

**DATE: 19 September 2011**

**I.T.L. (PRODUCT TESTING) LTD.**

# **FCC Radio Test Report**

**for**

**Visonic Ltd.**

**Equipment under test:**

## **Wireless Magnetic Contact Sensor**

**MCT-320 SMA**

Written by:



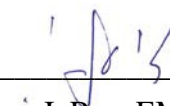
A. Moses, Documentation

Approved by:



A. Moses, Test Engineer

Approved by:



I. Raz, EMC Laboratory Manager

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This report relates only to items tested.

**Measurement/Technical Report for**  
**Visonic Ltd.**  
**Wireless Magnetic Contact Sensor**

**MCT-320 SMA**

**FCC ID:WP3MCT320SMA**

**IC ID:1467C-MCT320SMA**

This report concerns:                      Original Grant:                      X  
Class I Change:  
Class II Change:

Equipment type:

Limits used:  
47CFR15 Section 15.247

Measurement procedure used is ANSI C63.4-2003.

Application for Certification  
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# TABLE OF CONTENTS

<b>1.</b>	<b>GENERAL INFORMATION -----</b>	<b>5</b>
1.1	Administrative Information .....	5
1.2	List of Accreditations .....	6
1.3	Product Description .....	7
1.4	Test Methodology .....	7
1.5	Test Facility .....	7
1.6	Measurement Uncertainty .....	7
<b>2.</b>	<b>SYSTEM TEST CONFIGURATION-----</b>	<b>8</b>
2.1	Justification .....	8
2.2	Special Accessories .....	8
2.3	Equipment Modifications .....	8
2.4	Configuration of Tested System .....	8
<b>3.</b>	<b>RADIATED MEASUREMENT TEST SET-UP PHOTO -----</b>	<b>9</b>
<b>4.</b>	<b>6DB MINIMUM BANDWIDTH -----</b>	<b>10</b>
4.1	Test Specification .....	10
4.2	Test procedure .....	10
4.3	Test Results.....	12
4.4	Test Equipment Used.....	13
<b>5.</b>	<b>26DB BANDWIDTH-----</b>	<b>14</b>
5.1	Test Specification .....	14
5.2	Test procedure .....	14
5.3	Test Results.....	16
5.4	Test Equipment Used.....	17
<b>6.</b>	<b>RADIATED POWER OUTPUT -----</b>	<b>18</b>
6.1	Test Specification .....	18
6.2	Test procedure .....	18
6.3	Results Calculation.....	25
6.4	Test Equipment Used.....	26
<b>7.</b>	<b>BAND EDGE-----</b>	<b>27</b>
7.1	Test procedure .....	27
7.2	Results table.....	31
7.3	Test Equipment Used.....	32
<b>8.</b>	<b>RADIATED EMISSION, 9 KHZ – 30 MHZ-----</b>	<b>33</b>
8.1	Test Specification .....	33
8.2	Test Procedure .....	33
8.3	Measured Data .....	33
8.4	Test Instrumentation Used, Radiated Measurements .....	34
8.5	Field Strength Calculation .....	34
<b>9.</b>	<b>SPURIOUS RADIATED EMISSION 30 – 25000 MHZ-----</b>	<b>35</b>
9.1	Test Specification .....	35
9.2	Test Procedure .....	35
9.3	Test Data .....	36
9.4	Test Instrumentation Used, Radiated Measurements .....	47
9.5	Field Strength Calculation .....	48
<b>10.</b>	<b>RADIATED POWER SPECTRAL DENSITY-----</b>	<b>49</b>
10.1	Test procedure .....	49
10.2	Results table.....	52
10.3	Test Equipment Used.....	54
<b>11.</b>	<b>ANTENNA GAIN/INFORMATION -----</b>	<b>55</b>
<b>12.</b>	<b>R.F EXPOSURE/SAFETY -----</b>	<b>56</b>

<b>13.</b>	<b>APPENDIX B - CORRECTION FACTORS</b>	<b>57</b>
13.1	Correction factors for CABLE	57
13.2	Correction factors for CABLE	58
12.6	Correction factors for LOG PERIODIC ANTENNA	59
13.3	Correction factors for LOG PERIODIC ANTENNA	60
13.4	Correction factors for BICONICAL ANTENNA	61
13.5	Correction factors for Double-Ridged Waveguide Horn	62
13.6	Correction factors for Horn Antenna	63
13.7	Correction factors for ACTIVE LOOP ANTENNA	64

# 1. General Information

## 1.1 Administrative Information

Manufacturer:	Visonic Ltd.
Manufacturer's Address:	24 Habarzel St. Tel-Aviv 69710 Israel Tel: +972-3-645-6789 Fax: +972-3-645-6788
Manufacturer's Representative:	Arick Elshtein
Equipment Under Test (E.U.T):	Wireless Magnetic Contact Sensor
Equipment Model No.:	MCT-320 SMA
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T:	10.07.11
Start of Test:	10.07.11
End of Test:	18.09.11
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Part 15 Subpart C

## **1.2 List of Accreditations**

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), Registration No. 90715.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025B-1.
6. TUV Product Services, England, ASLLAS No. 97201.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

### **1.3 Product Description**

The MCT-320 is a fully supervised, wireless magnetic contact sensor, for use with iControl control panels. The sensor includes a built-in reed switch (that opens upon removal of a magnet placed near it).

The MCT-320 tamper switch is activated when the cover is removed or when the detector is removed from the wall.

A periodic supervision message is transmitted automatically. The target receiver is thus informed, at regular intervals, of the unit's active participation in the system.

Operating power is obtained from an on-board 3 V Lithium battery. When the battery voltage is low, a "low battery" message is sent to the receiver.

### **1.4 Test Methodology**

Radiated testing was performed according to the procedures in ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

### **1.5 Test Facility**

The radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing September 3, 2009).

I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

### **1.6 Measurement Uncertainty**

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site 30-1000 MHz:

Expanded Uncertainty (95% Confidence, K=2):

$\pm 4.96$  dB

## 2. System Test Configuration

### 2.1 *Justification*

Radiated emission screening was performed in 3 orthogonal orientations. The worst case orientation was the vertical position.

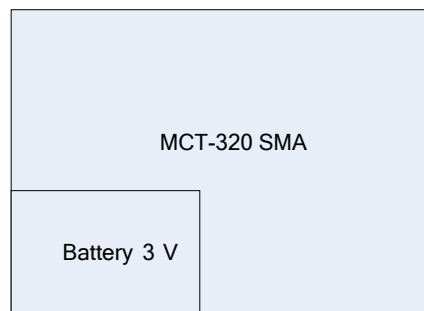
### 2.2 *Special Accessories*

No special accessories were required to achieve compliance.

### 2.3 *Equipment Modifications*

No modifications were needed in order to achieve compliance

### 2.4 *Configuration of Tested System*



**Figure 1. Configuration of Tested System**



### 3. Radiated Measurement Test Set-up Photo



**Figure 2. Radiated Emission Test**

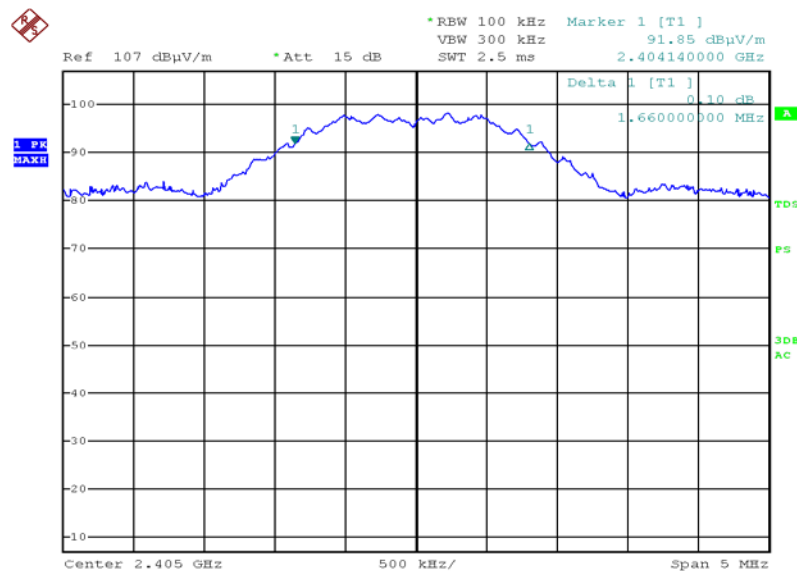
## 4. 6dB Minimum Bandwidth

### 4.1 Test Specification

F.C.C. Part 15, Subpart C: 15.247(a)(2)

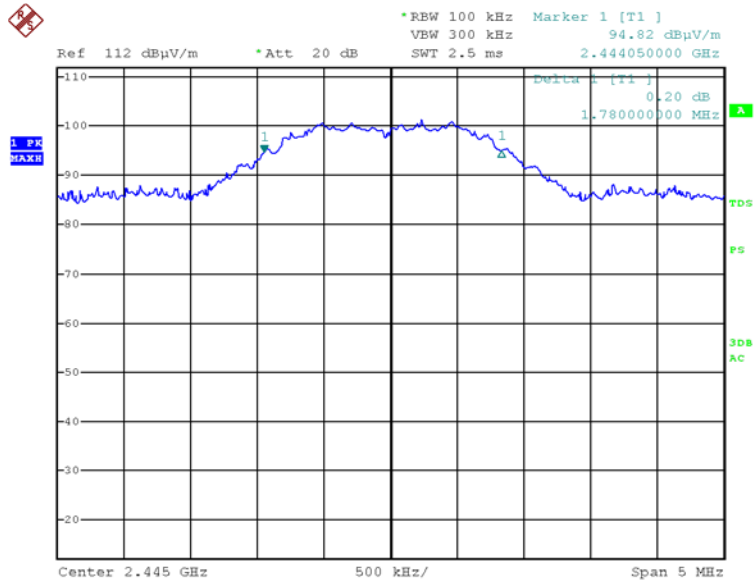
### 4.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters. The transmitter unit operated with normal modulation. The EMI receiver was set to 100 kHz resolution BW. The spectrum bandwidth of the transmitter unit was measured and recorded. The test was performed to measure the transmitter occupied bandwidth. The EUT was set up as shown in Figure 3, and its proper operation was checked. The transmitter occupied bandwidth was measured with the EMI receiver as frequency delta between reference points on modulation envelope. The E.U.T. was tested at 2405, 2445, 2475 MHz.



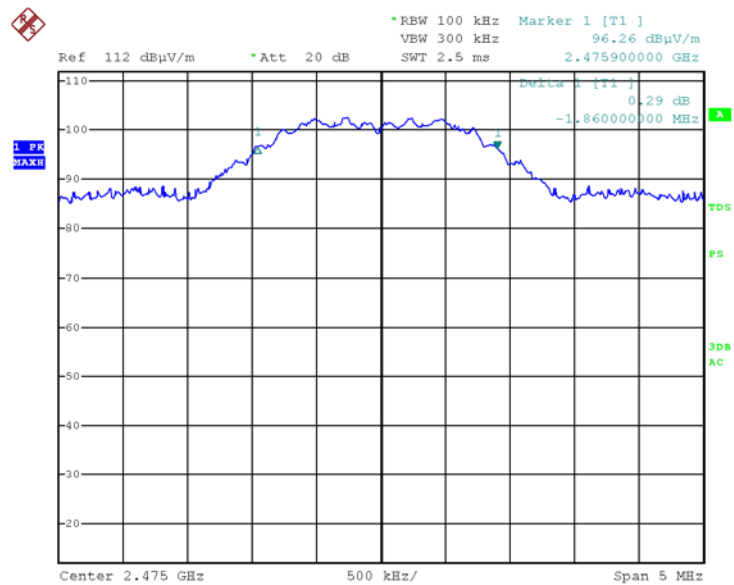
Date: 18.JUL.2011 08:56:59

Figure 3. 2405 MHz



Date: 18.JUL.2011 10:11:03

**Figure 4. 2445 MHz**



Date: 25.AUG.2011 10:37:41

**Figure 5. 2475 MHz**

### 4.3 Test Results

E.U.T Description: Wireless Magnetic Contact Sensor

Model: MCT-320 SMA

Serial Number: Not Designated

Operation Frequency (MHz)	Bandwidth Reading (MHz)	Specification (MHz)
2405	1.66	>0.5
2445	1.78	>0.5
2475	1.86	>0.5

**Figure 6 Test Results**

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 06.09.11

Typed/Printed Name: A. Moses

#### 4.4 Test Equipment Used.

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	July 22, 2010	2 years
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2011	2 years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

**Figure 7 Test Equipment Used**

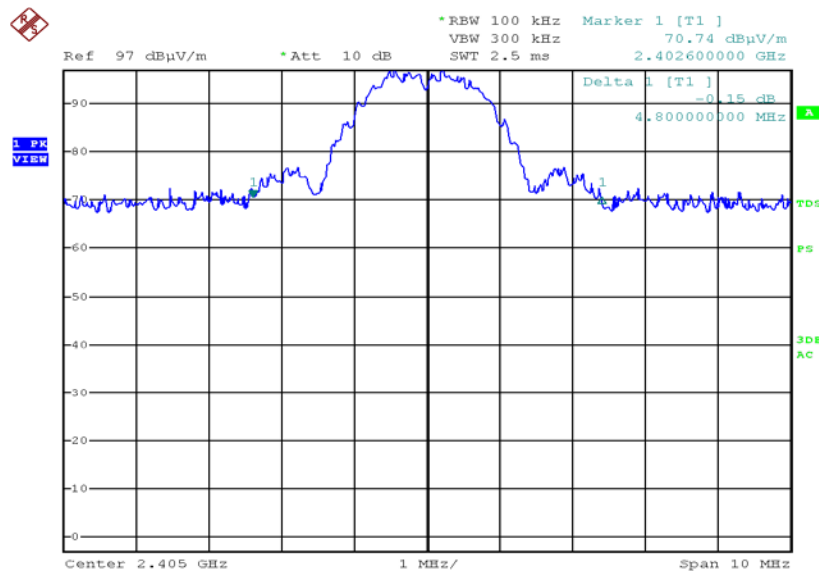
## 5. 26dB Bandwidth

### 5.1 Test Specification

F.C.C. Part 15, Subpart C: 15.247(a)(2)

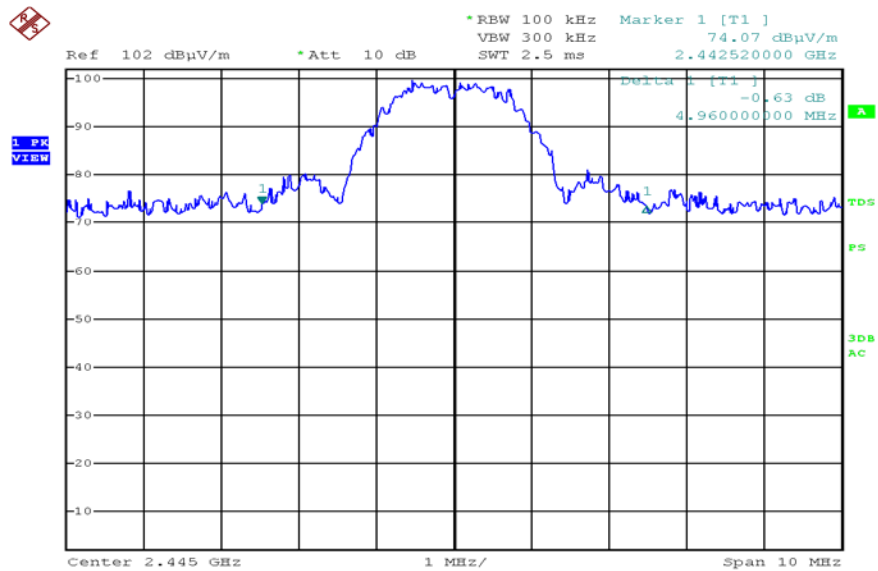
### 5.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters. The transmitter unit operated with normal modulation. The EMI receiver was set to 100 kHz resolution BW. The spectrum bandwidth of the transmitter unit was measured and recorded. The test was performed to measure the transmitter occupied bandwidth. The EUT was set up as shown in Figure 3, and its proper operation was checked. The transmitter occupied bandwidth was measured with the EMI receiver as frequency delta between reference points on modulation envelope. The E.U.T. was tested at 2405, 2445, 2475MHz.



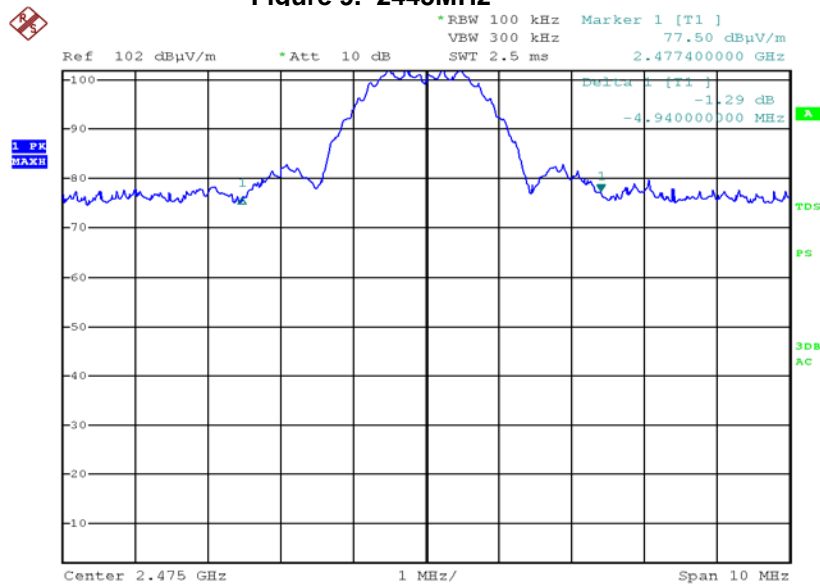
Date: 18.JUL.2011 09:26:45

Figure 8. 2405 MHz



Date: 18.JUL.2011 10:14:19

Figure 9. 2445MHz



Date: 25.AUG.2011 10:41:19

Figure 10. 2475MHz

### 5.3 Test Results

E.U.T Description: Wireless Magnetic Contact Sensor

Model: MCT-320 SMA

Serial Number: Not Designated

Operation Frequency (MHz)	Bandwidth Reading (MHz)	Specification (MHz)
2405	4.80	>0.5
2445	4.96	>0.5
2475	4.94	>0.5

**Figure 11 Test Results**

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 06.09.11

Typed/Printed Name: A. Moses



#### 5.4 Test Equipment Used.

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	July 22 , 2010	2 years
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2011	2 years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

**Figure 12 Test Equipment Used**

## 6. Radiated Power Output

### 6.1 Test Specification

F.C.C. Part 15, Subpart C: 15.247(b)

### 6.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.

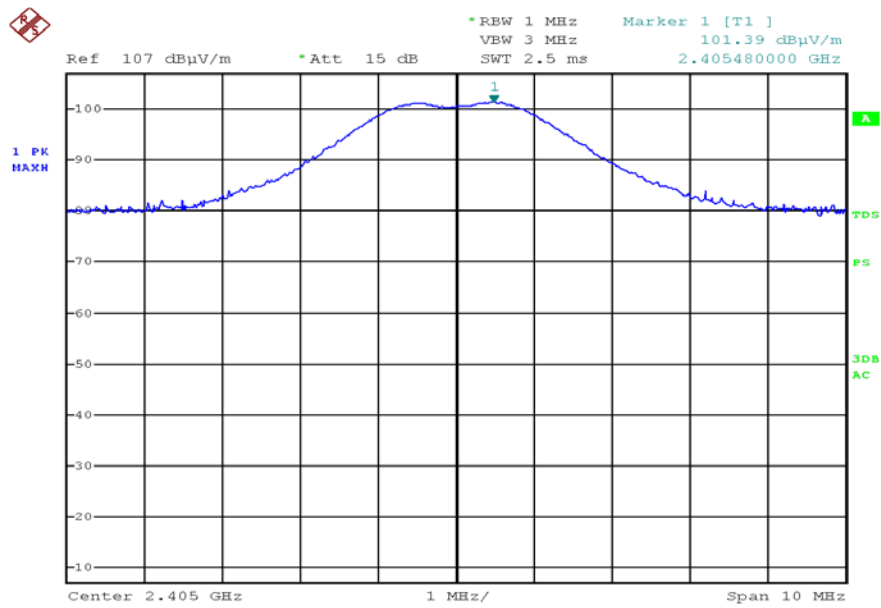
The transmitter unit operated with normal modulation. The EMI receiver was set to 1 MHz resolution BW. The EUT was set up as shown in Figure 3, and its proper operation was checked.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

The E.U.T. was tested in three frequencies 2.405 GHz, 2.445 GHz, and 2.475 GHz.

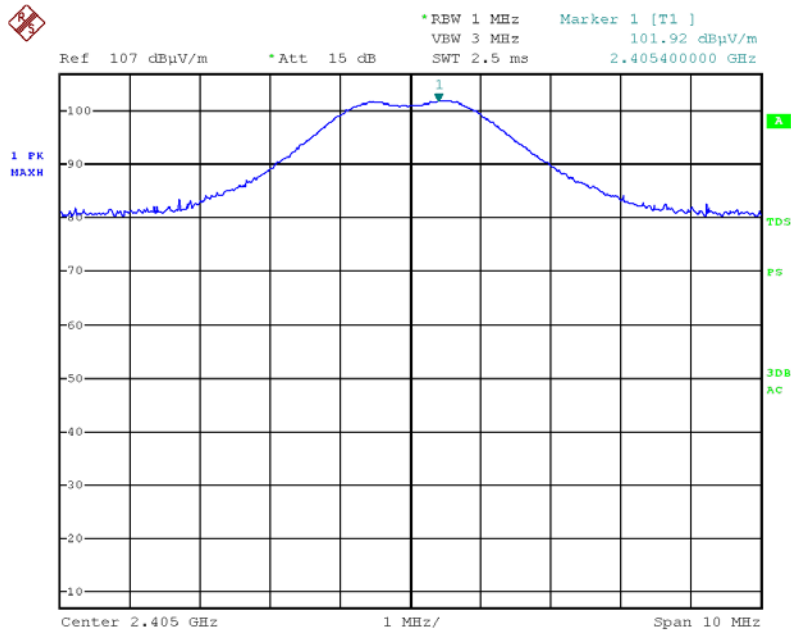
Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} [\text{W}]$$



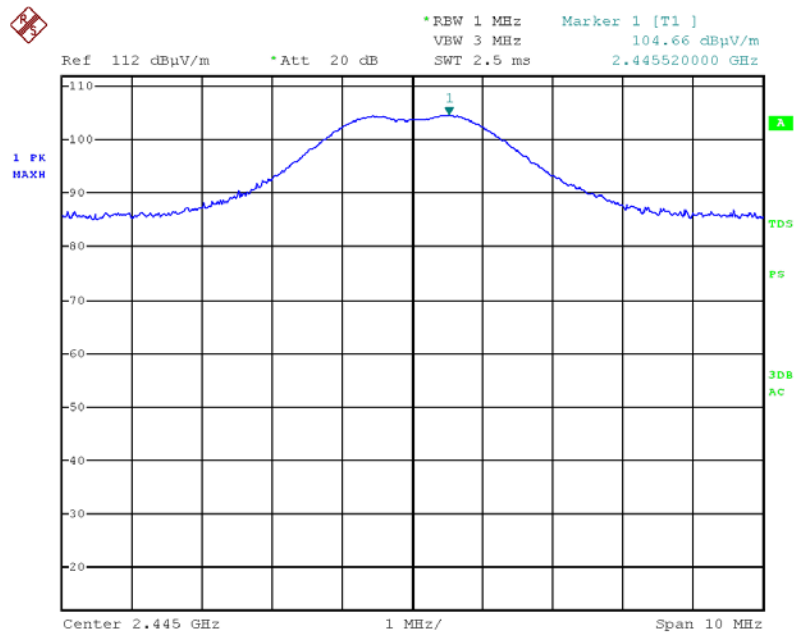
Date: 18.JUL.2011 08:21:21

Figure 13-2405 MHz- Vertical



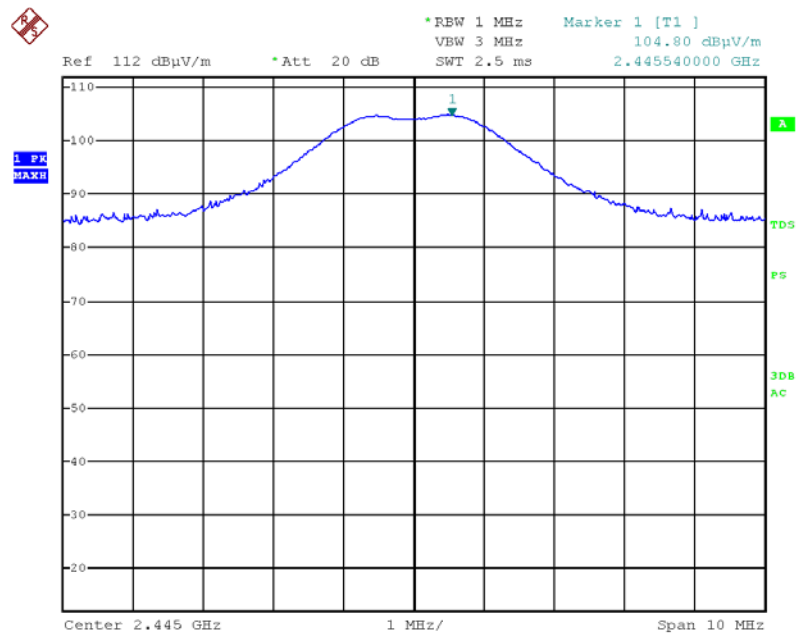
Date: 18.JUL.2011 08:49:09

Figure 14-2405 MHz- horizontal



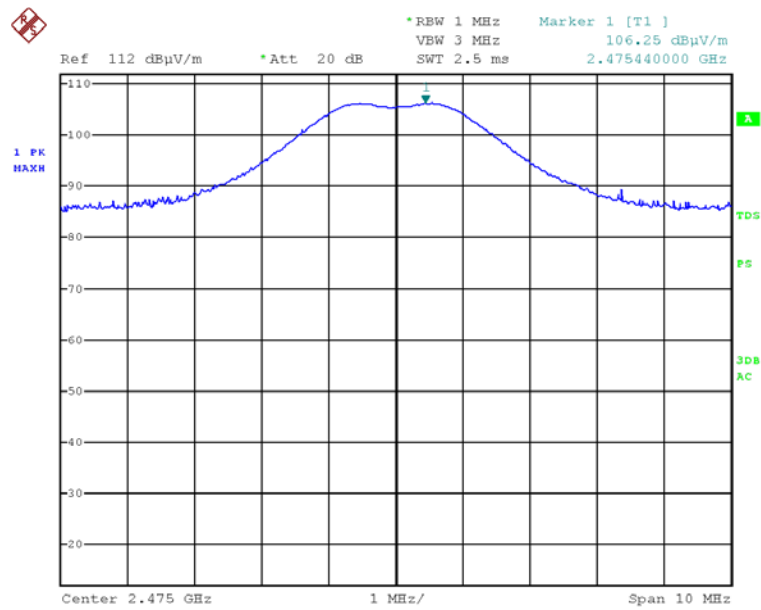
Date: 18.JUL.2011 10:03:44

Figure 15-2445 MHz- Vertical



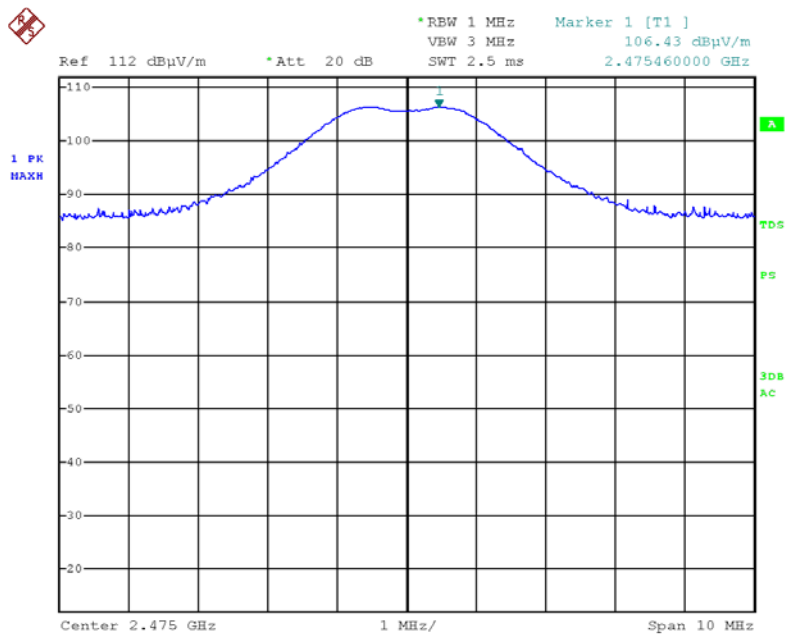
Date: 18.JUL.2011 10:09:33

Figure 16-2445 MHz- horizontal



Date: 25.AUG.2011 10:18:21

**Figure 17-2475 MHz- Vertical**



Date: 25.AUG.2011 10:32:49

Figure 18-2475 MHz- horizontal



### 6.3 Results Calculation

E.U.T. Description: Wireless Magnetic Contact Sensor

Model No.: MCT-320 SMA

Serial Number: Not Designated

Specification: F.C.C. Part 15, Subpart C

The following calculations were used to determine maximum radiated power output.

2410 MHz

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} [\text{W}]$$

$$E(V/m) = 10^{-6} \times 10^{\left(\frac{101.9}{20}\right)} = 0.124$$

$$P = \frac{(0.124 \times 3)^2}{(30 \times 0.79)} = 5.83 \text{ mW}$$

2445 MHz

$$E(V/m) = 10^{-6} \times 10^{\left(\frac{104.8}{20}\right)} = 0.173$$

$$P = \frac{(0.173 \times 3)^2}{(30 \times 0.79)} = 11.46 \text{ mW}$$

2475 MHz

$$E(V/m) = 10^{-6} \times 10^{\left(\frac{106.4}{20}\right)} = 0.2$$

$$P = \frac{(0.2 \times 3)^2}{(30 \times 0.79)} = 15.2 \text{ mW}$$

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 06.09.11

Typed/Printed Name: A. Moses

#### 6.4 Test Equipment Used.

##### Radiated Maximum Power Output

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	July 22 , 2010	2 years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A
Antenna-Log Periodic	A.H.System	SAS-200/511	253	January 27, 2011	2 years

**Figure 19 Test Equipment Used**

## 7. Band Edge

[In Accordance with section 15.247(d)]

### 7.1 Test procedure

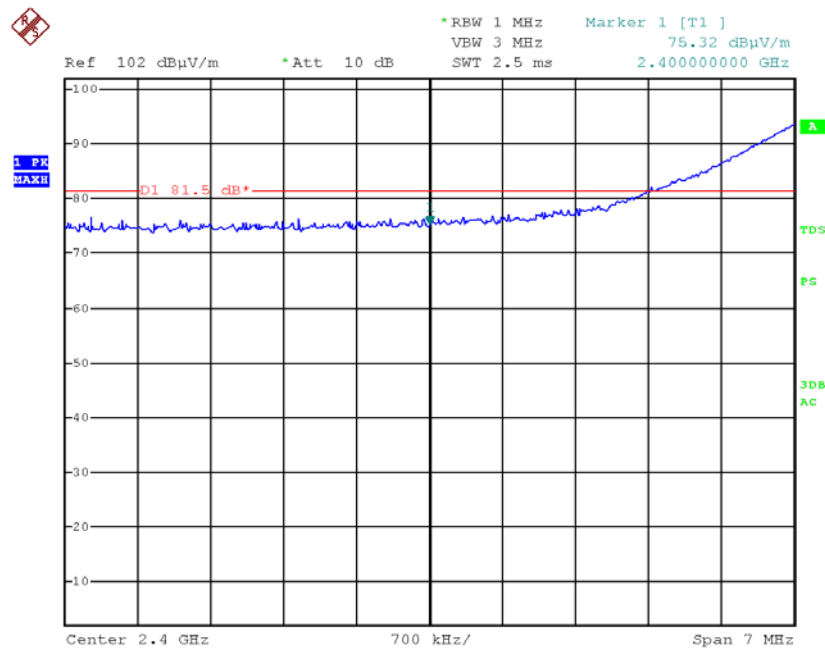
The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.

The transmitter unit operated with normal modulation. The EMI receiver was set to 1 MHz resolution BW. The EUT was set up as shown in Figure 3, and its proper operation was checked.

The EMI receiver was adjusted to the transmission channel at the maximum radiated level. The display line was set to 20 dBc and the EMI receiver was set to the band edge frequencies.

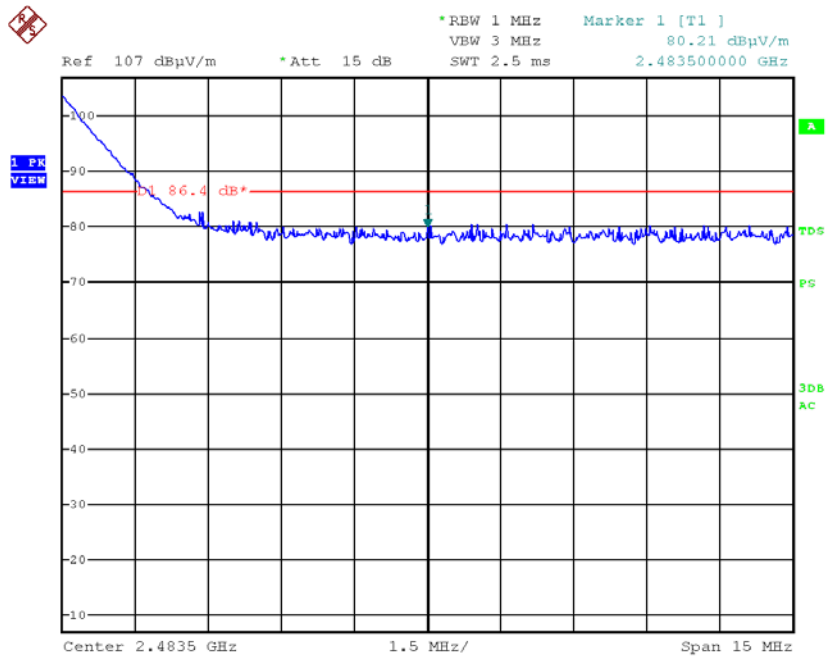
Maximum power level below 2400 MHz and above 2483.5 MHz was measured relative to power level at 2405 MHz, and 2475 MHz correspondingly.

The E.U.T. was tested at 2405 and 2475 MHz.



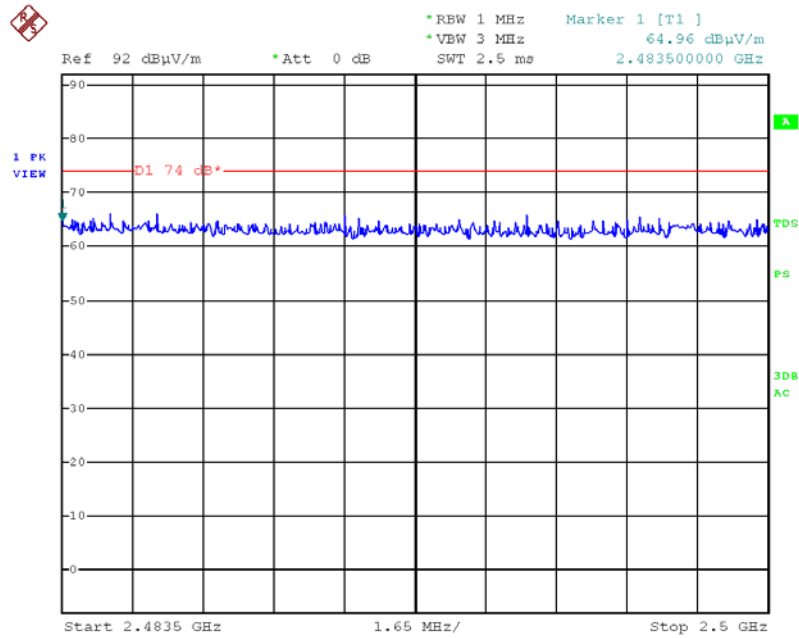
Date: 18.JUL.2011 09:37:42

Figure 20 — 2405 MHz (-20 dBc Limit)



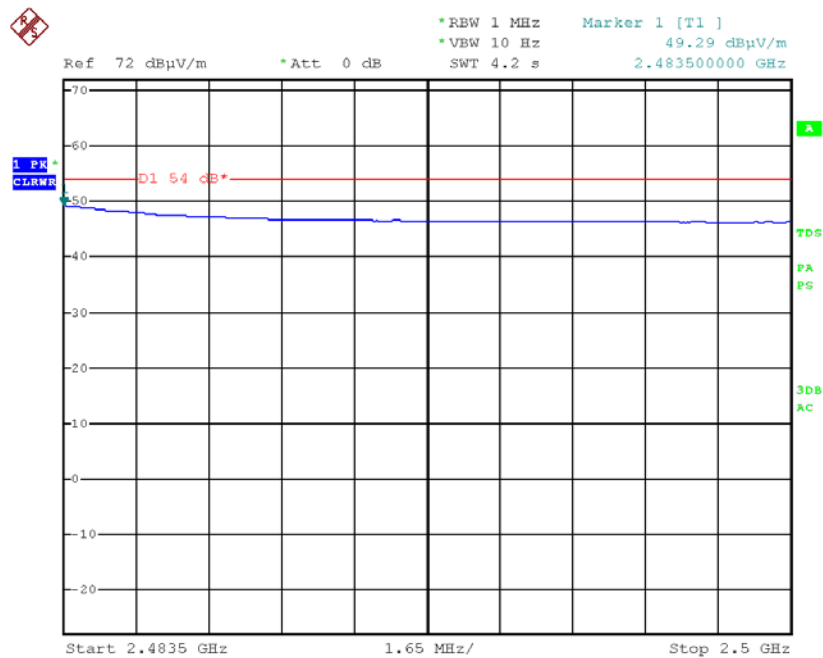
Date: 25.AUG.2011 10:50:39

**Figure 21 — 2475 MHz (-20 dBc Limit)**



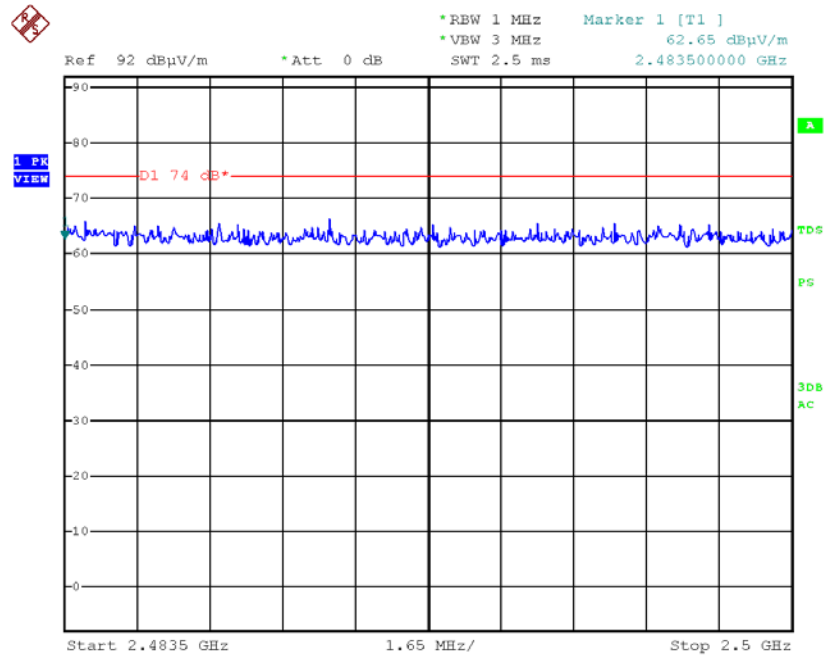
Date: 18.SEP.2011 14:41:24

**Figure 22 — 2475 MHz ( Restricted Band Limit) Horizontal Peak**



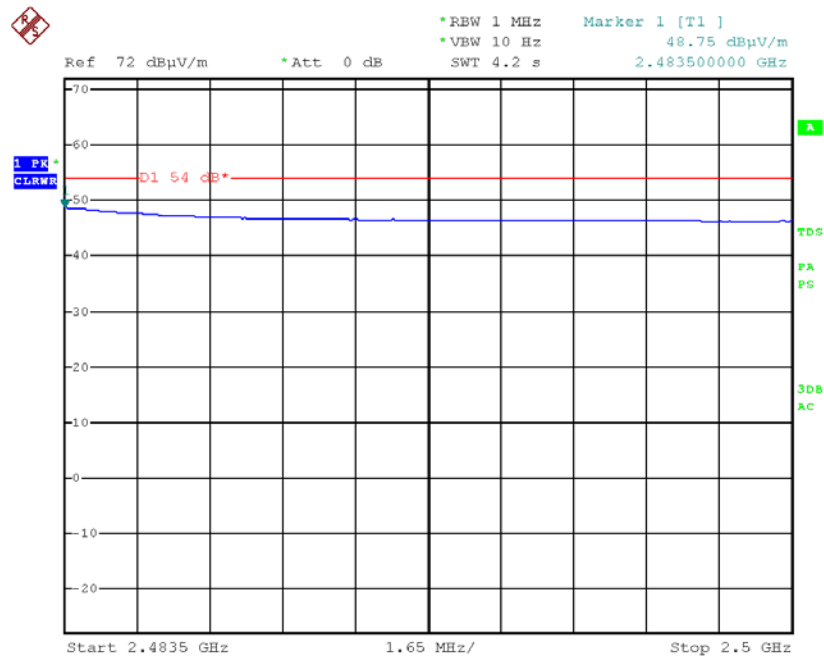
Date: 18.SEP.2011 14:42:23

**Figure 23 — 2475 MHz ( Restricted Band Limit) Horizontal Average**



Date: 18.SEP.2011 14:48:56

**Figure 24 — 2475 MHz ( Restricted Band Limit) Vertical Peak**



Date: 18.SEP.2011 14:49:55

**Figure 25 — 2475 MHz ( Restricted Band Limit) Vertical Average**

## 7.2 Results table

E.U.T. Description: Wireless Magnetic Contact Sensor

Model No.: MCT-320 SMA

Serial Number: Not Designated

Specification: F.C.C. Part 15, Subpart C (15.247 (d))

Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBuV/m)	Specification (dBuV/m)	Margin (dB)
2405.0	2400.0	75.3	81.5	-6.2
2475.0	2483.5	80.2	86.4	-6.2

**Figure 26 Band Edge (- 20 dBc Limit)**

Operation Frequency (MHz)	Band Edge Frequency (MHz)	Antenna Polarization (H/V)	Peak Reading (dBuV/m)	Average Reading (dBuV/m)	Specification (dBuV/m)	Margin (dB)
2475.0	2483.5	H	64.96		74.0	-9.04
2475.0	2483.5	H		49.29	54.0	-4.71
2475.0	2483.5	V	62.65		74.0	-11.35
2475.0	2483.5	V		48.75	54.0	-5.25

**Figure 27 Band Edge (Restricted Band Limit)**

JUDGEMENT: Passed by 4.3 dB (-20 dBc Limit)  
Passed by 4.7 dB (Restricted Band Limit)

TEST PERSONNEL:

Tester Signature: 

Date: 19.09.11

Typed/Printed Name: A. Moses

### 7.3 Test Equipment Used.

Band edge Spectrum

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	July 22 , 2010	2 years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A
Antenna-Log Periodic	A.H.System	SAS-200/511	253	January 27, 2011	2 years

**Figure 28 Test Equipment Used**



## 8. Radiated Emission, 9 kHz – 30 MHz

### 8.1 Test Specification

9 kHz-30 MHz, FCC, Part 15, Subpart C, Section 209

### 8.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 3.1.

The frequency range 9 kHz-30 MHz was scanned.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 9 kHz-30MHz, the loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter at a distance of 3 meters.

The E.U.T. was operated at the frequency of kHz. This frequency was measured using a peak detector.

The E.U.T. was tested at 2.405, 2.445, and 2.480 GHz.

### 8.3 Measured Data

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 209 specification.

The results for all three frequencies were the same.

No signals were detected in the frequency range of 9 kHz – 30 MHz.

TEST PERSONNEL:

Tester Signature: 

Date: 06.09.11

Typed/Printed Name: A. Moses

#### 8.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 24, 2010	1 year
RF Section	HP	85420E	3705A00248	November 24, 2010	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 19, 2010	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

#### 8.5 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$FS = RA + AF + CF$$

FS: Field Strength [dB $\mu$ V/m]

RA: Receiver Amplitude [dB $\mu$ V]

AF: Receiving Antenna Correction Factor [dB/m]

CF: Cable Attenuation Factor [dB]

Example: FS = 30.7 dB $\mu$ V (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dB $\mu$ V

No external pre-amplifiers are used.

## **9. Spurious Radiated Emission 30 – 25000 MHz**

### **9.1 Test Specification**

30 MHz-25000 MHz, F.C.C., Part 15, Subpart C

### **9.2 Test Procedure**

The E.U.T. operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground..

The frequency range 30 MHz-25000 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

In the frequency range 30 MHz - 2.9 GHz, a computerized EMI receiver complying to CISPR 16 requirements was used. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 2.9 - 25.0 GHz, a spectrum analyzer including a low noise amplifier was used. During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 100Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.

The test distance was 3 meters.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)

The E.U.T. was tested in three operating frequencies  
2.405 GHz, 2.445 GHz, and 2.475 GHz.

### 9.3 Test Data

JUDGEMENT: Passed by 1.3 dB

The EUT met the requirements of the F.C.C. Part 15, Subpart C, specification.

In the frequency range of 30 – 1000 MHz no signals were detected.

For the operation channel 2.405 GHz, the margin between the emission level and the specification limit is 1.3 dB in the worst case at the frequency of 4810 MHz, horizontal polarization.

For the operation channel 2.445 GHz, the margin between the emission level and the specification limit is 2.3 dB in the worst case at the frequency of 4890.00 MHz, horizontal polarization.

For the operation channel 2.475GHz, the margin between the emission level and the specification limit is 2.6 dB in the worst case at the frequency of 2483.50 MHz, vertical polarization.

The details of the highest emissions are given in *Figure 29* to *Figure 42*.

TEST PERSONNEL:

Tester Signature: 

Date: 19.09.11

Typed/Printed Name: A. Moses

## Radiated Emission

E.U.T Description    Wireless Magnetic Contact Sensor  
Type                      MCT-320 SMA  
Serial Number:        Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical    Frequency range: 1.0 GHz to 25.0 GHz  
Test Distance: 3 meters                            Detector: Peak  
Operation Frequency: 2405.00 MHz

Operation Frequency  (MHz)	Freq.  (MHz)	Polarity  (H/V)	Peak Reading  (dBμV/m)	Peak Specification  (dB μV/m)	Margin  (dB)
2405.00	2390.00	H	63.0	74.0	-11.0
2405.00	2390.00	V	60.5	74.0	-13.5
2405.00	4810.00	H	62.4	74.0	-11.6
2405.00	4810.00	V	58.6	74.0	-15.4
2405.00	7215.00	H	57.0	74.0	-17.0
2405.00	7215.00	V	51.1	74.0	-22.9

**Figure 29. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.  
Detector: Peak**

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Reading” includes correction factor.

\* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

## Radiated Emission

E.U.T Description    Wireless Magnetic Contact Sensor  
Type                      MCT-320 SMA  
Serial Number:        Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical    Frequency range: 1.0 GHz to 25.0 GHz  
Test Distance: 3 meters                            Detector: Peak  
Operation Frequency: 2445.00 MHz

Operation Frequency  (MHz)	Freq.  (MHz)	Polarity  (H/V)	Peak Reading  (dBμV/m)	Peak Specification  (dB μV/m)	Margin  (dB)
2445.00	4890.00	H	61.8	74.0	-12.2
2445.00	4890.00	V	56.2	74.0	-17.8
2445.00	7335.00	H	54.4	74.0	-19.6
2445.00	7335.00	V	51.8	74.0	-22.2

**Figure 30. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.  
Detector: Peak**

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Reading” includes correction factor.

\* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

## Radiated Emission

E.U.T Description    Wireless Magnetic Contact Sensor  
Type                      MCT-320 SMA  
Serial Number:        Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical    Frequency range: 1.0 GHz to 25.0 GHz  
Test Distance: 3 meters                            Detector: Peak  
Operation Frequency: 2475.00 MHz

Operation Frequency  (MHz)	Freq.  (MHz)	Polarity  (H/V)	Peak Reading  (dB $\mu$ V/m)	Peak Specification  (dB $\mu$ V/m)	Margin  (dB)
2475.00	2483.50	H	65.0	74.0	-9.0
2475.00	2483.50	V	62.7	74.0	-11.3
2475.00	4950.00	H	61.0	74.0	-13.0
2475.00	4950.00	V	55.9	74.0	-18.1
2475.00	7425.00	H	60.8	74.0	-13.2
2475.00	7425.00	V	57.3	74.0	-16.7

**Figure 31. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.  
Detector: Peak**

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Reading” includes correction factor.

\* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

## Radiated Emission

E.U.T Description    Wireless Magnetic Contact Sensor  
Type                      MCT-320 SMA  
Serial Number:        Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical      Frequency range: 1.0 GHz to 25.0 GHz  
Test Distance: 3 meters                              Detector: Average  
Operation Frequency: 2405.00 MHz

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Average Reading (dBμV/m)	Average Specification (dB μV/m)	Margin (dB)
2405.00	2390.00	H	46.2	54.0	-7.8
2405.00	2390.00	V	46.3	54.0	-7.7
2405.00	4810.00	H	52.7	54.0	-1.3
2405.00	4810.00	V	47.8	54.0	-6.2
2405.00	7215.00	H	43.7	54.0	-10.3
2405.00	7215.00	V	40.8	54.0	-13.2

**Figure 32. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.  
Detector: Average**

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Amp” includes correction factor.

\*        Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain



## Radiated Emission

E.U.T Description    Wireless Magnetic Contact Sensor  
Type                      MCT-320 SMA  
Serial Number:        Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical      Frequency range: 1.0 GHz to 25.0 GHz  
Test Distance: 3 meters                              Detector: Average  
Operation Frequency: 2445.00 MHz

Operation Frequency	Freq.	Polarity	Average Reading	Average Specification	Margin
(MHz)	(MHz)	(H/V)	(dBμV/m)	(dB μV/m)	(dB)
2445.00	4890.00	H	51.7	54.0	-2.3
2445.00	4890.00	V	46.4	54.0	-7.6
2445.00	7335.00	H	43.7	54.0	-10.3
2445.00	7335.00	V	40.7	54.0	-13.3

**Figure 33. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.  
Detector: Average**

### Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Amp” includes correction factor.

\*            Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

## Radiated Emission

E.U.T Description    Wireless Magnetic Contact Sensor  
Type                    MCT-320 SMA  
Serial Number:        Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical      Frequency range: 1.0 GHz to 25.0 GHz  
Test Distance: 3 meters                            Detector: Average  
Operation Frequency: 2475.00 MHz

Operation Frequency  (MHz)	Freq.  (MHz)	Polarity  (H/V)	Average Reading  (dBμV/m)	Average Specification  (dB μV/m)	Margin  (dB)
2475.00	2483.50	H	49.3	54.0	-4.7
2475.00	2483.50	V	48.8	54.0	-5.2
2475.00	4950.00	H	50.6	54.0	-3.4
2475.00	4950.00	V	44.6	54.0	-9.4
2475.00	7425.00	H	45.4	54.0	-8.6
2475.00	7425.00	V	44.8	54.0	-9.2

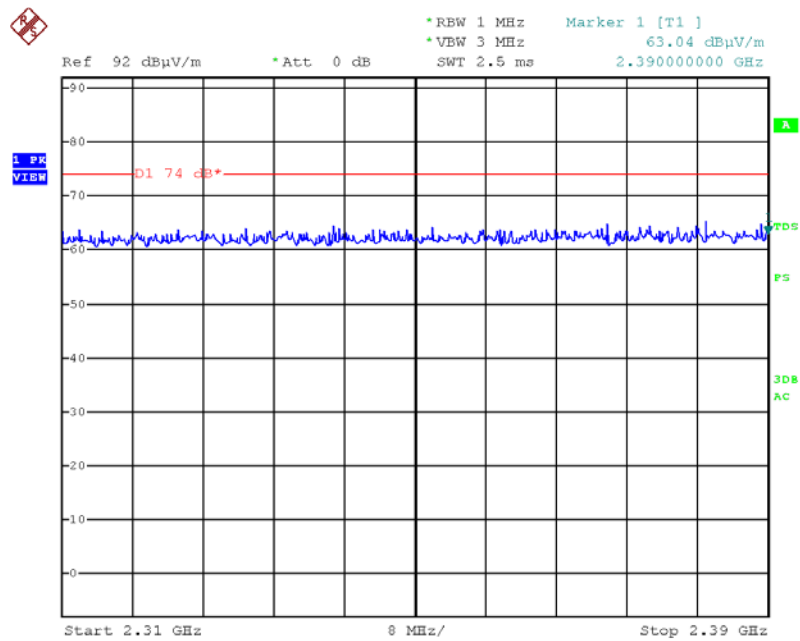
**Figure 34. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.  
Detector: Average**

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

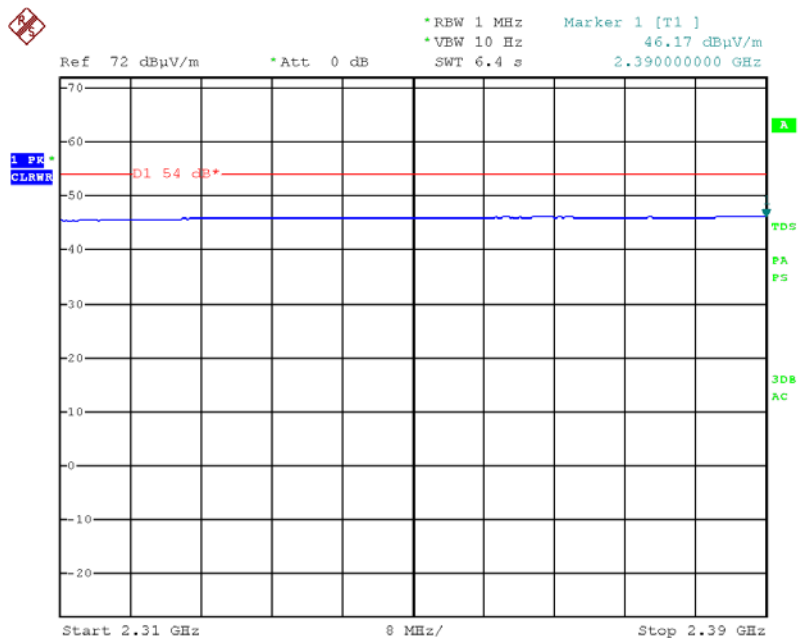
“Average Amp” includes correction factor.

\*        Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain



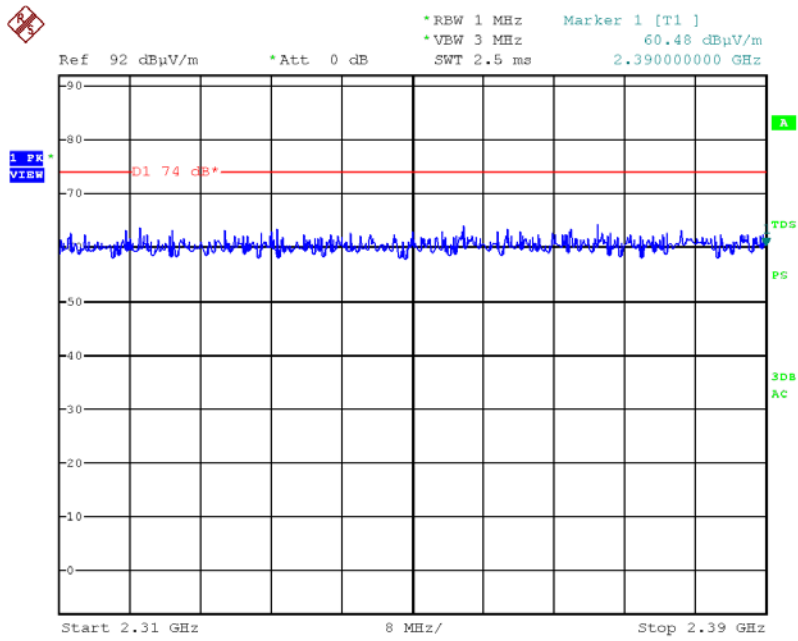
Date: 18.SEP.2011 10:35:20

**Figure 35. 2405 MHz ( Restricted Band Limit) Horizontal Peak**



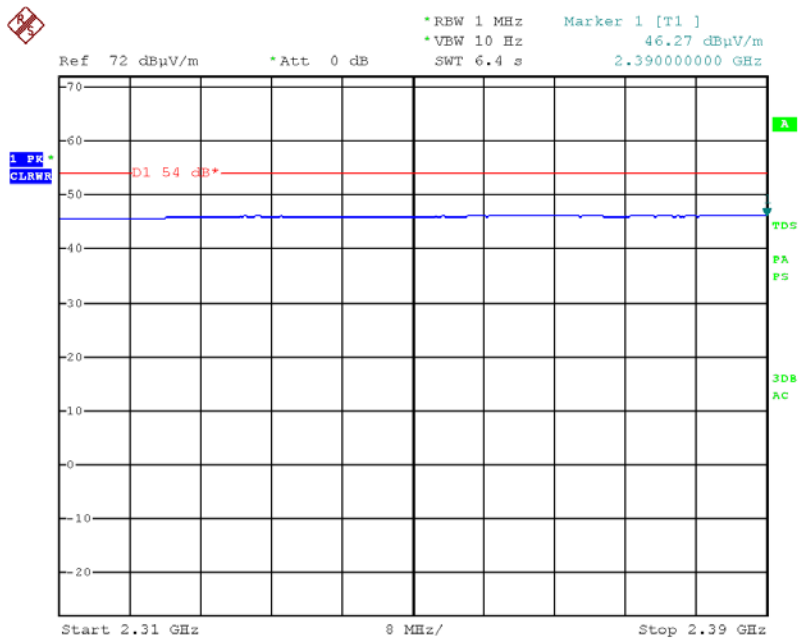
Date: 18.SEP.2011 10:36:18

**Figure 36. 2405 MHz ( Restricted Band Limit) Horizontal Average**



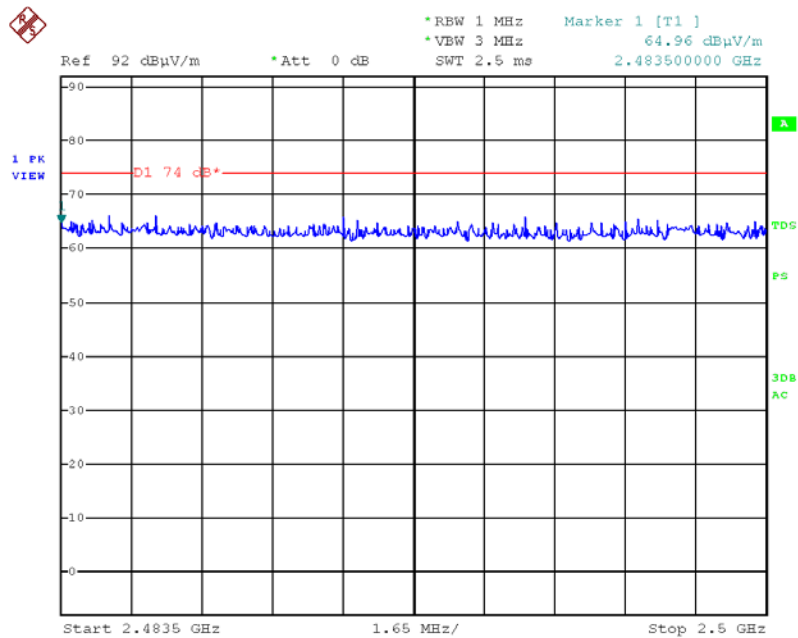
Date: 18.SEP.2011 10:25:22

**Figure 37. 2405 MHz ( Restricted Band Limit) Vertical Peak**



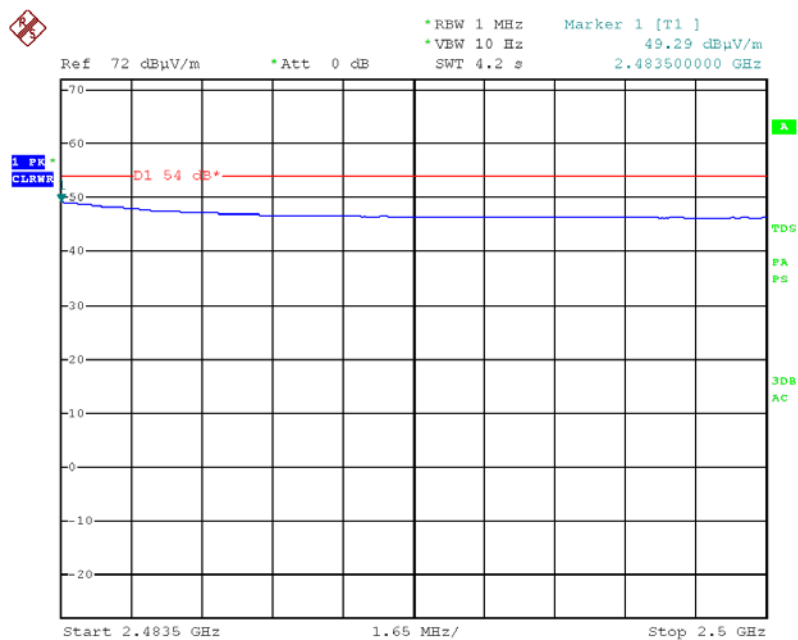
Date: 18.SEP.2011 10:28:40

**Figure 38. 2405 MHz ( Restricted Band Limit) Vertical Average**



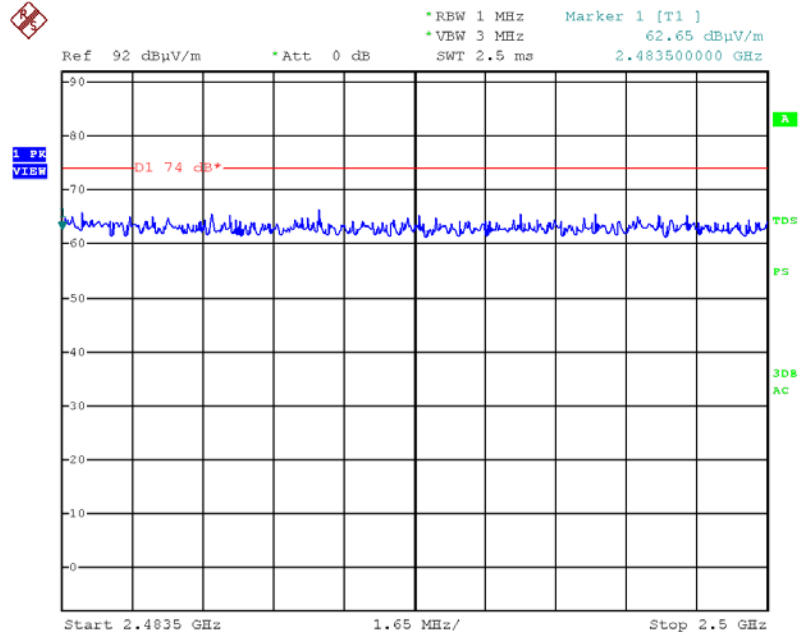
Date: 18.SEP.2011 14:41:24

**Figure 39. 2475 MHz ( Restricted Band Limit) Horizontal Peak**



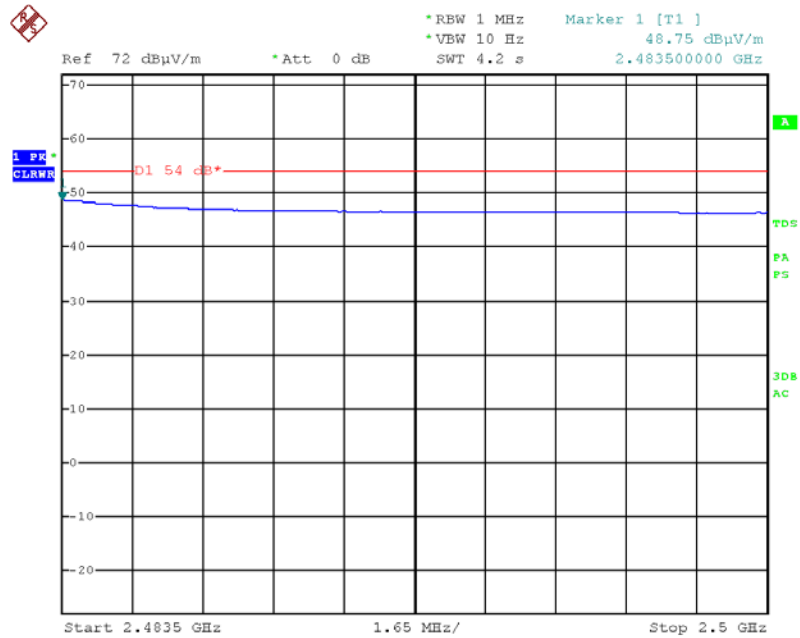
Date: 18.SEP.2011 14:42:23

**Figure 40. 2475 MHz ( Restricted Band Limit) Horizontal Average**



Date: 18.SEP.2011 14:48:56

**Figure 41. 2475 MHz ( Restricted Band Limit) Vertical Peak**



Date: 18.SEP.2011 14:49:55

**Figure 42. 2475 MHz ( Restricted Band Limit) Vertical Average**

#### 9.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	November 24, 2010	1 Year
RF Filter Section	HP	85420E	3705A00248	November 24, 2010	1 Year
Antenna Biconical	ARA	BCD 235/B	1041	August 1, 2010*	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 23, 2011	1 Year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2011	2 Years
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 14, 2010	2 Years
Horn Antenna	ARA	SWH-28	1008	January 26, 2011	2 Years
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	November 5, 2010	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	January 4, 2011	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 21, 2011	1 Year
Spectrum Analyzer	HP	8546E	3442A00275	January 11, 2011	1 Year
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	July 22 , 2010	2 years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

\* Testing was performed using this antenna during July 2010.

### 9.5 **Field Strength Calculation**

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$[\text{dB}\mu\text{V}/\text{m}] \text{ FS} = \text{RA} + \text{AF} + \text{CF}$$

FS: Field Strength [dB $\mu$ V/m]  
RA: Receiver Amplitude [dB $\mu$ V]  
AF: Receiving Antenna Correction Factor [dB/m]  
CF: Cable Attenuation Factor [dB]

Example: FS = 30.7 dB $\mu$ V (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dB $\mu$ V

No external pre-amplifiers are used.



## 10. Radiated Power Spectral Density

[In accordance with section 15.247(d)]

### 10.1 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.

The transmitter unit operated with normal modulation. The EMI receiver was set to 1 MHz resolution BW. The EUT was set up as shown in Figure 3, and its proper operation was checked.

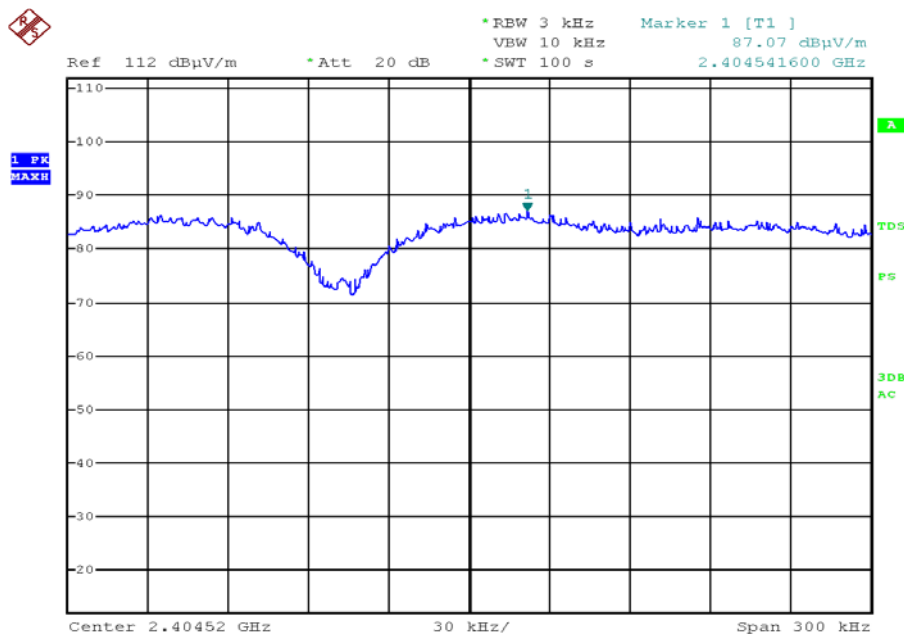
The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

The E.U.T. was tested in three frequencies 2.405 GHz, 2.445 GHz, 2.475 GHz.

Then the EMI receiver was set to 3 kHz resolution BW, span of 300.0 kHz, and sweep time of 100 seconds. The spectrum peaks were located at each of the 3 operating frequencies.

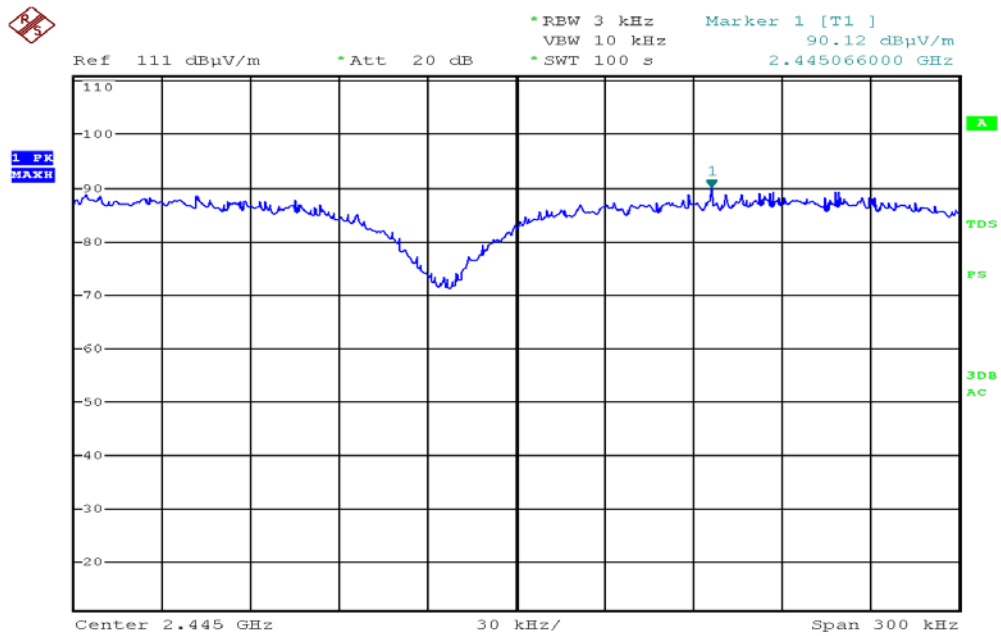
Radiated peak output power levels were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} [W]$$



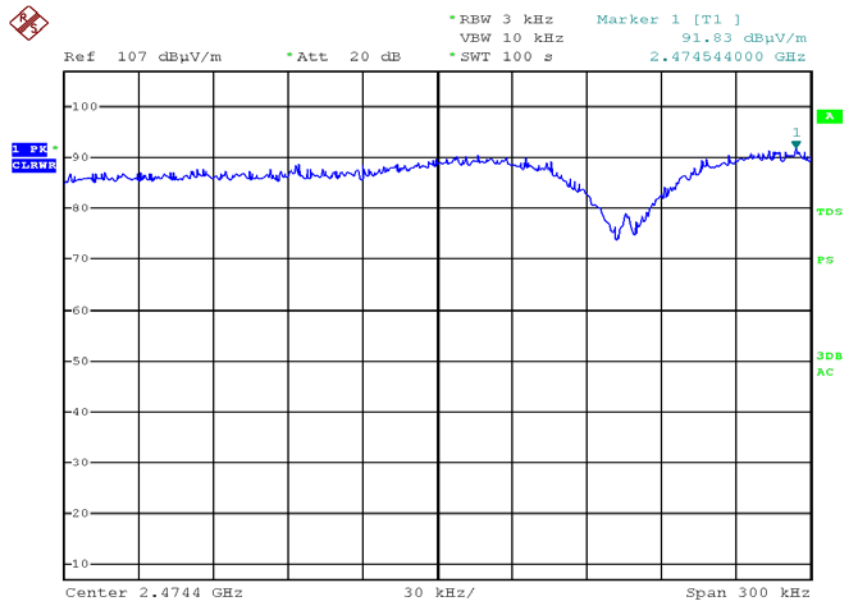
Date: 18.JUL.2011 09:43:29

Figure 43 — 2405MHz



Date: 18.JUL.2011 10:18:00

Figure 44 — 2445MHz



Date: 25.AUG.2011 11:04:30

Figure 45 — 2475 MHz

## 10.2 Results table

E.U.T. Description: Wireless Magnetic Contact Sensor

Model No.: MCT-320 SMA

Serial Number: Not Designated

Specification: F.C.C. Part 15, Subpart C (15.247(d))

Operation Frequency  (MHz)	Spectral Density Result*  (dBm)	Specification  (dBm)	Margin  (dB)
2410	-7.1	8.0	-15.1
2445	-4.1	8.0	-12.1
2475	-2.4	8.0	-10.4

**Figure 46 Test Results**

\* Spectral Density results were calculated as follows:

For 2405 MHz

$$P = \frac{(0.022 \times 3)^2}{(30 \times 0.79)} = 0.19mW$$

For 2445 MHz

$$P = \frac{(0.032 \times 3)^2}{(30 \times 0.79)} = 0.39mW$$

For 2475 MHz

$$P = \frac{(0.04 \times 3)^2}{(30 \times 0.79)} = 0.57mW$$

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 06.09.11

Typed/Printed Name: A. Moses

### 10.3 Test Equipment Used.

Transmitted Power Density

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	July 22 , 2010	2 years
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2011	2 years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

**Figure 47 Test Equipment Used**

## 11. Antenna Gain/Information

The antenna gain is -1.0 dBi.

## 12. R.F Exposure/Safety

Typical use of the E.U.T. is . The typical placement of the E.U.T. is wall or ceiling mounted. The typical distance between the E.U.T. and the user in the worst case application, is .

### Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1307(b)(1) Requirements

(a) FCC limits at 2400-2483.5MHz is:  $1 \frac{mW}{cm^2}$

Using table 1 of Section 1.1310 limit for general population/uncontrolled exposures, the above level is an average over 30 minutes.

(b) The power density produced by the E.U.T. is

$$S = \frac{P_t G_t}{4\pi R^2}$$

P<sub>t</sub>- Transmitted Power = 15.2 mw (Peak)

G<sub>T</sub>- Antenna Gain = 0.79 (numeric)

R- Distance from Transmitter using 0.25 m worst case

(c) The peak power density is :

$$S_p = \frac{15.2 \times 0.79}{4\pi(25)^2} = 1.53 \times 10^{-3} \frac{mW}{cm^2}$$

(d) This is orders of magnitude below the FCC limit.



## 13. APPENDIX B - CORRECTION FACTORS

### 13.1 Correction factors for CABLE

from EMI receiver  
to test antenna  
at 3 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)	FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3	1200.0	7.3
20.0	0.6	1400.0	7.8
30.0	0.8	1600.0	8.4
40.0	0.9	1800.0	9.1
50.0	1.1	2000.0	9.9
60.0	1.2	2300.0	11.2
70.0	1.3	2600.0	12.2
80.0	1.4	2900.0	13.0
90.0	1.6		
100.0	1.7		
150.0	2.0		
200.0	2.3		
250.0	2.7		
300.0	3.1		
350.0	3.4		
400.0	3.7		
450.0	4.0		
500.0	4.3		
600.0	4.7		
700.0	5.3		
800.0	5.9		
900.0	6.3		
1000.0	6.7		

#### NOTES:

1. The cable type is RG-214.
2. The overall length of the cable is 27 meters.
3. The above data is located in file 27MO3MO.CBL on the disk marked "Radiated Emission Tests EMI Receiver".

### 13.2 Correction factors for CABLE

from EMI receiver  
to test antenna  
at 3 meter range.

FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.2
2.0	1.6
3.0	2.0
4.0	2.4
5.0	3.0
6.0	3.4
7.0	3.8
8.0	4.2
9.0	4.6
10.0	5.0
12.0	5.8

**NOTES:**

1. The cable type is RG-8.
2. The overall length of the cable is 10 meters.

## 12.6 Correction factors for LOG PERIODIC ANTENNA

### Type LPD 2010/A at 3 and 10 meter ranges.

#### Distance of 3 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.1
250.0	10.2
300.0	12.5
400.0	15.4
500.0	16.1
600.0	19.2
700.0	19.4
800.0	19.9
900.0	21.2
1000.0	23.5

#### Distance of 10 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.0
250.0	10.1
300.0	11.8
400.0	15.3
500.0	15.6
600.0	18.7
700.0	19.1
800.0	20.2
900.0	21.1
1000.0	23.2

#### NOTES:

1. Antenna serial number is 1038.
2. The above lists are located in file number 38M30.ANT for a 3 meter range,  
and file number 38M100.ANT for a 10 meter range.
3. The files mentioned above are located on the disk marked "Radiated Emission  
Test EMI Receiver".

**13.3 Correction factors for LOG PERIODIC ANTENNA**  
**Type SAS-200/511**  
**at 3 meter range.**

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
1.0	24.9
1.5	27.8
2.0	29.9
2.5	31.2
3.0	32.8
3.5	33.6
4.0	34.3
4.5	35.2
5.0	36.2
5.5	36.7
6.0	37.2
6.5	38.1

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
7.0	38.6
7.5	39.2
8.0	39.9
8.5	40.4
9.0	40.8
9.5	41.1
10.0	41.7
10.5	42.4
11.0	42.5
11.5	43.1
12.0	43.4
12.5	44.4
13.0	44.6

**NOTES:**

1. Antenna serial number is 253.
2. The above lists are located in file number SAS3M0.ANT for a 3 meter range.
3. The files mentioned above are located on the disk marked "Antenna Factors".

### 13.4 Correction factors for **BICONICAL ANTENNA**

**Type BCD-235/B,  
at 3 meter range**

<b>FREQUENCY</b> (MHz)	<b>AFE</b> (dB/m)
20.0	19.4
30.0	14.8
40.0	11.9
50.0	10.2
60.0	9.1
70.0	8.5
80.0	8.9
90.0	9.6
100.0	10.3
110.0	11.0
120.0	11.5
130.0	11.7
140.0	12.1
150.0	12.6
160.0	12.8
170.0	13.0
180.0	13.5
190.0	14.0
200.0	14.8
210.0	15.3
220.0	15.8
230.0	16.2
240.0	16.6
250.0	17.6
260.0	18.2
270.0	18.4
280.0	18.7
290.0	19.2
300.0	19.9
310	20.7
320	21.9
330	23.4
340	25.1
350	27.0

**NOTES:**

1. Antenna serial number is 1041.
2. The above list is located in file 19BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".

### 13.5 Correction factors for Double-Ridged Waveguide Horn

**Model: 3115, S/N 29845  
at 3 meter range.**

FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)	FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)
1.0	24.8	5.4	10.0	38.8	11.4
1.5	26.1	7.6	10.5	38.9	11.8
2.0	28.6	7.7	11.0	39.0	12.1
2.5	29.8	8.4	11.5	39.6	11.8
3.0	31.4	8.4	12.0	39.8	12.0
3.5	32.4	8.7	12.5	39.6	12.5
4.0	33.7	8.6	13.0	40.0	12.5
4.5	33.4	9.9	13.5	39.8	13.0
5.0	34.5	9.7	14.0	40.2	13.0
5.5	35.1	9.9	14.5	40.6	12.9
6.0	35.4	10.4	15.0	41.3	12.4
6.5	35.6	10.8	15.5	39.5	14.6
7.0	36.2	10.9	16.0	38.8	15.5
7.5	37.3	10.4	16.5	40.0	14.6
8.0	37.7	10.6	17.0	41.4	13.4
8.5	38.3	10.5	17.5	44.8	10.3
9.0	38.5	10.8	18.0	47.2	8.1
9.5	38.7	11.1			

### 13.6 Correction factors for

**Horn Antenna**  
**Model: SWH-28**  
**at 1 meter range.**

<b>FREQUENCY</b> (GHz)	<b>APE</b> (dB /m)	<b>Gain</b> (dB1)
18.0	40.3	16.1
19.0	40.3	16.3
20.0	40.3	16.1
21.0	40.3	16.3
22.0	40.4	16.8
23.0	40.5	16.4
24.0	40.5	16.6
25.0	40.5	16.7
26.0	40.6	16.4

### 13.7 Correction factors for **ACTIVE LOOP ANTENNA**

**Model 6502**

**S/N 9506-2950**

<b>FREQUENCY</b>	<b>Magnetic Antenna Factor</b>	<b>Electric Antenna Factor</b>
(MHz)	(dB)	(dB)
.009	-35.1	16.4
.010	-35.7	15.8
.020	-38.5	13.0
.050	-39.6	11.9
.075	-39.8	11.8
.100	-40.0	11.6
.150	-40.0	11.5
.250	-40.0	11.6
.500	-40.0	11.5
.750	-40.1	11.5
1.000	-39.9	11.7
2.000	-39.5	12.0
3.000	-39.4	12.1
4.000	-39.7	11.9
5.000	-39.7	11.8
10.000	40.2	11.3
15.000	-40.7	10.8
20.000	-40.5	11.0
25.000	-41.3	10.2
30.000	42.3	9.2