DEKRA Certification, Inc.
405 Glenn Dr. Suite 12,
Sterling, VA 20164
United States of America

FCC LISTED, REGISTRATION NUMBER: 2764.01

ISED LISTED REGISTRATION NUMBER: 23595-1

Test Report No:
4235ERM.003A1

Test Report

USA FCC Part 15.519, 15.521, 15.207, 15.209, 15.212, 1; & CANADA RSS-220, RSS-Gen

RF Measurement of Ultra-Wideband (UWB) devices operating within the band 3100 MHz and 10600 MHz

(*) Identification of item tested	VAS2
(*) Trademark	Vehicle Access System 2.0
(*) Model and /or type reference	Vehicle Access System 2.0
Other identification of the product	FCC ID: 2AW3A-2WWG23VAS IC: 26958-2WWG23VAS
(*) Features	UWB/BLE
Manufacturer	Rivian Automotive LLC. 14600 Myford Road Irvine, CA 92606, USA
Test method requested, standard	USA FCC Part 15.519 (2020): Technical requirements for hand held UWB systems. USA FCC Part 15.521 (2020): Technical requirements applicable to all UWB devices. USA FCC Part 15.209 (2021): Radiated emission limits; general requirements. USA FCC Part 15.207 (2020): Conducted emission limits. USA FCC Part 15.212 (2020): Modular transmitters. CANADA RSS-220 Issue 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)	Domingo Galvez EMC&RF Lab Manager Digitally signed by Domingo Galvez DN: cn=Domingo Galvez, o=Dekra Certification Inc., ou=Regulatory Lab Manager, email=domingo.galvez@dekra.com, c=US
Date of issue	03-04-2024
Report template No	FDT08_23 (*) "Data provided by the client"

Index

Acronyms

Acronym ID	Acronym Description
# of Tx Chains	Number of Transmission Chains
26Ebw	Emission Bandwidth
Avg COT	Average Channel Occupancy Time
BW	Bandwidth
Equipment	Equipment Type
Freq	Frequency
Freq Sep	Frequency Separation
Inband Peak Lvl	Inband Peak Level
Lvl	Level
MP	Measurement Point
Mod	Modulation
NHC	Number of Hopping Channels
NHp	Number of hops over the period
Occ Ch BW	Occupied Channel Bandwidth
Peak Power	Maximum Peak Conducted Output Power
Port	Active Port

Competences and guarantees

DEKRA Certification Inc. is a testing laboratory accredited by A2LA (The American Association for Laboratory Accreditation), to perform the tests indicated in the Certificate 2764.01

DEKRA Certification Inc. is a testing laboratory competent to carry out the tests described in this report.

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

DEKRA Certification Inc. 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 Certification at the time of performance of the test.

DEKRA Certification Inc. 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.

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 Certification Inc.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Certification Inc. and the Accreditation Bodies.

Uncertainty

Uncertainty (factor k=2) was calculated according to the DEKRA Certification internal document PODT000.

Test case	Frequency (MHz)	U (k=2)	Units
Radiated Spurious Emission	30-180	4.27	dB
	180-1000	3.14	dB
	1000-18000	3.30	dB
	18000-40000	3.49	dB

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample consists of a Vehicle Access System Sensor based of KW45 BLE and DW3300 UWB.

DEKRA declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: The client.

The sample(s) is composed of the following elements, accessories and auxiliary equipment:

Id	Control Number	Description	Manufacturer / Model	Serial Nº	Date of Reception	Application
S/01	4235/01	VAS2 Sample	Rivian Automotive / Vehicle Access System 2.0	000366	12-07-2023	Element Under Test
S/01	4250/05	PCAN-USB Adapter	Phytools / PEAK-System	031650	09-20-2023	Accessory
S/01	4250/06	Harness	Rivian Automotive	--	09-20-2023	Accessory
S/01	1482	Laptop	LENOVO / V14 G2 ITL	PF3QAFFH	--	Auxiliary Element

Notes referenced to samples during the project:

Id	Type	Note
S/01	Commercial	Sample S/01 was used for: All Radiated test(s) indicated in appendix A.

Test sample description

Test Sample description (compulsory information for EMC and RF testing services

Ports..... :	Port name and description		Cable					
			Specified max length [m]	Attached during test	Shielded	Coupled to patient(3)		
	RF (radiated)			[ ]	[ ]	[ ]		
	.....		.....	[ ]	[ ]	[ ]		
	.....		.....	[ ]	[ ]	[ ]		
	.....		.....	[ ]	[ ]	[ ]		
	.....		.....	[ ]	[ ]	[ ]		
	.....		.....	[ ]	[ ]	[ ]		
Supplementary information to the ports..... :	No Data provided.							
Rated power supply..... :	Voltage and Frequency		Reference poles					
			L1	L2	L3	N	PE	
	[ ]	AC:	[ ]	[ ]	[ ]	[ ]	[ ]	
	[ ]	AC:	[ ]	[ ]	[ ]	[ ]	[ ]	
	[X]	DC: 13.5 Nominal (9.8~16V)						
	[ ]	DC:						
Rated Power..... :	6W							
Clock frequencies ..... :	38.4 MHz, 32.768 kHz, 32MHz							
Other parameters..... :	No Data provided							
Software version ..... :	23.46.3							
Hardware version..... :	D							
Dimensions in (W x H x D)..... :	2 x 2 x0.5 inches							
Mounting position..... :	[ ]	Table top equipment						
	[ ]	Wall/Ceiling mounted equipment						
	[ ]	Floor standing equipment						
	[ ]	Hand-held equipment						
	[X]	Other: Vehicular						
Modules/parts ..... :	Module/parts of test item		Type	Manufacturer				
	N/A		.....	.....				
	.....		.....	.....				
	.....		.....	.....				
	.....		.....	.....				
Accessories (not part of the test item) ..... :	Description		Type	Manufacturer				
	N/A		.....	.....				
	.....		.....	.....				
	.....		.....	.....				
	.....		.....	.....				

Documents as provided by the applicant ..... :	Description	File name	Issue date
	Declaration Equipment Data	FDT30_18 Declaration Equipment Data filled DEC 12 2023	12/12/2023
	Operational Description	VAS2OPSDES	TBD
	Vehicle User Manual	UM	TBD
	Sch/Bom (Long Term Confidential)	SCH_BOM	TBD
	Label Sample	LS	TBD

(3) Only for Medical Equipment

Identification of the client

Rivian Automotive LLC.
14600 Myford Road
Irvine, CA 92606,
USA

Testing period and place

Test Location	DEKRA Certification Inc.
Date (start)	12-06-2023
Date (finish)	02-29-2024

Document history

Report number	Date	Description
4235ERM.003	02-02-2024	First release.
4235ERM.003A1	03-04-2024	Second release. Standard information was updated in cover page. Occupied bandwidth (or 99% emission bandwidth) and 10 dB Bandwidth test results are added to Appendix A of the test report. This modified report cancels and replaces the report 4235ERM.003.

Environmental conditions

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860mbar Max. = 1060mbar

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860mbar Max. = 1060mbar

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860mbar Max. = 1060mbar

Remarks and comments

- The tests have been performed by the technical personnel: Juliana Cherry, Yuqi Wang, Yuri Barone, Victor Albrecht, and Koji Nishimoto.

Testing verdicts

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

Summary

Appendix A: Ultra-Wideband Operation

FCC PART 15F PARAGRAPH / RSS-220			
Requirement	**Test case**	**Verdict**	**Remark**
RSS-GEN 6.7 – Occupied bandwidth (or 99% emission bandwidth)		P	N/A
RSS-GEN 8.8 / FCC 15.207 - Conducted Emission limits.		N/A	Refer 1
RSS GEN 8.9 RSS -220 5.3.1(d) / FCC 15.519 (c) - Radiated Emissions		P	N/A
RSS -220 5.3.1(e) / FCC 15.519 (d) - Radiated Emission in GPS band		P	N/A
RSS -220 5.3.1(b) / FCC 15.519 (a) - Transmitter On/Off Requirement		P	N/A
RSS -220 5.1(a) / FCC 15.519 (b) - 10 dB Bandwidth		P	N/A
RSS -220 5.3.1(g) / FCC 15.519 (e) / FCC 15.521 (g) - Peak level of Emission		P	N/A

Supplementary information and remarks:

1) According with the requirements of FCC Rules and Regulations, title 47, Chapter I, Subchapter A, Part 15, Subpart C, §15.207 (c), Conducted limits, Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation, and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provision for, the use of battery chargers which permit operating while charging, AC adaptors or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

List of equipment used during the test

Radiated Measurements

Control No.	Equipment	Model	Manufacturer	Next Calibration
1010	EMI Test Receiver	ESR7	Rhode & Schwarz	2024-10-14
1014	Signal Analyzer 40GHz	FSV40	Rhode & Schwarz	2024-08-01
1055	Double-Ridged Waveguide Horn Antenna (18-40GHz)	3116C	ETS Lindgren	2026-02-06
1057	Double-Ridged Waveguide Horn Antenna (750 MHz-18 GHz)	3115	ETS Lindgren	2026-07-18
1064	Biconilog Antenna	3142E	ETS Lindgren	2024-12-13
1108	Ethernet SNMP Thermometer-SAC1 Room	HWg-STE Plain	HW Group	2024-10-17
1111	Ethernet SNMP Thermometer-CR1 Room	HWg-STE Plain	HW Group	2024-10-18
1179	Semi-Anechoic Chamber	SAC 3plus 'L'	Frankonia	--
1217	Frankonia Transparent Test Table 1	FFT-Square	Frankonia	--
1314	Wireless Measurement Software R&S EMC32	--	Rhode & Schwarz	--

Appendix A: Ultra-Wideband Operation

Appendix A

PRODUCT INFORMATION

The following information is provided by the client

Information	Description
Modulation	BPSK
Operation mode:	
• Operating Frequency Range	Ch5 Freq = 6489.6 MHz, Ch9 Freq = 7987.2 MHz
• Nominal Channel Bandwidth	UWB: 499.2MHz
• RF output Power	- 41.3dBm/MHz EIRP
Antenna type	Integral PCB antenna
Antenna gain	Channel 5 = 4.32dBic Channel 9 = 4.81dBic
Nominal Voltage	
• Supply Voltage	13.5 Vdc
• Type of power source	DC voltage
Equipment type	UWB
Data Rates	6.8 mbit/s
	850 kbit/s

TEST CONDITIONS

(*): Data provided by the client.

TEST CONDITIONS	DESCRIPTION
TC/01	Power supply (V): $V_{nominal}$: 13.5 Vdc Temperature: $T_{nominal}$: +15 to +35 ºC Modulation: BPSK Test Frequencies for Conducted/Radiated tests: Ch5 Freq: 6489.6 MHz Ch9 Freq: 7987.2 MHz

TEST CASES DETAILS

RSS-GEN 6.7 – Occupied bandwidth (or 99% emission bandwidth)

Limits

No Limit has been set to this test case.

Data Rates	Channel	Freq (MHz)	BW (MHz)	Occ Ch BW (MHz)
6.8 mbits	Channel 5	6489.6	1	611.2
	Channel 9	7987.2	1	593.6
850 kbits	Channel 5	6489.6	1	645.0
	Channel 9	7987.2	1	615.0

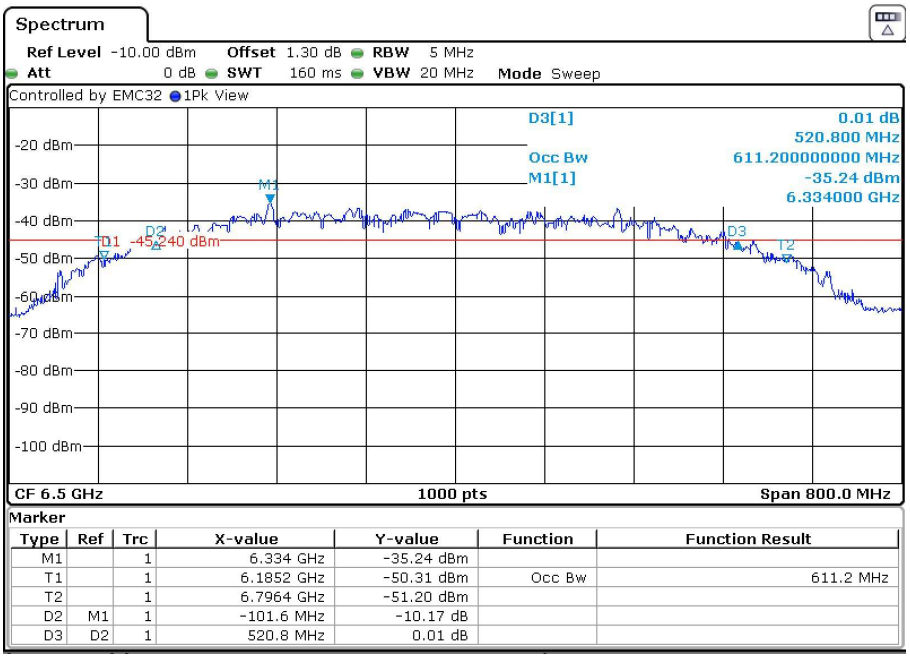
Verdict

Pass

Attachments

Channel 5:

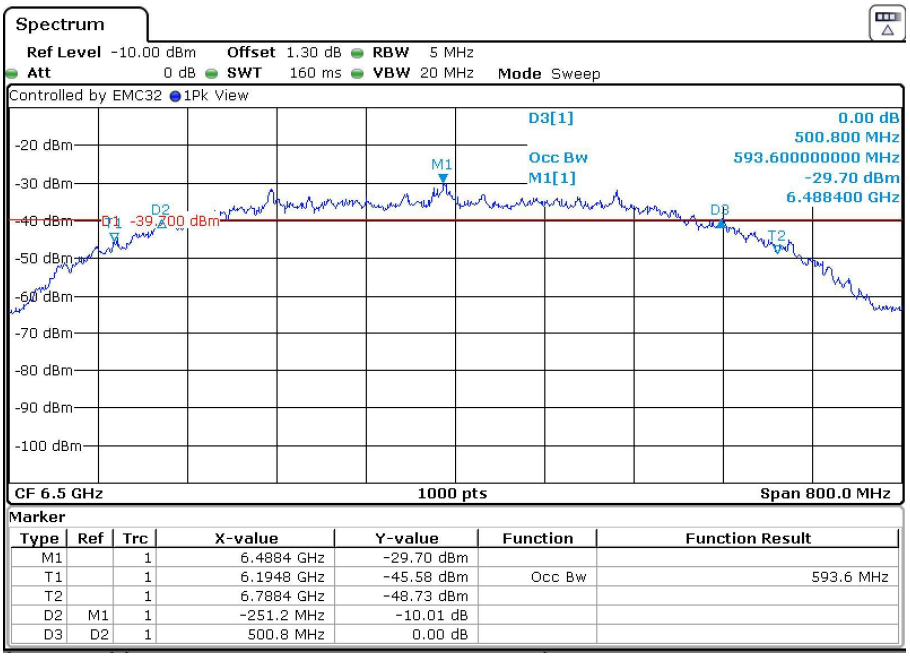
Data Rate: 6.8 Mbits



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	6.334 GHz	-35.24 dBm		
T1		1	6.1852 GHz	-50.31 dBm	Occ Bw	611.2 MHz
T2		1	6.7964 GHz	-51.20 dBm		
D2	M1	1	-101.6 MHz	-10.17 dB		
D3	D2	1	520.8 MHz	0.01 dB		

Data Rate: 850 Kbits

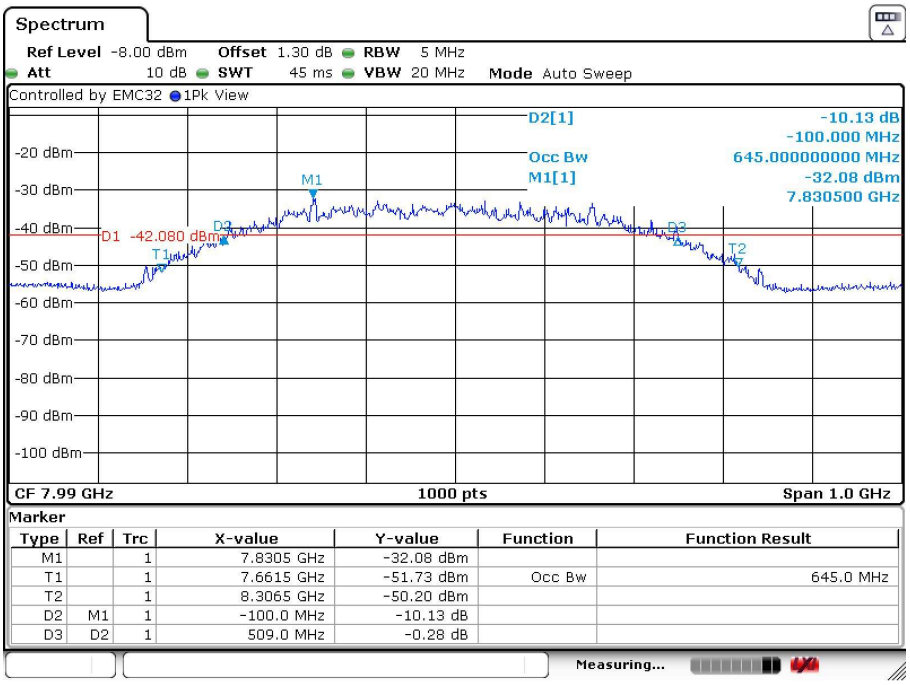


Marker

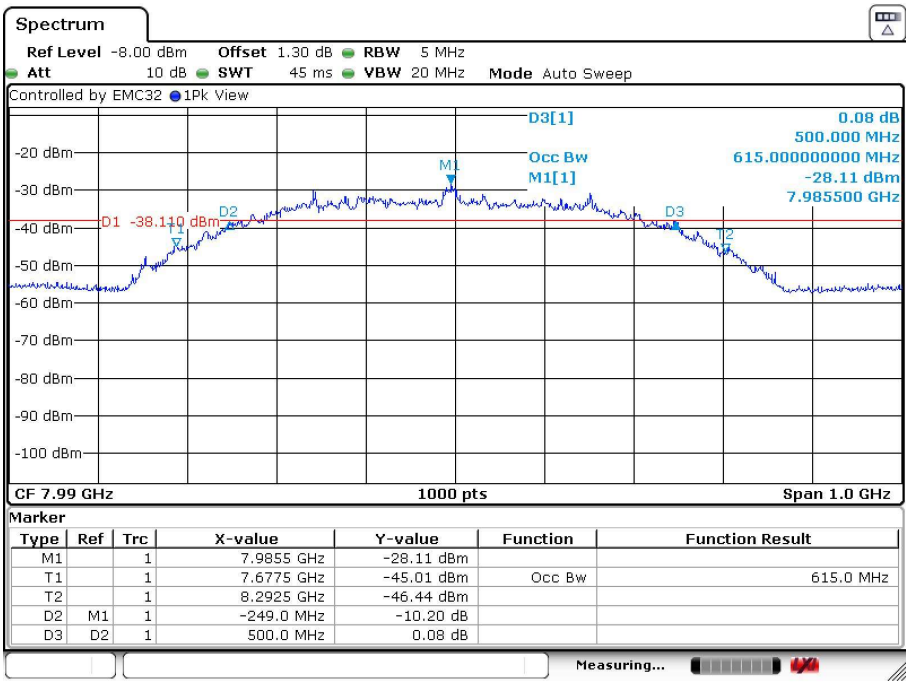
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	6.4884 GHz	-29.70 dBm		
T1		1	6.1948 GHz	-45.58 dBm	Occ Bw	593.6 MHz
T2		1	6.7884 GHz	-48.73 dBm		
D2	M1	1	-251.2 MHz	-10.01 dB		
D3	D2	1	500.8 MHz	0.00 dB		

Channel 9:

Data Rate: 6.8 Mbits



Data Rate: 850 Kbits



RSS GEN 8.9 RSS -220 5.3.1(d) / FCC 15.519 (c) - Radiated Emissions

Limits

FCC 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.

Fundamental frequency (MHz)	EIRP in dBm
960-1610	-75.3
1610-1990	-63.3
1990-3100	-61.3
3100-10600	-41.3
Above 10600	-61.3

FCC 15.209 (c): Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c) / RSS-Gen):

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

Note 1: The lower limit shall apply at the transition frequency.

Note 2: Distance refers to the distance in meters between the measuring instrument antenna and the close point of any part of the device or system.

Note 3: E field strength (dBμV/m) = 20 log E field strength (μV/m)

Note 4: E field strength (dBμV/m) = EIRP (dBm) + 95.2

RSS-GEN Clause 8.9 and RSS 220 Clause 5.3(c)(d)

Frequency (MHz)	Field Strength (Microvolts/m)	Distance(m)	E.i.r.p. (dBmW)
0.009-0.490	2,400/F (F in kHz)	300	10 log (17.28 / F^2) (F in kHz)
0.490-1.705	24,000/F (F in kHz)	30	10 log (17.28 / F^2) (F in kHz)
1.705-30.0	30	30	-45.7
30-88	100	3	-45.7
88-216	150	3	-51.7
216-960	200	3	-49.2

Radiated emissions at or below 960 MHz from a device shall not exceed the limits in section 3.4 (table above).

Radiated emissions above 960 MHz from a device shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Hand-held (Outdoor) Communication, Measurement, Location Sensing, and TrackingDevices	
Fundamental frequency (MHz)	**EIRP in a Resolution Bandwidth of 1 MHz (dBm)**
960-1610	-75.3
1610-4750	-70.0
4750-10600	-41.3
Above 10600	-61.3

Test Setup:

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at 3 m for the frequency range 30-1000 MHz (Bilog antenna) and 1-18 GHz Double ridge horn antennas, and 1m for the frequency range 18 GHz- 40 GHz Double ridge horn antenna.

For radiated emissions in the range 18 - 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 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

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

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

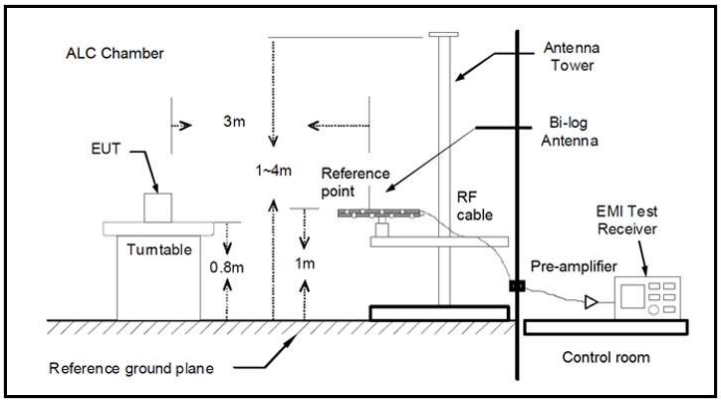


Fig A1: Radiated measurements Setup f < 1 GHz

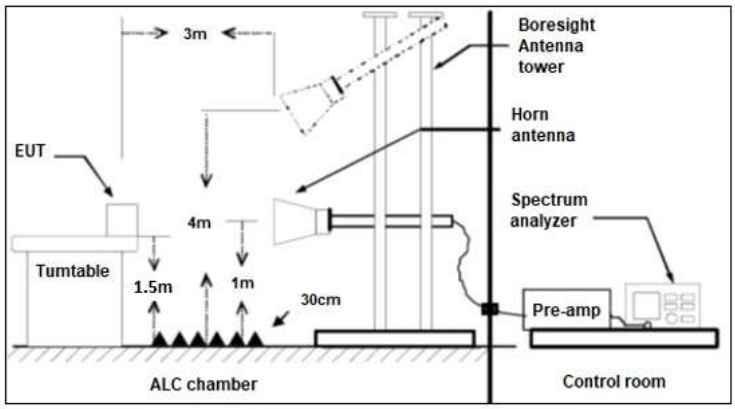


Fig A2: Radiated measurements setup f > 1-18 GHz

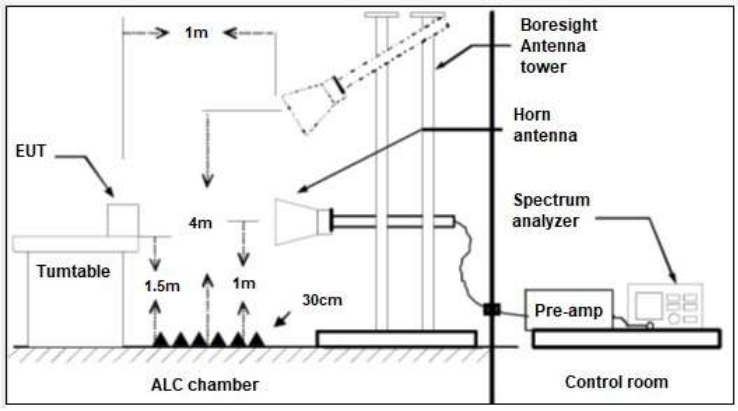


Fig A3: Radiated measurements setup f > 18 GHz

Verdict

Pass

Modulation: UWB (BPSK)

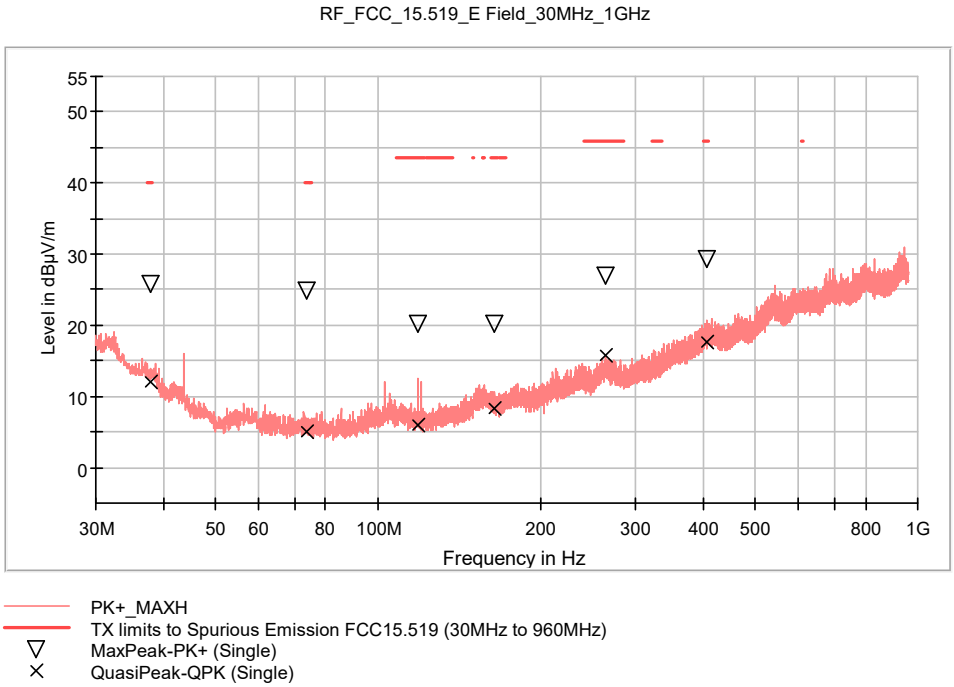
Results

Frequency range 0.03 - 1 GHz
The spurious emissions below 1 GHz do not depend on the operating channel selected in the EUT.

Channel 5

Frequency MHz = Ch5, Data Rate = 850 kbit/s, Modulation = UWB (BPSK), Frequency Range GHz = [0.03, 1]

Images:



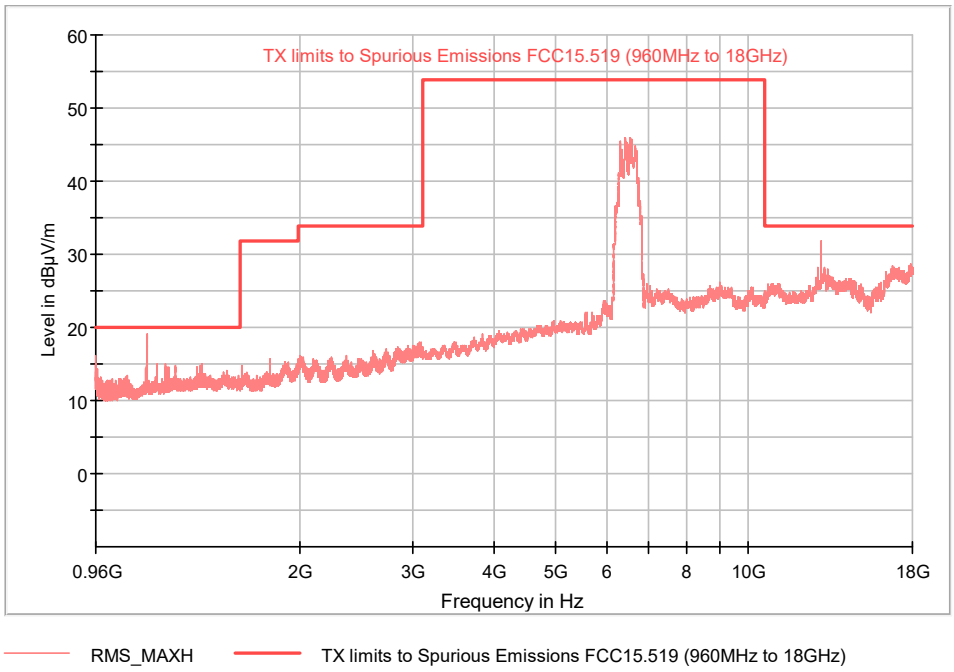
Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Pol	Margin - QPK (dB)	Limit - QPK (dBµV/m)
37.905000	25.9	11.9	V	28.1	40.0
73.896000	25.0	5.0	V	35.0	40.0
118.815000	20.1	5.9	V	37.6	43.5
164.803500	20.2	8.3	H	35.3	43.5
263.290500	26.9	15.9	H	30.1	46.0
407.394000	29.4	17.7	V	28.3	46.0

Frequency range 0.96 - 18 GHz

Channel 5

Frequency MHz = Ch5, Data Rate = 6.8 Mbits/s, Modulation = UWB (BPSK), Frequency Range GHz = [0.96, 18]

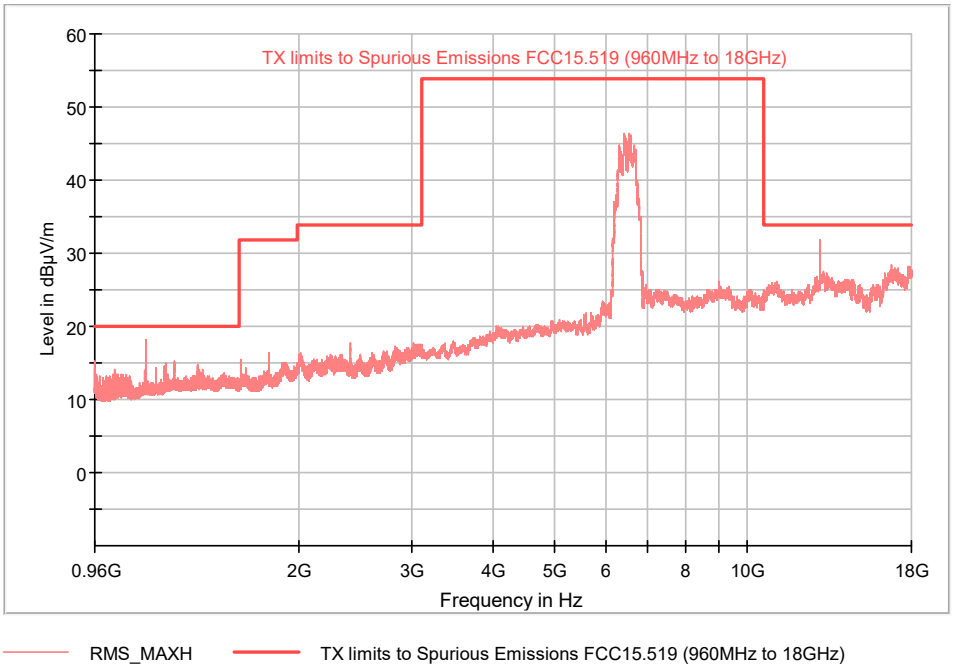
Images:



Frequency (MHz)	RMS_MAXH (dBµV/m)	Pol	Margin - RMS (dB)	Limit - RMS (dBµV/m)	Comment
1151.864375	19.1	V	0.7	19.9	
6547.656250	45.9	H	8.0	53.9	Fundamental
12979.100000	31.9	V	2.0	33.9	2nd Harmonic

Frequency MHz = Ch5, Data Rate = 850 kbits/s, Modulation = UWB (BPSK), Frequency Range GHz = [0.96, 18]

Images:

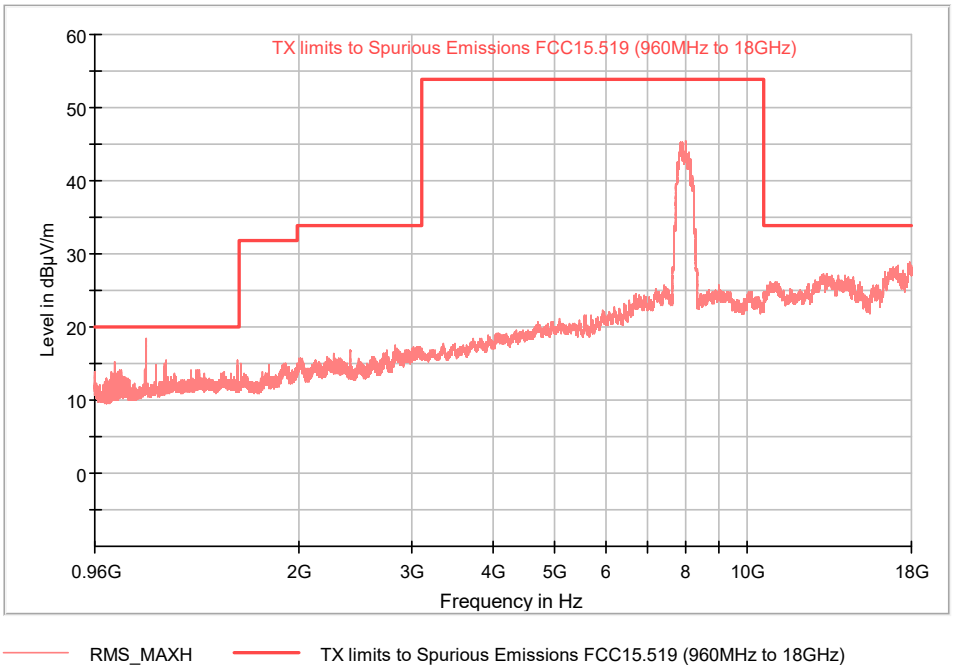


Frequency (MHz)	RMS_MAXH (dBµV/m)	Pol	Margin - RMS (dB)	Limit - RMS (dBµV/m)	Comment
1152.131875	18.2	H	1.7	19.9	
6431.406250	46.3	H	7.6	53.9	Fundamental
12979.100000	31.9	V	2.0	33.9	2nd Harmonic

Channel 9

Frequency MHz = Ch9, Data Rate = 6.8 Mbits/s, Modulation = UWB (BPSK), Frequency Range GHz = [0.96, 18]

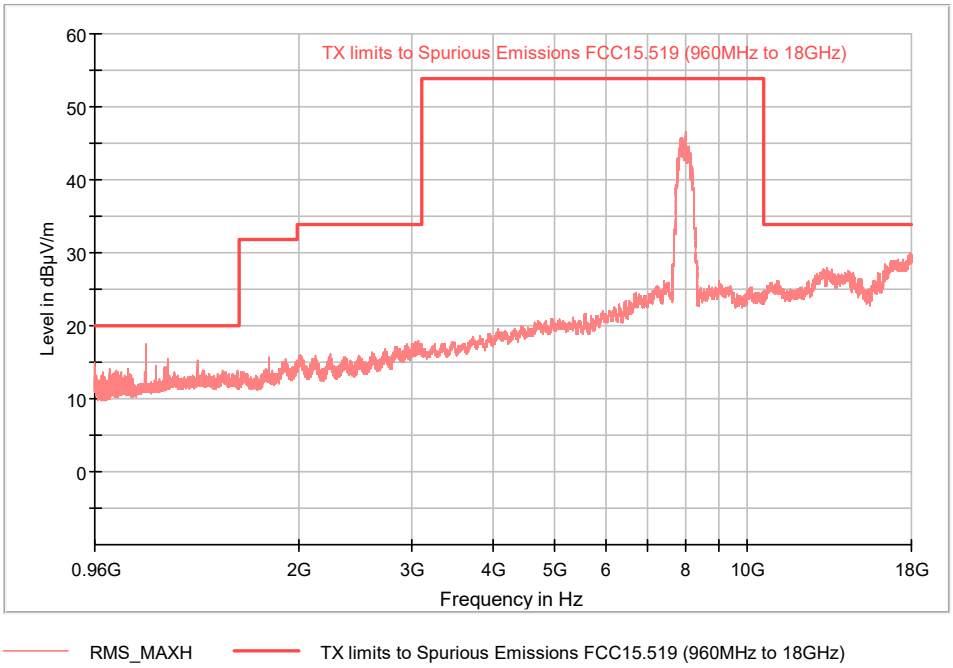
Images:



Frequency (MHz)	RMS_MAXH (dBµV/m)	Pol	Margin - RMS (dB)	Limit - RMS (dBµV/m)	Comment
1151.864375	18.5	H	1.4	19.9	
7987.187500	45.5	V	8.4	53.9	Fundamental
13303.775000	27.3	V	6.6	33.9	2nd Harmonic

Frequency MHz = Ch9, Data Rate = 850 kbits/s, Modulation = UWB (BPSK), Frequency Range GHz = [0.96, 18]

Images:



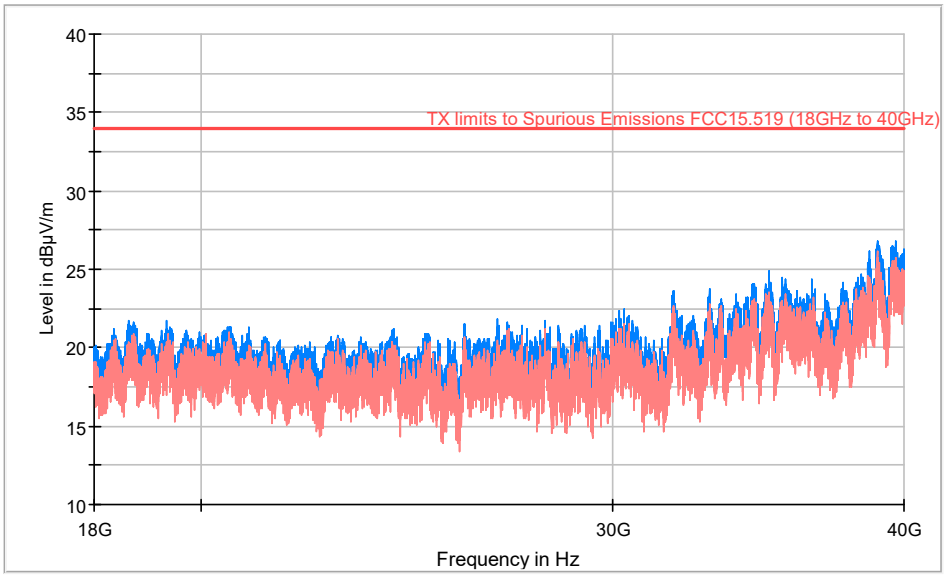
Frequency (MHz)	RMS_MAXH (dBµV/m)	Pol	Margin - RMS (dB)	Limit - RMS (dBµV/m)	Comment
1151.931250	17.4	V	2.5	19.9	
7988.125000	46.5	V	7.4	53.9	Fundamental
16257.300000	27.3	V	6.6	33.9	2nd Harmonic

Frequency range 18 - 40 GHz

Channel 5

Frequency MHz = Ch5, Data Rate = 6.8 Mbits/s, Modulation = UWB (BPSK), Frequency Range GHz = [18, 40]

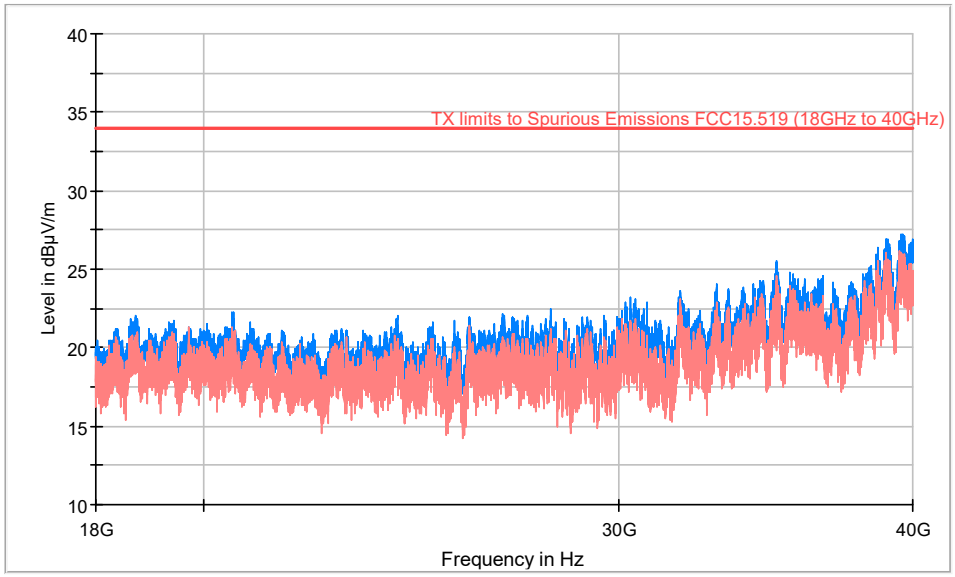
Images:



Frequency (MHz)	RMS_MAXH (dBµV/m)	Pol	Margin - RMS (dB)	Limit - RMS (dBµV/m)
19322.750000	21.7	V	12.2	33.9
31863.437500	23.6	H	10.3	33.9
38990.062500	26.8	V	7.1	33.9

Frequency MHz = Ch5, Data Rate = 850 kbits/s, Modulation = UWB (BPSK), Frequency Range GHz = [18, 40]

Images:



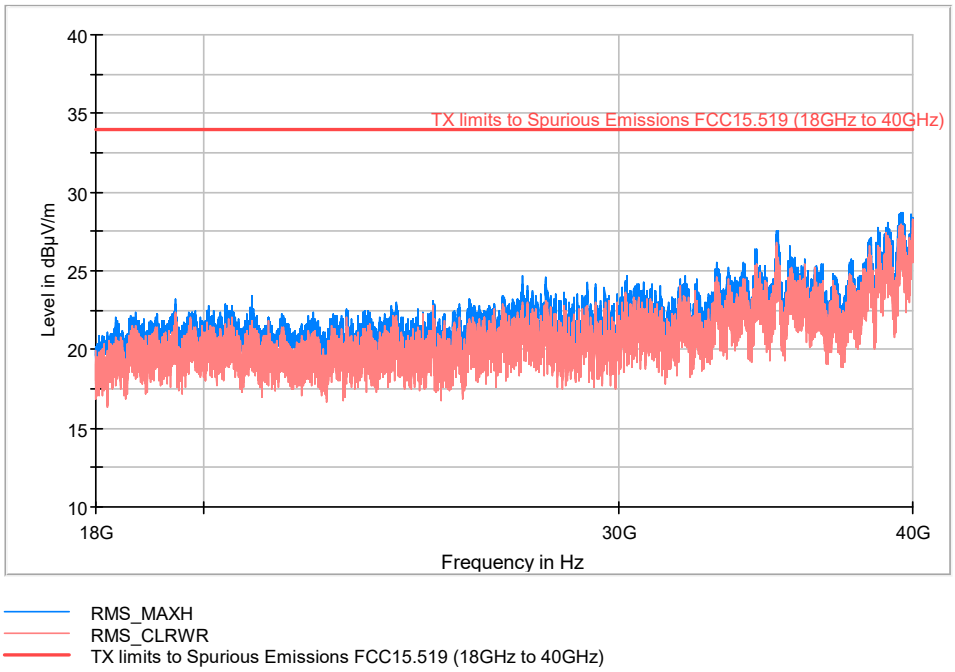
RMS_MAXH
RMS_CLRWR
TX limits to Spurious Emissions FCC15.519 (18GHz to 40GHz)

Frequency (MHz)	RMS_MAXH (dBµV/m)	Pol	Margin - RMS (dB)	Limit - RMS (dBµV/m)
20576.750000	22.2	V	11.2	33.9
31873.062500	23.6	H	10.3	33.9
39531.125000	27.2	V	6.7	33.9

Channel 9

Frequency MHz = Ch9, Data Rate = 6.8 Mbits/s, Modulation = UWB (BPSK), Frequency Range GHz = [18, 40]

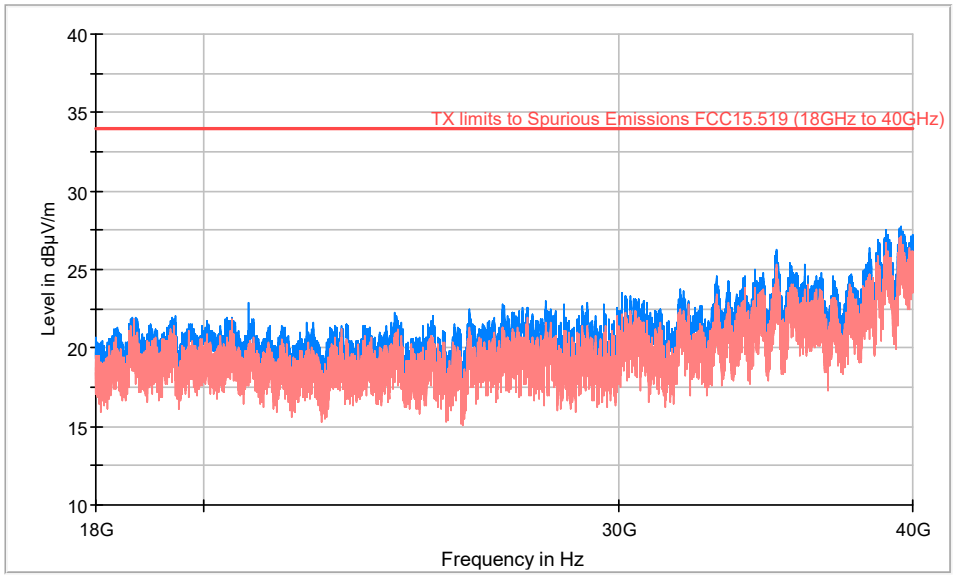
Images:



Frequency (MHz)	RMS_MAXH (dBµV/m)	Pol	Margin - RMS (dB)	Limit - RMS (dBµV/m)
20961.750000	23.4	V	10.5	33.9
30235.437500	24.7	V	9.2	33.9
39599.187500	28.7	H	5.2	33.9

Frequency MHz = Ch9, Data Rate = 850 kbits/s, Modulation = UWB (BPSK), Frequency Range GHz = [18, 40]

Images:



RMS_MAXH
RMS_CLRWR
TX limits to Spurious Emissions FCC15.519 (18GHz to 40GHz)

Frequency (MHz)	RMS_MAXH (dBµV/m)	Pol	Margin - RMS (dB)	Limit - RMS (dBµV/m)
20911.562500	22.9	V	11.0	33.9
31871.000000	23.7	V	10.2	33.9
39529.750000	27.7	H	6.2	33.9

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time
30 MHz - 960 MHz	46.5 kHz	PK+	100 kHz	1 s
960 MHz - 1 GHz	2 kHz	PK+	100 kHz	1 s

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time
960 MHz - 3.1 GHz	66.875 kHz	RMS	1 MHz	0.7 s
3.1 GHz - 10.6 GHz	468.75 kHz	RMS	1 MHz	0.7 s
10.6 GHz - 18 GHz	462.5 kHz	RMS	1 MHz	0.7 s

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time
18 GHz - 40 GHz	500.0 kHz	RMS	1 MHz	1 s

RSS -220 5.3.1(e) / FCC 15.519 (d) - Radiated Emission in GPS band

Limits

FCC 15.519 (d): In addition to the radiated emission limits specified in the table in paragraph (c) of this section, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

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

Test Setup:

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at 1 m for the frequency range 960 MHz -18 GHz (1-18 GHz Double ridge horn antenna).

For radiated emissions in the range 960 MHz - 18 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 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

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

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

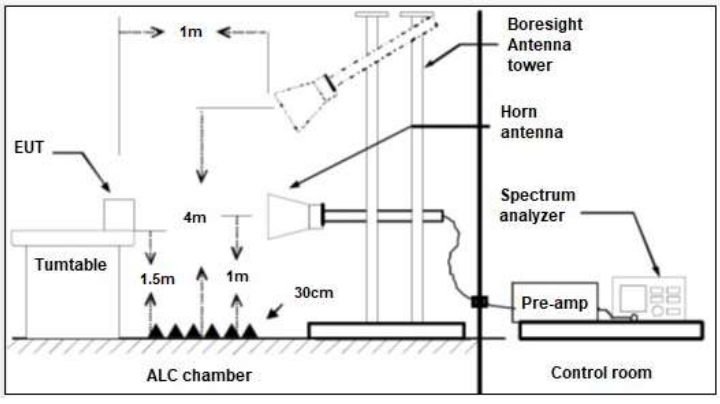


Fig A4: Radiated measurements setup f > 960 MHz

The following tables and plots show the results for the worst case

Verdict

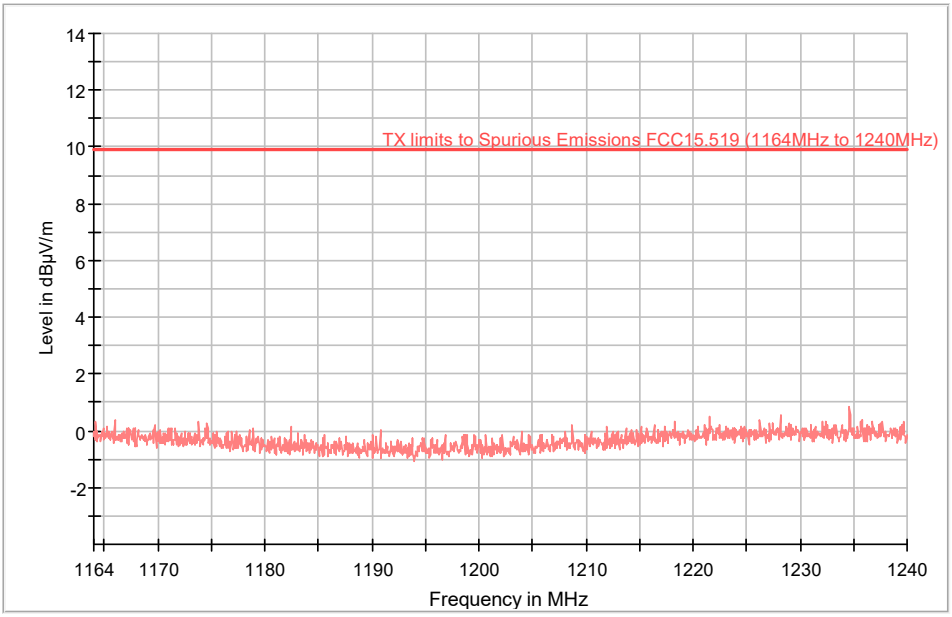
Pass

Channel 5

Frequency MHz = Ch5, Data Rate = 6.8 Mbits/s, Modulation = UWB (BPSK), Frequency Range GHz = [0.96, 18]

1164 MHz – 1240 MHz

Images:

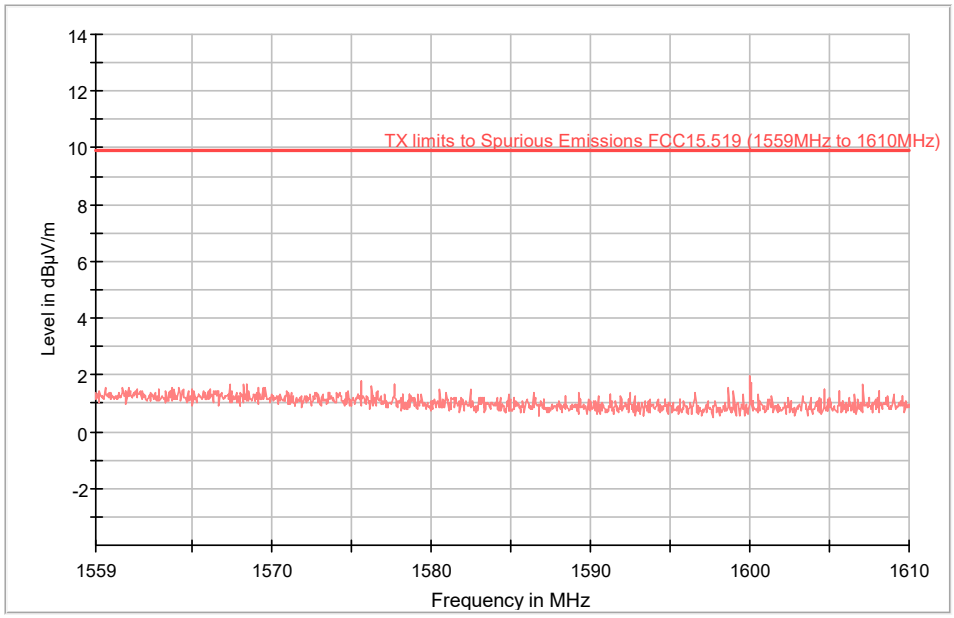


Frequency (MHz)	RMS_MAXH (dBµV/m)	Pol	Margin - RMS (dB)	Limit - RMS (dBµV/m)
1234.632500	0.8	V	9.1	9.9

Frequency MHz = Ch5, Data Rate = 6.8 Mbits/s, Modulation = UWB (BPSK), Frequency Range GHz = [0.96, 18]

1559 MHz –1610 MHz

Images:



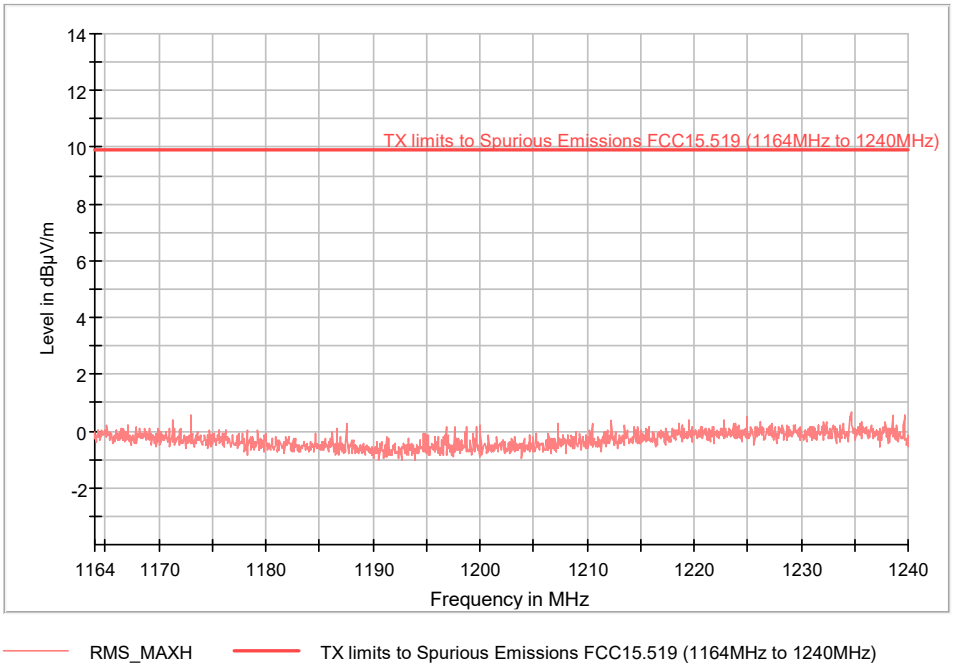
Frequency (MHz)	RMS_MAXH (dBµV/m)	Pol	Margin - RMS (dB)	Limit - RMS (dBµV/m)
1600.012500	2.0	V	7.9	9.9

Channel 9

Frequency MHz = Ch5, Data Rate = 6.8 Mbits/s, Modulation = UWB (BPSK), Frequency Range GHz = [0.96, 18]

1164 MHz – 1240 MHz

Images:

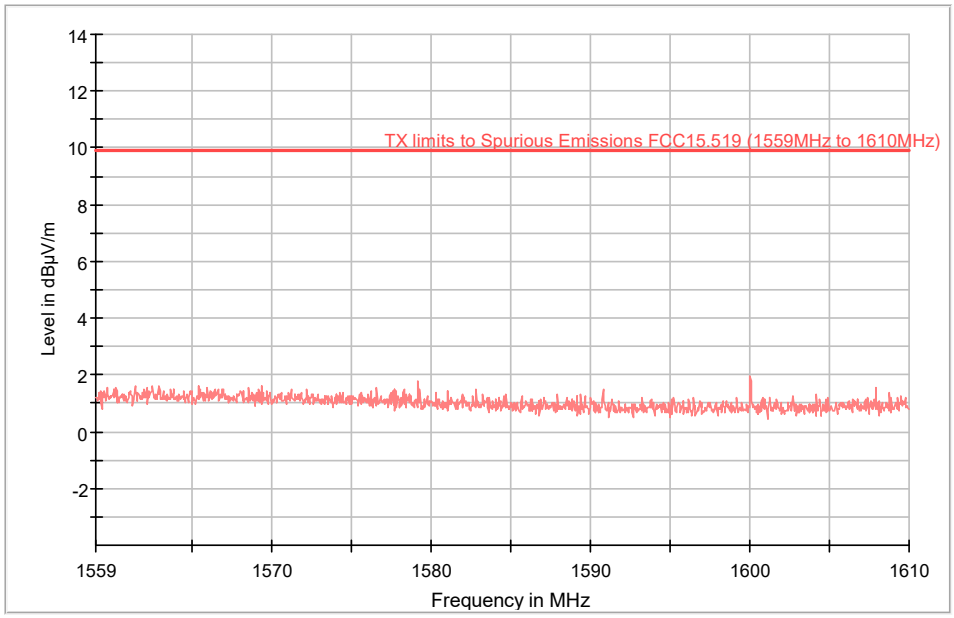


Frequency (MHz)	RMS_MAXH (dBµV/m)	Pol	Margin - RMS (dB)	Limit - RMS (dBµV/m)
1234.680000	0.6	V	9.3	9.9

Frequency MHz = Ch5, Data Rate = 6.8 Mbits/s, Modulation = UWB (BPSK), Frequency Range GHz = [0.96, 18]

1559 MHz –1610 MHz

Images:



Frequency (MHz)	RMS_MAXH (dBµV/m)	Pol	Margin - RMS (dB)	Limit - RMS (dBµV/m)
1600.055000	1.9	V	8.0	9.9

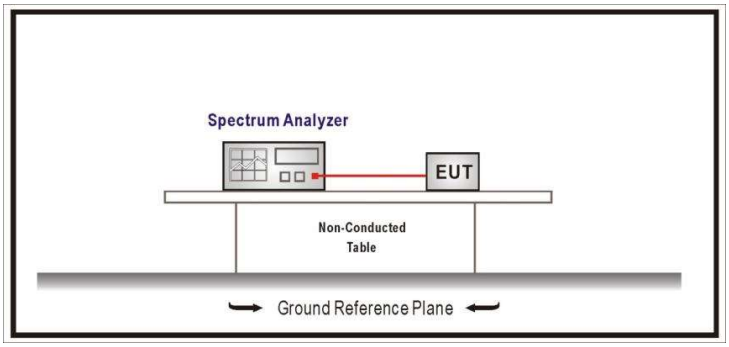
RSS -220 5.3.1(b) / FCC 15.519 (a) - Transmitter On/Off Requirement

Limits

FCC 15.519 (a): 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.

Frequency (MHz)	Measurement result (sec):	Limit (sec)	Test Result
6489.6	0.17	10	P
7987.2	0.23	10	P

Test Setup:



Verdict

Pass

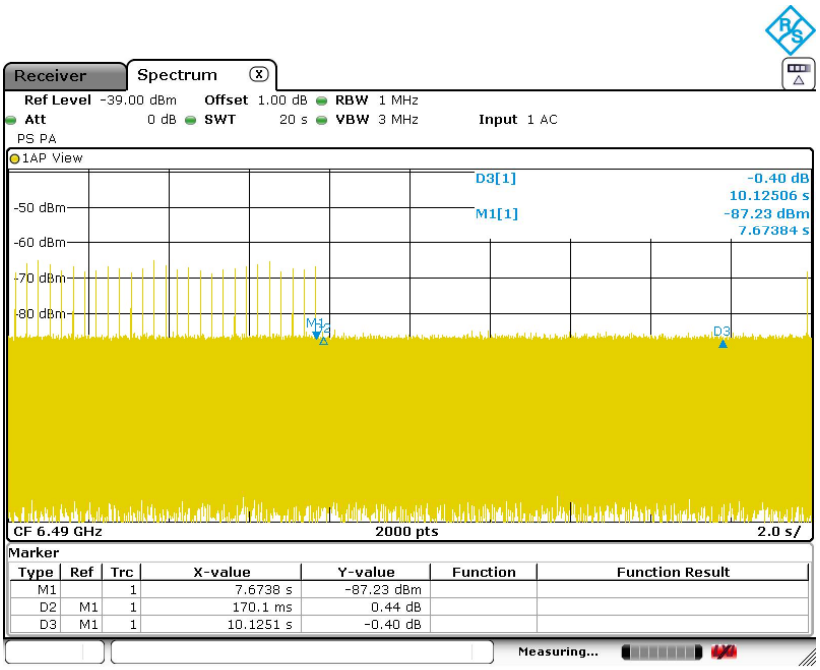
Marker M1: Associated receiver stopped transmission to send acknowledgement.

Marker D2: Transmitter device stopped transmission

Attachments

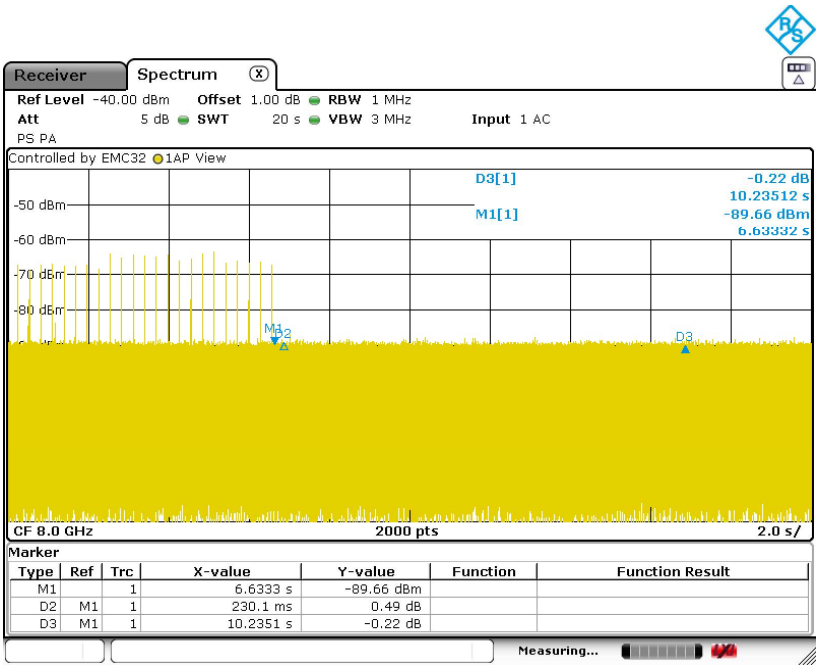
Channel 5

Images:



Channel 9

Images:



RSS -220 5.1(a) / FCC 15.519 (b) - 10 dB Bandwidth

Limits

FCC 15.519 (b): The UWB bandwidth of a device operating under the provisions of this section must be contained between 3100 MHz and 10,600 MHz.

FCC 15.503 (d): 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.

Data Rate: 6.8 Mbits

Frequency (MHz)	Lower Frequency (MHz)	Upper Frequency (MHz)	10 dB Bandwidth (MHz)	Limit (MHz)		Result
				Lower Frequency	Upper Frequency	
6334.0	6232.4	6753.2	520.8	3100	10600	P
7830.5	7730.5	8239.5	509.0	3100	10600	P

Data Rate: 850 Kbits

Frequency (MHz)	Lower Frequency (MHz)	Upper Frequency (MHz)	10 dB Bandwidth (MHz)	Limit (MHz)		Result
				Lower Frequency	Upper Frequency	
6488.4	6237.2	6738.0	500.8	3100	10600	P
7985.5	7736.5	8236.5	500.0	3100	10600	P

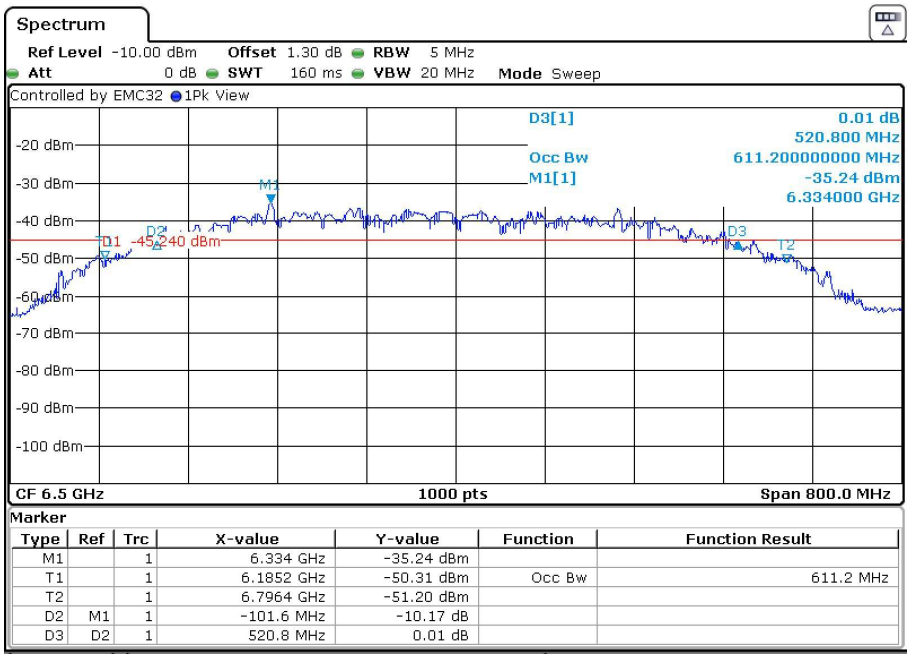
Verdict

Pass

Attachments
Data Rate: 6.8 Mbits

Channel 5:

Images:

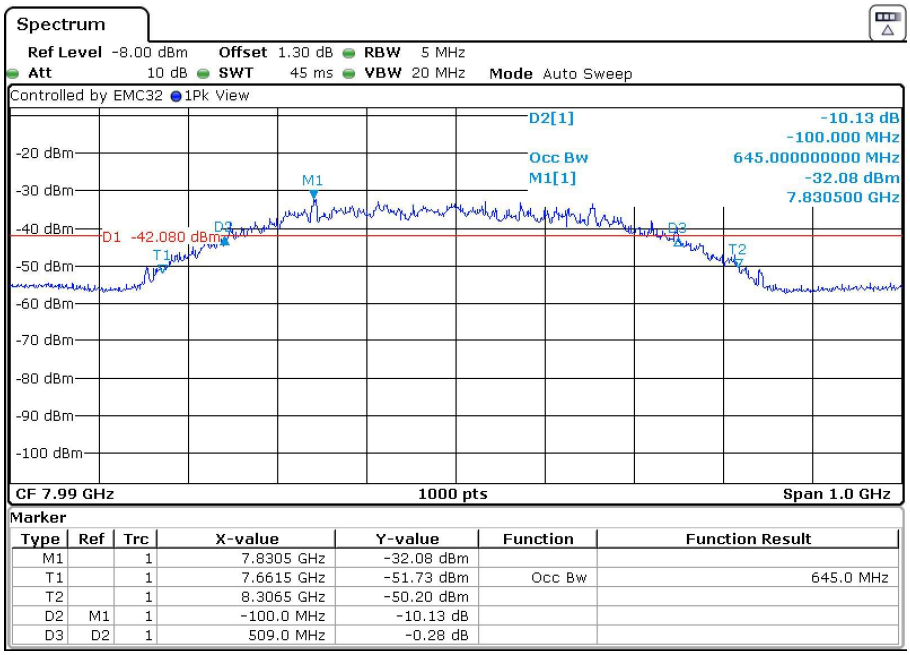


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	6.334 GHz	-35.24 dBm		
T1		1	6.1852 GHz	-50.31 dBm	Occ Bw	611.2 MHz
T2		1	6.7964 GHz	-51.20 dBm		
D2	M1	1	-101.6 MHz	-10.17 dB		
D3	D2	1	520.8 MHz	0.01 dB		

Channel 9:

Images:



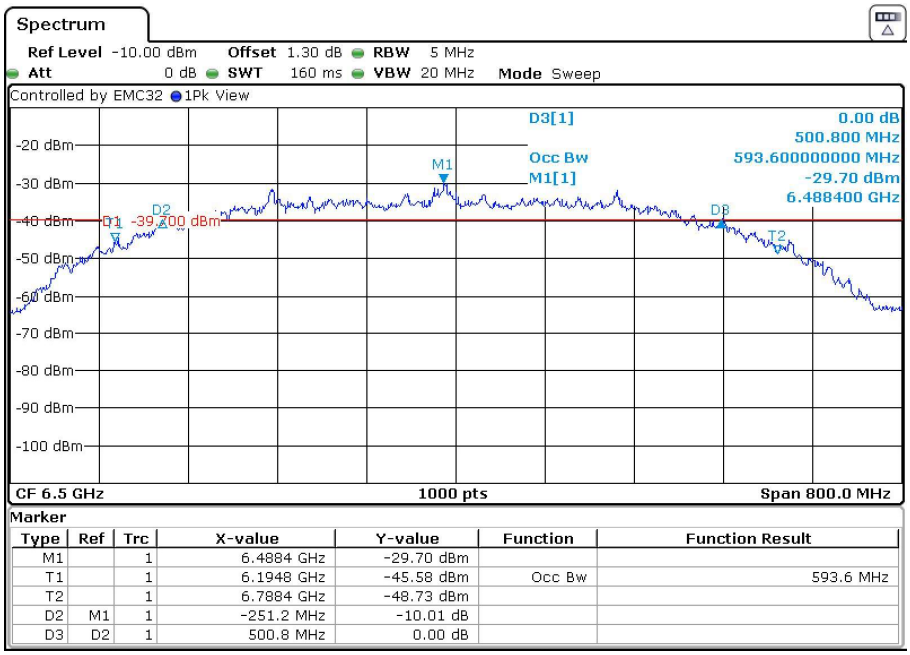
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	7.8305 GHz	-32.08 dBm		
T1		1	7.6615 GHz	-51.73 dBm	Occ Bw	645.0 MHz
T2		1	8.3065 GHz	-50.20 dBm		
D2	M1	1	-100.0 MHz	-10.13 dB		
D3	D2	1	509.0 MHz	-0.28 dB		

Data Rate: 850 Kbits

Channel 5:

Images:

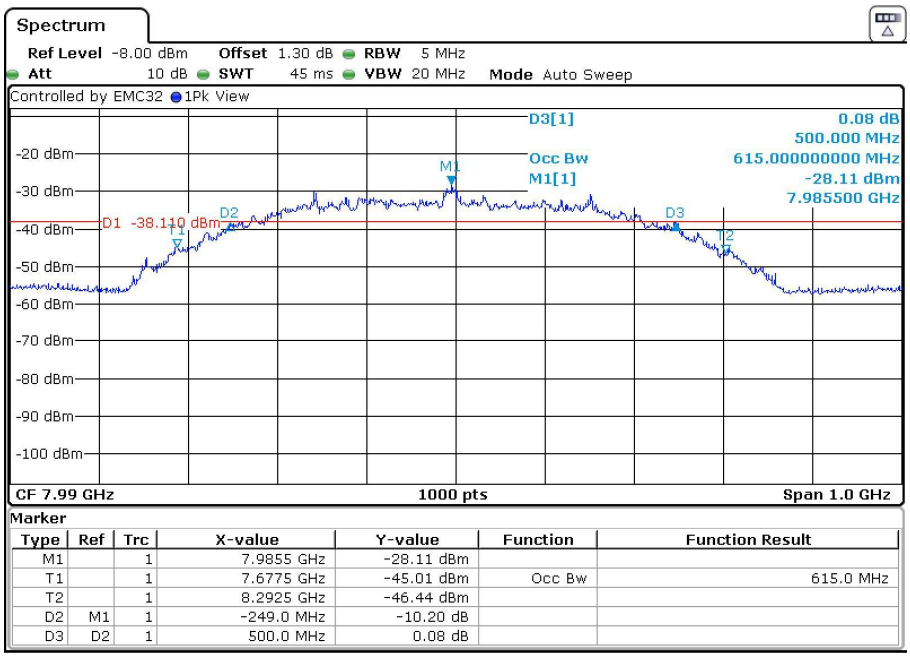


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	6.4884 GHz	-29.70 dBm		
T1		1	6.1948 GHz	-45.58 dBm	Occ Bw	593.6 MHz
T2		1	6.7884 GHz	-48.73 dBm		
D2	M1	1	-251.2 MHz	-10.01 dB		
D3	D2	1	500.8 MHz	0.00 dB		

Channel 9:

Images:



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	7.9855 GHz	-28.11 dBm		
T1		1	7.6775 GHz	-45.01 dBm	Occ Bw	615.0 MHz
T2		1	8.2925 GHz	-46.44 dBm		
D2	M1	1	-249.0 MHz	-10.20 dB		
D3	D2	1	500.0 MHz	0.08 dB		

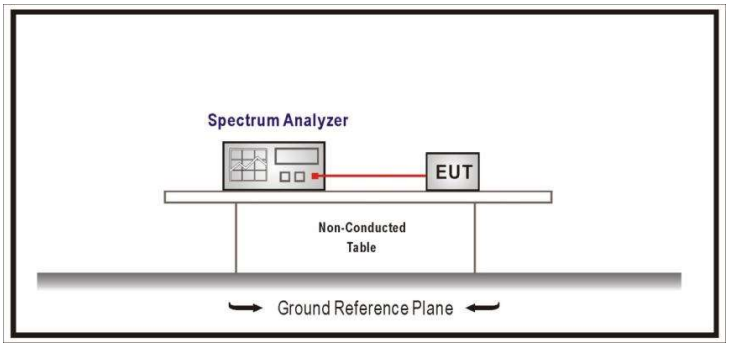
RSS -220 5.3.1(g) / FCC 15.519 (e) / FCC 15.521 (g) - Peak level of Emission

Limits

FCC 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.

FCC 15.521 (g): When a peak measurement is required, it is acceptable to use a resolution bandwidth other than the 50 MHz specified in this subpart. This resolution bandwidth shall not be lower than 1 MHz or greater than 50 MHz, and the measurement shall be centered on the frequency at which the highest radiated emission occurs, fM. If a resolution bandwidth other than 50 MHz is employed, the peak EIRP limit shall be 20 log (RBW/50) dBm where RBW is the resolution bandwidth in megahertz that is employed. This may be converted to a peak field strength level at 3 meters using E (dBµV/m) = P (dBm EIRP) + 95.2.

Test Setup:



Note: The RBW = 10 MHz, so the RBW correction is 20 log (10/50) = -14.0 dB.

Limit in dBµV/m @RBW 10 MHz = 0 + 95.2 -14.0 = 81.2 dBµV/m - This value is shown in the plot below.

Plot shows below represents worst case of the DUT Orientation

Verdict

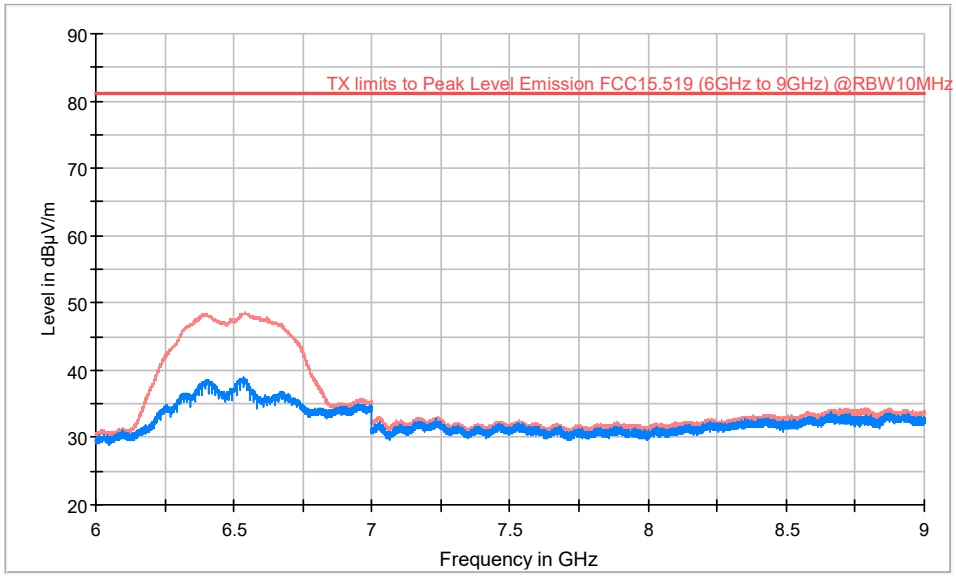
Pass

Attachments

Channel 5

Data Rate = 6.8 Mbits/s

Images:

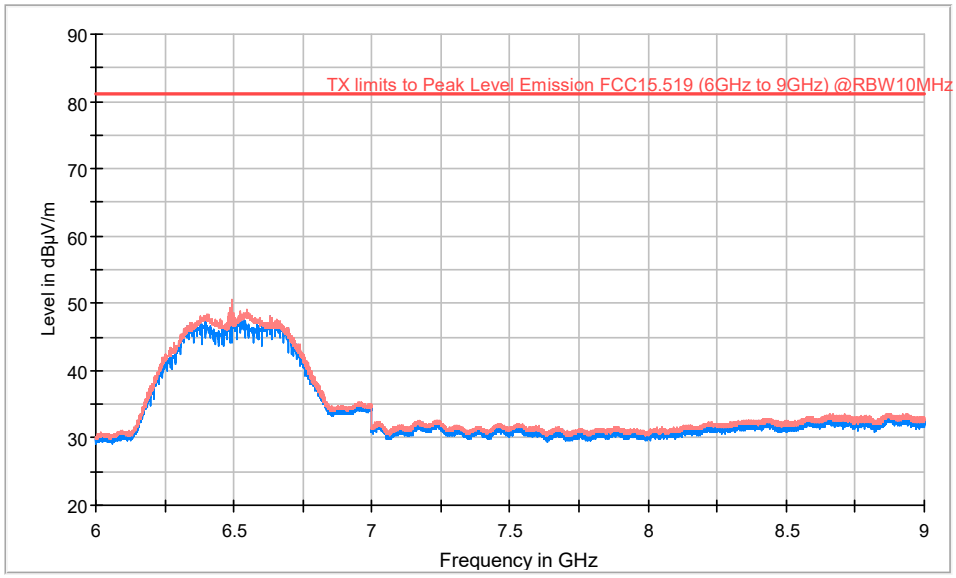


RMS_MAXH
RMS_CLRWR@RE0101_R6-9GHz_TX UWB CH5 DataRate_SP3
TX limits to Peak Level Emission FCC15.519 (6GHz to 9GHz) @RBW10MHz

Frequency (MHz)	RMS_CLRWR (dBµV/m)	RMS_MAXH (dBµV/m)	Pol	Margin - RMS (dB)	Limit - RMS (dBµV/m)	Comment
6539.250000	38.2	48.4	V	43.0	81.2	Fundamental
8651.718750	32.9	34.0	V	48.4	81.2	

Data Rate = 850 kbits/s

Images:



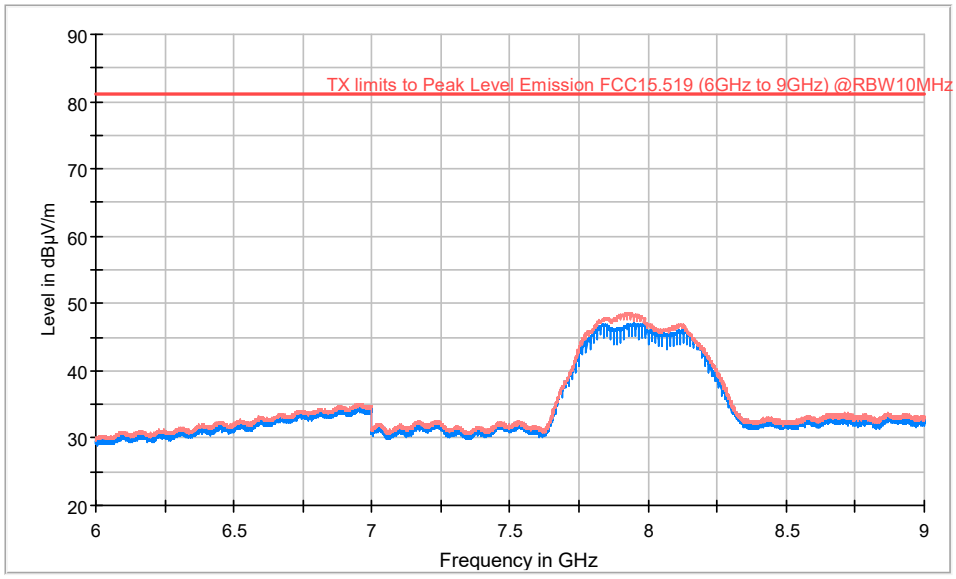
RMS_CLRWR@RE0101_R6-9GHz_TX UWB CH5 DataRate_SP3
TX limits to Peak Level Emission FCC15.519 (6GHz to 9GHz) @RBW10MHz
RMS_MAXH

Frequency (MHz)	RMS_CLRWR (dBµV/m)	RMS_MAXH (dBµV/m)	Pol	Margin - RMS (dB)	Limit - RMS (dBµV/m)	Comment
6490.312500	45.1	50.5	V	36.1	81.2	Fundamental
8031.937500	30.4	31.5	V	50.8	81.2	

Channel 9

Data Rate = 6.8 Mbits/s

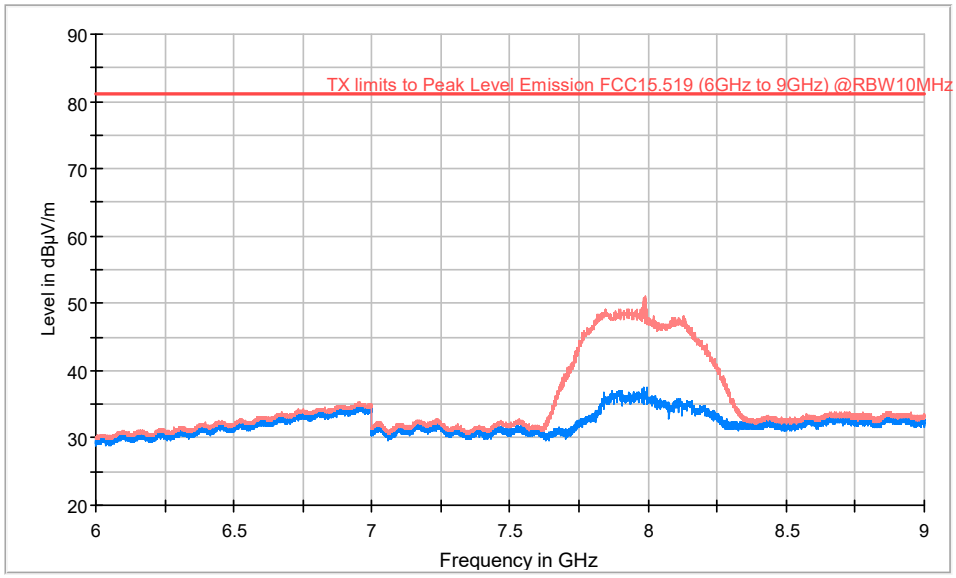
Images:



Frequency (MHz)	RMS_CLRWR (dBµV/m)	RMS_MAXH (dBµV/m)	Pol	Margin - RMS (dB)	Limit - RMS (dBµV/m)	Comment
6429.375000	31.3	32.0	V	49.9	81.2	
7932.656250	46.8	48.6	V	34.4	81.2	Fundamental

Data Rate = 850 kbits/s

Images:



RMS_CLRWR@RE0101_R6-9GHz_TX UWB CH5 DataRate_SP3
TX limits to Peak Level Emission FCC15.519 (6GHz to 9GHz) @RBW10MHz
RMS_MAXH

Frequency (MHz)	RMS_CLRWR (dBµV/m)	RMS_MAXH (dBµV/m)	Pol	Margin - RMS (dB)	Limit - RMS (dBµV/m)	Comment
6443.718750	31.5	32.5	V	49.7	81.2	
7987.312500	36.5	51.0	V	44.7	81.2	Fundamental

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time
6 GHz - 9 GHz	93.75 kHz	RMS	10 MHz	1 s