

TRaC Radio Test Report : TTR-000174WUS2

Applicant : Promethean Ltd

Specification(s) : CFR47 Part 15 July 2008

Apparatus : Activboard 300 Pro Series

FCC ID : QAM015

Purpose of Test : Class II Permissive Change

Authorised by :



: Radio Product Manager

Issue Date : 22nd October 2010

Authorised Copy Number : PDF

Contents

Section 1:	Introduction	3
	1.1 General	3
	1.2 Tests Requested By	4
	1.3 Manufacturer	4
	1.4 Apparatus Assessed	4
	1.6 Notes Relating To The Assessment	6
	1.7 Deviations from Test Standards	6
Section 2:	Measurement Uncertainty	7
	2.1 Measurement Uncertainty Values	7
Section 3:	Modifications	9
	3.1 Modifications Performed During Assessment	9
Appendix A:	Formal Emission Test Results	10
	A1 Conducted Fundamental Carrier Power	11
	A2 RF Antenna Conducted Spurious Emissions	12
	A3 Radiated Electric Field Emissions Within The Restricted Band 15.205	13
	A3 Radiated Electric Field Emissions Within The Restricted Band 15.205	18
	A4 Power Line Conducted Emissions	34
	A5 20 dB Bandwidth and Channel Spacing	38
	A6 Hopping frequencies	39
	A7 Channel Occupancy	40
	A8 Antenna Gain	41
Appendix B:	Supporting Graphical Data	42
Appendix C:	Additional Test and Sample Details	106
Appendix D:	Additional Information	112
Appendix E:	Calculation of the duty cycle correction factor	113
Appendix F:	Photographs and Figures	114

Section 1:

Introduction

1.1 General

This report contains an assessment of an apparatus against Electromagnetic Compatibility Standards based upon tests carried out on samples submitted to the Laboratory.

Test performed by: TRaC
Telecoms & Radio
Moss View
Nipe Lane
Up Holland
West Lancashire, WN8 9PY
United Kingdom

Telephone: +44 (0) 1695 556666
Fax: +44 (0) 1695 577077

Email: test@tracglobal.com
Web site: <http://www.tracglobal.com>

Tests performed by: S Hodgkinson, Radio Test Engineer

Report author: S Hodgkinson, Radio Test Engineer

This report must not be reproduced except in full without prior written permission from TRaC Telecoms & Radio.

1.2 Tests Requested By

This testing in this report was requested by :

Promethean Ltd
Promethean House
Lower Philips Road
Blackburn
Lancashire
BB1 5TH

1.3 Manufacturer

Promethean Ltd
Promethean House
Lower Philips Road
Blackburn
Lancashire
BB1 5TH

1.4 Apparatus Assessed

The following apparatus was assessed between 20th August 2010 – 20th September 2010:

Activboard 300 Pro Series

Models:-

PRM-AB378-03
PRM-AB387-03
PRM-AB395-03

Equipment description

The Promethean 300 Pro Series are available in three sizes 78", 87", 95 and have the following features:

Stereo Amplifier
Stereo Loudspeakers
USB Hub
USB Port
2.4GHz Radio Link
2 Pen Frequencies
18.0Vdc Power supply unit, model number DPS-605B A

The cables for the Loudspeakers are pre installed into the outer case of the boards.

The 300 Pro Series, testing was carried out with the audio amplifier and USB Hub and USB port exercised, and connected to the PC via a USB lead.

When required the testing was carried out with all of the boards connected to the PC via the 2.4GHz radio link.

1.5 EXAMINATIONS REQUIRED

Full details of test results are contained within Appendix A. The following table summarises the assessment.

EQUIPMENT TEST / EXAMINATIONS REQUIRED

TEST/EXAMINATION	RULE PART	DETECTOR	APPLICABILITY
Intentional Emission Frequency:	15.247	Peak	Yes
Intentional Emission Field Strength:	-	-	No
Intentional Emission Band Occupancy:	15.247(a)1	Peak	Yes
Intentional Emission EIRP (mW):	15.247(b)1	Peak	Yes
Spurious Emissions – Conducted:	-	-	No
Spurious Emissions – Conducted:	15.247	Peak	Yes
Spurious Emissions – Radiated <1000MHz:	15.209 ,15.247	Quasi Peak	Yes
Spurious Emissions – Radiated >1000MHz:	15.247 15.209	Peak average	Yes
Transmitter Carrier Frequency Separation:	15.247(a)(1)	Peak	Yes
Transmitter Maximum Peak Power Output Power:	15.247(b)(1)	Peak	Yes
Transmitter Band Edge Conducted Emissions:	15.247(c)	Peak	Yes
Transmitter Band Edge Radiated Emission:	15.247(c)	Peak	Yes
Extrapolation Factor:	15.31(f)	-	Yes
Maximum Frequency of Search:	15.33	-	Yes
Antenna Arrangements Integral:	15.203	-	Yes
Antenna Arrangements External Connector:	15.204	-	Yes
Restricted Bands:	15.205	-	Yes

Mod : Modification
CFR : Code of Federal Regulations
REFE : Radiated Electric Field Emissions

ANSI : American National Standards Institution
PLCE : Power Line Conducted Emissions

1.6 Notes Relating To The Assessment

With regard to this assessment, the following points should be noted:

The results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

The apparatus was set up and exercised using the configurations, modes of operation and arrangements defined in this report only.

Particular operating modes, apparatus monitoring methods and performance criteria required by the standards tested to have been performed except where identified in Section 1.7 of this test report (Deviations from Test Standards).

For emissions testing, throughout this test report, "Pass" indicates that the results for the sample as tested were below the specified limit (refer also to Section 2, Measurement Uncertainty).

Where relevant, the apparatus was only assessed using the monitoring methods and susceptibility criteria defined in this report.

All testing with the exception of testing at the Open Area Test Site was performed under the following environmental conditions:

Temperature	: 19 to 26 °C
Humidity	: 41 to 57 %

All dates used in this report are in the format dd/mm/yy.

1.7 Deviations from Test Standards

There were no deviations from the standards tested to.

Section 2:**Measurement Uncertainty****2.1 Measurement Uncertainty Values**

The following page contains the measurement uncertainties for measurements

All statements of uncertainty are expanded standard uncertainty using a coverage factor of 1.96 to give a 95% confidence where no required test level exists.

[1] Adjacent Channel Power

Uncertainty in test result = **1.86dB**

[2] Carrier Power

Uncertainty in test result (Equipment - TRLUH120) = **2.18dB**

Uncertainty in test result (Equipment – TRL05) = **1.08dB**

Uncertainty in test result (Equipment – TRL479) = **2.48dB**

[3] Effective Radiated Power

Uncertainty in test result = **4.71dB**

[4] Spurious Emissions

Uncertainty in test result = **4.75dB**

[5] Maximum frequency error

Uncertainty in test result (Equipment - TRLUH120) = **119ppm**

Uncertainty in test result (Equipment – TRL05) = **0.113ppm**

Uncertainty in test result (Equipment – TRL479) = **0.265ppm**

[6] Radiated Emissions, field strength OATS 14kHz-18GHz Electric Field

Uncertainty in test result (14kHz – 30MHz) = **4.8dB**,

Uncertainty in test result (30MHz – 1GHz) = **4.6dB**,

Uncertainty in test result (1GHz-18GHz) = **4.7dB**

[7] Frequency deviation

Uncertainty in test result = **3.2%**

[8] Magnetic Field Emissions

Uncertainty in test result = **2.3dB**

[9] Conducted Spurious

Uncertainty in test result (Equipment TRL479) Up to 8.1GHz = **3.31dB**

Uncertainty in test result (Equipment TRL479) 8.1GHz – 15.3GHz = **4.43dB**

Uncertainty in test result (Equipment TRL479) 15.3GHz – 21GHz = **5.34dB**

Uncertainty in test result (Equipment TRLUH120) Up to 26GHz = **3.14dB**

[10] Channel Bandwidth

Uncertainty in test result = **15.5%**

[11] Amplitude and Time Measurement – Oscilloscope

Uncertainty in overall test level = **2.1dB**, Uncertainty in time measurement = **0.59%**, Uncertainty in Amplitude measurement = **0.82%**

[11] Power Line Conduction

Uncertainty in test result = **3.4dB**

[12] Spectrum Mask Measurements

Uncertainty in test result = **2.59% (frequency)**
Uncertainty in test result = **1.32dB (amplitude)**

[13] Adjacent Sub Band Selectivity

Uncertainty in test result = **1.24dB**

[14] Receiver Blocking – Listen Mode, Radiated

Uncertainty in test result = **3.42dB**

[15] Receiver Blocking – Talk Mode, Radiated

Uncertainty in test result = **3.36dB**

[16] Receiver Blocking – Talk Mode, Conducted

Uncertainty in test result = **1.24dB**

[17] Receiver Threshold

Uncertainty in test result = **3.23dB**

[18] Transmission Time Measurement

Uncertainty in test result = **7.98%**

Section 3:

Modifications

3.1 Modifications Performed During Assessment

No modifications were performed during the assessment

Appendix A:**Formal Emission Test Results**

Abbreviations used in the tables in this appendix:

Spec	: Specification	ALSR	: Absorber Lined Screened Room
Mod	: Modification	OATS	: Open Area Test Site
EUT	: Equipment Under Test	ATS	: Alternative Test Site
SE	: Support Equipment		
		Ref	: Reference
		Freq	: Frequency
		MD	: Measurement Distance
		SD	: Spec Distance
L	: Live Power Line	Pol	: Polarisation
N	: Neutral Power Line	H	: Horizontal Polarisation
E	: Earth Power Line	V	: Vertical Polarisation
Pk	: Peak Detector	CDN	: Coupling & decoupling network
QP	: Quasi-Peak Detector		
Av	: Average Detector		

A1 Conducted Fundamental Carrier Power

The EUT transmitting on its lowest channel centre and highest carrier frequency in turn.

Test Details:	
Regulation	CFR 47 2008, Part15 Subpart (c) 15.247(b)(1)
EUT sample number	S01,S05
Modification state	0
SE in test environment	S04

Channel No	Channel Frequency (MHz)	Measured Peak Conducted Carrier Power (dBm)	Measured Peak Conducted Carrier Power (mW)	Limit (W)	Result
02	2401	6.79dBm	4.77	0.125	Pass
46	2440	6.47dBm	4.43		Pass
92	2480	6.07dBm	4.04		Pass

Note: Channel 02 is the lowest operating frequency, and channel 92 is the highest operating frequency.

For battery-operated equipment, the test was performed using a new battery as required by 15.31(e).

A2 RF Antenna Conducted Spurious Emissions

Measurement of conducted spurious emissions at the antenna port was performed using a peak detector with the RBW set to 100kHz and the VBW>RBW. Frequencies were scanned up through to the 10th harmonic with the EUT transmitting on its lowest, centre and highest carrier frequency in turn.

Test Details CH02	
Regulation	CFR 47 2008, Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.4:2003
Frequency range	30MHz to 25 GHz
EUT sample number	S01,S05
Modification state	0
SE in test environment	S04

The worst case conducted emission measurements at the antenna port are listed below:

Ref No.	Measured Freq (MHz)	Det.	Is measured Frequency within the Restricted bands (Y/N)	Measured Peak Conducted power (RBW =100kHz) (dBuV)	15.247(d) Limit (dBuV)	Summary
No significant emissions within 20 dB of the limit						

Notes:

1. The conducted emission limit for emissions outside the restricted bands, defined in CFR 47 Part 15.205(a) are based on a transmitted carrier level of 15.247(b). With the EUT transmitting on its lowest, centre and highest carrier frequencies in turn, emissions from the EUT are required to be 20 dB below the level of the highest fundamental as measured within a 100 kHz RBW in accordance with 15.247(d) using a peak detector.
2. The RBW = 100 kHz, Video bandwidth (VBW) > RBW and the radio spectrum was investigated up to the 10th harmonic in accordance 15.33 (a)(1).
3. The measurements at 2400 MHz and 2483.5 MHz were made to ensure band edge compliance.

The limit outside the restricted band in 100 kHz RBW is defined using the following formula in accordance with 15.247(d):

$$\text{The limit in 100 kHz RBW} = (\text{Maximum Peak Conducted Carrier}) - 20\text{dB}$$

A3 Radiated Electric Field Emissions Within The Restricted Band 15.205

Preliminary conducted emission testing was performed using a peak detector with the RBW = 100kHz. The radiated electric field emission test applies to spurious emissions and harmonics that fall within the restricted bands listed in Section 15.205. The maximum permitted field strength is listed in Section 15.209. The EUT was set to transmit on its lowest, centre and highest carrier frequency in turn.

The following test site was used for final measurements as specified by the standard tested to :

10m open area test site :

☐

3m alternative test site :

☒

The effect of the EUT set-up on the measurements is summarised in note (c) below.

PRM-AB378-03

Test Details CH02/46/92 Connected to Laptop	
Regulation	CFR 47 2008, Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.4:2003
Frequency range	30MHz to 1GHz
EUT sample number	S01,S05
Modification state	0
SE in test environment	S04
EUT set up	Refer to Appendix C
Photographs (Appendix F)	Photograph 1 and 2

The worst case radiated emission measurements for spurious emissions and harmonics that fall within the restricted bands are listed below and designated with (r).

Note: The 30MHz -1GHz results listed below show that the radiated emissions are the same regardless of the 2.4GHz test channels selected.

PRM-AB378-03 Radiated emissions 30MHz – 1GHz

Ref No.	FREQ. (MHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBμV/m)	EXTRAP FACT (dB)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
1.	31.35	33.83	0.6	18.10	27.53	25.00	N/A	17.78	100
2.	32.70	42.93	0.6	17.00	27.53	33.00	N/A	44.66	100
3.	33.10	42.03	0.6	16.90	27.53	32.00	N/A	39.81	100
4.	33.25	42.03	0.6	16.90	27.53	32.00	N/A	39.81	100
5.	33.65	45.63	0.6	16.90	27.53	35.60	N/A	60.25	100
6.	33.95	45.43	0.6	16.90	27.53	35.40	N/A	58.88	100
7.	34.50	46.73	0.6	16.00	27.53	35.80	N/A	61.66	100
8.	36.00	51.53	0.6	15.10	27.53	39.70	N/A	96.60	100
9.	36.85	42.31	0.6	14.60	27.51	30.00	N/A	31.62	100
10.	37.25	42.31	0.6	14.60	27.51	30.00	N/A	31.62	100
11.	40.20	45.41	0.7	13.00	27.51	31.60	N/A	38.01	100
12.	48.00	47.07	0.7	8.70	27.57	28.90	N/A	27.86	100
13.	53.25	47.39	0.7	6.50	27.59	27.00	N/A	22.38	100
14.	57.10	47.31	0.8	5.50	27.61	26.00	N/A	19.95	100
15.	58.35	49.41	0.8	5.40	27.61	28.00	N/A	25.11	100
16.	60.00	53.81	0.8	5.00	27.61	32.00	N/A	39.81	100
17.	67.35	49.63	0.8	5.20	27.63	28.00	N/A	25.11	100
18.	68.70	48.03	0.8	5.30	27.63	26.50	N/A	21.13	100
19.	72.00	47.45	0.8	5.60	27.65	26.20	N/A	20.41	100
20.	78.00	49.26	0.8	6.60	27.66	29.00	N/A	28.14	100
21.	79.15	43.66	0.8	6.80	27.66	23.60	N/A	15.13	100
22.	80.95	45.75	0.8	7.00	27.65	25.90	N/A	19.72	100
23.	81.40	48.65	0.9	7.10	27.65	29.00	N/A	28.14	100
24.	82.75	47.75	0.9	7.30	27.65	28.30	N/A	26.00	100
25.	84.00	58.57	0.9	7.70	27.67	39.50	N/A	94.40	100
26.	86.45	46.69	0.9	8.00	27.69	27.90	N/A	24.83	100
27.	88.85	45.60	0.9	8.40	27.70	27.20	N/A	22.90	150
28.	91.10	46.81	1.0	8.80	27.71	28.90	N/A	27.86	150

PRM-AB378-03 Radiated emissions 30MHz – 1GHz

Ref No.	FREQ. (MHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBμV/m)	EXTRAP FACT (dB)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
29.	93.45	46.58	1.1	9.00	27.68	29.00	N/A	28.18	150
30.	96.00	56.87	1.1	9.30	27.67	39.60	N/A	95.49	150
31.	104.60	47.28	1.1	10.30	27.68	31.00	N/A	35.48	150
32.	108.00	48.78	1.2	10.70	27.68	33.00	N/A	44.66	150
33.	111.05	44.49	1.2	11.00	27.69	29.00	N/A	28.18	150
34.	120.00	47.14	1.2	11.60	27.74	32.20	N/A	40.73	150
35.	123.50	41.80	1.2	11.70	27.70	27.00	N/A	22.38	150
36.	144.25	46.72	1.3	11.10	27.72	31.40	N/A	37.15	150
37.	145.75	46.62	1.3	10.90	27.72	31.10	N/A	35.89	150
38.	150.80	47.22	1.4	10.50	27.72	31.40	N/A	37.15	150
39.	159.80	46.06	1.4	10.20	27.76	29.90	N/A	31.26	150
40.	162.30	43.26	1.4	9.80	27.76	26.70	N/A	21.62	150
41.	204.55	52.15	1.5	8.10	27.75	34.00	N/A	50.11	150
42.	206.60	48.85	1.6	8.30	27.75	31.00	N/A	35.48	150
43.	211.15	49.31	1.7	8.60	27.71	31.90	N/A	39.35	150
44.	212.00	46.31	1.8	8.60	27.71	29.00	N/A	28.18	150
45.	234.25	47.00	1.9	9.70	27.70	30.90	N/A	35.07	200
46.	236.65	48.40	1.9	9.90	27.70	32.50	N/A	42.17	200
47.	240.00	47.90	1.9	10.40	27.70	32.50	N/A	42.17	200
48.	360.00	40.74	2.2	14.50	27.54	29.90	N/A	31.26	200
49.	480.00	45.60	2.4	17.50	27.50	38.00	N/A	79.43	200
50.	540.00	31.68	2.7	20.10	27.58	26.90	N/A	22.13	200
51.	576.00	44.92	2.7	19.90	27.52	40.00	N/A	100.00	200
52.	648.00	37.72	2.8	20.60	27.72	33.40	N/A	46.77	200
53.	720.00	43.06	3.0	22.40	27.96	40.50	N/A	105.92	200
54.	864.00	32.31	3.3	23.50	28.11	31.00	N/A	35.48	200
55.	960.05	38.56	3.5	24.70	27.76	39.00	N/A	89.12	500

Note: For radiated emissions that fall within 30MHz -1GHz the required limits are as part 15.209.

Radiated Electric Field Emissions that fall within the restricted bands 15.205 continued:**PRM-AB378-03 1GHz - 25GHz**

The following test site was used for final measurements as specified by the standard tested to :

10m open area test site : ☐

3m alternative test site : ☒

Test Details CH02	
Regulation	CFR 47 2008, Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.4:2003
Frequency range	1GHz to 25 GHz
EUT sample number	S01,S05
Modification state	0
SE in test environment	S02
EUT set up	Refer to Appendix C
Photographs (Appendix F)	Photograph 1 and 2

The worst case radiated emission measurements for spurious emissions and harmonics that fall within the restricted bands are listed below and designated with (r).

Ref No.	FREQ. (GHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBμV/m)	EXTRAP FACT (dB)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
1.	4.80500(r)	57.76 53.20	1.78 1.78	32.65 32.65	34.85 34.85	57.34pk 52.78Av	N/A	736.20pk 435.51Av	5011.0pk 500.0Av
2.	7.20836	55.93 49.46	2.16 2.16	35.88 35.88	35.16 35.16	58.81pk 52.34Av	N/A	871.96pk 414.00Av	20dBc
3.	9.61180	46.63 34.33	2.74 2.74	38.19 38.19	35.60 35.60	51.96pk 39.66Av	N/A	396.27pk 96.16Av	20dBc

Note: For other frequencies that do not fall into the restricted bands of operation that are ≥1 GHz the required Limit is 20dBc below the fundamental output power.

Radiated Electric Field Emissions that fall within the restricted bands 15.205 continued:

The following test site was used for final measurements as specified by the standard tested to :

10m open area test site : ☐

3m alternative test site : ☒

The effect of the EUT set-up on the measurements is summarised in note (c) below.

Test Details CH046	
Regulation	CFR 47 2008, Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.4:2003
Frequency range	1GHz to 25 GHz
EUT sample number	S01,S05
Modification state	0
SE in test environment	S04
EUT set up	Refer to Appendix C
Photographs (Appendix F)	Photograph 1 and 2

The worst case radiated emission measurements for spurious emissions and harmonics that fall within the restricted bands are listed below and designated with (r).

Ref No.	FREQ. (GHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBμV/m)	EXTRAP FACT (dB)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
1.	4.8811(r)	55.29 50.24	1.78 1.78	33.42 33.42	34.85 34.85	55.64pk 50.59Av	N/A	605.34pk 338.45Av	5011.0pk 500.0Av
2.	7.3223(r)	55.62 48.24	2.16 2.16	35.95 35.95	35.20 35.20	58.53pk 51.15Av	N/A	844.30pk 360.99Av	5011.0pk 500.0Av
3.	9.7623	46.86 34.40	2.82 2.82	38.08 38.08	35.70 35.70	52.06pk 39.60Av	N/A	400.86pk 95.49Av	20dBc

Note: For other frequencies that do not fall into the restricted bands of operation that are ≥1 GHz the required Limit is 20dBc below the fundamental output power.

A3 Radiated Electric Field Emissions Within The Restricted Band 15.205

The following test site was used for final measurements as specified by the standard tested to :

10m open area test site : ☐

3m alternative test site : ☒

The effect of the EUT set-up on the measurements is summarised in note (c) below.

Test Details CH92	
Regulation	CFR 47 2008, Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.4:2003
Frequency range	1GHz to 25 GHz
EUT sample number	S01,S05
Modification state	0
SE in test environment	S04
EUT set up	Refer to Appendix C
Photographs (Appendix F)	Photograph 1 and 2

The worst case radiated emission measurements for spurious emissions and harmonics that fall within the restricted bands are listed below and designated with (r).

Ref No.	FREQ. (GHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBμV/m)	EXTRAP FACT (dB)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
1.	2.1710	52.16 45.02	1.01 1.01	27.08 27.08	35.57 35.57	44.68pk 37.54Av	N/A	171.39pk 75.33Av	20dBc
2.	4.9605(r)	52.46 46.89	1.78 1.78	34.20 34.20	34.76 34.76	53.68pk 48.11Av	N/A	483.05pk 254.39Av	5011.0pk 500.0Av
3.	7.4408(r)	54.90 48.21	2.36 2.36	37.40 37.40	35.25 35.25	59.41pk 52.72Av	N/A	934.32pk 432.51Av	5011.0pk 500.0Av

Note: For other frequencies that do not fall into the restricted bands of operation that are ≥1 GHz the required Limit is 20dBc below the fundamental output power.

Radiated Electric Field Emissions Within The Restricted Band 15.205 continued:

Preliminary conducted emission testing was performed using a peak detector with the RBW = 100kHz. The radiated electric field emission test applies to spurious emissions and harmonics that fall within the restricted bands listed in Section 15.205. The maximum permitted field strength is listed in Section 15.209. The EUT was set to transmit on its lowest, centre and highest carrier frequency in turn.

The following test site was used for final measurements as specified by the standard tested to :

10m open area test site :

☐

3m alternative test site :

☒

The effect of the EUT set-up on the measurements is summarised in note (c) below.

PRM-AB387-03

Test Details CH02/46/92 Connected to Laptop	
Regulation	CFR 47 2008, Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.4:2003
Frequency range	30MHz to 1GHz
EUT sample number	S02,S05
Modification state	0
SE in test environment	S04
EUT set up	Refer to Appendix C
Photographs (Appendix F)	Photograph 1 and 2

The worst case radiated emission measurements for spurious emissions and harmonics that fall within the restricted bands are listed below and designated with (r).

Note: The 30MHz -1GHz results listed below show the radiated emissions are the same regardless of the 2.4GHz test channels selected.

Radiated Electric Field Emissions Within The Restricted Band 15.205 continued:**PRM-AB387-03 Radiated emissions 30MHz – 1GHz**

Ref No.	FREQ. (MHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBμV/m)	EXTRAP FACT (dB)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
1.	31.25	32.82	0.6	18.10	27.53	24.00	N/A	15.84	100
2.	33.10	30.93	0.6	16.90	27.53	20.90	N/A	11.09	100
3.	34.35	32.73	0.6	16.00	27.53	21.80	N/A	12.30	100
4.	34.85	33.93	0.6	16.00	27.53	23.00	N/A	14.12	100
5.	36.00	50.03	0.6	15.10	27.53	38.20	N/A	81.28	100
6.	37.05	41.11	0.6	14.60	27.51	28.80	N/A	27.54	100
7.	37.50	41.01	0.6	14.60	27.51	28.70	N/A	27.22	100
8.	39.30	45.31	0.7	13.00	27.51	31.50	N/A	37.58	100
9.	41.45	43.31	0.7	12.50	27.51	29.00	N/A	28.18	100
10.	43.55	43.42	0.7	11.40	27.52	28.00	N/A	25.11	100
11.	45.25	46.63	0.7	10.20	27.53	30.00	N/A	31.62	100
12.	45.95	49.63	0.7	10.20	27.53	33.00	N/A	44.66	100
13.	47.75	45.15	0.7	9.20	27.55	27.50	N/A	23.71	100
14.	48.00	48.27	0.7	8.70	27.57	30.10	N/A	31.98	100
15.	49.20	40.57	0.7	8.20	27.57	21.90	N/A	12.44	100
16.	50.35	49.17	0.7	7.70	27.57	30.00	N/A	31.98	100
17.	50.60	46.67	0.7	7.70	27.57	27.50	N/A	23.71	100
18.	50.90	49.17	0.7	7.70	27.57	30.00	N/A	31.98	100
19.	52.20	50.39	0.7	6.80	27.59	30.30	N/A	32.73	100
20.	53.45	51.89	0.7	6.50	27.59	31.50	N/A	37.58	100
21.	54.70	51.59	0.7	6.30	27.59	31.00	N/A	35.48	100
22.	56.00	49.91	0.8	5.70	27.61	28.80	N/A	27.54	100
23.	57.25	47.71	0.8	5.50	27.61	26.40	N/A	20.89	100
24.	58.55	45.80	0.8	5.40	28.00	24.00	N/A	15.84	100
25.	60.00	47.81	0.8	5.00	27.61	26.00	N/A	19.95	100
26.	61.05	45.71	0.8	5.10	27.61	24.00	N/A	15.84	100
27.	62.30	47.61	0.8	5.00	27.61	25.80	N/A	19.49	150
28.	64.80	48.82	0.8	5.00	27.62	27.00	N/A	22.38	150

PRM-AB387-03 Radiated emissions 30MHz – 1GHz

Ref No.	FREQ. (MHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBμV/m)	EXTRAP FACT (dB)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
29.	66.05	50.23	0.9	5.00	27.63	28.50	N/A	26.60	100
30.	67.30	49.83	0.9	5.20	27.63	28.30	N/A	26.00	100
31.	68.55	50.43	0.9	5.30	27.63	29.00	N/A	28.18	100
32.	70.80	48.63	0.9	5.40	27.63	27.30	N/A	23.17	100
33.	71.10	50.64	0.9	5.50	27.64	29.40	N/A	29.51	100
34.	72.00	60.84	0.9	5.60	27.64	39.70	N/A	96.60	100
35.	75.80	47.35	0.9	6.10	27.65	26.70	N/A	21.62	100
36.	78.00	49.46	0.9	6.60	27.66	29.30	N/A	29.17	100
37.	80.90	42.65	0.9	7.00	27.65	22.90	N/A	13.96	100
38.	83.10	43.16	0.9	7.60	27.66	24.00	N/A	15.84	100
39.	84.10	49.16	1.0	7.70	27.66	30.20	N/A	32.35	100
40.	91.20	44.31	1.0	8.80	27.71	26.40	N/A	20.89	150
41.	93.25	43.71	1.0	9.00	27.71	26.00	N/A	19.95	150
42.	96.00	56.57	1.0	9.30	27.67	39.20	N/A	91.20	150
43.	98.45	46.97	1.1	9.60	27.67	30.00	N/A	31.62	150
44.	105.10	43.48	1.1	10.40	27.68	27.30	N/A	23.17	150
45.	108.00	47.69	1.1	10.70	27.69	31.80	N/A	38.90	150
46.	120.00	47.54	1.2	11.60	27.74	32.60	N/A	42.65	150
47.	128.85	43.00	1.2	11.50	27.70	28.00	N/A	25.11	150
48.	130.20	42.96	1.2	11.50	27.66	28.00	N/A	25.11	150
49.	132.00	46.39	1.2	11.50	27.69	31.40	N/A	37.15	150
50.	134.00	44.86	1.3	11.50	27.66	30.00	N/A	31.62	150
51.	136.55	44.29	1.3	11.40	27.69	29.30	N/A	29.17	150
52.	140.15	40.62	1.3	11.30	27.72	25.50	N/A	18.83	150
53.	141.70	39.82	1.3	11.30	27.72	24.70	N/A	17.17	150
54.	154.00	39.54	1.3	10.50	27.74	23.60	N/A	15.13	150
55.	156.00	44.14	1.3	10.30	27.74	28.00	N/A	25.11	150

PRM-AB387-03 Radiated emissions 30MHz – 1GHz

Ref No.	FREQ. (MHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBμV/m)	EXTRAP FACT (dB)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
29.	156.70	40.74	1.3	10.3	27.74	24.60	N/A	16.98	150
30.	165.45	42.86	1.4	9.60	27.76	26.10	N/A	20.18	150
31.	179.30	44.15	1.5	9.00	27.75	26.90	N/A	22.13	150
32.	202.00	45.18	1.6	8.00	27.78	27.00	N/A	22.38	150
33.	204.60	46.38	1.6	8.10	27.78	28.30	N/A	26.00	150
34.	208.20	48.12	1.6	8.50	27.72	30.50	N/A	31.80	150
35.	216.00	46.41	1.6	8.90	27.71	29.20	N/A	28.84	150
36.	228.30	47.59	1.6	9.50	27.69	31.00	N/A	35.48	200
37.	229.70	46.77	1.7	9.50	27.67	30.30	N/A	32.73	200
38.	233.35	30.00	1.7	9.70	27.70	29.70	N/A	30.54	200
39.	235.95	45.82	1.7	9.80	27.72	29.60	N/A	30.20	200
40.	242.20	42.27	1.7	10.80	27.77	27.00	N/A	22.38	200
41.	253.45	44.49	1.8	12.40	27.69	31.00	N/A	35.48	200
42.	276.20	44.45	1.8	12.70	27.65	31.30	N/A	36.72	200
43.	330.10	38.50	2.0	14.10	27.60	27.00	N/A	22.38	200
44.	360.00	40.24	2.2	14.50	27.54	29.40	N/A	29.51	200
45.	480.00	46.50	2.4	17.50	27.50	38.90	N/A	88.10	200
46.	540.00	33.98	2.7	20.10	27.58	29.20	N/A	28.84	200
47.	552.00	30.40	2.7	20.60	27.60	26.10	N/A	20.18	200
48.	576.00	40.92	2.7	19.90	27.52	36.00	N/A	63.09	200
49.	648.00	33.42	2.8	20.60	27.72	29.10	N/A	28.51	200
50.	720.00	38.86	3.0	22.40	27.96	36.30	N/A	65.31	200
51.	780.05	35.17	3.1	22.80	28.07	33.00	N/A	44.66	200
52.	792.00	28.89	3.2	23.00	28.09	27.00	N/A	22.38	200
53.	810.05	28.13	3.2	23.20	28.13	26.40	N/A	20.89	200
54.	864.00	32.31	3.3	23.50	28.11	31.00	N/A	35.48	200
55.	870.05	29.47	3.3	23.30	28.07	28.00	N/A	25.11	200
56.	900.05	28.99	3.3	23.80	28.09	28.00	N/A	25.11	200
57.	930.05	30.85	3.4	24.70	27.95	31.00	N/A	35.48	200
58.	959.95	37.66	3.5	24.70	27.76	38.10	N/A	80.35	200

Note: For radiated emissions that fall within 30MHz -1GHz the required limits are as part 15.209.

Radiated Electric Field Emissions that fall within the restricted bands 15.205 continued:**PRM-AB387-03 1GHz - 25GHz**

The following test site was used for final measurements as specified by the standard tested to :

10m open area test site : ☐

3m alternative test site : ☒

Test Details CH02	
Regulation	CFR 47 2008, Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.4:2003
Frequency range	1GHz to 25 GHz
EUT sample number	S02,S05
Modification state	0
SE in test environment	S04
EUT set up	Refer to Appendix C
Photographs (Appendix F)	Photograph 1 and 2

The worst case radiated emission measurements for spurious emissions and harmonics that fall within the restricted bands are listed below and designated with (r).

Ref No.	FREQ. (GHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBμV/m)	EXTRAP FACT (dB)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
1.	4.8056(r)	56.21 50.18	1.78 1.78	32.65 32.65	34.85 34.85	55.79pk 49.76Av	N/A	615.88pk 307.61Av	5011.0pk 500.0Av
2.	7.2084	52.73 45.55	2.16 2.16	35.88 35.88	35.16 35.16	55.61pk 48.43Av	N/A	603.25pk 263.93Av	20dBc
3.	9.6111	51.01 42.04	2.74 2.74	38.19 38.19	35.60 35.60	56.34pk 47.37Av	N/A	656.14pk 233.61Av	20dBc

Note: For other frequencies that do not fall into the restricted bands of operation that are ≥1 GHz the required Limit is 20dBc below the fundamental output power.

Test Details CH46	
Regulation	CFR 47 2008, Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.4:2003
Frequency range	1GHz to 25 GHz
EUT sample number	S02,S05
Modification state	0
SE in test environment	S04
EUT set up	Refer to Appendix C
Photographs (Appendix F)	Photograph 1 and 2

The worst case radiated emission measurements for spurious emissions and harmonics that fall within the restricted bands are listed below and designated with (r).

Ref No.	FREQ. (GHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBμV/m)	EXTRAP FACT (dB)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
1.	4.8815(r)	54.63 49.05	1.78 1.78	33.42 33.42	34.85 34.85	54.98pk 49.40Av	N/A	561.04pk 295.12Av	5011.0pk 500.0Av
2.	7.3223(r)	54.74 46.96	2.16 2.16	35.95 35.95	35.20 35.20	57.65pk 49.87Av	N/A	762.95pk 311.53Av	5011.0pk 500.0Av
3.	9.7631	49.03 37.04	2.82 2.82	38.08 38.08	35.70 35.70	54.23pk 42.24Av	N/A	514.63pk 129.42Av	20dBc

Test Details CH92	
Regulation	CFR 47 2008, Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.4:2003
Frequency range	1GHz to 25 GHz
EUT sample number	S02,S05
Modification state	0
SE in test environment	S04
EUT set up	Refer to Appendix C
Photographs (Appendix F)	Photograph 1 and 2

The worst case radiated emission measurements for spurious emissions and harmonics that fall within the restricted bands are listed below and designated with (r).

Ref No.	FREQ. (GHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBμV/m)	EXTRAP FACT (dB)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
1.	4.9610(r)	59.19 51.94	1.01 1.01	27.08 27.08	35.57 35.57	51.71pk 44.46Av	N/A	385.03pk 167.10Av	5011.0pk 500.0Av
2.	7.4416(r)	58.20 51.01	1.78 1.78	34.20 34.20	34.76 34.76	59.42pk 52.23Av	N/A	935.40pk 408.79Av	5011.0pk 500.0Av
3.	9.9230	47.76 35.93	2.36 2.36	37.40 37.40	35.25 35.25	52.27pk 40.44Av	N/A	410.67pk 105.19Av	20dBc

Radiated Electric Field Emissions Within The Restricted Band 15.205 continued:

Preliminary conducted emission testing was performed using a peak detector with the RBW = 100kHz. The radiated electric field emission test applies to spurious emissions and harmonics that fall within the restricted bands listed in Section 15.205. The maximum permitted field strength is listed in Section 15.209. The EUT was set to transmit on its lowest, centre and highest carrier frequency in turn.

The following test site was used for final measurements as specified by the standard tested to :

10m open area test site :

☐

3m alternative test site :

☒

The effect of the EUT set-up on the measurements is summarised in note (c) below.

PRM-AB395-03

Test Details CH02/46/92 Connected to Laptop	
Regulation	CFR 47 2008, Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.4:2003
Frequency range	30MHz to 1GHz
EUT sample number	S03,S05
Modification state	0
SE in test environment	S04
EUT set up	Refer to Appendix C
Photographs (Appendix F)	Photograph 1 and 2

The worst case radiated emission measurements for spurious emissions and harmonics that fall within the restricted bands are listed below and designated with (r).

Note: The 30MHz -1GHz results listed below show the radiated emissions are the same regardless of the 2.4GHz test channels selected.

Radiated Electric Field Emissions Within The Restricted Band 15.205 continued:**PRM-AB395-03 Radiated emissions 30MHz – 1GHz**

Ref No.	FREQ. (MHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBμV/m)	EXTRAP FACT (dB)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
1.	31.50	36.03	0.6	18.10	27.53	27.20	N/A	22.90	100
2.	32.70	39.13	0.6	17.40	27.53	29.60	N/A	30.20	100
3.	33.35	42.03	0.6	16.90	27.53	32.00	N/A	39.81	100
4.	34.25	39.63	0.6	16.30	27.53	29.00	N/A	28.18	100
5.	34.50	40.23	0.6	16.30	27.53	29.60	N/A	30.20	100
6.	34.85	39.43	0.6	16.30	27.53	28.80	N/A	27.54	100
7.	36.00	47.82	0.6	15.10	27.52	36.00	N/A	63.09	100
8.	36.75	40.12	0.6	15.10	27.52	28.30	N/A	26.00	100
9.	37.05	41.32	0.6	14.60	27.52	29.00	N/A	28.18	100
10.	38.20	41.72	0.7	14.10	27.52	29.00	N/A	28.18	100
11.	39.15	43.31	0.7	13.50	27.51	30.00	N/A	31.62	100
12.	40.30	42.11	0.7	13.00	27.51	28.30	N/A	26.00	100
13.	44.90	46.92	0.7	10.20	27.52	30.30	N/A	32.73	100
14.	48.00	45.16	0.7	8.70	27.56	27.00	N/A	22.37	100
15.	51.60	41.17	0.7	7.30	27.57	21.60	N/A	12.02	100
16.	54.70	42.21	0.7	6.30	27.61	21.60	N/A	12.02	100
17.	60.00	50.91	0.8	5.00	27.61	29.10	N/A	28.51	100
18.	61.40	43.71	0.8	5.10	27.61	22.00	N/A	12.58	100
19.	72.00	58.04	0.9	5.60	27.64	36.90	N/A	69.98	100
20.	84.00	58.07	0.9	7.70	27.67	39.00	N/A	89.12	100
21.	89.25	48.01	1.0	8.50	27.71	29.80	N/A	30.90	150
22.	96.00	52.37	1.0	9.30	27.67	35.00	N/A	56.23	150
23.	105.60	44.68	1.1	10.40	27.68	28.50	N/A	26.60	150
24.	106.30	44.58	1.1	10.50	27.68	28.50	N/A	26.60	150
25.	107.85	43.08	1.1	10.70	27.68	27.20	N/A	22.90	150
26.	136.75	46.99	1.3	11.40	27.69	32.00	N/A	39.81	150
27.	144.00	43.42	1.3	11.10	27.72	28.10	N/A	25.41	150
28.	151.20	45.52	1.3	10.50	27.72	29.60	N/A	30.20	150

PRM-AB395-03 Radiated emissions 30MHz – 1GHz

Ref No.	FREQ. (MHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBμV/m)	EXTRAP FACT (dB)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
29.	167.70	42.26	1.4	9.40	27.76	25.30	N/A	18.40	150
30.	180.00	47.55	1.5	9.00	27.75	30.30	N/A	32.73	150
31.	193.00	45.97	1.5	7.90	27.77	27.60	N/A	23.98	150
32.	200.70	46.69	1.6	7.90	27.79	28.40	N/A	26.30	150
33.	240.00	48.67	1.7	10.40	27.77	33.00	N/A	44.66	200
34.	295.50	42.73	1.9	13.00	27.63	30.00	N/A	31.62	200
35.	311.05	47.16	1.9	13.30	27.66	34.70	N/A	54.32	200
36.	480.00	40.60	2.4	17.50	27.50	33.00	N/A	44.66	200
37.	492.00	38.07	2.5	17.90	27.47	31.00	N/A	35.48	200
38.	503.95	39.23	2.6	18.10	27.43	32.50	N/A	42.17	200
39.	516.00	37.37	2.6	18.40	27.47	30.90	N/A	35.07	200
40.	564.00	39.75	2.7	20.10	27.55	35.00	N/A	56.23	200
41.	576.00	43.82	2.7	19.90	27.52	38.90	N/A	88.10	200
42.	600.05	38.42	2.8	20.20	27.62	33.80	N/A	48.97	200
43.	648.00	32.42	2.8	20.60	27.72	28.10	N/A	25.41	200
44.	720.00	36.76	3.0	22.40	27.96	34.20	N/A	51.28	200
45.	959.95	37.16	3.5	24.70	27.76	37.60	N/A	75.85	200

Note: For radiated emissions that fall within 30MHz -1GHz the required limits are as part 15.209.

Radiated Electric Field Emissions that fall within the restricted bands 15.205 continued:**PRM-AB395-03 1GHz - 25GHz**

The following test site was used for final measurements as specified by the standard tested to :

10m open area test site : ☐

3m alternative test site : ☒

Test Details CH02	
Regulation	CFR 47 2008, Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.4:2003
Frequency range	1GHz to 25 GHz
EUT sample number	S03,S05
Modification state	0
SE in test environment	S04
EUT set up	Refer to Appendix C
Photographs (Appendix F)	Photograph 1 and 2

The worst case radiated emission measurements for spurious emissions and harmonics that fall within the restricted bands are listed below and designated with (r).

Ref No.	FREQ. (GHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBμV/m)	EXTRAP FACT (dB)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
1.	4.8056(r)	58.07 53.93	1.78 1.78	32.65 32.65	34.85 34.85	57.65pk 53.51Av	N/A	762.95pk 473.69Av	5011.0pk 500.0Av
2.	7.2085	55.21 48.34	2.16 2.16	35.88 35.88	35.16 35.16	58.09pk 51.22Av	N/A	802.60pk 372.39Av	20dBc
3.	9.6111	50.58 39.44	2.74 2.74	38.19 38.19	35.60 35.60	55.91pk 44.77Av	N/A	624.45pk 173.18Av	20dBc

Note: For other frequencies that do not fall into the restricted bands of operation that are ≥1 GHz the required Limit is 20dBc below the fundamental output power.

Test Details CH46	
Regulation	CFR 47 2008, Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.4:2003
Frequency range	1GHz to 25 GHz
EUT sample number	S03,S05
Modification state	0
SE in test environment	S04
EUT set up	Refer to Appendix C
Photographs (Appendix F)	Photograph 1 and 2

The worst case radiated emission measurements for spurious emissions and harmonics that fall within the restricted bands are listed below and designated with (r).

Ref No.	FREQ. (GHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBμV/m)	EXTRAP FACT (dB)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
1.	4.8815(r)	56.56 51.83	1.78 1.78	33.42 33.42	34.85 34.85	56.91pk 52.18Av	N/A	700.64pk 406.44Av	5011.0pk 500.0Av
2.	7.3218(r)	56.10 49.38	2.16 2.16	35.95 35.95	35.20 35.20	59.10pk 52.29Av	N/A	901.57pk 411.62Av	5011.0pk 500.0Av
3.	9.7631	49.85 41.11	2.82 2.82	38.08 38.08	35.70 35.70	55.05pk 46.31Av	N/A	565.58pk 206.77Av	20dBc

Test Details CH92	
Regulation	CFR 47 2008, Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.4:2003
Frequency range	1GHz to 25 GHz
EUT sample number	S03,S05
Modification state	0
SE in test environment	S04
EUT set up	Refer to Appendix C
Photographs (Appendix F)	Photograph 1 and 2

The worst case radiated emission measurements for spurious emissions and harmonics that fall within the restricted bands are listed below and designated with (r).

Ref No.	FREQ. (GHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBμV/m)	EXTRAP FACT (dB)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
1.	4.9611(r)		1.01 1.01	27.08 27.08	35.57 35.57	55.85pk 50.23Av	N/A	620.15pk 324.71Av	5011.0pk 500.0Av
2.	7.4415(r)		1.78 1.78	34.20 34.20	34.76 34.76	59.66pk 53.01Av	N/A	961.61pk 447.19Av	5011.0pk 500.0Av
3.	9.9223		2.36 2.36	37.40 37.40	35.25 35.25	56.44pk 46.54Av	N/A	663.74pk 212.32Av	20dBc

Notes:

- 1 Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.4: 2003 section 8.2.1.
- 2 In accordance with 15.35(b), above 1 GHz, emissions measured using a peak detector shall not exceed a level 20 dB above the average limit.
- 3 The measurements 2483.5 MHz was made to ensure band edge compliance.
- 4 Demonstration of band edge compliance at 2.4GHz (which lies outside the restricted bands as defined in section CFR47Part 15.205(a) is contained in section A2, RF Antenna Conducted Spurious Emissions and Appendix B of this test report.
- 5 Testing was performed with the EUT orientated in three orthogonal planes and the maximum emissions level recorded. In addition, the EUT antenna was varied within its range of motion in order to maximise emissions.
- 6 For Frequencies Below 1 GHz, RBW= 100 kHz, testing was performed with CISPR16 compliant test receiver with QP detector. Above 1 GHz tests were performed using a spectrum analyser using the following settings:

Peak Detector	RBW= 1MHz, VBW ≥ RBW
Average Detector	RBW= 1MHz, VBW ≥ RBW

These settings as per ANSI C63.4 and DA 00-705.

- 7 In accordance with DA 00-705, the average level of the spurious radiated emission may be reduced by the duty cycle correction factor. If the dwell time per channel (refer to the measured channel occupancy time, section A7 of this test report) of the hopping signal is less than 100ms then the average measurement may be further adjusted by the duty cycle correction factor which is derived from

$$20\log_{10}\left(\frac{\text{dwell time}}{100\text{ms}}\right)$$

The upper and lower frequency of the measurement range was decided according to CFR 47 Part 15:2008 Clause 15.33(a) and 15.33(a)(1).

Radiated emission limits (CFR 47 Part 15:2008 Clause 15.209) for emissions falling within the restricted bands defined in 15.205(a):

Frequency of emission (MHz)	Field strength $\mu\text{V/m}$	Measurement Distance m	Field strength $\text{dB}\mu\text{V/m}$
0.009-0.490	2400/F(kHz)	300	67.6/F (kHz)
0.490-1.705	24000/F(kHz)	30	87.6/F (kHz)
1.705-30	30	30	29.5
30-88	100	3	40.0
88-216	150	3	43.5
216-960	200	3	46.0
Above 960	500	3	54.0

Notes:

- (a) Where results have been measured at one distance, and a signal level displayed at another, the results have been extrapolated using the following formula:

$$\text{Extrapolation (dB)} = 20 \log_{10} \left(\frac{\text{measurement distance}}{\text{specification distance}} \right)$$

The results displayed take into account applicable antenna factors and cable losses.

- (b) The levels may have been rounded for display purposes.
- (c) The following table summarises the effect of the EUT operating mode, internal configuration and arrangement of cables / samples on the measured emission levels :

	See (i)	See (ii)	See (iii)	See (iv)
Effect of EUT operating mode on emission levels	✓			
Effect of EUT internal configuration on emission levels	✓			
Effect of Position of EUT cables & samples on emission levels	✓			
(i) Parameter defined by standard and / or single possible, refer to Appendix D (ii) Parameter defined by client and / or single possible, refer to Appendix D (iii) Parameter had a negligible effect on emission levels, refer to Appendix D (iv) Worst case determined by initial measurement, refer to Appendix D				

A4 Power Line Conducted Emissions

Preview power line conducted emission measurements were performed with a peak detector in a screened room. The effect of the EUT set-up on the measurements is summarised in note (b). Where applicable formal measurements of the emissions were performed with a peak, average and/or quasi peak detector.

Test Details: PRM-AB378-03	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.207
Measurement standard	ANSI C63.10:2009
Frequency range	150kHz to 30MHz
EUT sample number	S01,S05
Modification state	0
SE in test environment	S04,
SE isolated from EUT	S06
EUT set up	Refer to Appendix C
Photographs (Appendix F)	

The worst-case power line conducted emission measurements are listed below:

Results measured using the Quasi Peak detector compared to the Quasi Peak limit

	Ref No.	Freq (MHz)	Conductor	Result (dBuV)	Spec Limit (dBuV)	Margin (dB)
PRM-AB378-03	1	0.155	Live	53.12	65.73	12.61
	2	0.17	Neutral	48.67	64.96	16.29
	3	0.205	Live	45.58	63.41	17.83
	4	0.24	Live	42.60	62.10	19.50
	5	0.53	Live	42.58	56.00	13.42
	6	0.55	Live	45.49	56.00	10.51
	7	2.11	Live	36.04	56.00	19.96

Results measured using the average detector compared to the average limit

	Ref No.	Freq (MHz)	Conductor	Result (dBuV)	Spec Limit (dBuV)	Margin (dB)
PRM-AB378-03	1	0.175	Neutral	34.90	54.72	19.82
	2	0.525	Live	32.91	46.00	13.09
	3	0.555	Live	40.60	46.00	5.40
	4	0.96	Live	27.87	46.00	18.13
	5	1.605	Live	31.04	46.00	14.96
	6	2.24	Neutral	28.28	46.00	17.72
	7	2.885	Neutral	30.60	46.00	15.40
	8	3.52	Neutral	29.54	46.00	16.46
	9	3.635	Neutral	28.48	46.00	17.52
	10	5.13	Live	30.94	50.00	19.06
	12	6.415	Live	33.54	50.00	16.46
	13	15.575	Neutral	31.29	50.00	18.71

Test Details: PRM-AB387-03	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.207
Measurement standard	ANSI C63.10:2009
Frequency range	150kHz to 30MHz
EUT sample number	S02,S05
Modification state	0
SE in test environment	S04,
SE isolated from EUT	S06
EUT set up	Refer to Appendix C
Photographs (Appendix F)	

The worst-case power line conducted emission measurements are listed below:

Results measured using the Quasi Peak detector compared to the Quasi Peak limit

	Ref No.	Freq (MHz)	Conductor	Result (dBuV)	Spec Limit (dBuV)	Margin (dB)
PRM-AB387-03	1	0.175	Live	48.22	64.72	16.50
	2	0.21	Live	43.68	63.21	19.53
	3	0.525	Live	41.37	56.00	14.63
	4	0.555	Live	45.67	56.00	10.33
	5	2.2	Neutral	36.27	56.00	19.73

Results measured using the average detector compared to the average limit

	Ref No.	Freq (MHz)	Conductor	Result (dBuV)	Spec Limit (dBuV)	Margin (dB)
PRM-AB387-03	1	0.175	Live	36.11	54.72	18.61
	2	0.345	Live	30.79	49.08	18.29
	3	0.38	Live	30.05	48.28	18.23
	4	0.52	Live	36.27	46.00	9.73
	5	0.555	Live	42.90	46.00	3.10
	6	0.73	Live	30.35	46.00	15.65
	7	1.005	Live	29.18	46.00	16.82
	8	1.11	Live	29.57	46.00	16.43
	9	1.14	Live	27.66	46.00	18.34
	10	1.49	Live	29.72	46.00	16.28
	11	1.625	Live	27.62	46.00	18.38
	12	1.905	Live	28.44	46.00	17.56
	13	2.215	Neutral	32.48	46.00	13.52
	14	2.6	Neutral	31.80	46.00	14.20
	15	2.98	Neutral	31.80	46.00	14.20
	16	5.03	Neutral	33.09	50.00	16.91
	17	6.29	Neutral	37.46	50.00	12.54
	18	15.955	Neutral	34.33	50.00	15.67

Test Details: PRM-AB395-03	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.207
Measurement standard	ANSI C63.10:2009
Frequency range	150kHz to 30MHz
EUT sample number	S03,S05
Modification state	0
SE in test environment	S04
SE isolated from EUT	S06
EUT set up	Refer to Appendix C
Photographs (Appendix F)	

The worst-case power line conducted emission measurements are listed below:

Results measured using the Quasi Peak detector compared to the Quasi Peak limit

PRM-AB395-03	Ref No.	Freq (MHz)	Conductor	Result (dBuV)	Spec Limit (dBuV)	Margin (dB)
	1	0.17	Live	48.31	64.96	16.65
	2	0.205	Live	44.14	63.41	19.27
	3	0.525	Live	40.31	56.00	15.69
	4	0.55	Live	45.53	56.00	10.47
	5	2.11	Neutral	37.32	56.00	18.68
	6	2.95	Neutral	36.12	56.00	19.88

Results measured using the average detector compared to the average limit

PRM-AB395-03	Ref No.	Freq (MHz)	Conductor	Result (dBuV)	Spec Limit (dBuV)	Margin (dB)
	1	0.17	Live	36.12	54.96	18.84
	2	0.345	Live	31.51	49.08	17.57
	3	0.38	Live	30.27	48.28	18.01
	4	0.52	Live	34.11	46.00	11.89
	5	0.55	Neutral	42.90	46.00	3.10
	6	0.72	Live	30.70	46.00	15.30
	7	0.755	Live	30.62	46.00	15.38
	8	1.13	Live	28.85	46.00	17.15
	9	2.215	Live	30.03	46.00	15.97
	10	2.22	Neutral	27.19	46.00	18.81
	11	2.53	Neutral	29.20	46.00	16.80
	12	2.85	Live	29.60	46.00	16.40
	13	3.48	Live	29.45	46.00	16.55

Specification limits :

Conducted emission limits (CFR 47 2008 :Clause 15.207).

Conducted disturbance at the mains ports.

Frequency range MHz	Limits dB μ V	
	Quasi-peak	Average
0.15 to 0.5	66 to 56 ²	56 to 46 ²
0.5 to 5	56	46
5 to 30	60	50
Notes:		
1. The lower limit shall apply at the transition frequency.		
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.		

Notes:

- (a) The levels may have been rounded for display purposes.
- (b) The following table summarises the effect of the EUT operating mode and internal configuration on the measured emission levels :

	See (i)	See (ii)	See (iii)	See (iv)
Effect of EUT operating mode on emission levels	✓			
Effect of EUT internal configuration on emission levels	✓			
(i) Parameter defined by standard and / or single possible, refer to Appendix C (ii) Parameter defined by client and / or single possible, refer to Appendix C (iii) Parameter had a negligible effect on emission levels, refer to Appendix C (iv) Worst case determined by initial measurement, refer to Appendix C				

A5 20 dB Bandwidth and Channel Spacing

Title 47 of the CFR: 2002, Part 15 Subpart (c) 15.247(a)(1)(i) requires the measurement of the bandwidth of the transmission between the -20 dB points on the transmitted spectrum. The results of this test determine the limits for channel spacing. The channel spacing shall be a minimum of 25 kHz or the 20 dB bandwidth, whichever is the greater. The formal measurements are detailed below:

Test Details:	
Regulation	CFR 47 2008, Part 15 Subpart (c) 15.247(a)(1)(i)
EUT sample number	S01, S02, S03,S05
Modification state	0
SE in test environment	S04

Channel	Fl (MHz)	Fh (MHz)	Measured 20 dB Bandwidth (MHz)	Limit	Result
04	2403.775641	2405.217949	1.4423	≥500kHz	Pass
46	2438.318718	2439.780265	1.4615		
90	2478.032052	2479.519231	1.4871		

Plots of the 20 dB bandwidth and channel spacing are contained in Appendix B of this test report.

A6 Hopping frequencies

Hopping frequencies were verified using a spectrum analyser set to 85 MHz spans, displaying a set of the hopping channels in turn, while the EUT was operating in its normal frequency hopping mode.

Test Details:	
Regulation	CFR 47 2008, Part 15 Subpart (c) 15.247(a)(1)(i)
EUT sample number	S01,S05
Modification state	0
SE in test environment	S04
SE isolated from EUT	S06

No. of Hopping Channels	Requirement	Result
46	0.125mW 2.400GHz – 2.4835GHz	Pass

Plots showing the hopping channels are contained in Appendix B

A7 Channel Occupancy

Channel occupancy time was verified using a spectrum analyser in zero span mode, centred on the middle hopping channel frequency (2441 MHz), while the EUT was operating in its normal frequency hopping mode. The other channels were then verified to ensure that the channel occupancy was identical for all channels.

Test Details:	
Regulation	CFR 47 2008, Part15 Subpart (c) 15.247(a)(1)
EUT sample number	S01,S05
Modification state	0
SE in test environment	S04

Measured Channel Occupancy Time (ms)	Calculated Average Channel Occupancy Time (ms)	Average Channel Occupancy Time Limit (ms)	Result
555.128µs	26.64	400	Pass

Plots showing the channel occupancy time and time between successive transmissions are contained in Appendix B of this test report.

A8 Antenna Gain

The maximum antenna gain for the antenna types to be used with the EUT, as declared by the client, is 0 dBi.

Appendix B:

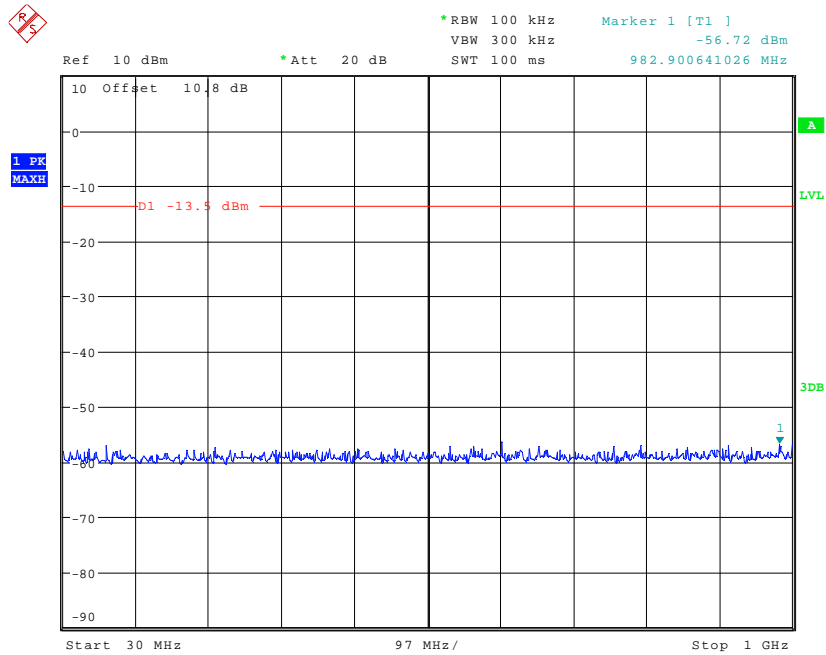
Supporting Graphical Data

This appendix contains graphical data obtained during testing.

Notes:

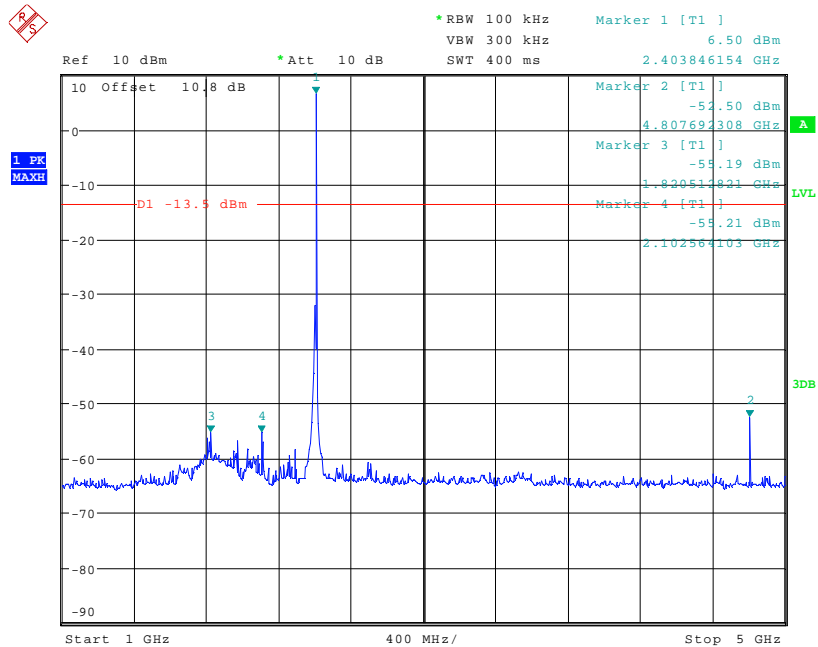
- (a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A and Appendix B.

Bottom Channel Conducted emissions 30MHz-1GHz



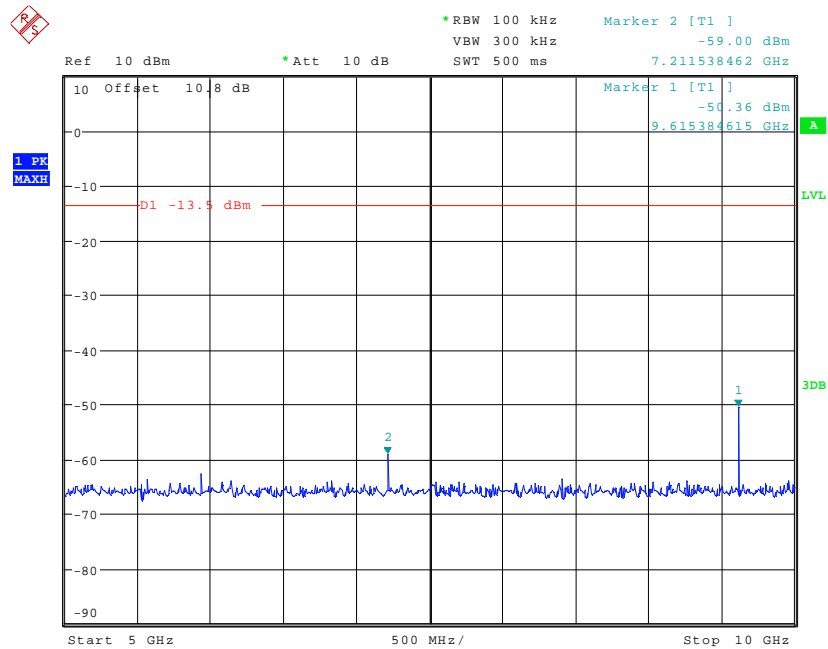
Date: 20.AUG.2010 08:51:26

Bottom Channel Conducted emissions 1GHz – 5GHz



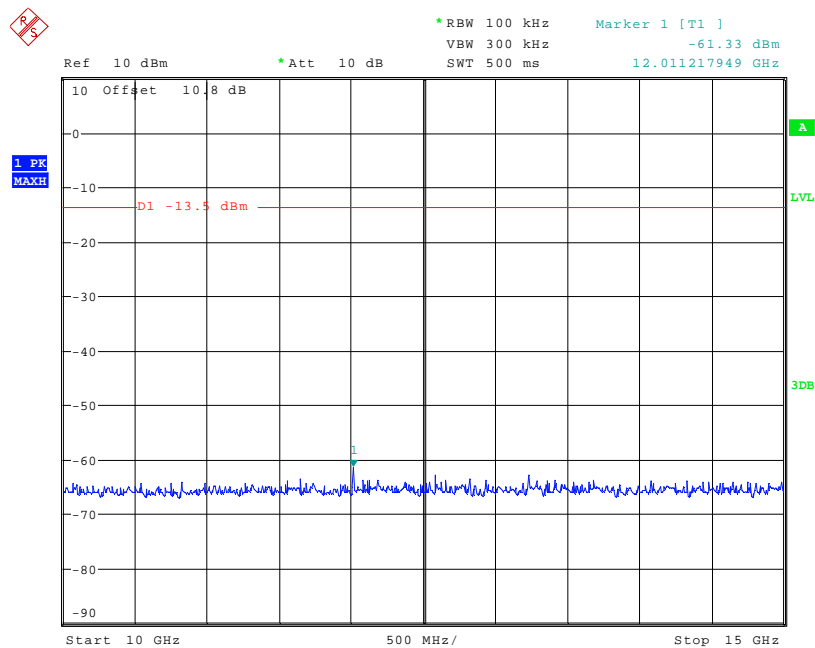
Date: 20.AUG.2010 08:49:58

Bottom Channel Conducted emissions 5GHz – 10GHz



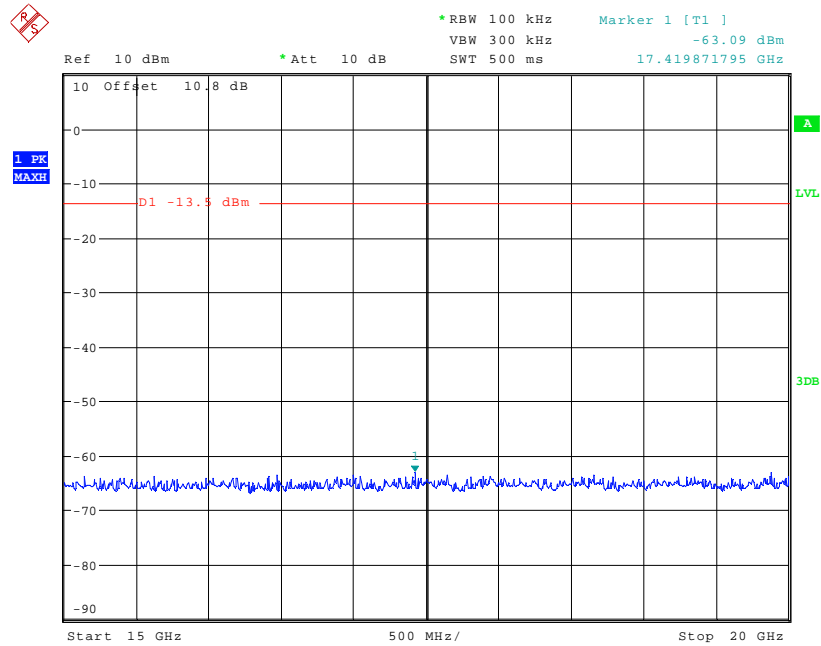
Date: 20.AUG.2010 08:50:13

Bottom Channel Conducted emissions 10GHz -15GHz



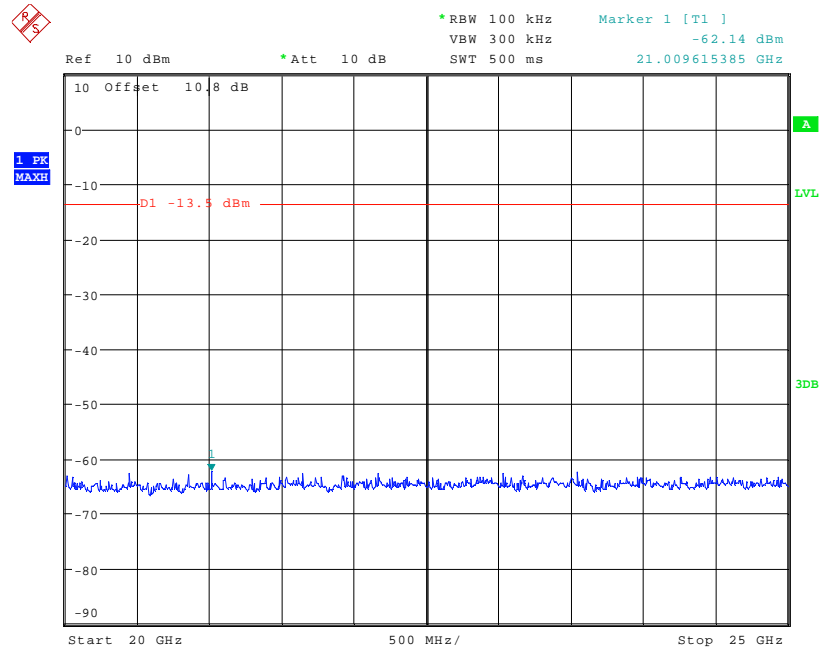
Date: 20.AUG.2010 08:50:29

Bottom Channel Conducted emissions 15GHz -20GHz



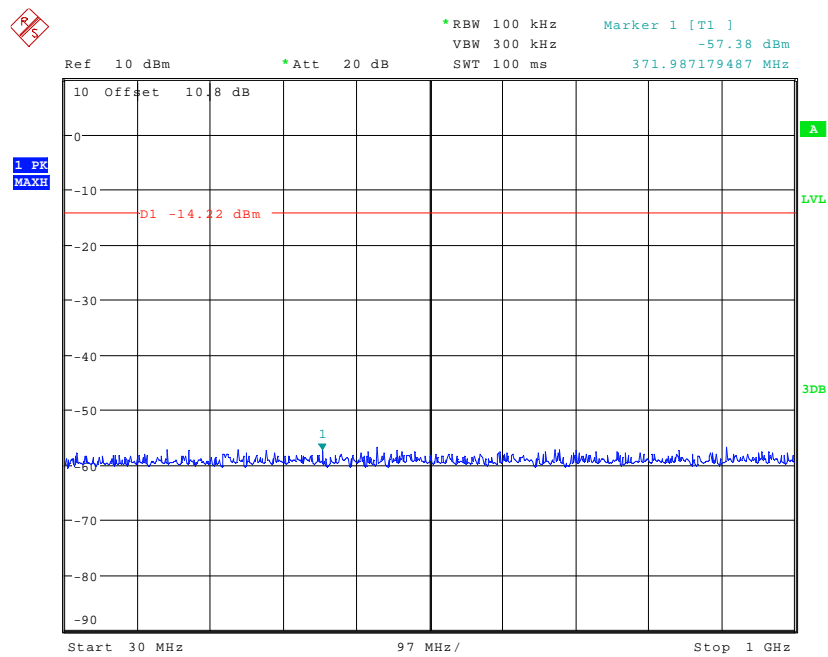
Date: 20.AUG.2010 08:50:46

Bottom Channel Conducted emissions 20GHz -25GHz



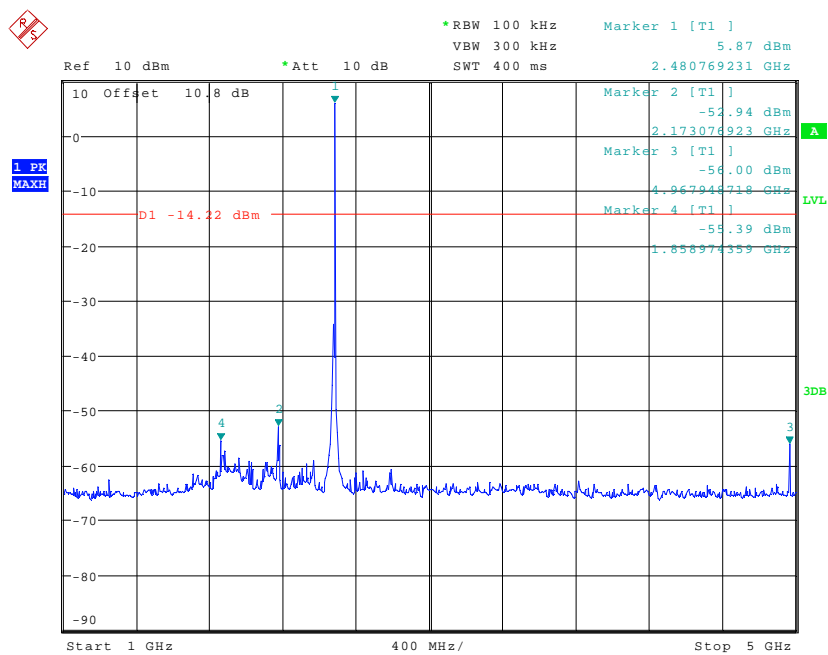
Date: 20.AUG.2010 08:51:05

Middle Channel Conducted emissions 30MHz-1GHz



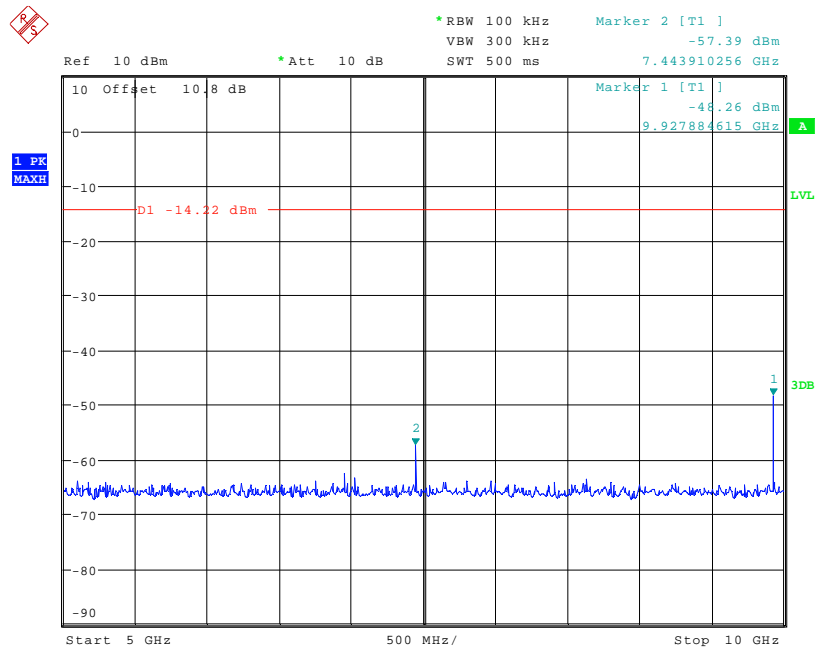
Date: 20.AUG.2010 08:47:24

Middle Channel Conducted emissions 1GHz – 5GHz



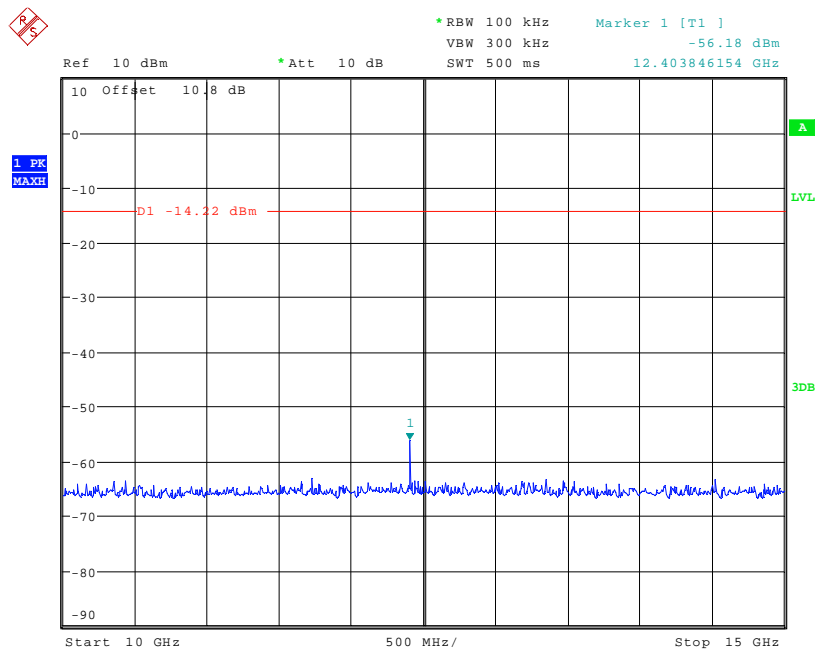
Date: 20.AUG.2010 08:45:32

Middle Channel Conducted emissions 5GHz – 10GHz



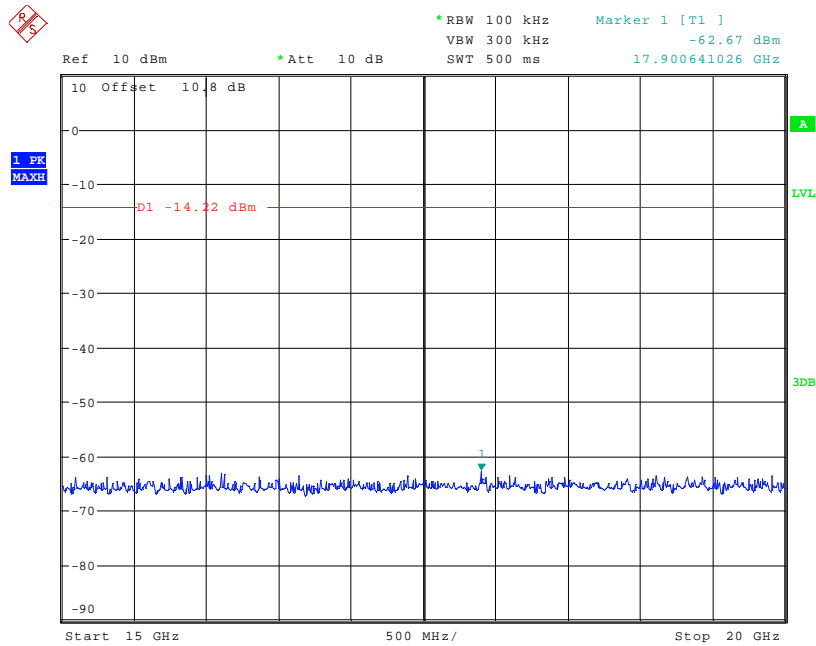
Date: 20.AUG.2010 08:46:17

Middle Channel Conducted emissions 10GHz – 15GHz



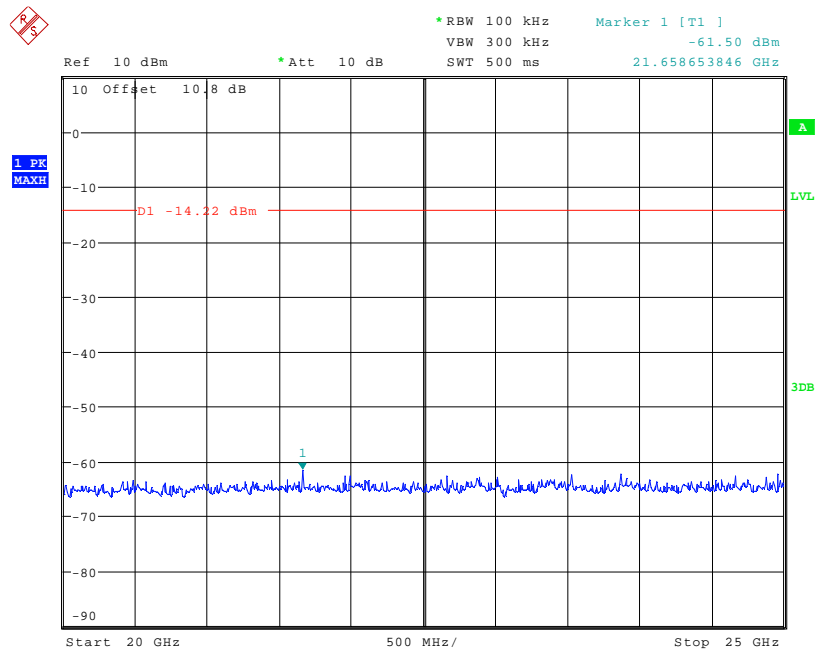
Date: 20.AUG.2010 08:46:34

Middle Channel Conducted emissions 15GHz – 20GHz



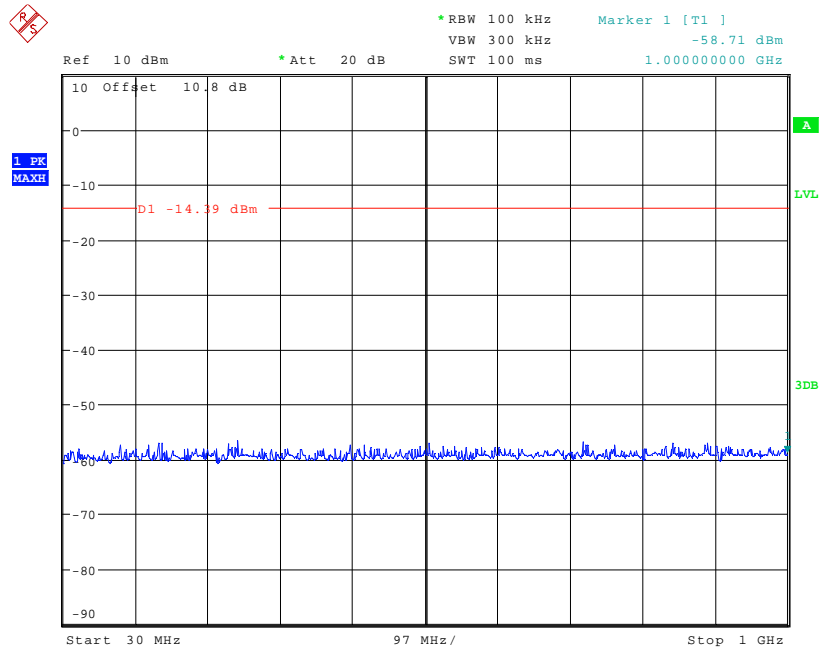
Date: 20.AUG.2010 08:46:46

Middle Channel Conducted emissions 20GHz – 25GHz



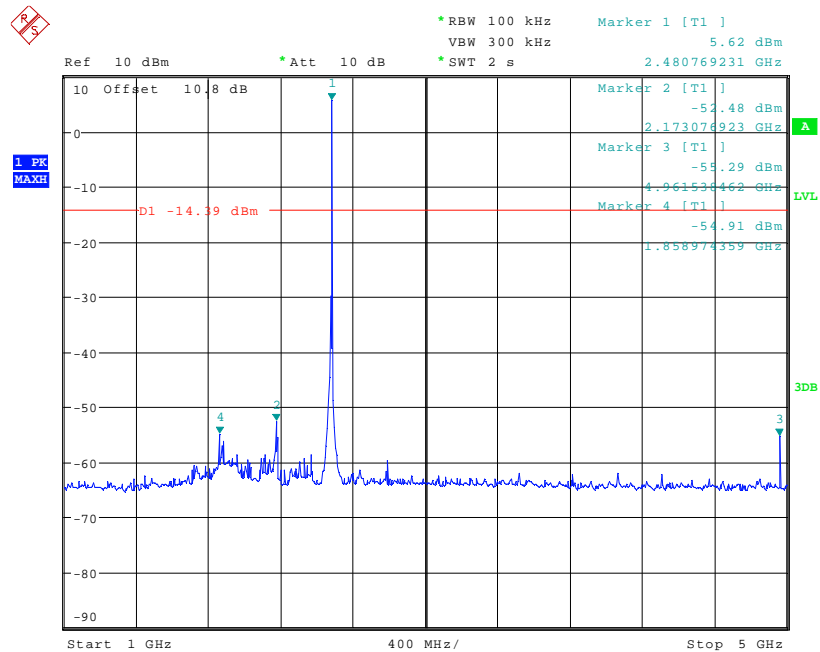
Date: 20.AUG.2010 08:47:04

Top Channel Conducted emissions 30MHz-1GHz



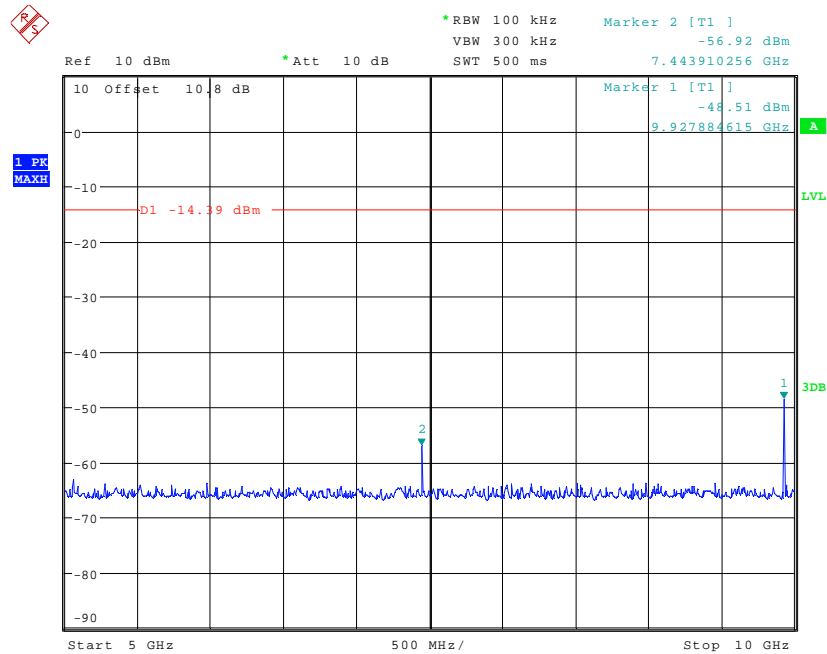
Date: 20.AUG.2010 08:43:02

Top Channel Conducted emissions 1GHz – 5GHz



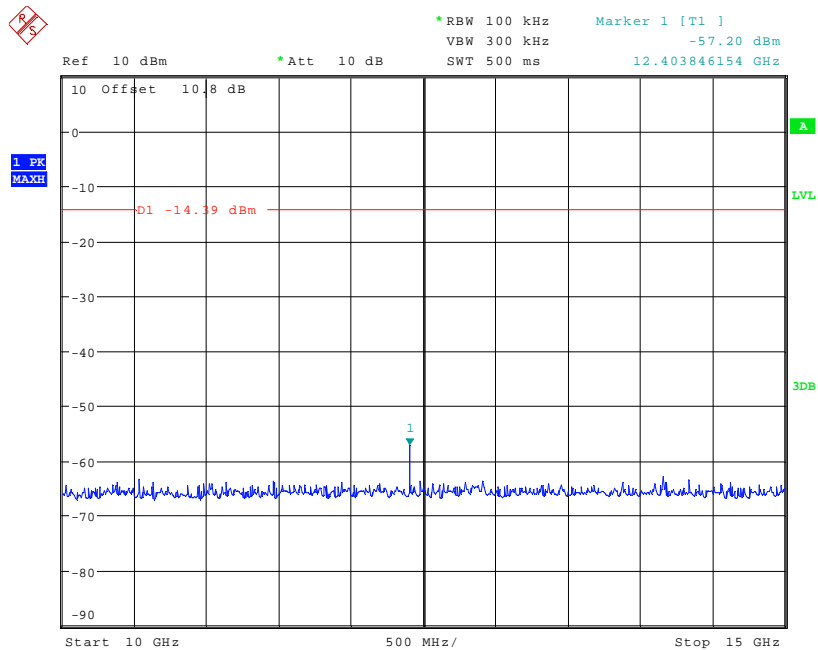
Date: 20.AUG.2010 08:40:55

Top Channel Conducted emissions 5GHz – 10GHz



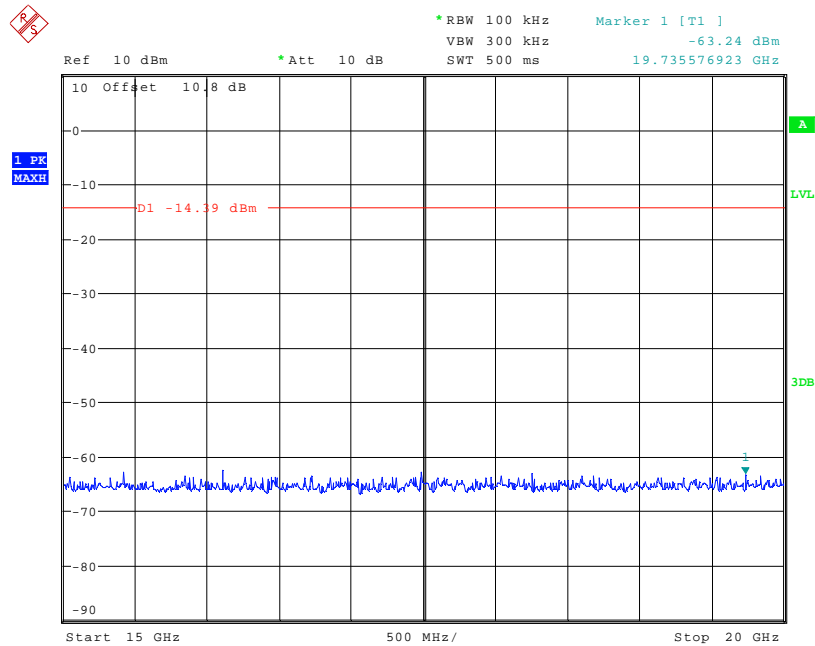
Date: 20.AUG.2010 08:41:28

Top Channel Conducted emissions 10GHz – 15GHz



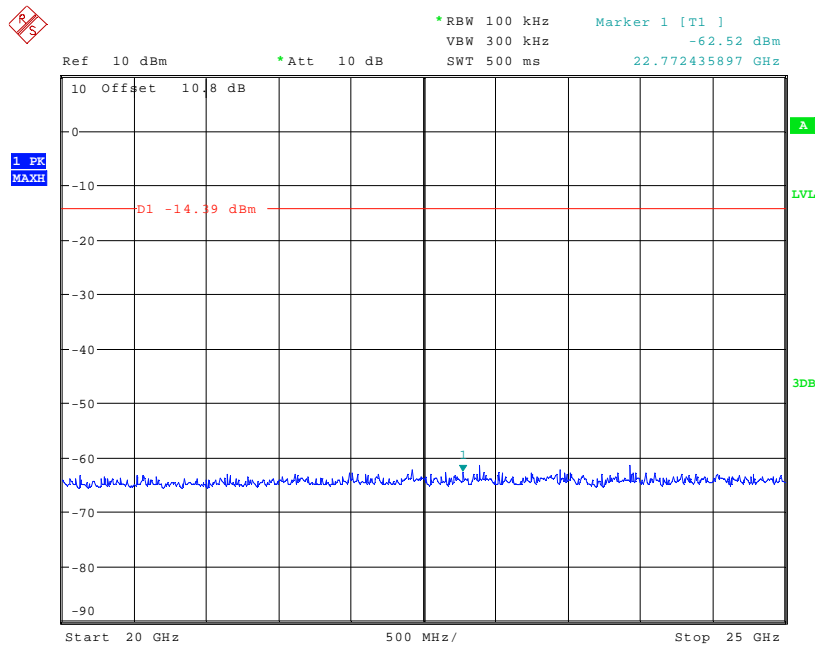
Date: 20.AUG.2010 08:41:40

Top Channel Conducted emissions 15GHz – 20GHz

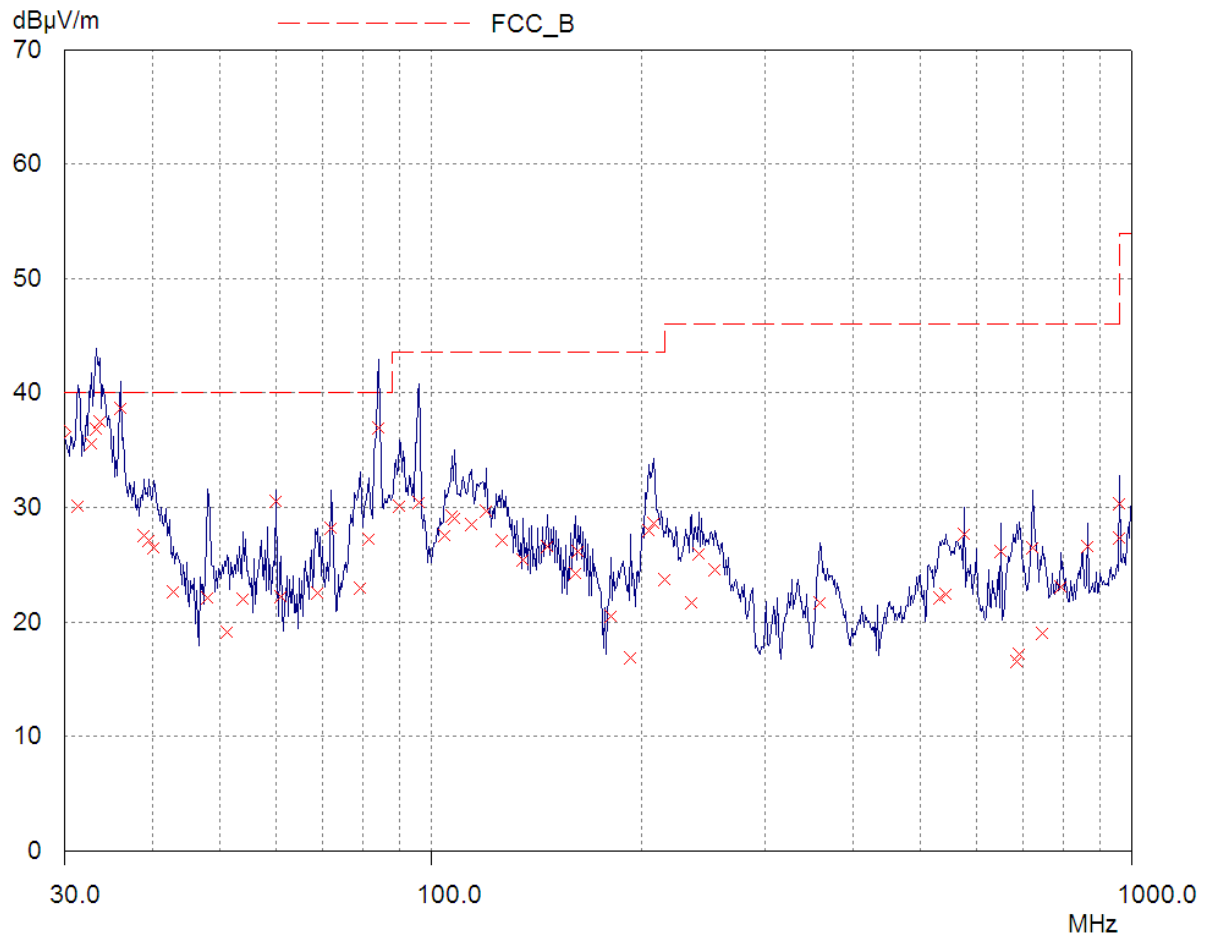


Date: 20.AUG.2010 08:41:56

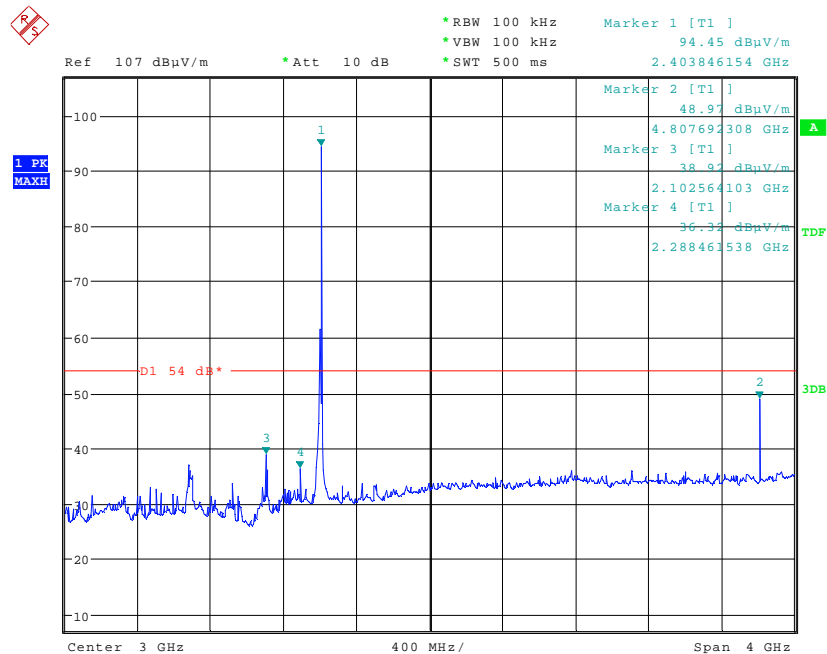
Top Channel Conducted emissions 20GHz – 25GHz



Date: 20.AUG.2010 08:42:34

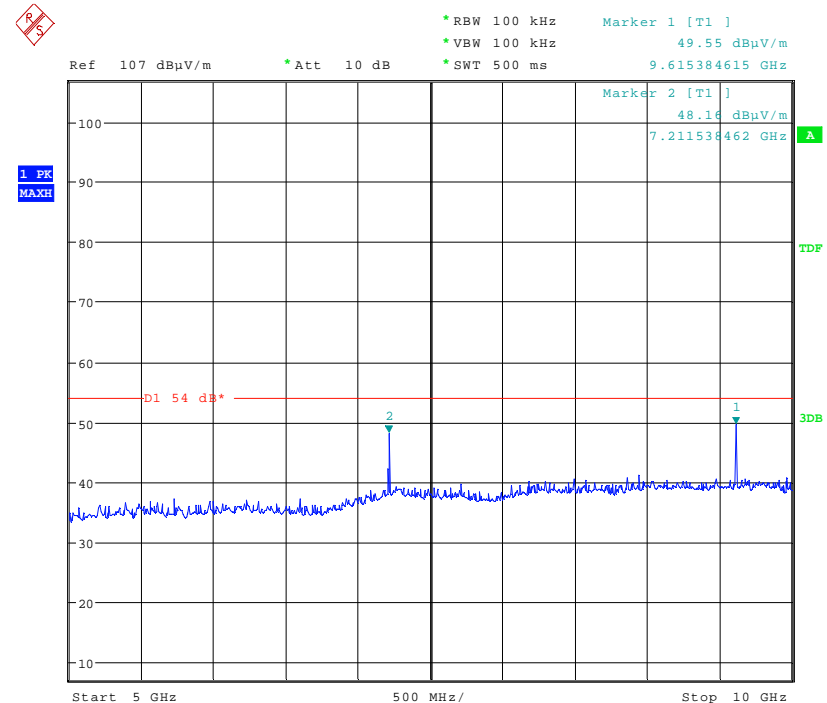
PRM-AB378-03 Radiated Plots**Bottom Channel Radiated emissions 30MHz-1GHz**

Bottom Channel Radiated emissions Vertical 1GHz – 5GHz



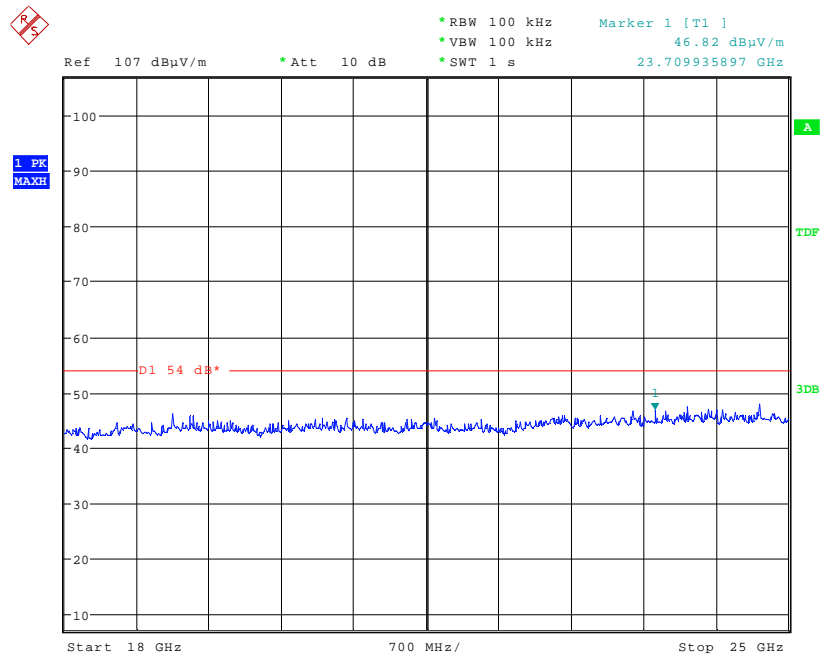
Date: 24.AUG.2010 15:34:32

Bottom Channel Radiated emissions Vertical 5GHz – 10GHz



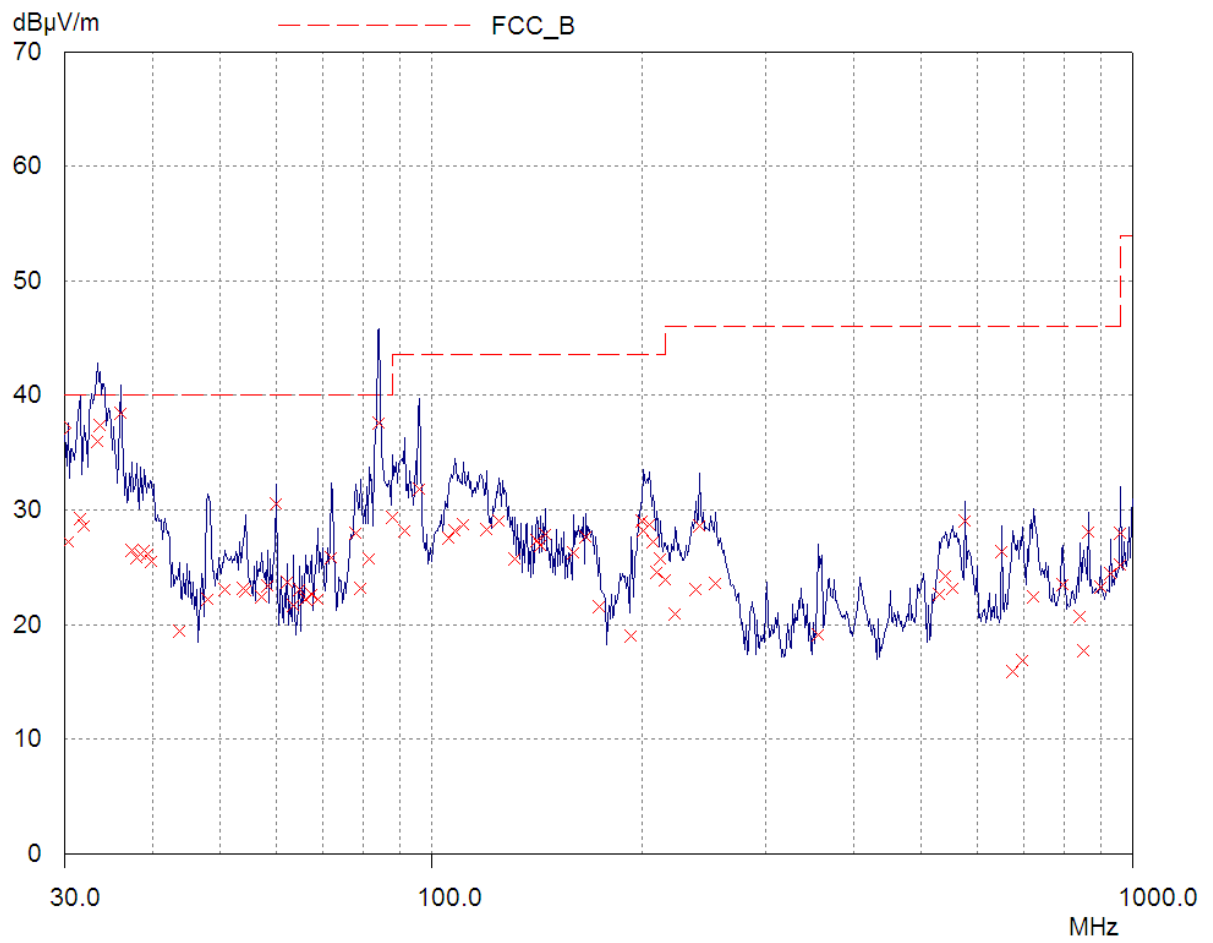
Date: 24.AUG.2010 15:35:52

Bottom Channel Radiated emissions Vertical 18GHz – 25GHz

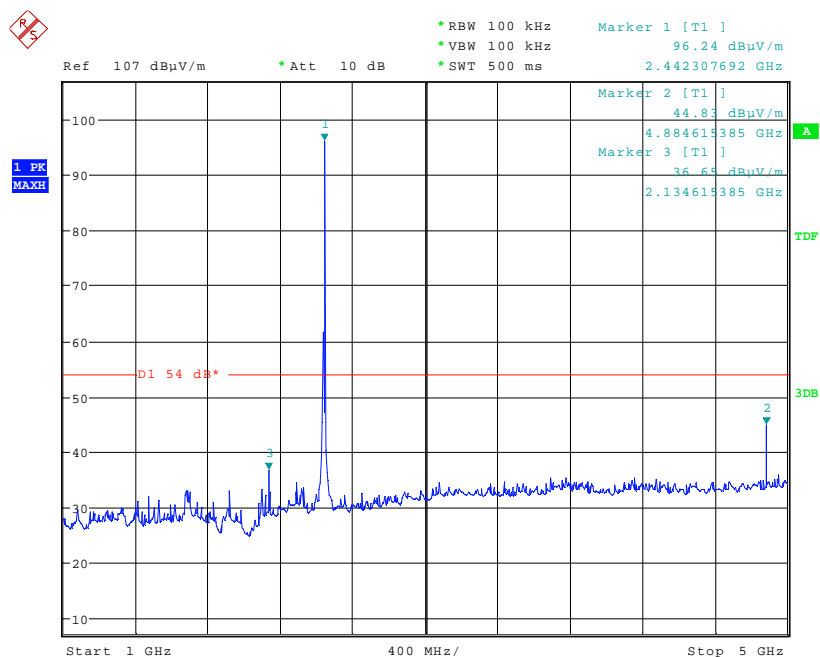


Date: 24.AUG.2010 13:21:14

Middle Channel Radiated emissions Vertical 30MHz-1GHz

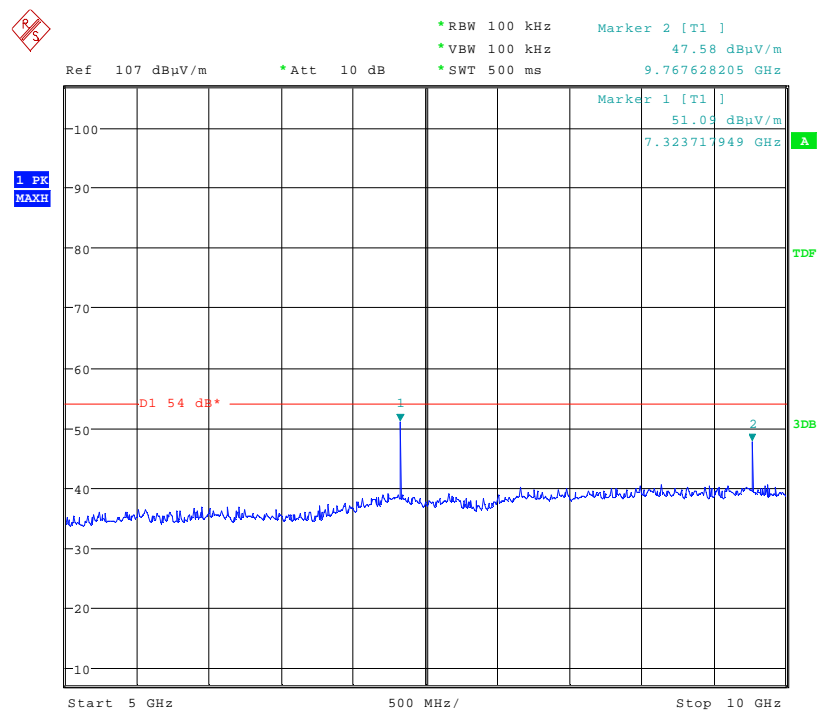


Middle Channel Radiated emissions Vertical 1GHz – 5GHz



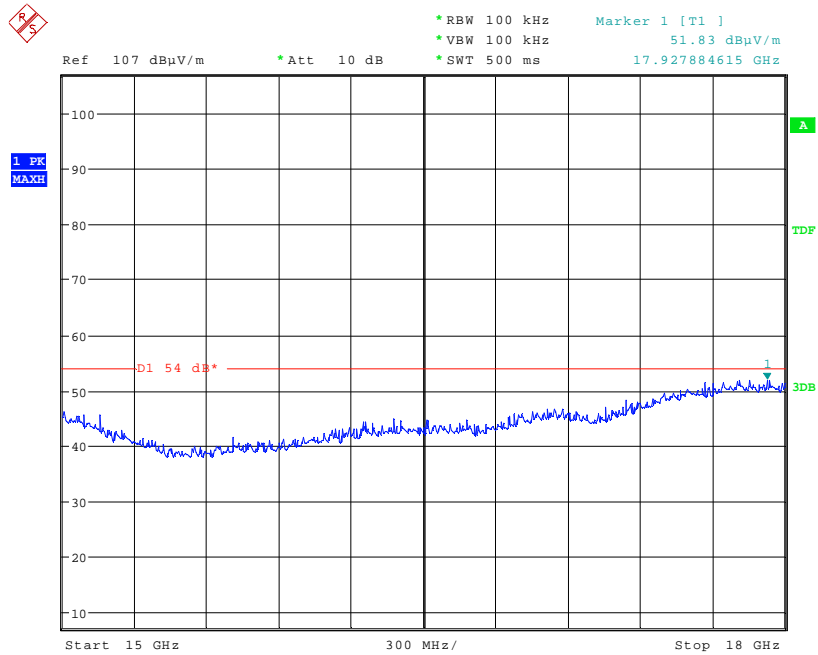
Date: 24.AUG.2010 15:47:04

Middle Channel Radiated emissions Vertical 5GHz- 10GHz



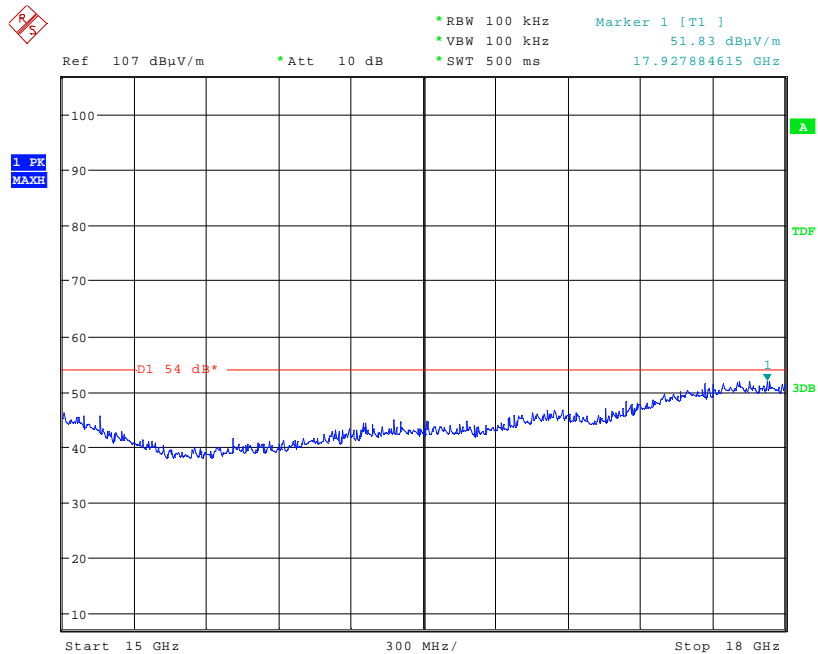
Date: 24.AUG.2010 15:47:57

Middle Channel Radiated emissions Vertical 10GHz- 15GHz



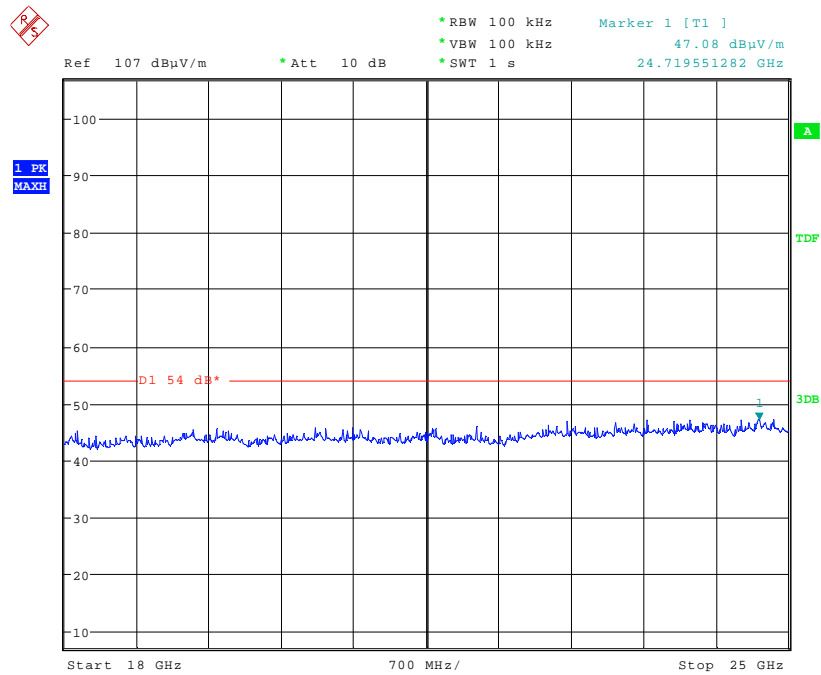
Date: 24.AUG.2010 15:49:25

Middle Channel Radiated emissions Vertical 15GHz- 18GHz



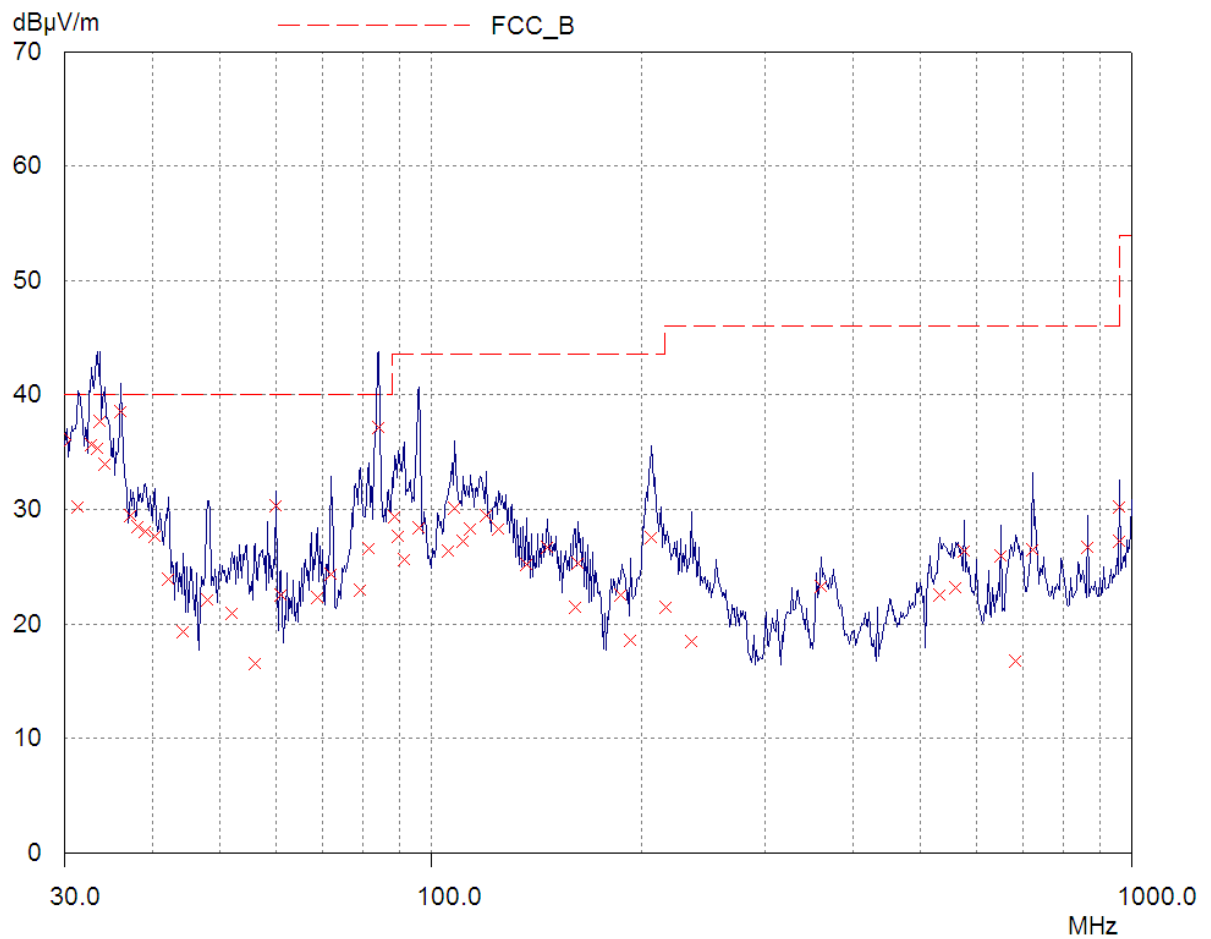
Date: 24.AUG.2010 15:49:25

Middle Channel Radiated emissions Vertical 18GHz- 25GHz

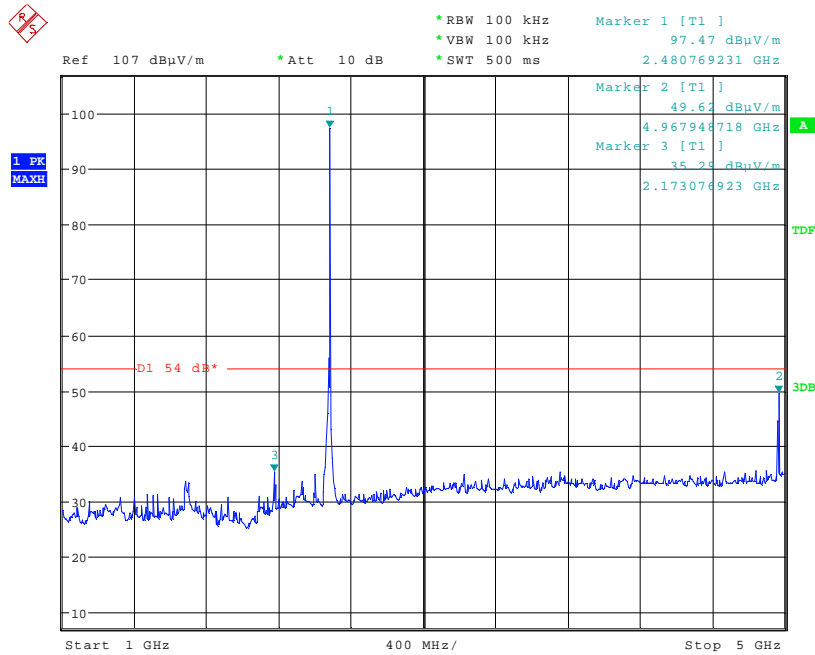


Date: 24.AUG.2010 13:27:43

Top Channel Radiated emissions Vertical 30MHz-1GHz

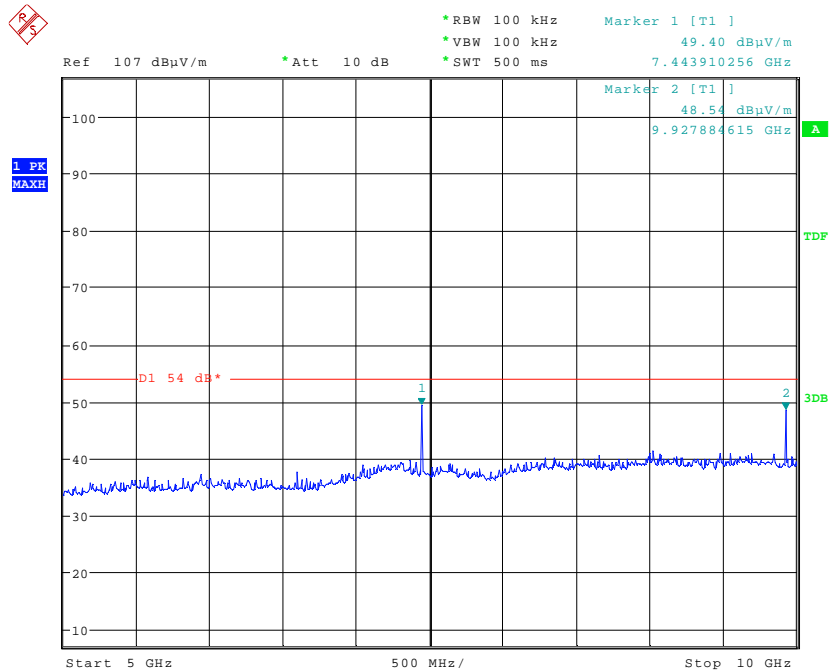


Top Channel Radiated emissions Vertical 1GHz – 5GHz



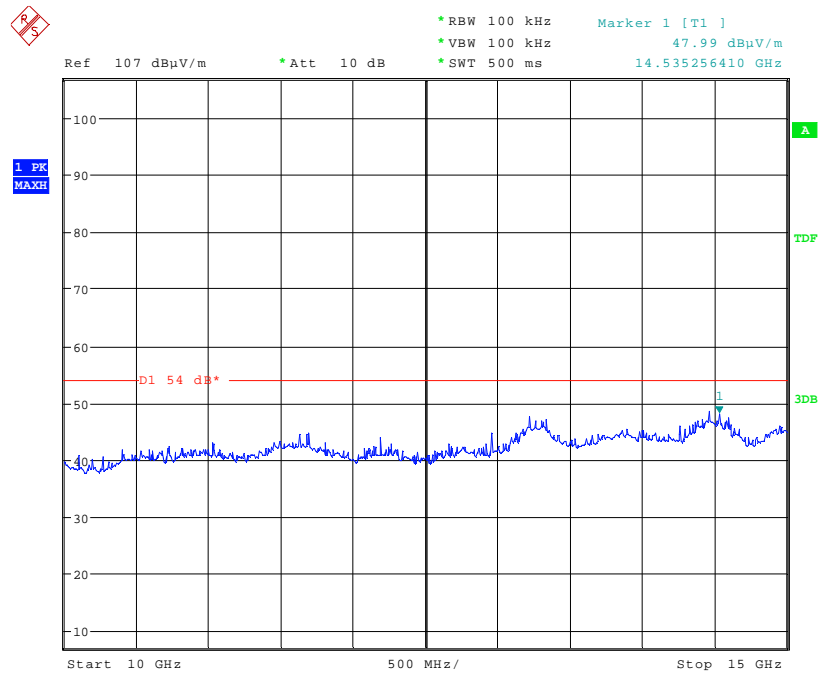
Date: 24.AUG.2010 15:57:42

Top Channel Radiated emissions Vertical 5GHz - 10GHz



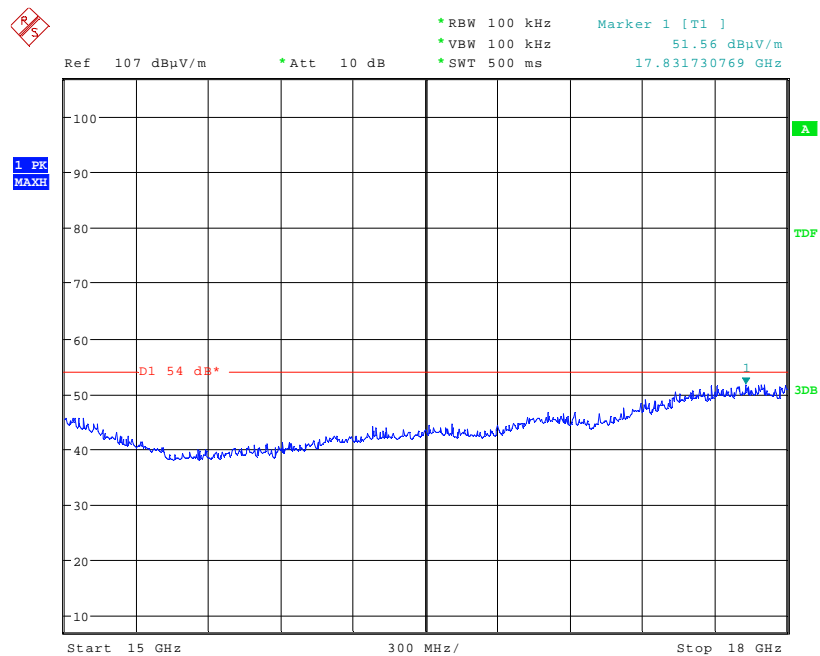
Date: 24.AUG.2010 15:58:39

Top Channel Radiated emissions Vertical 10GHz – 15GHz



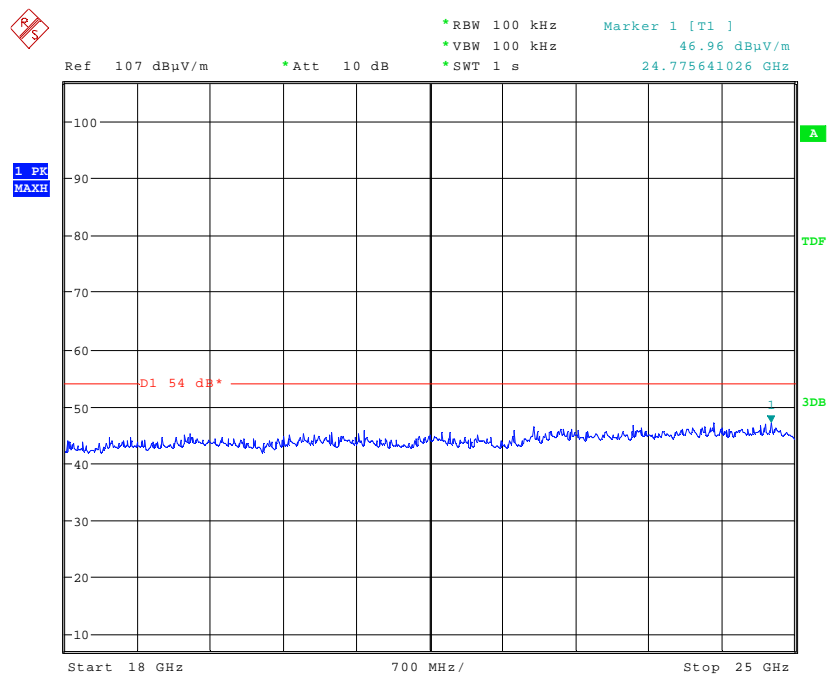
Date: 24.AUG.2010 15:59:20

Top Channel Radiated emissions Vertical 15GHz – 18GHz



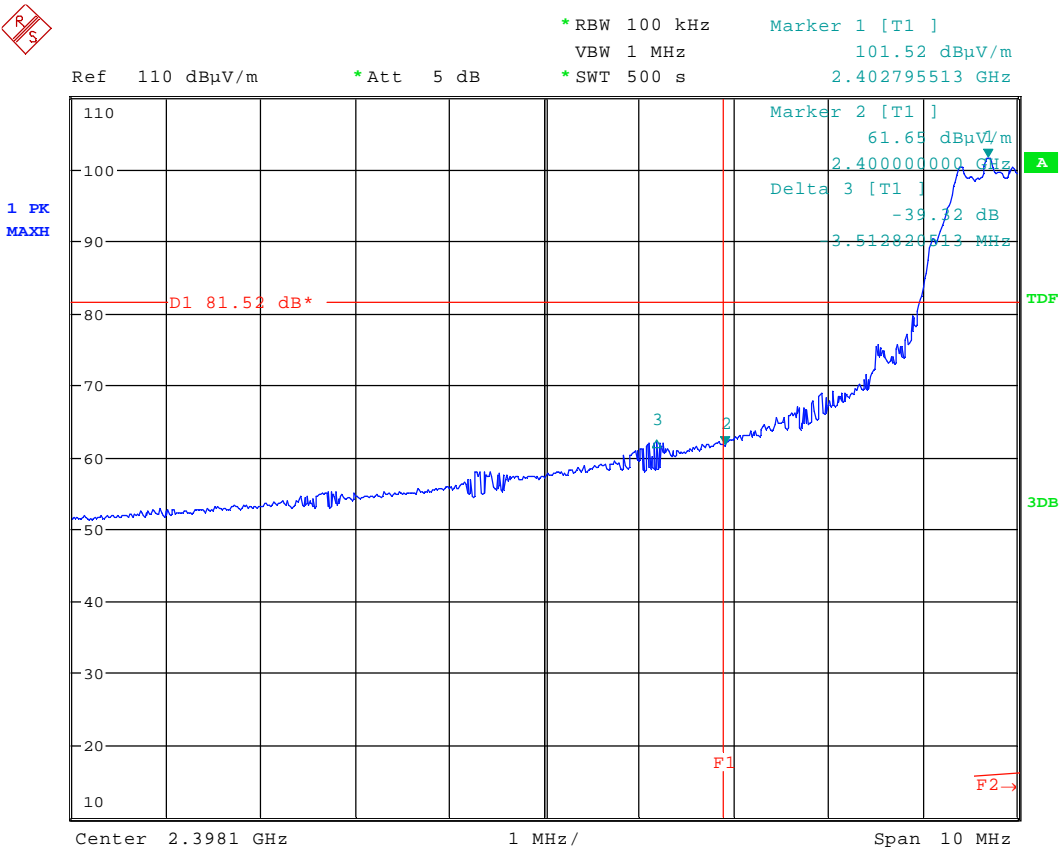
Date: 24.AUG.2010 16:00:00

Top Channel Radiated emissions Vertical 18GHz – 25GHz



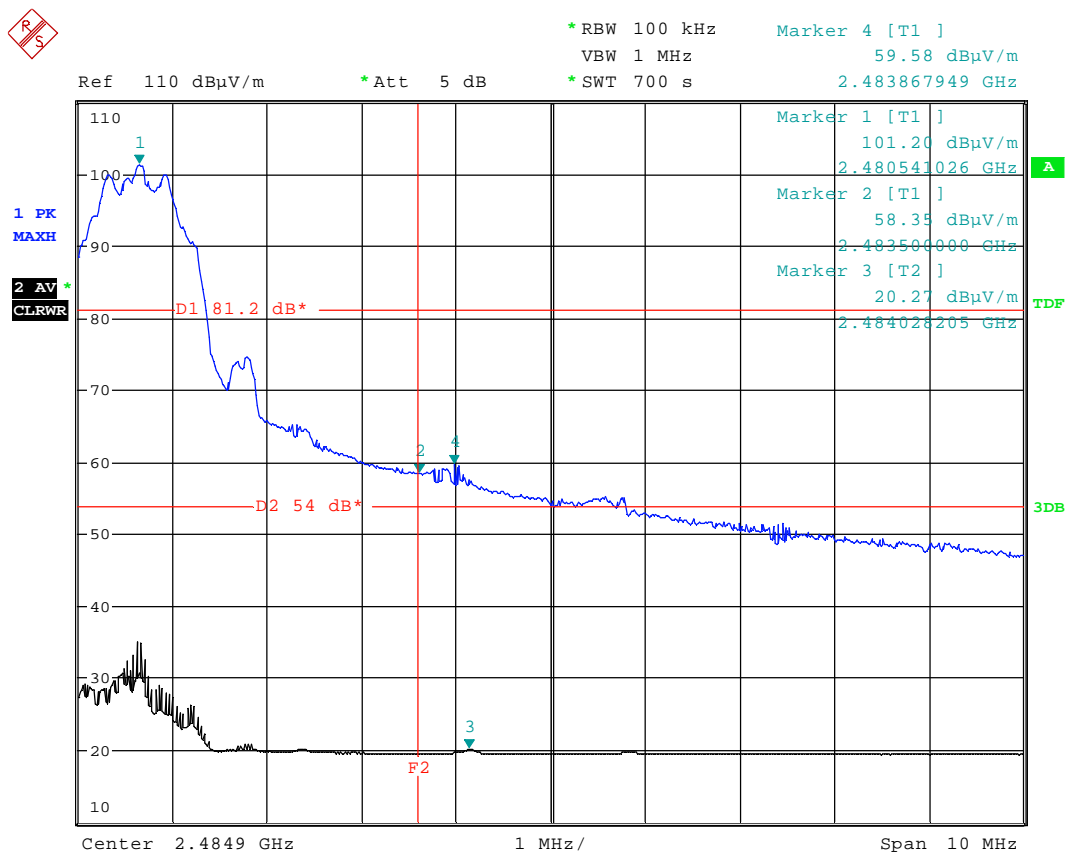
Date: 24.AUG.2010 13:36:16

Lower Band edge compliance



Date: 20.SEP.2010 08:47:48

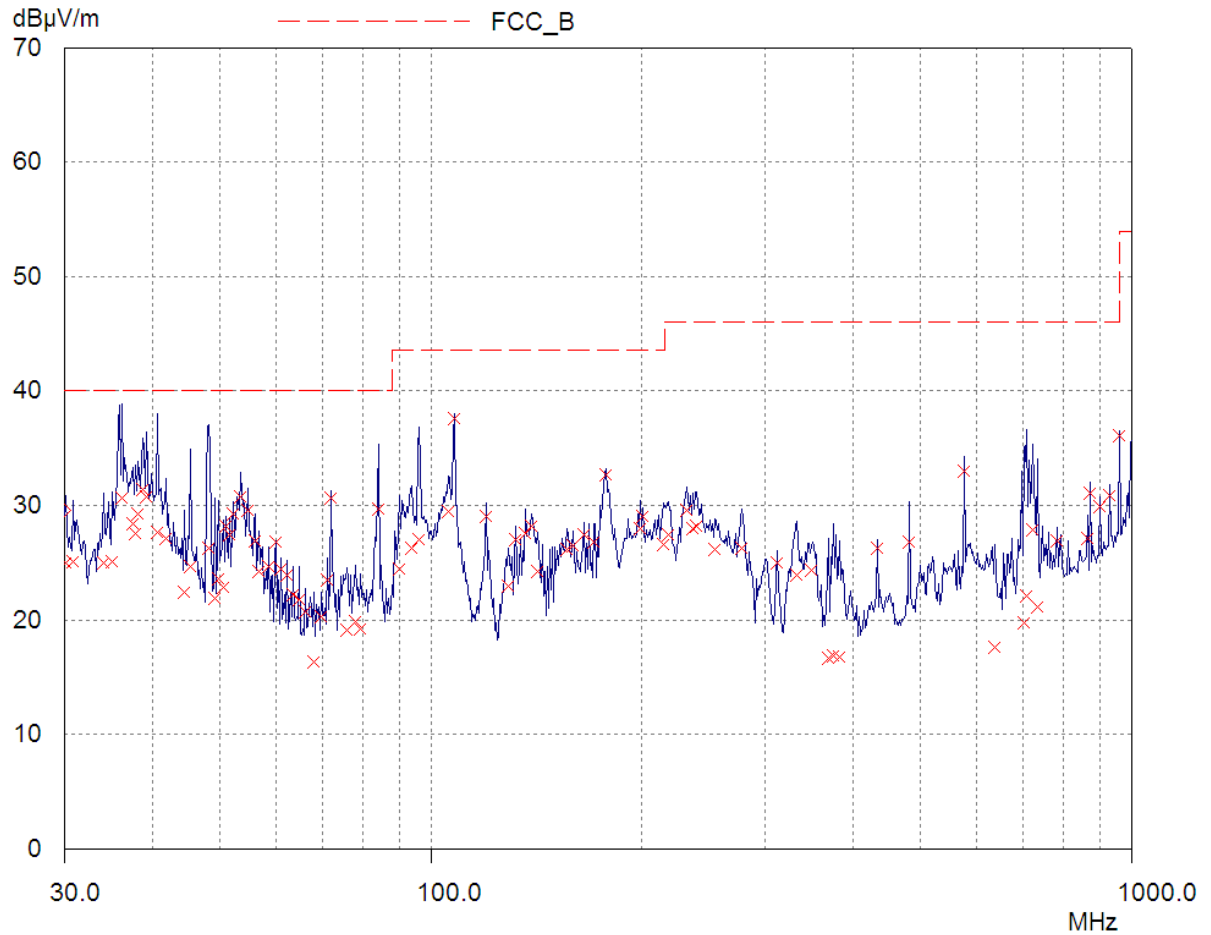
Upper Band edge compliance



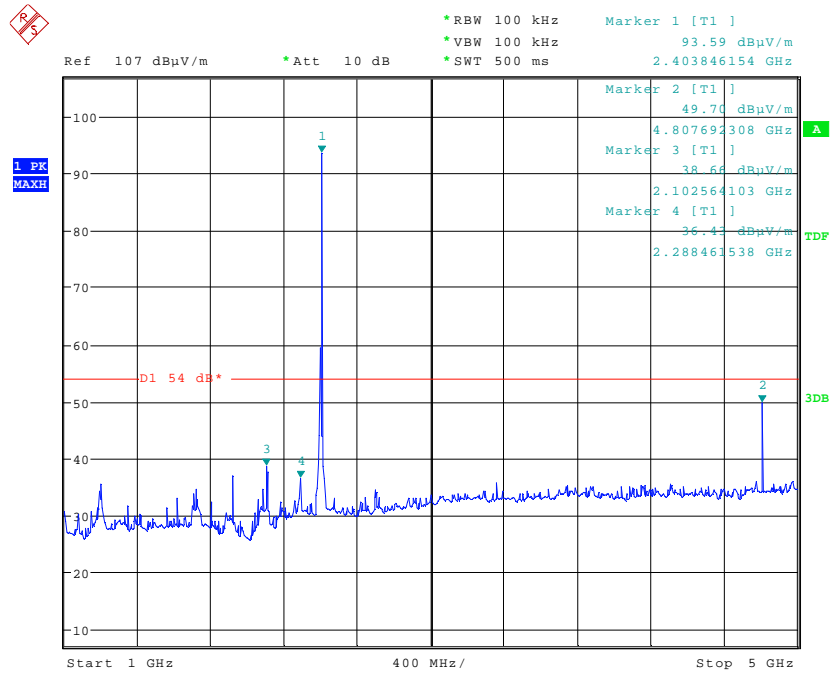
Date: 17.SEP.2010 15:40:51

PRM-AB387-03 Radiated Plots

Bottom Channel Radiated emissions 30MHz-1GHz

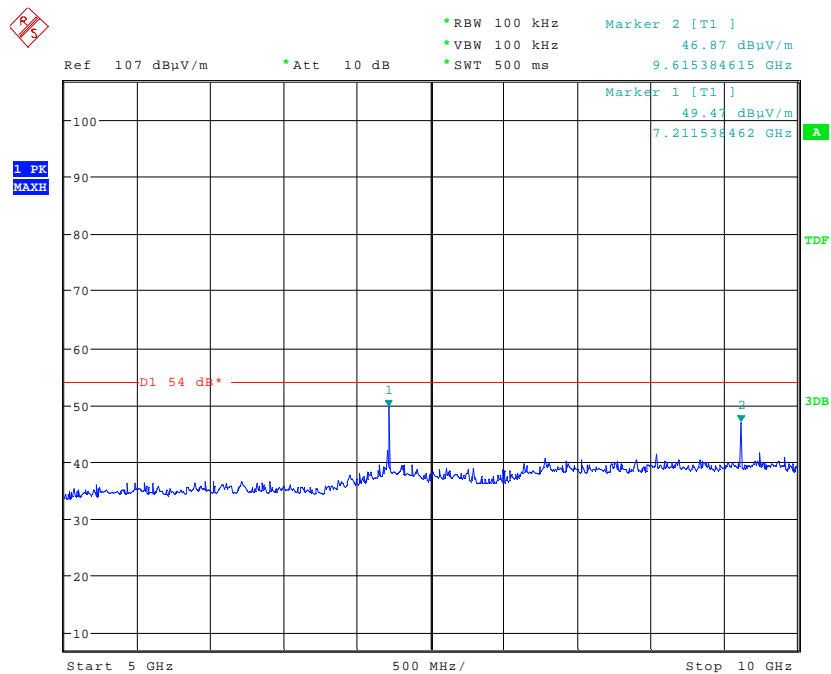


Bottom Channel Radiated emissions Vertical 1GHz – 5GHz



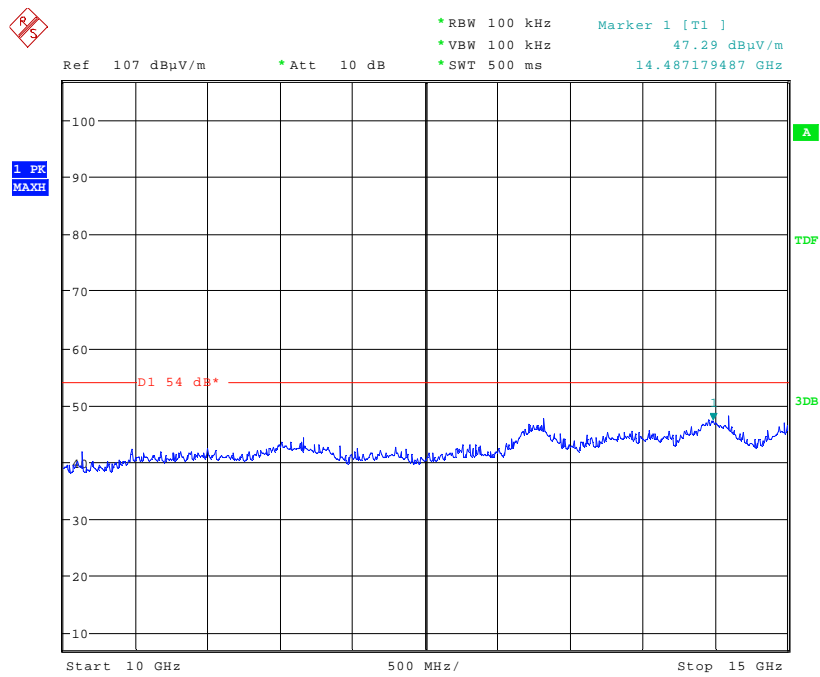
Date: 26.AUG.2010 11:41:33

Bottom Channel Radiated emissions Vertical 5GHz – 10GHz



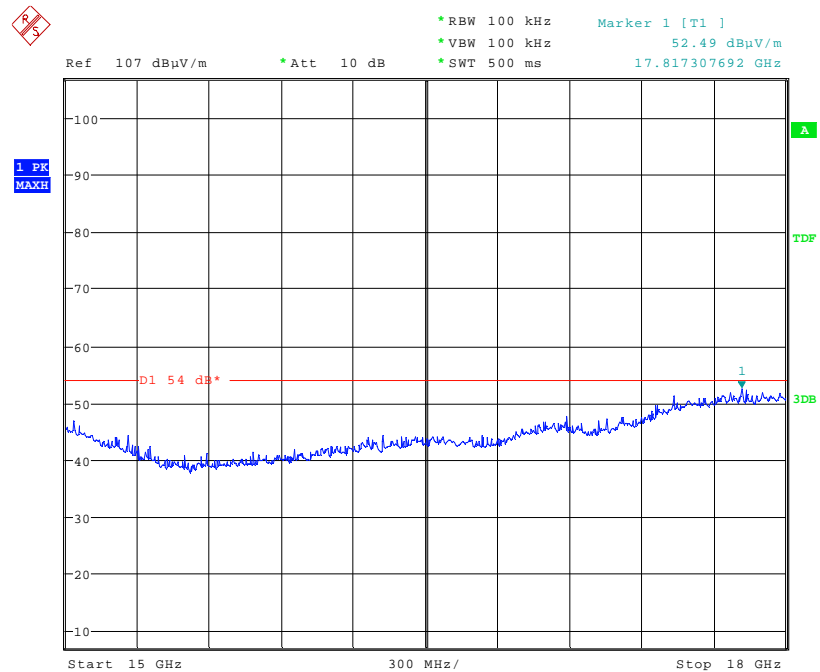
Date: 26.AUG.2010 11:42:22

Bottom Channel Radiated emissions Vertical 10GHz – 15GHz



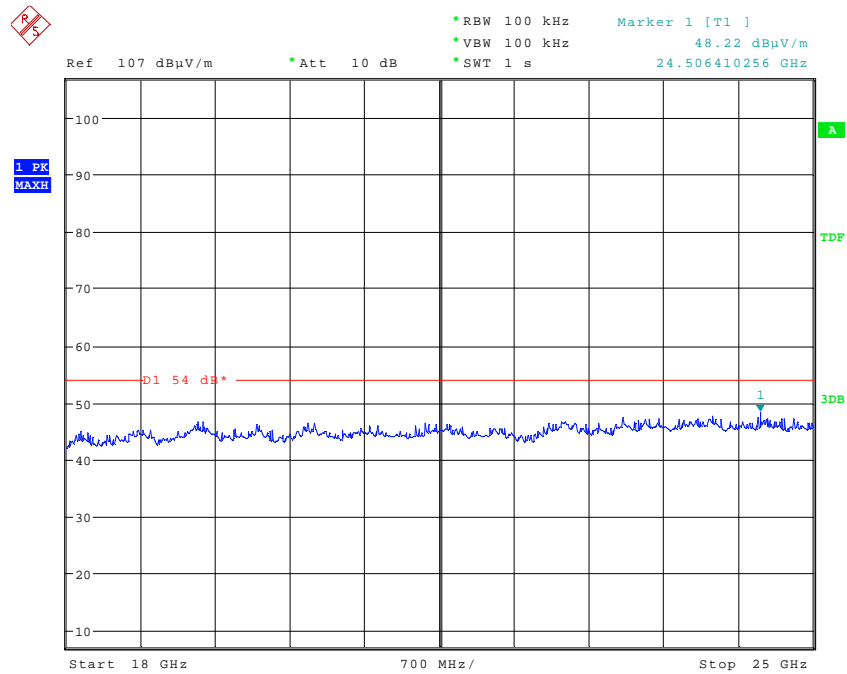
Date: 26.AUG.2010 11:43:43

Bottom Channel Radiated emissions Vertical 15GHz – 18GHz



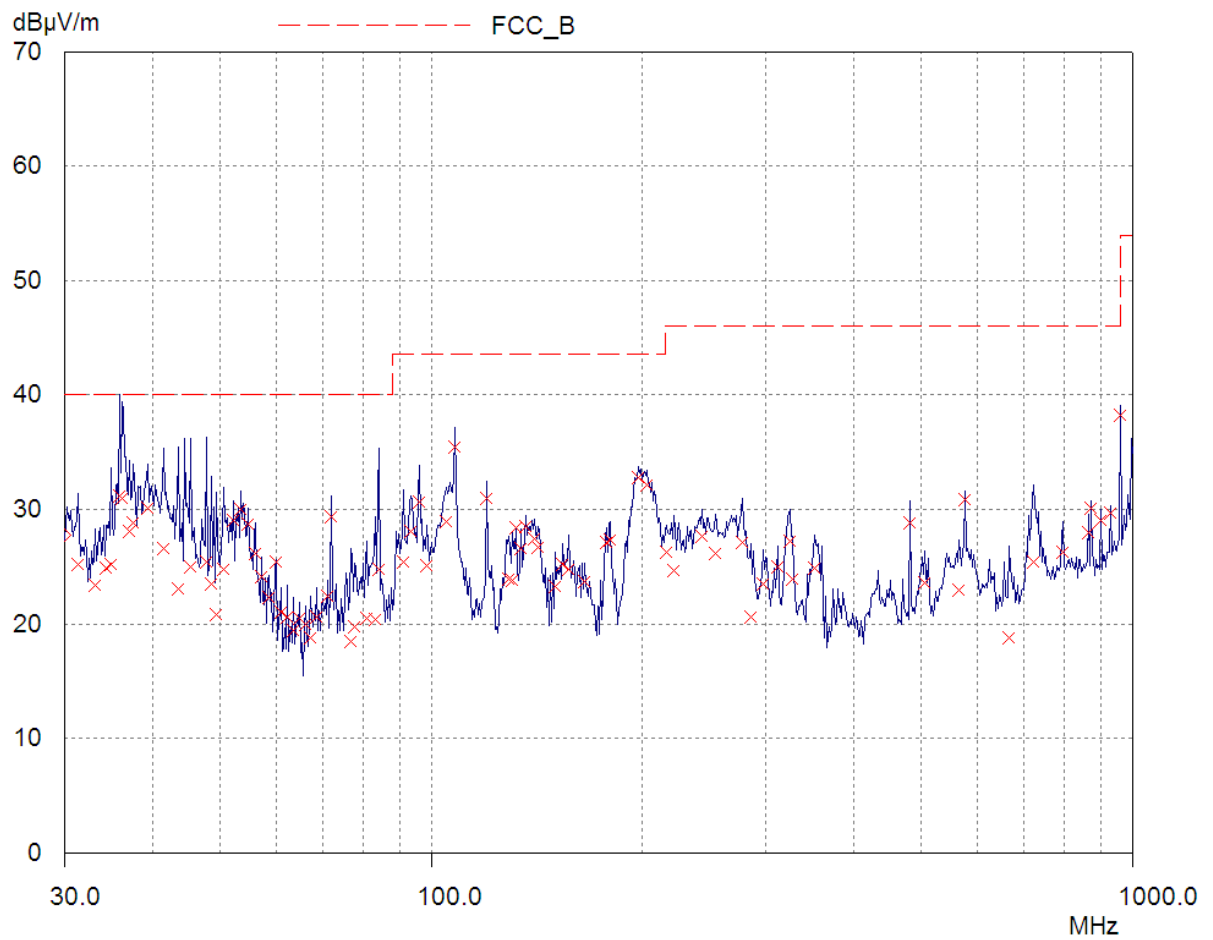
Date: 26.AUG.2010 11:45:28

Bottom Channel Radiated emissions Vertical 18GHz – 25GHz

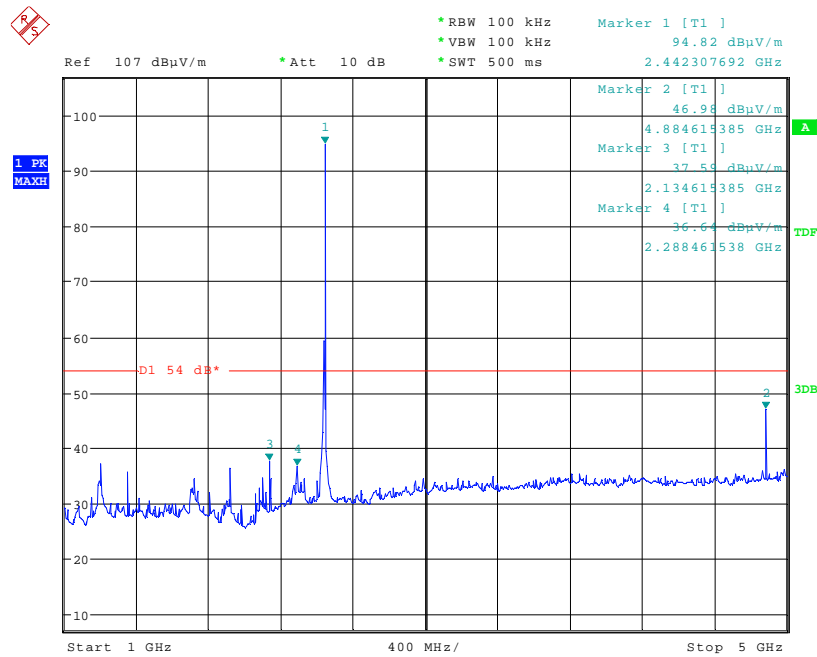


Date: 27.AUG.2010 09:22:04

Middle Channel Radiated emissions Vertical 30MHz-1GHz

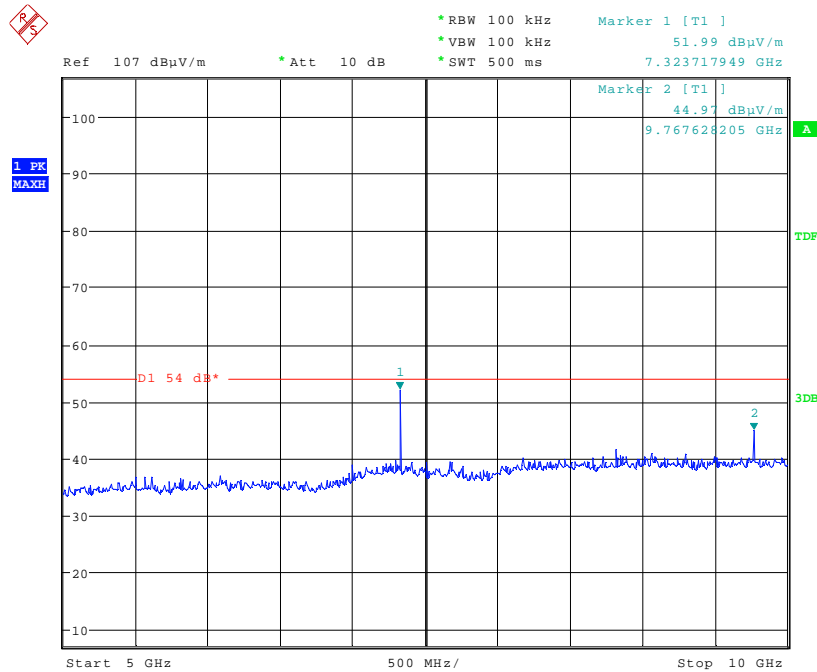


Middle Channel Radiated emissions Vertical 1GHz – 5GHz



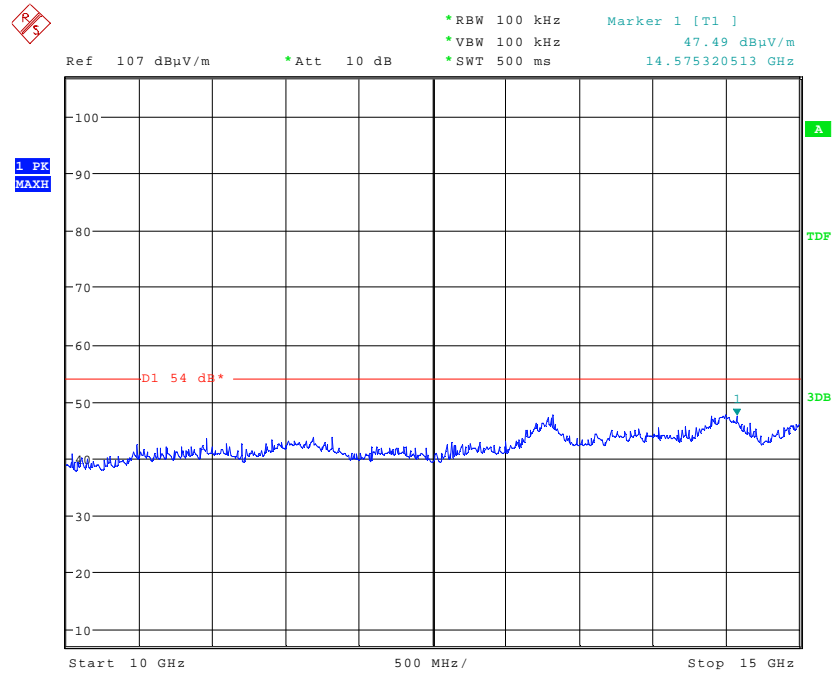
Date: 26.AUG.2010 12:58:42

Middle Channel Radiated emissions Vertical 5GHz- 10GHz



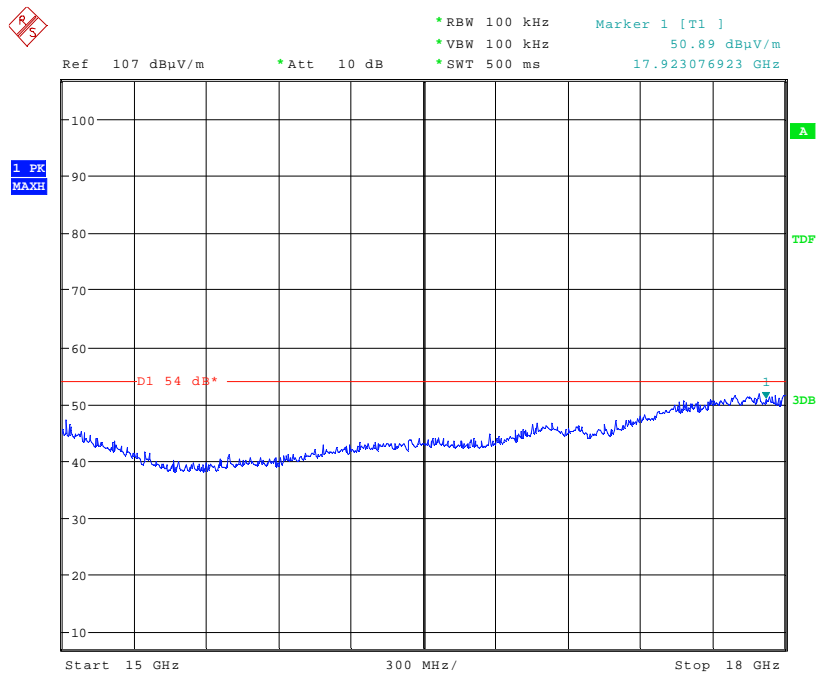
Date: 26.AUG.2010 12:59:31

Middle Channel Radiated emissions Vertical 10GHz- 15GHz



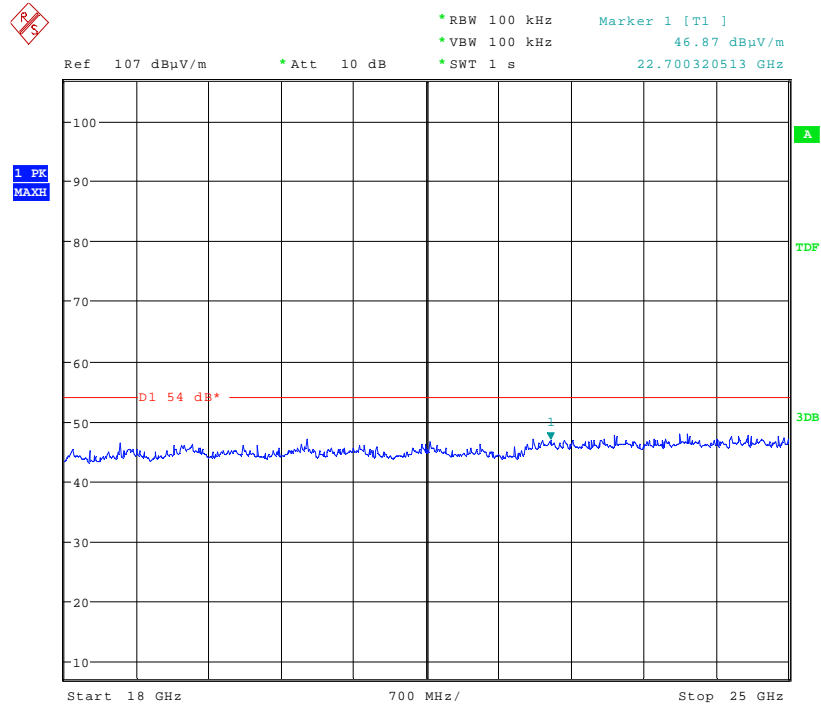
Date: 26.AUG.2010 13:00:11

Middle Channel Radiated emissions Vertical 15GHz- 18GHz



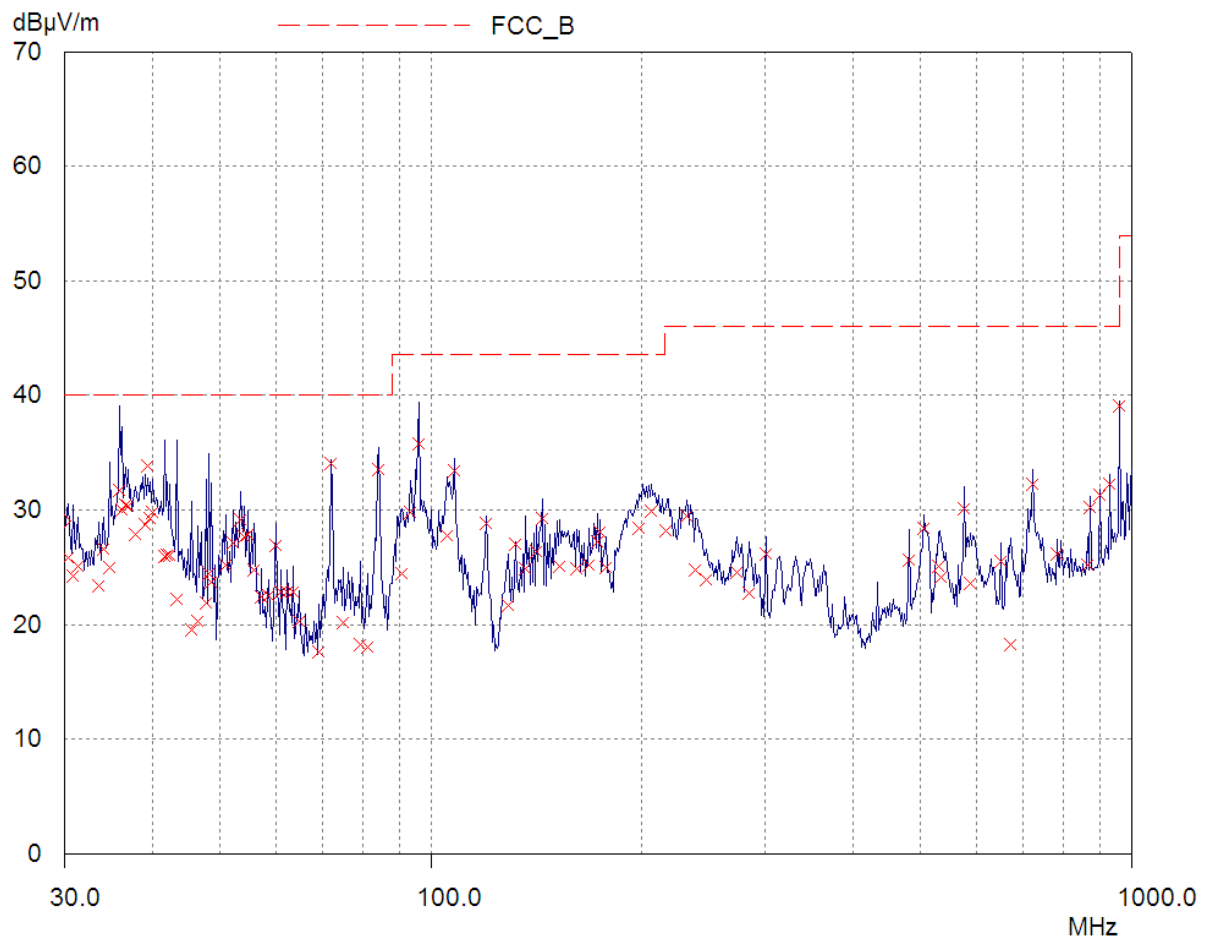
Date: 26.AUG.2010 13:00:59

Middle Channel Radiated emissions Vertical 18GHz- 25GHz

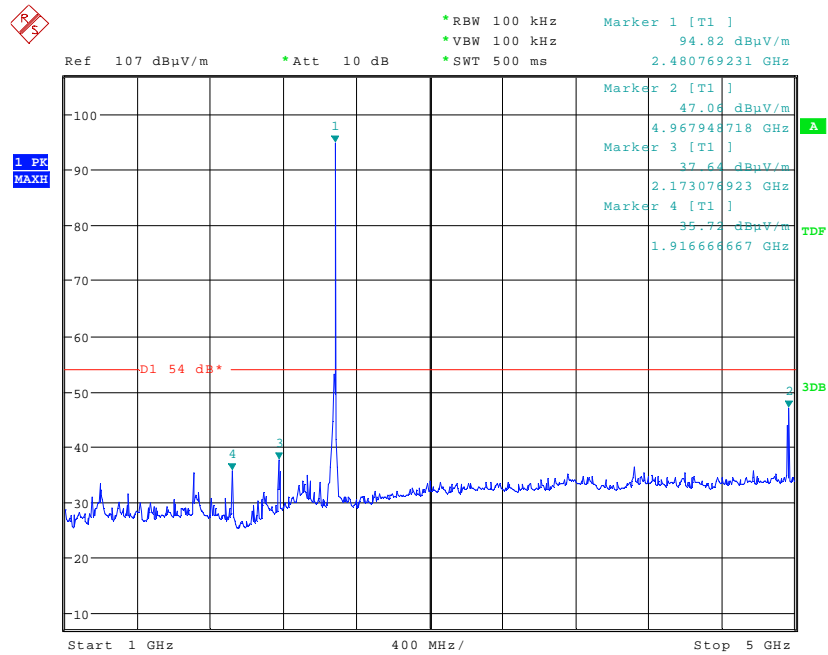


Date: 27.AUG.2010 09:31:58

Top Channel Radiated emissions Vertical 30MHz-1GHz

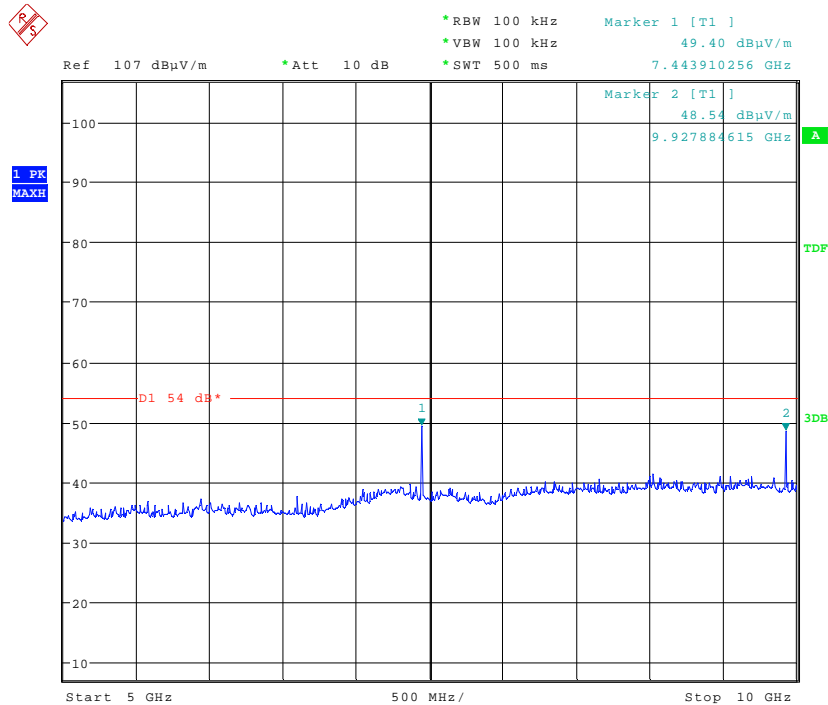


Top Channel Radiated emissions Vertical 1GHz – 5GHz



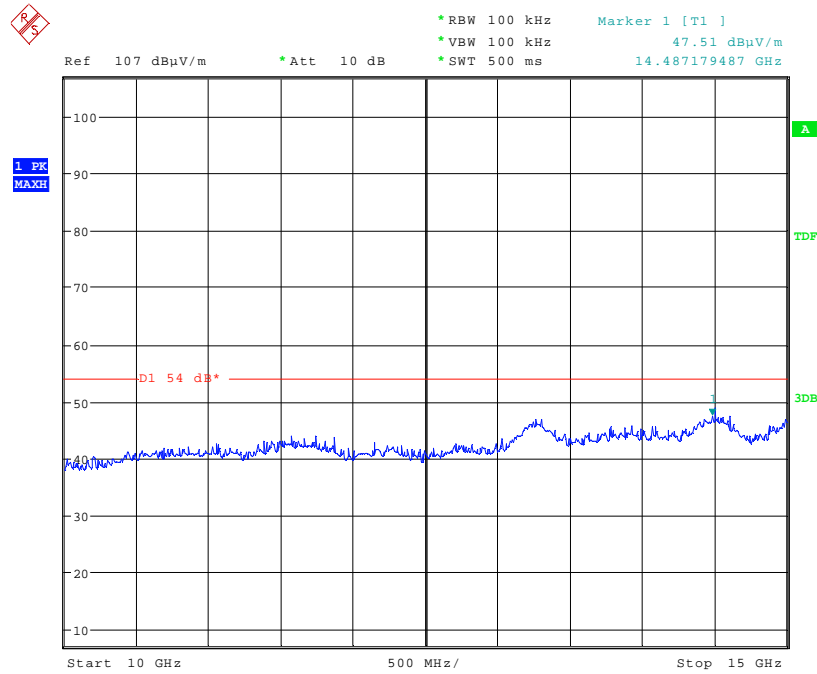
Date: 26.AUG.2010 13:10:27

Top Channel Radiated emissions Vertical 5GHz - 10GHz



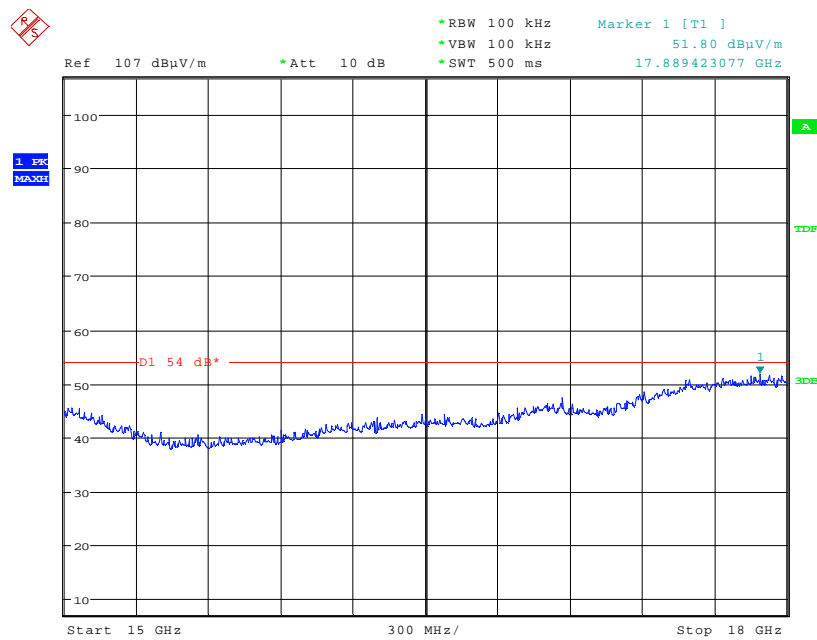
Date: 24.AUG.2010 15:58:39

Top Channel Radiated emissions Vertical 10GHz – 15GHz



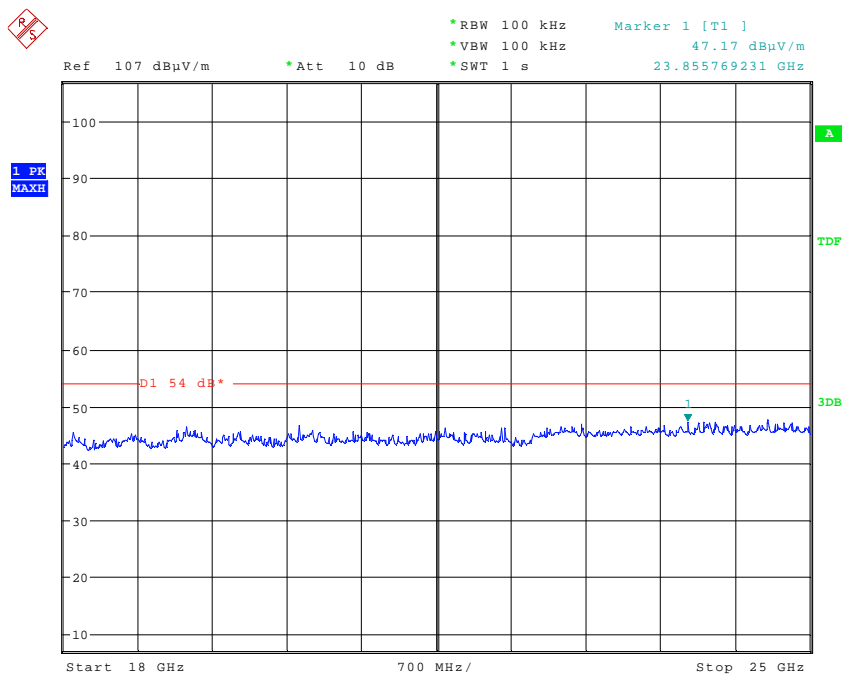
Date: 26.AUG.2010 13:12:25

Top Channel Radiated emissions Vertical 15GHz – 18GHz



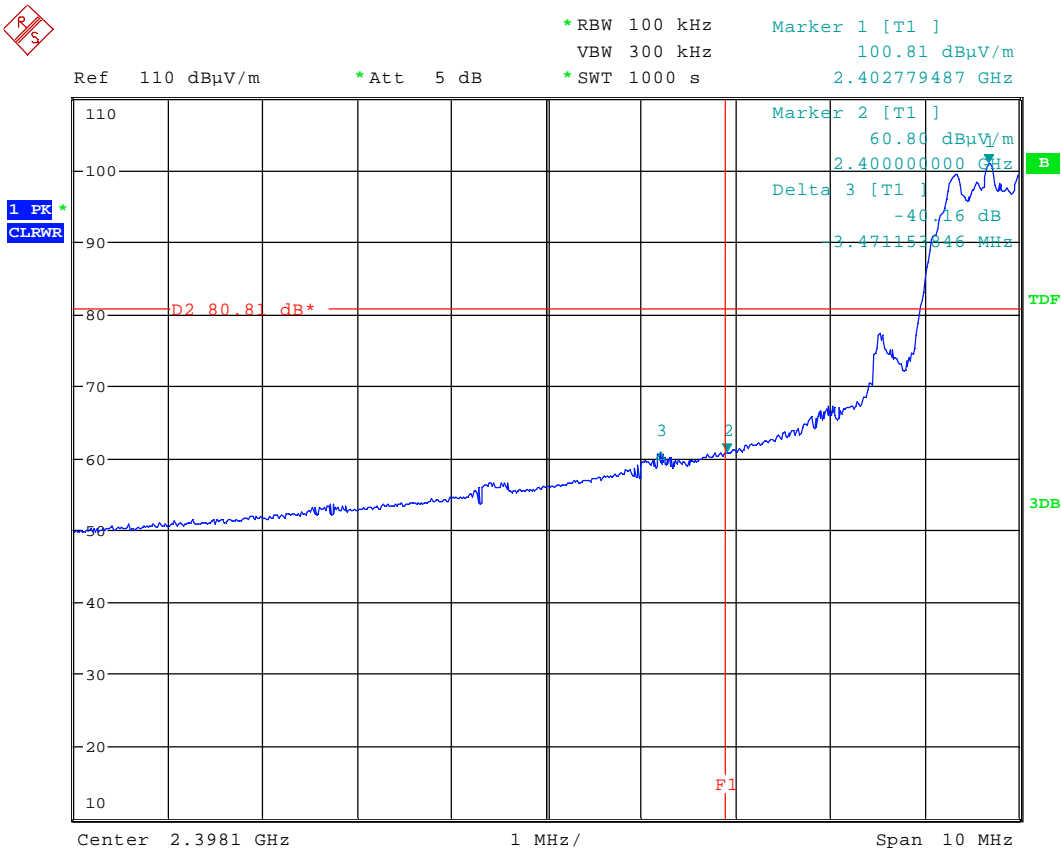
Date: 26.AUG.2010 13:13:07

Top Channel Radiated emissions Vertical 18GHz – 25GHz



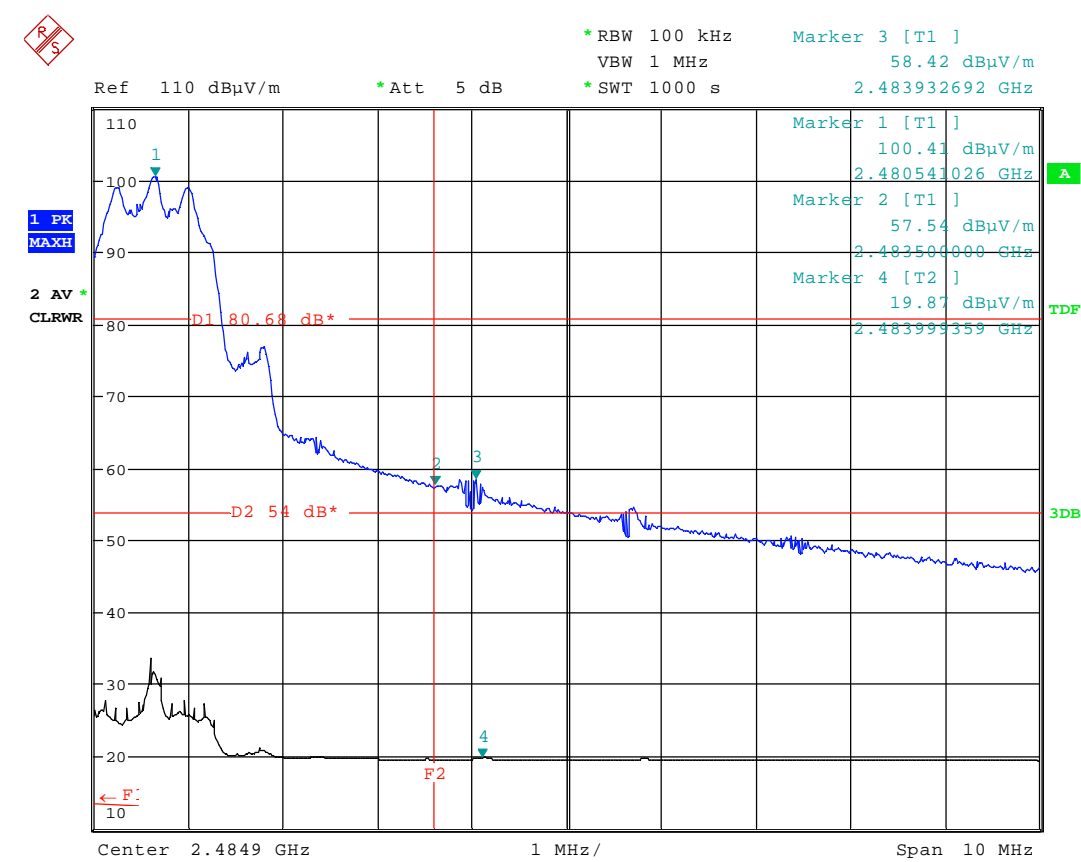
Date: 27.AUG.2010 09:36:26

Lower Band edge compliance



Date: 21.SEP.2010 10:33:03

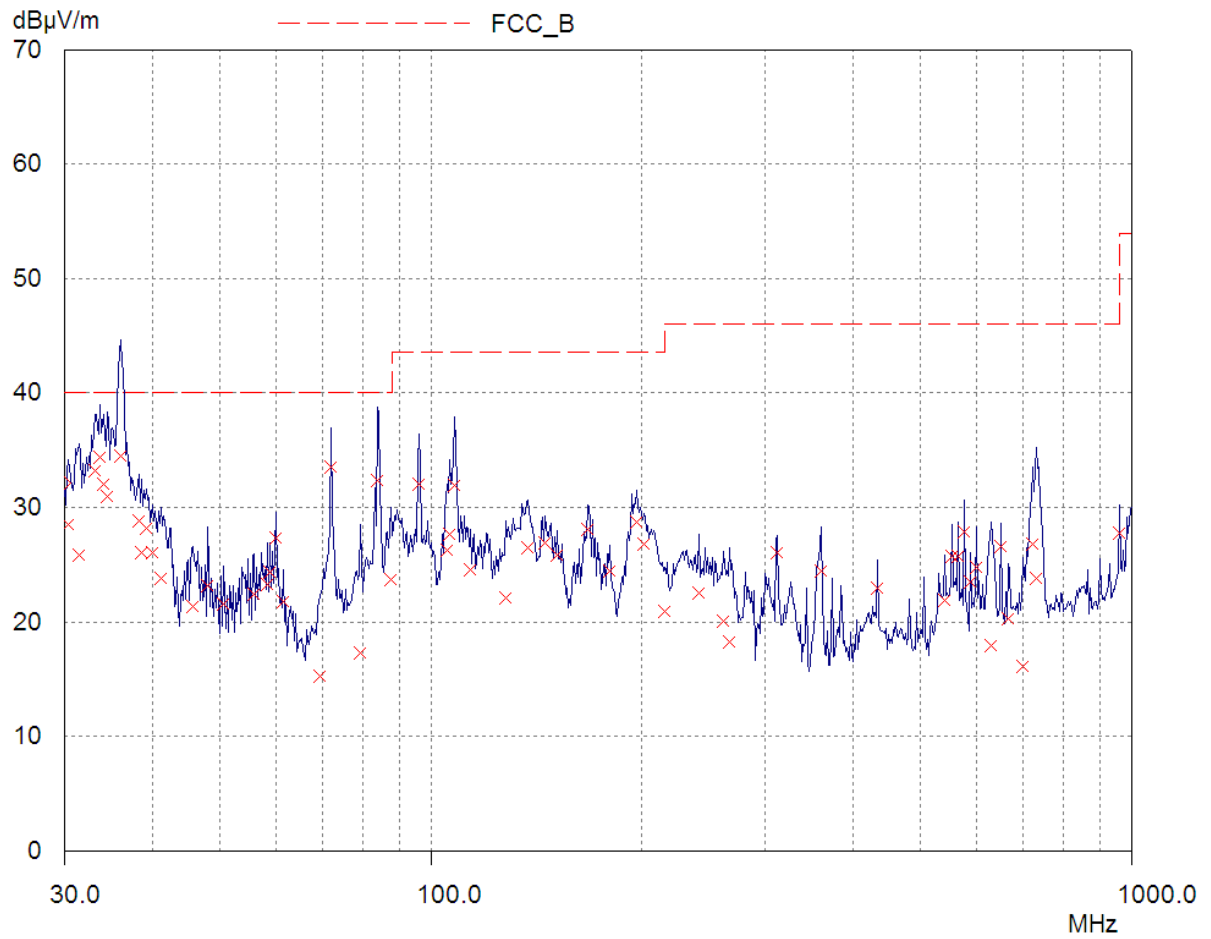
Upper Band edge compliance



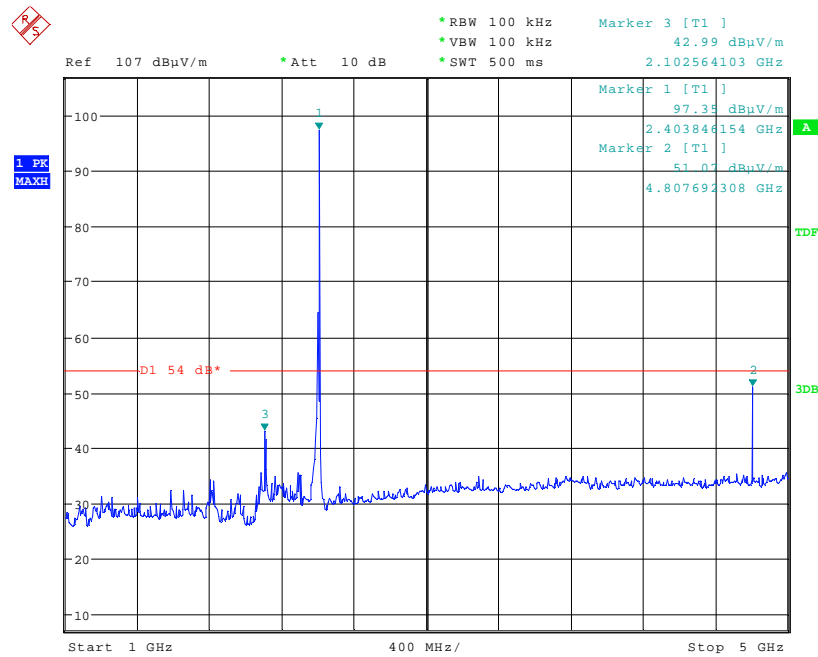
Date: 21.SEP.2010 10:57:02

PRM-AB395-03 Radiated Plots

Bottom Channel Radiated emissions 30MHz-1GHz

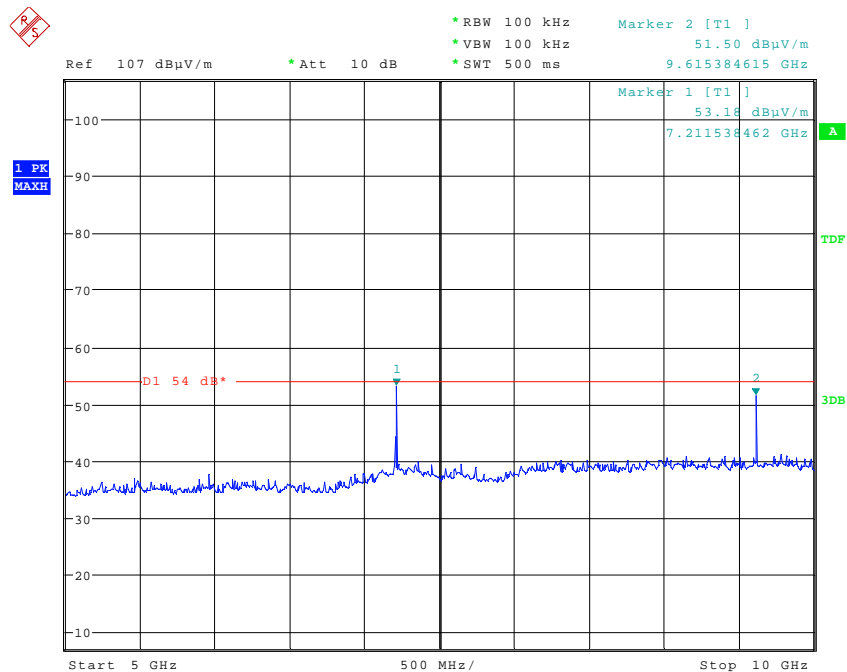


Bottom Channel Radiated emissions Vertical 1GHz – 5GHz



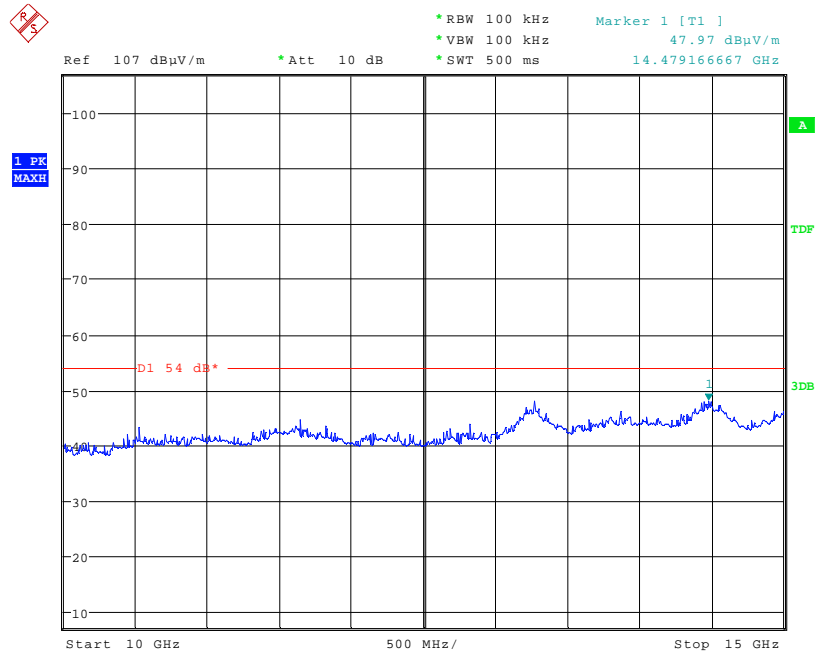
Date: 23.AUG.2010 10:30:16

Bottom Channel Radiated emissions Vertical 5GHz – 10GHz



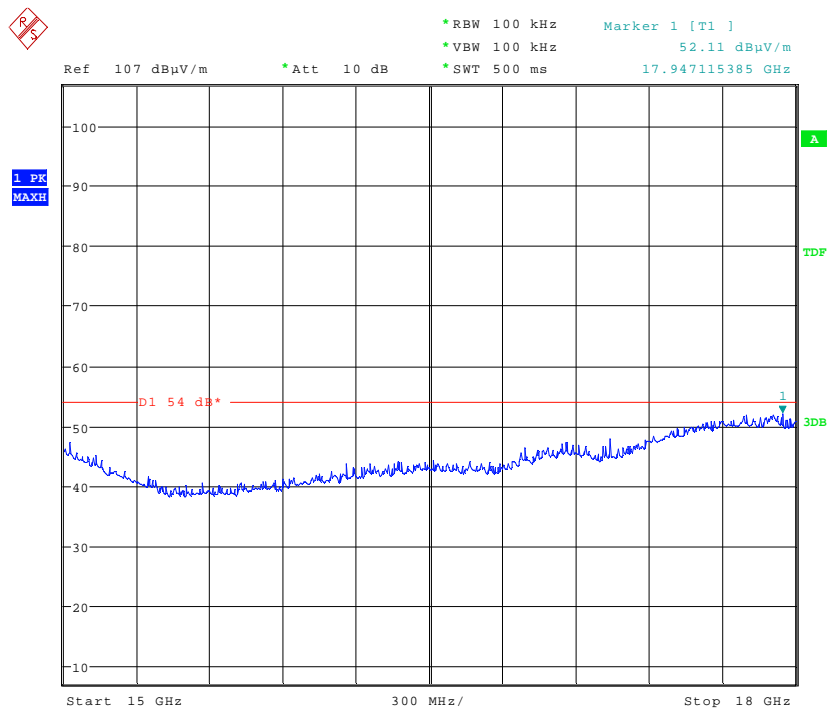
Date: 23.AUG.2010 10:31:23

Bottom Channel Radiated emissions Vertical 10GHz – 15GHz



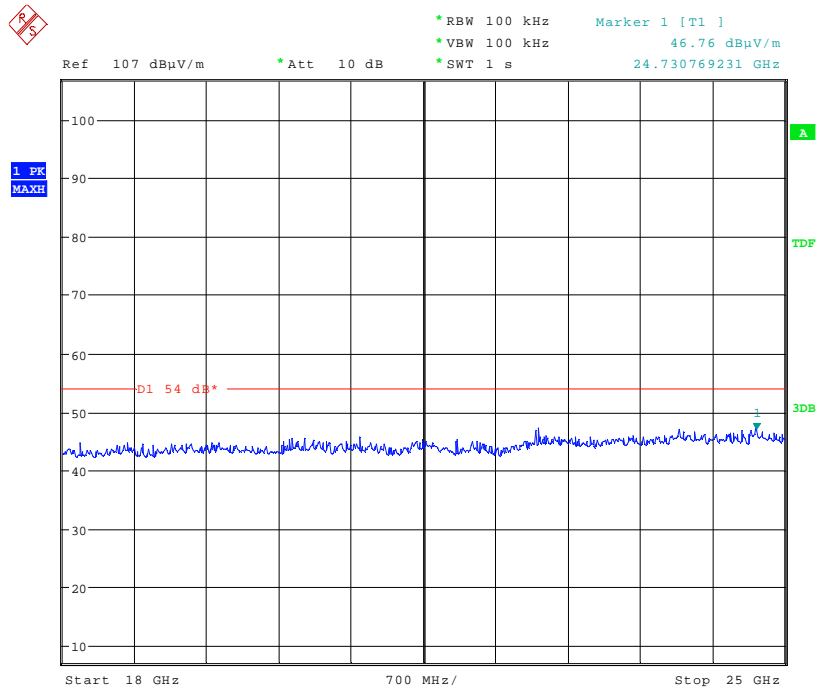
Date: 23.AUG.2010 10:32:17

Bottom Channel Radiated emissions Vertical 15GHz – 18GHz



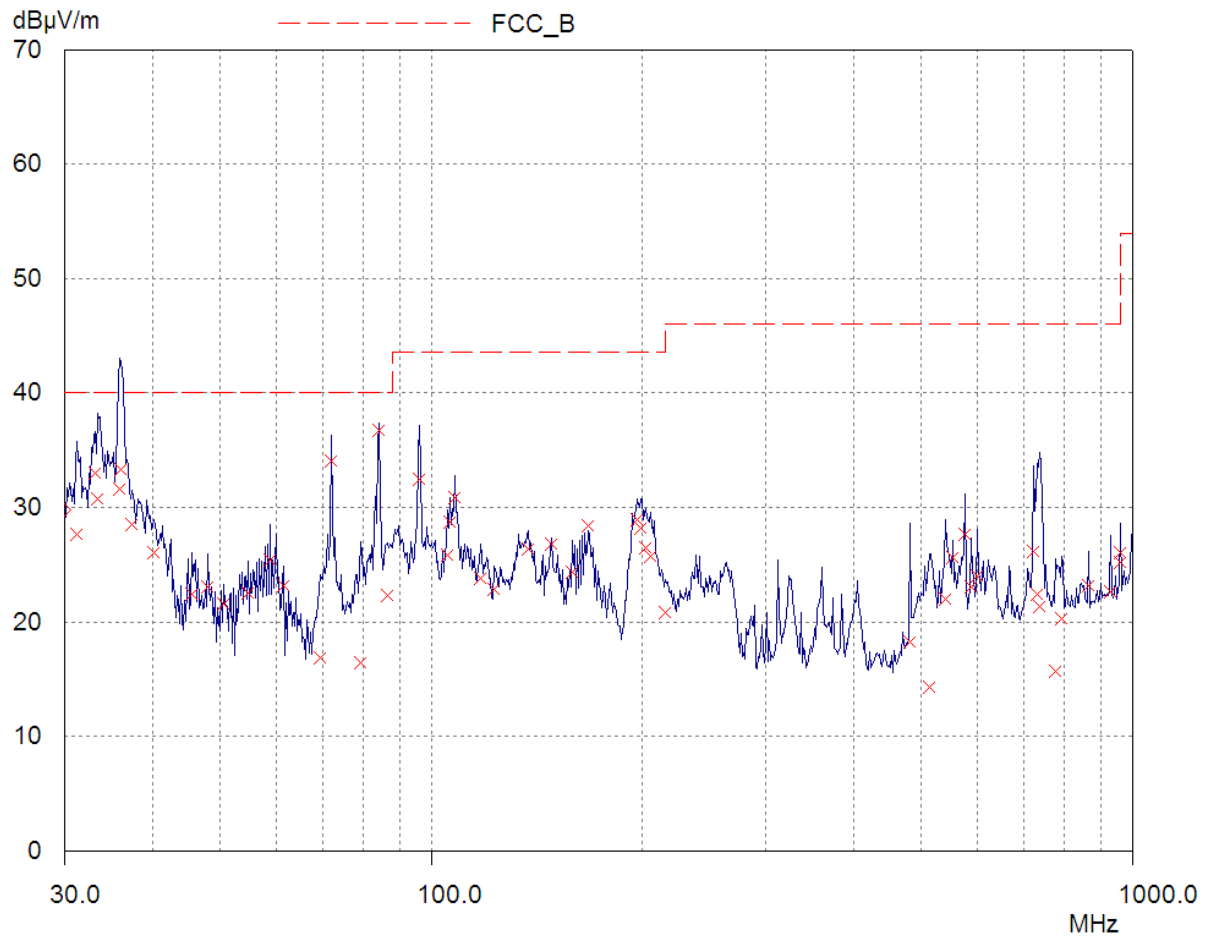
Date: 23.AUG.2010 10:33:10

Bottom Channel Radiated emissions Vertical 18GHz – 25GHz

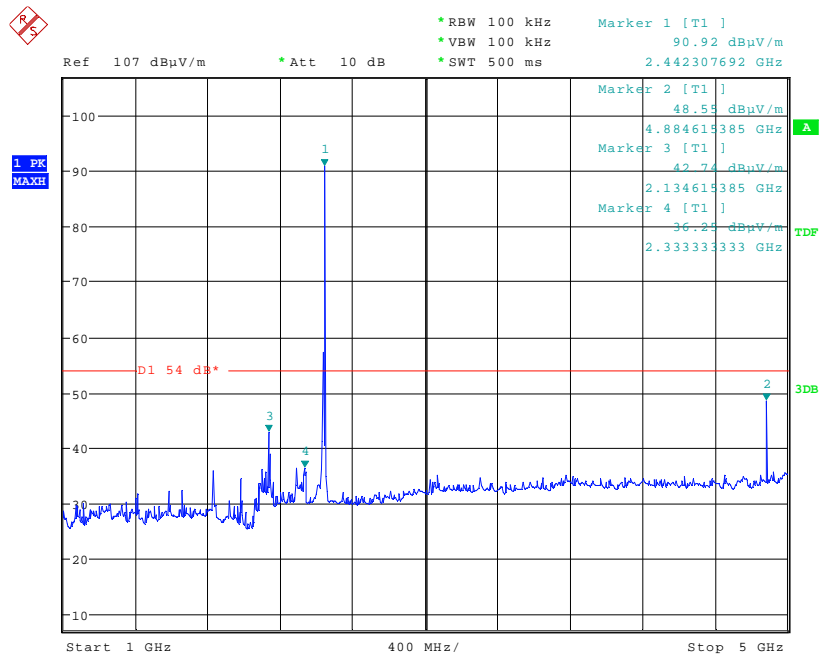


Date: 24.AUG.2010 12:32:43

Middle Channel Radiated emissions Vertical 30MHz-1GHz

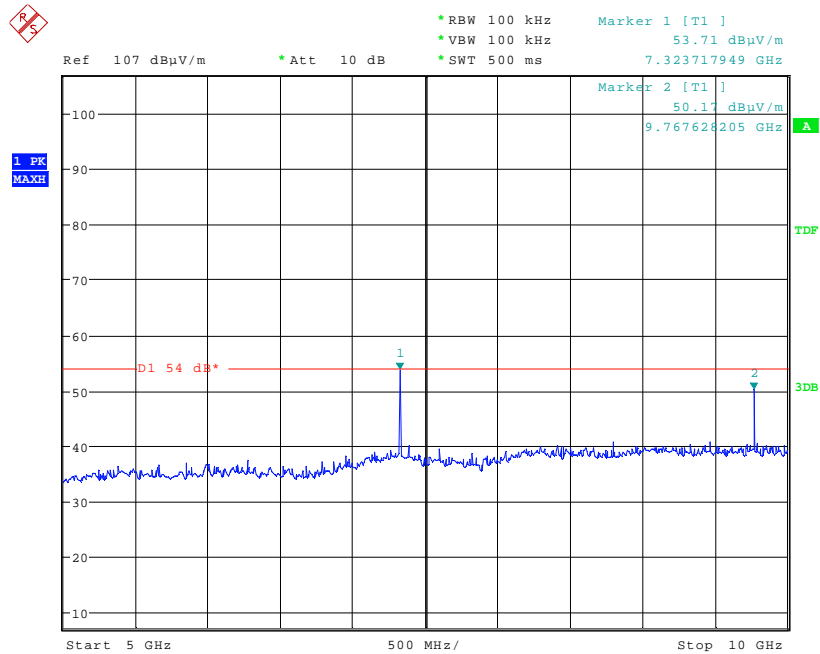


Middle Channel Radiated emissions Vertical 1GHz – 5GHz



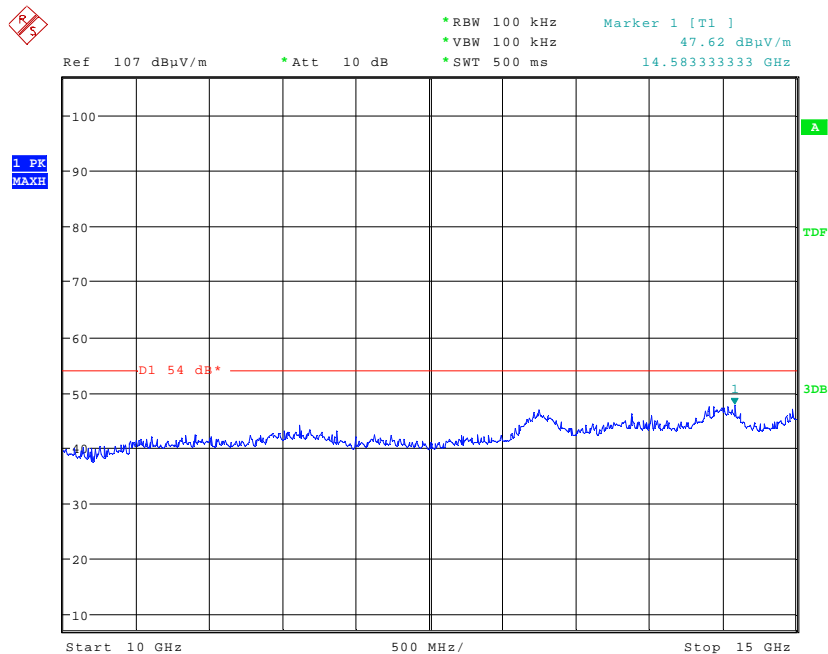
Date: 23.AUG.2010 10:45:52

Middle Channel Radiated emissions Vertical 5GHz- 10GHz



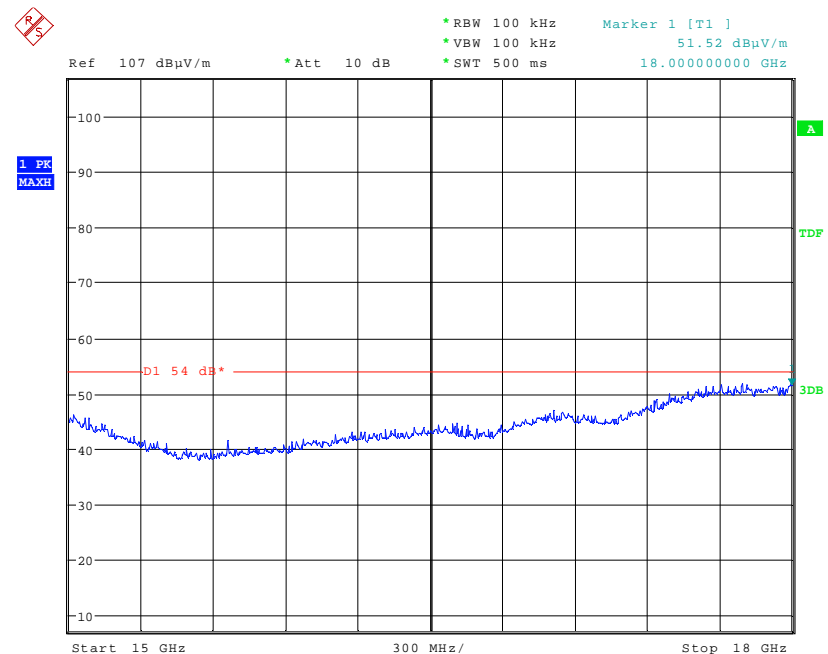
Date: 23.AUG.2010 10:46:49

Middle Channel Radiated emissions Vertical 10GHz- 15GHz



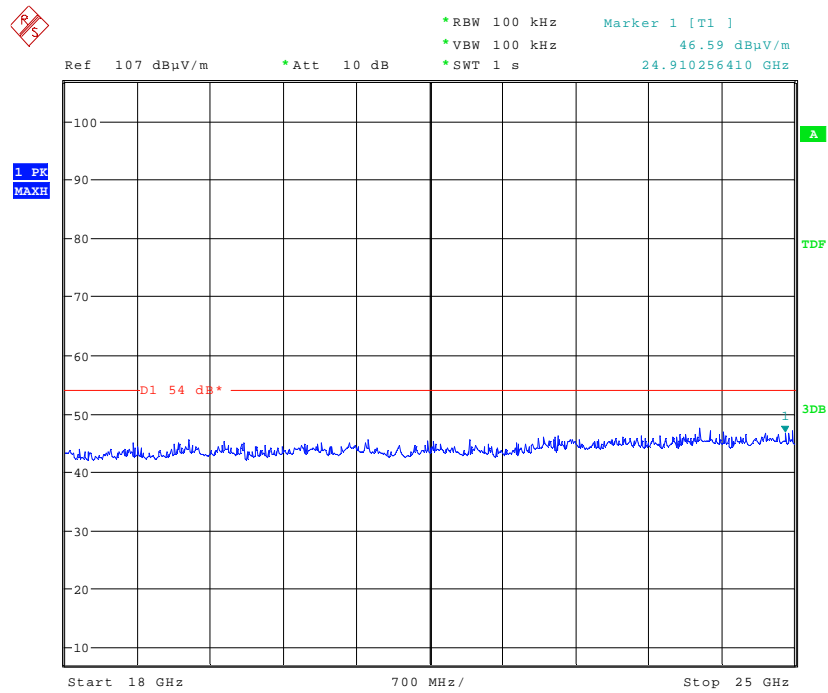
Date: 23.AUG.2010 10:47:37

Middle Channel Radiated emissions Vertical 15GHz- 18GHz



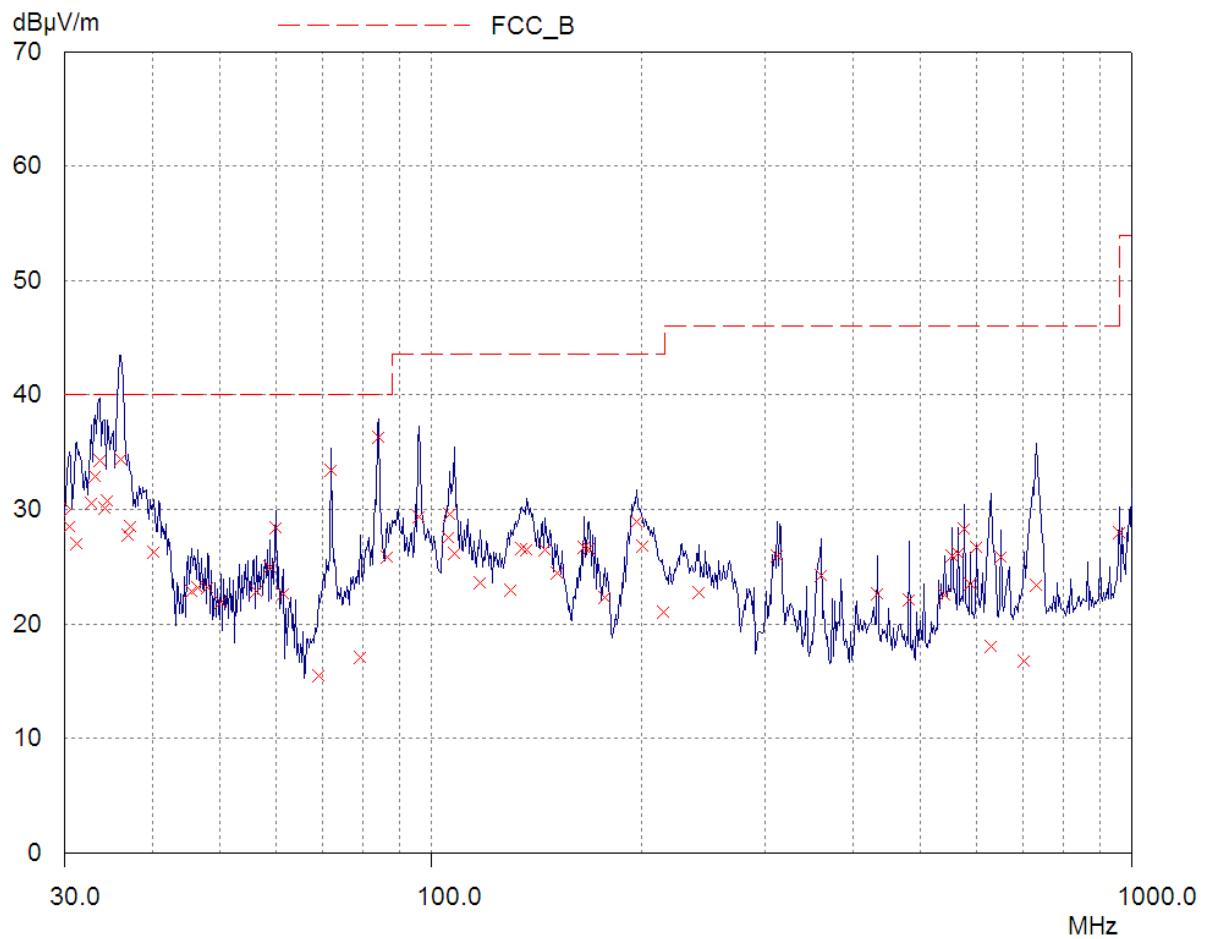
Date: 23.AUG.2010 10:55:35

Middle Channel Radiated emissions Vertical 18GHz- 25GHz

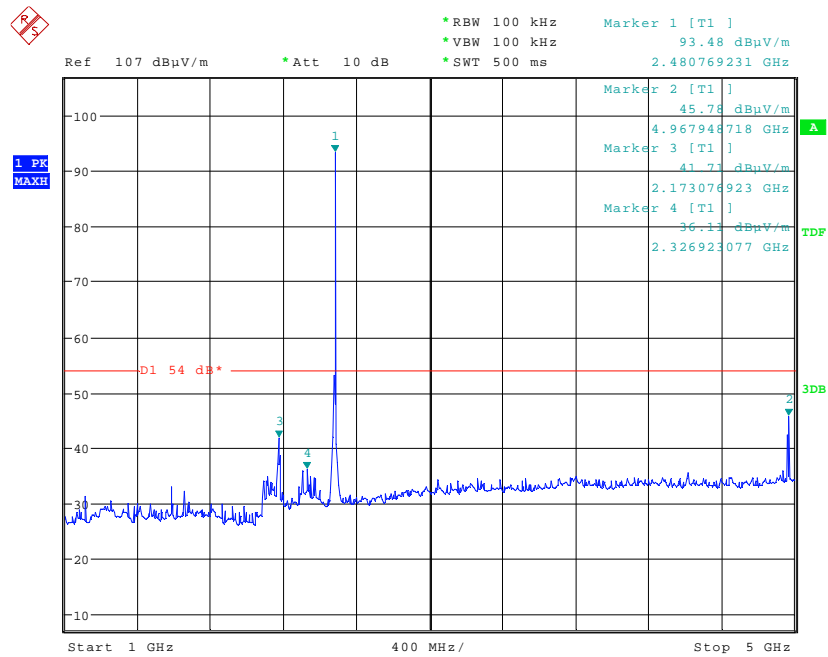


Date: 24.AUG.2010 12:36:44

Top Channel Radiated emissions Vertical 30MHz-1GHz

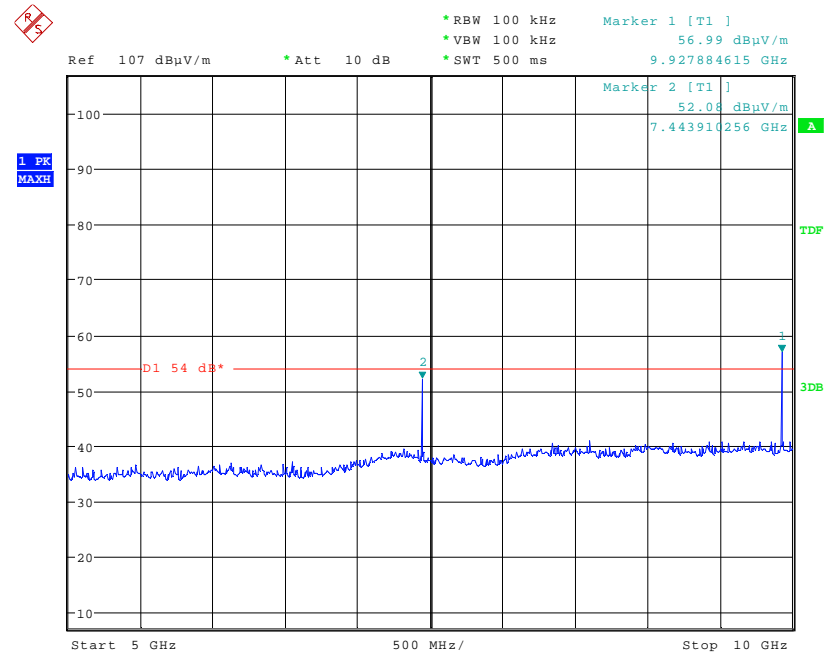


Top Channel Radiated emissions Vertical 1GHz – 5GHz



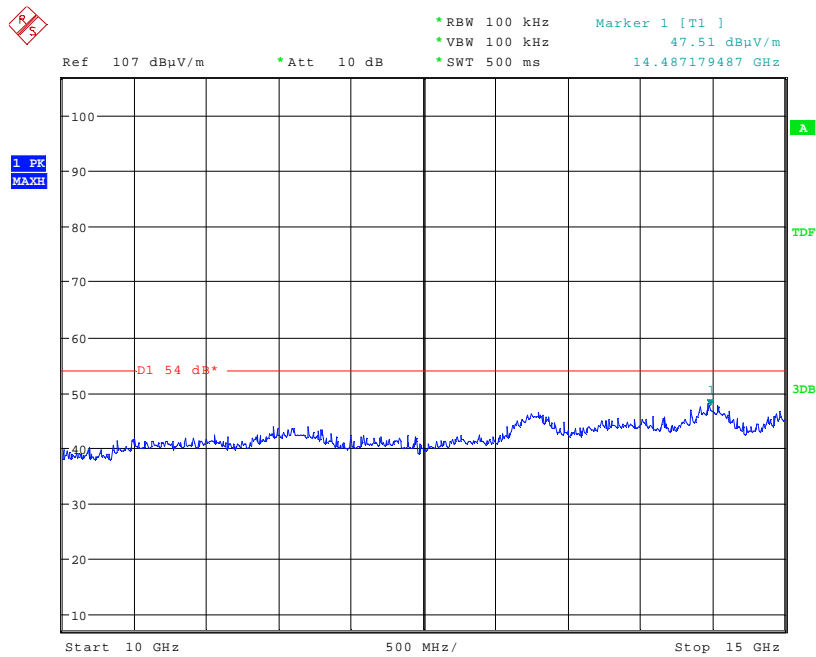
Date: 23.AUG.2010 11:08:41

Top Channel Radiated emissions Vertical 5GHz - 10GHz



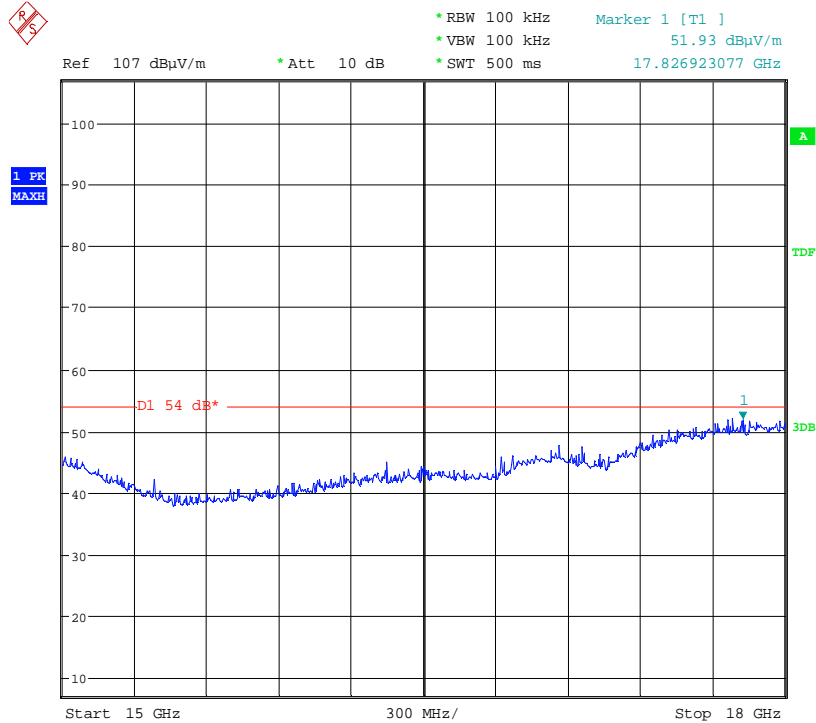
Date: 23.AUG.2010 11:09:50

Top Channel Radiated emissions Vertical 10GHz – 15GHz



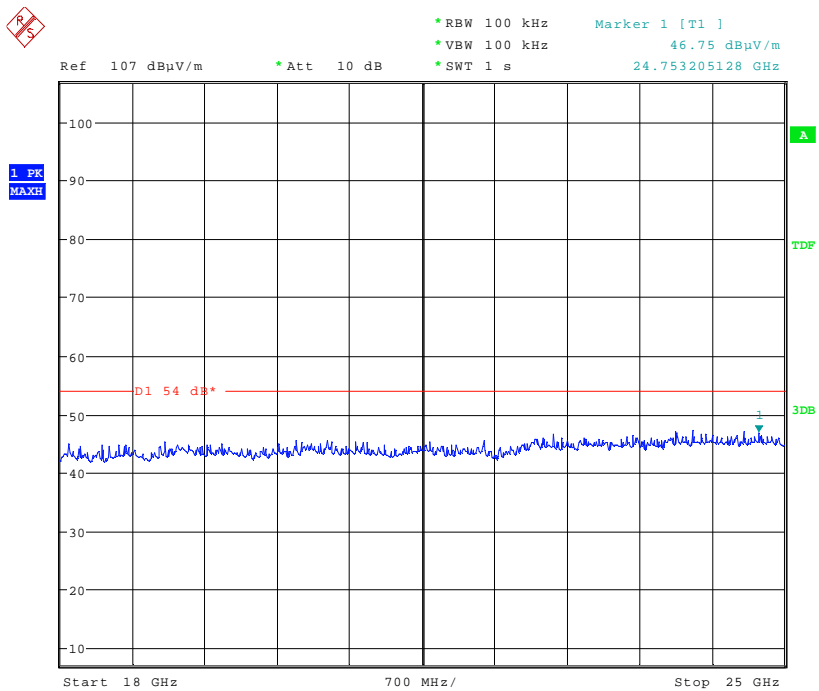
Date: 23.AUG.2010 11:10:30

Top Channel Radiated emissions Vertical 15GHz – 18GHz



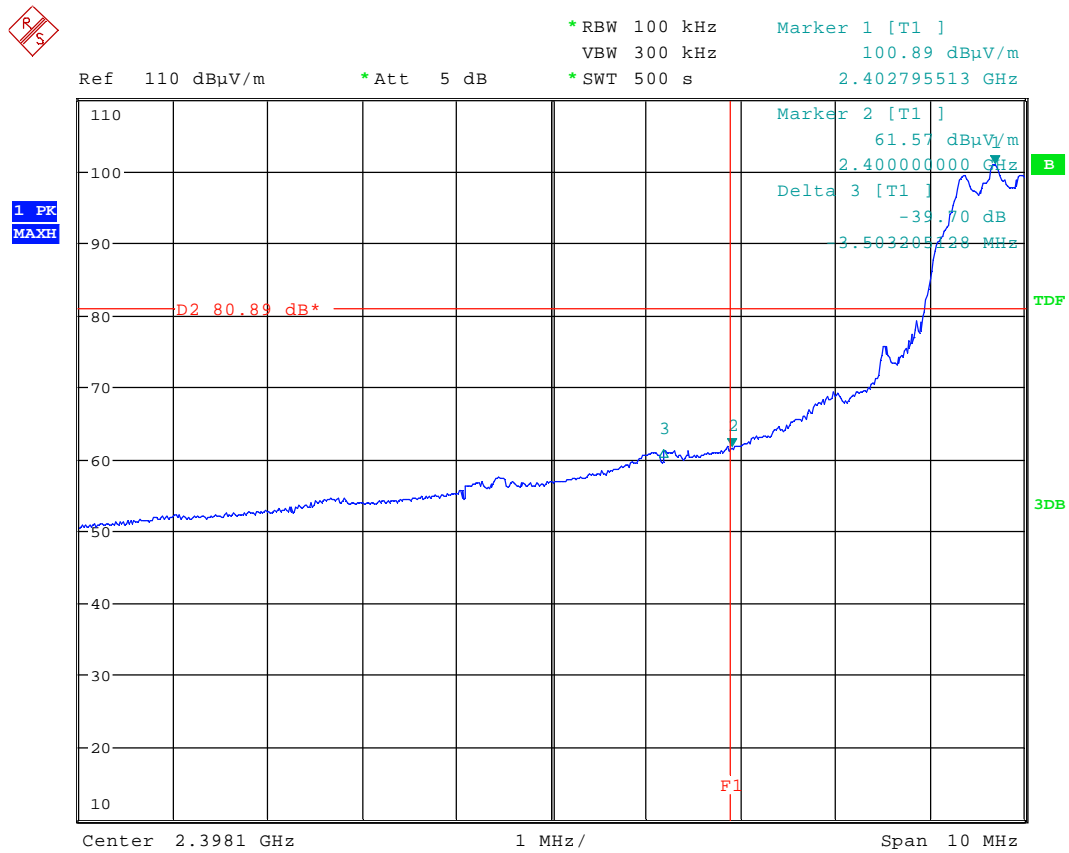
Date: 23.AUG.2010 11:11:09

Top Channel Radiated emissions Vertical 18GHz – 25GHz



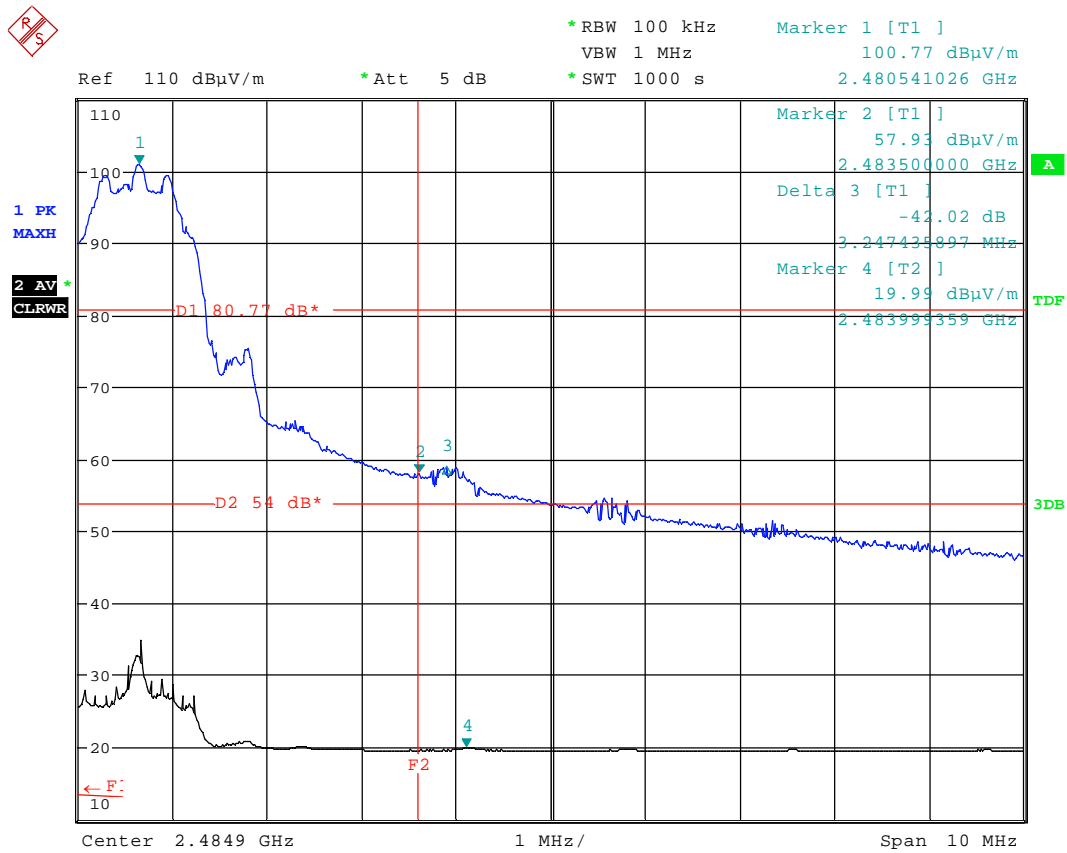
Date: 24.AUG.2010 12:39:07

Lower Band edge compliance



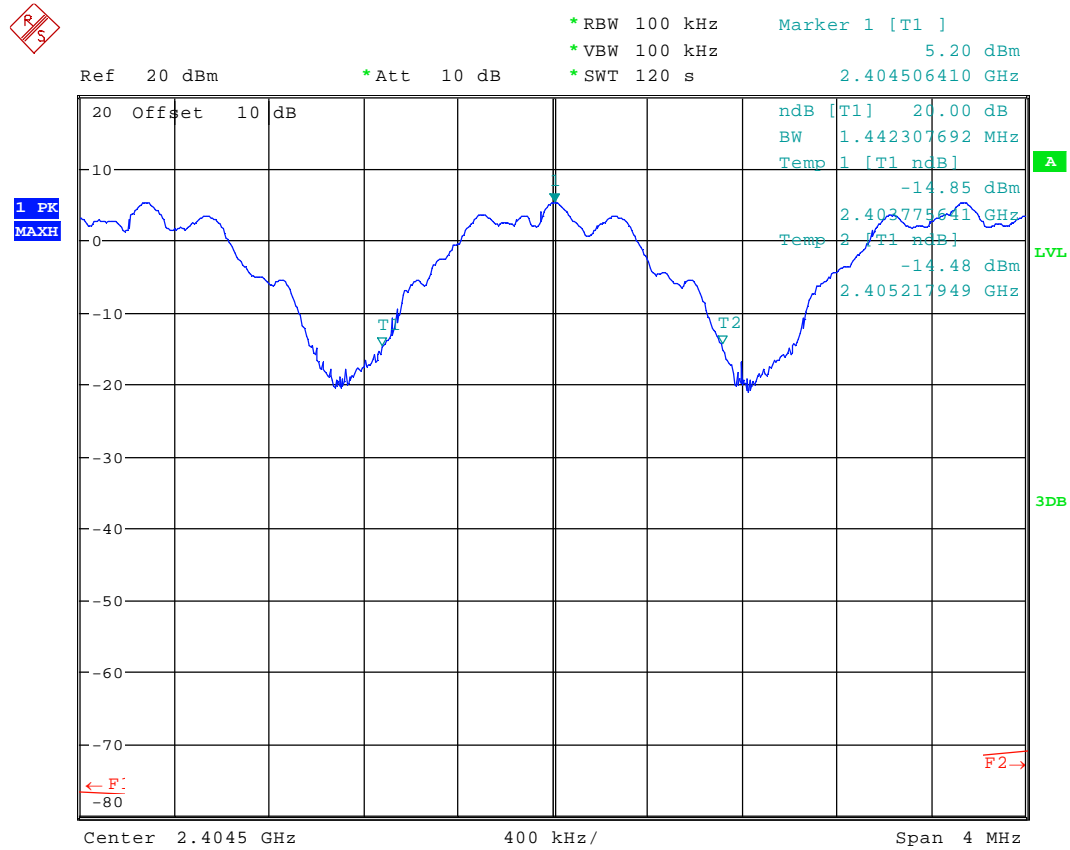
Date: 21.SEP.2010 09:44:46

Upper Band edge compliance



Date: 21.SEP.2010 09:10:37

Lower frequency 20dB Occupied Bandwidth



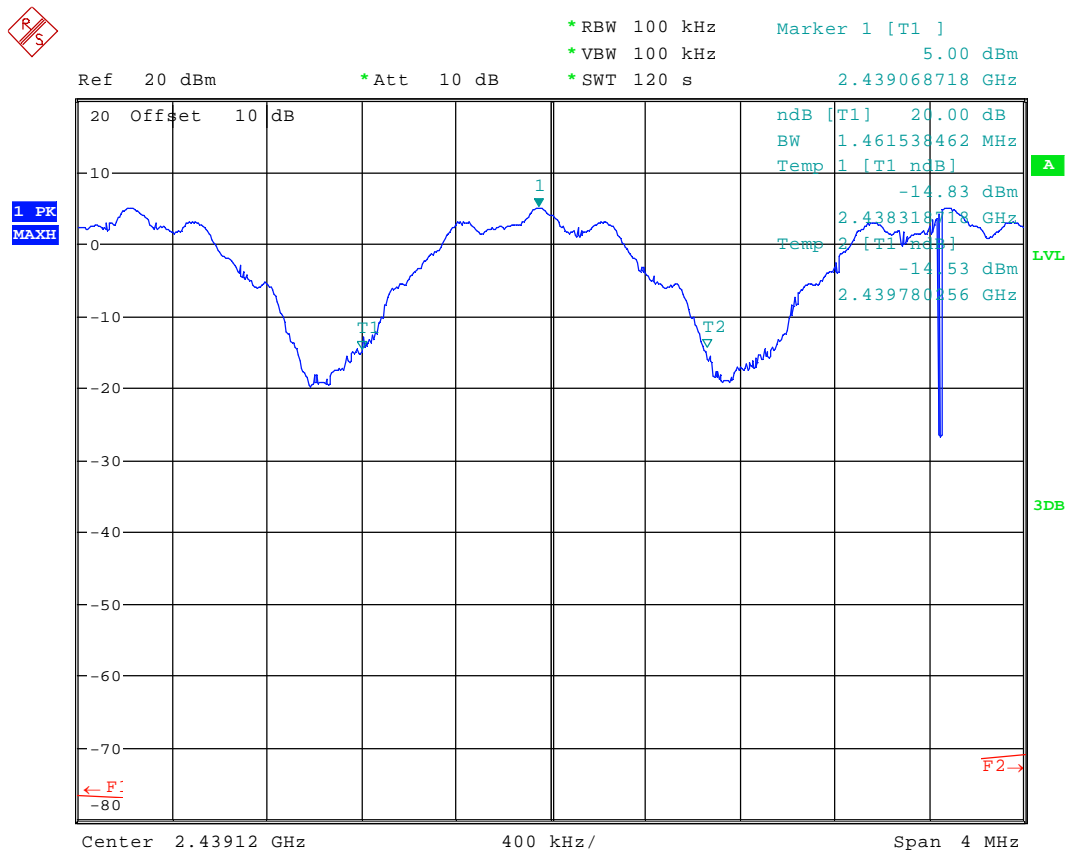
Date: 19.AUG.2010 11:20:25

fl = 2403.775641MHz

fh = 2405.217949MHz

20dB occupied bandwidth = 1.4423MHz

Middle Frequency 20dB Occupied Bandwidth



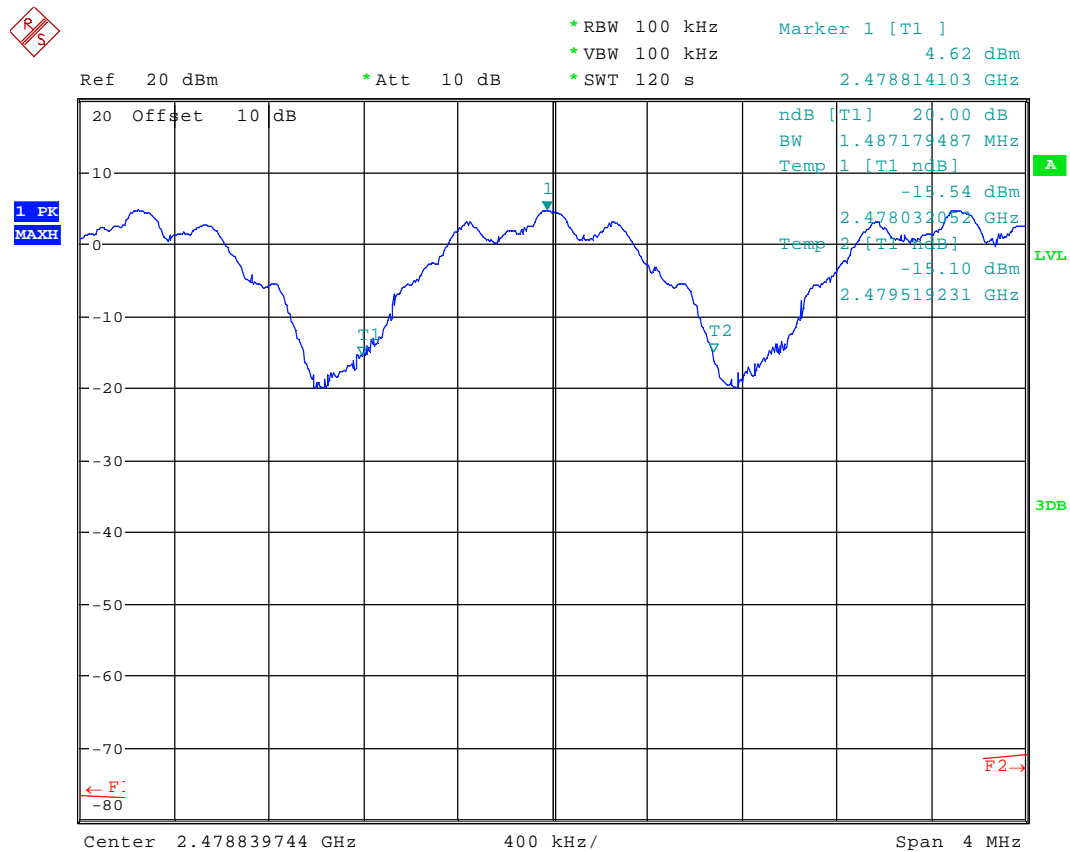
Date: 20.AUG.2010 04:41:42

fl = 2438.318718MHz

fh = 2439.780265MHz

20dB occupied bandwidth = 1.4615MHz

Top Frequency 20dB Occupied Bandwidth



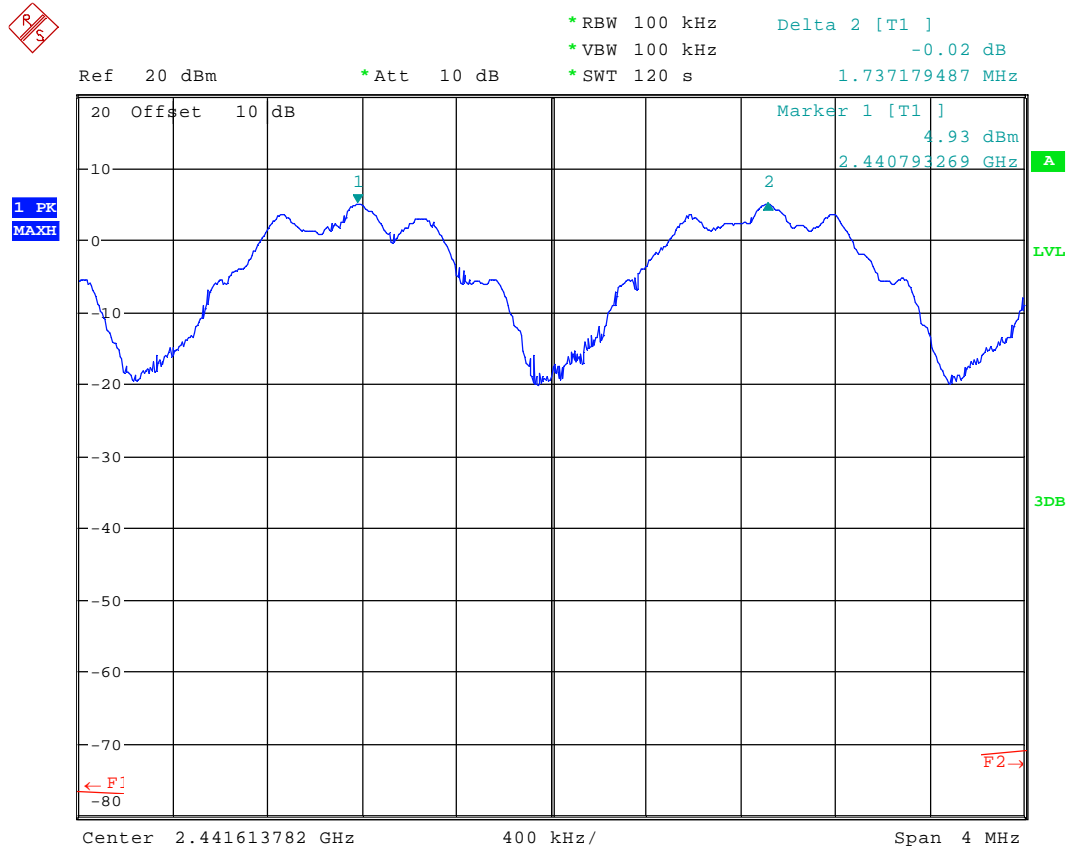
Date: 20.AUG.2010 05:18:18

fl = 2478.032052MHz

fh = 2479.519231MHz

20dB occupied bandwidth = 1.487MHz

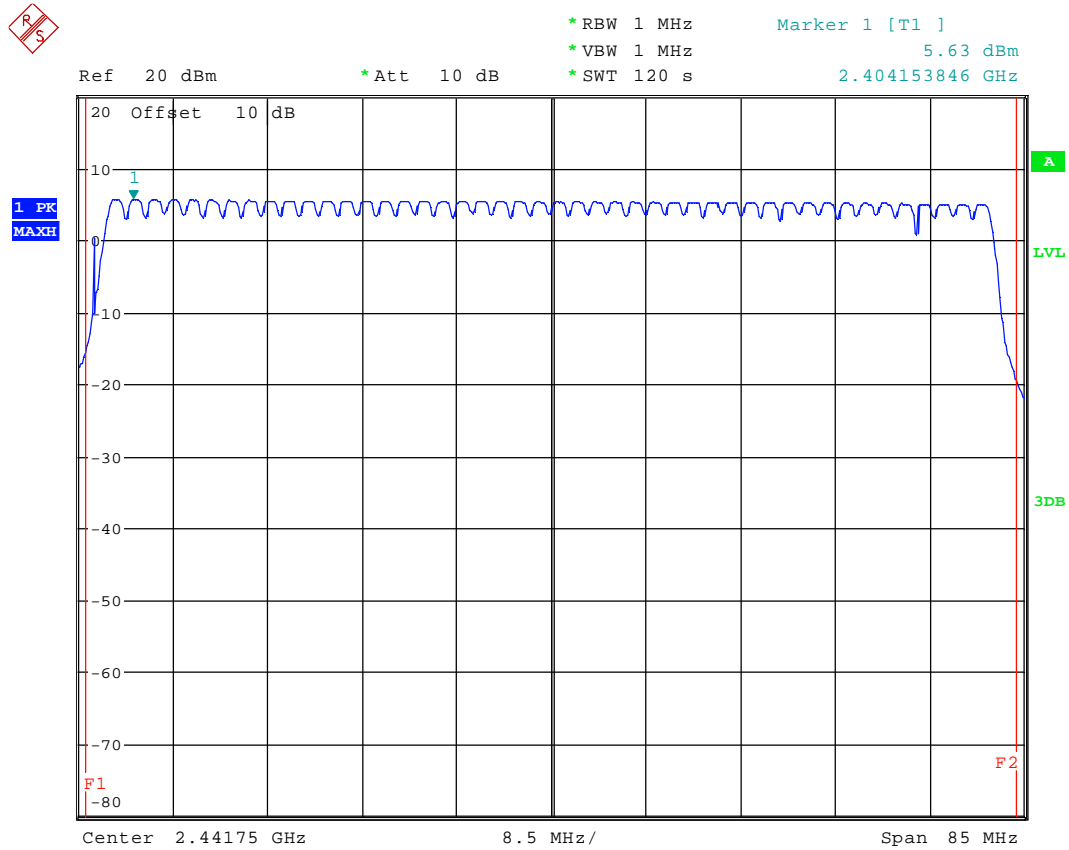
Carrier Frequency separation



Date: 19.AUG.2010 10:26:33

Carrier Frequency separation = 1.737MHz

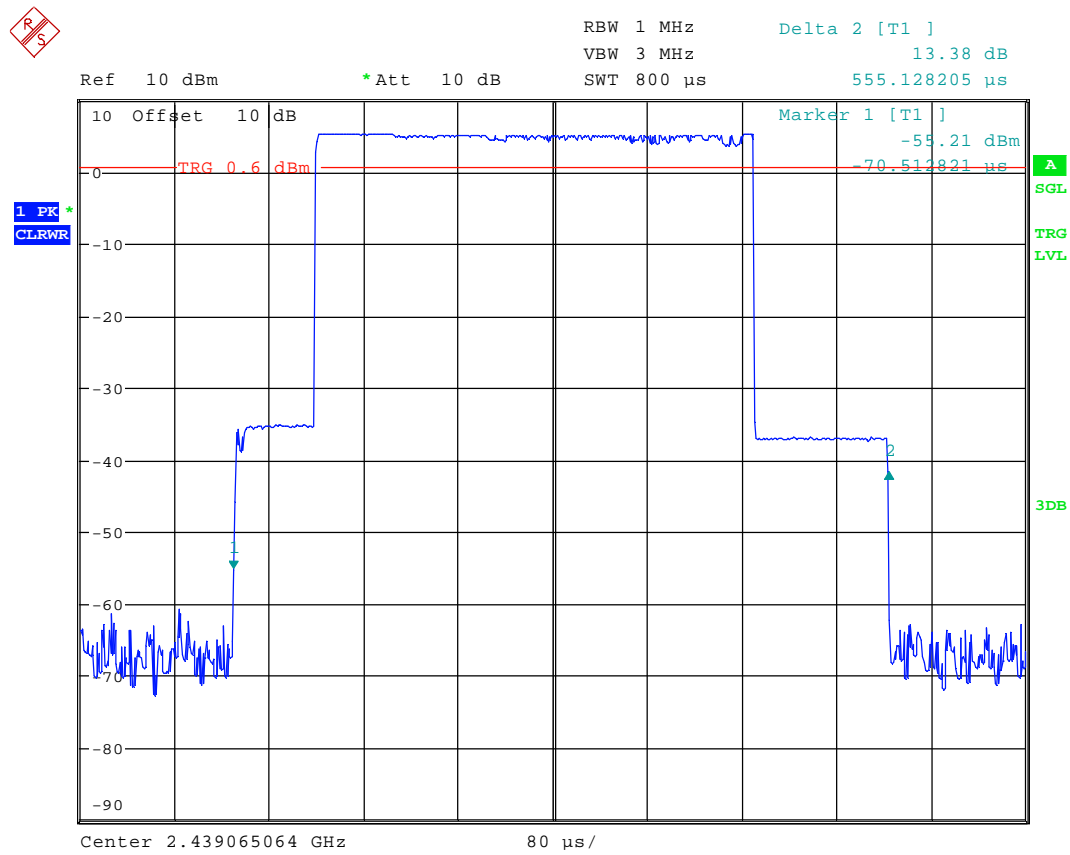
Number of hopping channels



Date: 19.AUG.2010 09:57:09

Number of hopping channels = 46 Channels

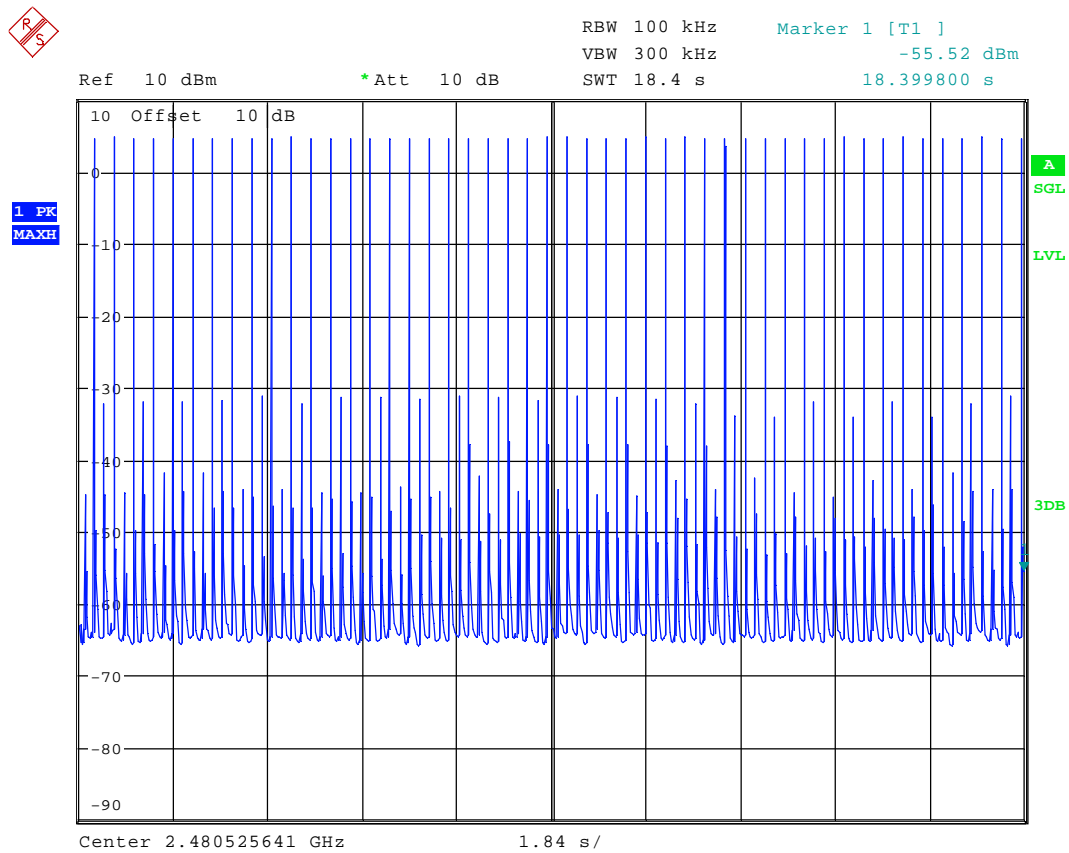
Channel occupancy



Date: 20.AUG.2010 05:43:15

Channel occupancy = 555.128μs

Channel repetition time

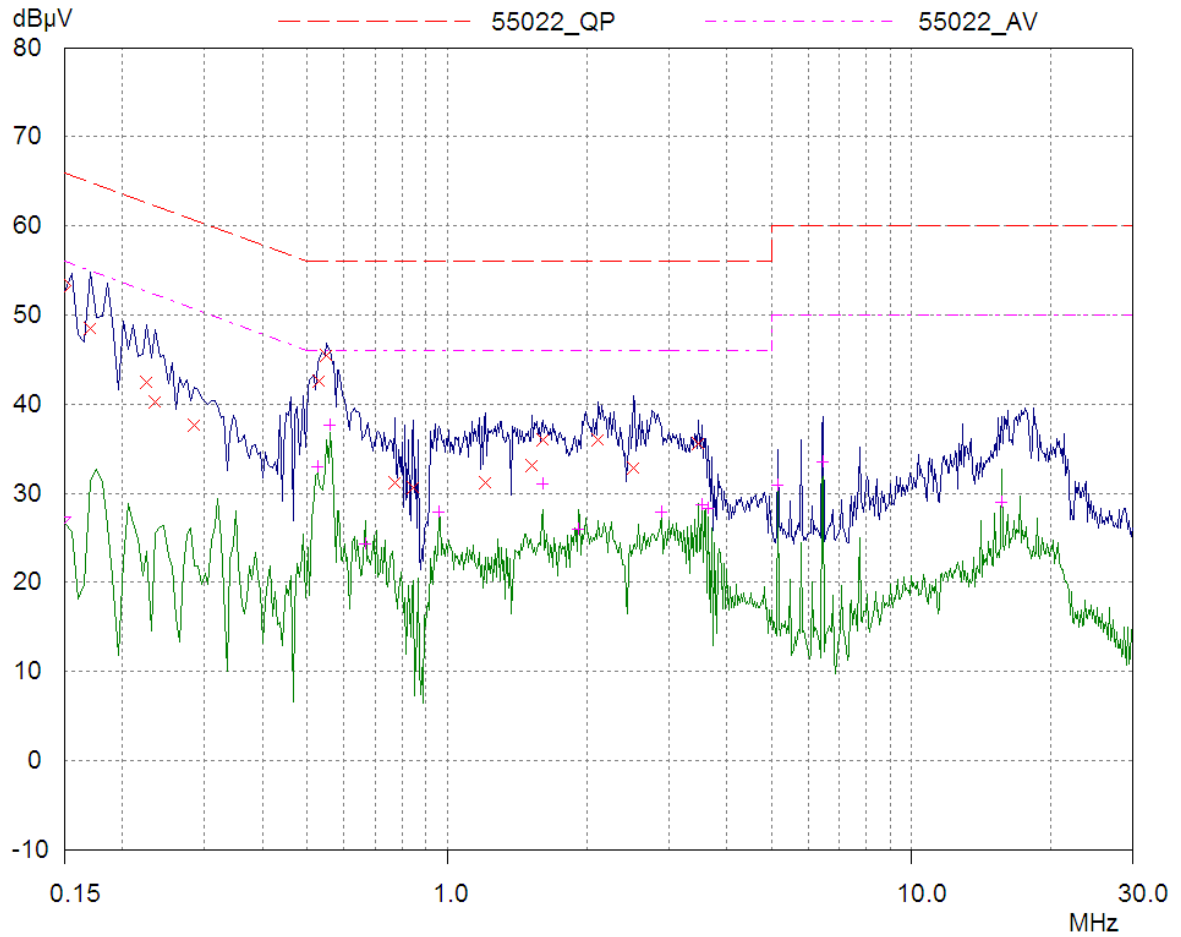


Date: 20.AUG.2010 06:35:33

46 channels X 0.4 seconds = 18.4 seconds

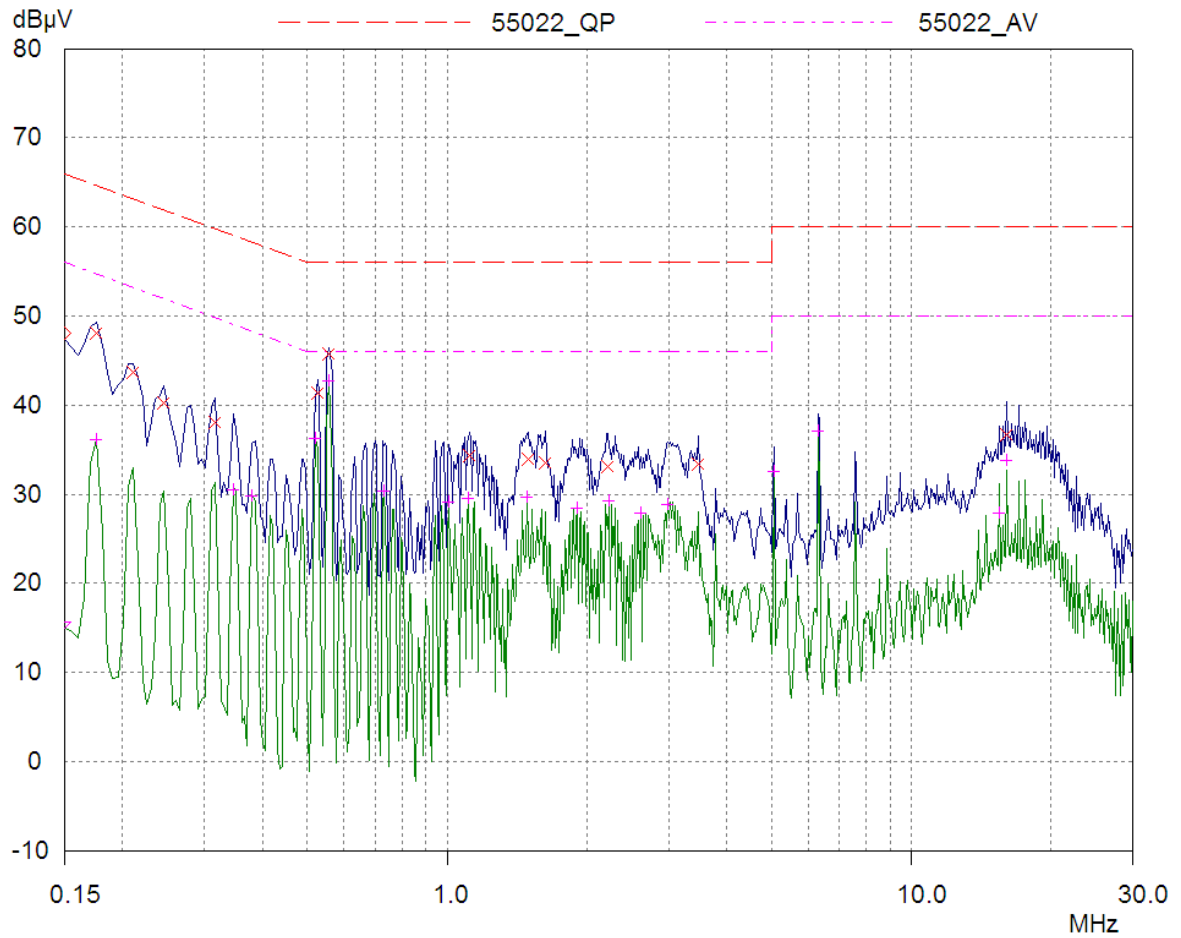
**AC Power Line Emissions hopping all 2.4GHz channels
connected via the laptop and USB cable.**

PRM-AB378-03



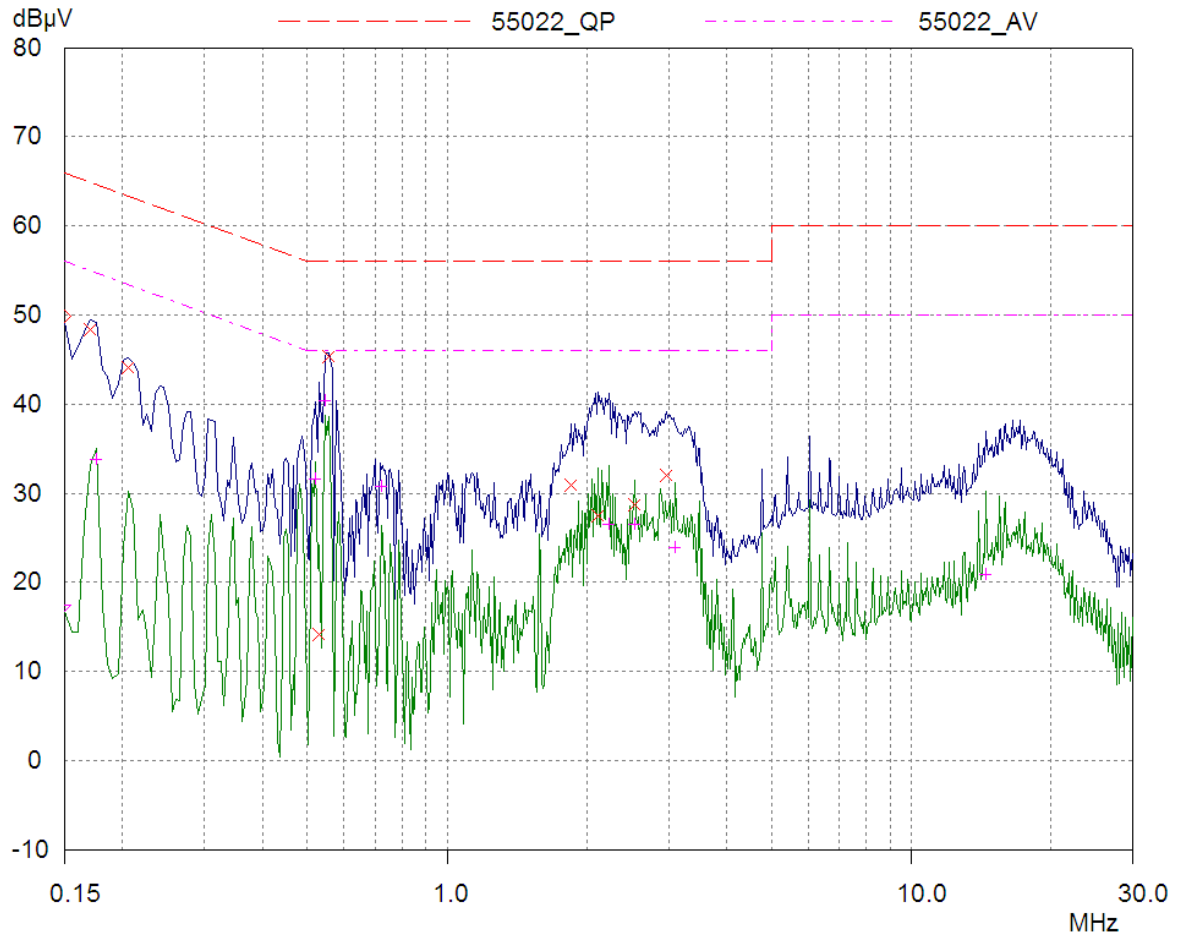
**AC Power Line Emissions hopping all 2.4GHz channels
connected via the laptop and USB cable.**

PRM-AB387-03

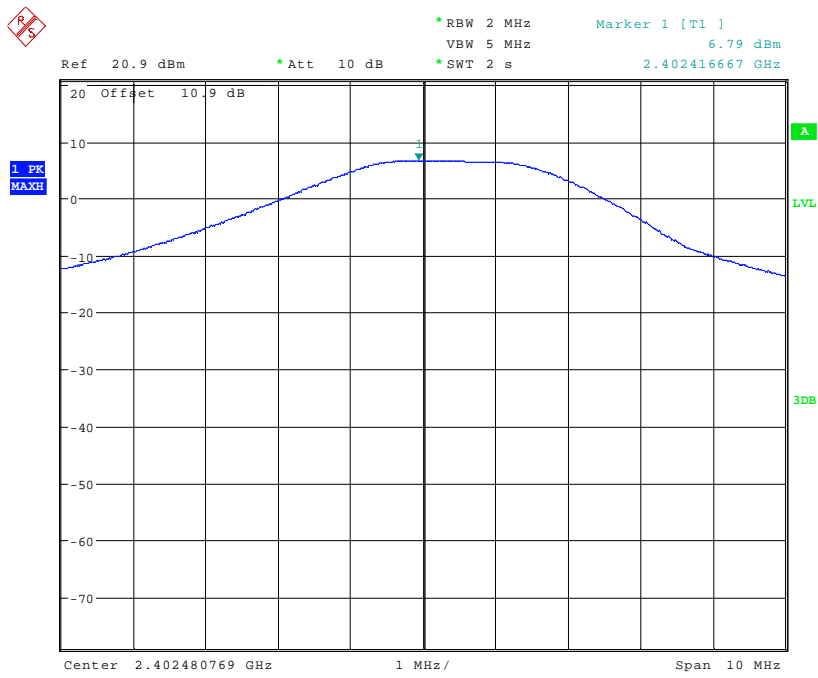


AC Power Line Emissions hopping all 2.4GHz channels
connected via the laptop and USB cable.

PRM-AB395-03

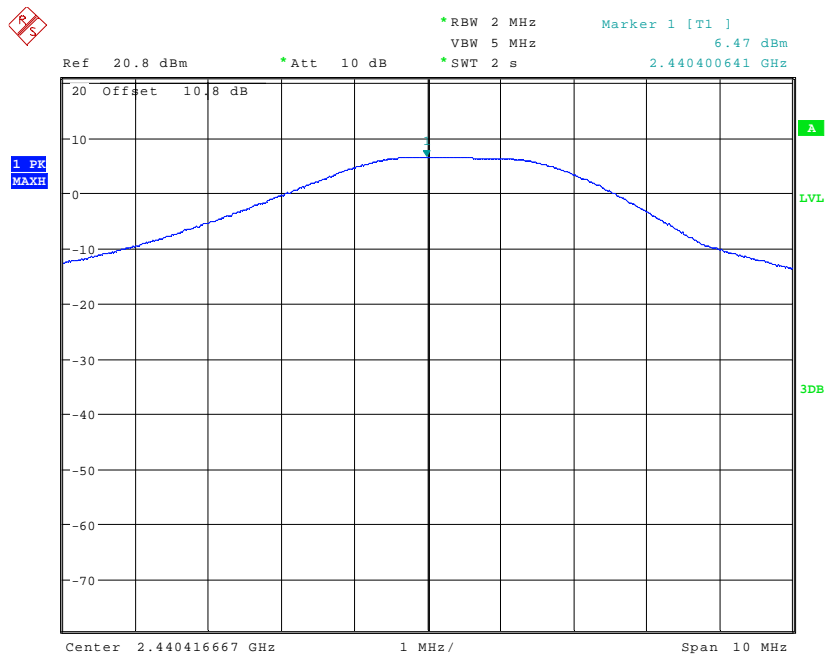


Conducted carrier power 2402MHz



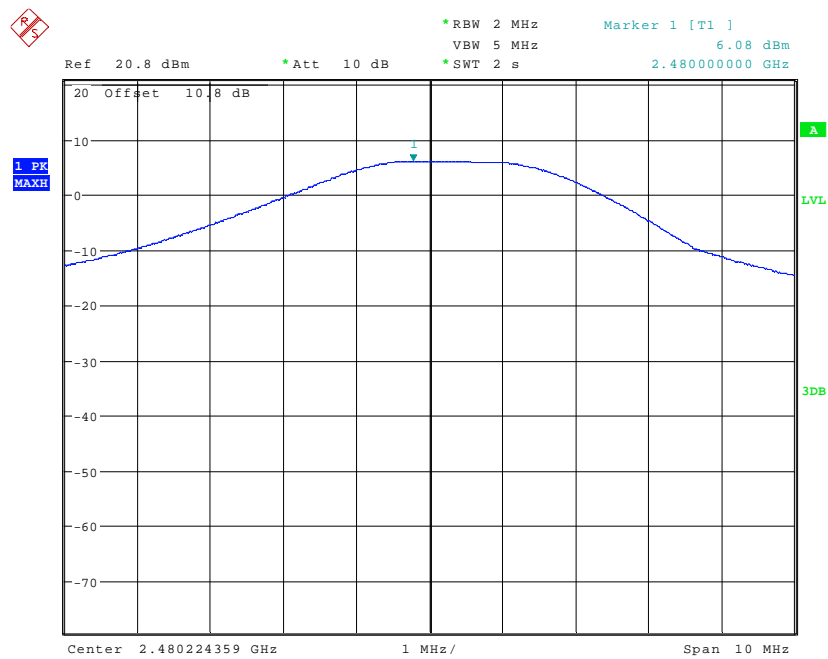
Date: 20.AUG.2010 08:23:06

Conducted carrier power 2440 MHz



Date: 20.AUG.2010 08:26:04

Conducted carrier power 2480 MHz



Date: 20.AUG.2010 08:33:59

Appendix C:**Additional Test and Sample Details**

This appendix contains details of:

1. The samples submitted for testing.
2. Details of EUT operating mode(s)
3. Details of EUT configuration(s) (see below).
4. EUT arrangement (see below).

Throughout testing, the following numbering system is used to identify the sample and it's modification state:

Sample No: Sxx Mod w

where:

xx	= sample number	eg. S01
w	= modification number	eg. Mod 2

The following terminology is used throughout the test report:

Support Equipment (SE) is any additional equipment required to exercise the EUT in the applicable operating mode. Where relevant SE is divided into two categories:

SE in test environment: The SE is positioned in the test environment and is not isolated from the EUT (e.g. on the table top during REFE testing).

SE isolated from the EUT: The SE is isolated via filtering from the EUT. (e.g. equipment placed externally to the ALSR during REFE testing).

EUT configuration refers to the internal set-up of the EUT. It may include for example:

- Positioning of cards in a chassis.
- Setting of any internal switches.
- Circuit board jumper settings.
- Alternative internal power supplies.

Where no change in EUT configuration is **possible**, the configuration is described as "single possible configuration".

EUT arrangement refers to the termination of EUT ports / connection of support equipment, and where relevant, the relative positioning of samples (EUT and SE) in the test environment.

C1) Test samples

The following samples of the apparatus were submitted by the client for testing :

Sample No.	Description	Identification
S01	PRM-AB378-03	N/A
S02	PRM-AB387-03	N/A
S03	PRM-AB395-03	N/A
S05	Delta power supply	DPS-605B A

The following samples of apparatus were submitted by the client as host, support or drive equipment (auxiliary equipment):

Sample No.	Description	Identification
S04	Dell Laptop	Service Tag 8Q0314J
S06	Activhub	N/A

C2) EUT Operating Mode During Testing.

During testing, the EUT was exercised as described in the following tables :

Test	Description of Operating Mode:
All tests detailed in this report	<i>EUT transmitting on maximum power using FHSS over 46 channels</i>

C3) EUT Configuration Information.

Sample	Internal Configuration Details
S01	Single possible internal configuration

The EUT was submitted for testing in one single possible configuration.

C4) List of EUT Ports

The table below describes the termination of EUT ports:

Sample : S01

Port	Description of Cable Attached	Cable length	Equipment Connected
<i>USB</i>	<i>USB</i>	<i>5.0mtr</i>	<i>PC - Activboard</i>
<i>USB</i>	<i>USB</i>	<i>1.5mtr</i>	<i>USB-Hub</i>
<i>USB</i>	<i>USB</i>	<i>0.90mtr</i>	<i>Audio Amp - Hub</i>
<i>Dc</i>	<i>Power supply</i>	<i>0.33mtr</i>	<i>Audio Amp – AC3</i>
<i>Dc</i>	<i>Power supply</i>	<i>1.8 5mtr</i>	<i>Switch mode supply - Audio Amp</i>

Notes on the above:

A photograph showing the termination of EUT ports is contained within Appendix F

C5 Details of Equipment Used

TRAC Ref	Type	Description	Manufacturer	Date Calibrated.
TRLUH281	FSU46	Spectrum Analyser	Rhode & Schwarz	29/01/2010
TRL138	3115	Horn Antenna	Emco	10/09/2010
TRL139	3115	Horn Antenna	Emco	17/08/2009
TRL572	8449B	Pre amp	Agilent	15/07/2009
TRLUH04	ESVS10	Receiver	Rhode & Schwarz	10/12/2009
TRLUH372	6201-69	Pre amp	Watkins& Johnson	27/11/2009
TRLUH93	CBL6112B	Antenna	Chase	03/06/2009
TRLUH377	FSU	Spectrum Analyser	Rhode & Schwarz	101/01/2010
TRLUH191	CBL611/A	Antenna	York	01/10/2008
TRLUH195	ESH3	Lisn	Rhode & Schwarz	27/01/10

Appendix D:

Additional Information

No additional information is included within this test report.

Appendix E:**Calculation of the duty cycle correction factor**

Using a spectrum analyser in zero span mode, centred on the fundamental carrier frequency with a RBW of 1MHz and a video Bandwidth of 1MHz the sweep time was set accordingly to capture the pulse train. The transmit pulsewidths and period was measured. A plots of the pulse train is contained in Appendix B of this test report.

If the pulse train was less than 100 ms, including blanking intervals, the duty cycle was calculated by averaging the sum of the pulsewidths over one complete pulse train. However if the pulse train exceeds 100ms then the duty cycle was calculated by averaging the sum of the pulsewidths over the 100ms width with the highest average value. (The duty cycle is the value of the sum of the pulse widths in one period (or 100ms), divided by the length of the period (or 100ms). The duty cycle correction factor was then expressed in dB and the peak emissions adjusted accordingly to give an average value of the emission.

Correction factor dB = $20 \times (\text{Log}_{10} \text{ Calculated Duty Cycle})$

Therefore the calculated duty cycle was determined:

The pulse train period was greater than >100ms and in as shown from the plots in contained in appendix B of this test report.

Duty cycle = $\frac{\text{the sum of the highest average value pulsewidths over 100ms}}{100\text{ms}}$

e.g

$$= \frac{7.459\text{ms}}{100\text{ms}} = 0.07459$$

0.07459 or 7.459%

Correction factor (dB) = $20 \times (\text{Log}_{10} 0.07459) = -22.54\text{dB}$

OR

For EUT that uses Zigbee device technology the EUT is designed to be compliant with the requirements of IEEE 802.15.4, which in general assumes a maximum duty cycle of 1%. Therefore in accordance with CFR 47 Part 15.35(c), the emissions may be reduced by a factor of 100 (40 dB). Plots of the duty cycle showing the duty cycle to be less than 1% are contained in Appendix B of this report.

Appendix F:

Photographs and Figures

The following photographs were taken of the test samples:

- 1: Radiated emissions test setup
- 2: Power line conducted emissions arrangement
- 3: Overview/ AC3 and Hub cover removed
- 4: Top View AC3 PCB/ Underside View AC3 PCB
- 5: Top View Hub PCB/ Underside View Hub PCB
- 6: Overview of Audio Amplifier
- 7: Top View Audio Amplifier PCB/ Underside View Audio PCB
- 8: Radio Section Screening cover removed

Photograph 1

Radiated emissions test setup



Photograph 2

Power line conducted emissions arrangement



Photograph 3

Overview



AC3 and Hub cover removed

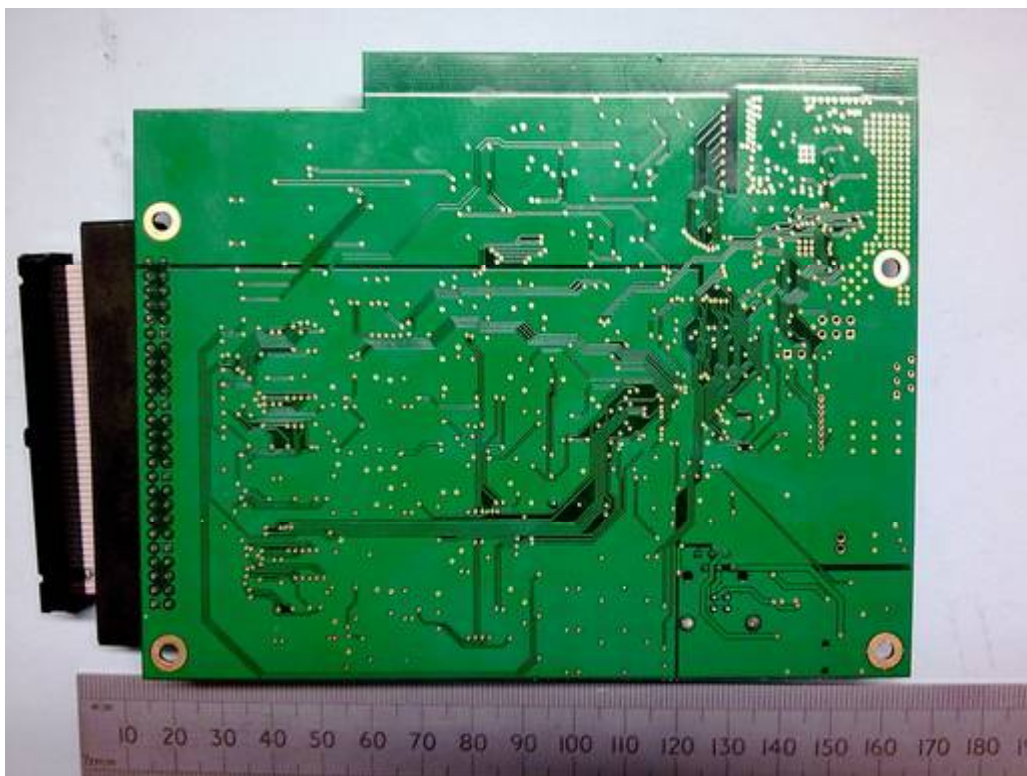


Photograph 4

Top View AC3 PCB



Underside View AC3 PCB



Photograph 5

Top View Hub PCB



Underside View Hub PCB



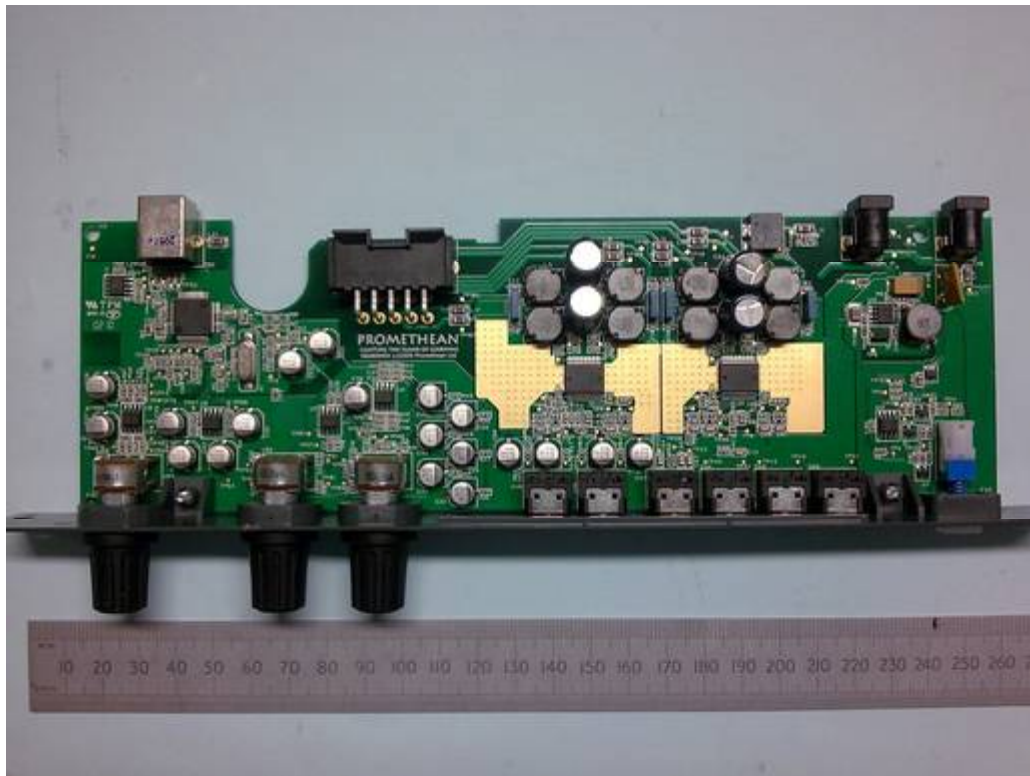
Photograph 6

Overview of Audio Amplifier

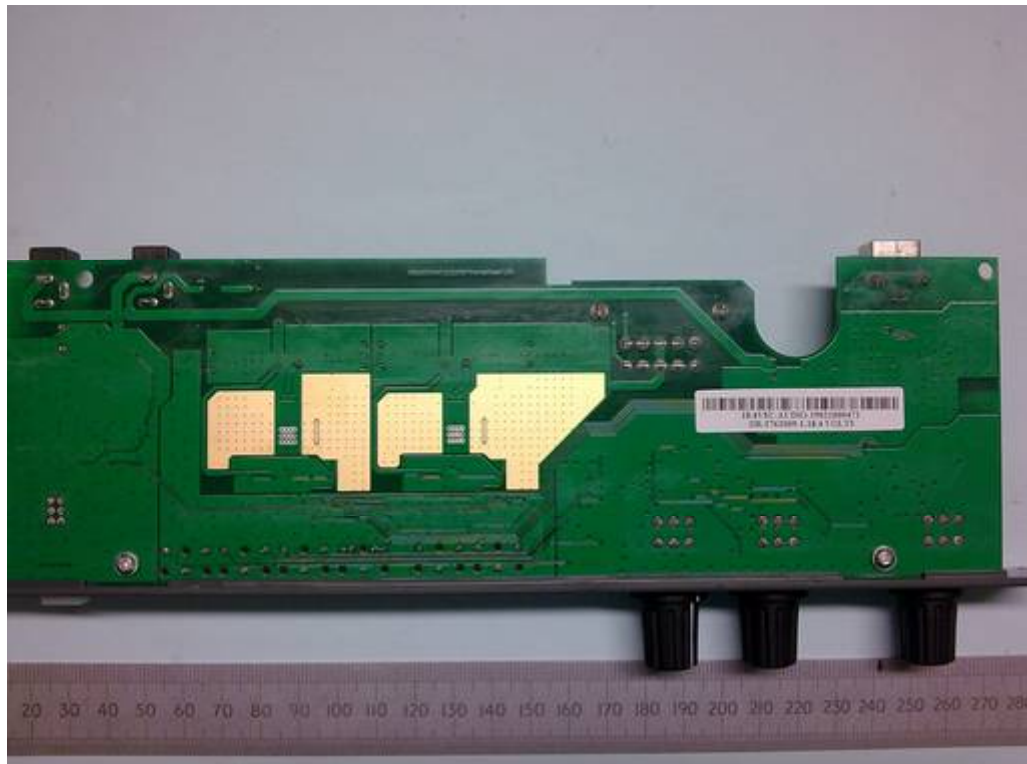


Photograph 7

Top View Audio Amplifier PCB



Underside View Audio PCB



Photograph 8

Radio Section Screening cover removed



The results herein relate only to the sample tested. Full results are contained in the relevant works order file.

UP HOLLAND

Moss View, Nipe Lane, Up Holland, West Lancashire, WN8 9PY, UK.

T +44 (0)1695 556666 **F** +44 (0)1695 557077 **E** test@tracglobal.com

www.tracglobal.com