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DATE: 17 May 2016

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

FCC/IC Radio Test Report

for

Pointer Telocation

Equipment under test:

All in One Multi-Sensing Device

MultiSense-TH P/N 715-50200, MultiSense P/N 715-50100

*See customer's Declaration on page 6

Tested by: _____
M. Zohar

Approved by: _____
D. Shidlowsky

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Measurement/Technical Report for

Pointer Telocation

All in One Multi-Sensing Device

MultiSense-TH P/N 715-50200

FCC ID: 2AG69MS

IC: 9975A-MS

This report concerns:	Original Grant: X Class I Change: Class II Change:
Equipment type:	FCC: 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 v03r03 and ANSI C63.10:2013.

Application for Certification
prepared by:
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Applicant for this device:
(different from "prepared by")
Igor Rogov
Pointer Telocation
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1. General Information

1.1 *Administrative Information*

Manufacturer:	Pointer Telocation
Manufacturer's Address:	14 Hamelacha St., Rosh Ha'ayin,48091 Israel Tel: +972-3-572-3111 Fax: +972-3-572-3100
Manufacturer's Representative:	Igor Rogov
Equipment Under Test (E.U.T):	All in One Multi-Sensing Device
Product Marketing Name (PMN):	1. MultiSense-TH P/N 715-50200, 2. MultiSense P/N 715-50100*
Equipment Serial No.:	Not designated
HVIN:	1. D 2. C
Date of Receipt of E.U.T:	20.12.2015
Start of Test:	21.12.2015
End of Test:	23.12.2015
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

*See customer's Declaration on following page.

POINTER

DECLARATION

Date: 17/5/2016

I HEREBY DECLARE THE FOLLOWING REGARDING THE BELOW MODELS:

#	Product name	P/N	HVIN
1	MultiSense	715-50100	C
2	MultiSense-TH	715-50200	D

These models use an identical PCB. The difference between the models is that MultiSense (P/N 715-50100) has a temperature sensor chip while the MultiSense-TH (P/N 715-50200) has a single combined chip of temperature and humidity with a filter and a corresponding hole in the Lexan to permit humidity measuring.

Please relate to them (from an EMC/RADIO point of view) as the same product.

IGOR ROGOV
17-05-2016
VP R&D

Signature
Igor Rogov
VP R&D
Pointer Telocation Inc.

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*

All in one multi-sensing device including humidity sensor for cargo and cold chain monitoring, supporting short range RF communication.

Model name	MultiSense-TH
Working voltage	DC battery operated
Mode of operation	Transceiver BLE
Modulations	GFSK
Assigned Frequency Range	2400.0MHz-2483.5MHz
Operating Frequency Range	2402.0MHz-2480.0MHz
Transmit power	7.0dBm
Antenna Gain	0.5 dBi
Modulation BW	>500.0kHz
Temperature (°C)/ Humidity (%RH)	22.0°C /44.0%

1.4 Test Methodology

Both conducted and radiated testing was performed according to the procedures in KDB 558074 D01 v03r03 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*

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):

± 4.98 dB

2. System Test Configuration

2.1 *Justification*

Conducted emission tests were performed with the E.U.T. antenna terminal connected by a RF cable to the Spectrum Analyzer through a 20dB external attenuator.
For radiated emission tests, exploratory emission testing was performed in 3 orthogonal polarities to determine the worst case regarding spurious emission in the restricted band section.

The results are shown in the below tables:

Frequency (MHz)	**Y axis** (dBuV/m)	**X axis** (dBuV/m)	**Z axis** (dBuV/m)
2402.0	94.4	90.1	87.3
2440.0	94.2	91.1	93.4
2480.0	97.4	94.9	95.1

Frequency	**Y axis**			**X axis**			**Z axis**		
(MHz)	2nd Harmonic	3rd Harmonic	Band-Edge	2nd Harmonic	3rd Harmonic	Band Edge	2nd Harmonic	3rd Harmonic	Band Edge
2402.0	33.1	37.6	18.0	33.0	37.5	17.5	32.9	37.6	17.0
2440.0	33.3	37.8	-	33.3	37.9	-	33.3	37.8	-
2480.0	33.5	39.1	16.7	33.5	38.9	16.3	33.5	38.8	15.3

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.

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*

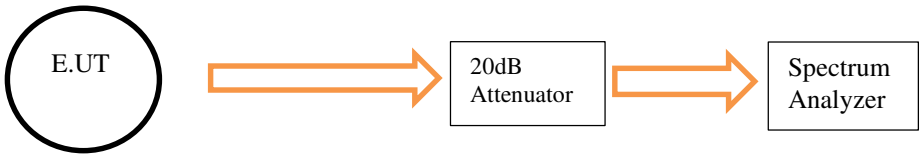

Figure 2. Configuration of Tested System – Conducted Emissions from Antenna Terminal

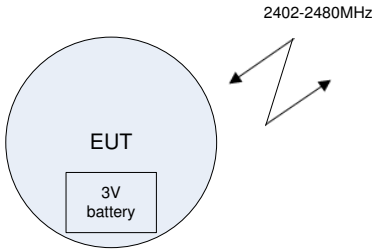

Figure 3. Configuration of Tested System Radiated

3. Conducted & Radiated Measurement Test Set-Up Photos

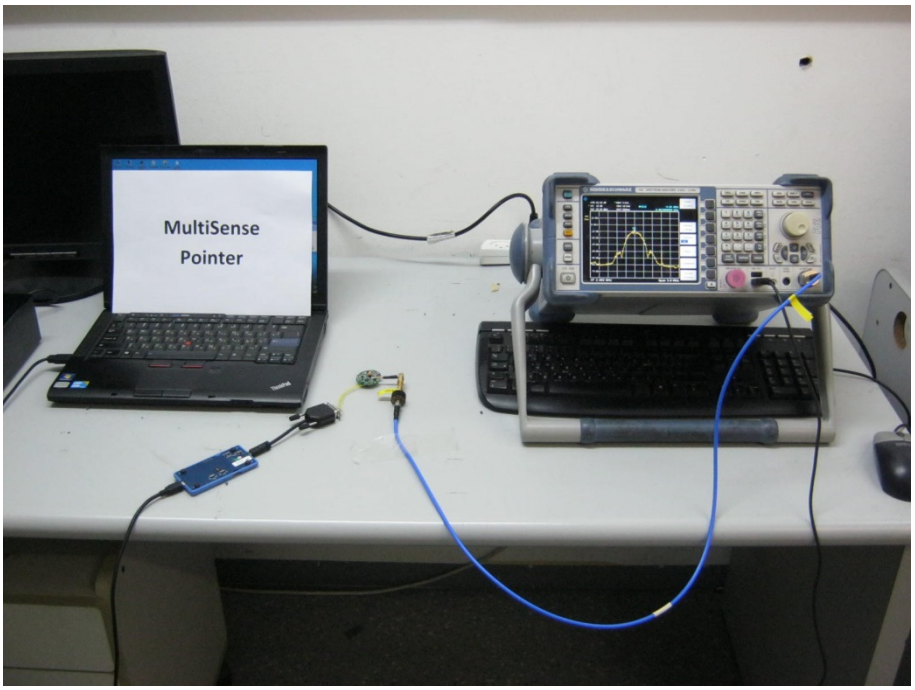

Figure 4. Conducted Emission from Antenna Terminal Test

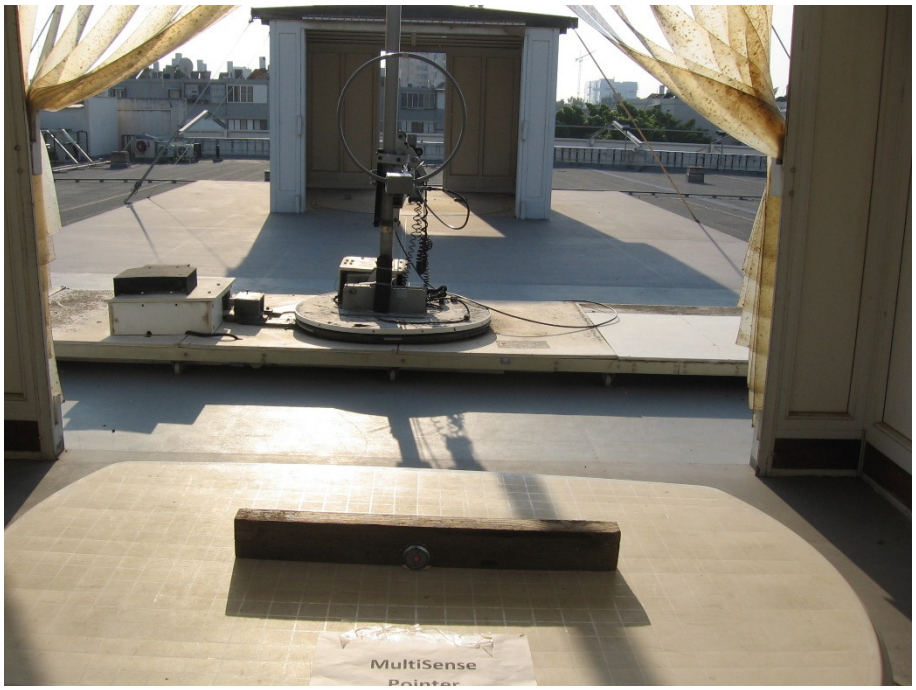

Figure 5. Radiated Emission Test

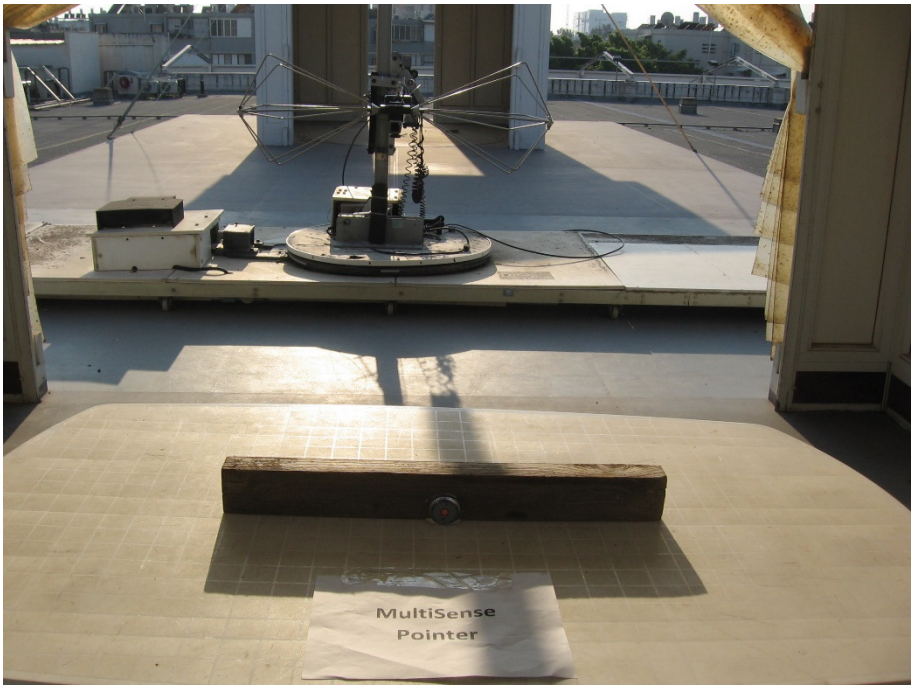

Figure 6. Radiated Emission Test

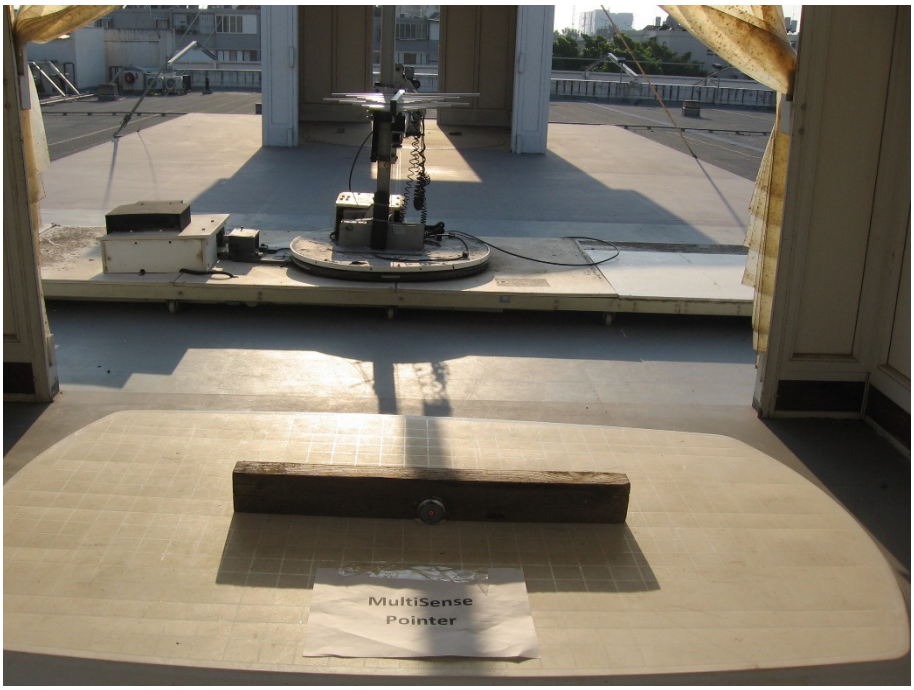

Figure 7. Radiated Emission Test

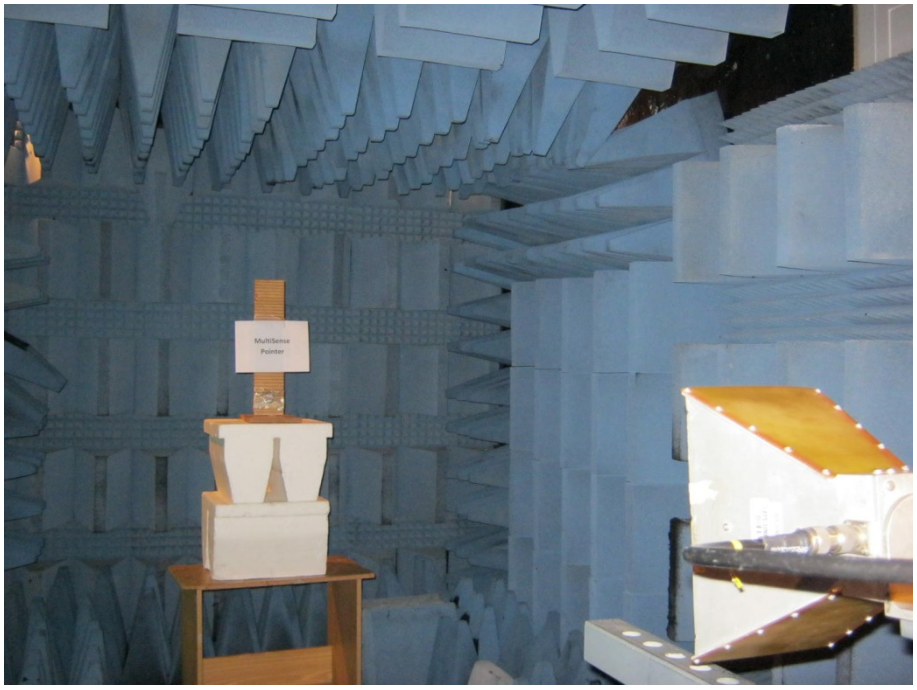

Figure 8. Radiated Emission Test

4. 6 dB Minimum Bandwidth

4.1 *Test Specification*

FCC Part 15, Subpart C, Section 247(a)(2)
RSS GEN 2014, Section 6.6

4.2 *Test Procedure*

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.

4.3 *Test Results*

Operation Frequency (MHz)	Reading (MHz)	Specification (MHz)
2402.0	0.699	>0.5
2440.0	0.689	>0.5
2480.0	0.689	>0.5

Figure 9 6 dB Minimum Bandwidth

JUDGEMENT: Passed

For additional information see *Figure 10* to *Figure 12*.

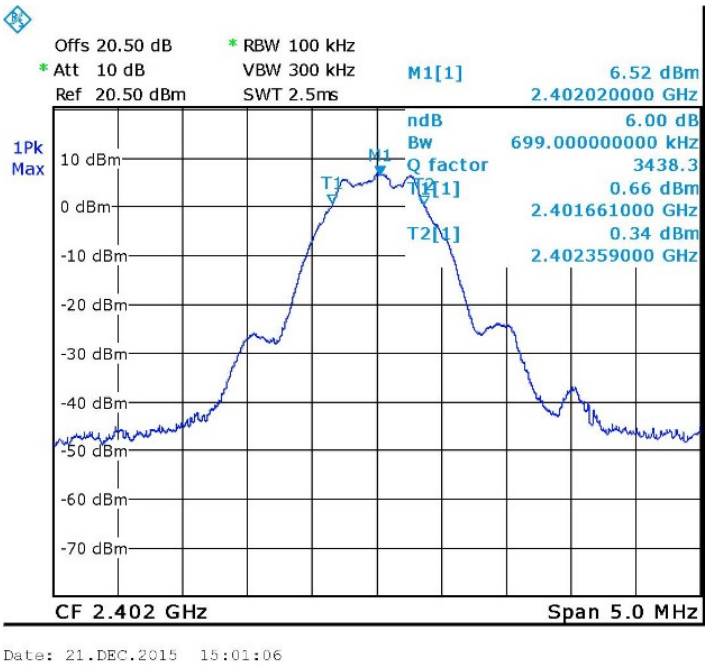

Figure 10. 2402.0 MHz

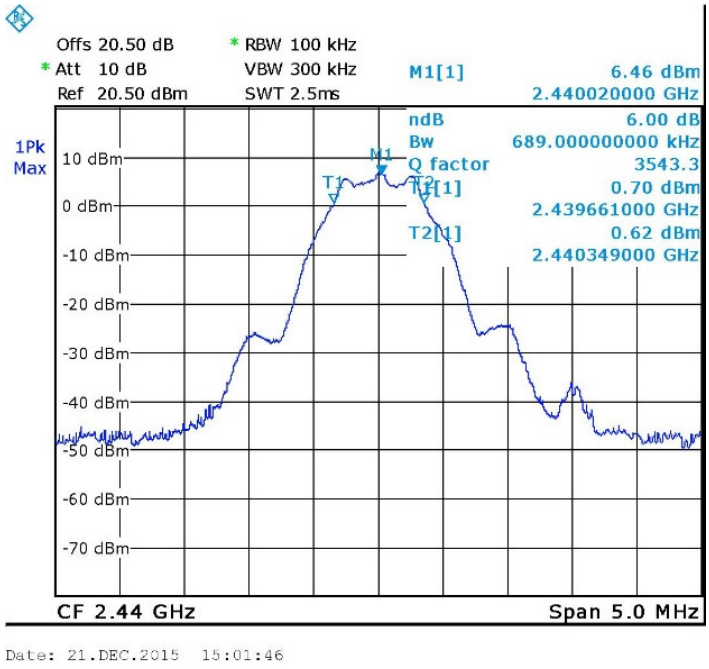

Figure 11. 2440.0 MHz

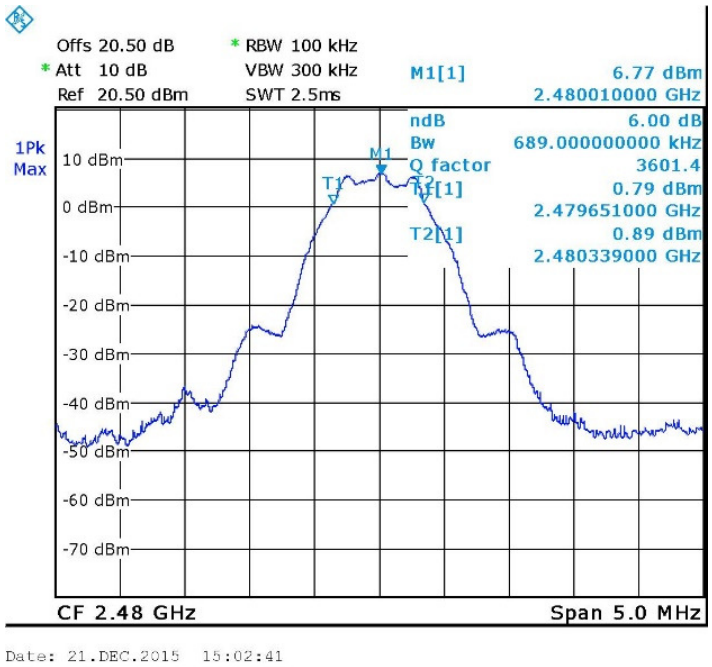

Figure 12. 2480.0 MHz

4.4 *Test Equipment Used; 6dB Bandwidth*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	January 31, 2016
20 dB Attenuator	MCL	VAT-20W2+	848	June 15, 2015	June 30, 2016

Figure 13 Test Equipment Used

5. Occupied Bandwidth

5.1 *Test Specification*

RSS GEN Issue 4: 2014, Section 6.6

5.2 *Test Procedure*

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.

The RBW was set to ~ 1% from the anticipated occupied bandwidth.
The occupied bandwidth function was activated at the SA (99% BW).

5.3 *Test Results*

Operation Frequency (MHz)	Reading (MHz)	Specification (MHz)
2402.0	1.057	N/A
2440.0	1.047	N/A
2480.0	1.047	N/A

Figure 14 Occupied Bandwidth

JUDGEMENT: Passed

5.4 *Test Equipment Used; Occupied Bandwidth*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	January 31, 2016
20 dB Attenuator	MCL	VAT-20W2+	848	June 15, 2015	June 30, 2016

Figure 15 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*

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	7.0	5.01	1000.0	-994.99
2440.0	6.9	4.90	1000.0	-995.10
2480.0	6.8	4.79	1000.0	-995.21

Figure 16 Maximum Peak Power Output

JUDGEMENT: Passed by 994.99 mW

For additional information see *Figure 17* to *Figure 19.*

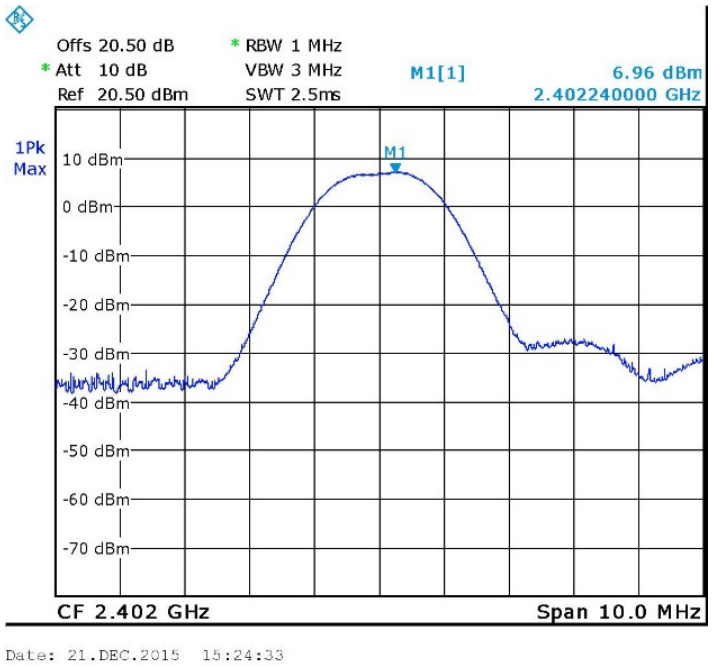

Figure 17 2402.0 MHz

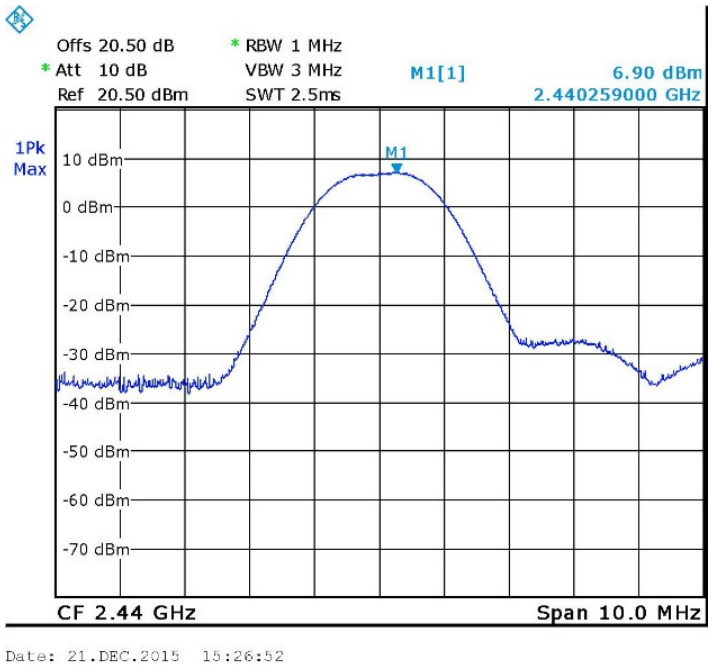

Figure 18 2440.0 MHz

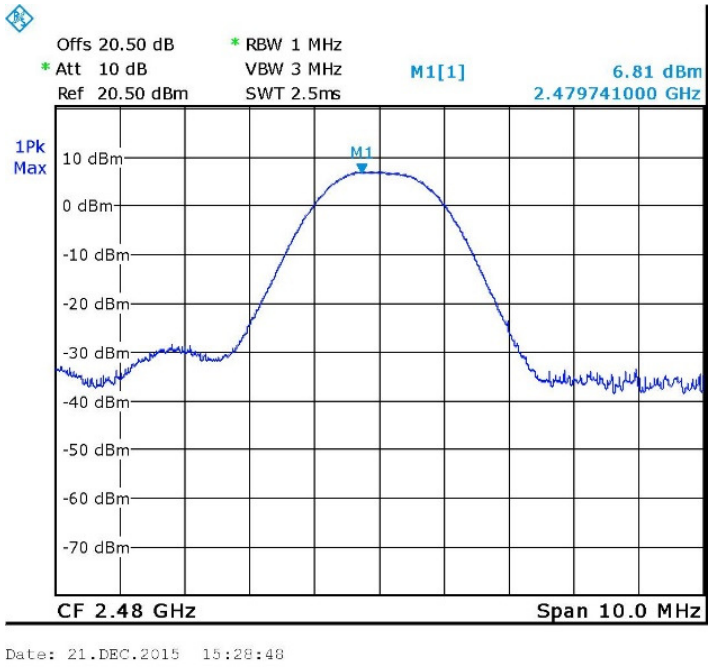

Figure 19 2480.0 MHz

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	January 1, 2015	January 31, 2016
20 dB Attenuator	MCL	VAT-20W2+	848	June 15, 2015	June 30, 2016

Figure 20 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*

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 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	-46.2	-13.5	-32.72
High	BLE	2483.5	-39.1	-12.4	-26.7

Figure 21 Band Edge Spectrum

JUDGEMENT: Passed by 26.7 dB

For additional information see *Figure 22* and *Figure 23*.

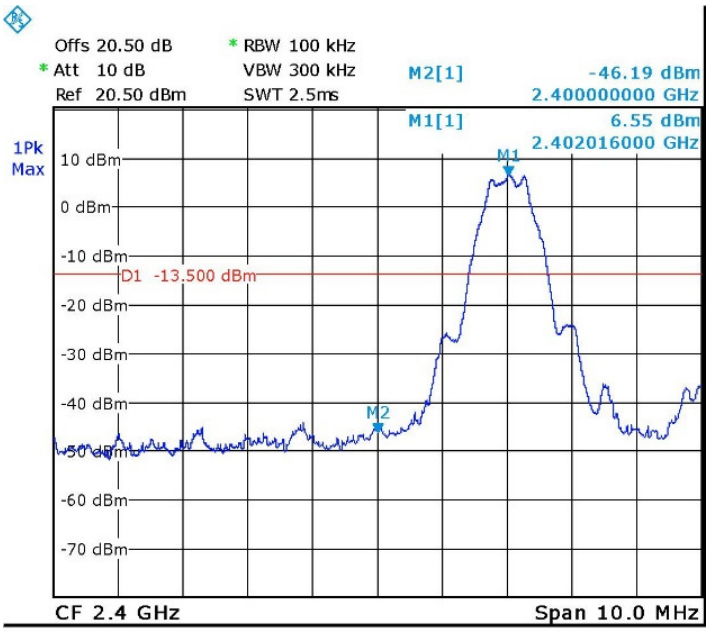

Figure 22 —Lower Band Edge

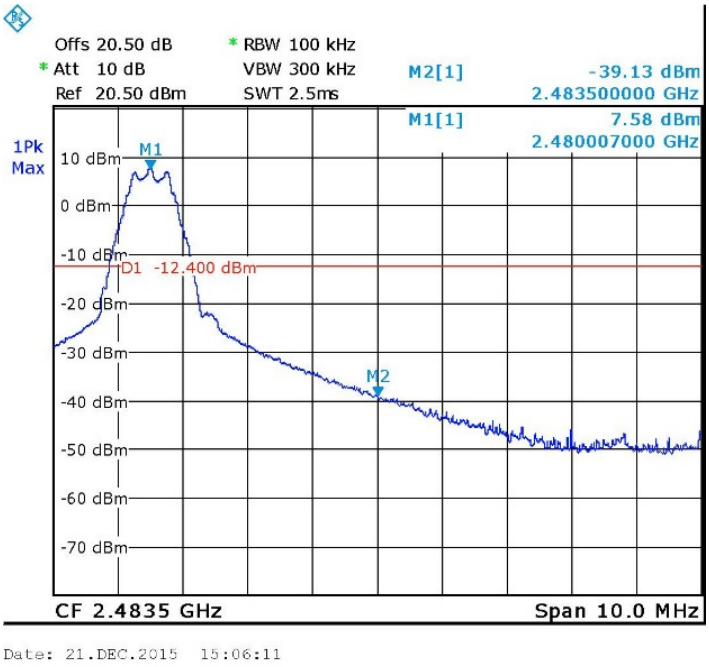

Figure 23 —Upper Band Edge

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	January 1, 2015	January 31, 2016
20 dB Attenuator	MCL	VAT-20W2+	848	June 15, 2015	June 30, 2016

Figure 24 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*

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 (max total loss=33.0 dB). Special attention was taken to prevent Spectrum Analyzer RF input overload. The E.U.T. was evaluated at the low, mid and high channels (2402.0 MHz, 2440 MHz and 2480.0 MHz).

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.

8.3 *Test Results*

JUDGEMENT: Passed

All detected emissions were greater than 20dBc from fundamental level.

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.

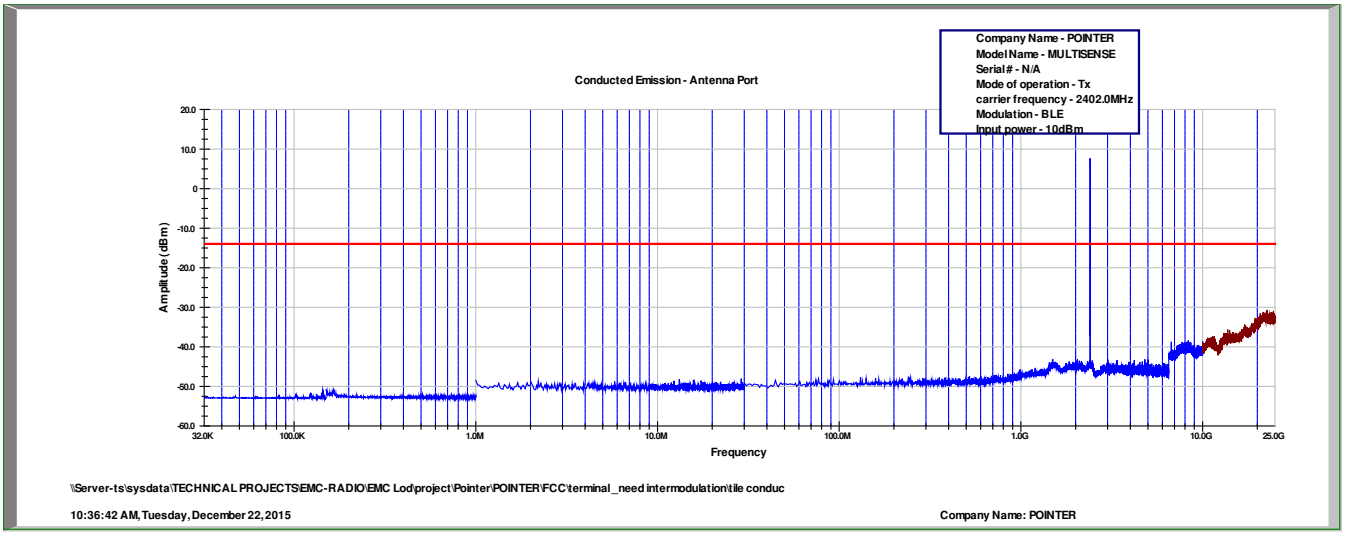

Figure 25 2402 MHz –Low*

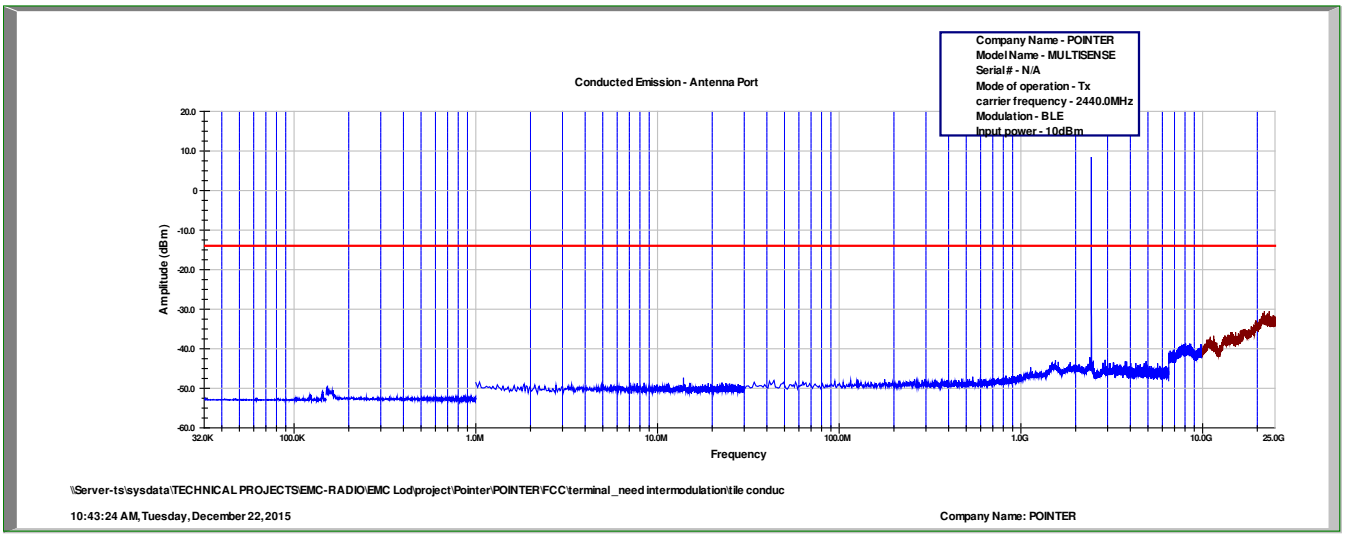

Figure 26 2440 MHz – Mid*

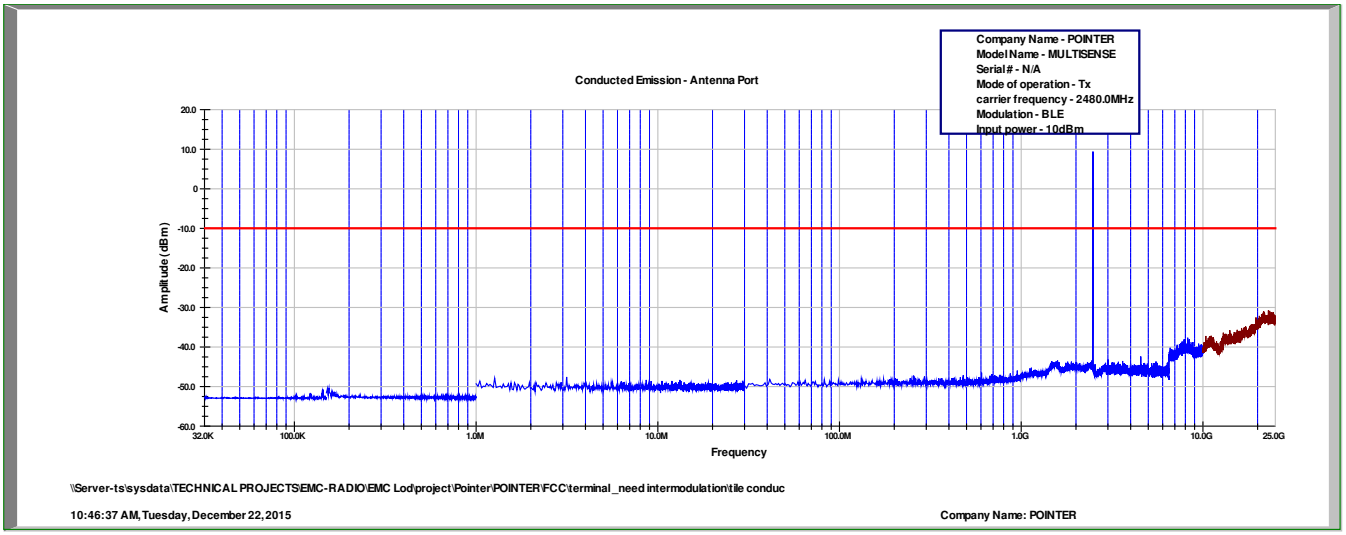

Figure 27 2480 MHz High*

*Note – The peak power that appears is the fundamental carrier

8.4 *Test Instrumentation Used, Emission in Non Restricted Frequency Bands*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	March 3, 2016
30 dB Attenuator	Bird	8304-N30DB	-	June 2, 2015	June 30, 2016

Figure 28 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*

For 9.0kHz-1000.0MHz range:

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 loop/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*.

The frequency range 9.0kHz-1000.0MHz was scanned.

The emissions were measured using a computerized EMI receiver complying with CISPR 16 requirements.

In the frequency range of 9kHz-30MHz, the center of the loop antenna height was one meter above the ground.

In the frequency range of 30MHz-1000MHz, the readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

For 1000.0MHz-25000.0MHz 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 1000.0MHz-25000.0MHz was scanned.

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

During average measurements, the IF bandwidth was 1.0MHz and the video bandwidth was 100.0Hz. During peak measurements, the IF bandwidth was 1MHz and the video bandwidth was 3 MHz.

In the frequency range 1000.0-7000.0MHz, a computerized EMI receiver complying with CISPR 16 requirements was used.
In the frequency range 7000.0MHz-25000.0MHz, a spectrum analyzer including a low noise amplifier was used.

For all final evaluations, the distance was 3 meters.

The E.U.T. was operated at the low, mid and high channels.
(2402.0, 2440.0, 2480.0MHz).

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 29 Table of Limits

9.3 *Test Results*

JUDGEMENT: Passed by 0.3 dB

For the operation frequency of 2402 MHz, the margin between the emission level and the specification limit is in the worst case 3.9.0 dB at the frequency of 2390.0 MHz, horizontal polarization.

For the operation frequency of 2440 MHz, the margin between the emission level and the specification limit is in the worst case 8.6 dB at the frequency of 7320.6 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 0.3 dB at the frequency of 2483.5 MHz, vertical and horizontal 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 30* to *Figure 31*.

Radiated Emission

E.U.T Description	All in One Multi-Sensing Device
Type	MultiSense-TH P/N 715-50200
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 9.0 kHz to 25.0 GHz
Test Distance: 3 meters
Detector: Peak

Operation Frequency	Freq.	Polarity	Peak Reading	Peak Specification	Peak Margin
(MHz)	(MHz)	(H/V)	(dBµV/m)	(dB µV/m)	(dB)
2402.0	2390.0	H	61.9	74.0	-12.1
2402.0	2390.0	V	61.4	74.0	-12.6
2402.0	7206.6	H	61.0	74.0	-13.0
2402.0	7206.1	V	66.0	74.0	-8.0
2440.0	7320.5	H	61.8	74.0	-12.2
2440.0	7320.6	V	65.4	74.0	-8.6
2480.0	7440.0	H	57.4	74.0	-16.6
2480.0	7440.0	V	56.4	74.0	-17.6
2480.0	2483.5	H	59.7	74.0	-14.3
2480.0	2483.5	V	61.3	74.0	-12.7

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

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

"Peak Amp" includes correction factor.

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

Radiated Emission

E.U.T Description All in One Multi-Sensing Device
Type MultiSense-TH P/N 715-50200
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Test Distance: 3 meters
Frequency range: 9.0 kHz to 25.0 GHz
Detector: Average

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Average Reading (dBµV/m)	Average Specification (dB µV/m)	Average Margin (dB)
2402.0	2390.0	H	50.1	54.0	-3.9
2402.0	2390.0	V	49.8	54.0	-4.2
2402.0	7206.1	H	40.1	54.0	-13.9
2402.0	7206.1	V	45.8	54.0	-8.2
2440.0	7320.5	H	42.5	54.0	-11.5
2440.0	7320.6	V	43.2	54.0	-10.8
2480.0	7440.0	H	38.7	54.0	-15.3
2480.0	7440.0	V	39.2	54.0	-14.8
2480.0	2483.5	H	53.5	54.0	-0.5
2480.0	2483.5	V	53.5	54.0	-0.5

Figure 31. 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	January 4, 2015	January 31, 2016
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	March 3, 2016
EMI Receiver	HP	8542E	3906A00276	March 11, 2015	March 31, 2016
RF Filter Section	HP	85420E	3705A00248	March 19, 2015	March 31, 2016
Spectrum Analyzer	HP	8564E	3442A00275	March 11, 2015	March 31, 2016
Biconical Antenna	EMCO	3104	2606	December 28, 2014	December 28, 2015
Log Periodic Antenna	EMCO	3146	9505-4081	December 28, 2014	December 28, 2015
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
Horn Antenna	ARA	SWH-28	1007	March 3, 2014	March 30, 2016
Active Loop Antenna	EMCO	6502	9506-2950	November 4, 2015	November 30, 2016
Low Noise Amplifier	Narda	DBS-0411N313	13	March 1, 2015	March 1, 2016
Low Noise Amplifier	Sophia Wireless	LNA28-B	232	March 1, 2015	March 1, 2016
Spectrum Analyzer	HP	8593EM	3536A00120 ADI	February 24, 2015	February 28, 2016
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 32 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*

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 3.0 kHz RBW and VBW to 10.0 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)	PSD (dBm)	Specification (dBm)	Margin (dB)
2402.0	-9.0	0.5	-8.5	8.0	-16.5
2440.0	-9.2	0.5	-8.7.	8.0	-16.7
2480.0	-8.8	0.5	-8.3	8.0	-16.3

Figure 33 Test Results

JUDGEMENT: Passed by 16.3 dB

For additional information see *Figure 34* to *Figure 36.*

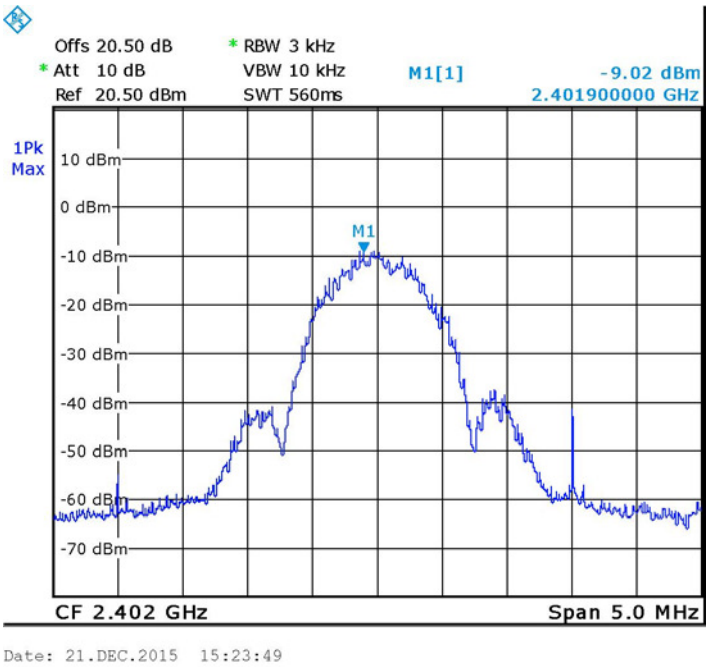

Figure 34 — 2402.0 MHz

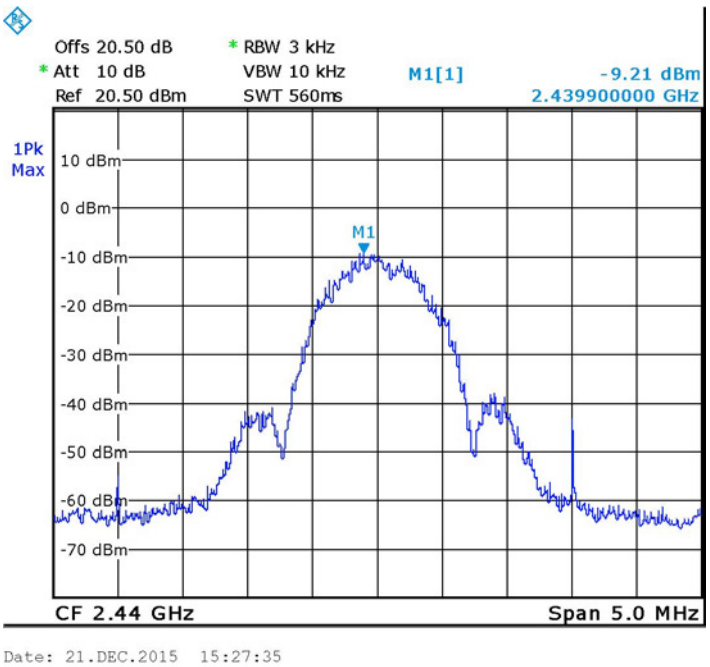

Figure 35 — 2440.0 MHz

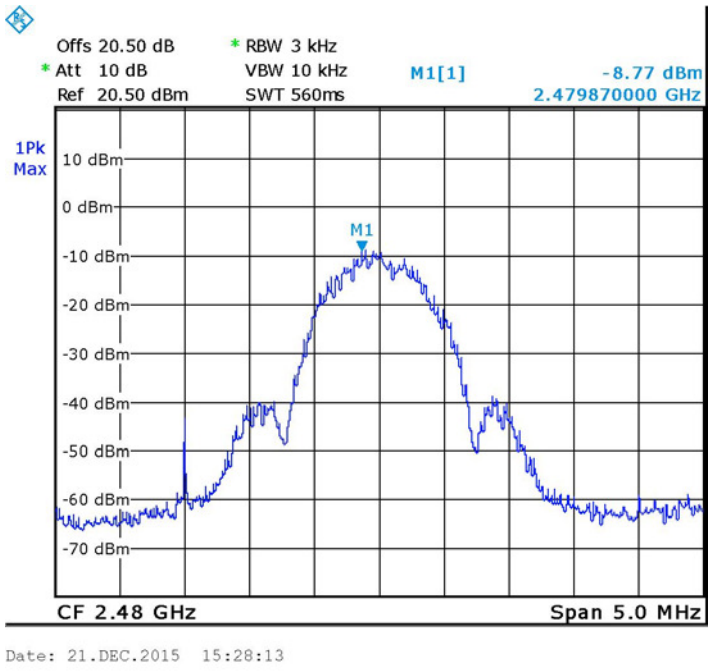

Figure 36 — 2480.0 MHz

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	January 1, 2015	January 31, 2016
20 dB Attenuator	MCL	VAT-20W2+	848	June 15, 2015	June 30, 2016

Figure 37 Test Equipment Used

11. Antenna Gain/Information

The antenna gain is 0.5dBi, integral.

12. R.F Exposure/Safety

Typical use of the E.U.T. is as a temperature/humidity sensor.

The typical placement of the E.U.T. is attached to the tracked equipment. The typical distance between the E.U.T. and the user is 20 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 limit at 2402 MHz is: $1\frac{mW}{cm^2}$

(b) IC limit at 2402 MHz is: $309\frac{mW}{cm^2}$

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

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

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

P_t- Transmitted Power 7.0 dBm (Peak) 5.01 mW

G_T- Antenna Gain, 0.5 dBi = 1.12 dBi numeric

R- Distance from Transmitter using 20cm worst case

(d) The peak power density is:

$$S = \frac{(5.01 \times 1.12)}{4\pi(20)^2} = 0.0011\frac{mW}{cm^2}$$

(e) This is below the FCC/IC limits.

13. APPENDIX A - CORRECTION FACTORS

13.1 *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

13.2 *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*

13.3 *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

13.4 *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

13.5 *Correction factors for Horn ANTENNA.*

Model: 3115

Antenna serial number: 29845

10 meter range

FREQUENCY (MHz)	AFE (dB/m)	FREQUENCY (MHz)	AFE (dB/m)
1000	22.4	10000	36.1
2000	25.2	11000	37.0
3000	31.1	12000	41.3
4000	30.2	13000	38.1
5000	34.2	14000	41.7
6000	31.6	15000	39.0
7000	34.7	16000	38.8
8000	34.8	17000	43.2
9000	36.2	18000	43.7

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

CALIBRATION DATA

Frequency, MHz	Antenna factor, dB/m [1]
200	11.55
250	11.60
300	14.43
400	15.38
500	17.98
600	18.78
700	21.17
800	21.16
900	22.67
1000	24.09

[1] The antenna factor shall be added to receiver reading in dBμV to obtain field strength in dBμV/m.

13.7 *Correction factors for Biconical Antenna EMCO, Model 3104, Serial #2606*

CALIBRATION DATA

Frequency, MHz	Near free space antenna factor, dB/m	Geometry specific correction factor, dB	Free space antenna factor, dB/m [1)]
30	12.97	0.13	12.84
35	12.34	0.09	12.25
40	12.03	0.06	11.97
45	11.42	0.02	11.40
50	11.91	0.03	11.88
60	11.92	0.37	11.55
70	9.60	0.25	9.35
80	6.99	-0.45	7.44
90	10.87	-0.34	11.21
100	11.51	-0.06	11.57
120	13.30	0.20	13.10
140	12.56	-0.01	12.57
160	14.49	-0.12	14.61
180	16.53	0.05	16.48
200	15.30	0.15	15.15

[1)] The antenna factor shall be added to receiver reading in dBµV to obtain field strength in dBµV/m.