

TEST REPORT
No.: 19-1-0002901T03a

According to:
FCC Regulations
Part 15.107 & 15.109

For

PPA15 GmbH
Stollbergstr. 22
80539 München (Germany)

Cash Point Interface
sensalytics taprbox

FCC ID : 2AT5NREV-GB-U

Laboratory Accreditation and Listings	
 DAkkS Deutsche Akreditierungsstelle D-PL-12047-01-01 D-PL-12047-01-03 D-PL-12047-01-04	 FEDERAL COMMUNICATIONS COMMISSION U.S.A. MRA US-EU 0003
accredited according to DIN EN ISO/IEC 17025	
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1. Summary of test results

The test results apply exclusively to the test samples as presented in this Report. The CETECOM GmbH does not assume responsibility for any conclusions and generalizations taken in conjunction with other specimens or samples of the type of the item presented to tests. Also we refer on special conditions which the applicant should fulfill according §2.927 to §2.948, special focus regarding modification of the equipment and availability of sample equipment for market surveillance tests.

The Equipment Under Test (in this report, hereinafter referred as EUT) is a digital device. For this test report typical operating mode were tested according intended use of the equipment **excluding wireless operating modes**.

Following tests have been performed to show compliance with applicable FCC Part 15, Subpart B (Unintentional Radiators) of the CFR 47 Rules, August 2019.

1.1. TEST OVERVIEW ACCORDING FCC PART 15B

No. of Diagram group	Test Cases	Port	References, Standards & Limits			EUT set-up	EUT op-mode	Result
			FCC	IC	Limits			
1	AC Power Lines Conducted emissions 0.15 – 30 MHz	AC Power lines	§15.107	ANSI C63.4	<input type="checkbox"/> Class A <input checked="" type="checkbox"/> Class B	1	1	passed
2	Radiated emissions 9 kHz - 30 MHz)	Cabinet + Inter-connecting cables	§15.109	RSS-Gen., Issue 4 Table 5	2400/F(kHz) μV/m 24000/F(kHz) μV/m 30 μV/m	-	-	not applied
3	Radiated emissions 30 MHz-1 GHz	Cabinet + Inter-connecting cables	§15.109	ANSI C63.4	<input type="checkbox"/> Class A <input checked="" type="checkbox"/> Class B	2	1	passed
4	Radiated emissions above 1 GHz	Cabinet + Inter-connecting cables	§15.109	ANSI C63.4	<input type="checkbox"/> Class A <input checked="" type="checkbox"/> Class B	2	1	passed

Remark: -

1.2. Attestation:

I declare that all measurements were performed by me or under my supervision and that all measurements have been performed and are correct to my best knowledge. All requirements as shown in above table are met in accordance with enumerated standards.



Dipl.-Ing. Niels Jeß
Head of Compliance Testing

G. Wege
Responsible for test report

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2. Administrative Data

2.1. Identification of the testing laboratory

Company name:	CETECOM GmbH
Address:	Mündelheimer Weg 35 40472 Düsseldorf Germany
Responsible for testing laboratory:	Volker Briddigkeit
Deputy:	Dipl.-Ing. Niels Jeß

2.2. Test location

2.2.1. Test laboratory

Company name:	see chapter 2.1. Identification of the testing laboratory
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2.3. Organizational items

Responsible for test report and project leader:	Gerrit Wege
Receipt of EUT:	2019-07-02
Date(s) of test:	2019-07-02, 2019-07-03 & 2019-07-08
Date of report:	2019-08-16
Version of template:	18.08.2016

2.4. Applicant's details

Applicant's name:	PPA15 GmbH
Address:	Stollbergstr. 22, 80539 München (Germany)
Contact person:	Mr. Obernitz Yorck

2.5. Manufacturer's details

Manufacturer's name:	please see Applicant's details
Address:	please see Applicant's details

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3. Equipment under test (EUT)

3.1. EUT: Type, S/N etc. and short descriptions used in this test report

Short description*)	EUT	Type	S/N serial number	HW hardware status	SW software status
EUT A	Cash Point Interface	sensalytics taprbox	81AB-0FFA	06/2019	Pi 3 Model B+
EUT B	AC/DC Adaptor	LEIKE NT03054	-	-	-

*) EUT short description is used to simplify the identification of the EUT in this test report.

3.2. Auxiliary Equipment (AE): Type, S/N etc. and short descriptions

AE short description *)	Auxiliary Equipment	Type	S/N serial number	HW hardware status	SW software status
AE 1	Printer	EPSON	-	-	-
AE 2	LAN (PC)	Medion MD 83002	-	-	Windows® 10

*) AE short description is used to simplify the identification of the auxiliary equipment in this test report.

EUT set-up no.*)	Combination of EUT and AE	Remarks
set. 1	EUT A +EUT B + AE1 & AE2	The EUT was connected to LISN
set. 2	EUT A +EUT B + AE1 & AE2	The EUT was connected to mains

*) EUT set-up no. is used to simplify the identification of the EUT set-up in this test report.

3.3. EUT operating mode

EUT operating mode no.*)	Description of operating mode	Additional information
op. 1	Test mode operation with continuous ping command on LAN Interface and ready for print of bill	-

*) EUT operating mode no. is used to simplify the test report.

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3.4. Additional declaration and description of EUT

(Applicant's declaration, = not selected, = selected)

Set-up 1		<input checked="" type="checkbox"/> Table top <input type="checkbox"/> floor-standing <input type="checkbox"/> wall-mounted <input type="checkbox"/> not defined	typical use <input type="checkbox"/> portable use <input checked="" type="checkbox"/> fixed use <input type="checkbox"/> vehicular use	typical operating cycle of EUT. <input checked="" type="checkbox"/> > 0,5 sec. <input type="checkbox"/> :
Place of use		<input checked="" type="checkbox"/> Residential, commercial and light industry <input type="checkbox"/> Industrial environment <input type="checkbox"/> vehicular use		
Highest frequency generated or used in the device or on which the device operates or tunes		<input type="checkbox"/> below 1.705 MHz -> up to 30 MHz <input type="checkbox"/> 1.705 MHz – 108 MHz -> up to 1 GHz <input type="checkbox"/> 108 MHz -500 MHz -> up to 2 GHz <input type="checkbox"/> 500MHz 1000 MHz -> up to 5 GHz <input checked="" type="checkbox"/> 1400 MHz (Main PLL) -> 7 GHz		
Operation Mode: Test mode operation Remark: no wireless functions				
Power line: <input type="checkbox"/> DC <input checked="" type="checkbox"/> L1, <input type="checkbox"/> L2, <input type="checkbox"/> L3, <input checked="" type="checkbox"/> N 60 Hz <input type="checkbox"/> 12V, <input type="checkbox"/> 24V, <input checked="" type="checkbox"/> 120V, <input type="checkbox"/> 400V <input type="checkbox"/> 5 V		EUT-grounding: <input type="checkbox"/> none <input checked="" type="checkbox"/> with power supply in case of deviation during tests the single details are described on chapter 4) <input type="checkbox"/> additional: ground bonding strap at pipe input		
Other Ports (description of interconnecting cables) Connector		total cable length used during the test		shielding connected during test
AC cable	-	<input type="checkbox"/> > 1m <input type="checkbox"/> > 2m <input type="checkbox"/> > 3m <input checked="" type="checkbox"/> : 1.4 m	<input type="checkbox"/> screened <input checked="" type="checkbox"/> unscreened	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
LAN I/O	RJ 45	<input type="checkbox"/> > 1m <input type="checkbox"/> > 2m <input type="checkbox"/> > 3m <input checked="" type="checkbox"/> : 12.0 m	<input checked="" type="checkbox"/> screened <input type="checkbox"/> unscreened	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
USB	USB	<input type="checkbox"/> > 1m <input type="checkbox"/> > 2m <input type="checkbox"/> > 3m <input checked="" type="checkbox"/> : 6.0m	<input checked="" type="checkbox"/> screened <input type="checkbox"/> unscreened	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
microUSB	microUSB	<input checked="" type="checkbox"/> > 1m <input type="checkbox"/> > 2m <input type="checkbox"/> > 3m <input type="checkbox"/> : 0.2m	<input checked="" type="checkbox"/> screened <input type="checkbox"/> unscreened	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
Does EUT contain devices susceptible to magnetic fields, e.g. Hall elements, electrodynamics microphones, etc.?				<input type="checkbox"/> yes <input checked="" type="checkbox"/> no
Is mounting position / usual operating position defined?				<input type="checkbox"/> yes <input checked="" type="checkbox"/> no

3.5. Configuration of cables used for testing

Cable number	Item	Type	S/N serial number	HW hardware status	Cable length
1	DC IN	from AC/DC adaptor	-	-	1.4 m
2	LAN	CAT VI to external PC	-	-	12 m
3	USB	USB Type A to Printer	-	-	6 m
4	microUSB	microUSB floating	-	-	1 m

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4. Description of test system set-up's
4.1. Test system set-up for AC power-line conducted emission measurements

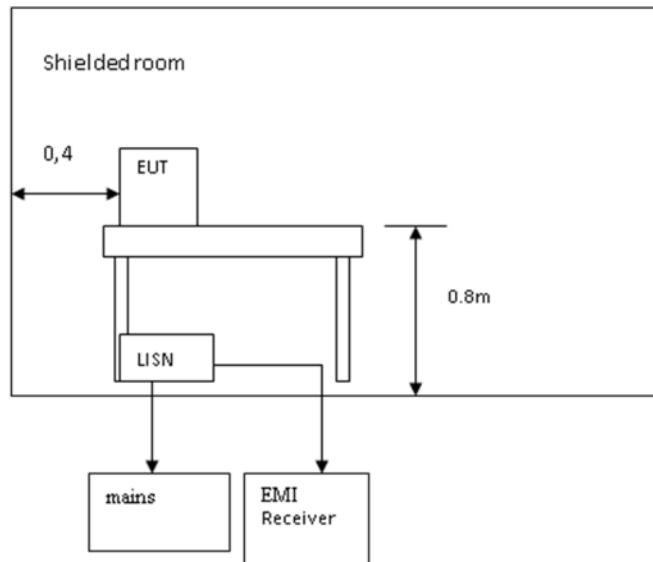
Specification: ANSI C63.4-2014 chapter 7

General Description: The radio frequency voltage conducted back into the AC power line in the frequency range 150 kHz to 30 MHz has to be investigated. Compliance should be tested by measuring the radio frequency voltage between each power line and ground at the power terminals in the stated frequency range.

A 50 Ohm / 50 μ H line impedance stabilization network (LISN) is used coupling the interface to the measurement equipment. The EUT power input leads are connected through the LISN to the AC-power source. The LISN enclosure is electrically connected to the ground plane. The measuring instrument is connected to the coaxial output of the LISN.

Tabletop devices were set-up on a 80 cm height above reference ground plane, floor standing equipment 10 cm raised above ground plane. Measurements have been performed on each phase line and neutral line of the devices AC-power lines. The EUT was power supplied with 120 V/60 Hz. The EUT was tested in the defined operating mode and installed (connected) to accessory equipment according the general description of use given by the applicant.

Schematic:



Testing method:

Exploratory, preliminary measurements as a first step, determines the worst-case phase line (neutral or phase) as well as the most critical operating mode of the equipment. A complete frequency-sweep with PK-Detector is performed on each current-carrying conductor.

Final testing for power phases and critical frequencies (Margin to AV- or QP limit lower than 3 dB) as a second step includes measurements with receivers detector set to Quasi-Peak and Average.

Formula:

$$V_C = V_R + C_L \quad (1)$$

$$M = L_T - V_C \quad (2)$$

V_C = measured Voltage -corrected value

V_R = Receiver reading

C_L = Cable loss

M = Margin

L_T = Limit

Values are in dB, positive margin means value is below limit.

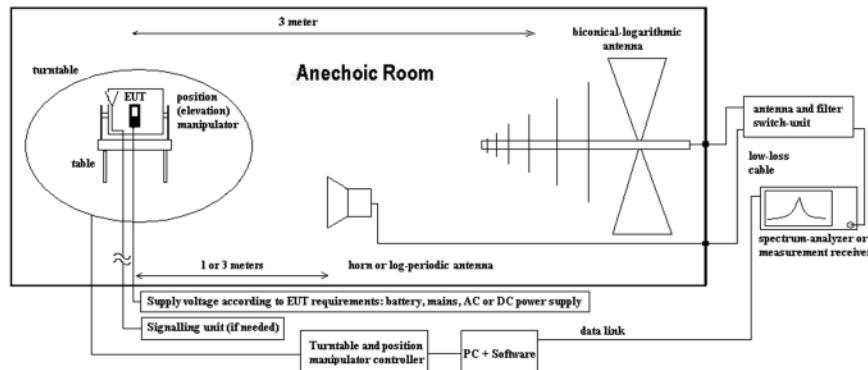
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4.2. Test system set-up for radiated electric field measurement 30 MHz to 1 GHz

Specification: ANSI C63.4-2014 chapter 8.2.3

General Description: Evaluating the field emissions have to be done first by an exploratory emissions measurement and a final measurement for most critical frequencies. The tests are performed in a NSA-compliant semi anechoic chamber (SAC) recognized by the regulatory commissions.

Schematic:



Testing method:

Exploratory, preliminary measurements

The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 0.8 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 90°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT) the emission spectrum and its characteristics were recorded with an EMI-receiver, broadband antenna and software.

Measurement antenna: horizontal and vertical, heights: 1.0 m and 1.82 m as worst-case determined by an exploratory emission measurements. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies

Based on the exploratory measurements, the most critical frequencies are re-measured by maintaining the EUT's worst-case operation mode, cable position, etc. either on 10m OATS or 3m semi-anechoic chamber.

First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined.

Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself either over 3-orthogonal axis (not defined usage position) or 2-orthogonal axis (defined usage position). The measurement antenna height between 1 m and 4 m.

On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out.

Formula:

$$E_C = E_R + AF + C_L + D_F - G_A \quad (1)$$

$$M = L_T - E_C \quad (2)$$

AF = Antenna factor

C_L = Cable loss

D_F = Distance correction factor (if used)

E_C = Electrical field – corrected value

E_R = Receiver reading

G_A = Gain of pre-amplifier (if used)

L_T = Limit

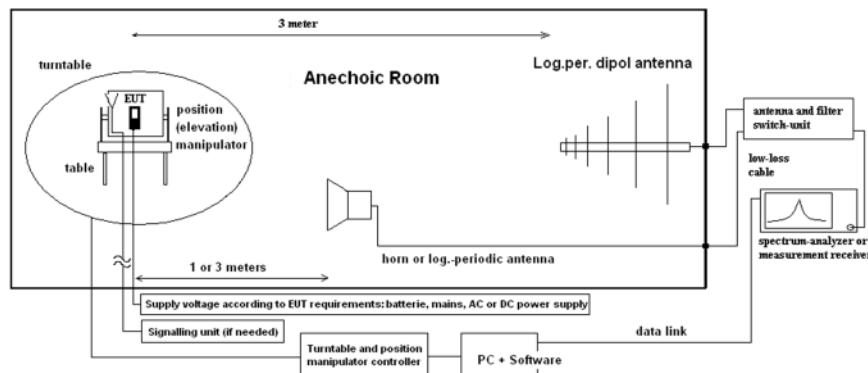
M = Margin

All units are dB-units, positive margin means value is below limit.

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4.3. Test system set-up for radiated electric field measurement above 1 GHz

Specification: ANSI C63.4-2014 chapter 8.3

General Description: Evaluating the emissions have to be done first by an exploratory emissions measurement and a final measurement for most critical frequencies. The tests are performed in a CISPR 16-1-4:2010 compliant fully anechoic room (FAR) recognized by the regulatory commission. The measurement distance was set to 3 meter for frequencies up to 18 GHz and 2 meter above 18 GHz. Horn antennas are used for frequency range 1 GHz to 40 GHz. The EUT is aligned within 3 dB beam width of the measurement antenna with three orthogonal axis measurements on the EUT.

Schematic:

Testing method:
Exploratory, preliminary measurements

The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 1.55 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 15°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT) the emission spectrum and its characteristics was recorded with an EMI-receiver, broadband antenna and software.

The measurements are performed in horizontal and vertical polarization of the measurement antennas. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies

Based on the exploratory measurements, the most critical frequencies are re-measured by main-taining the EUT's worst-case operation mode, cable position, etc.

First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined.

Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself over 3-orthogonal axis and the height for EUT with large dimensions.

On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out.

On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out.

Formula:

$$E_C = E_R + AF + C_L + D_F - G_A \quad (1)$$

$$M = L_T - E_C \quad (2)$$

E_C = Electrical field – corrected value

E_R = Receiver reading

M = Margin

L_T = Limit

AF = Antenna factor

C_L = Cable loss

D_F = Distance correction factor (if used)

G_A = Gain of pre-amplifier (if used)

All units are dB-units, positive margin means value is below limit.

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5. Measurements

5.1. General Limit - Conducted emissions on AC-Power lines

5.1.1. Test location and equipment

test location	<input checked="" type="checkbox"/> CETECOM Duesseldorf (Chapter 2.2.1)		<input type="checkbox"/> Please see Chapter 2.2.2	
test site	<input type="checkbox"/> 25911 EMI field < 1GHz; SAC5	<input type="checkbox"/> 25912 EMI field > 1GHz; SAC5	<input checked="" type="checkbox"/> 25341 Shielded room laboratory 1	
Receiver	<input type="checkbox"/> 25311 ESU 40	<input checked="" type="checkbox"/> 25370 ESR 7	<input type="checkbox"/> 25235 ESCS 30	
Antenna	<input type="checkbox"/> 25038 HFH2-Z2	<input type="checkbox"/> 25357 HL562E	<input type="checkbox"/> 25364 HF907	
LISN	<input checked="" type="checkbox"/> 25021 ESH2-Z5	<input type="checkbox"/> 25156 ESH3-Z6	<input type="checkbox"/> 25263 ESH3-Z6	
signalling	<input type="checkbox"/> 25xxx CMU 200	<input type="checkbox"/> 25xxx CMU 200	<input type="checkbox"/> 594 CMW500	<input type="checkbox"/> not used
DC voltage	<input type="checkbox"/> 25036 HP 6267 B	<input type="checkbox"/>	<input type="checkbox"/> 25289 5V via TDK-Lambda Americas Inc.	
AC voltage	<input type="checkbox"/> 230 V 50 Hz via public mains		<input checked="" type="checkbox"/> 25316 120 V 60 Hz via EM Test DPA 503N	

5.1.2. Requirements

FCC	Part 15, Subpart B, §15.107			
ANSI	C63.4-2014, § 5.2, 6, 7			
Limit	Frequency [MHz]	<input checked="" type="checkbox"/> Conducted limit Class B		<input type="checkbox"/> Conducted limit Class A
		QUASI-Peak [dB μ V]	AVERAGE [dB μ V]	QUASI-Peak [dB μ V]
	0.15 – 0.5	66 to 56*	56 to 46*	79 66
	0.5 – 5	56	46	73 60
5 – 30				
Remark: * decreases with the logarithm of the frequency				

5.1.3. Test condition and test set-up

Signal link to test system (if used):	<input type="checkbox"/> air link	<input type="checkbox"/> cable connection	<input type="checkbox"/> none
EUT-grounding	<input type="checkbox"/> none	<input checked="" type="checkbox"/> with power supply	<input type="checkbox"/> additional connection
Equipment set up	<input checked="" type="checkbox"/> table top (40 cm distance to reference ground plane (wall))	<input type="checkbox"/> floor standing	EUT stands isolated on reference ground plane (floor)
Climatic conditions	Temperature: 25.3°C	Rel. humidity: 30%	
EMI-Receiver or Analyzer settings	Scan data	<input type="checkbox"/> 9 – 150 kHz, RBW = 200 Hz, Step = 61 Hz <input checked="" type="checkbox"/> 150 kHz – 30 MHz RBW = 9 kHz, Step = 4 kHz <input type="checkbox"/> other:	
	Scan-Mode Pre-measurement Final measurement	10 dB EMI-Receiver Mode Peak detector, Repetitive-Scan, max-hold, sweep-time 10 ms per frequency point Average & Quasi-peak detector at critical frequencies	
General measurement procedures	Please see chapter "Test system set-up for AC power line conducted emissions measurements"		

5.1.4. Measurement results

The results are presented below in summary form only. For more information please see the diagrams

EUT set-up no.:		set-up 1		
Diagram- No.	EUT operating mode no. or command	Used Detector	Power line	Additional (scan-) information or remarks
1.01	1	<input checked="" type="checkbox"/> Peak (pre-scan) <input checked="" type="checkbox"/> AV (final) <input checked="" type="checkbox"/> QP (final)	L / N	-

5.2. General Limit - Radiated field strength emissions, 30 MHz - 1 GHz

5.2.1. Test location and equipment

test location	<input checked="" type="checkbox"/> CETECOM Duesseldorf (Chapter 2.2.1)		<input type="checkbox"/> Please see Chapter 2.2.2	
test site	<input checked="" type="checkbox"/> 25414	EMI field < 1GHz; SAC3	<input type="checkbox"/> 25912	EMI field > 1GHz; SAC5
Receiver	<input checked="" type="checkbox"/> 25311	ESU 40	<input type="checkbox"/> 25348	ESR 7
Antenna	<input type="checkbox"/> 25357	HL562E	<input checked="" type="checkbox"/> 25357	HL562E
LISN	<input type="checkbox"/> 25261	ESH2-Z5	<input type="checkbox"/> 25156	ESH3-Z6
signalling	<input type="checkbox"/> 20547	CMU 200	<input type="checkbox"/> 25xxx	CMU 200
DC voltage	<input type="checkbox"/> 25036	HP 6267 B	<input type="checkbox"/> Battery powered (4 V)	<input type="checkbox"/> 25289 5V via TDK-Lambda UP60-3.5
AC voltage	<input type="checkbox"/> 230 V 50 Hz via public mains		<input checked="" type="checkbox"/> 25316	120 V 60 Hz via EM Test DPA 503N

5.2.2. Requirements/Limits

FCC		<input checked="" type="checkbox"/> Part 15 Subpart B, §15.109, class B <input type="checkbox"/> Part 15 Subpart C, §15.209 @ frequencies defined in §15.205	
ANSI		<input checked="" type="checkbox"/> C63.4-2014 <input type="checkbox"/> C63.10-2013	
Limit	Frequency [MHz]		Radiated emissions limits, 3 meters
			QUASI Peak [μ V/m] QUASI-Peak [dB μ V/m]
30 - 88		100	40.0
88 - 216		150	43.5
216 - 960		200	46.0
above 960		500	49.0

5.2.3. Test condition and measurement test set-up

Signal link to test system (if used):	<input type="checkbox"/> air link	<input type="checkbox"/> cable connection	<input type="checkbox"/> none
EUT-grounding	<input type="checkbox"/> none	<input checked="" type="checkbox"/> with power supply	<input type="checkbox"/> additional connection
Equipment set up	<input checked="" type="checkbox"/> table top 0.8 m height		<input type="checkbox"/> floor standing
Climatic conditions	Temperature: 27.0°C		Rel. humidity: 35%
EMI-Receiver (Analyzer) Settings	<input checked="" type="checkbox"/> 30 - 1000 MHz <input type="checkbox"/> other: <input checked="" type="checkbox"/> 6 dB EMI-Receiver Mode <input type="checkbox"/> 3 dB spectrum analyser mode Scan-mode Detector RBW/VBW Mode: Scan step Sweep-Time		
General measurement procedures	Peak / Quasi-peak 120 kHz Repetitive-Scan, max-hold 40 kHz 10 ms		
Please see chapter "Test system set-up for electric field measurement in the range 30 MHz to 1 GHz"			

5.2.4. MEASUREMENT RESULTS

The results are presented below in summary form only. For more information please see diagrams included in annex 1.

Table of measurement results:

Dia-gram no.	Frequency range	Set-up no.	OP-mode no.	Remark	Used detector			Result
					PK	AV	QP	
2.01	30 MHz – 1 GHz	2	1	-	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	passed

Remark: see diagrams in annex 1 for more details

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5.3. General Limit - Radiated emissions, above 1 GHz

5.3.1. Test location and equipment absorber modified SAR

test location	<input checked="" type="checkbox"/> CETECOM Duesseldorf (Chapter 2.2.1)			<input type="checkbox"/> Please see Chapter 2.2.2	
test site	<input type="checkbox"/> 25358 EMI field < 1GHz; SAC5	<input checked="" type="checkbox"/> 25358 EMI field > 1GHz; SAC5	<input type="checkbox"/> 25901 EMI conducted		
Receiver	<input type="checkbox"/> 25311 ESU 40	<input checked="" type="checkbox"/> 25348 ESR 7	<input type="checkbox"/>		
Antenna	<input type="checkbox"/> 25038 HFH2-Z2	<input type="checkbox"/> 25357 HL562E	<input checked="" type="checkbox"/> 25364 HF907		
LISN	<input type="checkbox"/> 25261 ESH2-Z5	<input type="checkbox"/> 25156 ESH3-Z6	<input type="checkbox"/> 25263 ESH3-Z6		
signalling	<input type="checkbox"/> 20547 CMU 200	<input type="checkbox"/> 25xxx CMU 200	<input type="checkbox"/> 20594 CMW500	<input type="checkbox"/> not used	
DC voltage	<input type="checkbox"/> 25036 HP 6267 B	<input type="checkbox"/>	<input type="checkbox"/>		
AC voltage	<input type="checkbox"/> 230 V 50 Hz via public mains			<input checked="" type="checkbox"/> 25316 120 V 60 Hz via EM Test DPA 503N	

5.3.2. Requirements/Limits (CLASS B equipment)

FCC	<input checked="" type="checkbox"/> Part 15 Subpart B, §15.109 class B			
IC	<input type="checkbox"/> RSS-Gen., Issue 4, Chapter 8.9, Table 4+6 (transmitter licence exempt) <input type="checkbox"/> RSS-Gen., Issue 4, Chapter 8.9, Table 2 (receiver) <input type="checkbox"/> ICES-003, Issue 6, Chapter 6.2.2, Table 7 (class B)			
ANSI	<input checked="" type="checkbox"/> C63.4-2014 <input type="checkbox"/> C63.10-2013			
Limits				
Frequency [MHz]	AV [$\mu\text{V/m}$]	AV [$\text{dB}\mu\text{V/m}$]	Peak [$\mu\text{V/m}$]	Peak [$\text{dB}\mu\text{V/m}$] or [dBm/MHz]
above 1 GHz for frequencies as defined in §15.205	500	54.0	5000	74.0 $\text{dB}\mu\text{V/m}$

5.3.3. Test condition and measurement test set-up

Signal link to test system (if used):	<input type="checkbox"/> air link	<input checked="" type="checkbox"/> cable connection	<input checked="" type="checkbox"/> none
EUT-grounding	<input checked="" type="checkbox"/> none	<input type="checkbox"/> with power supply	<input type="checkbox"/> additional connection
Equipment set up	<input checked="" type="checkbox"/> table top 1.5 m height	<input type="checkbox"/> floor standing	
Climatic conditions	Temperature: (25.1 \pm 3°C) Rel. humidity: (33 \pm 20)%		
EMI-Receiver (Analyzer) Settings	Scan frequency range: <input checked="" type="checkbox"/> 1 – 6 GHz <input checked="" type="checkbox"/> other: 6 – 7 GHz Scan-Mode <input type="checkbox"/> 6 dB EMI-Receiver Mode <input checked="" type="checkbox"/> 3 dB spectrum analyser mode Detector Peak / Average RBW/VBW 1 MHz Mode: Repetitive-Scan, max-hold Scan step 400 kHz Sweep-Time 10 ms		
General measurement procedures	Please see chapter "Test system set-up for radiated electric field measurements above 1 GHz"		

5.3.4. Measurement Results

The results are presented below in summary form only. For more information please consult the diagrams included in annex 1.

Dia-gram no.	Carrier Channel		Frequency range	Set-up no.	OP-mode no.	Remark	Used detector			Result
	Range	No.					PK	AV	QP	
3.01	nominal	--	1- 6 GHz	2	1		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed
4.01	nominal	--	6- 7 GHz	2	1		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	passed

Remark: see diagrams in annex 1 for more details

5.4. Measurement uncertainties

The reported uncertainties are calculated based on the standard uncertainty multiplied with the appropriate coverage factor k , such that a confidence level of approximately 95% is achieved.

For uncertainty determination, each component used in the concrete measurement set-up was taken in account and its contribution to the overall uncertainty according its statistical distribution calculated.

Following table shows expectable uncertainties for each measurement type performed.

RF-Measurement	Reference	Frequency range	Calculated uncertainty based on a confidence level of 95%	Remarks
Conducted emissions (U _{CISPR})	CISPR 16-2-1	9 kHz - 150 kHz 150 kHz - 30 MHz	4.0 dB 3.6 dB	-
Radiated emissions Enclosure	CISPR 16-2-3	30 MHz - 1 GHz 1 GHz - 18 GHz	4.2 dB 5.1 dB	E-Field
Disturbance power	CISPR 16-2-2	30 MHz - 300 MHz	-	-
Radiated emissions Enclosure	-	150 kHz - 30 MHz 30 MHz - 1 GHz 1 GHz - 20 GHz	5.0 dB 4.2 dB 3.17 dB	Magnetic field E-field Substitution

Table: measurement uncertainties, valid for conducted/radiated measurements

Test Report No.: 19-1-0002901T03a

6. Abbreviations used in this report

The abbreviations	
ANSI	American National Standards Institute
AV , AVG, CAV	Average detector
EIRP	Equivalent isotropically radiated power, determined within a separate measurement
EGPRS	Enhanced General Packet Radio Service
EUT	Equipment Under Test
FCC	Federal Communications Commission, USA
IC	Industry Canada
n.a.	not applicable
Op-Mode	Operating mode of the equipment
PK	Peak
RBW	resolution bandwidth
RF	Radio frequency
RSS	Radio Standards Specification, Documents from Industry Canada
Rx	Receiver
TCH	Traffic channel
Tx	Transmitter
QP	Quasi peak detector
VBW	Video bandwidth
ERP	Effective radiated power

7. Accreditation details of CETECOM's laboratories and test sites

Ref.-No.	Accreditation Certificate	Valid for laboratory area or test site	Accreditation Body
-	D-PL-12047-01-01	All laboratories and test sites of CETECOM GmbH, Essen	DAkkS, Deutsche Akkreditierungsstelle GmbH
337 487 558 348 348	MRA US-EU 0003	Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS) Radiated Measurements 30 MHz to 1 GHz, 3 m (SAC) Radiated Measurements above 1 GHz, 3 m (FAR) Mains Ports Conducted Interference Measurements Telecommunication Ports Conducted Interference Measurement.	FCC, Federal Communications Commission Laboratory Division, USA
337 487 550 558	3462D-1 3462D-2 3462D-2 3462D-3	Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS) Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR) Radiated Measurements above 1 GHz, 3 m (FAR)	IC, Industry Canada Certification and Engineering Bureau
487 550 348 348	R-2666 G-301 C-2914 T-1967	Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR) Mains Ports Conducted Interference Measurements Telecommunication Ports Conducted Interference Measurements.	VCCI, Voluntary Control Council for Interference by Information Technology Equipment, Japan

OATS = Open Area Test Site, SAC = Semi Anechoic Chamber, FAR = Fully Anechoic Room

Test Report No.: 19-1-0002901T03a**8. Instruments and Ancillary****8.1. Used equipment**

The "Ref.-No" in the left column of the following tables allows the clear identification of the laboratory equipment.

8.1.1. Test software and firmware of equipment

Ref-No.	Equipment	Type	Serial-No.	Version of Firmware or Software during the test
358	Semi Anechoic Chamber	Albatross	No. 5	- -
348	EMI Test Receiver	ESR 7	825132/017	Firm.= 1.21 , OTP=2.0, GRA=2.0
235	EMI Test Receiver	ESCS 30	100160	Firm.= 2.30 , OTP= 02.01, GRA= 02.36
311	EMI Test Receiver	ESU40	1000-30	Firmware=4.43 SP3, Bios=V5.1-16-3, Spec. =01.00
357	Ultra-Broadband Antenna	HL562E	100824	- -
403	Ultra-Broadband Antenna	HL562E	101021	-
364	Double Rigid Horn Antenna	HF907	102488	- -
352	Continuous switch Unit	OSP	100123	Firmware=06.06
000	EMI Test Software	EMC 32	-	EMC 32 Version 9.26
021	Line Impedance Stabilization Network [1]	ESH2-Z5	872460/004	CISPR 16 compliant
261	Line Impedance Stabilization Network [2]	ESH2-Z5	871777/041	CISPR 16 compliant
316	Multifunction AC/DC power Source	Netwave 20	V1227113059	Firmware= 5.03.03
360	Antenna Tower	BAM 4.5-P	091/17791115	- -
361	Controller TT & Tower	NCD	202/17791115	Firmware= 0.4.03
363	Turn Table	TT 4.0-4t	553/17791115	- -
362	Measurement table	PTT 1.5 x1x0.8	127	- -

8.1.2. Single instruments and test systems

Ref-No.	Equipment	Type	Serial-No.	Manufacturer	Interval of calibration	Remark	Cal due
358	Semi Anechoic Chamber	SAC	No. 5	Albatross	10 Y	-	12 / 2019
348	EMI Test Receiver	ESR 7	825132/017	Rohde & Schwarz	24 M	-	04 / 2019
370	EMI Test Receiver	ESR 7	101715	Rohde & Schwarz	24 M	-	06 / 2020
311	EMI Test Receiver	ESU40	1000-30	Rohde & Schwarz	24 M	-	05 / 2019
357	Ultra-Broadband Antenna	HL562E	100824	Rohde & Schwarz	24 M	-	09 / 2020
403	Ultra-Broadband Antenna	HL562E	101021	Rohde & Schwarz	36 M	-	06 / 2021
364	Double Rigid Horn Antenna	HF907	102488	Rohde & Schwarz	36 M	-	06 / 2019
352	Continuous switch Unit	OSP	100123	Rohde & Schwarz	--	-	--
000	EMI Test Software	EMC 32	-	Rohde & Schwarz	--	-	--
021	Line Impedance Stabilization Network [1]	ESH2-Z5	872460/004	Rohde & Schwarz	24 M	1a	--
261	Line Impedance Stabilization Network [2]	ESH2-Z5	871777/041	Rohde & Schwarz	24 M	3	07 / 2020
316	Multifunction AC/DC power Source	Netwave 20	V1227113059	EM-Test	36 M	1g	06 / 2021
360	Antenna Tower	BAM 4.5-P	872460/004	Maturo	--	-	--
361	Controller TT & Tower	NCD	871777/041	Maturo	--	-	--
363	Turn Table	TT 4.0-4t	V1227113059	Maturo	--	-	--
362	Measurement table	PTT 1.5 x1x0.8	127	Maturo	--	-	--

8.1.3. Legend

Interval of calibration	12 M	12 month
	24 M	24 month
	36 M	36 month
	24/12 M	Calibration every 24 months, between this every 12 months internal validation
	36/12 M	Calibration every 36 months, between this every 12 months internal validation
	Pre-m	Check before starting the measurement
	-	Without calibration

9. Versions of test reports (change history)

Version	Applied changes	Date of release
Initial release	---	2019-08-16

Annex 1: DIAGRAMS OF TESTING to
TEST REPORT
No.: 19-1-0002901T03a

According to:
FCC Regulations
Part 15.107 & Part 15.109

for

PPA15 GmbH
Stollbergstr. 22
80539 München (Germany)

Cash Point Interface
sensalytics taprbox

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4. RADIATED EMISSIONS IN THE FREQUENCY RANGE 1 TO 6 GHZ.....	6
5. RADIATED EMISSIONS IN THE FREQUENCY RANGE 6 TO 7 GHZ.....	7

1. Measurement diagrams

2. Mains conducted emission in the frequency range 0.15 to 30 MHz

Report 19-1-0002901T03, CETECOM GmbH

Page 1

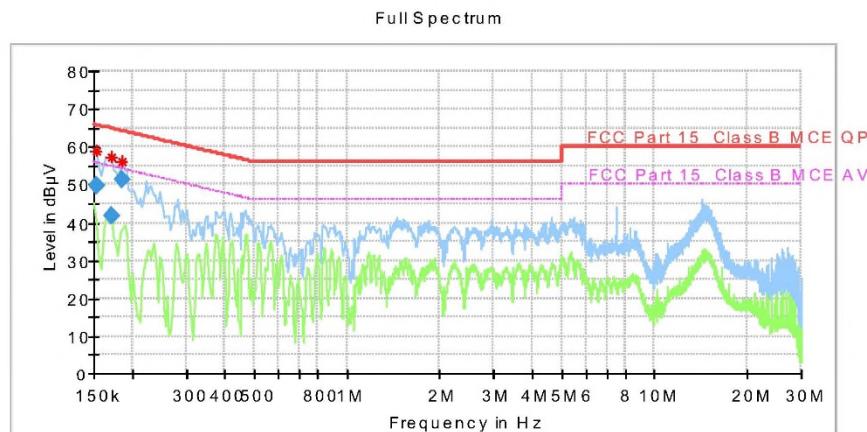
1.01_FCC_Conducted Emission 0.15 – 30 MHz

Date: 02.07.2019 Page 1 of 1
Mains conducted emission
Test description: Shielded Room No. 1
Test site and distance:

Test location: CETECOM GmbH Düsseldorf
Version of Test software: EMC32 V10.40.0
Test specification: FCC15.107, class B; RSS-Gen.: Issue 4
Technical Data: Please see page 2 for detailed data of measurement setup
Used filter: LISN
Operating Mode: ready to print and continuous ping command over LAN connection
Environmental conditions: Humidity: 39%RH; Temperature: 26.9°C
Operator: ACh
Test Voltage & frequency: AC 120 V / 60 Hz
Verdict: passed

EUT Information

EUT Name: Tapbox
Manufacturer: PPA 15
Serial Number: 81AB-0FFA
Hardware Rev: 6/ 2019
Software Rev: Pi 3 Model B+
Comment: EUT contain FCC approved parts



Final Result

Frequency (MHz)	QuasiPeak (dB μ V)	Average (dB μ V)	Limit (dB μ V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.153000	49.76	---	65.84	16.08	1000.0	9.000	N	0.1
0.171000	41.87	---	64.91	23.04	1000.0	9.000	N	0.1
0.186000	51.33	---	64.21	12.88	1000.0	9.000	L1	0.1

No further, conspicuous frequency found – margin to limit > 10 dB (Peak & Average)

03.07.2019

3. Radiated emissions in the frequency range 30 to 1000 MHz

Report 19-1-0002901T03, CETECOM GmbH

Page 1

Diagram No. 2.01_FCC_30 MHz-1 GHz

Date: 03.07.2019 Page 1 of 2

Electric Field Strength Measurement

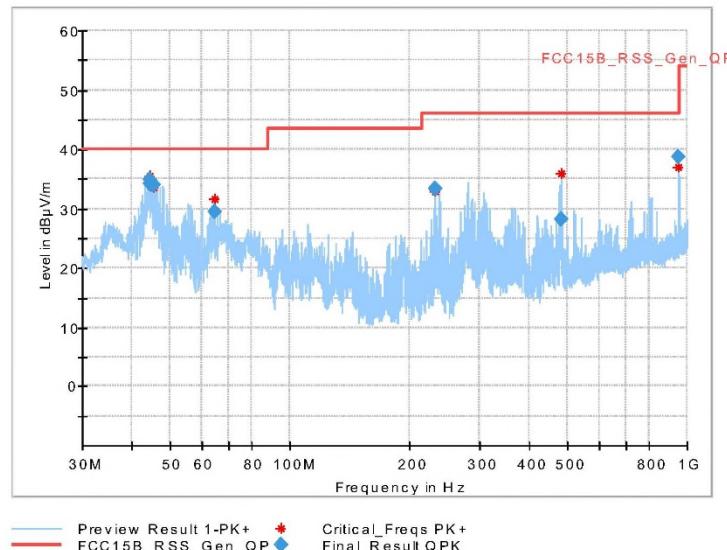
Semi Anechoic Chamber 2 (SAC5) with 3m measurement distance

Test description:	CETECOM GmbH Düsseldorf
Test site and distance:	EMC32 V10.40.0
Test location:	FCC15.109, class B; RSS-Gen.: Issue 4
Version of Test software:	not used
Test specification:	Please see page 2 for detailed data of measurement setup
Distance correction:	none
Technical Data:	
Used filter:	
Operating Mode:	ready to print and continuous ping command over LAN connection
Measured sides of EUT:	front, right, rear, left
Environmental conditions:	Humidity: 31%rH; Temperature: 27°C
Operator:	GWe
Comment 1:	

EUT Information

EUT Name:	Taprbox
Manufacturer:	PPA 15
Serial Number:	81AB-0FFA
Hardware Rev:	6/ 2019
Software Rev:	Pi 3 Model B+
Comment:	EUT contain FCC approved parts

03.07.2019

Full Spectrum

— Preview Result 1-PK+ * Critical_Freqs PK+
— FCC15B_RSS_Gen_QP ♦ Final_Result QPK

Final_Result

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
44.460000	34.78	40.00	5.22	120.000	106.0	V	280.0	11.0
44.464000	34.30	40.00	5.70	120.000	100.0	V	231.0	11.0
45.328000	33.92	40.00	6.08	120.000	106.0	V	321.0	10.4
64.776000	29.56	40.00	10.44	120.000	188.0	V	76.0	7.5
232.108000	33.47	46.00	12.53	120.000	171.0	H	35.0	10.2
480.004000	28.27	46.00	17.73	120.000	274.0	V	202.0	15.7
948.936000	38.67	46.00	7.33	120.000	100.0	V	288.0	20.6

03.07.2019

4. Radiated emissions in the frequency range 1 to 6 GHz

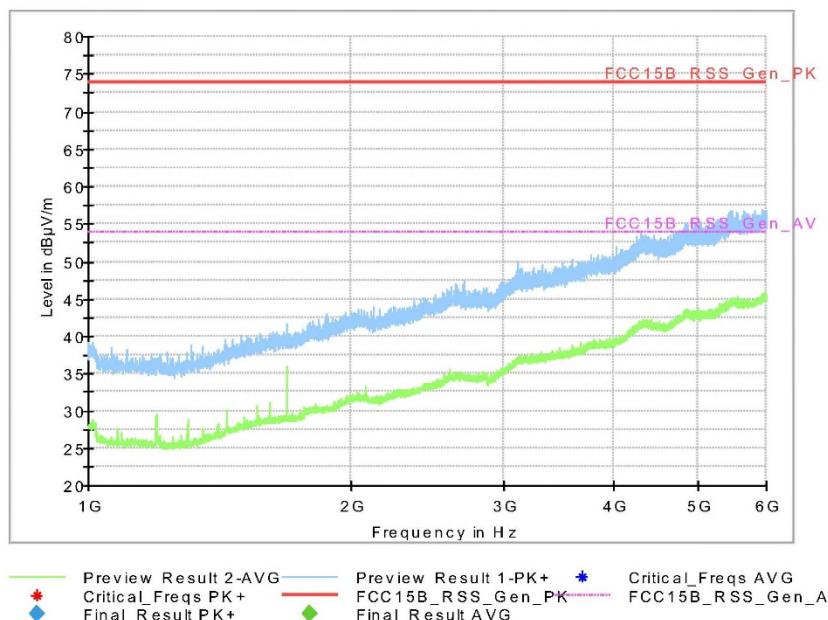
Diagram No. 3.01_FCC_1 - 6 GHz

Test description: Date: 08.07.2019 Page 1 of 1
 Test site and distance: Electric Field Strength Measurement
 Test location: Semi Anechoic Chamber 2 (SAC5) with 3 m measurement distance
 Version of Test software: CETECOM GmbH Düsseldorf
 EMC32 V10.0.0
 Test specification: FCC15.109, class B; RSS-Gen.: Issue 4
 Distance correction: not used
 Technical Data: Please see page 2 for detailed data of measurement setup
 Used filter: none
 Operating mode: ready to print and continuous ping command over LAN connection
 Measured sides of EUT: front, right, rear, left
 Environmental conditions: Humidity: 32%RH; Temperature: 25.1°C; Pressure: 1014hPa
 Operator: A. Ueberbach
 Comment 1:

EUT Information

EUT Name: Taprbox
 Manufacturer: PPA 15
 Serial Number: 81AB-0FFA
 Hardware Rev: 6/ 2019
 Software Rev: Pi 3 Model B+
 Comment: EUT contain FCC approved parts

Full Spectrum



Final Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
No conspicuous frequency found – margin to limit > 20 dB										

08.07.2019

5. Radiated emissions in the frequency range 6 to 7 GHz

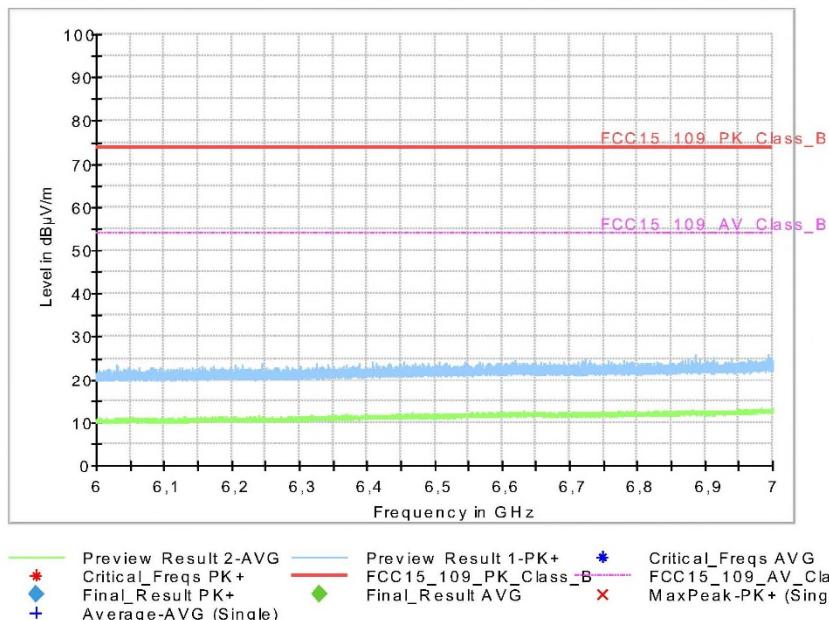
4.01_FCC_6 - 7 GHz

Test description: Date: 08.07.2019 Page 1 of 1
 Test site and distance: Electric Field Strength Measurement
 Test location: Semi Anechoic Chamber 2 (SAC5) with 3m measurement distance
 Version of Testsoftware: CETECOM GmbH Düsseldorf
 EMC32 V10.0.0
 Test specification: FCC15.109, class B; RSS-Gen.: Issue 4
 Distance correction: not used
 Technical Data: Please see page 2 for detailed data of measurement setup
 Used filter: none
 Operating mode: ready to print and continuous ping command over LAN connection
 Measured sides of EUT: front, right, rear, left
 Environmental conditions: Humidity: 32%RH; Temperature: 25.1°C; Pressure: 1014hPa
 Operator: MBe

EUT Information

EUT Name: Tapbox
 Manufacturer: PPA 15
 Serial Number: 81AB-0FFA
 Hardware Rev: 6/ 2019
 Software Rev: Pi 3 Model B+
 Comment: EUT contain FCC approved parts

Full Spectrum



Final Result

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
No conspicuous frequency found – margin to limit > 20 dB										

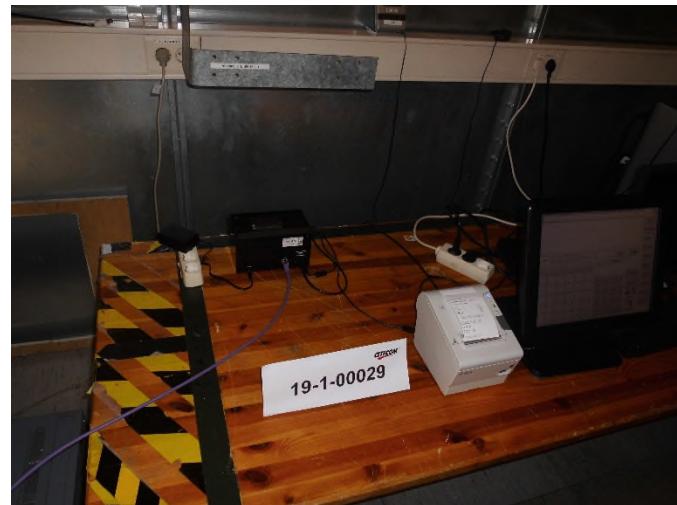
08.07.2019

Annex 2: Set-up photographs to
TEST REPORT
No.: 19-1-0002901T03a

For

PPA15 GmbH
Stollbergstr. 22
80539 München (Germany)

Cash Point Interface
sensalytics taprbox



Photograph 1: Mains conducted emission measurements test set-up for measurement of frequency up to 30MHz



Photograph 2: Radiated emission measurements test set-up for measurement of frequency up to 1000 MHz
Front side view



Photograph 3: Radiated emission measurements test set-up for measurement of frequency up to 7 GHz
Front side view