



**FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8**

CERTIFICATION TEST REPORT

FOR

RGBW Controller

MODEL NUMBER: FGRGBWM-441

FCC ID: 2AA9MFGRGBWM441

REPORT NUMBER: 100045153

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Prepared for
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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Fibar Group sp. z.o.o
Ul. Lotnicza 1
Poznan, Poland 60-453

EUT DESCRIPTION: RGBW Controller

MODEL: FGRGBWM-441

SERIAL NUMBER: Prototype

DATE TESTED: September 12, 2013 – September 25, 2013

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C Part 15.249	Pass

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 333 Pfingsten Road, Northbrook, IL 60062, USA.

UL NBK is accredited by NVLAP, Laboratory Code 100414-0.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test	Range	Equipment	Uncertainty k=2
Radiated Emissions	30-200MHz	Bicon 10m Horz	4.27dB
Radiated Emissions	30-200MHz	Bicon 10m Vert	4.28dB
Radiated Emissions	200-1000MHz	LogP 10m Horz	3.33dB
Radiated Emissions	200-1000MHz	LogP 10m Vert	3.39dB
Radiated Emissions	1-6GHz	Horn	5.02dB
Radiated Emissions	6-18GHz	Horn	5.34dB
Radiated Emissions	18-26GHz	Horn	6.60dB
Conducted Ant Port	30MHz-26GHz	Spectrum Analyzer	2.94
RF Power	dB	Power Meter	0.45dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a RGBW Controller that contains a 908MHz transceiver. The EUT is DC powered.

The radio device is manufactured by Fibar Group

5.2. MAXIMUM OUTPUT E-FIELD STRENGTH

The transmitter has a maximum output peak E-field as follows:

Frequency Range (MHz)	Mode	Output QP E-field Strength (dBuV/m)
908.4	TX	90.10

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an isolated copper wire type whip antenna

5.4. WORST-CASE CONFIGURATION AND MODE

The EUT was set in worst axis as found in preliminary testing.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Use	Product Type	Manufacturer	Model	Comments
EUT	Sensor	Fibar	FGFS-101	None
AE	Power Supply	-	MW41-1200500	12VDV 500mA output

Note: EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment, or SIM - Simulator (Not Subjected to Test)

I/O CABLES

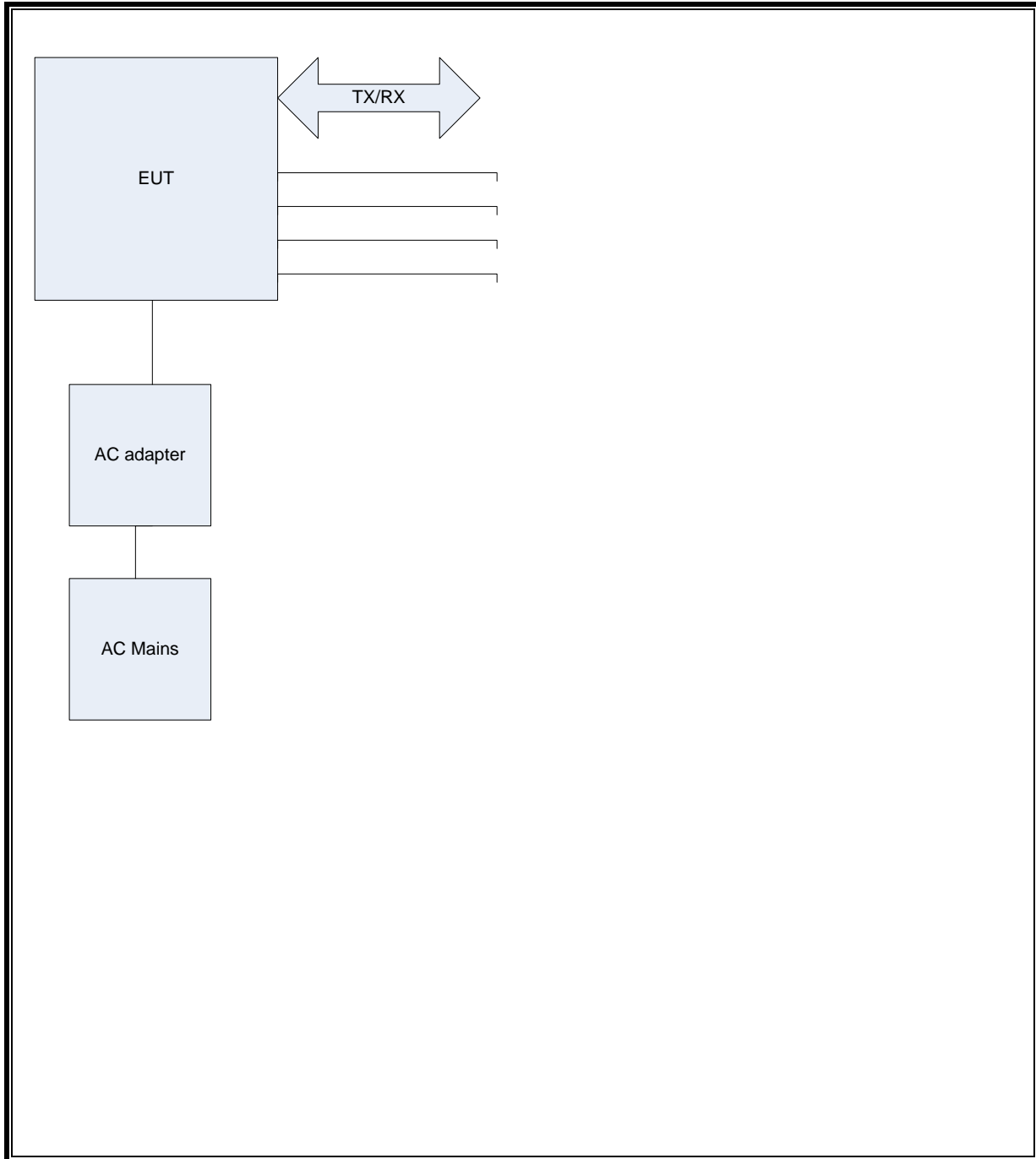
Port #	Name	Type*	Cable Max. >3m (Y/N)	Cable Shielded (Y/N)	Comments
0	Enclosure	N/E	—	—	None
1	DC input	DC	N	N	AC adapter provided DC input
2	IO lines	IO	N	N	6in wires connected to all IO ports

Note:
 AC = AC Power Port DC = DC Power Port N/E = Non-Electrical
 I/O = Signal Input or Output Port (Not Involved in Process Control)
 TP = Telecommunication Ports

TEST SETUP

The EUT is programmed for continuous TX mode.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List					
Description	Manufacturer	Model	Asset	Cal Date	Cal Due
EMI Test Receiver	Rohde & Schwarz	ESU	EMC4323	20121227	20131231
Bicon Antenna	Chase	VBA6106A	EMC4078	20130213	20140228
Log-P Antenna	Chase	UPA6109	EMC4258	20121015	20131030
Spectrum Analyzer	Rhode & Schwarz	FSEK	EMC4182	20121226	20131231
Antenna Array	UL	BOMS	EMC4276	20111227	20131231
Spectrum Analyzer	Agilent	N9030A	EMC4360	20121226	20131226
Near Field Antenna	EMCO	-	-	-	-
EMI Test Receiver	Rohde & Schwarz	ESCI	EMC4328	20121230	20131230
LISN	Solar	8602-50-TS-50-N	EMC4052	20130115	20140116
LISN	Solar	8602-50-TS-50-N	EMC4064	20130115	20140116

7. TEST RESULTS

7.1.1. 99%, 20dB BANDWIDTH

LIMITS

None; for reporting purposes only.

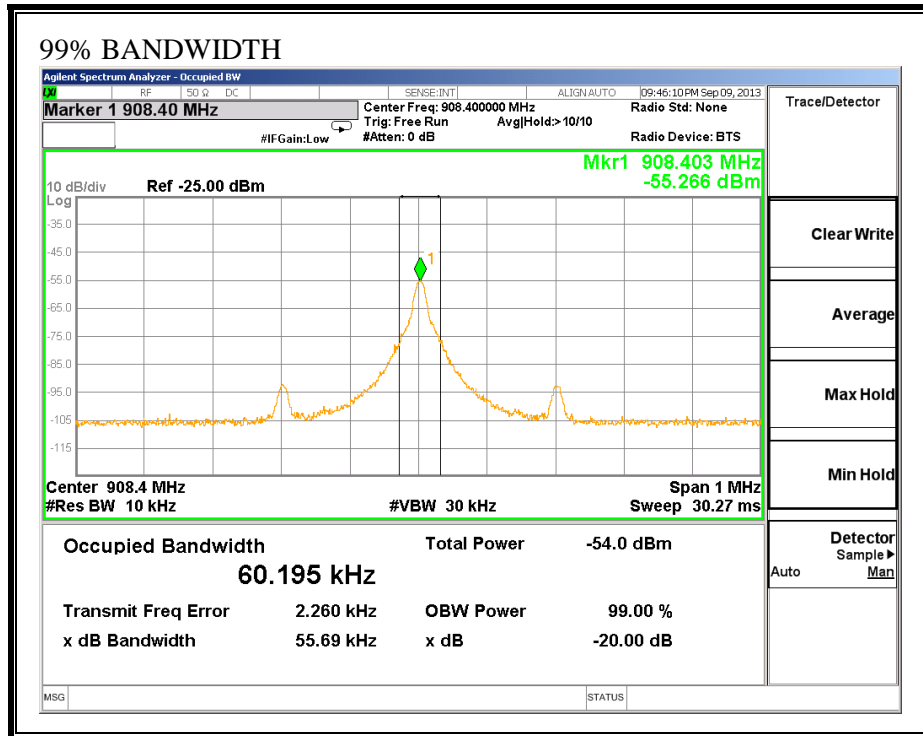
TEST PROCEDURE

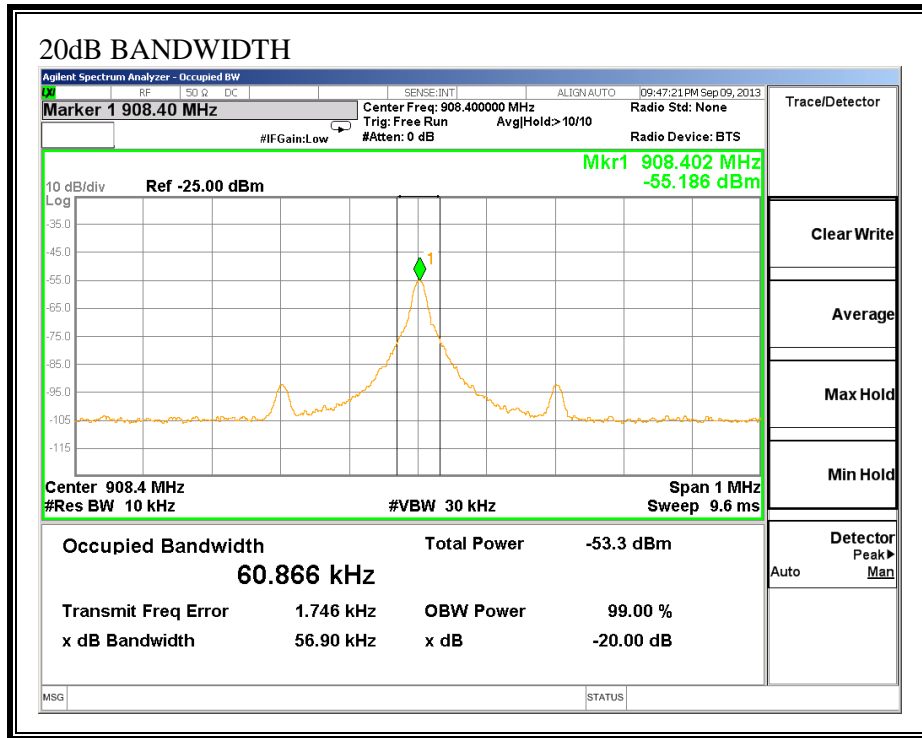
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

Channel	Frequency (kHz)
99%	60.195
20dB	56.9

99% BANDWIDTH





7.2. RADIATED EMISSIONS

TEST PROCEDURE

ANSI C63.4

LIMIT

IC RSS-210, A2.9
FCC 15.249

Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz, and 24.0–24.25 GHz.

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Limit is 3m

Fundamental frequency	Field strength of fundamental (millivolts/ meter)	Field strength of harmonics (microvolts/ meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

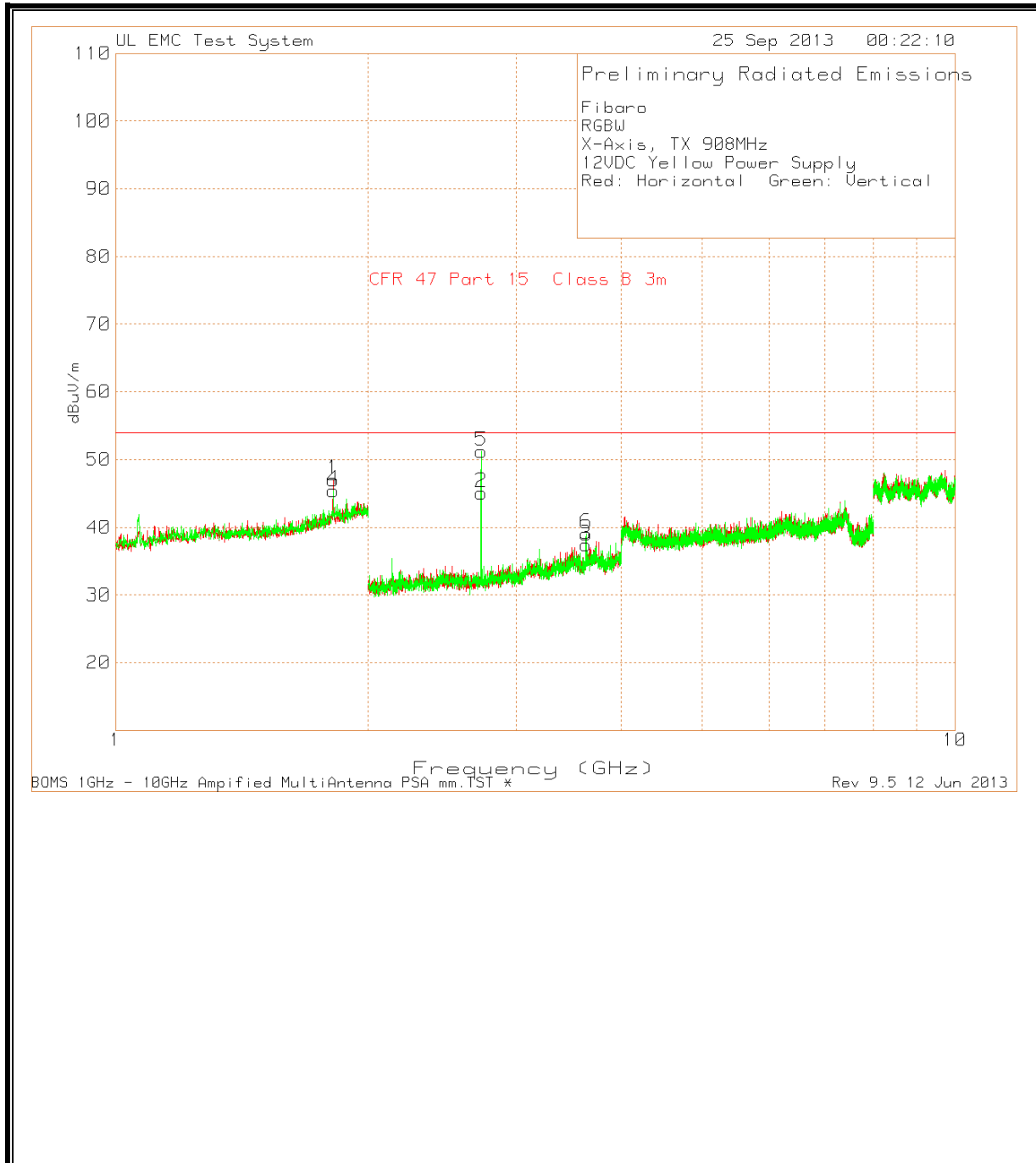
Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100 **	3
88-216	150 **	3
216-960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

RESULTS

Fibaro											
Model: RGBW											
X,Y and Z Axis, Worst Case.											
Fundamental Measurements											
With Yellow Power Supply											
LogP Horizontal 200 - 1000MHz											
Test Frequency (MHz)	Meter Reading (dBuV)	Detector	UPA6109 SN1060 EMC4258 3M dB/m	3 meter with LogP Emission s Ca dB	Corrected Reading dB(uVolts /meter)	Fundamental Limit	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity	Notes
908.4008	57.1	QP	23	10	90.1	94	-3.9	107	103	H	1
908.4008	53.96	QP	23	10	86.96	94	-7.04	175	118	V	1
908.4008	53.04	QP	23	10	86.04	94	-7.96	356	102	H	2
908.4008	54.75	QP	23	10	87.75	94	-6.25	132	151	V	2
908.4008	56.45	QP	23	10	89.45	94	-4.55	140	102	H	3
908.4008	53.56	QP	23	10	86.56	94	-7.44	103	135	V	3
Notes:											
1 - X-Axis											
2 - Z-Axis											
3 - Y-Axis											
PK - Peak detector											
QP - Quasi-Peak detector											

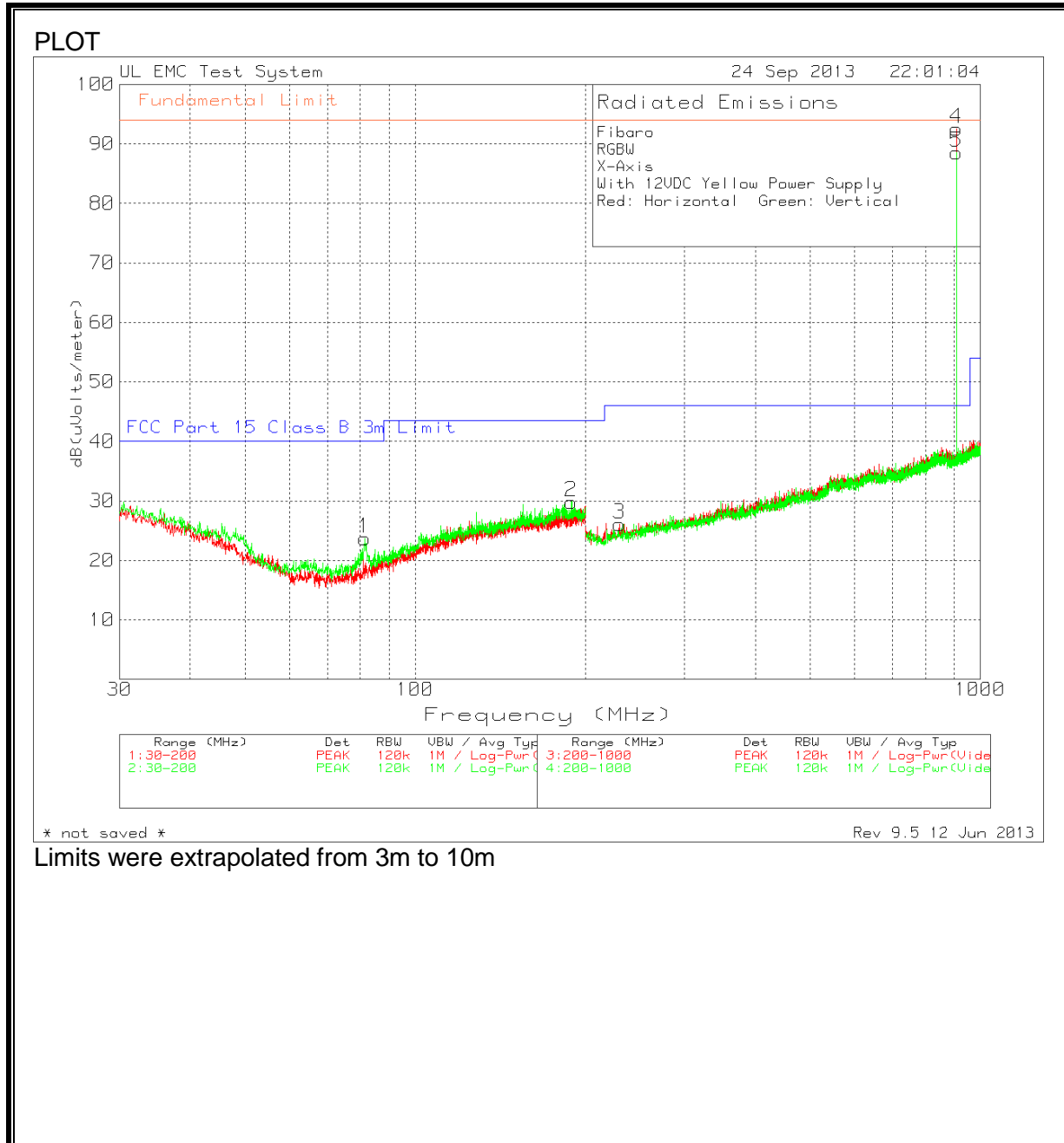
7.2.1. HARMONICS AND SPURIOUS EMISSIONS ABOVE 1GHZ



Fibaro											
RGBW											
X-Axis, TX 908MHz											
12VDC Yellow Power Supply											
Red: Horizontal Green: Vertical											
	Test	Meter		Antenna	BOMS	Corrected	CFR 47				
	Frequenc	Reading	Detector	Factor	Factor	Reading	Part 15	Margin	Azimuth	Height	
	y (GHz)	(dBuV)		dB/m	(dB)	dBuV/m	Class B	(dB)	[Degs]	[cm]	Polarity
	1	1.817	16.16 PK	26.9	3.98	47.04	54	-6.96	0-360	100	H
	2	2.725	73.64 PK	22.1	-50.66	45.08	54	-8.92	0-360	99	H
	3	3.633	63.85 PK	23.3	-49.75	37.4	54	-16.6	0-360	99	H
	4	1.817	14.57 PK	26.9	3.98	45.45	54	-8.55	0-360	100	V
	5	2.725	79.77 PK	22.1	-50.66	51.21	54	-2.79	0-360	149	V
	6	3.634	65.45 PK	23.3	-49.72	39.03	54	-14.97	0-360	100	V
Test	Meter		Antenna	BOMS	Corrected	CFR 47					
Frequency	Reading	Detector	Factor	Factor	Reading	Part 15	Margin	Azimuth	Height		
(GHz)	(dBuV)		dB/m	(dB)	dBuV/m	Class B	(dB)	[Degs]	[cm]		Polarity
2.7252	80.17	PK	22.1	-50.66	51.61	54	-2.39	22	115		V
2.7252	79.21	LnAv	22.1	-50.66	50.65	54	-3.35	22	115		V
PK - Peak detector											
LnAv - Linear Average detector											

7.2.2. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz



Fibaro														
RGBW														
X-Axis														
With 12VDC Yellow Power Supply														
Red: Horizontal Green: Vertical														
Bicon Vertical 30 - 200MHz														
				EMC4078										
	Test	Meter		BiCon	West 25-		Corrected	FCC Part						
Marker	Frequency	Reading	Detector	SN1246	1000MHz	10m to	Reading	15 Class B	Margin	Fundamental	Margin	Azimuth	Height	Polarity
No.	(MHz)	(dBuV)		10m	with	3m (dB)	dB(uVolts	3m Limit	(dB)	Limit dBuV/m	(dB)	[Degs]	[cm]	
				dB/m	Miteq dB		/meter)							
1	81.3993	35.82	PK	7.3	-29.9	10.5	23.72	40	-16.28	94	-70.28	0-360	400	V
2	188.7007	32.55	PK	15.9	-29.1	10.5	29.85	43.52	-13.67	94	-64.15	0-360	400	V
LogP Horizontal 200 - 1000MHz														
				UPA6109										
	Test	Meter		SN1060	East 25-		Corrected	FCC Part						
Marker	Frequency	Reading	Detector	EMC4258	1000MHz	10m to	Reading	15 Class B	Margin	Fundamental	Margin	Azimuth	Height	Polarity
No.	(MHz)	(dBuV)		10M	with	3m (dB)	dB(uVolts	3m Limit	(dB)	Limit dBuV/m	(dB)	[Degs]	[cm]	
				dB/m	Miteq dB		/meter)							
3	229.8468	30.49	PK	11.7	-26.6	10.5	26.09	46.02	-19.93	94	-67.91	0-360	99	H
PK - Peak detector														

8. AC MAINS LINE CONDUCTED EMISSIONS

LIMITS

§15.207 (a)
IC RSS-GEN, Section 7.2.2

Frequency of emission (MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

ANSI C63.4

RESULTS

No non-compliance noted:

6 WORST EMISSIONS

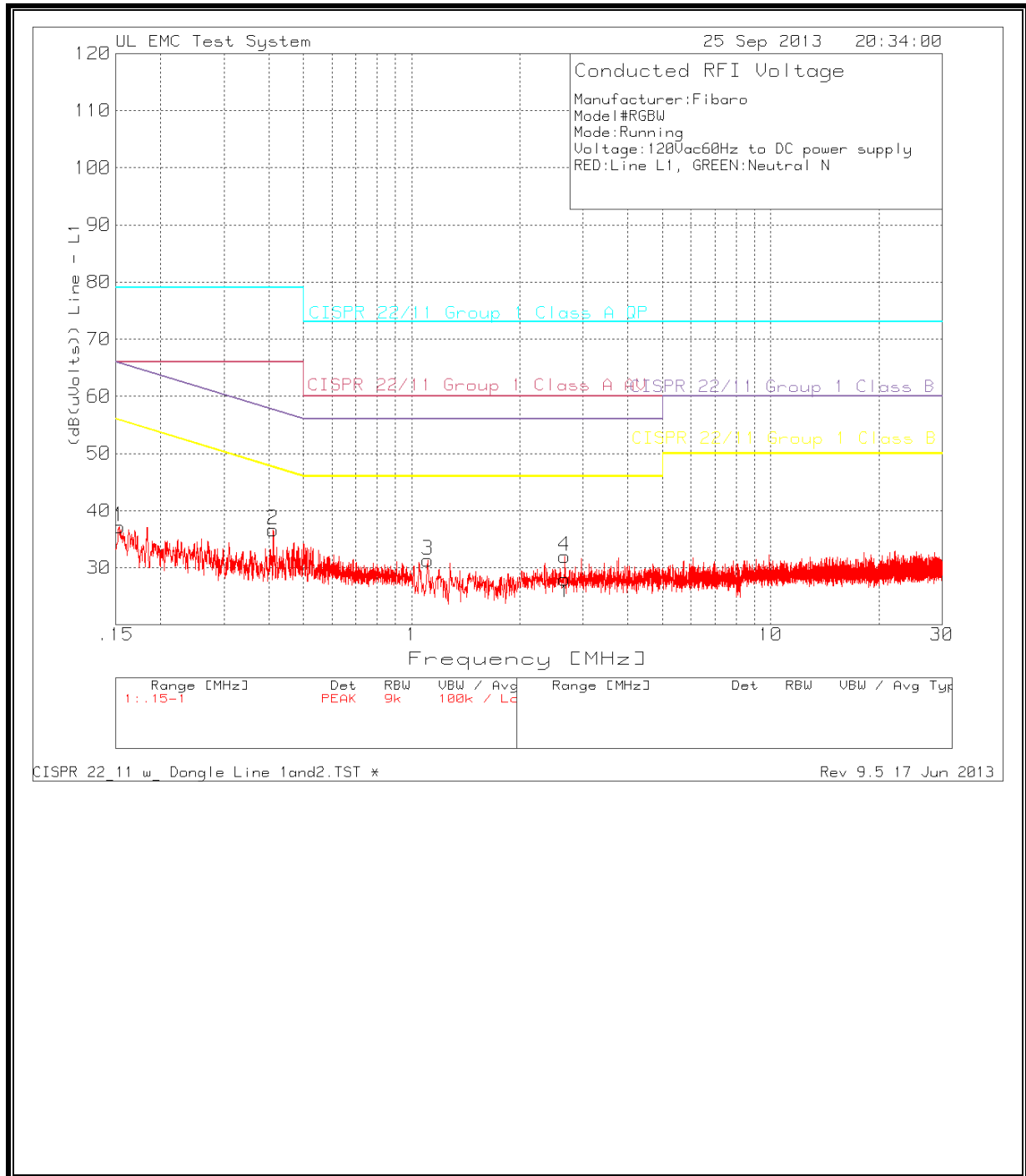
Manufacturer:Fibaro
 Model#RGBW
 Mode:Running
 Voltage:120Vac60Hz to DC power supply
 RED:Line L1, GREEN:Neutral N

Trace Markers										
No.	Test Frequency [MHz]	Meter Reading	Transducer Factor [dB]	Gain/Loss Factor [dB]	Corrected Reading (dB(uVolts))	Limit:1	2	3	4	
=====										
Line - L1 .15 - 1MHz -----										
1	.15319	22.72dBuV PK	.1	14.4	37.22	79	66	65.83	55.83	-
				Margin [dB]		-41.78	-28.78	-28.61	-18.61	-
2	.4116	25.87dBuV PK	.1	10.7	36.67	79	66	57.62	47.62	-
				Margin [dB]		-42.33	-29.33	-20.95	-10.95	-
Line - L1 1 - 30MHz -----										
3	1.10866	20.62dBuV PK	.1	10.6	31.32	73	60	56	46	-
				Margin [dB]		-41.68	-28.68	-24.68	-14.68	-
4	2.66966	21.3dBuV PK	.1	10.6	32	73	60	56	46	-
				Margin [dB]		-41	-28	-24	-14	-
Line - L2 .15 - 1MHz -----										
5	.15871	23.34dBuV PK	.1	14	37.44	79	66	65.53	55.53	-
				Margin [dB]		-41.56	-28.56	-28.09	-18.09	-
6	.63223	22.46dBuV PK	.1	10.6	33.16	73	60	56	46	-
				Margin [dB]		-39.84	-26.84	-22.84	-12.84	-
Line - L2 1 - 30MHz -----										
7	2.36543	21.67dBuV PK	.1	10.6	32.37	73	60	56	46	-
				Margin [dB]		-40.63	-27.63	-23.63	-13.63	-
8	26.47596	21.43dBuV PK	.3	11.7	33.43	73	60	60	50	-
				Margin [dB]		-39.57	-26.57	-26.57	-16.57	-

LIMIT 1: CISPR 22/11 Group 1 Class A QP
 LIMIT 2: CISPR 22/11 Group 1 Class A AV
 LIMIT 3: CISPR 22/11 Group 1 Class B QP
 LIMIT 4: CISPR 22/11 Group 1 Class B AV
 LIMIT 5: NONE
 LIMIT 6: NONE

PK - Peak detector

LINE 1 RESULTS



LINE 2 RESULTS

