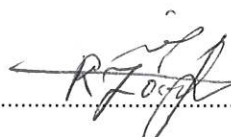


RADIO REPORT FCC 47 CFR Part 15F ISED Canada RSS-220 Ultra Wide Band Devices	
Report Reference No	G0M-2306-2086-TFC15FUW-V02
Testing Laboratory	Eurofins Product Service GmbH
Address	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation	    DAkkS - Registration number : D-PL-12092-01-03 (ISED) ISED Testing Laboratory site: 3470A DAkkS - Registration number : D-PL-12092-01-04 (FCC) FCC Filed Test Laboratory, Reg.-No.: 96970
Applicant	Focal JMLab
Address	108, Avenue De l'Avenir ZI Molina la Chazotte 42350 La Talaudière France
Test Specification	47 CFR Part 15F RSS-220, Issue 1 + A1, 2018-07 RSS-Gen, Issue 5, Amendment 2, 2021-02
Non-Standard Test Method	None
Equipment under Test (EUT):	
Product Description	UWB module
Model(s)	01-001-0759
Additional Model(s)	None
Brand Name(s)	None
Hardware Version(s)	01-001-0759
Software Version(s)	v 0.0.0.1700
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	2023-09-11	
Report:		
Compiled by	Florian Voigt	
Tested by (+ signature)	Azamat Ibraimov	
Test supervised by (+ signature) (Responsible for Test)	Florian Voigt	
Approved by (+ signature) (Test Lab Engineer)	Radwan Jaafar	
Date of Issue	2024-11-21	
Total number of pages	61	
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:		

Version History			
Version	Issue Date	Remarks	Revised By
01	2023-12-20	Initial Release	--
02	2024-11-21	Replaced document: G0M-2306-2086-TFC15FUW-V01 Replaced by: G0M-2306-2086-TFC15FUW-V02 Reason: Applicant changed. FCC ID / IC removed.	A. Ibraimov

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
f_L	Low edge frequency of UWB (-10) dB bandwidth
f_H	High edge frequency of UWB (-10) dB bandwidth
f_M	UWB frequency with highest peak power in UWB (-10) dB bandwidth measurement
f_C	Centre frequency of UWB (-10) dB bandwidth
B_{-10}	-10 dB bandwidth
μ_{-10}	-10 dB fractional bandwidth

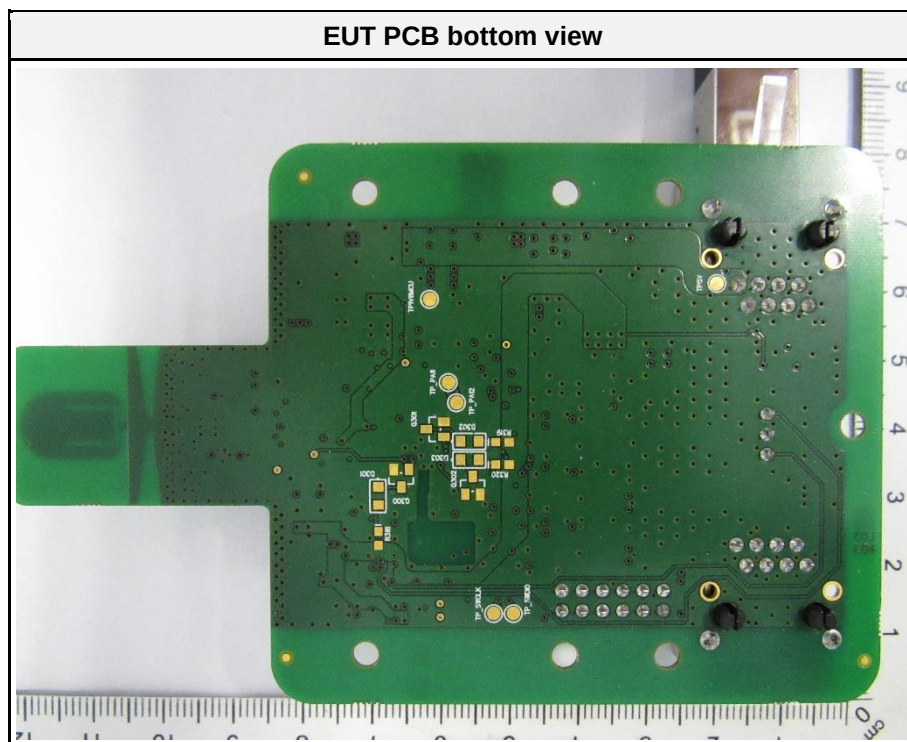
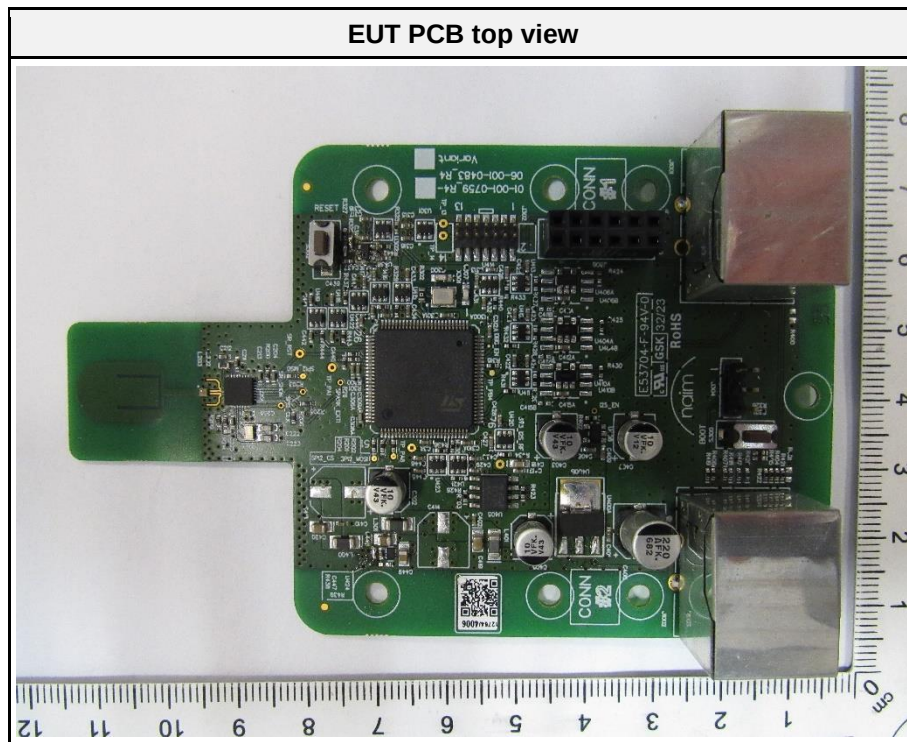
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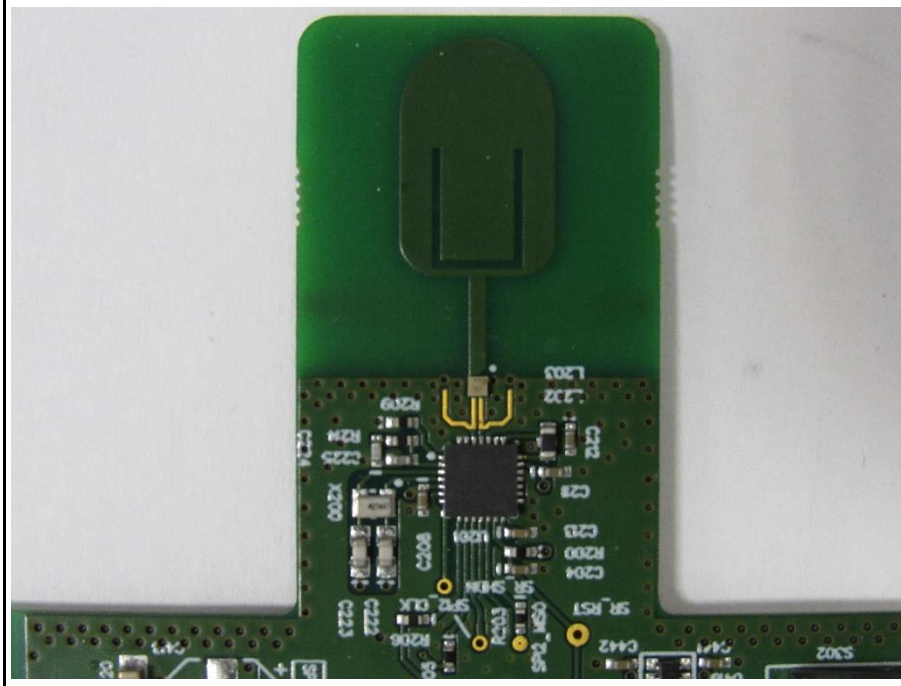
1 Equipment (Test Item) Under Test

Description	UWB module	
Model	01-001-0759	
Additional Model(s)	None	
Brand Name(s)	None	
Serial Number(s)	Prototype	
Test Sample Id(s)	46945 (Measurements in chamber AC2) 46946 (Measurements in chamber AC1)	
Hardware Version(s)	01-001-0759	
Software Version(s)	v 0.0.0.1700	
Equipment class	Indoor	
Equipment type	Radio Module	
Radio type	Transceiver	
Operating frequency range	6 - 9 GHz	
Radio technology	Ultra Wide-band	
Modulation	OOK	
Antenna	Type	Integrated PCB antenna
	Model	01-001-0759_R2_1
	Manufacturer	Naim
	Gain	1.8 dBi (customer declaration)
Supply Voltage	V _{NOM}	5 VDC
Operating Temperature	T _{NOM}	25 °C
AC/DC-Adaptor	None	
Manufacturer	Focal JMLab 108, Avenue De l'Avenir ZI Molina la Chazotte 42350 La Talaudière France	

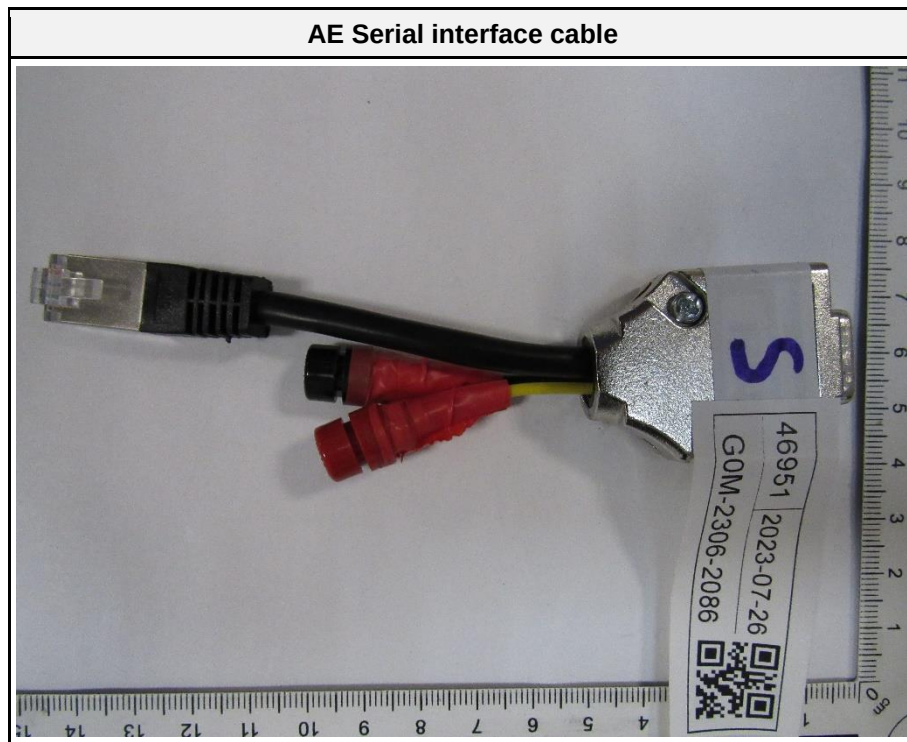
1.1 Photos – Equipment



EUT radio circuit detail view



1.2 Photos – Support Equipment



1.3 Support Equipment

Product Type	Device	Manufacturer	Model	Comment
AE	AC/DC Adapter	Syncwire	GPE032A-052600-Z	
CBL	Serial/USB/Power cable	-	-	
Description:				
AE	Auxiliary Equipment			
SIM	Simulator			
CBL	Connecting Cable			
SFT	Software			
Comment:				

1.4 Test Modes

Mode	Description
Transmit	Mode = Transmit Modulation = OOK Duty cycle = 100%
Receive	Mode = Receive
Comment:	

1.5 Test Frequencies

Designator	Mode	Channel	Frequency [MHz]
F1	Tx / Rx	164, 176, 188, 200	6717.44, 7208.96, 7700.48, 8192.00
Comment: All channels are used concurrently in a frequency hopping mode during UWB operation			

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).

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.

Field strength 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:

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

Example only for radiated field strength:

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

2 Result Summary

FCC 47 CFR Part 15F, ISED RSS-220				
Product Standard Reference	Requirement	Reference Method	Result	Remarks
ISED RSS-220 3.1, RSS-Gen 6.7	Occupied Bandwidth	ANSI C63.10-2013	N/R	Informational only
FCC 15.503(a), 15.517(b), ISED RSS-220 5.1a	UWB (-10 dB) Bandwidth	ANSI C63.10-2013	PASS	
FCC 15.517(e) ISED RSS-210 5.2.1g	Peak power	ANSI C63.10-2013	PASS	
FCC 15.517(c)(d) ISED RSS-210 5.2.1c-e	Transmitter radiated emissions	ANSI C63.10-2013	PASS	
ISED RSS-220 3.1, ISED RSS-Gen 7.1	Receiver radiated spurious emissions	ANSI C63.10-2013	PASS	
FCC 15.207 ISED RSS-220 3.1, RSS-Gen 8.8	AC power line conducted emissions	ANSI C63.10-2013	PASS	
Comment: The Decision Rule is applied on the basis of ETSI TR 102 273 and ETSI TR 100 028. These standards provide guidance on how to calculate and apply measurement uncertainty whilst providing maximum uncertainties allowance. In all cases due consideration will be given to ILAC-G8:09/2019. Where a result is considered conditional in respect of its proximity to the limit line, the customer would be made aware of situation so that they can make an informed decision on how to proceed.				

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

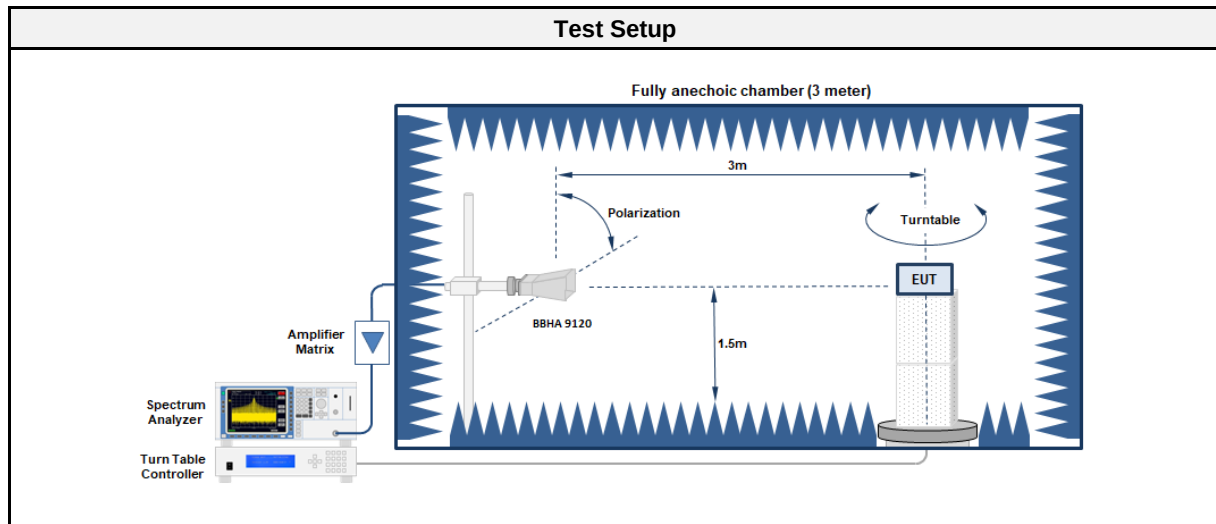
3.1.1 Information

Test Information	
Product Standard Reference	ISED RSS-220 3.1, RSS-Gen 6.7
Measurement Method	ANSI C63.10 6.9.3
Measurement Uncertainty	$\pm 1.26 \%$
Date	2023-09-12
Operator	Florian Voigt

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	FSU 26	EF01407	2023-08	2024-08
Anechoic Chamber	Frankonia	AC1	EF01011	2022-11	2023-11
Antenna	Schwarzbeck	BBHA 9120D	EF01561	2021-11	2024-11

3.1.5 Procedure

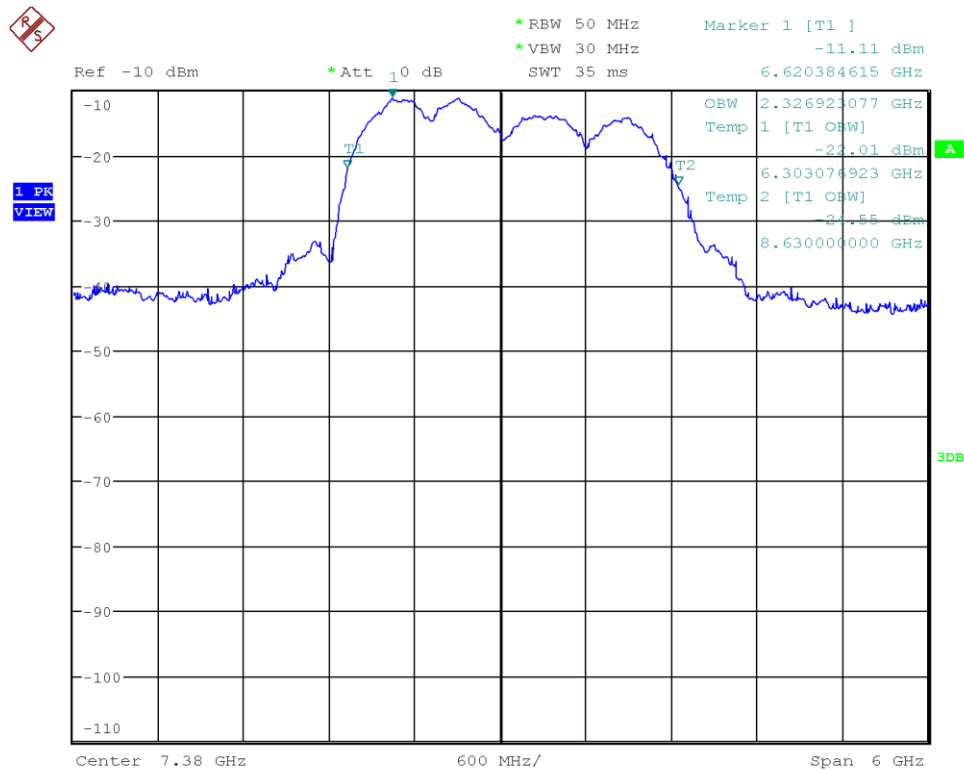
Test Procedure	
1.	EUT set to test mode
2.	The turntable and antenna height are set to the maximum emission level for the fundamental emission of the EUT
2.	Span set to at least twice the emission spectrum
3.	Resolution bandwidth set between 1 % to 5 % of OBW
4.	Occupied Bandwidth (99 %) measurement with spectrum analyzer built in measurement function

3.1.6 Results

Test Results	
Channel [MHz]	Bandwidth [MHz]
6717.44, 7208.96, 7700.48, 8192.00	2326.9

Occupied Bandwidth

Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46946
 Operator: Florian Voigt
 Test Site: Eurofins Product Service GmbH
 Test Date: 2023-09-12
 Operating Conditions: Tnom/Vnom
 Mode:



Date: 12.SEP.2023 14:24:16

3.2 Test Conditions and Results - UWB (-10 dB) Bandwidth

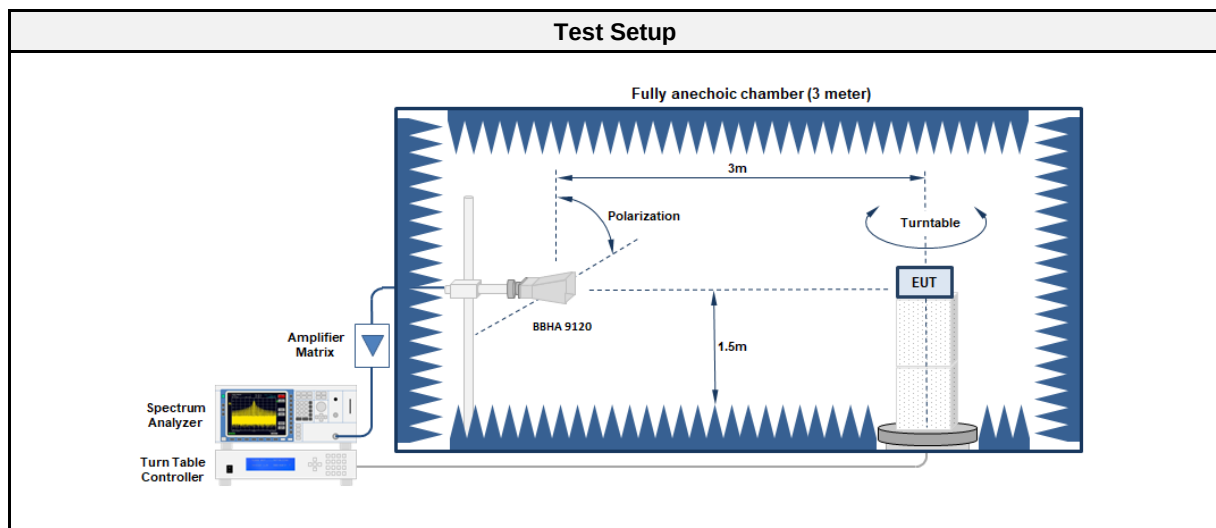
3.2.1 Information

Test Information	
Product Standard Reference	FCC Part 15.517 (a), ISED RSS-220 5.1 a
Measurement Method	ANSI C63.10 10.1
Measurement Uncertainty	$\pm 1.26 \%$
Date	2023-09-11
Operator	Azamat Ibraimov

3.2.2 Limits

Limits
UWB (-10 dB) bandwidth totally contained in the band 3.1 - 10.6 GHz additionally UWB (-10 dB) bandwidth ≥ 500 MHz or fractional bandwidth ≥ 0.20

3.2.3 Setup



3.2.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF01011	2022-11	2023-11
Measurement Receiver	Agilent	N9038A-526/WXP	EF01070	2023-02	2024-02
Antenna	Schwarzbeck	BBHA 9120D	EF01561	2021-11	2024-11

3.2.5 Procedure

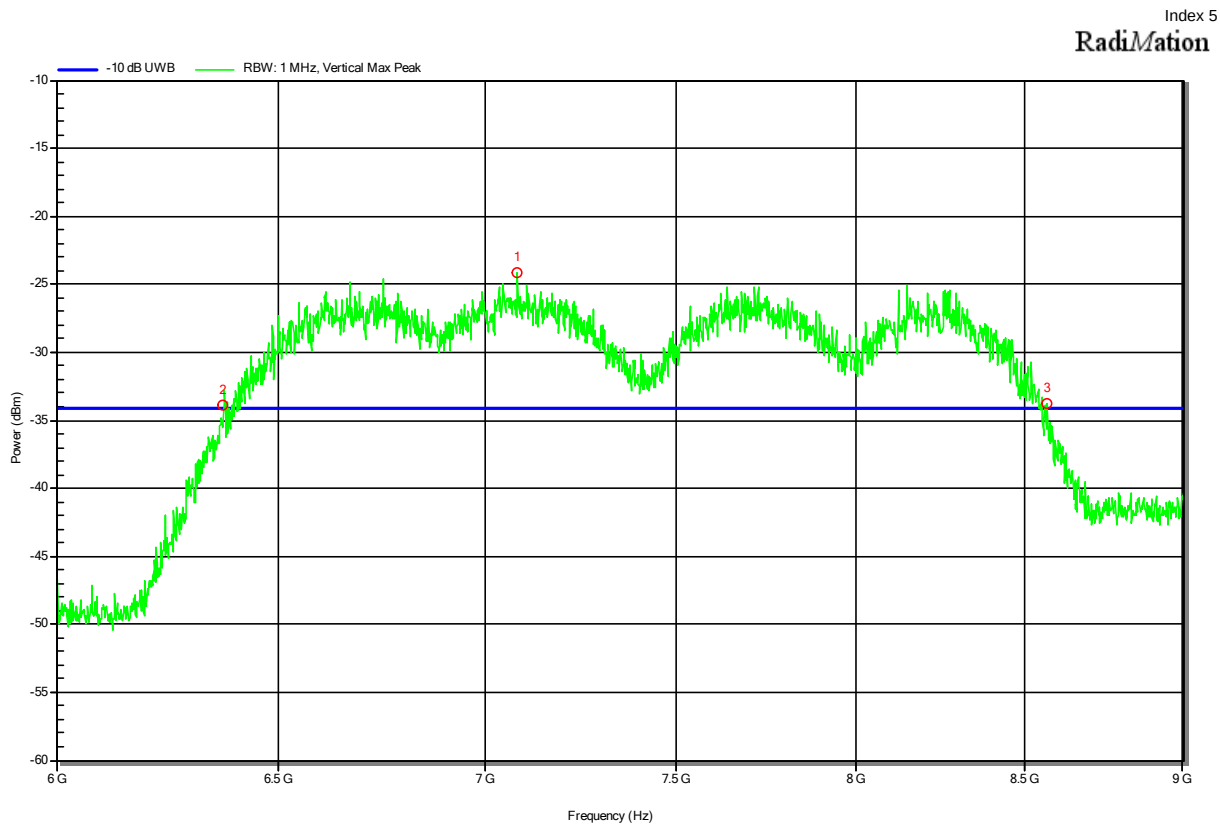
Test Procedure	
1.	EUT set to test mode
2.	The turntable and antenna polarization are set to the maximum emission level for the fundamental emission of the EUT
3.	Span is set so that the complete fundamental emission spectrum is captured
3.	Resolution bandwidth set to 1 MHz and the VBW is set to 3 MHz with peak detector and max. hold
4.	The emission spectrum is corrected by the antenna gain cable loss, low-noise amplifier gain
5.	The maximum of the spectrum envelope is determined as reference
6.	The spectrum is searched from the left edge to the center of the spectrum in order to find the lower -10 dB frequency
7.	The spectrum is searched from the right edge to the center of the spectrum in order to find the upper -10 dB frequency
8.	From the lower and upper frequency the center frequency, the -10 dB bandwidth and the fractional bandwidth are calculated

3.2.6 Results

Test Results							
Channel [MHz]	f_M [MHz]	f_C [MHz]	B_{-10} [MHz]	f_L [MHz]	f_H [MHz]	μ_{-10} [MHz]	Verdict
6717.44, 7208.96, 7700.48, 8192.00	7082.8	7470.8	2198.8	6371.4	8570.2	0.294	PASS

Radiated carrier according to RSS-220, 47 CFR § 15.517

Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46946
 Test Site: Eurofins Product Service GmbH
 Operator: A.Ibraimov
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 25 °Celsius, Vnom: 5.0 VDC
 Antenna: Schwarzbeck BBHA 9120D
 Measurement distance: 3 m
 Mode: Tx; 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Test Date: 2023-09-11
 Note:



Frequency	Peak	Polarization
6.3714 GHz	-33.8 dBm	Vertical
7.0828 GHz	-24.1 dBm	Vertical
8.5702 GHz	-33.8 dBm	Vertical

3.3 Test Conditions and Results - Maximum Peak Power

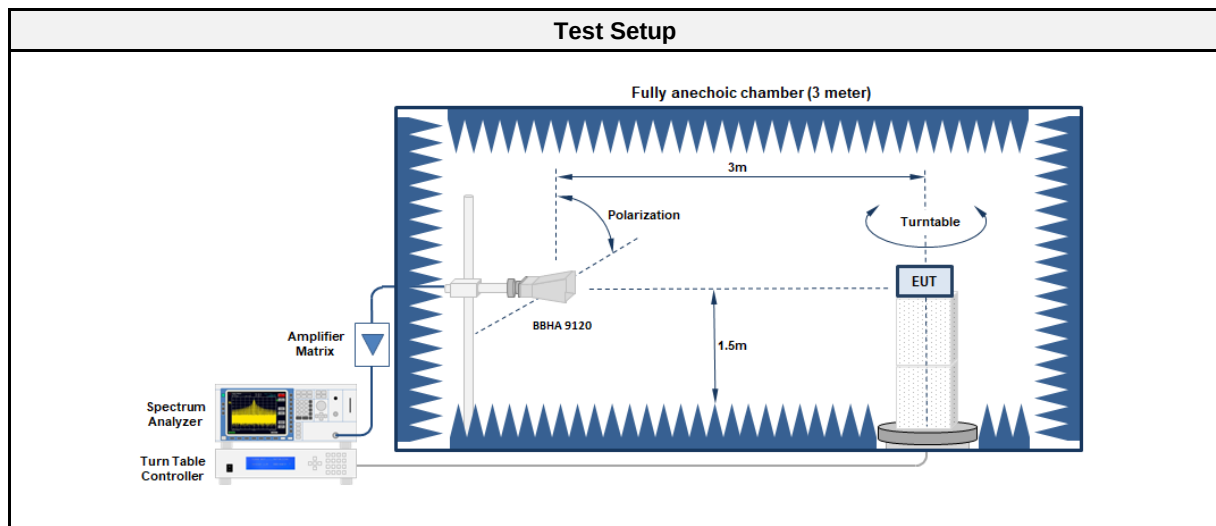
3.3.1 Information

Test Information	
Product Standard Reference	FCC Part 15.517 (e), ISED RSS-220 5.2.1 g
Date	2023-09-11
Operator	Azamat Ibraimov
Measurement Method	ANSI C63.10 10.3.5, 10.3.6, 10.3.9
Measurement Uncertainty	± 2.86 dB

3.3.2 Limits

Limits	
Bandwidth [MHz]	Power [dBm EIRP]
50	0

3.3.3 Setup



3.3.4 Equipment

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

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSU 26	EF01407	2023-08	2024-08
Anechoic Chamber	Frankonia	AC1	EF01011	2022-11	2023-11
Antenna	Schwarzbeck	BBHA 9120D	EF01153	2020-11	2023-11

3.3.5 Procedure

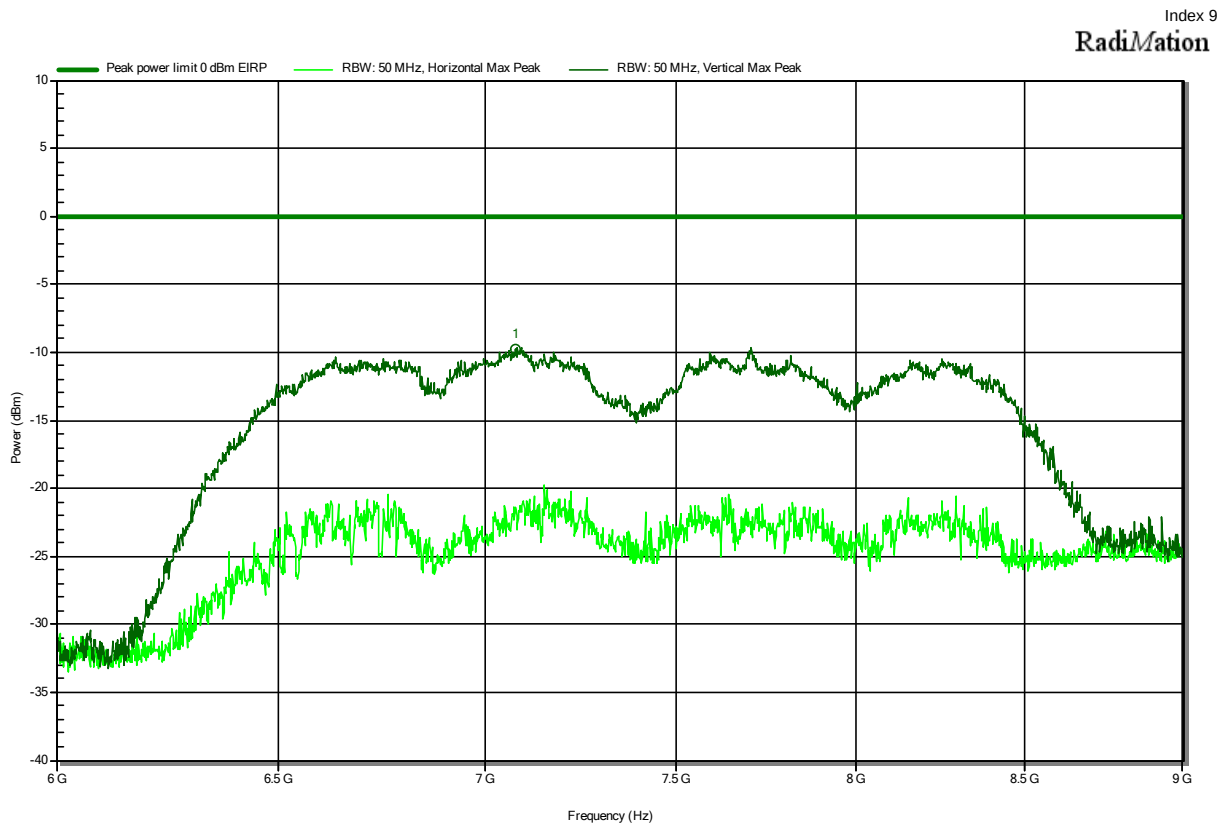
Test Procedure	
1.	EUT set to test mode
2.	The turntable and antenna polarization are set to the maximum emission level for the fundamental emission of the EUT
3.	Span is set so that the complete fundamental emission spectrum is captured
3.	Resolution bandwidth set to 50 MHz and the VBW is set to maximum with peak detector and max. hold
4.	The emission spectrum is corrected by the antenna gain cable loss, low-noise amplifier gain and path loss
5.	The maximum of the spectrum envelope is determined and compared to the limit

3.3.6 Results

Test Results				
Channel [MHz]	Emission [MHz]	Power [dBm EIRP]	Limit [dBm EIRP]	Margin [dB]
6717.44, 7208.96, 7700.48, 8192.00	7077.8	-9.8	0	-9.8

Radiated carrier according to RSS-220, 47 CFR § 15.517

Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46946
 Test Site: Eurofins Product Service GmbH
 Operator: A.Ibraimov
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 25 °Celsius, Vnom: 5.0 VDC
 Antenna: Schwarzbeck BBHA 9120D
 Measurement distance: 3 m
 Mode: Tx; 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Test Date: 2023-09-11
 Note:



Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Polarization
7.0778 GHz	-9.8 dBm	0 dBm	-9.83 dB	Pass	Vertical

3.4 Test Conditions and Results - Transmitter radiated emissions

3.4.1 Information

Test Information	
Product Standard Reference	FCC Part 15.517 (c)(d), ISSED RSS-220 5.2.1 c-f
Measurement Method	ANSI C63.10 10.2, 10.3
Measurement Uncertainty	± 5.95 dB
Date	2023-09-11 - 2023-09-12
Operator	Azamat Ibraimov

3.4.2 Limits

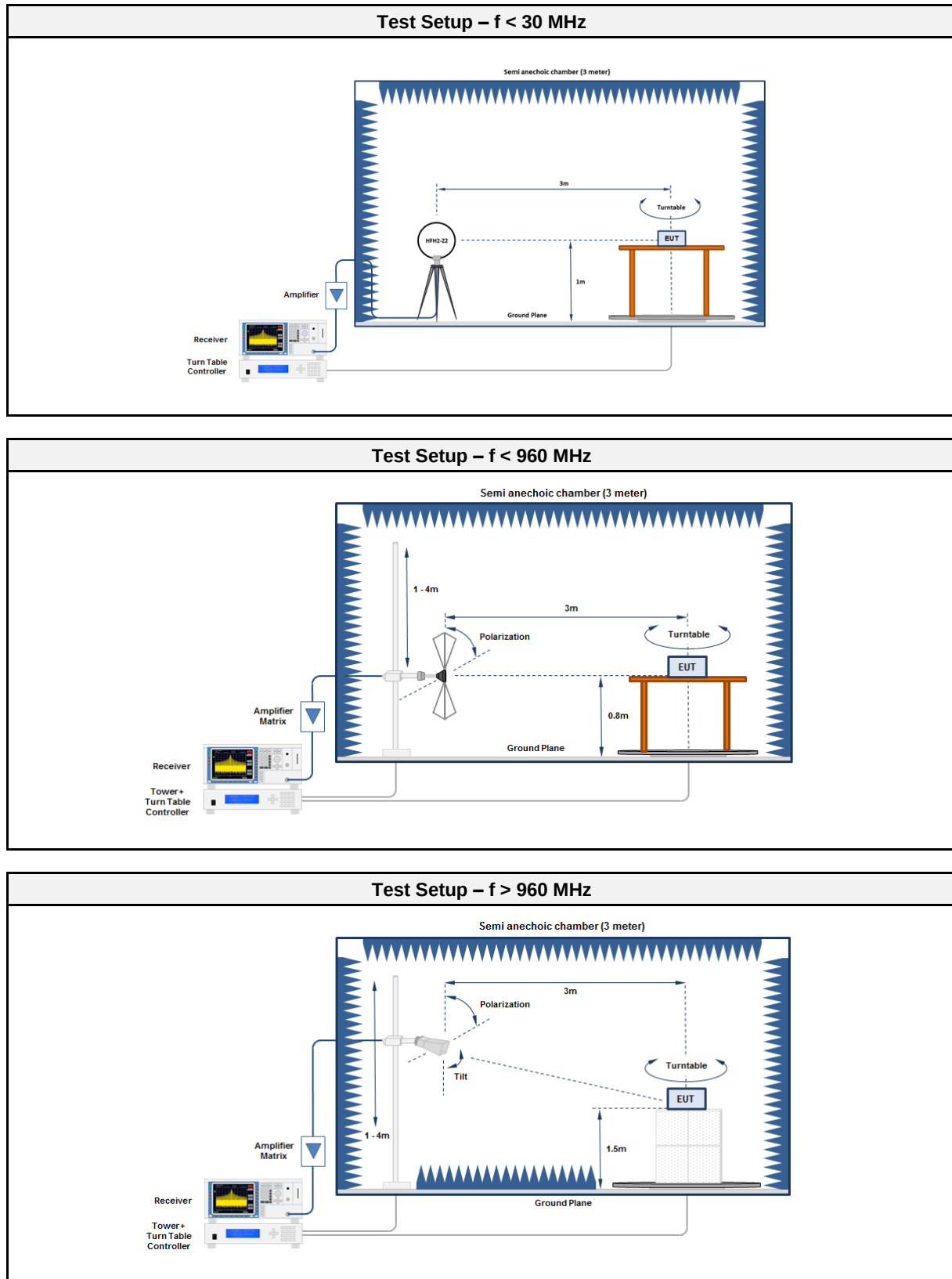
Limits - below 960 MHz			
Frequency [MHz]	Detector	Field strength [μV/m]	Measurement distance [m]
0.009 - 0.09	Average	2400/F[kHz]	300
0.09 - 0.110	Quasi-Peak	2400/F[kHz]	300
0.110 - 0.490	Average	2400/F[kHz]	300
0.490 - 1.705	Quasi-Peak	24000/F[kHz]	30
1.705 - 30.0	Quasi-Peak	30	30
30 - 88	Quasi-Peak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

Limits - FCC - above 960 MHz					
Frequency [MHz]	Bandwidth	Detector	Power [dBm EIRP]	Field Strength [dBμV/m@3m]	Field Strength [dBμV/m@1m]
960-1610	1 MHz	RMS	-75.3	19.9	29.5
1610-1990	1 MHz	RMS	-53.3	41.9	51.5
1990-3100	1 MHz	RMS	-51.3	43.9	53.5
3100-10600	1 MHz	RMS	-41.3	53.9	63.5
> 10600	1 MHz	RMS	-51.3	43.9	53.5

Limits - ISSED - above 960 MHz					
Frequency [MHz]	Bandwidth	Detector	Power [dBm EIRP]	Field Strength [dBμV/m@3m]	Field Strength [dBμV/m@1m]
960-1610	1 MHz	RMS	-75.3	19.9	29.5
1610-4750	1 MHz	RMS	-70.0	25.2	34.7
4750-10600	1 MHz	RMS	-41.3	53.9	63.5
> 10600	1 MHz	RMS	-51.3	43.9	53.5

Limits - GNSS Band					
Frequency [MHz]	Bandwidth	Detector	Power [dBm EIRP]	Field Strength [dBμV/m@3m]	Field Strength [dBμV/m@1m]
1164-1240	1 kHz	RMS	-85.3	9.9	19.5
1559-1610	1 kHz	RMS	-85.3	9.9	19.5

3.4.3 Setup



3.4.4 Equipment

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

Test Equipment f < 30 MHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2022-11	2025-11
Loop Antenna	R&S	HFH2-Z2	EF00184	2021-01	2024-01
Measurement Receiver	Agilent	N9038A-526/WXP	EF01070	2023-02	2024-02

Test Equipment 30 - 960 MHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2022-11	2025-11
Measurement Receiver	Agilent	N9038A-526/WXP	EF01070	2023-02	2024-02
Trilog Broadband Antenna	Schwarzbeck	VULB 9168	EF01824	2022-10	2023-10

Test Equipment 0.96 – 4.8 GHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF01011	2022-11	2023-11
Antenna	Schwarzbeck	BBHA 9120D	EF01561	2021-11	2024-11
EMI Test Receiver	R&S	ESR7	EF00943	2023-08	2024-08

Test Equipment f > 4.8 GHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic chamber	Frankonia	AC 2	EF01616	2022-10	2023-10
Spectrum analyzer	R&S	FSW43	EF00896	2023-08	2024-08
Horn antenna	Schwarzbeck	BBHA 9120B (1-10GHz)	EF01678	2021-03	2024-03
Double Ridged Waveguide Horn Antenna	Schwarzbeck	HWRD 650 (6,5-18GHz)	EF01679	2021-03	2024-03
Antenna	Amplifier Research	ATH18G40	EF01152	2020-11	2023-11
Antenna	Flann Microwave Ltd	22240-25 Amp. CBL26402075	EF00301	2023-01	2026-01

3.4.5 Procedure

Test Procedure $f < 30$ 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 and average detection with max hold 4. The EUT is rotated through 360° 5. All significant emissions are measured again using the corresponding final detector
Test Procedure 30 - 960 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 960 - 4800 MHz
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 RMS detection with max hold, measure time is set to 1 ms, step size is set to RBW/2. 4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m
Test Procedure > 4800 MHz
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 RMS detection with max hold, 30001 sweep points and 30 s sweep time. 4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m

3.4.6 Results

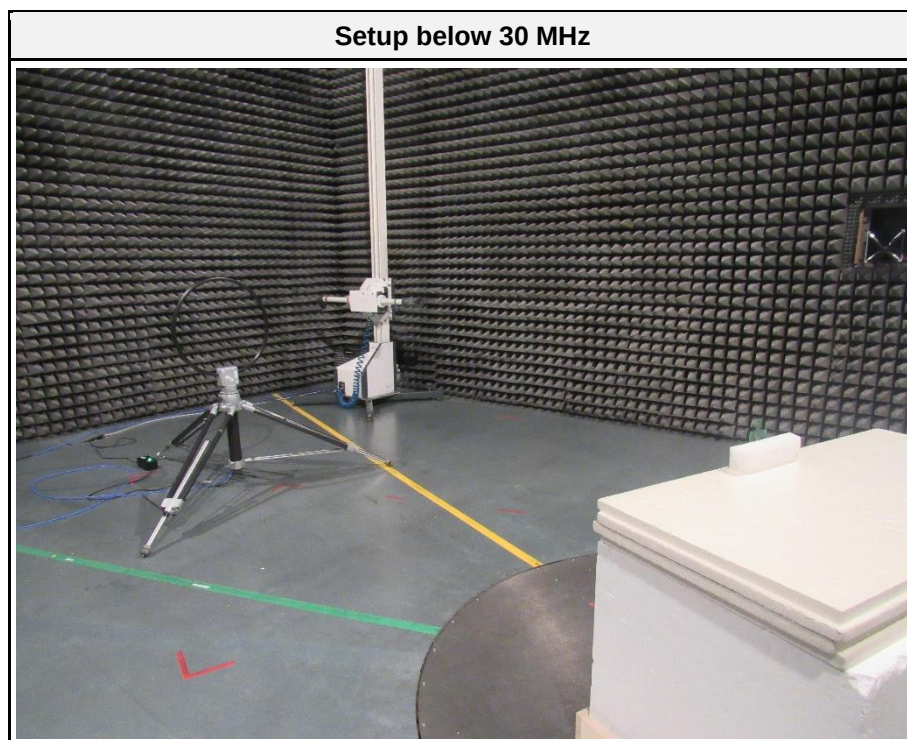
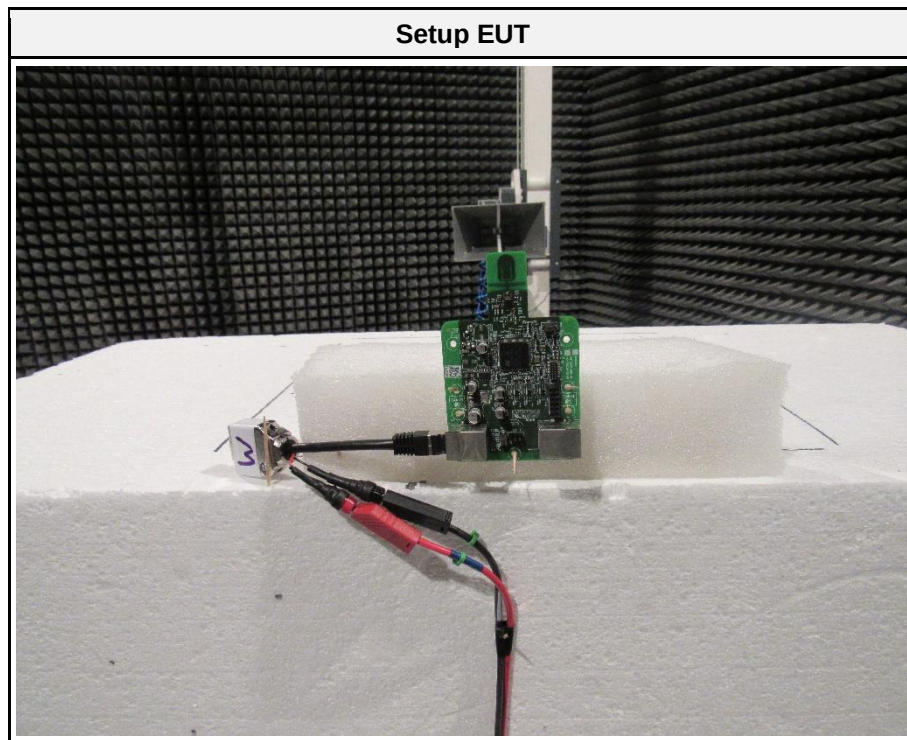
Test Results – f < 30 MHz					
Channel [MHz]	Emission [MHz]	Level [dBμV/m]	Det.	Limit [dBμV/m]	Margin [dB]
No significant spurious emissions					

Test Results – 30 - 960 MHz						
Channel [MHz]	Emission [MHz]	Level [dBμV/m]	Det.	Pol.	Limit [dBμV/m]	Margin [dB]
6717.44, 7208.96, 7700.48, 8192.00	42.5085	24.10	pk	ver	40.00	-15.92
6717.44, 7208.96, 7700.48, 8192.00	914.802	36.30	pk	ver	46.00	-09.70

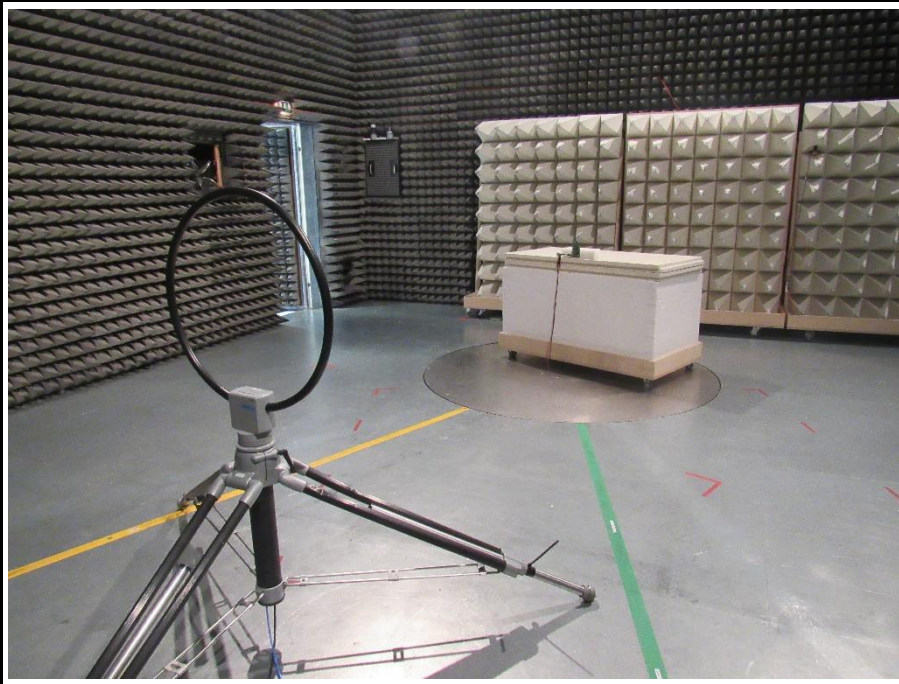
Test Results – 960 MHz - 40 GHz						
Channel [MHz]	Emission [MHz]	Level [dBμV/m]	Det.	Pol.	Limit [dBμV/m]	Margin [dB]
6717.44, 7208.96, 7700.48, 8192.00	6993.8	-42.5 dBm	RMS	ver	-41.3 dBm	-01.18
6717.44, 7208.96, 7700.48, 8192.00	7079.8	-41.4 dBm	RMS	ver	-41.3 dBm	-00.15
6717.44, 7208.96, 7700.48, 8192.00	8106	-44.2 dBm	RMS	ver	-41.3 dBm	-02.90

Test Results – GNSS Band						
Channel [MHz]	Emission [MHz]	Level [dBμV/m]	Det.	Pol.	Limit [dBμV/m]	Margin [dB]
No significant spurious emissions						

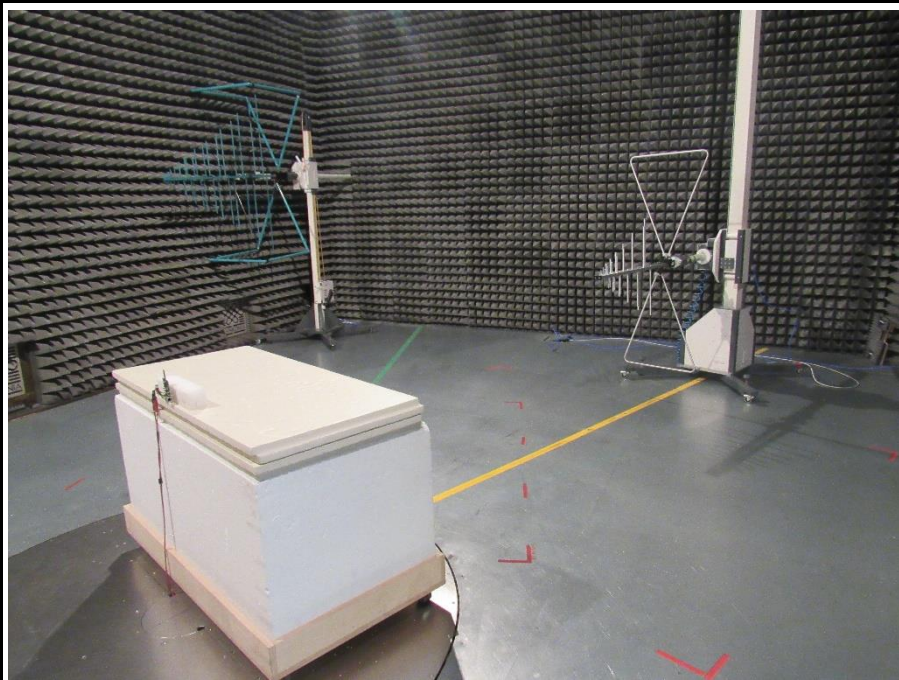
3.4.7 Setup photos



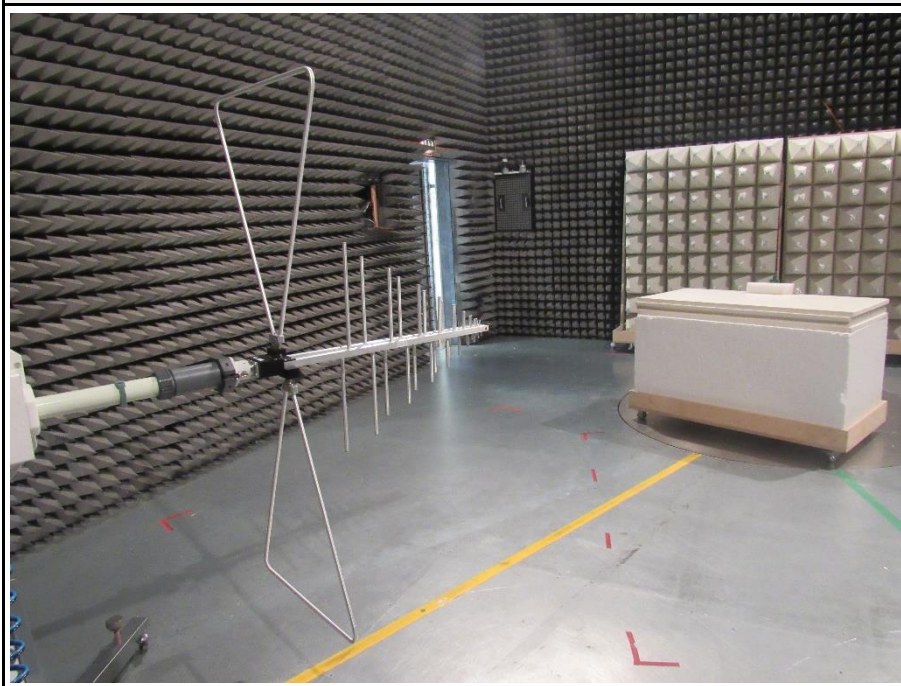
Setup below 30 MHz



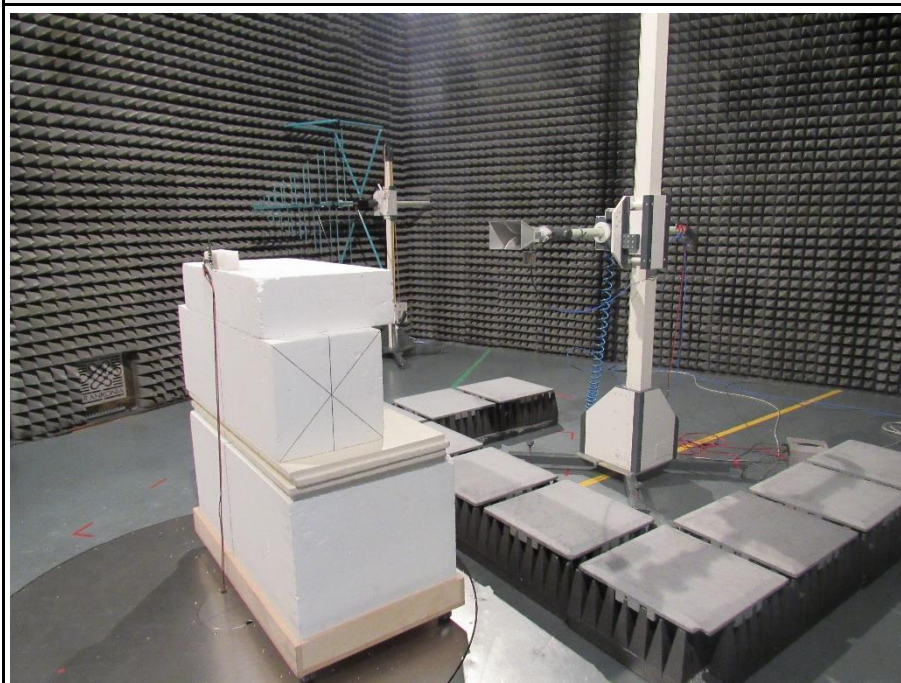
Setup 30 to 960 MHz



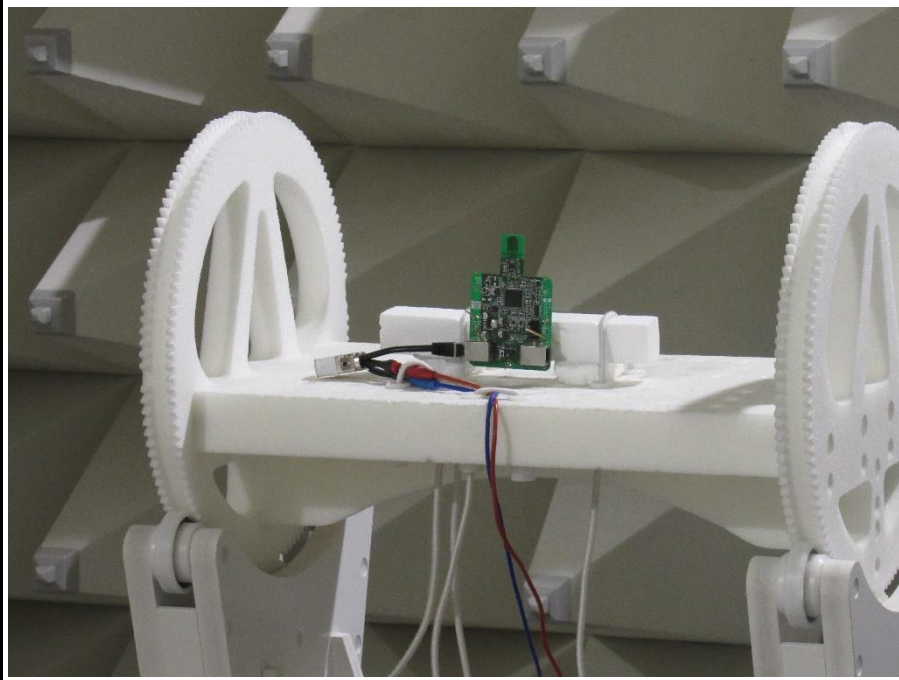
Setup 30 to 960 MHz



Setup 960 to 4800 MHz, 1.5 m measurement distance

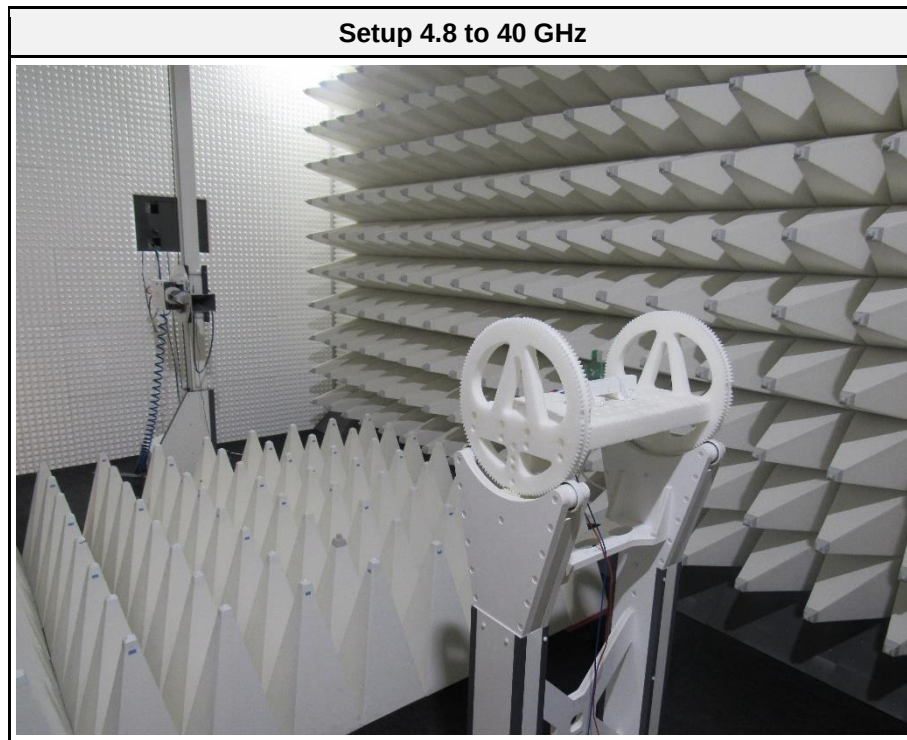


Setup EUT



Setup 4.8 to 40 GHz





3.5 Test Conditions and Results - Receiver radiated emissions

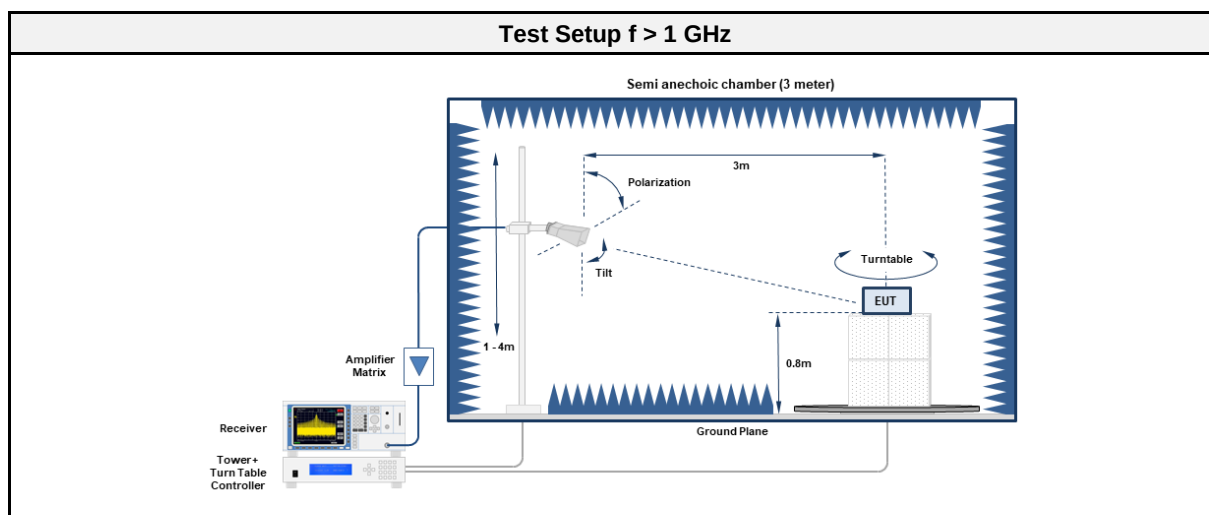
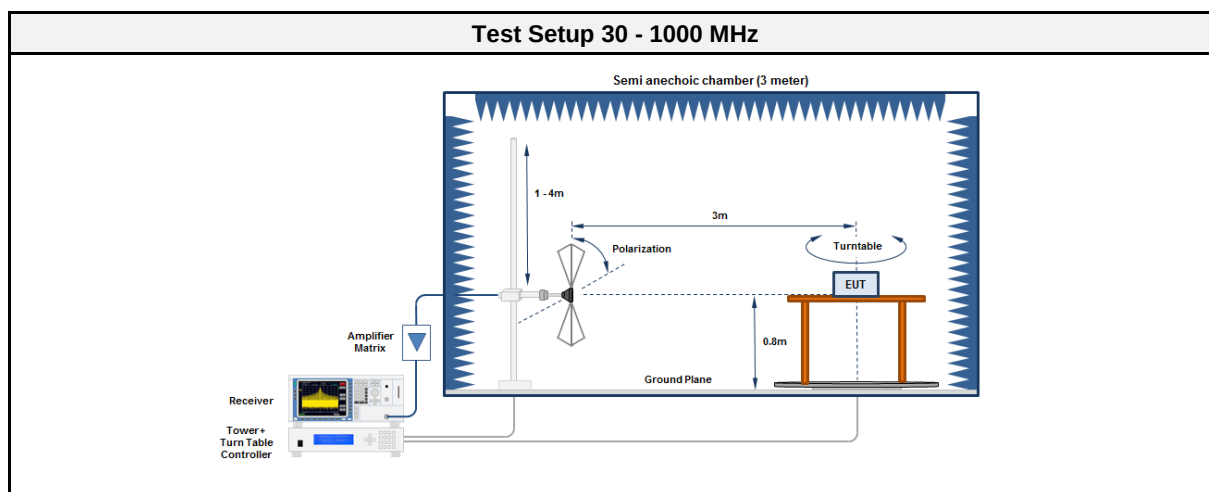
3.5.1 Information

Test Information	
Product Standard Reference	ISED RSS-220 3.1, RSS-Gen 7.3
Measurement Method	ANSI C63.4-2014 8.1-8.3
Measurement Uncertainty	± 5.95 dB
Operator	Azamat Ibraimov
Date	2023-09-12

3.5.2 Limits

Limits			
Frequency [MHz]	Detector	Field strength [dB μ 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

3.5.3 Setup



Test Report No.: G0M-2306-2086-TFC15FUW-V02

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

3.5.4 Equipment

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

Test Equipment 30 - 1000 MHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2022-11	2025-11
Measurement Receiver	Agilent	N9038A-526/WXP	EF01070	2023-02	2024-02
Trilog Broadband Antenna	Schwarzbeck	VULB 9168	EF01824	2022-10	2023-10

Test Equipment f > 1 GHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF01011	2022-11	2023-11
Measurement Receiver	Agilent	N9038A-526/WXP	EF01070	2023-02	2024-02
Spectrum analyzer	R&S	FSW43	EF00896	2023-08	2024-08
Antenna	Schwarzbeck	BBHA 9120D	EF01561	2021-11	2024-11
Double Ridged Waveguide Horn Antenna	Schwarzbeck	HWRD 650 (6,5-18GHz)	EF01679	2021-03	2024-03
Antenna	Amplifier Research	ATH18G40	EF01152	2020-11	2023-11
Antenna	Flann Microwave Ltd	22240-25 Amp. CBL26402075	EF00301	2023-01	2026-01

3.5.5 Procedure

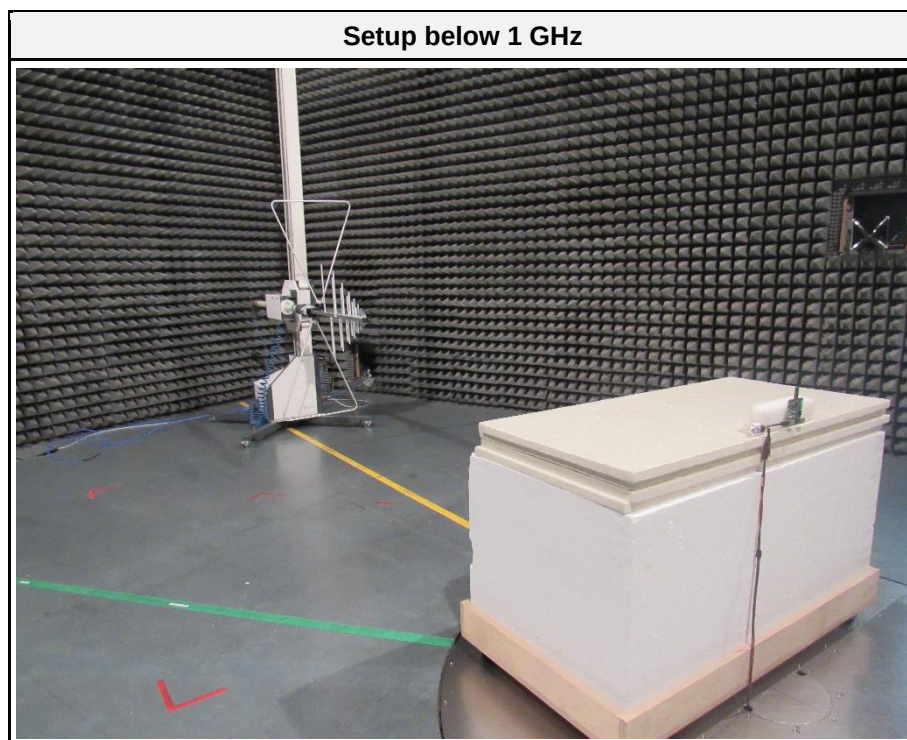
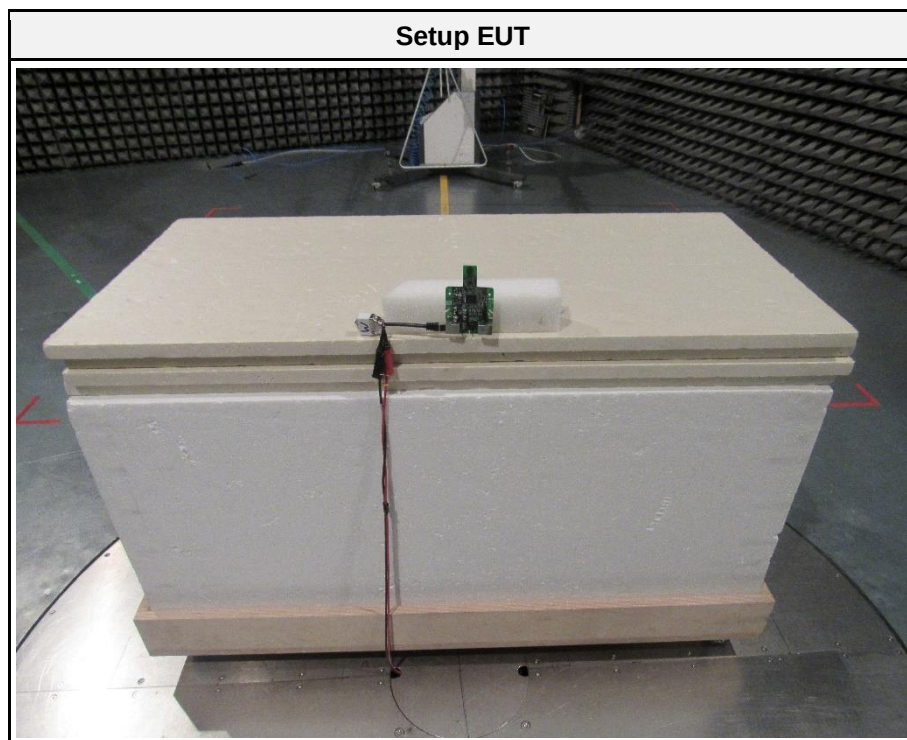
Test Procedure
1. EUT is placed on a non conducting support at the center of a turn table 0.8 m above the ground 2. EUT set to test mode 3. The receiver is set to peak detection with max hold 4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m 5. All significant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

Test Procedure f > 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

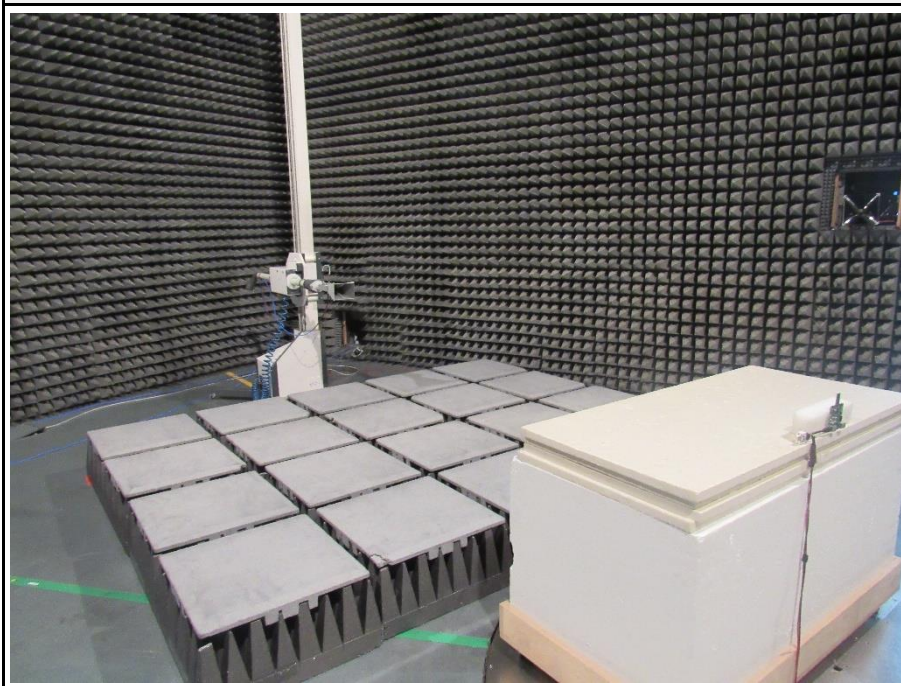
3.5.6 Results

Test Results						
Channel [MHz]	Emission [MHz]	Level [dBμV/m]	Det.	Pol.	Limit [dBμV/m]	Margin [dB]
6717.44, 7208.96, 7700.48, 8192.00	42.4888	22.60	pk	ver	40.00	-17.35
6717.44, 7208.96, 7700.48, 8192.00	39903	50.46	pk	ver	74.00	-23.54
6717.44, 7208.96, 7700.48, 8192.00	39903	41.24	avg	ver	53.98	-12.74

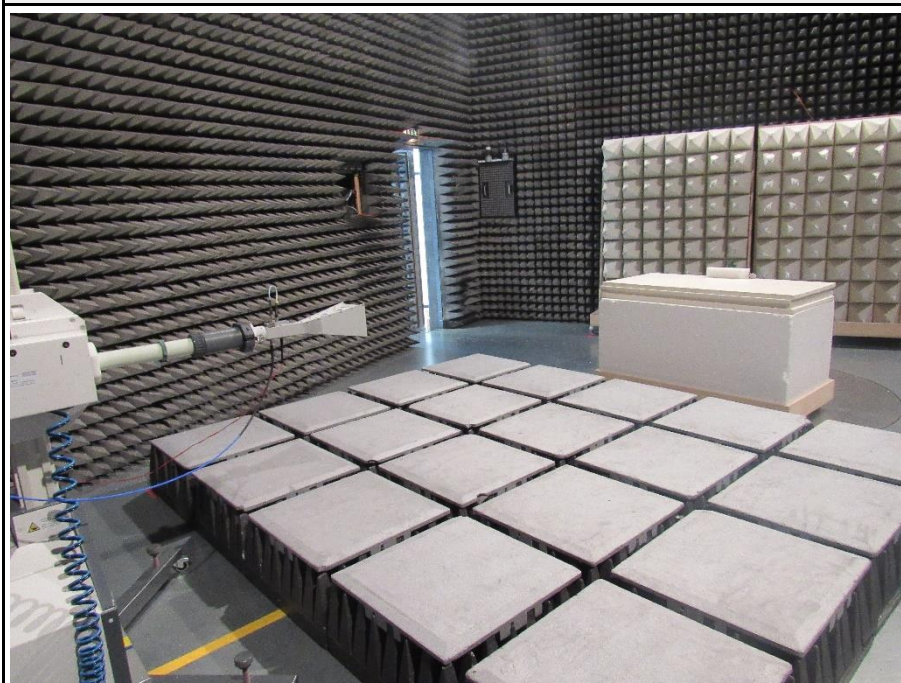
3.5.7 Setup photos



Setup above 1 GHz



Setup above 1 GHz



3.6 Test Conditions and Results - AC powerline conducted emissions

3.6.1 Information

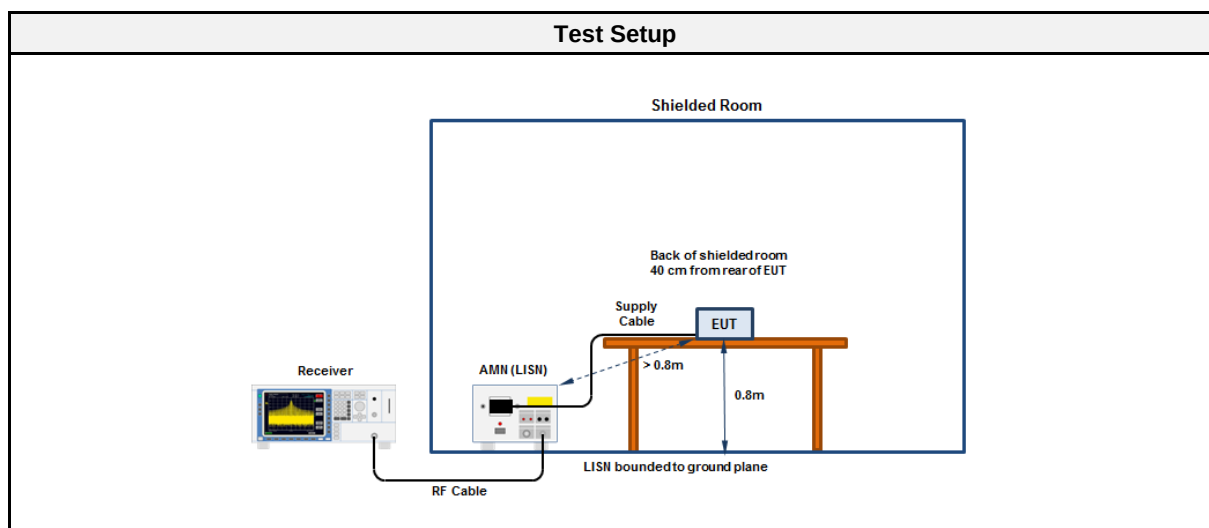
Test Information	
Reference	FCC 15.207; ISED RSS-220 3.1, RSS-Gen, Issue 5, Amendment 2
Measurement Method	ANSI C63.10 6.2
Measurement Uncertainty	± 3.82 dB
Operator	Florian Voigt
Date	2023-09-16

3.6.2 Limits

Limits		
Frequency [MHz]	Quasi-Peak [dB μ V]	Average [dB μ V]
0.15 - 0.5	66 - 56*	56 - 46*
0.5 - 5	56	46
5 - 30	60	50

* Limit decreases linearly with the logarithm of the frequency

3.6.3 Setup



3.6.4 Equipment

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

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
EMI Test Receiver	R&S	ESR7	EF00943	2023-08	2024-08
Pulse Limiter	R&S	ESH3-Z2	EF01222	2023-08	2025-08
LISN	Schwarzbeck	NSLK 8127 RC	EF01592	2023-06	2024-06

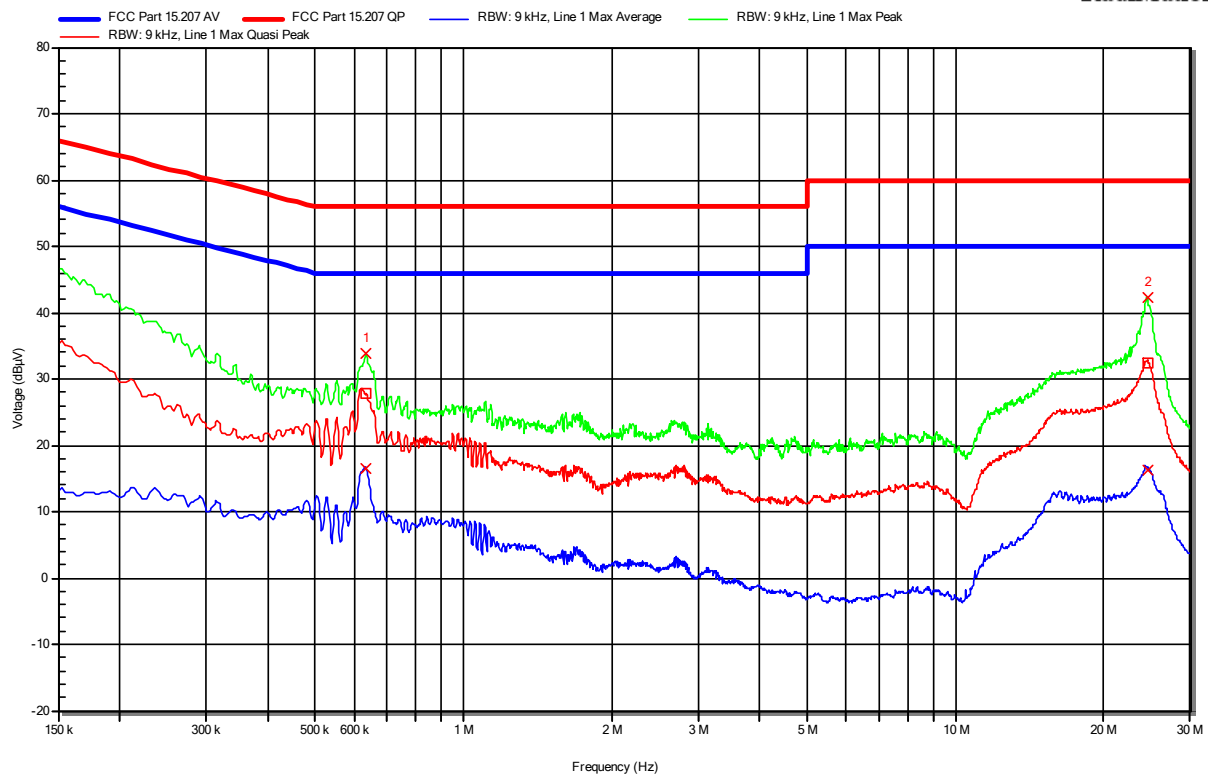
3.6.5 Results

Conducted emissions at the mains power port according to RSS-220, 47 CFR § 15.517

Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46946
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Voigt
 Test Date: 2023-09-16
 Operating Conditions: ambient temperature: 24 °Celsius
 power input: 5.0 VDC
 LISN: Schwarzbeck NSLK 8127 RC L1
 Operational Mode: 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Applied to Port: Mains
 Note 1:

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RadiMation



Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	LISN
1	633.75 kHz	27.79 dBμV	56 dBμV	-28.21 dB	Pass	Line 1
2	24.522 MHz	32.43 dBμV	60 dBμV	-27.57 dB	Pass	Line 1

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	LISN
1	633.75 kHz	16.43 dBμV	46 dBμV	-29.57 dB	Pass	Line 1
2	24.522 MHz	16.37 dBμV	50 dBμV	-33.63 dB	Pass	Line 1

Test Report No.: G0M-2306-2086-TFC15FUW-V02

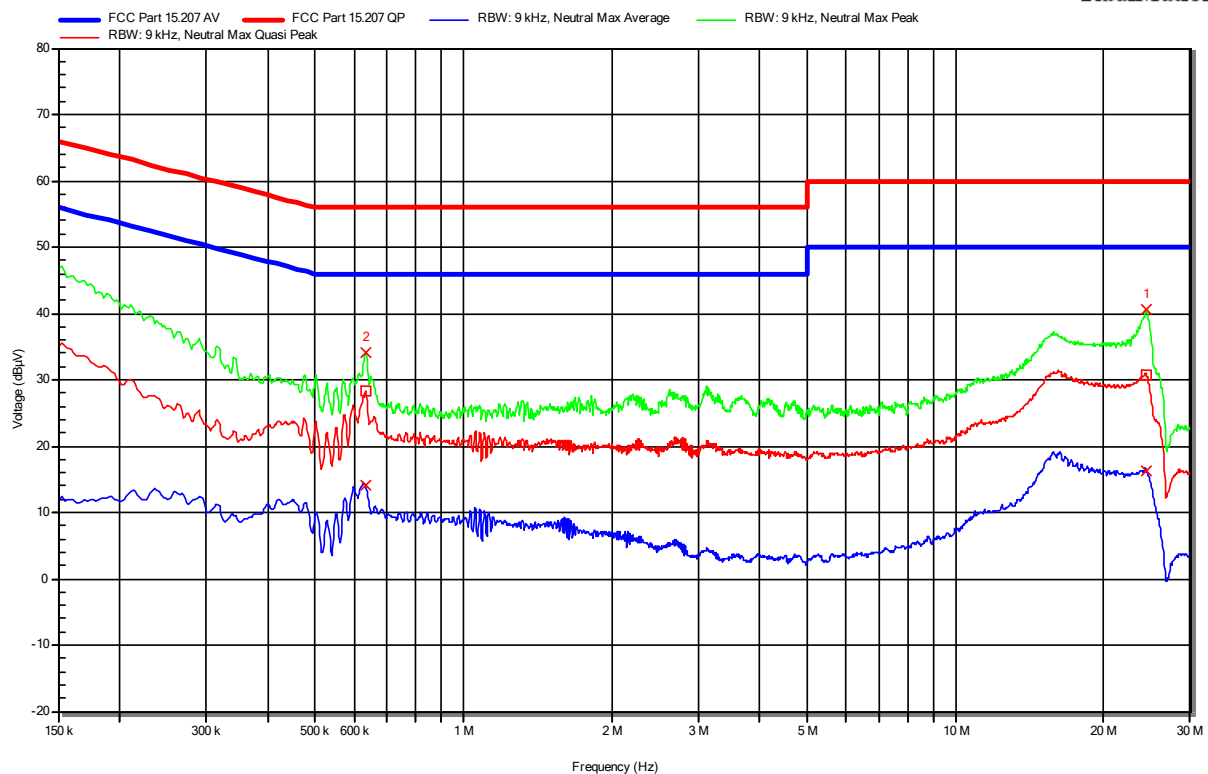
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Conducted emissions at the mains power port according to RSS-220, 47 CFR § 15.517

Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46946
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Voigt
 Test Date: 2023-09-16
 Operating Conditions: ambient temperature: 24 °Celsius
 power input: 5.0 VDC
 LISN: Schwarzbeck NSLK 8127
 Operational Mode: 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Applied to Port: Mains
 Note 1:

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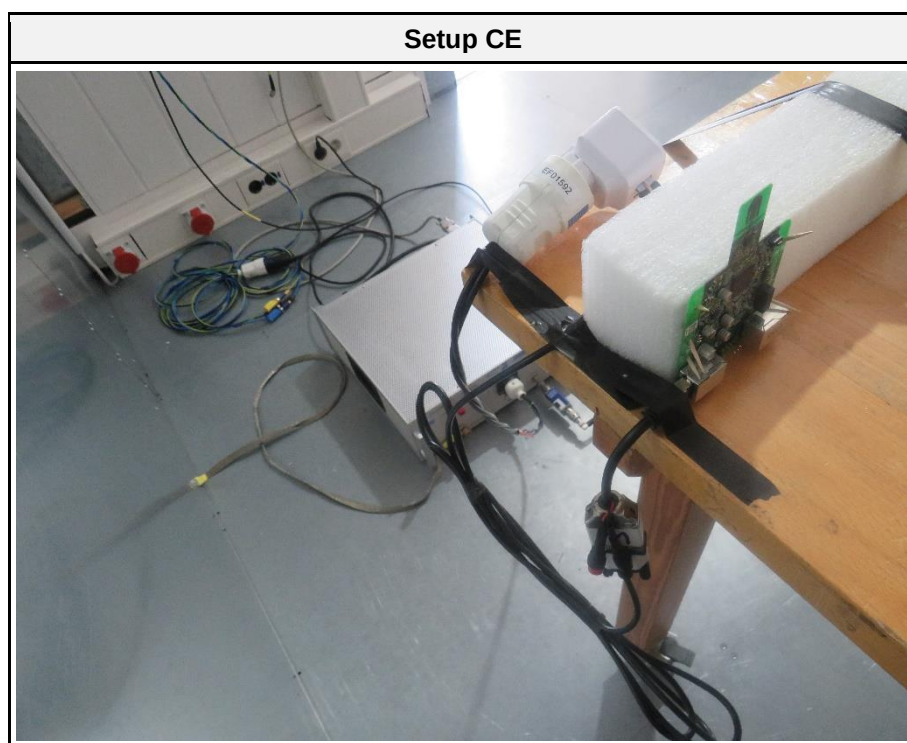
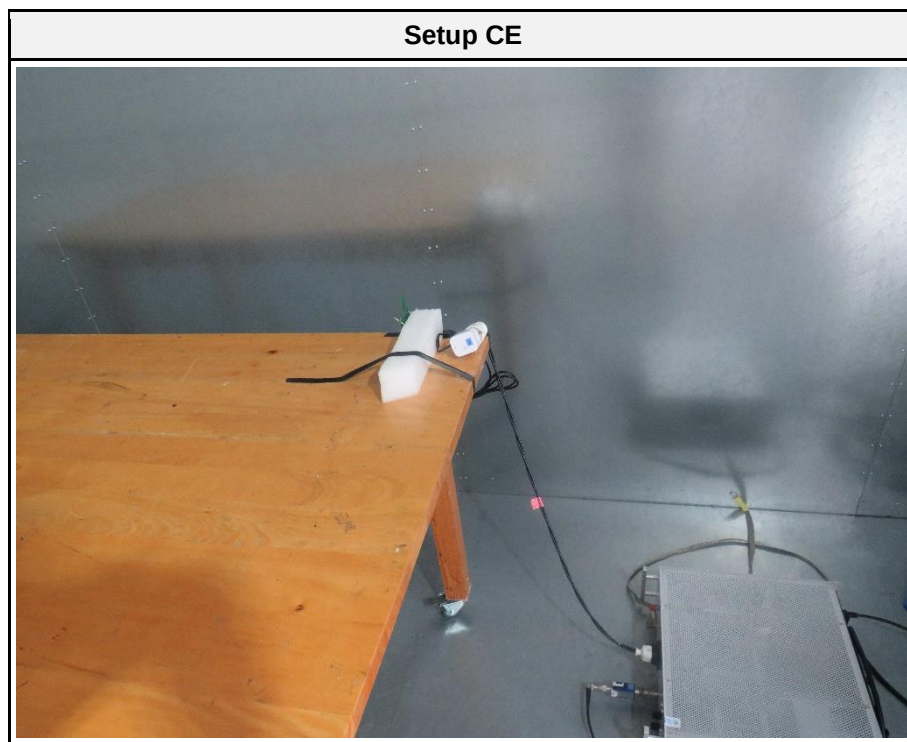
Radiation



Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	LISN
1	24.342 MHz	30.83 dBµV	60 dBµV	-29.17 dB	Pass	Neutral
2	631.5 kHz	28.27 dBµV	56 dBµV	-27.73 dB	Pass	Neutral

Peak Number	Frequency	Average	Average Limit	Average Difference	Average Status	LISN
1	24.342 MHz	16.17 dBµV	50 dBµV	-33.83 dB	Pass	Neutral
2	631.5 kHz	14.06 dBµV	46 dBµV	-31.94 dB	Pass	Neutral

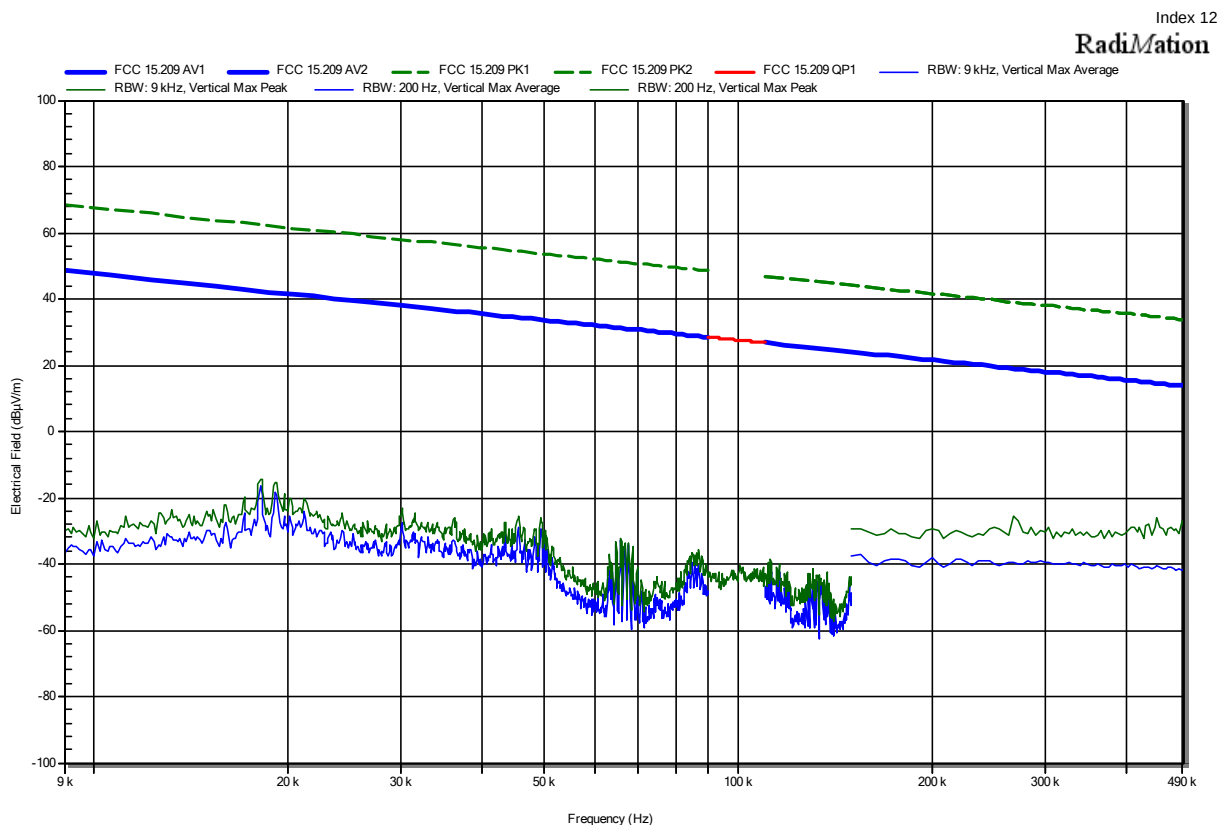
3.6.6 Setup photos



ANNEX A Transmitter radiated emissions

Radiated Spurious Emissions according to RSS-220, 47 CFR § 15.517

Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46946
 Test Site: Eurofins Product Service GmbH
 Operator: A.Ibraimov
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 25 °Celsius, Vnom: 5.0 VDC
 Antenna: Rohde & Schwarz HFH 2-Z2
 Measurement distance: 3 m, converted to 300 m
 Mode: Tx; 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Test Date: 2023-09-12
 Note: Antenna parallel to EUT PCB

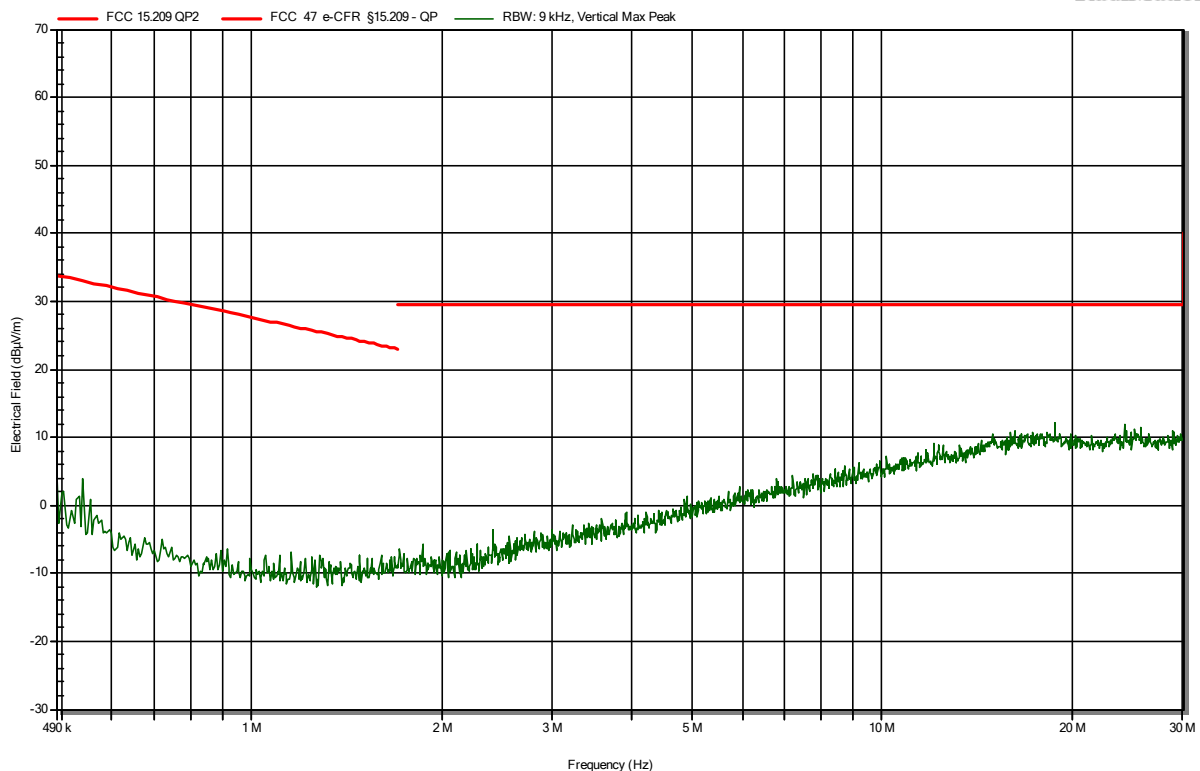


Radiated Spurious Emissions according to 47 CFR § 15.517

Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46946
 Test Site: Eurofins Product Service GmbH
 Operator: A.Ibraimov
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 25 °Celsius, Vnom: 5.0 VDC
 Antenna: Rohde & Schwarz HFH 2-Z2
 Measurement distance: 3 m, converted to 30 m
 Mode: Tx; 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Test Date: 2023-09-12
 Note: Antenna parallel to EUT PCB

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RadiMation

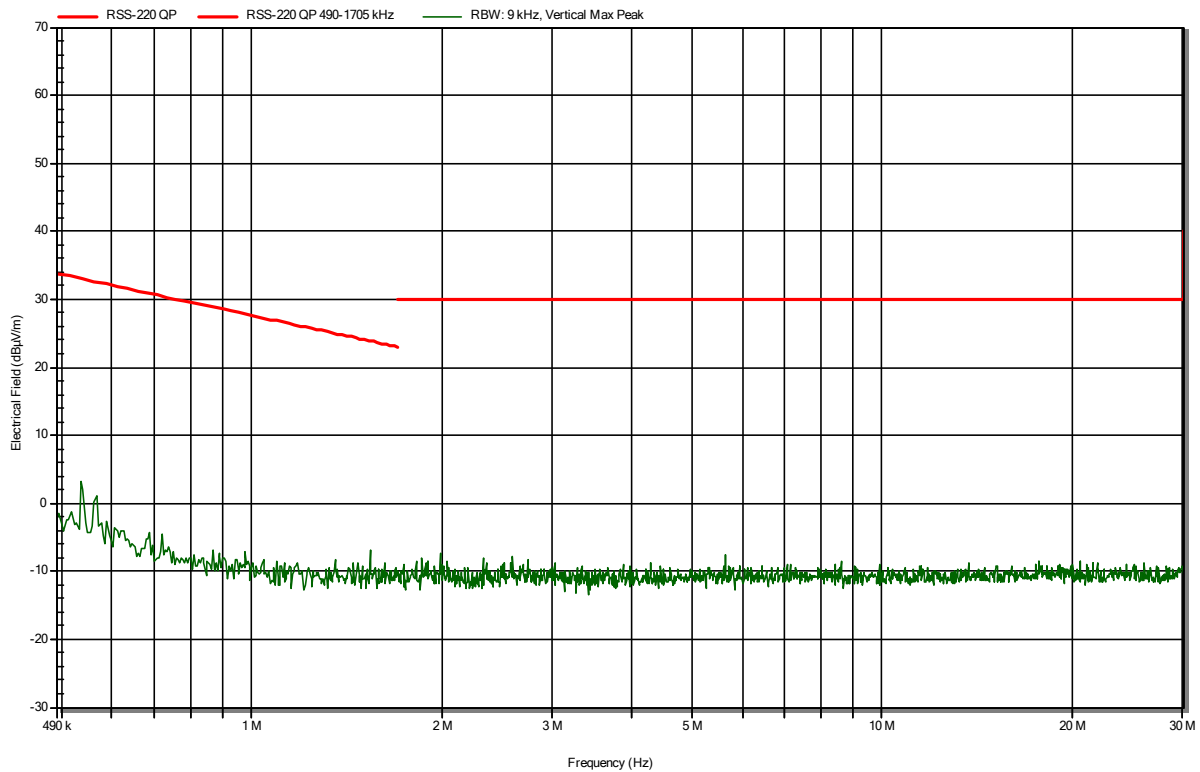


Radiated Spurious Emissions according to RSS-220

Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46946
 Test Site: Eurofins Product Service GmbH
 Operator: A.Ibraimov
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 25 °Celsius, Vnom: 5.0 VDC
 Antenna: Rohde & Schwarz HFH 2-Z2, Vertical
 Measurement distance: 3 m, converted to 30 m
 Mode: Tx; 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Test Date: 2023-09-12
 Note: Antenna parallel to EUT PCB

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RadiMation

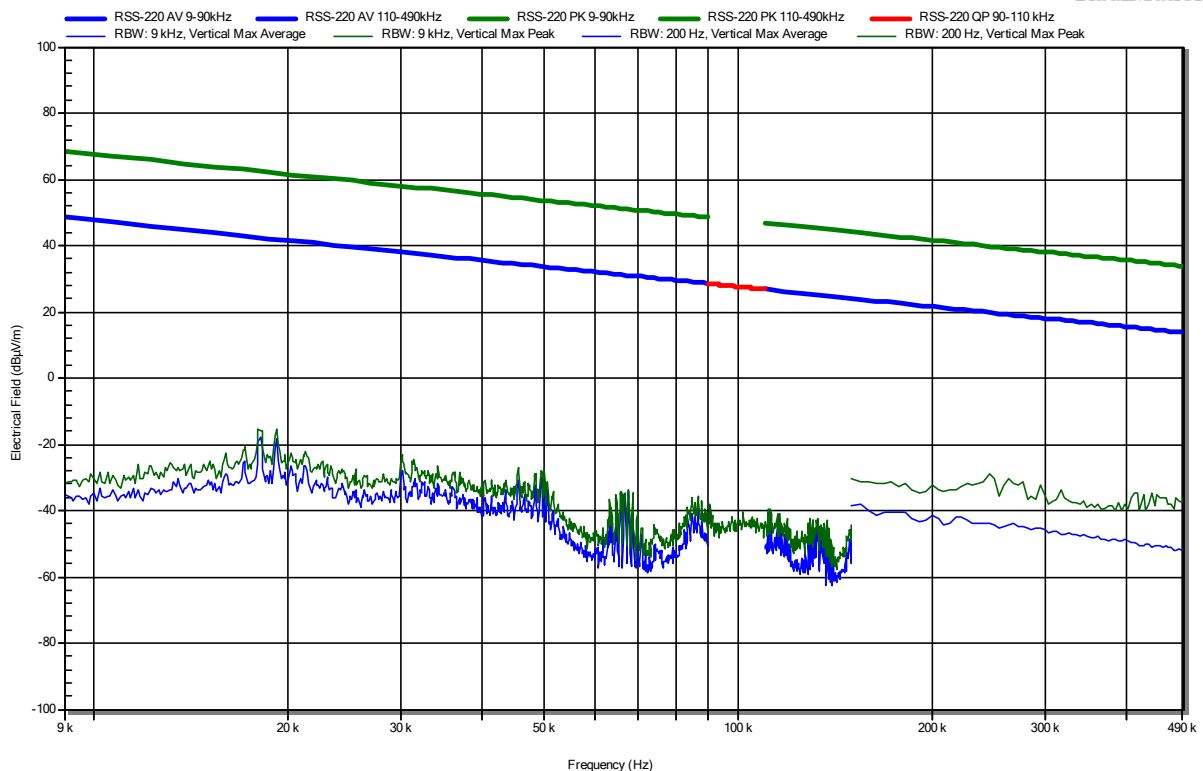


Radiated Spurious Emissions according to RSS-220, 47 CFR § 15.517

Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46946
 Test Site: Eurofins Product Service GmbH
 Operator: A.Ibraimov
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 25 °Celsius, Vnom: 5.0 VDC
 Antenna: Rohde & Schwarz HFH 2-Z2, Vertical
 Measurement distance: 3 m, converted to 300 m
 Mode: Tx; 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Test Date: 2023-09-12
 Note: Antenna perpendicular to EUT PCB

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RadiMation

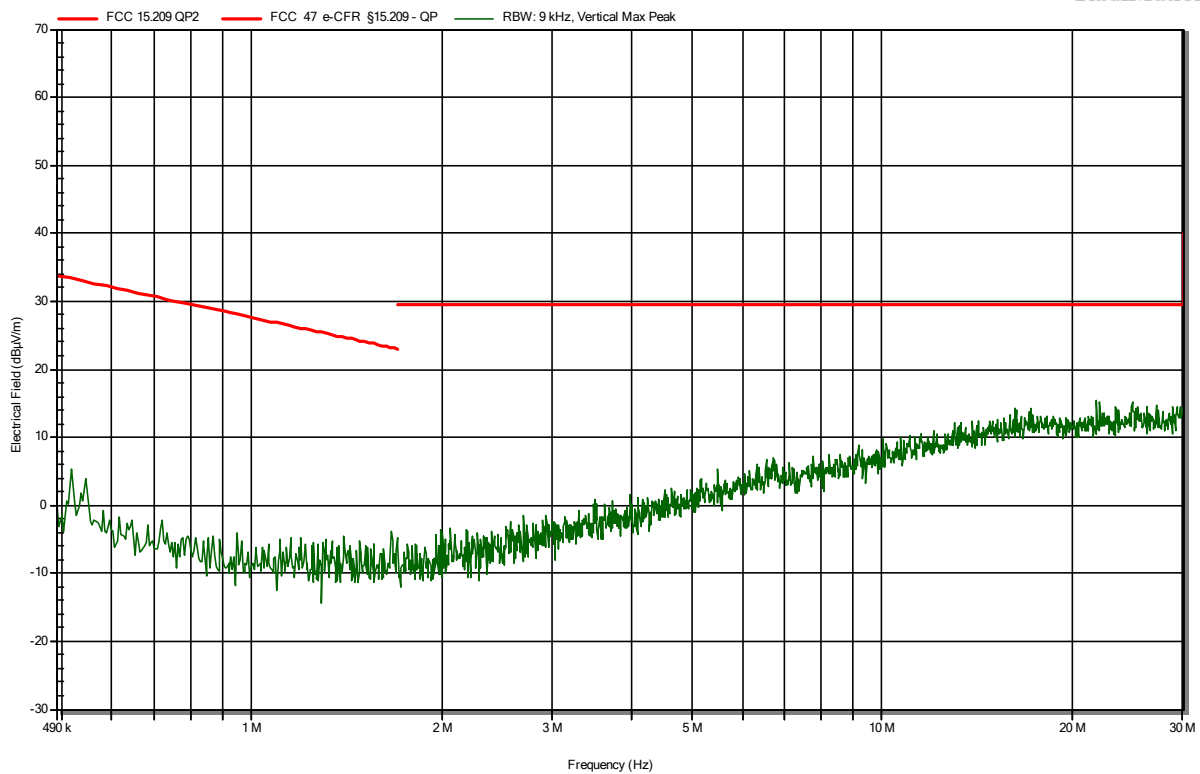


Radiated Spurious Emissions according to 47 CFR § 15.517

Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46946
 Test Site: Eurofins Product Service GmbH
 Operator: A.Ibraimov
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 25 °Celsius, Vnom: 5.0 VDC
 Antenna: Rohde & Schwarz HFH 2-Z2, Vertical
 Measurement distance: 3 m, converted to 30 m
 Mode: Tx; 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Test Date: 2023-09-12
 Note: Antenna perpendicular to EUT PCB

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RadiMation

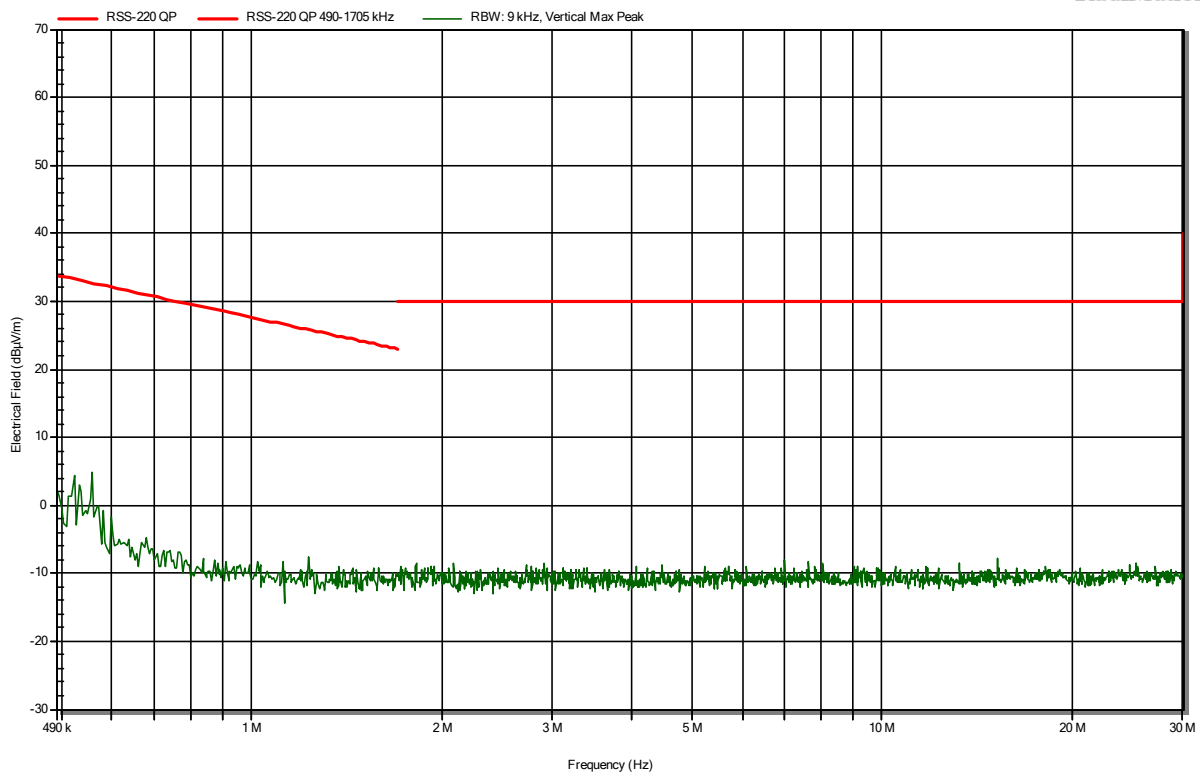


Radiated Spurious Emissions according to RSS-220

Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46946
 Test Site: Eurofins Product Service GmbH
 Operator: A.Ibraimov
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 25 °Celsius, Vnom: 5.0 VDC
 Antenna: Rohde & Schwarz HFH 2-Z2, Vertical
 Measurement distance: 3 m, converted to 30 m
 Mode: Tx; 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Test Date: 2023-09-12
 Note: Antenna perpendicular to EUT PCB

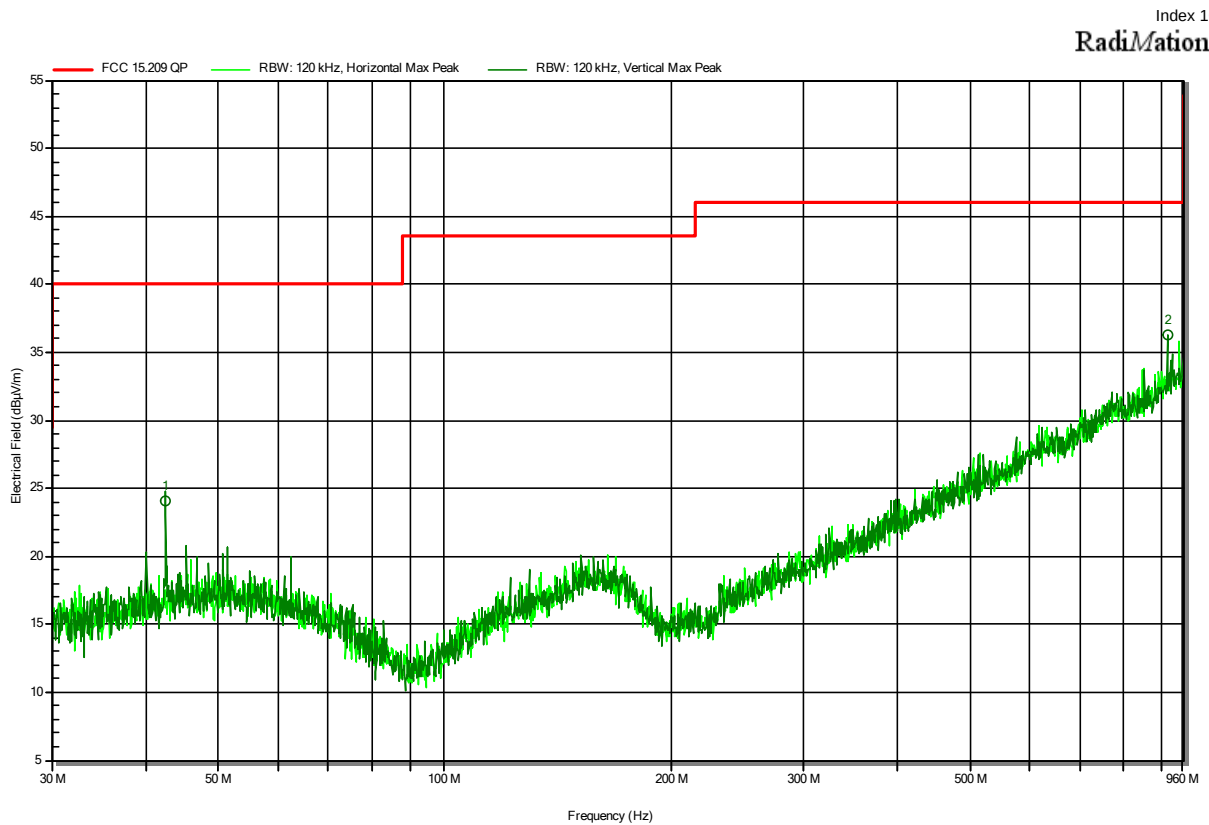
Index 19

RadiMation



Radiated Spurious Emissions according to RSS-220, 47 CFR § 15.517

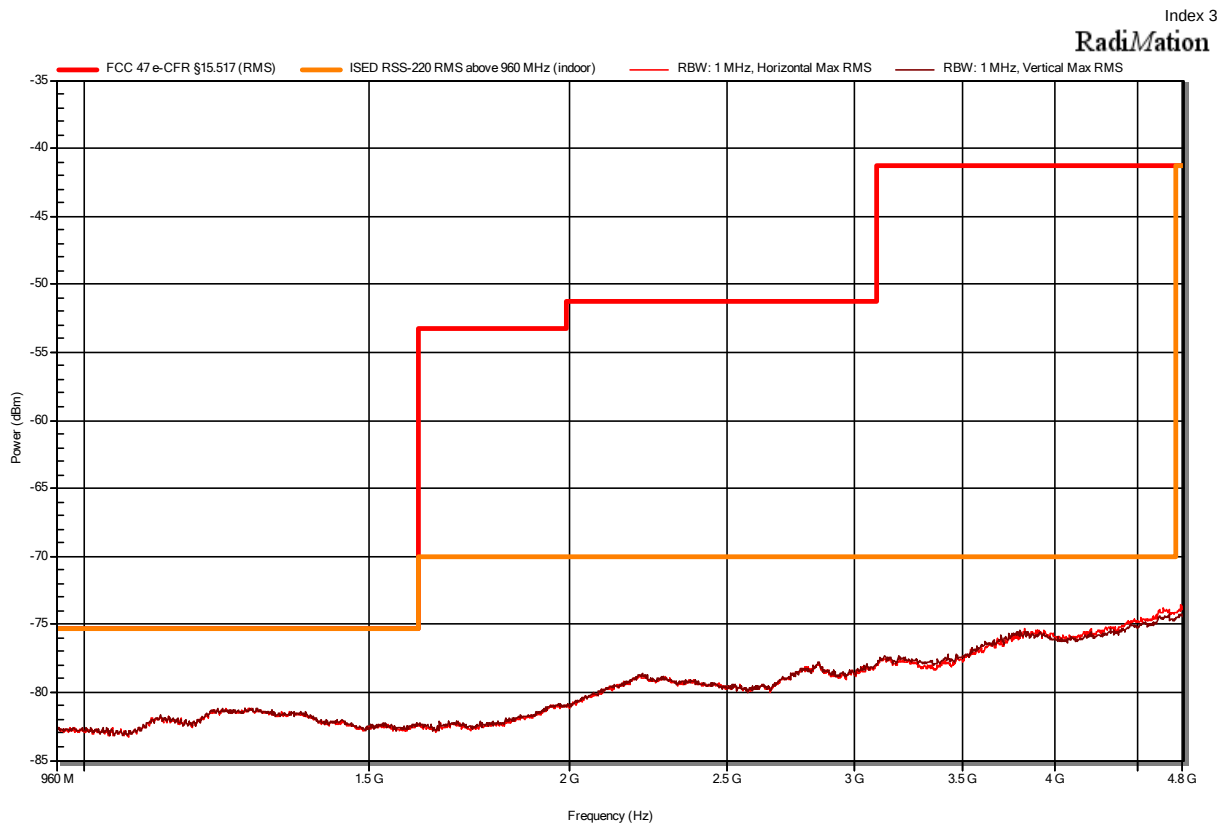
Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46946
 Test Site: Eurofins Product Service GmbH
 Operator: A.Ibraimov
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 25 °Celsius, Vnom: 5.0 VDC
 Antenna: Schwarzbeck VULB 9168
 Measurement distance: 3 m
 Mode: Tx; 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Test Date: 2023-09-12
 Note:



Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Polarization
42.5085 MHz	24.1 dBμV/m	40 dBμV/m	-15.92 dB	Pass	Vertical
914.802 MHz	36.3 dBμV/m	46 dBμV/m	-9.7 dB	Pass	Vertical

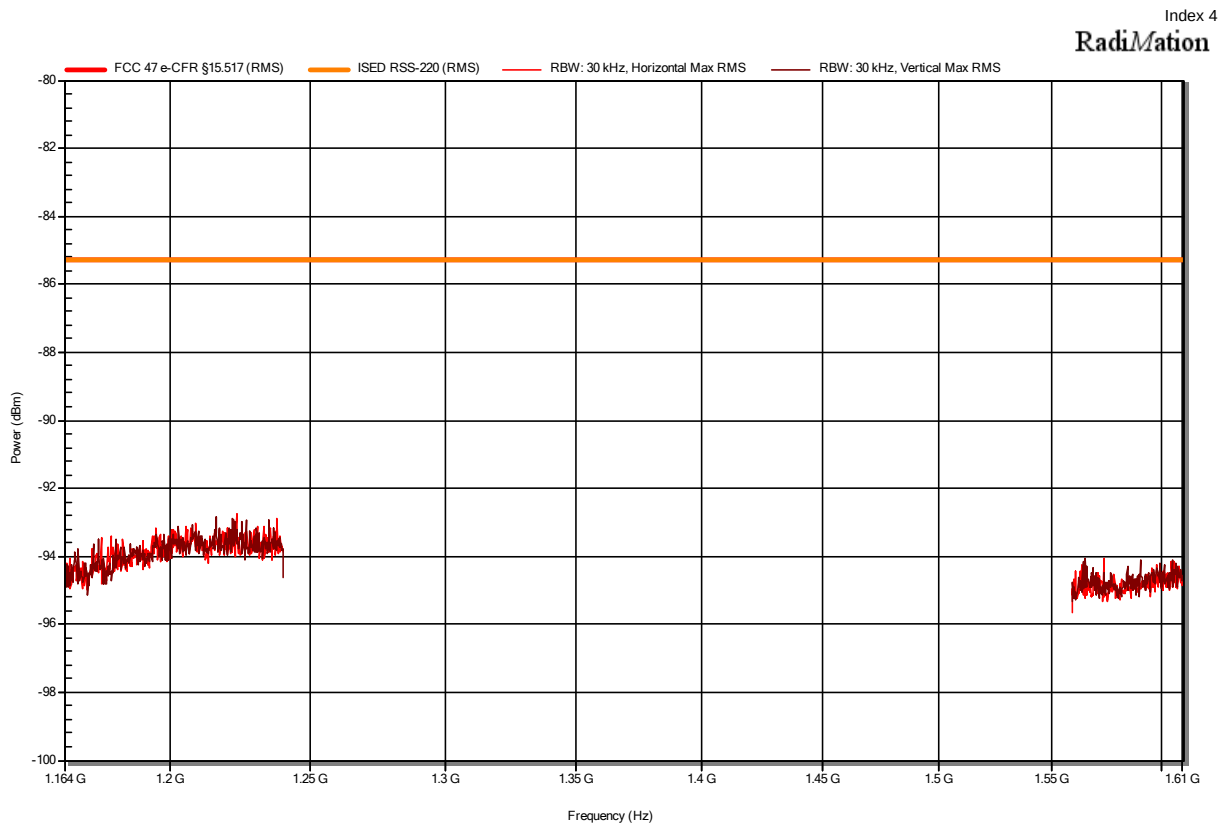
Radiated Spurious Emissions according to RSS-220, 47 CFR § 15.517

Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46946
 Test Site: Eurofins Product Service GmbH
 Operator: A.Ibraimov
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 25 °Celsius, Vnom: 5.0 VDC
 Antenna: Schwarzbeck BBHA 9120D
 Measurement distance: 1.5 m
 Mode: Tx; 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Test Date: 2023-09-11
 Note:



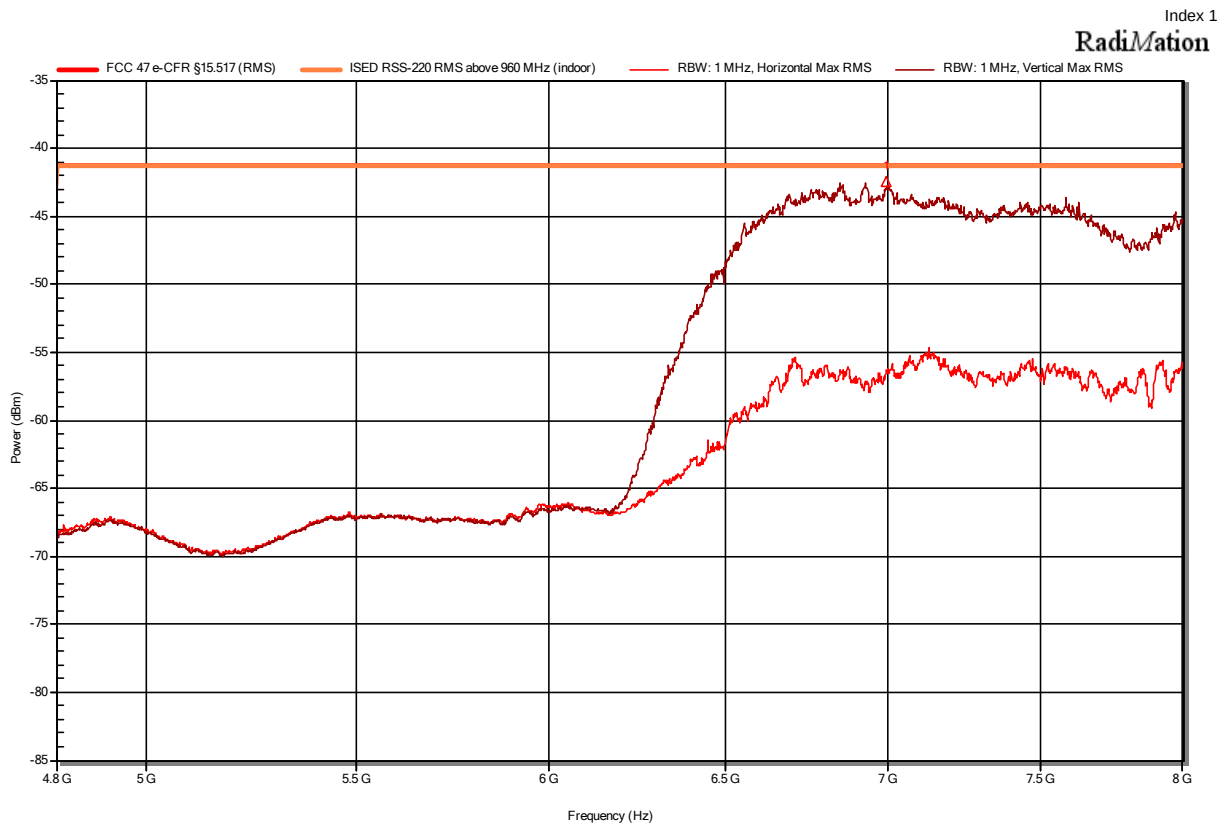
Radiated Spurious Emissions according to RSS-220, 47 CFR § 15.517

Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46946
 Test Site: Eurofins Product Service GmbH
 Operator: A.Ibraimov
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 25 °Celsius, Vnom: 5.0 VDC
 Antenna: Schwarzbeck BBHA 9120D
 Measurement distance: 1.5 m
 Mode: Tx; 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Test Date: 2023-09-11
 Note:



Radiated Spurious Emissions according to RSS-220, 47 CFR § 15.517

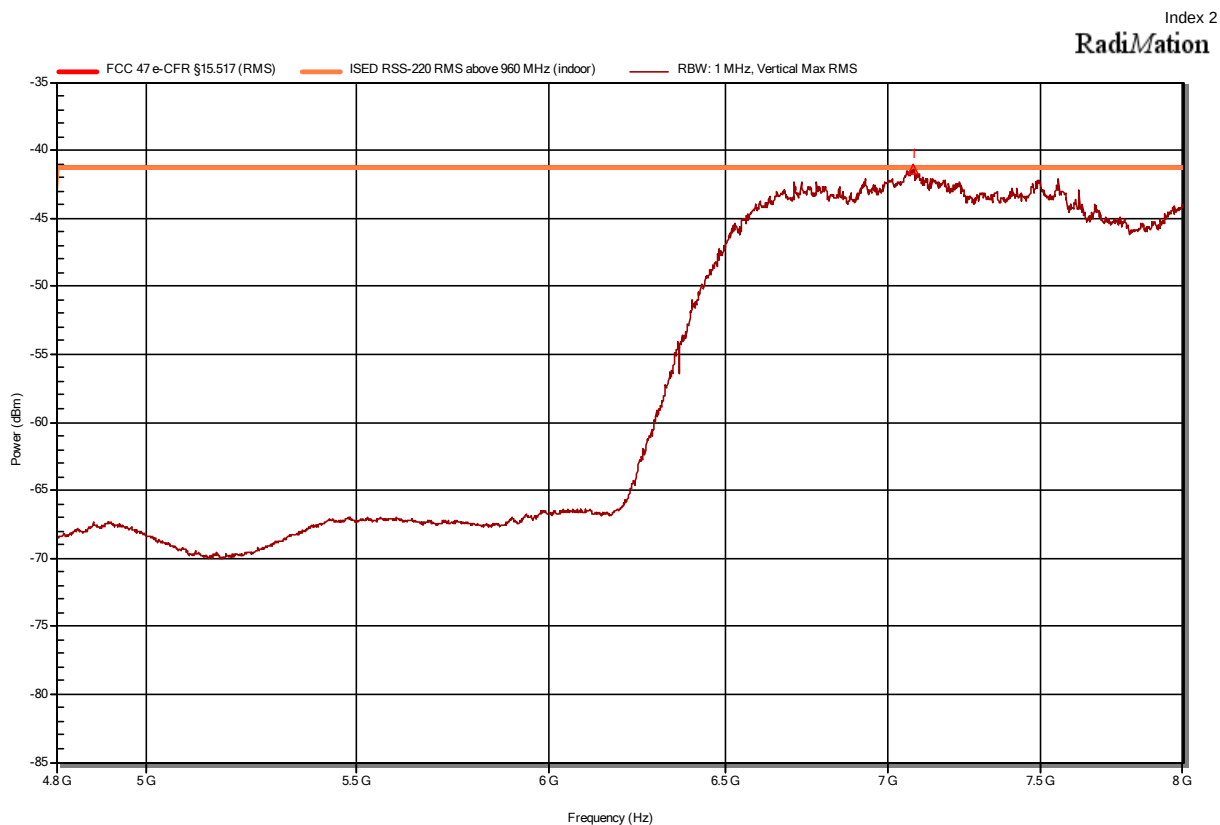
Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46945
 Test Site: Eurofins Product Service GmbH
 Operator: Ibraimov Azamat
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 25 °Celsius, Vnom: 5.0 VDC
 Antenna: Schwarzbeck BBHA 9120B
 Measurement distance: 3 m
 Mode: Tx; 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Test Date: 2023-09-11
 Note: 0 degree tilt



Frequency	RMS	RMS Limit	RMS Difference	RMS Status	Polarization
6.9938 GHz	-42.5 dBm	-41.3 dBm	-1.18 dB	Pass	Vertical

Radiated Spurious Emissions according to RSS-220, 47 CFR § 15.517

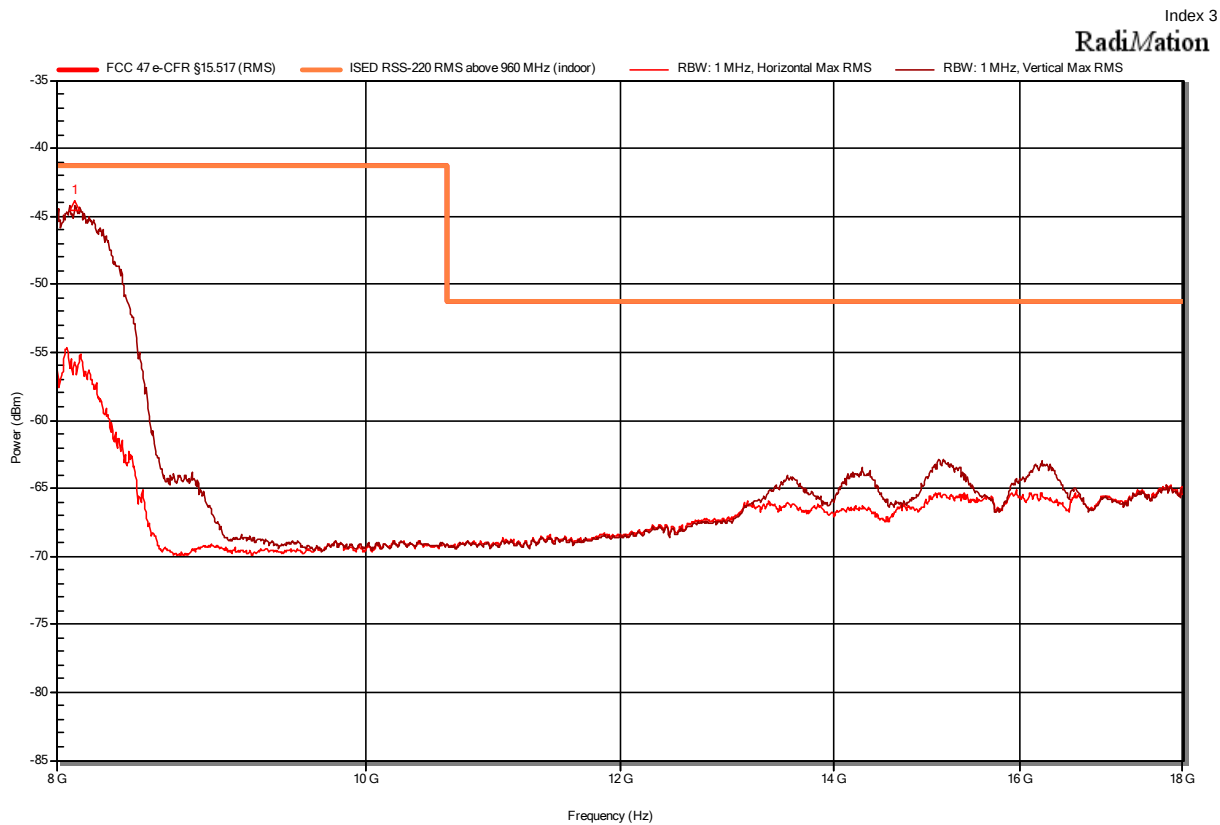
Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46945
 Test Site: Eurofins Product Service GmbH
 Operator: Ibraimov Azamat
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 25 °Celsius, Vnom: 5.0 VDC
 Antenna: Schwarzbeck BBHA 9120B
 Measurement distance: 3 m
 Mode: Tx; 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Test Date: 2023-09-11
 Note: 150 degree tilt



Frequency	RMS	RMS Limit	RMS Difference	RMS Status	Polarization
7.0798 GHz	-41.4 dBm	-41.3 dBm	-0.15 dB	Pass	Vertical

Radiated Spurious Emissions according to RSS-220, 47 CFR § 15.517

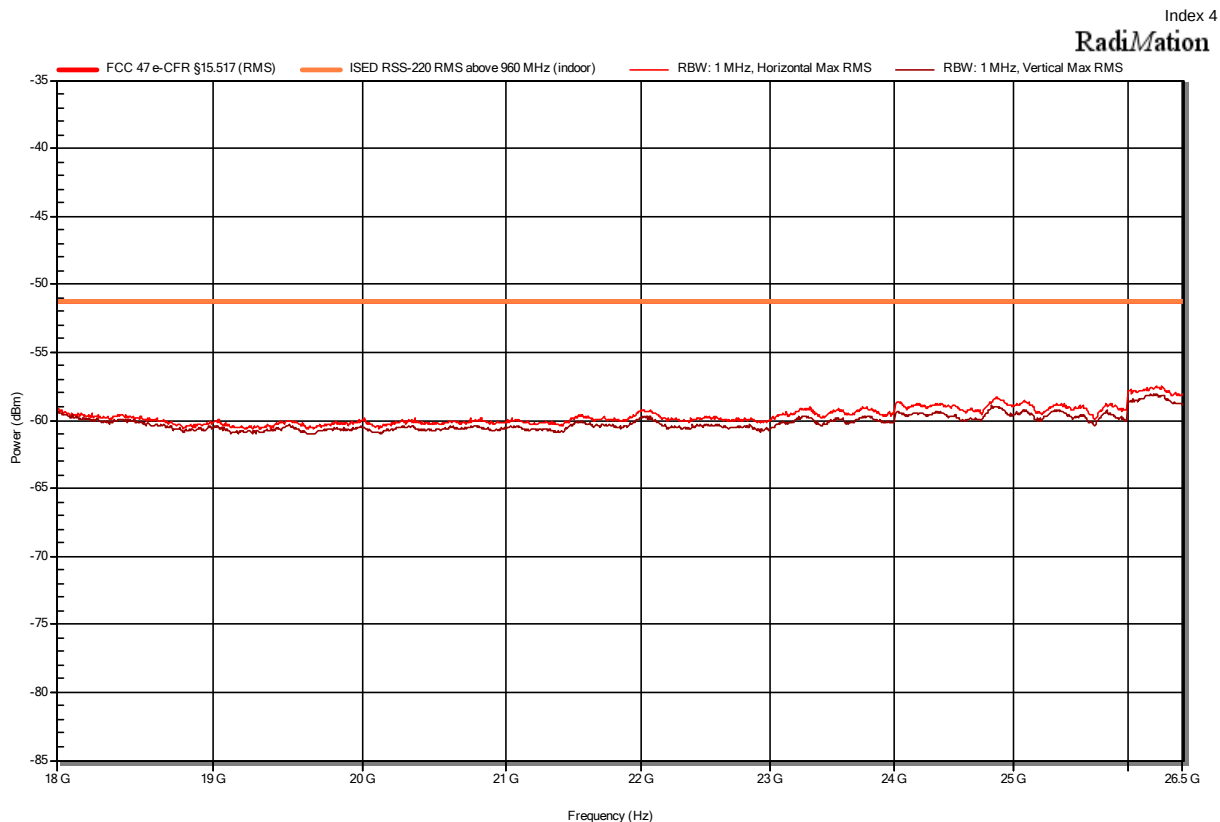
Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46945
 Test Site: Eurofins Product Service GmbH
 Operator: Ibraimov Azamat
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 25 °Celsius, Vnom: 5.0 VDC
 Antenna: Schwarzbeck HWRD 650
 Measurement distance: 3 m
 Mode: Tx; 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Test Date: 2023-09-11
 Note:



Frequency	RMS	RMS Limit	RMS Difference	RMS Status	Polarization
8.106 GHz	-44.2 dBm	-41.3 dBm	-2.9 dB	Pass	Vertical

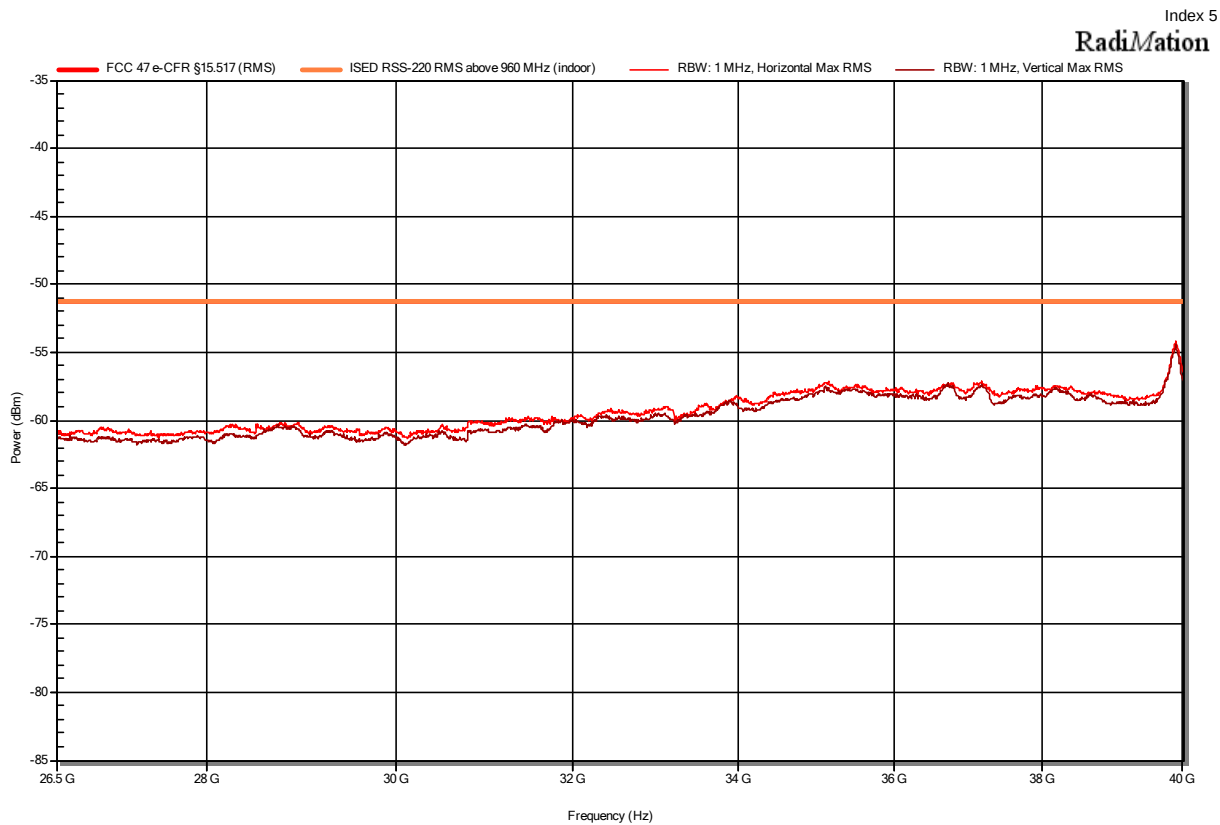
Radiated Spurious Emissions according to RSS-220, 47 CFR § 15.517

Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46945
 Test Site: Eurofins Product Service GmbH
 Operator: Ibraimov Azamat
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 25 °Celsius, Vnom: 5.0 VDC
 Antenna: Amplifier Research ATH18G40
 Measurement distance: 3 m
 Mode: Tx; 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Test Date: 2023-09-11
 Note:



Radiated Spurious Emissions according to RSS-220, 47 CFR § 15.517

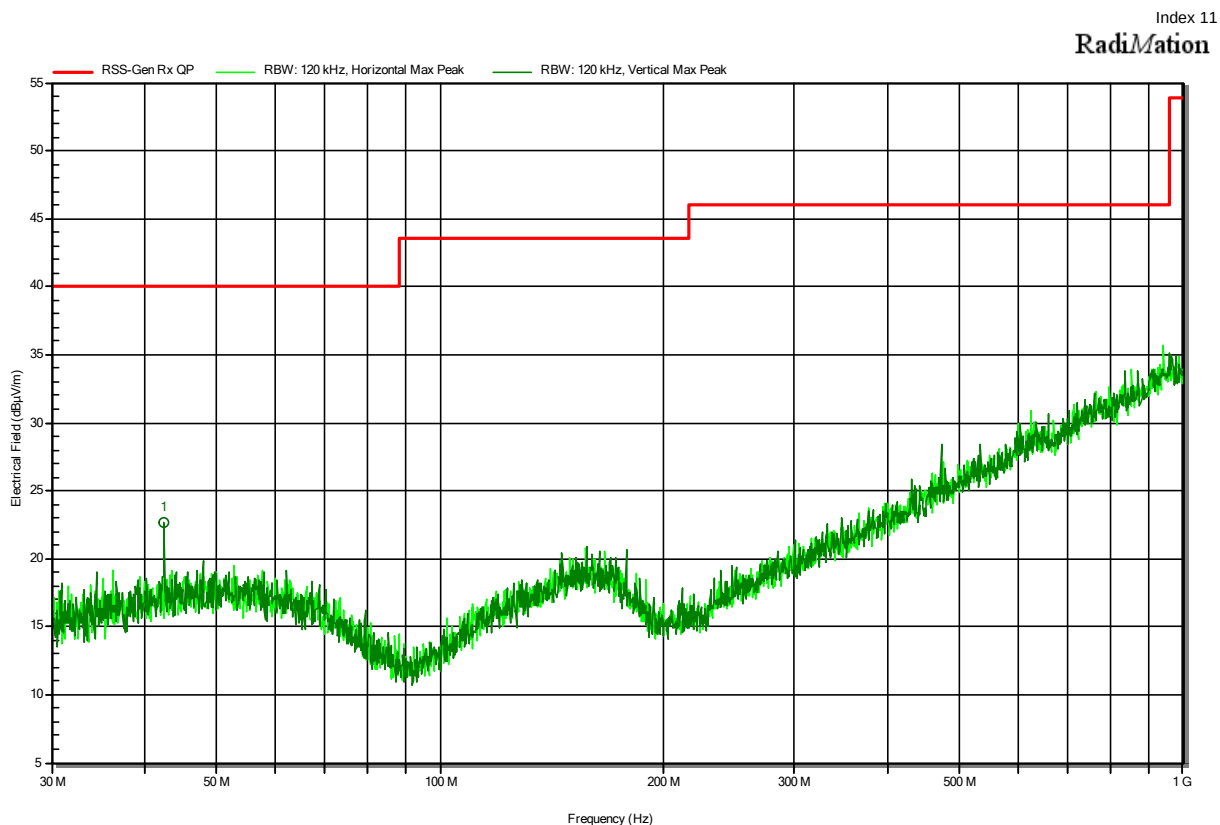
Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46945
 Test Site: Eurofins Product Service GmbH
 Operator: Ibraimov Azamat
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 25 °Celsius, Vnom: 5.0 VDC
 Antenna: Flann 22240-25
 Measurement distance: 3 m
 Mode: Tx; 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Test Date: 2023-09-11
 Note:



ANNEX B Receiver radiated emissions

Radiated Spurious Emissions according to RSS-220

Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46946
 Test Site: Eurofins Product Service GmbH
 Operator: A.Ibraimov
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 25 °Celsius, Vnom: 5.0 VDC
 Antenna: Schwarzbeck VULB 9168
 Measurement distance: 3 m
 Mode: Rx; 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Test Date: 2023-09-12
 Note:



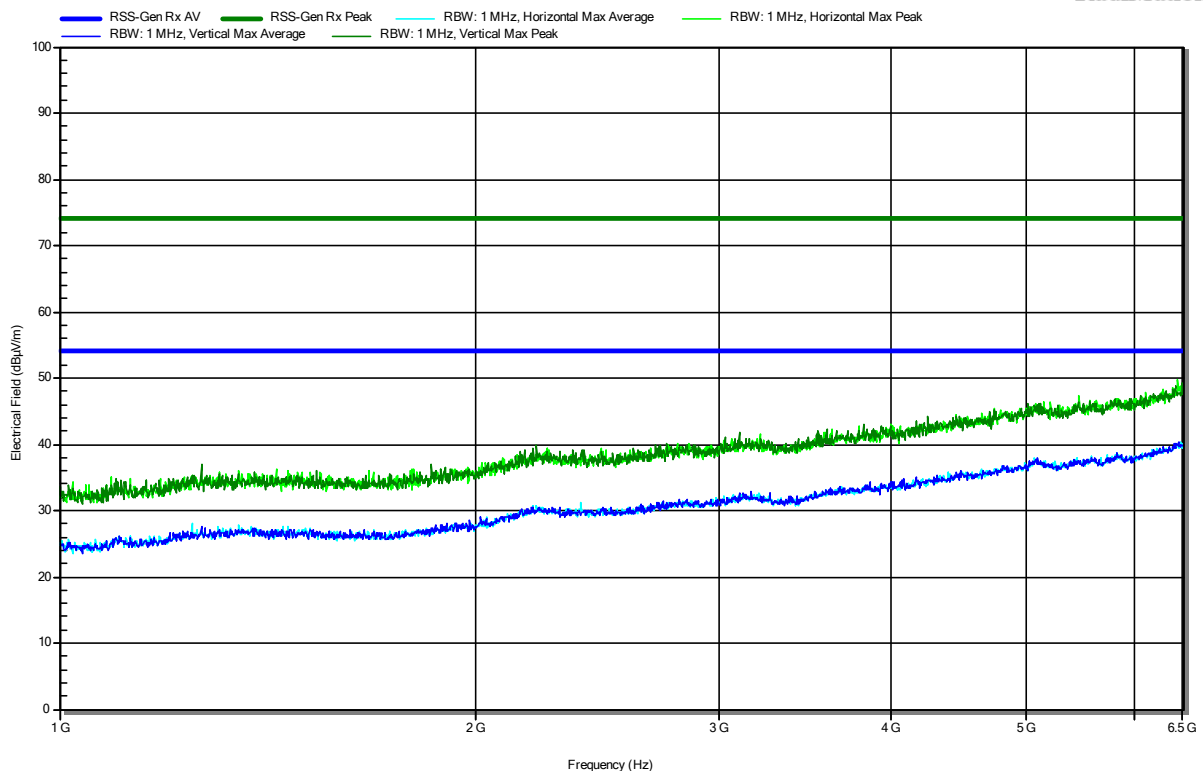
Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Polarization
42.4888 MHz	22.6 dBµV/m	40 dBµV/m	-17.35 dB	Pass	Vertical

Radiated Spurious Emissions according to RSS-220

Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46946
 Test Site: Eurofins Product Service GmbH
 Operator: A.Ibraimov
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 25 °Celsius, Vnom: 5.0 VDC
 Antenna: Schwarzbeck BBHA 9120D
 Measurement distance: 3 m
 Mode: Rx; 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Test Date: 2023-09-12
 Note:

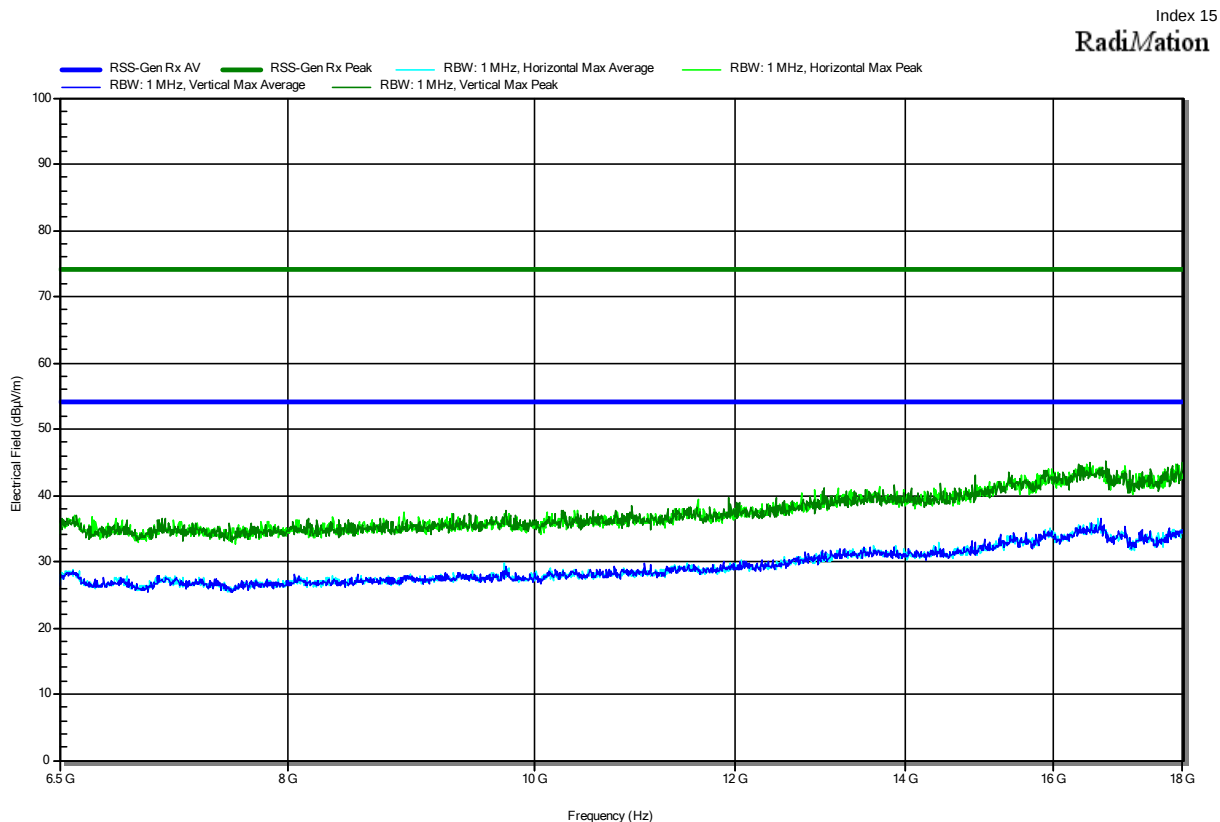
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RadiMation



Radiated Spurious Emissions according to RSS-220

Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46946
 Test Site: Eurofins Product Service GmbH
 Operator: A.Ibraimov
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 25 °Celsius, Vnom: 5.0 VDC
 Antenna: Schwarzbeck HWRD 650
 Measurement distance: 3 m
 Mode: Rx; 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Test Date: 2023-09-12
 Note:

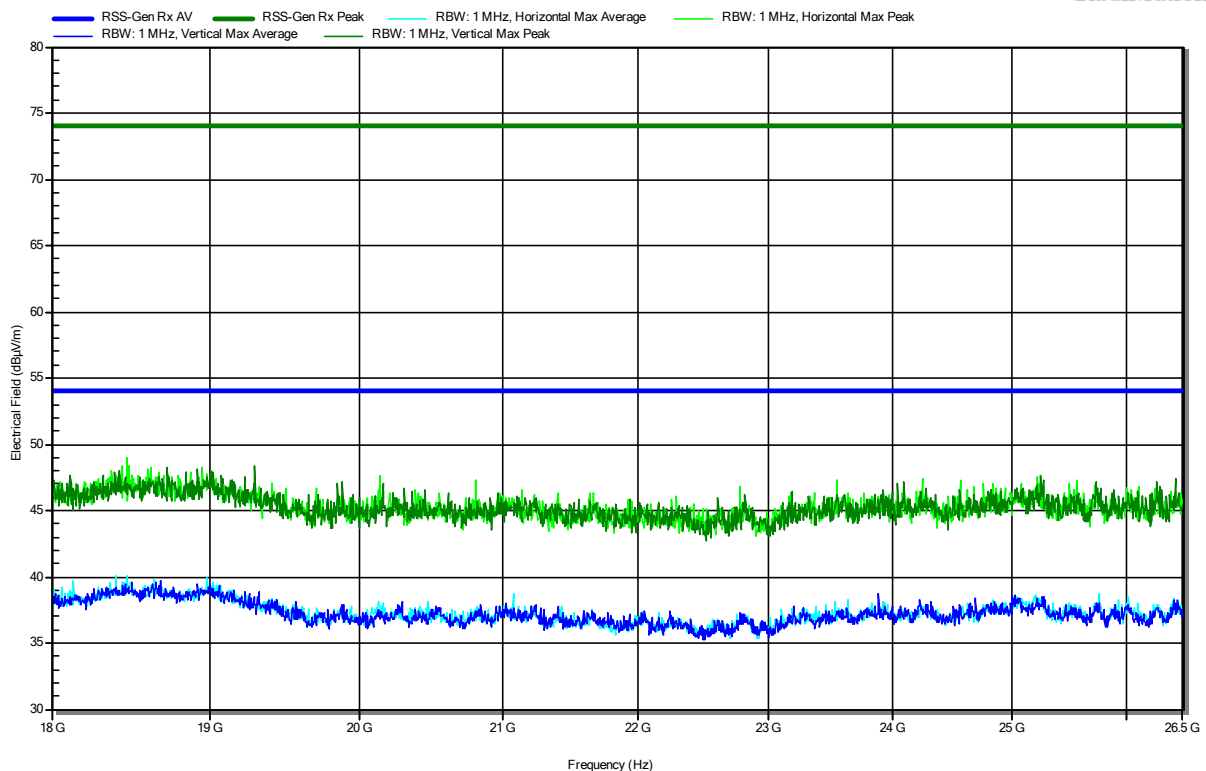


Radiated Spurious Emissions according to RSS-220

Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46946
 Test Site: Eurofins Product Service GmbH
 Operator: A.Ibraimov
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 25 °Celsius, Vnom: 5.0 VDC
 Antenna: ATH18G40
 Measurement distance: 3 m
 Mode: Rx; 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Test Date: 2023-09-12
 Note:

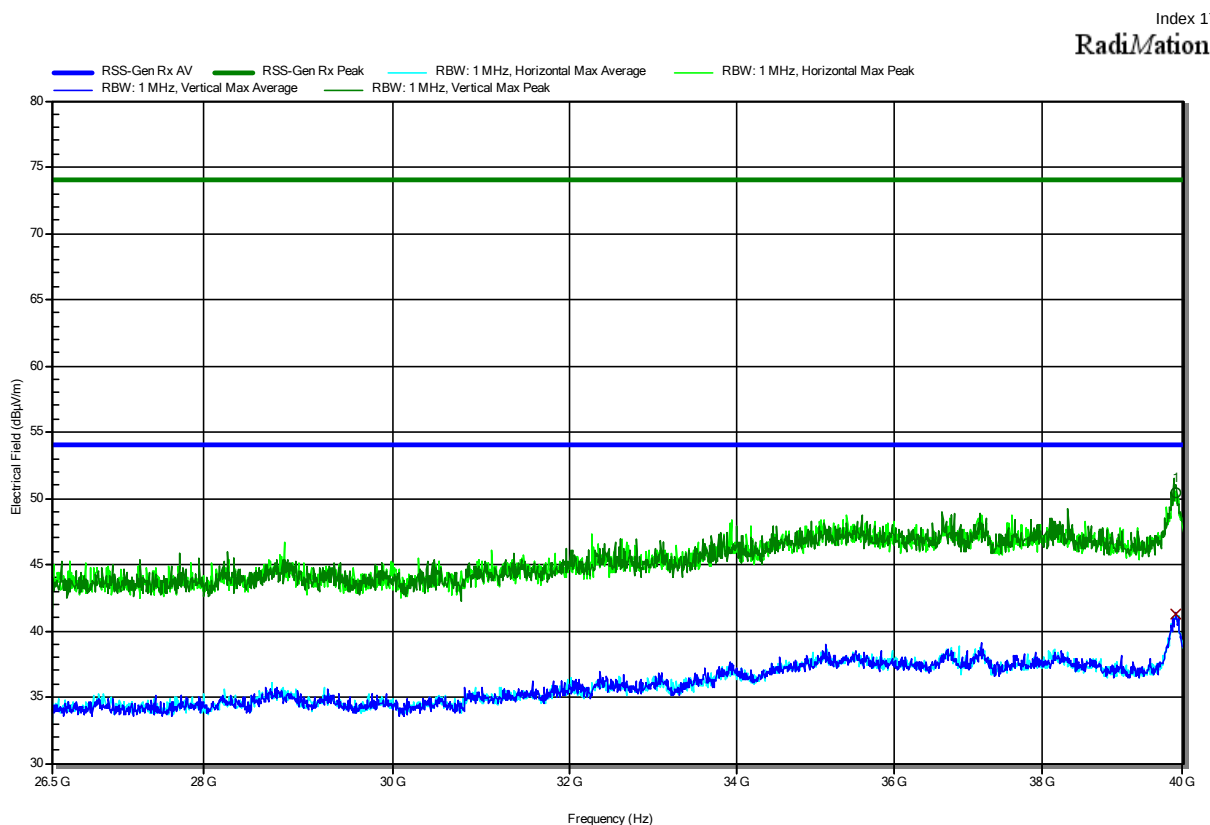
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RadiMation



Radiated Spurious Emissions according to RSS-220

Project Number: G0M-2306-2086
 Applicant: Focal JMLab
 Model Description: UWB module
 Model: 01-001-0759
 Test Sample ID: 46946
 Test Site: Eurofins Product Service GmbH
 Operator: A.Ibraimov
 Measurement software: RadiMation, version 2020.1.8
 Test Conditions: Tnom: 25 °Celsius, Vnom: 5.0 VDC
 Antenna: 22240-25 Amp. CBL26402075
 Measurement distance: 3 m
 Mode: Rx; 6717.44; 7208.96; 7700.48; 8192.00 MHz, OOK
 Test Date: 2023-09-12
 Note:



Frequency 39.903 GHz	Peak 50.46 dBµV/m	Peak Limit 74 dBµV/m	Peak Difference -23.54 dB	Peak Status Pass	Polarization Vertical
Frequency 39.903 GHz	Average 41.24 dBµV/m	Average Limit 53.98 dBµV/m	Average Difference -12.74 dB	Average Status Pass	Polarization Vertical

== = END OF TEST REPORT == =