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FCC PT 15.250 & PT 15.249 COMPOSITE DEVICE

Pt 15.250 WB TEST REPORT

APPLICANT	Ubisense Limited
ADDRESS	St Andrew's House, 90 St. Andrew's Road Chesterton, Cambridge CB4 1DL England
FCC ID	SEATAG23
MODEL NUMBER	UBITAG7023
PRODUCT DESCRIPTION	Wideband Tag
DATE SAMPLE RECEIVED	May 22, 2007
DATE TESTED	May 23, 2007
TESTED BY	Mario de Aranzeta
APPROVED BY	Mario de Aranzeta
TIMCO REPORT NO.	SEATAG23_15_250_TestReport.doc
TEST RESULTS	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL

THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT
THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.



Certificate # 0955-01

APPLICANT: Ubisense Limited

FCC ID: SEATAG23

Report#: W:\U\Ubisense_SEA\2153AUT7\SEATAG23_15_250_TestReport.doc



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ATTESTATION STATEMENT

This equipment has been tested in accordance with the standards identified in the referenced test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report and demonstrate that the equipment complies with the appropriate standards.

All Timco instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.

I attest that the necessary measurements were made by me or under my supervision, at Timco Engineering, Inc. located at 849 N.W. State Road 45, Newberry, Florida 32669 USA.



Certificate #0955-01

Authorized by: Mario de Aranzeta

Signature: On file

Function: Engineer

Date: May 29, 2007

APPLICANT: Ubisense Limited

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REPORT SUMMARY

Purpose of Test:	To demonstrate the DUT in compliance with FCC Pt 15.250 for operation of wideband systems within the band 5925-7250 MHz.
Disclaimer:	The test results relate only to the items tested.
Applicable Standards:	Pt 15.250, Pt 15.209, Pt 15.207, ANSI C63.4: 2003
Related Reports:	SEATAG23_15_249_TestReport.doc for Pt 15.249 Low Power Device

TEST ENVIRONMENT AND TEST SETUP

Test Facilities:	All measurements were made at one or more of the test sites of TIMCO ENGINEERING INC. located at 849 N.W. State Road 45, Newberry, FL 32669.
Laboratory Test Conditions:	Temperature: 26°C, Humidity: 55%
Test Exercise (software etc):	The DUT was set in continuous transmit mode of operation unless stated otherwise.
Deviation to the Standards:	No deviation from the standard.
Modification to the DUT:	No modification was made.
Supporting Accessories:	None

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DUT DESCRIPTION

Manufacturer:	Ubisense
Product Description:	A wireless device intended to be used for the real-time location of objects. It transmits a wideband signal which is picked up by a network of base stations, allowing the 3D position of the tag to be found to an accuracy of six inches (15 cm).
FCC ID:	SEATAG23
Model Number:	UBITAG7023 (Ubitag V2.3)
Brand Name:	Ubisense
Operating Frequency:	6-7.25 GHz
Emission Designator:	N/A
EUT Power Source:	Primary Power – 3 Vdc (Battery) Secondary Power – N/A
Test Item:	Prototype
Type of Equipment	Portable
Antennas	Permanently Attached
Antenna Connector	None

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EMC EQUIPMENT LIST

Device	Manufacturer	Model Number	Serial Number	Cal/Char Date	Due Date
3-Meter OATS	TEI	N/A	N/A	Listed 1/11/06	1/10/09
Antenna: Biconnical	Eaton	94455-1	1057	CAL 12/12/05	12/12/07
Antenna: Biconnical	Electro-Metrics	BIA-25	1171	CAL 4/29/07	4/29/09
Antenna: DR Horn	ETS	3117	N/A	CAL 12/29/06	12/29/08
Antenna: Log-Periodic	Eaton	96005	1243	CAL 12/14/05	12/14/07
Spectrum Analyzer	Rohde & Schwarz	ESIB 40	N/A	11/15/05	11/15/07
Preamp	AH Systems	PAM-0126	128	11/05/06	11/05/08
Mixer	Agilent	11970A,G,K	various	11/15/05	11/15/07

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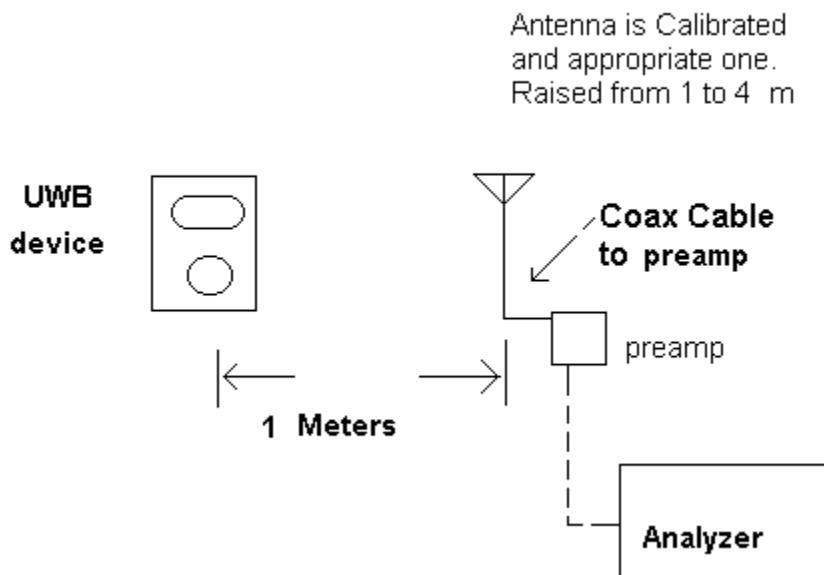
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TEST PROCEDURES

Bandwidth 10 dB: The measurements were made with the spectrum analyzer using a Peak detector and the procedures outlined by the FCC in 15.250 (e4). The test distance was 1 meter. Emissions from the DUT were maximized by rotating the DUT and adjusting the height of the measurement antenna.

Bandwidth Test Setup Diagram



Radiation Interference: The test procedure used was ANSI C63.4-2003 using a R&S ESIB 40 spectrum analyzer/receiver. The bandwidth (RBW) of the spectrum analyzer was typically 100 kHz up to 1GHz and 1MHz above 1GHz.

Measurements above 1GHz used the RMS detector function on the spectrum analyzer, with a sweep time set to 500ms or less – the spectrum analyzer scan had 500 points, and so a sweep time of 500ms or less ensured that the averaging time per point was 1ms or less. The frequency span was set to 500MHz, i.e. the number of frequency bins times 1MHz as specified in 15.250 (e1).

The RMS average emission measurement was repeated over multiple sweeps with the analyzer set to max hold until the amplitude stabilized. Emissions were maximized by rotating the DUT and adjusting the height of the measurement antenna. Emissions were measured to 40 GHz.

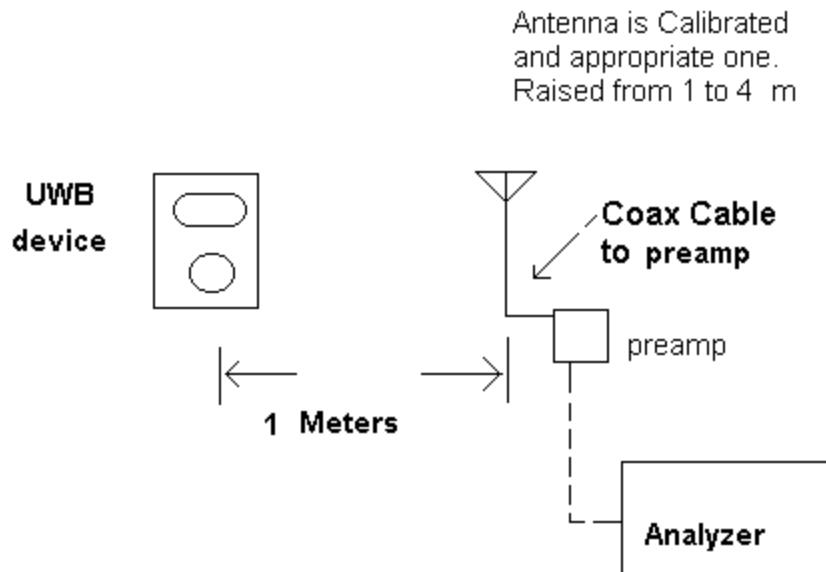
The analyzer was calibrated in dB above a microvolt at the output of the antenna.

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Radiated Spurious Emissions: The procedure used was ANSI C63.4-2003 & the test setup was as follows:



Power Line Conducted Interference: Testing not necessary as device is exclusively battery powered.

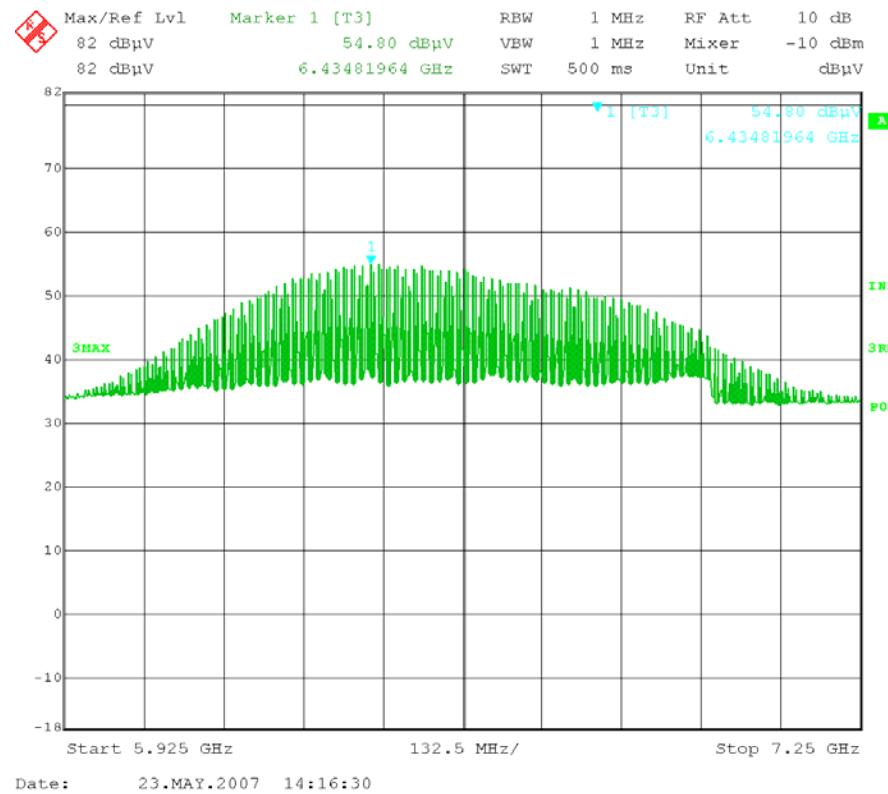
OPERATIONAL RESTRICTIONS

Rule Parts No.: Pt 15.250 - Operation of wideband systems within the band 5925 – 7250 MHz.

Requirements: Section 15.250 (a)

The -10 dB bandwidth of a device operating under the provisions of this section must be contained within the 5925-7250 MHz band under all conditions of operation including the effects from stepped frequency, frequency hopping or other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

Test Data:



-10dB bandwidth is completely contained within the 5925-7250 MHz band, as shown above.

APPLICANT: Ubisense Limited

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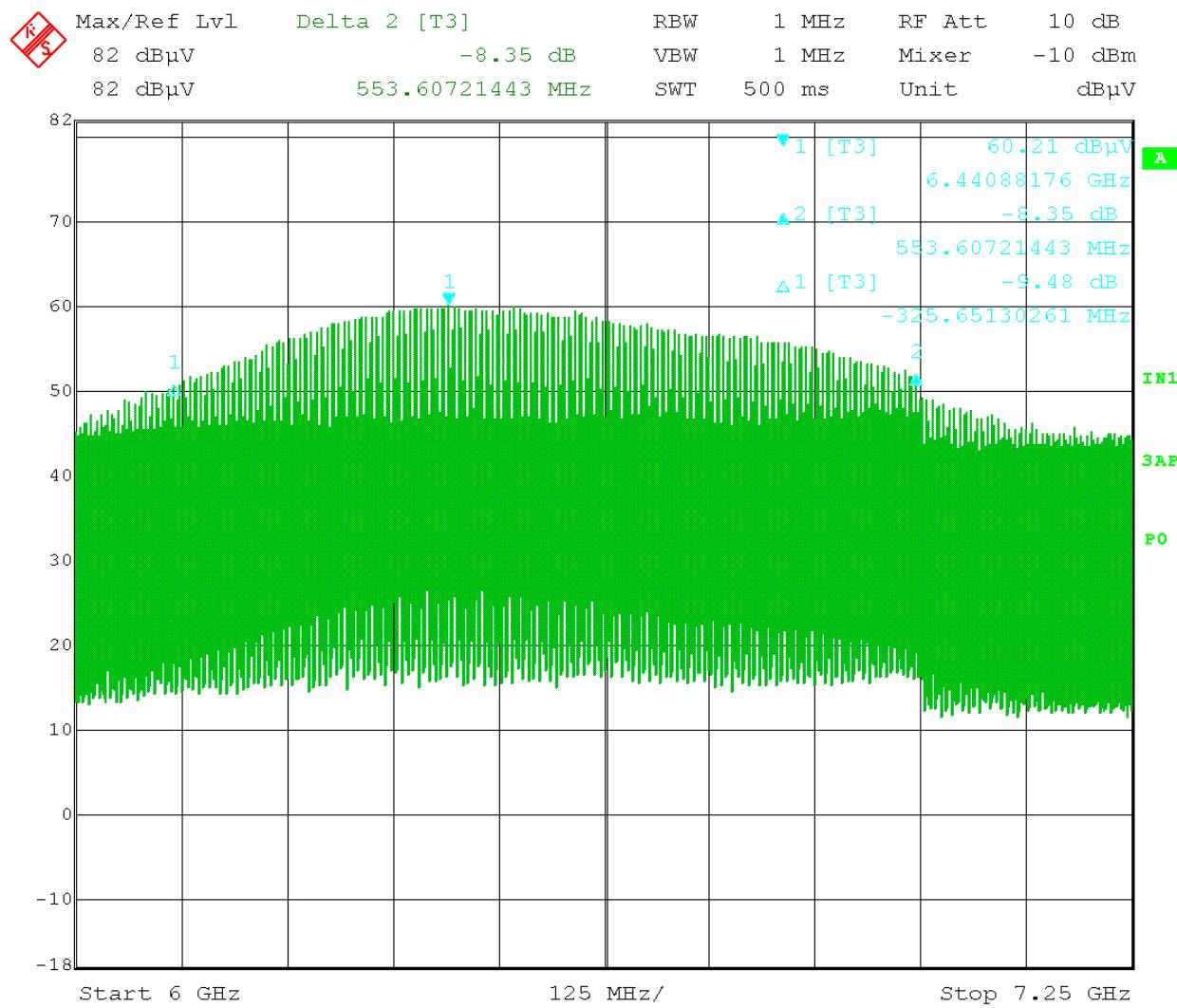
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-10 dB BANDWIDTH OF FUNDAMENTAL EMISSION

Rules Part No.: Pt 15.250(b)

Requirements: The -10 dB bandwidth of the fundamental emission shall be at least 50 MHz.

Test Data:



Date: 23.MAY.2007 14:01:04

The frequency with the highest emission is: 6.4409 GHz

The lower -10dB point is: 6.1152 GHz

The upper -10dB point is: 6.9945 GHz

The -10 dB bandwidth is 879.26 MHz

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FIELD STRENGTH SPURIOUS EMISSIONS (below 960 MHz)

Rules Part No.: Pt 15.250(d-1), Pt 15.209(a)

Requirements:

Frequency	Limits
Part 15.209	
9 to 490 kHz	2400/F (kHz) μ V/m @ 300 meters
490 to 1705 kHz	24000/F (kHz) μ V/m @ 30 meters
1705 kHz to 30 MHz	29.54 dB μ V/m @ 30 meters
30 – 88	40.0 dB μ V/m @ 3 meters
80 – 216	43.5 dB μ V/m @ 3 meters
216 – 960	46.0 dB μ V/m @ 3 meters
Above 960	54.0 dB μ V/m @ 3 meters

Test Data:

Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB
33.72	3.0	H	0.42	12.54	15.96	24.04
34.40	2.9	V	0.42	10.73	14.05	25.95
133.62	2.8	H	0.68	13.10	16.58	26.92
134.51	2.7	V	0.68	13.04	16.42	27.08
308.00	4.4	H	1.11	15.04	20.55	25.45
309.18	4.3	V	1.11	15.04	20.45	25.55

No significant emissions found. Values in chart are noise floor measurements.

All measurements are peak unless indicated as average by an 'A'.

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RADIATED EMISSIONS ABOVE 960 MHz

Rules Part No.: Pt 15.250(d-1)

Requirements: Radiated emissions above 960 MHz from a device operating under this section shall not exceed the following average limits when measured using a RBW of 1 MHz.

Frequency MHz	EIRP dBm
960 - 1610	-75.3
1610 - 1990	-63.3
1990 - 3100	-61.3
3100 - 5925	-51.3
5925 - 7250	-41.3
7250 - 10600	-51.3
Above 10600	-61.3

Measurement procedure: The procedures of ANSI C63.4:2003 were followed with the exception that the measurement distance was reduced to that shown in the table below and an RMS detector was used as required in 15.250 (d-1). A wide span was used at first to view the whole band, then the peak emission in each band was measured using a span of 500MHz as required by 15.250 (e-1).

Correction factor is a combination of coax loss (CL), preamp gain (Gamp), antenna factor (AF), and 'measurement distance' correction factor ($Dcf = 20 \log [D/3]$, where D is the measurement distance in meters).

Example correction factor calculation: $FS = MR + AF - (Gamp - CL) - Dcf$

The EIRP limits in dBm were converted to field strength limits in dBuV/m @ 3m.

Example EIRP limit conversion: $F.S. = EIRP + 95.2$

Emission Frequency MHz	Plot #	Meter Reading dBuV	Meas. Distance m	Correction Factor dB/m	Field Strength dBuV/m @3m (corrected)	Limit dBuV/m @ 3m
1040.2	2	31.59	1	14.63	16.96	19.9
1828.6	3	31.39	1	11.52	19.87	31.9
2051.1	5	31.82	1	10.10	21.72	33.9
5635.4	7	35.35	1	7.16	28.19	43.9
6434.8	9	57.03	1	6.45	50.58	53.9
7533.6	11	37.92	1	6.26	31.66	43.9
13136.6	13	39.78	0.5	7.95	31.83	33.9
22058.6	15	33.82	0.5	6.28	27.54	33.9

Both vertical and horizontal polarities were studied and the worst case presented. In all cases the vertical polarization resulted in the greatest signal.

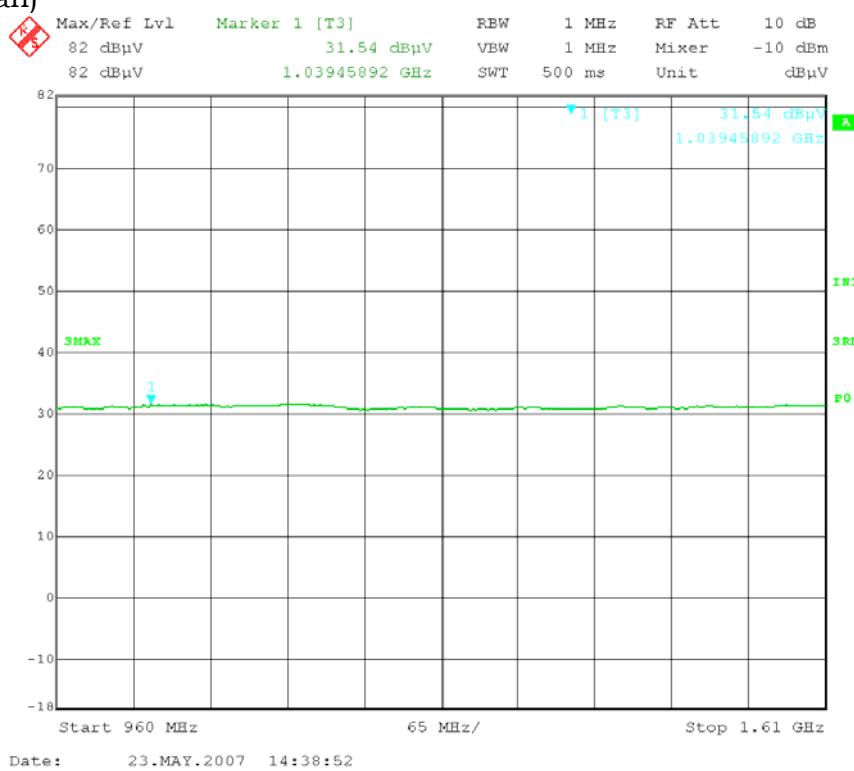
There were no measurable emissions above 26 GHz, up to 40 GHz.

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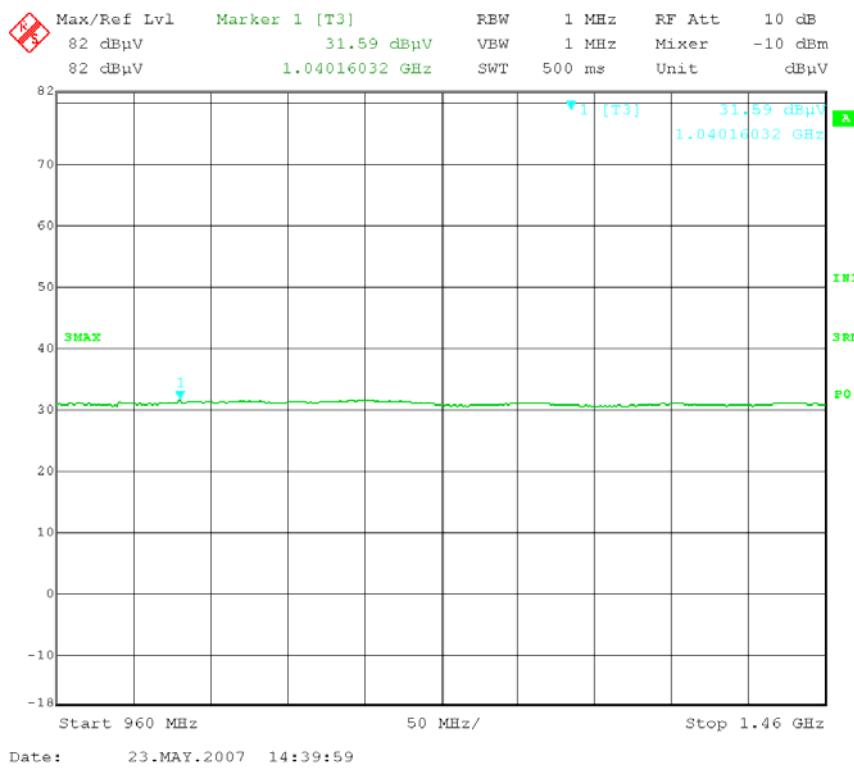
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Plot 1 (prescan)



Plot 2

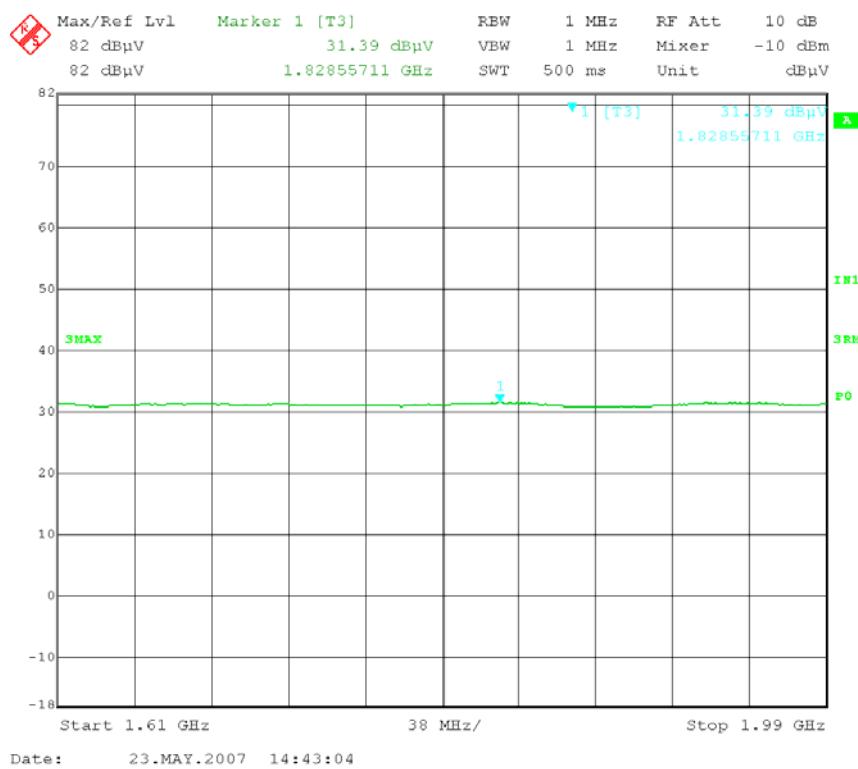


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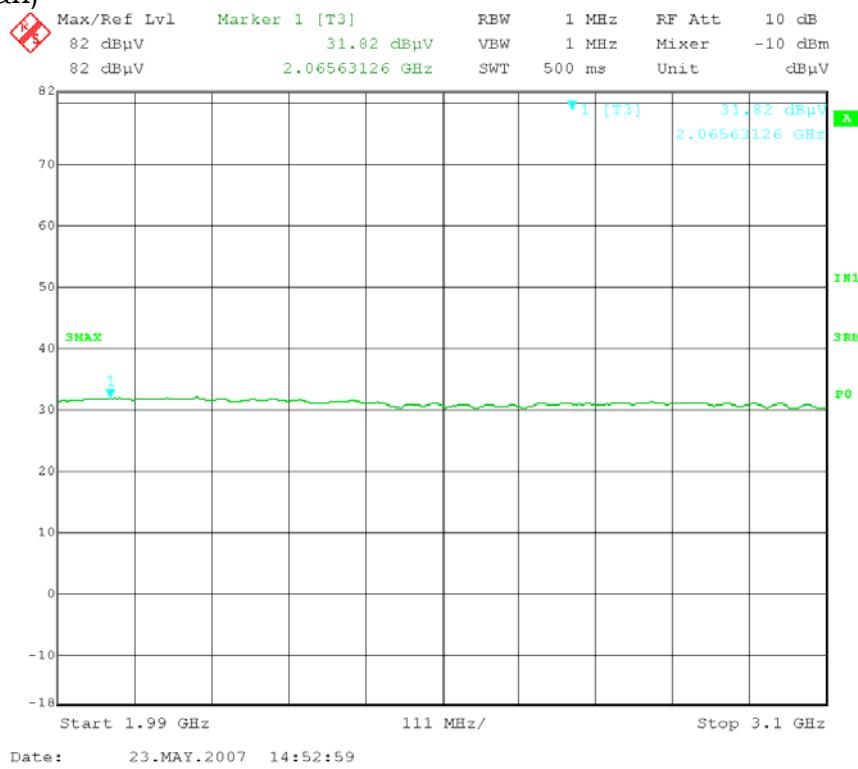
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Plot 3



Plot 4 (prescan)

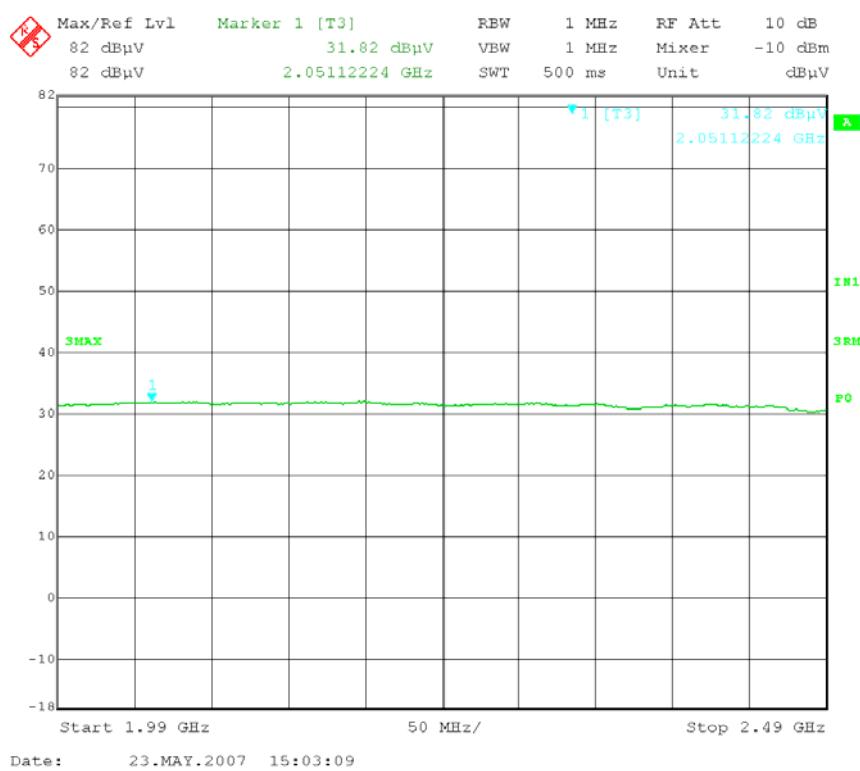


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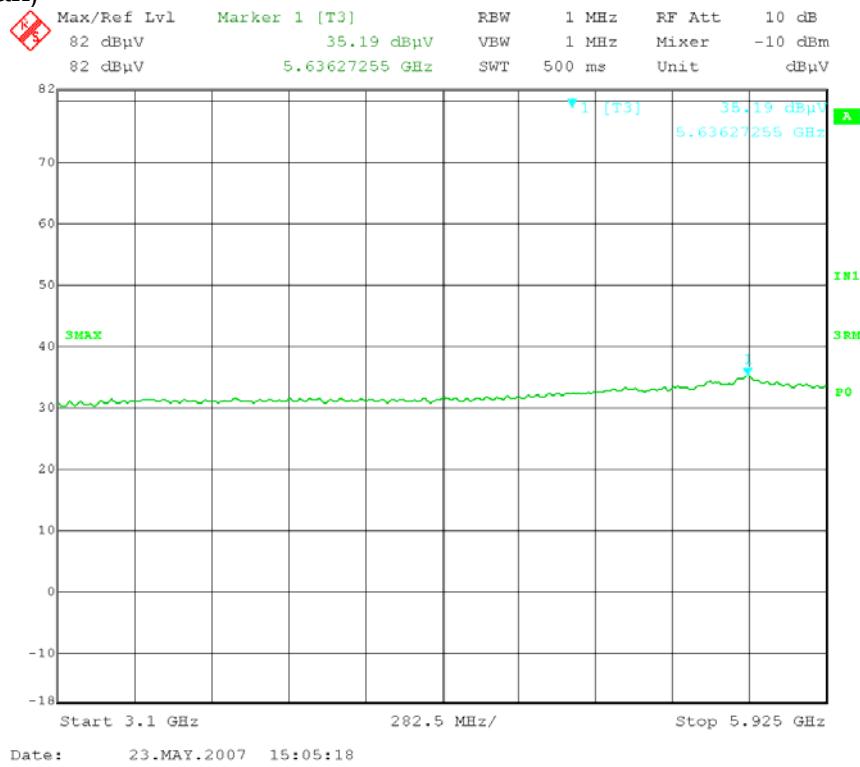
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Plot 5



Plot 6 (prescan)

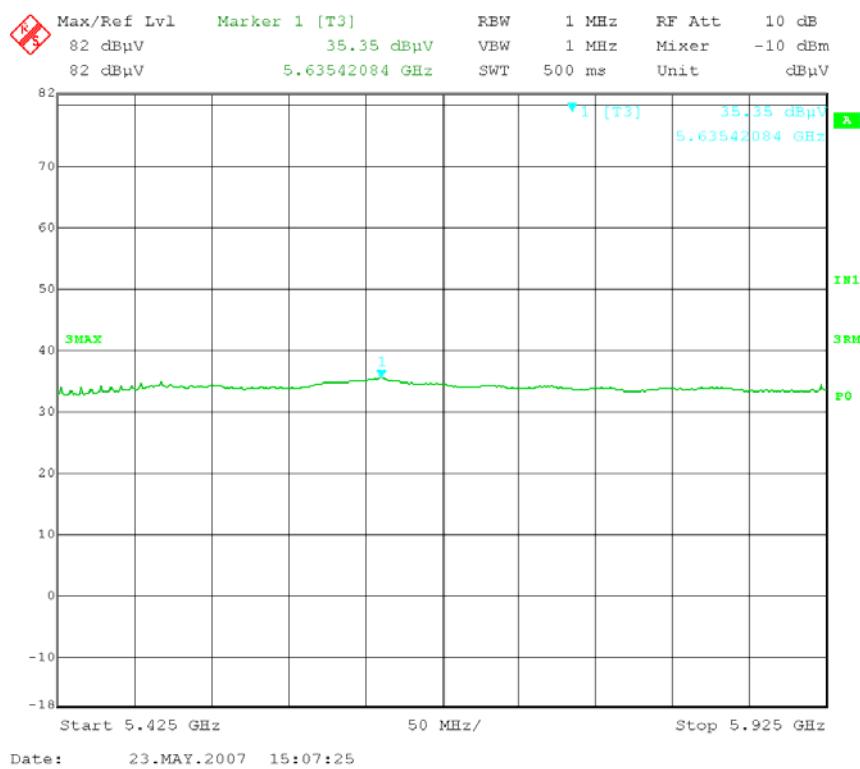


APPLICANT: Ubisense Limited

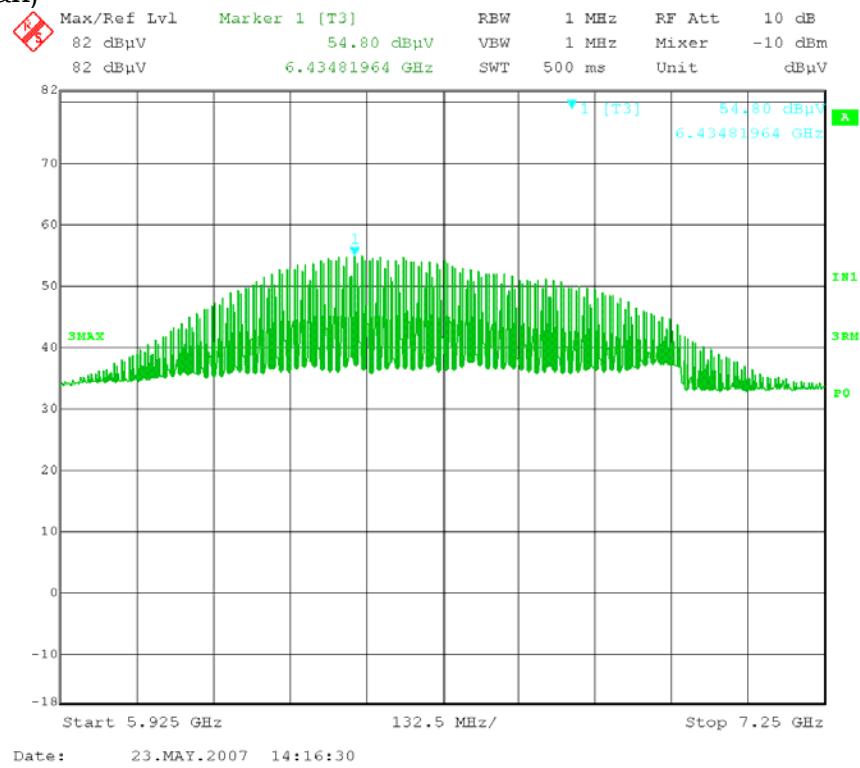
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Plot 7



Plot 8 (prescan)

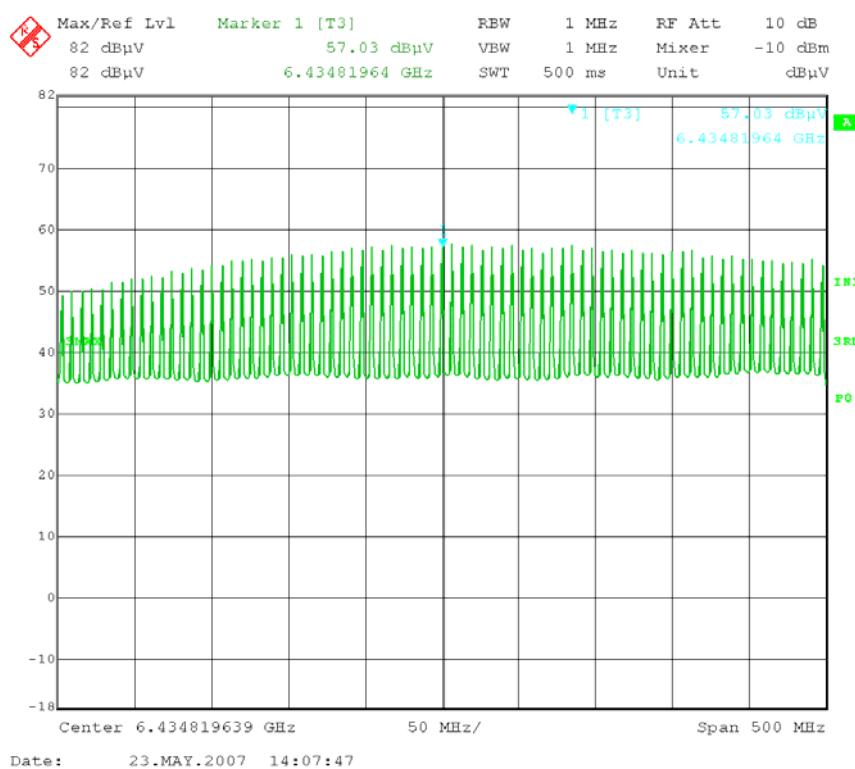


APPLICANT: Ubisense Limited

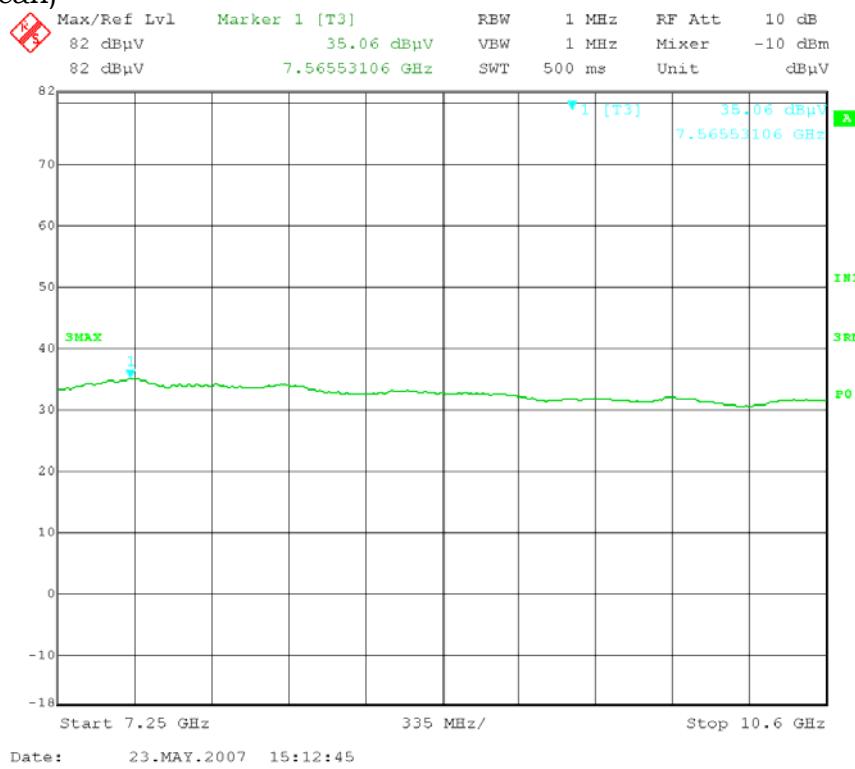
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Plot 9



Plot 10 (prescan)

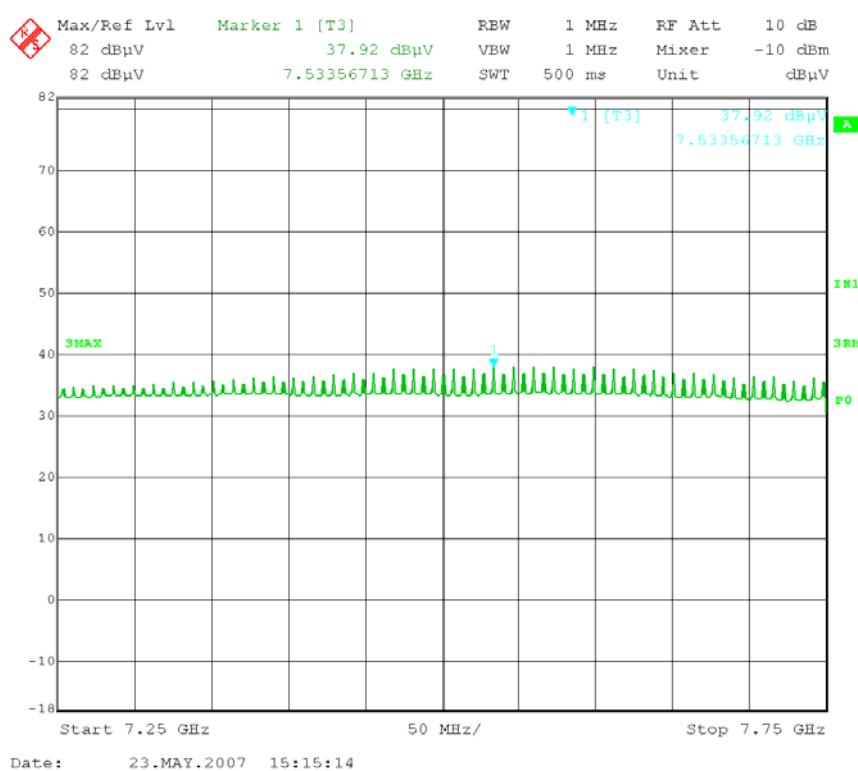


APPLICANT: Ubisense Limited

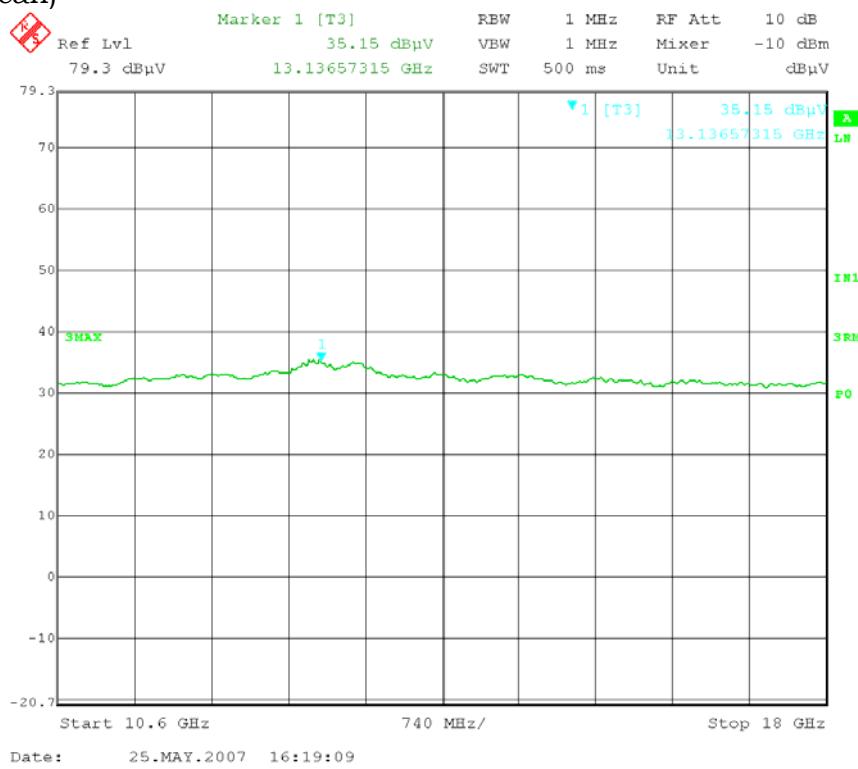
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Plot 11



Plot 12 (prescan)

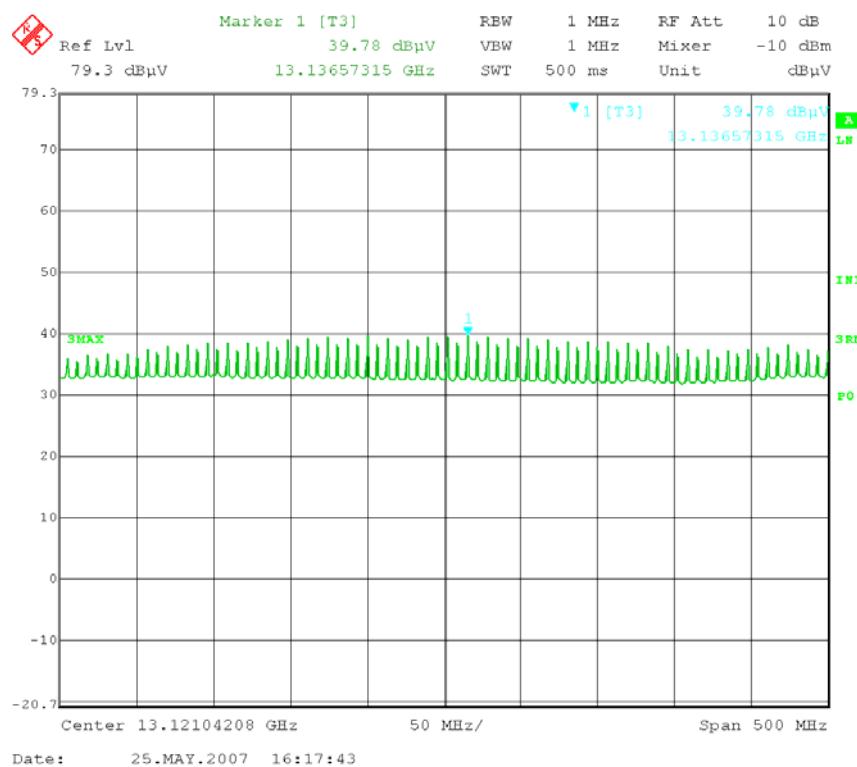


APPLICANT: Ubisense Limited

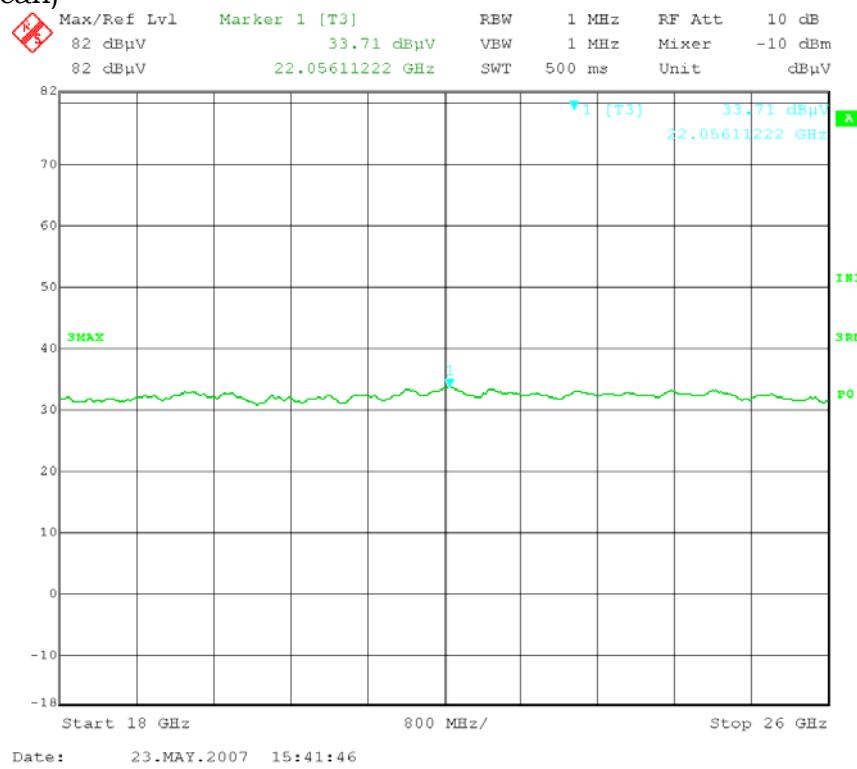
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Plot 13



Plot 14 (prescan)

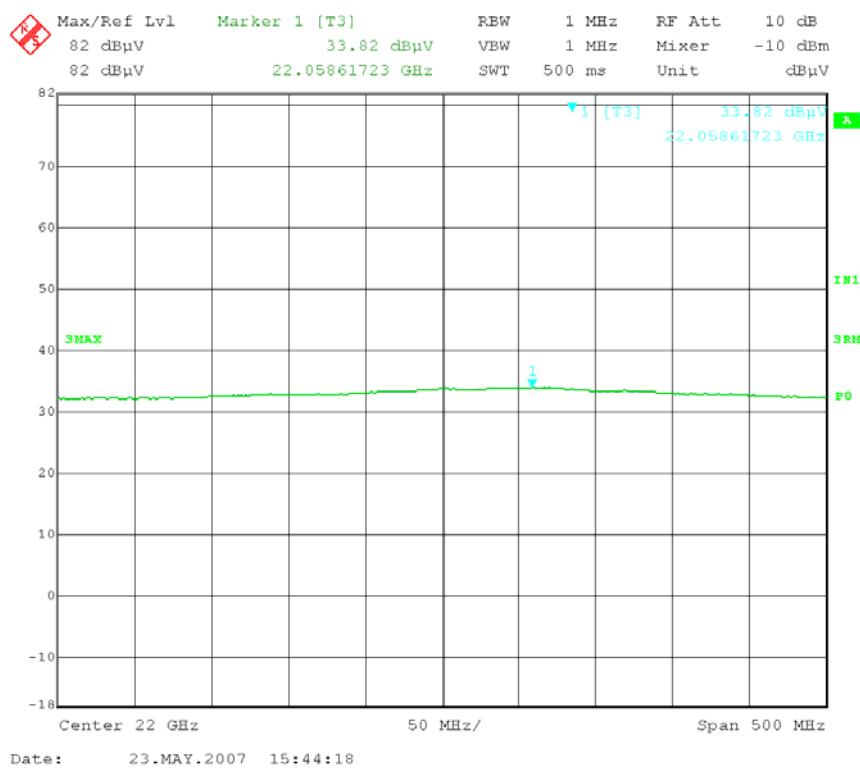


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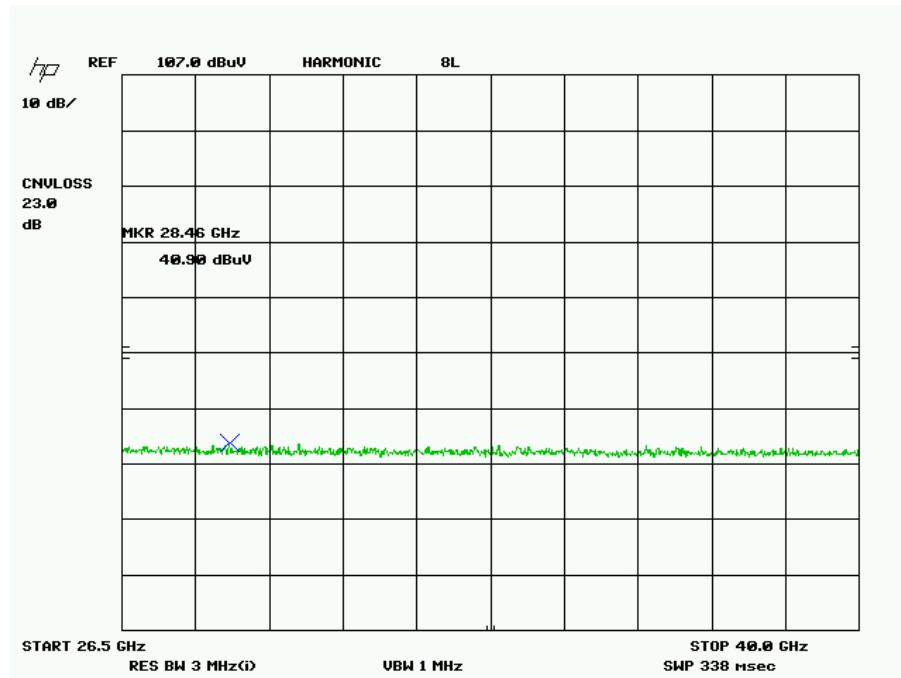
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Plot 15



Plot 16



APPLICANT: Ubisense Limited

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RADIATED EMISSIONS GPS BAND

Rules Part No.: Pt 15.250(d-2)

Requirements: Transmitters operating under the provisions of this section shall not exceed the following RMS average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency in MHz	EIRP in dBm	F.S. in dBuV/m
1164 – 1240	-85.3	9.9
1559 - 1610	-85.3	9.9

The equivalent field strength at 3m = (-85.3) + 95.2 = 9.9 dBuV/m

Test Data:

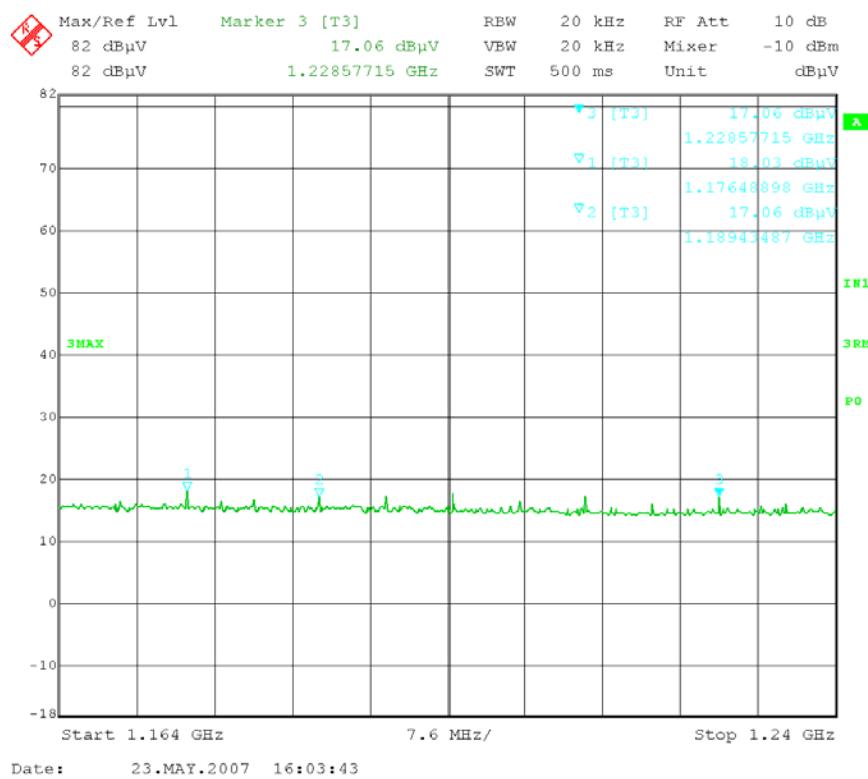
Emission Frequency MHz	Plot #	Meter Reading dBuV	Ant. Polarity V/H	Meas. Distance m	Correction Factor dB/m	Field Strength dBuV/m	Limit dBuV/m @3m
1176.5	1	18.03	V	1	14.43	3.60	9.9
1228.6	1	17.06	V	1	14.35	2.71	9.9
1189.4	1	17.06	V	1	14.41	2.65	9.9
1566.5	2	18.69	V	1	13.45	5.24	9.9
1592.5	2	18.26	V	1	13.25	5.01	9.9
1573.0	2	18.03	V	1	13.40	4.63	9.9

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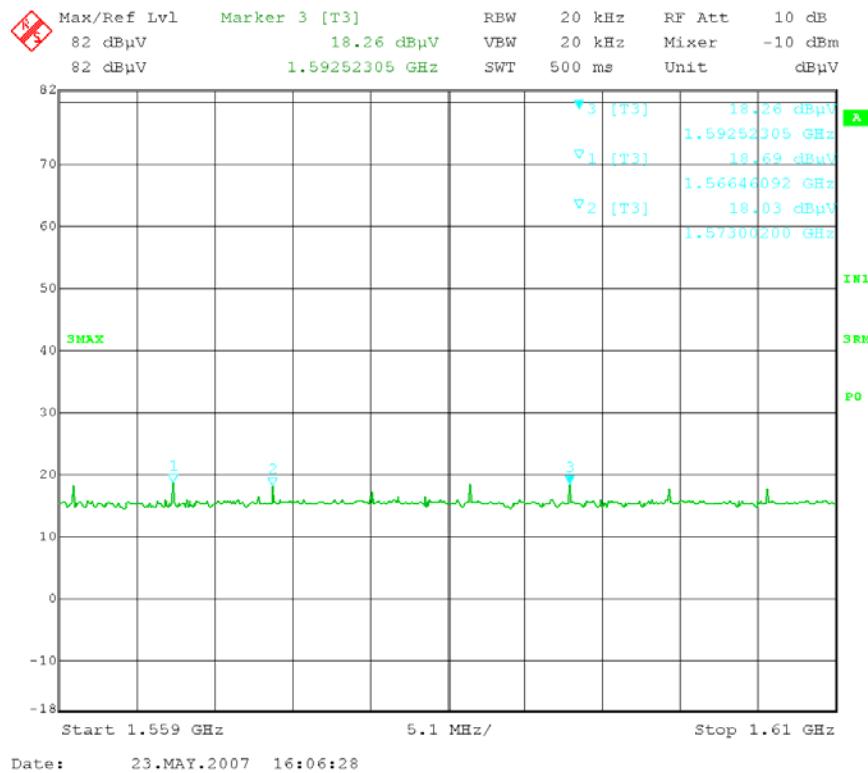
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Plot 1:



Plot 2:



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RADIATED EMISSIONS PEAK LEVEL

Rules Part No.: Pt 15.250(d)(3)

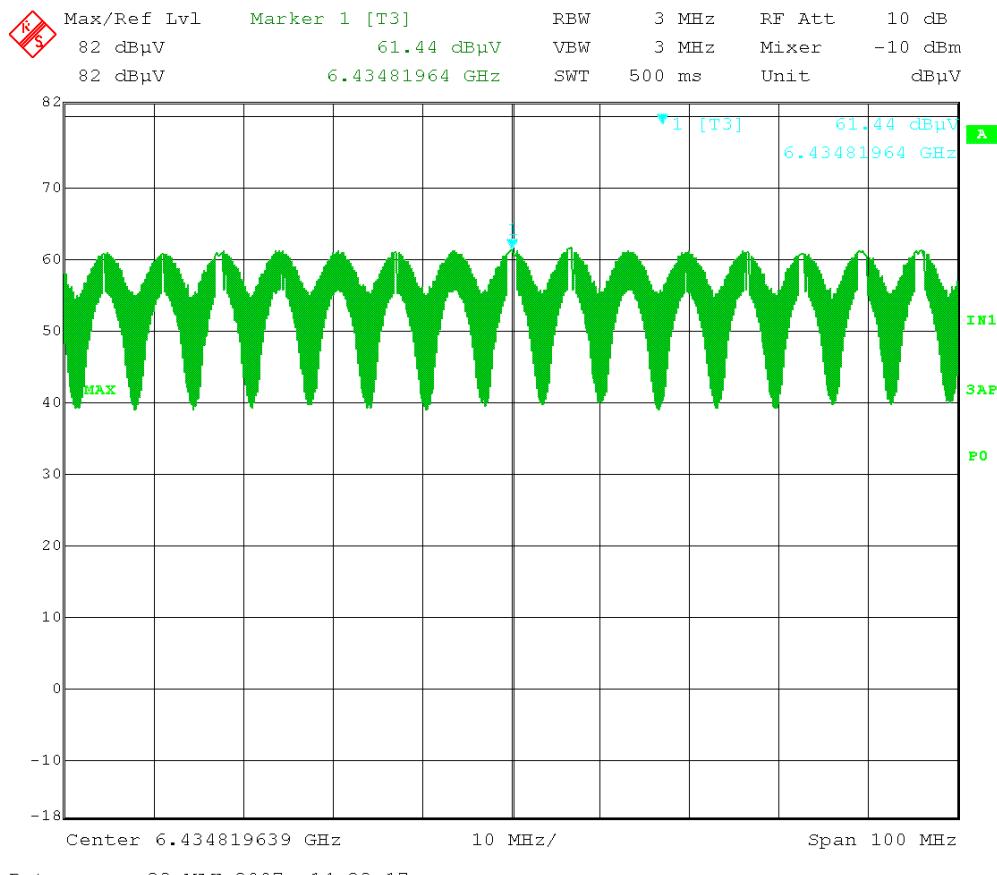
Requirements: The limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_M . That limit is 0 dBm EIRP. A different resolution bandwidth can be used and a correspondingly different peak emission limit, following the procedures described in Pt 15.250(d)(3).

Pursuant to Pt 15.250(d)(3), the peak EIRP limit = $20\log(3\text{MHz}/50) = -24.4 \text{ dBm}$. The equivalent field strength at 3m = $(-24.4) + 95.2 = 70.8 \text{ dBuV/m}$

Note: A RBW of 3 MHz was used to measure the peak radiated power.

Test Data:

Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity V/H	Meas. Distance m	Correction Factor dB	Field Strength dBuV	Limit dBuV/m @3m
6434.8	61.44	V	1	6.45	54.99	70.8



Date: 23.MAY.2007 14:23:17

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POWER LINE CONDUCTED INTERFERENCE

Rules Part No.: Pt 15.207

Requirements:

Frequency (MHz)	Quasi Peak Limits (dBuV)	Average Limits (dBuV)
0.15 – 0.5	66 – 56	56 – 46
0.5 – 5.0	56	46
5.0 – 30	60	50

Test Data: Not applicable because the DUT is exclusively battery-operated.

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