





FCC LISTED, REGISTRATION

NUMBER: 2764.01

ISED LISTED REGISTRATION

NUMBER: 23595-1

Test report No: 3750ERM.002A1

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.

(*) Identification of item tested	Battery Radiofrequency Module
(*) Trademark	Visteon
(*) Model and /or type reference tested	BRFMS
Other identification of the product	FCC ID: NT8-BRFMS IC: 3043A-BRFMS
(*) Features	Wireless Battery Management
Manufacturer	Visteon Corporation One Village Center Drive, Van Buren Township, MI 48111, USA.
Test method requested, standard	USA FCC Part 15.247, 10-1-20 Edition: Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz USA FCC Part 15.209, 10-1-20 Edition: Radiated emission limits; general requirements CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 (March 2019). 558074 D01 15.247 Meas. Guidance v05r02 (April 2019): Guidance for Compliance Measurements on Digital Transmission Systems, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under section §15.247 of the FCC Rules 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	09-22-2022
Report template No	FDT08_23 (*) "Data provided by the client"



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Competences and guarantees

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

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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.

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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
RF Power and PSD		0.88	dB
Occupied Bandwidth	2402-2483	1.87	%
Band Edge		0.64	dB
	30-180	4.27	dB
Radiated Spurious Emission	180-1000	3.14	dB
	1000-18000	3.30	dB
	18000-40000	3.49	dB



Data provided by the client

The DUT is a Module intended to aggregate individual cell voltages and module temperatures from the HV battery in addition to pack voltage and current and communicate them to the VICM3.

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 used for test have been selected by: The client.

Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
3621/01	BRFMS (MTF Radiated)	24049820001	1122075EM4550049	05/02/2022

Following Auxiliary items were used with Sample S/01 to perform testing:

Control Nº	Description	Model	Serial Nº
3183/12	isoSPI 2 Wire Serial Interface	Demo circuit 1941D	-
3183/06	GM BRFM test Board	-	-

Sample S/01 was used for following test(s)
 All Radiated tests indicated in appendix A.

Sample S/02 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
3621/02	BRFMS (MTF Conducted)	BRFMS	1122133000000001	05/24/2022

Following Auxiliary items were used with Sample S/01 to perform testing:

Control No	Description	Model	Serial Nº
3183/12	isoSPI 2 Wire Serial Interface	Demo circuit 1941D	-
3183/06	GM BRFM test Board	-	-

Sample S/02 was used for following test(s)
 All Conducted tests indicated in appendix A.

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



Test sample description

Ports:	Cable										
	Port n	ame and description		length [m] d		Attached during test		during		ielded	Coupled to patient
	Main	connector/harness	T	60 cm						N/A	
			\top							N/A	
										N/A	
										N/A	
Supplementary information to the ports:	No Da	ata Provided									
Rated power supply:	Voltad	ge and Frequency				Ref	erenc	e po	oles		
		,		L1	L	L2	L3	3	N	PE	
		AC:	T		[]			
		AC:			[]			
		DC: 5.4 V									
		DC:									
Rated Power:	Curre	nt in normal mode: 0.5	5 m	ıΑ							
Clock frequencies::	40 MH	l z									
Other parameters:	No Da	ata Provided									
Software version:	SWE	101-28371-000R04									
Hardware version:	VPPA	MU-14B115-EA									
Dimensions in cm (W x H x D) :	No Da	ata Provided									
Mounting position:		Table top equipment	t								
		Wall/Ceiling mounted	d e	quipmen	nt						
		Floor standing equip	me	ent							
		Hand-held equipmen	nt								
	\boxtimes	Other: Integrated in-s	side	e electrio	ve.	hicle i	batter	у ра	ack.		
Modules/parts::		le/parts of test item					ufacturer				
	ט טעו	ata FTOVIU C U									



Accessories (not part of the test item):	Description	Туре	Manufacturer			
,	Harness					
	Main connector					
	Cheetah					
	CMUr					
Documents as provided by the applicant:	Description	File name	Issue date			
	Declaration Equipment Data	FDT30_18 Declaration Equipment Data_BRFMS_July 12,	06/12/2022			
		2022.pdf				
Copy of marking plate:						
No Marking plate found.						

Identification of the client

VISTEON CORPORATION

One Village Center Drive. Van Buren Township, MI. 48111, USA.

Testing period and place

Test Location	DEKRA Certification Inc.		
Date (start)	06-14-2022		
Date (finish)	09-15-2022		

Document history

Report number	Date	Description
3750ERM.002	08-08-2022	First release
3750ERM.002A1	09-22-2022	Second release



Modifications to the reference test report

It was introduced the following modifications in respect to the test report number 3750ERM.002 related with the same samples, in the next clauses and sub-clauses:

Clauses/ Sub-Clauses	Modification	Justification
Page 9: List of equipment use during the test	Included Conducted Measurements table	Conducted results were added in the test report
Pages 14-16: TEST A.1: MAXIMUM PEAK OUTPUT POWER AND ANTENNA GAIN	Conducted measurement test setup added and output power test results updated	Conducted output power measured as per TCB request

This modification test report cancels and replaces the test report 3750ERM.002

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: Nasir Khan, Lourdes Maria Valverde and Koji Nishimoto.

Testing verdicts

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

Summary

	FCC PART 15 PARAGRAPH (Proprietary protocol)				
Section	FCC Spec Clause	RSS Spec Clause	Test Description	Verdict	Remark
-	§ 2.1049	RSS-GEN 6.7	99% Occupied Bandwidth	N/M	Refer 1
-	§15.247 (a) (2)	RSS-247 5.2 (a)	6dB Bandwidth	N/M	Refer 1
A.1	§ 15.247 (b) (3)	RSS-247 5.4 (d)	Maximum Peak Output Power and antenna gain	Р	N/A
-	§ 15.247 (d)	RSS-247 5.5	Band-edge conducted emissions compliance (Transmitter)	N/M	Refer 1
-	§ 15.247 (e)	RSS-247 5.2 (b)	Power Spectral Density	N/M	Refer 1
-	§15.247 (d)	RSS-247 5.5	Emission limitations Conducted (Transmitter)	N/A	Refer 1
A.2	§15.247 (d)	RSS-247 5.5	Emission limitations Radiated (Transmitter)	Р	N/A

Supplementary information and remarks:

1. Not requested.



List of equipment used during the test

Conducted Measurements

CONTROL NUMBER	DESCRIPTION	MANUFACTURER	MODEL	LAST CALIBRATION	NEXT CALIBRATION
1038	TS8997 TEST SYSTEM	Rohde & Schwarz	TS8997	N/A	N/A
1107	ETHERNET SNMP THERMOMETER	HW GROUP	HWg-STE Plain	2022/08	2024/08
1313	WIRELESS MEASUREMENT SOFTWARE R&S WMS32	Rohde & Schwarz	N/A	N/A	N/A

Radiated Measurements

CONTROL NUMBER	DESCRIPTION	MANUFACTURER	MODEL	LAST CALIBRATION	NEXT CALIBRATION
0981	RF pre-amplifier	Bonn Elektronik	BLMA0118-2A	2020/11	2022/11
1012	EMI TEST RECEIVER	Rohde & Schwarz	ESR 26	2022/04	2024/04
1014	Spectrum analyzer	Rohde & Schwarz	FSV40	2021/05	2023/05
1056	Double-ridge Waveguide Horn antenna 18-40 GHz	ETS LINDGREN	3116C	2020/01	2023/01
1057	Double-ridge Waveguide Horn antenna 1-18 GHz	ETS LINDGREN	3115	2020/06	2023/06
1065	Biconical Log antenna	ETS LINDGREN	3142E	2020/08	2023/08
1108	Ethernet SNMP Thermometer- CR Room	HW Group	HWg-STE Plain	2020/08	2022/08
1111	ETHERNET SNMP THERMOMETER	HW GROUP	HWg-STE Plain	2020/08	2022/08
1179	Semi anechoic Absorber Lined Chamber	Frankonia	SAC 3 plus "L"	N/A	N/A
1314	WIRELESS MEASUREMENT SOFTWARE R&S EMC32	Rohde & Schwarz	N/A	N/A	N/A



Appendix A: Test results (Proprietary Protocol)



Appendix A Content

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TEST A.1: MAXIMUM PEAK OUTPUT POWER AND ANTENNA GAIN	14
TEST A.2: EMISSION LIMITATIONS RADIATED (TRANSMITTER)	21



PRODUCT INFORMATION

The following information is provided by the client

Information	Description
Modulation	GFSK
Adaptive	Non-adaptive equipment
Operation mode	
- Operating Frequency Range	2405 – 2480 MHz
- Nominal Channel Bandwidth	2 MHz
- RF Output Power	10 dBm
Antenna type	Integrated chip antenna
Antenna gain	2.6 dBi
Nominal Voltage	
- Supply Voltage	5.4 V nominal
- Type of power source	DC Power supply
Equipment type	Wireless Battery Management
Geo-location capability	No



DESCRIPTION OF TEST CONDITIONS

TEST CONDITIONS	DESCRIPTION	
TC#01 (Port 1)	Power supply (V): Vnominal = 5.4 V dc Bandwidth: 2 MHz Test Frequencies for Conducted/ Radiated tests: Lowest channel: 2405 MHz Middle channel: 2445 MHz Highest channel: 2480 MHz	



TEST A.1: MAXIMUM PEAK OUTPUT POWER AND ANTENNA GAIN

I IMITO.	Product standard: Part 15 Subpart C §15.247 and RSS-247	
LIMITS:	Test standard:	Part 15 Subpart C §15.247(b)(3) and RSS-247 5.4(d)

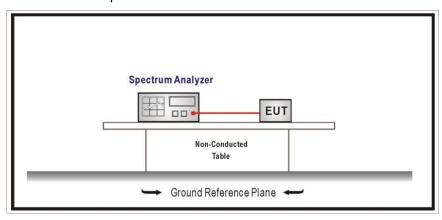
LIMITS

§15.247(b)(3) and RSS-247 5.4(d): For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt (30 dBm).

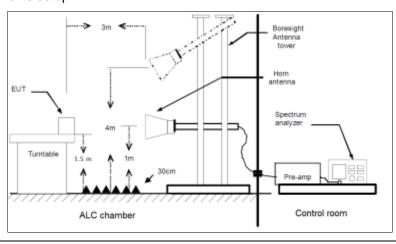
RSS-247 5.4(d): The e.i.r.p. shall not exceed 4 W (36 dBm)

TEST SETUP

Conducted measurements setup



Radiated measurements setup





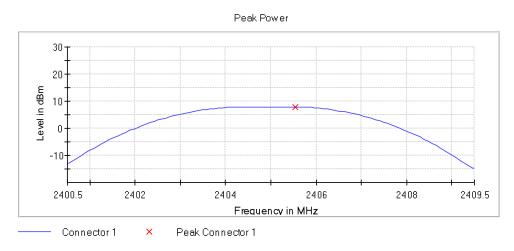
CONDUCTED TESTING		
TESTED SAMPLES: S/01		
TESTED CONDITIONS MODES:	TC#01	
TEST RESULTS:	PASS	

Maximum declared antenna gain: +2.6 dBi

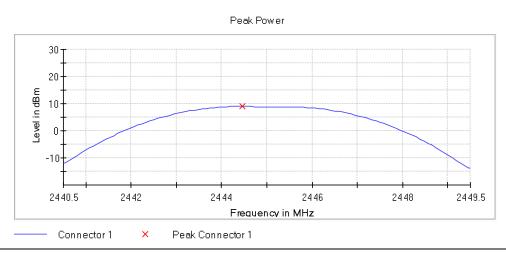
iazimam acciai ca amemia gami - 210 azi			
	Lowest frequency	Middle frequency	Highest frequency
	2405 MHz	2445 MHz	2480 MHz
Maximum conducted power (dBm)	7.9	9.0	9.4
Maximum EIRP power (dBm)	10.5	11.6	12.0

The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power limit is not required to be reduced from the stated values.

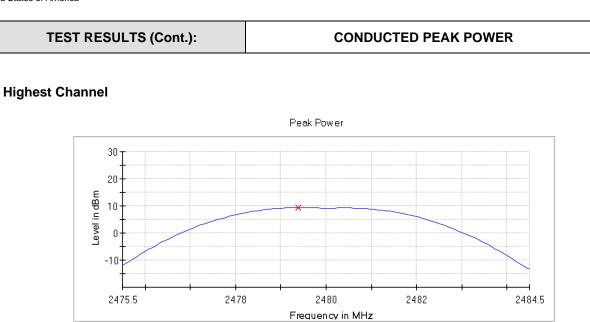
Lowest Channel



Middle Channel







Measurement

Peak Connector 1

Connector 1

Setting	Instrument Value	Instrument Value	Instrument Value
Start Frequency	2.40200 GHz	2.44200 GHz	2.47700 GHz
Stop Frequency	2.40800 GHz	2.44800 GHz	2.48300 GHz
Span	6.000 MHz	6.000 MHz	6.000 MHz
RBW	2.000 MHz	2.000 MHz	2.000 MHz
VBW	10.000 MHz	10.000 MHz	10.000 MHz
Sweep Points	101	101	101
Sweep time	953.450 ns	953.450 ns	953.450 ns
Reference Level	20.000 dBm	20.000 dBm	20.000 dBm
Attenuation	40.000 dB	40.000 dB	40.000 dB
Detector	MaxPeak	MaxPeak	MaxPeak
Sweep Count	100	100	100
Filter	3 dB	3 dB	3 dB
Trace Mode	Max Hold	Max Hold	Max Hold
Sweep type	FFT	FFT	FFT
Preamp	off	Off	off
Stable mode	Trace	Trace	Trace
Stable value	0.50 dB	0.50 dB	0.50 dB
Run	4 / max. 150	4 / max. 150	4 / max. 150
Stable	3/3	3/3	3/3
Max Stable Difference	0.04 dB	0.01 dB	0.11 dB



RADIATED TESTING		
TESTED SAMPLES: S/01		
TESTED CONDITIONS MODES:	Pre-scan to determine worst DUT orientation	
TEST RESULTS:	See followings	

The following table shows the measured fundamental signal levels at 2405 MHz with the three different DUT orientations and following the pre-scan process:

- Rotating the DUT from 0-360 degrees (turntable).
- Moving RX antenna from 1-4m in boresight mode according to ANSI 63.10 (horizon to 45 degrees).

DUT Orientation	PK+_MAXH (dBµV/m)	PK+_MAXH (dBm)
Orientation X*	104.2	9.0
Orientation Y	103.1	7.8
Orientation Z	101.5	6.3

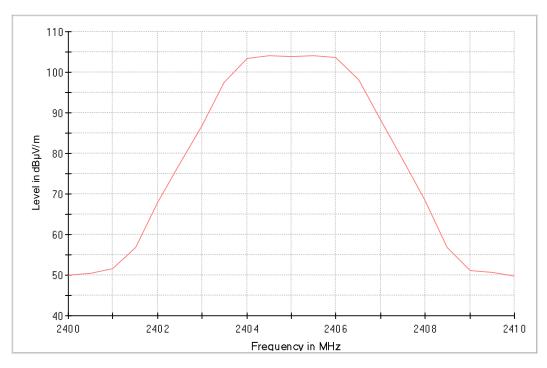
Orientation X	Orientation Y	Orientation Z

^{*} The following test results were based on the worst DUT orientation X.



TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#01
TEST RESULTS:	PASS

Lowest channel



---- PK+_MAXH

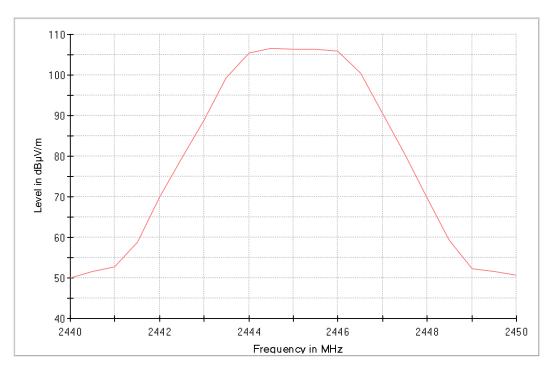
Frequency	PK+_MAXH	PK+_MAXH	Pol
(MHz)	(dBµV/m)	(dBm)	
2405.500000	104.2	9.0	Н

EIRP (dBm) = E (dB μ V/m) + 20log(D) - 104.8; where D is the measurement distance in meter



TEST RESULTS (Cont.):

Middle channel



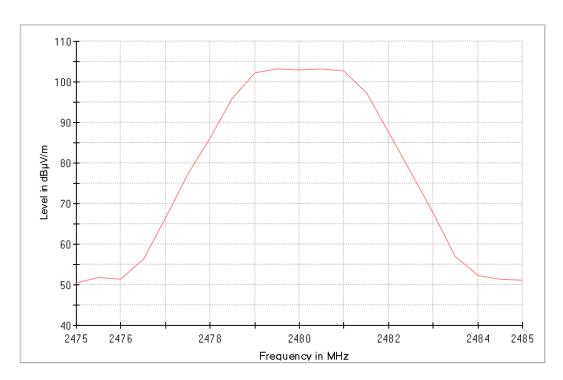
---- PK+_MAXH

Frequency (MHz)	PK+_MAXH (dBµV/m)	PK+_MAXH (dBm)	Pol
2444.500000	106.6	11.4	Н



TEST RESULTS (Cont.):

Highest channel



---- PK+_MAXH

Frequency	PK+_MAXH	PK+_MAXH	Pol
(MHz)	(dBµV/m)	(dBm)	
2480.500000	103.2	8.0	Н



TEST A.2: EMISSION LIMITATIONS RADIATED (TRANSMITTER)		
LIMITS: Product standard: Test standard:	Part 15 Subpart C §15.247 and RSS-247	
	Test standard:	Part 15 Subpart C §15.247 (d) and RSS-Gen 8.9 and 8.10

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 located 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- 26 GHz (Double ridge horn antenna).

For radiated emissions in the range 18 - 26 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.

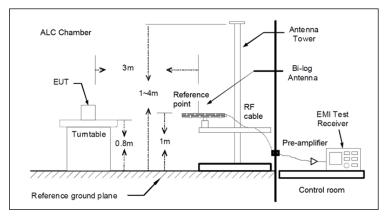
Measurements were made in both horizontal and vertical planes of polarization.

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.

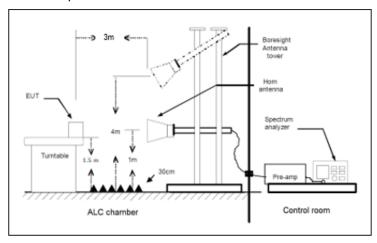


TEST SETUP (CONT.)

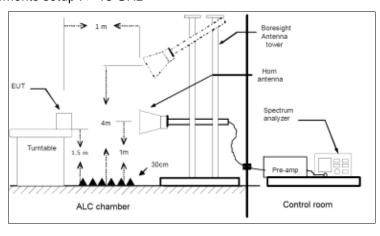
Radiated measurements Setup f < 1 GHz



Radiated measurements setup f > 1-18 GHz



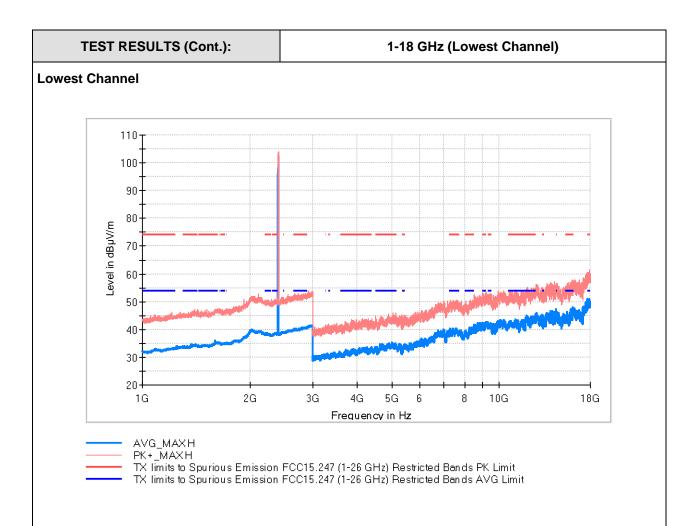
Radiated measurements setup f > 18 GHz





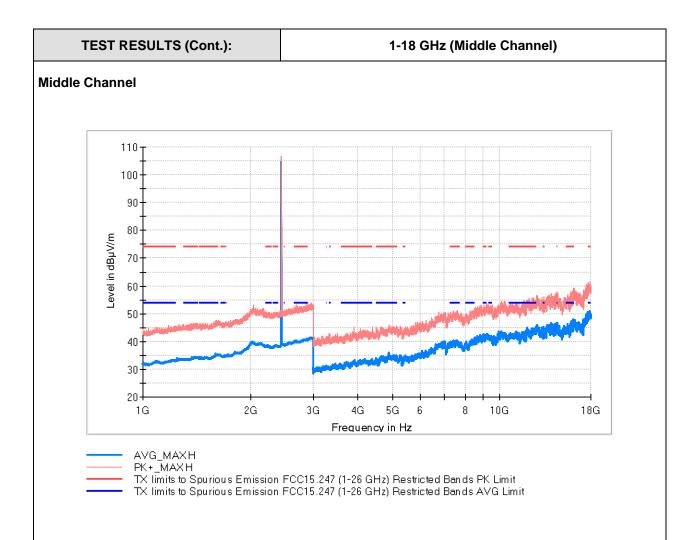
TESTED SAMPLES:	S/01	
TESTED CONDITIONS MODES:	TC#01	
TEST RESULTS:	Pass	
The preliminary test was performed in three different DUT orientations (X, Y and Z) to determine the worst case. The worst-case results were shown in the following test results.		
Frequency range 1 GHz – 26 GHz		
The results in the next tables show the marestricted bands 2.31-2.39 GHz and 2.483	aximum measured levels in the 1-26 GHz range including the 35-2.5 GHz (see next plots).	





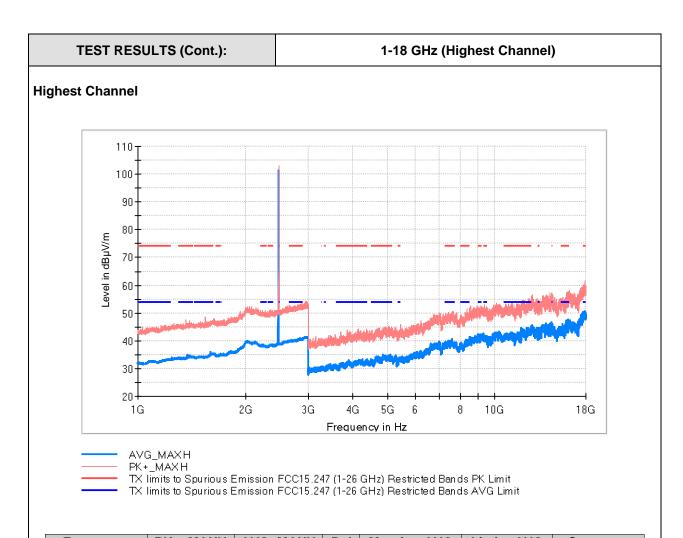
Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Comment
2405.500000	104.2	104.7	Н			Fundamental





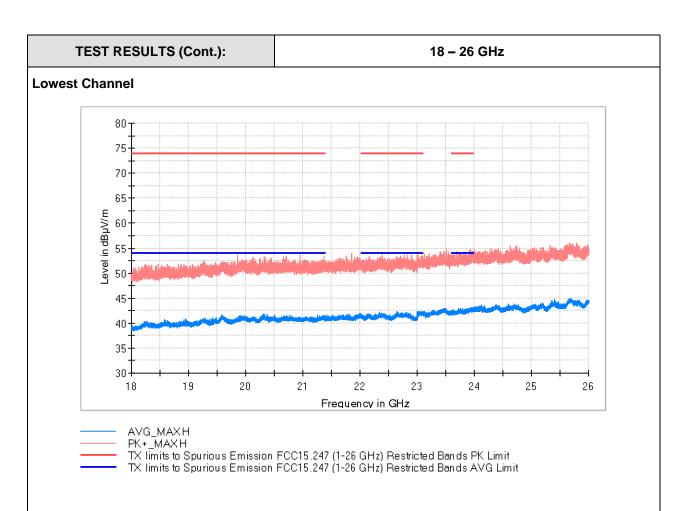
Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Comment
2444.500000	106.8	102.5	Н			Fundamental





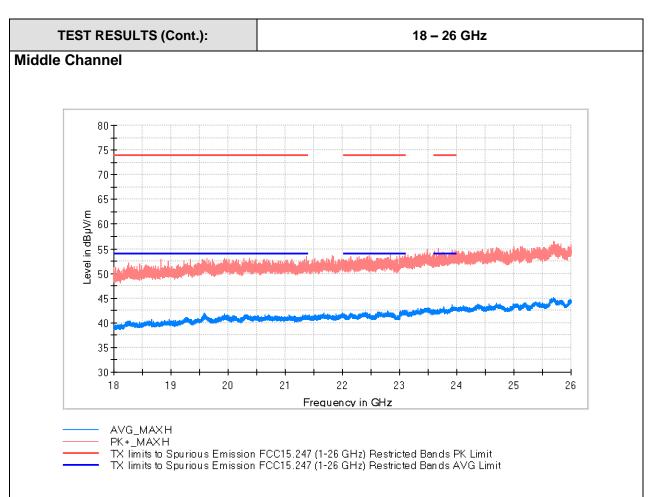
Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH Po (dBµV/m)		Margin - AVG (dB)	Limit - AVG (dBµV/m)	Comment
2480.500000	103.2	99.6	Н			Fundamental





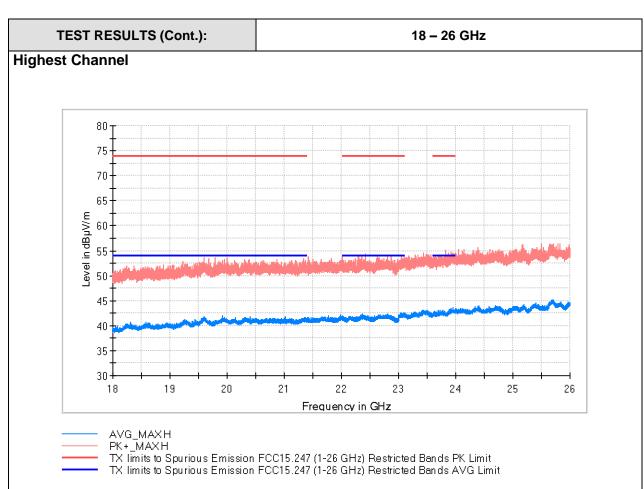
Frequency	PK+_MAXH	AVG_MAXH	Pol	Margin - PK+	Limit - PK+
(MHz)	(dBμV/m)	(dBμV/m)		(dB)	(dBµV/m)
23954.000000	52.7	43.2	Ι	10.8	54.0





Frequency	PK+_MAXH	AVG_MAXH	Pol	Margin - AVG	Limit - AVG
(MHz)	(dBµV/m)	(dBµV/m)		(dB)	(dBµV/m)
23913.000000	53.2	43.6	Ι	10.4	54.0





Frequency	PK+_MAXH	AVG_MAXH	Pol	Margin - AVG	Limit - AVG
(MHz)	(dBµV/m)	(dBμV/m)		(dB)	(dBµV/m)
23950.500000	54.0	43.6	٧	10.4	54.0



