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DATE: 05 February 2015

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

FCC Radio Test Report

For

Hachiko Technologies

Equipment under test:

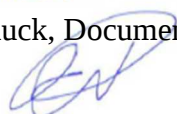
Dog Collar Sensor

HC2

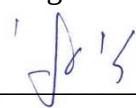
Written by:


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Approved by:


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Approved by:


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This report relates only to items tested.



Measurement/Technical Report for Hachiko Technologies Dog Collar Sensor

HC2

FCC ID: 2ACPXDIAMOND

This report concerns:

Original Grant:

Class I Change:

Class II Change: X

Equipment type:

Digital Transmission System

Limits used:

47CFR15 Section 15.247

Measurement procedure used is KDB 558074 D01 v03r02 and ANSI C63.4-2003.

Application for Certification
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1. General Information

1.1 Administrative Information

Manufacturer:	Hachiko Technologies
Manufacturer's Address:	Sutine 9 Tel Aviv, Israel
Manufacturer's Representative:	Zohar Fox
Equipment Under Test (E.U.T):	Dog Collar Sensor
Equipment Model No.:	HC2
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	02.11.14
Start of Test:	02.11.14
End of Test:	03.11.14
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
Test Specifications:	FCC Part 15, Sub-Part 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.), FCC Designation Number US1004.
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 4025A-1.

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

Sensor for pets, BT4 based - sense for dog location by connecting to Smartphone and acquires dog coordinates.
Once Smartphone is connected to EUT, it sends dog coordinates to a server.

1.4 Test Methodology

Both conducted and radiated testing was performed according to the procedures in KDB 558074 D01 v03r02 and ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

Radiated emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01 and its FCC Designation Number is US1004.

1.6 Measurement Uncertainty

Conducted Emission

Conducted Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) 0.15 – 30 MHz:

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

± 3.6 dB

Note: See ITL Procedure No. PM 198.

Radiated Emission

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

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

± 5.2 dB

Note: See ITL Procedure No. PM 198.

2. System Test Configuration

2.1 Justification

The original product, HC1 was originally authorized for FCC certification on 08/13/2014 under FCC ID: 2ACPXDIAMOND.

The HC2 will replace the HC1 in the market.

The Class II Permissive Changes to the original product are as follows:

1. PCB reduction (removed Gyro and Magnetometer- non-transmitter portions depopulated).
2. Minor enclosure changes to accommodate reduced board.

With regard to the changes a C2PC evaluation was performed.

Radiated emission testing was performed in 3 orthogonal orientations. The worst case scenario was the vertical position.

2.2 EUT Exercise Software

HC-SW

2.3 Special Accessories

No special accessories were needed in order to achieve compliance.

2.4 Equipment Modifications

No modifications were needed in order to achieve compliance

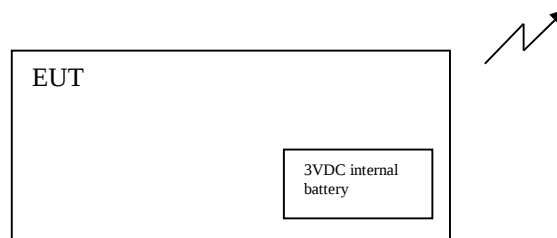
2.5 Configuration of Tested System

Figure 1. Configuration of Tested System

3. Radiated Measurement Test Set-up Photo



Figure 2. Radiated Emission Test



Figure 3. Radiated Emission Test

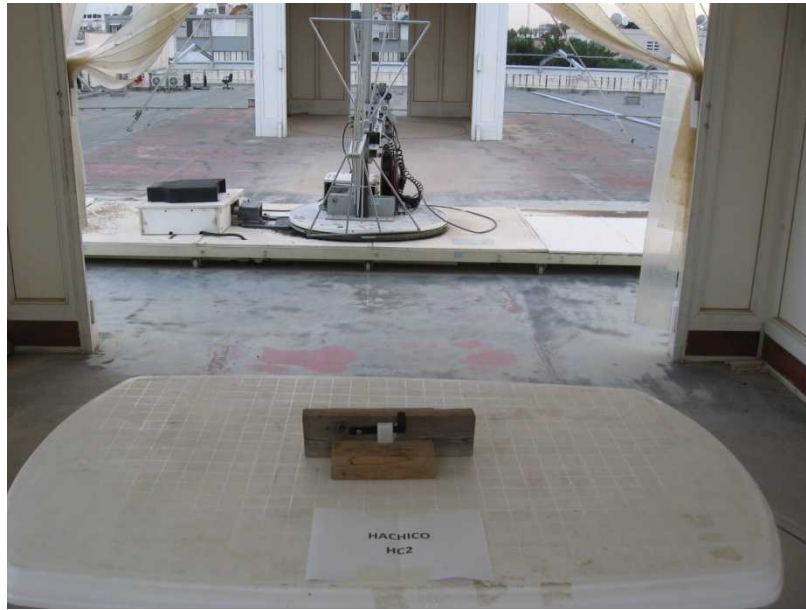


Figure 4. Radiated Emission Test

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 in Mid Channel for representative frequency.

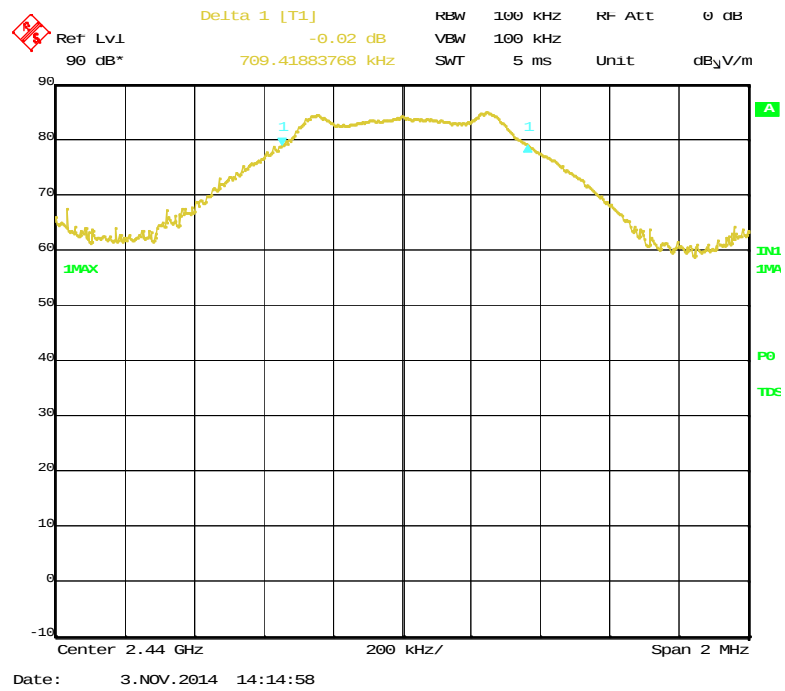


Figure 5. Mid Channel - 2442 MHz



4.3 Test Results

E.U.T Description: Dog Collar Sensor

Model: HC2

Serial Number: Not designated

Operation Frequency (MHz)	Bandwidth Reading (MHz)	Specification (MHz)
2442	0.709	>0.5

Figure 6 6dB Minimum Bandwidth Test Results

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 25.11.14

Typed/Printed Name: M. Zohar

4.4 Test Equipment Used. 6dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESIB7	100120	December 19, 2013	1 Year
Biconical Log Antenna	EMCO	3142B	1078	May 22, 2014	2 Years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	3 Years
Double Ridged Waveguide Horn Antenna	ETS	3115	29845	March 14, 2012	3 Years
Active Loop Antenna	EMCO	6502	2950	November 4, 2013	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 Year
Spectrum Analyzer	HP	8546E	3442A00275	March 2, 2014	1 Year
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 22, 2014	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 Year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 7 Test Equipment Used

5. 26dB Minimum 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 in mid channel as representative frequency.

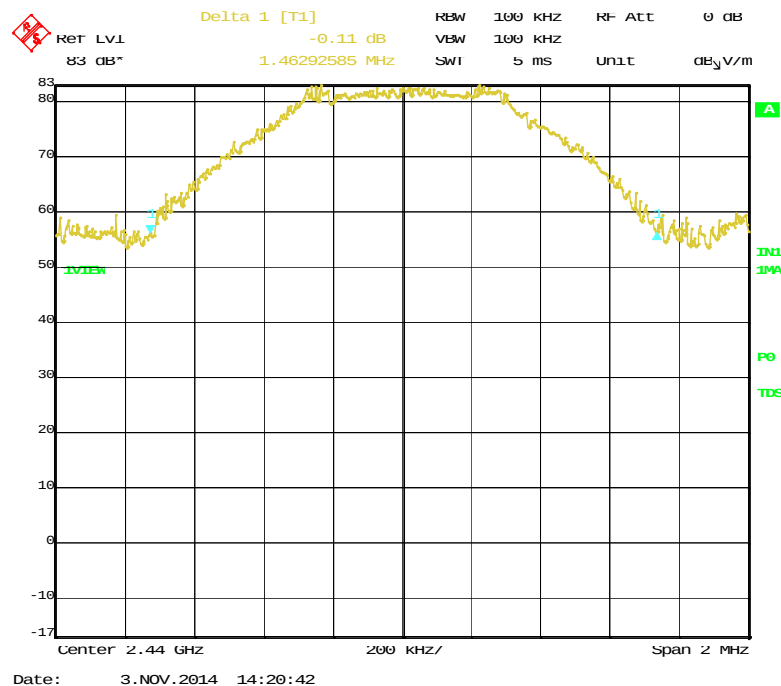


Figure 8. Mid Channel - 2442 MHz



5.3 Test Results

E.U.T Description: Dog Collar Sensor

Model: HC2

Serial Number: Not designated

Operation Frequency (MHz)	Bandwidth Reading (MHz)
Mid	1.4

Figure 9 26 dB Minimum Bandwidth Test Results

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 25.11.14

Typed/Printed Name: M. Zohar

5.4 Test Equipment Used, 26 dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESIB7	100120	December 19, 2013	1 Year
Biconical Log Antenna	EMCO	3142B	1078	May 22, 2014	2 Years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	3 Years
Double Ridged Waveguide Horn Antenna	ETS	3115	29845	March 14, 2012	3 Years
Active Loop Antenna	EMCO	6502	2950	November 4, 2013	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 Year
Spectrum Analyzer	HP	8546E	3442A00275	March 2, 2014	1 Year
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 22, 2014	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 Year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 10 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 operating channels and frequencies 2.402 GHz, 2.440 GHz and 2.480 GHz.

The EUT tested in vertical polarization antenna for worst case.

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:

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

E- Field Strength (v/m)

d- Distance from transmitter (m)

G- Antenna gain

P- Peak power (W)

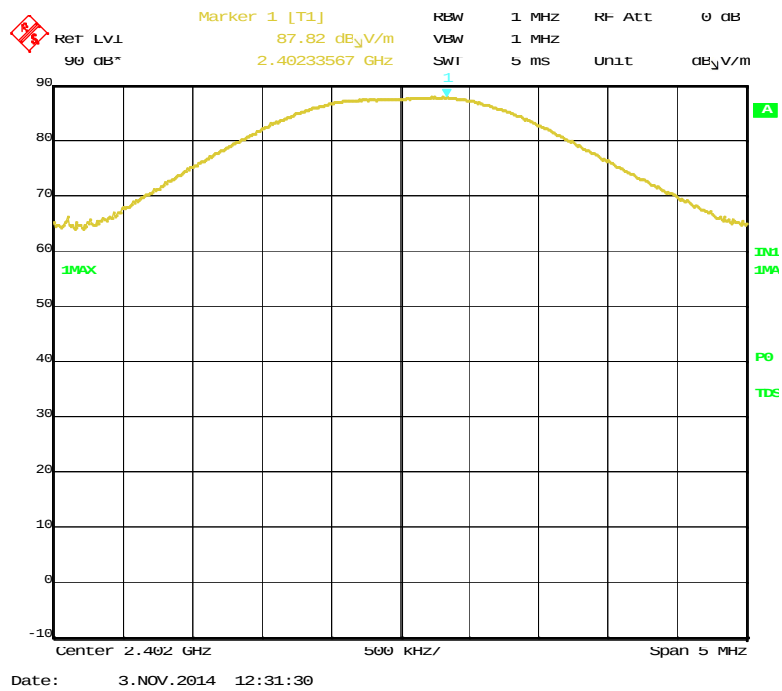


Figure 11 Low Channel – 2402.0 MHz – Vertical

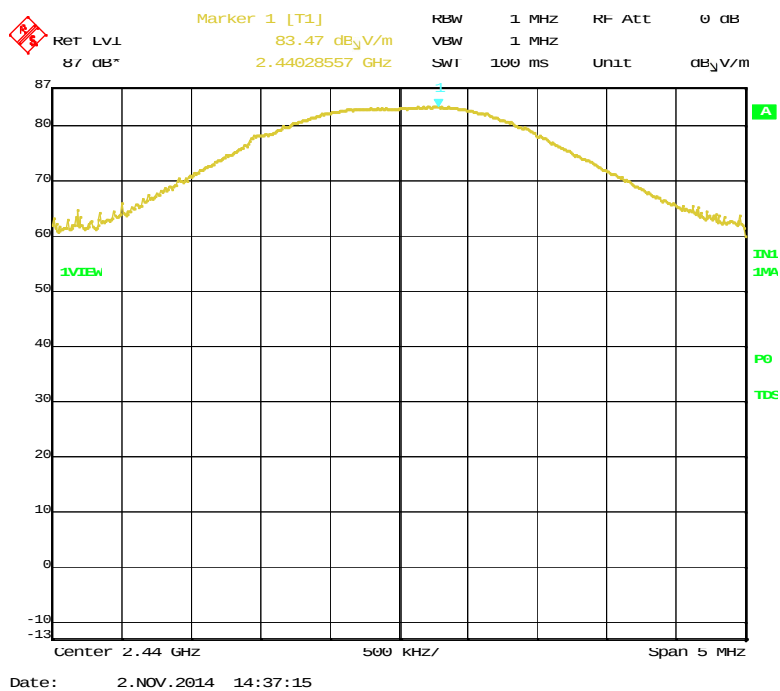


Figure 12 Mid Channel – 2440.0 MHz – Vertical

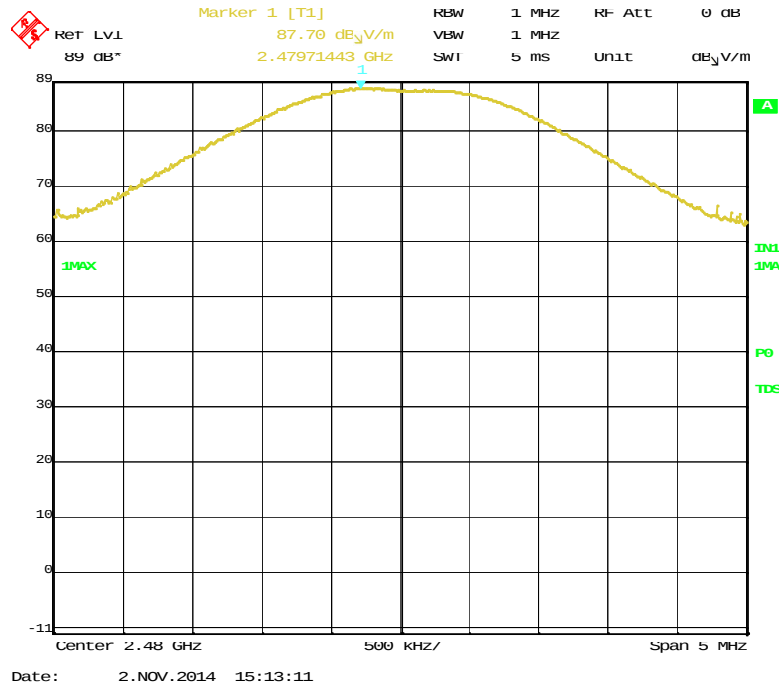


Figure 13 High Channel – 2480.0 MHz – Vertical

6.3 Results Calculation

E.U.T. Description: Dog Collar Sensor
Model No.: HC2
Serial Number: Not designated
Specification: F.C.C. Part 15, Subpart C

Operating Frequency (MHZ)	Field Strength (dBuV/m)	Polarization	Output Power (dBm)	Output Power (mW)	Limit (mW)	Margin (mW)
Low	87.8	V	-7.4	0.2	1000	-999.80
Mid	83.4	V	-11.8	0.06	1000	-999.94
High	87.7	V	-7.5	0.2	1000	-999.80

Figure 14 Radiated Power Output

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 25.11.14

Typed/Printed Name: M. Zohar

6.4 Test Equipment Used, Radiated Maximum Power Output

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESIB7	100120	December 19, 2013	1 Year
Biconical Log Antenna	EMCO	3142B	1078	May 22, 2014	2 Years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	3 Years
Double Ridged Waveguide Horn Antenna	ETS	3115	29845	March 14, 2012	3 Years
Active Loop Antenna	EMCO	6502	2950	November 4, 2013	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 Year
Spectrum Analyzer	HP	8546E	3442A00275	March 2, 2014	1 Year
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 22, 2014	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 Year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 15 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 100 KHz 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 2402 MHz, and 2480MHz correspondingly.

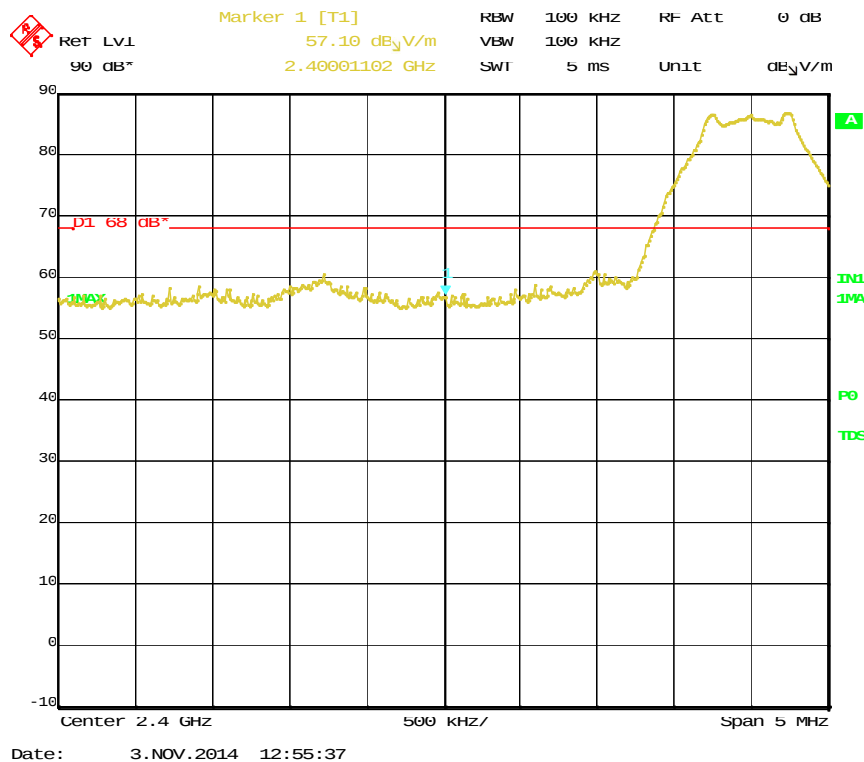


Figure 16 Lower Band Edge

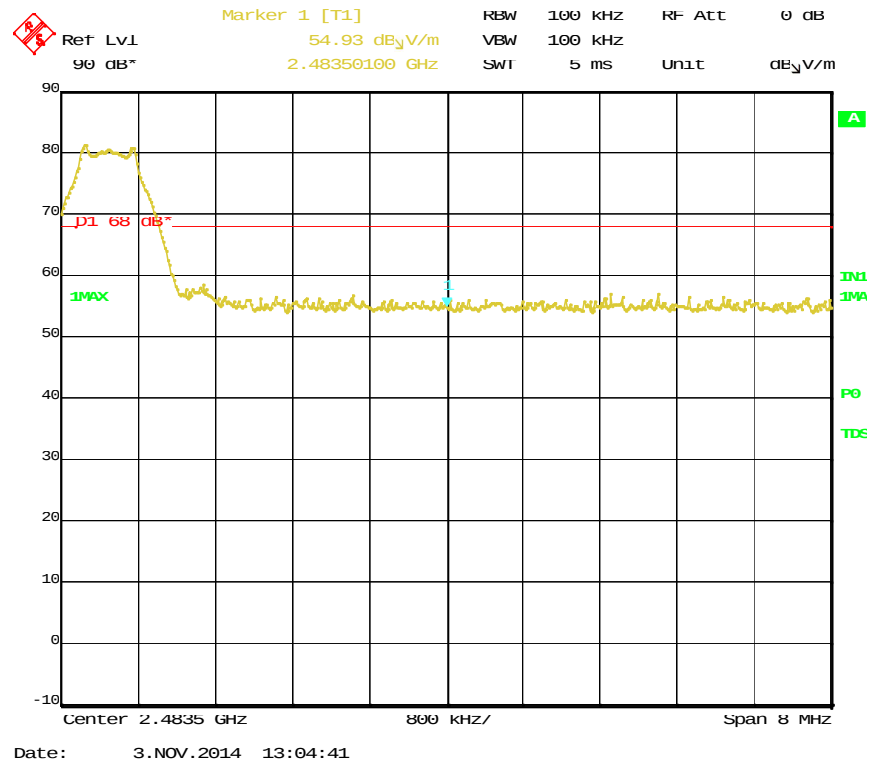


Figure 17 Upper Band Edge

7.2 Results table

E.U.T. Description: Dog Collar Sensor

Model No.: HC2

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)
2402	2400.0	57.1	68.0	-10.9
2480	2483.5	54.9	68.0	-13.1

Figure 18 Band Edge

JUDGEMENT: Passed by 10.9 dB

TEST PERSONNEL:

Tester Signature: 

Date: 25.11.14

Typed/Printed Name: M. Zohar

7.3 Test Instrumentation Used, BAND EDGE

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESIB7	100120	December 19, 2013	1 Year
Biconical Log Antenna	EMCO	3142B	1078	May 22, 2014	2 Years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	3 Years
Double Ridged Waveguide Horn Antenna	ETS	3115	29845	March 14, 2012	3 Years
Active Loop Antenna	EMCO	6502	2950	November 4, 2013	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 Year
Spectrum Analyzer	HP	8546E	3442A00275	March 2, 2014	1 Year
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 22, 2014	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 Year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 19 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 with 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.

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 channels were the same.

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

TEST PERSONNEL:

Tester Signature: 

Date: 25.11.14

Typed/Printed Name: M. Zohar

8.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESIB7	100120	December 19, 2013	1 Year
Biconical Log Antenna	EMCO	3142B	1078	May 22, 2014	2 Years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	3 Years
Double Ridged Waveguide Horn Antenna	ETS	3115	29845	March 14, 2012	3 Years
Active Loop Antenna	EMCO	6502	2950	November 4, 2013	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 Year
Spectrum Analyzer	HP	8546E	3442A00275	March 2, 2014	1 Year
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 22, 2014	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 Year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 20 Test Equipment Used

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 μ V/m]

RA: Receiver Amplitude [dB μ V]

AF: Receiving Antenna Correction Factor [dB/m]

CF: Cable Attenuation Factor [dB]

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

No external pre-amplifiers are used.

9. Spurious Radiated Emission 30 – 1000 MHz

9.1 Test Specification

30 MHz-1000 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-1000 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.

The emissions were measured using a computerized EMI receiver complying with 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 30-1000 MHz, 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 channels and frequencies
2.402 GHz, 2.442 GHz; 2.480 GHz.



9.3 **Test Data**

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C specification.
The results for all three operation channels were the same.
The signals in the band 30 MHz – 1.0 GHz were below the spectrum analyzer noise level.

TEST PERSONNEL:

Tester Signature:  _____

Date: 25.11.14

Typed/Printed Name: M. Zohar

9.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESIB7	100120	December 19, 2013	1 Year
Biconical Log Antenna	EMCO	3142B	1078	May 22, 2014	2 Years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	3 Years
Double Ridged Waveguide Horn Antenna	ETS	3115	29845	March 14, 2012	3 Years
Active Loop Antenna	EMCO	6502	2950	November 4, 2013	1 Year
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Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 22, 2014	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 Year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 21 Test Equipment Used

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:

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

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

RA: Receiver Amplitude $[\text{dB}\mu\text{V}]$

AF: Receiving Antenna Correction Factor $[\text{dB/m}]$

CF: Cable Attenuation Factor $[\text{dB}]$

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

No external pre-amplifiers are used.

10. Spurious Radiated Emission Above 1 GHz

10.1 Radiated Emission Above 1 GHz

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, 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 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 1.0-6.0 GHz, a computerized EMI receiver complying with CISPR 16 requirements was used.

In the frequency range 6.0-25.0 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 channels and frequencies 2.402 GHz; 2.440 GHz and 2.480 GHz.



10.2 Test Data

JUDGEMENT: Passed by 0.5 dB

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

The details of the highest emissions are given in *Figure 22* to *Figure 23*.

TEST PERSONNEL:

Tester Signature:  _____

Date: 25.11.14

Typed/Printed Name: M. Zohar

Radiated Emission Above 1 GHz

E.U.T Description Dog Collar Sensor
Type HC2
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 (MHz)	Freq. (MHz)	Polarity (H/V)	Peak Amp (dB μ V/m)	Peak. Specification (dB μ V/m)	Peak. Margin (dB)
2402.0	2390.0	V	52.7	74.0	-21.3
	4804.0	H	60.3	74.0	-13.7
		V	61.4	74.0	-12.6
	7206.0	H	63.4	74.0	-10.6
		V	63.5	74.0	-10.5
2440.0	4880.0	H	60.9	74.0	-13.1
		V	59.7	74.0	-14.3
	7320.0	H	63.1	74.0	-10.9
		V	63.9	74.0	-10.1
2480.0	2483.5	V	55.2	74.0	-18.8
	4960.0	H	61.4	74.0	-12.6
		V	60.7	74.0	-13.3
	7440	H	62.9	74.0	-11.1
		V	63.8	74.0	-10.2

**Figure 22. 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 Amp” includes correction factor.

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

Radiated Emission Above 1 GHz

E.U.T Description Dog Collar Sensor
Type HC2
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Test Distance: 3 meters

Frequency range: 1.0 GHz to 25.0 GHz
Detector: Average

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Avg Amp (dB μ V/m)	Average Specification (dB μ V/m)	AVg. Margin (dB)
2402.0	2390.0	V	43.7	54.0	-11.0
	4804.0	H	50.4	54.0	-3.6
		V	50.8	54.0	-3.2
	7206.0	H	53.3	54.0	-0.7
		V	53.4	54.0	-0.6
2440.0	4880.0	H	49.6	54.0	-4.4
		V	49.2	54.0	-4.8
	7320.0	H	53.1	54.0	-0.9
		V	52.8	54.0	-1.2
2480.0	2483.5	V	46.1	54.0	-7.9
	4960.0	H	52.0	54.0	-2.0
		V	51.1	54.0	-2.9
	7440	H	53.5	54.0	-0.5
		V	53.4	54.0	-0.6

**Figure 23. 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

10.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESIB7	100120	December 19, 2013	1 Year
Biconical Log Antenna	EMCO	3142B	1078	May 22, 2014	2 Years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	3 Years
Double Ridged Waveguide Horn Antenna	ETS	3115	29845	March 14, 2012	3 Years
Active Loop Antenna	EMCO	6502	2950	November 4, 2013	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 Year
Spectrum Analyzer	HP	8546E	3442A00275	March 2, 2014	1 Year
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 22, 2014	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 Year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 24 Test Equipment Used

11. Radiated Power Spectral Density

[In accordance with section 15.247(d)]

11.1 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 operating channels and frequencies (1 (2.402 GHz); 8 (2.442 GHz); 14 (2.480 GHz)).

Then the EMI receiver was set to 3 kHz resolution BW, span of 5 MHz. 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:

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

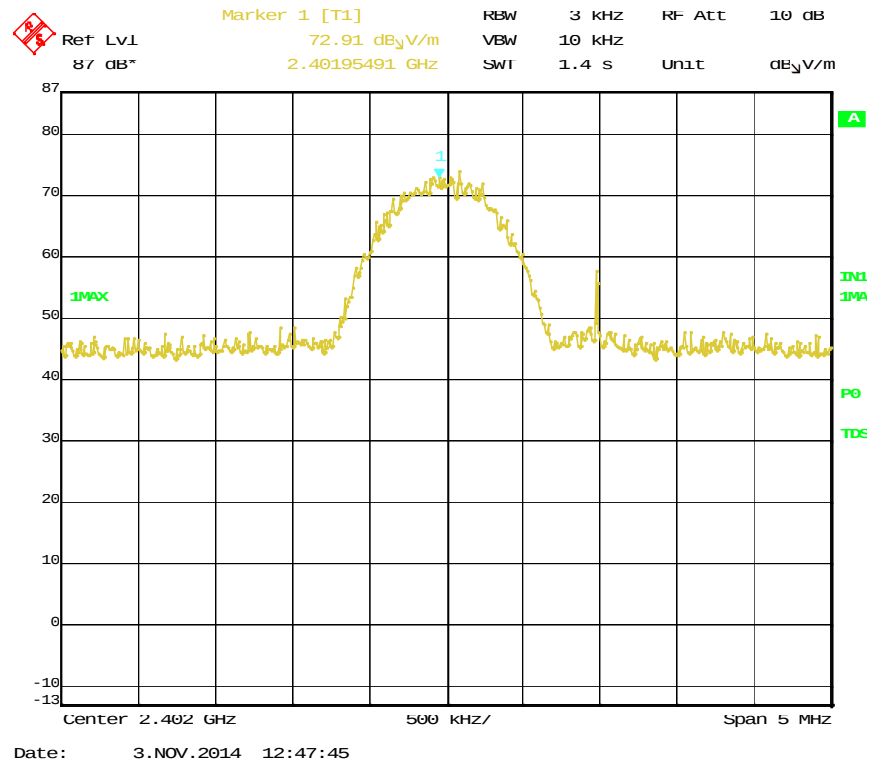


Figure 25 — 2402 MHz

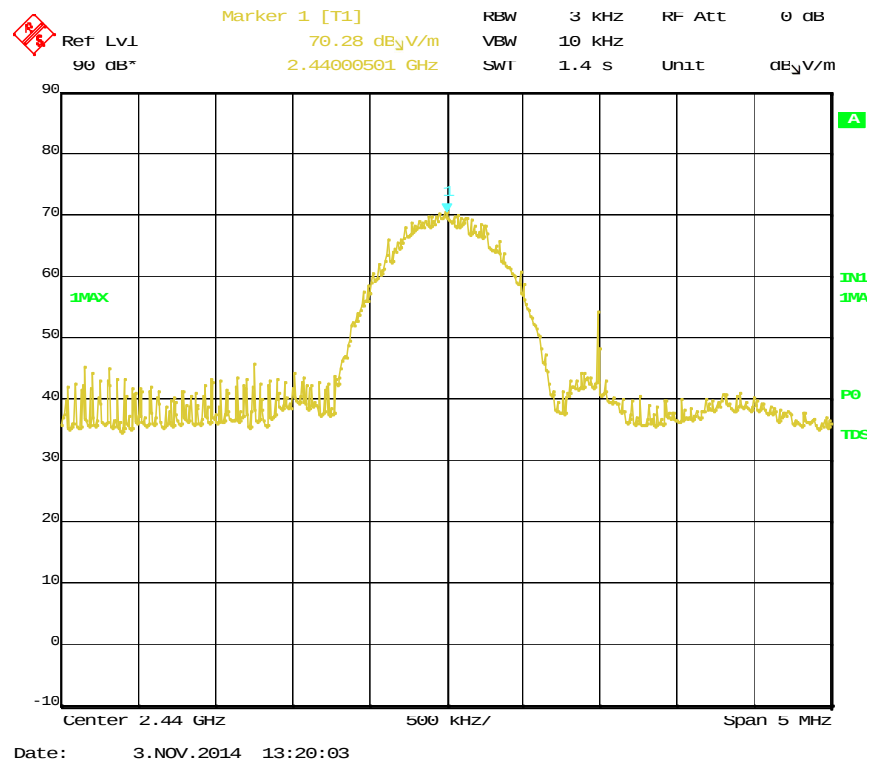


Figure 26 — 2440 MHz

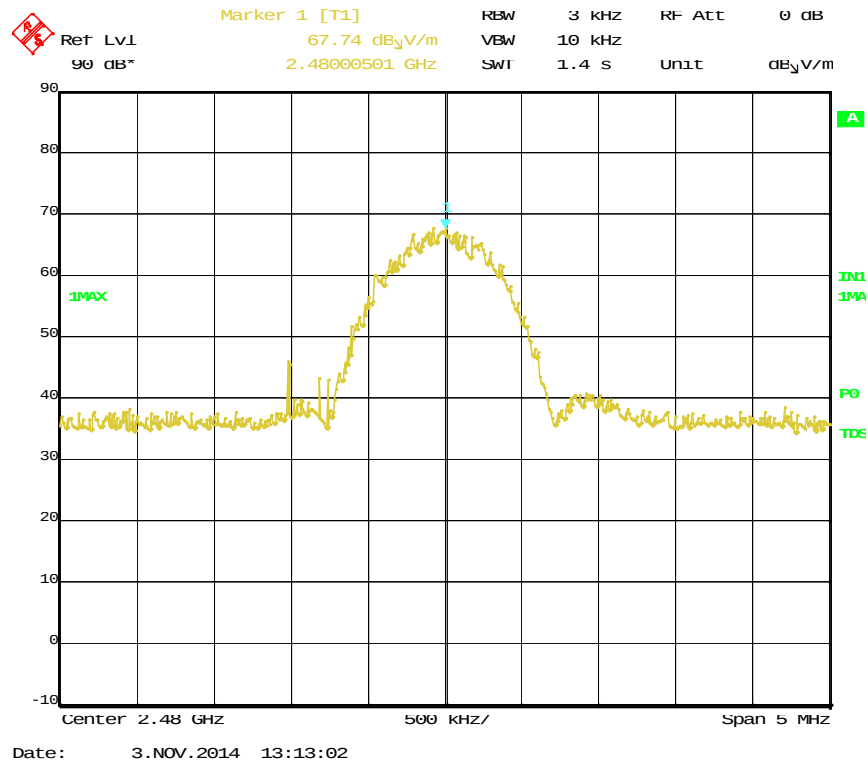


Figure 27 — 2480 MHz

11.2 Results table

E.U.T. Description: Dog Collar Sensor

Model No.: HC2

Serial Number: Not designated

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

Operation Frequency (MHz)	Spectral Density Result (dBuV/m))	Spectral Density Result (dBm)	Specification (dBm)	Margin (dB)
2402	72.9	-22.3	8.0	-30.3
2440	70.3	-24.9	8.0	-32.9
2480	67.7	-27.5	8.0	-35.5

Figure 28 Test Results

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 25.11.14

Typed/Printed Name: M. Zohar

11.3 Test Instrumentation Used, Power Spectral Density

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESIB7	100120	December 19, 2013	1 Year
Biconical Log Antenna	EMCO	3142B	1078	May 22, 2014	2 Years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	3 Years
Double Ridged Waveguide Horn Antenna	ETS	3115	29845	March 14, 2012	3 Years
Active Loop Antenna	EMCO	6502	2950	November 4, 2013	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 Year
Spectrum Analyzer	HP	8546E	3442A00275	March 2, 2014	1 Year
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 22, 2014	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 Year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 29 Test Equipment Used



12. Antenna Gain/Information

The antenna gain is -0.5 dBi.

13. R.F Exposure/Safety

Typical use of the E.U.T. is as a dog sensor. The typical placement of the E.U.T. is attached to a dog collar. The typical distance between the E.U.T. and the user in the worst case application, is 0.5 cm.

Calculation of Maximum Permissible Exposure (MPE)
Based on Section 1.1310 Requirements

(a) FCC limits at 2480 MHz 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

P_t - Transmitted Power 87.8 dBuV/m (Peak) = 0.181 mW

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

G_t - Antenna Gain, -0.5 dBi = 0.89 numeric

R- Distance from Transmitter using 0.5cm worst case

(c) The peak power density is :

$$S_p = \frac{0.181 \times 0.89}{4\pi (0.5)^2} = 0.0512 \frac{mW}{cm^2}$$

(d) This is below the FCC limit.

14. APPENDIX B - CORRECTION FACTORS

14.1 Correction factors for CABLE

from EMI receiver
to test antenna
at 3 meter range.

Frequency (MHz)	Cable Loss (dB)
0.010	0.4
0.015	0.2
0.020	0.2
0.030	0.3
0.050	0.3
0.075	0.3
0.100	0.2
0.150	0.2
0.200	0.3
0.500	0.4
1.00	0.4
1.50	0.5
2.00	0.5
5.00	0.6
10.00	0.8
15.00	0.9
20.00	0.8

Frequency (MHz)	Cable Loss (dB)
50.00	1.2
100.00	0.7
150.00	20.1
200.00	2.3
300.00	2.9
500.00	3.8
750.00	4.8
1000.00	5.4
1500.00	6.7
2000.00	9.0
2500.00	9.4
3000.00	9.9
3500.00	10.2
4000.00	11.2
4500.00	12.1
5000.00	13.1
5500.00	13.5
6000.00	14.5

NOTES:

1. The cable type is SPUMA400 RF-11N(X2) and 39m long
2. The cable is manufactured by Huber + Suhner

14.2 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.

14.3 Correction factors for CABLE

from spectrum analyzer
to test antenna above 2.9 GHz

FREQUENCY (GHz)	CORRECTION FACTOR (dB)	FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.9	14.0	9.1
2.0	2.7	15.0	9.5
3.0	3.5	16.0	9.9
4.0	4.2	17.0	10.2
5.0	4.9	18.0	10.4
6.0	5.5	19.0	10.7
7.0	6.0	20.0	10.9
8.0	6.5	21.0	11.2
9.0	7.0	22.0	11.6
10.0	7.5	23.0	11.9
11.0	7.9	24.0	12.3
12.0	8.3	25.0	12.6
13.0	8.7	26.0	13.0

NOTES:

1. The cable type is SUCOFLEX 104 E manufactured by SUHNER.
2. The cable is used for measurements above 2.9 GHz.
3. The overall length of the cable is 10 meters.

14.4 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".



14.5 Correction factors for Double-Ridged Waveguide Horn

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

FREQUENCY	ANTENNA	ANTENN	FREQUENCY	ANTENNA	ANTENNA
(GHz)	FACTOR	A Gain	(GHz)	FACTOR	Gain
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			



14.6 Correction factors for

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

FREQUENCY (GHz)	AFE (dB /m)	Gain (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



14.7 Correction factors for ACTIVE LOOP ANTENNA

Model 6502

S/N 9506-2950

FREQUENCY	Magnetic Antenna Factor	Electric Antenna Factor
(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