

ISED CABid: ES1909

Lab. Company Number: 4621A

Test Report No:

76889RRF.002A1

Test Report

USA FCC Part 15.225, 15.209

CANADA RSS-210, RSS-Gen

(*) Identification of item tested	Key Fob
(*) Trademark	iLOQ
(*) Model and /or type reference	K55S.2
Other identification of the product	FCC ID: 2A2HZ-FOB55S2 IC: 30160-FOB55S2
(*) Features	NFC, USB-C HW version: E2196C2 SW version: 32790
Applicant	iLOQ OY Elektroniikkatie 10, 90590 OULU, Finland
Test method requested, standard	USA FCC Part 15.225 (10-1-21 Edition): Operation within the band 13.110 -14.010. USA FCC Part 15.209 (10-1-21 Edition): Radiated emission limits, general requirements. CANADA RSS-210 Issue 10 (December 2019). CANADA RSS-Gen Issue 5 Amendment 2 (February 2021). ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	José Manuel Gómez Galván EMC Consumer & RF Lab. Manager  Firmado digitalmente por 53680346W JOSE MANUEL GOMEZ (C:A29507456)
Date of issue	2024-02-20
Report template No	FDT08_24 (*) "Data provided by the client"

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Acronyms

Acronym ID	Acronym Description
Freq	Frequency
Freq Rng	Frequency Range
FreqError%	Frequency Error
FreqErrorHz	Frequency Error in Hz
Mod	Modulation
Pol	Polarization
QuasiPeak	Radiated Quasi Peak Level
T	Temperature
Un	Nominal Voltage

Competences and guarantees

DEKRA Testing and Certification S.A.U. 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 an FCC-recognized accredited testing laboratory with appropriate scope of accreditation that covers the performed tests in this report.

DEKRA Testing and Certification is an ISED-recognized accredited testing laboratory, CABid: ES1909, Company Number: 4621A, with the appropriate scope of accreditation that covers the performed tests in this report.

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DEKRA Testing and Certification S.A.U. 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 S.A.U. at the time of performance of the test.

DEKRA Testing and Certification S.A.U. 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.

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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.

The total uncertainty of the measurement system for the radiated emissions of EUT from 9 kHz to 30 MHz is:
Measurement uncertainty $\leq \pm 3.08$ dB (with factor k = 2).

The total uncertainty of the measurement system for the radiated emissions of EUT from 30 MHz to 200 MHz is:
Measurement uncertainty $\leq \pm 5.35$ dB (with factor k = 2).

The total uncertainty of the measurement system for the conducted testing of EUT is:
Frequency Tolerance of the Carrier Signal: Measurement uncertainty $\leq \pm 12.3$ kHz
Occupied Bandwidth $\leq \pm 1.42$ kHz
Field strength of emissions within the band $\leq \pm 3.44$ dB

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 Key Fob. The iLOQ K55S.2 Key Fob is used for operating digital lock cylinders in the iLOQ 5 Series locking system for users without a compatible NFC-enabled smartphone for unlocking. The Key Fob supplies the required operating power to the lock over the NFC field during opening, thus the locks do not need their own power supply.

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.

Id	Control Number	Description	Model	Serial N°	Date of Reception	Application
S/01	76889B_11.1	Key Fob	K55S.2	34800923	2023-11-02	Element Under Test

Notes referenced to samples during the project:

Id	Type
S/01	Test samples used for conducted and radiated testing.

Test sample description

Ports..... :	Port name and description		Cable				
			Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾	
	USB service port (USB-C interface for service and charging)		< 3m	[]	[]	[]	
Supplementary information to the ports..... :							
Rated power supply	Voltage and Frequency			Reference poles			
				L1	L2	L3	N
	[X]	DC: Lithium-ion polymer rechargeable battery. DC 3.7V, 220mAh, 0.814Wh					
	[X]	DC: USB -C port, nom. 5 VDC					
Rated Power	USB-C port: max. 0,5 W (5 V/ 0,1 A)						
Clock frequencies.....	27.12MHz, 32.768kHz, 1MHz, 100kHz, 48MHz, 24MHz						
Other parameters							
Software version	32790						
Hardware version	E2196C2						
Dimensions in cm (W x H x D)	41 mm x 50,2 mm x 13,7 mm						
Mounting position	[]	Table top equipment					
	[]	Wall/Ceiling mounted equipment					
	[]	Floor standing equipment					
	[X]	Hand-held equipment					
	[]	Other:					
Modules/parts..... :	Module/parts of test item			Type		Manufacturer	
							
Accessories (not part of the test item)	Description			Type		Manufacturer	
							
Documents as provided by the applicant..... :	Description			File name		Issue date	
							

⁽³⁾ Only for Medical Equipment

Identification of the client

Bittium Wireless
Ritaharjuntie 1, 90590 Oulu, Finland

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2023-11-08
Date (finish)	2023-11-21

Document history

Report number	Date	Description
76889RRF.002	2023-12-20	First release.
76889RRF.002A1	2024-02-20	Second release. Modification due to missing information. This modification test report cancels and replaces the test report 76889RRF.002

Environmental conditions

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

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

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

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

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

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

Remarks and comments

The tests have been performed by the technical personnel: Alvaro Gutierrez Naranjo, Ireneo Bibang Bacale and Valentin Andarias Diaz.

Used instrumentation:

Control No.	Equipment	Model	Manufacturer	Next Calibration
6791	SEMIANECHOIC ABSORBER LINED CHAMBER IV	FACT 3 200 STP	ETS LINDGREN	N/A
6792	SHIELDED ROOM	S101	ETS LINDGREN	N/A
0242	ACTIVE LOOP ANTENNA 9 KHZ-30 MHz	11966A	HEWLETT PACKARD	2024-08
5641	HYBRID BILOG ANTENNA 30MHz-6GHz	3142E	ETS LINDGREN	2024-09
6144	RF PRE-AMPLIFIER G>40dB 10MHz-6GHz	BLNA 0160-01N	BONN ELEKTRONIK	2024-07
7817	EMI TEST RECEIVER 2Hz-44GHz	ESW44	ROHDE AND SCHWARZ	2023-12
9555	TWO-CHANNEL POWER SUPPLY, 32V, 10/5A, 188W	HMP2020	ROHDE AND SCHWARZ	N/A
7760	DIGITAL MULTIMETER	175	FLUKE	2024-11
4848	SOFTWARE FOR EMC/RF TESTING	EMC32	ROHDE AND SCHWARZ	--
6157	SIGNAL AND SPECTRUM ANALYZER 10 Hz - 40 GHz	FSV40	ROHDE AND SCHWARZ	2025-01
8002	TEMPERATURE CHAMBER MK56 BINDER	MK 56	BINDER	2024-03

Testing verdicts

Fail	F
Inconclusive	I
Not applicable	N/A
Not measured	N/M
Pass	P

Summary

RFID (NFC 13.56 MHz).

FCC PART 15 PARAGRAPH / RSS-210		
Requirement – Test case	Verdict	Remark
FCC 15.225 (a) / RSS-210 B.6 (a)(i) Field strength of emissions within the band 13.553 MHz -13.567 MHz	P	
FCC 15.225 (b) / RSS-210 B.6 (a)(ii) Field strength of emissions within the band 13.410 - 13.553 MHz and 13.567 – 13.710 MHz	P	
FCC 15.225 (c) / RSS-210 B.6 (a)(iii) Field strength of emissions within the band 13.110 - 13.410 MHz and 13.710 – 14.010 MHz	P	
FCC 15.225 (d) / RSS-210 B.6 (a)(iv) Field strength of emissions outside of the band 13.110 MHz -14.010 MHz	P	
FCC 15.225 (e) / RSS-210 B.6 (b) Frequency tolerance of the carrier signal	P	
<u>Supplementary information and remarks:</u> None.		

Appendix A: Test results

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<i>FCC 15.225 (A) (B) (C) / RSS-210 B.6 (A) (B) (C). FIELD STRENGTH OF EMISSIONS WITHIN THE BAND 13.553 -13.567 MHz, 13.410 - 13.553 MHz AND 13.567 - 13.710 MHz, 13.110 - 13.410 MHz AND 13.710 - 14.010 MHz</i>	15
<i>FCC 15.225 (d) / RSS-210 B.6 (a) (iv) [RSE] FCC 15.225 (d) / RSS-210 B.6 (a)(iv) Field Strength of Emissions outside of the band 13.110 MHz - 14.010 MHz</i>	17
<i>FCC 15.225 (e) / RSS-210 (b) Freq Tolerance FCC 15.225 (e) / RSS-210 B.6 (b) Frequency Tolerance of the Carrier Signal</i>	19

TEST CONDITIONS

(*): Data provided by the client.

POWER SUPPLY (*):

Vnominal: 3.7 Vdc
Vminimum: 3.145 Vdc
Vmaximum: 4.255 Vdc
Type of Power Supply: DC (Lithium-ion polymer rechargeable battery).

ANTENNA (*):

Type of Antenna: Integral (PCB Loop).
Maximum Declared Antenna Gain: N/A.

TEST FREQUENCIES (*):

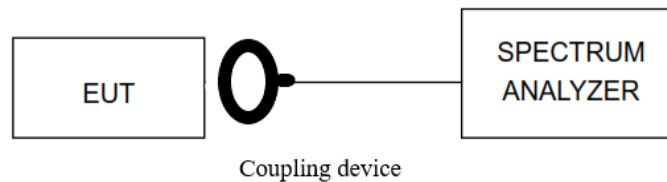
Nominal Operating Frequency: 13.56 MHz
Modulation: ASK

TEST SETUP

CONDUCTED MEASUREMENTS

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

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



For extreme test conditions the EUT was placed inside a climatic chamber and connected to a spectrum analyzer using a low-loss cable and a coupling device. An external DC power supply was connected to the EUT for voltage variation test.

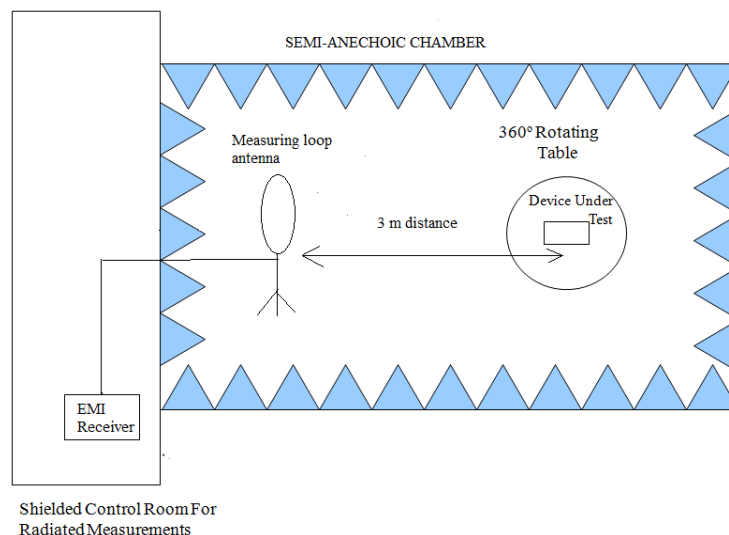
RADIATED MEASUREMENTS

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.

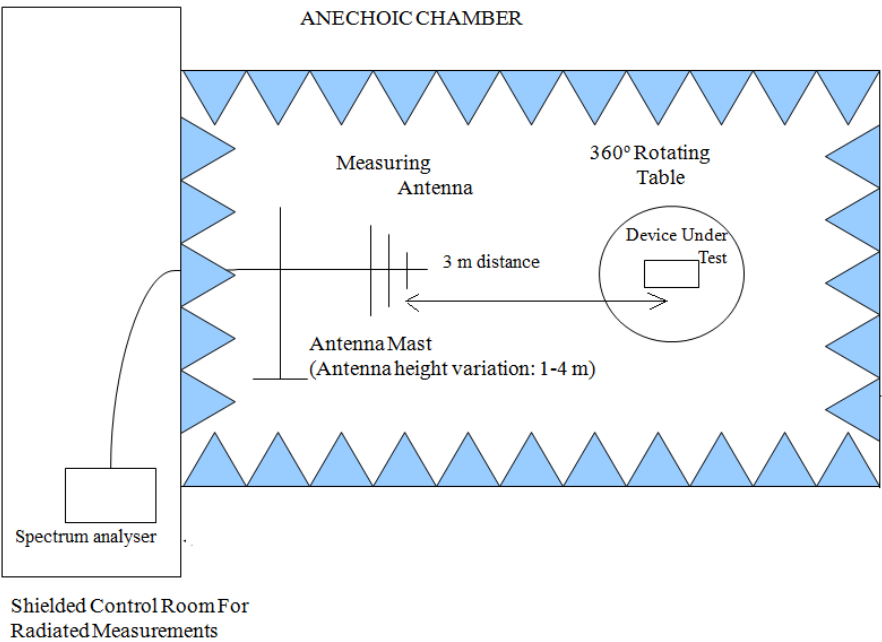
For radiated emissions in the range 9 kHz to 30 MHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 40 dB per decade is used to normalize the measured data for determining compliance.

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 360° 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:



TEST CASES DETAILS

Occupied Bandwidth

Results

99 % Occupied Bandwidth and 20 dB Bandwidth.

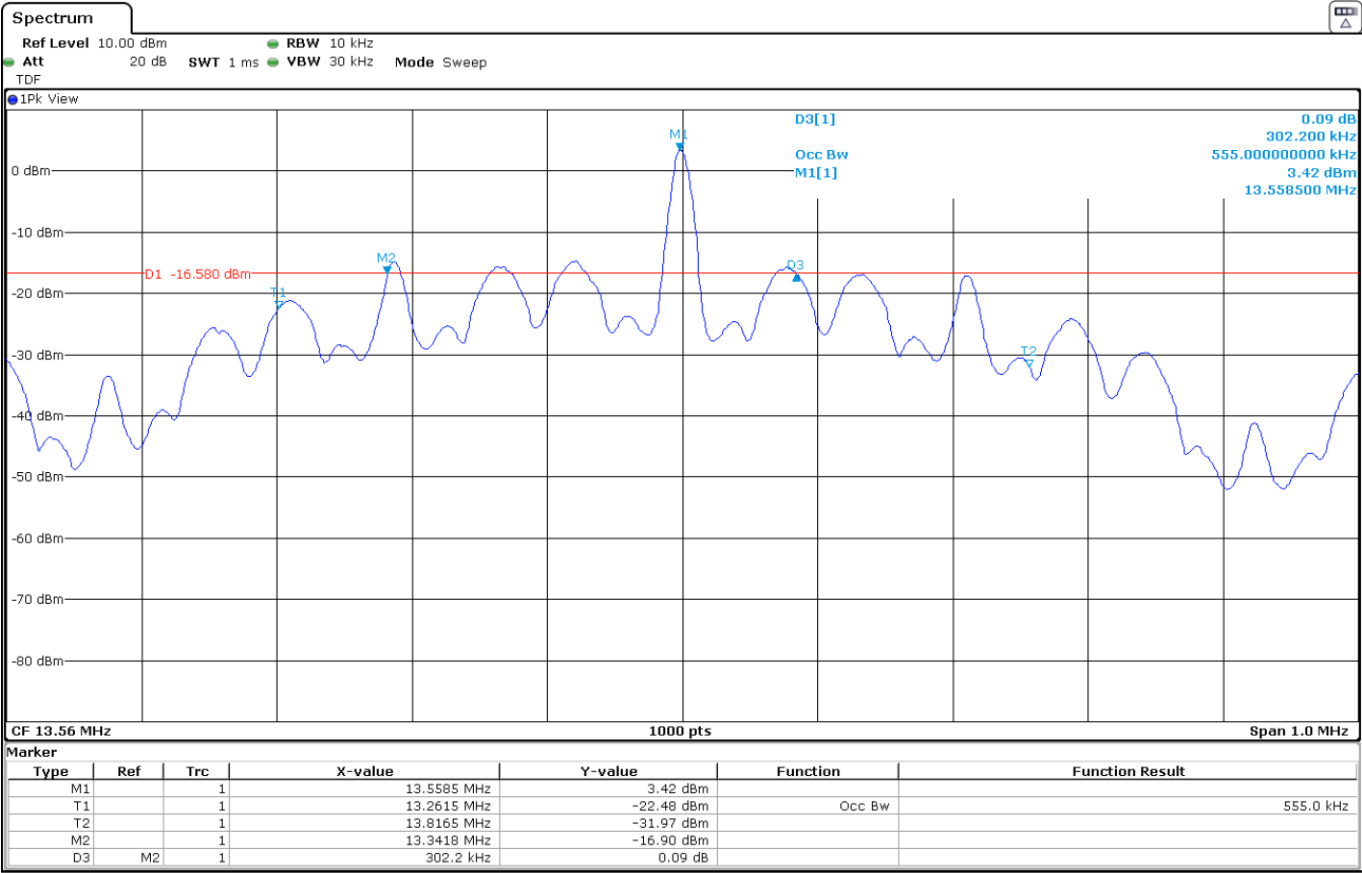
Modulation: ASK

Freq (MHz)	99% Occupied Bandwidth (kHz)	20dBw (kHz)
13.56	555.0	302.2

Attachments

Modulation = ASK Frequency MHz = 13.56

Images:



FCC 15.225 (a) (b) (c) / RSS-210 B.6 (a) (b) (c). Field strength of emissions within the band 13.553 -13.567 MHz, 13.410 - 13.553 MHz and 13.567 - 13.710 MHz, 13.110 - 13.410 MHz and 13.710 - 14.010 MHz

SPECIFICATION:

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

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.

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

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.

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

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.

- NFC - ASK Modulation:**

- Band 13.553 -13.567 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)
13.560	13.53	-26.47

- Band 13.410 - 13.553 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)
13.551	-11.19	-51.19

- 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)
13.569	-12.09	-52.09

- Band 13.110-13.410 MHz

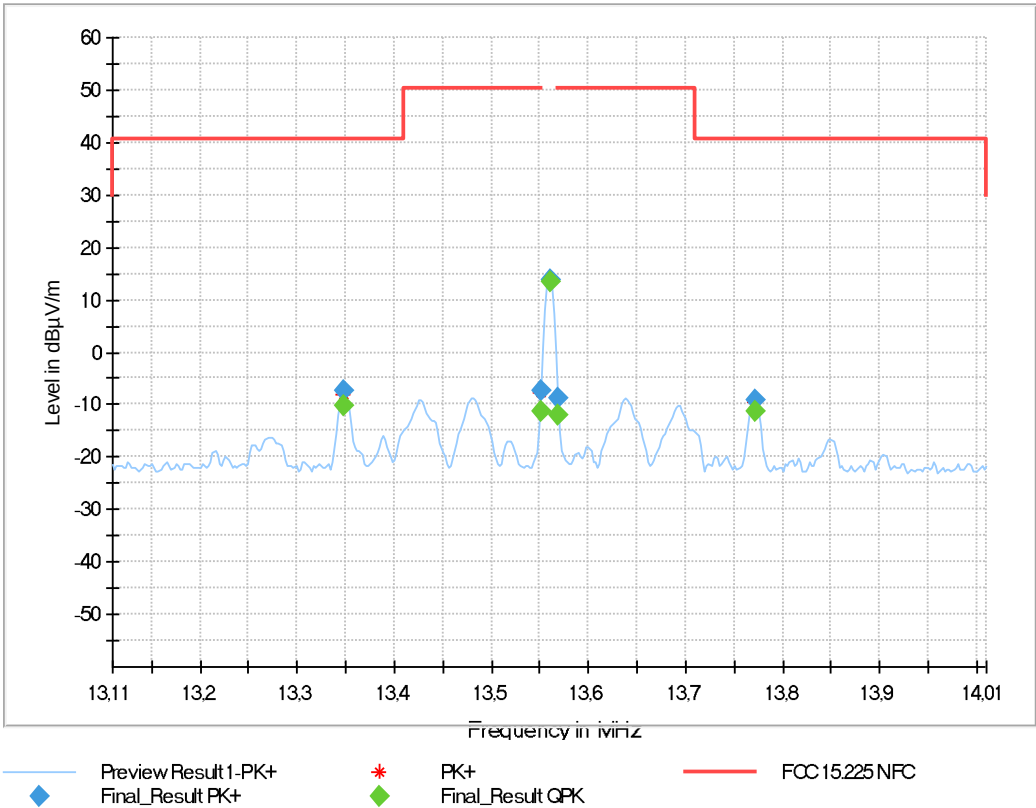
Frequency (MHz)	Maximum field strength (dBµV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBµV/m) extrapolated to 30 m (40 dB/decade)
13.349	-10.15	-50.15

- 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)
13.772	-11.24	-51.24

Spectrum analyzer parameters:

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamplifier
Receiver: [ESW 44]					
9 kHz - 150 kHz	50 Hz	PK+	200 Hz	0,1 s	0 dB
150 kHz - 30 MHz	2,25 kHz	PK+	9 kHz	0,1 s	0 dB



Verdict: PASS

FCC 15.225 (d) / RSS-210 B.6 (a) (iv) [RSE] FCC 15.225 (d) / RSS-210 B.6 (a)(iv) Field Strength of Emissions outside of the band 13.110 MHz - 14.010 MHz

Limits

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

Modulation: ASK

Results

No spurious frequencies at less than 20 dB below the limit.

Verdict

Pass

Spectrum analyzer parameters < 30 MHz:

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
Receiver: [ESW 44]					
9 kHz - 150 kHz	50 Hz	PK+	200 Hz	0,1 s	0 dB
150 kHz - 30 MHz	2,25 kHz	PK+	9 kHz	0,1 s	0 dB

Spectrum analyzer parameters > 30MHz:

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
Receiver: [ESW 44]					
30 MHz - 200 MHz	8,5 kHz	PK+	100 kHz	1 s	30 dB

Attachments

Modulation = ASK

Frequency MHz = 13.56

Frequency Range MHz = [0.009, 30] Polarization = Frontal side (worst case)

Images:

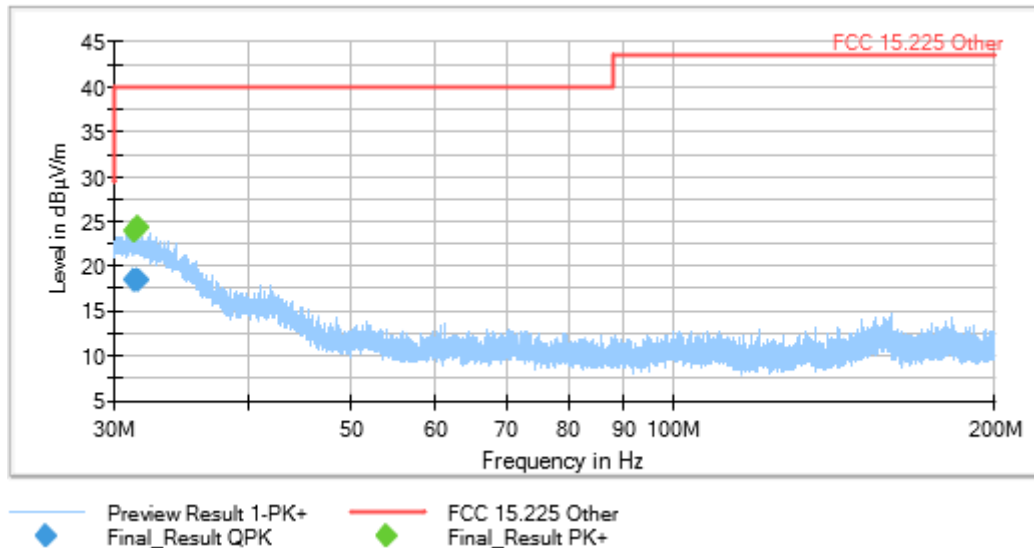


Modulation = ASK

Frequency MHz = 13.56

Frequency Range MHz = [30, 200] Polarization = H/V

Images:



FCC 15.225 (e) / RSS-210 (b) Freq Tolerance FCC 15.225 (e) / RSS-210 B.6 (b) Frequency Tolerance of the Carrier Signal

Limits

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.

Modulation: ASK

Results

Freq (MHz)	T (°C)	Voltage (V)	Freq Error (Hz)	Freq Error (%)
13.56	-20	3.70	163.500	0.001
	-10		132.000	0.001
	0		114.000	0.001
	10		121.500	0.001
	20	3.15	126.000	0.001
		3.70	135.000	0.001
		4.25	135.000	0.001
	30	3.70	150.000	0.001
	40		154.500	0.001
	50		144.000	0.001

Verdict

Pass