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Test report

425357TRFWL

Date of issue: February 9, 2021

Applicant:

CDVI Wireless Spa

Via Piave, 23 – 31020 S. Pietro di Feletto (TV) – Italy

Product:

Wireless Keypad

Model:

050551

FCC ID:

PWJRKPU

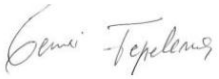
Specifications:

- FCC 47 CFR Part 15 Subpart C, §15.231

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

Test location

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	www.nemko.com
Site number	FCC ID number 682159 (10 m semi anechoic chamber)

Tested by (name, function and signature)	G. Tepelena	(project handler)	
Reviewed by (name, function and signature)	P. Barbieri	(verifier)	
Date	February 9, 2021		

Limits of responsibility

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 contain in this report are within Nemko Spa's ISO/IEC 17025 accreditation.

Copyright notification

Table of contents

Section 1. Report summary

1.1 Applicant and manufacturer info

Company name	CDVI WIRELESS SPA
Address	Via Piave, 23
City	San Pietro di Feletto
Province/State	Treviso
Postal/Zip code	31020
Country	Italy

1.2 Test specifications

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

1.3 Test methods

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

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies 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

None

1.6 Test report revision history

Revision #	Details of changes made to test report
425357TRFWL	Original report issued

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C test results

Part	Test description	Verdict
§15.207(a)	Conducted limits	Pass
§15.203	Antenna requirement	Pass [1]
FCC 15.207(a)	AC power line conducted emissions limits	Pass
§15.231(a)	Conditions for intentional radiators to comply with periodic operation	Pass
§15.231(b)	Field strength of emissions	Pass
§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	Not applicable

Notes: [1] The Antennas are located within the enclosure of EUT and not user accessible.

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	February 5, 2021
Nemko sample ID number	425357

3.2 EUT information

Product name	Wireless Keypad
Model	USAutomatic part name: 050551
Serial number	4253570001 (Number assigned by Nemko Spa)

3.3 Technical information

Operating band	Above 70 MHz
Operating frequency	433.92 MHz
Modulation type	ASK
Field strength (dBµV/m @ 3 m)	dBµV/m @ 3 m
Measured BW (kHz) (-20 dB)	28.8
Emission classification (F1D, G1D, D1D)	--
Power requirements	Battery type CR123A Lithium 3 VDC or Wired 12/24 ac/dc
Antenna information	The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.

3.4 Product description and theory of operation

The EUT is a radio keypad operating at 433.92 MHz. The radio transmission is enabled only after entering a valid access code. The internal memory can store up to 256 different access codes, 256 temporary codes and 1 Master code. This keypad has 4 unique transmitting channels controlling up to 4 different receiver.

3.5 EUT exercise details

The EUT has been forced in continuous transmission mode pushing all the key in sequence (1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 - * - 0 - #)

3.6 EUT setup diagram

EUT is powered by internal batteries and by an external DC power source without other I/O.

3.7 EUT sub assemblies

The EUT is composed by a single unit

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

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

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

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

Ambient temperature:	18 ÷ 33 °C [1]
Relative Humidity:	25 ÷ 70 % [2]
Atmospheric pressure:	860 ÷ 1060 hPa

[1] For luminaire, temperature during tests was verified to be within 18 ÷ 30 °C
[2] 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

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	(1)
		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	February 8, 2021	Temperature	20 °C
Test engineer	P. Barbieri	Air pressure	970 mbar
Verdict	Pass	Relative humidity	49 %

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
--	--	--	--	433.92	--

The EUT use only one channel

7.2 FCC 15.203 Antenna requirement

7.2.1 Definitions and limits

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

Test date	February 8, 2021	Temperature	20 °C
Test engineer	P. Barbieri	Air pressure	970 mbar
Verdict	Pass	Relative humidity	49 %

7.2.3 Observations, settings and special notes

None

7.2.4 Test data

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

7.3 FCC 15.207(a) AC power line conducted emissions limits

7.3.1 Definitions and limits

Except as shown in paragraphs (b) and (c) of this section, 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 50 µH/50 Ω 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.

Table 7.3-1: *Conducted emissions limit*

Frequency of emission, MHz	Conducted limit, dBµV	
	Quasi-peak	Average**
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

Note: * - The level decreases linearly with the logarithm of the frequency.
** - A linear average detector is required.

7.3.2 Test summary

Test date	February 8, 2021	Temperature	20 °C
Test engineer	G. Tepelena	Air pressure	970 mbar
Verdict	Pass	Relative humidity	49 %

7.3.3 Observations, settings and special notes

The EUT was set up as tabletop configuration.

The spectral scan has been corrected with transducer factors (i.e. cable loss, LISN factors, and attenuators) for determination of compliance.

A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver settings for preview measurements:

Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Detector mode	Peak and Average
Trace mode	Max Hold
Measurement time	1000 ms

Receiver settings for final measurements:

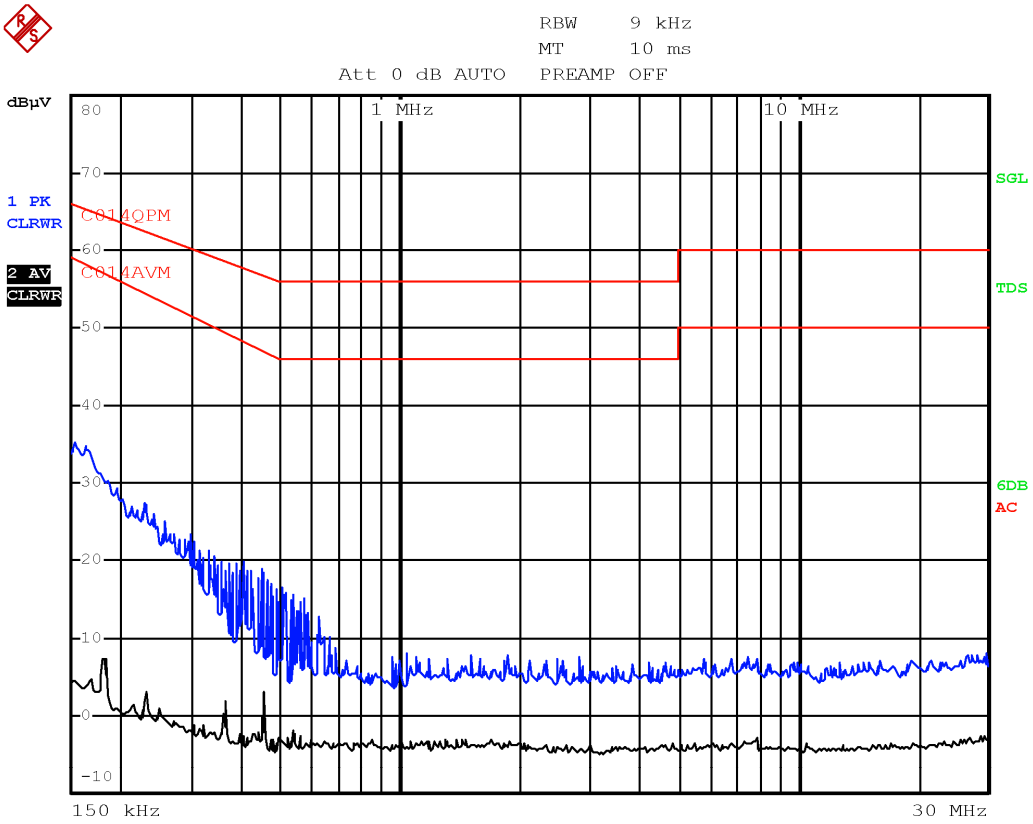
Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Detector mode	Quasi-Peak and Average
Trace mode	Max Hold
Measurement time	1000 ms

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
LISN	Rohde & Schwarz	ESH2-Z5	881 362/006	2020-02	2021-02
Shielded room	Siemens	Conducted emission test room	1862	NCR	NCR

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

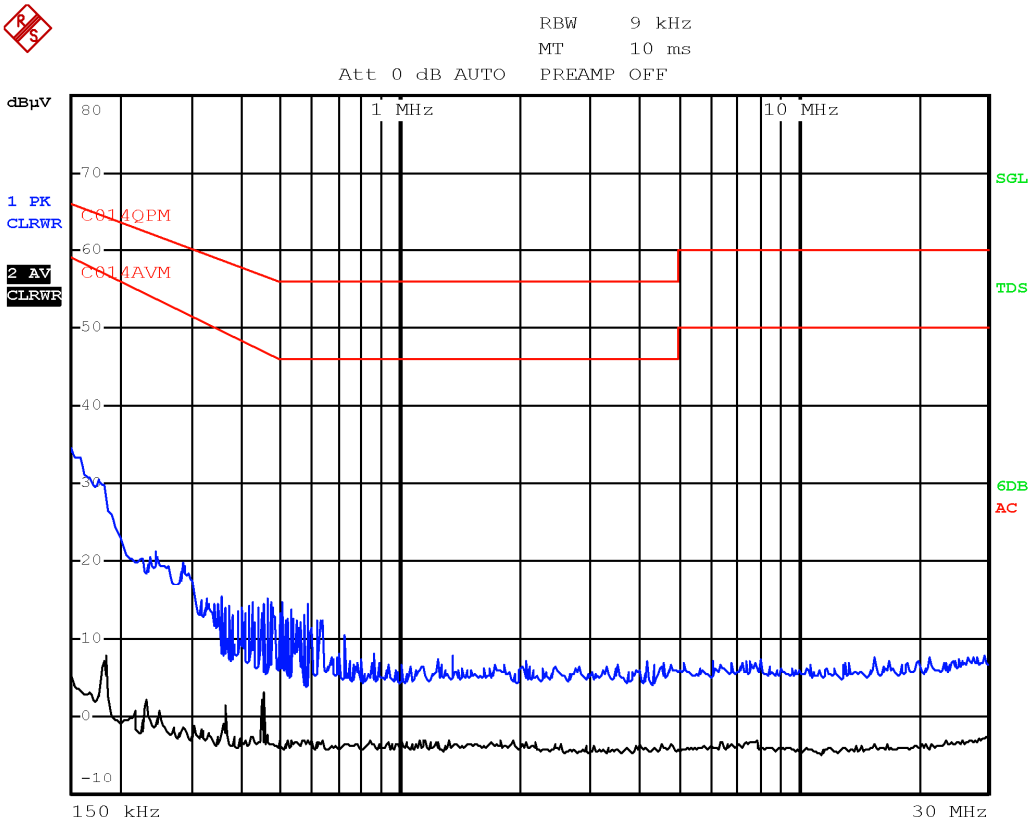
7.3.5 Test data



Plot 7.3-1: *Conducted emissions on phase line*

Table 7.3-2: *Quasi-Peak conducted emissions results on phase line*

Frequency, MHz	Q-Peak result, dBµV	Limit, dBµV	Margin, dB	Meas. Time, ms	Bandwidth, kHz	Correction, dB
0.150	34.99	66.00	31.01	100	9	10.00



Plot 7.3-2: *Conducted emissions on neutral line*

Table 7.3-3: *Quasi-Peak conducted emissions results on neutral line*

Frequency, MHz	Q-Peak result, dBµV	Limit, dBµV	Margin, dB	Meas. Time, ms	Bandwidth, kHz	Correction, dB
0.150	33.55	66.00	32.45	100	9	10.00

7.4 FCC 15.231(a) Conditions for intentional radiators to comply with periodic operation

7.4.1 Definitions and limits

(a) The provisions of this section are restricted to periodic operation within the band 40.66–40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:

(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

(4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.

(5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

7.4.2 Test summary

Test date	February 8, 2021	Temperature	20 °C
Test engineer	G. Tepelena	Air pressure	970 mbar
Verdict	Pass	Relative humidity	49 %

7.4.3 Observations, settings and special notes

None

7.4.4 Test equipment list

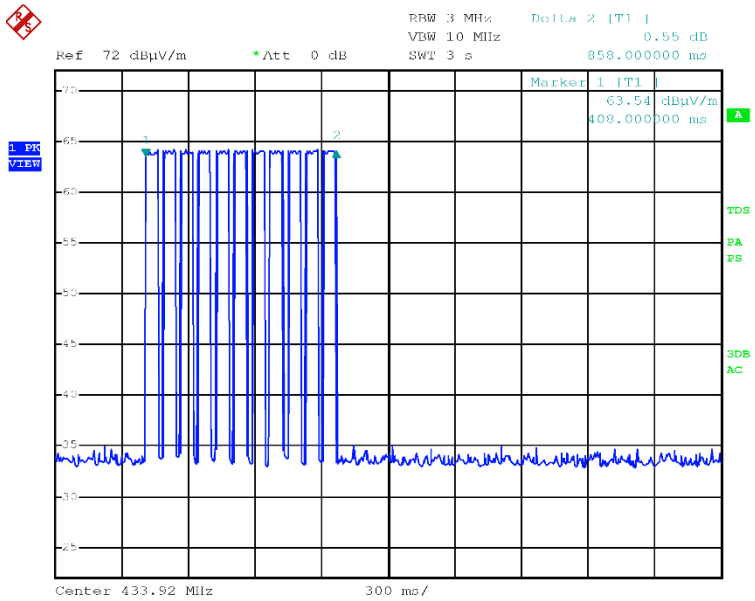
Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI receiver	R&S	ESU8	100202	2020-08	2021-08
EMI receiver	R&S	ESW44	101620	2020-09	2021-09
Trilog Broadband Antenna	Schwarzbeck	VULB 9162	9162-025	2018-07	2021-07
Bilog antenna (1 ÷ 18 GHz)	Schwarzbeck	STLP 9148	9148-152	2018-09	2021-09
Preamplifier (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

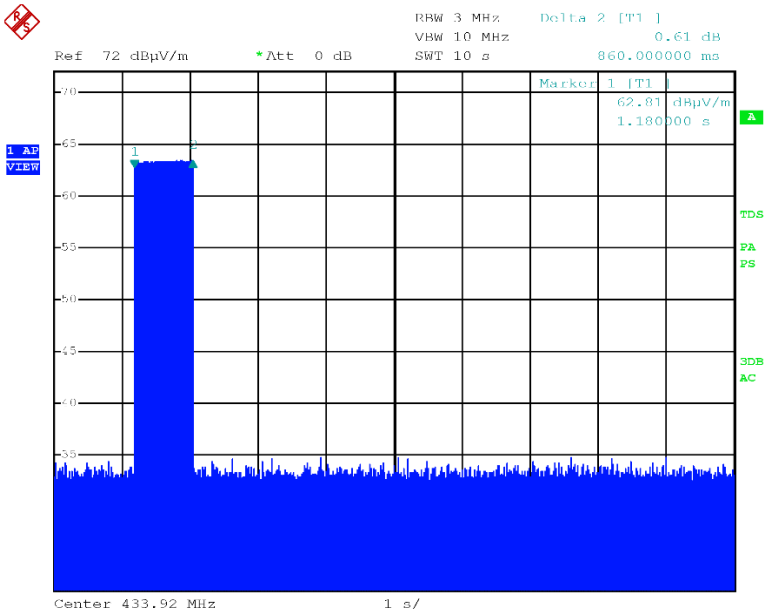
Note: NCR - no calibration required, VOU - verify on use

7.4.5 Test data

1)	The EUT is manually triggered?	☒ YES	☐ NO
2)	The EUT is activated automatically?	☐ YES	☒ NO
3)	The EUT is a periodic transmitter?	☐ YES	☒ NO
4)	The EUT's usage is for radio control purposes during emergencies?	☐ YES	☒ NO
5)	The EUT transmits set-up information?	☐ YES	☒ NO

Once manually triggered the EUT stop to transmit after 0.860 seconds.





7.5 FCC 15.231(b) Field strength of emissions

7.5.1 Definitions and limits

(b) In addition to the provisions of §15.205 the field strength of emissions from intentional radiators operated under this section shall not exceed the following table.

1) The field strength limits in the table are specified at a distance of 3 meters. The tighter limits apply at the band edges.
2) Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in §15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.
3) The limits on the field strength of the spurious emissions in the table below 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.

Table 7.5-1: *Field strength limits*

Fundamental frequency (MHz)	Field strength of fundamental (µV/m)	(dBµV/m)	Field strength of spurious emissions (µV/m)	(dBµV/m)
40.66–40.70	2,250	67	225	47
70–130	1,250	61.9	125	41.9
130–174	1,250 to 3,750*	61.9 to 71.5*	125 to 375*	41.9 to 51.5*
174–260	3,750	71.5	375	51.5
260–470	3,750 to 12,500*	71.5 to 81.9*	375 to 1,250*	51.5 to 61.9*
Above 470	12,500	81.9	1,250	61.9

* Linear interpolations

Note:

* Linear interpolation with frequency F in MHz

Table 7.5-2: *FCC §15.209– Radiated emission limits*

Frequency, MHz	Field strength of emissions µV/m	dBµV/m	Measurement distance, 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 7.5-3: *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			

7.5.2 Test summary

Test date	February 8, 2021	Temperature	20 °C
Test engineer	P. Barbieri (below 1 GHz) G. Tepelena (above 1 GHz)	Air pressure	970 mbar
Verdict	Pass	Relative humidity	49 %

7.5.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 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

7.5.4 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

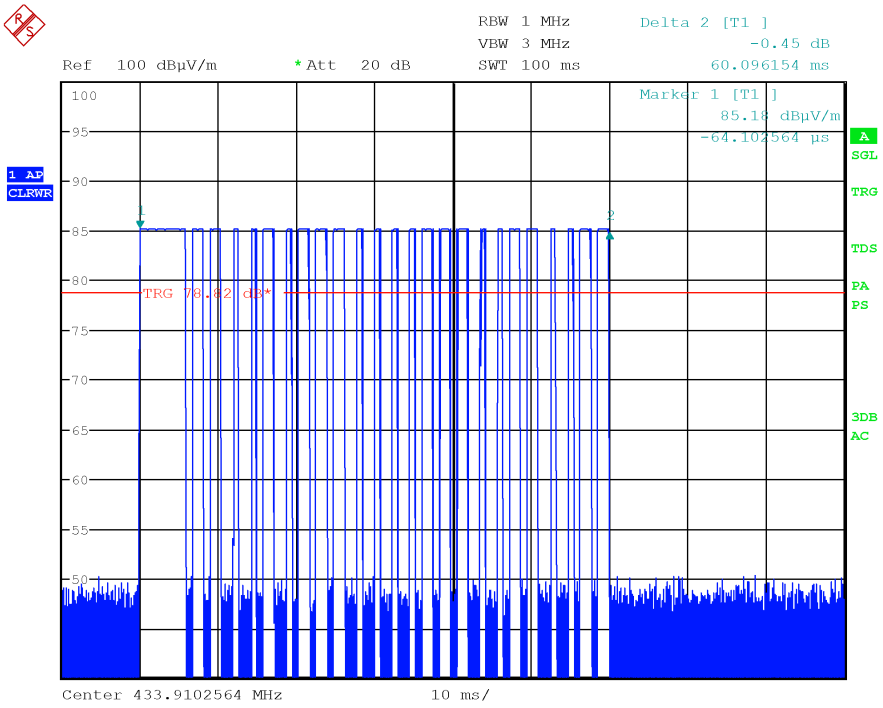
Note: NCR - no calibration required, VOU - verify on use

7.5.4 Test data

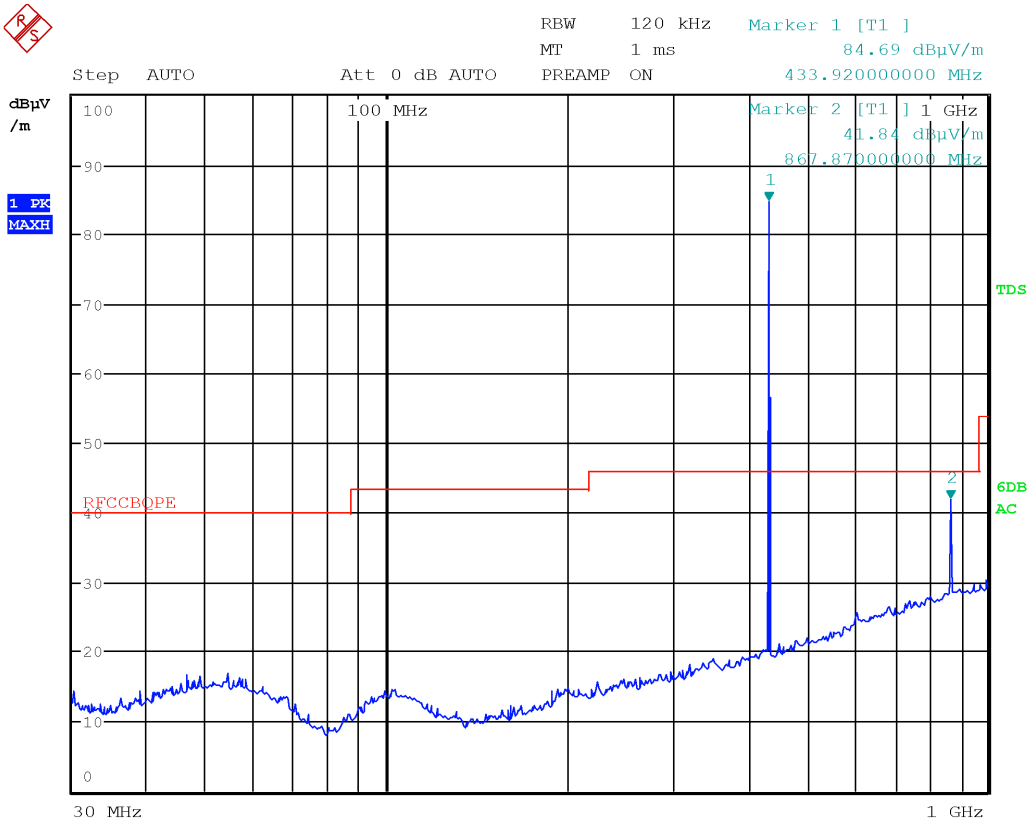
Duty cycle/average factor calculations

§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.

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

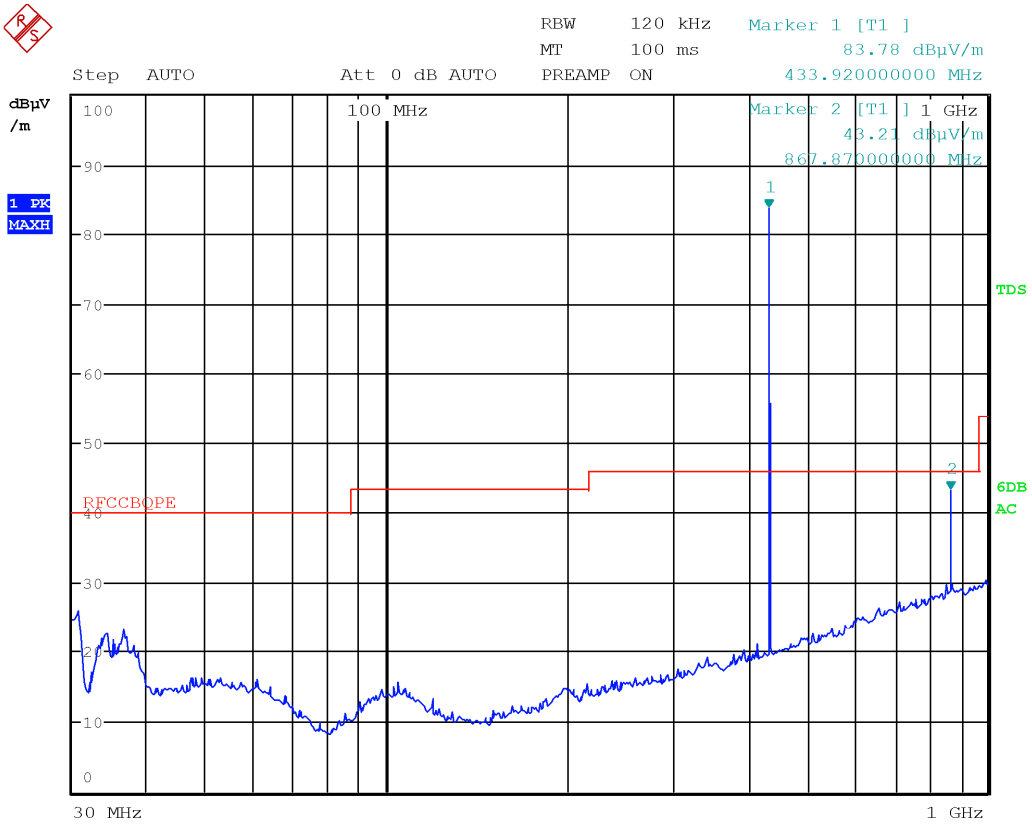


Duty cycle correction factor for 60.1 ms pulse duration = 20 × $\log_{10}$ (60.1 / 100) = −4.4 dB



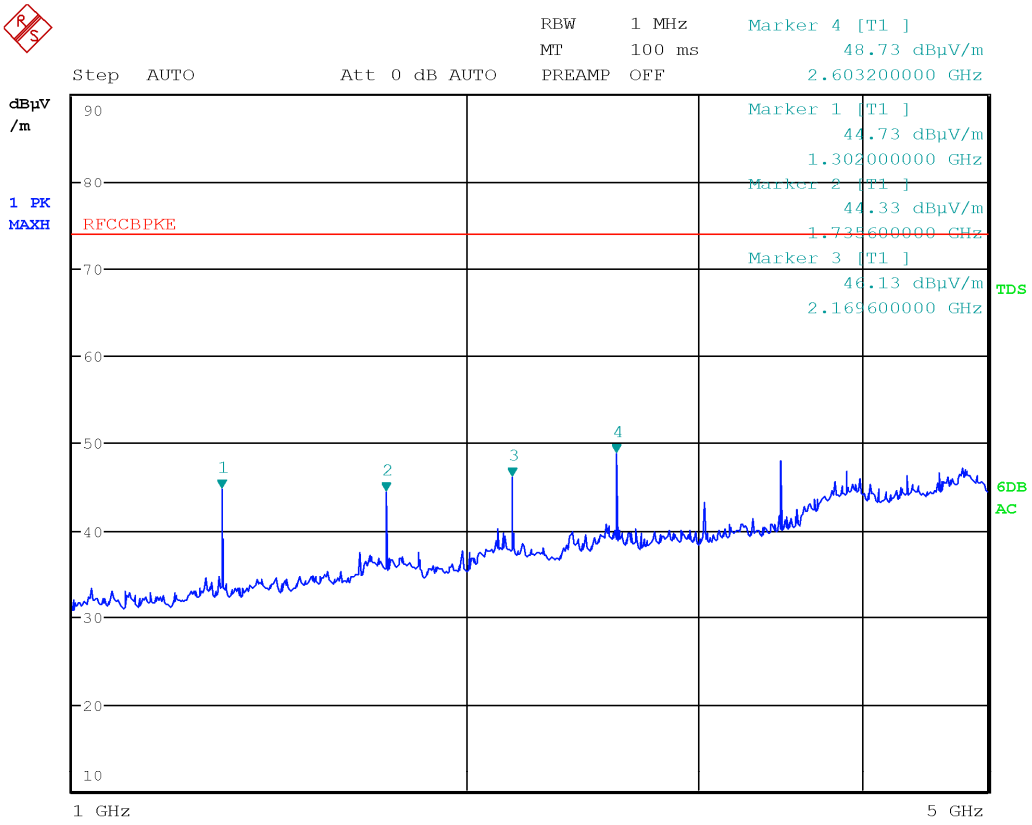
Radiated emission in the frequency range 30 to 1000 MHz with antenna in horizontal polarization. (worst case)

Frequency, MHz	Peak field strength, dBµV/m	Duty cycle factor, dB	Average field strength, dBµV/m	Average limit, dBµV/m	Margin, dB
433.92	84.7	-4.4	80.3	80.5	-0.2
867.87	41.9	-4.4	37.5	60.5	-23.0



Radiated emission in the frequency range 30 to 1000 MHz with the antenna in vertical polarization. (worst case)

Frequency, MHz	Peak field strength, dBµV/m	Duty cycle factor, dB	Average field strength, dBµV/m	Average limit, dBµV/m	Margin, dB
433.92	83.8	-4.4	79.4	80.5	-1.1
867.87	43.2	-4.4	38.8	60.5	-21.7



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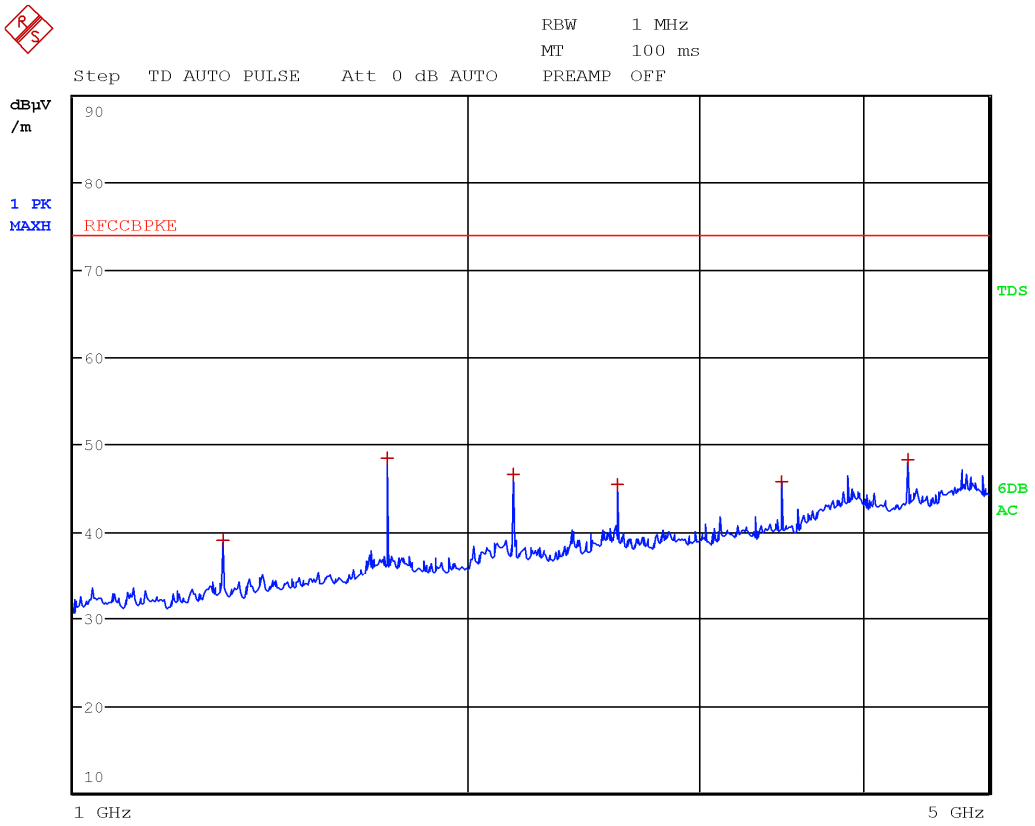
Radiated emission in the frequency range 1 to 5 GHz with antenna in horizontal polarization (worst case)

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
1302	44.54	74.00	29.46	-4.4	40.14	54	-13.86
1735	43.84	74.00	30.16	-4.4	39.44	60.1	-20.66
3471	43.89	74.00	30.11	-4.4	39.49	60.1	-20.61
2169	45.49	74.00	28.51	-4.4	41.09	60.1	-19.01
2603	39.05	74.00	34.95	-4.4	34.65	60.1	-25.45
3471	48.64	74.00	24.36	-4.4	45.24	60.1	-14.86



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Radiated emission in the frequency range 1 to 5 GHz with antenna in vertical polarization (worst case)

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
1302	38.98	74.00	35.02	-4.4	34.58	54	-19.42
1735	48.32	74.00	25.68	-4.4	43.92	60.1	-16.18
3471	46.63	74.00	27.37	-4.4	42.23	60.1	-17.87
2169	45.31	74.00	28.69	-4.4	40.91	60.1	-19.19
2603	45.64	74.00	28.36	-4.4	41.24	60.1	-18.86
3471	48.15	74.00	25.85	-4.4	43.75	60.1	-16.35
4339	38.98	74.00	35.02	-4.4	34.58	60.1	-19.42

7.6 FCC 15.231(c) Emission bandwidth of momentary signals

7.6.1 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.

7.6.2 Test summary

Test date	February 8, 2021	Temperature	20 °C
Test engineer	G. Tepelena	Air pressure	970 mbar
Verdict	Pass	Relative humidity	49 %

7.6.3 Observations, settings and special notes

Limit: 0.25 % of 433.92 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

7.6.4 Test equipment list

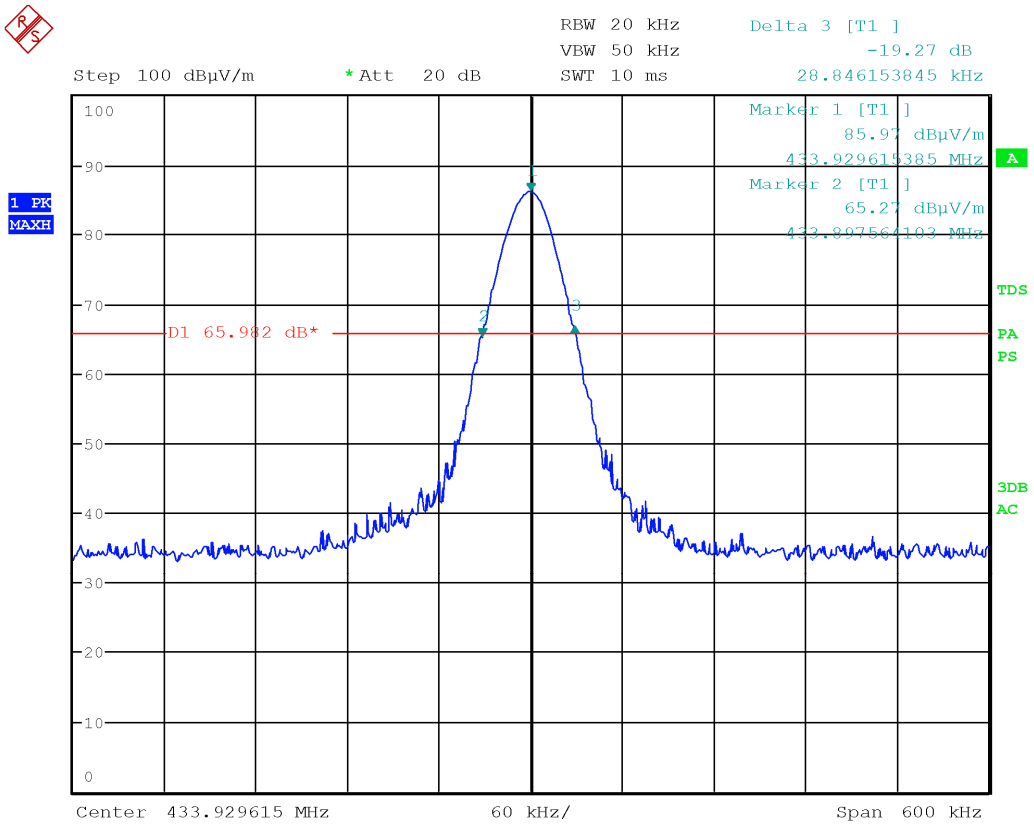
Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI receiver	R&S	ESU8	100202	2020-08	2021-08
EMI receiver	R&S	ESW44	101620	2020-09	2021-09
Trilog Broadband Antenna	Schwarzbeck	VULB 9162	9162-025	2018-07	2021-07
Bilog antenna (1 ÷ 18 GHz)	Schwarzbeck	STLP 9148	9148-152	2018-09	2021-09
Preamplifier (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

7.6.5 Test data

Occupied bandwidth measurement result

Occupied bandwidth per frequency, KHz	Limit, MHz	Margin, kHz
28.8	1084	1055



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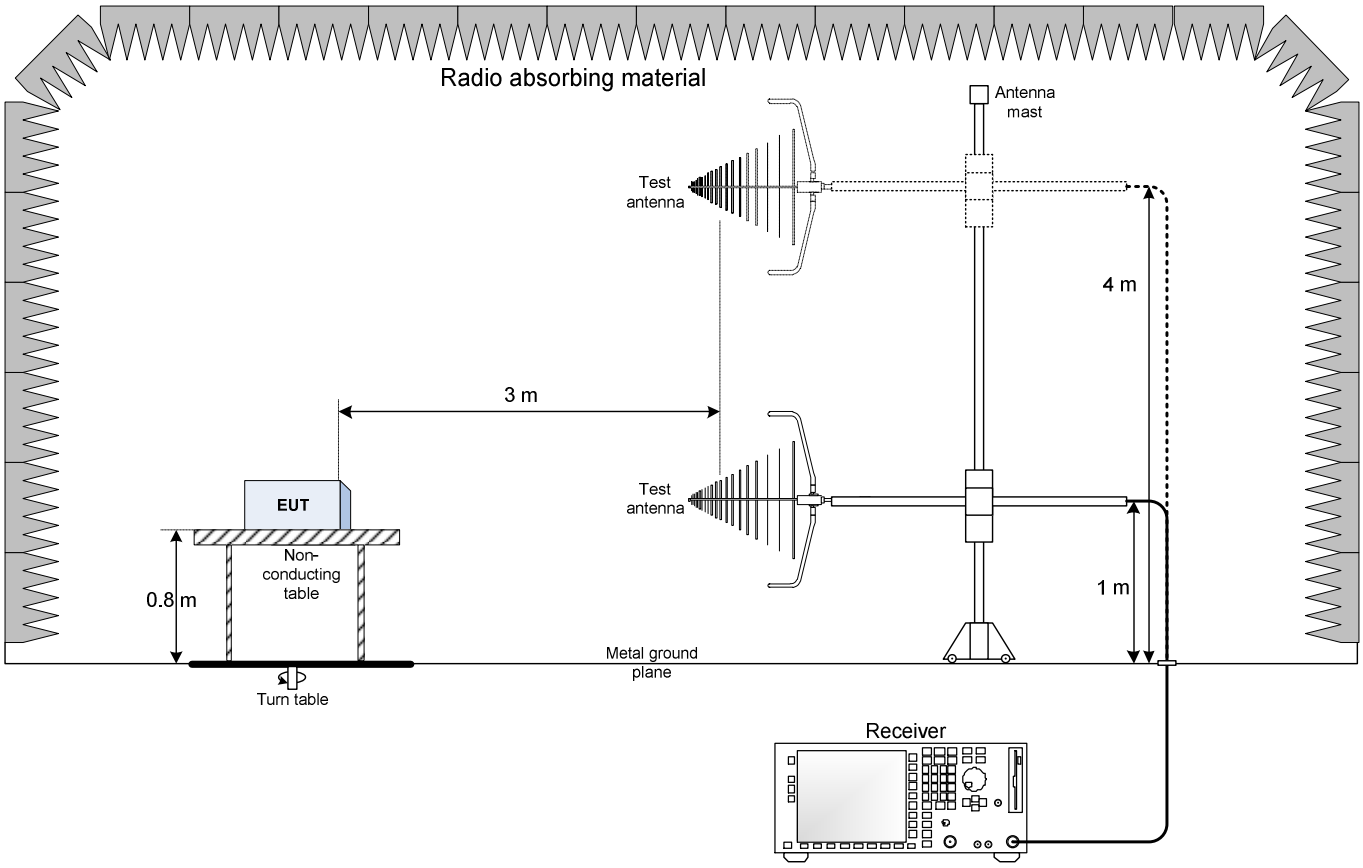
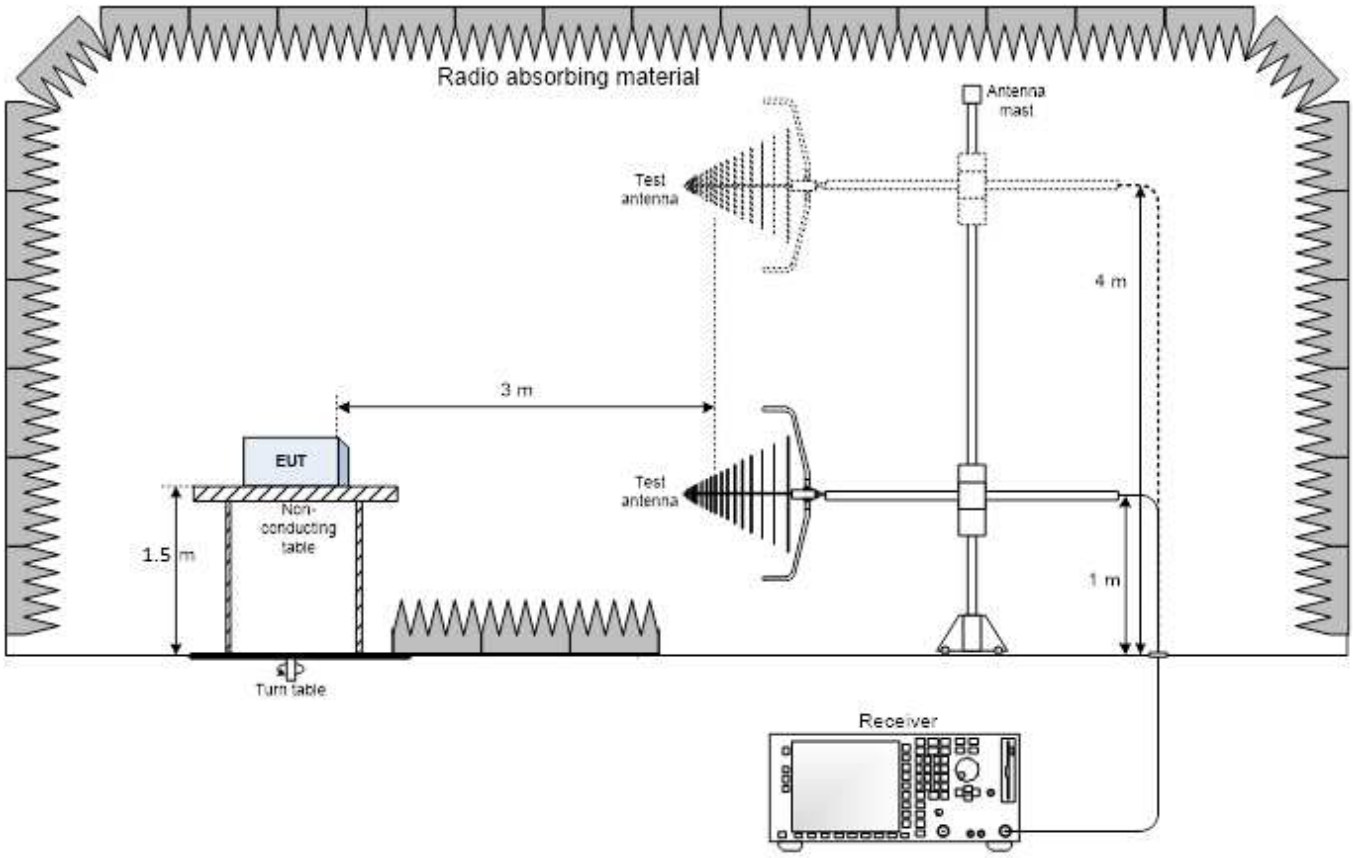
Section 8. Block diagrams of test set-ups

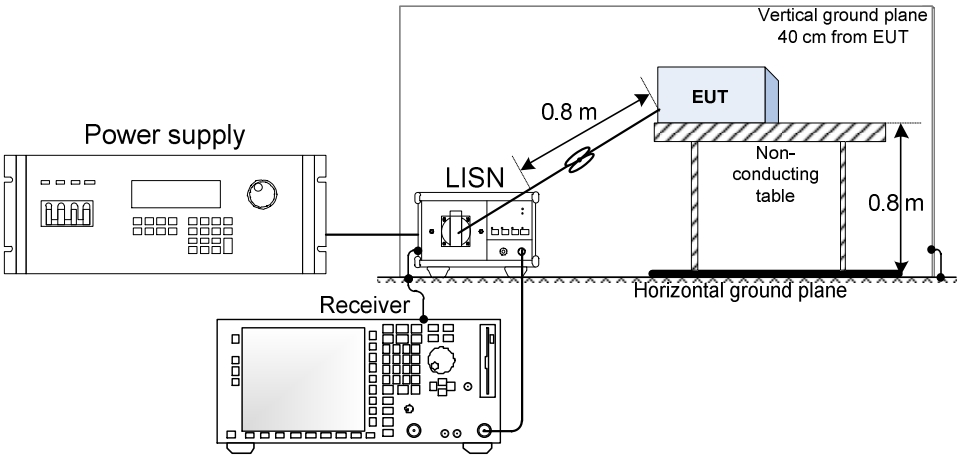
8.1 Radiated emissions set-up for frequencies below 1 GHz



8.2 Radiated emissions set-up for frequencies above 1 GHz



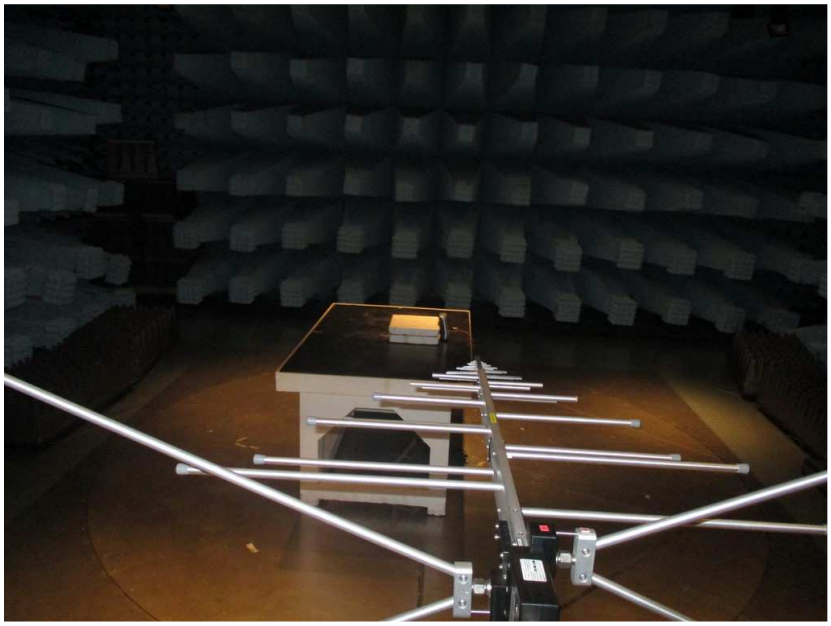
8.3 Conducted emissions set-up



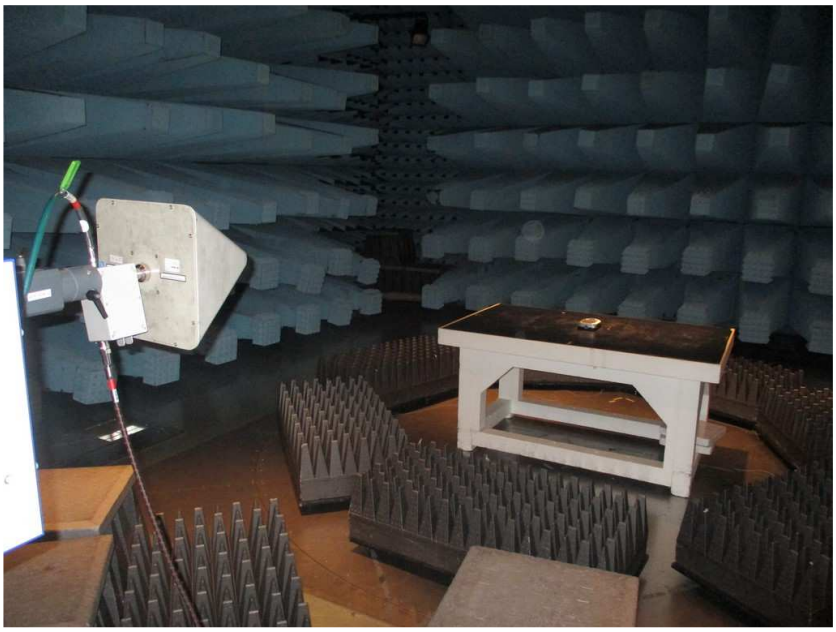
Section 9. Photos

9.1 Photos of the test set-up

Conducted emission set-up 150kHz – 30MHz

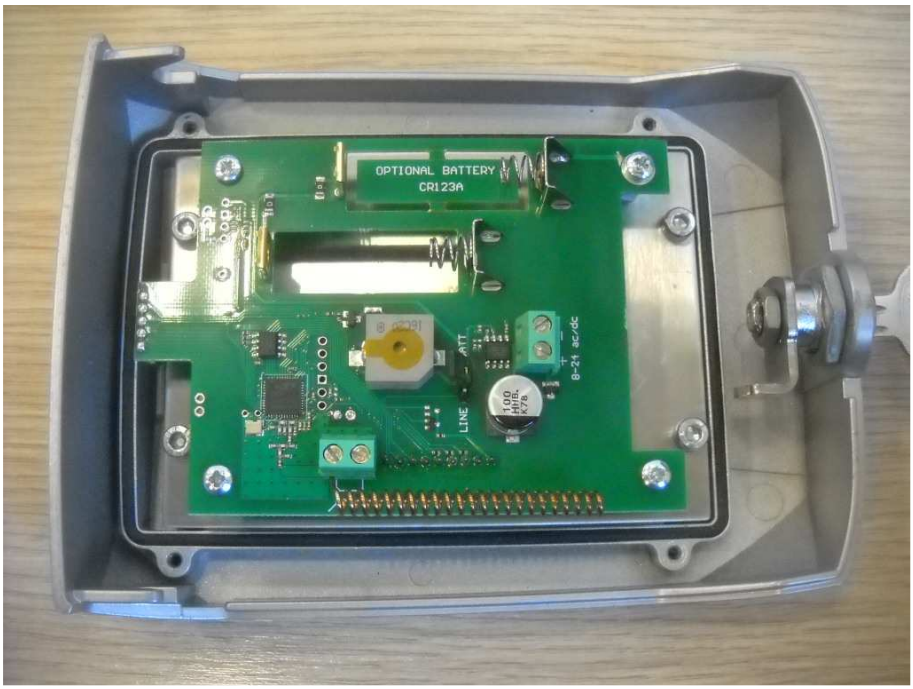


Radiated emission set-up below 1 GHz



Radiated emission set-up above 1 GHz

9.2 Photos of the EUT



End of report