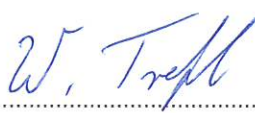


RADIO REPORT FCC 47 CFR Part 15C ISED Canada RSS-247 Frequency hopping systems operating within the 902.0 MHz - 928.0 MHz band	
Report Reference No	G0M-2201-1254-TFC247FH-V02
Testing Laboratory	Eurofins Product Service GmbH
Address	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation	    DAkkS - Registration number : D-PL-12092-01-03 (ISED) ISED Testing Laboratory site: 3470A DAkkS - Registration number : D-PL-12092-01-04 (FCC) FCC Filed Test Laboratory, Reg.-No.: 96970
Applicant	Nokeval Oy
Address	Rounionkatu 107 37150 Nokia Finland
Test Specification	47 CFR Part 15C RSS-247, Issue 2, 2017-02 RSS-Gen, Issue 5, Amendment 2, 2021-02
Non-Standard Test Method	None
Equipment under Test (EUT):	
Product Description	LoRaWAN temperature transmitter with external sensor
Model(s)	Flex2-Radio-LWNA
Additional Model(s)	None
Brand Name(s)	None
Hardware Version(s)	V1.0a
Software Version(s)	V1.1.06
FCC ID	2A3B4FLEX21
IC	28328-FLEX21
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 °C - 30 °C	
Test Lab Humidity	25 % - 55 %	
Date of receipt of test item	2022-02-24	
Report:		
Compiled by	Odai Qawasmeh	
Tested by (+ signature)	Odai Qawasmeh	
Supervised by (+ signature) (Responsible for Test)	Wilfried Treffke	
Approved by (+ signature) (Deputy Head of Lab)	Toralf Jahn	
Date of Issue	2022-06-21	
Total number of pages	57	
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:		

ADDITIONAL VARIANTS

Additional Variants (not tested and not evaluated variants)		
Not-tested Variant	Description	
1	Product Type Description	Measurement module for an external Pt100 temperature sensor
	Model name	Flex2-Module-CS
	Brand name	-
	Hardware Version	V1.2
	Software Version	V1.1
2	Product Type Description	Measurement module for an external Pt100 temperature sensor
	Model name	Flex2-Module-ES
	Brand name	-
	Hardware Version	V1.2
	Software Version	V1.1
3	Product Type Description	Measurement module for ambient temperature
	Model name	Flex2-Module-T
	Brand name	-
	Hardware Version	V1.2
	Software Version	V1.1
4	Product Type Description	Measurement module for ambient temperature and humidity
	Model name	Flex2-Module-T-RH
	Brand name	-
	Hardware Version	V1.2
	Software Version	V1.1
5	Product Type Description	Measurement module for ambient temperature and humidity with a Novasina probel
	Model name	Flex2-Module-nSens
	Brand name	-
	Hardware Version	V1.2
	Software Version	V1.1
Comment: Those named additional variants above have not been tested. Those additional variants of the series have been declared by the manufacturer. The test report explicitly states that those variants were neither tested nor assessed nor evaluated.		

VERSION HISTORY

Version History			
Version	Issue Date	Remarks	Revised By
01	2022-04-26	Initial Release	
02	2022-06-21	Replaced document: G0M-2201-1254-TFC247FH-V01 Replaced by: G0M-2201-1254-TFC247FH-V02 Reason: Reference to FCC and ISED module report has been added in section "Test Modes".	Odai Qawasmeh

ABBREVIATIONS AND ACRONYMS

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

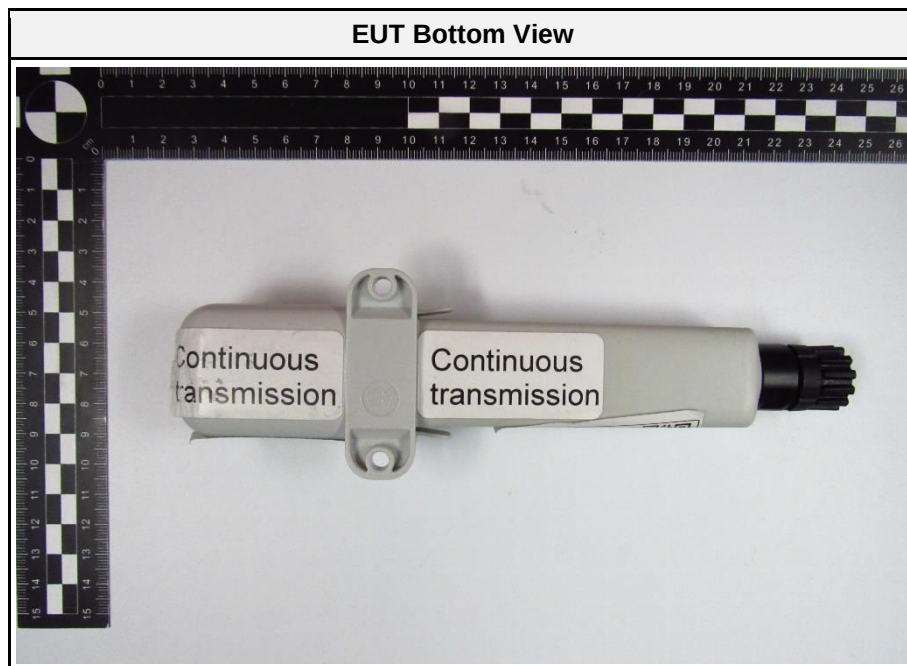
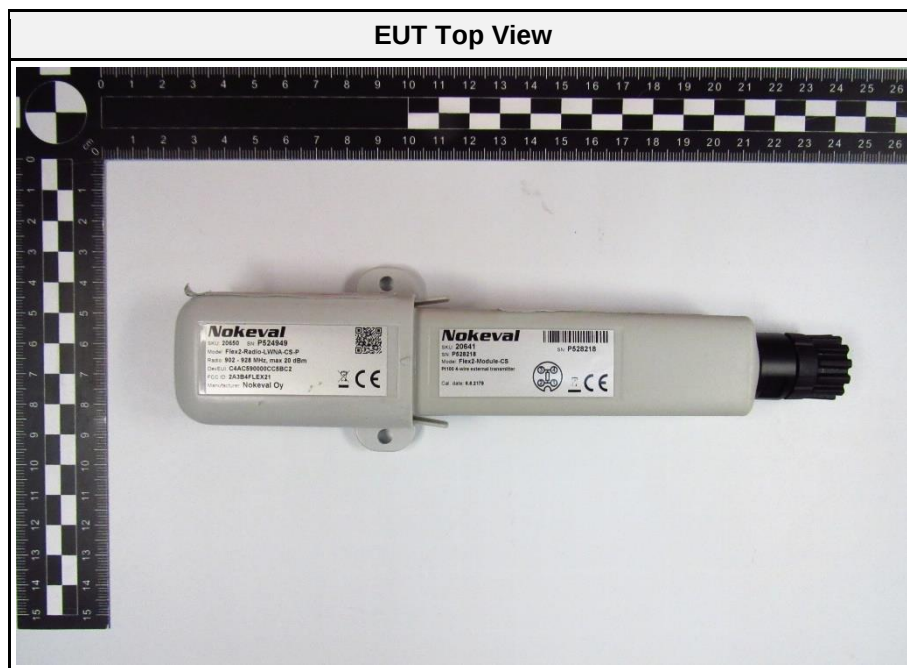
REPORT INDEX

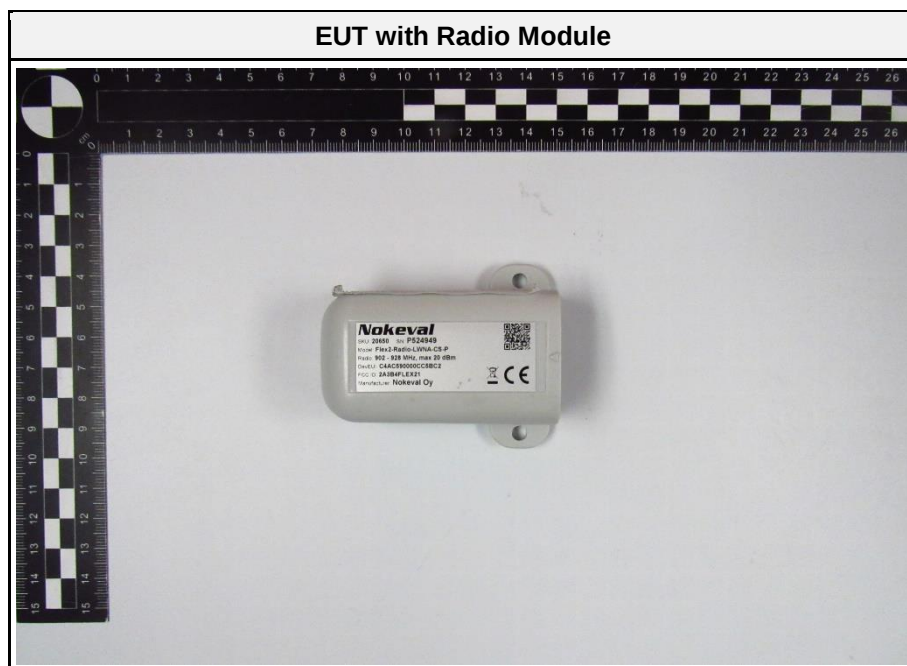
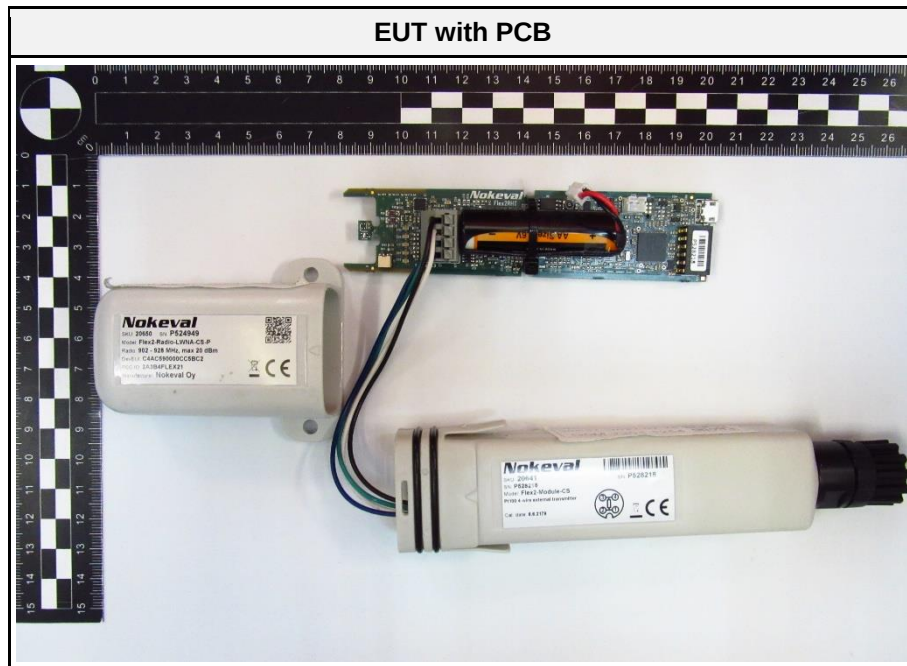
1	Equipment (Test Item) Under Test.....	7
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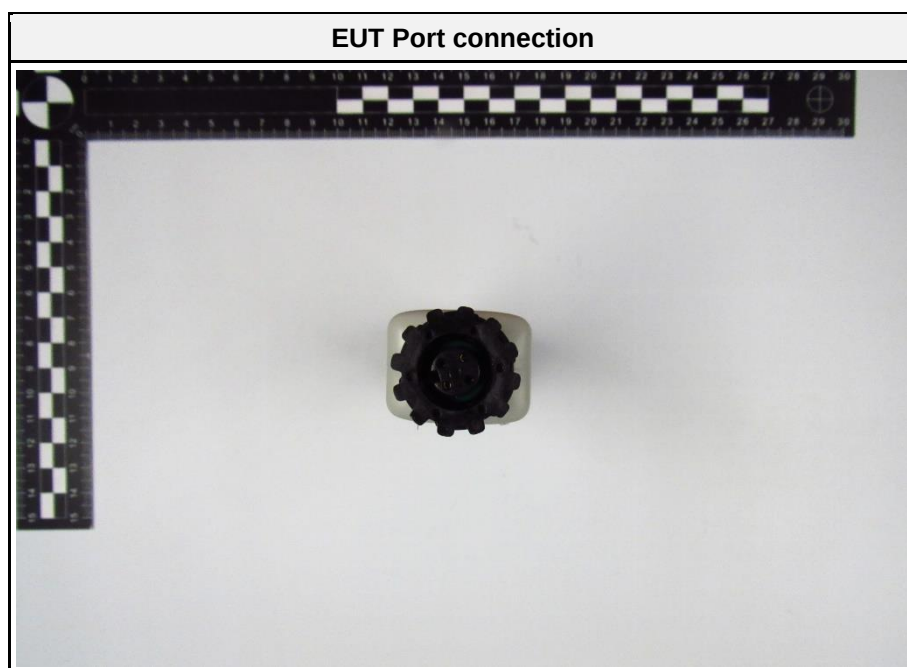
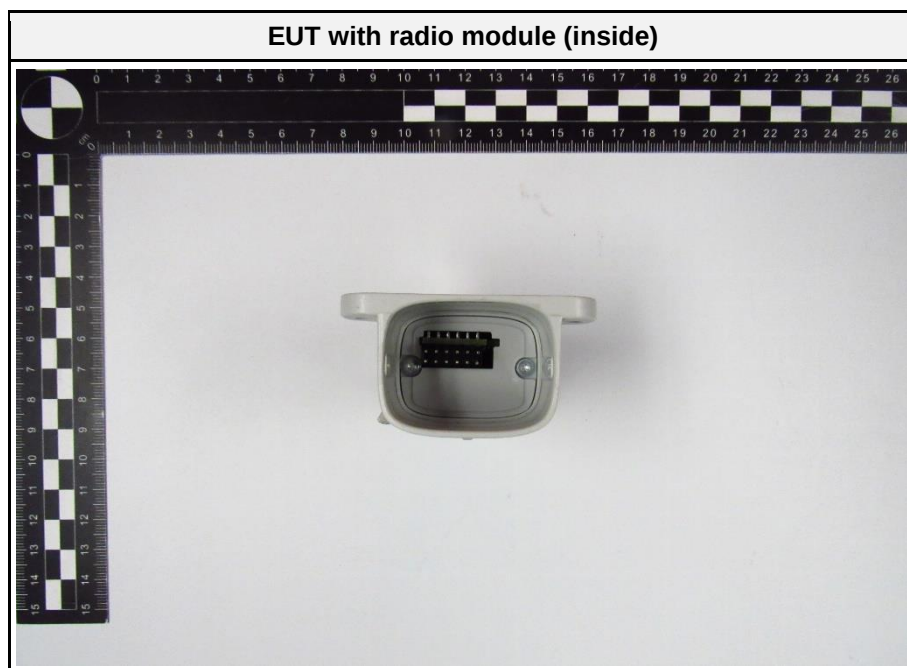
1 Equipment (Test Item) Under Test

Description	LoRaWAN temperature transmitter with external sensor	
Model	Flex2-Radio-LWNA	
Additional Model(s)	None	
Brand Name(s)	None	
Serial Number(s)	Prototype	Test Sample ID 38634
Hardware Version(s)	V1.0a	
Software Version(s)	V1.1.06	
PMN	Flex2-Radio-LWNA	
HVIN	Flex2-Radio-LWNA	
FVIN	V1.1.06	
HMN	N/A	
FCC ID	2A3B4FLEX21	
IC	28328-FLEX21	
Equipment type	End Product	
Radio type	Transceiver	
Assigned frequency bands	902.0 MHz - 928.0 MHz	
Radio technology	FHSS, DTS	
Modulation	LoRa (Chirp)	
Number of antenna ports	1	
Radio Module	Type	SRD
	Model	CMWX1ZZABZ-093
	Manufacturer	Murata
	HW Version	Not specified
	SW Version	1.1.03
Antenna	Type	Integrated
	Model	ANT-916-HETH
	Manufacturer	Linx Technologies
	Gain	0 dBi (declared by applicant)
Supply Voltage	V _{NOM}	3.6 VDC (Lithium thionyl chloride)
Operating Temperature	T _{NOM}	25 °C
Manufacturer	Nokeval Oy Rounionkatu 107 37150 Nokia Finland	

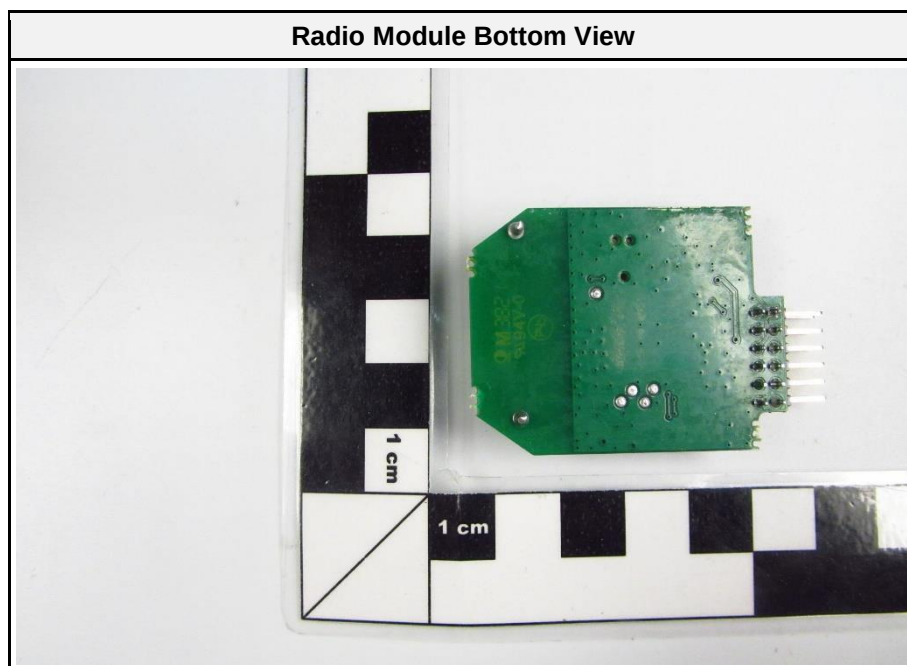
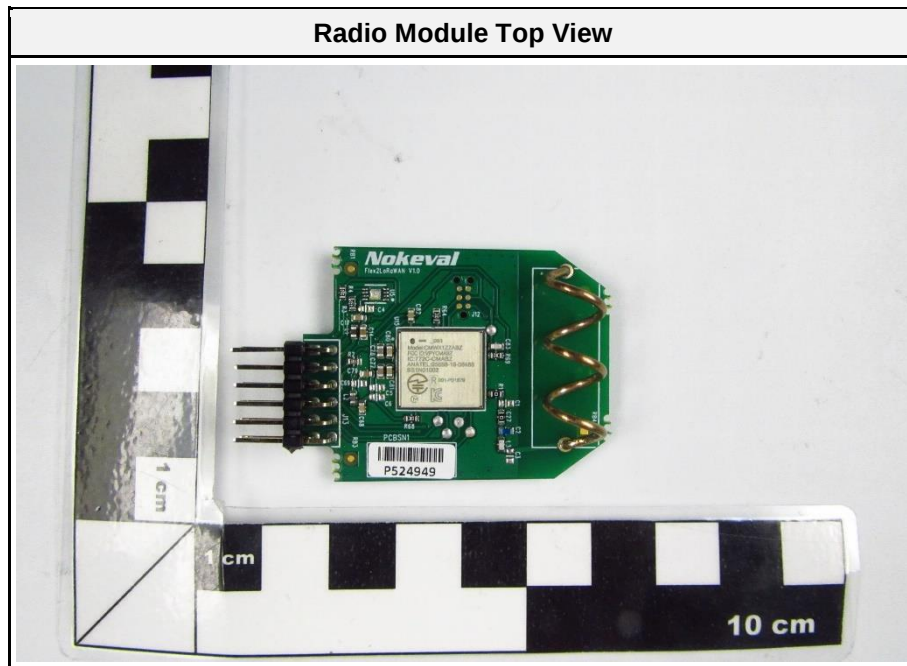
1.1 Photos – Equipment External







1.2 Photos – Equipment Internal



1.3 Support Equipment

Product Type	Device	Manufacturer	Model	Comment
AE	Notebook	-	-	For configuring test modes
SFT	-	Nokeval	MekuWin	For configuring test modes
CBL	PT100 Sensor	TC Direct	16-1-6.0-4-50-CE1	4-wire, 5m cable
Description:				
AE	Auxiliary Equipment			
SIM	Simulator			
CBL	Connecting Cable			
SFT	Software			
Comment:				

1.4 Test Modes

Mode	Description
Transmit FHSS 125 kHz	Mode = Transmit hopping mode Duty cycle = 100 % BW = 125 kHz SF = 10 CR = 1 Power = 20 dBm Paboost = enabled Interval = 0 Amount = 65535 Size = 255 LBT = None
Transmit DTS 500 kHz	Mode = Digital Transmission System Duty cycle = 100 % BW = 500 kHz SF = 12 CR = 1 Power = 20 dBm Paboost = enabled Interval = 0 Amount = 65535 Size = 255 LBT = None
Receive	Mode = Receive
Comment: Test mode and frequency selection is based on modular approval measurements of output power of all operational modes and channels. The operational modes with the highest output power were selected for compliance tests. Above worst case scenarios were found in module test report SDEM210200158201 from 2021-08-12 issued by SGS-CSTS Standards Technical Services (Shanghai) Co., Ltd.	

1.5 Test Frequencies

Designator	Mode 125 kHz	Channel	Frequency [MHz]
F1	Tx / Rx	0	902.3
F2	Tx / Rx	31	908.5
F3	Tx / Rx	63	914.9

Designator	Mode 500 kHz	Channel	Frequency [MHz]
F1	Tx / Rx	64	903
F2	Tx / Rx	67	907.8
F3	Tx / Rx	71	914.2

1.6 Sample emission level calculation

The following is a description of terms and a sample calculation, as appears in the radiated emissions data table. The numbers used in the calculation are for example only. There is no direct correlation to the specific data taken for the product described in this document:

Reading:

This is the reading obtained on the spectrum analyzer in dB μ V. Any external preamplifiers used are taken into account through internal analyzer settings.

A.F.:

This is the antenna factor for the receiving antenna. It is a conversion factor, which converts electric fields strengths to voltages, which can be measured directly on the spectrum analyzer. It is treated as a loss in dB. Cable losses have been included with the A.F. to simplify the calculations. The antenna factor is used in calculations as follows:

$$\text{Reading on Analyzer (dB}\mu\text{V)} + \text{A.F. (dB/m)} = \text{Net field strength (dB}\mu\text{V/m)}$$

Net:

This is the net field strength measurement (as shown above).

Limit:

This is the FCC Class B radiated emission limit (in units of dB μ V/m). The FCC limits are given in units of μ V/m. The following formula is used to convert the units of μ V/m to dB μ V/m:

$$\text{Limit (dB}\mu\text{V/m)} = 20 \cdot \log(\mu\text{V/m})$$

Margin:

This is the margin of compliance below the FCC limit. The units are given in dB. A negative margin indicates the emission was below the limit. A positive margin indicates that the emission exceeds the limit.

Example only:

Reading + AF	= Net Reading	:	Net reading - FCC limit	= Margin
+21.5 dB μ V + 26 dB/m	= 47.5 dB μ V/m	:	47.5 dB μ V/m - 57.0 dB μ V/m	= -9.5 dB

2 Result Summary

FCC 47 CFR Part 15C, ISED RSS-247				
Product Standard Reference	Requirement	Reference Method	Result	Remarks
ISED RSS-Gen, Issue 5 A2 (section 6.7)	Occupied Bandwidth	ANSI C63.10-2013	N/R	Informational only
FCC § 15.247(a)(1) ISED RSS-247 § 5.1 Issue 2	20 dB Bandwidth	ANSI C63.10-2013	N/T	
FCC § 15.247(a)(1)(i) ISED RSS-247, Issue 2 (section 5.1)	Number of hopping frequencies	ANSI C63.10-2013	N/T	
FCC § 15.247(a)(1) ISED RSS-247, Issue 2 (section 5.1)	Frequency hopping channel separation	ANSI C63.10-2013	N/T	
FCC § 15.247(a)(1)(i) ISED RSS-247, Issue 2 (section 5.1)	Time of occupancy (Dwell time)	ANSI C63.10-2013	N/T	
FCC § 15.247(b) ISED RSS-247, Issue 2 (section 5.4)	Maximum peak conducted power	ANSI C63.10-2013	N/T	
FCC § 15.207 ISED RSS-247, Issue 2 (section 3.1)	AC power line conducted emissions	ANSI C63.10-2013	N/R	
FCC § 15.247(d) ISED RSS-247, Issue 2 (section 5.5)	Band edge compliance	ANSI C63.10-2013	N/T	
FCC § 15.247(d) ISED RSS-247, Issue 2 (section 5.5)	Conducted spurious emissions	ANSI C63.10-2013	N/T	
FCC § 15.247(d) FCC § 15.209 ISED RSS-Gen, Issue 5 A2 (section 6.13)	Transmitter radiated spurious emissions	ANSI C63.10-2013	PASS	
ISED RSS-247, Issue 2 (section 3.1)	Receiver radiated spurious emissions	ANSI C63.4-2014	PASS	
Comment:				

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 - Transmitter radiated emissions

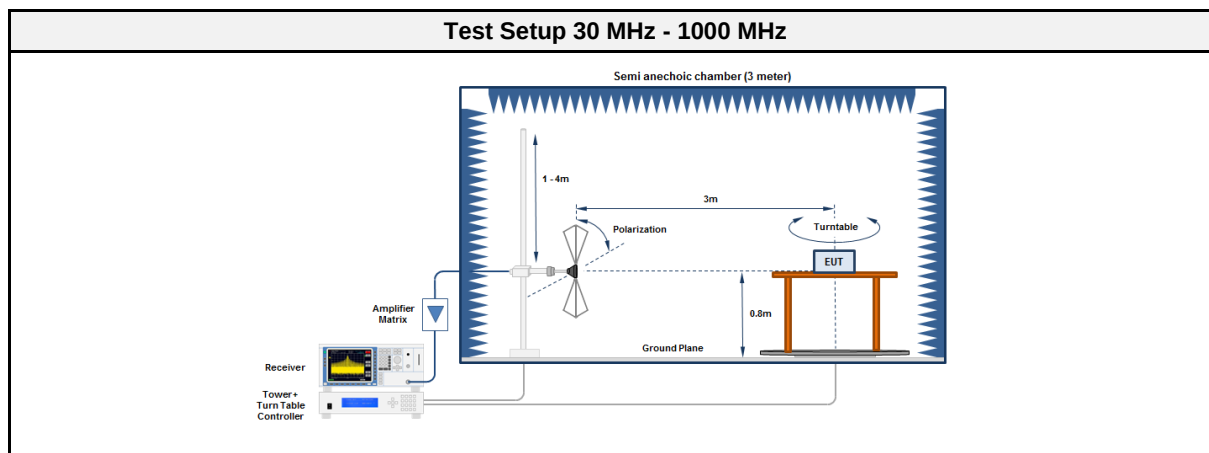
3.1.1 Information

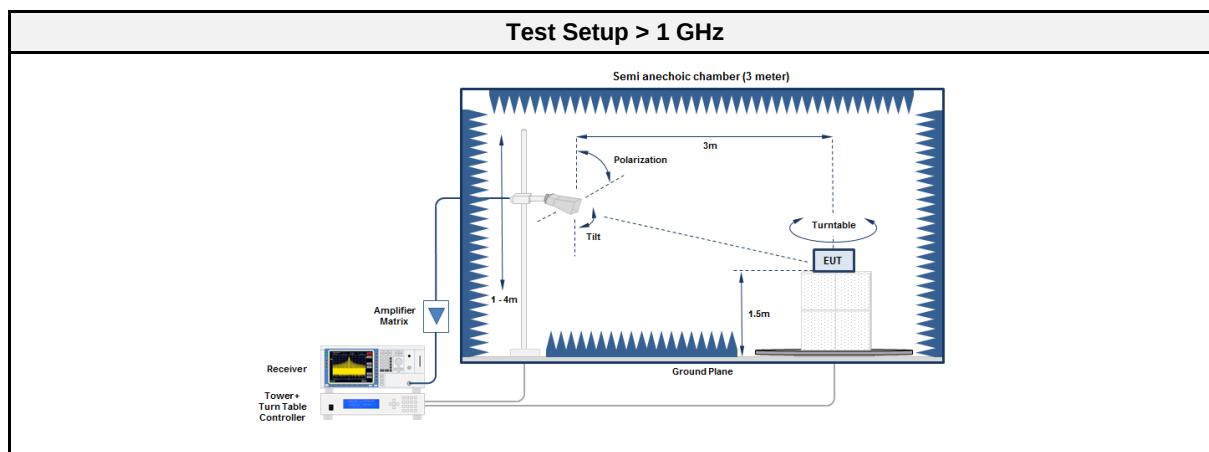
Test Information	
Reference	FCC § 15.247(d); FCC § 15.209; ISSED RSS-Gen, Issue 5 A2 (section 6.13)
Measurement Uncertainty	± 5.95 dB
Measurement Method	ANSI C63.10 6.4, 6.5, 6.6, 11.12
Operator	Odai Qawasmeh
Date	2022-03-02

3.1.2 Limits

Limits			
Frequency range [MHz]	Detector	Field strength [µV/m]	Measurement distance [m]
0.009 - 0.09	Average	2400/F[kHz]	300
0.09 - 0.110	Quasi-Peak	2400/F[kHz]	300
0.110 - 0.490	Average	2400/F[kHz]	300
0.490 - 1.705	Quasi-Peak	24000/F[kHz]	30
1.705 - 30.0	Quasi-Peak	30	30
30 - 88	Quasi-Peak	100	3
88 - 216	Quasi-Peak	150	3
216 - 960	Quasi-Peak	200	3
960 - 1000	Quasi-Peak	500	3
>1000	Average	500	3

3.1.3 Setup





3.1.4 Equipment

Test Software			
Description	Manufacturer	Name	Version
EMC Software	DARE Instruments	RadiMation	2020.1.8

Test Equipment 30 MHz - 1000 MHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2021-02	2024-02
Measurement Receiver	Agilent	N9038A-526/WXP	EF01070	2021-07	2022-07
Antenna	R&S	HK 116	EF00030	2021-05	2024-05
Antenna	R&S	HL 223	EF00212	2019-05	2022-05

Test Equipment > 1 GHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic chamber	Frankonia	AC 2	EF01616	2021-09	2022-09
Spectrum analyzer	R&S	FSU43	EF01631	2021-07	2022-07
Horn antenna	Schwarzbeck	BBHA 9120B	EF01678	2021-03	2022-03
Horn Antenna	Schwarzbeck	HWRD 650	EF01679	2021-03	2022-03

3.1.5 Procedure

Test Procedure 30 MHz - 1000 MHz	
1. EUT is placed on a non conducting support at the center of a turn table 0.8 m above the ground 2. EUT set to test mode 3. The receiver is set to peak detection with max hold 4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m 5. All significant emissions are measured again using the corresponding final detector	

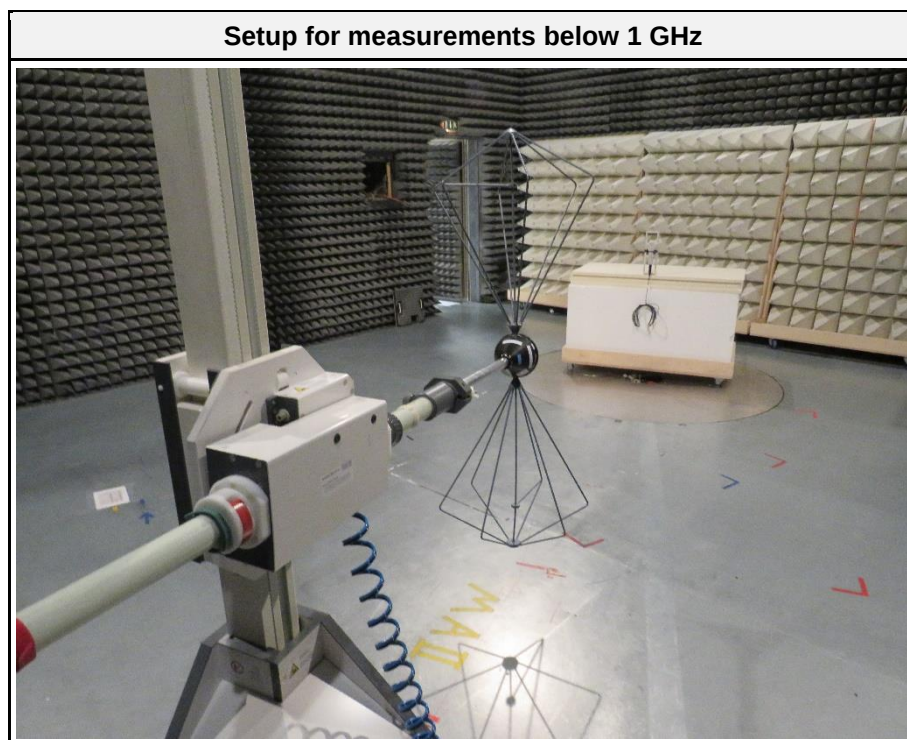
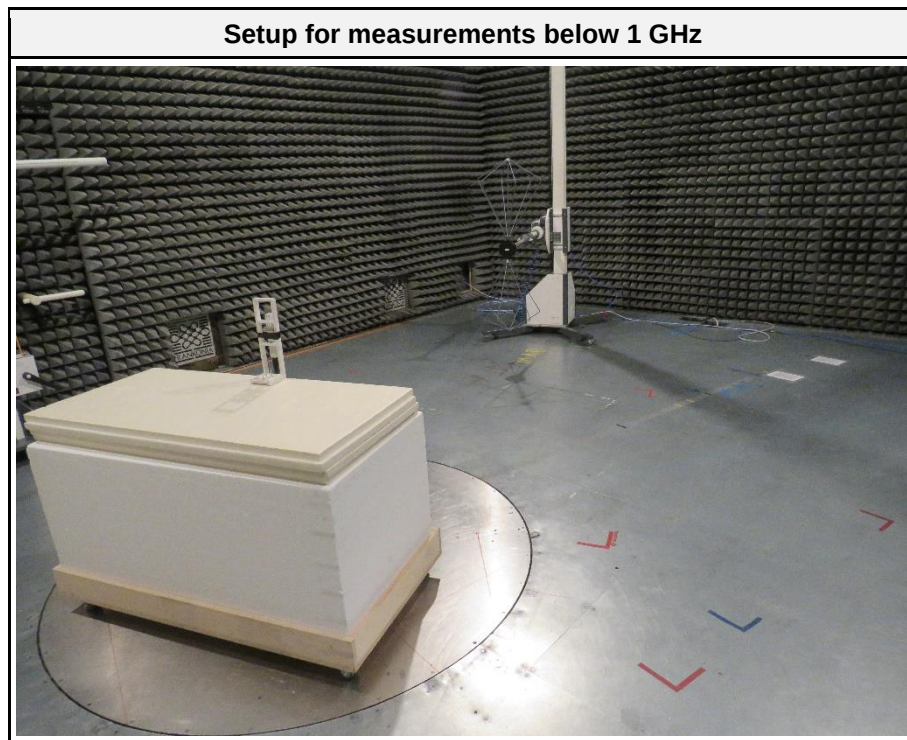
Test Procedure > 1 GHz	
1. EUT is placed on a non conducting support at the center of a turn table 1.5 m above the ground 2. EUT set to test mode 3. The receiver is set to peak detection with max hold 4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m 5. All significant emissions are measured again using the corresponding final detector	

3.1.6 Results

Test Results (DTS 500 kHz)						
Channel [MHz]	Emission [MHz]	Level [dBμV/m]	Det.	Pol.	Limit [dBμV/m]	Margin [dB]
903	2709.5	43.64	pk	ver	74.00	-30.36
903	2709.5	42.30	avg	ver	54.00	-11.70
907.8	2724	44.43	pk	ver	74.00	-29.57
907.8	2724	42.58	avg	ver	54.00	-11.42
907.8	8169	38.62	pk	ver	74.00	-35.38
907.8	8169	34.20	avg	ver	54.00	-19.80
914.2	137.9628	18.20	pk	ver	43.50	-25.27
914.2	2742.9	48.97	pk	ver	74.00	-25.03
914.2	2742.9	47.67	avg	ver	54.00	-06.33
914.2	8227	40.26	pk	ver	74.00	-33.74
914.2	8227	36.25	avg	ver	54.00	-17.75

Test Results (FHSS 125 kHz)						
Channel [MHz]	Emission [MHz]	Level [dBμV/m]	Det.	Pol.	Limit [dBμV/m]	Margin [dB]
902.3	611.4422	34.30	pk	ver	46.00	-11.73
902.3	988.6258	41.40	pk	ver	54.00	-12.64
902.3	2707	44.22	pk	ver	74.00	-29.78
902.3	2707	42.57	avg	ver	54.00	-11.43
902.3	4511.5	42.25	pk	ver	74.00	-31.75
902.3	4511.5	39.88	avg	ver	54.00	-14.12
908.5	611.021	34.10	pk	ver	46.00	-11.95
908.5	993.7	42.40	pk	ver	54.00	-11.65
908.5	2725.6	45.46	pk	ver	74.00	-28.54
908.5	2725.6	44.12	avg	ver	54.00	-09.88
914.9	613.0919	35.50	pk	ver	46.00	-10.47
914.9	994.2472	41.90	pk	ver	54.00	-12.07
914.9	2744.7	48.62	pk	ver	74.00	-25.38
914.9	2744.7	47.65	avg	ver	54.00	-06.35

3.1.7 Setup Photos



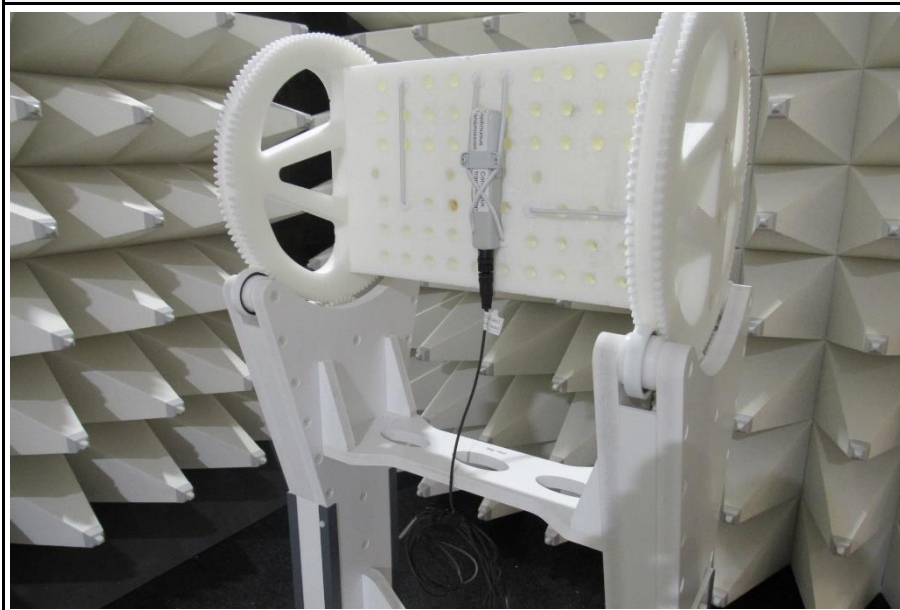
EUT Setup



Setup for measurements above 1 GHz



EUT Setup



3.2 Test Conditions and Results - Receiver radiated emissions

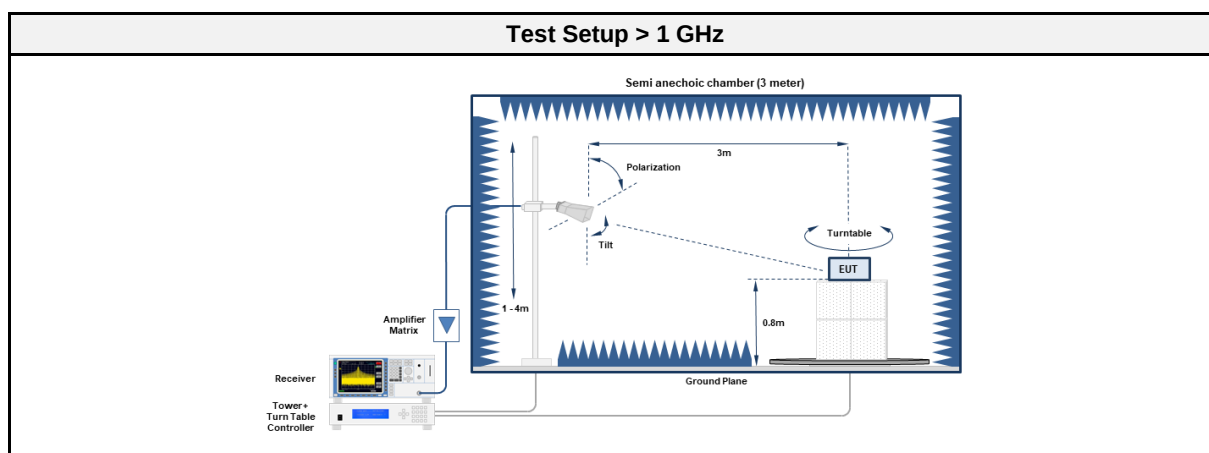
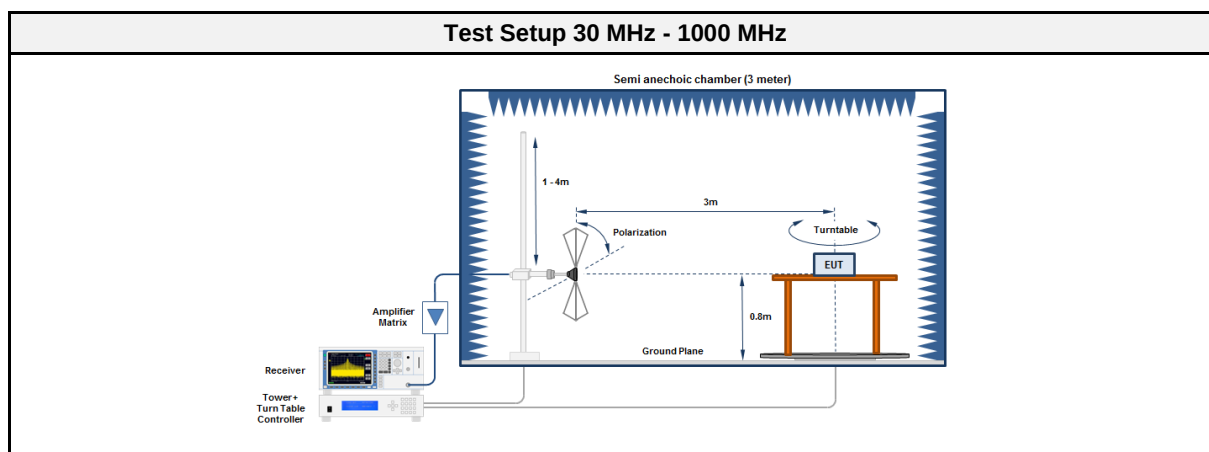
3.2.1 Information

Test Information	
Reference	ISED RSS-247, Issue 2 (section 3.1)
Measurement Uncertainty	± 5.95 dB
Measurement Method	ANSI C63.4-2014 8.1-8.3
Operator	Odai Qawasmeh
Date	2022-03-16

3.2.2 Limits

Limits			
Frequency range [MHz]	Detector	Field strength [$\mu\text{V/m}$]	Measurement distance [m]
30 - 88	Quasi-Peak	100	3
88 - 216	Quasi-Peak	150	3
216 - 960	Quasi-Peak	200	3
960 - 1000	Quasi-Peak	500	3
>1000	Average	500	3

3.2.3 Setup



3.2.4 Equipment

Test Software			
Description	Manufacturer	Name	Version
EMC Software	DARE Instruments	RadiMation	2020.1.8

Test Equipment 30 MHz - 1000 MHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2021-02	2024-02
Measurement Receiver	Agilent	N9038A-526/WXP	EF01070	2021-07	2022-07
Antenna	R&S	HK 116	EF00030	2021-05	2024-05
Antenna	R&S	HL 223	EF00212	2019-05	2022-05

Test Equipment > 1 GHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2021-02	2024-02
Measurement Receiver	Agilent	N9038A-526/WXP	EF01070	2021-07	2022-07
Horn antenna	Schwarzbeck	BBHA 9120B	EF01678	2021-03	2022-03

3.2.5 Procedure

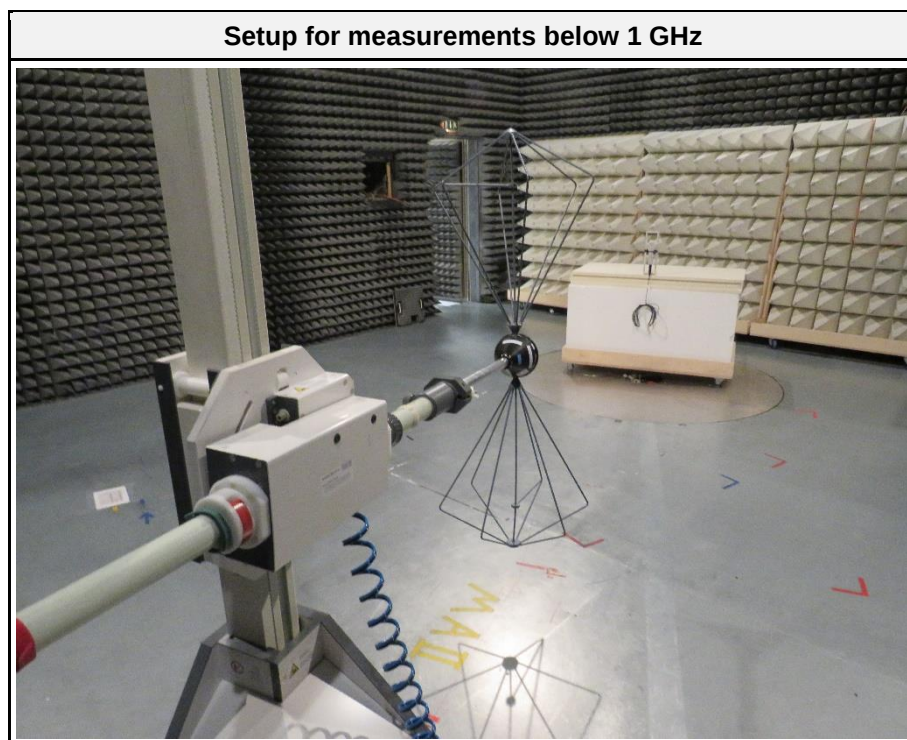
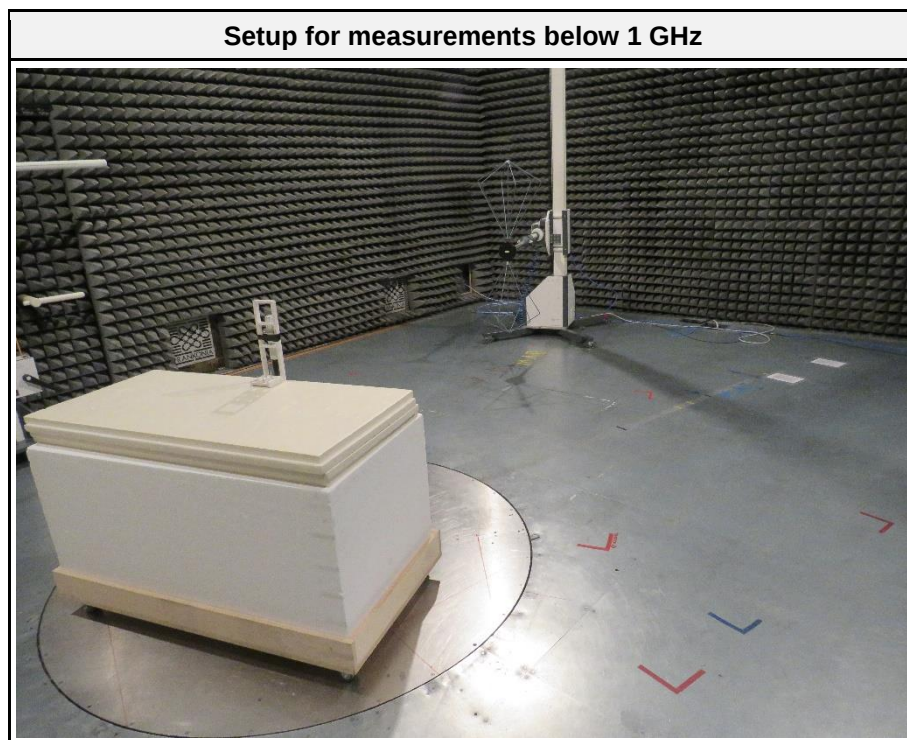
Test Procedure	
- EUT is placed on a non conducting support at the center of a turn table 0.8 m above the ground - EUT is set to test mode - The receiver is set to peak detection with max hold - The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m - All significant emissions are measured again using the corresponding final detector	

3.2.6 Results

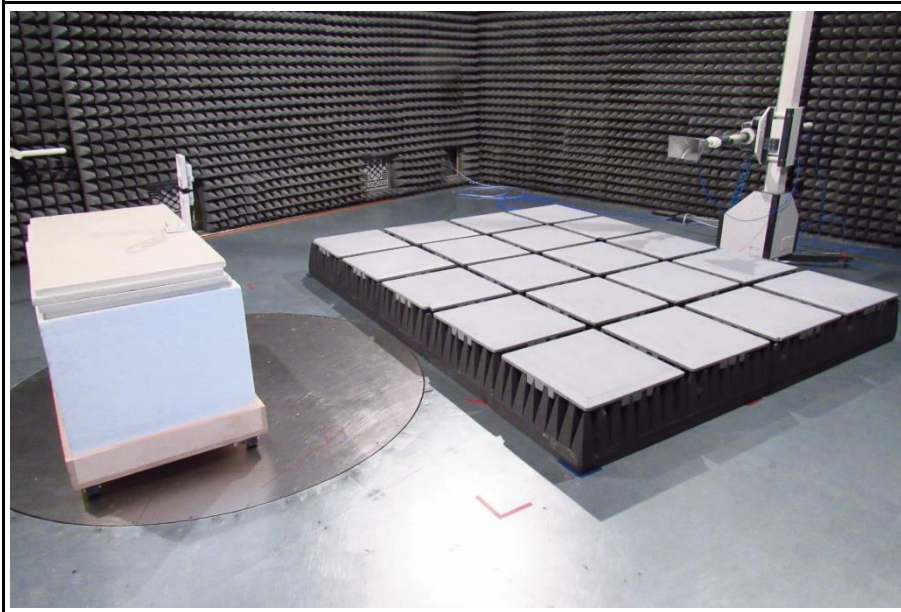
Test Results (DTS 500 kHz)						
Channel [MHz]	Emission [MHz]	Level [dBμV/m]	Det.	Pol.	Limit [dBμV/m]	Margin [dB]
907.8	152.8718	25.30	pk	ver	43.50	-18.20

Test Results (FHSS 125 kHz)						
Channel [MHz]	Emission [MHz]	Level [dBμV/m]	Det.	Pol.	Limit [dBμV/m]	Margin [dB]
No significant emissions detected.						

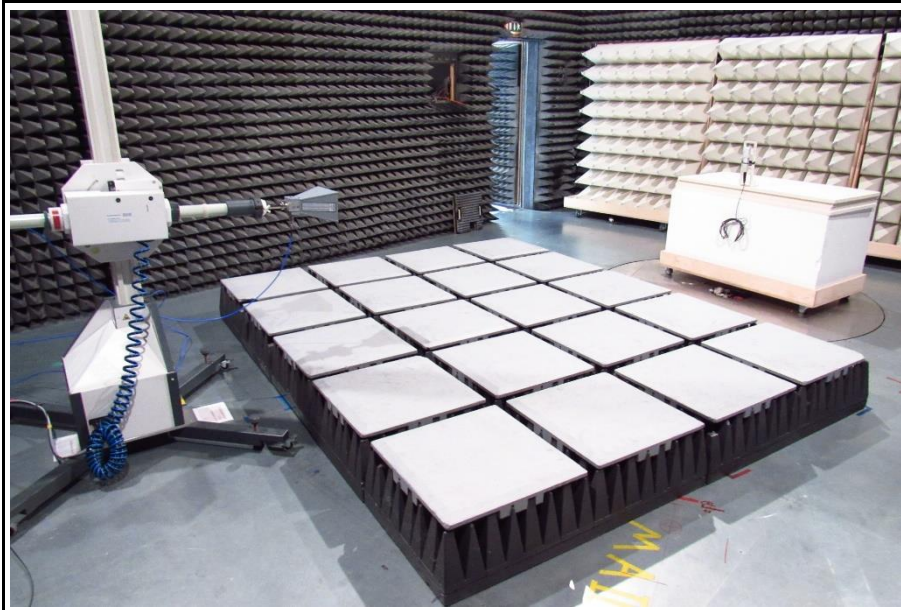
3.2.7 Setup Photos



Setup for measurements above 1 GHz



Setup for measurements above 1 GHz



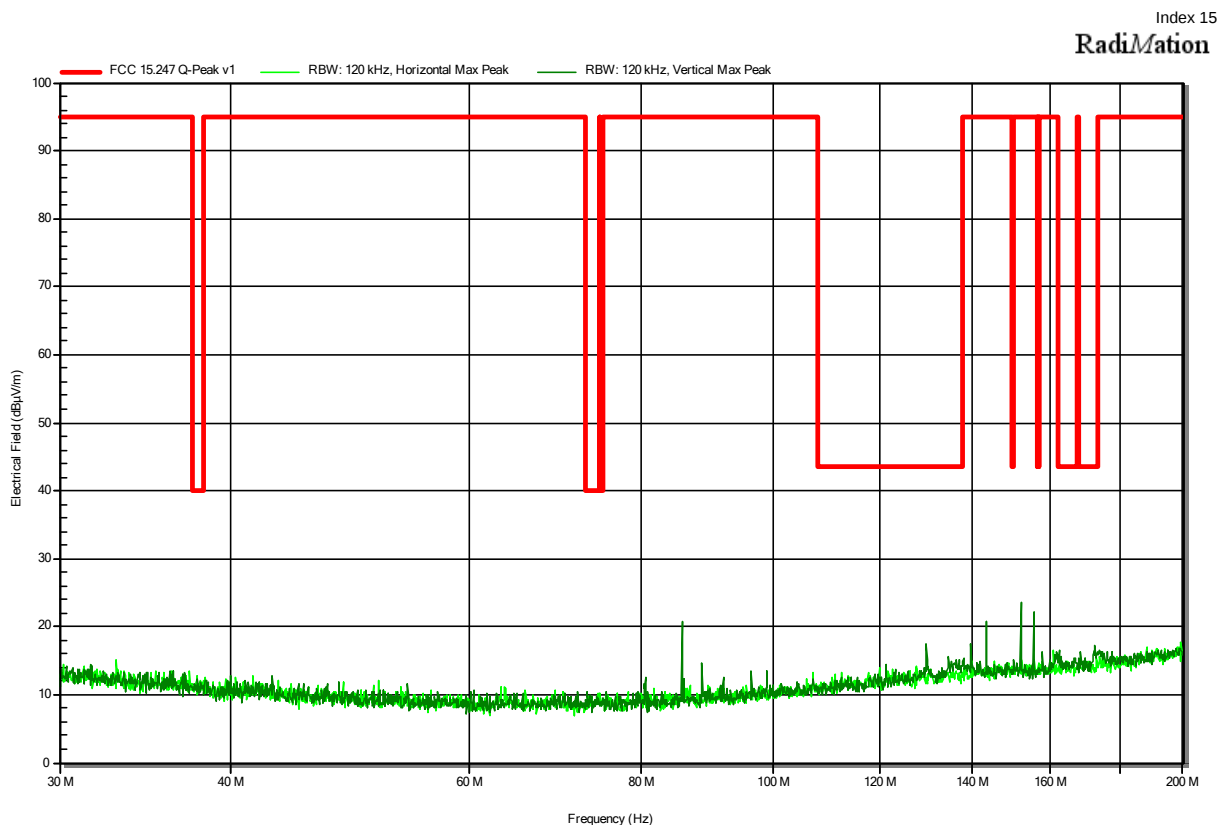
EUT Setup



ANNEX A Transmitter spurious emissions

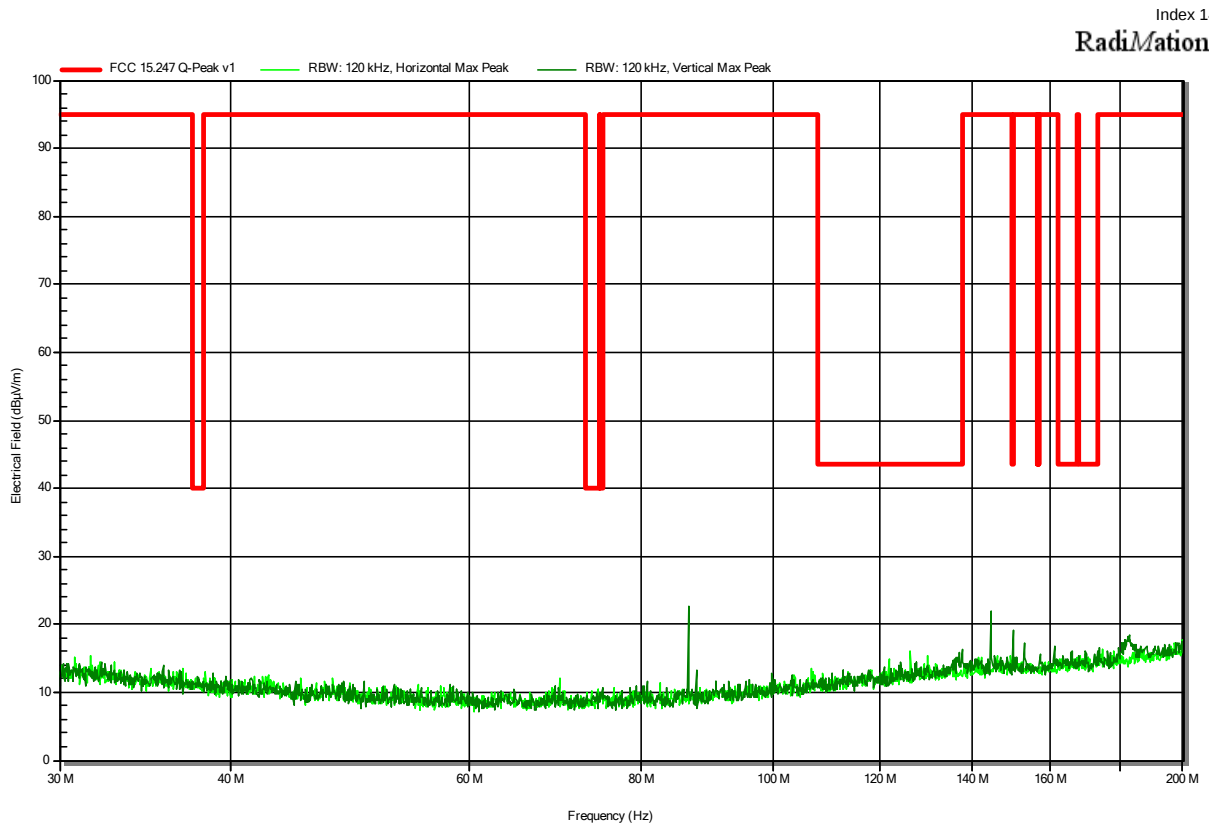
Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 20 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Rohde & Schwarz HK 116
 Measurement distance: 3 m
 Mode: Tx; LORA; 500 kHz; SF 12; 20 dBm; 903 MHz
 Test Date: 2022-03-15
 Note: EUT vertical



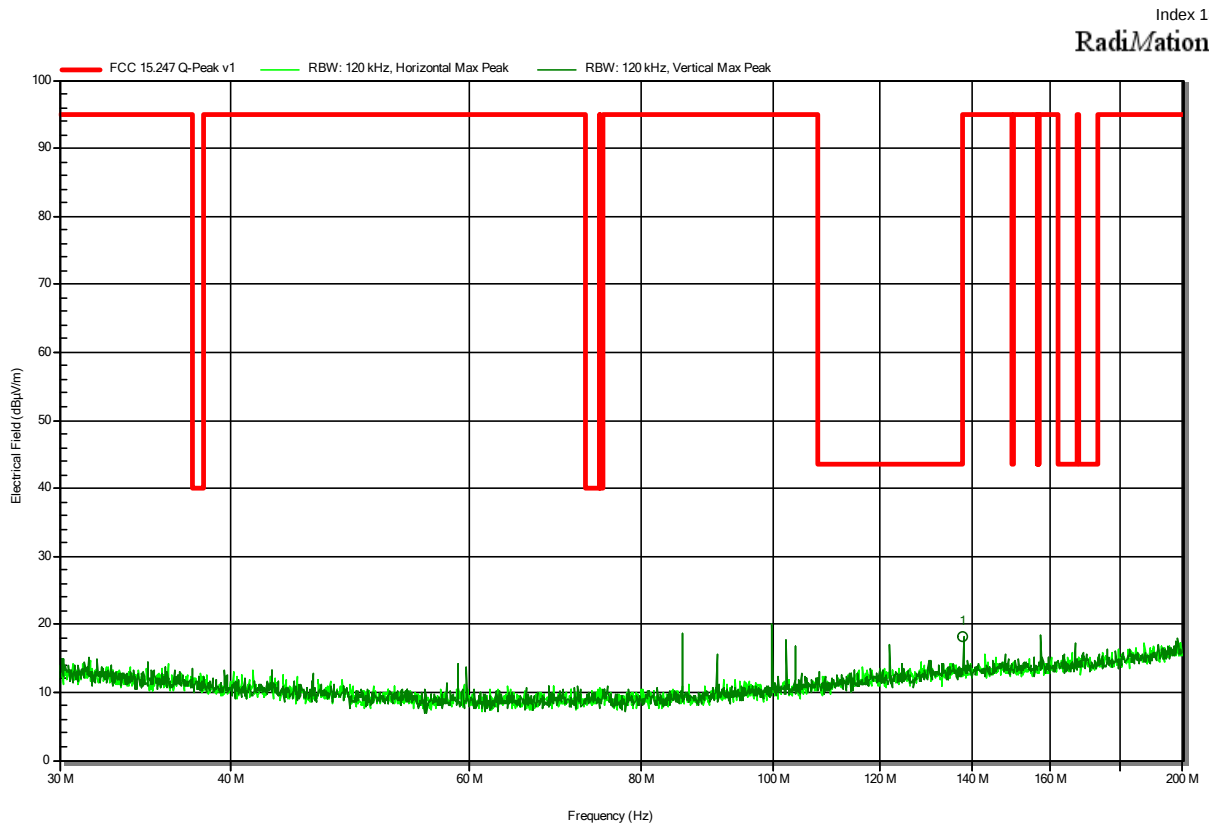
Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 20 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Rohde & Schwarz HK 116
 Measurement distance: 3 m
 Mode: Tx; LORA; 500 kHz; SF 12; 20 dBm; 907.8 MHz
 Test Date: 2022-03-15
 Note: EUT vertical



Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 20 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Rohde & Schwarz HK 116
 Measurement distance: 3 m
 Mode: Tx; LORA; 500 kHz; SF 12; 20 dBm; 914.2 MHz
 Test Date: 2022-03-15
 Note: EUT vertical



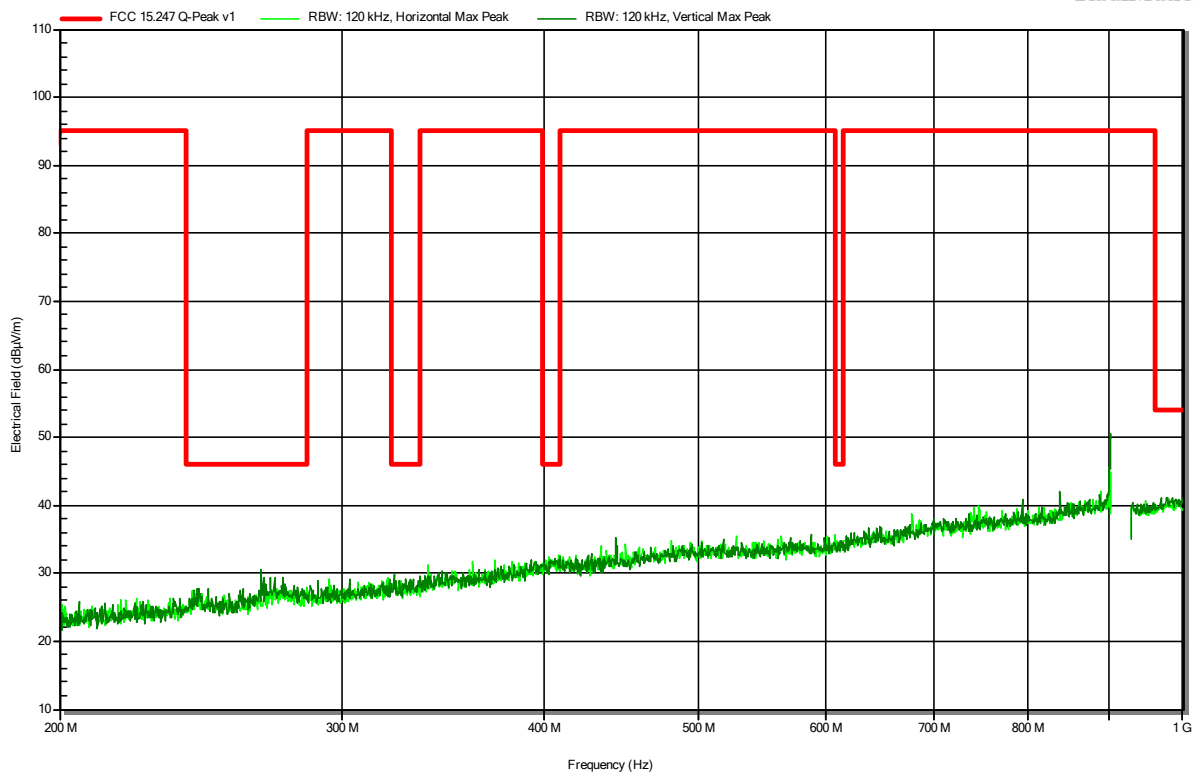
Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Polarization
137.9628 MHz	18.2 dBµV/m	43.5 dBµV/m	-25.27 dB	Pass	Vertical

Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 20 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Rohde & Schwarz HL 223
 Measurement distance: 3 m
 Mode: Tx; LORA; 500 kHz; SF 12; 20 dBm; 903 MHz
 Test Date: 2022-03-15
 Note: EUT vertical

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RadiMation

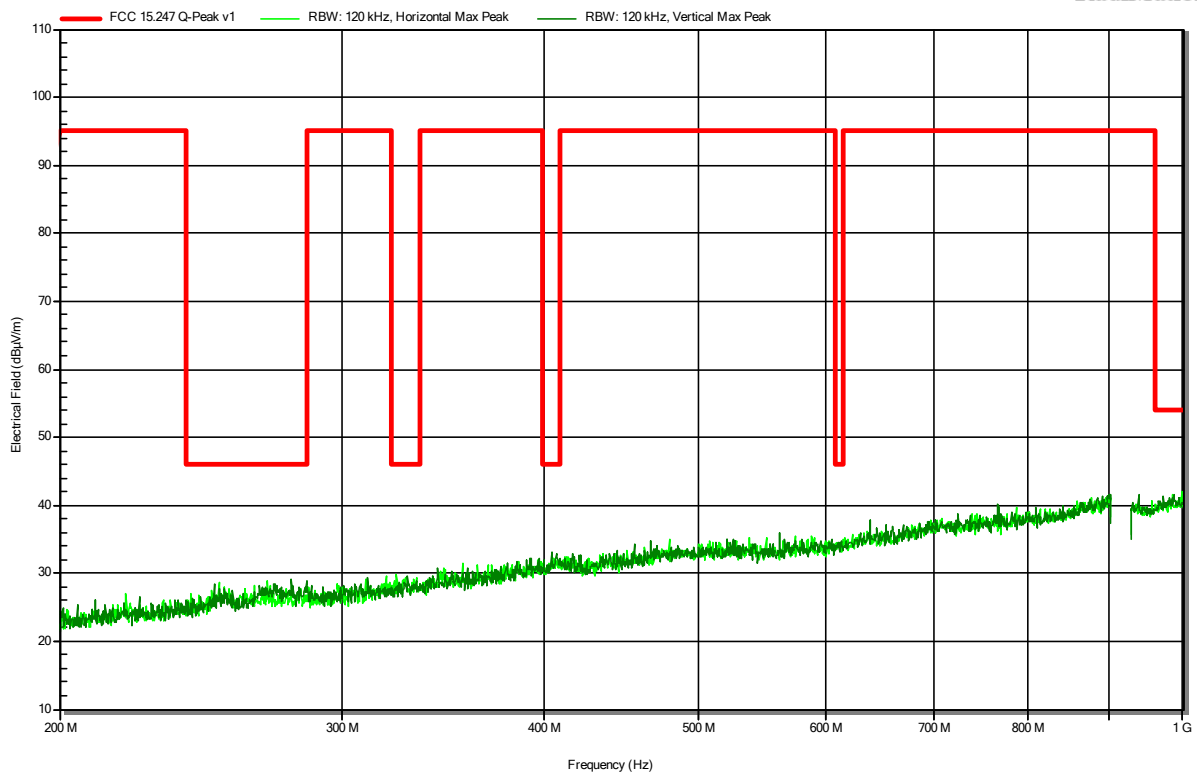


Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 20 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Rohde & Schwarz HL 223
 Measurement distance: 3 m
 Mode: Tx; LORA; 500 kHz; SF 12; 20 dBm; 907.8 MHz
 Test Date: 2022-03-15
 Note: EUT vertical

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RadiMation

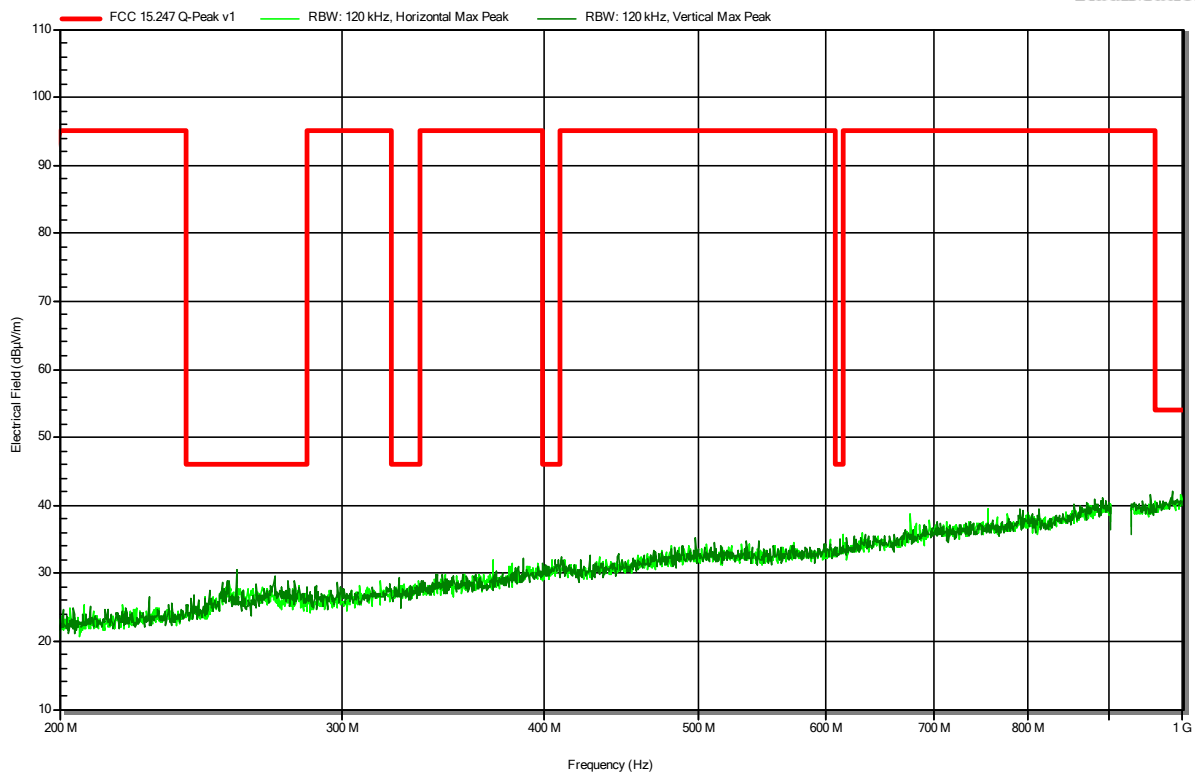


Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 20 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Rohde & Schwarz HL 223
 Measurement distance: 3 m
 Mode: Tx; LORA; 500 kHz; SF 12; 20 dBm; 914.2 MHz
 Test Date: 2022-03-15
 Note: EUT vertical

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RadiMation

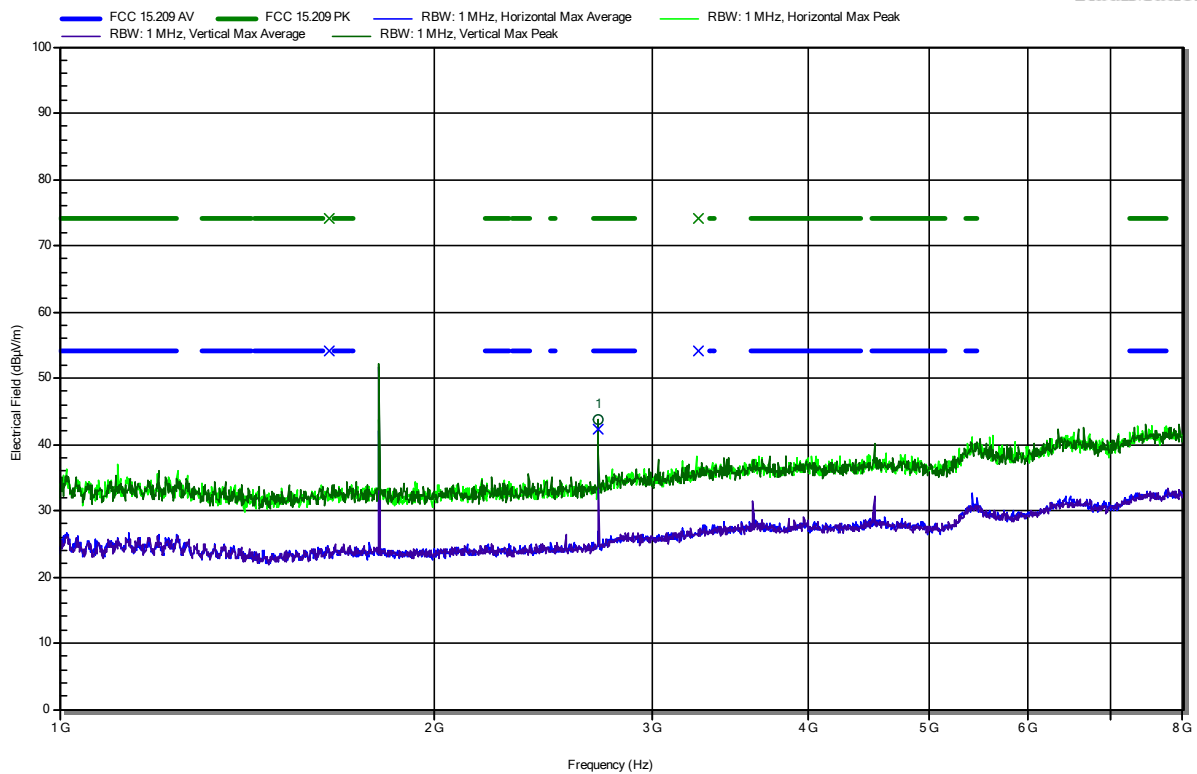


Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mrs Hoang
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 24 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Schwarzbeck BBHA 9120B
 Measurement distance: 3 m
 Mode: Tx; LORA; 500 kHz; SF 12; 20 dBm; 903 MHz
 Test Date: 2022-03-03
 Note: EUT vertical

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RadiMation



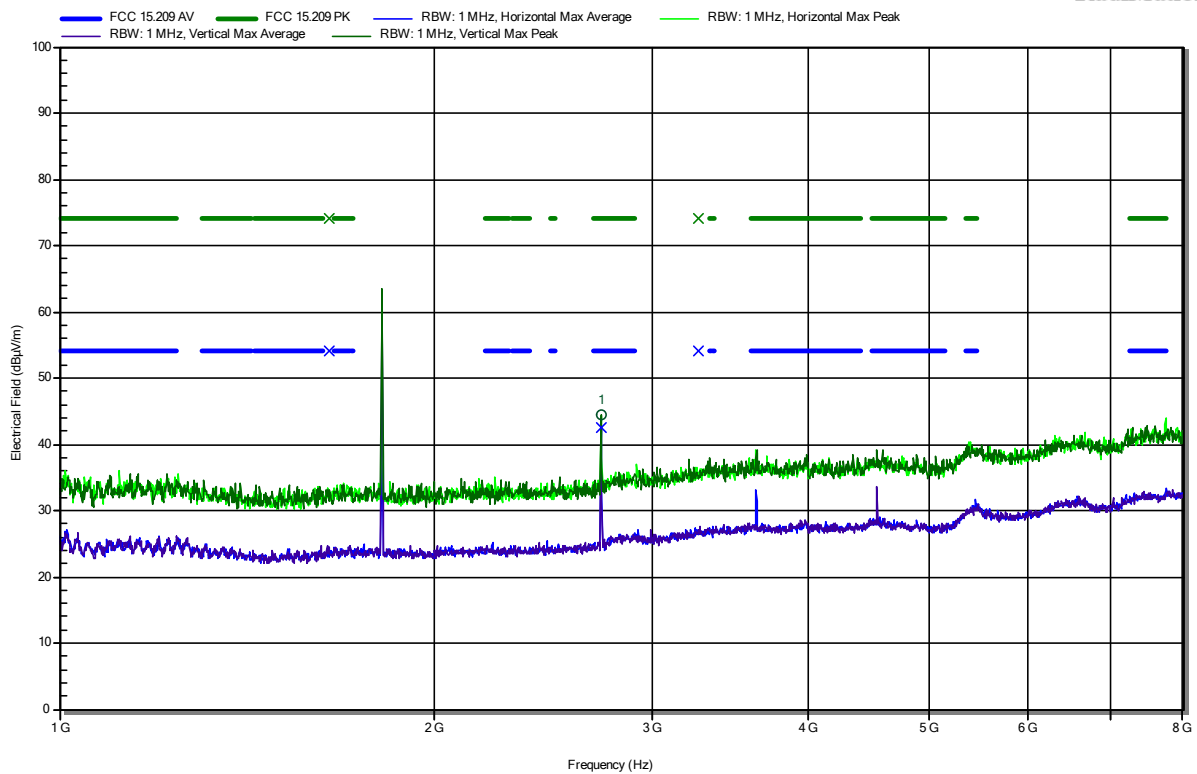
Frequency 2.7095 GHz	Peak 43.64 dBμV/m	Peak Limit 74 dBμV/m	Peak Difference -30.36 dB	Peak Status Pass	Polarization Vertical
Frequency 2.7095 GHz	Average 42.3 dBμV/m	Average Limit 54 dBμV/m	Average Difference -11.7 dB	Average Status Pass	Polarization Vertical

Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mrs Hoang
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 24 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Schwarzbeck BBHA 9120B
 Measurement distance: 3 m
 Mode: Tx; LORA; 500 kHz; SF 12; 20 dBm; 907.8 MHz
 Test Date: 2022-03-03
 Note: EUT vertical

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Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Polarization
2.724 GHz	44.43 dBV/m	74 dBV/m	-29.57 dB	Pass	Vertical
Frequency	Average	Average Limit	Average Difference	Average Status	Polarization
2.724 GHz	42.58 dBV/m	54 dBV/m	-11.42 dB	Pass	Vertical

Test Report No.: G0M-2201-1254-TFC247FH-V02

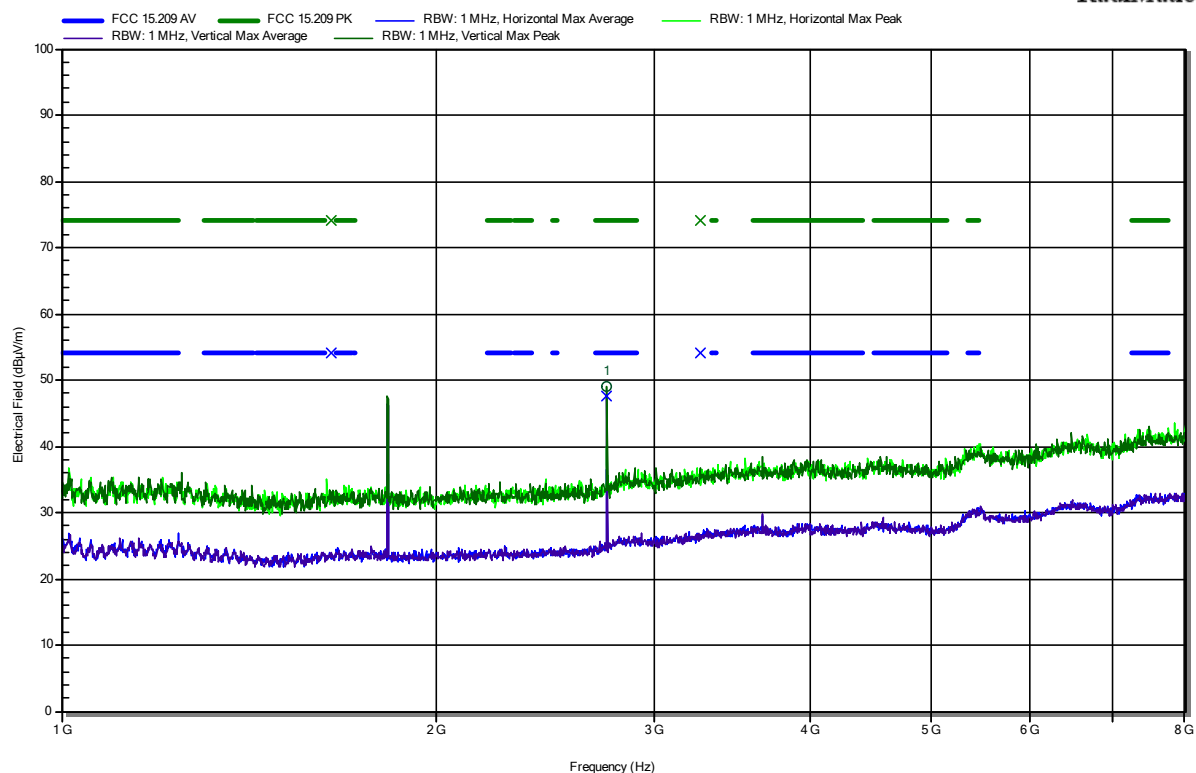
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mrs Hoang
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 24 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Schwarzbeck BBHA 9120B
 Measurement distance: 3 m
 Mode: Tx; LORA; 500 kHz; SF 12; 20 dBm; 914.2 MHz
 Test Date: 2022-03-02
 Note: EUT vertical

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Frequency 2.7429 GHz	Peak 48.97 dBV/m	Peak Limit 74 dBV/m	Peak Difference -25.03 dB	Peak Status Pass	Polarization Vertical
Frequency 2.7429 GHz	Average 47.67 dBV/m	Average Limit 54 dBV/m	Average Difference -6.33 dB	Average Status Pass	Polarization Vertical

Test Report No.: G0M-2201-1254-TFC247FH-V02

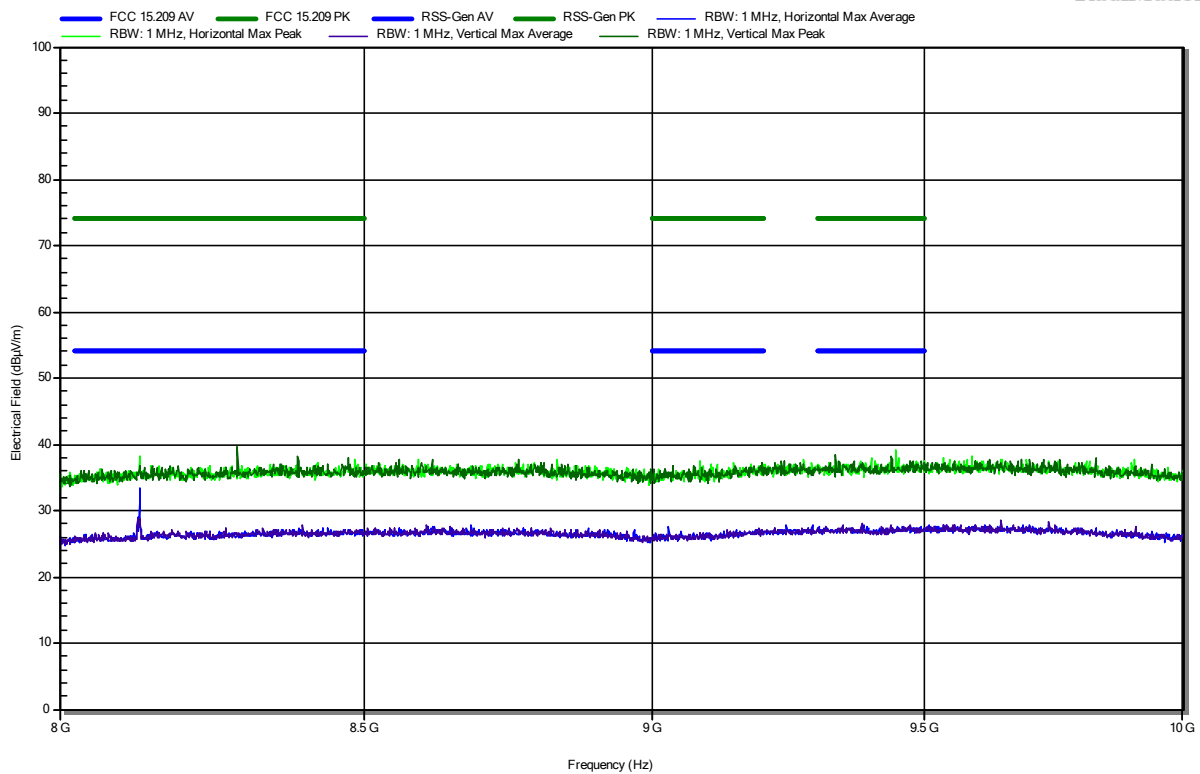
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mrs Hoang
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 24 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Schwarzbeck HWRD 650
 Measurement distance: 3 m
 Mode: Tx; LORA; 500 kHz; SF 12; 20 dBm; 903 MHz
 Test Date: 2022-03-03
 Note: EUT vertical

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RadiMation

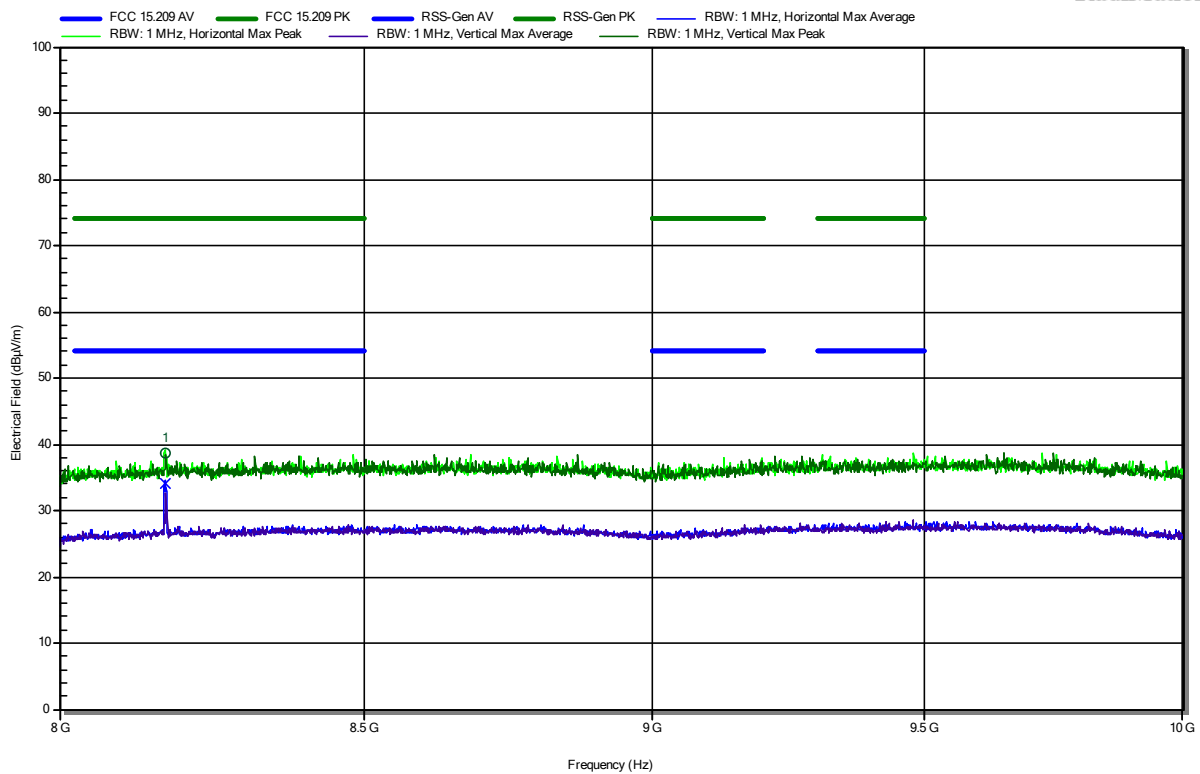


Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mrs Hoang
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 24 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Schwarzbeck HWRD 650
 Measurement distance: 3 m
 Mode: Tx; LORA; 500 kHz; SF 12; 20 dBm; 907.8 MHz
 Test Date: 2022-03-03
 Note: EUT vertical

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RadiMation



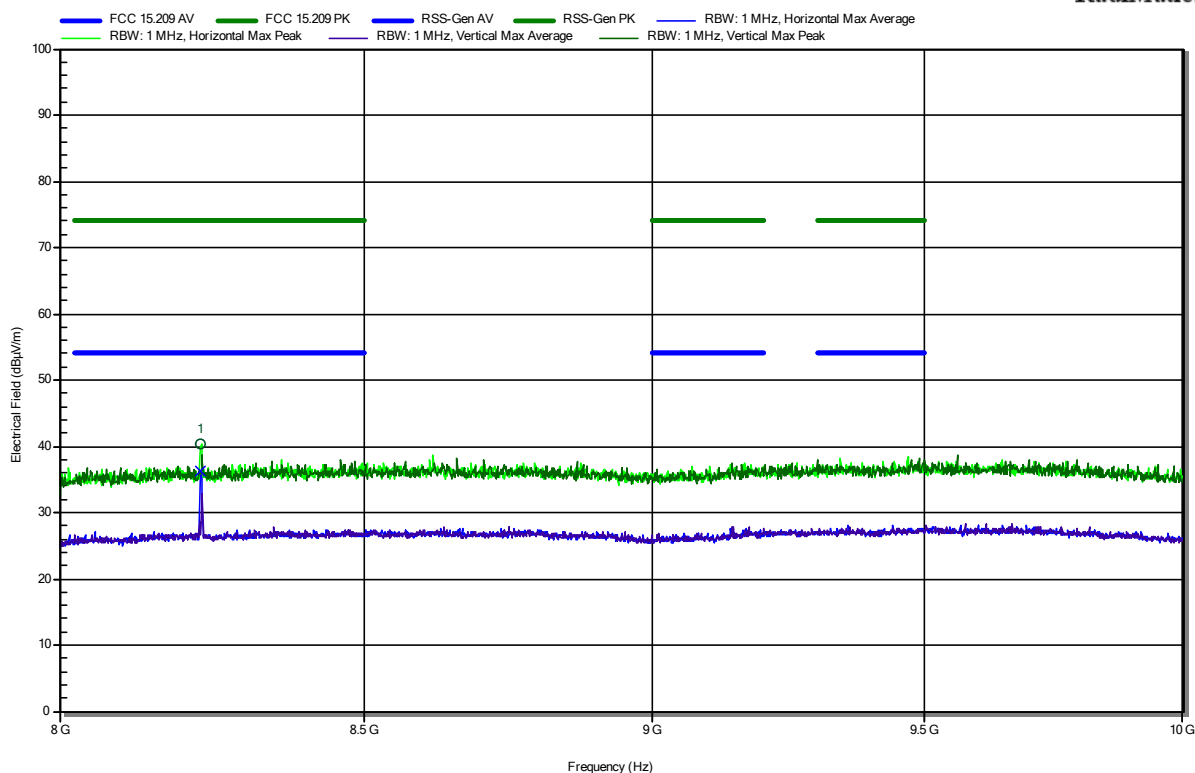
Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Polarization
8.169 GHz	38.62 dBμV/m	74 dBμV/m	-35.38 dB	Pass	Horizontal
Frequency	Average	Average Limit	Average Difference	Average Status	Polarization
8.169 GHz	34.2 dBμV/m	54 dBμV/m	-19.8 dB	Pass	Horizontal

Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mrs Hoang
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 24 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Schwarzbeck HWRD 650
 Measurement distance: 3 m
 Mode: Tx; LORA; 500 kHz; SF 12; 20 dBm; 914.2 MHz
 Test Date: 2022-03-03
 Note: EUT vertical

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RadiMation



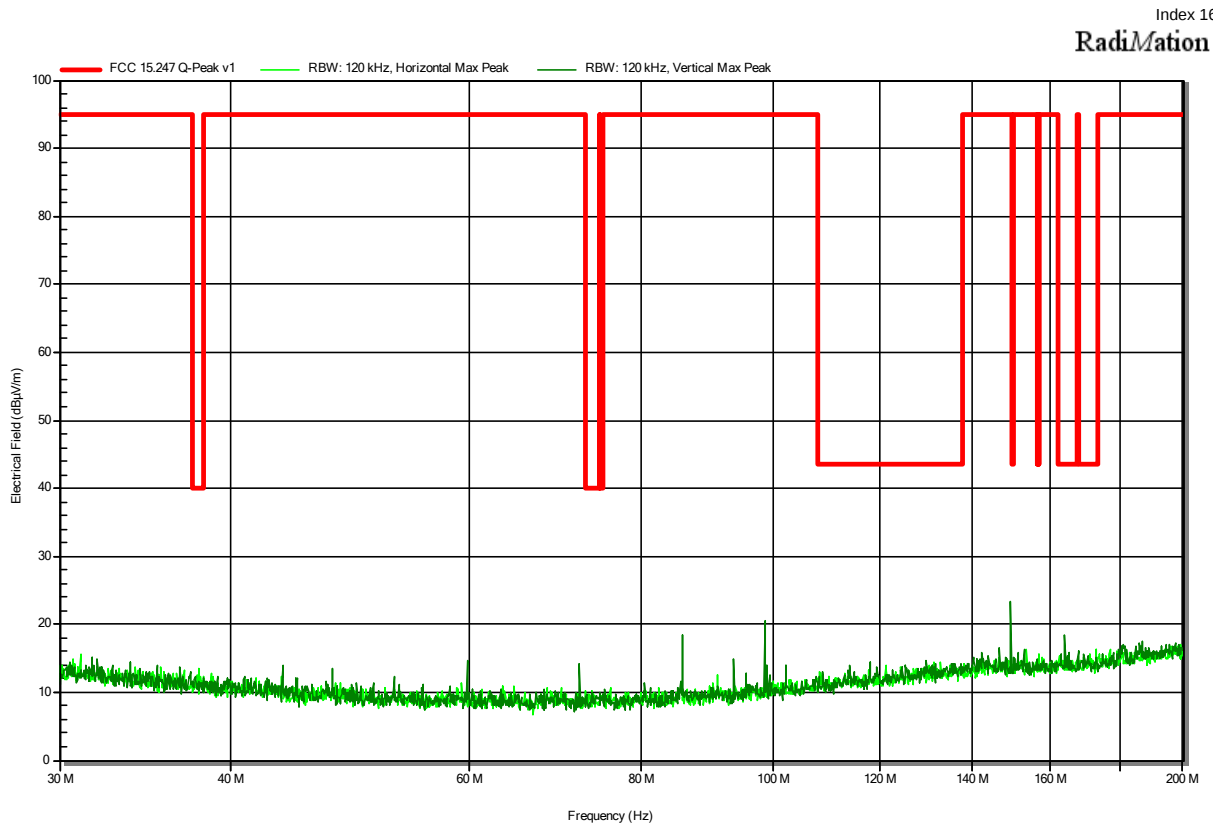
Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Polarization
8.227 GHz	40.26 dBμV/m	74 dBμV/m	-33.74 dB	Pass	Horizontal
Frequency	Average	Average Limit	Average Difference	Average Status	Polarization
8.227 GHz	36.25 dBμV/m	54 dBμV/m	-17.75 dB	Pass	Horizontal

Test Report No.: G0M-2201-1254-TFC247FH-V02

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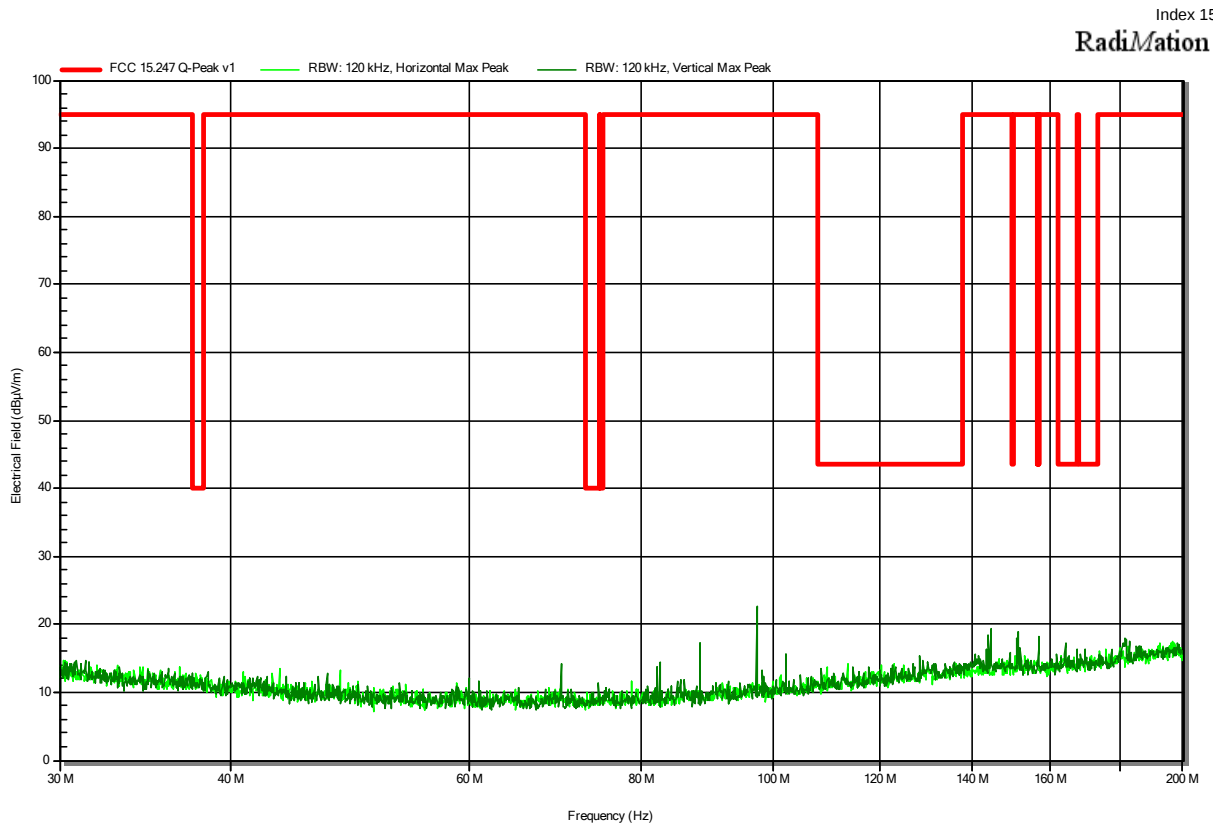
Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 20 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Rohde & Schwarz HK 116
 Measurement distance: 3 m
 Mode: Tx; LORA; 125 kHz; SF 10; 20 dBm; 902.3 MHz
 Test Date: 2022-03-15
 Note: EUT vertical



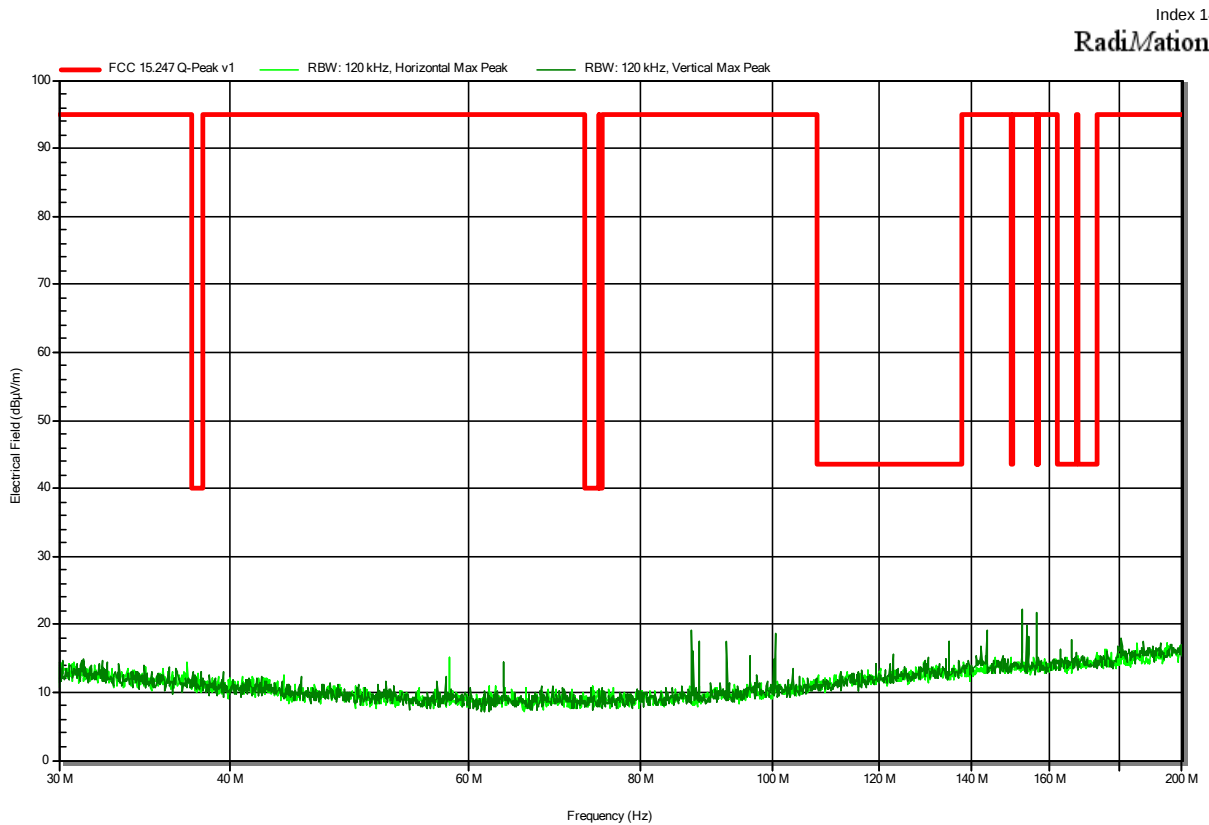
Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 20 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Rohde & Schwarz HK 116
 Measurement distance: 3 m
 Mode: Tx; LORA; 125 kHz; SF 10; 20 dBm; 908.5 MHz
 Test Date: 2022-03-15
 Note: EUT vertical



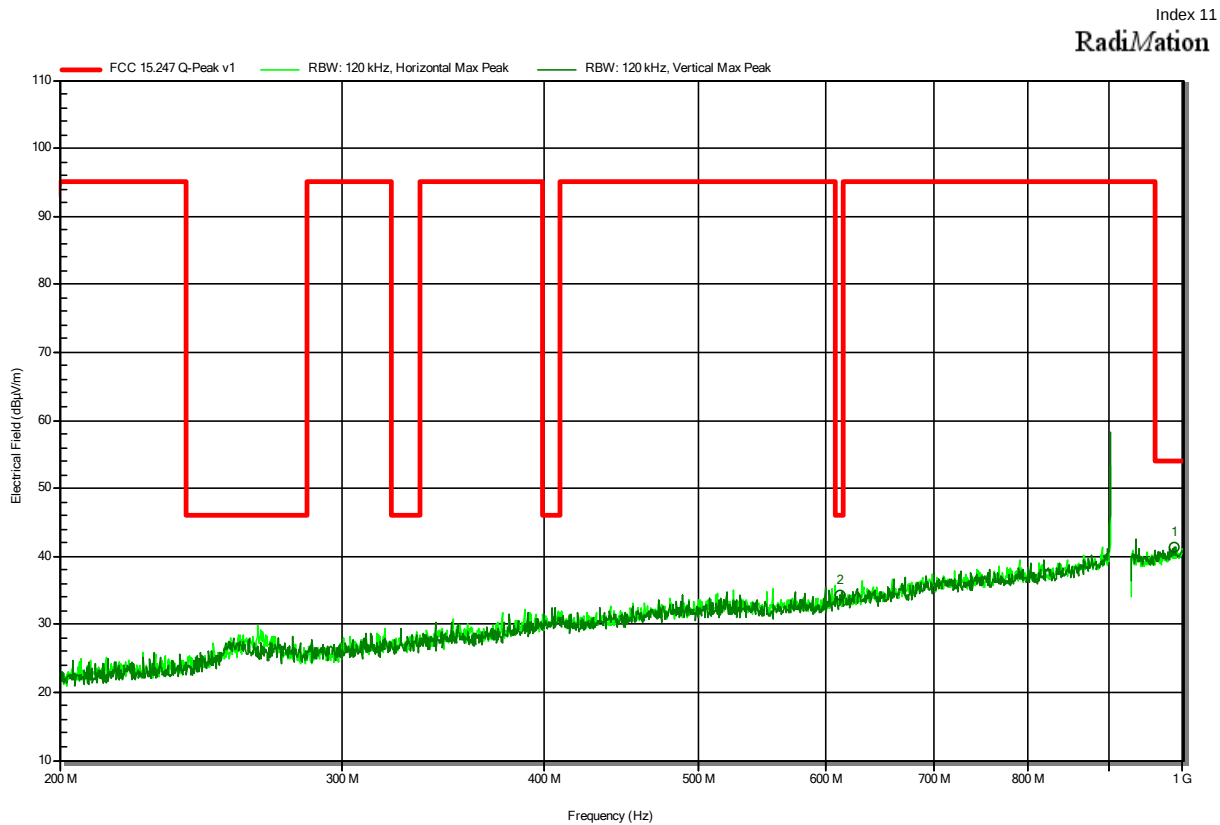
Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 20 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Rohde & Schwarz HK 116
 Measurement distance: 3 m
 Mode: Tx; LORA; 125 kHz; SF 10; 20 dBm; 914.9 MHz
 Test Date: 2022-03-15
 Note: EUT vertical



Radiated Spurious Emissions according to 47 CFR Part 15.247

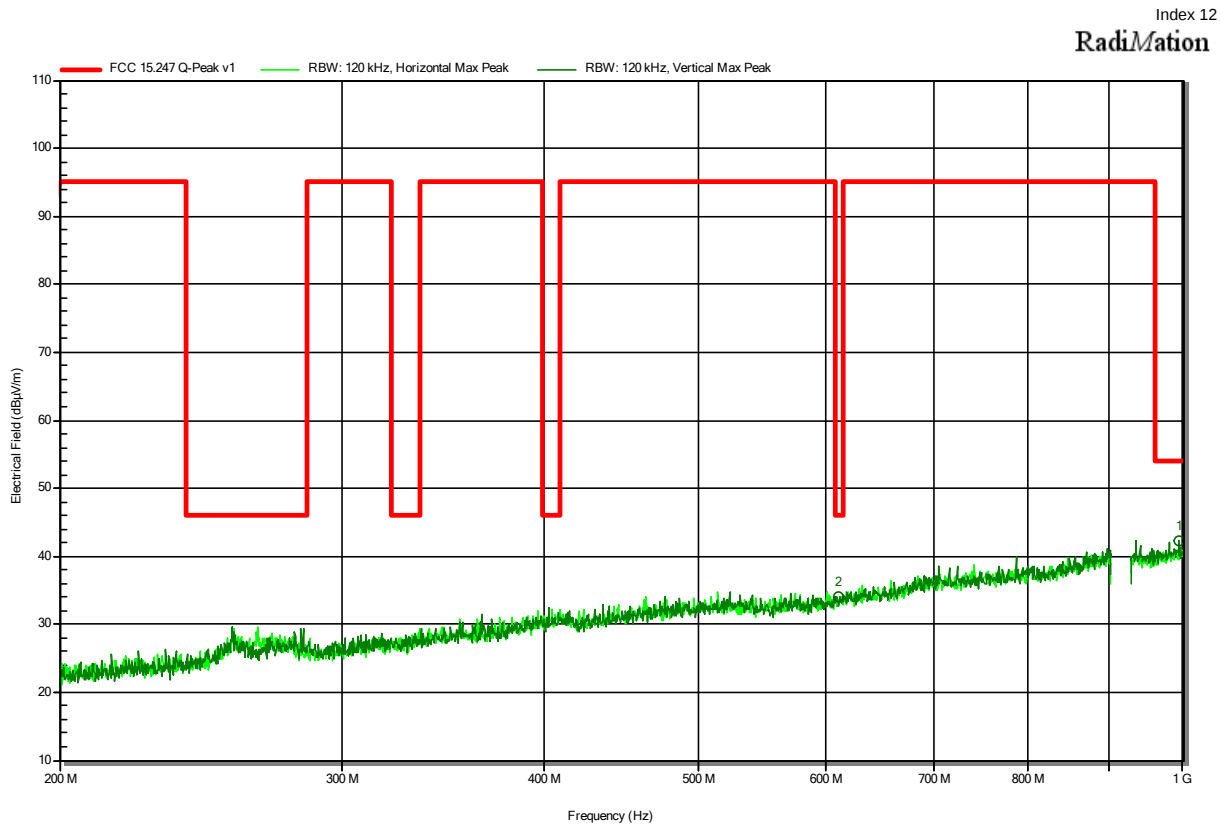
Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 20 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Rohde & Schwarz HL 223
 Measurement distance: 3 m
 Mode: Tx; LORA; 125 kHz; SF 10; 20 dBm; 902.3 MHz
 Test Date: 2022-03-15
 Note: EUT vertical



Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Polarization
611.4422 MHz	34.3 dBμV/m	46 dBμV/m	-11.73 dB	Pass	Vertical
988.6258 MHz	41.4 dBμV/m	54 dBμV/m	-12.64 dB	Pass	Vertical

Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 20 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Rohde & Schwarz HL 223
 Measurement distance: 3 m
 Mode: Tx; LORA; 125 kHz; SF 10; 20 dBm; 908.5 MHz
 Test Date: 2022-03-15
 Note: EUT vertical



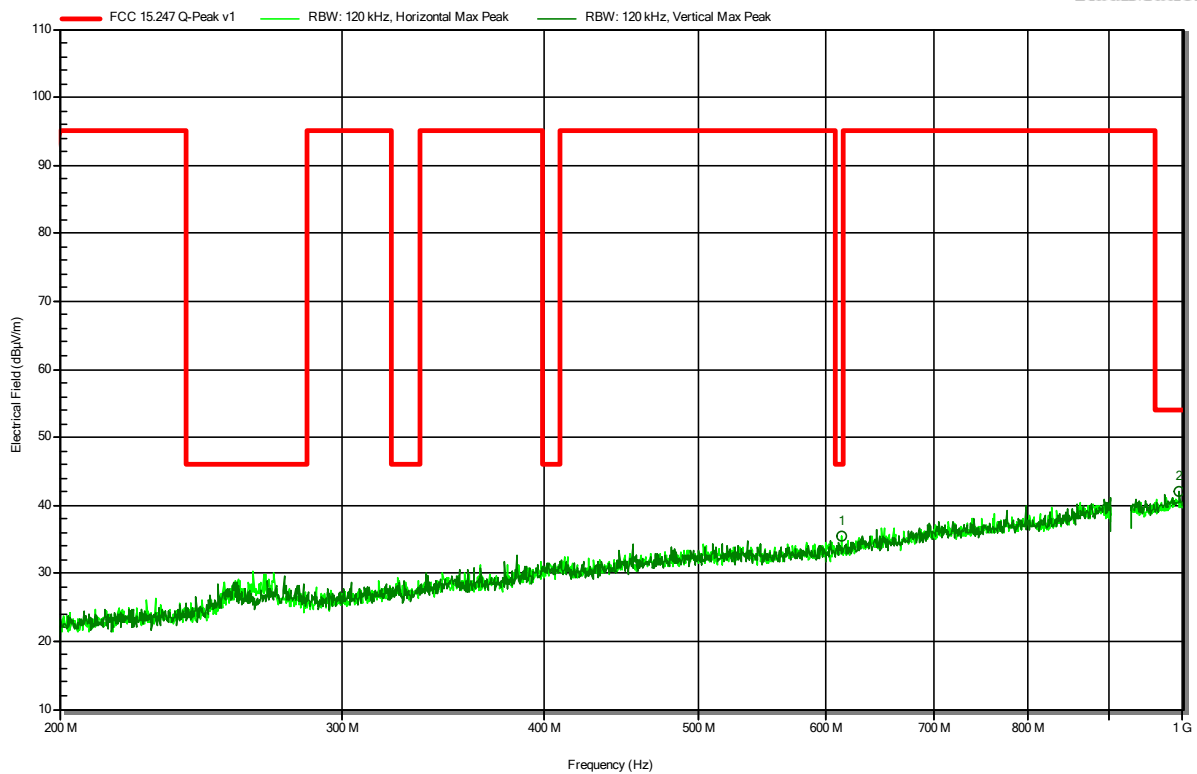
Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Polarization
611.021 MHz	34.1 dBμV/m	46 dBμV/m	-11.95 dB	Pass	Vertical
993.7 MHz	42.4 dBμV/m	54 dBμV/m	-11.65 dB	Pass	Vertical

Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 20 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Rohde & Schwarz HL 223
 Measurement distance: 3 m
 Mode: Tx; LORA; 125 kHz; SF 10; 20 dBm; 914.9 MHz
 Test Date: 2022-03-15
 Note: EUT vertical

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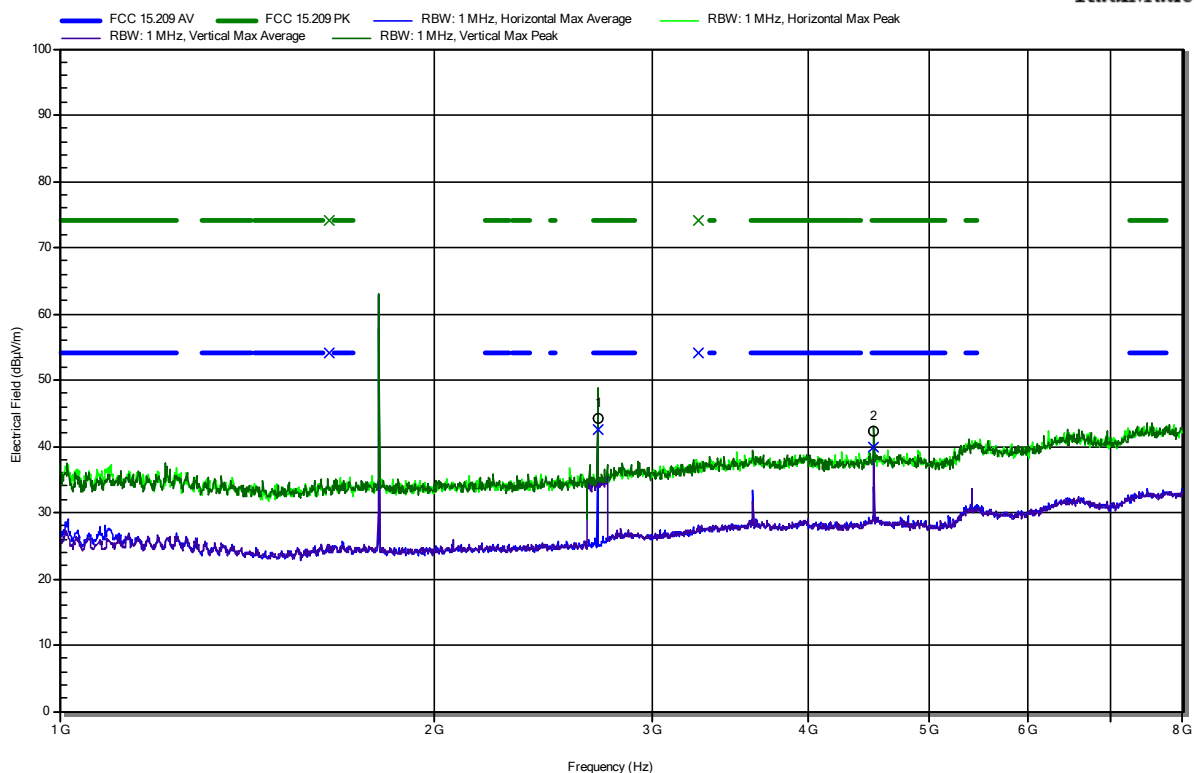
Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Polarization
613.0919 MHz	35.5 dBμV/m	46 dBμV/m	-10.47 dB	Pass	Horizontal
994.2472 MHz	41.9 dBμV/m	54 dBμV/m	-12.07 dB	Pass	Vertical

Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mrs. Hoang
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 23 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Schwarzbeck BBHA 9120B
 Measurement distance: 3 m
 Mode: Tx; LORA; 125 kHz; SF 10; 20 dBm; 902.3 MHz
 Test Date: 2022-03-02
 Note: EUT vertical

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Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Polarization
2.707 GHz	44.22 dBμV/m	74 dBμV/m	-29.78 dB	Pass	Horizontal
4.5115 GHz	42.25 dBμV/m	74 dBμV/m	-31.75 dB	Pass	Vertical

Frequency	Average	Average Limit	Average Difference	Average Status	Polarization
2.707 GHz	42.57 dBμV/m	54 dBμV/m	-11.43 dB	Pass	Horizontal
4.5115 GHz	39.88 dBμV/m	54 dBμV/m	-14.12 dB	Pass	Vertical

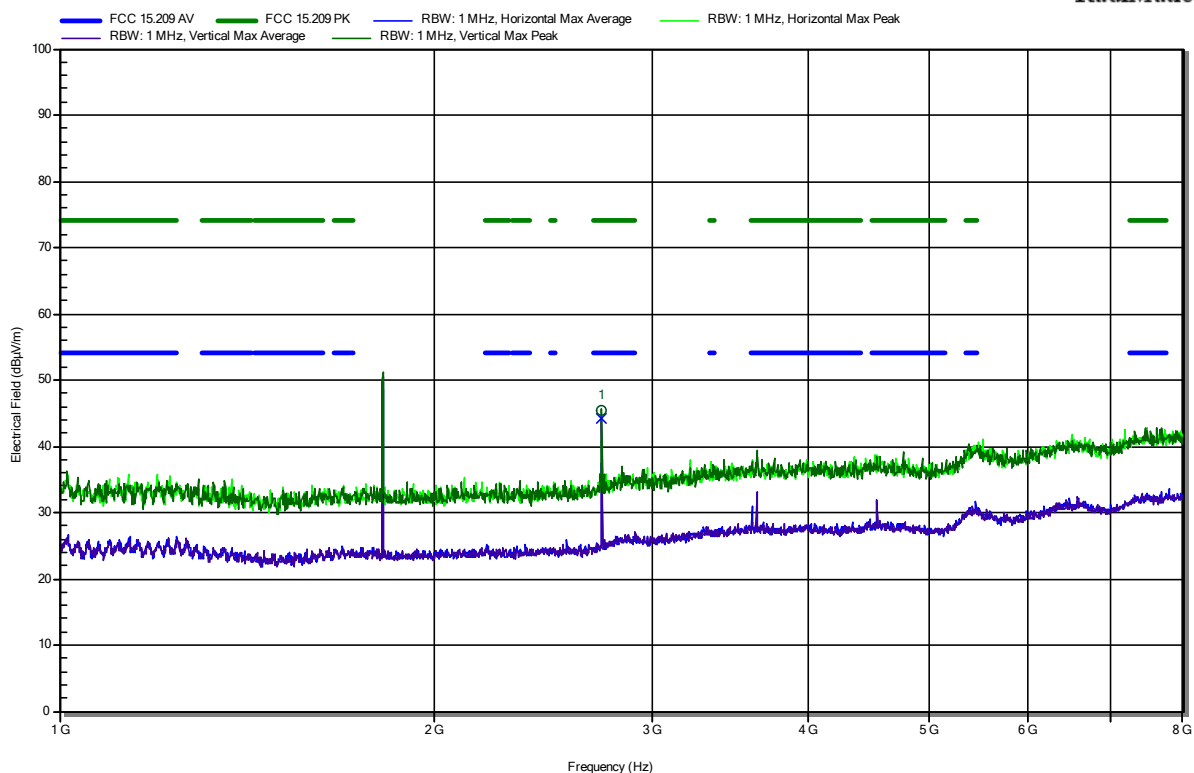
Test Report No.: G0M-2201-1254-TFC247FH-V02

Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mrs Hoang
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 24 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Schwarzbeck BBHA 9120B
 Measurement distance: 3 m
 Mode: Tx; LORA; 125 kHz; SF 10; 20 dBm; 908.5 MHz
 Test Date: 2022-03-03
 Note: EUT vertical

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RadiMation



Frequency 2.7256 GHz	Peak 45.46 dBμV/m	Peak Limit 74 dBμV/m	Peak Difference -28.54 dB	Peak Status Pass	Polarization Vertical
Frequency 2.7256 GHz	Average 44.12 dBμV/m	Average Limit 54 dBμV/m	Average Difference -9.88 dB	Average Status Pass	Polarization Vertical

Test Report No.: G0M-2201-1254-TFC247FH-V02

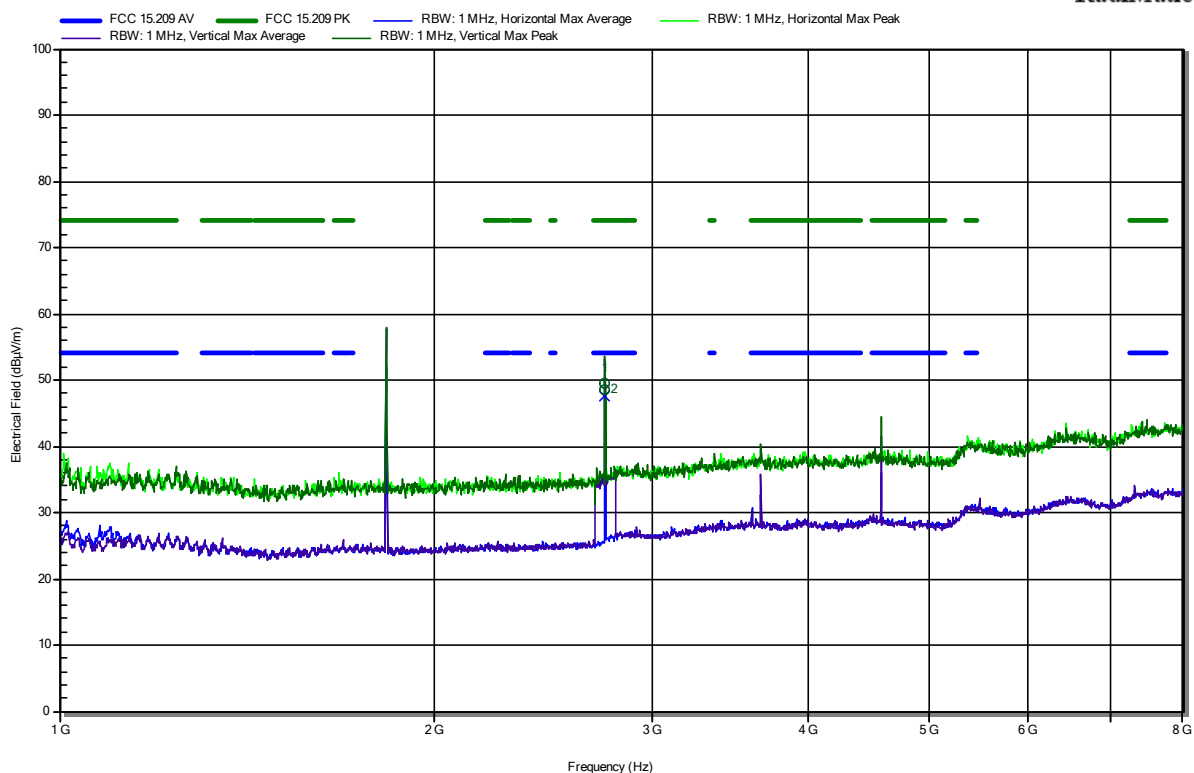
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mrs Hoang
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 24 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Schwarzbeck BBHA 9120B
 Measurement distance: 3 m
 Mode: Tx; LORA; 125 kHz; SF 10; 20 dBm; 914.9 MHz
 Test Date: 2022-03-02
 Note: EUT vertical

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Frequency 2.7447 GHz	Peak 48.62 dBV/m	Peak Limit 74 dBV/m	Peak Difference -25.38 dB	Peak Status Pass	Polarization Horizontal
Frequency 2.7447 GHz	Average 47.65 dBV/m	Average Limit 54 dBV/m	Average Difference -6.35 dB	Average Status Pass	Polarization Horizontal

Test Report No.: G0M-2201-1254-TFC247FH-V02

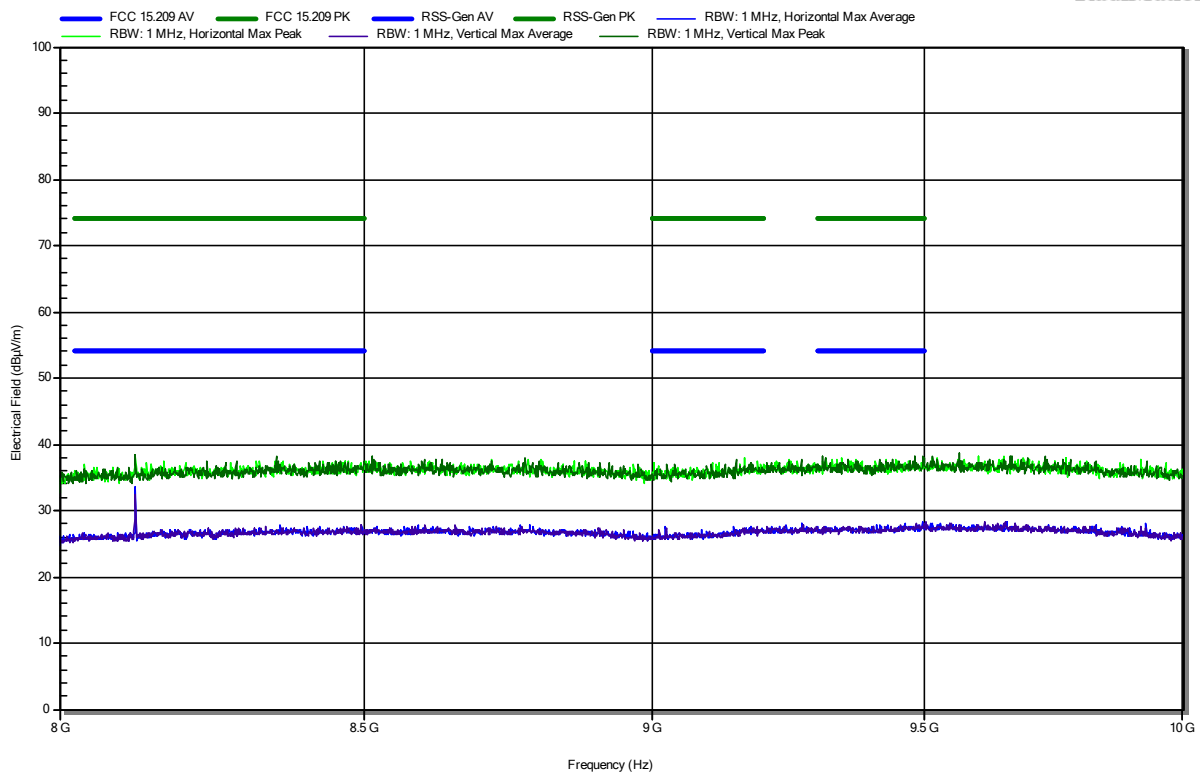
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mrs Hoang
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 23 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Schwarzbeck HWRD 650
 Measurement distance: 3 m
 Mode: Tx; LORA; 125 kHz; SF 10; 20 dBm; 902.3 MHz
 Test Date: 2022-03-02
 Note: EUT vertical

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RadiMation

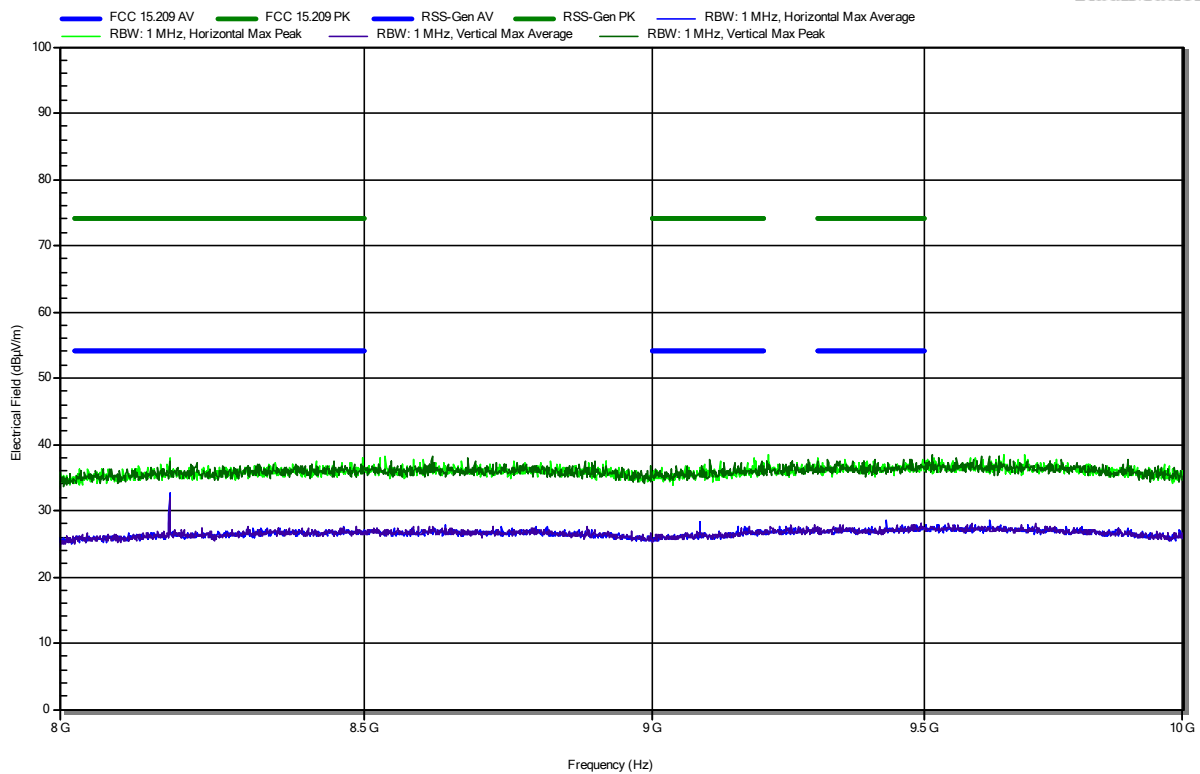


Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mrs Hoang
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 24 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Schwarzbeck HWRD 650
 Measurement distance: 3 m
 Mode: Tx; LORA; 125 kHz; SF 10; 20 dBm; 908.5 MHz
 Test Date: 2022-03-03
 Note: EUT vertical

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RadiMation

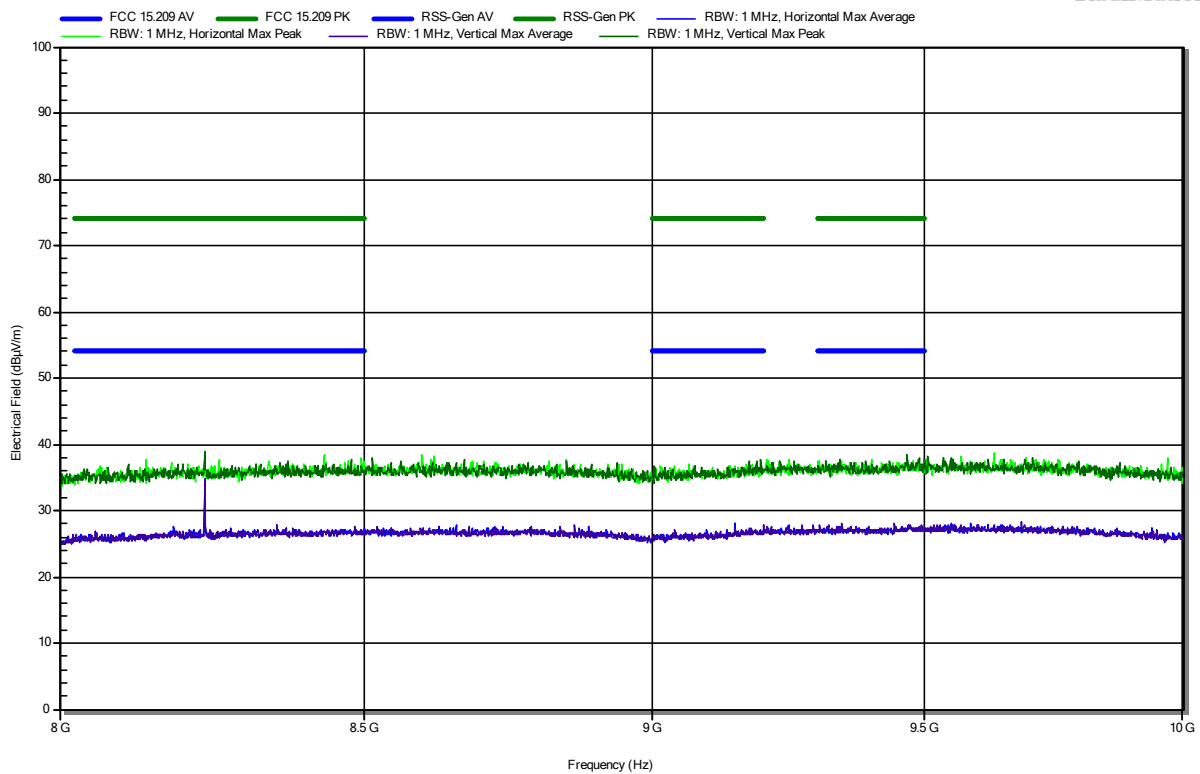


Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mrs Hoang
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 24 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Schwarzbeck HWRD 650
 Measurement distance: 3 m
 Mode: Tx; LORA; 125 kHz; SF 10; 20 dBm; 914.9 MHz
 Test Date: 2022-03-03
 Note: EUT vertical

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RadiMation



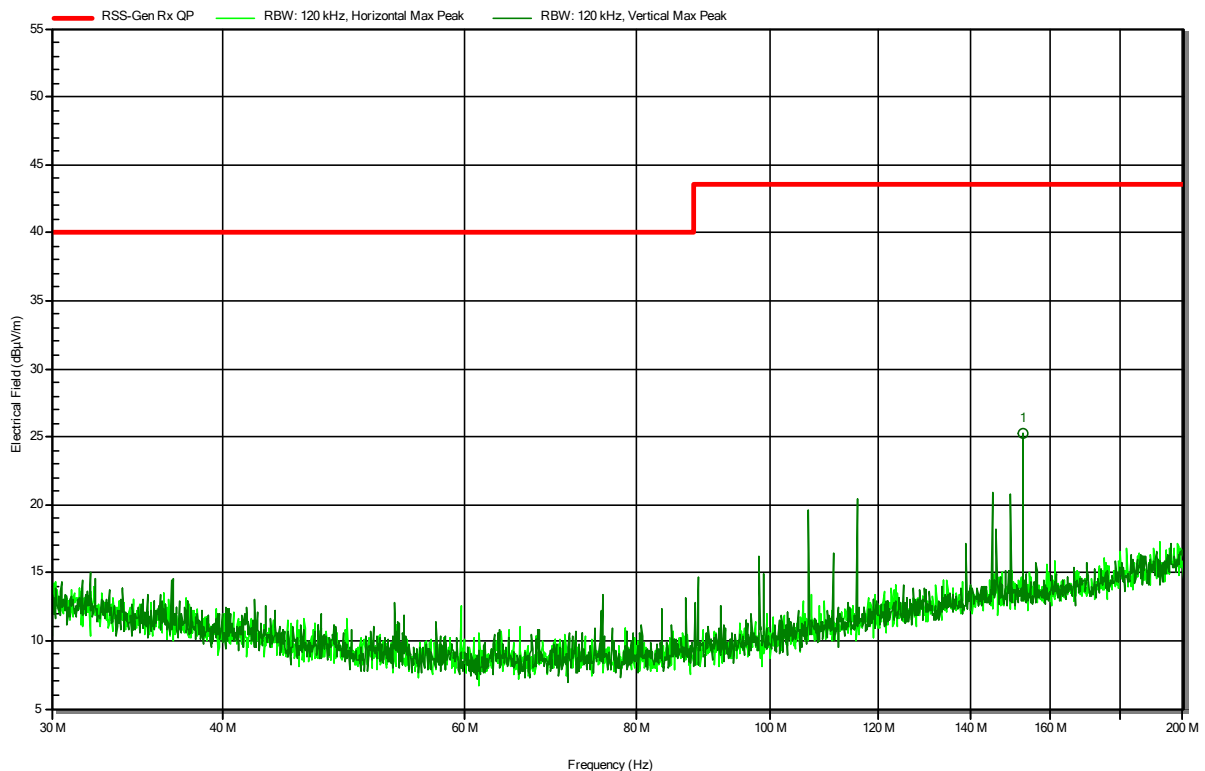
ANNEX B Receiver spurious emissions

Radiated Spurious Emissions according to RSS-247 Issue 2

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 20 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Rohde & Schwarz HK 116
 Measurement distance: 3 m
 Mode: Rx; LORA; 500 kHz; SF 12; 907.8 MHz
 Test Date: 2022-03-16
 Note: EUT vertical

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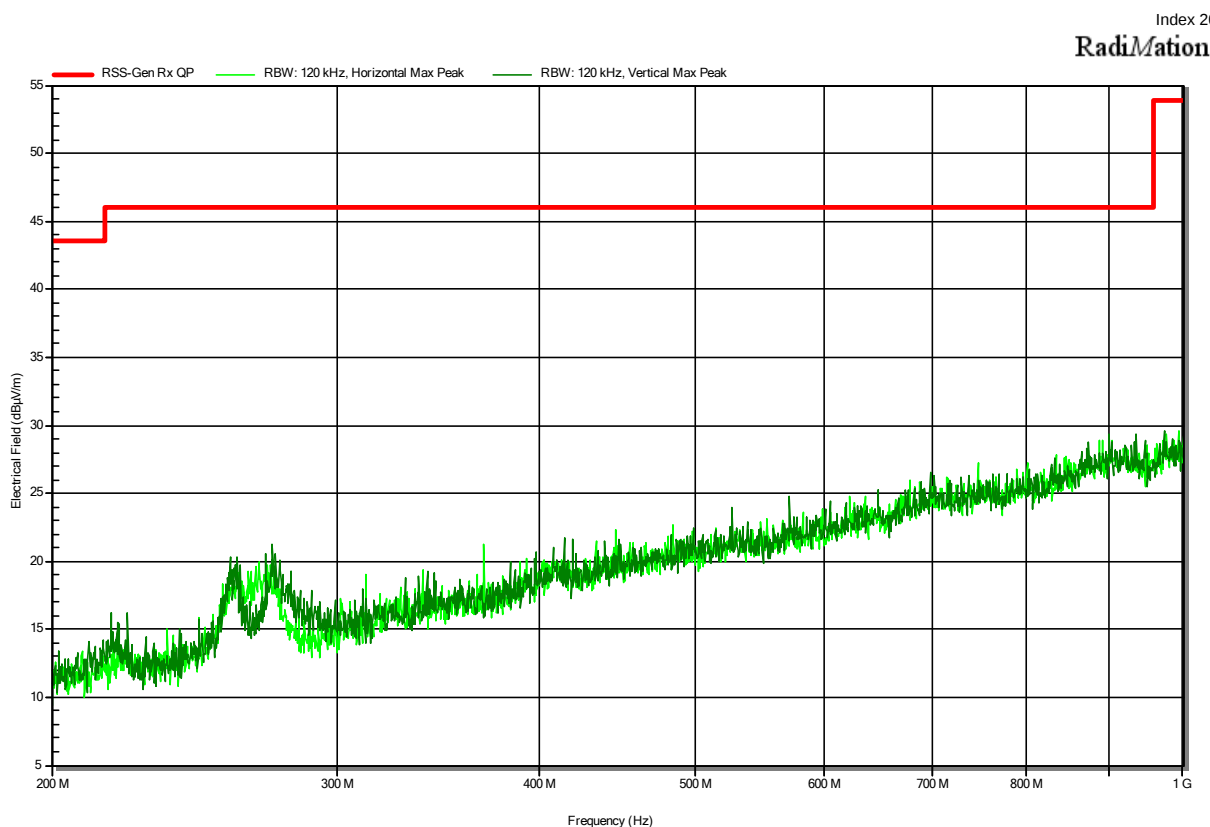
RadiMation



Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Polarization
152.8718 MHz	25.3 dBµV/m	43.5 dBµV/m	-18.2 dB	Pass	Vertical

Radiated Spurious Emissions according to RSS-247 Issue 2

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 20 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Rohde & Schwarz HL 223
 Measurement distance: 3 m
 Mode: Rx; LORA; 500 kHz; SF 12; 907.8 MHz
 Test Date: 2022-03-16
 Note: EUT vertical

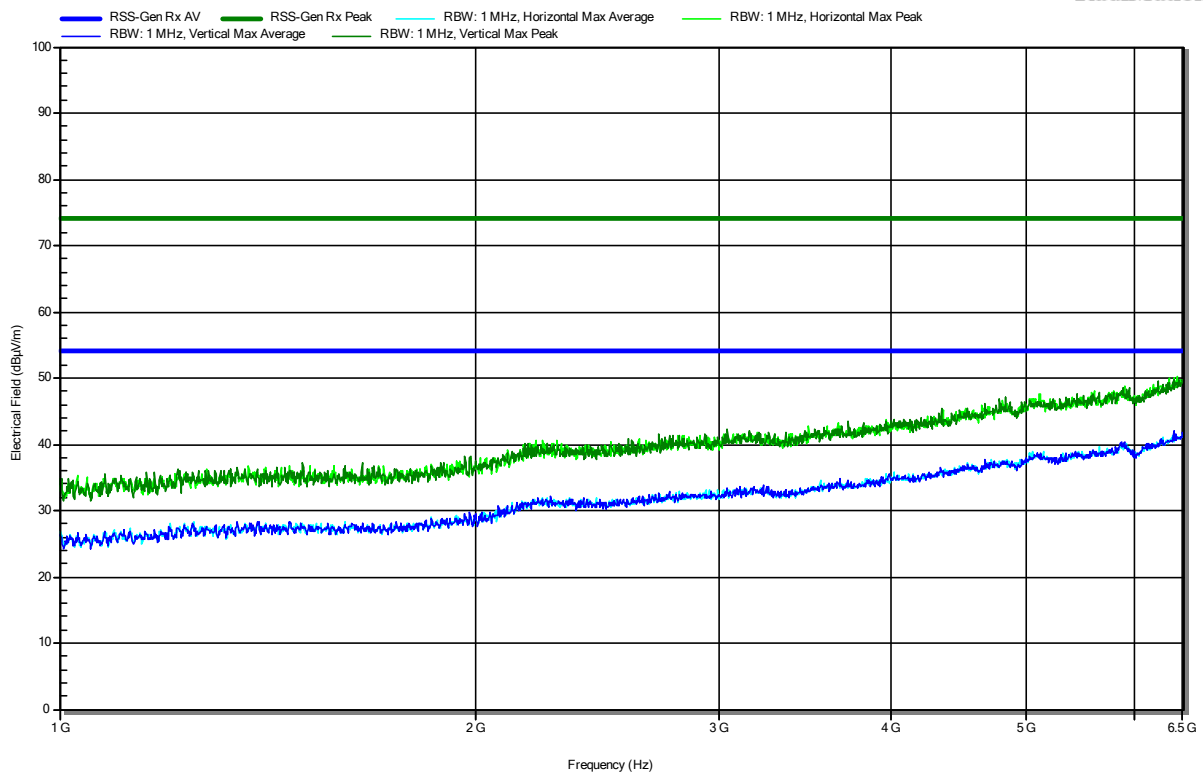


Radiated Spurious Emissions according to RSS-247 Issue 2

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 20 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Schwarzbeck BBHA 9120D
 Measurement distance: 3 m
 Mode: Rx; LORA; 500 kHz; SF 12; 907.8 MHz
 Test Date: 2022-03-16
 Note: EUT vertical

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RadiMation

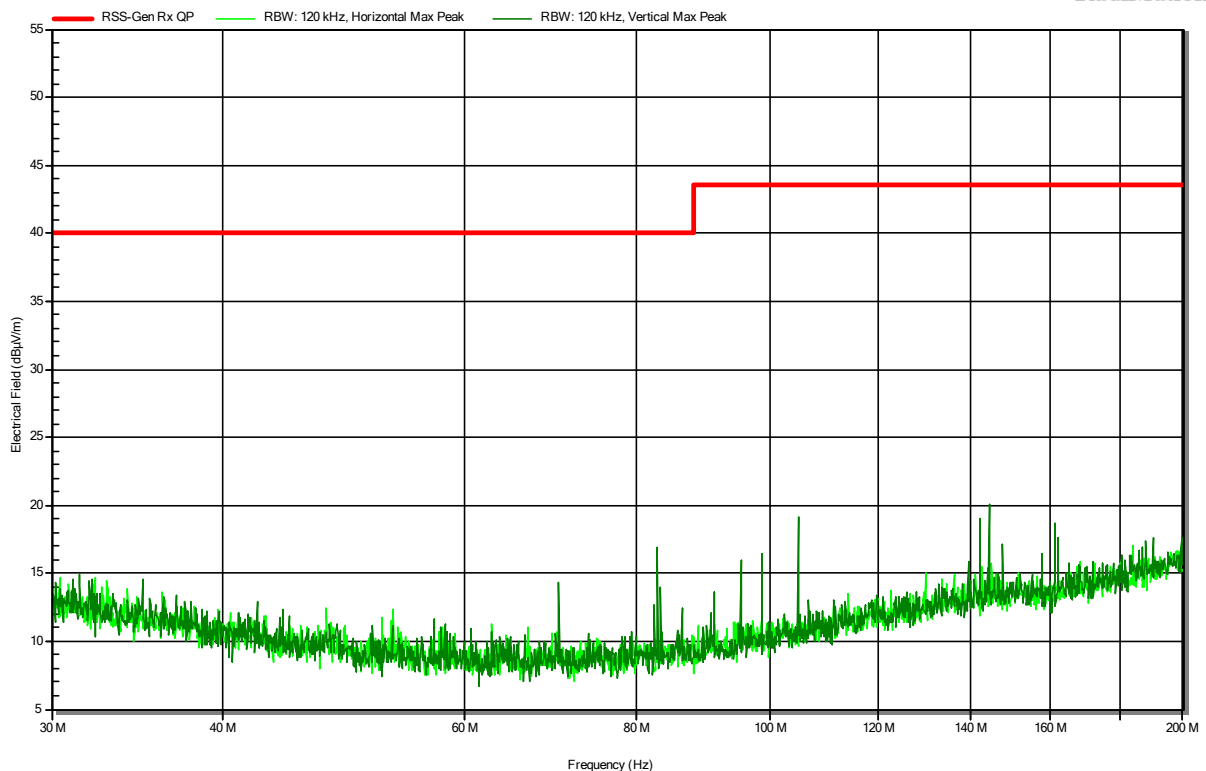


Radiated Spurious Emissions according to RSS-247 Issue 2

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 20 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Rohde & Schwarz HK 116
 Measurement distance: 3 m
 Mode: Rx; LORA; 125 kHz; SF 10; 908.5 MHz
 Test Date: 2022-03-16
 Note: EUT vertical

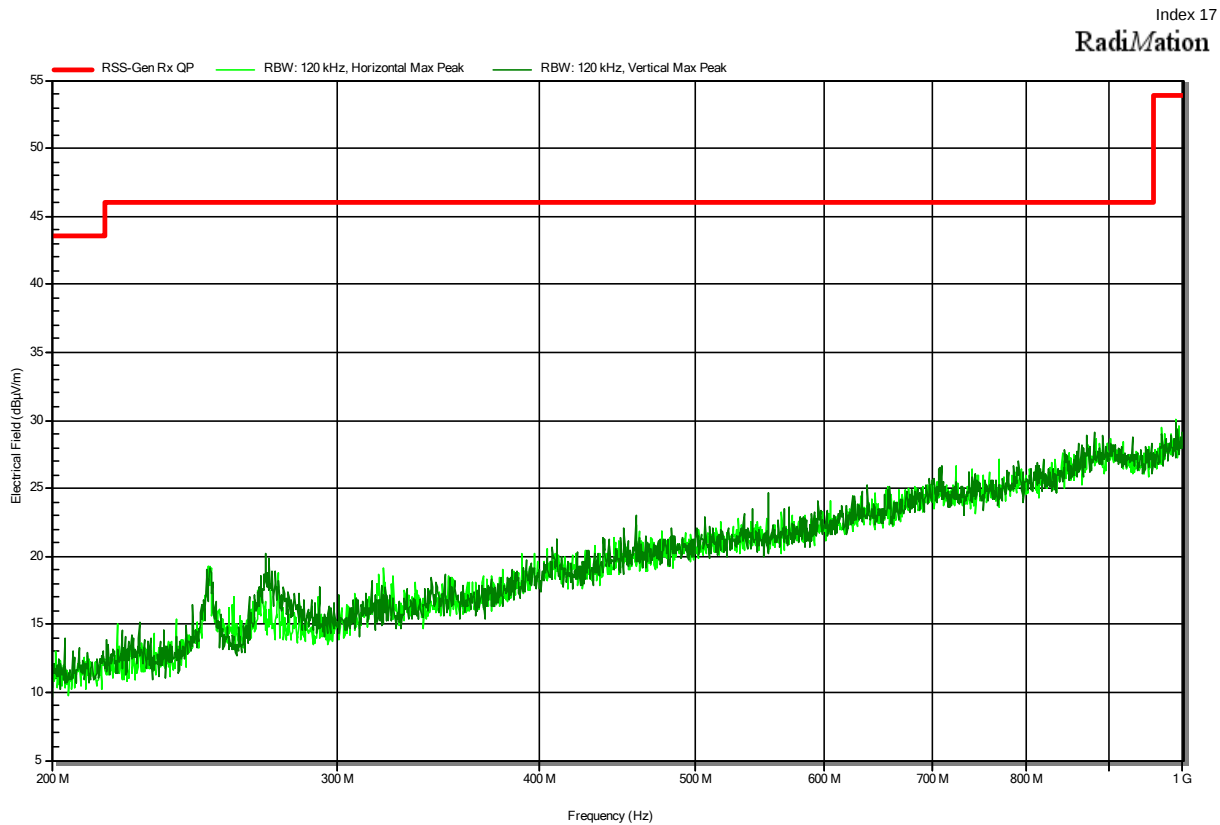
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RadiMation



Radiated Spurious Emissions according to RSS-247 Issue 2

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 20 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Rohde & Schwarz HL 223
 Measurement distance: 3 m
 Mode: Rx; LORA; 125 kHz; SF 10; 908.5 MHz
 Test Date: 2022-03-16
 Note: EUT vertical

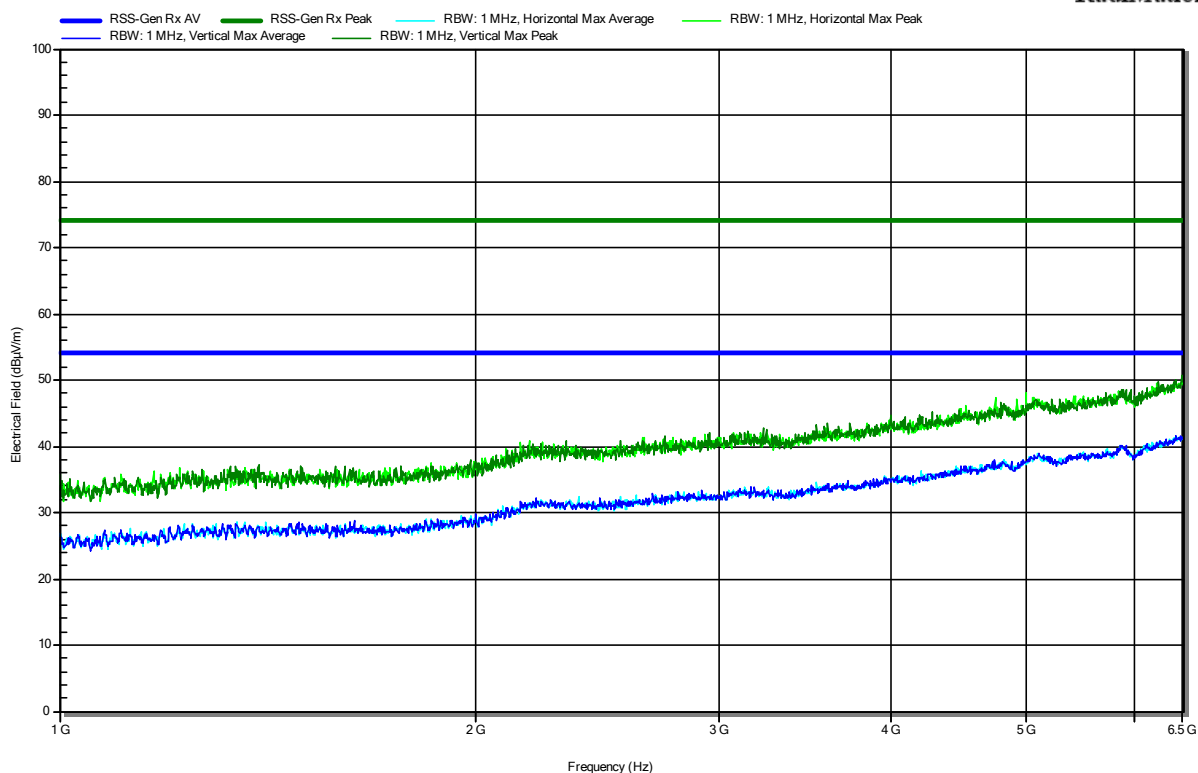


Radiated Spurious Emissions according to RSS-247 Issue 2

Project Number: G0M-2201-1254
 Applicant: Grant4Com Oy
 Model Description: LoRaWAN temperature transmitter with external sensor
 Model: Flex2-LWNA-CS-P
 Test Sample ID: 38634
 Test Site:
 Operator: Mr. Qawasmeh
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 20 °Celsius, Vnom: 3.6 VDC (Lithium thionyl chloride)
 Antenna: Schwarzbeck BBHA 9120D
 Measurement distance: 3 m
 Mode: Rx; LORA; 125 kHz; SF 10; 908.5 MHz
 Test Date: 2022-03-16
 Note: EUT vertical

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RadiMation



== END OF TEST REPORT ==