

	CC LISTED, REGISTRATION NUMBER: 2764.01Test report No:SED LISTED REGISTRATION4241ERM.002
CERTIFICATE #2764.01	NUMBER: 23595-1
Partial	l Test report
	t 15.247, 15.209, 15.207
	RSS-247, RSS-Gen in the bands 902 - 928 MHz, 2400 -2483.5 MHz, and
572	5 - 5850 MHz
	Frequency Hopping Systems (FHSs) and License- 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	12-11-2023
Report template No	FDT08_23 (*) "Data provided by the client"



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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.

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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
RF Power and PSD	2402-2483	0.88	dB
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").
- The sample consists of 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 and accessories:

ld	Control Number	Description	Model	Serial N⁰	Date of Reception	Application
S/01	4241/20	BRFMS Conducted	BRFMS	1123300000063538	11/10/2023	Element Under Test
S/01	4241/35	GM BRM test Board	Cheetah	-	11/10/2023	Accessory
S/01	4241/36	isoSPI 2 Wire Serial Interface	Demo Circuit 1941D	-	11/10/2023	Accessory

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

Sample S/02 is composed of the following elements and accessories:

ld	Control Number	Description	Model	Serial N⁰	Date of Reception	Application
S/02	4241/09	BRFMS Radiated	BRFMS	1123300000063533	11/10/2023	Element Under Test
S/02	4241/35	GM BRM test Board	Cheetah	-	11/10/2023	Accessory
S/02	4241/36	isoSPI 2 Wire Serial Interface	Demo Circuit 1941D	-	11/10/2023	Accessory

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



Test sample description

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

Ports:			Cable					
	Port nar	ne and description	Specified max length [m]	Attac during		Shielded		oupled to atient ⁽³⁾
	Main connector/harness		60 cm]]	[]		[]
] []	[]		[]
				[]	[]		[]
				[]	[]		[]
				[]	[]		[]
Supplementary information to the ports								
Rated power supply:	Voltago	and Frequency			Re	ference po	les	
	voltage	and Frequency		L1	L2	L3	Ν	PE
	[]	AC:		[]	[]	[]	[]	[]
	[]	AC:		[]	[]	[]	[]	[]
	[X]	DC: 5.4 V						
	[]	DC:						
Rated Power:	Current in normal mode: 0,5 A							
Clock frequencies:	40 MHz							
Other parameters:								
Software version:	SWE101-28371-000R09							
Hardware version:	VPPAM	U-14B115-ED						
Dimensions in cm (W x H x D):								
Mounting position:	[]	Table top equipme	ent					
	[] Wall/Ceiling mounted equipment							
	[]	Floor standing equ	uipment					
	[]	Hand-held equipm	nent					
	[X] Other: Integrated in-side electric vehicle battery pack.							
Modules/parts:	Module/	parts of test item			-	Type Manufactu		facturer
Accessories (not part of the test	Descript	ion			Туре		Manuf	acturer
item):	Harness							
	Main connector							
	Cheetah							
	Test Board							



Documents as provided by the applicant:	Description	File name	Issue date

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)	11-13-2023
Date (finish)	11-15-2023

Document history

Report number	Date	Description
4241ERM.002	12-11-2023	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. = 860mbar Max. = 1060mbar

In the semianechoic 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. = 860mbar Max. = 1060mbar

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

Remarks and comments

The tests have been performed by the technical personnel: Ivy Yousuf Moutushi, Juliana Cherry, Yuqi Wang, Koji Nishimoto, and Victor Albrecht.



Testing verdicts

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

Summary

		FCC PART 15 PAR	AGRAPH (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 2
A.2	§15.247 (d)	RSS-247 5.5	Emission limitations Radiated (Transmitter)	Р	N/A
Supplem	nentary information a	and remarks:	•		
1. 0	nly partial testing has he DUT has an integra	been requested by the	e client.		



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
1012	EMI Test Receiver	Rohde & Schwarz	ESR 26	2023-01-18	2025-01-18
1014	Spectrum analyzer	Rohde & Schwarz	FSV40	2022-08-01	2024-08-01
1056	Double-ridge Waveguide Horn antenna 18-40 GHz	ETS Lindgren	3116C	2023-02-23	2026-02-23
1057	Double-ridge Waveguide Horn antenna 1-18 GHz	ETS Lindgren	3115	2023-07-18	2026-07-18
1064	Biconical Log antenna	ETS Lindgren	3142E	2021-12-13	2024-12-13
1108	Ethernet SNMP Thermometer- CR Room	HW Group	HWg-STE Plain	2022-10-18	2024-10-18
1111	Ethernet SNMP Thermometer	HW Group	HWg-STE Plain	2022-10-18	2024-10-18
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
1461	Low noise Preamplifier (1-18 GHz)	Bonn Elektronik	BLMA0118-4A	2022-06-01	2024-06-01



Appendix A: Test results (Proprietary Protocol)



Appendix A Content

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Test A.2: Emission Limitations Radiated (Transmitter)	. 20



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



DESCRIPTION OF TEST CONDITIONS

TEST CONDITIONS	DESCRIPTION
TC/01 (Port 1)	Power supply (V): V _{nominal} = 5.4 V dc Bandwidth: 2 MHz <u>Test Frequencies for Conducted/ Radiated tests:</u> Lowest channel: 2405 MHz Middle channel: 2445 MHz Highest channel: 2480 MHz

Below is the comparison table between previous test results (test report 3750ERM.002A1_RF_FCC_Proprietary) and test results with the new sample shown in this test report:

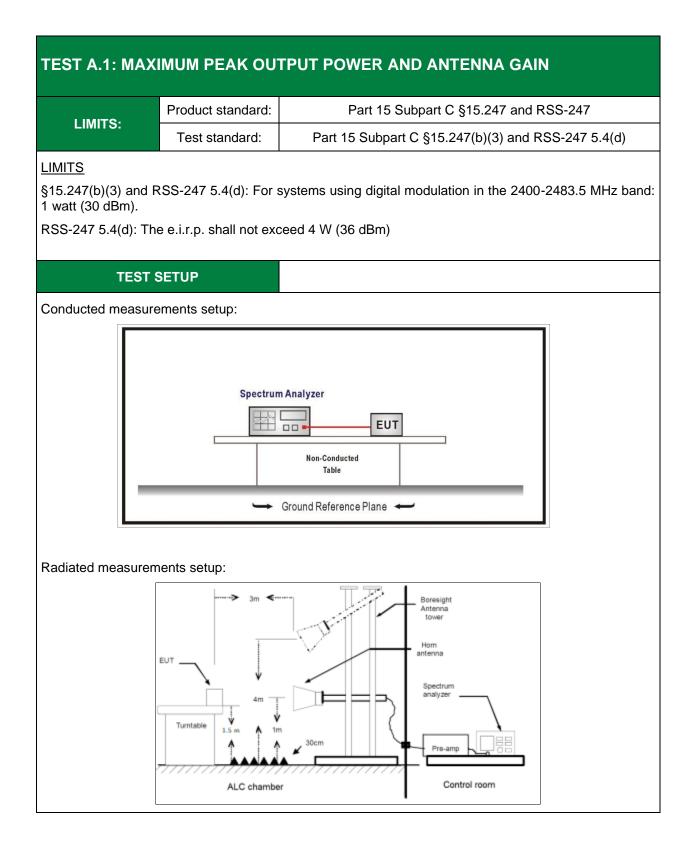
	_	Maximum Conducte	ed Power (dBm)	
Modulation	Frequency (MHz)	3750 BRFM-1p C2PC (test report 3750ERM.002A1)	4241E BRFMS	Delta
GFSK	2405	7.9	9.3	1.4
GFSK	2445	9.0	10.5	1.5
GFSK	2480	9.4	10.3	0.9

See below the comparison table between previous test results (test report

3750ERM.002A1_RF_FCC_Proprietary) and test results with the new sample for Radiated shown in this test report:

	_	Maximum Radiate	d Power (dBm)	
Modulation	Frequency (MHz)	3750 BRFM-1p C2PC (test report 3750ERM.002A1)	4241E BRFMS	Delta
GFSK	2405	104.7	104.5	-0.2
GFSK	2445	106.8	106.7	-0.1
GFSK	2480	103.2	103.5	0.3



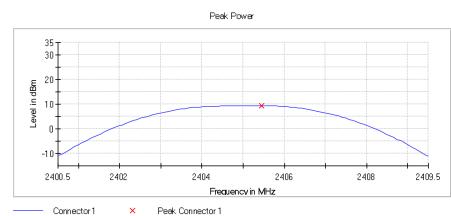


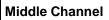


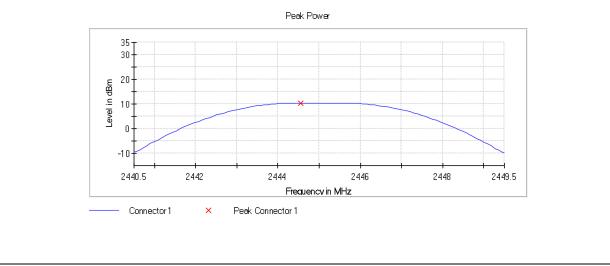
	CONDUCTED TEST	ING	
TESTED SAMPLES:		S/01	
TESTED CONDITIONS MODES:		TC/01	
TEST RESULTS:		PASS	
Maximum declared antenna gain: +2.6	dBi		
	Lowest frequency	Middle frequency	Highest frequency
	2405 MHz	2445 MHz	2480 MHz
Maximum conducted power (dBm)	9.3	10.5	10.3
Maximum EIRP power (dBm)	11.9	13.1	12.9

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



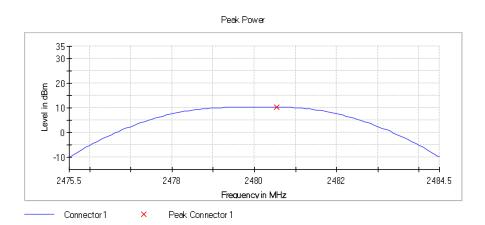






CONDUCTED PEAK POWER

Highest Channel



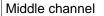
Measurement

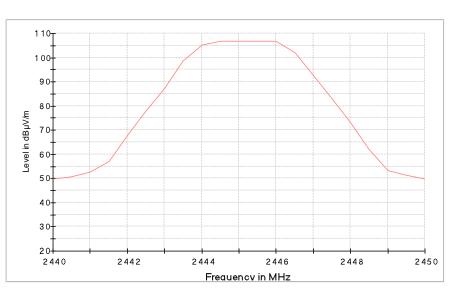
Setting	Instrument Value	Instrument Value	Instrument Value
Start Frequency	2.40050 GHz	2.44050 GHz	2.47550 GHz
Stop Frequency	2.40950 GHz	2.44950 GHz	2.48450 GHz
Span	9.000 MHz	9.000 MHz	9.000 MHz
RBW	3.000 MHz	3.000 MHz	3.000 MHz
VBW	10.000 MHz	10.000 MHz	10.000 MHz
Sweep Points	101	101	101
Sweep time	1.000 ms	1.000 ms	1.000 ms
Reference Level	20.000 dBm	20.000 dBm	20.000 dBm
Attenuation	30.000 dB	30.000 dB	30.000 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	Sweep	Sweep	Sweep
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	0.01 dB	0.04 dB	0.04 dB



TESTE	D SAN	NPLES	:		S/02						
	DITIC		ODES	\$:					TC	/01	
TEST	RESI	JLTS:							PA	SS	
ollowing tes	t resu	lts were) base	ed on t	the wo	rst DU	T orier	ntation	X.		
	110										
	- 100-	_									
	- 90-	-									
	- 80-	+									
	۳/۷ ۲۳ 70-	-								\	
	elin dE			/							
	9 00 9 . 50-	_									
	- 40-	-									
	30-	+									
	- 2 0-	-									
		400	24	402	2	404 Ereque	2 ncv in N	406 411-7	2	408	2
_	— т	K+_MAX X limits to X limits to	Spurio	ous Emi	ssion FC	с15.247 с15.247 _MAXH 3µV/m)	Restric	ted Ban	MAXH	im it	
		Frequ (Mł	iency Iz)		(dE	BuV/m)		(dl	3m)		



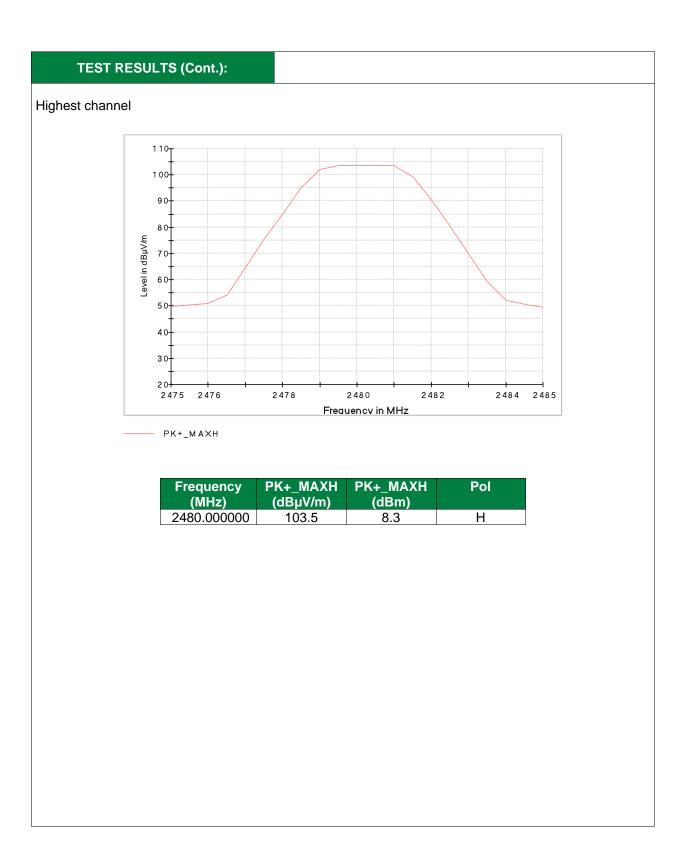




PK+_MAXH TX limits to Spurious Emission FCC15.247(1-26G) Restricted Bands AVG Limit TX limits to Spurious Emission FCC15.247 Restricted Bands PK Limit

Frequency	PK+_MAXH	PK+_MAXH	Pol
(MHz)	(dBµV/m)	(dBm)	
2445.000000	106.7	11.5	Н







TEST A.2: EMISSION LIMITATIONS RADIATED (TRANSMITTER)

LIMITS:	Product standard:	Part 15 Subpart C §15.247 and RSS-247				
LIMIT 5.	Test standard:	Part 15 Subpart C §15.247 (d) and RSS-Gen 8.9 and 8.10				

<u>LIMITS</u>

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 (μ V/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.

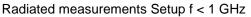
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

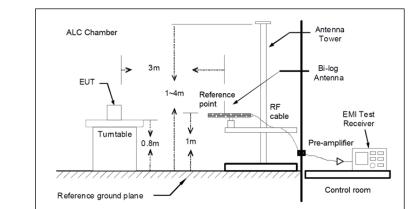
Measurements were made in both horizontal and vertical planes of polarization.

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.

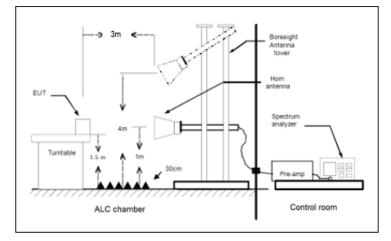


TEST SETUP (CONT.)

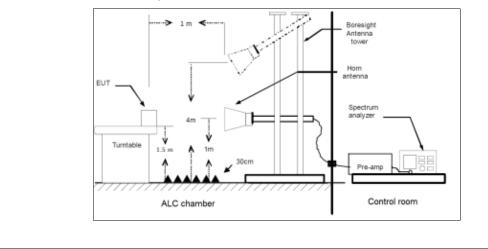




Radiated measurements setup f > 1-18 GHz



Radiated measurements setup f > 18 GHz



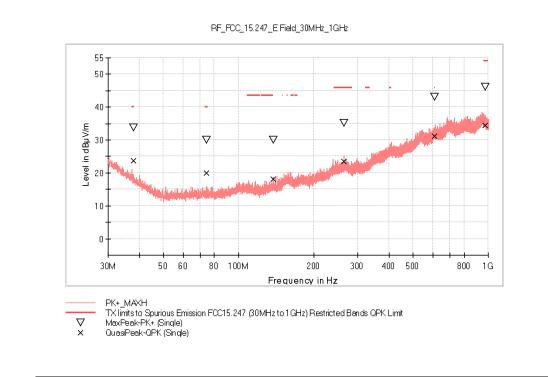


TESTED SAMPLES:	S/02
TESTED CONDITIONS MODES:	TC/01
TEST RESULTS:	Pass

Frequency range 30 MHz – 1000 MHz

The level of spurious emissions was measured as their effective radiated power when radiated by cabinet and antenna.

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



Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Pol	Margin - QPK (dB)	Limit - QPK (dBµV/m)
37.808500	33.8	23.6	Н	16.4	40.0
74.523000	30.0	19.9	Н	20.1	40.0
137.185000	30.0	18.0	V	25.5	43.5
264.788500	35.3	23.5	V	22.5	46.0
610.060000	43.0	31.2	V	14.8	46.0
970.269500	46.1	34.4	V	19.6	54.0

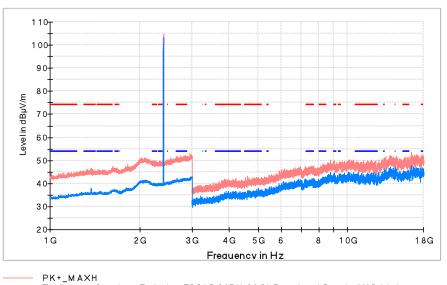


1-18 GHz (Lowest Channel)

Frequency range 1 GHz – 26 GHz

The results in the next tables show the maximum measured levels in the 1-18 GHz range (including the restricted bands 2.31-2.51 GHz) and 18-26 GHz (see next plots).

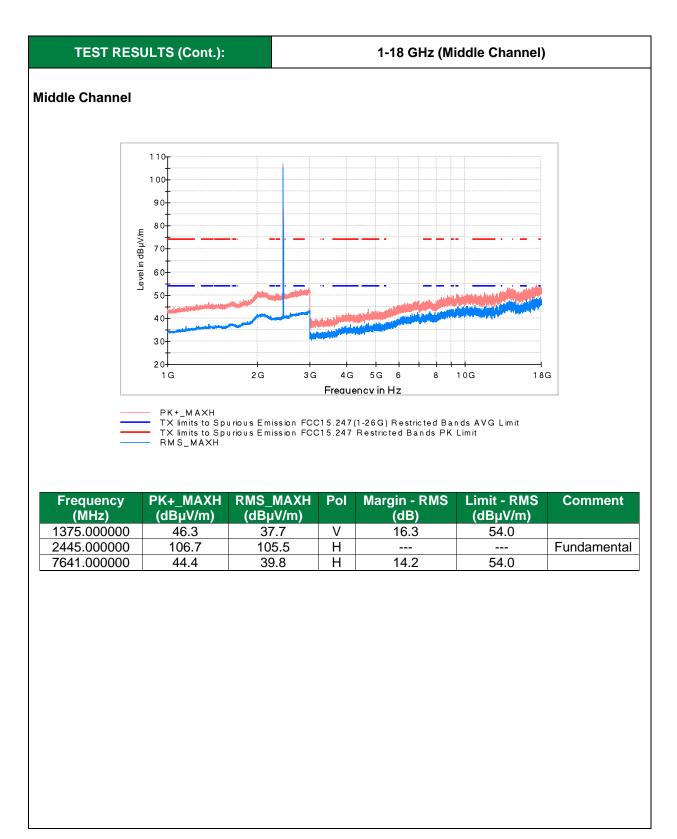
Lowest Channel



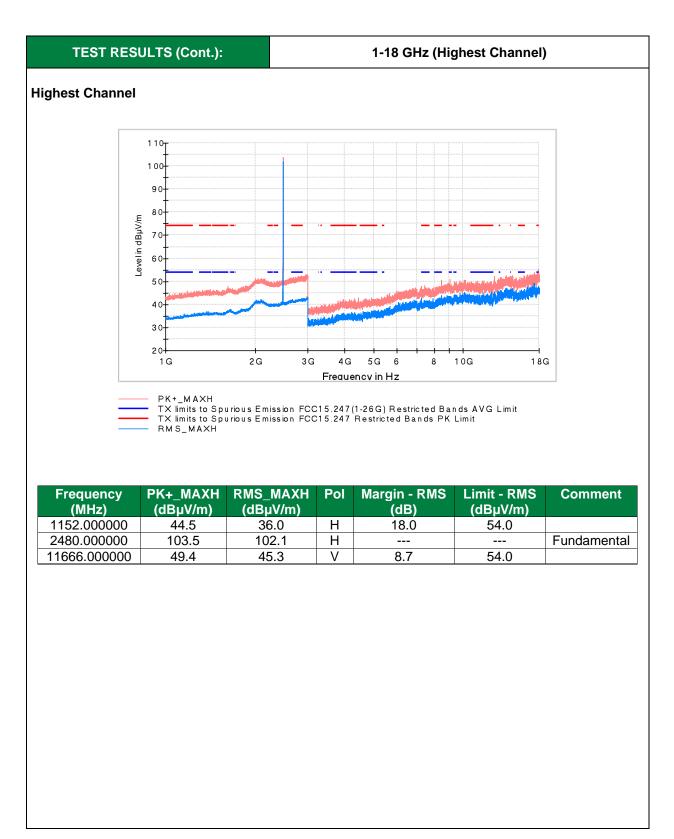
TX limits to Spurious Emission FCC15.247(1-26G) Restricted Bands AVG Limit TX limits to Spurious Emission FCC15.247 Restricted Bands PK Limit RMS_MAXH

Frequency (MHz)	PK+_MAXH (dBµV/m)	RMS_MAXH (dBµV/m)	Pol	Margin - RMS (dB)	Limit - RMS (dBµV/m)	Comment
1375.000000) 46.7	37.9	V	16.1	54.0	
2405.000000) 104.5	103.5	Н			Fundamental
9300.500000) 45.5	41.6	V	12.4	54.0	



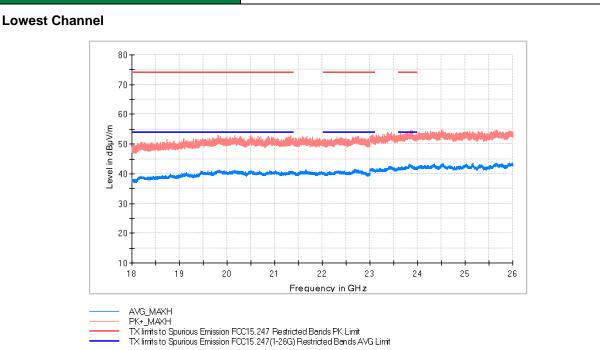








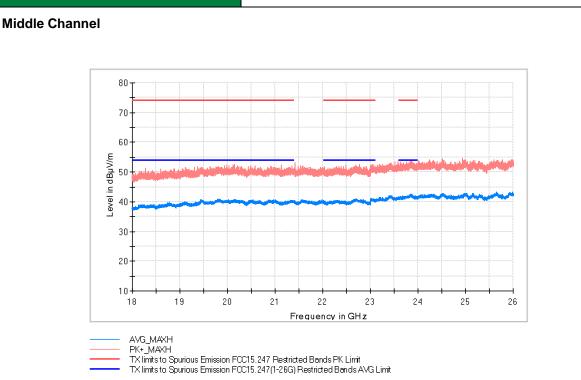




Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
19815.500000	52.9	40.9	Н	13.1	54.0
23041.500000	53.0	41.0	Н	13.0	54.0
23884.500000	54.6	42.4	V	11.6	54.0







	AVG_MAXH (dBuV/m)	Margin - AVG (dB)	Limi (dE

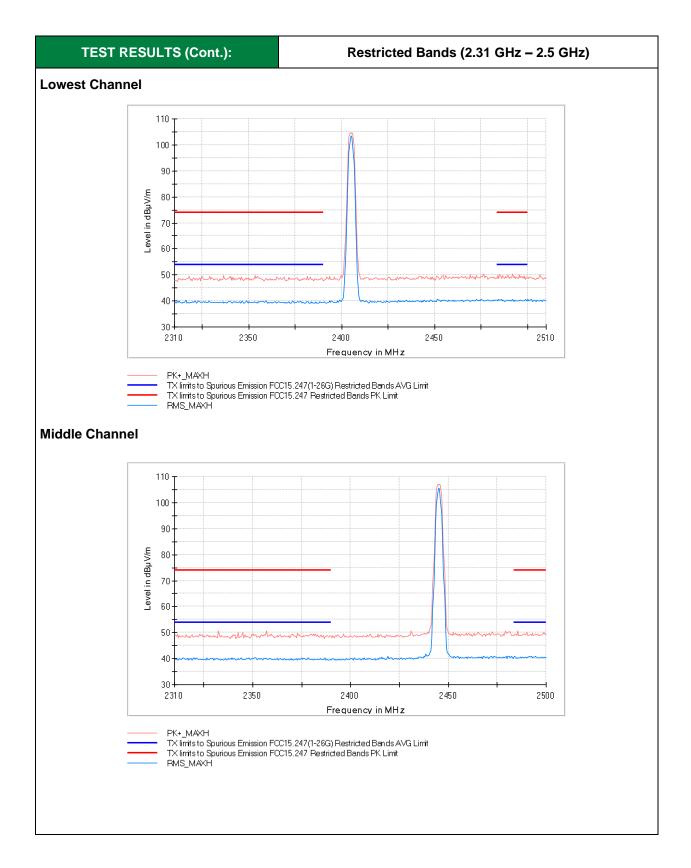
Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
19442.000000	51.3	40.8	Н	13.2	54.0
22773.500000	52.6	40.2	V	13.8	54.0
23842.000000	53.9	42.5	V	11.5	54.0



TEST RESULTS (Cont.): 18 – 26 GHz **Highest Channel** 80-70 60 Level in dBµV/m 05 30-20 10-19 20 21 22 23 24 25 26 18 Frequency in GHz AVG_MAXH PK+_MAXH TX limits to Spurious Emission FCC15.247 Restricted Bands PK Limit TX limits to Spurious Emission FCC15.247(1-26G) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
19435.000000	50.8	41.0	Н	13.0	54.0
23088.500000	50.4	41.4	V	12.6	54.0
23853.000000	51.6	42.5	Н	11.5	54.0







TEST RESULTS (Cont.): Restricted Bands (2.31 GHz - 2.5 GHz) **Highest Channel** 110 -100 90 Level in dBµ V/m 80-70-60 50 40 30-2350 2400 2450 2500 2310 Frequency in MHz PK+_MAXH TX limits to Spurious Emission FCC15.247(1-26G) Restricted Bands AVG Limit TX limits to Spurious Emission FCC15.247 Restricted Bands PK Limit RMS_MAXH