



Test Report No:
 4235ERM.004

Partial Test report

USA FCC Part 15.247, 15.209, 15.207; & CANADA RSS-247, RSS-Gen

Radio Frequency Devices. Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz

Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices.

USA FCC Part 15.519, 15.521, 15.207, 15.209, 15.212; & 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 15.247 (2020): Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 (2021): Radiated emission limits; general requirements. USA FCC Part 15.207 (2017): Conducted emission limits 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 15.212 (2020): Modular transmitters. CANADA RSS-247 Issue 3 (August 2023) CANADA RSS-220 Issue 1 (July 2018) CANADA RSS-Gen Issue 5 amendment 1 (March 2019). Guidance for Performing Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid Systems Devices Operating Under Section 15.247 of the FCC Rules. 558074 D01 Meas Guidance v05r02 dated April 2, 2019. ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Summary	See Appendix A
Approved by (name / position & signature)	Domingo Galvez EMC&RF Lab Manager
Date of issue	03-06-2024
Report template No	FDT08_23 (* "Data provided by the client")

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Acronyms

Acronym ID	Acronym Description
# of Tx Chains	Number of Transmission Chains
BEL	Band Edge Left
BER	Band Edge Right
DC	Duty Cycle
Freq	Frequency
Freq Rng	Frequency Range
Lvl Meas Pk	Level Pre Measurement Peak
MP	Measurement Point
MU	Medium Utilization Factor
Max EIRP	Maximum Burst EIRP
Max RMS	Maximum Burst RMS
Max Tx Seq	Maximum Transmission Sequence Time
Min Tx Gap	Minimum Transmission Gap Time
Mod	Modulation
Occ Ch BW	Occupied Channel Bandwidth
PSD	Power Spectrum Density
Port	Active Port
T	Temperature
Unwanted Freq	Unwanted Emissions Frequency
Unwanted Lvl	Unwanted Emissions Level

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.

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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 N°	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	VAS2OPSEDES	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)	12-04-2023
Date (finish)	12-07-2023

Document history

Report number	Date	Description
4235ERM.004	03-06-2024	First release

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. = 30 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

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

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

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

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 30 % Max. = 60 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

Remarks and comments

- The tests have been performed by the technical personnel: Qi Zhang, Koji Nishimoto, and Victor Albrecht.

Testing verdicts

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

Summary

Bluetooth Low Energy

Requirement – Test case	FCC PART 15C PARAGRAPH / RSS-247	Verdict	Remark
RSS-GEN 8.8 / FCC 15.207 - Conducted Emission limits.		N/M	Refer 1
RSS-247 5.2 (a) / FCC 15.247 (a) (2) - 6 dB Bandwidth		N/M	Refer 1
FCC 2.1049 - 99dBw Occupied Channel Bandwidth 99%		N/M	Refer 1
RSS-247 5.2 (b) / FCC 15.247 (e) - Power spectral density		N/M	Refer 1
RSS-247 5.4 (d) / FCC 15.247 (b) (3) - Maximum Peak Conducted output power		N/M	Refer 1
RSS-247 5.5 / FCC 15.247 (d) - Band-edge emissions compliance (Transmitter)		N/M	Refer 1
RSS-247 5.5 / FCC 15.247 (d) - Emissions compliance (Transmitter) - Conducted		N/M	Refer 1
RSS-247 5.5 / FCC 15.247 (d) - Emissions compliance (Transmitter) - Radiated		P	-
<u>Supplementary information and remarks:</u>			
1. Only multi-transmitter radiated spurious emission test was requested.			

Ultra-Wideband Operation

FCC PART 15F PARAGRAPH / RSS-220		Verdict	Remark
Requirement	Test case		
RSS-GEN 8.8 / FCC 15.207 - Conducted Emission limits.		N/M	Refer 1
RSS GEN 8.9 RSS -220 5.3.1(d) / FCC 15.519 (c) - Radiated Emissions		P	-
RSS -220 5.3.1(e) / FCC 15.519 (d) - Radiated Emission in GPS band		N/M	Refer 1
RSS -220 5.3.1(b) / FCC 15.519 (a) - Transmitter On/Off Requirement		N/M	Refer 1
RSS -220 5.1(a) / FCC 15.519 (b) - 10 dB Bandwidth		N/M	Refer 1
RSS -220 5.3.1(g) / FCC 15.519 (e) / FCC 15.521 (g) - Peak level of Emission		N/M	Refer 1
<u>Supplementary information and remarks:</u>			
1) Only multi-transmitter radiated spurious emission test was requested.			

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: FCC Multi-transmitters Test Results

Appendix A Content

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PRODUCT INFORMATION

The following information is provided by the supplier

Information	Description
Modulation	BLE: GFSK UWB: BPSK
Operation mode:	
<ul style="list-style-type: none"> Operating Frequency Range 	BLE: 2402 - 2480 MHz UWB: Ch5 Freq = 6489.6 MHz, Ch9 Freq = 7987.2 MHz
<ul style="list-style-type: none"> Nominal Channel Bandwidth 	BLE: 2 MHz UWB: 499.2MHz
<ul style="list-style-type: none"> RF Output Power 	BLE: 7 dBm EIRP UWB: -41.3dBm/MHz EIRP
Antenna type	Integral PCB antenna
Antenna gain	BLE: 3.45 dBic UWB: Channel 5 = 4.32dBic Channel 9 = 4.81dBic
Nominal Voltage	
<ul style="list-style-type: none"> Supply Voltage 	13.5 Vdc
<ul style="list-style-type: none"> Type of power source 	DC voltage
Equipment type	Bluetooth Low Energy, Ultra-Wideband

TEST CONDITIONS

TEST CONDITIONS	DESCRIPTION															
TC/01 ⁽¹⁾	<p>Power supply (V): V_{nominal}: 13.5 Vdc</p> <p>Temperature: T_{nominal}: +15 to +35 °C</p> <p>Test Frequencies for Radiated tests:</p> <table border="1"> <thead> <tr> <th>Technology</th> <th>Tested Frequency (MHz)</th> <th>BW (MHz)</th> <th>Modulation</th> <th>Data Rate</th> </tr> </thead> <tbody> <tr> <td>BLE</td> <td>2402</td> <td>2</td> <td>GFSK</td> <td>125 kb/sec.</td> </tr> <tr> <td>UWB</td> <td>6489.6</td> <td>499.2</td> <td>BPSK</td> <td>850 kb/sec.</td> </tr> </tbody> </table> <p>The test was performed with the equipment transmitting with BLE, and UWB radios simultaneously. These measurements have been performed in order to check the impact of the multi-transmitter of all radio interfaces that can be transmitting simultaneously.</p>	Technology	Tested Frequency (MHz)	BW (MHz)	Modulation	Data Rate	BLE	2402	2	GFSK	125 kb/sec.	UWB	6489.6	499.2	BPSK	850 kb/sec.
Technology	Tested Frequency (MHz)	BW (MHz)	Modulation	Data Rate												
BLE	2402	2	GFSK	125 kb/sec.												
UWB	6489.6	499.2	BPSK	850 kb/sec.												

Note (1): The following tables and plots show the results for the worst case in BLE, and UWB

TEST A.1: EMISSION LIMITATIONS RADIATED (TRANSMITTER)

LIMITS:	Product standard:	USA FCC Part 15.207, 15.209, 15.247, 15.249, 15.407, Part 90 CANADA RSS-247, RSS-210, RSS-140, RSS-Gen
	Test standard:	USA FCC Part 15.207, 15.209, 15.247, 15.249, 15.407, Part 90 CANADA RSS-247, RSS-210, RSS-140, RSS-Gen

LIMITS

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):

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
960 - 25000	500	54	3

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.

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 antenna), and 1m for the frequency range 18 GHz- 40 GHz (Double ridge horn antenna).

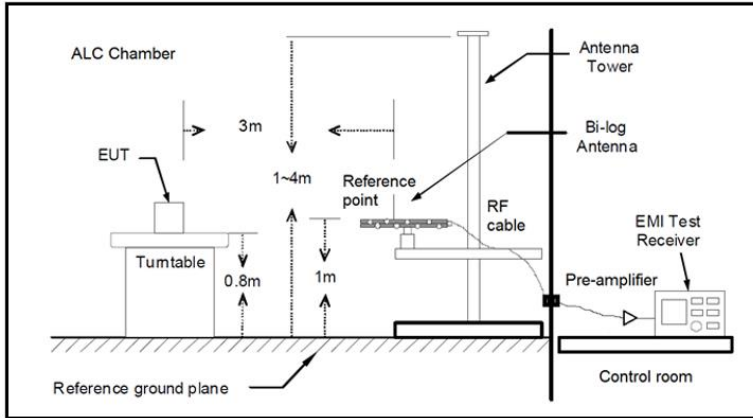
For radiated emissions in the range 18 - 40 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

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 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

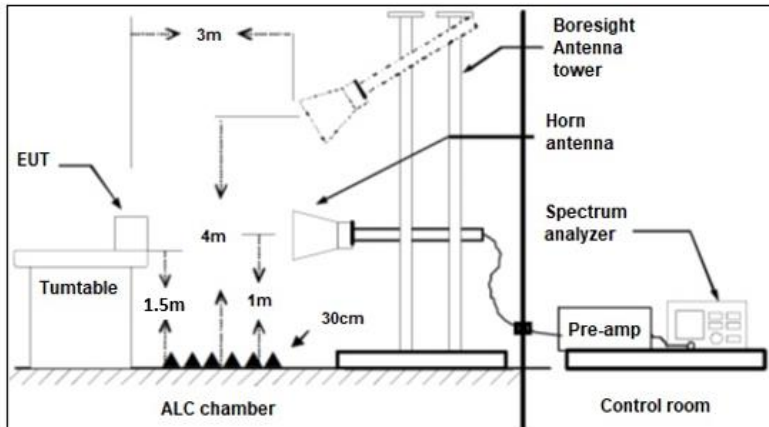
Measurements were made in both horizontal and vertical planes of polarization.

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.

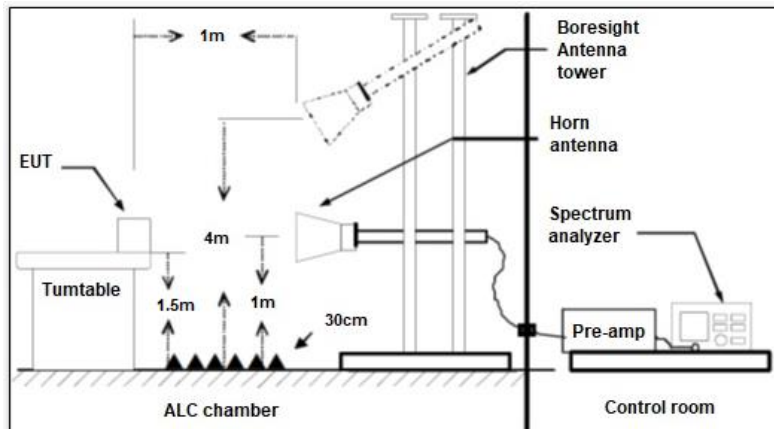
TEST SETUP (CONT.)



Radiated measurements Setup $f < 1$ GHz



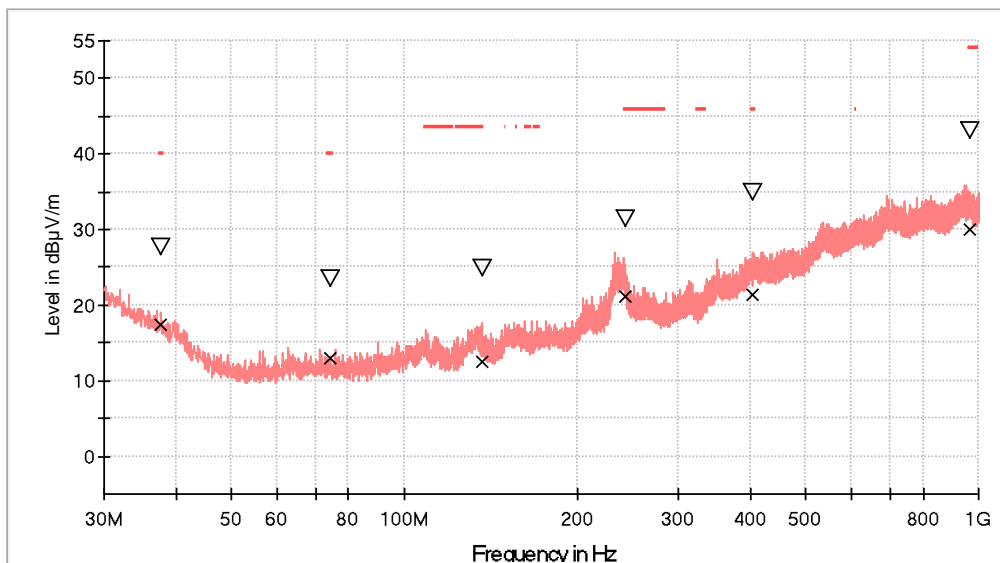
Radiated measurements setup $f > 1-18$ GHz



Radiated measurements setup $f > 18$ GHz

TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC/01
TEST RESULTS :	30 MHz - 1 GHz
VERDICT:	PASS

RF_FCC_15.247_E Field_30MHz_1GHz_SAC2

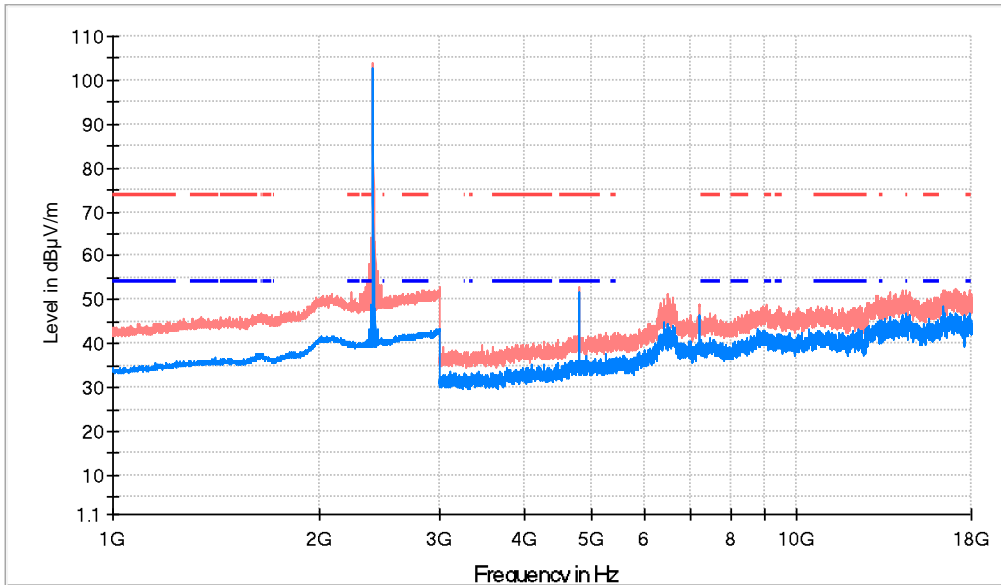


- PK+_MAXH
- - - TXlimits to Spurious Emission FCC15.247 (30MHz to 1GHz) Restricted Bands QPK Limit
- ▽ MaxPeak-PK+ (Single)
- × QuasiPeak-QPK (Single)

Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Pol	Margin - QPK (dB)	Limit - PK+ (dBµV/m)
37.711500	27.8	17.4	V	22.6	40.0
74.232000	23.4	12.9	H	27.1	40.0
136.894000	24.8	12.6	V	30.9	43.5
241.654000	31.4	21.2	H	24.8	46.0
403.595500	34.9	21.4	V	24.6	46.0
967.553500	43.0	30.1	H	23.9	54.0

TEST RESULTS (Cont.):

1 - 18 GHz

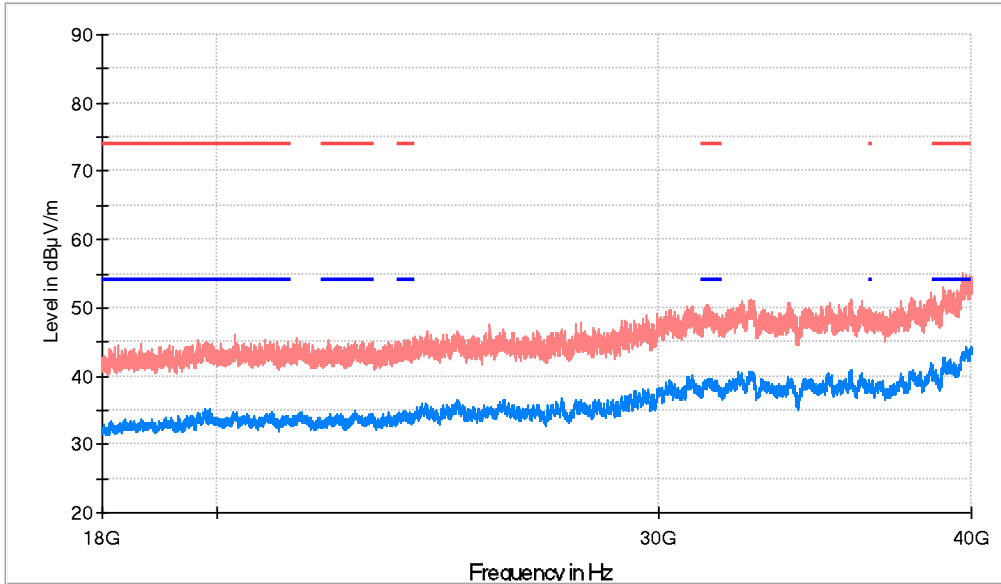


- PK+_MAXH
- TX limits to Spurious Emission FCC15.247 (1-26 GHz) Restricted Bands PK Limit
- TX limits to Spurious Emission FCC15.247 (1-26 GHz) Restricted Bands AVG Limit
- RMS_MAXH

Frequency (MHz)	PK+_MAXH (dBµV/m)	RMS_MAXH (dBµV/m)	Pol	Margin - RMS (dB)	Limit - RMS (dBµV/m)	Comment
2402.000000	103.7	102.9	V	---	---	BLE Fundamental
4803.500000	52.8	51.6	H	2.4	54.0	BLE 2nd Harmonic
6391.000000	50.1	44.8	V	---	---	UWB Fundamental

TEST RESULTS (Cont.):

18 - 40 GHz



- AVG_MAXH
- PK+_MAXH
- TX limits to Spurious Emission FCC15.247 Restricted Bands AVG Limit
- TX limits to Spurious Emission FCC15.247 Restricted Bands PK Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	RMS_MAXH (dBµV/m)	Pol	Margin - RMS (dB)	Limit - RMS (dBµV/m)
19863.125000	42.7	35.2	V	18.8	54.0
31486.000000	47.5	39.7	V	14.3	54.0
39204.562500	51.6	42.6	H	11.4	54.0

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time
30 MHz - 1 GHz	48.5	PK+	100 kHz	1 s

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time
1 GHz - 3 GHz	500 kHz	PK+ ; RMS	1 MHz	0.1 s
3 GHz - 18 GHz	500 kHz	PK+ ; RMS	1 MHz	0.1 s

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time
18 GHz - 26 GHz	500 kHz	PK+ ; AVG	1 MHz	1 s