



Report No. 399615-01

FCC TEST REPORT / IC TEST REPORT

Product	Track Box Passive	
Name and address of the applicant	race result AG Joseph-von-Fraunhofer-Str. 11 D - 76327 Pfinztal (Germany)	
Name and address of the manufacturer	race result AG Joseph-von-Fraunhofer-Str. 11 D - 76327 Pfinztal (Germany)	
Model	RR10	
Rating	100 – 240 VAC	
Trademark	race result	
Serial number	20953	
Technology	RFID 915 MHz	
Tested according to	FCC Part 15.207, 15.209 & 15.247 ISED Canada RSS-247 Issue 2 RSS-GEN Issue 5 For details of applied tests refer to test summary	
Report number	399615-01	
Tested in period	2020-06-05 - 2020-10-07	
Issue date	2020-10-14	
Name and address of the testing laboratory	Nemko GmbH & Co. KG Reetzstraße 58 D-76327 Pfinztal Tel.: + 49 (0) 7240 – 63 - 0 Fax: + 49 (0) 7240 – 63 - 11  Bundesnetzagentur BNetzA-CAB-17/21-17	FCC No: 973501 ISED OATS: 10921A
 Prepared by [F. Hupbauer]  Approved by [Dipl.-Ing. P. Lukas]		

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1 INFORMATION

1.1 Test Item

Name:	Track Box Passive	
FCC ID:	SZO-RR10	
Industry Canada ID:	20465-RR10	
Model/version:	Track Box Passive US RR10	
Serial number:	20953	
Software version:	27587 (firmware)	
Frequency Range:	902.5 – 927.5 MHz	
Number of Channels:	51	
Transmit Channels Tested:	Channel ID	Channel Frequency (MHz)
	Bottom	902.5
	Middle	915.0
	Top	927.5
Operating Modes:	RFID (FHSS)	
Type of Modulation:	Digital ASK	
Output Power (radiated):	31.47 dBm	
Type of Power Supply:	AC Adaptor: CUI SDI18-12-U (100 – 240V, 50 – 60Hz)	
Antenna Connector:	None (internal antenna)	
Number of Antennas	1	
Type of Antenna	Dual Patch RX/TX	
Maximal gain of Antenna	6 dBi	

Description of Test Item

The device is an RFID reader for passive transponders. It is mainly used for sports timing. Additionally, the device contains a 2.4 GHz (IEEE 802.15.4) and GSM Bands module for data transmission. For mobile use, the device can be powered by rechargeable internal batteries.

1.2 Normal test conditions

Temperature: 19 - 22 °C
Relative humidity: 45 - 60 %
Normal test voltage: 120V / 60Hz

The values are the limit registered during the test period.

1.3 Test Engineer(s)

Frederic Hupbauer; Abdoufataou Salifou

1.4 Description of modification for Modification Filing

Not Applicable.

1.5 Family List Rational

Not Applicable.

1.6 Antenna Requirement

Is the antenna detachable?

☐ Yes ☒ No

If detachable, is the antenna connector non-standard?

☐ Yes ☐ No

Type of antenna connector: N/A

Ref. FCC §15.203

1.7 Worst-Case Configuration and Mode

Radiated Emissions was performed with the EUT set to transmit at the channel with the highest output power as worst-case scenario.

1.8 Comments

The measurements were done with the EUT powered by 120V / 60Hz. It was checked that power variations between 85% and 115% did not have any influence on the measurements.

2 TEST REPORT SUMMARY

2.1 General

All measurements are traceable to national standards. The tests were conducted for the purpose of demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.247 and Industry Canada RSS-247 Issue 2.

Tests were performed in accordance with ANSI C63.4-2014 and ANSI C63.10-2013.

Radiated tests were performed in a semi-anechoic shielded room ($f < 1$ GHz) and a fully anechoic shielded room ($f > 1$ GHz) at a measuring distance of 3m. A description of the test facility is on file with the FCC and Industry Canada.

Test setup photo document: 399615-01TRFFCC Annex – Test set-up photos

☒ New Submission

☒ Production Unit

☐ Class II Permissive Change

☐ Pre-production Unit

DSS Equipment Code

☐ Family Listing



THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.

Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".

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2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-247 Issue 2, RSS-GEN Issue 5 reference	Result
Supply Voltage Variations	15.31(e)		Complies
Number of Hopping Frequencies and Average Time of Occupancy	15.247(a)(1)(i)	5.1 (c) (RSS-247)	Complies
Antenna Requirement	15.203	6.8 (RSS-Gen)	Complies ¹
AC Power Line Conducted Emission limits	15.207(a)	8.8 (RSS-Gen)	Complies
Carrier Frequency Separation	15.247(a)(1)	5.1 (b) (RSS-247)	Complies
Occupied Bandwidth	15.247(a)(1)	5.2 (1) (RSS-247)	Complies
Maximim 20 dB Bandwidth	15.247(a)(1)(i)	5.2 (1) (RSS-247)	Complies
Transmitter Output Power	15.247(b)(2)	5.4 (a) (RSS-247)	Complies
Transmitter Conducted Emissions	15.247(d)	5.5 (RSS-247)	Complies
Transmitter Band Edge Radiated Emissions	15.247(d) 15.209(a)	5.5 (RSS-247) 8.9 (RSS-Gen)	Complies

¹ The tested equipment has integrated antennas only

3 TEST RESULTS

3.1 AC Power Line Conducted Emissions limits

Para. No.: 15.207 (a)

Para. No.: 8.8

Test Performed by: Frederic Hupbauer

Date of Test: 2020-06-10 & 2020-10-07

Measurement procedure: ANSI C63.4-2014 using 50 μ H/50 ohms LISN.

Test Results: Complies.

Measurement Data: See attached graph.

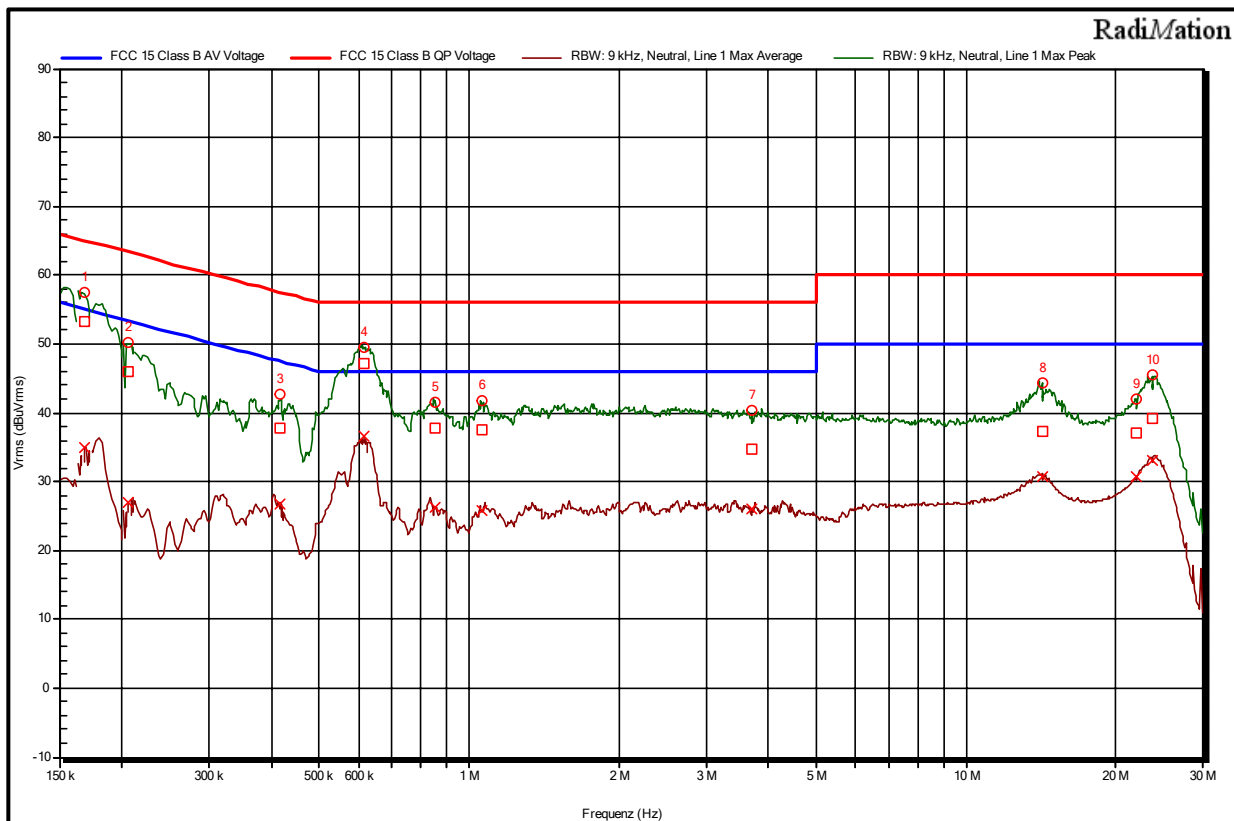
EUT supplied via AC adaptor

AC/DC adapter type: CUI SDI50-15-U

Input voltage to AC/DC adapter: 120V / 60Hz & 240V / 50Hz

Highest measured value (L1 and N):

Diagram by 120V / 60Hz



Measurement Data:

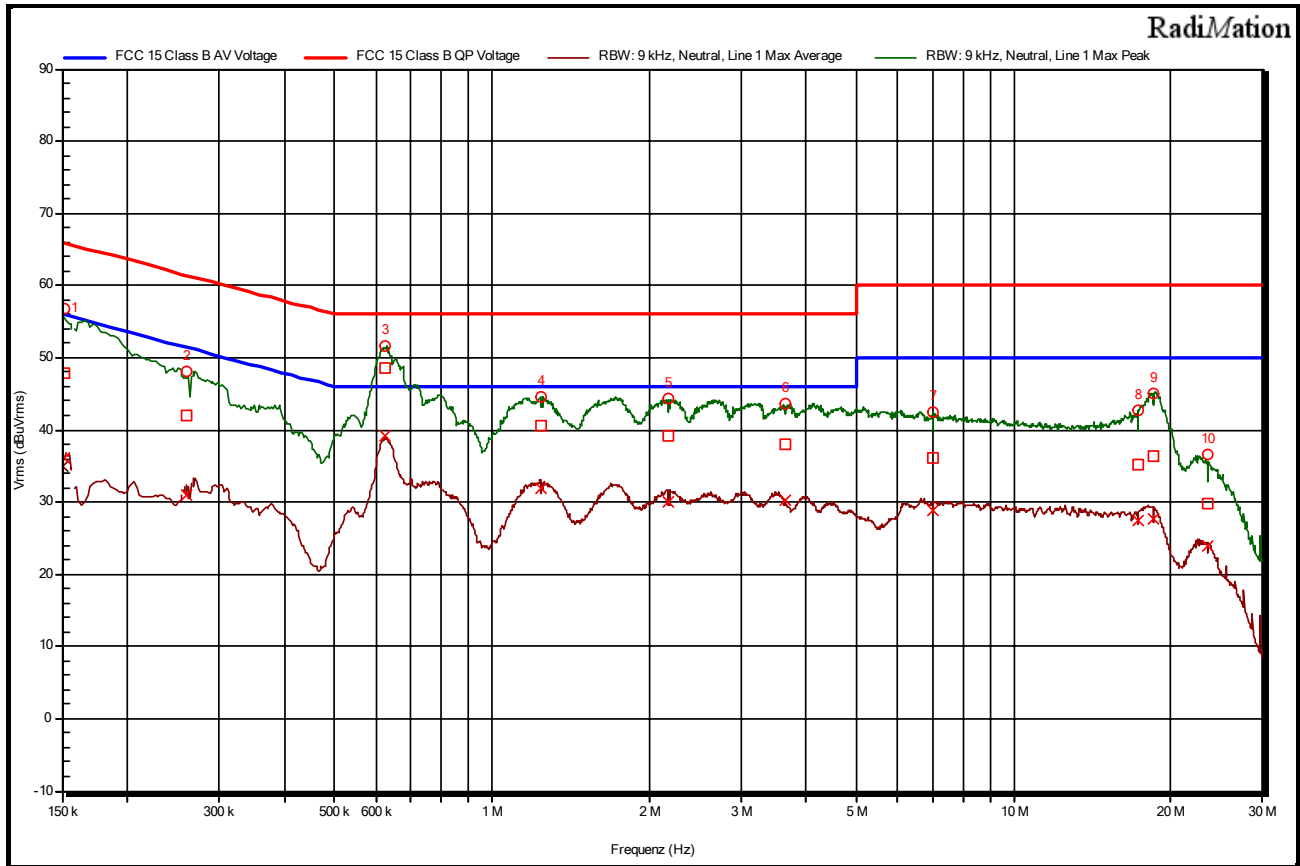
Final measurements QP with Quasi-Peak-Detector 120V / 60Hz

No.	Frequency (MHz)	Level (dBµV)	Transducer (dB)	Limit (dBµV)	Margin (dB)	Line	PE
1	0.168	53.35	9.97	65.06	11.71	Line 1	GND
2	0.20625	46.02	9.97	63.35	17.34	Line 1	GND
3	0.41775	37.87	9.99	57.49	19.63	Line 1	GND
4	0.61575	47.08	10.01	56	8.92	Neutral	GND
5	0.852	37.82	10.02	56	18.18	Line 1	GND
6	1.06125	37.48	10.04	56	18.52	Line 1	GND
7	3.69375	34.81	10.20	56	21.19	Line 1	GND
8	14.2035	37.35	10.72	60	22.65	Line 1	GND
9	22.065	37.02	10.94	60	22.98	Neutral	GND
10	23.649	39.24	11.11	60	20.76	Neutral	GND

Final measurements AV with Average-Detector 120V / 60Hz

No.	Frequency (MHz)	Level (dBµV)	Transducer (dB)	Limit (dBµV)	Margin (dB)	Line	PE
1	0.168	35.04	9.97	55.06	20.02	Line 1	GND
2	0.20625	26.92	9.97	53.35	26.43	Line 1	GND
3	0.41775	26.73	9.99	47.49	20.76	Line 1	GND
4	0.61575	36.6	10.01	46	9.4	Neutral	GND
5	0.852	26.3	10.02	46	19.7	Line 1	GND
6	1.06125	25.77	10.04	46	20.23	Line 1	GND
7	3.69375	26.01	10.20	46	19.99	Line 1	GND
8	14.2035	30.78	10.72	50	19.22	Line 1	GND
9	22.065	30.77	10.94	50	19.23	Neutral	GND
10	23.649	33.01	11.11	50	16.99	Neutral	GND

Diagramm by 240V / 50Hz



Measurement Data:

Final measurements QP with Quasi-Peak-Detector 240V / 50Hz

No.	Frequency (MHz)	Level (dBµV)	Transducer (dB)	Limit (dBµV)	Margin (dB)	Line	PE
1	0,152250	47,89	9,97	65,88	17,99	Neutral	GND
2	0,260250	41,92	9,98	61,42	19,50	Neutral	GND
3	0,624750	48,53	10,01	56,00	7,47	Neutral	GND
4	1,245750	40,58	10,06	56,00	15,42	Neutral	GND
5	2,184000	39,28	10,12	56,00	16,72	Line 1	GND
6	3,642000	37,97	10,20	56,00	18,03	Neutral	GND
7	7,003500	36,05	10,38	60,00	23,95	Neutral	GND
8	17,333250	35,10	10,84	60,00	24,90	Neutral	GND
9	18,523500	36,26	10,88	60,00	23,74	Neutral	GND
10	23,478000	29,90	11,09	60,00	30,10	Line 1	GND

Final measurements AV with Average-Detector 240V / 50Hz

No.	Frequency (MHz)	Level (dBµV)	Transducer (dB)	Limit (dBµV)	Margin (dB)	Line	PE
1	0,152250	36,21	9,97	55,88	19,67	Neutral	GND
2	0,260250	31,06	9,98	51,42	20,36	Neutral	GND
3	0,624750	39,28	10,01	46,00	6,72	Neutral	GND
4	1,245750	31,93	10,06	46,00	14,07	Neutral	GND
5	2,184000	30,04	10,12	46,00	15,96	Line 1	GND
6	3,642000	30,20	10,20	46,00	15,80	Neutral	GND
7	7,003500	28,88	10,38	50,00	21,12	Neutral	GND
8	17,333250	27,40	10,84	50,00	22,60	Neutral	GND
9	18,523500	27,66	10,88	50,00	22,34	Neutral	GND
10	23,478000	23,95	11,09	50,00	26,05	Line 1	GND

3.2 20 dB Bandwidth

Para. No.: 15.247 (a)(1)(i)

Para. No.: 5.2 (1)

Test Performed by: Frederic Hupbauer

Date of Test: 2020-06-08

Test Results: Complies

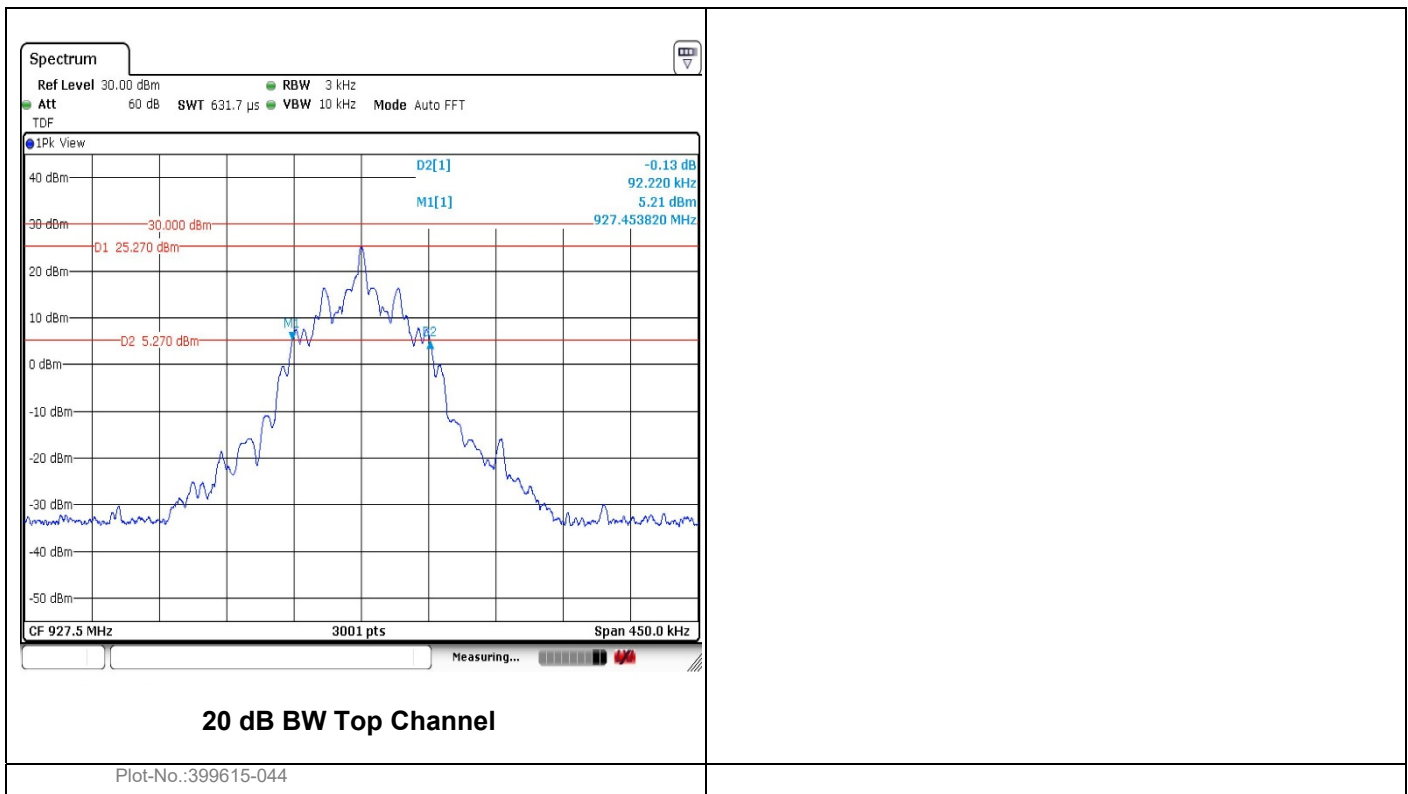
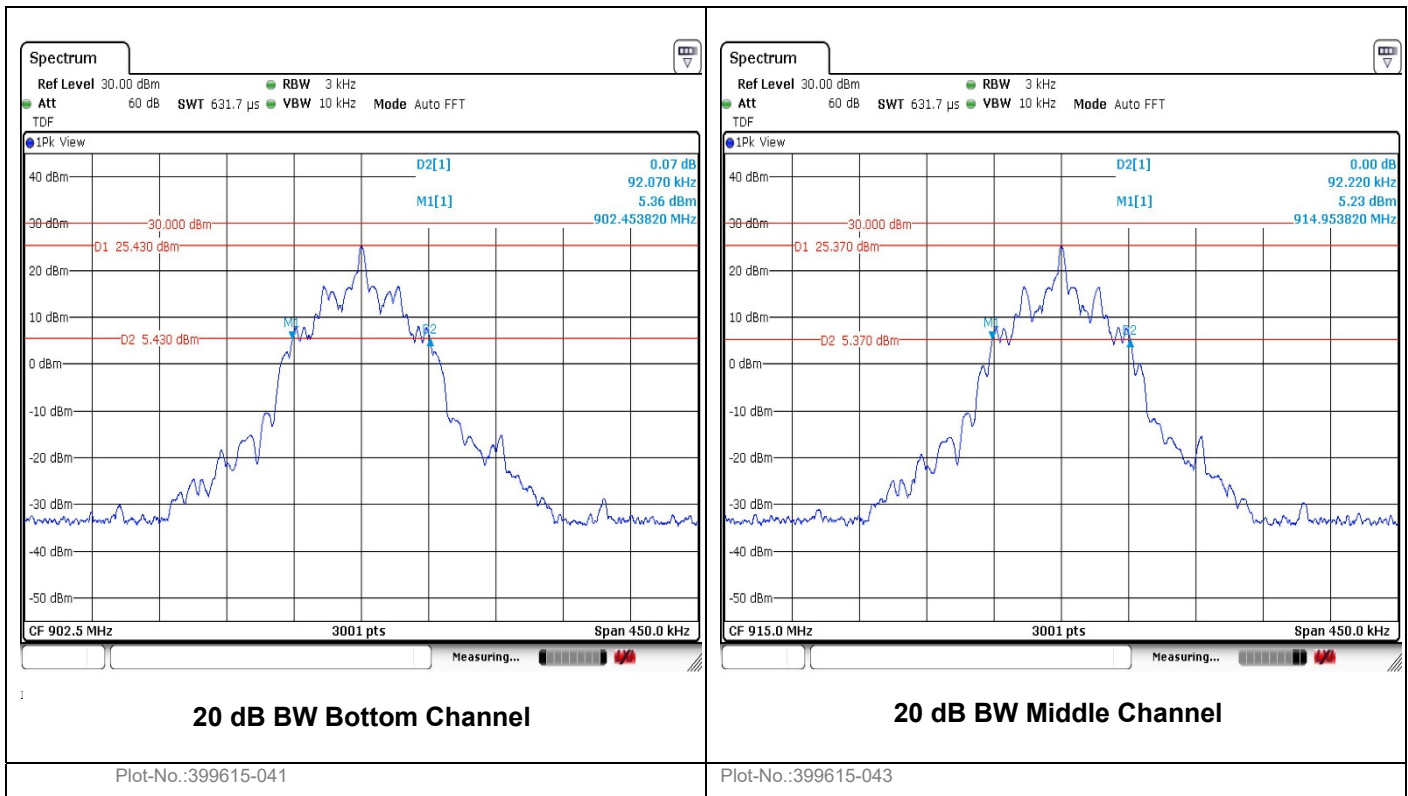
Measurement Data:

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	Maximum Limit (kHz)	Margin (kHz)
Bottom	902.5	92.070	500.0	407.93
Middle	915.0	92.220	500.0	407.78
Top	927.5	92.220	500.0	407.78

Requirements:

The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

20 dB Bandwidth Plots



3.3 Number of Hopping Frequencies and Average Time of Occupancy

Para. No.: 15.247(a)(1)(i)

Para. No.: 5.1 (c)

Test Performed by: Frederic Hupbauer	Date of Test: 2020-06-08
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Test Results: Complies

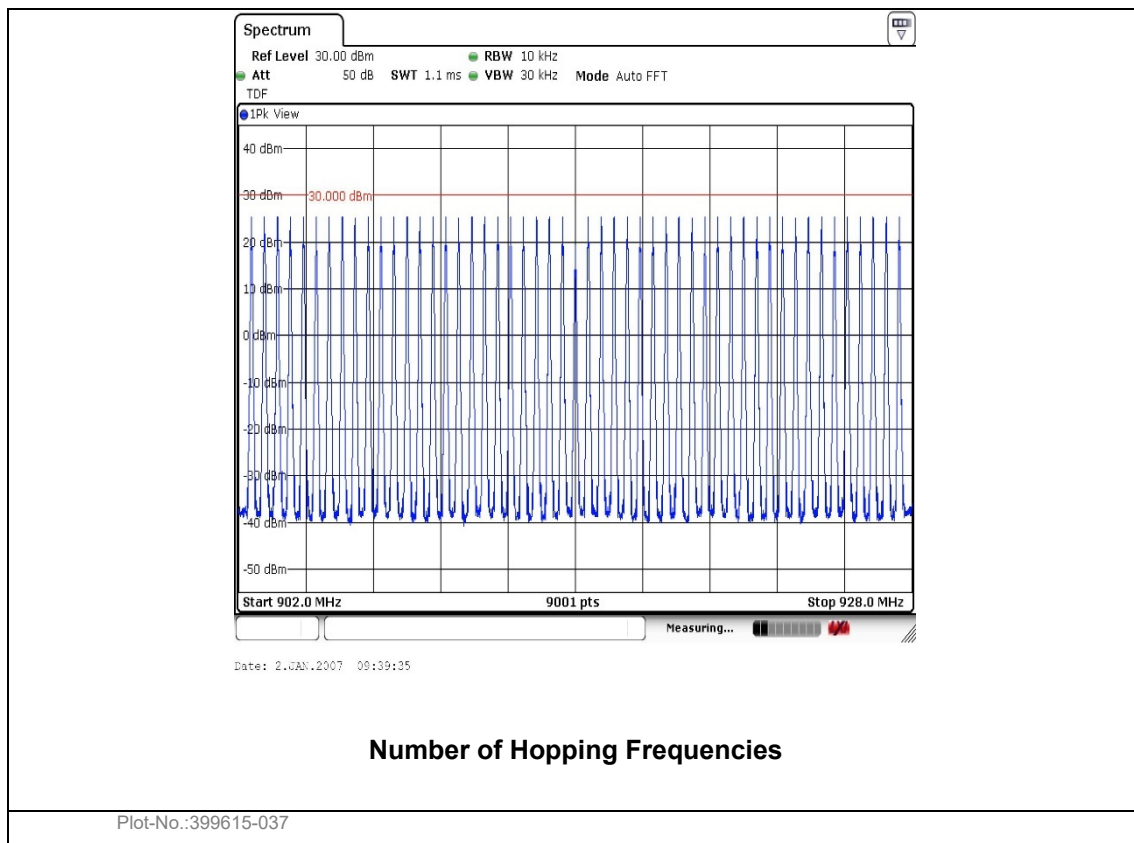
Measurement Data:

Number of Hoppings Frequencies	Emission Width (ms)	Number of Hops in 20 s	Average Time of Occupancy (s)	Limit (s)	Margin (s)
51	103.1667	3	0.2861	0.4	0.1139

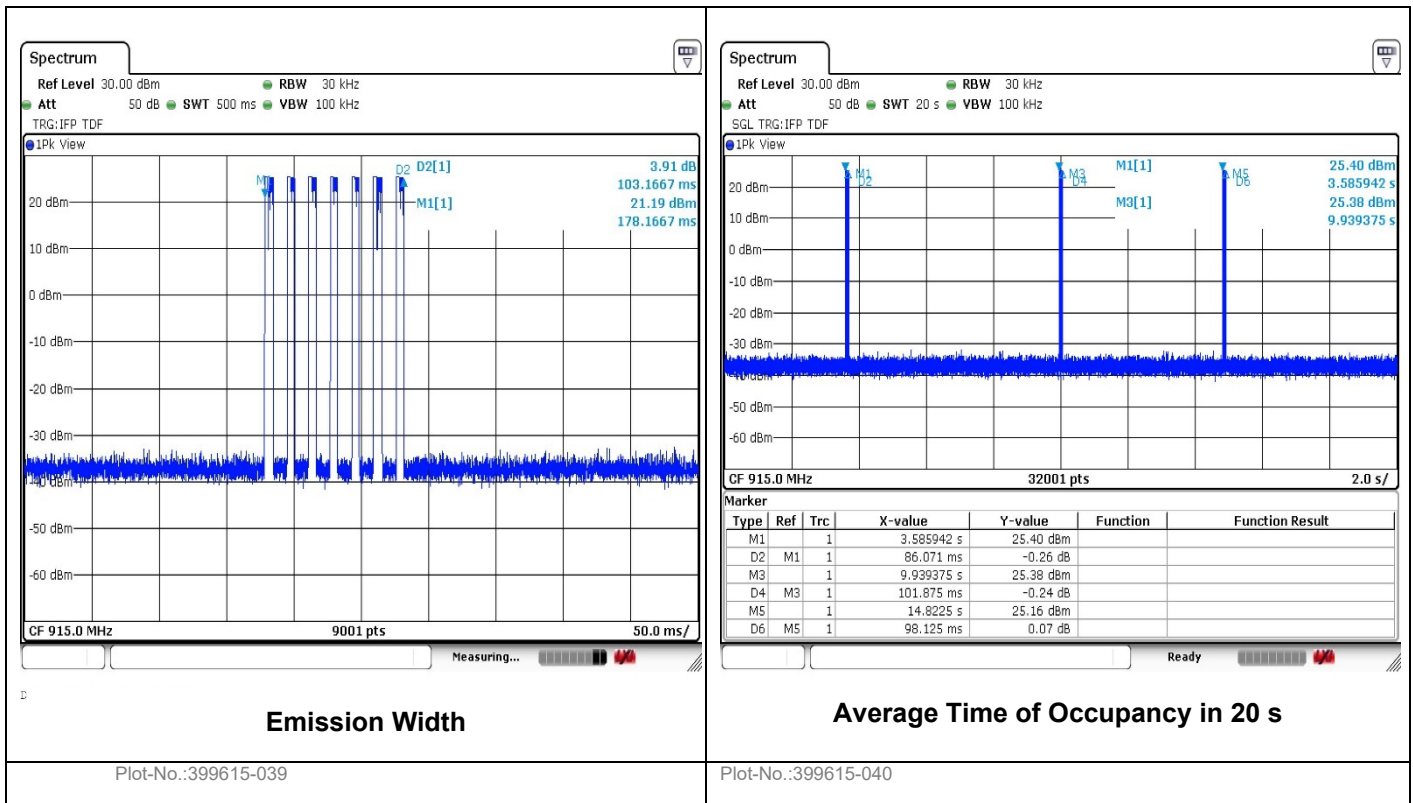
Requirements:

Frequency hopping systems shall have at least 50 hopping frequencies if the 20dB BW of the hopping channel is less than 250 kHz.

Number of Hopping Frequencies Plot



Emission Width and Average Time of Occupancy Plots



3.4 Carrier Frequency Separation

Para. No.: 15.247 (a)(1)

Para. No.: 5.1 (b)

Test Performed By: Frederic Hupbauer	Date of Test: 2020-06-08
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Test Results: Complies

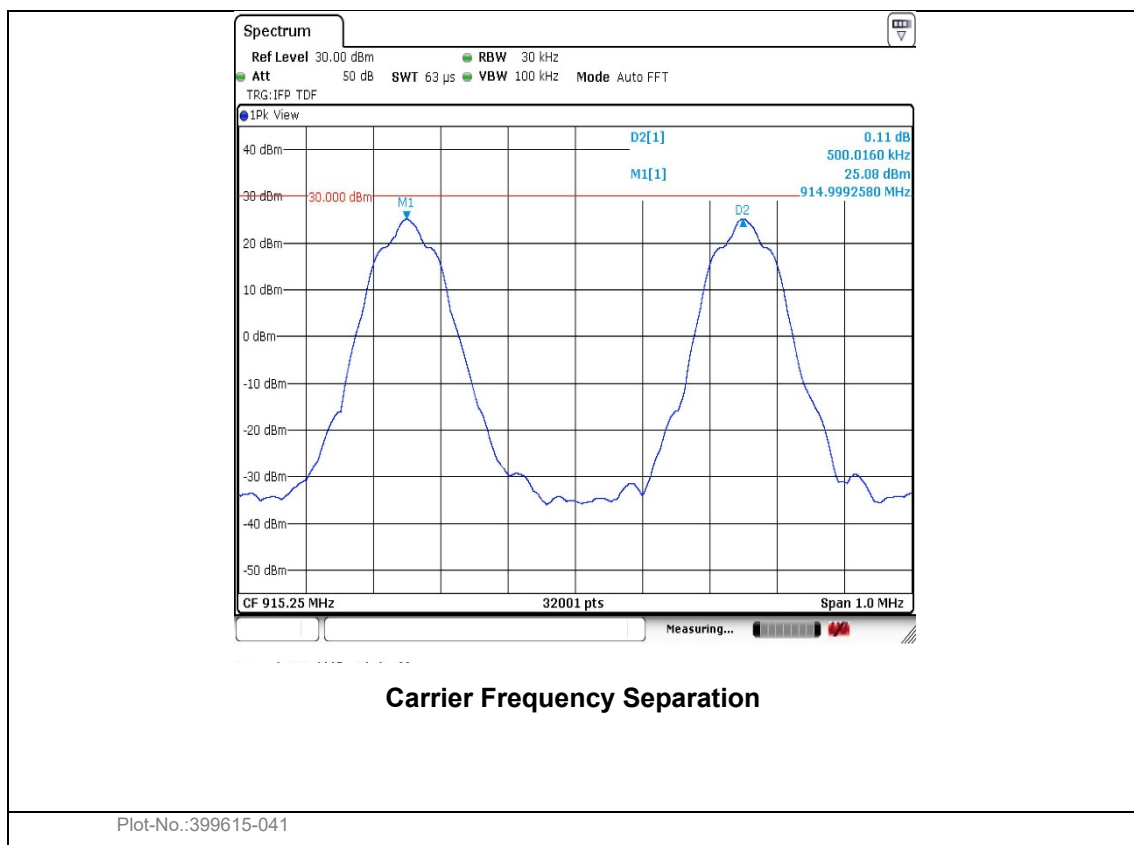
Measurement Data:

Carrier Frequency Separation (kHz)	Limit (20 dB BW) (kHz)	Margin (kHz)
500.016	92.220	407.796

Requirements:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Carrier Frequency Separation Plot



3.5 Occupied Bandwidth

Para. No.: 15.247 (a)(1)

Para. No.: 5.2 (1)

Test Performed By: Frederic Hupbauer

Date of Test: 2020-06-08

Test Results: Complies

Measurement Data:

Channel	Frequency (MHz)	99% Bandwidth (kHz)
Bottom	902.5	91.619
Middle	915.0	90.419
Top	927.5	90.419

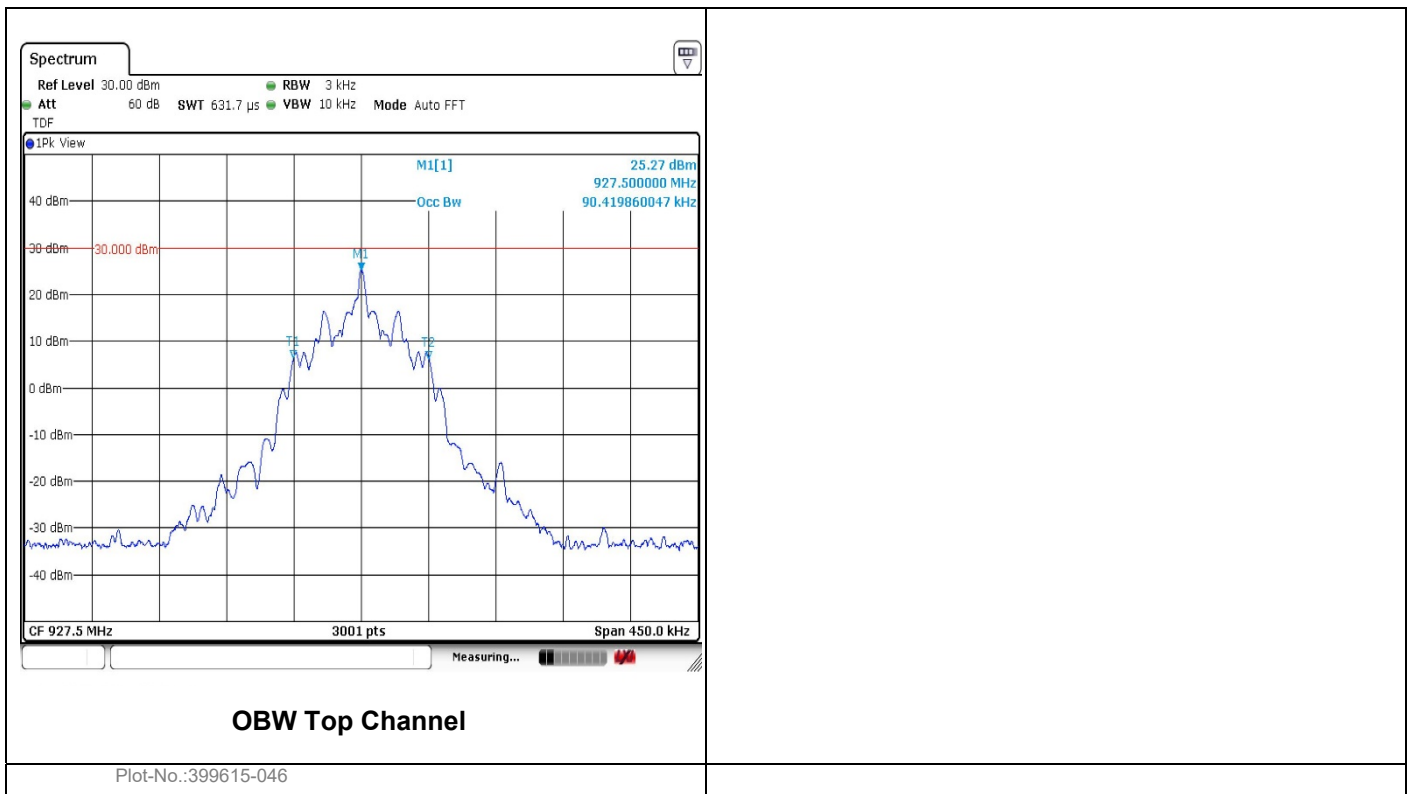
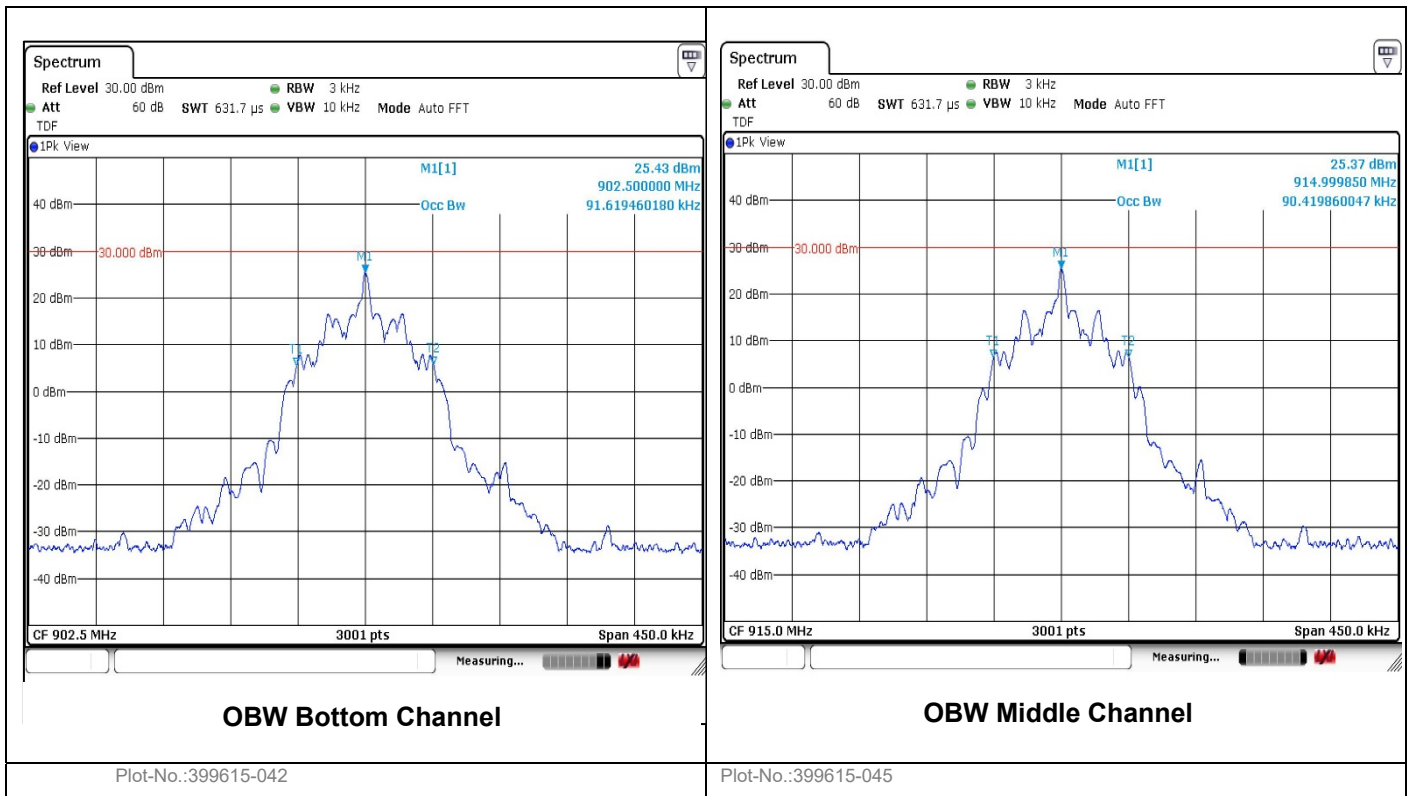
Requirements:

No requirements for bandwidth for this frequency band.

No requirements for Digital Transmission Systems.

Reported for information only

Occupied Bandwidth Plots



3.6 Transmitter Output Power

Para. No.: 15.247 (b)(2)

Para. No.: 5.4(a)

Test Performed by: Frederic Hupbauer	Date of Test: 2020-06-08
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Test Results: Complies

Measurement Data:

Channel	Conducted Output Power (dBm)	Limit (dBm)	Margin (dB)
Bottom	25.47	30.0	4.53
Middle	25.41	30.0	4.59
Top	25.32	30.0	4.68

Channel	Conducted Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)
Bottom	25.47	6.0	31.47	36.0	4.53
Middle	25.41	6.0	31.41	36.0	4.59
Top	25.32	6.0	31.32	36.0	4.68

Channel	Measured Maximum Field strength (dBμV/m)	Calculated EIRP (dBm)	Limit (dBm)	Margin (dB)
Bottom	130.05	34.85	36.0	1.15
Middle	129.42	34.22	36.0	1.78
Top	127.79	32.59	36.0	3.41

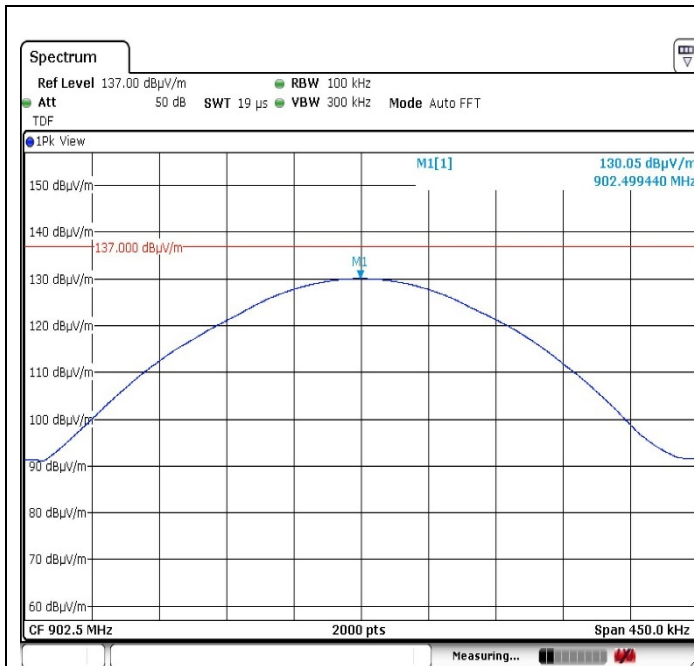
Requirements:

The maximum peak output power shall not exceed the following limits:

For frequency hopping systems in the 902 – 928 MHz band employing at least 50 hopping channels: 1 Watt

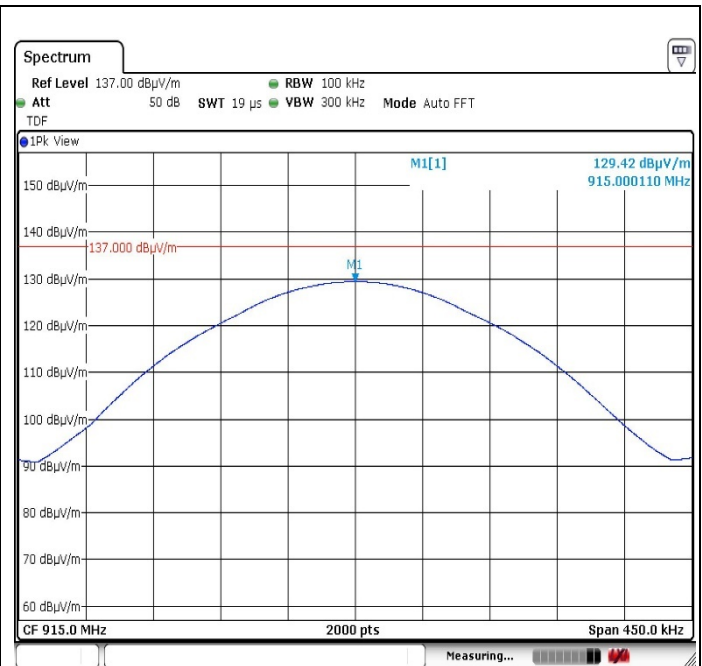
If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced below the stated value above by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Radiated Field Strength Plots



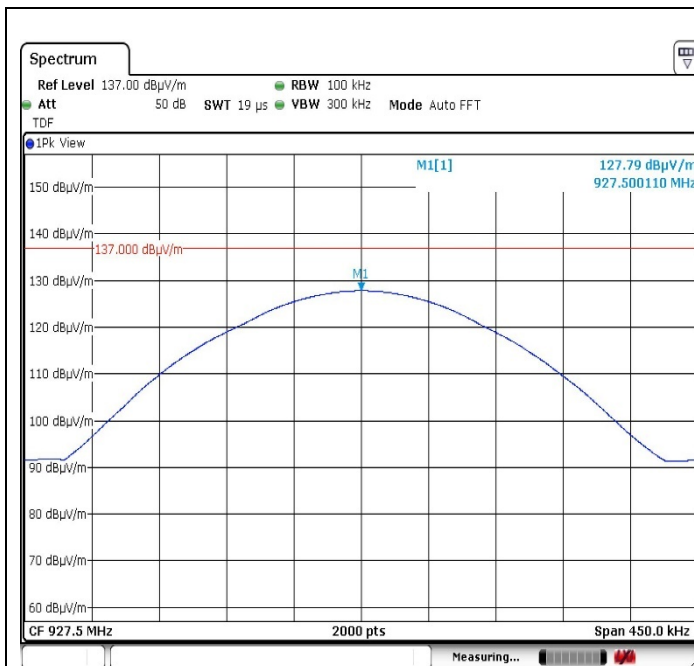
Radiated Field Strength Bottom Channel

Plot-No.:399615-052



Radiated Field Strength Middle Channel

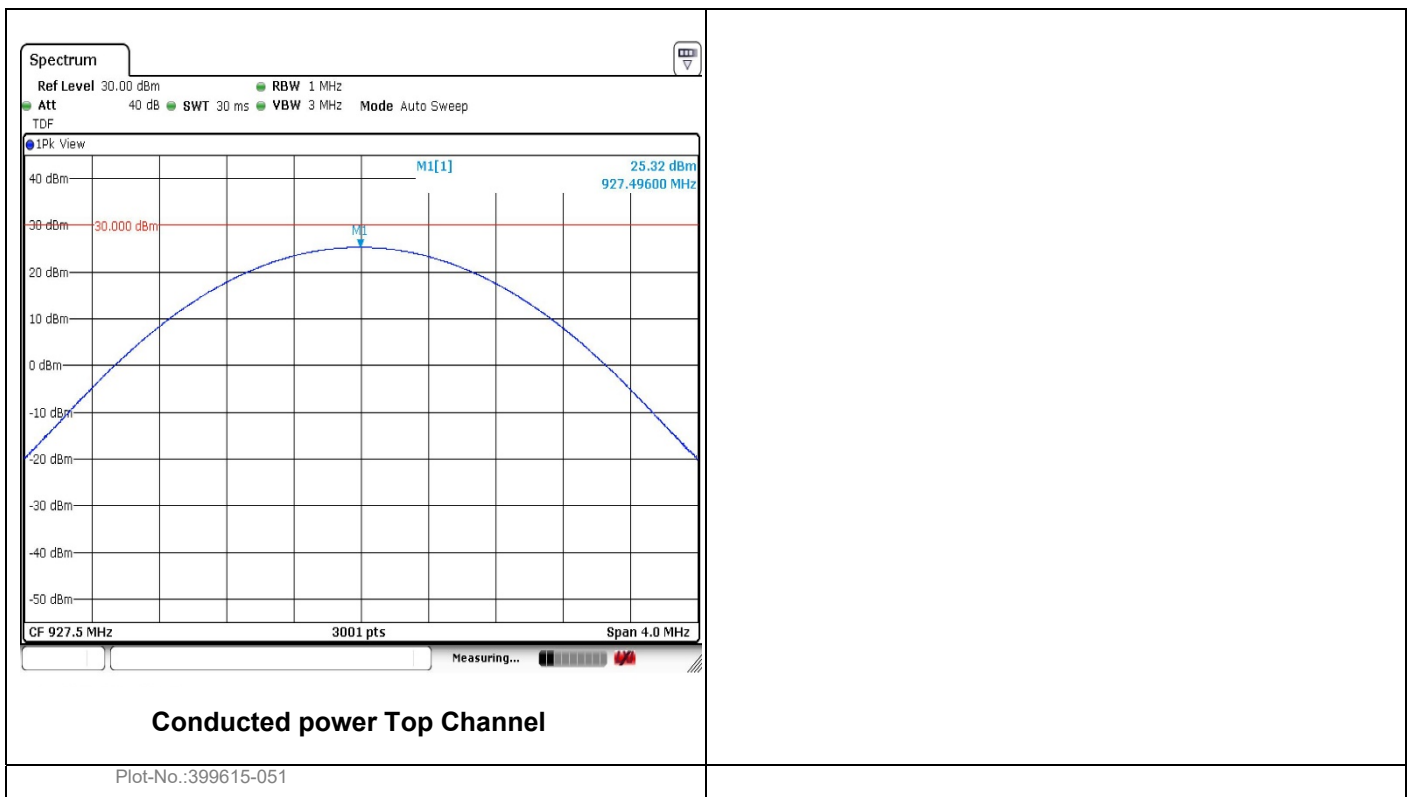
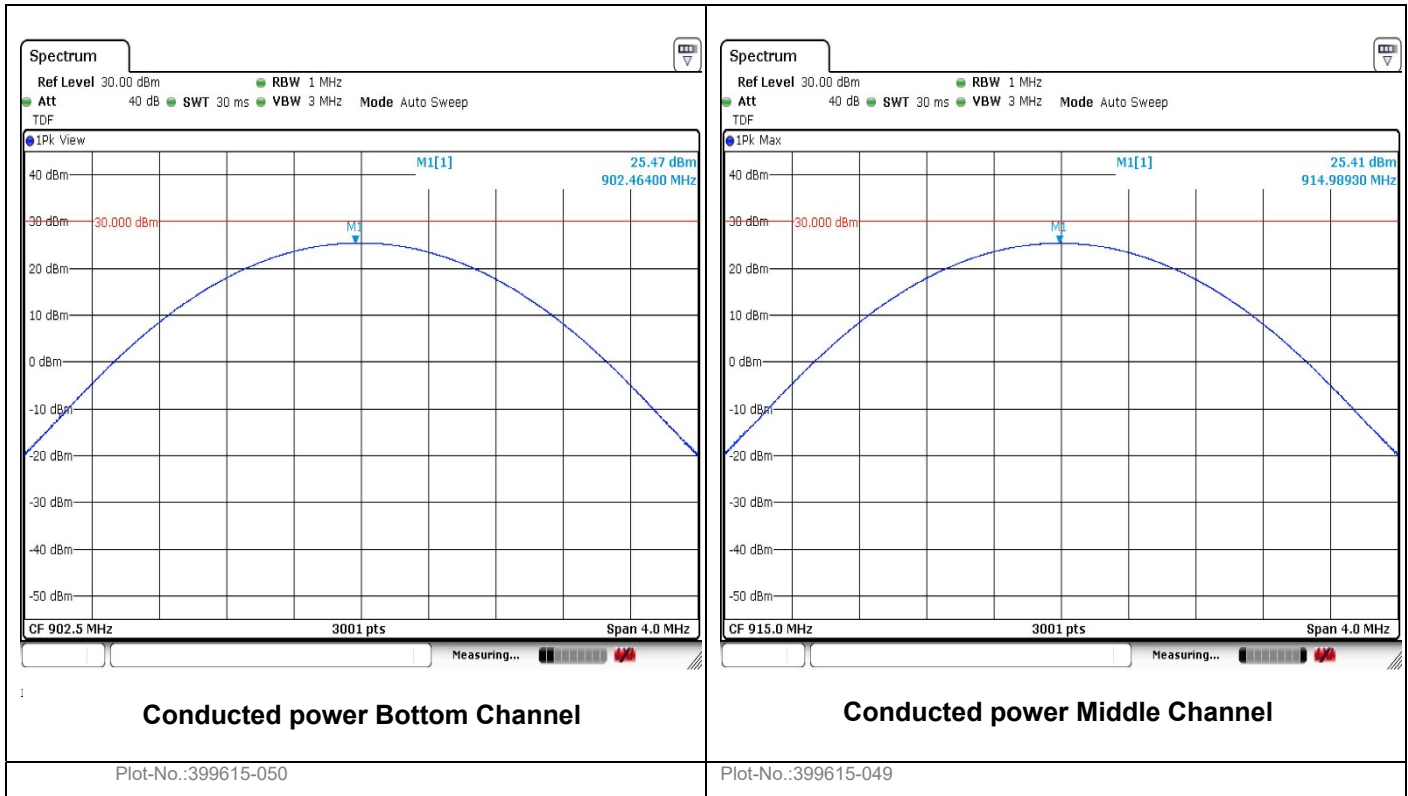
Plot-No.:399615-053



Radiated Field Strength Top Channel

Plot-No.:399615-054

Conducted Peak Output Power Plots



3.7 Transmitter Conducted Emissions

Para. No.: 15.247 (d)

Para. No.: 5.5

Transmitter conducted emissions from 9kHz to 30 MHz

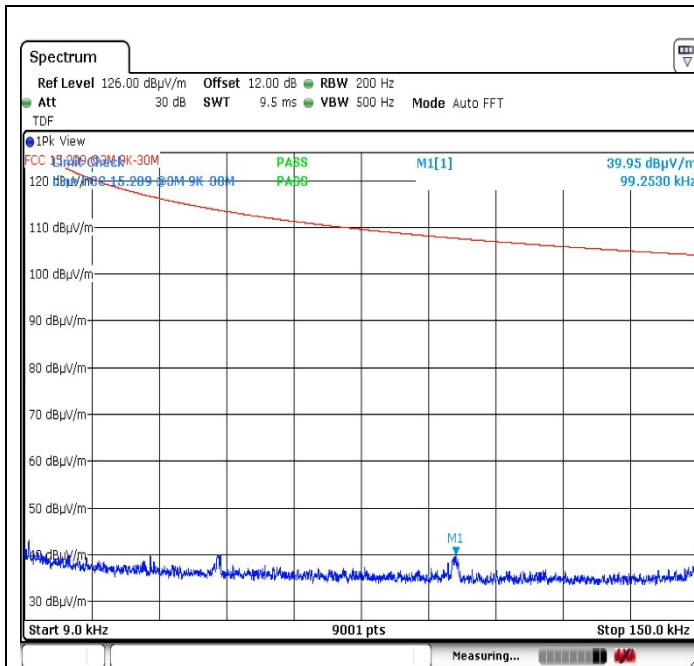
Test Performed by: Frederic Hupbauer	Date of Test: 2020-06-08
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Test Results: Complies

Measurement Data:

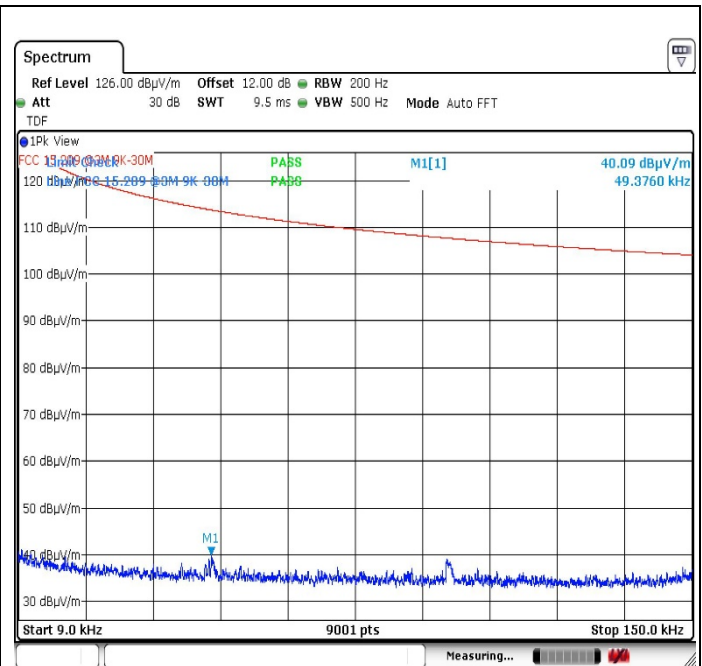
Measured Frequency (MHz)	Carrier Frequency (MHz)	Antenna	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
No spurious emissions were detected					

Conducted Emissions Plots



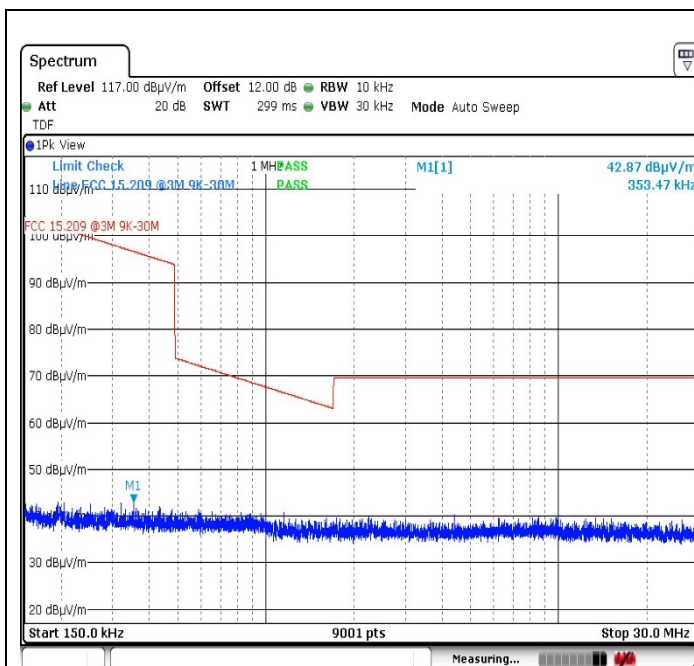
Conducted Emissions, 9 – 150 kHz Bottom Ch

Plot-No.:399615-029



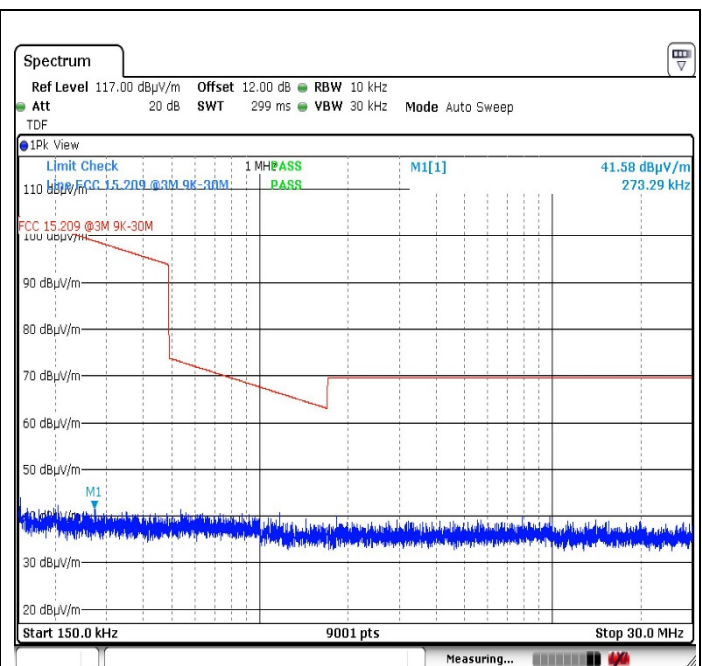
Conducted Emissions, 9 – 150 kHz Top Channel

Plot-No.:399615-033



Conducted Emissions, 150 kHz – 30 MHz Bot Ch

Plot-No.:399615-030



Conducted Emissions, 150 kHz – 30 MHz Top Ch

Plot-No.:399615-034

Transmitter conducted emissions from 30 MHz to 10 GHz

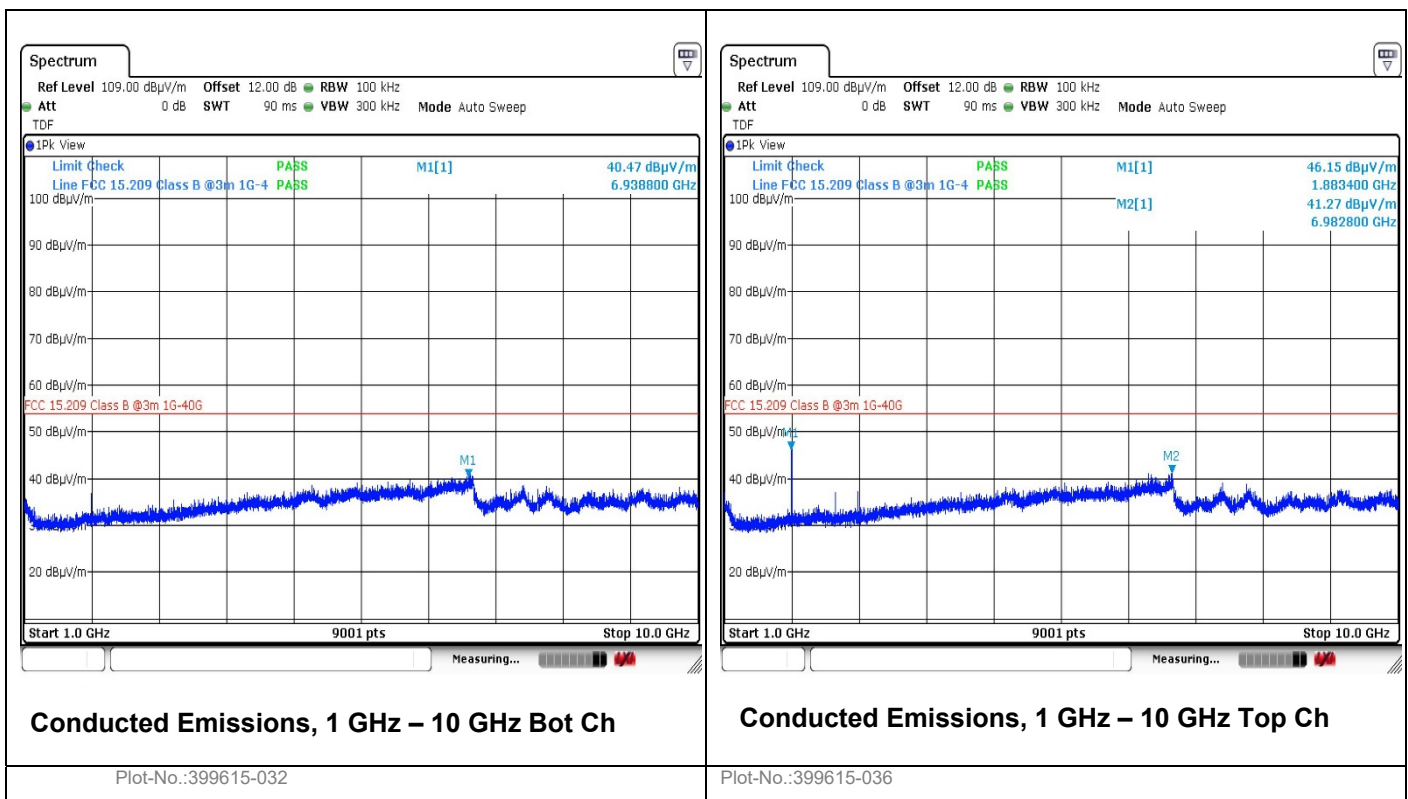
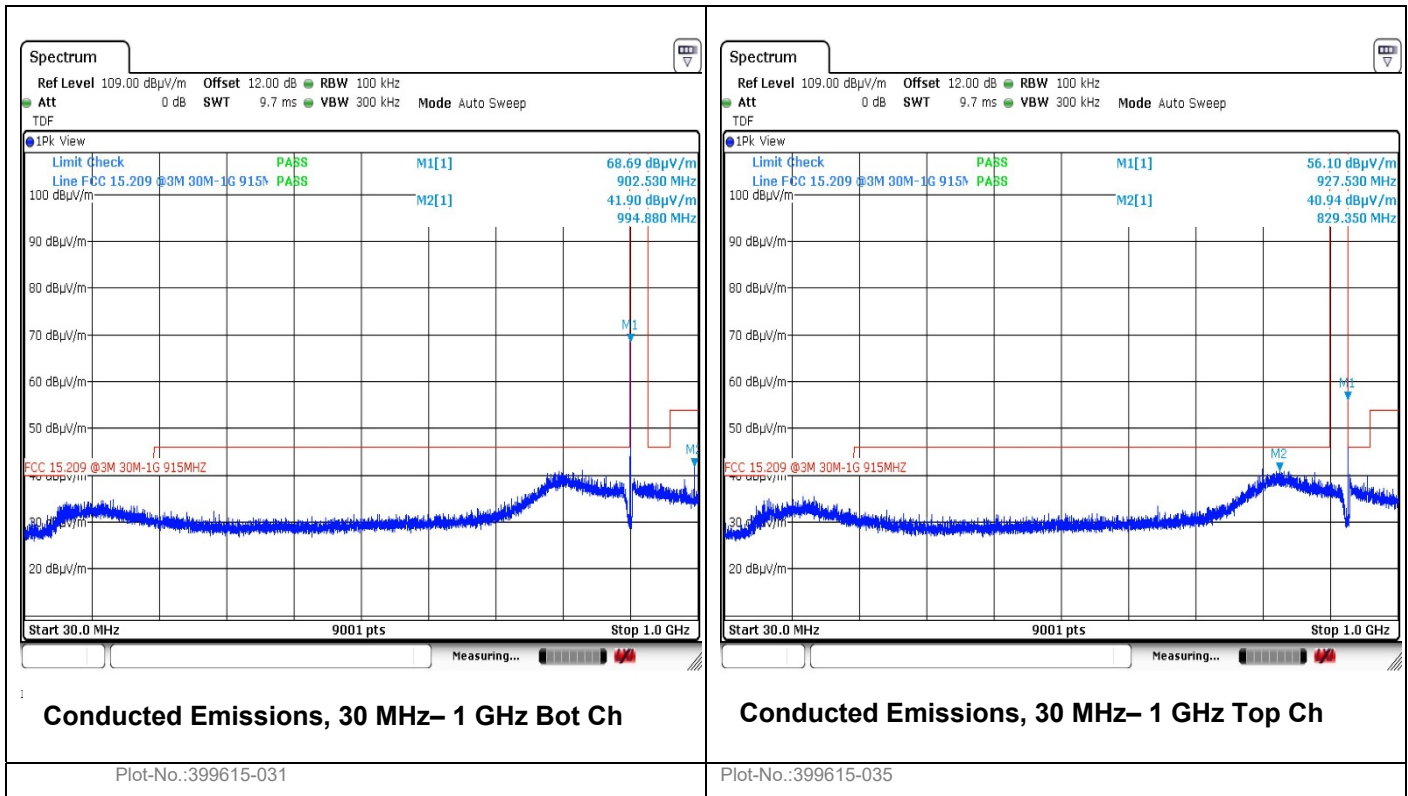
Test Performed by: Frederic Hupbauer	Date of Test: 2020-06-08
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Test Results: Complies

Measurement Data:

Measured Frequency (MHz)	Carrier Frequency (MHz)	Measured Emission Peak (dBµV/m)	Antenna Gain (dB)	Corrected Emission (dBµV/m)	Average Limit (dB)	Margin (dB)
994.880	902.53	41.90	6.0	47.90	54.0	6.10
1883.400	927.53	46.15	6.0	52.15	54.0	1.85

Transmitter conducted Emissions Plots



Restricted Bands of operation

Restricted Bands of operation for FCC and ISSED are defined in FCC Part 15.205 and ISSED RSS-GEN, Issue 5 clause 8.10.

Generally, no fundamentals are allowed in the restricted bands and all emissions must comply with the limits in FCC 15.209 or RSS-GEN, Issue 5, clause 8.9.

FCC (MHz)	ISED (MHz)	FCC (GHz)	ISED (GHz)
0.090-0.110		0.96-1.24 1.3-1.427	0.96-1.427
0.495-0.505		1.435-1.6265	
2.1735-2.1905		1.6455-1.6465	
	3.020-3.026	1.660-1.710	
4.125-4.128		1.7188-1.7222	
4.17725-4.17775		2.2-2.3	
4.20725-4.20775		2.31-2.39	
	5.677-5.683	2.4835-2.5	
6.215-6.218		2.69-2.9	2.655-2.9
6.26775-6.26825		3.26-3.267	
6.31175-6.31225		3.332-3.339	
8.291-8.294		3.3458-3.358	
8.362-8.366		3.6-4.4	3.5-4.4
8.37625-8.38675		4.5-5.15	
8.41425-8.41475		5.35-5.46	
12.29-12.293		7.25-7.75	
12.51975-12.52025		8.025-8.5	
12.57675-12.57725		9.0-9.2	
13.36-13.41		9.3-9.5	
16.42-16.423		10.6-12.7	
16.69475-16.69525		13.25-13.4	
16.80425-16.80475		14.47-14.5	
25.5-25.67		15.35-16.2	
37.5-38.25		17.7-21.4	
73-74.6		22.01-23.12	
74.8-75.2		23.6-24.0	
108-121.94 123-138	108-138	31.2-31.8	
149.9-150.05		36.43-36.5	
156.52475-156.52525		Above 38.6	
156.7-156.9			
162.0125-167.17			
167.72-173.2			
240-285			
322-335.4			
399.9-410			
608-614			

Frequencies in **Bold** text are specific for FCC or ISSED, all other frequencies are common.

3.8 Transmitter Band Edge Radiated Emission

Para. No.: 15.247 (d) / 15.209 (a)

Para. No.: RSS-247 5.5 / RSS-Gen 8.9

Test Performed by: Frederic Hupbauer	Date of Test: 2020-06-10
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Test Results: Complies

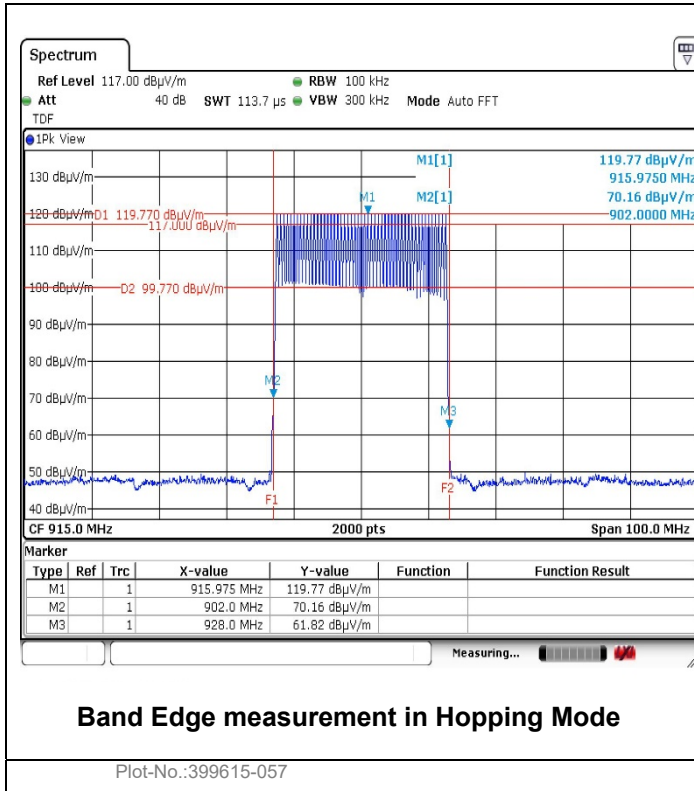
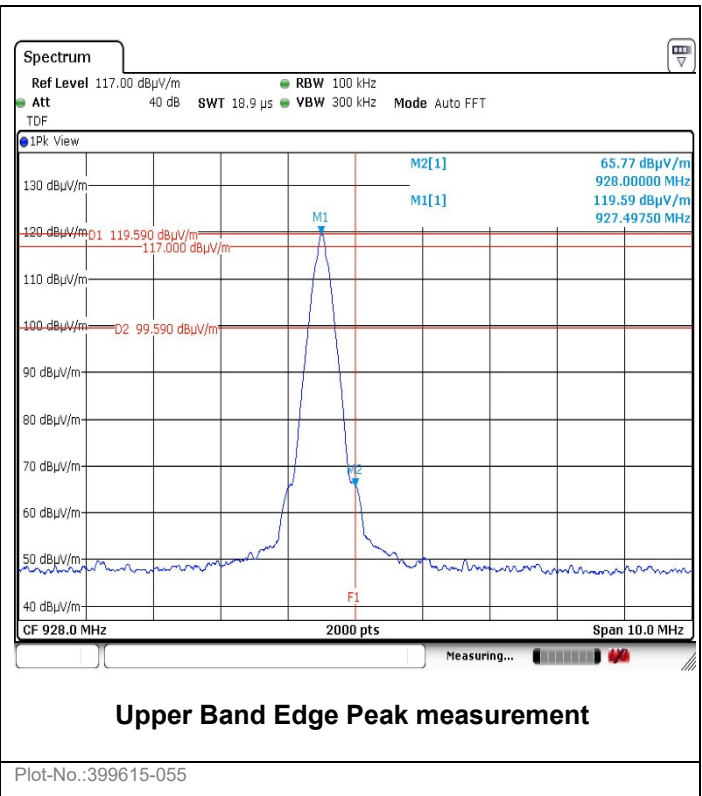
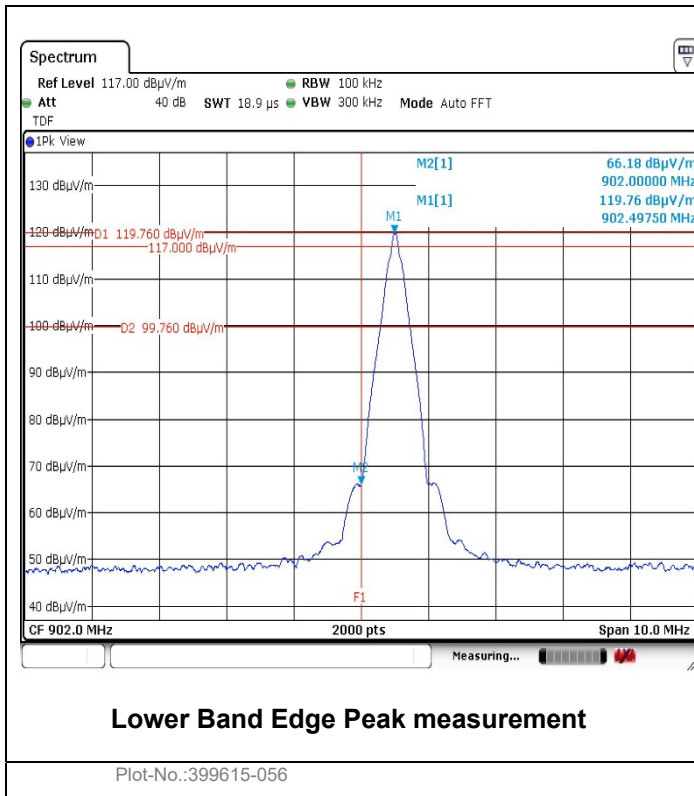
Measurement Data: EUT set on Bottom and Top Channel

Frequency (MHz)	Measured field strength (dB μ V/m)	Detector	20 dBc Limit (dB μ V/m)	Margin (dB)
902.00	66.18	Peak	99.76	33.58
928.00	65.67	Peak	99.59	33.92

Measurement Data: EUT in Hopping Mode

Frequency (MHz)	Measured field strength (dB μ V/m)	Detector	20 dBc Limit (dB μ V/m)	Margin (dB)
902.00	70.16	Peak	99.77	29.61
928.00	61.82	Peak	99.77	37.95

Band-edge Radiated Emissions Plots



4 MEASUREMENT UNCERTAINTY

Measurement Uncertainty Values		
Test Item		Uncertainty
Output Power		±0.8 dB
Out of Band Emissions, Conducted	< 3.6 GHz	±0.8 dB
	> 3.6 GHz	±1.2 dB
Spurious Emissions, Radiated	< 200 MHz	±4.77 dB
	200 MHz - 1 GHz	±5.02 dB
	1 GHz – 18 GHz	±4.94 dB
	> 18 GHz	±5.91 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		±3.58 %
Temperature Uncertainty		±1 °C

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2

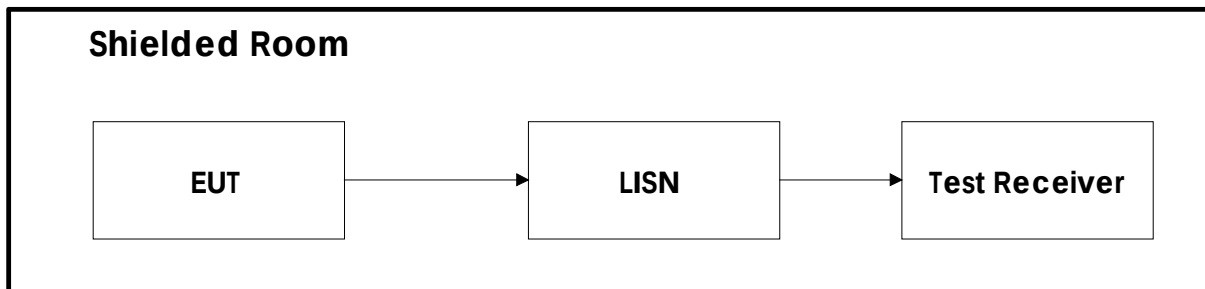
5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

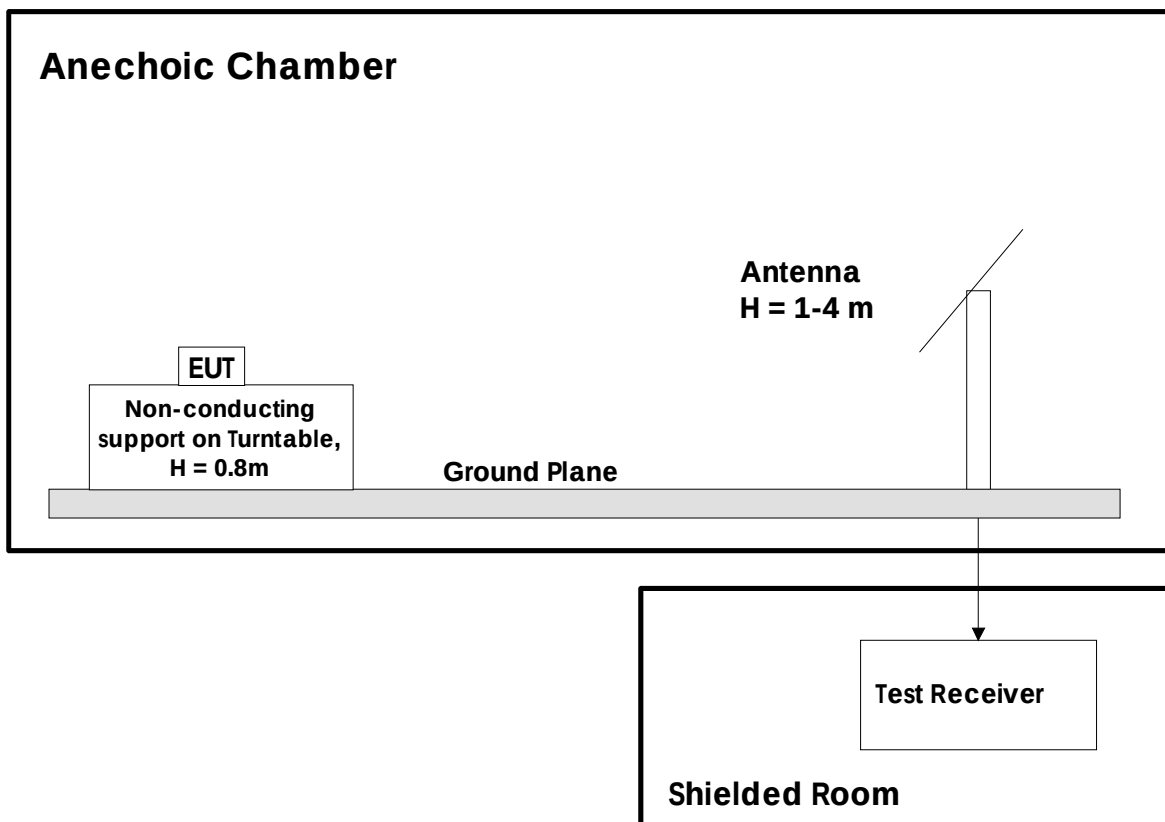
Inv.-Nr.	Instrument/ ancillary	Manufacturer	Type	Serial number	Cal. Date	Cal. Due
1-0037	Artificial mains network, 3ph	Rohde & Schwarz	ESH2-Z5	882394/019	2019-09	2020-09
1-0040	Biconical antenna	Rohde & Schwarz	HK116	888945/007	2017-07	2020-07
1-0054	Pulse limiter	Rohde & Schwarz	ESH3-Z2	3MSE/0099	2019-09	2020-09
1-0055	LogPer antenna	Rohde & Schwarz	HL223	826517/014	2017-07	2020-07
1-0072	Artificial mains network, 1ph	Rohde & Schwarz	ESH3-Z5	840062/001	2019-09	2020-09
1-0080	Turntable	H. Deisel	DS 420	1361114	N / A	N / A
1-0200	Trilog antenna	Schwarzbeck	VULB 9163	VULB 9163-107	2019-02	2022-02
1-0361	Semi anechoic chamber	Reinhold & Mahla	3m	1124	2019-12	2021-12
1-0364	Antenna cable 2	Kabelwerk Eupen	CMS / RG 214-N/7	none	2019-09	2022-09
1-0604	EMI test receiver	Rohde & Schwarz	ESU8	100203	2019-09	2020-09
1-0611	Spectrum analyzer	Rohde & Schwarz	FSV 40	100898	2019-09	2020-09
1-0614	Log.-per. antenna	Schwarzbeck	STLP 9148	STLP 9148-133	2019-08	2022-08
1-0615	Pre amplifier	Schwarzbeck	BBV-9718	BBV 9718-191	2019-09	2020-09
1-0619	Coaxial cable (to SAC)	Huber+Suhner	SF106/2x11N-651/2m	70168/6	2019-09	2022-09
1-0620	Antenna cable 3	Huber+Suhner	SF106/2x11N-651/3m	70619/6	2019-09	2022-09
1-0624	EMI-Software Radimation	DARE	Radimation	not applicable	N / A	N / A
1-0770	Horn antenna	Schwarzbeck	BBHA 9170	BBHA 9170-477	2018-06	2021-06
1-0771	Horn antenna	Schwarzbeck	BBHA 9170	BBHA 9170-476	2018-03	2021-03
1-0772	Horn antenna	Schwarzbeck	BBHA 9120D	BBHA 9120D-972	2018-03	2021-03
1-0781	Pre amplifier	Schwarzbeck	BBV 9721	BBV 9721-001	2019-09	2020-09
1-0782	Antenna cable	Huber & Suhner	FB142A1060002020	75193-01	2017-10	2020-10
1-0794	Coaxial cable	Rosenberger	FB142A0010002020	65627-01	2017-10	2020-10
1-0806	Controller	Innco	CO 3000	821/34571114/L	N / A	N / A
1-0807	Antenna mast	Innco	MA-400-XPET	4681114	N / A	N / A
1-0870	10 dB Attenuator	mini circuits	BW-N10W5+	1429	2019-09	2022-09
1-0871	10 dB Attenuator	mini circuits	BW-N10W5+	1414	2019-09	2022-09
1-0925	Coaxial cable	HARBOUR	RG316 MIL	#003	2019-09	2022-09
1-0927	Coaxial cable	HARBOUR	RG316 MIL	#005	2019-09	2022-09
1-0993	6 dB Attenuator	mini circuits	BW-N6W5+	1725	2017-10	2020-10
1-0994	3 dB Attenuator	mini circuits	BW-N3W5+	1734	2017-10	2020-10
1-0995	6 dB Attenuator	mini circuits	UNAT-6+	15542	2017-09	2021-09
1-1012	Coaxial cable	Rosenberger	LA2-018-2000	010-1964471 0001	2018-09	2021-09
1-1037	Coaxial cable	Schwarzbeck	AK 9515H	AK 9515H #91	2018-09	2021-09

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission



6.2 Test Site Radiated Emission



Measurements at 1GHz and above were performed with turntable height 1.5m and with the ground plane covered by absorbers.

Revision history

Version	Date	Comment	Sign
00	2020-10-14	First version	FH

End of Report