

ISED CABid: ES1909

Test Report No:
 NIE: 67442RRF.004

Test Report

USA FCC Part 15.247, 15.209

CANADA RSS-247, RSS-Gen

(*) Identification of item tested	Communications device
(*) Trademark	Ring LLC
(*) Model and /or type reference	5AT3T3
Other identification of the product	FCC ID: 2AEUPBHAXN001 IC: 20271-BHAXN001
(*) Features	--
Applicant	Ring LLC 1523 26th Street, Santa Monica, 90404, California, United States
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 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	IN COMPLIANCE
Approved by (name / position & signature)	José Manuel Gómez Industrial & Automotive EMC Lab. Manager
Date of issue	2021-08-26
Report template No	FDT08_23 (* "Data provided by the client")

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Competences and guarantees

DEKRA Testing and Certification S.A.U. is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

DEKRA Testing and Certification S.A.U. is an FCC-recognized accredited testing laboratory with the appropriate scope of accreditation that covers the performed test in this report.

DEKRA Testing and Certification S.A.U. is an ISED-recognized accredited testing laboratory, CABid: ES1909, with the appropriate scope of accreditation that covers the performed tests in this report.

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

DEKRA Testing and Certification S.A.U. 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 Testing and Certification S.A.U. at the time of performance of the test.

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

Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

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 of the model number 5AT3T3 is a communications device.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of result.

Usage of samples

Samples under test have been selected by: The client.

- Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Reception
67442/028	Communications Device	5AT3T3	GCB1ES0011360001	2021/05/03

Auxiliary elements used with the Sample S/01:

Control Nº	Description	Model	Serial Nº	Reception
67442/018	AC/DC Power Adapter	DSA-36PDB FUS	GB51PR011077003K	2021/04/13

Sample S/01 has undergone the test(s): The conducted tests indicated in the Appendix A.

- Sample S/02 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Reception
67442/017	Communications Device	5AT3T3	GCB1ES0012150057	2021/04/13

Auxiliary elements used with the Sample S/01:

Control Nº	Description	Model	Serial Nº	Reception
67442/020	AC/DC Power Adapter	DSA-36PDB FUS	GB51PR011077003M	2021/04/13

Sample S/02 has undergone the test(s): The radiated tests indicated in the Appendix A.

Test sample description

Ports..... :	Port name and description	Cable					
		Specified max length [m]	Attached during test	Shielded	Coupled to patient		
	<i>AC power port</i>	>3m	Yes	No			
	<i>USB power port</i>	<3m	Yes	Yes			
	<i>Ethernet ports</i>	>3m	Yes	No			
Supplementary information to the ports..... :							
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	X	AC: 110V (60Hz).	X			X	
	X	DC: 12V, 3A					
Rated Power	Not provided.						
Clock frequencies.....	Not provided.						
Other parameters	Not provided.						
Software version	Not provided.						
Hardware version	Not provided.						
Dimensions in cm (W x H x D)	Not provided.						
Mounting position	X	Table top equipment					
		Wall/Ceiling mounted equipment					
		Floor standing equipment					
		Hand-held equipment					
		Other:					
Modules/parts.....	Module/parts of test item			Type	Manufacturer		
Accessories (not part of the test item)	Description			Type	Manufacturer		
Documents as provided by the applicant	Description			File name	Issue date		

⁽³⁾ Only applicable to medical equipments.

Identification of the client

Ring LLC

1523 26th Street, Santa Monica, 90404, California, United States

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2021-04-21
Date (finish)	2021-05-09

Document history

Report number	Date	Description
67442RRF.004	2021-08-26	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. = 20 % Max. = 75 %

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

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %

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. = 20 % Max. = 75 %

Remarks and comments

The tests have been performed by the technical personnel: Daniel Mejías and Jaime Barranquero.

Used instrumentation:

Conducted Measurements:

	Last Calibration	Due Calibration
1. Spectrum Analyzer 9kHz-6GHz ROHDE AND SCHWARZ FSL6	2021/04	2023/04

Radiated Measurements:

	Last Calibration	Due Calibration
1. Semianechoic Absorber Lined Chamber VI ALBATROSS P29419	2020/01	2023/01
2. Shielded Room ALBATROSS PROJECTS GMBH P29419	N/A	N/A
3. Ultralog Antenna 30MHz-6GHz, ROHDE AND SCHWARZ HL562E_UPG	2019/10	2022/10
4. EMI Test Receiver 2Hz-44GHz, ROHDE AND SCHWARZ ESW44	2019/10	2021/10
5. Horn Antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2019/11	2022/11
6. Preamplifier 30 dB 500MHz-18GHz, SCHWARZBECK BBV 9718 C	2021/02	2022/02

Testing verdicts

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

Summary

A. Z-Wave Long Range.

FCC PART 15 PARAGRAPH / RSS-247			
Requirement – Test case		Verdict	Remark
FCC 15.247 (a)(2) / RSS-247 5.2. (a)	6 dB Bandwidth	P	
FCC 15.247 (b) / RSS-247 5.4. (d)	Maximum output power and antenna gain	P	
FCC 15.247 (d) / RSS-247 5.5.	Band-edge emissions compliance (Transmitter)	P	
FCC 15.247 (e) / RSS-247 5.2. (b)	Power spectral density	P	
FCC 15.247 (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	
<u>Supplementary information and remarks:</u>			
None.			

Appendix A: Test results. Z-Wave Long Range

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TEST CONDITIONS

(*) Declared by the Client.

POWER SUPPLY (*):

Vnominal: 110 Vac
Type of Power Supply: AC/DC Adapter.

ANTENNA (*):

Type of Antenna: Integral (stamped metal).
Maximum Declared Antenna Gain: +1.9 dBi

TEST FREQUENCIES (*):

Low Channel: 912 MHz
High Channel: 920 MHz

POWER SETTINGS (*):

Z-Wave Long Range setting is 248.

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and it is connected to the TS8997 using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



RADIATED MEASUREMENTS:

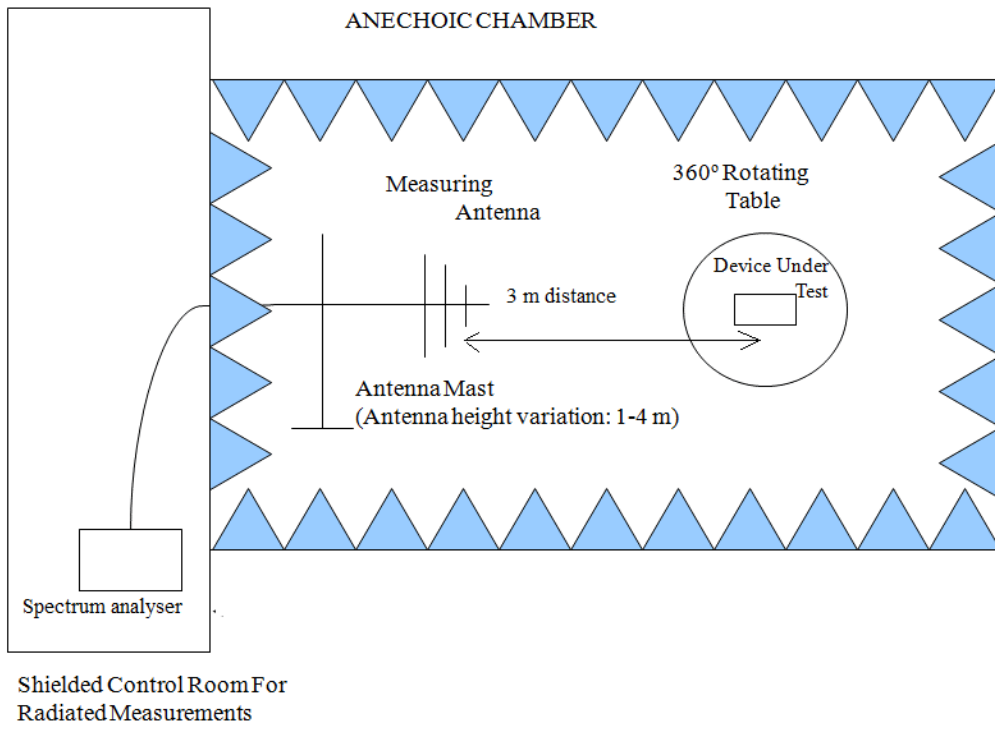
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Ultralog antenna for the range between 30 MHz to 1000 MHz and 1 GHz-10 GHz Double ridge horn antenna) is situated at a distance of 3 m.

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 (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

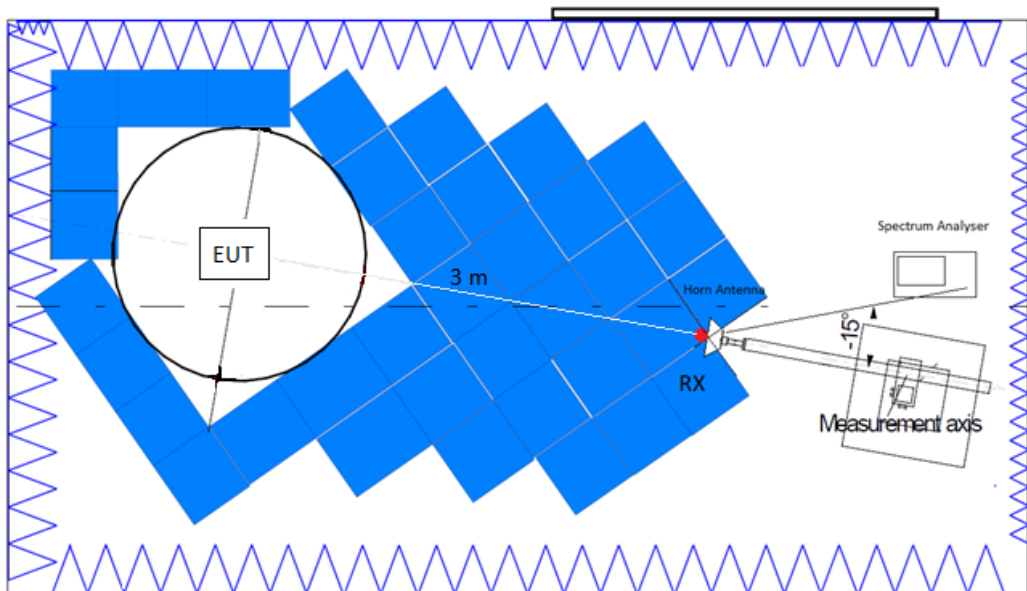
Measurements were made in both horizontal and vertical planes of polarization.

A resolution bandwidth/video bandwidth of 100 kHz/300 kHz was used for frequencies below 1 GHz and 1 MHz / 3 MHz for frequencies above 1 GHz.

Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 10 GHz:



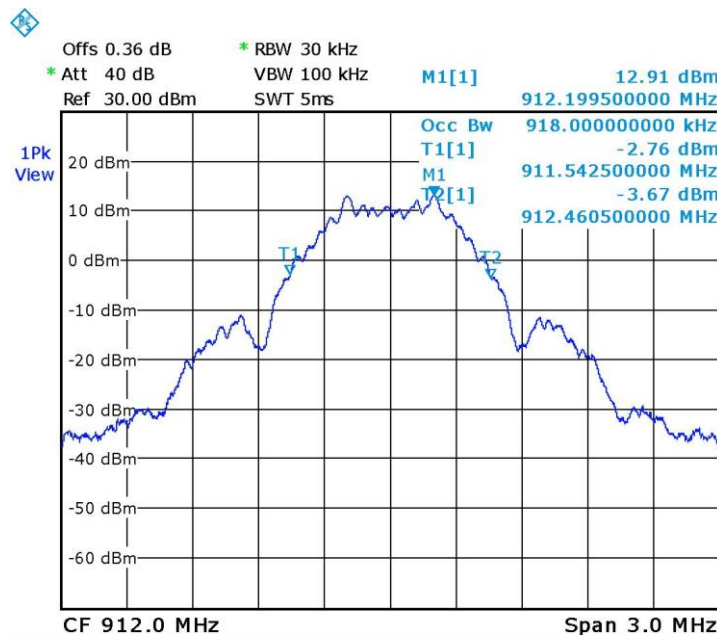
Occupied Bandwidth

RESULTS:

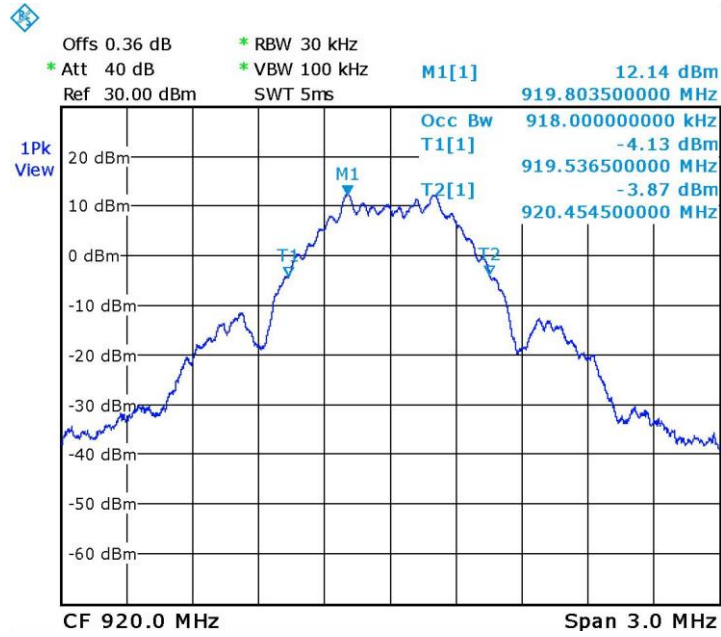
- Z-Wave Long Range:**

	Low Channel	High Channel
99% bandwidth (MHz)	0.918	0.918
Measurement uncertainty (%)	$<\pm 1.75$	

- Low Channel:



- High Channel:



FCC 15.247 (a)(2) / RSS-247 5.2. (a) 6 dB Bandwidth

SPECIFICATION:

The minimum 6 dB bandwidth shall be at least 500 kHz.

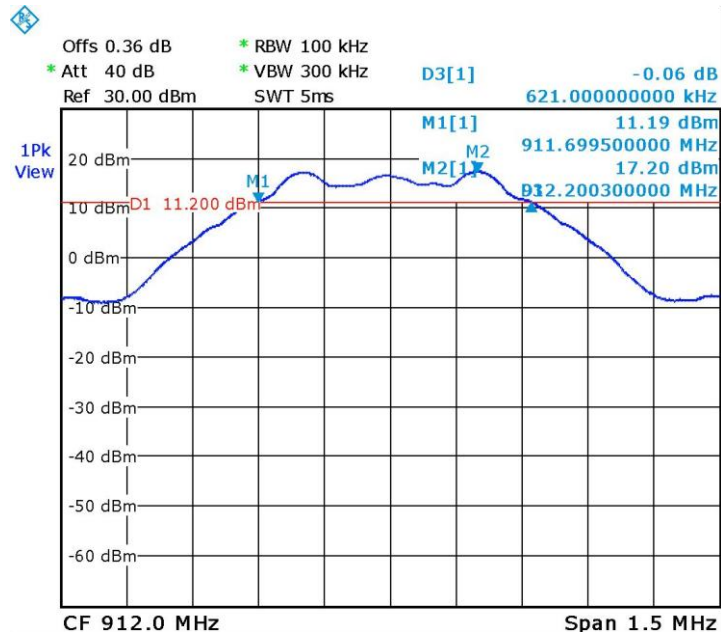
RESULTS:

- Z-Wave Long Range:**

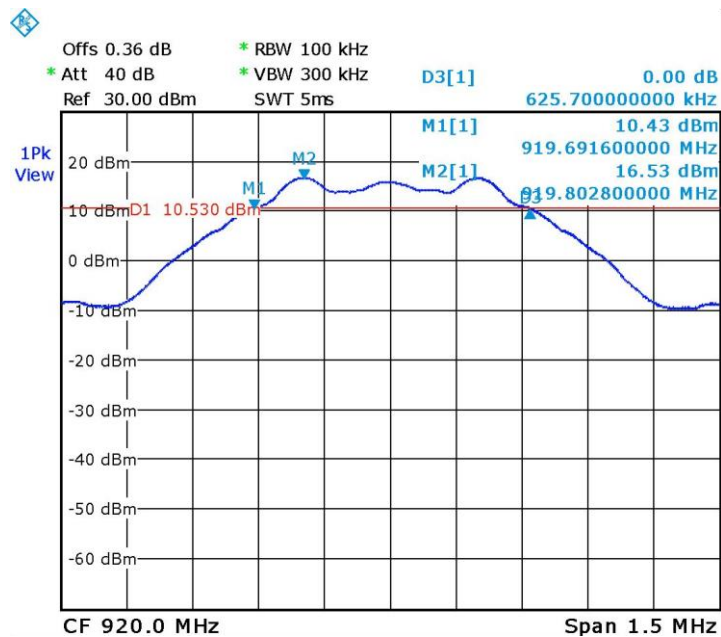
	Low Channel	High Channel
6 dB Spectrum bandwidth (kHz)	621	625.7
Measurement uncertainty (%)	<±0.88	

Verdict: PASS

- Low Channel:



- High Channel:



FCC 15.247 (b) / RSS-247 5.4. (d) Maximum Output Power and Antenna Gain

SPECIFICATION:

For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt (30 dBm).
 The e.i.r.p. shall not exceed 4 W (36 dBm) (Canada).

RESULTS:

The maximum peak conducted output power level in the fundamental emission was measured using the method according to point 11.9.1.1 "RBW ≥ DTS bandwidth" of ANSI C.63.10-2013.

The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

Maximum Declared Antenna Gain: +1.9 dBi

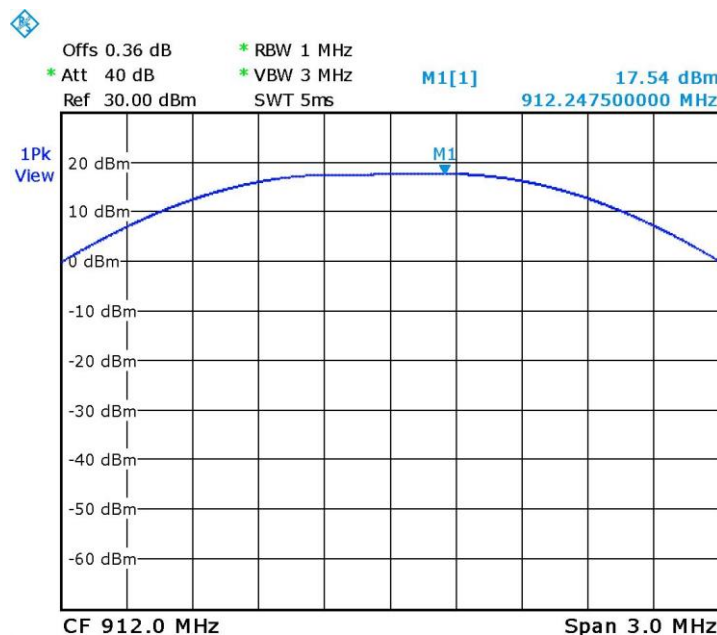
• **Z-Wave Long Range:**

	Low Channel	High Channel
Maximum Conducted Power (dBm)	17.54	16.88
Maximum EIRP Power (dBm)	19.44	18.78
Measurement uncertainty (dB)	<±2.06	

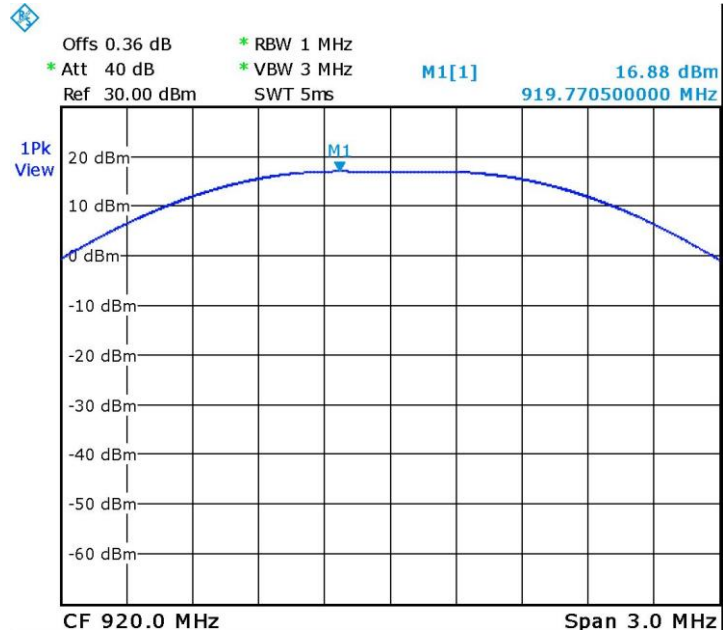
The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

Verdict: PASS

- Low Channel:



- High Channel:



FCC 15.247 (d) / RSS-247 5.5. Band-Edge Emissions Compliance (Transmitter)

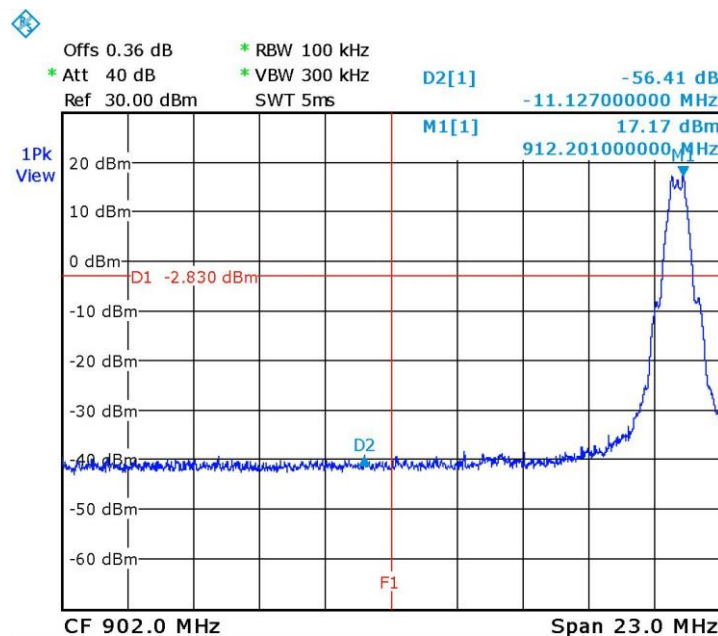
SPECIFICATION:

In any 100 kHz bandwidths outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

RESULTS:

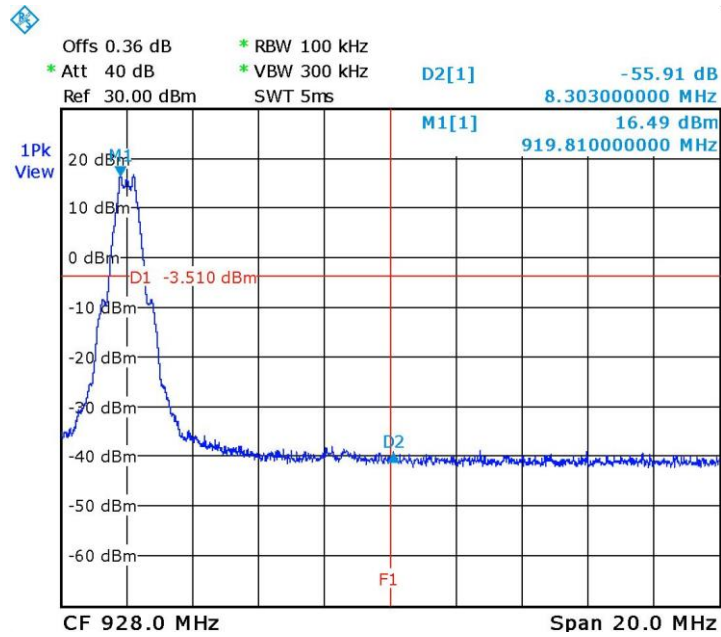
- Z-Wave Long Range:**

- Low Channel:



Measurement uncertainty (dB)	<±1.53
------------------------------	--------

- High Channel:



Measurement uncertainty (dB)	<±1.53
------------------------------	--------

Verdict: PASS

FCC 15.247 (e) / RSS-247 5.2. (b) Power Spectral Density

SPECIFICATION:

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS:

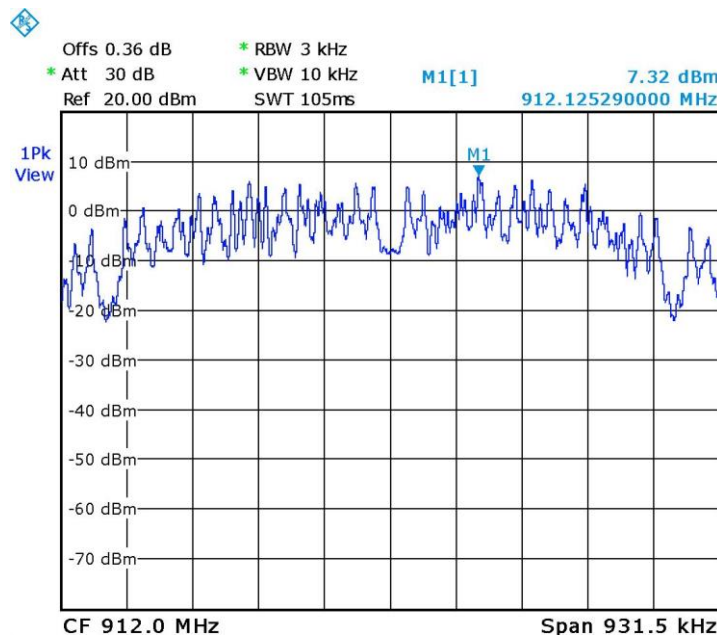
The maximum power spectral density level in the fundamental emission was measured using the method according to point 11.10.2." Method PKPSD (peak PSD)" of ANSI C.63.10-2013.

- Z-Wave Long Range:**

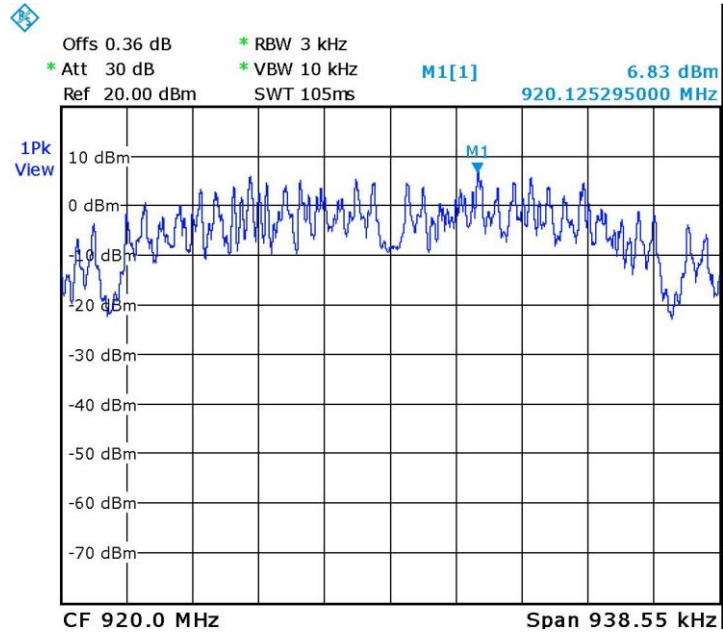
	Low Channel	High Channel
Power Spectral Density (dBm)	7.32	6.83
Measurement uncertainty (dB)	<±2.06	

Verdict: PASS

- Low Channel:



- High Channel:



FCC 15.247 (d) / RSS-247 5.5. Emission Limitations Radiated (Transmitter)

SPECIFICATION:

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

Frequency Range (MHz)	Field strength ($\mu\text{V}/\text{m}$)	Field strength ($\text{dB}\mu\text{V}/\text{m}$)	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 - 10000	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.

RSS-247: Attenuation below the general field strength limits specified in RSS-Gen is not required.

RESULTS:

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.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-10 GHz.

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.

RADIATED:

Frequency range 30 MHz - 1 GHz:

LOW CHANNEL:

Spurious frequencies detected at less than 20 dB below the limit:

Spurious Frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
249.996	36.64	V	Quasi-Peak

Measurement Uncertainty (dB) $<\pm 5.1$

HIGH CHANNEL:

Spurious frequencies detected at less than 20 dB below the limit:

Spurious Frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
249.996	36.93	V	Quasi-Peak

Measurement Uncertainty (dB) $<\pm 5.1$

Frequency range 1 - 10 GHz:

The results in the next tables show the maximum measured levels in the 1-10 GHz range (see next plots).

Spurious frequencies with peak levels above the average limit (54 dBµV/m at 3 m) are measured with average detector for checking compliance with the average limit.

- LOW CHANNEL. Spurious frequencies detected closest to the limit:

Spurious frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
3648.750000	44.86	H	Peak
3687.500000	42.29	H	Peak
3750.000000	44.48	H	Peak
3812.500000	43.43	H	Peak
4031.500000	43.23	H	Peak
6000.000000	44.73	V	Peak
6250.250000	45.59	V	Peak
8750.500000	50.73	V	Peak

- HIGH CHANNEL. Spurious frequencies detected closest to the limit:

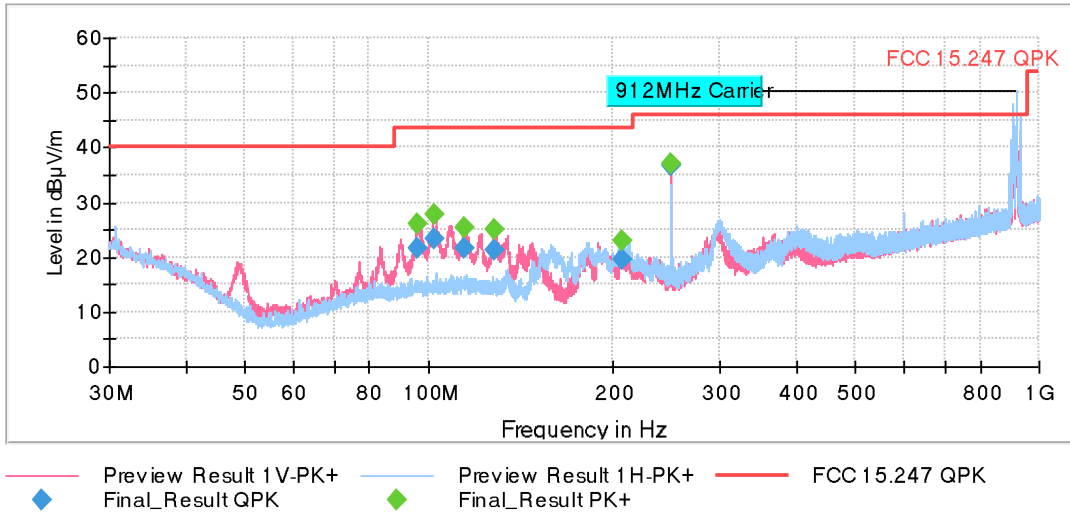
Spurious frequency (MHz)	Emission Level (dB μ V/m)	Polarization	Detector
3687.750000	42.83	H	Peak
3750.250000	43.86	V	Peak
3812.500000	43.08	H	Peak
6250.250000	46.19	V	Peak
8750.750000	50.58	V	Peak

Measurement Uncertainty (dB): $\leq \pm 4.6$ for $1 < f < \leq 17$ GHz

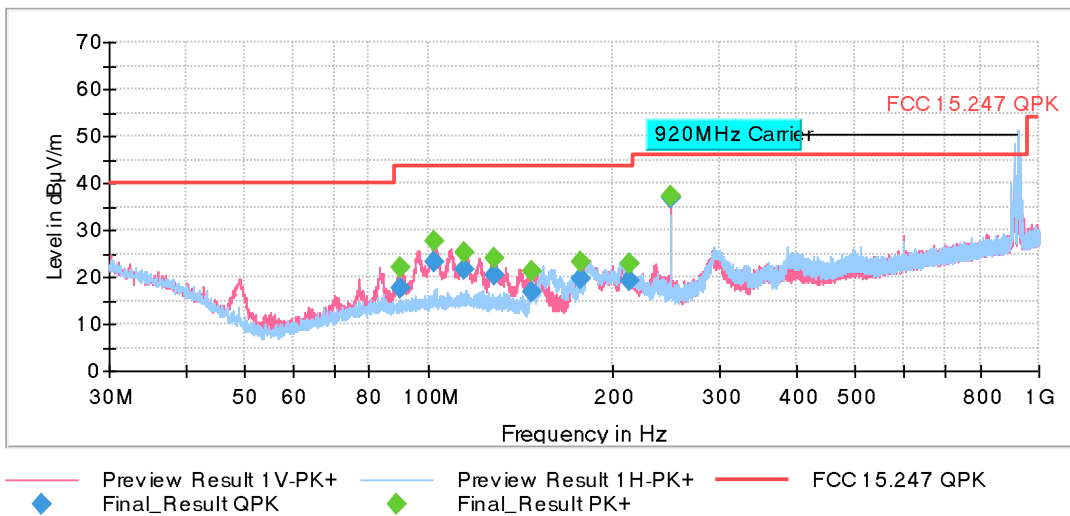
Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz:

- Low Channel:

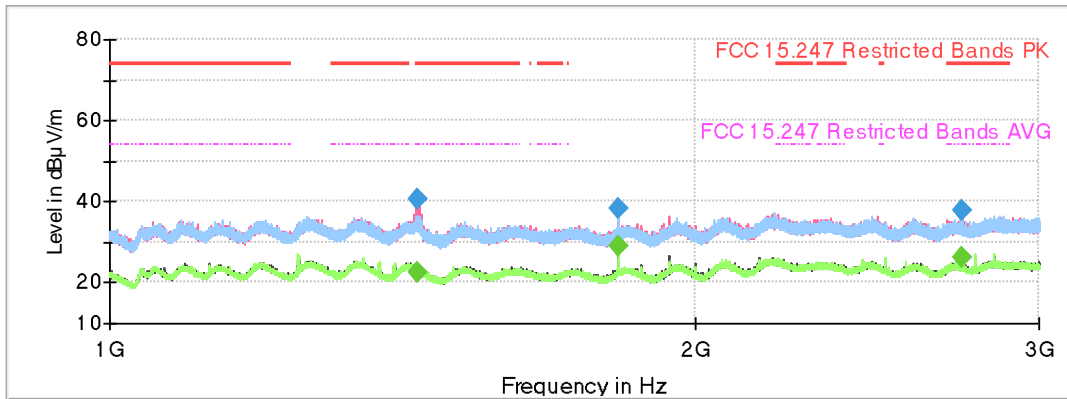


- High Channel:



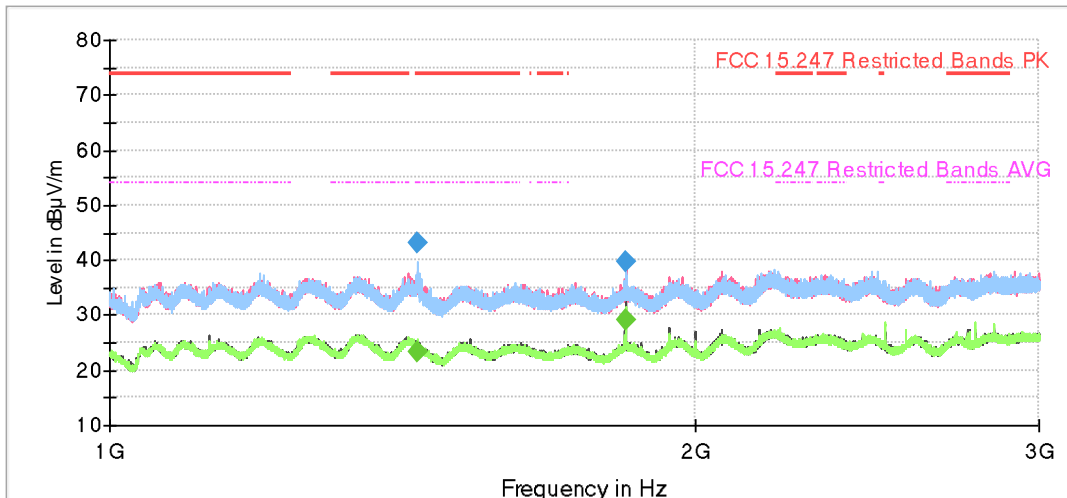
FREQUENCY RANGE 1 - 3 GHz:

- Low Channel:



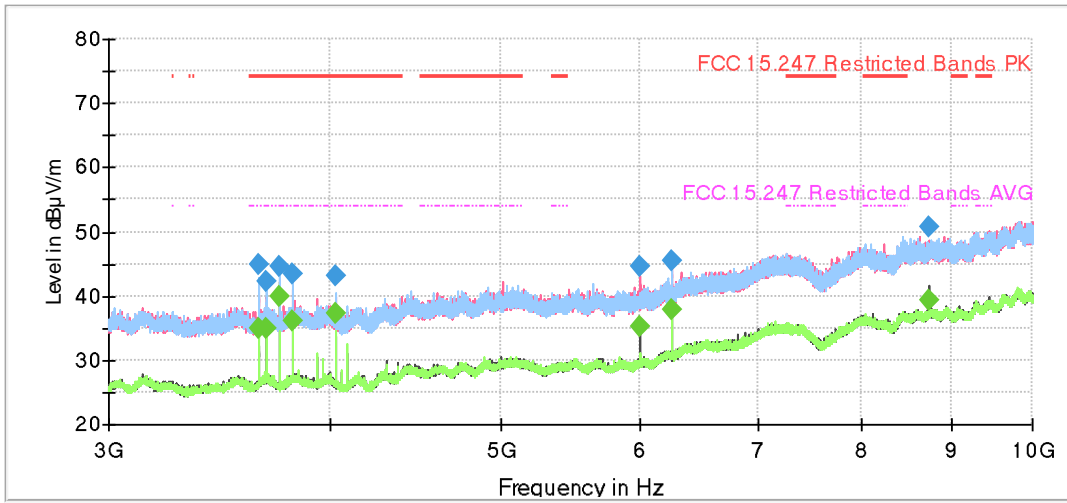
- Preview Result 2V-AVG
- Preview Result 2H-AVG
- Preview Result 1V-PK+
- Preview Result 1H-PK+
- ◆ Final_Result PK+
- ◆ Final_Result AVG
- FCC 15.247 Restricted Bands PK
- FCC 15.247 Restricted Bands AVG

- High Channel:



FREQUENCY RANGE 3 - 10 GHz:

- Low Channel:



- High Channel:

