

ISED CABid: ES1909

Test Report No:
NIE: 67442RRF.005

Test Report

USA FCC Part 15.249, 15.209

CANADA RSS-210, 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 15.249 (10-1-20 Edition): Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, 5725 - 5875 MHz, and 24.0 – 24.25 GHz. USA FCC Part 15.209 (10-1-20 Edition): Radiated emission limits; general requirements. CANADA RSS-210 Issue 10 (December 2019). CANADA RSS-Gen Issue 5 Amendment 1 (March 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.

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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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1. This report is only referred to the item that has undergone the test.
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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 undergoing test have been selected by: The client.

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

Control N°	Description	Model	Serial N°	Reception
67442/017	Communications Device	5AT3T3	GCB1ES0012150057	2021/04/13

Auxiliary elements used with the Sample S/01:

Control N°	Description	Model	Serial N°	Reception
67442/020	AC/DC Power Adapter	DSA-36PDB FUS	GB51PR011077003M	2021/04/13

Sample S/01 has undergone the test(s): The 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		
	AC power port	>3m	Yes	No			
	USB power port	<3m	Yes	Yes			
	Ethernet ports	>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 for Medical Equipment

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)	2021-05-07

Document history

Report number	Date	Description
67442RRF.005	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, Jaime Barranquero and Antonio Manuel Sánchez.

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

1. Z-Wave Classic.

FCC PART 15 PARAGRAPH / RSS-210			
Requirement – Test case		Verdict	Remark
15.249 (a) / RSS-210 B.10 (a)	Field strength of fundamental and harmonic emissions	P	
15.249 (d) / RSS-210 B.10 (b)	Emissions radiated outside of the specific frequency bands	P	
<u>Supplementary information and remarks:</u> None.			

Appendix A: Test results. Z-Wave Classic

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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 AND POWER SETTINGS:

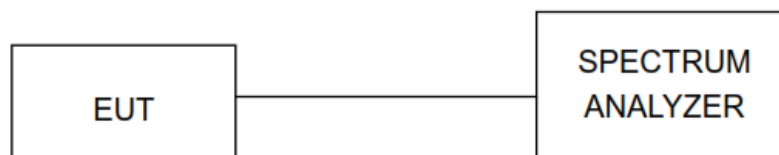
Z-wave 40 kBit/s FSK Lowest Channel: 908.40 MHz
Z-wave 100 kBit/s GFSK Highest Channel: 916 MHz

POWER SETTINGS (*):

Z-Wave Classic setting is 18.

CONDUCTED MEASUREMENTS:

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



RADIATED MEASUREMENTS:

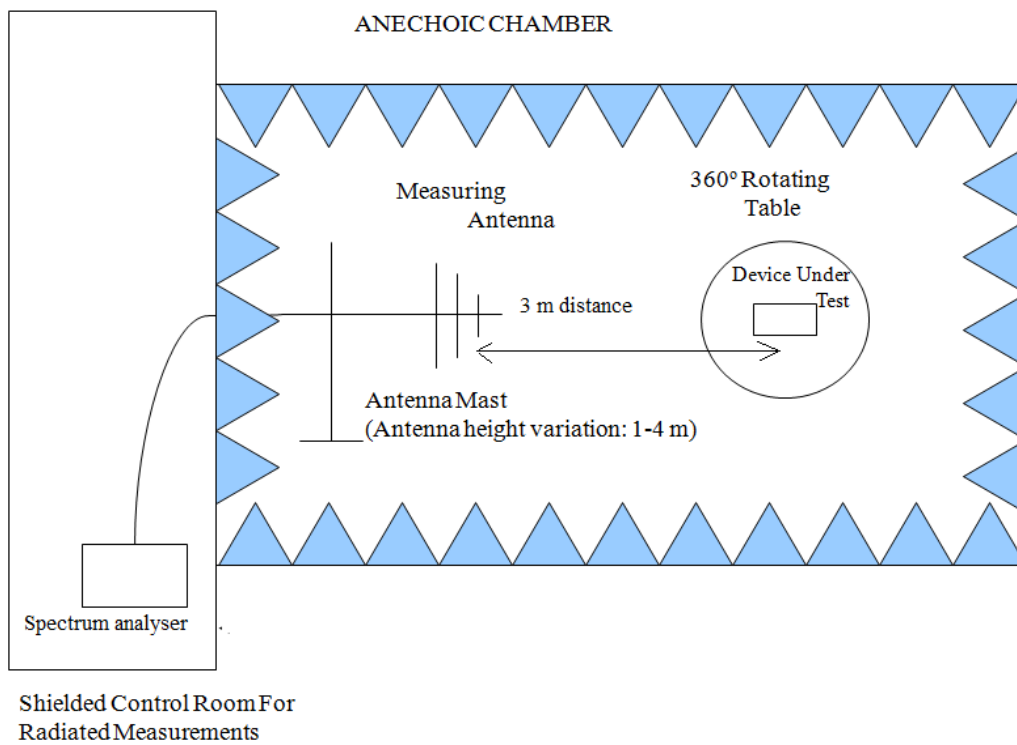
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz and 1 GHz-10 GHz Double ridge horn antenna) is situated at a distance of 3 m.

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.

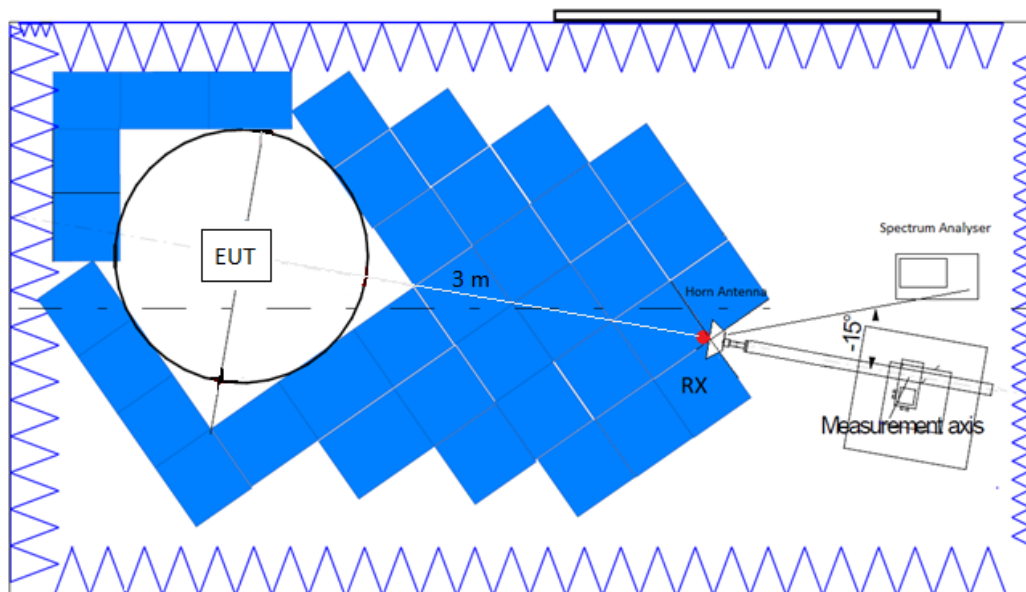
Measurements were made in both horizontal and vertical planes of polarization.

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 $f < 1$ GHz:



Radiated measurements setup from 1 GHz to 10 GHz:



Occupied Bandwidth

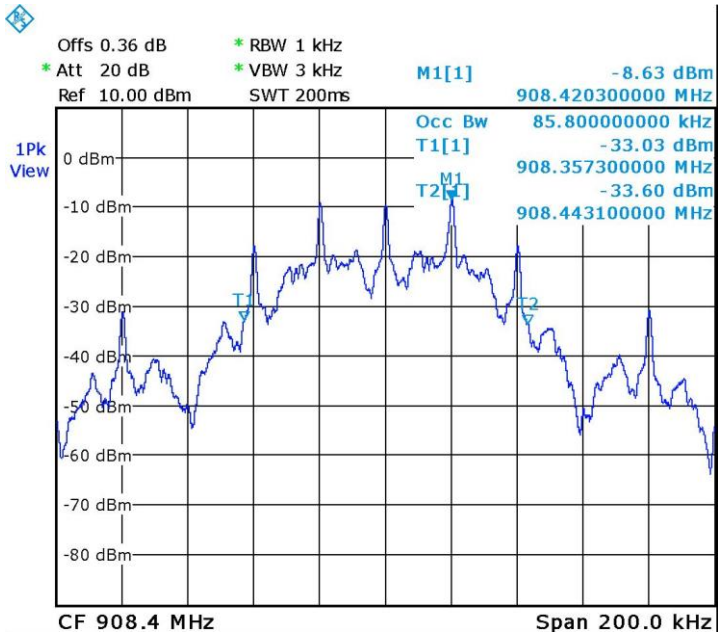
RESULTS:

• Z-Wave:

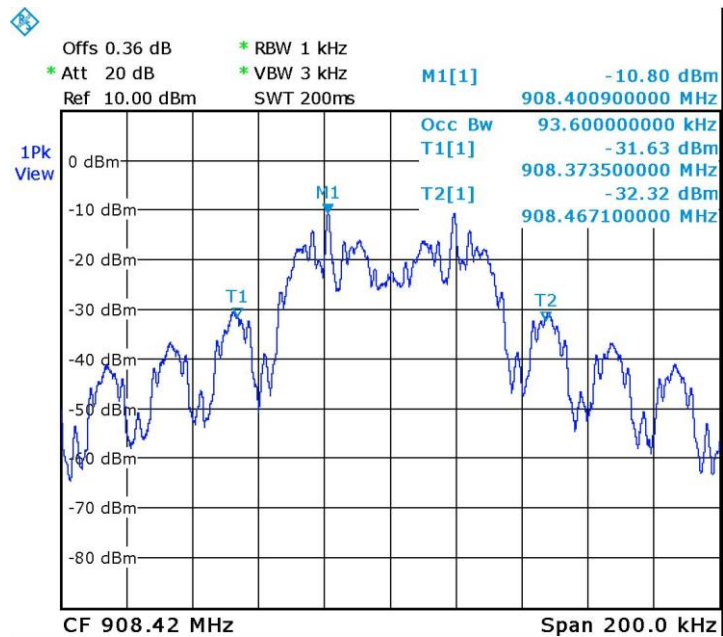
	40 kBit/s-FSK Lowest Channel	100 kBit/s-GFSK Highest Channel
99% Bandwidth (kHz)	85.8	114.5
Measurement Uncertainty (kHz)	<±3.64	

Verdict: PASS

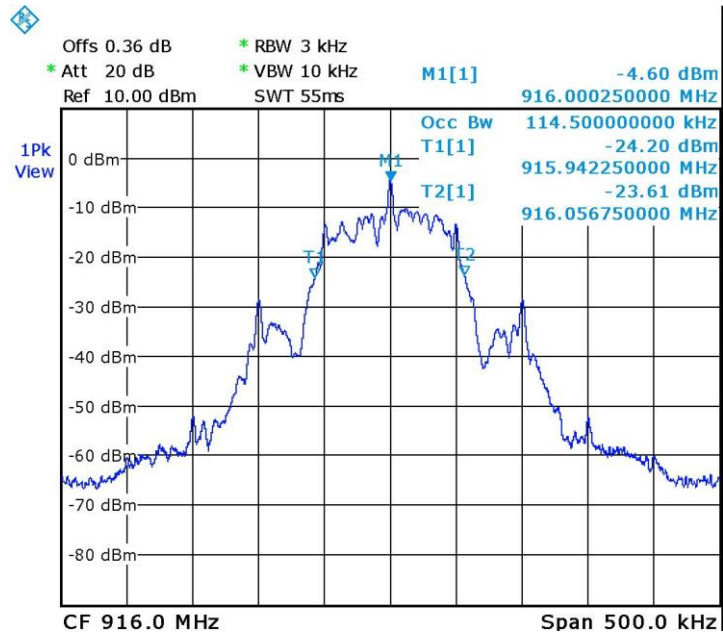
- Low Channel:



- Middle Channel:



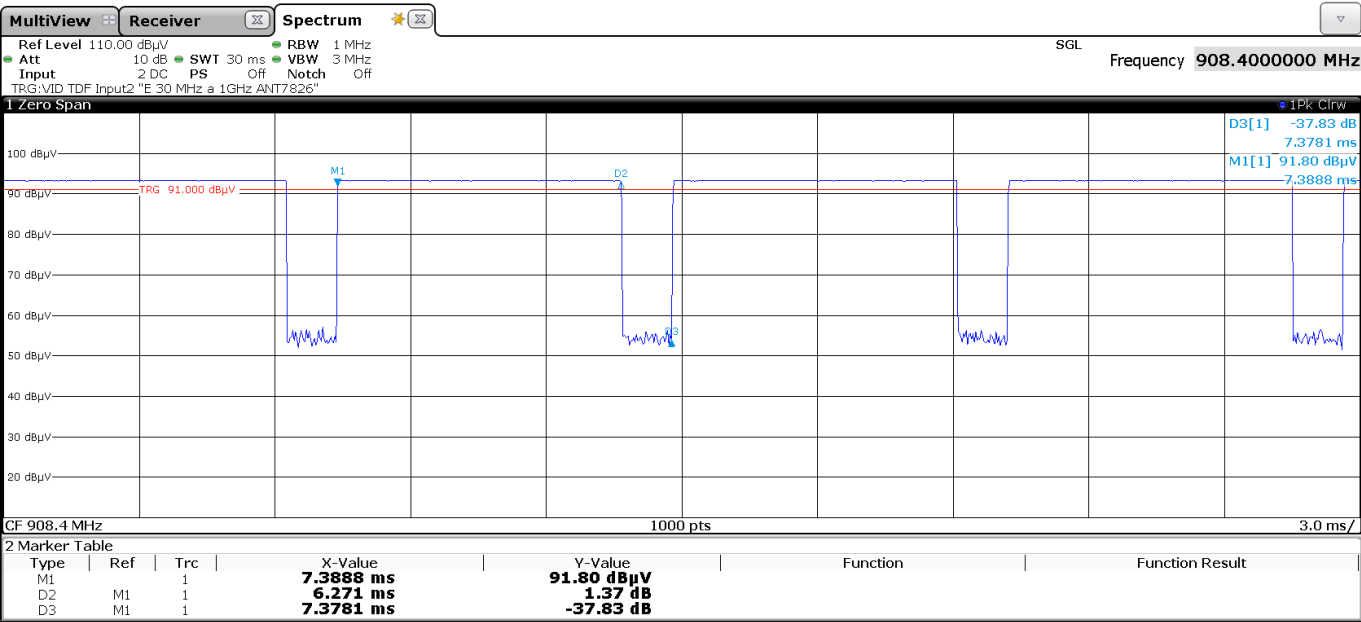
- High Channel:



Duty Cycle

- Z-Wave:
- 40 kBit/s-FSK:

Computation of Duty Cycle Correction factor:



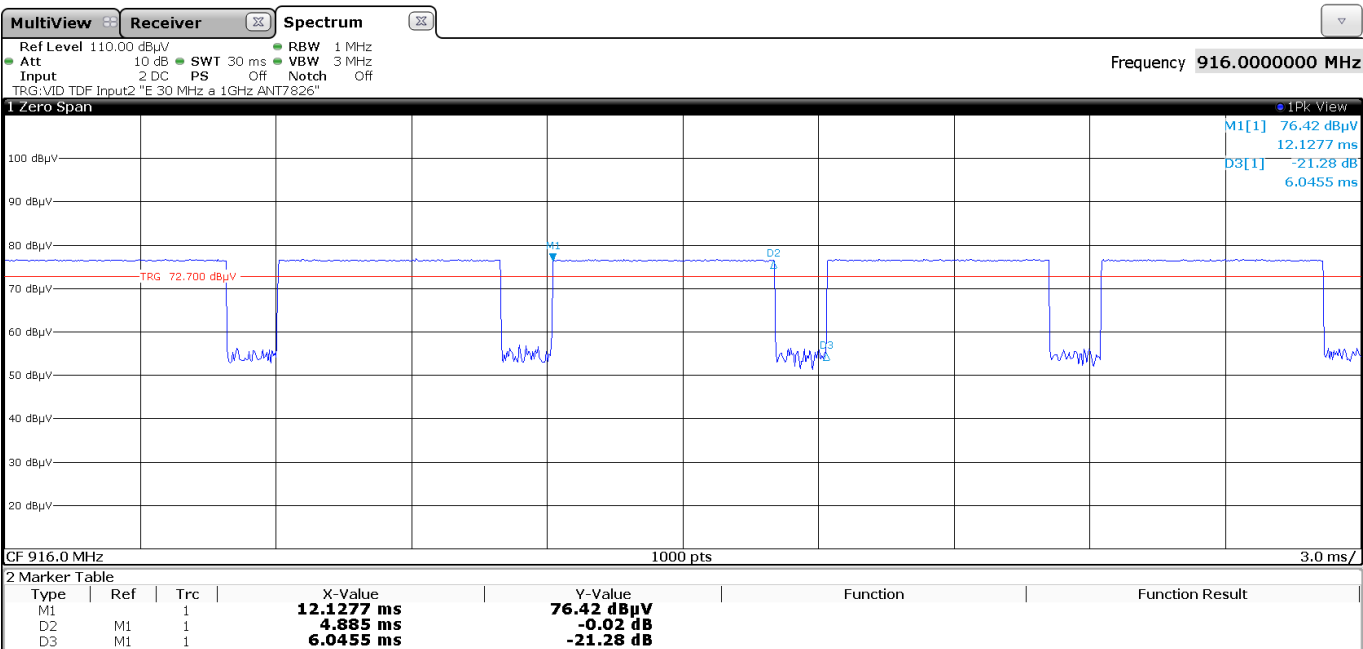
Note: Zoom.

Duty Cycle Correction factor calculation:

Pulse Duration (ms)	Period (ms)	Duty Cycle Correction (dB)
85	100	1.412

- 100 kBit/s-GFSK:

Computation of Duty Cycle Correction factor:



Note: Zoom.

Duty Cycle Correction factor calculation:

Pulse Duration (ms)	Period (ms)	Duty Cycle Correction (dB)
80.804	100	1.851

15.249 (a) / RSS-210 B.10 (a) Field strength of fundamental and harmonics emissions

SPECIFICATION:

The field strength of emissions from intentional radiators shall comply with the following:

Fundamental frequency (MHz)	Field strength of fundamental (mV/m)	Field strength (dBµV/m)	Measurement distance (m)
902 - 928	50	93.98	3
2400 – 2483.5	50	93.98	3
5725 - 5875	50	93.98	3
24000-24250	250	107.96	3

For frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

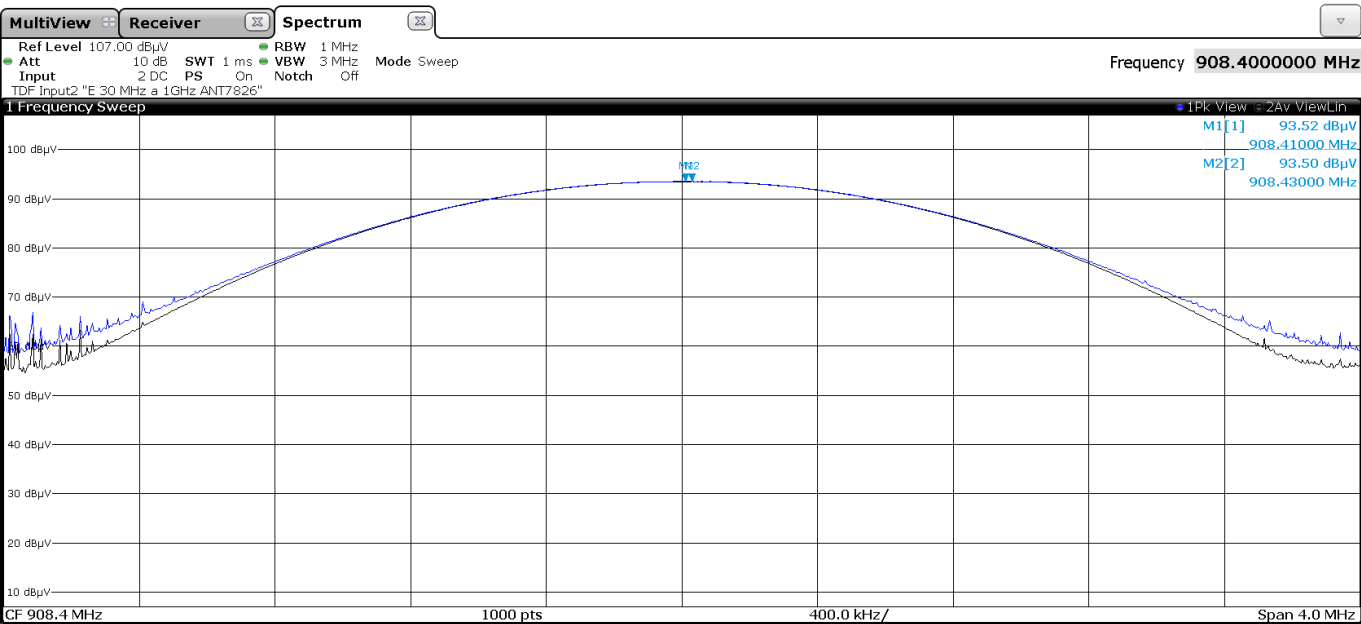
RESULTS:

• Z-Wave:

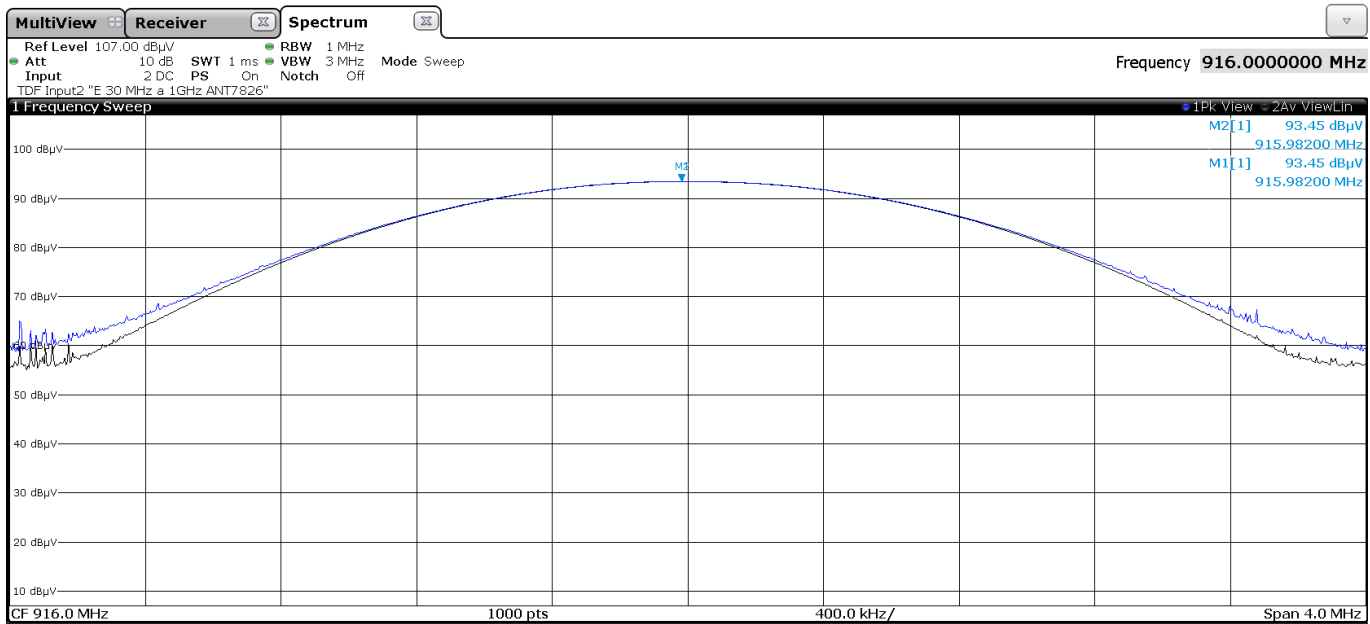
	Low Channel	High Channel
Field Strength (dBµV/m) Peak	93.52	93.45
Duty Cycle Correction factor δ (dB)	-1.412	-1.851
Field Strength (dBµV/m) Average	92.108	91.599
Measurement Uncertainty (dB)	<±4.11	

Verdict: PASS

- Low Channel:



- High Channel:



15.249 (d) / RSS-210 B.10 (b) Emissions radiated outside of the specific frequency bands

SPECIFICATION:

The field strength of harmonics from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of harmonics ($\mu\text{V/m}$)	Field strength of harmonics ($\text{dB}\mu\text{V/m}$)	Measurement distance (m)
902 - 928	500	54	3
2400 – 2483.5	500	54	3
5725 - 5875	500	54	3
24000-24250	2500	67.96	3

Emissions radiated outside of the specific frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of fundamental or to the general radiated emission limits specified in section 15.209:

Frequency Range (MHz)	Field strength ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	Measurement distance (m)
0.009-0.490	$2400/F(\text{kHz})$	-	300
0.490-1.705	$24000/F(\text{kHz})$	-	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

Whichever is the lesser attenuation.

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.

Frequency range 30 MHz - 1 GHz:

Z-wave 40 kBit/s FSK Lowest Channel:

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

Spurious frequency (MHz)	Emission Level (dBμV/m)	Polarization	Detector
95.863	24.45	V	Quasi-Peak
249.996	35.97	H	Quasi-Peak

Measurement Uncertainty (dB) $< \pm 5.1$

Z-wave 100 kBit/s GFSK Highest Channel:

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

Spurious frequency (MHz)	Emission Level (dBμV/m)	Polarization	Detector
95.863	25.31	V	Quasi-Peak
249.996	36.06	H	Quasi-Peak

Measurement Uncertainty (dB) $< \pm 5.1$

Verdict: PASS

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 signals with peak levels above the average limit (54 dB μ V/m at 3 m) are measured with average detector for checking compliance with the average limit.

Z-wave 40 kBit/s FSK Lowest Channel:

Spurious frequencies detected closest to the limit:

Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector
3.750	42.22	V	Peak
	37.99		Average

Z-wave 100 kBit/s GFSK Highest Channel:

Spurious frequencies detected closest to the limit:

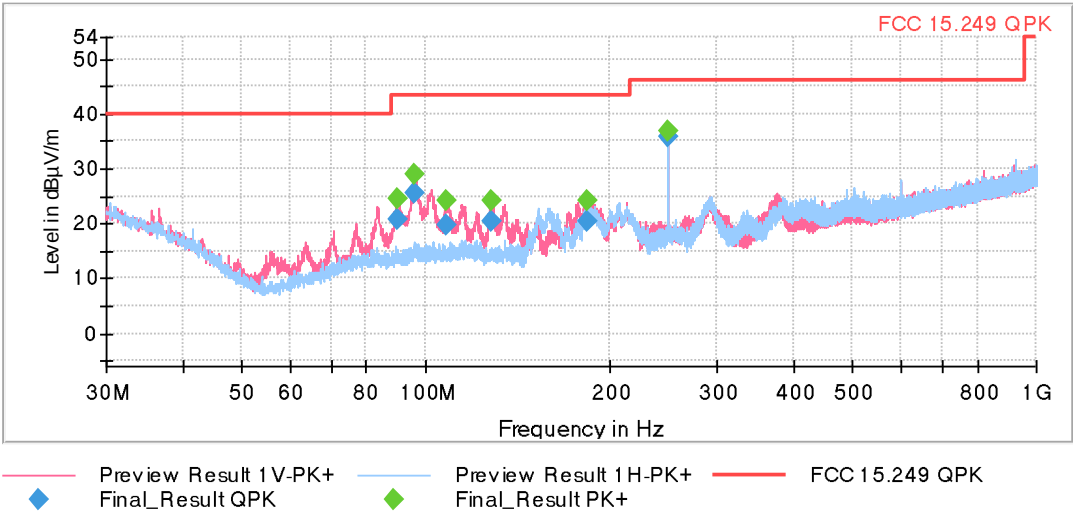
Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector
3.750	43.20	V	Peak
	37.34		Average

Measurement Uncertainty (dB): $\leq \pm 4.6$ for $1 \leq f \leq 10$ GHz

Verdict: PASS

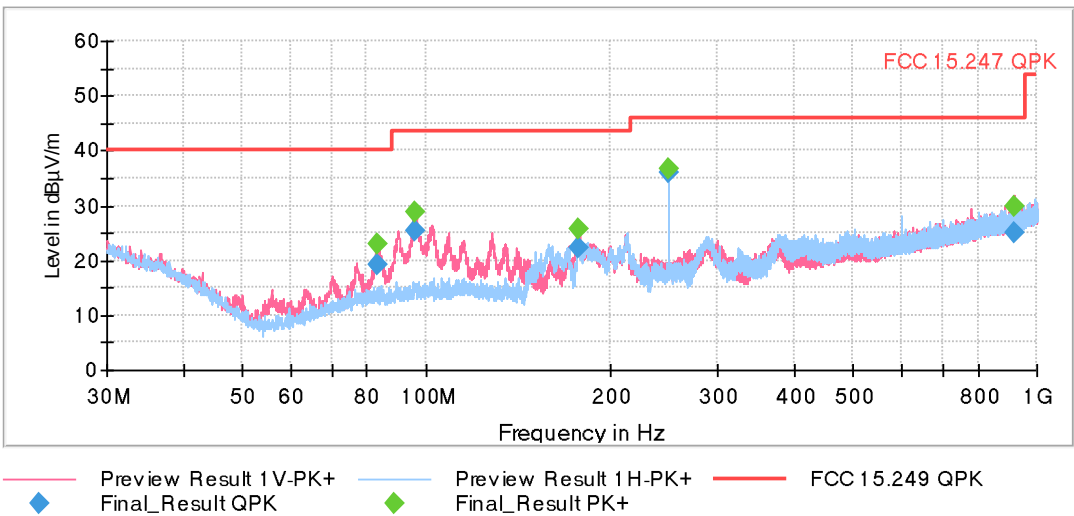
FREQUENCY RANGE 30 MHz - 1 GHz (worst-case):

Z-wave 40 kBit/s FSK Lowest Channel:



Note: The carrier was attenuated using a Notch filter.

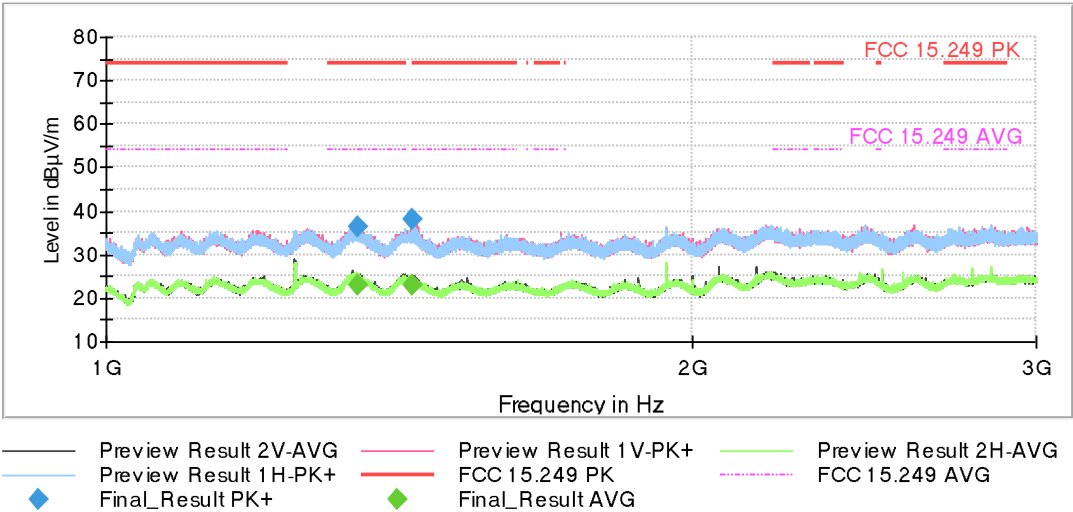
Z-wave 100 kBit/s GFSK Highest Channel:



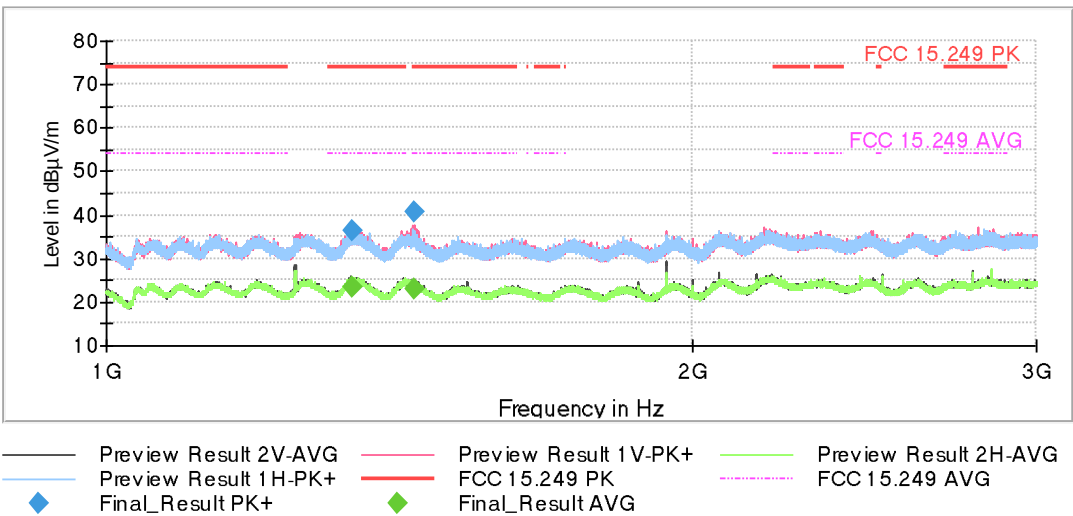
Note: The carrier was attenuated using a Notch filter.

FREQUENCY RANGE 1 - 3 GHz:

Z-wave 40 kBit/s FSK Lowest Channel:

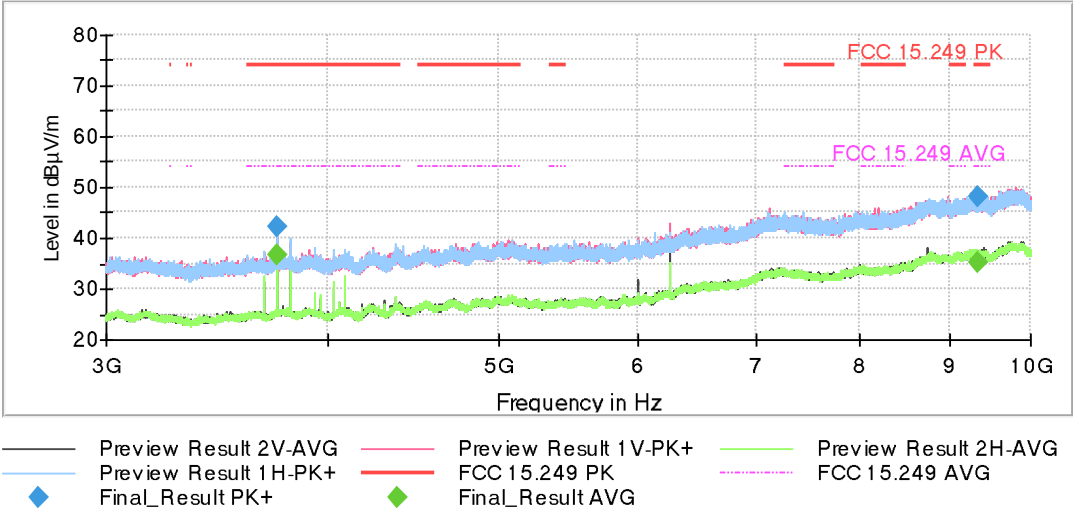


Z-wave 100 kBit/s GFSK Highest Channel:



FREQUENCY RANGE 3 - 10 GHz:

Z-wave 40 kBit/s FSK Lowest Channel:



Z-wave 100 kBit/s GFSK Highest Channel:

