ONE WORLD ○ OUR APPROVAL

Test report

450719-1TRFWL

Date of issue: October 7, 2021)

Applicant for ISED:

ZADI S.P.A. – Via C.Marx, 138 – 41012 Carpi (MO) – Italy

Applicant for FCC:

ZADI S.P.A. – Via C.Marx, 138 – 41012 Carpi (MO) – Italy

Product:

RRS Active / Remote Control Key

Model:

SA321600

FCC ID:

VFZKLRK0349-0

ISED Registration number:

22239-KLRK03490

Specifications:

- FCC 47 CFR Part 15 Subpart C, §15.231

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

- RSS-210, Issue 10, December 2019, Amendment (April 2020), Annex A.1

  Momentarily operated devices

- RSS-Gen, Issue 5, April 2018, Amendment 1 (March 2019), Amendment 2 (February 2021)

  General Requirements for Compliance of Radio Apparatus

Test location

Company name	Nemko Spa
Address	Via del Carroccio, 4 – 20853 Biassono (MB) – Italy
City	Biassono –
Province	(MB) – Italy
Postal code	20853
Country	Italy
Telephone	+39 2201201
Facsimile	--
Toll free	--
Website	www.nemko.com
Site number	FCC: 682159; IC: 9109A (10 m semi anechoic chamber)

Tested by	Daniele Guarnone Senior Wireless/EMC Specialist
Reviewed by	Paolo Barbieri, Wireless/EMC Specialist
Date	October 7, 2021
Signature of reviewer	

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 Canada's ISO/IEC 17025 accreditation.

Copyright notification

Table of contents

Section 1. Report summary

1.1 Applicant and manufacturer info

	Manufacturer:	**ISED applicant:**	**FCC applicant:**
Company name	ZADI S.P.A.	ZADI S.P.A.	ZADI S.P.A.
Address	Via C.Marx, 138	Via C.Marx, 138	Via C.Marx, 138
City	Carpi	Carpi	Carpi
Province/State	Modena Italy	Modena Italy	Modena Italy
Postal/Zip code	41012	41012	41012
Country	Italy	Italy	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
RSS-210, Issue 10, December 2019, Amendment (April 2020), Annex A.1	Momentarily operated devices
RSS-Gen, Issue 5, April 2018, Amendment 1 (March 2019), Amendment 2 (February 2021)	General Requirements for Compliance of Radio Apparatus

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

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 Applicability

Due to a nature of the equipment under test some parts of the standards could not be fulfilled and required special authorization from the government authorities. It is up to manufacturer to obtain permission to operate in the frequency range and with the field strength of fundamental as tested and reported in this document.

1.6 Test report revision history

Revision #	**Details of changes made to test report**
TRF	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	Not applicable
§15.203	Antenna requirement	Pass[2]
§15.231(a)	Conditions for intentional radiators to comply with periodic operation	Pass
§15.231(b)	Field strength of emissions	Tested
§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] Measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, was performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage. No noticeable output power variation was observed

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

2.2 IC RSS-Gen, Issue 5 test results

Part	Test description	Verdict
7.3	Receiver radiated emission limits	Not applicable
7.4	Receiver conducted emission limits	Not applicable
6.9	Operating bands and selection of test frequencies	Pass
8.8	AC power line conducted emissions limits	Not applicable

Notes: [1] According to sections 5.2 and 5.3 of RSS-Gen, Issue 5 the EUT does not have a stand-alone receiver neither scanner receiver, therefore exempt from receiver requirements.

2.3 IC RSS-210, Issue 10 test results

Part	Test description	Verdict
A.1.1	Types of momentary signals	Pass
A.1.2	Field strength of emissions	Pass
A.1.3	Bandwidth of momentary signals	Pass
A.1.4	Reduced Field Strengths	Not applicable

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	October 4, 2021
Nemko sample ID number	4447510006

3.2 EUT information

Product name	RRS Active / Remote Control Key
Model	SA321600
Serial number	4447510006 assigned by Nemko

3.3 Technical information

Applicant IC company number	22239
IC UPN number	KLRK03490
All used IC test site(s) Reg. number	IC: 9109A (10 m semi anechoic chamber)
RSS number and Issue number	RSS-210 Issue 10, December 2019, Amendment (April 2020), Annex A.1
Frequency band	(TX) 433.92 MHz
Frequency Min (MHz)	433.92 MHz
Frequency Max (MHz)	433.92 MHz
RF power Max (W)	N/A
Field strength (dBµV/m @ 3 m)	68.6
Measured BW (kHz) (99%)	247.8
Calculated BW (kHz), as per TRC-43	--
Type of modulation	FSK
Emission classification (F1D, G1D, D1D)	248KF1D
Transmitter spurious, (dBµV/m @ 3 m)	63.9 (@ 2169.75 MHz)
Power requirements	3 Vdc
Antenna information	Integral, 0 dBi

3.4 Product description and theory of operation

The Rider Recognition System (RRS) is a mechatronic system which fully integrated “Automatic Main Switch and Steering Lock”
The system is composed by:

1. 1x Main Unit (transmits LF 134,4 kHz and receives 433 MHz) Model: XCB0331 (aesthetic variant: Model: XCB0332)
2. 1x Active Key (transmits 433 MHz and receive 134,4 kHz) Model: SA321600

installation will be with a separation distance of approximately 1.5 metres separation between the two panels

3.5 Test plan and measurement techniques

3.6 EUT setup diagram

Figure 3.6-1: *EUT overview*

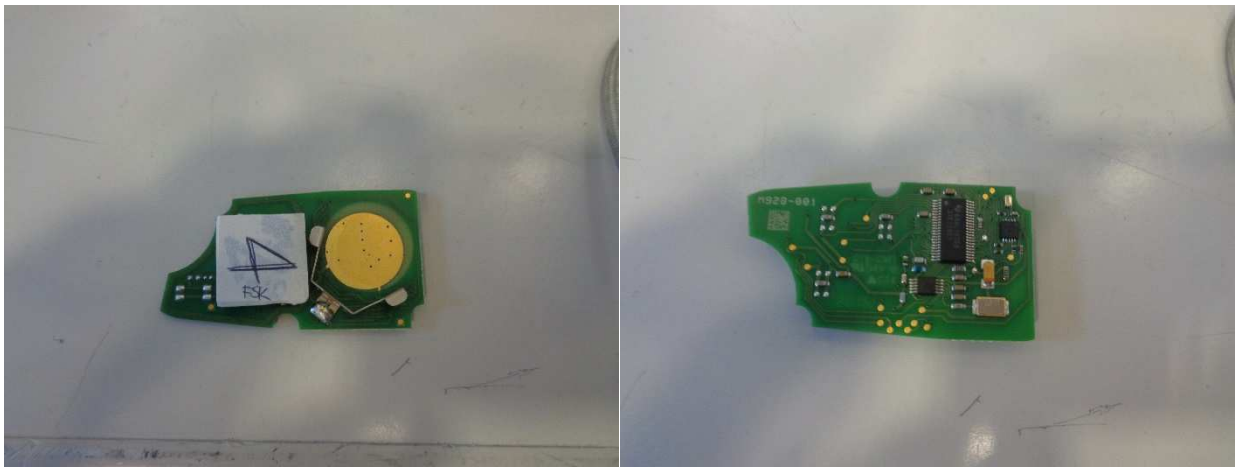


Figure 3.6-2: *EUT setup block diagram*

3.7 EUT sub assemblies

Table 3.7-1: *EUT sub assemblies*

Description	Brand name	Model/Part number	Serial number
--	--	--	--
--	--	--	--

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

Due to a nature of the equipment under test some parts of the standards could not be fulfilled and required special authorization from the government authorities. It is up to manufacturer to obtain permission to operate in the frequency range and with the field strength of fundamental as tested and reported in this document.
EUT was tested as proposed in specially developed test plan for this project.

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	860–1060 mbar

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of K = 2 with 95% certainty.

Table 6.1-1: *Measurement uncertainty*

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)
Receiver	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)
		Sensitivity measurement	1 MHz ÷ 18 GHz	6.0 dB	(1)
	Conducted	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)

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. Test equipment

7.1 Test equipment list

Table 7.1-1: *Equipment list*

Description	Manufacturer	Model	Identifier	Cal Date	Due Date
Loop antenna	Teseq	HLA6121+PI6121	45749	2021-07	2023-07
Antenna Trilog 25MHz - 8GHz	Schwarzbeck Mess-Elektronik	VULB9162	9162-025	2021-07	2024-07
Antenna 1 - 18 GHz	Schwarzbeck Mess-Elektronik	STLP9148	STLP 9148-152	2021-09	2024-09
Broadband Amplifier	Schwarzbeck Mess-Elektronik	BBV9718C	00121	2021-01	2022-01
EMI receiver 20 Hz ÷ 8 GHz	R&S	ESU8	100202	2021-09	2022-09
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530	2021-09	2023-09
Shielded room	Siemens	10m control room	1947	NCR	NCR
Note: N/A = Not Applicable, NCR = No Cal Required, COU = CAL On Use					

Section 8. Testing data

8.1 FCC 15.31(m) and RSS-Gen 6.9 Number of frequencies

8.1.1 Definitions and limits

FCC:
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.

ISED:
Except where otherwise specified, measurements shall be performed for each frequency band of operation for which the radio apparatus is to be certified, with the device operating at the frequencies in each band of operation shown in table below. The frequencies selected for measurements shall be reported in the test report.

Table 8.1-1: *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.

8.1.2 Test date

Start date	October 6, 2021

8.1.3 Observations, settings and special notes

None

8.1.4 Test data

Table 8.1-2: *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	433.92	--	--	--	--

8.2 FCC 15.203 and RSS-Gen, section 6.8 Antenna requirement

8.2.1 Definitions and limits

FCC:
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.

ISED:
The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report.

8.2.2 Test date

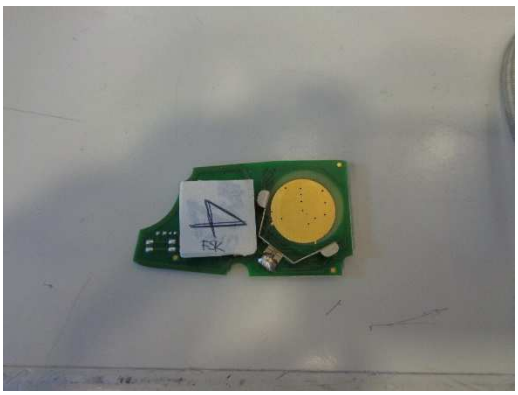
Start date	October 5, 2021

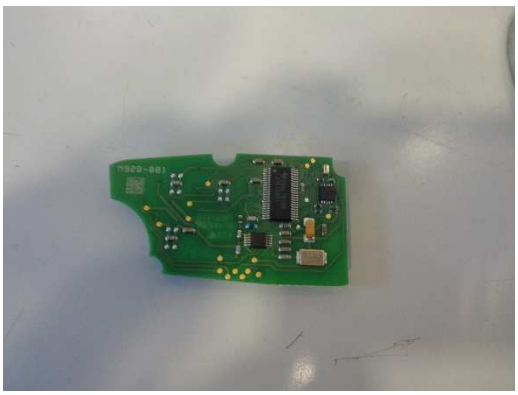
8.2.3 Observations, settings and special notes

None

8.2.4 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





8.3 FCC 15.231(a) and RSS-210 A.1.1 Conditions for intentional radiators to comply with periodic operation

8.3.1 Definitions and limits

FCC:

(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.

ISED:

Devices shall comply with the following for momentary operation:

(a) A manually operated transmitter shall be equipped with a push-to-operate switch and be under manual control at all times during transmission. When released, the transmitter shall cease transmission within no more than 5 seconds of being released.

(b) A transmitter that has been activated automatically shall cease transmission within 5 seconds of activation.

(c) Periodic transmissions at regular, predetermined intervals are not permitted, except as specified in Section A.1.4. However, polling or supervision transmissions that determine system integrity of transmitters used in security or safety applications are permitted, provided the total duration of transmission does not exceed 2 seconds per hour for each transmitter.

(d) Intentional radiators used for radio control during emergencies involving fire, security of goods (e.g. burglar alarms), and safety-of-life, when activated to signal an alarm, may operate during the interval of the alarm condition.

8.3.2 Test summary

Test date	October 5, 2021

8.3.3 Observations, settings and special notes

The timing details were declared and provided by the manufacturer.

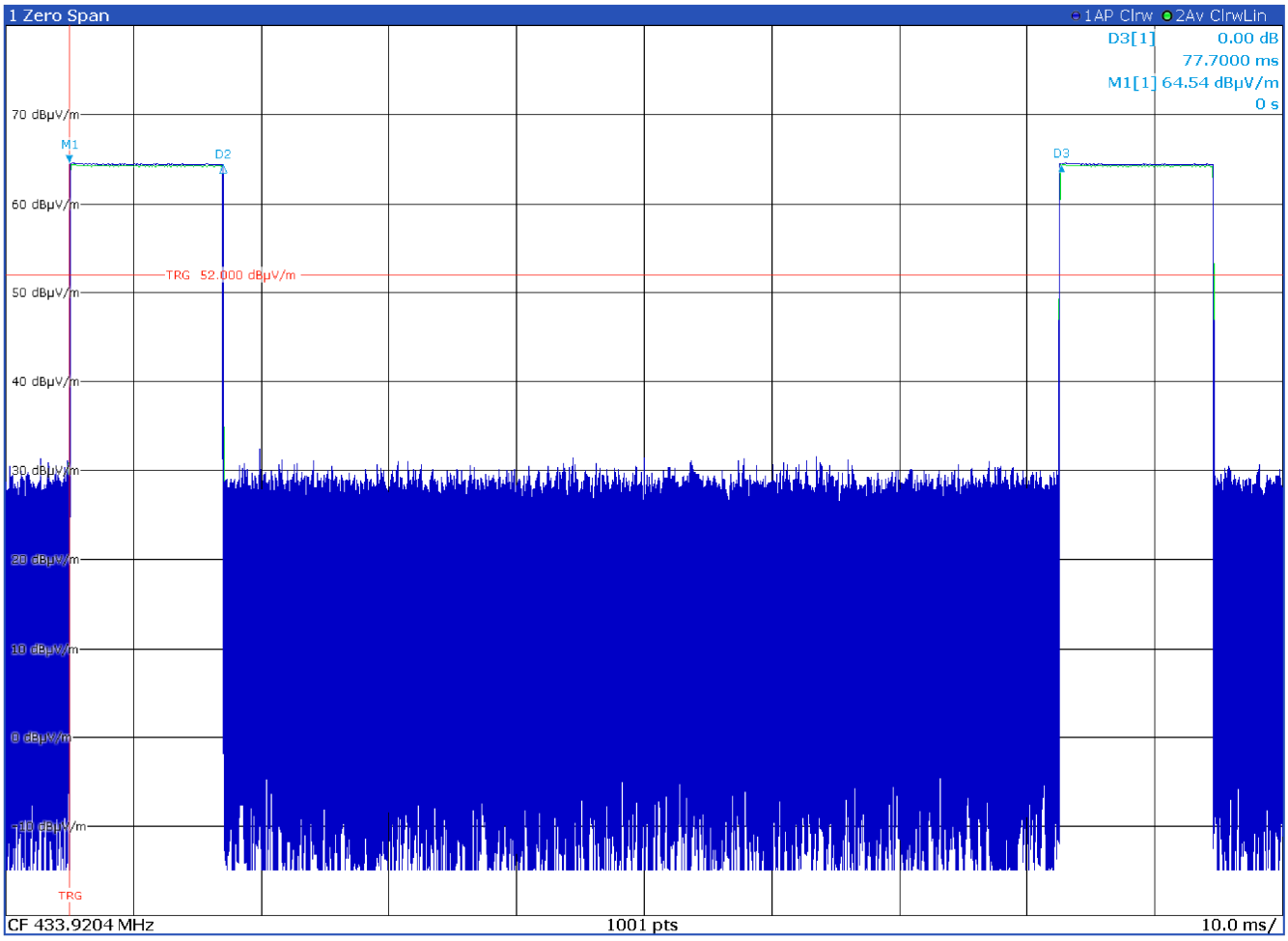
8.3.4 Test data

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 transmit time for each of the two panels is 32 milliseconds with 100 ms interval between them. Both panels cannot transmit simultaneously. Total duration of the transmission session is 164 ms.

Detailed timing information:
Transmit time for each antenna: 80 ns (80 × 3008 = 0.24 ms)
Transmit time for each of the 128 frequencies: 240 µs (128 × 240 µs = 30.72 ms)
Total transmit time per panel = 30.72 + 0.24 = 30.96 msec. (Rounded up to 32 ms for specifications).

§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.



15:18:32 05.10.2021 **Page 1/2**

2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**-1.7 as**	**64.54 dBµV/m**		
D2	M1	1	**12.0 ms**	**-0.13 dB**		
D3	M1	1	**77.7 ms**	**-0.00 dB**		

$Duty\ cycle\ or\ average\ factor = 20 \times \log_{10}\left(\frac{Tx_{100ms}}{100_{ms}}\right)$=20 x $\log_{10}$(24 / 100)=

Duty cycle correction factor for pulse duration = 20 × $\log_{10}$ (24 / 100) = −12.4 dB

8.4 FCC 15.231(b) and RSS-210 A.1.2 Field strength of emissions

8.4.1 Definitions and limits

FCC:

(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.

ISED:

a. The field strength of emissions from momentarily operated intentional radiators shall not exceed the limits outlined in the table below, based on the average value of the measured emissions. The requirements of the Pulsed Operation section of RSS-Gen apply for averaging pulsed emissions and limiting peak emissions.
Alternatively, compliance with the limits in the table below may be demonstrated using an International Special Committee on Radio Interference (CISPR) quasi‑peak detector.
b. Unwanted emissions shall be 10 times below the fundamental emissions field strength limits in the table below or comply with the limits specified in RSS-Gen, whichever is less stringent.
c. The field strength limits shown in Table A are based on the fundamental frequency of the intentional radiator. Unwanted emissions shall be attenuated to the limits listed in RSS-Gen or to the limits shown in table below, whichever are less stringent.

Table 8.4-1: *Field strength limits*

Fundamental frequency	Field strength of fundamental		Field strength of spurious emissions	
(MHz)	(µV/m)	(dBµV/m)	(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 8.4-2: *FCC §15.209 and RSS-Gen – Radiated emission limits*

Frequency, MHz	Field strength of emissions		Measurement distance, m
	µV/m	dBµV/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 8.4-3: *ISED restricted frequency bands*

MHz	MHz	MHz	GHz
0.090–0.110	12.57675–12.57725	399.9–410	7.25–7.75
0.495–0.505	13.36–13.41	608–614	8.025–8.5
2.1735–2.1905	16.42–16.423	960–1427	9.0–9.2
3.020–3.026	16.69475–16.69525	1435–1626.5	9.3–9.5
4.125–4.128	16.80425–16.80475	1645.5–1646.5	10.6–12.7
4.17725–4.17775	25.5–25.67	1660–1710	13.25–13.4
4.20725–4.20775	37.5–38.25	1718.8–1722.2	14.47–14.5
5.677–5.683	73–74.6	2200–2300	15.35–16.2
6.215–6.218	74.8–75.2	2310–2390	17.7–21.4
6.26775–6.26825	108–138	2483.5–2500	22.01–23.12
6.31175–6.31225	149.9–150.05	2655–2900	23.6–24.0
8.291–8.294	156.52475–156.52525	3260–3267	31.2–31.8
8.362–8.366	156.7–156.9	3332–3339	36.43–36.5
8.37625–8.38675	162.0125–167.17	3345.8–3358	Above 38.6
8.41425–8.41475	167.72–173.2	3500–4400	
12.29–12.293	240–285	4500–5150	
12.51975–12.52025	322–335.4	5350–5460	

Note: Certain frequency bands listed in Table 8.4-3 and above 38.6 GHz are designated for low-power licence-exempt applications. These frequency bands and the requirements that apply to the devices are set out in this Standard

Table 8.4-4: *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			

8.4.2 Test summary

Test date	October 5, 2021

8.4.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 220 GHz.
Radiated measurements were performed at a distance of 3 m. Where the distance was reduced to increase dynamic range appropriate distance correction factor was applied to the measurement results.

Average radiated emissions were obtained by subtracting duty cycle / correction factor from the peak measurement results.

Spectrum analyzer settings for radiated measurements within restricted bands below 1 GHz:

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

Spectrum analyzer settings for peak radiated measurements within restricted bands above 1 GHz:

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

8.4.4 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 pulse duration = $20 \times \log_{10}(24 / 100) = -12.4$ dB

Table 8.4-5: *Radiated field strength of fundamental measurement results*

E.U.T in horizontal polarization

Frequency (MHz)	Polarization V/H	Peak field strength (dBµV/m)	Duty cycle corr. (dB)	Avg field strength (dBµV/m)	Avg limit (dBµV/m)	Avg margin (dB)
434.01	H	68.6	-12.4	56.2	80.8	-24.6
867.69	H	39.1	-12.4	26.7	61.9	-35.2
Frequency (MHz)	Polarization V/H	Peak field strength (dBµV/m)	Duty cycle corr. (dB)	Avg field strength (dBµV/m)	Avg limit (dBµV/m)	Avg margin (dB)
433.83	V	52.8	-12.4	40.4	80.8	-40.4
867.99	V	36.2	-12.4	23.8	61.9	-38.1
Frequency (MHz)	Polarization V/H	Peak field strength (dBµV/m)	Duty cycle corr. (dB)	Avg field strength (dBµV/m)	Avg limit (dBµV/m)	Avg margin (dB)
1302	V	53.5	-12.4	41.1	54.0	-12.9
1736	V	55.0	-12.4	42.6	61.9	-19.3
2169.25	V	62.3	-12.4	49.9	61.9	-12.0
3470.75	V	50.7	-12.4	38.3	61.9	-23.6
Frequency (MHz)	Polarization V/H	Peak field strength (dBµV/m)	Duty cycle corr. (dB)	Avg field strength (dBµV/m)	Avg limit (dBµV/m)	Avg margin (dB)
1301.5	H	55.5	-12.4	43.1	54	-10.9
1736	H	53.6	-12.4	41.2	61.9	-20.7
2169.75	H	63.9	-12.4	51.5	61.9	-10.4
2603.25	H	53.3	-12.4	40.9	61.9	-21.0
3038	H	50.6	-12.4	38.2	61.9	-23.7
3470.75	H	50.3	-12.4	37.9	61.9	-24.0
Frequency (MHz)	Polarization V/H	Peak field strength (dBµV/m)	Duty cycle corr. (dB)	Avg field strength (dBµV/m)	Avg limit (dBµV/m)	Avg margin (dB)
1301.5	V	45.7	-12.4	43.1	54	-10.9
1736	V	47.9	-12.4	41.2	61.9	-20.7
2169.75	V	54.3	-12.4	51.5	61.9	-10.4
2603.25	V	48.0	-12.4	40.9	61.9	-21.0
3038	V	50.6	-12.4	38.2	61.9	-23.7
3470.75	V	49.5	-12.4	37.9	61.9	-24.0

E.U.T in vertical polarization

Frequency (MHz)	Polarization V/H	Peak field strength (dBµV/m)	Duty cycle corr. (dB)	Avg field strength (dBµV/m)	Avg limit (dBµV/m)	Avg margin (dB)
433.83	H	61.7	-12.4	49.3	80.8	-31.5
867.99	H	34.8	-12.4	22.4	61.9	-39.5
Frequency (MHz)	Polarization V/H	Peak field strength (dBµV/m)	Duty cycle corr. (dB)	Avg field strength (dBµV/m)	Avg limit (dBµV/m)	Avg margin (dB)
433.83	V	68.2	-12.4	55.8	80.8	-25.0
867.69	V	39.9	-12.4	27.5	61.9	-34.4
Frequency (MHz)	Polarization V/H	Peak field strength (dBµV/m)	Duty cycle corr. (dB)	Avg field strength (dBµV/m)	Avg limit (dBµV/m)	Avg margin (dB)
1302	V	53.5	-12.4	41.1	54.0	-12.9
1736	V	55.0	-12.4	42.6	61.9	-19.3
2169.25	V	62.3	-12.4	49.9	61.9	-12.0
3470.75	V	50.7	-12.4	38.3	61.9	-23.6
Frequency (MHz)	Polarization V/H	Peak field strength (dBµV/m)	Duty cycle corr. (dB)	Avg field strength (dBµV/m)	Avg limit (dBµV/m)	Avg margin (dB)
1301.5	H	40.8	-12.4	28.4	54	-25.6
1736	H	43.8	-12.4	31.4	61.9	-30.5
2169.25	H	51.1	-12.4	38.7	61.9	-23.2
2603.25	H	51.1	-12.4	38.7	61.9	-23.2
3038	H	49.0	-12.4	36.6	61.9	-25.3
3470.75	H	53.2	-12.4	40.8	61.9	-21.1

The correction factor was calculated as follows: $20 \times \log_{10}$ (24 ms/100 ms) = −12.40 dB

There is no limit for the fundamental at the tested frequencies in the specifications tested, therefore the final result is subject for special authorization.

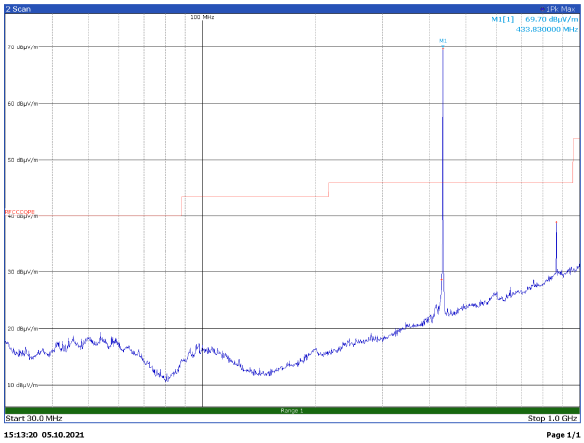


Figure 8.4-1: Horizontal polarization, Radiated spurious emissions below 1 GHz, E.U.T in horizontal position

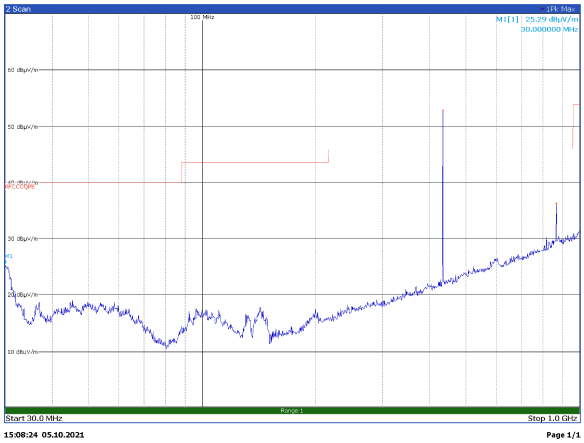


Figure 8.4-2: Vertical polarization, Radiated spurious emissions below 1 GHz, E.U.T in horizontal position

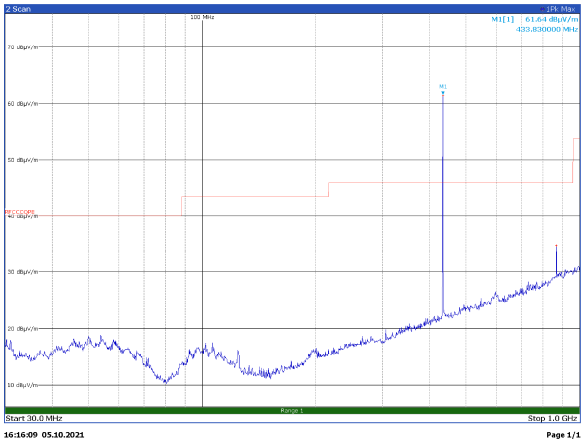


Figure 8.4-3: Horizontal polarization, Radiated spurious emissions below 1 GHz, E.U.T in vertical position

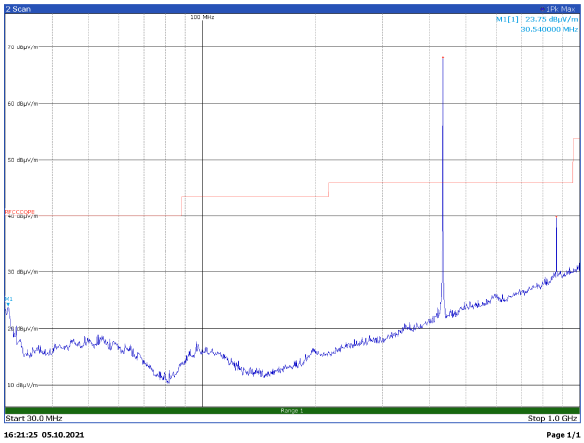


Figure 8.4-4: Vertical polarization, Radiated spurious emissions below 1 GHz, E.U.T in vertical position

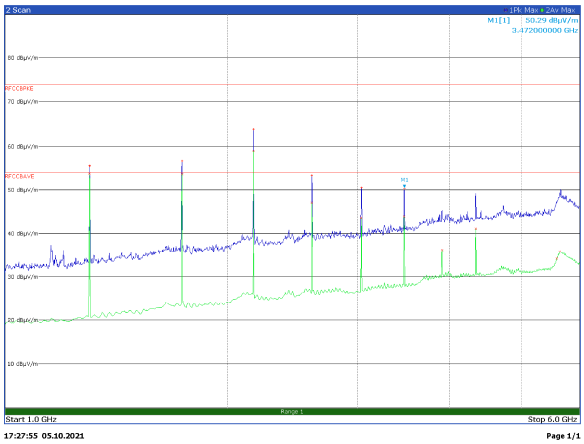


Figure 8.4-5: Horizontal polarization, Radiated spurious emissions above 1 GHz, E.U.T in horizontal position

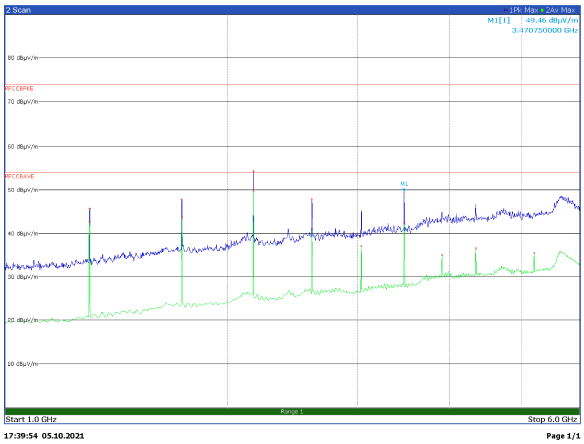


Figure 8.4-6: Vertical polarization, Radiated spurious emissions above 1 GHz, E.U.T in horizontal position

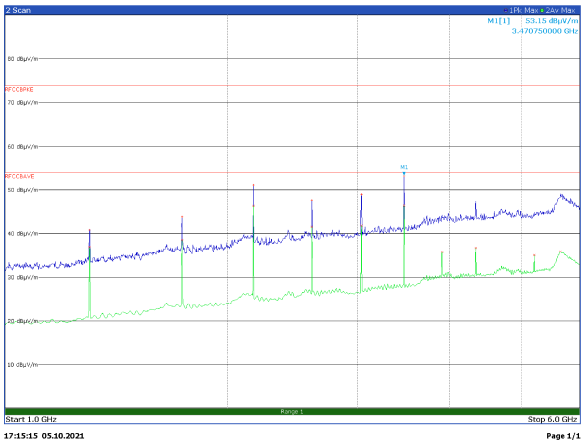


Figure 8.4-7: Horizontal polarization, Radiated spurious emissions above 1 GHz, E.U.T in vertical position

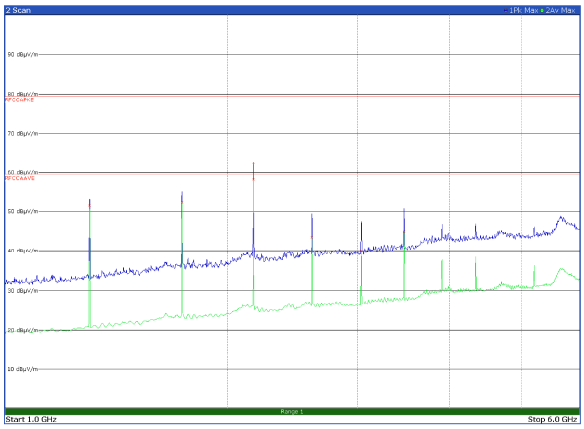


Figure 8.4-8: Vertical polarization, Radiated spurious emissions above 1 GHz, E.U.T in vertical position

8.5 FCC 15.231(c) and RSS-210 A.1.3 Emission bandwidth of momentary signals

8.5.1 Definitions and limits

FCC:
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.

ISED:
The 99% bandwidth of momentarily operated devices shall be less or equal to 0.25% of the center frequency for devices operating between 70 MHz and 900 MHz. For devices operating above 900 MHz, the 99% bandwidth shall be less or equal to 0.5% of the center frequency.

8.5.2 Test summary

Test date:	October 5, 2021

8.5.3 Observations, settings and special notes

Limit: 0.5 % of 433.92 GHz is 2.1696 MHz

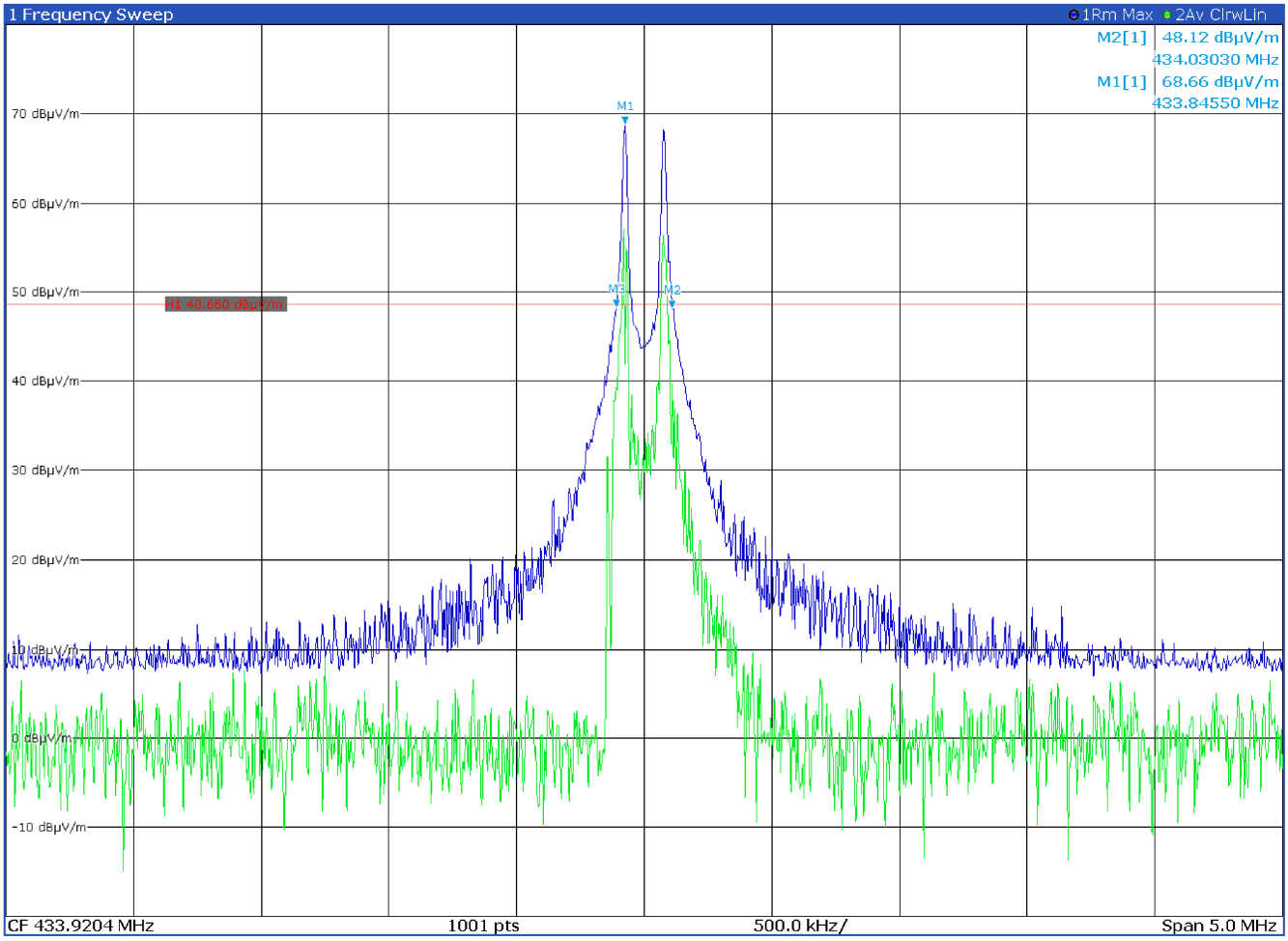
Spectrum analyzer settings:

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

8.5.4 Test data

Table 8.5-1: *Occupied bandwidth measurement result*

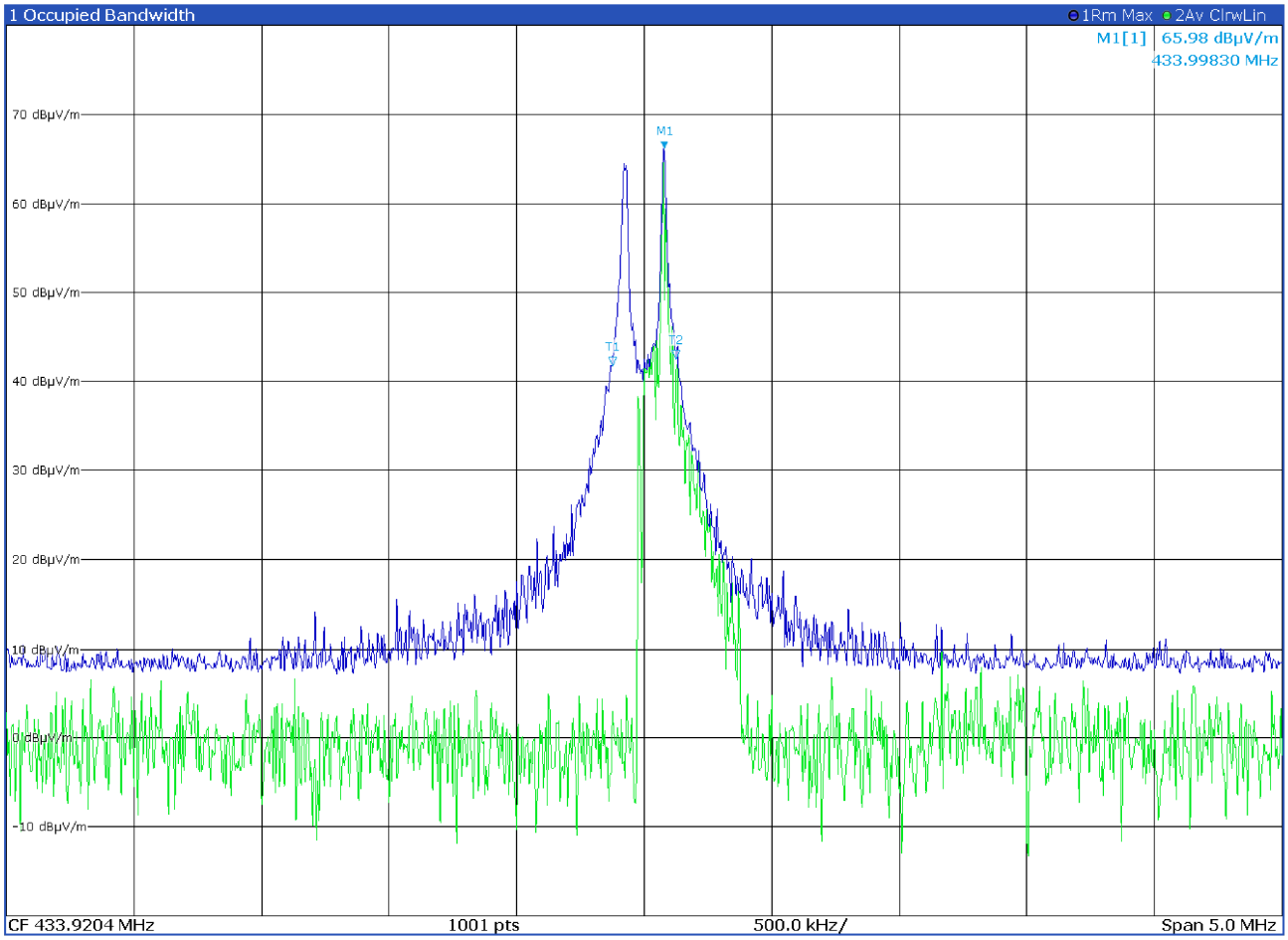
Occupied bandwidth per frequency, MHz	Limit, MHz	Margin, MHz
0.2198	2.1696	1.9496



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	433.8455 MHz	68.66 dBµV/m		
M2		1	434.0303 MHz	48.12 dBµV/m		
M3		1	433.8105 MHz	48.19 dBµV/m		

Figure 8.5-1: *Occupied bandwidth measurement 20 dB = 434.0303 MHz - 433.8105 MHz =0.2198 MHz*



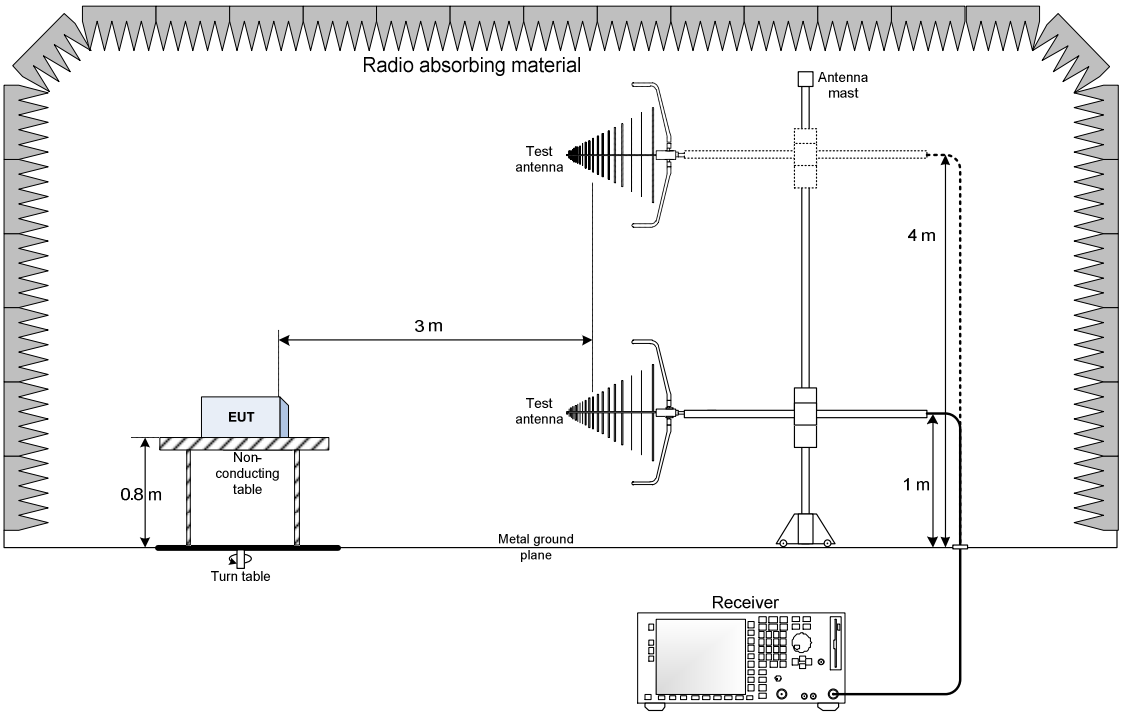
2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**433.9983 MHz**	**65.98 dBµV/m**	Occ Bw	**247.779582843 kHz**
T1		1	433.79792 MHz	41.76 dBµV/m	Occ Bw Centroid	433.921808651 MHz
T2		1	434.0457 MHz	42.53 dBµV/m	Occ Bw Freq Offset	1.408651024 kHz

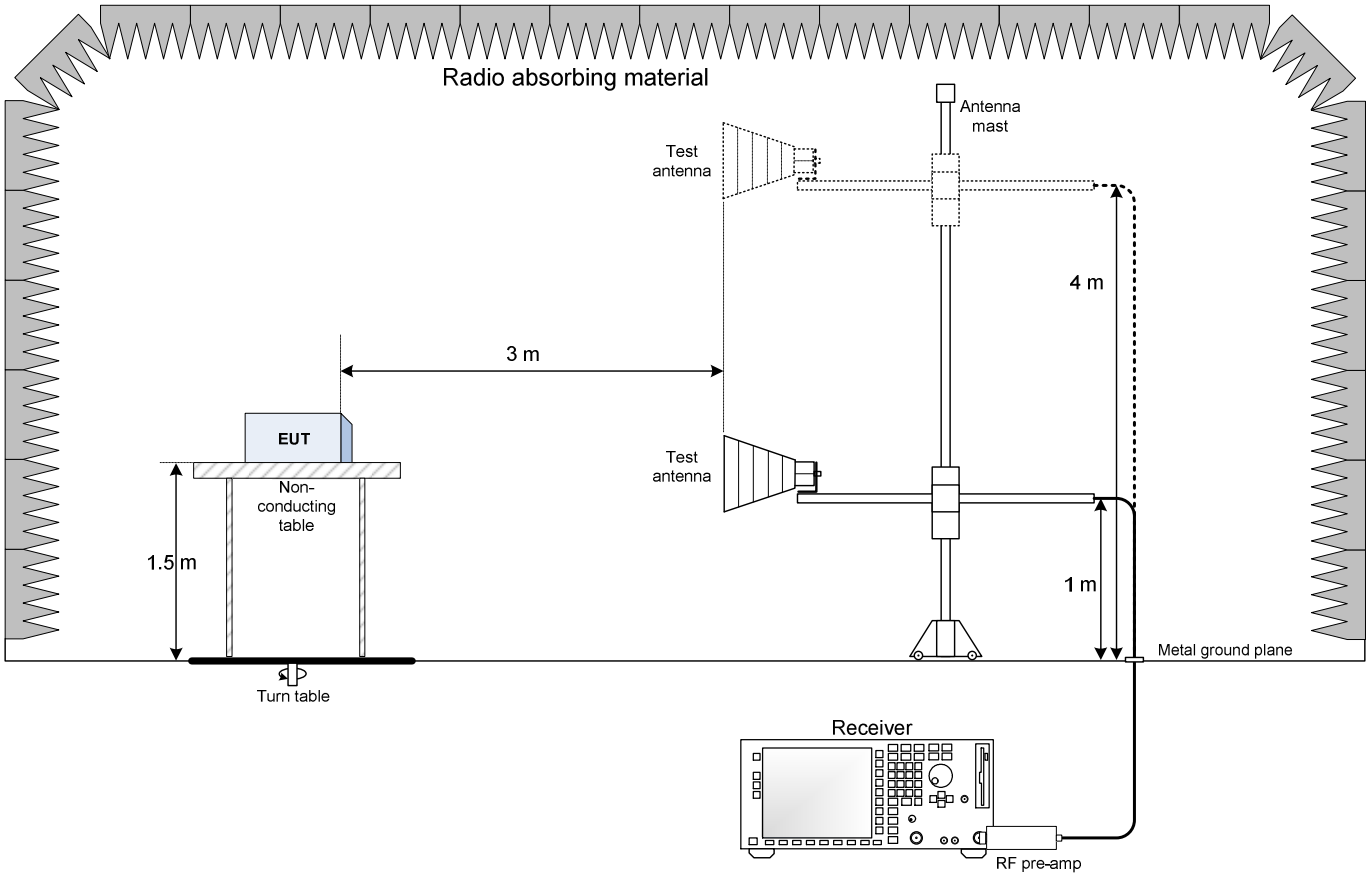
*Figure 8.5-2: Occupied bandwidth measurement **99%= 247.779 kHz***

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up for frequencies below 1 GHz



9.2 Radiated emissions set-up for frequencies above 1 GHz



9.3 Photo set up