AT4 wireless, S.A.U.
Parque Tecnológico de Andalucía,
c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España
www.at4wireless.com · C.I.F. A29 507 456

Nº 51/LE147

Test report No:

NIE: 47969REM.001

Test report

FCC Rules and Regulations 47 CFR Chapter I Part 15 Subpart B (10-01-14 Edition) & ICES-003 ISSUE 5 (2012)

Identification of item tested.....:	Digital camera
Trademark .....:	Nokia OZO
Model and /or type reference.....:	OZO Professional VR Camera PC-01
Other identification of the product .....:	S/N: PC01001065 FCC ID: 2AEJS-PC0100 IC: 661F-PC0100
Final HW version .....:	HW build MK1.1 HWID 0201
Final SW version .....:	Week 01 (v0.1.5) release, Firmware: 201601072333
Features.....:	Video and audio capture on local storage. Video and audio streaming over SDI interface for live monitoring and for recording on external storage. Local control of the camera with on-device user interface. Wireless remote control of the camera over WiFi. Operates on battery power or on external AC/DC power supply.
Manufacturer.....:	NOKIA TECHNOLOGIES LTD Yrttipellontie 1. 90230 Oulu. Finland.
Test method requested, standard.....:	FCC Rules and Regulations 47 CFR Chapter I Part 15 Subpart B (10-01-14 Edition) & ICES-003 ISSUE 5 (2012)
Summary.....:	IN COMPLIANCE
Approved by (name / position & signature).....:	Rafael López EMC LAB Manager Firmado digitalmente por RAFAEL LÓPEZ MARTÍN Fecha: 2016.02.05 13:35:31 +01'00'
Date of issue.....:	2016-02-02
Report template No.....:	FDT08_17

Index

Competences and guarantees

AT4 wireless is a testing laboratory accredited by the National Accreditation Body (ENAC - Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

This certificate of conformity was issued in accordance with the decision Nº 3/2000 of the Joint Committee established under the Agreement on Mutual Recognition between the European Community and the United States of America. By this decision, AT4 wireless can act as Conformity Assessment Body (CAB) on Electromagnetic Compatibility. This Certificate applies to the samples listed at technical reports.

This laboratory is designed by the Federal Communications Commission (ES0004)

AT4 wireless is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, AT4 wireless has a calibration and maintenance program for its measurement equipment.

AT4 wireless guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at AT4 wireless at the time of performance of the test.

AT4 wireless is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of AT4 wireless.

General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of AT4 wireless.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of AT4 wireless and the Accreditation Bodies.

Uncertainty

Uncertainty (factor k=2) was calculated according to the AT4 wireless internal document PODT000.

Usage of samples

Samples under test have been selected by: The client.

Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial number	Reception date
47969B/004	AC/DC Adapter	SDI65-12-U OZO	SDI65-12-U-PS	2016-01-20
47969B/010	Digital camera	Professional VR Camera PC-01	PC01001065	2016-01-20
47969B/011	Battery	---	---	2016-01-20

Auxiliary elements used with the sample S/01:

Control Nº	Description	Model	Serial number	Reception date
47969B/005	AC Cable	---	---	2016-01-20
47969B/012	Tripod support	T-005KX	---	2016-01-20
47969B/026	Video BNC cable	---	---	2016-01-20
47969B/027	BNC-BNC cable	---	---	2016-01-20

Test sample description

Digital virtual reality cinematography camera utilizing 8 integrated image sensors and 8 microphones for recording 360 degree stereoscopic virtual reality content to removable data storage media or wired external data storage. Supports battery or external powered operation.

Identification of the client

NOKIA TECHNOLOGIES LTD

Karaportti 3, Espoo. Finland. FI-02610

Testing period

The performed test started on 2016-01-20 and finished on 2016-01-21.

The tests have been performed at AT4 wireless.

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 30 % Max. = 60 %
Shielding effectiveness	> 100 dB
Reference resistance to earth	< 1 Ω

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 30 % Max. = 60 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar
Shielding effectiveness	> 100 dB
Reference resistance to earth	< 1 Ω
Normal site attenuation (NSA)	< ±4 dB at 10 m & 3m distance between item under test and receiver antenna, (30 MHz to 1000 MHz)
Site VSWR	< ±6 dB at 3m distance between item under test and receiver antenna, (1 GHz to 18 GHz)
Field homogeneity	More than 75% of illuminated surface is between 0 and 6 dB (26 MHz to 18 GHz).

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 30 % Max. = 60 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar
Shielding effectiveness	> 100 dB
Reference resistance to earth	< 1 Ω

Remarks and comments

The tests have been realized by the technical personnel: Mario Alberto Ureña & José Manuel Márquez.

The total uncertainty of the measurement system for the measured radio disturbance characteristics of EUT from 150 kHz to 30 MHz is I = ± 3,60 dB for quasi-peak measurements, I = ± 3,48 dB for peak measurements (k = 2).

The total uncertainty of the measurement system for the measured radio disturbance characteristics of EUT from 30 MHz to 1 GHz is I = ± 4,57 dB for quasi-peak measurements, I = ± 4,48 dB for peak measurements (k = 2) and from 1 to 12,75 GHz is I = ± 3,43 dB for average and peak measurements.

The total uncertainty of the measurement system for the measured radio disturbance characteristics of EUT from 12,75 GHz to 26 GHz is I = ± 4,09 dB for average and peak measurements.

Testing verdicts (Legend)

Not applicable ..... :	N/A
Pass ..... :	P
Fail ..... :	F
Not measured ..... :	N/M

List of equipment used during the test					
CONTROL NUMBER	**DESCRIPTION**	**MANUFACTURER**	**MODEL**	**LAST CALIBRATION**	**NEXT CALIBRATION**
1999	EMI Receptor	ROHDE & SCHWARZ	ESIB 26	2015-06-16	2017-06-16
2932	Bilog Hybrid Antenna	SUNOL	JB6	2014-05-11	2017-05-11
4578	Biconilog Antenna	ETS LINDGREN	3142E	2014-03-17	2017-03-17
4658	RF Amplifier	SCHWARZBECK	BBV9743	2015-03-19	2016-03-19
4662	Transient limiter	SCHWARZBECK	VTSD 9561-D	2014-02-12	2016-02-12
4659	RF Amplifier	SCHWARZBECK	BBV 9718	2015-09-29	2016-09-29
4729	RF Amplifier	BONN ELEKTRONIK	BLMA 1840-1M	2015-12-02	2017-12-02
4657	Horn Antenna	SCHWARZBECK	BBHA 9170	2014-03-28	2017-03-28
4679	LISN	NARDA	PMM L3-32	2015-04-06	2016-04-06
4575	Digital termohigrometer	T&D	TR-702W	2015-04-01	2016-04-01
4570	Temperature and relative humidity recorder	HW GROUP	HWg-STE	2015-03-25	2016-03-25

Appendix A – Test result

APPENDIX A CONTENT:

DESCRIPTION OF THE OPERATION MODES

The operation modes described in this paragraph constitute a functionality of the sample under test for itself. Every operation mode takes a failure criteria for the immunity test that they were applying to it and a monitoring to guarantee performance of the same ones.

In the following table appears the operation modes used by the samples tested to that it refers the present test report.

OPERATION MODE	DESCRIPTION
OM#01	EUT ON. WiFi OFF. Continuous streaming video and audio transmission. Power supply: 115Vac/60Hz. (Worst case)
OM#02	EUT ON. WiFi ON. Continuous WiFi communication by PING. Continuous streaming video and audio transmission. Power supply: 115Vac/60Hz. (Worst case)

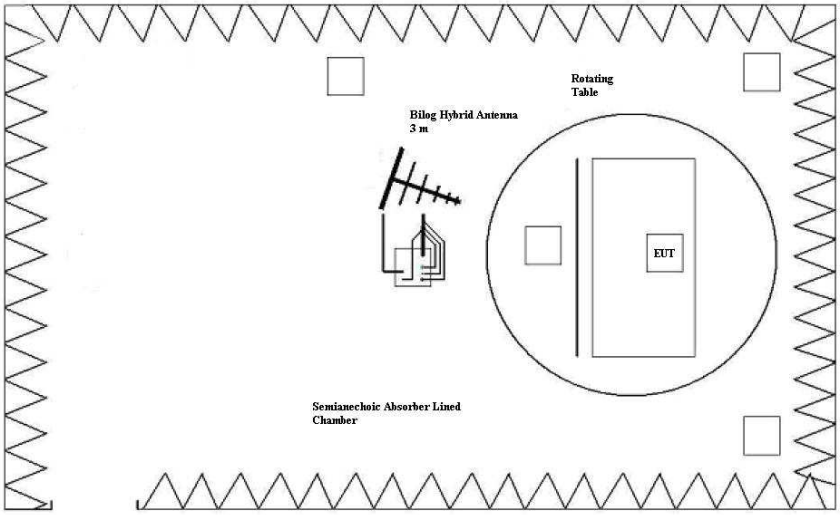
RADIATED EMISSION. ELECTROMAGNETIC FIELD MEASURE.

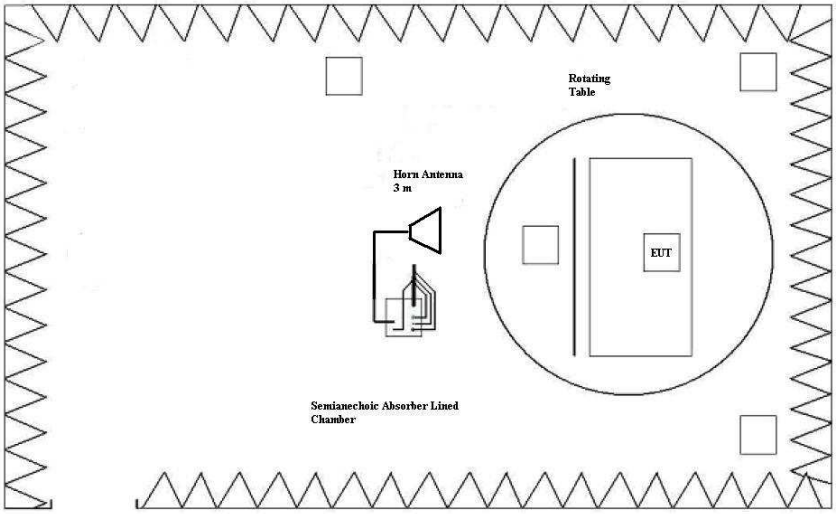
LIMITS:	Product standard:	FCC RULES AND REGULATIONS 47 CFR PART 15, SUBPART B (10-01-14 Edition) & ICES-003 ISSUE 5 (2012)
	Test standard:	FCC RULES AND REGULATIONS 47 CFR PART 15, SUBPART B (10-01-14 Edition) & ICES-003 ISSUE 5 (2012)

LIMITS OF INTERFERENCE CLASS B

The applied limit for radiated emissions, 3 m distance, according with the requirements of FCC Rules and Regulations 47 CFR Part 15.109, Subpart B (10-01-14 Edition) & ICES-003 ISSUE 5 (2012) in the frequency range 30 MHz to 26 GHz, for Class B equipment, which is a transmitter in a band over 500 MHz, was:

Frequency range (MHz)	QP Limit for 3 m (µV/m)	QP Limit for 3 m (dBµV/m)
30 to 88	100	40
88 to 216	150	43.52
216 to 960	200	46.02
Above 960	500	53.98
Above 1000	Limit for 3m AVG	Limit for 3m PK
	53.98 dBµV/m	73.98 dBµV/m





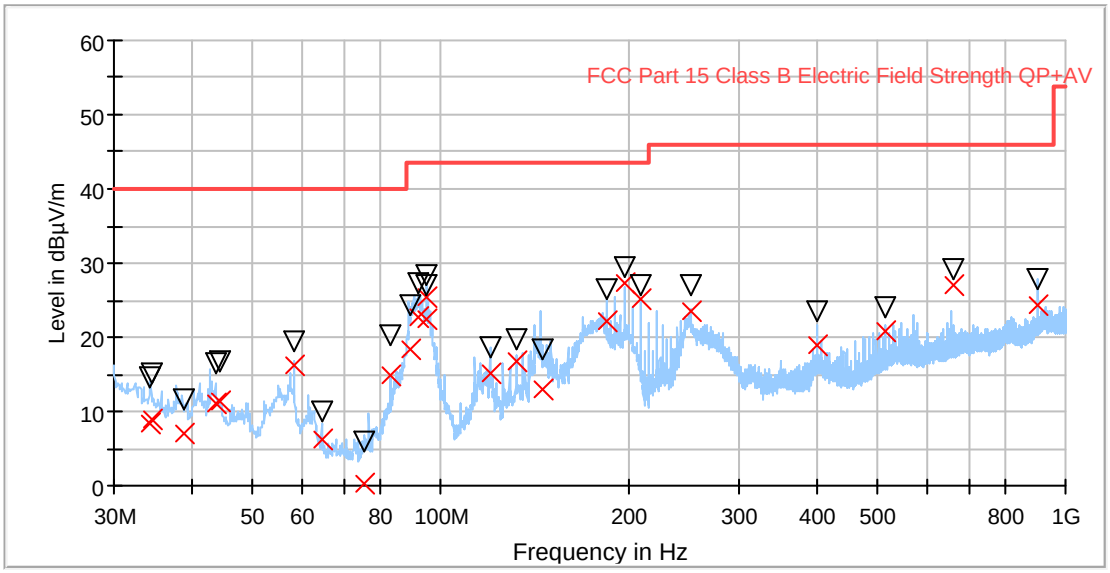
TESTED SAMPLES:	S/01
TESTED OPERATION MODES:	OM#01
TEST RESULTS :	CRmmnnxxyy: CR, Radiation Condition; mm: Sample number; nn: Operation mode ; xx: Measured range; yy: Polarisation.

CRmmnnxxyy	Description	Result
CR0101_RB	Range 30-1000 MHz.	P
CR0101_RA1_PH	Range 1-18 GHz. Horizontal pol.	P
CR0101_RA1_PV	Range 1-18 GHz. Vertical pol.	P
CR0101_RA2_PH	Range 18-26 GHz. Horizontal pol.	P
CR0101_RA2_PV	Range 18-26 GHz. Vertical pol.	P

Radiated Emission: CR0101_RB (30MHz to 1GHz)

Project:	47969REM.001
Company:	HALTIAN OY
Sample:	S/01
Operation mode:	OM#01
Description:	EUT ON. Power Supply 115 Vac 60 Hz. WiFi OFF. Continuous streaming video and audio transmission (worst case).

Full Spectrum



Peak Preview
FCC Part 15 Class B Electric Field Strength QP+AV
QuasiPeak
MaxPeak

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
34.338961	8.25	---	40.00	31.75	144.0	V	33.0
34.338961	---	14.60	---	---	144.0	V	33.0
34.637662	---	15.26	---	---	125.0	V	273.0
34.637662	8.99	---	40.00	31.01	125.0	V	273.0
38.983117	---	11.68	---	---	256.0	V	134.0
38.983117	6.94	---	40.00	36.06	256.0	V	134.0
43.575325	11.05	---	40.00	28.95	127.0	V	152.0
43.575325	---	16.62	---	---	127.0	V	152.0
44.293506	11.44	---	40.00	23.56	104.0	V	345.0
44.293506	---	16.67	---	---	104.0	V	345.0
58.400000	---	19.51	---	---	105.0	V	287.0
58.400000	16.20	---	40.00	23.80	105.0	V	287.0
64.500000	6.33	---	40.00	33.67	400.0	V	151.0
64.500000	---	10.12	---	---	400.0	V	151.0
75.259740	0.33	---	40.00	39.67	394.0	V	142.0
75.259740	---	5.96	---	---	394.0	V	142.0
82.945455	14.79	---	40.00	25.21	369.0	H	5.0

Radiated Emission: CR0101_RB (30MHz to 1GHz) (Cont)

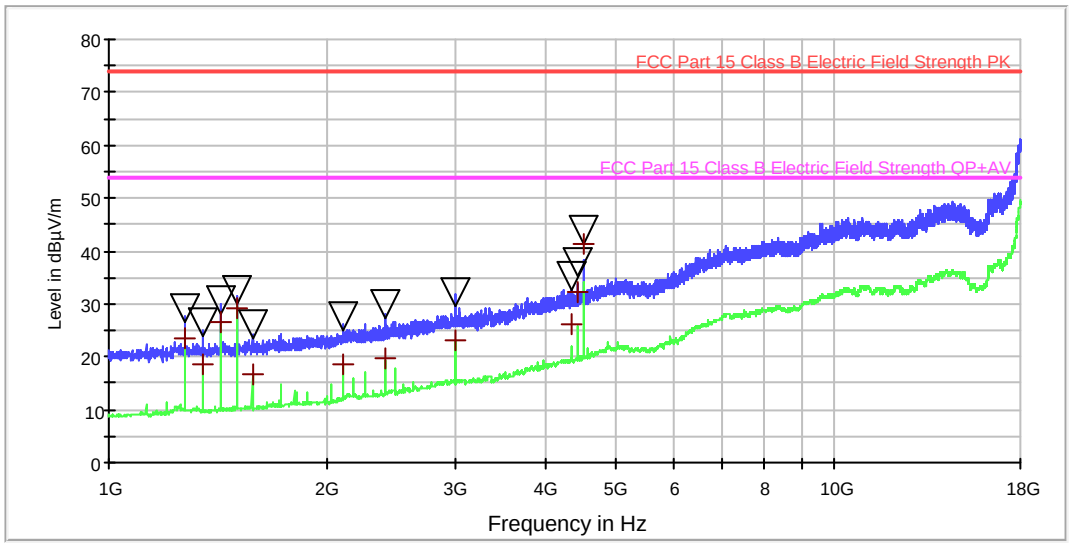
Final_Result (Cont)

Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
82.945455	---	20.30	---	---	369.0	H	5.0
89.457143	---	24.27	---	---	115.0	V	55.0
89.457143	18.51	---	43.50	24.99	115.0	V	55.0
92.184416	22.69	---	43.50	20.81	139.0	V	39.0
92.184416	---	27.26	---	---	139.0	V	39.0
95.187013	22.35	---	43.50	21.15	141.0	V	194.0
95.187013	---	26.90	---	---	141.0	V	194.0
95.232468	25.37	---	43.50	18.13	167.0	V	103.0
95.232468	---	28.25	---	---	167.0	V	103.0
119.787013	15.05	---	43.50	28.45	200.0	H	313.0
119.787013	---	18.73	---	---	200.0	H	313.0
132.080519	---	19.85	---	---	118.0	V	342.0
132.080519	16.63	---	43.50	26.87	118.0	V	342.0
145.490909	12.88	---	43.50	30.62	149.0	H	124.0
145.490909	---	18.45	---	---	149.0	H	124.0
184.306494	22.23	---	43.50	21.27	175.0	H	318.0
184.306494	---	26.45	---	---	175.0	H	318.0
196.619481	---	29.35	---	---	131.0	H	182.0
196.619481	27.30	---	43.50	16.20	131.0	H	182.0
208.874026	25.22	---	43.50	18.28	136.0	H	197.0
208.874026	---	27.12	---	---	136.0	H	197.0
251.893506	---	26.99	---	---	176.0	V	221.0
251.893506	23.62	---	46.00	22.38	176.0	V	221.0
399.967532	---	23.58	---	---	168.0	H	88.0
399.967532	18.82	---	46.00	27.18	168.0	H	88.0
516.074026	---	24.18	---	---	149.0	H	148.0
516.074026	20.73	---	46.00	25.27	149.0	H	148.0
660.493506	26.92	---	46.00	19.08	182.0	H	184.0
660.493506	---	29.14	---	---	182.0	H	184.0
899.961039	---	27.93	---	---	148.0	V	275.0
899.961039	24.30	---	46.00	21.70	148.0	V	275.0
82.945455	---	20.30	---	---	369.0	H	5.0

Radiated Emission: CR0101_RA1_PH (1 – 18 GHz)

Project:	47969REM.001
Company:	HALTIAN OY
Sample:	S/01
Operation mode:	OM#01
Description:	EUT ON. Power Supply 115 Vac 60 Hz. WiFi OFF. Continuous streaming video and audio transmission (worst case). Horizontal Polarization.

ER EMI FCC 15 Class B (1-18GHz)



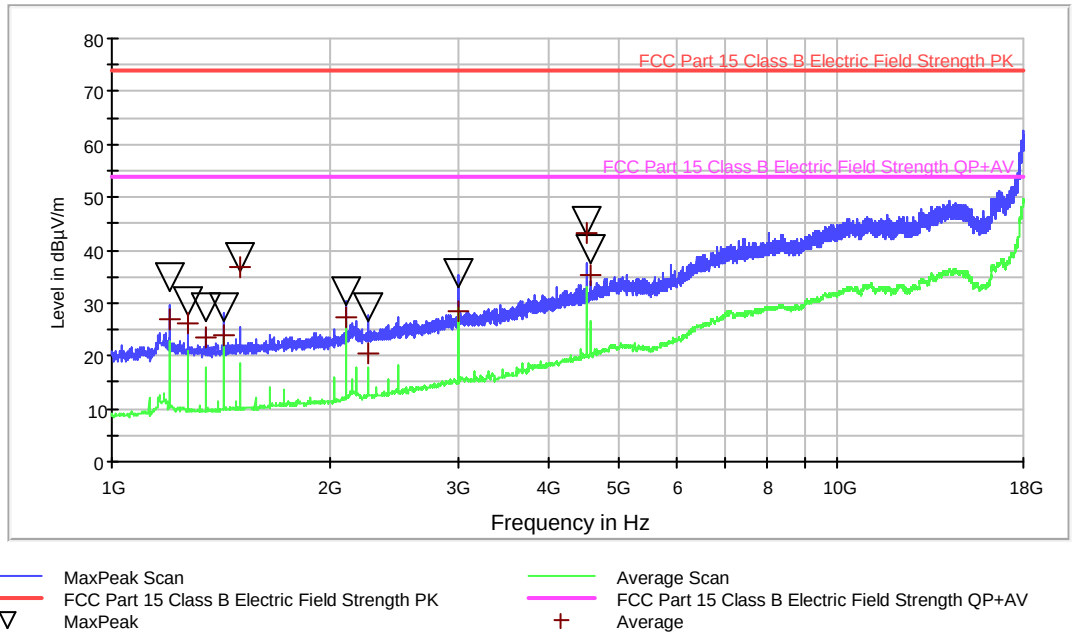
Result Table_Single

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Height (cm)	Comment
4350.000000	35.4	26.1	100.0	130º
4425.000000	38.0	32.1	100.0	130º
4500.000000	44.1	41.3	100.0	130º
1275.000000	29.4	23.5	100.0	130º
1350.000000	26.5	18.6	100.0	130º
1425.000000	30.8	26.4	100.0	130º
1500.000000	32.6	29.2	100.0	130º
1575.000000	26.2	16.6	100.0	130º
3000.000000	32.2	23.0	100.0	130º
2100.000000	27.8	18.5	100.0	130º
2400.000000	29.9	19.7	100.0	130º

Radiated Emission: CR0101_RA1_PV (1 – 18 GHz)

Project:	47969REM.001
Company:	HALTIAN OY
Sample:	S/01
Operation mode:	OM#01
Description:	EUT ON. Power Supply 115 Vac 60 Hz. WiFi OFF. Continuous streaming video and audio transmission (worst case). Vertical Polarization.

ER EMI FCC 15 Class B (1-18GHz)



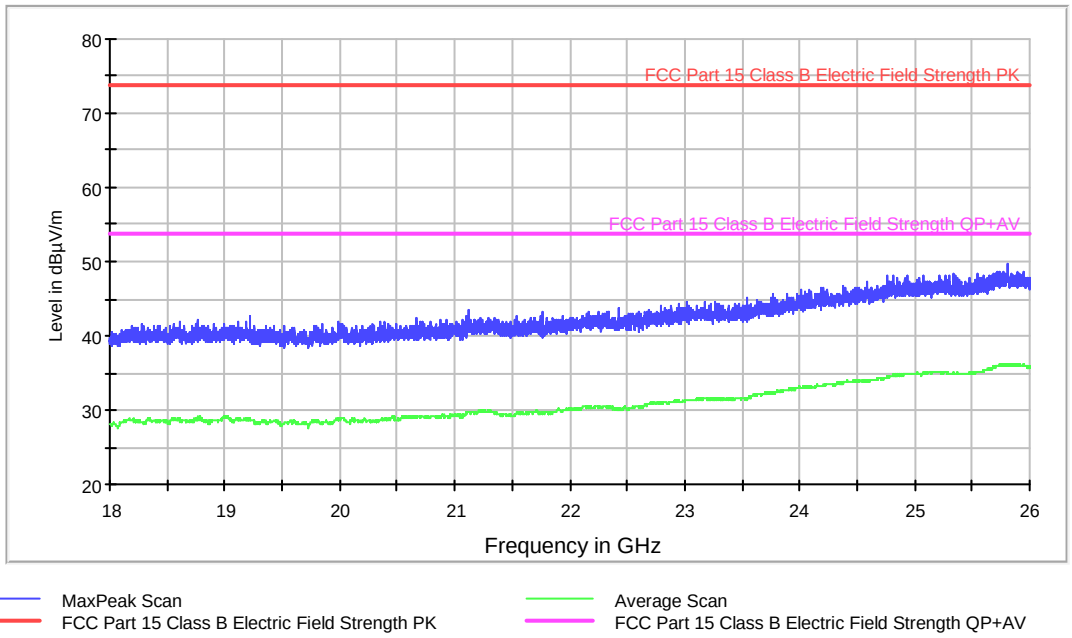
Result Table_Single

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Height (cm)	Comment
4500.000000	45.5	43.3	100.0	180º
4575.000000	40.2	35.2	100.0	180º
1200.000000	34.7	26.9	100.0	180º
1275.000000	30.3	26.1	100.0	180º
1350.000000	29.2	23.4	100.0	180º
1425.000000	29.3	23.8	100.0	180º
1500.000000	38.7	36.8	100.0	180º
2100.000000	32.2	27.4	100.0	130º
2250.000000	29.1	20.4	100.0	180º
3000.000000	35.7	28.3	100.0	180º

Radiated Emission: CR0101_RA2_PH (18 – 26 GHz)

Project:	47969REM.001
Company:	HALTIAN OY
Sample:	S/01
Operation mode:	OM#01
Description:	EUT ON. Power Supply 115 Vac 60 Hz. WiFi OFF. Continuous streaming video and audio transmission (worst case). Horizontal Polarization.

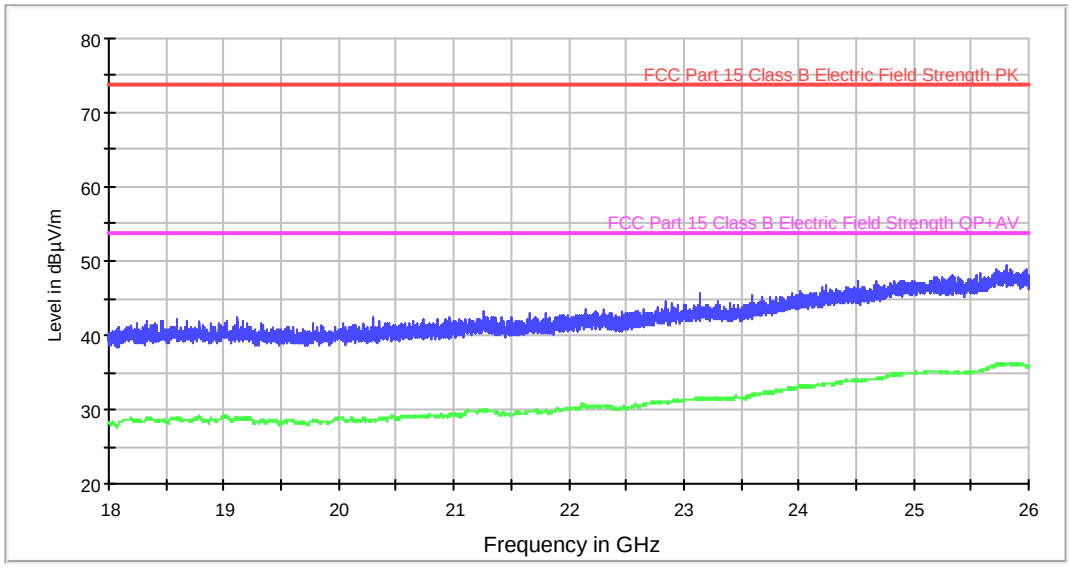
ER EMI FCC 15 Class B(18-26GHz)



Radiated Emission: CR0101_RA2_PV (18 – 26 GHz)

Project:	47969REM.001
Company:	HALTIAN OY
Sample:	S/01
Operation mode:	OM#01
Description:	EUT ON. Power Supply 115 Vac 60 Hz. WiFi OFF. Continuous streaming video and audio transmission (worst case). Vertical Polarization.

ER EMI FCC 15 Class B(18-26GHz)



MaxPeak Scan
FCC Part 15 Class B Electric Field Strength PK
Average Scan
FCC Part 15 Class B Electric Field Strength QP+AV

CONTINUOUS CONDUCTED EMISSION ON POWER LEADS

LIMITS:	Product standard :	FCC RULES AND REGULATIONS 47 CFR PART 15, SUBPART B (10-01-14 Edition) & ICES-003 ISSUE 5 (2012)
	Test standard :	FCC RULES AND REGULATIONS 47 CFR PART 15, SUBPART B (10-01-14 Edition) & ICES-003 ISSUE 5 (2012)

CLASS B

The applied limit for continuous conducted emissions in power leads, according with the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart B (10-01-14 Edition) & ICES-003 ISSUE 5 (2012) ; in the frequency range 0,15 to 30 MHz, for Class B equipment was:

Frequency range (MHz)	**Limit (dBµV)**	
	Quasi-peak	**Average**
0,15 to 0,5	66-56	56-46
0,5 to 5	56	46
5 to 30	60	50

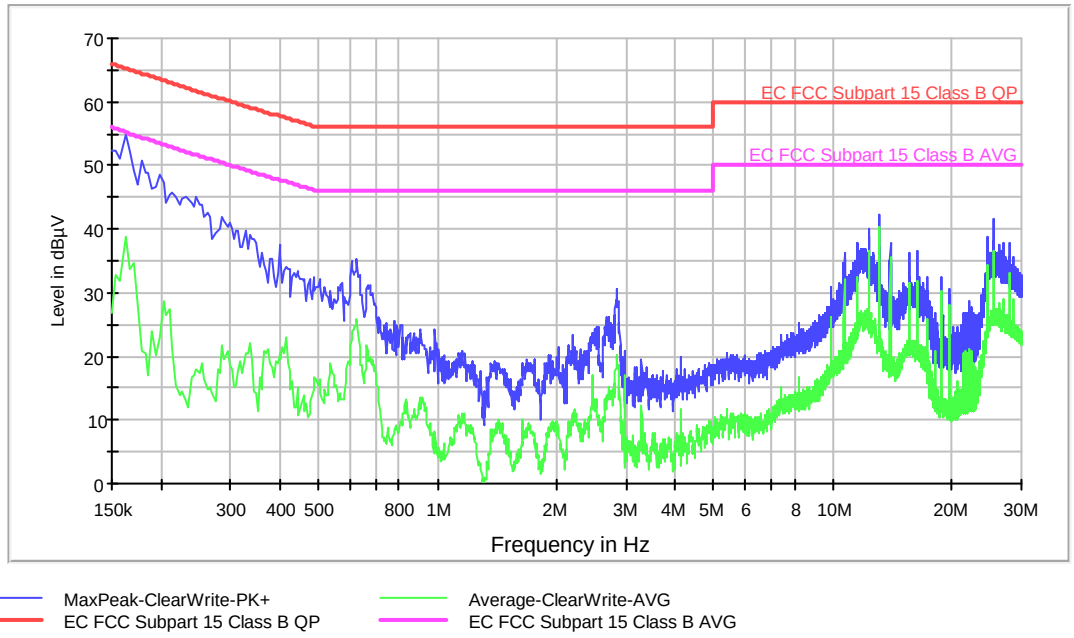
TESTED SAMPLES:	S/01
TESTED OPERATION MODES:	OM#01 & 02
TEST RESULTS :	CCmmnnhh: CC, Conducted Condition; mm: Sample number; nn: Operation mode; hh: wire

CCmmnnhh	**Description**	**Result**
CC01010N	Neutral wire noise.	P
CC0101L1	Phase wire noise	P
CC01020N	Neutral wire noise.	P
CC0102L1	Phase wire noise	P

Continuous Conducted emission : CC01010N	**Detector : Peak / Average / Cuasi-peak**

Project: 47969REM.001
Company: HALTIAN OY
Sample: S/01
Operation mode: OM#01
Description: EUT ON. Power Supply 115 Vac 60 Hz. WiFi OFF. Continuous streaming video and audio transmission (worst case). Neutral noise.

EMI EC FCC Subpart 15 Class B CC



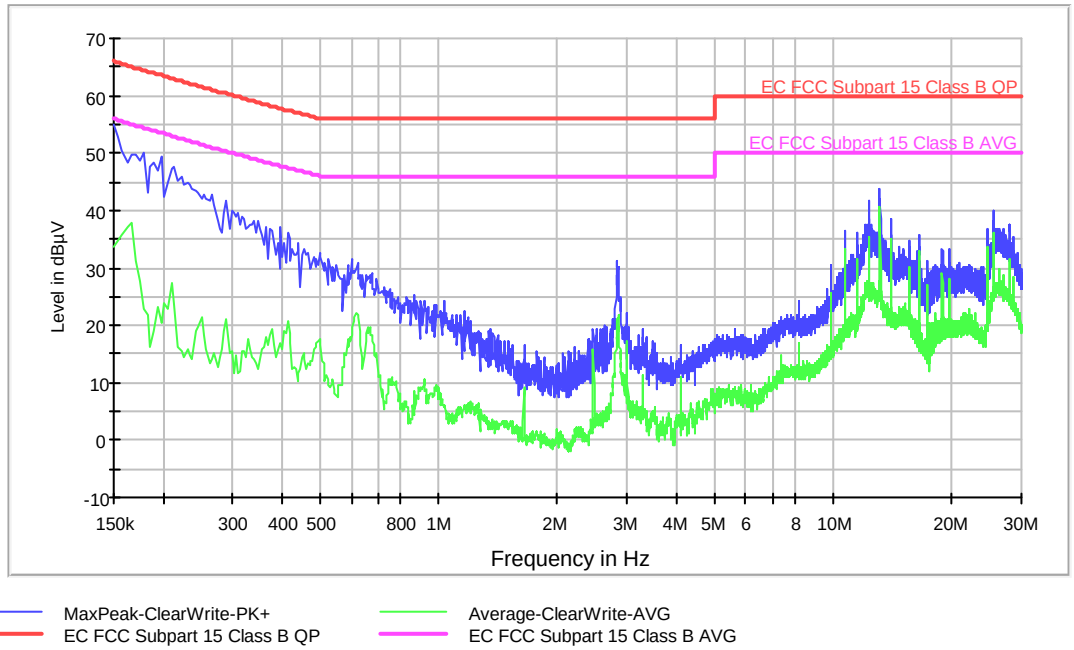
Subrange Maxima

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
0.162000	54.9	38.7
0.262000	42.5	15.0
0.626000	35.2	25.9
0.778000	25.6	8.1
2.018000	21.5	8.9
2.850000	30.6	19.2
5.386000	20.5	11.6
10.314000	31.4	18.7
13.150000	42.3	40.3
25.478000	41.5	36.6

Continuous Conducted emission : CC0101L1	**Detector : Peak / Average / Cuasi-peak**

Project: 47969REM.001
Company: HALTIAN OY
Sample: S/01
Operation mode: OM#01
Description: EUT ON. Power Supply 115 Vac 60 Hz. WiFi OFF. Continuous streaming video and audio transmission (worst case). Phase noise.

EMI EC FCC Subpart 15 Class B CC



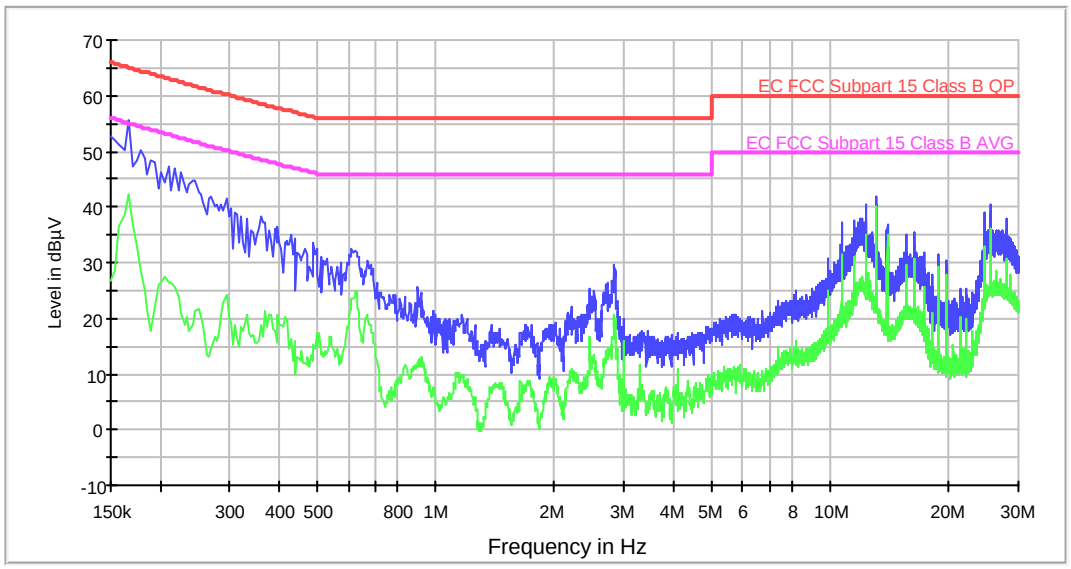
Subrange Maxima

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
0.150000	55.1	33.6
0.266000	42.7	14.2
0.442000	34.4	11.8
0.750000	26.3	10.5
1.350000	19.3	3.0
2.834000	31.2	20.5
5.654000	19.2	8.2
9.862000	30.5	25.6
13.146000	43.7	40.6
25.474000	40.0	36.2

Continuous Conducted emission : CC01020N	**Detector : Peak / Average / Cuasi-peak**

Project: 47969REM.001
Company: HALTIAN OY
Sample: S/01
Operation mode: OM#02
Description: EUT ON. Power Supply 115 Vac 60 Hz. WiFi ON. Continuous WiFi communication by ping. Continuous streaming video and audio transmission (worst case). Neutral noise.

EMI EC FCC Subpart 15 Class B CC



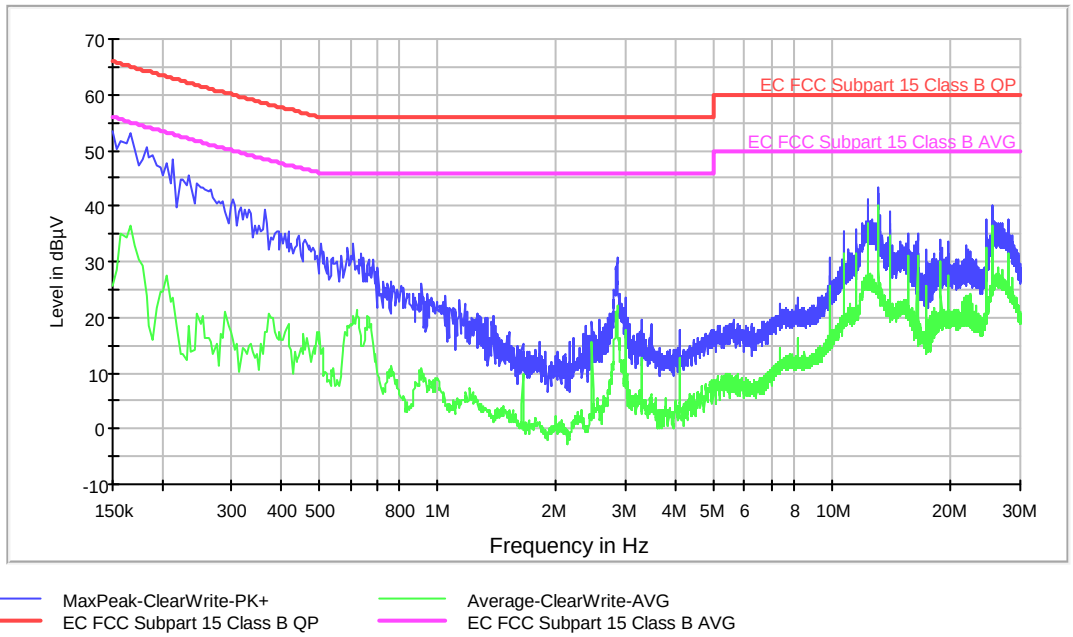
Subrange Maxima

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
0.166000	55.5	42.2
0.270000	42.0	14.5
0.438000	34.3	15.9
0.902000	25.6	11.8
2.014000	19.0	9.2
2.834000	29.6	20.7
5.602000	20.7	10.4
9.834000	30.7	18.7
13.126000	41.7	40.1
25.434000	40.4	36.0

Continuous Conducted emission : CC0102L1	**Detector : Peak / Average / Cuasi-peak**

Project: 47969REM.001
Company: HALTIAN OY
Sample: S/01
Operation mode: OM#02
Description: EUT ON. Power Supply 115 Vac 60 Hz. WiFi ON. Continuous WiFi communication by ping. Continuous streaming video and audio transmission (worst case). Phase noise.

EMI EC FCC Subpart 15 Class B CC



Subrange Maxima

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
0.150000	53.4	25.6
0.258000	43.0	16.4
0.446000	34.6	13.2
0.762000	26.5	9.3
1.258000	20.5	4.9
2.846000	30.5	22.1
5.626000	19.6	7.5
9.858000	30.9	25.6
13.142000	43.3	40.2
25.466000	40.1	36.5