849 NW STATE ROAD 45
NEWBERRY, FL 32669 USA
PH: 888.472.2424 OR 352.472.5500
FAX: 352.472.2030
Email: tei@timcoengr.com
Email: info@timcoengr.com
HTTP://WWW.TIMCOENGR.COM

FCC PT 15.517 & PT 15.249 COMPOSITE DEVICE

Pt 15.517 UWB TEST REPORT

APPLICANT	Ubisense Limited
ADDRESS	St Andrew's House, 90 St. Andrew's Road Chesterton, Cambridge CB4 1DL England
FCC ID	SEATAG22
MODEL NUMBER	UBITAG7022
PRODUCT DESCRIPTION	UWB Tag
DATE SAMPLE RECEIVED	May 22, 2007
DATE TESTED	May 22, 2007
TESTED BY	Mario de Aranzeta
APPROVED BY	Mario de Aranzeta
TIMCO REPORT NO.	SEATAG22_15_517_TestReport.pdf
TEST RESULTS	☒ PASS ☐ FAIL

ACCREDITED

Certificate # 0955-01

TABLE OF CONTENTS

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.

ACCREDITED

Certificate #0955-01

Authorized by: Mario de Aranzeta

Signature: On file

Function: Engineer

Date: June 18th, 2007

REPORT SUMMARY

Purpose of Test:	To demonstrate the DUT in compliance with FCC Pt 15.517 for indoor UWB systems.
Disclaimer:	The test results relate only to the items tested.
Applicable Standards:	Pt 15.517, Pt 15.209, Pt 15.207, ANSI C63.4: 2003
Related Reports:	1) SEATAG22_15_249_TestReport

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

DUT DESCRIPTION

Manufacturer:	Ubisense
Product Description:	A wireless device intended to be used for the real-time location of objects within buildings. It transmits an ultra-wideband (UWB) emission which are picked up by a network of base stations placed inside the building, allowing the 3D position of the tag to be found to an accuracy of six inches (15 cm).
FCC ID:	SEATAG22
Model Number:	UBITAG7022 (Ubitag V2.2)
Brand Name:	Ubisense
Operating Frequency:	6-8 GHz
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

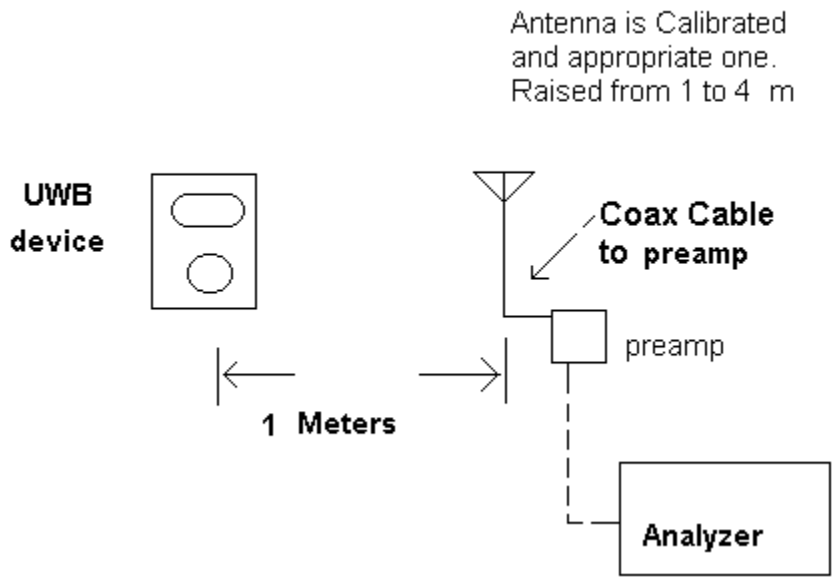
EMC EQUIPMENT LIST

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		CAL 12/29/06	12/29/08
LISN	Electro-Metrics	EM-7820	2682	CAL 4/28/07	4/28/09
Antenna: Log-Periodic	Eaton	96005	1243	CAL 12/14/05	12/14/07
Spectrum Analyzer	Rohde & Schwarz	ESIB 40		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
Analyzer Tan Tower Spectrum Analyzer	HP	8568B Opt 462	3138A07786 3144A20661	CAL 12/7/05	12/7/07

TEST PROCEDURES

Bandwidth 10 dB: The measurements were made with the spectrum analyzer using a RMS detector and the procedures outlined by the FCC in 15.521. The test distance was 1 meter. Emissions from the DUT were maximized by rotating the DUT and adjusting the height of the measurement antenna.

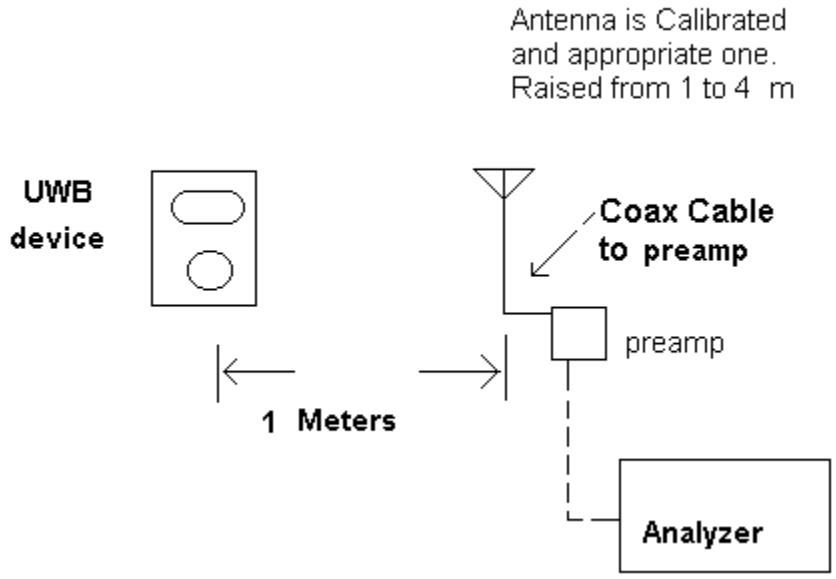
Bandwidth Test Setup Diagram



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 1.0MHz 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 VBW was always greater than or equal to the RBW unless noted. Emissions from the DUT were maximized by rotating the DUT and adjusting the height of the measurement antenna. The analyzer was calibrated in dB above a microvolt at the output of the antenna.

As required by subpart 15.33 emissions were measured to 40 GHz.

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 15.517 (a) Technical Requirements for indoor UWB systems

Requirements: Operation under the provisions of this section is limited to UWB transmitters employed solely for indoor operation.

(1) Indoor UWB devices, by the nature of their design, must be capable of operation only indoors. The necessity to operate with a fixed indoor infrastructure, e.g., a transmitter that must be connected to the AC power lines, may be considered sufficient to demonstrate this.
(2) The emissions from equipment operated under this section shall not be intentionally directed outside of the building in which the equipment is located, such as through a window or a doorway, to perform an outside function, such as the detection of persons about to enter a building.
(3) The use of outdoor mounted antennas, e.g., antennas mounted on the outside of a building or on a telephone pole, or any other outdoors infrastructure is prohibited.
(4) Field disturbance sensors installed inside of metal or underground storage tanks are considered to operate indoors provided the emissions are directed towards the ground.
(5) A communications system shall transmit only when the intentional radiator is sending information to an associated receiver.

Results:

- The UBITAG7022 is a wireless device intended to be used for the real-time location of objects within buildings (applications include healthcare, workplace productivity, security, retail management and manufacturing), and will be marketed as such.
- The UBITAG7022 will not transmit ultra-wideband signals unless it receives suitable trigger commands (over a separate §15.249 conventional radio link) from an associated base station. Base stations will be professionally installed, in accordance with instructions detailing procedures for adjusting the power of the base stations' conventional radio signals to ensure that they cannot trigger Ubitags outside the building.
- The UBITAG7022 User's Guide (see Exhibits) also stresses the requirement for indoor use, and reiterates the technical requirements for indoor UWB systems listed in §15.517.
- Furthermore, each UBITAG7022 is clearly marked with a label indicating that it is for indoor use only.

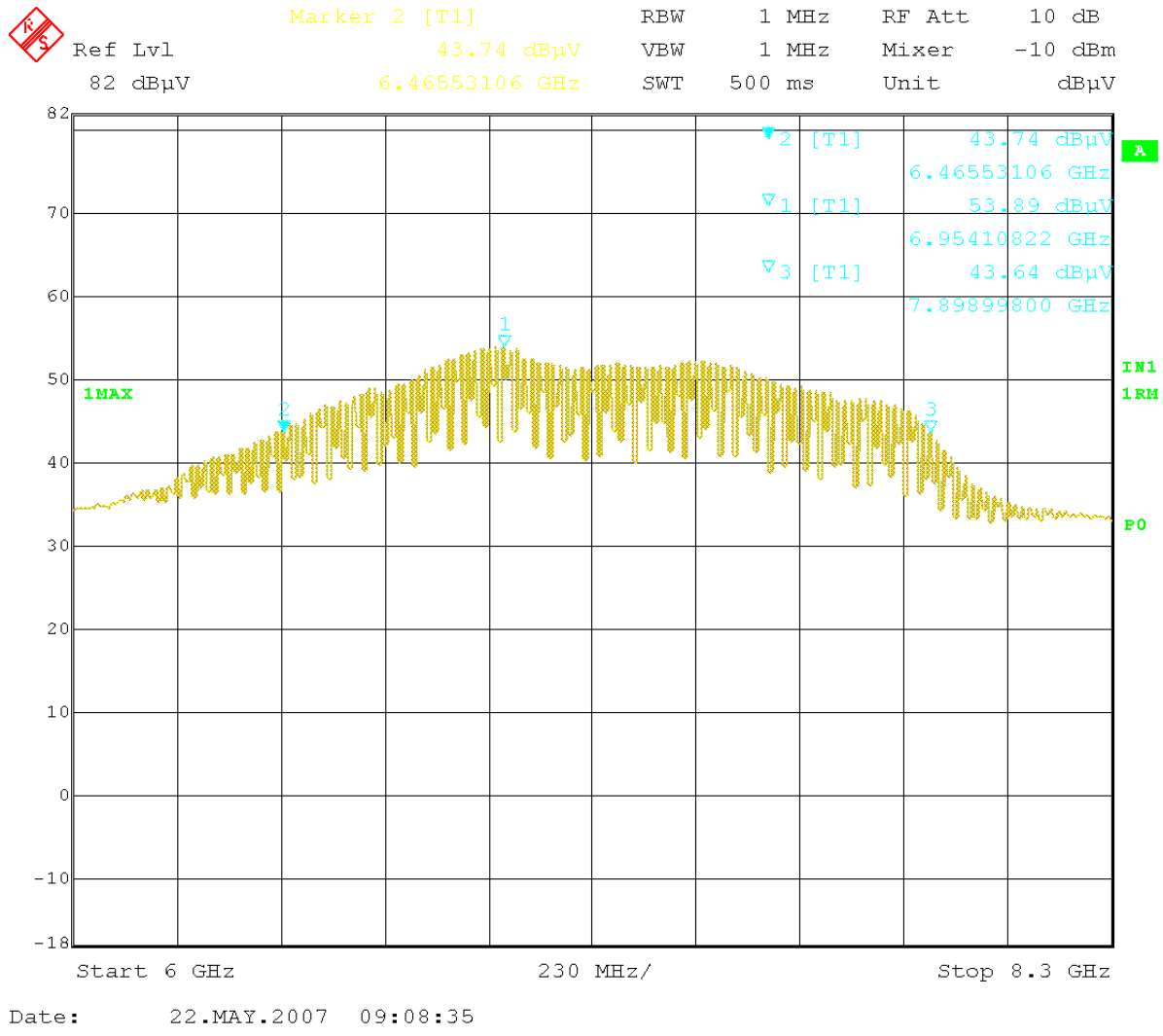
ULTRA-WIDEBAND 10 dB BANDWIDTH

Rules Part No.: Pt 15.517(b)

Requirements: The UWB bandwidth must be contained between 3100 MHz and 10.6 GHz.

The test distance was 1 meter.

Test Data:



The frequency with the highest emission is: 6.954 GHz
The lower -10dB point is: 6.466 GHz
The upper -10dB point is: 7.899 GHz
The 10 dB bandwidth is 1.433 GHz

FIELD STRENGTH SPURIOUS EMISSIONS (below 960 MHz)

Rules Part No.: Pt 15.517(c), Pt 15.209(a)

Requirements:

Frequency	Limits
Part 15.209	
9 to 490 kHz	2400/F (kHz) µV/m @ 300 meters
490 to 1705 kHz	24000/F (kHz) µV/m @ 30 meters
1705 kHz to 30 MHz	29.54 dBµV/m @ 30 meters
30 – 88	40.0 dBµV/m @ 3 meters
80 – 216	43.5 dBµV/m @ 3 meters
216 – 960	46.0 dBµV/m @ 3 meters
Above 960	54.0 dBµV/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
32.55	3.7	V	0.41	11.43	15.54	24.46
41.94	4.0	H	0.46	11.32	15.78	24.22
44.13	5.1	V	0.47	10.03	15.60	24.40
119.97	4.9	H	0.67	13.61	19.18	24.32
131.71	3.3	V	0.68	13.26	17.24	26.26
302.2	4.0	V	1.10	14.57	19.67	26.33
306.8	4.5	H	1.11	14.94	20.55	25.45

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

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

RADIATED EMISSIONS ABOVE 960 MHz

Rules Part No.: Pt 15.517(d)

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	-53.3
1990 – 3100	-51.3
3100 – 10600	-41.3
Above 10600	-51.3

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 15.521 (d).

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

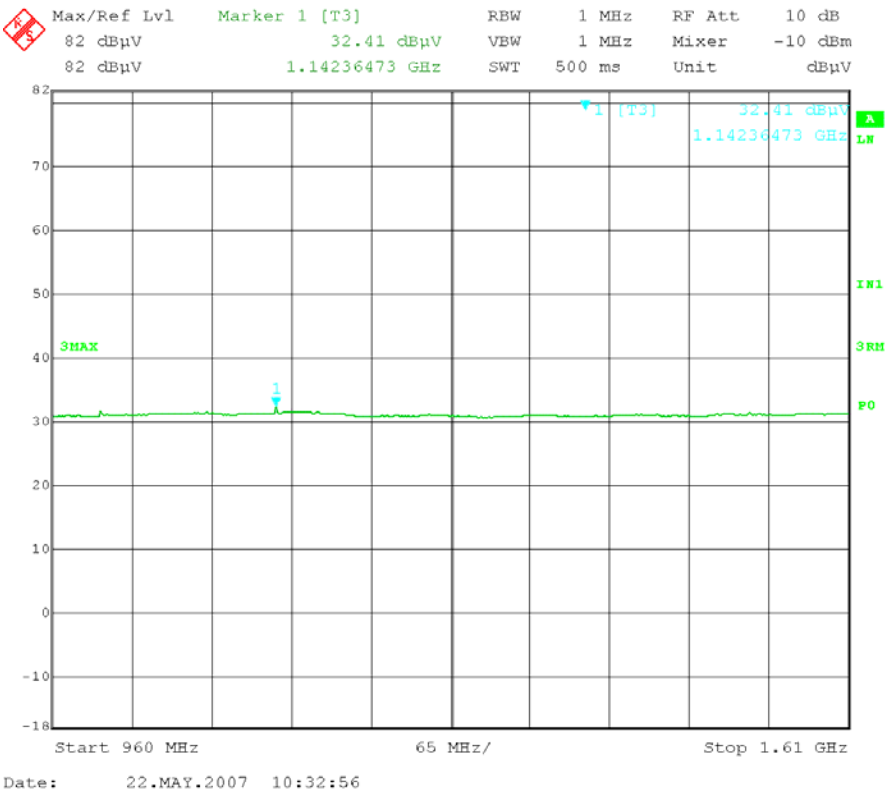
The EIRP limits in dBm were converted to field strength limits in dBuV/m @ 3m.
Example EIRP limit conversion: F.S.=EIRP+95.2

Emission Frequency MHz	Plot #	Meter Reading dBuV	Meas. Distance m	Correction Factor dB/m	Field Strength dBuV/m @ 3m (corrected)	Limit dBuV/m @ 3m
1142.4	1	32.41	1	14.48	17.93	19.90
1824.0	2	31.34	1	11.56	19.78	41.90
2190.2	3	31.92	1	9.64	22.28	43.90
6961.6	5	58.85	1	6.70	52.15	53.90
14782	6	35.47	0.5	6.67	28.80	43.90
22056.1	7	34.25	0.5	6.28	27.97	43.90

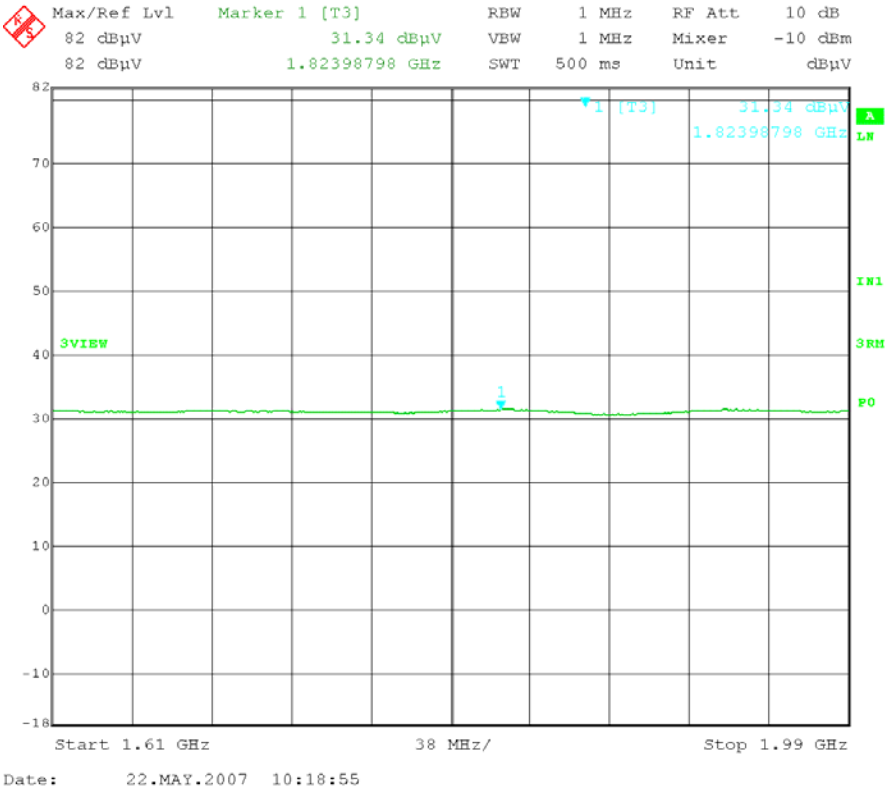
Both vertical and horizontal polarities were studied and the worst case presented. In all cases the vertical polarization resulted in the greatest signal.

There were no measurable emissions above 10.6 GHz, up to 40 GHz. The measurement noise floor is well below the specified limit. Measurements in the table above for emissions greater than 10.6 GHz are of the noise floor.

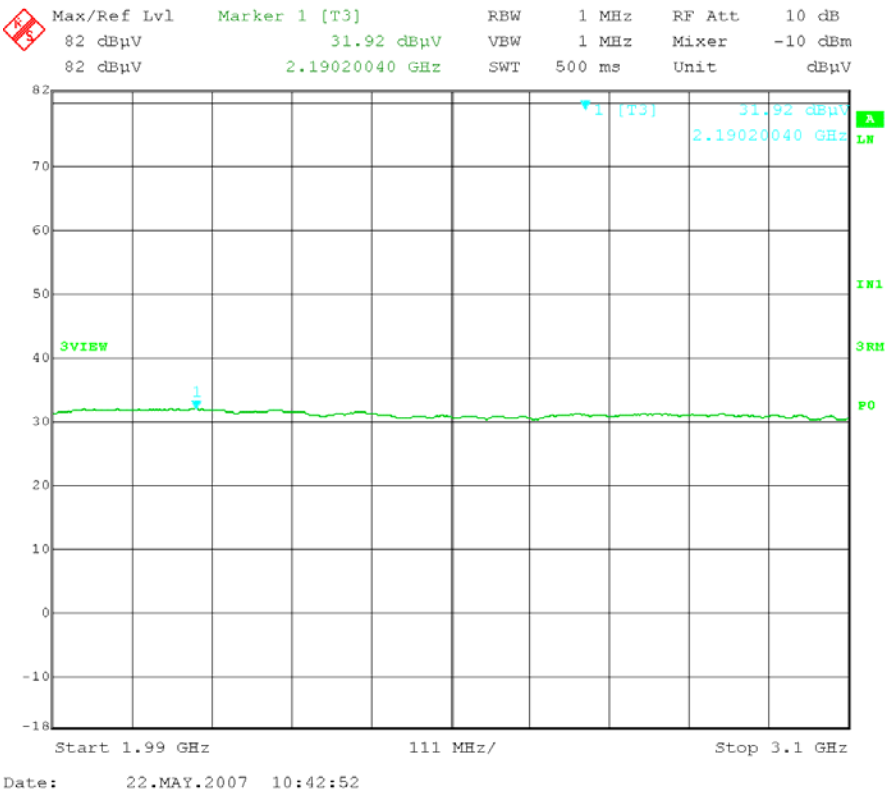
Plot 1


Max/Ref Lvl
82 dBµV
82 dBµV
Marker 1 [T3]
32.41 dBµV
1.14236473 GHz
RBW 1 MHz
VBW 1 MHz
SWT 500 ms
RF Att 10 dB
Mixer -10 dBm
Unit dBµV
1 [T3] 32.41 dBµV
1.14236473 GHz
3MAX
IN1
3RM
PO
Start 960 MHz
65 MHz/
Stop 1.61 GHz
Date: 22.MAY.2007 10:32:56

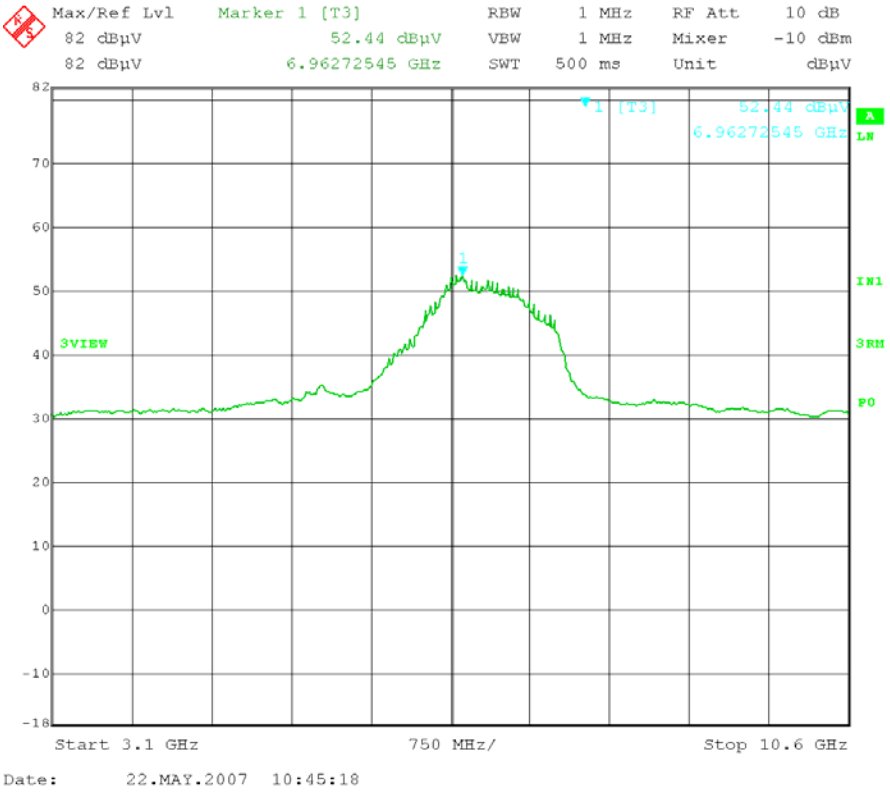
Plot 2


Max/Ref Lvl
82 dBµV
82 dBµV
Marker 1 [T3]
31.34 dBµV
1.82398798 GHz
RBW 1 MHz
VBW 1 MHz
SWT 500 ms
RF Att 10 dB
Mixer -10 dBm
Unit dBµV
1 [T3] 31.34 dBµV
1.82398798 GHz
3VIEW
IN1
3RM
PO
Start 1.61 GHz
38 MHz/
Stop 1.99 GHz
Date: 22.MAY.2007 10:18:55

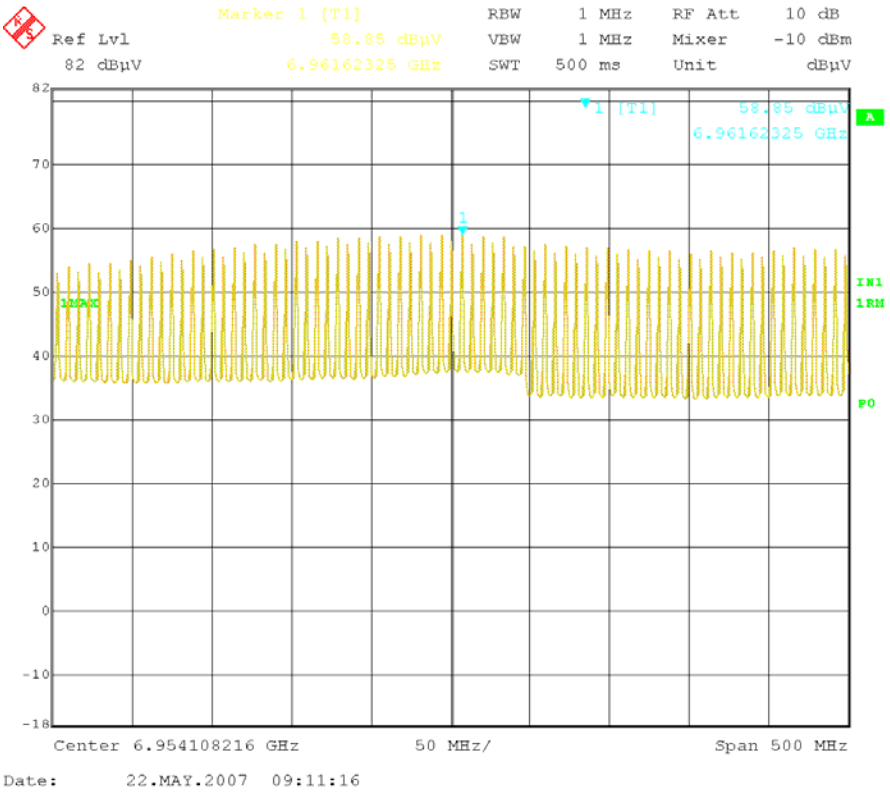
Plot 3


Max/Ref Lvl
82 dBµV
82 dBµV
Marker 1 [T3]
31.92 dBµV
2.19020040 GHz
RBW 1 MHz
VBW 1 MHz
SWT 500 ms
RF Att 10 dB
Mixer -10 dBm
Unit dBµV
1 [T3] 31.92 dBµV
2.19020040 GHz
3VIEW
IN1
3RM
PO
Start 1.99 GHz
111 MHz/
Stop 3.1 GHz
Date: 22.MAY.2007 10:42:52

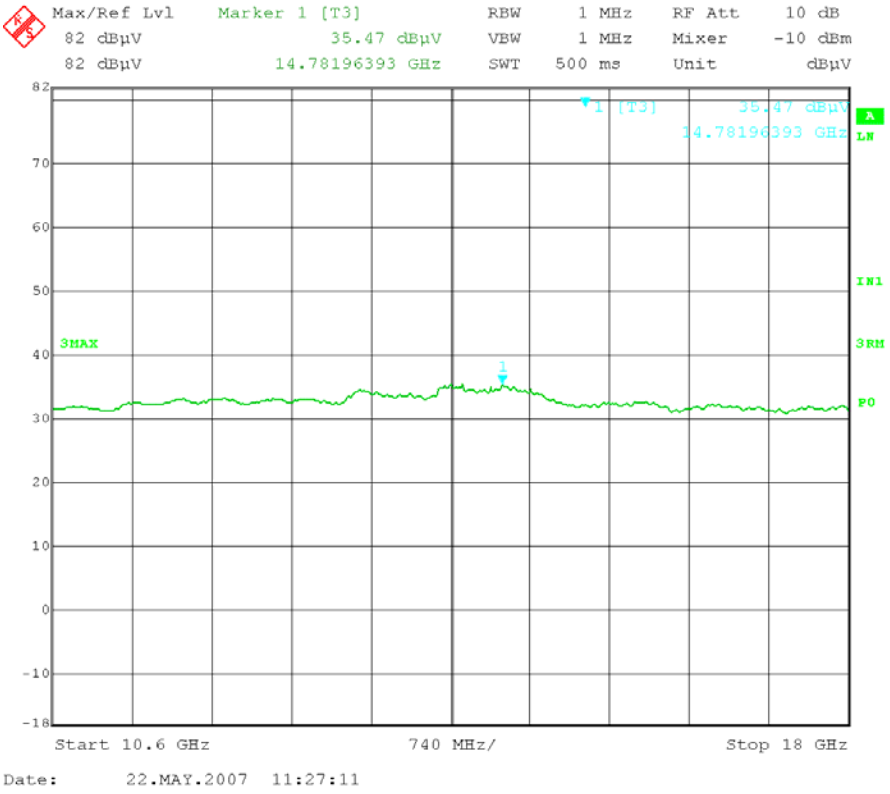
Plot 4


Max/Ref Lvl
82 dBµV
82 dBµV
Marker 1 [T3]
52.44 dBµV
6.96272545 GHz
RBW 1 MHz
VBW 1 MHz
SWT 500 ms
RF Att 10 dB
Mixer -10 dBm
Unit dBµV
1 [T3] 52.44 dBµV
6.96272545 GHz
3VIEW
IN1
3RM
PO
Start 3.1 GHz
750 MHz/
Stop 10.6 GHz
Date: 22.MAY.2007 10:45:18

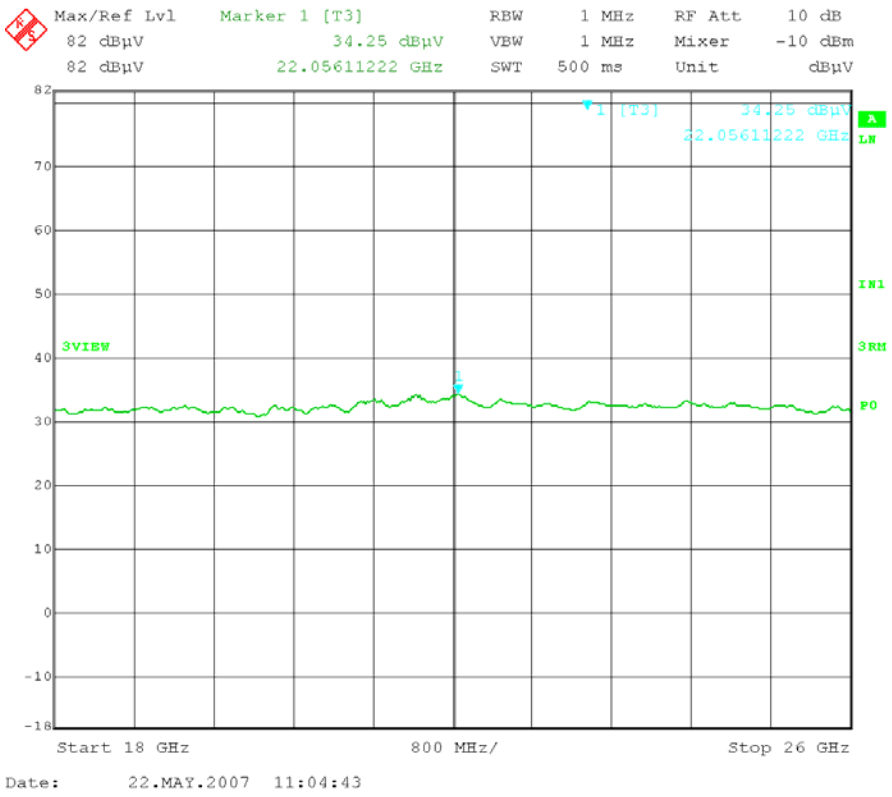
Plot 5


Marker 1 [T1]
Ref Lvl
82 dBµV
58.85 dBµV
6.96162325 GHz
RBW 1 MHz
VBW 1 MHz
SWT 500 ms
RF Att 10 dB
Mixer -10 dBm
Unit dBµV
1MAX
IN1
1RM
PO
Center 6.954108216 GHz
50 MHz/
Span 500 MHz
Date: 22.MAY.2007 09:11:16

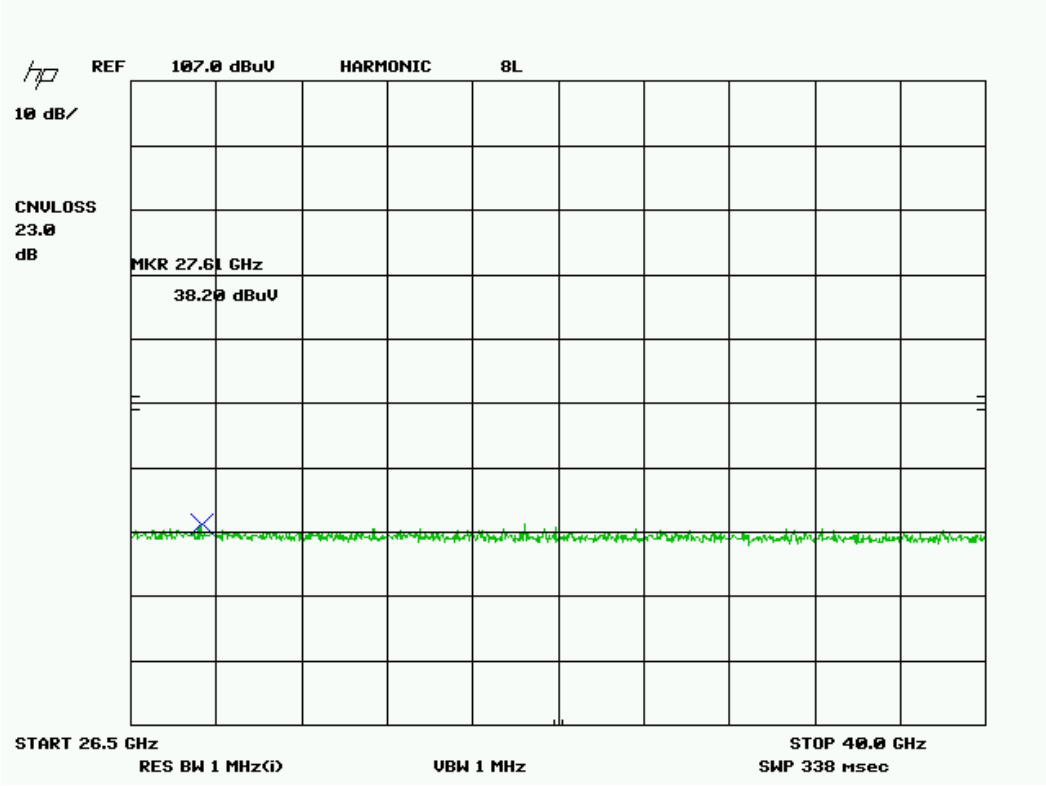
Plot 6


Max/Ref Lvl
Marker 1 [T3]
82 dBµV
82 dBµV
35.47 dBµV
14.78196393 GHz
RBW 1 MHz
VBW 1 MHz
SWT 500 ms
RF Att 10 dB
Mixer -10 dBm
Unit dBµV
3MAX
IN1
3RM
PO
Start 10.6 GHz
740 MHz/
Stop 18 GHz
Date: 22.MAY.2007 11:27:11

Plot 7


Max/Ref Lvl
82 dBµV
82 dBµV
Marker 1 [T3]
34.25 dBµV
22.05611222 GHz
RBW 1 MHz
VBW 1 MHz
SWT 500 ms
RF Att 10 dB
Mixer -10 dBm
Unit dBµV
1 [T3] 34.25 dBµV
22.05611222 GHz
3VIEW
IN1
3RM
PO
Start 18 GHz
800 MHz/
Stop 26 GHz
Date: 22.MAY.2007 11:04:43

Plot 8


REF 107.0 dBuV
HARMONIC
8L
10 dB/
CNVLOSS
23.0
dB
MKR 27.61 GHz
38.20 dBuV
START 26.5 GHz
STOP 40.0 GHz
RES BW 1 MHz(i)
VBW 1 MHz
SWP 338 msec

RADIATED EMISSIONS GPS BAND

Rules Part No.: Pt 15.517(d)

Requirements: Radiated emissions in this segment of the spectrum above 960 MHz shall not exceed the following average limits when measured using a RBW of no less than 1 kHz.

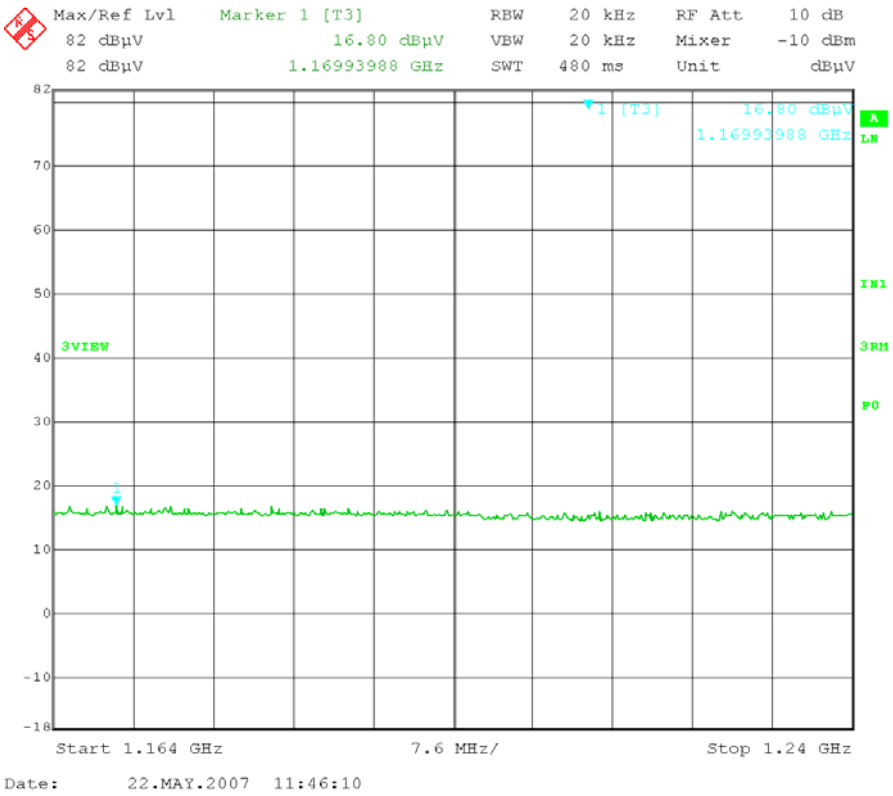
Frequency in MHz	EIRP in dBm	F.S. in dBuV/m
1164 – 1240	-85.3	9.9
1559 - 1610	-85.3	9.9

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

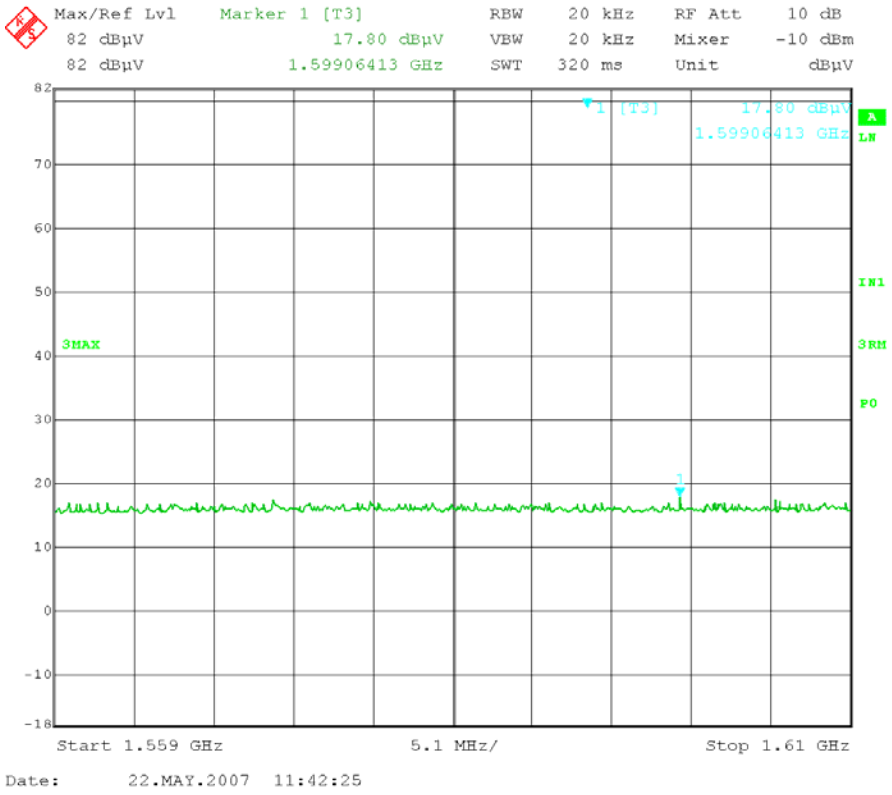
Test Data:

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
1169.9	1	16.80	V	1	14.44	2.36	9.90
1599.1	2	17.80	V	1	13.21	4.59	9.90

Plot 1:



Plot 2:


Max/Ref Lvl
82 dBµV
82 dBµV
Marker 1 [T3]
17.80 dBµV
1.59906413 GHz
RBW 20 kHz
VBW 20 kHz
SWT 320 ms
RF Att 10 dB
Mixer -10 dBm
Unit dBµV
1 [T3] 17.80 dBµV
1.59906413 GHz
A
LN
IN1
3RM
PO
3MAX
82
70
60
50
40
30
20
10
0
-10
-18
Start 1.559 GHz
5.1 MHz/
Stop 1.61 GHz
Date: 22.MAY.2007 11:42:25

RADIATED EMISSIONS PEAK LEVEL

Rules Part No.: Pt 15.517(e)

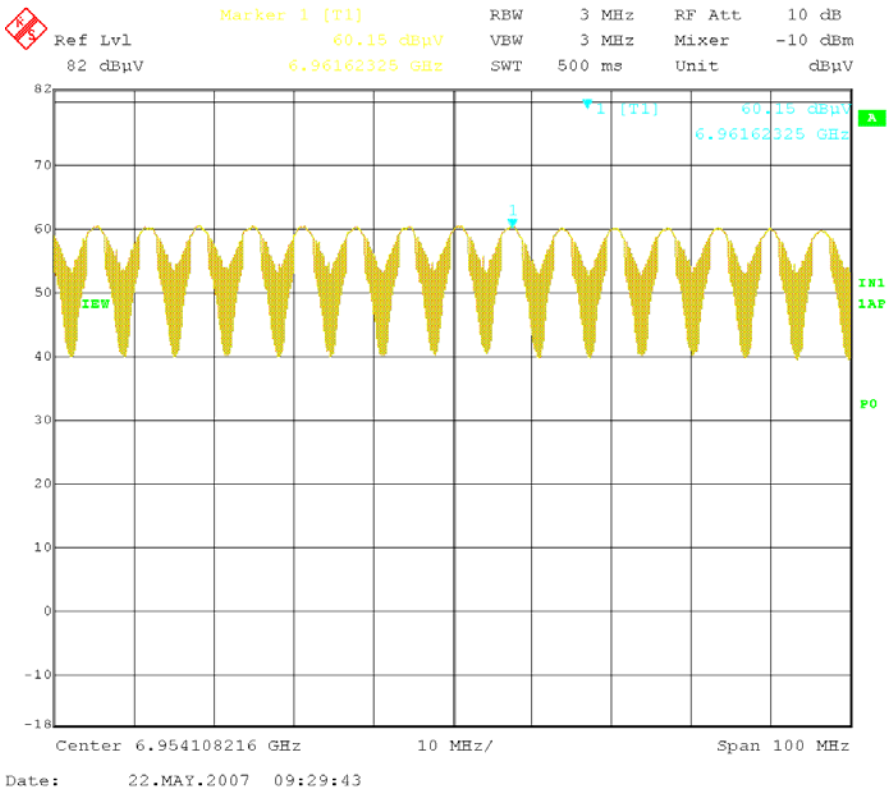
Requirements: The limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_M. That limit is 0 dBm EIRP. A different resolution bandwidth can be used and a correspondingly different peak emission limit, following the procedures described in Pt 15.521.

Pursuant to Pt 15.521(g), the peak EIRP limit = 20log(3MHz/50) = -24.4 dBm. The equivalent filed strength at 3m = (-24.4) + 95.2 = 70.8 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/m	Field Strength dBuV/m	Limit dBuV/m @3m
6961.6	60.15	V	1	6.70	53.45	70.8



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
* decreases with the logarithm of frequency.		

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