DEKRA Testing and Certification, S.A.U.
Parque Tecnológico de Andalucía,
c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España
C.I.F. A29 507 456

Test report No:
NIE: 61376RRF.002

Test report
USA FCC Part 15.225, 15.209
CANADA RSS-210, RSS-Gen

(*) Identification of item tested	Material manager machine
(*) Trademark	Ultimaker
(*) Model and /or type reference	Material Station
Other identification of the product	FCC ID: 2AL8MMISP IC: 23486-MISP
(*) Features	Not provided data Hardware Version: B Software Version: 90699630852b04273ebf985d6f2efc7b156e2901
Applicant	ULTIMAKER BV Stationsplein 32 3511 ED Utrecht, NEDERLAND
Test method requested, standard	USA FCC Part 15.225 (10–1–18 Edition): Operation within the band 13.110 -14.010. USA FCC Part 15.209 (10–1–18 Edition): Radiated emission limits, general requirements. CANADA RSS-210 Issue 9 (August 2016). CANADA RSS-Gen Issue 5 (April 2018). ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager 2022.10.24 17:03:57 +02'00'
Date of issue	2022-10-06
Report template No	FDT08_22 (*) "Data provided by the client"

Index

Competences and guarantees

DEKRA Testing and Certification is a testing laboratory accredited by the National Accreditation Body (ENAC - Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

DEKRA Testing and Certification is a FCC-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

DEKRA Testing and Certification is an ISED-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Testing and Certification at the time of performance of the test.

DEKRA Testing and Certification is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA Testing and Certification.

General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification S.A.U.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification S.A.U. and the Accreditation Bodies.

Uncertainty

Uncertainty (factor k=2) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").

2. The sample consists of a Material Station, also referred to internally as the ‘MISP’, is a peripheral/supporting device to be included within the Ultimaker “Office Generation” product portfolio and will be utilized to store multiple spools of material and will facilitate automatic loading of the material to the attached printer

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: The client.

- Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Reception
61376/002	Material manager machine	Material Station	---	2019/06/03

Sample S/01 has undergone the following test(s): All tests indicated in appendix A.

Test sample description

Ports..... :	Port name and description	Cable						
		Specified max length [m]	Attached during test	Shielded	Coupled to patient(3)			
	RS422 to S5 printer	0.2	☐	☐	☒			
	RS422 to Air manager	0.5	☐	☐	☒			
Supplementary information to the ports..... :	Communication bus (RS422) is only used sporadically to pass information such as spools and humidity to the printer.							
Rated power supply .....:	Voltage and Frequency		Reference poles					
			L1	L2	L3	N	PE	
	☒	AC: 115V input	☒	☐	☐	☒	☒	
	☐	DC: 24V (internal power)						
Rated Power .....:	100W							
Clock frequencies .....:	8MHz for CPU clock 13.56MHz for NFC 115200baud for communication bus 1MHz for internal DC/DC converter							
Other parameters.....:	---							
Software version .....:	90699630852b04273ebf985d6f2efc7b156e2901							
Hardware version.....:	B							
Dimensions in cm (W x H x D)....:								

Mounting position.....:	☒	Table top equipment		
	☐	Wall/Ceiling mounted equipment		
	☐	Floor standing equipment		
	☐	Hand-held equipment		
	☐	Other:		
Modules/parts .....:	Module/parts of test item		Type	Manufacturer
	N/A			
Accessories (not part of the test item).....:	Description		Type	Manufacturer
	N/A			
Documents as provided by the applicant.....:	Description		File name	Issue date
	N/A			

Identification of the client

ULTIMAKER BV
Stationsplein 32
3511 ED Utrecht, NEDERLAND

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2019-08-07
Date (finish)	2019-09-10

Document history

Report number	Date	Description
61376RRF.002	2019-09-12	First release
61376RRF.002A1	2022-10-06	First modification due typos. This report replaces previous versions

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 35 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

Remarks and comments

The tests have been performed by the technical personnel: Miguel Ángel Torres, Jose Gabriel Pendón y Carolina Postigo.

Used instrumentation:

Conducted measurements:

		Last Calibration	Due Calibration
1.	Climatic Chamber DM600 C ACS Angelatoni	2019/01	2020/01
2.	Spectrum Analyzer PSA 3Hz-26.5 GHz AGILENT TECHNOLOGIES E4440A	2017/10	2019/10
3.	Tree-phase Power Source 5kVA 5001IX California Instruments	2018/11	2020/11

Radiated measurements:

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2.	EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7	2018/10	2020/10
3.	Active Loop Antenna 11966A HEWLETT PACKARD	2018/06	2020/06
4.	RF Pre-amplifier 40 dB, 10 MHz - 6 GHz BONN ELEKTRONIK BLNA 0160-01N	2019/02	2020/08
5.	Biconical/Log Antenna 30MHz - 6GHz ETS LINDGREN 3142E	2017/09	2020/09

Testing verdicts

Not applicable:	N/A
Pass:	P
Fail:	F
Not measured:	N/M

Summary

FCC Part 15.225, 15.209 CANADA RSS-210, RSS-Gen		
Requirement – Test case	**Verdict**	**Remark**
15.225 Subclause (a) / RSS-210 Clause B.6 (a). Field strength of emissions within the band 13.553 - 13.567 MHz	P	
15.225 Subclause (b) / RSS-210 Clause B.6 (b). Field strength of emissions within the band 13.410 - 13.553 MHz and 13.567 – 13.710 MHz	P	
15.225 Subclause (c) / RSS-210 Clause B.6 (c). Field strength of emissions within the band 13.110 - 13.410 MHz and 13.710 – 14.010 MHz	P	
15.225 Subclause (d) / RSS-210 Clause B.6 (d). Field strength of emissions outside of the band 13.110 MHz -14.010 MHz	P	
15.225 Subclause (e) / RSS-210 Clause B.6. Frequency tolerance of the carrier signal	P	
Supplementary information and remarks: None.		

Appendix A: Test results.

INDEX

TEST CONDITIONS

POWER SUPPLY (V):

Vn: 115 Vac
Vmin: 97,7 Vac
Vmax: 132,2 Vac

Type of Power Supply: AC voltage from external power supply.

Type of Antenna: Electrical shielded magnetic loop antenna.

TEMPERATURE (ºC):

Tn: +15 to + 35.

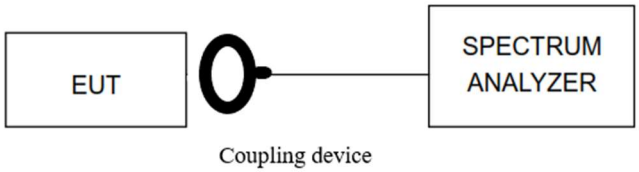
The subscripts 'n', 'min' and 'max' indicate temperature test conditions (normal, minimum and maximum respectively).

TEST FREQUENCY:

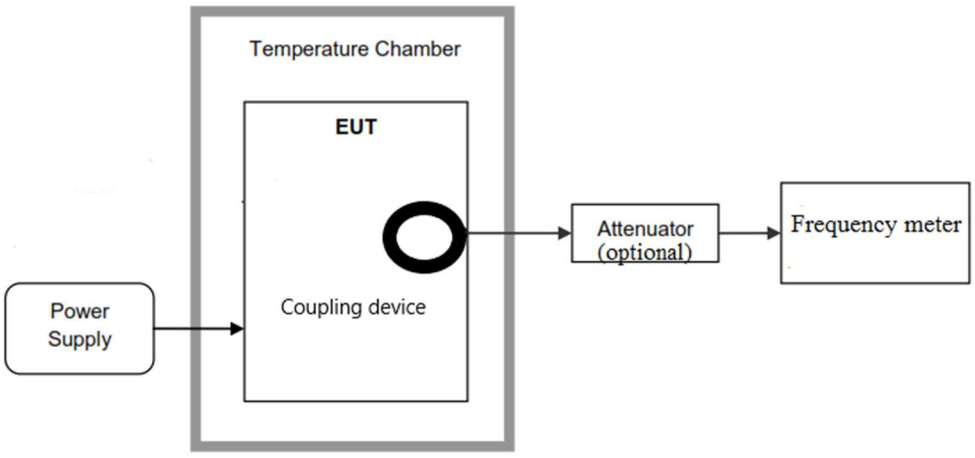
Nominal Operating Frequency: 13.56 MHz

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is directly connected to the spectrum analyzer through a coupling device.



For frequency stability test the EUT was placed inside a climatic chamber and connected to a frequency meter using a low loss cable and a coupling device. An external AC power supply was connected to the EUT for voltage variation test.



RADIATED MEASUREMENTS

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Loop antenna for the range between 9 kHz to 30 MHz and Bilog antenna for the range between 30 MHz to 200 MHz) is situated at a distance of 3 m.

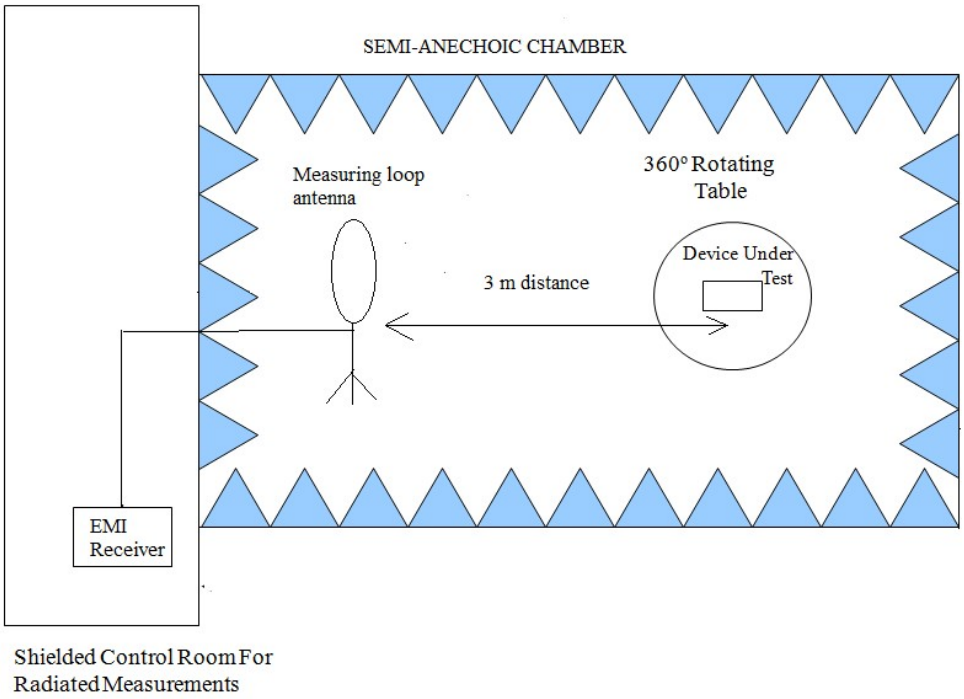
For radiated emissions in the range 9 kHz to 30 MHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 40 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and in the range between 30 MHz and 200 MHz the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

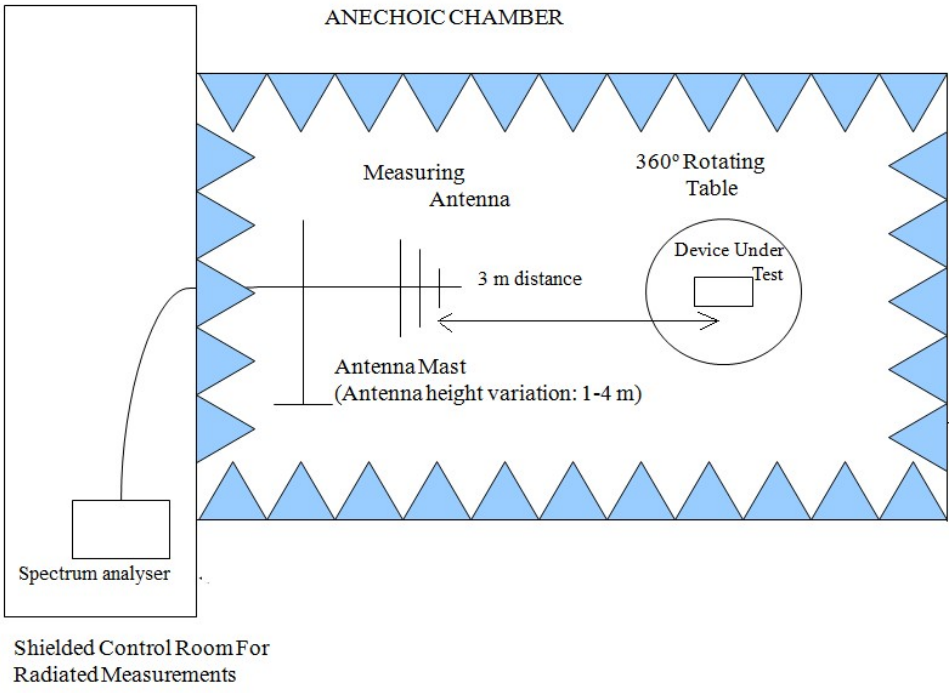
In the range between 9 kHz and 30 MHz the measurements were made in the three different orientation planes of the loop antenna to determine the maximum received field.

In the range between 30 MHz and 200 MHz the measurements were made in both horizontal and vertical planes of polarization.

Radiated measurements setup 9 kHz to 30 MHz.



Radiated measurements setup 30 MHz to 200 MHz.

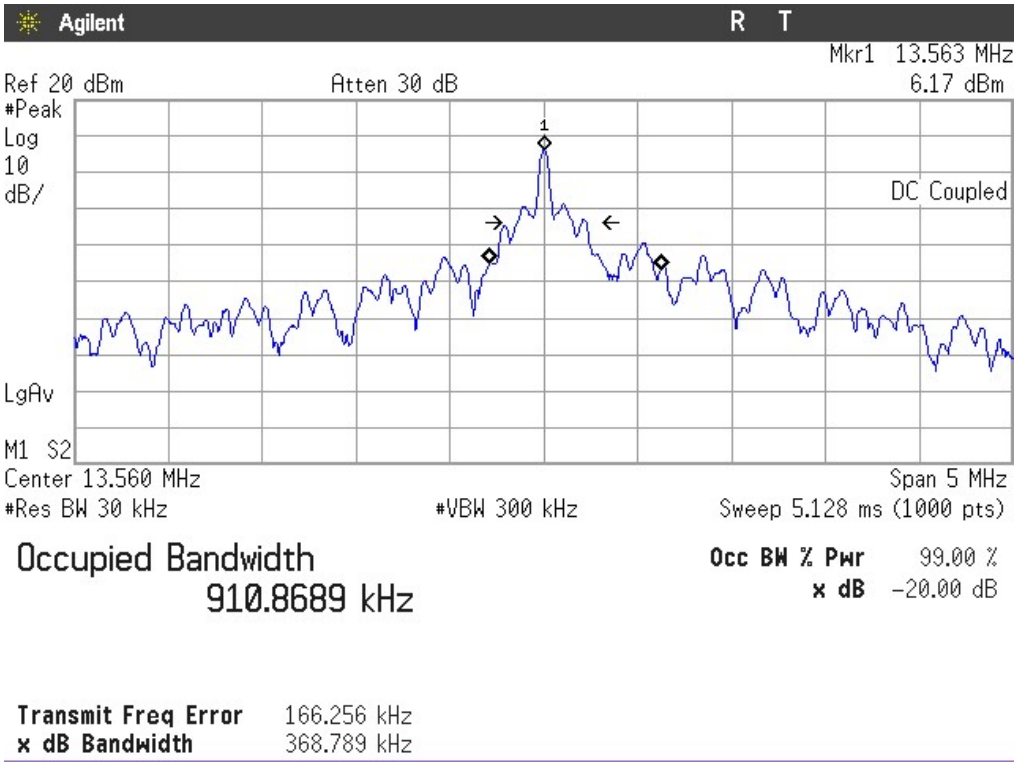


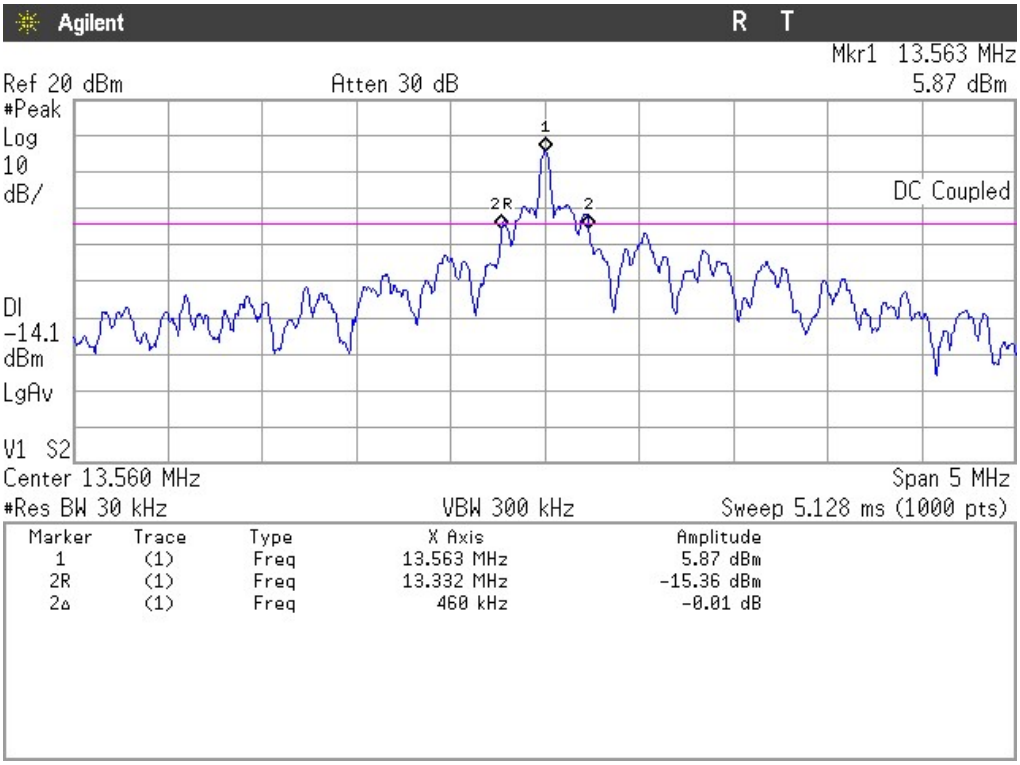
Occupied Bandwidth

RESULTS:

99 % Occupied Bandwidth and 20 dB Bandwidth.

Operation Mode	99% Occupied Bandwidth (kHz)	20 dB Bandwidth (kHz)
NFC	910.87	460.00
Measurement uncertainty (kHz)	<±0.65	





Verdict: PASS

Section 15.225 Subclause (a) / RSS-210 Clause B.6 (a). Field strength of emissions within the band 13.553 -13.567 MHz

SPECIFICATION:

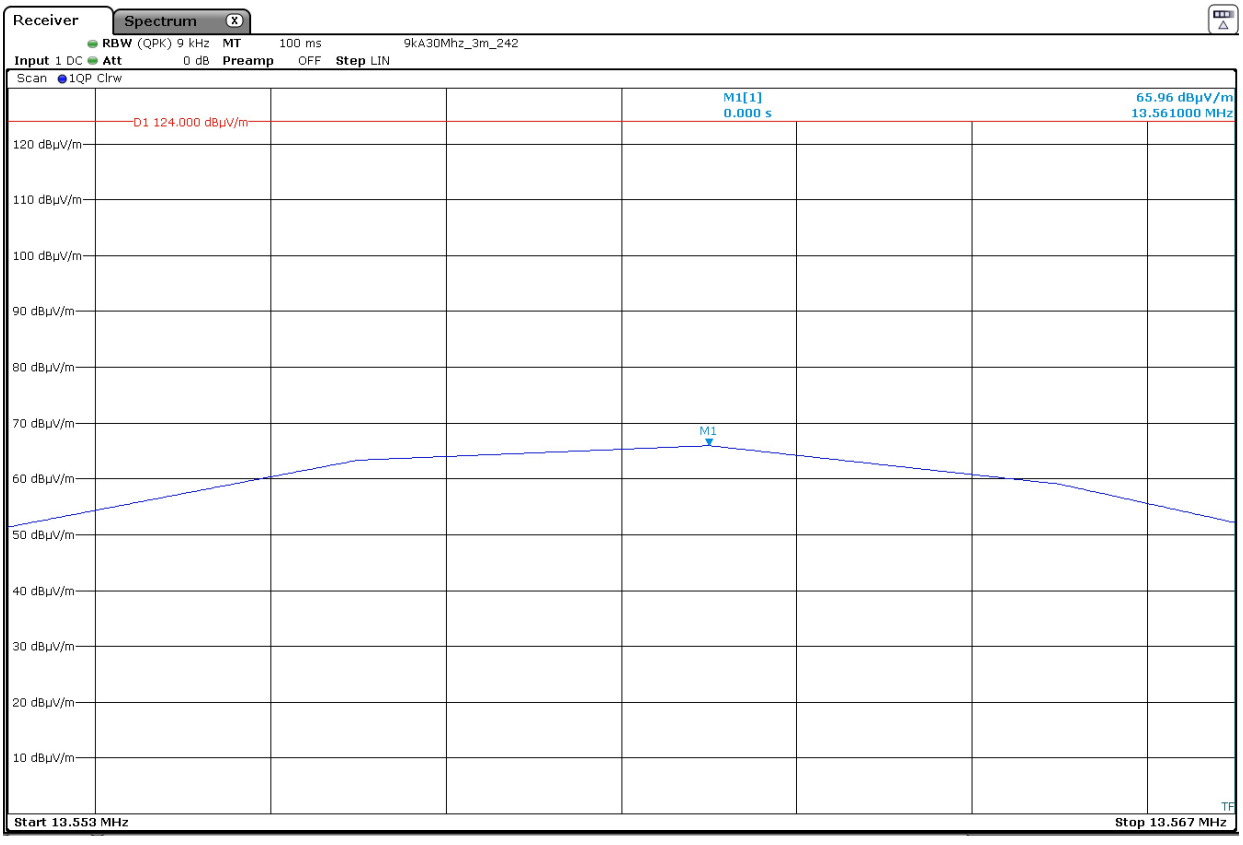
The field strength of any emissions within the band 13.553 – 13.567 MHz shall not exceed 15,848 microvolts/meter (84 dBµV/m) at 30 meters.

RESULTS:

Measurement distance: 3 meters.

The maximum field strength of fundamental emission:

Frequency (MHz)	Maximum field strength (dBµV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBµV/m) extrapolated to 30 m (40 dB/decade)
13.561	65.96	25.96
Measurement uncertainty (dB)	<±3.44	



The limit shown in the above plot is extrapolated to 3 meters

Verdict: PASS

Section 15.225 Subclause (b) / RSS-210 Clause B.6 (b). Field strength of emissions within the band 13.410 - 13.553 MHz and 13.567 - 13.710 MHz

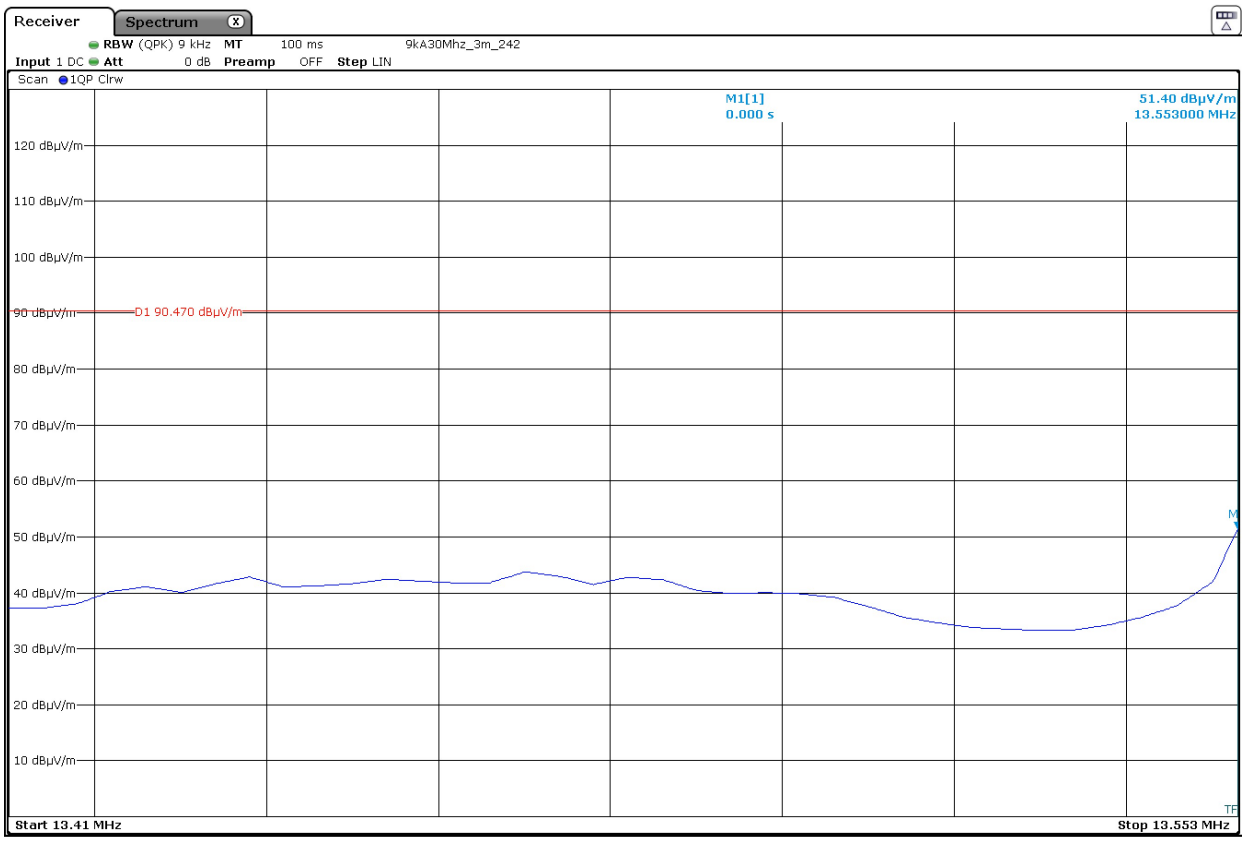
SPECIFICATION:

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 (50.47 dBµV/m) at 30 meters.

RESULTS:

Measurement distance: 3 meters.

Frequency (MHz)	Maximum field strength (dBµV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBµV/m) extrapolated to 30 m (40 dB/decade)
13.553	51.40	11.40
Measurement uncertainty (dB)	<±3.44	

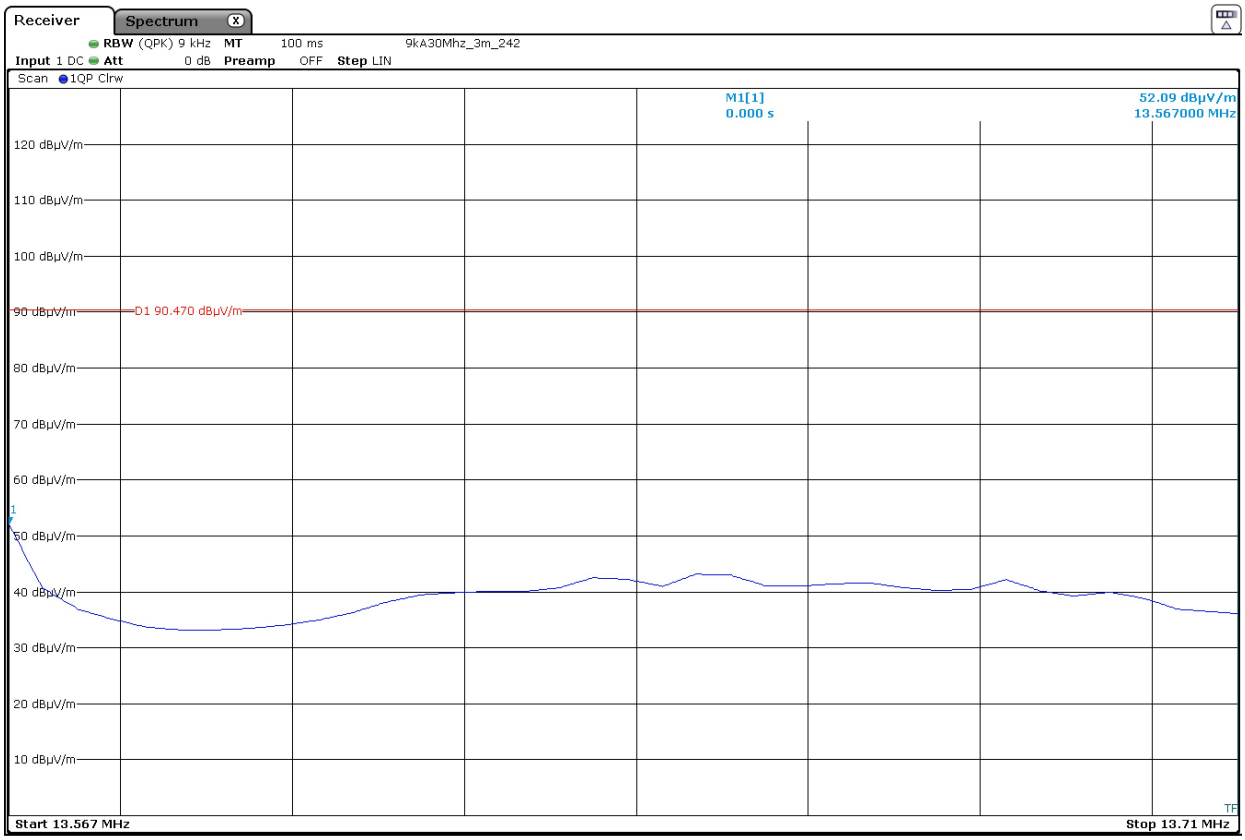


The limit shown in the above plot is extrapolated to 3 meters

Verdict: PASS

- Band 13.567-13.710 MHz

Frequency (MHz)	Maximum field strength (dBµV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBµV/m) extrapolated to 30 m (40 dB/decade)
13.567	52.09	12.09
Measurement uncertainty (dB)	<±3.44	



The limit shown in the above plot is extrapolated to 3 meters

Verdict: PASS

Section 15.225 Subclause (c) / RSS-210 Clause B.6 (c). Field strength of emissions within the band 13.110 - 13.410 MHz and 13.710 - 14.010 MHz

SPECIFICATION:

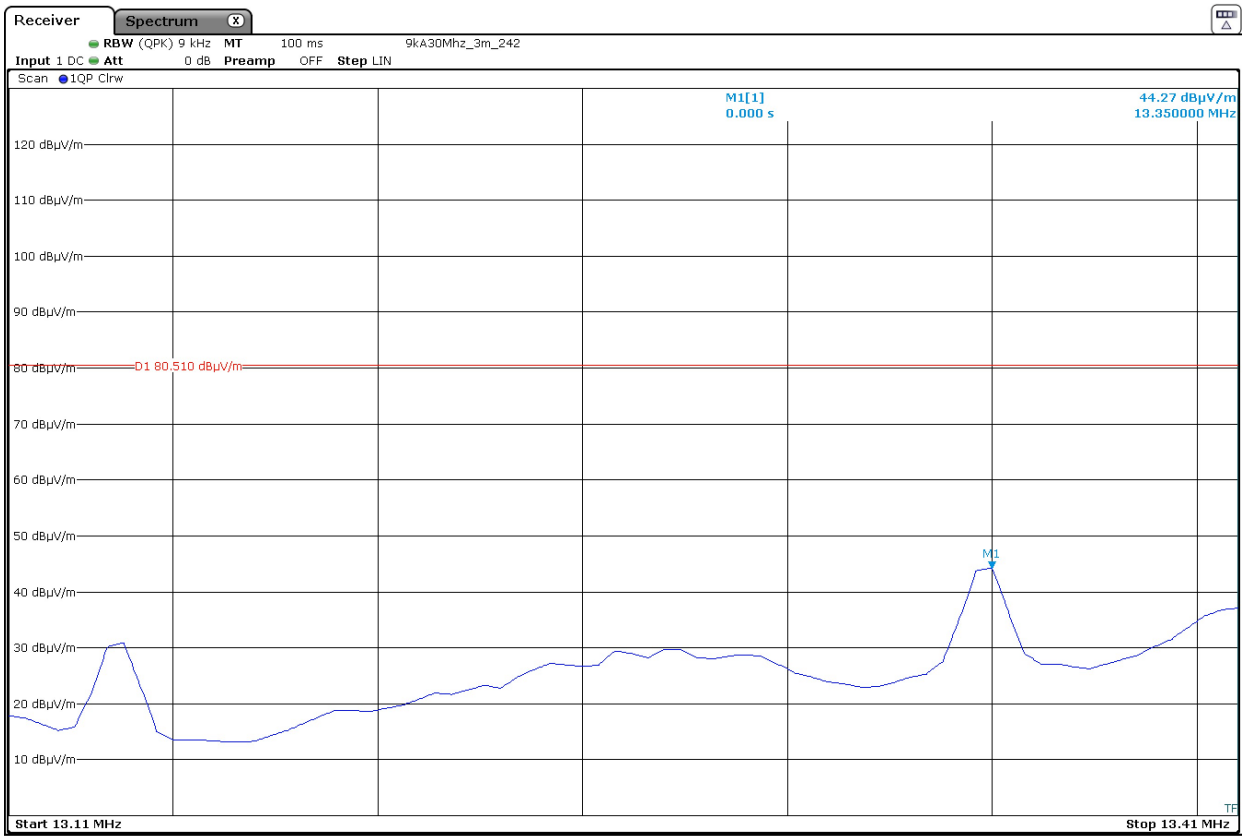
Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz, the field strength of any emissions shall not exceed 106 microvolts/meter (40.51 dBµV/m) at 30 meters.

RESULTS:

Measurement distance: 3 meters.

- Band 13.110-13.410 MHz

Frequency (MHz)	Maximum field strength (dBµV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBµV/m) extrapolated to 30 m (40 dB/decade)
13.350	44.27	4.27
Measurement uncertainty (dB)	<±3.44	

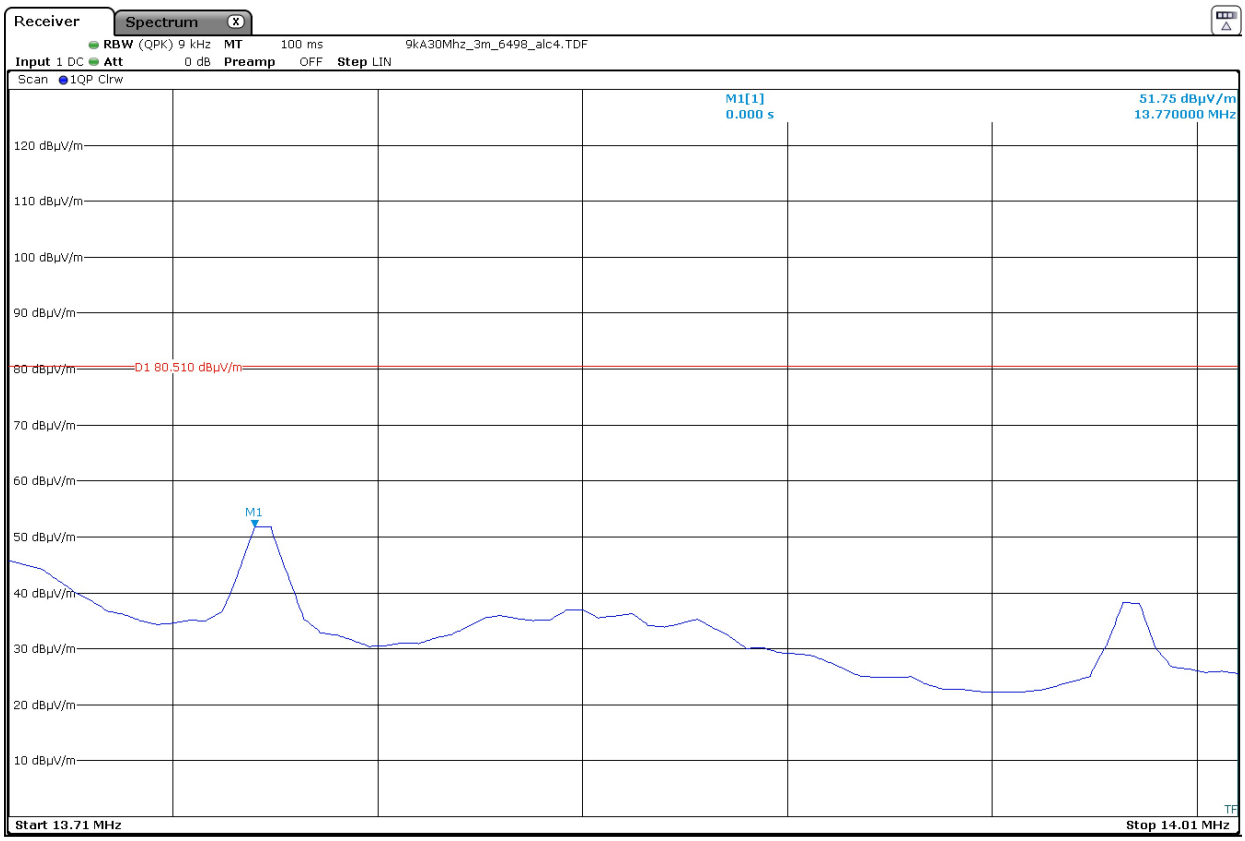


The limit shown in the above plot is extrapolated to 3 meters

Verdict: PASS

- Band 13.710-14.010 MHz

Frequency (MHz)	Maximum field strength (dBµV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBµV/m) extrapolated to 30 m (40 dB/decade)
13.770	51.75	11.75
Measurement uncertainty (dB)	±3.44	



The limit shown in the above plot is extrapolated to 3 meters

Verdict: PASS

Section 15.225 Subclause (d) / RSS-210 Clause B.6 (d). Field strength of emissions outside of the band 13.110 - 14.010 MHz

SPECIFICATION:

Field strength of any emissions appearing outside of the band 13.110 MHz - 14.010 MHz band shall not exceed the general radiated emission limits in 15.209/RSS-Gen:

Frequency Range (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	29.54	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

RESULTS:

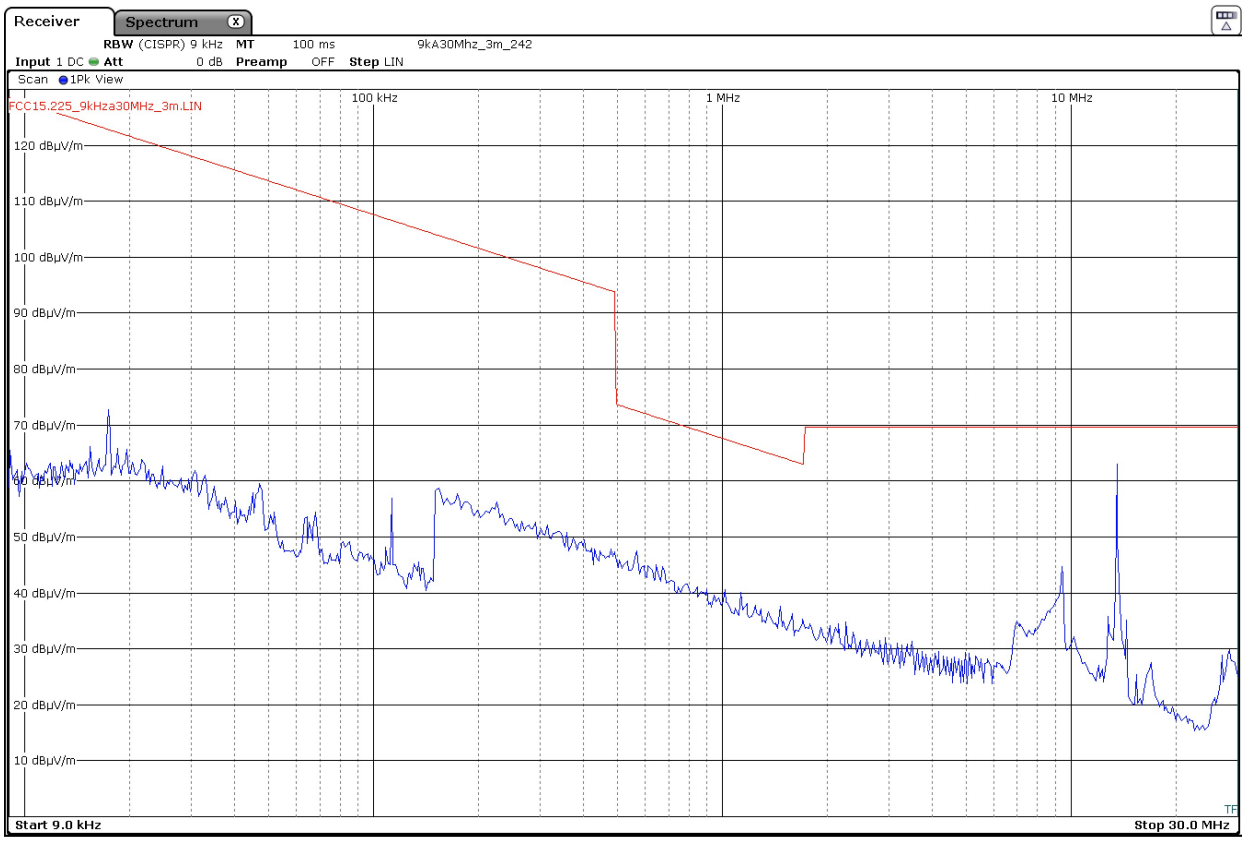
All tests were performed in a semi-anechoic chamber at a distance of 3 m.

The spectrum was inspected from 9 kHz to 200 MHz searching for spurious signals.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifier gain.

- Frequency range 9 kHz - 30 MHz:

No spurious frequencies were found at less than 20 dB of the limit.

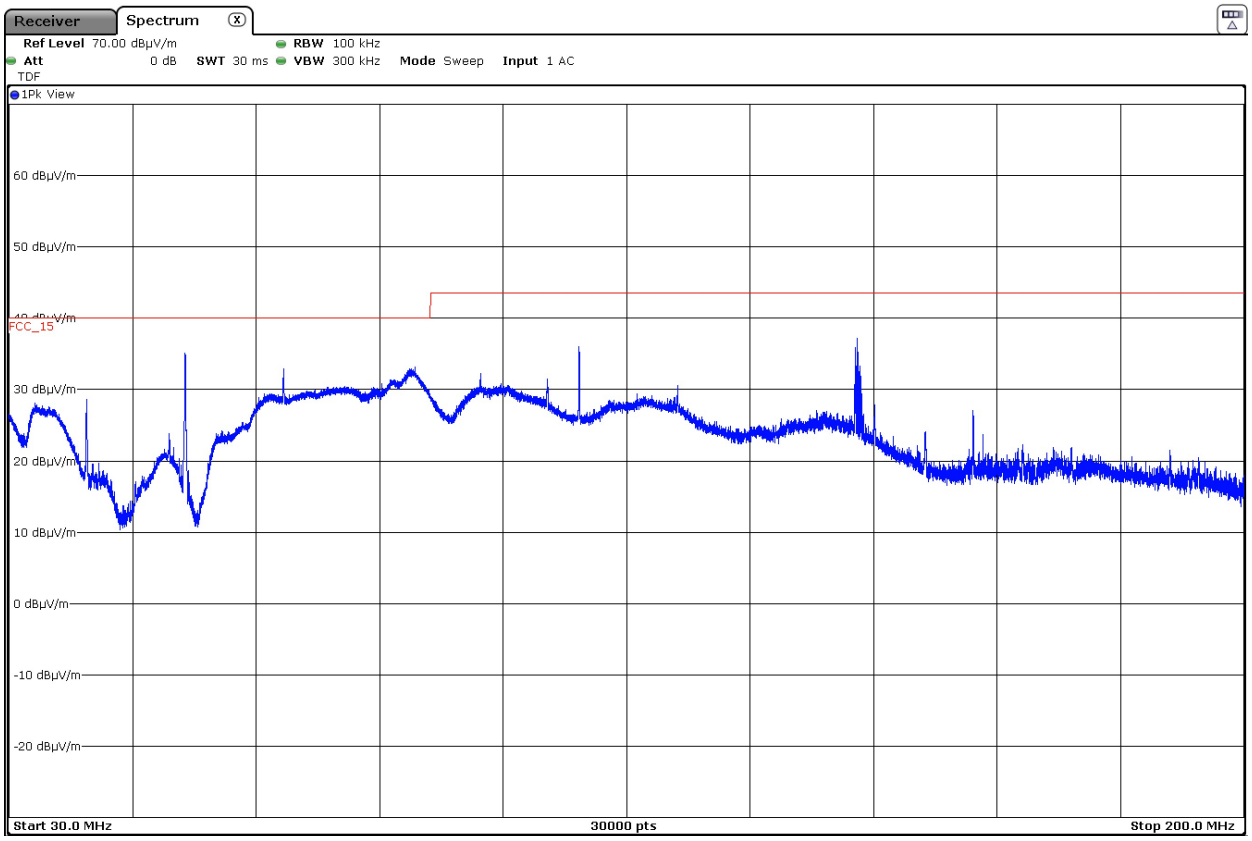


The limits shown in the above plot are extrapolated to 3 meters. The highest peak corresponds to the carrier level.

Resolution bandwidth:
200 Hz for 9 kHz ≤ f ≤ 150 kHz
9 kHz for 150 kHz ≤ f ≤ 30 MHz

- Frequency range 30 - 200 MHz

Spurious frequency (MHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
40.6902	Quasi peak	26.70	V	<± 3.88
54.2448	Quasi peak	28.20	V	<± 3.88
108.4748	Quasi peak	31.80	V	<± 3.88
146.8212	Quasi peak	19.60	V	<± 3.88
178.0955	Quasi peak	17.70	H	<± 3.88



The above plot shows the results of the scan using peak detector.

Verdict: PASS

Section 15.225 Subclause (e) / RSS-210 Clause B.6. Frequency tolerance of the carrier signal

SPECIFICATION:

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 hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

RESULTS:

Nominal Operating Frequency: 13.56 MHz.

- Frequency stability over temperature variations:

Temperature (ºC)	Frequency Error (kHz)	Frequency Error (%)
+50	632.5	0.004664
+40	-1335.9	-0.009852
+30	-1330.0	-0.009808
+20	-910.2	-0.006712
+10	-1345.0	-0.009919
0	300.0	0.002212
-10	-1200.0	-0.008850
-20	-1200.0	-0.008850

- Frequency stability over voltage variations:

DC Supply	Voltage (V)	Frequency Error (Hz)	Frequency Error (%)
Vmax	264.5	-1258.0	-0,009280
Vmin	195.5	-1200.0	-0,008850

Verdict: PASS