DARE!!

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Electromagnetic Compatibility Test Report

Partial FCC test results of an FS Concentrator

Customer	:	EasyLogic Westbaan 288 2841 MC Moordrecht The Netherlands
Customer's representative	:	Mr. M. Berkouwer
In the capacity of	:	Manufacturer
Reference number	:	15C01458RPT01
Status test report	:	Final

Test engineer:	Author:	Released:
A.S. Diks	M.J. Rommen	D. van der Vlugt
Senior test engineer	Administrative assistant	Director

1 Summary

A summary of the test results gained from testing the FS Concentrator is shown in the table below.

	Standard	Class / level	Result (Pass/Fail)
Emission	47 CFR 15	B	Pass, as far as tested
Testplan	14C01272TPR01	--	--

Note 1: The test results presented in this report relate only to the tested sample(s).

Note 2: The test results are based on the tested mode of operation(s), the applicable performance criteria and the acceptance criteria as specified by the customer.

The following table gives a summary of the results of the tests that have been carried out on the FS Concentrator.

Test sequence	Test Description	Basic standard	EUT Modified during test (yes/no)	Result (Pass/Fail)
1	Conducted emission, test with a LISN	ANSI C63.4 (2009)	Yes	Pass
--	Radiated emission up to 1 GHz (OATS/SAC)	ANSI C63.4 (2009)	--	Not requested
--	Radiated emission above 1 GHz (FAC)	ANSI C63.4 (2009)	--	Not requested

All tests are excluded from accreditation.

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2 Table of Contents

3 Introduction

DARE!! Measurements is requested by EasyLogic, to perform Electromagnetic Compatibility (EMC) tests.

The objective of the test was to assess the FS Concentrator in accordance with the standards as mentioned in chapter 5 of this report. This report may only be used for this purpose.

At request of EasyLogic, the EMC tests are carried out in order to find out whether the product complies with 47 CFR 15 of the FCC regulations for computers and other digital devices.

The test sample(s) were received on 2015 October, 5. Testing was performed on 2015 October, 5. The test report is issued on 2015 October, 6.

The tests are carried out at our facilities located in Woerden, The Netherlands.

The test results presented in this report relate only to the product tested.

In this report, the sample tested will be referred to as Equipment Under Test (EUT).

This report is in conformity with ISO 17025. However, the report is excluded from accreditation.

All tests as described in the applied standard(s) are carried out, unless otherwise specified in this report.

4 Explanation Status Report

- Final : Formally signed report, with a final conclusion. Changes in the report will lead to a new report with a new report number.
- Preliminary : Interim signed report, with a temporary conclusion. Test is not completed, for example due to missing information. Changes in the report will lead to an updated report with a new report number.

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5 Standards and test plan

The EUT is assessed against the following requirements.

- Emission : 47 CFR 15
- : FCC Public Notice DA 09-2478
- : KDB Publication 714737
- Test plan : 14C01272TPR01

If available, a test plan is used as a supplement.

5.1 Test plan deviations

None.

6 Measurement Uncertainties

The reported expanded uncertainty of measurement is based on a standard uncertainty of measurement multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%, but excluding the contribution of the EUT. The expanded uncertainty of measurement has been determined in accordance with EN 55016-4-2 (2011).

7 EUT details

7.1 Condition of EUT on receipt

The condition of the EUT during reception was undamaged and fully functional.

7.2 Purpose, functional and physical description

Wireless access point for the labour registration system for the horticulture industry / light industrial environments (inside buildings).

The details for the EUT that is supplied for test, were as follows.

Description	Sample
Name	FS Concentrator
Manufacturer	EasyLogic
Brand	Priva (Multiple brand names possible)
Model number	Not applicable
Serial number	000990
Rating power	5W
Rating amperage	--
Rating voltage	115Vac during FCC tests
Rating frequency	60Hz
Dimensions (L*W*H [m])	210 x 129 x 60 mm
Software release	V1.0.34
Hardware release	V3.0
Environment to be used	Horticulture industry / light industrial environments (Inside buildings)

7.3 Equipment authorization

The EUT can be authorized as Verification.

7.4 Potential sources of emission

The highest generated or used frequency of the EUT is 700MHz (FS Router 32MHz).
(With the exclusion of the RF signal between 868MHz and 928MHz which will be taken into account during the Radio measurements).

7.5 Interfaces to external objects

The cable connections to EUT and peripheral equipment during testing are displayed in the table below.

Description	Port Type	Type Of Cable	Cable Length	Fixing shield	Load at port
AC mains	Undefined	Unshielded	1.8m	Not applicable	Not applicable
Ethernet	I/O Communication	Unshielded (CAT5 RJ45)	15m (>30m)	Not applicable	Peripheral PC

7.6 Test configuration

The EUT is tested as table top equipment.
According the specifications of the EUT, the upper frequency to be measured is -- for Radiated Emission.
According the information of the customer, the class of emission is B.

8 Operating conditions during test

8.1 Test considerations

- It is decided to make two modes of operation and the worst case will be tested for each EMC test
- The FS Router is a variant of the FS Concentrator, without the Ethernet functionality. Therefore the EMC tests will be carried out, worst case at the FS Concentrator representing the EMC tests of both variants.
- During the EMC tests the RF communication will take place for one of the two European RF channels, because the radio module is the same for all six frequency channels.
- The minimum required test level is in accordance with EN 301 489-1/3. Without any obligation the tests will be carried out at the increased test levels in accordance with EN61000-6-2.
- The internal temperature controller will not be taken into account during the pass/fail determination during the immunity tests, because this is not a standard functionality of the FS concentrator.
- The Concentator 1 phase AC mains connection has no grounding.

8.2 Mode(s) of operation

The test mode(s) during testing were defined as:

Mode of operation	Description
Mode 1	The FS Concentrator is continuously communication with the peripheral PC by Ethernet.

The applicant's representative was present to witness the testing.
The Appendixes of this report shows pictures of the test configuration during the tests.

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9 Possible test case verdicts

- NA or not applicable : test does not apply to the EUT
- P(ass) : EUT does meet the requirement
- F(ail) : EUT does not meet the requirement
- U(ndetermined) : Pass or Fail could not be established
- NR or not requested : test is not requested by customer

During pass or fail decisions, the measurement uncertainty is not taken into account.

10 Test equipment

The instruments used to perform the tests are displayed in the Appendix.

11 Measurement software

The measurement software during testing was DARE!! Instruments Radimation version 2015.2.3.

12 Test results

12.1 Conducted emission, test with a LISN

12.1.1 Test method

The conducted emission tests at the supply port are carried out by means of a "Line Impedance Stabilisation Network" (LISN). The tests are recorded with a Spectrum Analyzer / EMI Receiver. The tests are carried out in accordance with the applied standard(s) (see chapter 5) and the basic standard ANSI C63.4 (2009), where the first standard takes precedence. The measured value is calculated by the following formula:

$$V = V_r + a_c + F_{AMN}$$

Where:

- V = Conducted Disturbance Level (measured value) [dBµV]
- V_r = Receiver Indication (receiver reading) [dBµV]
- a_c = Cable Loss (coax cable) [dB]
- F_{AMN} = Artificial Mains Network Loss (AMN) (LISN insertion loss) [dB]

12.1.2 Measurement Uncertainty

The measurement uncertainty during testing is displayed in the table below.

Frequency	U
9 kHz – 150 kHz (Measurement at EUT port LISN)	± 4.0 dB
150 kHz – 30 MHz (Measurement at EUT port LISN)	± 3.7 dB
150 kHz – 30 MHz (Measurement with extension cord)	± 4.1 dB

12.1.3 Requirements

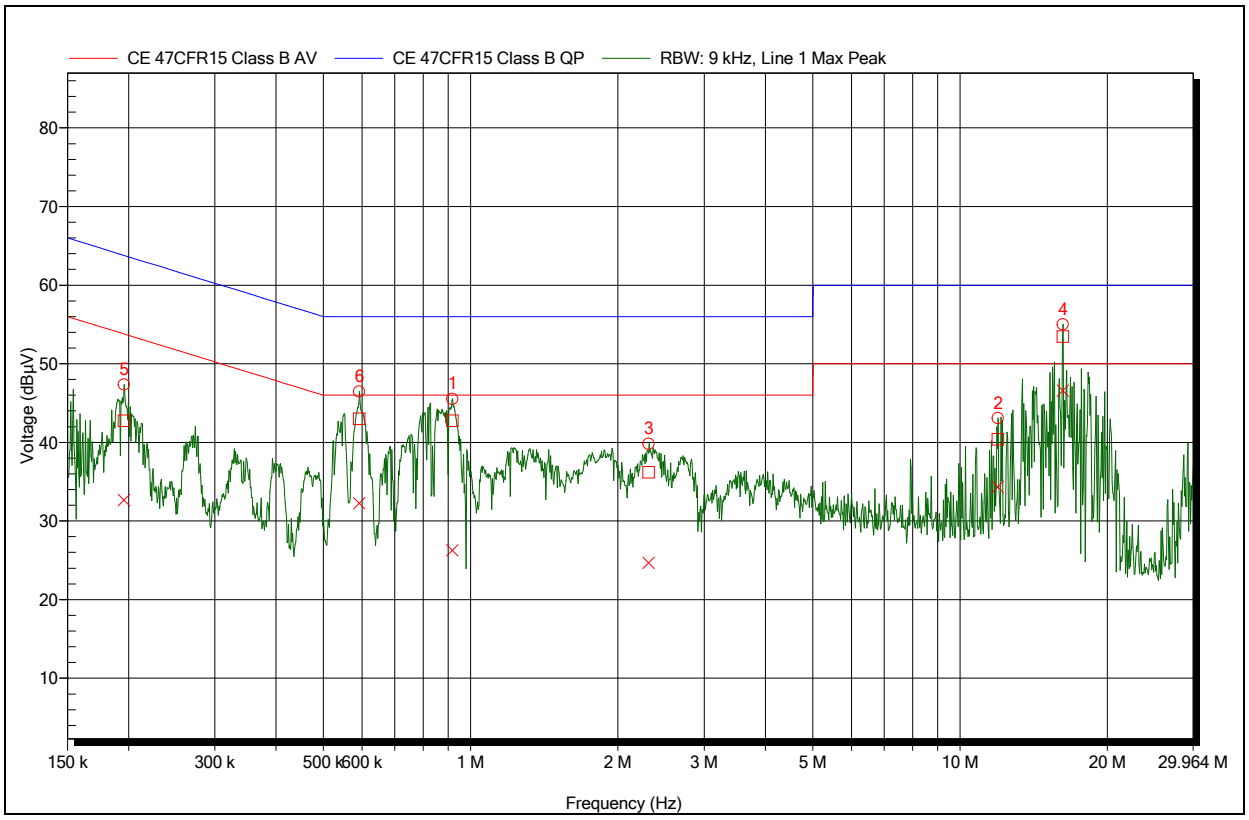
The requirements are laid down in the table below.

Frequency band	QP Limit class A	AV Limit class A	QP Limit class B	AV Limit class B
150 kHz - 500 kHz	79 dBµV	66 dBµV	66-56[1] dBµV	56-46[1] dBµV
500 kHz - 5 MHz	73 dBµV	60 dBµV	56 dBµV	46 dBµV
5 MHz - 30 MHz	73 dBµV	60 dBµV	60 dBµV	50 dBµV

[1] Decreasing linear with log of frequency.

Result Conducted Emission LISN 150 kHz to 30 MHz

PIN number:	15C01458	Resolution Bandwidth:	9 kHz
Test ID:	6	Video Bandwidth:	1 MHz
Mode of operation:	Mode 1, modification: CM choke (Wurth 744 824 220) placed in the AC mains lines. 15nF X2 placed after CM choke.	Line:	Line 1



Detected Peaks

Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Average	Average Limit	Status
1	918.016 kHz	42.8 dBµV	56 dBµV	26.3 dBµV	46 dBµV	Pass
2	11.954 MHz	40.4 dBµV	60 dBµV	34.3 dBµV	50 dBµV	Pass
3	2.311 MHz	36.2 dBµV	56 dBµV	24.7 dBµV	46 dBµV	Pass
4	16.228 MHz	53.5 dBµV	60 dBµV	46.6 dBµV	50 dBµV	Pass
5	195.8 kHz	42.8 dBµV	63.8 dBµV	32.7 dBµV	53.8 dBµV	Pass
6	592.272 kHz	43 dBµV	56 dBµV	32.3 dBµV	46 dBµV	Pass

Remarks

115Vac / 60Hz: Pass (-3.4dB @ 16.228MHz)

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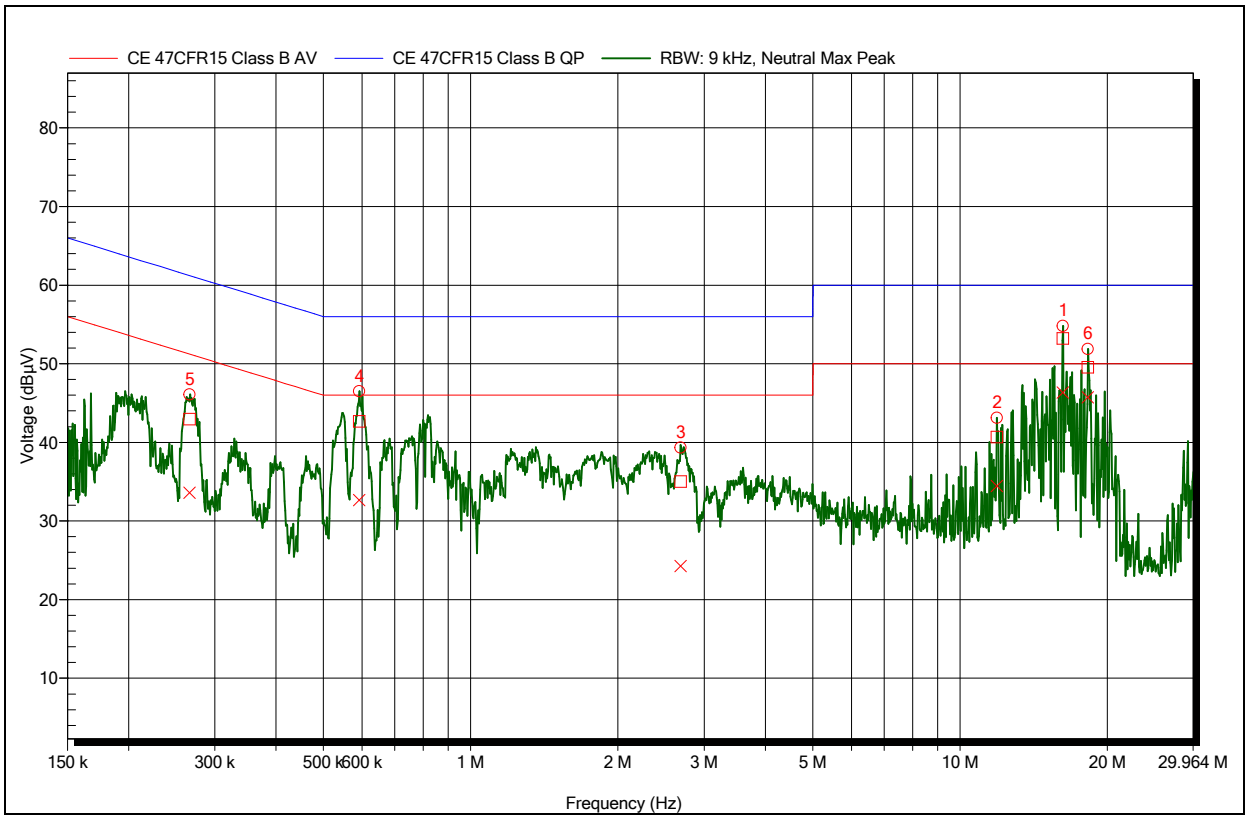
Result Conducted Emission LISN 150 kHz to 30 MHz

PIN number:	15C01458	Resolution Bandwidth:	9 kHz
Test ID:	7	Video Bandwidth:	1 MHz
Mode of operation:	Mode 1, modification: CM choke (Wurth 744 824 220) placed in the AC mains lines. 15nF X2 placed after CM choke.	Line:	Neutral



Detected Peaks

Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Average	Average Limit	Status
1	16.229 MHz	53.2 dBµV	60 dBµV	46.3 dBµV	50 dBµV	Pass
2	11.892 MHz	40.7 dBµV	60 dBµV	34.5 dBµV	50 dBµV	Pass
3	2.687 MHz	35 dBµV	56 dBµV	24.3 dBµV	46 dBµV	Pass
4	591.66 kHz	42.7 dBµV	56 dBµV	32.6 dBµV	46 dBµV	Pass
5	266.52 kHz	43 dBµV	61.2 dBµV	33.6 dBµV	51.2 dBµV	Pass
6	18.244 MHz	49.5 dBµV	60 dBµV	45.7 dBµV	50 dBµV	Pass

Remarks

115Vac / 60Hz: Pass (-3.7dB @ 16.229MHz)

13 Conclusion

The FS Concentrator has been partially evaluated. A partial test does not cover all the required tests, for a full compliant EMC test the emission test must be performed as described in the basic standards.

The FS Concentrator meets, as far as tested, the emission limits of an Unintentional Radiator as described in 47 CFR 15, class B Digital Device, if the modifications as described in this report are applied.

14 Appendix A: Pictures of EUT

Picture 1: Conducted emission

Picture 2: EUT detail

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15 Appendix B: Equipment List

Conducted Emission LISN 150 kHz to 30 MHz

Description	Brand	Model	Serial	ID	Last Calibration	Calibration interval
Test site Conducted Emission, Einstein	DARE!! Consultancy	-	-	1572	-	-
Spectrum analyzer / Receiver	R&S	ESIB40	844261	1192	27/6/2013	3 years
LISN 50Ohm/50uH + 5Ohm, 3~, 16A, incl. 10 dB Att.	Schwarzbeck+Minicircuits	NSLK 8126 + BW-N10W5	506+-	1607+1608	4/11/2014	3 years
Power Source	California Instruments	5001iX	55707	1324	6/2/2014	5 years
Cable RF-coaxial, CE LISN Einstein (EMC)	Huber + Suhner	RG142	-	1226	23/4/2015	1 year