

Radio Test Report
for
Universal Electronics
on
TV REMOTE CONTROLLER

Document No: TRA-014307-00-47-00-A

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-014307-00-47-00-A

Applicant : Universal Electronics

Apparatus : TV REMOTE CONTROLLER

Specification(s) : CFR47 Part 15.247 & RSS-210 Annex 8

FCCID : MG3-YD003

Unique Product Number : 2575A-YD003

Purpose of Test : Certification

Authorised by :



(Radio Product Manager)

Issue Date : 7th August 2013

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	8
Section 2:	Measurement Uncertainty	9
2.1	Measurement Uncertainty Values	9
Section 3:	Modifications	11
3.1	Modifications Performed During Assessment	11
Appendix A:	Formal Emission Test Results	12
A1	Transmitter Peak Output Power	13
A2	Conducted Spurious Emissions	14
A3	Radiated Emissions	18
A4	20dB Bandwidth and Channel Separation	26
A5	Hopping frequencies	27
A6	Channel Occupancy	28
A7	Antenna Gain	29
A8	Unintentional Radiated Emissions	30
Appendix B:	Supporting Graphical Data	33
Appendix C:	Additional Test and Sample Details	67
C1	Test samples	68
C2	EUT operating mode during testing	69
C3	EUT Configuration Information	70
C4	List of EUT Ports	71
C5	Details of Equipment Used	72
Appendix D:	Additional Information	73
Appendix E:	Calculation of the duty cycle correction factor	74
Appendix F:	Photographs and Figures	75
Appendix G:	MPE Calculation	78

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

Author(s): Daniel Winstanley

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

Gemstar Technology (China) Co., Ltd.
Gemstar Industrial Park,
45# Shiguang Road,
Zhong'er Village, Zhongcun Town, Panyu District
Guangzhou City, Guangdong Province
511495, P.R China

1.4 Apparatus Assessed

The following products were assessed between 23rd – 29th July 2013

TV REMOTE CONTROLLER. Model Number: RMF-YD003

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
	Title 47 of the CFR: Part 15 Subpart (c)	RSS-210 Issue 8 December 2012		
Radiated spurious emissions (Restricted bands)	15.247	Annex 8 A8.5	ANSI C63.10:2009	Pass
Conducted spurious emissions (Non-restricted bands)	15.247	Annex 8 A8.5	ANSI C63.10:2009	Pass
AC Power conducted emissions	15.207	RSS-Gen Section 7.2.2	ANSI C63.10:2009	N/A Note 1
20dB Bandwidth and Channel Spacing	15.247(a)(1)(i)	Annex 8 A8.1(b)	ANSI C63.10:2009	Pass
Conducted Carrier Power	15.247(b)(2)	Annex 8 A8.4(2)	ANSI C63.10:2009	Pass
Hopping Frequencies	15.247(a)(1)	Annex 8 A8.1(d)	ANSI C63.10:2009	Pass
Channel Occupancy	15.247(a)(1)(i)	Annex 8 A8.1(d)	ANSI C63.10:2009	Pass
Unintentional Radiated Spurious Emissions	15.109	RSS-Gen Section 7.2.3	ANSI C63.10:2009	Pass

Note 1: The TV REMOTE CONTROLLER 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
CFR : Code of Federal Regulations
REFE : Radiated Electric Field Emissions

RSS : Radio Standards Specification
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	: 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	Part15 Clause 15.247(b)(1), RSS-210 Annex 8 A8.4(2)
Measurement standard	ANSI C63.10
EUT sample number	S10
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C

GFSK Modulation			
Channel Frequency (MHz)	Peak Carrier Power (mW)	Limit (W)	Result
2402 MHz	1.92	1	Pass
2441 MHz	2.04	1	Pass
2480 MHz	2.04	1	Pass

QPSK Modulation			
Channel Frequency (MHz)	Peak Carrier Power (mW)	Limit (W)	Result
2402 MHz	2.99	1	Pass
2441 MHz	2.99	1	Pass
2480 MHz	3.16	1	Pass

8PSK Modulation			
Channel Frequency (MHz)	Peak Carrier Power (mW)	Limit (W)	Result
2402 MHz	3.11	1	Pass
2441 MHz	3.18	1	Pass
2480 MHz	3.27	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 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 – GFSK Modulation	
Regulation	Part 15 Clause 15.247(d) and Clause 15.205, RSS-210 Annex 8 A8.5
Measurement standard	ANSI C63.10
Frequency range	9 kHz 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

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)	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					

Conducted Spurious Emissions - Continued

Test Details – QPSK Modulation	
Regulation	Part 15 Clause 15.247(d) and Clause 15.205; RSS-210 Annex 8 A8.5
Measurement standard	ANSI C63.10
Frequency range	9 kHz 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

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)	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					

Conducted Spurious Emissions - Continued

Test Details –8PSK Modulation	
Regulation	Part 15 Clause 15.247(d) and Clause 15.205; RSS-210 Annex 8 A8.5
Measurement standard	ANSI C63.10
Frequency range	9 kHz 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

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)	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, are based on a transmitted carrier level of 15.247(b) and Annex 8, A8.4(2). 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) and Annex 8, A8.5 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) and RSS-Gen4.9
3. The measurements at 2400 MHz and 2483.5 MHz were made to ensure band edge compliance
4. Conducted spurious emissions plots for the highest power modulation type 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) and Annex 8, A8.5:

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. 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: GFSK Modulation	
Regulation	Part 15 (c) Clause 15.247(d) and Clause 15.205, RSS-210 Annex 8 A8.5
Measurement standard	ANSI C63.10
Frequency range	30MHz to 25 GHz
EUT sample number	S11
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:

2402 MHz									
Frequency (MHz)	Det	Measured Level (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Gain (dB)	Filter Loss (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
3202.64	Pk	53.43	3	30.7	35.5	0.4	52.03	399.48	5000
3202.64	Av	48.54	3	30.7	35.5	0.4	47.14	227.51	500
4803.98	Pk	49.36	4	32.6	35.4	0.7	51.26	365.59	5000
4803.98	Av	41.36	4	32.6	35.4	0.7	43.26	145.55	500
7206.01	Pk	50.16	6.3	35.9	35.7	0.8	57.46	746.45	5000
7206.01	Av	41.41	6.3	35.9	35.7	0.8	48.71	272.58	500

2441 MHz									
Frequency (MHz)	Det	Measured Level (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Gain (dB)	Filter Loss (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
3254.60	Pk	53.82	3.1	30.9	35.5	0.4	52.72	432.51	5000
3254.60	Av	49.20	3.1	30.9	35.5	0.4	48.10	254.10	500
4881.95	Pk	51.14	4.2	32.9	35.5	0.6	53.34	464.52	5000
4881.95	Av	43.58	4.2	32.9	35.5	0.6	45.78	194.54	500
7322.92	Pk	51.77	5.9	36.3	35.8	0.8	58.97	888.18	5000
7322.92	Av	43.97	5.9	36.3	35.8	0.8	51.17	361.83	500
9763.86	Pk	48.66	5.5	37.9	36.4	0.6	56.26	650.13	5000
9763.86	Av	37.71	5.5	37.9	36.4	0.6	45.31	184.29	500

2480 MHz									
Frequency (MHz)	Det	Measured Level (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Gain (dB)	Filter Loss (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
3306.62	Pk	54.73	3.1	31	35.5	0.4	53.73	485.85	5000
3306.62	Av	50.81	3.1	31	35.5	0.4	49.81	309.39	500
4959.94	Pk	50.98	4.3	33.1	35.5	0.5	53.38	466.66	5000
4959.94	Av	43.61	4.3	33.1	35.5	0.5	46.01	199.76	500
7439.90	Pk	52.59	5.4	36.4	35.8	0.8	59.39	932.18	5000
7439.90	Av	45.26	5.4	36.4	35.8	0.8	52.06	400.87	500
9919.93	Pk	49.4	5.5	38.2	36.4	0.5	57.20	724.44	5000
9919.93	Av	39.21	5.5	38.2	36.4	0.5	47.01	224.13	500

Radiated Emissions

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

Test Details: QPSK Modulation	
Regulation	Part 15 (c) Clause 15.247(d) and Clause 15.205, RSS-210 Annex 8 A8.5
Measurement standard	ANSI C63.10
Frequency range	30MHz to 25 GHz
EUT sample number	S11
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:

2402 MHz									
Frequency (MHz)	Det	Measured Level (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Gain (dB)	Filter Loss (dB)	Field Strength (dBµV/m)	Field Strength (µV/m)	Limit (µV/m)
3202.64	Pk	53.78	3	30.7	35.5	0.4	52.38	415.91	5000
3202.64	Av	48.56	3	30.7	35.5	0.4	47.16	228.03	500
4803.98	Pk	50.72	4	32.6	35.4	0.7	52.62	427.56	5000
4803.98	Av	40.56	4	32.6	35.4	0.7	42.46	132.74	500
7206.01	Pk	52.86	6.3	35.9	35.7	0.8	60.16	1018.59	5000
7206.01	Av	42.26	6.3	35.9	35.7	0.8	49.56	300.61	500

2441 MHz									
Frequency (MHz)	Det	Measured Level (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Gain (dB)	Filter Loss (dB)	Field Strength (dBµV/m)	Field Strength (µV/m)	Limit (µV/m)
3254.60	Pk	53.90	3.1	30.9	35.5	0.4	52.80	436.52	5000
3254.60	Av	49.24	3.1	30.9	35.5	0.4	48.14	255.27	500
4881.95	Pk	51.66	4.2	32.9	35.5	0.6	53.86	493.17	5000
4881.95	Av	42.66	4.2	32.9	35.5	0.6	44.86	174.98	500
7322.92	Pk	53.73	5.9	36.3	35.8	0.8	60.93	1113.01	5000
7322.92	Av	44.82	5.9	36.3	35.8	0.8	52.02	399.02	500
9763.86	Pk	49.07	5.5	37.9	36.4	0.6	56.67	681.55	5000
9763.86	Av	37.34	5.5	37.9	36.4	0.6	44.94	176.60	500

2480 MHz									
Frequency (MHz)	Det	Measured Level (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Gain (dB)	Filter Loss (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
3306.62	Pk	54.89	3.1	31	35.5	0.4	53.89	494.88	5000
3306.62	Av	50.86	3.1	31	35.5	0.4	49.86	311.17	500
4959.94	Pk	51.86	4.3	33.1	35.5	0.5	54.26	516.42	5000
4959.94	Av	42.74	4.3	33.1	35.5	0.5	45.14	180.72	500
7439.90	Pk	55.96	5.4	36.4	35.8	0.8	62.76	1374.04	5000
7439.90	Av	46.06	5.4	36.4	35.8	0.8	52.86	439.54	500
9919.93	Pk	49.66	5.5	38.2	36.4	0.5	57.46	746.45	5000
9919.93	Av	39.20	5.5	38.2	36.4	0.5	47.00	223.87	500

Radiated Emissions

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

Test Details: 8PSK Modulation	
Regulation	Part 15 (c) Clause 15.247(d) and Clause 15.205, RSS-210 Annex 8 A8.5
Measurement standard	ANSI C63.10
Frequency range	30MHz to 25 GHz
EUT sample number	S11
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:

2402 MHz									
Frequency (MHz)	Det	Measured Level (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Gain (dB)	Filter Loss (dB)	Field Strength (dBµV/m)	Field Strength (µV/m)	Limit (µV/m)
3202.64	Pk	53.44	3	30.7	35.5	0.4	52.04	399.94	5000
3202.64	Av	48.55	3	30.7	35.5	0.4	47.15	227.77	500
4803.98	Pk	50.26	4	32.6	35.4	0.7	52.16	405.51	5000
4803.98	Av	40.60	4	32.6	35.4	0.7	42.50	133.35	500
7206.01	Pk	53.47	6.3	35.9	35.7	0.8	60.77	1092.70	5000
7206.01	Av	42.12	6.3	35.9	35.7	0.8	49.42	295.80	500

2441 MHz									
Frequency (MHz)	Det	Measured Level (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Gain (dB)	Filter Loss (dB)	Field Strength (dBµV/m)	Field Strength (µV/m)	Limit (µV/m)
3254.60	Pk	54.13	3.1	30.9	35.5	0.4	53.03	448.23	5000
3254.60	Av	49.25	3.1	30.9	35.5	0.4	48.15	255.56	500
4881.95	Pk	51.62	4.2	32.9	35.5	0.6	53.82	490.91	5000
4881.95	Av	42.67	4.2	32.9	35.5	0.6	44.87	175.19	500
7322.92	Pk	55.40	5.9	36.3	35.8	0.8	62.60	1348.96	5000
7322.92	Av	44.58	5.9	36.3	35.8	0.8	51.78	388.15	500
9763.86	Pk	48.90	5.5	37.9	36.4	0.6	56.50	668.34	5000
9763.86	Av	37.36	5.5	37.9	36.4	0.6	44.96	177.01	500

2480 MHz									
Frequency (MHz)	Det	Measured Level (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Gain (dB)	Filter Loss (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
3306.62	Pk	55.01	3.1	31	35.5	0.4	54.01	501.76	5000
3306.62	Av	50.86	3.1	31	35.5	0.4	49.86	311.17	500
4959.94	Pk	52.05	4.3	33.1	35.5	0.5	54.45	527.84	5000
4959.94	Av	42.92	4.3	33.1	35.5	0.5	45.32	184.50	500
7439.90	Pk	56.68	5.4	36.4	35.8	0.8	63.48	1492.79	5000
7439.90	Av	45.86	5.4	36.4	35.8	0.8	52.66	429.54	500
9919.93	Pk	50.11	5.5	38.2	36.4	0.5	57.91	786.14	5000
9919.93	Av	39.24	5.5	38.2	36.4	0.5	47.04	224.91	500

Plots are contained in appendix B

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 As required, above 1 GHz, emissions measured using a peak detector shall not exceed a level 20 dB above the average limit.
- 3 Spurious emissions plots for the EUT operating using a carrier wave are included in Appendix B of this report.
- 4 Measurements at 2400 & 2483.5 MHz were made to ensure band edge compliance.
- 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	RBW=VBW= 1MHz
Average	RBW=VBW= 1MHz

These settings as per ANSI C63.10 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 47 CFR Part 15 Clause 15.33(a) and 15.33(a)(1) and RSS-Gen4.9.

Radiated emission limits for emissions falling within the restricted bands.

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) and RSS-210, Annex 8 A8.1(b) 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	Part 15 (c) Clause 15.247(a)(1)(i); RSS-210 Annex 8 A8.1(b)
EUT sample number	S10
Modification state	0
SE in test environment	None
SE isolated from EUT	S
EUT set up	Refer to Appendix C

Channel Frequency (MHz)	GFSK Modulation Measured 20dB Bandwidth (kHz)	QPSK Modulation Measured 20dB Bandwidth (kHz)	8PSK Modulation Measured 20dB Bandwidth (kHz)
2402 MHz	1161.859	1434.295	1434.295
2441 MHz	1145.833	1442.307	1434.295
2480 MHz	1161.859	1450.32	1434.294
Limit		>500kHz	
Result		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	Part 15(c) Clause 15.247(a)(1)(i); RSS-201 Annex 8 A8.1(d)
EUT sample number	S10
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

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	Part15 (c) Clause 15.247(a)(1); RSS-210, Annex 8 A8.1(d)
EUT sample number	S10
Modification state	0
SE in test environment	None
SE isolated from EUT	S07
EUT set up	Refer to Appendix C

Modulation Type	T _{occ} (ms)	MP (s)	MPTX	AOT (s)
GFSK	2.895	31.6	115	0.3329
QPSK	2.900	31.6	96	0.2784
8FSK	2.900	31.6	102	0.2958
Limit (s)		0.4		
Result		Pass		

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

Average Channel Retention Time Calculation:

No. Of utilised hopping channels (N) = 79

Measured channel occupancy time (T_{occ}) = 2.895ms

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 = 0.3329 seconds

A7 Antenna Gain

The antenna gain is detailed in the information below and is extracted from
074-UEI(RC_Test)_UEI_Passive_Characterization_NewRemotes_050913.pptx

Average Gain(dB) Plastic GroundFixed	-95 to -85	-85 to -75	-75 to -65	-65 to -55	-55 to -45	-45 to - 35	-35 to - 25
Freq=2400MHz	-3.47	-3.81	-3.85	-4.59	-6.48	-8.13	-8.40
Freq=2450MHz	-3.97	-4.08	-3.91	-4.75	-6.70	-8.41	-8.85
Freq=2480MHz	-4.64	-4.51	-4.32	-5.27	-7.38	-9.21	-9.47

	-25 to -15	-15 to -5	-5 to 5	5 to 15	15 to 25	25 to 35	35 to 45
Freq=2400MHz	-8.27	-7.76	-6.76	-5.86	-5.52	-5.85	-6.74
Freq=2450MHz	-8.47	-7.55	-6.55	-5.91	-5.77	-6.15	-7.00
Freq=2480MHz	-8.81	-7.87	-7.04	-6.56	-6.54	-6.97	-7.87

	45 to 55	55 to 65	65 to 75	75 to 85	85 to 95	Average
Freq=2400MHz	-8.13	-10.26	-13.42	-16.39	-16.14	-6.74
Freq=2450MHz	-8.42	-10.66	-13.53	-15.53	-15.65	-6.93
Freq=2480MHz	-9.43	-11.94	-15.02	-16.60	-16.28	-7.56

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 and RSS-Gen 7.2.3. 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	Part 15 (b) Clause 15.109; RSS-Gen Section 7.2.3
Measurement standard	ANSI C63.10
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 are listed below:

2402 MHz									
Frequency (MHz)	Det	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)
3205.304	Pk	52.68	3.1	30.7	35.9	50.58	-9.54	112.72	5000
3205.304	Av	47.25	3.1	30.7	35.9	45.15	-9.54	60.33	500

Unintentional Radiated Emissions - Continued

2441 MHz									
Frequency (MHz)	Det	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)
3257.288	Pk	53.7	3.2	30.9	35.8	52.00	-9.54	132.74	5000
3257.288	Av	48.54	3.2	30.9	35.8	46.84	-9.54	73.28	500

2480 MHz									
Frequency (MHz)	Det	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)
3309.31	Pk	54.08	3.2	31	35.8	52.48	-9.54	140.28	5000
3309.31	Av	49.71	3.2	31	35.8	48.11	-9.54	84.82	500

Notes:

- 1 Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.10:2009: section 4.5, Table 1 For emissions below 30MHz the cable losses are assumed to be negligible.
- 2 As required, above 1 GHz, emissions measured using a peak detector shall not exceed a level 20 dB above the average limit.
- 3 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.
- 4 For Frequencies below 1 GHz, RBW = 120 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= 1MHz, VBW ≥ RBW
 Average RBW= 1MHz, VBW ≥ RBW

Radiated emission limits for all emissions:

Frequency of emission (MHz)	Field strength □V	Measurement Distance m	Field strength dB □V
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

- (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:

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

- (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				

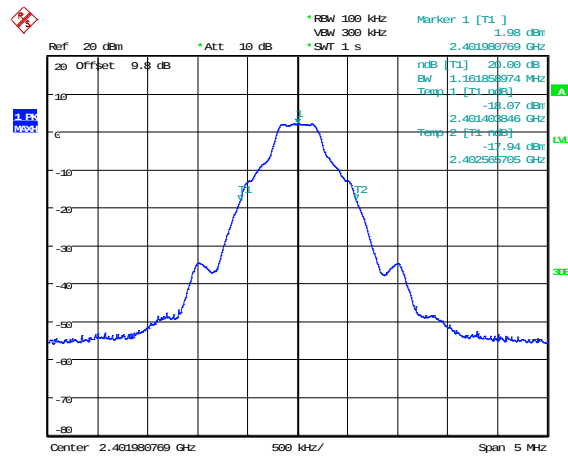
Appendix B:**Supporting Graphical Data**

This appendix contains graphical data obtained during testing.

Notes:

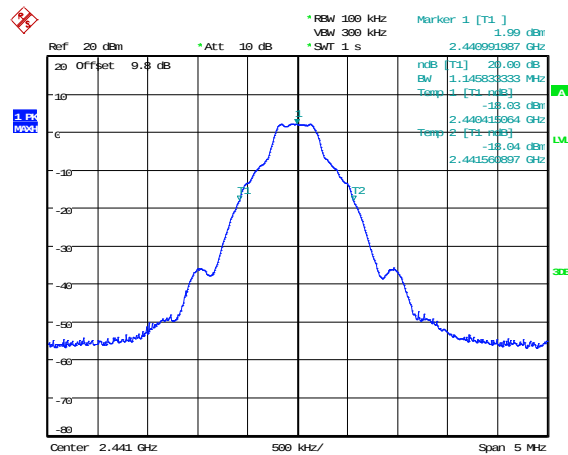
- (a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A and Appendix B.
- (b) The time and date on the plots do not necessarily equate to the time of the test.
- (c) Where relevant, on power 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 – GFSK Modulation



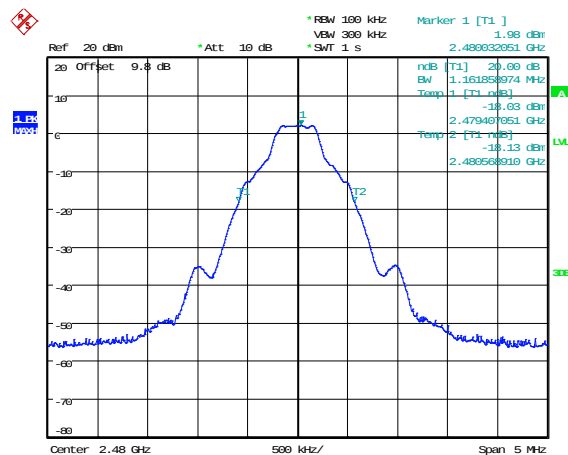
Date: 19.JUL.2013 10:18:59

20dB Bandwidth – 2441MHz Channel– GFSK Modulation



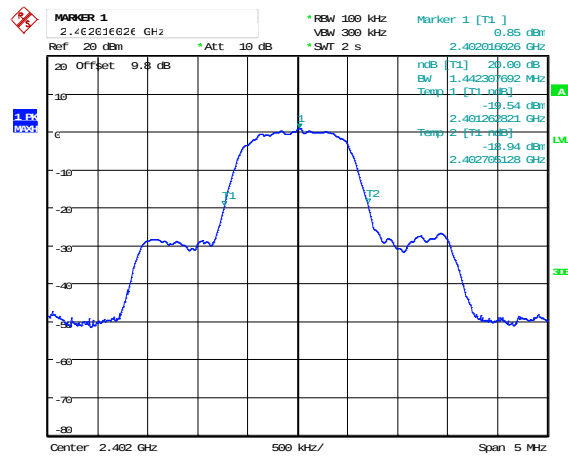
Date: 19.JUL.2013 10:20:16

20dB Bandwidth – 2480MHz Channel– GFSK Modulation



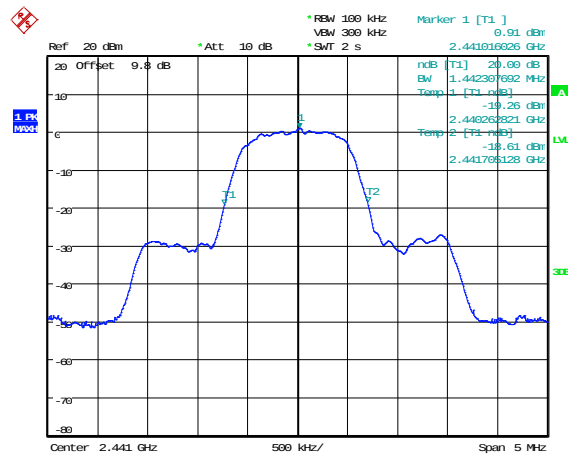
Date: 19.JUL.2013 10:22:36

20dB Bandwidth – 2402MHz Channel – QPSK Modulation



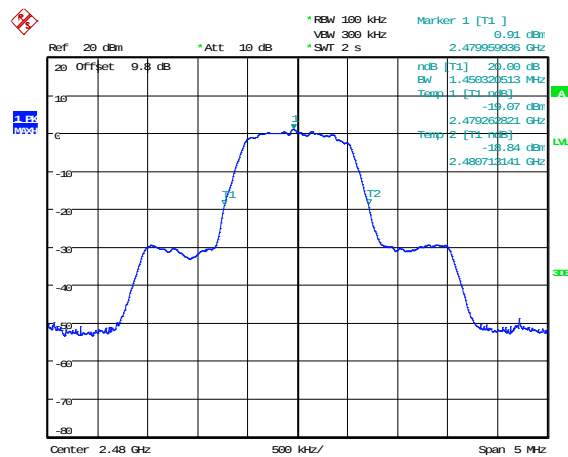
Date: 19.JUL.2013 11:02:04

20dB Bandwidth – 2441MHz Channel– QPSK Modulation



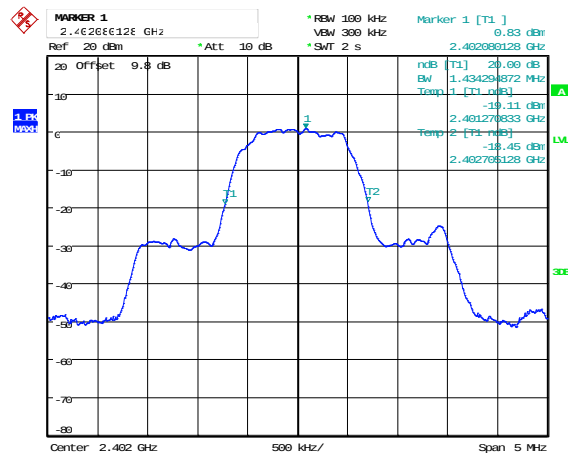
Date: 19.JUL.2013 11:10:41

20dB Bandwidth – 2480MHz Channel– QPSK Modulation



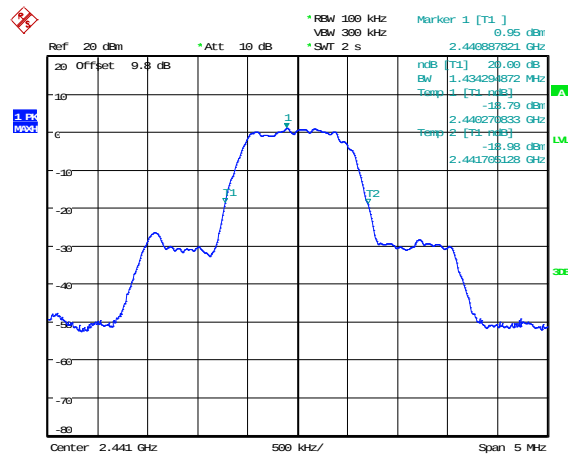
Date: 19.JUL.2013 11:11:52

20dB Bandwidth – 2402MHz Channel – 8PSK Modulation



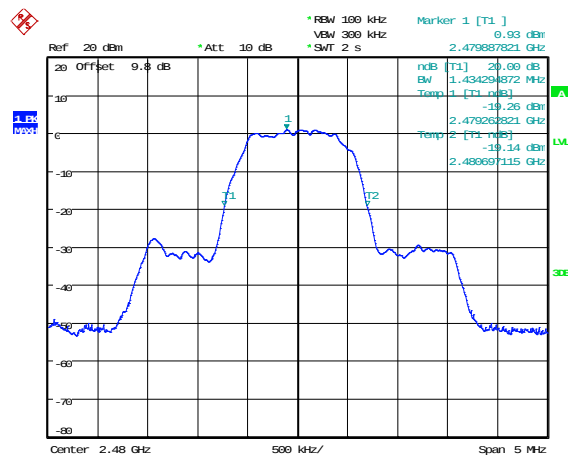
Date: 19.JUL.2013 11:34:02

20dB Bandwidth – 2441MHz Channel– 8PSK Modulation



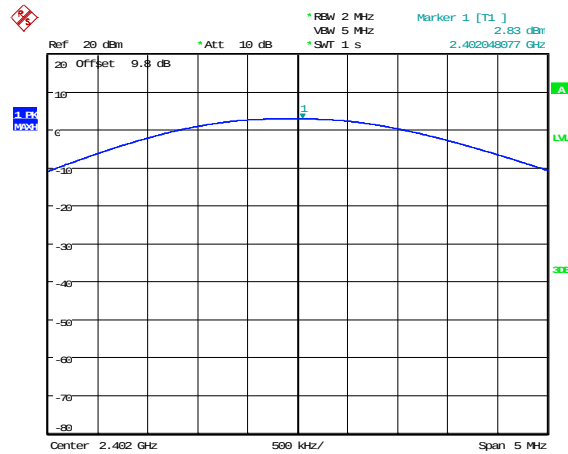
Date: 19.JUL.2013 11:35:16

20dB Bandwidth – 2480MHz Channel– 8PSK Modulation



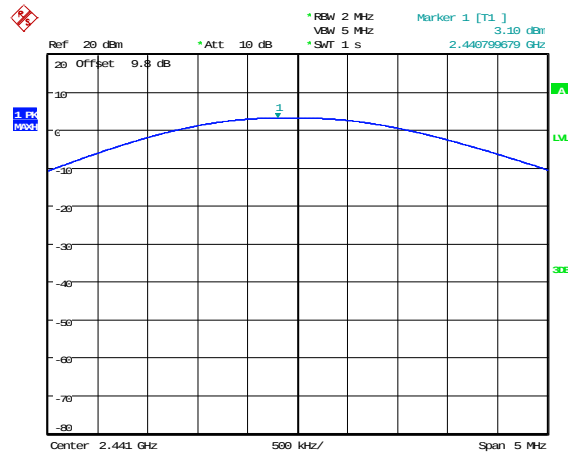
Date: 19.JUL.2013 11:36:26

Carrier Power – 2402MHz Channel– GFSK Modulation



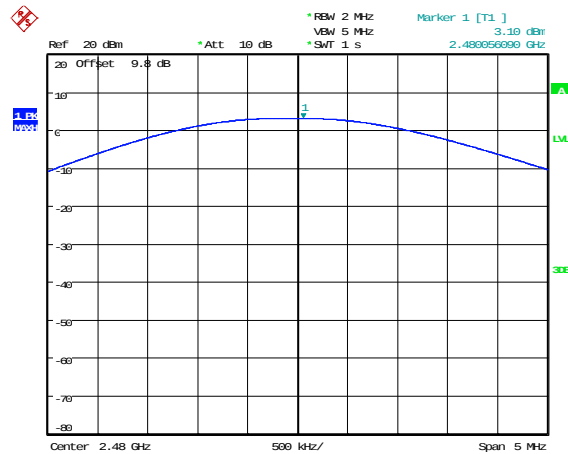
Date: 19.JUL.2013 10:31:02

Carrier Power – 2441MHz Channel– GFSK Modulation



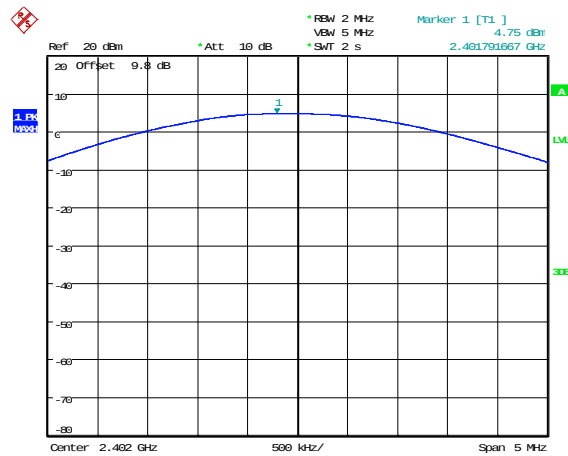
Date: 19.JUL.2013 10:29:45

Carrier Power – 2480MHz Channel– GFSK Modulation



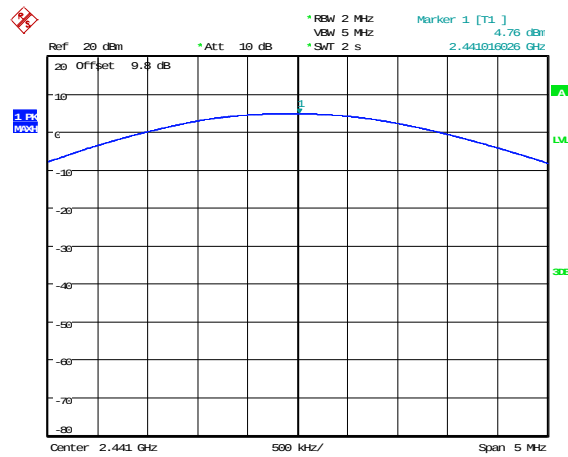
Date: 19.JUL.2013 10:24:38

Carrier Power – 2402MHz Channel– QPSK Modulation



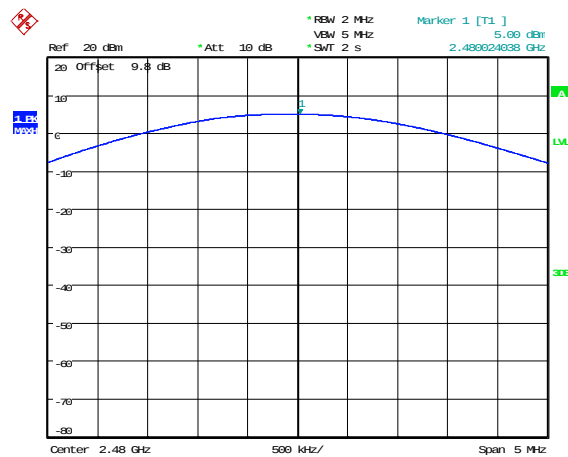
Date: 19.JUL.2013 11:28:57

Carrier Power – 2441MHz Channel– QPSK Modulation



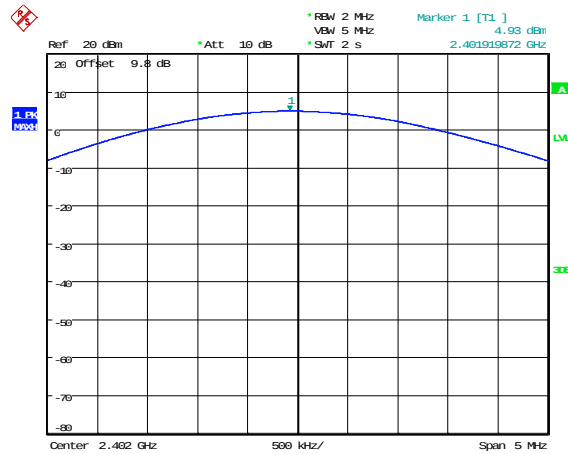
Date: 19.JUL.2013 11:21:55

Carrier Power – 2480MHz Channel– QPSK Modulation



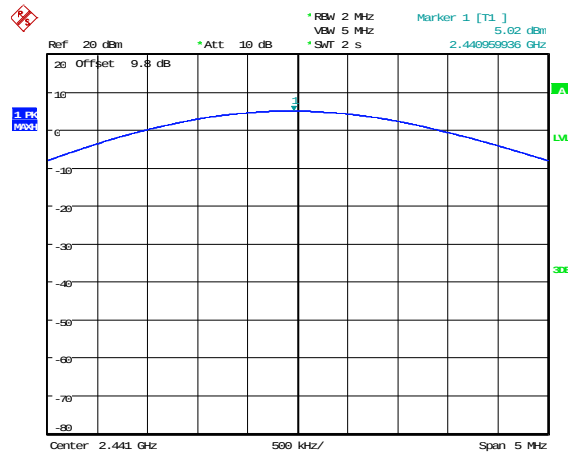
Date: 19.JUL.2013 11:12:35

Carrier Power – 2402MHz Channel– 8PSK Modulation



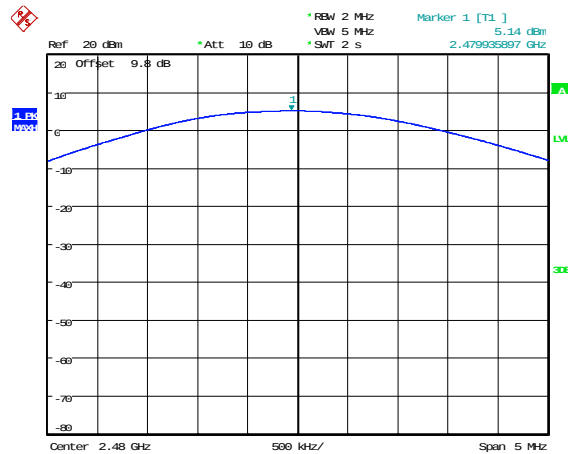
Date: 19.JUL.2013 11:39:19

Carrier Power – 2441MHz Channel– 8PSK Modulation



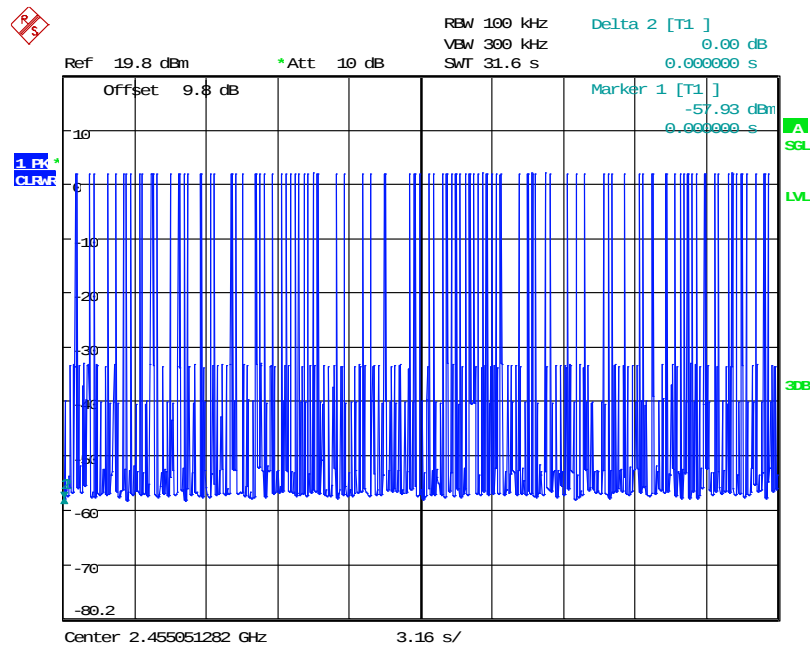
Date: 19.JUL.2013 11:38:24

Carrier Power – 2480MHz Channel– 8PSK Modulation



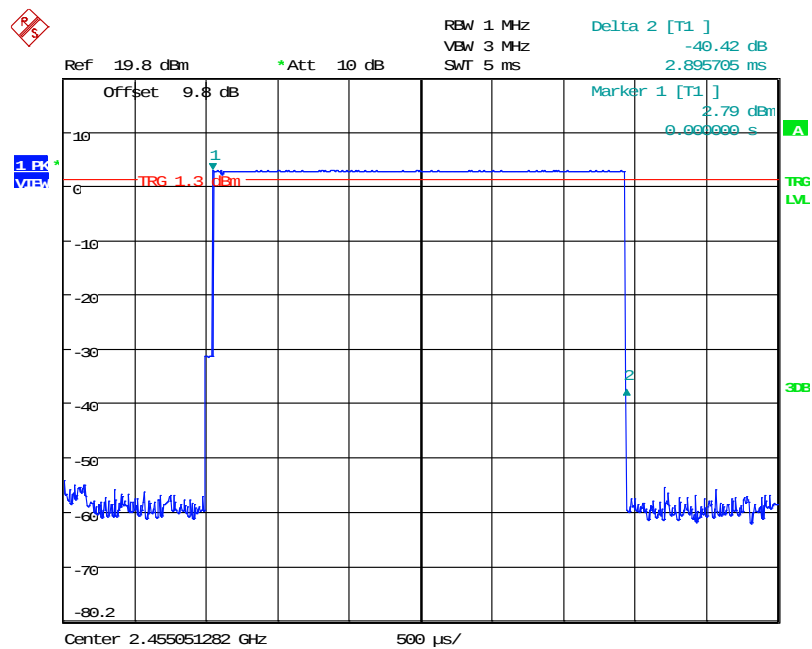
Date: 19.JUL.2013 11:36:57

Channel Repetitions - GFSK Modulation



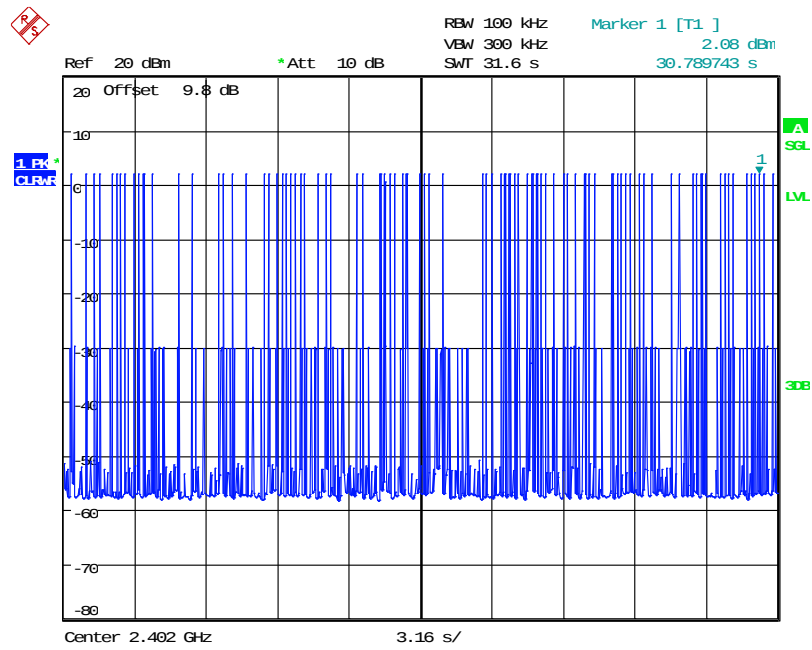
Date: 18.JUL.2013 14:50:52

Channel Dwell Time - GFSK Modulation



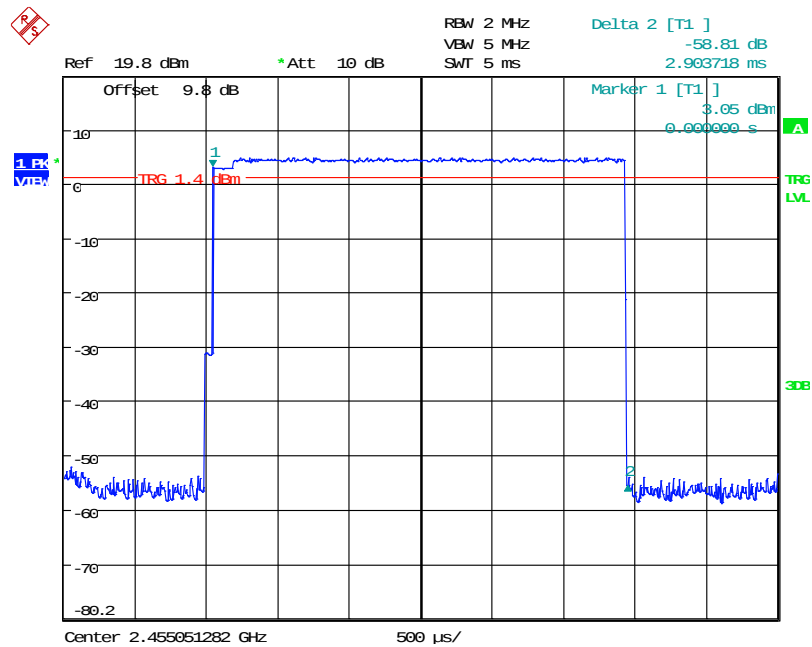
Date: 18.JUL.2013 14:40:10

Channel Repetitions - QPSK Modulation



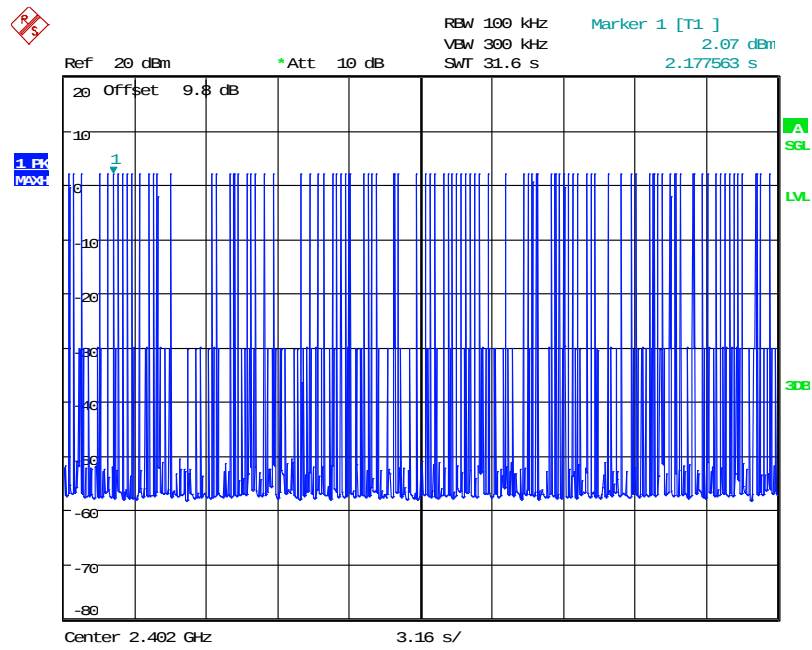
Date: 19.JUL.2013 11:44:24

Channel Dwell Time - QPSK Modulation



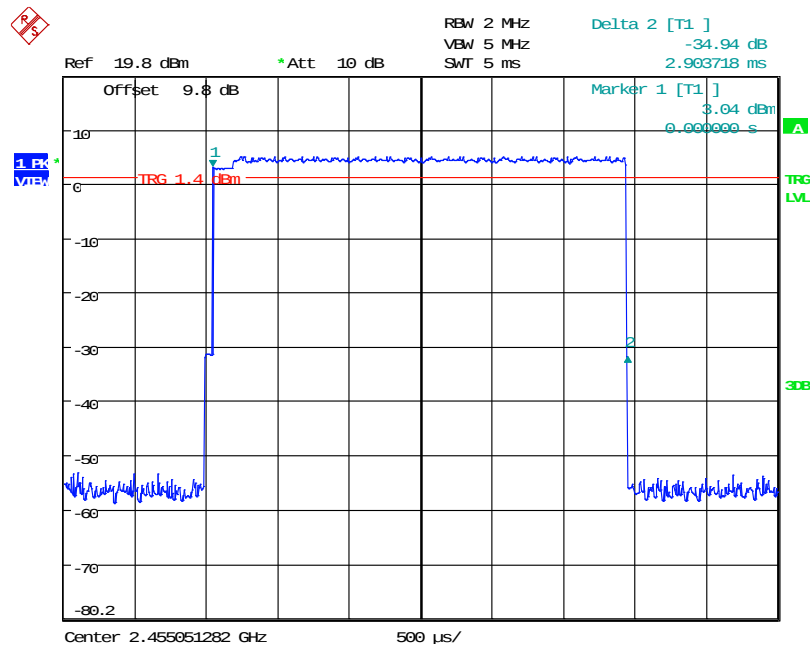
Date: 18.JUL.2013 14:43:46

Channel Repetitions - 8PSK Modulation



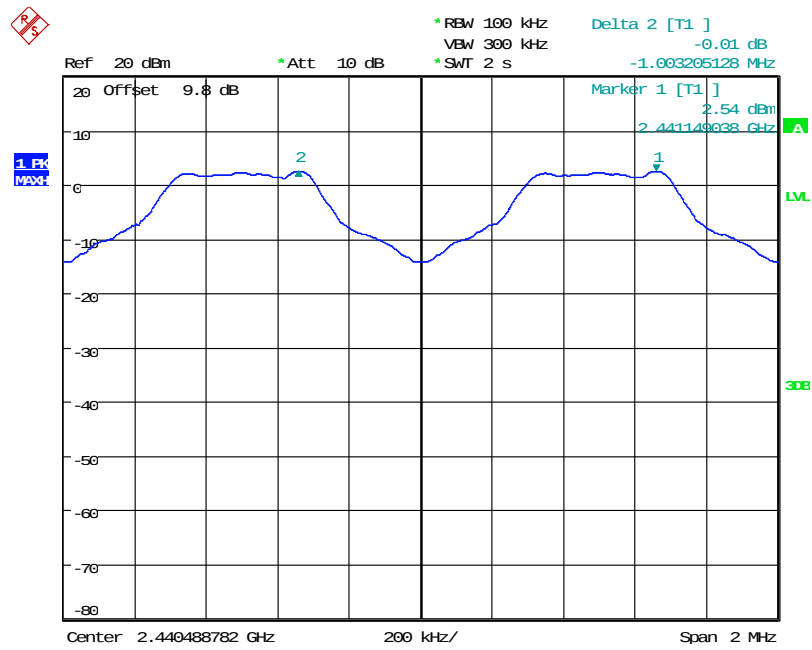
Date: 19.JUL.2013 11:42:23

Channel Dwell Time - 8PSK Modulation



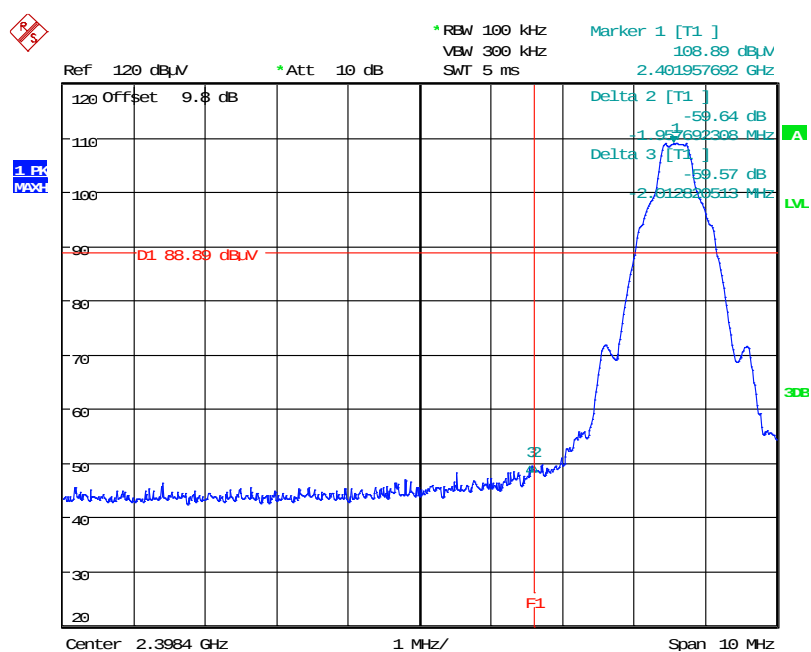
Date: 18.JUL.2013 14:43:09

Carrier Frequency Separation



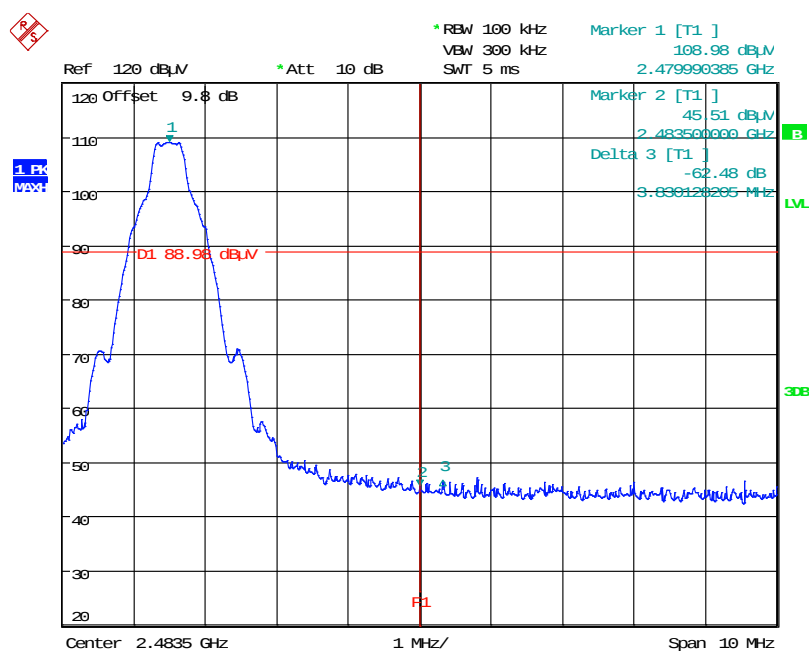
Date: 19.JUL.2013 10:58:14

Conducted Lower Band-edge Compliance - GFSK Modulation



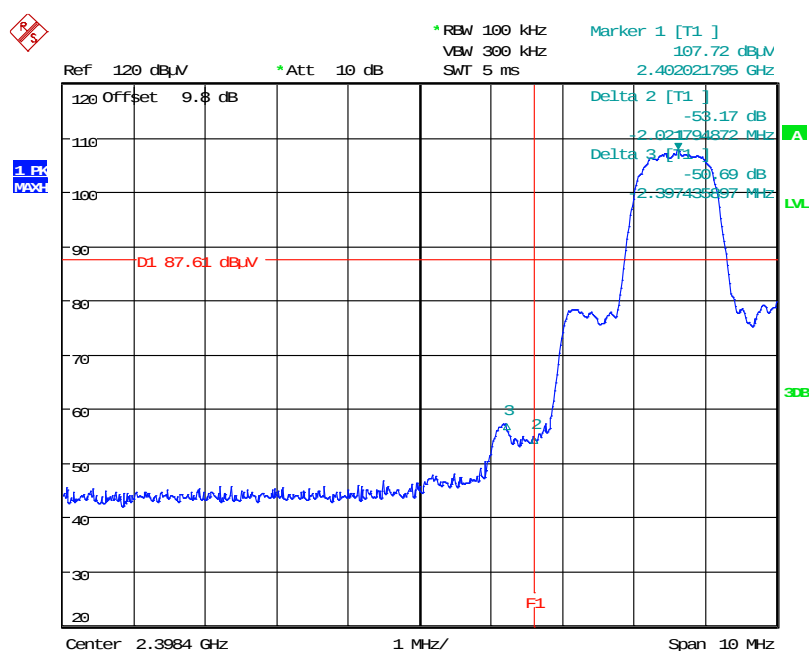
Date: 19.JUL.2013 12:18:33

Conducted Upper Band-edge Compliance - GFSK Modulation



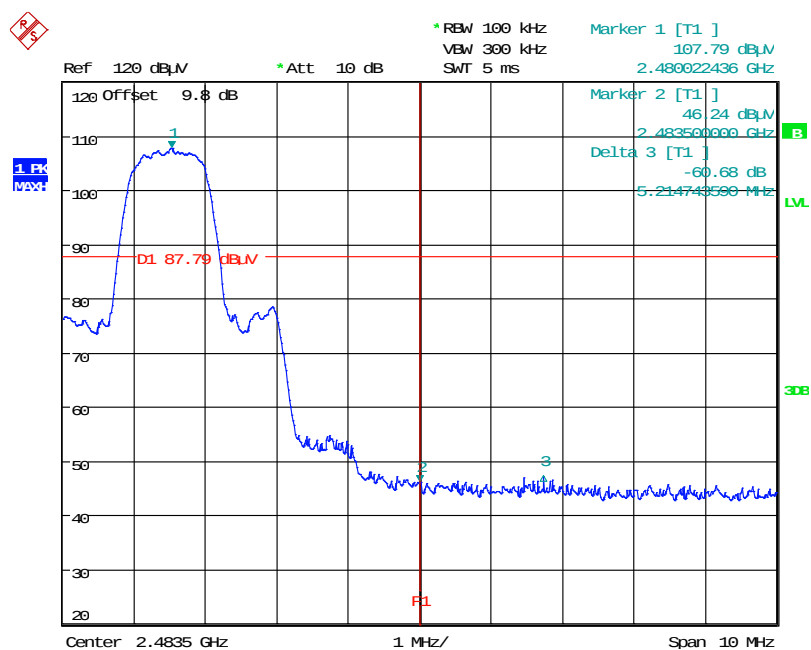
Date: 19.JUL.2013 12:21:18

Conducted Lower Band-edge Compliance - QPSK Modulation



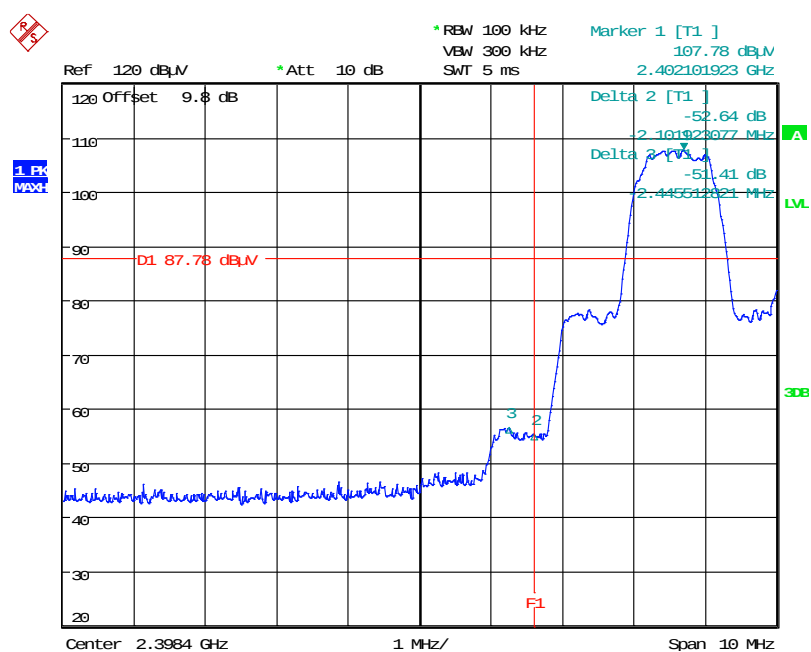
Date: 19.JUL.2013 12:17:24

Conducted Upper Band-edge Compliance - QPSK Modulation



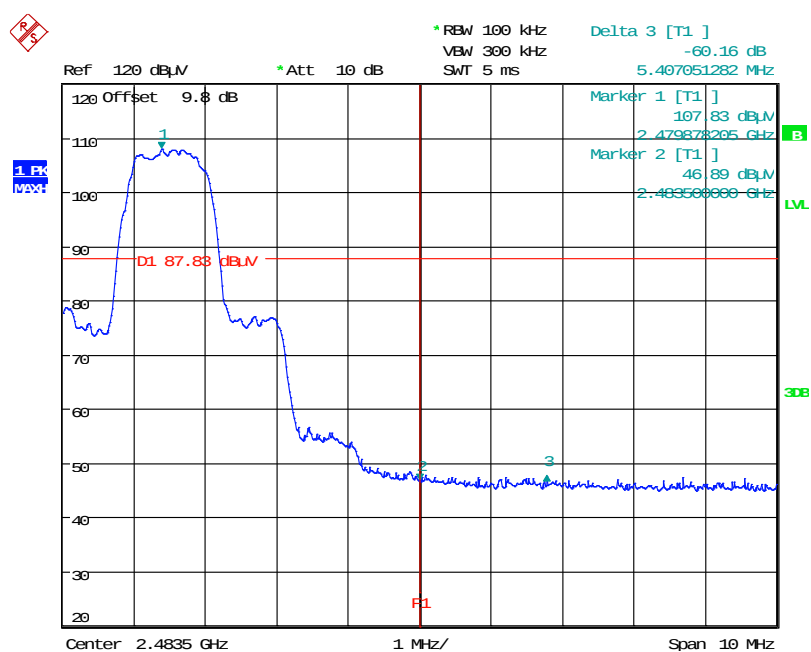
Date: 19.JUL.2013 12:22:39

Conducted Lower Band-edge Compliance - 8PSK Modulation



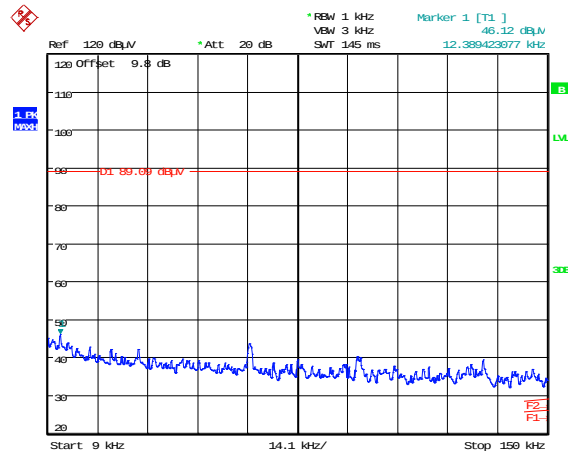
Date: 19.JUL.2013 12:16:06

Conducted Upper Band-edge Compliance - 8PSK Modulation



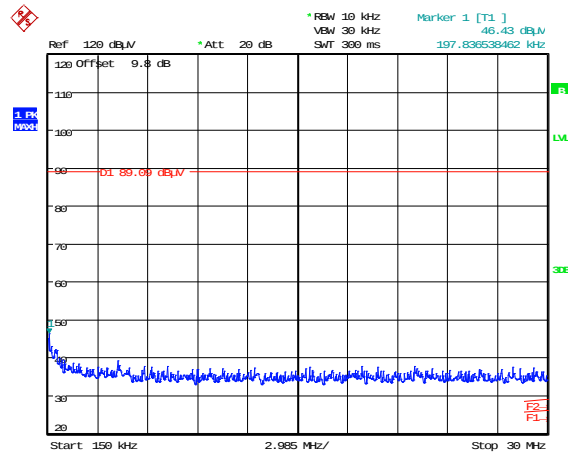
Date: 19.JUL.2013 12:37:18

Conducted Spurious Emissions 9kHz to 150kHz – 2402MHz



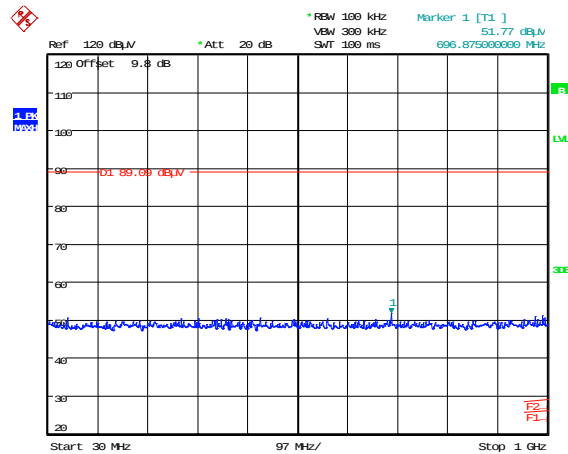
Date: 19.JUL.2013 12:52:38

Conducted Spurious Emissions 150kHz to 30MHz – 2402MHz



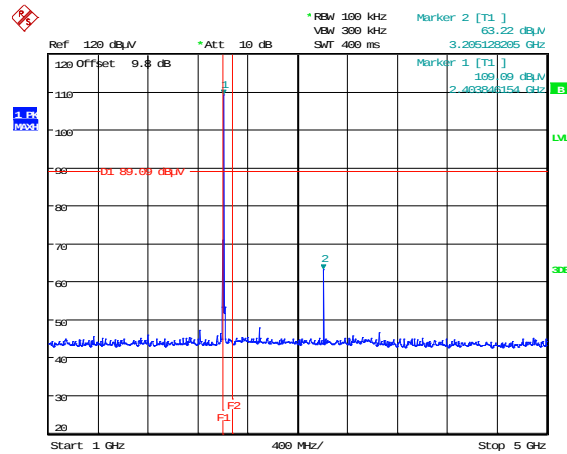
Date: 19.JUL.2013 12:53:07

Conducted Spurious Emissions 30MHz to 1GHz– 2402MHz



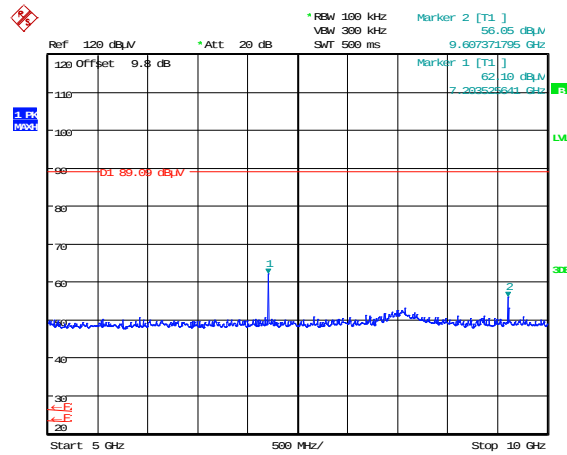
Date: 19.JUL.2013 12:50:10

Conducted Spurious Emissions 1GHz to 5GHz– 2402MHz



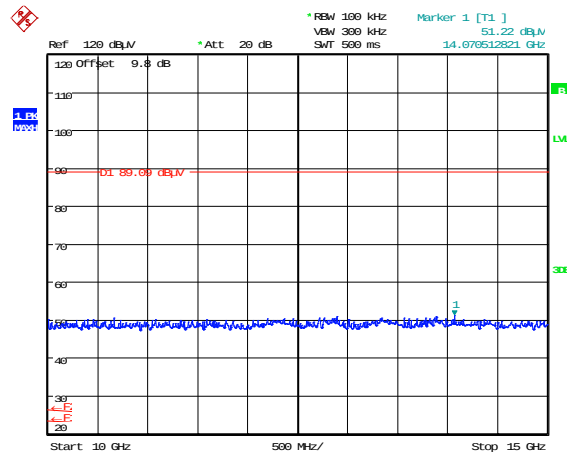
Date: 19.JUL.2013 12:49:44

Conducted Spurious Emissions 5GHz to 10GHz– 2402MHz



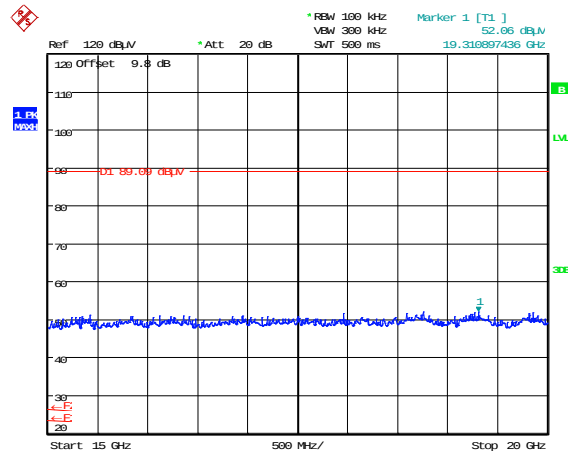
Date: 19.JUL.2013 12:51:08

Conducted Spurious Emissions 10GHz to 15GHz– 2402MHz



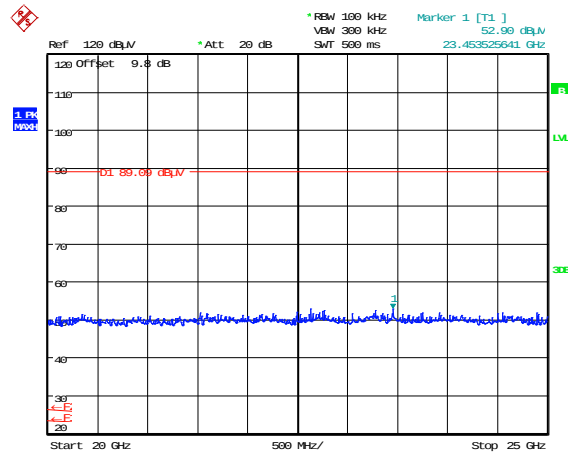
Date: 19.JUL.2013 12:51:27

Conducted Spurious Emissions 15GHz to 20GHz– 2402MHz



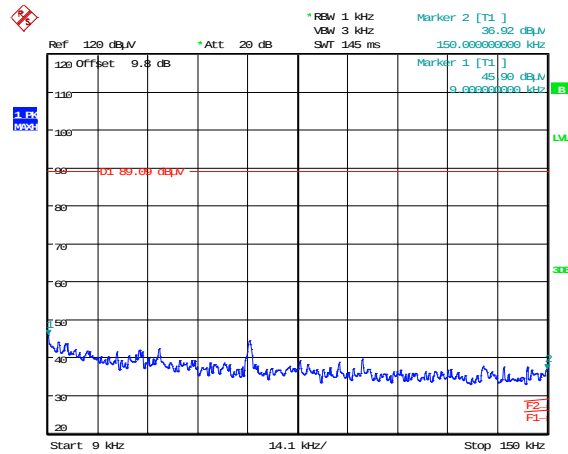
Date: 19.JUL.2013 12:51:43

Conducted Spurious Emissions 20GHz to 25GHz– 2402MHz



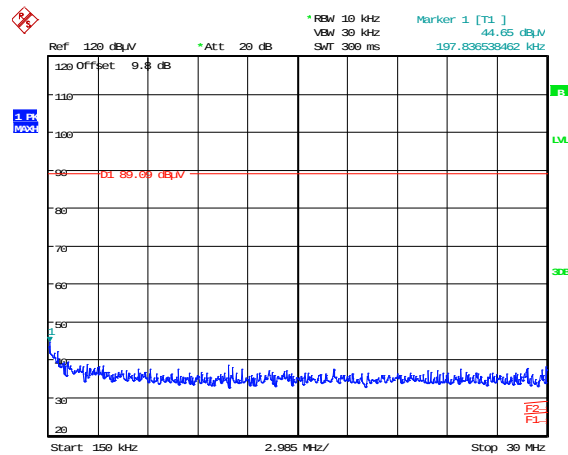
Date: 19.JUL.2013 12:52:05

Conducted Spurious Emissions 9kHz to 150kHz – 2441MHz



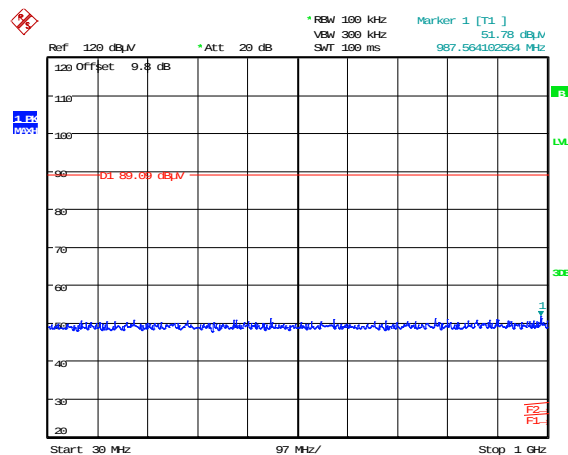
Date: 19.JUL.2013 12:54:11

Conducted Spurious Emissions 150kHz to 30MHz – 2441MHz



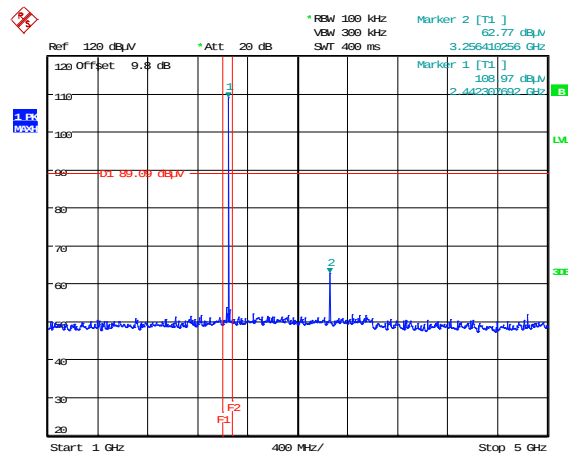
Date: 19.JUL.2013 12:54:34

Conducted Spurious Emissions 30MHz-1GHz– 2441MHz



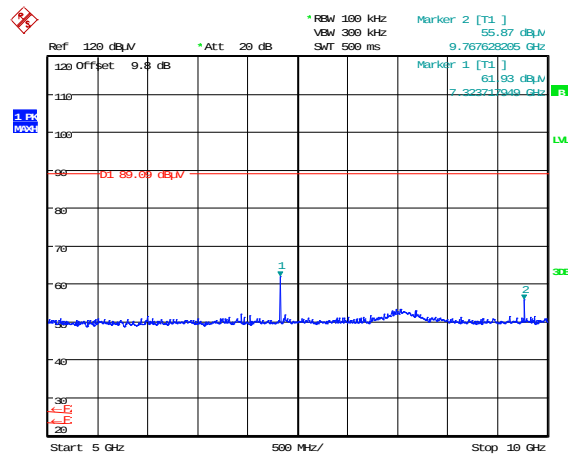
Date: 19.JUL.2013 12:55:23

Conducted Spurious Emissions 1GHz-5GHz – 2441MHz



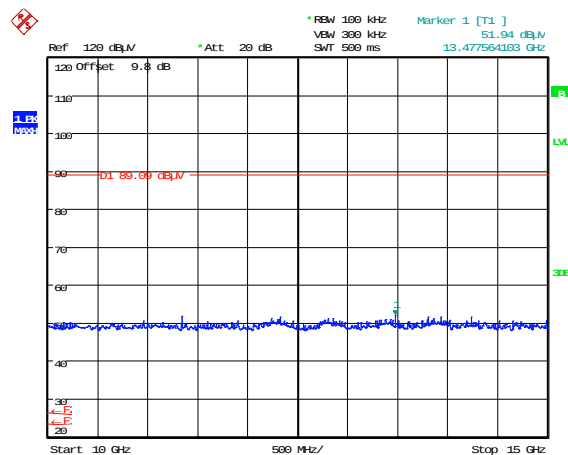
Date: 19.JUL.2013 12:53:48

Conducted Spurious Emissions 5GHz-10GHz – 2441MHz

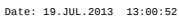
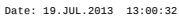


Date: 19.JUL.2013 12:59:38

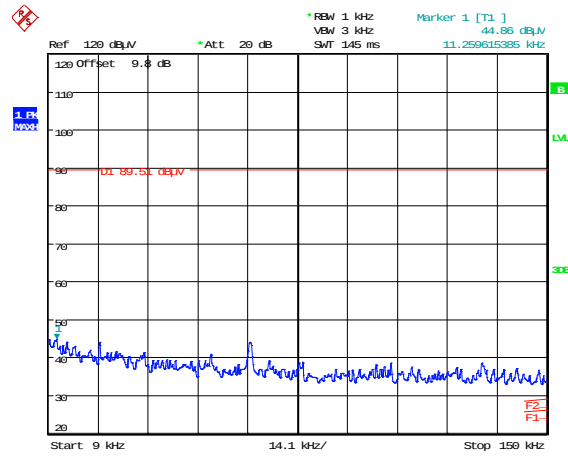
Conducted Spurious Emissions 10GHz-15GHz – 2441MHz



Date: 19.JUL.2013 13:00:12

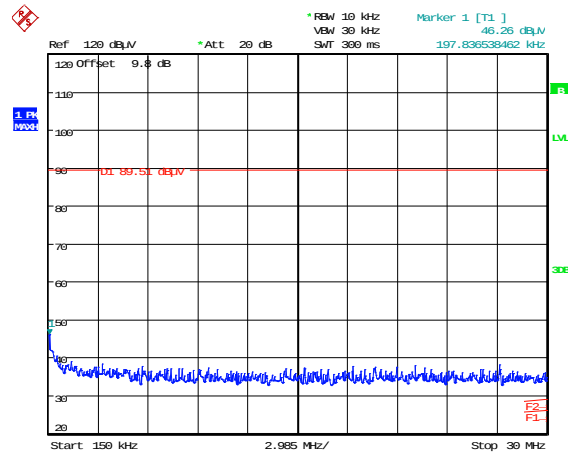


Conducted Spurious Emissions 9kHz to 150kHz – 2480MHz



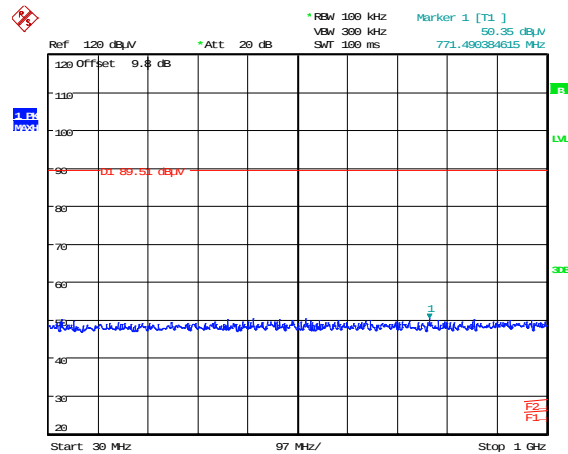
Date: 19.JUL.2013 13:03:54

Conducted Spurious Emissions 150kHz to 30MHz – 2480MHz



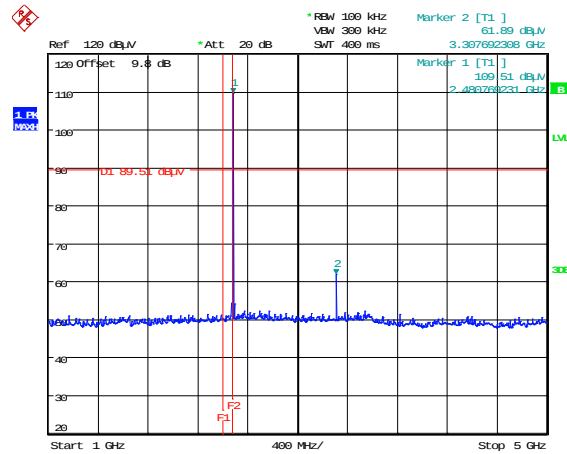
Date: 19.JUL.2013 13:04:20

Conducted Spurious Emissions 30MHz-1GHz – 2480MHz



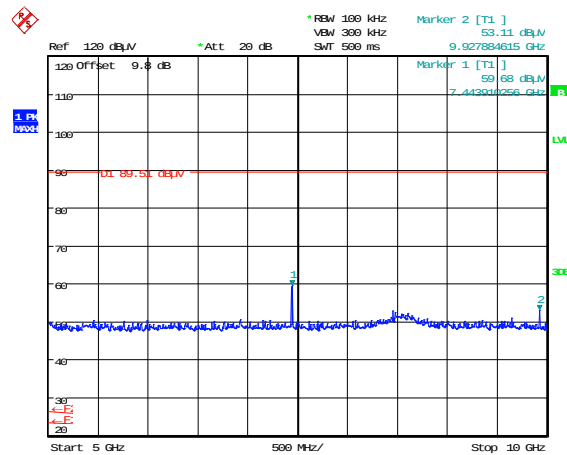
Date: 19.JUL.2013 13:03:20

Conducted Spurious Emissions 1GHz-5GHz – 2480MHz



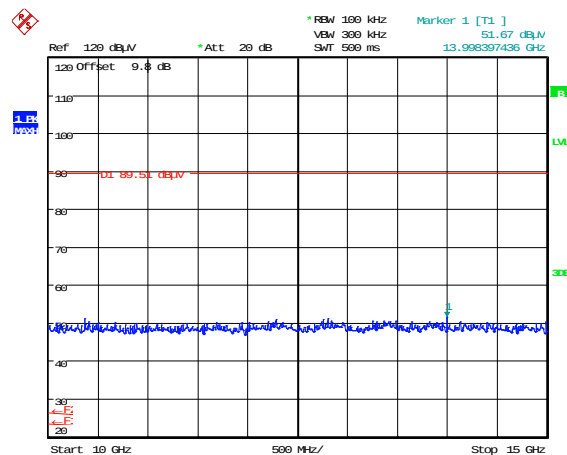
Date: 19.JUL.2013 13:01:47

Conducted Spurious Emissions 5GHz-10GHz – 2480MHz



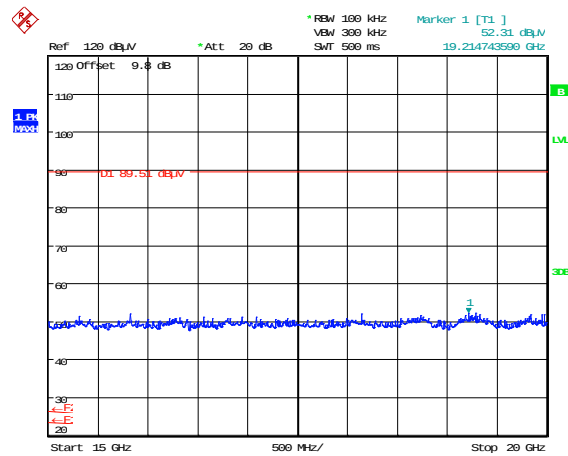
Date: 19.JUL.2013 13:02:14

Conducted Spurious Emissions 10GHz-15GHz – 2480MHz



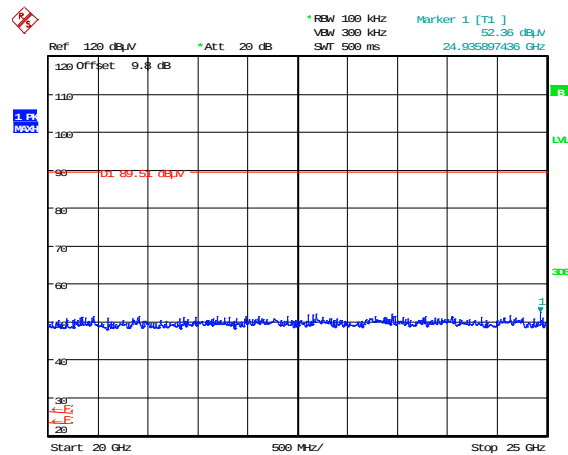
Date: 19.JUL.2013 13:02:29

Conducted Spurious Emissions 15GHz-20GHz – 2480MHz



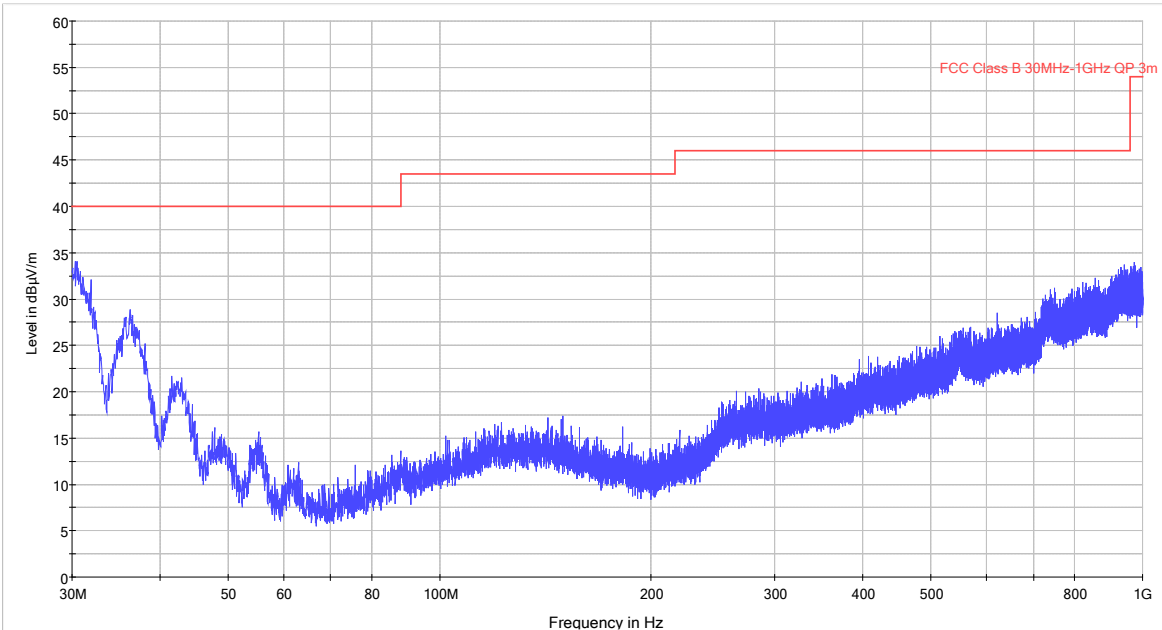
Date: 19.JUL.2013 13:02:50

Conducted Spurious Emissions 20GHz-25GHz – 2480MHz

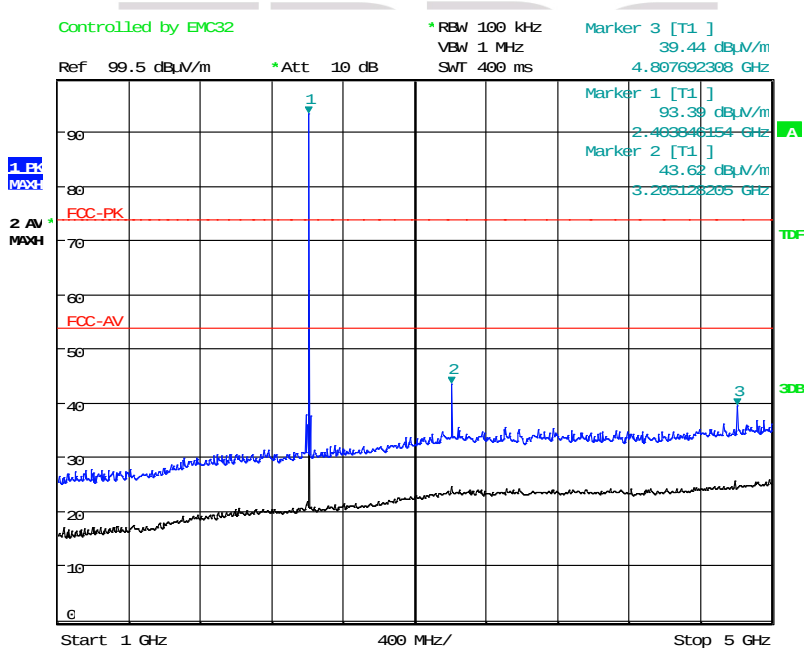


Date: 19.JUL.2013 13:03:06

Radiated Spurious Emissions 30MHz to 1GHz – 2402MHz

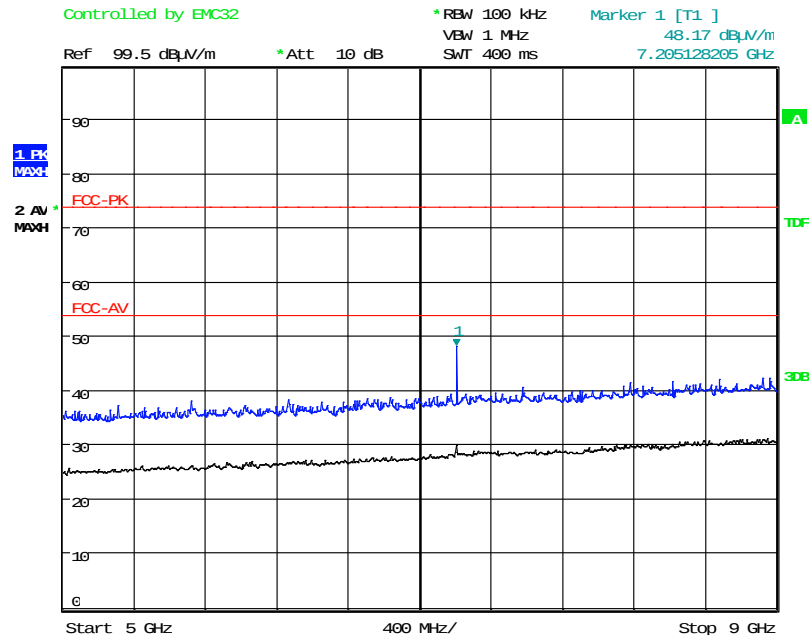


Radiated Spurious Emissions 1GHz to 5GHz – 2402MHz



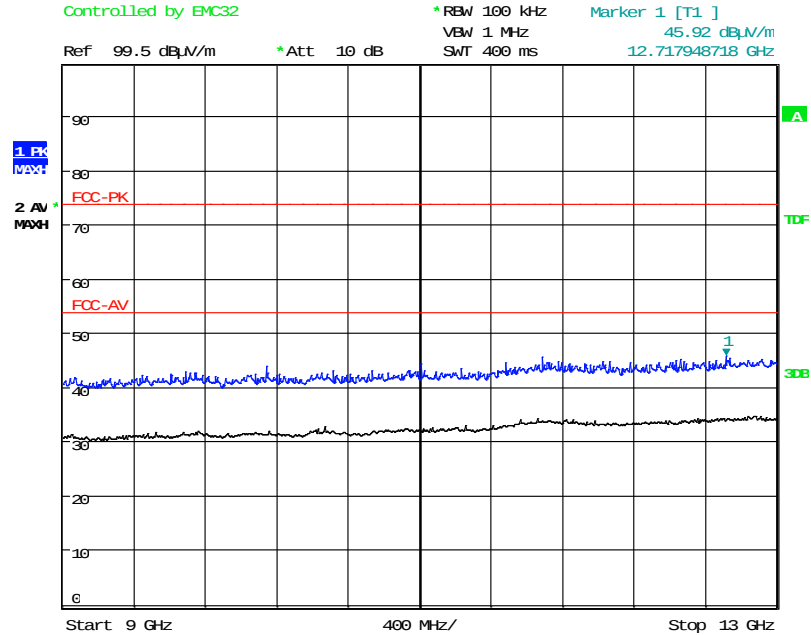
Date: 23.JUL.2013 12:36:32

Radiated Spurious Emissions 5GHz to 9GHz – 2402MHz



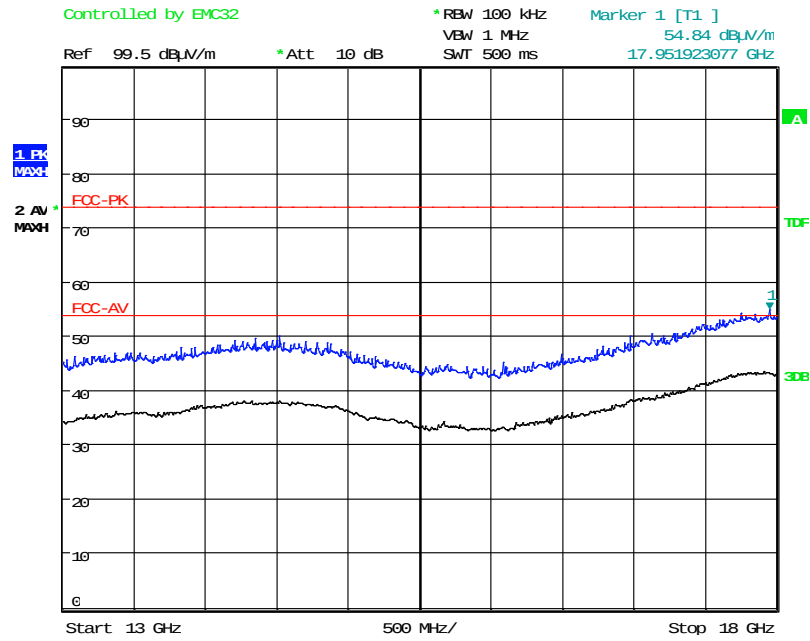
Date: 23.JUL.2013 12:35:31

Radiated Spurious Emissions 9GHz-13GHz– 2402MHz



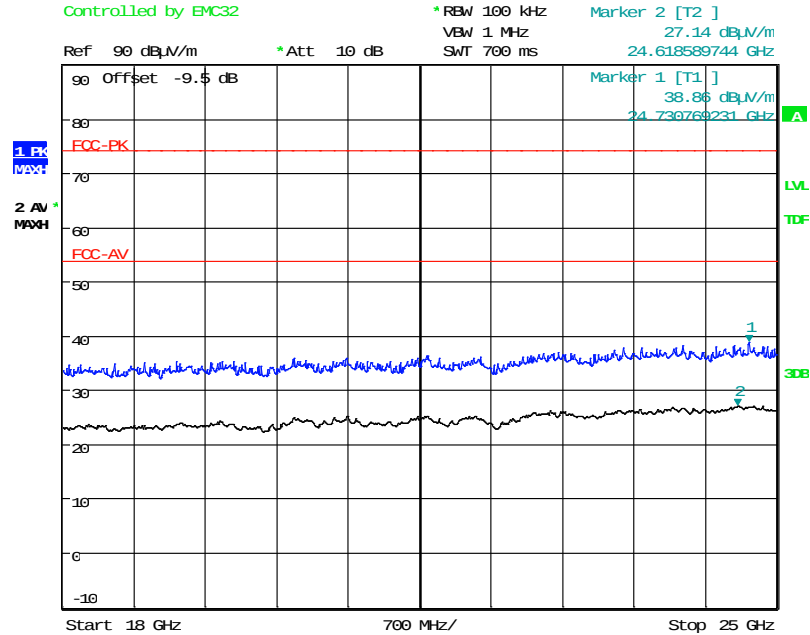
Date: 23.JUL.2013 12:34:42

Radiated Spurious Emissions 13GHz-18GHz – 2402MHz



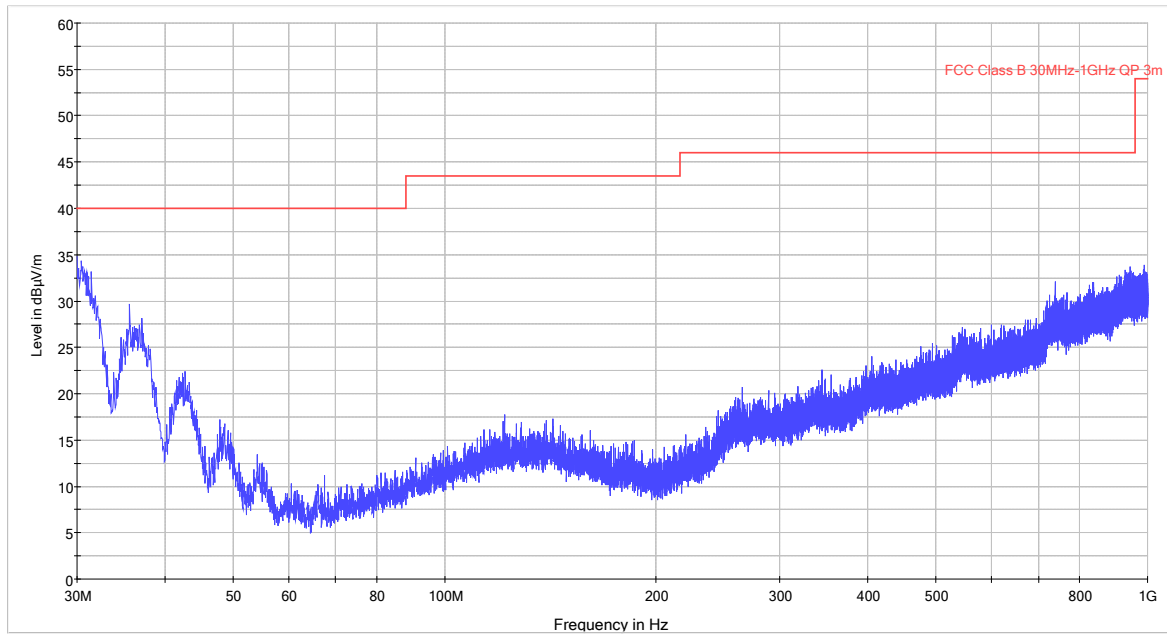
Date: 23.JUL.2013 12:33:51

Radiated Spurious Emissions 18GHz -25GHz– 2402MHz

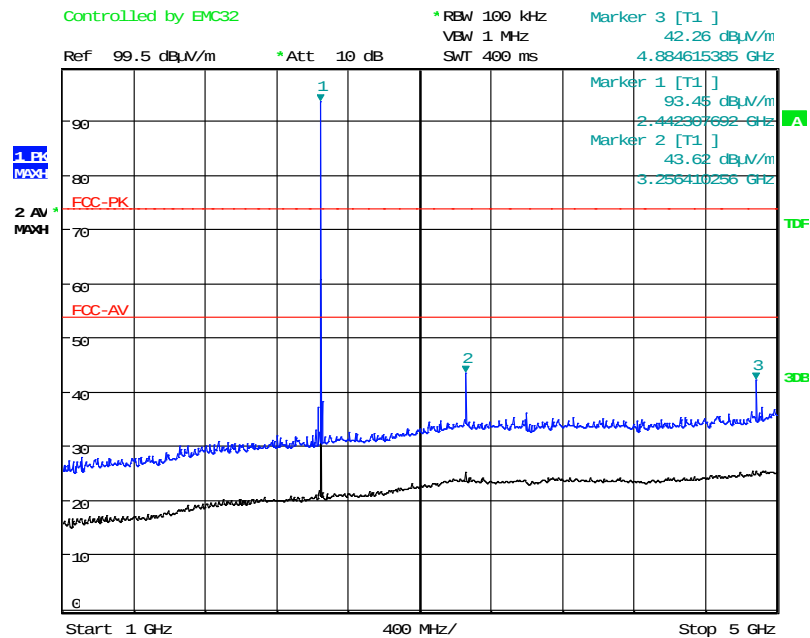


Date: 23.JUL.2013 11:44:15

Radiated Spurious Emissions 30MHz to 1GHz – 2441MHz

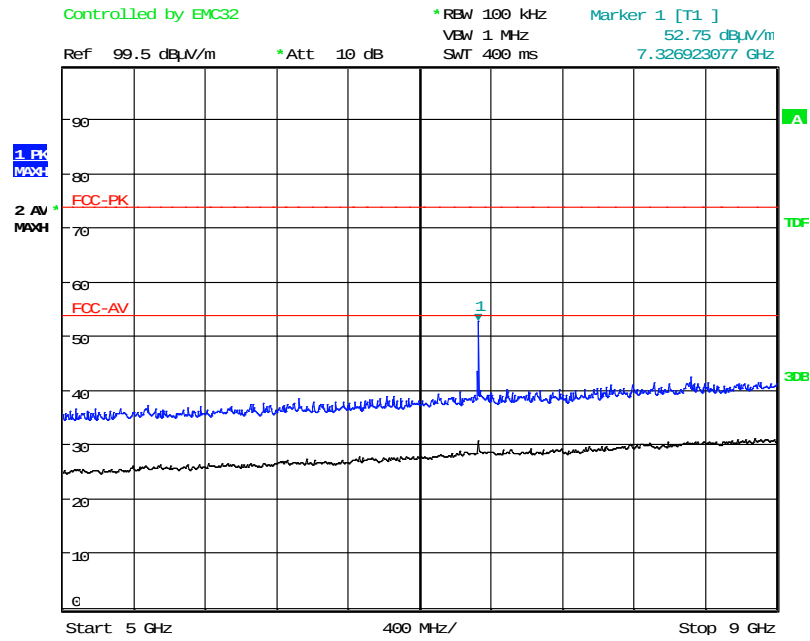


Radiated Spurious Emissions 1GHz to 5GHz – 2441MHz



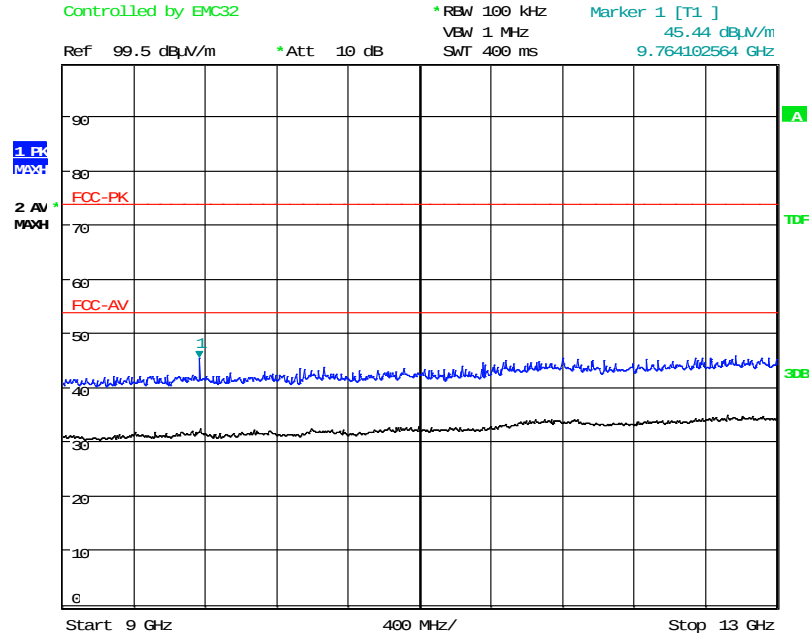
Date: 23.JUL.2013 12:15:52

Radiated Spurious Emissions 5GHz-9GHz – 2441MHz



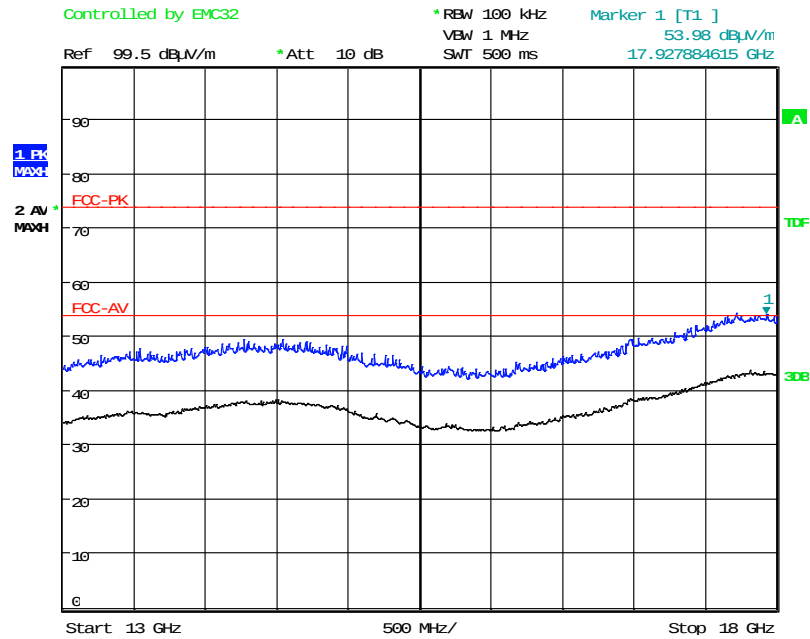
Date: 23.JUL.2013 12:16:52

Radiated Spurious Emissions 9GHz-13GHz – 2441MHz



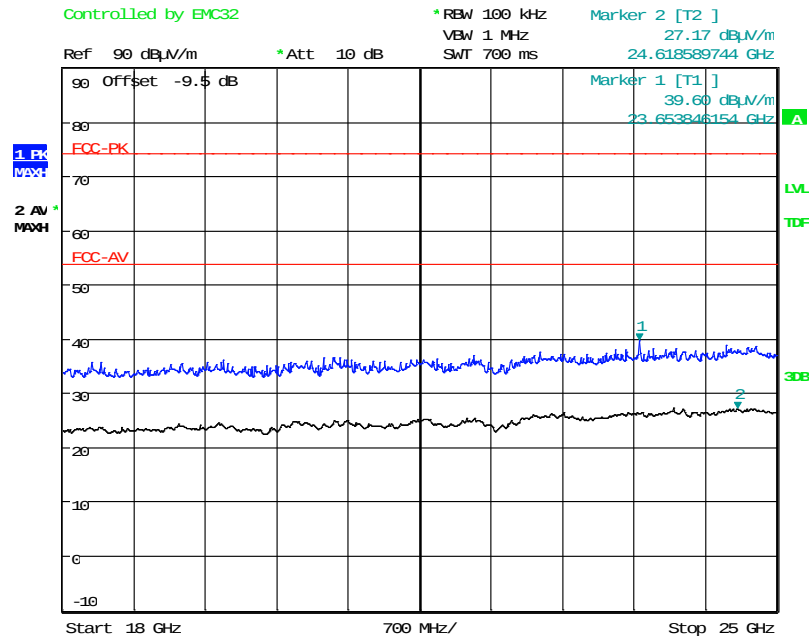
Date: 23.JUL.2013 12:18:13

Radiated Spurious Emissions 13GHz-18GHz – 2441MHz



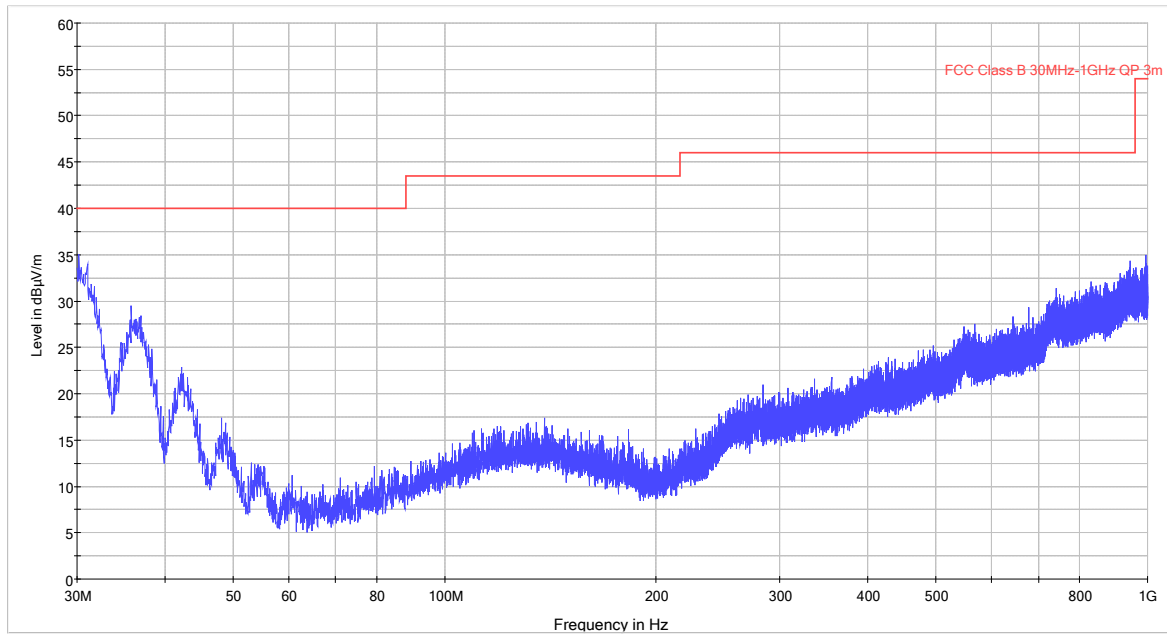
Date: 23.JUL.2013 12:19:14

Radiated Spurious Emissions 18GHz to 25GHz – 2441MHz

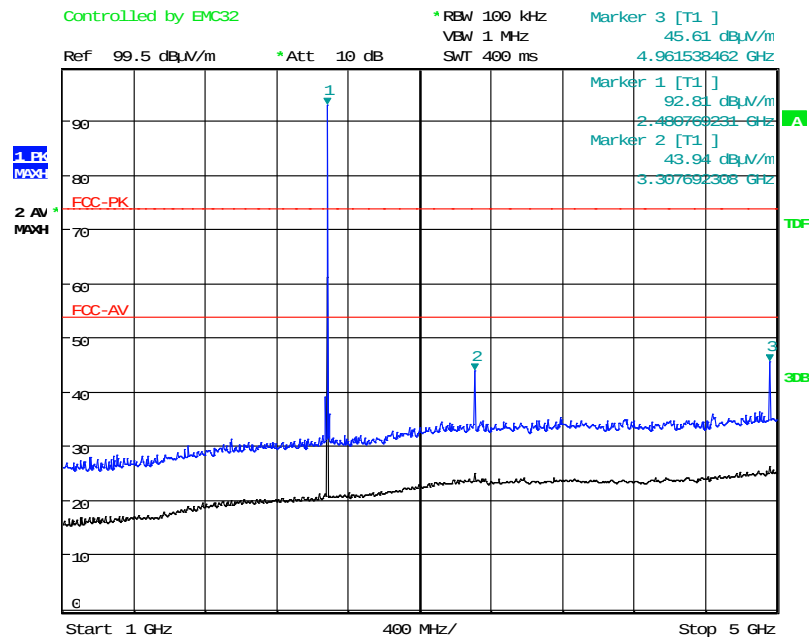


Date: 23.JUL.2013 11:46:02

Radiated Spurious Emissions 30MHz to 1GHz – 2480MHz

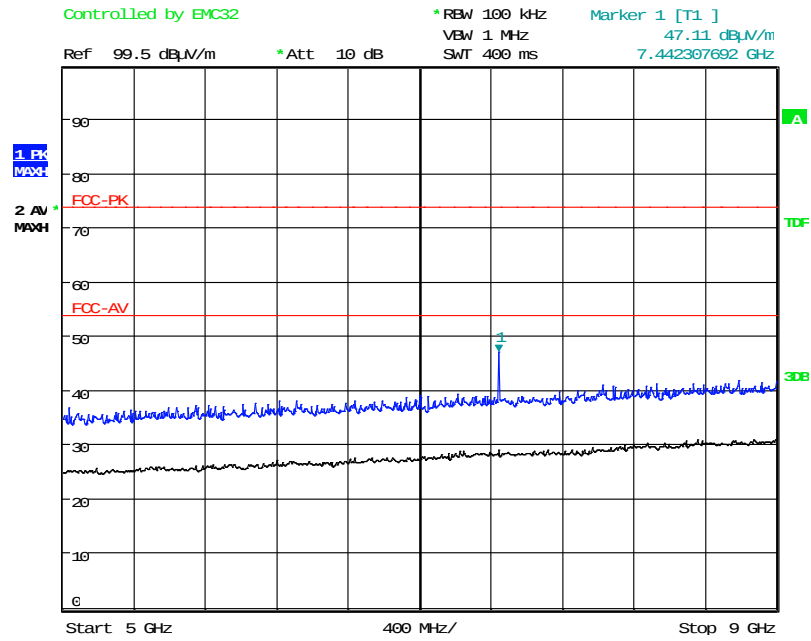


Radiated Spurious Emissions 1GHz to 5GHz – 2480MHz



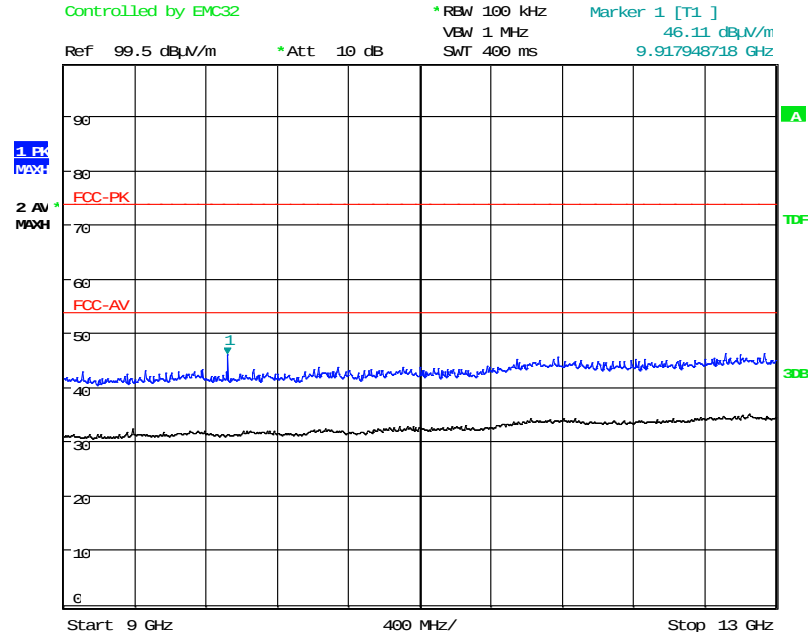
Date: 23.JUL.2013 12:13:43

Radiated Spurious Emissions 5GHz-9GHz– 2480MHz



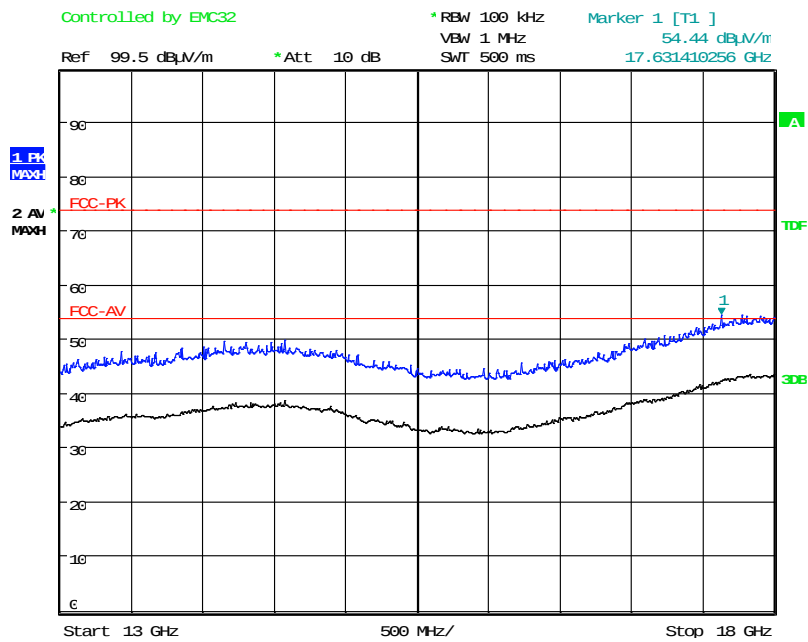
Date: 23.JUL.2013 12:12:10

Radiated Spurious Emissions 9GHz-13GHz – 2480MHz



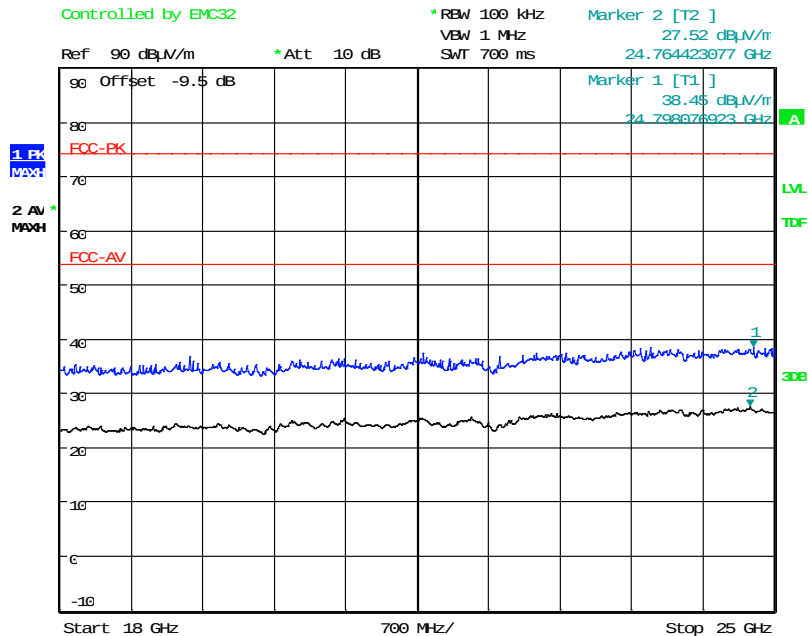
Date: 23.JUL.2013 12:10:13

Radiated Spurious Emissions 13GHz to 18GHz – 24801MHz

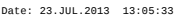
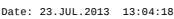
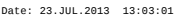


Date: 23.JUL.2013 12:07:09

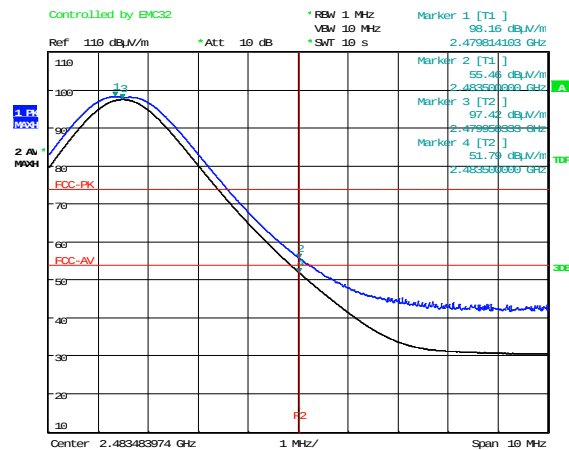
Radiated Spurious Emissions 18GHz to 25GHz – 2480MHz



Date: 23.JUL.2013 11:50:16

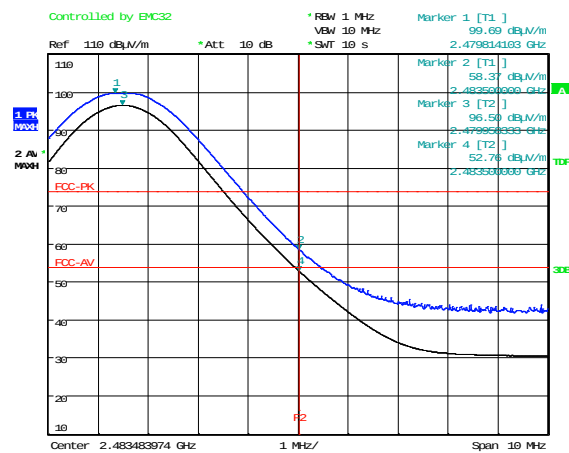


Radiated Upper Band-edge Compliance – GFSK Modulation



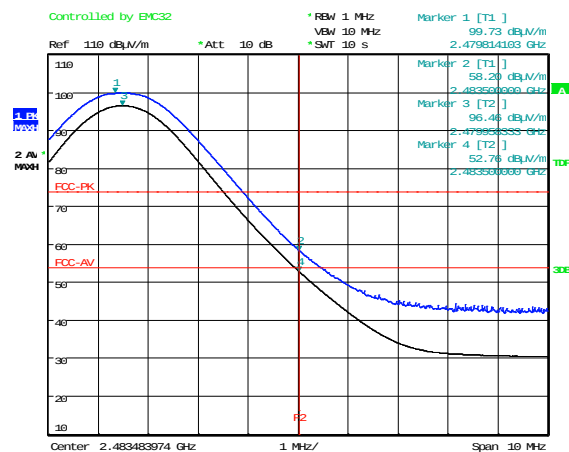
Date: 23. JUL.2013 12:56:45

Radiated Upper Band-edge Compliance – QPSK Modulation



Date: 23. JUL.2013 12:57:57

Radiated Upper Band-edge Compliance – 8PSK Modulation



Date: 23. JUL.2013 12:58:46

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
S10	TV REMOTE CONTROLLER With Antenna Connector	Model Number: RMF-YD003
S11	TV REMOTE CONTROLLER Without Antenna Connector	Model Number: RMF-YD003

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 or hopping as required using the following using GFSK Modulation, QPSK Modulation or 8PSK Modulation
Band-edge tests, channel separation, number of channels, hop frequency	EUT transmitting, hopping on all channels
Unintentional spurious emissions	EUT in receive mode.

Type of Modulation	Packet Length	Packet type
GFSK	339	DH5/3-DH5
QPSK	679	DM5/2-DH5
8PSK	1021	DH5/3-DH5

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 : S10
Tests : All conducted tests

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

Sample : S11
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	ESVS11	Receiver	R&S	11/02/2013
UH093	CBL6112B	30MHz – 2GHz Bilog	Chase	20/06/2011
UH281	FSU46	Spectrum Analyser	R&S	06/03/2013
TRL572	8449B	Pre Amp	Agilent	12/12/2012
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.

$$\begin{aligned}\text{Duty cycle} &= \frac{\text{the sum of the highest average value pulsewidths over 100ms}}{100\text{ms}} \\ &= \frac{5.8044\text{ms}}{100\text{ms}} = 0.058044 \\ &0.058044 \text{ or } 5.8044\%\end{aligned}$$

Correction factor (dB) = $20 \times \text{Log}_{10} (1/0.058044) = 24.7\text{dB}$

Duty cycle correction may not be applicable / required by the device covered in this report. The correction factor above is for example of how the correction is calculated. Any applicable duty cycle used will be recorded in the relevant results sections of this report.

Appendix F:

Photographs and Figures

The following photographs were taken of the test samples:

1. Radiated electric field emissions arrangement: Overview.
2. Radiated electric field emissions arrangement: Close Up.



Photograph 1



Photograph 2

Appendix G:**MPE Calculation**

OET Bulletin No. 65, Supplement C 01-01

47 CFR §§1.1307 and 2.1091 & RSS-102

Radio frequency radiation exposure evaluation:

For purposes of these requirements mobile devices are defined by the FCC as transmitters designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimetres is normally maintained between radiating structures and the body of the user or nearby persons. These devices are normally evaluated for exposure potential with relation to the MPE limits. As the 20cm separation specified under FCC rules may not be achievable under normal operation of the EUT, an RF exposure calculation is needed to show the minimum distance required to be less than 1mW/cm² or 10W/m² power density limit, as required.

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{EIRP}{4\pi R^2} \text{ re - arranged } R = \sqrt{\frac{EIRP}{S 4\pi}}$$

where:

S = power density

R = distance to the centre of radiation of the antenna

EIRP = EUT Maximum power

Note:

The EIRP measurement was performed using a signal substitution method.

Result

Prediction Frequency (MHz)	Conducted Power (dBm)	Peak Antenna Gain (dBi)	Maximum EIRP (mW)	Power density limit (S) (mW/cm ²)	Distance (R) cm required to be less than 1mW/cm ²
2402 MHz	4.93	-3.47	1.40	1	0.34 cm
2480 MHz	5.14	-4.32	1.20	1	0.31 cm

1 mW/cm² = 10 W/m²



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