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DATE: 6 July 2016

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

FCC Radio Test Report

for

Galcon Bakarim Agricultural Cooperative Society Ltd.

Equipment under test:

Irrigation Controller

XCI16-WiFi, XCI12-WiFi*; XCI8-WiFi*; XCI6-WiFi*; XCI4-WiFi*; XCI2-WiFi*

* See customer's declaration on page 6.

Tested by: _____
M. Zohar

Approved by: _____
D. Shidlowsky

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Measurement/Technical Report for

Galcon Bakarim Agricultural Cooperative Society Ltd.

Irrigation Controller

XCI16-WiFi

FCC ID: SZ8XCIW

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

Measurement procedure used is KDB 558074 D01 v03r03 and ANSI 63.10: 2013

Application for Certification
prepared by:
R. Pinchuck
ITL (Product Testing) Ltd.
1 Bat Sheva St.
Lod 7116002
e-mail Rpinchuck@itl.co.il

Applicant for this device:
(different from "prepared by")
Tom Rash
Galcon Bakerim Agricultural etc.
Kibbutz Kfar Blum
D.N. Upper Galilee, 12150, Israel
Tel:: +972-4-690-0222
Fax: +972-4-690-2727
e-mail: tomr@galcon.co.il

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1. General Information

1.1 *Administrative Information*

Manufacturer:	Galcon Bakarim Agricultural Cooperative Society Ltd.
Manufacturer's Address:	Kibbutz Kfar Blum D.N. Upper Galilee, 1215000 Israel Tel: +972-4-690-0222 Fax: +972-4-690-2727
Manufacturer's Representative:	Tom Rash
Equipment Under Test (E.U.T):	Irrigation Controller
Equipment Model No.:	XCI16-WiFi, XCI12-WiFi*; XCI8-WiFi*; XCI6-WiFi*; XCI4-WiFi*; XCI2-WiFi*
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	16.09.2015
Start of Test:	16.09.2015
End of Test:	20.09.2015
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.

Galcon

Date: 26.11.2015

DECLARATION

I hereby declare that the E.U.T. and model name of the unit tested at the ITL EMC laboratory between 16 to 20 September 2015 is as follows:

E.U.T. Name: Indoor Irrigation Controller

Model Name: XCI16-WiFi

I hereby declare that model **XCI16-WiFi** is a full configuration model.
I hereby declare that the only difference between model XCI16-WiFi **and model** XCI2-WiFi, XCI4-WiFi, XCI6-WiFi, XCI8-WiFi, XCI12-WiFi **is the** removal of a Varistor, a Triac,a Capcitor and a Ressistor per station .

The number in the model manes indicate the number of stations that can be connected to the controller.
Please use the above names in the test report and certificate.
Please relate to them all from an RF/EMC point of view as the same product

Thank you,

Signature: _____
Tom Rash
Galcon standards manager
Galcon Bakarim Agricultural Cooperative Society Ltd.

Galcon Tel. 972-4-6900222 **Fax.** 972-4-6902727
Address. Kfar Blum 1215000 Israel **Email.** info@galconc.com **Web.** www.galconc.com

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, 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 E.U.T. is an indoor irrigation controller with integrated Wi-Fi connectivity
• Cloud based internet application lets you control your system from anywhere at any time using your computer, laptop, tablet or smartphone.
• Smart ET Scheduling.
• Checks the weather and automatically adjusts your irrigation schedule according to changing conditions.
• System advisor offers optimized irrigation schedules that factor plant type, irrigation type, location and site parameters.
• Available with 8 or 16 stations.
• Easy to install.
• Easy to operate.

1.4 Test Methodology

Both conducted and radiated testing was performed according to the procedures in KDB 558074 D01 v03r03 and ANSI 63.10: 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

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

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*

The E.U.T. was evaluated in the installation position.

The E.U.T. was evaluated while transmitting at the low channel (2412 MHz), mid channel (2437 MHz) and the high channel (2462 MHz) using 802.11 standard (Wi-Fi).

Regarding Radiated Spurious Emission, exploratory testing was performed to find the "worst case" bit rate between the different modulations (DSSS, CCK and OFDM). The CCK modulation was chosen as the worst case. See results below in *Figure 1*.

FREQUENCY MHz	**DSSS** (1Mbps)	**CCK** (5.5Mbps)	**OFDM** (6.0Mbps)
2412	101.6	102.5	101.3
2437	101.9	103.5	103.5
2462	101.3	103.0	102.7

Figure 1. Screening Results

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*

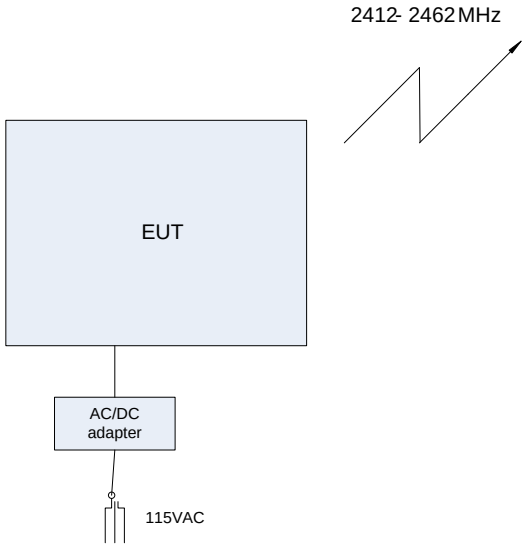


Figure 2. Configuration of Tested System

3. Conducted & Radiated Measurement Test Set-up Photos

Figure 3. Conducted Emission Test

Figure 4. Radiated Emission Test

Figure 5. Radiated Emission Test

Figure 6. Radiated Emission Test

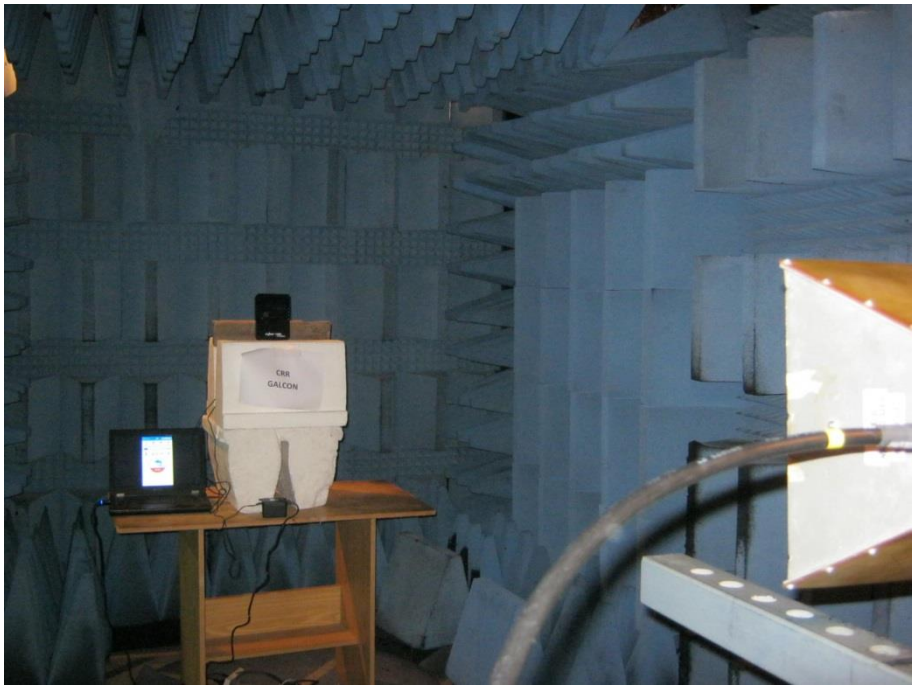


Figure 7. Radiated Emission Test

4. Conducted Emission From AC Mains

4.1 *Test Specification*

FCC Part 15, Subpart C, Section 15.207

4.2 *Test Procedure*

The E.U.T operation mode and test setup are as described in Section 2 of this report. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room with the E.U.T placed on a 0.8 meter high wooden table, 0.4 meter from the room's vertical wall. In the case of a floor-standing E.U.T., it was placed on the horizontal ground plane.

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

The center of the E.U.T.'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 3. Conducted Emission Test.*

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

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

JUDGEMENT: Passed by 17.9 dB

The margin between the emission levels and the specification limit is, in the worst case, 17.90 dB for the phase line at 19.71 MHz and 19.08 dB at 19.71 MHz for the neutral line.

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

The details of the highest emissions are given in *Figure 8* to *Figure 11*.

Conducted Emission

E.U.T Description	Irrigation Controller
Type	XCI16-WiFi
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart C, Class B
Lead:	Phase
Detectors:	Peak, Quasi-peak, Average

EDIT PEAK LIST (Final Measurement Results)

Trace1: CE22BQP
Trace2: CE22BAP
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
2	Average	194 kHz	15.75	-38.11
1	Quasi Peak	242 kHz	16.76	-45.26
1	Quasi Peak	414 kHz	15.84	-41.72
2	Average	414 kHz	8.35	-39.21
2	Average	518 kHz	7.53	-38.46
1	Quasi Peak	538 kHz	13.23	-42.76
2	Average	962 kHz	13.50	-32.49
1	Quasi Peak	1.09 MHz	22.33	-33.67
2	Average	1.29 MHz	10.73	-35.26
1	Quasi Peak	1.634 MHz	26.19	-29.80
2	Average	2.986 MHz	10.99	-35.00
1	Quasi Peak	3.266 MHz	25.09	-30.90
1	Quasi Peak	3.69 MHz	14.77	-41.22
2	Average	3.93 MHz	9.70	-36.29
2	Average	7.922 MHz	19.04	-30.95
1	Quasi Peak	10.27 MHz	16.14	-43.85
1	Quasi Peak	16.23 MHz	31.61	-28.39
2	Average	16.23 MHz	26.44	-23.55
1	Quasi Peak	19.71 MHz	35.96	-24.03
2	Average	19.71 MHz	32.09	-17.90

Date: 17.SEP.2015 11:26:10

Figure 8. Detectors: Peak, 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	Irrigation Controller
Type	XCI16-WiFi
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart C, Class B
Lead:	Phase
Detectors:	Peak, Quasi-peak, Average

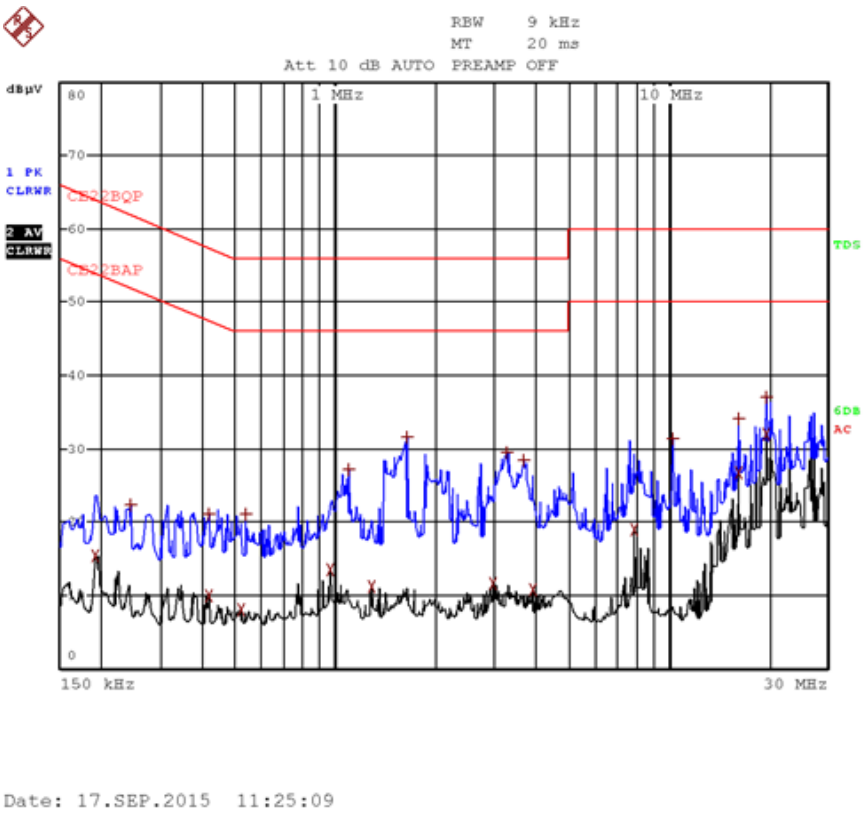


Figure 9. Detectors: Peak, Quasi-peak, Average

Conducted Emission

E.U.T Description	Irrigation Controller
Type	XCI16-WiFi
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart C, Class B
Lead:	Neutral
Detectors:	Peak, Quasi-peak, Average

EDIT PEAK LIST (Final Measurement Results)

Trace1: CE22BQP
Trace2: CE22BAP
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	194 kHz	22.39	-41.46
2	Average	194 kHz	17.19	-36.66
2	Average	386 kHz	10.04	-38.10
1	Quasi Peak	406 kHz	14.66	-43.06
2	Average	470 kHz	8.69	-37.82
1	Quasi Peak	534 kHz	11.96	-44.03
2	Average	962 kHz	13.96	-32.03
1	Quasi Peak	1.158 MHz	18.12	-37.88
1	Quasi Peak	1.35 MHz	17.62	-38.37
2	Average	1.35 MHz	12.43	-33.56
2	Average	3.05 MHz	12.39	-33.60
1	Quasi Peak	3.522 MHz	15.71	-40.28
1	Quasi Peak	4.57 MHz	14.72	-41.27
2	Average	4.59 MHz	10.10	-35.89
2	Average	7.922 MHz	18.91	-31.09
1	Quasi Peak	10.246 MHz	24.68	-35.31
1	Quasi Peak	10.618 MHz	16.35	-43.64
2	Average	16.23 MHz	25.53	-24.47
1	Quasi Peak	19.71 MHz	34.73	-25.26
2	Average	19.71 MHz	30.91	-19.08

Date: 17.SEP.2015 11:30:59

Figure 10. Detectors: Peak, 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	Irrigation Controller
Type	XCI16-WiFi
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart C, Class B
Lead:	Neutral
Detectors:	Peak, Quasi-peak, Average

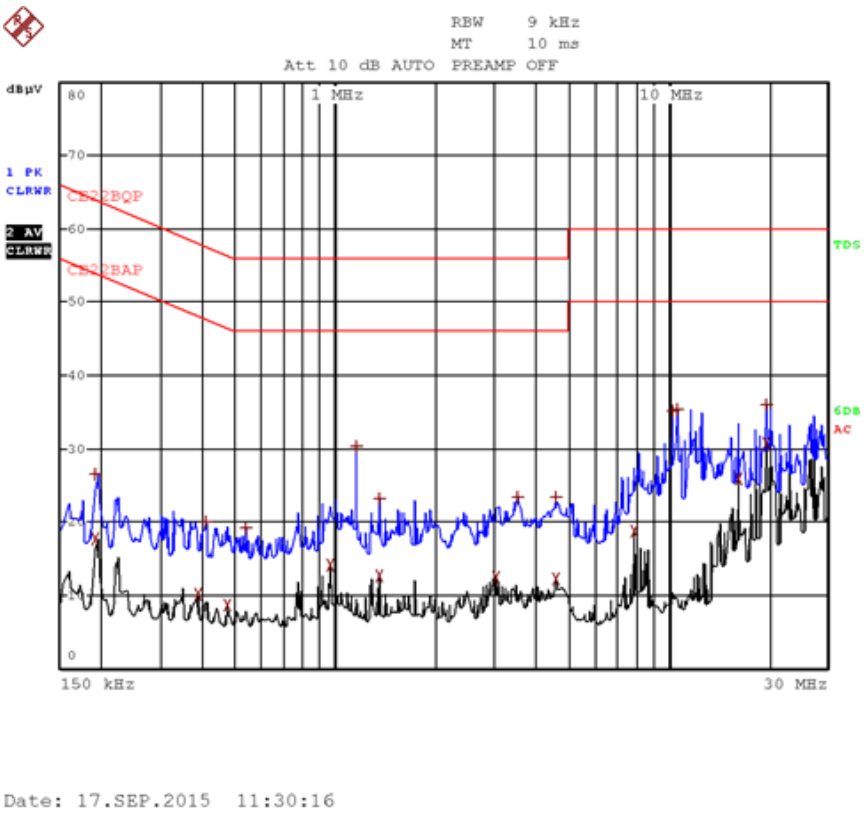


Figure 11 Conducted Emission: NEUTRAL
Detectors: Peak, Quasi-peak, Average

4.4 *Test Instrumentation Used, Conducted Measurement*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Date
LISN	Fischer	FCC-LISN-25A	127	March 16, 2015	March 16, 2016
Transient Limiter	HP	11947A	3107A03041	May 13, 2015	May 13, 2016
EMI Receiver	Rohde & Schwarz	ESCI7	100724	January 4, 2015	January 31, 2016

Figure 12 Test Equipment Used

5. 6 dB Minimum Bandwidth

5.1 *Test Specification*

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

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 was tested 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 2*.

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.

The evaluation was done in Low (2412 MHz), Mid (2437 MHz) and High (2462 MHz) channels each with the 3 modulations: DSS, CCK and OFDM.

5.3 *Test Results*

Modulation	Operation Frequency (MHz)	Reading (MHz)	Specification (MHz)
DSSS	2412.0	8.7	>0.5
	2437.0	8.5	>0.5
	2462.0	9.5	>0.5
CCK	2412.0	8.4	>0.5
	2437.0	7.5	>0.5
	2462.0	7.9	>0.5
DSSS	2412.0	15.1	>0.5
	2437.0	14.1	>0.5
	2462.0	13.8	>0.5

Figure 13 6 dB Minimum Bandwidth

JUDGEMENT: Passed

For additional information see *Figure 14* to *Figure 22*.

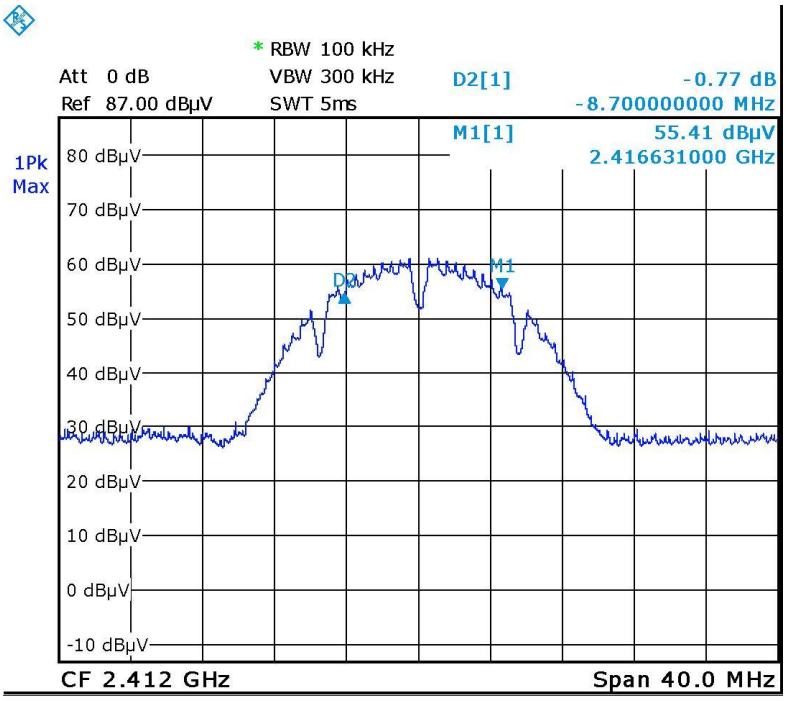


Figure 14. Low Channel, DSSS

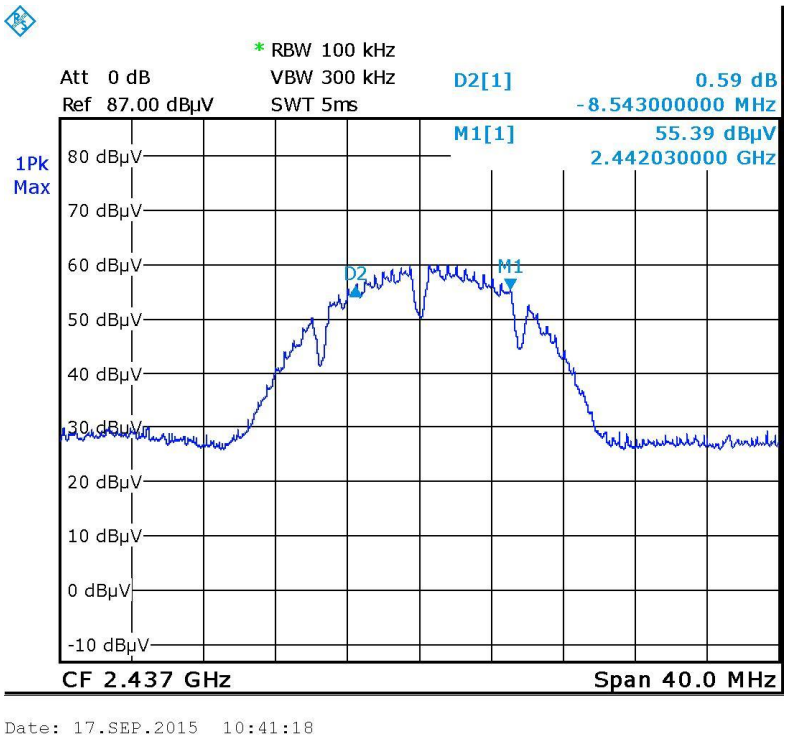


Figure 15. Mid Channel, DSSS

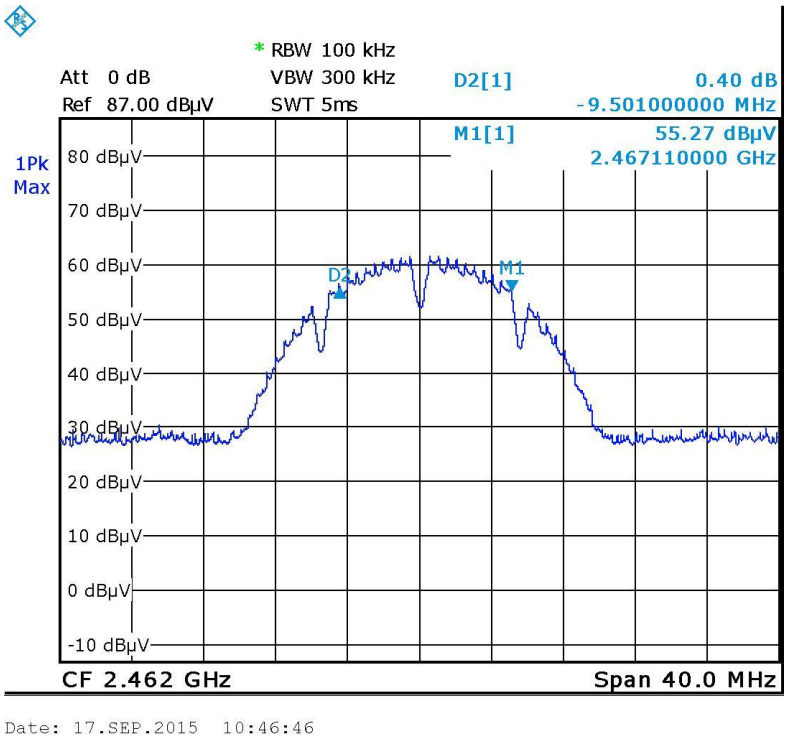


Figure 16. High Channel, DSSS

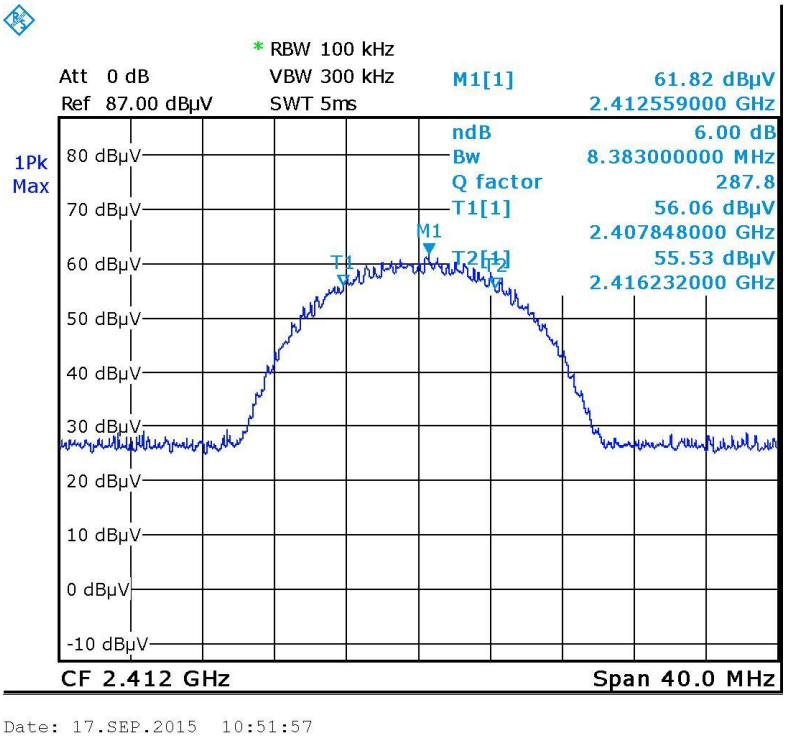


Figure 17. Low Channel, CCK

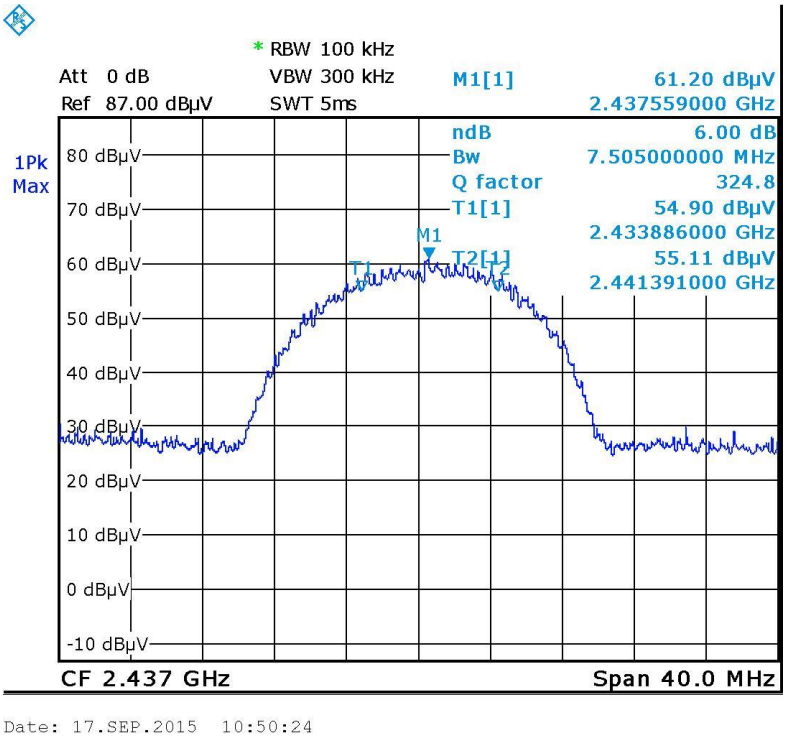


Figure 18. Mid Channel, CCK

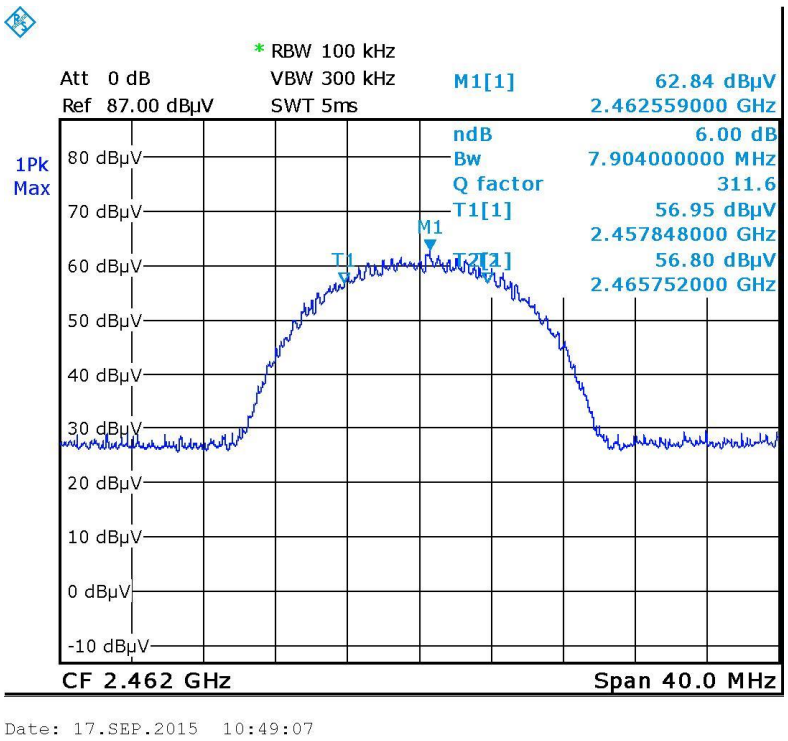


Figure 19. High Channel, CCK

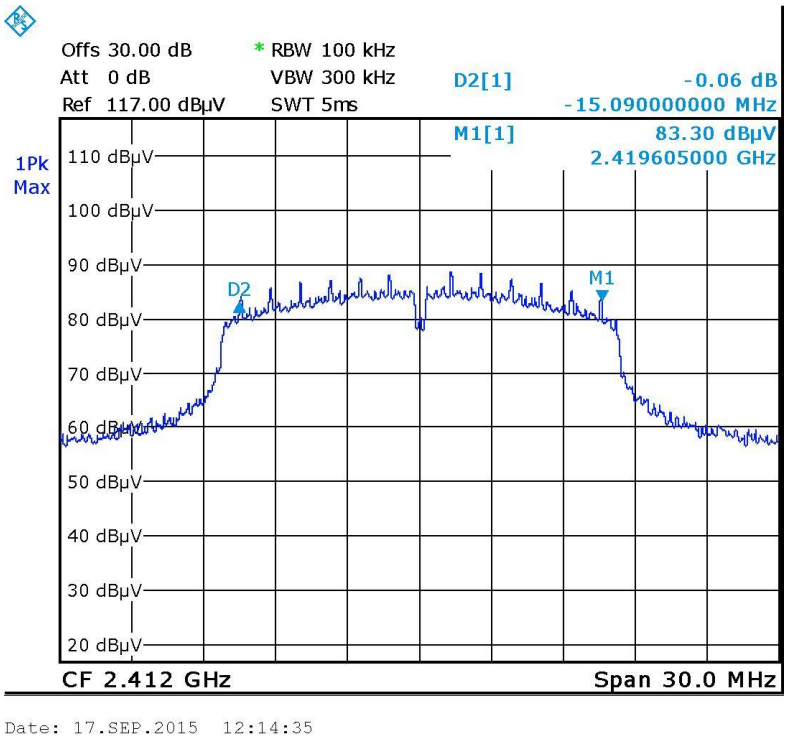


Figure 20. Low Channel, OFDM

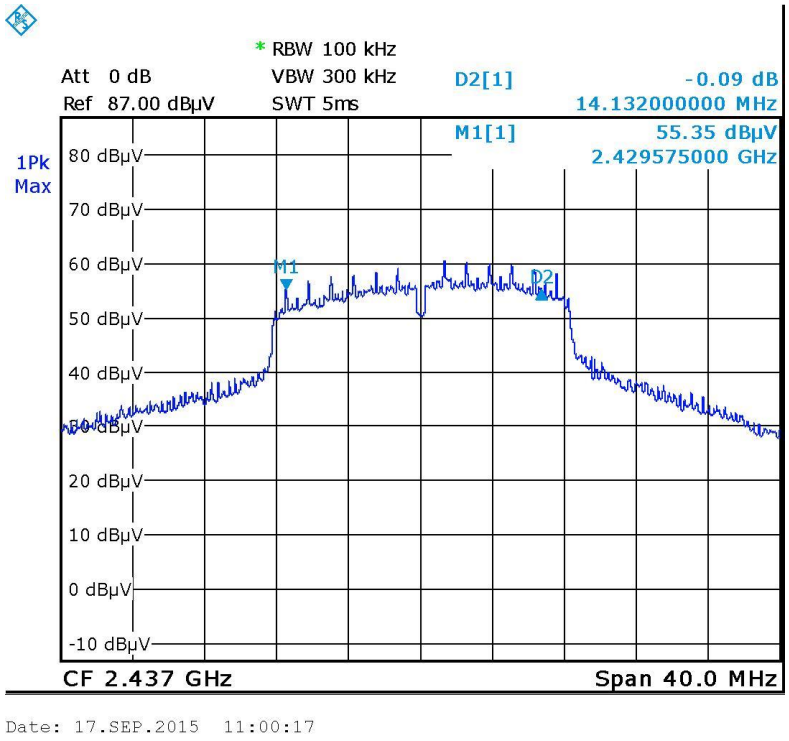


Figure 21. Mid Channel, OFDM

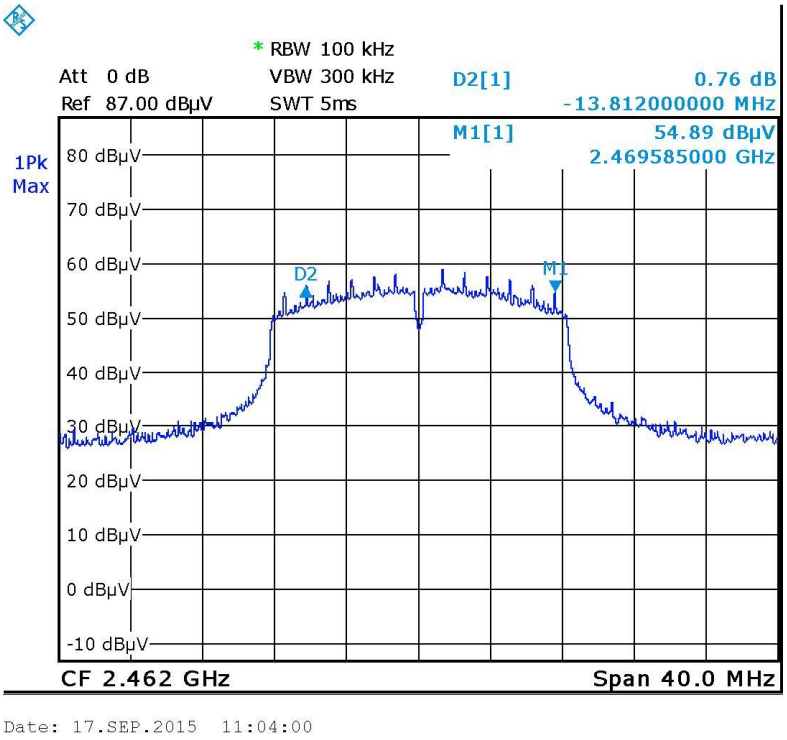


Figure 22. High Channel, OFDM

5.4 *Test Equipment Used; 6dB Bandwidth*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Date
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	January 1, 2016
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	N/A	N/A

Figure 23 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 of this report.

The E.U.T was tested 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 2*.

The E.U.T was evaluated in 3 channels: Low (2412 MHz), Mid (2437 MHz) and High (2462 MHz) each with 3 modulations: DSS, CCK and OFDM.

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)

6.3 *Test Results*

Modulation	Operation Frequency (MHz)	Polarization (V/H)	Power (dBuV/m)	Power (dBm)	Power (W)	Specification (W)	Margin (W)
DSSS	2412.0	V	109.0	13.8	0.024	1.0	-0.976
	2412.0	H	109.3	14.1	0.026	1.0	-0.974
	2437.0	V	**109.4**	14.2	0.026	1.0	-0.974
	2437.0	H	106.1	10.9	0.012	1.0	-0.988
	2462.0	V	109.3	14.1	0.026	1.0	-0.974
	2462.0	H	107.9	12.7	0.019	1.0	-0.981
CCK	2412.0	V	**112.6**	17.4	0.055	1.0	-0.945
	2412.0	H	111.9	16.7	0.047	1.0	-0.953
	2437.0	V	109.3	14.1	0.026	1.0	-0.974
	2437.0	H	110.5	15.3	0.034	1.0	-0.966
	2462.0	V	109.8	14.6	0.029	1.0	-0.971
	2462.0	H	108.7	13.5	0.022	1.0	-0.978
OFDM	2412.0	V	110.3	15.1	0.032	1.0	-0.968
	2412.0	H	109.7	14.5	0.028	1.0	-0.972
	2437.0	V	111.3	16.1	0.041	1.0	-0.959
	2437.0	H	**111.5**	16.3	0.043	1.0	-0.957
	2462.0	V	109.3	14.1	0.026	1.0	-0.974
	2462.0	H	109.1	13.9	0.025	1.0	-0.975

Figure 24 Maximum Peak Power Output

JUDGEMENT: Passed by 0.945 W

For additional information see *Figure 25* to *Figure 42.*

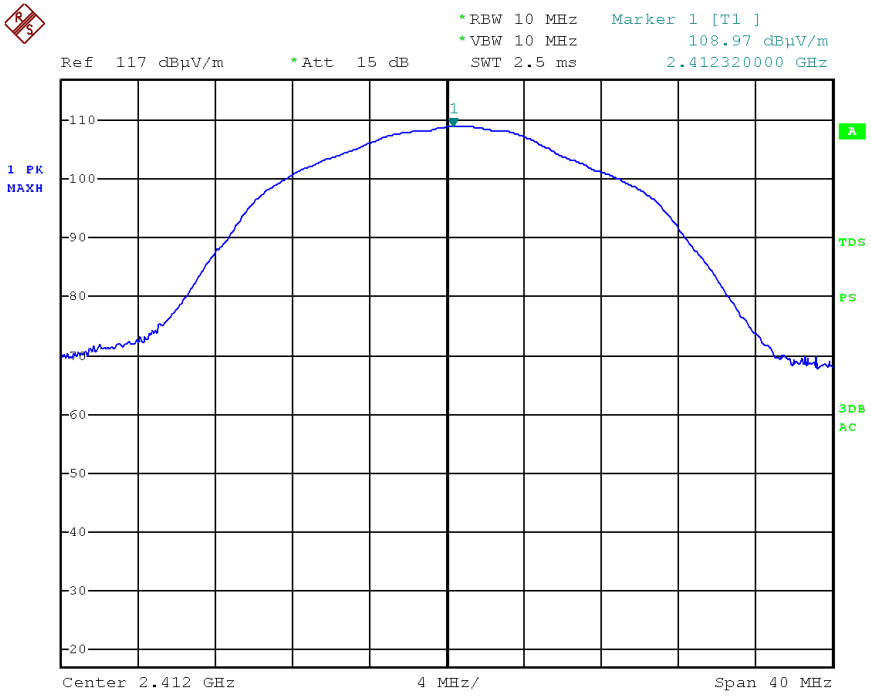


Figure 25 2412.0 MHz – Vertical, DSSS

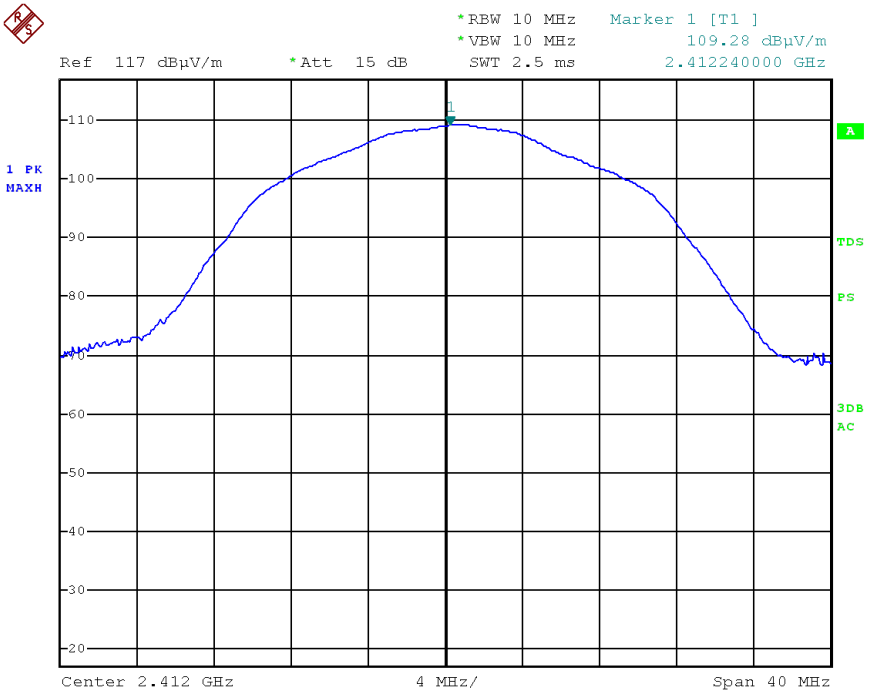


Figure 26 2412.0 MHz – Horizontal, DSSS

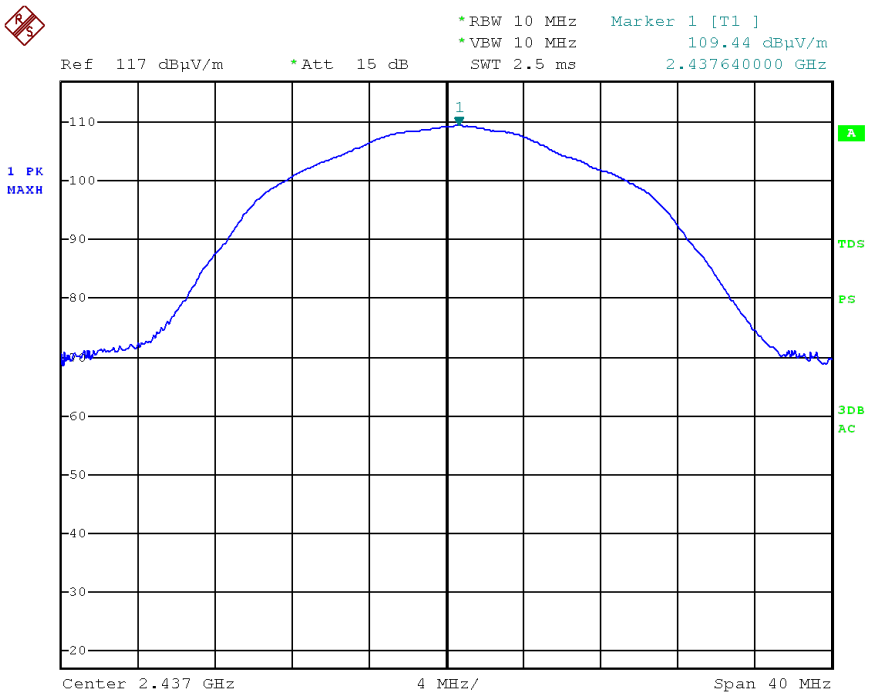


Figure 27 2437.0 MHz – Vertical, DSSS

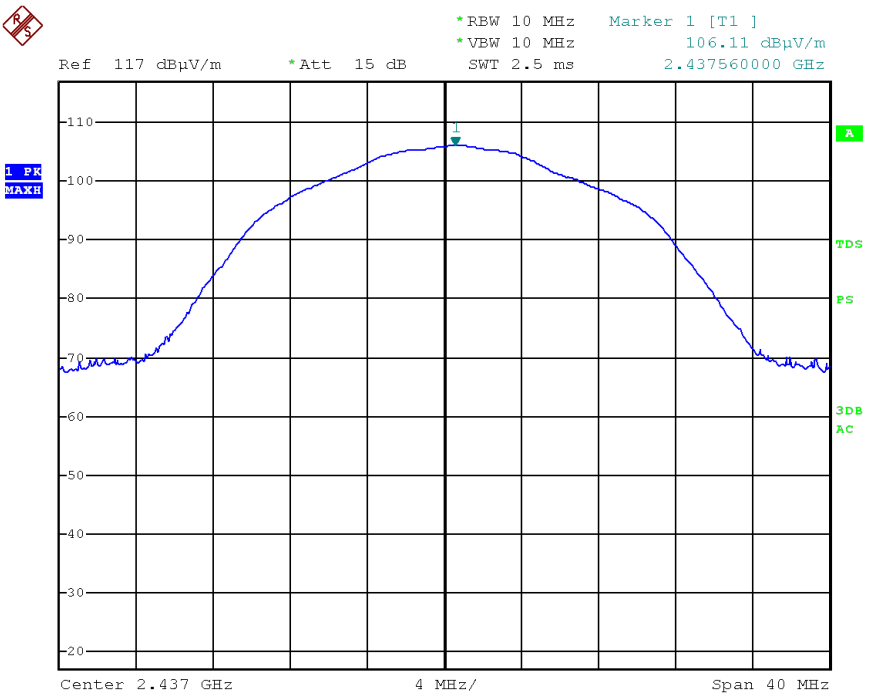


Figure 28 2437.0 MHz – Horizontal, DSSS

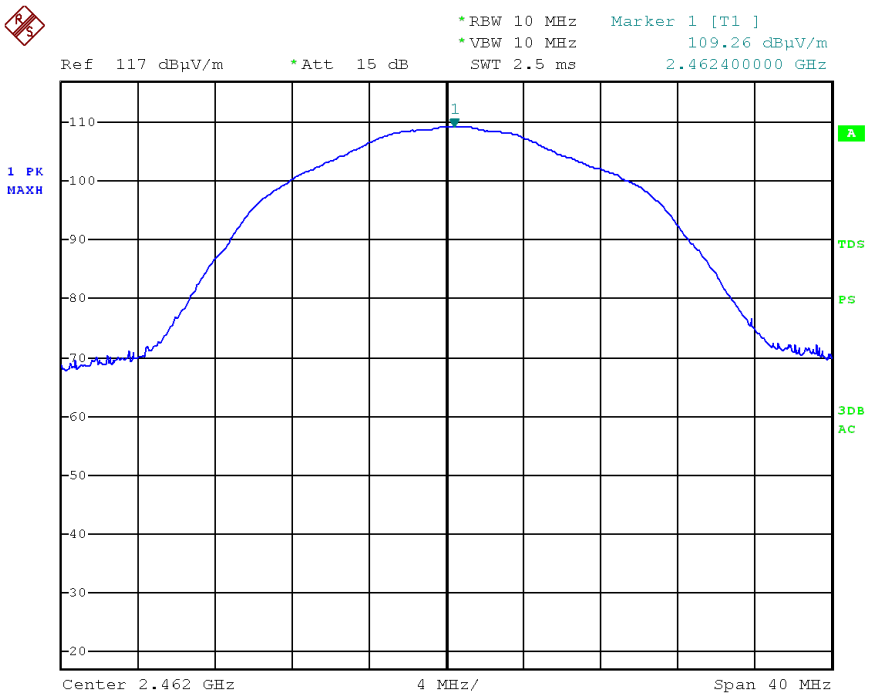


Figure 29 2462.0 MHz – Vertical, DSSS

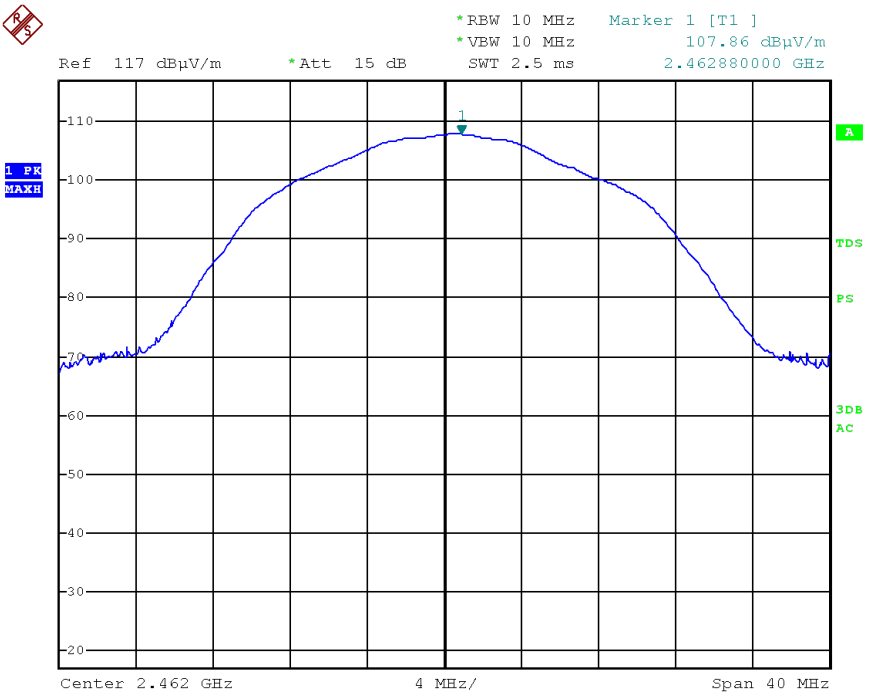


Figure 30 2462.0 MHz – Horizontal, DSSS

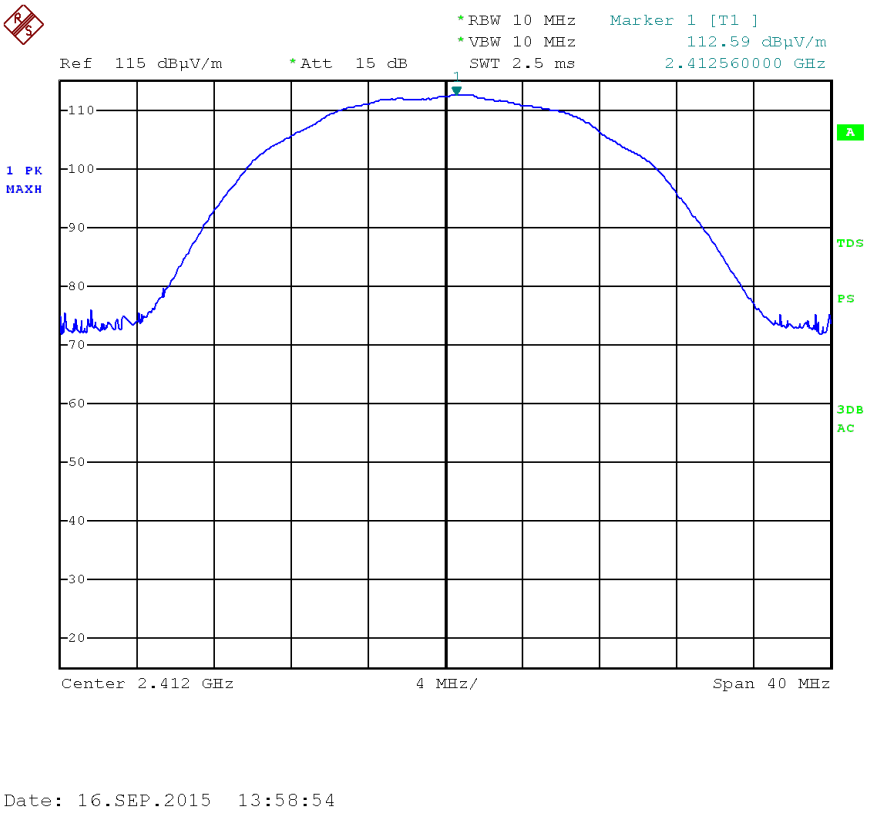


Figure 31 2412.0 MHz – Vertical, CCK

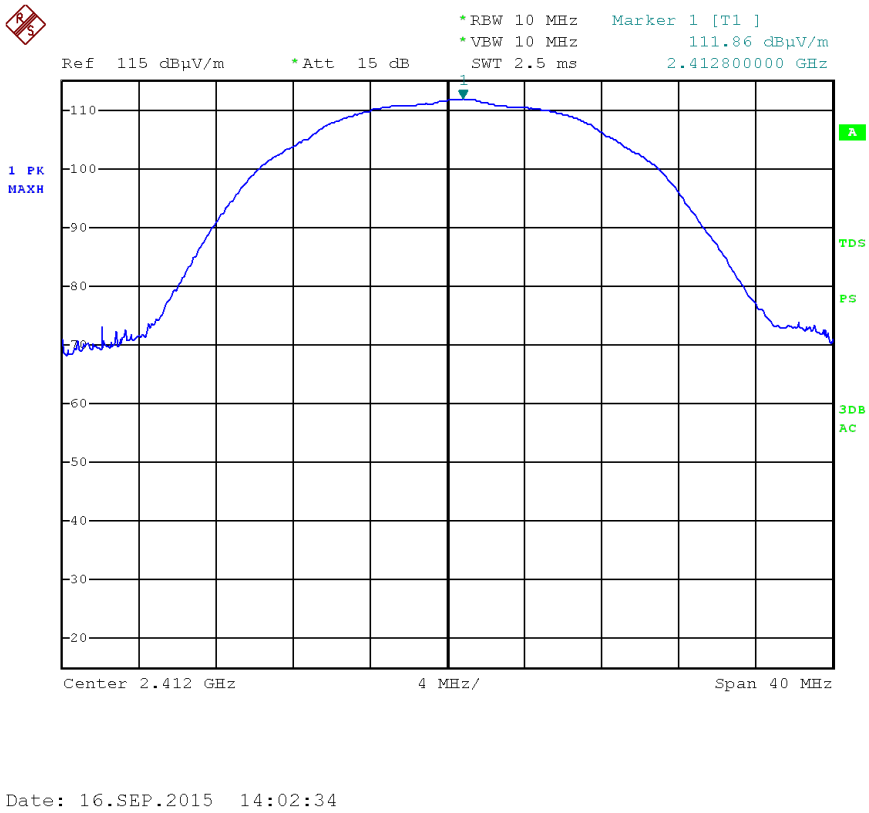


Figure 32 2412.0 MHz – Horizontal, CCK

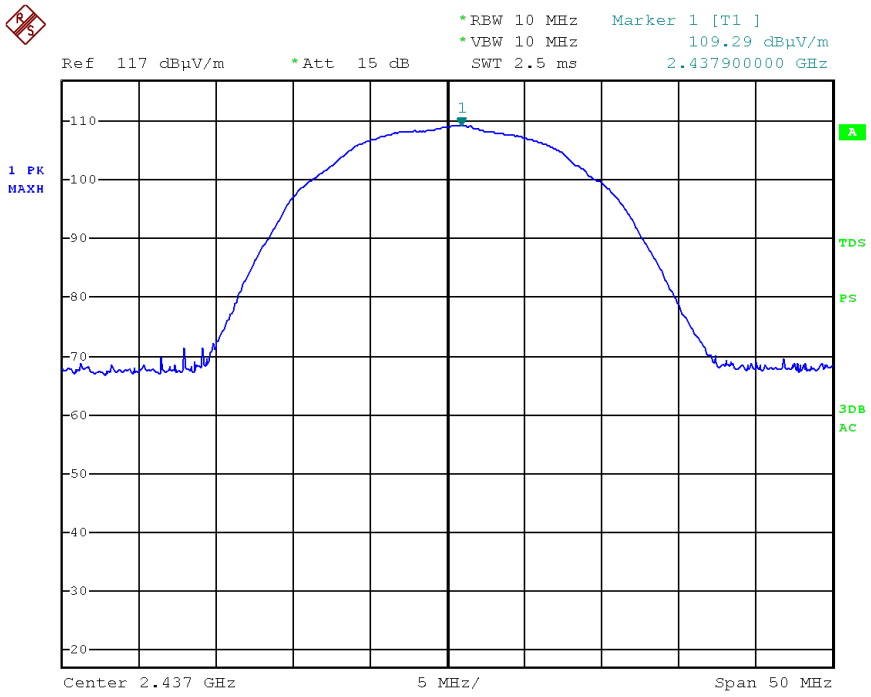


Figure 33 2437.0 MHz – Vertical, CCK

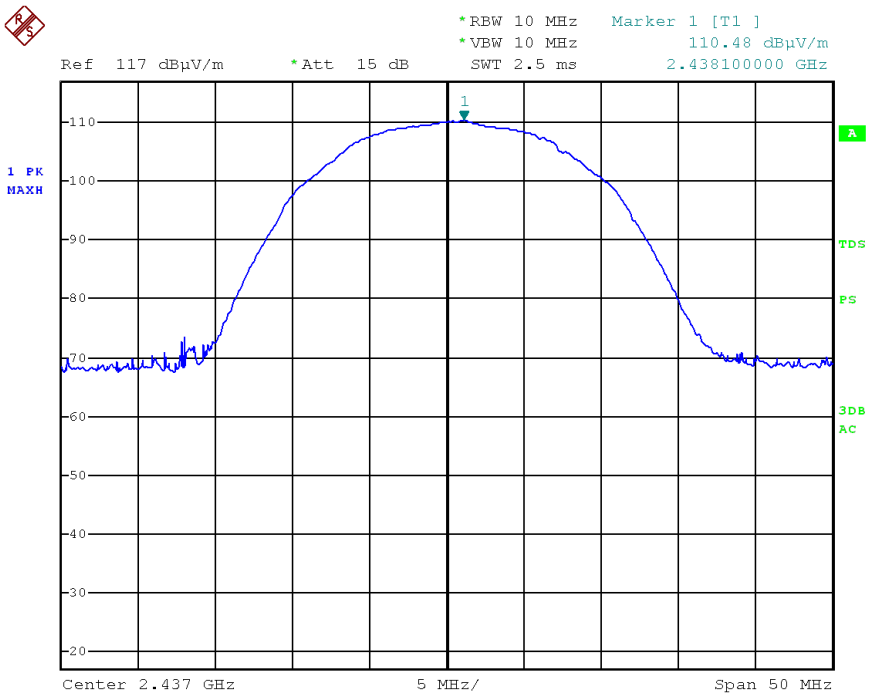


Figure 34 2437.0 MHz – Horizontal, CCK

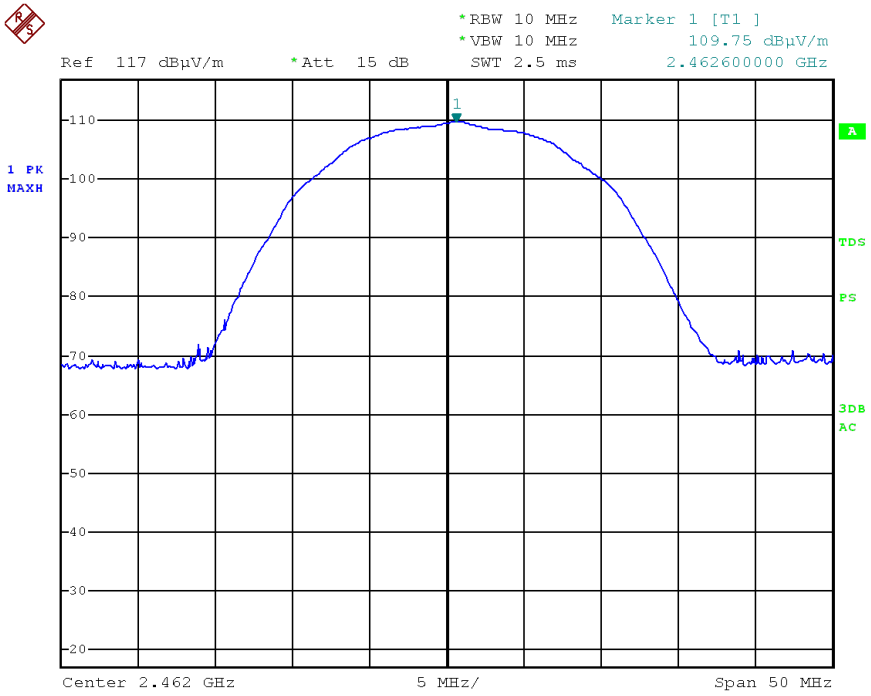


Figure 35 2462.0 MHz – Vertical, CCK

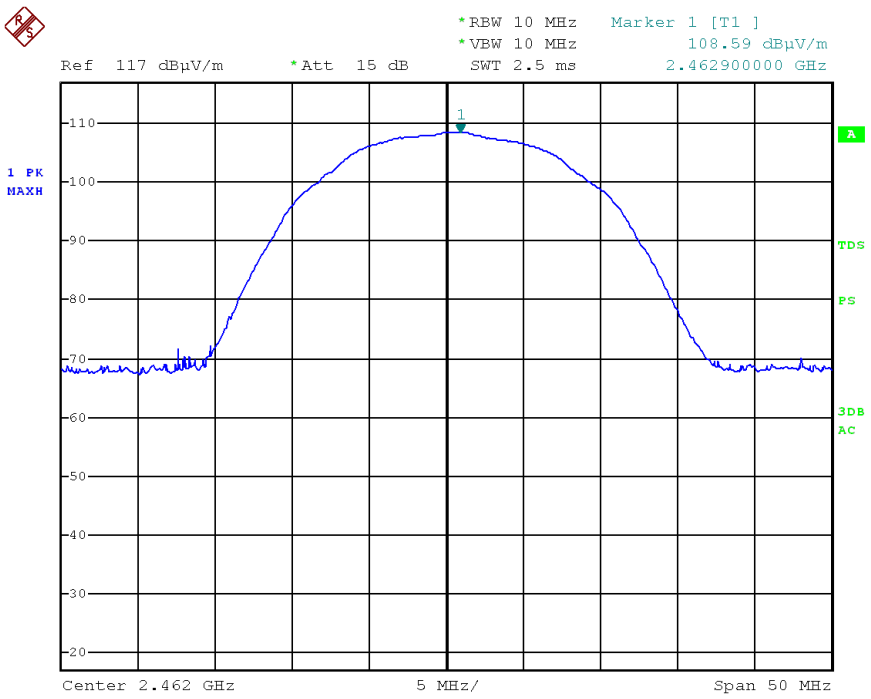


Figure 36 2462.0 MHz – Horizontal, CCK

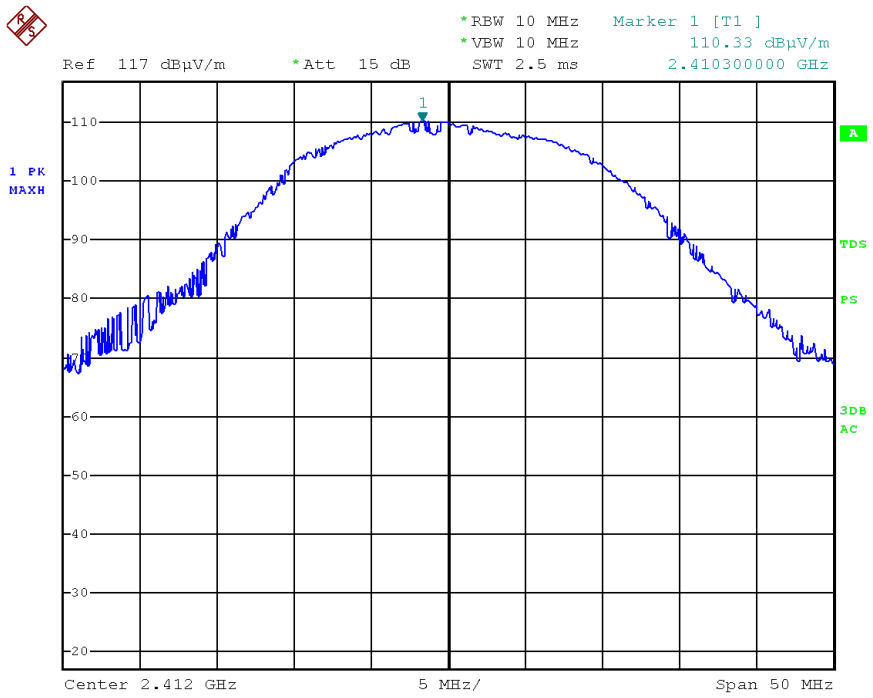


Figure 37 2412.0 MHz – Vertical, OFDM

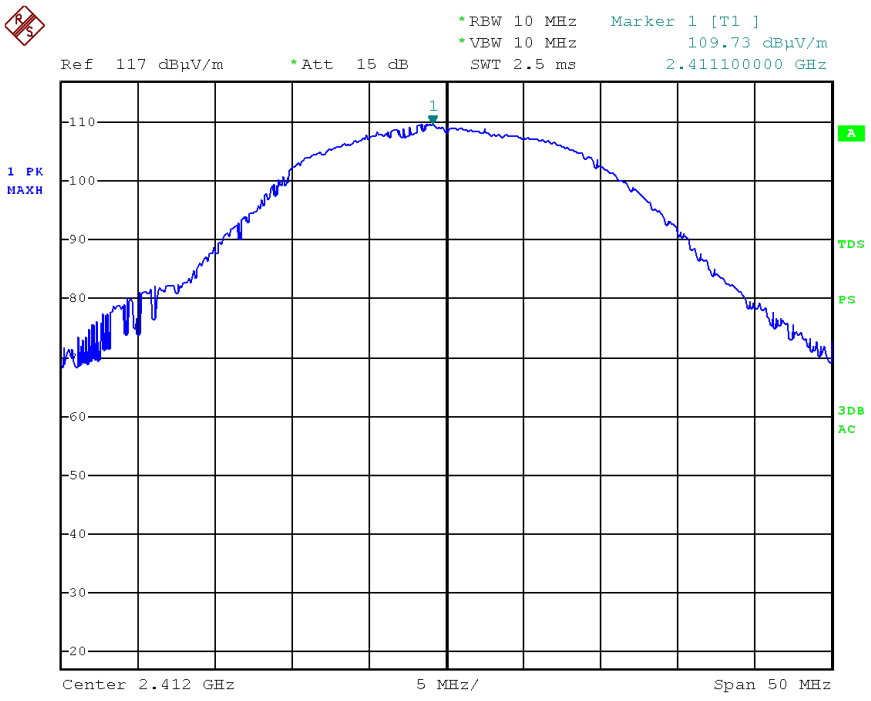


Figure 38 2412.0 MHz – Horizontal, OFDM

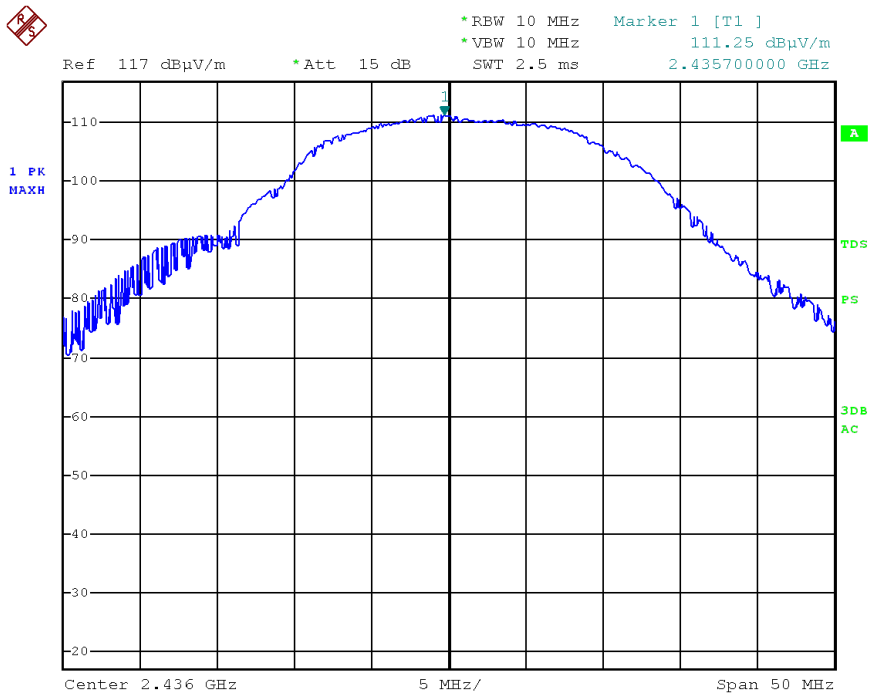


Figure 39 2437.0 MHz – Vertical, OFDM

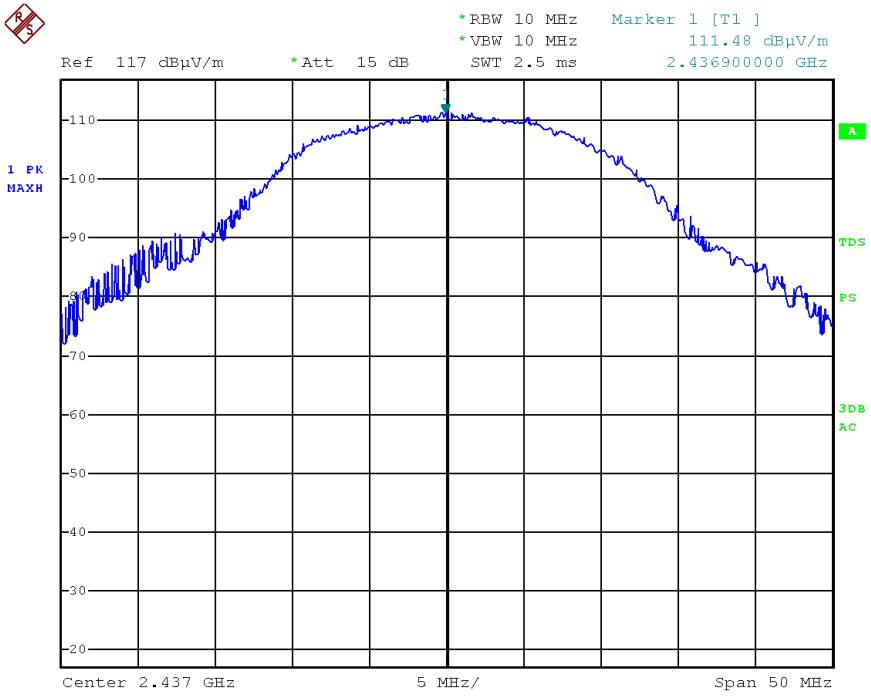


Figure 40 2437.0 MHz – Horizontal, OFDM

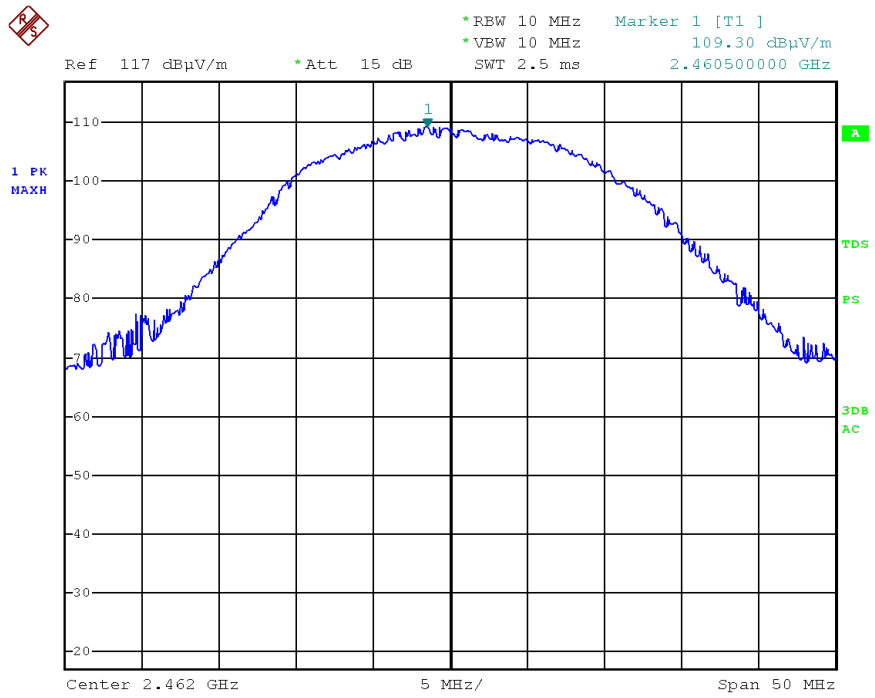


Figure 41 2462.0 MHz – Vertical, OFDM

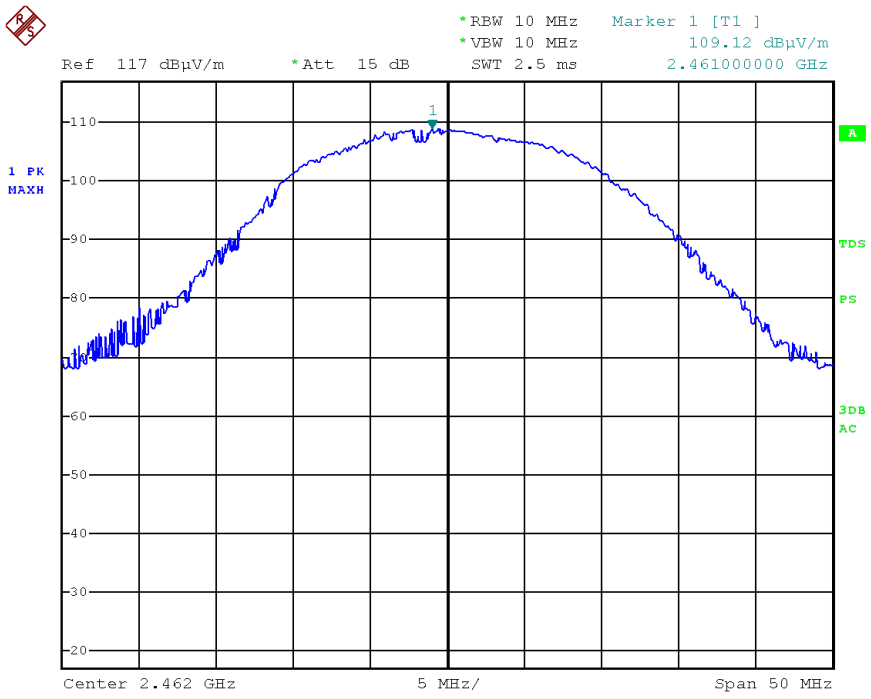


Figure 42 2462.0 MHz – Horizontal, OFDM

6.4 *Test Equipment Used; Maximum Peak Power Output*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Last Calibration Date
EMI Receiver	R&S	ESCI7	100724	January 4, 2015	January 31, 2016
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	N/A	N/A

Figure 43 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 of this report.

The E.U.T was tested 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 2.*

The E.U.T was evaluated in 2 channels: Low and High each in 3 modulations.

The RBW was set to 100 kHz.

7.3 *Test Results*

Modulation	Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBm)	Specification (dBm)	Margin (dB)
DSSS	Low	2400.0	57.0	70.5	-13.5
	High	2483.5	56.9	71.7	-14.8
CCK	Low	2400.0	57.1	71.0	-13.9
	High	2483.5	58.2	73.2	-15.0
OFDM	Low	2400.0	58.5	68.1	-9.6
	High	2483.5	57.2	68.5	-11.3

Figure 44 Band Edge Spectrum

JUDGEMENT: Passed by 9.6 dB

For additional information see *Figure 45* to *Figure 50.*

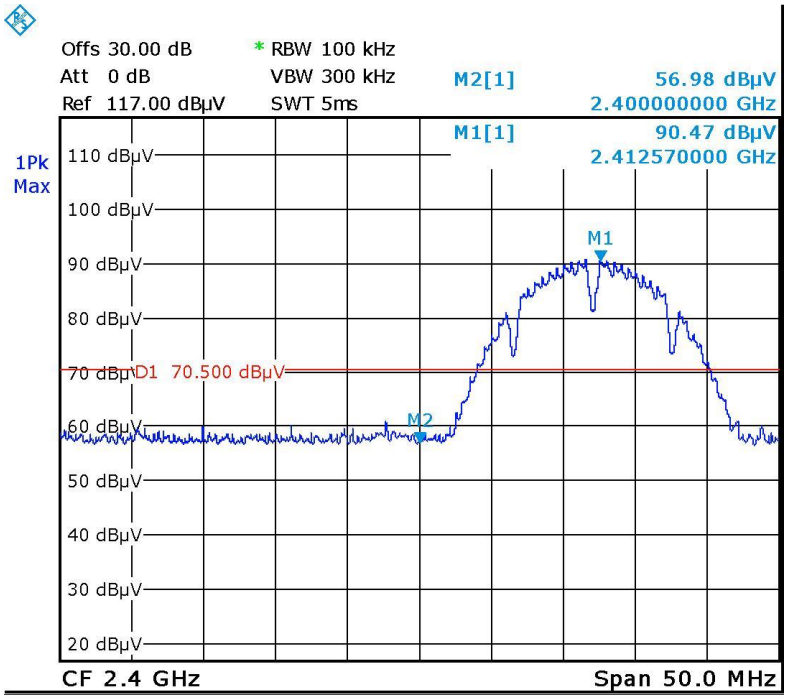


Figure 45 —Lower Band Edge, DSSS

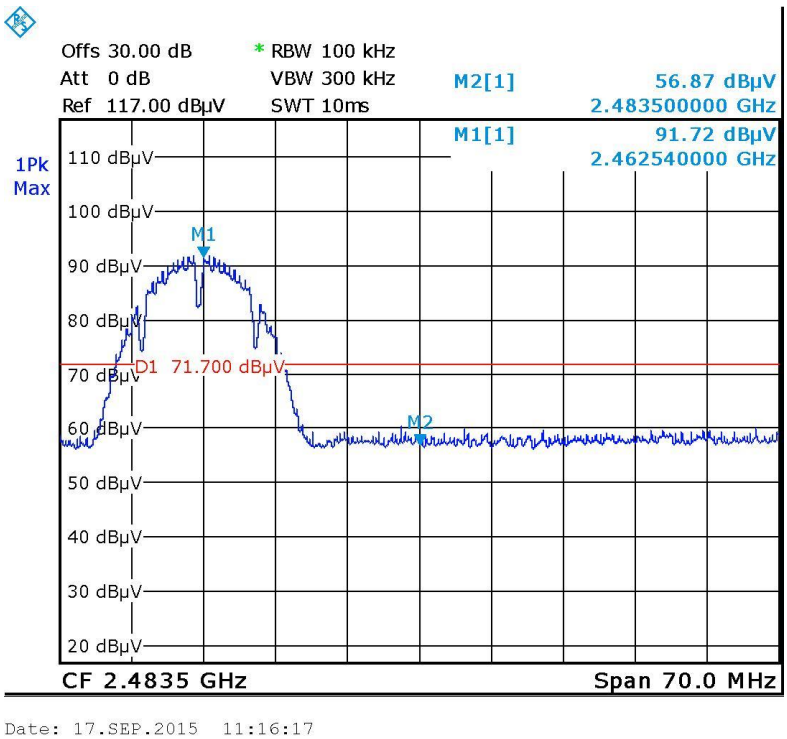


Figure 46 —Upper Band Edge, DSSS

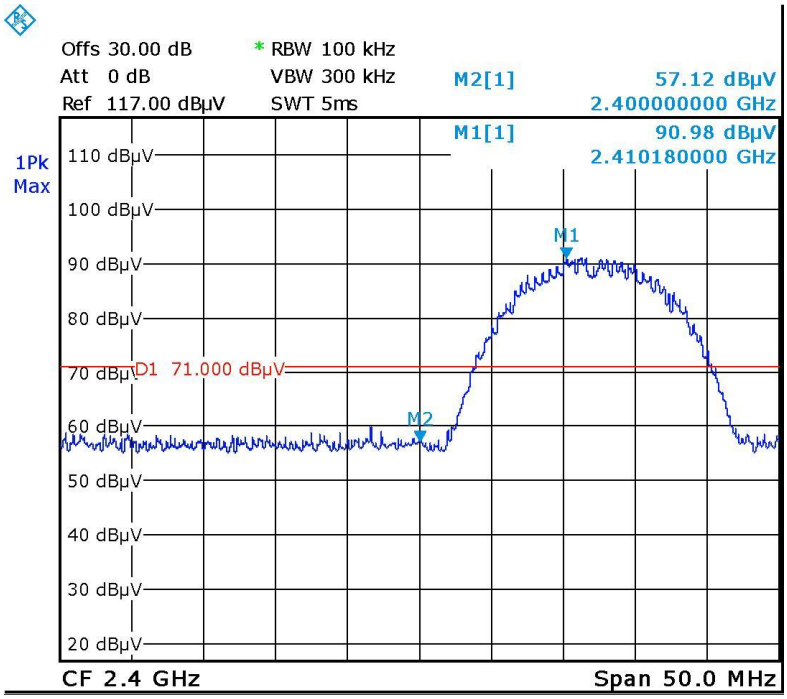


Figure 47 —Lower Band Edge, CCK

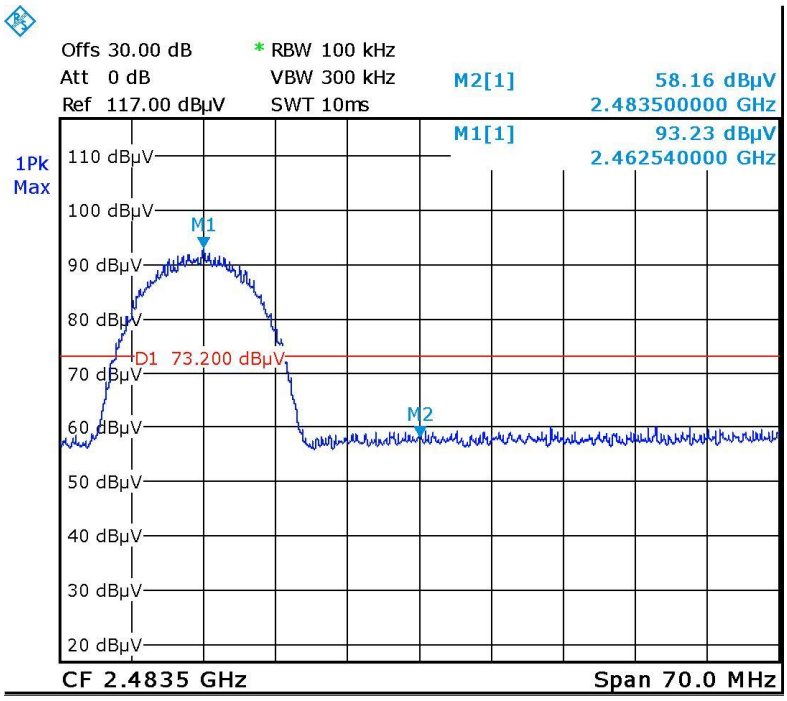


Figure 48 —Upper Band Edge, CCK

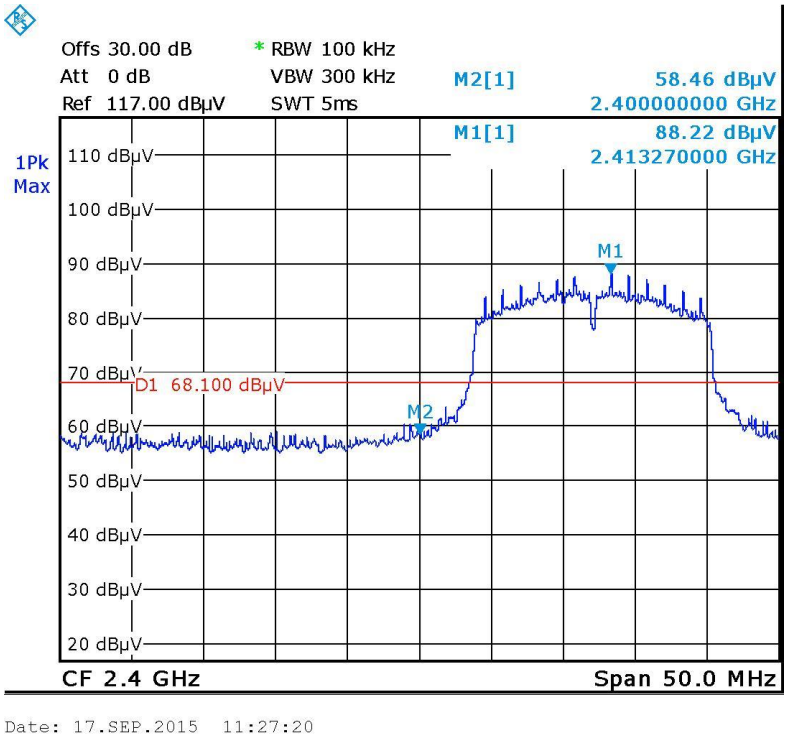


Figure 49 —Lower Band Edge, OFDM

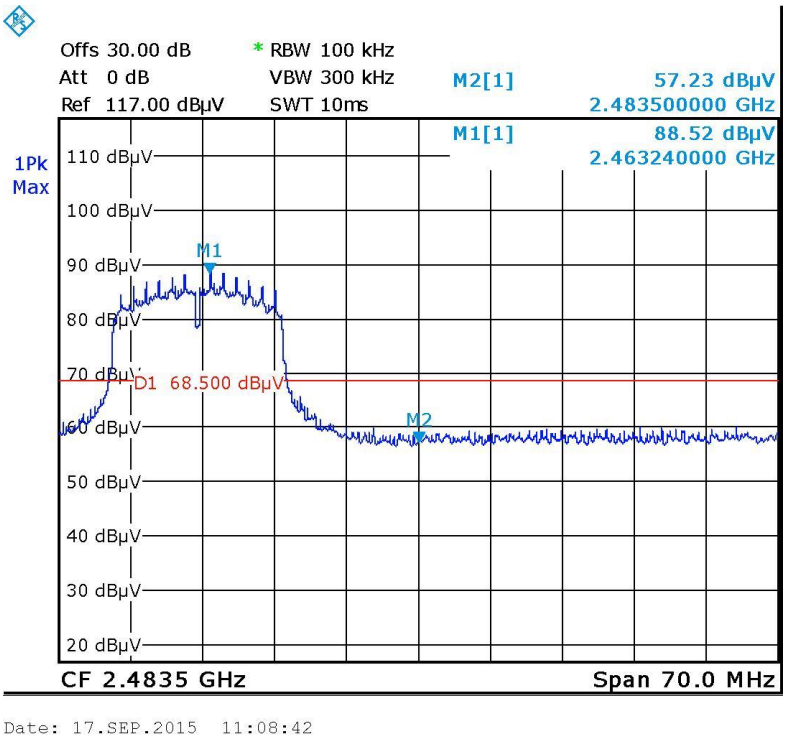


Figure 50 —Upper Band Edge, OFDM

7.4 *Test Equipment Used; Band Edge Spectrum*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Last Calibration Date
EMI Receiver	R&S	FSL6	100194	January 1, 2015	January 1, 2016
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	N/A	N/A

Figure 51 Test Equipment Used

8. Emissions in Non-Restricted Frequency Bands

8.1 *Test Specification*

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

8.2 *Test Procedure*

The E.U.T.'s operation mode and test set-up are as described in Section 2 of this report.

For 0.009MHz-1000MHz 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 2.

The frequency range 0.009 MHz-1000 MHz was scanned.

RBW was set to 100 kHz.

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 1000MHz-25000MHz 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 2.

The frequency range 1000 MHz-25000 MHz was scanned.

RBW was set to 1000 kHz.

In the frequency range 30-7000MHz, a computerized EMI receiver complying with CISPR 16 requirements was used.
In the frequency range 7000MHz-25000 MHz, a spectrum analyzer including a low noise amplifier was used.

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

For all final evaluations the distance was 3 meters.
The E.U.T. was operated at the low, mid and high channels (2412.0 MHz, 2437 MHz and 2462.0 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 emission levels were more than 20dBc below the fundamental level.

The EUT met the requirements of the F.C.C. Part 15, Subpart C, 247(d) specification.

8.4 *Test Instrumentation Used, Emissions in Non-Restricted Frequency Bands*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Date
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
Active Loop Antenna	EMCO	6502	9506-2950	November 4, 2014	November 5, 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
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	3536A00120A DI	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 52 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. Emissions in Restricted Frequency Bands

9.1 *Test Specification*

FCC, Part 15, Subpart C, Sections 15.247(d), 15.205, 15.209

9.2 *Test Procedure*

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

For 0.009MHz-1000M 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 2.
The frequency range 0.009 MHz-1000 MHz was scanned.

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

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

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

For 1000M-25000M 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 2.

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.

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.

In the frequency range 30-7000MHz, a computerized EMI receiver complying with CISPR 16 requirements was used.
In the frequency range 7000M-25000 MHz, 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. (2412, 2437, 2462 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 53 Table of Limits

9.3 *Test Results*

JUDGEMENT: Passed by 4.4 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 54* to *Figure 55*.

Radiated Emission

E.U.T Description Irrigation Controller
Type XCI16-WiFi
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 0.009MHz 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	61.6	74.0	-12.4
2412.0	2390.0	V	60.4	74.0	-13.4
2412.0	4824.0	H	56.5	74.0	-17.5
2412.0	4824.0	V	58.8	74.0	-15.2
2437.0	4874.0	H	56.9	74.0	-17.1
2437.0	4874.0	V	56.4	74.0	-17.6
2462.0	4924.0	H	56.0	74.0	-18.0
2462.0	4924.0	V	56.6	74.0	-17.4
2462.0	2483.5	H	54.5	74.0	-19.5
2462.0	2483.5	V	57.2	74.0	-16.8

Figure 54. 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 Irrigation Controller
Type XCI16-WiFi
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 0.009MHz 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	49.6	54.0	-4.4
2412.0	2390.0	V	49.2	54.0	-4.8
2412.0	4824.0	H	39.9	54.0	-14.1
2412.0	4824.0	V	41.0	54.0	-13.0
2437.0	4874.0	H	45.3	54.0	-8.7
2437.0	4874.0	V	45.0	54.0	-9.0
2462.0	4924.0	H	44.4	54.0	-9.6
2462.0	4924.0	V	43.1	54.0	-10.9
2462.0	2483.5	H	42.0	54.0	-12.0
2462.0	2483.5	V	42.1	54.0	-11.9

Figure 55. 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 Date
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
Active Loop Antenna	EMCO	6502	9506-2950	November 4, 2014	November 5, 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
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	3536A00120ADI	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 56 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 of this report.

The E.U.T was tested 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 2*.

The spectrum analyzer was set to 3 kHz RBW.

The E.U.T was evaluated in 3 channels: Low (2412 MHz), Mid (2437 MHz) and High (2462 MHz) each in 3 modulations: DSS, CCK and OFDM.

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*

Modulation	Operation Frequency (MHz)	Reading Spectrum Analyzer (dBµV/m)	Reading Spectrum Analyzer (dBm)	Specification (dBm)	Margin (dB)
DSSS	Low	81.2	-14.0	8.0	-22.0
	Mid	81.7	-13.5	8.0	-21.5
	High	81.1	-14.1	8.0	-22.1
CCK	Low	81.7	-13.5	8.0	-21.5
	Mid	81.5	-13.7	8.0	-21.7
	High	81.1	-14.1	8.0	-22.1
OFDM	Low	75.9	-19.3	8.0	-27.3
	Mid	79.5	-15.7	8.0	-23.7
	High	74.5	-20.7	8.0	-28.7

Figure 57 Test Results

JUDGEMENT: Passed by 21.5 dB

For additional information see *Figure 58* to *Figure 66.*

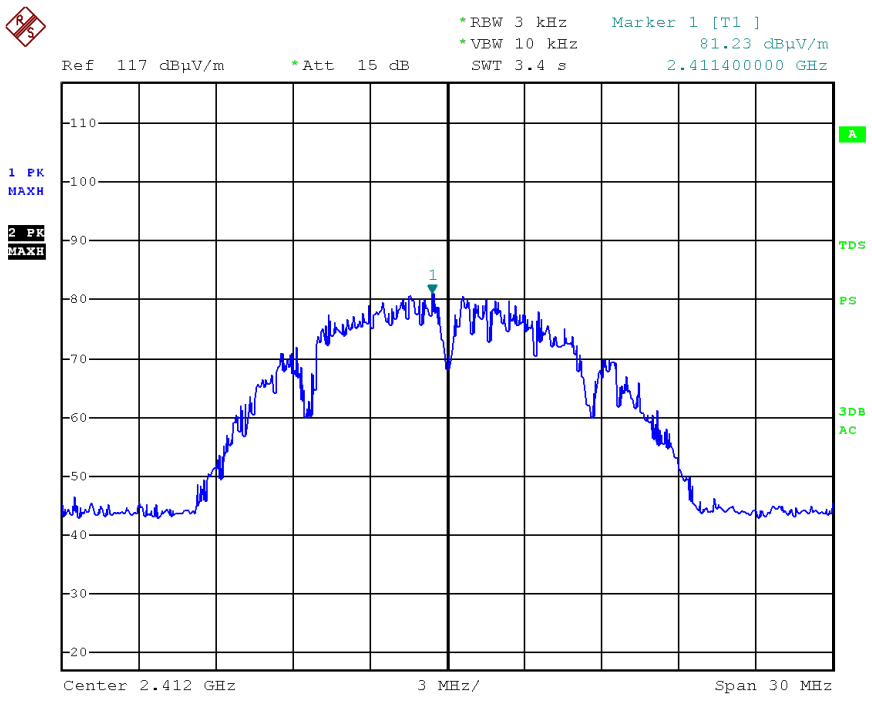


Figure 58 — Low Channel, DSSS

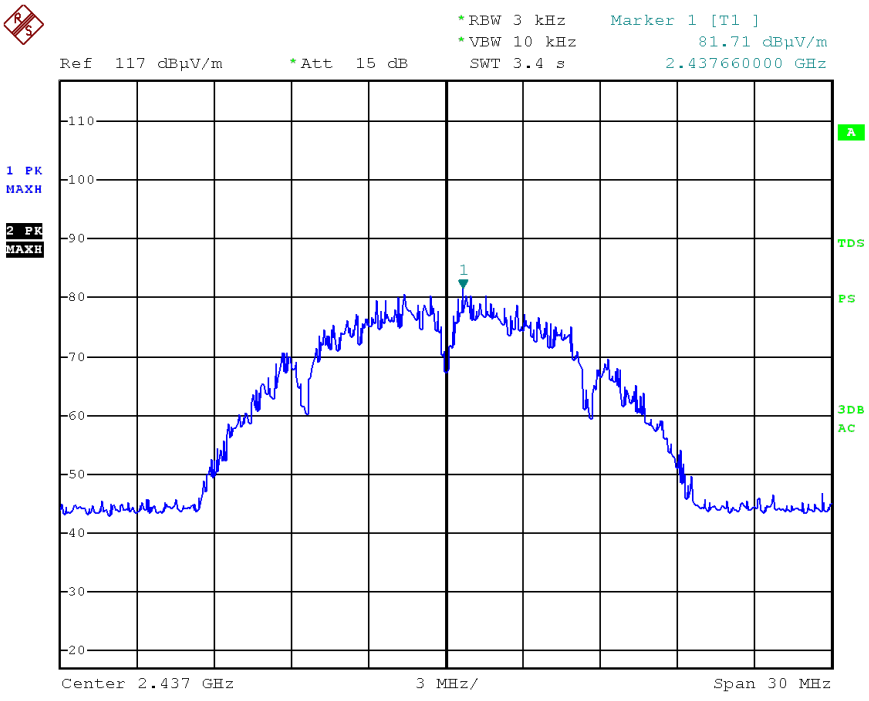
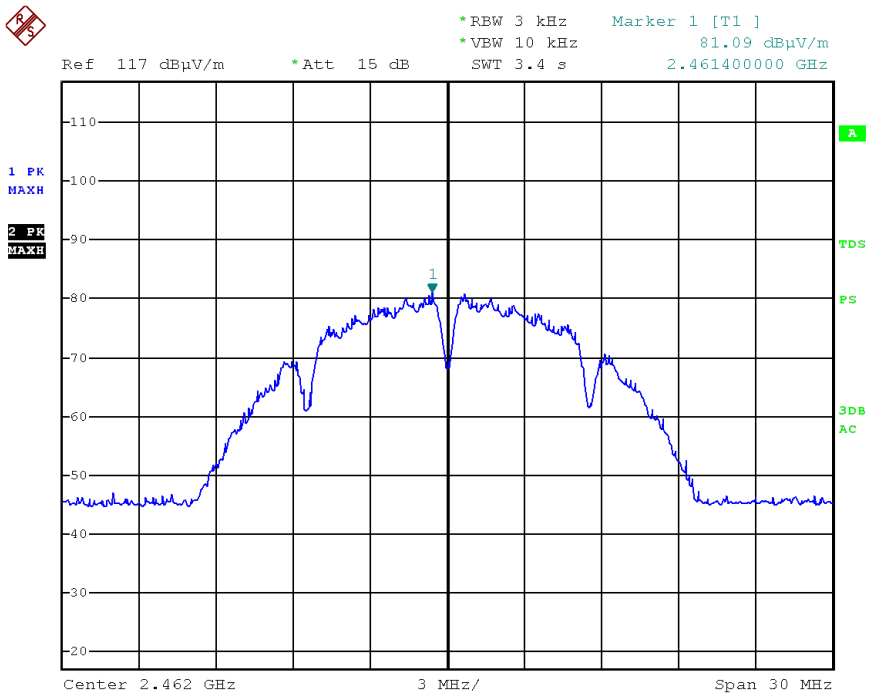
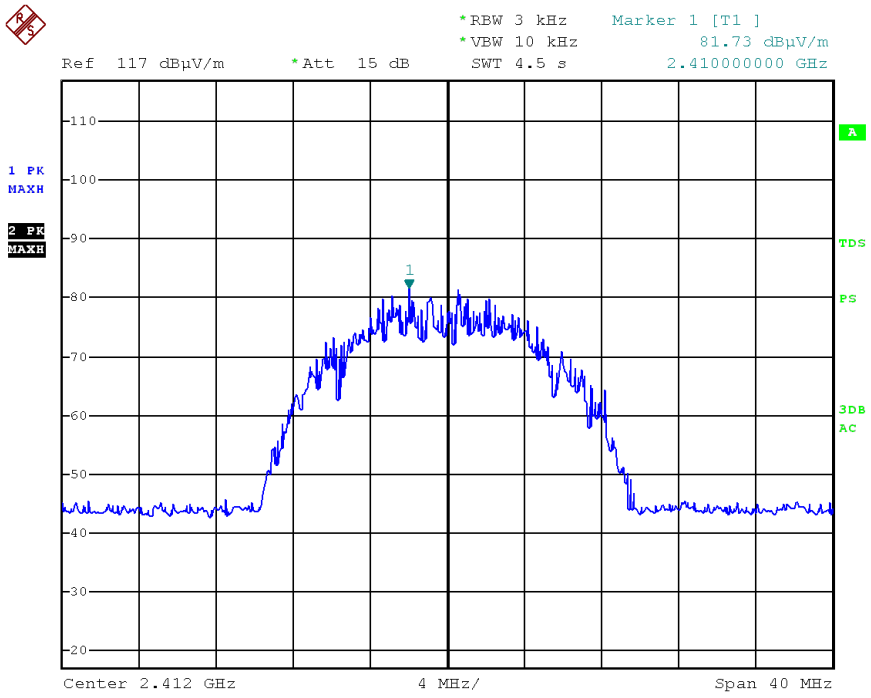


Figure 59 — Mid Channel, DSSS



Date: 16.SEP.2015 12:55:46

Figure 60 — High Channel, DSSS



Date: 16.SEP.2015 14:48:16

Figure 61 — Low Channel, CCK

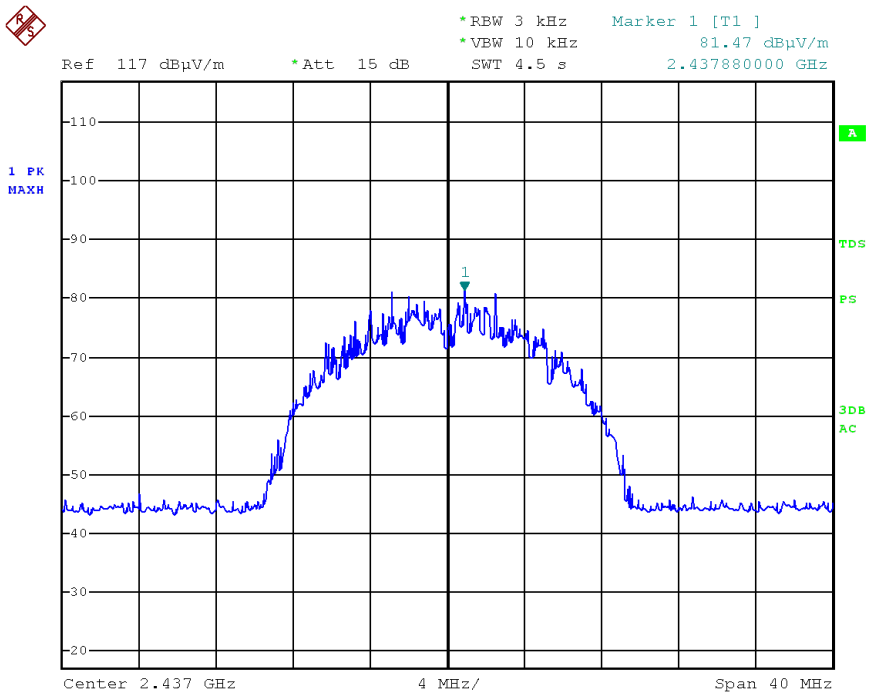


Figure 62 — Mid Channel, CCK

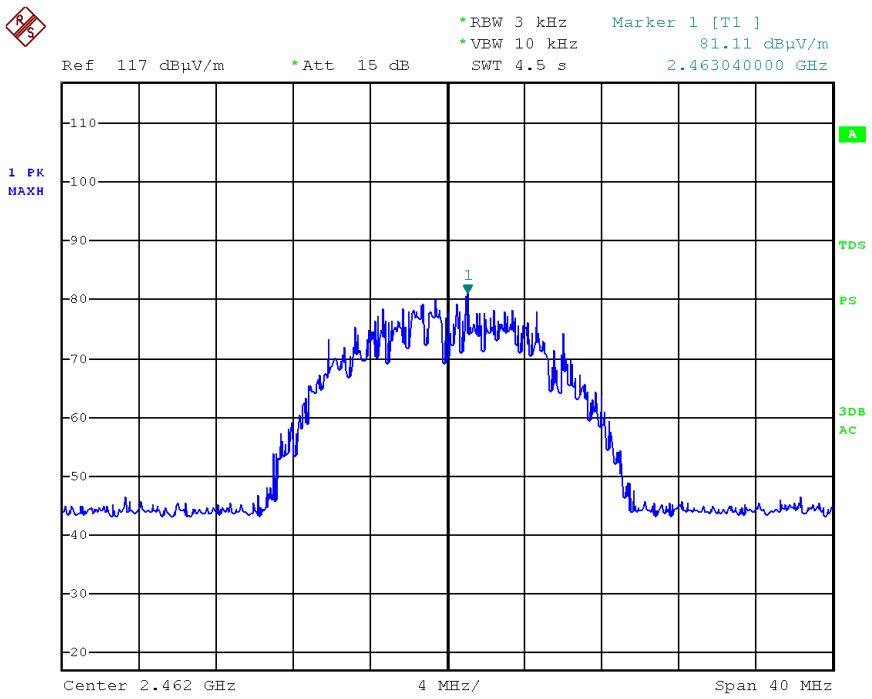


Figure 63 — High Channel, CCK

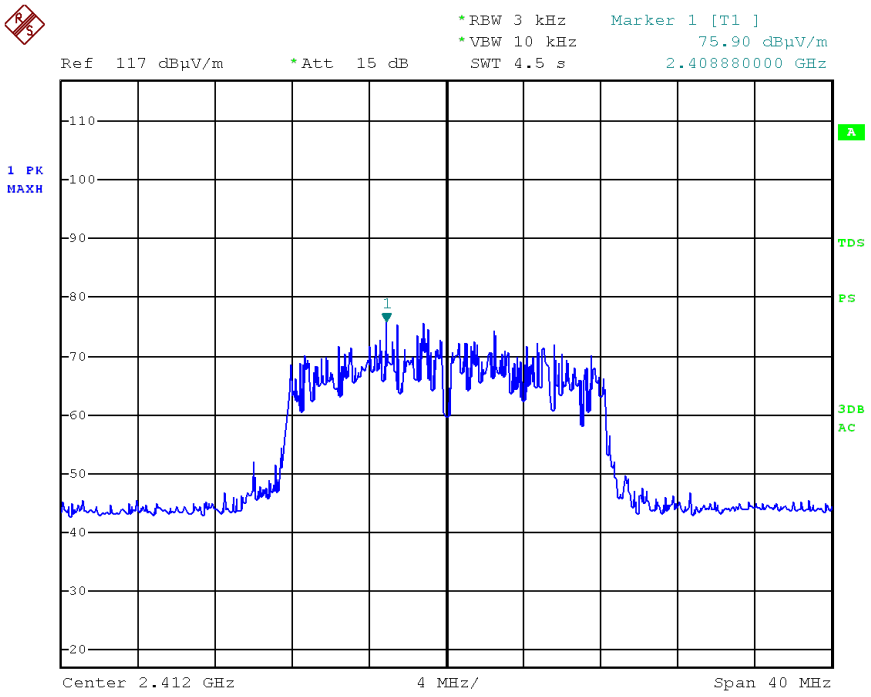


Figure 64 — Low Channel, OFDM

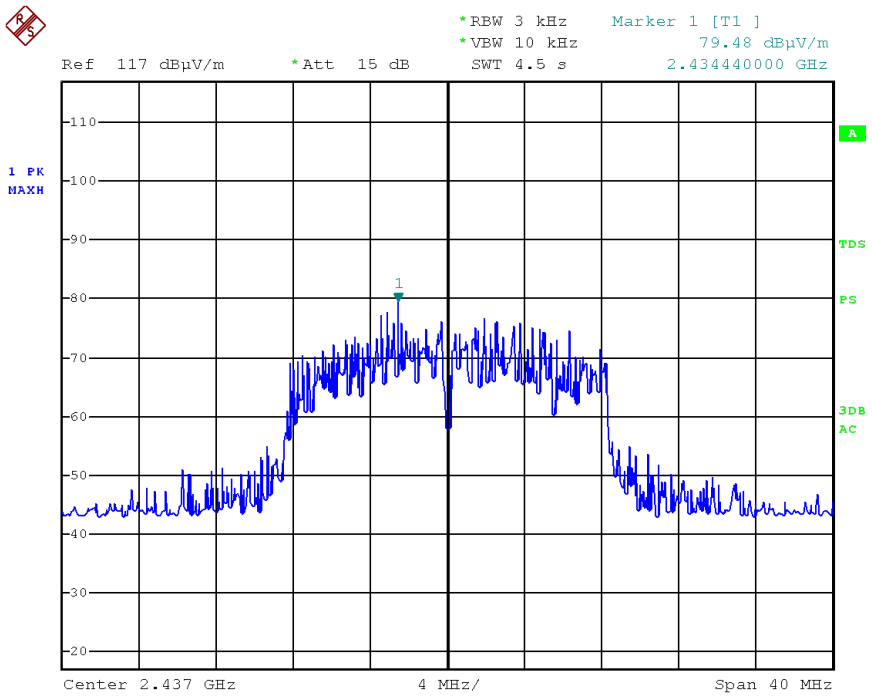


Figure 65 — Mid Channel, OFDM

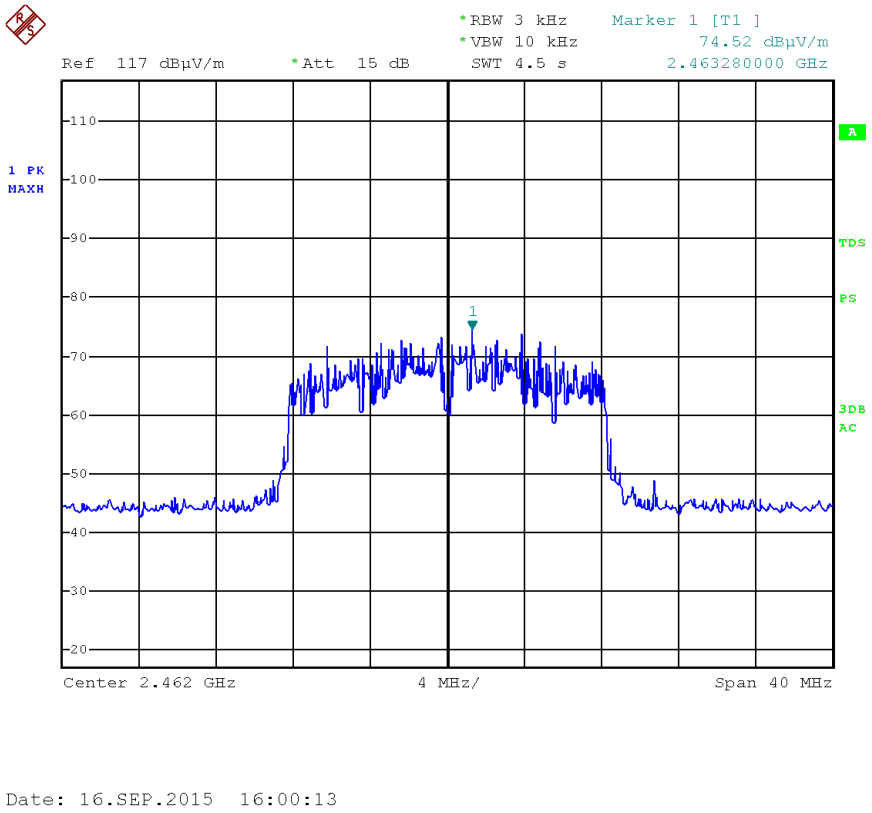


Figure 66 — High Channel, OFDM

10.4 *Test Equipment Used; Transmitted Power Density*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Date
EMI Receiver	R&S	ESCI7	100724	January 4, 2015	January 31, 2016
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	N/A	N/A

Figure 67 Test Equipment Used

11. Antenna Gain/Information

The antenna gain is 1.9 dBi, integral.

12. R.F Exposure/Safety

Typical use of the E.U.T. is as an irrigation controller.

The typical placement of the E.U.T. is in a greenhouse. The typical distance between the E.U.T. and the user is 20 cm.

Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1310 Requirements

(a) FCC limits at 2480 MHz is:

$$1\frac{mW}{cm^2}$$

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

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

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

P_t- Transmitted Power 112.6 dBuV/m (Peak) = 55 mW (testing performed radiated; power result includes antenna gain)

G_T- Antenna Gain = 1.9 dBi

R- Distance from Transmitter using 20cm worst case

(c) The peak power density is:

$$S = \frac{(55)}{4\pi(20)^2} = 0.011\frac{mW}{cm^2}$$

(d) This is below the FCC limit.

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

Frequency (MHz)	Cable Loss (dB)
50.00	1.2
100.00	0.7
150.00	2.1
200.00	2.3
300.00	2.9
500.00	3.8
750.00	4.8
1000.00	5.4
1500.00	6.7
2000.00	9.0
2500.00	9.4
3000.00	9.9
3500.00	10.2
4000.00	11.2
4500.00	12.1
5000.00	13.1
5500.00	13.5
6000.00	14.5

NOTES:

1. The cable type is SPUMA400 RF-11N(X2) and 39m long

2. The cable is manufactured by Huber + Suhner

13.2 Correction factors for log periodic antenna

EMCO Model: 3146

Serial number: 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.

13.3 *Correction factors for biconical antenna*

EMCO Model: 3104
Serial number: 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.

13.4 *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		
600	19.6		
700	21.1		
800	21.4		
900	23.5		
1000	24.3		

13.5 *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

13.6 *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

13.7 Correction factors for ACTIVE LOOP ANTENNA

Model 6502
S/N 9506-2950

FREQUENCY	Magnetic Antenna Factor	Electric Antenna Factor
(MHz)	(dB)	(dB)
.009	-35.1	16.4
.010	-35.7	15.8
.020	-38.5	13.0
.050	-39.6	11.9
.075	-39.8	11.8
.100	-40.0	11.6
.150	-40.0	11.5
.250	-40.0	11.6
.500	-40.0	11.5
.750	-40.1	11.5
1.000	-39.9	11.7
2.000	-39.5	12.0
3.000	-39.4	12.1
4.000	-39.7	11.9
5.000	-39.7	11.8
10.000	40.2	11.3
15.000	-40.7	10.8
20.000	-40.5	11.0
25.000	-41.3	10.2
30.000	42.3	9.2