

	CC LISTED, REGISTRATION NUMBER: 2764.01	Test report No:			
ACCREDITED	SED LISTED REGISTRATION NUMBER: 23595-1	3751ERM.002A1			
Partia	l Test report				
CANADA Radio Frequency Devices. Operation with	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), F Exempt Local Area	requency Hopping Systems (FH Network (LE-LAN) Devices.	ISs) and License-			
(*) Identification of item tested	Battery Radiofrequency Module				
(*) Trademark	Visteon				
(*) Model and /or type reference tested	BRFM				
Other identification of the product	FCC ID: NT8-BRFM IC: 3043A-BRFM				
(*) Features	Wireless Battery Management				
Manufacturer	Visteon Corporation One Village Center Drive, Van E	Buren Township, MI 48111, USA.			
Test method requested, standard	for Compliance Measurements	z, and 5725 - 5850 MHz dition: Radiated emission limits; uary 2017). ch 2019). ance v05r02 (April 2019): Guidance on Digital Transmission Systems, ectrum System, and Hybrid System §15.247 of the FCC Rules			
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

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

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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
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 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 N <sup>o</sup>	Date of reception
3616/01	BRFM (MTF Radiated)	BRFM	112213300000003	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/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
3616/03	BRFM (MTF Conducted)	BRFM	112213300000002	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.



# Test sample description

Ports:				Cable			
	Port r	ame and description	Specified length [m]	Attached during test	Shielded	Coupled to patient	
	Main	connector/harness	60 cm			N/A	
						N/A	
						N/A	
						N/A	
Supplementary information to the ports	No Da	ata Provided	-	-	-	<u> </u>	
Rated power supply	Voltage and Frequency			Reference	e poles		
			L1	L2 L3	3 N	PE	
		AC:					
		AC:					
		DC: 5.4 V			·		
		DC:					
Rated Power:	Curre	nt in normal mode: 0.5 r	mA				
Clock frequencies:	40 Mł	Ηz					
Other parameters:	No Da	ata Provided					
Software version:	SWE	101-28371-000R04					
Hardware version:	VPPAMU-14B115-FA						
Dimensions in cm (W x H x D) :	810.43 mm X 266.80 mm						
Mounting position		Table top equipment					
	Wall/Ceiling mounted equipment						
		Floor standing equipm	ent				
		Hand-held equipment					
	$\square$	Other: Integrated in-sid	de electric v	ehicle batte	ry pack.		



Modules/parts:	Module/parts of test item	Туре	Manufacturer
	No Data Provided		
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_BRFM_July 12, 2022.pdf	06/12/2022
	Copy of marking pl	ate:	
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
3751ERM.002	08-11-2022	First release
3751ERM.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 3751ERM.002 related with the same samples, in the next clauses and sub-clauses:

Clauses/ Sub-Clauses	Modification	Justification
Page 9: List of equipment use	Included Conducted	Conducted results were
during the test	Measurements table	added in the test report
Pages 14-23: 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 3751ERM.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 :	Ρ
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
	lementary informatic requested.	on and remarks:		-	



# 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.2: EMISSION LIMITATIONS RADIATED (TRANSMITTER)	23



# **PRODUCT INFORMATION**

The following information is provided by the client

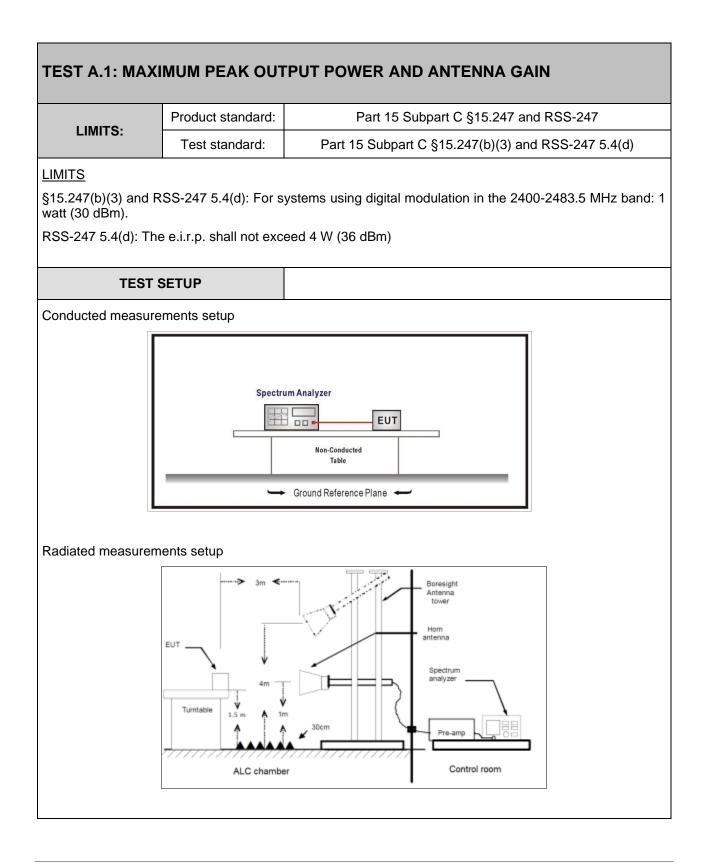
Description		
GFSK		
Non-adaptive equipment		
2405 – 2480 MHz		
2 MHz		
10 dBm		
Integrated chip antenna		
2.6 dBi		
5.4 V nominal		
DC Power supply		
Wireless Battery Management		
No		



# 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
TC#02 (Port 2)	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







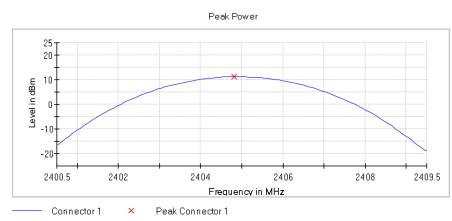
CONDUCTED TESTING			
TESTED SAMPLES: S/02			
TESTED CONDITIONS MODES:	TC#01		
TEST RESULTS:	PASS		

Maximum declared antenna gain: +2.6 dBi

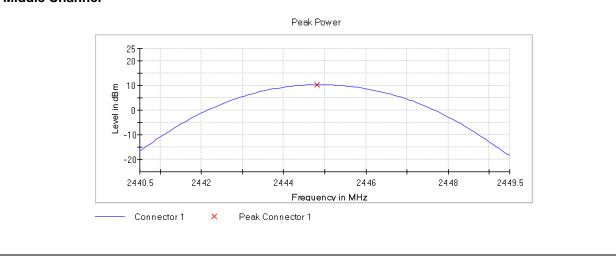
	Lowest frequency	Middle frequency	Highest frequency
	2405 MHz	2445 MHz	2480 MHz
Maximum conducted power (dBm)	11.2	10.5	10.4
Maximum EIRP power (dBm)	13.8	13.1	13.0

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





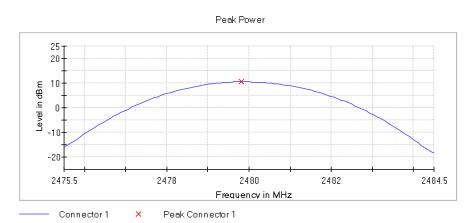




### TEST RESULTS (Cont.):

### 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	1.271 µs	1.271 µs	1.271 µs
Reference Level	20.000 dBm	20.000 dBm	20.000 dBm
Attenuation	35.000 dB	35.000 dB	35.000 dB
Detector	Max Peak	Max Peak	Max Peak
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	0.00 dB	0.01 dB	0.02 dB



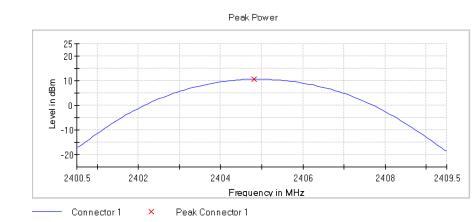
TESTED SAMPLES:	S/02
TESTED CONDITIONS MODES:	TC#02
TEST RESULTS:	PASS

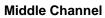
Maximum declared antenna gain: +2.6 dBi

	Lowest frequency	Middle frequency	Highest frequency
	2405 MHz	2445 MHz	2480 MHz
Maximum conducted power (dBm)	10.6	10.2	10.4
Maximum EIRP power (dBm)	13.2	12.8	13.0

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





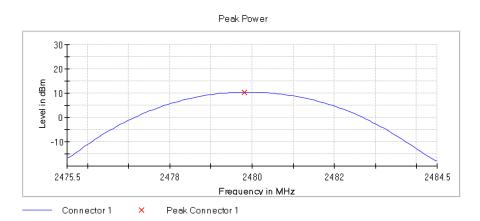




### TEST RESULTS (Cont.):

### 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	1.271 µs	1.271 µs	1.271 µs
Reference Level	20.000 dBm	20.000 dBm	20.000 dBm
Attenuation	35.000 dB	35.000 dB	35.000 dB
Detector	Max Peak	Max Peak	Max Peak
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	0.02 dB	0.00 dB	0.09 dB



RADIATED TESTING		
TESTED SAMPLE:	S/01	
TESTED CONDITION MODE:	Pre-scan to determine worst DUT orientation	
TEST RESULT:	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:

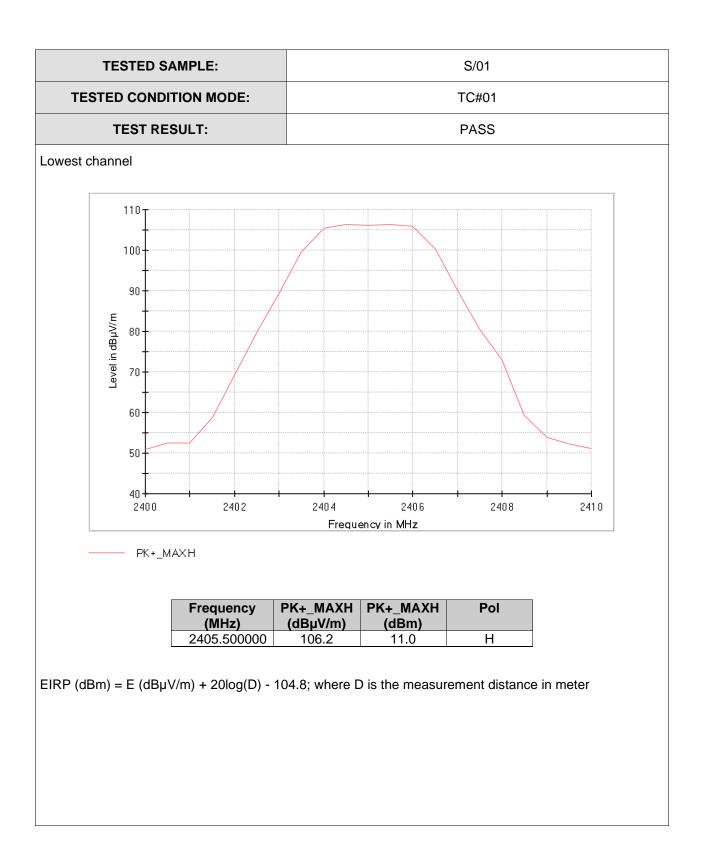
- Rotating the DUT from 0-360 degrees (turntable).
- Moving RX antenna from 1-4m in boresight mode according to ANSI 63.10 (horizon to 45 degrees).

DUT Orientation	PK+_MAXH (dBµV/m)	PK+_MAXH (dBm)
Orientation X*	106.2	11.0
Orientation Y	104.9	9.7
Orientation Z	103.7	8.5

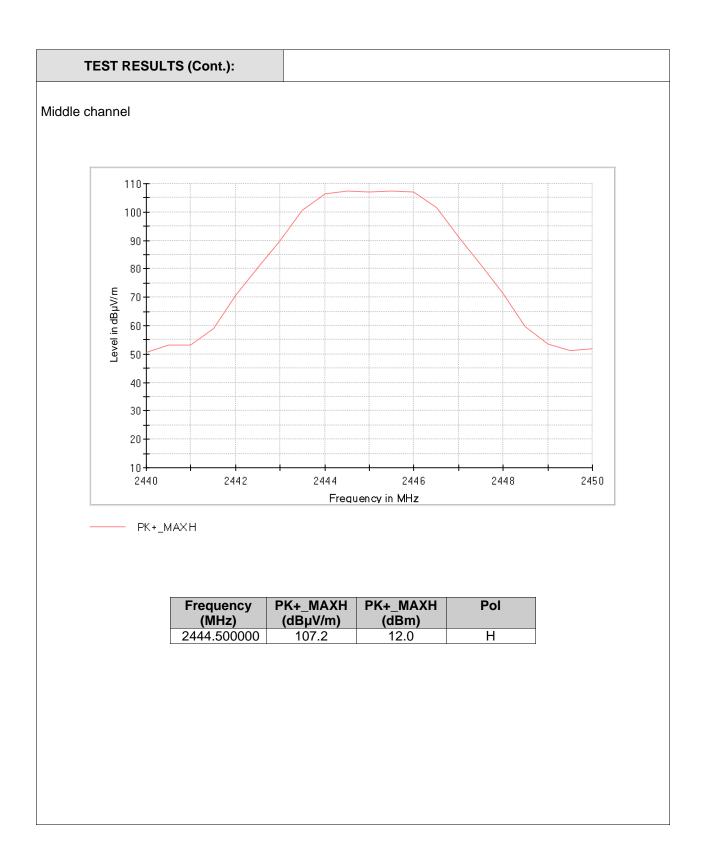
Orientation X	Orientation Y	Orientation Z

\* The following test results were based on the worst DUT orientation X and the worst case in test modes.

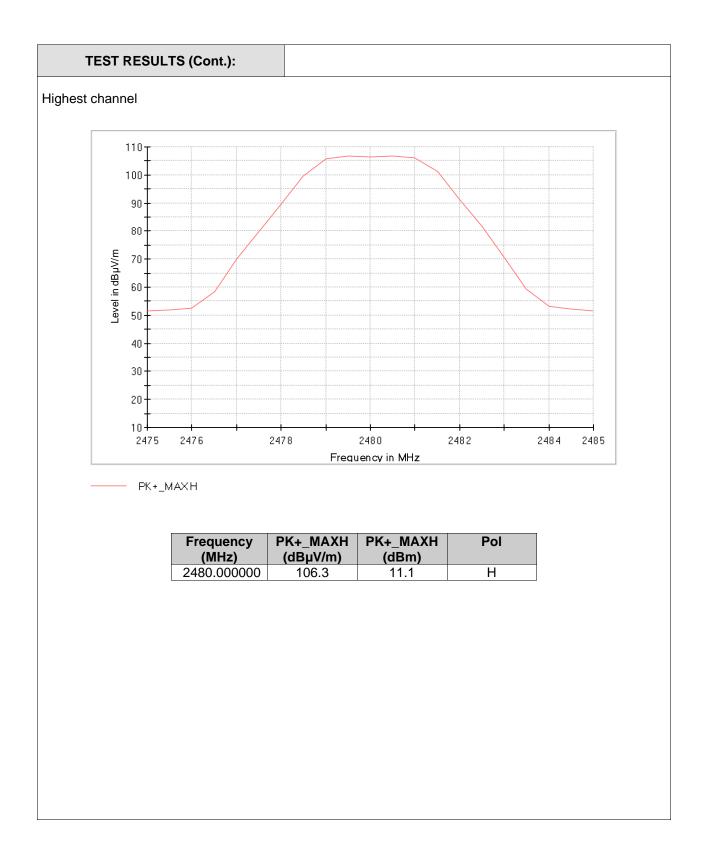














### TEST A.2: EMISSION LIMITATIONS RADIATED (TRANSMITTER)

	Product standard:	Part 15 Subpart C §15.247 and RSS-247		
LIMITO.	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 (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.

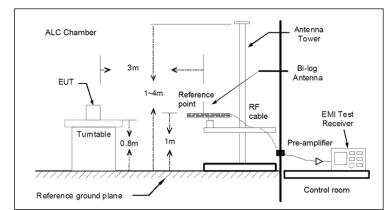
Measurements were made in both horizontal and vertical planes of polarization.

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.

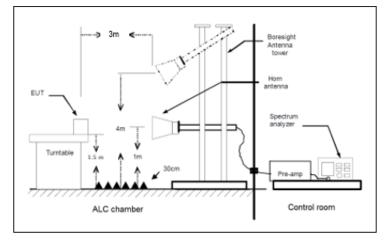


### **TEST SETUP (CONT.)**

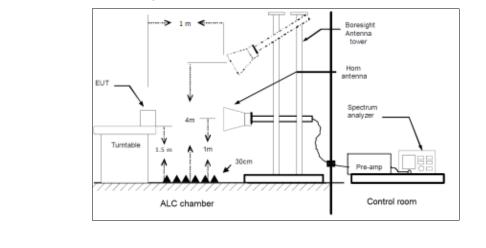




### Radiated measurements setup f > 1-18 GHz



### Radiated measurements setup f > 18 GHz





TESTED SAMPLE:	S/01
TESTED CONDITION MODE:	TC#01
TEST RESULT:	Pass

The preliminary test was performed in three different DUT orientations (X, Y and Z) in two test modes 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 maximum measured levels in the 1-26 GHz range including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz (see next plots).



