

# Test report

**411478TRFWL**

Date of issue: January 25, 2021

Applicant:

**Ste Industries Srl**

**Via Oslavia, 17/8D – 20134 Milano (MI) – Italy**

Product:

**TPMS transmitter**

Model:

**VEX1712**

FCC ID:

**2ASEL-VEX17**

Specifications:

◆ **FCC 47 CFR Part 15 Subpart C, §15.231**

Periodic operation in the band 40.66-40.70 MHz and above 70 MHz.

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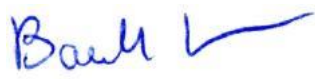

The test report merely corresponds to the tested sample.

The phase of sampling / collection of equipment under test is carried out by the customer.

Test location

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Company name	Nemko Spa
Address	Via del Carroccio, 4
City	Biassono
Province	MB
Postal code	20853
Country	Italy
Telephone	+39 039 220 12 01
Facsimile	+39 039 220 12 21
Website	<a href="http://www.nemko.com">www.nemko.com</a>
Site number	FCC ID number 682159 (10 m semi anechoic chamber)

Tested by (name, function and signature)	P. Barbieri	(project handler)	
Reviewed by (name, function and signature)	D. Guarnone	(verifier)	
Date	January 25, 2021		

Limits of responsibility

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Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report. This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contained in this report are within Nemko Spa's ISO/IEC 17025 accreditation.

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# Table of contents

<b>Table of contents</b> .....	<b>3</b>
<b>Section 1. Report summary</b> .....	<b>4</b>
1.1 Applicant and manufacturer info .....	4
1.2 Test specifications .....	4
1.3 Test methods.....	4
1.4 Statement of compliance .....	4
1.5 Exclusions .....	4
1.6 Test report revision history .....	4
<b>Section 2. Summary of test results</b> .....	<b>5</b>
2.1 FCC Part 15 Subpart C test results .....	5
<b>Section 3. Equipment under test (EUT) details</b> .....	<b>6</b>
3.1 Sample information.....	6
3.2 EUT information .....	6
3.3 Technical information .....	6
3.4 Product description and theory of operation .....	6
3.5 EUT exercise details.....	6
3.6 EUT setup diagram .....	6
3.7 EUT sub assemblies .....	6
<b>Section 4. Engineering considerations</b> .....	<b>7</b>
4.1 Modifications incorporated in the EUT.....	7
4.2 Technical judgment .....	7
4.3 Deviations from laboratory tests procedures .....	7
<b>Section 5. Test conditions</b> .....	<b>8</b>
5.1 Atmospheric conditions .....	8
5.2 Power supply range.....	8
<b>Section 6. Measurement uncertainty</b> .....	<b>9</b>
6.1 Uncertainty of measurement .....	9
<b>Section 7. Testing data</b> .....	<b>10</b>
7.1 FCC 15.31(m) Number of frequencies .....	10
7.2 FCC 15.203 Antenna requirement .....	11
7.3 FCC 15.231(e) Conditions for intentional radiators to comply with periodic operation .....	12
7.4 FCC 15.231(c) Emission bandwidth of momentary signals .....	25
<b>Section 8. Block diagrams of test set-ups</b> .....	<b>27</b>
8.1 Radiated emissions set-up for frequencies below 1 GHz.....	27
8.2 Radiated emissions set-up for frequencies above 1 GHz.....	28
<b>Section 9. Photos</b> .....	<b>29</b>
9.1 Photos of the test set-up .....	29
9.2 Photos of the EUT.....	30

## Section 1. Report summary

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### 1.1 Applicant and manufacturer info

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Company name	Ste Industries Srl
Address	Via Oslavia, 17/8D
City	Milano
Province/State	MI
Postal/Zip code	20134
Country	Italy

### 1.2 Test specifications

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FCC 47 CFR Part 15, Subpart C, Clause 15.231	Periodic operation in the band 40.66–40.70 MHz and above 70 MHz
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### 1.3 Test methods

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ANSI C63.10 v 2013	American National Standard for Procedures for Compliance Testing of Unsilenced Wireless Devices
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### 1.4 Statement of compliance

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Testing was performed against all relevant requirements of the test standard. Results obtained indicate that the product under test does not comply in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

### 1.5 Exclusions

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None

### 1.6 Test report revision history

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Revision #	Details of changes made to test report
411478TRFWL	Original report issued

## Section 2. Summary of test results

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### 2.1 FCC Part 15 Subpart C test results

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Part	Test description	Verdict
§15.207(a)	Conducted limits	Not applicable <sup>1</sup>
§15.203	Antenna requirement	Pass <sup>2</sup>
§15.231(a)	Conditions for intentional radiators to comply with periodic operation	Not applicable
§15.231(b)	Field strength of emissions	Not applicable
§15.231(c)	Emission bandwidth	Pass
§15.231(d)	Requirements for devices operating within 40.66–40.70 MHz band	Not applicable
§15.231(e)	Conditions for intentional radiators to comply with periodic operation	Pass

Notes: <sup>1</sup> The EUT is powered by internal battery

<sup>2</sup> The Antennas are located within the enclosure of EUT and not user accessible.

## Section 3. Equipment under test (EUT) details

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### 3.1 Sample information

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Receipt date	2020-12-18
Nemko sample ID number	411478

### 3.2 EUT information

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Product name	TPMS transmitter
Model	VEX1712
Serial number	4114780002 (Number assigned by Nemko Spa)

### 3.3 Technical information

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Operating band	Above 70 MHz
Operating frequency	434.2 MHz
Modulation type	Proprietary Micro.sp© technology
Field strength (dB $\mu$ V/m @ 3 m)	61.3 dB $\mu$ V/m
Measured BW (kHz) (99 %)	818.2 kHz
Emission classification (F1D, G1D, D1D)	818KF1D
Equipment class	DSC - Part 15 Security/Remote Control Transmitter
Power requirements	3 V DC from internal battery
Antenna information	The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.

### 3.4 Product description and theory of operation

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The EUT is a Tire Pressure Monitoring System sensor to be equipped on standard tubeless tire valves, designed for application on trucks, trailers, buses and other commercial vehicles. It measures the air pressure of the tire, temperature and battery voltage level and transmits these data through radio interface (434 MHz) with proprietary technology.

### 3.5 EUT exercise details

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The EUT has been forced to transmit every second

### 3.6 EUT setup diagram

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EUT is powered by internal batteries without I/O lines

### 3.7 EUT sub assemblies

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The EUT is composed by a single unit

## Section 4. Engineering considerations

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### 4.1 Modifications incorporated in the EUT

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There were no modifications performed to the EUT during this assessment.

### 4.2 Technical judgment

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None

### 4.3 Deviations from laboratory tests procedures

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No deviations were made from laboratory procedures.

## Section 5. Test conditions

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### 5.1 Atmospheric conditions

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In the laboratory, the following ambient conditions are respected for each test reported below:

Ambient temperature:	<u>18 ÷ 33 °C <sup>(1)</sup></u>
Relative Humidity:	<u>25 ÷ 70 % <sup>(2)</sup></u>
Atmospheric pressure:	<u>860 ÷ 1060 hPa</u>

<sup>(1)</sup> For luminaire, temperature during tests was verified to be within 18 ÷ 30 °C

<sup>(2)</sup> During ESD test, humidity was verified to be within 30 ÷ 60 %

The following instruments are used to monitor the environmental conditions:

Equipment	Manufacturer	Model	Serial N°
Thermo-hygrometer data loggers	Testo	175-H2	20012380/305
Thermo-hygrometer data loggers	Testo	175-H2	38203337/703
Barometer	Castle	GPB 3300	072015

### 5.2 Power supply range

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For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.



## Section 6. Measurement uncertainty

### 6.1 Uncertainty of measurement

The measurement uncertainty was calculated for each test and quantity listed in this test report, according to CISPR 16-4-2 and other specific test standard and is documented in Nemko Spa working manual WML1002. The assessment of conformity for each test performed on the equipment is performed not taking into account the measurement uncertainty. The two following possible verdicts are stated in the report:

P (Pass) - The measured values of the equipment respect the specification limit at the points tested. The specific risk of false accept is up to 50% when the measured result is close to the limit.

F (Fail) - One or more measured values of the equipment do not respect the specification limit at the points tested. The specific risk of false reject is up to 50% when the measured result is close to the limit.

Hereafter Nemko's measurement uncertainties are reported:

EUT	Type	Test	Range	Measurement Uncertainty	Notes
Transmitter	Conducted	Frequency error	0.001 MHz ÷ 40 GHz	0.08 ppm	(1)
		Carrier power RF Output Power	0.009 MHz ÷ 30 MHz	1.1 dB	(1)
			30 MHz ÷ 18 GHz	1.5 dB	(1)
			18 MHz ÷ 40 GHz	3.0 dB	(1)
			40 MHz ÷ 140 GHz	5.0 dB	(1)
			Adjacent channel power	1 MHz ÷ 18 GHz	1.4 dB
		Conducted spurious emissions	0.009 MHz ÷ 18 GHz	3.0 dB	(1)
			18 GHz ÷ 40 GHz	4.2 dB	(1)
			40 GHz ÷ 220 GHz	6.0 dB	(1)
		Intermodulation attenuation	1 MHz ÷ 18 GHz	2.2 dB	(1)
		Attack time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Attack time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Release time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Release time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Transient behaviour of the transmitter– Transient frequency behaviour	1 MHz ÷ 18 GHz	0.2 kHz	(1)
		Transient behaviour of the transmitter – Power level slope	1 MHz ÷ 18 GHz	9%	(1)
		Frequency deviation - Maximum permissible frequency deviation	0.001 MHz ÷ 18 GHz	1.3%	(1)
		Frequency deviation - Response of the transmitter to modulation frequencies above 3 kHz	0.001 MHz ÷ 18 GHz	0.5 dB	(1)
		Dwell time	-	3%	(1)
		Hopping Frequency Separation	0.01 MHz ÷ 18 GHz	1%	(1)
	Occupied Channel Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)	
	Modulation Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)	
	Radiated	Radiated spurious emissions	0.009 MHz ÷ 26.5 GHz	6.0 dB	(1)
26.5 GHz ÷ 66 GHz			8.0 dB	(1)	
66 GHz ÷ 220 GHz			10 dB	(1)	
Effective radiated power transmitter		10 kHz ÷ 26.5 GHz	6.0 dB	(1)	
		26.5 GHz ÷ 66 GHz	8.0 dB	(1)	
66 GHz ÷ 220 GHz	10 dB	(1)			

**NOTES:**

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

## Section 7. Testing data

### 7.1 FCC 15.31(m) Number of frequencies

#### 7.1.1 Definitions and limits

Measurements on intentional radiators or receivers shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table.

**Table 7.1-1: Frequency Range of Operation**

Frequency range over which the device operates (in each band)	Number of test frequencies required	Location of measurement frequency inside the operating frequency range
1 MHz or less	1	Center (middle of the band)
1–10 MHz	2	1 near high end, 1 near low end
Greater than 10 MHz	3	1 near high end, 1 near center and 1 near low end

Note: “near” means as close as possible to or at the centre / low end / high end of the frequency range over which the device operates.

#### 7.1.2 Test summary

Test date	December 23, 2020	Temperature	22 °C
Test engineer	P. Barbieri	Air pressure	990 mbar
Verdict	Pass	Relative humidity	35 %

#### 7.1.3 Observations, settings and special notes

None

#### 7.1.4 Test data

**Table 7.1-2: Test channels selection**

Start of Frequency range, MHz	End of Frequency range, MHz	Frequency range bandwidth, MHz	Low channel, MHz	Mid channel, MHz	High channel, MHz
--	--	--	--	434.2	--

The EUT use only one channel

## 7.2 FCC 15.203 Antenna requirement

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### 7.2.1 Definitions and limits

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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 this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. 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 §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.

### 7.2.2 Test summary

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Test date	December 23, 2020	Temperature	22 °C
Test engineer	P. Barbieri	Air pressure	990 mbar
Verdict	Pass	Relative humidity	35 %

### 7.2.3 Observations, settings and special notes

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None

### 7.2.4 Test data

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- Must the EUT be professionally installed?  YES  NO  
 Does the EUT have detachable antenna(s)?  YES  NO  
 If detachable, is the antenna connector(s) non-standard?  YES  NO  N/A

The EUT use a quarter-wave helical antenna with max gain of 0 dBi



## 7.3 FCC 15.231(e) Conditions for intentional radiators to comply with periodic operation

### 7.3.1 Definitions and limits

(e) Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this section, except the field strength table in paragraph (b) of this section is replaced by the following:

**Table 7.3-1: Field strength limits**

Fundamental frequency (MHz)	Field strength of fundamental		Field strength of spurious emissions	
	( $\mu\text{V}/\text{m}$ )	( $\text{dB}\mu\text{V}/\text{m}$ )	( $\mu\text{V}/\text{m}$ )	( $\text{dB}\mu\text{V}/\text{m}$ )
40.66–40.70	1000	60.0	100	40.0
70–130	500	54.0	50	34.0
130–174	500 to 1500*	54.0 to 63.5*	50 to 150*	34.0 to 43.5*
174–260	1500	63.5	150	43.5
260–470	1500 to 5000*	63.5 to 74.0*	150 to 500*	43.5 to 54.0*
Above 470	5000	74.0	500	54.0

\* Linear interpolations

Note:

\* Linear interpolation with frequency F in MHz: @ 434.2 MHz the limit is 440.33  $\mu\text{V}/\text{m}$  (52.87  $\text{dB}\mu\text{V}/\text{m}$ ).

The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

**Table 7.3-2: FCC §15.209– Radiated emission limits**

Frequency, MHz	Field strength of emissions		Measurement distance, m
	$\mu\text{V}/\text{m}$	$\text{dB}\mu\text{V}/\text{m}$	
0.009–0.490	2400/F	$67.6 - 20 \times \log_{10}(F)$	300
0.490–1.705	24000/F	$87.6 - 20 \times \log_{10}(F)$	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

Notes: In the emission table above, the tighter limit applies at the band edges.

For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test

**Table 7.3-3: FCC restricted frequency bands**

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

7.3.2 Test summary

Test date	December 23, 2020	Temperature	22 °C
Test engineer	P. Barbieri	Air pressure	990 mbar
Verdict	Pass	Relative humidity	35 %

7.3.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to 5 GHz. Radiated measurements were performed at a distance of 3 m. EUTs that can be operated in multiple orientations (such as handheld, portable, or modular devices) shall be tested in three orientations. Average radiated emissions were obtained by subtracting duty cycle / correction factor from the peak measurement results.

Spectrum analyser settings for radiated measurements below 1 GHz:

Resolution bandwidth	100 kHz
Video bandwidth	300 kHz
Detector mode	Peak
Trace mode	Max Hold

Spectrum analyser settings for radiated measurements above 1 GHz:

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Detector mode	Peak
Trace mode	Max Hold

7.3.4 Test equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI receiver	R&S	ESU8	100202	2020-08	2021-08
EMI receiver	R&S	ESW44	101620	2020-09	2021-09
Trilog Broadband Antenna	Schwarzbeck	VULB 9162	9162-025	2018-07	2021-07
Bilog antenna (1 ÷ 18 GHz)	Schwarzbeck	STLP 9148	9148-152	2018-09	2021-09
Preamplifier (1 ÷ 18 GHz)	Schwarzbeck	BBV9718	9718-137	2020-07	2021-07
Controller	Maturo	FCU3.0	10041	NCR	NCR
Tilt antenna mast	Maturo	TAM4.0-E	10042	NCR	NCR
Turntable	Maturo	TT4.0-5T	2.527	NCR	NCR
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530	2018-09	2021-09
Shielded room	Siemens	10m control room	1947	NCR	NCR

Note: NCR - no calibration required, VOU - verify on use

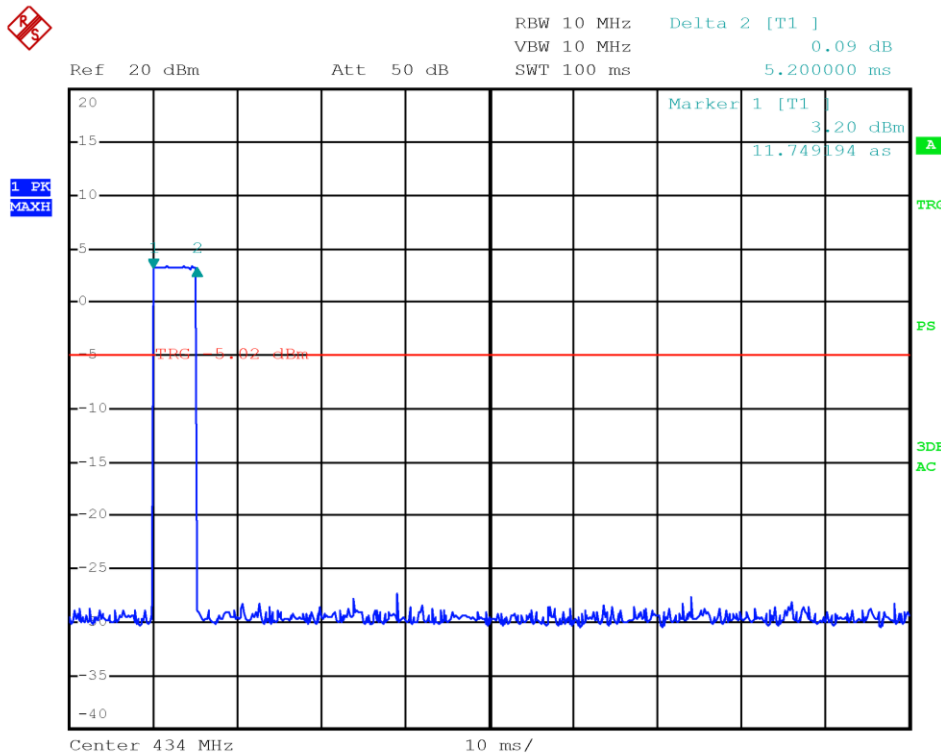
7.3.5 Test data

Duty cycle/average factor calculations

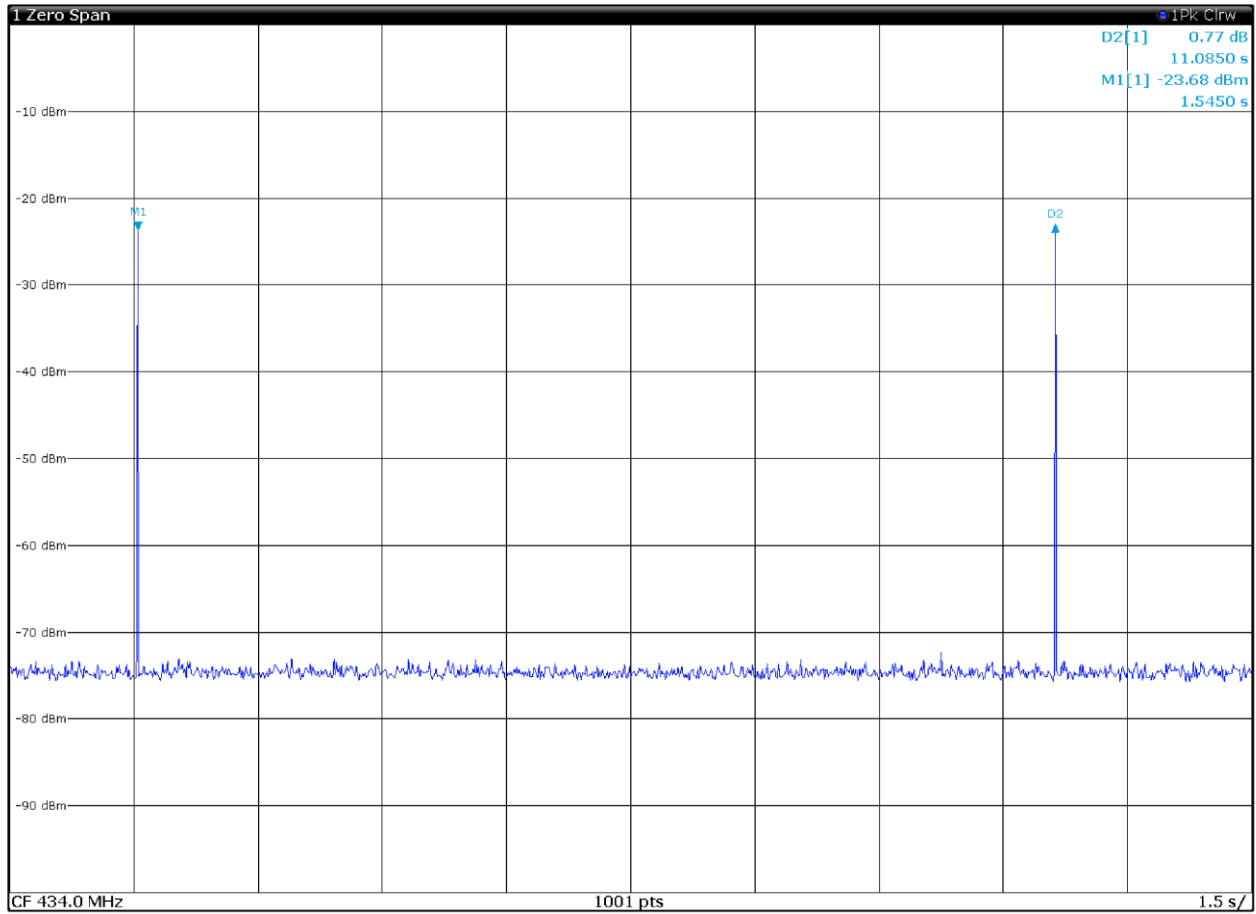
\$15.35(c) When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed; the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

$$\text{Duty cycle or average factor} = 20 \times \log_{10} \left( \frac{T_{x_{100ms}}}{100ms} \right)$$

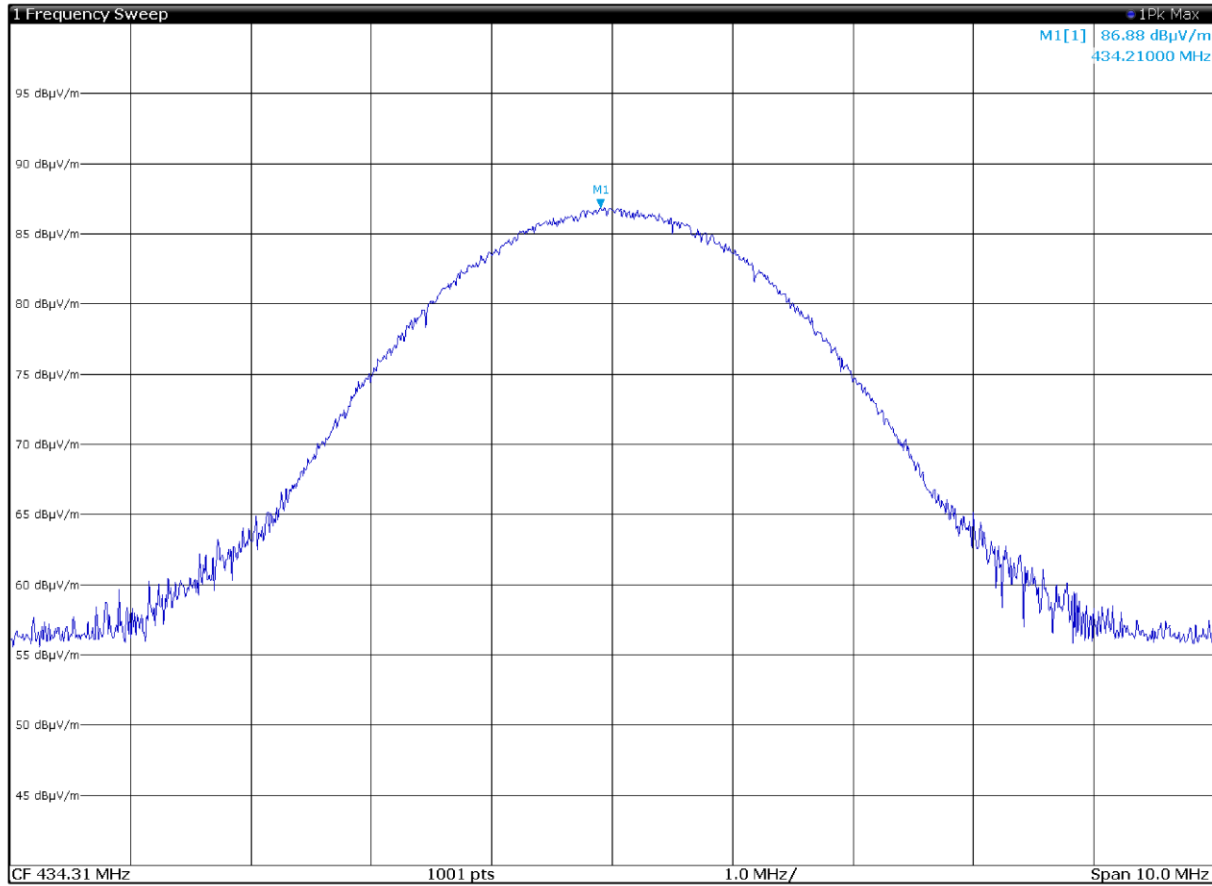
$$\text{Duty cycle correction factor for 5.2 ms pulse duration} = 20 \times \log_{10} (5.2 / 100) = -25.6 \text{ dB}$$



The pulse is repeated every 11 seconds as show in the following plot.



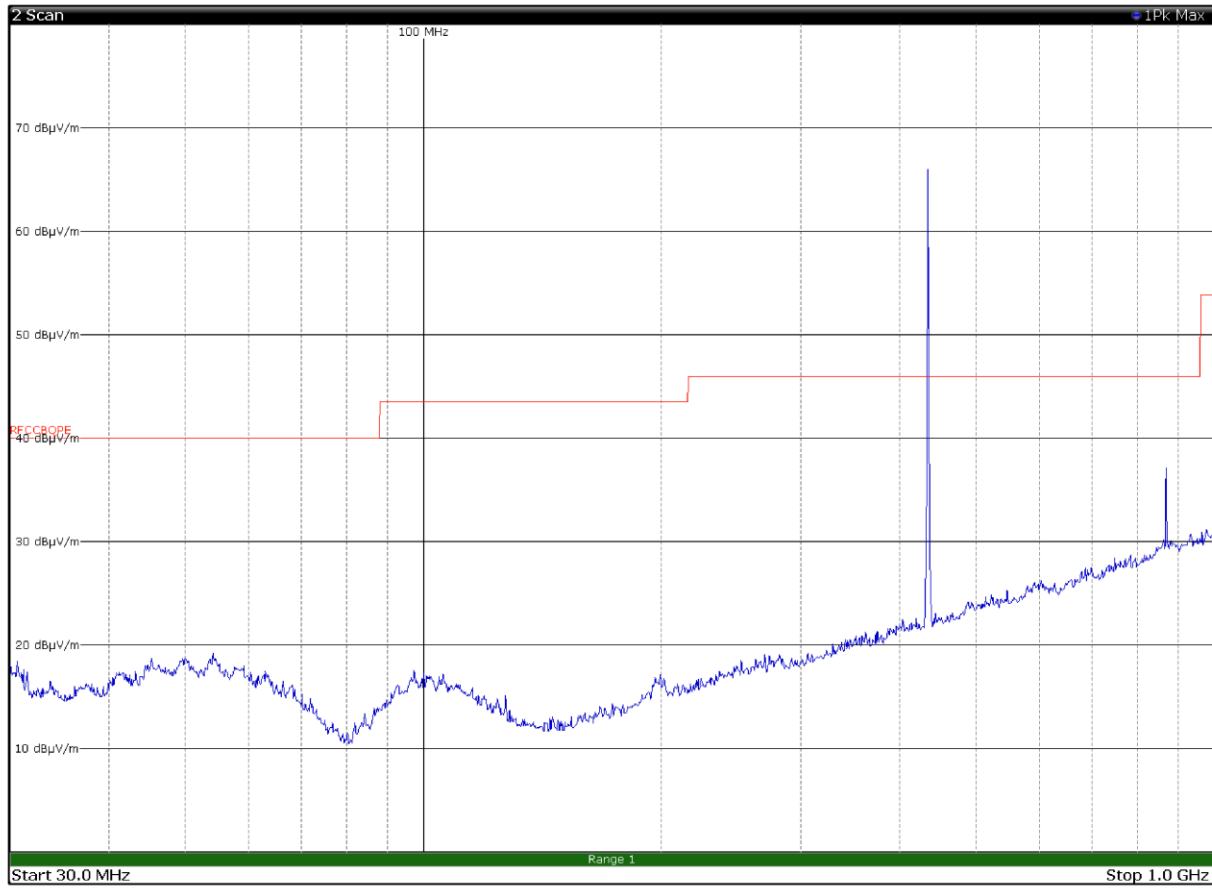
Transmission duration: transmission is repeated every 11 seconds, as shown in the previous measure; the single pulse duration is 5.2ms (< 1 sec.), as show in the measure of p.14. The resulting silent period is then > 10 sec.



Field strength of fundamental

Frequency, MHz	Peak field strength, dBµV/m	Duty cycle factor, dB	Average field strength, dBµV/m	Average limit, dBµV/m	Margin, dB
434.2	86.9	-25.6	61.3	72.6	-11.3

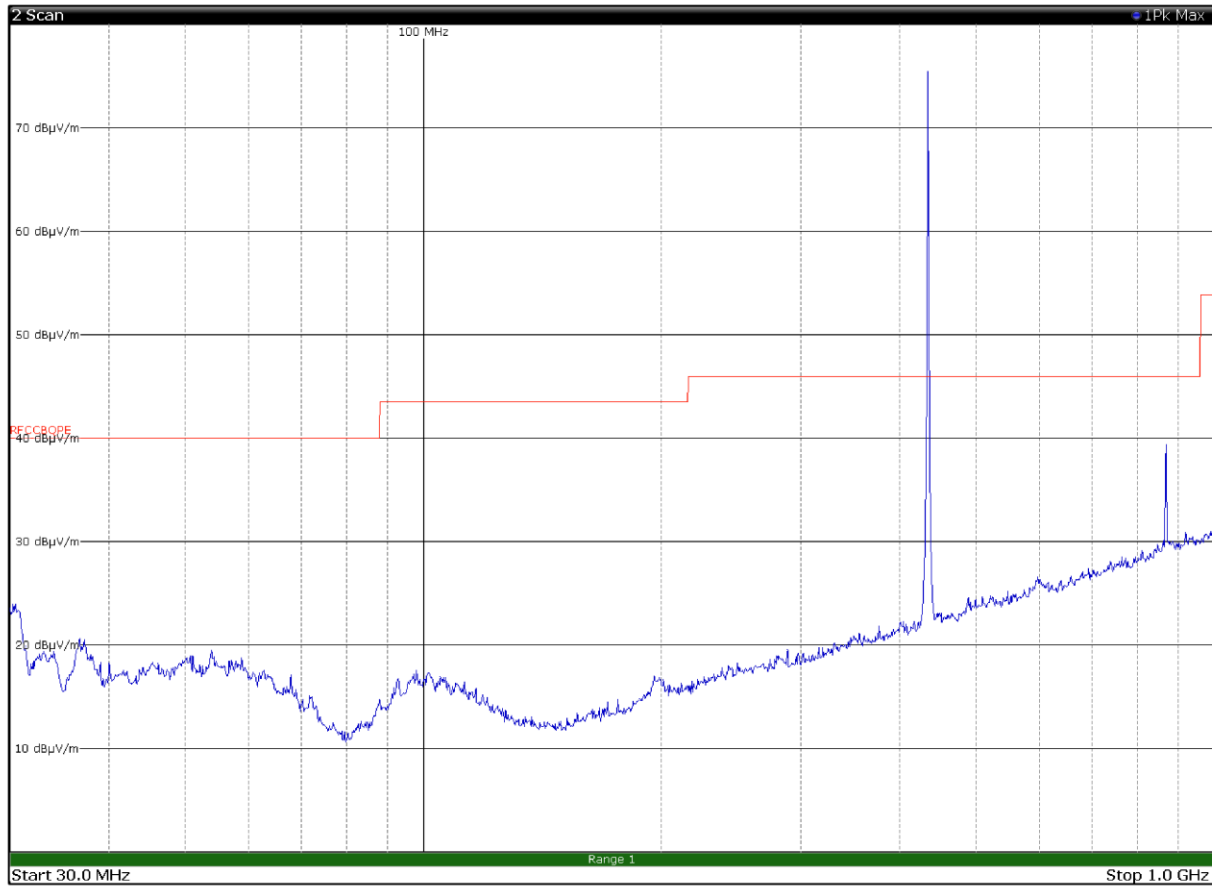




Radiated emission in the frequency range 30 to 1000 MHz with EUT in horizontal position and the antenna in horizontal polarization

Frequency, MHz	Peak field strength, dBµV/m	Limit, dBµV/m	Margin, dB
868.5900	37.2	46.0	-8.8

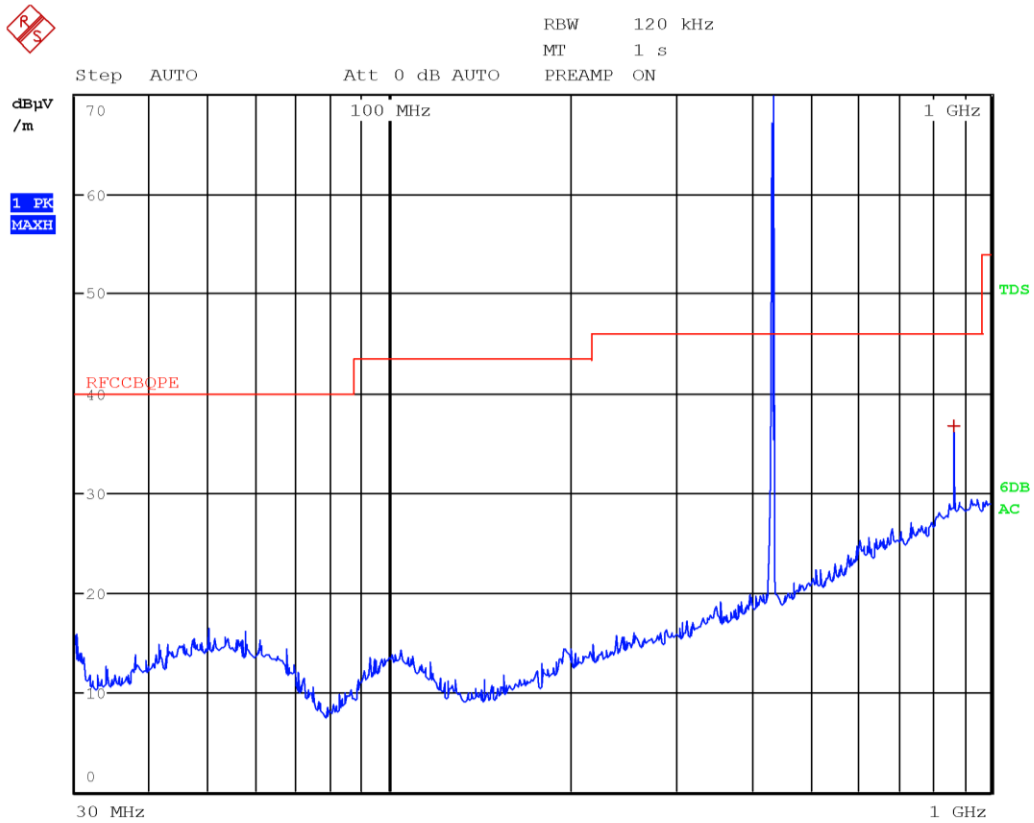
Limit exceeded by the carrier. No additional measure needed because peak value of the field strength is under the 15.209 limits



Radiated emission in the frequency range 30 to 1000 MHz with EUT in horizontal position and the antenna in vertical polarization

Frequency, MHz	Peak field strength, dBµV/m	Limit, dBµV/m	Margin, dB
868.6500	39.5	46.0	-6.5

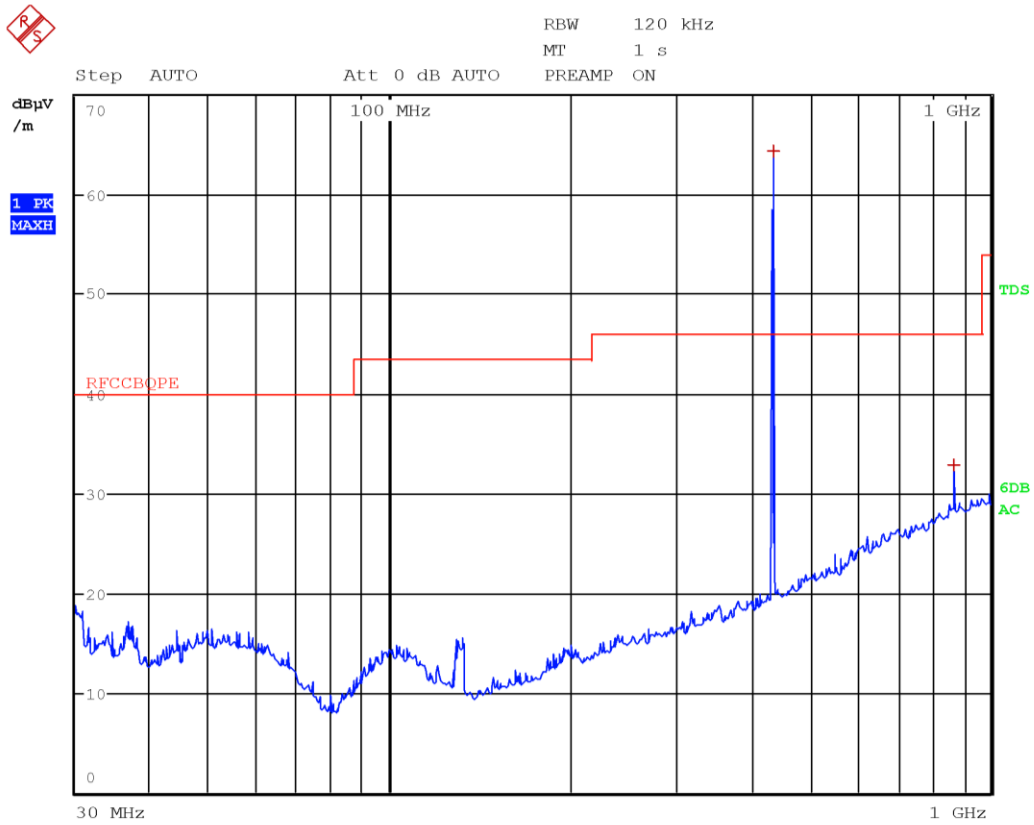
Limit exceeded by the carrier. No additional measure needed because peak value of the field strength is under the 15.209 limits



Radiated emission in the frequency range 30 to 1000 MHz with EUT in vertical position and the antenna in horizontal polarization

Frequency, MHz	Peak field strength, dBµV/m	Limit, dBµV/m	Margin, dB
868.4000	36.9	46.0	-9.1

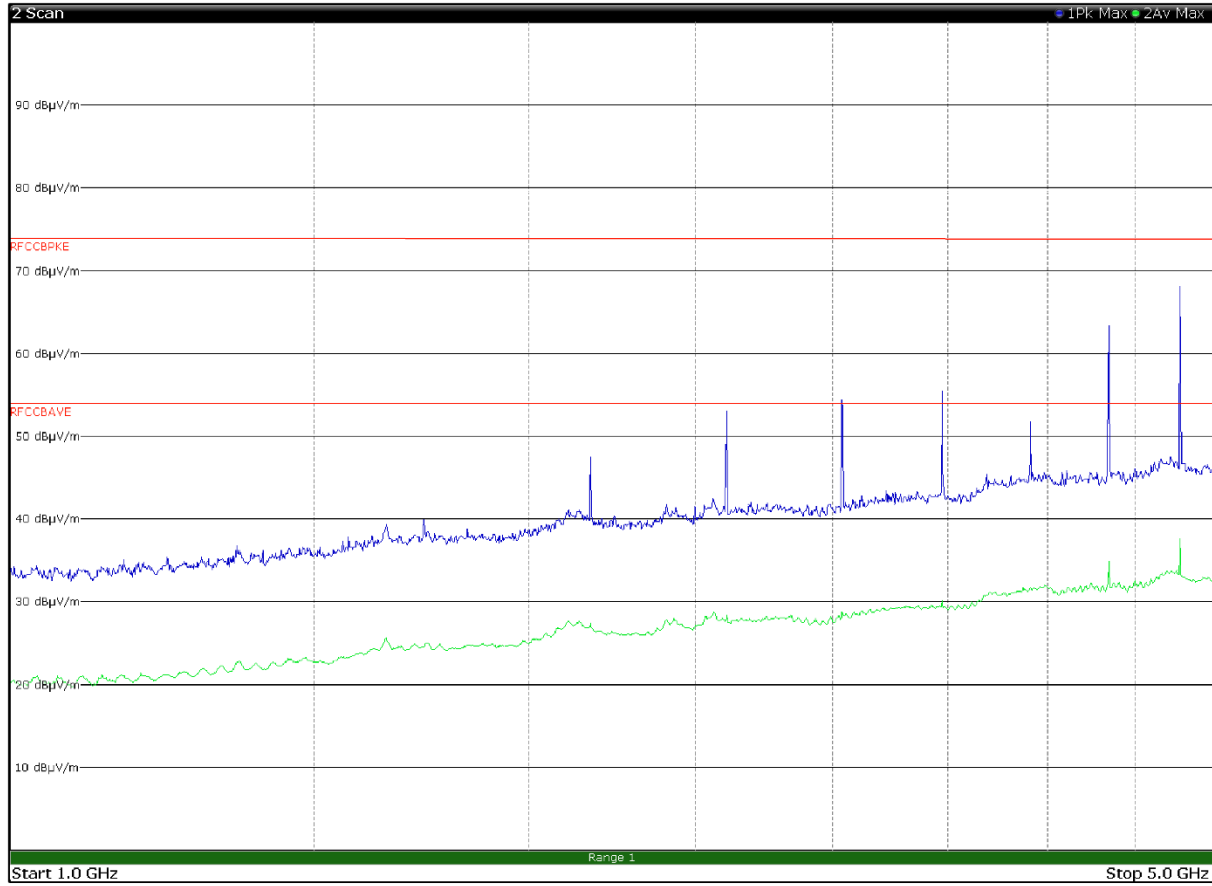
Limit exceeded by the carrier. No additional measure needed because peak value of the field strength is under the 15.209 limits



Radiated emission in the frequency range 30 to 1000 MHz with EUT in vertical position and the antenna in vertical polarization

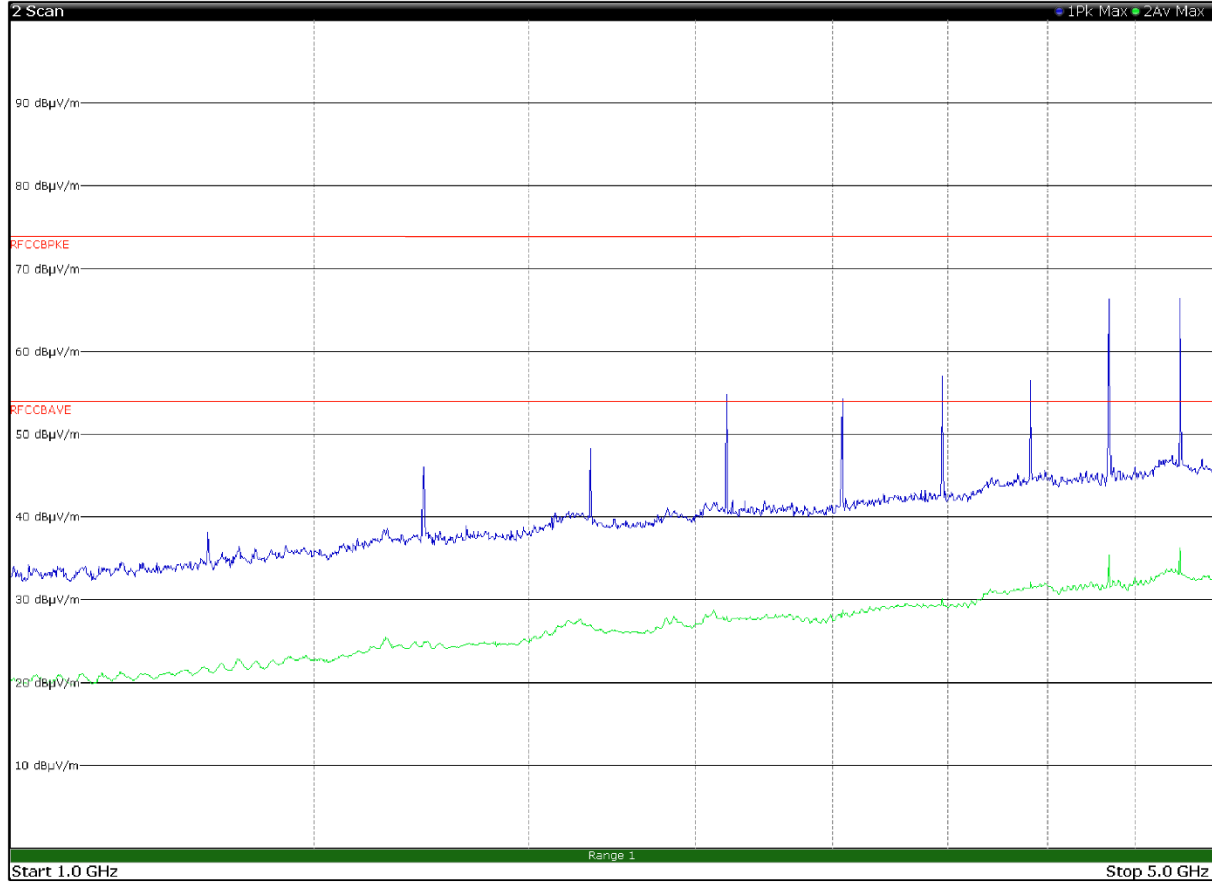
Frequency, MHz	Peak field strength, dBµV/m	Limit, dBµV/m	Margin, dB
868.5600	32.9	46.0	-13.1

Limit exceeded by the carrier. No additional measure needed because peak value of the field strength is under the 15.209 limits



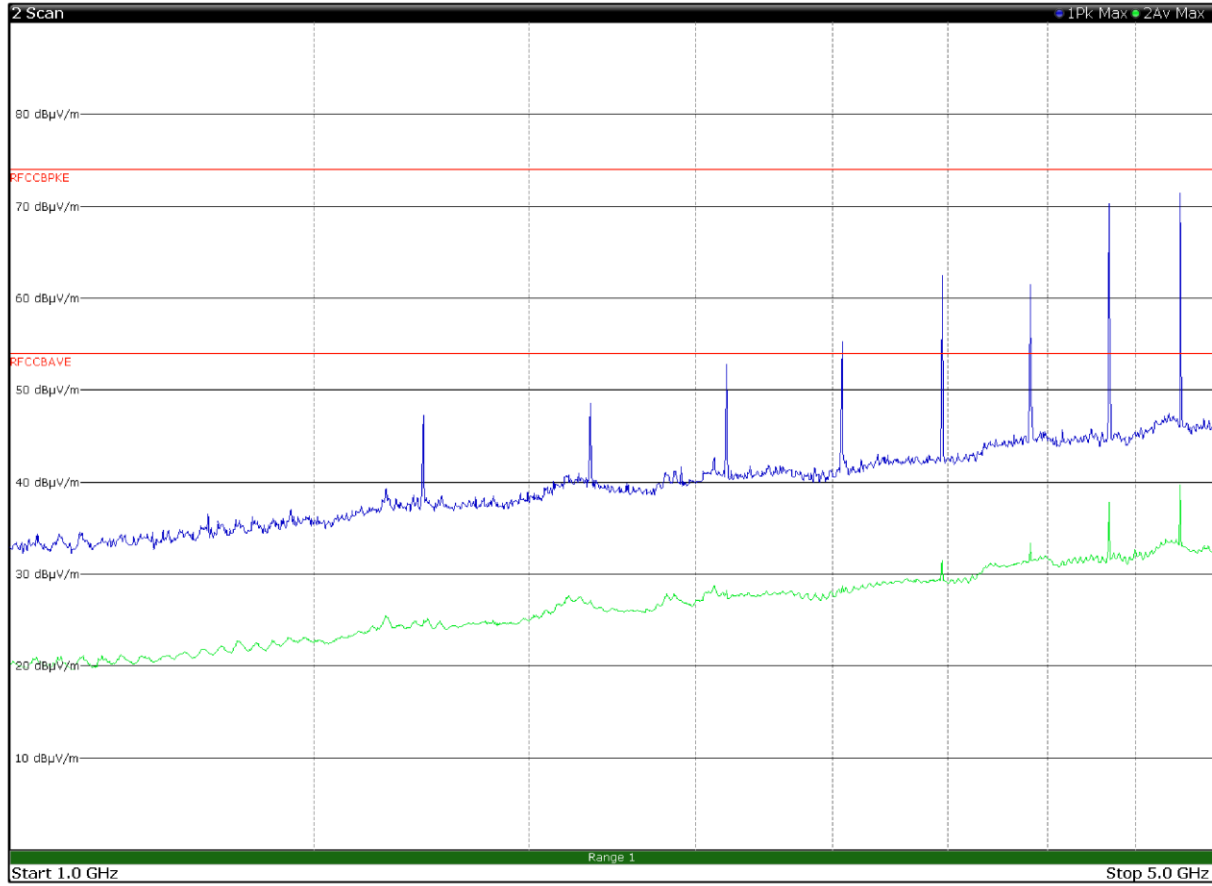
Radiated emission in the frequency range 1 to 5 GHz with EUT in horizontal position and the antenna in horizontal polarization

Frequency, MHz	Peak field strength, dBµV/m	Peak limit, dBµV/m	Margin, dB	Duty cycle factor, dB	Average field strength, dBµV/m	Average limit, dBµV/m	Margin, dB
1737.2500	39.9	74.0	-34.1	-25.6	14.3	52.87	-38,57
2171.5000	48.1	74.0	-25.9	-25.6	22.5	52.87	-30,37
2605.5000	53.8	74.0	-20.2	-25.6	28.2	52.87	-24,67
3041.2500	54.1	74.0	-19.9	-25.6	28.5	52.87	-24,37
3475.5000	55.3	74.0	-18.7	-25.6	29.7	52.87	-23,17
3910.0000	52.1	74.0	-21.9	-25.6	26.5	52.87	-26,37
4343.0000	67.4	74.0	-6.6	-25.6	41.8	52.87	-11,07
4777.0000	66.5	74.0	-7.5	-25.6	40.9	52.87	-11,97



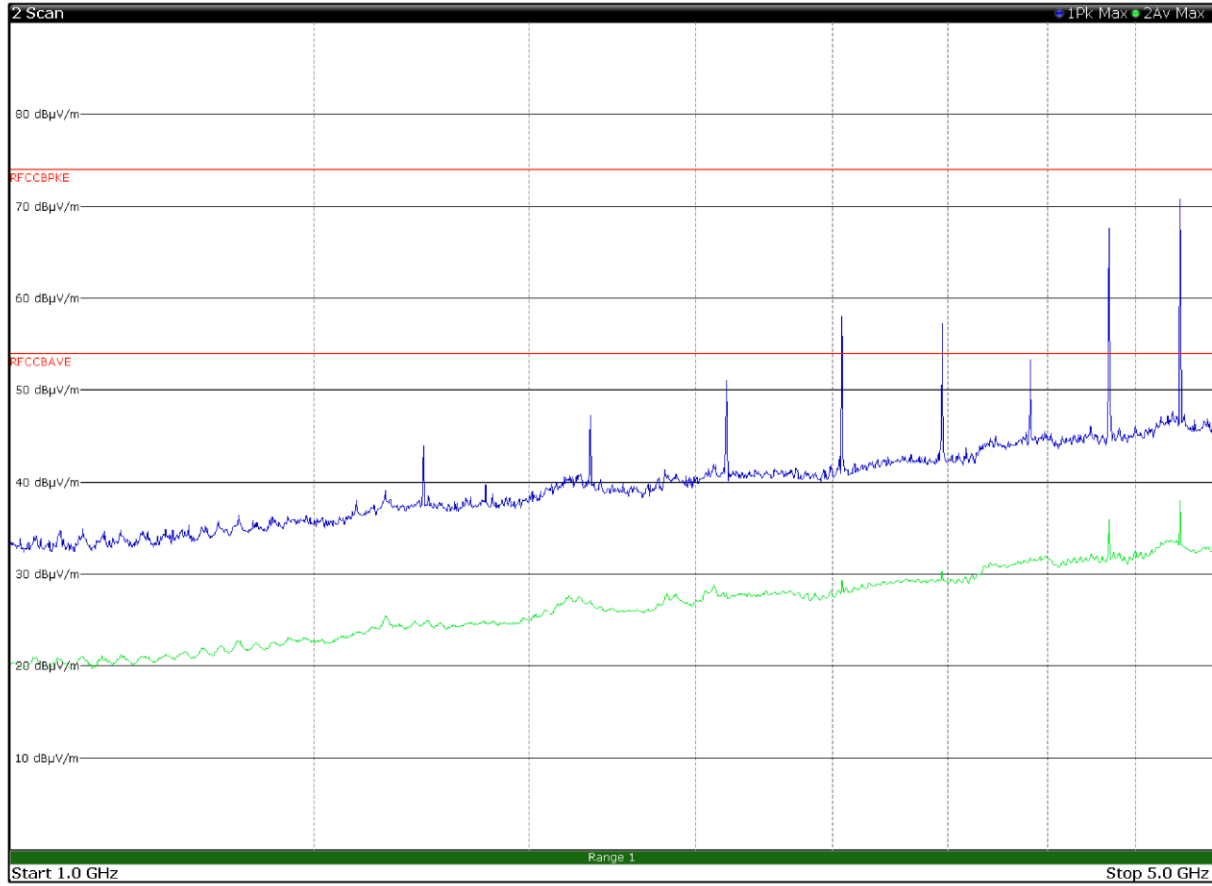
Radiated emission in the frequency range 1 to 5 GHz with EUT in horizontal position and the antenna in vertical polarization

Frequency, MHz	Peak field strength, dBµV/m	Peak limit, dBµV/m	Margin, dB	Duty cycle factor, dB	Average field strength, dBµV/m	Average limit, dBµV/m	Margin, dB
1737.2500	47.1	74.0	-26.9	-25.6	21.5	52.87	-31,37
2171.5000	48.3	74.0	-25.7	-25.6	22.7	52.87	-30,17
2605.5000	54.8	74.0	-19.2	-25.6	29.2	52.87	-23,67
3041.2500	54.3	74.0	-19.7	-25.6	28.7	52.87	-24,17
3475.5000	57.1	74.0	-16.9	-25.6	31.5	52.87	-21,37
3910.0000	56.5	74.0	-17.5	-25.6	30.9	52.87	-21,97
4343.0000	66.4	74.0	-7.6	-25.6	40.8	52.87	-12,07
4777.0000	66.5	74.0	-7.5	-25.6	40.9	52.87	-11,97



Radiated emission in the frequency range 1 to 5 GHz with EUT in vertical position and the antenna in horizontal polarization

Frequency, MHz	Peak field strength, dBµV/m	Peak limit, dBµV/m	Margin, dB	Duty cycle factor, dB	Average field strength, dBµV/m	Average limit, dBµV/m	Margin, dB
1737.0000	47.3	74.0	-26.7	-25.6	21.7	52.87	-31,17
2171.5000	48.6	74.0	-25.4	-25.6	23.0	52.87	-29,87
2605.5000	52.9	74.0	-21.1	-25.6	27.3	52.87	-25,57
3041.2500	55.3	74.0	-18.7	-25.6	29.7	52.87	-23,17
3475.5000	62.5	74.0	-11.5	-25.6	36.9	52.87	-15,97
3910.0000	61.6	74.0	-12.4	-25.6	36.0	52.87	-16,87
4343.0000	70.3	74.0	-3.7	-25.6	44.7	52.87	-8,17
4777.2500	71.5	74.0	-2.5	-25.6	45.9	52.87	-6,97



Radiated emission in the frequency range 1 to 5 GHz with EUT in vertical position and the antenna in vertical polarization

Frequency, MHz	Peak field strength, dBµV/m	Peak limit, dBµV/m	Margin, dB	Duty cycle factor, dB	Average field strength, dBµV/m	Average limit, dBµV/m	Margin, dB
1737.0000	44.0	74.0	-30.0	-25.6	18.4	52.87	-34,47
2171.5000	47.3	74.0	-26.7	-25.6	21.7	52.87	-31,17
2605.5000	51.1	74.0	-22.9	-25.6	25.5	52.87	-27,37
3039.7500	58.1	74.0	-15.9	-25.6	32.5	52.87	-20,37
3475.5000	57.3	74.0	-16.7	-25.6	31.7	52.87	-21,17
3908.2500	53.3	74.0	-20.7	-25.6	27.7	52.87	-25,17
4343.0000	67.7	74.0	-6.3	-25.6	42.1	52.87	-10,77
4777.2500	70.8	74.0	-3.2	-25.6	45.2	52.87	-7,67



## 7.4 FCC 15.231(c) Emission bandwidth of momentary signals

### 7.4.1 Definitions and limits

The bandwidth of the emission shall be no wider than 0.25 % of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5 % of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

### 7.4.2 Test summary

Test date	December 23, 2020	Temperature	22 °C
Test engineer	P. Barbieri	Air pressure	990 mbar
Verdict	Pass	Relative humidity	35 %

### 7.4.3 Observations, settings and special notes

Limit: 0.25 % of 434 MHz is 1.08 MHz

Spectrum analyser settings:

Resolution bandwidth	≥ 1 % of emission bandwidth
Video bandwidth	≥ 3 × RBW
Frequency span	Wider than emission bandwidth
Detector mode	Peak

### 7.4.4 Test equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI receiver	R&S	ESW44	101620	2020-09	2021-09
Trilog Broadband Antenna	Schwarzbeck	VULB 9162	9162-025	2018-07	2021-07
Controller	Maturo	FCU3.0	10041	NCR	NCR
Tilt antenna mast	Maturo	TAM4.0-E	10042	NCR	NCR
Turntable	Maturo	TT4.0-5T	2.527	NCR	NCR
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530	2018-09	2021-09
Shielded room	Siemens	10m control room	1947	NCR	NCR

Note: NCR - no calibration required, VOI - verify on use

### 7.4.5 Test data

**Table 7.4-1: Occupied bandwidth measurement result**

Occupied bandwidth per frequency, KHz	Limit, MHz	Margin, kHz
818.2	1.08	-261.8



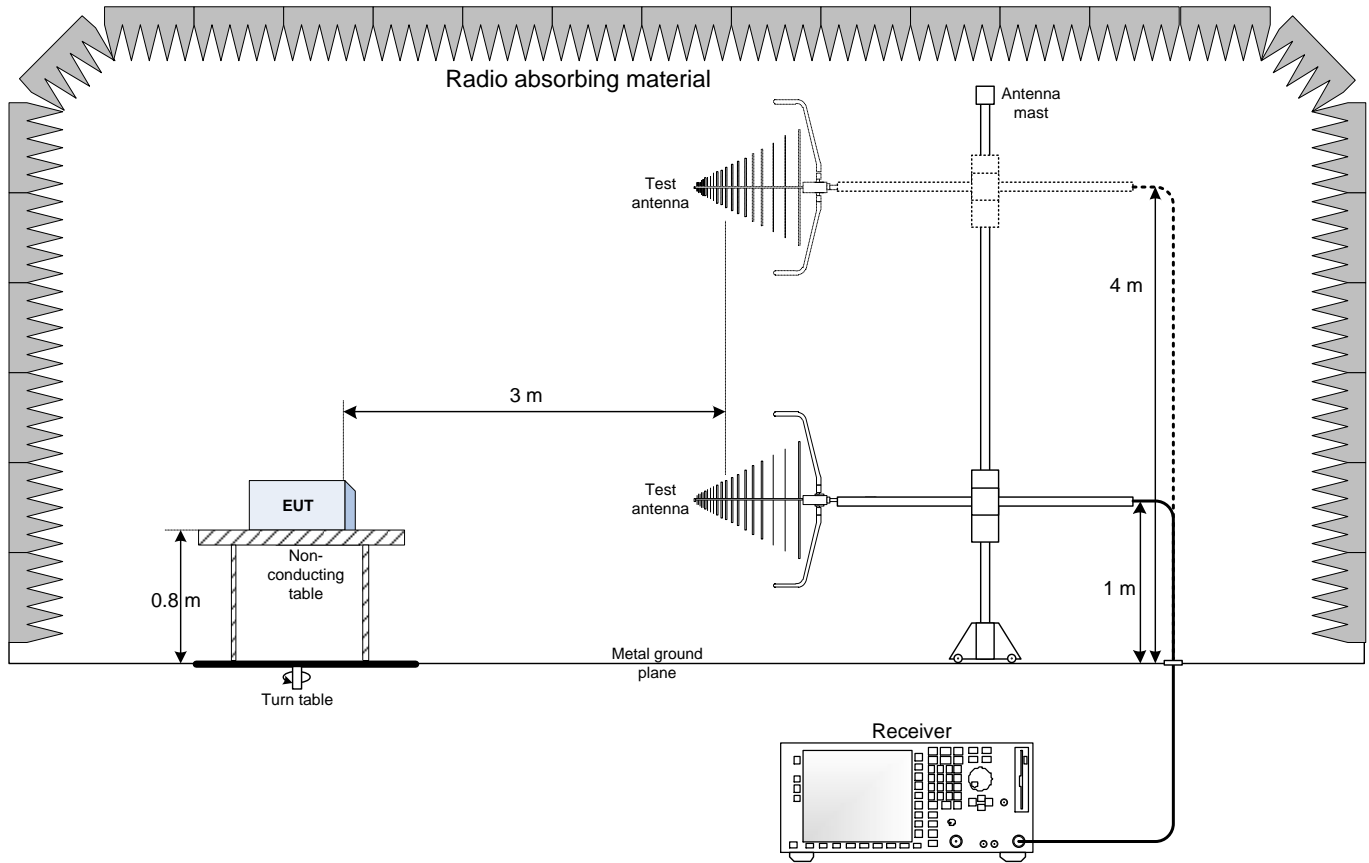
2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1	1	1	<b>434.279 MHz</b>	<b>-63.53 dBm</b>	ndB	20.0 dB
T1	1	1	433.8954 MHz	-83.40 dBm	ndB down BW	<b>818.20 kHz</b>
T2	1	1	434.7136 MHz	-83.39 dBm	Q Factor	530.8

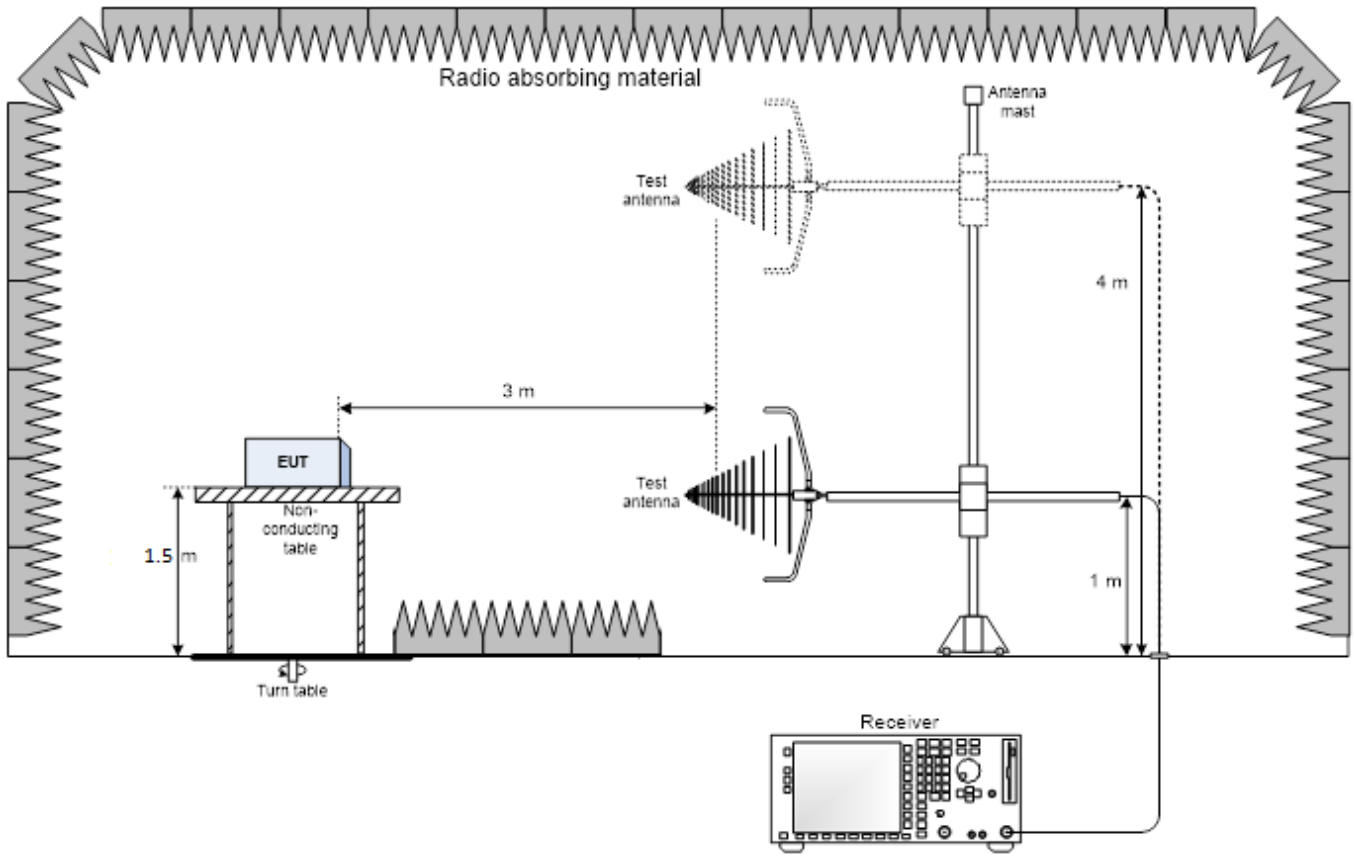
Figure 7.4-1: Occupied bandwidth measurement

## Section 8. Block diagrams of test set-ups

### 8.1 Radiated emissions set-up for frequencies below 1 GHz



### 8.2 Radiated emissions set-up for frequencies above 1 GHz

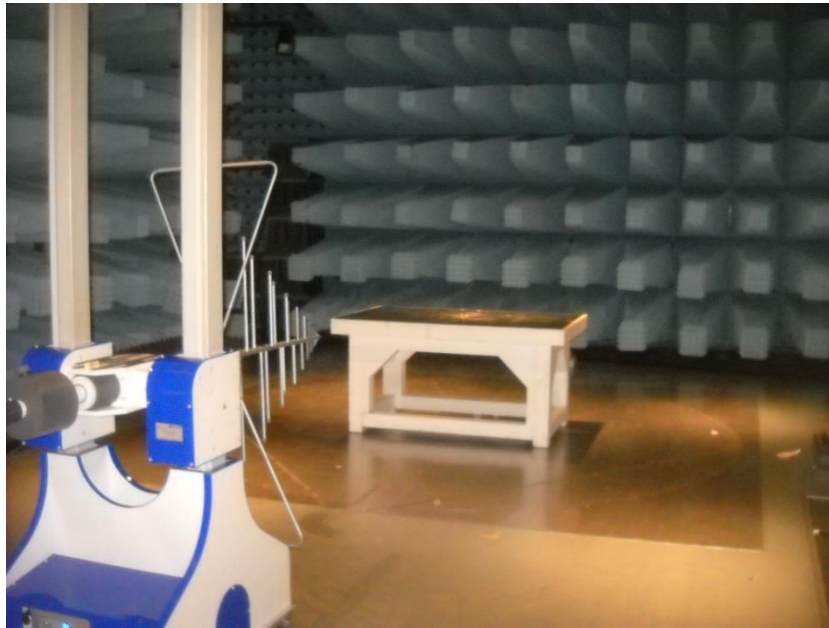


## Section 9. Photos

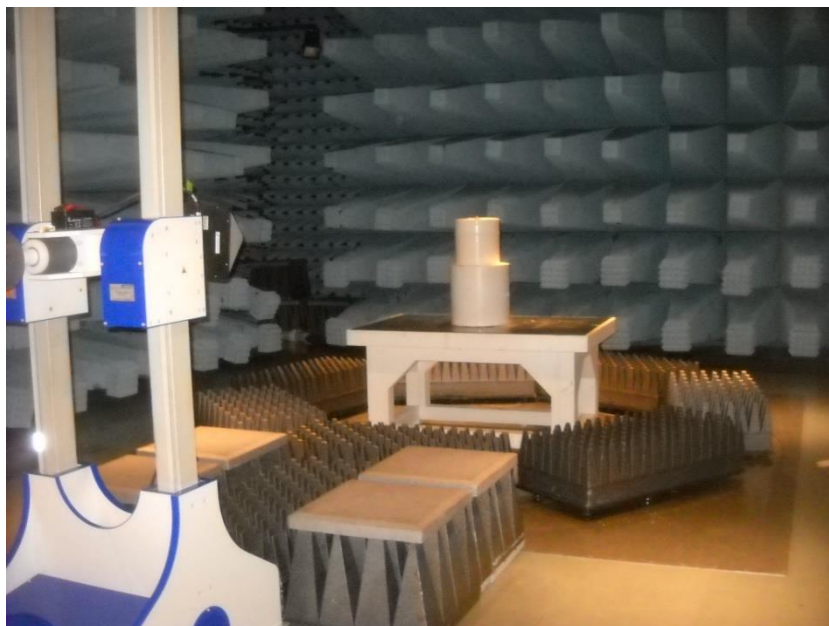
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### 9.1 Photos of the test set-up

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Radiated emissions set-up for frequencies below 1 GHz



Radiated emissions set-up for frequencies above 1 GHz

9.2 Photos of the EUT

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End of report