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DATE: 01 November 2015

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

FCC Radio Test Report

for

AeroScout Industrial

Equipment under test:

Asset Tag

T22T TAG; T22 TAG*; T22W TAG*

*See customer's declaration on page 6

Tested by: _____
M. Zohar

Approved by: _____
D. Shidlowsky

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Measurement/Technical Report for

AeroScout Industrial

Asset Tag

T22T TAG

FCC ID: 2AEFEIND-T22

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

Measurement procedure used is KDB 558074 D01 v03r03 and ANSI C63.4-2014.

Application for Certification
prepared by:
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Applicant for this device:
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1. General Information

1.1 *Administrative Information*

Manufacturer:	AeroScout Industrial
Manufacturer's Address:	2 Ilan Ramon Street Ness Ziona, 7403635, Israel Tel: +972-8-936-9393 Fax: +972-8-936-5977
Manufacturer's Representative:	Doron Lilo
Equipment Under Test (E.U.T):	Asset Tag
Product Marketing Name/No:	T22T TAG; T22 TAG*; T22W TAG*
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T:	20.04.2015
Start of Test:	20.04.2015
End of Test:	26.05.2015
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
Test Specifications:	FCC Part 15, Subpart C

*See customer's declaration on following page

AeroScout Industrial

Date: July 6, 2015

DECLARATION

I HEREBY DECLARE THAT THE

T22T TAG

Is A Maximum CONFIGURATION MODEL.

OTHER MODELS, WHICH INCLUDE

T22 TAG
T22W TAG

DIFFER FROM THE T22T TAG ONLY BY SOFTWARE AND/OR EXTRACTED COMPONENTS/ASSEMBLIES.

Please relate to them all (from a Radio point of view) as the same product.

Thank you,
Signature: Ely Basri
Printed Name: Eli Basri RF Engineer, AeroScout Industrial
(Place official title here)

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. US1004.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025A-1.

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

1.3 *Product Description*

The T22 Bi-directional Asset Tag is a component of AeroScout Industrial's suite of enterprise visibility solutions for location-based applications. The T22 Tag adds further flexibility and scalability to track assets across a wide variety of applications.
Once deployed, the tag uses its bi-directional functionality to receive firmware and configuration updates from MobileView. This removes the need to manually collect, update and re-deploy tags in the field.

1.4 Test Methodology

Both conducted and radiated testing was performed according to the procedures in KDB 558074 D01 v03r03 and ANSI C63.4: 2014. 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 US1004.

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

Note: See ITL Procedure No. PM 198.

2. System Test Configuration

2.1 *Justification*

Exploratory testing was performed in 3 orthogonal positions to determine the worst case position.

The fundamental results are shown in the below table:

Frequency (GHz)	Y axis (dBuV/m)	X axis (dBuV/m)	Z axis (dBuV/m)
2.412	80.0	75.7	72.5
2.437	75.9	73.0	70.0
2.462	75.0	68.1	62.6

In all axes the spurious levels were under the noise level.

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

The unit was evaluated when transmitting at the low channel (2412MHz) the mid channel (2437MHz) and the high channel (2462MHz).

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*

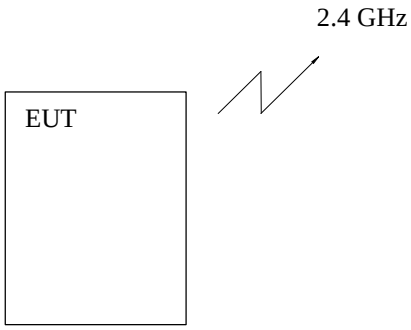

Figure 1. Configuration of Tested System

3. Radiated Measurement Test Set-up Photos

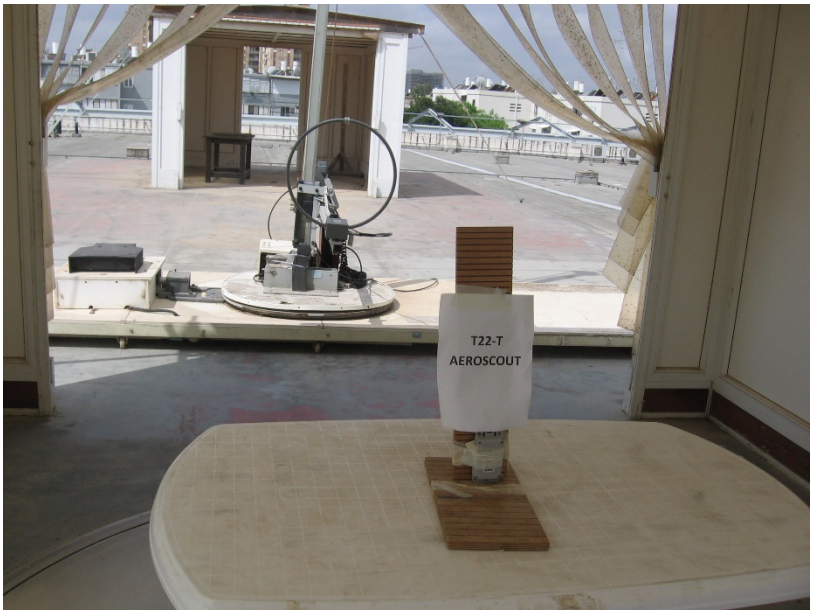

Figure 2. Radiated Emission Test

Figure 3. Radiated Emission Test

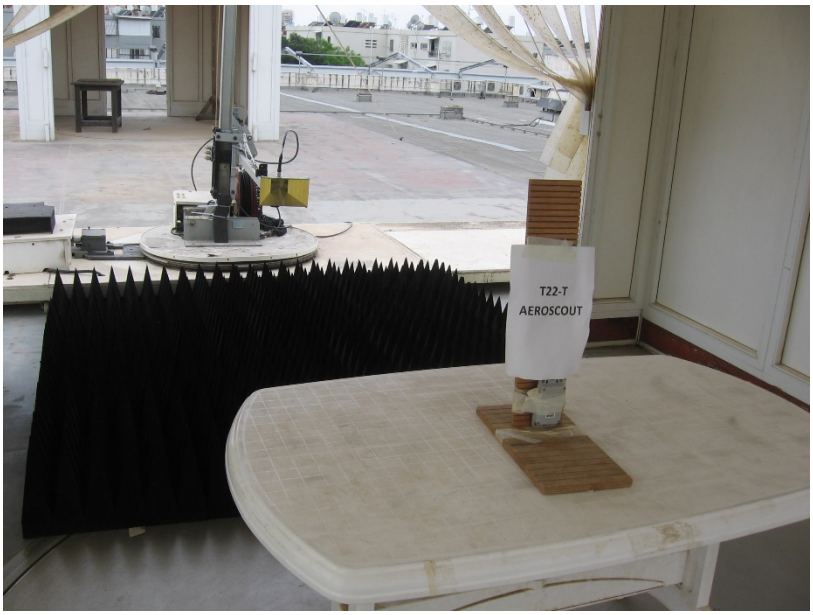

Figure 4. Radiated Emission Test

4. 6 dB Minimum Bandwidth

4.1 *Test Specification*

FCC, Part 15, Subpart C, Section 247(a)(2)

4.2 *Test Procedure*

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

The E.U.T was tested at 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 1*.

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 *Results*

Operation Frequency (MHz)	Reading (MHz)	Specification (MHz)
Low	16.0	>0.5
Mid	16.4	>0.5
High	16.3	>0.5

Figure 5 6 dB Minimum Bandwidth

JUDGEMENT: Passed

For additional information see *Figure 6* to *Figure 8.*

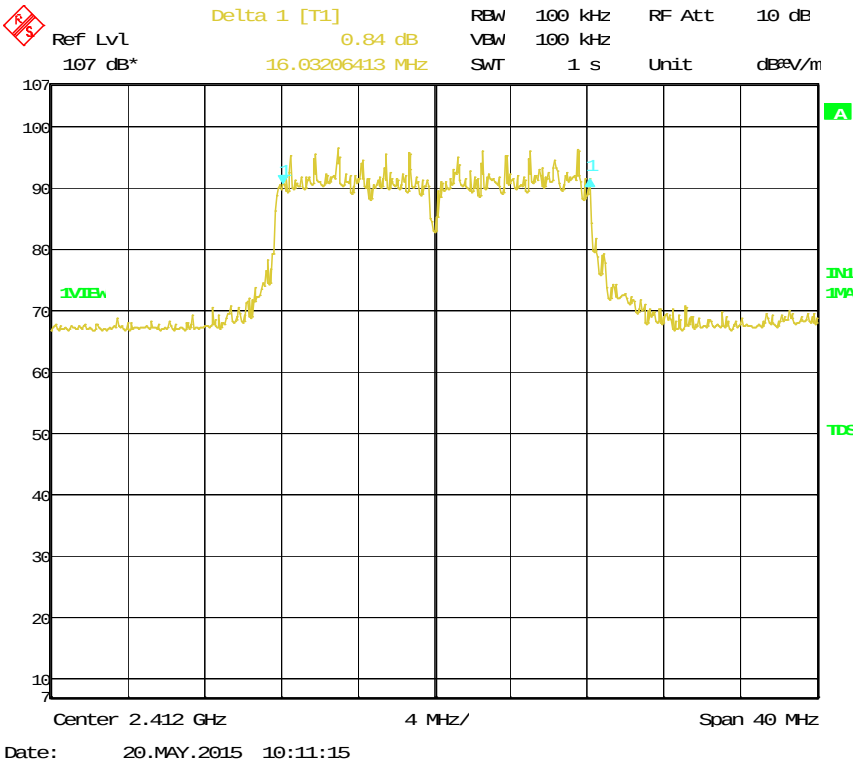

Figure 6. Low Channel

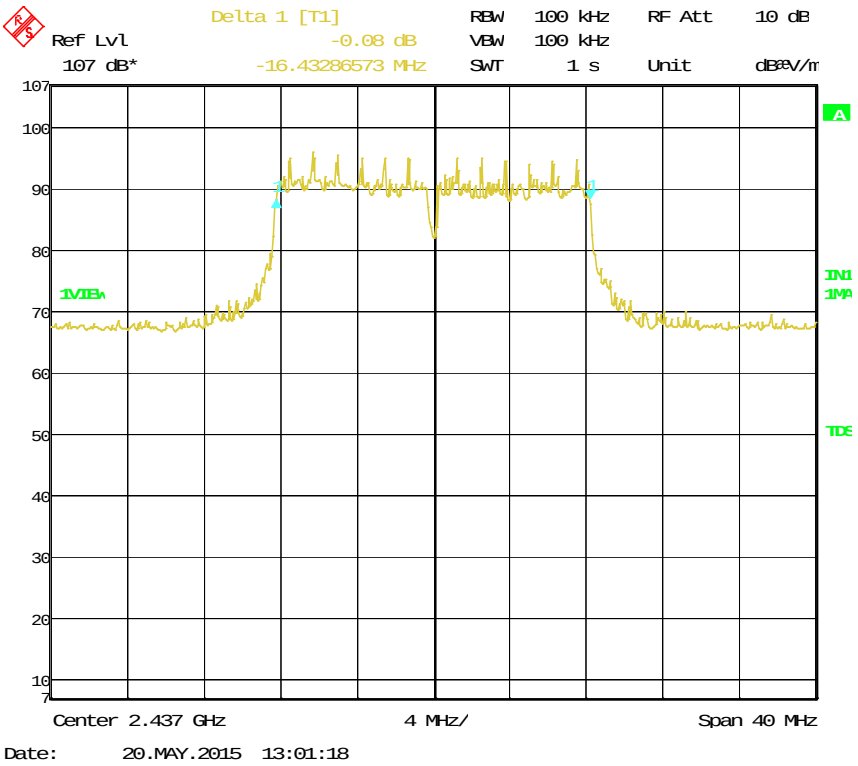

Figure 7. Mid Channel

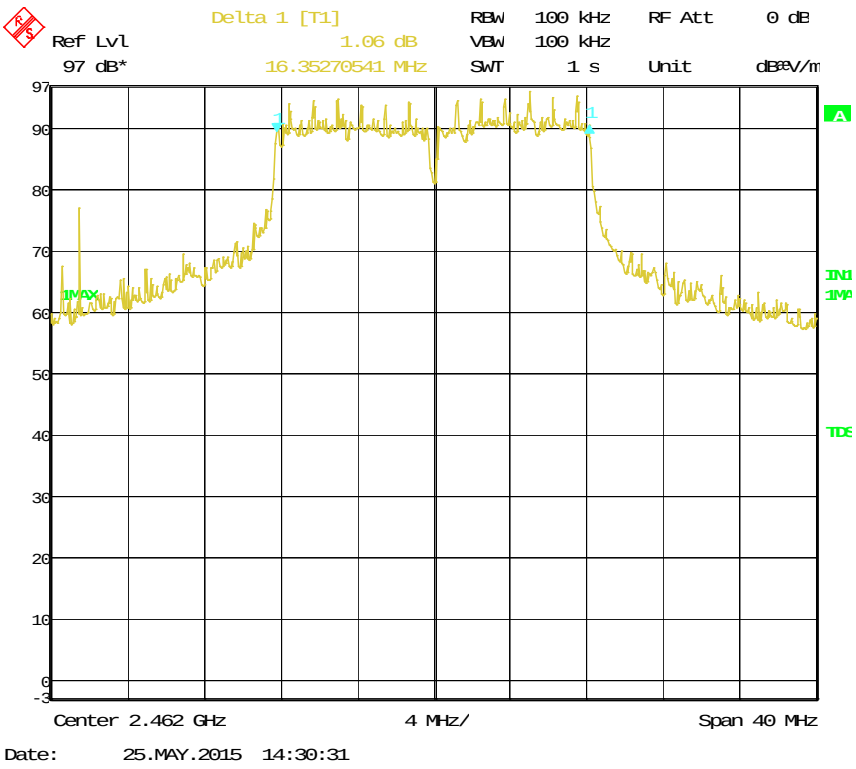

Figure 8. High Channel

4.4 *Test Equipment Used; 6dB Bandwidth*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESIB7	100120	January 4, 2015	1 year
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	1 year
Active Loop Antenna	EMCO	6502	2950	November 4, 2014	1 year
Biconilog Antenna	EMCO	3142	1250	May 22, 2014	2 years
Horn Antenna	ETS	3115	6142	May 19, 2015	3 years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	3 years
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	1 year
Spectrum Analyzer	HP	8564E	3442A00275	March 11, 2015	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	August 22, 2014	1 year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 9 Test Equipment Used

5. 26 dB Minimum Bandwidth

5.1 *Test Specification*

FCC Part 2 Section 2.1049

5.2 *Test Procedure*

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

See Section 2.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

The E.U.T was tested at 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 1*.

The spectrum bandwidth of the E.U.T. at the point of 26 dB below maximum peak power was measured and recorded. The RBW was set to 100 kHz.

5.3 *Results*

Operation Frequency (MHz)	Reading (MHz)
Low	20.4
Mid	21.4
High	19.4

Figure 10 26 dB Minimum Bandwidth

JUDGEMENT: Passed

For additional information see *Figure 11* to *Figure 13.*

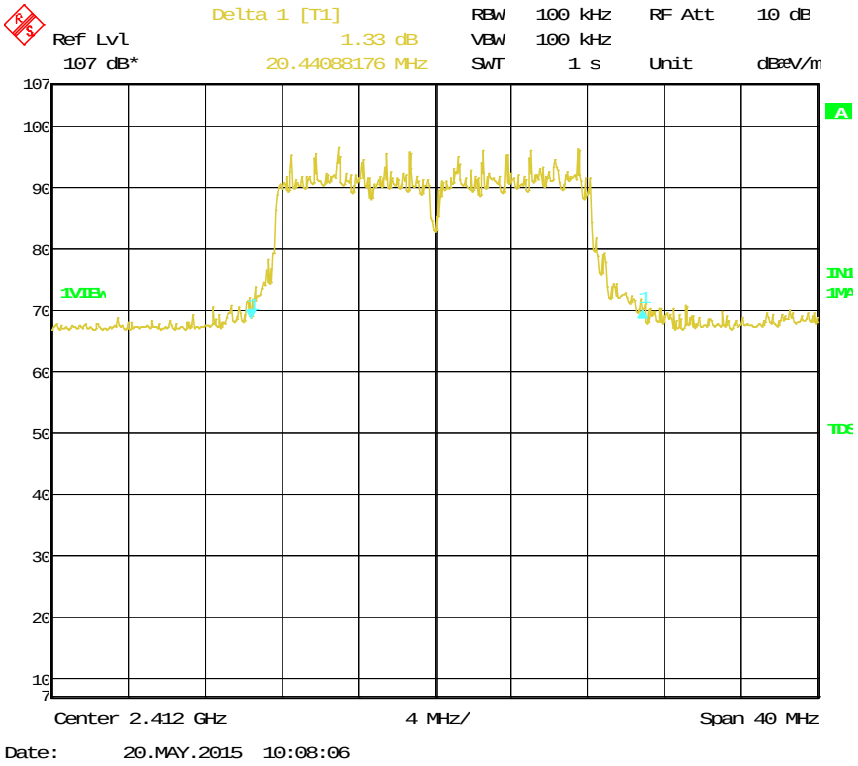

Figure 11. Low Channel

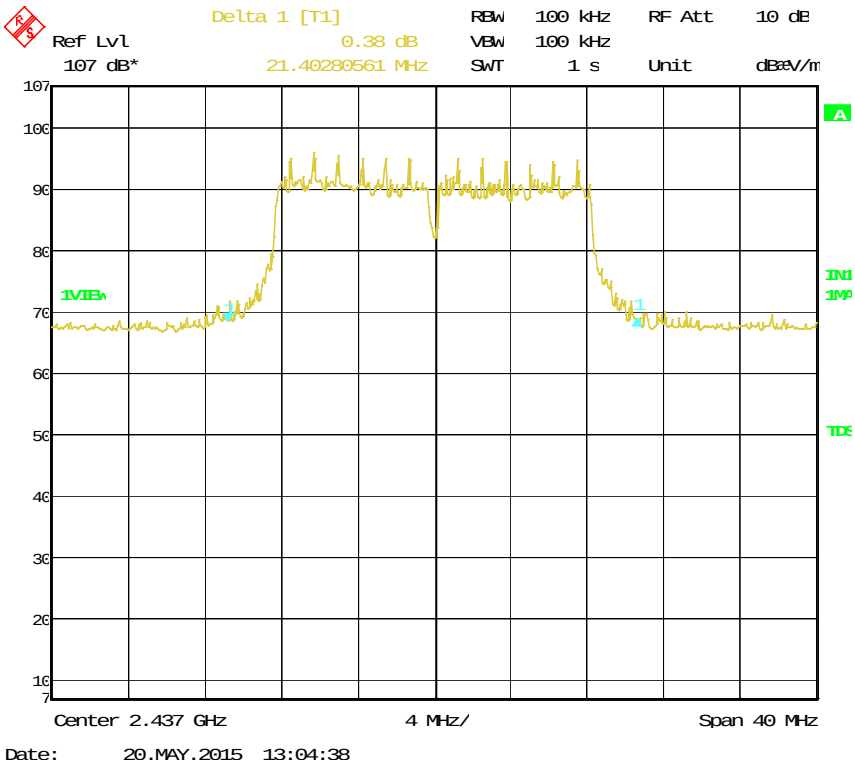

Figure 12. Mid Channel

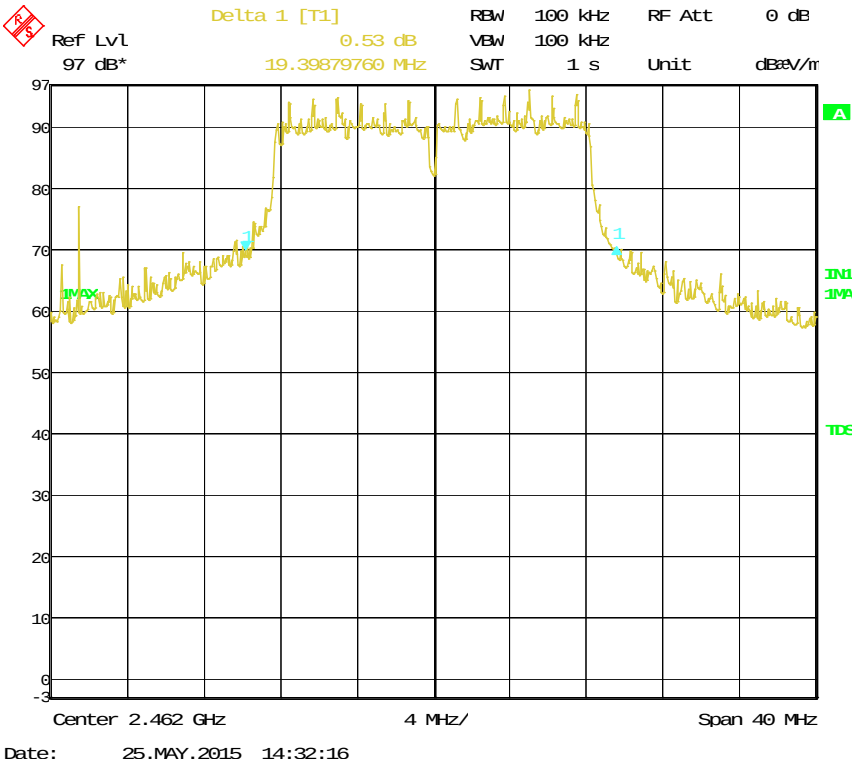

Figure 13. High Channel

5.4 *Test Equipment Used; 26dB Bandwidth*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESIB7	100120	January 4, 2015	1 year
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	1 year
Active Loop Antenna	EMCO	6502	2950	November 4, 2014	1 year
Biconilog Antenna	EMCO	3142	1250	May 22, 2014	2 years
Horn Antenna	ETS	3115	6142	May 19, 2015	3 years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	3 years
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	1 year
Spectrum Analyzer	HP	8564E	3442A00275	March 11, 2015	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	August 22, 2014	1 year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 14 Test Equipment Used

6. Maximum Transmitted Peak Power Output

6.1 *Test Specification*

FCC, Part 15, Subpart C, Section 247(b)(3)

6.2 *Test Procedure*

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

The E.U.T was tested at 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 1*.

The E.U.T was evaluated in 3 channels: Low, Mid and High.

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:

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

E - Field Strength (V/m)

d – Distance from transmitter (m)

G – Antenna gain

P – Peak power (W)

6.1 *Results*

Operation Frequency (MHz)	Polarization	Power (dBuV/m)	Power (dBm)	Power (W)	Specification (W)	Margin (W)
Low	V	105.9	10.7	0.012	1.0	-0.988
Low	H	101.2	6.0	0.004	1.0	-0.996
Mid	V	104.0	8.8	0.008	1.0	-0.992
Mid	H	101.9	6.7	0.005	1.0	-0.995
High	V	105.3	10.1	0.010	1.0	-0.990
High	H	97.8	2.6	0.002	1.0	-0.998

Figure 15 Maximum Peak Power Output

JUDGEMENT: Passed by 0.988 W

For additional information see *Figure 16* to *Figure 21*.

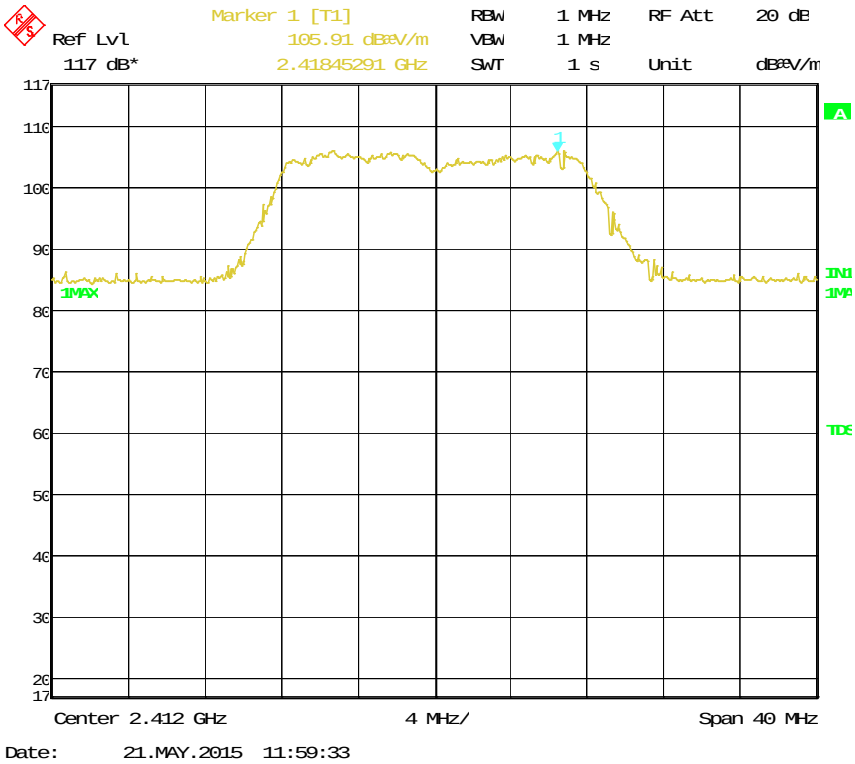

Figure 16 2412.0 MHz – Vertical

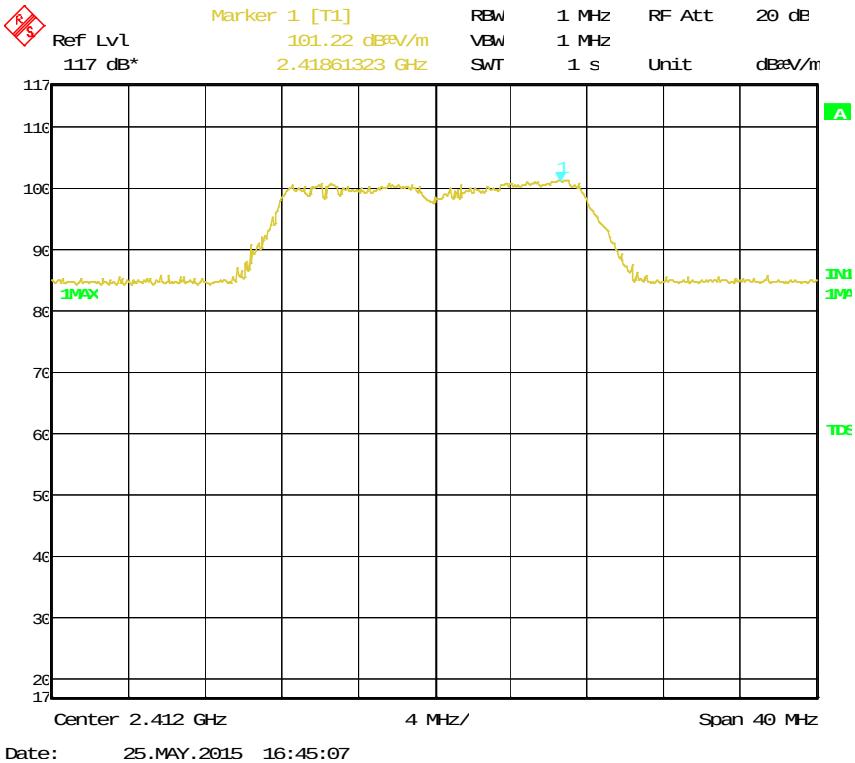

Figure 17 2412.0 MHz – Horizontal

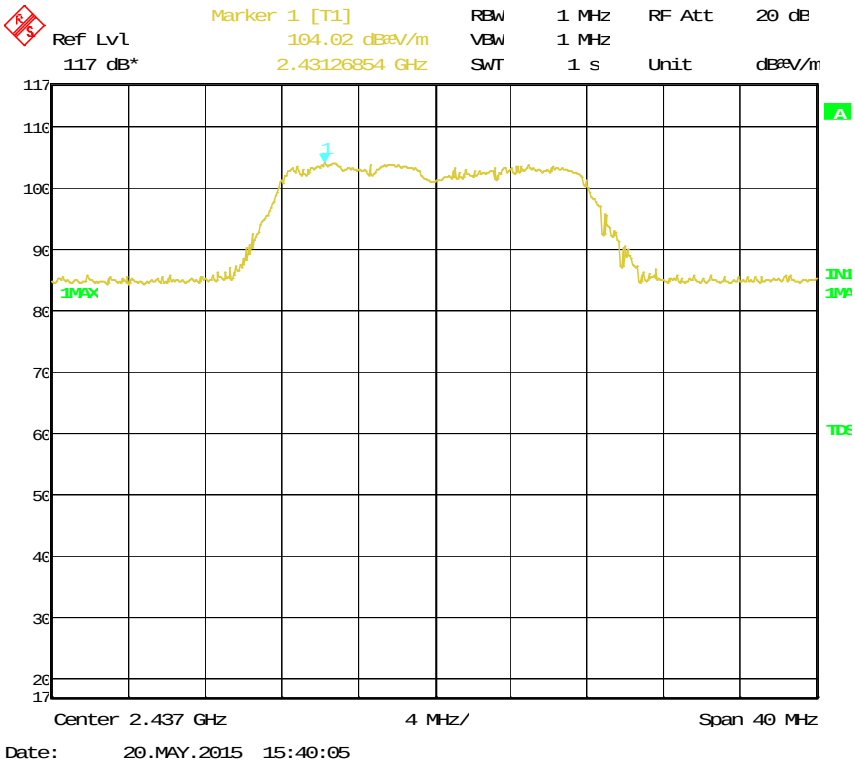

Figure 18 2437.0 MHz – Vertical

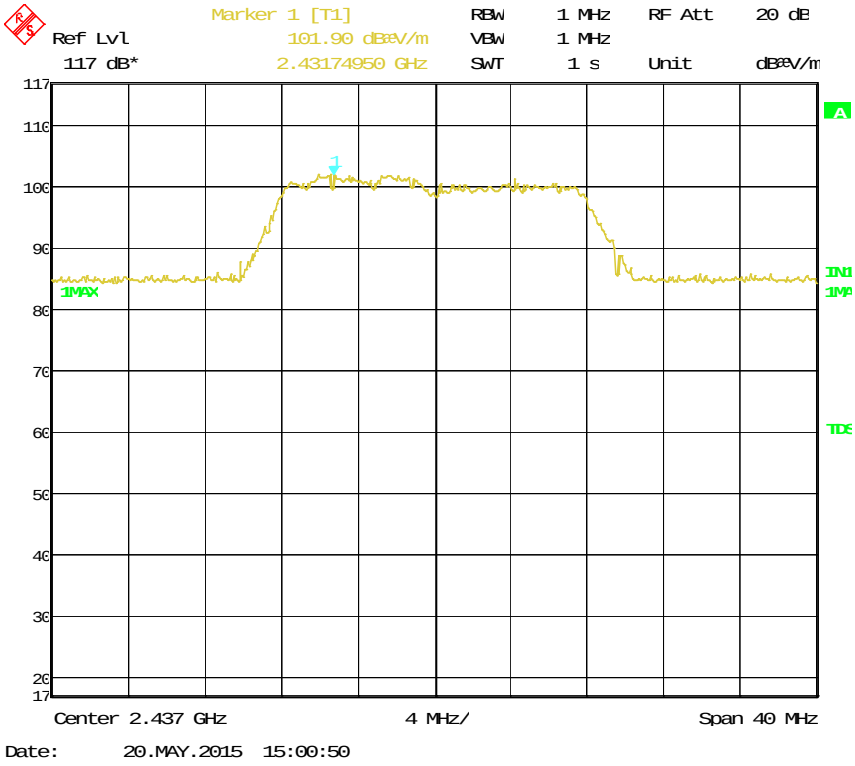

Figure 19 2437.0 MHz – Horizontal

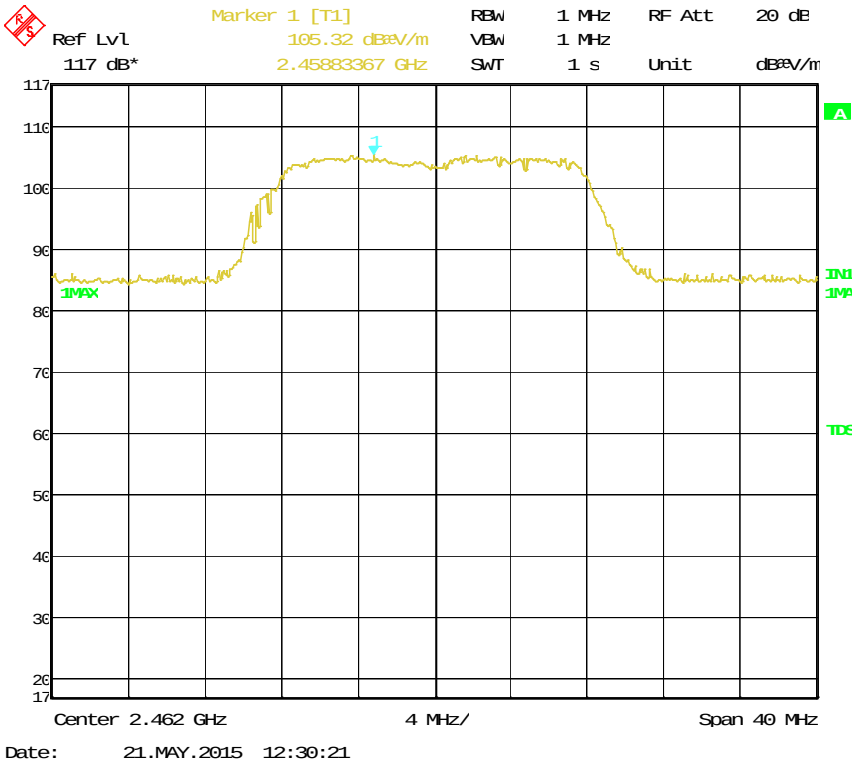

Figure 20 2462.0 MHz – Vertical

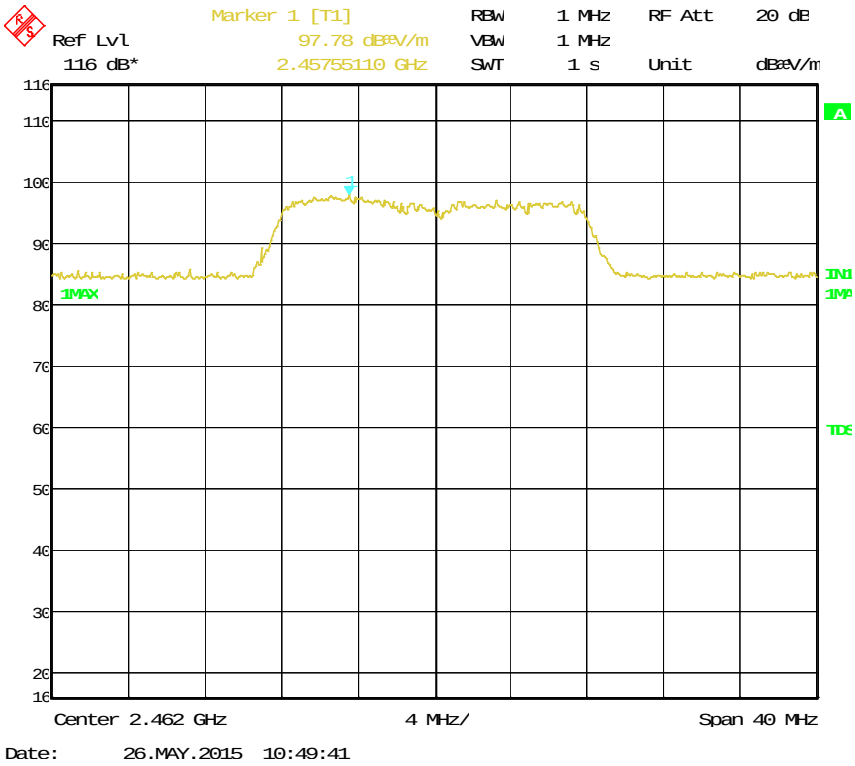

Figure 21 2462.0 MHz – Horizontal

6.2 *Test Equipment Used; Maximum Peak Power Output*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESIB7	100120	January 4, 2015	1 year
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	1 year
Active Loop Antenna	EMCO	6502	2950	November 4, 2014	1 year
Biconilog Antenna	EMCO	3142	1250	May 22, 2014	2 years
Horn Antenna	ETS	3115	6142	May 19, 2015	3 years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	3 years
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	1 year
Spectrum Analyzer	HP	8564E	3442A00275	March 11, 2015	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	August 22, 2014	1 year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 22 Test Equipment Used

7. Band Edge Spectrum

7.1 *Test Specification*

FCC, Part 15, Subpart C, Section 247(d)

7.2 *Test Procedure*

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

The E.U.T was tested at 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 1*.

The E.U.T was evaluated in 2 channels: Low and High and with vertical antenna test polarization as worst case.

The RBW=VBW was set to 100 kHz.

7.3 *Results*

Operation Frequency (MHz)	Modulation	Band Edge Frequency (MHz)	Spectrum Level (dBm)	Specification (dBm)	Margin (dB)
Low	BLE	2400.0	66.9	76.0	-9.1
High	BLE	2483.5	66.4	75.5	-9.1

Figure 23 Band Edge Spectrum

JUDGEMENT: Passed by 9.1 dB

For additional information see *Figure 24* and *Figure 25*.

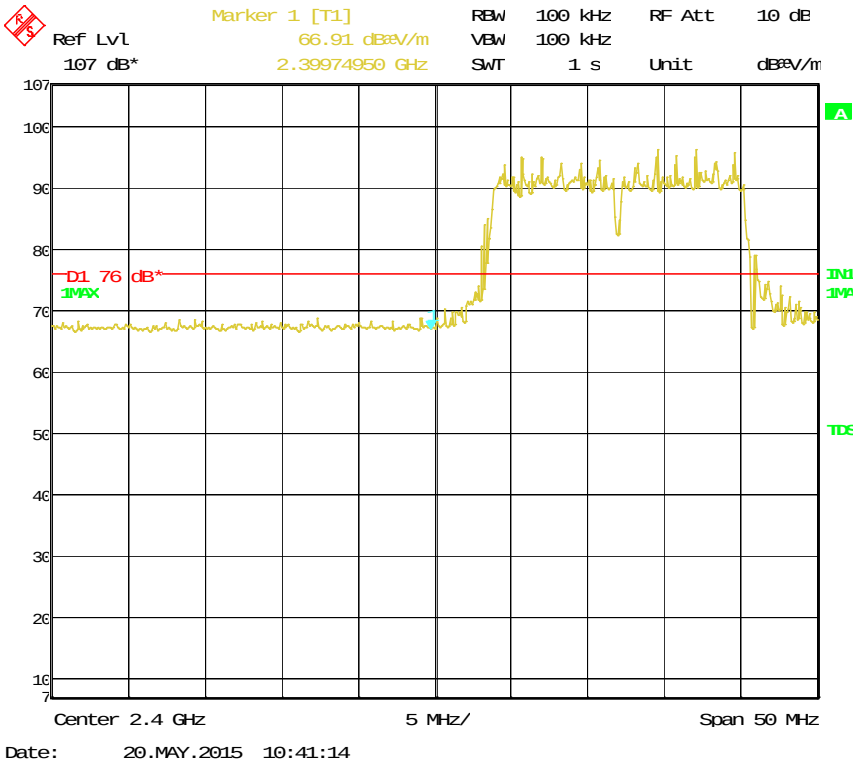

Figure 24 —Lower Band Edge

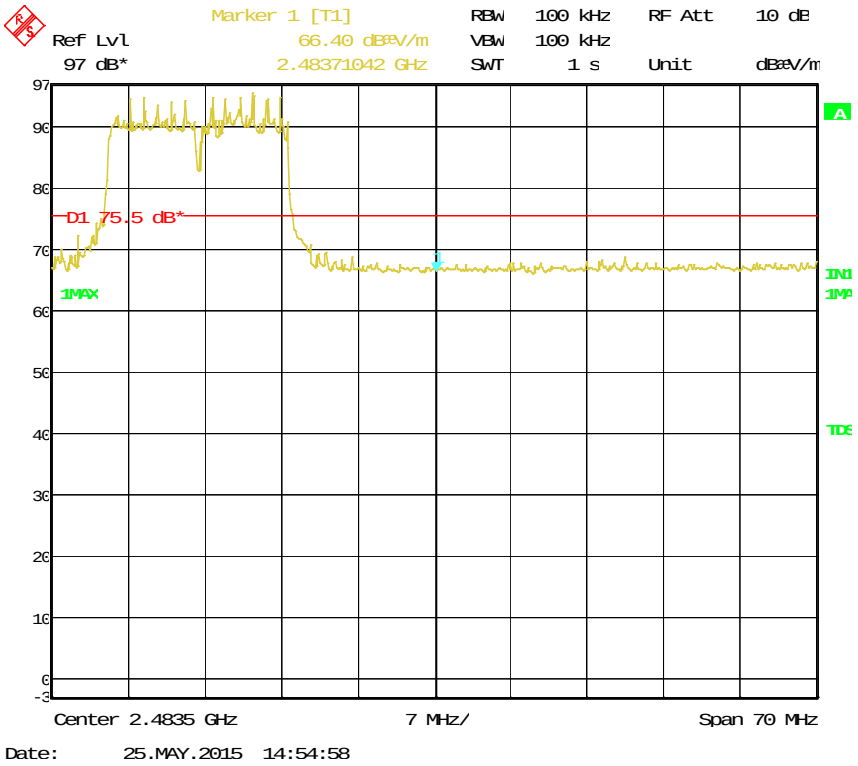

Figure 25 —Upper Band Edge

7.4 *Test Equipment Used; Band Edge Spectrum*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESIB7	100120	January 4, 2015	1 year
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	1 year
Active Loop Antenna	EMCO	6502	2950	November 4, 2014	1 year
Biconilog Antenna	EMCO	3142	1250	May 22, 2014	2 years
Horn Antenna	ETS	3115	6142	May 19, 2015	3 years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	3 years
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	1 year
Spectrum Analyzer	HP	8564E	3442A00275	March 11, 2015	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	August 22, 2014	1 year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 26 Test Equipment Used

8. Radiated Emission, 9 kHz – 30 MHz

8.1 *Test Specification*

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

8.2 *Test Procedure*

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

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 1*.

The frequency range 9 kHz-30 MHz was scanned.

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

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

The E.U.T. was operated at the low, mid and high channels using a peak detector.

8.3 *Test Results*

JUDGEMENT: Passed

All emissions 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 209 specification.

8.4 *Test Instrumentation Used, Radiated Measurements*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESIB7	100120	January 4, 2015	1 year
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	1 year
Active Loop Antenna	EMCO	6502	2950	November 4, 2014	1 year
Biconilog Antenna	EMCO	3142	1250	May 22, 2014	2 years
Horn Antenna	ETS	3115	6142	May 19, 2015	3 years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	3 years
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	1 year
Spectrum Analyzer	HP	8564E	3442A00275	March 11, 2015	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	August 22, 2014	1 year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 27 Test Equipment Used

8.5 *Field Strength Calculation*

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors", 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.

9. Spurious Radiated Emission, 30 – 25000 MHz

9.1 *Test Specification*

FCC, Part 15, Subpart C, Sections 15.209, 15.247

9.2 *Test Procedure*

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

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 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 30-7000 MHz, a computerized EMI receiver complying with CISPR 16 requirements was used.
In the frequency range 7.0-25.0 GHz, a spectrum analyzer including a low noise amplifier was used.
During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 100Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.
The test distance was 3 meters.
The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)

The E.U.T. was operated at the low, mid and high channels.

9.3 *Test Results*

JUDGEMENT: Passed by 0.4 dB

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

The details of the highest emissions are given in *Figure 28* to *Figure 29.*

Radiated Emission

E.U.T Description Asset Tag
Type T22T TAG
Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C

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

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Peak Reading (dBµV/m)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
2412.0	2390.0	H	65.7	74.0	-8.3
2412.0	2390.0	V	69.8	74.0	-4.2
2412.0	4824.0	H	59.1	74.0	-14.9
2412.0	4824.0	V	59.6	74.0	-14.4
2437.0	4874.0	H	50.1	74.0	-23.9
2437.0	4874.0	V	50.6	74.0	-23.4
2462.0	4924.0	H	59.8	74.0	-14.2
2462.0	4924.0	V	60.1	74.0	-13.9
2462.0	2483.5	H	65.9	74.0	-8.1
2462.0	2483.5	V	68.9	74.0	-5.1

Figure 28. 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 Asset Tag
Type T22T TAG
Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C

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

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Average Reading (dBµV/m)	Average Specification (dB µV/m)	Average Margin (dB)
2412.0	2390.0	H	50.9	54.0	-3.1
2412.0	2390.0	V	50.1	54.0	-3.9
2412.0	4824.0	H	53.6	54.0	-0.4
2412.0	4824.0	V	53.5	54.0	-0.5
2437.0	4874.0	H	51.1	54.0	-2.9
2437.0	4874.0	V	51.2	54.0	-2.8
2462.0	4924.0	H	49.4	54.0	-4.6
2462.0	4924.0	V	49.5	54.0	-4.5
2462.0	2483.5	H	40.3	54.0	-13.7
2462.0	2483.5	V	42.6	54.0	-11.4

Figure 29. 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, Radiated Measurements Above 1 GHz*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESIB7	100120	January 4, 2015	1 year
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	1 year
Active Loop Antenna	EMCO	6502	2950	November 4, 2014	1 year
Biconilog Antenna	EMCO	3142	1250	May 22, 2014	2 years
Horn Antenna	ETS	3115	6142	May 19, 2015	3 years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	3 years
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	1 year
Spectrum Analyzer	HP	8564E	3442A00275	March 11, 2015	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	August 22, 2014	1 year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 30 Test Equipment Used

10. Transmitted Power Density

10.1 *Test Specification*

FCC, Part 15, Subpart C, Section 247(e)

10.2 *Test Procedure*

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

The E.U.T was tested at 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 1*.

The E.U.T was tested in vertical antenna test polarity for worst case.

The spectrum analyzer was set to 3 KHz RBW.

The E.U.T was evaluated in 3 channels: Low, Mid and High.

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:

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

E - Field Strength (V/m)

d – Distance from transmitter (m)

G – Antenna gain

P – Peak power (W)

10.3 *Test Results*

Operation Frequency (MHz)	Reading Spectrum Analyzer (dBµV/m)	Reading Spectrum Analyzer (dBm)	Specification (dBm)	Margin (dB)
Low	79.5	-15.7	8.0	-23.7
Mid	80.4	-14.8	8.0	-22.8
High	80.2	-15.0	8.0	-23.0

Figure 31 Transmitter Power Density Test Results

JUDGEMENT: Passed by 22.8 dB

For additional information see *Figure 32* to *Figure 34*.

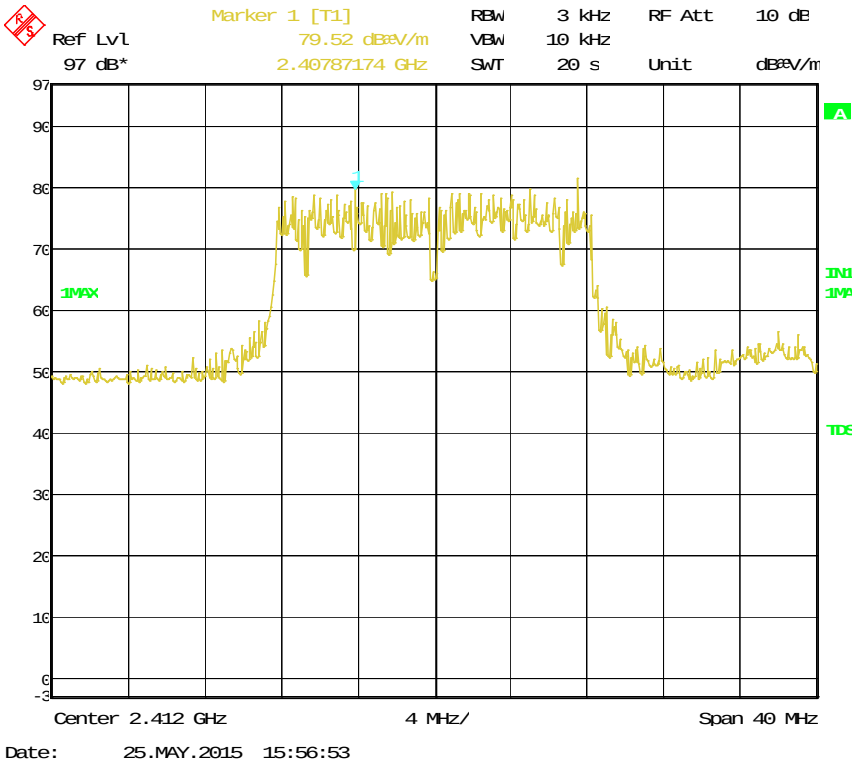

Figure 32 — Low Channel

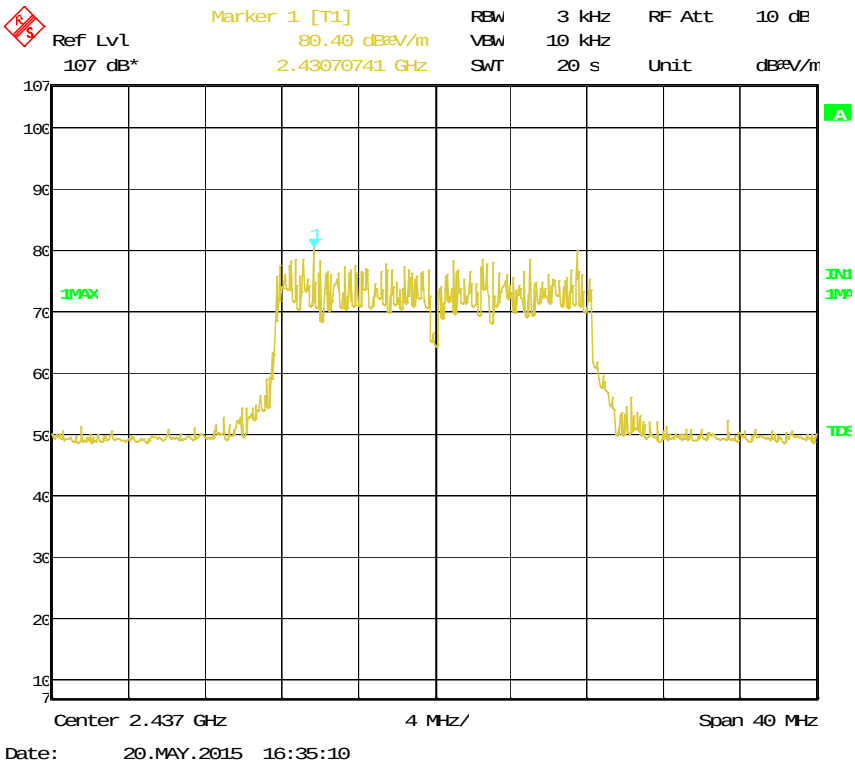

Figure 33 — Mid Channel

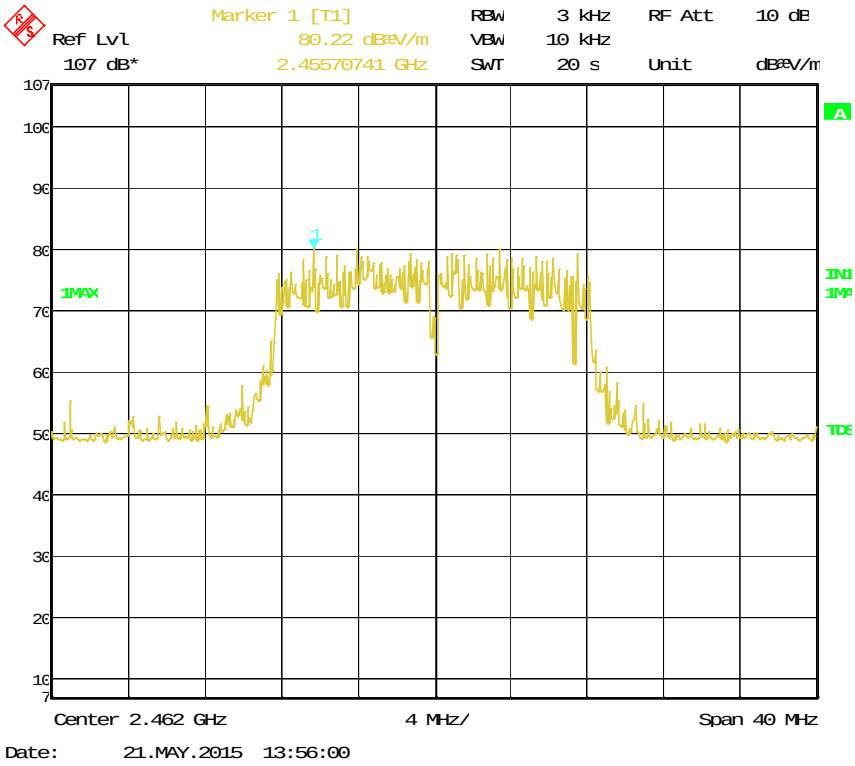

Figure 34 — High Channel

10.4 *Test Equipment Used; Transmitted Power Density*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESIB7	100120	January 4, 2015	1 year
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	1 year
Active Loop Antenna	EMCO	6502	2950	November 4, 2014	1 year
Biconilog Antenna	EMCO	3142	1250	May 22, 2014	2 years
Horn Antenna	ETS	3115	6142	May 19, 2015	3 years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	3 years
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	1 year
Spectrum Analyzer	HP	8564E	3442A00275	March 11, 2015	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	August 22, 2014	1 year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 35 Test Equipment Used

11. Antenna Gain/Information

The antenna gain is 3.3 dBi, integral.

12. R.F Exposure/Safety

Typical use of the E.U.T. is as an asset tag.

The typical placement of the E.U.T. is mounted either vertically or horizontally or handheld. The typical distance between the E.U.T. and the user is 1.0 cm.

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

(a) FCC limits at 2412 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- Maximum Calculated Transmitted Power 105.9 dBuV/m (Peak) (including antenna gain) = 12mW

G_T- Antenna Gain, 3.3 dBi

R- Distance from Transmitter using 1.0 cm worst case

The E.U.T. does not transmit continuously.
The duty cycle, according to customer declaration is 0.018%.

Accordingly, the average power result is 0.018*12= 0.22mW).

(c) The peak power density is:

$$S = \frac{0.22}{4\pi(1)^2} = 0.018\frac{mW}{cm^2}$$

(d) This is below the FCC limit.

13. APPENDIX A - CORRECTION FACTORS

13.1 *Correction factors for CABLE*

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 factors for Correction factors for Bilog ANTENNA*

Model: 3142
Antenna serial number: 1250
3 meter range

FREQUENCY (MHz)	AFE (dB/m)	FREQUENCY (MHz)	AFE (dB/m)
30	18.4	1100	25
40	13.7	1200	24.9
50	9.9	1300	26
60	8.1	1400	26.1
70	7.4	1500	27.1
80	7.2	1600	27.2
90	7.5	1700	28.3
100	8.5	1800	28.1
120	7.8	1900	28.5
140	8.5	2000	28.9
160	10.8		
180	10.4		
200	10.5		
250	12.7		
300	14.3		
400	17		
500	18.6		
600	19.6		
700	21.1		
800	21.4		
900	23.5		
1000	24.3		

13.3 *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

13.4 *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