

ISED CABid: ES1909

Test Report No:
NIE: 69086RRF.008

Partial Test Report

USA FCC Part 15.247, 15.209

CANADA RSS-247, RSS-Gen

(*) Identification of item tested	Drive Box for Solar Tracking and Data Acquisition
(*) Trademark	Deeprack
(*) Model and /or type reference	DBOX 4.0
Other identification of the product	HW version: 4.0 SW version: 3.x FCC ID: 2AVRXDBOX40 IC ID: 26278-DBOX40
(*) Features	LoRa/LoRaWANEU868 and US915 communications, NFC tag, RS485
Applicant	Deeprack SLU Avenida de La Transicion Española (Pq. Empresarial Omega), 32 Piso 3, 28108, Alcobendas, Madrid, Spain
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.
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager
Date of issue	2022-02-03
Report template No	FDT08_23 (*) "Data provided by the client"

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Competences and guarantees

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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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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.
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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 DBOX 4.0 is a device that allows remote control of motor and data acquisition for solar trackers in Photovoltaic Industry.

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 results.

Usage of samples

Samples undergoing test have been selected by: The client.

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

Control Nº	Description	Model	Serial Nº	Reception
69086C/006	Drive Box for Solar Tracking and Data Acquisition	DBOX 4.0	--	2021/09/15

Auxiliary elements used with the Sample S/01:

Control Nº	Description	Model	Serial Nº	Reception
64461B/011	Module	DBOARD R3	--	2020/06/23

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
69086C/006	Drive Box for Solar Tracking and Data Acquisition	DBOX 4.0	--	2021/09/15

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 ⁽³⁾		
	RS485	less than 3m	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	MC4 Male	less than 3m	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	MC4 Female	less than 3m	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	-		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Supplementary information to the ports..... :							
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	<input type="checkbox"/>	AC:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	AC:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input checked="" type="checkbox"/>	DC: 24V					
Rated Power		0.75W					
Clock frequencies		32MHz					
Other parameters.....		-					
Software version		3.x					
Hardware version.....		4.0					
Dimensions in cm (W x H x D).....		27x17x12					
Mounting position.....	<input type="checkbox"/>	Table top equipment					
	<input type="checkbox"/>	Wall/Ceiling mounted equipment					
	<input type="checkbox"/>	Floor standing equipment					
	<input type="checkbox"/>	Hand-held equipment					
	<input checked="" type="checkbox"/>	Other: Outdoor Field Environment					
Modules/parts	Module/parts of test item		Type		Manufacturer		
	MODBUS Inclinator				RION		
	Motor				WUXI		
	PV Panel				LONGT		
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

Deeprack SLU

Avenida de La Transición Española (Pq. Empresarial Omega), 32 Piso 3, 28108, Alcobendas,
Madrid, Spain

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2021-11-24
Date (finish)	2021-12-23

Document history

Report number	Date	Description
69086RRF.008	2022-02-03	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: Antonio Manuel Sánchez and Jaime Barranquero.

Used instrumentation:

Conducted Measurements:

	Last Calibration	Due Calibration
1. Shielded Room ETS LINDGREN S101	N/A	N/A
2. Signal and Spectrum Analyzer 2 Hz - 50 GHz ROHDE AND SCHWARZ FSW50	2021/07	2023/07

Radiated Tests:

	Last Calibration	Due Calibration
1. Semianechoic Absorber Lined Chamber ALBATROSS PROJECTS GMBH P29419	N/A	N/A
2. Shielded Room ALBATROSS PROJECTS GMBH P29419	N/A	N/A
3. Active Loop Antenna 9kHz-30MHz SCHWARZBECK FMZB 1519B	2019/11	2022/11
4. EMI Test Receiver 2Hz-44GHz, ROHDE AND SCHWARZ ESW44	2021/12	2023/12
5. Ultralog Antenna 30MHz-6GHz, ROHDE AND SCHWARZ HL562E_UPG	2019/10	2022/10
6. Horn Antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2019/11	2022/11
7. 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. LORA 915 MHz, Multi Channel (64):

FCC PART 15 PARAGRAPH / RSS-247			
Requirement – Test case		Verdict	Remark
FCC 15.247 (a)(1) / RSS-247 5.1. (b)	20 dB Bandwidth and Carrier frequency separation	N/M	(1)
FCC 15.247 (a)(1)(iii) / RSS-247 5.1. (c)	Number of hopping channels	N/M	(1)
FCC 15.247 (f) / RSS-247 5.3. (a)	Time of occupancy (Dwell Time)	N/M	(1)
FCC 15.247 (b) / RSS-247 5.4. (a)	Maximum peak output power and antenna gain	P	
FCC 15.247 (d) / RSS-247 5.5.	Band-edge compliance of conducted emissions (Transmitter)	N/M	(1)
FCC 15.247 (f) / RSS-247 5.3. (b)	Power spectral density for hybrid systems	N/M	(1)
FCC 15.247 (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	
<u>Supplementary information and remarks:</u>			
(1) Test not requested.			

Appendix A: Test results

TEST CONDITIONS	11
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TEST CONDITIONS

(*) Data provided by the Applicant.

POWER SUPPLY (*):

Vnominal: 24 Vdc
Type of Power Supply: Regulated DC power supply

ANTENNA (*):

Type of Antenna: Discrete Antenna Booster.
Maximum Declared Antenna Gain: +4.5 dBi

TEST FREQUENCIES:

Conducted Tests:

Low Channel: 902.3 MHz
Middle Channel: 908.5 MHz
High Channel: 914.9 MHz

Radiated Tests:

Low Channel: 902.3 MHz
Middle Channel: 908.5 MHz
High Channel: 914.9 MHz

Declared Operating Channel Width (OCW): 200 kHz

The EUT is continuously transmitting.

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.



The DC supply voltage is applied using an external calibrated power supply.

RADIATED MEASUREMENTS:

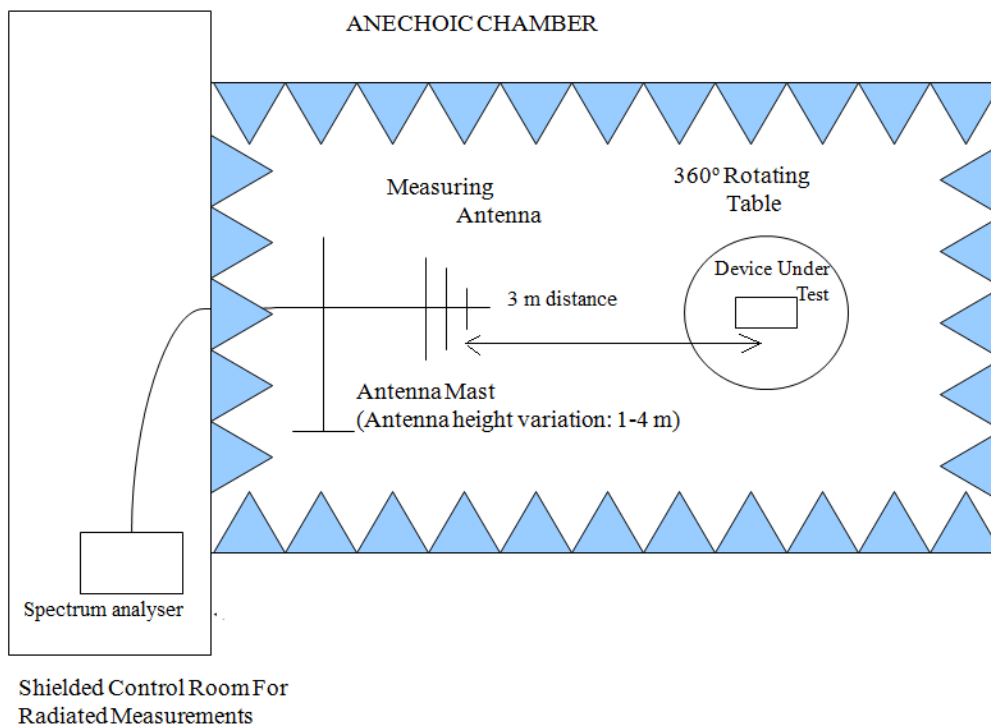
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz and 1 GHz-10 GHz Double ridge horn antenna) is situated at a distance of 3 m.

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.

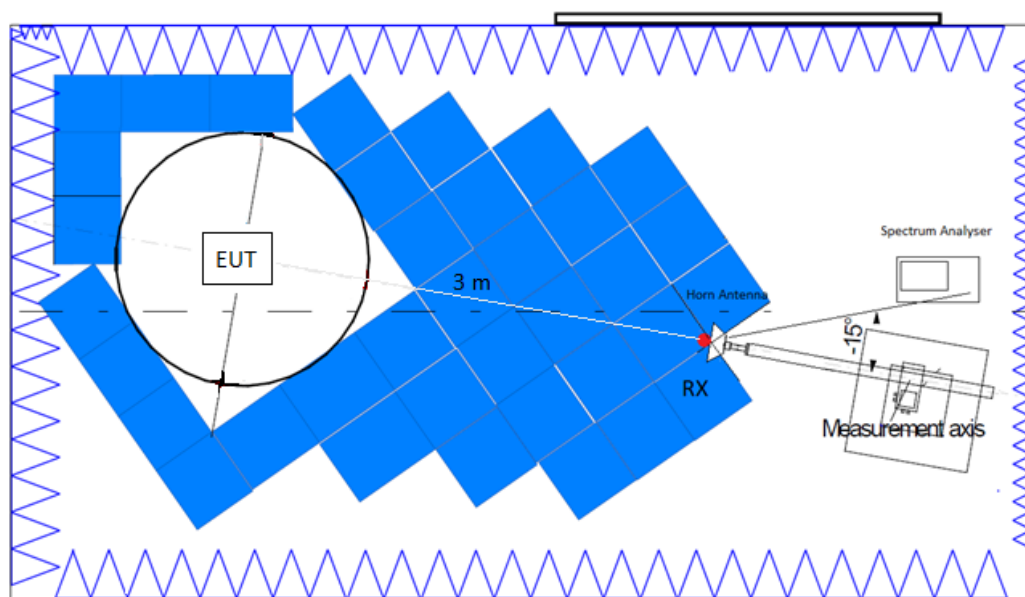
Measurements were made in both horizontal and vertical planes of polarization.

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 from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 10 GHz:



Occupied Bandwidth

SPECIFICATION:

FCC §2.1049. Measurements required: Occupied bandwidth.

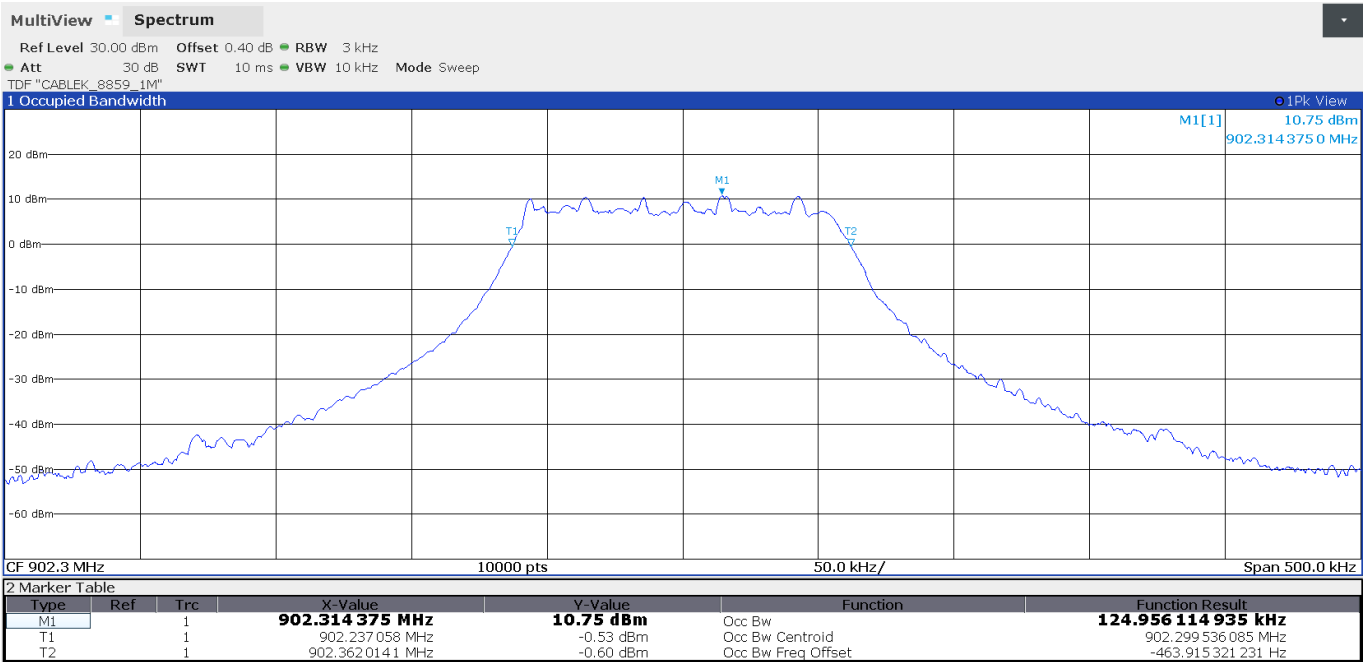
RSS-Gen Clause 6.7.

RESULTS:

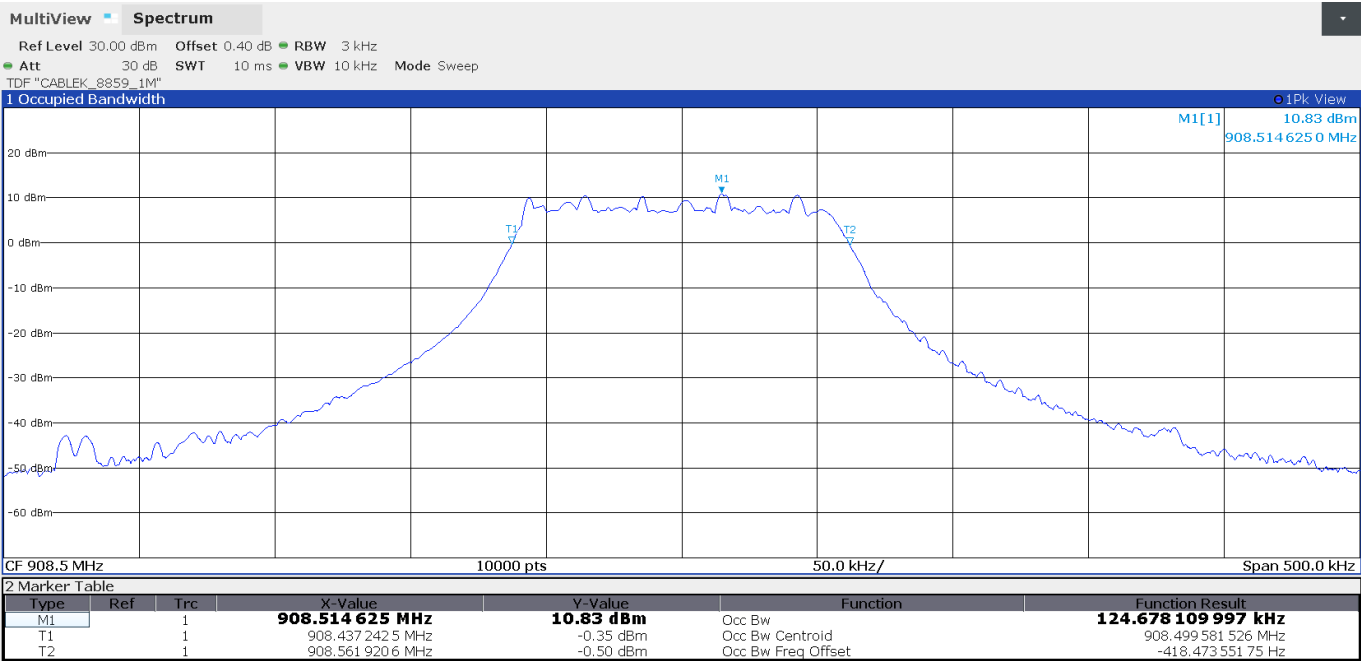
	Low Channel	Middle Channel	High Channel
99% Bandwidth (kHz)	124.9561149	124.67811	125.0139448
Measurement Uncertainty (kHz)	<± 0.38		

Verdict: PASS

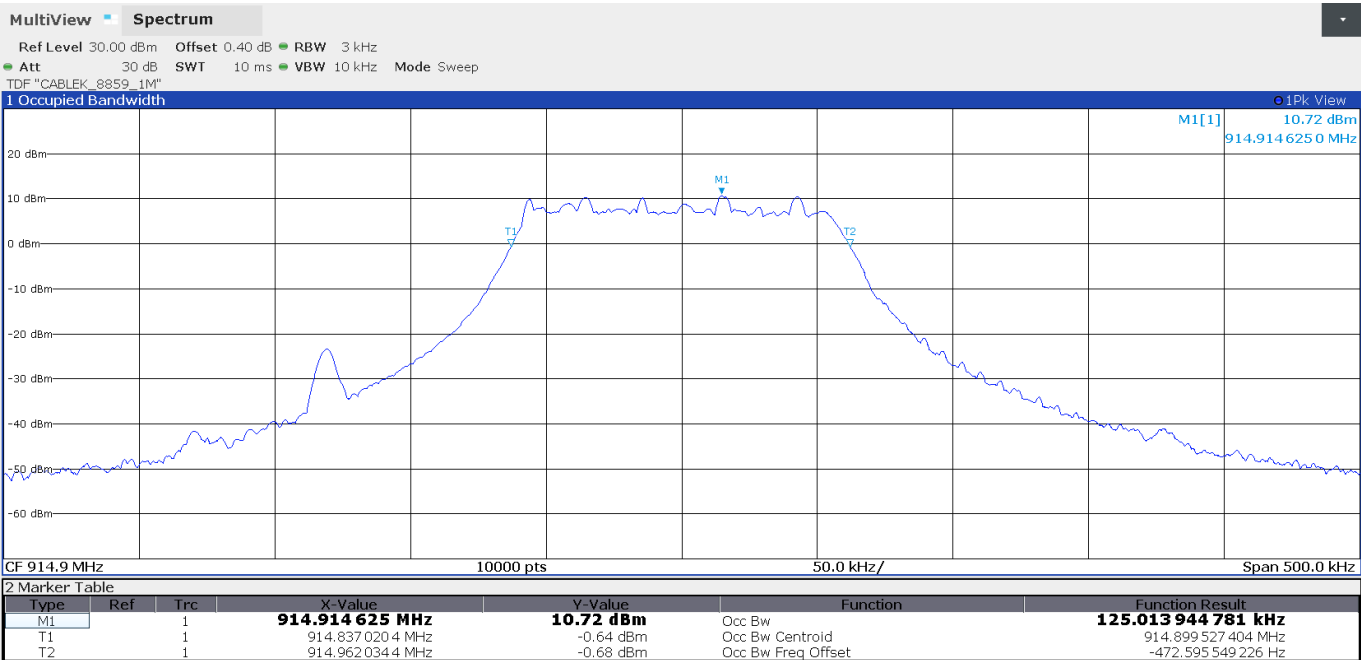
- Low Channel:



- Middle Channel:



- High Channel:



FCC 15.247 (b) / RSS-247 5.4 (a) Maximum output power and antenna gain

SPECIFICATION:

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels.

Hybrid systems shall comply with the 1 W limit.

Additionally for RSS-247:

For FHSs operating in the band 902-928 MHz, the e.i.r.p. shall not exceed 4 W if the hopset uses 50 or more hopping channels; the e.i.r.p. shall not exceed 1 W if the hopset uses less than 50 hopping channels.

RESULTS:

The maximum conducted (average) output power was measured using the method AVGSA-1 (trace averaging across on and off times of the EUT transmissions) according to point 11.9.2.2.2 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: +4.5 dBi

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.

	Low Channel	Middle Channel	High Channel
Maximum conducted power (dBm)	10.83	11.45	10.98
Duty cycle correction (dB)	2.71344511		
Maximum corrected conducted power (dBm)	13.54	14.16	13.69
Maximum EIRP power (dBm)	18.04	18.66	18.19
Measurement Uncertainty (dB)	<± 1.91		

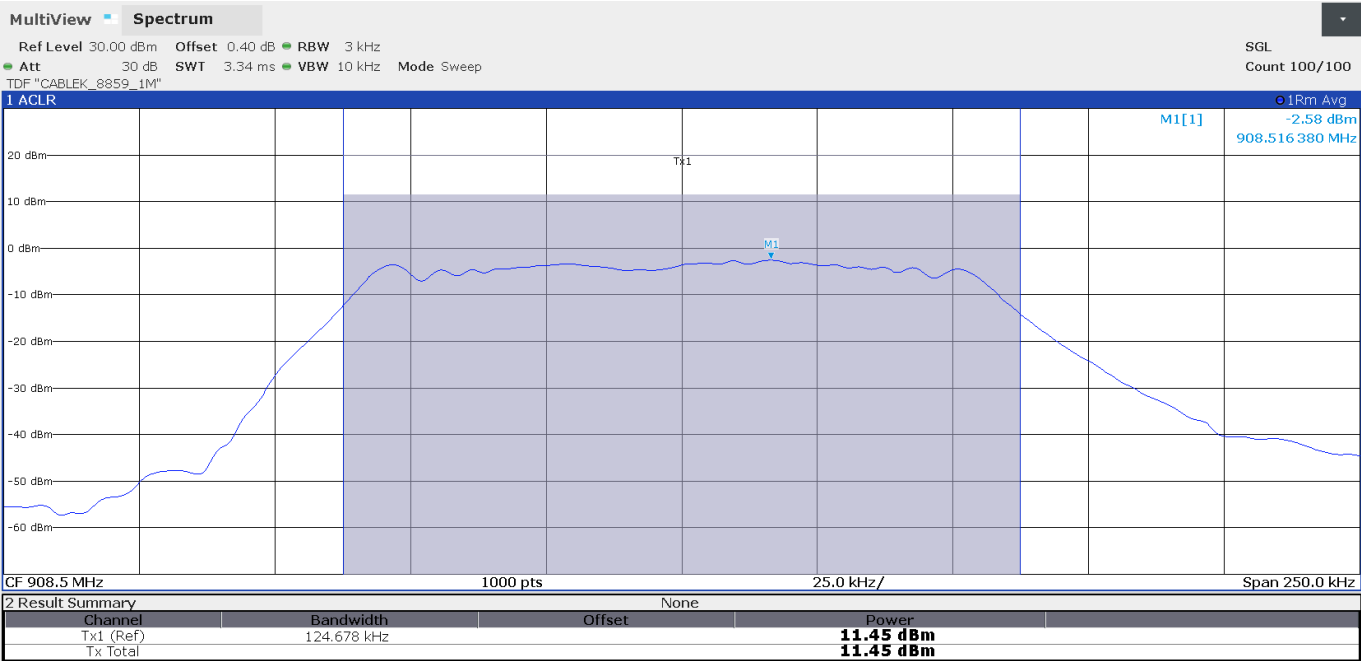
Verdict: PASS

Maximum Average Output Power:

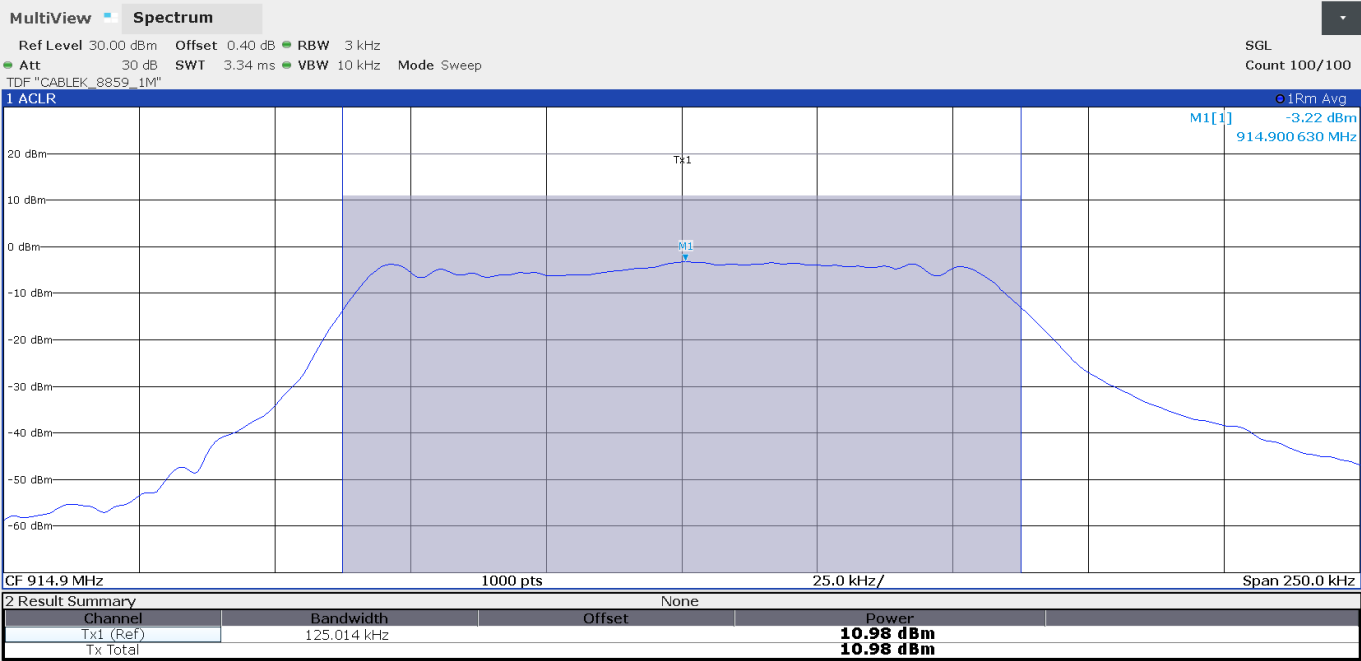
Low Channel:



Middle 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 §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 - 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:

The spurious frequencies do not depend on the operating channel.

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

Spurious Frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
44.404500	25.16	V	Quasi-Peak
57.160000	25.41	V	Quasi-Peak
191.990000	27.37	V	Quasi-Peak
906.928500	30.20	V	Quasi-Peak

Measurement Uncertainty (dB) <± 4.94

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 closest to the limit:

Spurious Frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
1804.600000	39.52	V	Peak
3609.100000	41.35	V	Peak
4511.200000	46.81	V	Peak
5414.200000	44.06	H	Peak
6316.300000	56.79	H	Peak
	52.28		Peak
7219.000000	49.57	H	Peak
8120.200000	49.69	H	Peak

- MIDDLE CHANNEL. Spurious frequencies closest to the limit:

Spurious Frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
3634.000000	42.90	H	Peak
4542.700000	47.85	H	Peak
5451.100000	47.84	H	Peak
6359.800000	55.90	H	Peak
	47.86		Peak
7267.600000	49.05	H	Peak
8177.200000	48.56	H	Peak

- HIGH CHANNEL. Spurious frequencies closest to the limit:

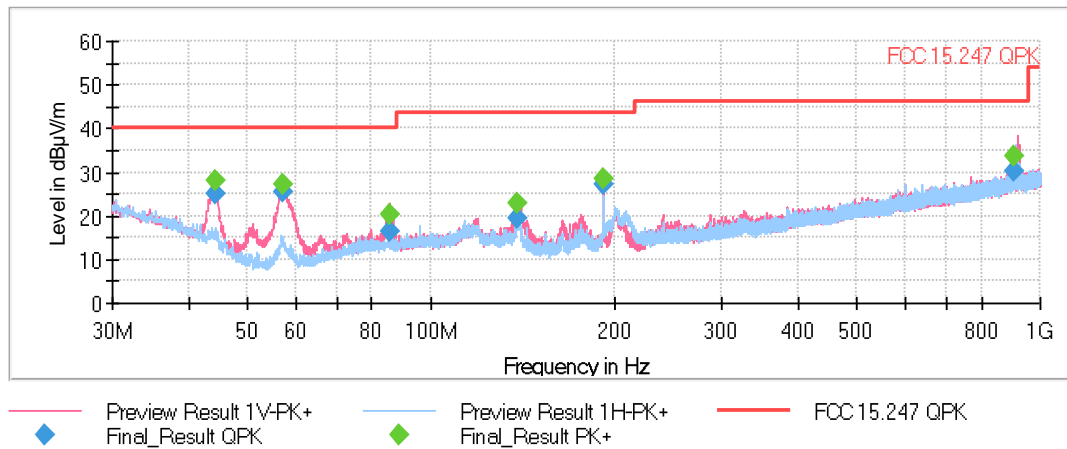
Spurious Frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
3659.200000	41.70	H	Peak
4574.800000	47.84	H	Peak
7319.200000	46.81	H	Peak

Measurement Uncertainty (dB) $< \pm 4.60$ for $f \geq 1$ to 10 GHz

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz:

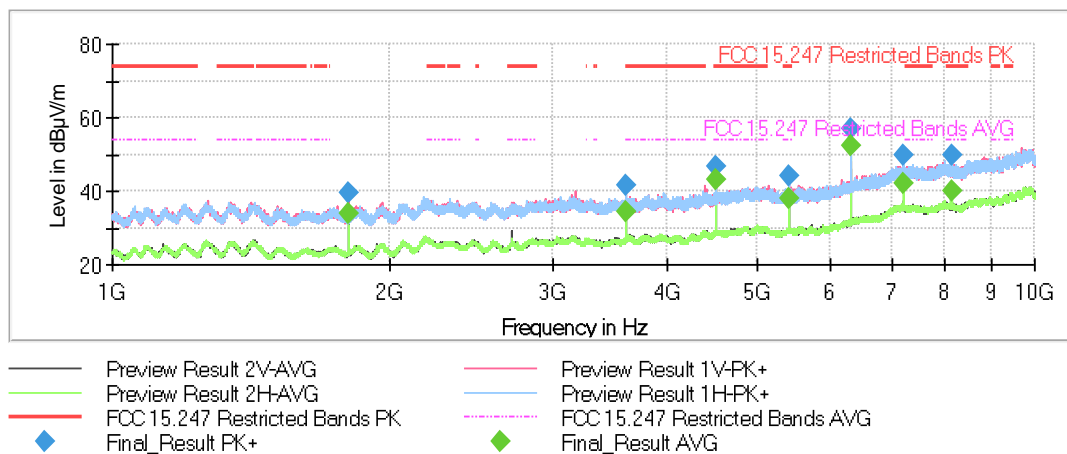
This plot is valid for all channels.



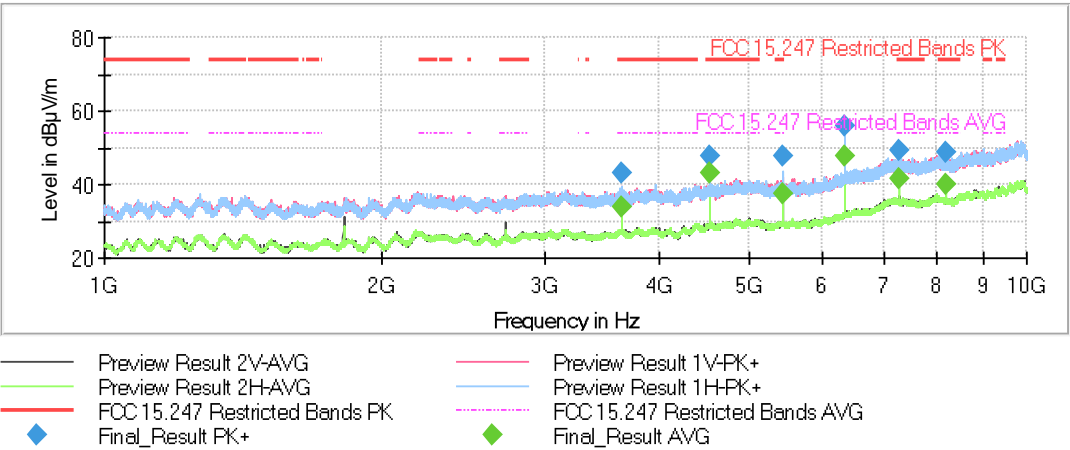
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 1 - 10 GHz:

- Low Channel:



- Middle Channel:



- High Channel:

