

RR051-20-103141-9-A Ed. 0

**Certification Radio test report**

**According to the standard:**  
CFR 47 FCC PART 15

**Equipment under test:**  
ZB5SKR01  
RFID compact station

**FCC ID: Y7HZB5SK**

**Company:**  
**SCHNEIDER ELECTRIC INDUSTRIES**

**Distribution:** Mr CORAZZA

**(Company:** Schneider Electric Industries)

**Number of pages:** 22 with 4 annexes

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S51 RTY 000 INT 00002 [03]

**DESIGNATION OF PRODUCT:** ZB5SKR01 RFID compact station

**Serial number (S/N):** Without

**Reference / model (P/N):** ZB5SKR01

**Software version:** 1.05

**MANUFACTURER:** SCHNEIDER ELECTRIC INDUSTRIES

**COMPANY SUBMITTING THE PRODUCT:**

**Company:** SCHNEIDER ELECTRIC INDUSTRIES

**Address:** BLD SALVADOR ALLENDE  
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**Responsible:** Mr CORAZZA

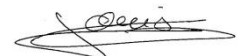
**Person present during the tests:** Mr LAVIGNE (the first day)

**DATES OF TEST:** From 7-Oct-20 to 29-Jun-21

**TESTING LOCATION:** EMITECH ANGERS laboratory at JUIGNE SUR LOIRE (49) FRANCE  
FCC Accredited under US-EU MRA Designation Number: FR0009  
Test Firm Registration Number: 873677

**TESTED BY:** S. LOUIS

**VISA:**



**WRITTEN BY:** S. LOUIS

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## 1. INTRODUCTION

This report presents the results of radio test carried out on the following radio equipment: **ZB5SKR01 RFID compact station**, in accordance with normative reference.

The device under test integrates a RFID Radio part.

## 2. PRODUCT DESCRIPTION

Class:	B
Utilization:	Tag and barcode reader
Antenna type and gain:	integrated antenna, 0dBi
Operating frequency range:	From 13.110 MHz to 14.010 MHz
Number of channels:	1
Channel spacing:	Not concerned
Modulation:	ASK
Power source:	24Vdc by AC/DC Adapter

Power level, frequency range and channels characteristics are not user adjustable.  
The details pictures of the product and the circuit boards are joined with this file.

## 3. NORMATIVE REFERENCE

The standards and testing methods related throughout this report are those listed below.  
They are applied on the whole test report even though the extensions (version, date and amendment) are not repeated.

CFR 47 FCC Part 15 (2020)	Radio Frequency Devices
ANSI C63.10	2013 Procedures for Compliance Testing of Unlicensed Wireless Devices.

**4. TEST METHODOLOGY**

Radio performance tests procedures given in CFR 47 part 15:

Subpart C – Intentional Radiators

- Paragraph 203: Antenna requirement
- Paragraph 205: Restricted bands of operation
- Paragraph 207: Conducted limits
- Paragraph 209: Radiated emission limits; general requirements
- Paragraph 212: Modular transmitter
- Paragraph 215: Additional provisions to the general radiated emission limitations
- Paragraph 225: Operation within the band 13.110-14.010 MHz

**5. TEST EQUIPMENT CALIBRATION DATES**

Emitech Number	Model	Type	Last calibration	Calibration interval (years)	Next calibration due
0	BAT-EMC V3.18.0.26	Software	/	/	/
1406	EMCO 6502	Loop antenna	13/04/2021	1	13/04/2022
4088	R&S FSP40	Spectrum Analyzer	04/05/2020	2	04/05/2022
5275	R&S ESPC	Test receiver	10/01/2019	2	09/01/2021
6796	R&S FSP7	Spectrum Analyzer	21/08/2019	2	20/08/2021
7279	SUCOFLEX SF104 N 1.5m	Cable	11/06/2020	2	11/06/2022
8508	California instruments 1251RP	Power source	(1)	(1)	(1)
8511	HP 8447D	Low-noise amplifier	26/01/2021	1	26/01/2022
8526	Schwarzbeck VHBB 9124	Biconical antenna	17/08/2018	3	16/08/2021
8528	Schwarzbeck VHA 9103	Biconical antenna	09/03/2019	3	08/03/2022
8543	Schwarzbeck UHALP 9108A	Log periodic antenna	17/08/2018	3	16/08/2021
8590	RG214 N-5m	Cable	25/02/2020	2	24/02/2022
8593	SIDT Cage 2	Anechoic chamber	/	/	/
8707	R&S ESI7	Test receiver	29/06/2020	1	29/06/2021
8719	Thurbly Thandar Instruments 1600	LISN	26/02/2020	2	25/02/2022
8732	Emitech	OATS	03/07/2019	3	02/07/2022
8749	La Crosse Technology WS-9232	Meteo station	22/09/2020	2	22/09/2022
8750	La Crosse Technology WS-9232	Meteo station	22/09/2020	2	22/09/2022
8775	Fontaine FTN 2515B	Power source	(1)	(1)	(1)
8855	EMITECH	Turntable and mat controller	/	/	/
8864	Champ libre Juigné. V3.5	Software	/	/	/
8896	ACQUISYS GPS8	Satellite synchronized frequency standard	/	/	/
10523	EMITECH	Absorber sheath current	27/05/2020	2	27/05/2022
10788	Emitech	Outside room Hors cage	/	/	/
11535	R&S EZ-25	High pass filter	22/03/2019	3	21/03/2022
12911	Huber + Suhner N-2m	cable	11/06/2020	2	11/06/2022
14716	GMH 3710	Precision Termometer -30°C/+100°C	10/02/2021	1	10/02/2022
14736	MATURO	Turntable and mat controller MCU	/	/	/
14831	Fluke 177	Multimeter	25/02/2020	2	24/02/2022
15882	SUCOFLEX	cable N 5m	26/01/2021	2	26/01/2023
16059	CLIMATS EXCAL <sup>2</sup> 1411-TA	Climatic chamber	30/11/2020	2	30/11/2022

(1) The equipment is not verified; instead, the output voltage is checked before each measurement with the calibrated multimeter.

**6. TESTS RESULTS SUMMARY**

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAP	NAs	
FCC Part 15.203	ANTENNA REQUIREMENT	X				Note 1
FCC Part 15.205	RESTRICTED BANDS OF OPERATION	X				
FCC Part 15.207	CONDUCTED LIMITS	X				
FCC Part 15.209	RADIATED EMISSION LIMITS; general requirements	X				Note 2
FCC Part 15.212	MODULAR TRANSMITTERS			X		Note 3
FCC part 15.215	ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS					
	(a) Alternative to general radiated emission limits	X				
	(b) Unwanted emissions outside of §15.225 frequency bands	X				Note 4
	(c) 20 dB bandwidth and band-edge compliance	X				
FCC Part 15.225	OPERATION WITHIN THE BAND 13.110-14.010 MHZ					
	(a) Field strength within the band 13.553-13.567 MHz	X				
	(b) Field strength within the bands 13.410-13.553 MHz and 13.567-13.710 MHz	X				
	(c) Field strength within the bands 13.110-13.410 MHz and 13.710-14.010 MHz	X				
	(d) Field strength outside the band 13.110-14.010 MHz	X				
	(e) Carrier frequency tolerance	X				
	(f) Powered tags			X		

NAP: Not Applicable    NAs: Not Asked

Note 1: Integral antenna without standard connector.

Note 2: See FCC part 15.225 (d).

Note 3: Single / split modular transmitter.

The host devices of the certified modules shall be properly labeled to identify the module(s) within.

Note 4: See FCC part 15.209. Unwanted emissions levels are all below the fundamental emission field strength level.

**7. MEASUREMENT UNCERTAINTY**

To declare, or not, the compliance with the specifications, it was not explicitly taken into account of uncertainty associated with the result(s)

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k=2$ , which for normal distribution corresponds to a coverage probability of approximately 95%.

<b>Parameter</b>	<b>Emitech Uncertainty</b>
RF power, conducted	$\pm 0.75\text{dB}$
Radiated emission valid to 26 GHz	
F < 62.5 MHz:	$\pm 5.14\text{ dB}$
62.5 MHz < F < 1 GHz:	$\pm 5.13\text{ dB}$
1 GHz < F < 26 GHz:	$\pm 5.16\text{ dB}$
AC Power Lines conducted emissions	$\pm 3.38\text{ dB}$
Temperature	$\pm 1\text{ }^\circ\text{C}$
Humidity	$\pm 5\%$



**8. CONDUCTED LIMITS****Temperature (°C) :** 21.6**Humidity (%HR):** 62**Date :** October 9, 2020**Technician :** S. LOUIS**Standard:** FCC Part 15**Test procedure:** Paragraph 15.207**Software used:** BAT-EMC V3.17.0.25**Test set up:**

The EUT is isolated and placed on a wooden table, 0.8 m over an horizontal reference plane and 0.4 m from a vertical reference plane. It is powered by an artificial main network placed on the ground reference plane.

The AC/DC Adapter is powered with the AC power operating voltage of 120 V / 60 Hz.

This terminal provided by the applicant supplies the equipment under test.

**Frequency range:** 150 kHz - 30 MHz**Detection mode:** Peak / Quasi-peak / Average**Bandwidth:** 10 kHz / 9 kHz**Equipment under test operating condition:**

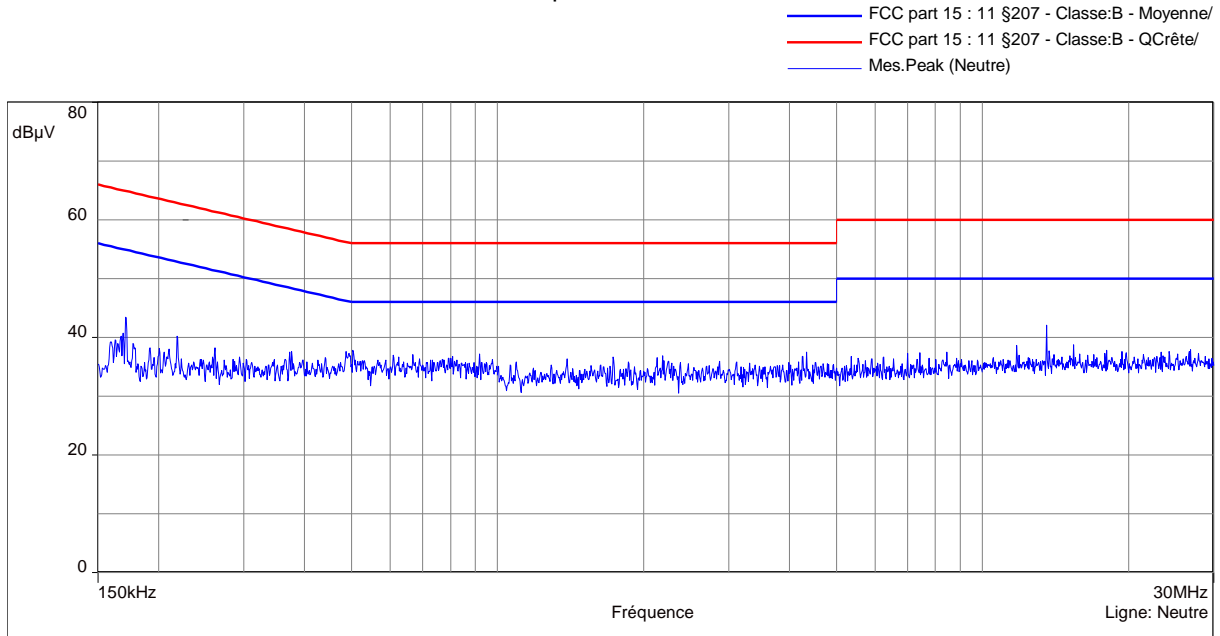
The equipment under test is blocked in alternance of emission and reception mode.

**Results:**

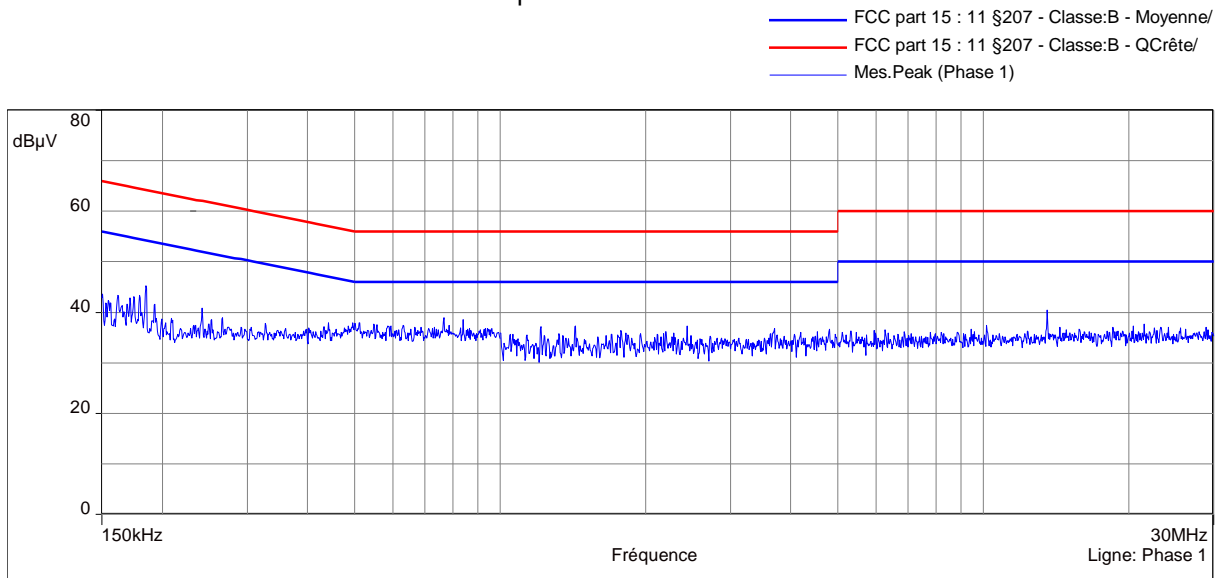
Sample N° 1: Measurement on the mains power supply:

The measurement is first realized with peak detector.

Curve N° 1: measurement on the Neutral with peak detector



Curve N° 2: measurement on the Line with peak detector



There are no frequencies at 6 dB below the Quasi-peak and average limit.

**Test conclusion:**

RESPECTED STANDARD

<b>9. ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS</b>
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Temperature (°C) : 21.6

Humidity (%HR): 52

Date : June 29, 2021

Technician : S. LOUIS

**Standard:** FCC Part 15

**Test procedure:** Paragraph 15.215

**Test set up:**

Test realized in near field. All field strength measurements are correlated with the radiated maximum peak output power

**Test operating condition of the equipment:**

The equipment under test is blocked in alternance of emission and reception mode.

Power source: 24 Vdc by an external power supply

 Percentage of voltage variation during the test (%):  $\pm 1$ 
**Results:**

Lower Band Edge: From 12.910 MHz to 13.110 MHz

Upper Band Edge: From 14.010 MHz to 14.210 MHz

Sample N° 1:

Fundamental frequency (MHz)	Field Strength Level of fundamental (dB $\mu$ V/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Calculated Max Out-of-Band Emission Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
13.56	41.14	Peak	13.0634	34.14	7.0 (2)	48.63	41.63
13.56	41.14	Peak	14.0618	38.93	2.21 (2)	48.63	46.42

(1) Marker-Delta method

 (2) *The peak level is lower than the limit (48.63 dB $\mu$ V/m).*

20 dB bandwidth curves are given in appendix 2; band-edge curves are given in appendix 4.

**Test conclusion:**

RESPECTED STANDARD

**10. OPERATION WITHIN THE BAND 13.110 – 14.010 MHZ****Temperature (°C) :** 21.6**Humidity (%HR):** 52**Date :** June 29, 2021**Technician :** S. LOUIS**Standard:** FCC Part 15**Test procedure:** paragraph 15.225 (a), (b), (c), (e)**Test set up:**

First an exploratory radiated measurement was performed.

During this phase the product is oriented in these two normal positions.

Then the final measurement is realized with the product on the most critical orientation.

The system is tested in an open area test site (OATS). The EUT is placed on a rotating table, 0.8 m from a ground plane. Zero degree azimuth corresponds to the front of the equipment under test.

The frequency stability measure is realized in near-field with the product in a climatic chamber.

**Detection mode:** Quasi-peak ( $F < 1$  GHz)**Bandwidth:** 9 kHz ( $150 \text{ kHz} < F < 30\text{MHz}$ )**Distance of antenna:** 10 meters**Antenna height:** 1 meter**Antenna polarization:** oriented in the vertical plane. The lowest point of the loop is 1m above ground level.**Equipment under test operating condition:**

The equipment under test is blocked in alternance of emission and reception mode.

Power source: 24 Vdc by an external power supply

Percentage of voltage variation during the test (%):

 $\pm 1$

**Results:**

Sample N° 1:

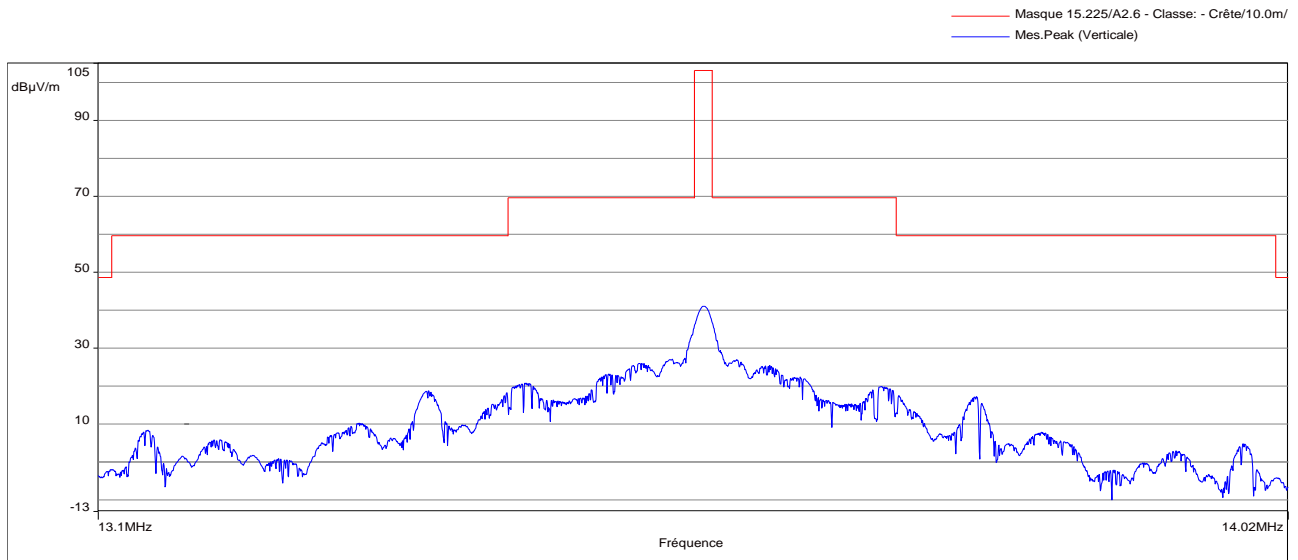
**Carrier field strength**

	Field strength (dB $\mu$ V/m) at frequency: 13.56 MHz
Normal test conditions measure at 10 m	41.14
Normal test conditions correlated at 30 m	22.06
Limits at 30m (dB $\mu$ V/m)	84
Margin (dB)	61.94

Polarization of test antenna: perpendicular at the equipment at 0 degree.

Position of equipment: see photos in appendix 2 – Position 2 (azimuth: 87°)

**Field strength within the band 13.110-14.010 MHz**



## Frequency stability

### Results for temperature variation

Realized with a power source at 24Vdc

Temperature (°C)	Measure at startup		Measure at 2 min		Measure at 5 min		Measure at 10 min		Drift limit (kHz)
	Frequency measured (MHz)	Frequency drift (kHz)	Frequency measured (MHz)	Frequency drift (kHz)	Frequency measured (MHz)	Frequency drift (kHz)	Frequency measured (MHz)	Frequency drift (kHz)	
50	13.560170	0.170	13.560165	0.165	13.560162	0.162	13.560165	0.165	± 1.356 (a)
40	13.560191	0.191	13.560185	0.185	13.560181	0.181	13.560179	0.179	
30	13.560223	0.223	13.560219	0.219	13.560215	0.215	13.560206	0.206	
20	13.560238	0.238	13.560234	0.234	13.560229	0.229	13.560225	0.225	
10	13.560256	0.256	13.560253	0.253	13.560255	0.255	13.560255	0.255	
0	13.560246	0.246	13.560253	0.253	13.560259	0.259	13.560261	0.261	
-10	13.560211	0.211	13.560231	0.231	13.560243	0.243	13.560246	0.246	
-20	13.560152	0.152	13.560188	0.188	13.560201	0.201	13.560207	0.207	

(a) ±0.01% of the operating frequency

### Results for power supply variation

Realized at +20 °C

Power supply (Vac)	Frequency measured (MHz)	Frequency drift (kHz)	Drift limit (kHz)
20.4	13.560237	0.237	± 1.356 (b)
24.0	13.560237	0.237	
27.6	13.560238	0.238	

(b) ±0.01% of the operating frequency

### **Test conclusion:**

RESPECTED STANDARD

**11. FIELD STRENGTH OUTSIDE THE BAND 13.110-14.01 MHZ****Temperature (°C) :** 21.6**Humidity (%HR):** 52**Date :** June 29, 2021**Technician :** S. LOUIS**Standard:** FCC Part 15**Test procedure:** paragraph 209  
paragraph 15.225 (d)**Test set up:**

First an exploratory radiated measurement was performed.

During this phase the product is oriented in these two normal positions.

Then the final measurement is realized with the product on the most critical orientation.

The measure is realized on open area test site under 1 GHz.

The system is tested in an open area test site (OATS), the EUT is placed on a rotating table, 0.8m from a ground plane.

Zero degree azimuths correspond to the front of the device under test.

See photos in appendix 2.

**Frequency range:** From 9 kHz to 1GHz**Detection mode:** Quasi-peak (F < 1 GHz)

Peak / Average (F &gt; 1 GHz)

**Bandwidth:** 200Hz (9 kHz < F < 150kHz)  
9 kHz (150 kHz < F < 30MHz)  
120 kHz (30 MHz < F < 1 GHz)  
1 MHz (F > 1 GHz)**Distance of antenna:** 10 meters (in open area test site)**Antenna height:** 1 to 4 meters (in open area test site)**Antenna polarization:** vertical and horizontal (only the highest level is recorded)**Equipment under test operating condition:**

The equipment under test is blocked in alternance of emission and reception mode.

Power source: 24 Vdc by an external power supply

Percentage of voltage variation during the test (%):

± 1

**Results:**
Sample N° 1:

## Below 30 MHz

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Position	Polarization (Parallel Perpendicular)	RBW (kHz)	Field strength Measured at 10 m (dB $\mu$ V/m)	Field strength Computed at 30 m (dB $\mu$ V/m)	Limits at 30m (dB $\mu$ V/m)	Margin (dB)
27.12	QP	100	1	Perpendicular	9	7.08	-12	29.5	41.5

## Above 30 MHz

Frequencies (MHz)	Detector P QP Av	Position	Azimuth (degree)	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 10 m (dB $\mu$ V/m)	Field strength Computed at 3 m (dB $\mu$ V/m)	Limits at 3m (dB $\mu$ V/m)	Margin (dB)
54.24	QP	1	132	100	V	17.55	27.95	40	12.05
67.8	QP	1	258	100	V	14.56	24.96	40	15.04
81.36	QP	2	324	100	V	21.16	31.56	40	8.44
108.48	QP	2	162	100	V	24.84	35.24	43.5	8.26
122.04	QP	1	62	100	V	15.5	25.9	43.5	17.6
135.6	QP	2	0	100	V	24.89	35.29	43.5	8.21
162.72	QP	2	43	100	V	31.08	41.48	43.5	2.02
176.28	P	1	180	125	V	25.49	35.89	43.5	7.61
203.4	P	1	190	123	V	27.56	37.96	43.5	5.54
230.52	P	1	183	152	V	29.52	39.92	46	6.08
257.64	P	2	216	220	V	23.97	34.37	46	11.63

P= Peak, QP=Quasi-peak, Av=Average

Applicable limits:

for 9 kHz $\leq$ F $\leq$ 490 kHz :	2400/F(kHz) at 300 meters
for 490 kHz < F $\leq$ 1.705 MHz :	24000/F(kHz) at 30 meters
for 1.705 MHz < F $\leq$ 30 MHz :	29.5 dB $\mu$ V/m at 30 meters
for 30 MHz < F $\leq$ 88 MHz :	40 dB $\mu$ V/m at 3 meters
for 88 MHz < F $\leq$ 216 MHz :	43.5 dB $\mu$ V/m at 3 meters
for 216 MHz < F $\leq$ 960 MHz :	46 dB $\mu$ V/m at 3 meters
Above 960 MHz :	54 dB $\mu$ V/m at 3 meters

**Test conclusion:**

RESPECTED STANDARD

**□□□ End of report, 4 appendixes to be forwarded □□□**



## APPENDIX 1: Test equipment list

### Conducted limits

TYPE	MANUFACTURER	EMITECH NUMBER
Outside room Hors cage	Emitech	10788
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Test receiver ESPC	Rohde & Schwarz	5275
Spectrum Analyzer FSP7	Rohde & Schwarz	6796
LISN 1600	Thurbly Thandar Instruments	8719
High-pass filter EZ-25	Rohde & Schwarz	11535
Absorber sheath current	Emitech	10523
Cable N-5m RG214	GYL Technologies	8590
Power source 1251RP	California instruments	8508
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.17.0.25	0000

### Additional provisions to the general radiated emission limitations

TYPE	MANUFACTURER	EMITECH NUMBER
Outside room Hors cage	Emitech	10788
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP7	Rohde & Schwarz	6796
Power source FTN 2515B	Fontaine	8775
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
Software	GPIBShot V2.4	-

**Operation within the band 13.110 – 14.010 MHz**

<b>TYPE</b>	<b>MANUFACTURER</b>	<b>EMITECH NUMBER</b>
Open test site	EMITECH	8732
Turntable and mat controller	EMITECH	8855
Anechoic Chamber	EMITECH	8593
Turntable controller 1060C	MATURO	14736
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Test receiver ESI7	Rohde & Schwarz	8707
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Loop antenna 6502	EMCO	1406
Climats EXCAL <sup>2</sup> 1411-TA	CLIMATS	16059
Precision thermometer GMH 3710	GHM Greisinger	14716
N-1.5M Cable	SUCOFLEX	7279
N-2M Cable	Huber + Suhner	12911
N-5M Cable	SUCOFLEX	15882
Power source FTN 2515B	Fontaine	8775
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8749
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.17.0.25	0000

## Field strength outside the band 13.110-14.010 MHz

TYPE	MANUFACTURER	EMITECH NUMBER
Open test site	EMITECH	8732
Turntable and mat controller	EMITECH	8855
Anechoic Chamber	EMITECH	8593
Turntable controller 1060C	MATURO	14736
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Test receiver ESI7	Rohde & Schwarz	8707
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Loop antenna 6502	EMCO	1406
Biconical antenna VHBB 9124	Schwarzbeck	8526
Biconical antenna VHA 9103	Schwarzbeck	8528
Log periodic antenna UHALP 9108A	Schwarzbeck	8543
Low-noise amplifier 8447D	Hewlett Packard	8511
N-1.5M Cable	SUCOFLEX	7279
N-2M Cable	Huber + Suhner	12911
N-5M Cable	SUCOFLEX	15882
Power source FTN 2515B	Fontaine	8775
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8749
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.17.0.25	0000
Software	Champ libre Juigné. V3.5	8864

### APPENDIX 2: 20 dB bandwidth

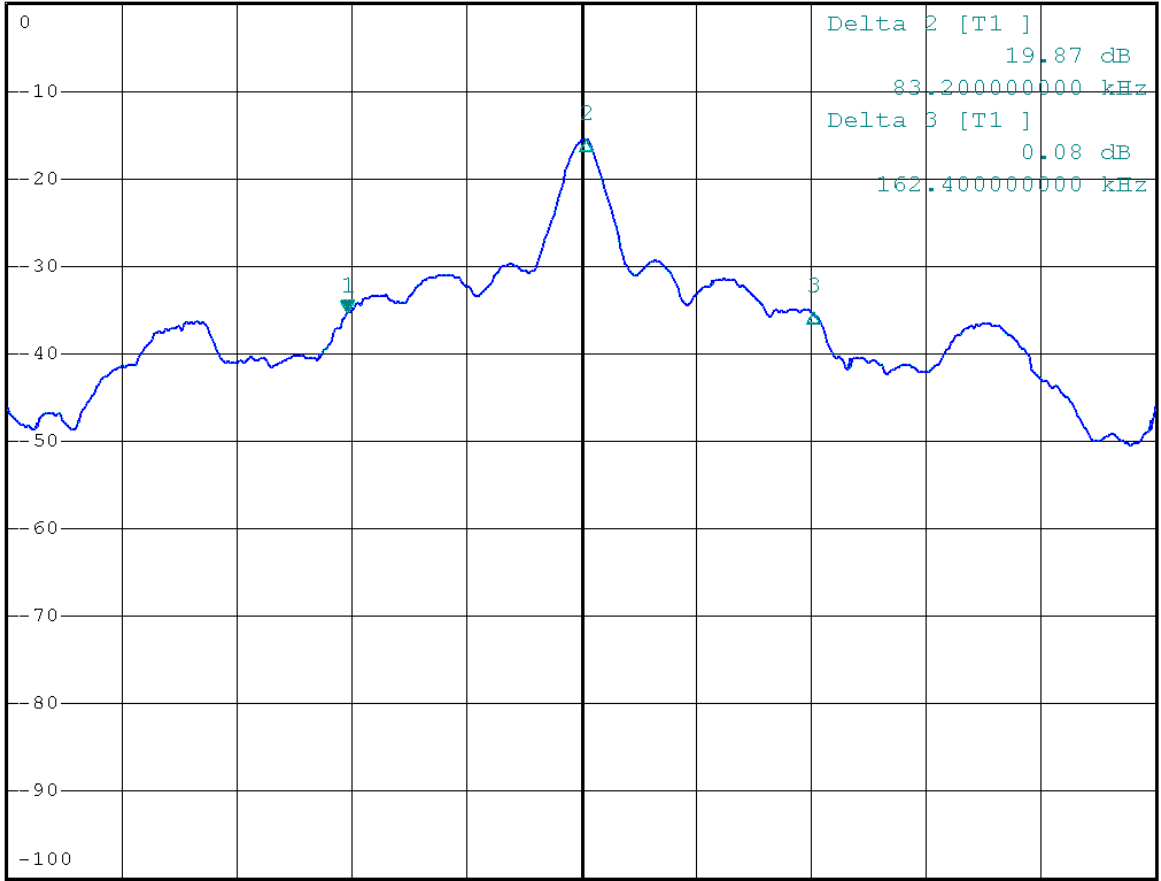


**MARKER 1**  
13.4784 MHz

\*RBW 10 kHz    Marker 1 [T1 ]  
\*VBW 30 kHz                                 -35.43 dBm  
SWT 5 ms                                         13.478400000 MHz

Ref 0 dBm                                         \*Att 10 dB

1 PK  
MAXH



Center 13.56 MHz

40 kHz/

Span 400 kHz

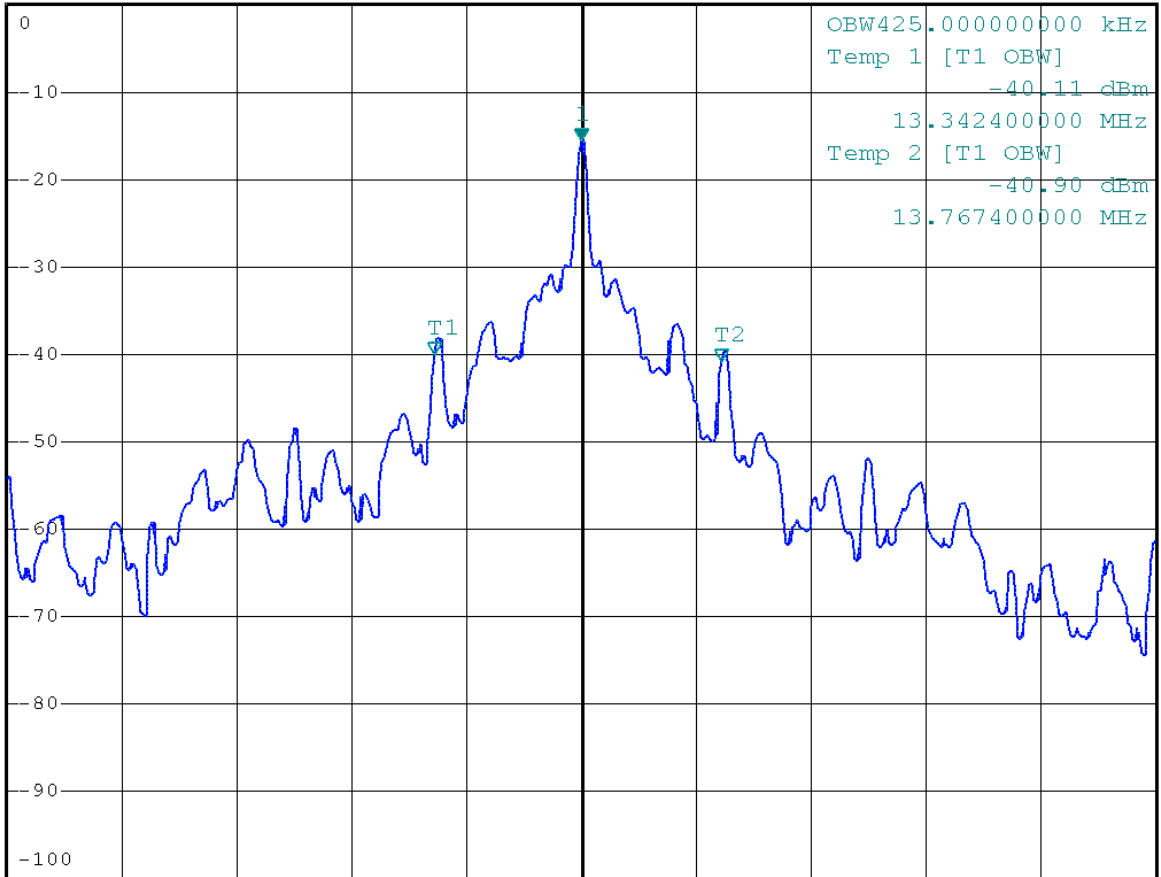
### APPENDIX 3: 99% bandwidth



**MARKER 1**  
13.56 MHz  
Ref 0 dBm \*Att 10 dB

\*RBW 10 kHz \*VBW 30 kHz SWT 20 ms  
Marker 1 [T1 ]  
-15.65 dBm  
13.560000000 MHz

1 PK  
MAXH



Center 13.56 MHz 170 kHz/ Span 1.7 MHz

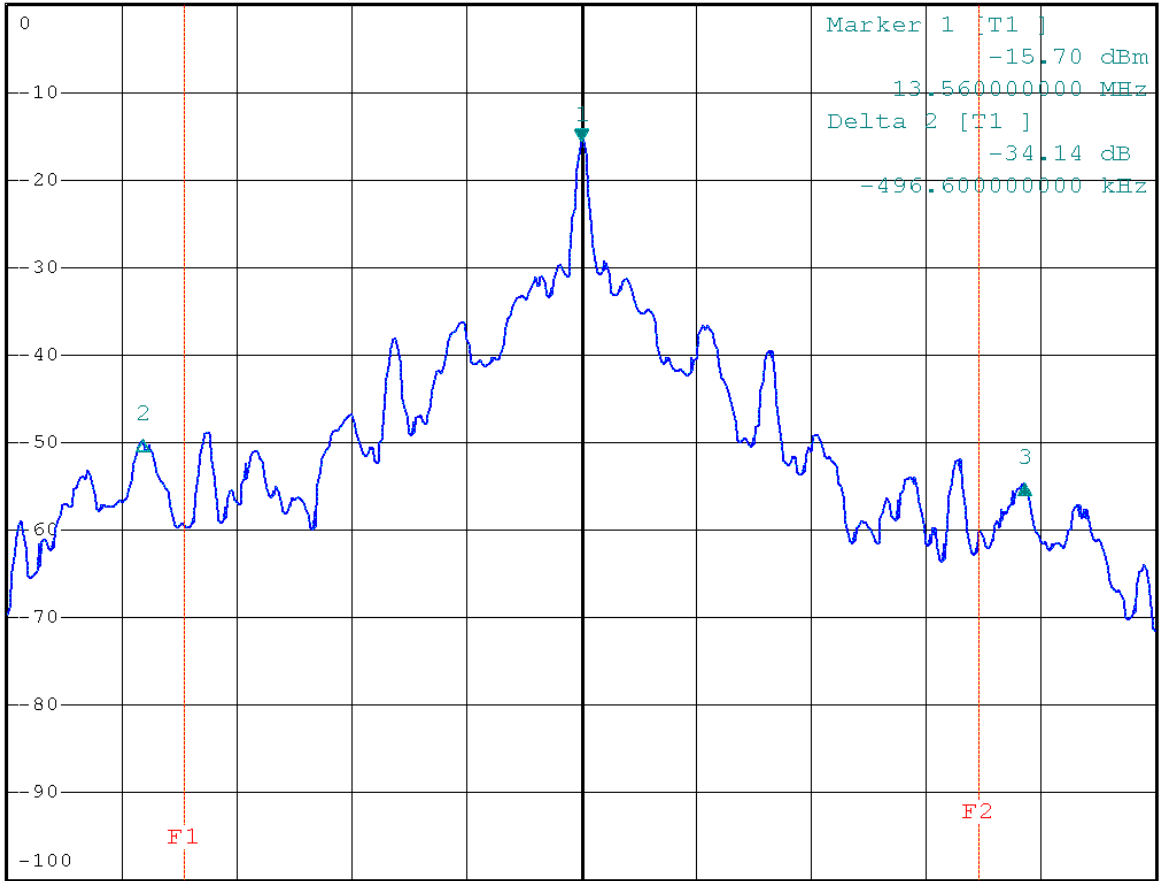
### APPENDIX 4: Band edge



**DELTA MARKER 3**  
 501.8 kHz  
 Ref 0 dBm \* Att 10 dB

\* RBW 10 kHz Delta 3 [T1 ]  
 \* VBW 30 kHz -38.93 dB  
 SWT 15 ms 501.80000000 kHz

1 PK  
 MAXH



Center 13.56 MHz

130 kHz/

Span 1.3 MHz