RFID 125kHz Template: Release September 02nd, 2016

TEST REPORT

N°: 143697-690650 **Version : 01**

Subject	**Radio spectrum matters tests according to standards: 47 CFR Part 15.209 & Part 15.207**
Issued to	**ADVEEZ** 12 Rue Michel Labrousse 31100-TOULOUSE FRANCE
Apparatus under test	
Product	**TRACKING SYSTEMS**
Trade mark	**ADVEEZ**
Manufacturer	**ADVEEZ**
Model under test	**FAMAv3**
Serial number	**AD-P02-0315-149**
Test date	: August 30, 2016 to August 31, 2016
Test location	Ecuelles
Composition of document	26 pages
Document issued on	November 2, 2016

Written by :
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Tests operator

Approved by :
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PUBLICATION HISTORY

Version	Date	Author	Modification
01	October 6, 2016	Laurent DENEUX	Creation of the document

SUMMARY

1. TEST PROGRAM

References

- **47 CFR Part 15.209 & 15.207**
- **ANSI C63.10-2013**

Radio requirement:

Clause (47CFR Part 15.209 & 15.207) Test Description	Test result - Comments			
AC Power Line Conducted Emission	☑ **PASS**	☐ **FAIL**	☐ **NA(2)**	☐ **NP(1)**
Transmitter Radiated Emission	☑ **PASS**	☐ **FAIL**	☐ **NA**	☐ **NP(1)**
Receiver Radiated Emissions	☑ **PASS (3)**	☐ **FAIL**	☐ **NA**	☐ **NP(1)**
This table is a summary of test report, see conclusion of each clause of this test report for detail.				

(1): Limited program
(2): EUT not directly or indirectly connected to the AC Power Public Network
(3):Testing covered the receive mode, and receiver spurious emissions are considered to be the same as transmitter.

PASS: EUT complies with standard's requirement
FAIL: EUT does not comply with standard's requirement
NA: Not Applicable
NP: Test Not Performed

2. EQUIPMENT UNDER TEST: CONFIGURATION (DECLARED BY PROVIDER)

2.1. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

Equipment under test (EUT):
ADVEEZ FAMAv3 **Serial Number: AD-P02-0315-149**

125KHz antenna
6-wire cable
+
CAN bus 2 wires
+
2-wires connected to Power Supply Box

Equipment Under Test

Inputs/outputs - Cable:

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
CAN bus	2-wire unshielded cable	< 30cm	☑	☐	☐	
Power Supply	2-wire unshielded cable	< 30cm	☑	☐	☐	
125KHz antenna	6-wire unshielded cable	< 1m	☑	☐	☐	
GPS	coaxial	3m	☐	☑	☐	
LoRa	coaxial	3m	☐	☑	☐	

Auxiliary equipment used during test:

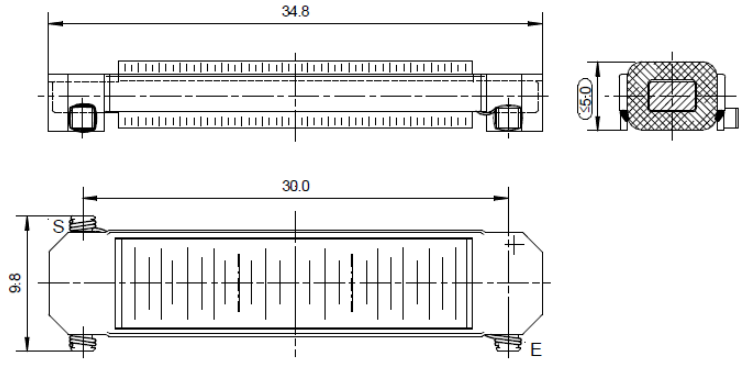
Type	Reference	Sn	Comments
Power supply DC-24V	6201B HP		

Equipment information:

Type:	☑ **RFID**			
Frequency band:	[125] kHz			
Number of Channel:	1			
Antenna Type:	☐ Integral	☑ External	☐ Dedicated	
Transmit chains:	1			
Receiver chains	1			
Type of equipment:	☐ Stand-alone	☑ Plug-in	☐ Combined	
Equipment type:	☐ Production model		☐ Pre-production model	
Operating temperature range:	Tmin:	☑ -20°C	☐ 0°C	☐ X°C
	Tnom:	20°C		
	Tmax:	☐ 35°C	☐ 55°C	☑ 85°C
Type of power source:	☐ AC power supply	☐ DC power supply	☑ Battery	
Operating voltage range:	Vnom:	☐ 120V/60Hz	☑ 24Vdc	

Antenna Characteristic			
Antenna assembly	**Gain (dBi)**	**Frequency Band (MHz)**	**Impedance(Ω)**
1	-	0.125	50

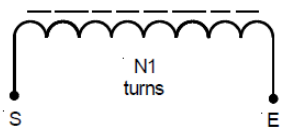
SMD - Coil Ms 62 s / 400 µH — **00 6169 02 Rev. 0**



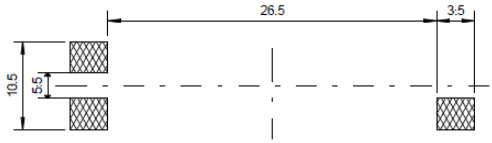
RoHS-conform

⊂⊃ = test dimensions. *Dimensions*: mm

Circuit



Recommended pad pattern



Solderable acc.
IPC/JEDEC J-STD-020-D

Testing: *measured on:* L, R, Q = Agilent E 4980A

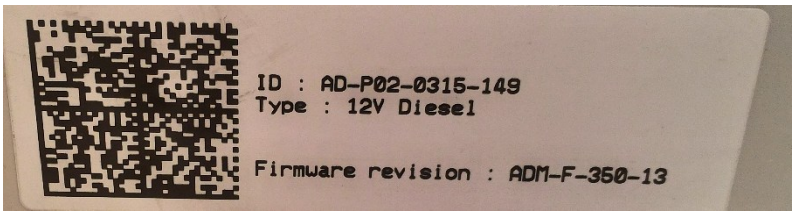
L [µH]	± %	R ≤ [Ω]	Q ≥	$f_{L,Q}$ [kHz] [0.1 V]	Remark
400	5	1.4	100	125	

Operating temperature range: -40 - +125°C. Max. sol dering temperature: 260°C, 10 sec.

2.2. RUNNING MODE

The EUT is set in the following modes during tests:
- Permanent emission with modulation on a fixed channel in the data rate that produced the highest power (without tag)

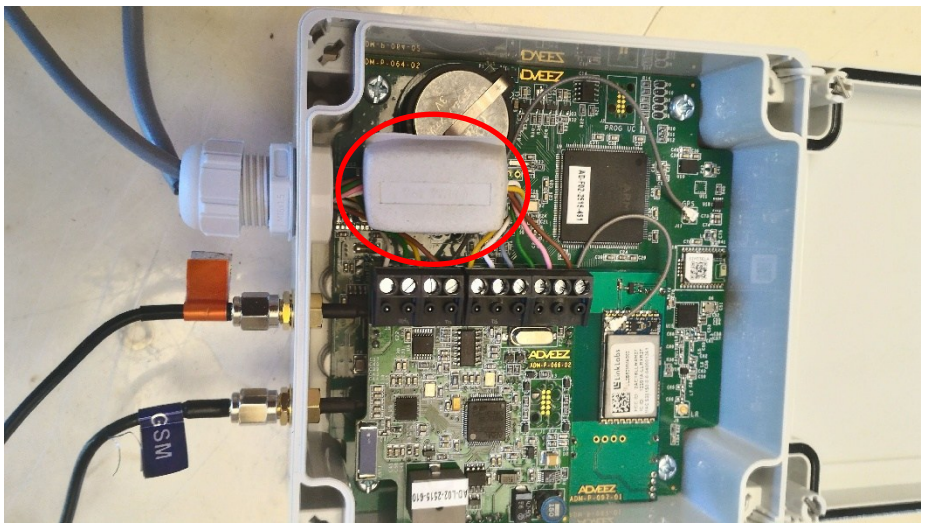
2.3. EQUIPMENT LABELLING



EQUIPMENT MODIFICATION

☐ None ☑ Modification:

Adding a reference 7427111 ferrite antenna cable is 125 kHz, to reduce the radiated emission in the frequency range 40 to 50MHz.



3. AC POWER LINE CONDUCTED EMISSIONS

3.1. TEST CONDITIONS

Test performed by	: Laurent DENEUX
Date of test	: August 30, 2016
Ambient temperature	: Temperature 21°C
Relative humidity	: Humidity 51%

3.2. TEST SETUP

The product has been tested according to ANSI C63.10 (2013) method. The EUT is placed on the ground reference plane, at 80cm from the LISN. The distance between the EUT and the vertical ground plane is 40cm. Auxiliaries are powered by another LISN. The cable has been shorted to 1meter length. The EUT is powered through the LISN. Measurement is made with a receiver in peak mode. This was followed by a Quasi-Peak, i.e. CISPR measurement for any strong signal. If the average limit is met when using a Quasi-Peak detector, the EUT shall be deemed to meet both limits and measurement with the average detector is unnecessary. The LISN (measure) is 50Ω / 50µH. Interconnecting cables and equipment's were moved to position that maximized emission.

Photograph for AC Power Line Conducted Emissions (Front view)

Photograph for AC Power Line Conducted Emissions (Rear view)

3.3. LIMIT

Quasi-Peak
0,15kHz to 0,5MHz: 66dBµV to 56dBµV*
0,5MHz to 5MHz: 56dBµV
5MHz to 30MHz: 60dBµV

Average
0,15kHz to 0,5MHz: 56dBµV to 46dBµV*
0,5MHz to 5MHz: 46dBµV
5MHz to 30MHz: 50dBµV

*Decreases with the logarithm of the frequency

3.4. TEST EQUIPMENT LIST

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
EMI Test Receiver	ROHDE & SCHWARZ	ESCI	A2642017	2016-08	2017-08
V ISLN	ROHDE & SCHWARZ	ESH2-Z5	C2322001	2016-05	2017-05
Pulse limiter	ROHDE & SCHWARZ	ESH3-Z2	A2649008	2016-03	2017-03
Cable	-	-	A5329417	2015-10	2016-10
Ground plane	LCIE	-	-	-	

Note: In our quality system, the test equipment calibration due is more & less 2 months

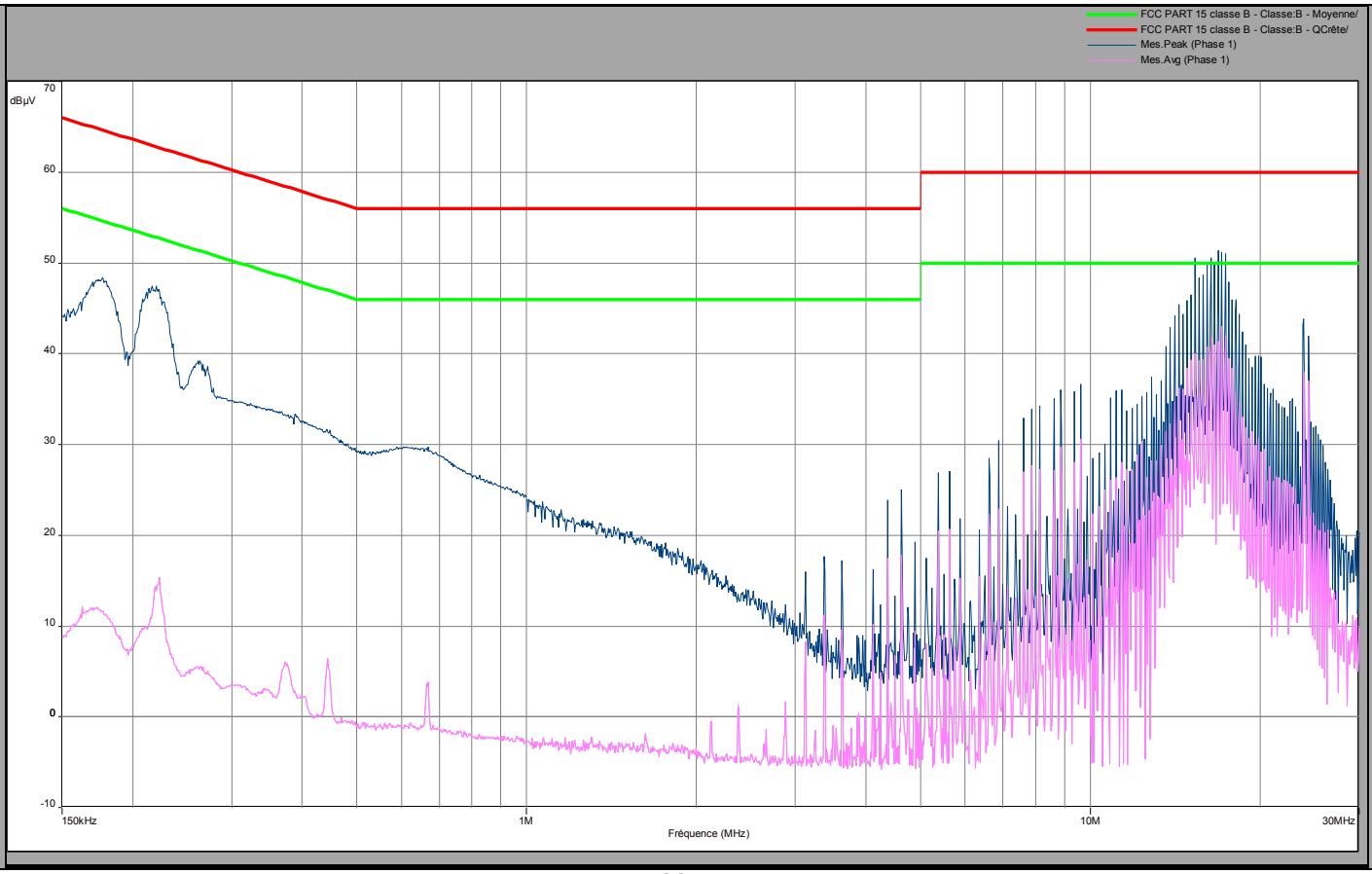
3.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

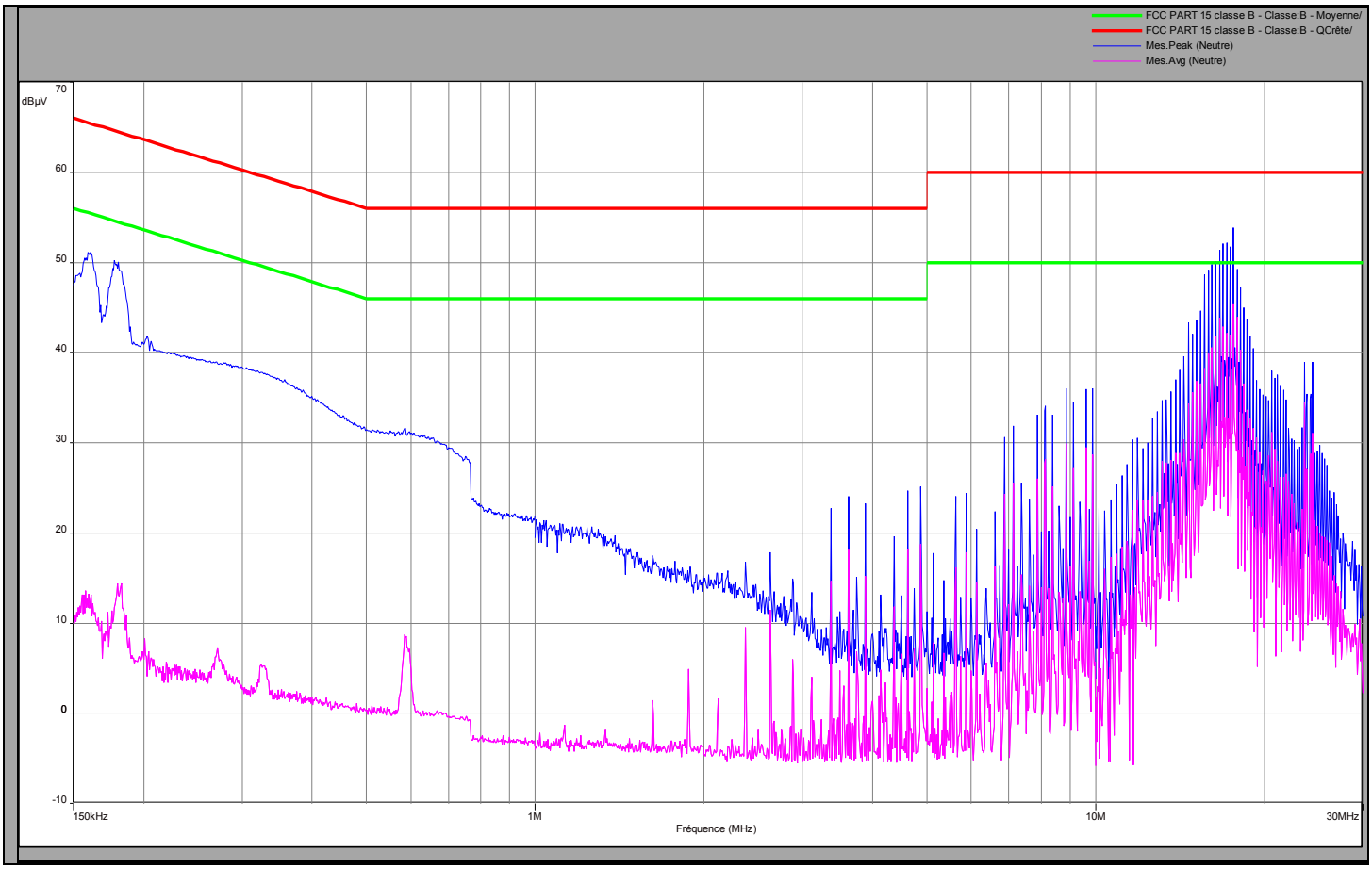
3.6. RESULTS

AC Power Line Conducted Emission

Phase



Line


FCC PART 15 classe B - Classe:B - Moyenne/
FCC PART 15 classe B - Classe:B - QCrête/
Mes.Peak (Neutre)
Mes.Avg (Neutre)
dBµV
70
60
50
40
30
20
10
0
-10
150kHz
1M
10M
30MHz
Fréquence (MHz)

Phase Line					
Frequency (MHz)	**Peak Level (dBµV)**	**Quasi-Peak Level (dBµV)**	**Quasi-Peak Limit (dBµV)**	**Average Level (dBµV)**	**Average Limit (dBµV)**
220	47.4	-	63	16	53
4626	25	-	56	17.8	46
11370	36	-	60	28	50
17116	51.2	-	60	43	50
23876	43.8	-	60	37.9	50

Neutral Line					
Frequency (MHz)	**Peak Level (dBµV)**	**Quasi-Peak Level (dBµV)**	**Quasi-Peak Limit (dBµV)**	**Average Level (dBµV)**	**Average Limit (dBµV)**
179	49.7	-	64.5	14.4	54.5
578.5	31	-	56	8.6	46
8876	36	-	60	30	50
17632	54	-	60	45	50
23630	39	-	60	34.4	50

3.7. CONCLUSION

Ac Power Line Conducted Emission measurement performed on the sample of the product **ADVEEZ FAMAv3**, SN: **AD-P02-0315-149**, in configuration and description presented in this test report, show levels **compliant** to the 47 CFR PART 15.207.

4. TRANSMITTER RADIATED EMISSION

4.1. TEST CONDITIONS

Test performed by	: Laurent DENEUX
Date of test	: August 30, 2016 to August 31, 2016
Ambient temperature	: Temperature 24°C
Relative humidity	: Humidity 46%

4.2. TEST SETUP

The product has been tested according to ANSI C63.10 (2013). The EUT is placed **on an open area test site**.

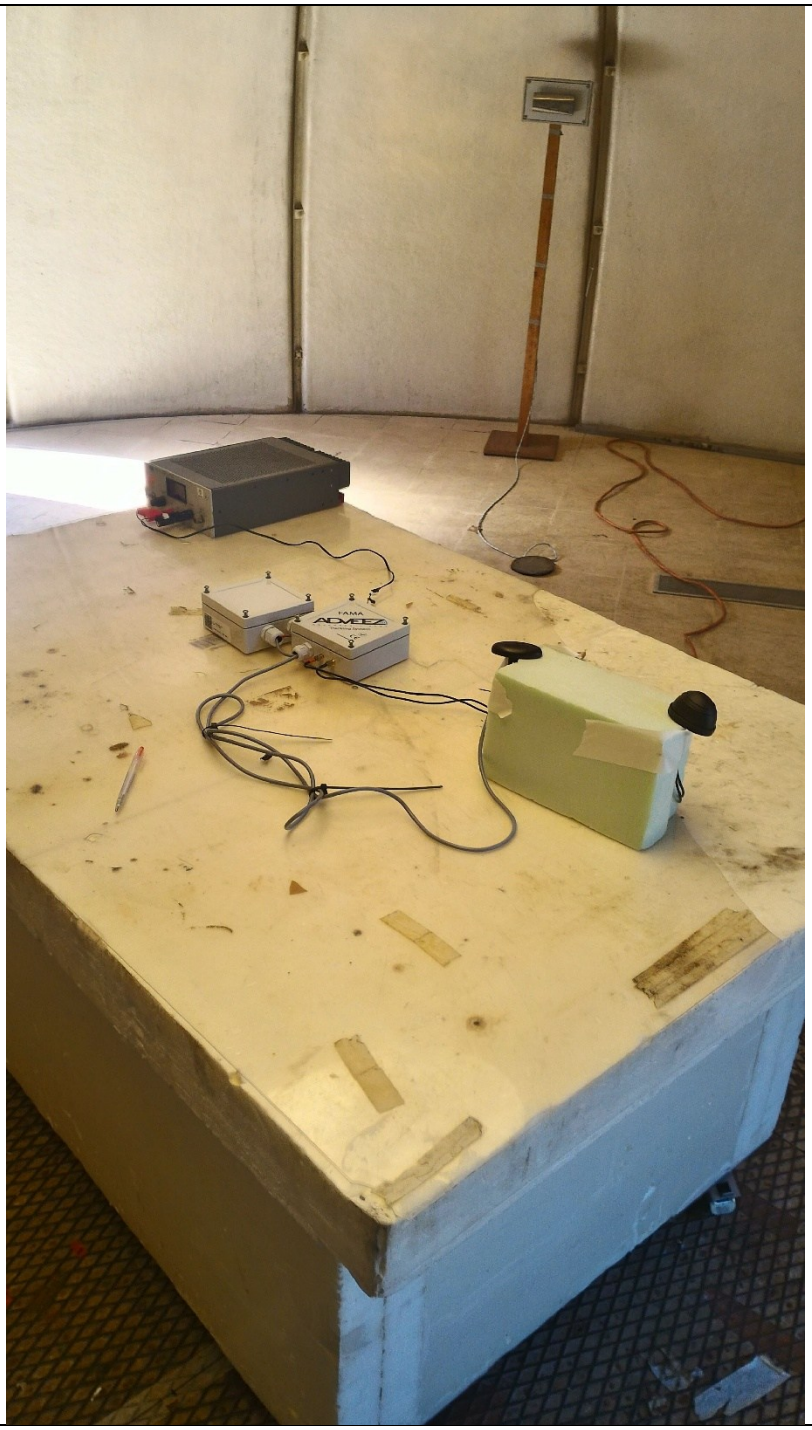
Test is performed in parallel and perpendicular axis with a loop antenna below 30MHz. Measurement bandwidth was 200Hz below 150kHz and 9kHz between 150kHz & 30MHz. The level has been maximised by the turntable rotation of 360 degrees range on the 3 axis of EUT. Antenna height was 1m. Distance between measuring antenna and the EUT is **3m**.

Test is performed in horizontal (H) and vertical (V) polarization with **bilog** between 30MHz & 1GHz and with a horn antenna above 1GHz. Measurement bandwidth was 120kHz below 1GHz and 1MHz above 1GHz. The level has been maximised by the turntable rotation of 360 degrees range on the 3 axis of EUT. Antenna height search was performed from 1 to 4m. The EUT is place at 1.5m high above 1GHz and at 0.8m high under 1GHz.
Distance between measuring antenna and the EUT is **10m**.

Photograph for Transmitter Radiated Emission

Photograph for Transmitter Radiated Emission

Photograph for Transmitter Radiated Emission



Photograph for Transmitter Radiated Emission

4.3. LIMIT

Limit at 3m:
9kHz to 0,490MHz: 2400/F(kHz)µV/m (300m) or 20log(2400/F(kHz))dBµV/m (3m) QPeak
0,490MHz to 1.705MHz: 240000/F(kHz)µV/m (30m) or 20log(240000/F(kHz))dBµV/m (3m) QPeak
1.705MHz to 30MHz: 30µV/m (30m) or dBµV/m (3m) QPeak

Limit at 10m:
30MHz to 88MHz: 29.5dBµV/m QPeak
88MHz to 216MHz: 33dBµV/m QPeak
216MHz to 960MHz: 35.5dBµV/m QPeak
960MHz to 1000MHz: 43.5dBµV/m QPeak
Above 1000MHz: 63.5BµV/m Peak
43.5BµV/m Average

4.4. TEST EQUIPMENT LIST

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
EMI Test Receiver	ROHDE & SCHWARZ	ESCI	A2642017	2016-08	2017-08
EMI Test Receiver	ROHDE & SCHWARZ	ESIB26	A2642021	2015-12	2016-12
Open test site	LCIE	-	F2000400	2016-05	2017-05
Preamplifier	HEWLETT PACKARD	8449B	A4069002	2016-01	2017-01
Bilog antenna	CHASE	CBL 6112A	C2040040	2016-01	2017-01
loop antenna	RHODE & SCHWARZ	HFH2-Z2	C2040007	2015-11	2016-11
Horn antenna	EMCO	.3115	C2042016	2016-02	2017-02
Cable	-	-	A5329542	2016-02	2017-02
Cable	-	-	A5329449	2015-11	2016-11
Cable	-	-	A5329368	2015-11	2016-11
cable	-	-	A5329444	2015-11	2016-11

Note: In our quality system, the test equipment calibration due is more & less 2 months

4.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

4.6. RESULTS

9kHz to 30MHz at 3m			
Polarization	Frequency (MHz)	QPeak Level (dBµV/m)	Limit (dBµV/m)
Paralell	0.125	73.5	105.6
Paralell	16	21.5	69.5
Paralell	20.20	29	69.5
Paralell	21.66	31	69.5
Paralell	23.13	30	69.5
Perpendicular	0.125	69	105.6
Perpendicular	20.20	27	69.5
Perpendicular	21.66	30	69.5
Perpendicular	23.13	29	69.5

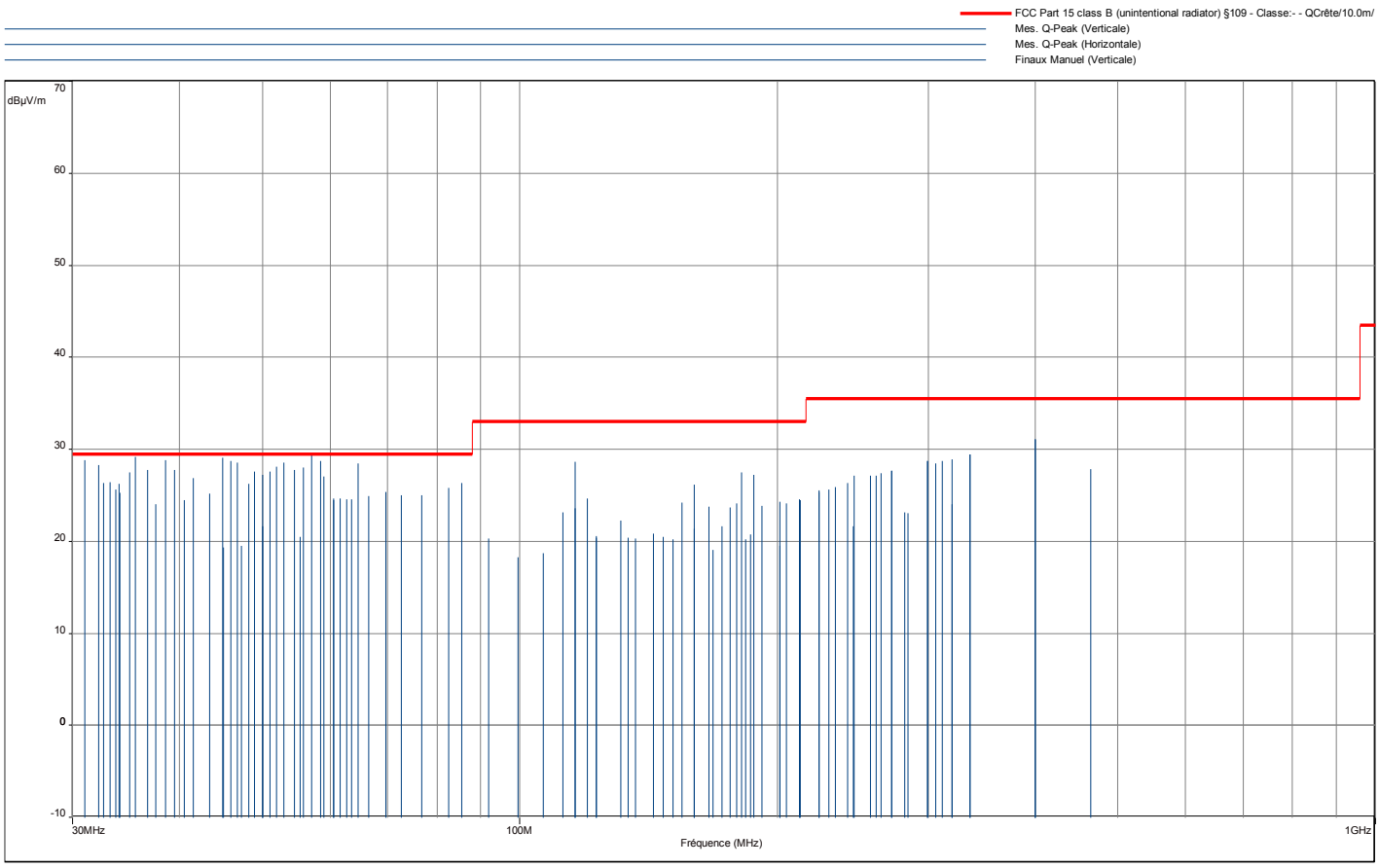
30MHz to 1GHz at 10m			
Polarization	**Frequency (MHz)**	**QPeak Level (dBµV/m)**	**Limit (dBµV/m)**
Vertical	31	28,81	29,5
Vertical	32,2	28,28	29,5
Vertical	32,6	26,36	29,5
Vertical	33,2	26,42	29,5
Vertical	33,7	25,62	29,5
Vertical	34	26,28	29,5
Vertical	35	27,56	29,5
Vertical	35,5	29,23	29,5
Vertical	36,7	27,79	29,5
Vertical	37,5	24,05	29,5
Vertical	38,5	28,87	29,5
Vertical	39,5	27,79	29,5
Vertical	40,5	24,54	29,5
Vertical	41,5	26,93	29,5
Vertical	43,4	25,18	29,5
Vertical	44,9	29,11	29,5
Vertical	45,9	28,72	29,5
Vertical	46,7	28,6	29,5
Vertical	47,3	19,54	29,5
Vertical	48,2	26,25	29,5
Vertical	49	27,62	29,5
Vertical	50	27,27	29,5
Vertical	51	27,59	29,5

30MHz to 1GHz at 10m			
Polarization	**Frequency (MHz)**	**QPeak Level (dBµV/m)**	**Limit (dBµV/m)**
Vertical	53	28,62	29,5
Vertical	54,5	27,79	29,5
Vertical	55,8	28,06	29,5
Vertical	57,1	29,54	29,5
Vertical	58,5	28,75	29,5
Vertical	59	27,07	29,5
Vertical	60,6	24,71	29,5
Vertical	61,6	24,65	29,5
Vertical	62,7	24,59	29,5
Vertical	63,6	24,6	29,5
Vertical	64,7	28,47	29,5
Vertical	66,6	24,96	29,5
Vertical	69,7	25,38	29,5
Vertical	72,7	25,04	29,5
Vertical	76,8	25,06	29,5
Vertical	82,5	25,81	29,5
Vertical	85,5	26,38	29,5
Vertical	112,3	23,2	33
Vertical	116,1	28,67	33
Vertical	120	24,64	33
Vertical	122,9	20,63	33
Vertical	131,1	22,26	33
Vertical	133,9	20,43	33
Vertical	136,5	20,34	33
Vertical	147,1	20,51	33
Vertical	151	20,29	33
Vertical	154,8	24,2	33
Vertical	160	26,16	33
Vertical	166,5	23,8	33
Vertical	172,4	21,69	33
Vertical	181,5	27,51	33
Vertical	183,7	20,27	33
Vertical	187,5	27,24	33
Vertical	192	23,85	33
Vertical	201,3	19,51	33
Vertical	212,4	24,63	33
Vertical	223,9	25,56	35,5

30MHz to 1GHz at 10m			
Polarization	**Frequency (MHz)**	**QPeak Level (dBµV/m)**	**Limit (dBµV/m)**
Vertical	229,9	25,63	35,5
Vertical	233,7	25,95	35,5
Vertical	241,6	26,34	35,5
Vertical	245,4	21,66	35,5
Vertical	256,9	27,17	35,5
Vertical	264,1	27,44	35,5
Vertical	272,1	27,71	35,5
Vertical	281,9	23,15	35,5
Vertical	299,9	28,73	35,5
Vertical	306	28,46	35,5
Vertical	320	24,06	35,5
Vertical	336,1	29,49	35,5
Vertical	400	31,14	35,5
Vertical	464,7	27,91	35,5
Horizontal	34,1	25,29	29,5
Horizontal	45	19,35	29,5
Horizontal	50	21,65	29,5
Horizontal	55,4	20,54	29,5
Horizontal	60,6	24,52	29,5
Horizontal	116,1	23,61	33
Horizontal	122,9	20,46	33
Horizontal	143,2	20,89	33
Horizontal	160	21,37	33
Horizontal	168	19,14	33
Horizontal	176	23,7	33
Horizontal	179,4	24,16	33
Horizontal	185,9	20,8	33
Horizontal	201,3	24,36	33
Horizontal	204,8	24,14	33
Horizontal	212,6	24,48	33
Horizontal	223,9	25,36	35,5
Horizontal	245,6	27,13	35,5
Horizontal	260,9	27,2	35,5
Horizontal	229,9	25,63	35,5
Horizontal	233,7	25,95	35,5
Horizontal	241,6	26,34	35,5
Horizontal	245,4	21,66	35,5

30MHz to 1GHz at 10m			
Polarization	***Frequency (MHz)***	***QPeak Level (dBµV/m)***	***Limit (dBµV/m)***
Horizontal	*245,6*	*27,13*	*35,5*
Horizontal	*260,9*	*27,2*	*35,5*
Horizontal	*272,1*	*27,68*	*35,5*
Horizontal	*284,5*	*23,07*	*35,5*
Horizontal	*299,8*	*28,74*	*35,5*
Horizontal	*312*	*28,75*	*35,5*
Horizontal	*320*	*28,94*	*35,5*
Horizontal	*336*	*29,45*	*35,5*
Horizontal	*400*	*31,11*	*35,5*

Above 1GHz
No emission observed



4.7. CONCLUSION

Unwanted Emission in restricted frequency bands measurement performed on the sample of the product **ADVEEZ FAMAv3**, SN: **AD-P02-0315-149**, in configuration and description presented in this test report, show levels **compliant** to the 47 CFR PART 15.209.

5. UNCERTAINTIES CHART

47 CFR Part 15.209 & 15.207 Kind of test	Wide uncertainty laboratory (k=2) ±x(dB) / (Hz)/ ms	Uncertainty limit
Measurement of conducted disturbances in voltage on the AC power port (9 kHz – 150 kHz)	2,67	3.8
Measurement of conducted disturbances in voltage on the AC power port (150 kHz – 30 MHz)	2,67	3.4
Measurement of conducted disturbances in voltage on the telecommunication port. (AAN)	3,67	5.0
Measurement of conducted disturbances in current (current clamp)	2,73	2.9
Measurement of disturbance power	2,67	4.5
Measurement of radiated magnetic field from 10kHz to 30MHz in SAC V01	4,48	/
Measurement of radiated magnetic field from 10kHz to 30MHz in SAC C01	4,48	/
Measurement of radiated electric field from 30 to 1000MHz in horizontal position on the OATS (Ecuelles)	4,88	6.3
Measurement of radiated electric field from 1 to 18GHz on the Ecuelles site	5.16	/
Measurement of radiated electric field from 30 to 1000MHz in vertical position on the OATS (Ecuelles)	4,99	6.3
Measurement of radiated electric field from 30 to 1000MHz in horizontal position in SAC C01	5,08	6.3
Measurement of radiated electric field from 30 to 1000MHz in vertical position in SAC C01	5,16	6.3
Measurement of radiated electric field from 30 to 1000MHz in horizontal position in SAC V01	5,08	6.3
Measurement of radiated electric field from 30 to 1000MHz in vertical position in SAC V01	5,15	6.3
Measurement of radiated electric field from 1 to 6 GHz C01	5,1	5.2
Measurement of radiated electric field from 1 to 6 GHz V01	4,85	5.2
Measurement of radiated magnetic field from 10kHz to 30MHz on the OATS (Ecuelles)	4,48	/

The uncertainty values calculated by the laboratory are lower than limit uncertainty values defined by the CISPR. The conformity of the sample is directly established by the applicable limits values. This table includes all uncertainties maximum feasible for testing in the laboratory, whether or not made in this report