

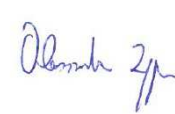
Test Report

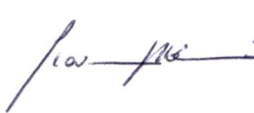
47 CFR FCC Part 15 subpart C Intentional Radiators

Report reference no. : 28113165 001

FCC Designation Number : IT0008

FCC Test Firm Registration # : 804595

Tested by (name + signature) :

Alessandro Zappa \ Tester

Approved by (name + signature) :

Giovanni Molteni \ TM

Date of issue : March 04, 2019

Total number of pages : 23 Pages

Testing Laboratory : TÜV Rheinland Italia S.r.l.

Address : Via Mattei 3 - 20010 - Pogliano Milanese (MI) – Italy

Applicant's name : Inventhio s.r.l.

Address : Via A. Pacinotti 43 40141 Bologna (BO) - ITALY

Test item description : electronic chessboard with piece recognition technology

Trade Mark : CERTABO

Manufacturer : Inventhio s.r.l.

Model/Type reference : VITTORIA

FCC ID : 2ASVHVT-ID-DV-C3-17

Ratings : 5Vdc
external AC/DC adapter: 100-240V 50/60Hz

Sample :

Samples received on : 25/02/2019

TUV reference samples : 190168 (sampled by the customer)

Samples tested n. : 1

Testing :

Start Date: : 19/03/2019

End Date: : 19/03/2019

The results in this Test Report are exclusively referred to the tested samples. Without the written authorization of TÜV Rheinland Italia S.r.l., this document can be reproduced only integrally

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RELEASE CONTROL RECORD		
Test report Number	Reason of change	Date of Issue
28113165 001	Original release	2019-April-11

1. Reference Standards	
Standard	Description
FCC Part 15 (Subpart C)	§15.207 Conducted Limits
FCC Part 15 (Subpart C)	§15.209 Radiated emission limits; general requirements
FCC Part 15 (Subpart C)	§15.203 Antenna equipment
ANSI C63.4:2014	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10:2013	American National Standard for Testing Unlicensed Wireless Devices

2. Summary of testing

§ 15.203	Antenna Requirements	PASS
§ 15.207 (a)	Power Line Conducted Emission	PASS
§ 15.209 (a) (f)	Radiated Emission	PASS
§ 15.215 (a) (b) (c)	Additional provisions to the general radiated emission limitations	PASS
(§ 47CFR 1.1307(b)(1))	RF humane exposure	PASS

Possible test case verdicts:

- test case does not apply to the test object: N/A
- test object does meet the requirement: PASS
- test object does not meet the requirement: FAIL

General remarks:

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

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

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"(see Enclosure #)" refers to additional information appended to the report.

"(see appended table)" refers to a table appended to the report.

Throughout this report a comma is used as the decimal separator.

3. General product information

Electronic chessboard with piece recognition technology

4. General Transmitter module information

Chipset model : EM4100
Modulation: AMPLITUDE – MODULATED BACKSCATTERING SIGNAL Coding: Manchester DATA
MODULATION-Direct

5. General Antennas information

L : 290uH±5%(10KHz/0.1V) DCR : 4.8Ω±20%
Antenna gain: 1.46 dBi

6. Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
EUT	Electronic chessboard	Inventhio	Vittoria	---
AE	None			

Note:

* Use :

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

No other Auxiliary/Associated Equipment was connected/installed on the EUT

7. Input/Output Ports

CONNECTIONS

Port	Description	Connection	Cable lenght
1	Enclosure	Non conductive surface	---
2	DC Power Port	USB	5Vdc
3	AC Power Port	AC/DC adapter	100-240V 50/60Hz

*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)
WN = Wired Network

8. Power Interface

Mode #	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
Rated	100÷240Vac	---	---	AC	1	---

9. EUT Operation Modes

Operation mode	Description
#1	Continuous RF Transmission (reading tags) at 125kHz. EUT supplied at 5Vdc (USB) by external AC/DC adapter model DSA-13PFC-05 FCA supplied at 120V 60Hz . AC/DC adapter was provided by customer for testing but is not included as part of EUT

10. EUT Configuration Modes

Description		
DVCWIRDCHARGER supplied at 120Vac 60Hz		
Par.	test	EUT Operation Modes
§ 15.203	Antenna Requirements	#1
§ 15.209 (a) (f)	Radiated Emission 9kHz-30MHz	#1
§ 15.209 (a) (f)	Radiated Emission 30MHz-1GHz	#1
§ 15.215 (a) (b) (c)	Additional provisions to the general radiated emission limitations	#1
§ 15.215 (c)	20 dB Bandwidth	#1
(§ 47CFR 1.1307(b)(1))	RF humane exposure	#1

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

$$\text{Field Strength (dB}\mu\text{V/m)} = \text{RAW} - \text{AMP} + \text{CBL} + \text{ACF}$$

Where: RAW = Measured level before correction (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu\text{V/m} = 10^{\frac{\text{dB}\mu\text{V/m}}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

$$25 \text{ dBuV/m} + 17.5 \text{ dB} - 20 \text{ dB} + 1.0 \text{ dB} = 23.5 \text{ dBuV/m}$$

11. Test Conditions and Results

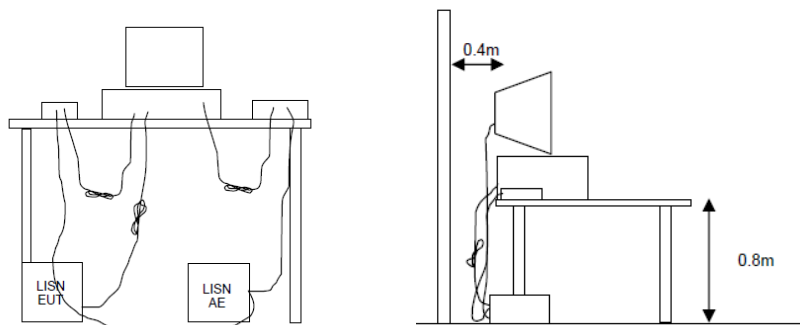
11.1 TEST: Antenna requirements		PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C
	Relative Humidity (%)	30 to 60 %
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	21°C
	Relative Humidity (%)	56%
	Air pressure (hPa)	1020
—	Power Supply / Frequency	Application Point
Fully configured sample tested at the power line frequency	120V ~ 60Hz	Enclosure
Equipment mode:	Operation mode	#1
FCC Standard	§15.203	
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.		
Antenna specifications		
N° of authorized antenna types	1	
Antenna type	Coil L=290uH±5% (10KHz/0.1V) DCR : 4.8Ω±20%	
Maximum total gain	<6dBi	
External power amplifiers	Not present	

11.2 TEST: AC Power Conducted Emission			PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	21°C	
	Relative Humidity (%)	56%	
	Air pressure (hPa)	1020	
—	Power Supply / Frequency	Application Point	
Fully configured sample tested at the power line frequency	120V ~ 60Hz	AC Mains	
Equipment mode:	Operation mode	#1	
FCC Standard	§15.207		
Frequency (MHz)	Quasi-peak (dBuV)	Average (dBuV)	Result
0.15-0.5	66 to 56	56 to 46	PASS
0.5-5	56	46	PASS
5-30	60	50	PASS

Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

Further information to test setup

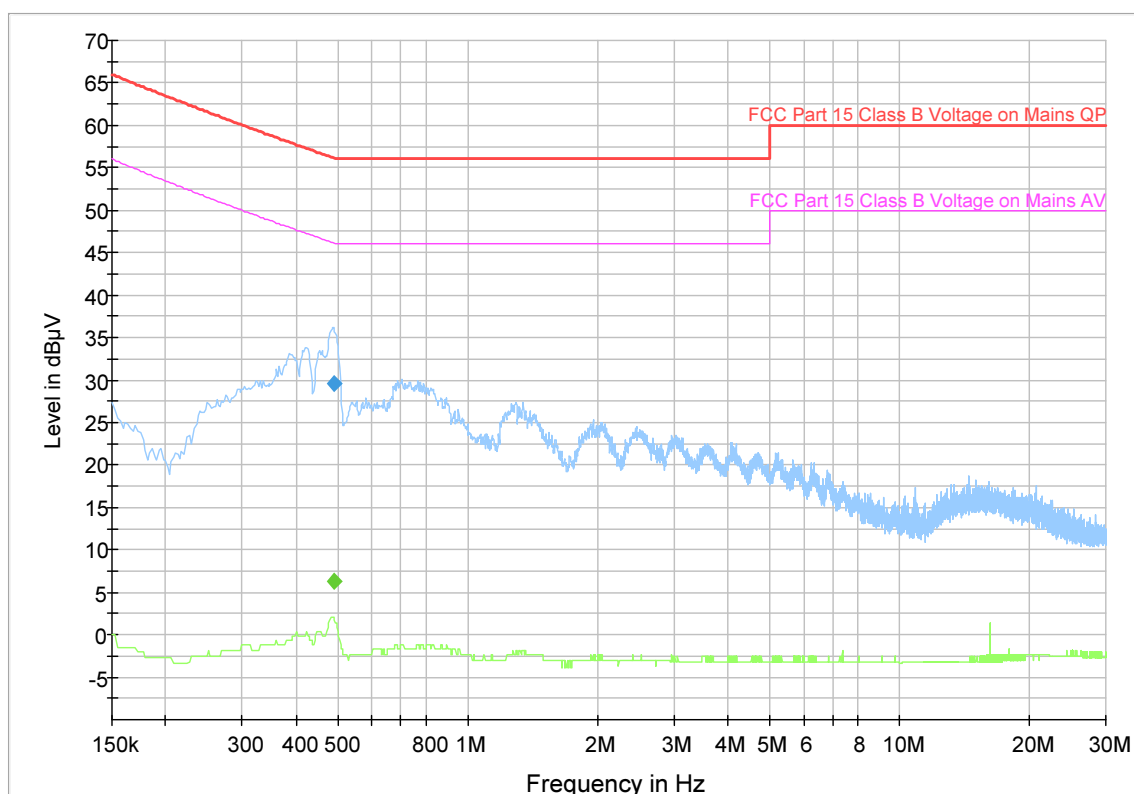


Test Equipment Used					
Description	Manufacturer	Model	TUV Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESR	87020864	12/2018	12/2019
Two line V-Network	R&S	ENV216	87020993	01/2018	01/2020
Stabilized Power Supply	Elettrotest	TPS T 30K60S	87020490	09/2018	09/2021

Graphical representation of Mains Terminal Disturbance Voltage Measurement

Operation Mode: #1

Full Spectrum



Final Measurement - Table representation of Mains Terminal Disturbance Voltage Measurement

Operation Mode: #1

Test Results

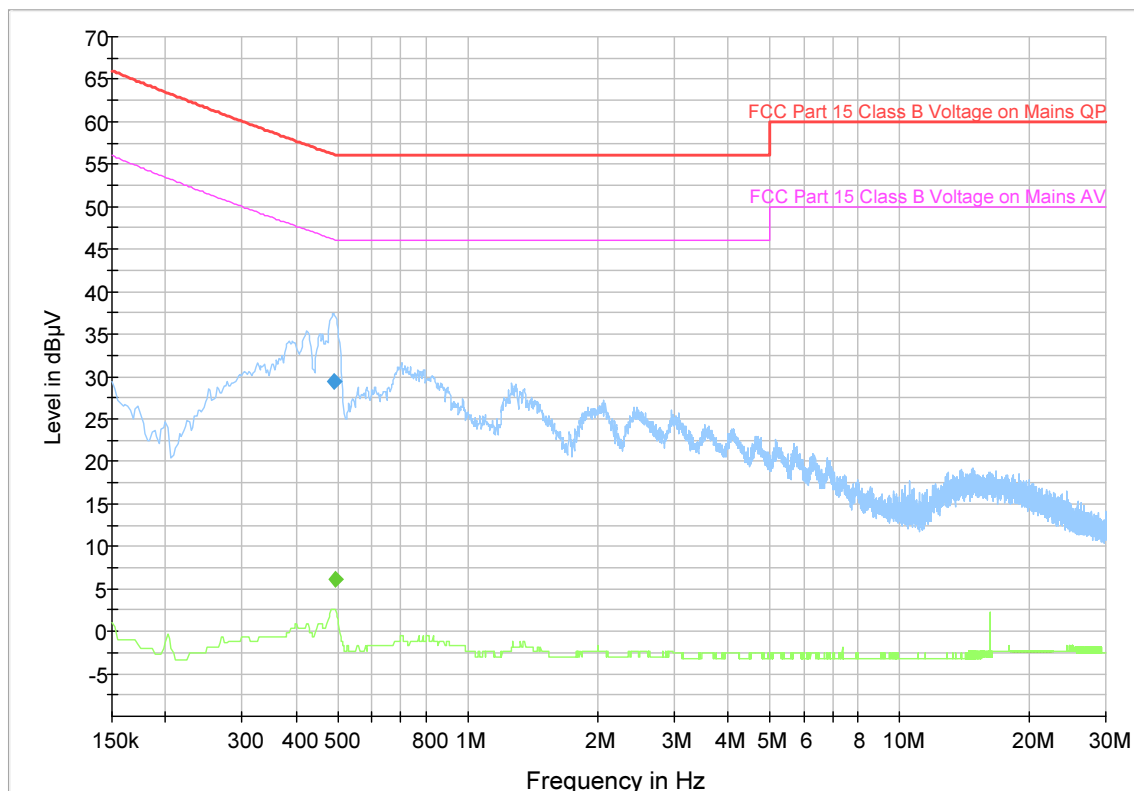
Tested Port	Line	Frequency (MHz)	Quasi-Peak			Average Value			Factor total Line P (dB)
			Value (dBμV)	Limit (dBμV)	Margin (dB)	Value (dBμV)	Limit (dBμV)	Margin (dB)	
AC Mains	P	0,489	29,58	56,16	28,58	-----	-----	-----	9,90

Note: Factor total = Lisen factor + Cable factor

Graphical representation of Mains Terminal Disturbance Voltage Measurement

Operation Mode: #1

Full Spectrum



Final Measurement - Table representation of Mains Terminal Disturbance Voltage Measurement

Operation Mode: #1

Test Results

Tested Port	Line	Frequency (MHz)	Quasi-Peak			Average Value			Factor total Line P (dB)
			Value (dBμV)	Limit (dBμV)	Margin (dB)	Value (dBμV)	Limit (dBμV)	Margin (dB)	
AC Mains	N	0,489	29,41	56,16	26,75	-----	-----	-----	9,90

Note: Factor total = Liss factor + Cable factor

11.3 TEST: Radiated Emission

PASS

Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C
	Relative Humidity (%)	30 to 60 %
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	22°C
	Relative Humidity (%)	54%
	Air pressure (hPa)	1020
—	Power Supply / Frequency	Application Point
Fully configured sample tested at the power line frequency	120V ~ 60Hz	Enclosure
Equipment mode:	Operation mode	#1
FCC Standard	§15.205; §15.209;	

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table :

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.

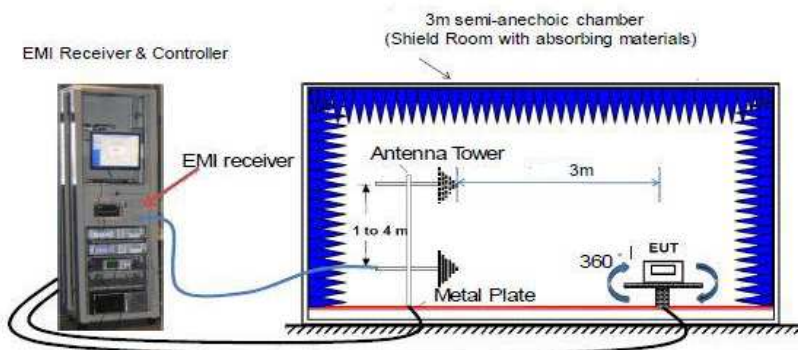
Remark: In accordance with part 15.31 (f) (2), where the measurement distance was specified to be 30 or 300 meters, a correction factor was applied in order to permit measurement to be performed at a separation distance. The applied formula for limits at 3 meter is:

Limit 3m(dBμV/m)=Limit 300m(dBμV/m)+40Log(300m/3m) (Below 30MHz)

Limit 3m(dBμV/m)=Limit 300m(dBμV/m)+40Log(30m/3m) (Below 30MHz)

Further information to test setup.

For frequencies above 1GHz, the anechoic material is also placed on the metallic floor between EUT and Antenna

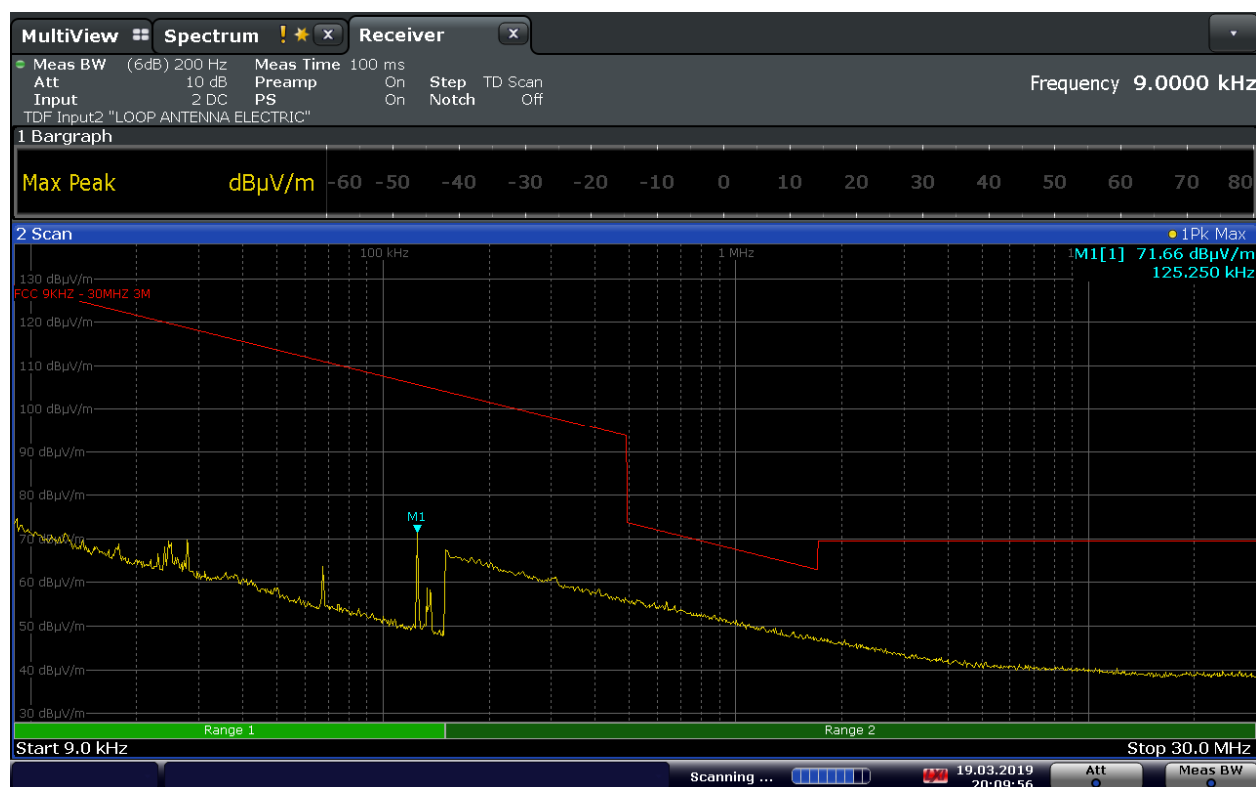


Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
CSSA	ETS Lindgren	FACT3	2926063	05/2017	05/2019
EMI Test Receiver	R&S	ESW 44	87020967	05/2018	05/2019
Loop Antenna	EMCO	6512	2782356	02/2017	02/2020
Antenna BiConiLog	ETS Lindgren	3142E	2782348	04/2017	04/2020

Graphical representation of Radiated Emission Measurement

Operation Mode: #1

Frequency: 9kHz – 30MHz



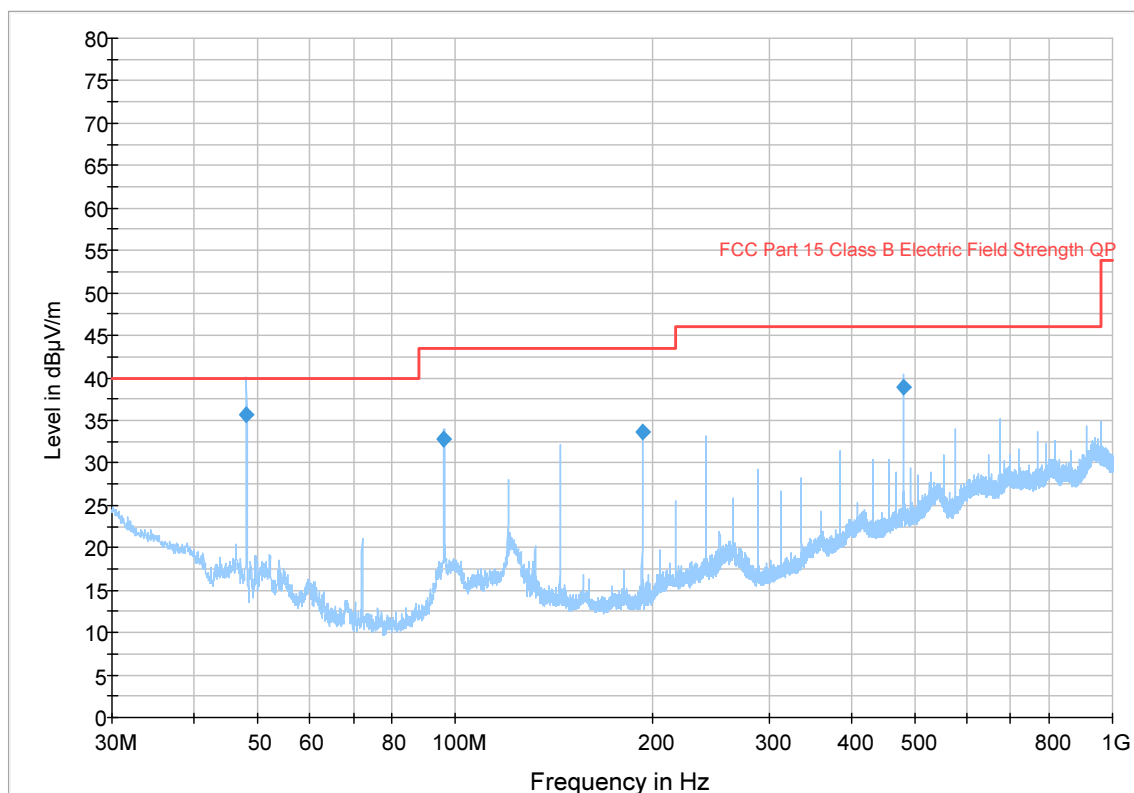
20:09:56 19.03.2019

Graphical representation of Radiated Emission Measurement

Operation Mode: #1

Frequency: 30MHz – 1GHz

Full Spectrum



Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
48.060000	35.63	40.00	4.37	1000.0	120.000	99.0	V	120.0	7.5
96.120000	32.83	43.50	10.67	1000.0	120.000	204.0	H	82.0	8.2
192.270000	33.58	43.50	9.92	1000.0	120.000	175.0	H	71.0	10.4
480.660000	38.97	46.00	7.03	1000.0	120.000	196.0	H	264.0	20.2

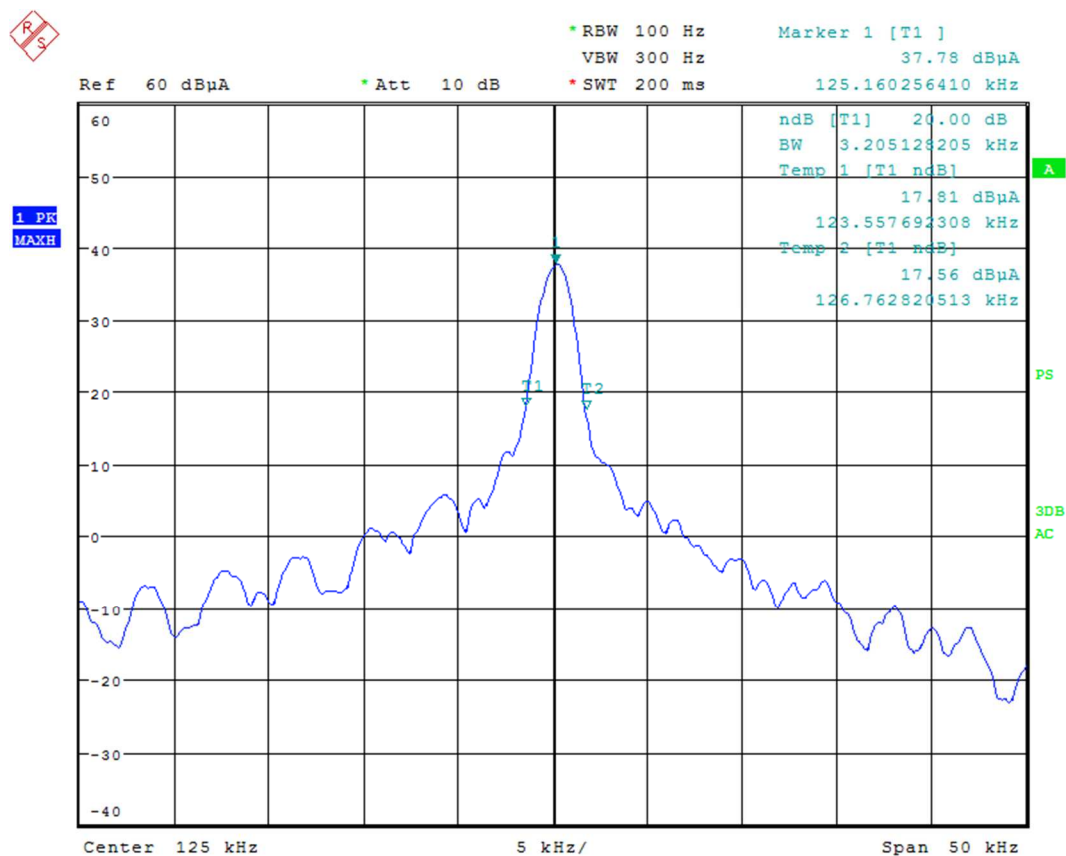
11.4 TEST: Additional provisions to the general radiated emission limitations.		PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C
	Relative Humidity (%)	30 to 60 %
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	24°C
	Relative Humidity (%)	37%
	Air pressure (hPa)	1020
—	Power Supply / Frequency	Application Point
Fully configured sample tested at the power line frequency	120V ~ 60Hz	-----
Equipment mode:	Operation mode	#1
FCC Standard	§15.215 (A) (B) (C)	
(A) The regulations in §§ 15.217-15.257 provide alternatives to the general radiated emission limits for intentional radiators operating in specified frequency bands. Unless otherwise stated, there are no restrictions as to the types of operation permitted under these sections.		
(B) In most cases, unwanted emissions outside of the frequency bands shown in these alternative provisions must be attenuated to the emission limits shown in Section 15.209. In no case shall the level of the unwanted emissions from an intentional radiator operating under these additional provisions exceed the field strength of the fundamental emission.		VERDICT
		PASS
(C) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least		VERDICT
		PASS

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU 40	2782345	05/2018	05/2019

Test Results

EUT Operating Mode(s) Operating mode #1, 120Vac, 60Hz

Fundamental frequency 20dB bandwidth



Bandwidth at -20dB: 3,205 kHz

11.5 TEST: RF Exposure Requirements			PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	---	
	Relative Humidity (%)	---	
	Air pressure (hPa)	1020	
—	Frequency	Application Point	
Fully configured sample tested at the power line frequency	120V ~ 60Hz	---	
Equipment mode:	Operation mode	#1	
FCC Standard	§ 1.1310 (1) (B)		
Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines § 1.1310, table (1) (b)			
EUT classification (fixed, mobile or portable devices)	Fixed equipment used in Uncontrolled Exposure environment		
Limits Freq. 125 kHz	According to 447498 D01 General RF Exposure Guidance v06 (See table below)		

Appendix C

SAR Test Exclusion Thresholds for < 100 MHz and < 200 mm

Approximate SAR test exclusion power thresholds at selected frequencies and test separation distances are illustrated in the following table. The equation and threshold in 4.3.1 must be applied to determine SAR test exclusion.

MHz	< 50	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	mm
100	237	474	481	487	494	501	507	514	521	527	534	541	547	554	561	567	mW
50	308	617	625	634	643	651	660	669	677	686	695	703	712	721	729	738	
10	474	948	961	975	988	1001	1015	1028	1041	1055	1068	1081	1095	1108	1121	1135	
1	711	1422	1442	1462	1482	1502	1522	1542	1562	1582	1602	1622	1642	1662	1682	1702	
0.1	948	1896	1923	1949	1976	2003	2029	2056	2083	2109	2136	2163	2189	2216	2243	2269	
0.05	1019	2039	2067	2096	2125	2153	2182	2211	2239	2268	2297	2325	2354	2383	2411	2440	
0.01	1185	2370	2403	2437	2470	2503	2537	2570	2603	2637	2670	2703	2737	2770	2803	2837	

Operation Mode: #1						
CH	Frequency	Radiated Output Power	Radiated Output Power EIRP*	Radiated Output Power EIRP	Min. test separation Distance (r)	Limit (mW)
	(MHz)	(dBuV/m)	(dBm)	(mW)	(mm)	
1	0,125	71,66	-23,56	0,0044	<50	941**
VERDICT						
The EUT Radiated Power density at evaluation distance is WHITIN THE LIMIT at the distance < 50mm.						
* according to formula $EIRP[dBm] = E[dB\mu V/m] + 20 \log(d[meters]) - 104.77$						
**Linear interpolation.						

12. UNCERTAINTY

Test Method	Uncertainty (95%)	Coverage factor k
RF Conducted continuous emissions - range (9 kHz – 30 MHz)	3,5 dB	2,0
RF Radiated emissions – range (1 – 3,6) GHz	5,9 dB	2,0
RF Radiated emissions – range (3,6 – 8) GHz	6,4 dB	2,0
RF Radiated emissions – range (8 – 40) GHz	7,3 dB	2,0
Loop Large Antenna – range (9 kHz – 30 MHz)	4,6 dB	2,0
Measurement of Normalised Site Attenuation and VSWR	6,0 dB	2,0



Test Report nr.

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LAB N° 1356

Report No. 28113165 001

13. ANNEX

Photographic Documentation

External photo	See Annex1
Internal photo	See Annex2
Set-up photo	See Annex3

END OF TEST REPORT