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DATE: 11 December 2016

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

FCC/IC Radio Test Report

for

AllBe Solutions Ltd, Israel

Equipment under test:

AllBe1 Multisensor

00001

Tested by: _____
A. Yizhak

Approved by: _____
D. Shidlowsky

Measurement/Technical Report for

AllBe Solutions Ltd, Israel

AllBe1 Multisensor

00001

FCC ID: 2AJWE-ALLBE

IC: 22019-ALLBE

This report concerns:	Original Grant: X Class I Change: Class II Change:
Equipment type:	Digital Transmission System IC: Spread Spectrum Digital Device (2400-2483.5)
Limits used:	47CFR15 Section 15.247 RSS-247, Issue 1, May 2015 RSS Gen, Issue 4, November 2014

Measurement procedure used is KDB 558074 D01 v03r05 and ANSI C63.10:2013.

Application for Certification
prepared by:
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Applicant for this device:
(different from "prepared by")
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1 General Information

1.1 Administrative Information

Manufacturer:	AllBe Solutions Ltd, Israel
Manufacturer's Address:	6 Hashaked St., Nordiya, 4295400 Israel Tel: +972-52-288-2883
Manufacturer's Representative:	Ofer Lugasi
Equipment Under Test (E.U.T):	AllBe1 Multisensor
Product Marketing Name (PMN):	AllBe1
Equipment Serial No.:	Not designated
HVIN:	AB001
Date of Receipt of E.U.T:	August 28, 2016
Start of Test:	August 28, 2016
End of Test:	September 12, 2016
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
Test Specifications:	FCC Part 15, Subpart C RSS-247, Issue 1, May 2015 RSS Gen Issue 4, November 2014

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 No. IL1005.
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-3006, R-2729, T-1877, G-245.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site Nos. IC 4025A-1, IC 4025A-2.

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 AllBe1 is a multi-sensor with extended BLE range that the user can define many features via the Smart phone app.

The AllBe1 has the following features:
* Human detection- by passive infra-red detector;
* Tilt alarm by 3D accelerometer;
* UV sensing monitoring;
* Temperature sensing and monitoring;
* Out of range detection;
* Asset tracking.

Working voltage	3.1-4.2V DC battery operated
Mode of operation	Transceiver
Modulations	GFSK
Frequency Range	2402MHz-2480MHz
Transmit power	~8dBm
Antenna Gain	2.5 dBi
Modulation BW	>500kHz
Temperature (°C)/ Humidity (%RH)	25°C/44%

1.4 Test Methodology

Both conducted and radiated testing was performed according to the procedures in KDB 558074 D01 v03r05 and ANSI C63.10: 2013. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

Emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. I.T.L.'s EMC Laboratory is accredited by A2LA, certificate No. 1152.01 and its FCC Designation Number is IL1005.

1.6 Measurement Uncertainty

Conducted Emission

(CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4)

0.15 – 30 MHz:

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

± 3.44 dB

Radiated Emission

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

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

± 4.98 dB

2 System Test Configuration

2.1 Justification

Exploratory emission testing was performed in 3 orthogonal polarities to determine the worst case.

The fundamental results are shown in the below table:

Frequency (MHz)	**Y axis** (dBuV/m)	**X axis** (dBuV/m)	**Z axis** (dBuV/m)
2402.0	98.78	97.28	88.52
2440.0	100.93	95.21	95.12
2480.0	102.24	98.49	95.34

Figure 1. Screening Results

According to above results the worst case was the Y axis.

The unit was evaluated while transmitting at the low channel (2402MHz), the mid channel (2440MHz) and the high channel (2480MHz) in BLE technology.

The E.U.T. was tested connected via a jig to a laptop in order to change the tested frequencies.

2.2 EUT Exercise Software

No special exercise software was used.

2.3 Special Accessories

No special accessories were needed to achieve compliance.

2.4 Equipment Modifications

No modifications were necessary in order to achieve compliance.

2.5 Configuration of Tested System

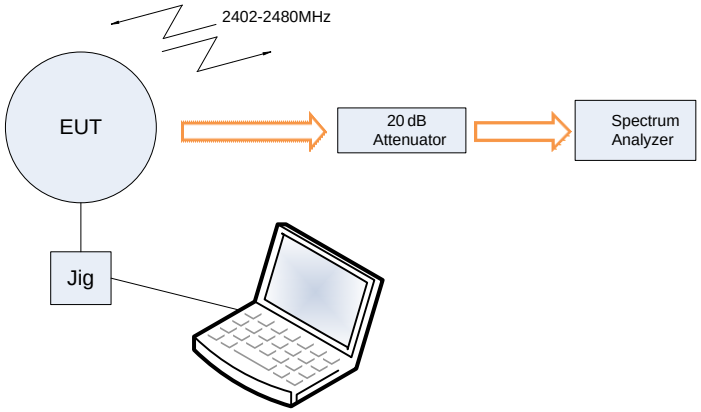

Figure 2. Configuration of Tested System Conducted

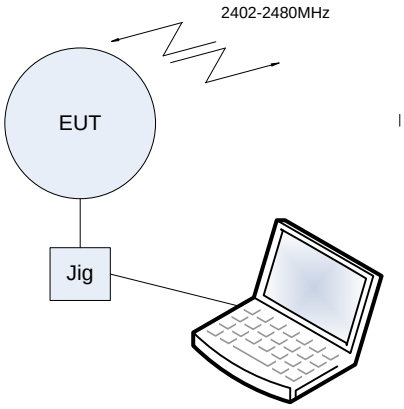

Figure 3. Configuration of Tested System Radiated

3 Conducted & Radiated Measurement Test Set-Up Photos

Figure 4. Conducted Emission From AC Mains Test

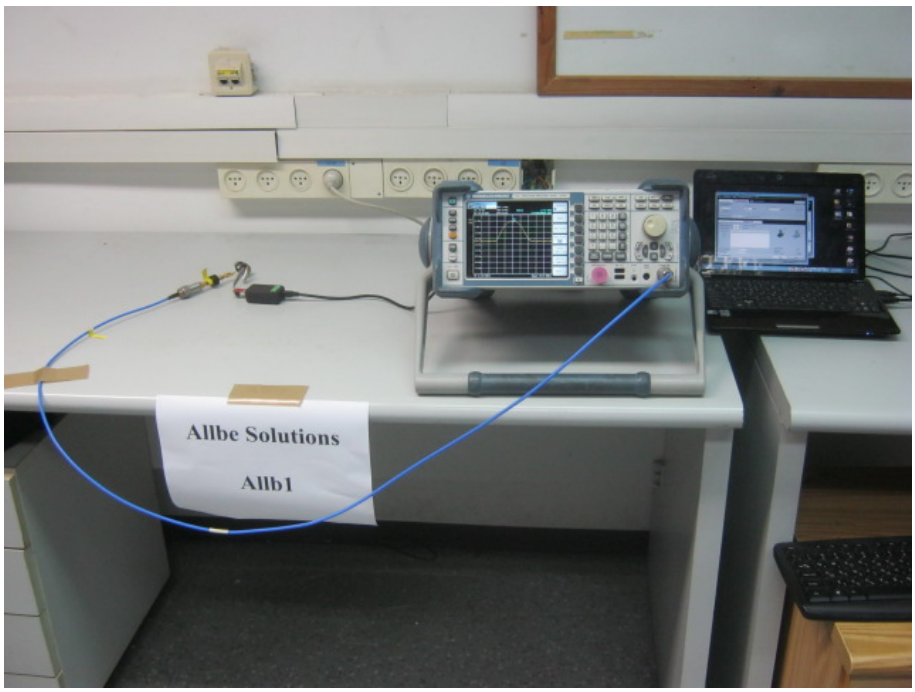

Figure 5. Conducted Test Set-Up

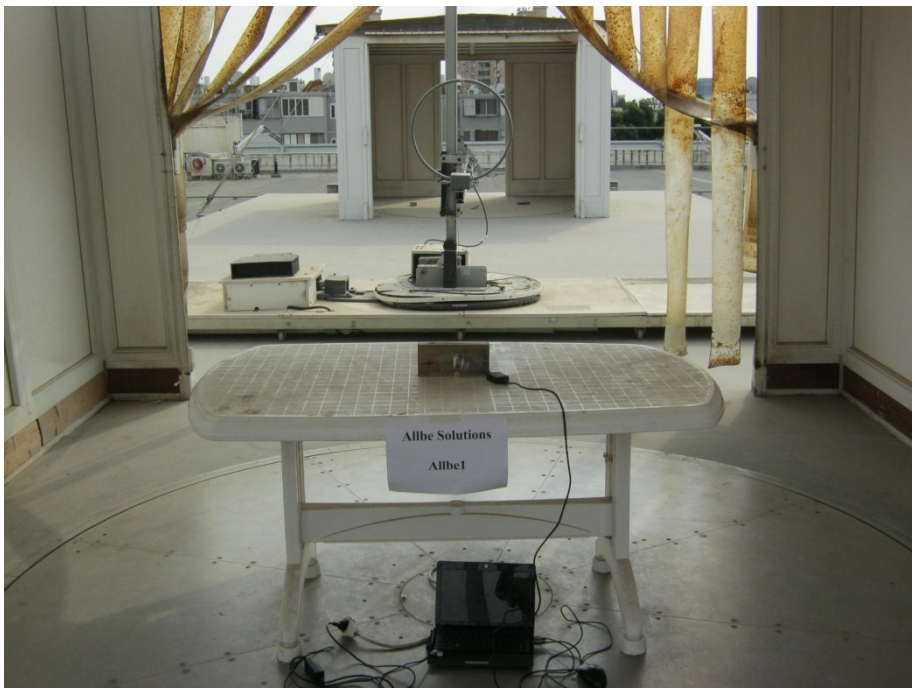

Figure 6. Radiated Emission Test

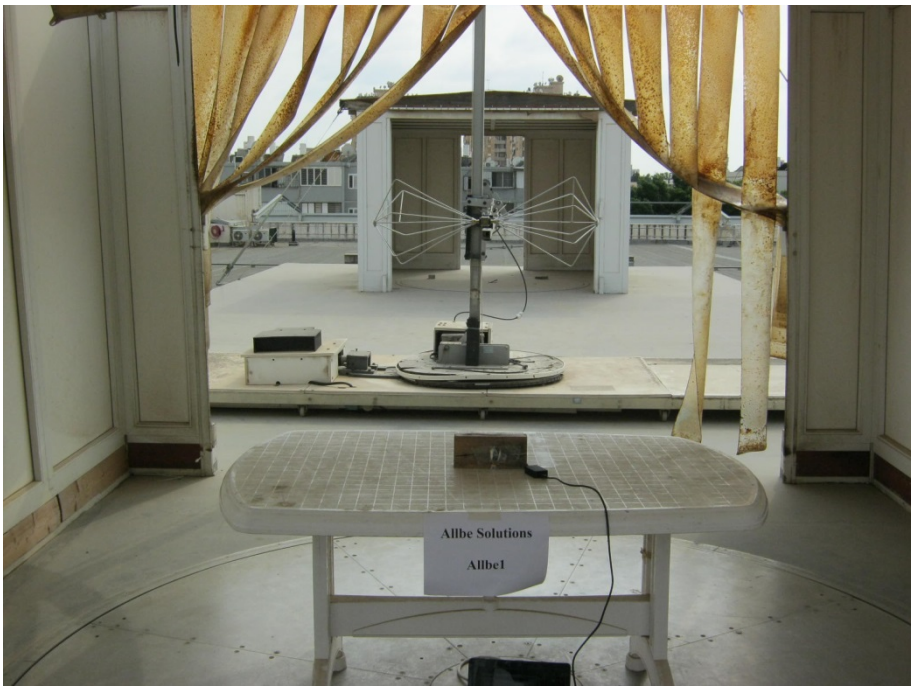

Figure 7. Radiated Emission Test

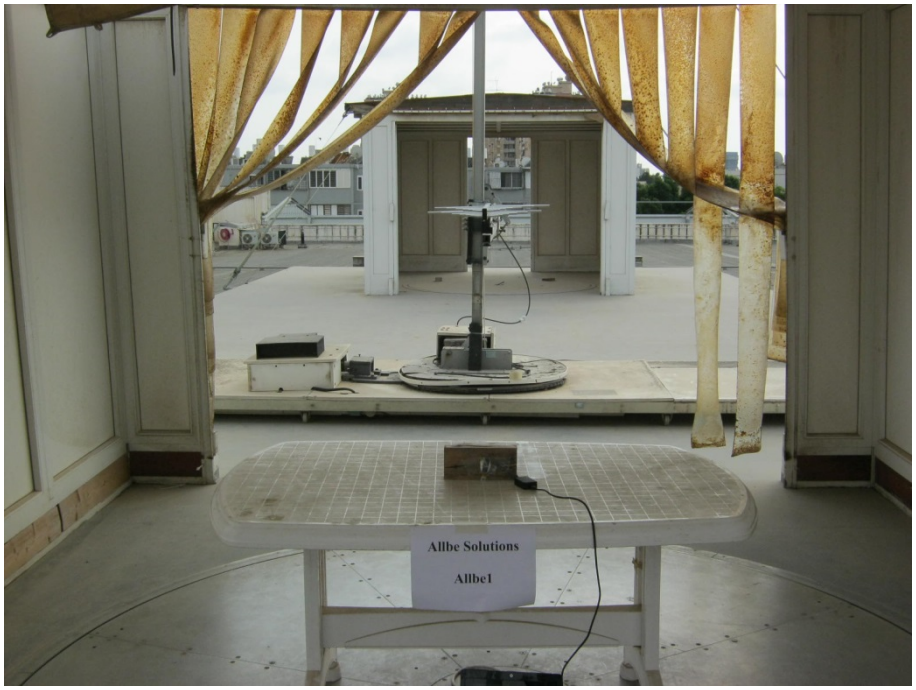

Figure 8. Radiated Emission Test

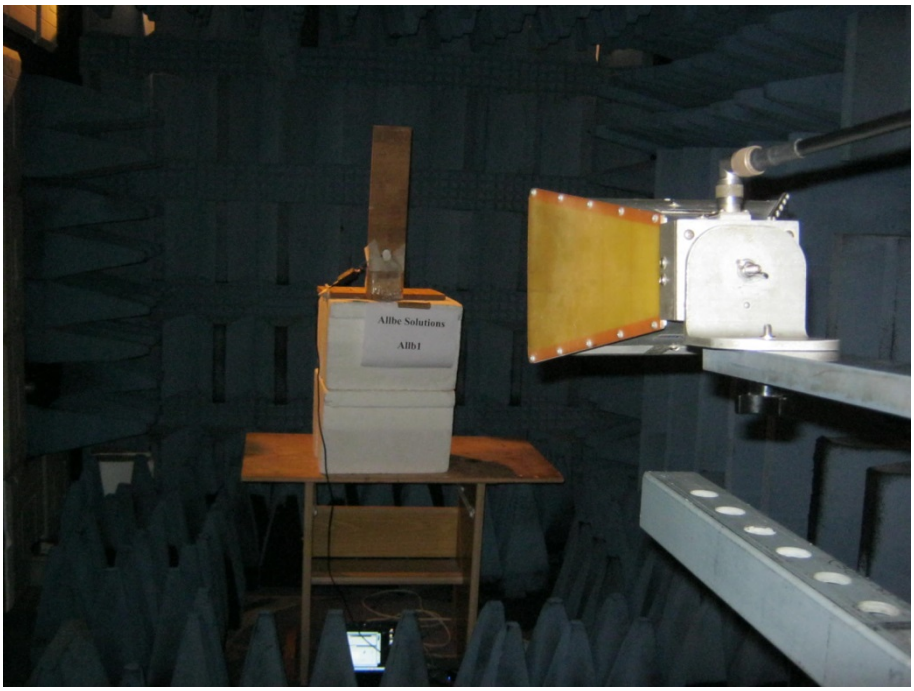

Figure 9. Radiated Emission Test

4 Conducted Emission From AC Mains

4.1 Test Specification

FCC Part 15, Subpart C, Class B
RSS Gen, Issue 4, 2014, Section 8.8

4.2 Test Procedure

The E.U.T operation mode and test setup are as described in Section 4.1. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room (see Section 3), with the E.U.T placed on a 0.4 meter high wooden table. In the case of a floor-standing E.U.T., it was placed on the horizontal ground plane.

The E.U.T was powered via 50 Ohm / 50 µHn Artificial Mains Network (AMN) on the phase and neutral lines. The AMN'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.'s 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 effect of varying the position of the cables was investigated to find the configuration that produces maximum emission. The configuration tested is shown in the photograph, *Figure 4. Conducted Emission From AC Mains Test* .

The emission voltages at the AMN's outputs were measured using a computerized receiver, complying with CISPR 16 requirements. The specification limits are
pre-loaded to the receiver 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, using peak detection.

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

4.3 Test Results

The E.U.T met the requirements of the FCC Part 15, Subpart C, Class **B** and RSS Gen, Issue 4, 2014, Section 8.8 specifications.

The margin between the emission levels and the specification limit is, in the worst case, 24.05 dB for the phase line at 0.150 MHz and 27.38 dB at 0.150 MHz for the neutral line.

The details of the highest emissions are given in *Figure 10* to *Figure 13.*

Conducted Emission

E.U.T Description	AllBe1 Multisensor
Type	00001
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart C, Class B RSS Gen, Issue 4, 2014, Section 8.8
Lead:	Phase
Detectors:	Quasi-peak, Average

EDIT PEAK LIST (Final Measurement Results)

Trace1: CE22BQP
Trace2: CE22BAP
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	150 kHz	33.95	-32.04
2	Average	150 kHz	31.94	-24.05
1	Quasi Peak	206 kHz	31.04	-32.32
2	Average	206 kHz	25.30	-28.06
2	Average	358 kHz	21.23	-27.54
1	Quasi Peak	378 kHz	25.93	-32.38
2	Average	578 kHz	14.20	-31.79
2	Average	722 kHz	12.25	-33.74
2	Average	890 kHz	12.83	-33.16
2	Average	1.142 MHz	9.60	-36.40
2	Average	1.29 MHz	12.87	-33.12
1	Quasi Peak	4.842 MHz	17.53	-38.46
1	Quasi Peak	11.31 MHz	17.18	-42.82
1	Quasi Peak	11.582 MHz	17.62	-42.37
1	Quasi Peak	12.006 MHz	18.66	-41.33
1	Quasi Peak	12.03 MHz	18.78	-41.21
1	Quasi Peak	12.122 MHz	18.51	-41.48
2	Average	12.486 MHz	11.64	-38.35
1	Quasi Peak	23.93 MHz	20.73	-39.26
2	Average	23.93 MHz	16.70	-33.29

Date: 28.AUG.2016 16:16:40

Figure 10. Detectors: Quasi-peak, Average

Note: DELTA LIMIT 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	AllBe1 Multisensor
Type	00001
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart C, Class B RSS Gen, Issue 4, 2014, Section 8.8
Lead:	Phase
Detectors:	Quasi-peak, Average

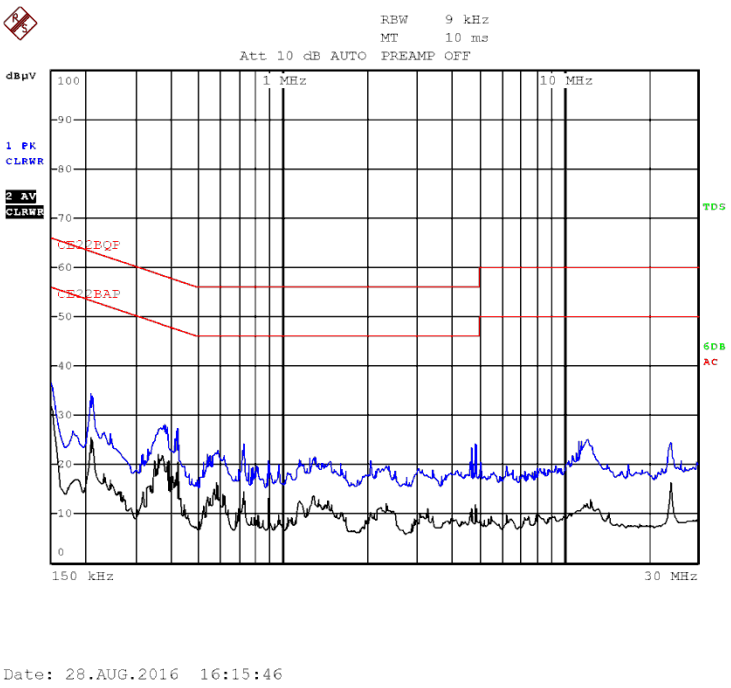

Figure 11 Detectors: Quasi-peak, Average

Conducted Emission

E.U.T Description	AllBe1 Multisensor
Type	00001
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart C, Class B RSS Gen, Issue 4, 2014, Section 8.8
Lead:	Neutral
Detectors:	Quasi-peak, Average

EDIT PEAK LIST (Final Measurement Results)

Trace1: CE22BQP
Trace2: CE22BAP
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	150 kHz	31.11	-34.89
2	Average	150 kHz	28.61	-27.38
1	Quasi Peak	210 kHz	28.12	-35.08
2	Average	210 kHz	22.58	-30.62
2	Average	370 kHz	15.35	-33.14
1	Quasi Peak	414 kHz	22.95	-34.61
1	Quasi Peak	10.778 MHz	17.48	-42.51
1	Quasi Peak	11.326 MHz	18.99	-41.00
2	Average	11.43 MHz	10.93	-39.06
1	Quasi Peak	11.594 MHz	19.82	-40.18
2	Average	12.13 MHz	12.37	-37.63
1	Quasi Peak	12.19 MHz	21.17	-38.82
2	Average	12.306 MHz	11.97	-38.03
1	Quasi Peak	12.322 MHz	21.06	-38.93
1	Quasi Peak	12.474 MHz	19.99	-40.00
1	Quasi Peak	12.498 MHz	20.18	-39.81
2	Average	12.498 MHz	13.31	-36.68
2	Average	12.526 MHz	10.78	-39.22
2	Average	13.318 MHz	11.55	-38.44
2	Average	23.93 MHz	13.55	-36.44

Date: 28.AUG.2016 16:23:53

Figure 12. Detectors: Quasi-peak, Average

Note: DELTA LIMIT 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	AllBe1 Multisensor
Type	00001
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart C, Class B RSS Gen, Issue 4, 2014, Section 8.8
Lead:	Neutral
Detectors:	Quasi-peak, Average

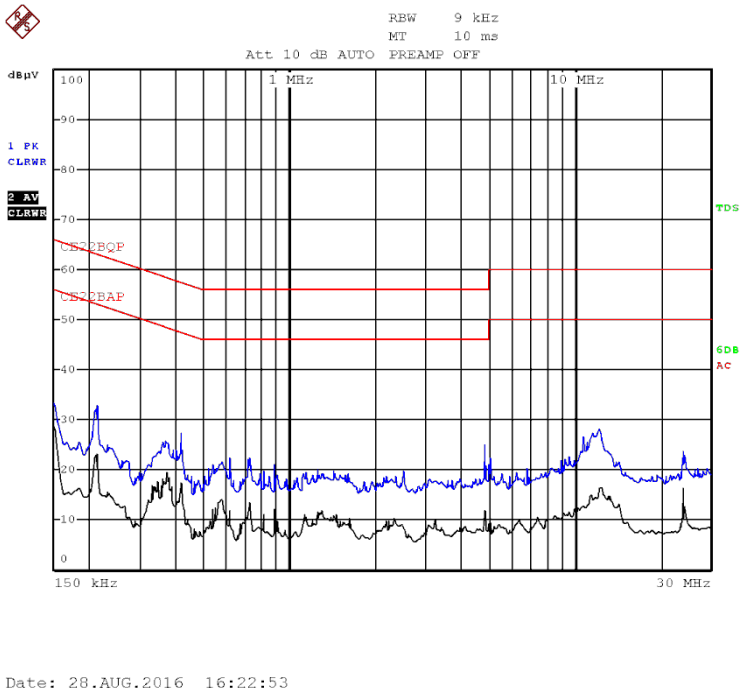

Figure 13 Detectors: Quasi-peak, Average

4.4 Test Equipment Used; Conducted Emissions from AC Mains

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
AMN	Fischer	FCC-LISN-25A	127	June 23, 2016	June 23, 2017
Transient Limiter	HP	11947A	3107A03041	June 15, 2016	June 15, 2017
EMI Receiver	Rohde & Schwarz	ESCI7	100724	February 29, 2016	March 1, 2017

Figure 14 Test Equipment Used

5 6dB Minimum Bandwidth

5.1 Test Specification

FCC Part 15, Subpart C, Section 247(a)(2)
RSS 247, Issue 1, 2015 , Section 5.2

5.2 Test Procedure

(Temperature (23°C)/ Humidity (60%RH))
The E.U.T operation mode and test set-up are as described in Section 2 of this report.
The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (loss=20.5 dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.
The spectrum bandwidth of the E.U.T. at the point of 6 dB below maximum peak power was measured and recorded. The RBW was set to 100 kHz.

5.3 Test Results

Operation Frequency (MHz)	Reading (MHz)	Specification (MHz)
2402	0.709	>0.5
2440	0.719	>0.5
2480	0.708	>0.5

Figure 15 6 dB Minimum Bandwidth

JUDGEMENT: Passed

For additional information see *Figure 16* to *Figure 18.*

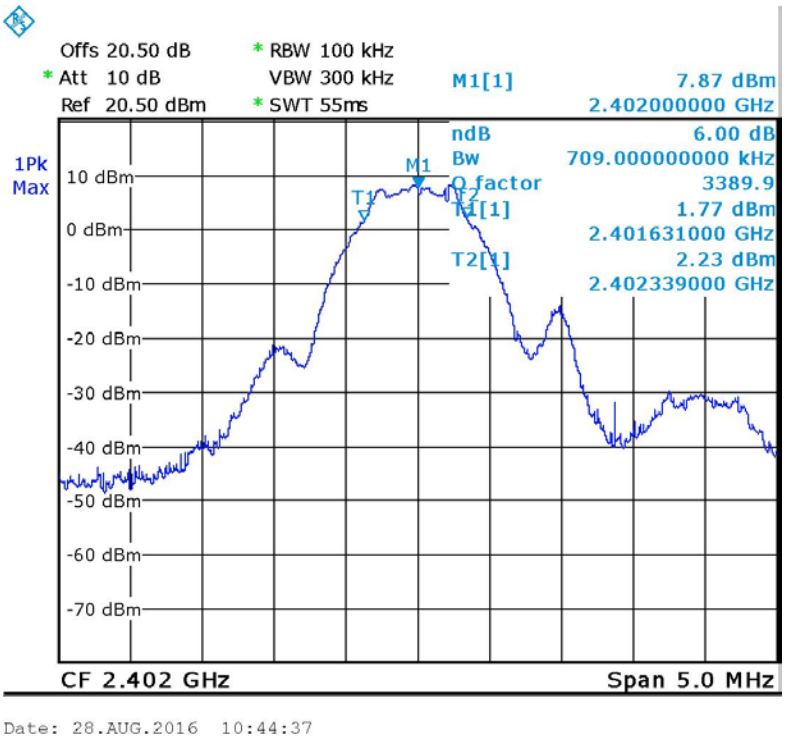

Figure 16. 2402.0 MHz

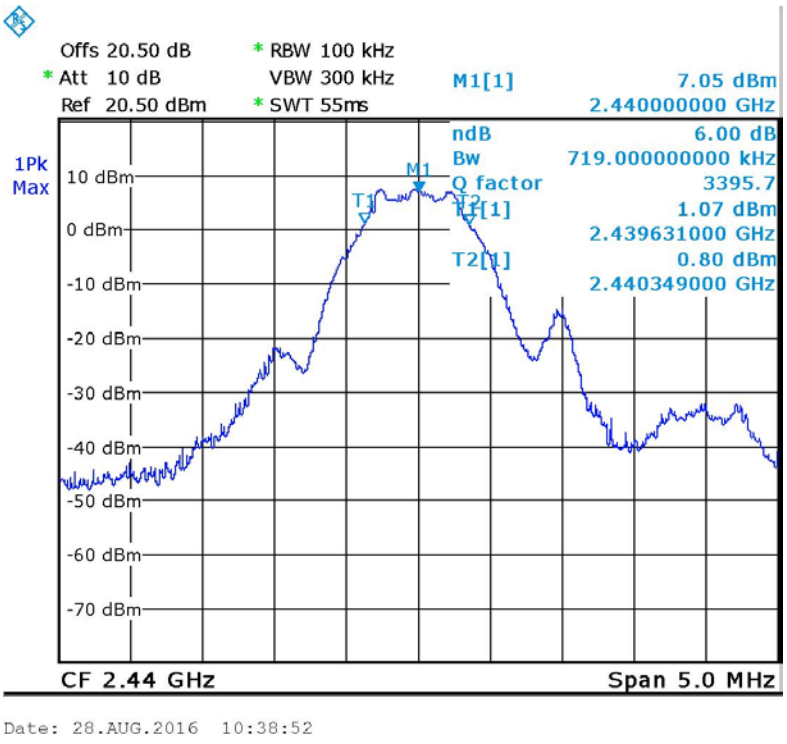

Figure 17. 2440.0 MHz

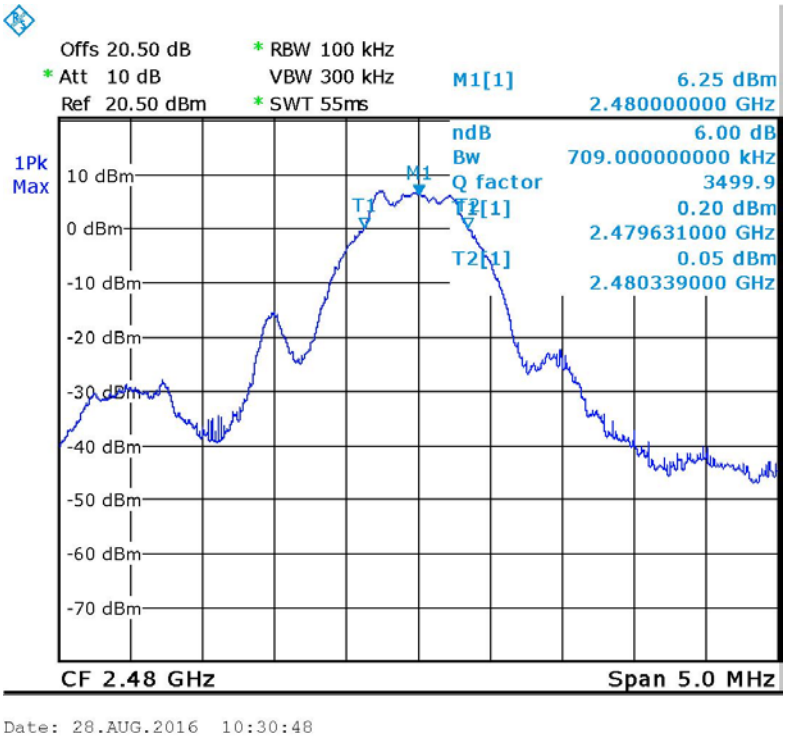

Figure 18. 2480.0 MHz

5.4 Test Equipment Used; 6dB Bandwidth

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	February 29, 2016	March 1, 2017
20 dB Attenuator	MCL	VAT-20W2+	848	July 5, 2016	July 5, 2017

Figure 19 Test Equipment Used

6 Maximum Transmitted Peak Power Output

6.1 Test Specification

FCC, Part 15, Subpart C, Section 247(b)(3)
RSS-247, Issue 1, May 2015, Section 5.4.4

6.2 Test Procedure

(Temperature (23°C)/ Humidity (60%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.
The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (loss=20.5 dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

The E.U.T was evaluated in 3 channels: Low (2402.0 MHz), Mid (2440.0 MHz) and High (2480 MHz).

6.3 Test Results

Operation Frequency (MHz)	Power (dBm)	Power (mW)	Specification (mW)	Margin (mW)
2402.0	9.23	8.38	1000.0	-991.62
2440.0	8.43	6.97	1000.0	-993.03
2480.0	7.91	6.18	1000.0	-993.82

Figure 20 Maximum Peak Power Output

JUDGEMENT: Passed by 991.62 mW

For additional information see *Figure 21* to *Figure 23.*

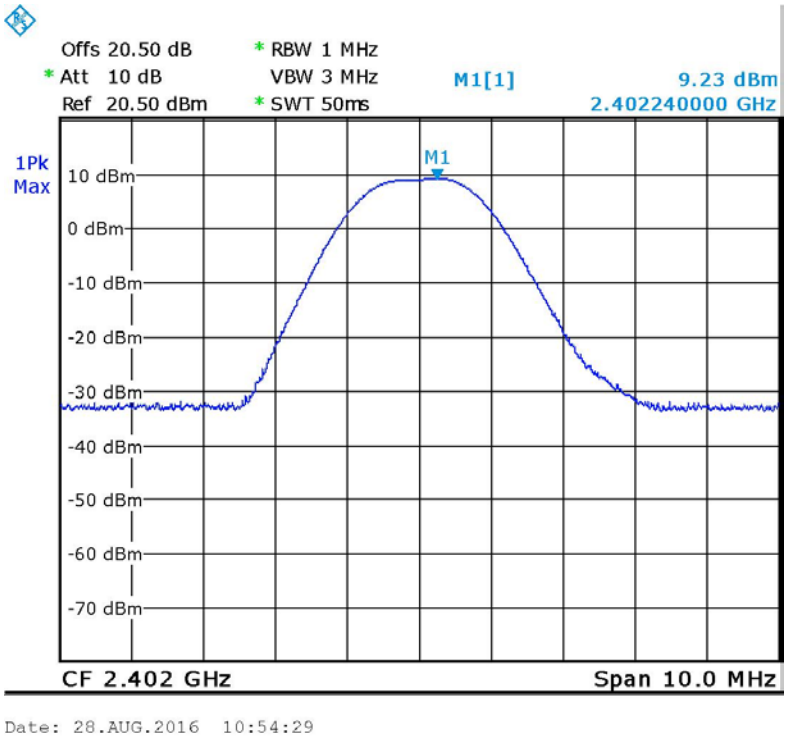

Figure 21 2402.0 MHz

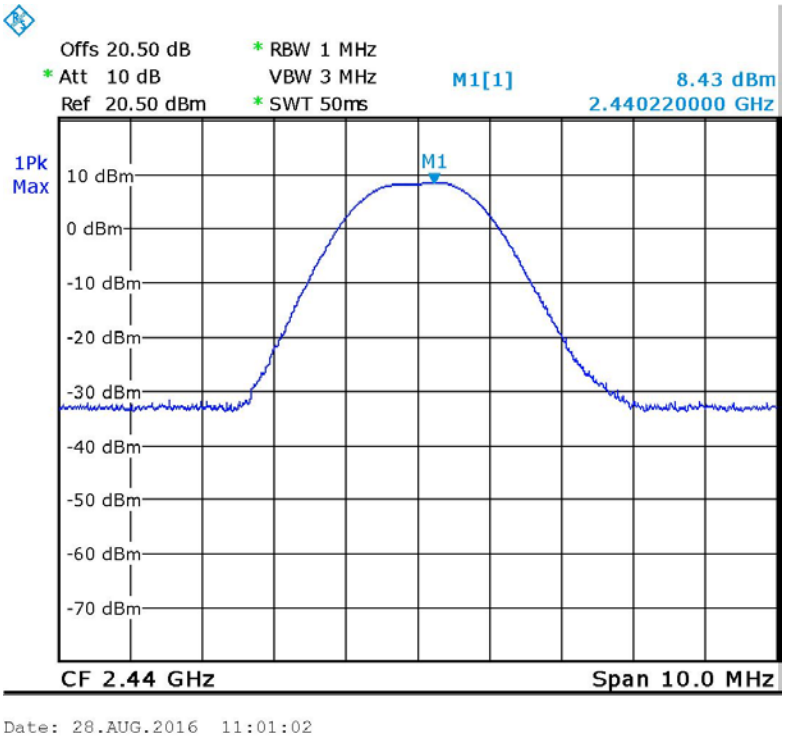

Figure 22 2440.0 MHz

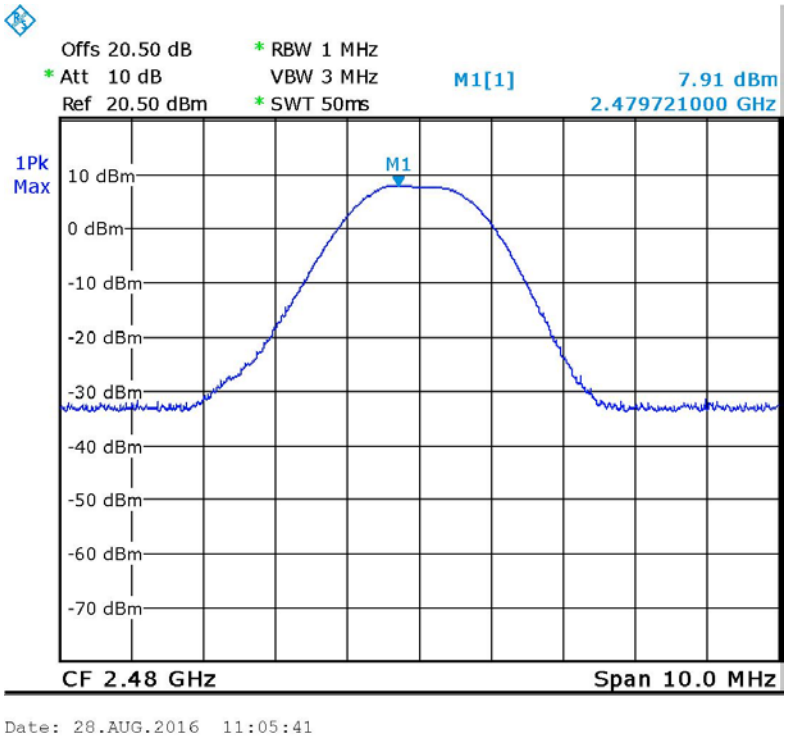

Figure 23 2480.0 MHz

6.4 Test Equipment Used; Maximum Peak Power Output

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	February 29, 2016	March 1, 2017
20 dB Attenuator	MCL	VAT-20W2+	848	July 5, 2016	July 5, 2017

Figure 24 Test Equipment Used

7 Band Edge Spectrum

7.1 Test Specification

FCC, Part 15, Subpart C, Section 247(d)
RSS-247, Issue 1, May 2015, Section 5.5

7.2 Test Procedure

(Temperature (23°C)/ Humidity (60%RH))

The E.U.T operation mode and test set-up are as described in Section 2.
The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (loss=20.5 dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

The E.U.T was evaluated in 2 channels: Low and High.

The RBW was set to 100 kHz.

7.3 Test Results

Operation Frequency (MHz)	Modulation	Band Edge Frequency (MHz)	Spectrum Level (dBm)	Limit (dBm)	Margin (dB)
Low	BLE	2400.0	-37.36	-10.77	-26.59
High	BLE	2483.5	-39.01	-12.09	-26.92

Figure 25 Band Edge Spectrum

JUDGEMENT: Passed by 26.59 dB

For additional information see *Figure 26* and *Figure 27*.

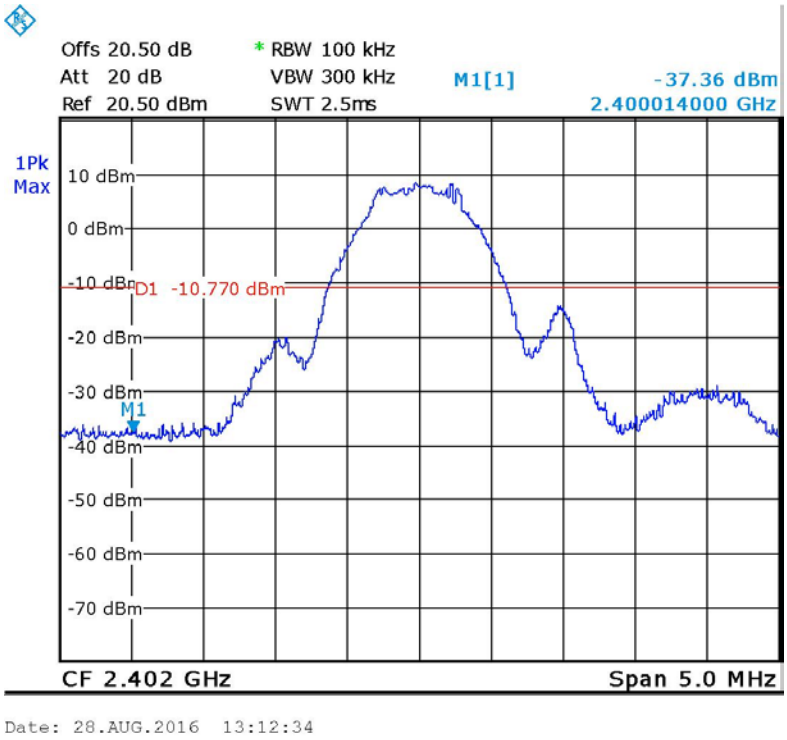

Figure 26 —Lower Band Edge

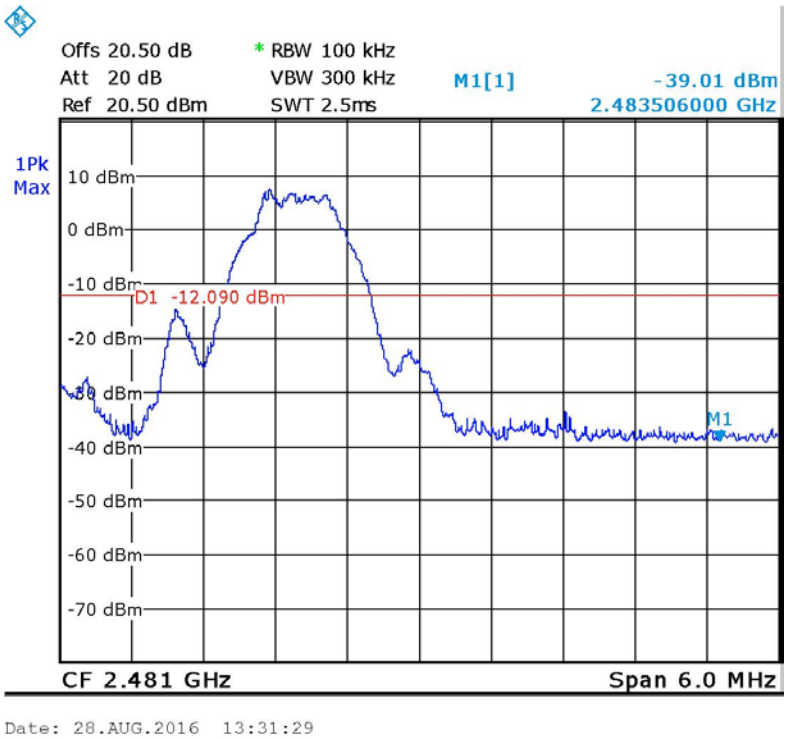

Figure 27 —Upper Band Edge

7.4 Test Equipment Used; Band Edge Spectrum

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	February 29, 2016	March 1, 2017
20 dB Attenuator	MCL	VAT-20W2+	848	July 5, 2016	July 5, 2017

Figure 28 Test Equipment Used

8 Emissions in Non-Restricted Frequency Bands

8.1 Test Specification

FCC, Part 15, Subpart C, Section 247(d)
RSS 247 Issue 1 May 2015, Clause 5.5

8.2 Test Procedure

(Temperature (23°C)/ Humidity (60%RH))

For measurements between 0.009MHz-30.0MHz:

The E.U.T was tested inside the chamber at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The frequency range 0.009MHz-30MHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

For measurements between 30.0MHz-1.0GHz:
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 30.0MHz -1.0GHz was scanned and the list of the highest emissions was verified and updated accordingly.
The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

For 1000.0MHz-25,000.0MHz range:

The E.U.T was placed in the chamber and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The configuration tested is shown in *Figure 3*.

The frequency range 1000 MHz-25000 MHz was scanned.

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

The emissions were measured at a distance of 3 meters.

The E.U.T. was operated at the low, mid and high channels.
(2402, 2440, 2480 MHz).

8.3 Test Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

8.4 Test Results

JUDGEMENT: Passed

All signals were below the EMI receiver noise level which is at least 6dB below the specification limit.

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 247(d) and RSS 247 Issue 1 May 2015, Clause 5.5 specification.

8.5 Test Instrumentation Used, Emission in Non Restricted Frequency Bands

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	February 29, 2016	March 1, 2017
Spectrum Analyzer	HP	8592L	3826A01204	March 13, 2016	March 13, 2017
EMI Receiver	HP	8542E	3906A00276	March 3, 2016	March 3, 2017
RF Filter Section	HP	85420E	3705A00248	March 3, 2016	March 3, 2017
Spectrum Analyzer	HP	8564E	3442A00275	March 10, 2016	March 10, 2017
Biconical Antenna	EMCO	3110B	9912-3337	March 24, 2016	March 24, 2018
Log Periodic Antenna	EMCO	3146	9505-4081	April 23, 2016	April 23, 2017
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
Horn Antenna	ARA	SWH-28	1007	March 3, 2014	September 30, 2016
Active Loop Antenna	EMCO	6502	9506-2950	November 4, 2015	November 30, 2016
Low Noise Amplifier	Narda	DBS-0411N313	13	August 8, 2016	August 8, 2017
Low Noise Amplifier	Sophia Wireless	LNA28-B	232	August 8, 2016	August 8, 2017
Spectrum Analyzer	HP	8593EM	3536A00120 ADI	March 10, 2016	March 10, 2017
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	N/A	N/A
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

9 Emissions in Restricted Frequency Bands

9.1 Test Specification

FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)
RSS GEN, Issue 4: 2014, Clause 8.9; 8.10

9.2 Test Procedure

(Temperature (23°C)/ Humidity (60%RH))

For measurements between 0.009MHz-30.0MHz:

The E.U.T was tested inside the chamber at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The frequency range 0.009MHz-30MHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

For measurements between 30.0MHz-1.0GHz:
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 30.0MHz -1.0GHz was scanned and the list of the highest emissions was verified and updated accordingly.
The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

For 1000.0MHz-25,000.0MHz range:

The E.U.T was placed in the chamber and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The configuration tested is shown in *Figure 3*.

The frequency range 1000 MHz-25000 MHz was scanned.

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

The emissions were measured at a distance of 3 meters.

The E.U.T. was operated at the low, mid and high channels.
(2402, 2440, 2480 MHz).

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.
Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)	Field strength* (dBµV/m)	Field strength* (dBµV/m)@3m
0.009-0.490	2400/F(kHz)	300	48.5-13.8	128.5-73.8
0.490-1.705	24000/F(kHz)	30	33.8-23.0	73.8-63.0
1.705-30.0	30	30	29.5	69.5
30-88	100	3	40.0	40.0
88-216	150	3	43.5	43.5
216-960	200	3	46.0	46.0
Above 960	500	3	54.0	54.0

*The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector. For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

Figure 30 Table of Limits

9.3 Test Results

JUDGEMENT: Passed by 1.9 dB

For the operation frequency of 2402 MHz, the margin between the emission level and the specification limit is in the worst case 1.1 dB at the frequency of 4804.0MHz, vertical polarization.

For the operation frequency of 2440 MHz, the margin between the emission level and the specification limit is in the worst case 11.7 dB at the frequency of 4880.0 MHz, vertical polarization.

For the operation frequency of 2480 MHz, the margin between the emission level and the specification limit is in the worst case 1.9 dB at the frequency of 2483.5 MHz, vertical polarization.

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 31* to *Figure 34.*

Radiated Emission

E.U.T Description AllBe1 Multisensor
Type 00001
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 9KHz to 25.0 GHz
Test Distance: 3 meters Detector: Peak

Operation Frequency (MHz)	Frequency (MHz)	Polarity (H/V)	Peak Reading (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)
2402.0	2390.0	H	59.2	74.0	-14.8
2402.0	2390.0	V	59.7	74.0	-14.3
2402.0	4804.0	H	58.6	74.0	-15.4
2402.0	4804.0	V	59.7	74.0	-14.3
2402.0	7206.0	H	48.5	74.0	-25.5
2402.0	7206.0	V	49.8	74.0	-24.2
2402.0	9608.0	H	49.1	74.0	-24.9
2402.0	9608.0	V	52.3	74.0	-21.7
2402.0	12010.0	H	46.4	74.0	-27.6
2402.0	12010.0	V	50.0	74.0	-24.0
2440.0	4890.0	H	50.4	74.0	-23.6
2440.0	4890.0	V	51.8	74.0	-22.2
2440.0	7320.0	H	46.1	74.0	-27.9
2440.0	7320.0	V	44.2	74.0	-29.8

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 Amp" includes correction factor.

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

Radiated Emission

E.U.T Description AllBe1 Multisensor
Type 00001
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 9KHz to 25.0 GHz
Test Distance: 3 meters Detector: Peak

Operation Frequency (MHz)	Frequency (MHz)	Polarity (H/V)	Peak Reading (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)
2480.0	4960.3	H	50.4	74.0	-23.6
2480.0	4960.0	V	44.8	74.0	-29.2
2480.0	7439.2	H	50.2	74.0	-23.8
2480.0	7439.4	V	44.9	74.0	-29.1
2480.0	2483.5	H	63.0	74.0	-11.0
2480.0	2483.5	V	62.1	74.0	-11.9

Figure 32. 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

E.U.T Description AllBe1 Multisensor
Type 00001
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 9KHz to 25.0 GHz
Test Distance: 3 meters
Detector: Average

Operation Frequency (MHz)	Frequency (MHz)	Polarity (H/V)	Average Reading (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)
2402.0	2390.0	H	49.1	54.0	-4.9
2402.0	2390.0	V	49.5	54.0	-4.5
2402.0	4804.0	H	52.2	54.0	-1.8
2402.0	4804.0	V	52.9	54.0	-1.1
2402.0	7206.0	H	42.8	54.0	-11.2
2402.0	7206.0	V	41.0	54.0	-13.0
2402.0	9608.0	H	39.2	54.0	-14.8
2402.0	9608.0	V	42.3	54.0	-11.7
2402.0	12010.0	H	39.3	54.0	-14.7
2402.0	12010.0	V	42.5	54.0	-11.5
2440.0	4880.0	H	42.3	54.0	-11.7
2440.0	4880.0	V	41.5	54.0	-12.5
2440.0	7320.0	H	41.7	54.0	-12.3
2440.0	7320.0	V	37.1	54.0	-16.9

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 AllBe1 Multisensor
Type 00001
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 9KHz to 25.0 GHz
Test Distance: 3 meters
Detector: Average

Operation Frequency (MHz)	Frequency (MHz)	Polarity (H/V)	Average Reading (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)
2480.0	4960.3	H	43.5	54.0	-10.5
2480.0	4960.0	V	37.7	54.0	-16.3
2480.0	7439.3	H	43.2	54.0	-10.8
2480.0	7439.3	V	34.6	54.0	-19.4
2480.0	2483.5	H	52.1	54.0	-1.9
2480.0	2483.5	V	51.2	54.0	-2.8

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

9.4 Test Instrumentation Used; Emissions in Restricted Frequency Bands

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	February 29, 2016	March 1, 2017
Spectrum Analyzer	HP	8592L	3826A01204	March 13, 2016	March 13, 2017
EMI Receiver	HP	8542E	3906A00276	March 3, 2016	March 3, 2017
RF Filter Section	HP	85420E	3705A00248	March 3, 2016	March 3, 2017
Spectrum Analyzer	HP	8564E	3442A00275	March 10, 2016	March 10, 2017
Biconical Antenna	EMCO	3110B	9912-3337	March 24, 2016	March 24, 2018
Log Periodic Antenna	EMCO	3146	9505-4081	April 23, 2016	April 23, 2017
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
Horn Antenna	ARA	SWH-28	1007	March 3, 2014	September 30, 2016
Active Loop Antenna	EMCO	6502	9506-2950	November 4, 2015	November 30, 2016
Low Noise Amplifier	Narda	DBS-0411N313	13	August 8, 2016	August 8, 2017
Low Noise Amplifier	Sophia Wireless	LNA28-B	232	August 8, 2016	August 8, 2017
Spectrum Analyzer	HP	8593EM	3536A00120 ADI	March 10, 2016	March 10, 2017
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	N/A	N/A
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 35 Test Equipment Used

10 Transmitted Power Density

10.1 Test Specification

FCC, Part 15, Subpart C, Section 247(e)
RSS-247, Issue 1:2015, Clause 5.2(2)

10.2 Test Procedure

(Temperature (23°C)/ Humidity (60%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (loss=20.5 dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

The spectrum analyzer was set to 3 kHz RBW and VBW to 10 kHz.

The E.U.T was evaluated in 3 channels: Low (2402.0MHz), Mid (2440.0MHz) and High (2480.0MHz).

10.3 Test Results

Operation Frequency (MHz)	Reading Spectrum Analyzer (dBm)	Antenna Gain (dBi)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
2402.0	-4.88	2.5	-2.38	8.0	-10.38
2440.0	-6.04	2.5	-3.54	8.0	-11.54
2480.0	-6.58	2.5	-4.08	8.0	-12.08

Figure 36 Test Results

JUDGEMENT: Passed by 11.54 dB

For additional information see *Figure 37* to *Figure 39.*

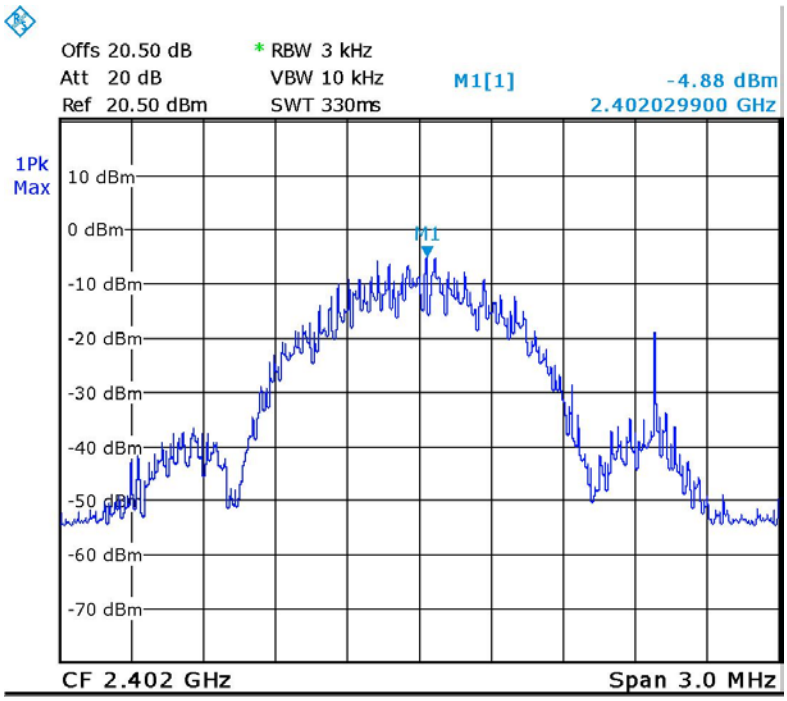

Figure 37 — 2402.0 MHz

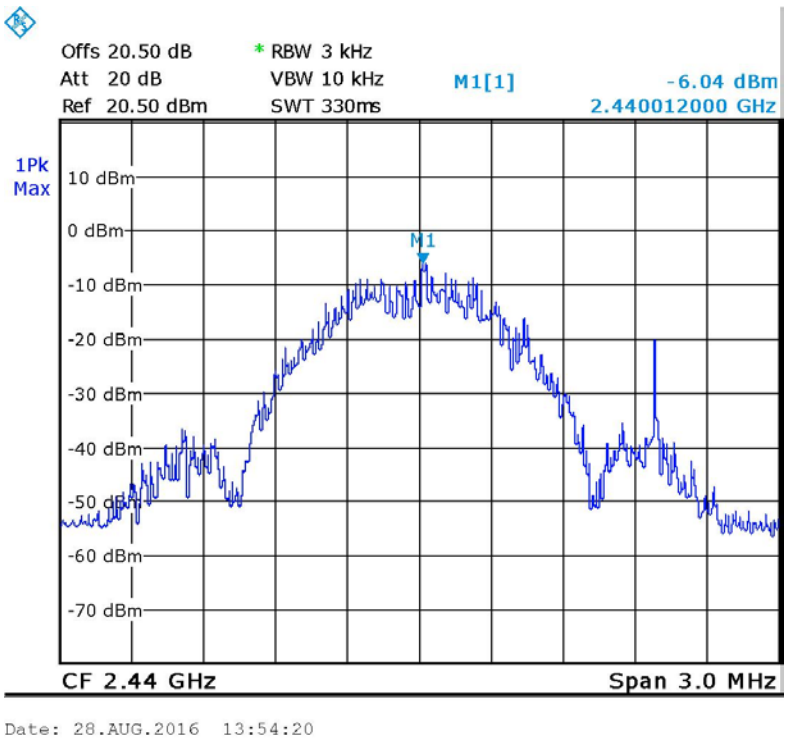

Figure 38 — 2440.0 MHz

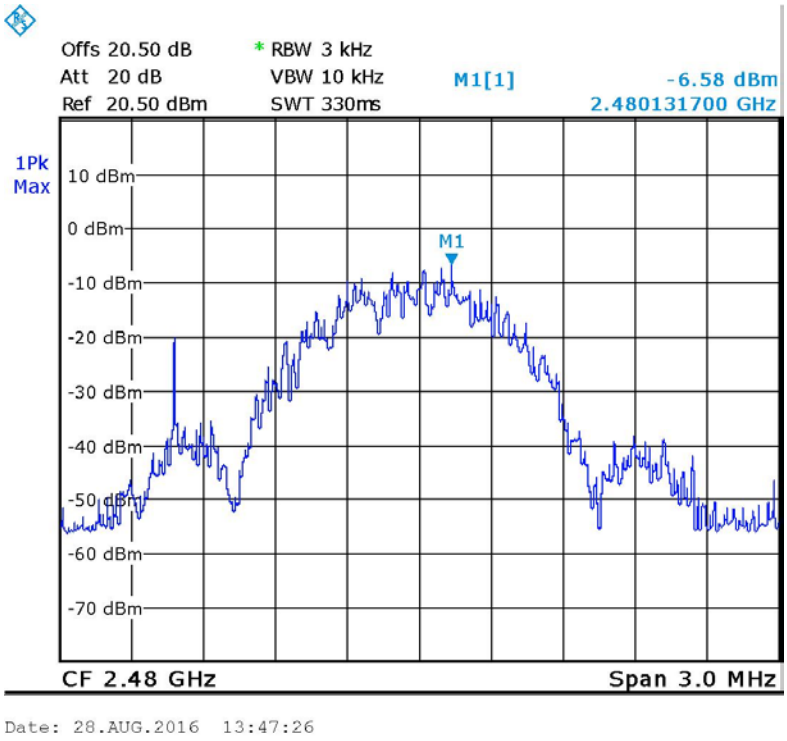

Figure 39 — 2480.0 MHz

10.4 Test Equipment Used; Transmitted Power Density

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	February 29, 2016	March 1, 2017
20 dB Attenuator	MCL	VAT-20W2+	848	July 5, 2016	July 5, 2017

Figure 40 Test Equipment Used

11 Antenna Gain/Information

The antenna gain is 2.5 dBi, internal.

12 AVG. Factor Calculation

1. Pulse period = 1msec (worst scenario)
2. Pulse duration = 1msec (worst scenario)
3. Burst duration = 0.185msec
4. $$\text{Average Factor} = 10\log\left[\frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{burst duration}}{100\text{msec}} \times \text{Num of burst within } 100\text{msec}\right]$$

$$\text{Average Factor} = 10\log\left[1 * \frac{0.185}{100} * 0.3\right] = -32.6dB$$

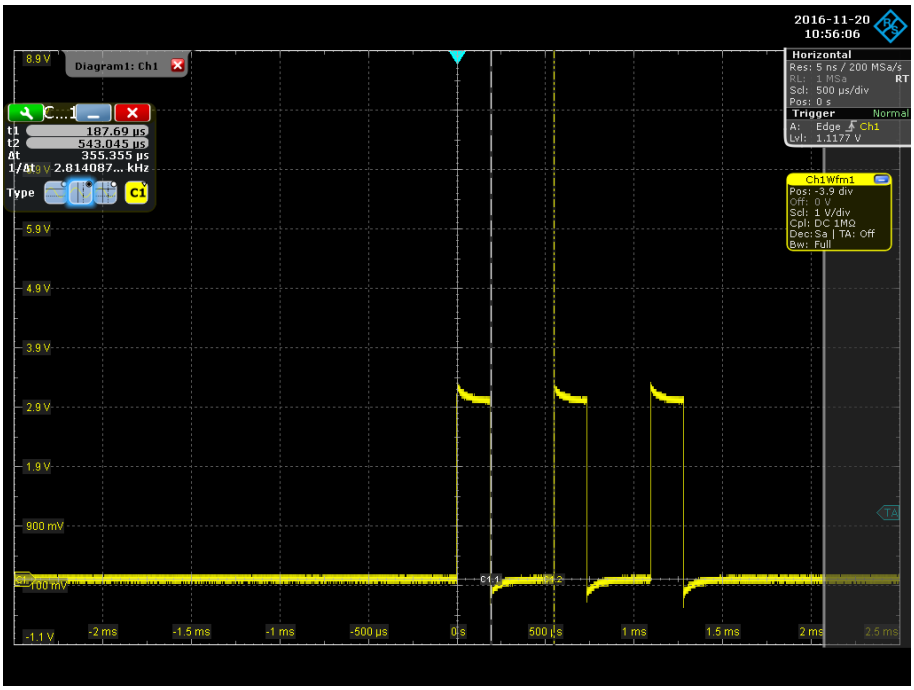

Figure 41 Pulse Duration and no. of bursts

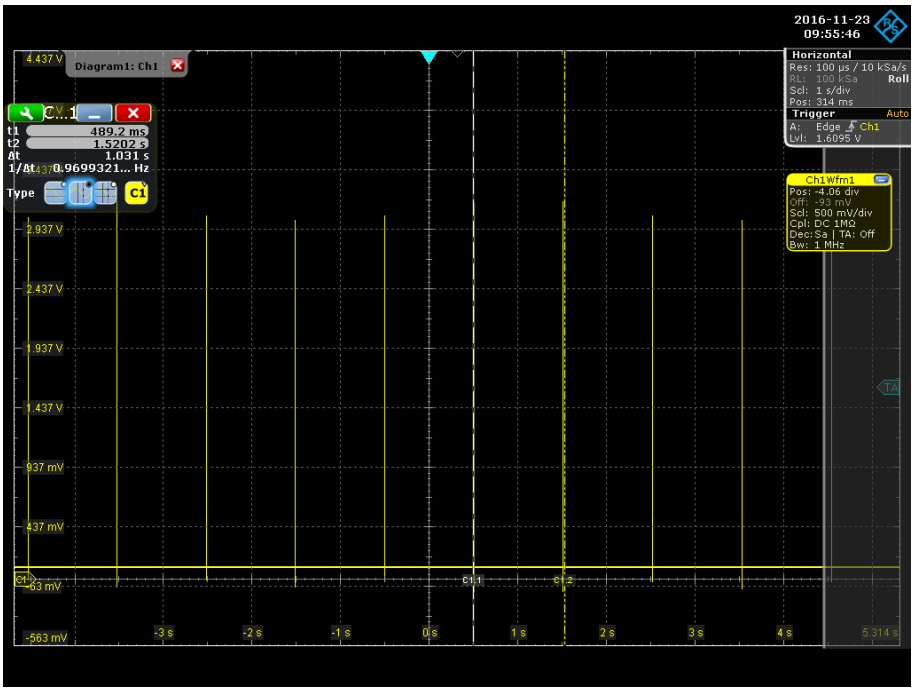

Figure 42 No. of Bursts in 1s

Note: Due to the short pulse duration, the three bursts appear together.

13 R.F Exposure/Safety

Typical use of the E.U.T. is as a multi sensor.
The typical distance between the E.U.T. and the user is 0.2 cm.

Calculation of Maximum Permissible Exposure (MPE)
Based on FCC Section 1.1310 and RSS 102, Issue 5, Section 2.5.2 Requirements

(a) FCC limits at 2402 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

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

P_t- Transmitted Power 9.23 dBm (Peak) = 8.38 mW
G_T- Antenna Gain, 2.5 dBi = 1.78 numeric
R- Distance from Transmitter using 0.2cm worst case
AVG Factor calculation per page 37 of this report = -32.6dB
9.23 dBm – 32.6 dB = -23.37dBm = 0.0046 mW transmitter power

(c) The peak power density is:

$$S = \frac{(0.0046 \times 1.78)}{4\pi(.2)^2} = 0.016\frac{mW}{cm^2}$$

(d) This is below the FCC limit.

Continued on following page

(e) For IC per Table 1 of RSS 102 Issue 5, SAR exemption based on IC limit of 4mW at a separation distance of ≤5mm=0.2cm at 2450 MHz. EUT power transmission is 0.0046mW which is below the 4mW SAR exemption.

g) Per section 2.5.2 of RSS 102 Issue 5 Exemption Limits for Routine Evaluation – RF exposure Evaluation the limit is:
at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz.

f=2402
$2402^{0.6834}$=204.31
0.0131 x 204.31 =2.67W Limit
The E.U.T's power of 0.0046mW transmitted power is less than 2.67W limit. The EUT is therefore exempt from RF exposure calculation.

14 APPENDIX A - CORRECTION FACTORS

14.1 Correction factors for CABLE from EMI receiver

to test antenna at 3 meter range.

Frequency (MHz)	Cable Loss (dB)	Frequency (MHz)	Cable Loss (dB)
0.010	0.4	50.00	1.2
0.015	0.2	100.00	0.7
0.020	0.2	150.00	2.1
0.030	0.3	200.00	2.3
0.050	0.3	300.00	2.9
0.075	0.3	500.00	3.8
0.100	0.2	750.00	4.8
0.150	0.2	1000.00	5.4
0.200	0.3	1500.00	6.7
0.500	0.4	2000.00	9.0
1.00	0.4	2500.00	9.4
1.50	0.5	3000.00	9.9
2.00	0.5	3500.00	10.2
5.00	0.6	4000.00	11.2
10.00	0.8	4500.00	12.1
15.00	0.9	5000.00	13.1
20.00	0.8	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 factor for RF CABLE for Semi Anechoic Chamber

FREQ (MHz)	LOSS (dB)
1000.0	1.5
2000.0	2.1
3000.0	2.7
4000.0	3.1
5000.0	3.5
6000.0	4.1
7000.0	4.6
8000.0	4.9
9000.0	5.7
10000.0	5.7
11000.0	6.1
12000.0	6.1
13000.0	6.2
14000.0	6.7
15000.0	7.4
16000.0	7.5
17000.0	7.9
18000.0	8.1
19000.0	8.8
20000.0	9.1

NOTES:

1. *The cable is manufactured by Commscope*
2. *The cable type is 0623 WBC-400, serial # G020132 and 10m long*
3. *ITL # 1840*

14.3 Correction factors for Low Loss CABLE

Huber Suner #1696
Serial No. 705A009301 EIM

FREQ (MHz)	INPUT (dBm)	OUTPUT (dBm)	LOSS (dB)
1000.0	-10	-10.7	0.7
2000.0	-10	-10.7	0.7
3000.0	-10	-10.6	0.6
4000.0	-10	-10.5	0.5
5000.0	-10	-10.7	0.7
6000.0	-10	-10.8	0.8
7000.0	-10	-10.8	0.8
8000.0	-10	-11.0	1.0
9000.0	-10	-10.5	0.5
10000.0	-10	-10.3	0.3
11000.0	-10	-10.5	0.5
12000.0	-10	-11.3	1.3
13000.0	-10	-11.6	1.6
14000.0	-10	-11.8	1.8
15000.0	-10	-11.0	1.0
16000.0	-10	-10.6	0.6
17000.0	-10	-12.0	2.0
18000.0	-10	-11.6	1.6

14.4 Correction factors for Horn Antenna

Model: SWH-28
at 1 meter range.

Frequency, MHz	Measured antenna factor, dB/m 1)
18000	33.0
18500	32.9
19000	33.1
19500	33.3
20000	33.6
20500	33.6
21000	33.4
21500	33.8
22000	33.7
22500	33.9
23000	34.8
23500	34.5
24000	34.2
24500	34.8
25000	34.4
25500	35.2
26000	35.9
26500	36.0

14.5 Correction factors for Horn ANTENNA.

Model: 3115

Antenna serial number: 29845

3 meter range

f(GHz)	AF(dB/m)	GA(dB)
0.75	25	3
1G	23.5	7
1.5G	26	8
2G	29	7
2.5G	27.5	10
3G	30	10
3.5G	31.5	10
4G	32.5	9.5
4.5G	32.5	10.5
5G	33	10.5
5.5G	35	10.5
6G	36.5	9.5
6.5G	36.5	10
7G	37.5	10
7.5G	37.5	10
8G	37.5	11
8.5G	38	11
9G	37.5	11.5
9.5G	38	11.5
10G	38.5	11.5
10.5G	38.5	12
11G	38.5	12.5
11.5G	38.5	13
12G	38	13.5
12.5G	38.5	13
13G	40	12
13.5G	41	12
14G	40	13
14.5G	39	14
15G	38	15.5
15.5G	37.5	16
16G	37.5	16
16.5G	39	15
17G	40	15
17.5G	42	13.5
18G	42.5	13

14.6 Correction factors for Log Periodic Antenna EMCO, Model 3146, Serial #9505-4081

Frequency [MHz]	AF [dB/m]
200.0	11.47
250.0	12.06
300.0	14.77
400.0	15.77
500.0	18.01
600.0	18.84
700.0	20.93
800.0	21.27
900.0	22.44
1000.0	24.10

14.7 Correction factors for ACTIVE LOOP ANTENNA

Model 6502
S/N 9506-2950

f(MHz)	MAF(dBs/m)	AF(dB/m)
0.01	-33.1	18.4
0.02	-37.2	14.3
0.03	-38.2	13.3
0.05	-39.8	11.7
0.1	-40.1	11.4
0.2	-40.3	11.2
0.3	-40.3	11.2
0.5	-40.3	11.2
0.7	-40.3	11.2
1	-40.1	11.4
2	-40	11.5
3	-40	11.5
4	-40.1	11.4
5	-40.2	11.3
6	-40.4	11.1
7	-40.4	11.1
8	-40.4	11.1
9	-40.5	11
10	-40.5	11
20	-41.5	10
30	-43.5	8

14.8 Correction factors for Biconical Antenna EMCO, Model 3110B, Serial #9912-3337

Frequency [MHz]	AF [dB/m]
30.0	14.18
35.0	13.95
40.0	12.84
45.0	11.23
50.0	11.10
60.0	10.39
70.0	9.34
80.0	9.02
90.0	9.31
100.0	8.95
120.0	11.53
140.0	12.20
160.0	12.56
180.0	13.49
200.0	15.27