FCC TEST REPORT

Test Report No. :	DST-RR-16-F002
Applicant :	**TIT ENG CO., Ltd.** 7 Floor, Shin-do B/D. 10. Garak-dong, Songpa-gu, Seoul, korea 138-160
Manufacturer :	**TIT ENG CO., Ltd.** 7 Floor, Shin-do B/D. 10. Garak-dong, Songpa-gu, Seoul, korea 138-160
FCC ID :	XTNNUVIA
Product name :	ID CARD PRINTER
Model name :	**Javelin DNA Pro** (Please see P4 for all the model numbers)
Brand name:	POINTMAN, CIM, JAVELIN
Standard applied :	ANSI C63.10:2013 and ANSI C63.4:2014
Rule parts :	FCC CFR 47, Part 15, Subpart C-15.225
Equipment Class :	DXX - Part 15 Low Power Communication Device Transmitter
Date of receipt :	April 8, 2016
Test Period :	April 10, 2016 ~ April 16, 2016
Date of issue :	April 21, 2016
Test Result :	PASS ☒ FAIL ☐

Tested by : **Jung-tae Kim / testing Engineer**

Reviewed by: **Chang-youl, Kim / Chief Engineer**

DSTech Co.

*This report only responds to the tested sample. It is not allowed to copy this report even partly without the allowance of the test laboratory.

Revision History

Issue Report No.	Issued Date	Revisions	Effect Section
DST-RR-16-F002	April 21, 2016	Initial Release	All

TABLE OF CONTENTS

1 Basic Description of EUT 4

2 Facilities and accreditations 5

3 Summary of test results 6
3.1 Standards & results 6
3.2 Uncertainty 6

4 Description of Test System 7
4.1. Test configuration (arrangement of EUT) 7
4.2. Type of Peripheral Equipment Used: 7
4.3. Type of Cables Used: 7

5 Test and measurements 8
5.1. Antenna requirement 8
5.2. Radiated emissions 9
5.3. 20 dB Bandwidth 24
5.4. Frequency tolerance of carrier signal 26
5.5. AC power line Conducted emissions 29

1 Basic Description of EUT

1.1 Basic Description of EUT

Product name:	ID CARD PRINTER
Model name:	Javelin DNA Pro
Serial No:	Proto Type
Transmit Frequency:	13.56 MHz
Number of Channels:	1
Type of Modulation	ASK
Local Oscillator or X-Tal	4 MHz, 8 MHz, 12 MHz, 13.56 MHz, 16 MHz, 22.1184 MHz, 24 MHz, 25 MHz 27.12 MHz
Power source	AC 100 – 240 V
Test SW Version	TP9000_TP.exe, Ver 3.0.0.0

Model differences:

Model name:	Difference	Remark
Javelin DNA Pro	Original (tested sample)	Full version
NUVIA N20, NUVIA N30, SATURN	For marketing purpose; these variant models are electrically identical to the model Javelin DNA Pro. To be added for the marketing purpose; the variant models are added by a buyer's request.	
Javelin DNA Pro, NUVIA N20, NUVIA N30, SATURN	The removing some components related to Input Hopper.	Removig function; 1. Input Hopper - Stores additional cards, (Standard+Optional: max. 200 cards)
Javelin DNA, NUVIA N10, SATURN	The removing some components related to Input Hopper and Output Stacker	Removig function; 1. Input Hopper - Stores additional cards, (Standard+Optional: max. 200 cards)) 2. Output Stacker - Stores printed cards (max. 60 cards)

Note: *The option models were by the applicant request EMC Tests.*
The applicant declared that the variant models are option difference to the basic model and added for the marketing purpose.

1.2 Antenna Description

Type of Antenna	Internal PCB loop antenna
Length(Card RFID)	57 mm × 37 mm, 4-turns
Length(Ribbon tag RFID)	40 mm × 37 mm, 5-turns

Note : The above EUT information was declared by the manufacturer.

2 Facilities and accreditations

2.1 Address

DSTech Co.

Test Site Location : 80, Jeil-ri, Yangji-myun, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

TEL : 82-31-336-1798, FAX : 82-31-336-3451

2.2 Certificated

FCC Site Registration No.: 325242

VCCI Site Registration No.: R-3420, C-3794

IC Site Registration No.: 9147A-1

2.3 List of test and measurement instruments

Equipment Type	Model	Manufacture	Serial No	Next Cal. Date	Cal time	Use
EMI TEST RECEIVER	ESCI	R&S	100049	2016.07.29	1 year	☒
Spectrum Analyzer	FSP	R&S	100785	2016.07.29	1 year	☒
Pre-amplifier	8447D	H.P	2727A06183	2016.07.30	1 year	☒
ARTIFICIAL MAIN NETWORK	MN425B	ANRITSU	M05519	2016.07.30	1 year	☒
2-LINE V-NETWORK	ESH3-Z5	R&S	100193	2016.07.30	1 year	☒
Loop Antenna	AL-130	COM-POWER	121010	2016.06.05	1 year	☒
TRILOG Broadand Antenna	VULB9168	Schwarzbeck	600	2017.01.16	1 year	☒
VHF Precision Dipole Antenna	VHAP	Schwarzbeck	953	2017.01.16	1 year	☒
UHF Precision Dipole Antenna	UHAP	Schwarzbeck	954	2017.01.16	1 year	☒
PSG analog signal generator	E8257D	Agilent	MY46522036	2016.06.24	1 year	☒
Digital Thermo-Hygrometer	PC-5000TRH-II	SATO	15042254-1	2016.04.27	1 year	☒
Tempeature / Humidity Chamber	DS-150SP(T)	DAEWON SCIENCE	150417-01	2016.11.20	1 year	☒
Antenna Mast	EAM 4.0	DAEIL EMC	N/A	N/A	N/A	☒
Antenna Turntable Controller	EMRT2015	HD	N/A	N/A	N/A	☒

3 Summary of test results

3.1 Standards & results

Requirement	CFR 47 Section	Result
Antenna Requirement	15.203	Meets the requirements
Radiated Emissions Field Strength within the band 13.553-13.567 MHz	15.225(a)	Meets the requirements
Field Strength within the bands 13.410-13.553 MHz and 13.567-13.710 MHz 13.110-13.410 MHz and 13.710-14.010 MHz	15.225(b) & (c)	Meets the requirements
Radiated Harmonics and Spurious Emissions Outside of the 13.110 – 14.010 MHz	15.225(d) 15.209(a)	Meets the requirements
Frequency Tolerance of Carrier Signal	15.225(e)	Meets the requirements
AC power line Conducted emissions	15.207(a)	Meets the requirements

Note: -

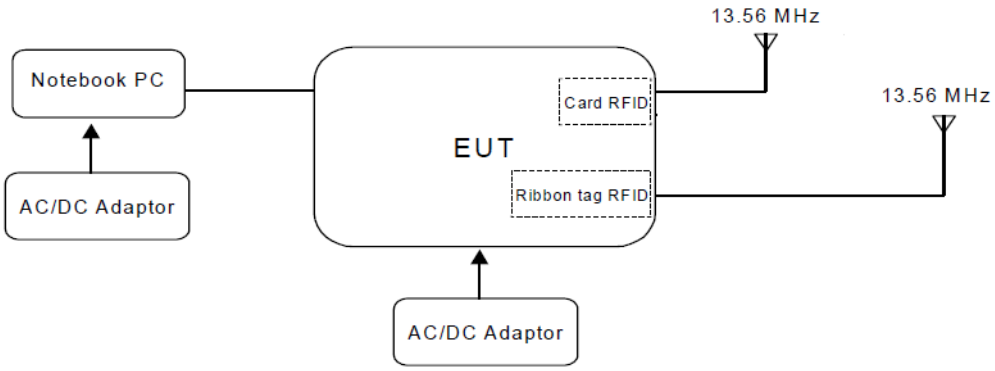
3.2 Uncertainty

Measurement Item	Combined Standard Uncertainty Uc	Expanded Uncertainty U = k × Uc (k = 2)
Conducted RF power	±1.520 dB	±3.04 dB
Radiated disturbance	±2.529 dB	±5.08 dB
Conducted disturbance	±1.950 dB	±3.90 dB

4 Description of Test System

4.1. Test configuration (arrangement of EUT)

The EUT was transmitting RF signals continuously while the USB cable was connected to PC.
Test software used: TP9000_TP.exe, Ver 3.0.0.0 (Card Reader Test Program)



Test mode

#	Description	Test case
1	Card RFID	Card type A
2		Card type B
3		Card type Mifare
4		Card type 15693
5		Card type DESFire
6	Ribbon tag RFID	Ribbon Tag

Note : The above EUT information was declared by the manufacturer.

4.2. Type of Peripheral Equipment Used:

#	Equipment	Manufacturer	Model No.	Serial No.
1	AC Adapter	Dee Van Electronic(Long Chuan) Co., Ltd.	DSA-42D-12 1	120350
2	RFID card	N/A	N/A	N/A
3	Note PC	LENOVO	20095	WB05800041

4.3. Type of Cables Used:

The following support units or accessories were used to form a representative test configuration during the tests.

#	Start		End		Cable	
	Name	I/O port	Name	I/O port	length (m)	shielded (Y/N)
1	EUT	DC Input	AC Adapter	DC Output	1.5	N
2	EUT	USB	Note PC	USB	1.8	N
3	EUT	RJ45	Note PC	RJ45	2.7	N
4	Note PC	AC Input	AC Mains	AC Mains	1.1	N
5	RFID card	-	-	-	-	-

Note: *1) All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*
2) Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

5 Test and measurements

5.1. Antenna requirement

5.1.1 Regulation

FCC section 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 Part 15C. The manufacturer may design the unit so that the user can replace a broken antenna, 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.

5.1.2 Result: PASS

The EUT has an integral PCB loop antenna, and meets the requirements of this section.

5.2. Radiated emissions

5.2.1 Regulation

FCC 47CFR15 – 15.225

(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

Frequency (MHz)	Field strength limit (μV/m) @ 30 m	Field strength limit (dBμV/m) @ 30 m	Field strength limit (dBμV/m) @ 3 m
13.110 – 13.410	106	40.5	80.5
13.410 – 13.553	334	50.5	90.5
13.553 – 13.567	15,848	84.0	124.0
13.567 – 13.710	334	50.5	90.5
13.710 – 14.010	106	40.5	80.5

FCC 47CFR15 – 15.209

(a) 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 limit (μV/m)	Field strength limit (dBμV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F (kHz) = 266.7 – 4.9	48.5 – 13.8	300
0.490 – 1.705	24000/F (kHz) = 49.0 – 14.1	33.8 – 23.0	30
1.705 – 30.0	30	29.5	30
30 – 88	100	40.0	3
88 – 216	150	43.5	3
216 – 960	200	46.0	3
Above 960	500	54.0	3

* The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector. For the frequency bands 9 – 90 kHz, 110 – 490 kHz and above 1000 MHz, the radiated emission limits are based on measurements employing an average detector.

* The lower limit shall apply at the transition frequencies.

5.2.2 Measurement Procedure

Radiated Emissions Test, 9 kHz to 30 MHz (Magnetic Field Test)

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions at a distance of 1 meter or 3 meters according to Section 15.31(f)(2).
2. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table.
3. Emissions from the EUT are maximized by adjusting the orientation of the Loop antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions if applicable.
4. To obtain the final measurement data, each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
5. Section 15.31(d) states that Field strength measurements shall be made, to the extent possible, on an open field site. Test sites other than open field sites may be employed if they are properly calibrated so that the measurement results correspond to what would be obtained from an open field site. In the case of equipment for which measurements can be performed only at the installation site, such as perimeter protection systems, carrier current systems, and systems employing a leaky coaxial cable as an antenna, measurements for verification or for obtaining a grant of equipment authorization shall be performed at a minimum of three installations that can be demonstrated to be representative of typical installation sites.
6. Section 15.31(f) requires that to the extent practicable, the device under test shall be measured at the distance specified in the appropriate rule section.

Radiated Emissions Test, above 30 MHz

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters.
2. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360˚.
3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 30 to 1000 MHz using the broadband antenna.
4. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
5. The EUT is situated in three orthogonal planes (if appropriate)

5.2.3 Calculation of the field strength limits below 30 MHz

1. No special calculation for obtaining the field strength in dBμV/m is necessary, because the EMI receiver and the active loop antenna operate as a system, where the reading gives directly the field strength result (dBμV/m). The antenna factors and cable losses are already taken into consideration.
2. For test distance other than what is specified, but fulfilling the requirements of section 15.31 (f) (2) the field strength is calculated by adding additionally an extrapolation factor of 40dB/decade (inverse linear distance for field strength measurements).
3. All following emission measurements were performed using the test receiver's average, peak, and quasi-peak detector function with specified bandwidth.
4. The basic equation is as follows;

FS= RA + DF

Where

FS = Field strength in dBμV/m

RA = Receiver Amplitude in dBμV/m

DF = Distance Extrapolation Factor in dB

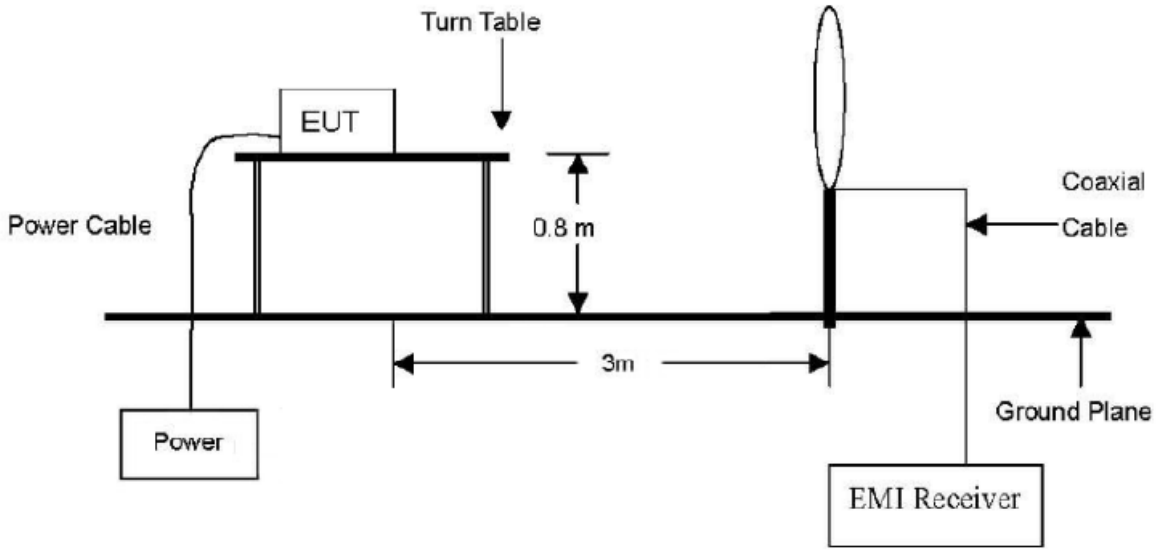
Where DF = $40\log(D_{TEST} / D_{SPEC})$ where D_{TEST} = Test Distance and D_{SPEC} = Specified Distance

DF = 40log(3m/300m) = -80 dB, for frequency band: 0.009 to 0.490 MHz

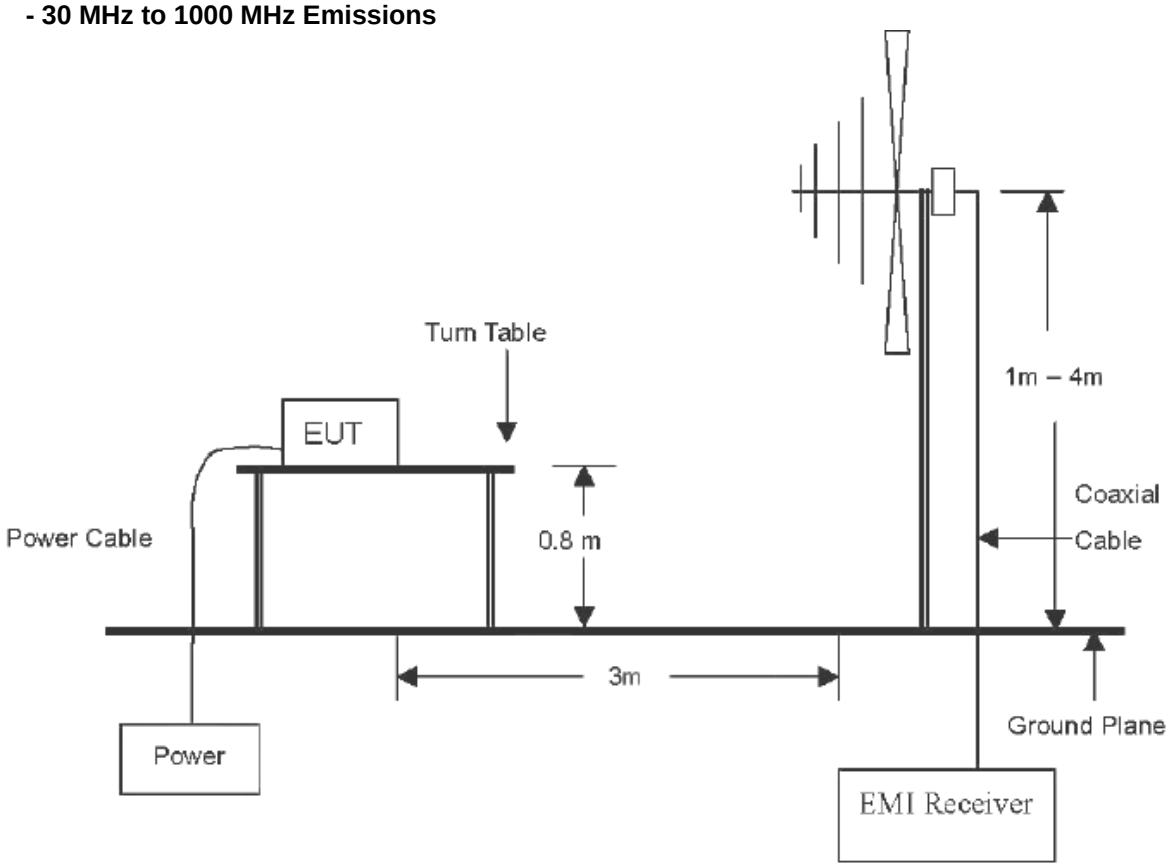
DF = 40log(3m/30m) = -40 dB, for frequency band: 0.490 to 30 MHz

5.2.4 Test setup

- 9 kHz to 30 MHz Emissions



- 30 MHz to 1000 MHz Emissions



5.2.4 Test Results:

PASS

(Card type A)

Frequency [MHz]	RBW [kHz]	Reading [dB(μV/m)]	Cable Loss [dB]	Actual [dB(μV/m)]	Limit (at 3m) [dB(μV/m)]	Margin [dB]
Emissions Quasi-peak DATA under 15.225(a), (b)&(c)						
13.560 0	9	58.18	0.5	58.68	124.0	65.32
13.345 8	9	---	0.5	---	80.5	---
13.434 0	9	---	0.5	---	90.5	---
13.660 8	9	---	0.5	---	90.5	---
13.772 4	9	---	0.5	---	80.5	---
Emissions Quasi-peak DATA under 15.225(d), 15.209						
27.12	9	---	0.5	---	69.5	---

(Card type B)

Frequency [MHz]	RBW [kHz]	Reading [dB(μV/m)]	Cable Loss [dB]	Actual [dB(μV/m)]	Limit (at 3m) [dB(μV/m)]	Margin [dB]
Emissions Quasi-peak DATA under 15.225(a), (b)&(c)						
13.560 0	9	59.24	0.5	59.74	124.0	64.26
13.489 8	9	---	0.5	---	90.5	---
13.590 6	9	---	0.5	---	90.5	---
Emissions Quasi-peak DATA under 15.225(d), 15.209						
27.12	9	---	0.5	---	69.5	---

(Card type Mifare)

Frequency [MHz]	RBW [kHz]	Reading [dB(μV/m)]	Cable Loss [dB]	Actual [dB(μV/m)]	Limit (at 3m) [dB(μV/m)]	Margin [dB]
Emissions Quasi-peak DATA under 15.225(a), (b)&(c)						
13.560 0	9	56.11	0.5	56.61	124.0	67.39
13.435 8	9	---	0.5	---	80.5	---
13.482 3	9	---	0.5	---	90.5	---
13.633 8	9	---	0.5	---	90.5	---
13.774 2	9	---	0.5	---	80.5	---
Emissions Quasi-peak DATA under 15.225(d), 15.209						
27.12	9	---	0.5	---	69.5	---

Actual (dBμV/m) = Reading + Cable Loss
Margin (dB) = Limit – Actual
NOTE: These test results were measured at the 3 m distance.
Remark:"---" means the emission level was too low to be measured or in the noise floor.

(Card type 15693)

Frequency [MHz]	RBW [kHz]	Reading [dB(μV/m)]	Cable Loss [dB]	Actual [dB(μV/m)]	Limit (at 3m) [dB(μV/m)]	Margin [dB]
Emissions Quasi-peak DATA under 15.225(a), (b)&(c)						
13.560 0	9	58.18	0.5	58.68	124.0	65.32
13.347 6	9	---	0.5	---	80.5	---
13.453 8	9	---	0.5	---	90.5	---
13.650 0	9	---	0.5	---	90.5	---
13.671 6	9	---	0.5	---	80.5	---
Emissions Quasi-peak DATA under 15.225(d), 15.209						
27.12	9	---	0.5	---	69.5	---

(Card type DESFire)

Frequency [MHz]	RBW [kHz]	Reading [dB(μV/m)]	Cable Loss [dB]	Actual [dB(μV/m)]	Limit (at 3m) [dB(μV/m)]	Margin [dB]
Emissions Quasi-peak DATA under 15.225(a), (b)&(c)						
13.560 0	9	54.53	0.5	55.03	124.0	68.97
13.347 6	9	---	0.5	---	80.5	---
13.475 4	9	---	0.5	---	90.5	---
13.671 6	9	---	0.5	---	90.5	---
13.774 2	9	---	0.5	---	80.5	---
Emissions Quasi-peak DATA under 15.225(d), 15.209						
27.12	9	---	0.5	---	69.5	---

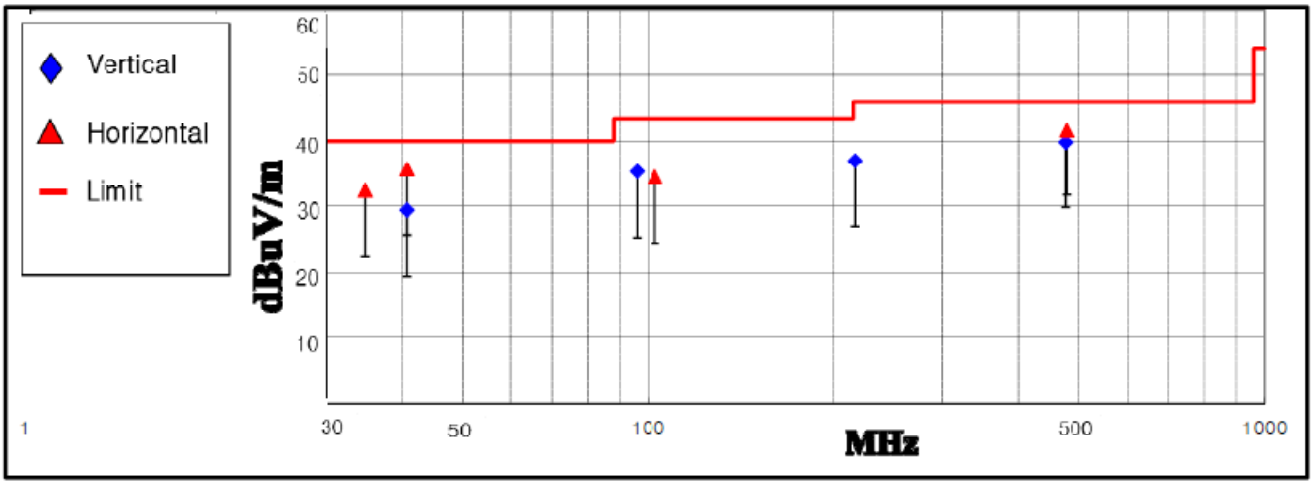
(Ribbon Tag)

Frequency [MHz]	RBW [kHz]	Reading [dB(μV/m)]	Cable Loss [dB]	Actual [dB(μV/m)]	Limit (at 3m) [dB(μV/m)]	Margin [dB]
Emissions Quasi-peak DATA under 15.225(a), (b)&(c)						
13.560 0	9	57.77	0.5	58.27	124.0	65.73
13.347 6	9	---	0.5	---	80.5	---
13.448 4	9	---	0.5	---	90.5	---
13.655 4	9	---	0.5	---	90.5	---
13.772 4	9	---	0.5	---	80.5	---
Emissions Quasi-peak DATA under 15.225(d), 15.209						
27.12	9	---	0.5	---	69.5	---

Actual (dBμV/m) = Reading + Cable Loss
Margin (dB) = Limit – Actual
NOTE: These test results were measured at the 3 m distance.
Remark:"---" means the emission level was too low to be measured or in the noise floor.

(Card type A)

Frequency (MHz)	RBW [kHz]	Actual [dB(μV)/m]	Antenna height (cm)	Pol	Table Angle (Deg)	Corr. (dB)	Margin (dB)	Limits [dB(μV)/m]
34.85	100	32.4	100	H	0	-12.1	7.6	40.0
40.67	100	35.7	355	H	0	-13.4	4.3	40.0
40.67	100	29.4	100	V	0	-13.4	10.6	40.0
95.96	100	35.3	400	V	132	-14.0	8.2	43.5
102.75	100	34.5	100	H	143	-13.5	9.0	43.5
217.21	100	37.0	100	V	356	-6.8	9.0	46.0
476.21	100	39.9	300	V	263	-5.2	6.1	46.0
478.14	100	41.7	110	H	183	-5.2	4.3	46.0

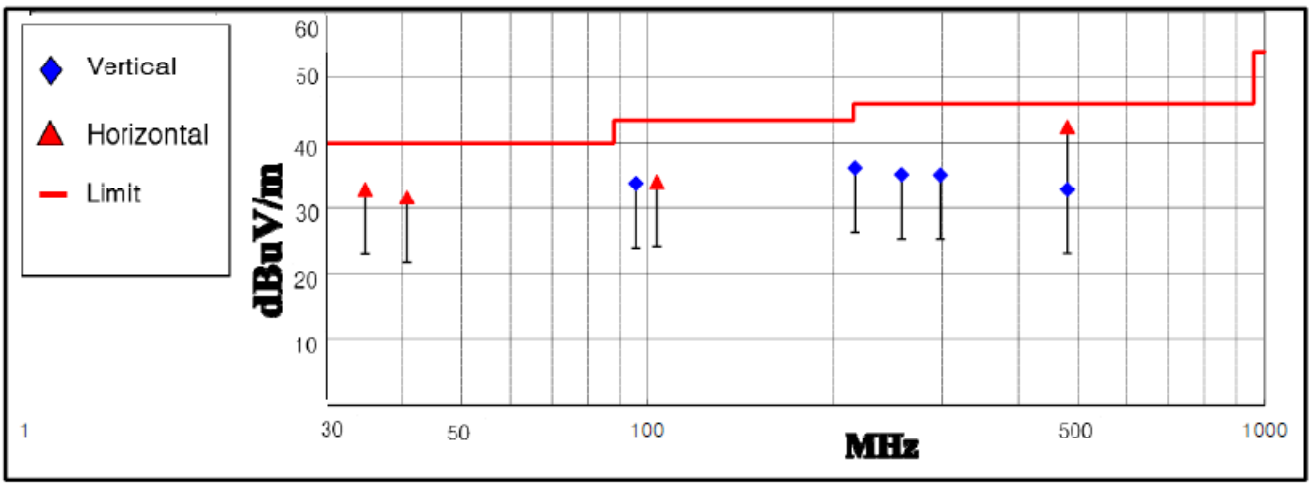


1. H: Horizontal polarization, V: Vertical polarization
2. Actual = Reading + Corr. (Amp + Antenna factor + Cable loss)
3. Margin value = Limit – Actual

NOTE: 1. All emissions not reported were more than 20 dB below the specified limit or in the noise floor.
2. These test results measured at the 3 m distance.

(Card type B)

Frequency (MHz)	RBW [kHz]	Quasi-Peak [dB(μV)/m]	Antenna height (cm)	Pol	Table Angle (Deg)	Corr. (dB)	Margin (dB)	Limits [dB(μV)/m]
34.85	100	33.0	100	H	258	-12.1	7.0	40.0
40.67	100	31.7	190	H	236	-13.4	8.3	40.0
95.96	100	33.9	330	V	92	-14.0	9.6	43.5
103.72	100	34.1	100	H	0	-13.5	9.4	43.5
217.21	100	36.3	100	V	358	-6.8	9.7	46.0
257.95	100	35.3	220	V	355	-4.5	10.7	46.0
297.72	100	35.2	200	V	261	-2.3	10.8	46.0
479.11	100	42.5	130	H	178	-5.2	3.5	46.0
479.11	100	33.0	400	V	200	-5.2	13.0	46.0

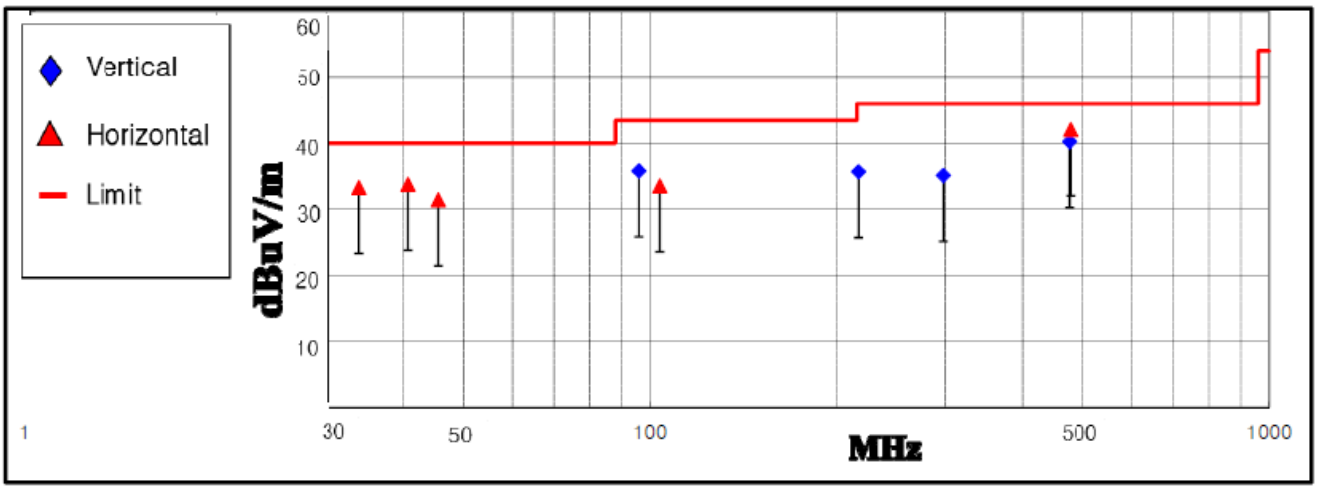


1. H: Horizontal polarization, V: Vertical polarization
2. Actual = Reading + Corr. (Amp - Antenna factor + Cable loss)
3. Margin value = Actual

NOTE: 1. All emissions not reported were more than 20 dB below the specified limit or in the noise floor.
2. These test results measured at the 3 m distance.

(Card type Mifare)

Frequency (MHz)	RBW [kHz]	Quasi-Peak [dB(μV)/m]	Antenna height (cm)	Pol	Table Angle (Deg)	Corr. (dB)	Margin (dB)	Limits [dB(μV)/m]
33.88	100	33.3	100	H	240	-11.9	6.7	40.0
40.67	100	33.8	190	H	0	-13.4	6.2	40.0
45.52	100	31.4	150	H	263	-14.2	8.6	40.0
95.96	100	35.8	400	V	69	-14.0	7.7	43.5
103.72	100	33.5	110	H	137	-13.5	10.0	43.5
217.21	100	35.7	100	V	210	-6.8	10.3	46.0
297.72	100	35.1	150	V	256	-2.3	10.9	46.0
476.20	100	40.3	130	V	263	-5.2	5.7	46.0
478.14	100	42.1	300	H	0	-5.2	3.9	46.0

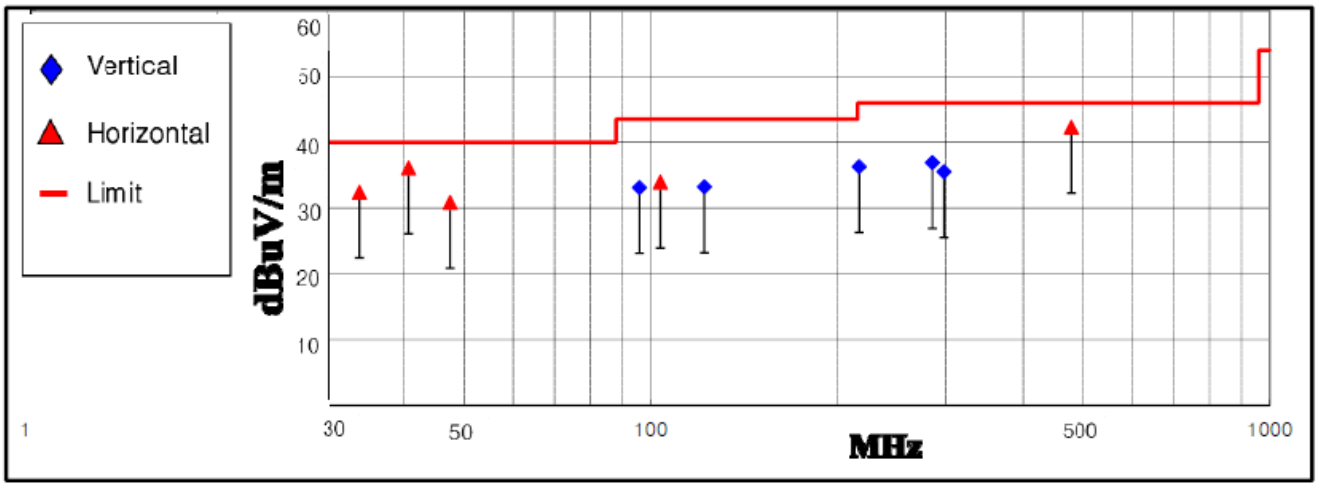


1. H: Horizontal polarization, V: Vertical polarization
2. Actual = Reading + Corr. (Amp - Antenna factor + Cable loss)
3. Margin value = Actual

NOTE: 1. All emissions not reported were more than 20 dB below the specified limit or in the noise floor.
2. These test results measured at the 3 m distance.

(Card type 15693)

Frequency (MHz)	RBW [kHz]	Actual [dB(μV)/m]	Antenna height (cm)	Pol	Table Angle (Deg)	Corr. (dB)	Margin (dB)	Limits [dB(μV)/m]
33.88	100	32.4	100	H	258	-11.9	7.6	40.0
40.67	100	36.1	175	H	246	-13.4	3.9	40.0
47.46	100	30.9	220	H	3	-14.4	9.1	40.0
95.96	100	33.1	365	V	57	-14.0	10.4	43.5
103.72	100	33.9	100	H	126	-13.5	9.6	43.5
122.15	100	33.2	400	V	0	-12.4	10.3	43.5
217.21	100	36.3	190	V	358	-6.8	9.7	46.0
285.11	100	36.9	100	V	358	-3.0	9.1	46.0
297.72	100	35.5	200	V	250	-2.3	10.5	46.0
478.14	100	42.3	100	H	184	-5.2	3.7	46.0

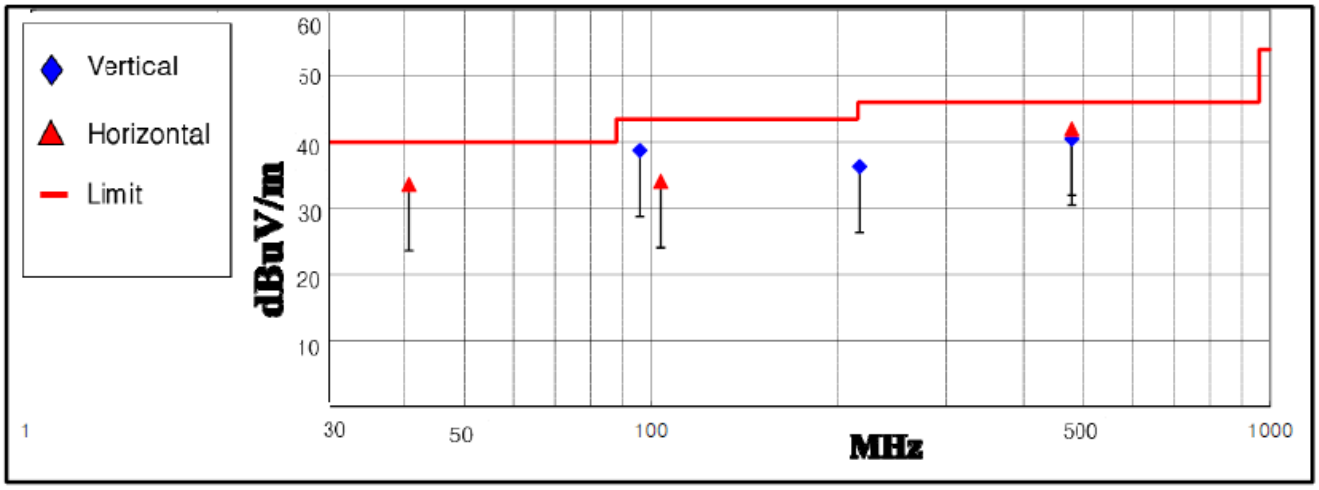


1. H: Horizontal polarization, V: Vertical polarization
2. Actual = Reading + Corr. (Amp + Antenna factor + Cable loss)
3. Margin value = Limit – Actual

NOTE: 1. All emissions not reported were more than 20 dB below the specified limit or in the noise floor.
2. These test results measured at the 3 m distance.

(Card type DESFire)

Frequency (MHz)	RBW [kHz]	Quasi-Peak [dB(μV)/m]	Antenna height (cm)	Pol	Table Angle (Deg)	Corr. (dB)	Margin (dB)	Limits [dB(μV)/m]
40.67	100	33.6	170	H	223	-13.4	6.4	40.0
95.96	100	35.2	290	V	69	-14.0	4.8	43.5
103.72	100	34.0	100	H	24	-13.5	9.5	43.5
217.21	100	36.3	100	V	358	-6.8	9.7	46.0
478.14	100	42.0	130	H	24	-5.2	4.0	46.0
478.14	100	40.5	100	V	0	-5.2	5.5	46.0

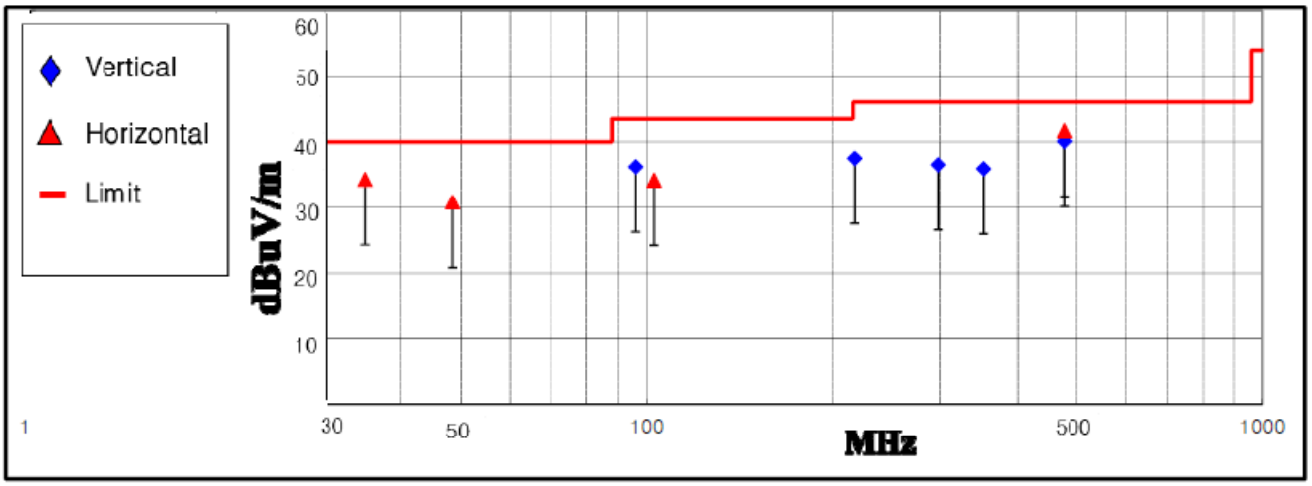


1. H: Horizontal polarization, V: Vertical polarization
2. Actual = Reading + Corr. (Amp - Antenna factor + Cable loss)
3. Margin value = Actual

NOTE: 1. All emissions not reported were more than 20 dB below the specified limit or in the noise floor.
2. These test results measured at the 3 m distance.

(Ribbon Tag)

Frequency (MHz)	RBW [kHz]	Quasi-Peak [dB(μV)/m]	Antenna height (cm)	Pol	Table Angle (Deg)	Corr. (dB)	Margin (dB)	Limits [dB(μV)/m]
34.85	100	34.2	100	H	228	-12.1	5.8	40.0
48.43	100	30.8	230	H	245	-14.6	9.2	40.0
95.96	100	36.2	380	V	97	-14.0	7.3	43.5
102.75	100	34.2	100	H	0	-13.5	9.3	43.5
217.21	100	37.5	100	V	358	-6.8	8.5	46.0
297.72	100	36.5	160	V	359	-2.3	9.5	46.0
352.04	100	35.9	110	V	336	-4.4	10.1	46.0
478.14	100	41.7	100	H	0	-5.2	4.3	46.0
478.14	100	40.1	320	V	269	-5.2	5.9	46.0

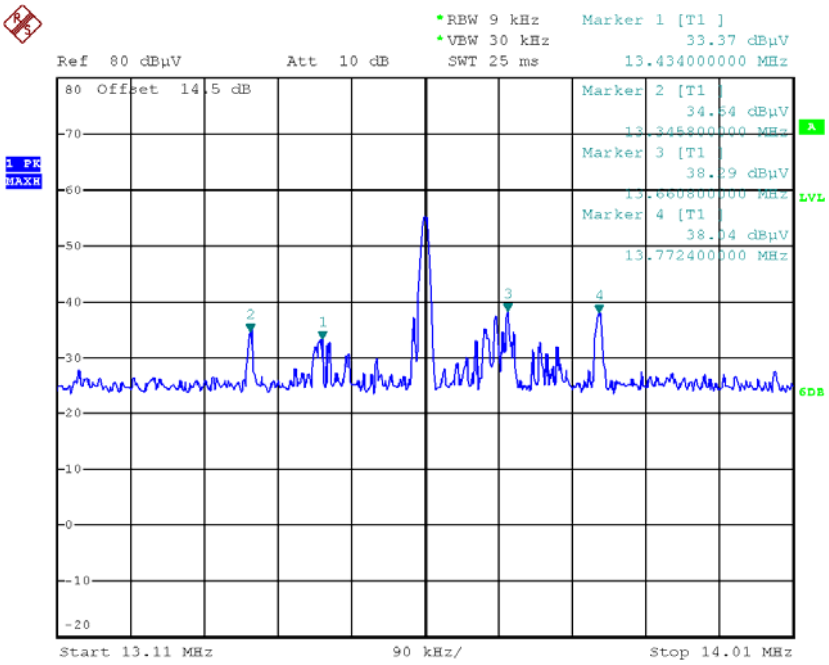


1. H: Horizontal polarization, V: Vertical polarization
2. Actual = Reading + Corr. (Amp - Antenna factor + Cable loss)
3. Margin value = Actual

NOTE: 1. All emissions not reported were more than 20 dB below the specified limit or in the noise floor.
2. These test results measured at the 3 m distance.

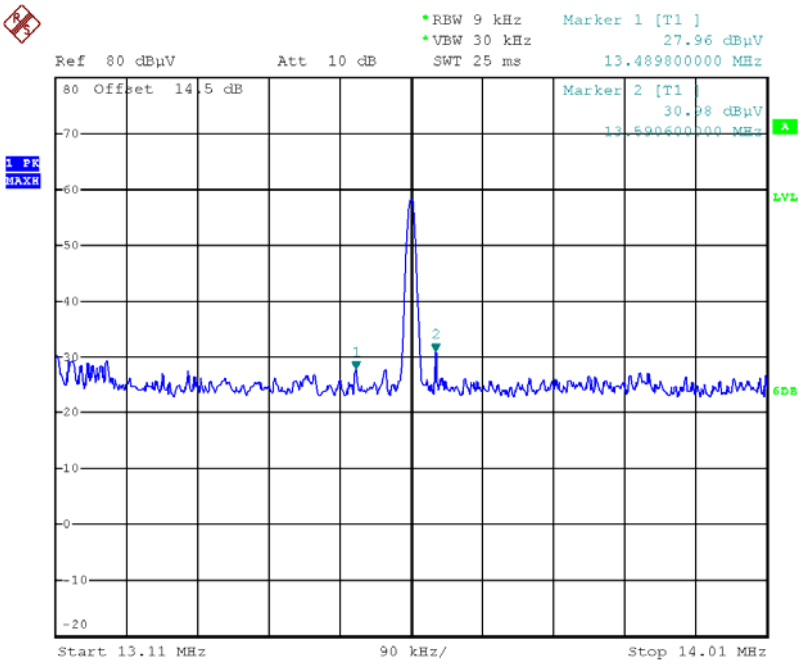
Plot of the Band edge (Preliminary measurement in the anechoic chamber at 3 m distance to find out the frequencies, at which the spurious emissions occur, with the peak detector function)

(Card type A)



Date: 12.APR.2016 09:37:44

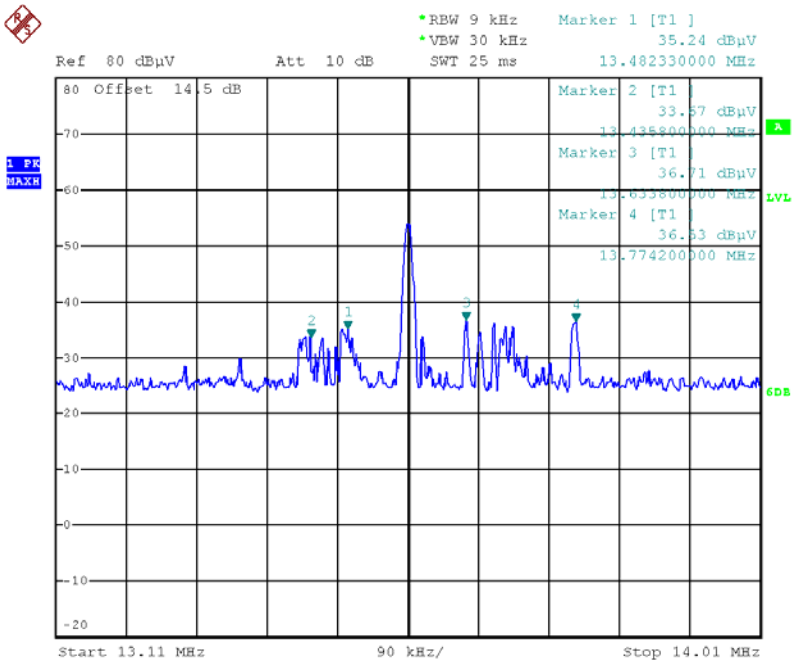
(Card type B)



Date: 12.APR.2016 09:41:52

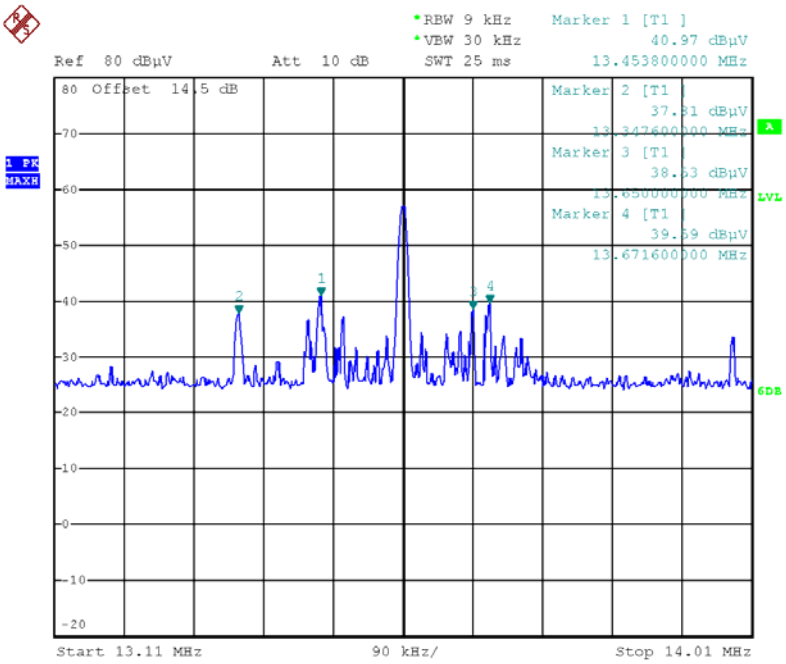
Plot of the Band edge (Preliminary measurement in the anechoic chamber at 3 m distance to find out the frequencies, at which the spurious emissions occur, with the peak detector function)

(Card type Mifare)



Date: 12.APR.2016 10:00:49

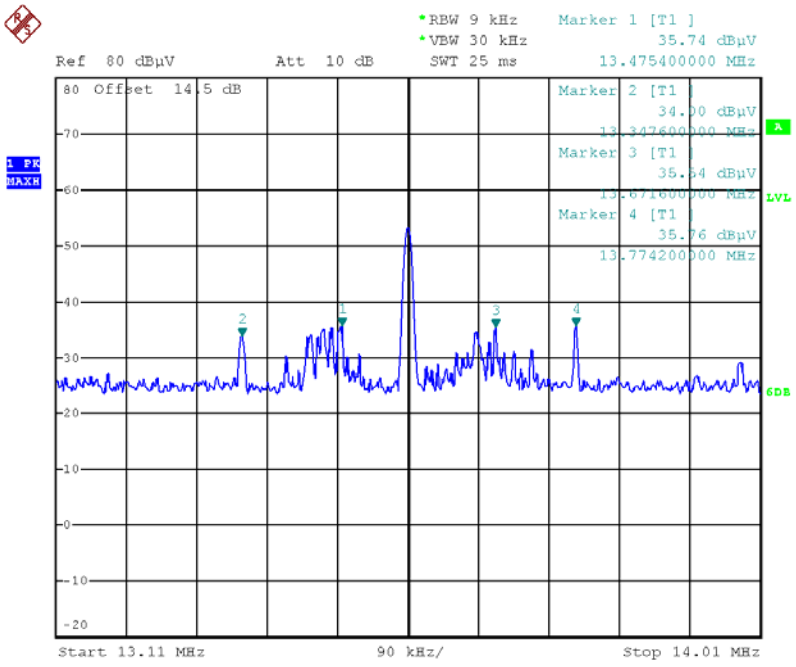
(Card type 15693)



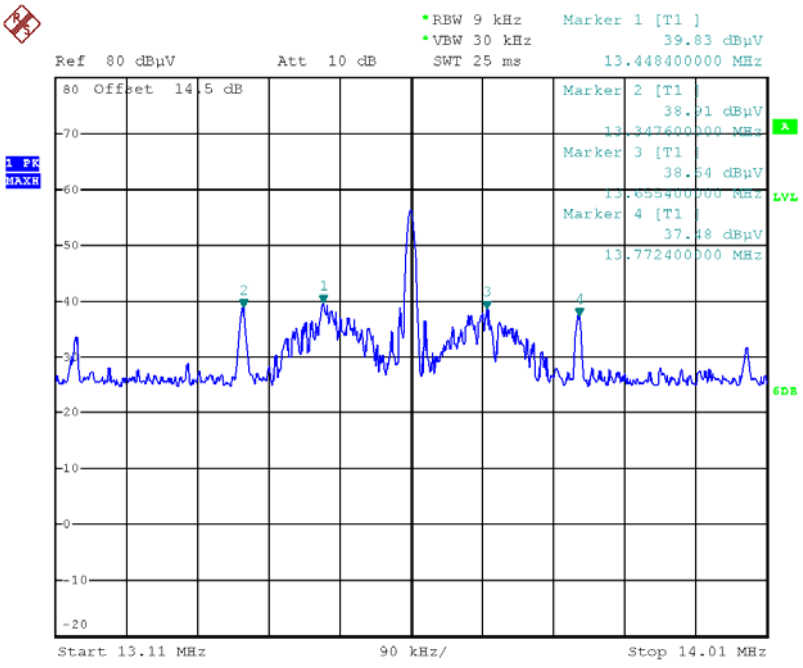
Date: 12.APR.2016 10:50:04

Plot of the Band edge (Preliminary measurement in the anechoic chamber at 3 m distance to find out the frequencies, at which the spurious emissions occur, with the peak detector function)

(Card type DESFire)



(Ribbon tag)



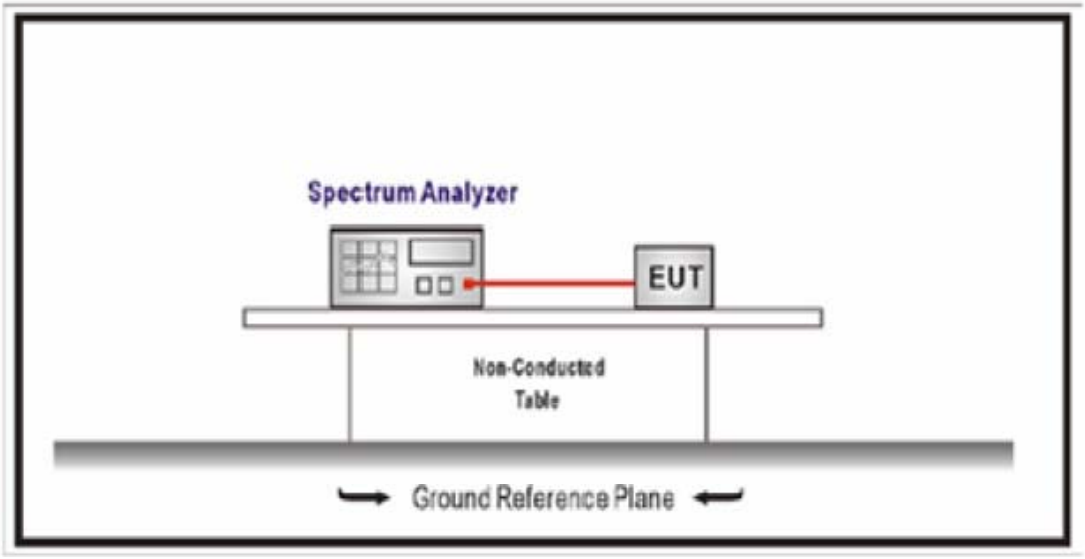
5.3. 20 dB Bandwidth

5.3.1 Regulation

FCC 47CFR15 – 15.225(e)

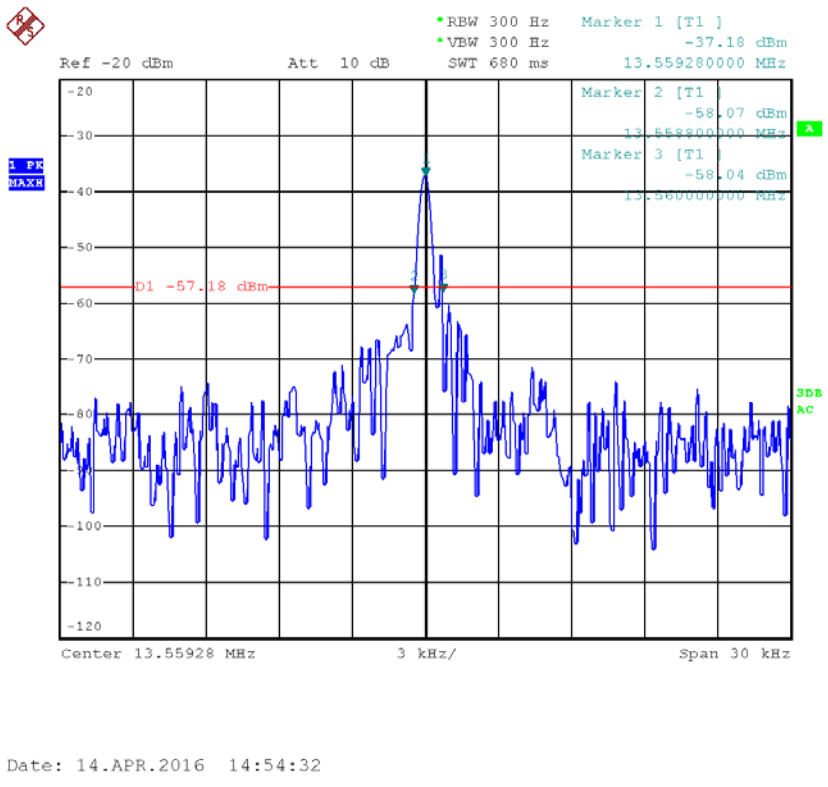
Test setup: The EUT was connected to a spectrum analyzer.
Test procedure: The 20 dB bandwidth was measured by using a spectrum analyzer.

5.3.2 Test setup

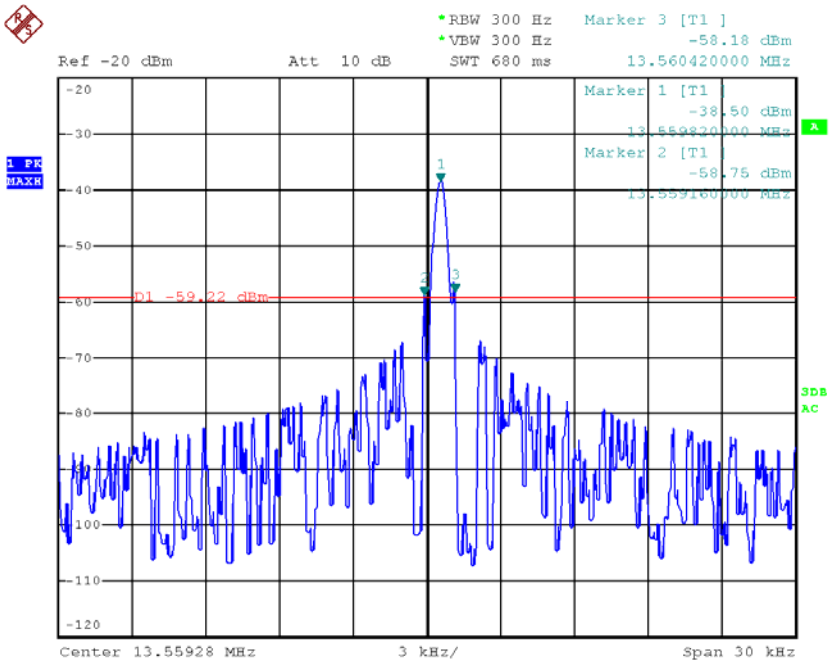


5.3.3 Test Results: PASS

(Card RFID)



(Ribbon tag RFID)



5.4. Frequency tolerance of carrier signal

5.4.1 Regulation

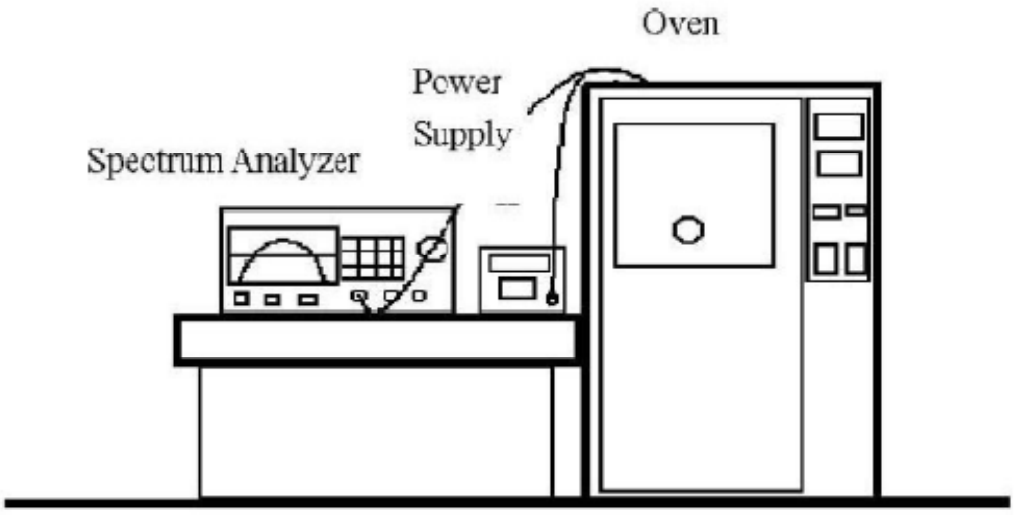
FCC 47CFR15 – 15.225(e)

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of –20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery-operated equipment, the equipment tests shall be performed using a new battery.

5.4.2 Measurement Procedure

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. The transmission time was measured with the spectrum analyzer using RBW=1 ㎑, VBW=1 ㎑.
3. Set the temperature of chamber to -20 . Allow sufficient time ℃ (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.
4. Repeat step 2 with a 10℃ decreased per stage until the highest temperature 50℃ is measured, record all measured frequencies on each temperature step.

5.4.2 Test setup



5.4.3 Test Results: PASS

(Card RFID)

Table 5: Frequency Tolerance

Reference Frequency: 13.5600MHz, LIMIT: within ± 1 356 Hz									
Environment Temperature [°C]	Power Supplied [V_{AC}]	Carrier Frequency Measured with Time Elapsed							
		STARUP		2 minutes		5 minutes		10 minutes	
		[MHZ]	Err [Hz]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]
+50	120	13.559830	170	13.559830	170	13.559829	171	13.559829	171
+40	120	13.559865	135	13.559864	136	13.559861	139	13.559860	140
+30	120	13.559872	128	13.559872	128	13.559870	130	13.559869	131
+20	120	13.559899	101	13.559899	101	13.559893	107	13.559893	107
+10	120	13.559905	95	13.559905	95	13.559905	95	13.559902	98
0	120	13.559916	84	13.559915	85	13.559914	86	13.559913	87
-10	120	13.559925	75	13.559925	75	13.559922	78	13.559921	79
-20	120	13.559930	70	13.559930	70	13.559931	69	13.559931	69

Reference Frequency: 13.5600MHz, LIMIT: within ± 1 356 Hz								
Power Supplied [V_{AC}]	Carrier Frequency Measured with Time Elapsed							
	STARUP		2 minutes		5 minutes		10 minutes	
	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]
85 %	13.559898	102	13.559898	102	13.559899	101	13.559899	101
100 %	13.559899	101	13.559899	101	13.559893	107	13.559893	107
115 %	13.559897	103	13.559897	103	13.559898	102	13.559898	102

Err [Hz] = Measured carrier frequency (MHz) - Reference Frequency (13.56 MHz)

(Ribbon tag RFID)

Table 5: Frequency Tolerance

Reference Frequency: 13.5600MHz, LIMIT: within ± 1 356 Hz									
Environment Temperature [°C]	Power Supplied [V_{AC}]	Carrier Frequency Measured with Time Elapsed							
		STARUP		2 minutes		5 minutes		10 minutes	
		[MHZ]	Err [Hz]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]
+50	120	13.559220	780	13.559220	780	13.559215	785	13.559215	785
+40	120	13.559239	761	13.559239	761	13.559233	767	13.559233	767
+30	120	13.559250	750	13.559250	750	13.559242	758	13.559242	758
+20	120	13.559280	720	13.559278	722	13.559280	720	13.559280	720
+10	120	13.559310	690	13.559310	690	13.559305	695	13.559305	695
0	120	13.559340	660	13.559340	660	13.559335	665	13.559335	665
-10	120	13.559350	650	13.559350	650	13.559342	658	13.559341	659
-20	120	13.559390	610	13.559390	610	13.559391	609	13.559391	609

Reference Frequency: 13.5600MHz, LIMIT: within ± 1 356 Hz								
Power Supplied [V_{AC}]	Carrier Frequency Measured with Time Elapsed							
	STARUP		2 minutes		5 minutes		10 minutes	
	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]
85 %	13.559281	719	13.559281	719	13.559282	718	13.559282	718
100 %	13.559280	720	13.559278	722	13.559280	720	13.559280	720
115 %	13.559283	717	13.559283	717	13.559283	717	13.559284	716

Err [Hz] = Measured carrier frequency (MHz) - Reference Frequency (13.56 MHz)

5.5. AC power line Conducted emissions

5.5.1 Regulation

FCC 47CFR15 – 15.207(a)

According to §15.207(a), 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 50μH/50Ω 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 (dBμV)	
	Qausi-peak	Average
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 – 30	60	50

* Decreases with the logarithm of the frequency.

5.5.2 Test Procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω/50μH LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5. The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

5.5.3 Test Results: PASS

(**Card type A** - Neutral Line)

NO	FREQ [MHz]	READING QP [dBuV]	READING AV [dBuV]	C.FACTOR [dB]	RESULT QP [dBuV]	RESULT AV [dBuV]	LIMIT QP [dBuV]	LIMIT AV [dBuV]	MARGIN QP [dBuV]	MARGIN AV [dBuV]	PHASE
1	0.18380	35.0	22.1	10.0	45.0	32.1	64.3	54.3	19.3	22.2	N(PK)
2	0.50535	26.1	16.3	10.0	36.1	26.3	56.0	46.0	19.9	19.7	N(PK)
3	13.55980	35.2	34.8	10.5	45.7	45.3	60.0	50.0	14.3	4.7	N(PK)
4	17.04200	30.9	24.6	10.6	41.5	35.2	60.0	50.0	18.5	14.8	N(PK)
5	24.49680	27.4	20.4	11.0	38.4	31.4	60.0	50.0	21.6	18.6	N(PK)

(**Card type A -** Live Line)

NO	FREQ [MHz]	READING QP [dBuV]	READING AV [dBuV]	C.FACTOR [dB]	RESULT QP [dBuV]	RESULT AV [dBuV]	LIMIT QP [dBuV]	LIMIT AV [dBuV]	MARGIN QP [dBuV]	MARGIN AV [dBuV]	PHASE
1	0.18098	33.8	19.7	10.0	43.8	29.7	64.4	54.4	20.6	24.7	L(PK)
2	0.23119	28.8	16.9	10.0	38.8	26.9	62.4	52.4	23.6	25.5	L(PK)
3	13.55904	34.1	33.9	10.5	44.6	44.4	60.0	50.0	15.4	5.6	L(PK)
4	18.81620	29.1	22.5	10.7	39.8	33.2	60.0	50.0	20.2	16.8	L(PK)
5	24.49811	27.2	21.1	11.0	38.2	32.1	60.0	50.0	21.8	17.9	L(PK)

(**Card type B** - Neutral Line)

NO	FREQ [MHz]	READING QP [dBuV]	READING AV [dBuV]	C.FACTOR [dB]	RESULT QP [dBuV]	RESULT AV [dBuV]	LIMIT QP [dBuV]	LIMIT AV [dBuV]	MARGIN QP [dBuV]	MARGIN AV [dBuV]	PHASE
1	0.18375	33.4	20.2	10.0	43.4	30.2	64.3	54.3	20.9	24.1	N(PK)
2	0.50356	25.2	15.4	10.0	35.2	25.4	56.0	46.0	20.8	20.6	N(PK)
3	13.56039	36.4	36.1	10.5	46.9	46.6	60.0	50.0	13.1	3.4	N(PK)
4	17.04175	31.2	24.3	10.6	41.8	34.9	60.0	50.0	18.2	15.1	N(PK)
5	23.07545	26.2	19.3	10.9	37.1	30.2	60.0	50.0	22.9	19.8	N(PK)

(**Card type B** - Live Line)

NO	FREQ [MHz]	READING QP [dBuV]	READING AV [dBuV]	C.FACTOR [dB]	RESULT QP [dBuV]	RESULT AV [dBuV]	LIMIT QP [dBuV]	LIMIT AV [dBuV]	MARGIN QP [dBuV]	MARGIN AV [dBuV]	PHASE
1	0.18365	34.3	20.6	10.0	44.3	30.6	64.3	54.3	20.1	23.7	L(PK)
2	0.50584	26.4	17.1	10.0	36.4	27.1	56.0	46.0	19.6	18.9	L(PK)
3	13.55998	36.6	36.2	10.5	47.1	46.7	60.0	50.0	12.9	3.3	L(PK)
4	17.02987	30.0	24.1	10.6	40.6	34.7	60.0	50.0	19.4	15.3	L(PK)
5	24.50997	26.3	19.9	11.0	37.3	30.9	60.0	50.0	22.7	19.1	L(PK)

(**Card type Mifare** - Neutral Line)

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.18388	33.5	20.7	10.0	43.5	30.7	64.3	54.3	20.8	23.6	N(PK)
2	0.50915	25.7	14.8	10.0	35.7	24.8	56.0	46.0	20.3	21.2	N(PK)
3	13.55905	34.9	34.5	10.5	45.4	45.0	60.0	50.0	14.6	5.0	N(PK)
4	17.04125	30.6	24.2	10.6	41.2	34.8	60.0	50.0	18.8	15.2	N(PK)
5	24.82500	26.8	19.8	11.0	37.8	30.8	60.0	50.0	22.2	19.2	N(PK)

(**Card type Mifare** - Live Line)

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.18366	34.0	20.7	10.0	44.0	30.7	64.3	54.3	20.3	23.6	L(PK)
2	0.50497	26.6	16.9	10.0	36.6	26.9	56.0	46.0	19.4	19.1	L(PK)
3	13.55808	33.7	33.4	10.5	44.2	43.9	60.0	50.0	15.8	6.1	L(PK)
4	17.04075	30.2	23.8	10.6	40.8	34.4	60.0	50.0	19.2	15.6	L(PK)
5	24.84775	26.1	19.6	11.0	37.1	30.6	60.0	50.0	22.9	19.4	L(PK)

(**Card type 15693** - Neutral Line)

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.18400	32.4	19.8	10.0	42.4	29.8	64.3	54.3	21.9	24.5	N(PK)
2	0.50323	24.9	14.9	10.0	34.9	24.9	56.0	46.0	21.1	21.1	N(PK)
3	13.55906	34.3	34.1	10.5	44.8	44.6	60.0	50.0	15.2	5.4	N(PK)
4	17.04000	28.2	23.9	10.6	38.8	34.5	60.0	50.0	21.2	15.5	N(PK)
5	24.84908	26.1	19.2	11.0	37.1	30.2	60.0	50.0	22.9	19.8	N(PK)

(**Card type 15693** - Live Line)

-

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.18367	34.2	21.0	10.0	44.2	31.0	64.3	54.3	20.1	23.3	L(PK)
2	0.50718	26.7	16.6	10.0	36.7	26.6	56.0	46.0	19.3	19.4	L(PK)
3	13.56087	34.2	33.9	10.5	44.7	44.4	60.0	50.0	15.3	5.6	L(PK)
4	17.04303	30.2	24.1	10.6	40.8	34.7	60.0	50.0	19.2	15.3	L(PK)
5	22.72212	26.1	19.4	10.9	37.0	30.3	60.0	50.0	23.0	19.7	L(PK)

(**Card type DESFire** - Neutral Line)

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.15100	29.1	10.3	10.0	39.1	20.3	65.9	55.9	26.8	35.6	N(PK)
2	0.18403	34.1	21.2	10.0	44.1	31.2	64.3	54.3	20.2	23.1	N(PK)
3	13.56147	34.0	33.7	10.5	44.5	44.2	60.0	50.0	15.5	5.8	N(PK)
4	17.04081	30.6	23.9	10.6	41.2	34.5	60.0	50.0	18.8	15.5	N(PK)
5	24.49490	26.8	20.2	11.0	37.8	31.2	60.0	50.0	22.2	18.8	N(PK)

(**Card type DESFire** - Live Line)

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.18588	34.0	20.5	10.0	44.0	30.5	64.2	54.2	20.2	23.7	L(PK)
2	0.50482	27.0	17.3	10.0	37.0	27.3	56.0	46.0	19.0	18.7	L(PK)
3	13.55904	34.2	34.0	10.5	44.7	44.5	60.0	50.0	15.3	5.5	L(PK)
4	17.39727	29.9	23.5	10.6	40.5	34.1	60.0	50.0	19.5	15.9	L(PK)
5	24.49613	27.3	20.4	11.0	38.3	31.4	60.0	50.0	21.7	18.6	L(PK)

(**Ribbon Tag** - Neutral Line)

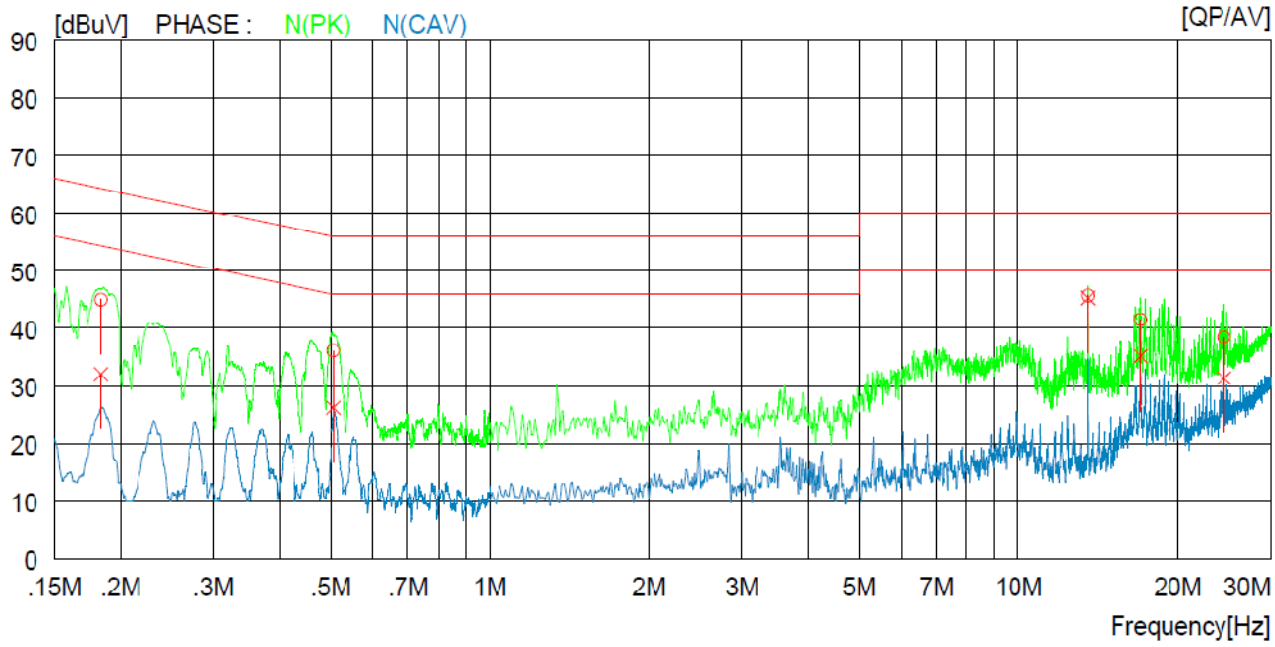
NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.15323	39.9	26.7	10.0	49.9	36.7	65.8	55.8	15.9	19.1	N(PK)
2	0.51286	26.4	15.9	10.0	36.4	25.9	56.0	46.0	19.6	20.1	N(PK)
3	13.56001	20.4	18.3	10.5	30.9	28.8	60.0	50.0	29.1	21.2	N(PK)
4	17.38520	30.5	24.1	10.6	41.1	34.7	60.0	50.0	18.9	15.3	N(PK)
5	24.82160	25.2	18.9	11.0	36.2	29.9	60.0	50.0	23.8	20.1	N(PK)

(**Ribbon Tag** - Live Line)

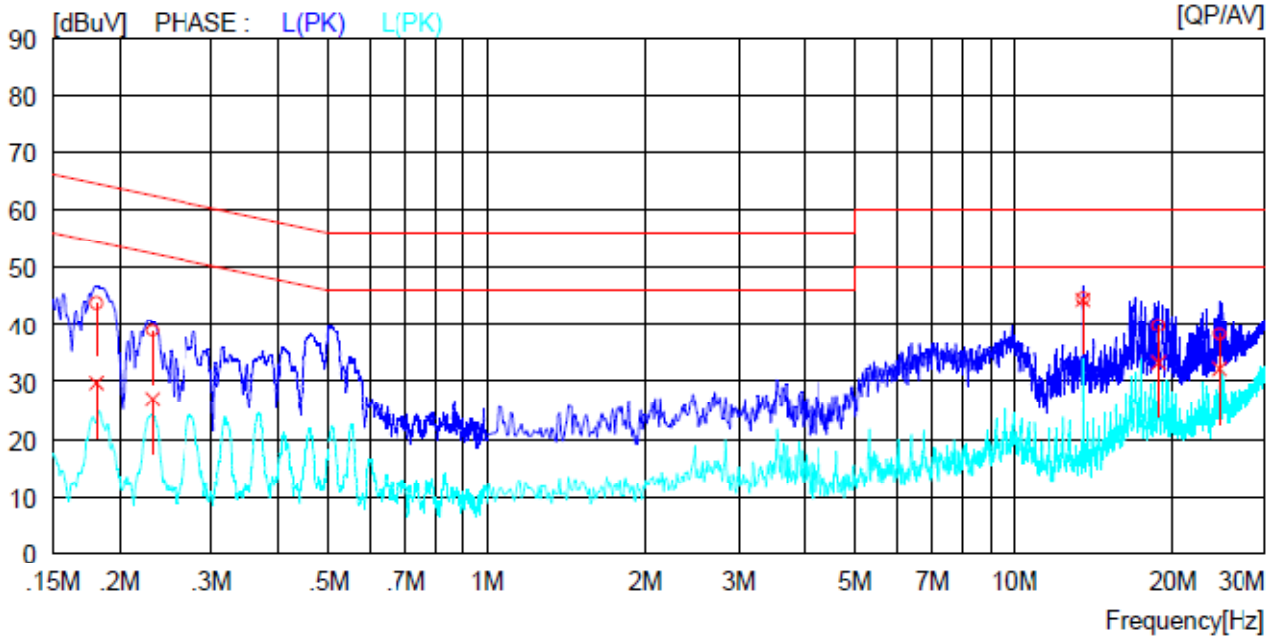
NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.20703	30.7	17.2	10.0	40.7	27.2	63.3	53.3	22.6	26.1	L(PK)
2	0.51394	26.1	15.3	10.0	36.1	25.3	56.0	46.0	19.9	20.7	L(PK)
3	13.56090	19.7	16.2	10.5	30.2	26.7	60.0	50.0	29.8	23.3	L(PK)
4	18.81653	29.0	22.5	10.7	39.7	33.2	60.0	50.0	20.3	16.8	L(PK)
5	22.72044	26.0	19.2	10.9	36.9	30.1	60.0	50.0	23.1	19.9	L(PK)

Plot of the Conducted Emissions - (Card type A)

Neutral Line

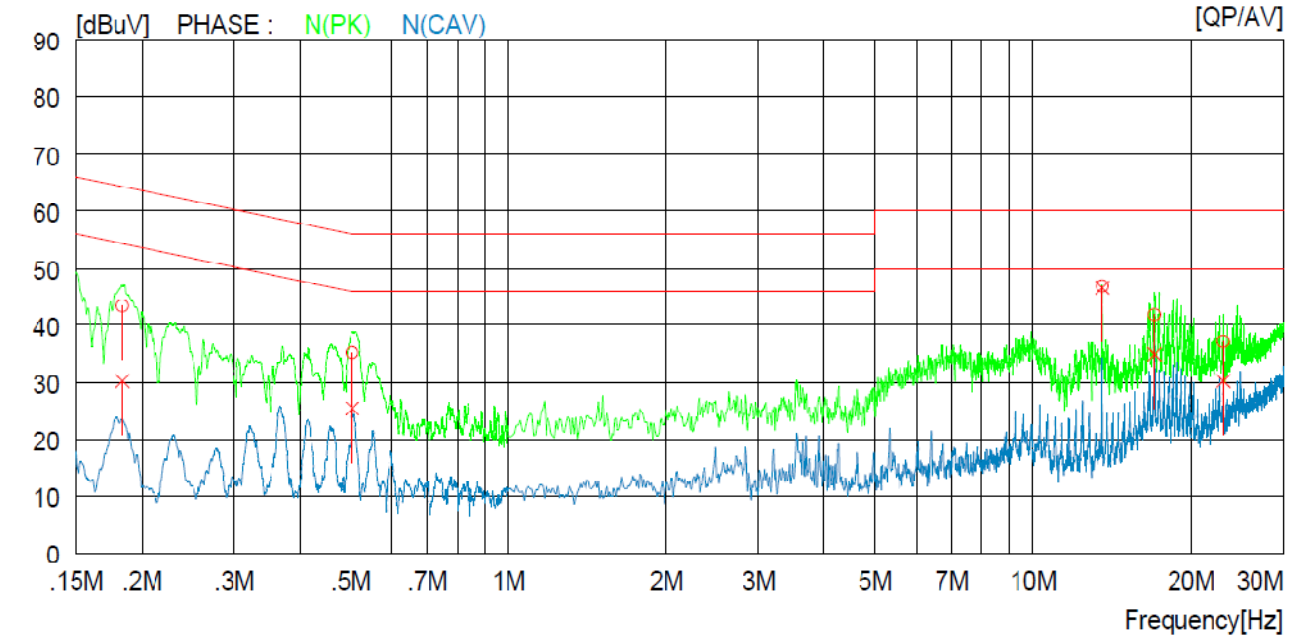


Live Line

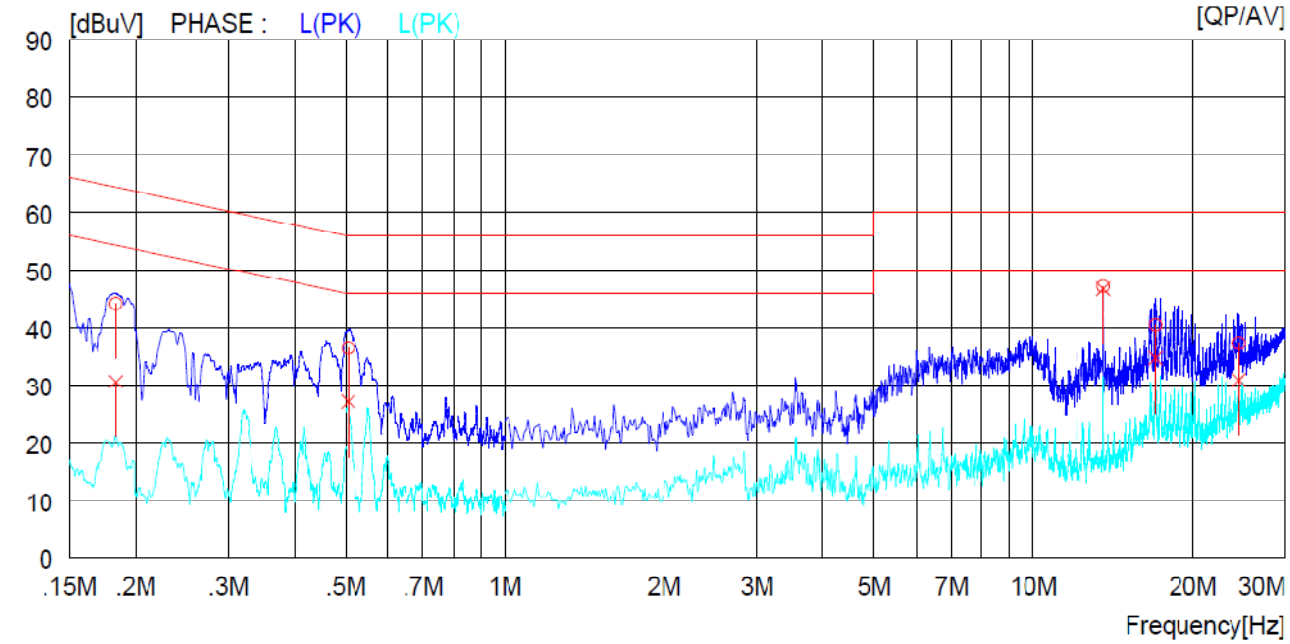


Plot of the Conducted Emissions - (Card type B)

Neutral Line

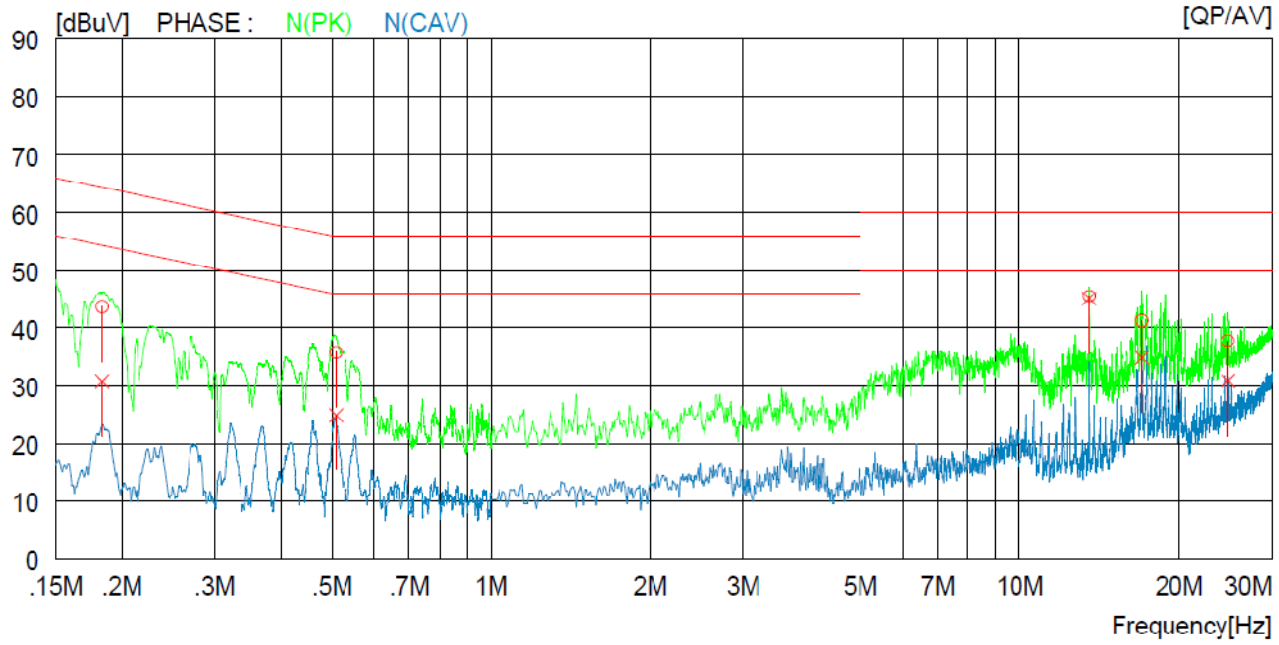


Live Line

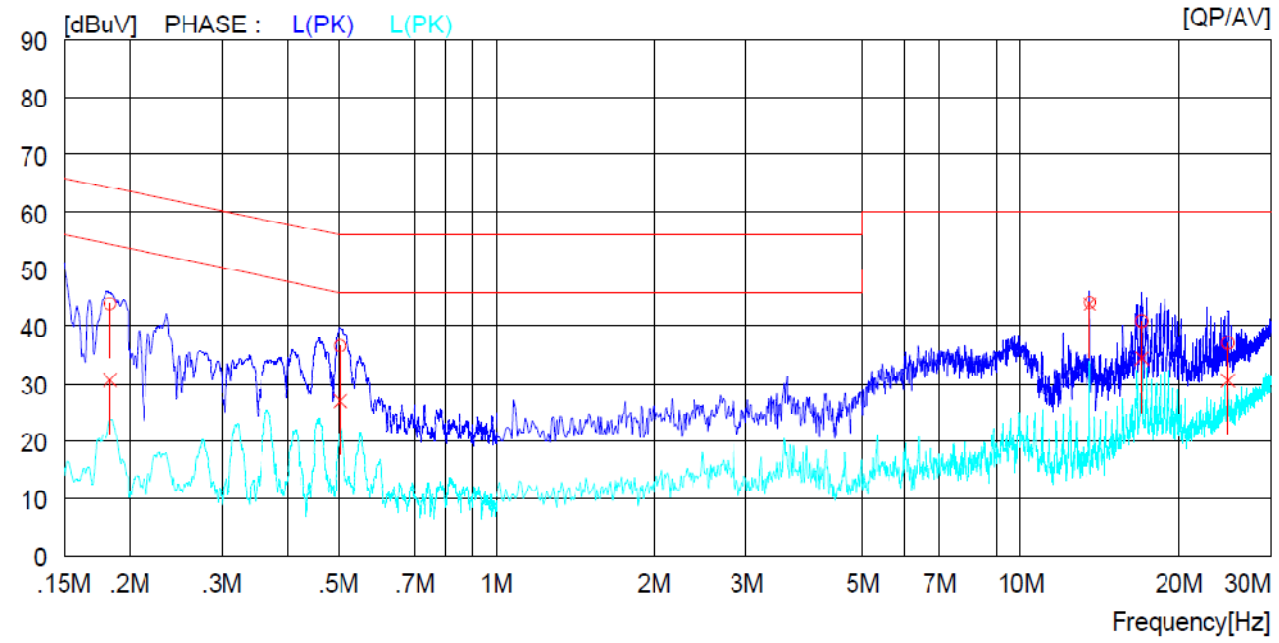


Plot of the Conducted Emissions - (Card type Mifare)

Neutral Line

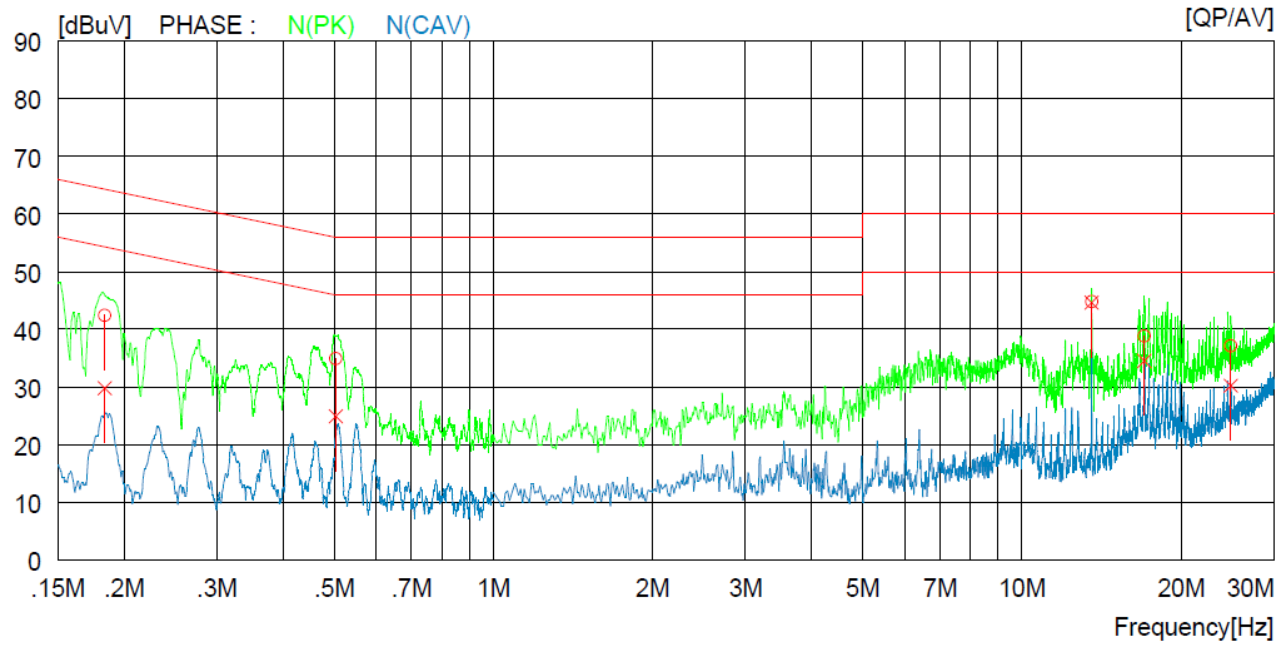


Live Line

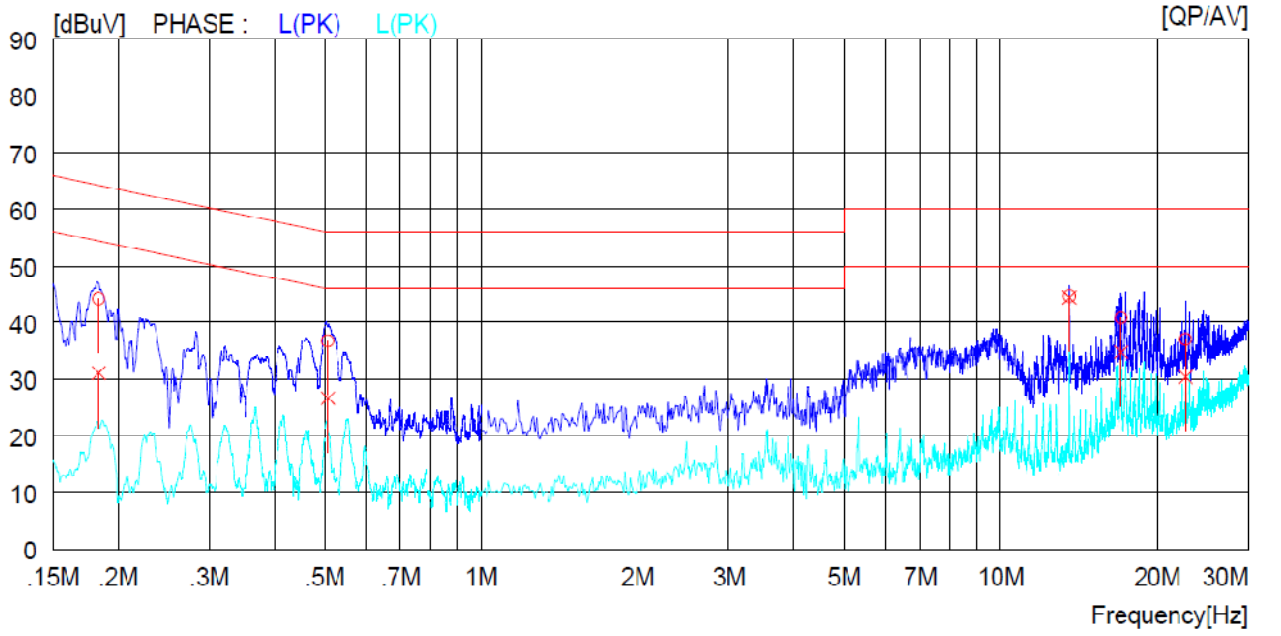


Plot of the Conducted Emissions - (Card type 15693)

Neutral Line

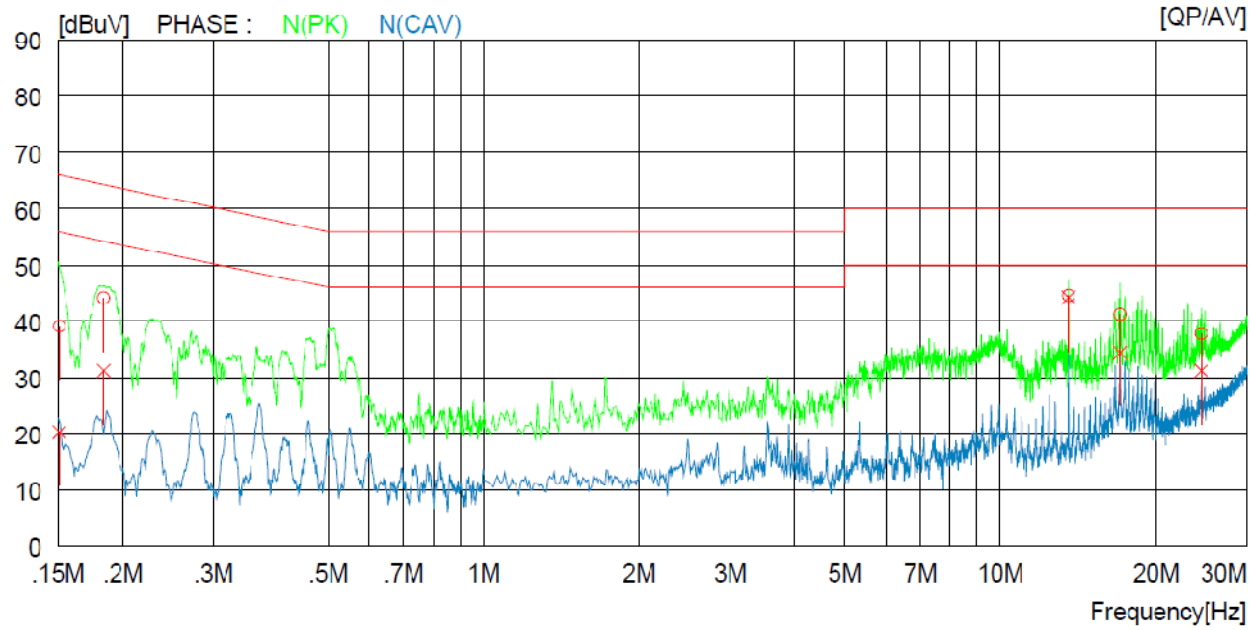


Live Line

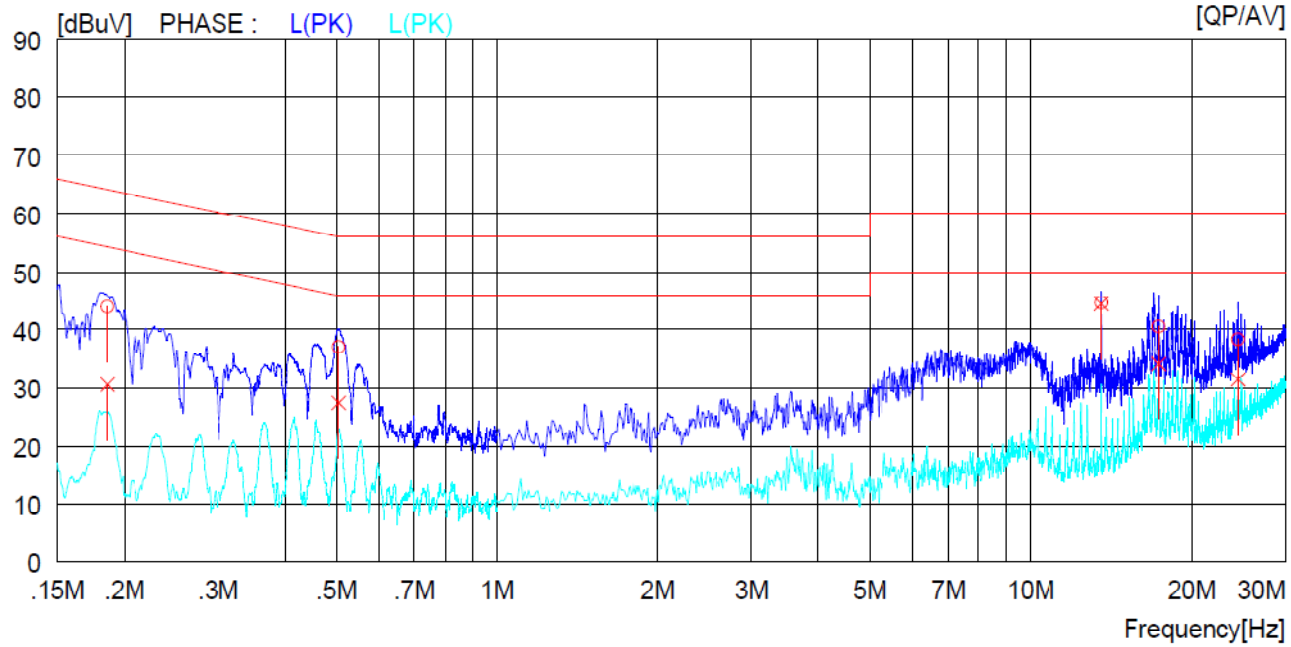


Plot of the Conducted Emissions - (Card type DESFire)

Neutral Line

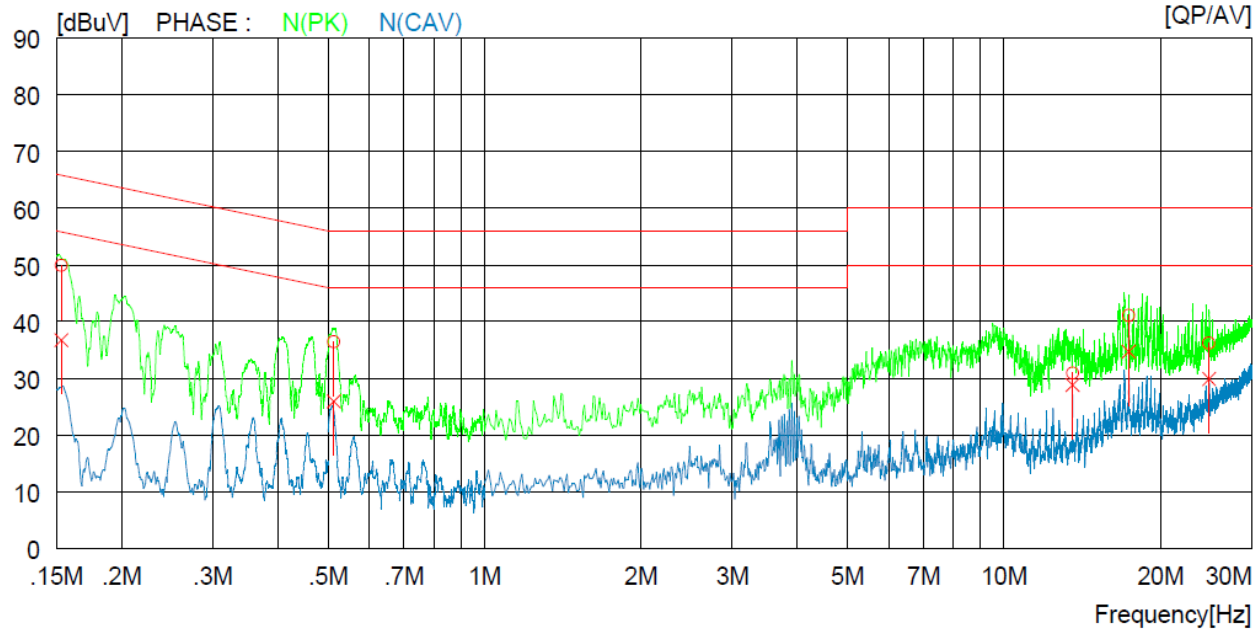
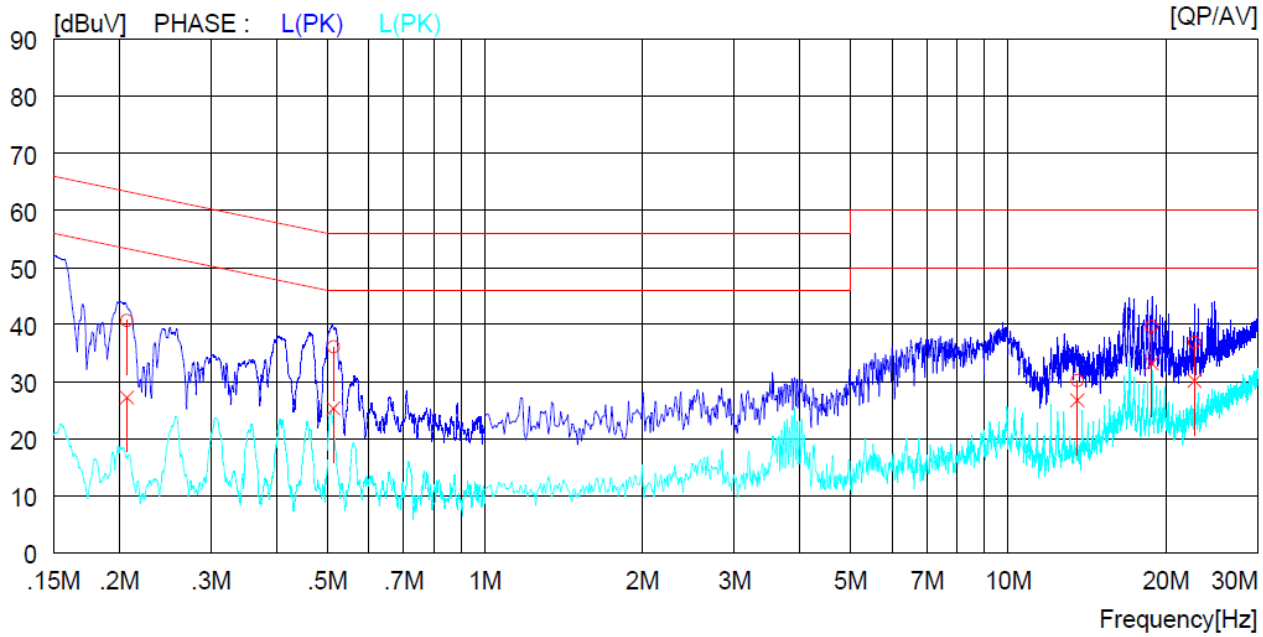


Live Line



Plot of the Conducted Emissions - (Ribbon tag)

Neutral Line



Live Line