

**FCC LISTED, REGISTRATION  
NUMBER: 905266**

**IC LISTED REGISTRATION NUMBER  
IC 4621A-1**

**AT4 wireless, S.A.**

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Registro Mercantil de Málaga, Tomo 1169,

Libro 82, Folio 133, Hoja MA3729

## TEST REPORT

### REFERENCE STANDARD:

**USA FCC Part 15.225, 15.207 and Part 15.209**

**NIE**..... : 38685RRF.001

Approved by  
(name / position & signature) ..... : A. Llamas / RF Lab. Manager

Elaboration date ..... : 2013-08-07

**Identification of item tested** ..... : NFC-Bluetooth Gateway

Trademark ..... : Sistelnetworks

Model and/or type reference ..... : SVW-10-1021B vWand Black/Aluminum

SVW-10-1021W vWand White/Aluminum

Serial number ..... : VWBBB000307

VWBBB000393

Other identification of the product ..... : Commercial name: VWAND

HW version: R1RD2

FCC ID: 2AAHG1

Features ..... : 3.7 V Rechargeable Li-ion battery, PCB antenna, 13.56 MHz band.

NFC peer-to-peer, read/write and card emulation modes.

Up to 75.000 NFC read/write actions with a battery charge.

Bluetooth 2.1 connectivity with the tablet or smartphone.

Low energy consumption and long battery duration.

Charging through micro-USB connector. Can be charged with virtually any micro-USB mobile charger.

Power on and charging indicator LEDs.

Description ..... : The vWand is an innovative NFC-Bluetooth Gateway designed to add NFC to smartphones and tablets in a natural way.

With the form factor of a marker, it features a soft rubber nib to interact with the touchscreen, and enables a variety of NFC applications.

**Applicant** ..... : SISTELNETWORKS S.L.

Address ..... : Ronda Narciso Monturiol 6, Dpcho. 109B, 46980 Paterna, Valencia SPAIN

CIF/NIF/Passport ..... : B98327489

Contact person: Jorge Marcos

Telephone / Fax ..... : +34961366533 / +34961318383

e-mail: ..... : Jorge.marcos@sistelnetworks.com

**Test samples supplier** ..... : Same as applicant

**Manufacturer** ..... : Same as applicant

Test method requested .....	See Standard																																																																																																																		
Standard .....	USA FCC Part 15.225 (10–1–11 Edition): Operation within the band 13.110 -14.010. USA FCC Part 15.209 (10–1–11 Edition): Radiated emission limits, general requirements USA FCC Part 15.207 (10–1–11 Edition): Conducted limits																																																																																																																		
Test procedure .....	PERF000 PEEM103																																																																																																																		
Non-standardized test method .....	N/A																																																																																																																		
Used instrumentation .....	<u>Conducted Measurements</u> <table border="1"> <thead> <tr> <th></th> <th></th> <th></th> <th></th> <th>Last Cal. date</th> <th>Cal. due date</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Spectrum analyser</td> <td>Agilent</td> <td>PSA E4440A</td> <td>2012/02</td> <td>2014/02</td> </tr> <tr> <td>2.</td> <td>Climatic chamber</td> <td>HERAEUS</td> <td>VM 07/100</td> <td>2012/10</td> <td>2015/10</td> </tr> <tr> <td>4.</td> <td>DC power supply</td> <td>R&amp;S</td> <td>NGPE 40/40</td> <td>2011/11</td> <td>2014/11</td> </tr> <tr> <td>5.</td> <td>EMI Test Receiver</td> <td>R&amp;S</td> <td>ESU40</td> <td>2012/03</td> <td>2014/03</td> </tr> <tr> <td>6.</td> <td>Transient limiter.</td> <td>HP</td> <td>11947A</td> <td>2012/09</td> <td>2014/09</td> </tr> <tr> <td>7.</td> <td>Line Impedance Stabilization Network (L.I.S.N.)</td> <td>R&amp;S.</td> <td>ESH2-Z5</td> <td>2013/01</td> <td>2015/01</td> </tr> </tbody> </table> <u>Radiated Measurements</u> <table border="1"> <thead> <tr> <th></th> <th></th> <th></th> <th></th> <th>Last Cal. date</th> <th>Cal. due date</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Semianechoic Absorber Lined Chamber</td> <td></td> <td>IR 11. BS</td> <td>N.A.</td> <td>N.A.</td> </tr> <tr> <td>2.</td> <td>Control Chamber</td> <td></td> <td>IR 12.BC</td> <td>N.A.</td> <td>N.A.</td> </tr> <tr> <td>3.</td> <td>Hybrid Bilog antenna</td> <td>Sunol Sciences Corporation</td> <td>JB6</td> <td>2011/05</td> <td>2014/05</td> </tr> <tr> <td>4.</td> <td>Antenna mast</td> <td>EM</td> <td>1072 NMT</td> <td>N.A.</td> <td>N.A.</td> </tr> <tr> <td>5.</td> <td>Rotating table</td> <td>EM</td> <td>1084-4. ON</td> <td>N.A.</td> <td>N.A.</td> </tr> <tr> <td>6.</td> <td>Loop antenna</td> <td>HP</td> <td>1196 A.</td> <td>2011/10</td> <td>2013/10</td> </tr> <tr> <td>7.</td> <td>EMI Test Receiver</td> <td>R&amp;S</td> <td>ESU40</td> <td>2012/03</td> <td>2014/03</td> </tr> <tr> <td>8.</td> <td>Multi Device Controller</td> <td>EMCO</td> <td>2090</td> <td>N.A.</td> <td>N.A.</td> </tr> <tr> <td>10.</td> <td>RF pre-amplifier</td> <td>Schaffner</td> <td>CPA 9232.</td> <td>2011/06</td> <td>2013/06</td> </tr> <tr> <td>11.</td> <td>Antenna tripod</td> <td>EMCO</td> <td>11968C.</td> <td>N.A.</td> <td>N.A.</td> </tr> <tr> <td>12.</td> <td>Spectrum analyser</td> <td>Agilent</td> <td>PSA E4440A</td> <td>2012/02</td> <td>2014/02</td> </tr> </tbody> </table>					Last Cal. date	Cal. due date	1.	Spectrum analyser	Agilent	PSA E4440A	2012/02	2014/02	2.	Climatic chamber	HERAEUS	VM 07/100	2012/10	2015/10	4.	DC power supply	R&S	NGPE 40/40	2011/11	2014/11	5.	EMI Test Receiver	R&S	ESU40	2012/03	2014/03	6.	Transient limiter.	HP	11947A	2012/09	2014/09	7.	Line Impedance Stabilization Network (L.I.S.N.)	R&S.	ESH2-Z5	2013/01	2015/01					Last Cal. date	Cal. due date	1.	Semianechoic Absorber Lined Chamber		IR 11. BS	N.A.	N.A.	2.	Control Chamber		IR 12.BC	N.A.	N.A.	3.	Hybrid Bilog antenna	Sunol Sciences Corporation	JB6	2011/05	2014/05	4.	Antenna mast	EM	1072 NMT	N.A.	N.A.	5.	Rotating table	EM	1084-4. ON	N.A.	N.A.	6.	Loop antenna	HP	1196 A.	2011/10	2013/10	7.	EMI Test Receiver	R&S	ESU40	2012/03	2014/03	8.	Multi Device Controller	EMCO	2090	N.A.	N.A.	10.	RF pre-amplifier	Schaffner	CPA 9232.	2011/06	2013/06	11.	Antenna tripod	EMCO	11968C.	N.A.	N.A.	12.	Spectrum analyser	Agilent	PSA E4440A	2012/02	2014/02
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## Competences and guarantees

AT4 wireless is a laboratory with a measurement facility in compliance with the requirements of Section 2.948 of the FCC rules and has been added to the list of facilities whose measurements data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Registration Number: 905266.

AT4 wireless is a laboratory with a measurement site in compliance with the requirements of RSS 212, Issue 1 (Provisional) and has been added to the list of filed sites of the Canadian Certification and Engineering Bureau. Reference File Number: IC 4621A-1.

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

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

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

## General conditions

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

## Uncertainty

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

PODT000: Procedimiento para el cálculo de incertidumbres de medida.

## Usage of samples

Samples undergoing test have been selected by: **the client**.

Sample M/01 is composed of the following elements:

<u>Control N°</u>	<u>Description</u>	<u>Model</u>	<u>Serial N°</u>	<u>Date of reception</u>
38685D/01	RFID device with integral antenna	SVW-10-1021W vWand White/Aluminum	VWBBB000393	24/04/2013

Sample M/02 is composed of the following elements:

<u>Control N°</u>	<u>Description</u>	<u>Model</u>	<u>Serial N°</u>	<u>Date of reception</u>
38685D/01	RFID device with integral antenna	SVW-10-1021W vWand White/Aluminum	VWBBB000393	24/04/2013
38685D/06	USB cable	---	---	24/04/2013

1. Sample M/01 has undergone following test(s).  
All tests indicated in appendix A and B.
2. Samples M/02 has undergone the next test(s):  
Continuous conducted emission, power leads, in appendix B.

## Testing period

The performed test started on 2013-04-26 and finished on 2013-05-03.

The tests have been performed at AT4 wireless.

## Environmental conditions

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

Temperature	Min. = 21.4 °C Max. = 22.3 °C
Relative humidity	Min. = 45.8 % Max. = 46.3 %
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 0,5 Ω

In the semianechoic chamber (21 meters x 11 meters x 8 meters), the following limits were not exceeded during the test.

Temperature	Min. = 21.1 °C Max. = 22.4 °C
Relative humidity	Min. = 45 % Max. = 46 %
Air pressure	Min. = 1018 mbar Max. = 1018 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 0,5 Ω
Normal site attenuation (NSA)	< ±4 dB at 10 m distance between item under test and receiver antenna, (30 MHz to 1000 MHz)
Field homogeneity	More than 75% of illuminated surface is between 0 and 6 dB (26 MHz to 1000 MHz).

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

Temperature	Min. = 23.7 °C Max. = 25.3 °C
Relative humidity	Min. = 43.1 % Max. = 45.7 %
Air pressure	Min. = 1020 mbar Max. = 1020 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 0,5 Ω

## Summary

Considering the results of the performed test according to standard USA FCC Parts 15.225, 15.207 and 15.209, the item under test is **IN COMPLIANCE** with the requested specifications specified in the standard.

NOTE: The results presented in this Test Report apply only to the particular item under test established in page 1 of this document, as presented for test on the date(s) shown in section, "USAGE OF SAMPLES, TESTING PERIOD AND ENVIRONMENTAL CONDITIONS".

## Remarks and comments

None.

### Testing verdicts

Not applicable .....: NA  
 Pass.....: P  
 Fail .....: F  
 Not measured.....: NM

FCC PART 15 PARAGRAPH	VERDICT			
	NA	P	F	NM
15.225 Subclause (a). Field strength of emissions within the band 13.553 MHz - 13.567 MHz		P		
15.225 Subclause (b). Field strength of emissions within the band 13.410 - 13.553 MHz and 13.567 – 13.710 MHz		P		
15.225 Subclause (c). Field strength of emissions within the band 13.110 - 13.410 MHz and 13.710 – 14.010 MHz		P		
15.225 Subclause (d). Field strength of emissions outside of the band 13.110 MHz -14.010 MHz		P		
15.225 Subclause (e). Frequency tolerance of the carrier signal		P		
15.207. Conducted limits		P		

## **APPENDIX A: Test result**



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## TEST CONDITIONS

Power supply (V):

$$V_{\text{nominal}} = 3.7 \text{ Vdc}$$

Type of power supply = DC voltage from rechargeable Li-Ion battery.

Type of antenna = Integral antenna

Operating Temperature Range (°C):

$$T_n = +15 \text{ to } +35$$

### TEST FREQUENCIES:

Nominal Operating frequency: 13.56 MHz

The equipment can operate with 6 different possible modes:

Mifare at 106 kbps

Mifare at 212 kbps

Mifare at 424 kbps

Mifare at 848 kbps

Felica at 212 kbps

Felica at 424 kbps

### CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is connected to the spectrum analyser.

### RADIATED MEASUREMENTS

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Loop antenna for the range between 9 kHz to 30 MHz and Bilog antenna for the range between 30 MHz to 200 MHz) is situated at a distance of 3 m.

For radiated emissions in the range 9 kHz to 30 MHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 40 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive (wooden) platform one meter above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and in the range between 30 MHz and 200 MHz the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

In the range between 9 kHz and 30 MHz the measurements were made in the three different orientation planes of the loop antenna to determine the maximum received field.

In the range between 30 MHz and 200 MHz the measurements were made in both horizontal and vertical planes of polarization.

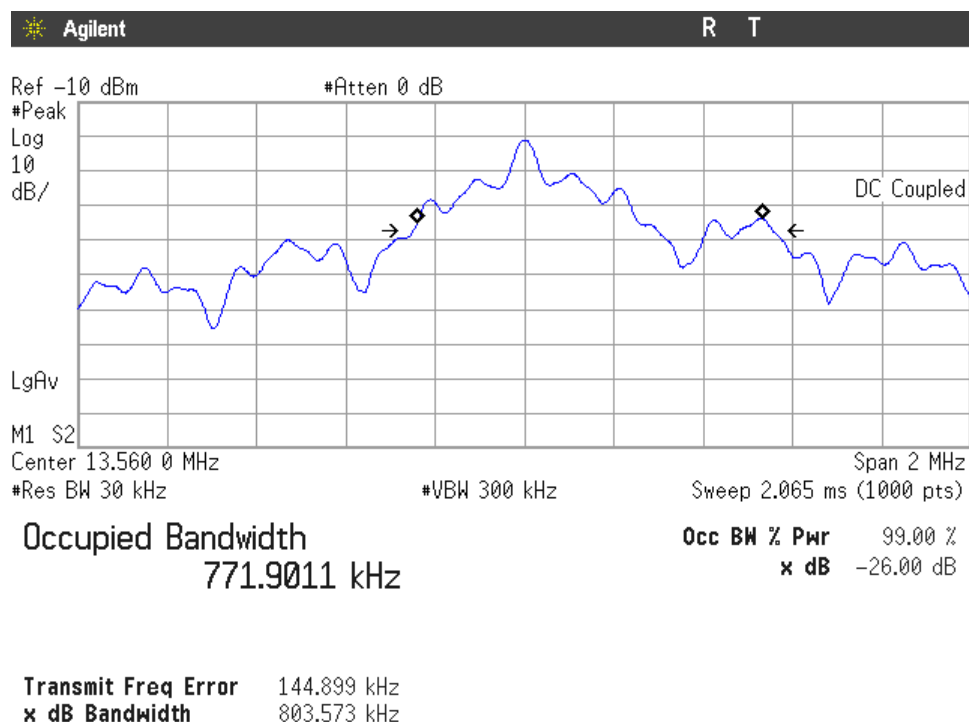
## Occupied Bandwidth

### RESULTS

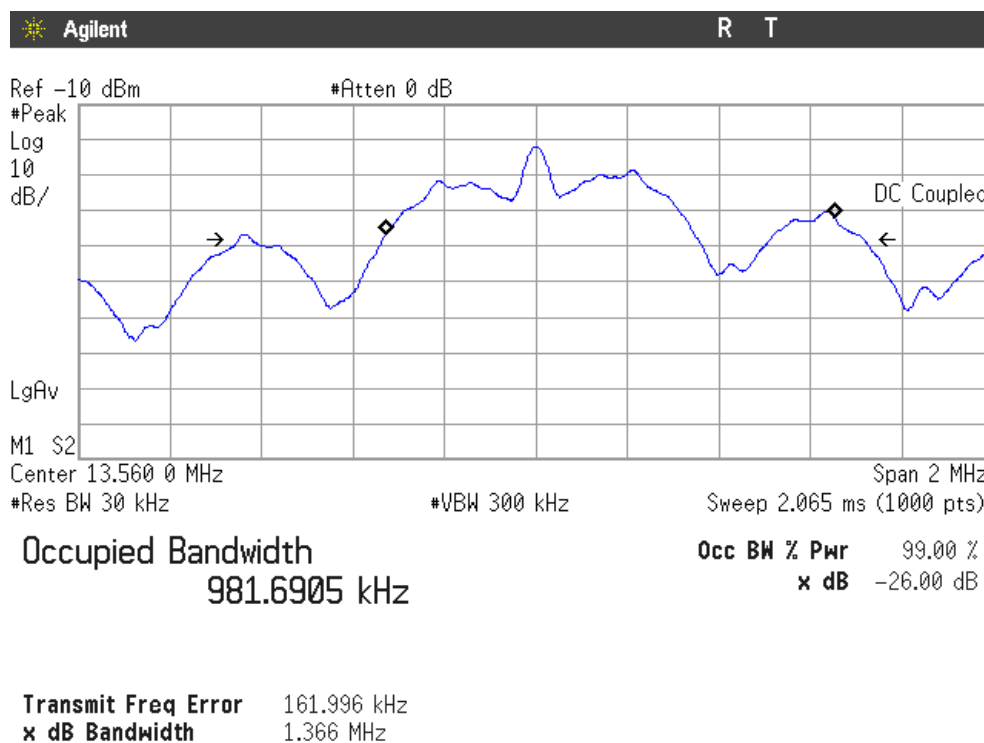
99 % Occupied Bandwidth and 26 dB Bandwidth (see next plot).

Operation mode	99% occupied bandwidth (kHz)	26 dB Spectrum bandwidth (kHz)
Mifare at 106 kbps	771.90	803.57
Mifare at 212 kbps	981.69	1366.00
Mifare at 424 kbps	1656.80	1886.00
Mifare at 828 kbps	2070.00	2124.00
Felica at 212 kbps	366.48	35.00
Felica at 424 kbps	583.20	36.54
Measurement uncertainty (Hz)	$\pm 16$	

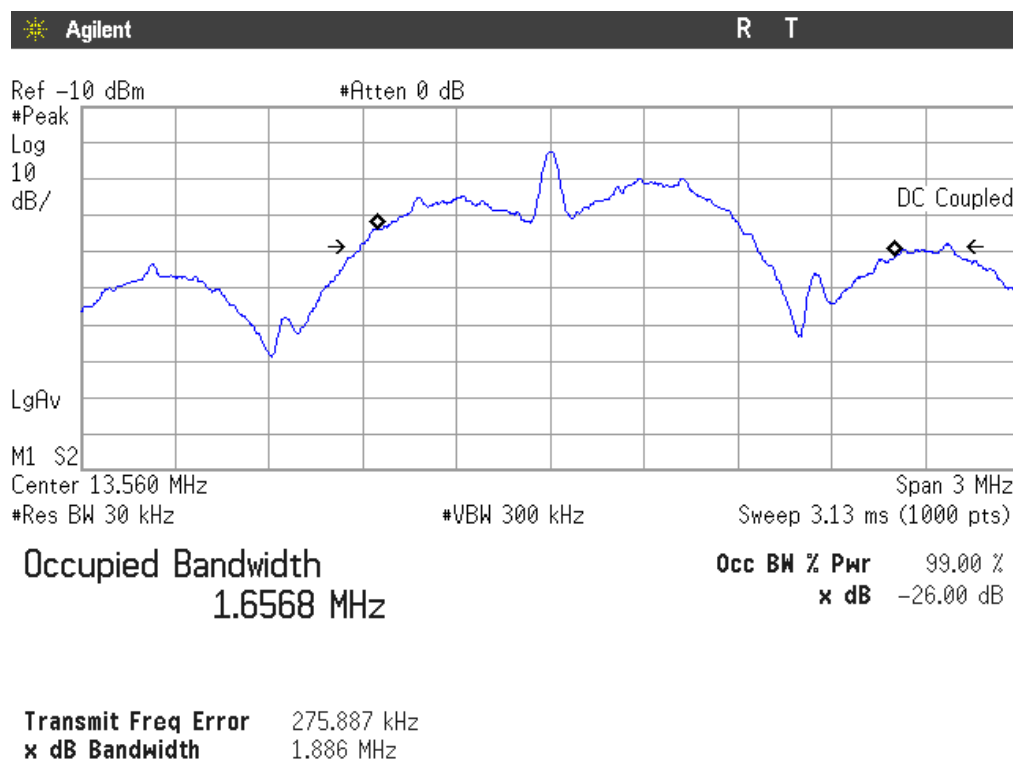
Operation mode: Mifare at 106 kbps



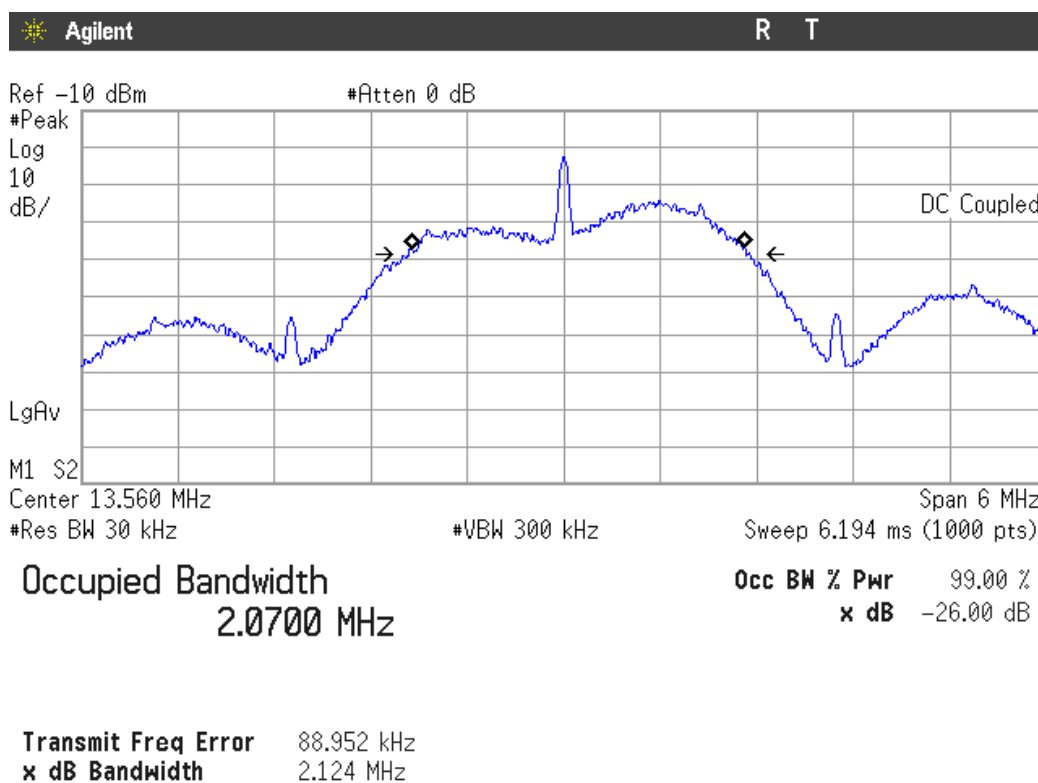
Operation mode: Mifare at 212 kbps



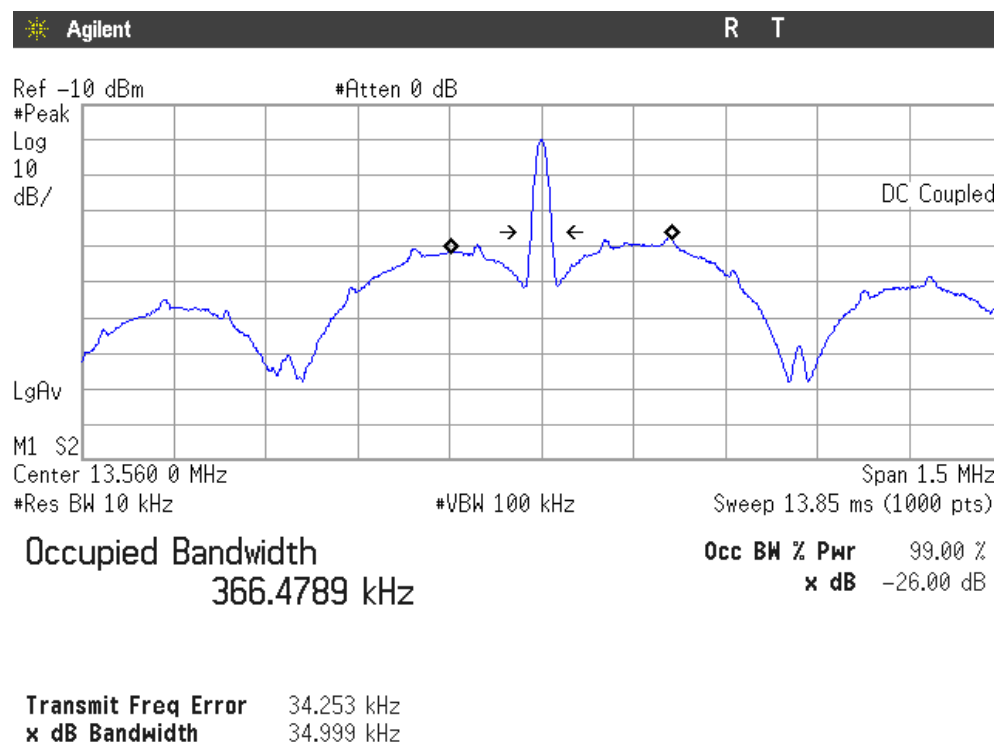
Operation mode: Mifare at 424 kbps



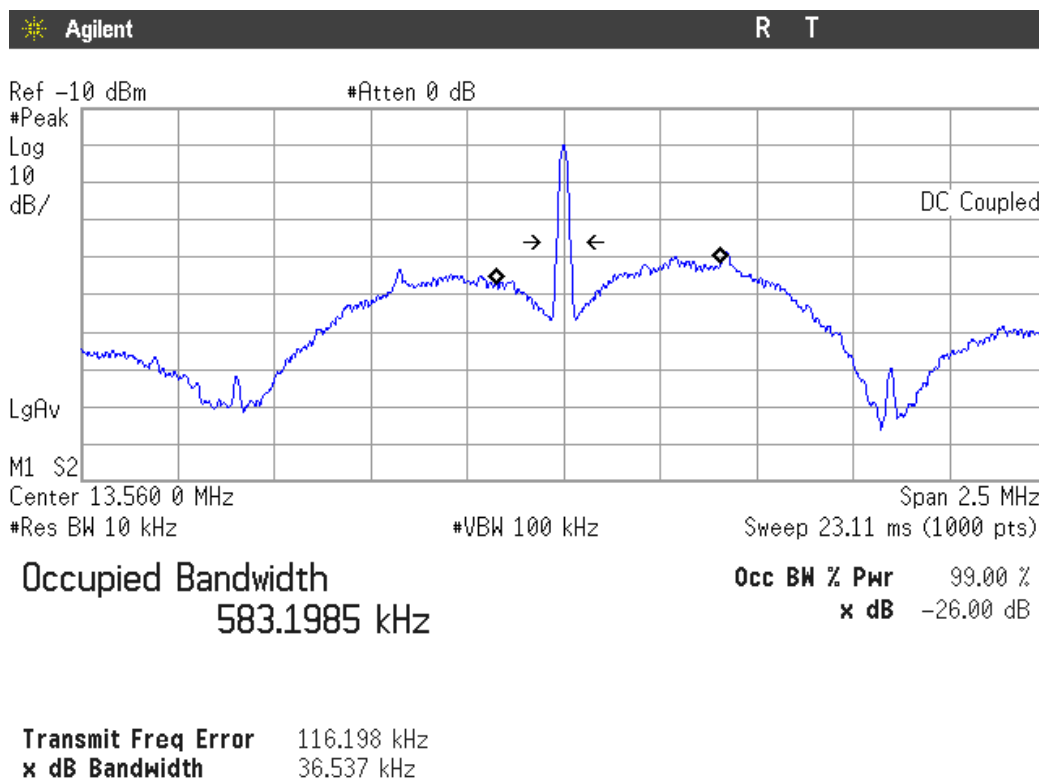
Operation mode: Mifare at 848 kbps



Operation mode: Felica at 212 kbps



Operation mode: Felica at 424 kbps



## Section 15.225 Subclause (a). Field strength of emissions within the band 13.553 MHz -13.567 MHz

### SPECIFICATION

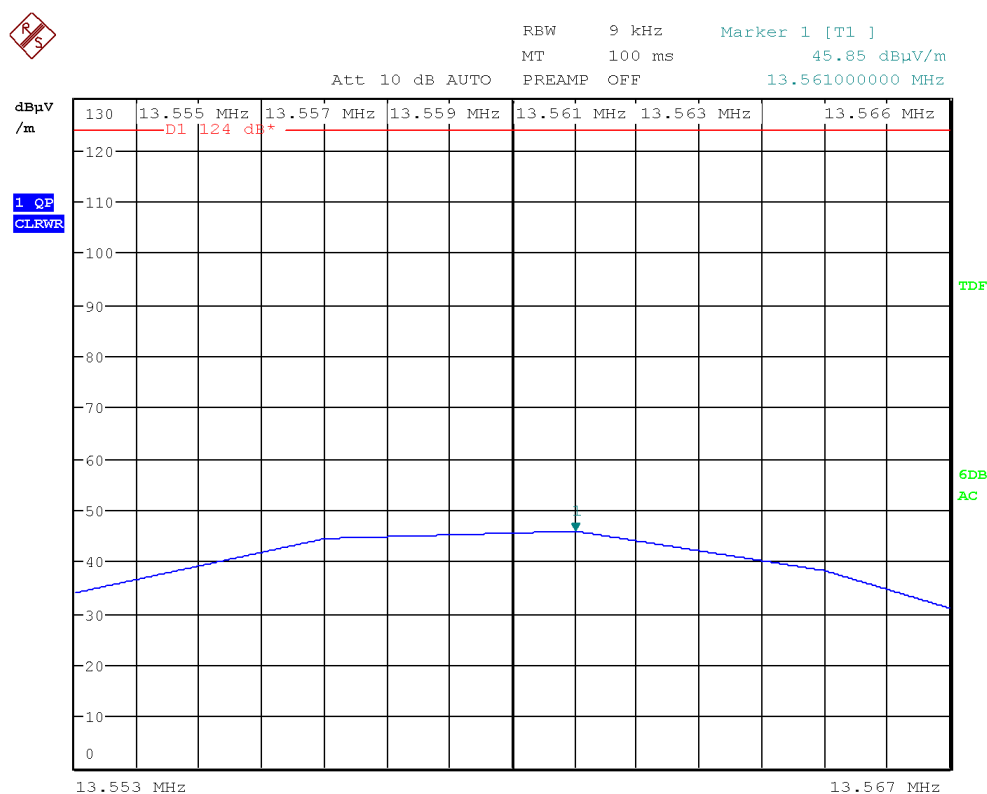
The field strength of any emissions within the band 13.553 – 13.567 MHz shall not exceed 15,848 microvolts/meter (84 dB $\mu$ V/m) at 30 meters.

### RESULTS

Measurement distance: 3 meters

1. Operation mode: Mifare.

A preliminary scan determined that the worst case is for 212 kbps bit rate.



Note: The limit shown in the above plot is extrapolated to 3 meters

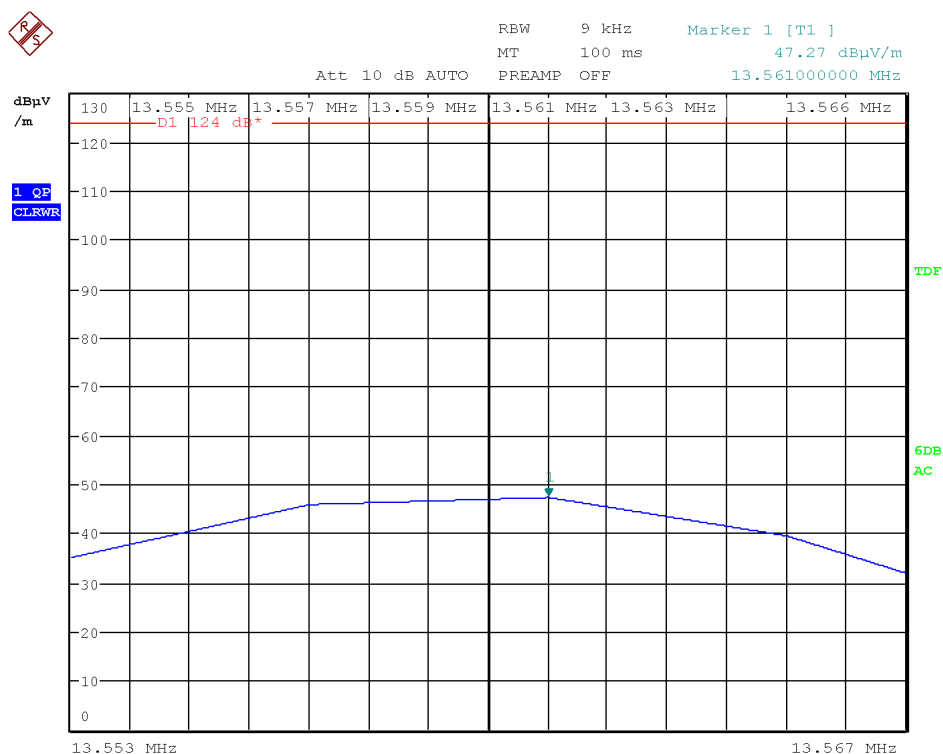
Frequency (MHz)	Maximum field strength (dB $\mu$ V/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dB $\mu$ V/m) extrapolated to 30 m (40 dB/decade)
13.561	45.85	5.85
Measurement uncertainty (dB)	$\pm 3.2$	

Verdict: PASS



## 2. Operation mode: Felica.

A preliminary scan determined that the worst case is for 212 kbps bit rate.



Note: The limit shown in the above plot is extrapolated to 3 meters

Frequency (MHz)	Maximum field strength (dBμV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBμV/m) extrapolated to 30 m (40 dB/decade)
13.561	47.27	7.27
Measurement uncertainty (dB)	±3.2	

Verdict: PASS

## Section 15.225 Subclause (b). Field strength of emissions within the band 13.410 MHz -13.553 MHz and 13.567 MHz -13.710 MHz

### SPECIFICATION

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 (50.47 dB $\mu$ V/m) at 30 meters.

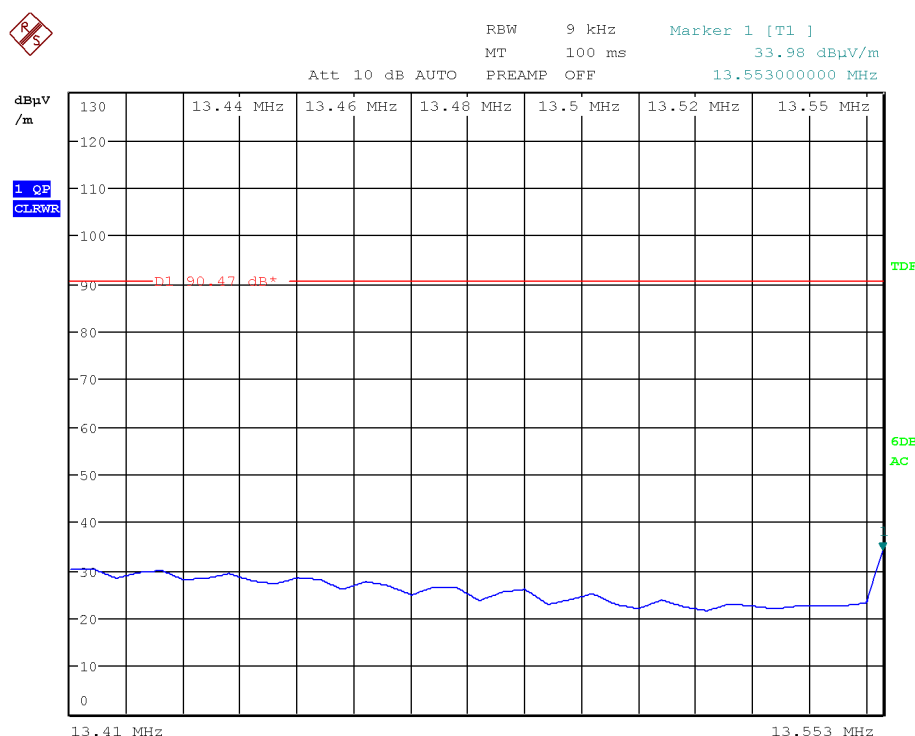
### RESULTS

#### Band 13.410-13.553 MHz

Measurement distance: 3 meters

1. Operation mode: Mifare.

A preliminary scan determined that the worst case is for 212 kbps bit rate.



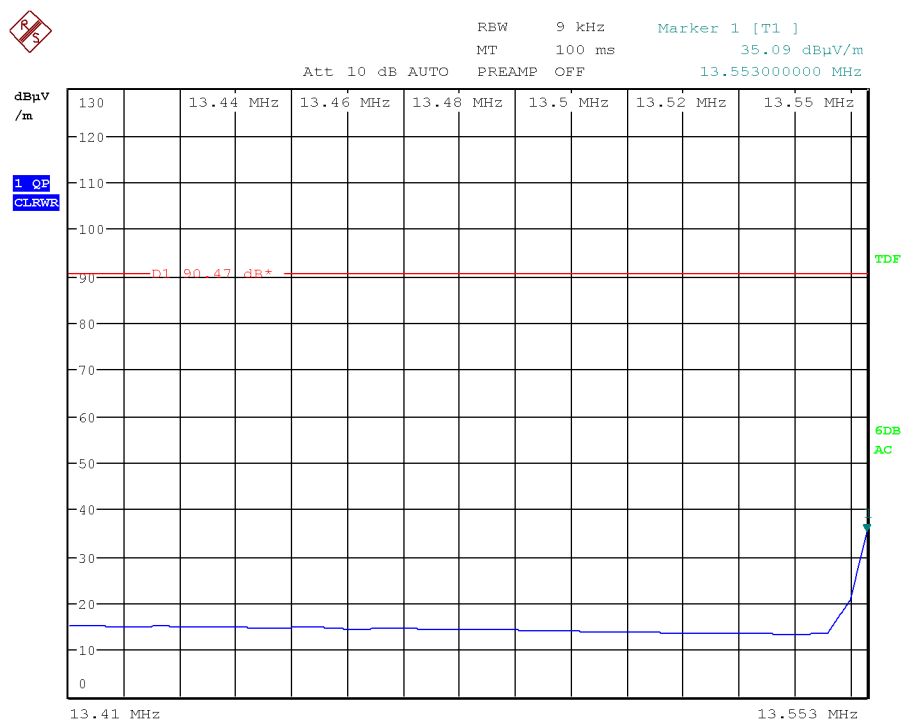
Note: The limit shown in the above plot is extrapolated to 3 meters

Frequency (MHz)	Maximum field strength (dB $\mu$ V/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dB $\mu$ V/m) extrapolated to 30 m (40 dB/decade)
13.553	33.98	-6.02
Measurement uncertainty (dB)	$\pm 3.2$	

Verdict: PASS

## 2. Operation mode: Felica.

A preliminary scan determined that the worst case is for 212 kbps bit rate.



Note: The limit shown in the above plot is extrapolated to 3 meters

Frequency (MHz)	Maximum field strength (dBμV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBμV/m) extrapolated to 30 m (40 dB/decade)
13.553	35.09	-4.91
Measurement uncertainty (dB)	±3.2	

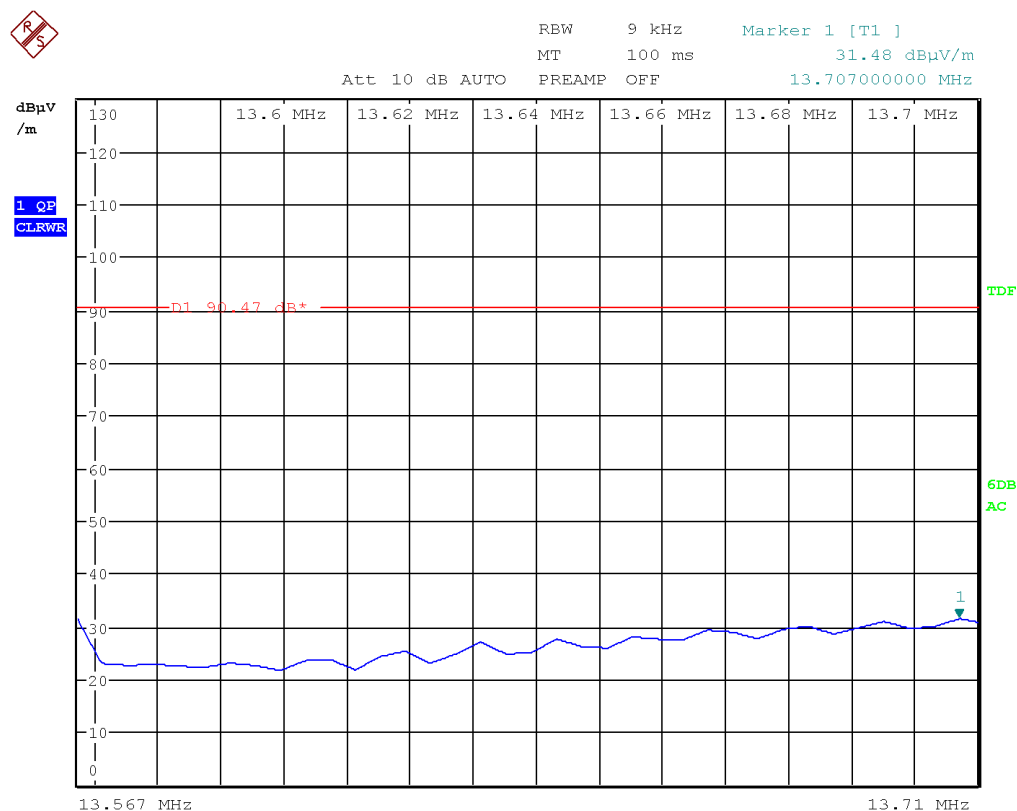
Verdict: PASS

## Band 13.567-13.710 MHz

Measurement distance: 3 meters

1. Operation mode: Mifare.

A preliminary scan determined that the worst case is for 212 kbps bit rate.



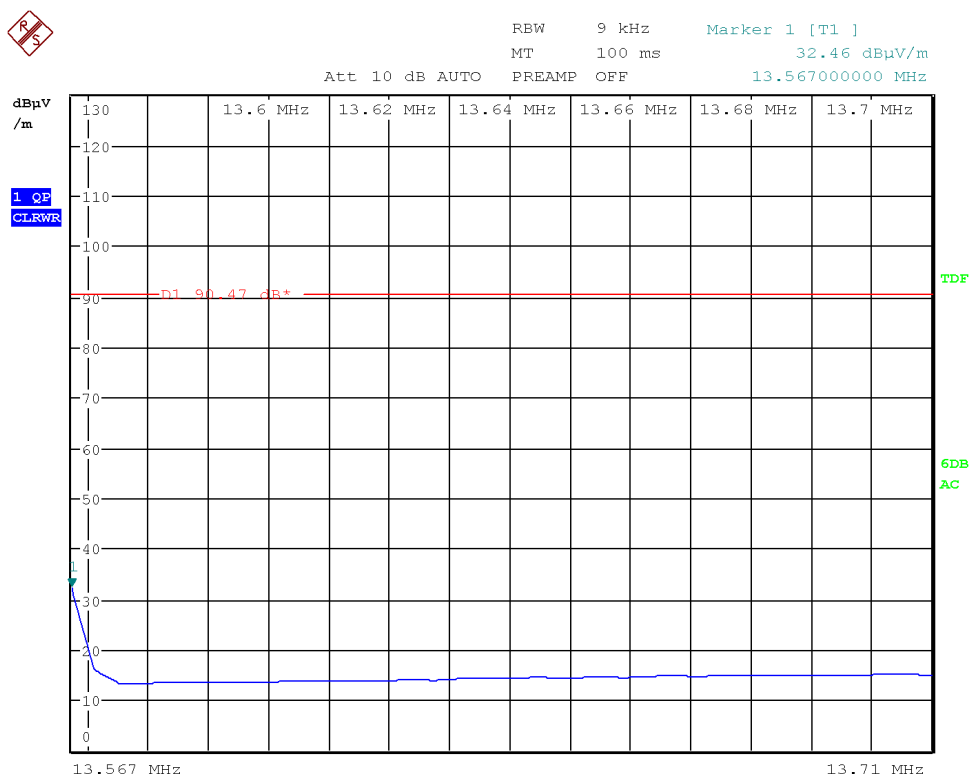
Note: The limit shown in the above plot is extrapolated to 3 meters

Frequency (MHz)	Maximum field strength (dBμV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBμV/m) extrapolated to 30 m (40 dB/decade)
13.707	31.48	-8.52
Measurement uncertainty (dB)	±3.2	

Verdict: PASS

2. Operation mode: Felica.

A preliminary scan determined that the worst case is for 212 kbps bit rate.



Note: The limit shown in the above plot is extrapolated to 3 meters

Frequency (MHz)	Maximum field strength (dBμV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBμV/m) extrapolated to 30 m (40 dB/decade)
13.567	32.46	-7.54
Measurement uncertainty (dB)	±3.2	

Verdict: PASS

## Section 15.225 Subclause (c). Field strength of emissions within the band 13.110 MHz -13.410 MHz and 13.710 MHz -14.010 MHz

### SPECIFICATION

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 (40.51 dBμV/m) at 30 meters.

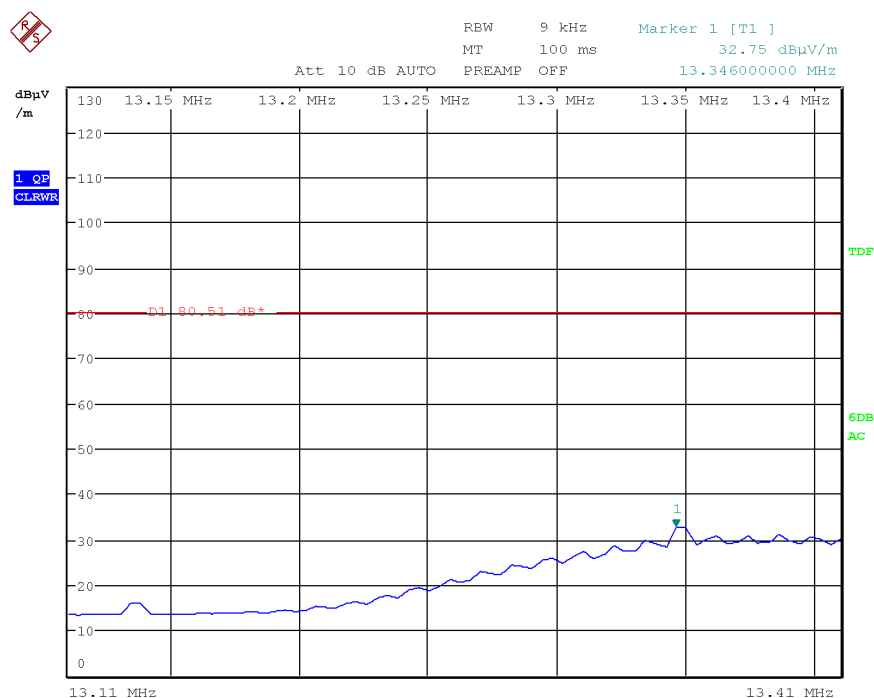
### RESULTS

#### Band 13.110-13.410 MHz

Measurement distance: 3 meters

1. Operation mode: Mifare.

A preliminary scan determined that the worst case is for 212 kbps bit rate.



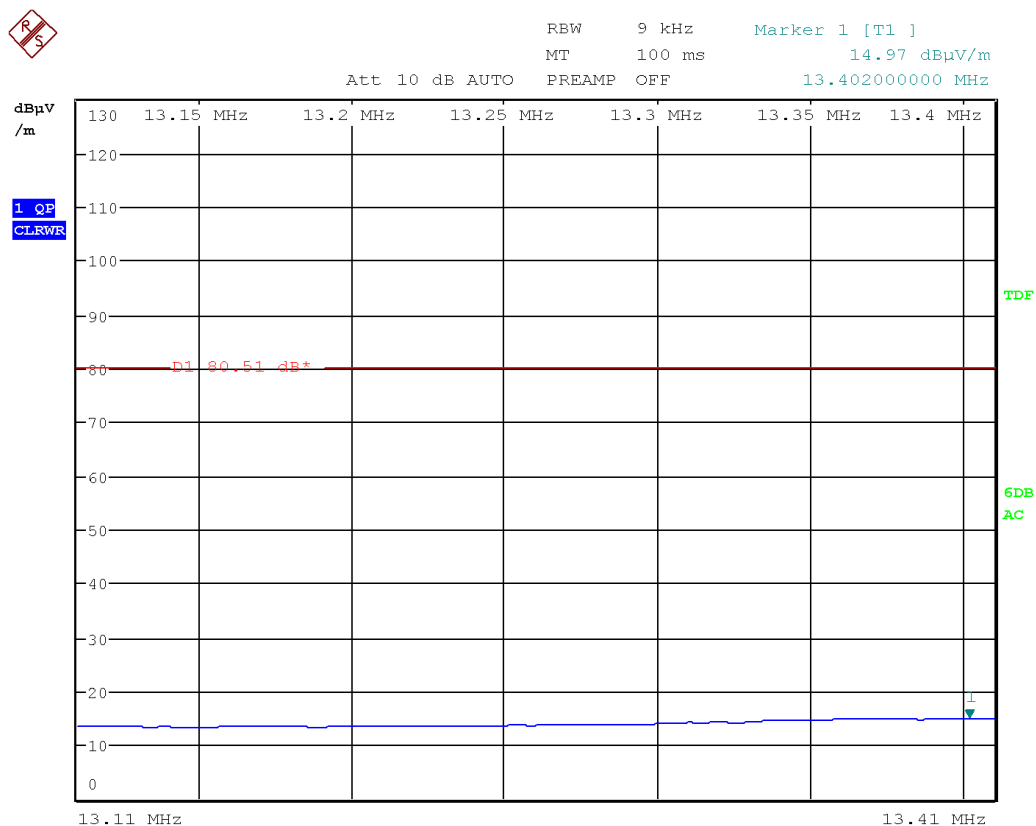
Note: The limit shown in the above plot is extrapolated to 3 meters

Frequency (MHz)	Maximum field strength (dBμV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBμV/m) extrapolated to 30 m (40 dB/decade)
13.346	32.75	-7.25
Measurement uncertainty (dB)	±3.2	

Verdict: PASS

## 2. Operation mode: Felica.

A preliminary scan determined that the worst case is for 212 kbps bit rate.



Note: The limit shown in the above plot is extrapolated to 3 meters

Frequency (MHz)	Maximum field strength (dBμV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBμV/m) extrapolated to 30 m (40 dB/decade)
13.402	14.97	-25.03
Measurement uncertainty (dB)	±3.2	

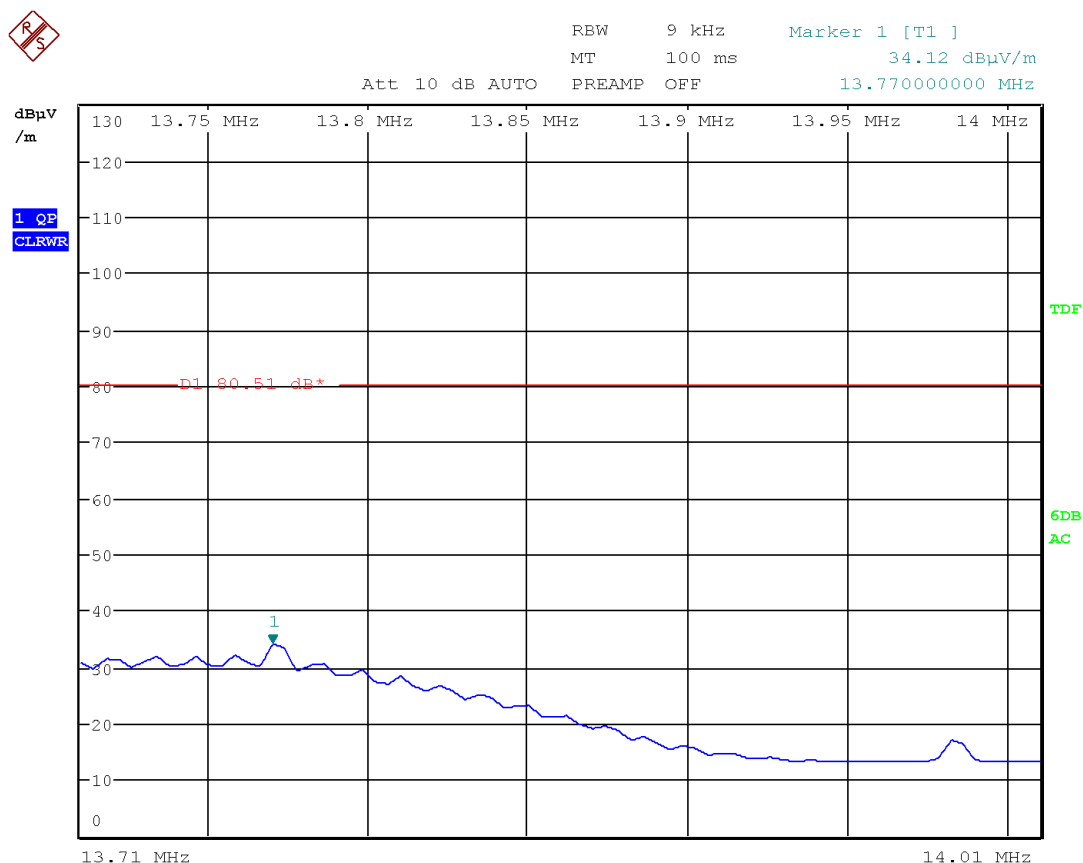
Verdict: PASS

## Band 13.710-14.010 MHz

Measurement distance: 3 meters

1. Operation mode: Mifare.

A preliminary scan determined that the worst case is for 212 kbps bit rate.



Note: The limit shown in the above plot is extrapolated to 3 meters

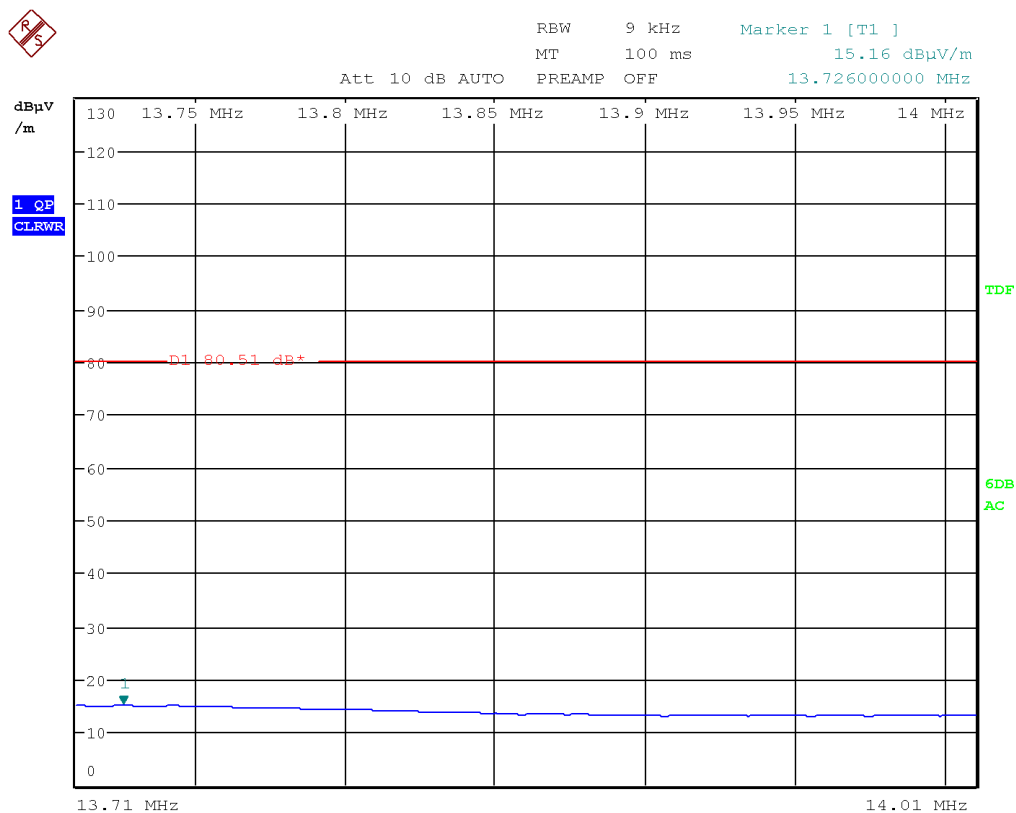
Frequency (MHz)	Maximum field strength (dBμV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBμV/m) extrapolated to 30 m (40 dB/decade)
13.770	34.12	-5.88
Measurement uncertainty (dB)	±3.2	

Verdict: PASS



2. Operation mode: Felica.

A preliminary scan determined that the worst case is for 212 kbps bit rate.



Note: The limit shown in the above plot is extrapolated to 3 meters

Frequency (MHz)	Maximum field strength (dBμV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBμV/m) extrapolated to 30 m (40 dB/decade)
13.726	15.16	-24.84
Measurement uncertainty (dB)	±3.2	

Verdict: PASS

**Section 15.225 Subclause (d). Field strength of emissions outside of the band 13.110 MHz -14.010 MHz**

**SPECIFICATION**

Field strength of any emissions appearing outside of the band 13.110 MHz - 14.010 MHz band shall not exceed the general radiated emission limits in 15.209:

Frequency Range (MHz)	Field strength ( $\mu\text{V/m}$ )	Field strength ( $\text{dB}\mu\text{V/m}$ )	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	300
1.705 - 30.0	30	29.54	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

**RESULTS:**

All tests were performed in a semi-anechoic chamber at a distance of 3 m.

The spectrum was inspected from 9 kHz to 200 MHz searching for spurious signals.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyser. This correction factor includes antenna factor, cable loss and pre-amplifier gain.

**Frequency range 9 kHz-30 MHz.**

No spurious signals were found for both Mifare and Felica operation modes.

### Frequency range 30 MHz-200 MHz

1. Operation mode: Mifare.

A preliminary scan determined that the worst case is for 212 kbps bit rate.

Spurious levels closest to the limit

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBμ V/m)	Measurement Uncertainty (dB)
35.115	V	Quasi-Peak	22.60	± 3.8
40.047	V	Quasi-Peak	25.47	± 3.8
49.418	V	Quasi-Peak	21.60	± 3.8

2. Operation mode: Felica.

A preliminary scan determined that the worst case is for 212 kbps bit rate.

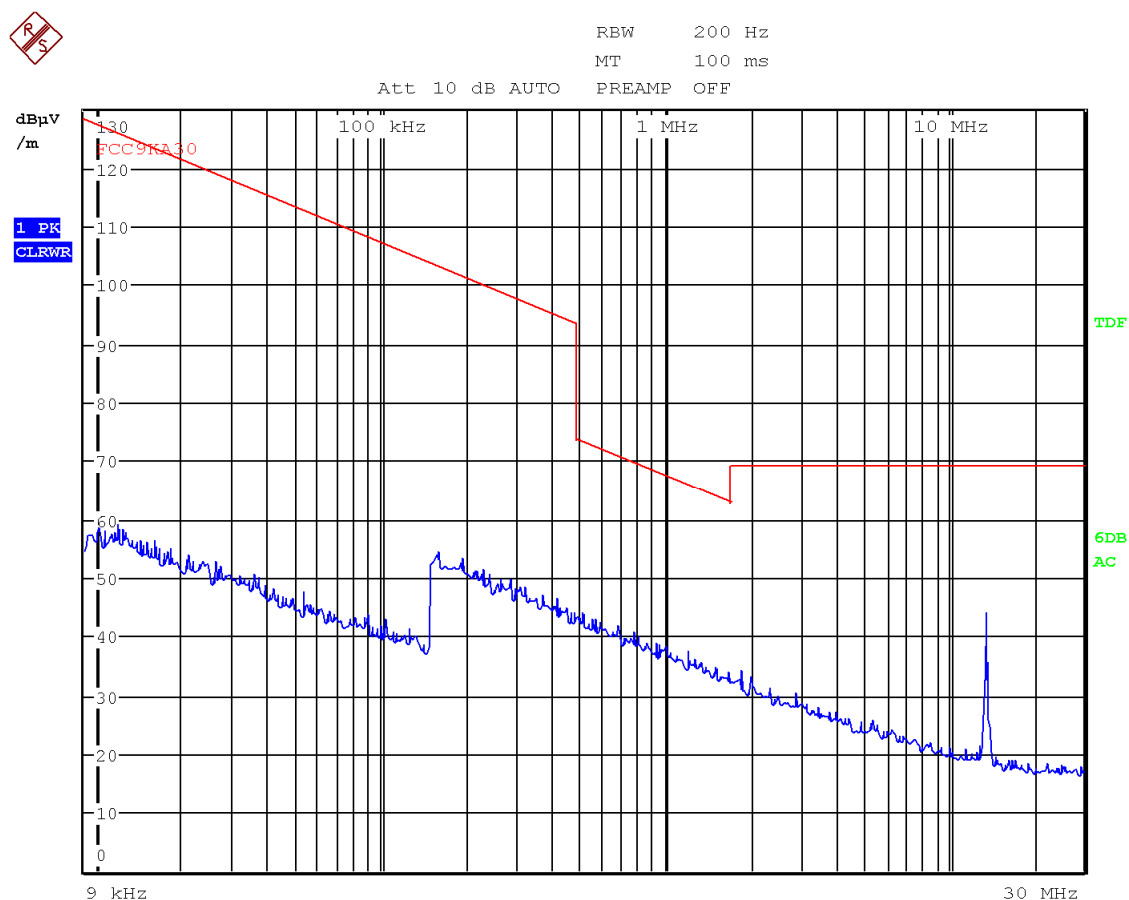
Spurious levels closest to the limit

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBμ V/m)	Measurement Uncertainty (dB)
34.765	V	Quasi-Peak	21.60	± 3.8
40.047	V	Quasi-Peak	25.08	± 3.8
51.954	V	Quasi-Peak	21.54	± 3.8
65.064	V	Quasi-Peak	20.05	± 3.8

Verdict: PASS

FREQUENCY RANGE 9 kHz-30 MHz.

1. Operation mode: Mifare 212 kbps.



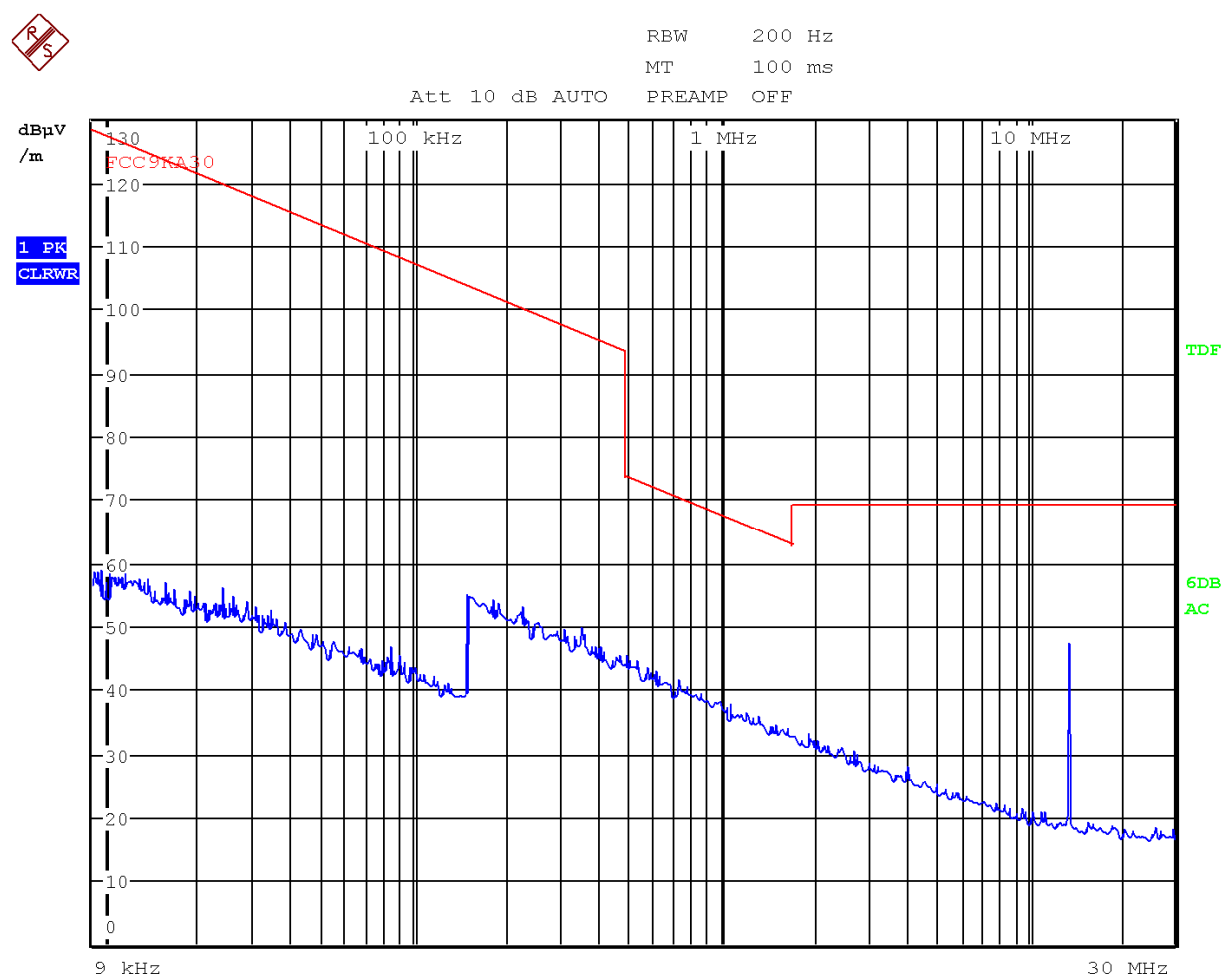
Resolution bandwidth:

200 Hz for  $9 \text{ kHz} \leq f \leq 150 \text{ kHz}$

9 kHz for  $150 \text{ kHz} \leq f \leq 30 \text{ MHz}$

Note: The limits shown in the above plot are extrapolated to 3 meters. The highest peak corresponds to the carrier level.

## 2. Operation mode: Felica 212 kbps.



Resolution bandwidth:

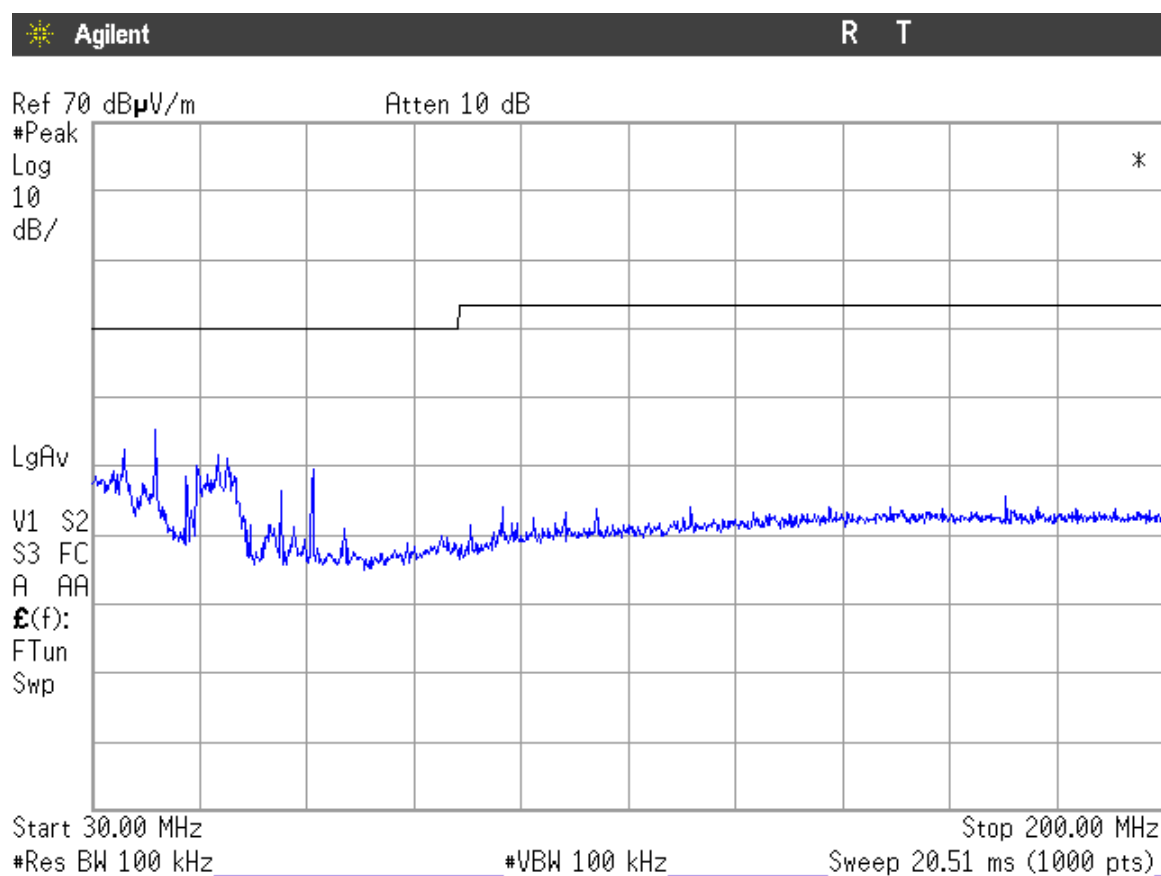
200 Hz for  $9 \text{ kHz} \leq f \leq 150 \text{ kHz}$

9 kHz for  $150 \text{ kHz} \leq f \leq 30 \text{ MHz}$

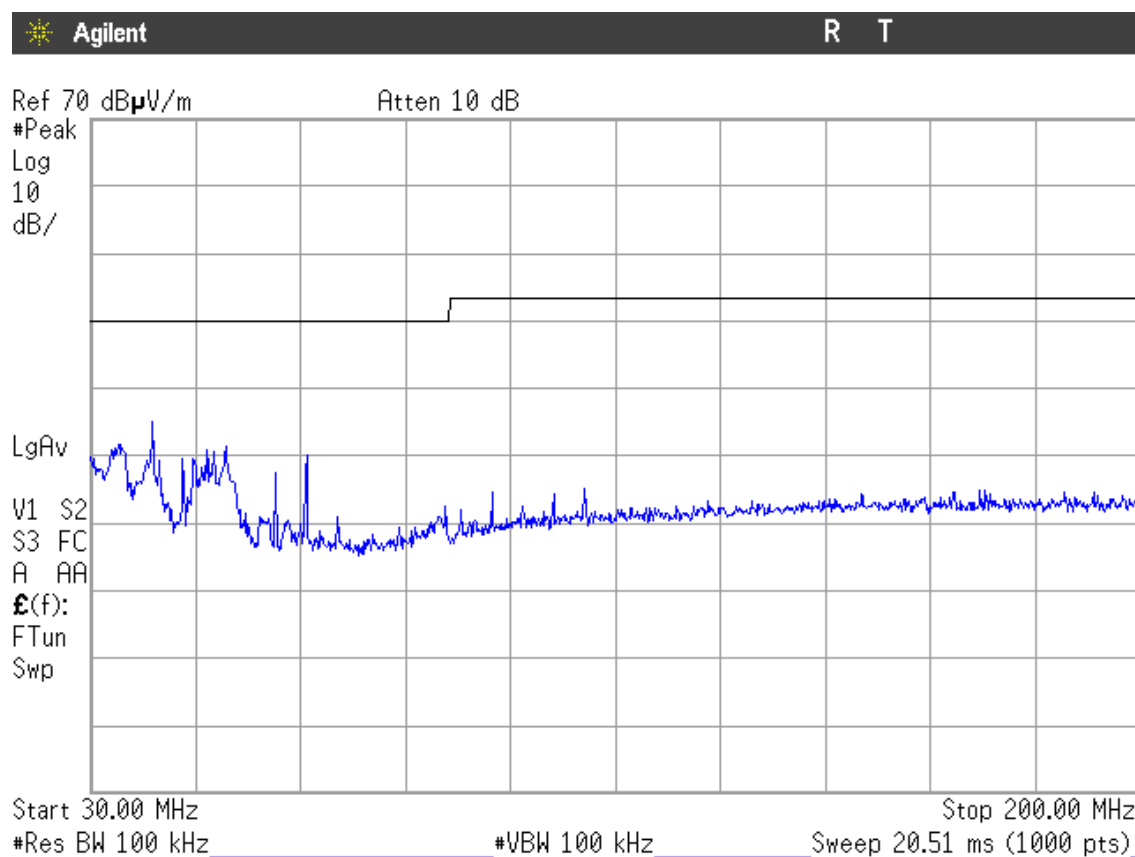
Note: The limits shown in the above plot are extrapolated to 3 meters. The highest peak corresponds to the carrier level.

FREQUENCY RANGE 30 MHz to 200 MHz.

1. Operation mode: Mifare 212 kbps.



2. Operation mode: Felica 212 kbps.



## **Section 15.225 Subclause (e). Frequency tolerance of the carrier signal**

### SPECIFICATION

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.

### RESULTS

Nominal operating frequency: 13.56 MHz

Frequency stability over temperature variations.

Temperature (°C)	Frequency Error (Hz)	Frequency Error (%)
+50	+431	0.0031785
+40	+441	0.0032522
+30	-422	-0.0031121
+20	-407	-0.0030015
+10	-390	-0.0028761
0	-365	-0.0026917
-10	-394	-0.0029056
-20	-426	-0.0031416

Frequency stability over voltage variations.

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (%)
Vmax	4.225	-425	-0.0031342
Vmin	3.145	-423	-0.0031195

Verdict: PASS



## **APPENDIX B: Measuring results for electromagnetic conducted emission**

**CONTENT:**

DESCRIPTION OF THE OPERATION MODES.....	35
CONTINUOUS CONDUCTED EMISSION ON POWER LEADS .....	36

## DESCRIPTION OF THE OPERATION MODES

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

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

OPERATION MODE	DESCRIPTION
OM#01	EUT ON. Equipment in Stand-By mode and charging batteries by USB cable.
OM#02	EUT ON. Equipment in transmission mode and charging batteries by USB cable.

## CONTINUOUS CONDUCTED EMISSION ON POWER LEADS

<b>LIMITS:</b>	Product standard :	FCC RULES AND REGULATIONS 47 CFR PART 15, SUBPART B (10-01-10 ED.)
	Test standard :	FCC RULES AND REGULATIONS 47 CFR PART 15, SUBPART B (10-01-10 ED.)

### CLASS B

The applied limit for continuous conducted emissions in power leads, according with the requirements of FCC RULES AND REGULATIONS 47 CFR PART 15, SUBPART B (10-01-10 Ed.) & IC RSS-Gen Issue 2, June 2007 in the frequency range 0,15 to 30 MHz, for Class B equipment was:

Frequency range (MHz)	Limit (dB $\mu$ V)	
	Quasi-peak	Average
0,15 to 0,5	66-56	56-46
0,5 to 5	56	46
5 to 30	60	50

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

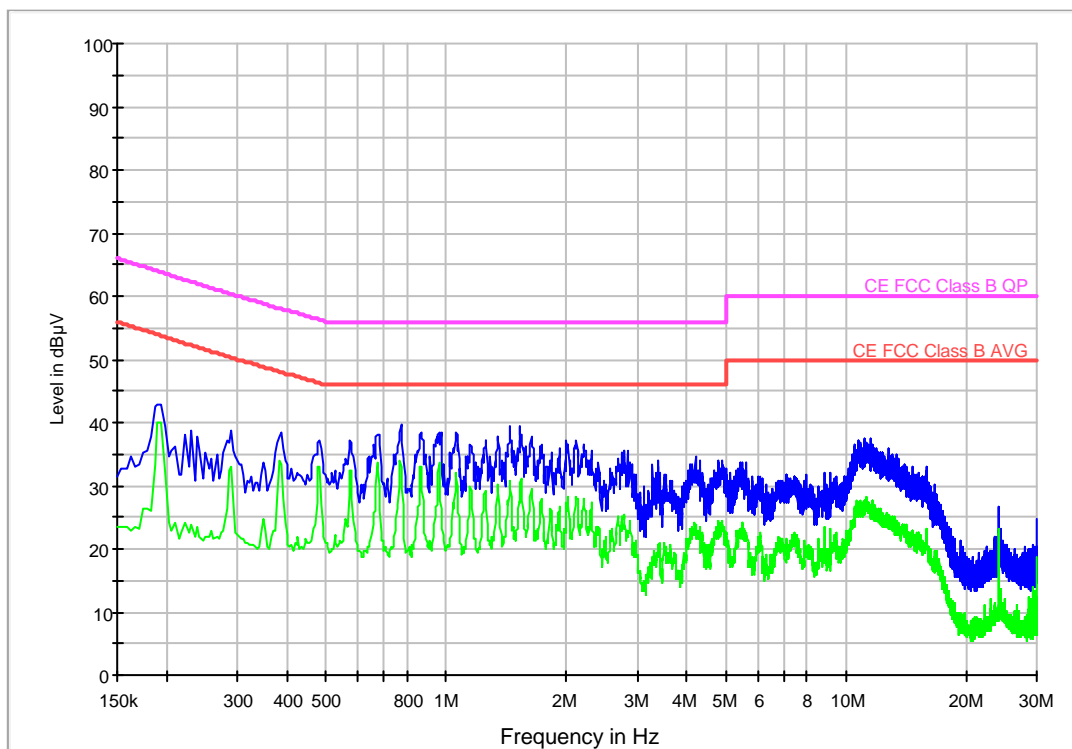
CCmmnnhh	Description	Result
CC01010N	Neutral wire noise	P
CC0101L1	Phase wire noise	P
CC01020N	Neutral wire noise	P
CC0102L1	Phase wire noise	P

Continuous Conducted emission : CC01010N

Detector : Peak / Average / Cuasi-peak

Project: 38685REM.001  
 Company: SISTELNETWORKS, S.L.  
 Sample: S/01  
 Operation mode: OM#01  
 Mode: EUT ON. Stand-By mode. Charging batteries. Neutral wire noise.

EC FCC Class B ESPI CC



— MaxPeak — Average — CE FCC Class B AVG — CE FCC Class B QP

## Max PK AVG

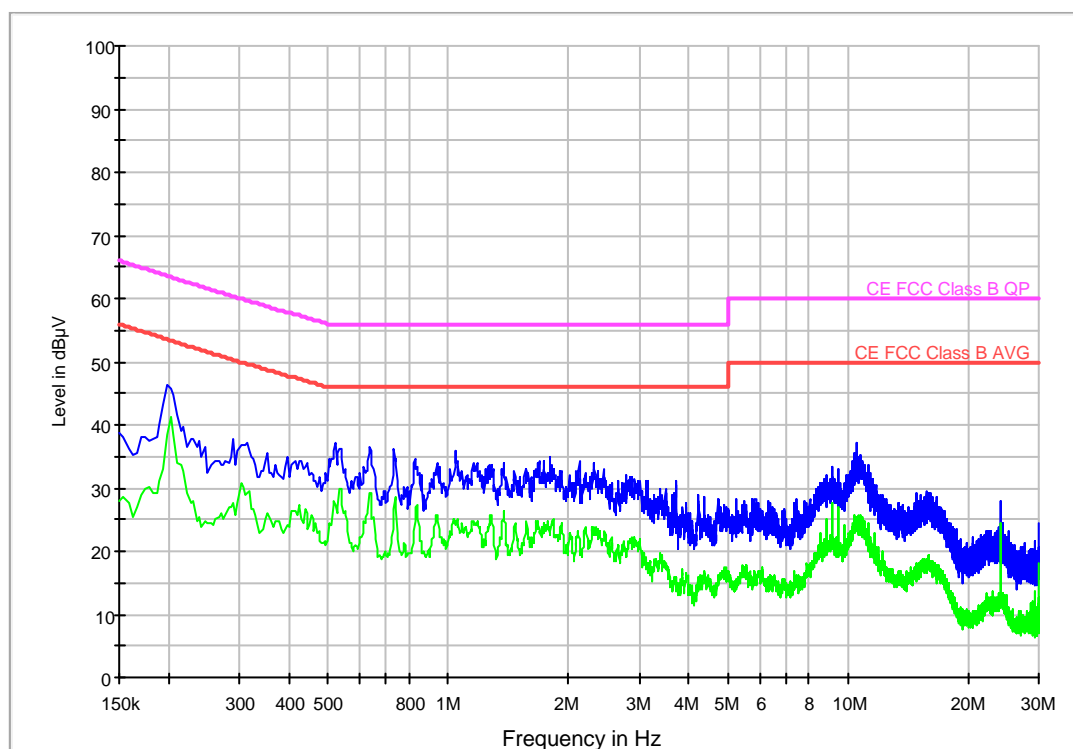
Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
0.190000	42.9	40.1
0.290000	38.8	33.1
0.670000	38.1	33.6
0.770000	39.7	32.9
1.530000	39.4	30.0
2.214000	36.7	27.5
4.194000	34.5	23.8
10.394000	33.9	24.3
11.074000	37.6	27.1
23.994000	26.5	23.1

Continuous Conducted emission : CC0101L1

Detector : Peak / Average / Cuasi-peak

Project: 38685REM.001  
 Company: SISTELNETWORKS, S.L.  
 Sample: S/01  
 Operation mode: OM#01  
 Mode: EUT ON. Stand-By mode. Charging batteries. Phase wire noise.

EC FCC Class B ESPI CC



MaxPeak Average CE FCC Class B AVG CE FCC Class B QP

## Max PK AVG

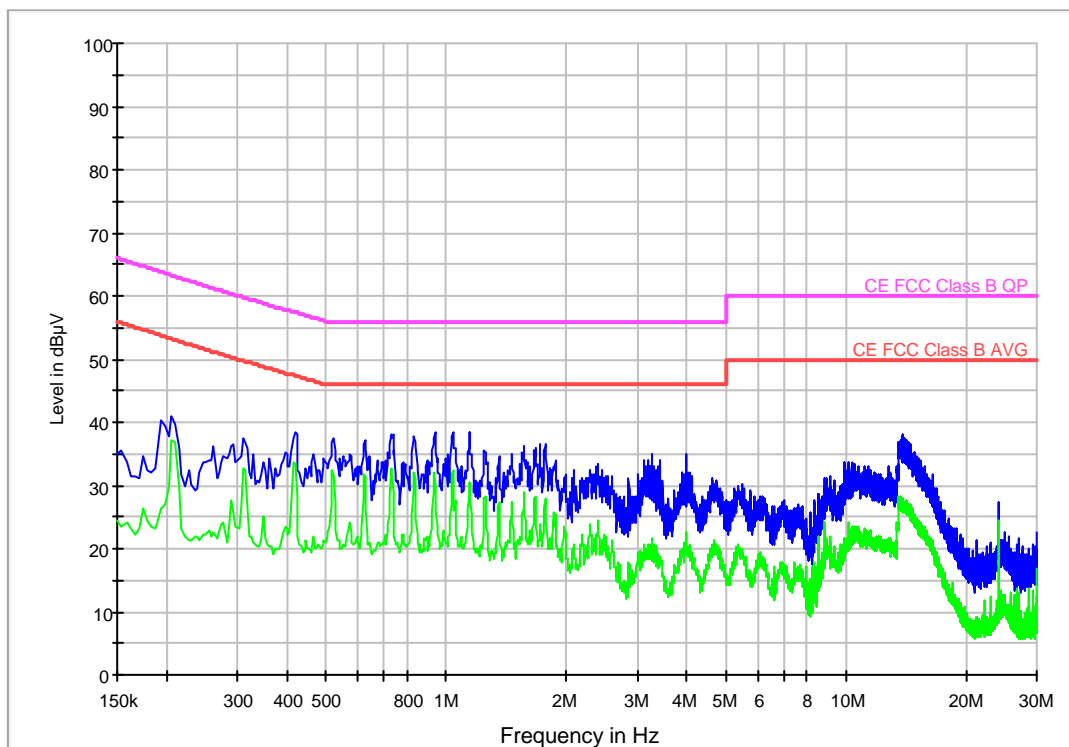
Frequency (MHz)	MaxPeak-ClearWrite (dBμV)	Average-ClearWrite (dBμV)
0.198000	46.3	38.3
0.290000	37.9	27.5
0.522000	37.1	27.2
1.042000	35.8	24.7
1.798000	35.0	22.6
2.122000	34.2	21.8
3.714000	31.0	15.8
10.366000	35.6	24.0
10.510000	37.3	25.5
23.994000	27.9	24.5

Continuous Conducted emission : CC01020N

Detector : Peak / Average / Cuasi-peak

Project: 38685REM.001  
 Company: SISTELNETWORKS, S.L.  
 Sample: S/01  
 Operation mode: OM#02  
 Mode: EUT ON. Transmission mode. Charging batteries. Neutral wire noise.

EC FCC Class B ESPI CC



MaxPeak Average CE FCC Class B AVG CE FCC Class B QP

## Max PK AVG

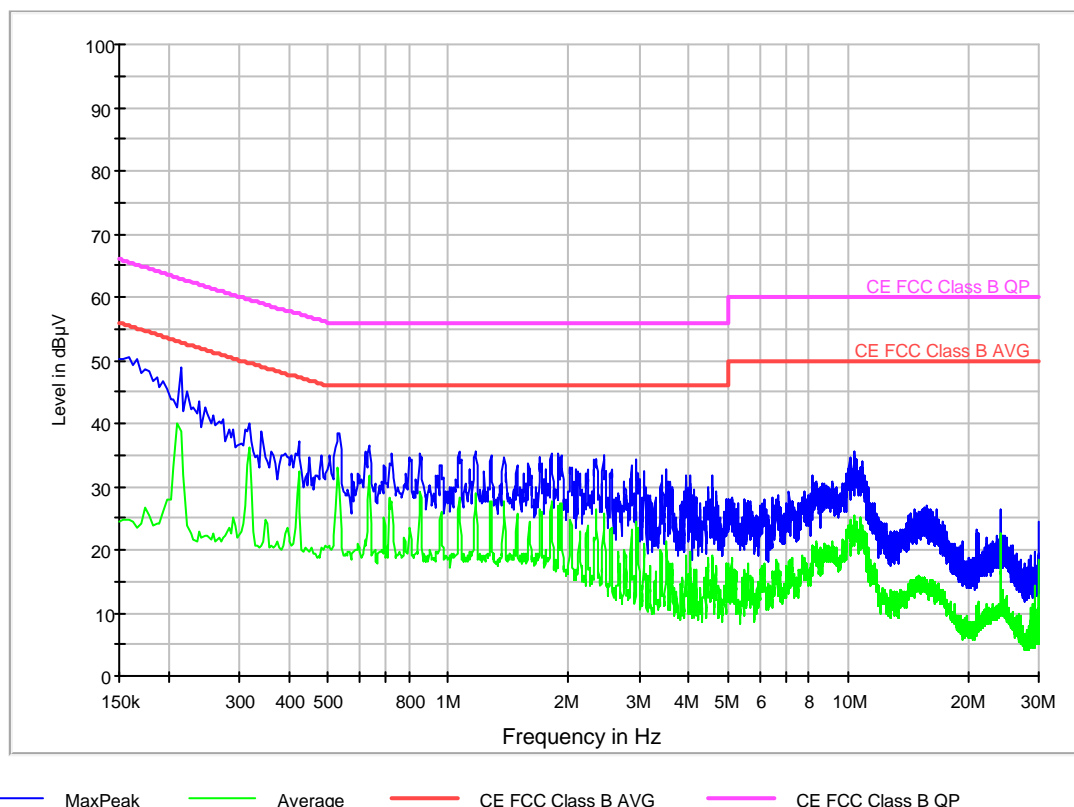
Frequency (MHz)	MaxPeak-ClearWrite (dBμV)	Average-ClearWrite (dBμV)
0.206000	41.0	37.1
0.418000	38.5	33.4
0.734000	38.2	28.8
1.038000	38.5	32.5
1.770000	36.5	26.9
3.274000	34.8	21.5
3.994000	34.8	22.5
9.930000	33.6	20.5
13.910000	37.9	26.5
23.994000	27.3	24.2

Continuous Conducted emission : CC0102L1

Detector : Peak / Average / Cuasi-peak

Project: 38685REM.001  
 Company: SISTELNETWORKS, S.L.  
 Sample: S/01  
 Operation mode: OM#02  
 Mode: EUT ON. Transmission mode. Charging batteries. Phase wire noise.

EC FCC Class B ESPI CC



## Max PK AVG

Frequency (MHz)	MaxPeak-ClearWrite (dBμV)	Average-ClearWrite (dBμV)
0.158000	50.6	24.6
0.258000	41.2	22.5
0.530000	38.5	32.9
1.062000	35.6	28.0
1.810000	35.3	27.5
2.446000	34.8	25.8
4.030000	31.8	17.1
10.370000	35.4	24.8
10.510000	34.3	24.3
23.994000	26.4	22.6