



TEST REPORT

No. AR22-0073493-01

performed in accordance with

FCC Rules: Code of Federal Regulations (CFR) no. 47
Part 15 Subpart C Section 15.231

PRODUCT	433 MHz module integrated in radiographic controller device
MODEL(s) TESTED	x-mind dc
FCC ID	2AZ78WDC0
TRADE MARK(s)	The logo for Acteon, featuring the brand name in a bold, black, sans-serif font with a stylized blue swoosh graphic to the left of the letters.

APPLICANT	DE GOTZEN SRL Via Roma 45 – 21057 – Olgiate Olona (VA) - Italy
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Tested by	Alessandro Macrì <i>[Laboratory technician]</i>	
Approved by	Roberto Colombo <i>[Laboratory manager]</i>	

Revision Sheet

Release No.	Date	Revision Description
Rev. 0	2021-12-20	First edition Digital signed – AR22-0073493-01- TR_FCC Part C 15.231 – De Gotzen – X-Mind DC

The results of tests and checks reported in this Test Report refer exclusively to the samples tested and described in the Report itself.

This Report shall not be reproduced partially the written approval of IMQ S.p.A..

The authenticity of this Test Report and its contents can be verified by contacting IMQ S.p.A., responsible for this Test Report.

1. GENERAL DATA

SAMPLE				
Samples received on	2021-05-05	(Item(s) sampled and sent by applicant)		
IMQ reference samples	BEM	104031		
Samples tested No.	1			
Object under analysis recognition	Not carried out			
	Except where stated, characteristics of products were taken from client description and were not verified by the laboratory			
Date of acceptance of test item	2021-05-11			
TEST LOCATION				
Testing dates	2021-12-14 ÷ 2021-12-15			
Testing laboratory.	IMQ S.p.A. - Via Quintiliano, 43 – I-20138 Milano			
Testing site	Via Quintiliano, 43 – I-20138 Milano			
ENVIRONMENTAL CONDITIONING				
Parameter	Measured			
Ambient Temperature	21.7 ÷ 24.9 °C			
Relative Humidity	42 ÷ 51 %			
Atmospheric Pressure	992 ÷ 1008 mbar			
The laboratory is monitored by a continuous environmental conditions measurements system. Temperature, humidity and pressure data are recorded on a weekly basis and stored in local archive.				
REMARKS				
<p>Throughout this report a point is used as the decimal separator.</p> <p>The ability or reliability of this product to perform its intended function in a particular application has not been investigated.</p> <p>The test results apply to the sample as received.</p> <p>All information relating to the details of the equipment under test at the § 3 of this document was provided by the applicant.</p> <p>IMQ declines any responsibility derived from missing or wrong information provided aside by the applicant.</p>				

2. REFERENCE DOCUMENT

DOCUMENT	DATE	TITLE
<input checked="" type="checkbox"/> 47 CFR Part 15	2015	Radio Frequency Device
<input checked="" type="checkbox"/> ANSI C63.4	2014	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
<input checked="" type="checkbox"/> ANSI C63.10	2013	American National Standard for Testing Unlicensed Wireless Devices

3. UNIT UNDER TEST (EUT) DETAILS

GENERAL DATA

MODEL (basic)	Description
x-mind dc	Radiographic controller device
VARIANTS	
MODEL DERIVED	Description
xgenus dc	As x-mind dc , de Götzen trade mark
Leadex 70 DC	As x-mind dc , Ritter trade mark

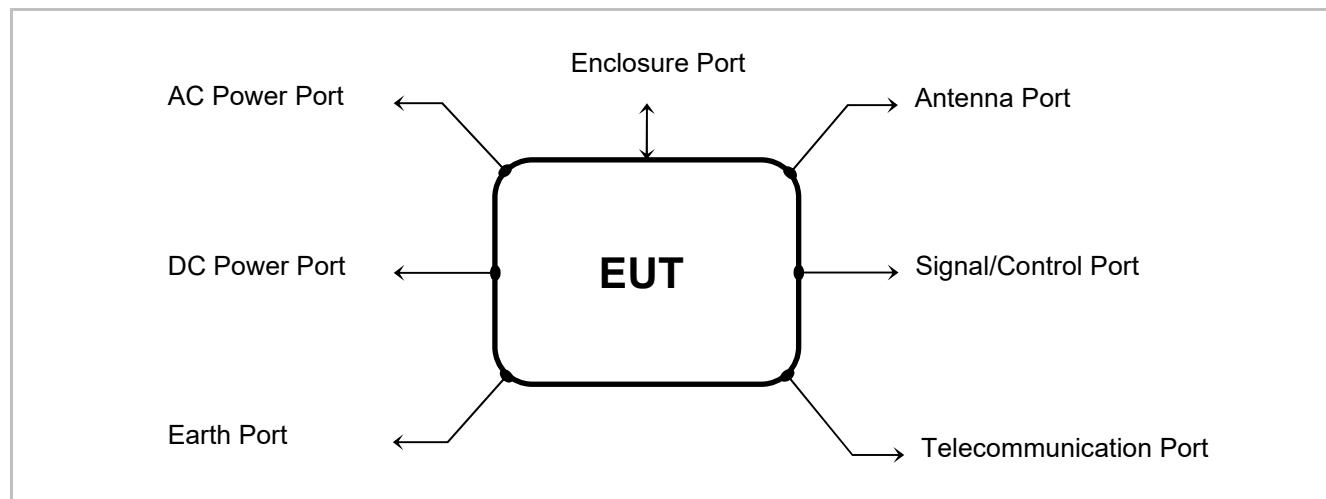
FCC ID	2AZ78WDC0
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Manufacturer	DE GOTZEN SRL Via Roma 45 – 21057 – Olgiate Olona (VA) - Italy
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Type of equipment	Radiographic controller device
Operating frequency:	433.92 MHz
Maximum RF radiated power:	84.30 dB μ V/m
Modulation:	ASK
Channel Spacing:	/
Antenna:	Dedicated
Power supply type:	AC

4. TEST CONFIGURATION OF UNIT UNDER TEST

EUT PORTS



Port	Description	Max length
Enclosure	Plastic	/
AC power	110/230 V	/
DC power	5V DC for the radio module	/
Earth	/	/
Wired Network	/	/
Signal / Control	I/O bus	/
Antenna	Dedicated	/

STATE OF THE EUT DURING TESTS

Ref.	Mode	Description
#1	CW	Continuous unmodulated transmission mode (constant tone)
#2	Modulated	Continuous modulated transmission (duty cycle 100%)
#3	Normal operating	Receiving mode / Normal transmission

SUPPORT EQUIPMENT

Defined as equipment needed for correct operation or loading of the EUT, but not considered as tested:

Equipment	Manufacturer	Model
/	/	/



ELECTROMAGNETICALLY RELEVANT COMPONENTS

Component	No.	Manufacturer	Model
PCB mainboard	1	De Götzen s.r.l	XGENUS CONTROL V.1.2
PCB keyboard	1	De Götzen s.r.l	XGENUS LED V.1.3
PCB radio	1	AUREL	RTX-4M5V-ASK
Microprocessor	1	Microchip	PIC17C756A
Mains filter	1	SCHURTER	FMBB-3409-0340

RFI SUPPRESSION DEVICES

Component	No.	Manufacturer	Model
/	/	/	/

EMI PROTECTION DEVICES

Component	No.	Manufacturer	Model
/	/	/	/

EUT TECHNICAL DOCUMENTATION

Document	Reference
/	/

5. METHODS OF MEASUREMENT

All compliance measurements have been carried out using the procedures described in the standard ANSI C63.4:2014, ANSI C63.10:2013 and Section 15.31 of CFR47 Part 15 – Subpart A (General).

Additional test requirements have been adopted according to the reference Section indicated in the § 6 of this test report.

FREQUENCY RANGE INVESTIGATED

Conducted emission tests: from 9 kHz to 30 MHz.

Radiated emission tests: from 9 kHz to tenth harmonic of fundamental (or 1GHz)

6. SUMMARY OF TEST RESULTS

POSSIBLE TEST CASE VERDICTS:	
Test object meets the requirement	PASS
Test object does not meet the requirement	FAIL
Test case does not apply to the test object	N.A.
Test not performed	N.P.

CFR47 Part 15	TITLE	RESULT
§ 15.203	Antenna Requirements	PASS
§ 15.207 (a)	Conducted Emission	PASS
§ 15.209 (a) (f) § 15.231 (b)	Radiated Emission	PASS
§ 15.231 (a) (1)	Duration of manually activated transmission	PASS
§ 15.231 (c)	Bandwidth of the emission	PASS



7. TEST RESULTS

7.1 ANTENNA REQUIREMENTS

TEST REQUIREMENT

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 carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, 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 Section 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.

Testing dates

2021-12-14

Antenna specifications

N° of authorized antenna types	1
Antenna type	Dedicated
Antenna size	/
Maximum total gain	/
External power amplifiers	Not present

TEST RESULT

The EUT meets the requirements of section 15.203 and 15.204

7.2 CONDUCTED DISTURBANCES

TEST REQUIREMENT	
Test setup	ANSI C63.4
Frequency range	150 kHz ÷ 30 MHz
IF bandwidth	9 kHz
EMC class	B
Limits	sections 15.207 (a)
EUT operating condition	#1
Remark	None
Testing dates	2021-12-14

TEST RESULT

The EUT meets the requirements of sections 15.207.

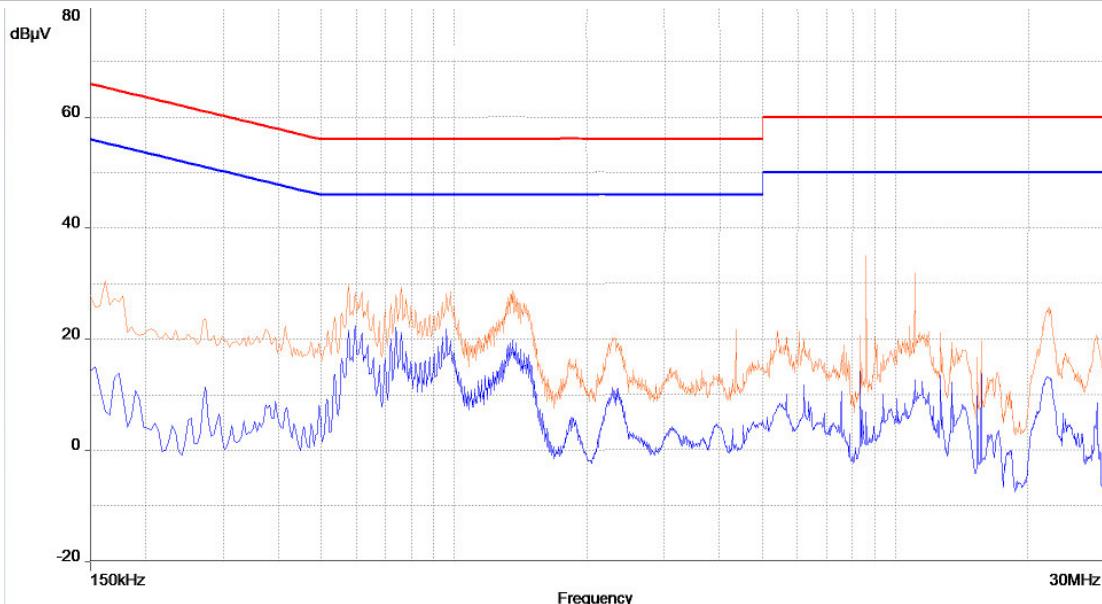
TEST PROCEDURE

- 1) The EUT was placed on a wooden table of size 80 cm by 80 cm, raised 10 cm in which is located 40 cm away from the vertical wall the shielded room.
- 2) Each EUT power cord input cord was individually connected through a 50Ω/50µH LISN to the input power source.
- 3) Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
- 4) The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
- 5) The measurements were made with the detector set to PEAK and AVERAGE amplitude within a bandwidth of 10 kHz during the measurements.
- 6) The measurements with Quasi-Peak detector are performed only for frequencies for which the Peak values are \geq (Q.P. limit - 6 dB).
- 7) Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

MEASUREMENTS RESULTS

Port: AC MAINS POWER PORT Radiographic controller device

Line: PHASE + LINE



7.3 RADIATED DISTURBANCES

TEST REQUIREMENT	
Test setup	ANSI C63.4
Test facility	Semi-anechoic chamber
Test distance	3 meters
Frequency range	9 kHz to tenth harmonic of fundamental
IF bandwidth (below 30 MHz)	9 kHz
IF bandwidth (below 1,000 MHz)	120 kHz
IF bandwidth (above 1,000 MHz)	1 MHz
Deviation to test procedure	None
Limits	sections 15.209 (a) & 15.231 (b)
EUT operating condition	#1
Remark	(*) In accordance with part 15.31 (f) (2), where the measurement distance was specified to be 30 or 300 meters, a correction factor was applied in order to permit measurement to be performed at a separation distance. The applied formula for limits at 3 meter is: Extrapolation (dB) = 40log (300meter / 3meter) = +80db Extrapolation (dB) = 40log (30meter / 3meter) = +40db
Testing dates	2021-12-15

TEST RESULT

The EUT meets the requirements of sections 15.209 (a) & 15.231 (b)

LIMITS FOR SPURIOUS		
Band of operations	Peak (dB μ V/m)	Average Limit (dB μ V/m)
Restricted bands (par. 15.205)	74	54
Other bands	According to 15.209 or fundamental –20dB (which is greater)	According to 15.209 or fundamental –20dB (which is greater)

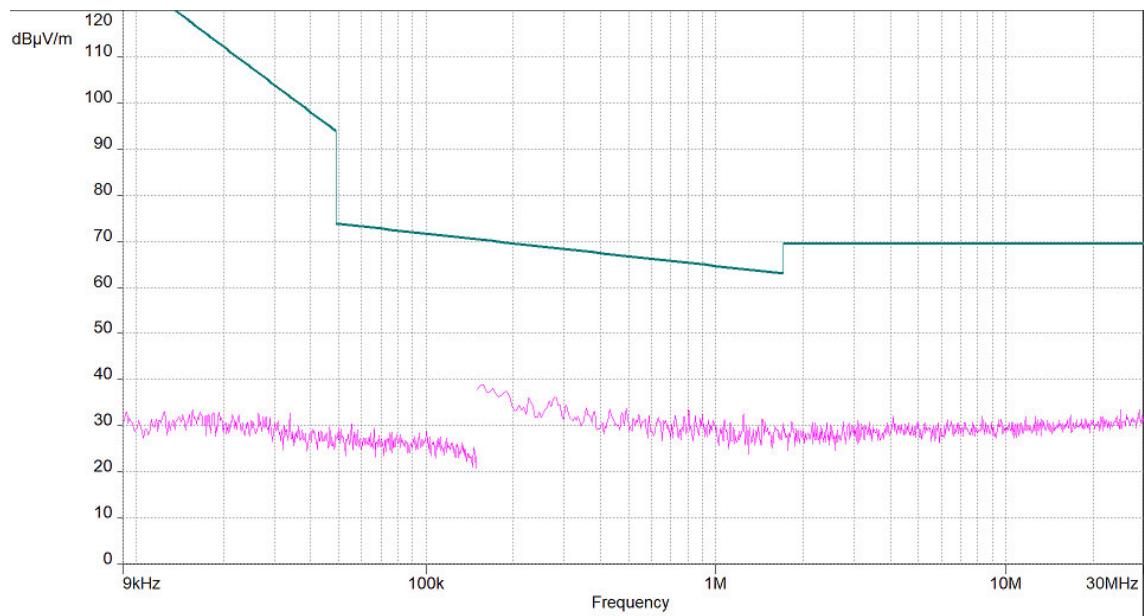
TEST PROCEDURE

- 1) The EUT was placed on turntable
- 2) The turntable shall rotate from 0° to 360° degrees to determine the position of maximum emission level.
- 3) The EUT is positioned 3 m away from the receiving antenna which varied from 1 to 4 m to find the highest emission.
- 4) The measurements were made with the detector set to PEAK and AVERAGE amplitude within a bandwidth of 120 kHz below 1000 MHz and 1 MHz above 1000 MHz.
- 5) The receiving antenna was positioned in both horizontal and vertical polarization.
- 6) The measurements with Quasi-Peak detector, below 1000 MHz are performed only for frequencies for which the Peak values are \geq (Q.P. limit – 6 dB).



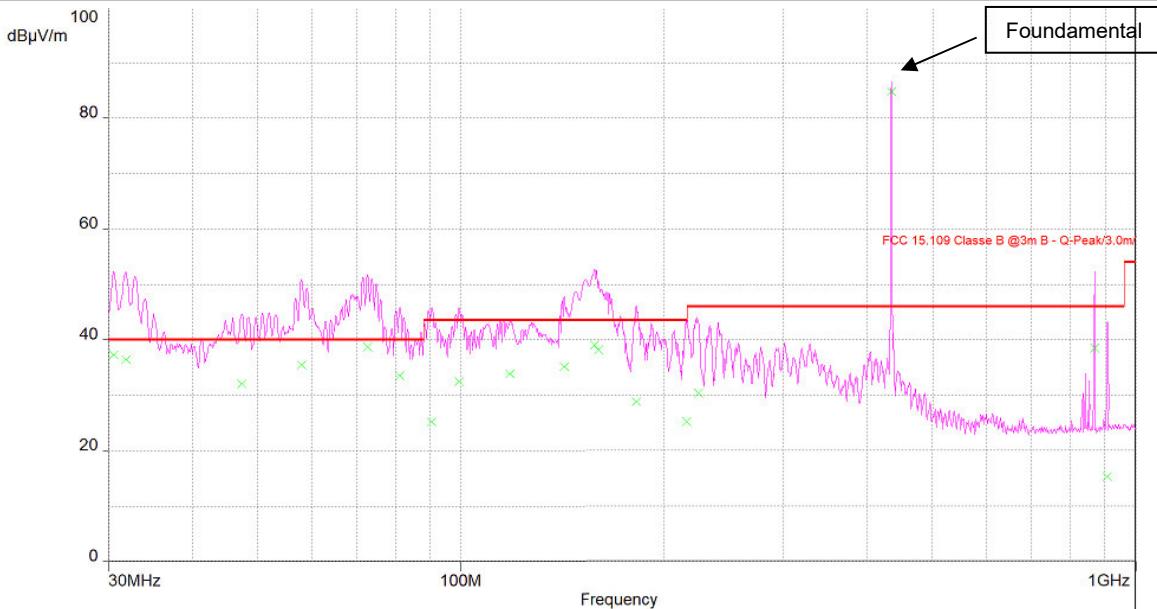
MEASUREMENTS RESULTS

Range: 9kHz – 30 MHz

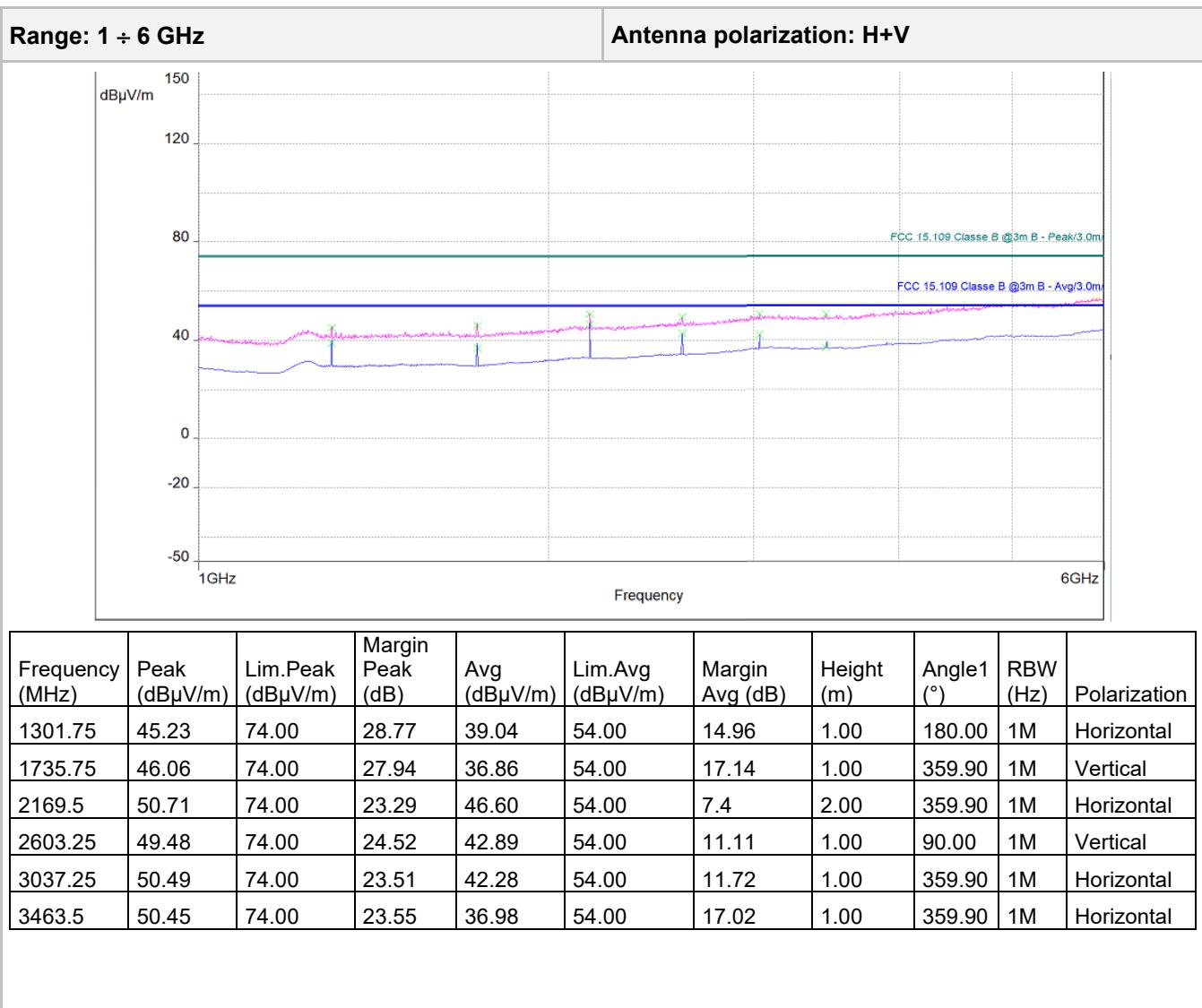


Range: 30 ÷ 1000 MHz

Antenna polarization: H+V

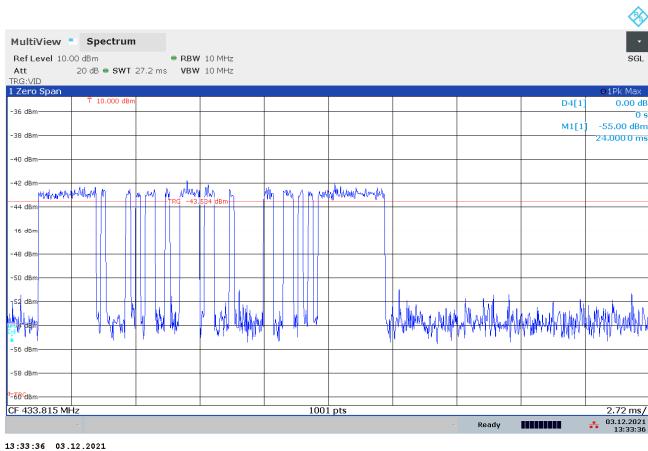


Frequency (MHz)	QPeak (dBμV/m)	QPeak Limit (dBμV/m)	Margin (dB)	Height (m)	Angle (°)	Polarization	RBW (Hz)
30.56	37.36	40.00	2.64	1.00	39.40	Vertical	120k
31.84	36.52	40.00	3.48	1.00	35.10	Vertical	120k
47.32	32.08	40.00	7.92	1.02	4.70	Vertical	120k
58	35.50	40.00	4.50	1.08	0.30	Vertical	120k
72.6	38.75	40.00	1.25	1.00	0.00	Vertical	120k
81.04	33.58	40.00	6.42	2.02	34.80	Vertical	120k
90.4	25.20	43.50	18.30	1.55	45.00	Vertical	120k
99.32	32.57	43.50	10.93	2.34	84.50	Vertical	120k
118.16	33.95	43.50	9.55	2.20	27.30	Vertical	120k
142.08	35.18	43.50	8.32	1.22	9.80	Vertical	120k
157.64	39.03	43.50	4.47	1.02	24.80	Vertical	120k
159.8	38.19	43.50	5.31	1.00	39.70	Vertical	120k
181.72	28.93	43.50	14.57	1.00	4.90	Vertical	120k
216.32	25.11	46.00	20.89	2.25	12.30	Vertical	120k
224.72	30.41	46.00	15.59	2.25	22.00	Vertical	120k
433.88							
Foundamental	84.30	46.00	-38.30	2.00	94.70	Horizontal	120k
867.8	38.52	46.00	7.48	1.62	0.00	Vertical	120k
908.52	15.26	46.00	30.74	1.17	54.80	Vertical	120k



DUTY CYCLE Radiographic controller device

Tx:



Duty cycle: Ton=8.582 ms. Ton+Toff= 100ms

AV factor: $20\log(8.582/100) = -21.32 \text{ dB}$ **TEST RESULT**

The results reported are worst case.

The worst Peak/Average measures are reported.

No significant values were found in receiver mode through careful preliminary scans.

The EUT meets the requirements.

7.4 FIELD STRENGTHS

TEST REQUIREMENT

Spectrum analyzer settings

Span	Wide enough to capture the peak level of the emission
Resolution bandwidth (RBW)	100 kHz
Video bandwidth (VBW)	300 kHz
Sweep time (SWT)	2.5 ms
Detector function	Peak
Trace	Max hold
Attenuator	/
Deviation to test procedure	None
EUT operating condition	#1
Remark	None
Testing dates	2021-12-15

TEST PROCEDURE

Radiated measurements:

As the EUT is supplied with a dedicated antenna, the effective radiated power is measured in a 3 m anechoic chamber with the substitution antenna method

LIMITS

For 260-470 MHz: Frequency Strength (μ V/m) = $(41.67 \times f) - 7083$

$(41.67 \times 433.92) - 7083 = 10998.4464 \mu$ V/m = 80.83 dB μ V/m (AV); 100.83 dB μ V/m (PK)

Average correction factor Wireless remote controller: -16.5 dB (see pag 17 for correction factor determination).

Average correction factor Radiographic controller device: -21.3 dB (see pag 18 for correction factor determination).

TEST RESULT

The EUT meets the requirements of § 15.231 (b)

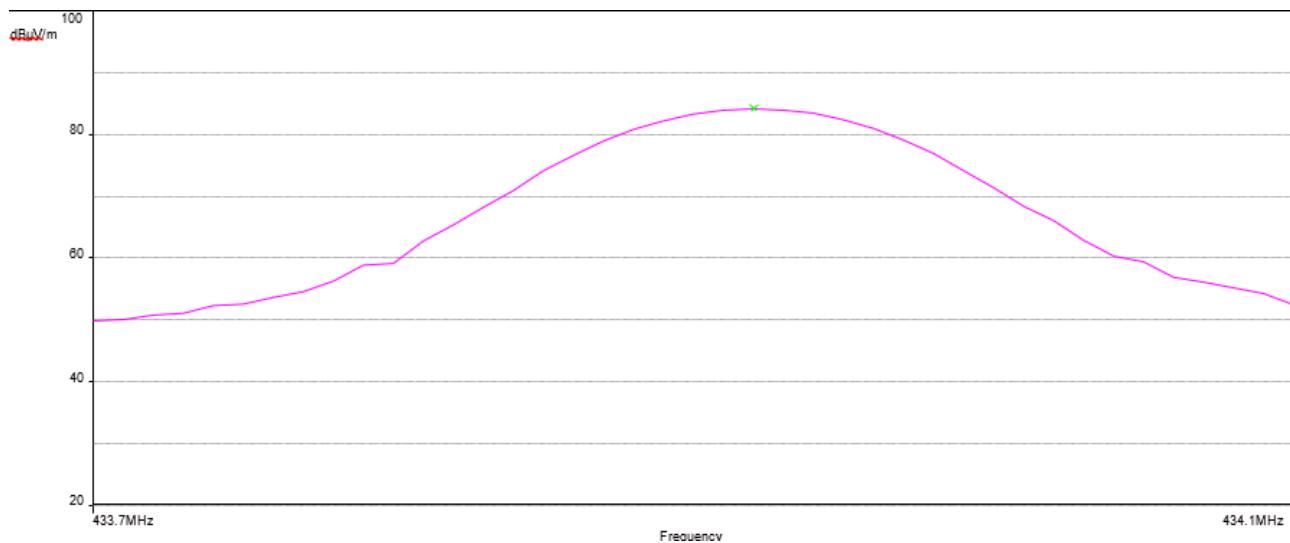


FIELDS STRENGHT RESULTS (RADIATED)

Radiographic controller device

Channel (No.)	Frequency (MHz)	Detector	Radiated Output Power (at 3m. distance) (dB μ V/m)	Limit (dB μ V/m)
1	433.92	PK	84.30	100.83
1	433.92	AV (calculated)	62.98	80.83

Plot 1



Frequency (MHz)	Reading Power (dBm)	Correction Factor (dB)	Measured Output Power (dBm)	Output Power (dB μ V/m)
433.92	-17.84	6.91	-10.93	84.30

7.5 CHARACTERISTICS OF TRANSMISSION

TEST REQUIREMENT § 15.231 (A)

The provisions of this Section are restricted to periodic operation within the band 40.66 -MHz and above 70 MHz. Except as shown in paragraph (e) of this Section, the intentional radiator 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 transmission 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.

EUT operating condition	#3
Testing dates	2021-12-14

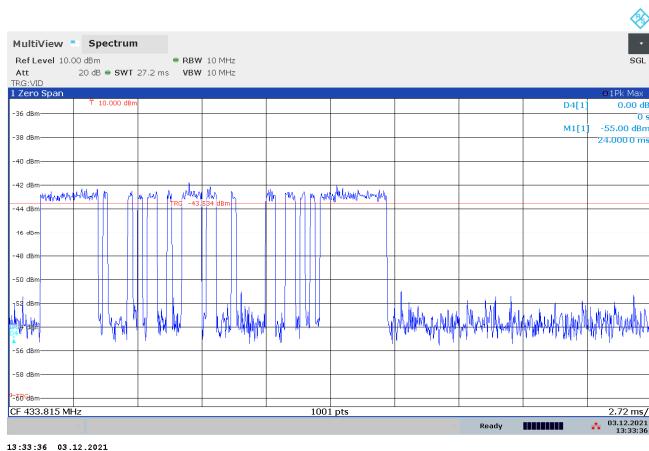
LIMITS

TX time < 5 s

TEST RESULT

The EUT meets the requirements of sections 15.231 (a)

MEASUREMENTS RESULTS



After activation of transmission the equipment send a pulses train and then ceases the transmission.
Maximum deactivated time = <1 s
Limit: < 5s

7.6 BANDWIDTH OF EMISSION IN PERIODIC TRANSMISSION

TEST REQUIREMENT	
Test setup	ANSI C63.4
Test facility	Semi-Anechoic chamber
Frequency range	Over 70MHz
Resolution BW	See next table
Deviation to test procedure	None
Limits	0,25% of the center frequency (in Range 70÷900MHz) 0,5 % of the center frequency (for frequencies above 900MHz)
EUT operating condition	#1
Remark	None
Testing dates	2021-12-15

TEST RESULT	
The EUT meets the requirements of sections 15.231 (c)	

ANSI C63-4 SPECIFICATION	
13.1.7 Occupied bandwidth measurements	
In order to measure the modulated signal properly, a resolution bandwidth that is small compared with the bandwidth required by the procuring or regulatory agency shall be used on the measuring instrument.	
However, the resolution bandwidth of the measuring instrument shall be set to a value greater than 5% of the bandwidth requirements. When no bandwidth requirements are specified, the minimum resolution bandwidth of the measuring instrument is given in the following table:	
Fundamental frequency	Minimum resolution bandwidth
9 kHz to 30 MHz	1 kHz
30 to 1000 MHz	10 kHz
1000 MHz to 40 GHz	100 kHz

MEASUREMENTS RESULTS - BANDWIDTH OF EMISSION (AT 20dB POINTS)
Radiographic controller device

Frequency (MHz)	Bandwidth at -20dB points (kHz)	Channel Bandwidth (%)	Limit (kHz)	Plot (No.)
433.91	12.737	0.003	1084.8	1

Plot 1


8. MEASUREMENTS AND TESTS UNCERTAINTY

Unless otherwise stated the uncertainties for the tests and measurements are evaluated in according to IMQ Operational Instruction IO-LAB-001, IO-LAB-004 and IO-LAB-009 and requirement of NIST Technical Note 1297 and NIS 81: 1994 "The Treatment of Uncertainty in EMC Measurements"

The expanded uncertainty was calculated for all measurements and tests listed in this test report according to CISPR 16-4-2 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainty in EMC Measurements", with UKAS document LAB 34 and is documented in the quality system accordance to ISO/IEC 17025.

Internal Procedure PG-037 ensures that the requirements for traceability of calibrations, of all test equipment requiring calibration, and calibration intervals are met.

Methods/Standard	Parameter	Expanded Uncertainty	Unit	Confidence level
Continuous disturbance	QP detector 9 – 150 kHz	2.47	dB	95%
	QP detector 150 k – 30 MHz	2.61	dB	95%
	QP detector using Voltage Probe	2.45	dB	95%
	QP detector using ISN	3.15	dB	95%
	QP detector using Current Probe	2.15	dB	95%
Radiated disturbance	QP detector (30 MHz - 100 MHz) H polarization	4.33	dB	95%
	QP detector (30 MHz - 100 MHz) V polarization	4.22	dB	95%
	QP detector (100 MHz - 200 MHz) H polarization	3.40	dB	95%
	QP detector (100 MHz - 200 MHz) V polarization	4.76	dB	95%
	QP detector (200 MHz - 1000 MHz) H polarization	3.91	dB	95%
	QP detector (200 MHz - 1000 MHz) V polarization	3.82	dB	95%
	P detector 1-6 GHz	4.77	dB	95%

9. LIST OF MEASURING EQUIPMENT AND CALIBRATION INFORMATION

Instrument	Manufacturer	Model	IMQ Ref.	Cal. Date	Cal. Due
Shielded anechoic chamber	SIDT	/	P-01709	2020-10-29	2021-12-31(*)
Turntable controller	FRANKONIA	FCTAM01	P-02486	/	/
Mast antenna	FRANKONIA	FAM4	P-02488	/	/
EMI Receiver	ROHDE & SCHWARZ	ESW44	S-07965	2021-09-30	2022-09-30
Log antenna	SCHWARZBECK	STLP 9128 ES	S-09109	2021-05-21	2022-05-31
Preamplifier	SCHWARZBECK	BBV9744	S-09213	2021-05-10	2022-05-31
Horn antenna	SCHWARZBECK	BBHA 9120D	S-03463	2020-12-14	2021-12-31
Loop Antenna	ROHDE & SCHWARZ	HFH2-Z2E	S08623	2020-12-18	2021-12-31
Preamplifier	Hewlett Packard	HP 8449B	S-03542	2020-11-06	2021-12-31(*)
Pulse limiter	ROHDE & SCHWARZ	ENV216	S-03631	2021-01-15	2022-01-31
Software	NEXIO	BAT-EMC Vers. 3.20.0.21	W-00316	/	/
PC	/	/	H-00164	/	/

Note

(*)Some calibration intervals may be extended, based on sufficient calibration data and experience of use
(see IECEE OD-5011:2015 clause 8.3)

END OF REPORT