A RADIO TEST REPORT

FOR

UBISENSE

ON

WATCH LOCATION DEVICE

DOCUMENT NO. TRA-011589-47-01-A

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TRaC Wireless Test Report	**:** TRA-011589-47-01-A
Applicant	**:** Ubisense
Apparatus	**:** Watch Location Device
Specification(s)	**:** CFR47 Part 15.249
Purpose of Test	**:** Certification
FCCID	**:** SEAWATCH21
Authorised by	: 
	: Radio Product Manager
Issue Date	**:**16th April 2013
Authorised Copy Number	**:** *PDF*

Total number of pages: 44

Contents

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.

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1.2 Tests Requested By

This testing in this report was requested by :

Ubisense
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1.3 Manufacturer

As Above

1.4 Apparatus Assessed

The following apparatus was assessed between: 7/2/13 and 8/2.13

UWB Watch Location Device

The apparatus is a UWB Watch Location Device containing an UWB transmitter operating at around 7200 MHz in the 3100MHz to 10600 MHz UWB band and a 2.4GHz Transceiver.

This report covers the 2.4GHz transceiver part of the device.

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
Spurious Emissions Radiated <1000MHz	Title 47 of the CFR: Part 15 Subpart (c) 15.249 & 12.209	ANSI C63.10:2009	Pass
Spurious Emissions Radiated >1000MHz	Title 47 of the CFR: Part 15 Subpart (c) 15.249 & 12.209	ANSI C63.10:2009	Pass
AC Power conducted emissions	Title 47 of the CFR: Part 15 Subpart (c) 15.207	ANSI C63.10:2009	N/A
Intentional Emission Frequency	Title 47 of the CFR: Part 15 Subpart (c) 15.249	ANSI C63.10:2009	Pass
Intentional Emission Field Strength	Title 47 of the CFR: Part 15 Subpart (c) 15.249	ANSI C63.10:2009	Pass
Intentional Emission Band Occupancy	Title 47 of the CFR: Part 15 Subpart (c) 15.215	ANSI C63.10:2009	Pass
Intentional Emission ERP (mW)	Title 47 of the CFR: Part 15 Subpart (c)	ANSI C63.10:2009	N/A
Unintentional Radiated Spurious Emissions	Title 47 of the CFR: Part 15 Subpart (b) 15.109	ANSI C63.10:2009	Pass
Antenna Arrangements Integral:	Title 47 of the CFR: Part 15 Subpart (c) 15.203	-	-
Antenna Arrangements External Connector	Title 47 of the CFR: Part 15 Subpart (c) 15.204	-	-
Restricted Bands	Title 47 of the CFR: Part 15 Subpart (c) 15.205	-	-
Maximum Frequency of Search	Title 47 of the CFR: Part 15 Subpart (c) 15.33	-	-
Extrapolation Factor	Title 47 of the CFR: Part 15 Subpart (c) 15.31(f)	-	-

Abbreviations used in the above table:

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

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	: 17 to 23 °C
Humidity	: 45 to 75 %
Barometric Pressure	: 86 to 106 kPa

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 test data recorded, the following measurement uncertainty was calculated:

Radiated Electric Field Emissions

Quantity Range	Quantity	Expanded Uncertainty
9kHz to 150 kHz	Amplitude dB(µV/m)	±1.6dB
150 kHz to 30 MHz	Amplitude dB(µV/m)	±2.1dB
30MHz to 300MHz Horizontal	Amplitude dB(µV/m)	±5.1dB
30MHz to 300MHz Vertical	Amplitude dB(µV/m)	±5.2dB
300MHz to 1GHz Horizontal	Amplitude dB(µV/m)	±5.4dB
300MHz to 1GHz Vertical	Amplitude dB(µV/m)	±5.2dB
1GHz to 18GHz Horizontal	Amplitude dB(µV/m)	±4.4dB
1GHz to 18GHz Vertical	Amplitude dB(µV/m)	±4.4dB
18GHz to 26.5GHz Horizontal	Amplitude dB(µV/m)	±4.2dB
18GHz to 26.5GHz Vertical	Amplitude dB(µV/m)	±4.2dB
26.5GHz to 40GHz Horizontal	Amplitude dB(µV/m)	±4.3dB
26.5GHz to 40GHz Vertical	Amplitude dB(µV/m)	±4.3dB

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
Mod	: Modification
EUT	: Equipment Under Test
SE	: Support Equipment
L	: Live Power Line
N	: Neutral Power Line
E	: Earth Power Line
Pk	: Peak Detector
QP	: Quasi-Peak Detector
Av	: Average Detector
CDN	: Coupling & decoupling network

ALSR	: Absorber Lined Screened Room
OATS	: Open Area Test Site
ATS	: Alternative Test Site
Ref	: Reference
Freq	: Frequency
MD	: Measurement Distance
SD	: Spec Distance
Pol	: Polarisation
H	: Horizontal Polarisation
V	: Vertical Polarisation

A1 Transmitter Intentional Emission Radiated

Carrier power was verified with the EUT transmitting Test Details:	
Regulation	Title 47 of the CFR: Part15 Subpart (c) 15.249
Measurement standard	ANSI C63.10:2009
EUT sample number	S01
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix F)	1&2

FREQ. (MHz)	MEASUREMENT Rx. READING (dBµV)	CABLE LOSS (dB)	ANT FACTOR (dB/m)	PRE AMP (dB)	FIELD STRENGTH (dBµV/m)	FIELD STRENGTH (mV/m)
2402.500	53.4	5.1	29.6	35.30	88.10	25.41
2442.000	51.7	5.2	29.8	35.31	86.70	21.63
2480.500	50.2	5.3	29.9	35.32	85.40	18.62
Limit value @ fc			50 mV/m @ 3m			

Band occupancy

FREQ. (MHz)	f lower (MHz)	f higher (MHz)	Band occupancy @ -20 dBc
2402.500	2402.216752	2402.809700	592.949
2442.000	2441.717949	2442.310898	592.949
2480.500	2480.214744	2480.817308	602.564

Notes:
1 Results quoted are extrapolated as indicated
2 Receiver detector @ fc Peak 1MHz bandwidth
3 When battery powered the EUT was powered with new batteries

Test Method:
1 As per Radio – Noise Emissions, ANSI C63.10:2009
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 orthagonal planes.
Maximum results recorded

A2 Radiated Electric Field Emissions

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The radiated electric filed emission test applies to all spurious emissions and harmonics emissions . The maximum permitted field strength is listed in Section 15.209. 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:	
Regulation	Title 47 of the CFR, Part 15 Subpart (c) Clause 15.209
Measurement standard	ANSI C63.10:2009
Frequency range	30MHz – 25GHz
EUT sample number	S01
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix F)	1&2

The worst case radiated emission measurements for spurious emissions and harmonics that fall within the restricted bands are listed below:

Ref No.	FREQ. (MHz)	MEAS Rx (dBµV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBµV/m)	EXTRAP FACT (dB)	FIELD ST'GH (µV/m)	LIMIT (µV/m)
1.	2400.0_{Pk}	62.90	5.0	29.6	35.30	62.2	-9.54	429.54	5000
2.	2400.0_{Av}	50.70	5.0	29.6	35.30	50.0	-9.54	105.44	500
3.	2483.5_{Pk}	58.72	5.4	29.9	35.32	58.7	-9.54	287.08	5000
4.	2483.5_{Av}	46.72	5.4	29.9	35.32	46.7	-9.54	72.11	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 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= 1MHz, VBW ≥ RBW
Average	RBW= 1MHz, VBW ≥ RBW

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

Radiated emission limits 47 CFR Part 15: Clause 15.209 for 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:

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

(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

A3 Unintentional Radiated Emissions

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The radiated electric filed emission test applies to all spurious emissions on directly related to the transmitter. The maximum permitted field strength is listed in Section 15.109. The EUT was set to operate in a transmit standby / receive mode.

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 : [X]

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

Test Details:	
Regulation	Title 47 of the CFR, Part 15 Subpart (c) Clause 15.109
Measurement standard	ANSI C63.10:2009
Frequency range	30MHz – 25GHz
EUT sample number	S01
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix F)	1&2

The worst case radiated emission measurements for spurious 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)	EXTRAP FACT (dB)	FIELD ST'GH (µV/m)	LIMIT (µV/m)
1.	No Significant Emissions Within 20 dB of Limit								

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

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

Radiated emission limits 47 CFR Part 15: Clause 15.209 for 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:

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

(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 ac Power Line Conducted Emissions 15.107 (Receiver/Digital circuitry)

No ac Power Line emissions were performed as the EUT is exclusively battery powered

Appendix B: Supporting Graphical Data

This appendix contains graphical data obtained during testing.

Notes:

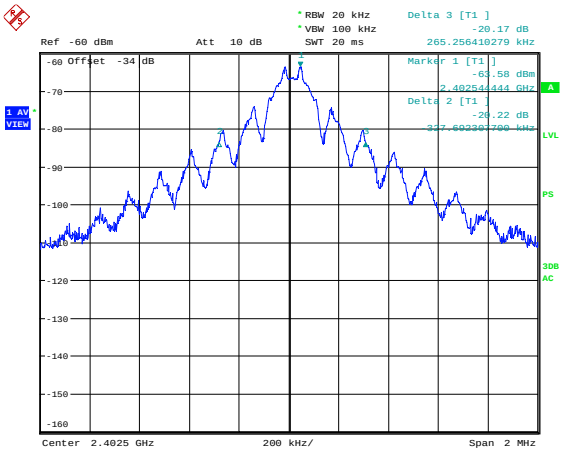
(a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A and Appendix B.

(b) The time and date on the plots do not necessarily equate to the time of the test.

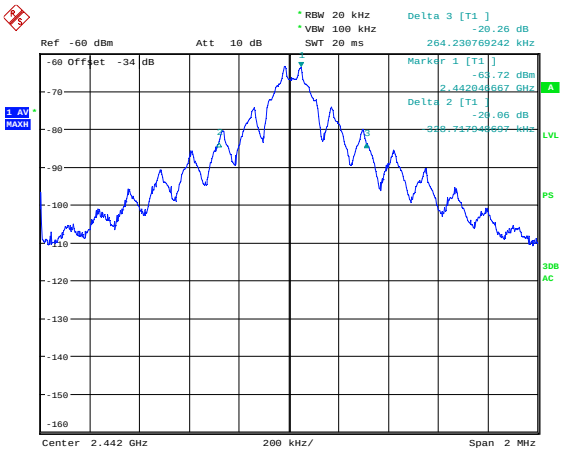
(c) Where relevant, on power line conducted emission plots, the limit displayed is the average limit, which is stricter than the quasi peak limit.

(d) Appendix C details the numbering system used to identify the sample and its modification state.

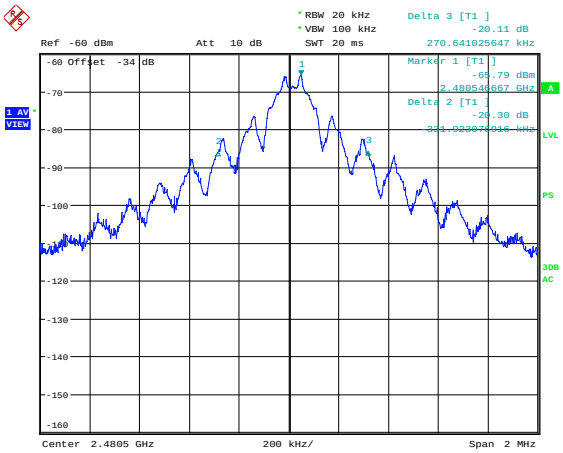
(e) The plots presented in this appendix may not be a complete record of the measurements performed, but are a representative sample, relative to the final assessment.



20dB Bandwidth – 2402.5 MHz

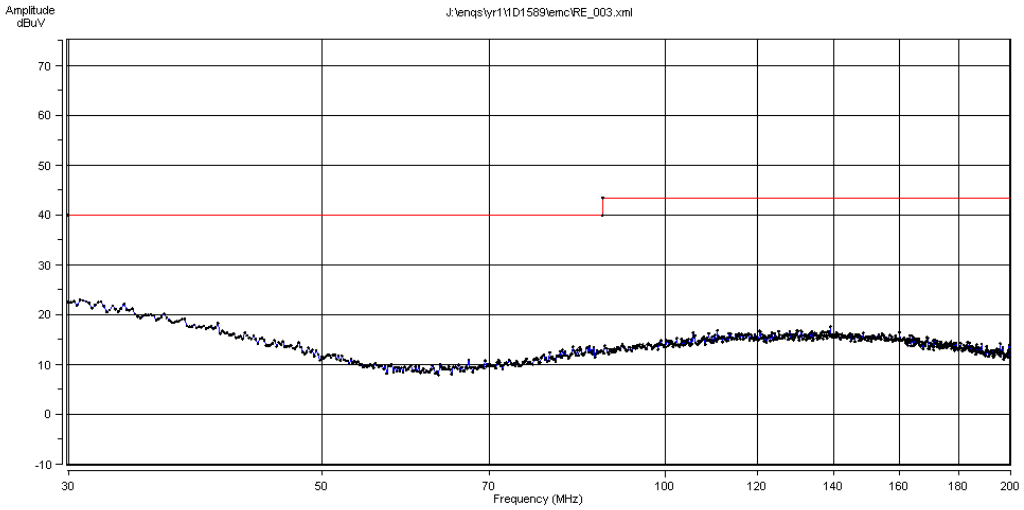


20dB Bandwidth – 2442.0 MHz



20dB Bandwidth – 2480.5 MHz

TRaC EMC Emissions Software - Radiated emissions

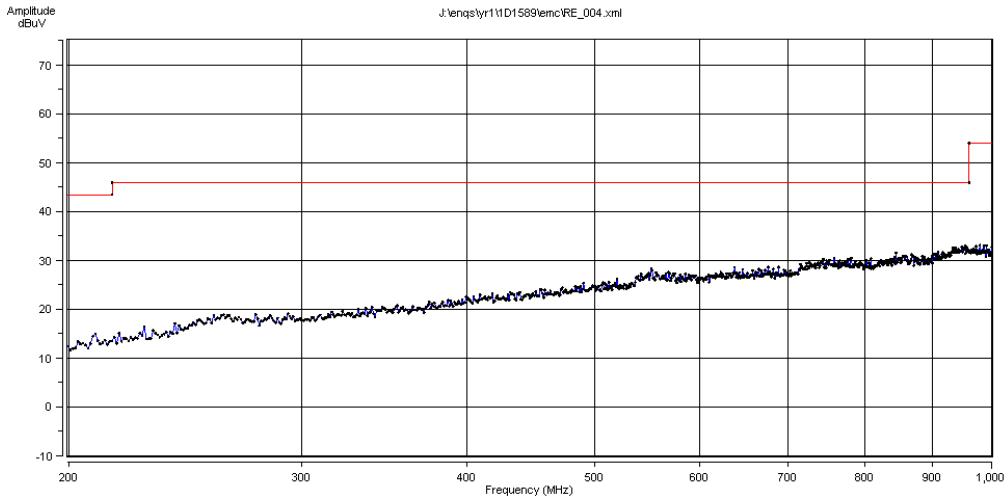


Test Location:	EMC Ferrite	**Remote Drive Eq.:**	None
Analyser Type:	ESU40	**Sample Numbers:**	N/A
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	15.249 Tx Bottom Channel
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	3.0	**Engineer:**	Ken Anderson
EUT Names:	UWB Watch Location Device	**Date/Time:**	08/02/2013 09:44:01
Sample Numbers:	S01	**Job Number:**	1D1589
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

2402.5 MHz - Radiated spurious emissions 30 MHz to 200 MHz

TRaC EMC Emissions Software - Radiated emissions

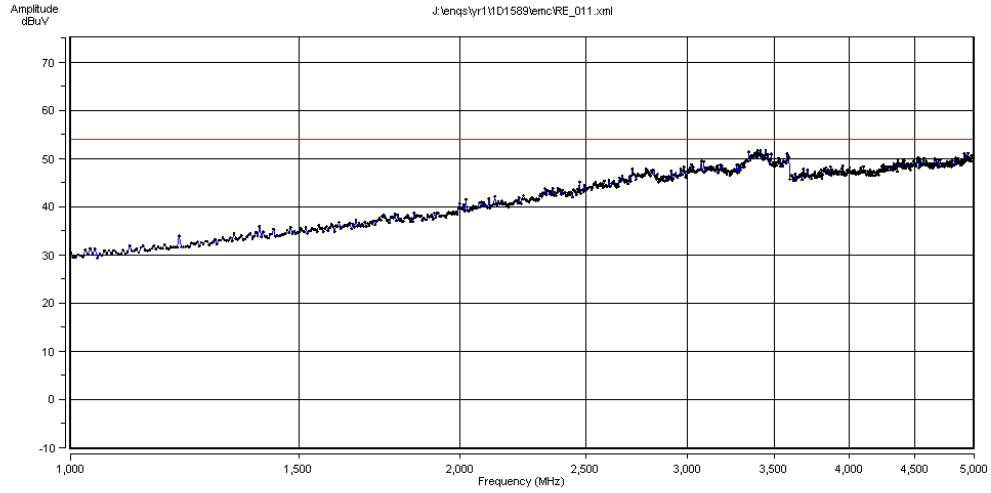


Test Location:	EMC Ferrite	**Remote Drive Eq.:**	None
Analyser Type:	ESU40	**Sample Numbers:**	N/A
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	15.249 Tx Bottom Channel
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	3.0	**Engineer:**	Ken Anderson
EUT Names:	UWB Watch Location Device	**Date/Time:**	08/02/2013 09:46:21
Sample Numbers:	S01	**Job Number:**	1D1589
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

2402.5 MHz - Radiated spurious emissions 200 MHz to 1000 MHz

TRaC EMC Emissions Software - Radiated emissions

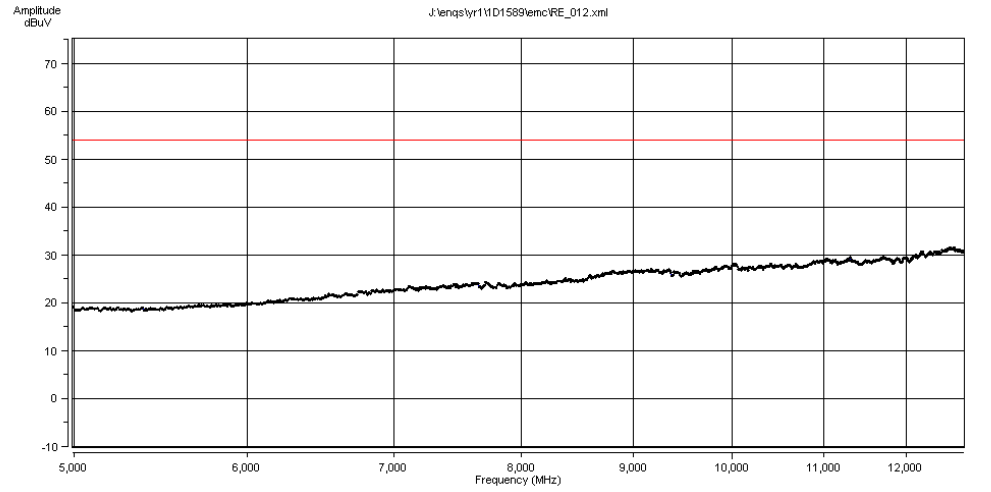


Test Location:	EMC Ferrite	**Remote Drive Eq.:**	None
Analyser Type:	ESU40	**Sample Numbers:**	N/A
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	15.249 Tx Mode Bottom Channel
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	1.0	**Engineer:**	Ken Anderson
EUT Names:	UWB Watch Location Device	**Date/Time:**	08/02/2013 10:16:22
Sample Numbers:	S01	**Job Number:**	1D1589
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

2402.5 MHz - Radiated spurious emissions 1 GHz to 5 GHz

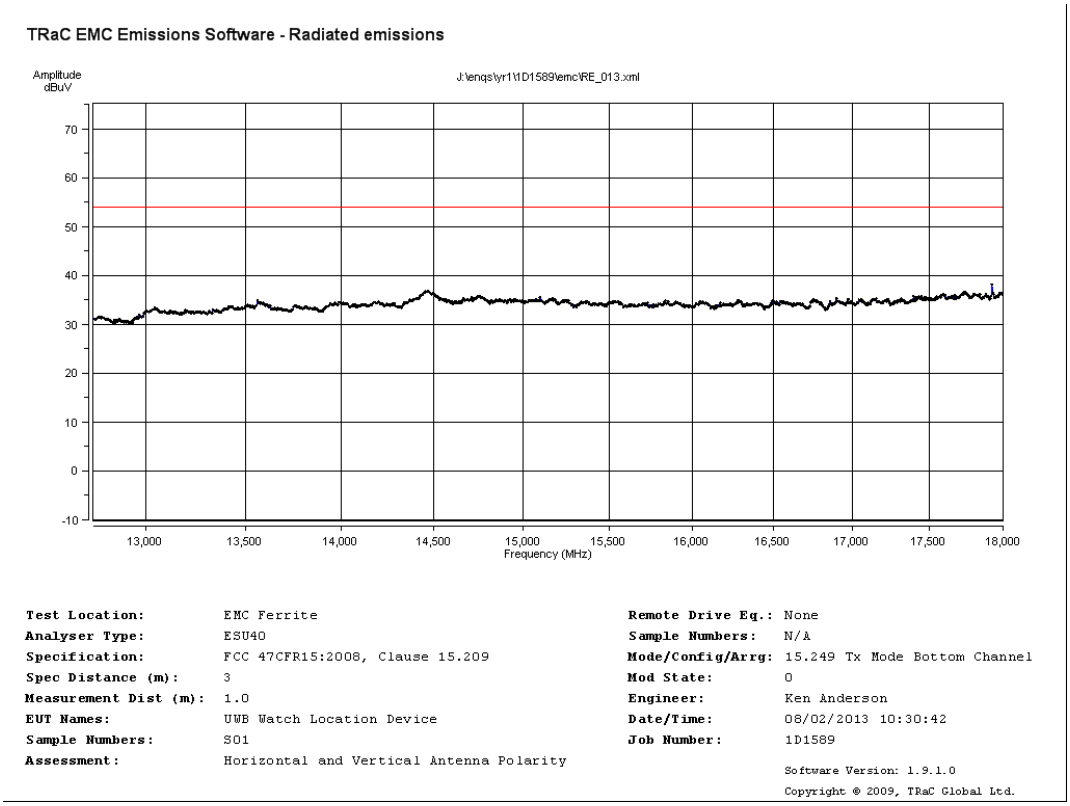
TRaC EMC Emissions Software - Radiated emissions



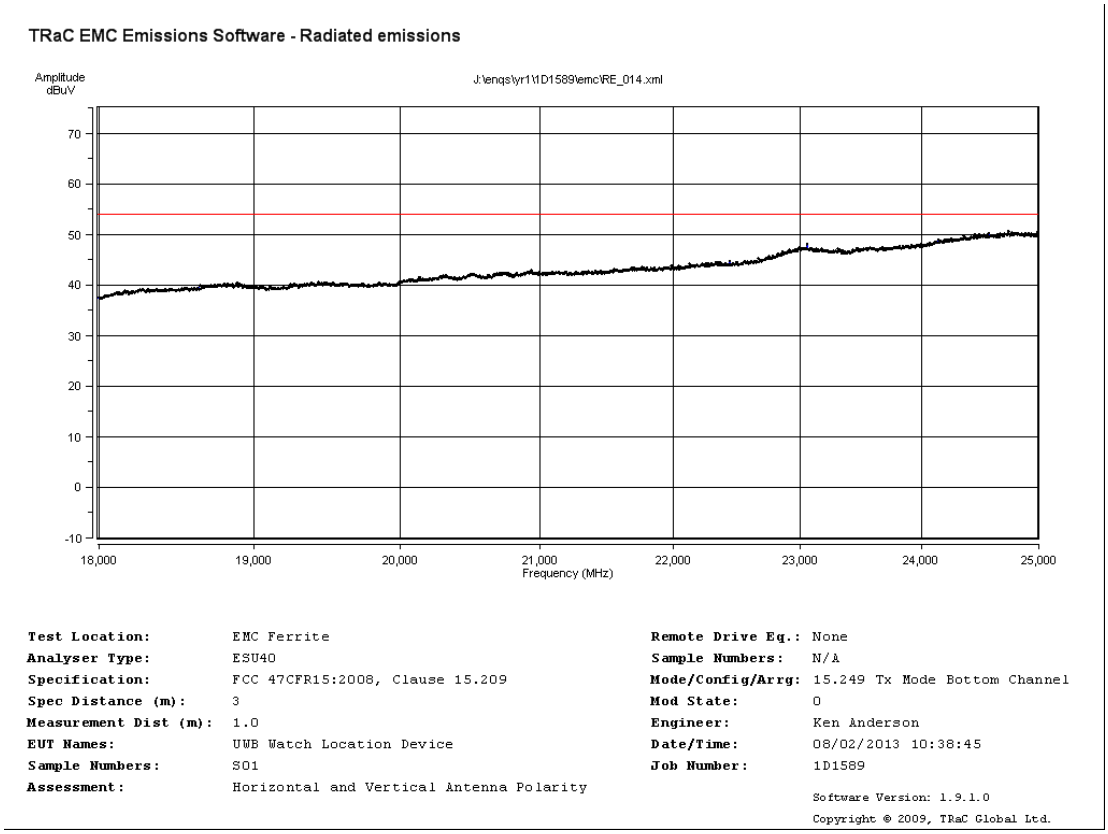
Test Location:	EMC Ferrite	**Remote Drive Eq.:**	None
Analyser Type:	ESU40	**Sample Numbers:**	N/A
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	15.249 Tx Mode Bottom Channel
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	1.0	**Engineer:**	Ken Anderson
EUT Names:	UWB Watch Location Device	**Date/Time:**	08/02/2013 10:26:31
Sample Numbers:	S01	**Job Number:**	1D1589
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

2402.5 MHz - Radiated spurious emissions 5 GHz to12.75 GHz

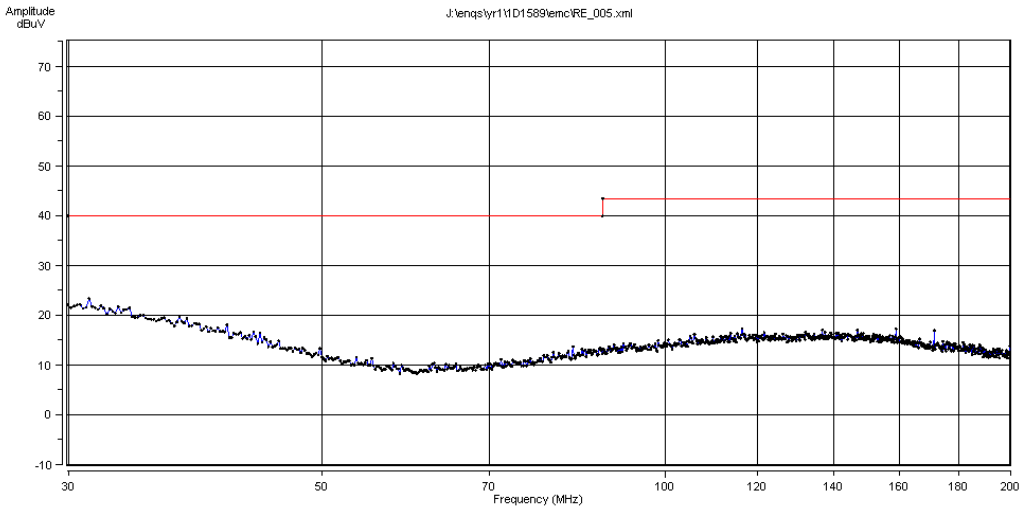


2402.5 MHz - Radiated spurious emissions 12.75 GHz to 18GHz



2402.5 MHz - Radiated spurious emissions 18 GHz to 25 GHz

TRaC EMC Emissions Software - Radiated emissions



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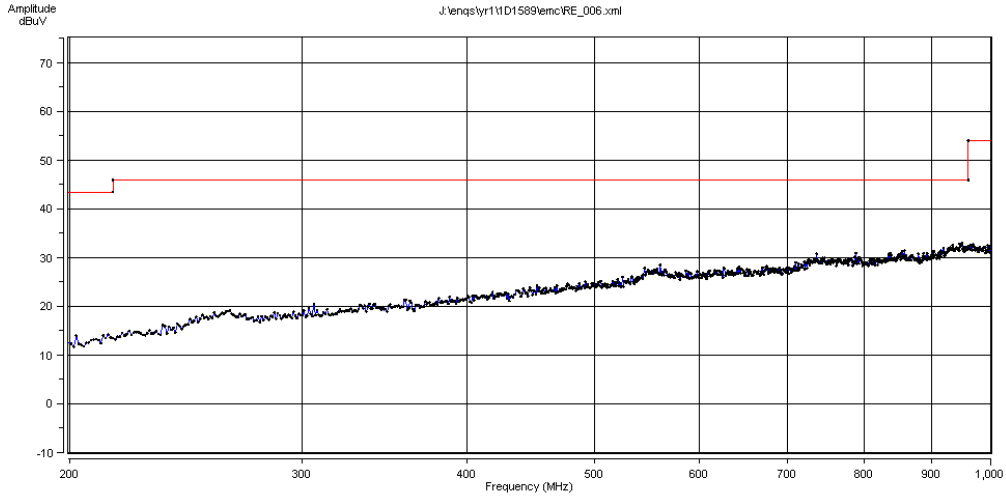
Analyser Type:	ESU40	**Sample Numbers:**	N/A
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	15.249 Tx Bottom Channel
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	3.0	**Engineer:**	Ken Anderson
EUT Names:	UWB Watch Location Device	**Date/Time:**	08/02/2013 09:54:02
Sample Numbers:	S01	**Job Number:**	1D1589
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

2442.0 MHz - Radiated spurious emissions 30 MHz to 200 MHz

TRaC EMC Emissions Software - Radiated emissions

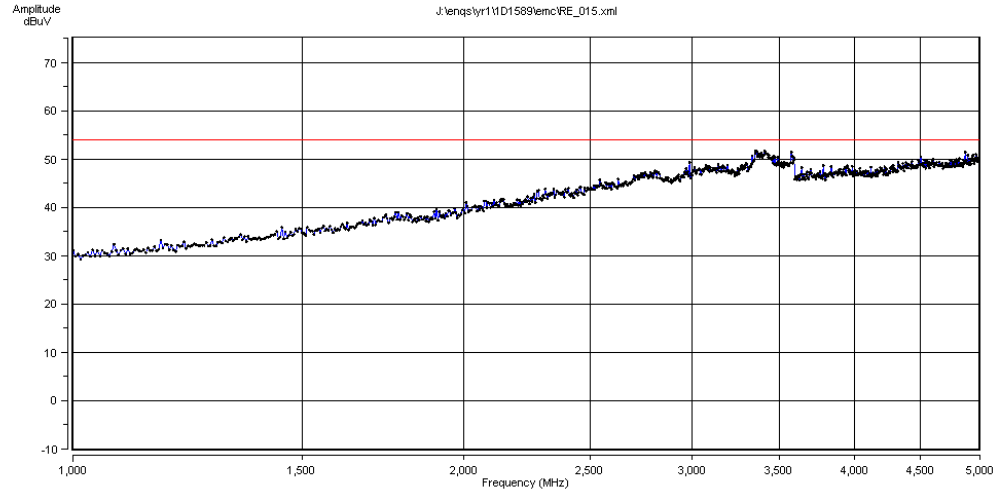


Test Location:	EMC Ferrite	**Remote Drive Eq.:**	None
Analyser Type:	ESU40	**Sample Numbers:**	N/A
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	15.249 Tx Bottom Channel
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	3.0	**Engineer:**	Ken Anderson
EUT Names:	UWB Watch Location Device	**Date/Time:**	08/02/2013 09:56:19
Sample Numbers:	S01	**Job Number:**	1D1589
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

2442.0 MHz - Radiated spurious emissions 200 MHz to 1000 MHz

TRaC EMC Emissions Software - Radiated emissions

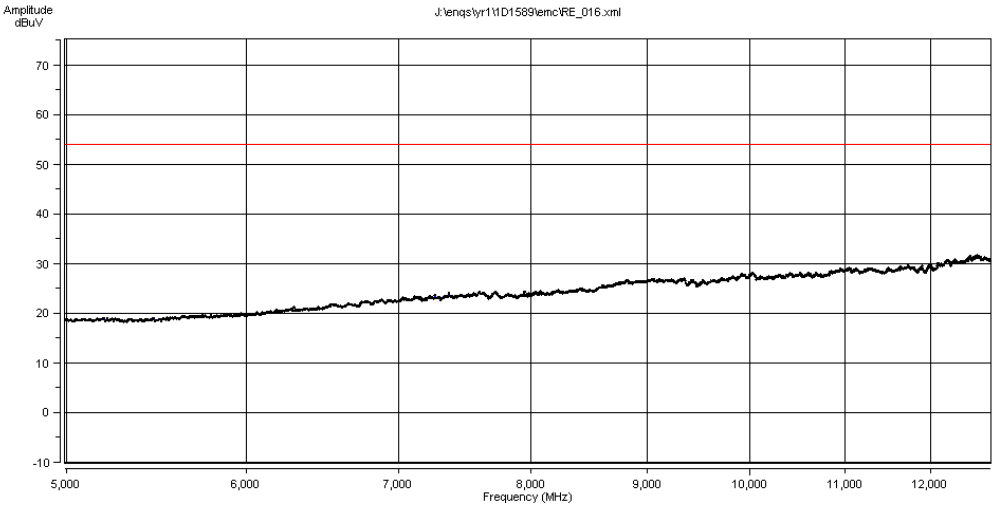


Test Location:	EMC Ferrite	**Remote Drive Eq.:**	None
Analyser Type:	ESU40	**Sample Numbers:**	N/A
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	15.249 Tx Mode Middle Channel
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	1.0	**Engineer:**	Ken Anderson
EUT Names:	UWB Watch Location Device	**Date/Time:**	08/02/2013 10:41:51
Sample Numbers:	SO1	**Job Number:**	1D1589
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

2442.0 MHz - Radiated spurious emissions 1 GHz to 5 GHz

TRaC EMC Emissions Software - Radiated emissions

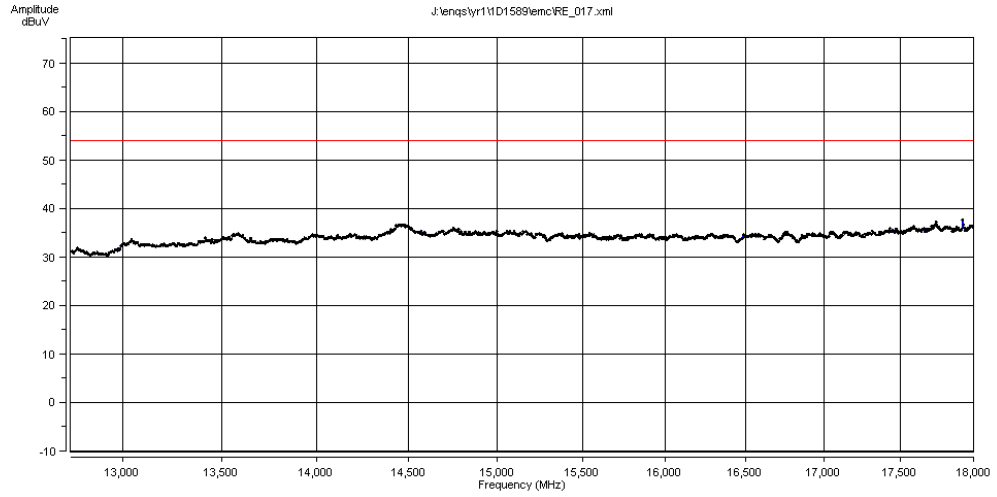


Test Location:	EMC Ferrite	**Remote Drive Eq.:**	None
Analyser Type:	ESU40	**Sample Numbers:**	N/A
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	15.249 Tx Mode Middle Channel
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	1.0	**Engineer:**	Ken Anderson
EUT Names:	UWB Watch Location Device	**Date/Time:**	08/02/2013 10:45:33
Sample Numbers:	SO1	**Job Number:**	1D1589
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

2442.0 MHz - Radiated spurious emissions 5 GHz to12.75 GHz

TRaC EMC Emissions Software - Radiated emissions

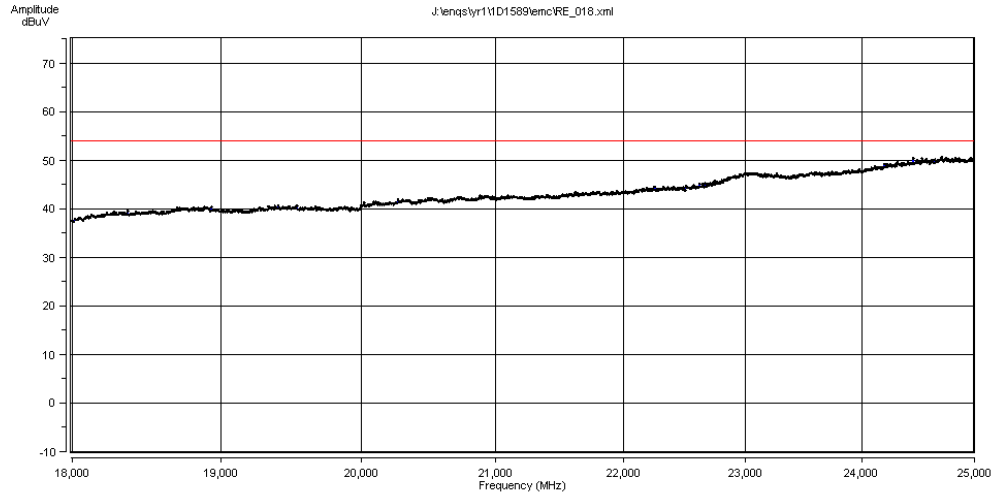


Test Location:	EMC Ferrite	**Remote Drive Eq.:**	None
Analyser Type:	ESU40	**Sample Numbers:**	N/A
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	15.249 Tx Mode Middle Channel
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	1.0	**Engineer:**	Ken Anderson
EUT Names:	UWB Watch Location Device	**Date/Time:**	08/02/2013 10:50:08
Sample Numbers:	S01	**Job Number:**	1D1589
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

2442.0 MHz - Radiated spurious emissions 12.75 GHz to 18GHz

TRaC EMC Emissions Software - Radiated emissions

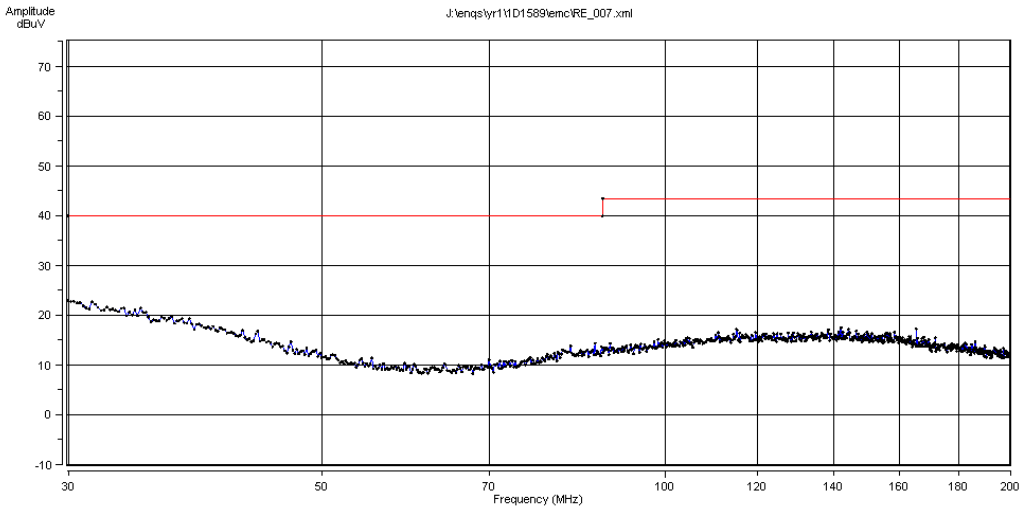


Test Location:	EMC Ferrite	**Remote Drive Eq.:**	None
Analyser Type:	ESU40	**Sample Numbers:**	N/A
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	15.249 Tx Mode Middle Channel
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	1.0	**Engineer:**	Ken Anderson
EUT Names:	UWB Watch Location Device	**Date/Time:**	08/02/2013 10:53:08
Sample Numbers:	S01	**Job Number:**	1D1589
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

2442.0 MHz - Radiated spurious emissions 18 GHz to 25 GHz

TRaC EMC Emissions Software - Radiated emissions

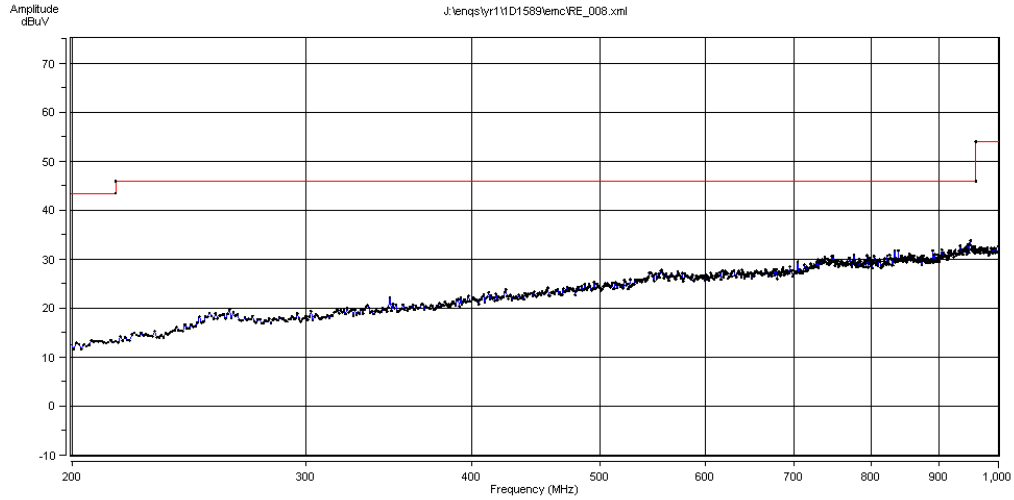


Test Location:	EMC Ferrite	**Remote Drive Eq.:**	None
Analyser Type:	ESU40	**Sample Numbers:**	N/A
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	15.249 Tx Top Channel
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	3.0	**Engineer:**	Ken Anderson
EUT Names:	UWB Watch Location Device	**Date/Time:**	08/02/2013 09:59:48
Sample Numbers:	S01	**Job Number:**	1D1589
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

2480.5 MHz - Radiated spurious emissions 30 MHz to 200 MHz

TRaC EMC Emissions Software - Radiated emissions

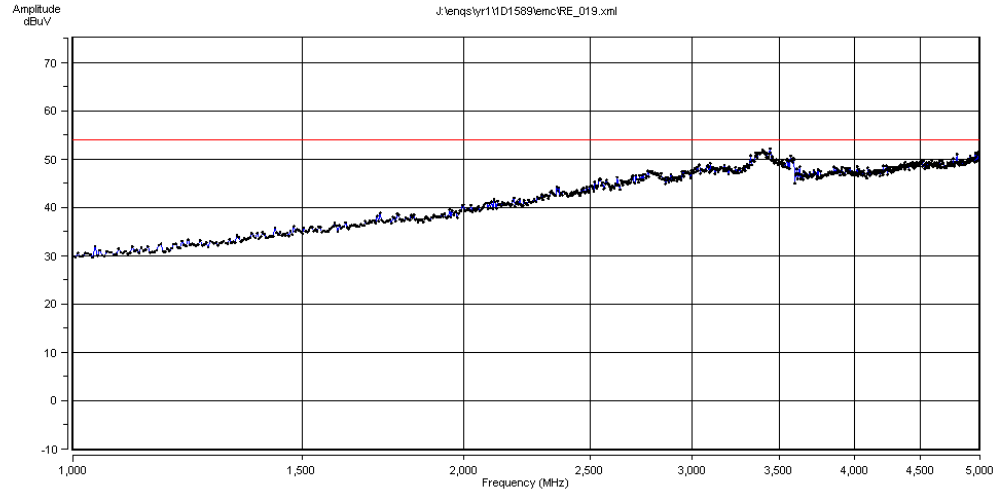


Test Location:	EMC Ferrite	**Remote Drive Eq.:**	None
Analyser Type:	ESU40	**Sample Numbers:**	N/A
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	15.249 Tx Top Channel
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	3.0	**Engineer:**	Ken Anderson
EUT Names:	UWB Watch Location Device	**Date/Time:**	08/02/2013 10:02:01
Sample Numbers:	S01	**Job Number:**	1D1589
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

2480.5 MHz - Radiated spurious emissions 200 MHz to 1000 MHz

TRaC EMC Emissions Software - Radiated emissions

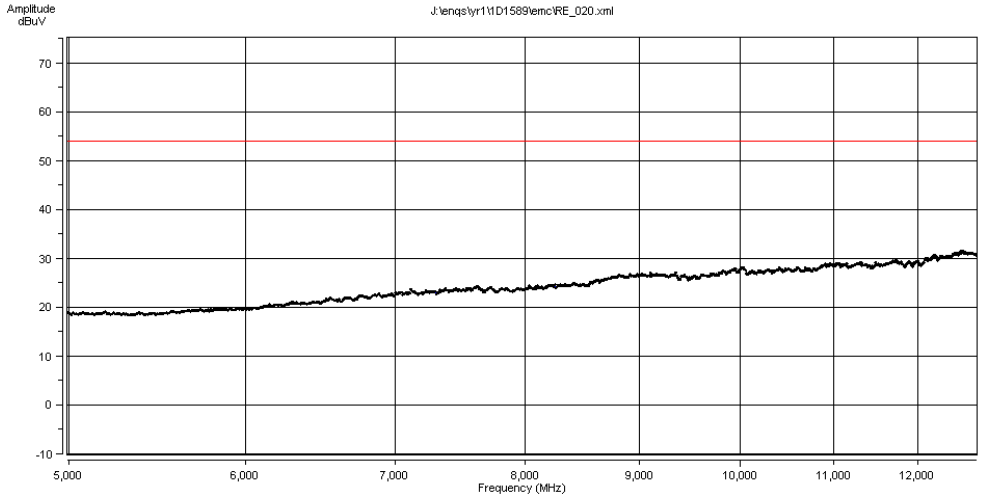


Test Location:	EMC Ferrite	**Remote Drive Eq.:**	None
Analyser Type:	ESU40	**Sample Numbers:**	N/A
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	15.249 Tx Mode Top Channel
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	1.0	**Engineer:**	Ken Anderson
EUT Names:	UWB Watch Location Device	**Date/Time:**	08/02/2013 11:05:29
Sample Numbers:	SO1	**Job Number:**	1D1589
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

2480.5 MHz - Radiated spurious emissions 1 GHz to 5 GHz

TRaC EMC Emissions Software - Radiated emissions

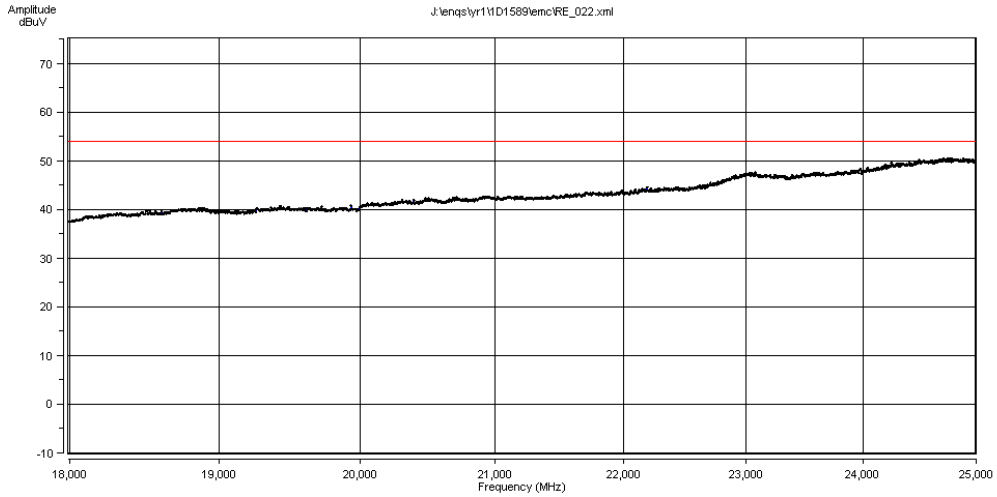


Test Location:	EMC Ferrite	**Remote Drive Eq.:**	None
Analyser Type:	ESU40	**Sample Numbers:**	N/A
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	15.249 Tx Mode Top Channel
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	1.0	**Engineer:**	Ken Anderson
EUT Names:	UWB Watch Location Device	**Date/Time:**	08/02/2013 11:09:51
Sample Numbers:	SO1	**Job Number:**	1D1589
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

2480.5 MHz - Radiated spurious emissions 5 GHz to12.75 GHz

TRaC EMC Emissions Software - Radiated emissions

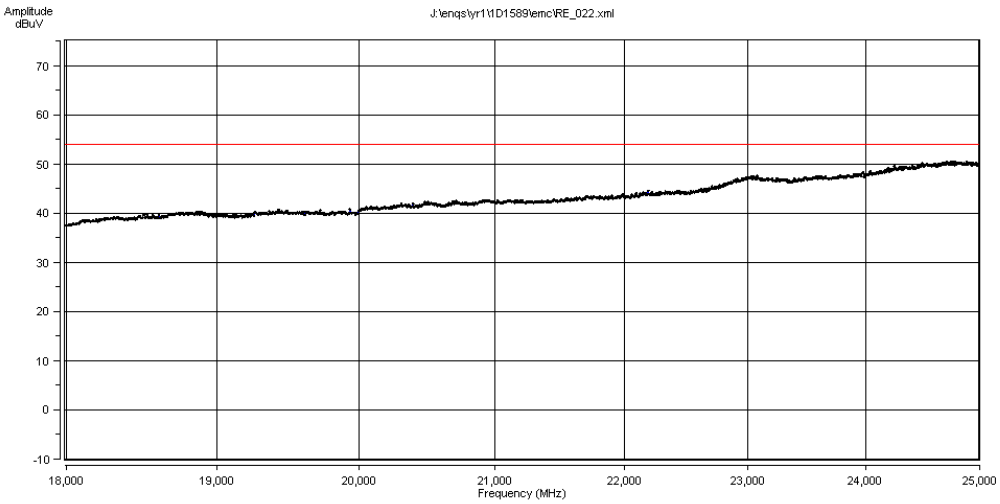


Test Location:	EMC Ferrite	**Remote Drive Eq.:**	None
Analyser Type:	ESU40	**Sample Numbers:**	N/A
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	15.249 Tx Mode Top Channel
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	1.0	**Engineer:**	Ken Anderson
EUT Names:	UWB Watch Location Device	**Date/Time:**	08/02/2013 11:17:53
Sample Numbers:	S01	**Job Number:**	1D1589
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

2480.5 MHz - Radiated spurious emissions 12.75 GHz to 18GHz

TRaC EMC Emissions Software - Radiated emissions



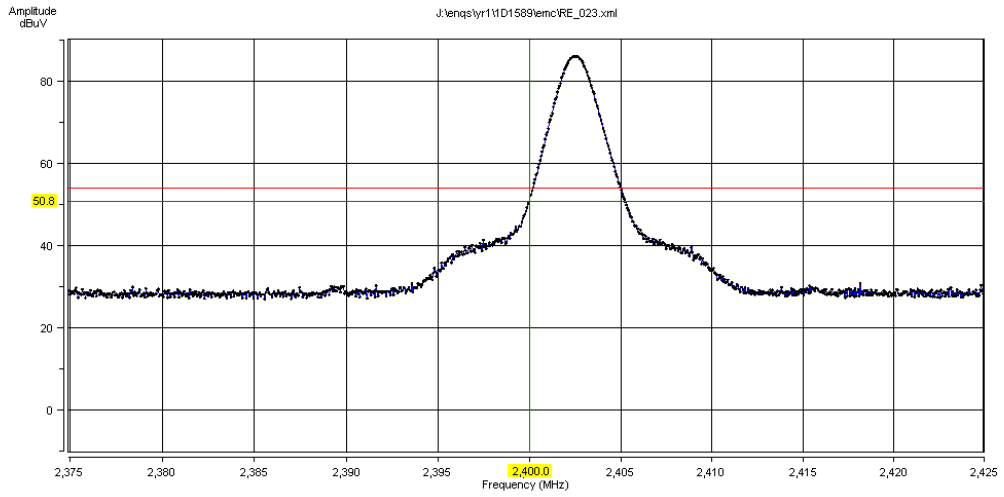
Test Location:	EMC Ferrite	**Remote Drive Eq.:**	None
Analyser Type:	ESU40	**Sample Numbers:**	N/A
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	15.249 Tx Mode Top Channel
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	1.0	**Engineer:**	Ken Anderson
EUT Names:	UWB Watch Location Device	**Date/Time:**	08/02/2013 11:17:53
Sample Numbers:	S01	**Job Number:**	1D1589
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

2480.5 MHz - Radiated spurious emissions 18 GHz to 25 GHz

Radiated Bandedge Compliance

TRaC EMC Emissions Software - Radiated emissions

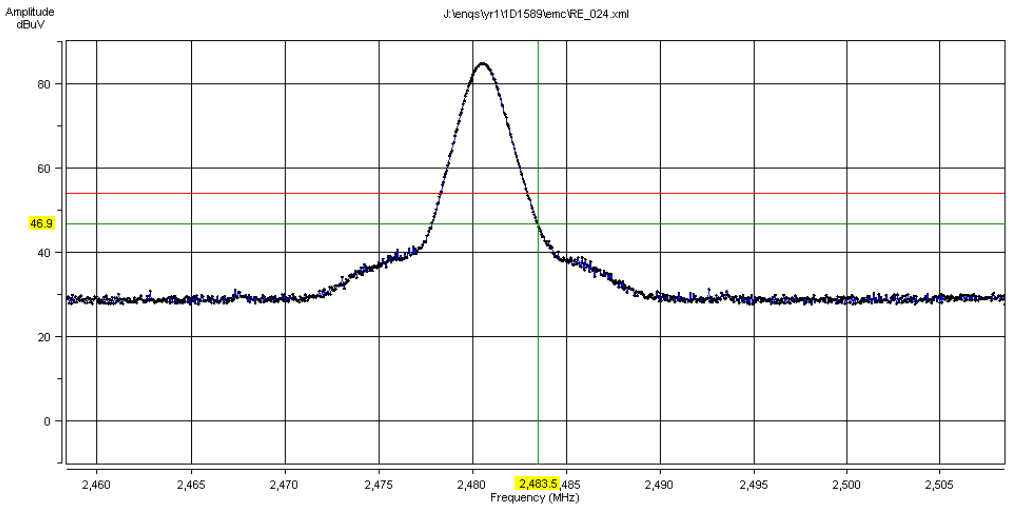


Test Location:	EMC Ferrite	**Remote Drive Eq.:**	None
Analyser Type:	ESU40	**Sample Numbers:**	N/A
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	15.249 Tx Mode Bottom Channel ban
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	1.0	**Engineer:**	Ken Anderson
EUT Names:	UWB Watch Location Device	**Date/Time:**	08/02/2013 11:28:27
Sample Numbers:	S01	**Job Number:**	1D1589
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

Lower Bandedge

TRaC EMC Emissions Software - Radiated emissions

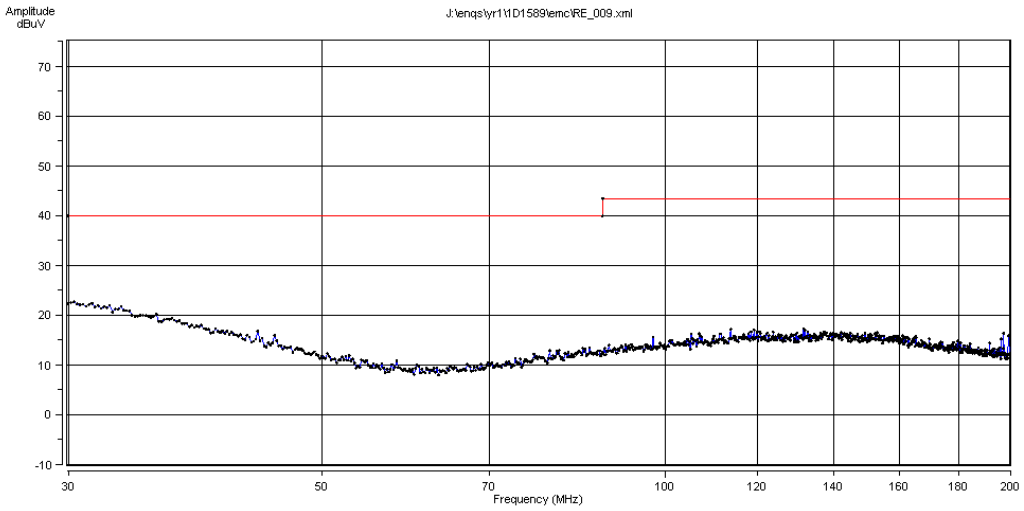


Test Location:	EMC Ferrite	**Remote Drive Eq.:**	None
Analyser Type:	ESU40	**Sample Numbers:**	N/A
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	15.249 Tx Mode Top Channel band e
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	1.0	**Engineer:**	Ken Anderson
EUT Names:	UWB Watch Location Device	**Date/Time:**	08/02/2013 11:34:14
Sample Numbers:	S01	**Job Number:**	1D1589
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

Upper Bandedge

TRaC EMC Emissions Software - Radiated emissions

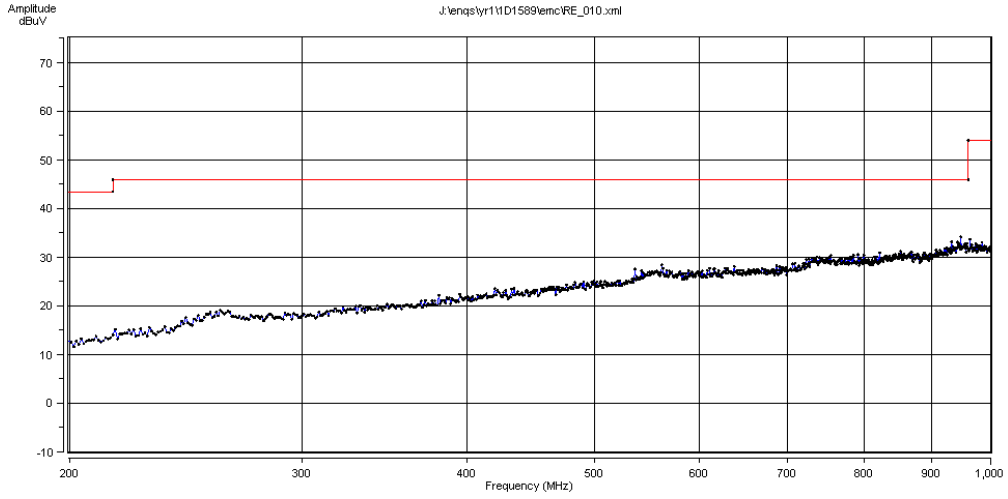


Test Location:	EMC Ferrite	**Remote Drive Eq.:**	None
Analyser Type:	ESU40	**Sample Numbers:**	N/A
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	15.249 Standby Mode
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	3.0	**Engineer:**	Ken Anderson
EUT Names:	UWB Watch Location Device	**Date/Time:**	08/02/2013 10:04:56
Sample Numbers:	S01	**Job Number:**	1D1589
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

Unintentional Radiated spurious emissions 30 MHz to 200 MHz

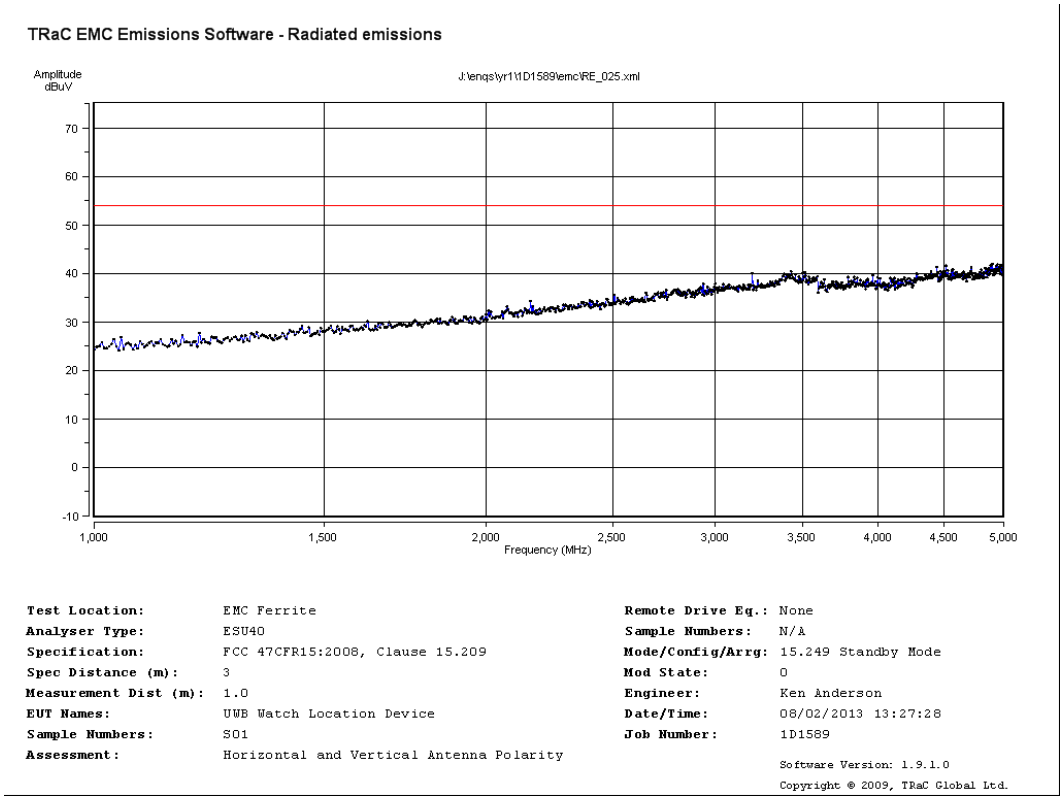
TRaC EMC Emissions Software - Radiated emissions



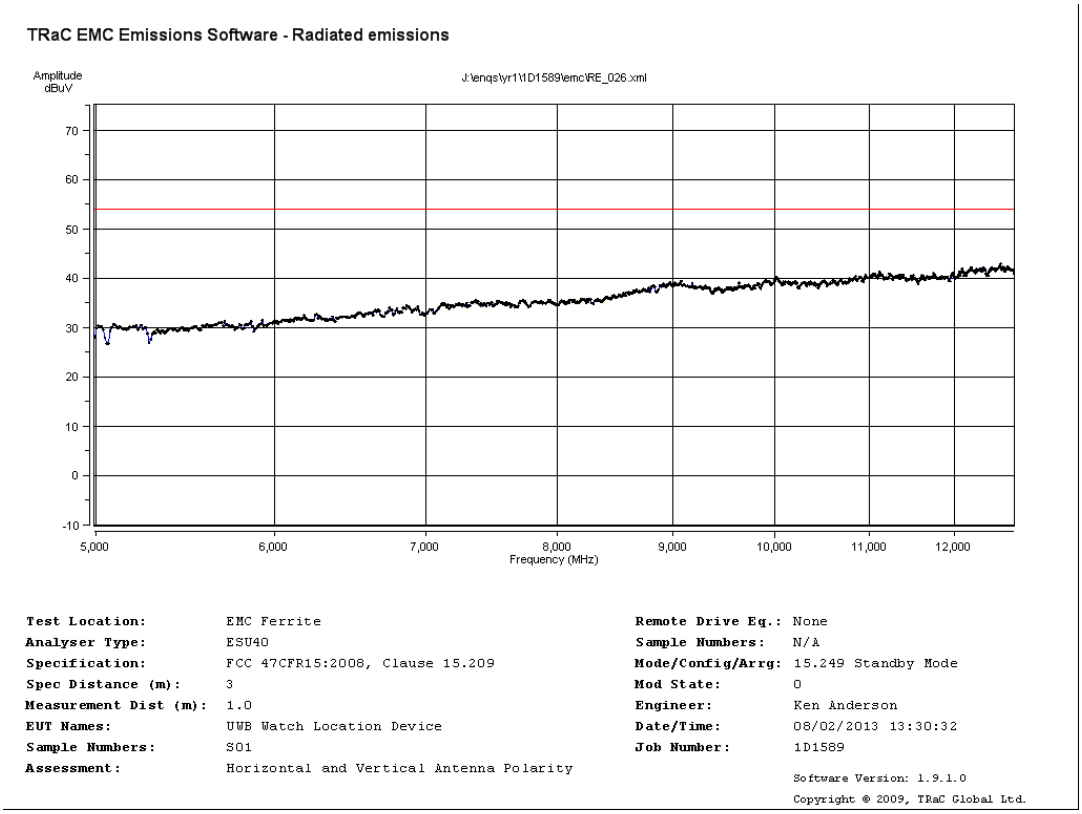
Test Location:	EMC Ferrite	**Remote Drive Eq.:**	None
Analyser Type:	ESU40	**Sample Numbers:**	N/A
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	15.249 Standby Mode
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	3.0	**Engineer:**	Ken Anderson
EUT Names:	UWB Watch Location Device	**Date/Time:**	08/02/2013 10:07:26
Sample Numbers:	S01	**Job Number:**	1D1589
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

Unintentional Radiated spurious emissions 200 MHz – 1000 MHz

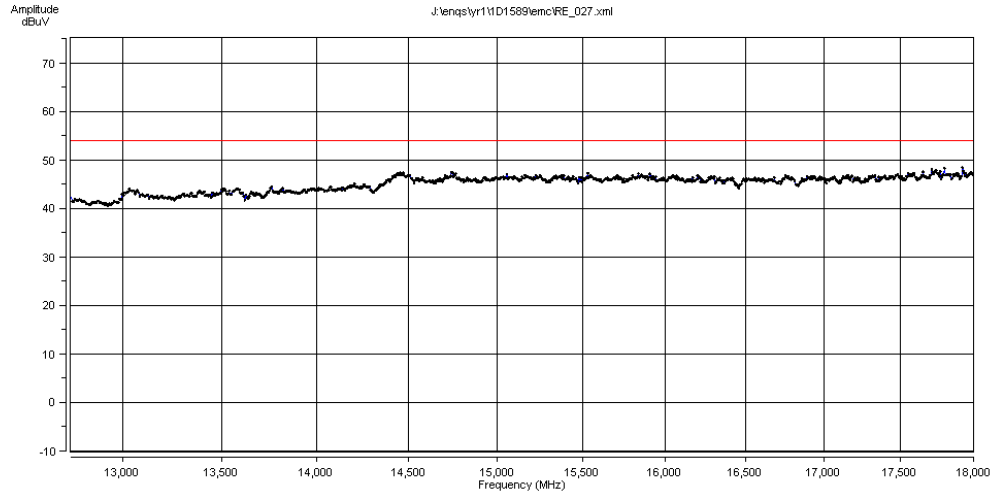


Unintentional Radiated Spurious emissions 1 GHz to 5 GHz



Unintentional Radiated Spurious emissions 5 GHz to 12.75 GHz

TRaC EMC Emissions Software - Radiated emissions

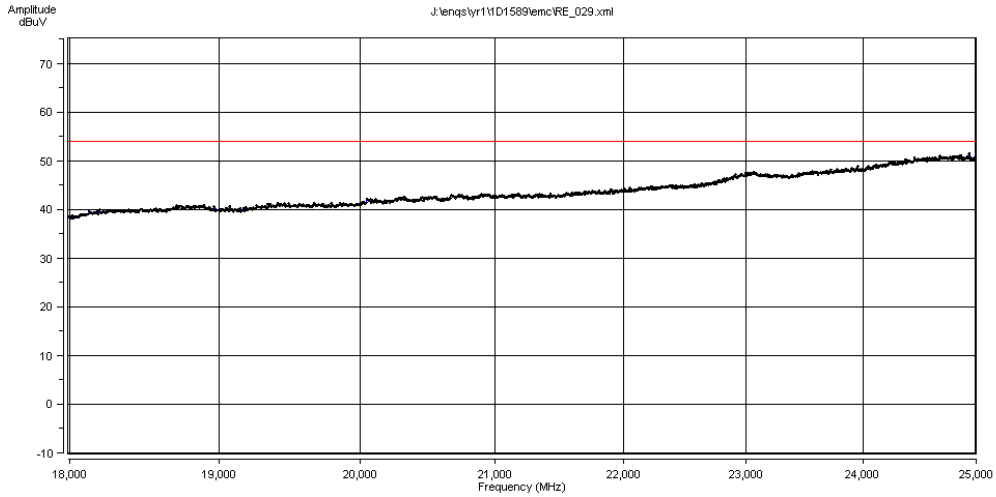


Test Location:	EMC Ferrite	**Remote Drive Eq.:**	None
Analyser Type:	ESU40	**Sample Numbers:**	N/A
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	15.249 Standby Mode
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	1.0	**Engineer:**	Ken Anderson
EUT Names:	UWB Watch Location Device	**Date/Time:**	08/02/2013 13:33:06
Sample Numbers:	S01	**Job Number:**	1D1589
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

Unintentional Radiated Spurious emissions 12.75 GHz to 18GHz

TRaC EMC Emissions Software - Radiated emissions



Test Location:	EMC Ferrite	**Remote Drive Eq.:**	None
Analyser Type:	ESU40	**Sample Numbers:**	N/A
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	15.249 Standby Mode
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	1.0	**Engineer:**	Ken Anderson
EUT Names:	UWB Watch Location Device	**Date/Time:**	08/02/2013 13:53:20
Sample Numbers:	S01	**Job Number:**	1D1589
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

Unintentional Radiated Spurious emissions 18 GHz to 25 GHz

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
S01	UWB Watch Location Device	Serial No. 0001

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

Sample No.	Description	Identification
	None	

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:
Transmitter Fundamental field strength Radiated spurious emissions	EUT active and transmitting on the required transceiver frequency.

Test	Description of Operating Mode:
Receiver Radiated spurious emissions	EUT active but non-transmitting.

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 : S01
Tests : Radiated

Port	Description of Cable Attached	Cable length	Equipment Connected
None			

* Only connected during setup.

C5 Details of Equipment Used

For Radiated Electric Field Emissions 30MHz to 1GHz:

Lab 10				
RFG/REF No	Type	Description	Manufacturer	Date Calibrated.
274	ATS	Ferrite Lined Chamber	Panashield	10/07/11
679	CBL6111	Blue Bilog Antenna (0.03 – 1GHz)	Chase	05/05/11
008	8447D	Pre-amp (0.1 – 1300MHz)	H & P	16/02/11
126	ESV20	Test Receiver	R & S	18/05/11
404	E4407B	Spectrum Analyser	Agilent	17/05/11
643	N-type	Sucotest Microwave Cable 1m	Huber & Suhner	17/09/10
651	N-type	Sucotest Microwave Cable 7m	Huber & Suhner	17/09/10
678	N-type	Sucotest Microwave Cable 2m	Huber & Suhner	28/03/11
636	NSG1007	110Vac / 60Hz	Schaffner	N/A
REF887	34405A	Multi-meter	Agilent	25/08/10

For Radiated Electric Field Emissions 1GHz to 18GHz:

Lab 10				
RFG/REF No	Type	Description	Manufacturer	Date Calibrated
274	ATS	Ferrite Lined Chamber	Panashield	10/07/11
129	3115	Horn Antennas	EMCO	11/08/09
307	HP8449B	Microwave Pre-Amp (1-26.5GHz)	HP	01/03/10
643	N-type	Sucotest Microwave Cable 1m	Huber & Suhner	17/09/10
651	N-type	Sucotest Microwave Cable 7m	Huber & Suhner	17/09/10
678	N-type	Sucotest Microwave Cable 2m	Huber & Suhner	28/03/11
404	E4407B	Spectrum Analyser	Agilent	17/05/11
636	NSG1007	110Vac / 60Hz	Schaffner	N/A
REF887	34405A	Multi-meter	Agilent	25/08/10

For Radiated Electric Field Emissions 1GHz to 18GHz:

Lab 16				
RFG/REF No	Type	Description	Manufacturer	Date Calibrated
REF886	Lab 16	Large Anechoic Chamber	Rainford EMC systems	27/07/10
REF880	HL050	Log Perodic Antenna (1-26.5GHz)	R&S	14/05/10
913	HP8449B	Microwave Pre-Amp (1-26.5GHz)	HP	07/01/11
404	E4407B	Spectrum Analyser	Agilent	17/05/11
452	SMA	1m 50Ohm coaxial UTIFLEX cable	Teledyne Reynolds	25/05/11
REF881	N-type	50Ohm coaxial HF RF coaxial cable	Teledyne Reynolds	06/06/11
REF882	N-type	50Ohm coaxial HF RF coaxial cable	Teledyne Reynolds	06/06/11
REF884	N-type	50Ohm coaxial HF RF coaxial cable	Teledyne Reynolds	06/06/11
REF885	N-type	50Ohm coaxial HF RF coaxial cable	Teledyne Reynolds	06/06/11
REF915	PCR500L	ac/dc Power Supply	Kikusui	N/A
REF887	34405A	Multi-meter	Agilent	25/08/10

Appendix D: Additional Information

No additional information is included within this test report.

Appendix E: Calculation of the duty cycle correction factor

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

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

Correction factor dB = 20 x (Log_{10} Calculated Duty Cycle)

Therefore the calculated duty cycle was determined:

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

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

e.g

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

0.07459 or 7.459%

Correction factor (dB) = 20 x (Log_{10} 0.07459) = -22.54dB

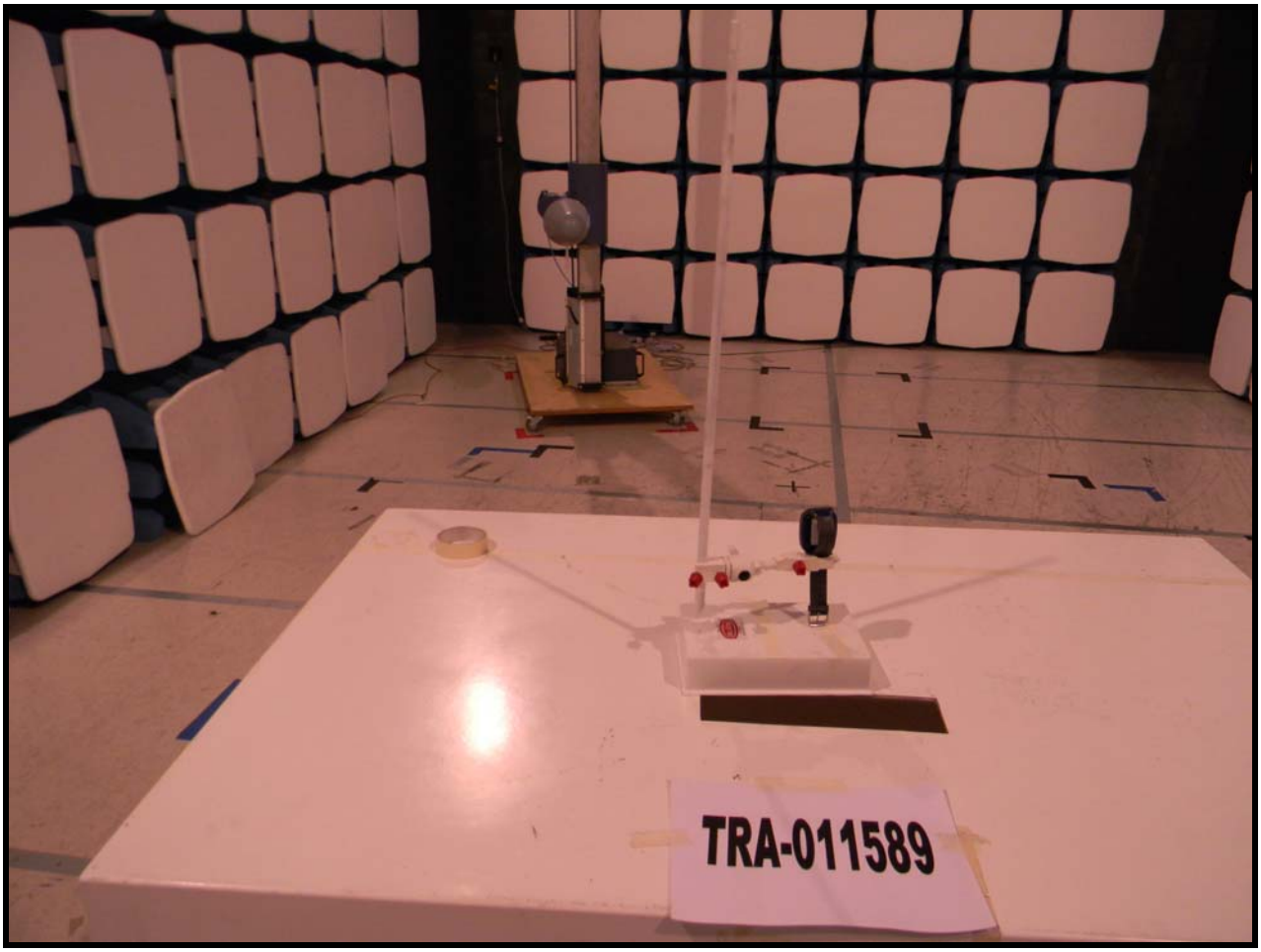
Duty cycle correction may not be applicable / required by the device covered in this report.
The correction factor above is for example of how the correction is calculated.
Any applicable duty cycle used will be recorded in the relevant results sections of this report.

The UWB Watch Location Device is operated at 100% duty cycle during testing

Appendix F: Photographs and Figures

The following photographs were taken of the test samples:

1. Radiated electric field emissions arrangement: front view.
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

2.1091 Radio frequency radiation exposure evaluation: mobile devices.

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/cm^2 power density limit, as required under FCC rules.

Prediction of MPE limit at a given distance

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

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

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)	Maximum EIRP (mW)	Power density limit (S) (mW/cm^2)	Distance (R) cm required to be less than 1mW/cm^2
2402.5	0.118	1	0.097 cm

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