Report No. 357461-03

Test Report

Product	Door Lock with radio Module
Name and address of the applicant	ASSA ABLOY Global Solutions Norway AS Anolitveien 1-3, 1400 Ski, Norway
Name and address of the manufacturer	ASSA ABLOY Global Solutions Norway AS Anolitveien 1-3, 1400 Ski, Norway
Model	LCX7302C1
Rating	3.2Vdc
Trademark	ASSA ABLOY
Serial number	/
Additional information	Door lock with 906MHz Radio Module
Tested according to	**FCC Part 15.249** Low Power Transmitter. 902 – 928MHz **Industry Canada RSS-210, Issue 9** Licence-Exempt Radio Apparatus, Category I Equipment
Order number	357461
Tested in period	2019.09.16 - 2019.10.03
Issue date	2019.10.22
Name and address of the testing laboratory	Instituttveien 6 Kjeller, Norway CAB Number: FCC: NO0001 ISED: NO0470 **An accredited technical test executed under the Norwegian accreditation scheme**

Prepared by [G. Suhanthakumar]	Approved by [Frode Sveinsen]

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1 INFORMATION

1.1 Test Item

Name :	ASSA ABLOY
FCC ID :	Y7V-LCX7302C1
Industry Canada ID :	9514A-LCX7302C1
Model/version :	LCX7302C1
Serial number :	/
Hardware identity and/or version:	C1
Software identity and/or version :	V1.00
Frequency Range :	906MHz
Tunable Bands :	None
Number of Channels :	1
Operating Modes :	Transceiver
Type of Modulation :	GFSK
User Frequency Adjustment :	None
Rated Output Power :	0.51 mW
Type of Power Supply :	3.2Vdc, Li-Ion Battery
Antenna Connector :	None, PCB antenna
Antenna Diversity Supported :	No
Desktop Charger :	No

Description of Test Item

LCX or LCU (Lock Case Unit) (door lock – LCX7302) and proximity:

I. LCX/LCU sends data over RF (906MHz) only in case when a person who has access to the cabin is in proximity of it (probably around 1.5m).
II. Proximity function works all the time and it turns on GREEN LED if s person has access to the cabin and touched a door handle or RED if a person do not have access to the cabin and also touch a door handle.
III. It is important to know that LCX must receive ‘permission’ to active RF and this permission comes from Master. In our system Master is a Panel which hangs on the wall. The distance between Panel and door is approximately 1 meter.

Theory of Operation

When a person comes into the proximity of the Master/Panel then it sends command to the LCX to be ready to open a door. When that person touches the door handle then LCX opends the door and then sends preamble which is 10ms long plus some data (data contains information about lock case status, dead bolt, door switch etc.).

If a person comes out from the ‘proximity’ of the Master/Panel then the LCX does not send any data and goes into sleep mode. It is just listening for ‘permission’ signal from the Master/Panel.

1.2 Normal test condition

Temperature:	20 - 24 °C
Relative humidity:	20 - 50 %
Normal test voltage:	3.2 V DC

The values are the limit registered during the test period.

1.3 Test Engineer(s)

G.Suhanthakumar

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

All measurements were done with the EUT powered by a fully charged battery.

All ports were populated during spurious emission measurements, i.e. with host device.

2 TEST REPORT SUMMARY

2.1 General

All measurements are tracable to national standards.

The tests were conducted for demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.249 and Industry Canada RSS-210 Issue 9.

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

Radiated tests were made in a semi-anechoic chamber at measuring distances of 1m, 3m and 10m.

A description of the test facility is on file with the FCC and Industry Canada.

☒ New Submission	☒ Production Unit
☐ Class II Permissive Change	☐ Pre-production Unit
DXT 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”.

2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-210 Issue 9, RSS-GEN Issue 5 reference	Result
Supply Voltage Variations	15.31(e)	F.2.2 (RSS-210) 6.11, 8.11 (RSS-Gen)	N/A[1]
Antenna Requirement	15.203	6.8 (RSS-GEN)	Complies [2]
Power Line Conducted Emission	15.107(a) 15.207(a)	8.8 (RSS-GEN)	N/A[1]
99% Occupied Bandwidth	N/A	6.7 (RSS-GEN)	-
Peak Power Output	15.249(a),(c),(e)	B.10 (RSS-210)	Complies
Band edge emissions	15.249(d)	B.10 (RSS-210)	Complies
Spurious Emissions (Radiated)	15.249(d), 15.209 15.35 (b)	B.10 (RSS-210) 6.13 (RSS-GEN) 8.9 (RSS-GEN)	Complies

1 EUT is battery powered

2 The EUT has only integrated antenna.

RSS-Gen Issue 5 covers section 6 & 8

RSS-210 issue 9 covers Annex B

3 TEST RESULTS

3.1 99% Occupied Bandwidth

Para. No.: 6.6 RSS-Gen

Test Results: -

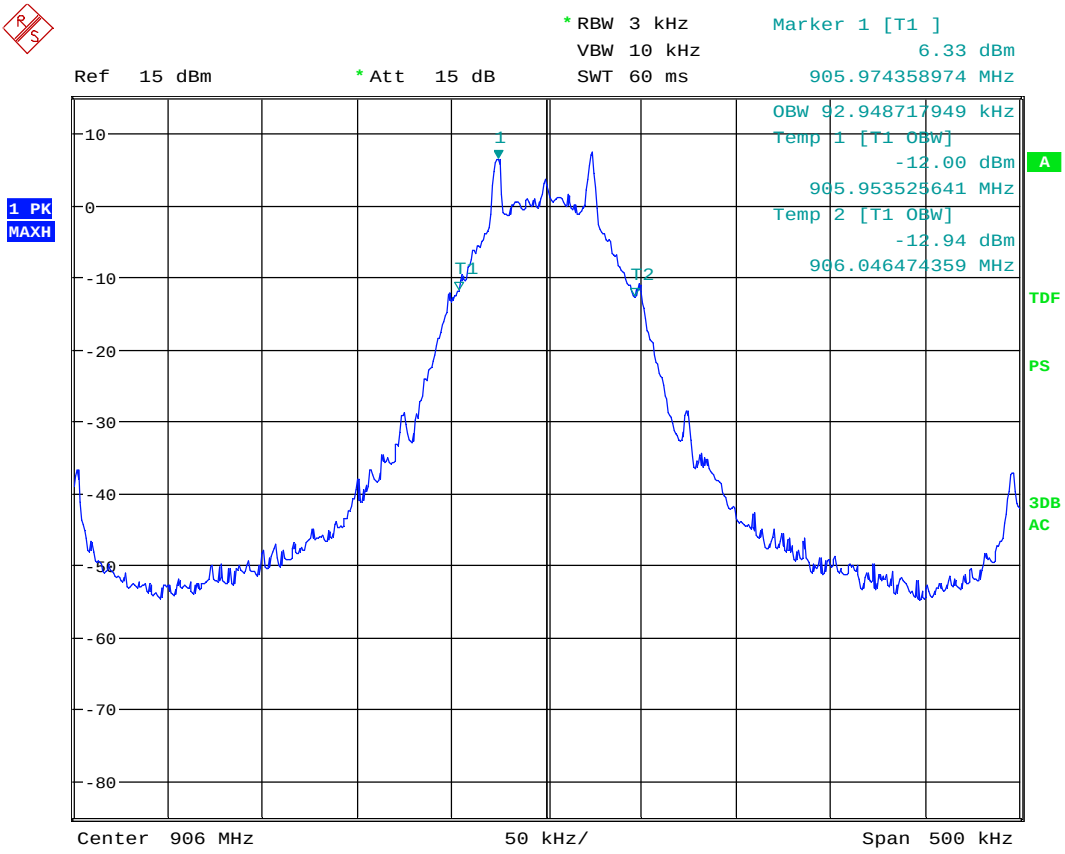
Measurement Data:

Measured 99% Bandwidth (kHz)		
-	**906 MHz**	**-**
-	92.95	-

See attached plots.

Requirements:

No requirement for 99% BW, reported for information only.



99% Bandwidth

3.2 Peak Power Output

FCC part 15.249 (a),(c),(e)

ISED Canada RSS-210 Issue 9, B.10

Measurement procedure: ANSI C63.10-2013 Clause 11.9.1.2

Test Results: Complies

Measurement Data:

PK detector

	906 MHz
Conducted Power (dBm)	8.33
Conducted Power (mWatts)	6.81
Field Strength (dBµV/m)	92.33
EIRP, Calculated (mWatts)	0.51
Antenna gain (dBd)	-13.4

Duty Cycle Correction Factor Calculation:

Duty Cycle = ON time / ON +OFF time= (9.8 ms/ 100 ms)*100= 9.8%

Duty Cycle Correction factor = -20 x log (0.098) = -20.18 dB

Maximum Duty Cycle Correction Factor according to Para 15.35 (b): 20 dB

Measured with 100%.

Antenna gain = 10*log(EIRP/Conducted power) dBi

EIRP is calculated from measured field strength by the formulas in KDB 412172 D01 Determining ERP and EIRP v01r01.

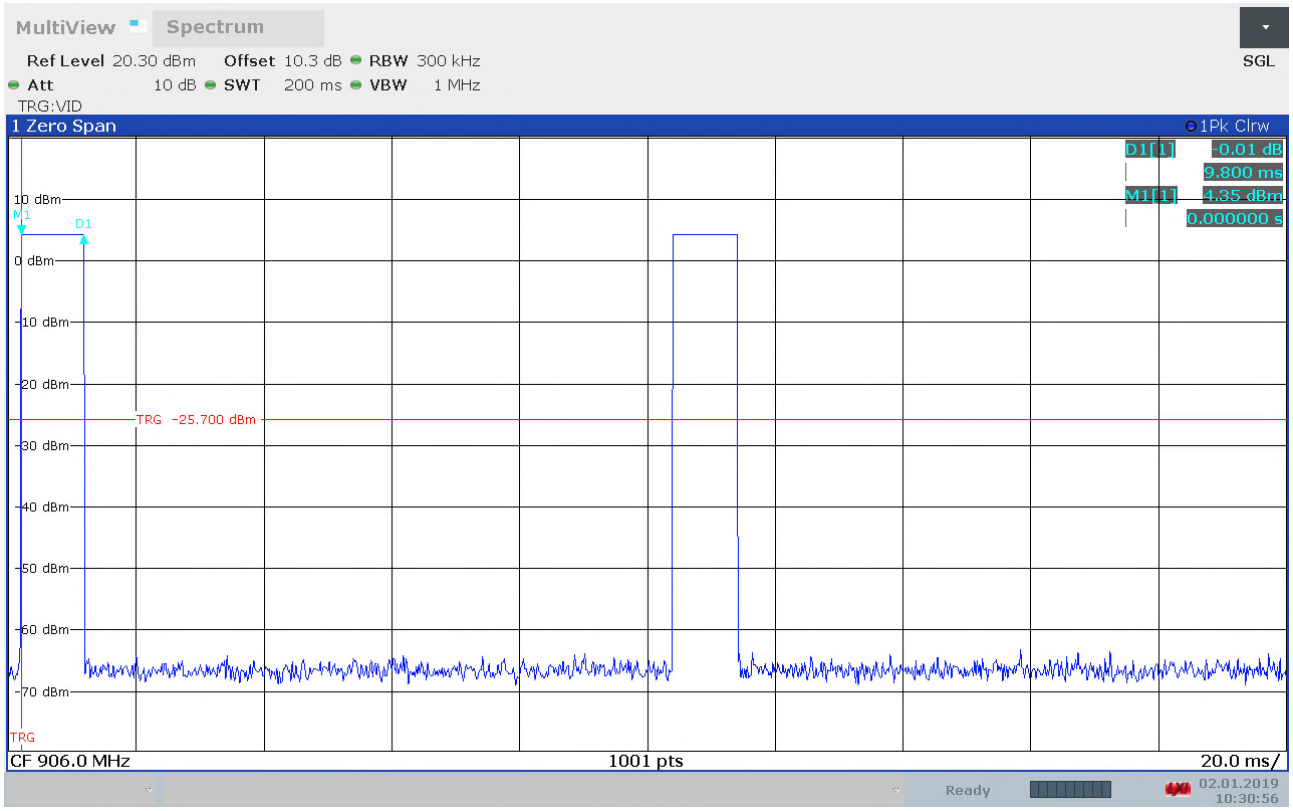
See attached plots.

Requirements:

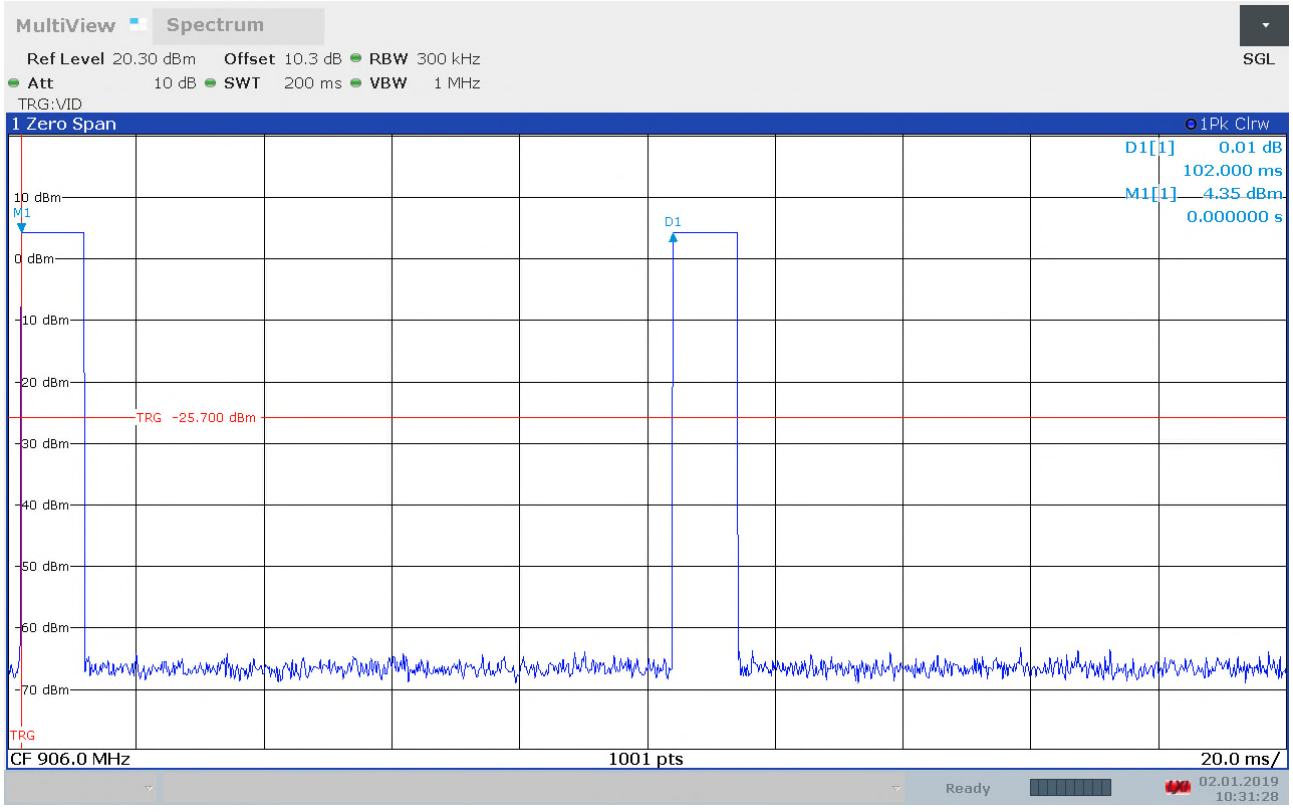
(e) As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a)

The maximum output power shall be ≤94 dBµV/m

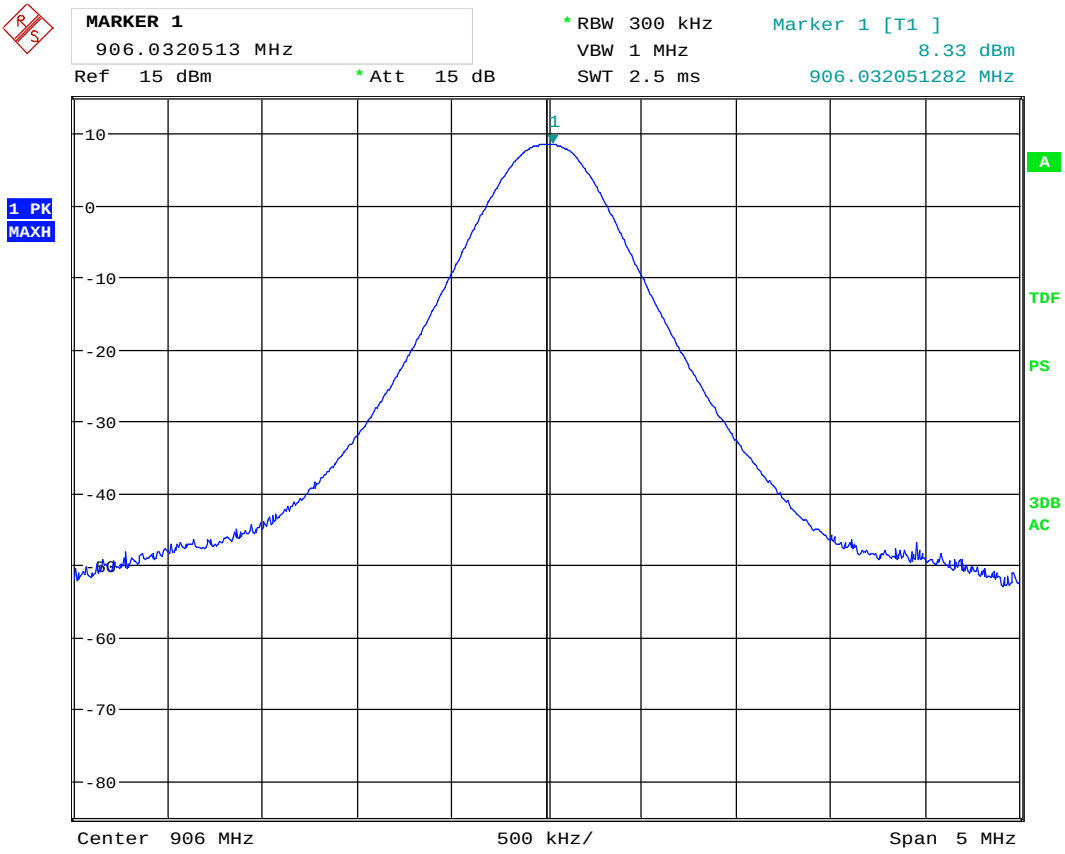
and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.



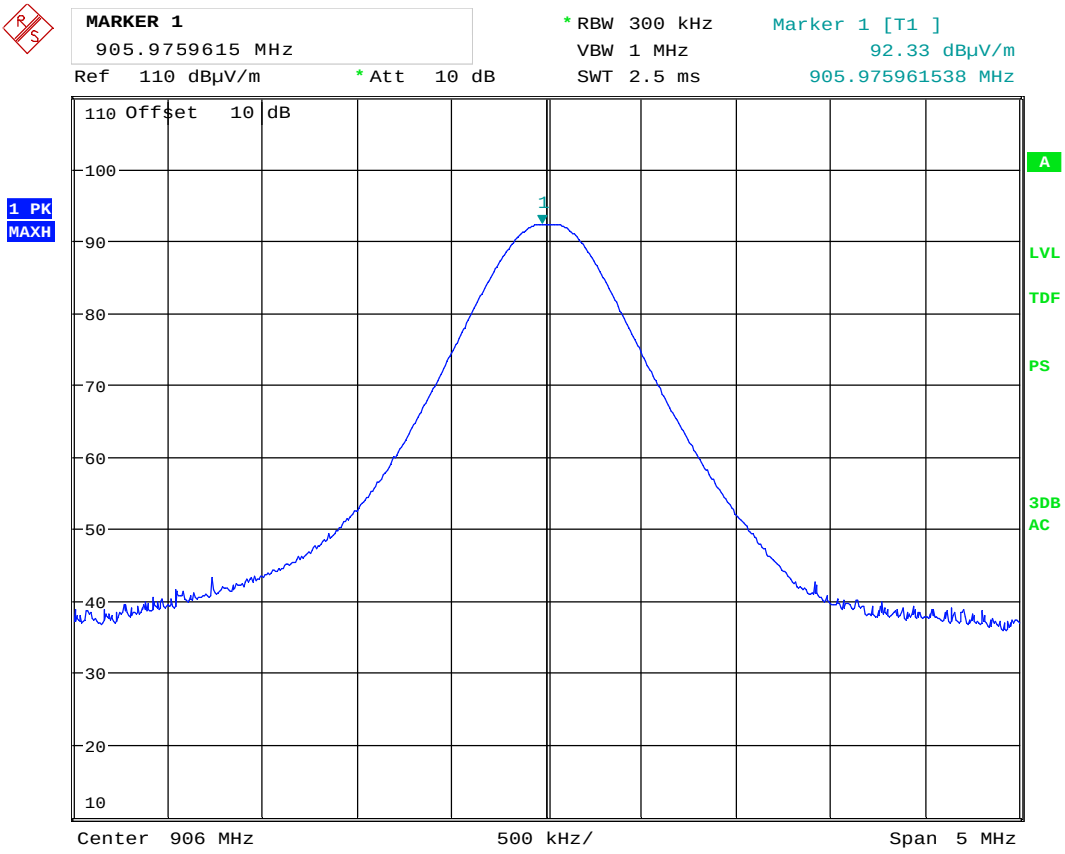
ON time



ON+OFF time

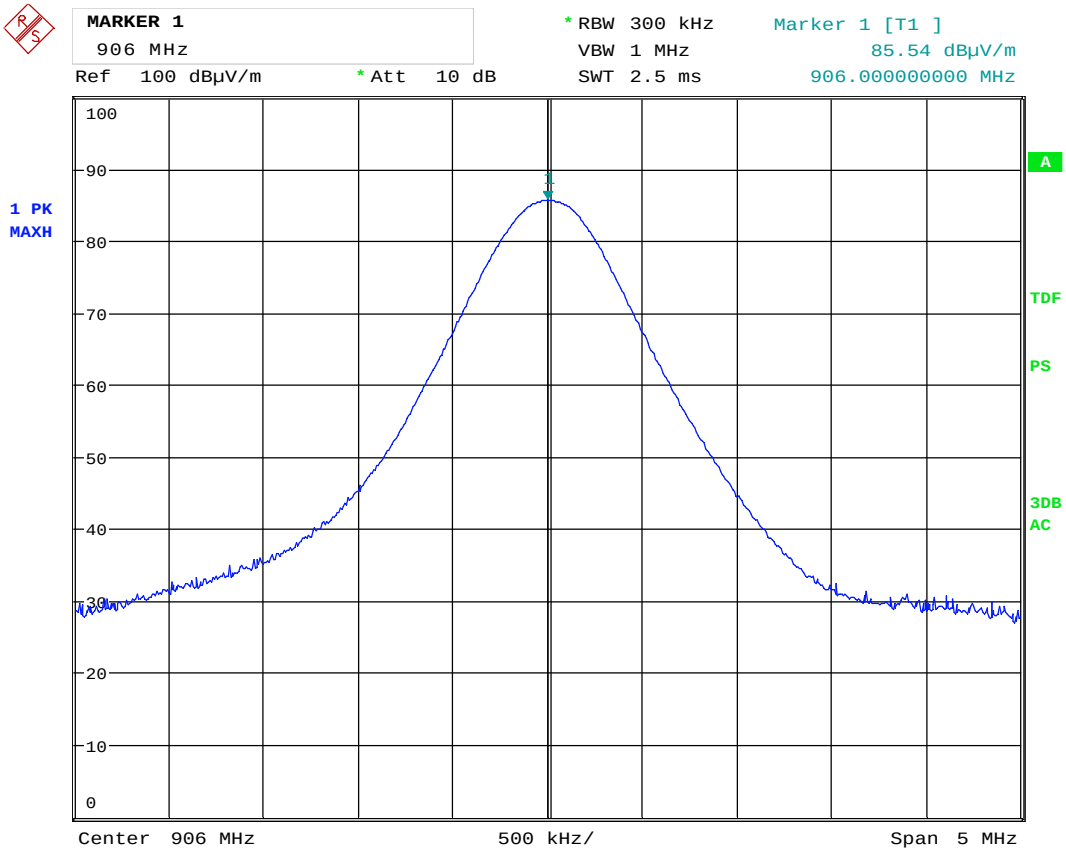


Conducted power, 906MHz



Date: 3.OCT.2019 08:19:00

Field strength @ Horizontal Polarization-906MHz



Date: 3.OCT.2019 08:09:55

Field strength @ Vertical Polarization-906MHz

3.3 Restricted Bands of operation

Restricted Bands of operation for FCC and ISED are defined in FCC Part 15.205 and ISED RSS-GEN, Issue 4 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 ISED, all other frequencies are common.

3.4 Spurious Emissions (Radiated)

FCC Part 15.209, 249 (d)

ISED Canada RSS-210 Issue 9, B.10 , ISED Canada RSS-Gen Issue 5, clause 6.13.1 and 8.9,8.10

Measurement procedure: ANSI C63.10-2013 Clause 11.9.1.2

Test Results: Complies

See attached plots.

Duty Cycle Correction Factor Calculation:

Duty Cycle = ON time / ON +OFF time= (9.8 ms/ 100 ms)*100= 9.8%

Duty Cycle Correction factor = -20 x log(0.098) = -20.18dB

Maximum Duty Cycle Correction Factor according to Para 15.35 (b): 20 dB

Radiated emission 30 – 1000 MHz.

Measuring distance 3 m.

Tested in speech mode with active connection.

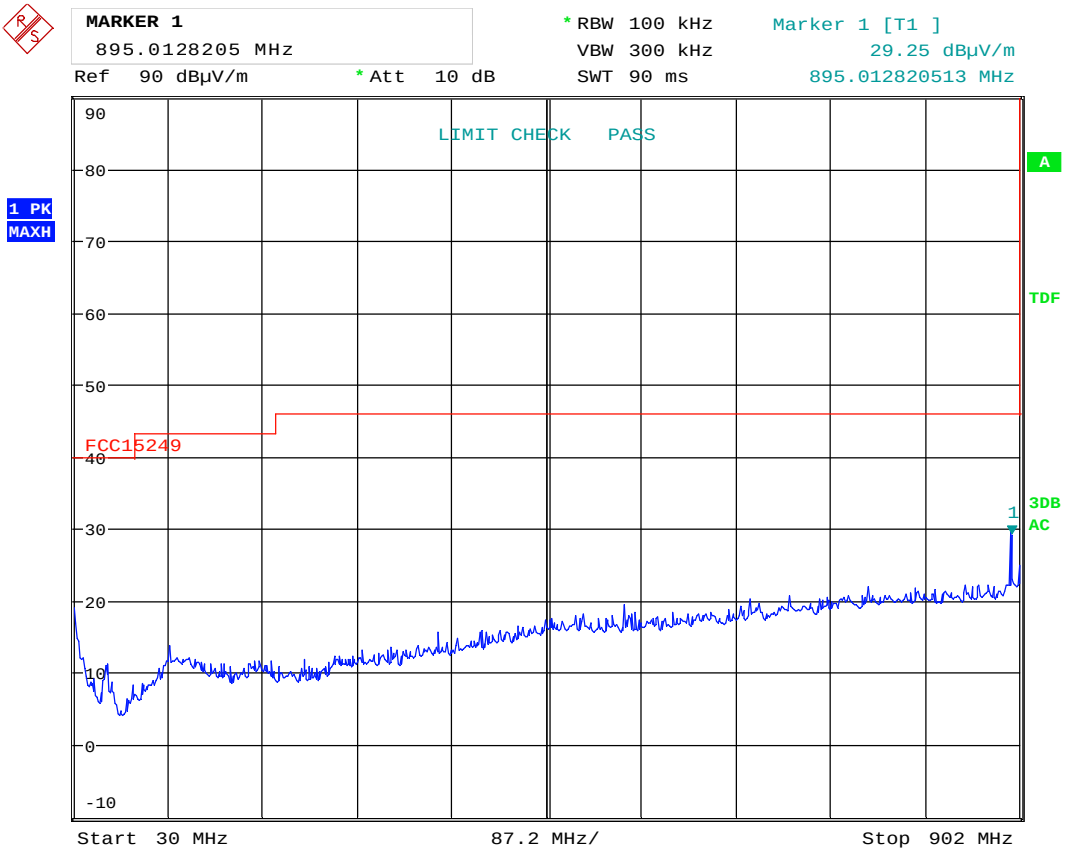
Frequency	Operational condition	Field strength	Measuring distance	Limit FCC15.209	Margin
MHz		dBµV/m	metres	dBµV/m	dB
34.6	TX on	17.29	3	40	22.7
902	TX on	36.4	3	46	9.6

See attached graphs.

Requirements/Limit

FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency (MHz)	**Quasi Peak (µV/m)**	**Quasi Peak (dBµV/m)**
30 – 88	100	40.0
88 – 216	150	43.5
216 – 960	200	46.0
Above 960	500	54.0

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.



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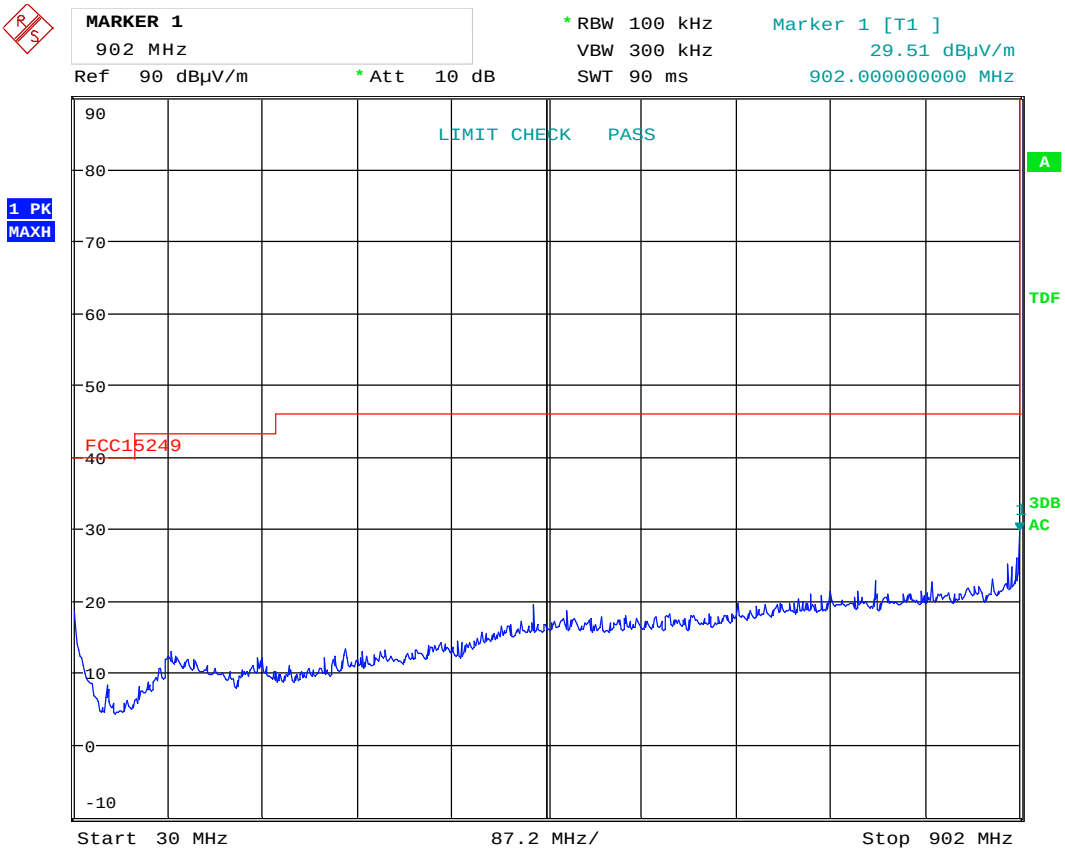
VP: 30 - 902MHz, PKscan



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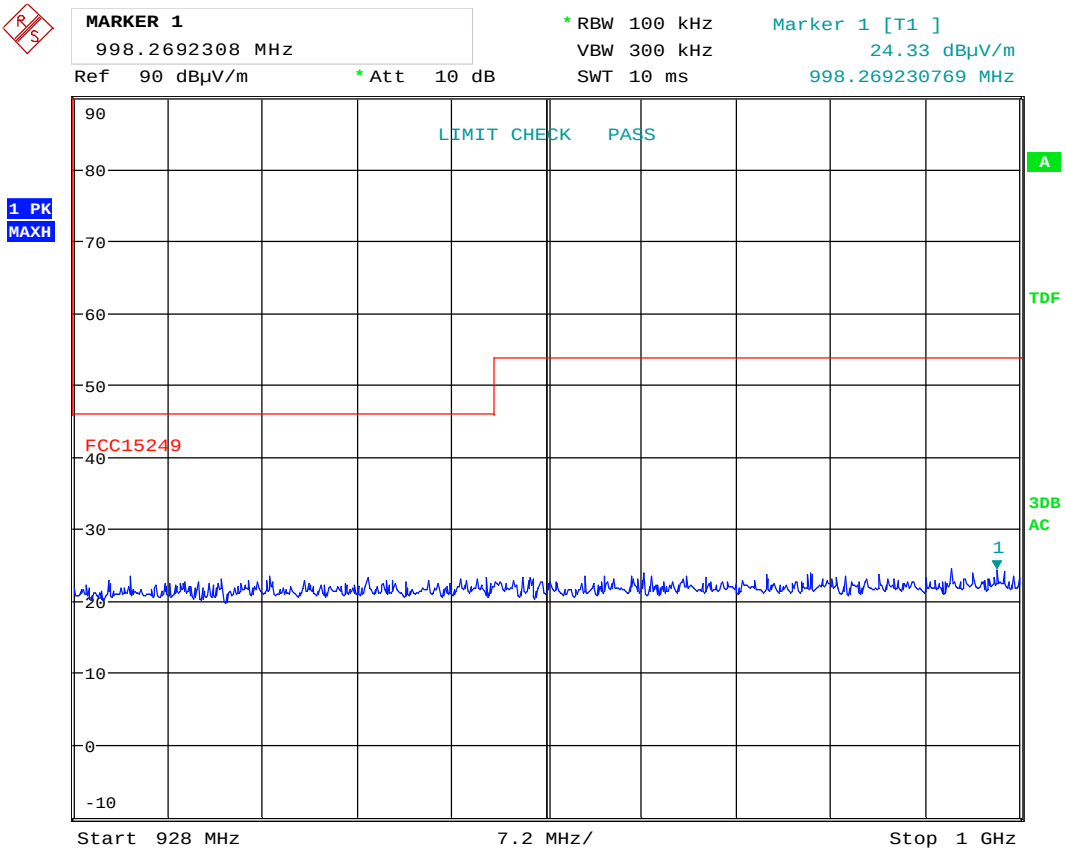
HP: 30 - 902MHz, PKscan



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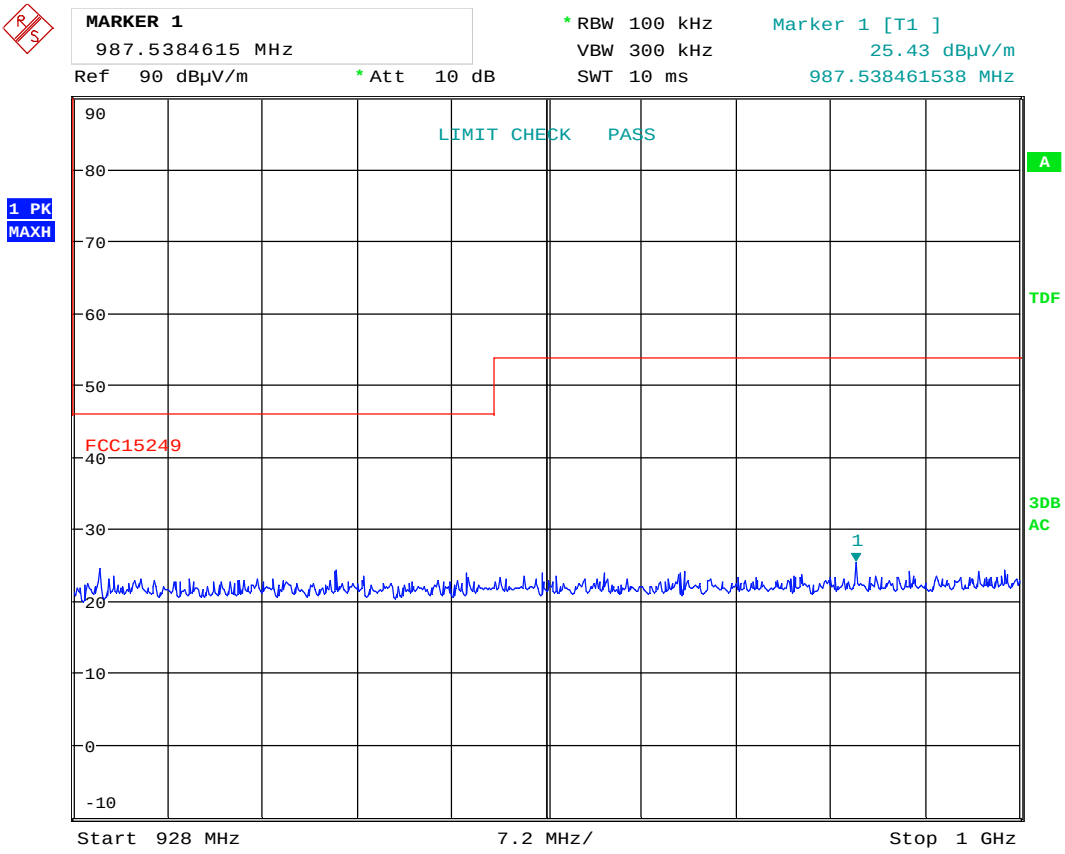
VP: 928 - 1000MHz, PKscan



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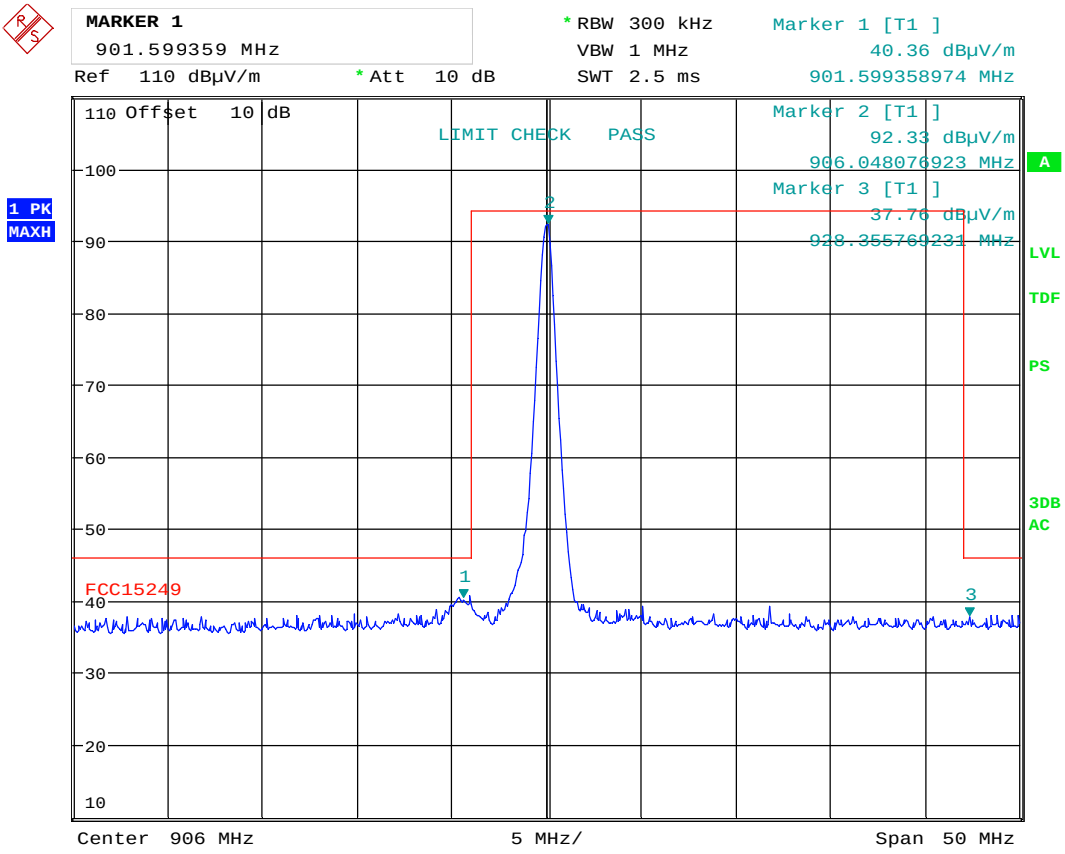
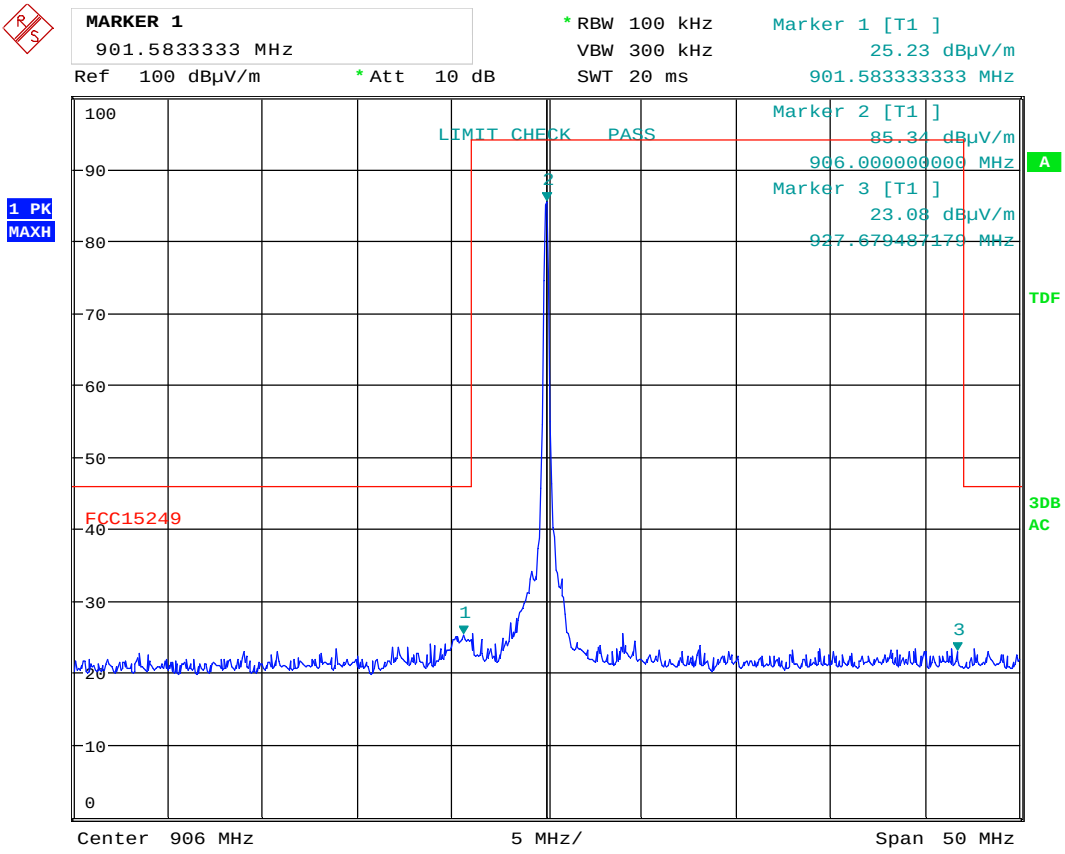
HP: 928 - 1000MHz, PKscan



Date: 3.OCT.2019 08:22:38

HP : In band



Date: 3.OCT.2019 08:31:26

VP: In band

Radiated Emissions, 1-10 GHz

Measuring distance: 3m (1 – 10 GHz)
1m (8.5 – 18 GHz)

Peak Detector:

Frequency	RF channel	Dist. corr. factor	Field strength, Peak Detector, 3m	Duty cycle corr. factor	Limit	Margin
MHz	L,M,H	dB	dBµV/m	dB	dBµV/m	dB
1807.69	906MHz	0	/	20	74	/
2718.0	906MHz	0	57.97	20	74	16.03
3625.0	906MHz	0	/	20	74	/
4533.65	906MHz	0	/	20	74	/
Other freqs	906MHz	0	None detected	20	74	-

Average Detector:

Frequency	RF channel	Dist. corr. factor	Field strength, Peak Detector, 3m	Duty cycle corr. factor	Limit	Margin
GHz	L,M,H	dB	dBµV/m	dB	dBµV/m	dB
1807.69	906MHz	0	/	20	54	/
2718.0	906MHz	0	46.45	20	54	7.55
3625.0	906MHz	0	/	20	54	/
4533.65	906MHz	0	/	20	54	/
Other freqs	L,M,H	/	None detected	20	54	-

Average Detector values are measured.

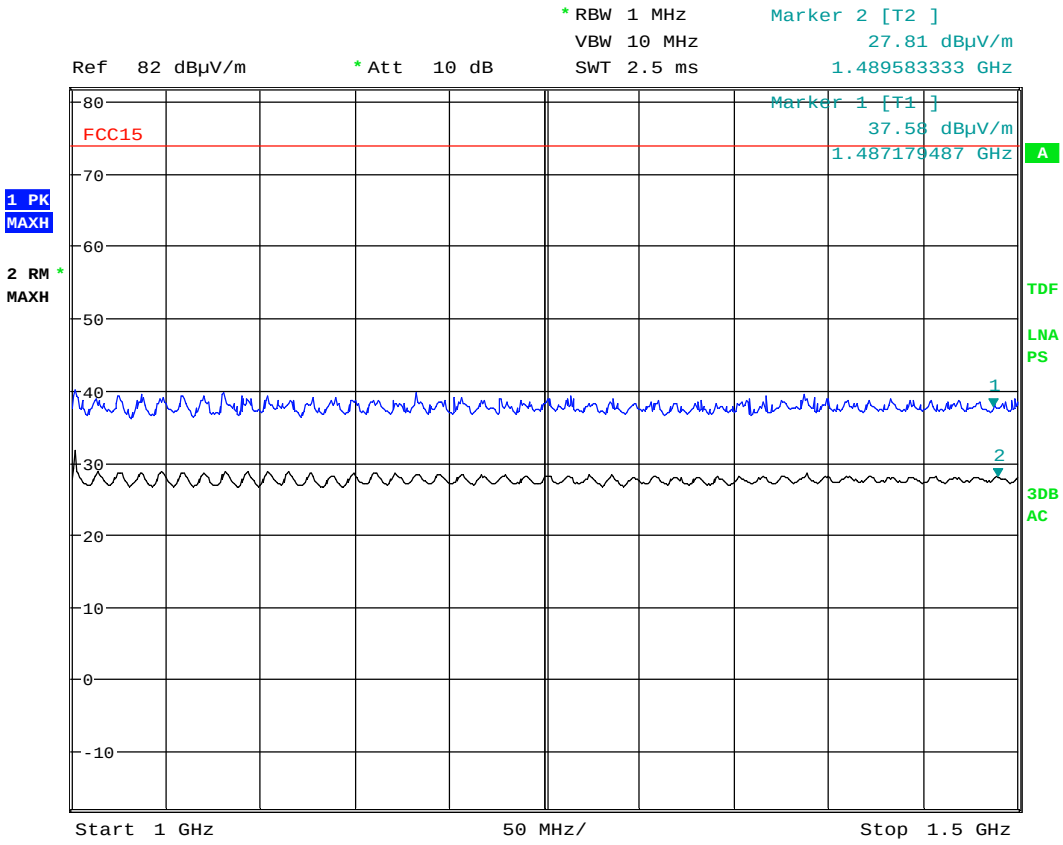
Antenna factor, amplifier gain and cable loss are included in spectrum analyzer “Transducer factor”.

See plots.

Requirements/Limit

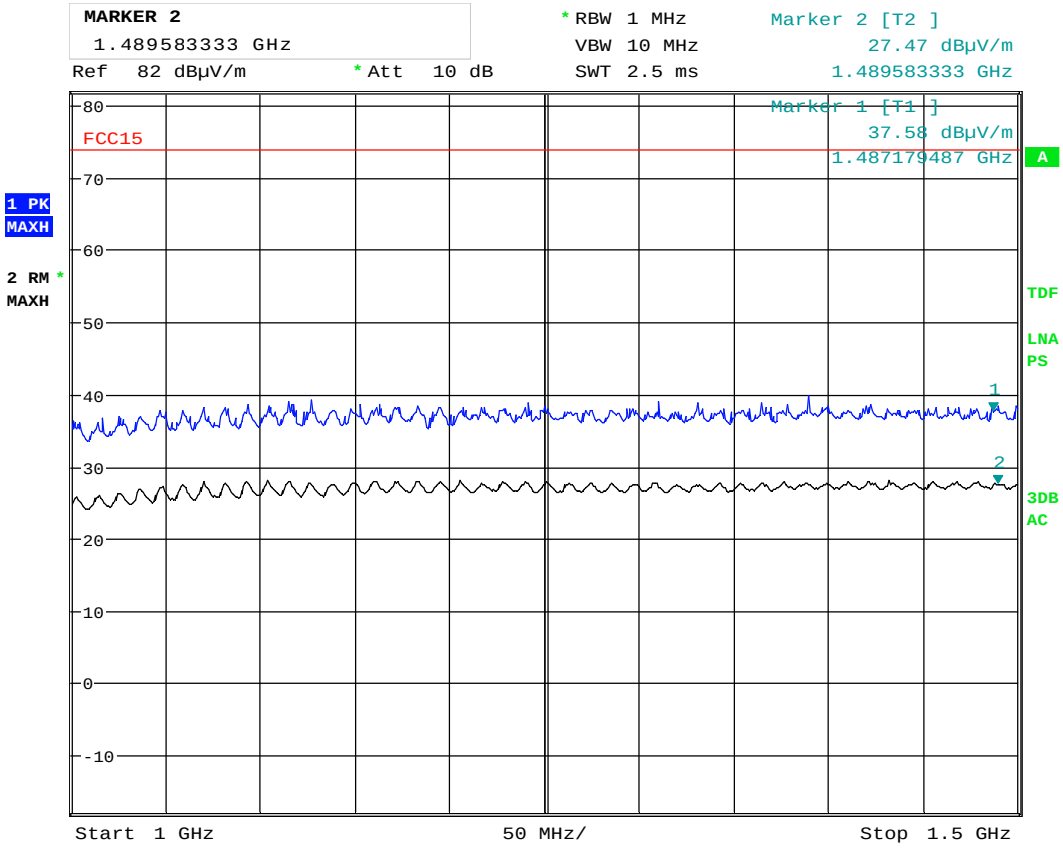
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency (MHz)	**AV (dBµV/m)**	**Peak (dBµV/m)**
Above 1 GHz	54.0	74.0

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.



Date: 16.SEP.2019 10:58:45

VP: 1 - 1.5GHz , PK scan



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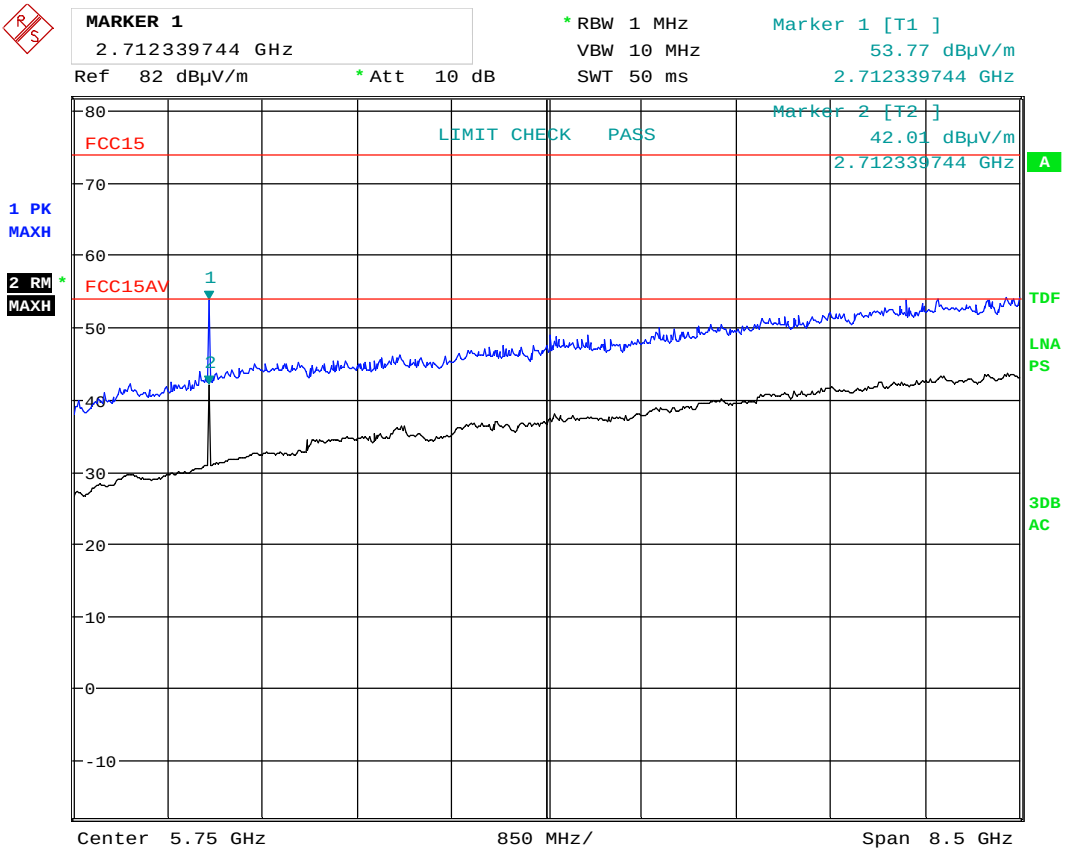
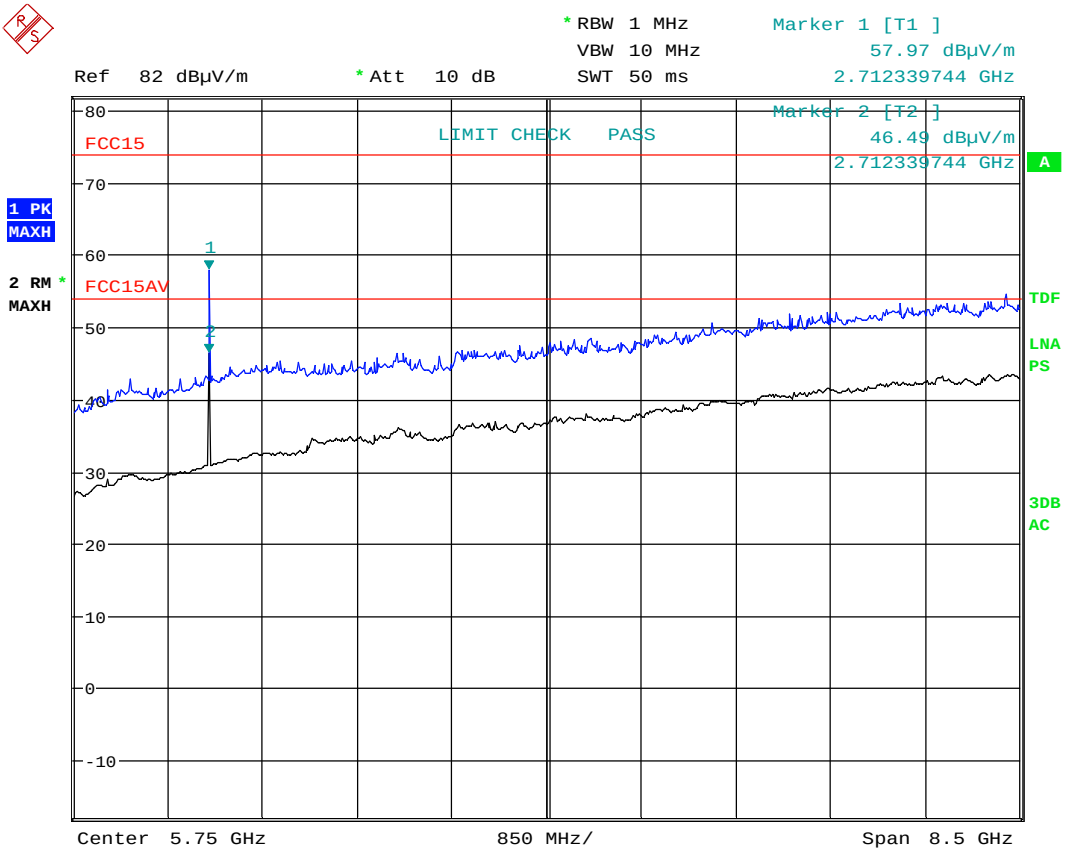
HP: 1 – 1.5GHz , PK scan



Date: 3.OCT.2019 09:03:58

VP: 1.5 - 10GHz , PK scan



Date: 3.OCT.2019 09:06:41

HP: 1.5 – 10GHz , PK scan

4 Measurement Uncertainty

Measurement Uncertainty Values		
Test Item		**Uncertainty**
Output Power		±0.5 dB
Power Spectral Density		±0.5 dB
Out of Band Emissions, Conducted	**< 3.6 GHz**	±0.6 dB
	> 3.6 GHz	±0.9 dB
Spurious Emissions, Radiated	**< 1 GHz**	±2.5 dB
	> 1 GHz	±2.2 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		+2.9 / -4.1 dB
Spectrum Mask Measurements	**Frequency**	±5 %
	Amplitude	±1.0 dB
Frequency Error		±0.6 ppm
Temperature Uncertainty		±1 °C

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

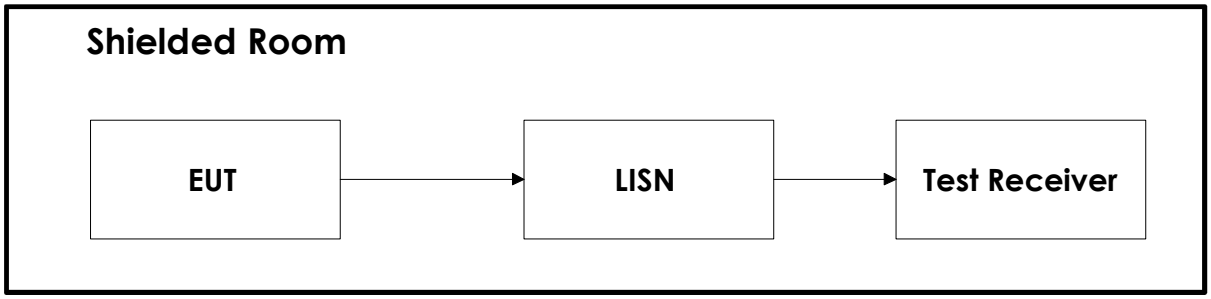
5 LIST OF TEST EQUIPMENT

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.

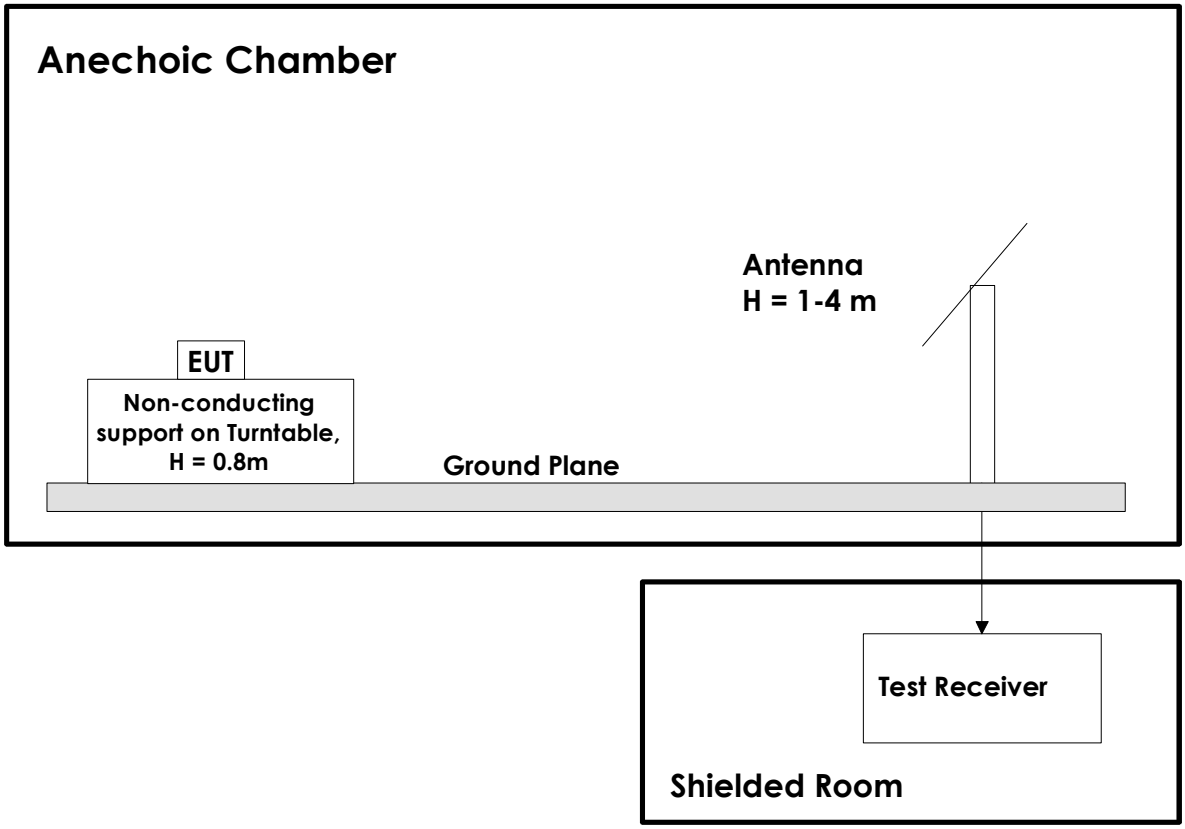
No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2018.03 2019.01	2019.03 2020.01
2	317	Preamplifier	Sonoma	LR 1687	2019.07	2020.07
3	HK116	Biconical Antenna	Rohde & Schwarz	LR 1260	2013.12	2019.12
4	HL223	Log Periodic Dipole	Rohde & Schwarz	LR 1261	2013.12	2019.12
5	3115	Horn Antenna	EMCO	LR 1330	2016.10	2020.10
6	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2019.07	2020.07
7	6HC1500/10000	Highpass Filter	Trilithic	LR 1614	Cal b4 use	
8	Model 87V	Multimeter	Fluke	LR 1599	2018.10	2020.10

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission



6.2 Test Site Radiated Emission



This test setup is used for all radiated emissions tests. For frequencies below 30 MHz the measuring distance is 10m, for all other frequencies it is 3m or 1m. Emissions above 1 GHz are measured with a Spectrum Analyzer and Horn Antenna. For measurements above 18 GHz the test receiver is moved inside the anechoic chamber and located next to the antenna to minimize the cable loss. All measurements at 1GHz and above were performed with turntable height 1.5m and with the ground plane covered by absorbers. A pre-amplifier is used for all measurements above 30 MHz, and High-Pass or Band-Pass filter is used for all harmonics.

Revision history

Version	Date	Comment	Sign
00	2019-07-24	First version	gns
01	2019-10-03	Retested all parameters	gns
02	2019-10-22	Model name corrected	gns