

Radio Test Report
for
Universal Electronics
on
JPN Sony Othello NFC Remote 2013

Document No: TRA-009758-W-US-1

HULL

Unit E, South Orbital Trading Park, Hedon Road, Hull, HU9 1NJ, UK.
T +44 (0)1482 801801 **F** +44 (0)1482 801806 **E** test@tracglobal.com
www.tracglobal.com

TRaC Wireless Test Report : TRA-009758-W-US-1

Applicant : Universal Electronics

Apparatus : JPN Sony Othello NFC Remote 2013

Specification(s) : CFR47 Part 15.247

FCCID : MG3-YD001

Purpose of Test : Certification

Authorised by

: 

(Radio Products Manager)

Issue Date : **21st September 2012**

Authorised Copy Number : *PDF*

Contents

Section 1:	Introduction	4
1.1	General	4
1.2	Tests Requested By	5
1.3	Manufacturer	5
1.4	Apparatus Assessed	5
1.5	Test Result Summary	6
1.6	Notes relating to the assessment	7
1.7	Deviations from Test Standards	7
Section 2:	Measurement Uncertainty	8
2.1	Measurement Uncertainty Values	8
Section 3:	Modifications	10
3.1	Modifications Performed During Assessment	10
Appendix A:	Formal Emission Test Results	11
A1	Transmitter Peak Output Power	12
A2	Conducted Spurious Emissions	13
A3	Radiated Emissions	15
A4	20dB Bandwidth and Channel Separation	20
A5	Hopping frequencies	21
A6	Channel Occupancy	22
A7	Antenna Gain	23
A8	Unintentional Radiated Emissions	24
A9	Unintentional Radiated Emissions	25
Appendix B:	Supporting Graphical Data	26
Appendix C:	Additional Test and Sample Details	56
C1	Test samples	57
C2	EUT operating mode during testing	58
C3	EUT Configuration Information	59
C4	List of EUT Ports	60
C5	Details of Equipment Used	61
Appendix D:	Additional Information	62
Appendix E:	Calculation of the duty cycle correction factor	63
Appendix F:	Photographs and Figures	64

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 Global []
Unit E
South Orbital Trading Park
Hedon Road
Hull, HU9 1NJ.
United Kingdom.

Telephone: +44 (0) 1482 801801
Fax: +44 (0) 1482 801806

TRaC Global [X]
Unit 1
Pendle Place
Skelmersdale
West Lancashire, WN8 9PN
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: Daniel Winstanley, Sandeep Bharat

Author(s): Daniel Winstanley, S Hodgkinson

This report must not be reproduced except in full without prior written permission from TRaC Global Ltd.

1.2 Tests Requested By

All testing in this report was requested by:

Universal Electronics
201 E. Sandpointe Ave
8th Floor
Santa Ana
CA 92707
USA

1.3 Manufacturer

Same as above

1.4 Apparatus Assessed

The following products were assessed between 28th August and 5th September 2012

JPN Sony Othello NFC Remote 2013

The above equipment is a FHSS transmitter operating in the 2400 MHz to 2483.5 MHz band.

1.5 Test Result Summary

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

The statements relating to compliance with the standards below apply ONLY as qualified in the notes and deviations stated in sections 1.6 to 1.7 of this test report.

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

Test Type	Regulation	Measurement standard	Result
Radiated spurious emissions (Restricted bands)	Title 47 of the CFR: Part 15 Subpart (c) 15.247	ANSI C63.10:2009	Pass
Conducted spurious emissions (Non-restricted bands)	Title 47 of the CFR: Part 15 Subpart (c) 15.247	ANSI C63.10:2009	Pass
AC Power conducted emissions	Title 47 of the CFR: Part 15 Subpart (c) 15.207	ANSI C63.10:2009	N/A Note 1
20dB Bandwidth and Channel Spacing	Title 47 of the CFR : Part 15 Subpart (c) 15.247(a)(1)(i)	ANSI C63.10:2009	Pass
Conducted Carrier Power	Title 47 of the CFR : Part 15 Subpart (c) 15.247(b)(2)	ANSI C63.10:2009	Pass
Hopping Frequencies	Title 47 of the CFR : Part 15 Subpart (c) 15.247(a)(1)	ANSI C63.10:2009	Pass
Channel Occupancy	Title 47 of the CFR : Part 15 Subpart (c) 15.247(a)(1)(i)	ANSI C63.10:2009	Pass
Unintentional Radiated Spurious Emissions	Title 47 of the CFR: Part 15 Subpart (b) 15.109	ANSI C63.10:2009	Pass

Note 1: The JPN Sony Othello NFC Remote 2013 is a battery power device.

Abbreviations used in the above table:

ANSI C 63.10:2009 is outside the scope of the laboratories UKAS accreditation.

Mod	: Modification	ANSI	: American National Standards Institution
CFR	: Code of Federal Regulations	PLCE	: Power Line Conducted Emissions
REFE	: Radiated Electric Field 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	: 20 to 23 °C
Humidity	: 45 to 75 %

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

This assessment has been performed in accordance with the requirements of ISO/IEC 17025.

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 table contains the measurement uncertainties for TRaC Global measurements

Radio Testing – General Uncertainty Schedule

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 (Power Meter) = **1.08dB**

Uncertainty in test result (Spectrum Analyser) = **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 (Power Meter) = **0.113ppm**

Uncertainty in test result (Spectrum Analyser) = **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 – Up to 8.1GHz = **3.31dB**

Uncertainty in test result – 8.1GHz – 15.3GHz = **4.43dB**

Uncertainty in test result – 15.3GHz – 21GHz = **5.34dB**

Uncertainty in test result – 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%**

[12] Power Line Conduction

Uncertainty in test result = **3.4dB**

[13] Spectrum Mask Measurements

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

[14] Adjacent Sub Band Selectivity

Uncertainty in test result = **1.24dB**

[15] Receiver Blocking – Listen Mode, Radiated

Uncertainty in test result = **3.42dB**

[16] Receiver Blocking – Talk Mode, Radiated

Uncertainty in test result = **3.36dB**

[17] Receiver Blocking – Talk Mode, Conducted

Uncertainty in test result = **1.24dB**

[18] Receiver Threshold

Uncertainty in test result = **3.23dB**

[19] 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
		ATS	: Alternative Test Site
EUT	: Equipment Under Test		
SE	: Support Equipment	Ref	: Reference
		Freq	: Frequency
L	: Live Power Line		
N	: Neutral Power Line	MD	: Measurement Distance
E	: Earth Power Line	SD	: Spec Distance
Pk	: Peak Detector	Pol	: Polarisation
QP	: Quasi-Peak Detector	H	: Horizontal Polarisation
Av	: Average Detector	V	: Vertical Polarisation
CDN	: Coupling & decoupling network		

A1 Transmitter Peak Output Power

Carrier power was verified with the EUT transmitting on its lowest, centre and highest carrier frequency in turn.

Test Details	
Regulation	Title 47 of the CFR: Part15 Subpart (c) 15.247(b)(1)
Measurement standard	ANSI C63.10:2003
EUT sample number	S05
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C

Channel Frequency (MHz)	Peak Carrier Power (mW)	Limit (W)	Result
2402 MHz	1.183	1	Pass
2441 MHz	1.364	1	Pass
2480 MHz	1.503	1	Pass

Notes:

- 1 Number of hopping channels employed is 79
- 2 Measured Peak Carrier power does not include gain of any antenna to be used.
- 3 Highest Gain of any antenna to be used = 1.87dBi
- 4 Conducted measurements were performed with a temporary antenna connector provided by the client.

A2 Conducted Spurious Emissions

Measurement of conducted spurious emissions at the antenna port was performed using a peak detector with the RBW set to 100 kHz 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	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.10:2003
Frequency range	9 kHz to 25 GHz
EUT sample number	S05
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C

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

2402 MHz						
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
1	No Significant Emissions Within 20 dB of limit					

2441 MHz						
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
1	No Significant Emissions Within 20 dB of limit					

2480 MHz						
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
1	No Significant Emissions Within 20 dB of limit					

Notes:

1. The conducted emission limit for emissions outside the restricted bands, defined in 47CFR 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
4. Conducted spurious emissions plots for the worst case channel are included in Appendix B of this report
5. The carrier level was measured whilst varying the supply voltage between 85% and 105% of the nominal supply voltage as required by 15.31(e). No variation in carrier level was observed. All other emissions were at least 20dB below the test limit

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

The limit in 100 kHz RBW = (Maximum Peak Conducted Carrier)-20dB

A3 Radiated Emissions

Preliminary scans were 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.

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

3m 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: 2402 MHz	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.10:2003
Frequency range	30MHz to 25 GHz
EUT sample number	S10
Modification state	0
SE in test environment	None
SE isolated from EUT	None
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:

Frequency (MHz)	Detector	Measured Level (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Gain (dB)	Field Strength (dBµV/m)	Extrap (dB)	Field Strength (µV/m)	Limit (µV/m)
4804	Peak	50.44	3.6	32.6	35.7	50.94	-	352.37	5000
4804	Average	41.56	3.6	32.6	35.7	42.06	-	126.77	500

Radiated Emissions

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

Test Details: 2441 MHz	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.10:2003
Frequency range	30MHz to 25 GHz
EUT sample number	S10
Modification state	0
SE in test environment	None
SE isolated from EUT	None
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:

Frequency (MHz)	Detector	Measured Level (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Gain (dB)	Field Strength (dBμV/m)	Extrap (dB)	Field Strength (μV/m)	Limit (μV/m)
4882	Peak	50.76	3.8	32.9	35.7	51.76	-	387.26	5000
4882	Average	42.40	3.8	32.9	35.7	43.40	-	147.91	500
7323	Peak	49.69	4.2	36.3	36.2	53.99	-	500.61	5000
7323	Average	40.47	4.2	36.3	36.2	44.77	-	173.18	500

Radiated Emissions

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

Test Details: 2480 MHz	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.10:2003
Frequency range	30MHz to 25 GHz
EUT sample number	S10
Modification state	0
SE in test environment	None
SE isolated from EUT	None
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:

Frequency (MHz)	Detector	Measured Level (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamplifier Gain (dB)	Field Strength (dBμV/m)	Extrap (dB)	Field Strength (μV/m)	Limit (μV/m)
4960	Peak	50.29	3.6	33.1	35.7	51.29	-	366.86	5000
4960	Average	42.16	3.6	33.1	35.7	43.16	-	143.88	500
7440	Peak	50.00	4.3	36.4	36.3	54.40	-	524.81	5000
7440	Average	40.05	4.3	36.4	36.3	44.45	-	166.92	500

Notes:

- 1 Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.10: section 4.5, Table 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 Measurements at 2400 & 2483.5 MHz were made to ensure band edge compliance.
- 4 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.
- 5 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	RBW=VBW= 1MHz
Average	RBW=VBW= 1MHz

These settings as per ANSI C63.10 and DA 00-705.

- 6 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 47 CFR Part 15 Clause 15.33(a) and 15.33(a)(1).

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

Frequency of emission (MHz)	Field strength (μV/m)	Measurement Distance (m)	Field strength (dBμV/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 20dB Bandwidth and Channel Separation

Title 47 of the CFR: 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 separation, which shall be a minimum of 25 kHz or $2/3^{\text{rd}}$ of the 20dB bandwidth, whichever is greater. The formal measurements are detailed below:

Test Details	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) 15.247(a)(1)(i)
EUT sample number	S05
Modification state	0
SE in test environment	None
SE isolated from EUT	S
EUT set up	Refer to Appendix C

Channel Frequency (MHz)	Measured 20dB Bandwidth (kHz)	Limit	Result
2402 MHz	1137.82	>500kHz	Pass
2441 MHz	1137.82	>500kHz	Pass
2480 MHz	1137.82	>500kHz	Pass

Measured Channel Separation (kHz)	Limit	Result
1003.205	$\geq 2/3^{\text{rd}}$ of Measured 20dB Bandwidth	Pass

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

A5 Hopping frequencies

Hopping frequencies were verified using a spectrum analyser, while the EUT was operating in its normal frequency hopping mode.

Test Details	
Regulation	Title 47 of the CFR : Part 15 Subpart (c) 15.247(a)(1)(i)
EUT sample number	S05
Modification state	0
SE in test environment	None
SE isolated from EUT	S07
EUT set up	Refer to Appendix C

No. of Hopping Channels	Requirement	Result
79	15	Pass

Plots showing the hopping channels are contained in Appendix B

A6 Channel Occupancy

Channel occupancy time was verified using a spectrum analyser in zero span mode, centred on the middle hopping channel frequency (2442MHz), 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	Title 47 of the CFR: Part15 Subpart (c) 15.247(a)(1)
EUT sample number	S05
Modification state	0
SE in test environment	None
SE isolated from EUT	S07
EUT set up	Refer to Appendix C

T _{occ} (ms)	MP (s)	MPTX	AOT (s)	Limit (s)	Result
2.948	31.6	106	0.3125	0.4	Pass

Plots showing the channel occupancy time and time between successive transmissions are contained in Appendix B of this test report. These are identical for all modulation modes.

Average Channel Retention Time Calculation:

No. Of utilised hopping channels (N) = 79

Measured channel occupancy time (T_{occ}) = 2.948ms

Specified averaging period =

$$0.4 * N = SAP(seconds) \quad \therefore 0.4 \times 79 = 31.6(Seconds)$$

 $\therefore$ The Average Retention Time =

Total activation time T_{occ} x No. of transmission cycles in specified averaging period

Average Channel Occupancy Time ms x = 0.3125 seconds

A7 Antenna Gain

The maximum antenna gain for the antenna types to be used with the EUT, as declared by the client, is 1.87 dBi

A8 Unintentional Radiated Emissions

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The maximum permitted field strength is listed in Section 15.109. The EUT was set to receive whilst hopping on all channels.

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

3m open area test site :

☐

3m alternative test site :

☒

Test Details	
Regulation	Title 47 of the CFR: Part 15 Subpart (b) Clause 15.109
Measurement standard	ANSI C63.10:2003
Frequency range	30MHz to 25 GHz
EUT sample number	S010
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix F)	Photograph 1 and 2

The worst case unintentional radiated emission measurements that fall within the restricted bands are listed below:

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)
No emissions were detected within 20dB of the limit									

A9 Unintentional Radiated Emissions

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The maximum permitted field strength is listed in Section 15.109. The EUT was set to receive whilst hopping on all channels.

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

3m open area test site :

☐

3m alternative test site :

☒

Test Details	
Regulation	Title 47 of the CFR: Part 15 Subpart (b) Clause 15.109
Measurement standard	ANSI C63.10:2003
Frequency range	30MHz to 25 GHz
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix F)	Photograph 3 and 4

The worst case unintentional radiated emission measurements that fall within the restricted bands are listed below:

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)
No emissions were detected within 20dB of the limit									

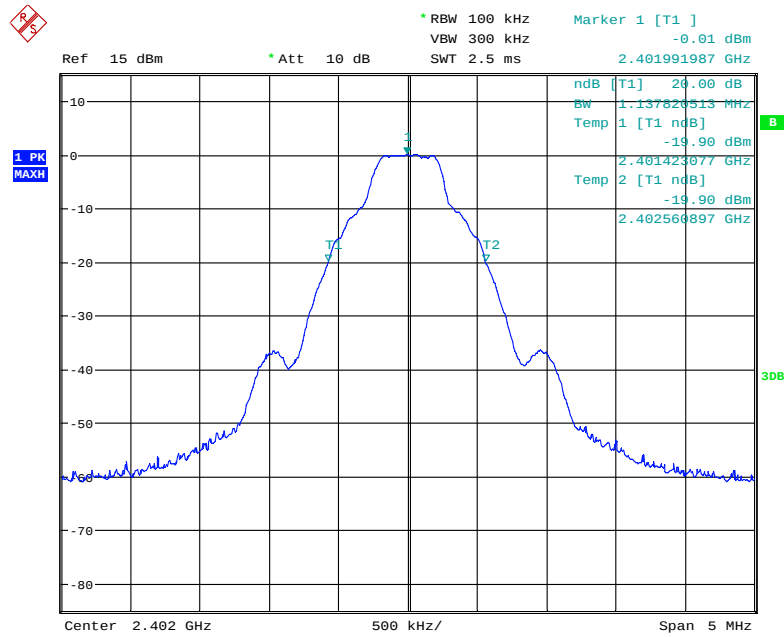
Appendix B:**Supporting Graphical Data**

This appendix contains graphical data obtained during testing.

Notes:

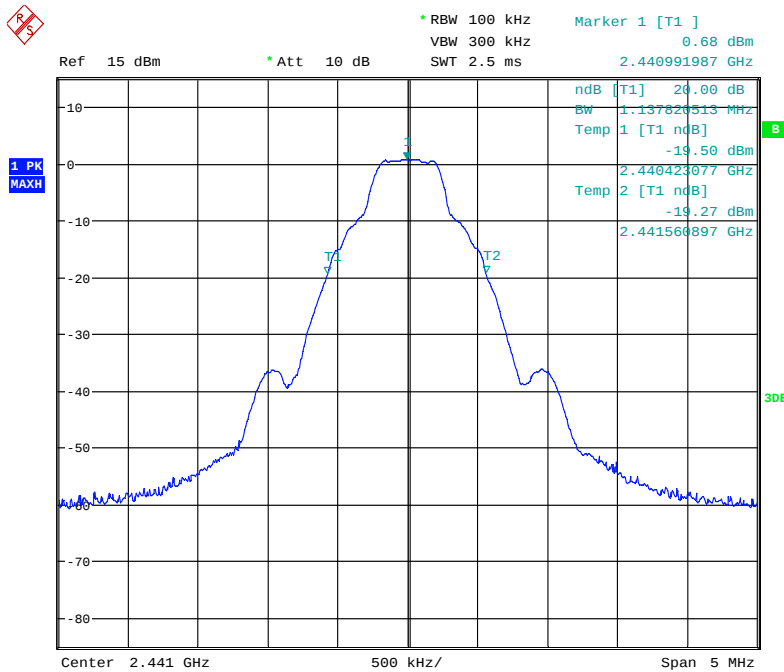
- (a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A and Appendix B.
- (b) The time and date on the plots do not necessarily equate to the time of the test.
- (c) Where relevant, on power line conducted emission plots, the limit displayed is the average limit, which is stricter than the quasi peak limit.
- (d) Appendix C details the numbering system used to identify the sample and its modification state.
- (e) The plots presented in this appendix may not be a complete record of the measurements performed, but are a representative sample, relative to the final assessment.

20dB Bandwidth – 2402MHz Channel



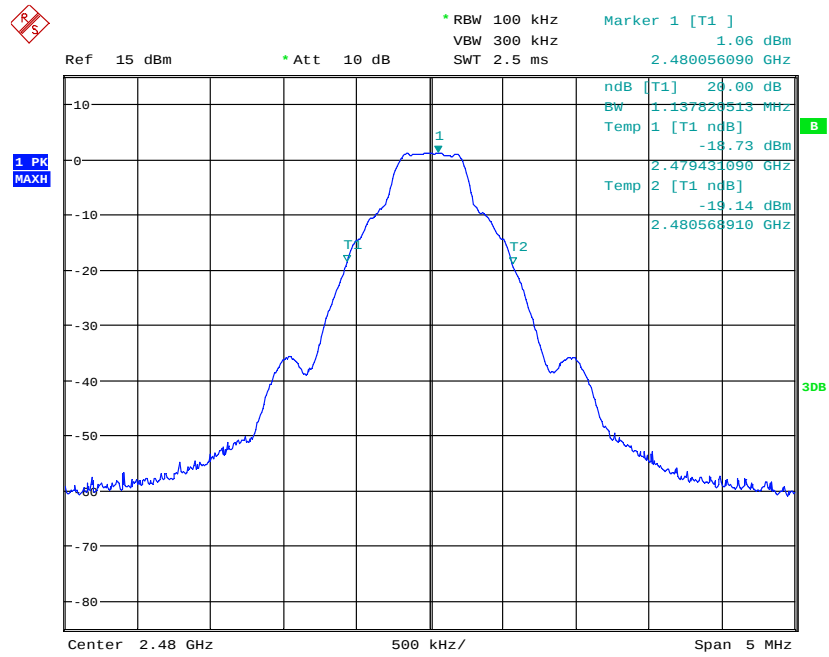
Date: 30.AUG.2012 15:44:05

20dB Bandwidth – 2441MHz Channel



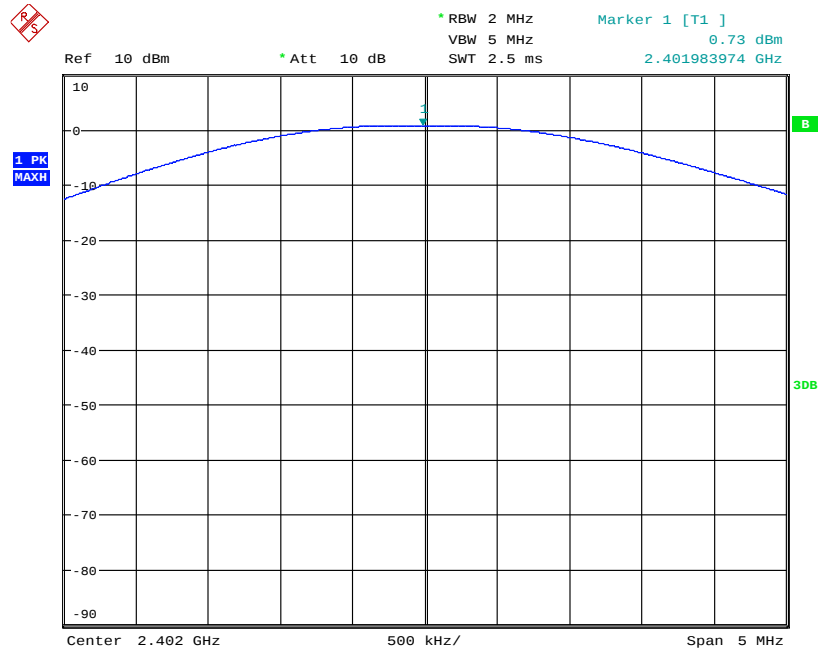
Date: 30.AUG.2012 15:48:52

20dB Bandwidth – 2480MHz Channel



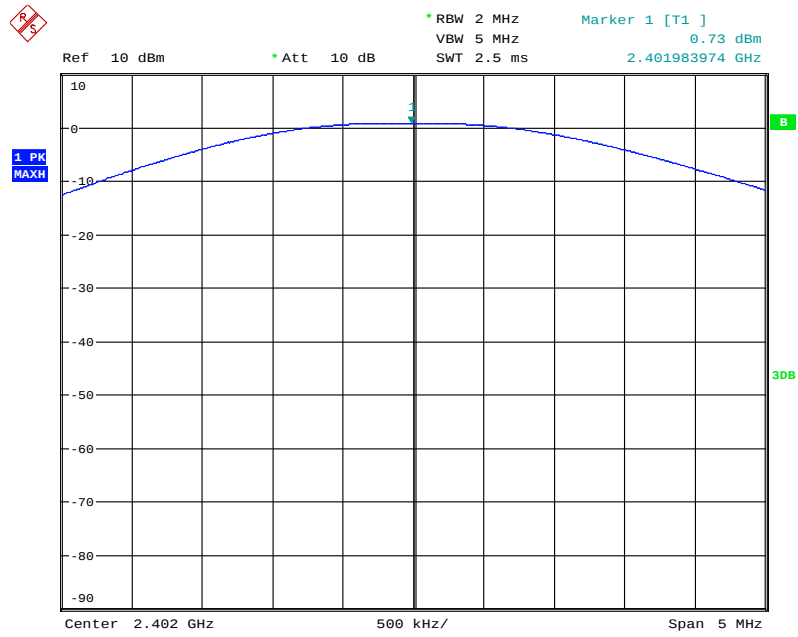
Date: 30.AUG.2012 15:46:25

Carrier Power – 2402MHz Channel



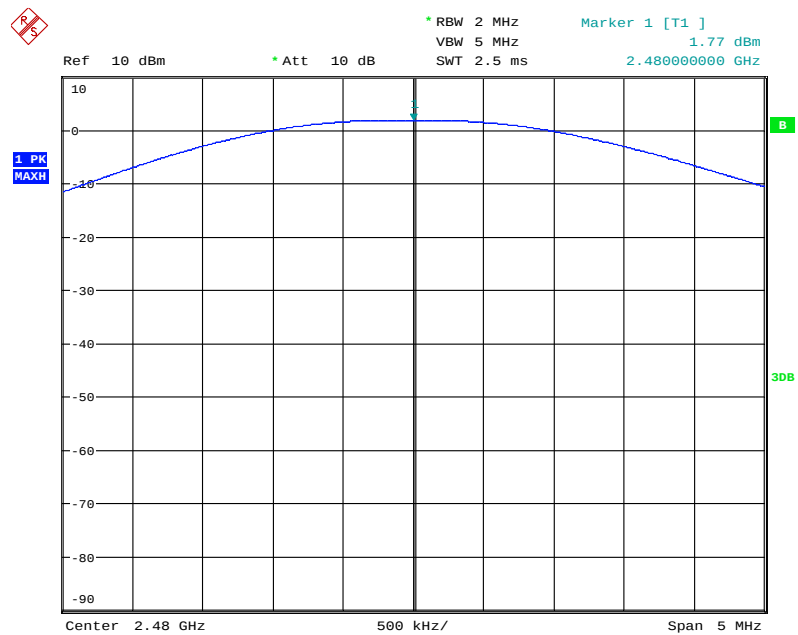
Date: 30.AUG.2012 16:31:28

Carrier Power – 2441MHz Channel



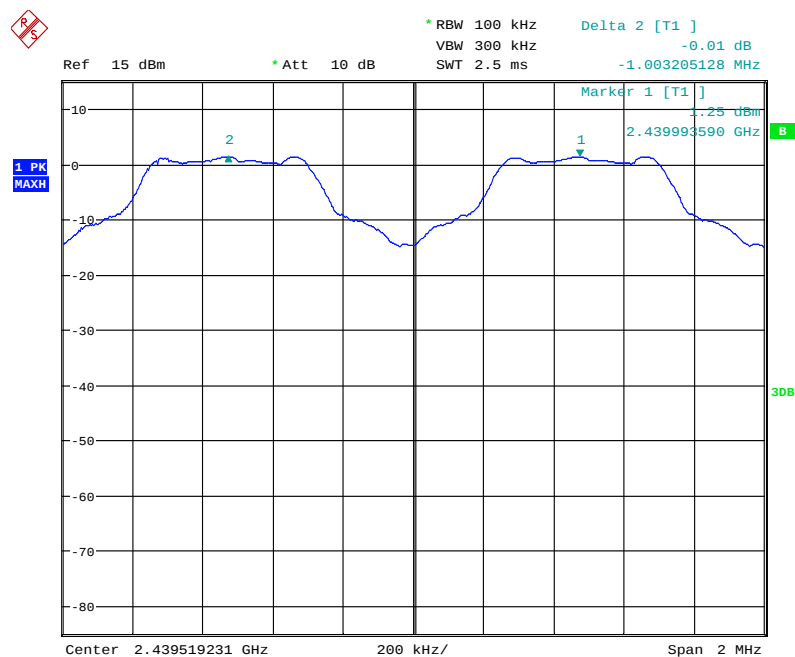
Date: 30.AUG.2012 16:31:28

Carrier Power – 2480MHz Channel



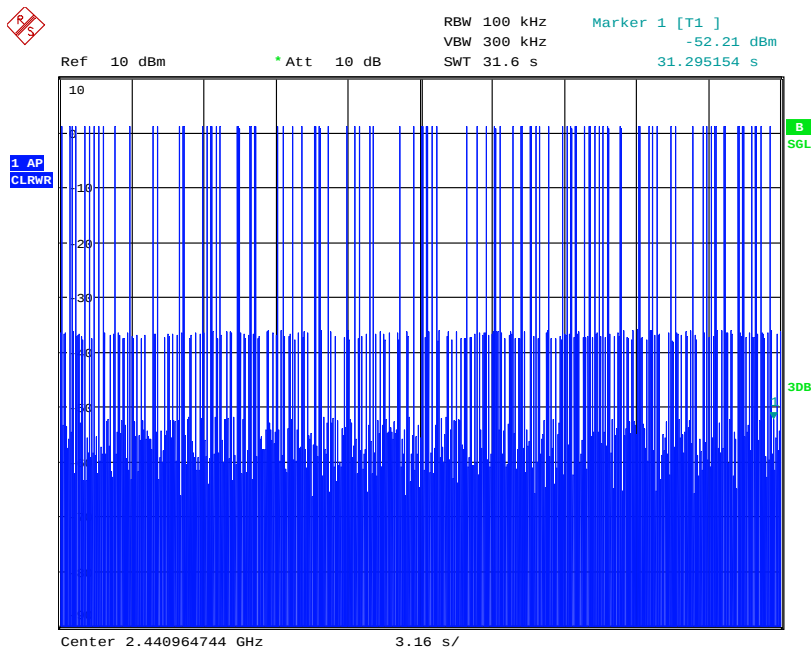
Date: 30.AUG.2012 16:30:56

Channel Separation



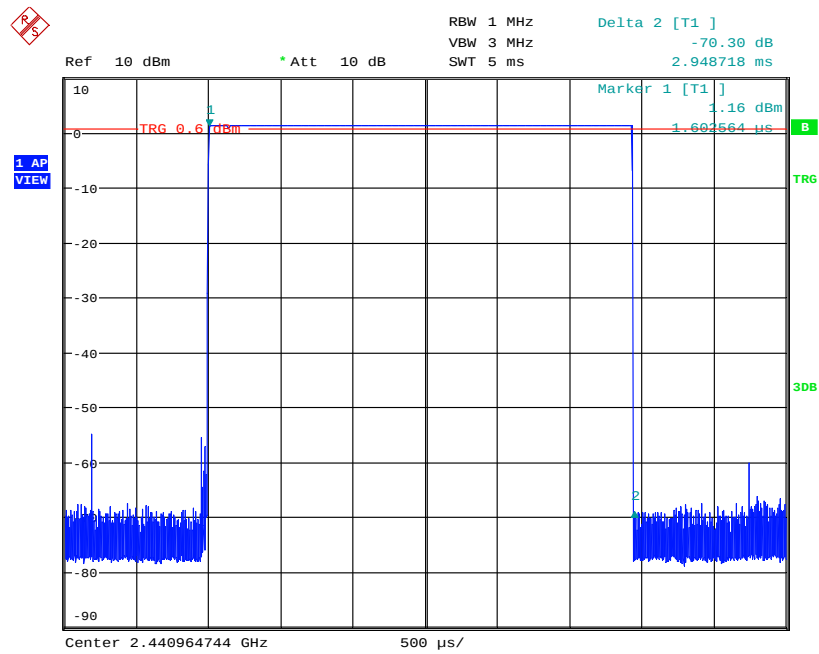
Date: 30.AUG.2012 15:39:24

Channel Repetitions



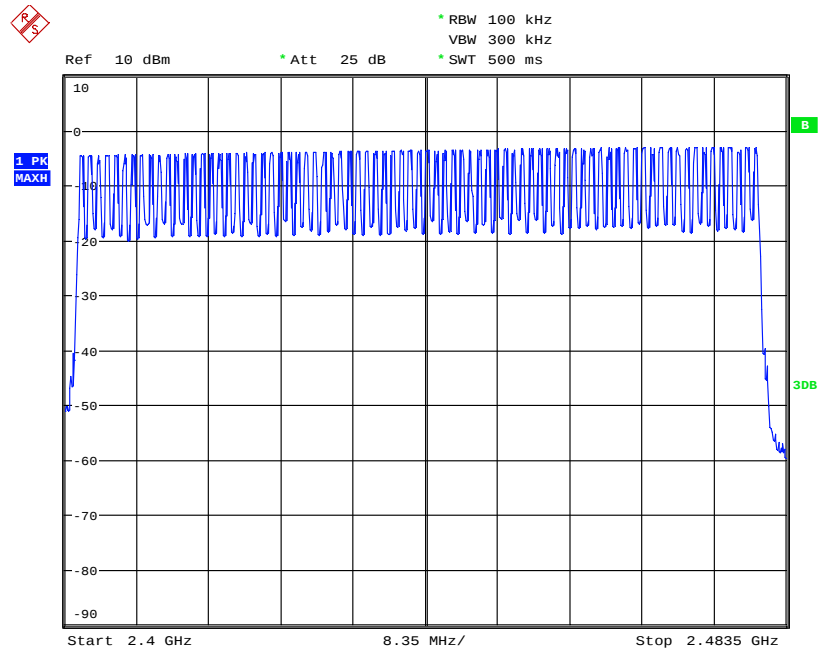
Date: 30.AUG.2012 15:58:31

Channel Dwell Time



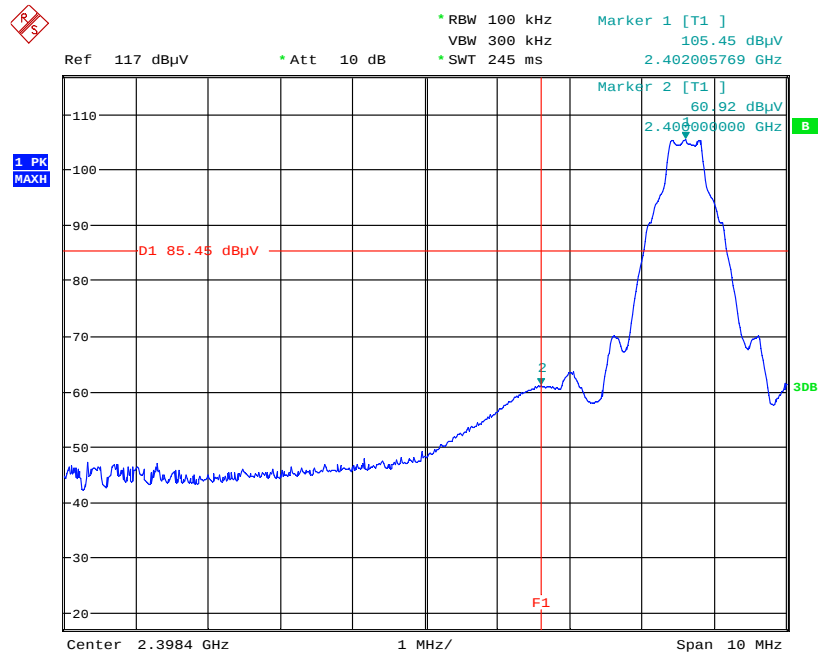
Date: 30.AUG.2012 15:54:58

Total Number of Hopping Channels



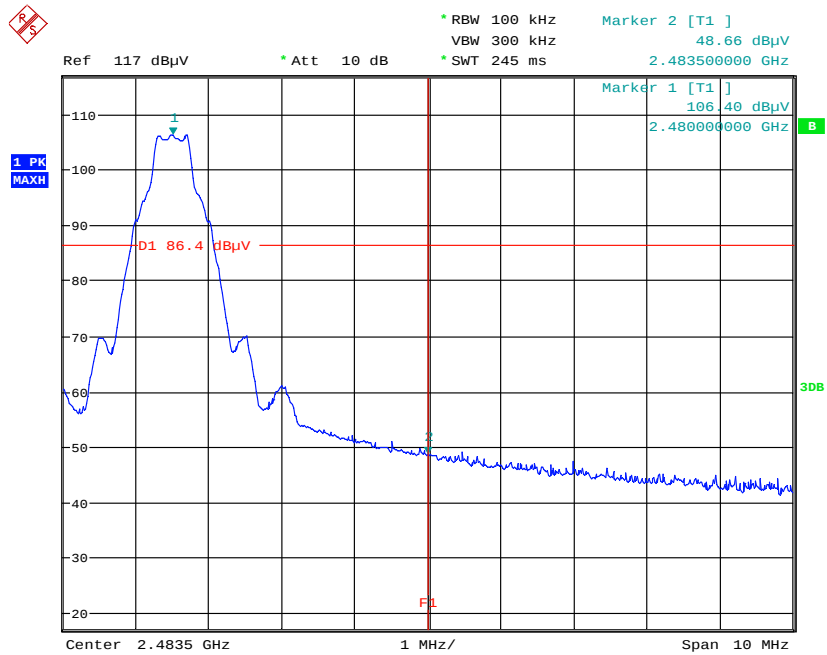
Date: 31.AUG.2012 12:11:37

Conducted Lower Band-edge Compliance



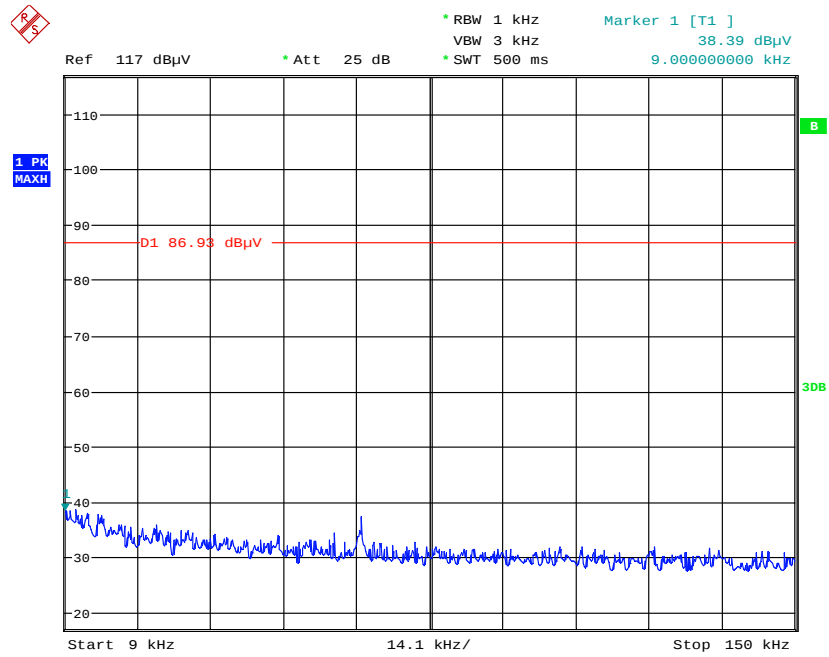
Date: 5.SEP.2012 14:40:54

Conducted Upper Band-edge Compliance



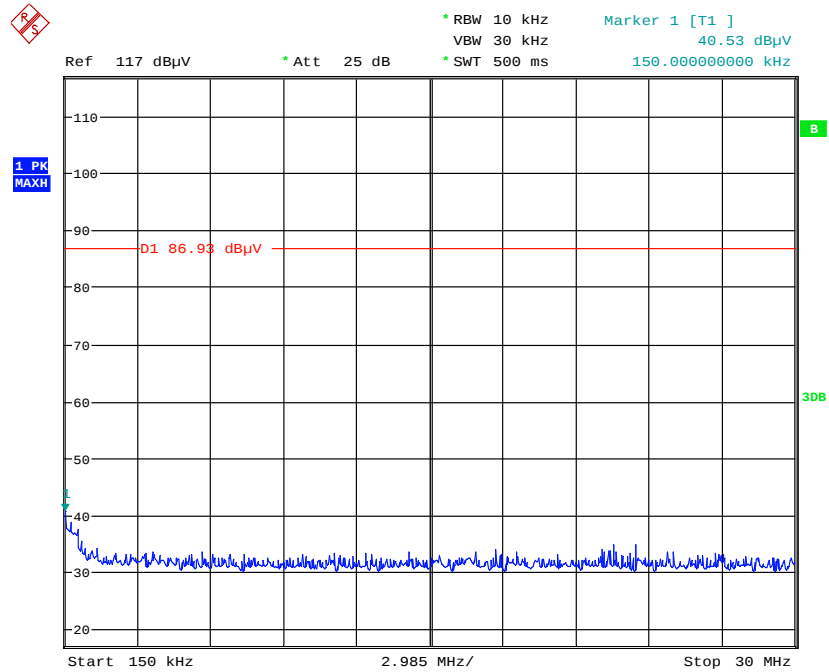
Date: 5.SEP.2012 14:43:09

Conducted Spurious Emissions 9kHz to 150kHz Bottom channel



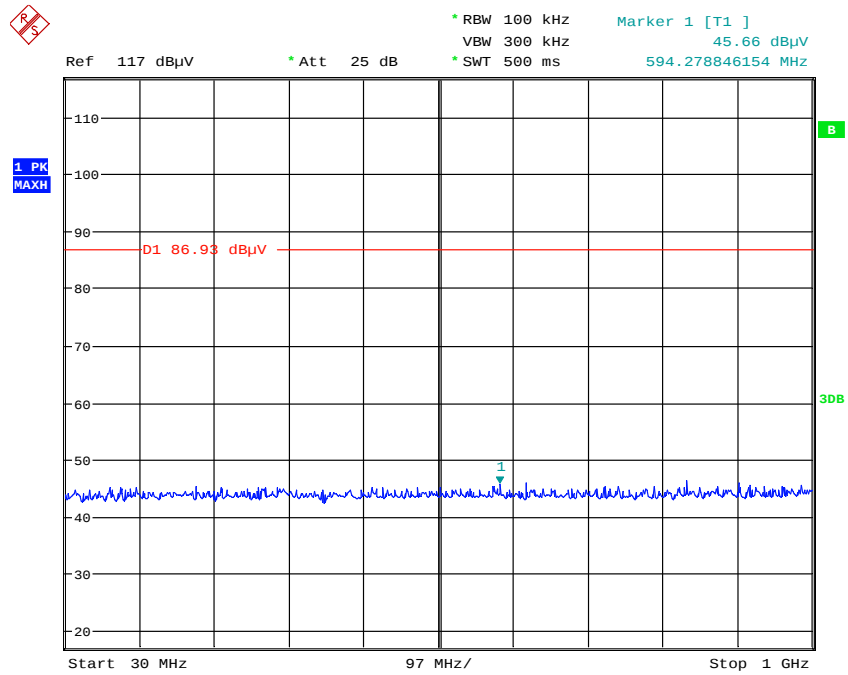
Date: 31.AUG.2012 10:35:26

Conducted Spurious Emissions 150kHz to 30MHz



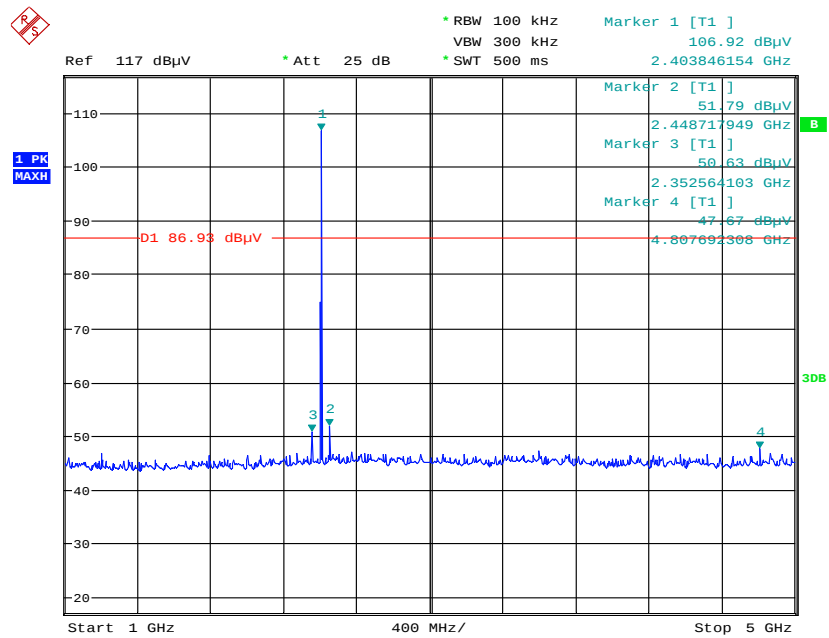
Date: 31.AUG.2012 10:36:06

Conducted Spurious Emissions 30MHz to 1GHz



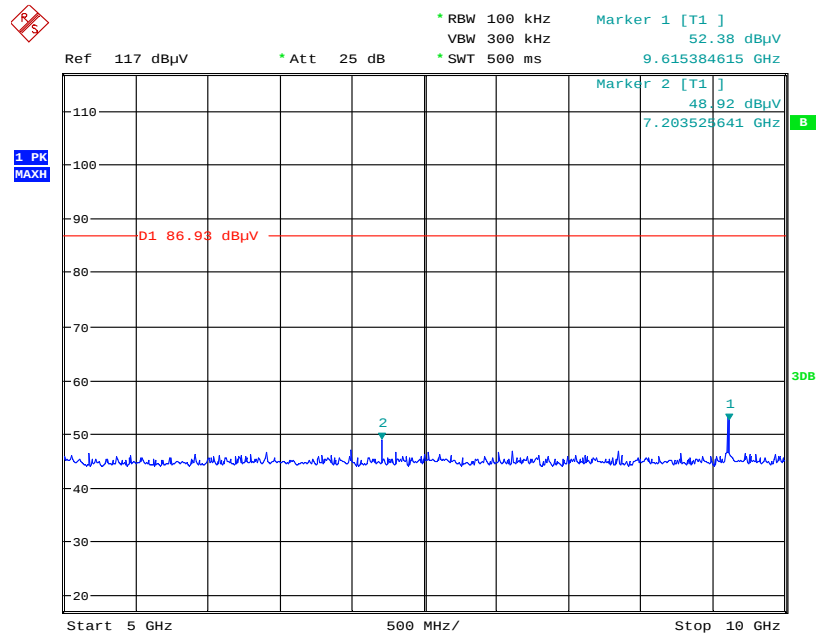
Date: 31.AUG.2012 10:36:40

Conducted Spurious Emissions 1GHz to 5GHz



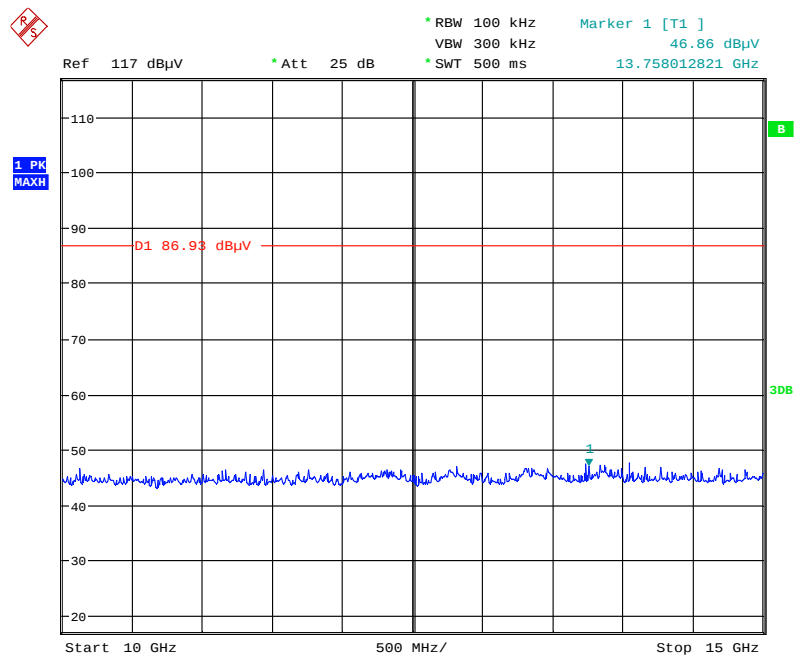
Date: 31.AUG.2012 10:52:42

Conducted Spurious Emissions 5GHz to 10GHz



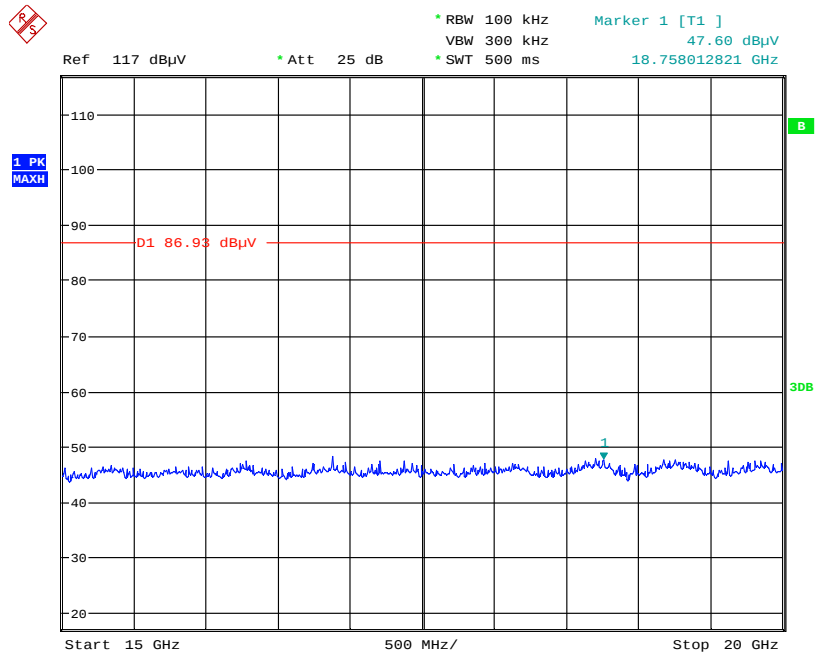
Date: 31.AUG.2012 10:38:54

Conducted Spurious Emissions 10GHz to 15GHz



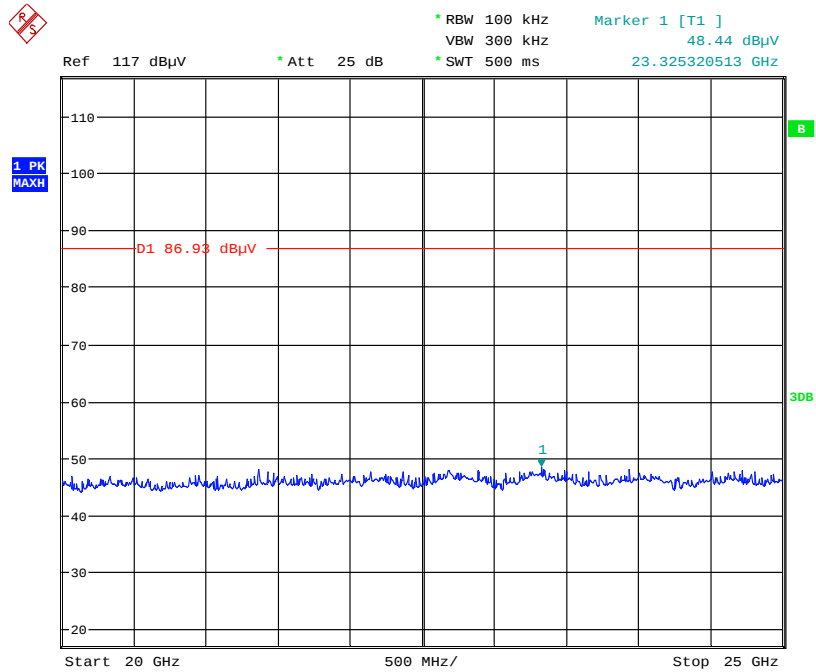
Date: 31.AUG.2012 10:39:23

Conducted Spurious Emissions 15GHz to 20GHz



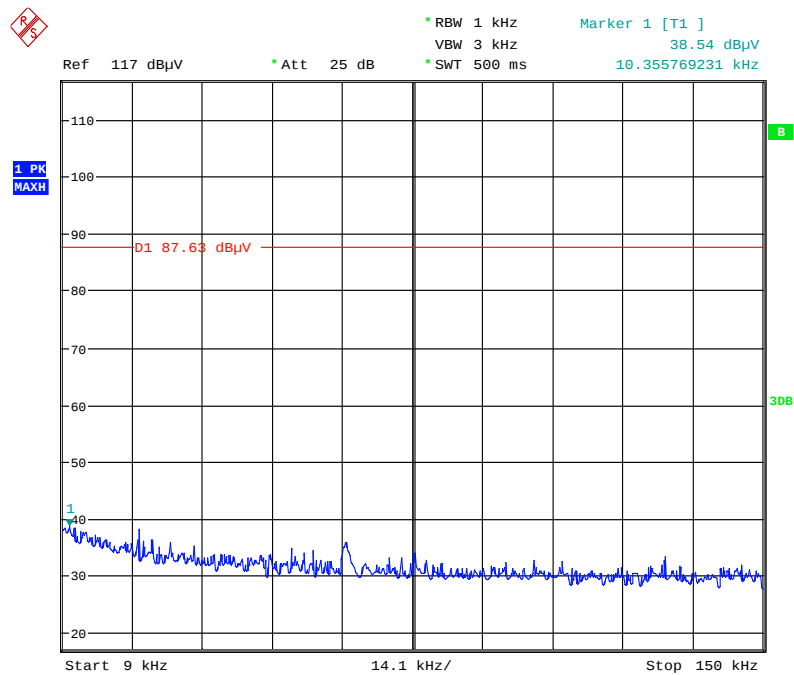
Date: 31.AUG.2012 10:40:10

Conducted Spurious Emissions 20GHz to 25GHz



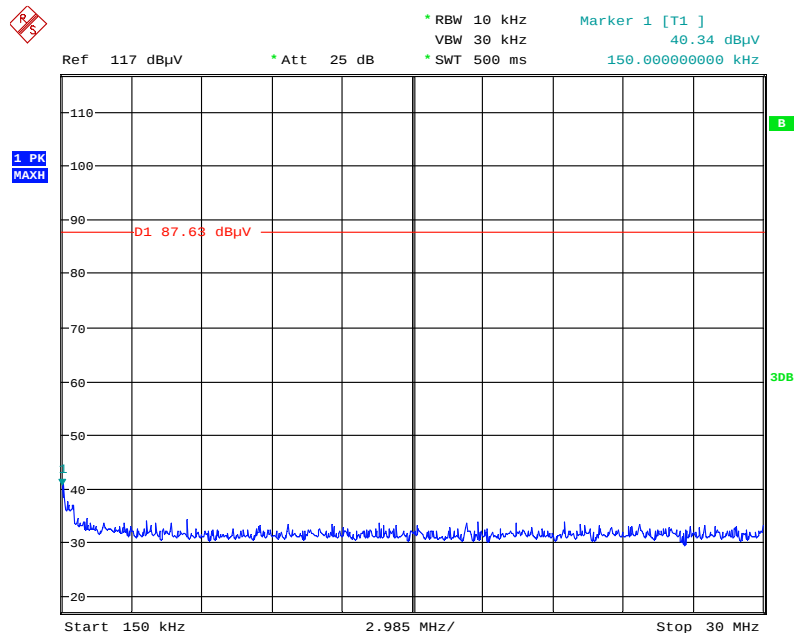
Date: 31.AUG.2012 10:40:41

Conducted Spurious Emissions 9kHz to 150kHz Middle channel



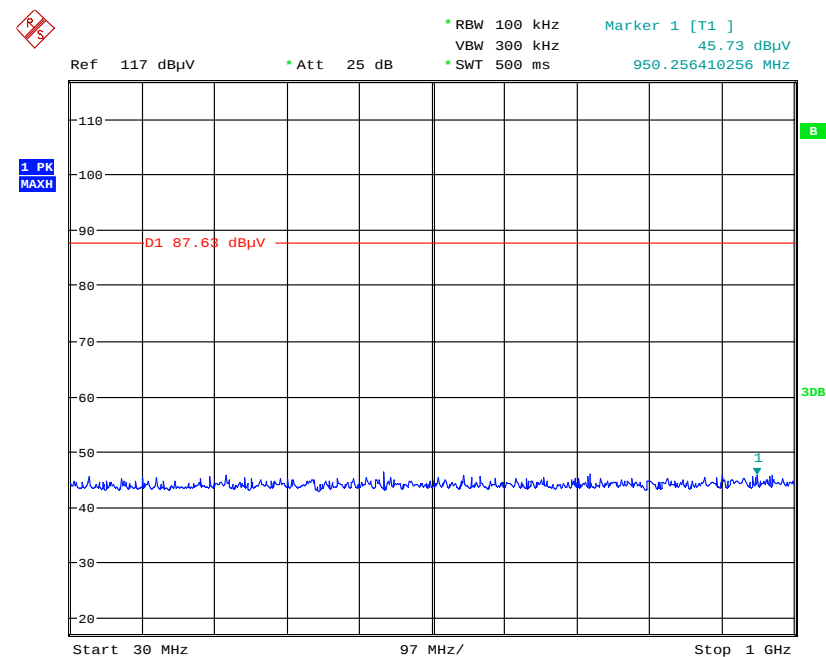
Date: 31.AUG.2012 10:43:42

Conducted Spurious Emissions 150kHz to 30MHz



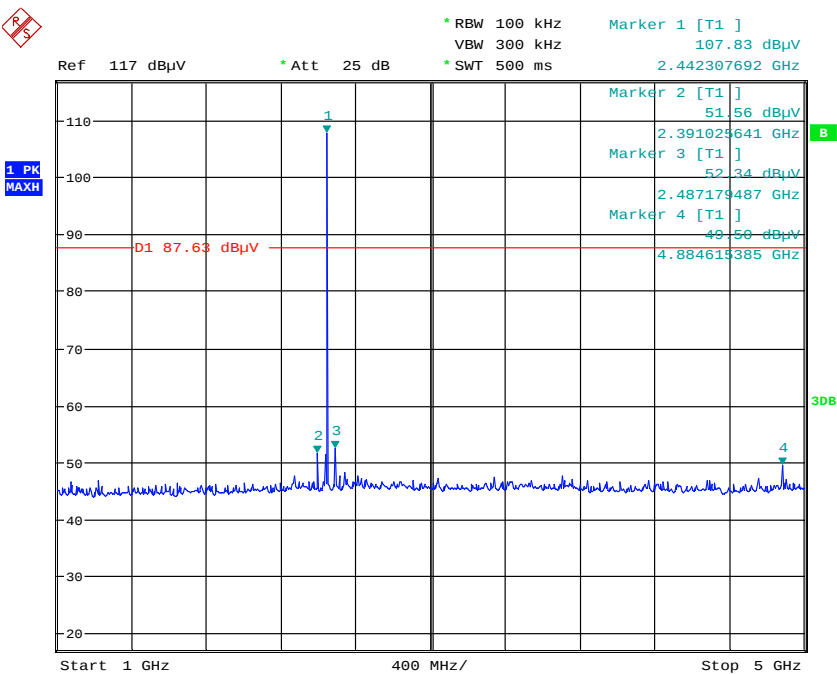
Date: 31.AUG.2012 10:44:21

Conducted Spurious Emissions 30MHz-1GHz



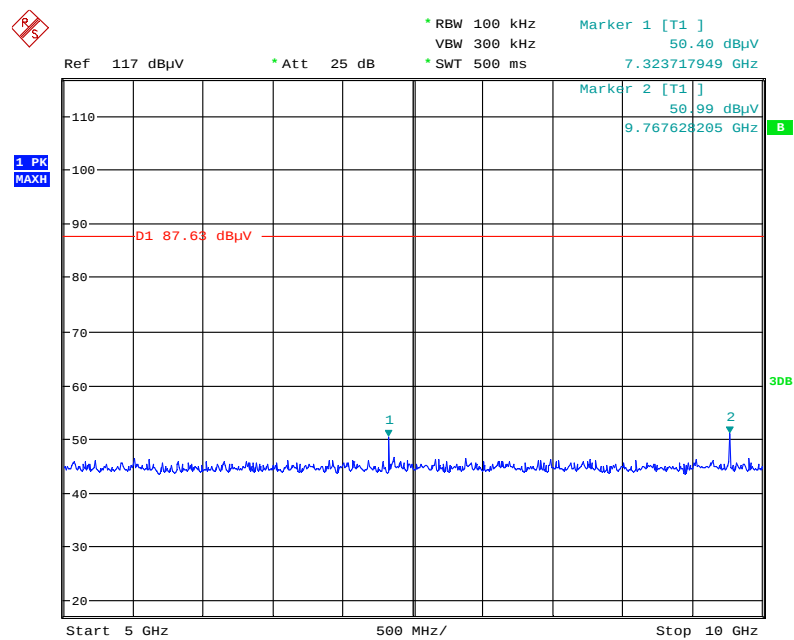
Date: 31.AUG.2012 10:44:58

Conducted Spurious Emissions 1GHz-5GHz



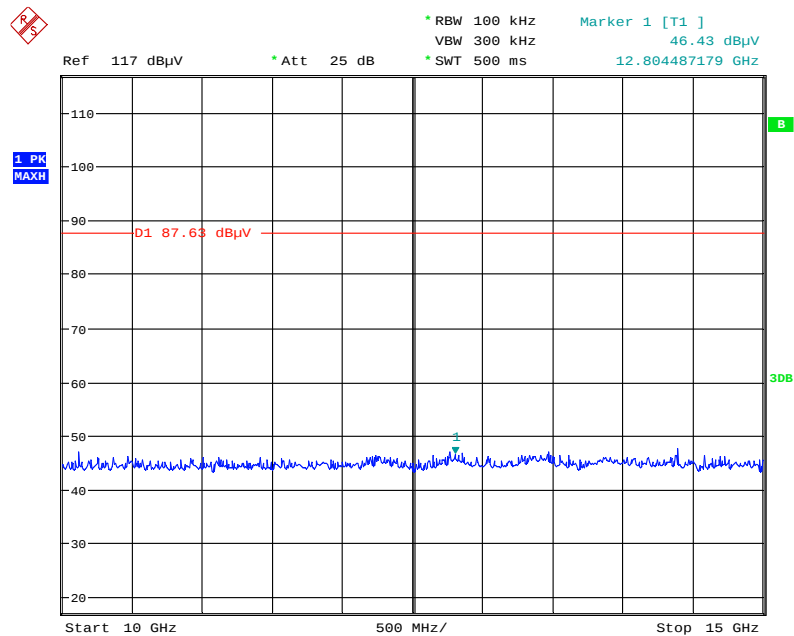
Date: 31.AUG.2012 10:48:10

Conducted Spurious Emissions 5GHz-10GHz



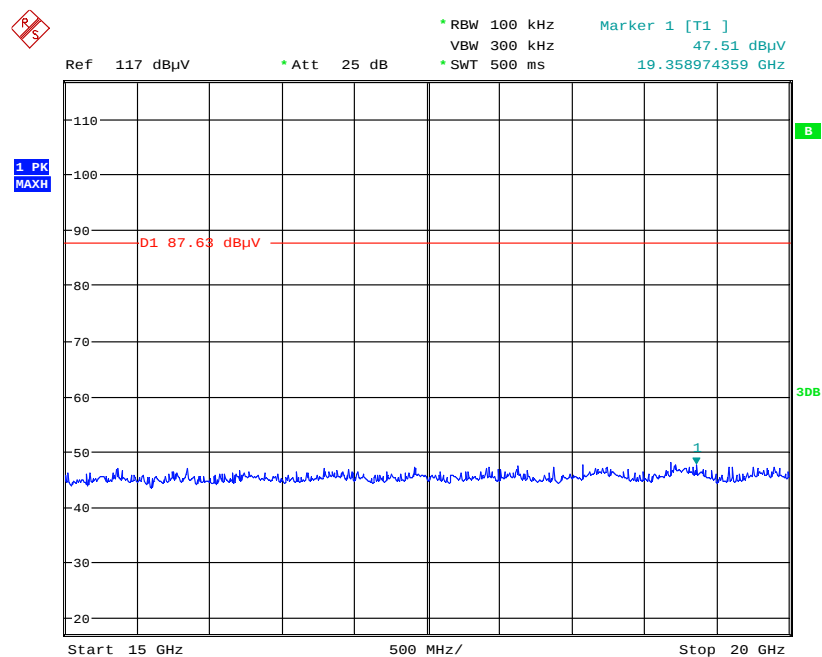
Date: 31.AUG.2012 10:48:59

Conducted Spurious Emissions 10GHz-15GHz



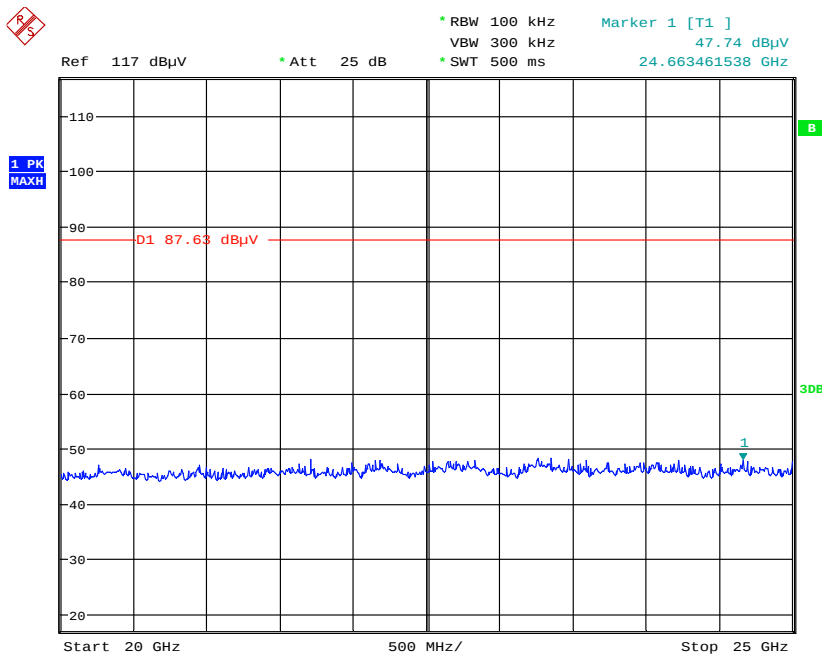
Date: 31.AUG.2012 10:49:33

Conducted Spurious Emissions 15GHz-20GHz



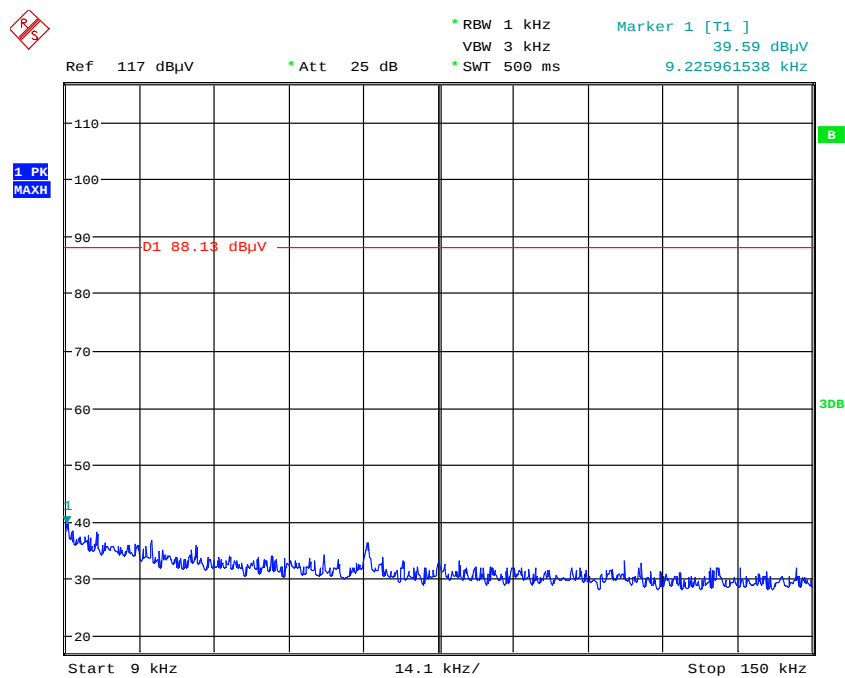
Date: 31.AUG.2012 10:50:09

Conducted Spurious Emissions 20GHz-25GHz



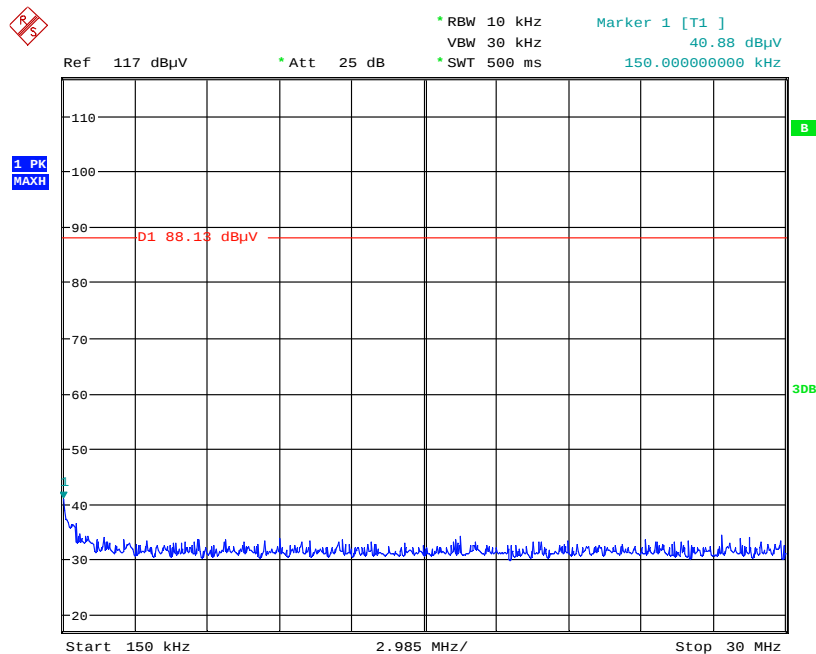
Date: 31.AUG.2012 10:50:45

Conducted Spurious Emissions 9kHz to 150kHz Top channel



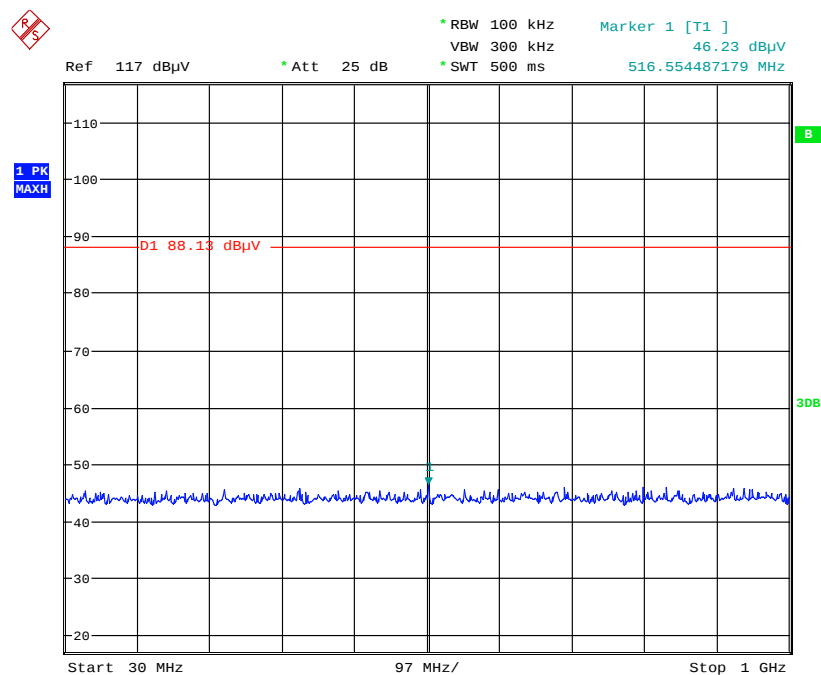
Date: 31.AUG.2012 10:55:36

Conducted Spurious Emissions 150kHz-30MHz



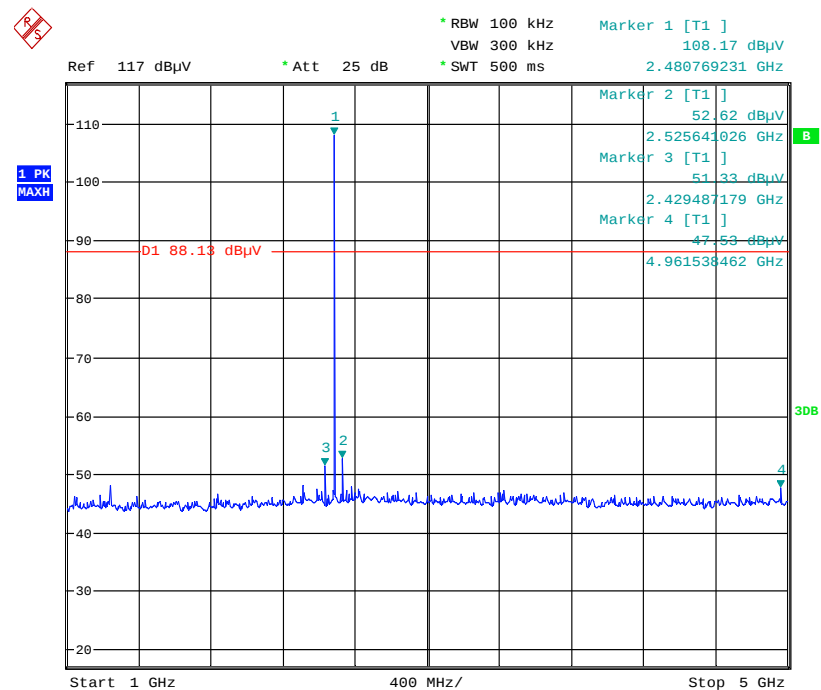
Date: 31.AUG.2012 10:56:17

Conducted Spurious Emissions 30MHz-1GHz



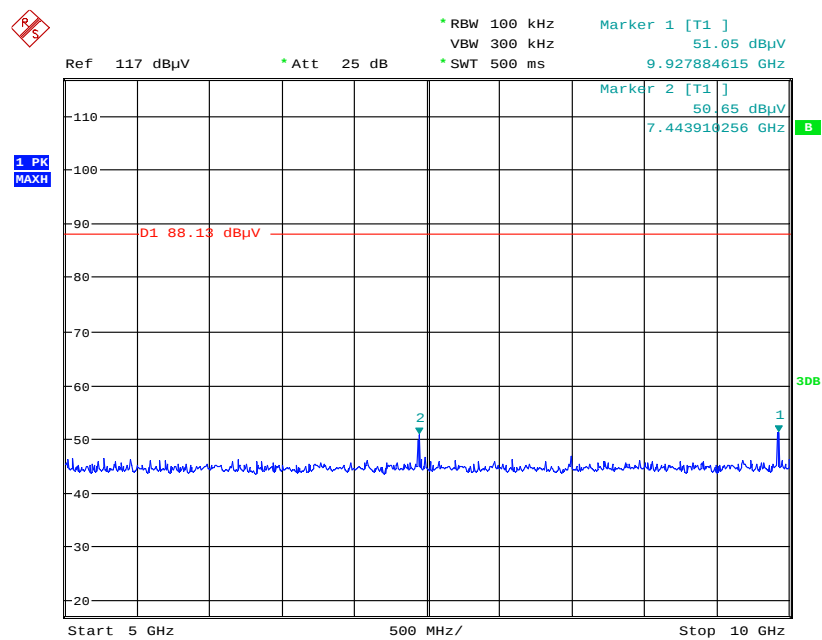
Date: 31.AUG.2012 10:56:54

Conducted Spurious Emissions 1GHz-5GHz



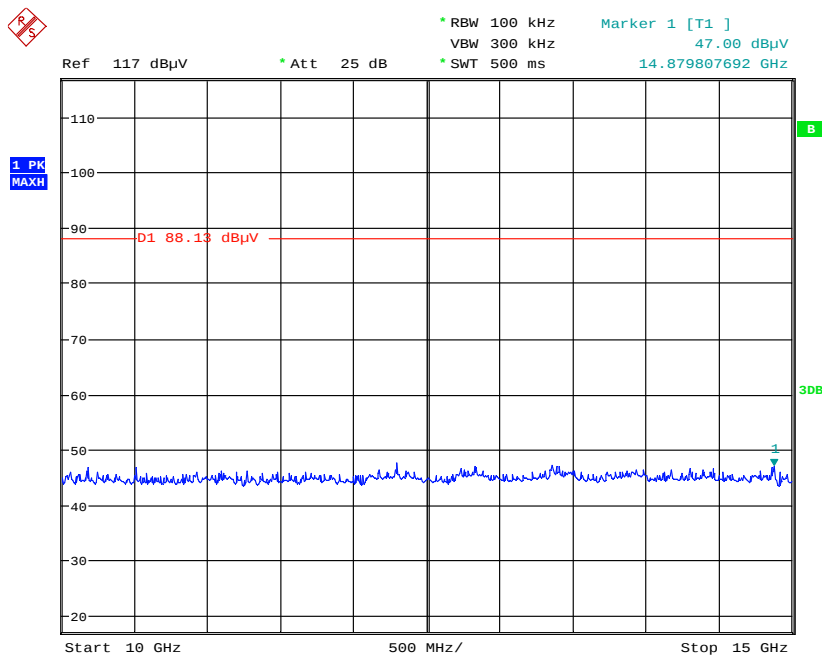
Date: 31.AUG.2012 10:54:43

Conducted Spurious Emissions 5GHz-10GHz



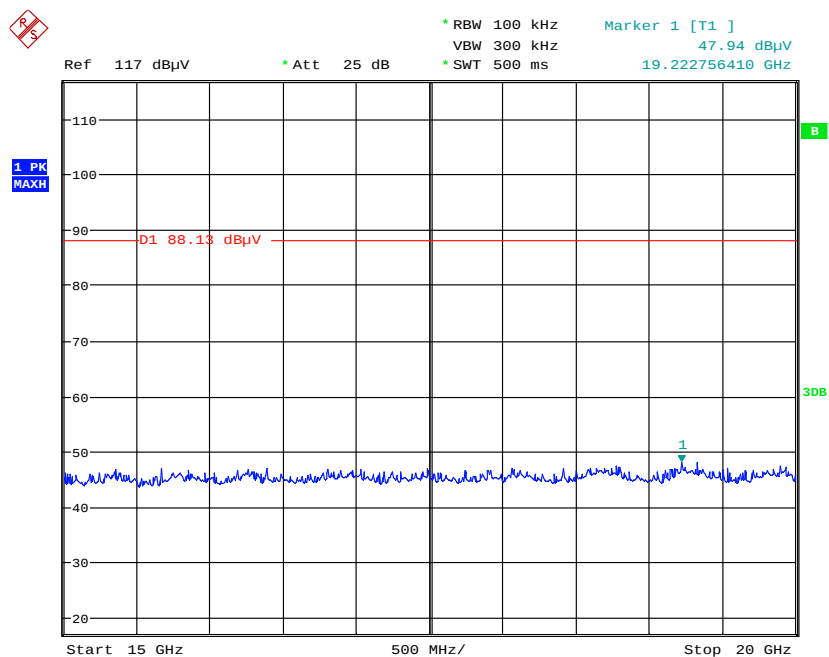
Date: 31.AUG.2012 10:57:37

Conducted Spurious Emissions 10GHz-15GHz



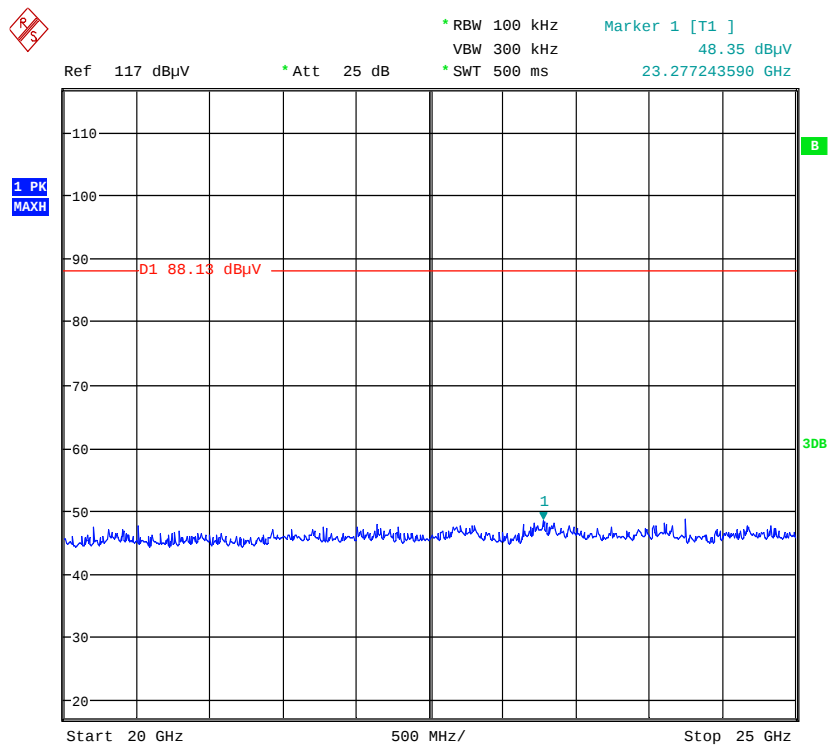
Date: 31.AUG.2012 10:58:14

Conducted Spurious Emissions 15GHz-20GHz



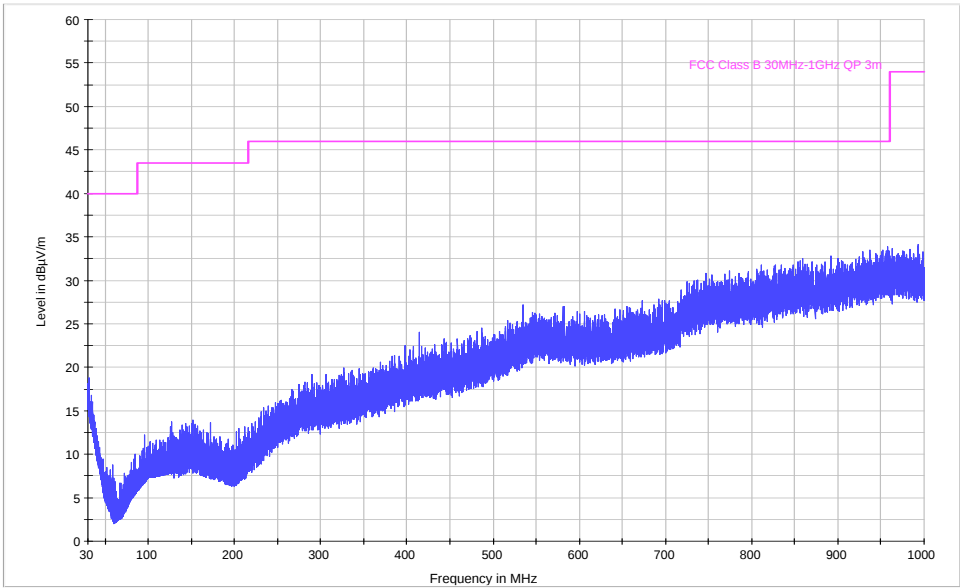
Date: 31.AUG.2012 10:58:46

Conducted Spurious Emissions 20GHz-25GHz

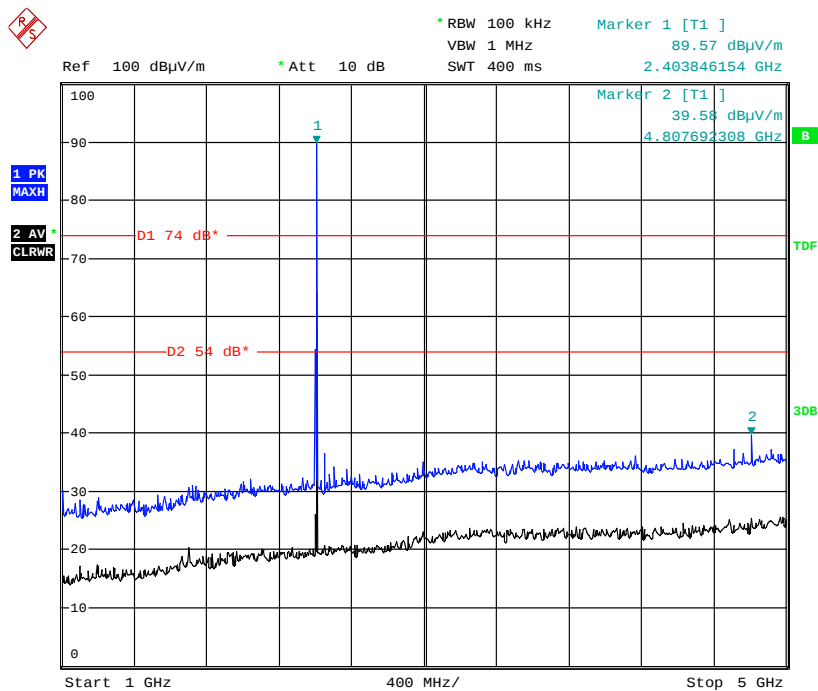


Date: 31.AUG.2012 10:59:18

Radiated Spurious Emissions 30MHz to 1GHz – 2402MHz

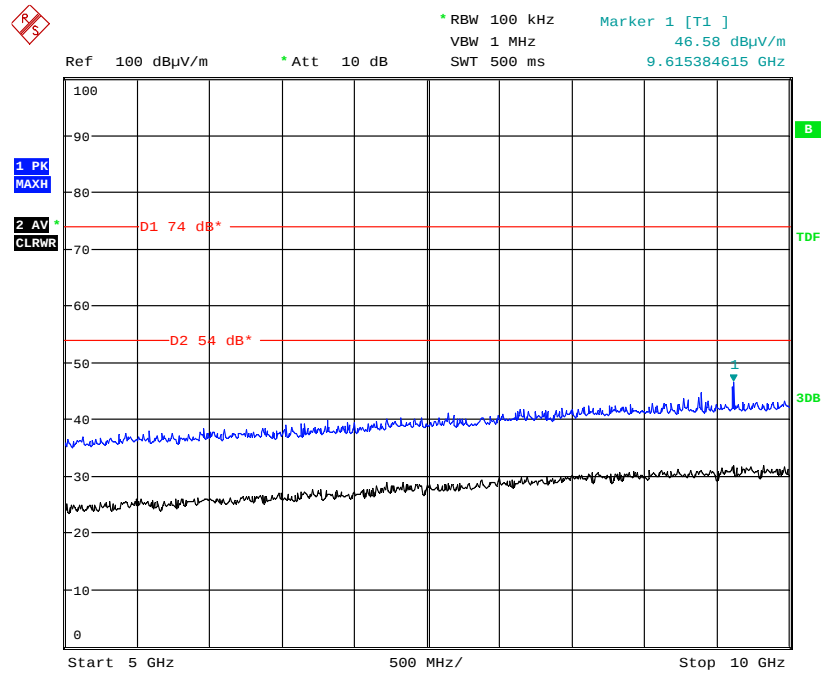


Radiated Spurious Emissions 1GHz to 5GHz – 2402MHz



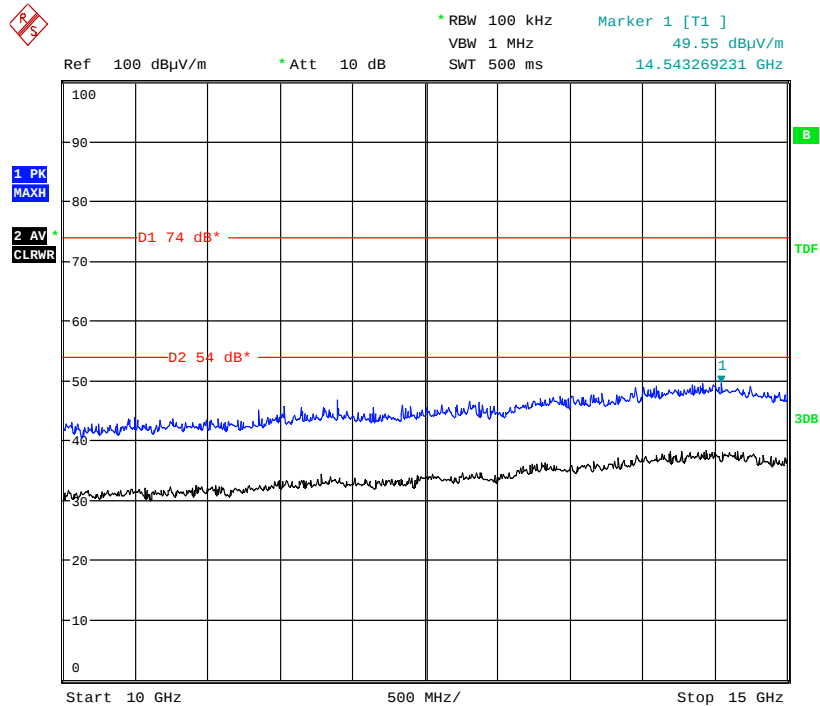
Date: 29.AUG.2012 16:35:23

Radiated Spurious Emissions 5GHz to 10GHz – 2402MHz



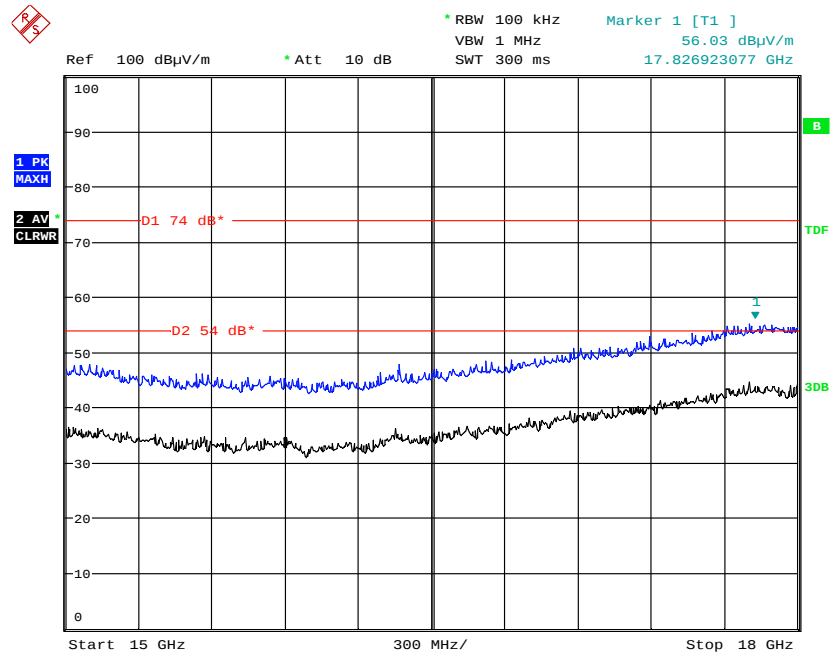
Date: 29.AUG.2012 16:36:54

Radiated Spurious Emissions 10GHz-15GHz– 2402MHz



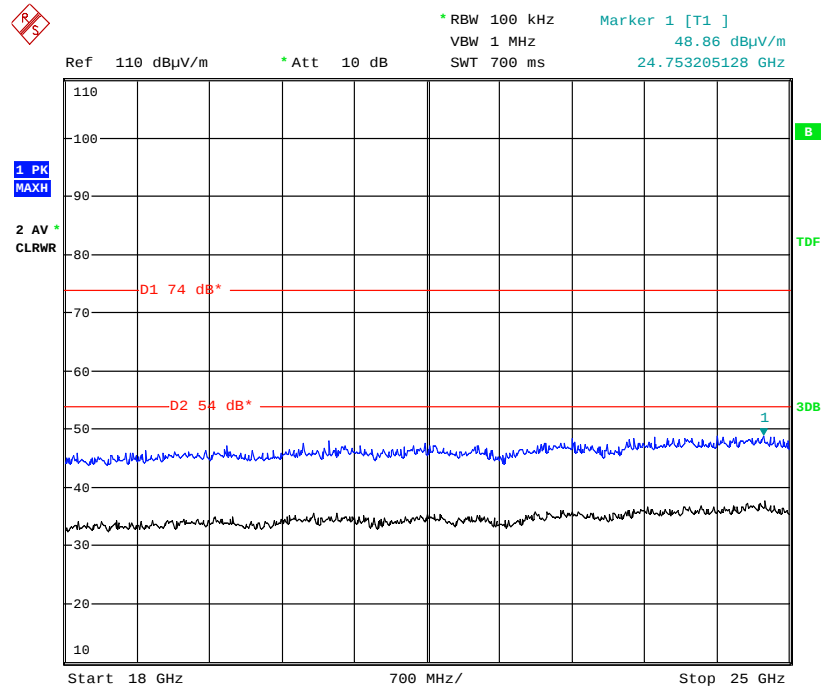
Date: 29.AUG.2012 16:37:30

Radiated Spurious Emissions 15GHz-18GHz – 2402MHz



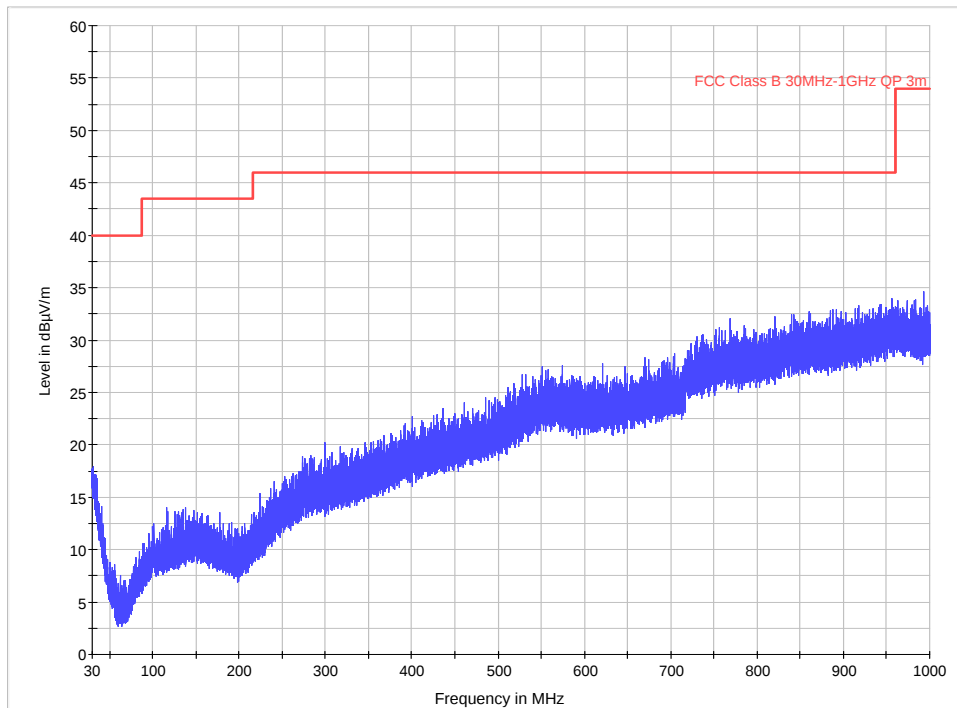
Date: 29.AUG.2012 16:38:27

Radiated Spurious Emissions 18GHz -25GHz– 2402MHz

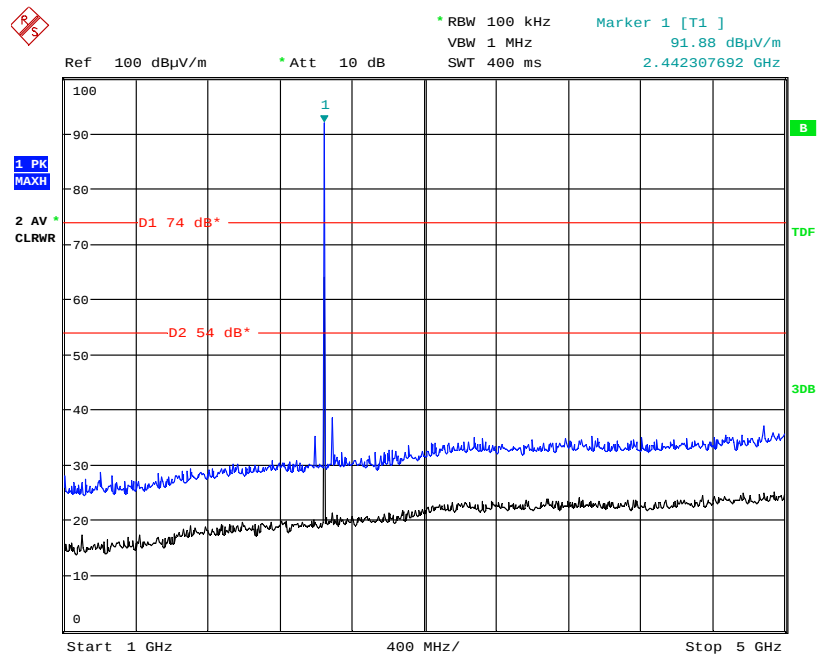


Date: 30.AUG.2012 15:55:02

Radiated Spurious Emissions 30MHz to 1GHz – 2441MHz

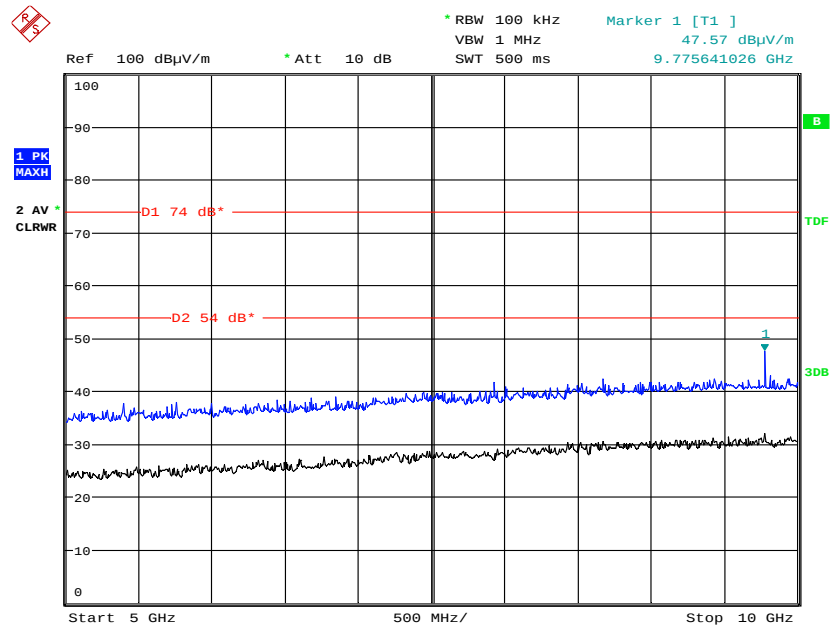


Radiated Spurious Emissions 1GHz to 5GHz – 2441MHz



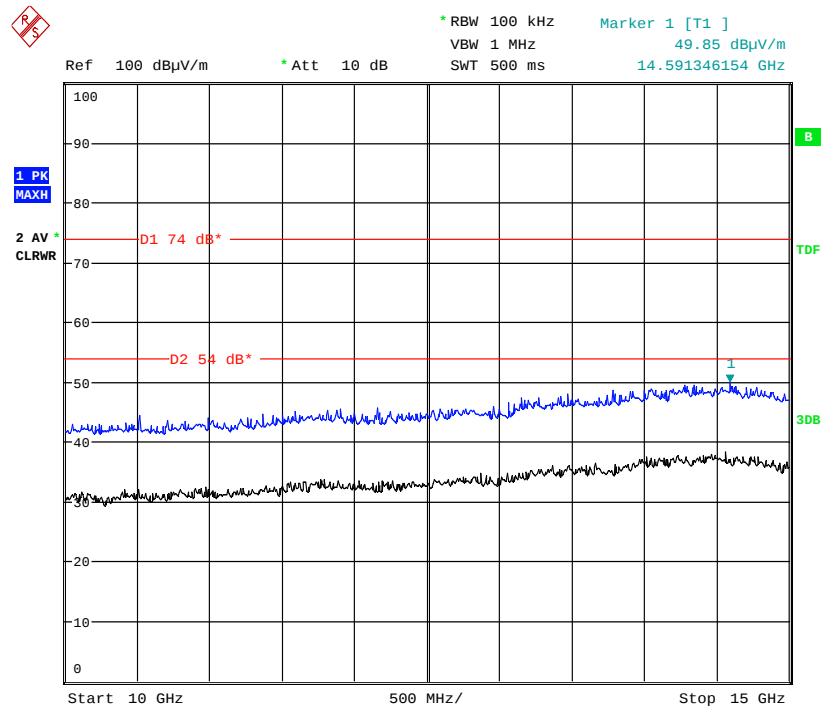
Date: 29.AUG.2012 17:04:23

Radiated Spurious Emissions 5GHz-10GHz – 2441MHz



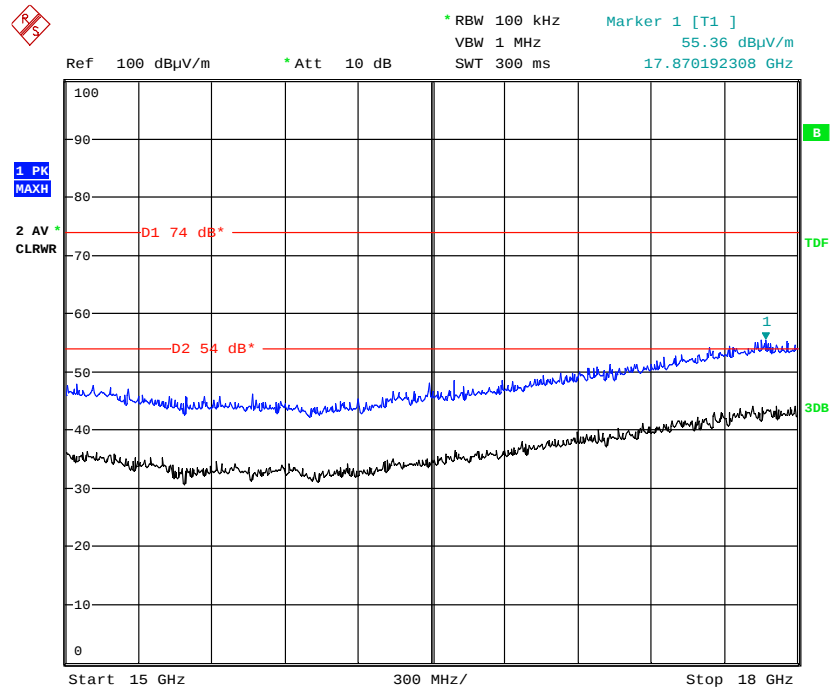
Date: 29.AUG.2012 17:03:58

Radiated Spurious Emissions 10GHz-15GHz – 2441MHz



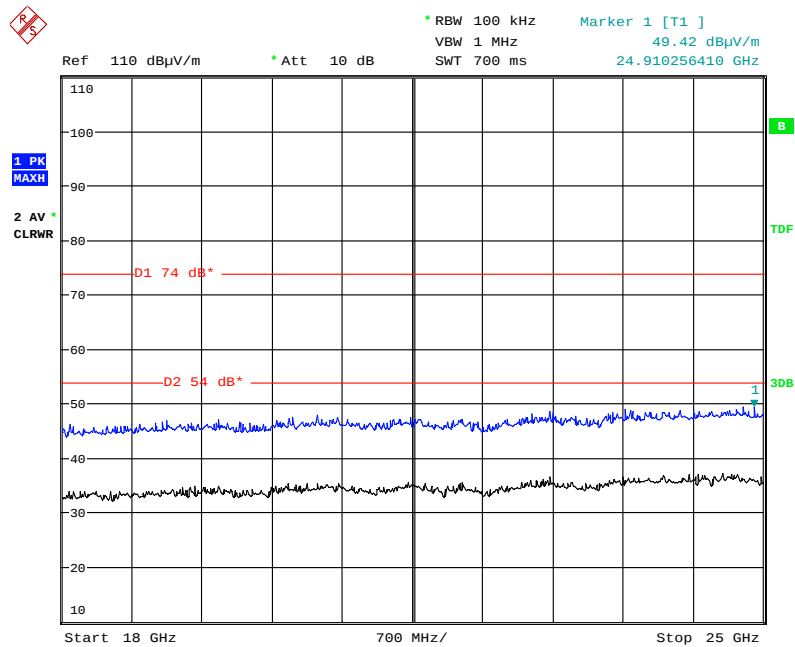
Date: 29.AUG.2012 17:03:36

Radiated Spurious Emissions 15GHz-18GHz – 2441MHz



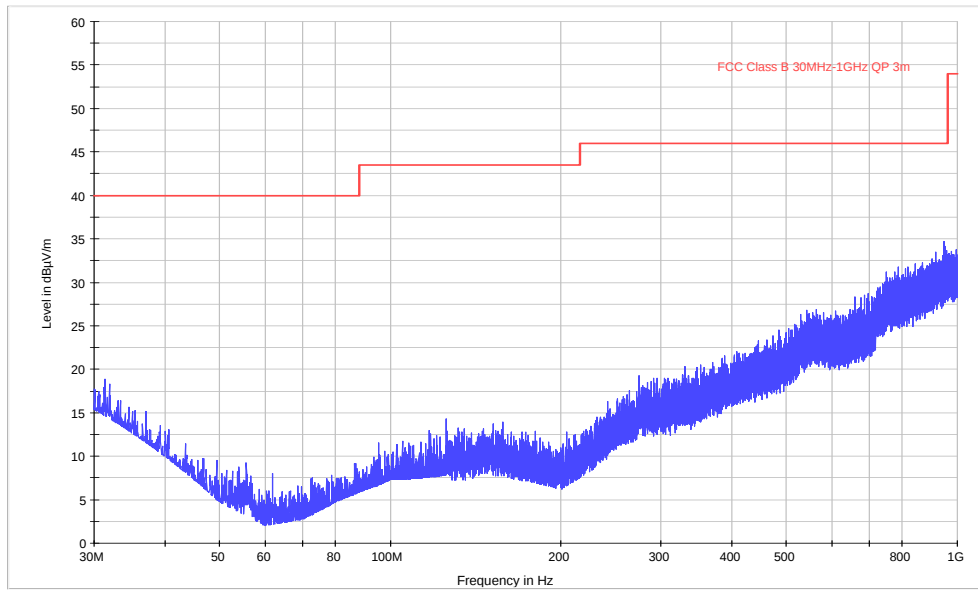
Date: 29.AUG.2012 17:02:39

Radiated Spurious Emissions 18GHz to 25GHz – 2441MHz

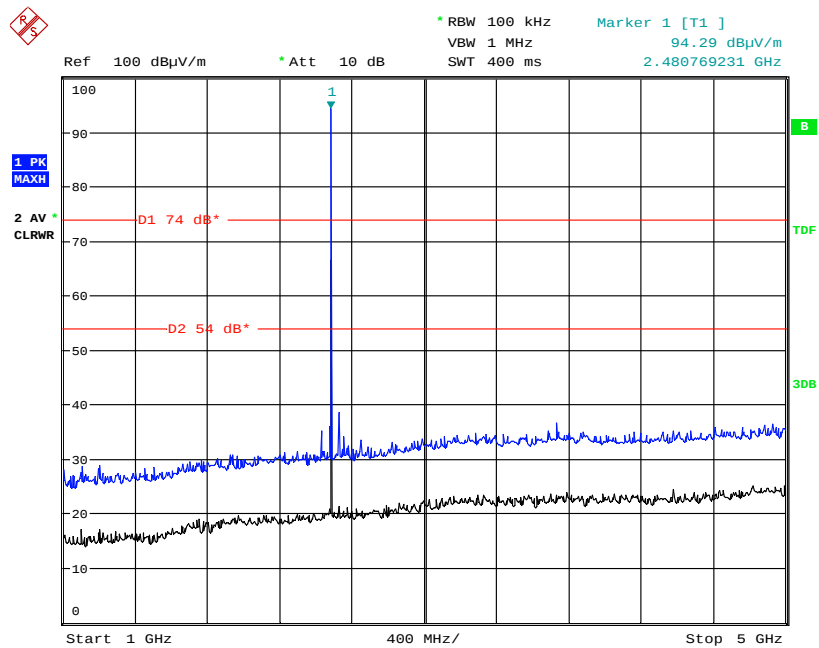


Date: 30.AUG.2012 15:56:30

Radiated Spurious Emissions 30MHz to 1GHz – 2480MHz

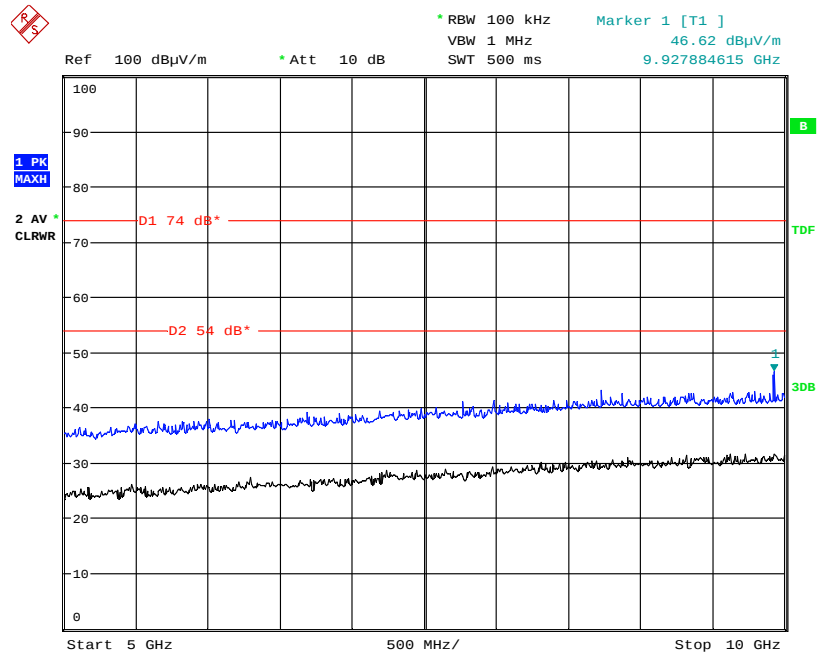


Radiated Spurious Emissions 1GHz to 5GHz – 2480MHz



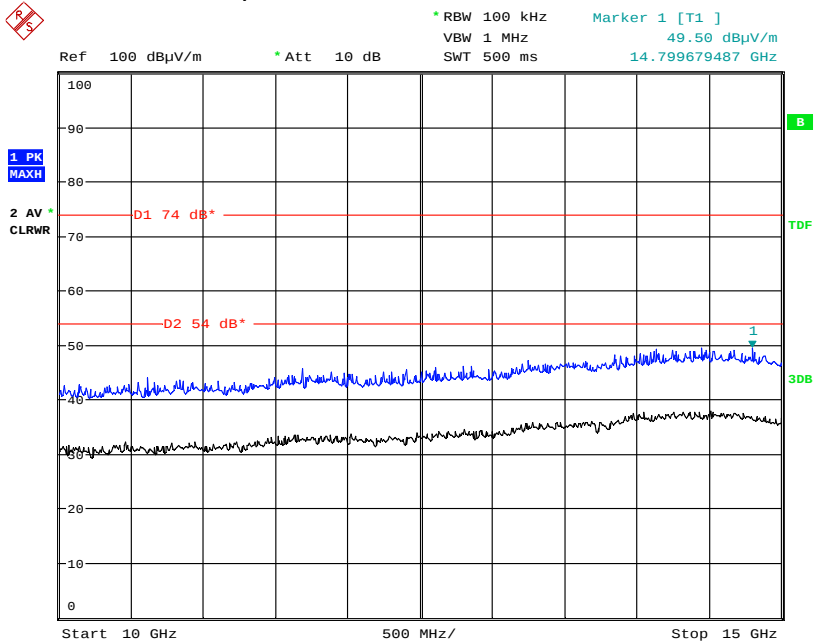
Date: 29.AUG.2012 17:11:35

Radiated Spurious Emissions 5GHz-10GHz– 2480MHz



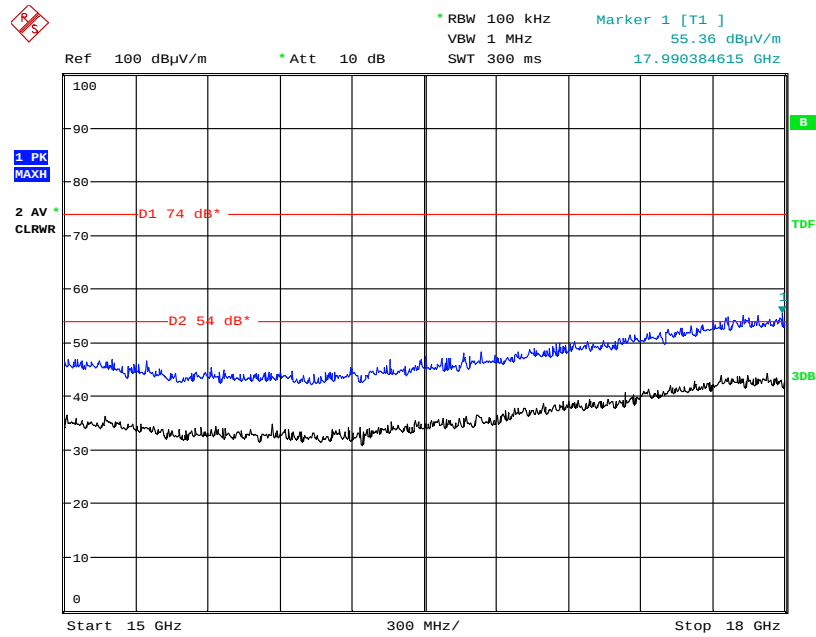
Date: 29.AUG.2012 17:12:16

Radiated Spurious Emissions 10GHz-15GHz – 2480MHz



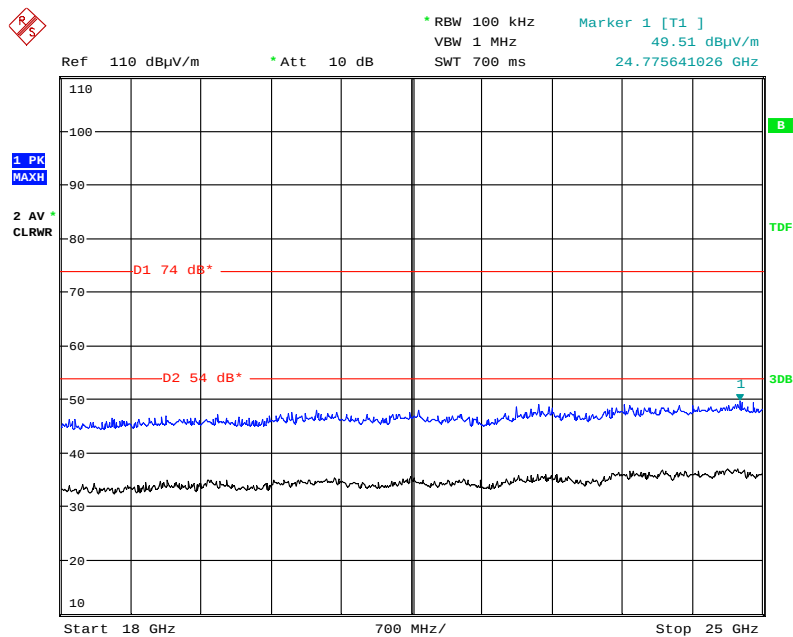
Date: 29.AUG.2012 17:13:43

Radiated Spurious Emissions 15GHz to 18GHz – 24801MHz



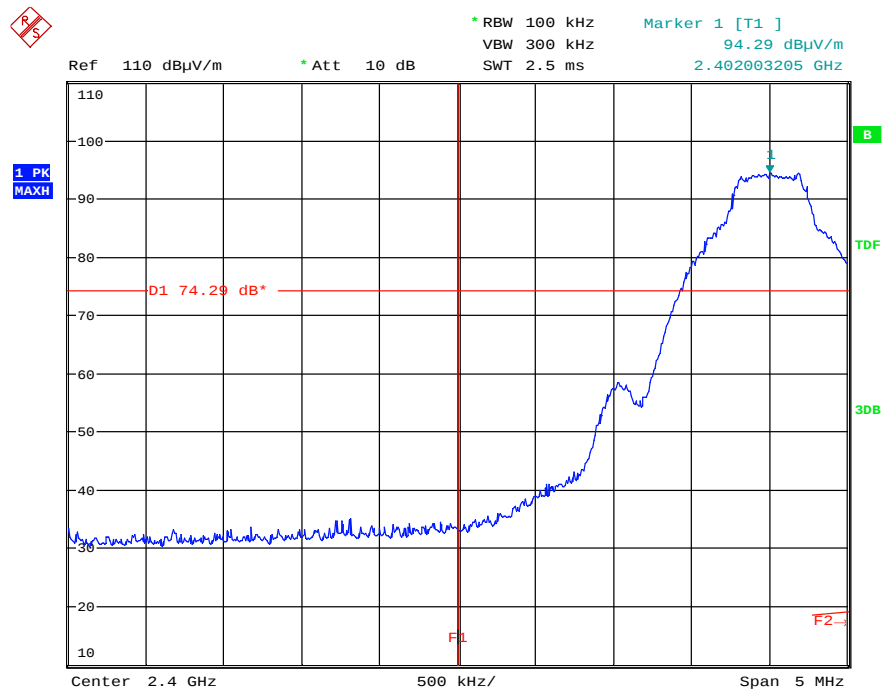
Date: 29.AUG.2012 17:14:28

Radiated Spurious Emissions 18GHz to 25GHz – 2480MHz



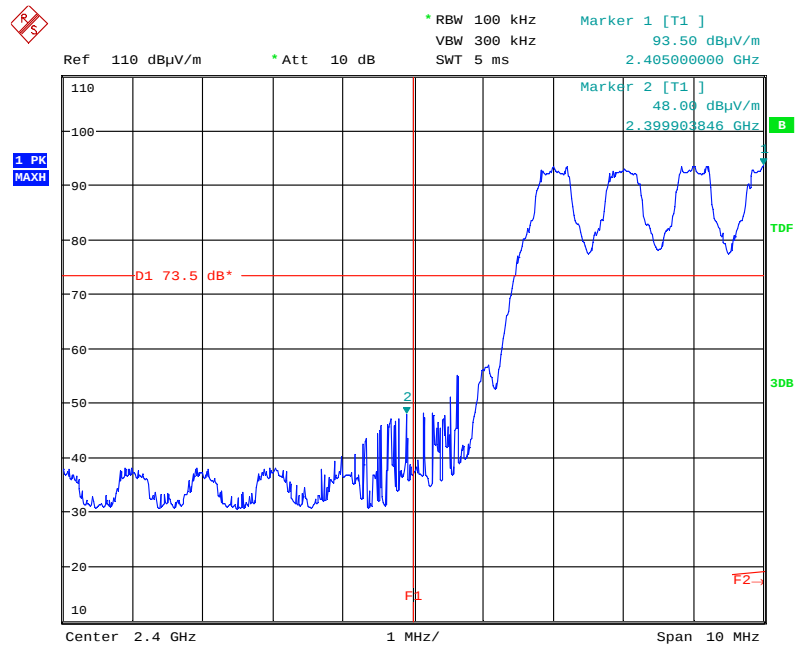
Date: 30.AUG.2012 15:57:25

Radiated Lower Band-edge Compliance



Date: 30.AUG.2012 11:43:19

Radiated Lower Band-edge Compliance – Hopping mode



Date: 30.AUG.2012 12:38:38

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.

For further details of the test procedures and general test set ups used during testing please refer to the related document "EMC Test Methods - An Overview", which can be supplied by TRaC Global upon request.

C1 Test samples

The following samples of the apparatus submitted by the client were tested:

Sample No.	Description	Identification
S05	JPN Sony Othello NFC Remote 2013 With Antenna Connector	001C FD00 1546
S10	JPN Sony Othello NFC Remote 2013 Without Antenna Connector	001C FD00 155C

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

Sample No.	Description	Identification
S04	Serial Adaptor	1543720

C2 EUT operating mode during testing

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

Test	Description of Operating Mode
Carrier power, spurious emissions, dwell time, bandwidth tests	EUT constantly transmitting at maximum power on bottom, middle and top channels using GFSK Modulation with a 1MB data rate.
Band-edge tests, channel separation, number of channels, hop frequency	EUT transmitting, hopping on all channels
Unintentional spurious emissions	EUT in receive mode.

C3 EUT Configuration Information

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

C4 List of EUT Ports

The tables below describe the termination of EUT ports:

Sample : S05
Tests : All conducted tests

Port	Description of Cable Attached	Cable length	Equipment Connected
Antenna	Coaxial	20cm	TRaC Test equipment

Sample : S10
Tests : Radiated Emissions

Port	Description of Cable Attached	Cable length	Equipment Connected
No External Ports			

C5 Details of Equipment Used

TRaC Ref	Equipment Type	Description	Brand	Last Calibrated
UH004	ESVS10	Receiver	R&S	12/01/2012
UH093	CBL6112B	30MHz – 2GHz Bilog	Chase	20/06/2011
UH281	FSU46	Spectrum Analyser	R&S	09/02/2012
TRL572	8449B	Pre Amp	Agilent	24/11/2010
TRL138	3115	1GHz-18GHz Horn	Emco	08/11/2011
TRL300	20240-20	18GHz-26GHz Horn	Flann	17/11/2011

Appendix D:

Additional Information

No Additional Information is contained in this 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 = $20 \times \text{Log}_{10} (1/\text{Calculated Duty Cycle})$

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%

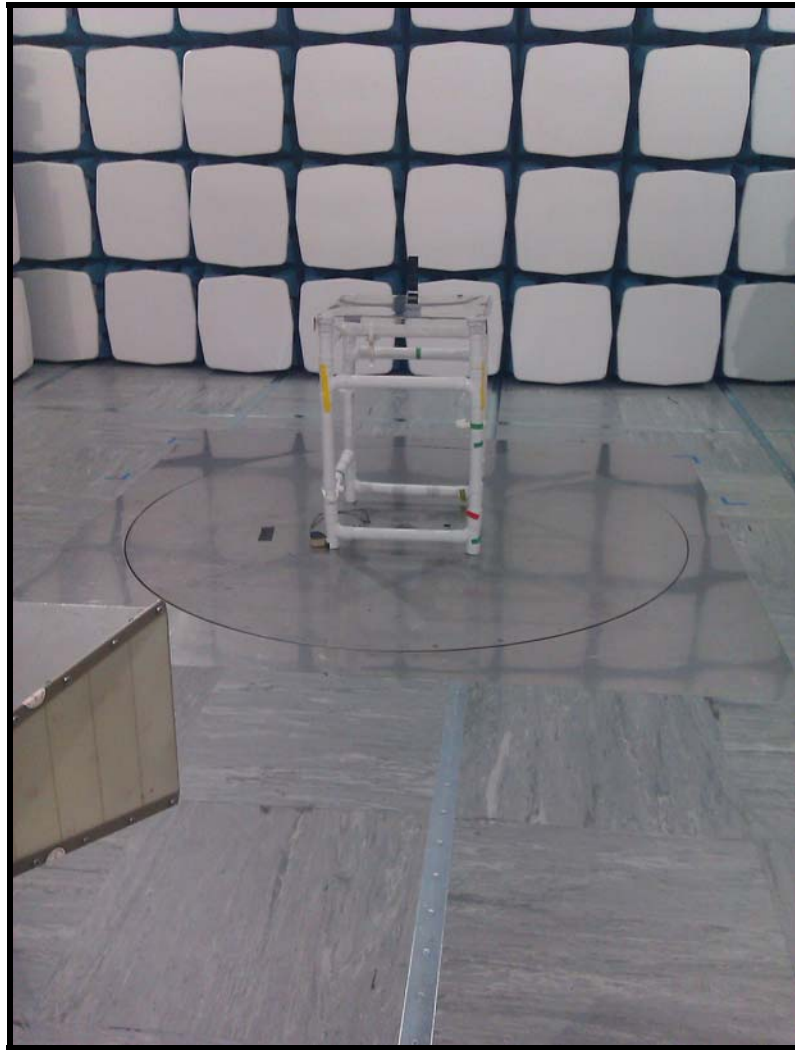
Correction factor (dB) = $20 \times \text{Log}_{10} (1/0.07459) = 22.54\text{dB}$

Appendix F:

Photographs and Figures

The following photographs were taken of the test samples:

1. Radiated electric field emissions arrangement: Overview.
2. EUT: Overview.



Photograph 1



Photograph 2

