LAB N° 1356 L

TEST REPORT
47 CFR FCC Part 15 subpart C Par. 15.225
Intentional Radiators

Applicant:	EVTRONIC – 34 Rue Denis Papin – 33850 – Leognan - France
Test item:	RFID module
Identification / Type No.:	RFID Board TMOD
FCC ID:	2A3C7-RFID
Order content:	Full testing according to the following standard(s):
Test specification:	FCC Part 15, Subpart C (par. 15.225)
Date of receipt:	04/10/2023
Internal storage No.:	A003574365-001
Testing period:	06/10/2023 to 09/10/2023
Place of testing:	TÜV Rheinland Italia S.r.l. Via E. Mattei, 3 20005 Pogliano Milanese (MI) - IT
Testing laboratory:	TÜV Rheinland Italia S.r.l. Via E. Mattei,3 20005 Pogliano Milanese (MI) - IT
Test result:	*Pass*

Photos were removed for confidentiality as demanded by the customer

Tested by:	Roberto Radice & Francesco Lombardi	**Authorized by:**	Andrea Bortolotti
Date: 21/11/2023	(Laboratory technician)	**Date:** 21/11/2023	(Reviewer)
Position	Sachverständige(r)/Expert	**Position**	Sachverständige(r)/Expert

Condition of the test item at delivery: Test item complete and undamaged

(#) Test sample(s), as well sample information, description, product details and intended usage was provided by customer.

1	*The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system.* *Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.*
2	*As contractually agreed, this document has been signed digitally only. TUV Rheinland has not verified and unable to verify which legal or other pertaining requirements are applicable for this document. Such verification is within the responsibility of the user of this document. Upon request by its client, TUV Rheinland can confirm the validity of the digital signature by a separate document. Such request shall be addressed to our Sales department. An environmental fee for such additional service will be charged.*
3	*Test clauses with remark of * are subcontracted to qualified subcontractors and descripted under the respective test clause in the report.* *Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.*
4	*Unless otherwise agreed with the customer, a conformity assessment is always carried out based on the applied standards.* *At the customer's request, the statement on the conformity of the product tested in this test report is carried out according to the criteria/requirements of the applied standards.* *Evaluation conditions deviating from these are documented separately in the respective chapters.*

0. Table of Contents

1. General description of test item(s)	
Identification / Type No.:	RFID module BID0011 (p/n S001405AB4)
Serial number	22317047
Manufacturer	EVBox North America Inc.
Trade Mark	EVBox
Rated voltage / frequency	+5V dc
Rated current / power	---
Equipment type	Stand alone Intentional radiator
Number of phases	N.A.
(#) Hardware version	PCB000276 V1.2.0
Software version	Not provided by the customer
Dimensions	110 x 50 mm.
Weight	---
Other	Temperature Range: -30° to +85°C
Test sample obtaining:	☒ Sampling by customer ☐ Sampling by TÜV Rheinland Group ☐ others:

2. Test method	
	§15.225 Operation within the band 13.110 – 14.010 MHz (a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters. (b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters. (c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters. (d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209. (e) The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of –20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery. (f) In the case of radio frequency powered tags designed to operate with a device authorized under this section, the tag may be approved with the device or be considered as a separate device subject to its own authorization. Powered tags approved with a device under a single application shall be labeled with the same identification number as the device

§15.207 Conducted limits.

(a) 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 ohms 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.

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*

* Decreases with the logarithm of the frequency.

(b) The shown limit in paragraph (a) of this Section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:
(1) For carrier current systems containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.
(2) For all other carrier current systems: 1000 µV within the frequency band 535-1705 kHz, as measured using a 50 µH/50 ohms LISN.
(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits in Section 15.205 and Section 15.209, 15.221, 15.223, 15.225 or 15.227, as appropriate.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provision for, the use of battery chargers which permit operating while charging, AC adaptors or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

§15.209 Radiated emission limits, general requirements.

(a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	*Field strength (microvolts/meter)*	*Measurement Distance (meter)*
0.009 - 0.490	*2400/F(kHz)*	*300*
0.490 - 1.705	*24000/F(kHz)*	*30*
1.705 - 30.0	*30*	*30*
30-88	*100***	*3*
88-216	*150***	*3*
216-960	*200***	*3*
Above 960	*500*	*3*

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

(b) In the emission table above, the tighter limit applies at the band edges.

(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other Sections within this Part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

(d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
(e) The provisions i
n Sections 15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this Part.

(f) In accordance with Section 15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in Section 15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in Section 15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit. Emissions which must be measured above the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator and which fall within the restricted bands shall comply with the general radiated emission limits in Section 15.109 that are applicable to the incorporated digital device.

(g) Perimeter protection systems may operate in the 54-72 MHz and 76-88 MHz bands under the provisions of this section. The use of such perimeter protection systems is limited to industrial, business and commercial applications.

	§ 15.33 Frequency range of radiated measurements. (a) Unless otherwise noted in the specific rule section under which the equipment operates for an intentional radiator the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in this paragraph: (1) If the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. (2) If the intentional radiator operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower. (3) If the intentional radiator operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower, unless specified otherwise elsewhere in the rules. (4) If the intentional radiator contains a digital device, regardless of whether this digital device controls the functions of the intentional radiator or the digital device is used for additional control or function purposes other than to enable the operation of the intentional radiator, the frequency range shall be investigated up to the range specified in paragraphs (a)(1)-(a)(3) of this section or the range applicable to the digital device, as shown in paragraph (b)(1) of this Section, whichever is the higher frequency range of investigation.

3. Reference standards

Reference document		
47 CFR Part 15	Last edition	Radio Frequency Device
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
ANSI C63.10	2020	American National Standard for Testing Unlicensed Wireless Devices
996369 D04 Module Integration Guide	v02 October 13, 2020	Modular transmitter integration guide; guidance for host product manufacturers.

Note: The following referenced documents are indispensable for the application of this document.
For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

4. Equipment used during test

Equipment under test

No.	Product type	Manufacturer	Model	Comments
1	RFID module	EVBox	RFID Board TMOD	—
2	—	—	—	—

Auxiliary Equipment / Peripherals

No.	Product type	Manufacturer	Model	Comments
1	Demo board	EVBox	—	Board provided by applicant. Demo board supplied at 24Vdc.
2	—	—	—	—
3	—	—	—	—

5. Input/Output ports

Nr.	Name	Type	Cable length	Cable shielded	Comments
1	Enclosure port	Open frame board	---	---	---
2	AC power port	Port not present			
3	DC power port	+5V Input power supply	<3m.	No	Positive and negative line
4	Signal/control port	I/O data	<3m.	No	---
5	Wired Network port	Port not present			

6. Radio type identification	
Brand name and model of radio module	RFID Board TMOD
Antenna model and Gain	Loop antenna 4x4 cm. diameter
Antenna type	☐ External antenna ☐ Dedicated antenna ☒ Integral antenna
Type of equipment	☒ stand-alone equipment ☐ combined equipment ☐ multi-radio equipment
Type of modulation	ASK
Nominal voltage of stand-alone or combined equipment	+5Vdc
Operatig frequency	13.56MHz
Number of channels	1
Transmit operating mode	☒ single antenna ☐ multiple antennas
Environmental equipment	☐ Test only in normal conditions ☒ Test in normal conditions and extreme conditions
Temperature range	-30 °C to +85 °C

7. Operating modes	
No.	**Description**
1	Continuous modulated transmission at 13.56MHz; RFID module supplied by external board provided by applicant.

8. Climatic conditions	
Ambient Temperature	10 - 40 °C
Relative Humidity	10 - 90 %
Air pressure	Not specified
According to ANSI C63.4	

Ambient Temperature Humidity Sensor (used to control climatic conditions)	Type: 6152C (ID: 2782344; manufacturer: Davis Instruments) • Semi-Anechoic Chamber FACT 3	**Calibration due date** 06/2024
	Type: T3511 (ID: 2782075; manufacturer: Comet system) • Semi-Anechoic Chamber SAC 5	**Calibration due date** 06/2024
	Type: T3511 (ID: 2782070; manufacturer: Comet system) • Transitory phenomena area	**Calibration due date** 06/2024
	Type: T3511 (ID: 2781962; manufacturer: Comet system) • ESD room	**Calibration due date** 06/2024
Barometer (used to control climatic conditions)	Type P3267S07801 + E1999X (ID: 2782560; manufacturer: Tecsis)	**Calibration due date** 03/2025

9. Modification during tests		
☒	No modifications done during testing	
☐	Modifications done during testing (see details below)	
No.	**Description of modification**	**Date of modification**
1		
2		
3		
Supplementary information: --		

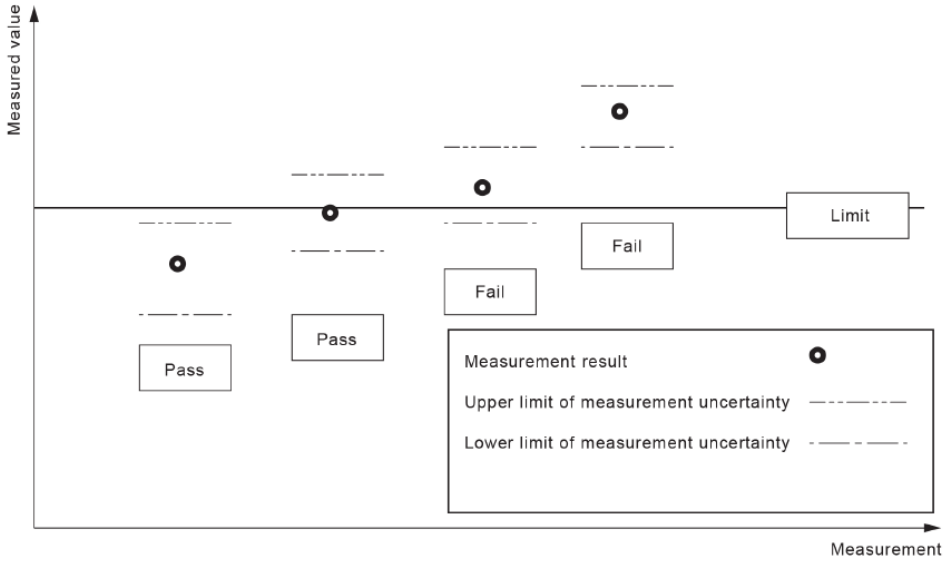
10. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the quality system acc. to ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation.

The manufacturer has the sole responsibility of continued compliance of the device.

11. Example for interpretation of measuring results

The decision rule for statements of conformity in this test report is based on the “Zero Guard Band Rule” and “Simple Acceptance” in accordance to and ILAC-G8:09/2019 and IEC Guide 115:2023, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report.”



Decision Rule

Statements of conformity (PASS or FAIL) to specifications are made in this report without taking measurement uncertainty into account.

Where statements of conformity are made in this report, the following decision rules are applied:

Test result complies with test specification.	**P**	= passed
Test result does not comply with test specification.	**F**	= failed
Requirement not applicable	**N/A**	= not applicable
Requirement not tested	**N/T**	= not tested

12. Measurement uncertainty

Test Method	Uncertainty (95%)	Coverage factor k
RF Conducted continuous emissions - range (9 kHz – 30 MHz)	3.3 dB	2.0
RF Radiated emissions – range (30 – 1000) MHz	4.9 dB	2.0
Occupied Bandwidth	514.4 x 10^{-9}	2.0
Measurement of Normalised Site Attenuation and VSWR	6.0 dB	2.0

13. EUT configuration

The test setup was made in accordance with mentioned FF standards.

Measurements and tests were executed under ”worst case” conditions. Typical EUT arrangements or operating modes were chosen or assumed which let suspect maximum emission or susceptibility (a so called ”unfavourable configuration”).

Details of test setup or adjustments are (particularly) shown inside the photo documentation.
As far as not mentioned otherwise these statements are valid for all following tests.

REVISION HISTORY

14. Change history

Test report number	List of revisions	Date
IT23WS91 001	First edition	21/11/2023

ADDITIONAL DOCUMENTATION

15. Result summary section

Clause	Requirement – Test case	Result
§ 15.203	Antenna Requirements	**P**
§ 15.207 (a)	Conducted emission test	**P**
§ 15.215 (a) (b) (c)	Additional provisions to the general radiated emission limitations	**P**
§ 15.215 (c)	20 dB Bandwidth	**P**
§ 15.225 (a)	Field strength in band 13,553-13,567MHz	**P**
§ 15.225 (b)	Field strength in band 13,410-13,553 MHz and 13,567-13,710 MHz	**P**
§ 15.225 (c)	Field strength in band 13,110-13,410 MHz and 13,710-14,010 MHz	**P**
§ 15.225 (d) § 15.209 (a) (f)	Field strength outside of the 13,110-14,010 MHz band	**P**
§ 15.225 (e)	Frequency tolerance of the carrier signal	**P**
§ 15.225 (f)	Radio frequency powered tags	**N/A[1]**

N.A.[1]: No powered tag.

ADDITIONAL DOCUMENTATION

16. Emission Test

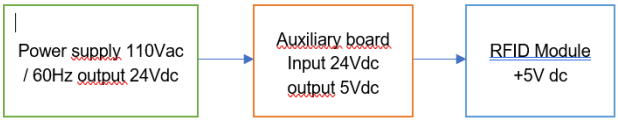
Antenna requirement	
Test date	06/10/2023
Applied Standard	FCC part 15 C
Paragraph	§15.203
Temperature	21.5° C
Humidity	46%
Tested by	Roberto Radice
Model	RFID Board TMOD
Internal Storage No.	A003574365-001
Remarks	None

ADDITIONAL DOCUMENTATION

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.

Antenna specifications	
N° of authorized antenna types	1
Antenna type	PCB loop antenna 4x4cm. diameter
Maximum total gain	< 6dBi
External power amplifiers	Not present

ADDITIONAL DOCUMENTATION

Conducted emission test	
Test date	06/10/2023
Applied Standard	FCC part 15 C
Paragraph	§15.207
Test method	§ 7 of ANSI C63-4
Temperature	20.5° C
Humidity	42%
Voltage/Frequency used during the test	110Vac / 60Hz (see remarks below)
Tested by	Francesco Lombardi
Model	RFID Board TMOD
Internal Storage No.	A003574365-001
Operating mode	1
Tested terminals	AC Mains input
Remarks	Test executed on AC Mains of AC/DC power supply Model FSP100-RTAAN2 (Input 100-240V 50-60Hz / Output 24V) not provided by applicant. RFID Loop Antenna replaced by 50ohm load. 

ADDITIONAL DOCUMENTATION

Test parameter of

EMI Auto Test Template: Emi cond lisn ENV 216 150k-30MHz

Hardware Setup: Emissione condotta LISN ENV216
Measurement Type: 2 Line LISN
Frequency Range: 150 kHz - 30 MHz
Graphics Level Range: 0 dBµV - 90 dBµV

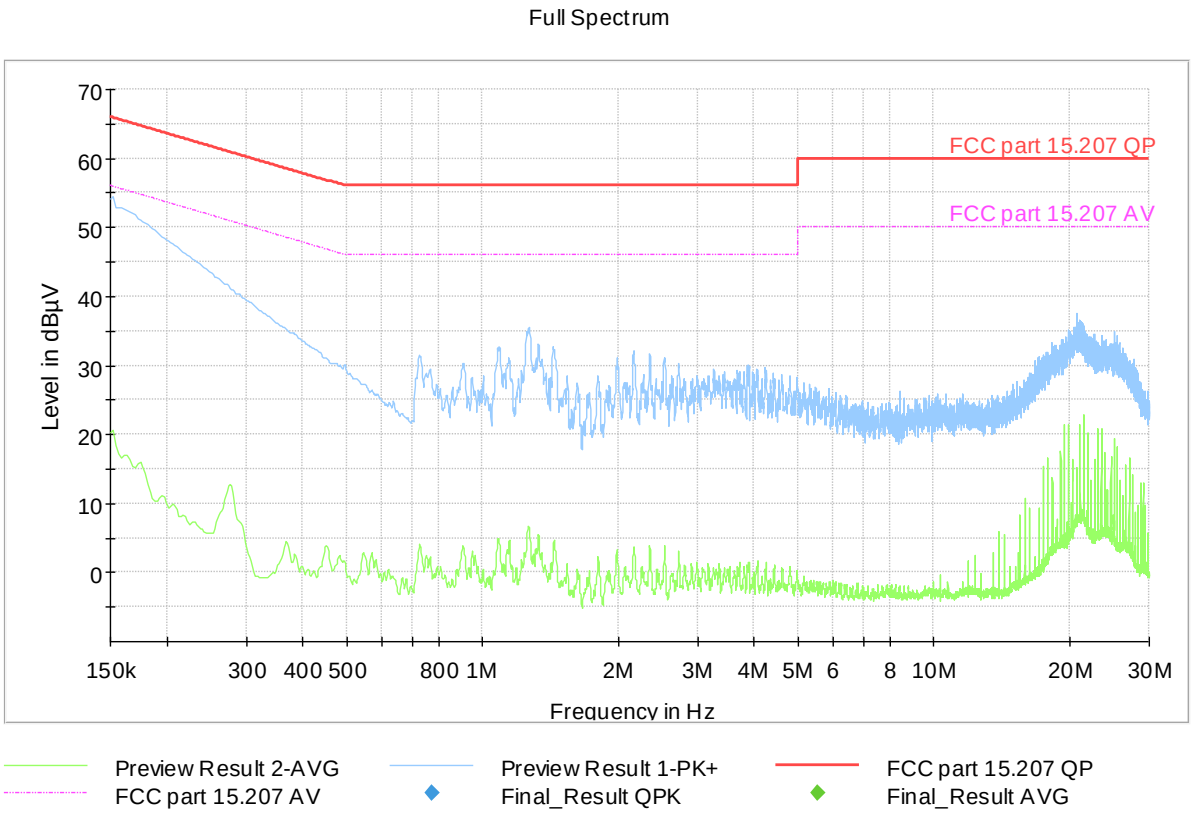
Preview Measurements:
LISN Lines: L1 + N
Scan Test Template: Emissione condotta Lisn ENV 216

Final Measurements:
Template for Single Meas.: Emissione condotta Lisn ENV 216 - fin QP

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
Receiver: [ESW 44]					
150 kHz - 30 MHz	2.25 kHz	QPK ; AVG	9 kHz	1 s	0 dB

ADDITIONAL DOCUMENTATION

Graphical presentation of	Phase Line



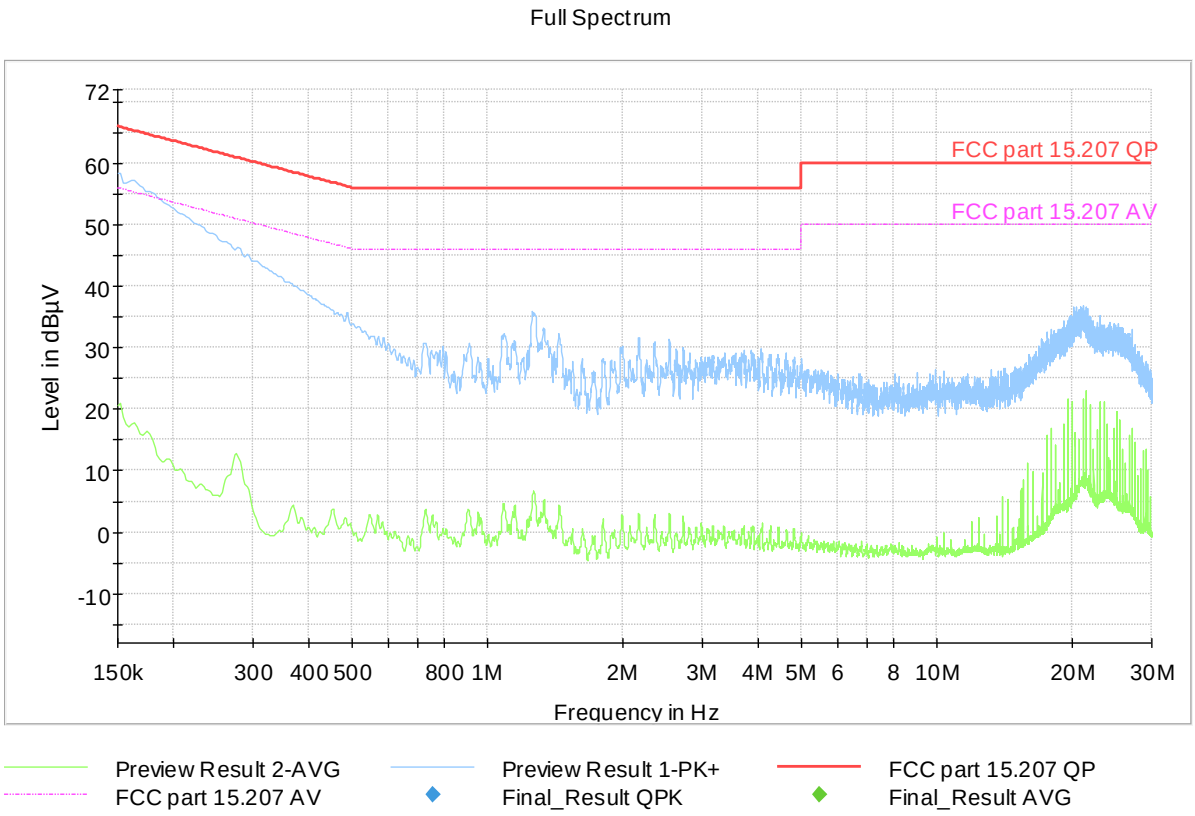
Measurement data of

Remarks:

Margin value = Measurement value – Limit value

ADDITIONAL DOCUMENTATION

Graphical presentation of	Neutral Line



Measurement data of

Remarks:

Margin value = Measurement value – Limit value

ADDITIONAL DOCUMENTATION

Radiated emission test - Field strength outside of the 13,110-14,010 MHz band	
Test date	06/10/2023
Applied Standard	FCC part 15 C
Paragraph	§15.205; §15.209; §15.225
Test method	§ 8 of ANSI C63-4
Temperature	21.5° C
Humidity	46%
Voltage/Frequency used during the test	+5V dc (from auxilary board)
Tested by	Roberto Radice
Model	RFID Board TMOD
Internal Storage No.	A003574365-001
Operating mode	1
Tested terminals	Enclosure
Further information to test setup	For frequencies above 1GHz, the anechoic material is also placed on the metallic floor between EUT and Antenna
Remarks	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

ADDITIONAL DOCUMENTATION

RANGE 9kHz-30MHz

Test parameter of

EMI Auto Test Template: Emi rad 9kHz-30MHz HFH2-Z2E Electric Field 3metri

Hardware Setup: Emissione irradiata 9kHz-30MHz HFH2-Z2E Electric Field 3metri
Measurement Type: Open-Area-Test-Site (SAC/FAR)
Frequency Range: 9 kHz - 30 MHz
Graphics Level Range: 0 dBµV/m - 110 dBµV/m

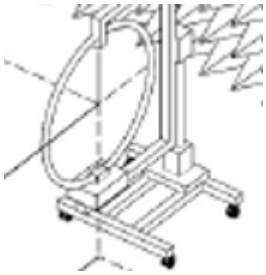
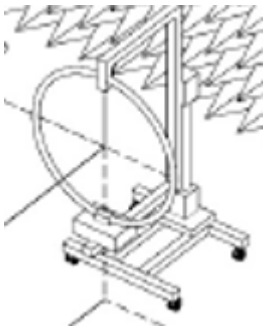
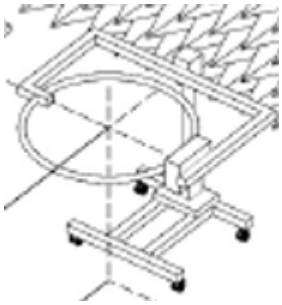
Preview Measurements:
- Antenna height: 100 - 400 cm , Step Size = 100 cm , Positioning Speed = 2
- Polarization: V
- Turntable position: 0 - 315 deg , Step Size = 45 deg , Positioning Speed = 3
- Scan Test Template: Emissione irradiata 9kHz-30MHz HFH2-Z2E Electric Field 3metri

Adjustment:
- Antenna height: Range = 25 cm , Measuring Speed = 3
- Turntable position: Range = 45 deg , Measuring Speed = 2
- Template for Single Meas.: Emissione irradiata 9kHz-30MHz HFH2-Z2E Electric Field 3metri

Final Measurements:
- Template for Single Meas.: Emissione irradiata 9kHz-30MHz HFH2-Z2E Electric Field 3metri - fin QP

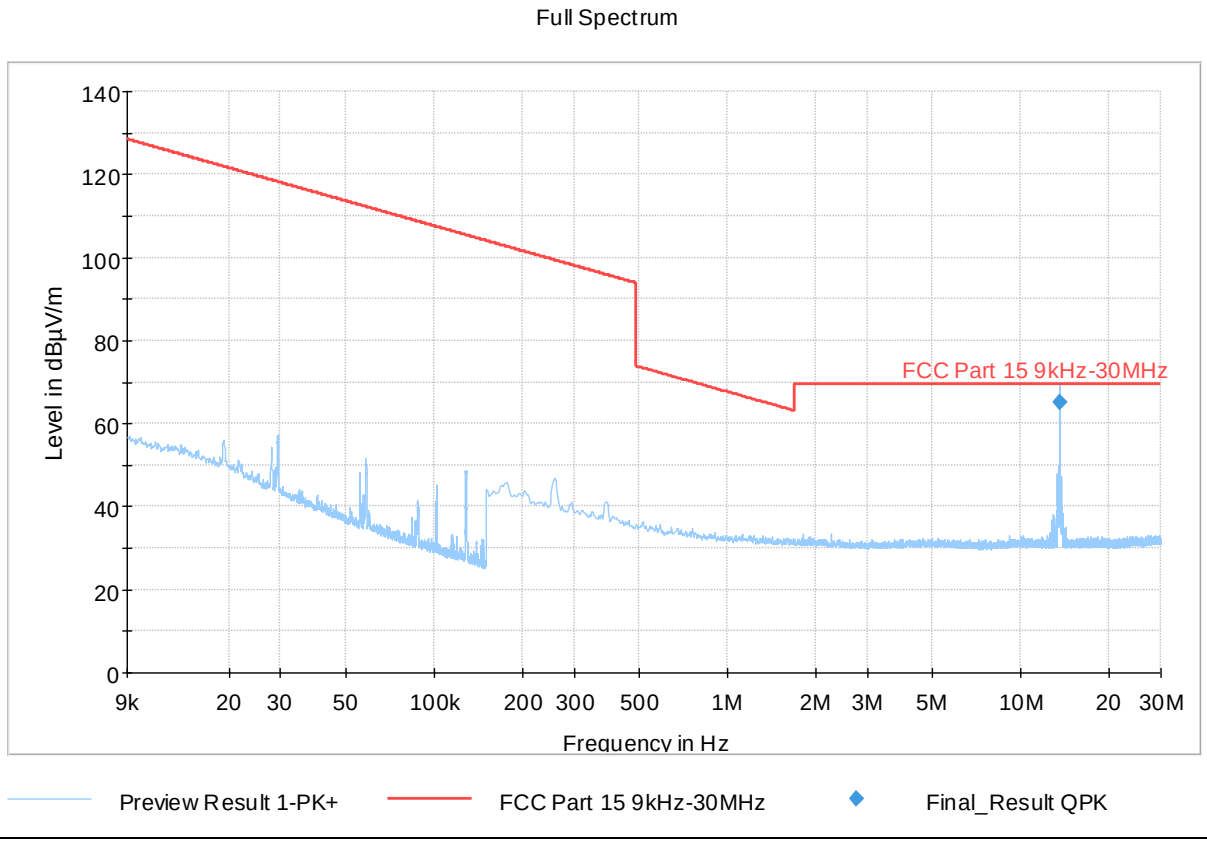
Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
Receiver: [ESW 44]					
9 kHz - 150 kHz	50 Hz	QPK	200 Hz	15 s	0 dB
150 kHz - 30 MHz	2.25 kHz	QPK	9 kHz	15 s	0 dB

ADDITIONAL DOCUMENTATION

Loop Antenna direction	
 **X direction**	 **Y direction**
 **Z direction**	**BLANK**

ADDITIONAL DOCUMENTATION

Graphical presentation of: Antenna X direction - EUT X position



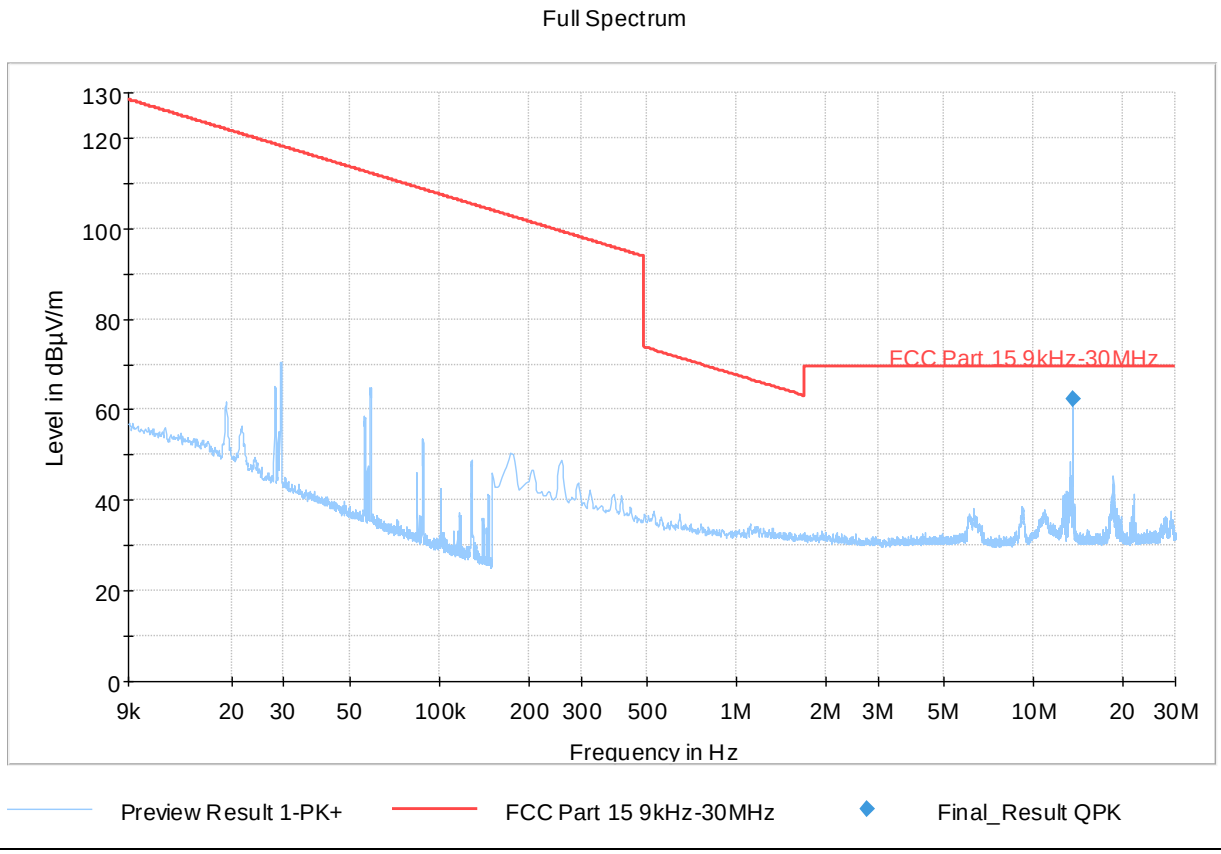
Measurement data of

Frequency (MHz)	QuasiPeak (dBµV/m) @3mt	QuasiPeak (dBµV/m) @30mt	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
13.560000	65.09	25.09	100.0	V	1.0	21.3

Note: fundamental frequency not related to limit

ADDITIONAL DOCUMENTATION

Graphical presentation of: Antenna Y direction - EUT X position



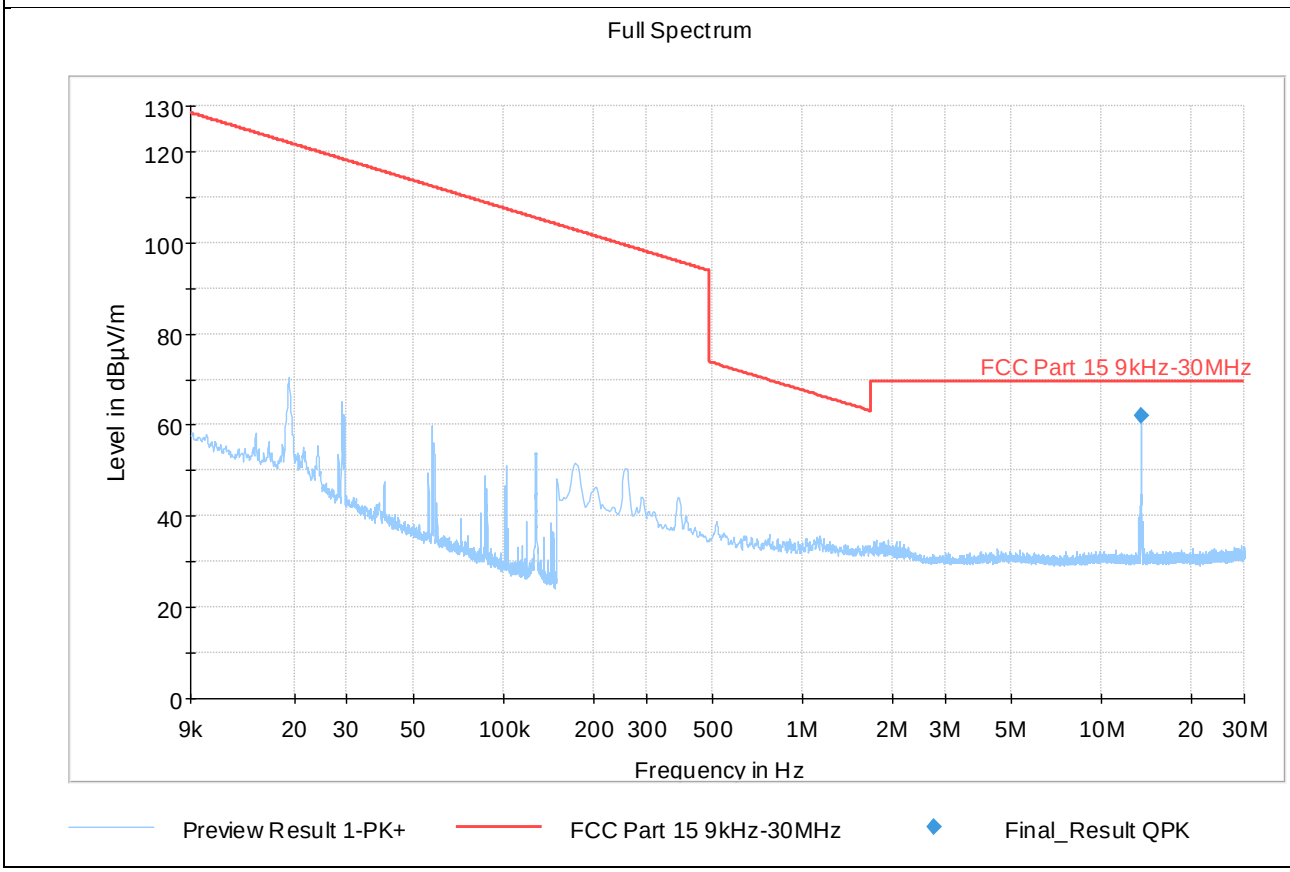
Measurement data of

Frequency (MHz)	QuasiPeak (dBµV/m) @3mt	QuasiPeak (dBµV/m) @30mt	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
13.560000	62.48	22.48	188.0	V	68.0	21.3

Note: fundamental frequency not related to limit

ADDITIONAL DOCUMENTATION

Graphical presentation of: Antenna Z direction - EUT X position



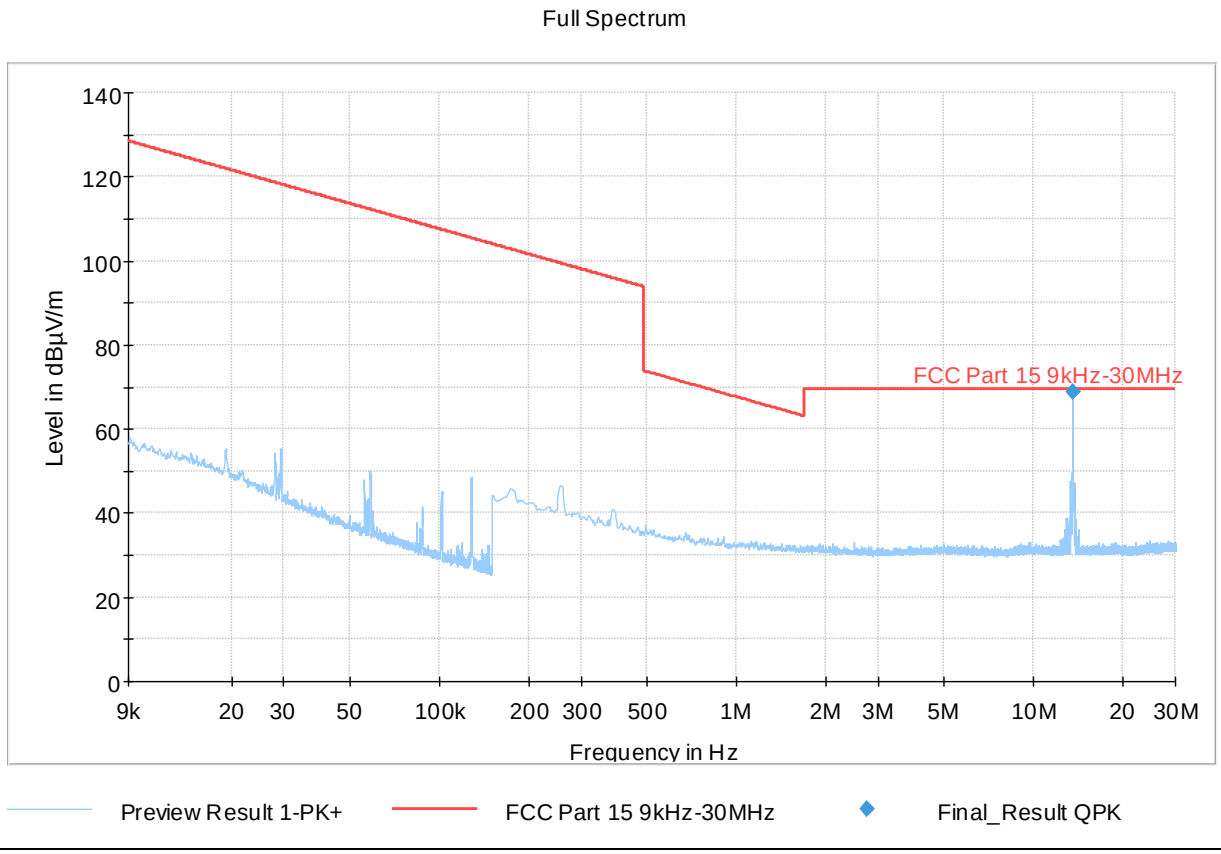
Measurement data of

Frequency (MHz)	QuasiPeak (dBµV/m) @3mt	QuasiPeak (dBµV/m) @30mt	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
13.560000	61.94	21.94	132.0	V	-7.0	21.3

Note: fundamental frequency not related to limit

ADDITIONAL DOCUMENTATION

Graphical presentation of: Antenna X direction - EUT Y position



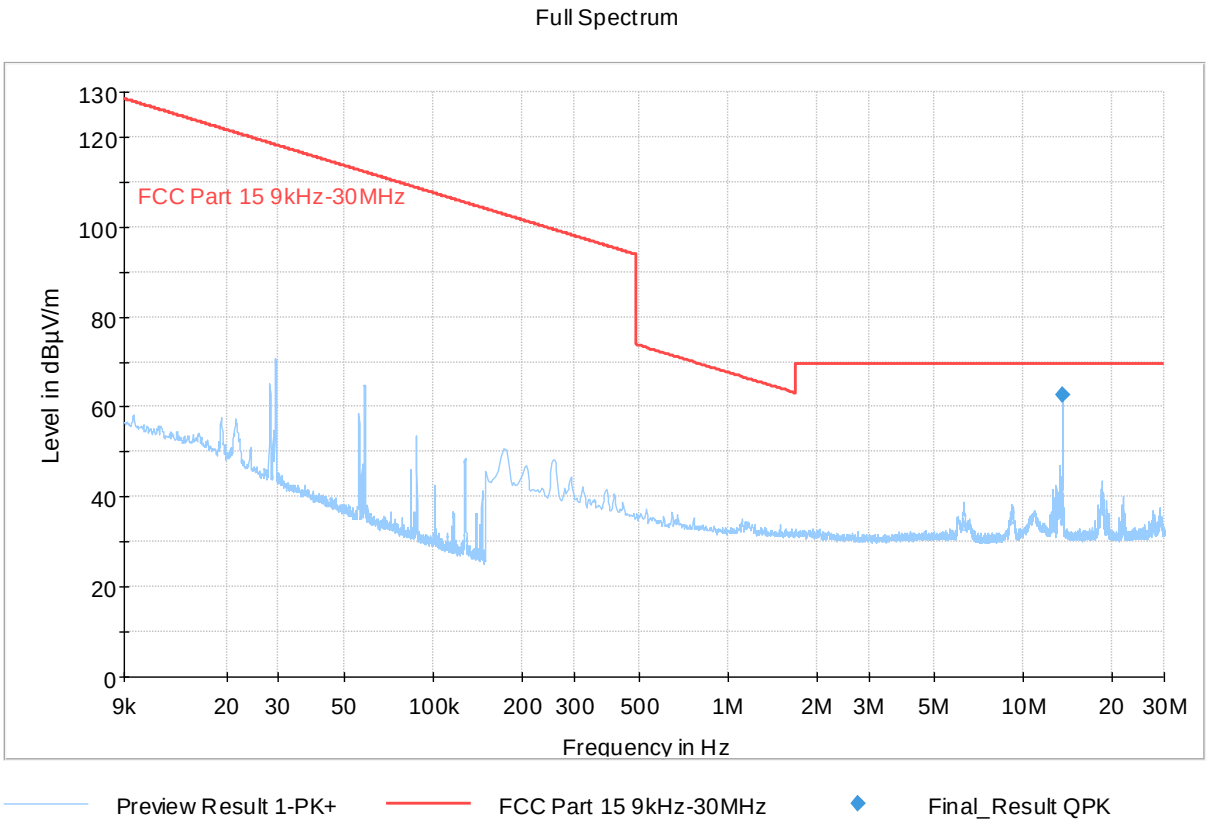
Measurement data of

Frequency (MHz)	QuasiPeak (dBµV/m) @3mt	QuasiPeak (dBµV/m) @30mt	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
13.560000	68.71	28.71	100.0	V	0.0	21.3

Note: fundamental frequency not related to limit

ADDITIONAL DOCUMENTATION

Graphical presentation of: Antenna Y direction - EUT Y position



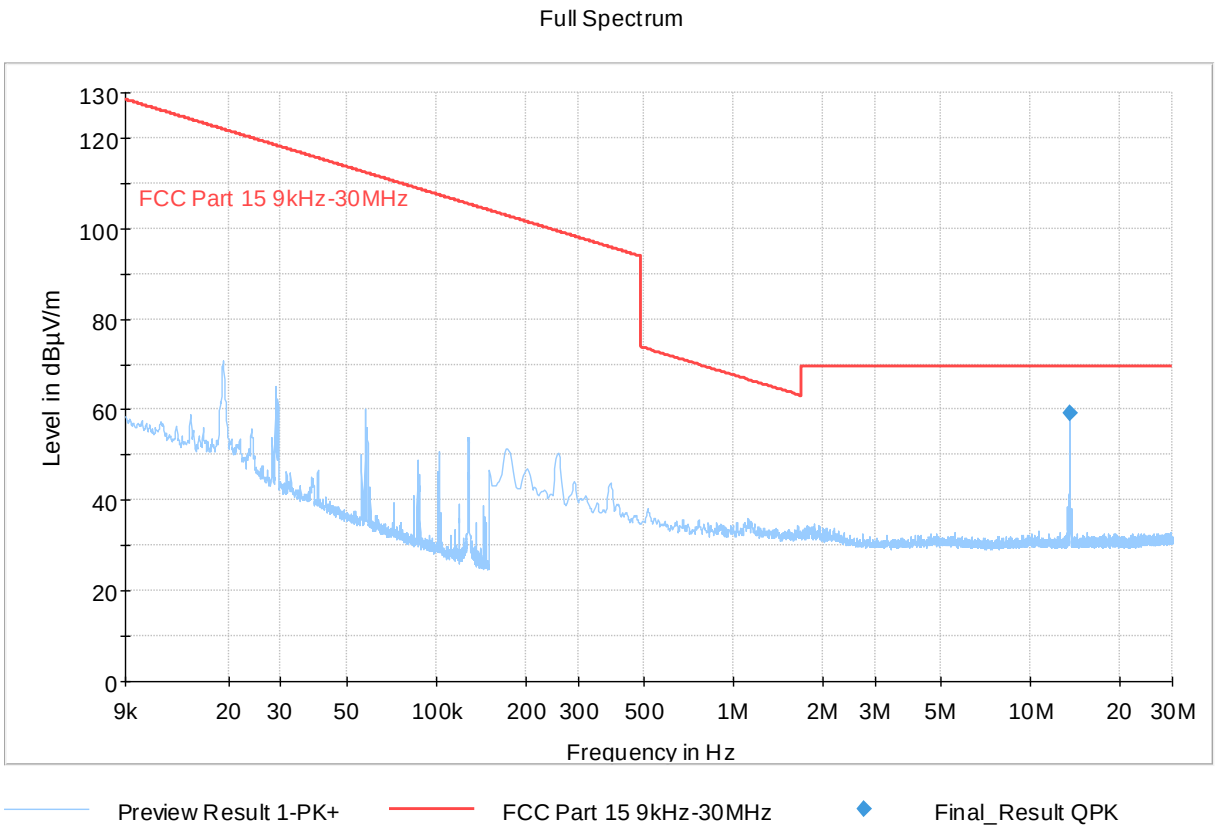
Measurement data of

Frequency (MHz)	QuasiPeak (dBµV/m) @3mt	QuasiPeak (dBµV/m) @30mt	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
13.560000	62.68	22.68	188.0	V	68.0	21.3

Note: fundamental frequency not related to limit

ADDITIONAL DOCUMENTATION

Graphical presentation of: Antenna Z direction - EUT Y position



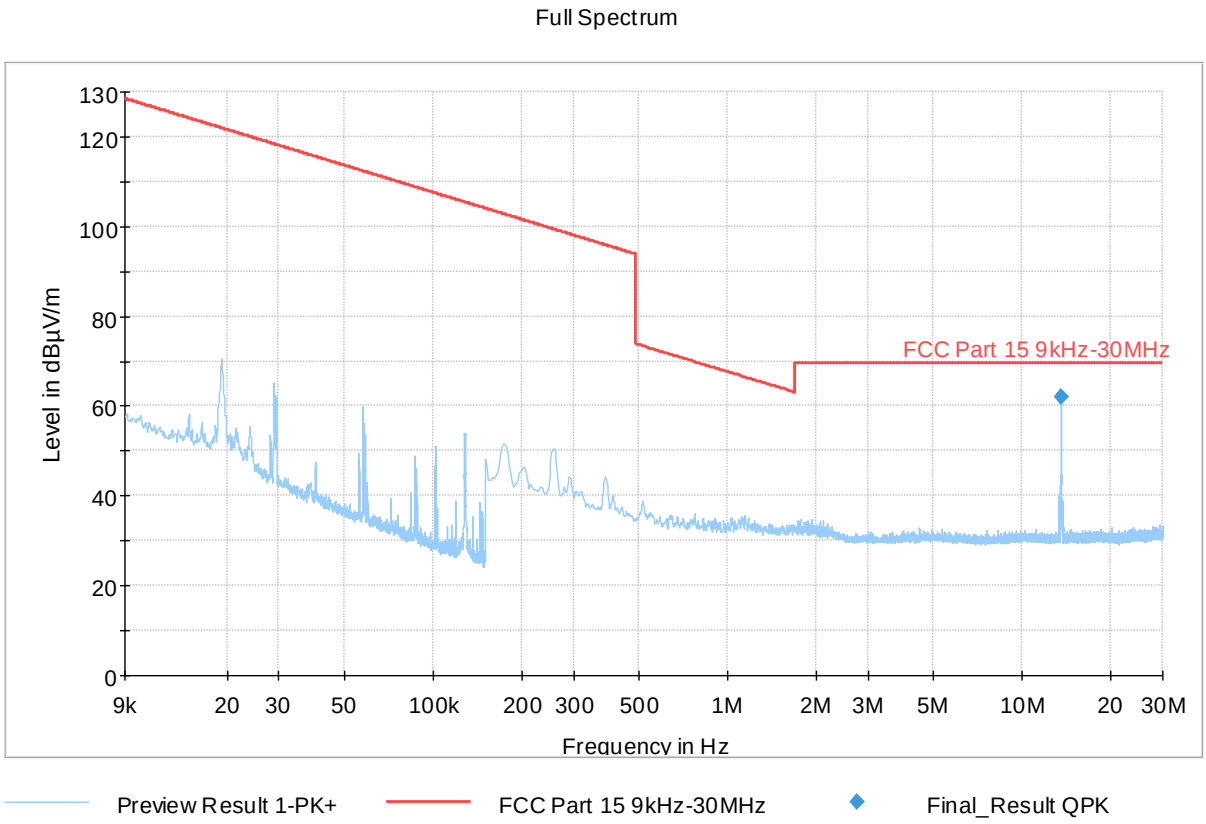
Measurement data of

Frequency (MHz)	QuasiPeak (dBµV/m) @3mt	QuasiPeak (dBµV/m) @30mt	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
13.560000	59.33	19.33	128.0	V	168.0	21.3

Note: fundamental frequency not related to limit

ADDITIONAL DOCUMENTATION

Graphical presentation of: Antenna X direction - EUT Z position



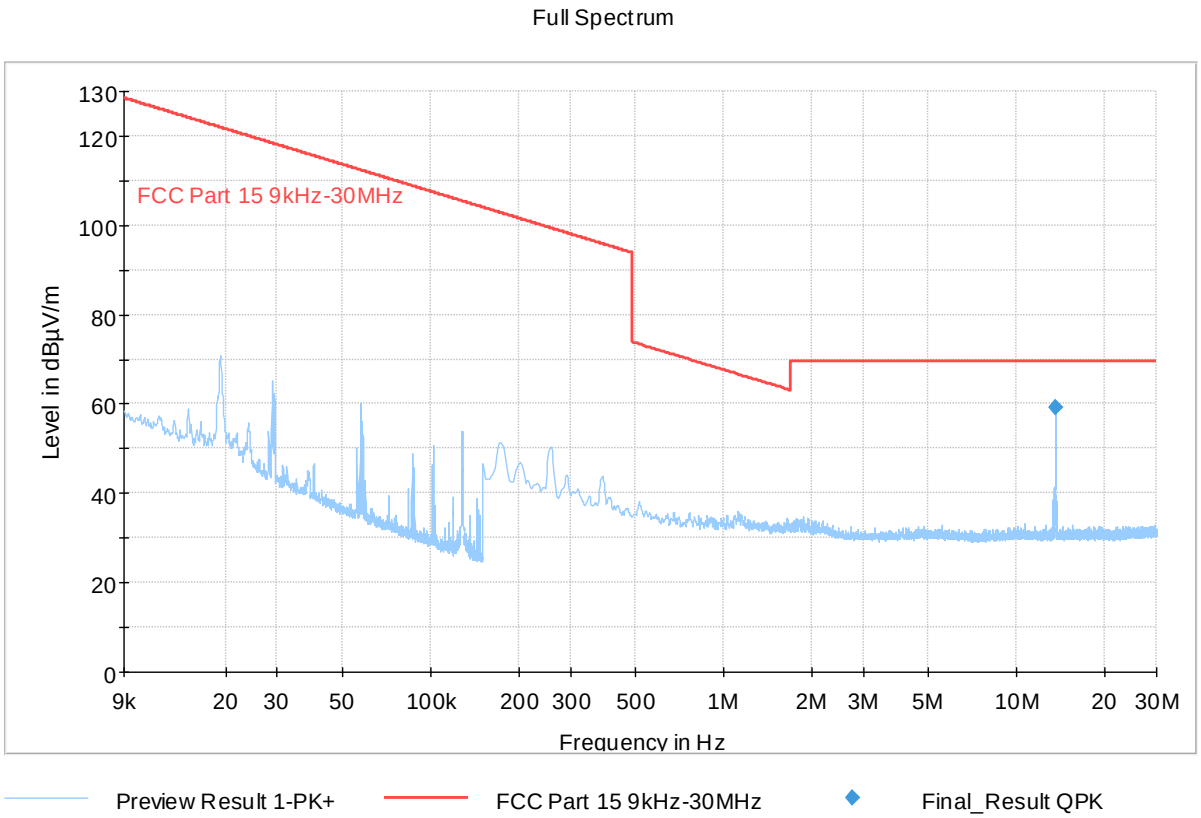
Measurement data of

Frequency (MHz)	QuasiPeak (dBµV/m) @3mt	QuasiPeak (dBµV/m) @30mt	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
13.560000	61.94	21.94	132.0	V	-7.0	21.3

Note: fundamental frequency not related to limit

ADDITIONAL DOCUMENTATION

Graphical presentation of: Antenna Y direction - EUT Z position



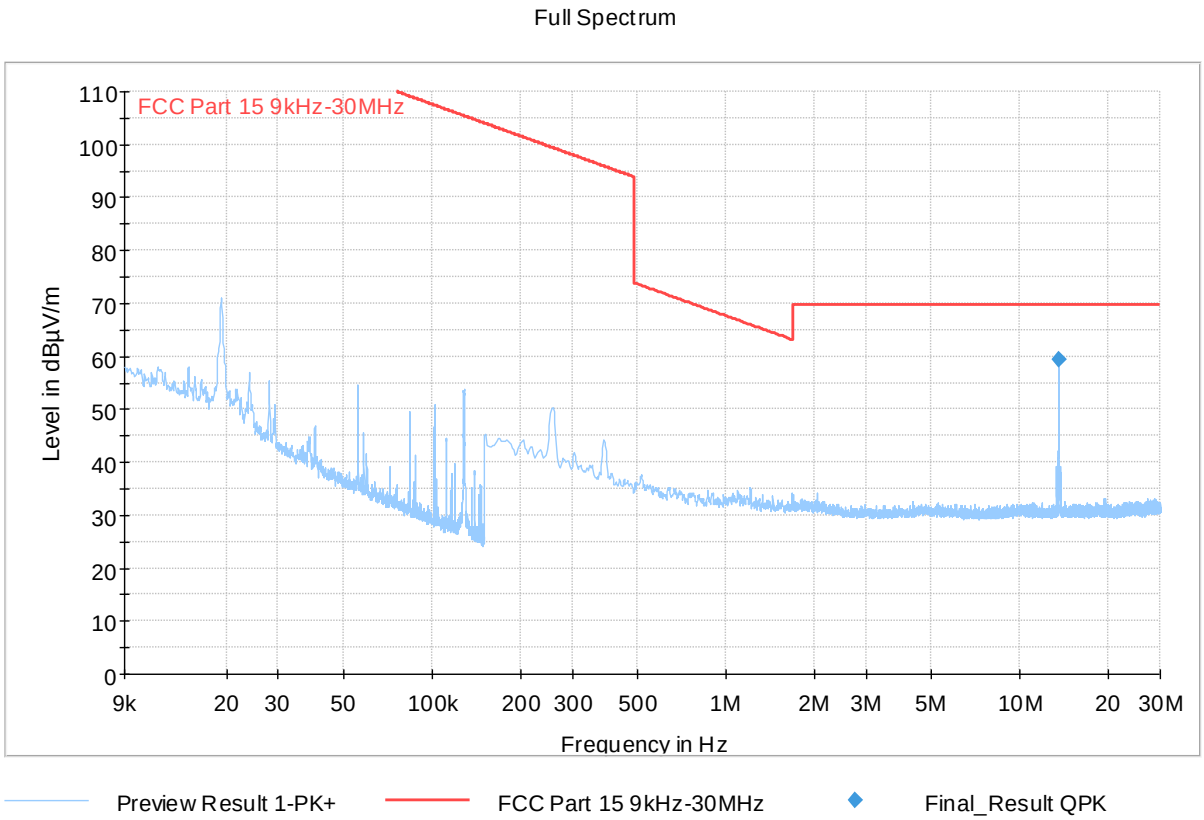
Measurement data of

Frequency (MHz)	QuasiPeak (dBµV/m) @3mt	QuasiPeak (dBµV/m) @30mt	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
13.560000	59.33	19.33	128.0	V	168.0	21.3

Note: fundamental frequency not related to limit

ADDITIONAL DOCUMENTATION

Graphical presentation of: Antenna Z direction - EUT Z position



Measurement data of

Frequency (MHz)	QuasiPeak (dBµV/m) @3mt	QuasiPeak (dBµV/m) @30mt	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
13.560000	59.40	19.40	132.0	V	-7.0	21.3

Note: fundamental frequency not related to limit

ADDITIONAL DOCUMENTATION

RANGE 30-1000 MHz

Test parameter of

EMI Auto Test Template: Emi rad 30-1000MHz HL562E 3metri

Hardware Setup:	Emissione irradiata 30-1000MHz HL562E 3metri
Measurement Type:	Open-Area-Test-Site (SAC/FAR)
Frequency Range:	30 MHz - 1 GHz
Graphics Level Range:	0 dBµV/m - 80 dBµV/m

Preview Measurements:

Antenna height:	100 - 400 cm , Step Size = 100 cm , Positioning Speed = 4
Polarization:	H + V
Turntable position:	0 - 270 deg , Step Size = 90 deg , Positioning Speed = 5
Scan Test Template:	Emissione irradiata 30-1000MHz HL562E 3metri

Adjustment:

Antenna height:	Range = 25 cm , Measuring Speed = 3
Turntable position:	Range = 30 deg , Measuring Speed = 3
Template for Single Meas.:	Emissione irradiata 30-1000MHz HL562E 3metri - fin QP

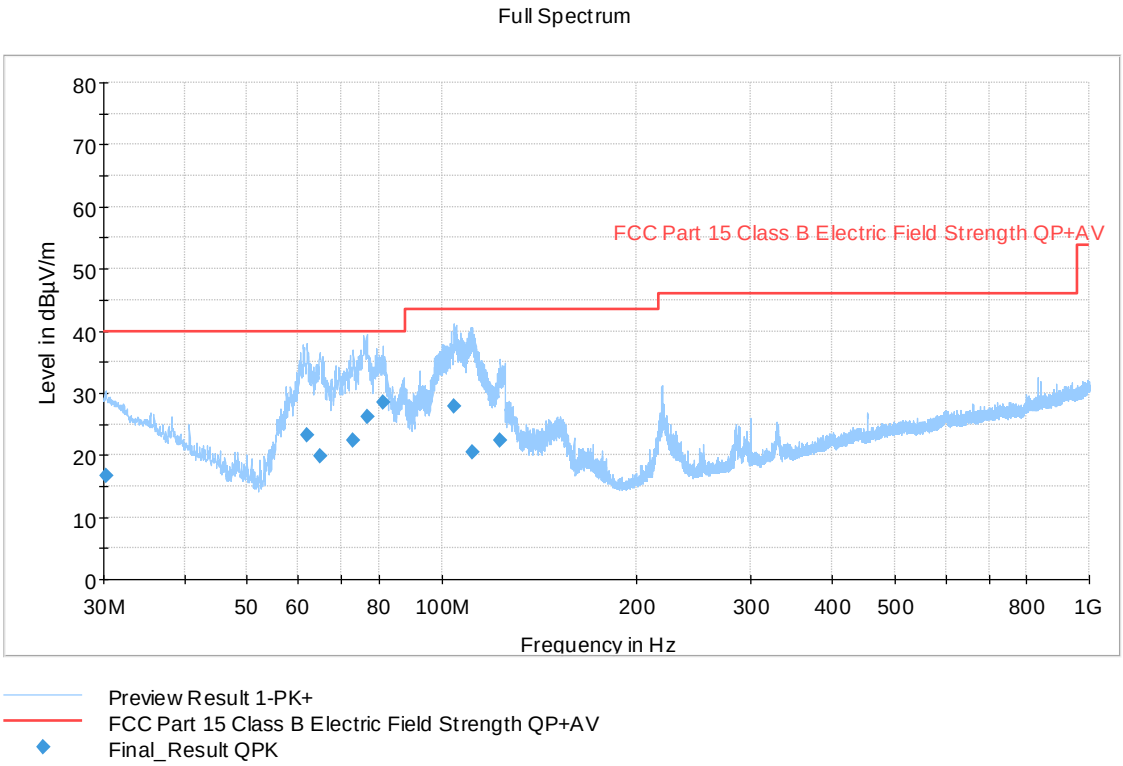
Final Measurements:

Template for Single Meas.:	Emissione irradiata 30-1000MHz HL562E 3metri - fin QP

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
Receiver: [ESW 44]					
30 MHz - 1 GHz	30 kHz	QPK	120 kHz	1 s	20 dB

ADDITIONAL DOCUMENTATION

Graphical presentation of: EUT X position



Measurement data of

Final_Result

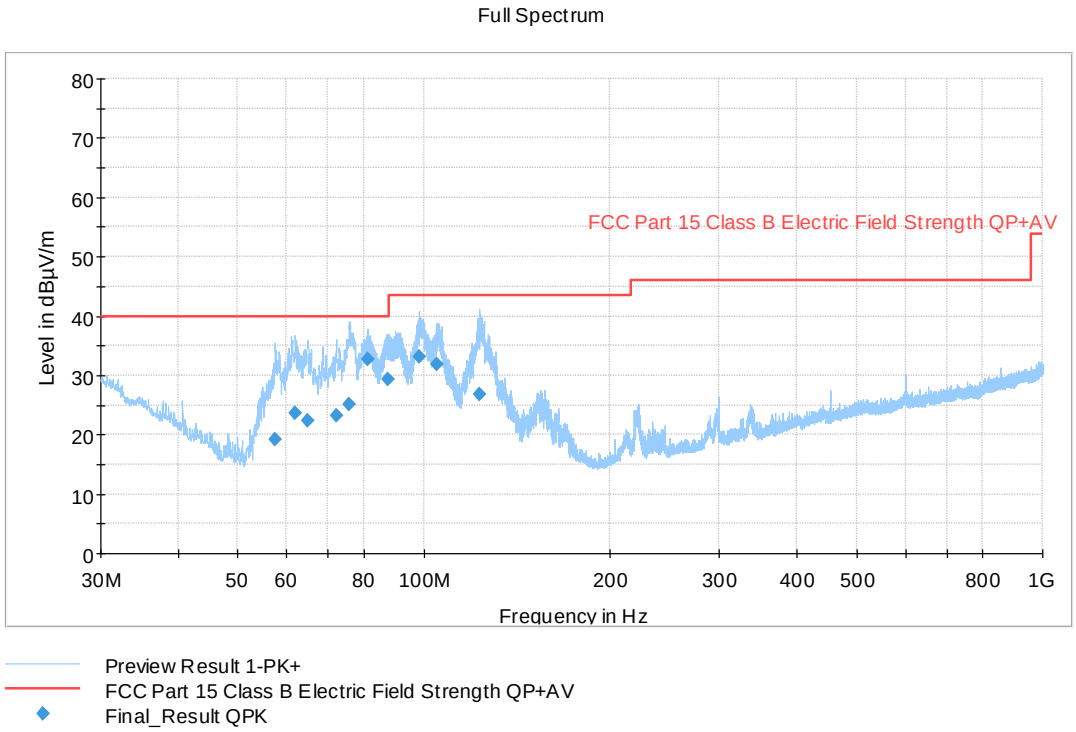
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.240000	16.78	40.00	23.22	1000.0	120.000	100.0	V	105.0	22.6
61.920000	23.28	40.00	16.72	1000.0	120.000	103.0	V	185.0	9.7
64.710000	19.93	40.00	20.07	1000.0	120.000	106.0	V	193.0	10.5
72.960000	22.36	40.00	17.64	1000.0	120.000	104.0	V	193.0	12.4
76.530000	26.14	40.00	13.86	1000.0	120.000	100.0	V	165.0	12.8
81.210000	28.45	40.00	11.55	1000.0	120.000	103.0	V	103.0	13.3
104.220000	27.82	43.50	15.68	1000.0	120.000	103.0	V	103.0	14.0
111.510000	20.52	43.50	22.98	1000.0	120.000	100.0	V	258.0	14.4
123.090000	22.47	43.50	21.03	1000.0	120.000	107.0	V	78.0	14.7

Remarks:

Margin value = Measurement value – Limit value

ADDITIONAL DOCUMENTATION

Graphical presentation of: EUT Y position



Measurement data of

Final_Result

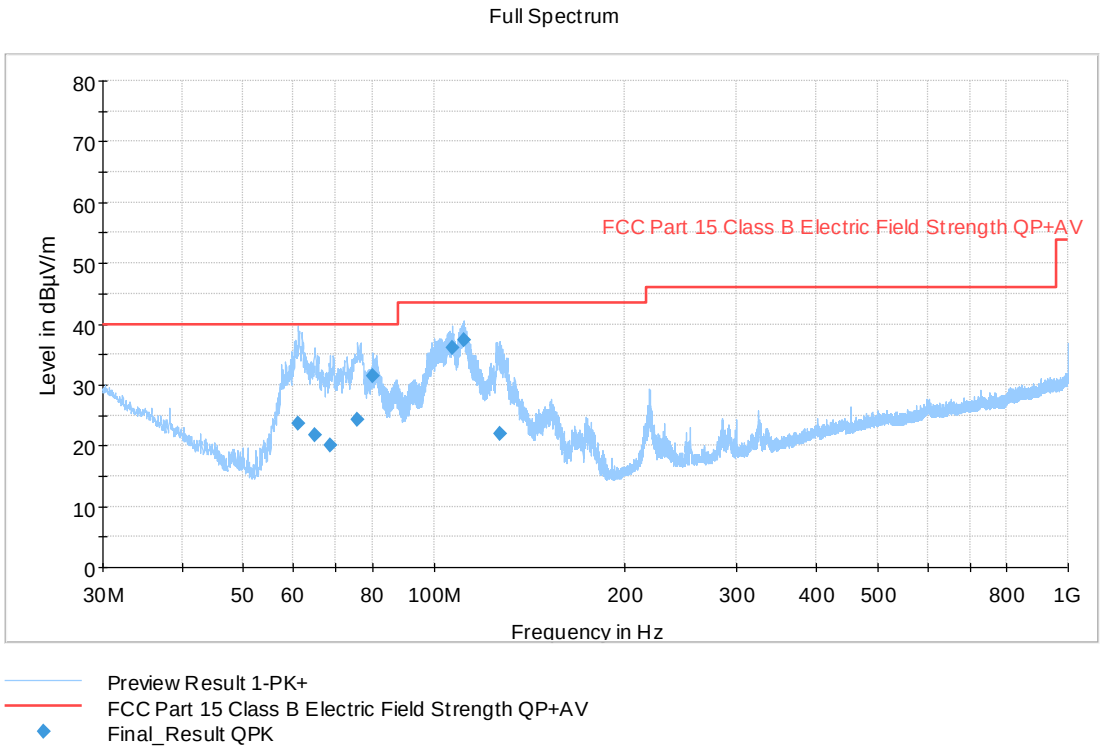
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
57.480000	19.19	40.00	20.81	1000.0	120.000	291.0	V	255.0	8.4
61.950000	23.72	40.00	16.28	1000.0	120.000	103.0	V	105.0	9.8
64.920000	22.30	40.00	17.70	1000.0	120.000	105.0	V	78.0	10.6
72.090000	23.13	40.00	16.87	1000.0	120.000	103.0	V	75.0	12.2
75.780000	25.01	40.00	14.99	1000.0	120.000	106.0	V	75.0	12.7
81.240000	32.66	40.00	7.34	1000.0	120.000	103.0	V	285.0	13.3
87.210000	29.34	40.00	10.66	1000.0	120.000	103.0	V	255.0	13.6
98.400000	33.08	43.50	10.42	1000.0	120.000	100.0	V	-15.0	13.9
105.060000	31.88	43.50	11.62	1000.0	120.000	100.0	V	193.0	14.0
123.120000	26.86	43.50	16.64	1000.0	120.000	103.0	V	15.0	14.7

Remarks:

Margin value = Measurement value – Limit value

ADDITIONAL DOCUMENTATION

Graphical presentation of: EUT Z position



Measurement data of

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
61.080000	23.54	40.00	16.46	1000.0	120.000	188.0	V	266.0	9.5
64.920000	21.65	40.00	18.35	1000.0	120.000	191.0	V	285.0	10.6
68.520000	20.00	40.00	20.00	1000.0	120.000	188.0	V	275.0	11.5
75.750000	24.23	40.00	15.77	1000.0	120.000	188.0	V	258.0	12.7
80.040000	31.35	40.00	8.65	1000.0	120.000	100.0	V	75.0	13.2
106.710000	36.02	43.50	7.48	1000.0	120.000	100.0	V	193.0	14.1
111.480000	37.36	43.50	6.14	1000.0	120.000	100.0	V	285.0	14.4
126.780000	21.99	43.50	21.51	1000.0	120.000	100.0	V	13.0	14.1

Remarks:

Margin value = Measurement value – Limit value

ADDITIONAL DOCUMENTATION

Radiated emission test - Field strength inside of the 13,110-14,010 MHz band	
Test date	06/10/2023
Applied Standard	FCC part 15 C
Paragraph	§15.225(a); §15.225(b); §15.225(c)
Temperature	21.5° C
Humidity	46%
Voltage/Frequency used during the test	+5V dc (from auxilary board)
Tested by	Roberto Radice
Model	RFID Board TMOD
Internal Storage No.	A003574365-001
Operating mode	1
Tested terminals	Enclosure
Remarks	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

ADDITIONAL DOCUMENTATION

Extrapolation from the measurement of a single point

If field strength is measured at only a single point, then that point shall be at the radial from the EUT that produces the maximum emission at the frequency being measured, as described in 5.4. If that point is closer to the EUT than λ/2π and the limit distance is greater than λ/2π, the measurement shall be extrapolated to the limit distance by conservatively presuming that the field strength decreases at a 40 dB/decade of distance rate to the λ/2π distance, and at a 20 dB/decade of distance rate beyond λ/2π.
This shall be accomplished using **Equation (A):**

$$FS_{\text{limit}} = FS_{\text{max}} - 40\log\left(\frac{d_{\text{near field}}}{d_{\text{measure}}}\right) - 20\log\left(\frac{d_{\text{limit}}}{d_{\text{near field}}}\right)$$

where
FSlimit is the calculation of field strength at the limit distance, expressed in dBμV/m
FSmax is the measured field strength, expressed in dBμV/m
dnear field is the λ/2π distance
dmeasure is the distance of the measurement point from the EUT
dlimit is the reference limit distance
If the single point measured is at a distance greater than λ/2π, then extrapolation to the limit distance shall be calculated using Equation (B):

$$FS_{\text{limit}} = FS_{\text{max}} - 20\log\left(\frac{d_{\text{limit}}}{d_{\text{measure}}}\right)$$

If both the single point and the limit distance are equal to or closer to the EUT than λ/2π, then extrapolation to the limit distance shall be calculated using Equation (C):

$$FS_{\text{limit}} = FS_{\text{max}} - 40\log\left(\frac{d_{\text{limit}}}{d_{\text{measure}}}\right)$$

where
FSlimit is the calculation of field strength at the limit distance, expressed in dBμV/m
FSmax is the measured field strength, expressed in dBμV/m
dnear field is the λ/2π distance
dmeasure is the distance of the measurement point from the EUT
dlimit is the reference distance or the distance of the λ/2π point

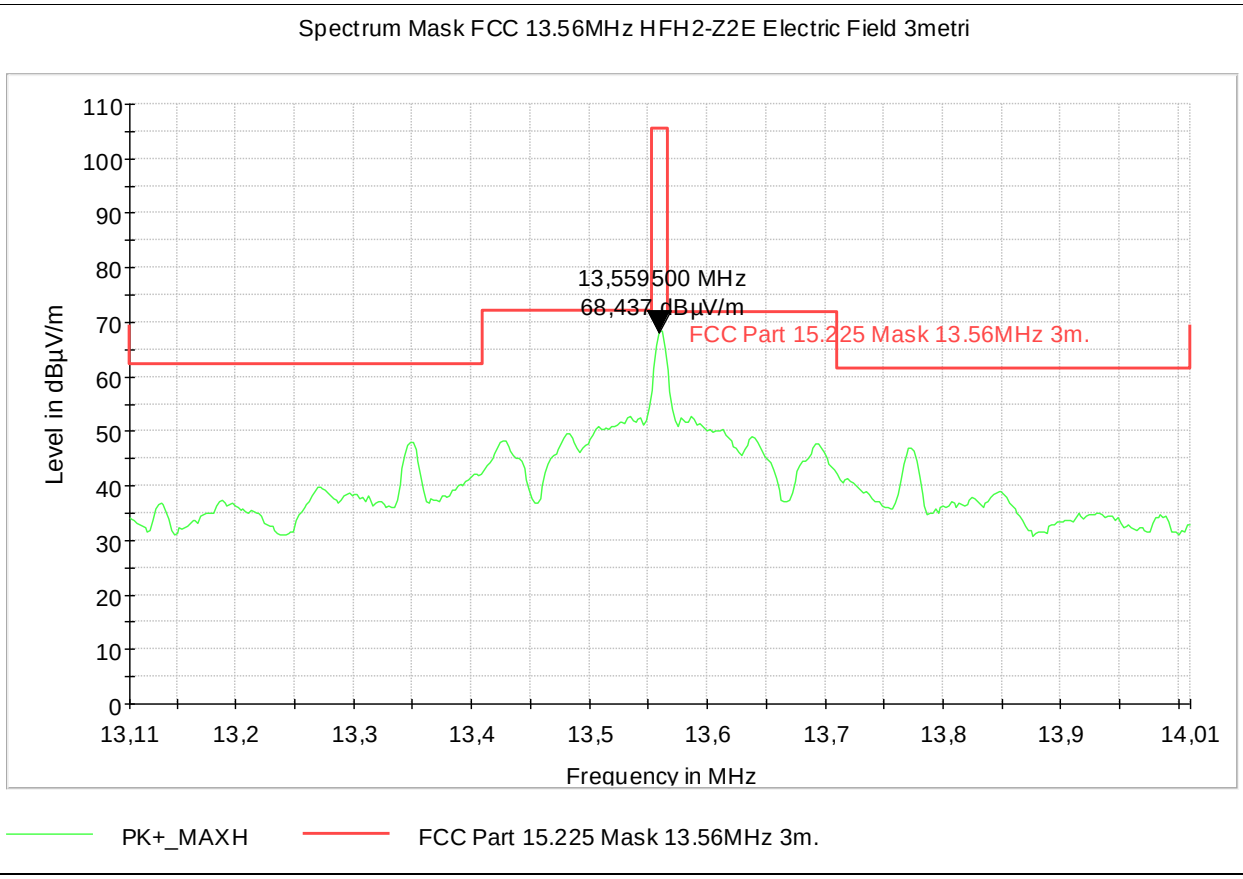
ADDITIONAL DOCUMENTATION

New limit (according to equation A)						
f (MHz)	Fs limit (uV/m)	Fs limit (dBuV/m)	d(near field) (m)	d(measure) (m)	d(limit) (m)	FS (max) (dBuV/m)
13,11	106	40,51	3,64	3	30	62,2
13,41	334	50,47	3,56	3	30	72,0
13,41	334	50,47	3,56	3	30	72,0
13,553	15848	84,00	3,52	3	30	105,4
13,567	15848	84,00	3,52	3	30	105,4
13,71	334	50,47	3,48	3	30	71,8
13,71	334	50,47	3,48	3	30	71,8
14,01	106	40,51	3,41	3	30	61,6

ADDITIONAL DOCUMENTATION

Graphical presentation of: Antenna X direction - EUT Y position (worst case)

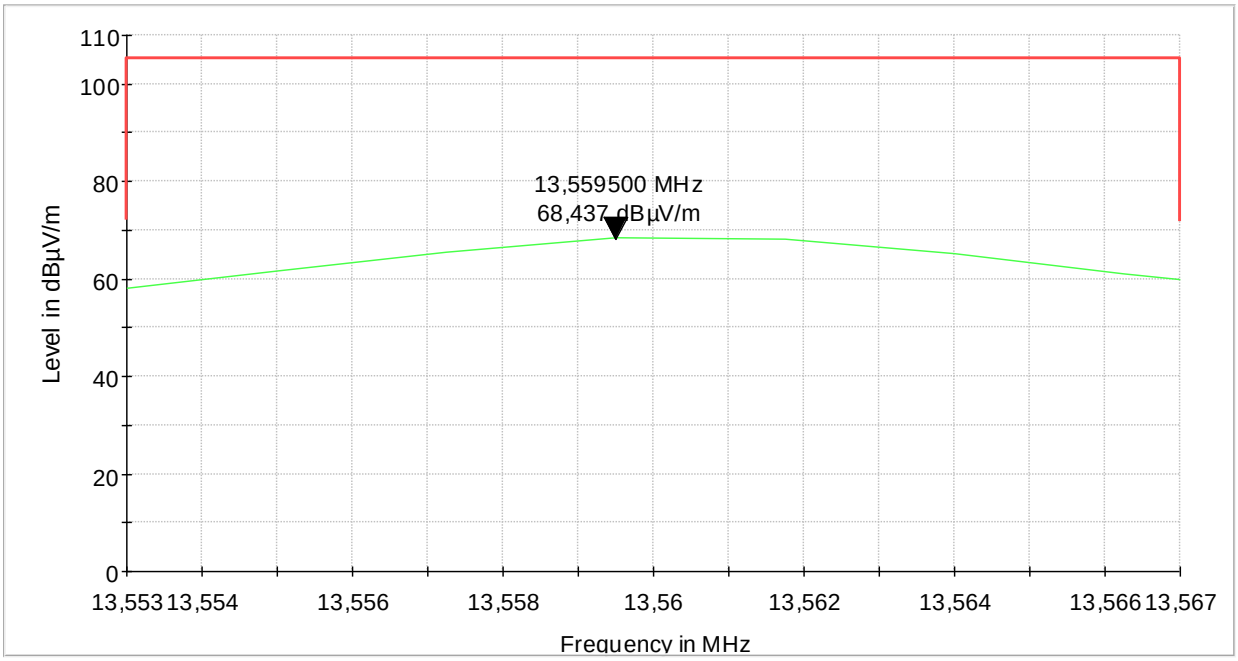
Frequency: 13.110-14.010 MHz



ADDITIONAL DOCUMENTATION

Graphical presentation of: Antenna X direction - EUT Y position (worst case)

Frequency: 13.553-13.567 MHz



Measurement data of

Frequency (MHz)	PositivePeak (dBµV/m) @3mt	PositivePeak (dBµV/m) @30mt
13.560000	68.44	28.44

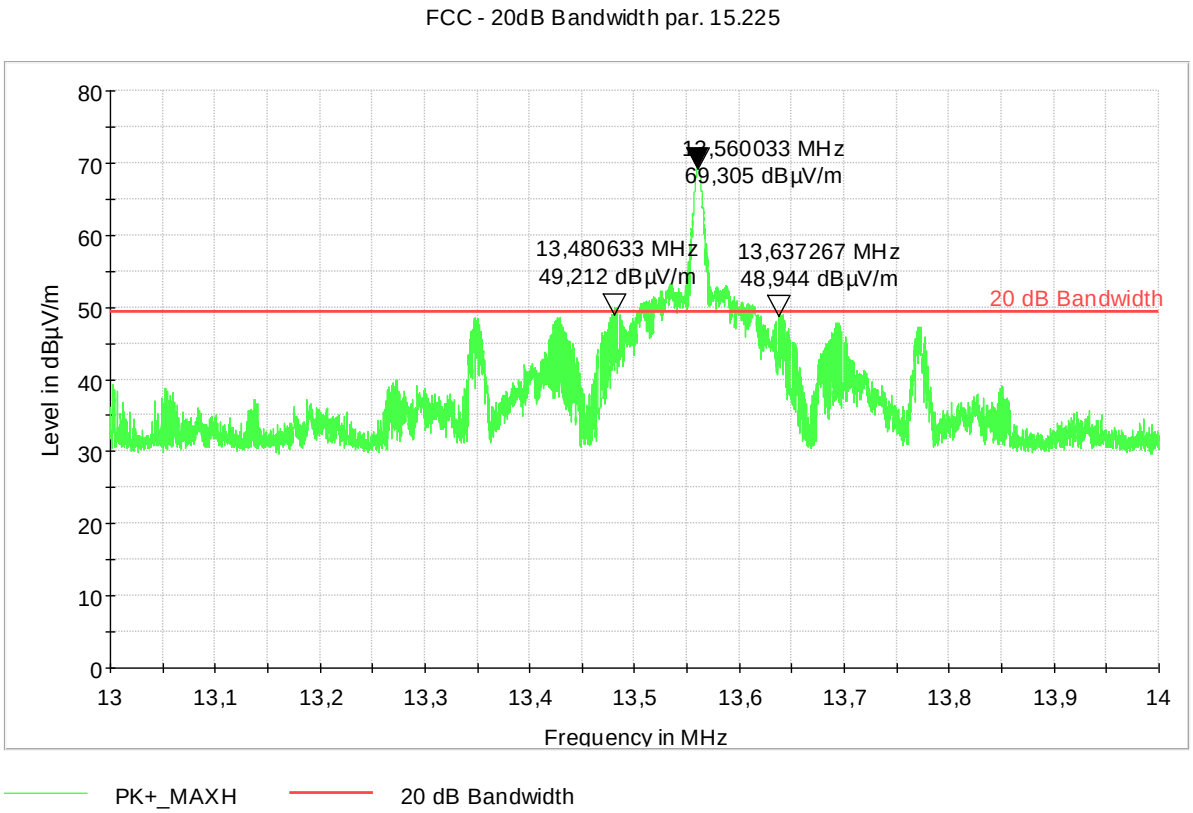
Note: fundamental frequency not related to limit

ADDITIONAL DOCUMENTATION

20dB Bandwidth	
Test date	06/10/2023
Applied Standard	FCC part 15 C
Paragraph	§15.215(c)
Temperature	21.5° C
Humidity	46%
Voltage/Frequency used during the test	+5V dc (from auxilary board)
Tested by	Roberto Radice
Model	RFID Board TMOD
Internal Storage No.	A003574365-001
Operating mode	1
Tested terminals	Enclosure
Remarks	None
Note: Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.	

ADDITIONAL DOCUMENTATION

Graphical presentation of **20dB Bandwidth**

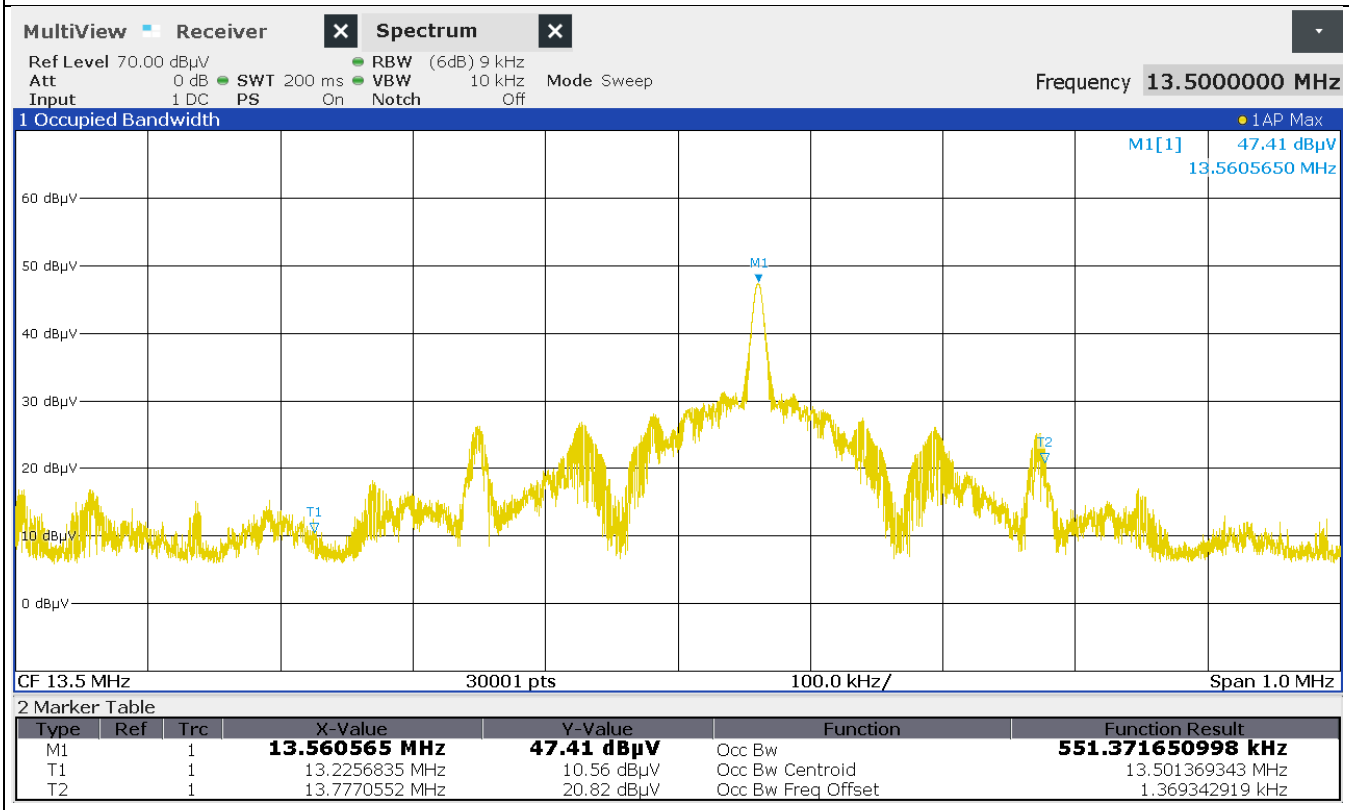


Channel (No.)	Frequency (MHz)	Channel Bandwidth at -20dB (kHz)	Plot (No.)
1	13.560033	156.634	1

Bandwidth at -20dB (Fmin and Fmax)			
Fmin	13.480633 MHz	Fmax	13.637267 MHz

ADDITIONAL DOCUMENTATION

Graphical presentation of **99% Bandwidth**



Channel (No.)	Frequency (MHz)	Channel Bandwidth at 99% (kHz)	Plot (No.)
1	13.560565	551.371	1

Bandwidth at 99% (Fmin and Fmax)			
Fmin	13.225683 MHz	Fmax	13.777055 MHz

ADDITIONAL DOCUMENTATION

Frequency tolerance of the carrier signal	
Test date	09/10/2023
Applied Standard	FCC part 15 C
Paragraph	§15.225(e)
Temperature	20.5° C
Humidity	40%
Tested by	Francesco Lombardi
Model	RFID Board TMOD
Internal Storage No.	A003574365-001
Operating mode	1
Tested terminals	Enclosure
Remarks	None
Note: the frequency tolerance of the carrier signal shall be maintained within +0.01% of the operating frequency over a temperature variation of -20 degrees to + 50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.	

ADDITIONAL DOCUMENTATION

Frequency stability

Temperature (°C)	Voltage (Vdc)	Measured Frequency (MHz)	Frequency Delta (ppm)
25	5	13.559358	0
25	4.25	13.559358	0
25	5.75	13.559358	0

Temperature (°C)	Voltage (Vdc)	Measured Frequency (MHz)	Frequency Delta (ppm)
-20	5	13.559358	0
-10	5	13.559358	0
0	5	13.559358	0
+10	5	13.559358	0
+20	5	13.559358	0
+30	5	13.559358	0
+40	5	13.559358	0
+50	5	13.559358	0

ADDITIONAL DOCUMENTATION

Additional provisions to the general radiated emission limitations.	
Test date	06/10/2023
Applied Standard	FCC part 15 C
Paragraph	§15.215 (a) (b) (c)
Temperature	21.5° C
Humidity	46%
Tested by	Roberto Radice
Model	RFID Board TMOD
Internal Storage No.	A003574365-001
Operating mode	1
Tested terminals	Enclosure
Remarks	None

ADDITIONAL DOCUMENTATION

(A) The regulations in §§ 15.217-15.257 provide alternatives to the general radiated emission limits for intentional radiators operating in specified frequency bands. Unless otherwise stated, there are no restrictions as to the types of operation permitted under these sections.	
(B) In most cases, unwanted emissions outside of the frequency bands shown in these alternative provisions must be attenuated to the emission limits shown in Section 15.209. In no case shall the level of the unwanted emissions from an intentional radiator operating under these additional provisions exceed the field strength of the fundamental emission.	VERDICT P
(C) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least	VERDICT P

ADDITIONAL DOCUMENTATION

17. List of test equipment

Equipment	Type	Inventory no.	Manufacturer	Calibration due date
Test stand: Radiated emission test - Field strength outside of the 13,110-14,010 MHz band				
Semi-anechoic Chamber	SAC5	9020567	Albatross project	12/2024
Active Loop Antenna and power supply	HFH2-Z2E+IN 600	9015215	Rohde&Schwarz	06/2026
Ultralog antenna	HL562E	9020497	Rohde&Schwarz	02/2026
EMI Receiver	ESW44	9019591	Rohde&Schwarz	05/2024
Power Supply	NGP814	9020303	Rohde&Schwarz	---
Software EMC32	11.40.00	---	Rohde&Schwarz	---
Test stand: Radiated emission test - Field strength inside of the 13,110-14,010 MHz band				
Semi-anechoic Chamber	SAC5	9020567	Albatross project	12/2024
Active Loop Antenna and power supply	HFH2-Z2E+IN 600	9015215	Rohde&Schwarz	06/2026
EMI Receiver	ESW44	9019591	Rohde&Schwarz	05/2024
Power Supply	NGP814	9020303	Rohde&Schwarz	---
Software EMC32	11.40.00	---	Rohde&Schwarz	---

ADDITIONAL DOCUMENTATION

Equipment	Type	Inventory no.	Manufacturer	Calibration due date
Test stand: 20dB Bandwidth				
Semi-anechoic Chamber	SAC5	9020567	Albatross project	12/2024
Active Loop Antenna and power supply	HFH2-Z2E+IN 600	9015215	Rohde&Schwarz	06/2026
EMI Receiver	ESW44	9019591	Rohde&Schwarz	05/2024
Power Supply	NGP814	9020303	Rohde&Schwarz	---
Software EMC32	11.40.00	---	Rohde&Schwarz	---
Test stand: Frequency tolerance of the carrier signal				
Climatic Chamber	CTS C-40/350	2789468	CTS	07/2024
Active Loop Antenna and power supply	HFH2-Z2E+IN 600	9015215	Rohde&Schwarz	06/2026
EMI Receiver	ESR 3	2782768	Rohde&Schwarz	05/2024
Power Supply	NGP814	9020303	Rohde&Schwarz	---
Test stand: Conducted emission				
EMI Receiver	ESW44	9019591	Rohde&Schwarz	05/2024
Single-phase LISN 16A	ENV216	2782895	Rohde&Schwarz	06/2024
Three-Phases Power Supply	TPS T 30K60S	2782385	Elettrotest	10/2024
Software EMC32	11.40.00	---	Rohde&Schwarz	---

ADDITIONAL DOCUMENTATION

PHOTOGRAPHIC DOCUMENTATION	
See the Annex below:	
IT23WS91 001 Annex 1	Photo of board
IT23WS91 001 Annex 2	Test Set-up photos

SAR EVALUATION	
See the Annex below:	
IT23WS91 001 Annex 3	SAR Evaluation

---END OF TEST REPORT---