Report No. 481244-03-R01

Test Report

Product	Radio module
Name and address of the applicant	Radiocrafts AS, attn Ø Nottveit Sandakerveien 64, N-0404 OSLO, Norway
Name and address of the manufacturer	Radiocrafts AS, attn Ø Nottveit Sandakerveien 64, N-0404 OSLO, Norway
Model	RC1892HP-CF
Rating	3.6V_{DC} (Primary Battery)
Trademark	-
Serial number	-
Additional information	902-928 MHz band
Tested according to	**FCC Part 15.247** Frequency Hopping Transmitters / Digital Transmission Systems **Industry Canada RSS-247, Issue 2** Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
Order number	481244
Tested in period	2022-09-05 to 2022-12-12
Issue date	2023-02-03
Name and address of the testing laboratory	Instituttveien 6 Kjeller, Norway www.nemko.com CAB Number: FCC: NO0001 ISED: NO470 **An accredited technical test executed under the Norwegian accreditation scheme**

Prepared by [Jan G Eriksen]	Approved by [Frode Sveinsen]

Nemko Group
Nemko Scandinavia AS, Instituttveien 6, 2027 Kjeller, Norway
TEL +47 22 96 03 30 EMAIL info@nemko.com

nemko.com/no

Revision history

Revision	Date	Comment	Sign
00	2022-12-13	First edition	JGER
01	2023-02-03	Editorials concerning duty cycle correction factor, Time of occupancy formula.	JGER

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”.

CONTENTS

1 INFORMATION

1.1 Test Item

Name	**Radiocrafts High Power device**
Model/version	**RC1892HP-CF**
FCC ID	**Y2NRC189XHP-IPM**
ISED ID	**-**
Serial number	**-**
Hardware identity and/or version	**1.00**
Software identity and/or version	**SDK 3.2.3**
Frequency Range	**902 - 928 MHz**
Number of Channels	**50**
Operating Modes	**Transmission, Reception and IDLE/SLEEP**
Type of Modulation	**GFSK**
Conducted Output Power	**Nominal 27 dBm (500 mW)**
Antenna Connector	**PCB Solder Pad**
Number of Antennas	**1**
Diversity or Smart Antennas	**No**
Power Supply	**DC 3.6 V**
Desktop Charger	**N/A**

Description of Test Item

The tested item is a wireless 902-928 MHz transmitter.

This device has been tested as a Frequency Hopping system and fullfils all requirements for FHSS systems.

1.2 Normal test condition

Temperature:	**20 - 24 °C**
Relative humidity:	**20 - 50 %**
Normal test voltage:	**3.6 V DC**

The values are the limit registered during the test period.

1.3 Test Engineer(s)

Jan G Eriksen

1.4 Antenna Requirement

Does the EUT have detachable antenna(s)?	☒ **YES**	☐ **NO**
If detachable, is the antenna connector(s) non-standard?	☒ **YES**	☐ **NO**
The tested equipment has external antenna(s).		

Requirement: FCC 15.203, 15.204

1.5 EUT Operating Modes

Description of operating modes	TX/RX/Idle
Additional information	The following settings were used for all tests: Power Setting: Maximum Power as preset by manufacturer.

1.6 Comments

The EUT uses Mesh protocol, with 50 kb/s FSK, Frequency Hopping, and 6LoWPAN (acronym for “IPv6 Low-Power Wireless Personal Area Networks”) protocol.

The measurements were done with the EUT powered by 3.6 V DC. It was checked that power variations between 85% and 115% did not have any influence on the measurements.

All measurements were done with the EUT powered from an external DC power supply.

All ports were populated during spurious emission measurements.

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 15.247 and Industry Canada RSS-247 Issue 2 and RSS-GEN Issue 5.

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 distance of 3m.

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

☒ **New Submission**	☒ **Production Unit**
☐ **Class II Permissive Change**	☐ **Pre-production Unit**
DSS Equipment Code	☐ **Family Listing**

2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-247 Issue 2, RSS-GEN Issue 5 reference	ANSI C63.10-2013 Reference	Result
Supply Voltage Variations	**15.31(e)**	**6.11 (RSS-GEN)**	**5.13**	**PASS**
Antenna Requirement	**15.203**	**6.8 (RSS-GEN)**	**5.8**	**PASS**
Power Line Conducted Emission	**15.107(a) 15.207(a)**	**7.2 / 8.8 (RSS-GEN)**	**6.2**	**PASS**
Channel Separation and 20 dB BW	**15.247(a)(1)**	**5.1 (4) (RSS-247)**	**7.8.2 (FHSS)**	**PASS**
Number of Hopping Frequencies	**15.31(m)**	**5.1 (6) (RSS-247)**	**7.8.3 (FHSS)**	**PASS**
Pseudorandom Hopping Algorithm	**15.247(a)(1)**	**5.1 (3) (RSS-247)**	**N/A (FHSS)**	**PASS**
Time of Occupancy (dwell time)	**15.247(a)(1)(iii)**	**5.1 (5) (RSS-247)**	**7.8.4 (FHSS)**	**PASS**
Occupied Bandwidth	**15.247(a)(1)**	**5.1 (7) (RSS-247)**	**6.9.2 FHSS)**	**PASS**
Occupied Bandwidth (99% BW)	**N/A**	**6.7 (RSS-GEN)**	**6.9.3**	**PASS**
DTS Bandwidth	**15.247(a)(2)**	**5.2 (1) (RSS-247)**	**11.8 Option 2**	**N/A**
Peak Power Output	**15.247(b)**	**5.4 (RSS-247)**	**11.9.1.1**	**PASS**
Power Spectral Density	**15.247(d)**	**5.2 (2) (RSS-247)**	**11.10.2 PKPSD (DTS)**	**N/A**
Spurious Emissions (Antenna Conducted)	**15.247(c)**	**5.5 (RSS-247)**	**6.7 11.11 (DTS) 7.8.6 (FHSS) 7.8.8 (FHSS)**	**PASS**
Spurious Emissions (Radiated)	**15.247(c) 15.109(a) 15.209(a)**	**5.5 (RSS-247) 7.3 (RSS-GEN) 8.9 (RSS-GEN)**	**6.3, 6.5, 6.6, 6.10 11.12, 11.13 (DTS)**	**PASS**

3 TEST RESULTS

3.1 Power Line Conducted Emissions

FCC Part 15.107 (a)

ISED RSS-GEN Issue 5, Clause 7.2/8.8

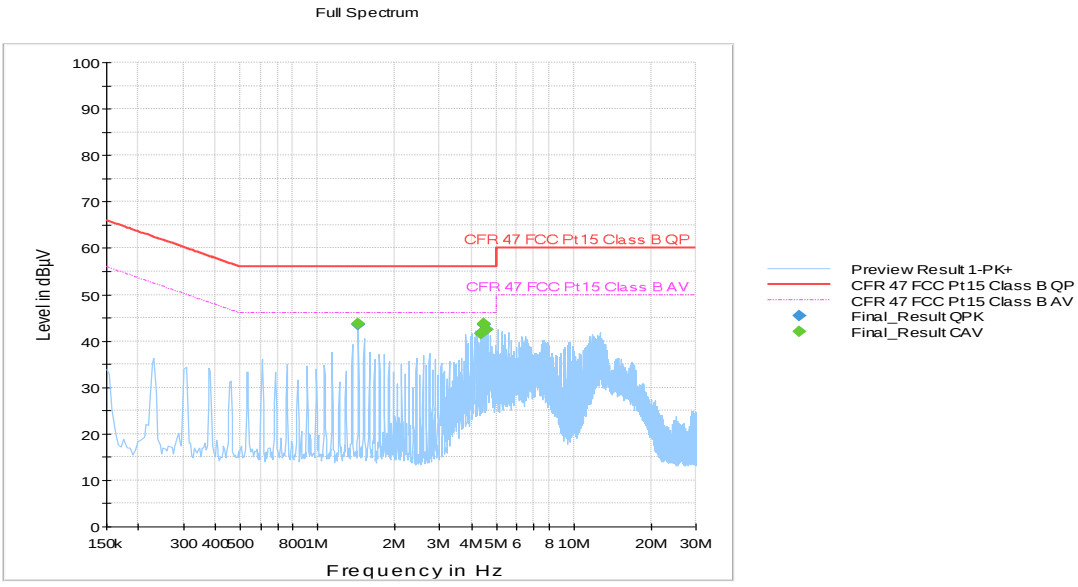
Measurement procedure: **ANSI C63.4-2014 using 50 µH/50 ohms LISN.**

Test Results: **Complies**

Measurement Data: **See attached plots.**

Highest measured value (L1 and N):

Frequency	Detector	Measured value	Limit	Margin
MHz	Peak/QP/AV	dBµV	dBµV	dB
1.442000	QP	43.5	56.0	12.5
1.442000	AV	43.8	46.0	2.2
4.326000	QP	41.6	56.0	14.4
4.326000	AV	41.6	46.0	4.4
4.478000	QP	43.6	56.0	12.4
4.478000	AV	43.7	46.0	2.3
4.938000	QP	42.4	56.0	13.6
4.938000	AV	42.5	46.0	3.5



Tested with Power Supply (LR-1711) and Multimeter (LR-1597, for DC and AC voltage measurement).

3.2 20dB Bandwidth

FCC Part 15.247(a)(1)

ISED RSS-247 Issue 2, Clause 5.1 (b)

Measurement procedure: ANSI C63.10-2013 Clause 7.8.2

Test Results: Complies

Measurement Data:

Modulation	20dB Bandwidth		
	903 MHz	915 MHz	927 MHz
Basic Rate (FSK)	107.9 kHz	107.4 kHz	108.4 kHz

RF channel has no influence on 20 dB bandwidth.

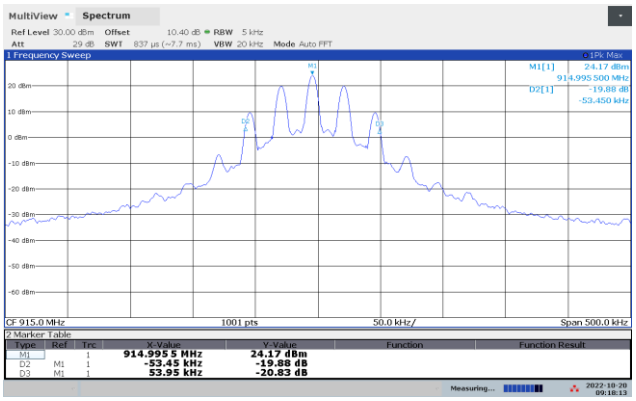
See attached plots

Frequency Band	Requirement for Frequency Hopping
902-928 MHz	The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.
2400-2483.5 MHz	The maximum 20 dB bandwidth shall be less than channel separation, alternatively, less than 150% of channel separation if output power is less than 125 mW.
5725-5850 MHz	The maximum 20 dB bandwidth of the hopping channel is 1 MHz.

No requirements for Digital Transmission Systems.

Channel Separation

20dB Bandwidth 903 MHz, GFSK



20dB Bandwidth 915 MHz, GFSK

20dB Bandwidth 927 MHz, GFSK

3.3 Pseudorandom Hopping Algorithm

FCC Part 15.247 (a)(1)

ISED Canada RSS-247 Issue 2, Clause 5.1

Test Results: Complies

Measurement Data: Information about hopping sequence/algorithm is provided by the manufacturer.

Requirements:

The channel frequencies shall be selected from a pseudorandom ordered list of hopping frequencies. Each frequency must be used equally by the transmitter.

No requirements for Digital Transmission Systems.

3.4 Hopping Bandwidth

FCC Part 15.247 (a)(1)(iii)

ISED Canada RSS-247 Issue 2, Clause 5.1

Measurement procedure: ANSI C63.10-2013 Clause 6.9.2 / 7.8.3

Test Results: Complies

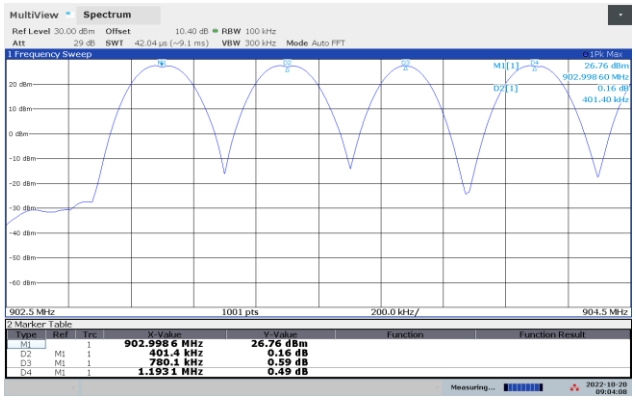
Measurement Data:

Number of RF Channels in use	**50**
Channel Centre Frequencies	**903 to 927 MHz**
Channel Separation	**Carriers 1-28: 400 kHz** **Carriers 28-50: 600 kHz**

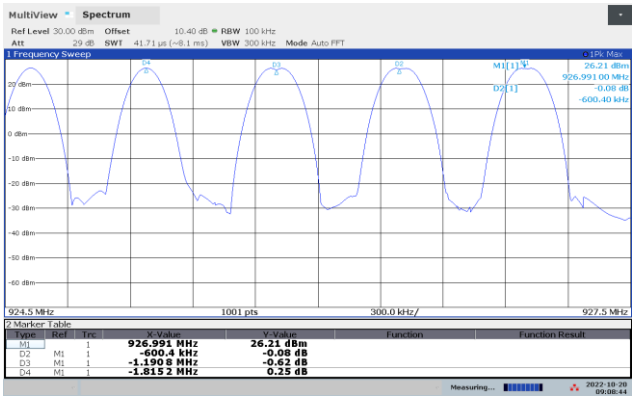
See attached plots.

Frequency Band	Requirement for Frequency Hopping
902-928 MHz	If the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies. If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.
2400-2483.5 MHz	Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.
5725-5850 MHz	Frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies.

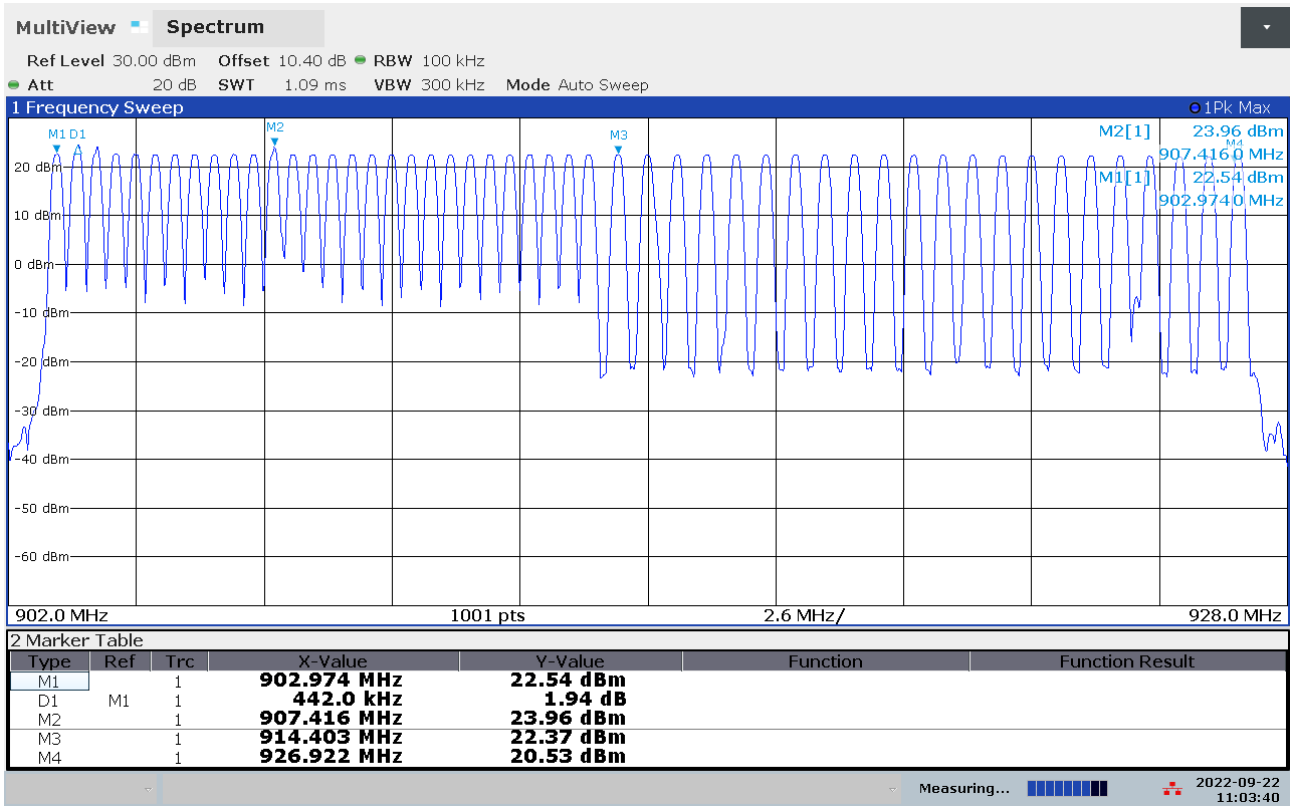
No requirements for Digital Transmission Systems.



RF Channels in Use, Lower part of band



RF Channels in Use, Upper part of band



Frequency hopping whole band carrier separation

3.5 Occupancy Time

FCC Part 15.247 (a)(1)(iii)

ISED Canada RSS-247 Issue 2, Clause 5.1 (c)

Measurement procedure: **ANSI C63.10-2013 Clause 7.8.4**

Test Results: **Complies**

Measurement Data:

Frame Type and Data Rate	Burst Length (ms)	Frame Length (ms)	Time of Occupancy (ms)	Verdict
	14.660	22004	13.325	Complies

Burst length is the same for all data rates.

Time between RF burst on same channel = Frame Length * Number of Channels

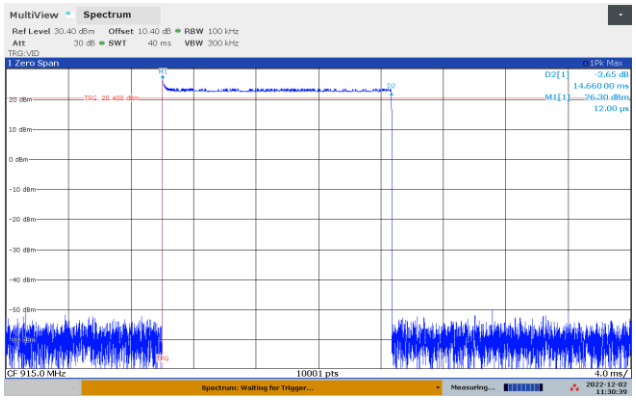
Time of occupancy = (Burst Length * Number of Channels * 20 s) / Time Between Burst on Same Channel
= (Burst Length * 20 s) / Frame Length

Number of RF channels is 50.

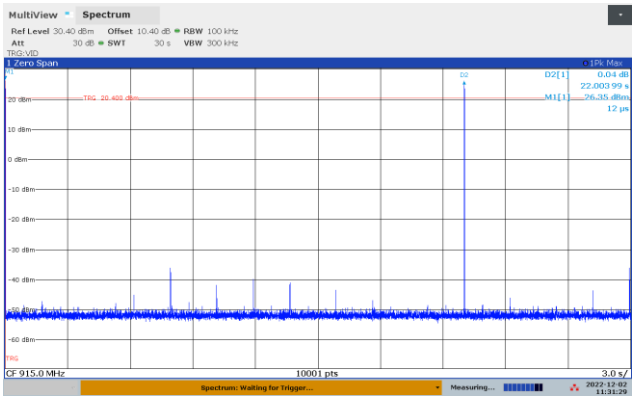
See attached plots

Frequency Band	Requirement for Frequency Hopping
902-928 MHz	The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.
2400-2483.5 MHz	The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.
5725-5850 MHz	The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

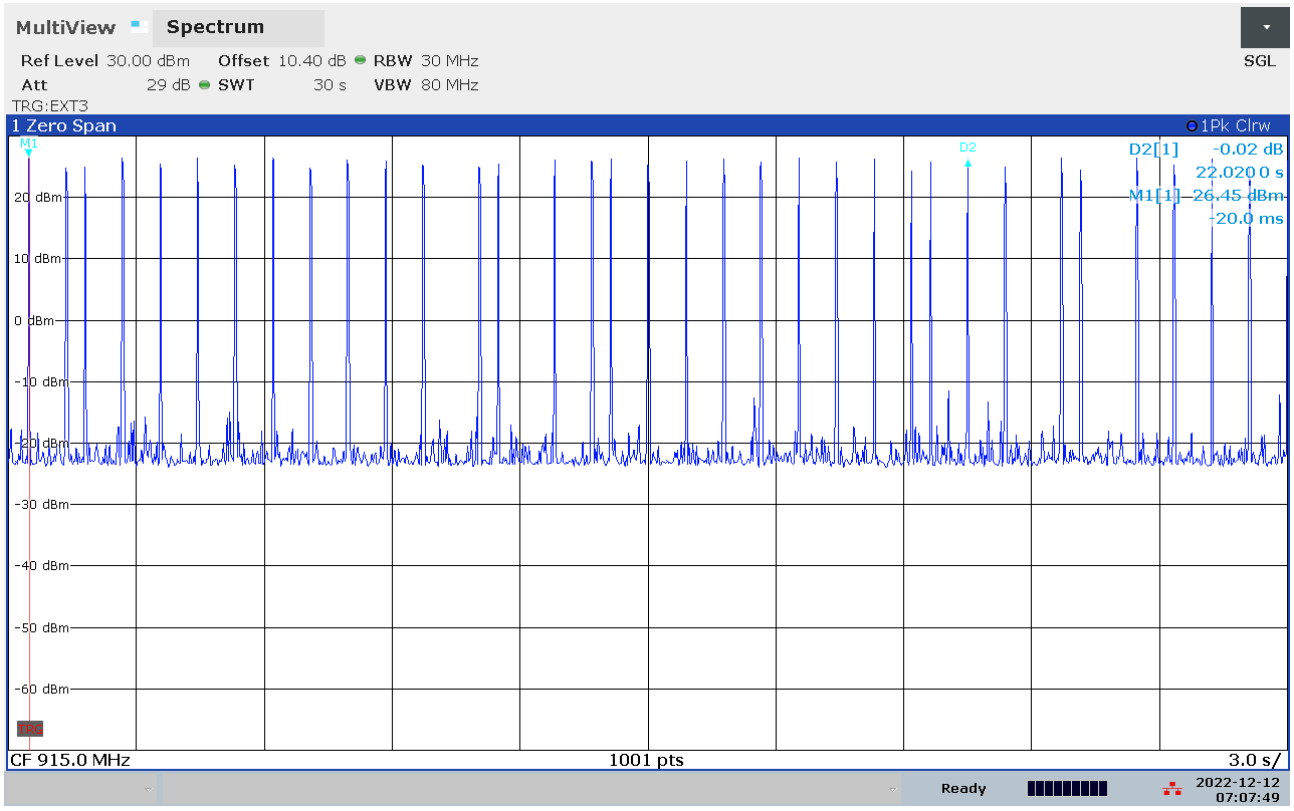
No requirements for Digital Transmission Systems.



915 MHz: Frequency Hopping Burst



915 MHz: Frequency Hopping Frame



This plot shows all transmitted bursts between two occurrences at 915 MHz. The spectrumanalyzer is triggered with the first pulse at 915 MHz, and until (and including) the next pulse at 915 MHz occurs we see 26 pulses that have been transmitted at other carriers (including one burst at 915 MHz).

3.6 Occupied Bandwidth (99% BW)

FCC Part 15.247 (a)(1)(iii)

ISED Canada RSS-247 Issue 2, Clause 5.1

ISED Canada RSS-GEN Issue 5, Clause 6.7

Measurement procedure: ANSI C63.10-2013 Clause 6.9.3 / 7.8.3

Test Results: Complies

Measurement Data:

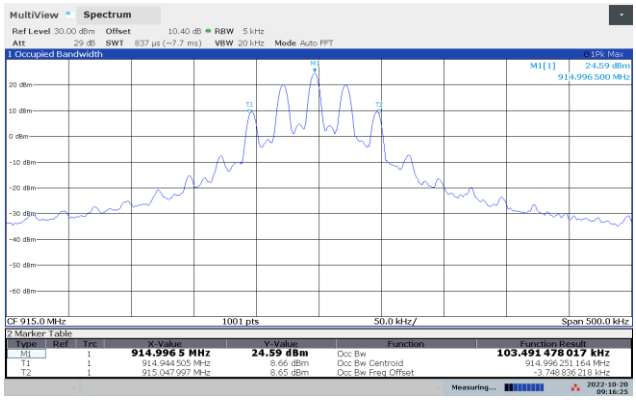
Carrier Frequency and Data Rate	Occupied Bandwidth (99% BW)
915 MHz Basic Rate	104 kHz

Occupied Bandwidth is the same for all channels

See attached plots.

Requirements:

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



915 MHz: 99% Occupied BW, GFSK

3.7 Peak Power Output

FCC Part 15.247 (b)

ISED Canada RSS-247 Issue 2, Clause 5.4

Measurement procedure: ANSI C63.10-2013 Clause 11.9.1.2

Test Results: Complies

Measurement Data:

Carrier Frequency (MHz)	Modulation Type	Conducted Power (dBm)	Conducted Power (mW)	Field Strength (dBµV/m)	ERP (mW)	Antenna gain (dBd)
903	FSK	26.90	489.78	124.24	481.15	-0.04
915	FSK	26.68	467.74	124.62	527.57	0.56
927	FSK	25.78	380.19	123.08	373.49	-0.08

Output Power reported is Maximum Peak Power.

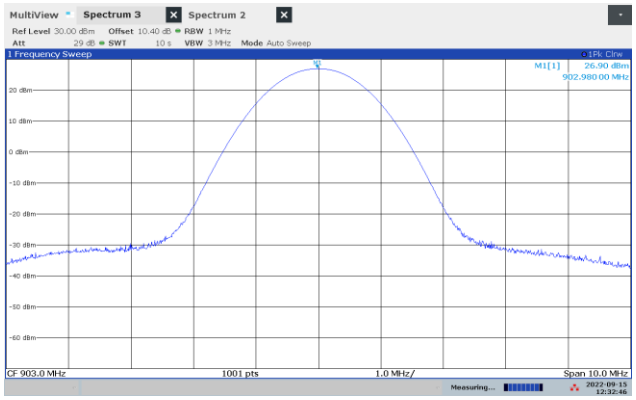
1 MHz RBW and marker peak function was used to measure Output Power

Radiated Power was calculated from measured Field Strength using the method described in FCC KDB 412172 D01.

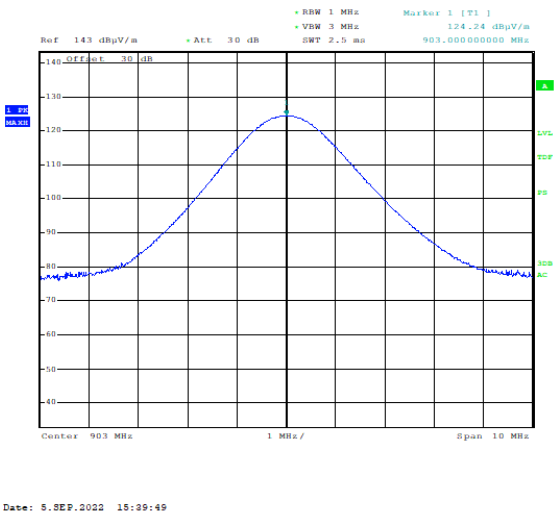
Antenna Gain is less than 6 dBi.

See attached plots.

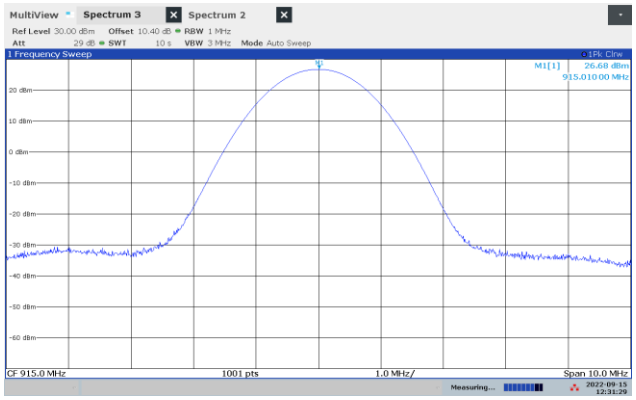
Frequency Band	Requirements for Frequency Hopping systems
902-928 MHz	For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels
2400-2483.5 MHz	For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels: 1 watt For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts
5725-5850 MHz	For all frequency hopping systems in the 5725-5850 MHz band: 1 watt
Requirements for Digital Modulation systems	
For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the 1 Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.	
Maximum allowed Antenna Gain	
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.	



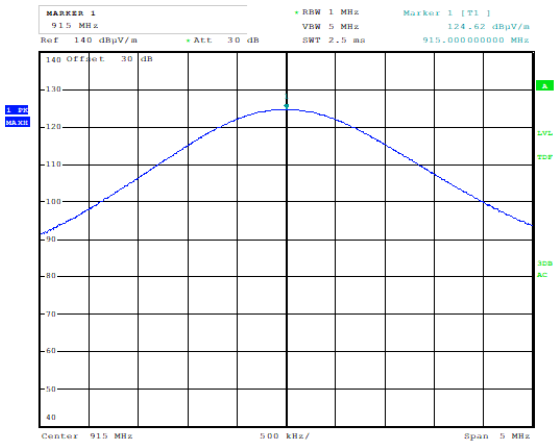
Conducted Peak Power, 903 MHz, GFSK



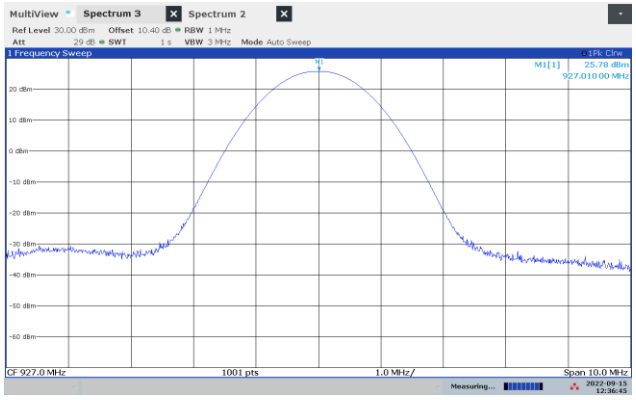
Radiated Maximum Field Strength, 903 MHz, GFSK



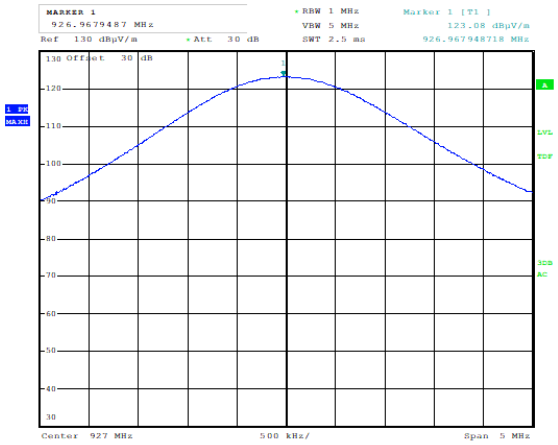
Conducted Peak Power, 915 MHz, GFSK



Radiated Maximum Field Strength, 915 MHz, GFSK



Conducted Peak Power, 927 MHz, GFSK



Radiated Maximum Field Strength, 927 MHz, GFSK

3.8 Conducted Emissions at Antenna Connector

FCC Part 15.247 (d)

ISED Canada RSS-247 Issue 2, Clause 5.5

Measurement procedure: ANSI C63.10-2013 Clause 11.11

Test Results: Complies

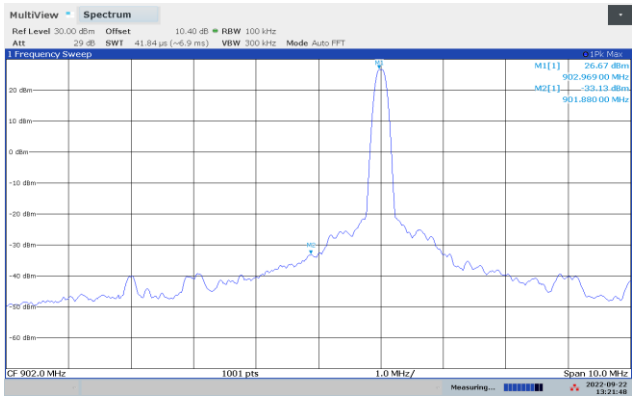
Measurement Data:

Carrier Frequency	Highest Value (dBc)	Margin (dB)	Verdict
903 MHz	> 40	> 20	Pass
915 MHz	> 40	> 20	Pass
927 MHz	> 40	> 20	Pass

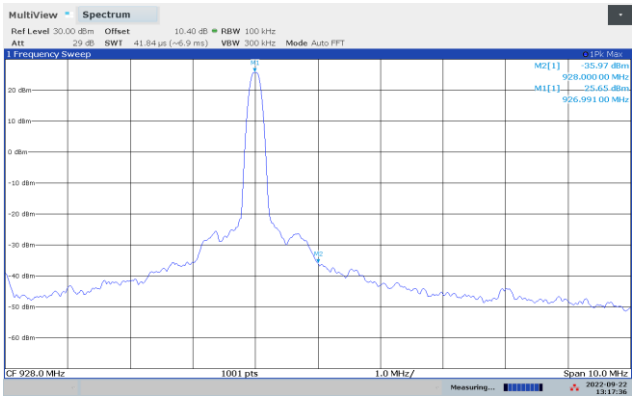
Measured with Peak Detector

RF conducted power to 10 GHz: see attached plots.

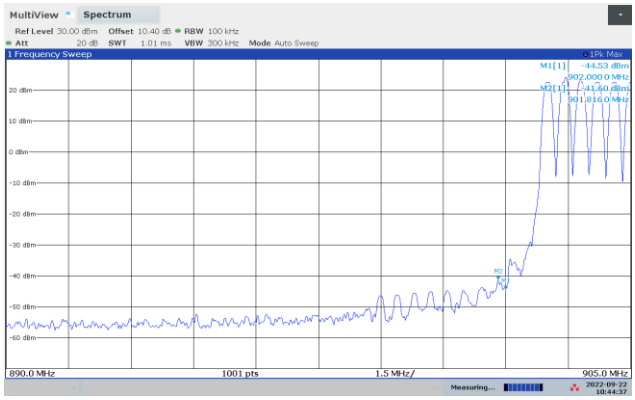
Requirements for all systems	
Peak measurement	**RMS averaging (alternative measurement)**
20 dB or more below carrier measured in 100 kHz bandwidth	30 dB or more below carrier measured in 100 kHz bandwidth
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required.	



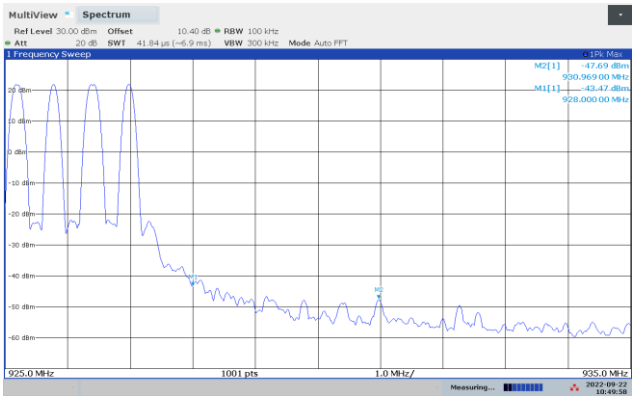
TX 902 MHz: Lower Band Edge, Peak



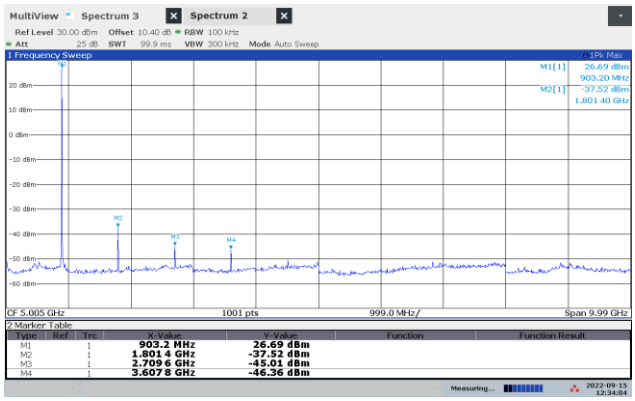
TX 927 MHz: Upper Band Edge, Peak



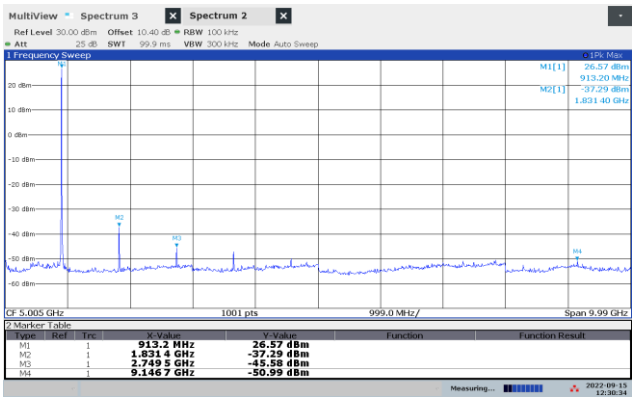
Frequency hopping, Lower Band Edge, Peak



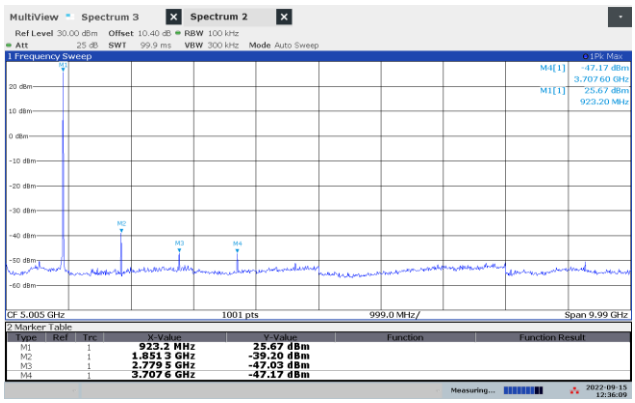
Frequency hopping, Upper Band Edge, Peak



903 MHz: 10-10000 MHz



915 MHz: 10-10000 MHz



927 MHz: 10-10000 MHz

3.9 Restricted Bands of operation

Restricted Bands of operation for FCC and ISED are defined in FCC Part 15.205 and ISED 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 Canada (MHz)	FCC (GHz)	ISED Canada (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.

3.10 Radiated Emission, 30 – 1000 MHz

FCC Part §15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 7.3/8.9

Measurement procedure: ANSI C63.10-2013 Clause 11.12

Test Results: Complies

Measurement Data:

Detector: Peak. Found frequencies in restricted bands measured with QP-detector

Measuring distance 3 m

Tested in TX-mode with modulation.

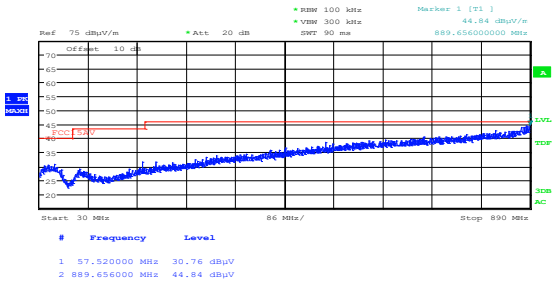
Measured Frequency (MHz)	Carrier Frequency (MHz)	Detector (PK/QP)	MSM polarization	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
30 – 88	903	PK	HP/VP	< 35	40.0	> 5
30 – 88	915	PK	HP/VP	< 35	40.0	> 5
30 – 88	927	PK	HP/VP	<35	40.0	> 5
88 – 216	903	PK	HP/VP	< 35	43.5	> 8
88 – 216	915	PK	HP/VP	< 35	43.5	> 8
88 – 216	927	PK	HP/VP	<35	43.5	> 8
899.000	903	PK	VP	52.3	46.0	*)
899.000	903	QP	VP	50.2	46.0	*)
216 – 960	903	PK	HP/VP	< 43	46.0	> 3
216 – 902	915	PK	HP/VP	< 43	46.0	> 3
216 – 902	927	PK	HP/VP	< 43	46.0	> 3
929.296	927	PK	VP	47.6	46	*)
929.296	927	QP	VP	41.6	46	*)
960 – 1000	903	PK	HP/VP	< 43	54.0	> 11
960 – 1000	915	PK	HP/VP	< 43	54.0	> 11

Note *) FCC Part §15.247 (d) – As the equipment complies with the requirements of this paragraph and because spurious is not in restricted bands, attenuation below the general limits specified in FCC Part §15.209 (a) does not apply.

See attached plots

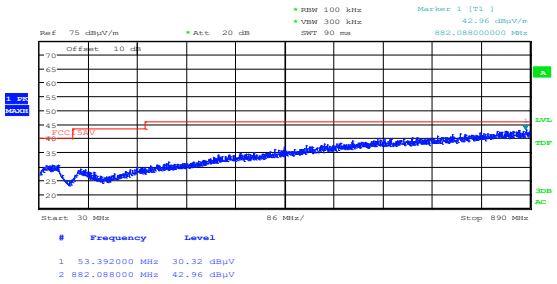
Requirements/Limit

FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
Frequency	Radiated emission limit @3 meters	
30 – 88 MHz	100 µV/m	40.0 dBµV/m
88 – 216 MHz	150 µV/m	43.5 dBµV/m
216 – 960 MHz	200 µV/m	46.0 dBµV/m
960 – 1000 MHz	500 µV/m	54.0 dBµV/m
	Limits above are with Quasi Peak Detector	



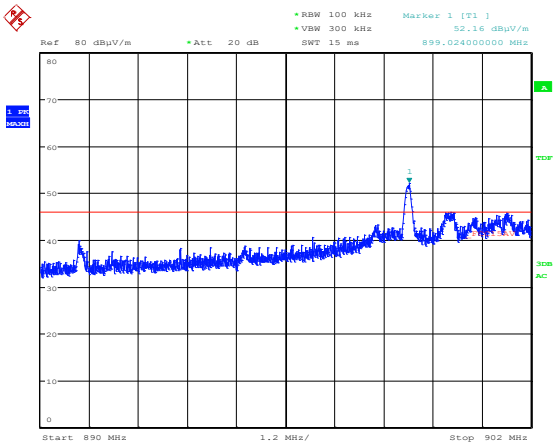
Date: 5.SEP.2022 16:36:36

TX 903 MHz: Radiated Emissions 30 – 890 MHz, VP



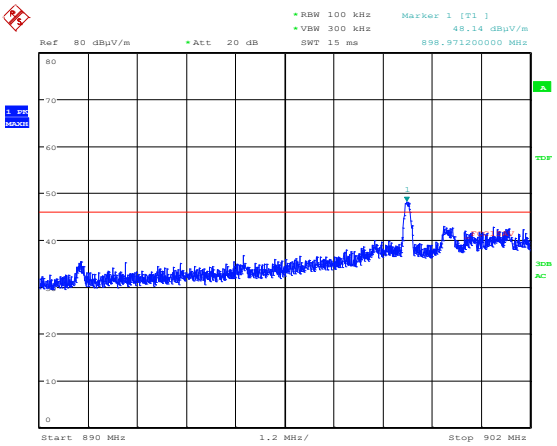
Date: 5.SEP.2022 16:38:39

TX 903 MHz: Radiated Emissions 30 – 890 MHz, HP



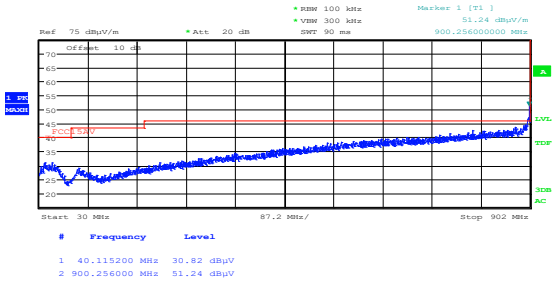
Date: 7.DEC.2022 10:25:45

TX 903 MHz: Radiated Emissions 890-902 MHz, VP



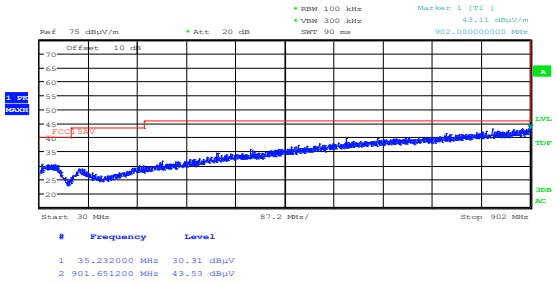
Date: 7.DEC.2022 10:27:40

TX 903 MHz: Radiated Emissions 890-902 MHz, HP



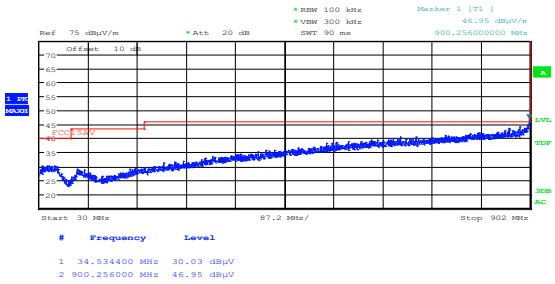
Date: 5.SEP.2022 16:29:26

TX 915 MHz: Radiated Emissions 30 – 902 MHz, VP



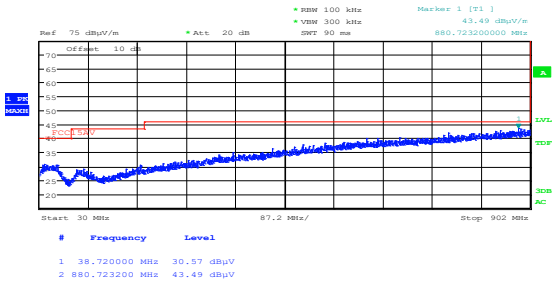
Date: 5.SEP.2022 16:31:28

TX 915 MHz: Radiated Emissions 30 – 902 MHz, HP



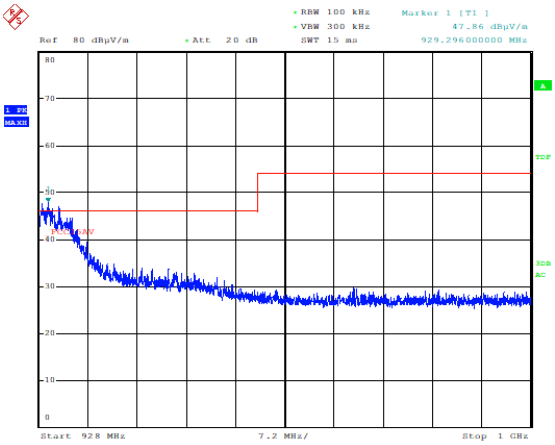
Date: 5.SEP.2022 16:06:37

TX 927 MHz: Radiated Emissions 30 – 902 MHz, VP



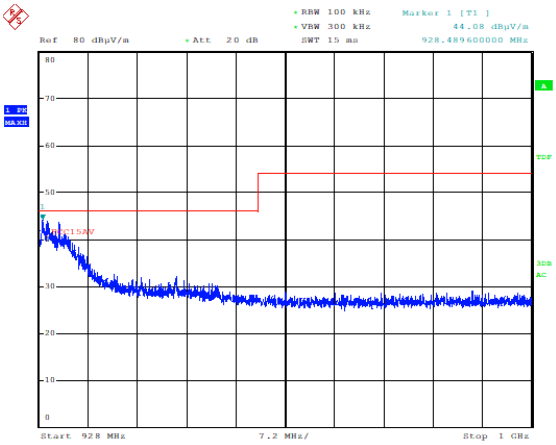
Date: 5.SEP.2022 16:08:40

TX 927 MHz: Radiated Emissions 30 – 902 MHz, HP



Date: 7.DEC.2022 09:05:42

TX 927 MHz: Radiated Emissions 928 – 1000 MHz, VP



Date: 7.DEC.2022 09:07:36

TX 927 MHz: Radiated Emissions 928 – 1000 MHz, HP

3.11 Radiated Emissions, 1-10 GHz

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 7.3/8.9

Measurement procedure: **ANSI C63.10-2013 Clause 11.12**

Test Results: Complies

Measurement Data:

Measuring distance: 3m (1 – 10 GHz)

Peak Detector, RBW=1 MHz

Carrier freq. (MHz)	Measured Frequency (MHz)	Modulation	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
903	9030	GFSK	66.5	74	7.5
915	9150	GFSK	64.9	74	9.1
927	-	GFSK	-	74	-
903 / 915 / 927	Other freqs 1000 - 9300	GFSK	< 65	74	> 9

Average Detector, RBW=1 MHz

Carrier freq. (MHz)	Measured Frequency (GHz)	Modulation	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
903	9030	GFSK	49.8	54	4.2
915	9150	GFSK	48.2	54	5.8
927	-	GFSK	-	54	-
903 / 915 / 927	Other freqs 1000 - 9300	GFSK	< 53	54	> 1

Average Detector values are calculated from Peak values by Duty Cycle Correction Factor (maximum 20 dB correction allowed). Actual **permissible** correction factor: 20 * Log (14.660 / 100) = **-16.7 dB**.

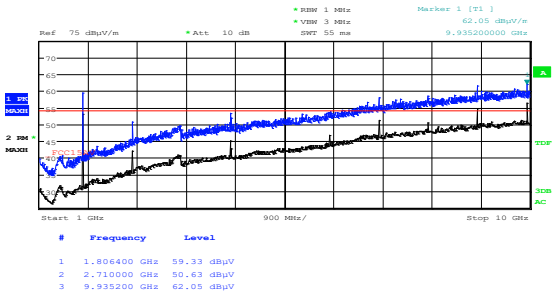
A Band Reject Filter was used for measurements from 1 GHz to 18 GHz

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

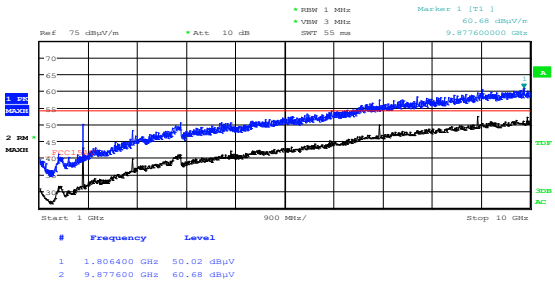
See plots

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	Average Detector	Peak Detector
1 – 26 GHz	54.0 dBµV/m	74.0 dBµV/m

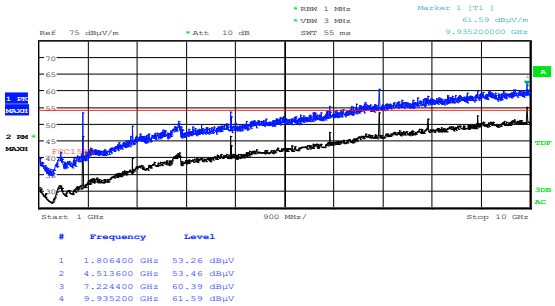


Date: 5.SEP.2022 10:52:44



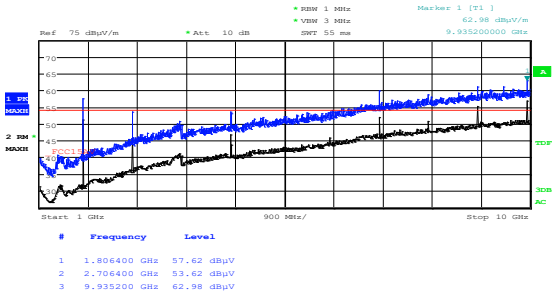
Date: 5.SEP.2022 10:54:33

903 MHz: Radiated Emissions 1 – 10 GHz XY-plane, VP



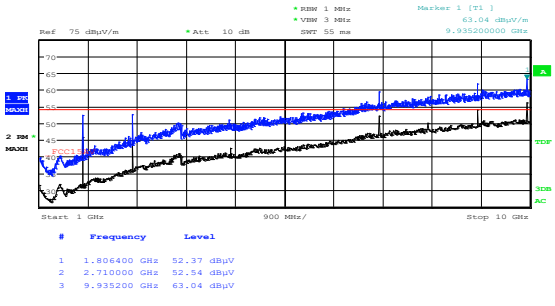
Date: 5.SEP.2022 11:02:49

903 MHz: Radiated Emissions 1 – 10 GHz XY-plane, HP



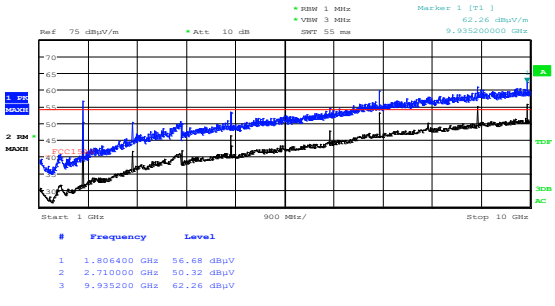
Date: 5.SEP.2022 11:04:37

903 MHz: Radiated Emissions 1 – 10 GHz ZX-plane, VP



Date: 5.SEP.2022 10:57:50

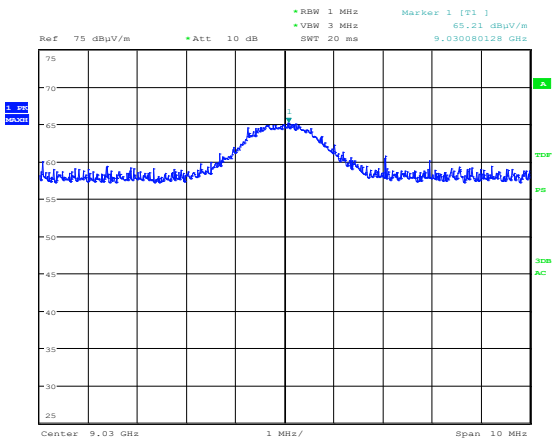
903 MHz: Radiated Emissions 1 – 10 GHz ZX-plane, HP



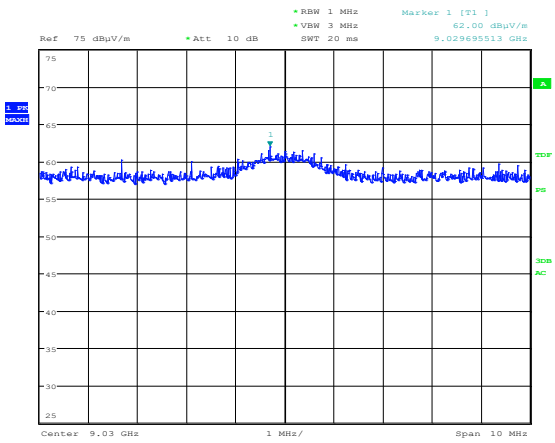
Date: 5.SEP.2022 10:59:39

903 MHz: Radiated Emissions 1 – 10 GHz YZ-plane, VP

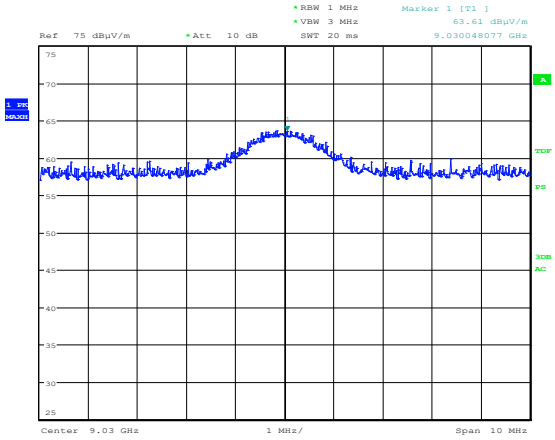
903 MHz: Radiated Emissions 1 – 10 GHz YZ-plane, HP



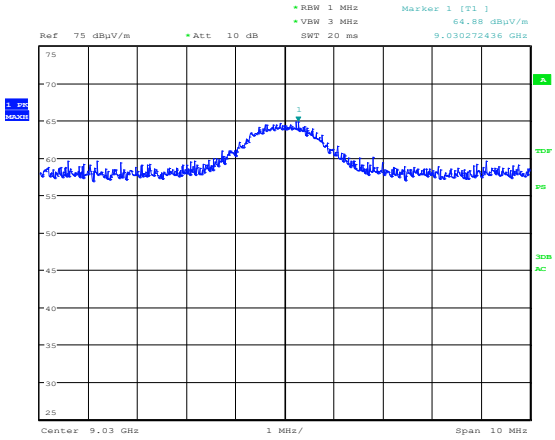
903 MHz: Radiated Emissions 9030 MHz XY-plane, VP



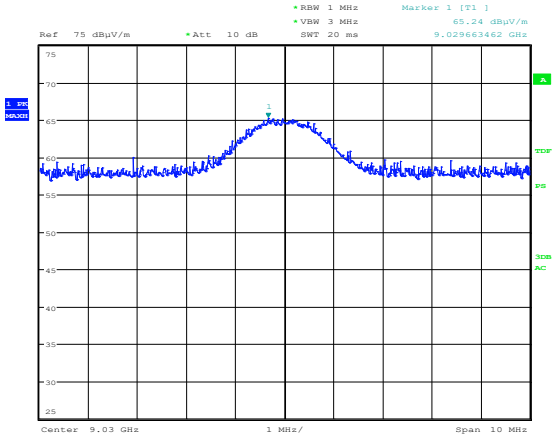
903 MHz: Radiated Emissions 9030 MHz XY-plane, HP



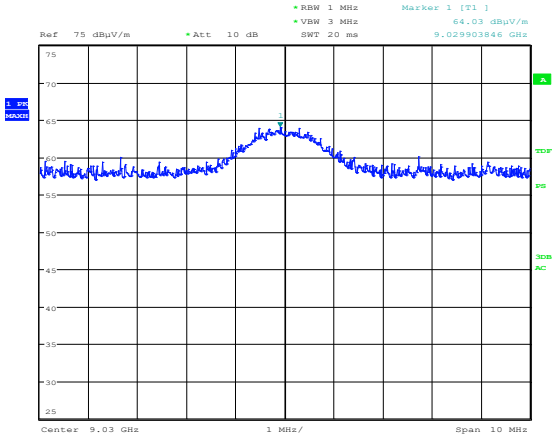
903 MHz: Radiated Emissions 9030 MHz ZX-plane, VP



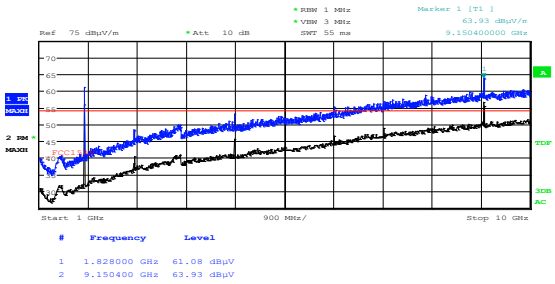
903 MHz: Radiated Emissions 9030 MHz ZX-plane, HP



903 MHz: Radiated Emissions 9030 MHz YZ-plane, VP

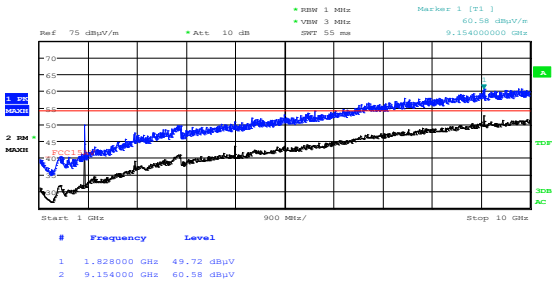


903 MHz: Radiated Emissions 9030 MHz YZ-plane, HP



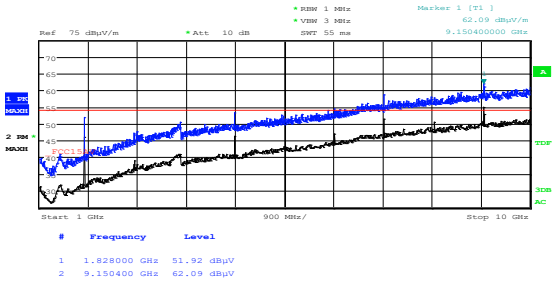
Date: 5.SEP.2022 09:44:01

915 MHz: Radiated Emissions 1 – 10 GHz XY-plane, VP



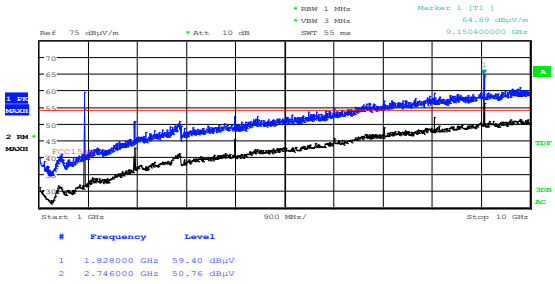
Date: 5.SEP.2022 09:45:50

915 MHz: Radiated Emissions 1 – 10 GHz XY-plane, HP



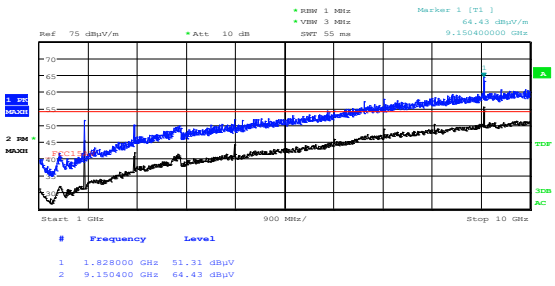
Date: 5.SEP.2022 10:45:42

915 MHz: Radiated Emissions 1 – 10 GHz ZX-plane, VP



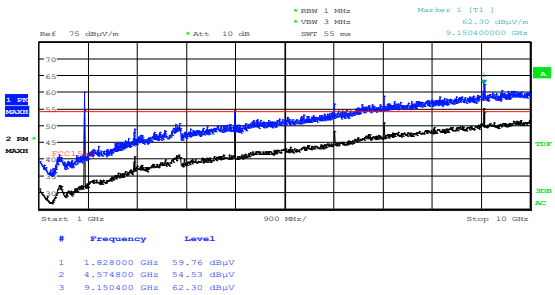
Date: 5.SEP.2022 10:47:31

915 MHz: Radiated Emissions 1 – 10 GHz ZX-plane, HP



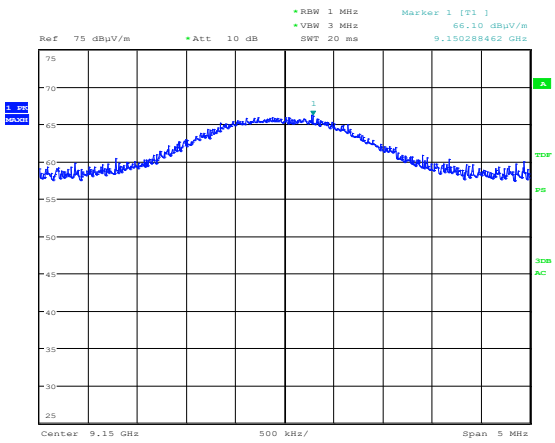
Date: 5.SEP.2022 09:50:22

915 MHz: Radiated Emissions 1 – 10 GHz YZ-plane, VP



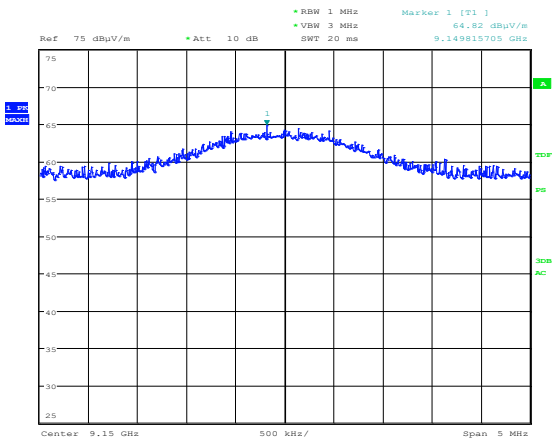
Date: 5.SEP.2022 09:52:11

915 MHz: Radiated Emissions 1 – 10 GHz YZ-plane, HP



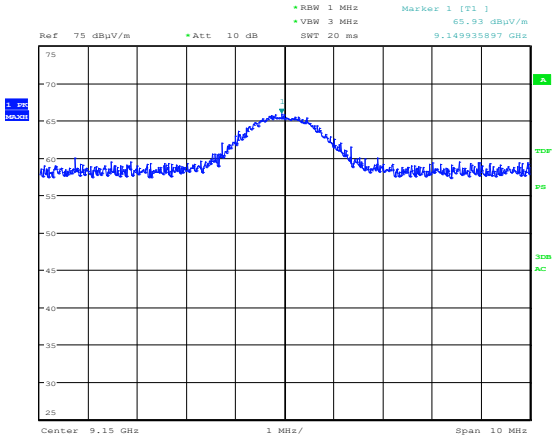
Date: 5.SEP.2022 10:12:25

915 MHz: Radiated Emissions 9150 MHz XY-plane, VP



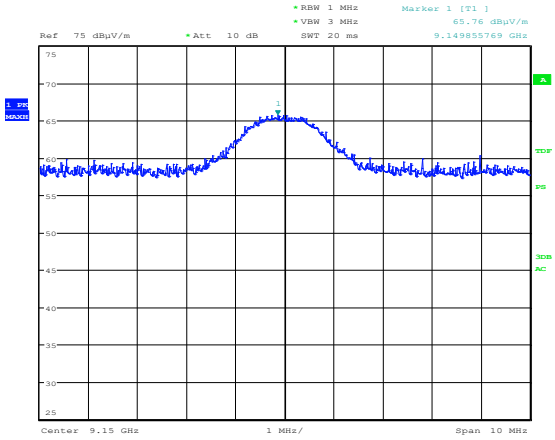
Date: 5.SEP.2022 10:10:53

915 MHz: Radiated Emissions 9150 MHz XY-plane, HP



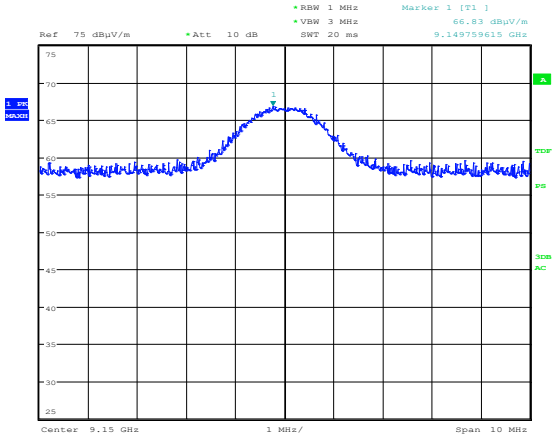
Date: 5.SEP.2022 10:31:14

915 MHz: Radiated Emissions 9150 MHz YZ-plane, VP



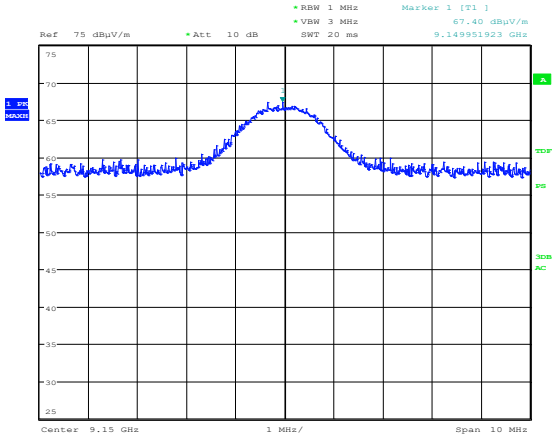
Date: 5.SEP.2022 10:30:08

915 MHz: Radiated Emissions 9150 MHz YZ-plane, HP



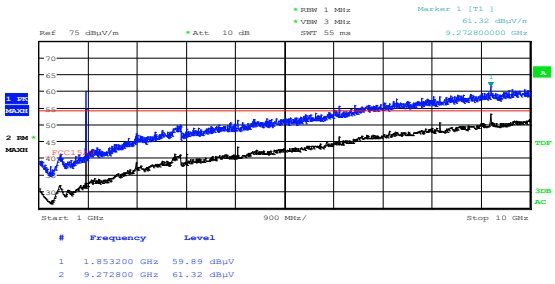
Date: 5.SEP.2022 10:40:57

915 MHz: Radiated Emissions 9150 MHz ZX-plane, VP

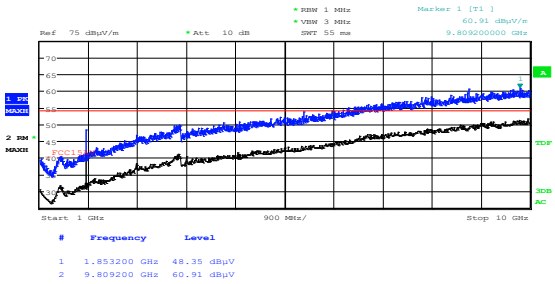


Date: 5.SEP.2022 10:39:47

915 MHz: Radiated Emissions 9150 MHz ZX-plane, HP



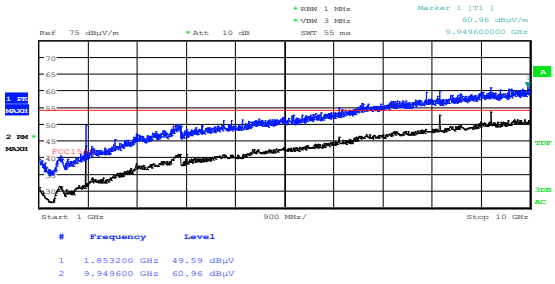
Date: 5.SEP.2022 11:09:56



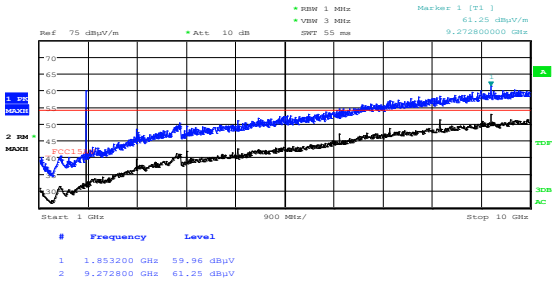
Date: 5.SEP.2022 11:11:45

927 MHz: Radiated Emissions 1 – 10 GHz XY-plane, VP

927 MHz: Radiated Emissions 1 – 10 GHz XY-plane, HP



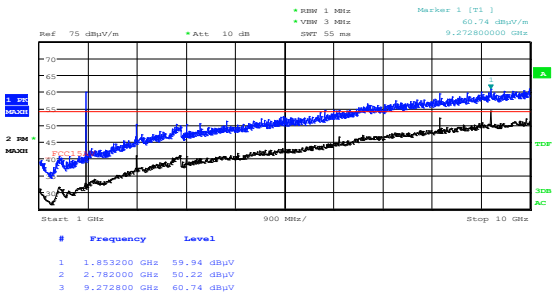
Date: 5.SEP.2022 11:14:48



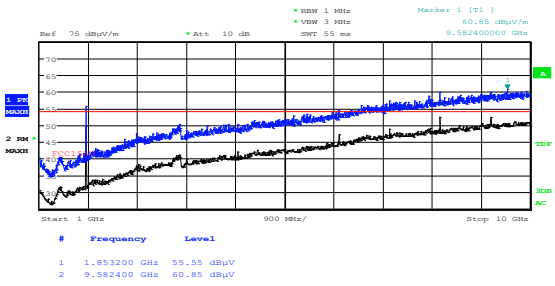
Date: 5.SEP.2022 11:16:38

927 MHz: Radiated Emissions 1 – 10 GHz YZ-plane, VP

927 MHz: Radiated Emissions 1 – 10 GHz YZ-plane, HP



Date: 5.SEP.2022 11:21:25



Date: 5.SEP.2022 11:19:35

927 MHz: Radiated Emissions 1 – 10 GHz ZX-plane, VP

927 MHz: Radiated Emissions 1 – 10 GHz ZX-plane, HP

All harmonic components (9th harmoncis) falling into a restricted band have a peak value more than 10 dB below Peak Limit. Thus, the average value will also have a value being more than 10 dB below Average Limit.

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.

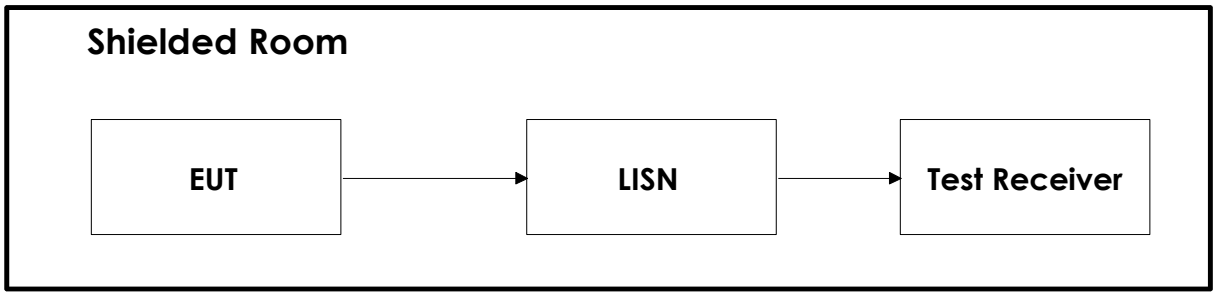
No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	FSW43	Spectrum Analyzer	Rohde & Schwarz	LR 1690	2022-01	2023-01
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2022-01	2023-01
3	6810.17B	Attenuator	Suhner	LR 1669	2021-08	2022-08
4	6HC1500/18000	Highpass Filter	Trilithic	LR 1612	COU	
5	VULB 9163	BiLog Antenna	Schwarzbech	LR 1616	2021-05	2023-05
6	310	Preamplifier	Sonoma	LR 1686	2021-08	2022-08
7	3115	Horn Antenna	EMCO	LR 1330	2016-10	2026-10
8	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2021-08	2022-08
9	CPX 400S	Power Supply	Aim TTi	LR 1711	NA	NA
10	87 V	Multimeter	Fluke	LR-1597	2022-04	2023-04

The software listed below has been used for one or more tests.

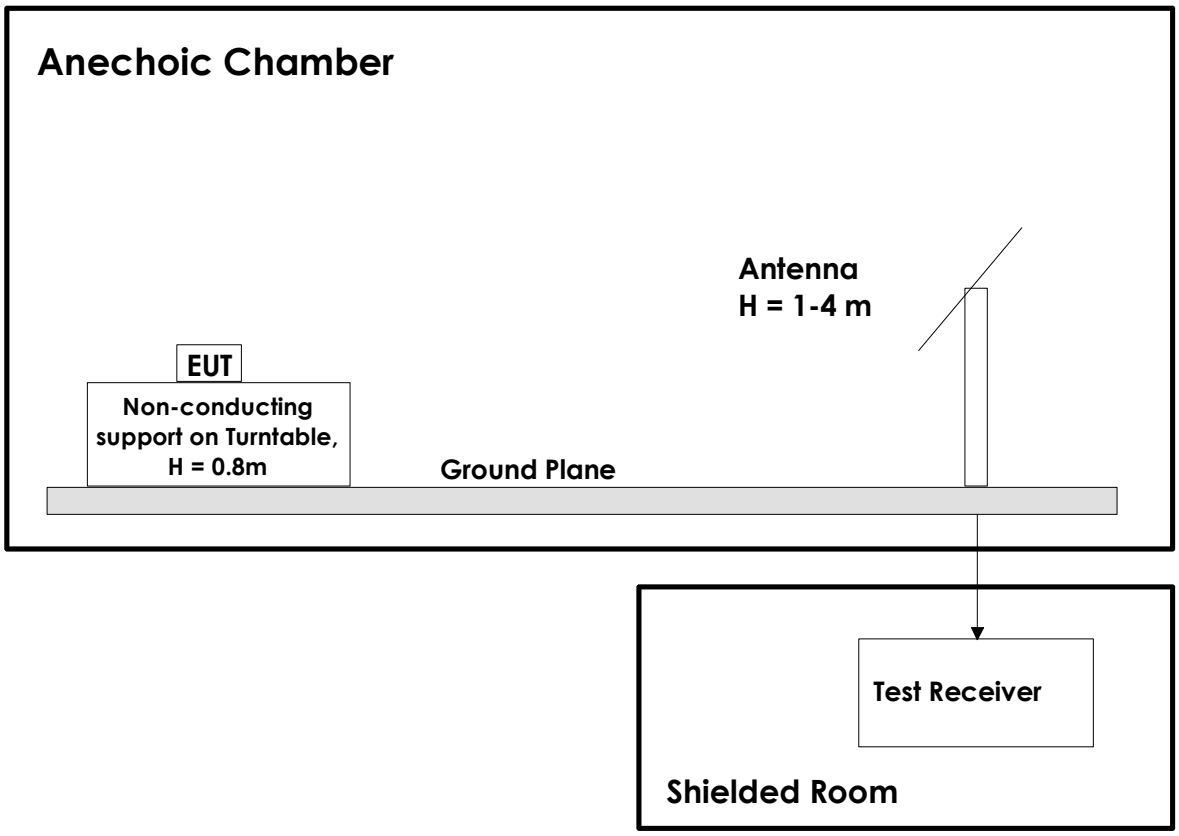
No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	EMC32	10.50.40	EMC test software
2	Nemko AS	RSPlot	1.0.8.0	Screen capture from R&S Spectrum Analyzers

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.