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C.I.F. A29507456

ISED CABid: ES1909

Test Report No:
NIE: 69086RRF.007

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	Deeptrack
(*) Model and /or type reference	DBOX 3.1
Other identification of the product	HW version: 3.1 SW version: 3.x FCC ID: 2AVRXDBOX31 IC ID: 26278-DBOX31
(*) Features	LoRa/LoRaWANEU868 and US915 communications, NFC tag, RS485
Applicant	Deeptrack 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 2022.02.03 08:28:54 +01'00'
Date of issue	2022-02-03
Report template No	FDT08_23 (*) "Data provided by the client"

Index

Competences and guarantees 3
General conditions 3
Uncertainty 3
Data provided by the client 3
Test sample description 5
Identification of the client 6
Testing period and place 6
Document history 6
Environmental conditions 6
Remarks and comments 7
Testing verdicts 8
Summary 8
Appendix A: Test results 9

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 DBOX 3.1 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/013	Drive Box for Solar Tracking and Data Acquisition	DBOX 3.1	--	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/ 013	Drive Box for Solar Tracking and Data Acquisition	DBOX 3.1	--	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	☒	☐	☐
	MC4 Male	less than 3m	☒	☐	☐
	MC4 Female	less than 3m	☒	☐	☐
	-		☐	☐	☐
	-		☐	☐	☐
Supplementary information to the ports…… :	-				

Rated power supply .....:	Voltage and Frequency		Reference poles			
			L1	L2	L3	N	PE
	☐	AC:	☐	☐	☐	☐	☐
	☐	AC:	☐	☐	☐	☐	☐
	☒	DC: 24V					
	☐	DC:					

Rated Power .....:	0.75W
Clock frequencies .....:	32MHz
Other parameters.....:	-
Software version .....:	3.x
Hardware version.....:	3.1
Dimensions in cm (W x H x D)....:	27x17x12

Mounting position.....:	☐	Table top equipment
	☐	Wall/Ceiling mounted equipment
	☐	Floor standing equipment
	☐	Hand-held equipment
	☒	Other: Outdoor Field Environment

Modules/parts .....:	Module/parts of test item	Type	Manufacturer
	MODBUS Inclinometer		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

Deeptrack SLU

Avenida de La Transicion 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.007	2022-02-03	First release.

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

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

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

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

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
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 Measurements:

		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.	Ultralog Antenna 30MHz-6GHz, ROHDE AND SCHWARZ HL562E_UPG	2019/10	2022/10
4.	EMI Test Receiver 2Hz-44GHz, ROHDE AND SCHWARZ ESW44	2021/12	2023/12
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. 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	
Supplementary information and remarks: (1) Test not requested.			

Appendix A: Test results

INDEX

TEST CONDITIONS 11
Occupied Bandwidth 14
FCC 15.247 (b) / RSS-247 5.4 (a) Maximum output power and antenna gain 16
FCC 15.247 (d) / RSS-247 5.5. Emission limitations radiated (Transmitter) 19

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:

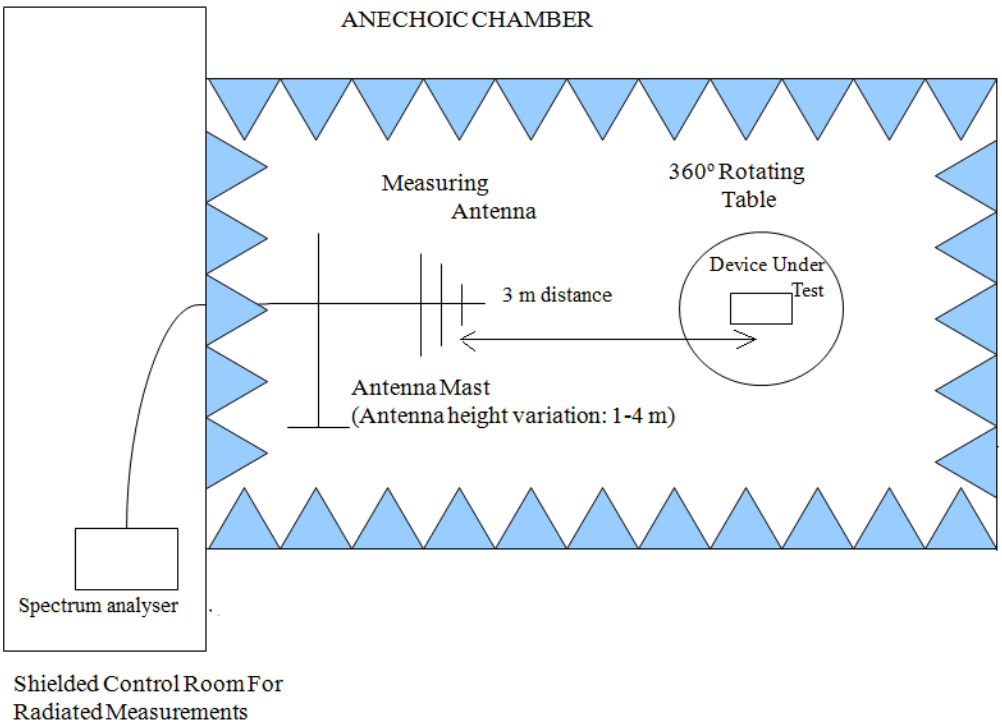
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz and 1 GHz-10 GHz Double ridge horn antenna) is situated at a distance of 3 m.

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 360º and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

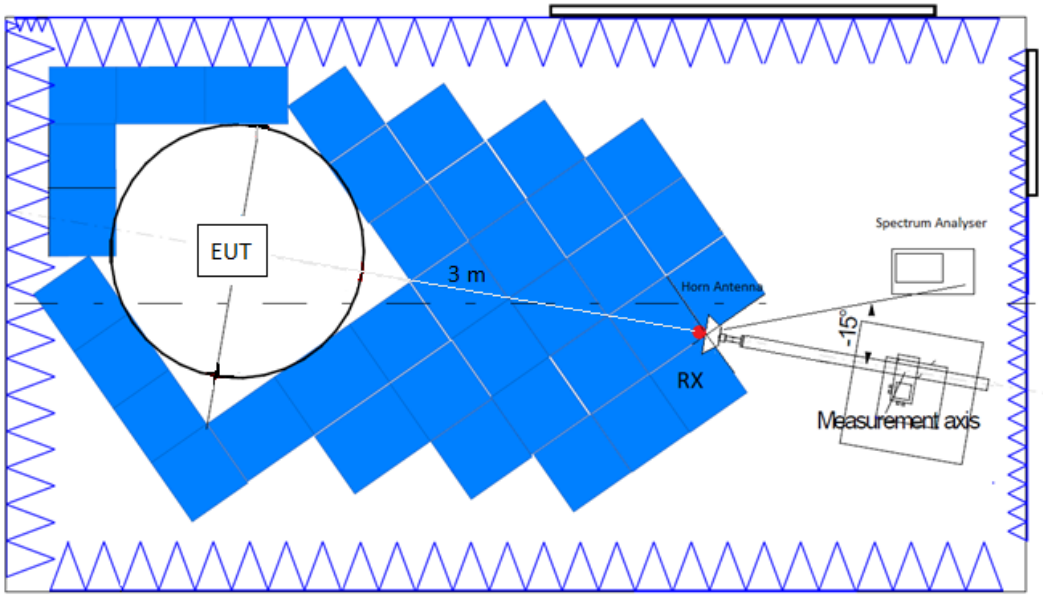
Measurements were made in both horizontal and vertical planes of polarization.

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.

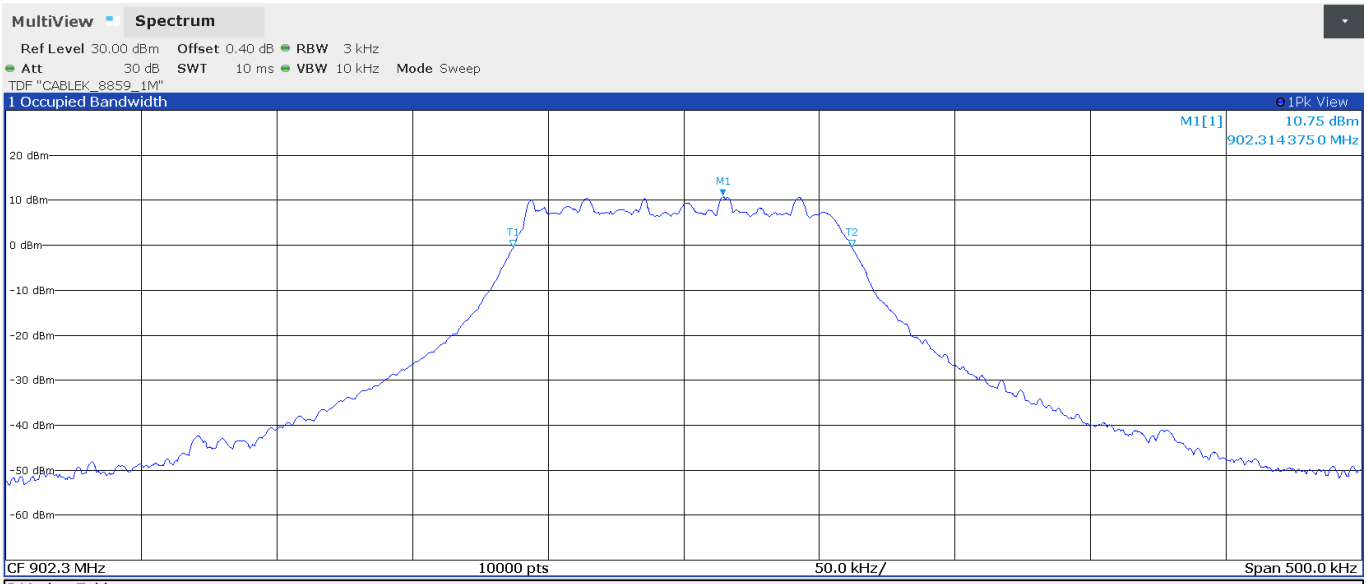
RSS-Gen Clause 6.7.

RESULTS:

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

Verdict: PASS

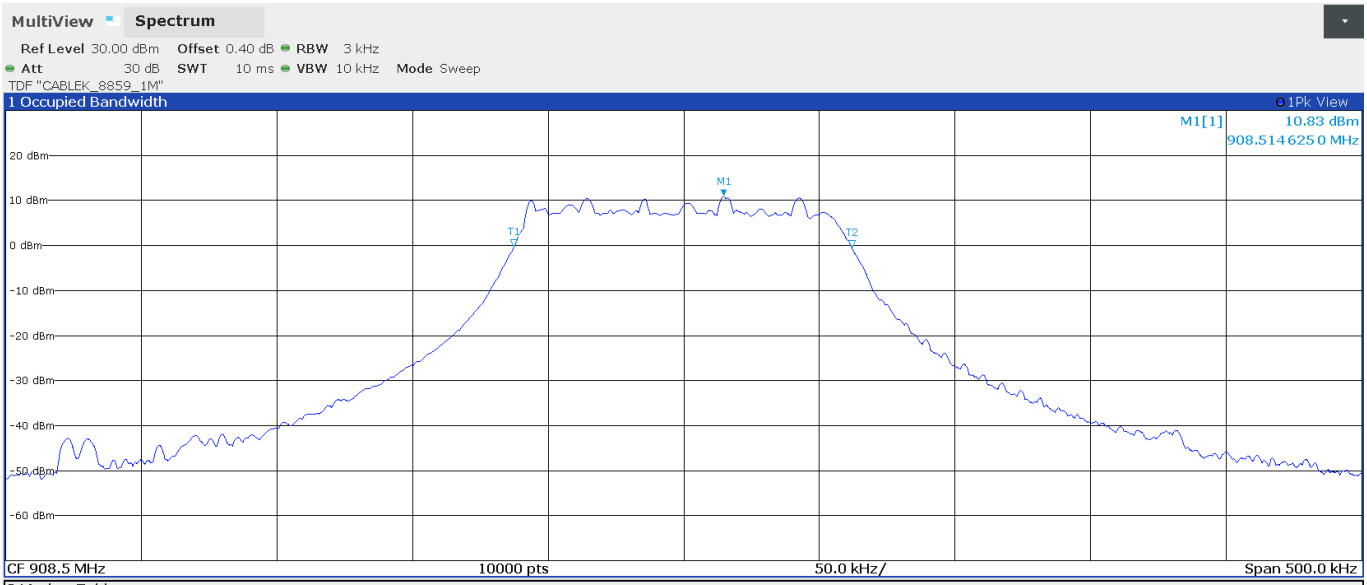
- Low Channel:



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**902.314 375 MHz**	**10.75 dBm**	Occ Bw	**124.956 114 935 kHz**
T1		1	902.237 058 MHz	-0.53 dBm	Occ Bw Centroid	902.299 536 085 MHz
T2		1	902.362 014 1 MHz	-0.60 dBm	Occ Bw Freq Offset	-463.915 321 231 Hz

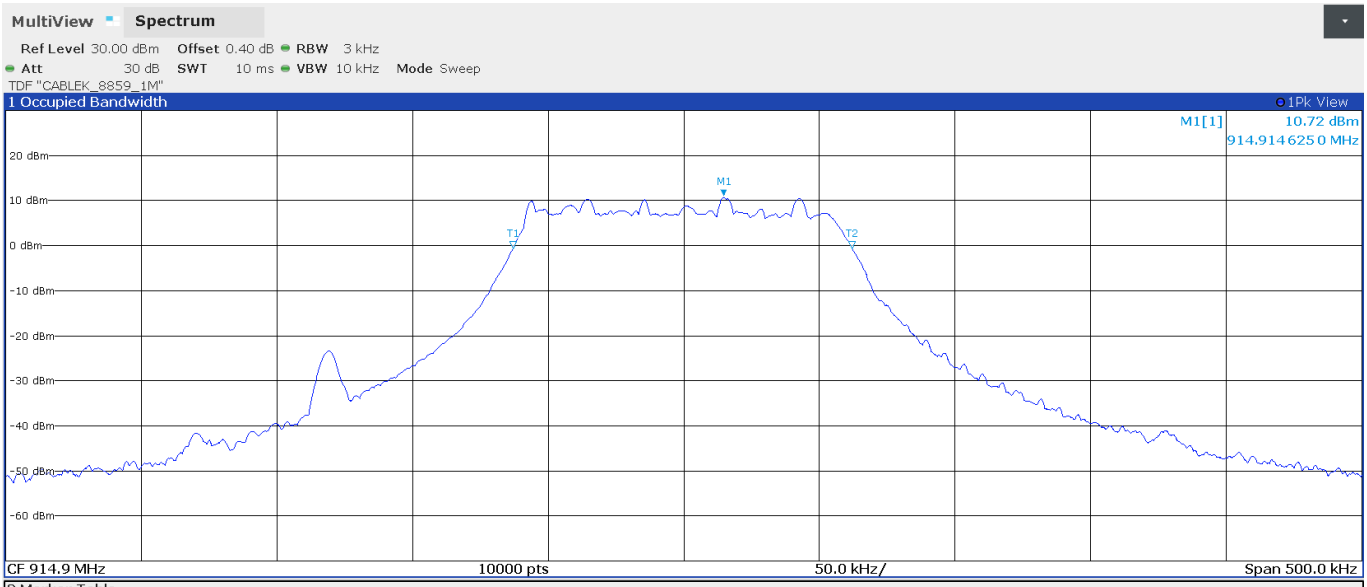
- Middle Channel:



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**908.514 625 MHz**	**10.83 dBm**	Occ Bw	**124.678 109 997 kHz**
T1		1	908.437 242 5 MHz	-0.35 dBm	Occ Bw Centroid	908.499 581 526 MHz
T2		1	908.561 920 6 MHz	-0.50 dBm	Occ Bw Freq Offset	-418.473 551 75 Hz

- High Channel:



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**914.914 625 MHz**	**10.72 dBm**	Occ Bw	**125.013 944 781 kHz**
T1		1	914.837 020 4 MHz	-0.64 dBm	Occ Bw Centroid	914.899 527 404 MHz
T2		1	914.962 034 4 MHz	-0.68 dBm	Occ Bw Freq Offset	-472.595 549 226 Hz

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

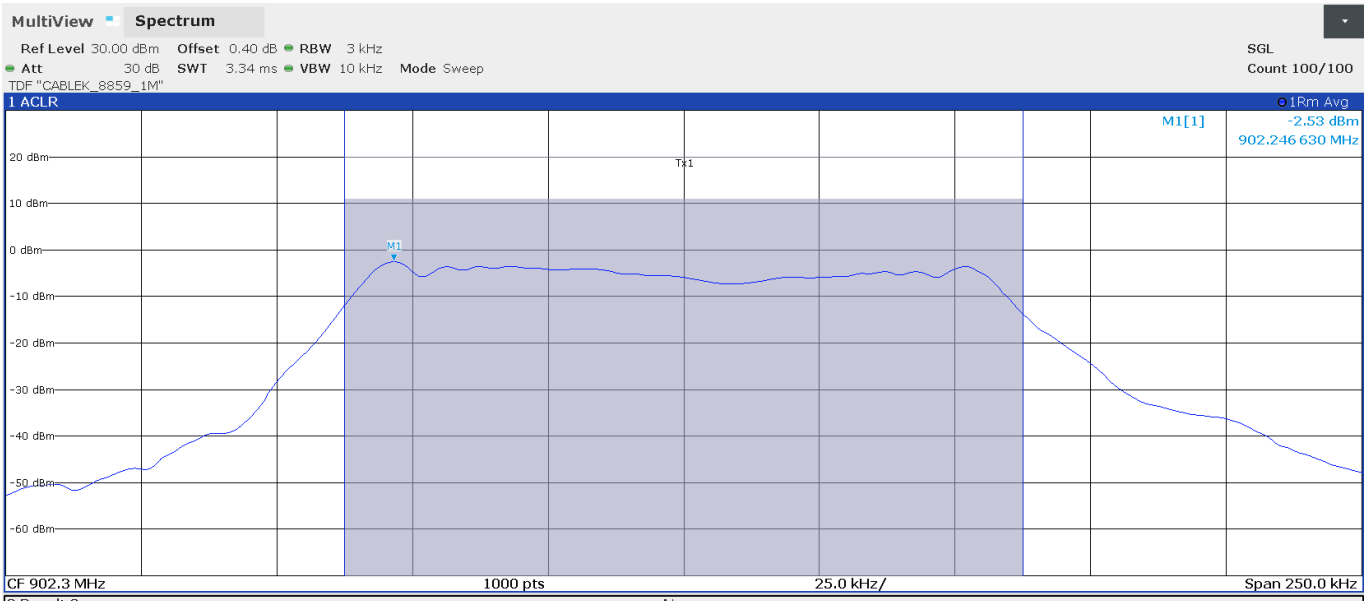
The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

	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:

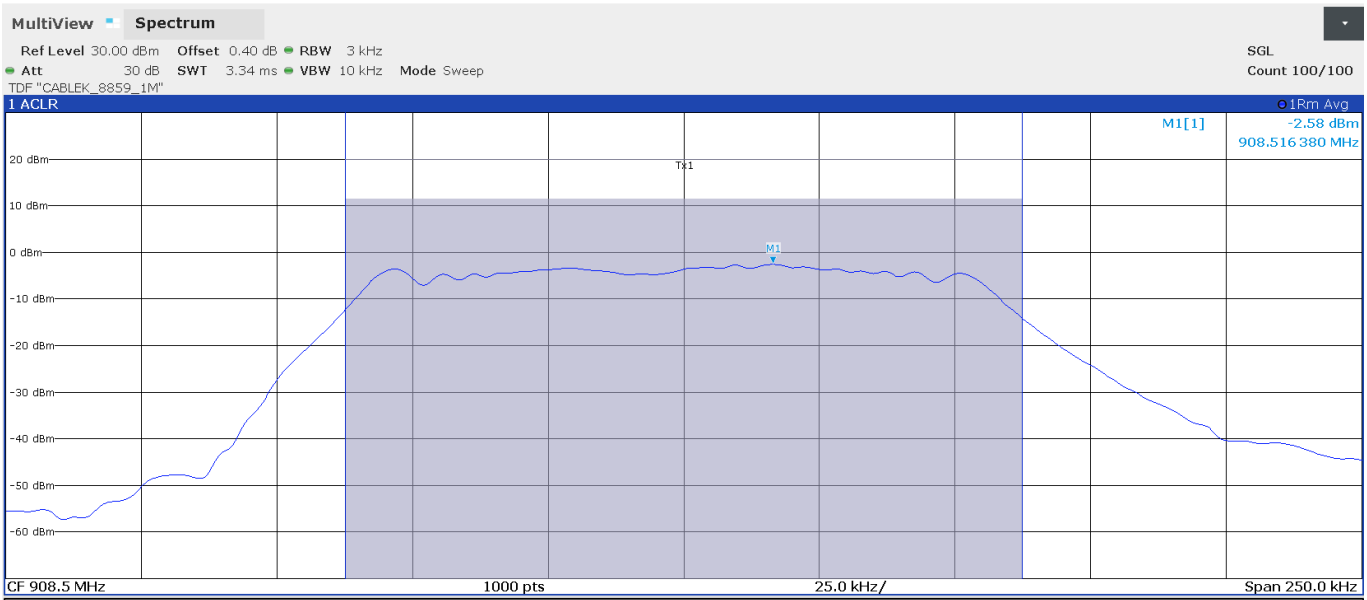
Low Channel:



2 Result Summary — None

Channel	Bandwidth	Offset	Power
Tx1 (Ref)	124.956 kHz		**10.83 dBm**
Tx Total			**10.83 dBm**

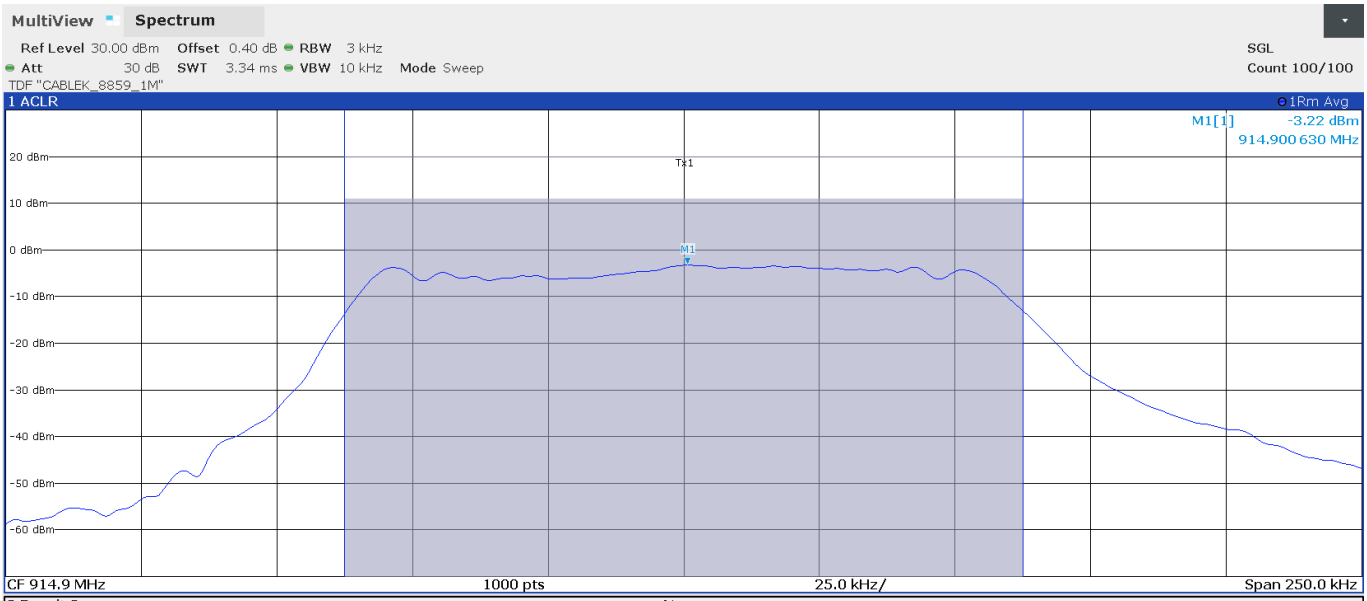
Middle Channel:



2 Result Summary — None

Channel	Bandwidth	Offset	Power
Tx1 (Ref)	124.678 kHz		**11.45 dBm**
Tx Total			**11.45 dBm**

High Channel:



2 Result Summary — None

Channel	Bandwidth	Offset	Power
Tx1 (Ref)	125.014 kHz		**10.98 dBm**
Tx Total			**10.98 dBm**

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 360º 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
126.272500	23.61	V	Quasi-Peak
132.092500	27.03	V	Quasi-Peak
191.990000	30.29	V	Quasi-Peak
287.971500	27.11	H	Quasi-Peak
900.478000	33.94	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
1804.000000	50.03	V	Peak
2706.700000	56.29	H	Peak
	34.53		Peak
3608.800000	42.58	V	Peak
4511.200000	50.76	V	Peak
5413.900000	48.25	H	Peak
6316.000000	58.13	H	Peak
	53.80		Peak
7218.100000	46.60	H	Peak
8120.500000	46.40	H	Peak

- MIDDLE CHANNEL. Spurious frequencies closest to the limit:

Spurious Frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
1816.900000	46.28	V	Peak
3634.300000	43.12	V	Peak
4542.400000	49.51	V	Peak
5451.100000	48.61	H	Peak
6359.500000	58.77	H	Peak
	42.81		Peak
7267.900000	46.76	H	Peak
8176.300000	47.33	H	Peak

- HIGH CHANNEL. Spurious frequencies closest to the limit:

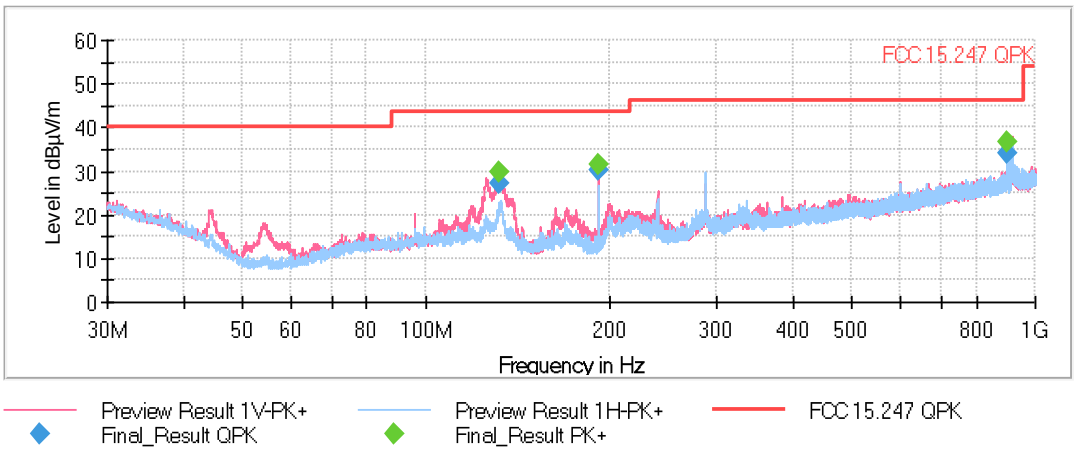
Spurious Frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
1829.500000	49.15	V	Peak
3659.500000	45.27	V	Peak
4574.500000	49.54	V	Peak
5489.500000	49.61	H	Peak
6404.500000	57.59	H	Peak
	49.75		Peak

Measurement Uncertainty (dB) <± 4.60 for f ≥ 1 to 10 GHz

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz:

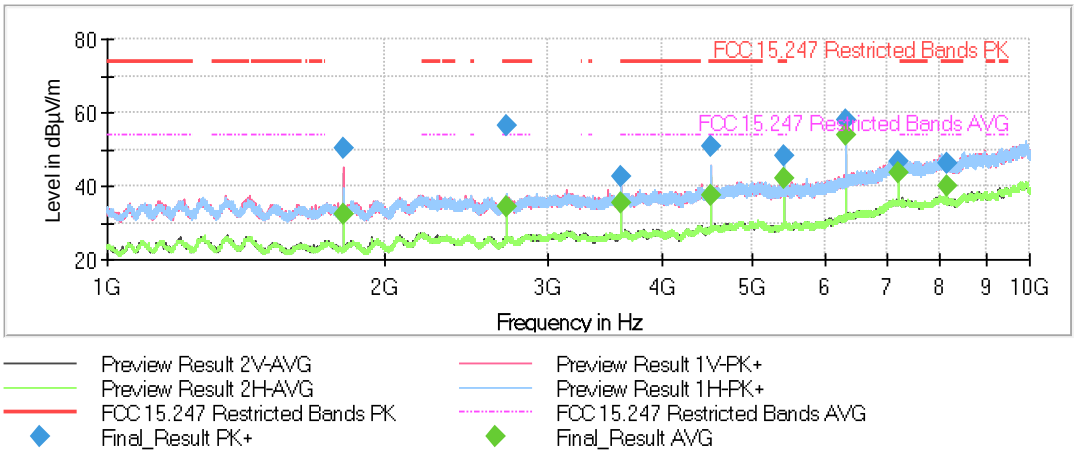
This plot is valid for all channels.



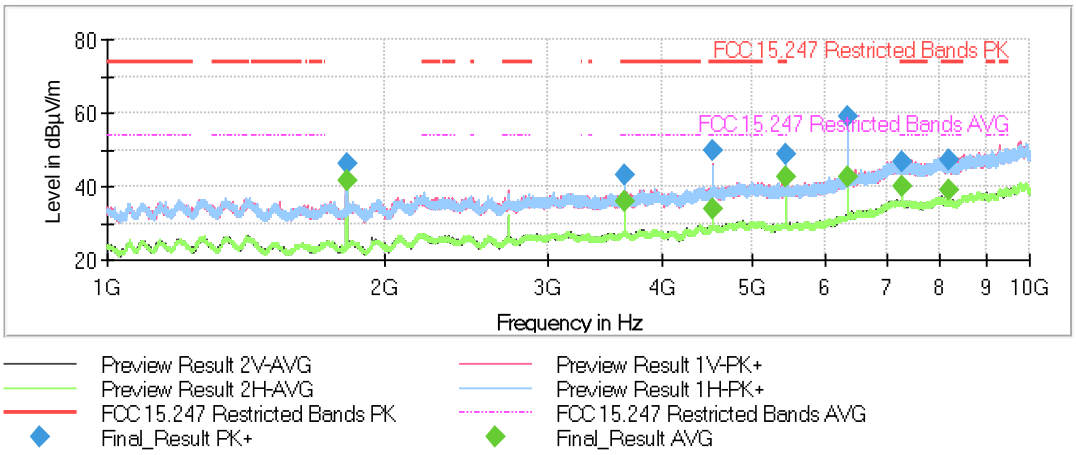
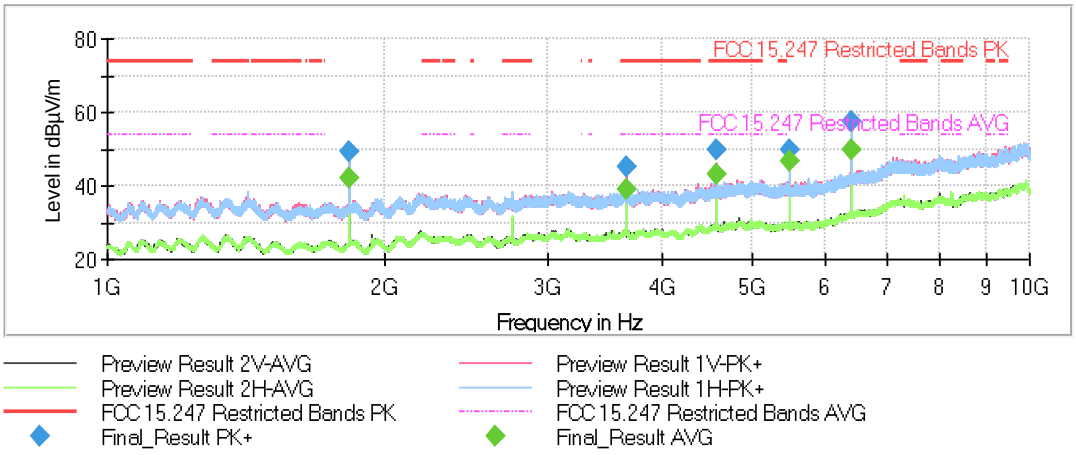
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 1 - 10 GHz:

- Low Channel:



- Middle Channel:



- High Channel: