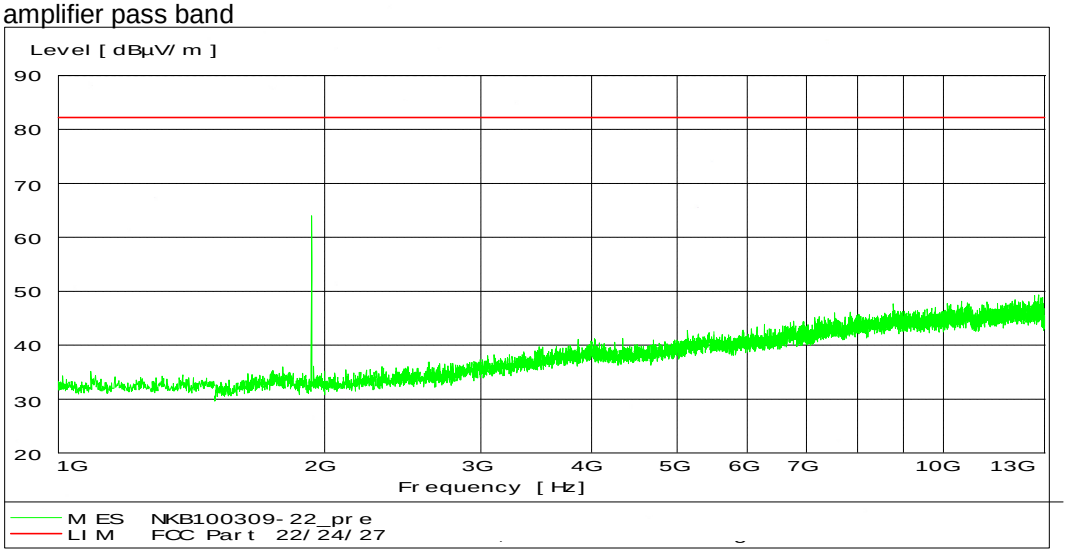
1000 – 13000 MHz, max peak at a distance of 3 m. CW carrier in upper part of the 850MHz amplifier pass band



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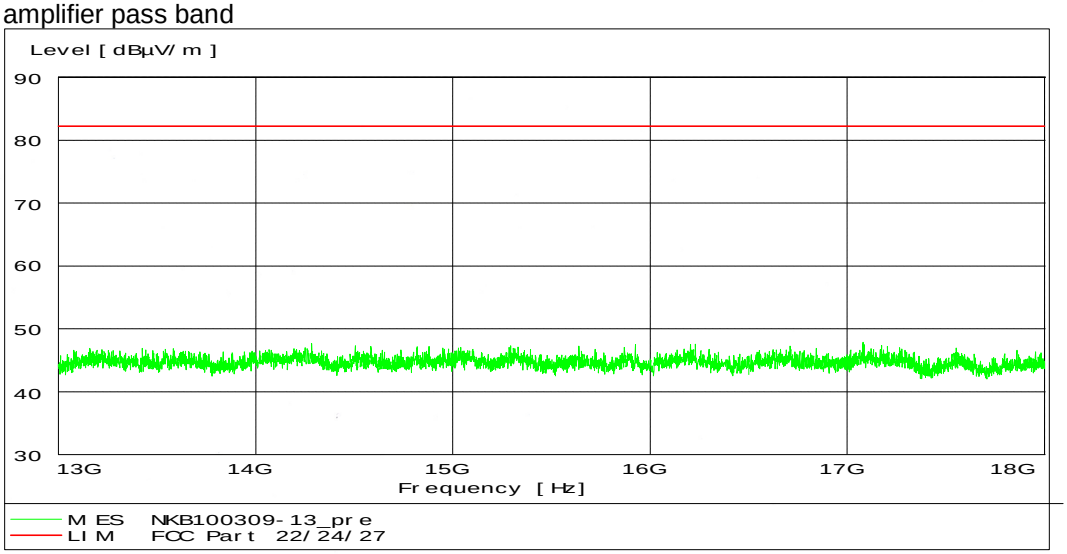
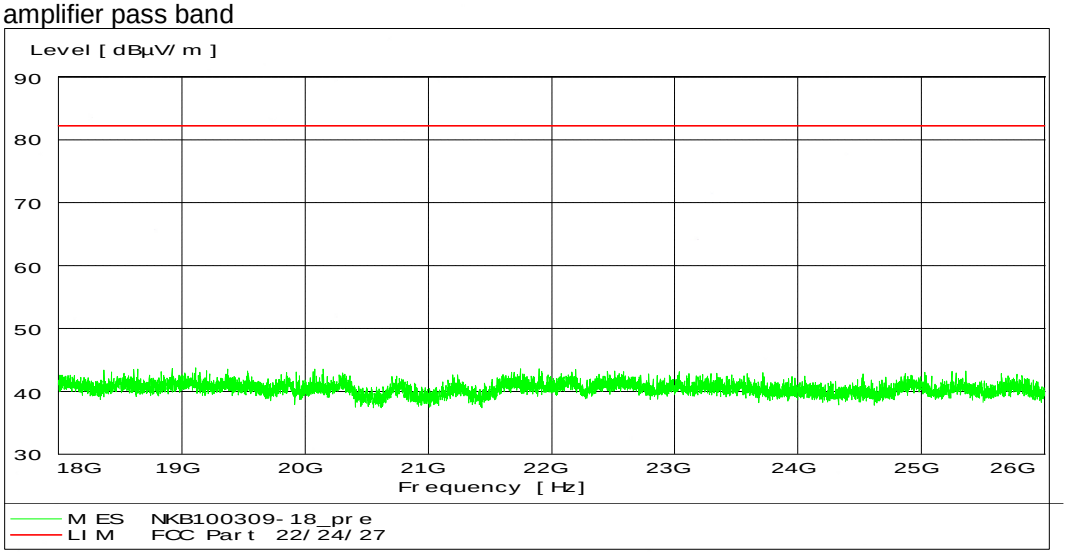
13000 – 18000 MHz, max peak at a distance of 3 m. CW carrier in lower part of the 1900MHz amplifier pass band



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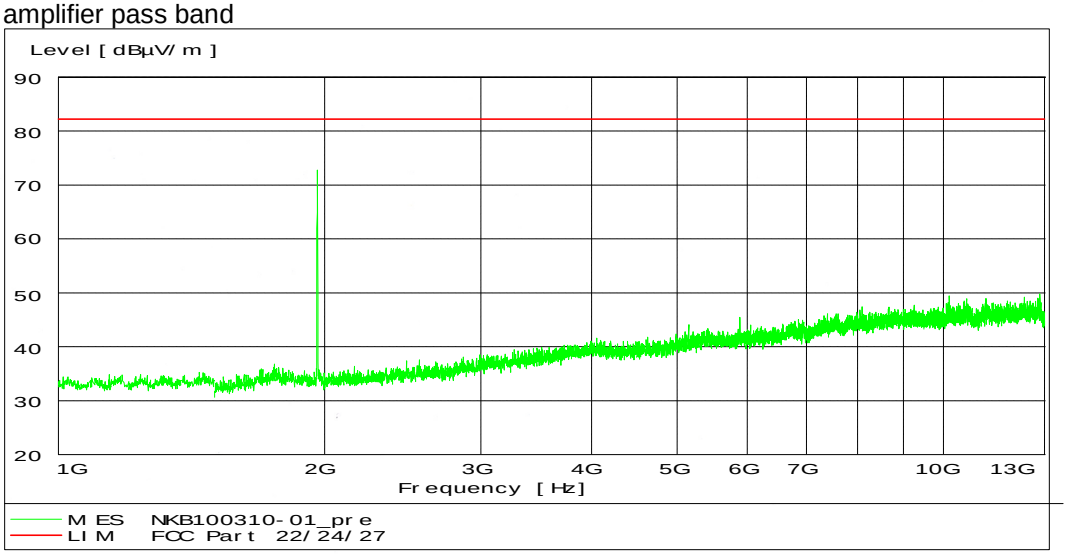
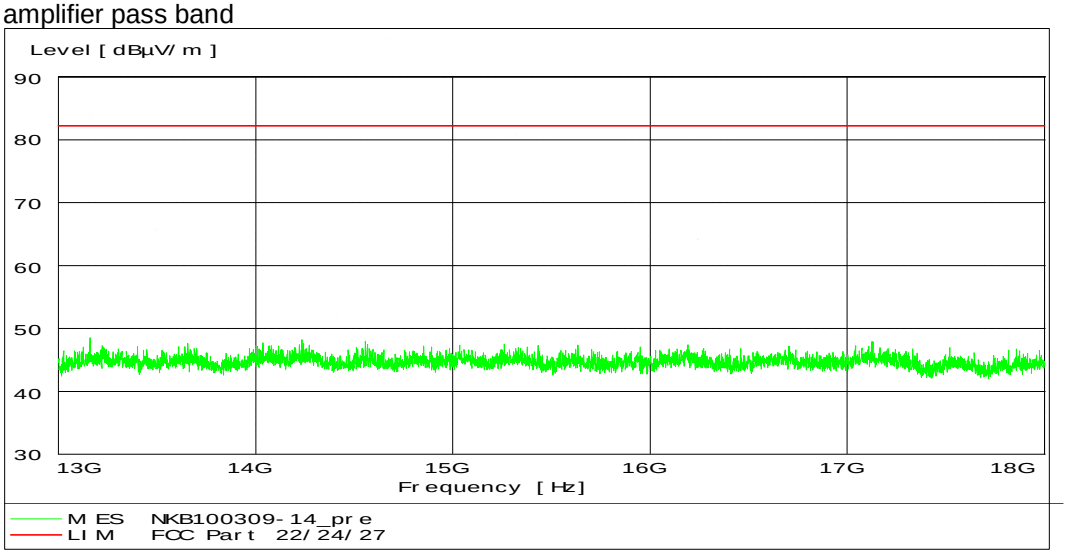
1000 – 13000 MHz, max peak at a distance of 3 m. CW carrier in middle part of the 1900MHz amplifier pass band



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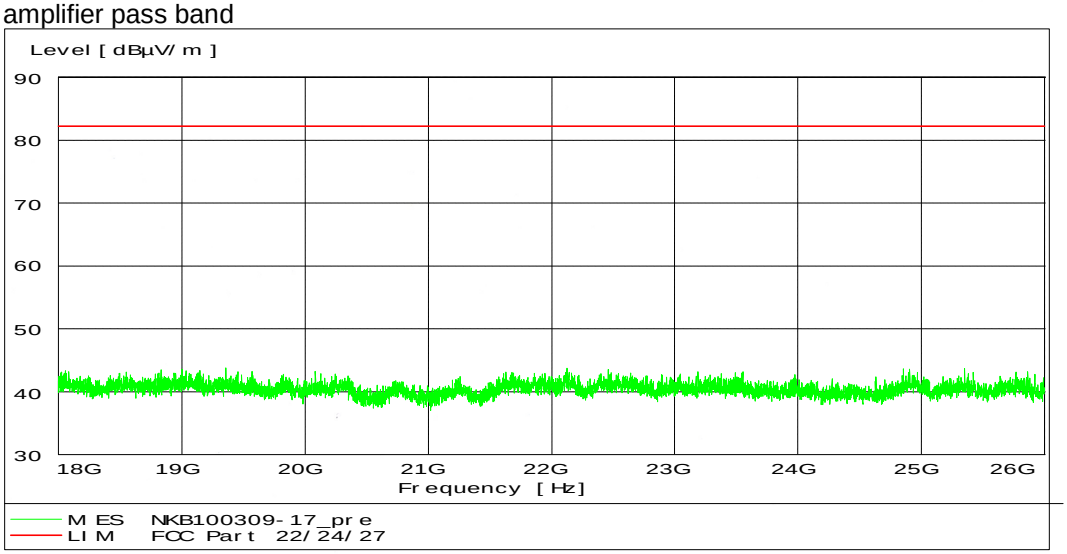
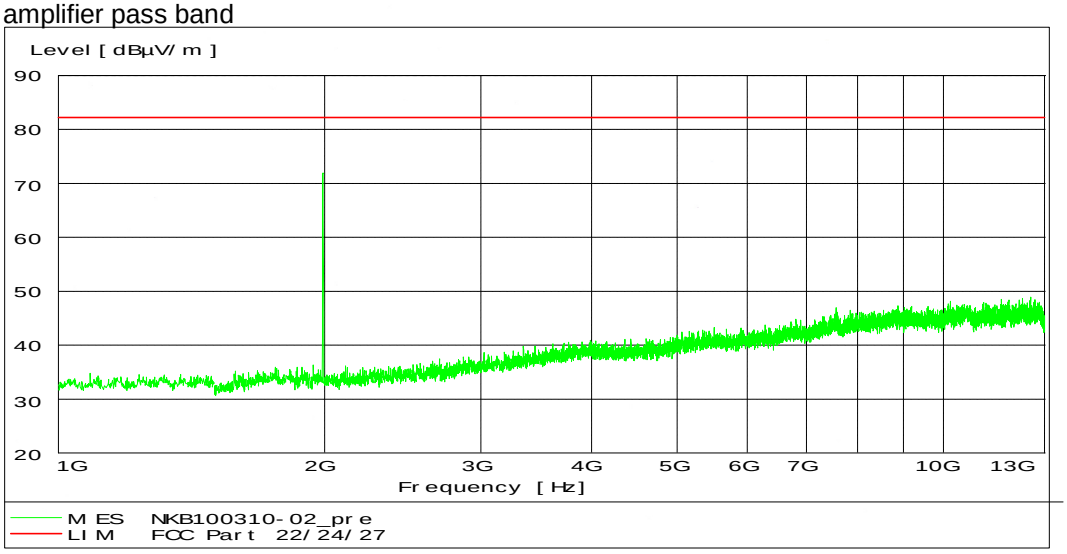
18000 – 26000 MHz, max peak at a distance of 3 m. CW carrier in middle part of the 1900MHz amplifier pass band



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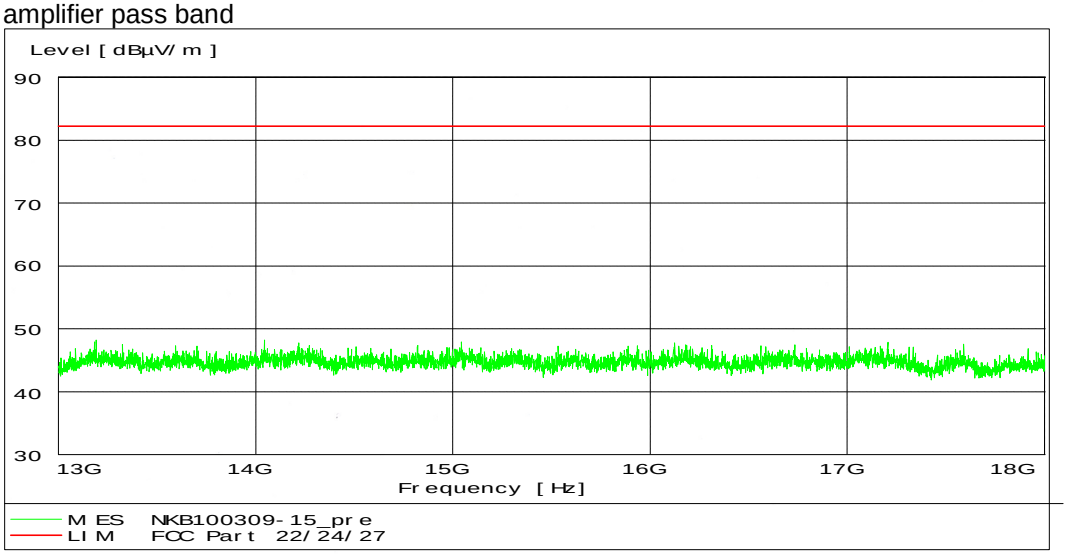
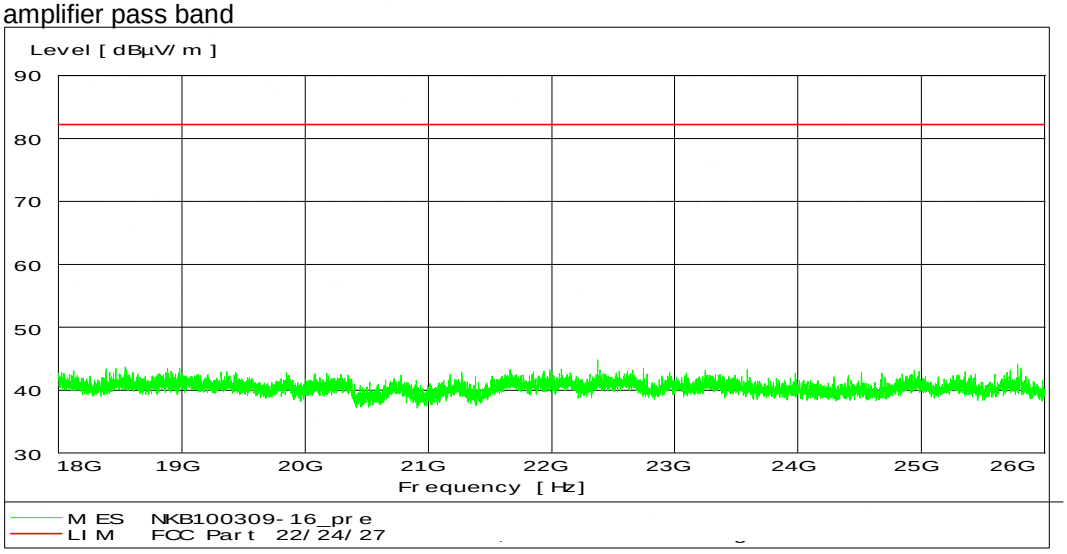
13000 – 18000 MHz, max peak at a distance of 3 m. CW carrier in upper part of the 1900MHz amplifier pass band



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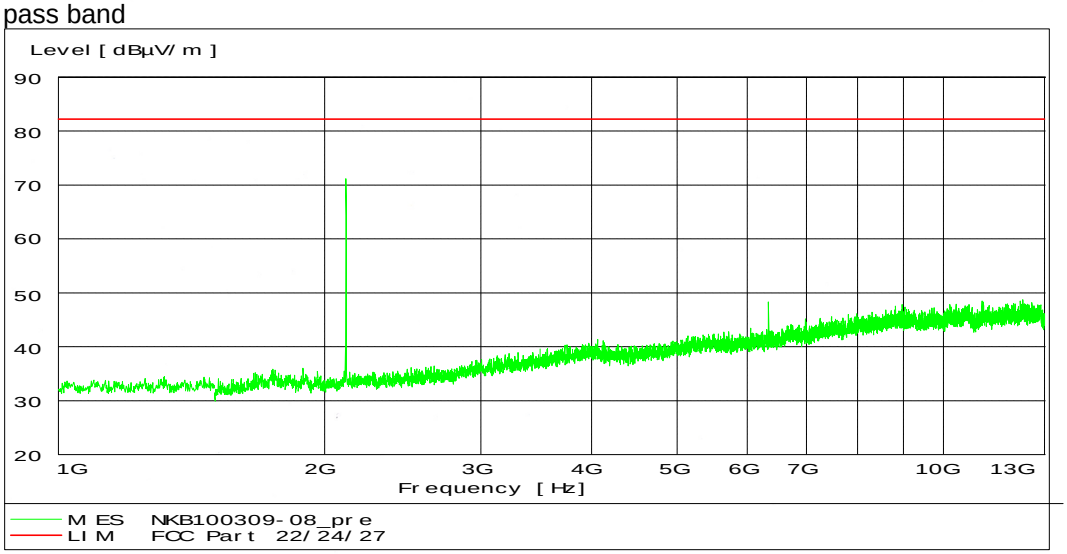
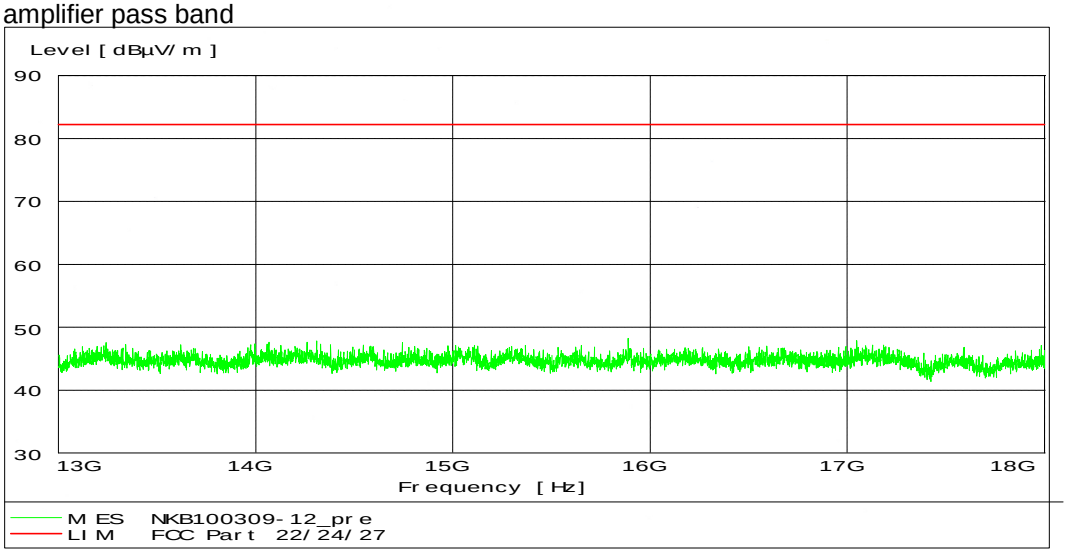
1000 – 13000 MHz, max peak at a distance of 3 m. CW carrier in lower part of the AWS amplifier pass band



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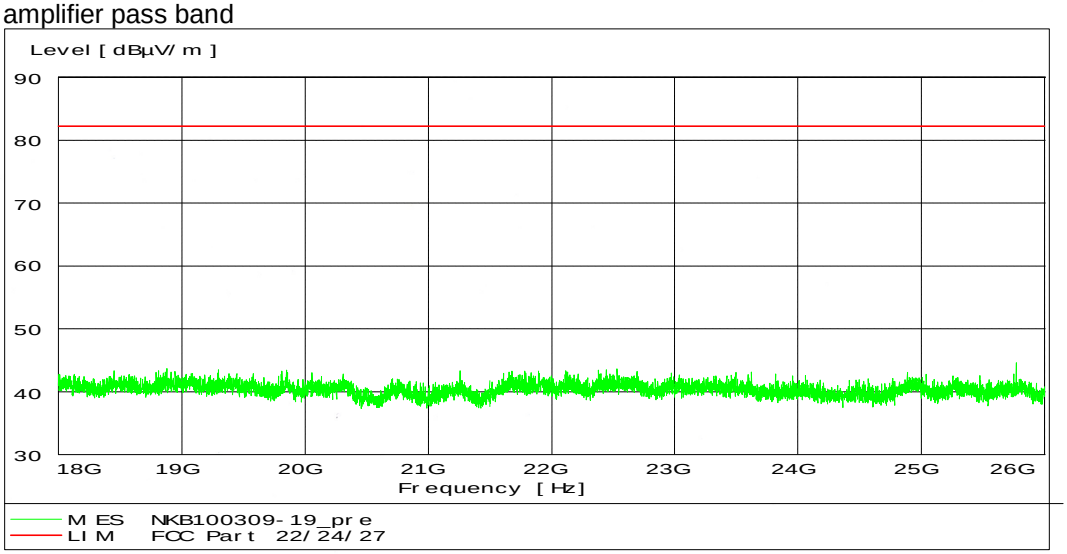
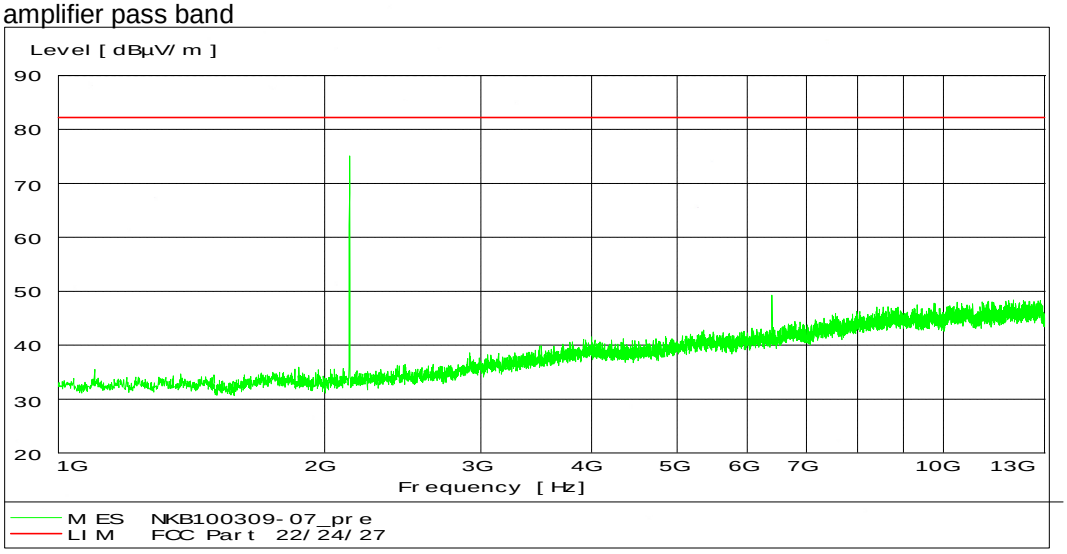
18000 – 26000 MHz, max peak at a distance of 3 m. CW carrier in lower part of the AWS amplifier pass band



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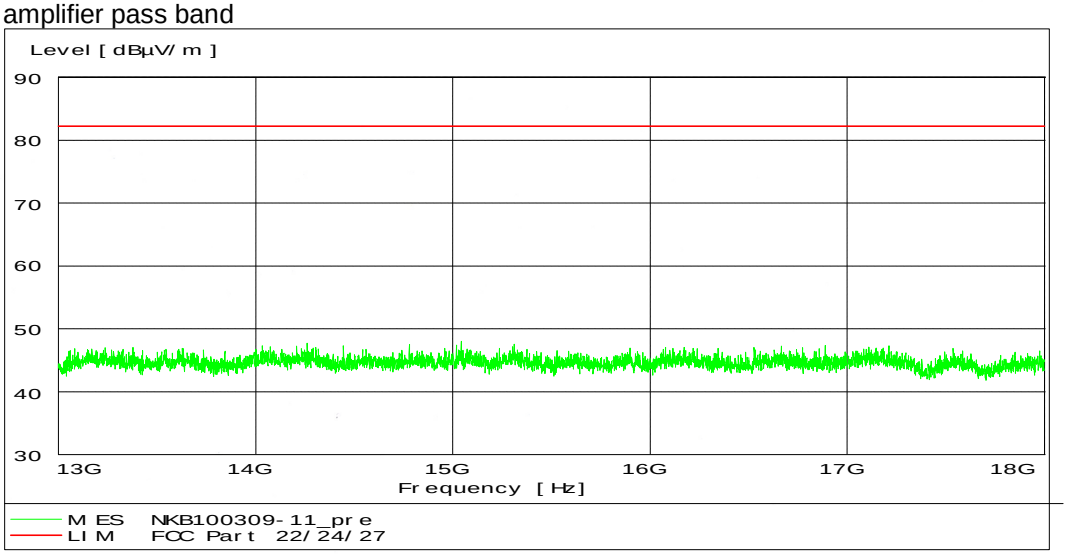
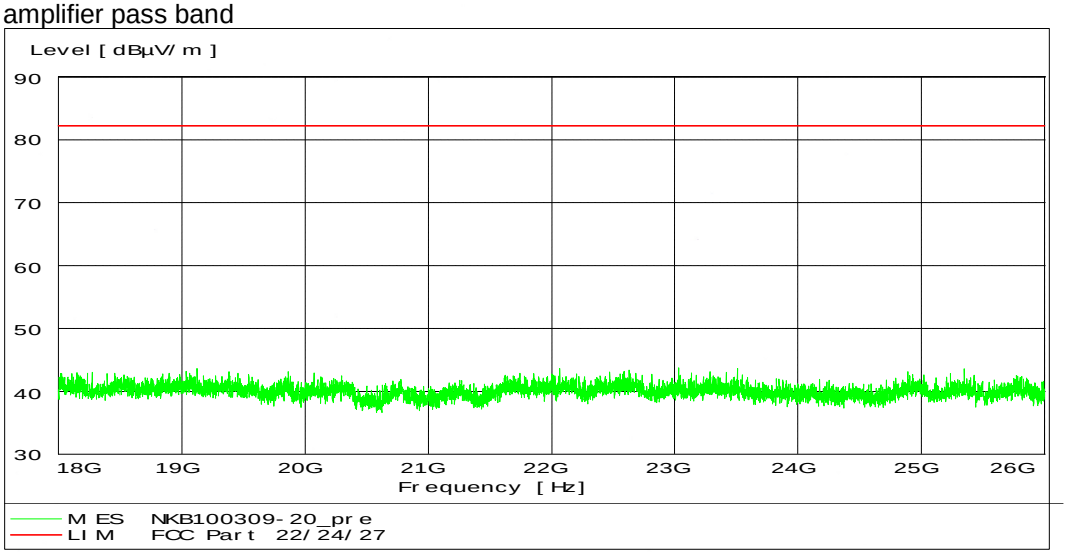
13000 – 18000 MHz, max peak at a distance of 3 m. CW carrier in middle part of the AWS amplifier pass band



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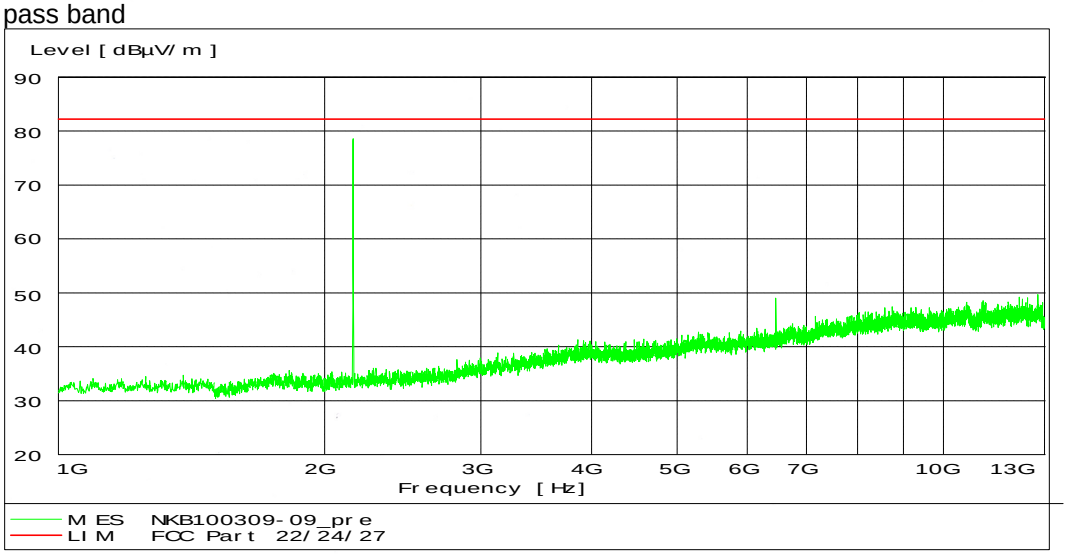
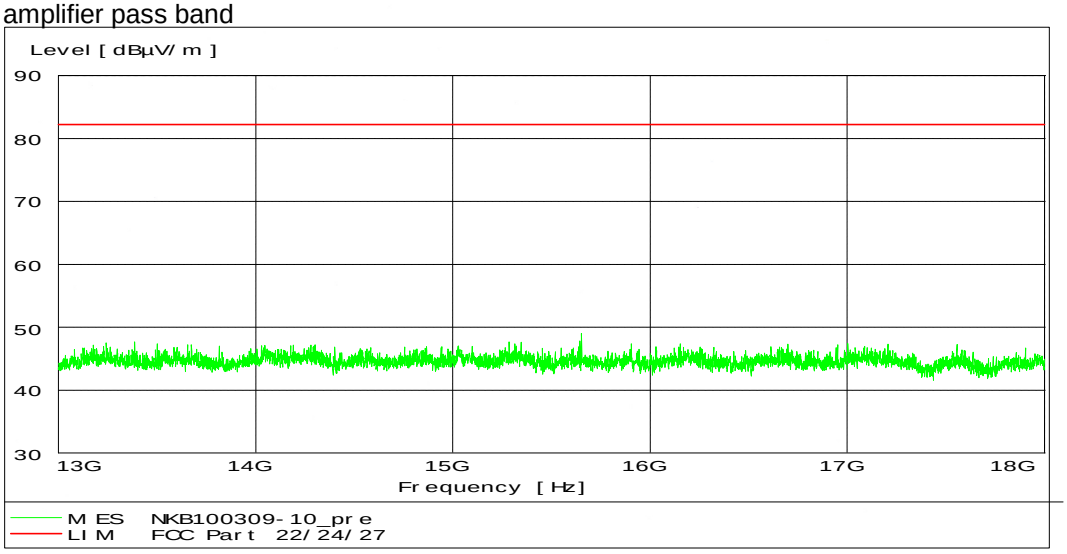
1000 – 13000 MHz, max peak at a distance of 3 m. CW carrier in upper part of the AWS amplifier pass band



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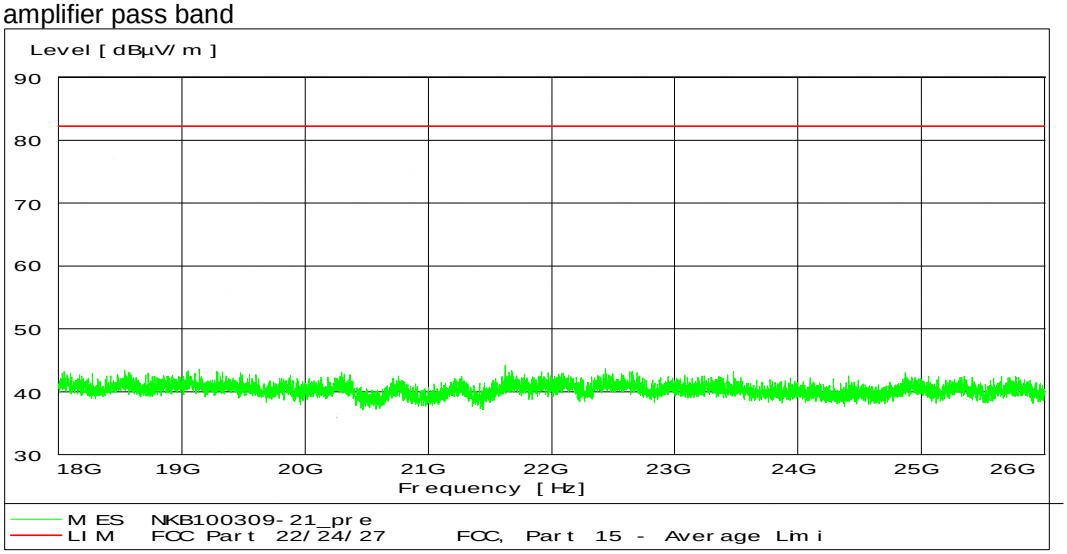
18000 – 26000 MHz, max peak at a distance of 3 m. CW carrier in upper part of the AWS amplifier pass band



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9.5 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	Pol.	Turntable Position	Correction	Limit
(MHz)	(dBµV/m)	(kHz)	(cm)		(deg)	(dB)	(dBµV/m)
45.090	53.8	120	250	V	158	11.9	77.8
174.180	48.4	120	301	H	238	10.9	77.8

No spurious emissions were found above 1GHz (noise floor below 50 dBµV/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	Pol.	Turntable Position	Correction	Limit
(MHz)	(dBµV/m)	(kHz)	(cm)		(deg)	(dB)	(dBµV/m)
44.790	51.6	120	100	V	162	12.1	77.8
44.9700	56.2	120	100	V	194	12.0	77.8
174.360	47.4	120	317	H	241	10.9	77.8

No spurious emissions were found above 1GHz (noise floor below 50 dBµV/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	Pol.	Turntable Position	Correction	Limit
(MHz)	(dBµV/m)	(kHz)	(cm)		(deg)	(dB)	(dBµV/m)
44.910	55.8	120	100	V	206	12.0	77.8
173.700	46.3	120	100	V	139	11.0	77.8

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

Example calculation:

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

Fulfil requirements: YES

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9.6 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/AVG/Pk	Bandwidth	Pol.	Turntable Position	Limit	Comment
(MHz)	(dBµV/m)	(kHz)		(deg)	(dBµV/m)	
30 – 1000	< 55	120	--	--	77.8	Noise floor
1931	72.8	1000	H	240	82.2	Carrier frequency
1000 – 26000	< 50	1000	--	--	82.2	Noise floor except at carrier frequency

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

Field strength of spurious emissions						
Frequency	Corrected amplitude QP/AVG/Pk	Bandwidth	Pol.	Turntable Position	Limit	Comment
(MHz)	(dBµV/m)	(kHz)		(deg)	(dBµV/m)	
30 – 1000	< 55	120	--	--	77.8	Noise floor
1960	77.0	1000	H	170	82.2	Carrier frequency
1000 – 26000	< 50	1000	--	--	82.2	Noise floor except at carrier frequency

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

Field strength of spurious emissions

Frequency	Corrected amplitude QP/AVG/Pk	Bandwidth	Pol.	Turntable Position	Limit	Comment
(MHz)	(dBµV/m)	(kHz)		(deg)	(dBµV/m)	
30 – 1000	< 55	120	--	--	77.8	Noise floor
1960	74.4	1000	H	170	82.2	Carrier frequency
1000 – 26000	< 50	1000	--	--	82.2	Noise floor except at carrier frequency

Example calculation:

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

Fulfil requirements: YES

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9.7 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/AVG/Pk	Bandwidth	Pol.	Turntable Position	Limit	Comment
(MHz)	(dBµV/m)	(kHz)		(deg)	(dBµV/m)	
30 – 1000	< 55	120	--	--	77.8	Noise floor
2113	73.8	1000	H	60	82.2	Carrier frequency
1000 – 26000	< 50	1000	--	--	82.2	Noise floor except at carrier frequency

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

Field strength of spurious emissions						
Frequency	Corrected amplitude QP/AVG/Pk	Bandwidth	Pol.	Turntable Position	Limit	Comment
(MHz)	(dBµV/m)	(kHz)		(deg)	(dBµV/m)	
30 – 1000	< 55	120	--	--	77.8	Noise floor
2132	76.6	1000	H	180	82.2	Carrier frequency
1000 – 26000	< 50	1000	--	--	82.2	Noise floor except at carrier frequency

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

Field strength of spurious emissions

Frequency	Corrected amplitude QP/AVG/Pk	Bandwidth	Pol.	Turntable Position	Limit	Comment
(MHz)	(dBµV/m)	(kHz)		(deg)	(dBµV/m)	
30 – 1000	< 55	120	--	--	77.8	Noise floor
2152	81.0	1000	H	140	82.2	Carrier frequency
1000 – 26000	< 50	1000	--	--	82.2	Noise floor except at carrier frequency

Example calculation:

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

Fulfil requirements: YES

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10. FREQUENCY STABILITY 850 BAND

Date of test: 2010-04-07 and 2010-04-08

Ambient temperature 24°C Relative humidity 23 %

10.1 Test protocol

The test was done with two different input signals:

- First test was with a GSM carrier and the frequency error was measured with a signal analyzer.

- Second test was with a CW signal and the frequency error was measured with a frequency counter.

Input signal: GSM carrier at 881,0 MHz
CW at 881,0 MHz

Frequency error		
Ambient temperature (°C)	GSM frequency error (Hz)	CW frequency error (Hz)
-30	< 6	+3
-20	< 7	+3
-10	< 8	+3
0	< 8	+3
10	< 8	+4
20	< 8	+3
30	< 9	+3
40	< 9	+3
50	< 9	+3
55	< 9	+3

Frequency error Nominal voltage: 120 VAC		
Voltage (V AC)	GSM frequency error (Hz)	CW frequency error (Hz)
85% of nominal = 102	< 8	+3
90% of nominal = 108	< 8	+3
95% of nominal = 114	< 8	+3
100% of nominal = 120	< 8	+3
105% of nominal = 126	< 8	+3
110% of nominal = 132	< 8	+3
115% of nominal = 138	< 8	+3

10.2 Limits

The frequency tolerance for a fixed Base transmitter in 47 CFR §22.255 is 1.5 ppm, at 894MHz that equals 1.34kHz.

Fulfill requirements: YES

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11. FREQUENCY STABILITY 1900 BAND

Date of test: 2010-04-07 and 2010-04-08

Ambient temperature 24°C Relative humidity 23 %

11.1 Test protocol

The test was done with two different input signals:

- First test was with a GSM carrier and the frequency error was measured with a signal analyzer.

- Second test was with a CW signal and the frequency error was measured with a frequency counter.

Input signal: GSM carrier at 1965 MHz
CW at 1965 MHz

Frequency error		
Ambient temperature (°C)	GSM frequency error (Hz)	CW frequency error (Hz)
-30	< 8	+7
-20	< 6	+6
-10	< 8	+6
0	< 8	+6
10	< 8	+6
20	< 9	+6
30	< 9	+7
40	< 8	+6
50	< 9	+6
55	< 8	+6

Frequency error Nominal voltage: 120 VAC		
Voltage (V AC)	GSM frequency error (Hz)	CW frequency error (Hz)
85% of nominal = 102	< 9	+6
90% of nominal = 108	< 9	+6
95% of nominal = 114	< 9	+6
100% of nominal = 120	< 9	+6
105% of nominal = 126	< 9	+6
110% of nominal = 132	< 9	+6
115% of nominal = 138	< 9	+6

11.2 Limits

The frequency tolerance in 47 CFR §24.135 is 1.0 ppm, at 1990MHz that equals 1.99kHz.

Fulfill requirements: YES

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12. FREQUENCY STABILITY AWS BAND

Date of test: 2010-04-07 and 2010-04-08

Ambient temperature 24°C Relative humidity 23 %

12.1 Test protocol

The test was done with two different input signals:

- First test was with a WCDMA carrier and the frequency error was measured with a signal analyzer.

- Second test was with a CW signal and the frequency error was measured with a frequency counter.

Input signal: WCDMA carrier at 2132.5 MHz
CW at 2132.5 MHz

Frequency error		
Ambient temperature (°C)	WCDMA frequency error (Hz)	CW frequency error (Hz)
-30	< 2	+6
-20	< 3	+6
-10	< 2	+6
0	< 2	+6
10	< 2	+6
20	< 3	+5
30	< 3	+7
40	< 2	+6
50	< 3	+6
55	< 3	+6

Frequency error Nominal voltage: 120 VAC		
Voltage (V AC)	WCDMA frequency error (Hz)	CW frequency error (Hz)
85% of nominal = 102	< 3	+6
90% of nominal = 108	< 3	+6
95% of nominal = 114	< 3	+6
100% of nominal = 120	< 3	+6
105% of nominal = 126	< 3	+6
110% of nominal = 132	< 3	+6
115% of nominal = 138	< 3	+6

These measurements of frequency error only show errors < 7 Hz so the fundamental emissions will always stay within the band of operations.

12.3 Limits

In 47 CFR §27.54 the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

Fulfill requirements: YES

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13 INSTRUMENTATION LIST

Invnr	Equipment	Manufacturer	Type	Last Calibrated	Calibration due
3148	SIGNALGENERATOR	HEWLETT-PACKARD	83712A	2009-12	2010-12
4936	HORNANTENNA	EMCO	3115	2007-08	2010-08
5185	CABLE	HUBER + SUHNER	SUCOFLEX 104 2m	2009-06	2010-06
5190	CABLE	HUBER + SUHNER	SUCOFLEX 104 1,5m	2009-06	2010-06
5192	CABLE	HUBER + SUHNER	SUCOFLEX 104 1,5m	2009-06	2010-06
5193	CABLE	HUBER + SUHNER	SUCOFLEX 104 1,5m	2009-06	2010-06
5616	RUBIDIUM REFERENS	PHILIPS	PM6685R/071	2009-08	2010-08
7861	POWER SENSOR	ROHDE & SCHWARZ	NRV-Z51	2009-06	2010-06
7982	ATTENUATOR	HEWLETT-PACKARD	8491A	2009-06	2010-06
8337	ATTENUATOR	NARDA	776B-10	2009-06	2010-06
8578	ANTENNA	CHASE ELECTR. LIMITED	CBL 6111	2008-09	2011-09
9444	ATTENUATOR	AEROFLEX / WEINSCHEL	46-10-34	2009-06	2010-06
9750	CABLE	HUBER + SUHNER	SUCOFLEX 104	2009-06	2010-06
12335	PREAMPLIFIER	SANGUS	AFS6-00101400-23-10P -6-S ; AFS44-12002400-32-10P -44	2009-06	2010-06
12455	POWERMETER	ROHDE & SCHWARZ	NRVD	2009-06	2010-06
12792	SIGNALGENERATOR	ROHDE & SCHWARZ	SMIQ 03B	2009-06	2010-06
12793	SIGNALANALYZER	ROHDE & SCHWARZ	FSIQ 40	2009-06	2010-06
12866	MEASUREMENT RECIEVER	ROHDE & SCHWARZ	ESU	2009-06	2010-06
30090	ATTENUATOR	HEWLETT-PACKARD	8491A	2009-06	2010-06
30099	HORNANTENNA	EMCO	460420	2007-08	2010-08
30101	HORNANTENNA	EMCO	460451	2007-08	2010-08
40017	SIGNALGENERATOR	ROHDE & SCHWARZ	SMIQ 03B	2009-06	2010-06
40035	CABLE	SUHNER	SUCOFLEX 104PEA	2009-06	2010-06
40036	CABLE	SUHNER	SUCOFLEX 104	2009-06	2010-06

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14 UNCERTAINTIES SUMMARY

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

Measurement uncertainty for radiated emission, 30 - 1000 MHz at 10 m	± 4,6 dB
Measurement uncertainty for radiated emission, 1 – 13 GHz	± 5,3 dB
Measurement uncertainty for radiated emission, 13 – 18 GHz	± 5,1 dB
Measurement uncertainty for radiated emission, 18– 26,5 GHz	± 5,4 dB
Measurement uncertainty for conducted disturbances at the antenna port	± 3,6 dB
Measurement uncertainty for Frequency error (Radio)	± 150 Hz
Measurement uncertainty for Output power (Radio)	
Analog signals, conducted	
Power meter	± 0,6 dB
Spectrum analyser	± 3,5 dB
Analog signal, radiated	
25 - 1000 MHz	± 3,1 dB
1 - 18 GHz	± 3,3 dB
Digital signal, conducted	± 0,6 dB
Digital signals, radiated	
25 - 1000 MHz	± 3,1 dB
1 - 18 GHz	± 3,3 dB

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APPENDIX I – PHOTOS OF THE EUT

DDH 101 front side

DDH 101 back side

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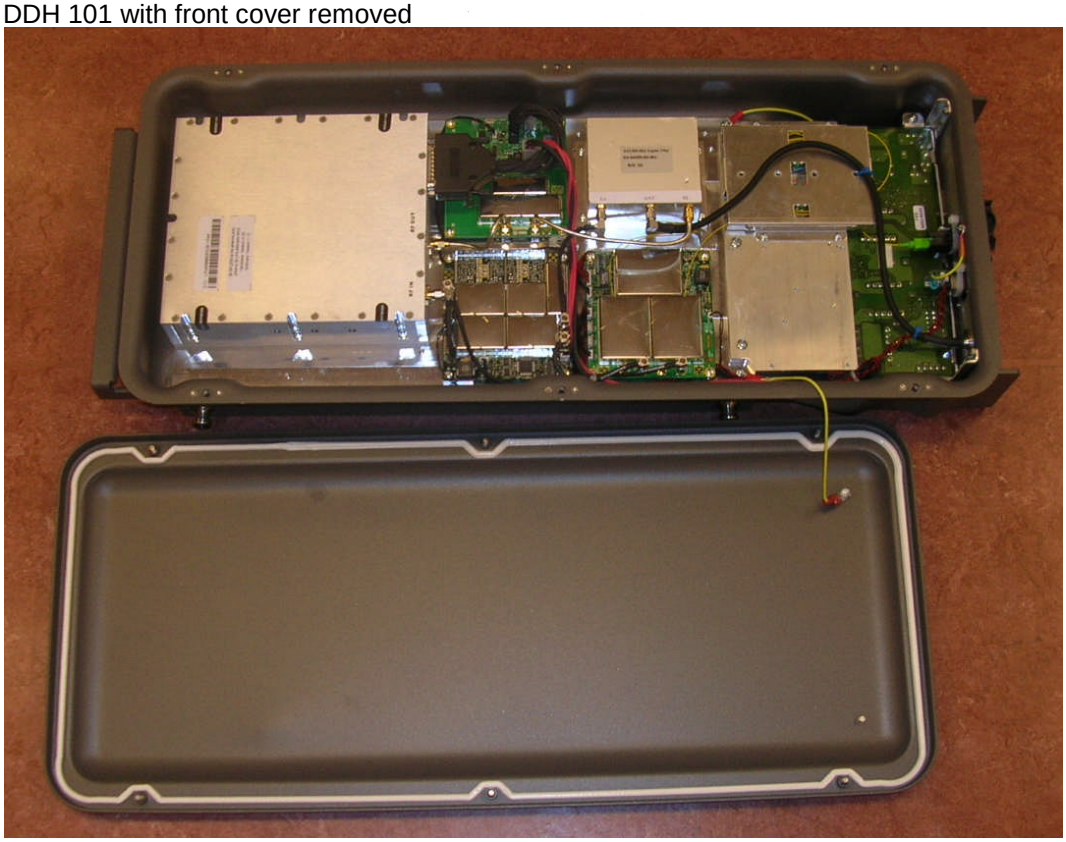
DDH 101 with front cover removed



DDH 101 bottom side with connectors

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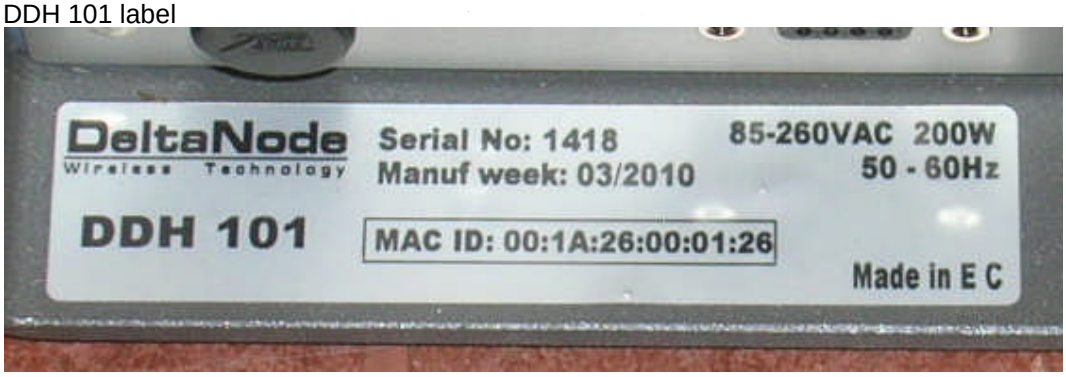
DDH 101 label



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DDH 202 front side

DDH 202 back side

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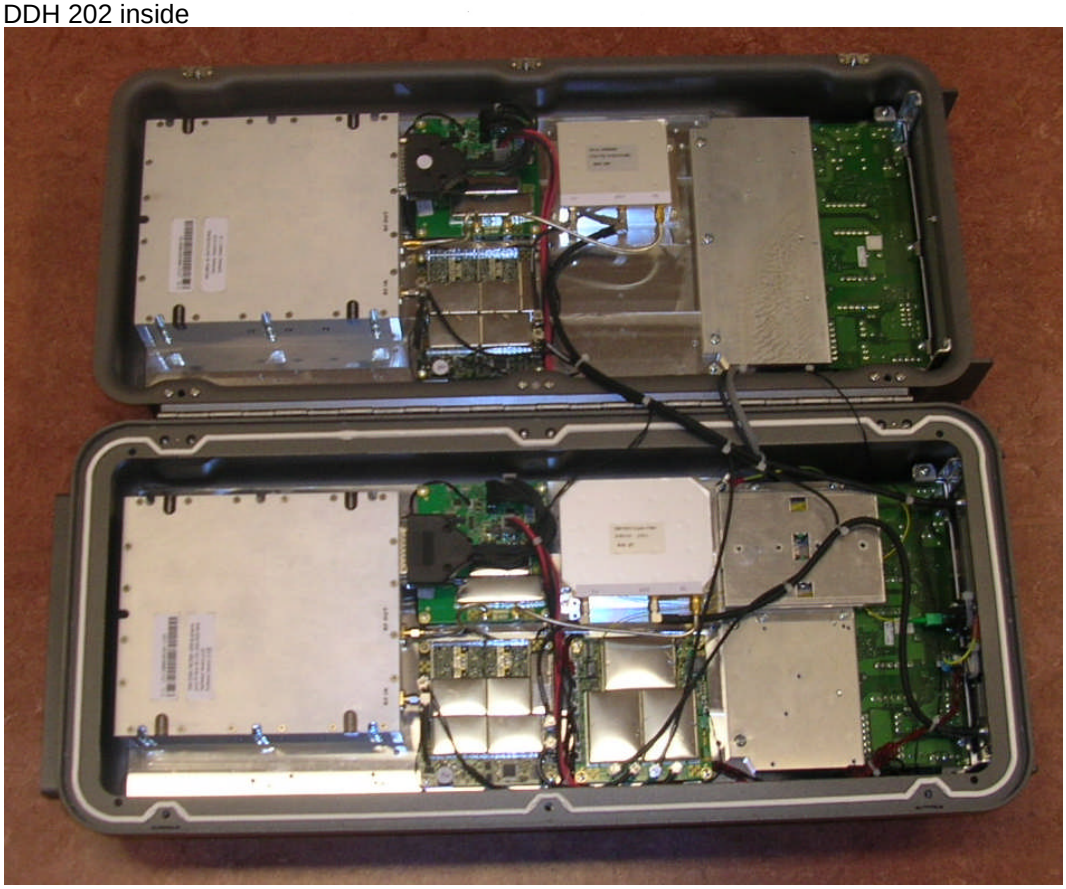
DDH 202 inside



DDH 202 bottom side with connectors

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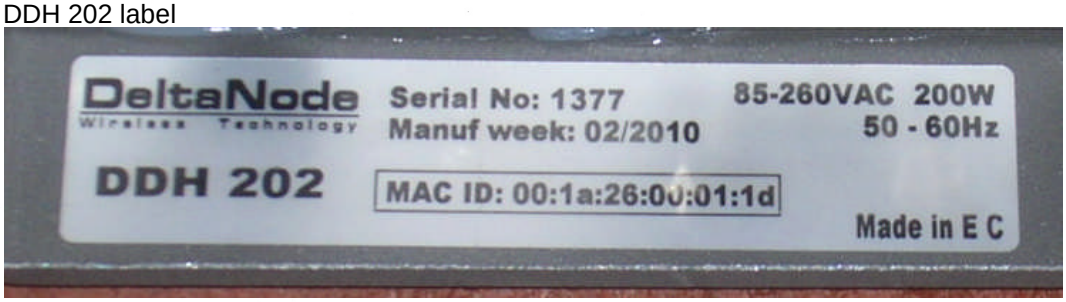
DDH 202 label



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