ISRAEL TESTING LABORATORIES
Global Certifications You Can Trust

ACCREDITED
TESTING Cert No.1152.01

DATE: 11 May 2017

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

FCC Radio Test Report

for

Metrycom Communications Ltd.

Equipment under test:

Wireless Control & Data Acquisition System

R-FULL-CON-US-915 EXT ANT*

*See customer's declaration on page 6

Tested by: _____
N. Levi

Approved by: _____
D. Shidlowsky

ISRAEL TESTING LABORATORIES
Global Certifications You Can Trust

ACCREDITED
TESTING Cert No.1152.01

Measurement/Technical Report for

Metrycom Communications Ltd.

Wireless Control & Data Acquisition System

R-FULL-CON-US-915 EXT ANT

FCC ID: 2AG7UMS3000-915

This report concerns:	Original Grant: X Class I Change: Class II Change:
Equipment type:	DSS – Spread Spectrum Transmitter
Limits used:	47CFR15 Section 15.247

Measurement procedures used are FCC Public Notice DA-00-705 and ANSI C63.10: 2013.

Application for Certification
prepared by:
R. Pinchuck
ITL (Product Testing) Ltd.
1 Bat Sheva Street
Lod 7120101
Israel
e-mail rpinchuck@itl.co.il

Applicant for this device:
(different from "prepared by")
Liron Frenkel
Metrycom Communications Ltd.
20 Galgalei Haplada St.
Herzliya, 4673324
Israel
Tel: +972-3-510 2221
Fax +972-153-986-5861
e-mail: liron@metrycom.com

TABLE OF CONTENTS

1. General Information

1.1 *Administrative Information*

Manufacturer:	Metrycom Communications Ltd.
Manufacturer's Address:	20 Galgalei Haplada St. Herzliya, 4673324 Israel Tel: +972-3-510 2221 Fax +972-153-986-5861
Manufacturer's Representative:	Liron Frenkel
Equipment Under Test (E.U.T):	Wireless Control & Data Acquisition System
Model Name/Number:	R-FULL-CON-US-915 EXT ANT*
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	February 13, 2016
Start of Test:	February 13, 2016
End of Test:	April 30, 2017** February 14, 2016 April 30, 2017**
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
Test Specifications:	FCC Part 15, Subpart C

*See customer declaration on following page.
**Maximum Output Power, 20dB Bandwidth and Band Edge tests were performed on April 30, 2017.

Metrycom

Declaration

Date: July 20, 2016

I hereby declare that the E.U.T. and model name of the unit tested at ITL Radio Laboratory on February 13, 2016 to February 14, 2016 is as follows:

E.U.T. Name: Wireless Control & Data Acquisition System

Model Name: R-FULL-CON-US-915 EXT ANT

Serial No.: Not designated

Thank you,

Liron Frenkel, CEO

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*

MetrySense-3000 is a modular low-power outdoor connectivity system that interfaces digital and analog sensors, meters and actuators and connects them via a low power wireless mesh-network to IP gateways and remote monitoring centers.

1.4 *Test Methodology*

Radiated testing was performed according to the procedures in FCC Public Notice DA 00-705 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):

± 4.96 dB

2. System Test Configuration

2.1 *Justification*

Testing was performed with E.U.T. wall mounted in installation position.

E.U.T. was transmitting at low (921.2MHz), mid (924.5MHz) and high channels (927.8MHz) with external antenna.

2.2 *EUT Exercise Software*

The EUT was tested when programmed with the formal, commercially released firmware, configured to transmit periodically at maximum transmission rate.

2.3 *Special Accessories*

No special accessories were needed in order to achieve compliance.

2.4 *Equipment Modifications*

No modifications were needed in order to achieve compliance.

2.5 *Configuration of Tested System*

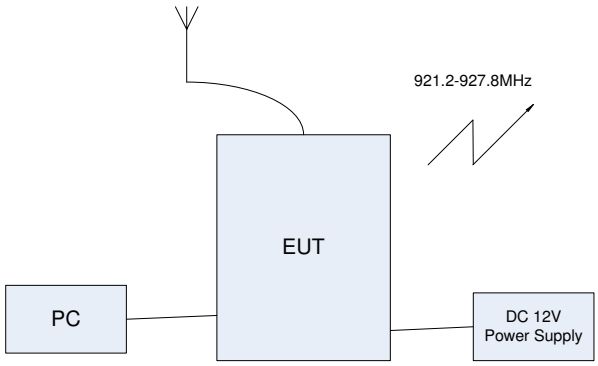

Figure 1. Configuration of Tested System - Radiated

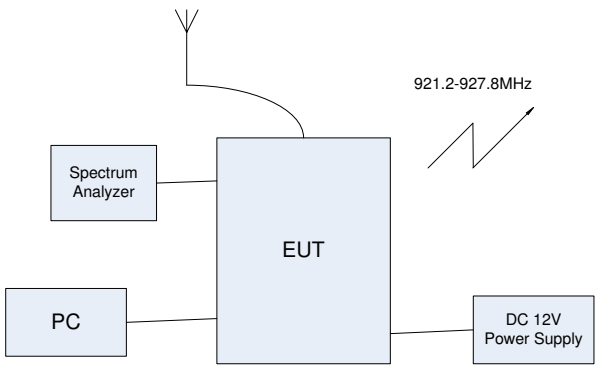

Figure 2. Configuration of Tested System - Conducted

3. Test Set-Up Photos

Figure 3. Radiated Emission Test

Figure 4. Radiated Emission Test

Figure 5. Radiated Emission Test

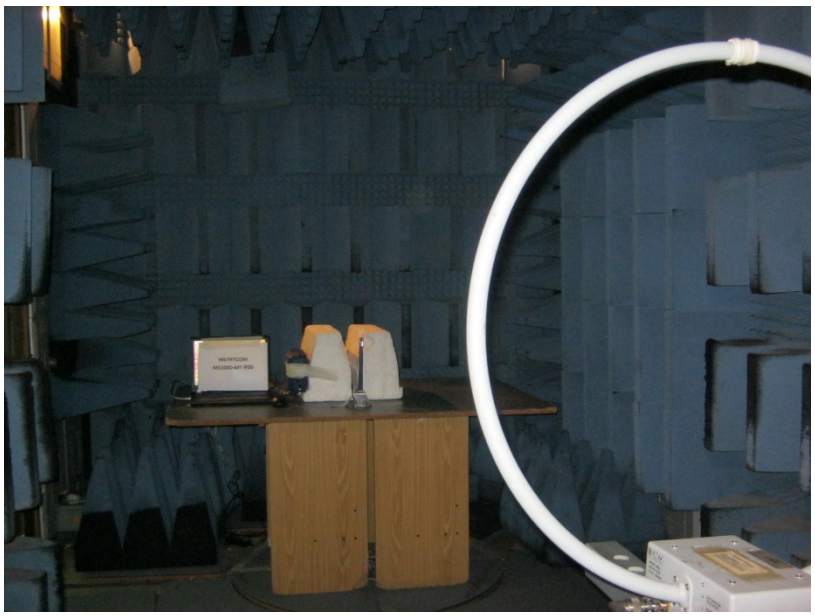

Figure 6. Radiated Emission Test

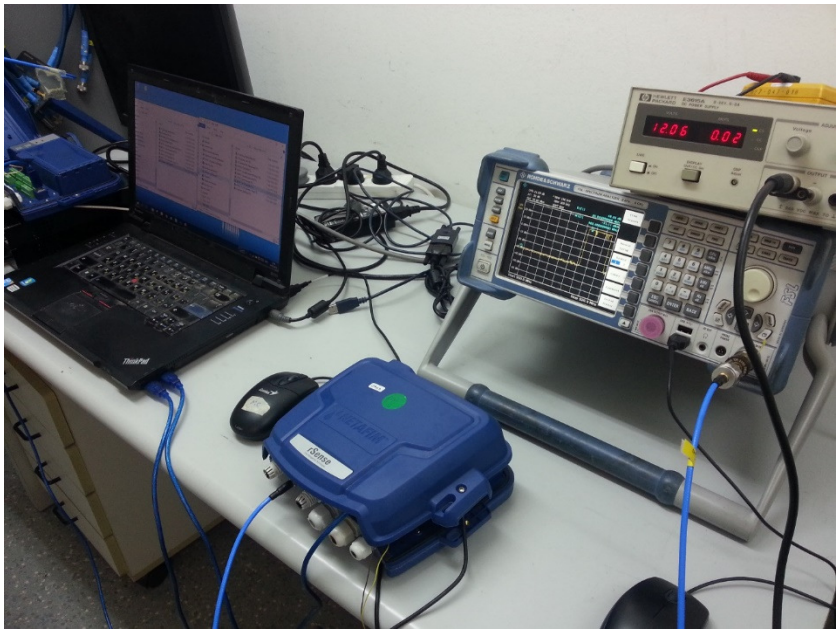

Figure 7. Conducted Tests

4. 20dB Minimum Bandwidth

4.1 *Test Specification*

F.C.C. Part 15, Subpart C: 15.247(a)(1)(i)

4.2 *Test Procedure*

The transmitter unit operated with normal modulation. The spectrum analyzer was set to 10 kHz resolution BW. The spectrum bandwidth of the transmitter unit was measured and recorded. The test was performed to measure the transmitter occupied bandwidth. The EUT was set up as shown in *Figure 2* and its proper operation was checked. The transmitter occupied bandwidth was measured with the spectrum analyzer as frequency delta between reference points on modulation envelope.

4.3 *Test Results*

Operation Frequency (MHz)	Bandwidth Reading (kHz)	Specification (kHz)
921.2	71.3	<250
924.5	70.1	<250
927.8	70.7	<250

Figure 8 — 20 dB Minimum Bandwidth Test Results

JUDGEMENT: Passed

For additional information see *Figure 9 to Figure 10.*

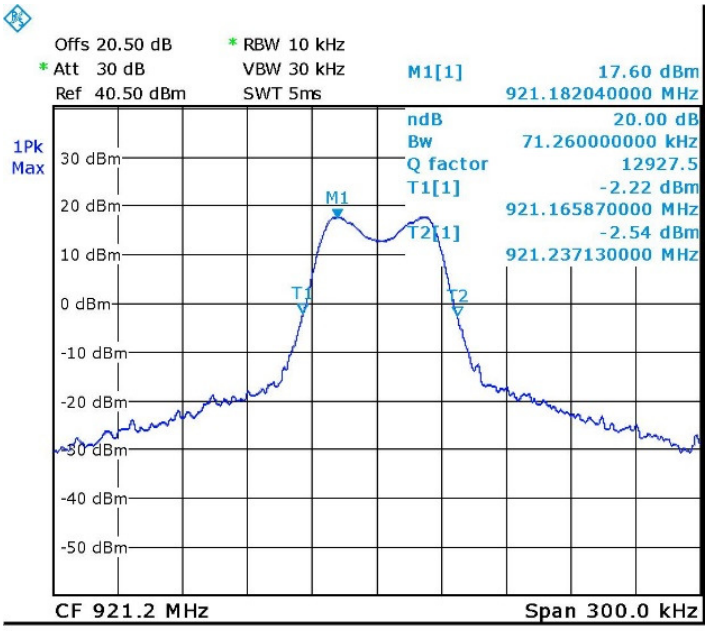

Figure 9. — 921.2 MHz

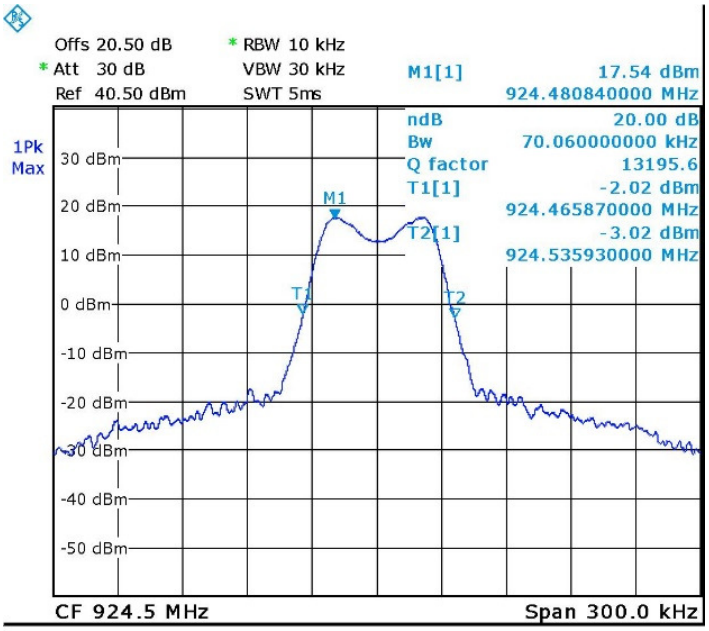

Figure 10. — 924.5 MHz

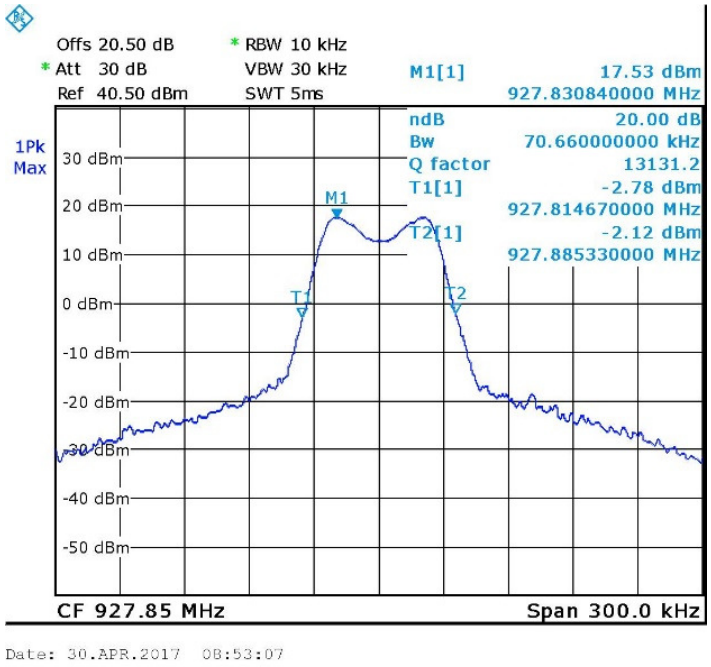

Figure 11. — 927.8 MHz

4.4 *Test Equipment Used, 20 dB Minimum Bandwidth*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	March 2, 2017	March 2, 2018

Figure 12 Test Equipment Used

6. Number of Hopping Frequencies

6.1 *Test Specification*

F.C.C., Part 15, Subpart C Section 15.247(a)(1)(i)

6.2 *Test Procedure*

The E.U.T. was set to hopping mode.
The spectrum analyzer was set to the following parameters:

Band of Operation: 921.2-927.8 MHz
RBW: 30 kHz
VBW: 30 kHz
Detector Function: Peak
Trace: Maximum Hold

6.3 *Test Results*

Number of Hopping Frequencies	Specification
50	>=50

Figure 13 Number of Hopping Frequencies Test Results Table

JUDGEMENT: Passed

For additional information see *Figure 13* to *Figure 19.*

Number of Hopping Frequencies

E.U.T Description	Wireless Control & Data Acquisition System
Type	R-FULL-CON-US-915 EXT ANT
Serial Number:	Not designated

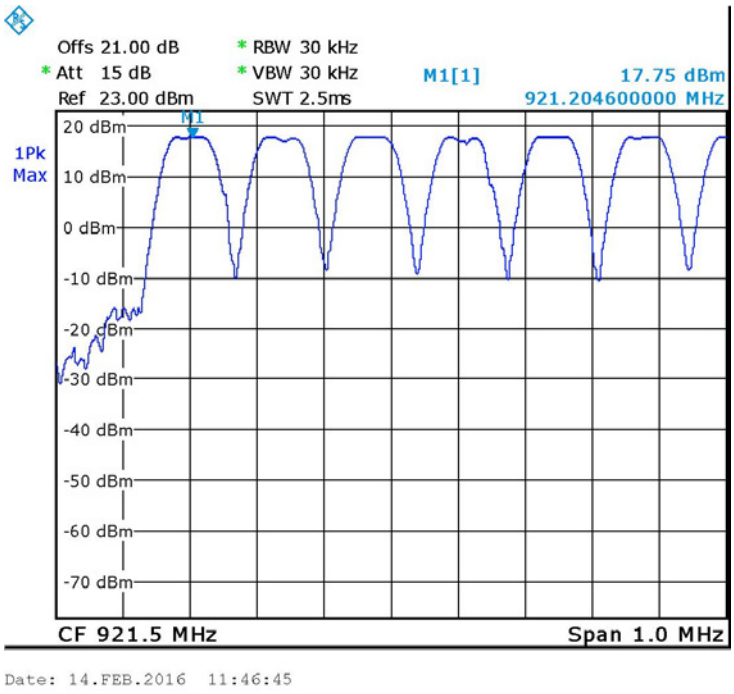

Figure 14. Number of Channels

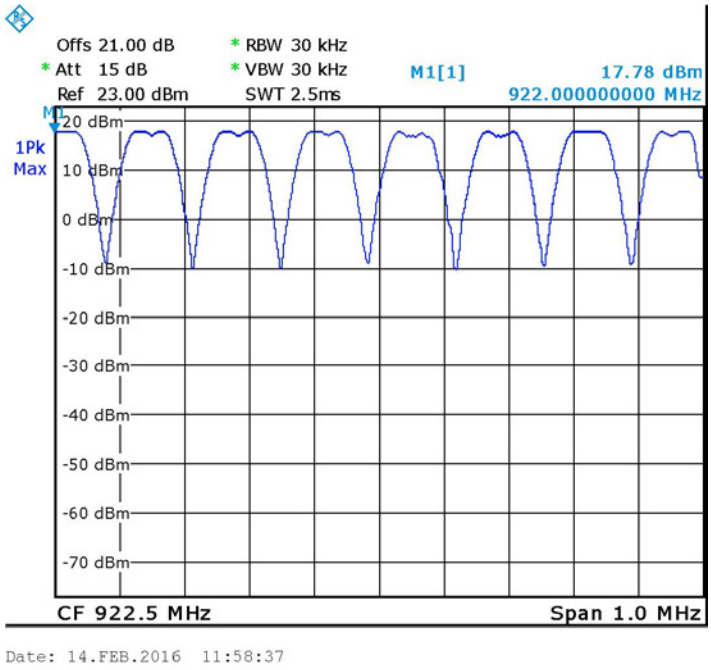

Figure 15. Number of Channels

Number of Hopping Frequencies

E.U.T Description	Wireless Control & Data Acquisition System
Type	R-FULL-CON-US-915 EXT ANT
Serial Number:	Not designated

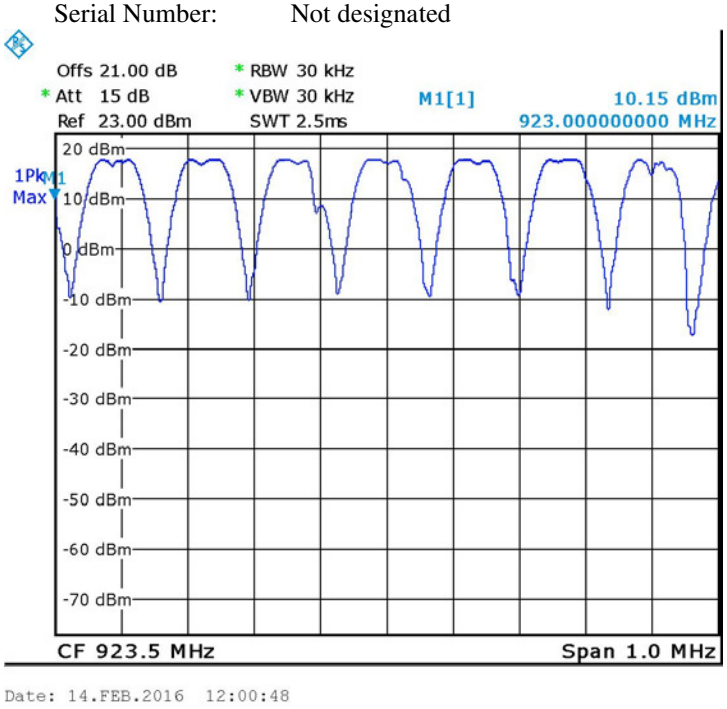

Figure 16. Number of Channels

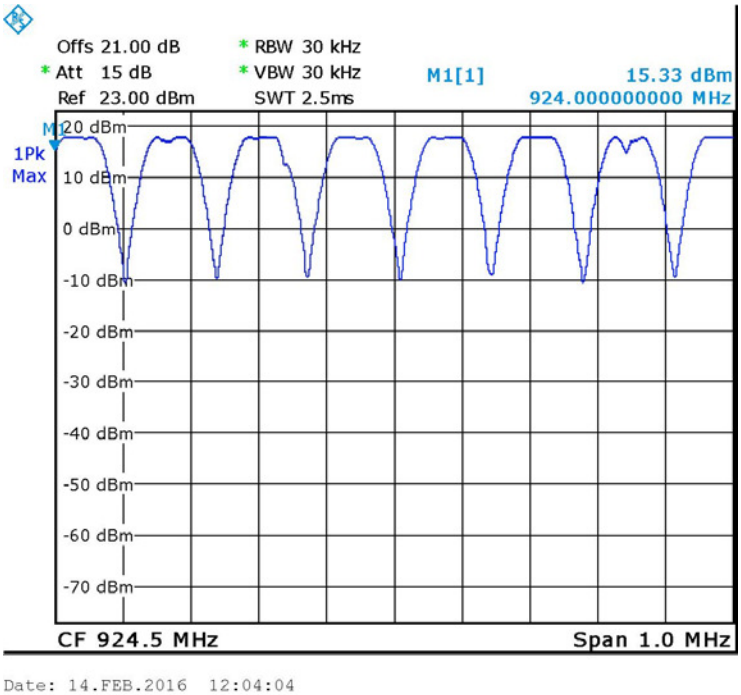

Figure 17. Number of Channels

Number of Hopping Frequencies

E.U.T Description	Wireless Control & Data Acquisition System
Type	R-FULL-CON-US-915 EXT ANT
Serial Number:	Not designated

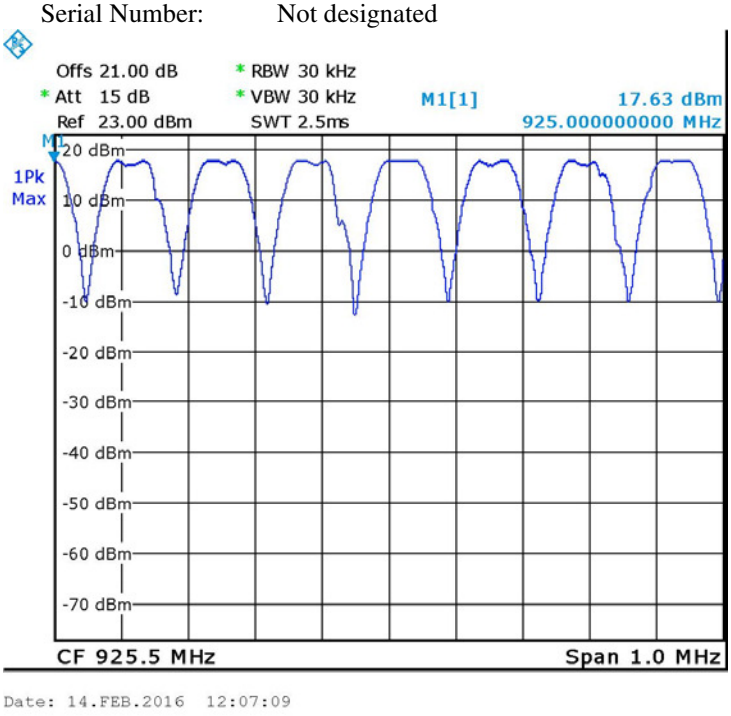

Figure 18. Number of Channels

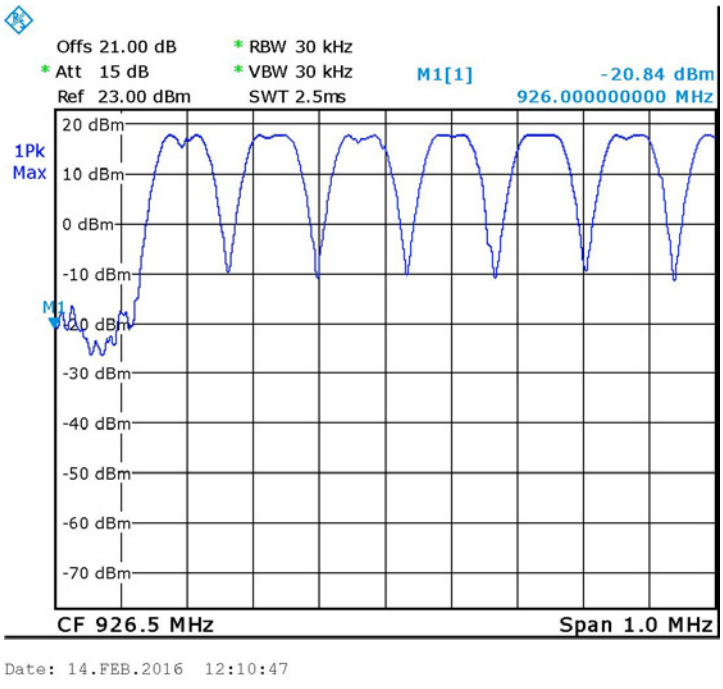

Figure 19. Number of Channels

Number of Hopping Frequencies

E.U.T Description	Wireless Control & Data Acquisition System
Type	R-FULL-CON-US-915 EXT ANT
Serial Number:	Not designated

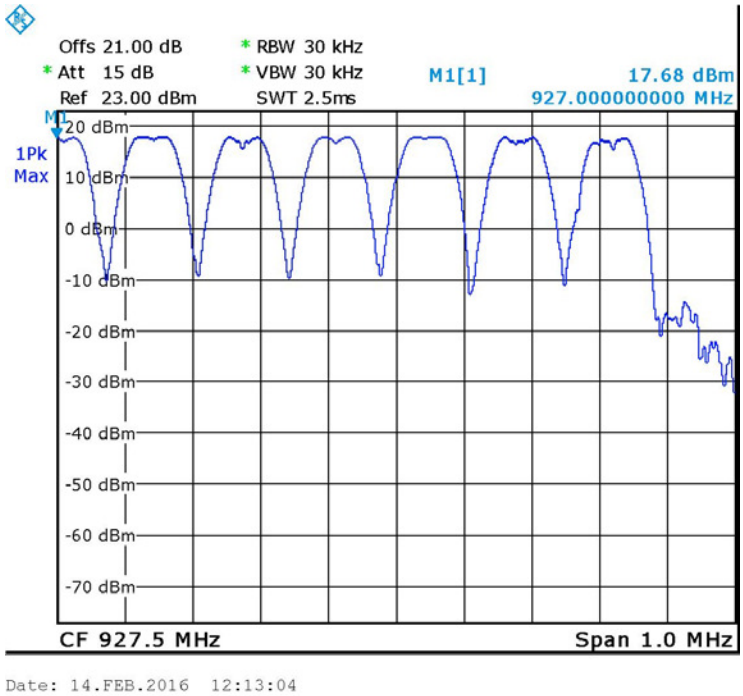

Figure 20. Number of Channels

6.4 *Test Equipment Used, Number of Hopping Frequencies*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	January 1, 2015	February 28, 2016

Figure 21 Test Equipment Used

7. Channel Frequency Separation

7.1 *Test Specification*

FCC Part 15, Subpart C, 15.247(a) (1)

7.2 *Test Procedure*

The E.U.T. was set to hopping mode.
The spectrum analyzer was set to the following parameters:

RBW: 30 kHz
VBW: 30 kHz
Detector Function: Peak
Trace: Maximum Hold

The marker delta function to determine the separation between the peaks of the adjacent channels was used.

7.3 *Test Results*

Channel Frequency Separation (kHz)	Specification (kHz)	Margin (kHz)
129.7	>100	29.7

Figure 22 Channel Frequency Separation Test Results Table

JUDGEMENT: Passed by 29.7 kHz

For additional information see *Figure 22*.

Channel Frequency Separation

E.U.T Description	Wireless Control & Data Acquisition System
Type	R-FULL-CON-US-915 EXT ANT
Serial Number:	Not designated

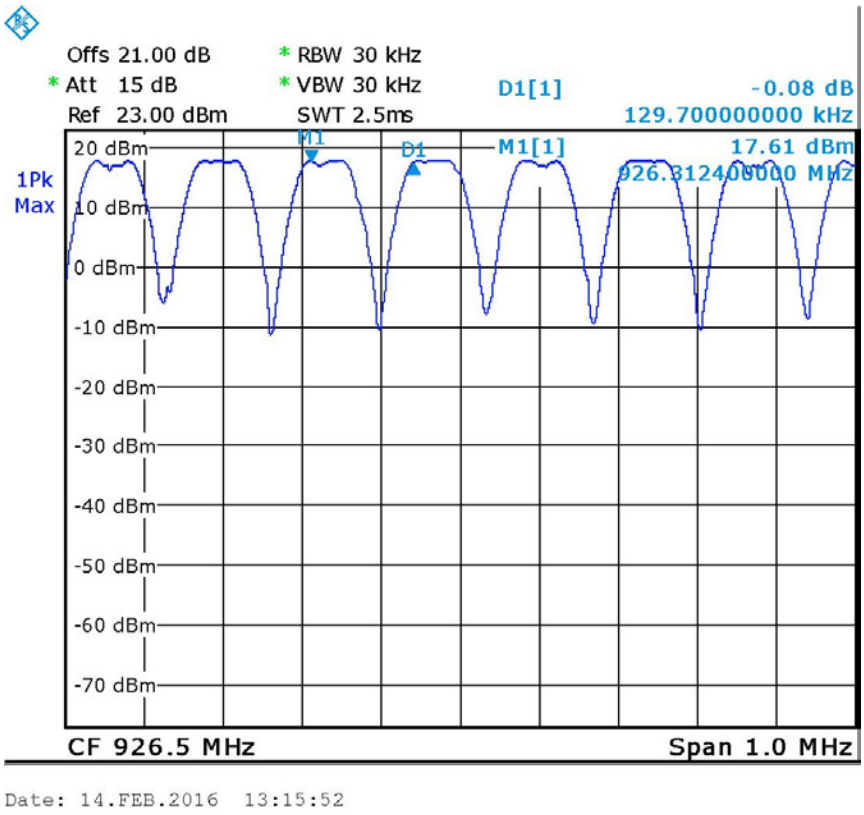

Figure 23. Channel Frequency Separation

7.4 *Test Equipment Used, Channel Frequency Separation Test*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	January 1, 2015	February 28, 2016

Figure 24 Test Equipment Used

8. Maximum Power Output

8.1 *Test Specification*

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

8.2 *Test Procedure*

The transmitter unit operated with normal modulation. The spectrum analyzer was set to 100 kHz resolution BW. The EUT was set up as shown in *Figure 2* and its proper operation was checked.

The E.U.T. was tested at the Low (921.2 MHz) Mid (924.5MHz) and High (927.8 MHz) channels with modulation.

8.3 *Test Results*

Frequency	Measured Power	Results	Limit	Margin
(MHz)	(dBm)	(W)	(W)	(W)
921.2	17.3	0.054	1.0	-0.946
924.5	17.3	0.054	1.0	-0.946
927.8	17.3	0.054	1.0	-0.946

Figure 25 Power Output Test Results Table

JUDGEMENT: Passed by 0.946W

For additional information see *Figure* 25 to *Figure 27.*

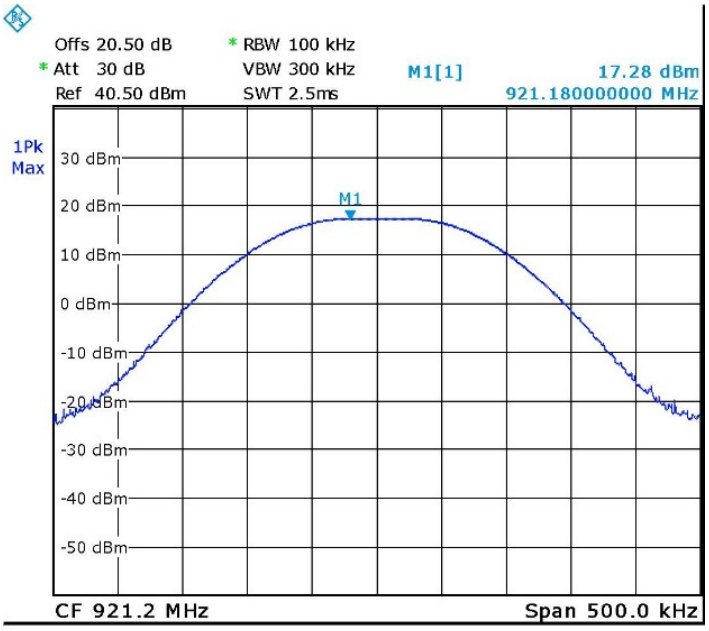

Figure 26 — 921.2 MHz

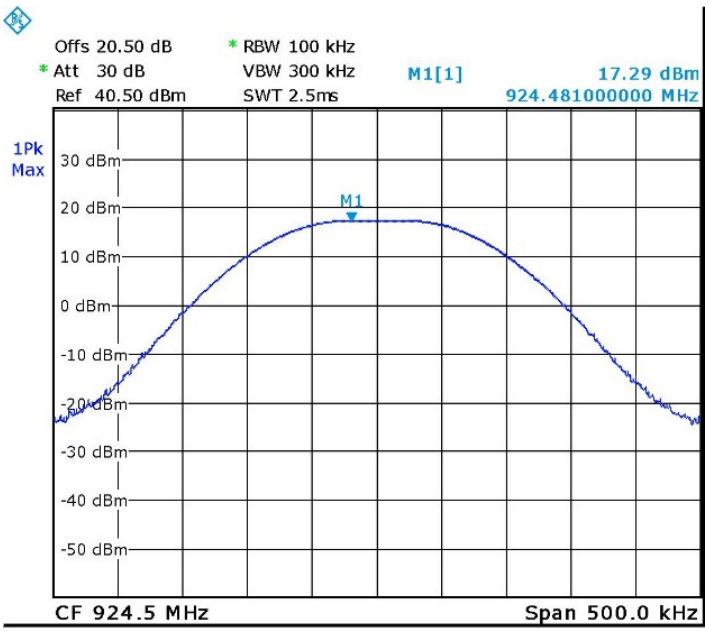

Figure 27 — 924.5 MHz

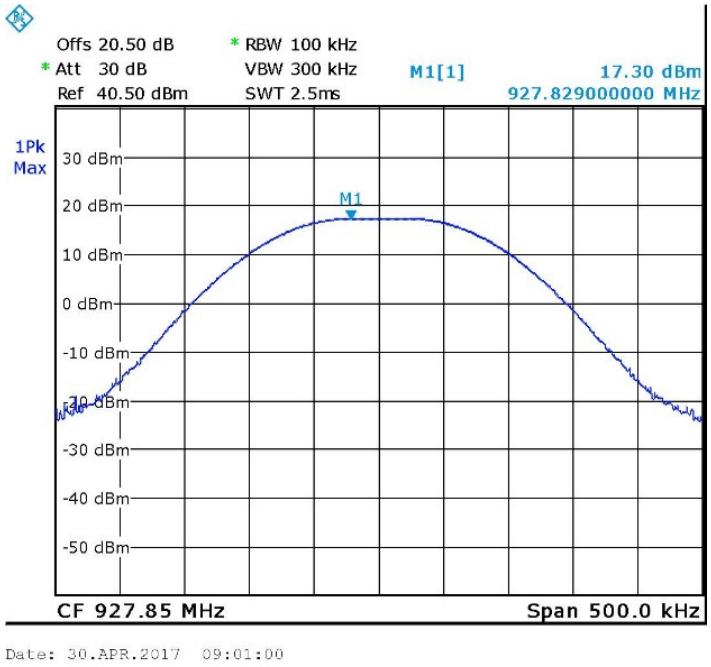

Figure 28 — 927.8 MHz

8.4 *Test Equipment Used, Radiated Maximum Power Output*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	March 2, 2017	March 2, 2018

Figure 29 Test Equipment Used

9. Dwell Time on Each Channel

9.1 *Test Specification*

FCC Part 15, Section 15.247(a)(1)(i)

9.2 *Test Procedure*

The test was performed by Conducted method. The spectrum analyzer was set to 30 kHz VBW.

9.3 *Test Limit*

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 20 seconds.

9.4 *Test Results*

The E.U.T met the requirements of the FCC Part 15, Section 15.247(a)(1)(i).

JUDGEMENT: Passed

Additional information of the results is given in *Figure 29 to Figure 30.*

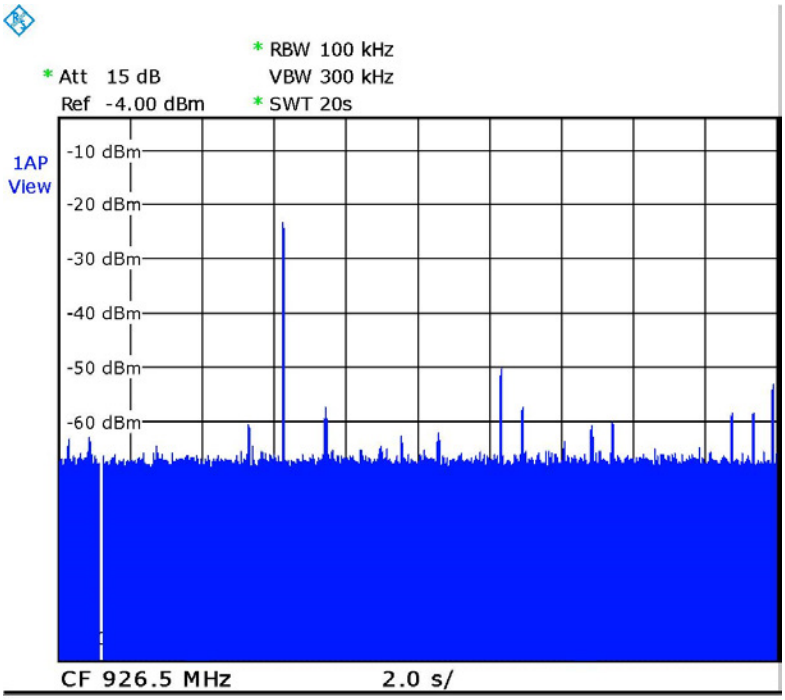

Figure 30 — Transmission within 20 sec

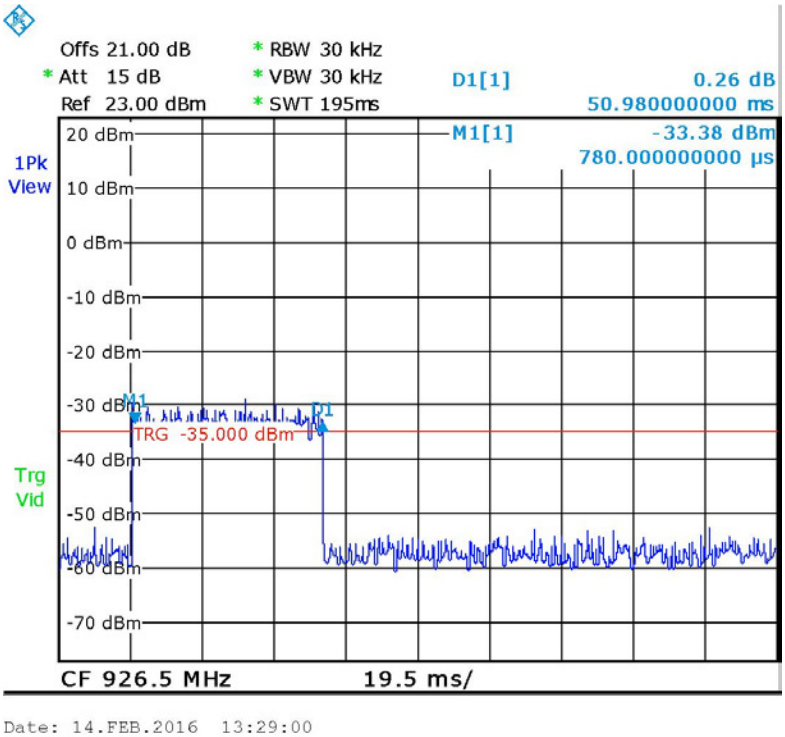

Figure 31 — Burst Duration

(Burst duration=50.98msec*2=101.96msec<400msec)

9.5 *Test Equipment Used, Dwell Time on Each Channel*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	January 1, 2015	February 28, 2016

Figure 32 Test Equipment Used

10. Band Edge

10.1 *Test Specification*

FCC Part 15, Section 15.247(d)

10.2 *Test Procedure*

The test was performed by Conducted method using a spectrum analyzer.
The transmitter unit operated with normal modulation. The spectrum analyzer was set to 100 kHz resolution BW. The EUT was set up as shown in *Figure 2, a*nd its proper operation was checked.

The E.U.T. was tested at the low and the high channels and in two modes: hopping and non-hopping

10.3 *Test Results*

Mode	Operation Frequency	Band Edge Frequency	Spectrum Level	Limit	Margin
	(MHz)	(MHz)	(dBm)	(dBm)	(dB)
Hopping	Low	902.0	-31.7	-2.7	-29.0
	High	928.0	-12.3	-2.7	-9.6
Non- Hopping	Low	902.0	-30.5	-2.7	-27.8
	High	928.0	-11.6	-2.7	-8.9

Figure 33 Band Edge Test Results Table

JUDGEMENT: Passed

For additional information see *Figure 33* to *Figure 34.*

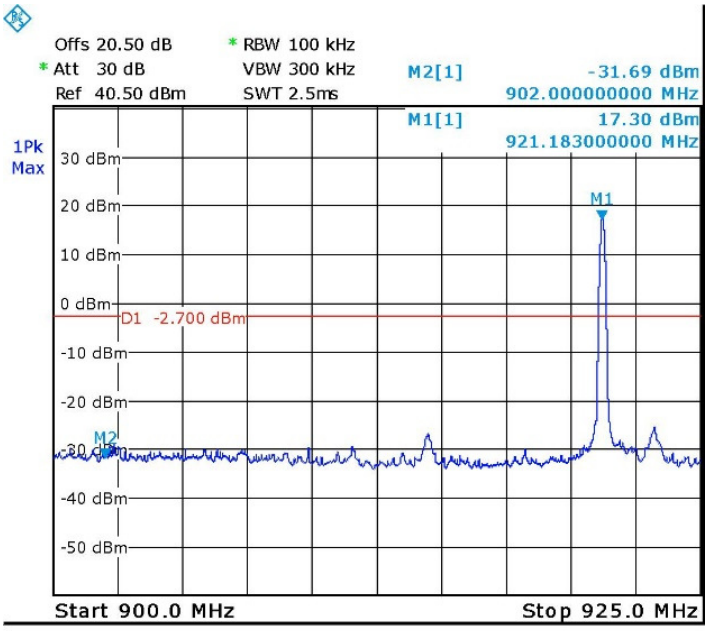

Figure 34 — Low Channel, Non-Hopping Mode

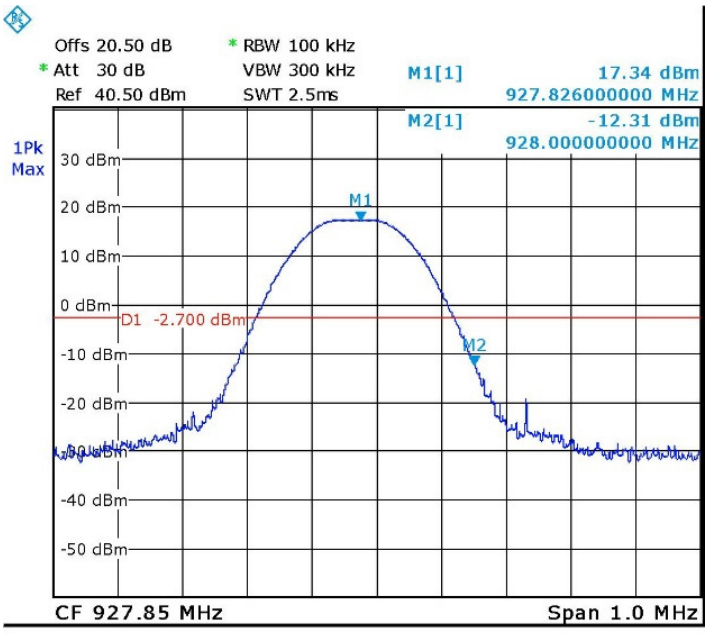

Figure 35 — High Channel, Non-Hopping Mode

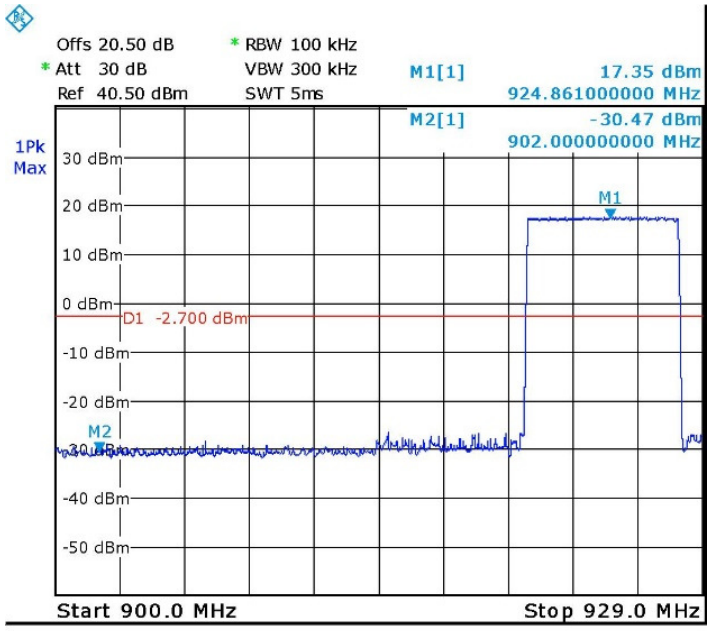

Figure 36 — Low Channel, Hopping Mode

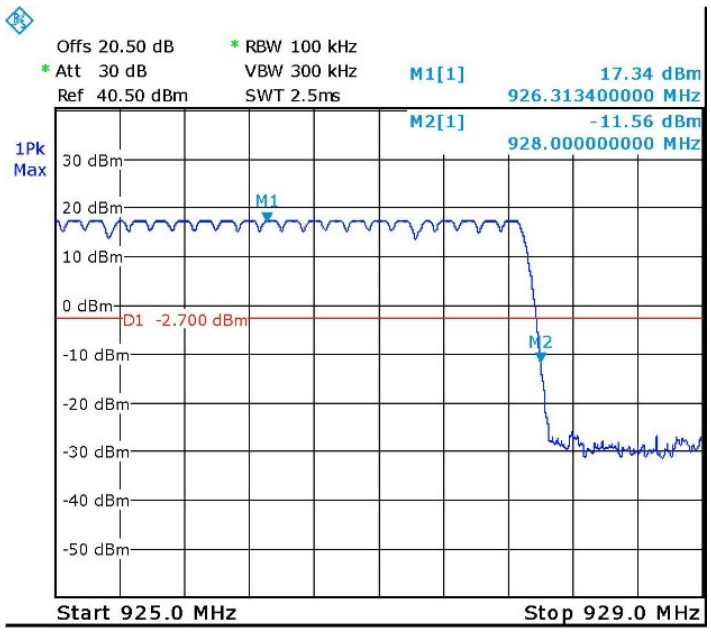

Figure 37 — High Channel, Hopping Mode

10.4 *Test Equipment Used, Band Edge Spectrum*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	March 2, 2017	March 2, 2018

Figure 38 Test Equipment Used

11. Emissions in Non-Restricted Frequency Bands

11.1 *Test Specification*

FCC, Part 15, Subpart C, Section 247(d)
FCC, Part 15, Subpart C, Section 209

11.2 *Test Procedure*

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

For 0.009MHz-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 1*.

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-10000MHz 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 1.*

The frequency range 1000 MHz-10000 MHz was scanned.

RBW was set to 100 kHz.

In the frequency range 30-7000MHz, a computerized EMI receiver complying with CISPR 16 requirements was used.
In the frequency range 7000MHz-10000 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 operational frequencies of 921.2MHz and 927.8 MHz. These frequencies were measured using a peak detector.

11.3 *Test Limits*

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.

11.4 *Test Results*

JUDGEMENT: Passed

All detected emissions were greater than 20dBc below the fundamental level.

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

11.5 *Field Strength Calculation*

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

$$FS = RA + AF + CF$$

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

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

No external pre-amplifiers are used.

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

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Date
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
Biconical Antenna	EMCO	3104	2606	December 28, 2014	February 28, 2016
Active Loop Antenna	EMCO	6502	9506-2950	November 4, 2015	November 4, 2016
Log Periodic Antenna	EMCO	3146	9505-4081	December 28, 2014	February 28, 2016
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
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 39 Test Equipment Used

12. Emissions in Restricted Frequency Bands

12.1 *Test Specification*

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

12.2 *Test Procedure*

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 1.*

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-10000M 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 1.*

The frequency range 1000 MHz-10000 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-10000 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 tested in 2 operating frequencies:
921.2MHz and 927.8 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 40 Table of Limits

12.3 *Test Results*

JUDGEMENT: Passed

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

For the operation frequency 921.2 MHz, the margin between the emission level and the specification limit is 2.9dB in the worst case at the frequency of 2763.5 MHz, vertical polarization.

For the operation frequency 927.815 MHz, the margin between the emission level and the specification limit is 2.7dB in the worst case at the frequency of 2783.4 MHz, horizontal polarization.

Radiated Emission

E.U.T Description	Wireless Control & Data Acquisition System
Type	R-FULL-CON-US-915 EXT ANT
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 30 MHz to 10.0 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)
921.200	1842.0	H	56.2	74.0	-17.8
921.200	1842.0	V	57.1	74.0	-16.9
921.200	2763.5	H	61.4	74.0	-12.6
921.200	2763.5	V	62.9	74.0	-11.1
927.815	1855.5	H	56.2	74.0	-17.8
927.815	1855.5	V	57.4	74.0	-16.6
927.815	2783.4	H	59.4	74.0	-14.6
927.815	2783.4	V	60.6	74.0	-13.4

Figure 41. 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 Reading" includes correction factor.

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

Radiated Emission

E.U.T Description	Wireless Control & Data Acquisition System
Type	R-FULL-CON-US-915 EXT ANT
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 30 MHz to 10.0 GHz
Test Distance: 3 meters
Detector: Average

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Average Result (dBµV/m)	Average Specification (dB µV/m)	Average Margin (dB)
921.200	1842.0	H	43.3	54.0	-10.7
921.200	1842.0	V	45.3	54.0	-8.7
921.200	2763.5	H	49.1	54.0	-4.9
921.200	2763.5	V	51.1	54.0	-2.9
927.815	1855.5	H	45.9	54.0	-8.1
927.815	1855.5	V	46.4	54.0	-7.6
927.815	2783.4	H	51.3	54.0	-2.7
927.815	2783.4	V	49.1	54.0	-4.9

Figure 42. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Average

Field Strength Calculation 30 – 1000 MHz

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

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

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

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

No external pre-amplifiers are used.

12.4 *Test Equipment Used, Spurious Radiated Emission Restricted Frequency Bands*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Date
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
Biconical Antenna	EMCO	3104	2606	December 28, 2014	February 28, 2016
Active Loop Antenna	EMCO	6502	9506-2950	November 4, 2015	November 4, 2016
Log Periodic Antenna	EMCO	3146	9505-4081	December 28, 2014	February 28, 2016
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
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	March 1, 2016
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 43 Test Equipment Used

13. Antenna Gain/Information

The antenna gain is 2.15dBi.

14. R.F Exposure/Safety

The EUT is a wireless control and data acquisition system. The typical placement of the E.U.T. is wall mounted. The typical distance between the E.U.T. and the user is 36cm.

Calculation of Maximum Permissible Exposure (MPE)
Based on 47CFR1 Section1.1310 Requirements

a. FCC Limit at 921.2 MHz is: $\frac{f}{1500}=0.614\frac{mW}{cm^2}$

Using Table 1 of 47CFR1 Section 1.1310 limit for general population/uncontrolled exposures, the above levels are 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 = 17.3 dBm = 54 mW

G_t = Antenna Gain = 2.15 dBi = 1.64 dBi numeric

R = Distance From Transmitter= 36 cm

c. The peak power density produced by the E.U.T. is:

$$S_{Avg}=\frac{54.0\times 1.64}{4\pi(36)^2}=0.0054\frac{mW}{cm^2}$$

d. This value is below the FCC limit.

15. APPENDIX A - CORRECTION FACTORS

15.1 *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

15.2 *Correction factors for Log Periodic Antenna Model EMCO 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.

15.3 *Correction factors for Biconical Antenna Model EMCO 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.

15.4 *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

15.5 *Correction factors for Double-Ridged Waveguide Horn*

Model: 3115, S/N 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