

ISED CABid: ES1909

Test Report No:
 NIE: 67871RRF.001A2

Test Report

USA FCC Part 15.519, 15.521, 15.209

CANADA RSS-220, RSS-Gen

(*) Identification of item tested	Mobile UWB anchor
(*) Trademark	Romware
(*) Model and /or type reference	M-Anchor 100
Other identification of the product	HW version: W4 SW version: 1.2.1 FCC ID: 2AVTBRWM1W5 IC: 27593-RWM1W5
(*) Features	LTE Cat M1, Cat NB2, UWB
Applicant	Rombit Meir 30, 2000 Antwerpen, Belgium
Test method requested, standard	USA FCC Part 15.519 (10-1-20 Edition): Technical requirements for hand held UWB systems. USA FCC Part 15.521 (10-1-20 Edition): Technical requirements applicable to all UWB devices. USA FCC Part 15.209 (10-1-20 Edition): Radiated emission limits; general requirements. CANADA RSS-220 Issue 1 amendment 1 (July 2018). CANADA RSS-Gen Issue 5 amendment 1 (March 2019). ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager
Date of issue	2022-05-03
Report template No	FDT08_24 (*) "Data provided by the client"

Index

Competences and guarantees	3
General conditions	3
Uncertainty	3
Data provided by the client.....	3
Usage of samples	4
Test sample description	5
Identification of the client.....	5
Testing period and place.....	6
Document history	6
Environmental conditions	6
Remarks and comments	7
Testing verdicts.....	8
Summary	8
Appendix A: Test results. Ultra-Wideband (UWB)	9

Competences and guarantees

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

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

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

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

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

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

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

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

General conditions

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

Uncertainty

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

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample of the model M-Anchor 100 is a connected UWB anchor, to be installed on industrial vehicles such as forklifts or reach-stackers.

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

Usage of samples

Samples undergoing test have been selected by: The client.

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

Control Nº	Description	Model	Serial Nº	Reception
67871/004	Enclosure of Mobile UWB anchor	M-Anchor 100	--	2021/05/04
67871/034	PCB Mobile UWB anchor	M-Anchor 100	--	2021/07/01

Auxiliary elements used with the Sample S/01:

Control Nº	Description	Model	Serial Nº	Reception
67871/005	Enclosure of Mobile UWB anchor (RX)	M-Anchor 100	--	2021/05/04
67871/035	PCB Mobile UWB anchor (RX)	M-Anchor 100	--	2021/07/01
67871/016	Power Cable DC	--	--	2021/05/04
67871/017	Power Cable DC	--	--	2021/05/04

Sample S/01 has undergone the test(s): The UWB Transmission Cessation tests indicated in the Appendix A.

- Sample S/02 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Reception
67871/005	Enclosure of Mobile UWB anchor	M-Anchor 100	--	2021/05/04
67871/035	PCB Mobile UWB anchor	M-Anchor 100	--	2021/07/01
67871/015	GPS antenna	--	--	2021/05/04
67871/025	Omni antenna	AZ7794G	FOM78W47ASZ	2021/05/04

Auxiliary elements used with the Sample S/02:

Control Nº	Description	Model	Serial Nº	Reception
67871/016	Power Cable DC	--	--	2021/05/04
67871/020	USB Cable	--	--	2021/05/04
67871/021	Stlink-V3set	LKV3SET\$AT1	--	2021/05/04

Sample S/02 has undergone the test(s): All Radiated tests except the UWB Transmission Cessation test indicated in the Appendix A.

Test sample description

Ports..... :	Port name and description	Cable			
		Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾
	Power	5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	CAN	5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	GPS	5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	LTE	5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Supplementary information to the ports..... :	-				
Rated power supply	Voltage and Frequency				
	<input checked="" type="checkbox"/>	DC: 6V-24V			
Rated Power..... :	-				
Clock frequencies..... :	-				
Other parameters	-				
Software version..... :	1.2.1				
Hardware version	W4				
Dimensions in cm (W x H x D) ... :	11 x 17 x 4 cm				
Mounting position	<input type="checkbox"/>	Table top equipment			
	<input type="checkbox"/>	Wall/Ceiling mounted equipment			
	<input type="checkbox"/>	Floor standing equipment			
	<input type="checkbox"/>	Hand-held equipment			
	<input checked="" type="checkbox"/>	Other: Mounted to an industrial vehicle			
Modules/parts..... :	Module/parts of test item		Type	Manufacturer	
	-				
	-				
	-				
	-				
Accessories (not part of the test item)	Description		Type	Manufacturer	
	LTE antenna (SMA connection)				
	GPS antenna (SMA connection)				
	-				
	-				
	-				
Documents as provided by the applicant	Description		File name	Issue date	
	-				
	-				
	-				
	-				

⁽³⁾ Only applicable to medical equipments.

Identification of the client

Rombit
 Meir 30, 2000 Antwerpen, Belgium

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2021-07-02
Date (finish)	2021-08-27

Document history

Report number	Date	Description
67871RRF.001	2021-12-16	First release.
67871RRF.001A1	2022-03-04	First modification: typo correction on IC number. This modification test report cancels and replaces the test report 67678RRF.001.
67871RRF.001A2	2022-05-03	Second modification: clarifications for testing procedures and corrections added. This modification test report cancels and replaces the test report 67678RRF.001A1.

Environmental conditions

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

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

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

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

Remarks and comments

The tests have been performed by the technical personnel: Nicolás Salguero.

Used instrumentation:

Radiated Measurements:

	Last Calibration	Due Calibration
1. Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N/A	N/A
2. Shielded Room ETS LINDGREN S101	N/A	N/A
3. EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7	2020/12	2022/12
4. Preamplifier G>40dB 10MHz-6GHz, BONN ELEKTRONIK, BLNA 0160-01N	2021/03	2022/03
5. Biconical/Log Antenna 30 MHz - 6 GHz ETS LINDGREN 3142E	2020/04	2023/04
6. Attenuator 3dB, 2W, DC-18GHz, TECHNIWAVE TWTS2G	2021/02	2022/02
7. Spectrum Analyzer ROHDE AND SCHWARZ FSW50	2020/07	2022/07
8. RF Preamplifier, 40 dB ,1-18 GHz BONN ELEKTRONIK BLMA 0118-1M	2021/06	2022/06
9. Horn Antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2019/11	2022/11
10. Low Noise Amplifier G>30dB, 18 - 40 GHz BONN ELEKTRONIK BLMA 1840-3G	2019/11	2021/11
11. Horn Antenna 18-40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2020/05	2023/05
12. DC Power Supply 30V/5A KEYSIGHT TECHNOLOGIES U8002A	N/A	N/A
13. Digital Multimeter FLUKE 175	2020/11	2021/11

Testing verdicts

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

Summary

Ultra-Wideband (UWB):

FCC PART 15 PARAGRAPH / RSS-220			
Requirement – Test case		Verdict	Remark
FCC 15.519 (a)(1) / RSS-220 5.3.1. (b)	UWB Transmission Cessation	P	
FCC 15.519 (b) / RSS-220 5.1. (a)	UWB Bandwidth	P	
FCC 15.519 (c),(d), 15.521 (c) / RSS-220 5.3.1. (c),(d),(e), Annex. Sect.4 (m)	Radiated Emissions	P	
FCC 15.519 (e) / RSS-220 5.3.1. (g)	UWB Peak Level	P	
<u>Supplementary information and remarks:</u>			
None.			

Appendix A: Test results. Ultra-Wideband (UWB)

INDEX

TEST CONDITIONS.....	11
FCC 15.519 (a)(1) / RSS-220 5.3.1. (b) UWB Transmission Cessation	13
FCC 15.519 (b) / RSS-220 5.1. (a) UWB Bandwidth	15
FCC 15.519 (c),(d), 15.521 (c) / RSS-220 5.3.1. (c),(d),(e), Radiated Emissions	19
FCC 15.519 (e) / RSS-220 5.3.1. (g) UWB Peak Level.....	49

TEST CONDITIONS

(*) Declared by the Applicant

POWER SUPPLY (*):

Vnominal: 24 Vdc
Type of Power Supply: External DC (vehicle battery).

ANTENNA (*):

Type of Antenna: Integral (on board ceramic antenna).
Maximum Declared Antenna Gain: +6 dBi

TEST FREQUENCIES FOR FCC:

Channel 2: 3993.6 MHz
Channel 5: 6489.6 MHz

TEST FREQUENCIES FOR CANADA:

Channel 5: 6489.6 MHz

RADIATED MEASUREMENTS:

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog Antenna) and at a distance of 1 m for the frequency range 960 MHz-40 GHz (960 MHz-17 GHz Double Ridge Horn Antenna and 17 GHz-40 GHz Horn Antenna).

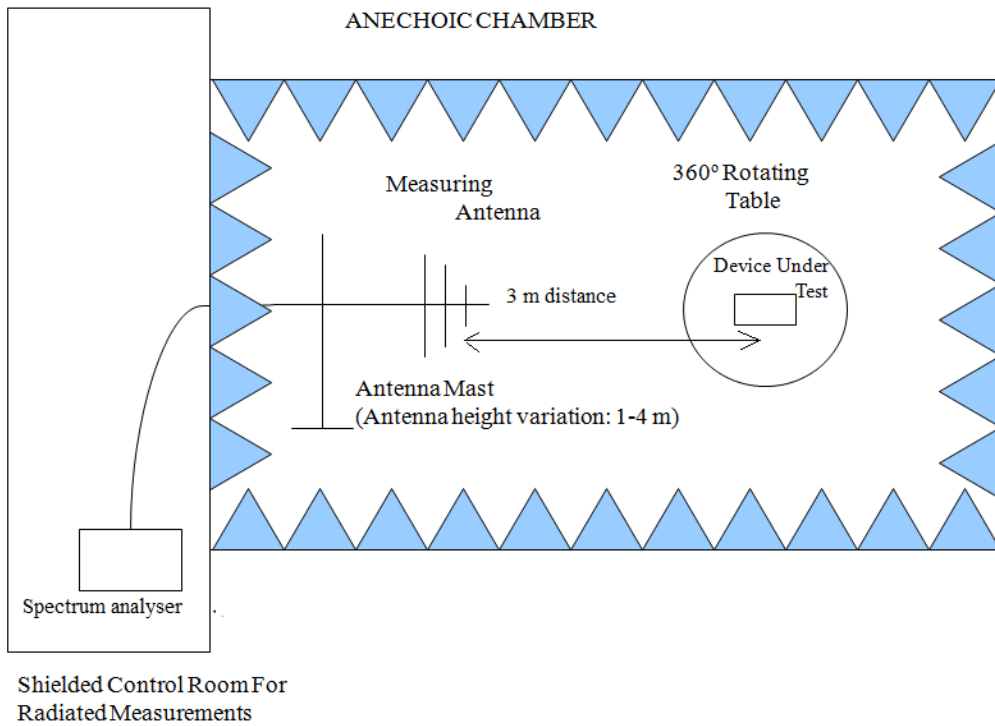
For radiated emissions in the range 960 MHz-40 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

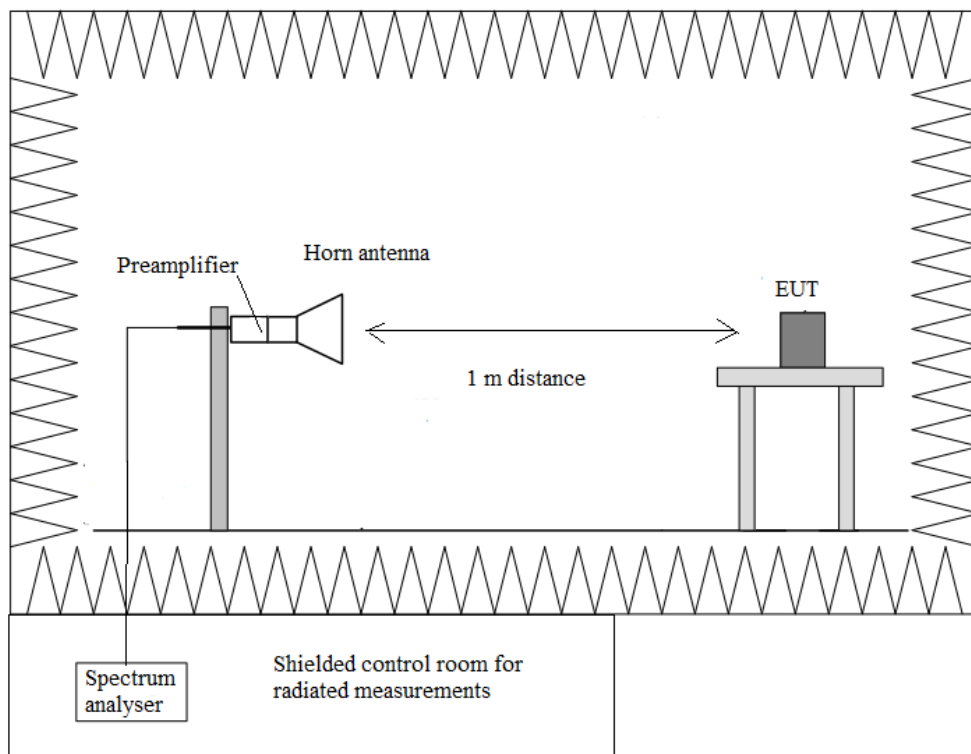
Measurements were made in both horizontal and vertical planes of polarization.

A resolution bandwidth/video bandwidth of 100kHz / 300 kHz was used for frequencies below 960 MHz and 1 MHz / 3 MHz for frequencies above 960MHz.

Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements above 960 MHz.



FCC 15.519 (a)(1) / RSS-220 5.3.1. (b) UWB Transmission Cessation

SPECIFICATION:

* FCC §15.519 (a)(1): A UWB device operating under the provisions of this section shall transmit only when it is sending information to an associated receiver. The UWB intentional radiator shall cease transmission within 10 seconds unless it receives an acknowledgement from the associated receiver that its transmission is being received. An acknowledgment of reception must continue to be received by the UWB intentional radiator at least every 10 seconds or the UWB device must cease transmitting.

* RSS-220 5.3.1. (b): The device is to transmit only when it is sending information to an associated receiver. The device shall cease transmission of information within 10 seconds unless it receives an acknowledgement from the associated receiver that its transmission is being received. An acknowledgment of reception must continue to be received by the UWB device at least every 10 seconds or the UWB device shall cease transmitting any information other than periodic signals used for the establishment or re-establishment of a communication link with an associated receiver.

TEST METHOD:

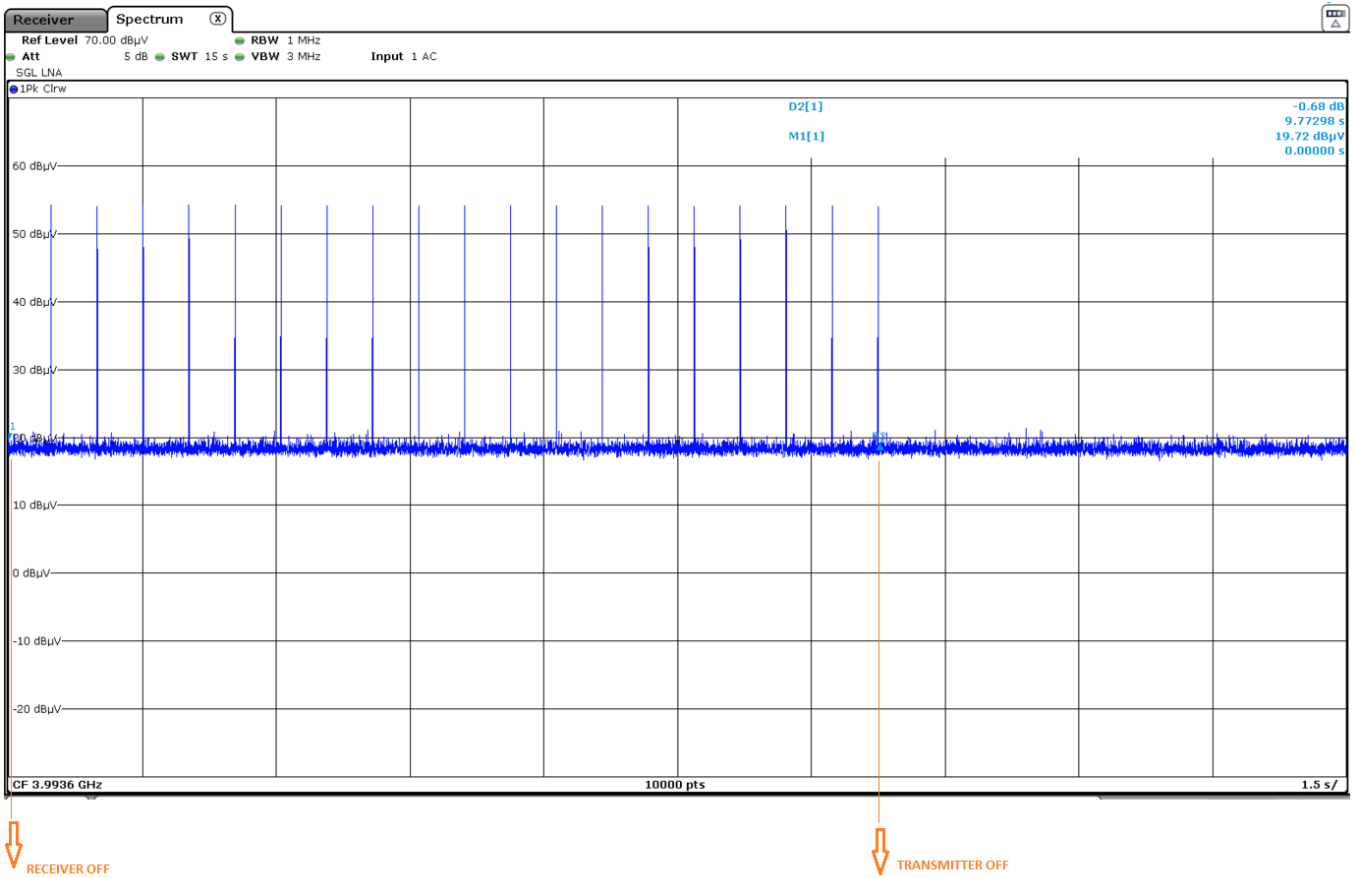
Communication is established between a device under test configured as a transmitter and a second auxiliary device under test configured as an associated receiver. Once communication is established, receiver is turned off. It is measured time interval since the transmitter stops receiving acknowledgement from the receiver and transmitter stops transmission.

RESULTS:

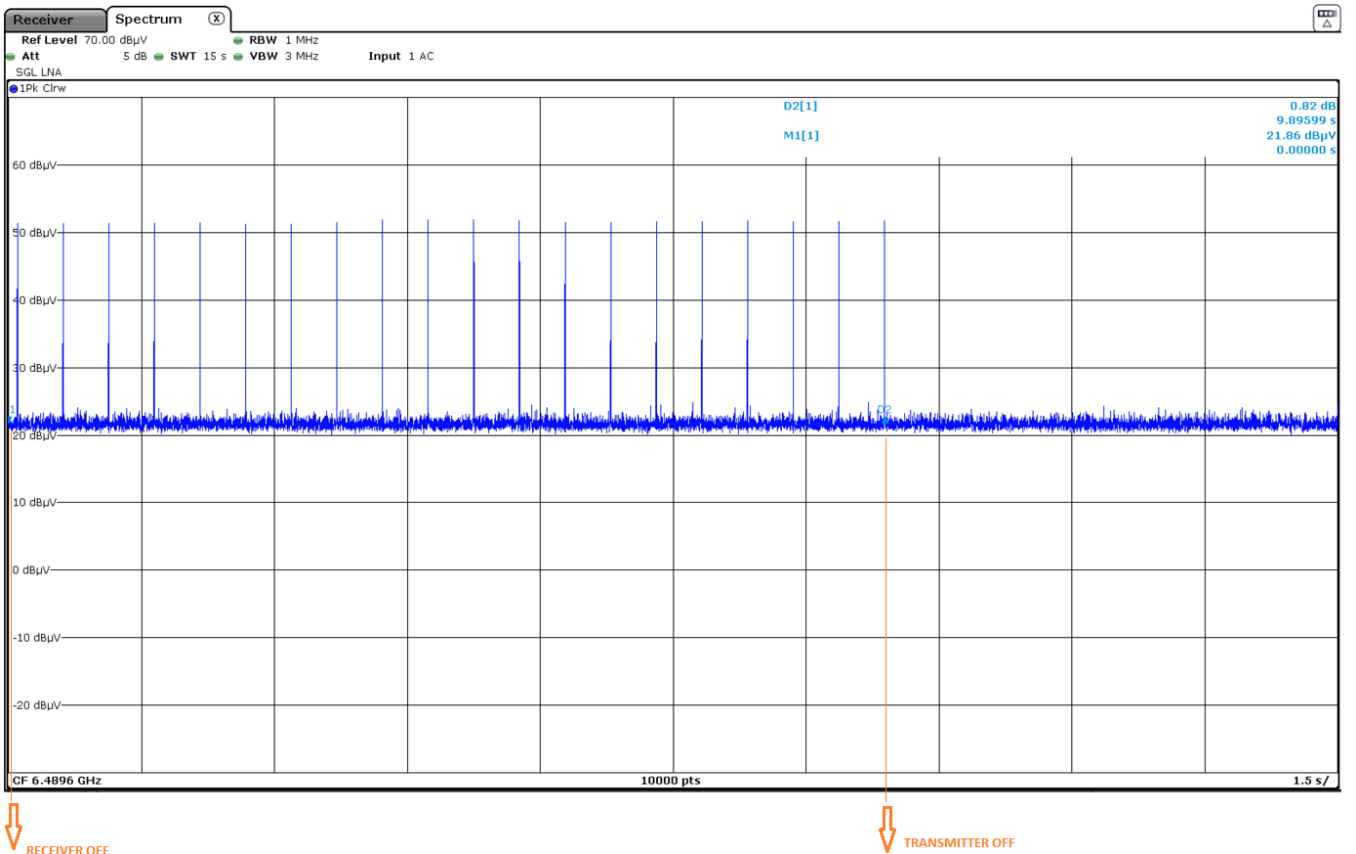
Channel	Transmitter Cessation (s)
2	9.77298
5	9.89599

Verdict: PASS

• CHANNEL 2:



• CHANNEL 5:



FCC 15.519 (b) / RSS-220 5.1. (a) UWB Bandwidth

SPECIFICATION:

* FCC §15.503 (a) UWB bandwidth. For the purpose of this subpart, the UWB bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna. The upper boundary is designated fH and the lower boundary is designated fL. The frequency at which the highest radiated emission occurs is designated fM.

* FCC §15.503 (b) Center frequency. The center frequency, fC, equals (fH + fL)/2.

* FCC §15.503 (c) Fractional bandwidth. The fractional bandwidth equals 2(fH-fL)/(fH + fL).

* FCC §15.503 (d) Ultra-wideband (UWB) transmitter. An intentional radiator that, at any point in time, has a fractional bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth.

* FCC §15.519 (b): The UWB bandwidth of a device operating under the provisions of this section must be contained between 3100 MHz and 10600 MHz.

* RSS-220 2. A UWB device is an intentional radiator that has either a -10dB bandwidth of at least 500MHz or a -10dB fractional bandwidth greater than 0.2.

* RSS-220 5.1. (a): The -10 dB bandwidth of the device shall be totally contained in the band 3.1-10.6 GHz.

"-10 dB bandwidth B₋₁₀" and "-10 dB fractional bandwidth μ₋₁₀" are defined as follows:

$$B_{-10} = fH - fL$$
$$\mu_{-10} = B_{-10}/fC$$

where:

fM is the frequency of maximum UWB transmission;

fH is the highest frequency at which the power spectral density of the UWB transmission is -10 dB relative to fM;

fL is the lowest frequency at which the power spectral density of the UWB transmission is -10 dB relative to fM; and

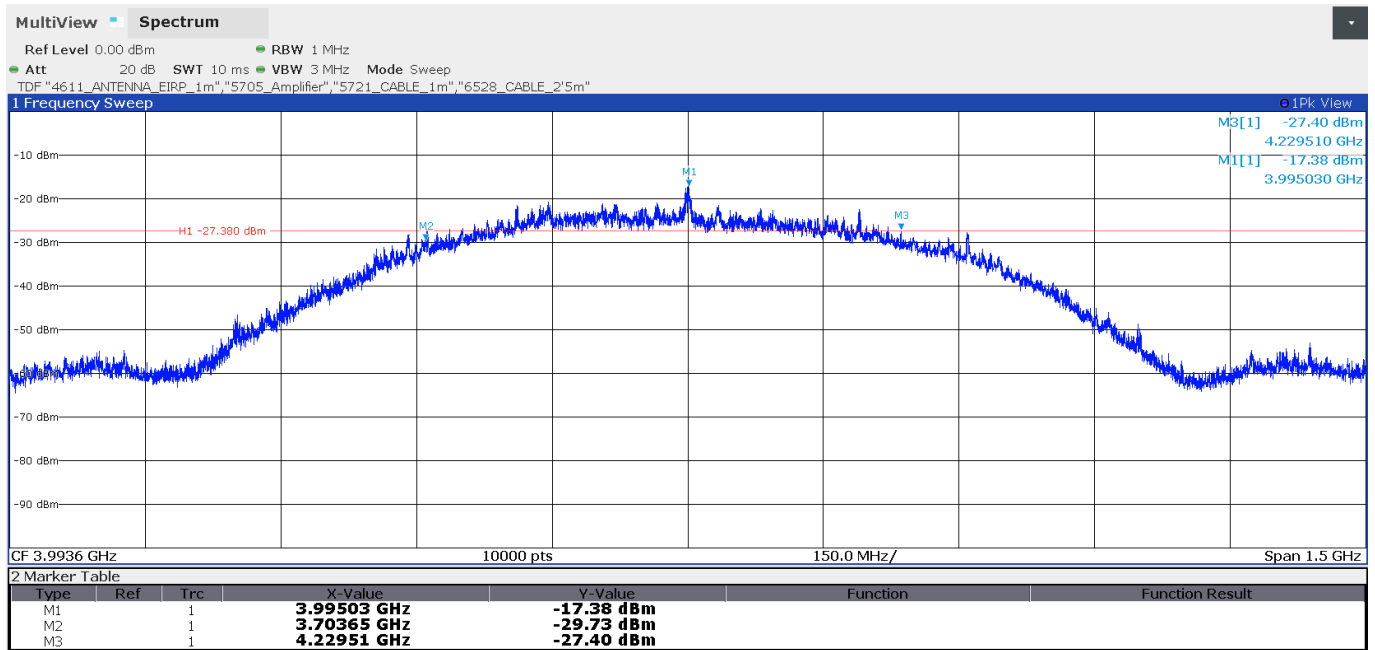
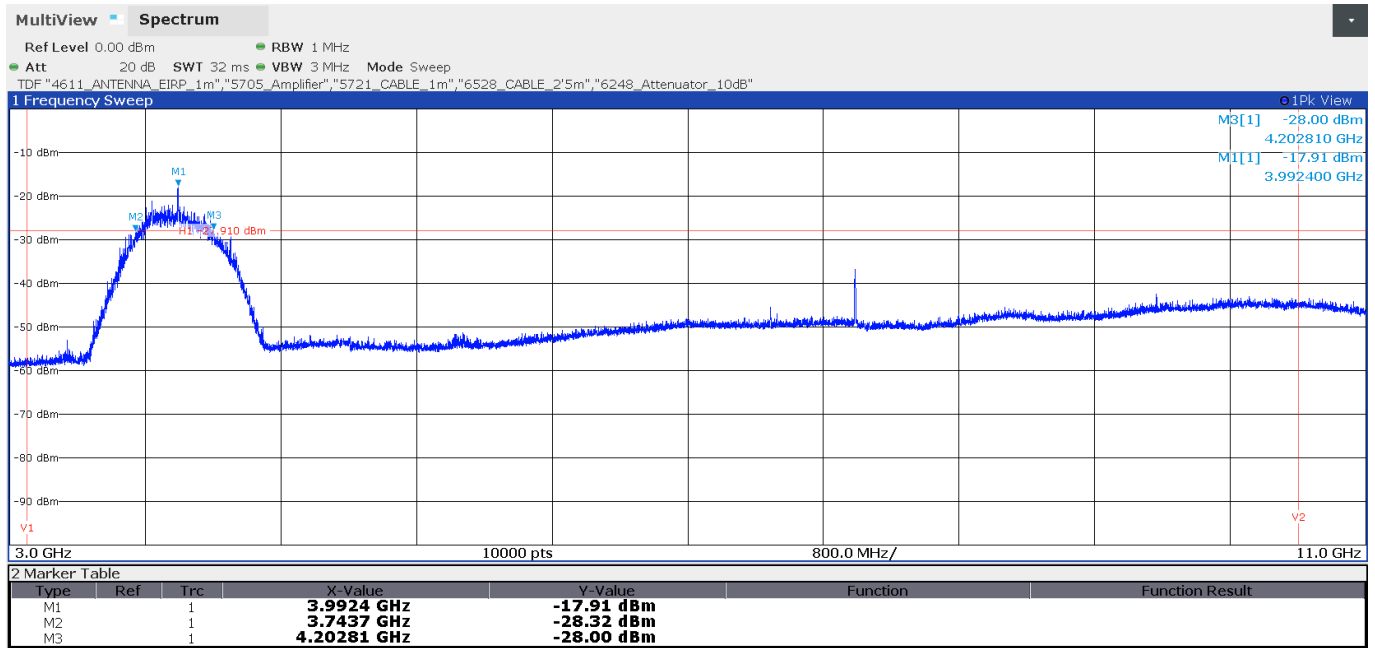
fC = (fH + fL)/2 is the centre frequency of the -10 dB bandwidth.

RESULTS:

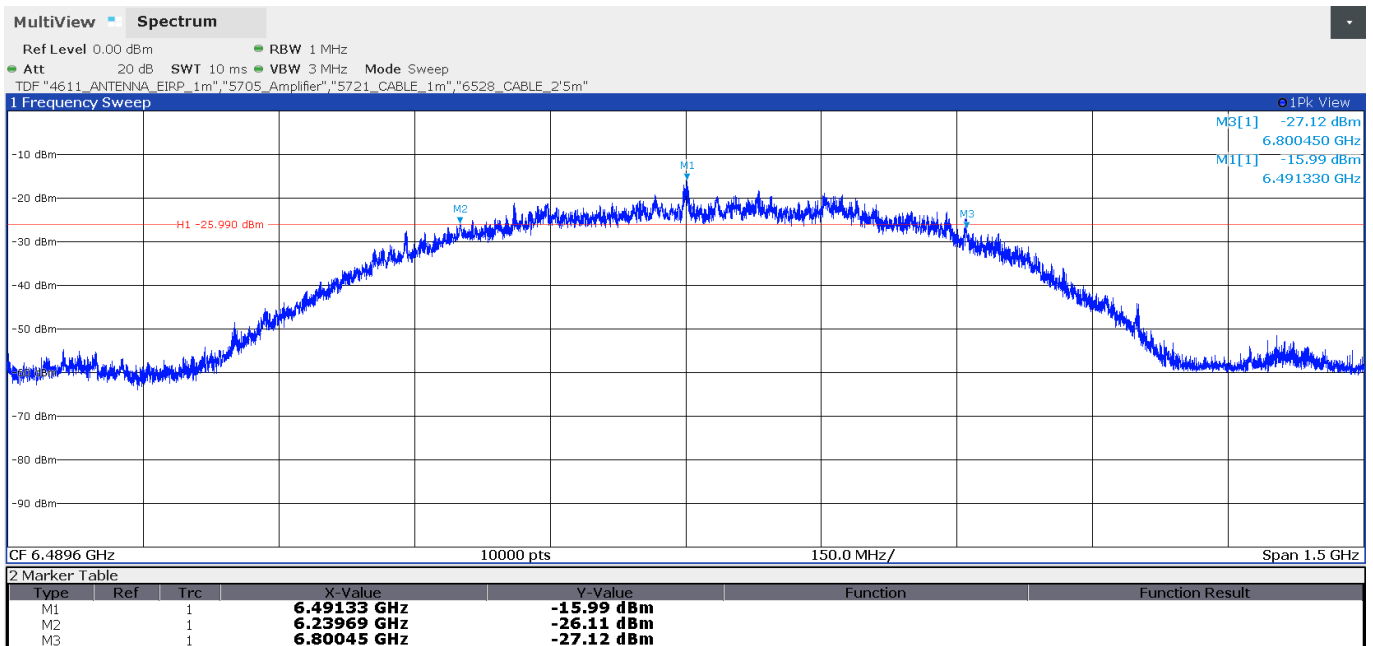
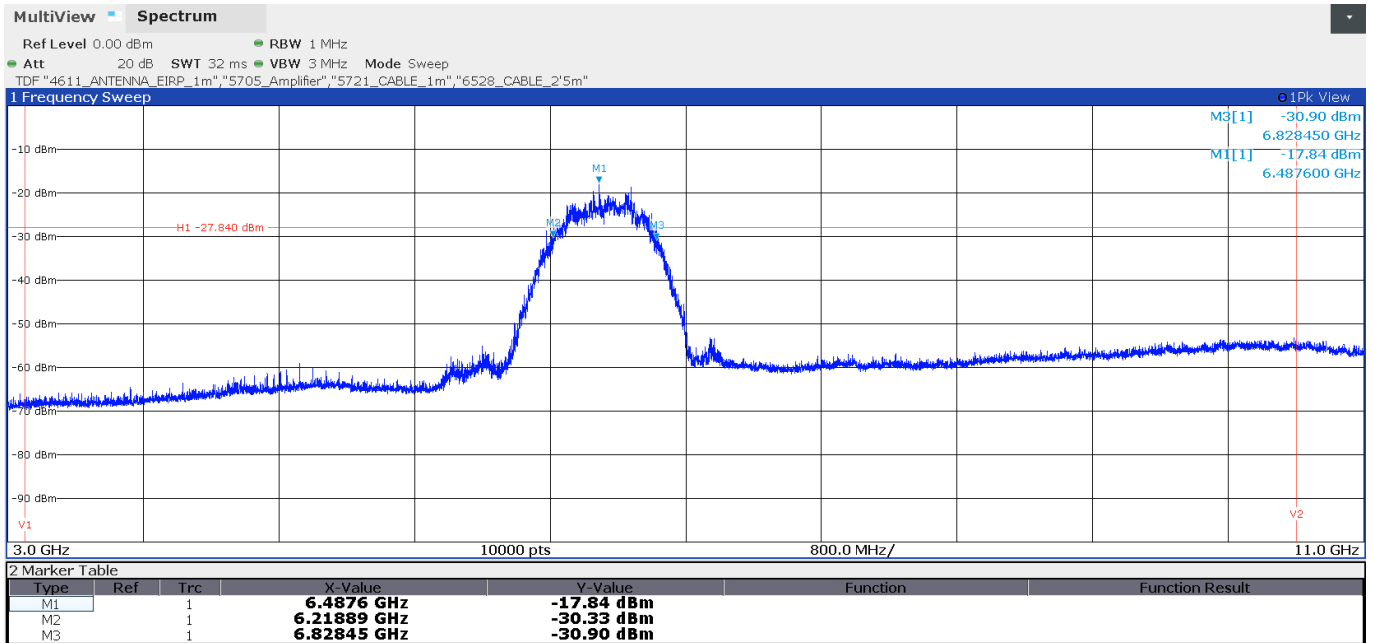
Channel	FM (GHz)	FL (GHz)	FH (GHz)	FC (GHz)	B ₋₁₀ (MHz)	Min B ₋₁₀ (MHz)
2	3.99503	3.70365	4.22951	3.96658	525.86	500
5	6.49133	6.23969	6.80045	6.52007	560.76	500
Measurement uncertainty (kHz)	<± 130					

Verdict: PASS

• CHANNEL 2:



• CHANNEL 5:



FCC 15.519 (c),(d), 15.521 (c) / RSS-220 5.3.1. (c),(d),(e), Annex. Section 4 (m): Radiated Emissions

SPECIFICATION:

The radiated emissions at or below 960 MHz shall not exceed the emission levels in §15.209:

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

* §15.519 (c): The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in § 15.209. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency Range (MHz)	EIRP (dBm)
960-1610	-75.3
1610-1990	-63.3
1990-3100	-61.3
3100-10600	-41.3
Above 10600	-61.3

* §15.519 (d): In addition to the radiated emission limits specified in the table above, UWB transmitters shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency Range (MHz)	EIRP (dBm)
1164-1240	-85.3
1559-1610	-85.3

* §15.521 (c): Emissions from digital circuitry used to enable the operation of the UWB transmitter shall comply with the limits in §15.209, rather than the limits specified above for EIRP, provided it can be clearly demonstrated that those emissions from the UWB device are due solely to emissions from digital circuitry contained within the transmitter and that the emissions are not intended to be radiated from the transmitter’s antenna. Emissions from associated digital devices, as defined in § 15.3(k), e.g., emissions from digital circuitry used to control additional functions or capabilities other than the UWB transmission, are subject to the limits contained in Subpart B of this part.

* RSS-220 5.3.1. (c): Radiated emissions at or below 960 MHz from a device shall not exceed the limits. Measurements of radiated emissions at and below 960 MHz are to be made using a CISPR quasi-peak detector. CISPR measurement bandwidth specifications are to be used.

Frequency Range (MHz)	Field strength (µV/m)	Measurement distance (m)	E.i.r.p (dBmW)
0.009-0.490	2400/F(kHz)	300	10 log (17.28 / F ²) (F in KHz)
0.490-1.705	24000/F(kHz)	30	10 log (17.28 / F ²) (F in KHz)
1.705 - 30.0	30	30	-45.7
30 - 88	100	3	-55.2
88 - 216	150	3	-51.7
216 - 960	200	3	-49.2

Note: The emission limits for the bands 9-90 kHz and 110-490 kHz are based on measurements employing an average emissions detector.

* RSS-220 5.3.1. (d): Radiated emissions above 960 MHz from a device shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz.

Frequency Range (MHz)	EIRP (dBm) in a RBW of 1 MHz
960-1610	-75.3
1610-4750	-70.0
4750-10600	-41.3
Above 10600	-61.3

* RSS-220 5.3.1. (e): In addition to the radiated emission limits specified in the table above, radiated emissions shall not exceed the following average limits when measured using a resolution bandwidth greater than or equal to 1 kHz. The measurements shall demonstrate compliance with the stated limits at whatever resolution bandwidth is used.

Frequency Range (MHz)	EIRP (dBm)
1164-1240	-85.3
1559-1610	-85.3

* RSS-220 Annex. Section 4 (m): Emissions from digital circuitry (used only to enable the operation of the UWB transmitter and that does not control additional functions or capabilities) shall comply with the average and peak power limits applicable to the UWB transmitter. If it can be clearly demonstrated that an emission from a UWB transmitter is due solely to emissions from digital circuitry contained within the transmitter, and that the emission is not intended to be radiated from the transmitter's antenna, the limits for emissions from digital circuitry prescribed in RSS-Gen apply to that emission rather than the UWB limits.

RESULTS:

1. UWB TRANSMITTER ON:

• **CHANNEL 2:**

Frequency range 30 - 960 MHz:

Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (MHz)	Emission Level (dB μ V/m)	Polarization	Detector
43.903500	26.56	V	Quasi-Peak
67.851000	23.75	V	Quasi-Peak
102.168000	24.92	V	Quasi-Peak
153.597000	36.27	V	Quasi-Peak
180.009000	32.24	V	Quasi-Peak
192.006000	33.17	V	Quasi-Peak
219.906000	32.18	V	Quasi-Peak
259.942500	34.75	V	Quasi-Peak
537.594000	40.36	V	Quasi-Peak
806.410500	38.53	H	Quasi-Peak

Frequency range 960 MHz - 7 GHz:

Spurious Frequency (GHz)	Emission Level (dBm)	Polarization	Detector
3.9569725	-41.353	V	RMS

Note: For emissions on the range 960MHz to 3.1GHz it is demonstrated that are produced by digital circuitry used to control additional functions other than the UWB continuous transmission. Therefore, according to § FCC 15.521 (c), these emissions are subject to the limits contained in Part 15 Subpart B (67871REM.003).

Frequency range 7 - 10.6 GHz:

Spurious frequencies at less than 20 dB below the limit.

Spurious Frequency (GHz)	Emission Level (dBm)	Polarization	Detector
7.987525000	-58.105	V	RMS

Frequency range 10.6 - 17 GHz:

No spurious signals were found.

Frequency range 17 - 26 GHz:

No spurious signals were found.

Frequency range 26 - 40 GHz:

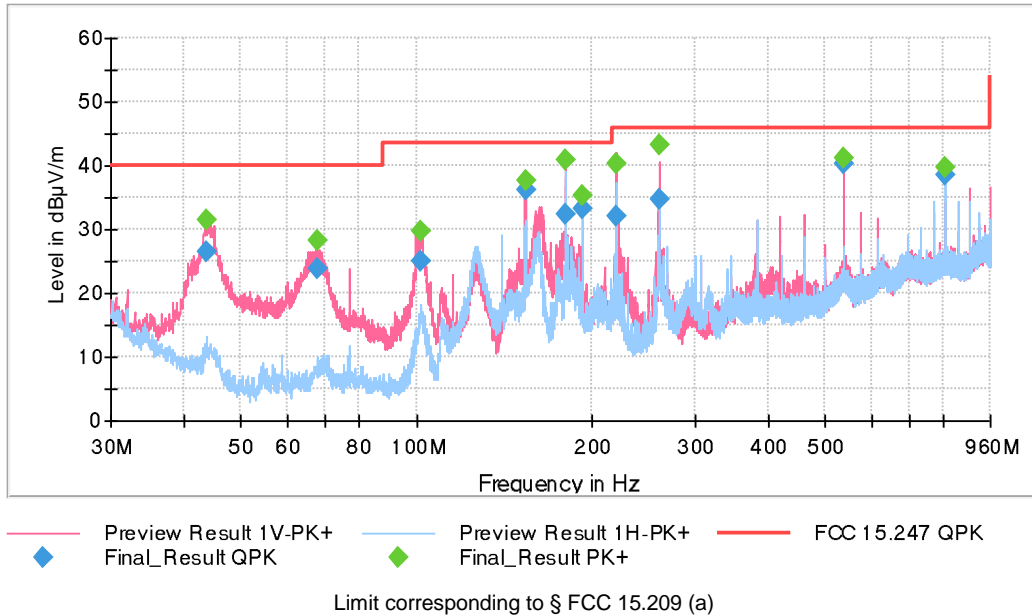
No spurious signals were found.

Measurement Uncertainty (dB): 1 GHz \leq f < 17 GHz: \leq ± 4.6
17 GHz \leq f <± 26.5 GHz: \leq ± 4.89
26.5 GHz \leq f <± 40 GHz: \leq ± 5.14

Verdict: PASS

• CHANNEL 2:

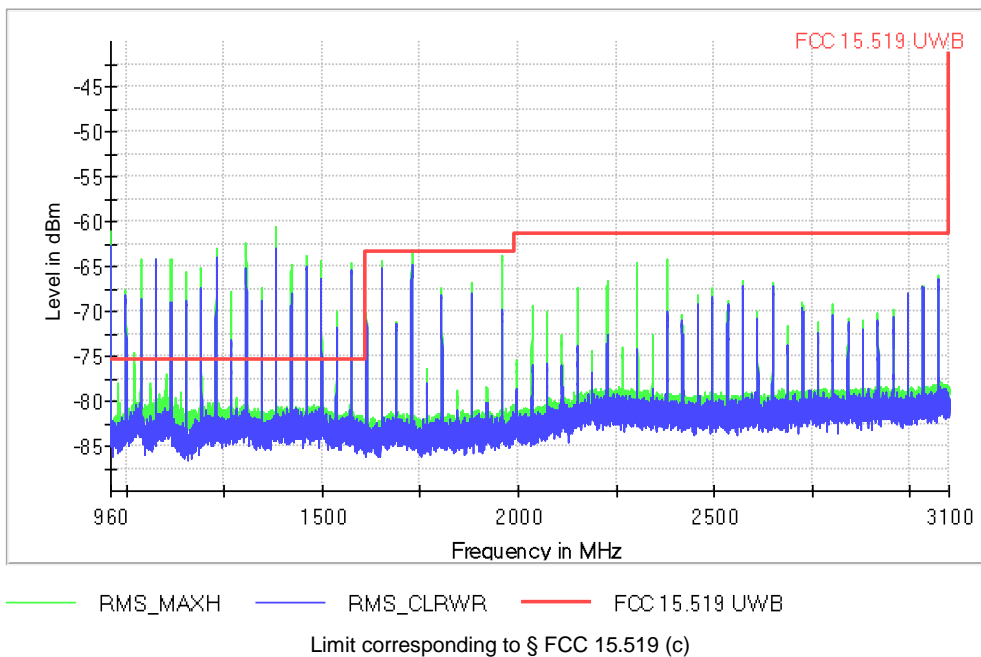
FREQUENCY RANGE 30 - 960 MHz:



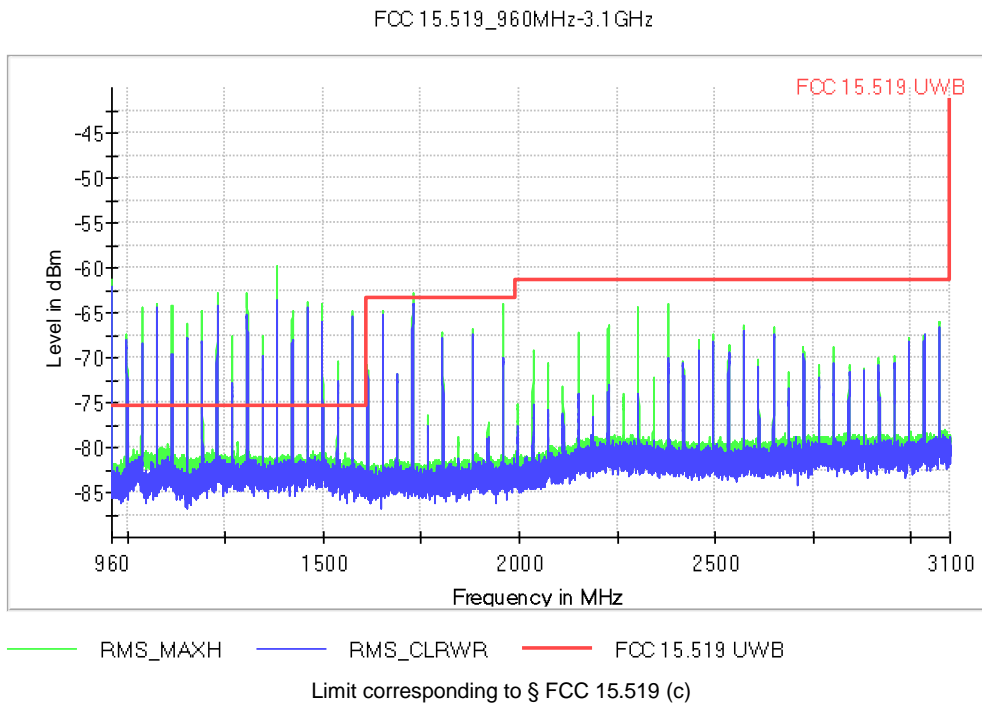
FREQUENCY RANGE 960 MHz - 7 GHz:

UWB Signal ON 960 MHz - 3100 MHz:

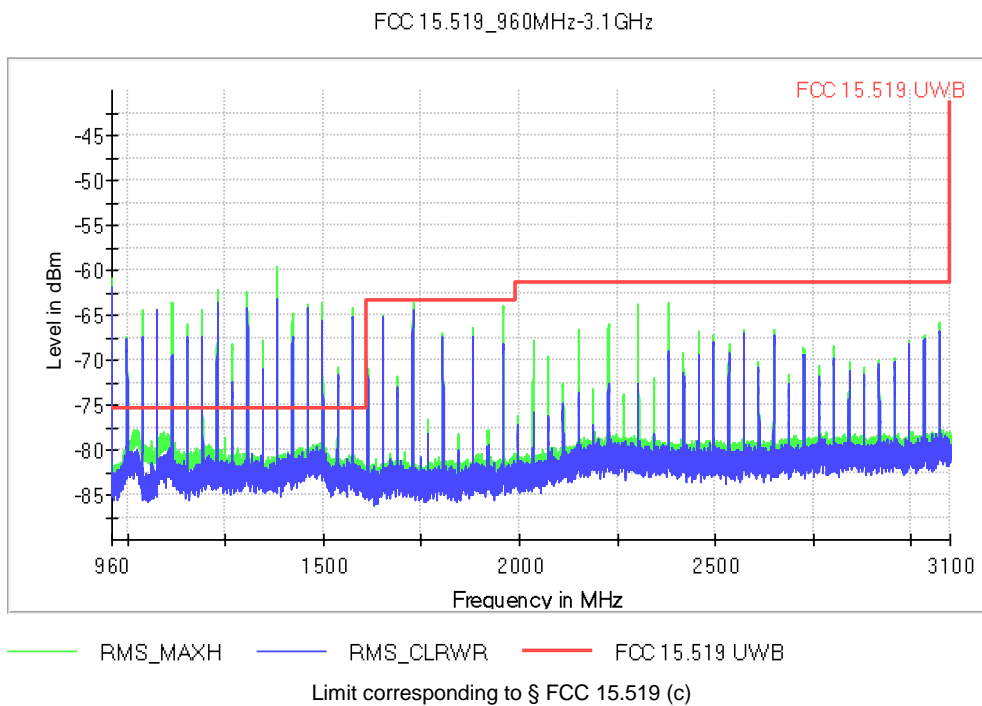
FCC 15.519_960MHz-3.1GHz



UWB TX OFF and digital circuitry used for continuous UWB transmission is enabled.
 960 MHz - 3100 MHz:

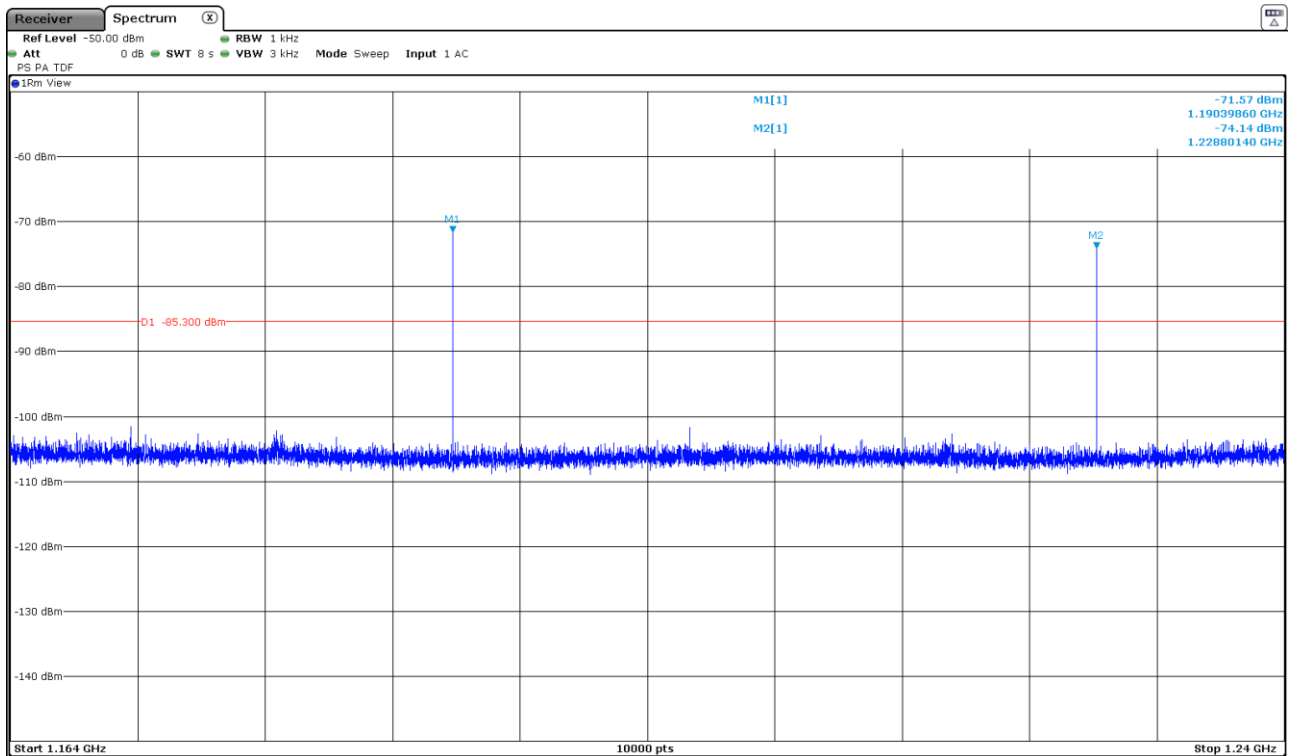


UWB TX OFF and digital circuitry used for continuous UWB transmission is disabled.
 960 MHz - 3100 MHz:



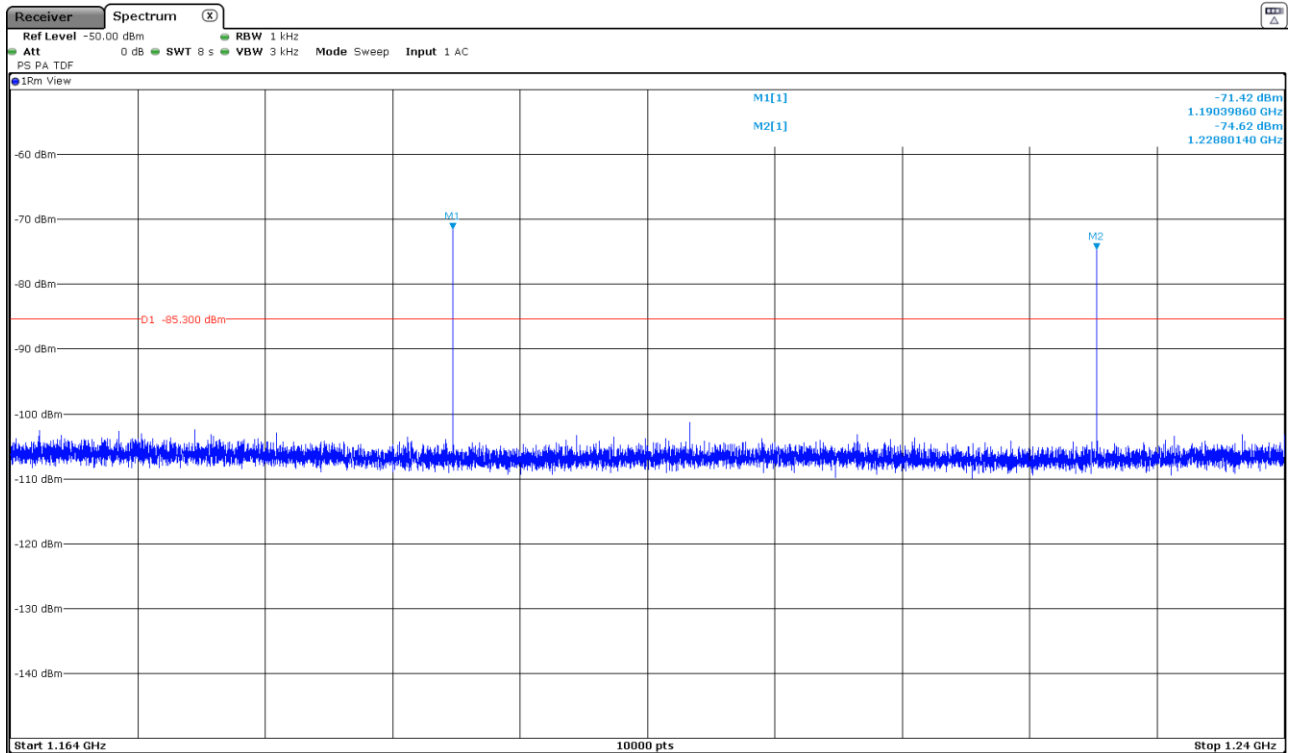
Note: As it can be checked in the three last plots above, emissions are the same and still present with UWB TX OFF and with digital circuitry used for continuous UWB transmission disabled, so it is demonstrated that this emissions are produced by digital circuitry used to control additional functions other than the UWB continuous transmission. Therefore, according to § FCC 15.521 (c), these emissions are subject to the limits contained in Part 15 Subpart B (67871REM.003).

UWB Signal ON 1164 MHz-1240 MHz at RBW=1KHz:



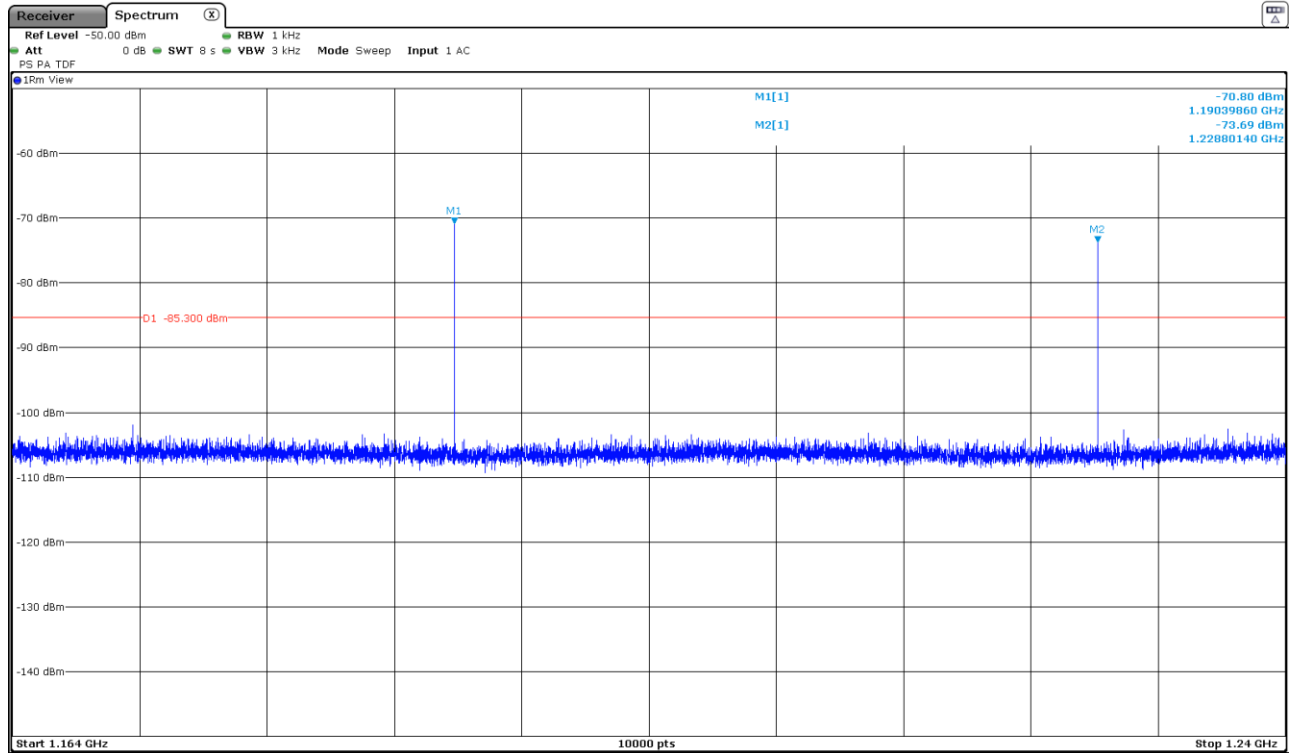
Limit corresponding to § FCC 15.519 (d)

UWB TX OFF and digital circuitry used for continuous UWB transmission is enabled.
 1164 MHz-1240 MHz at RBW=1KHz:



Limit corresponding to § FCC 15.519 (d)

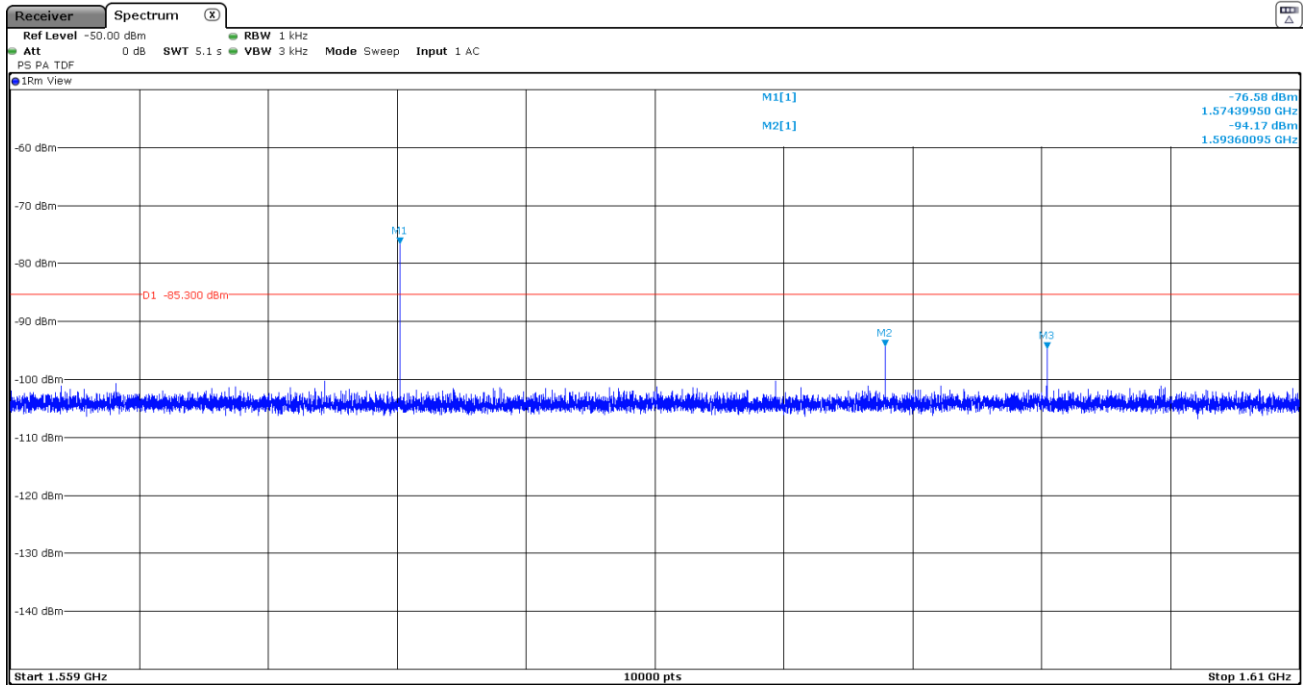
UWB TX OFF and digital circuitry used for continuous UWB transmission is disabled.
 1164 MHz-1240 MHz at RBW=1KHz:



Limit corresponding to § FCC 15.519 (d)

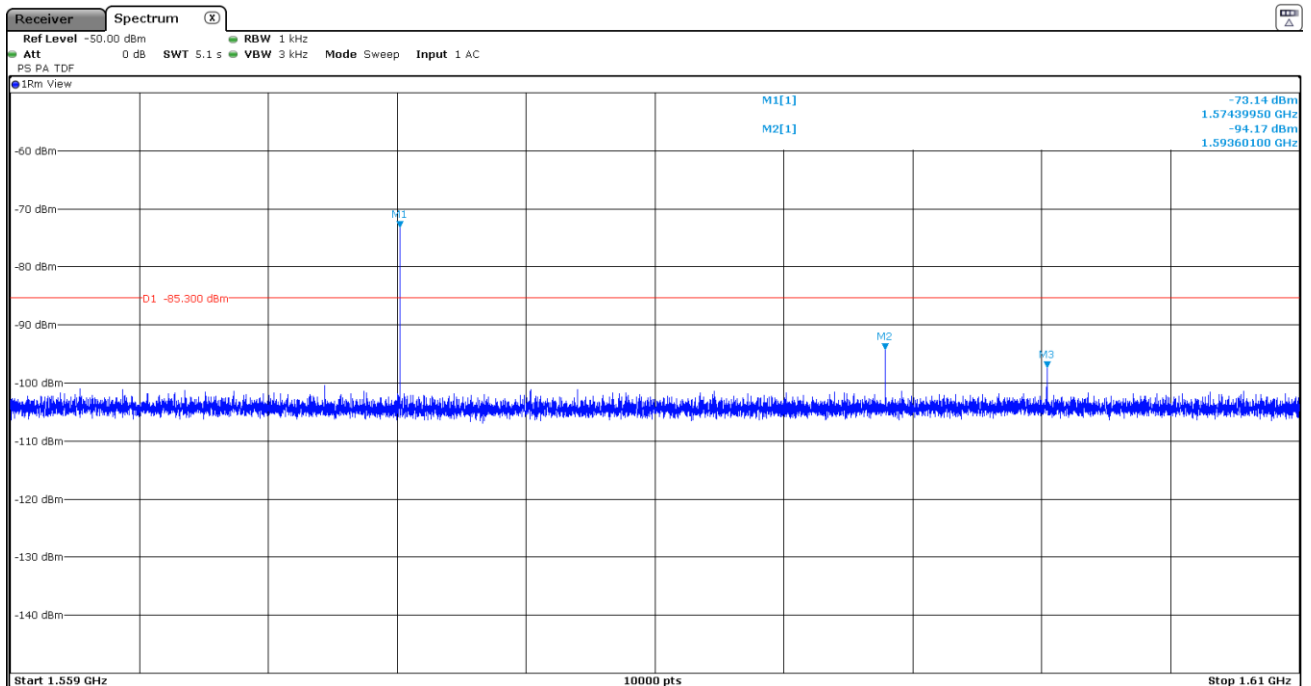
Note: As it can be checked in the three last plots above, emissions are the same and still present with UWB TX OFF and with digital circuitry used for continuous UWB transmission disabled, so it is demonstrated that this emissions are produced by digital circuitry used to control additional functions other than the UWB continuous transmission. Therefore, according to § FCC 15.521 (c), these emissions are subject to the limits contained in Part 15 Subpart B (67871REM.003).

UWB Signal ON 1559 MHz-1610 MHz at RBW=1KHz:



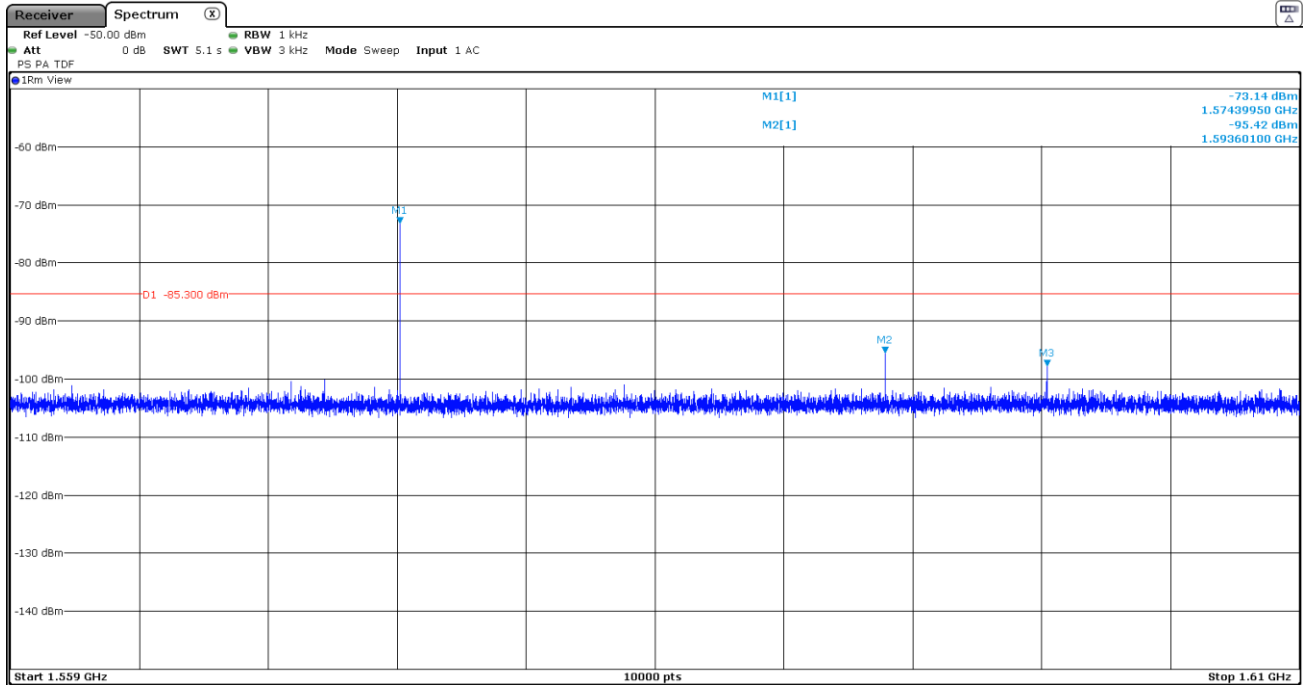
Limit corresponding to § FCC 15.519 (d)

UWB TX OFF and digital circuitry used for continuous UWB transmission is enabled.
 1559 MHz-1610 MHz at RBW=1KHz:



Limit corresponding to § FCC 15.519 (d)

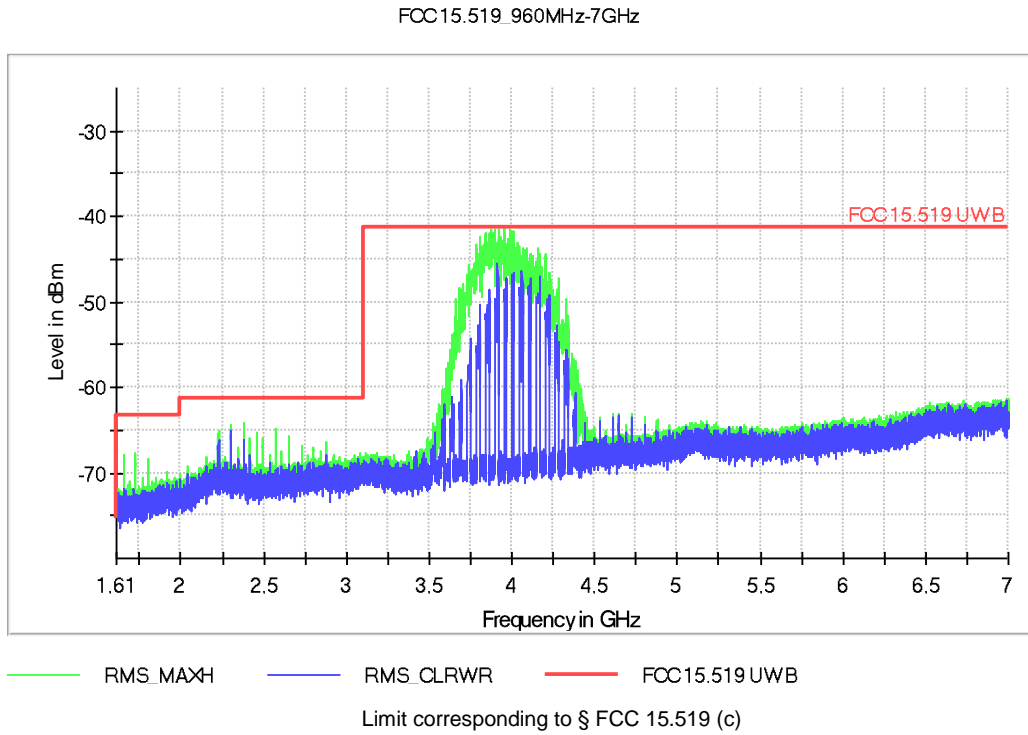
UWB TX OFF and digital circuitry used for continuous UWB transmission is disabled.
1559 MHz-1610 MHz at RBW=1KHz:



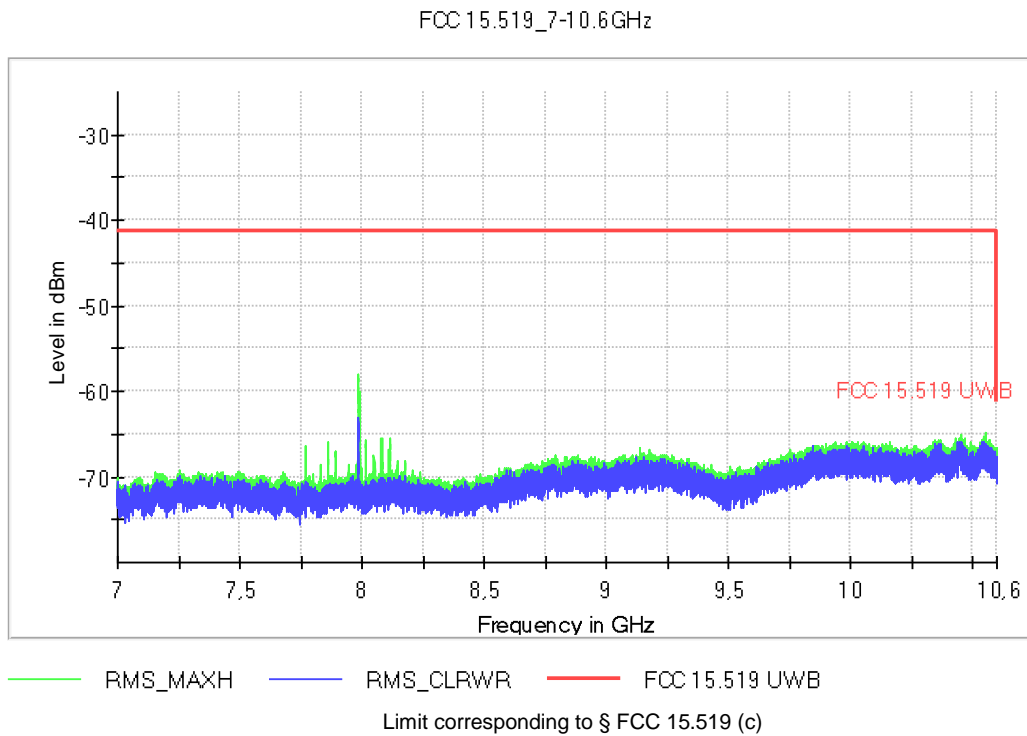
Limit corresponding to § FCC 15.519 (d)

Note: As it can be checked in the three last plots above, emissions are the same and still present with UWB TX OFF and with digital circuitry used for continuous UWB transmission disabled, so it is demonstrated that this emissions are produced by digital circuitry used to control additional functions other than the UWB continuous transmission. Therefore, according to § FCC 15.521 (c), these emissions are subject to the limits contained in Part 15 Subpart B (67871REM.003).

UWB Signal ON 1.61 GHz-7 GHz:

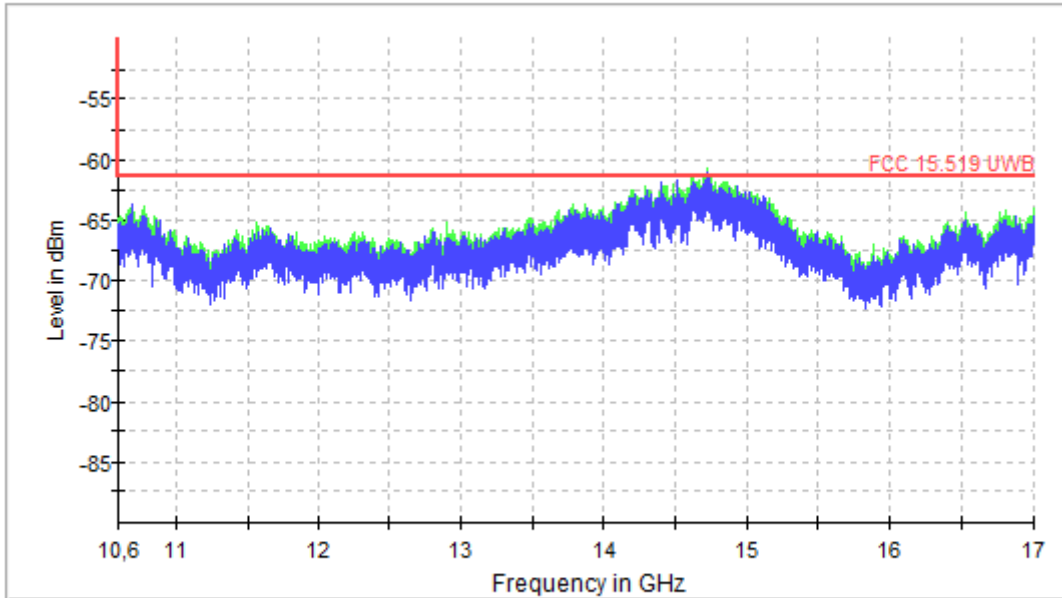


FREQUENCY RANGE 7 - 10.6 GHz:



FREQUENCY RANGE 10.6 - 17 GHz:

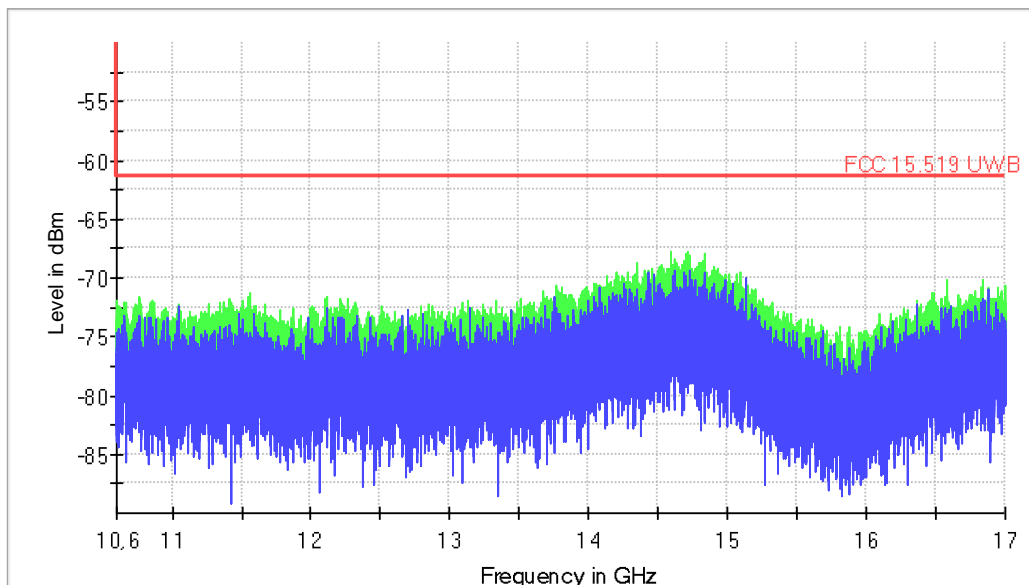
FCC 15.519_960MHz-17GHz RBW 1MHz



— RMS_MAXH — RMS_CLRWR — FCC 15.519 UWB

Limit corresponding to § FCC 15.519 (c)

FCC 15.519_10.6-17GHz RBW 100kHz



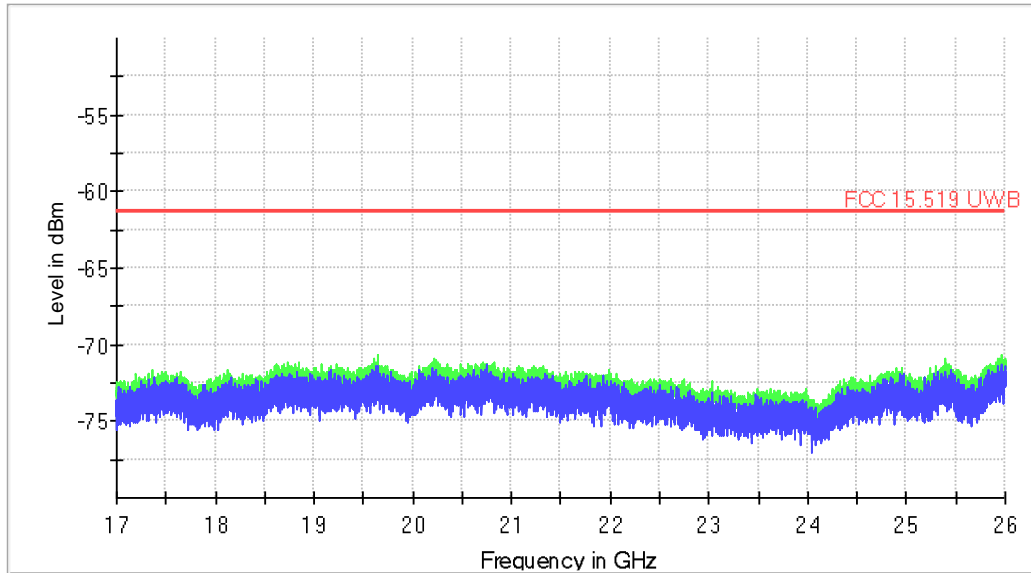
— RMS_MAXH — RMS_CLRWR — FCC 15.519 UWB

Limit corresponding to § FCC 15.519 (c)

Note: Due to there is no emissions produced by the device under test in the scan with RBW 1MHz, RBW was reduced to 100 kHz for improving the dynamic range.

FREQUENCY RANGE 17 - 26 GHz:

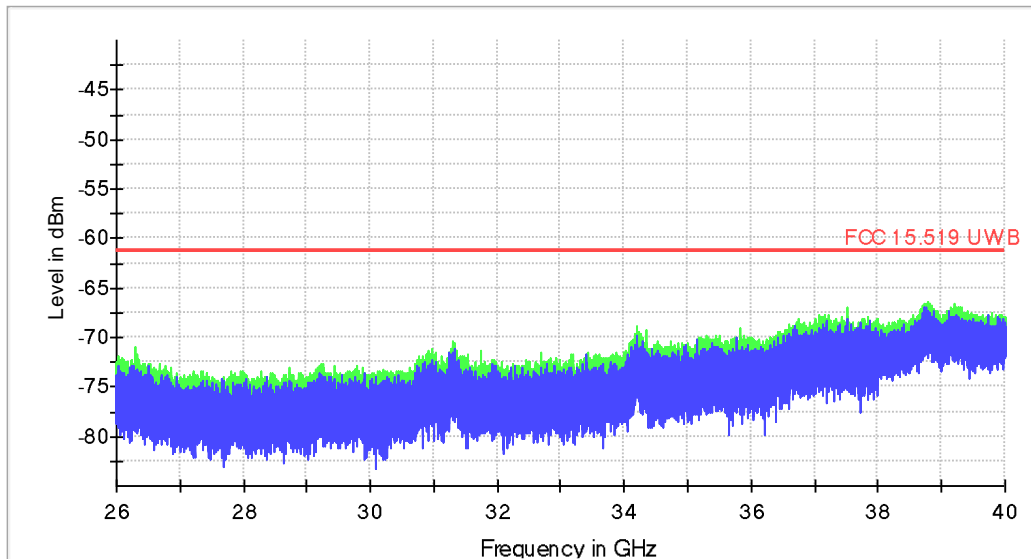
FCC 15.519_17GHz-26GHz



— RMS_MAXH — RMS_CLRWR — FCC 15.519 UWB
Limit corresponding to § FCC 15.519 (c)

FREQUENCY RANGE 26 - 40 GHz:

FCC 15.519_26GHz-40GHz



— RMS_MAXH — RMS_CLRWR — FCC 15.519 UWB
Limit corresponding to § FCC 15.519 (c)

• **CHANNEL 5:**

Frequency range 30 - 960 MHz:

Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
43.810500	24.50	V	Quasi-Peak
76.779000	22.57	V	Quasi-Peak
106.678500	25.69	V	Quasi-Peak
153.597000	33.75	V	Quasi-Peak
180.148500	28.21	H	Quasi-Peak
219.906000	27.37	V	Quasi-Peak
260.082000	34.33	V	Quasi-Peak
383.958000	26.76	V	Quasi-Peak
537.594000	38.88	V	Quasi-Peak
806.410500	35.93	H	Quasi-Peak

Frequency range 960 MHz - 7 GHz:

Spurious Frequency (GHz)	Emission Level (dBm)	Polarization	Detector
6.4881100	-41.370	V	RMS

Note: For emissions on the range 960MHz to 4.75GHz it is demonstrated that are produced by digital circuitry used to control additional functions other than the UWB continuous transmission. Therefore, according to § FCC 15.521 (c), this emissions are subject to the limits contained in Part 15 Subpart B (67871REM.003).

Note: For emissions on the range 960MHz to 4.75GHz it is demonstrated that are due solely to emissions from digital circuitry contained within the transmitter, and that the emission is not intended to be radiated from the transmitter's antenna. According to RSS-220 Annex. Section 4(m), the limits for emissions from digital circuitry prescribed in RSS-Gen apply to that emission rather than the UWB limits (measurements performed in "2. UWB TRANSMITTER OFF AND ITS DIGITAL CIRCUITRY FOR CONTINUOUS UWB TRANSMISSION DISABLED", page 43 of this report).

Frequency range 7 - 10.6 GHz:

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

Frequency range 10.6 - 17 GHz:

No spurious signals were found.

Frequency range 17 - 26 GHz:

No spurious signals were found.

Frequency range 26 - 40 GHz:

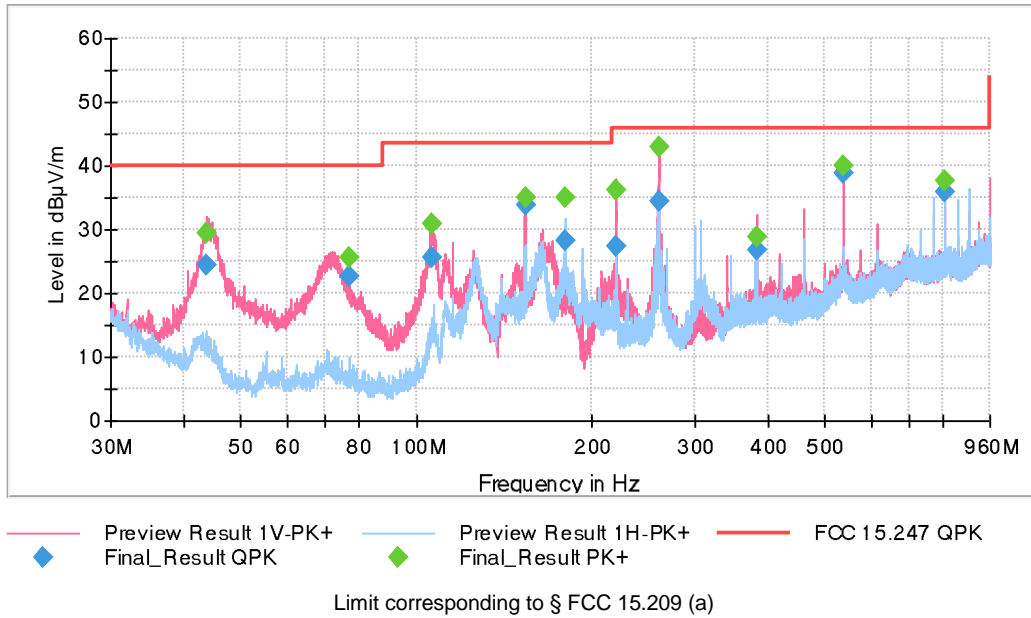
No spurious signals were found.

Measurement Uncertainty (dB): 1 GHz <± f < 17 GHz: <± 4.6
 17 GHz <± f <± 26.5 GHz: <± 4.89
 26.5 GHz <± f <± 40 GHz: <± 5.14

Verdict: PASS

• CHANNEL 5:

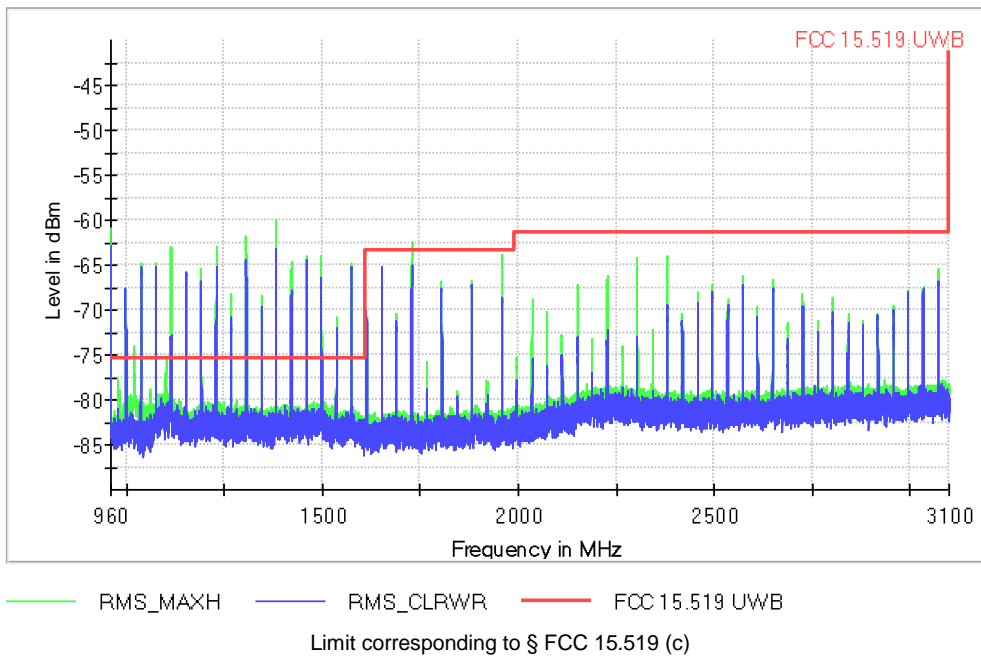
FREQUENCY RANGE 30 - 960 MHz:



FREQUENCY RANGE 960 MHz - 7 GHz:

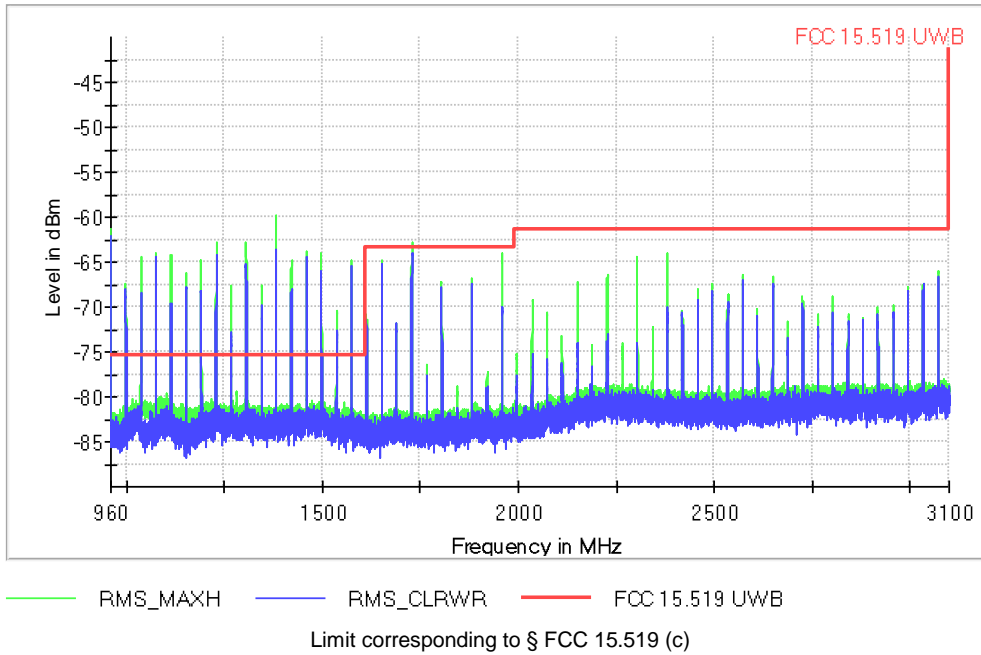
UWB Signal ON 960 MHz - 3100 MHz:

FCC 15.519_960MHz-3.1GHz



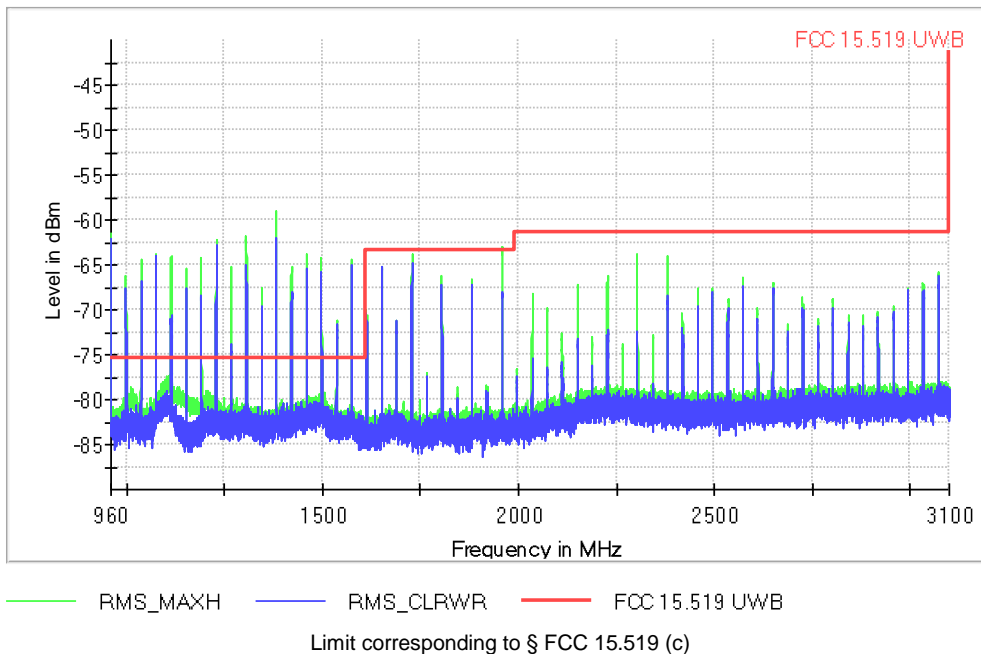
UWB TX OFF and digital circuitry used for continuous UWB transmission is disabled.
 960 MHz - 3100 MHz:

FCC 15.519_960MHz-3.1GHz



UWB TX OFF and digital circuitry used for continuous UWB transmission is enabled.
 960 MHz - 3100 MHz:

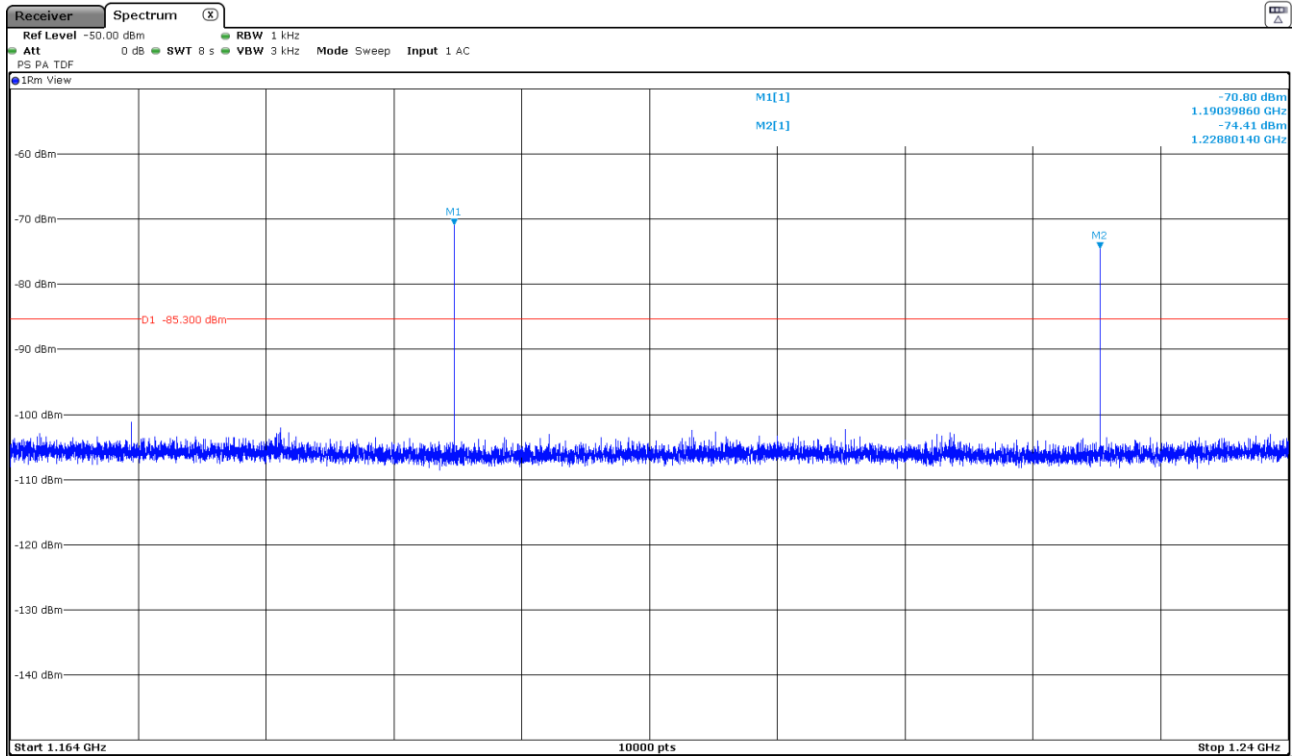
FCC 15.519_960MHz-3.1GHz



Note: As it can be checked in the three last plots above, emissions are the same and still present with UWB TX OFF and with digital circuitry used for continuous UWB transmission disabled, so it is demonstrated that this emissions are produced by digital circuitry used to control additional functions other than the UWB continuous transmission. Therefore, according to § FCC 15.521 (c), these emissions are subject to the limits contained in Part 15 Subpart B (67871REM.003).

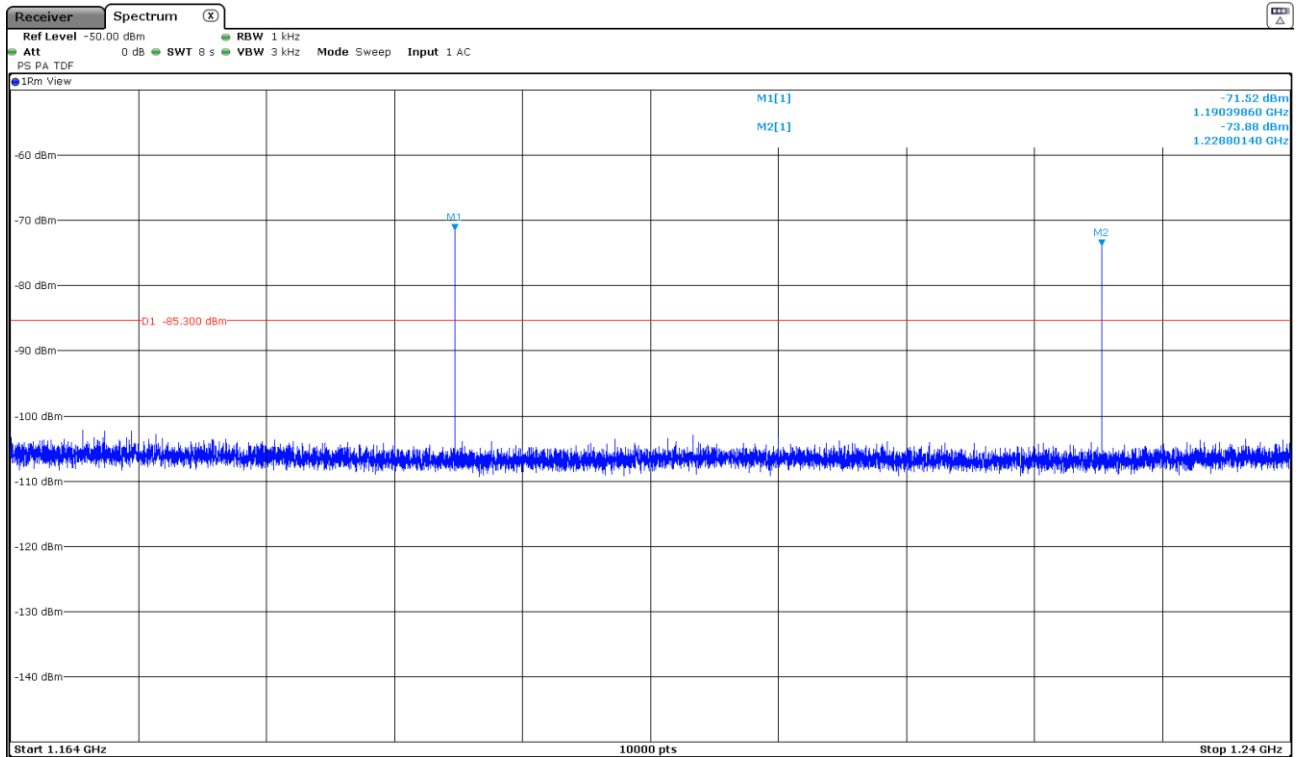
According to RSS-220 Annex. Section 4(m), the limits for emissions from digital circuitry prescribed in RSS-Gen apply to that emission rather than the UWB limits (measurements performed in "2. UWB TRANSMITTER OFF AND ITS DIGITAL CIRCUITRY FOR CONTINUOUS UWB TRANSMISSION DISABLED", page 43 of this report).

UWB Signal ON 1164 MHz-1240 MHz at RBW=1KHz:



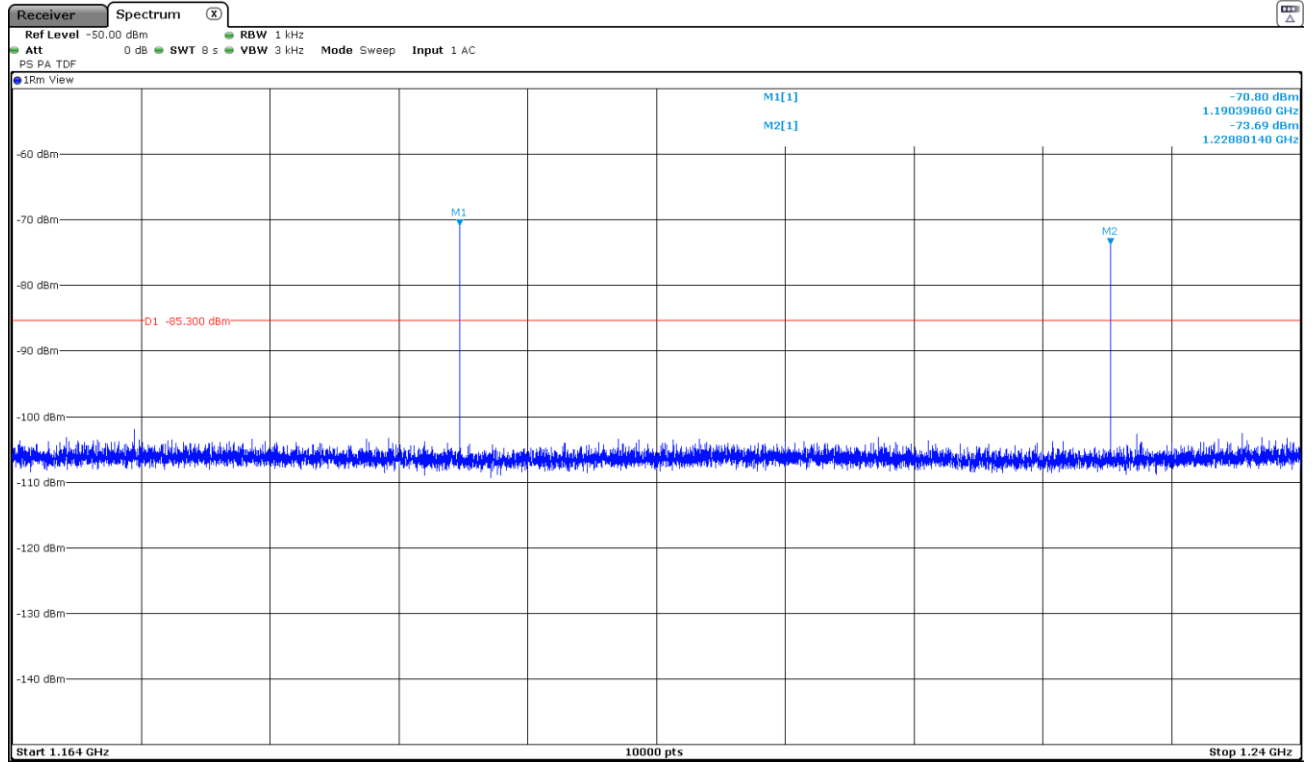
Limit corresponding to § FCC 15.519 (d)

UWB TX OFF and digital circuitry used for continuous UWB transmission is enabled.
 1164 MHz-1240 MHz at RBW=1KHz:



Limit corresponding to § FCC 15.519 (d)

UWB TX OFF and digital circuitry used for continuous UWB transmission is disabled.
 1164 MHz-1240 MHz at RBW=1KHz:

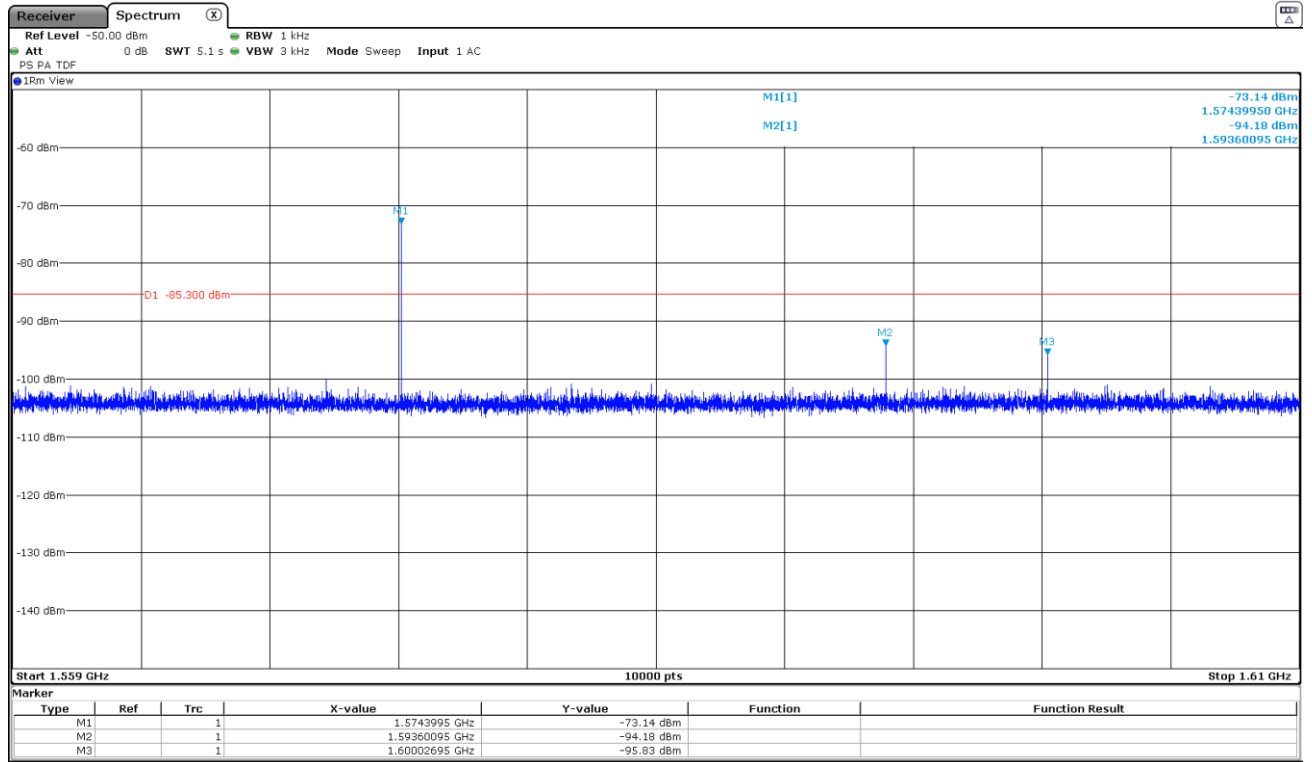


Limit corresponding to § FCC 15.519 (d)

Note: As it can be checked in the three last plots above, emissions are the same and still present with UWB TX OFF and with digital circuitry used for continuous UWB transmission disabled, so it is demonstrated that this emissions are produced by digital circuitry used to control additional functions other than the UWB continuous transmission. Therefore, according to § FCC 15.521 (c), these emissions are subject to the limits contained in Part 15 Subpart B (67871REM.003).

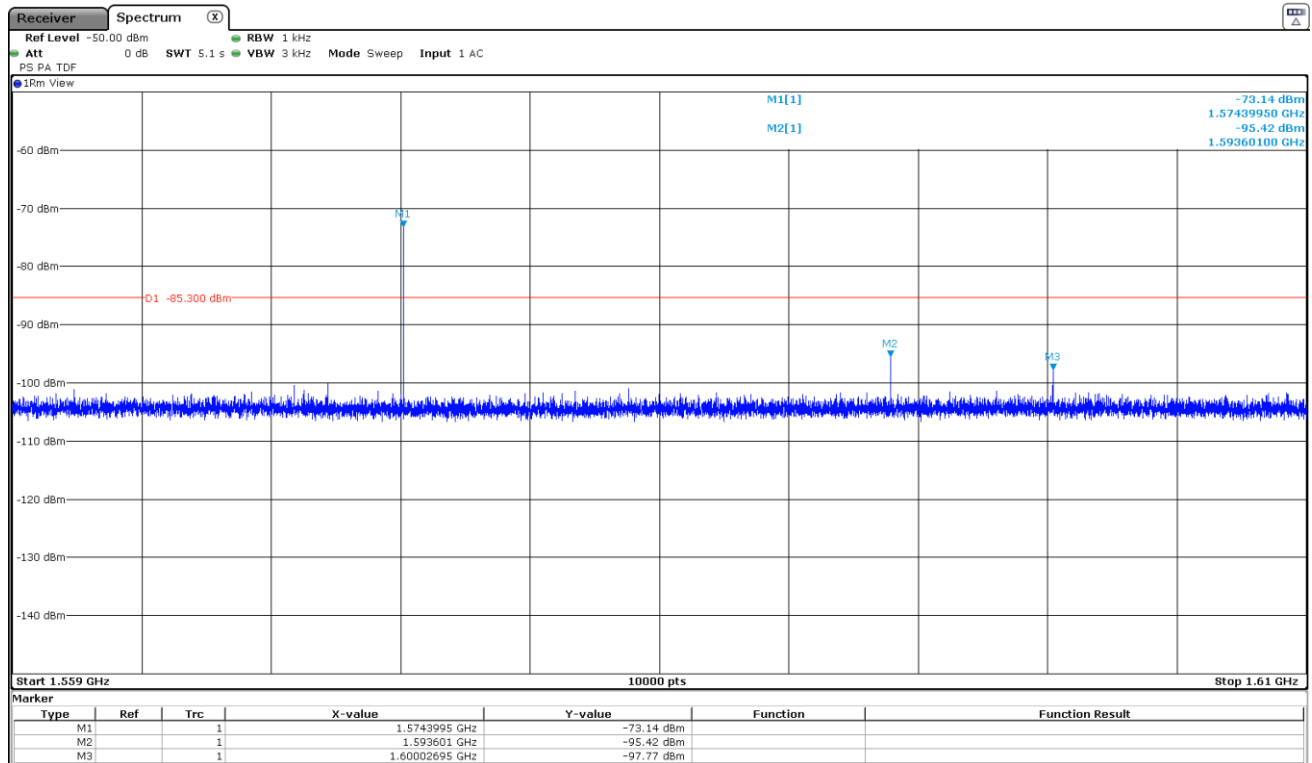
According to RSS-220 Annex, Section 4(m), the limits for emissions from digital circuitry prescribed in RSS-Gen apply to that emission rather than the UWB limits (measurements performed in "2. UWB TRANSMITTER OFF AND ITS DIGITAL CIRCUITRY FOR CONTINUOUS UWB TRANSMISSION DISABLED", page 43 of this report).

UWB Signal ON 1559 MHz-1610 MHz at RBW=1KHz:



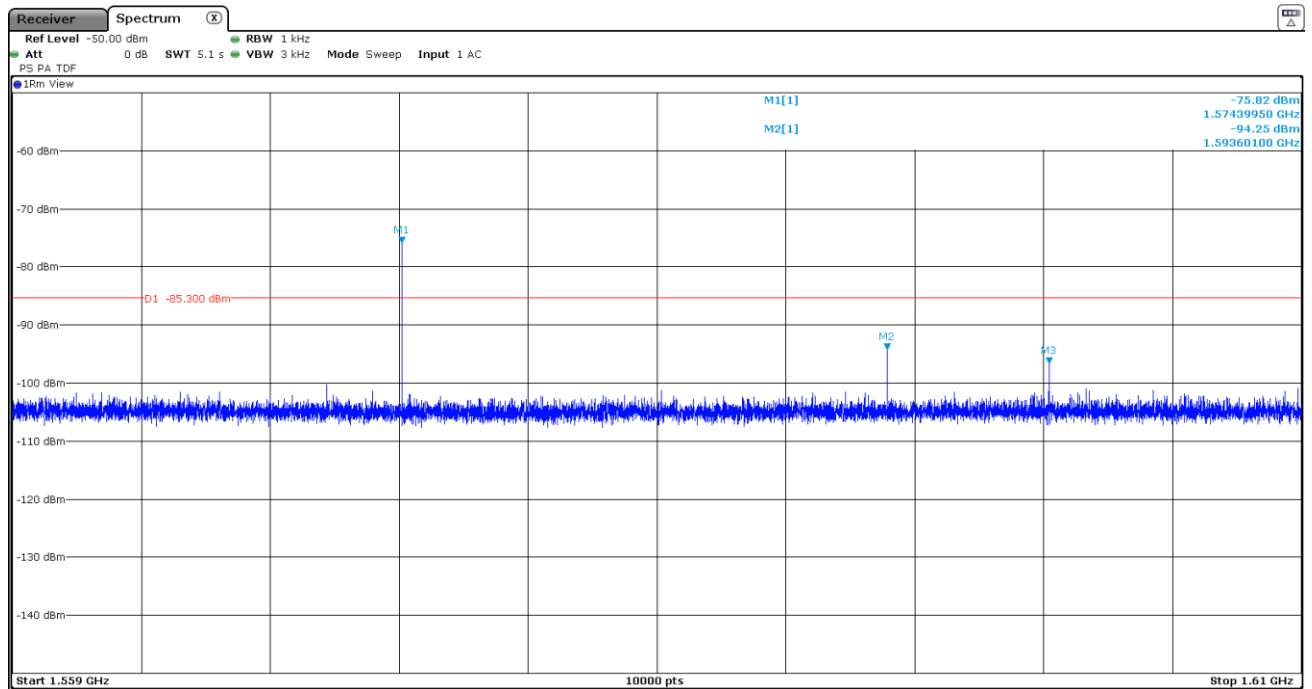
Limit corresponding to § FCC 15.519 (d)

UWB TX OFF and digital circuitry used for continuous UWB transmission is disabled.
 1559 MHz-1610 MHz at RBW=1KHz:



Limit corresponding to § FCC 15.519 (d)

UWB TX OFF and digital circuitry used for continuous UWB transmission is enabled.
 1559 MHz-1610 MHz at RBW=1KHz:



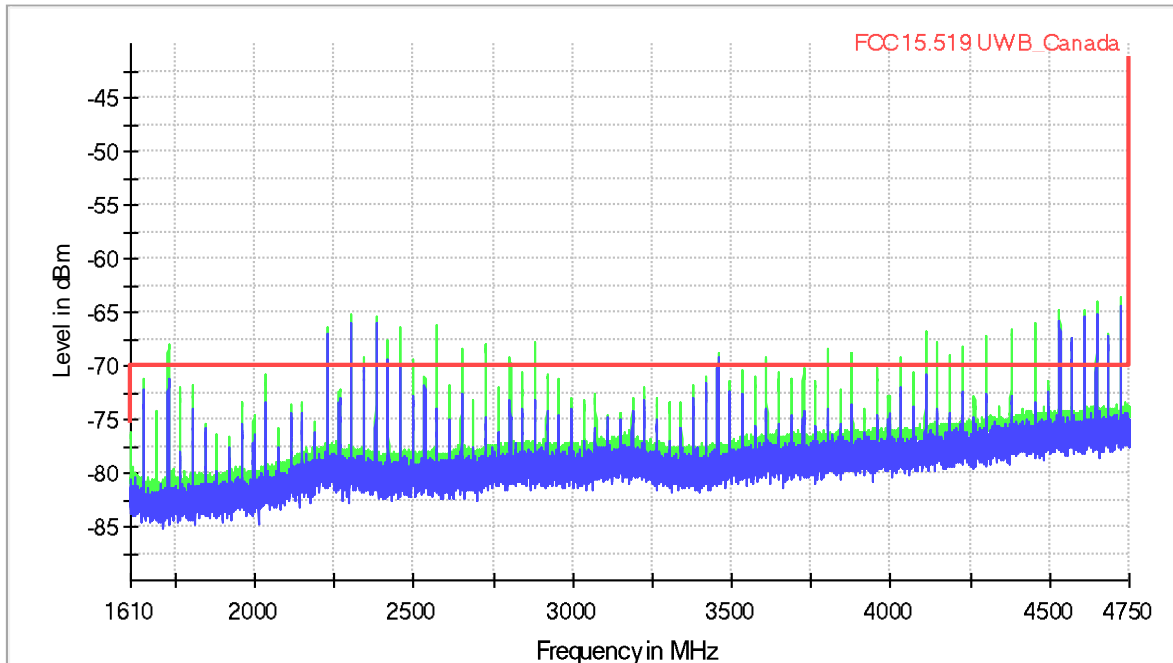
Limit corresponding to § FCC 15.519 (d)

Note: As it can be checked in the three last plots above, emissions are the same and still present with UWB TX OFF and with digital circuitry used for continuous UWB transmission disabled, so it is demonstrated that this emissions are produced by digital circuitry used to control additional functions other than the UWB continuous transmission. Therefore, according to § FCC 15.521 (c), this emissions are subject to the limits contained in Part 15 Subpart B (67871REM.003).

According to RSS-220 Annex. Section 4(m), the limits for emissions from digital circuitry prescribed in RSS-Gen apply to that emission rather than the UWB limits (measurements performed in "2. UWB TRANSMITTER OFF AND ITS DIGITAL CIRCUITRY FOR CONTINUOUS UWB TRANSMISSION DISABLED", page 43 of this report).

UWB Signal ON 1.61 GHz-4.75 GHz (CANADA Limit):

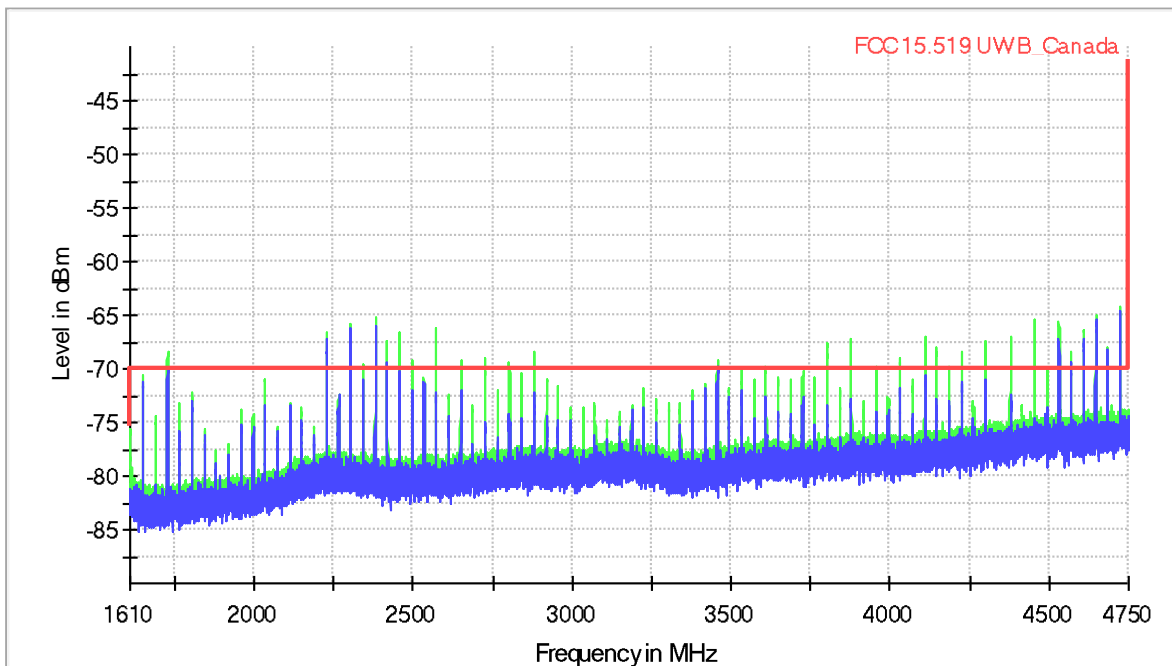
FCC15.519_Canada_1.61-4.75GHz



— RMS_MAXH — RMS_CLRWR — FCC15.519 UWB_Canada
 Limit corresponding to RSS-220 5.3.1. (d)

UWB TX OFF and digital circuitry used for continuous UWB transmission is disabled.
 1.61 GHz-4.75 GHz (CANADA Limit):

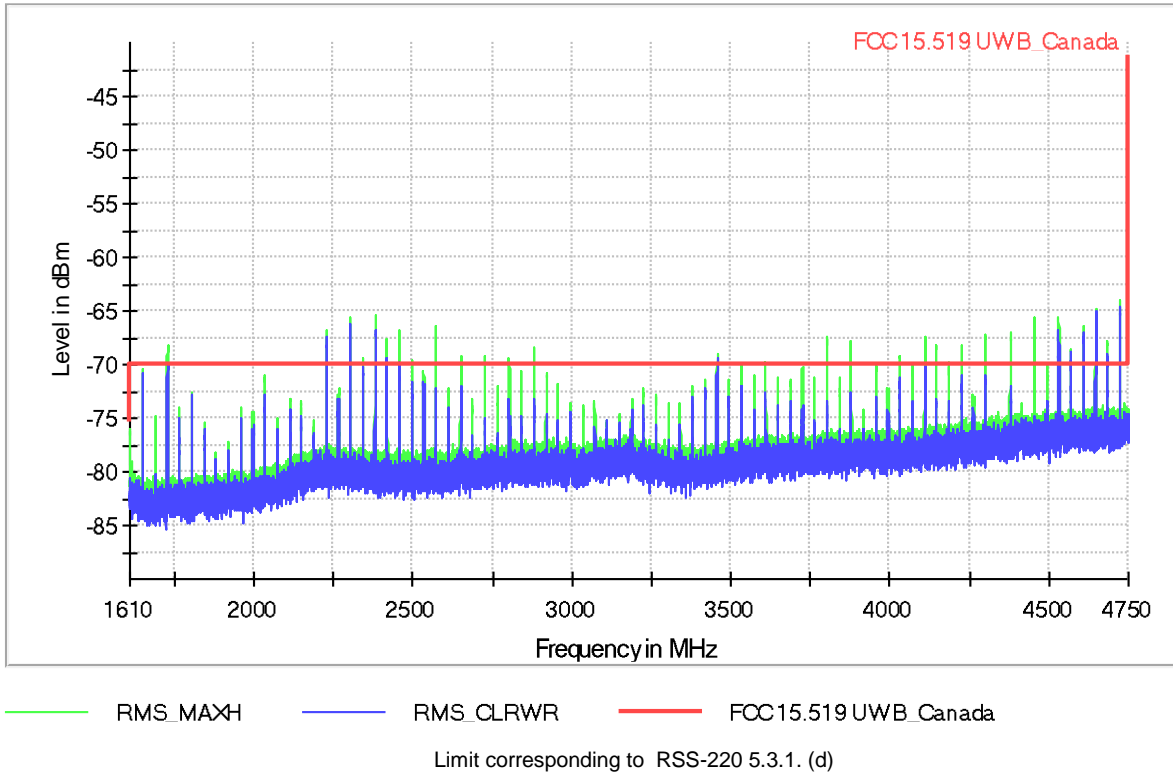
FCC15.519_Canada_1.61-4.75GHz



— RMS_MAXH — RMS_CLRWR — FCC15.519 UWB_Canada
 Limit corresponding to RSS-220 5.3.1. (d)

UWB TX OFF and digital circuitry used for continuous UWB transmission is enabled.
 1.61 GHz-4.75 GHz (CANADA Limit):

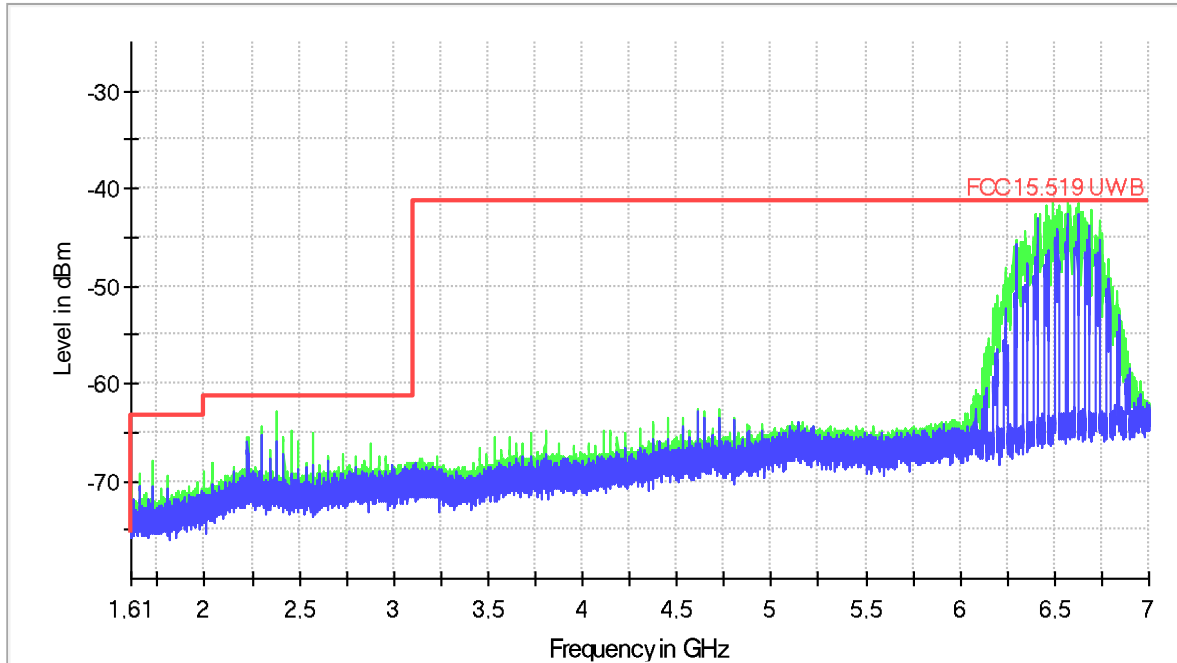
FCC15.519_Canada_1.61-4.75GHz



Note: As it can be checked in the three last plots above, emissions are the same and still present with UWB TX OFF and with digital circuitry used for continuous UWB transmission disabled, so it is demonstrated that this emissions are due solely to emissions from digital circuitry contained within the transmitter, and that the emission is not intended to be radiated from the transmitter's antenna. According to RSS-220 Annex. Section 4(m), the limits for emissions from digital circuitry prescribed in RSS-Gen apply to that emission rather than the UWB limits (measurements performed in "2. UWB TRANSMITTER OFF AND ITS DIGITAL CIRCUITRY FOR CONTINUOUS UWB TRANSMISSION DISABLED", page 43 of this report).

UWB Signal ON 1.61 - 7 GHz (FCC limit):

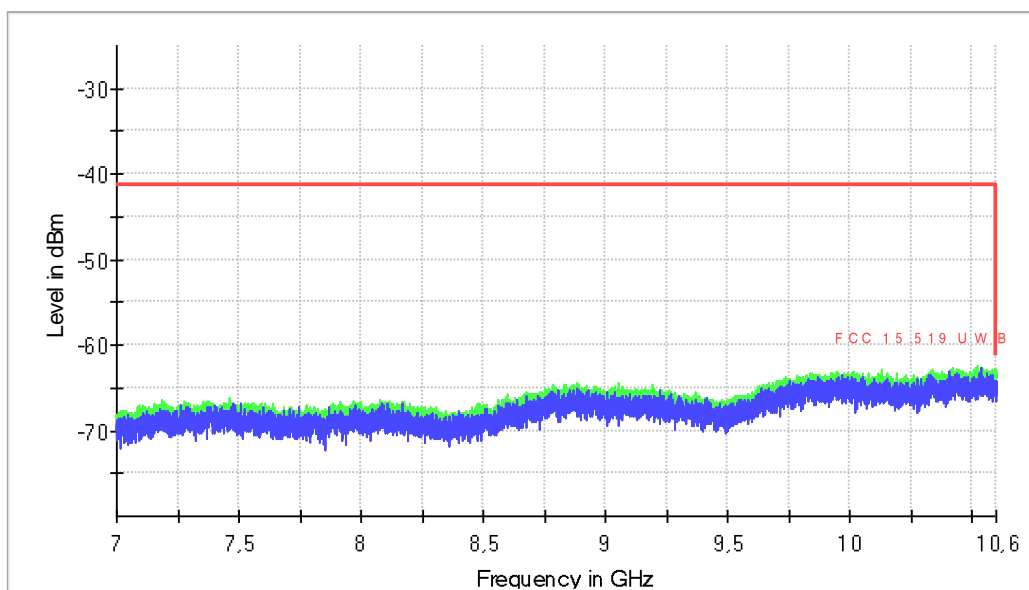
FCC15.519_960MHz-7GHz



— RMS_MAXH — RMS_CLRWR — FCC15.519 UWB
 Limit corresponding to § FCC 15.519 (c)

FREQUENCY RANGE 7 - 10.6 GHz:

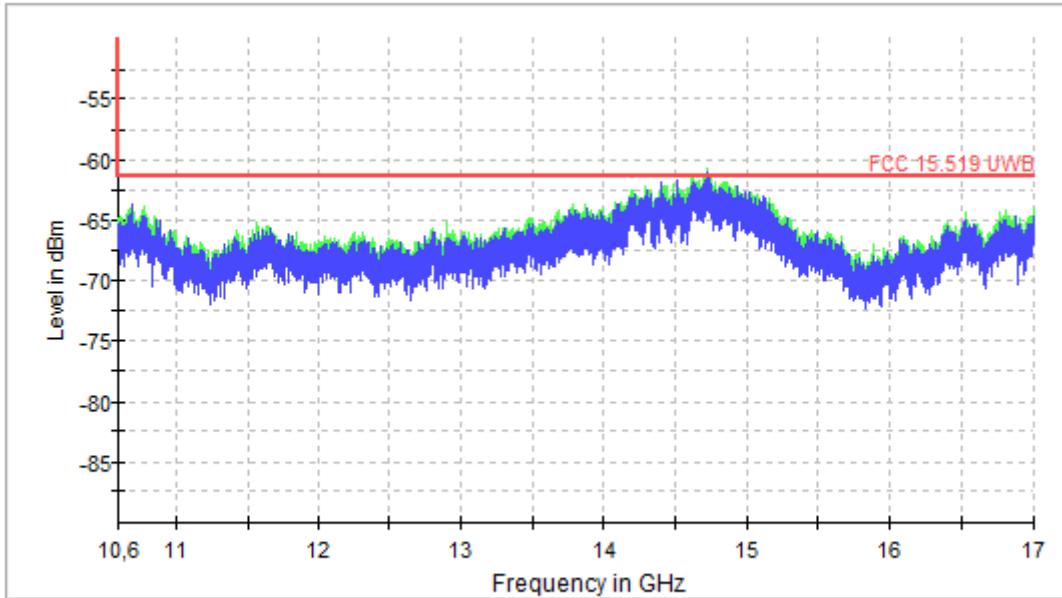
FCC15.519_7-10.6GHz



— RMS_MAXH — RMS_CLRWR — FCC 15.519 UWB
 Limit corresponding to § FCC 15.519 (c)

FREQUENCY RANGE 10.6 - 17 GHz:

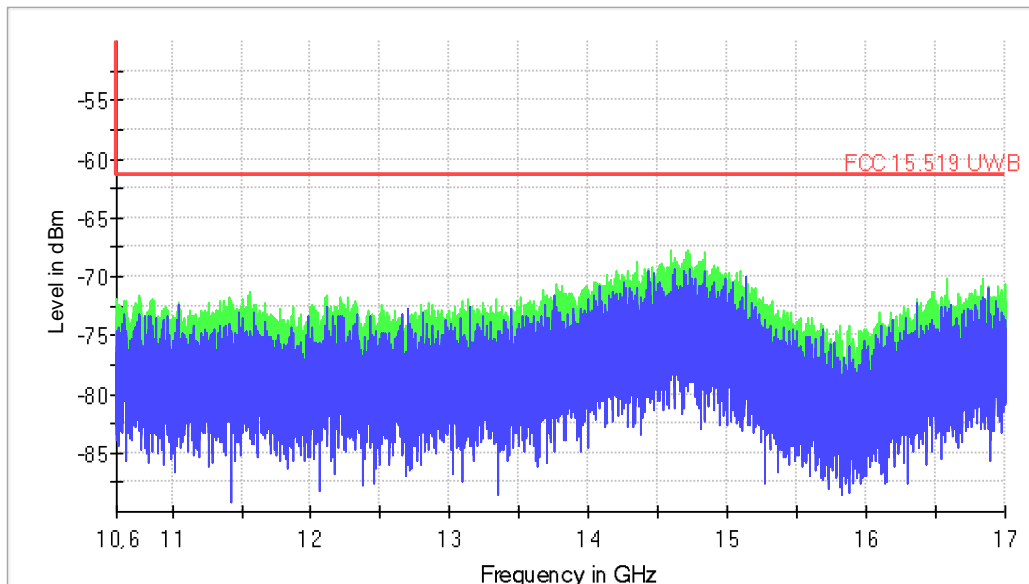
FCC 15.519_960MHz-17GHz RBW 1MHz



— RMS_MAXH — RMS_CLRWR — FCC 15.519 UWB

Limit corresponding to § FCC 15.519 (c)

FCC 15.519_10.6-17GHz RBW 100kHz



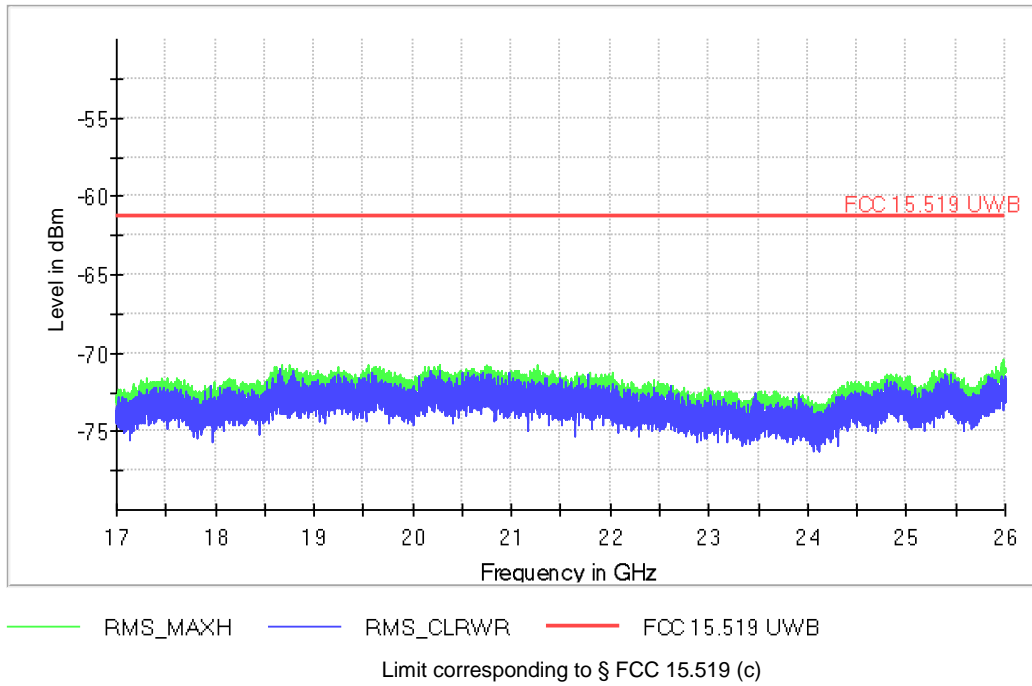
— RMS_MAXH — RMS_CLRWR — FCC 15.519 UWB

Limit corresponding to § FCC 15.519 (c)

Note: Due to there is no emissions produced by the device under test in the scan with RBW 1MHz, RBW was reduced to 100 kHz for improving the dynamic range.

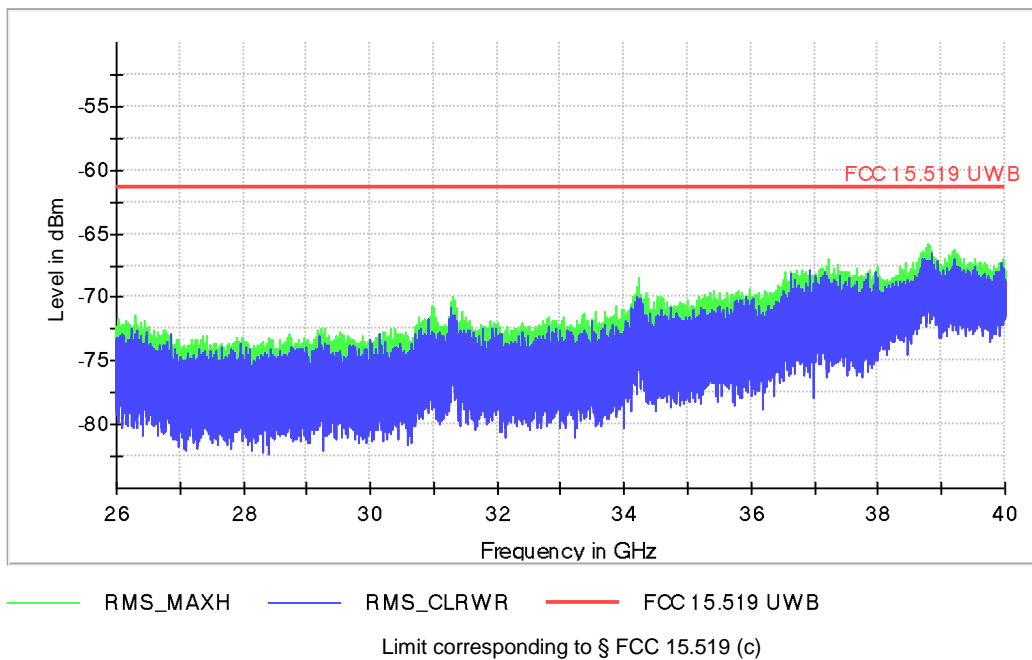
FREQUENCY RANGE 17 - 26 GHz:

FCC 15.519_17GHz-26GHz



FREQUENCY RANGE 26 - 40 GHz:

FCC 15.519_26GHz-40GHz



2. UWB TRANSMITTER OFF AND ITS DIGITAL CIRCUITRY FOR CONTINUOUS UWB TRANSMISSION DISABLED:

• CHANNEL 2:

Frequency range 30 MHz - 1 GHz:

Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (MHz)	Emission Level (dB μ V/m)	Polarization	Detector
153.578000	29.49	V	Quasi-Peak
384.001500	29.88	V	Quasi-Peak
537.601000	34.28	H	Quasi-Peak
614.376500	34.72	V	Quasi-Peak
883.212000	41.85	V	Quasi-Peak

Frequency range 1 - 17 GHz:

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

Frequency range 17 - 26 GHz:

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

Frequency range 26 - 40 GHz:

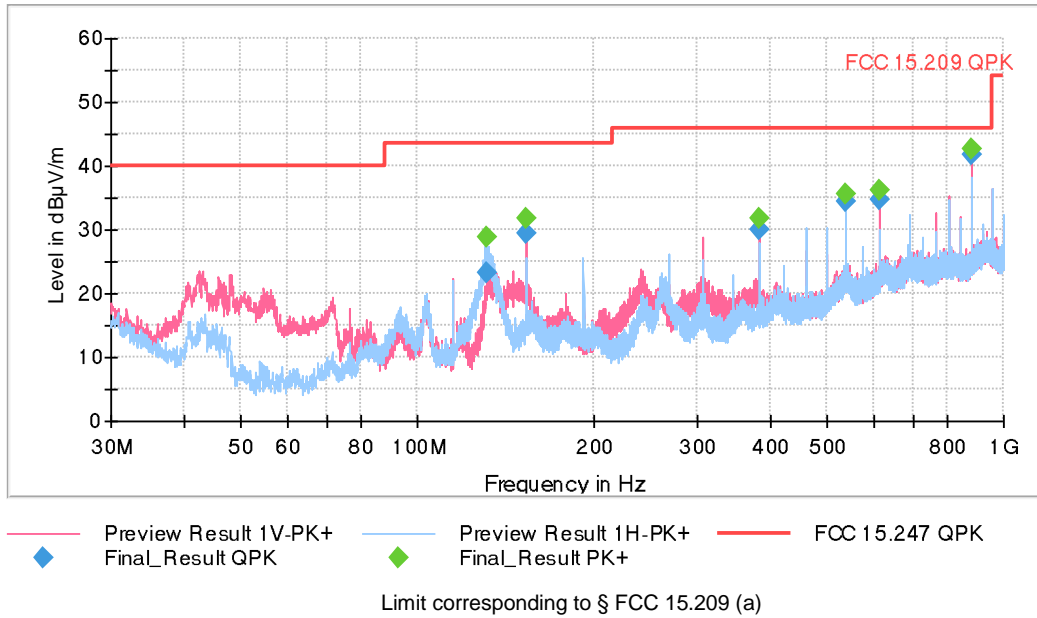
No spurious frequencies detected at less than 20 dB below the limit.

Measurement Uncertainty (dB): 1 GHz \leq f < 17 GHz: \leq 4.6
17 GHz \leq f \leq 26.5 GHz: \leq 4.89
26.5 GHz \leq f \leq 40 GHz: \leq 5.14

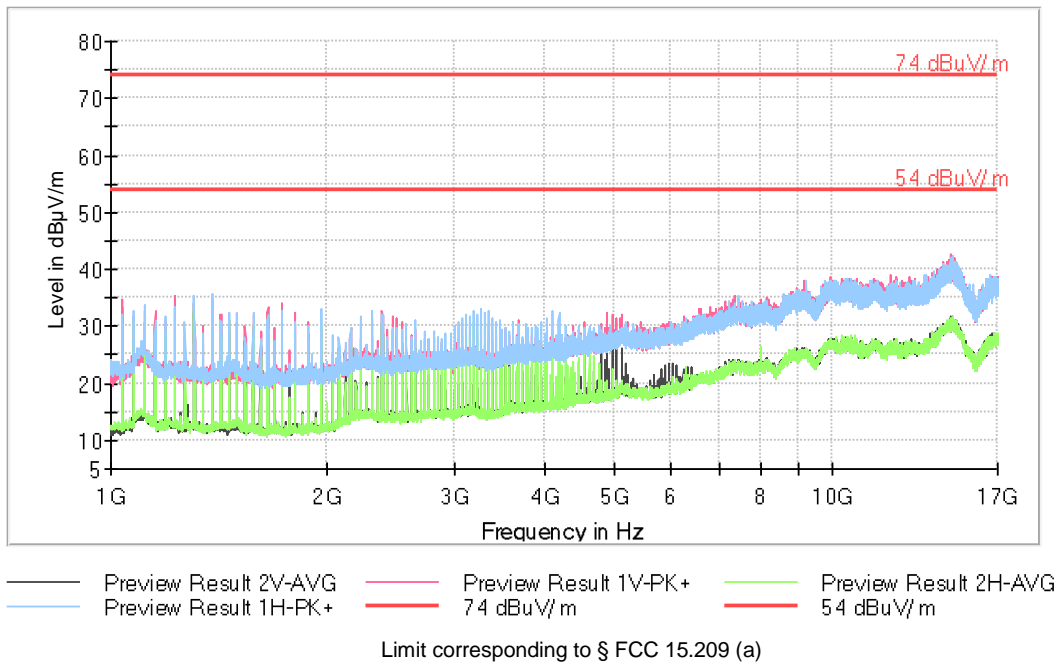
Verdict: PASS

• CHANNEL 2:

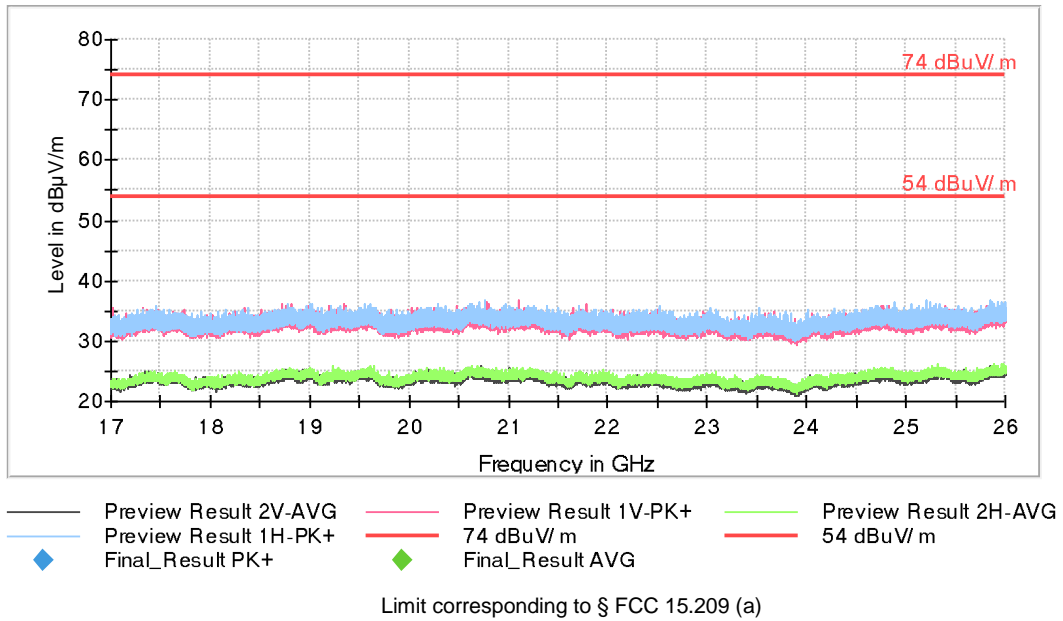
FREQUENCY RANGE 30 MHz - 1 GHz:



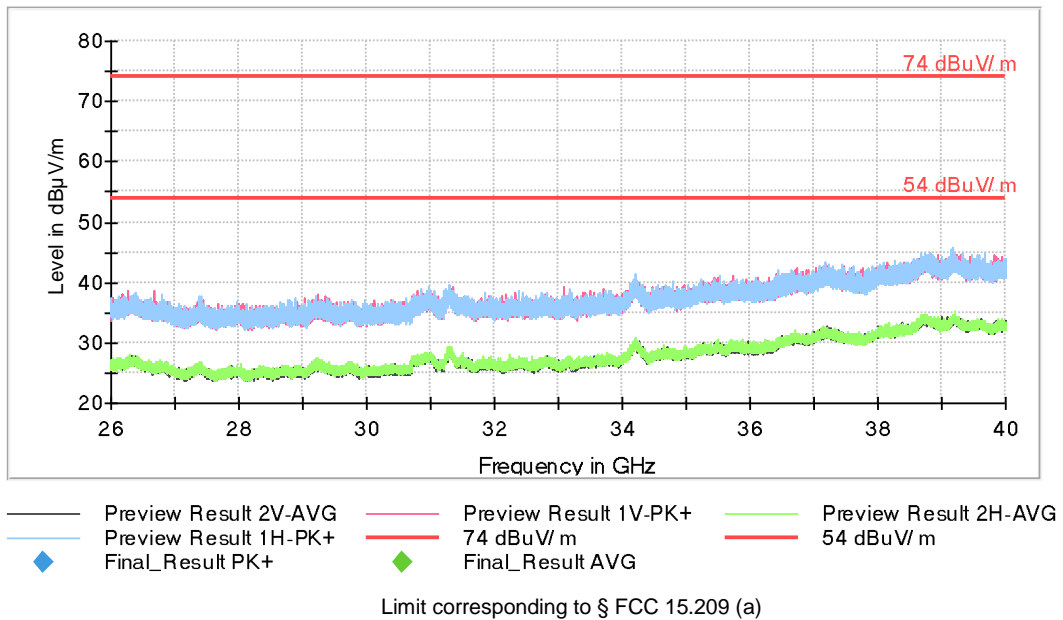
FREQUENCY RANGE 1 - 17 GHz:



FREQUENCY RANGE 17 - 26 GHz:



FREQUENCY RANGE 26 - 40 GHz:



• **CHANNEL 5:**

Frequency range 30 MHz - 1 GHz:

Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (MHz)	Emission Level (dB μ V/m)	Polarization	Detector
153.578000	28.16	V	Quasi-Peak
384.001500	29.37	V	Quasi-Peak
537.601000	34.46	H	Quasi-Peak
614.376500	34.54	V	Quasi-Peak
883.212000	41.23	V	Quasi-Peak

Frequency range 1 - 17 GHz:

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

Frequency range 17 - 26 GHz:

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

Frequency range 26 - 40 GHz:

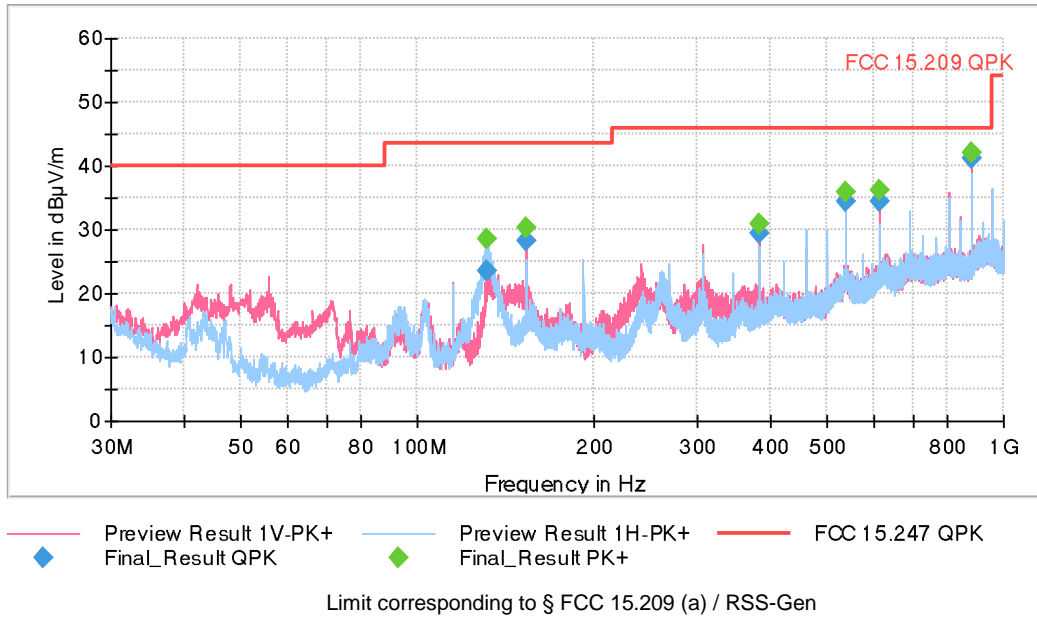
No spurious frequencies detected at less than 20 dB below the limit.

Measurement Uncertainty (dB): 1 GHz \leq f < 17 GHz: \leq 4.6
17 GHz \leq f < 26.5 GHz: \leq 4.89
26.5 GHz \leq f < 40 GHz: \leq 5.14

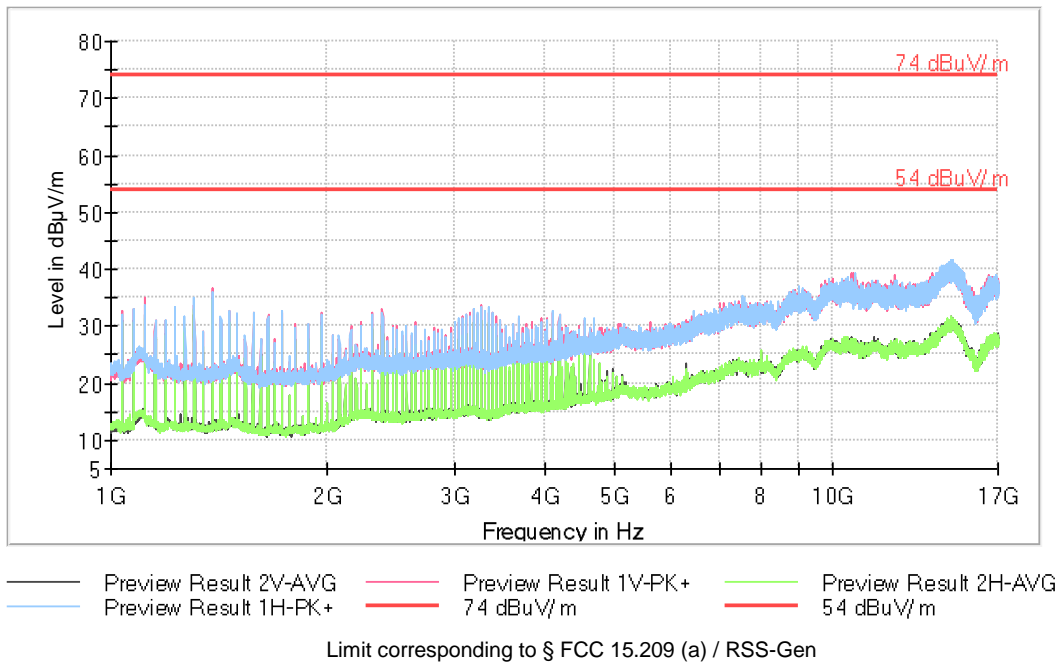
Verdict: PASS

• CHANNEL 5:

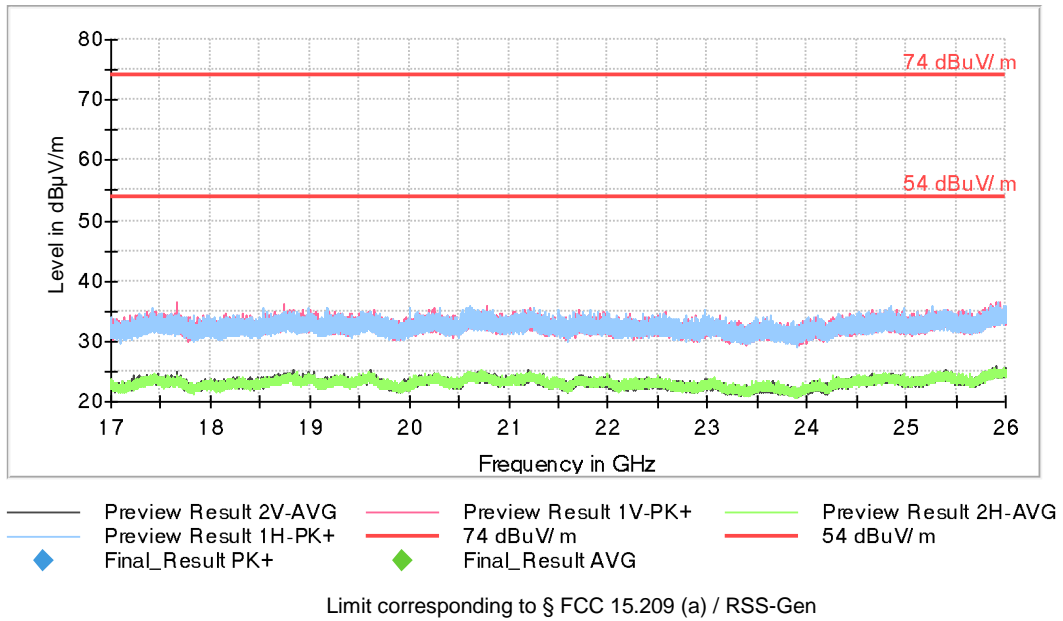
FREQUENCY RANGE 30 MHz - 1 GHz:



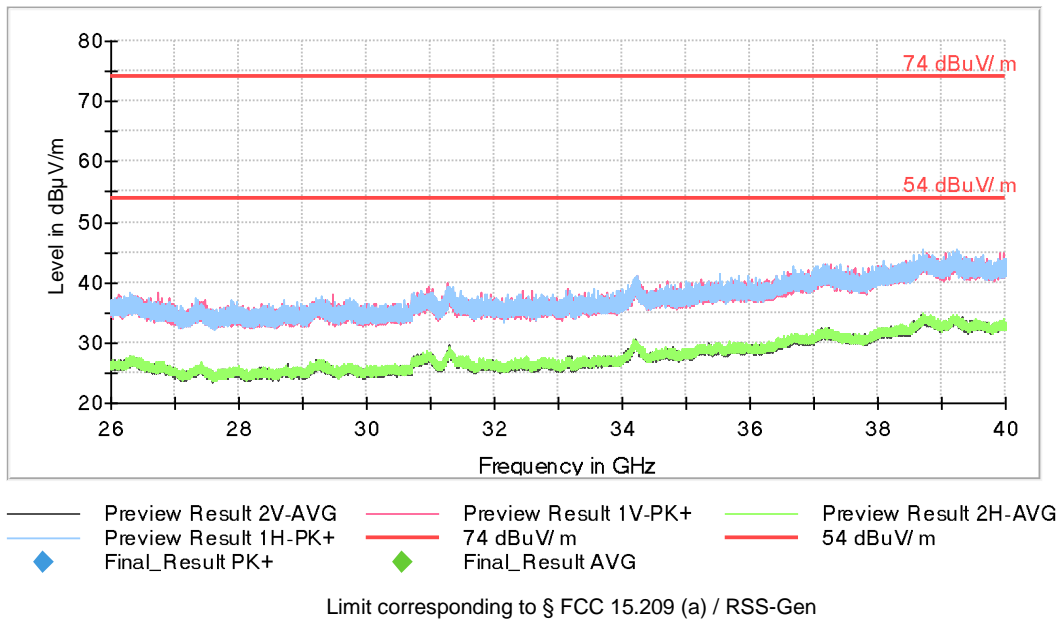
FREQUENCY RANGE 1 - 17 GHz:



FREQUENCY RANGE 17 - 26 GHz:



FREQUENCY RANGE 26 - 40 GHz:



FCC 15.519 (e) / RSS-220 5.3.1. (g) UWB Peak Level

SPECIFICATION:

* §15.519 (e): There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, fM. That limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described in § 15.521.

* RSS-220 5.3.1. (g): The peak level of the transmissions shall not exceed the peak equivalent of the average limit contained within any 50 MHz bandwidth, as defined in section 4 of the Annex.

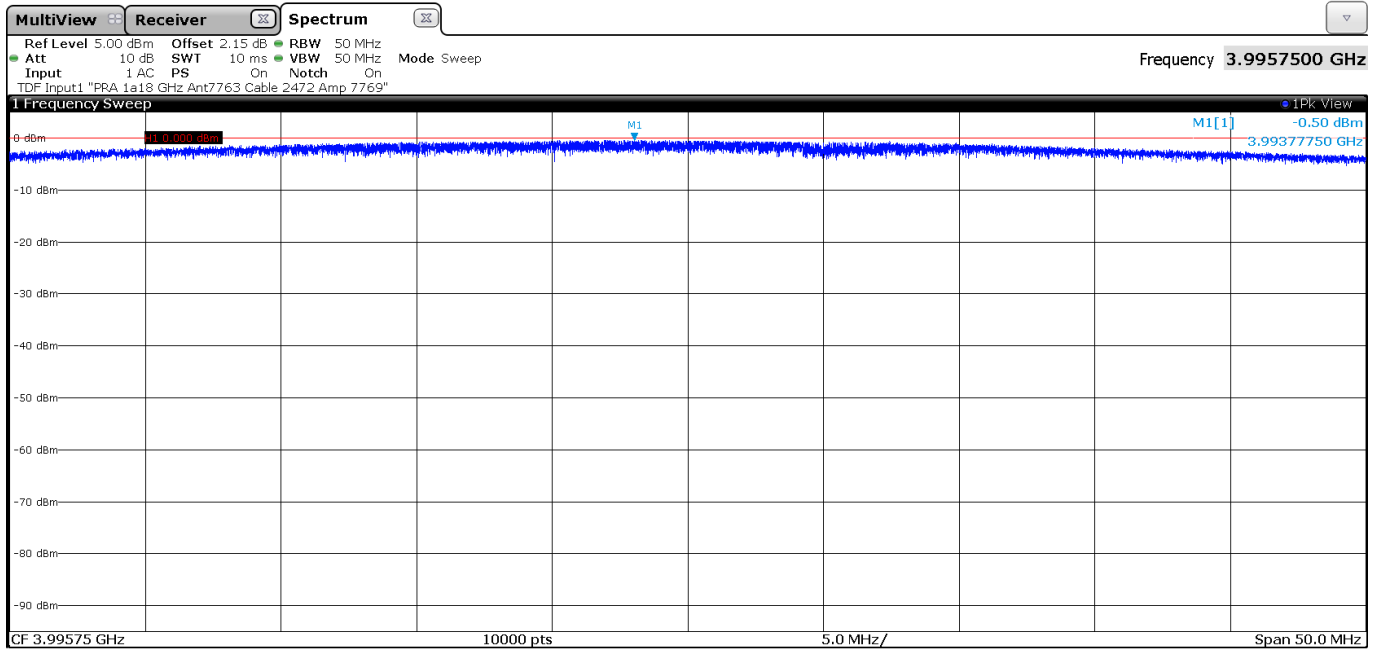
* Annex, Section 4 (c): Peak measurements shall be made in addition to average measurements. Transmissions shall not exceed 0 dBm e.i.r.p. in any 50 MHz bandwidth when the average limit is -41.3 dBm/MHz.

RESULTS:

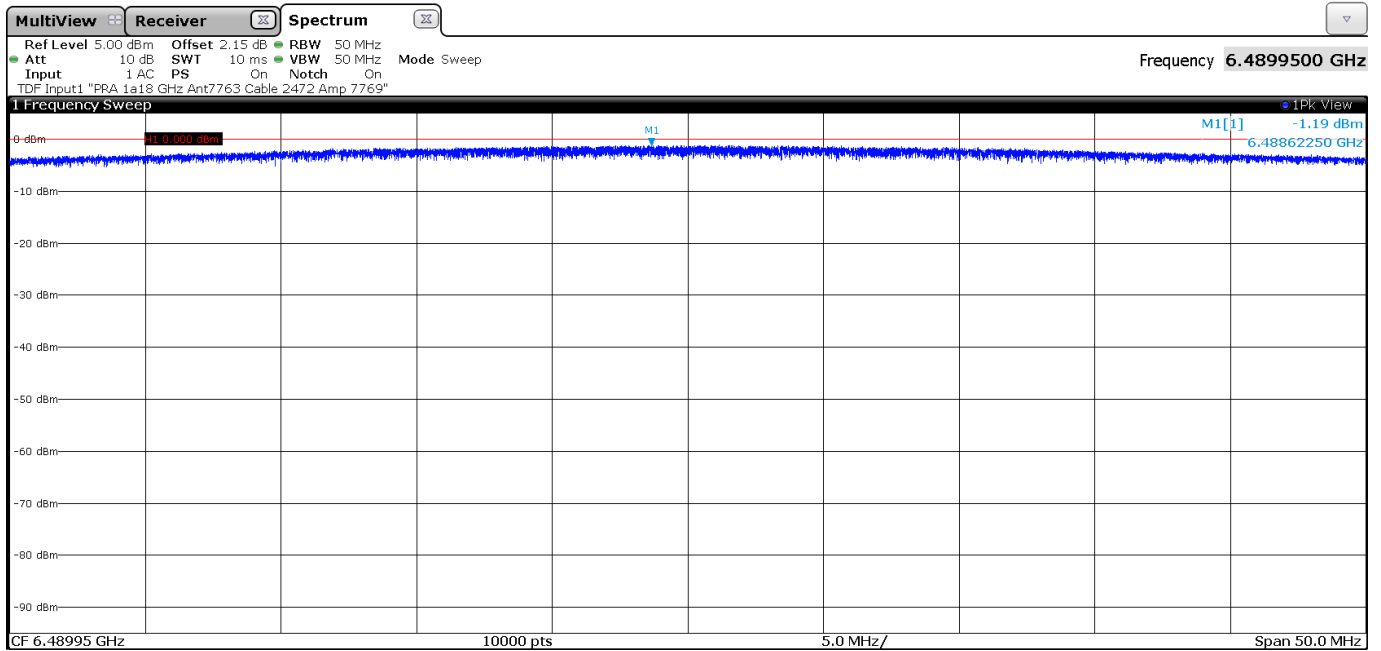
The resolution bandwidth employed was 50 MHz and according to §15.519 Subclause (e).

Channel	Frequency at which the highest radiated emission occurs (GHz)	EIRP Peak Level (dBm)
2	3.9957500	-0.50
5	6.4899500	-1.19

• CHANNEL 2 (FCC):



• CHANNEL 5 (FCC&CANADA):



Verdict: PASS