

An Engineering Document

FOR

Buddi Limited

ON

Buddi Colorado System - Smart Tag

Document No. TRA-021068-02-47-01A

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-021068-02-47-01A

Applicant : Buddi Limited

Apparatus : Buddi Colorado System – Smart Tag

Specification(s) : FCC CFR47 Part 15(c) & RSS-210 Issue 8

Purpose of Test : Certification

FCC ID : ZDLST1

Authorised by :



: Radio Product Manager

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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: A Tosif

Report author: A Tosif

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1.2 Tests Requested By

This testing in this report was requested by:

Buddi Limited

Talbot House
17 Church Street
Rickmansworth
Herts
WD3 1DE

1.3 Manufacturer

As above

1.4 Apparatus Assessed

The following apparatus was assessed between 17th and 25th June 2014.

- Buddi Colorado System – Smart Tag

The Smart Tag is an ankle worn device fitted with a GPS, GSM modem and SRD operating in the band 902 – 928MHz. SRD and GSM do not operate simultaneously.

Full testing is done on each of the three modes of operations listed below.

- Smart Tag Standalone
- Smart Tag with on body Charger
- Smart Tag with Docking Station

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	FCC Regulation	IC Regulation	Measurement standard	Result
Spurious Emissions Radiated	Title 47 of the CFR: Part 15 Subpart (c) 15.249(a)(d)	RSS-210 Issue 8 December 2010 Annex 2 A2.9	ANSI C63.10	Pass
Unintentional Radiated Spurious Emissions	Title 47 of the CFR: Part 15 Subpart (b) 15.109	RSS-Gen Issue 3 December 2010 Section 4.10	ANSI C63.10	Pass
AC Power conducted emissions	Title 47 of the CFR: Part 15 Subpart (c) 15.207	RSS-Gen Issue 3 December 2010 Section 7.2.4	ANSI C63.10	Pass
Intentional Emission Frequency	Title 47 of the CFR: Part 15 Subpart (c) 15.249 (a)	RSS-210 Issue 8 December 2010 Annex 2 A2.9	ANSI C63.10	Pass
Intentional Emission Field Strength	Title 47 of the CFR: Part 15 Subpart (c) 15.249 (a)	RSS-210 Issue 8 December 2010 Annex 2 A2.9	ANSI C63.10	Pass
Intentional Emission Band Occupancy	Title 47 of the CFR: Part 15 Subpart (c) 15.215 (c)	RSS-Gen Issue 3 December 2010 Section 4.6.1	ANSI C63.10	Pass

Abbreviations used in the above table:

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

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

1.6 Notes relating to the assessment

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

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

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

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

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

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

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

Temperature	: 20 to 22 °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**

For the test data recorded in accordance with note (iii) of Section 2.1 the following measurement uncertainty was calculated:

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 Intentional Emission Radiated

Test Details: Smart Tag Standalone	
Regulation	Part15 Subpart (c) 15.249 (a) / RSS-210 Issue 8 Annex 2 A2.9
Measurement standard	ANSI C63.10:2003
EUT sample number	S28
Modification state	0
SE in test environment	S24
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	21.6°C
Photographs	Refer to Appendix F

FREQ. (MHz)	MEASUREMENT Rx. READING (dBµV)	CABLE LOSS (dB)	ANT FACTOR (dB/m)	DUTY CYCLE CORRECTION (dB)	FIELD STRENGTH (dBµV/m)	FIELD STRENGTH (mV/m)
914.5	67.9	4.5	23.4	-	95.7	61.0pk
914.5	67.9	4.5	23.4	24.5	71.2	3.6av
917.5	67.7	4.5	23.6	-	95.7	61.2pk
917.5	67.7	4.5	23.6	24.5	71.2	3.6av
921.0	67.8	4.5	23.6	-	95.8	61.9pk
921.0	67.8	4.5	23.6	24.5	71.3	3.7av
Limit av			50mV/m @ 3m			

Test Details: Smart Tag with on body charger	
Regulation	Part15 Subpart (c) 15.249 (a) / RSS-210 Issue 8 Annex 2 A2.9
Measurement standard	ANSI C63.10:2003
EUT sample number	S28
Modification state	0
SE in test environment	S10
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	21.6°C
Photographs	Refer to Appendix F

FREQ. (MHz)	MEASUREMENT Rx. READING (dBµV)	CABLE LOSS (dB)	ANT FACTOR (dB/m)	DUTY CYCLE CORRECTION (dB)	FIELD STRENGTH (dBµV/m)	FIELD STRENGTH (mV/m)
914.5	67.1	4.5	23.4	-	94.9	55.6pk
914.5	67.1	4.5	23.4	24.5	70.4	3.3av
917.5	66.8	4.5	23.6	-	94.8	55.2pk
917.5	66.8	4.5	23.6	24.5	70.3	3.3av
921.0	66.5	4.5	23.6	-	94.5	53.3pk
921.0	66.5	4.5	23.6	24.5	70.0	3.2av
Limit av			50mV/m @ 3m			

Test Details: Smart Tag with docking station	
Regulation	Part15 Subpart (c) 15.249 (a) / RSS-210 Issue 8 Annex 2 A2.9
Measurement standard	ANSI C63.10:2003
EUT sample number	S28
Modification state	0
SE in test environment	S07, S17
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	21.6°C
Photographs	Refer to Appendix F

FREQ. (MHz)	MEASUREMENT Rx. READING (dBµV)	CABLE LOSS (dB)	ANT FACTOR (dB/m)	DUTY CYCLE CORRECTION (dB)	FIELD STRENGTH (dBµV/m)	FIELD STRENGTH (mV/m)
914.5	67.4	4.5	23.4	-	95.2	57.5pk
914.5	67.4	4.5	23.4	24.5	70.7	3.4av
917.5	67.5	4.5	23.6	-	95.5	59.8pk
917.5	67.5	4.5	23.6	24.5	71.0	3.6av
921.0	68.3	4.5	23.6	-	96.3	65.5pk
921.0	68.3	4.5	23.6	24.5	71.8	3.9av
Limit av			50mV/m @ 3m			

- Notes:**
- 1 Results quoted are extrapolated as indicated
 - 2 Receiver detector @ fc = Peak / 120kHz bandwidth
 - 3 When battery powered the EUT was powered with new batteries

- Test Method:**
- 1 As per Radio – Noise Emissions, ANSI C63.10
 - 2 Measuring distances 3m
 - 3 EUT 0.8 metre above ground plane
 - 4 Emissions maximised by rotation of EUT, on an automatic turntable.
Raising and lowering the receiver antenna between 1m & 4m.
Horizontal and vertical polarisations, of the receive antenna.
EUT orientation in three orthogonal planes.
Maximum results recorded

A2 Transmitter Bandwidth

Test Details:	
Regulation	Part 15.215 (c) / RSS-Gen Issue 3 Section 4.6.1
Measurement standard	ANSI C63.10:2009
EUT sample number	S05
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	22.5°C

Band occupancy @ -20 dBc			
FREQ. (MHz)	f lower (MHz)	f higher (MHz)	Occ BW (kHz)
914.5	914.462404	914.532620	70.216
917.5	917.461298	917.531514	70.216
921.0	920.960745	921.030961	70.216

The 20dB Bandwidth of the carrier must be contained within the frequency band 902-928 MHz.

99% Band occupancy			
FREQ. (MHz)	f lower (MHz)	f higher (MHz)	Occ BW (kHz)
914.5	914.330929	914.661058	330.128
917.5	917.334135	917.660256	326.122
921.0	920.837340	921.156250	318.910

A3 Radiated Electric Field Emissions

Preliminary scans were performed using a peak detector with the RBW = 100 kHz. The radiated electric field emission test applies to all spurious emissions and harmonics emissions. The maximum permitted field strength is listed in Part 15 Subpart (c) Clause 15.209 (a) / RSS-Gen Issue 3 Section 7.2.5. The EUT was set to transmit as required.

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: Smart Tag Standalone	
Regulation	Part 15 Subpart (c) Clause 15.249 (a)(d) / RSS-210 Issue 8 Annex 2 A2.9
Measurement standard	ANSI C63.10:2003
Frequency range	30MHz-16GHz
EUT sample number	S28
Modification state	0
SE in test environment	S24
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	23.6°C

The worst case emissions are listed below:

Bottom Channel

Ref No.	FREQ. (MHz)	MEAS Rx (dBµV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	HPF Loss (dB)	Duty Cycle correction (dB)	Field ST'GH (dBµV/m)	FIELD ST'GH (µV/m)	LIMIT (µV/m)
1.	1828.97	63.0	3.0	27.1	36.3	-	-	56.8	694.2pk	5011pk
2.	1828.97	63.0	3.0	27.1	36.3	-	24.5	32.3	41.4av	500av
3.	2743.44	46.1	3.2	29.1	36.0	-	-	42.4	131.7av	500av
4.	3657.92	48.6	3.1	31.5	35.7	-	-	47.5	237.4av	500av
5.	4572.52	38.4	3.6	32.3	35.6	-	-	38.7	86.4av	500av
6.	5486.84	43.3	3.9	33.9	35.7	-	-	45.4	186.0av	500av
7.	7315.92	38.7	4.4	36.5	36.1	-	-	43.5	148.8av	500av

Middle Channel

Ref No.	FREQ. (MHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	HPF Loss (dB)	Duty Cycle correction (dB)	Field ST'GH (dBμV/m)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
8.	1834.91	61.5	3.0	27.2	36.3	-	-	55.4	590.9pk	5011pk
9.	1834.91	61.5	3.0	27.2	36.3	-	24.5	30.9	35.2av	500av
10.	2752.39	45.0	3.1	29.1	36.0	-	-	41.2	114.2av	500av
11.	3669.94	48.6	3.1	31.6	35.7	-	-	47.6	239.6av	500av
12.	4587.40	39.0	3.6	32.3	35.6	-	-	39.3	92.4av	500av
13.	5504.95	43.2	3.9	33.9	35.7	-	-	45.3	184.7av	500av
14.	7339.86	39.3	4.3	36.6	36.1	-	-	44.1	160.7av	500av

Top Channel

Ref No.	FREQ. (MHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	HPF Loss (dB)	Duty Cycle correction (dB)	Field ST'GH (dBμV/m)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
15.	1841.98	62.0	2.9	27.2	36.3	-	-	55.8	618.7pk	5011pk
16.	1841.98	62.0	2.9	27.2	36.3	-	24.5	31.3	36.9av	500av
17.	2762.99	43.4	3.2	29.1	36.0	-	-	39.7	96.1av	500av
18.	3683.91	48.3	3.1	31.7	35.7	-	-	47.4	233.6av	500av
19.	4604.91	39.0	3.6	32.3	35.6	-	-	39.3	92.7av	500av
20.	5525.94	43.4	3.9	33.9	35.7	-	-	45.5	187.7av	500av
21.	7367.94	39.7	4.4	36.7	36.2	-	-	44.6	170.0av	500av

Radiated Electric Field Emissions continued:

Test Details: Smart Tag with on body charger	
Regulation	Part 15 Subpart (c) Clause 15.249 (a)(d) / RSS-210 Issue 8 Annex 2 A2.9
Measurement standard	ANSI C63.10:2003
Frequency range	30MHz-16GHz
EUT sample number	S28
Modification state	0
SE in test environment	S10
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	23.6° C

The worst case emissions are listed below:

Bottom Channel

Ref No.	FREQ. (MHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	HPF Loss (dB)	Duty Cycle correction (dB)	Field ST'GH (dBμV/m)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
1.	1828.97	64.6	3.0	27.1	36.3	-	-	58.4	827.0pk	5011pk
2.	1828.97	64.6	3.0	27.1	36.3	-	24.5	33.9	49.3av	500av
3.	2743.44	47.3	3.2	29.1	36.0	-	-	43.6	150.5av	500av
4.	3657.92	49.9	3.1	31.5	35.7	-	-	48.8	274.8av	500av
5.	4572.52	43.6	3.6	32.3	35.6	-	-	43.9	156.7av	500av
6.	5486.84	44.8	3.9	33.9	35.7	-	-	46.9	222.1av	500av

Middle Channel

Ref No.	FREQ. (MHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	HPF Loss (dB)	Duty Cycle correction (dB)	Field ST'GH (dBμV/m)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
7.	1834.91	63.0	3.0	27.2	36.3	-	-	56.9	698.2pk	5011pk
8.	1834.91	63.0	3.0	27.2	36.3	-	24.5	32.4	41.6av	500av
9.	2752.39	43.0	3.1	29.1	36.0	-	-	39.2	90.9av	500av
10.	3669.94	49.7	3.1	31.6	35.7	-	-	48.7	270.7av	500av
11.	4587.40	43.9	3.6	32.3	35.6	-	-	44.2	162.4av	500av
12.	5504.95	44.5	3.9	33.9	35.7	-	-	46.6	214.3av	500av

Top Channel

Ref No.	FREQ. (MHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	HPF Loss (dB)	Duty Cycle correction (dB)	Field ST'GH (dBμV/m)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
13.	1841.98	61.7	2.9	27.2	36.3	-	-	55.5	598.4pk	5011pk
14.	1841.98	61.7	2.9	27.2	36.3	-	24.5	31.0	35.6av	500av
15.	2762.99	41.7	3.2	29.1	36.0	-	-	38.0	79.8av	500av
16.	3683.91	48.5	3.1	31.7	35.7	-	-	47.6	239.9av	500av
17.	4604.91	43.1	3.6	32.3	35.6	-	-	43.4	147.7av	500av
18.	5525.94	45.4	3.9	33.9	35.7	-	-	47.5	237.4av	500av

Radiated Electric Field Emissions continued:

Test Details: Smart Tag with docking station	
Regulation	Part 15 Subpart (c) Clause 15.249 (a)(d) / RSS-210 Issue 8 Annex 2 A2.9
Measurement standard	ANSI C63.10:2003
Frequency range	30MHz-16GHz
EUT sample number	S28
Modification state	0
SE in test environment	S7, S17
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	23.6° C

The worst case emissions are listed below:

Bottom Channel

Ref No.	FREQ. (MHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	HPF Loss (dB)	Duty Cycle correction (dB)	Field ST'GH (dBμV/m)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
1.	1828.97	61.9	3.0	27.1	36.3	-	-	55.7	608.1av	500av
2.	1828.97	59.8	3.0	27.1	36.3	-	-	53.6	480.3av	500av
3.	2743.44	43.5	3.2	29.1	36.0	-	-	39.8	98.2av	500av
4.	3657.92	47.2	3.1	31.5	35.7	-	-	46.1	200.7av	500av
5.	5486.84	41.6	3.9	33.9	35.7	-	-	43.7	152.4av	500av

Middle Channel

Ref No.	FREQ. (MHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	HPF Loss (dB)	Duty Cycle correction (dB)	Field ST'GH (dBμV/m)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
6.	1834.91	61.2	3.0	27.2	36.3	-	-	55.1	571.5av	500av
7.	1834.91	59.6	3.0	27.2	36.3	-	-	53.5	473.2av	500av
8.	2752.39	42.6	3.1	29.1	36.0	-	-	38.8	87.0av	500av
9.	3669.94	45.7	3.1	31.6	35.7	-	-	44.7	172.6av	500av
10.	5504.95	41.5	3.9	33.9	35.7	-	-	43.6	151.2av	500av

Top Channel

Ref No.	FREQ. (MHz)	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	HPF Loss (dB)	Duty Cycle correction (dB)	Field ST'GH (dBμV/m)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
11.	1841.98	60.7	2.9	27.2	36.3	-	-	54.5	532.1av	500av
12.	1841.98	59.0	2.9	27.2	36.3	-	-	52.8	437.5av	500av
13.	2762.99	42.5	3.2	29.1	36.0	-	-	38.8	86.8av	500av
14.	3683.91	45.3	3.1	31.7	35.7	-	-	44.4	165.4av	500av
15.	5525.94	41.3	3.9	33.9	35.7	-	-	43.4	148.6av	500av

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. For emissions below 30MHz the cable losses are assumed to be negligible.
- 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 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=VBW= 1MHz
Average RBW=VBW= 1MHz

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 / RSS-Gen Issue 3 Section 7.2.5 for all emissions.

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

- (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				

A4 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 in RSS- GEN Section 7.2.3. The EUT was set to receive mode only on its lowest, centre and highest carrier frequency in turn.

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

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 : Smart Tag Standalone	
Regulation	Part 15 Subpart (c) Clause 15.109 / RSS-Gen Issue 3 Section 4.10
Measurement standard	ANSI C63.10:2009
Frequency range	30MHz-16GHz
EUT sample number	S28
Modification state	0
SE in test environment	S24
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	23.6°C

No emissions detected within 20dB of the limit.

Unintentional Radiated Emissions continued:

Test Details : Smart Tag with on body charger	
Regulation	Part 15 Subpart (c) Clause 15.109 / RSS-Gen Issue 3 Section 4.10
Measurement standard	ANSI C63.10:2003
Frequency range	30MHz-16GHz
EUT sample number	S28
Modification state	0
SE in test environment	S10
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	23.6°C

The worst case emissions 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)	FIELD ST'GH (μV/m)	LIMIT (μV/m)
1.	32.50	6.9	0.7	18.1	-	25.7	19.3	100
2.	37.60	14.1	0.8	15.3	-	30.2	32.4	100
3.	43.90	17.8	0.9	11.9	-	30.6	33.7	100
4.	44.20	18.9	0.9	11.7	-	31.5	37.5	100
5.	50.20	22.4	0.9	8.5	-	31.9	39.1	100
6.	50.50	22.3	0.9	8.4	-	31.6	38.2	100
7.	50.90	18.9	0.9	8.4	-	28.2	25.8	100
8.	51.35	21.9	1.0	8.0	-	30.9	35.1	100
9.	89.20	18.1	1.3	9.3	-	28.7	27.3	150
10.	91.20	18.4	1.3	9.6	-	29.3	29.2	150
11.	808.25	-0.1	4.1	22.1	-	26.1	20.2	200
12.	867.65	0.7	4.3	22.4	-	27.4	23.3	200
13.	900.95	0.5	4.4	23.0	-	27.8	24.7	200
14.	945.05	-0.1	4.5	24.3	-	28.7	27.2	200
15.	949.75	-0.1	4.6	24.0	-	28.5	26.5	200

Unintentional Radiated Emissions continued:

Test Details : Smart Tag with docking station	
Regulation	Part 15 Subpart (c) Clause 15.109 / RSS-Gen Issue 3 Section 4.10
Measurement standard	ANSI C63.10:2003
Frequency range	30MHz-16GHz
EUT sample number	S28
Modification state	0
SE in test environment	S7, S17
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	23.6°C

No emissions detected within 20dB of the limit.

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. For emissions below 30MHz the cable losses are assumed to be negligible.
- 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 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 (pk)	RBW=VBW= 1MHz
Average (Av)	RBW=VBW= 1MHz

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 15.109 / RSS-Gen Issue 3 section 6.1 for all emissions:

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

- (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				

A5 Power Line Conducted Emissions

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

Test Details: Smart Tag with on body charger	
Regulation	Part 15 Subpart (c) Clause 15.207 / RSS-Gen Issue 3 Section 7.2.4
Measurement standard	ANSI C63.10:2009
Frequency range	150kHz to 30MHz
EUT sample number	S28
Modification state	0
SE in test environment	S10
SE isolated from EUT	None
EUT set up	Refer to Appendix C

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

Results measured using the average detector compared to the average limit

Ref No.	Freq (MHz)	Conductor	Result (dB μ V)	Spec Limit (dB μ V)	Margin (dB)	Result Summary
1	0.590	Nuetral Line	31.85	46	14.15	Pass

Results measured using the quasi-peak detector compared to the quasi-peak limit

Ref No.	Freq (MHz)	Conductor	Result (dB μ V)	Spec Limit (dB μ V)	Margin (dB)	Result Summary
1	0.590	Nuetral Line	39.48	56	16.52	Pass
2	0595	Live Line	37.30	56	18.70	Pass

Power Line Conducted Emissions continued:

Test Details: Smart Tag with docking station	
Regulation	Part 15 Subpart (c) Clause 15.207 / RSS-Gen Issue 3 Section 7.2.4
Measurement standard	ANSI C63.10:2009
Frequency range	150kHz to 30MHz
EUT sample number	S28
Modification state	0
SE in test environment	S7, S17
SE isolated from EUT	None
EUT set up	Refer to Appendix C

No emissions detected within 20dB of the limit.

Specification limits :

Conducted emission limits (47 CFR Part 15:Clause 15.207 / RSS-Gen Issue 3 Section 7.2.4):

Conducted disturbance at the mains ports.

Frequency range MHz	Limits dB μ V	
	Quasi-peak	Average
0.15 to 0.5	66 to 56 ²	56 to 46 ²
0.5 to 5	56	46
5 to 30	60	50

Notes:

1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

Notes:

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

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

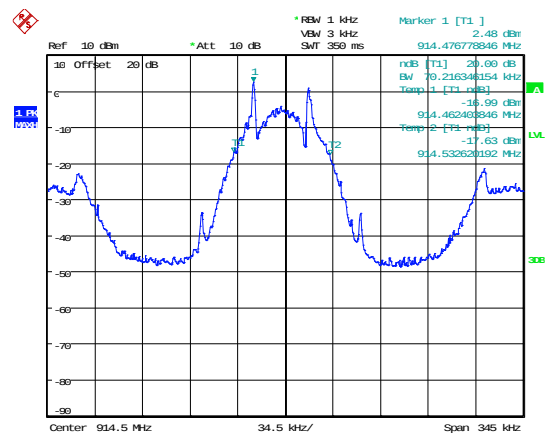
Appendix B:**Supporting Graphical Data**

This appendix contains graphical data obtained during testing.

Notes:

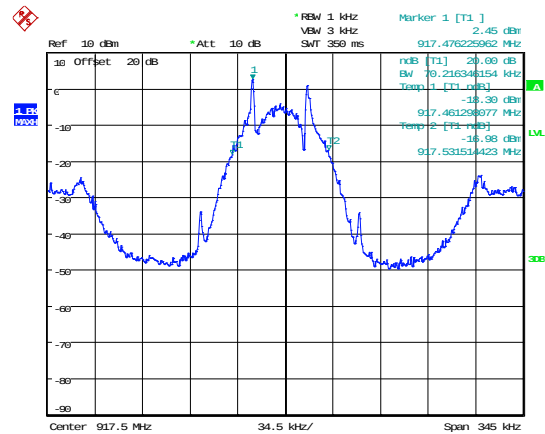
- (a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A and Appendix B.
- (b) The time and date on the plots do not necessarily equate to the time of the test.
- (c) Where relevant, on power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



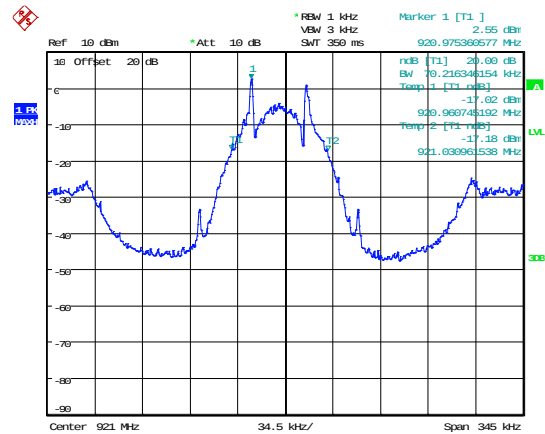
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20dB Bandwidth 914.5MHz



Date: 17. JUN. 2014 15:37:07

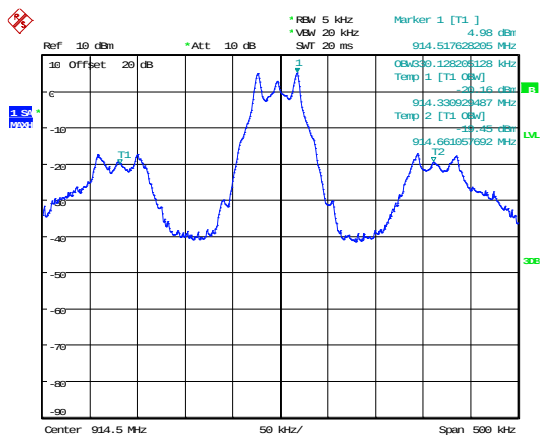
20dB Bandwidth 917.5MHz



Date: 17. JUN. 2014 15:18:21

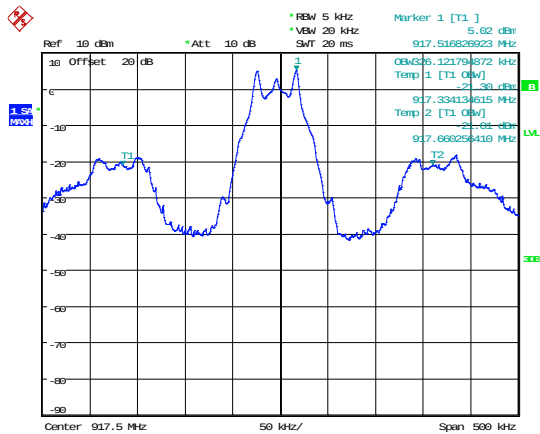
20dB Bandwidth 921MHz

99% Bandwidth



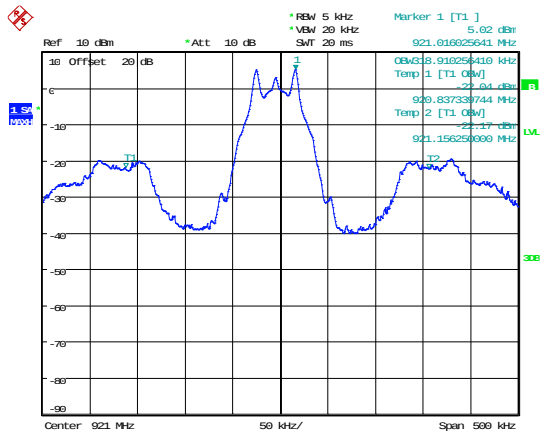
Date: 17 JUN 2014 15:31:56

99% Bandwidth 914.5MHz



Date: 17 JUN 2014 15:39:20

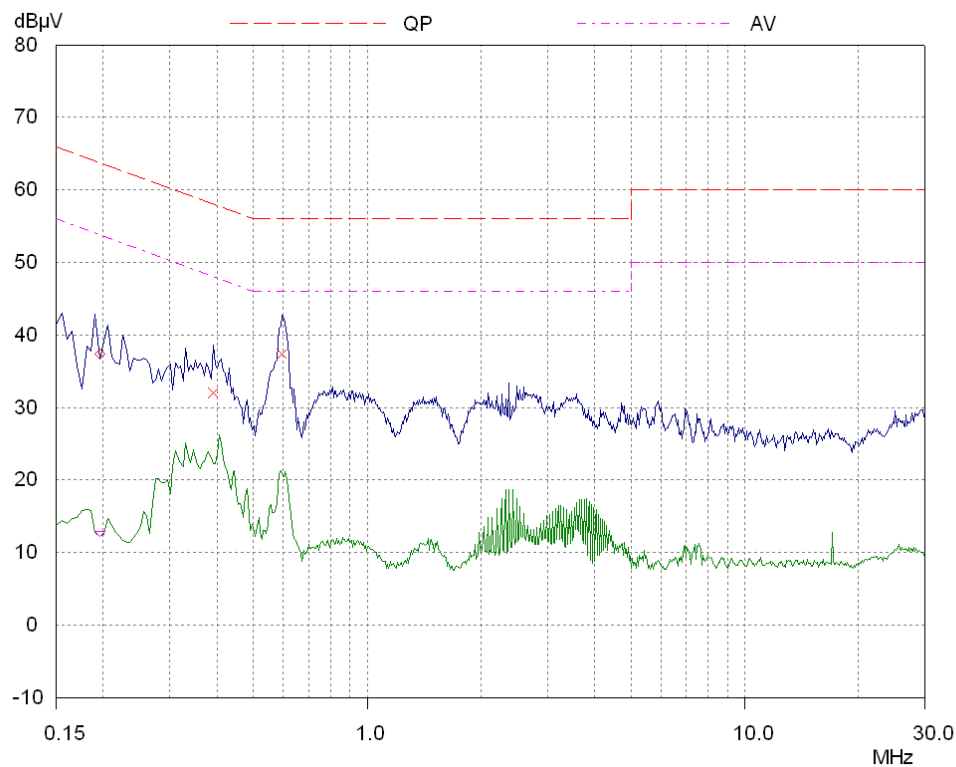
99% Bandwidth 917.5MHz



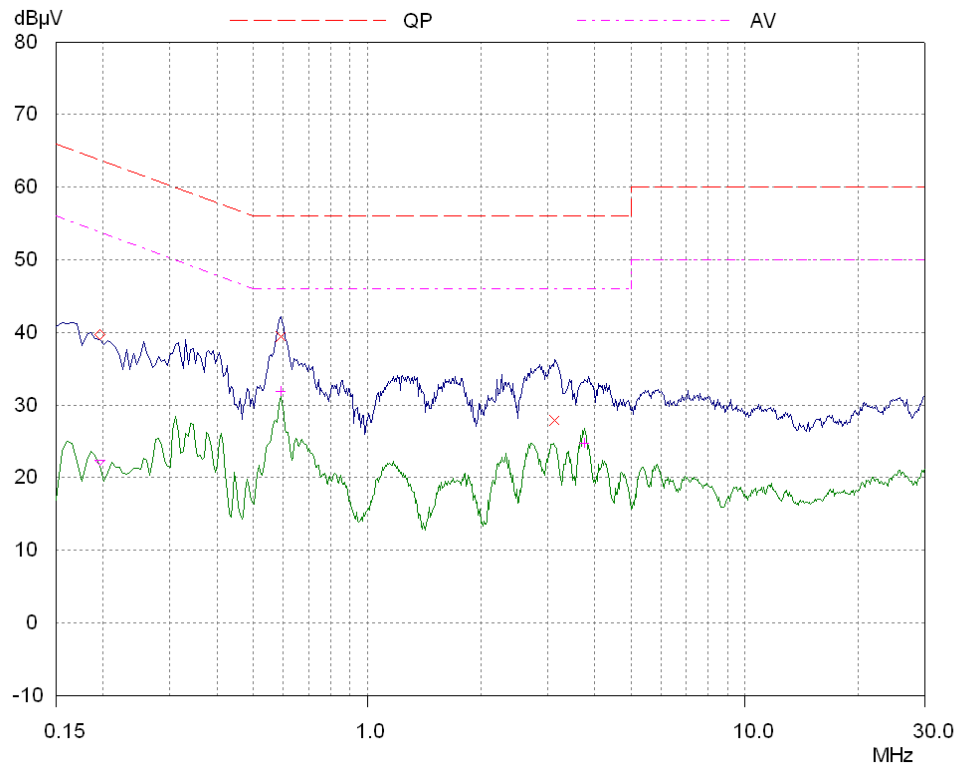
Date: 17 JUN 2014 14:48:10

99% Bandwidth 921MHz

Powerline Conducted Emissions - Smart Tag with on body charger

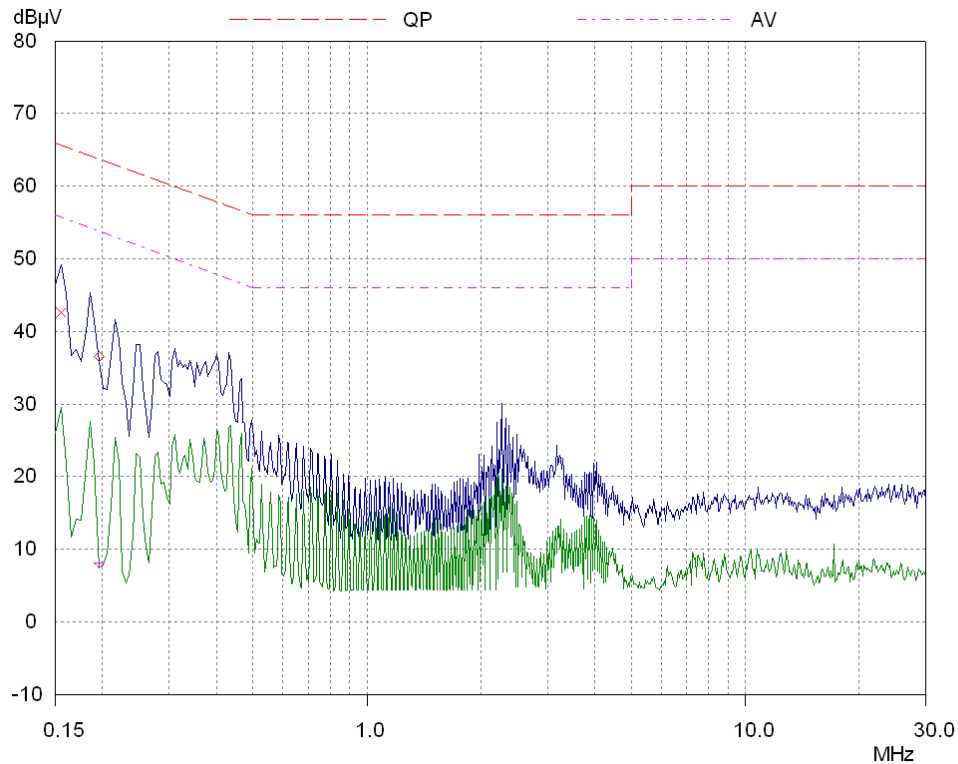


Live Line

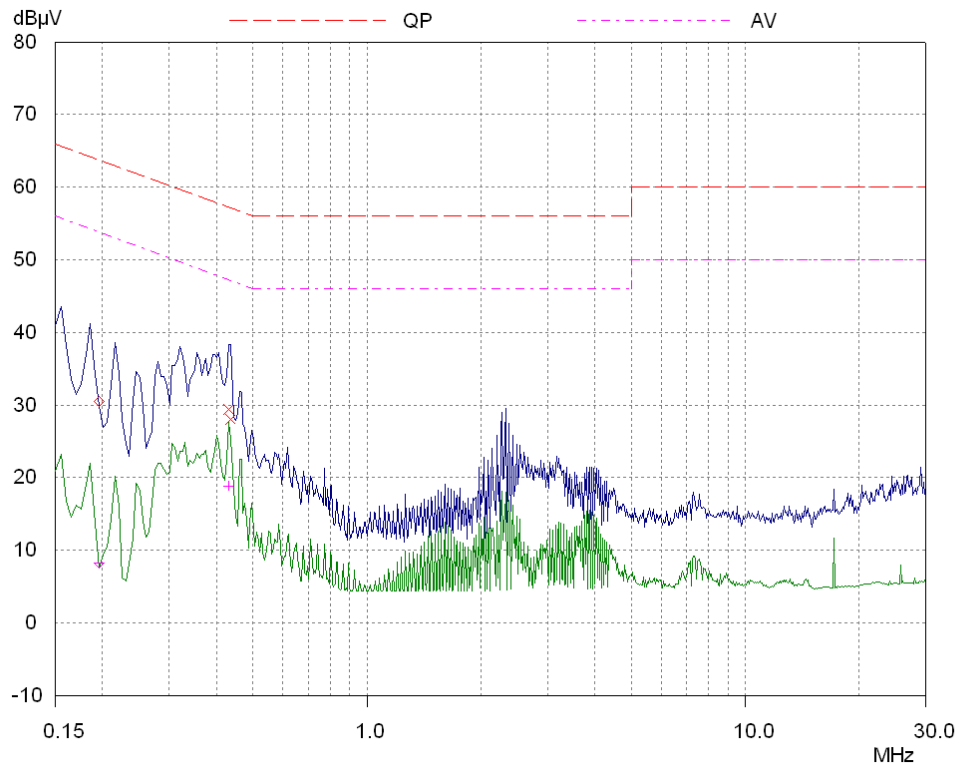


Neutral Line

Powerline Conducted Emissions - Smart Tag with docking station

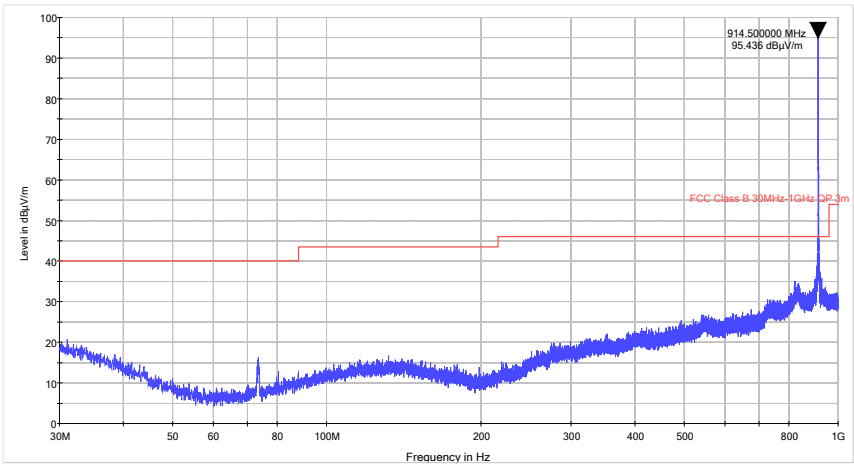


Live Line

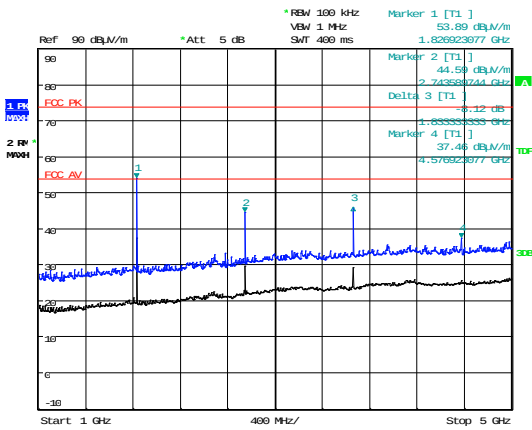


Neutral Line

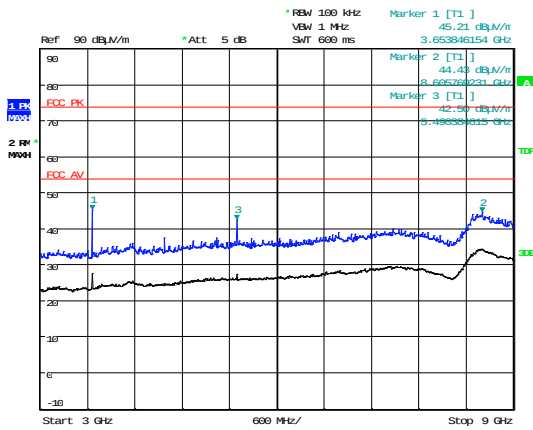
Radiated Transmitter Emissions 914.5MHz - Smart Tag Standalone



30MHz – 1GHz



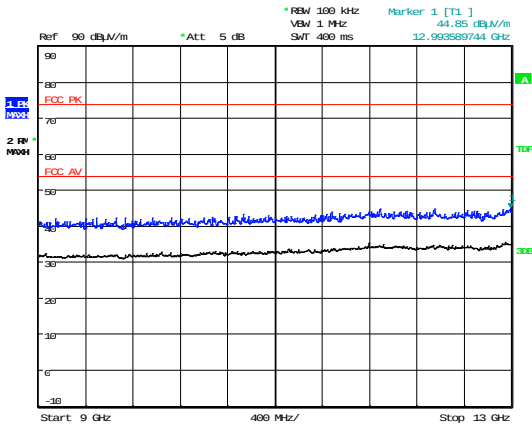
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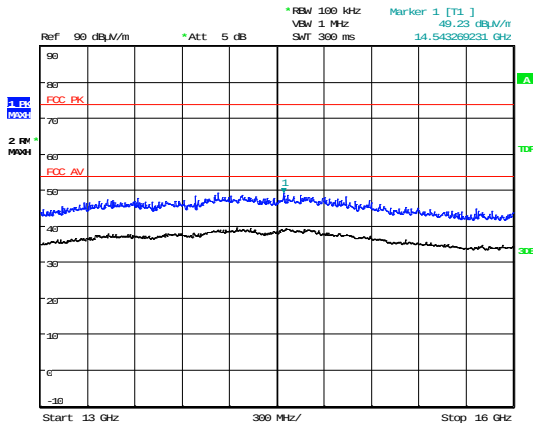
Date: 24.JUN.2014 18:43:33

1GHz – 5GHz

5GHz – 9GHz



Date: 24.JUN.2014 18:44:05

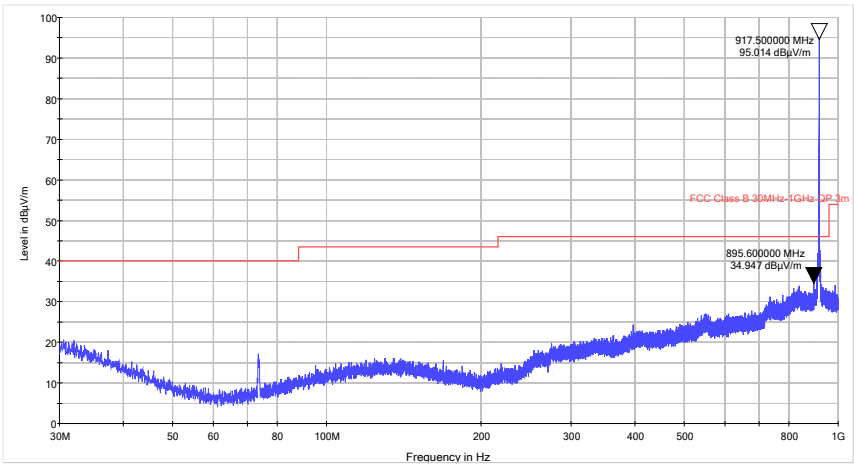


Date: 24.JUN.2014 18:44:33

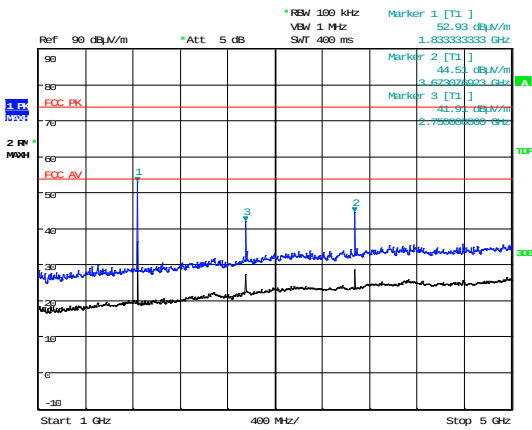
9GHz – 13GHz

13GHz – 16GHz

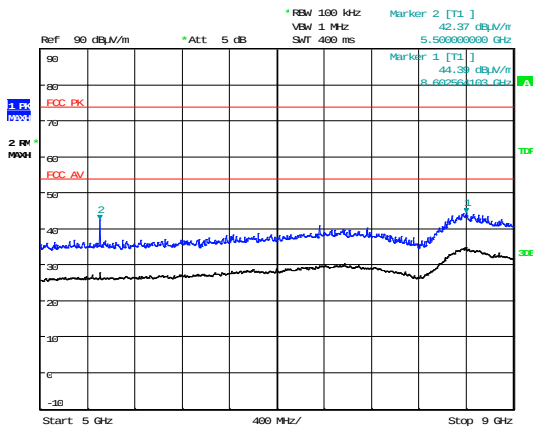
Radiated Transmitter Emissions 917.5MHz - Smart Tag Standalone



30MHz – 1GHz



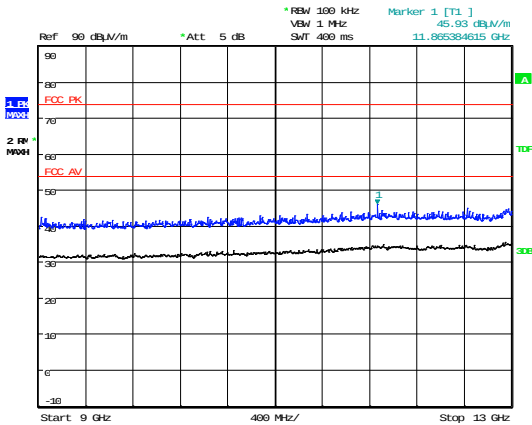
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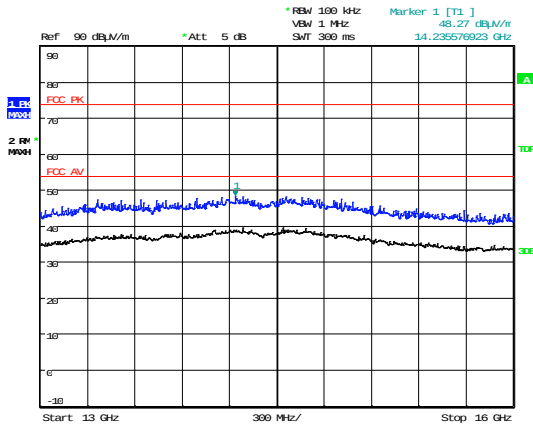
Date: 24.JUN.2014 18:56:58

1GHz – 5GHz

5GHz – 9GHz



Date: 24.JUN.2014 18:55:48

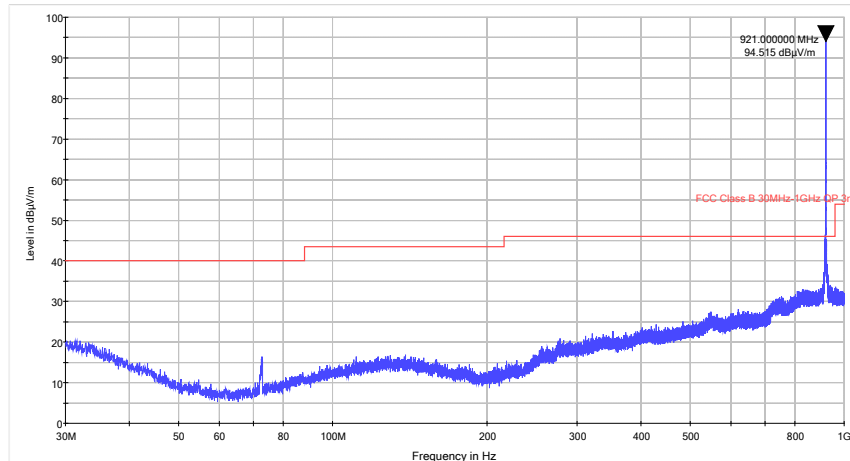


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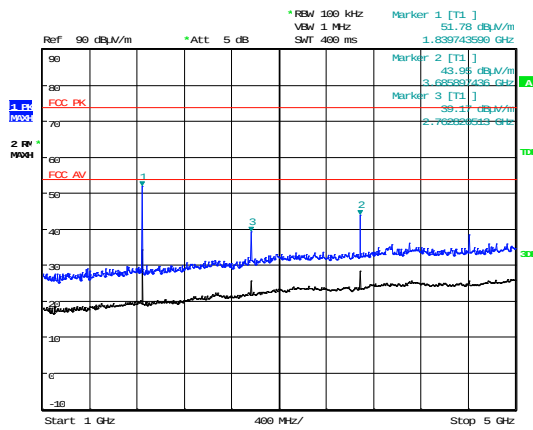
9GHz – 13GHz

13GHz – 16GHz

Radiated Transmitter Emissions 921MHz - Smart Tag Standalone

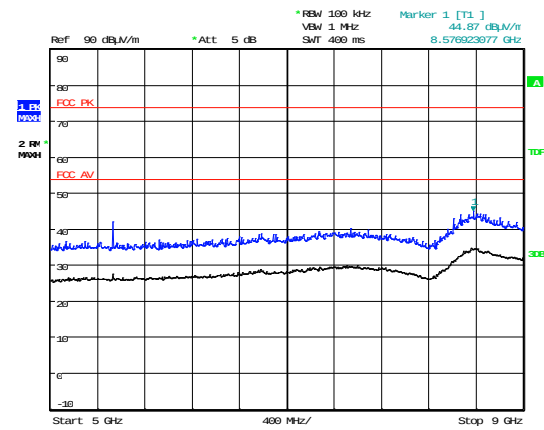


30MHz – 1GHz



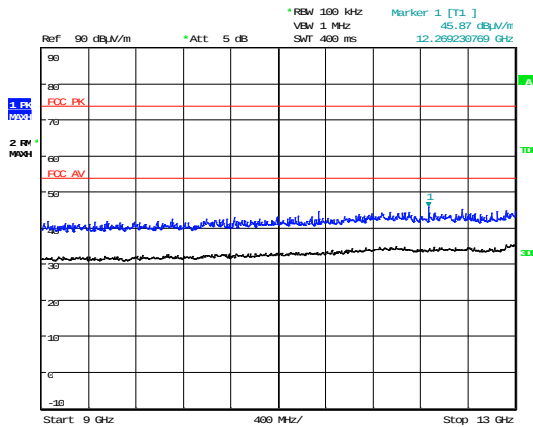
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1GHz – 5GHz



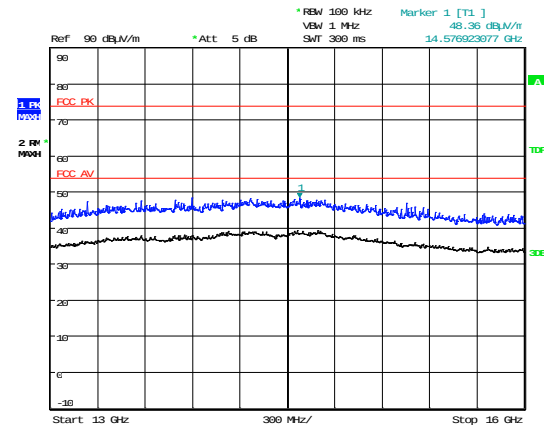
Date: 24.JUN.2014 19:00:08

5GHz – 9GHz



Date: 24.JUN.2014 19:00:28

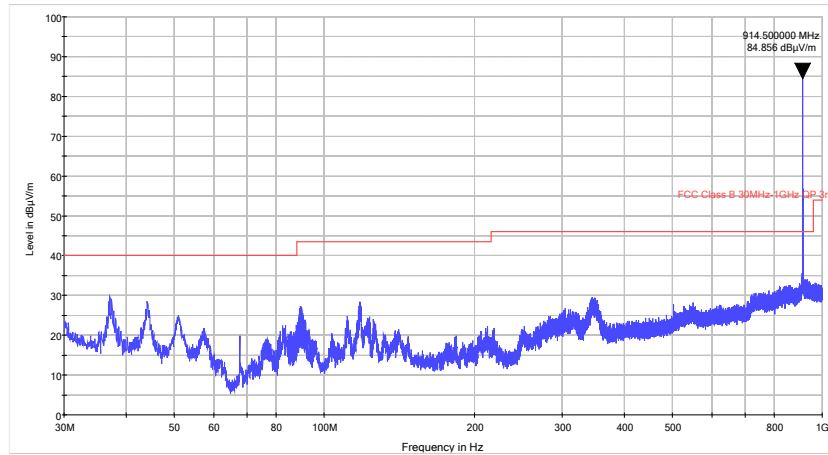
9GHz – 13GHz



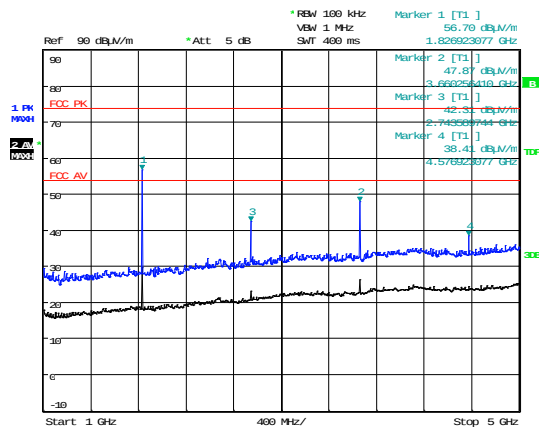
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13GHz – 16GHz

Radiated Transmitter Emissions 914.5MHz - Smart Tag with on body charger

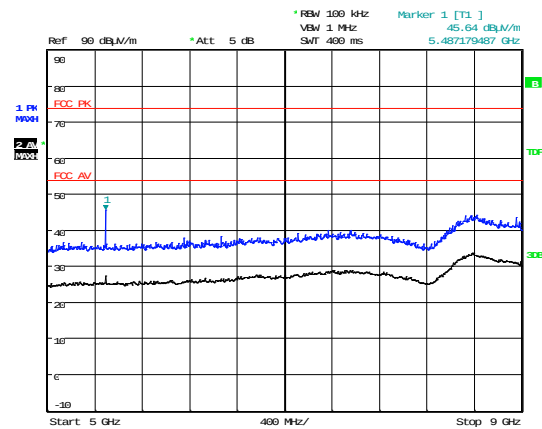


30MHz – 1GHz



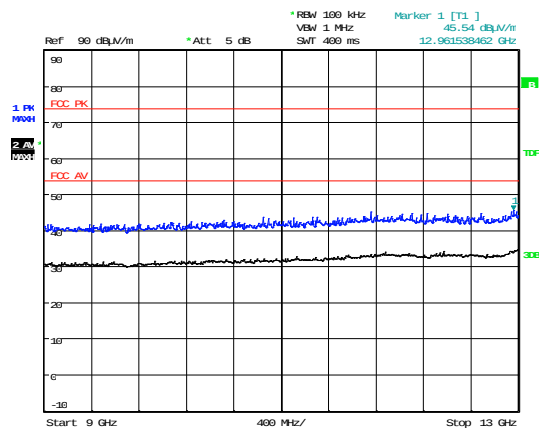
Date: 24.JUN.2014 15:38:59

1GHz – 5GHz



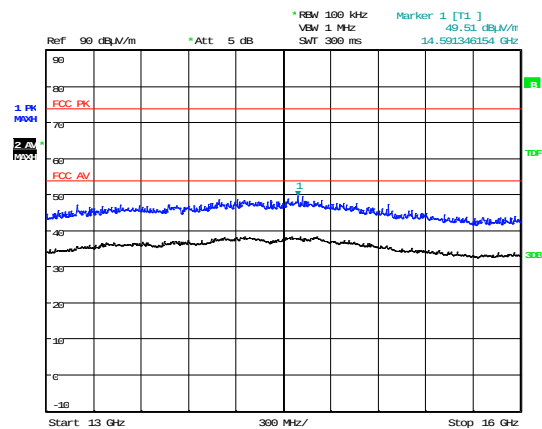
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5GHz – 9GHz



Date: 24.JUN.2014 15:37:15

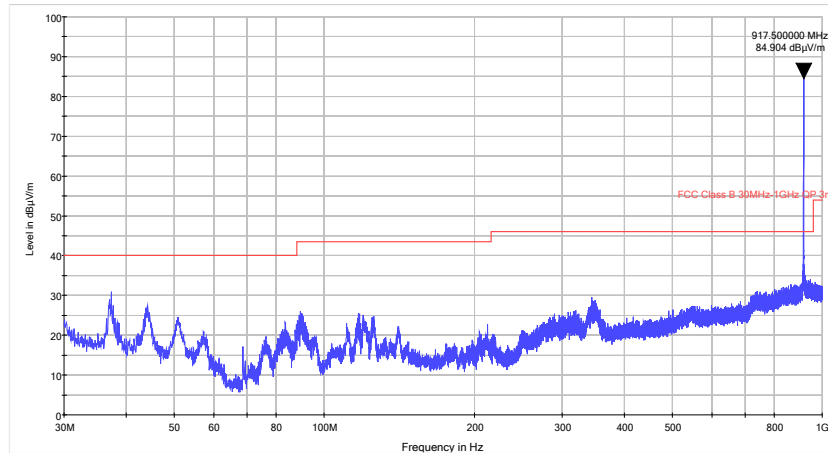
9GHz – 13GHz



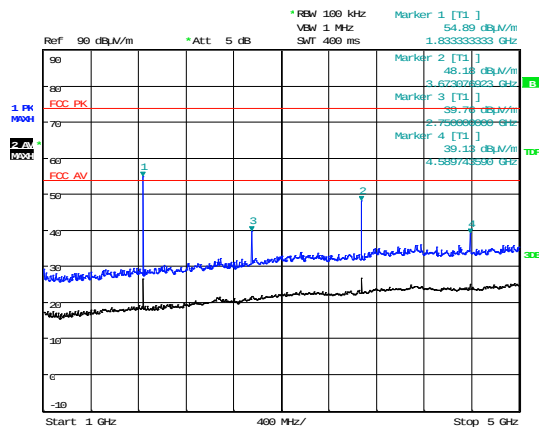
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13GHz – 16GHz

Radiated Transmitter Emissions 917.5MHz - Smart Tag with on body charger

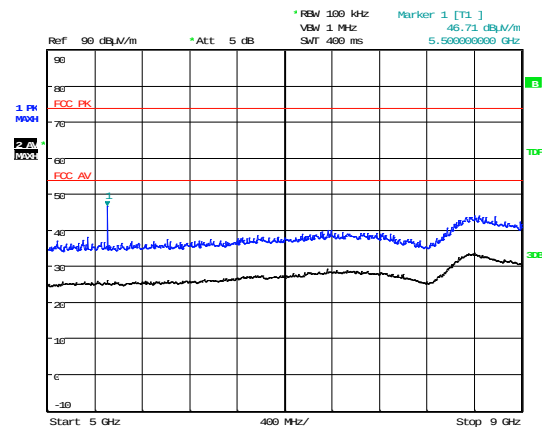


30MHz – 1GHz



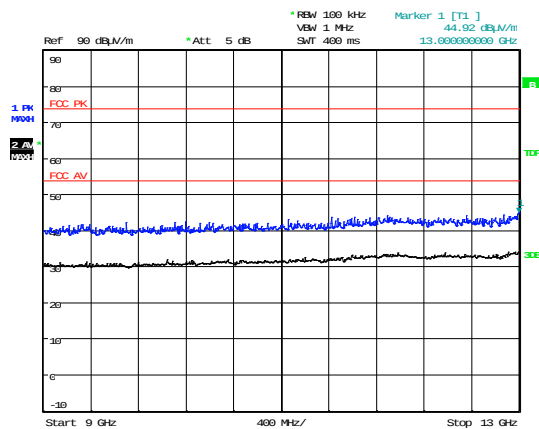
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1GHz – 5GHz



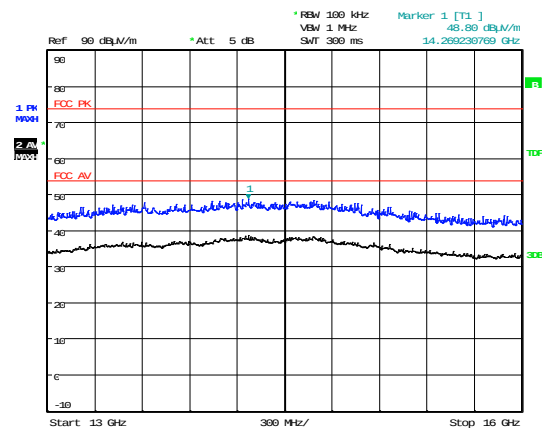
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5GHz – 9GHz



Date: 24.JUN.2014 15:42:09

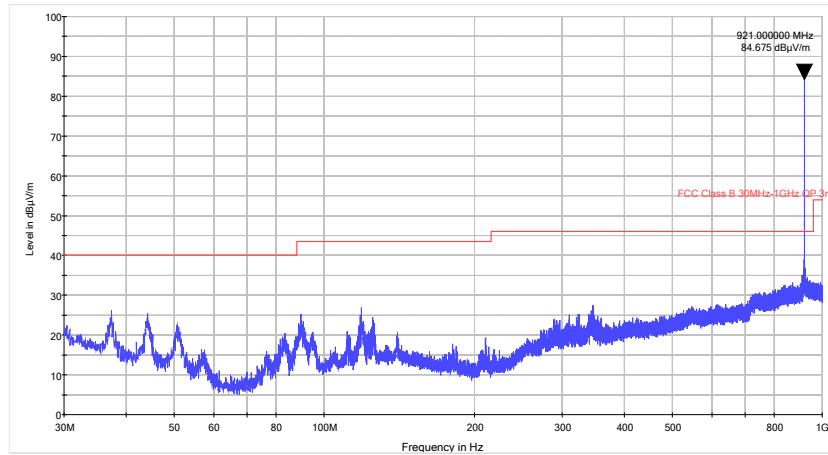
9GHz – 13GHz



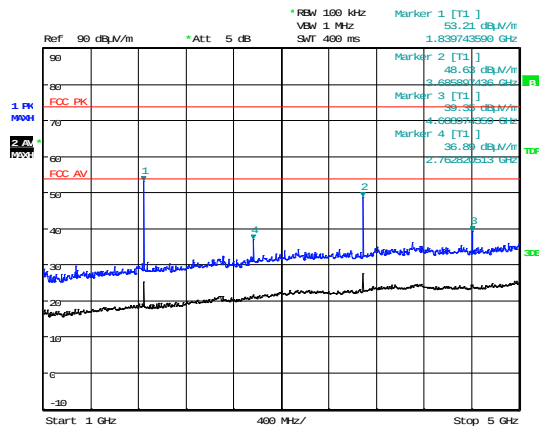
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13GHz – 16GHz

Radiated Transmitter Emissions 921MHz - Smart Tag with on body charger

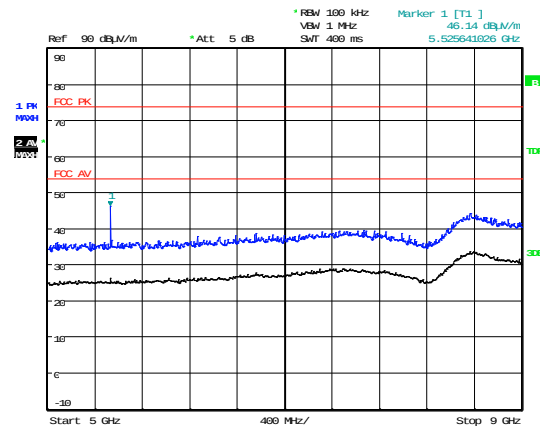


30MHz – 1GHz



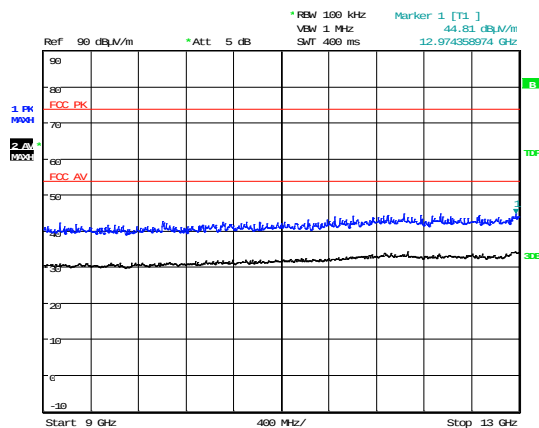
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1GHz – 5GHz



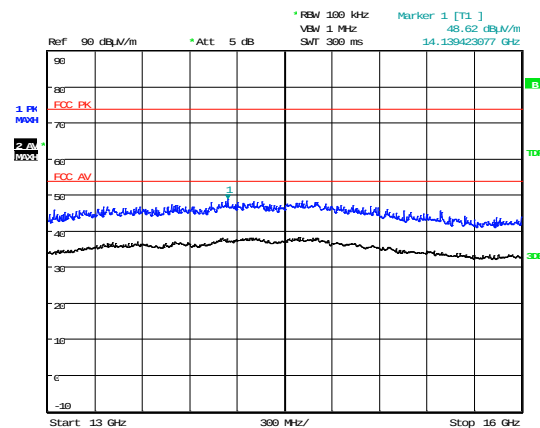
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5GHz – 9GHz



Date: 24 JUN 2014 15:49:16

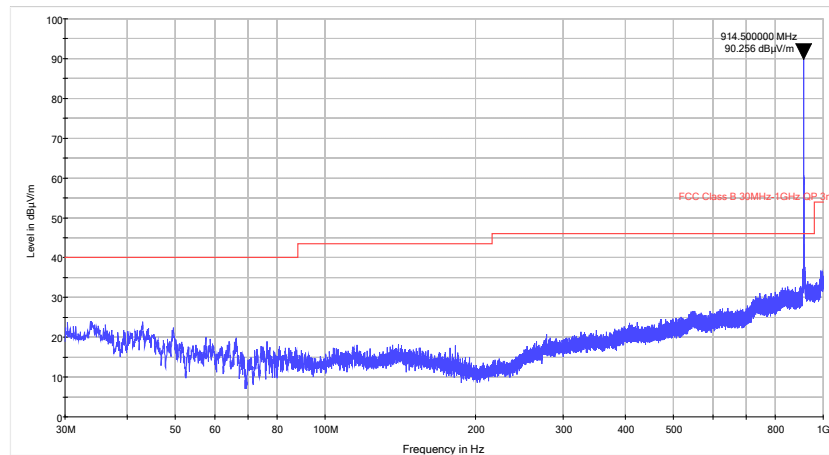
9GHz – 13GHz



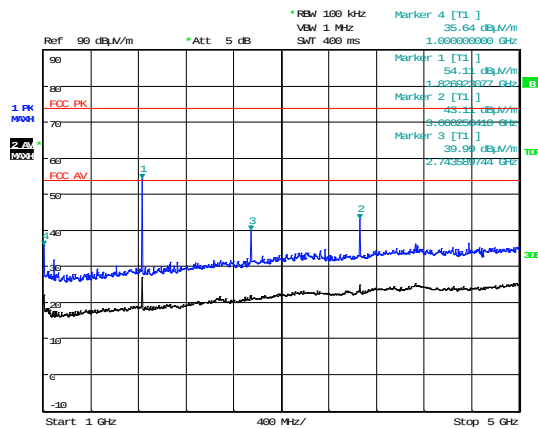
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13GHz – 16GHz

Radiated Transmitter Emissions 914.5MHz - Smart Tag with docking station

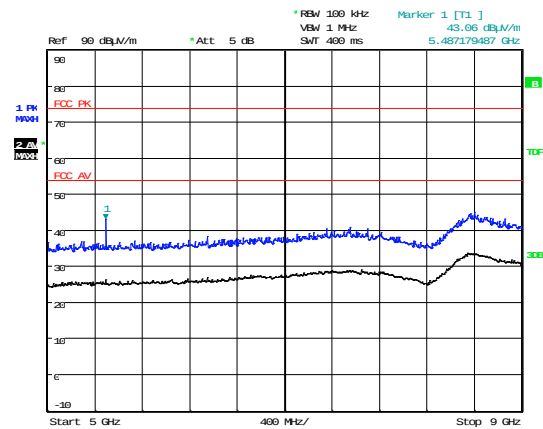


30MHz – 1GHz



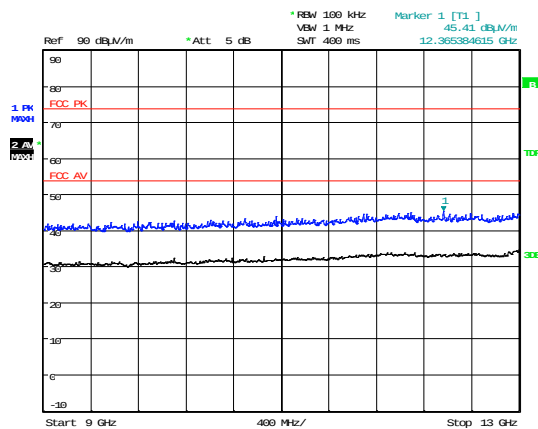
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1GHz – 5GHz



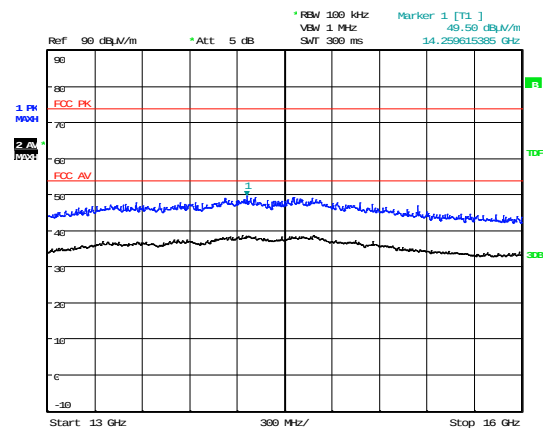
Date: 24.JUN.2014 12:00:21

5GHz – 9GHz



Date: 24.JUN.2014 11:59:25

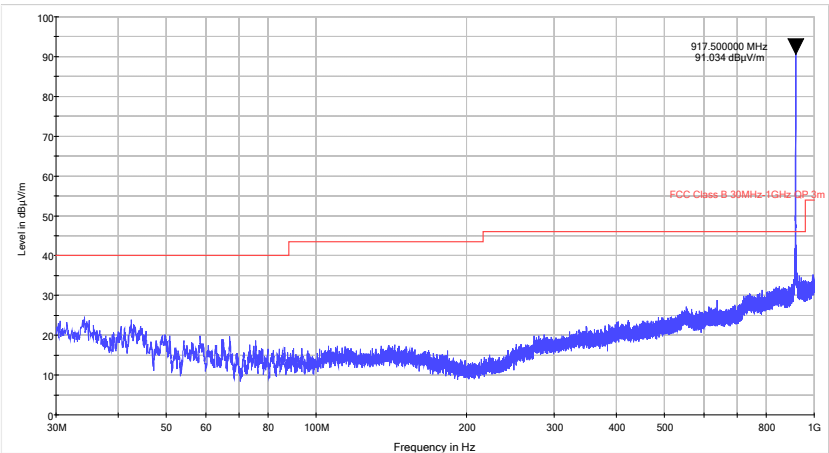
9GHz – 13GHz



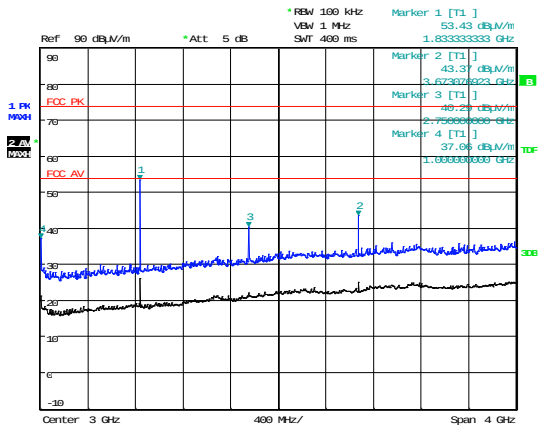
Date: 24.JUN.2014 11:58:31

13GHz – 16GHz

Radiated Transmitter Emissions 917.5MHz - Smart Tag with docking station

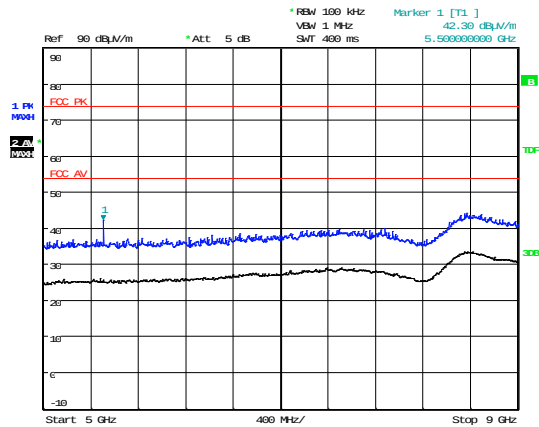


30MHz – 1GHz



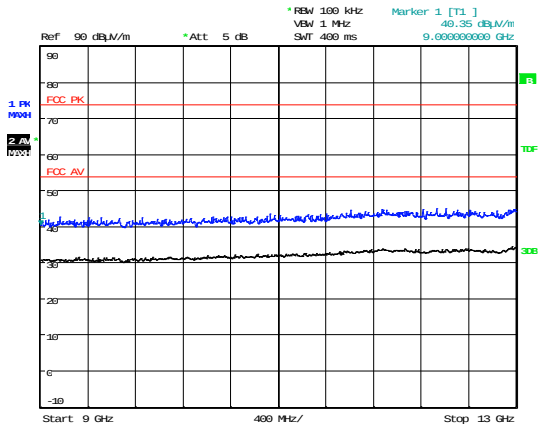
Date: 24.JUN.2014 12:03:42

1GHz – 5GHz



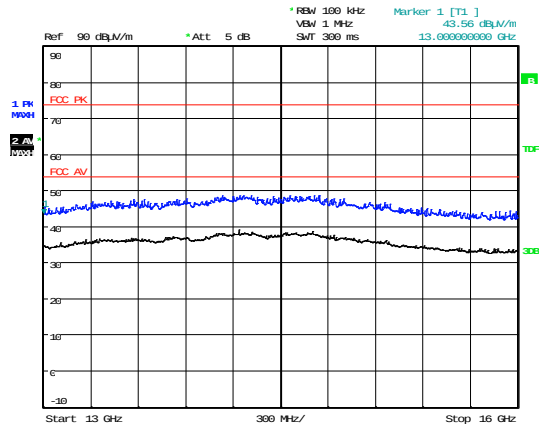
Date: 24.JUN.2014 12:04:48

5GHz – 9GHz



Date: 24.JUN.2014 12:05:48

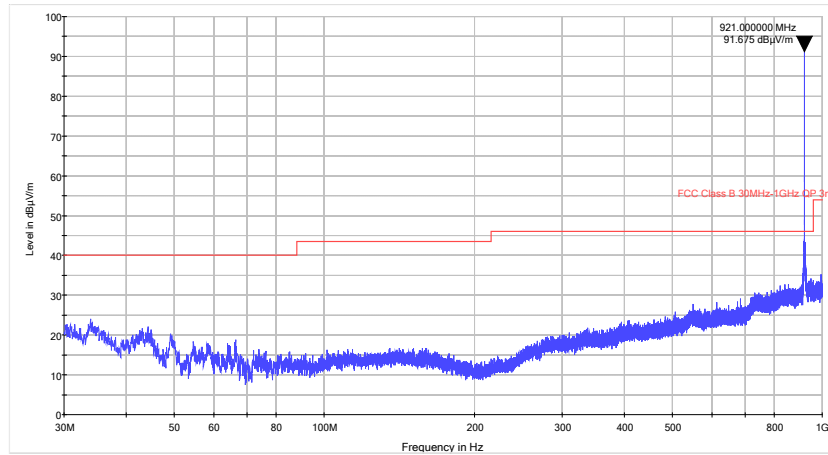
9GHz – 13GHz



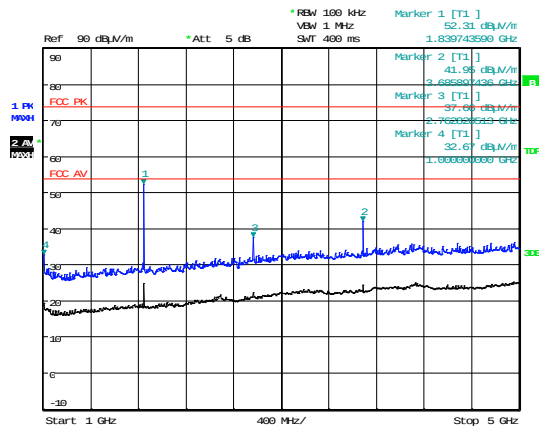
Date: 24.JUN.2014 12:06:44

13GHz – 16GHz

Radiated Transmitter Emissions 921MHz - Smart Tag with docking station

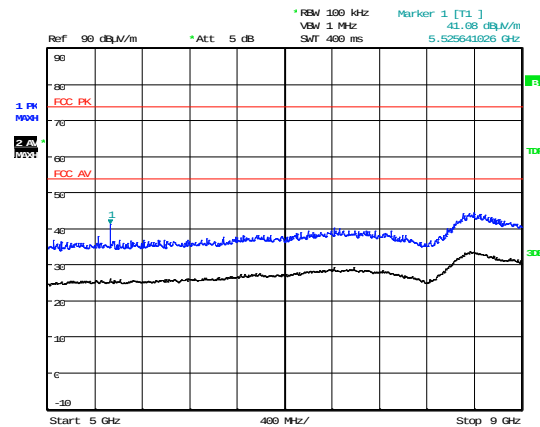


30MHz – 1GHz



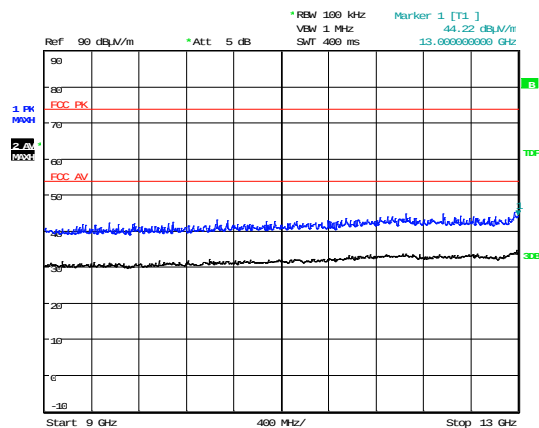
Date: 24 JUN 2014 12:18:02

1GHz – 5GHz



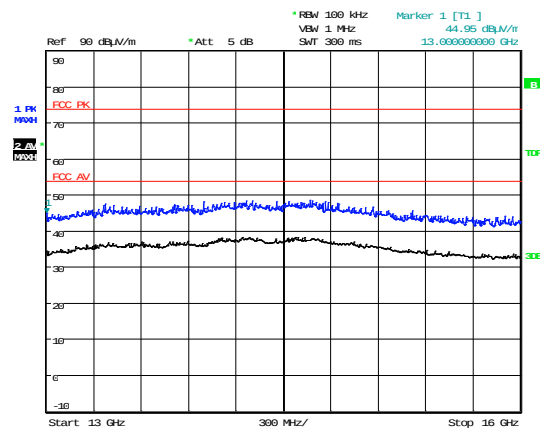
Date: 24 JUN 2014 12:17:04

5GHz – 9GHz



Date: 24 JUN 2014 12:16:05

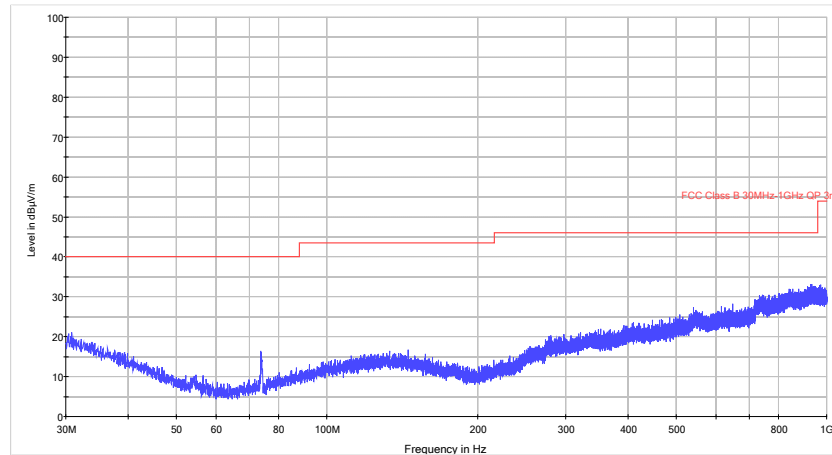
9GHz – 13GHz



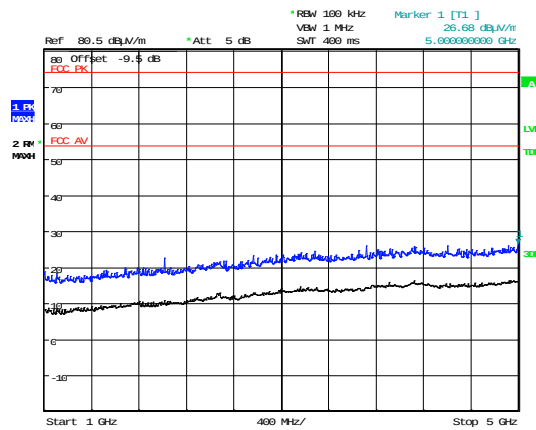
Date: 24 JUN 2014 12:15:47

13GHz – 16GHz

Unintentional Radiated Emissions 914.5MHz - Smart Tag Standalone

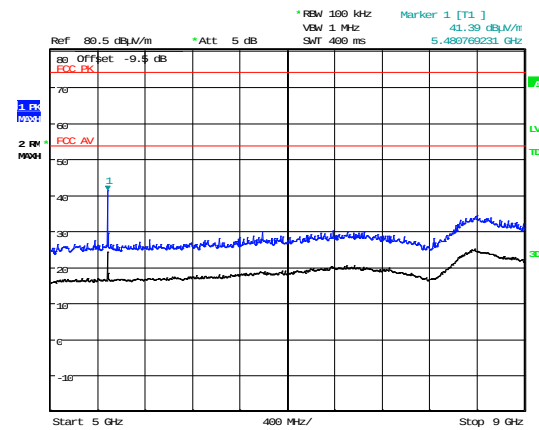


30MHz – 1GHz



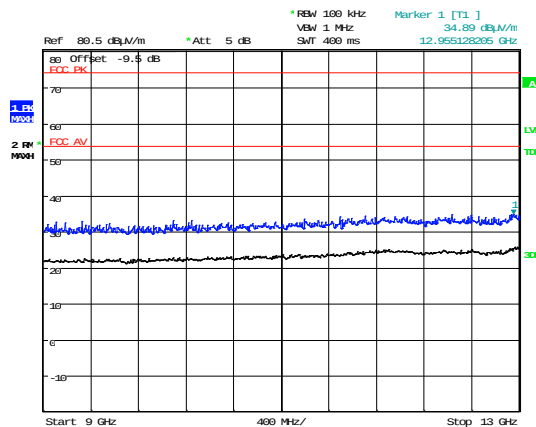
Date: 24 JUN 2014 18:28:35

1GHz – 5GHz



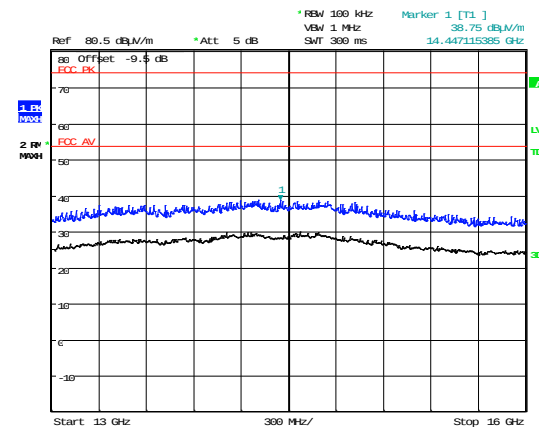
Date: 24 JUN 2014 18:38:25

5GHz – 9GHz



Date: 24 JUN 2014 18:39:43

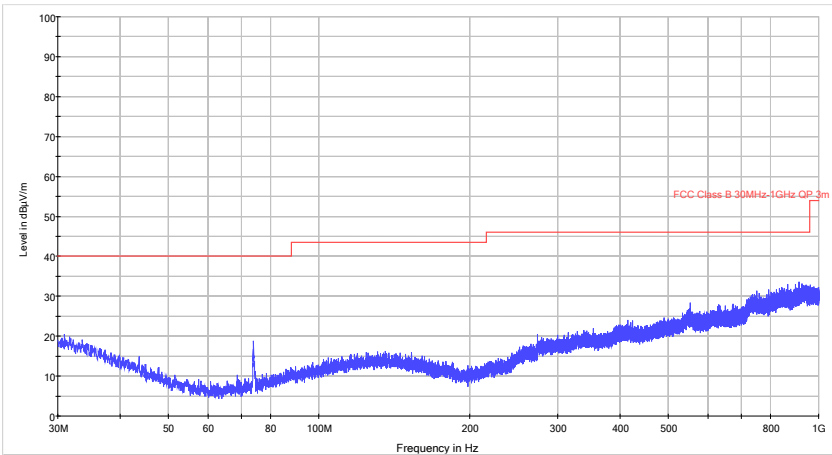
9GHz – 13GHz



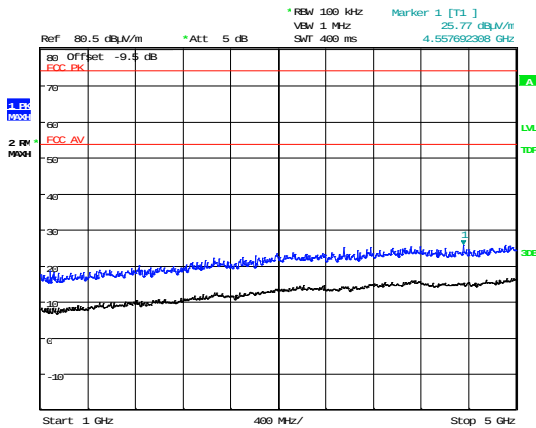
Date: 24 JUN 2014 18:39:58

13GHz – 16GHz

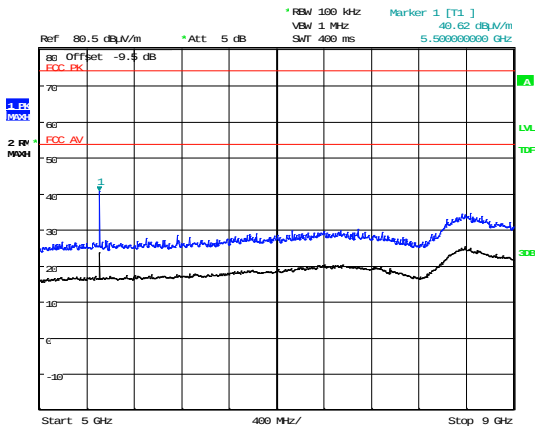
Unintentional Radiated Emissions 917.5MHz - Smart Tag Standalone



30MHz – 1GHz



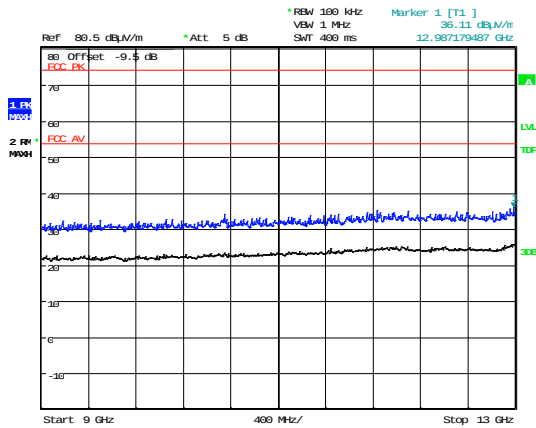
Date: 24.JUN.2014 18:36:08



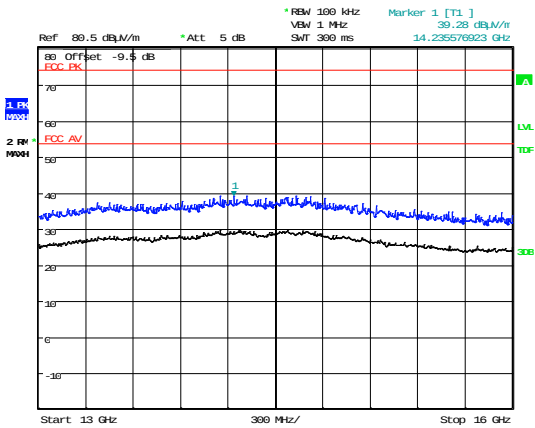
Date: 24.JUN.2014 18:36:45

1GHz – 5GHz

5GHz – 9GHz



Date: 24.JUN.2014 18:35:49

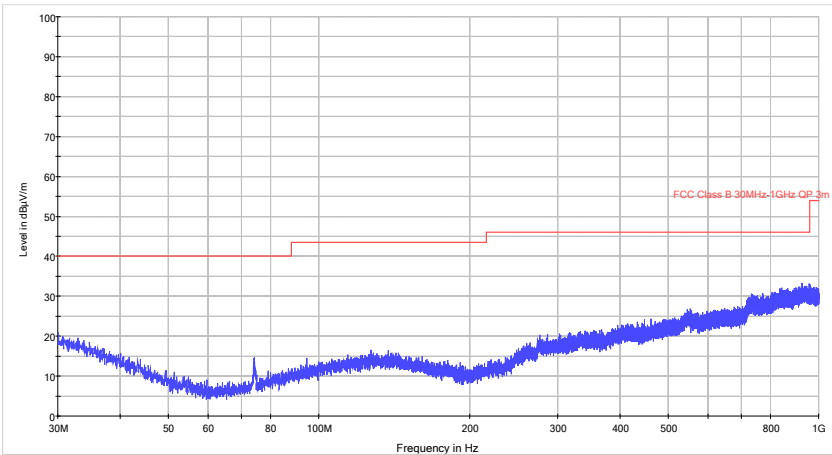


Date: 24.JUN.2014 18:35:15

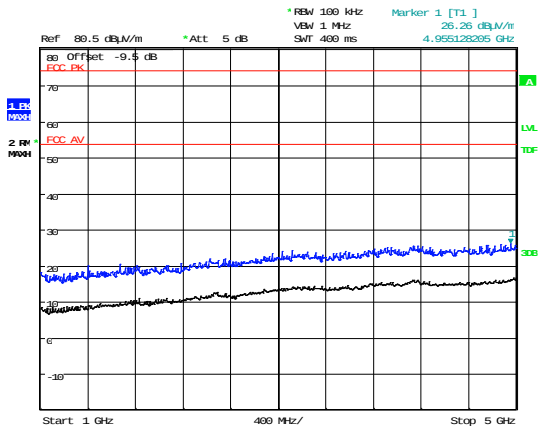
9GHz – 13GHz

13GHz – 16GHz

Unintentional Radiated Emissions 921MHz - Smart Tag Standalone

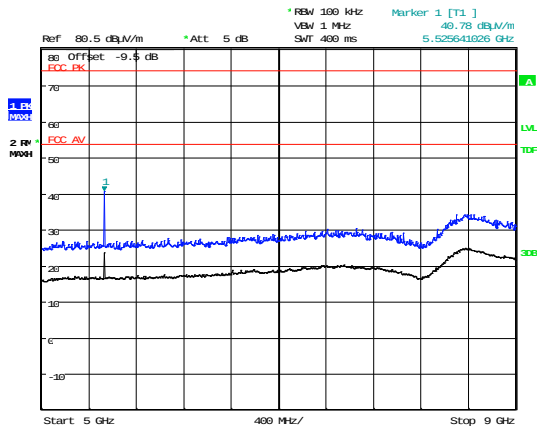


30MHz – 1GHz



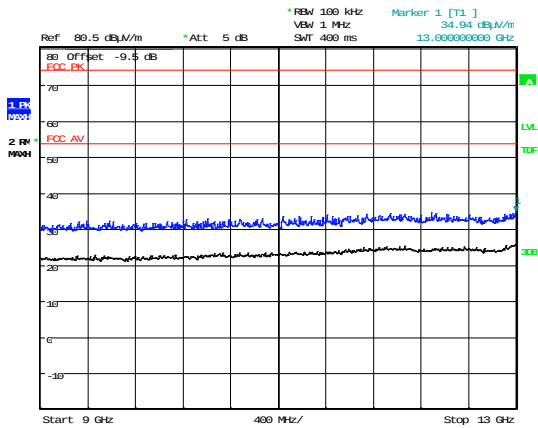
Date: 24.JUN.2014 18:26:12

1GHz – 5GHz



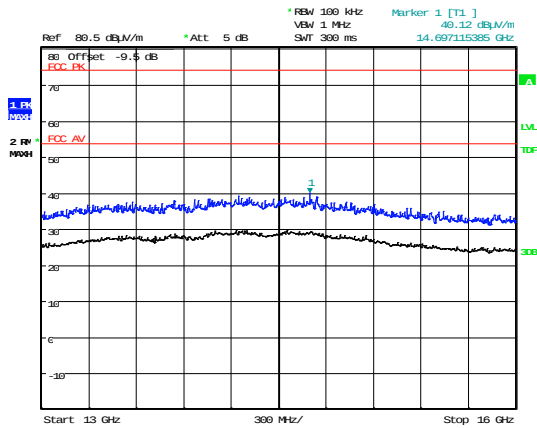
Date: 24.JUN.2014 18:25:42

5GHz – 9GHz



Date: 24.JUN.2014 18:24:46

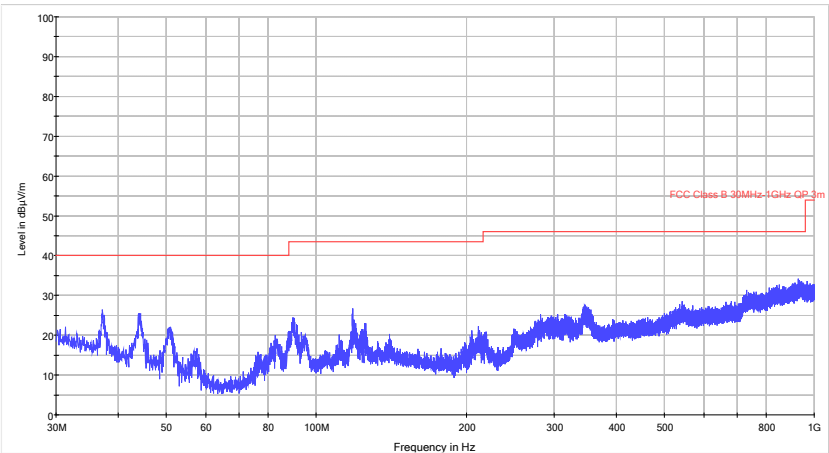
9GHz – 13GHz



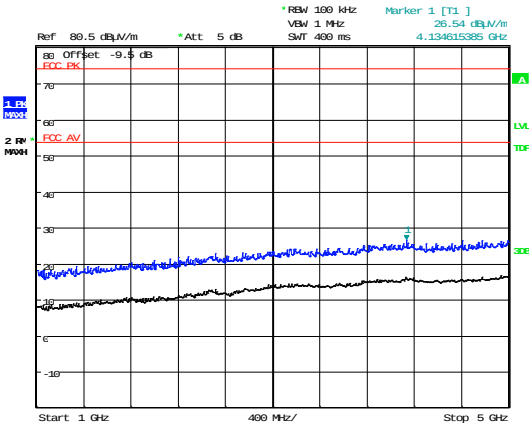
Date: 24.JUN.2014 18:24:28

13GHz – 16GHz

Unintentional Radiated Emissions 914.5MHz - Smart Tag with on body charger

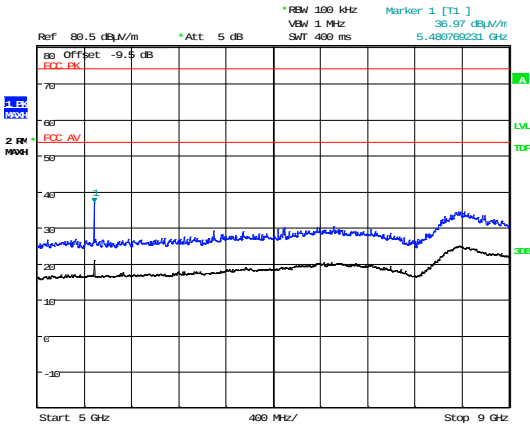


30MHz – 1GHz



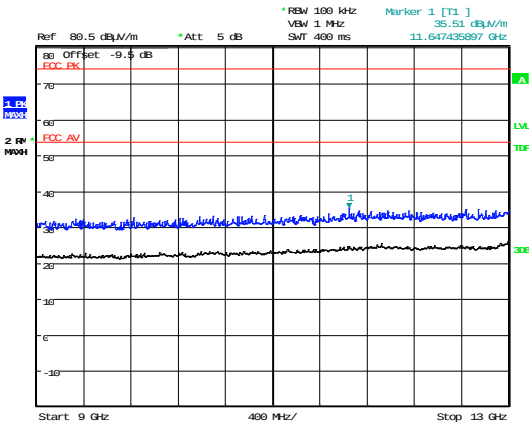
Date: 24.JUN.2014 17:56:27

1GHz – 5GHz



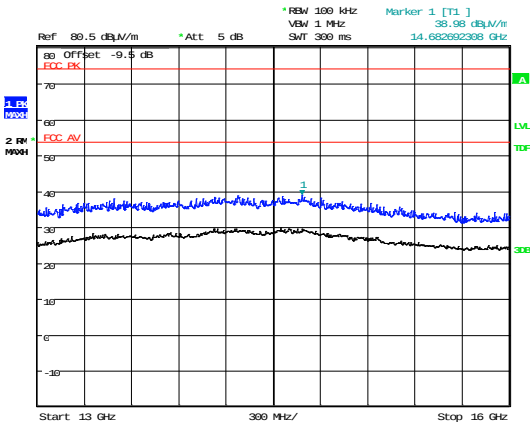
Date: 24.JUN.2014 17:57:14

5GHz – 9GHz



Date: 24.JUN.2014 17:57:31

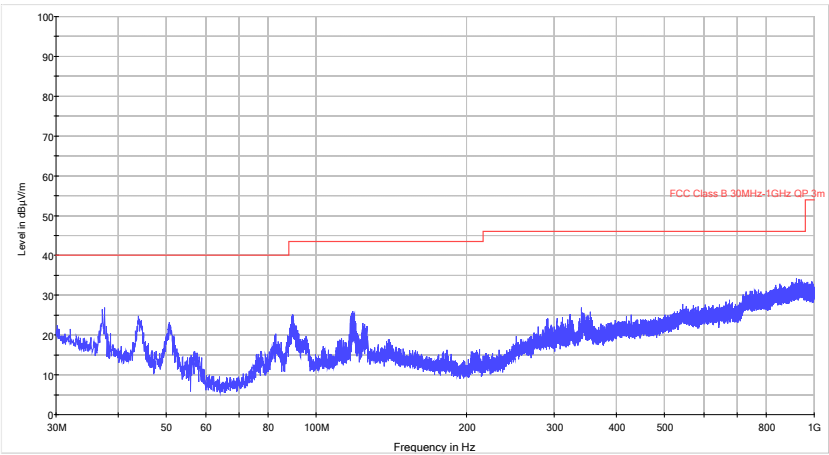
9GHz – 13GHz



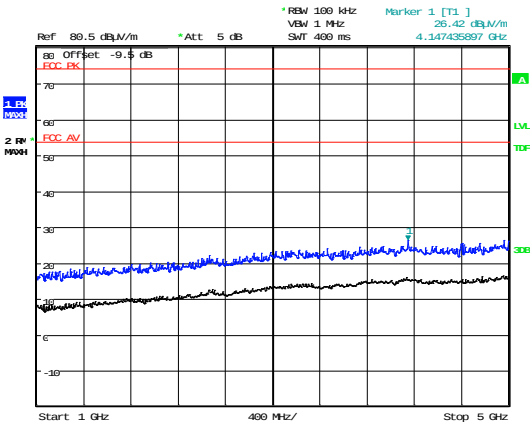
Date: 24.JUN.2014 17:57:47

13GHz – 16GHz

Unintentional Radiated Emissions 917.5MHz - Smart Tag with on body charger

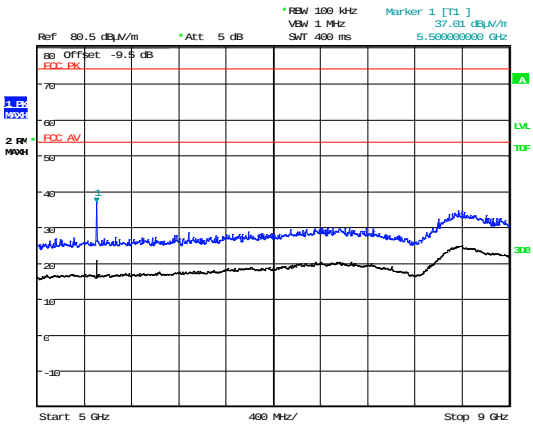


30MHz – 1GHz



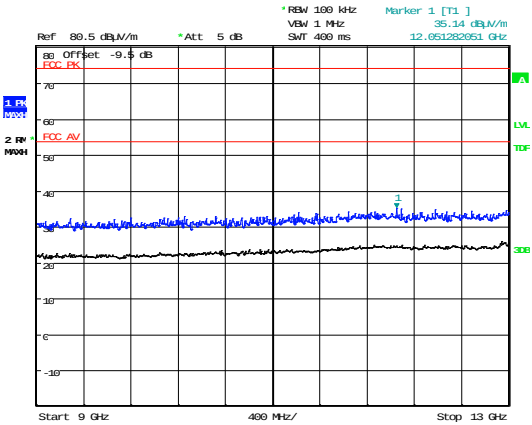
Date: 24.JUN.2014 18:05:04

1GHz – 5GHz



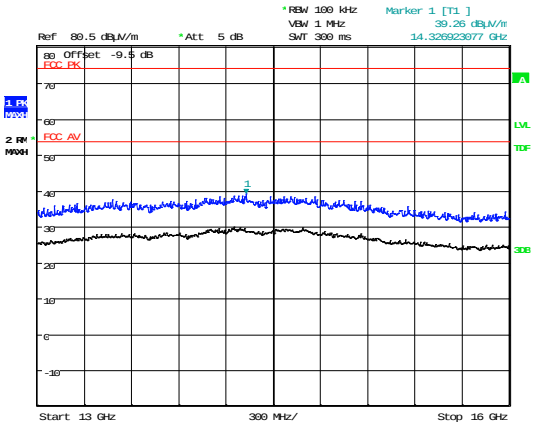
Date: 24.JUN.2014 18:04:47

5GHz – 9GHz



Date: 24.JUN.2014 18:04:07

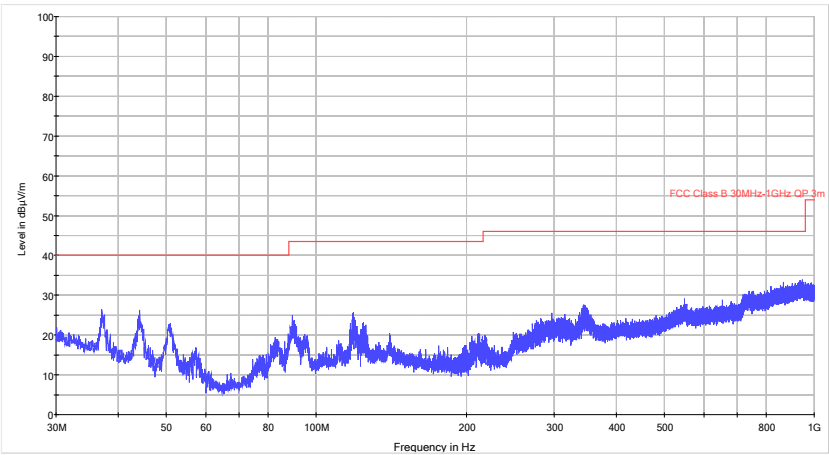
9GHz – 13GHz



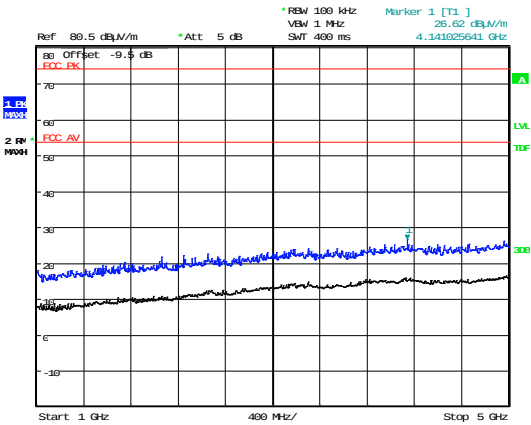
Date: 24.JUN.2014 18:03:48

13GHz – 16GHz

Unintentional Radiated Emissions 921MHz - Smart Tag with on body charger

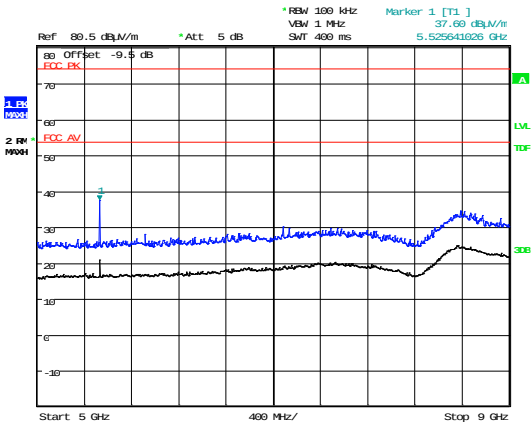


30MHz – 1GHz



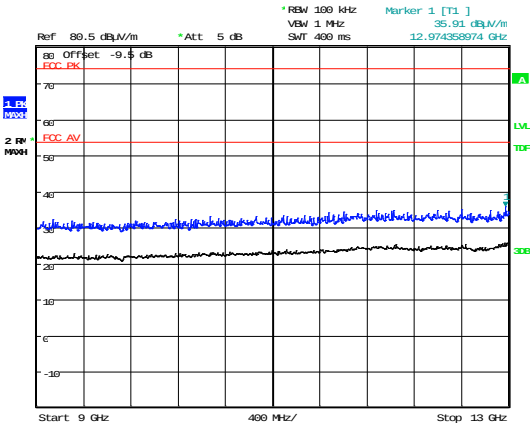
Date: 24.JUN.2014 18:06:25

1GHz – 5GHz



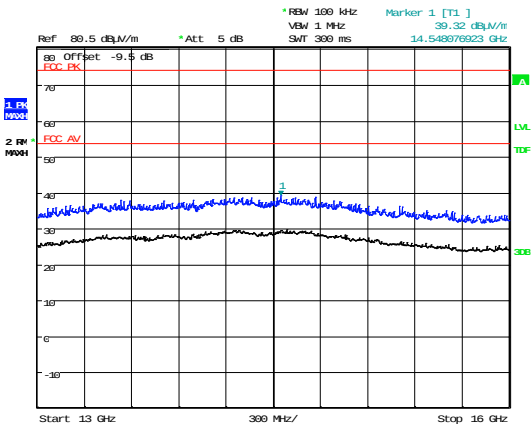
Date: 24.JUN.2014 18:06:48

5GHz – 9GHz



Date: 24.JUN.2014 18:07:05

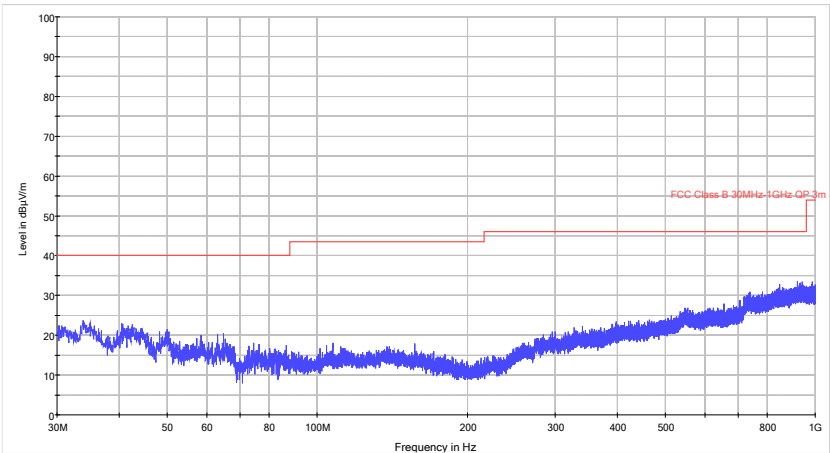
9GHz – 13GHz



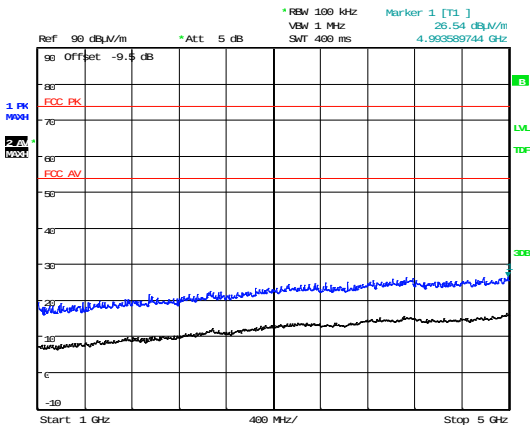
Date: 24.JUN.2014 18:07:24

13GHz – 16GHz

Unintentional Radiated Emissions 914.5MHz - Smart Tag with docking station

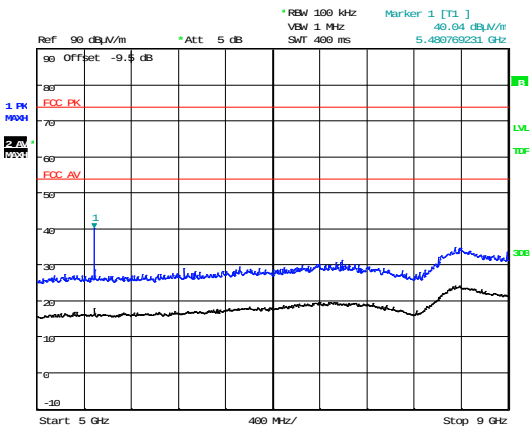


30MHz – 1GHz



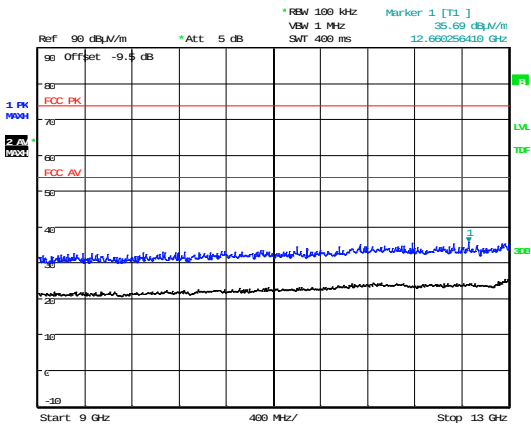
Date: 24.JUN.2014 12:32:19

1GHz – 5GHz



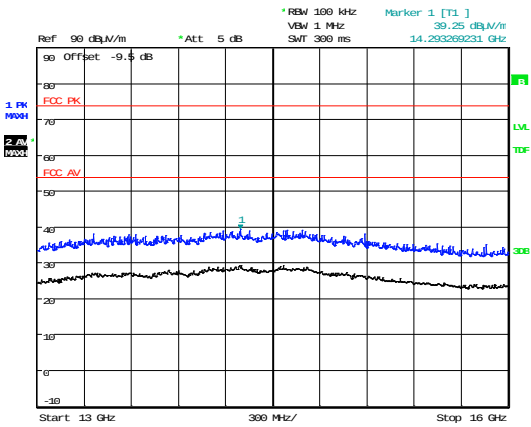
Date: 24.JUN.2014 12:31:36

5GHz – 9GHz



Date: 24.JUN.2014 12:30:21

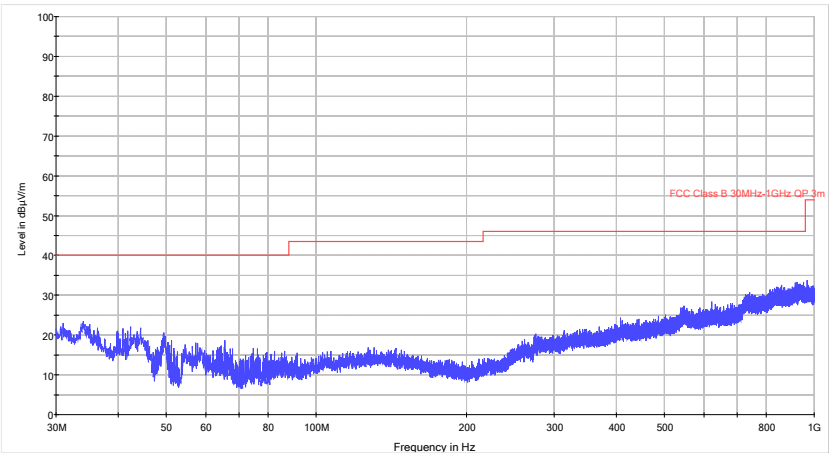
9GHz – 13GHz



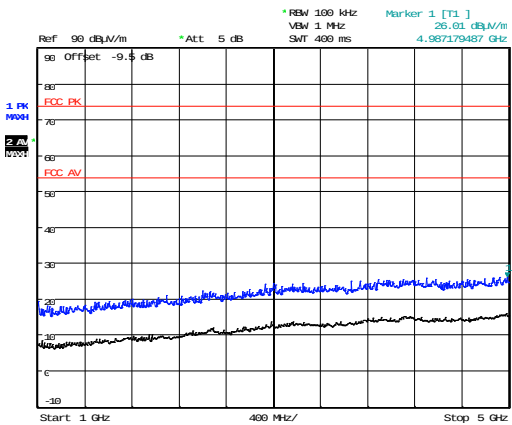
Date: 24.JUN.2014 12:29:59

13GHz – 16GHz

Unintentional Radiated Emissions 917.5MHz - Smart Tag with docking station

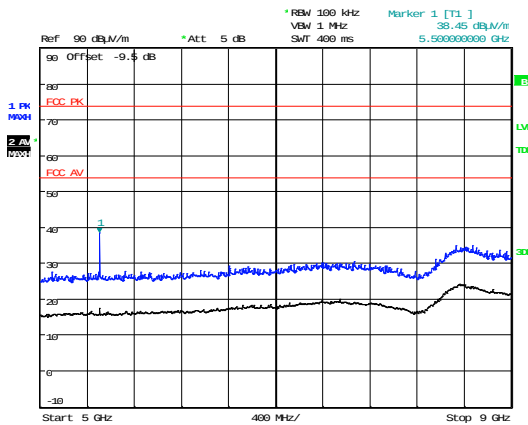


30MHz – 1GHz



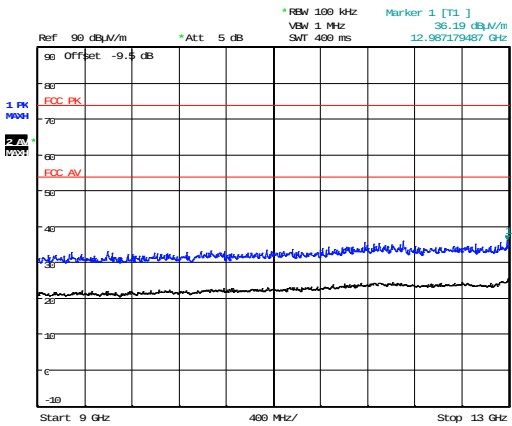
Date: 24.JUN.2014 12:33:56

1GHz – 5GHz



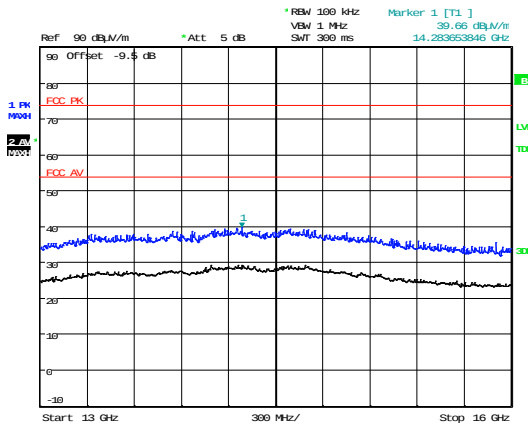
Date: 24.JUN.2014 12:34:39

5GHz – 9GHz



Date: 24.JUN.2014 12:34:59

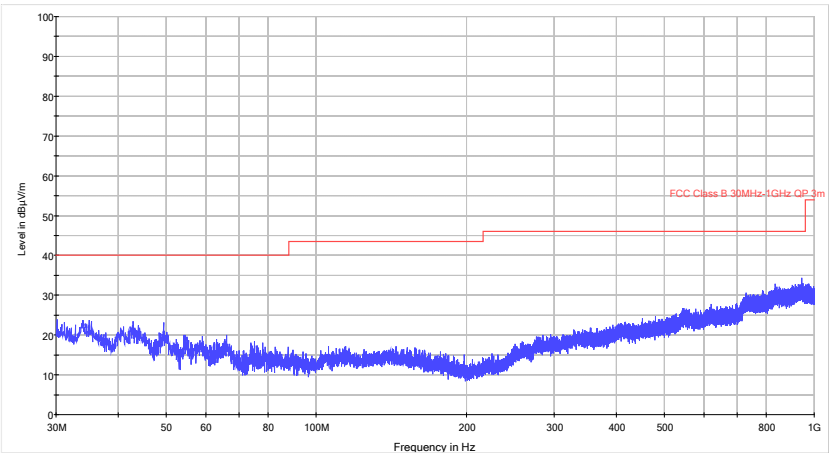
9GHz – 13GHz



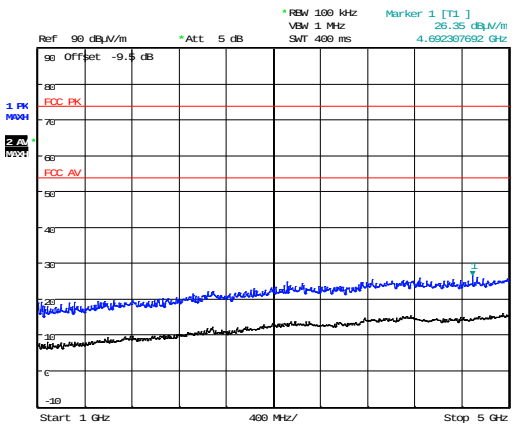
Date: 24.JUN.2014 12:35:42

13GHz – 16GHz

Unintentional Radiated Emissions 921MHz - Smart Tag with docking station

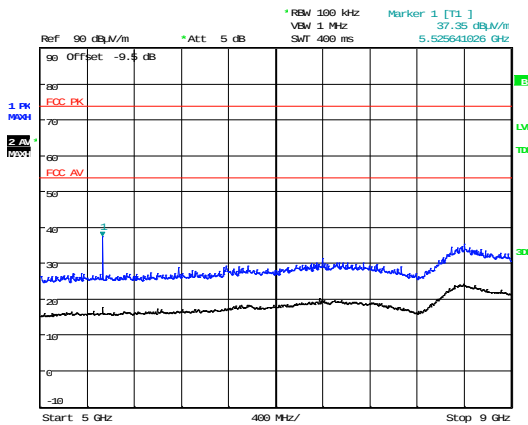


30MHz – 1GHz



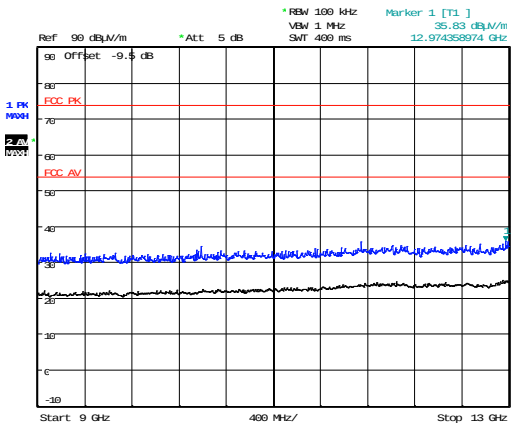
Date: 24.JUN.2014 12:44:56

1GHz – 5GHz



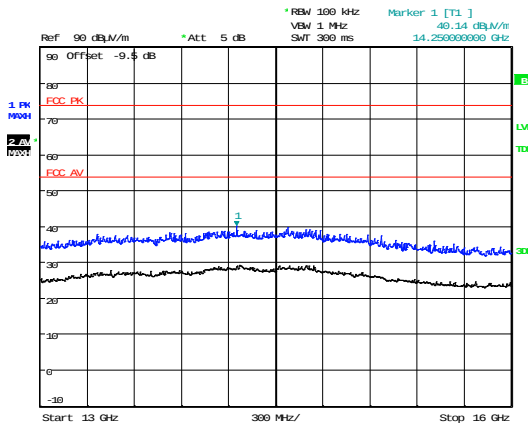
Date: 24.JUN.2014 12:44:35

5GHz – 9GHz



Date: 24.JUN.2014 12:43:56

9GHz – 13GHz



Date: 24.JUN.2014 12:43:39

13GHz – 16GHz

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 were submitted by the client for testing:

Sample No.	Description	Identification
S07	Dock Power Supply	3A-181WP06
S10	On body Charger with Power Supply	OBC00028 / EPU15
S17	Docking Station	UBIN 34030017
S24	Smart Tag Strap	None
S28	Buddi Colorado System – Smart Tag	STG00038

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

Sample No.	Description	Identification
S22	Mode Switch Tool	T4641RW

The following samples of apparatus were supplied by TRaC Global as support or drive equipment (auxiliary equipment):

Identification	Description
None	

C2 EUT operating mode during testing

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

Test	Description of Operating Mode:
All Transmitter Tests	EUT actively transmitting

Test	Description of Operating Mode:
Receiver radiated spurious emissions	EUT in receive mode

Test	Description of Operating Mode:
PLCE	EUT in transmit and receive modes

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 : S28
Tests : Radiated Emissions

Port	Description of Cable Attached	Cable length	Equipment Connected
EUT has got no external ports			

C5 Details of Equipment Used

TRaC No	Equipment Type	Equipment Description	Manufacturer	Last Cal Calibration	Calibration Period	Due For Calibration
UH191	CBL611/A	Bilog	Chase	13/12/2012	24	13/12/2014
UH387	ATS	Chamber 1	Rainford EMC	04/07/2013	12	04/07/2014
UH405	FSU26	Spectrum Analyser	R&S	16/04/2014	12	16/04/2015
UH281	FSU46	Spectrum Analyser	R&S	26/03/2014	12	26/03/2015
L138	3115	1-18GHz Horn	EMCO	17/10/2013	24	17/10/2015
L317	ESVS10	Receiver	R&S	12/02/2014	12	12/02/2015
REF940	ATS	Radio Chamber - PP	Rainford EMC	09/07/2013	12	09/07/2014
L572	8449B	Pre Amp	Agilent	11/02/2014	12	11/02/2015
UH187	ESHS10	Receiver	R&S	19/02/2014	12	19/02/2015
UH396	ENV216	Lisn	R&S	22/05/2014	12	22/05/2015

Appendix D:

Additional Information

This report contains no additional information.

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

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

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

Therefore the calculated duty cycle was determined:

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

e.g

$$= \frac{5.929\text{ms}}{100\text{ms}} = 0.05929$$

Correction factor (dB) = $20 \times (\text{Log}_{10} 0.05929) = 24.5\text{dB}$

Duty cycle correction factor to be used is:

Txon period 5.929ms in 100ms
Worse case 5.929ms in 100ms

Therefore $20\log (5.929 \div 100) = 24.5\text{dB}$.

Appendix F:**Photographs and Figures**

The following photographs were taken of the test samples:

For Smart Tag standalone

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

For Smart tag with on body charger

3. Radiated electric field emissions arrangement: Overview
4. Radiated electric field emissions arrangement: Close up
5. AC Powerline Conducted Emissions: Overview

For Smart Tag with docking station

6. Radiated electric field emissions arrangement: Overview
7. Radiated electric field emissions arrangement: Close up
8. AC Powerline Conducted Emissions: Overview

Photograph 1



Photograph 2



Photograph 3



Photograph 4



Photograph 5



Photograph 6



Photograph 7



Photograph 8



