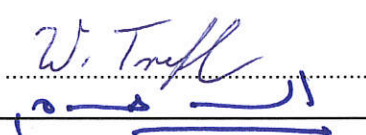


RADIO REPORT FCC 47 CFR Part 15C ISED Canada RSS-210 Operation within the 13.110 – 14.010 MHz band	
Report Reference No	G0M-1705-6546-TFC225RI-V01
Testing Laboratory	Eurofins Product Service GmbH
Address	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation	 A2LA Accredited Testing Laboratory, Certificate No.: 1983.01 FCC Test Firm Designation Number: DE0008 IC Testing Laboratory site: 3470A-2
Applicant	Kubo Robotics ApS
Address	Niels Bohrs Allé 185 5220 Odense SØ Denmark
Test Specification	According to FCC/ISED rules
Standard	47 CFR Part 15C RSS-210, Issue 9, 2016-08
Non-Standard Test Method	None
Test Scope	Full compliance test
Equipment under Test (EUT):	
Product Description	Educational robot
Model(s)	Kubo
Additional Model(s)	None
Brand Name(s)	Kubo
Hardware Version(s)	P1
Software Version(s)	P1
FCC-ID	2AOWV-KUBO-10
IC	N/A
Test Result	PASSED

Possible test case verdicts:		
required by standard but not tested	N/T	
not required by standard	N/R	
not applicable to EUT	N/A	
test object does meet the requirement	P(PASS)	
test object does not meet the requirement	F(FAIL)	
Testing:		
Test Lab Temperature	20 - 23 °C	
Test Lab Humidity	32 – 38 %	
Date of receipt of test item	2017-08-25	
Report:		
Compiled by	Abdullah Al Jamal	
Tested by (+ signature) (Responsible for Test)	Abdullah Al Jamal / Wilfried Treffke	
Approved by (+ signature) (Head of Lab)	Christian Weber	
Date of Issue	2018-03-02	
Total number of pages	31	
General Remarks:		
The test results presented in this report relate only to the object tested. The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report. This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.		
Additional Comments:		
None		

VERSION HISTORY

Version History			
Version	Issue Date	Remarks	Revised By
01	2018-03-02	Initial Release	

ABBREVIATIONS AND ACRONYMS

Acronyms	
Acronym	Description
EUT	Equipment Under Test
FCC	Federal Communications Commission
ISED	Innovation, Science and Economic Development Canada
RBW	Resolution bandwidth
RFID	Radio Frequency Identification
RMS	Root mean square
VBW	Video bandwidth
V _{NOM}	Nominal supply voltage

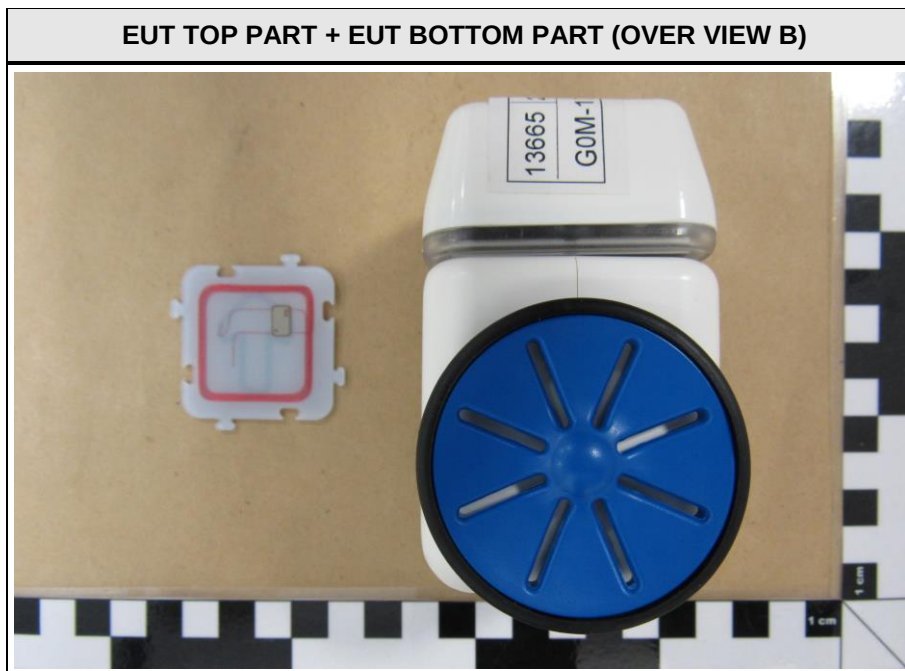
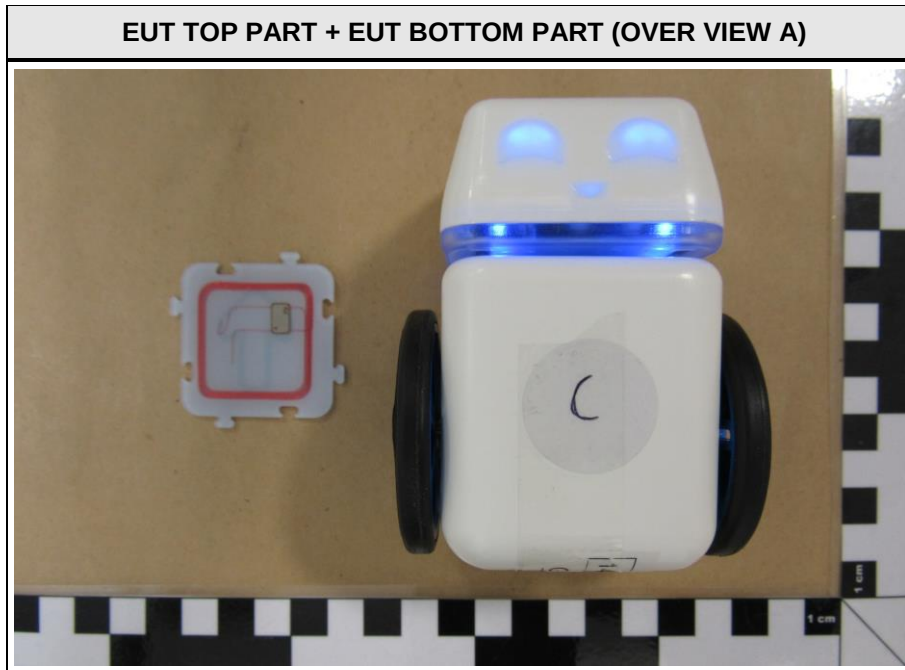
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1 Equipment (Test Item) Under Test

Description	Educational robot	
Model	Kubo	
Additional Model(s)	None	
Brand Name(s)	Kubo	
Serial Number(s)	Not specified	
Hardware Version(s)	P1	
Software Version(s)	P1	
PMN	N/A	
HVIN	N/A	
FVIN	N/A	
HMN	N/A	
FCC-ID	2AOWV-KUBO-10	
IC	N/A	
Equipment type	End Product	
Radio type	Transceiver	
Assigned frequency bands	13.110 - 14.010 MHz	
Radio technology	RFID	
Modulation	ASK	
Antenna	Type	Integrated antenna
	Model	Printed loop antenna
	Manufacturer	Not specified
	Gain	Not specified
Supply Voltage	V _{NOM}	5.0 VDC
Operating Temperature	T _{NOM}	25 °C
AC/DC-Adaptor	Model	None
	Vendor	None
	Input	None
	Output	None
Manufacturer	Kubo Robotics ApS Niels Bohrs Allé 185 5220 Odense SØ Denmark	

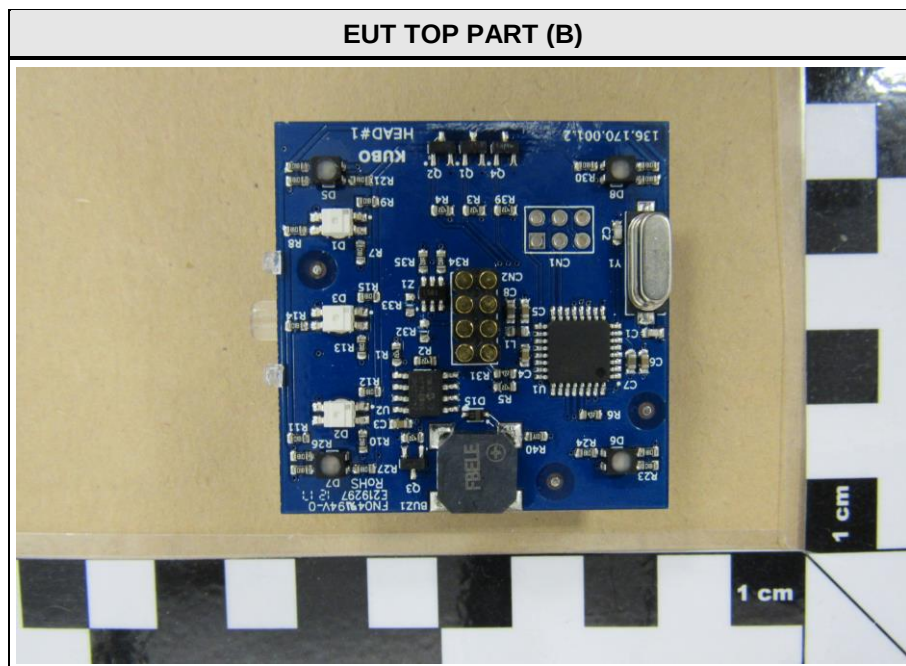
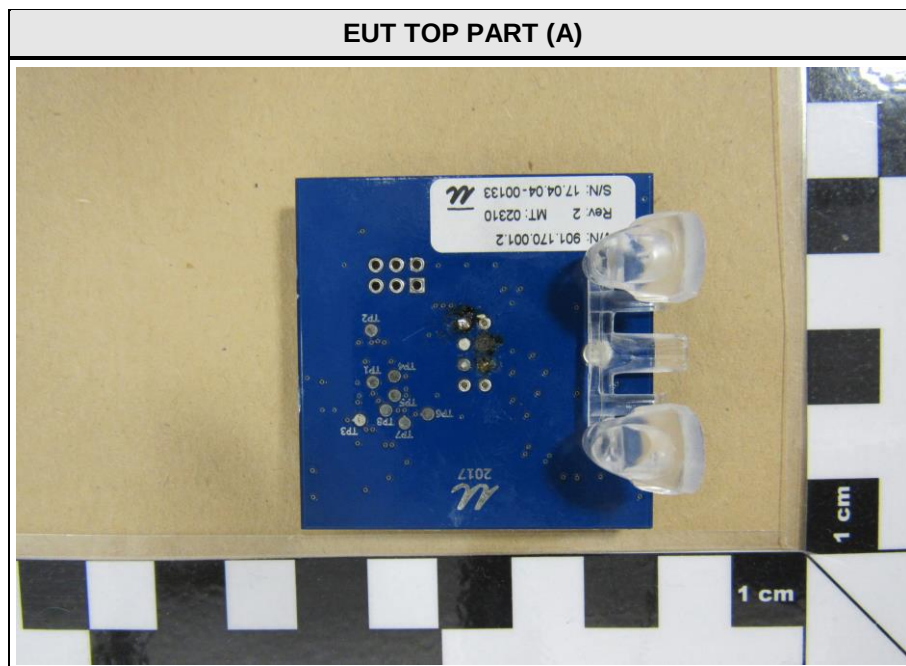
1.1 Photos – Equipment External



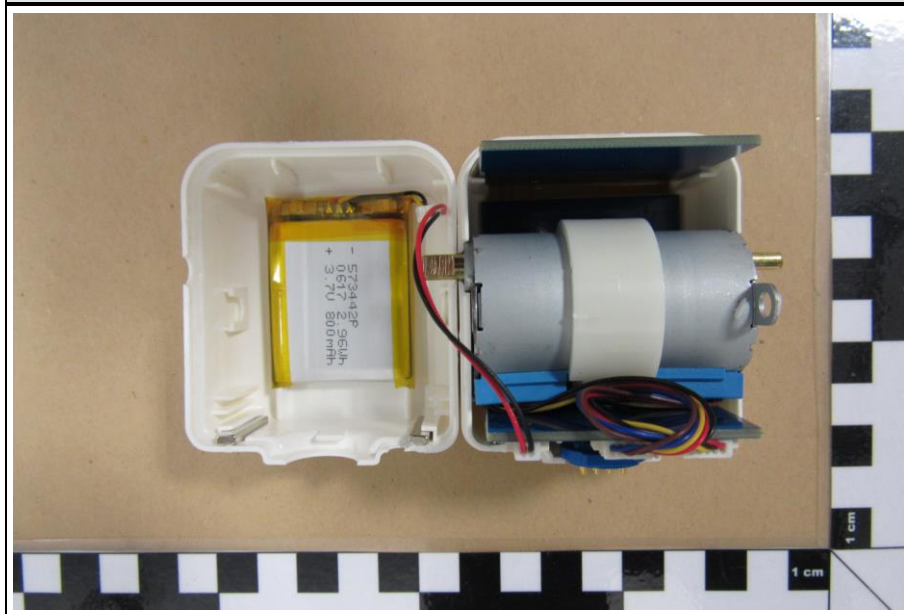
EUT TOP PART + EUT BOTTOM PART (OVER VIEW C)



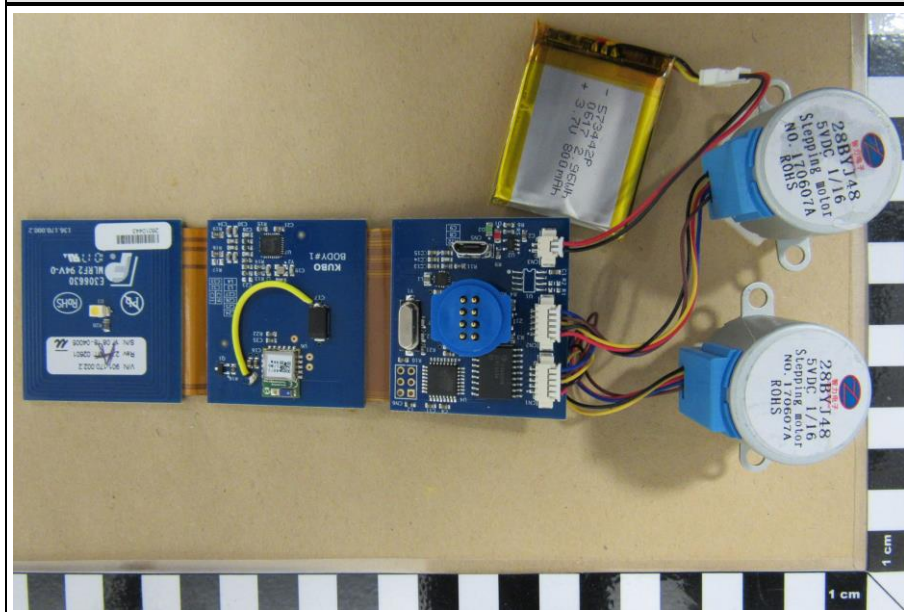
1.2 Photos – Equipment Internal



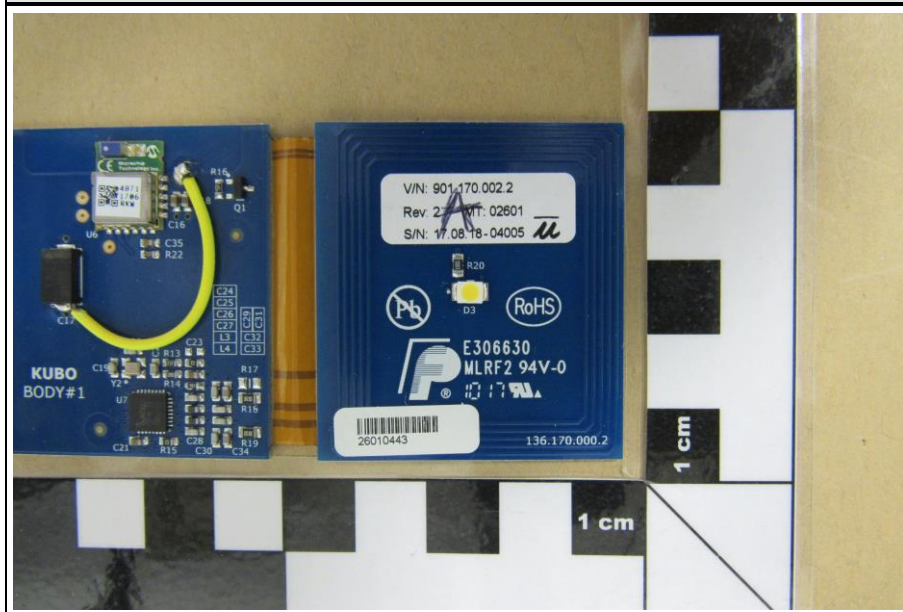
EUT BOTTOM PART (A) OVERVIEW (A)



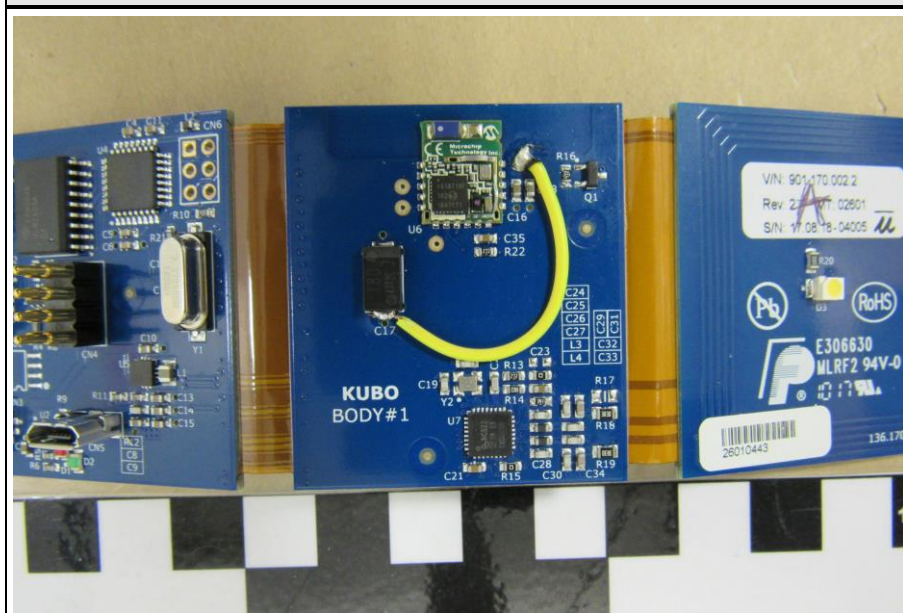
EUT BOTTOM PART (B) OVERVIEW (B)



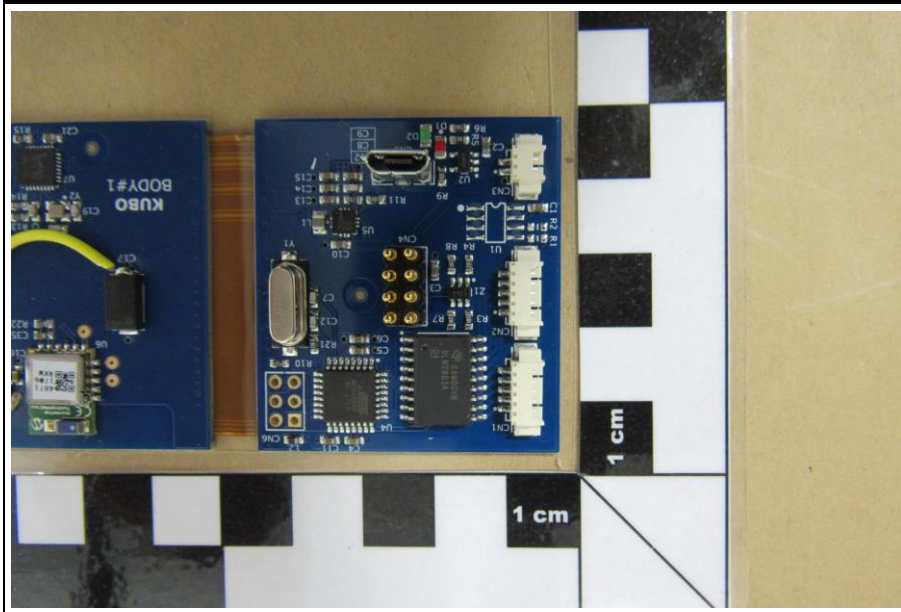
EUT BOTTOM PART (C) DETAILS (A)



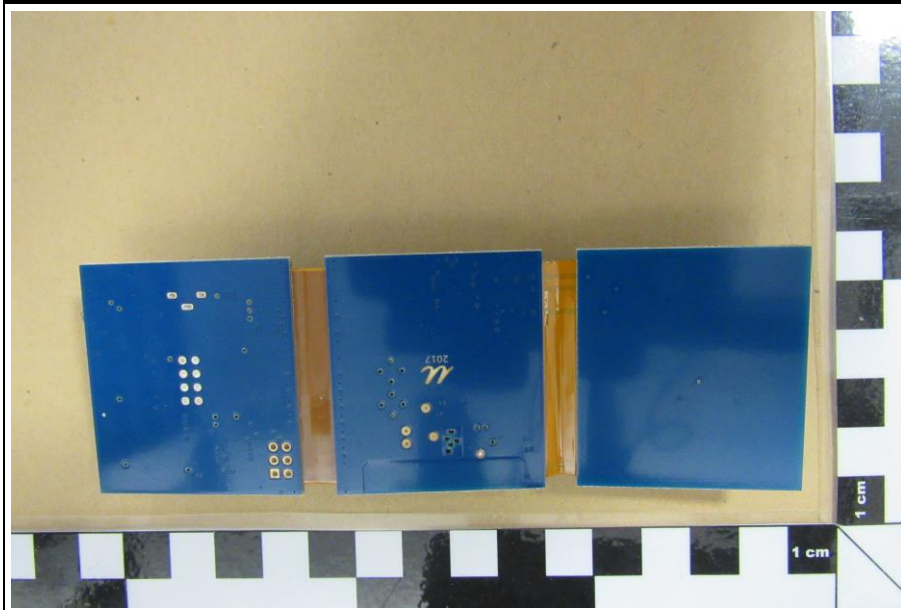
EUT BOTTOM PART (D) DETAILS (B)



EUT BOTTOM PART (E) DETAILS (C)



EUT BOTTOM PART (F) OVERVIEW (C)



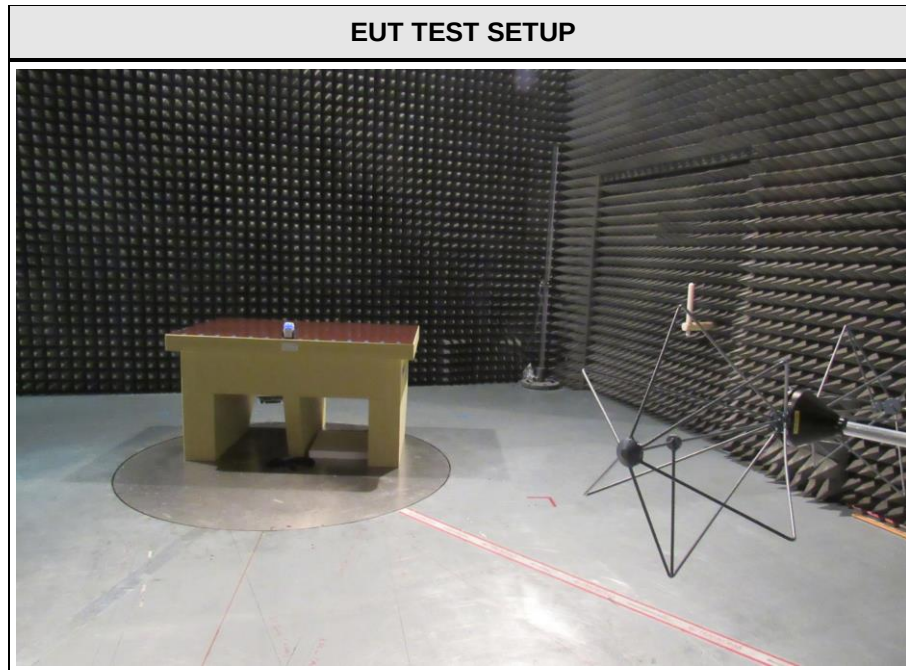
EUT BOTTOM PART (G) BATTERY



EUT BOTTOM PART (H) MOTOR



1.3 Photos – Test Setup



1.4 Support Equipment

Product Type	Device	Manufacturer	Model	Comment
N/A				
Description:				
AE	Auxillary Equipment			
SIM	Simulator			
CBL	Connecting Cable			
Comment: None				

1.5 Test Modes

Mode	Description
Transmit	Mode = Transmit Modulation = ASK Duty cycle = 100 %
Comment: None	

1.6 Test Frequencies

Designator	Mode	Channel	Frequency [MHz]
F1	Tx / Rx	0	13.56

2 Result Summary

FCC 47 CFR Part 15C, ISED RSS-210				
Product Standard Reference	Requirement	Reference Method	Result	Remarks
RSS-Gen 6.6	Occupied Bandwidth	ANSI C63.10	N/R	Informational only
FCC 15.225(a-c) ISED RSS-210 A2.6(a-c)	Fundamental in-band field strength emissions	ANSI C63.10	PASS	
FCC 15.225(d) FCC 15.209 ISED RSS-210 A2.6(d)	Emission radiated outside the specified frequency band	ANSI C63.10	PASS	
FCC 15.225(e) ISED RSS-210 A2.6	Frequency stability	ANSI C63.10	PASS	
ISED RSS-Gen 4.10 ISED RSS-Gen 7.1	Receiver radiated spurious emissions	ANSI C63.10	N/T	
47 CFR 15.207 RSS-Gen 8.8	AC power line conducted emissions	ANSI C63.10	N/R	No transmissions during charging
Comment: None				

Possible Test Case Verdicts	
PASS	Test object does meet the requirements
FAIL	Test object does not meet the requirements
N/T	Required by standard but not tested
N/R	Not required by standard for the test object

3 Test Conditions and Results

3.1 Test Conditions and Results - Occupied bandwidth

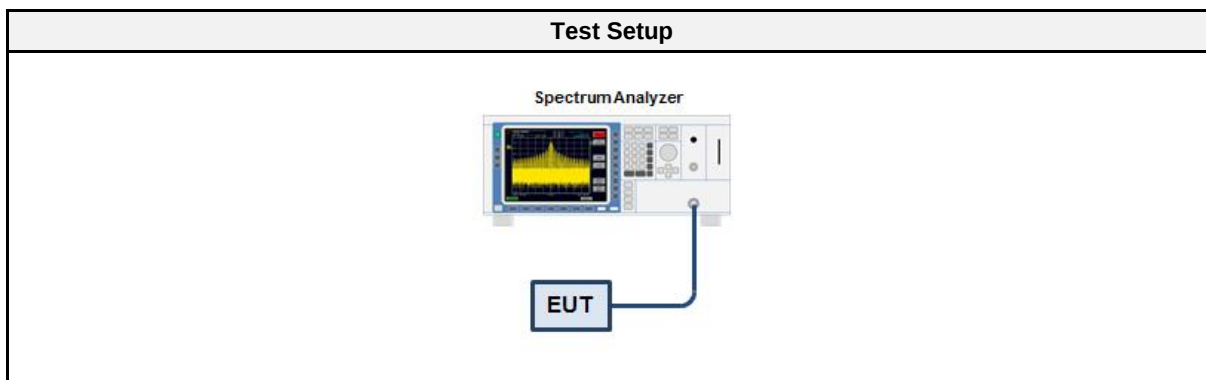
3.1.1 Information

Test Information	
Reference	ISED RSS-Gen 6.6
Measurement Method	Conducted

3.1.2 Limits

Limits
None (Informational only)

3.1.3 Setup



3.1.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSW 43	EF00896	2017-08	2018-08

3.1.5 Procedure

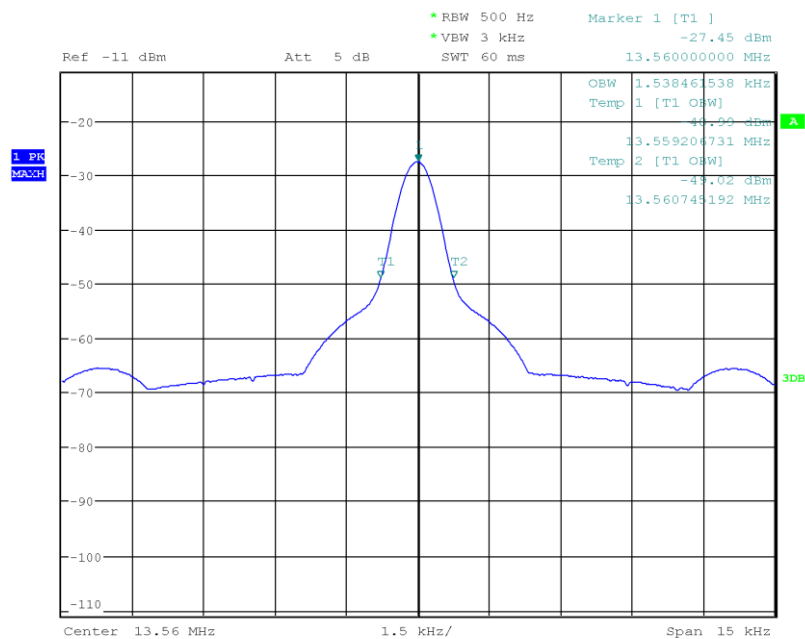
Test Procedure
1. EUT set to test mode (Communication tester is used if needed) 2. Span set to at least twice the emission spectrum 3. Resolution bandwidth set to 1 % of span 4. Occupied Bandwidth (99 %) measurement with spectrum analyzer built in measurement function

3.1.6 Results

Test Results	
Channel [MHz]	Bandwidth [kHz]
13.56	1.54

Occupied Bandwidth

Project Number: G0M-1705-6546
 Applicant: Kubo Robot
 Model Description: 13.56 MHz RFID
 Model: Kubo
 Test Sample ID: 14885 (EUT) and 13665 (EUT)
 Operator: Abdullah Al Jamal
 Test Site: Eurofins Product Service GmbH
 Test Date: 2018-02-19



Date: 19.FEB.2018 13:46:19

3.2 Test Conditions and Results - Fundamental in-band field strength emissions

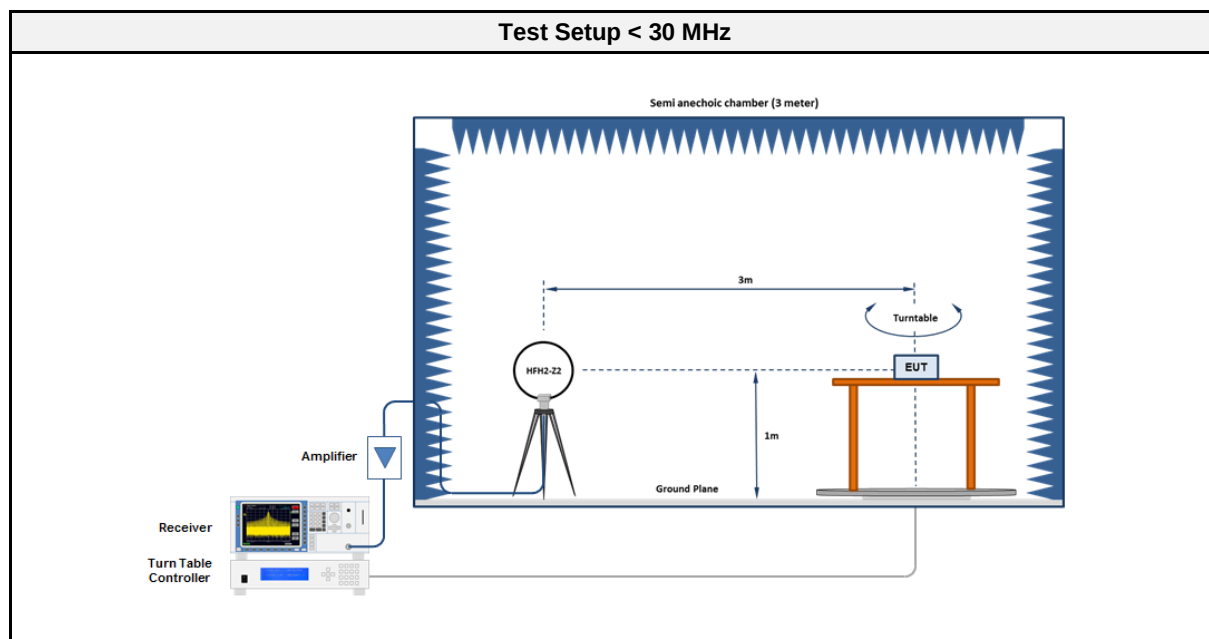
3.2.1 Information

Test Information	
Reference	FCC 15.225(a-c) / ISSED RSS-210 A2.6(a-c)
Measurement Method	Radiated

3.2.2 Limits

Limits			
Frequency range [MHz]	Limit [$\mu\text{V/m}$]	Limit [$\text{dB}\mu\text{V/m}$]	Limit Distance [m]
13.553 - 13.567	15848	84	30
13.410 - 13.553 13.567 - 13.710	334	50.5	30
13.110 - 13.410 13.710 - 14.010	106	40.5	30

3.2.3 Setup



3.2.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Semi-Anechoic Chamber	Frankonia	AC1	EF00062	2017-02	2020-02
Spectrum Analyzer	R&S	FSU 3	EF00241	2017-07	2019-07
Antenna	R&S	HFH2-Z2	EF00184	2017-12	2019-12

3.2.5 Procedure

Test Procedure	
1.	EUT set to test mode
2.	Span it set according to measurement range
3.	Resolution bandwidth below 1 GHz is set according to CISPR 16 with peak/quasi-peak detector
4.	Below 30MHz and extrapolation factor of 40dB/decade is used and at 30MHz and above an extrapolation factor of 20dB/decade is used (47 CRF 15.31(f)).

3.2.6 Results

Test Results						
Channel [MHz]	Emission [MHz]	Level @ 30 m [dBμV/m]	Detector	Polarization	Limit @ 30 m [dBμV/m]	Margin
13.56	13.56	18.20	pk	N/A	40.5	-22.3

3.3 Test Conditions and Results - Emissions radiated outside the specified frequency band

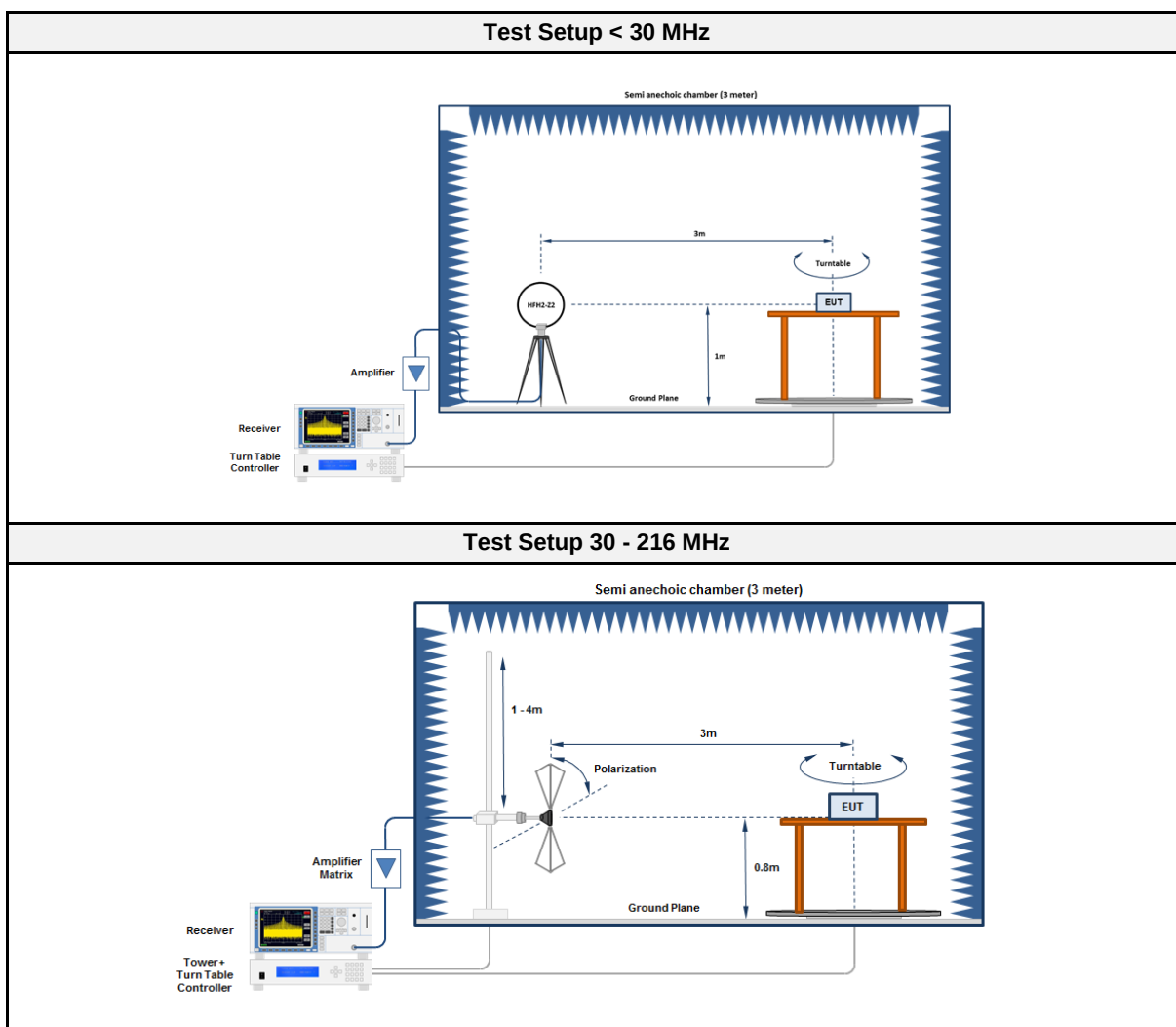
3.3.1 Information

Test Information	
Reference	FCC 15.225(d) / ISED RSS-210 A2.6 (d)
Measurement Method	Radiated

3.3.2 Limits

Limits				
Frequency range [MHz]	Detector	Limit [$\mu\text{V/m}$]	Limit [$\text{dB}\mu\text{V/m}$]	Limit Distance [m]
0.009 - 0.490	Quasi-Peak	$2400/F[\text{kHz}]$	48.5 - 13.8	300
0.490 - 1.705	Quasi-Peak	$2400/F[\text{kHz}]$	13.8 - 2.97	30
1.705 - 30	Quasi-Peak	30	29.5	30
30 - 88	Quasi-Peak	100	40	3
88 - 216	Quasi-Peak	150	43.5	3

3.3.3 Setup



3.3.4 Equipment

Test Equipment < 30 MHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2017-02	2020-02
Loop Antenna	R&S	HFH2-Z2	EF00184	2017-12	2019-12
Spectrum Analyzer	R&S	FSU 3	EF00241	2017-07	2019-07
Test Equipment 30 - 216 MHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2017-02	2020-02
Measurement Receiver	R&S	ESU 26	EF00887	2017-07	2018-07
Antenna	R&S	HK116	EF00186	2016-02	2018-02

3.3.5 Procedure

Test Procedure
1. EUT set to test mode 2. Span it set according to measurement range 3. Resolution bandwidth below 1 GHz is set according to CISPR 16 with peak/quasi-peak detector and RBW of 1 MHz with peak/average detector is used above 1 GHz 4. Markers are set to maximum emission levels

3.3.6 Results

Test Results							
Channel [MHz]	Emission [MHz]	Level [dBμV/m]	Detector	Polarization	Limit [dBμV/m]	Limit distance [dBμV/m]	Margin [dB]
No significant emissions were measured.							

3.4 Test Conditions and Results - Frequency stability

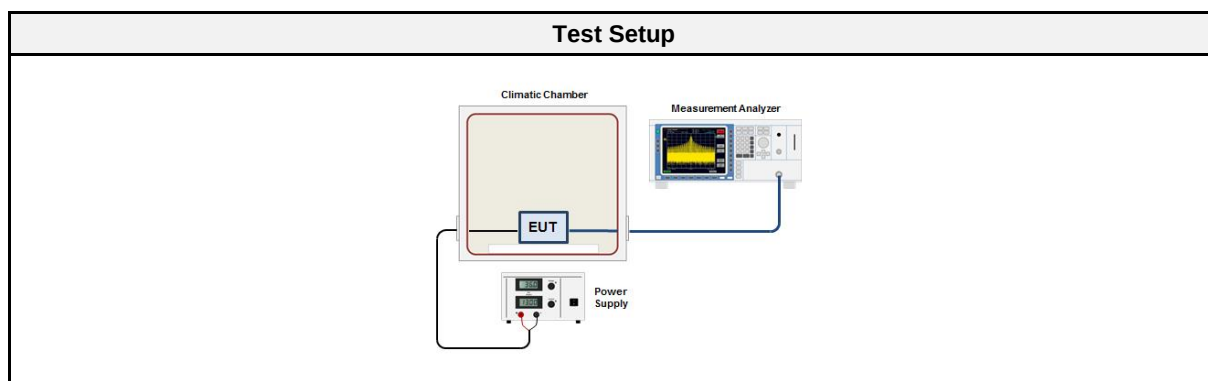
3.4.1 Information

Test Information	
Reference	FCC 15.225(e) / ISED RSS-210 A2.6
Measurement Method	Conducted

3.4.2 Limits

Limits
Frequency error limit
$\pm 0.01\%$ ($\pm 100\text{ppm}$)

3.4.3 Setup



3.4.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSU 3	EF00241	2017-07	2019-07
Climatic chamber	Vötsch	VT 4010	EF00134	2017-09	2018-09

3.4.5 Procedure

Test Procedure
1. EUT set to test mode 2. The ambient temperature and supply voltage is set according to measurement conditions 3. Span is set to capture fundamental emission 4. Frequency error is measured with frequency counter measurement function

3.4.6 Results

Test Results				
Channel [MHz]	Temperature [°C]	Voltage [V]	Measured Frequency [MHz]	Error [ppm]
13.56	25	5.0	13.559992	-2.25
13.56	25	5.0	13.560126	9.27
13.56	25	5.0	13.560127	9.39
13.56	-20	5.0	13.560110	8.12
13.56	-10	5.0	13.560075	5.52
13.56	0	5.0	13.560025	1.88
13.56	10	5.0	13.559973	-1.99
13.56	20	5.0	13.559912	-6.49
13.56	30	5.0	13.559859	-10.39
13.56	40	5.0	13.559992	-2.25
13.56	50	5.0	13.560126	9.27

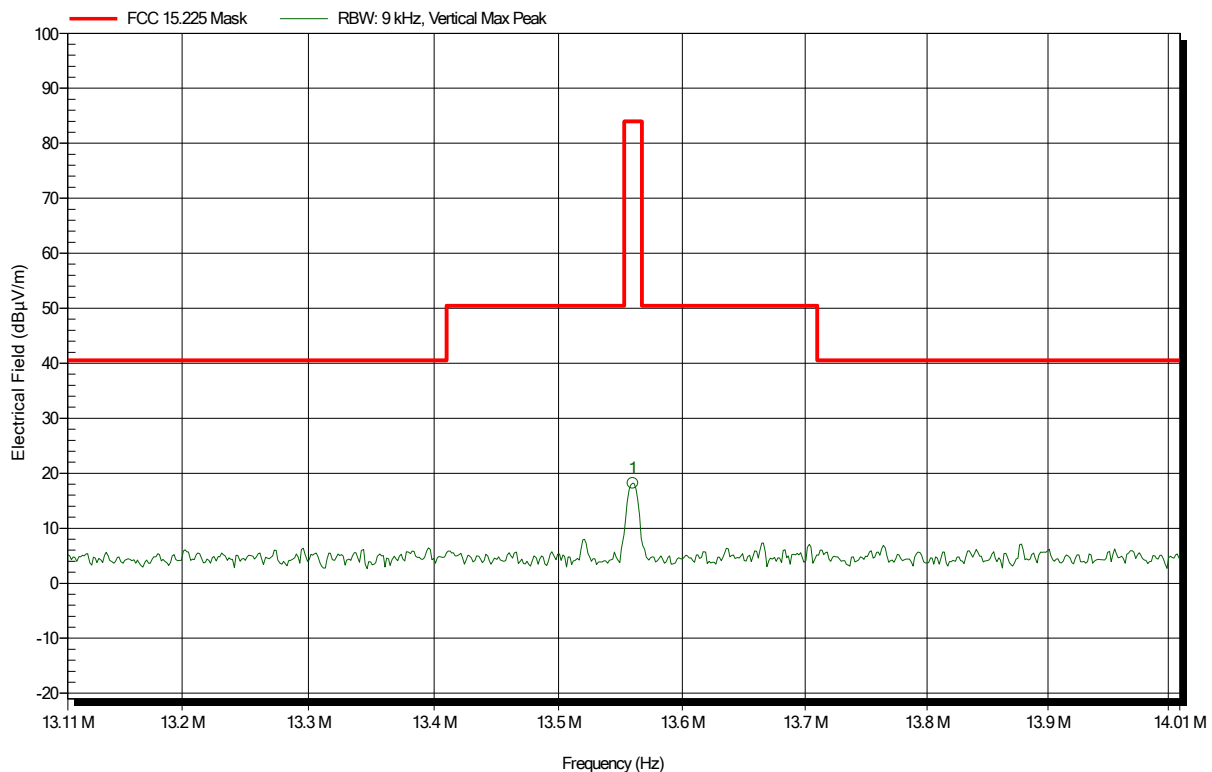
ANNEX A Transmitter in-band emissions

Spurious emissions according to FCC 15.225

Project number: G0M-1705-6546

Applicant: Kubo Robot
EUT Name: 13.56 MHz RFID
Model: Kubo
Test Site: Eurofins Product Service GmbH
Operator: Mr. Al Jamal
Test Conditions: Tnom: 24.1°C, Vnom: 5.0 VDC (lithium battery)
Antenna: Rohde & Schwarz HFH 2-Z2
Measurement distance: 3 m converted to 30 m
Mode: TX; RFID; 13.56 MHz
Test Date: 2018-01-22
Note:

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Frequency
13.56 MHz

Peak
18.2 dBµV/m

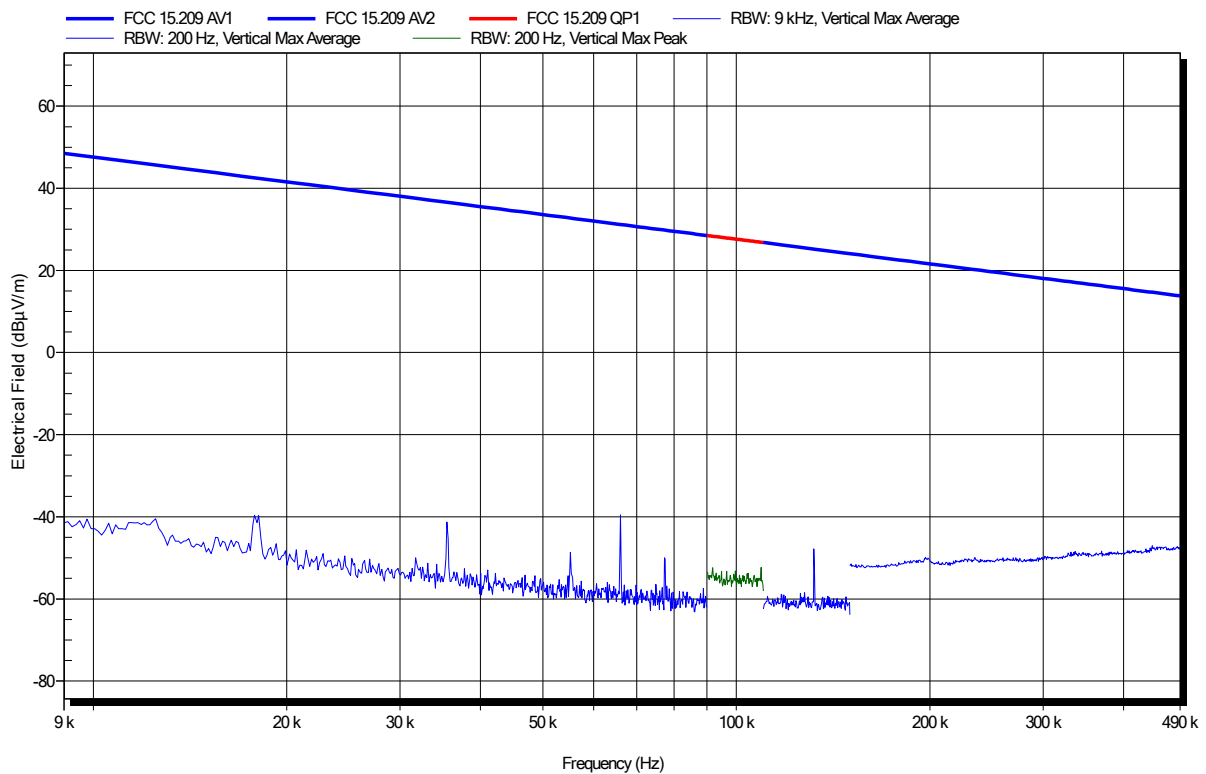
ANNEX B Transmitter radiated spurious emissions

Spurious emissions according to FCC 15.225

Project number: G0M-1705-6546

Applicant: Kubo Robot
EUT Name: 13.56 MHz RFID
Model: Kubo
Test Site: Eurofins Product Service GmbH
Operator: Mr. Al Jamal
Test Conditions: Tnom: 24.1°C, Vnom: 5.0 VDC (lithium battery)
Antenna: Rohde & Schwarz HFH 2-Z2
Measurement distance: 3 m converted to 300 m
Mode: TX; RFID; 13.56 MHz
Test Date: 2018-01-22
Note:

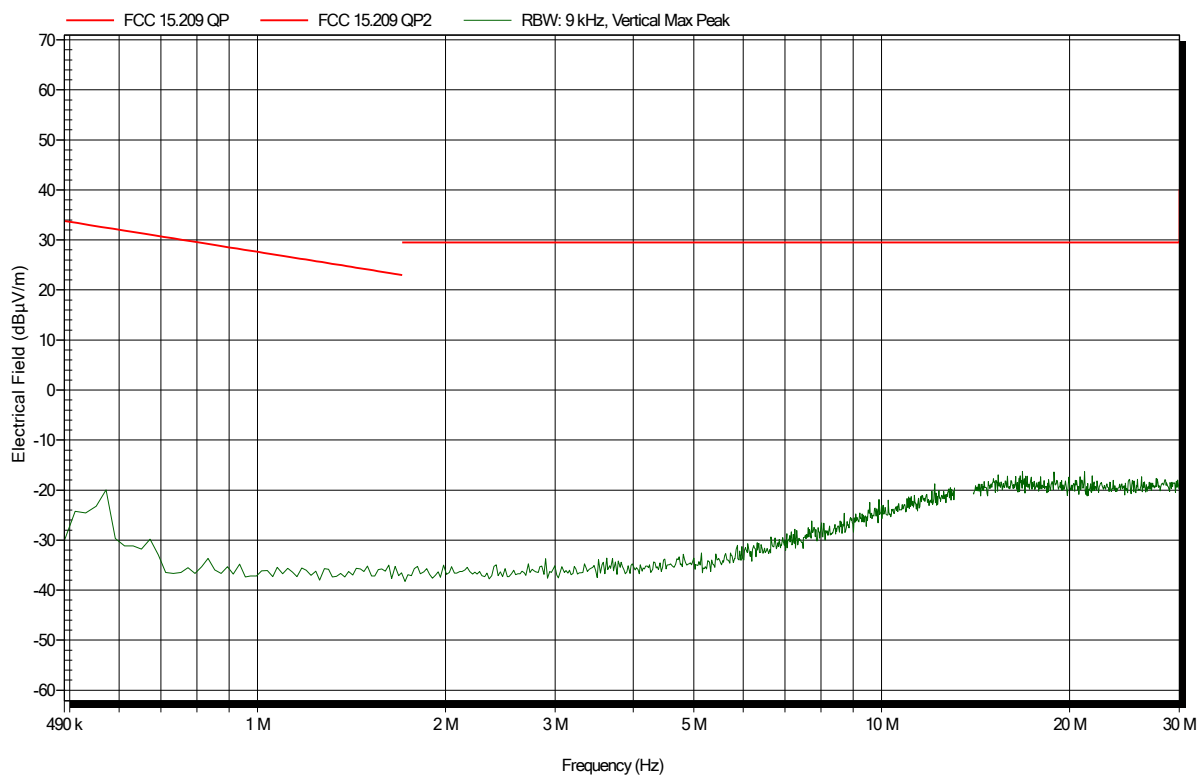
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Spurious emissions according to FCC 15.225

Project number: G0M-1705-6546
 Applicant: Kubo Robot
 EUT Name: 13.56 MHz RFID
 Model: Kubo
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Al Jamal
 Test Conditions: Tnom: 24.1°C, Vnom: 5.0 VDC (lithium battery)
 Antenna: Rohde & Schwarz HFH 2-Z2
 Measurement distance: 3 m converted to 30 m
 Mode: TX; RFID; 13.56 MHz
 Test Date: 2018-01-22
 Note:

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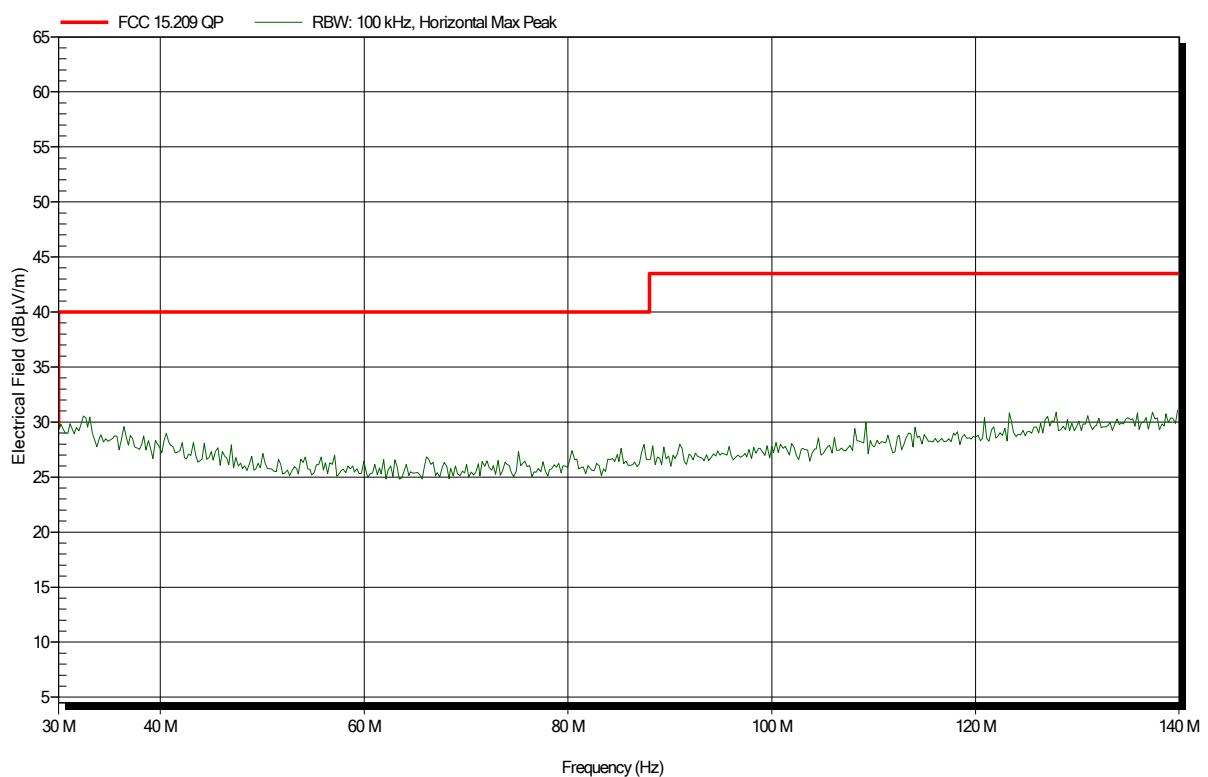


Spurious emissions according to FCC 15.225

Project number: G0M-1705-6546

Applicant: Kubo Robot
 EUT Name: 13.56 MHz RFID
 Model: Kubo
 Test Site: Eurofins Product Service GmbH
 Operator: Abdullah Al Jamal
 Test Conditions: Tnom: 24.2°C, Vnom: 5.0 VDC (lithium battery)
 Antenna: HK116, Horizontal
 Measurement distance: 3 m
 Mode: TX; RFID; 13.56 MHz
 Test Date: 2018-01-23
 Note:

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Spurious emissions according to FCC 15.225

Project number: G0M-1705-6546

Applicant: Kubo Robot
 EUT Name: 13.56 MHz RFID
 Model: Kubo
 Test Site: Eurofins Product Service GmbH
 Operator: Abdullah Al Jamal
 Test Conditions: Tnom: 24.2°C, Vnom: 5.0 VDC (lithium battery)
 Antenna: HK116, Horizontal
 Measurement distance: 3 m
 Mode: TX; RFID; 13.56 MHz
 Test Date: 2018-01-23
 Note:

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