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TESTING Cert No.1152.01

DATE: 03 February 2014

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

FCC Radio Test Report

for

F. Robotics Acquisitions Ltd.

Equipment under test:

BLE Robot Board/RF Module

ESB6007D

Written by: _____
R. Pinchuck, Documentation

Approved by: _____
A. Sharabi, Test Engineer

Approved by: _____
I. Raz, EMC Laboratory Manager

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Measurement/Technical Report for
F. Robotics Acquisitions Ltd.

BLE Robot Board/RF Module

ESB6007D

FCC ID: 2ABHE-RB-1

03 February 2014

This report concerns:	Original Grant:	X
	Class I Change:	
	Class II Change:	
Equipment type:	Digital Transmission System	
Limits used:	47CFR15 Section 15.247	

Measurement procedure used is KDB 558074 D01 April 9, 2013 and ANSI C63.4-2003.

Application for Certification
prepared by:
R. Pinchuck
ITL (Product Testing) Ltd.
1 Bat Sheva Street
Lod 716002
Israel
e-mail RPinchuck@itl.co.il

Applicant for this device:
(different from "prepared by")
Eli Levi
F. Robotics Acquisitions Ltd.
PO Box 1412
Hatzabar St., Industrial Zone
Pardesia, 42815, Israel
Tel: +972-09-898-7933
Fax: +972-09-898-7934
e-mail: eli@robomow.co.il

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1. General Information

1.1 Administrative Information

Manufacturer:	F. Robotics Acquisitions Ltd.
Manufacturer's Address:	PO Box 1412 Hatzabar St., Industrial Zone Pardesia, 42815 Israel Tel: +972--09-898-7933 Fax: +972-09-898-7934
Manufacturer's Representative:	Eli Levi
Equipment Under Test (E.U.T):	BLE Robot Board/RF Module
Equipment Model No.:	ESB6007D
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T:	01.01.14
Start of Test:	05.01.14
End of Test:	08.01.14
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
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.), 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.

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

BLE Robot Board P/N: ESB6007D (AKA “RF Module” or “RBLE”) is a Bluetooth Low Energy transceiver - SCR chip based module intended to enable robotic lawn mower communicating with external devices.

1.4 Test Methodology

Both conducted and radiated testing was performed according to the procedures in KDB 558074 D01 April 9, 2013 and 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 November 21, 2012).
I.T.L.’s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

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

To select the worst case host to be tested for Limited Modular Approval certification, exploratory Fundamental Emission from channel 20 (2442MHz) was conducted inside a semi-anechoic chamber to determine the worst case unit at the distance of 1m. The results of the exploratory fundamental emission appear in the table below.

Unit	2442MHz level (dBuv/m)@1 meter
RS 612*	86.0
RC 306	88.0
Base Unit	92.7

Based on the above results, the Base Unit was selected as the worst case host for full testing.

*There are five host models using the RS platform. The differences between the host models appear in the manufacturer's Declaration on the following page. None of the differences affect the radio performance. Host model RS612 was used for exploratory testing.

Robomow®
Your robot. Our expertise.

Date: February 19, 2014

DECLARATION

I Hereby declare that
Model Robo Scooter 1800 is identical electronically, physically, and mechanically to Model RS612.
Model RS622 is identical physically and mechanically to Model RS612. Model RS622 differs from Model RS612 only by the DC motor. Model RS622 has a brushless motor and Model RS612 has a brush motor.
Models RS630 and Robo Scooter 3000 are identical electronically, physically, and mechanically to Model RS622 except for battery capacity. Models RS630 and Robo Scooter 3000 have a battery capacity of 6 Ah and model RS622 has a battery capacity of 4.5 Ah.
The differences between models RS622, RS630, and Robo Scooter 3000 and model RS612 are in the type of DC motor and capacity of the battery.

The differences in the above listed models do not affect the radio module in the devices.
Please relate to them all (from a Radio point of view) as the same product.

Thank you,
Signature: _____
Vadim Pilipenko
Product Manager
F. Robotics Acquisitions Ltd.

F Robotics Acquisitions Ltd.
Hatzabar St. Industrial Zone P.O.Box 1412 Pardesiya, 42815 Israel T: 972-9-8901901 F: 972-9-8987934
E: info@robomow.co.il • www.robomow.eu

2.2 EUT Exercise Software

No exercise software was needed in order to achieve compliance.

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

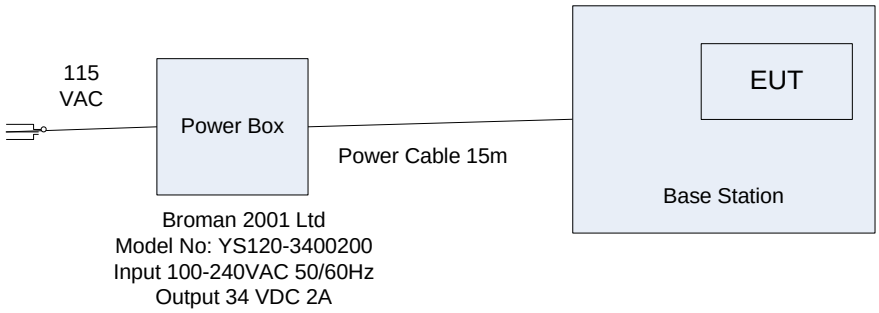


Figure 1. Configuration of Tested System

3. Conducted and Radiated Measurement Test Set-up Photo

Figure 2. Conducted Emission Test

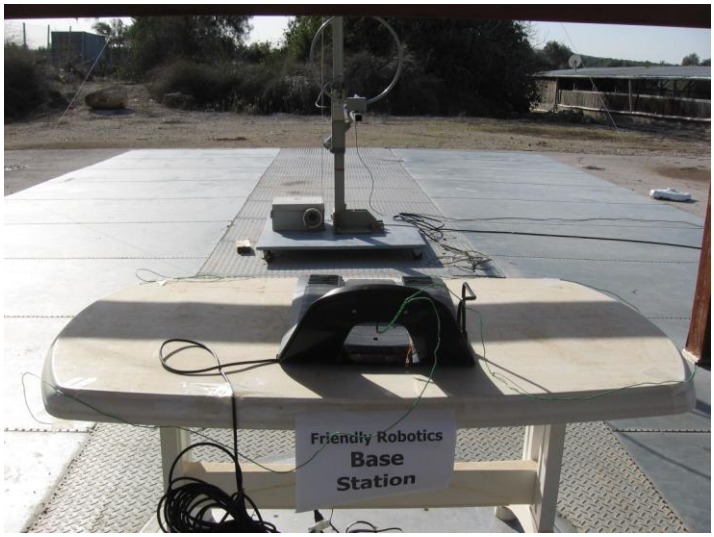


Figure 3. Radiated Emission Test Base Station

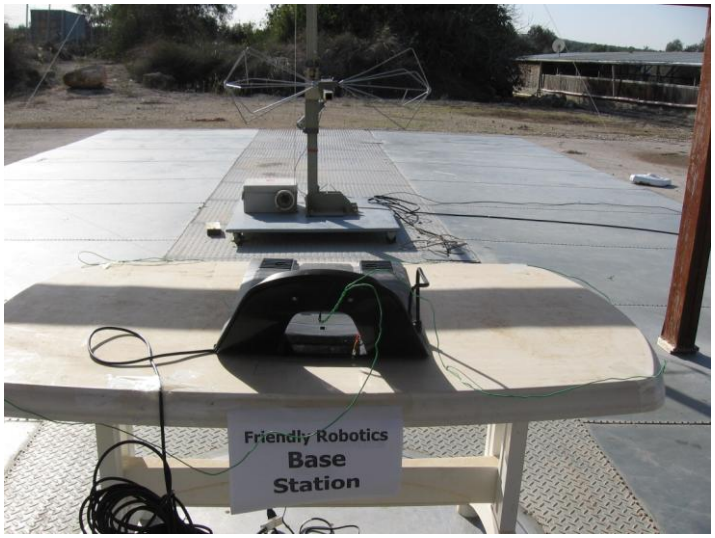


Figure 4. Radiated Emission Test Base Station

Figure 5. Radiated Emission Test Base Station

Figure 6. Radiated Emission Test Base Station

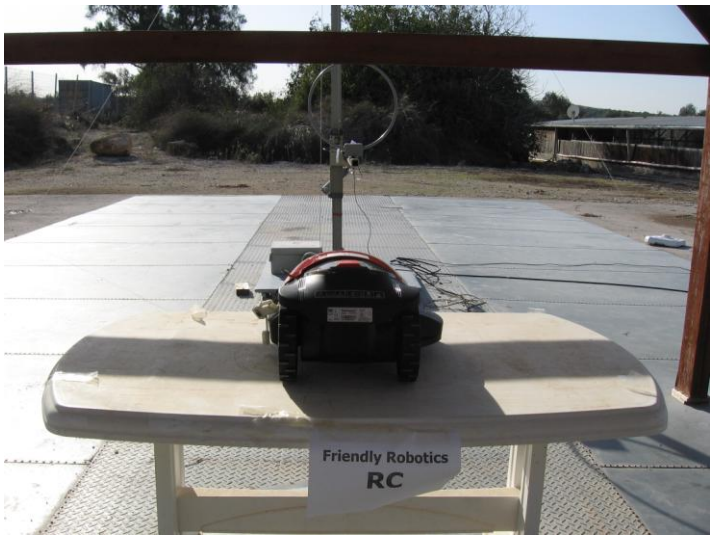


Figure 7. Radiated Emission Test RC

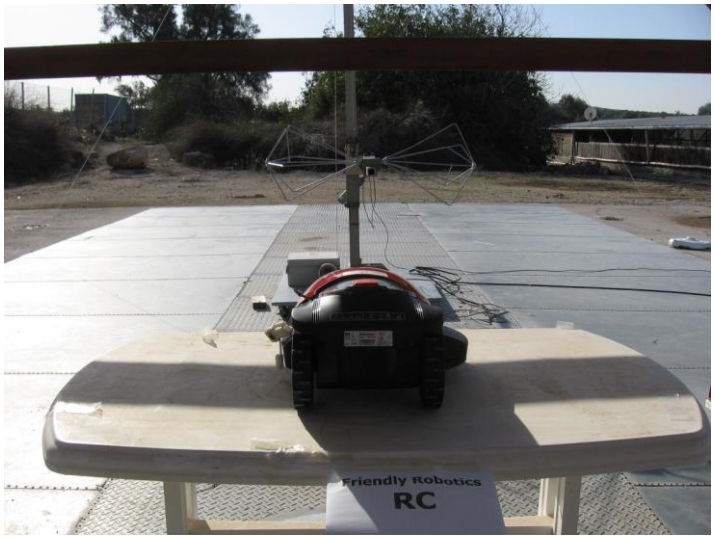


Figure 8. Radiated Emission Test RC

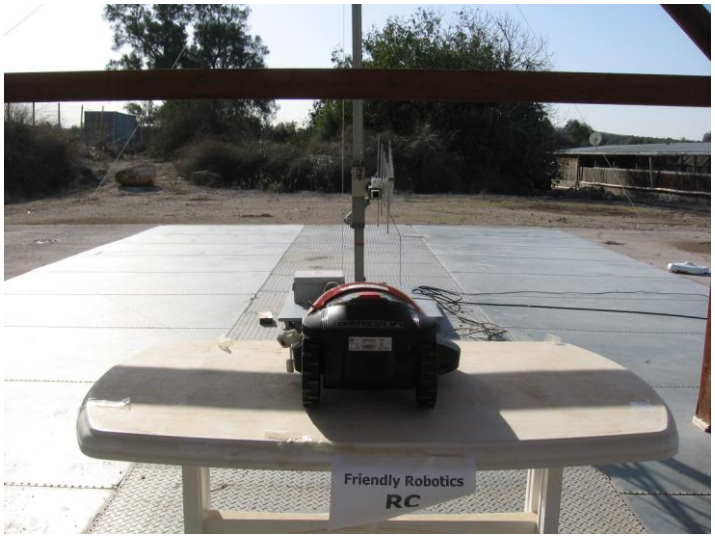


Figure 9. Radiated Emission Test RC

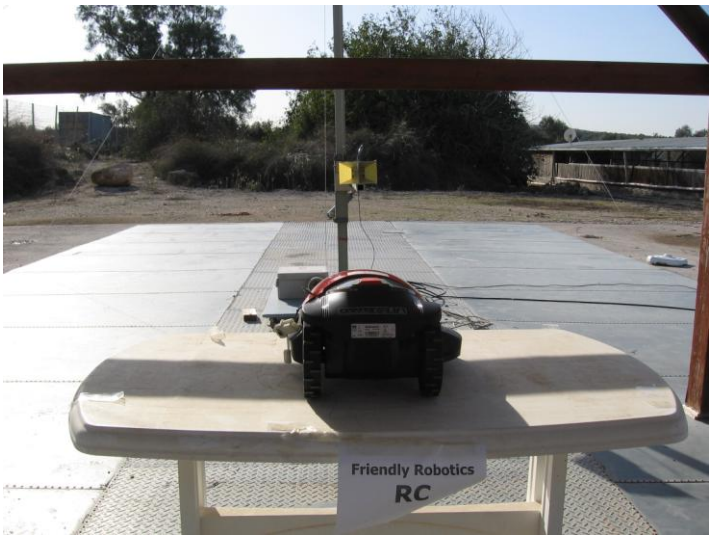


Figure 10. Radiated Emission Test RC

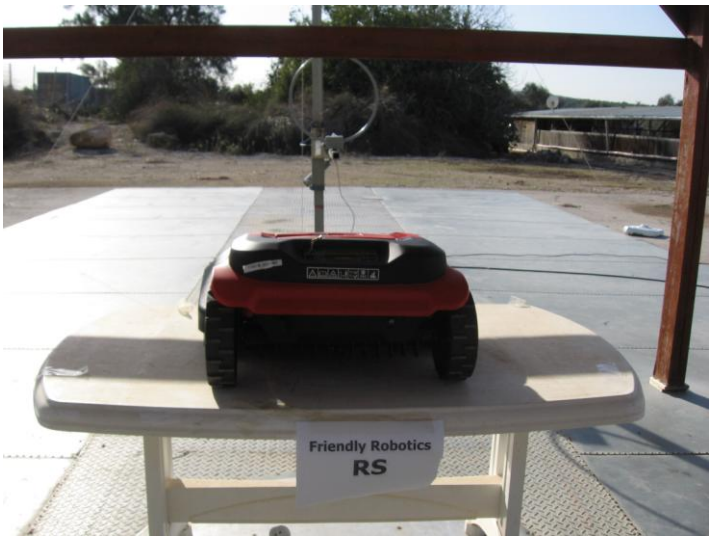


Figure 11. Radiated Emission Test RS

Figure 12. Radiated Emission Test RS

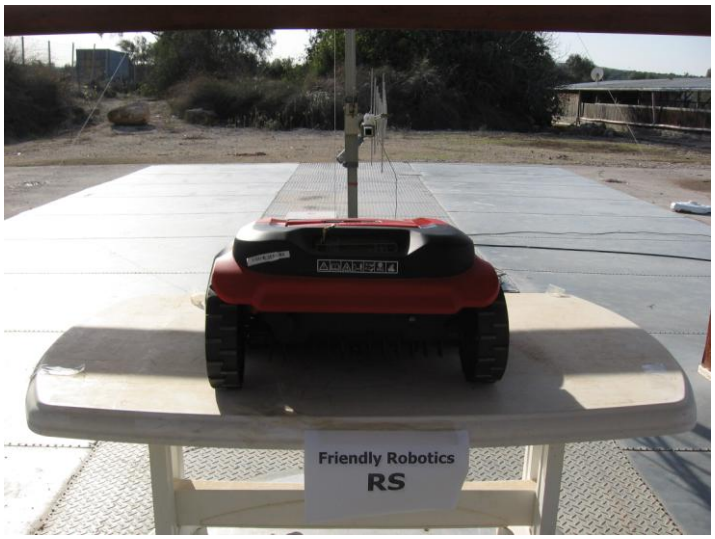


Figure 13. Radiated Emission Test RS

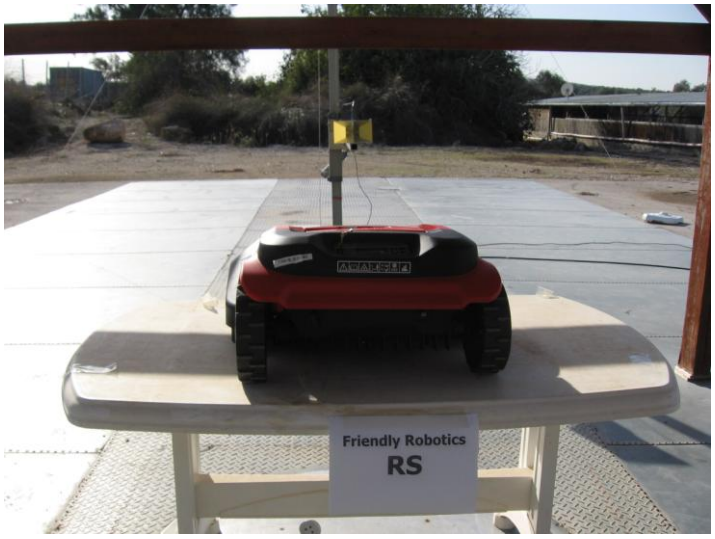


Figure 14. Radiated Emission Test RS

Figure 15. Exploratory Base Station

Figure 16. Exploratory RC

Figure 17. Exploratory RS

4. Conducted Emission Data

4.1 Test Specification

F.C.C., Part 15, Subpart C

4.2 Test Procedure

The E.U.T operation mode and test set-up are as described in Section 3. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room, with the E.U.T placed on an 0.8 meter high wooden table, 0.4 meter from the room's vertical wall.

The E.U.T was powered from 115 V AC / 60 Hz via a 50 Ohm / 50 µHn Line Impedance Stabilization Network (LISN) on the phase and neutral lines. The LISN's were grounded to the shielded room ground plane (floor), and were kept at least 0.8 meters from the nearest boundary of the E.U.T

The center of the E.U.T AC cable was folded back and forth, in order to form a bundle less than 0.40 meters and a total cable length of 1 meter.

The emission voltages at the LISN's outputs were measured using a computerized receiver, complying with CISPR 16 requirements. The specification limits are loaded to the receiver via a 3.5" floppy disk and are displayed on the receiver's spectrum display.

A frequency scan between 0.15 and 30 MHz was performed at 9 kHz I.F. band width, and using peak detection.

The spectral components having the highest level on each line were measured using a quasi-peak and average detector.

4.3 Measured Data

JUDGEMENT: Passed by 1.7 dB

The margin between the emission levels and the specification limit is, in the worst case, 1.7 dB for the phase line at 0.481702 MHz and 1.9 dB at 0.481708 MHz for the neutral line.

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

The details of the highest emissions are given in *Figure 18* to *Figure 21*.

TEST PERSONNEL:

Tester Signature: _____ Date: 04.02.14

Typed/Printed Name: A. Sharabi

Conducted Emission

E.U.T Description	BLE Robot Board/RF Module
Type	ESB6007D
Serial Number:	Not Designated

Specification:	F.C.C., Part 15, Subpart C
Lead:	Phase
Detectors:	Peak, Quasi-peak, Average

Signal Number	Frequency (MHz)	Peak (dBuV)	QP (dBuV)	QP Delta L 1 (dB)	Avg (dBuV)	Av Delta L 2 (dB)	Corr (dB)
1	0.481702	52.5	51.2	-5.2	44.6	-1.7	0.0
2	0.821489	44.5	39.7	-16.3	34.6	-11.4	0.0
3	2.838036	43.7	34.9	-21.1	21.9	-24.1	0.0
4	4.210534	46.4	33.4	-22.6	24.2	-21.8	0.0
5	12.117993	38.5	29.0	-31.0	22.5	-27.5	0.0
6	27.086190	23.0	18.5	-41.5	13.0	-37.0	0.0

Figure 18. Conducted Emission: PHASE

Detectors: Peak, Quasi-peak, AVERAGE

Note: QP Delta/Av Delta 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.

Conducted Emission

E.U.T Description	BLE Robot Board/RF Module
Type	ESB6007D
Serial Number:	Not Designated

Specification:	F.C.C., Part 15, Subpart C
Lead:	Phase
Detectors:	Peak, Quasi-peak, Average

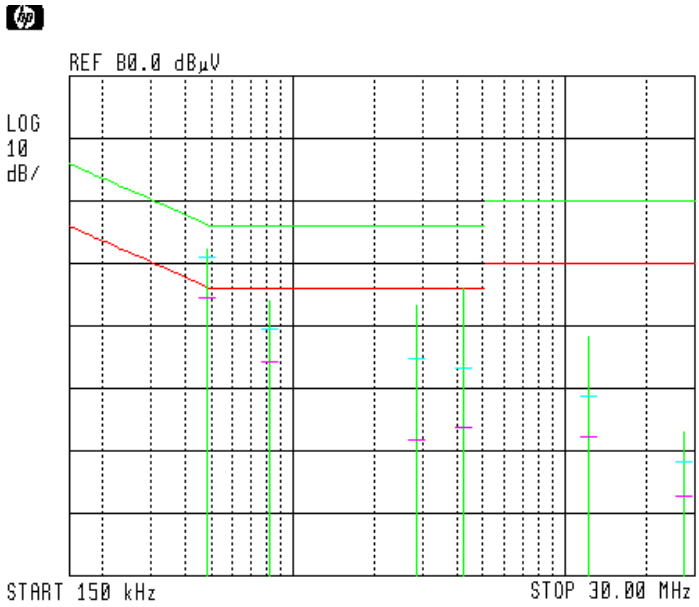


Figure 19. Conducted Emission: PHASE
Detectors: Peak, Quasi-peak, Average

Notes:

1. *Horizontal axis shows logarithmic frequency scale.*
2. *The vertical axis shows amplitude (in dB µV).*
3. *Peak detection is designated by the top of each vertical line.*
4. *Quasi-peak detection is designated by the first dash mark (from the top) of each vertical line.*
5. *Average detection is designated by the second dash mark (from the top) of each vertical line.*

Conducted Emission

E.U.T Description	BLE Robot Board/RF Module
Type	ESB6007D
Serial Number:	Not Designated

Specification:	F.C.C., Part 15, Subpart C
Lead:	Neutral
Detectors:	Peak, Quasi-peak, Average

Signal Number	Frequency (MHz)	Peak (dBuV)	QP (dBuV)	QP Delta L 1 (dB)	Avg (dBuV)	Av Delta L 2 (dB)	Corr (dB)
1	0.481708	57.4	51.0	-5.3	44.4	-1.9	0.0
2	0.821493	53.6	38.5	-17.5	32.7	-13.4	0.0
3	2.838037	44.7	35.4	-20.6	21.8	-24.2	0.0
4	4.210534	44.9	35.3	-20.7	24.4	-21.6	0.0
5	12.117993	38.7	28.4	-31.6	19.4	-30.6	0.0
6	27.086190	36.1	31.4	-28.6	26.1	-23.9	0.0

Figure 20. Conducted Emission: NEUTRAL

Detectors: Peak, Quasi-peak, AVERAGE

Note: QP Delta/Av Delta 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.

Conducted Emission

E.U.T Description	BLE Robot Board/RF Module
Type	ESB6007D
Serial Number:	Not Designated

Specification:	F.C.C., Part 15, Subpart C
Lead:	Neutral
Detectors:	Peak, Quasi-peak, Average

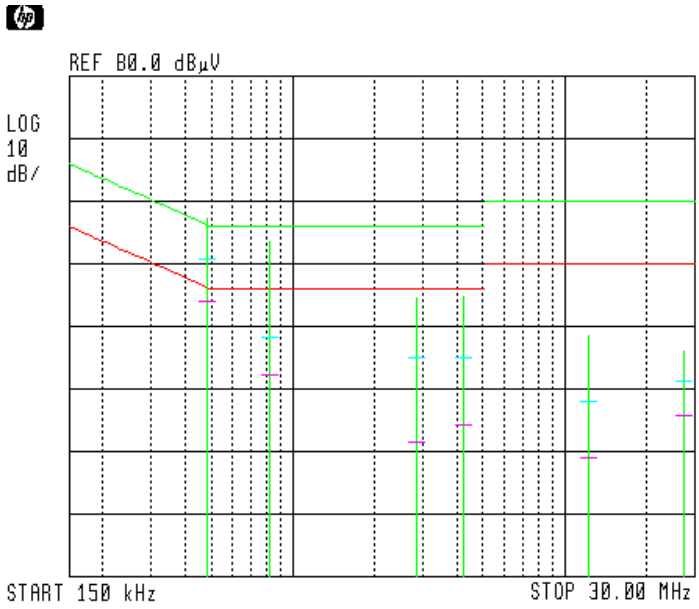


Figure 21 Conducted Emission: NEUTRAL
Detectors: Peak, Quasi-peak, Average

Notes:

1. *Horizontal axis shows logarithmic frequency scale.*
2. *The vertical axis shows amplitude (in dB µV).*
3. *Peak detection is designated by the top of each vertical line.*
4. *Quasi-peak detection is designated by the first dash mark (from the top) of each vertical line.*
5. *Average detection is designated by the second dash mark (from the top) of each vertical line.*

4.4 Test Instrumentation Used, Conducted Measurement

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
LISN	Fischer	FCC-LISN-2A	128	January 1, 2014	1 Year
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1Year
RF Filter Section	HP	85420E	3705A00248	February 26, 2013	1Year
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

5. 6dB 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 three frequencies: Low, Mid and High.

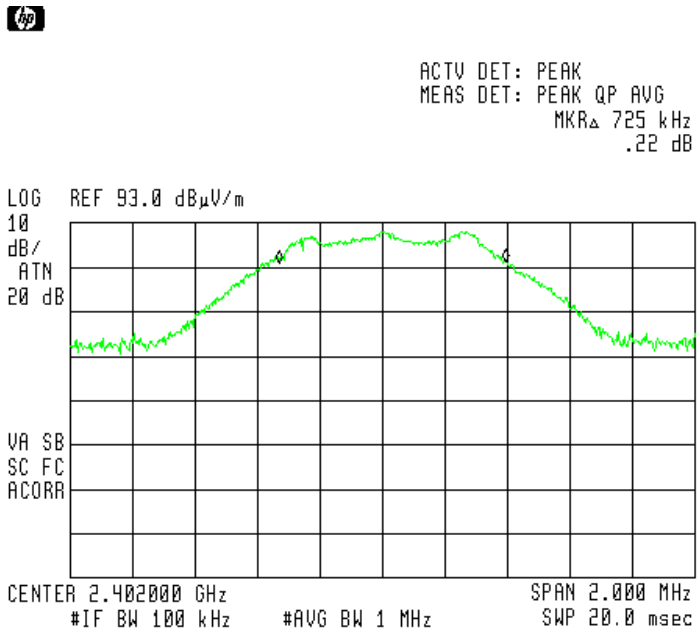


Figure 22. Low Channel - 2402 MHz

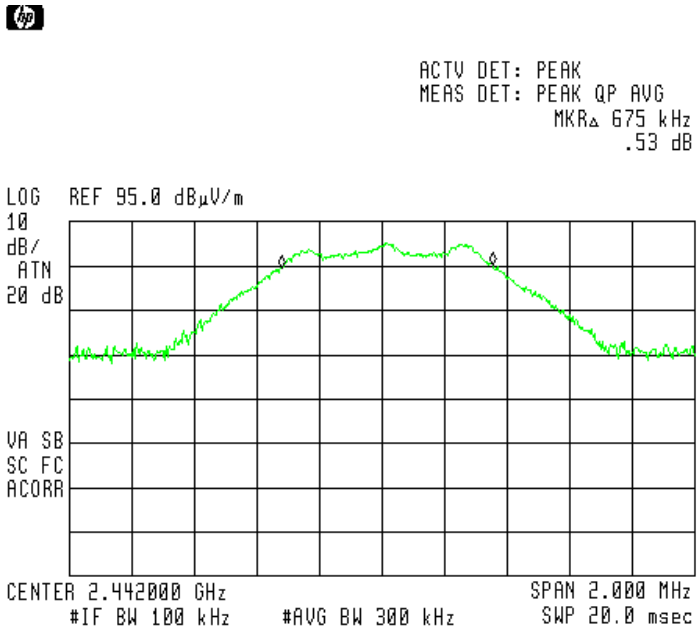


Figure 23. Mid Channel - 2442 MHz

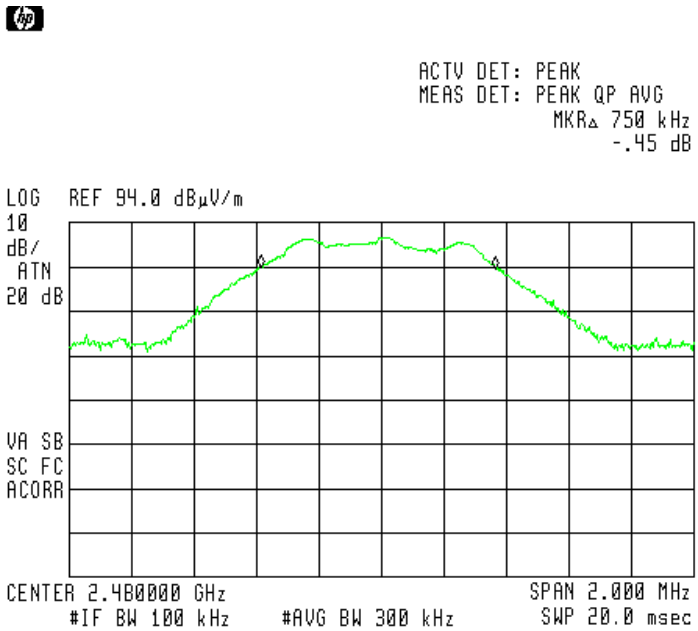


Figure 24. High Channel - 2480 MHz

5.3 Test Results

E.U.T Description: BLE Robot Board/RF Module
Model: ESB6007D
Serial Number: Not Designated

Operation Frequency (MHz)	Bandwidth Reading (MHz)	Specification (MHz)
2402	0.725	>0.5
2442	0.675	>0.5
2480	0.750	>0.5

Figure 25 6dB Minimum Bandwidth Test Results

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 04.02.14

Typed/Printed Name: A. Sharabi

5.4 Test Equipment Used. 6dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Horn Antenna	ETS	3115	29845	March 14, 2012	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 26 Test Equipment Used

6. 26dB Minimum Bandwidth

6.1 Test Specification

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

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 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 three frequencies: Low, Mid and High.

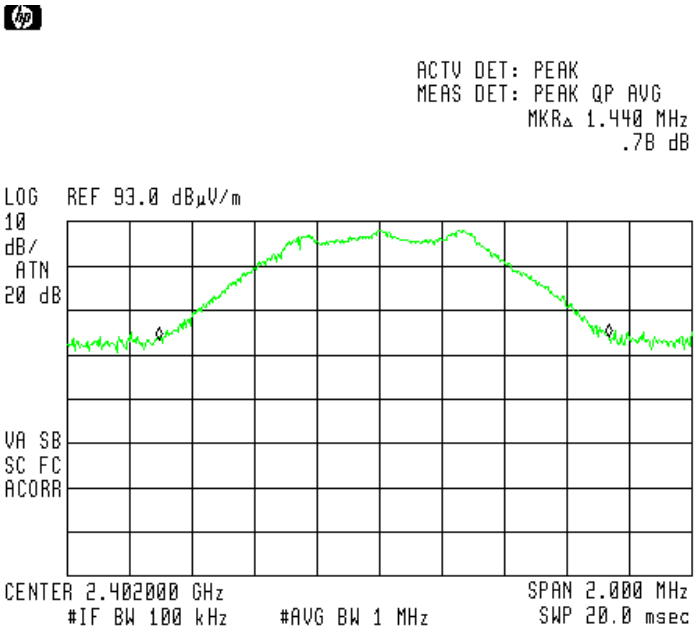


Figure 27. Low Channel 2402 MHz

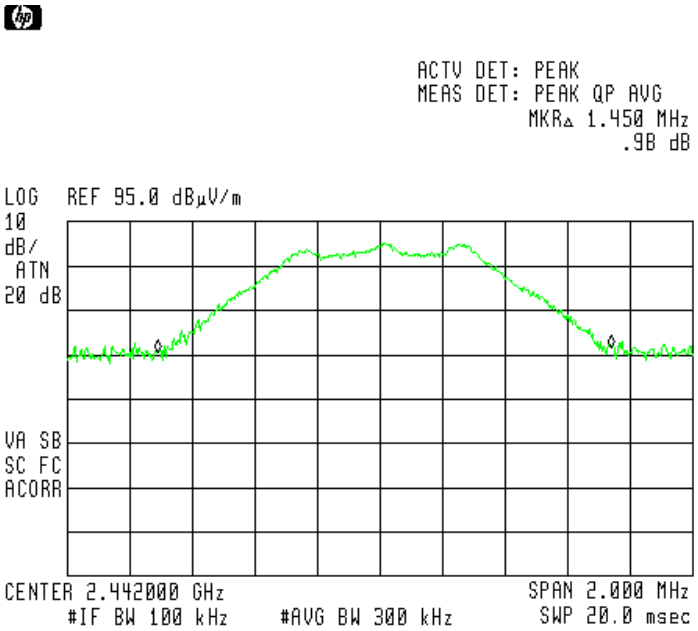


Figure 28. Mid Channel - 2442 MHz

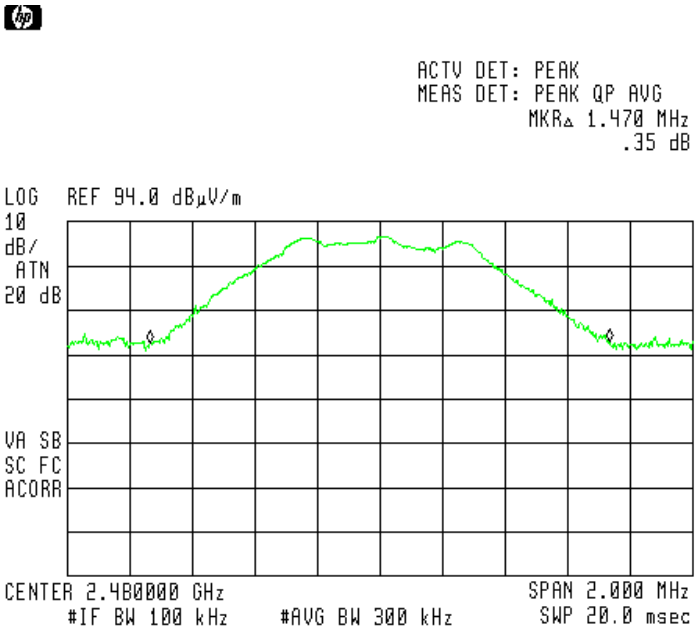


Figure 29. High Channel - 2480 MHz

6.3 Test Results

E.U.T Description: BLE Robot Board/RF Module
Model: ESB6007D
Serial Number: Not Designated

Operation Frequency (MHz)	Bandwidth Reading (MHz)
Low	1.440
Mid	1.450
High	1.470

Figure 30 26 dB Minimum Bandwidth Test Results

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 04.02.14

Typed/Printed Name: A. Sharabi

6.4 Test Equipment Used, 26 dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	2 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

Figure 31 Test Equipment Used

7. Radiated Power Output

7.1 Test Specification

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

7.2 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
(1 (2.402 GHz); 8 (2.442 GHz); 14 (2.480 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:

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

Pout = E (dBuv/m) – 95.2

E- Field Strength (v/m)

d- Distance from transmitter (m)

G- Antenna gain

P- Peak power (W)

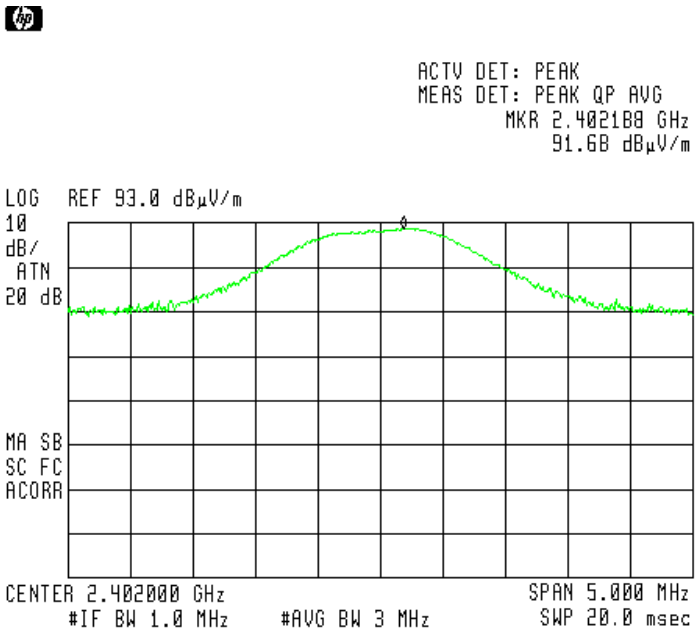


Figure 32 Low Channel – 2402.00 MHz - Vertical

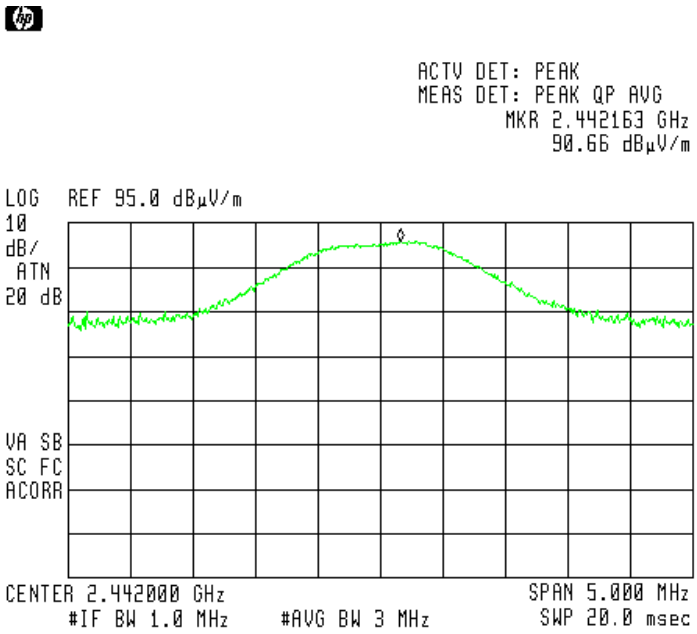


Figure 33 Mid Channel – 2442.00 MHz - Vertical

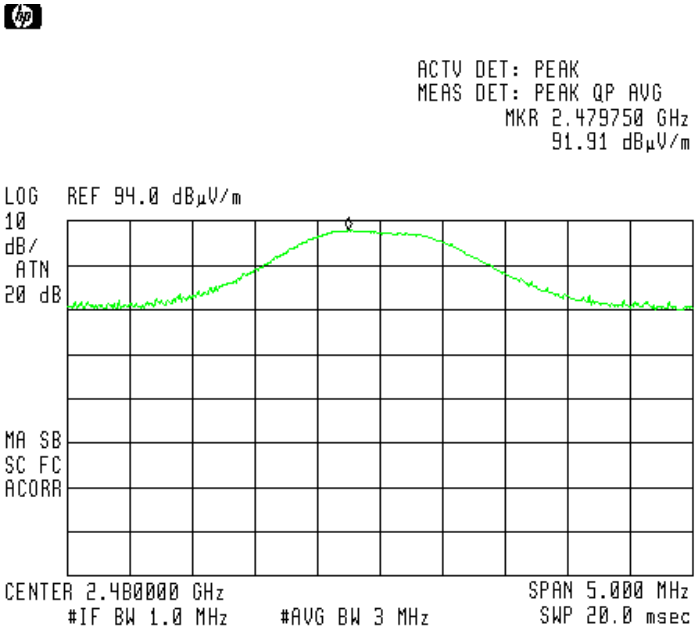


Figure 34 High Channel – 2480.00 MHz - Vertical

7.3 Results Calculation

E.U.T. Description: BLE Robot Board/RF Module
Model No.: ESB6007D
Serial Number: Not Designated
Specification: F.C.C. Part 15, Subpart C

Operating Frequency (MHZ)	Field Strength (dBuV/m)	Polarization	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	91.68	V	-3.52	30	-33.52
Mid	90.66	V	-4.52	30	-34.52
High	91.91	V	-3.29	30	-33.29

Figure 35 Radiated Power Output

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 04.02.14

Typed/Printed Name: A. Sharabi

7.4 Test Equipment Used, Radiated Maximum Power Output

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Antenna-Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 year
Horn Antenna	ETS	3115	29845	March 14, 2012	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 36 Test Equipment Used

8. Band Edge

[In Accordance with section 15.247(d)]

8.1 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 2402 MHz, and 2480MHz correspondingly.

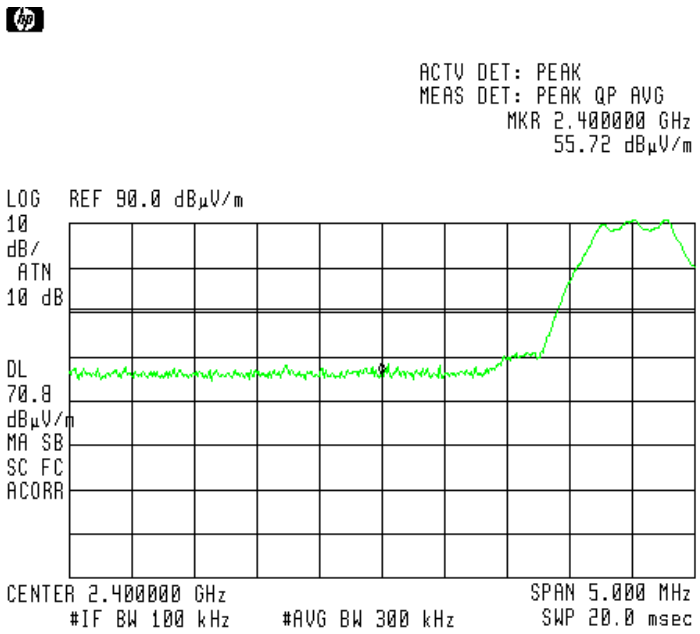


Figure 37 Lower Band Edge

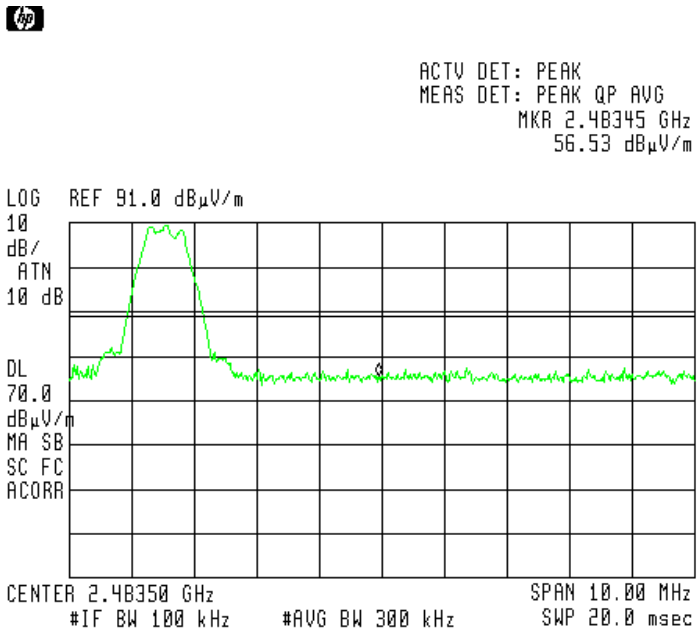


Figure 38 Upper Band Edge

8.2 Results table

E.U.T. Description: BLE Robot Board/RF Module
Model No.: ESB6007D
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	55.72	70.8	-15.08
2480	2483.5	56.53	70.0	-13.47

Figure 39 Band Edge

JUDGEMENT: Passed by 13.47 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 04.02.14

Typed/Printed Name: A. Sharabi

8.3 Test Equipment Used, Band Edge Spectrum

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Antenna-Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 year
Horn Antenna	ETS	3115	29845	March 14, 2012	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 40 Test Equipment Used

9. Radiated Emission, 9 kHz – 30 MHz

9.1 Test Specification

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

9.2 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.

9.3 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: 04.02.14

Typed/Printed Name: A. Sharabi

9.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 21, 2012	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

Figure 41 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:

$$FS = RA + AF + CF$$

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

Example: FS = 30.7 dBμV (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dBμV

No external pre-amplifiers are used.

10. Spurious Radiated Emission 30 – 1000 MHz

10.1 Test Specification

30 MHz-1000 MHz, F.C.C., Part 15, Subpart C

10.2 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 (1 (2.402 GHz); 8 (2.442 GHz; 14 (2.480 GHz)).

10.3 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, at least 20 dB below the specification limit.

TEST PERSONNEL:

Tester Signature: _____ Date: 04.02.14

Typed/Printed Name: A. Sharabi

10.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Antenna Bioconical	EMCO	3104	2606	August 30, 2013	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	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

Figure 42 Test Equipment Used

10.5 Field Strength Calculation

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

$$[dB\mu v/m]\ FS = RA + AF + CF$$

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

Example: FS = 30.7 dBμV (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dBμV

No external pre-amplifiers are used.

11. Spurious Radiated Emission Above 1 GHz

11.1 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 1-2.9 GHz, a computerized EMI receiver complying to CISPR 16 requirements was used.
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 channels and frequencies (1 (2.402 GHz); 8 (2.442 GHz); 14 (2.480 GHz)).

11.2 Test Data

JUDGEMENT: Passed by 16.9 dB

For the operation channel 1 (2.402 GHz), the margin between the emission level and the specification limit is in the worst case 17.1 dB at the frequency of 4804.0 MHz, vertical polarization for the Base Unit.

For the operation channel 8 (2.442 GHz), the margin between the emission level and the specification limit is in the worst case 17.0 dB at the frequency of 4884.0 MHz, vertical polarization for the Base Unit.

For the operation channel 14 (2.480 GHz), the margin between the emission level and the specification limit is in the worst case 16.9 dB at the frequency of 4960.0 MHz, vertical and horizontal polarizations for both the Base Unit and RC.

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 43* to *Figure 48*.

TEST PERSONNEL:

Tester Signature: _____ Date: 04.02.14

Typed/Printed Name: A. Sharabi

Radiated Emission Above 1 GHz

E.U.T Description	BLE Robot Board/RF Module
Type	ESB6007D
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
Unit: RC

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Peak Amp (dBµV/m)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
2402.0	2390.0	H	44.0	74.0	-30.0
2402.0	2390.0	V	45.4	74.0	-28.6
2402.0	4804.0	H	44.8	74.0	-29.2
2402.0	4804.0	V	45.9	74.0	-28.1
2442.0	4884.0	H	44.7	74.0	-29.3
2442.0	4884.0	V	46.0	74.0	-28.0
2480.0	2483.5	H	46.9	74.0	-27.1
2480.0	2483.5	V	47.0	74.0	-27.0
2480.0	4960.0	H	48.9	74.0	-25.1
2480.0	4960.0	V	49.0	74.0	-25.0

Figure 43. 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 BLE Robot Board/RF Module
Type ESB6007D
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
Unit: RC

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Average Amp (dBµV/m)	Average Specification (dB µV/m)	Average Margin (dB)
2402.0	2390.0	H	33.9	54.0	-20.1
2402.0	2390.0	V	34.0	54.0	-20.0
2402.0	4804.0	H	35.2	54.0	-18.8
2402.0	4804.0	V	36.3	54.0	-17.7
2442.0	4884.0	H	35.0	54.0	-19.0
2442.0	4884.0	V	34.7	54.0	-19.3
2480.0	2483.5	H	35.0	54.0	-19.0
2480.0	2483.5	V	34.3	54.0	-19.7
2480.0	4960.0	H	35.0	54.0	-19.0
2480.0	4960.0	V	37.1	54.0	-16.9

Figure 44. 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 Above 1 GHz

E.U.T Description	BLE Robot Board/RF Module
Type	ESB6007D
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
Unit: RS

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Peak Amp (dBµV/m)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
2402.0	2390.0	H	45.8	74.0	-28.2
2402.0	2390.0	V	46.7	74.0	-27.3
2402.0	4804.0	H	45.5	74.0	-28.5
2402.0	4804.0	V	46.9	74.0	-27.1
2442.0	4884.0	H	45.6	74.0	-28.4
2442.0	4884.0	V	46.8	74.0	-27.2
2480.0	2483.5	H	47.5	74.0	-26.5
2480.0	2483.5	V	48.9	74.0	-25.1
2480.0	4960.0	H	47.8	74.0	-26.2
2480.0	4960.0	V	48.3	74.0	-25.7

Figure 45. 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 BLE Robot Board/RF Module
Type ESB6007D
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
Unit: RS

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Average Amp (dBµV/m)	Average Specification (dB µV/m)	Average Margin (dB)
2402.0	2390.0	H	34.5	54.0	-19.5
2402.0	2390.0	V	35.8	54.0	-18.2
2402.0	4804.0	H	35.6	54.0	-18.4
2402.0	4804.0	V	36.8	54.0	-17.2
2442.0	4884.0	H	35.8	54.0	-18.2
2442.0	4884.0	V	36.9	54.0	-17.1
2480.0	2483.5	H	34.9	54.0	-19.1
2480.0	2483.5	V	35.0	54.0	-19.0
2480.0	4960.0	H	36.0	54.0	-18.0
2480.0	4960.0	V	36.6	54.0	-17.4

Figure 46. 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 Above 1 GHz

E.U.T Description	BLE Robot Board/RF Module
Type	ESB6007D
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
Unit: Base Unit

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Peak Amp (dBµV/m)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
2402.0	2390.0	H	46.5	74.0	-27.5
2402.0	2390.0	V	47.0	74.0	-27.0
2402.0	4804.0	H	45.9	74.0	-28.1
2402.0	4804.0	V	47.2	74.0	-26.8
2442.0	4884.0	H	45.9	74.0	-28.1
2442.0	4884.0	V	46.9	74.0	-27.1
2480.0	2483.5	H	46.0	74.0	-28.0
2480.0	2483.5	V	49.5	74.0	-24.5
2480.0	4960.0	H	48.3	74.0	-25.7
2480.0	4960.0	V	49.0	74.0	-25.0

Figure 47. 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 BLE Robot Board/RF Module
Type ESB6007D
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
Unit: Base Unit

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Average Amp (dBµV/m)	Average Specification (dB µV/m)	Average Margin (dB)
2402.0	2390.0	H	34.7	54.0	-19.3
2402.0	2390.0	V	35.4	54.0	-18.6
2402.0	4804.0	H	36.3	54.0	-17.7
2402.0	4804.0	V	36.9	54.0	-17.1
2442.0	4884.0	H	36.2	54.0	-17.8
2442.0	4884.0	V	37.0	54.0	-17.0
2480.0	2483.5	H	35.4	54.0	-18.6
2480.0	2483.5	V	35.9	54.0	-18.1
2480.0	4960.0	H	37.1	54.0	-16.9
2480.0	4960.0	V	36.9	54.0	-17.1

Figure 48. 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

11.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1Year
RF Filter Section	HP	85420E	3705A00248	February 26, 2013	1Year
Antenna Biconical	EMCO	3104	2606	August 30, 2013	1Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 Year
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 14, 2012	2 Years
Horn Antenna	ARA	SWH-28	1008	January 26, 2011	3 Years
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	August 21, 2013	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 28, 2013	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 Year
Spectrum Analyzer	HP	8546E	3442A00275	February 28, 2013	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

Figure 49 Test Equipment Used

12. Radiated Power Spectral Density

[In accordance with section 15.247(d)]

12.1 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, 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:

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

Pout = E(dBuV/m)-95.2

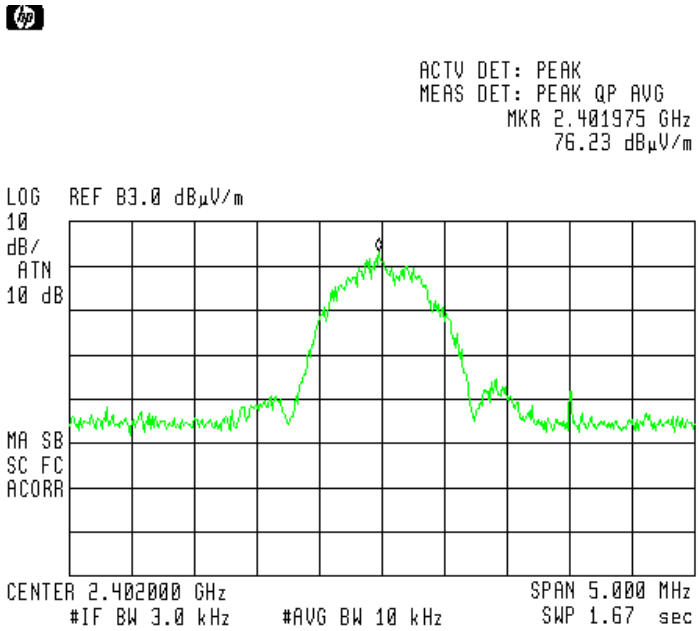

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.401975 GHz
76.23 dBµV/m
LOG REF 83.0 dBµV/m
10
dB/
ATN
10 dB
MA SB
SC FC
ACORR
CENTER 2.402000 GHz
SPAN 5.000 MHz
#IF BW 3.0 kHz
#AVG BW 10 kHz
SWP 1.67 sec

Figure 50 — 2402 MHz

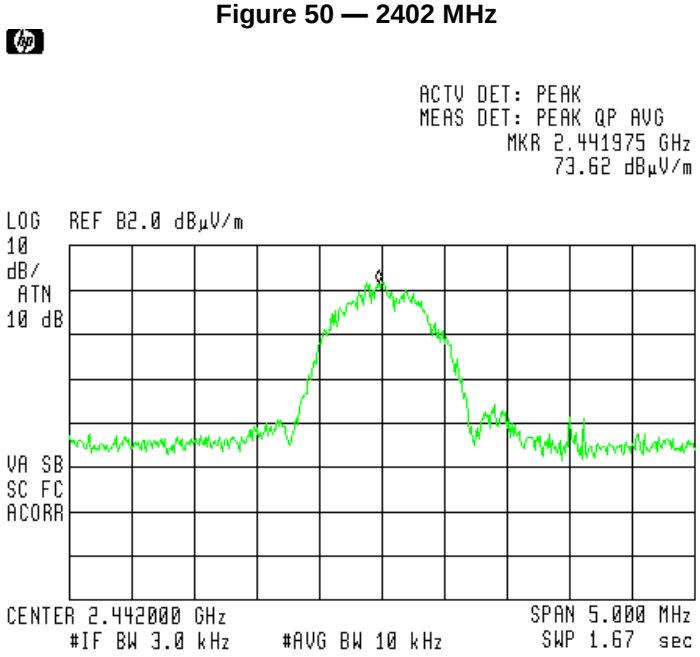


Figure 51 — 2442 MHz

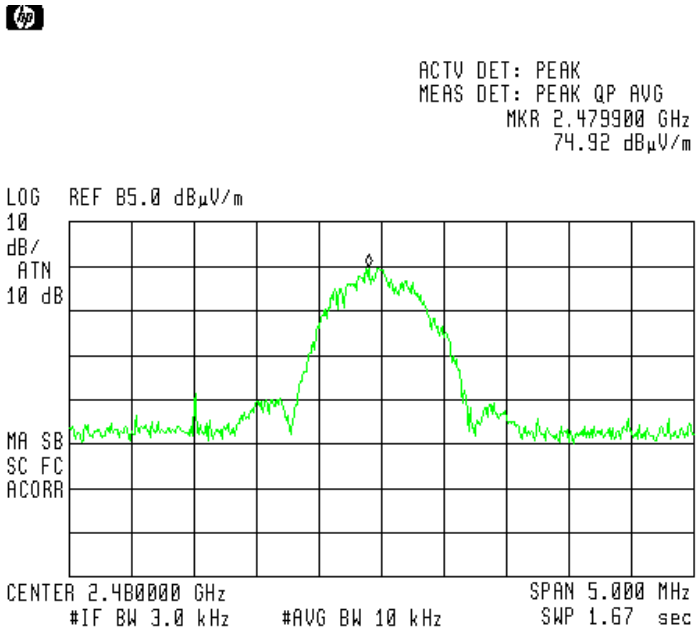


Figure 52 — 2480 MHz

12.2 Results table

E.U.T. Description: BLE Robot Board/RF Module
Model No.: ESB6007D
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	76.23	-18.97	8.0	-26.97
2442	73.62	-21.58	8.0	-29.58
2480	74.92	-20.28	8.0	-28.28

Figure 53 Test Results

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 04.02.14

Typed/Printed Name: A. Sharabi

12.3 Test Equipment Used, Transmitted Power Density

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	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

Figure 54 Test Equipment Used

13. Antenna Gain/Information

The antenna gain is -0.5 dBi.

"High Frequency Ceramic Solutions"

2450 MHz Antenna — **P/N 2450AT18B100**
Detail Specification: 08/10/09 — Page 1 of 3

General Specifications

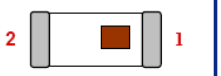
Part Number	2450AT18B100
Frequency Range	2400 - 2500 Mhz
Peak Gain	0.5 dBi typ. (XZ-V)
Average Gain	-0.5 dBi typ. (XZ-V)
Return Loss	9.5 dB min.

Input Power	3W max.
Impedance	50 Ω
Operating Temperature	-40 to +85°C
Reel Quanity	3,000

P/N Suffix	**Packaging Style**	Bulk	Suffix = S	Eg. 2450AT18B100S
		T & R	Suffix = E	Eg. 2450AT18B100E
	Termination Style	100% Tin	Suffix = None	Eg. 2450AT18B100(E or S)
		Tin / Lead	Please consult Factory	

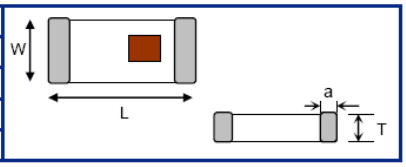
Terminal Configuration

No.	Function
1	Feeding Point
2	NC



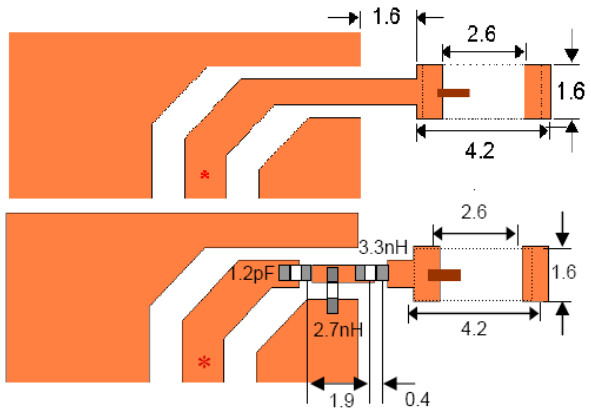
Mechanical Dimensions

	In	mm
L	0.126 ± 0.008	3.20 ± 0.20
W	0.063 ± 0.008	1.60 ± 0.20
T	0.051 +.004/-.008	1.30 +0.1/-0.2
a	0.020 ± 0.012	0.50 ± 0.30



Mounting Considerations

Mount these devices with brown mark facing up. Units: mm
Line width should be designed to provide 50 Ω impedance matching characteristics.



a) Without Matching Circuits

b) With Matching Circuits

JTI P/N for Matching Circuit:
Cap (1.2pF): 500R07S1R2BV4T
Inductor (2.7nH): L-07C2N7SV6T
Inductor (3.3nH): L-07C3N3SV6T

Johanson Technology, Inc. reserves the right to make design changes without notice.
All sales are subject to Johanson Technology, Inc. terms and conditions.

JOHANSON TECHNOLOGY

www.johansontechnology.com
4001 Calle Tecate • Camarillo, CA 93012 • TEL 805.389.1166 FAX 805.389.1821

14. R.F Exposure/Safety

Typical use of the E.U.T. is a robotic lawn mower. The typical placement of the E.U.T. is driving on the floor. The typical distance between the E.U.T. and the user in the worst case application, is 10cm.

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 91.91 dBuV/m (Peak) = 0.5 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 10cm worst case

(c) The peak power density is :

$$S_p = \frac{0.5 \times 0.89}{4\pi(10)^2} = 0.3 \times 10^{-3} \frac{mW}{cm^2}$$

(d) This is below the FCC limit.

15. APPENDIX B - CORRECTION FACTORS

15.1 Correction factors for CABLE

**from EMI receiver
to test antenna
at 3 meter range.**

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3
20.0	0.6
30.0	0.8
40.0	0.9
50.0	1.1
60.0	1.2
70.0	1.3
80.0	1.4
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

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	7.3
1400.0	7.8
1600.0	8.4
1800.0	9.1
2000.0	9.9
2300.0	11.2
2600.0	12.2
2900.0	13.0

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".*

15.2 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.

15.3 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.

15.4 Correction factors for CABLE

**from EMI receiver
to test antenna
at 10 meter range.**

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3
20.0	0.8
30.0	0.9
40.0	1.2
50.0	1.4
60.0	1.6
70.0	1.8
80.0	1.9
90.0	2.0
100.0	2.1
150.0	2.6
200.0	3.2
250.0	3.8
300.0	4.2
350.0	4.6
400.0	5.1
450.0	5.3
500.0	5.6
600.0	6.3
700.0	7.0
800.0	7.6
900.0	8.0
1000.0	8.7

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	9.8
1400.0	10.0
1600.0	11.3
1800.0	12.2
2000.0	13.1
2300.0	14.5
2600.0	15.9
2900.0	16.4

NOTES:

1. The cable type is RG-214.

2. The overall length of the cable is 34 meters.

3. The above data is located in file 34M10MO.CBL on the disk marked "Radiated Emissions Tests EMI Receiver".

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 38M3O.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".*

15.5 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".*

15.6 Correction factors for BICONICAL ANTENNA

Type BCD-235/B,
at 3 meter range

FREQUENCY (MHz)	AFE (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".

15.7 Correction factors for BICONICAL ANTENNA

Type BCD-235/B,
10 meter range

FREQUENCY (MHz)	AFE (dB/m)
30.0	12.1
40.0	10.6
50.0	10.6
60.0	8.9
70.0	8.5
80.0	9.6
90.0	9.4
100.0	9.6
110.0	10.3
120.0	10.7
130.0	12.6
140.0	12.7
150.0	12.7
160.0	13.8
170.0	13.7
180.0	14.9
190.0	13.4
200.0	13.1
210.0	14.0
220.0	14.5
230.0	15.8
240.0	16.0
250.0	16.6
260.0	16.7
270.0	18.3
280.0	18.5
290.0	19.3
300.0	20.9

NOTES:

1. *Antenna serial number is 1041.*
2. *The above list is located in file 41BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".*

15.8 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			

15.9 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

15.10 Correction factors for Horn Antenna

Model: V637

FREQUENCY (GHz)	AFE (dB /m)	Gain (dB1)
26.0	43.6	14.9
27.0	43.7	15.1
28.0	43.8	15.3
29.0	43.9	15.5
30.0	43.9	15.8
31.0	44.0	16.0
32.0	44.1	16.2
33.0	44.1	16.4
34.0	44.1	16.7
35.0	44.2	16.9
36.0	44.2	17.1
37.0	44.2	17.4
38.0	44.2	17.6
39.0	44.2	17.8
40.0	44.2	18.0

15.11 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